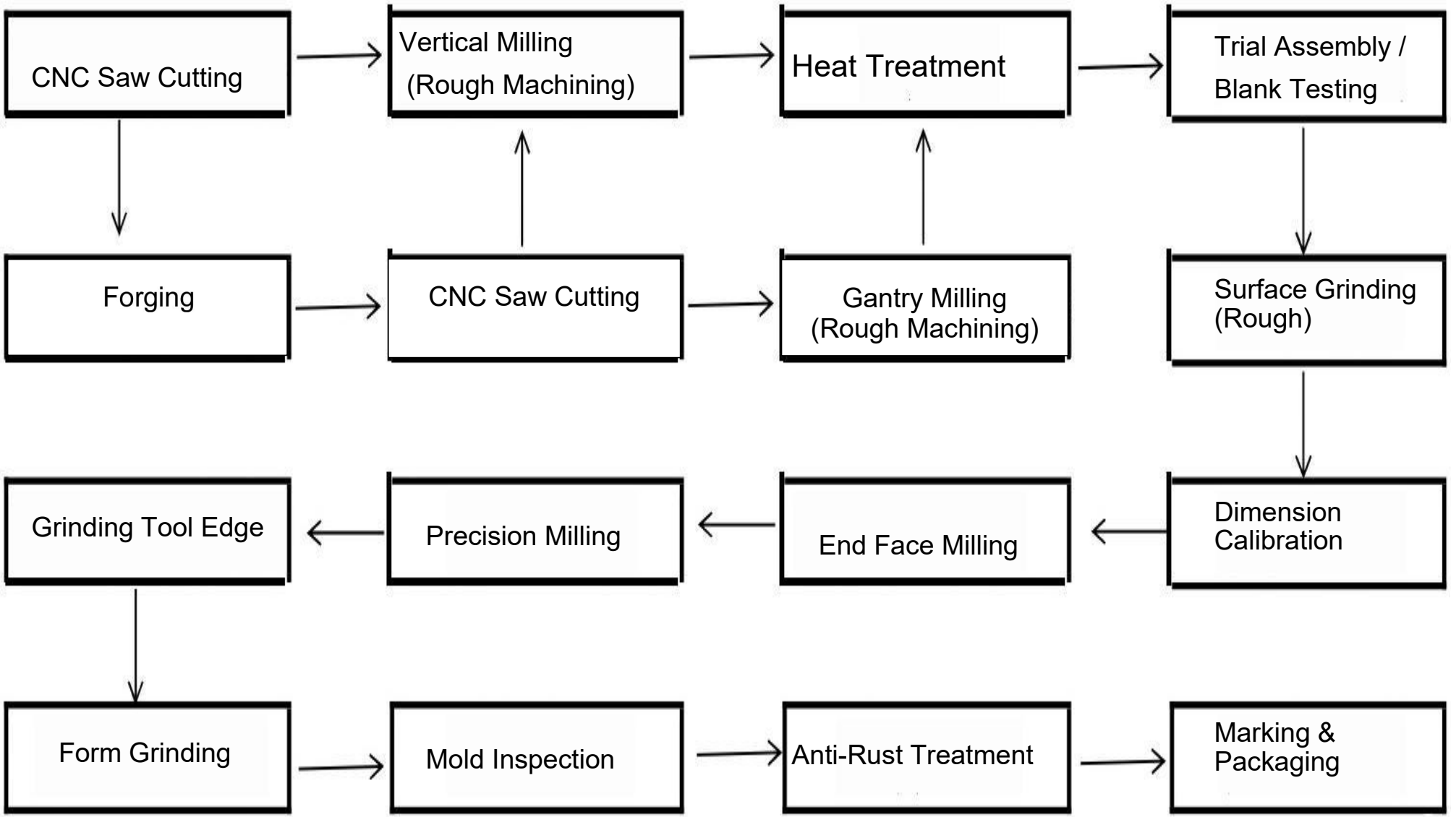
Production Process：



Press Brake Tooling Manufacturing Process (Standard Precision Type)

The core process is divided into six major stages, with strict precision control and long service life in mind. The workflow is clear and systematic:

I. Pre-Production Preparation

Define the plan and build the foundation to avoid rework later

1. **Drawing Design and Review**
   Based on the customer's bending parts, including material (steel / aluminum / copper), thickness, bending angle and radius, 3D models (SolidWorks) and 2D drawings are created.
   The dimensions, clearances, and guiding structure of the upper and lower tools are defined.
   Design review focuses on strength (to prevent fracture) and compatibility (matching press brake models).

