ISOTEC ENERJİ / TECHNICAL REPORT

Specification, Composition, Testing, and Inspection Plan for ZM-Coated Steel Sheets

This report provides an applicable technical framework for procurement, incoming quality control, supplier approval, and project-based verification.

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Usage Note	This report is based on standards uploaded by the user, manufacturer publications, EN 10204 Type 3.1 certificates, and publicly available sources verified as of 16.04.2026.

Critical terminology note: *"Magnelis" is a registered trademark. For technical accuracy, the generic term "ZM (Zn-Al-Mg) coated steel" is used wherever possible in this study; manufacturer-specific data are separated accordingly.*

Executive Summary

• A single-layer acceptance criterion is not sufficient for ZM-coated steel sheets; at minimum, three levels of control are required: base-steel chemistry/mechanical properties, coating class/mass, and supplier-specific coating chemistry and performance.

• EN 10346 is the primary standard for base steel and coating mass; however, it does not prescribe a brand-independent exact ZM chemistry. Therefore, the product family and the verification method should additionally be stated in the contract.

• For routine shipment acceptance, use 100% document review plus surface / thickness verification; for supplier qualification and dispute resolution, use destructive coating-mass and advanced chemical verification.

• For PV plant structures, welding, cutting, drilling, soil/concrete contact, and galvanic coupling require not only laboratory testing but also a project specification and EN 1090-2 on-site execution control.

• Published in late 2024, ISO 8353 is a dedicated international standard for ZM-coated steel. In Europe and Turkey, EN 10346 remains the primary reference.

1. Technical Clauses That Must Appear in the Procurement Specification

Specification Heading	Recommended Wording	Why It Matters
Steel grade	EN 10346 S350GD / S420GD / S450GD	Forms the basis of both structural strength and the certificate
Coating class	ZM310 / ZM430 / ZM620*	Determines corrosion resistance and coating thickness
Document level	EN 10204 Type 3.1	Explicitly required by TS 13891
Surface protection	C / O / CO / P / PO / S	Affects storage and paintability behavior

Specification Heading	Recommended Wording	Why It Matters
Supplier chemistry	Magnelis / PosMAC / equivalent ZM – bath composition declared	Supports any brand-specific performance claim
Application limits	Atmospheric class, distance from shoreline, soil/concrete contact, welding yes/no	Prevents misinterpretation of warranty

Recommendation: *Instead of "Magnelis sheet", procurement language should state the normative designation first, followed by the brand. Example: "EN 10346 S420GD + ZM430, ArcelorMittal Magnelis® or equivalent; for an equivalent product, the coating chemistry and field performance shall be separately evidenced."*

2. What Should the Chemical Composition Be?

This question must be answered at two distinct levels:

- **Base steel chemistry:** The limits in EN 10346 Table 2 for structural steels must be met. For S350GD, S420GD, and S450GD, the applicable limits are: C ≤ 0.20%; Si ≤ 0.60%; Mn ≤ 1.70%; P ≤ 0.10%; S ≤ 0.045%.
- **Coating chemistry:** The generic ZM definition in EN 10346 is Al + Mg total 1.5%-8%, Mg ≥ 0.2%, balance Zn. However, this does not make brand-specific formulations such as Magnelis or PosMAC equivalent.

Level	Mandatory Criterion	Additional / Preferred Criterion
Base steel	EN 10346 chemical limits and mechanical minimums	Declaration of any micro-alloying on the 3.1 certificate
Generic ZM coating	EN 10346 ZM definition and coating mass	Supplier declaration of coating density and per-side distribution
Brand-specific coating	Bath chemistry or manufacturer technical data sheet	Field performance, warranty, cut-edge data, and soil-contact data

3. Which Test Answers Which Question?

Purpose	Recommended Method	Standard / Reference	Destructive?	Use
Base steel chemistry	Spark OES / spectral analysis	TS EN 10351, TS EN 14726, ASTM E415	No / minimal	Identity confirmation of S350GD-S450GD
Tensile properties	Tensile test	EN ISO 6892-1	Yes	Verification of Rp0.2 / Rm / elongation
Coating mass	Chemical stripping + mass difference	EN 10346 Annex A	Yes	Arbitration and lot acceptance
Coating thickness	XRF or magnetic measurement	ASTM B568, ISO 3497, ISO 2178	No	Fast process / incoming control
Section thickness / layer morphology	Cross-section microscopy	ASTM B487	Yes	Local thickness and structural examination
Coating element distribution	GD-OES depth profiling	Method validation required; ISO 16962 / lab internal method framework	Yes	Zn-Al-Mg distribution / profile

Purpose	Recommended Method	Standard / Reference	Destructive?	Use
Local point chemistry	SEM/EDS	Internal laboratory method	Generally yes	Phase / local composition mapping
Total chemical verification	Dissolution + ICP-OES / ICP-MS	Lab-validated method	Yes	Dispute resolution / R&D
Salt spray	NSS / AASS / CASS	ISO 9227:2022	No	Supplier qualification, not lot acceptance
Removal of corrosion products and mass loss	Cleaning + gravimetric assessment	ISO 8407:2021 + Amd.1:2025	Yes	Post-field / post-cyclic-test mass loss

Critical note: EN 10346 provides the normative arbitration method for ZM coating mass; however, it does not by itself answer the question "Is it Magnelis or PosMAC? What is the Mg/Al ratio?" For that, a supplier data sheet and a validated additional analytical method are required.

