CONBYTH Quality Inspection Procedure for Galvalume Steel

1. Purpose and Scope

This procedure defines the quality inspection and control requirements for hot-dip 55% aluminium-zinc alloy coated steel sheet and strip (Galvalume) from incoming raw materials to finished products. It ensures that appearance, dimensional accuracy, mechanical properties and coating performance comply with GB/T 2518, GB/T 14978 and customer specifications. The procedure applies to continuously hot-dip 55% Al - 43.5% Zn - 1.5% Si alloy coated steel in the thickness range 0.20 mm – 3.0 mm, mainly used in building, household appliance, electrical and automotive industries.

2. Applicable Standards

Standard No.	Title	Description
GB/T 2518-2019	Continuously hot-dip zinc and zinc alloy coated steel sheet and strip	Product standard covering zinc and zinc-alloy coatings including Al-Zn
GB/T 14978-2008	Continuously hot-dip 55% Al-Zn alloy coated steel sheet and strip	Specific standard for Galvalume
GB/T 1839-2008	Test method for mass of zinc coating on steel products	Coating weight test method
GB/T 228.1	Metallic materials – Tensile testing – Part 1: Method of test at room temperature	Mechanical properties
GB/T 10125-2012	Corrosion tests in artificial atmospheres – Salt spray tests	Corrosion resistance test
GB/T 232	Metallic materials – Bend test	Coating adhesion (bend test)
YB/T 4456-2022	Color-coated steel sheets and strips for building	Reference standard

Note: GB/T 14978-2008 is currently valid. Please monitor future revisions.

3. Quality Inspection Procedure (Five-Stage Control)

Stage 1 – Incoming Raw Material Inspection

- **Substrate inspection**: Check surface quality of hot-rolled or cold-rolled substrate (no severe rust, residual scale, scratches, oil, inclusions). Measure thickness and width. Re-test mechanical properties per batch.
- **Al-Zn alloy ingot inspection**: Verify chemical composition (Al 55% ± 2%, Zn 43.5% ± 0.2%, Si 1.5% ± 0.1%). Appearance clean, free of inclusions and oil.
- **Post-treatment chemicals**: Confirm type, batch number, concentration/viscosity of passivation solution, anti-fingerprint solution and rust preventive oil. Appearance free of sedimentation.
- **Non-conforming materials:** shall be rejected and a non-conformance notice issued.

Stage 2 – Pre-production Process Check

- **Annealing furnace**: Verify temperature profile, protective atmosphere (dew point, oxygen content), strip centering.
- **Zinc pot and coating control**: Check molten bath temperature (600℃–620℃), bath chemistry (Al, Zn, Si content), air knife parameters (pressure, gap, angle).
- **Skin pass and tension leveler**: Confirm skin pass mill force, elongation, work roll roughness; tension leveler elongation.
- **Post-treatment line**: Check roll coater parameters, passivation/AFP film thickness settings, curing oven temperature, oil application rate.

Stage 3 – In-process Inspection (Online)

Inspection Item	Frequency	Method
Coating weight	At least once per shift	XRF or gravimetric method
Coating thickness	3–5 points per coil	Magnetic thickness gauge
Coating uniformity	Once per shift	XRF or metallographic
Spangle pattern	Continuous visual	Visual + reference spangle panel
Flatness	Head & tail of each coil	Feeler gauge / shape meter
Surface defects	Continuous visual	Visual + auxiliary light
Mechanical properties	At least once per batch	Tensile testing machine
Surface roughness	Once per shift	Roughness tester

Any non-conformity found online shall be immediately marked, recorded and fed back; stop production if necessary.

Stage 4 – Finished Product (Off-line) Inspection

- **Appearance**: Uniform spangle; no skip plating (bare spots), scratches, raised zinc dots, black streaks, black stains, dross adherence.
- **Dimensional accuracy**: Thickness tolerance (point-to-point variation ≤8% of nominal thickness), width tolerance (0 to +5 mm), crescent (sickle) shape (≤4 mm/2 m), flatness (≤3 mm/m).
- **Coating performance**: Coating weight (e.g. AZ100, AZ120, AZ150), coating thickness, 180° bend adhesion (no flaking).
- **Mechanical properties**: Yield strength, tensile strength, elongation (as per grade).
- **Corrosion resistance**: Neutral salt spray test (passivated ≥ 96h white rust free; anti-fingerprint ≥120 h white rust free; high-corrosion grades as agreed).
- **Post-treatment performance**: Passivation corrosion resistance, anti-fingerprint property and anti-blackening property, oil film weight.

Stage 5 – Packaging, Marking and Warehouse Inspection

- **Packaging**: Inner moisture-proof paper/film intact; outer steel strapping tight; edge protectors correctly installed.
- **Marking verification**: Label information (product name, grade, dimensions, coating weight, surface treatment, batch number, net weight, production date) matches coil and quality certificate.
- **Warehouse re-inspection**: Random re-inspection per batch; non-conforming product handled according to non-conformance procedure.

