ASTM INTERNATIONAL

ASTM

ASTM International, formerly known as the American Society for Testing and Materials, was founded in 1898 and is headquartered in West Conshohocken, Pennsylvania, USA. It is an international standards organization.

ASTM has developed over 12,000 standards covering metals, plastics, construction materials, petroleum, medical devices, and other fields to ensure product quality and consistency.

ASTM collaborates with ISO, ANSI, SAE, ASME, and other organizations to promote standard harmonization and global standardization development.

ASTM Standard Naming Method and Structure

① Standard Code + ② Letter Classification Code + ③ Standard Serial Number + ④ Establishment Year (Revision Year) + ⑤ Revision Version

① **Standard Code:** ASTM.

② **Letter Classification Code:** (Refer to page 4).

③ **Standard Serial Number:** A standard serial number with the letter "M" indicates a metric standard, while one without "M" indicates an imperial (inch–pound) standard.
Example: ASTM C685/C685M–2001 is a metric standard.

④ **Establishment Year (Revision Year):** The year in parentheses after the establishment year represents the standard' s reapproval year.
Example: ASTM A605–72(1977) indicates that the specification was originally published in 1972 and reapproved in 1977 without content changes.

⑤ **Revision Version:** a, b, c... represent revision versions.
Example: ASTM A36–77a (Refer to page 4).

② Letter Classification Code

Category A: Ferrous metals (ferrometallic)

Contain: carbon steel, alloy steel, cast steel, cast iron
Use: For structural, mechanical processing, mold, wear-resistant applications

Standard	Steel Grade	Application
ASTM A36	Structural Steel	Buildings, Bridges, Mechanical Structures
ASTM A572	High-Strength Low-Alloy Steel (HSLA Steel)	Construction, Engineering, Machinery
ASTM A514	Wear-Resistant Steel / Abrasion-Resistant Steel	Mining Equipment, Mechanical Structures
ASTM A108	Carbon Steel Bar	Mechanical Parts, Turning Processing
ASTM A681	Tool Steel	Cutting Tools, Molds
ASTM A295	Bearing Steel	Rolling Bearings, Machine Shafts
ASTM A536	Ductile Cast Iron	Compressor Housings, Gears
ASTM A48	Gray Cast Iron	Motor Housings, Valve Bodies

Category B: Non-ferrous metals and alloys

Includes: Copper, Aluminum, Magnesium, and Their Alloys
Application: Suitable for conductivity, corrosion resistance, and lightweight applications

Standard	Steel Grade	Application
ASTM B209	Aluminum Plate	Aerospace, Construction, Automotive
ASTM B221	Aluminum Extrusions	Engineering Structures, Mechanical Components
ASTM B103	Copper Alloy	Electrical Components, Bearings
ASTM B505	Copper-Aluminum Alloy	Corrosion-Resistant Parts

Category C: Material Testing and Analysis Standards

Includes: Metal material testing methods, non-destructive testing, corrosion resistance testing
Application: Suitable for quality inspection, material research, and failure analysis

Standard	Steel Grade	Application
ASTM A370	Metal Mechanical Properties Testing	Used for testing tensile strength, impact resistance, and hardness properties
ASTM E8	Tensile Test	Tests tensile strength and yield strength
ASTM E10	Brinell Hardness Test	Tests hardness
ASTM E18	Rockwell Hardness Test	Tests surface hardness
ASTM E23	Charpy Impact Test	Tests low-temperature impact toughness
ASTM E92	Vickers Hardness Test	Tests hardness of small components
ASTM E466	Fatigue Test	Tests material lifespan
ASTM G101	High-Strength Low-Alloy Steel (HSLA Steel)	Tests corrosion resistance of steel

This classification method is primarily applicable to steel materials and testing standards, making it more suitable for metal processing, mechanical engineering, and material inspection. Unlike ASTM's official 16-category standard system, this classification is based on the practical needs of the steel industry, enabling engineers and technical personnel to quickly identify and apply relevant standards.

④ Establishment Year (Revision Year)& ⑤ Revision Version

- Establishment Year or Latest Revision Year:
  The number following the specification code indicates the year the **specification was established** or **the latest revision year.**
  Example:
  A36–77 → Revised in 1977
  A276–19 → Revised in 2019

- Revision Version:
  If a lowercase letter (a, b, c...) follows the year, it indicates the Xth revision within that year.
  Example:
  A36–77**a** → **Second revision in 1977**
  A36–77**b** → **Third revision in 1977**

ASTM Standard Naming Method

Example:

ASTM A36–77a

- a → Indicates the "second revision" within the year 1977.
- 77 → Indicates the "year," revised in 1977.
- A36 → Indicates "ferrous metals" category and "structural steel"

※The second revision of the A36 specification was published in 1977.

