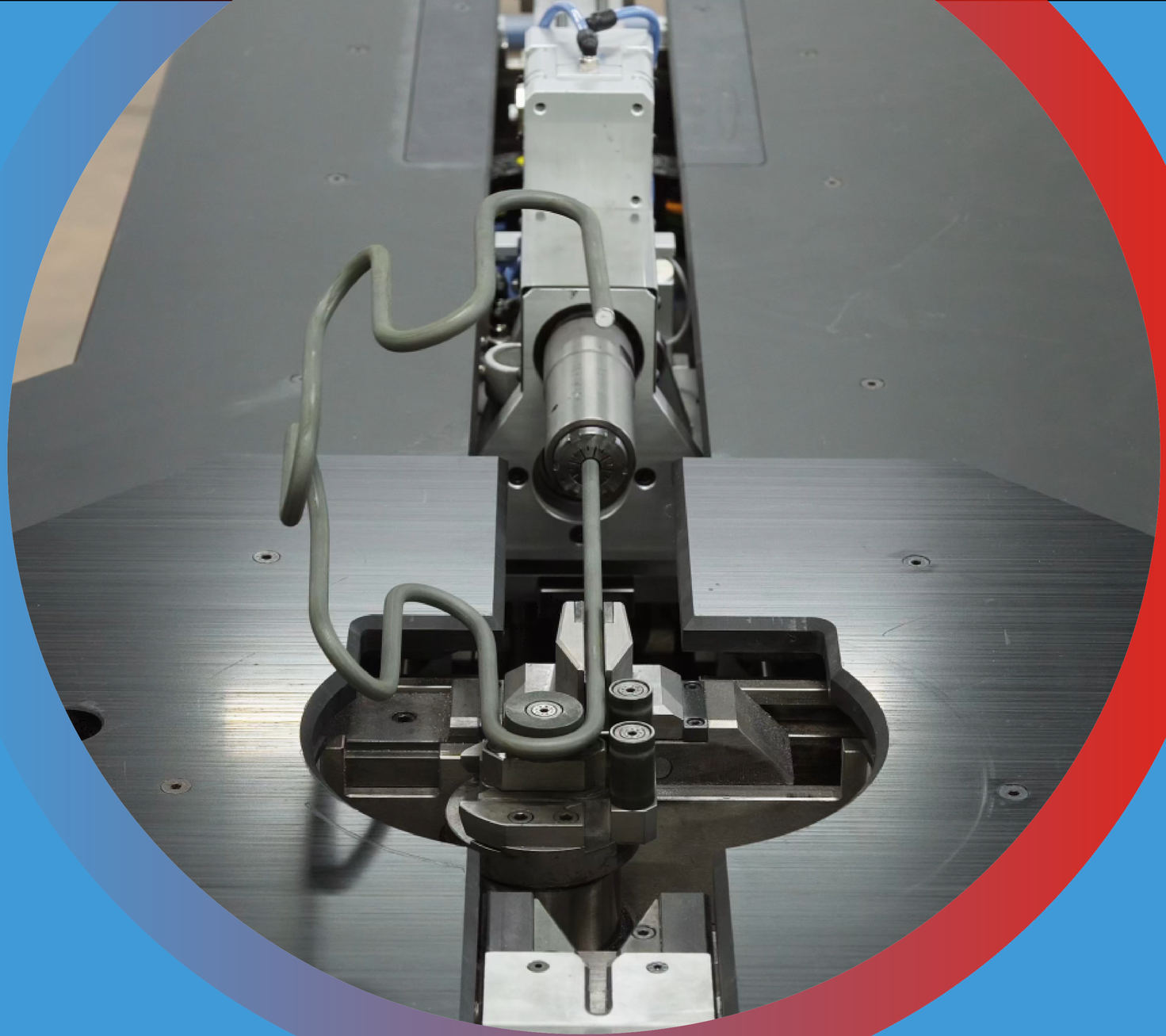
CSM MACHINERY

OAKLEY
INDUSTRIAL MACHINERY

Universal Bending Machine

CNC bending machine with one bending unit, designed for automatic multi-plane bending of heating elements in a wide range of shapes, sizes, and angles.



