

23-GP-9
28 April 1955
CANCELLATION
6 January 1967

CANADIAN GOVERNMENT SPECIFICATIONS BOARD

Schedule
of

Recommended Practices for Application
of Aluminum and Zinc by Metallizing for
Protection of Iron and Steel

Schedule 23-GP-9, Recommended Practices for Application of Aluminum and Zinc by Metallizing for Protection of Iron and Steel, dated 28 April 1955, is hereby cancelled. This subject is covered by Canadian Standards Association Standard G189, Sprayed Metal Coatings for Atmospheric Corrosion Protection.



CANADIAN GOVERNMENT SPECIFICATIONS BOARD

SCHEDULE

OF

RECOMMENDED PRACTICES FOR APPLICATION OF ALUMINUM AND ZINC BY METALLIZING FOR PROTECTION OF IRON AND STEEL

28-GP-9

28 APRIL 1955

ARCHIVES

Withdrawal

THIS SCHEDULE DESCRIBES THE RECOMMENDED PROCEDURES EMPLOYED IN
METALLIZING IRON AND STEEL SURFACES WITH ZINC AND ALUMINUM
FOR PROTECTION AGAINST CORROSION BY THE APPLICATION OF
METAL IN WIRE FORM BY GAS METALLIZING ONLY.

NATIONAL RESEARCH COUNCIL, OTTAWA, CANADA

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SCHEDULE

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CANADIAN GOVERNMENT SPECIFICATIONS BOARD

Schedule*
of

RECOMMENDED PRACTICES FOR
APPLICATION OF ALUMINUM AND ZINC
BY METALLIZING FOR PROTECTION OF IRON AND STEEL

1. GENERAL

1.1 Scope - This schedule describes the recommended procedures employed in metallizing iron and steel surfaces with zinc and aluminum for protection against corrosion, by the application of metal in wire form by gas metallizing only.

1.2 Equipment Requirements - It is recommended that the spraying be done with metallizing guns and auxiliary equipment complying with CGSB specification 23-GP-1: Metallizing Gun Sets; Wire Gas.

2. SURFACE PREPARATION

2.1 Purpose - For coatings as discussed herein, the surfaces to be metallized must be cleaned and roughened by blasting. Sprayed metal generally will bond only to cleaned and roughened surfaces. However, prior cleaning may be done by other means. Other methods of surface preparation than blasting are so infrequently used for the application of zinc and aluminum that they are not covered in this schedule.

2.2 Cleaning Prior to Blasting - Where heavy scale is encountered on steel or iron it may be much more economical to remove most of this by flame descaling, air hammer, or other suitable means prior to final blasting. Blasting with spent sand or a low grade of sand is often useful as a cleaning method prior to the final roughening blast with the proper grade of abrasive. This procedure would also apply to surfaces heavily coated with oil, paint or other materials. Since such methods are common knowledge and depend on the individual circumstances, they are not discussed here.

2.3 Abrasives for Blasting

2.3.1 Sand, special crushed slag, flint or garnet are used outdoors where the abrasive cannot be reclaimed and reused. It must be hard, sharp and angular as might be produced by crushing. Round silica sand or similar materials should never be used. (See Para. 2.3.4(a))

2.3.2 Crushed steel grit is most commonly used where the abrasive can be reclaimed. Round steel shot or rounded grit should never be used. Aluminum oxide is also used where it can be reclaimed. All abrasives should be clean, dry and free from oil or other contamination.

2.3.3 Blasting speed and costs depend on many factors. With larger blast nozzles, more area will be prepared per hour. However, the size of nozzle may be limited by the amount of air available. See Table I for air requirements. Smaller abrasive size will allow the preparation of more area per hour. However, abrasive size can be too small to provide a properly-roughened surface.

* Based on part IB of Recommended Practices for Metallizing, No. C2.2-52T, as prepared by the American Welding Society Committee on Metallizing.

2.3.4 Where zinc coatings 0.009 inch thick or less or aluminum coatings 0.007 inch thick or less are to be applied, the following abrasives are recommended for use with pressure-type blast machines.

(a) Washed, salt-free, angular silica sand, flint, crushed garnet or special crushed slag, free of feldspar or other mineral constituents which tend to break down and remain on the surface in visible quantity. Mesh size: through 20 and retained on 40, with a minimum of 40% retained on a 30-mesh screen.