4. Key Inspection Items and Acceptance Criteria

4.1 Appearance

Item	Acceptance Criteria	Method
Spangle	Matches reference panel; uniform size and distribution	Visual comparison
Surface defects	No skip plating, bare spots, scratches, raised zinc dots, black streaks, black stains, dross	Visual + auxiliary light
Colour/gloss (AFP/oiled)	Uniform	Visual / glossmeter

4.2 Dimensions and Shape

Item	Acceptance Criteria	Method
Thickness	Nominal ± tolerance; point variation ≤8% of nominal	Micrometer / thickness gauge
Width	0 to +5 mm (per standard or contract)	Steel tape / width gauge
Crescent (sickle)	≤4 mm per 2 m	Straight edge + feeler gauge
Flatness	≤3 mm per metre	Feeler gauge

4.3 Coating Performance

Item	Acceptance Criteria	Method	Standard
Coating weight	Meets order requirement (e.g. AZ100 → 100 g/m² both sides)	Gravimetric / XRF	GB/T 1839
Coating thickness	Meets order requirement	Magnetic gauge	GB/T 2518
Coating adhesion (bend)	180° bend, no flaking	Bend test	GB/T 232

4.4 Mechanical Properties (Typical Grades)

Grade	Yield strength ReL (MPa)	Tensile strength Rm (MPa)	Elongation A80mm (%)
DX51D+AZ	140 – 300	270 – 500	≥22
S250GD+AZ	≥250	≥330	≥18
S350GD+AZ	≥350	≥420	≥14
S550GD+AZ	≥550	≥570	≥8

4.5 Corrosion Resistance

Item	Acceptance Criteria	Method
Neutral salt spray (passivated)	≥96 h, no white rust	Salt spray chamber
Neutral salt spray (anti-fingerprint)	≥120 h, no white rust	Salt spray chamber
Neutral salt spray (high corrosion)	500–1000 h, no red rust (as agreed)	Salt spray chamber
Humidity resistance	≥48 h, no white rust	Constant climate chamber

4.6 Post-treatment Performance

Treatment	Inspection Item	Acceptance Criteria
Passivation	Corrosion resistance	Salt spray test passes
Anti-fingerprint (AFP)	Anti-fingerprint property	No permanent mark after sweat/oleic acid wipe
Anti-fingerprint (AFP)	Anti-blackening	No darkening after humidity test
Oiling	Oil film weight	Meets process requirement

5. Common Defects – Identification and Disposition

Defect	Description	Probable Cause	Disposition
Skip plating / bare spot	Local area without coating	Residual scale, poor cleaning, poor wettability	Scrap or downgrade; check cleaning section
Raised zinc dot	Local point-like protrusion	Residual iron oxide	Light: grind; severe: scrap
Dross adherence	Lump or particle on surface	Dross not removed; air knife blow-off insufficient	Light: remove by grinding; severe: scrap; clean dross
Black streak	Longitudinal black line	Substrate scratch causing uneven passivation film	Scrap or downgrade; inspect rolls
Black stain	Local black patch	Uneven coating thickness leading to uneven passivation	Scrap or downgrade; optimise air knife
Scratch	Linear mark	Foreign matter or damage on line roller	Light: repair; severe: scrap
Uneven spangle	Non-uniform spangle size	Bath temperature fluctuation, uneven cooling	Adjust process parameters
Coating flaking	Peeling during forming	Abnormal substrate, excessive coating thickness, surface oxidation	Scrap; adjust coating process

Defect	Description	Probable Cause	Disposition
Poor flatness	Wavy edge, bow	Improper skin pass / leveler parameters	Downgrade or scrap; adjust process
Film weight out of spec	Passivation/AFP film too high or low	Roll coater parameters incorrect	Adjust parameters; over-thick: rework

6. Quality Records and Reports

The quality inspector shall maintain the following records:

1. **Raw material inspection records**: Substrate batch number, thickness, surface quality; chemical composition of Al-Zn ingots; batch numbers and concentration of post-treatment chemicals.
2. **In-process inspection records**: Coating weight, thickness, spangle pattern, flatness, surface defects per coil/shift.
3. **Mechanical properties test records**: Yield strength, tensile strength, elongation.
4. **Corrosion resistance test records**: Salt spray and humidity test data.
5. **Finished product test report**: Final inspection data per batch, including quality certificate.
6. **Non-conformance handling records**: Non-conforming item, quantity, disposition, corrective action and verification.
7. **Instrument calibration records**: Regular calibration and maintenance of all testing equipment.

Special note: The 55% Al-Zn coating has a relatively high thermal emissivity (approx. 0.86). If the material is subsequently coil‑ coated, the curing curve should be adjusted (step-wise heating, reduced line speed) to avoid pinhole/blister defects. Quality inspectors should be aware of this characteristic and provide relevant advice when needed.