Machine composition

- **Welded steel frame** with horizontal work surface, designed for structural rigidity and long-term dimensional stability under cyclic bending loads.
- **Electronic length-measurement system** for automatic detection and verification of heating element dimensions prior to bending.
- **Pneumatically actuated fixed clamp** for firm, consistent gripping of the heating element throughout the bending cycle, ensuring repeatable part positioning.
- **CNC-controlled motion system**, comprising up to 3 numerically controlled axes:
  - **1st axis**: Pneumatically actuated mobile clamp, driven by a brushless servomotor via ball screw on recirculating rollers, for precise longitudinal positioning of the heating element.
  - **2nd axis:** Bending unit, for numerically controlled execution of single and multi-step bending sequences with programmable angle and radius.
  - **3rd axis** *(optional)*: Pneumatically actuated mobile rotational clamp, enabling controlled rotation of the heating element to execute complex multi-plane bending geometries.
- **Main control cabinet** housing industrial PC, paired with a **mobile operator cart** equipped with touchscreen monitor and keyboard; the cart allows the operator to reposition freely along the machine according to the geometry of the part being processed. 3D part visualization with step-by-step bending simulation supports programming assistance and in-process quality verification.
- **Dedicated safety PLC** compliant with applicable machinery safety standards, managing all safety-critical functions independently of the main controller.

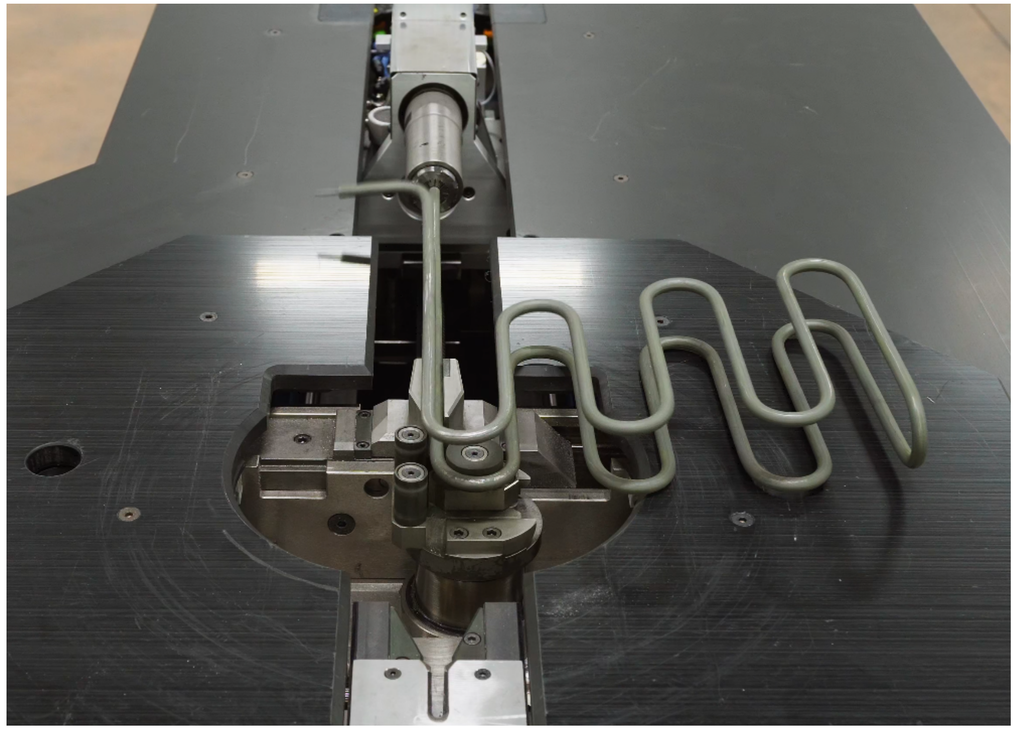
How it works

The machine supports bending of heating elements with varying lengths, offering **individual branch tolerance programming** on a per-element basis (single-element, measured cycle). When processing elements of **uniform length (within ±1 mm), up to four elements can be bent simultaneously** depending on tube diameter (unmeasured cycle).

A dedicated curve generation program enables the production of **multiple bending radii**, while **springback and elongation** compensation factors are stored by diameter, material type, and bending radius. Bends that cannot be executed in automatic cycle are achievable via **secondary bending**, which can be programmed directly into the machine sequence.

The control system allows storage of up to **10,000 programs, ensuring fast and straightforward setup changes**, an essential feature when handling small production batches across different element diameters and geometries.
A 3D simulation displays each bending phase sequentially through to the fully bent element, providing a **feasibility check and programming verification tool.**

This machine has been designed and built to bend even a single heating element with correct dimensions, tolerances, and bending angles, eliminating the need for preliminary bending tests.