◆ If a specification is **tentative**, the letter "**T**" is added after the year. "T" indicates that the standard was still in a **tentative** or **provisional stage** at the time (e.g., 1960) and had **not yet become an official ASTM standard**.
It might undergo further modifications based on subsequent testing and practical applications before formal publication.
This marking was more common in older ASTM standards.

Example:

ASTM A36–60T

- A36 → Specification number for structural steel
- 60 → Year, established in 1960
- T → Tentative nature, still in the testing phase

※ Indicates that A36 was established in 1960 as a tentative specification.

◆ **Gray Cast Iron**

Example:

ASTM A48–20

- A → Ferrous Metals (Cast Iron)
- 48 → Standard Number (Represents "Gray Cast Iron")
- 20 → Revised in 2020

Steel Symbol Indication

◆ Tensile Testing Method Standard

Example:

ASTM E8-21

- E → Testing Methods Category
- 8 → Standard Number (Represents "Tensile Testing Method")
- 21 → Revised in 2021

◆ Tool Steel Standard

Example:

ASTM M2

- M → Material Number
- 2 → Tool Steel Category

Labeling	Material Type
A	Air-Hardening Medium Alloy Cold Work Tool Steel
D	High Carbon High Chromium Cold Work Tool Steel
F	C-W Tool Steel
H1	Medium Carbon High Chromium Hot Work Die Steel
H2	W-Series Hot Work Die Steel
H4	Mo-Series Hot Work Die Steel
L	Low-Alloy Special-Purpose Tool Steel
M	Mo-Series High-Speed Tool Steel
O	Oil-Hardening Cold Work Tool Steel
P	Low Carbon Tool Steel
S	Shock-Resistant Tool Steel
T	W-Series High-Speed Tool Steel
W	Water-Hardening Tool Steel

AISI

The American Iron and Steel Institute (AISI) is a key industry association representing U.S. steel producers.

AISI's primary objectives include collecting and disseminating statistical data and information for industry stakeholders, conducting industry research, providing a forum for discussing critical issues, and safeguarding the interests of the steel industry.

Initially responsible for steel classification, AISI no longer develops standards, with SAE now handling updates.
Three-digit (3-digit) codes are primarily used for stainless steels (300 and 400 series).

AISI Early Numbering System

AISI Specifications vs. SAE Specifications
AISI specifications are generally similar to SAE specifications, but AISI includes an additional prefix letter before the numerical code to indicate the steelmaking process.

For example: AISI **C** 1045 indicates that the steel was produced using the **basic open-hearth process**.

The steelmaking process codes include five letters (A, B, C, D, E), with their meanings as follows:

First Letter	Representation Meaning
A	Basic Open-Hearth Alloy
B	Acid Bessemer Carbon
C	Basic Open-Hearth Carbon
D	Acid Open-Hearth Carbon
E	Electric Furnace

Example:

AISI A 2340 indicates a nickel alloy steel produced using the basic open-hearth process.

- Nickel content: Approximately 3% (actual range: 3.25–3.75%).
- Average carbon content: 0.40% (actual range: 0.38–0.43%).

AISI Stainless Steel Naming Method

AISI (American Iron and Steel Institute) uses a "three-digit" numbering system to designate various standard grades of stainless steel.

Series	Main Composition	Microstructure
200 Series	Cr-Ni-Mn (Chromium-Nickel-Manganese)	Austenitic
300 Series	Cr-Ni (Chromium-Nickel)	Austenitic
400 Series	Cr (Chromium)	Ferritic Martensitic

Example:

AISI 316

- 316 → Serial Number (Represents Cr-Ni-Mo Stainless Steel)
- 3 → Material Category (300 Series) Hardened Stainless Steel

Hardened Stainless Steel
Cr-Mn-Ni-N Austenitic Stainless Steel
Cr-Ni Austenitic Stainless Steel
High-Cr Martensitic Stainless Steel
Low-C High-Cr Ferritic Stainless Steel
Low-Cr Martensitic Stainless Steel

SAE

Society of Automotive Engineers (SAE International) was founded in 1905 and is a key organization in the global automotive, aerospace, and commercial vehicle engineering fields.

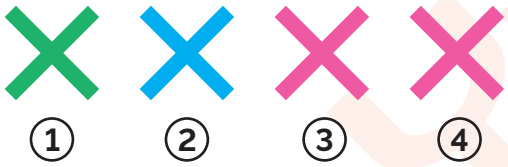
SAE develops standards for materials, mechanical, and electronic technologies, while also providing technical research and educational training.

Its standards are widely applied and are developed in collaboration with ISO, ASTM, and other organizations to advance engineering technology.

Steel Symbol Indication

ASTM、AISI、SAE

- SAE is responsible for the naming of carbon steel and alloy steel, using a four-digit (4-digit) coding system, primarily applied in machinery, automotive, and aerospace steels.
- The SAE steel numbering system uses four-digit numbers to represent steel grades:



① First Digit: Primary Alloying Element Type

1 – Carbon Steel　2 – Nickel Steel　3 – Nickel-Chromium Steel
4 – Molybdenum Steel　5 – Chromium Steel
6 – Chromium-Vanadium Steel　7 – Tungsten Steel
8 – Nickel-Chromium-Molybdenum Steel
9 – Silicon-Manganese Steel

Example: 2320 – The first digit "2" indicates Nickel Steel.