(b) Angular steel grit, clean and reasonably sharp. Old grit which is rusty, noticeably worn or dull when compared visually with new grit shall not be used. Mesh size: SAE-G-25 to and including SAE-G-40. An individual size or a mixture may be used.

(c) Aluminum oxide, clean and free of excessive fines (See Para. 6.1.1) Mesh size: through 20 and retained on 50, with a minimum of 40% retained on a 40-mesh screen.

2.3.5 Where zinc coatings 0.010 inch or thicker, or aluminum coatings 0.008 inch or thicker are to be applied, the following abrasives are recommended for use with pressure-type blast machines.

(a) Washed, salt-free, angular silica sand, flint, crushed garnet, or special crushed slag, free of feldspar or other mineral constituents which tend to break down and remain on the surface in visible quantity. Mesh size: through 12 and retained on 30, with a minimum of 40% retained on a 20-mesh screen.

(b) Angular steel grit, clean and reasonably sharp. Old grit which is rusty, noticeably worn or dull when compared visually with new grit should not be used. Mesh size: SAE G-18 to and including G-25. An individual size or a mixture may be used.

(c) Aluminum oxide, clean and free of excessive fines (See Para. 6.1.1). Mesh size: through 12 and retained on 36, with a minimum of 40% retained on a 24-mesh screen.

2.4 Blasting Procedures

2.4.1 The nozzle should be maintained at a suitable distance from the work (normally from 4 to 12 inches) in order to obtain a satisfactory degree of roughness.

2.4.2 The abrasive stream should be directed against the work at an angle of approximately 15 degrees (not over 30 degrees) from the vertical.

2.4.3 The blast nozzle should be replaced when the diameter of the orifice has been increased 25% by wear.

2.4.4 All areas that may be injured by the blast should be protected by masking.

2.4.5 Where a pressure-type blast machine is used, the minimum pressure at the nozzle, according to the type of abrasive, should be:

- a. With aluminum oxide, flint or slag - 50 psi.
- b. With sand, garnet or steel grit - 75 psi.

2.4.6 When a suction-type blast machine is used, the minimum pressure at the nozzle, according to the type of abrasive, shall be:

- a. With aluminum oxide, flint or slag - 75 psi.
- b. With sand, garnet or steel grit - 90 psi.

TABLE I - RATE OF AIR AND ABRASIVE FLOW FOR VARIOUS SIZE NOZZLES

Blast Nozzle Orifice Size(In.)	Volume of Air Required, Cu.Ft./Min.					Approximate Rate of Abrasive Flow, Lb./Hr.						Blast Nozzle Orifice Size(in.)
	60psi.	70psi.	80psi.	90psi.	100psi.	Sharp Angular Sand	Crushed Steel Grit	Alum- inum Oxide	Flint	Garnet	Crush- ed Slag	
3/16	37.5	43.0	47.5	52.5	57.8	500	1250	750	450	700	500	3/16
1/4	67.0	76.0	85.0	94.0	103.0	900	2250	1350	800	1250	950	1/4
5/16	105.0	119.0	133.0	146.0	161.0	1200	3250	1950	1150	1800	1400	5/16
3/8	151.0	171.0	191.0	211.0	232.0	1700	4250	2550	1500	2350	1800	3/8
7/16	206.0	233.0	260.0	286.0	315.0	2200	5500	3300	1950	3050	2350	7/16
1/2	268.0	304.0	340.0	376.0	413.0	3000	7500	4500	2650	4100	3200	1/2

2.4.7 Centrifugal-type blast machines may be used with steel grit in grit sizes, velocities and distance to produce the desired roughening of surfaces. Details should be developed with the manufacturer of the blast machine used.

3. METALLIZED BONDING COAT

3.1 Purpose - Where surfaces are to be coated with aluminum over 0.008 inch thick or zinc over 0.010 inch thick a metallized steel bonding coat should be applied. This steel coat increases the bond strength and tends to eliminate blistering sometimes encountered with heavier coatings of these metals.

3.2 Material - Low-carbon steel wire having a maximum carbon content of 0.28% in sizes of 11 gauge B&S (0.09 inch), 1/8 or 3/16 inch diameter should be used.

