Ercolina Giga Bender's Improved Design
Ercolina benders are more rugged and versatile than traditional outdated "swing arm" technology. Bending axis positioned directly beneath pressure die, eliminates the need for a tie bar and prevents material slippage. Bending force exerted by the spindle is resisted by pressure die which is monitored and continuously adjusted automatically for consistent pressure throughout the bend cycle. Giga Bender series internal design incorporates large spindle and bearing diameters ensuring the greatest rigidity. Ercolina benders are engineered using today's state of the art technology and machine tool standards. Capacities rated in material size as well as section modulus enable the customer to determine the machine's true capacity for application. If you are considering purchasing a heavy-duty tube, pipe or profile mandrel-bending machine please consider the Ercolina advantage.

The Bend Head
The bend head moves transversally to the machine axis for bending radius adjustment. This concept is very useful for tooling set up when adjusting for different bend radius. CML International developed a new concept of bend head horizontal slide (patented in 2007), that allows a very heavy bend head to move accurately with ease. The bend head designed for KST Clamping is compact, rigid and offers a high torque of bend. It's manufactured entirely in spheroidal cast iron GS500 which provides stability and absorbs vibration during the bending process.

Traditional Swing Arm Clamping Difficulties
Swing arm benders clamp die are mounted on a carrier resting on a slide built into the top of a "swing-arm". The arm assembly "swings" with the bend die's rotation. The clamp die, upon closure inherently induces a massive offset load onto the bend die. This can produce tilt of the bend die. As the bend die rotates, this tilt results in a continuously varying out-of-plane relationship between the bend die and both the pressure die and wiper die. The older the machine and tooling, the worse the condition becomes. The bend die moves and tilts under clamp loads, the upper portions of the clamp surface actually pull away from the workpiece, resulting in a reduced clamping grip.

Because extremely high clamping and bending forces are required in bending large workpieces, this tilting phenomenon necessitates the use of overhead tie bars, center-posts, multiple hold-down bolt patterns, and flange-mounted bend dies on swing arm benders. Toggle type clamp closure mechanisms used on most swing arm benders generate indeterminate excessive clamping force at its dead-center position before reaching the over-dead-center locked-up position. With hydraulically actuated mechanical device clamping, it is not possible to use hydraulic pressure gauges to measure true clamping.

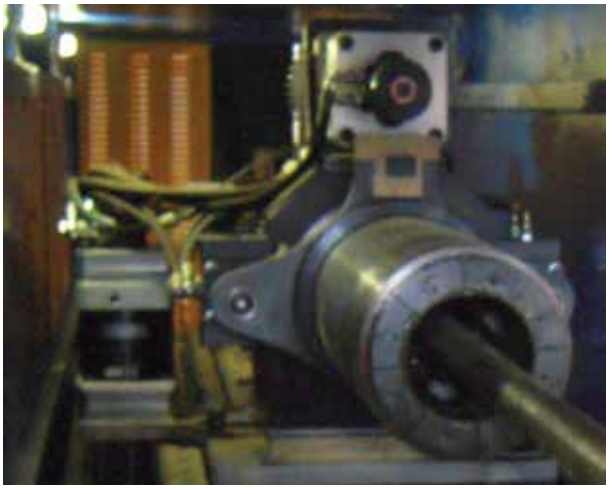
As bending machines become larger, the swing arm assembly becomes disproportionately more massive in order to impose the necessary clamping forces and to accommodate up to 5 X D bend dies. The main beam of a swing arm bender is at right angles to the pressure die slide. These benders use the immovable main frame for functions which are related to the variable centerline location of the workpiece - functions such as 3-axis carriage ways support and mandrel extractor mounting. Heavy loads imposed by larger workpieces are carried through unnecessarily complex

and/or indirect mechanisms. In addition, the arm and clamp become interference obstacles when the pipe is being advanced between bends. This difficulty can only be resolved by either a drop-away clamp mechanism or a separately pivoted coaxial swing arm and main shaft – each more complex, and weaker, representing compromises for outdated machine design. Eliminating clamp interference by mechanical means increases maintenance costs and decreases reliability.

C Axis Design

C Axis movement uses single two speed hydraulic cylinder to operate bend and return functions, simple to regulate, minimizes bending head dimensions, reducing the overall footprint of machine. C Axis driven with two chains directly connected to axis eliminates sprockets and play in axis. Return bending pressure is controlled to 50 Bar for safety. Bend head axis moves to adjust centerline, maintains axis alignment with mandrel carriage. Bend head axis adjustable for centerline radius of former maintains axis alignment. CNC7 models have motorized axis alignment for bending head alignment and workpiece loading and unloading. Powered centerline radius adjustment of the bending head allows the mandrel table to remain stationary and rigid. All cast parts are certified GS500 steel Spheroid design. Multiple design improvements and patents eliminate dated mechanical systems and mass.