4. Recommended Structure for Routine Incoming Quality Control

Inspection Step	Frequency	Acceptance Criterion	Decision
3.1 certificate review	Every coil / every lot	Grade, coating class, mechanical results, heat no., lot no. consistent	Lot held if nonconformant
Visual surface check	Every coil / every package	No cracks, scratches, coating blowouts, or heavy staining	Segregation on nonconformance
XRF coating thickness	At least 3 points/side per coil or per internal procedure	Within expected range for the specified class	Out-of-limits → destructive verification
Base steel OES verification	New supplier, grade change, periodic audit	Within EN 10346 chemical limits	Supplier CAPA on deviation
Tensile testing	First approval, grade change, complaint, periodic audit	Rp0.2 / Rm / A80 minimums satisfied	Reject if not satisfied
Coating mass stripping test	First approval, dispute, critical project, periodic audit	EN 10346 individual and triple-test criteria	Used as arbitration data
Advanced chemical analysis	Only for supplier qualification, dispute, or brand verification	Mg/Al/Zn profile consistent with product family	Determines brand equivalence

5. Acceptance Criteria – Recommended Internal Procedure for ISOTEC

Inspection Item	Minimum Expectation	Advanced Expectation
Documentation	EN 10204 Type 3.1	3.1 + brand data sheet + project warranty
Base steel chemistry	EN 10346 Table 2 limits	Periodic verification via OES
Mechanical properties	S350GD / S420GD / S450GD minimums	Internal confirmation on first-article

Inspection Item	Minimum Expectation	Advanced Expectation
Coating mass	Ordered ZM class	EN 10346 Annex A arbitration in case of dispute
Surface condition	Consistent with EN 10346 §7.4–7.6	Additional surface conformity check prior to paint/duplex
Post-weld / post-cut	Repair plan per EN 1090-2	Linked to routine work order / welding procedure
Galvanic coupling	Steel-aluminum contact verified	Insulation elements and water-drainage details confirmed

6. Welding, Cutting, Drilling, and Post-Assembly Inspections

• If welding is performed on a pre-coated product, the coating repair method and the boundary of the repair zone must be explicitly stated on the work order.

• EN 1090-2 requires the repair method to be defined in the specification if pre-coated products are welded.

• If a hot-dip galvanized coating is damaged by welding, EN 1090-2 requires a zinc-rich repair system providing equivalent protection.

• For ZM products, cut-edge behavior following laser, plasma, or shear cutting varies by manufacturer; for project-critical work, internal cyclic-test data should be generated.

• For elements in continuous contact with soil or concrete, the atmospheric classification table alone is insufficient; additional verification matched to site conditions is required.

7. Example Specification Text

Example text: *"The material shall conform to EN 10346. The steel grade shall be S420GD. The coating class shall be a minimum of ZM430. The material shall be supplied with EN 10204 Type 3.1 certification. The supplier shall declare the coating chemistry and the commercial product family used (e.g., Magnelis®, PosMAC®) by way of a data sheet. If welding or thermal cutting is performed on pre-coated elements, a coating repair method in accordance with EN 1090-2 shall be defined in advance."*

8. Current Standards Landscape

Published at the end of 2024, ISO 8353 establishes a dedicated international product standard for ZM-coated steel. EN 10346 remains the primary reference for projects in Europe and Turkey; however, for international contracts, consideration of ISO 8353 as an additional reference is recommended.

References

• TS EN 10346:2015 – in particular §3.4, Table 2, Table 8, Table 12, §7.4.5, §7.6, §8.1–8.5.5.

• TS 13891:2019 – pp. 5–9; clauses 5.2, 5.5, 6.2.2, and 6.2.4.

• TS EN 1090-2:2018 – pp. 80–81; clauses 10.4, 10.5, and 10.9.

• TS EN ISO 1461:2022 – acceptance criteria and hot-dip galvanizing thickness/mass tables.

• ISO 3497:2000, ISO 2178:2016, ISO 9227:2022, ISO 8407:2021/Amd 1:2025 – verified via publicly available official summary pages; access date 16.04.2026.

• ISO 8353:2024 – dedicated international standard for ZM-coated steel; access date 16.04.2026.