ASTM A312 TP321H (S32109) Technical Datasheet

Prepared from ASTM A312/A312M-22a

1. Basic designation

Standard	Grade	UNS	Product forms	Scope
ASTM A312/A312M-22a	TP321H	S32109	Seamless / Welded / HCW welded pipe	High-temperature and general corrosive service

2. Chemical composition (%)

C	Mn	P	S	Si	Cr	Ni	Mo	Ti	Nb/Ta	N
0.04–0.10	≤2.00	≤0.045	≤0.030	≤1.00	17.0–19.0	9.0–12.0	—	4 × (C+N) min, 0.70 max	—	0.10

V	Cu	Ce	B	Al	Other
—	—	—	—	—	—

3. Mechanical properties

Condition / thickness range	Tensile strength, min	Yield strength, min	Elongation longitudinal, min %	Elongation transverse, min %
Welded	75 [515]	30 [205]	35	25
Seamless, t ≤ 0.375 in. [9.50 mm]	75 [515]	30 [205]	35	25
Seamless, t > 0.375 in. [9.50 mm]	70 [480]	25 [170]	35	25

4. Heat treatment / annealing requirements

Minimum heat-treating temperature	Cooling note code	Cooling / testing requirement
Cold finished: 2000 °F [1100 °C]; Hot finished: 1925 °F [1050 °C]	D	Quenched in water or rapidly cooled by other means.

Supplementary note S6: When specified in the purchase order, a stabilizing heat treatment after solution anneal is required for this grade.

5. Standard required inspection and testing

Requirement	Details
Mechanical lot definition	Per ASTM A312 Section 11.1; based on size, wall, heat, furnace type, temperature, time at heat, and production run.
Tension test	1 specimen for lots of not more than 100 pipes; specimens from 2 tubes for lots of more than 100 pipes.
Flattening / bend	Flattening test per Section 11.3. For welded pipe, a transverse-guided face bend test may be used instead; for wall > 3/8 in., two side bends may be used.
Flattening frequency	For continuous furnace / quench after hot forming / controlled batch furnace: 5% of lot, but not less than 2 lengths. For uncontrolled batch furnace: 5% of each heat-treated lot.
Hydrostatic or NDE electric test	Each pipe shall be subjected to the nondestructive electric test or the hydrostatic test, unless otherwise specified in the purchase order.
Hydro waiver for NPS 10 and larger	May be waived by agreement when purchaser performs a system test; pipe must be marked NH.
HCW manufacturing inspection	For HCW pipe, prior to cold working the weld shall be 100% radiographically inspected in accordance with ASME BPVC Section VIII, Division 1, Paragraph UW-51.
Grain size determination	ASTM grain size No. 7 or coarser; frequency as prescribed for flattening tests in Section 11.4.

6. Optional supplementary requirements (when specified in PO)

Supplementary requirement	Summary
S1 Product analysis	Additional product analysis frequency when specified in PO.
S2 Transverse tension	One transverse tension test from one end of 10% of lengths furnished per heat; applicable only to NPS 8 and larger.
S3 Flattening	Flattening test on one end or both ends of each pipe, as specified.
S4 Etching	Etching tests per ASTM E381 on cross section from one end or both ends of each pipe.
S5 Radiographic examination	Entire length of weld in each double welded pipe radiographically examined; marking RT required.
S6 Stabilizing heat treatment	Applies, when specified, to TP309HCb, TP310HCb, TP321, TP321H, TP347, TP347H, TP348, TP348H.

S7 Intergranular corrosion	Intergranular corrosion test per ASTM A262, Practice E, when specified.
S8 Intergranular corrosion by copper sulfate-sulfuric acid	Additional corrosion test option when specified.
S9 Weld decay	One sample from each lot in boiling 50% HCl / 50% water; HCW pipe must meet weld metal to base metal loss ratio 0.90 to 1.1 when specified.

7. Permitted variations in wall thickness

NPS designator range	Condition	Over	Under
1/8 to 2-1/2 incl.	All t/D ratios	+20.0%	-12.5%
3 to 18 incl.	t/D up to 5% incl.	+22.5%	-12.5%
3 to 18 incl.	t/D > 5%	+15.0%	-12.5%
20 and larger, welded	All t/D ratios	+17.5%	-12.5%
20 and larger, seamless	t/D up to 5% incl.	+22.5%	-12.5%
20 and larger, seamless	t/D > 5%	+15.0%	-12.5%

t = nominal wall thickness; D = ordered outside diameter. For welded pipe, the weld area is not limited by the “Over” wall tolerance.

8. Welding filler metal listed in ASTM A312 Table 6

AWS A5.9 / A5.14 class	UNS designation / note
No specific filler metal listed	ASTM A312 Table 6 does not assign a filler for this grade

For weld seam repair with filler metal, ASTM A312 requires GTAW and compatible filler; alternatively, a more highly alloyed filler may be used subject to purchaser approval.

9. Purchase order description example

Example wording
ASTM A312 TP321H Pipe, UNS S32109, seamless (or welded / HCW), NPS 6, Schedule 40S, random length 6 m, heat treated in accordance with ASTM A312 Table 2, hydrostatic test or NDE electric test, certification EN 10204 3.1, supplementary requirements as specified.

Purchase orders should also conform to ASTM A999/A999M ordering requirements.

10. Grade-specific notes

- This grade has a specific ASTM grain size requirement.
- This grade is eligible for supplementary stabilizing heat treatment requirement S6 when specified.
- Marking shall also include heat number and heat-treatment lot identification.