2. **Material Selection and Procurement**
   High-quality tool steels are selected, commonly 42CrMo or 55SiCr, offering high hardness and wear resistance.
   Raw materials are cut according to drawings (round or square steel for upper tools, steel plates for lower tools).
   Material inspection certificates are required to ensure chemical composition compliance.

3. **Process Planning**
   A detailed process sheet is prepared, defining machining equipment (milling, grinding, wire EDM), tolerance requirements (e.g. lower die opening tolerance), and heat treatment parameters to minimize deformation.

II. Blank Pre-Treatment

Stabilize the material and prevent deformation (critical foundation step)

- **Annealing Treatment**
  The blank is heated to 850–900°C, held, and slowly cooled to reduce hardness for machining and eliminate internal stress, preventing cracks during processing or use.

- **Rough Milling of Reference Surfaces**
  Upper, lower, left, and right reference surfaces are milled flat to ensure flatness and provide accurate positioning references for subsequent machining.

III. Core Machining

Rough machining → precision machining → wire cutting (precision control core)

1. **Rough Machining (Shape Forming with Allowance)**

- Upper tool: Rough milling of the profile, leaving 0.3–0.5 mm allowance for finishing.
- Lower tool: Rough milling of the profile and V-opening, reserving allowance according to bending angle and clearance, ensuring symmetrical opening.

2. **Heat Treatment (Hardness and Wear Resistance)**

- Quenching and tempering to achieve required hardness and durability.
- Optional aging treatment for complex tools to further eliminate internal stress and stabilize dimensions.

3. **Finish Machining (Achieving Drawing Accuracy)**

- Grinding: Precision grinding of reference surfaces, upper tool profiles, and lower tool surfaces to ensure flatness and perpendicularity.
- CNC Milling: Fine machining of upper tool tips and lower die openings to meet dimensional tolerances.
- Wire EDM (Slow Wire Cutting): Used for complex openings and special shapes (non-right-angle bends, special radii), ensuring high precision and smooth, burr-free surfaces.

4. **Hole Machining**
   Drilling and tapping of mounting holes, locating holes, and set-screw holes, with hole position tolerance within ±0.02 mm.

IV. Surface Treatment

Rust prevention and friction reduction to extend service life

- **Standard Treatment:** Black oxide or anti-oxidation treatment for rust prevention.
- **Auxiliary Processes:** Deburring (manual or ultrasonic cleaning) and polishing to reduce scratches on workpieces.

V. Assembly and Debugging

Assembly → test bending → calibration (ready for use)

1. **Tool Assembly**
   Tools are assembled according to drawings, ensuring perfect alignment between upper and lower tools.

2. **Test Bending**
   Installed on a press brake, test bending is performed using the same material and thickness as the actual workpiece.
   Bending angle accuracy, surface quality, and springback control are checked.

3. **Precision Calibration**
   If results are not acceptable, fine adjustments are made to upper tool height, lower die clearance, or by polishing and angle correction until requirements are met.

VI. Final Inspection and Delivery

Final check and packaging to ensure compliance

1. **Final Inspection**
   Tool dimensions (calipers, micrometers), hardness, and surface quality are verified.
   Sample test bends are inspected, and a quality inspection report is issued.

2. **Rust-Proof Packaging**
   Tools are coated with anti-rust oil and packed using bubble wrap, cartons, or wooden cases.
   Drawings, inspection reports, and usage instructions (recommended bending clearances and maintenance notes) are included.

Key Technical Points

- **Precision Control**
  Wire EDM and grinding are critical, especially for lower die opening clearance:
  Clearance = material thickness × 0.15–0.20
  Too tight may damage the workpiece, too loose may cause excessive springback.

- **Service Life Factors**
  Proper material selection, accurate heat treatment parameters (quenching and tempering), and surface oxidation treatment.

- **Compatibility**
  Tool dimensions must match the press brake throat depth and tonnage.
  Die opening must correspond to the required bending radius to prevent cracking of the workpiece.