Choosing the Proper Carriage



Less expensive and poorly designed benders offer no carriage or only manually operated models. Ercolina's powered indexing carriage advances and rotates the workpiece between bends. Primarily the carriage is a material handling mechanism positioning the workpiece for each bend just as accurately as the carriage of a CNC bender. Standard with positioning tailstock for controlling Y and B movements meaning Distance Between Bends (DBB) and Plane of Bend (POB) includes DRO standard. Tailstock with Hydraulic clamping and split collet material capacity securely supports material. The most important benefits of the powered carriage on a larger bender are powered loading, positioning, and unloading of heavy workpiece, especially when the pipe or tube must be drawn many feet over a snug fitting mandrel. The basic bender is complemented by the carriage-mandrel beam, without design compromises to either. Because the main beam and drive cylinder is under the pressure die slide, rather than under the mandrel beam, as in most benders, the carriage is designed to accommodate the centerline height of the bender's tooling, not vice versa. When a carriage is added to a traditional swing arm bender, the centerline height of the bend die must be elevated to accommodate the carriage collet's height above the main beam. This extra tooling height compounds the risk of bend die tilt. GB series axis travel and load length is not restricted by the bender's main beam length and does not require an extended frame. The carriage rides on precision ground ways for smooth movement for distance between bends, driven by a powerful hydraulic motor through a rack and pinion. Carriage chuck rotation plane-of-bend movement is also hydraulically driven. The carriage provides safe, accurate, one-man, powered positioning for distance-between-bends and plane-of-bend movements. Positioning is achieved by use of digital encoders with digital read out for each axis. The inside dimension of the carriage allows tube to pass through enabling recapture cycle, increasing machine length capacity. This cycle is selected automatically from the control. A radial slide on the Y1 axis allows the carriage to move out of the machine axis. During bend cycle if radial movement occurs due to a tube movement the linear axis guides are not under pressure, rather the carriage moves. A powered carriage eliminates the need for additional operators, reducing labor cost and improving accuracy. Powered carriage options are ideal for multiple bend applications requiring greater accuracy. Hydraulic oil cooler operates under variable temperature conditions.

KST Clam Shell Material Clamping Advantages

Patented Ercolina KST clamp system mounts directly over C bending axis, eliminating dated swing arm and tie bar systems. Simple tooling installation of clamp and pressure die. Clam shell clamping system uses two double acting cylinders, one for positioning and one for clamping, creating direct proportional pressure (Patented). No tie bar required, tooling maintains consistent balance of pressure. No clamp-pressure induced bend die tilt - even when bending the heaviest or most "critical" workpieces. Built-in clamp alignment in the matching mounting surfaces of the

clamp mechanism and bend die assure that no vertical or horizontal clamp set-up adjustment is required. Therefore, tool changing is faster and easier. The clamp opens upwards, eliminating interference with the forward feed of the bent workpiece. Clamping forces are self contained - not carried through the die mount, the spindle, or any other part of the machine. Thus, there is never any bend-die tilt caused by clamping forces. Tooling remains properly aligned because the bend die rotates in a level plane throughout the bend. Machine and tooling maintenance are reduced. There are no swing arm slides or toggle linkages to sear or break, and less stress and wear on the tooling. Overhead clamping is safer. Dangerous “pinch points” between the swing arm and pressure die arm are eliminated. Bender operator has direct control of the clamping forces. They are easily read on a pressure gauge and easily set with a relief valve, assuring consistent, accurate set-ups.

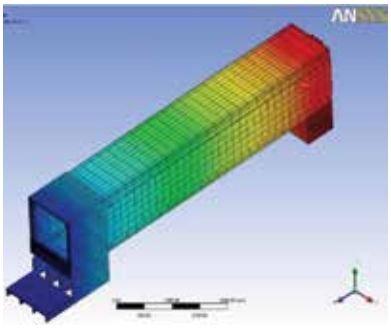
Mandrel Functions
Standard programmable anticipated mandrel extraction. Tool free installation and adjustment of mandrel rod. Twenty-foot over-mandrel load length and carriage travel available accepts full pipe lengths in one continuous motion with no hitch feeding. Mandrel lubricator system designed to pump heavy lubricant through hollow mandrel rod out through holes in side of mandrel throughout the bend cycle as needed. Lubricator is automatically controlled with touch screen and is included with all Giga Bender models.

Mandrel Retract System
Cylinder controls mandrel support rod with position maintained by encoder, eliminating any manual switch regulation. Mandrel in and out positions are adjustable from software on the control. Anticipated mandrel retract is also programmable from the software to improve the bend quality. Mandrel in position is accessible and adjusted outside the machine frame. Position can be regulated any time during initial setup by turning a nut. Other advantages for the GB mandrel system include faster set up, more rigidity, quick tooling change over, mandrel rod can be fixed or can rotate with the profile.

Pressure Die System
Patented feature offers programmable pressure die with auto recapture during bend cycle to 180 degrees. Operator enters pressure die length and machine auto calculates and performs required cycle movements. Pressure die cylinder automatically compensates and adjusts pressure throughout the bend cycle as tube dimensions change. System offers more clearance for tube loading and unloading, adjustable speed control of linear booster. Compact machine design with reduced pressure die length greatly reduces material waste at end of bend. Programmable inward and outward pressure die positioning.

