MATERIAL AND FINISHED-PRODUCT DATA

AISI 4120
Sucker Rod

Material & Engineering Reference

Chemistry, published processing references, Grade D strength baseline, nominal body dimensions, connection inspection and calculated axial stress.

0.18-0.23%
carbon reference

5/8-1 1/8 in.
nominal body range

85 ksi
Grade D yield minimum

115-140 ksi
Grade D tensile range

HOW TO USE THIS GUIDE

Treat AISI 4120 as a material designation. Accept a finished rod only after its ordered grade, dimensions, connection gauges and heat-specific records meet the governing purchase requirements.

Engineering reference | Revision 0 | September 2026

Material Composition and Identity

AISI 4120 is a low-carbon chromium-molybdenum alloy steel. Chemistry controls material identity and heat-treatment response, but it does not by itself establish the finished sucker-rod grade.

Published chemistry reference

Element	Symbol	Published range, mass %	Acceptance use
Carbon	C	0.18-0.23	Verify measured heat value
Manganese	Mn	0.90-1.20	Verify against approved material specification
Silicon	Si	0.15-0.35	Verify measured heat value
Chromium	Cr	0.40-0.60	Verify alloy range
Molybdenum	Mo	0.13-0.20	Verify alloy range
Phosphorus	P	0.035 maximum	Do not exceed contractual maximum
Sulfur	S	0.040 maximum	Do not exceed contractual maximum
Iron	Fe	Balance	Base metal

Alloying range profile

Bar length scaled to 1.20 mass %

Material substitution gate

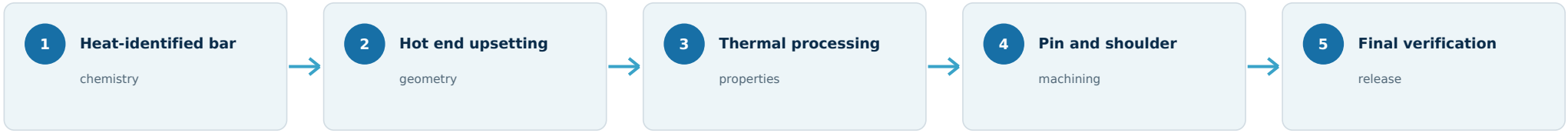
Offered designation	Automatic equivalent?	Required verification before approval
AISI 4120	No	Controlling standard, heat analysis, delivery condition and finished-rod qualification
4120M / modified 4120	No	Actual chemistry and purchaser-approved material route
20CrMo / SCM420	No	Governing regional standard, chemistry, processing condition and finished tests
Unspecified 41XX steel	No	Reject description alone; require a defined designation and certificate

ACCEPTANCE RULE

Use this composition only as a published reference. The purchase specification and heat certificate must identify the controlling material limits and measured heat values.

Manufacturing and Heat Treatment

Manufacturing converts the certified bar into a straight load-carrying rod with upset ends, controlled thermal condition and gauged connections. Temperature records demonstrate process execution; finished tests demonstrate the delivered condition.



Published material-level thermal references

Operation	Published reference	Required production interpretation
Initial forging temperature	1,200 C	Reference starting condition for hot forging
Final forging temperature	800 C	Approved procedure defines the operating limit
Normalizing	880-920 C, air cool	Potential conditioning route; not mandatory for every rod
Austenitizing before quench	870-890 C	Reference range for a quench-and-temper route
Tempering	500 C	Published condition; not a universal finished-grade setting

Production records and release evidence

Control point	Recorded evidence	Release basis
Incoming material	Heat number and heat analysis	Approved material specification
Forged upset	Lot ID, visual exam and specified NDT	Applicable surface-discontinuity limits
Final heat treatment	Furnace chart, cycle ID and treatment lot	Qualified manufacturing procedure
Finished mechanical condition	Tensile result after final thermal processing	Ordered finished-grade requirements
Pin and shoulder	Dimensions, working gauges and gauge status	Approved connection specification