3.3 Procedure -

3.3.1 Clean, dry air should be used at pressures recommended by the manufacturer of the gun being used. There should not be more than 50 feet of 3/8-inch i.d. hose between the air regulator and the metallizing gun. Adjustments in air pressure at the air regulator should be made to compensate for hose greater than 15 feet in length.

3.3.2 The metallizing gun should be lighted and adjusted with the spray directed away from the work. During the spraying operation, the gun should be held from 3 to 10 inches away from the surface, depending upon the equipment and the size of wire being used.

3.3.3 Any surface which shows visible moisture, rust, scale or other contamination should be reblasted before spraying. The bonding coat must be applied within 3 hours of blasting. The specified thickness may be applied in a single layer. The bonding coat should be 0.0005 to 0.002 inch (preferably 0.001 inch) thick.

4. ZINC AND ALUMINUM COATINGS

4.1 Material

4.1.1 Wire used in spraying should be made especially for that purpose and should be 11 gauge B&S (0.09 inch), 1/8 or 3/16 inch diameter. Zinc wire should have a minimum purity of 99.9%. Aluminum wire should have a minimum purity of 99.0%, or if preferred, an aluminum-silicon alloy having a maximum silicon content of 6% may be used.

4.1.2 Zinc coatings 0.005 inch thick provide approximately 2-1/2 ounces of zinc per square foot of surface. As galvanized coatings are usually given in ounces for two sides, 0.005 inch of zinc would thus be double the weight of a 2-1/2 ounce galvanized coating. Aluminum 0.005 inch thick would give a coating of approximately 1 ounce per square foot of surface.

4.1.3 To apply a zinc coating 0.005 inch thick requires the spraying of approximately 0.25 lb. (4.0 oz.) per square foot. To apply an aluminum coating 0.005 inch thick requires the spraying of approximately 0.07 lb. (1.12 oz.) per square foot. This takes into consideration the average deposition efficiency of metallizing equipment, but does not allow for edge or other unusual losses.

4.2 Procedure

4.2.1 Clean, dry air should be used at pressures recommended by the manufacturer of the gun being used. Not more than 50 feet of 3/8 inch i.d. hose should be used between the air regulator and metallizing gun. Adjustments in air pressure at the air regulator should be made to compensate for hose greater than 15 feet in length.

4.2.2 The metallizing gun should be lighted and adjusted with the spray directed away from the work. During the spraying operation, the gun should be held from 3 to 10 inches away from the surface, depending upon the equipment and the size of the wire being used.

4.2.3 Any surface which shows visible moisture, rust, scale or other contamination should be reblasted before spraying. At least one layer of the coating must be applied as soon as possible following blasting, at least within 4 hours of blasting, and the surface must be completely coated to the specified thickness within 8 hours of blasting. It is preferable to apply the full thickness of metal within 2 hours after blasting.

Where the coating is being applied manually, multiple passes should be used, preferably 0.001 to 0.003 inch thick, and in no case should less than two passes be made over every part of the surface. The sprayed metal should overlap on each pass of the gun to assure uniform coverage. Where possible, successive passes or layers should be applied at right angles to one another. It is recommended that the work area be sprayed in sections each section being sprayed to full coating thickness with the required number of passes, before moving on to the next section.

* Note - The shortest possible interval of time between blasting and spraying is desirable to prevent contamination from the atmosphere in which the work is located.

5. ADDITIONAL PROTECTIVE MEASURES

5.1 Purpose - Sealing and finishing coats may be used on zinc and aluminum to provide additional protection. In some cases, organic coatings are applied for appearance.

5.2 Materials

5.2.1 Extreme care must be taken in the selection of materials for sealing and finishing coats. The materials used must be compatible with the zinc or aluminum. Many materials will react with these metals and cause early blistering and failure. Suitable chlorinated rubber and suitable vinyl coatings are examples of materials used for sealing and finishing coats.

5.2.2 Where any moisture may be encountered between the time of metallizing and the application of the finishing coat, a proper primer must be used. Wash primers must not have a phosphoric acid content in excess of 4%. Where a wash primer is used, the additional coats must be compatible with it.

5.2.3 Application - Sealing and finishing coats must be applied to clean, dry surfaces. These coatings may be applied by brush or spray. If sprayed, pressure-type spray guns should be used. Any oil, grease or other contamination should be removed by thorough washing with a suitable thinner until no visible traces exist, and the surfaces should be allowed to dry thoroughly before applying the sealers. Coats must be applied heavy enough to produce a thoroughly wet appearance. First coats must be properly thinned to provide complete penetration of the metallized zinc or aluminum coating.