Technical characteristics

Mod. 170/50.A30000

Minimum length of heating elements — with measure	500 mm (20")
Minimum length of heating elements — without measure	300 mm (12")
Maximum length of heating elements	3,000 mm (118") — extendable up to 9,000 mm (354") with optional extensions (see options)
Maximum difference in length of heating elements	180 mm (7.08")
Maximum length of terminal pin	40 mm (1.6")
Minimum programmable length of last straight section *(limited by the physical clearance between clamp and bending center)*	45 mm (1.8") — 130 mm (5") with Heavy-Duty Head
Number of programmable bends per cycle	80
Max. bending speed	360°/sec
Tolerance on diameter (when bending 2+ elements at a time)	±0,06 mm (.0023")
Power supply	V to be defined
Pneumatic supply	6 Atm
Installed power	3 KVA

Technical characteristics

Working range by head configuration

The machine is supplied with the **Standard Head**. Two optional heads extend the working range:

- The **Heavy-Duty Head** increases the maximum workable diameter.
- The **Small Radii Head** enables bending at tighter radii.

Mod. 170/50.A30000	**Standard Head**	**+ Heavy-Duty Head (optional)**	**+ Small Radii Head (optional)**
Range of diameters of heat treated heating elements	6,3–12,5 mm (.248–.492")	Up to 16 mm (.629")	Up to 8,5 mm (.334")
Bending roll diameter	18–60 mm (0.7–2.4")	33–60 mm (1.3–2.4")	12–17 mm (0.47–0.67")

Operating modes

The machine can operate in two modes:

- **With measure:** one heating element per cycle, for all diameters. Used when elements of different lengths are being bent and the machine needs to distribute the length differences (within defined tolerances) across each section of the element.
- **Without measure:** used when bending elements of similar lengths (±1 mm), allowing multiple elements to be processed simultaneously in a single cycle. The number of elements per cycle depends on the diameter:
  - Ø 6,30-6,50 mm (.248–.255"): up to **4 elements** per cycle
  - Ø 8,00–8,50 mm (.314–.334"): up to **2 elements** per cycle
  - Ø > 8,50 mm (.334"): **1 element** per cycle

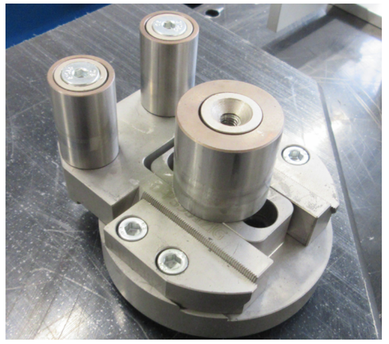
Options

BENDING HEADS

Optional heads to extend the machine's working range.

Model	Description
171/50.000000	**Heavy-Duty Head** - extends max. element diameter up to 16 mm (.629″). Supplied with a bending roll of Ø 33 mm (1.299″); additional roll diameters available in the Tooling section below. Single element per cycle only.
170/52.100S00	**Small Radii Head** - enables tight-radius bending using bending rolls of diameter 12–17 mm (.472–.669″); suitable for elements with diameter up to 8,5 mm (.334″). Single element per cycle only.

NOTE: The Standard Head is supplied with a bending roll of Ø 18 mm (.709″).
The Heavy-Duty Head is supplied with a bending roll of Ø 33 mm (1.299″).
For the Small Radii Head, the desired bending roll diameter must be specified by the customer at the time of order.



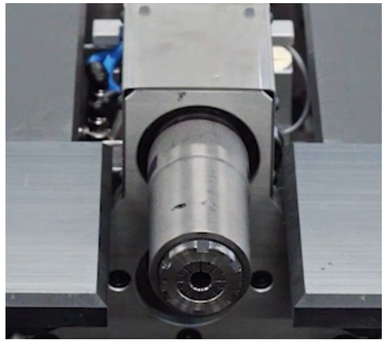
Heavy-Duty Head

Small Radii Head

ROTATING CLAMP - 3D OPTION

Adds the 3rd CNC axis for automatic multiplane bending of 3D heating elements.