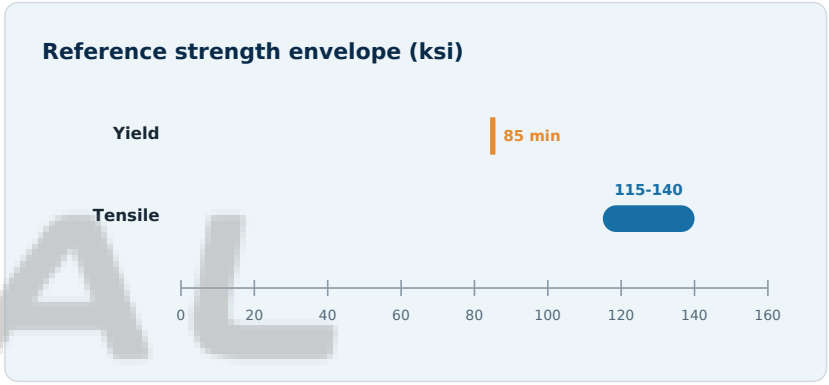
Qualification principle: the selected route must account for actual chemistry, rod geometry, holding time, quench response and required finished properties. Furnace setpoint alone is not product acceptance.

Finished Mechanical Grade and Test Acceptance

The AISI designation identifies the steel. The ordered finished grade controls mechanical acceptance. The baseline below applies only when the rod is specified and qualified to the cited Grade D requirements.

Published Grade D strength envelope

Property	Published reference	Acceptance interpretation
Yield strength	85 ksi / 586 MPa minimum	Measured value must meet or exceed the minimum
Yield determination	0.2% offset	Use the specified method and report the basis
Tensile strength	115-140 ksi / 793-965 MPa	Result must remain inside the complete range
Elongation / reduction of area	Applicable grade or purchase requirement	Report measured values and specimen basis
Hardness	Approved manufacturing or purchase requirement	Do not infer a universal range from AISI 4120



Sampling and test-method reference

Control	Published reference
Minimum sampling	At least 2 tests on at least 2 rod bodies per steel heat
Sample location	Near the beginning and end of the heat production
Test condition	After final thermal processing
Test methods	ASTM A370 or ISO 6892

Illustrative strength-screen examples

Yield, ksi	Tensile, ksi	Strength-screen result
82	120	Reject: yield below 85 ksi
92	125	Passes illustrated strength limits; other requirements still apply
100	145	Reject: tensile above 140 ksi

IMPORTANT

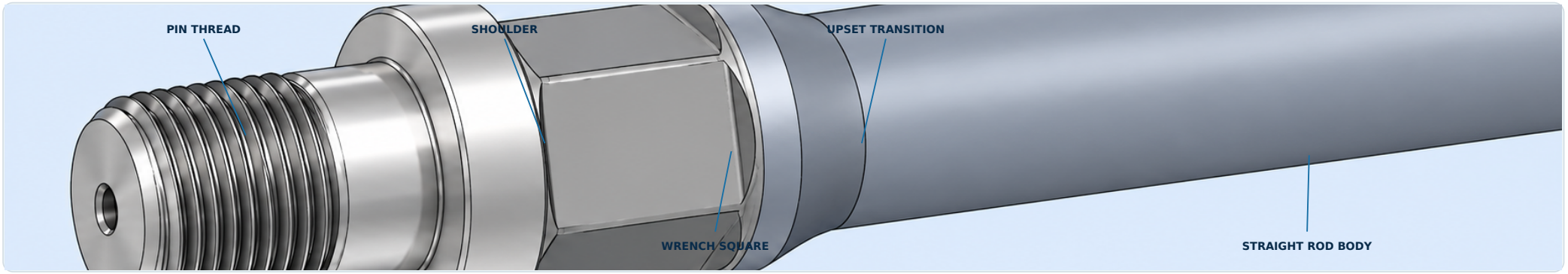
A higher tensile result is not automatically better when the specified grade includes an upper limit.

Reference basis: API Spec 11B, 27th edition, Table A.5 and Clause A.4.2. Confirm the current order edition and grade designation.

Nominal Dimensions and Connection Inspection

Body size determines nominal area and mass. Connection acceptance requires the complete pin, shoulder and coupling specification - nominal thread diameter alone does not establish interchangeability.

Jointed sucker-rod end anatomy



Nominal body and pin reference

Body size	Body, mm	Area, in2	Mass, kg/m*	Nominal pin diameter
5/8 in.	15.875	0.3068	1.554	15/16 in.
3/4 in.	19.050	0.4418	2.237	1 1/16 in.
7/8 in.	22.225	0.6013	3.045	1 3/16 in.
1 in.	25.400	0.7854	3.978	1 3/8 in.
1 1/8 in.	28.575	0.9940	5.034	1 9/16 in.

* Calculated from nominal circular body and steel density of 7,850 kg/m3; excludes upset-end and coupling mass.

