Light Steel Framing: Steel Grades, Properties, and Standards

Light-gauge framing (“LSF”) uses cold-formed, high-strength steel sheets that are roll-formed into studs, tracks, joists, etc. These sheets are typically hot-dipped galvanized or zinc-aluminium coated to prevent corrosion [1]. Coiled steel stock (as shown below) is produced to stringent material grades and coating classes, so that yield strength and durability meet code requirements.

Figure: Coiled galvanized steel sheet (spangled finish) ready for roll-forming. LSF steels are specified by standardized grade and coating (e.g. AS1397/G550/AM125 or ASTM A653/G90) to ensure consistent strength and corrosion protection [2] [3].

Material is designated by yield strength. For example, AS/NZS “G550” steel guarantees ≥550 MPa yield, “G450” ≥450 MPa [2] [4]. European standards use S-grades: e.g. S350GD (Z275 galvanize) means ≥350 MPa yield [5]. ASTM A1003 uses names like “Structural Grade 50” (≈345 MPa) [6]. Designers should note both yield *and* tensile strengths: typical high-strength LSF steel might have 550 MPa yield and ~580–600 MPa tensile, whereas lower grades (300–450 MPa) have proportionally lower tensile [4] [7]. Elongation is also listed – G550 steel often has limited ductility (~4–8% at ≥0.6 mm) while G450 steel offers higher elongation (~9%) [4] [8]. The yield-to-tensile (Y/T) ratio is a key check (typically 0.75–0.85 for LSF grades) and is often provided on the mill test report.

- **Common Grades:** For example, *G300* (min 300 MPa yield, ~340 MPa tensile, ≥20% elongation) [9]; *G450* (≥450 MPa, ~480 MPa, ~9%) [4]; *G550* (≥550 MPa, ~580–600 MPa, ~4–11%) [7] [8]. European *S350GD* (zinc-galvanized) requires Rp0.2 ≥350 MPa, Rm ≥420 MPa, A80 ≥16% [10]. ASTM

"Grade 50 Type H" similarly calls for 50 ksi (≈345 MPa) yield, 65 ksi (448 MPa) tensile, 10% elongation [6].

Coating and Corrosion Protection

Coatings are specified by weight (g/m²) and alloy. Zinc (galvanized) or Zn-Al alloys (e.g. 55% Al) protect the steel sacrificially. For example, AS/NZS defines **AZ150** as a 150 g/m² total aluminium-zinc coating [11], while ASTM "G90" (Z275) is ~275 g/m² total zinc [3]. Thicker coatings (AZ200/Z450, etc.) give longer life in harsh environments. Datasheets will state the coating class (e.g. AZ150, ZA80) and typically include a 180° bend adhesion test. In practice LSF members often use at least AZ150 or Z275 on exterior surfaces. Manufacturing often adds a chromate or other passivation and a light resin/oil coating to inhibit **white rust** during storage [12].

For example, Zincalume® G550 steel is supplied with an AZ150 coating (≥150 g/m² total) and a fine spangled finish [13] [11]. The coating mass is guaranteed by tests: AZ150 (150 g/m²) and AZ200 (200 g/m²) each have specified triple-spot adhesion values [11]. ASTM standards govern the same concepts: A653 (galvanized) and A792 (55% Al-Zn) are commonly used for LSF sheet [14]. Under either system, verify that the coating class meets the project's corrosion category (e.g. 1-2 oz/ft² Zn per side for moderate exposure [3]).

Thickness Tolerances and Quality

Coated steel gauges are tightly controlled. Standards like AS/NZS 1365 or ASTM A1003 define tolerances. For thin sheet, AS/NZS 1365 (Class A) typically allows ±0.03 mm on 0.30–0.50 mm thickness and ±0.05 mm on ~1.0 mm [15]. (Width tolerances are also given, e.g. ±0.5–1.0 mm.) Flatness is usually Class A (minimal waviness) [16]. ASTM A1003 historically required ordering by base-metal thickness, but since 2013 permits specifying coated thickness if agreed [17]. In any case, the datasheet should state the tolerance class. For LSF, Class A or "plenum" tolerances are common.

Other checks: Verify whether the listed thickness is **base** metal or includes coating. Check tolerances on width/length (slit coil width, etc.) and flatness. Many producers include flatness class (A or B). Also look for any special tests (e.g. full-width in-sheet thickness mapping) or certificates (e.g. EN 10204 inspection document).

International Standards (ASTM, EN, ISO, etc.)

- **ASTM (North America):** Cold-formed framing steel is specified by ASTM A1003 (incorporating earlier A653/A792/A875) [18]. Structural "Grade 33"/"Grade 50" (Type H) correspond to former A653 "SS33"/"SS50" [6]. These specify mechanicals in ksi (33, 50 ksi) and require ~10% elongation [6]. Coating classes G40–G90 (galvanized oz/ft²) or AZ coatings (A40–A120) appear in A653/A924. ASTM standards use psig values and imperial units, but are essentially equivalent to metric specs.

- **EN/ISO (Europe and International):** EN 10346 (superseding EN 10147) covers hot-dip coated sheet. It defines steel grades S250GD through S550GD, where the number is Rp0.2 in MPa [10]. For example, S350GD requires Rp0.2 ≥350 MPa and ≥16% elongation [10]. Coatings Z (zinc), ZA (Zn-Al), ZM (Zn-Al-Mg) are given in g/m² (EN uses total both sides like AS/NZS). Testing is per EN-ISO standards: e.g. EN-ISO 6892-1 for tension [19]. Mill test certificates conform to EN 10204.