Model	Element Ø	Description
170/50.000R01	Up to Ø 12 mm (.472″)	**Rotating Clamp** - Adds the 3rd CNC axis, enabling automatic multiplane bending. Supplied with a short-body bending roll with diameter Ø 18 mm (.709″) and a clamp for element diameter 8,5 mm (.334″); additional short-body rolls and clamps for other diameters available in the Tooling section below. Single element per cycle only (required for multiplane rotation clearance).



3D Rotating Clamp

Options

TOOLING - Bending Rolls and Clamps

Bending rolls and clamp units for all head configurations.

Model	Description
065.08.146-00	Bending roll for Standard Head — roll diameter Ø 18–60 mm (0.7–2.4"); diameter to be specified by customer
P3967*0	Bending roll for Heavy-Duty Head — roll diameter Ø 33–60 mm (1.3–2.4"); diameter to be specified by customer
PM00018912*0	Bending roll for Small Radii Head — roll diameter Ø 12–17 mm (.472–.669"); diameter to be specified by customer
PM00001555*0	Short-body bending roll for Standard Head with Rotating Clamp (3D elements) — roll diameter Ø 18–60 mm (0.7–2.4"); diameter to be specified by customer
PM00001371*0	Clamp unit for Rotating Clamp; diameter of the heating element to be specified by customer

EXTENSIONS FOR ELEMENTS OVER 3,000 mm (118″) IN LENGTH

The machine is supplied as standard for a maximum element length of 3.000 mm (118″).
Rear extensions can be added and combined to reach the required working length, up to a maximum of 9.000 mm (354″).

Model	Description
170/50.PR1000	Rear extension 1,000 mm (40") — for elements up to 4,000 mm (158")
170/50.PR2000	Rear extension 2,000 mm (80") — for elements up to 5,000 mm (197")
170/50.PR3000	Rear extension 3,000 mm (120") — for elements up to 6,000 mm (236")
170/50.PR4000	Rear extension 4,000 mm (160") — for elements up to 7,000 mm (276")
170/50.PR5000	Rear extension 5,000 mm (200") — for elements up to 8,000 mm (315")
170/50.PR6000	Rear extension 6,000 mm (240") — for elements up to 9,000 mm (354")

Options

LASER SCANNER

Mod. 170/50.PRPE00

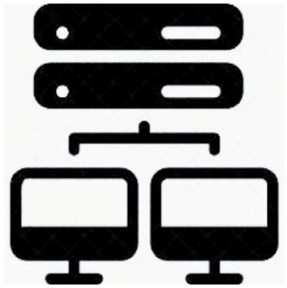
Defines a programmable safety perimeter around the machine's work area. When the operator enters the monitored zone, the bending cycle is automatically interrupted. With this option, the operator does not need to keep the two-hand safety control device pressed throughout the entire bending cycle, allowing greater freedom of movement and reducing operator fatigue during production. While the machine runs the bending cycle, the operator is free to work in parallel on other activities, such as making secondary bends on previously processed elements or preparing the next elements to be run on the machine.