6. INSPECTION

6.1 Blasting

6.1.1 New abrasive should be checked periodically to see that it conforms to the requirements of Para. 2.3. Abrasive which is to be reused should be checked to see that at least 80% of it conforms to the requirements.

6.1.2 The blasted surfaces should be inspected visually and approved as suitable for metallizing before moving and dismantling the blast equipment. A sample steel plate should be blasted until the surface cannot be further cleaned or roughened. This should be used for visual comparison, and any areas which do not compare favorably with this plate as to roughness or cleanliness should be reblasted.

6.2 Metallized Bonding Coat - The steel bonding coat need not be measured for thickness. It is sufficient if the coating shows a dark color over the entire surface. The steel blasted surface underneath the coating may be slightly visible through the coating. Inspection should follow as closely as possible after the completion of spraying.

6.3 Zinc or Aluminum Coatings -

6.3.1 The metal coating should be inspected for thickness by means of a magnetic or electric thickness gauge. Inspection should follow as closely as possible after completion of the spraying. Unless a minimum thickness is specified the coating thickness should in no place be less than 75% of the nominal thickness.

6.3.2 As a further test, the inspector may cut through the coating with a knife or chisel. If, during the operation, any part of the coating lifts away from the base metal 1/4 inch or more ahead of the cutting blade, without actually cutting the metal away, this is an indication that the bond is improper.

6.3.3 Any defective sections should be blasted clean of all sprayed metal prior to respraying, except that where the rejection has been solely due to too thin a coating, additional sprayed metal may be added if the surface is completely dry and free of visible contamination.

6.4 Sealer Coats - The inspector should verify that sealer coatings have been applied in accordance with Para. 5 and that the coating completely and uniformly covers the metal over the entire surface.

7. TYPICAL COATINGS FOR VARIOUS EXPOSURES

7.1 General

7.1.1 In using this section it is important to recognize that each specific application must be evaluated on the basis of the actual conditions to be encountered in service. The examples given herein are intended only as a guide but will be helpful in arriving at final coatings for a given job.

7.1.2 All thicknesses given in this section are nominal thicknesses.

7.2 Rural Atmospheres - For rural atmospheric conditions, where galvanizing or similar methods are satisfactory, sprayed zinc 0.003 inch thick followed by one or two coats of chlorinated rubber or aluminum vinyl could be used.

7.3 Salt Atmospheres

7.3.1 For average salt atmospheres without salt spray present, zinc or aluminum 0.005 inch thick plus two coats of aluminum vinyl may be used.

7.3.2 For salt atmospheres where salt spray will be present, zinc or aluminum 0.008 inch thick plus one coat of proper primer and two coats of aluminum vinyl may be used.

7.4 Industrial Atmospheres - For more severe industrial atmospheres, the use of aluminum is recommended exclusively as it provides much better protection against sulphurous gases (sulphur dioxide, hydrogen sulphide, etc.) and other gases encountered. For average industrial atmospheres a coating of aluminum 0.005 inch thick plus two coats of aluminum vinyl may be used. For heavier industrial atmospheres, a coating thickness of 0.008 inch plus two coats of aluminum vinyl should be used.

7.5 Fresh and Salt Water Exposure (Continuous Immersion)

7.5.1 For immersion in fresh water having a pH value of over 6.5 and in salt water, only zinc is used, the coating thickness being 0.010 to 0.015 inch. This is satisfactory only when the water temperature does not exceed 120°F. Zinc coatings also have some antifouling properties. In salt or brackish waters, one or two sealing coats of chlorinated rubber may be used.

7.5.2 For fresh water, where the temperature is not over 120°F and where the pH is 4.5 to 6.5, 0.012-inch thick aluminum is used without sealing coats. For this application 99% aluminum should be used.

7.6 Sealer and Finishing Coats - In all cases where two coats of aluminum vinyl have been recommended it is satisfactory to substitute proper primers together with vinyl-alkyd color coats.

8. NOTES

All pressures referred to in this schedule are gauge pressures.

Correspondence regarding this schedule should be addressed to the Secretary, Canadian Government Specifications Board, National Research Council, Ottawa, Canada.