Working-gauge acceptance reference

Check	Published criterion
P6 No-Go ring	Pin enters no more than 3 full turns
P8 Go ring	Gauge reaches pin-shoulder face
Shoulder parallelism	0.002 in. / 0.051 mm flat feeler does not enter

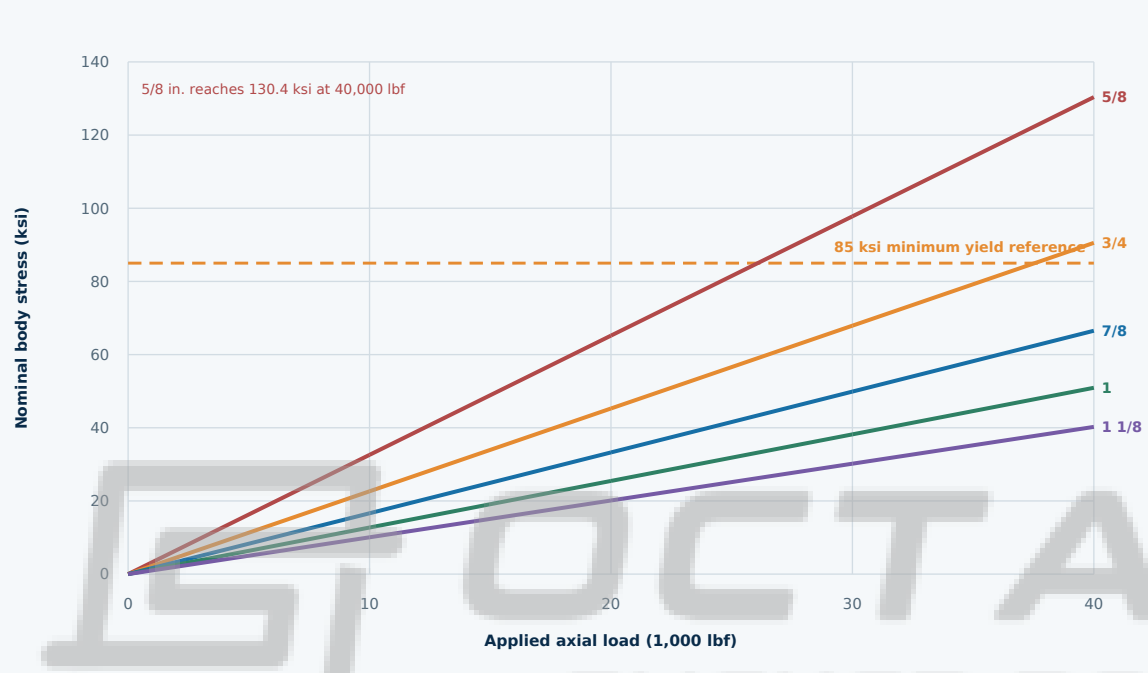
RELEASE DOCUMENT SET

Heat analysis + treatment-lot record + finished tensile report + dimensional/gauge record + specified NDT + packing traceability.

Calculated Axial Stress by Rod-Body Diameter

The calculations compare nominal, unworn solid bodies under static axial load. They quantify the effect of diameter; they are not allowable-load ratings and do not replace rod-string analysis.

Stress-load relationship



ENGINEERING USE

Use maximum and minimum sectional load to establish the stress cycle for every taper. Then apply the approved fatigue method, connection check, service factor, deviation contact, wear allowance and corrosion assessment. The 85 ksi line is a material acceptance reference - not an allowable working-stress line.

Calculated values

Body	Area	10k	20k	30k	40k
in.	in2	ksi	ksi	ksi	ksi
5/8	0.3068	32.6	65.2	97.8	130.4
3/4	0.4418	22.6	45.3	67.9	90.5
7/8	0.6013	16.6	33.3	49.9	66.5
1	0.7854	12.7	25.5	38.2	50.9
1 1/8	0.9940	10.1	20.1	30.2	40.2

Calculation basis

Area: A = pi d2 / 4
Nominal stress: sigma = F / A
Diameter: nominal unworn rod body
Load: applied static sectional load

What the calculation does not include

Excluded input	Why it matters
Rod and fluid weight	Changes sectional load with depth
Acceleration / pumping dynamics	Changes cycle maximum and minimum
Thread and shoulder concentration	Local stress exceeds body average
Deviation, wear and corrosion loss	Adds bending or reduces effective area