



**Effects of Imposing A Universal Requirement
of G-60 and/or G-90 Coating
For All Components of Ductwork**

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G-60 or G-90 Zinc Coatings Specifications

Introduction

Specifiers should exercise caution and judgment in the consideration of the coating requirements for sheet metal ductwork accessories. Duct system designers should be knowledgeable about construction standards, trade practice, product availability and cost/benefit analysis of any unusually stringent specifications.

While the location and/or intended application for galvanized sheet metal ductwork usually dictates the requirement for G-60 and/or G-90 coating for the ductwork panels, similar coatings for the accessories (i.e., access doors, tie rods, rod hangers, etc.) may not be generally available in the normal supply channels. Special coatings for some accessories may be available at increased costs and delivery times.

Factors To Be Considered

Where ductwork exposures do not involve wet and dry cycles, high humidity and chemically polluted environments, the traditionally used zinc coating amounts reviewed herein have provided satisfactory service life in HVAC system service.

Zinc coating thickness on galvanized sheet has a linear relationship to service life and for building interior service, coating grade G-60, which has two-thirds the life expectancy of G-90, is consistent with anticipated building service life of 30 years. Base metal thickness is reduced as zinc coating is increased.

The service life of both G-60 and G-90 zinc coatings in outdoor exposures is relatively short; G-90 is a recommended minimum on exposed sheet and reinforcements when supplemental paint coatings are not specified. The cost increase for G-90 versus G-60 coated sheet is small **but availability** varies nationally.

Zinc plating on commercially available screws and rivets is about 0.2 mils. G-60 coating weight is 0.34 mils. G-60 zinc coating on tie rods is routinely available. Supplemental coatings are available for fasteners in outdoor exposures.

Any project specification that, for example, purports to make G-90 or G-60 coating a requirement for all steel components incorporated in ductwork and exposed to airflow is a radical departure from trade practice and will entail significant cost increases and procurement and delivery delays.

Fire dampers that comply with UL 555 and other equipment items inserted in ducts will not categorically have G-90 coatings.

**Additional Details and Comment From
SMACNA's HVAC Duct Construction Standards, 2nd Edition, 1995
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1. RECTANGULAR DUCT

Paragraph S1.8, Page 1.8: Unless otherwise specified steel sheet and strip used for duct and connectors shall be G-60 coated galvanized steel of lockforming grade conforming to ASTM A653 and A924 standards. Minimum yield strength for steel sheet and reinforcements is 30,000 psi (207 kPa).

Paragraph S1.11, Page 1.16: The duct gage tables are based on G-60 coated galvanized steel of lockforming grade conforming to ASTM Standards A653 and A924.

Paragraph S1.12, Page 1.16: Unless otherwise specified, reinforcement may be uncoated steel or galvanized steel.

Paragraph S1.21, Page 1.16: Tie rods shall be galvanized steel. All internal ties, whether of rod, tube, pipe, or angle shall be of material having the same nature and corrosion resistance as the duct wall material. Concealed components shall not be subject to nor cause galvanic corrosion. Tie straps, used on positive pressure only, shall be 1" x 1/8" (25 x 3.2 mm) minimum galvanized steel and the smallest edge shall face the airflow.

Comment: All thread rod, partially threaded rod, tubing of pipe, EMT conduit or rigid conduit grades, ASTM A653 grade pipe and angles are routinely available in the marketplace with zinc coatings that meet or exceed the thickness of G-60 coated steel sheet. If hot-dipped, they may have coatings as thick as G-90 sheet. However, the industry has rods, conduits and other structural support members that are electroplated with zinc that is about 0.5 mils (a mil is one-thousandth of an inch). This exceeds the ASTM A653 G-60 coating weight (minimum one side by triple spot test) of 0.34 mils (0.20 oz/ft²; 8.64 micrometers) and is near the G-90 minimum of 0.54 mils (0.32 oz/ft²).

Paragraph S1.41, Page 1.62: Fasteners used on steel duct shall be steel. They may be zinc or cadmium coated. Standard or self-drilling sheet metal screws may be used as appropriate. Blind rivets using pull-through mandrels are not permitted if they leave holes for air leakage. Fastenings shall not project into duct interiors more than 1/2" (13 mm). Where only bolts or welds are specified, other types of fastening are not allowed.