NETWORK SERVER CONNECTION

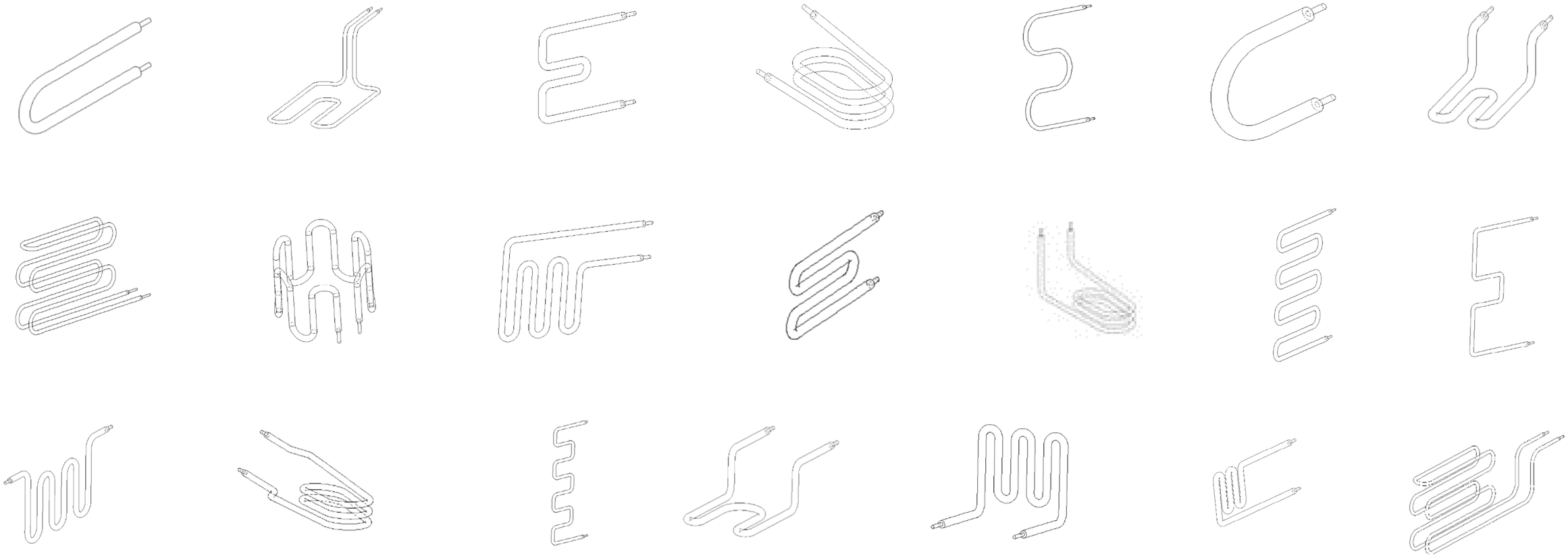
Mod. 170/50.SW0030

Connects the bending machine directly to the customer's company server, enabling the machine to read and write bending programs and related data tables directly on the server. This provides three key advantages:

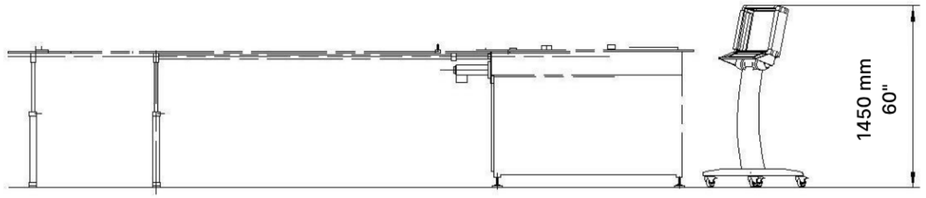
- **Automatic back-up:** all programs are stored on the server in real time, with no need for manual back-up operations.
- **Remote programming:** programs can be prepared at the office, saved on the server, and recalled directly from the machine on the shop floor.
- **Multi-machine sharing:** when multiple machines are connected, the same program can be recalled from any machine without manually transferring files between them.

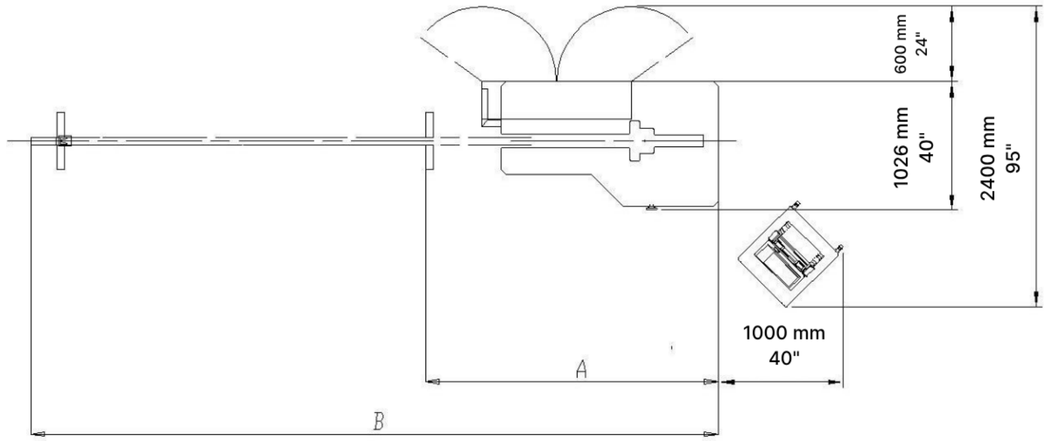


Examples of heating elements produced with the machine



Layout





HEATING ELEMENT LENGTH	3000 mm 118.11″	4000 mm 157.48″	5000 mm 196.85″	6000 mm 236.22″	6500 mm 255.91″
A	4500 mm 177.17″	/	/	/	/
B	/	5700 mm 224.41″	6500 mm 255.91″	7500 mm 295.28″	8000 mm 314.96″