

API 5CT Q125 Mechanical Properties and Chemical Composition

Technical data guide for Q125 casing and tubing grade - mechanical strength range, public chemistry references, metallurgy notes, and MTC verification points.

Scope: API 5CT Q125 is a high-strength OCTG grade for casing and tubing. This guide summarizes public technical references for mechanical properties and chemical composition. Final acceptance shall follow the applicable API 5CT edition, project specification, and mill test certificate (MTC).

1. Quick Technical Identification

Item	Reference value / technical meaning
Product family	API 5CT casing and tubing / OCTG
Grade	Q125
Strength identity	125 ksi minimum yield strength
Metric equivalent	862 MPa minimum yield strength
Typical product forms	API 5CT Q125 casing, API 5CT Q125 tubing, Q125 tube
Common condition	Quenched and tempered (Q&T); for controlled strength and toughness balance
Primary technical caution	Do not judge Q125 by yield strength alone; connection capacity, collapse design, toughness, hardness behavior, NDE, and traceability still control field suitability.

2. Mechanical Properties

The most cited Q125 mechanical data are the yield-strength range and minimum tensile strength. Public API 5CT Q125 product tables commonly list a minimum yield strength of 125,000 psi / 862 MPa, maximum yield strength of 150,000 psi / 1,034 MPa, and minimum tensile strength of 135,000 psi / 931 MPa.

Mechanical property	Reference value	Metric / imperial meaning	Technical interpretation
Minimum yield strength	125,000 psi / 862 MPa	125 ksi minimum yield	Minimum stress level associated with the Q125 grade identity. It is used in pipe-body strength calculations but does not define connection capacity.
Maximum yield strength	150,000 psi / 1,034 MPa	150 ksi maximum yield	Upper yield limit helps avoid excessive strength/hardness levels that may reduce toughness or create service sensitivity.
Minimum tensile strength	135,000 psi / 931 MPa	135 ksi minimum tensile	Indicates minimum tensile load-bearing capability before fracture under tensile loading.
Total elongation under load	0.65% reported in public Q125 tabulations	Use with applicable standard edition	A strength-grade table value often shown with Q125 Type 1 public data; final requirement must be checked against the governing edition and pipe size.
Heat treatment condition	Quenched and tempered	Q&T;	Required strength level is normally achieved by heat-treatment control rather than chemistry alone.
Hardness requirement	No single basic value should be assumed from public summary tables	Project/API requirement controlled	Hardness testing still matters because Q125 is a high-strength grade. Review applicable API 5CT edition, service environment and sour-service requirements.

Mechanical-property notes

- Yield strength is the main grade identifier, but burst, collapse and tensile performance are also affected by OD, wall thickness, ovality, residual stress and connection design.
- For deep or high-load strings, Q125 pipe-body strength can be limited by connection efficiency, thread condition, coupling selection or premium-connection rating.
- For sour environments, Q125 shall not be assumed suitable only because it is an API 5CT grade. Review NACE MR0175 / ISO 15156, hardness, SSC risk and project-specific environmental data.

3. Chemical Composition - How to Read the Data

Q125 chemistry is controlled to support hardenability, strength after quenching and tempering, toughness, and steel cleanliness. Public sources show both broad maximum limits and narrower supplier ranges. The broad limits are useful for screening; the actual delivered chemistry must be verified by heat number and MTC.

Important: API 5CT Q125 may be reported by type/variant in public API-style tables. Do not treat one supplier chemistry table as a universal design limit. The purchase specification and applicable standard edition control the final requirement.

3.1 Public maximum chemistry limits commonly reported for Q125

Element	Common public maximum / limit	Technical meaning
Carbon (C)	max 0.350%	Supports strength and hardenability. Higher carbon can raise strength but may reduce weldability and toughness if not controlled.
Manganese (Mn)	max 1.350%	Improves hardenability and strength; also assists deoxidation. Excess can affect toughness and hardenability balance.
Molybdenum (Mo)	max 0.850%	Improves hardenability and tempering response; supports strength stability in Q&T; steels.
Chromium (Cr)	max 1.500%	Improves hardenability and contributes to strength stability. This is not a CRA-level corrosion-resistance addition.
Nickel (Ni)	max 0.990%	May support toughness and hardenability depending on the steel design.
Phosphorus (P)	max 0.020%	Restricted impurity; excess phosphorus may reduce toughness and increase embrittlement risk.
Sulfur (S)	max 0.010%	Restricted impurity; lower sulfur supports steel cleanliness and toughness.