Comment: This specification does not require that zinc coating equivalent to G-60 be used. The prevailing and customary plating on screws and rivets is about 0.2 mils. Special orders and expense would occur as a consequence if coatings equivalent to G-60 or G-90 were demanded. Polymer, chromate or phosphate coatings could be added to the 0.2 mil zinc at additional expense; however, for dry indoor environments, renovation work has not revealed a track record problem with the customary 0.2 mil coated fasteners. Otherwise, pullout and shear test data on thicker zinc-coated fasteners are not known to exist; values could be different.

Cadmium coatings are seldom used but are available. Mechanically deposited coatings per ASTM B696 come in three classes: Class 12 (0.472 mil); Class 8 (0.315 mil); Class 5 (0.197 mil).

Paragraph S2.11, Page 2.25: Liners shall also be installed with mechanical fastening devices that:

- a) are spaced in accordance with Figure 2-21;
- b) when installed, are as corrosion resistant as G-60 coated galvanized steel.

2. ROUND DUCT

Paragraph S3.0, Page 3.1: Round ducts shall be constructed in accordance with Tables 3-2 and 3-3. Table 3-2 is based on G-60 coated galvanized steel of ASTM Standards A653 and A924 grades.

Comment: Stiffeners and fasteners are expected to have coatings as on rectangular ducts.

3. OVAL DUCT

Comment: Paragraph S1.8 applies for ducts of all shapes. Otherwise, reinforcements and fasteners are expected to be zinc coated as specified for rectangular ducts.

4. DUCT HANGERS

Comment: Consult HVAC-DCS Chapter 4 for requirements and options.

5. SERVICE LIFE FORECASTS

- A. Ductwork: 30 years median. Source: ASHRAE Applications Handbook
- B. Zinc Coating, indoors: G-60 — 34 years
G-90 — 54 years

Source: ASTM Standard B695 Appendix, based on mean corrosion rate less than 0.01 mils/year.

- C. Zinc Coating, outdoors (to first rust):
 - 1. Industrial: G-90 — 2.5 to 4 years. G-60 — 1.5 to 2.5 years
 - 2. Marine: G-90 — 2.5 to 6 years. G-60 — 1.5 to 4 years
 - 3. Urban/Suburban: G-90 — 4 years. G-60 — 2.5 years
 - 4. Rural: G-90 — 12 to 25 years. G-60 — 8 to 16 years

Source: ASTM and zinc-related industry research.

Comment: Corrosive elements present can cause significant deviation from averages. The life of zinc coating in a given not-severely-polluted, outdoor atmosphere is generally considered to be linear and varying with thickness. For extensive reporting of corrosion from outdoor atmospheres and chemicals, consult the many publications available from ASM International (www.asm-intl.org) and the National Association of Corrosion Engineers (www.nace.org).

Specification of G-90 coated galvanized steel is recommended for components exposed to weather. Where painting or waterproof coating of exterior insulation is applied G-60 coating may suffice. The commonly used standard for phosphatizing or other treatment is ASTM D2092, Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint. Several publications on surface preparation and painting galvanized steel surfaces, including preventing and treating wet storage stain and touch-up and repair of galvanized surfaces with zinc-rich paint, are available from the American Galvanizers Association (www.galvanizeit.org) and the Society for Protective Coatings (www.sspc.org). (SPC was formerly known as the Steel Structures Paint Council and many codes and specifications still refer to it by its former name.)

Zinc-iron alloy coated steel (also known as "galvanealed") has a grey, unspangled A60 coating that is ready for immediate painting (with normal cleaning); however, it is not suitable for coil coating lines.