- **AS/NZS (Australia/New Zealand):** AS 1397 covers coated sheet (up to 5 mm) and AS/NZS 4600 covers cold-formed members. Steel grades (e.g. G300, G450, G550) are defined by yield (MPa) [2]. Coating classes (Z, ZM, ZA, AM, etc.) and surface finish (spangle) are standardized [2]. AS 1397 requires coils to be marked with the standard number, base thickness, steel grade and coating (see "AS 1397/G550/AM125" example) [2].

- **ISO (global test methods):** Various ISO standards govern test methods (e.g. ISO 6892-1 for tensile, ISO 7500 for strain measurement). ISO 9001 certification is common for quality systems, and ISO 3576 (bend test) parallels ASTM bend tests. While there is no single "ISO framing steel" spec, global manufacturers often cite ISO methods in their reports (e.g. ISO 6892-1 tensile) [19].

Each system aligns closely in intent, though units and some requirements differ (e.g. ASTM's 10% elongation vs EN's 16%). Checking the equivalence table or manufacturer cross-references (e.g. EN S350GD ≈ ASTM Grade 50) is prudent.

G550 vs G450 Comparison

- **Strength:** G550 guarantees ≥550 MPa yield vs G450 ≥450 MPa [4] [7]. Correspondingly, tensile strength is higher for G550 (~580–600 MPa) than G450 (~480 MPa) [4] [20].
- **Ductility:** G550 is stiffer; its elongation can be as low as ~4% in thicker gauges [8]. G450 typically offers higher elongation (~9% at ≥0.6 mm) [4], making it more forgiving for tight bends.
- **Formability:** High-strength G550 usually requires larger bend radii. Data sheets often note G550 can be roll-formed to a minimum internal diameter ~4×thickness [21]. G450 (and G300) can typically roll into tighter radii (e.g. G300 allows ~1×thickness) [22].
- **Applications:** G550 is used where weight or section modulus must be minimized (longer spans or higher loads), whereas G450 is chosen for moderate loads or where greater ductility is desired. Cost is generally higher for G550 due to alloying. In any case, engineers must ensure the chosen grade's strength **and** formability meet design and fabrication needs.

Key Datasheet Parameters (Checklist)

When sourcing LSF steel, verify that the manufacturer's data sheet specifies all of the following:

- **Steel Grade & Standard:** Confirm the grade designation (e.g. G550, S350GD, ASTM Grade 50) and applicable spec (AS 1397/EN 10346/ASTM A1003) [2] [10]. Ensure the grade's guaranteed min yield/tensile match project requirements.
- **Mechanical Properties:** Check minimum yield and tensile strengths, and minimum elongation (at specified gauge) [4] [10]. The datasheet should state these values *with coating intact*. Also look for yield point (Rp0.2 or Rp0.05) if given.
- **Coating Class & Mass:** Verify the coating type (galvanized Zn, Galvalume (Zn-Al), Zn-Fe, etc.) and class (e.g. AZ150, Z275/G90) [11] [3]. The table should show mass in g/m^2 or oz/ft^2 (total both sides). Confirm there is a 180° bend adhesion (spot test) result.
- **Thickness & Tolerance:** Confirm the nominal base-metal thickness and its tolerance. The tolerance class (typically AS/NZS Class A or ASTM Class) should be listed [15] [16]. Clarify whether the dimension is base thickness or coated thickness (ASTM A1003 allows either if specified [17]).

- **Width/Length & Flatness:** Check coil/slit width and length ranges, and flatness tolerance. A Class A flatness (low surface waviness) is common [16].
- **Surface Finish & Treatments:** Note the visible finish (spangled vs smooth) and any passivation/oil coat. Most LSF steel is **passivated and resin-coated** for corrosion inhibition [12]. If "as-oiled", the datasheet should warn that further coating is needed for exposure.
- **Formability Data:** Look for minimum bend radii or roll-forming capability. Sheets often list ratings (1–5) or explicit radii (e.g. ≥3–4×thickness for high strength) [21] [22]. This ensures the steel can be formed into the intended profiles.
- **Chemical Composition:** While generally low-carbon (<0.20%) steels are used, confirm carbon and alloying limits if provided [23]. Lower C and alloy improves formability.
- **Certifications & Markings:** Ensure the coil is marked per the standard (e.g. "AS 1397/G550/AM125, t=1.0 mm") [2] [24]. The mill or supplier should provide an inspection certificate (EN 10204 3.1/3.2 or ASTM MTR) showing the test results.
- **Standards Compliance:** Confirm the datasheet references the correct standard and grade. If design is per AISI/AISI or Eurocode, the steel spec must align. Discrepancies between ASTM vs EN names (ksi vs MPa) should be clarified with equivalency tables if needed [6] [10].

In summary, an LSF steel datasheet should explicitly state the grade, mechanicals, coating class, thickness (with tolerance), and applicable standards. Checking these parameters (and reviewing mill test certificates) ensures the steel will perform as required in the structure.

Sources: Authoritative steel producer datasheets and industry technical references [13] [25] [7] [2] [10] [1] [9] [12] [6], among others.

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