3.2 Narrower supplier chemistry ranges often shown for Cr-Mo Q125 material

Element	Typical reference range / limit	Why it matters
Carbon (C)	0.28-0.33%	Builds strength and hardenability after heat treatment.
Manganese (Mn)	0.90-1.20%	Supports hardenability, strength and deoxidation.
Chromium (Cr)	0.50-0.80%	Contributes to hardenability and strength stability.
Molybdenum (Mo)	0.15-0.25%	Supports tempering response and hardenability.
Silicon (Si)	0.15-0.35%	Deoxidation and moderate strength contribution.
Phosphorus (P)	<= 0.020%	Restricted impurity; lower levels help toughness.
Sulfur (S)	<= 0.010%	Restricted impurity; low sulfur supports cleanliness and toughness.

4. Technical Meaning of Each Chemistry Group

The following interpretation helps avoid a common misunderstanding: Q125 is not selected because one element is high. It is selected because chemistry, Q&T; heat treatment, mechanical properties and inspection results work together.

Chemistry group	Controlled effect	Practical caution
C + Mn	Base strength and hardenability	Too much carbon-equivalent tendency may make toughness and weld-related repair more sensitive.
Cr + Mo	Hardenability and tempering stability	These additions help high-strength response, but they do not make Q125 a corrosion-resistant alloy.
P + S	Cleanliness and toughness control	Both are kept low because high-strength OCTG is sensitive to inclusions and embrittlement mechanisms.
Ni / Si and minor elements	Toughness, deoxidation and steelmaking balance	Actual role depends on the mill steel design and type/variant; verify with MTC.
Heat treatment response	Transforms chemical potential into target strength/toughness	Without stable quenching and tempering, chemistry alone does not guarantee Q125 performance.

5. MTC Verification Checklist

A useful Q125 data sheet should connect chemistry and mechanical performance with traceability. The MTC and inspection package should make it possible to trace each pipe back to its heat, lot and test results.

Check item	What to verify	Why it matters for Q125
Heat number / lot number	Chemical analysis and mechanical tests match the delivered pipe identity.	Prevents mixing between heats or grades; essential for high-strength OCTG.
Chemical composition	C, Mn, Cr, Mo, Ni, P, S and other controlled elements match applicable specification.	Confirms that Q&T; response and impurity control are in the intended range.
Yield and tensile results	Yield strength falls within 125-150 ksi range; tensile strength meets minimum.	Confirms pipe-body strength requirement for the grade.
Heat treatment record	Quenching and tempering route is consistent with Q125 condition.	Controls strength, hardness and toughness balance.
Hardness / impact records	Required tests completed per applicable edition or project specification.	Important for high-strength performance and possible sour-service review.
NDE / pipe body release	UT, EMI or other NDE results available as required.	High-strength pipe is less tolerant of hidden pipe-body defects under severe loads.
Thread and coupling inspection	Thread geometry, coupling match and make-up-related records reviewed.	Connection performance can limit the full string even when pipe-body strength is acceptable.

6. Design and Use Cautions

Q125 is a high-strength grade, not a universal severe-service solution. The following cautions should be considered when interpreting mechanical and chemical data.

Q125 vs high collapse	High yield strength can support pipe-body strength, but collapse resistance also depends on OD/wall ratio, wall thickness, ovality, residual stress, manufacturing control and collapse-rating basis.
Q125 vs sour service	Do not assume Q125 is suitable for H ₂ S-containing wells. Review NACE MR0175 / ISO 15156, hardness, SSC risk, temperature, pH, chloride and project-specific sour-service limits.
Q125 vs P110	Q125 has a higher minimum yield strength than P110, but connection rating, impact toughness, collapse design and well condition decide the grade choice.
Q125 chemistry	Supplier chemistry ranges may be narrower than broad public maximum tables. Treat chemistry data as screening information until confirmed by the governing standard and MTC.

7. Reference Notes

API official notice	API Spec 5CT 11th edition was published in December 2023 with Monogram Program effective date of January 1, 2025; the 11th edition no longer references the former Product Specification Levels.
Public mechanical data	Multiple public Q125 supplier tables list 862-1,034 MPa yield strength and 931 MPa minimum tensile strength.
Public chemistry data	Public Q125 chemistry tables show broad maximum chemistry values such as C max 0.350%, Mn max 1.350%, Mo max 0.850%, Cr max 1.500%, Ni max 0.990%, P max 0.020%, S max 0.010%, while some supplier references show narrower Cr-Mo ranges.
Final authority	For manufacturing, inspection or acceptance, use the applicable API 5CT edition, purchase order, project specification, and certified MTC rather than a public summary table alone.

Sources consulted: API official 5CT 11th edition notice; API 5CT Q125 public product and supplier data pages including Tubos, Gnee, Pipeun, oilandgasingmaterials, and PandaPipe public PDF. Public sources may summarize standard tables differently; final values must be verified against the official standard and MTC.