Galvanized Sheet Thickness Tolerances

Gage	Thickness in Inches			Weight				Thickness in Millimeters		
	Min.	Max.	Nom.	Min lb/sf	Nom. lb/sf	Max. lb/sf	Nom. kg/m ²	Min.	Max.	Nom.
33	.0060	.0120	.0090	.2409	.376	.486		.1524	.3048	.2286
32	.0104	.0164	.0134	.4204	.563	.665		.2642	.4166	.3404
31	.0112	.0172	.0142	.4531	.594	.698		.2845	.4369	.3607
30	.0127	.0187	.0157	.5143	.656	.759	3.20	.3188	.4783	.3988
29	.0142	.020	.0172	.5755	.719	.820		.3569	.5169	.4369
28	.0157	.0217	.0187	.6367	.781	.881	3.81	.3950	.5550	.4750
27	.0172	.0232	.0202	.6979	.844	.943		.4331	.5931	.5131
26	.0187	.0247	.0217	.7591	.906	1.004	4.42	.4712	.6312	.5512
25	.0217	.0287	.0247	.8407		1.167		.5274	.7274	.6274
24	.0236	.0316	.0276	.9590	1.156	1.285	5.64	.6010	.8010	.7010
23	.0266	.0346	.0306	1.0814		1.408		.6772	.8772	.7772
22	.0296	.0376	.0336	1.2038	1.406	1.530	6.86	.7534	.9534	.8534
21	.0326	.0406	.0336	1.3263		1.653		.8296	1.0296	.9296
20	.0356	.0436	.0396	1.4486	1.656	1.775	8.08	.906	1.106	1.006
19	.0406	.0506	.0456	1.6526		2.061		1.028	1.288	1.158
18	.0466	.0566	.0516	1.8974	2.156	2.305	10.52	1.181	1.441	1.311
17	.0525	.0625	.0575	2.1381		2.546		1.331	1.591	1.461
16	.0575	.0695	.0635	2.342	2.656	2.832	12.96	1.463	1.763	1.613
15	.0650	.0770	.0710	2.6481		3.138		1.653	1.953	1.803
14	.0705	.0865	.0785	2.8725	3.281	3.525	16.01	1.784	2.204	1.994
12	.0854	.1014	.0934	3.4804		4.133		2.162	2.5823	2.372
12	.0994	.1174	.1084	4.0516	4.531	4.786	22.11	2.523	2.983	2.753
11	.1143	.1323	.1233	4.6505		5.394		2.902	3.362	3.132
10	.1292	.1472	.1382	5.2675	5.781	6.002	28.21	3.280	3.740	3.510
9	.1442	.1622	.1532	5.8795		6.614		3.661	4.121	3.891
8	.1591	.1771	.1681	6.4874	6.875	7.222		4.040	4.500	4.270

NOTES:

- Based on ASTM A924/924M-9, Standard Specification for General Requirements for Sheet Steel, Metallic Coated by the Hot-Dip Process (formerly ASTM A525); and ASTM A653/A653M-94, Standard Specification for Sheet Steel, Zinc-Coat (Galvanized) or Zinc-Iron Alloy Coated (Galvanized) by the Hot-Dip Process.
- Tolerances are valid for 48" and 60" wide coil and cut length stock - other dimensions apply to other sheet widths and to strip.
- The lock forming grade of steel will conform to ASTM A653 (formerly ASTM A527).
- The steel producing industry recommends that steel be ordered by decimal thickness only. Thickness and zinc coating class can be stenciled on the sheet. The gage designation is retained for residual familiarity reference only.
- Minimum weight in this table is based on the following computation:
Minimum sheet thickness minus 0.001" of G60 coating times 40.8 lb per sf. per inch plus 0.0369 lb/sf of zinc.
G90 stock would be comparably calculated from:
(t - .00153") 40.8 ÷ 0.05564 = minimum weight.
However, scale weight may run 2% (or more) greater than theoretical weight. Actual weight may be near 40.82 lb. per s.f. per inch.
- G60 coating, per ASTM A653 and ASTM A90, has 0.60 oz/sf (triple spot test) total for two sides. 0.59 oz/sf of zinc equals 0.001". 1 oz is 0.0017" and is 305.15 g/m².
G90 coating is 0.90 oz/sf (triple spot test), or 0.00153". Magnetic gage measurement of zinc coating may have 15% error.
- ASTM D2092, Practice for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint, includes mill phosphatizing.
- ASTM A755 is the Specification for Sheet Steel, Metallic Coated by the Hot-Dip Process and Prepainted by the Coating Process for Exterior Building Products. Other information is available from the National Coil Coaters Association, Philadelphia, PA.
- Much chemical and atmospheric corrosion information is available from ASM International in Metals Park, Ohio and from NACE International in Houston, TX.
- A principle international standard is ISO 3575, Continuous Hot-Dip Process, Zinc-Coated Carbon Steel Sheet of Commercial, Lock Forming and Drawing Qualities.

