

Formula 1

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Formula 2

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Formula 3

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Detailed Explanation

Pitting Resistance Equivalent Number (PREN) is an empirically derived index used to rank the relative pitting corrosion resistance of chromium-, molybdenum-, and nitrogen-alloyed metals—primarily stainless and duplex steels. It is calculated from bulk alloy composition (typically weight %) using variations of the formula $PREN = \%Cr + 3.3 \times \%Mo + 16 \times \%N$, with adjustments for specific alloy families (e.g., adding $0.5 \times \%W$ for tungsten-containing grades). While PREN provides a quick, compositional proxy for resistance, it does not account for microstructural factors (e.g., sigma phase, inclusion distribution) or surface condition; thus, it serves best as a preliminary screening tool. Critical Pitting Temperature (CPT), by contrast, is an experimentally determined parameter—the lowest temperature at which stable pitting initiates in a standardized electrochemical test (e.g., ASTM G150) under controlled chloride concentration and pH. CPT reflects real-world performance more directly than PREN but requires rigorous laboratory testing and is sensitive to test methodology, specimen preparation, and electrolyte composition. The lookup table bridges these two metrics, listing both PREN (calculated per accepted conventions) and published CPT values (where available) for 42 industrially relevant alloys—including UNS S32205, S32750, N08926, N08367, S31254, and N10276—enabling engineers to cross-reference theoretical resilience with validated thermal limits. This integration supports robust, risk-informed material selection across sectors where chloride exposure, elevated temperature, or stagnant conditions threaten integrity—such as offshore oil & gas, chemical processing, desalination, and flue gas desulfurization systems.

Key Components

#	Component
1	Alloy designation (UNS/EN/ASTM)
2	Chemical composition (wt% Cr, Mo, N, W)
3	PREN value (calculated per alloy-specific formula)
4	CPT value (°C, measured per ASTM G150 or equivalent)
5	Notes on test conditions and data source

Applications

#	Application
1	Material selection for seawater-cooled heat exchangers
2	Qualification of weld filler metals in sour service
3	Corrosion allowance reduction in process piping design
4	Failure analysis root cause assessment in chloride-rich environments
5	Specification development for API RP 581/ISO 15156-compliant equipment

Related Concepts

#	Concept
1	Localized corrosion
2	Chloride stress corrosion cracking (CLSCC)
3	Electrochemical noise analysis
4	ASTM G48/G150 test methods

#	Concept
5	Microstructure-sensitive corrosion

Tags

corrosion-resistance, material-selection, PREN, CPT, stainless-steel, duplex-alloys, nickel-alloys

PREN & CPT Lookup Table for 42 Common Corrosion-Resistant Alloys

ToolFusion Engineering