

HIP Process Window Guide

A preliminary framework for connecting material, manufacturing route, pressure, temperature, hold time, cooling, and release evidence.

1. Start with Material and Manufacturing Route

Define the alloy, casting or AM route, powder or feedstock history, defect type, section thickness, part envelope, and required properties. The same alloy may require a different HIP window when its manufacturing history or release specification changes.

2. Define Pressure, Temperature, and Hold Time

Pressure supports pore collapse while temperature activates plastic flow, creep, and diffusion. Hold time must be long enough for the governing mechanism and section size without causing unacceptable grain growth, phase change, or distortion. Cooling strategy should be selected with the target microstructure in mind.

3. Validate Against the Required Evidence

Treat every value below as an initial engineering reference. Confirm the final window through the applicable material standard, customer specification, sample trials, equipment capability, temperature uniformity, inspection plan, and acceptance criteria.

Material Family	Pressure Reference	Temperature Reference	Typical Evaluation Focus
Ti-6Al-4V	100-103 MPa	890-920 deg C	AM or cast porosity; alpha-beta microstructure; fatigue performance.
Inconel 718 / 625	100-103 MPa	1120-1165 deg C	Pore closure; grain response; subsequent solution and aging route.
CoCrMo	100 MPa class	1150-1200 deg C	Medical or wear applications; atmosphere; surface and batch evidence.
Al-Si alloys	100 MPa class	480-520 deg C	Casting or AM porosity; distortion risk; alloy-specific heat treatment.

Important: these ranges are starting references only. They are not qualified recipes or guarantees of part performance. Final values require material-specific and customer-specific validation.