② Second Digit: Alloying Element Content
Example: 2320 – The second digit "3" indicates approximately 3% Nickel content.

③ ④ Third and Fourth Digits: Carbon Content (in 0.01% units)
Example: 1095 – Carbon Steel, with an average carbon content of 1%.

- Practice Examples:

2320 – Nickel Steel, with an average nickel content of 3.0% and an average carbon content of 0.20%.

4130 – Nickel-Chromium Steel, with an average nickel and chromium content of 1.0% and an average carbon content of 0.30%.

6150 – Chromium-Vanadium Steel, with an average chromium and vanadium content of approximately 1.0% and an average carbon content of 0.50%.

Introduction to the SAE/AISI Designation System

- The SAE designation system uses a straightforward four-digit numbering scheme, with some alloy steels using five digits (51XXX; 52XXX). The system's structure is as follows:

Carbon Steel Classifications

10xx series: Plain carbon steels (1.00% Mn maximum)
11xx series: Resulfurized carbon steels
12xx series: Resulfurized and rephosphorized carbon steels
15xx series: Non-resulfurized high-manganese carbon steels (up to 1.65%)

Alloy Steel Classifications

The first digit indicates the primary alloying element:
2xxx: Nickel steels
3xxx: Nickel-chromium steels
4xxx: Molybdenum steels
5xxx: Chromium steels
6xxx: Chromium-vanadium steels
7xxx: Tungsten-chromium steels
9xxx: Silicon-manganese steels

Additional Designations

Special letter designations provide further classification:
B: Indicates boron content (0.0005-0.003%)
L: Indicates lead content (0.15-0.35%)
M: Designates merchant quality steel
E: Indicates electric-furnace steel
H: Indicates hardenability requirements

The SAE/AISI steel numbering designation system

Carbon steels	10XX	Plain carbon, Mn 1.00% max
	11XX	Resulfurized free machining
	12XX	Resulfurized/rephosphorized free machining
	15XX	Plain carbon, Mn 1.00–1.65%
Manganese steels	13XX	Mn 1.75%
Nickel steels	23XX	Ni 3.50%
	25XX	Ni 5.00%
Nickel–chromium steels	31XX	Ni 1.25%, Cr 0.65–0.80%
	32XX	Ni 1.75%, Cr 1.07%
	33XX	Ni 3.50%, Cr 1.50–1.57%
	34XX	Ni 3.00%, Cr 0.77%
Molybdenum steels	40XX	Mo 0.20–0.25%
	44XX	Mo 0.40–0.52%
Chromium–molybdenum steels	41XX	Cr 0.50–0.95%, Mo 0.12–0.30%
Nickel–chromium–molybdenum steels	43XX	Ni 1.82%, Cr 0.50–0.80%, Mo 0.25%
	47XX	Ni 1.05%, Cr 0.45%, Mo 0.20–0.35%
Nickel–molybdenum steels	46XX	Ni 0.85–1.82%, Mo 0.20–0.25%
	48XX	Ni 3.50%, Mo 0.25%
Chromium steels	50XX	Cr 0.27–0.65%
	51XX	Cr 0.80–1.05%
	50XXX	Cr 0.50%, C 1.00% min
	51XXX	Cr 1.02%, C 1.00% min
	52XXX	Cr 1.45%, C 1.00% min
Chromium–vanadium steels	61XX	Cr 0.60–0.95%, V 0.10–0.015%
Tungsten–chromium steels	72XX	W 1.75%, Cr 0.75%
Nickel–chromium–molybdenum steels	81XX	Ni 0.30%, Cr 0.40%, Mo 0.12%
	86XX	Ni 0.30%, Cr 0.40%, Mo 0.12%
	87XX	Ni 0.55%, Cr 0.50%, Mo 0.20%
	88XX	Ni 0.55%, Cr 0.50%, Mo 0.25%
Silicon–manganese steels	92XX	Si 1.40–2.00%, Mn 0.65–0.85%, Cr 0–0.65%
Nickel–chromium–molybdenum steels	93XX	Ni 3.25%, Cr 1.20%, Mo 0.12%
	94XX	Ni 0.45%, Cr 0.50%, Mo 0.12%
	97XX	Ni 0.55%, Cr 0.20%, Mo 0.20%
	98XX	Ni 1.00%, Cr 0.80%, Mo 0.25%

SAE Bearing Steel Naming System

Example:

SAE 51100

- Last Two Digits: Carbon content × 100 (unit: 0.01%)
- Second Digit: Chromium (Cr) content

Low Chromium	0.5%
Medium Chromium	1%
High Chromium	1.45%

- First Digit: Bearing steel category = 5