Booster Feature
Involves a continuous push-force applied directly to the workpiece through a booster clamp. To achieve maximum booster effect, the booster cylinder and its mounting system must be able to exert a sufficient load to bring the workpiece close to compressive yield. Booster clamp is mounted directly on the rear of the pressure die, providing continuous column strength reinforcement of the workpiece under high booster loads.

Overall Structure



All mandrel bending machines have a frame. The Ercolina GB series frame maintains the mandrel in axial position during the bend cycle. Force is high, approaching 15.000kg, when bending 6" tube. The bender's structure must maintain the mandrel in position as this occurs. Structure on a mandrel machine works in flexion, If the frame is not stable enough, the mandrel position changes and moves forward to the bend axis, the traction effort increases and the frame reacts pulling the mandrel back to the initial position creating vibration. To stabilize the mandrel position, older bending machines require larger, heavier frames increasing the machine size and weight. This style of machine requires it to be fixed to shop floor. Flexion on frame will still exist. The structure for a 5" tube of 15.000t working in flexion moves around ½" inch when bending. CML's patent uses a frame working in compression. This tunnel structure increased stability more than 50 times with less weight. The tube axis is located inside the structure, unlike conventional bending machines which are outside. The structure supports pure compression with more stability of the machine, higher bending accuracy, stability for components and safer bending.

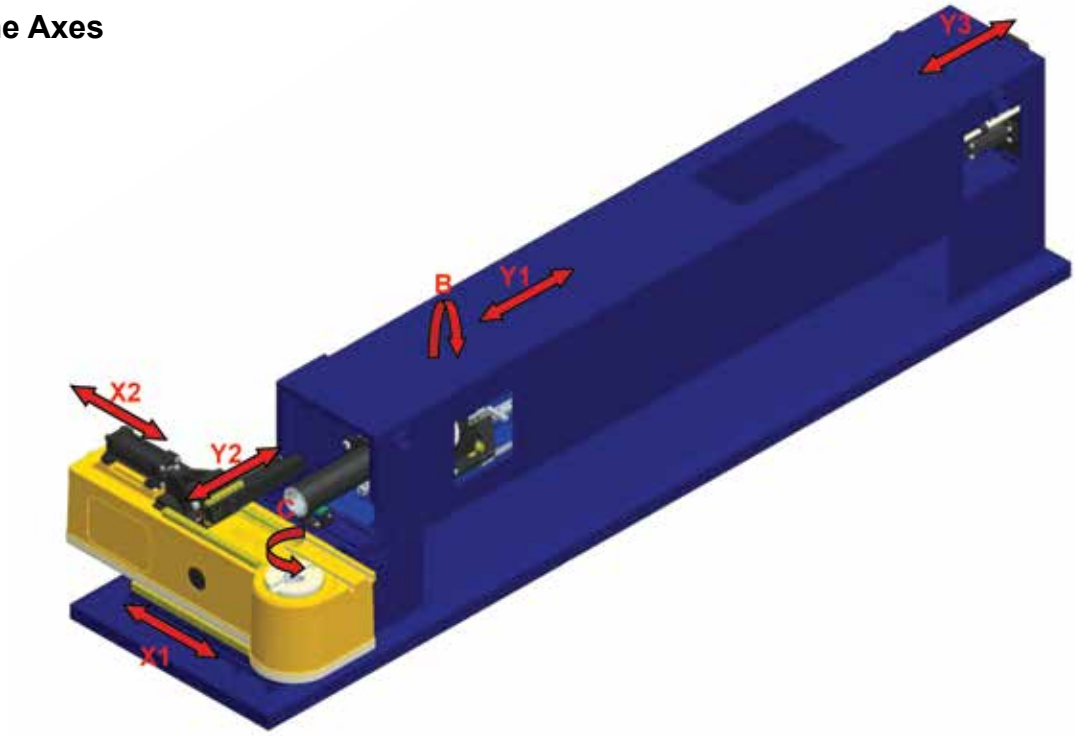
Operator Control

Industrial PC with 17" touch screen is located in movable separate tower with hand held Sic safety control. Windows 10® operating system with easy storage of programs to hard drive or external USB Key or via network. Automatic and manual cycle with individual axis control manual override of Clamp, Pressure Die, Boost, Mandrel, and Clamp release function. Programming capable of Cartesian or polar coordinates to tangent or CLR dimensions. Programs in YBC and XYZ with auto convert to LRA. Accepts XYZ cad values with manual input. Displays five axis positions in Absolute or Incremental readout value. Inch and Metric programming and display of bend angle with individual springback settings for all programmed bends. Tooling profile setup page automatically creates bending program from XYZ coordinates. Calculates material length required for application. Machine load requirement based on material specs. Program calculates material stretch and theoretical wall thinning percentage minimizing setup. Full machine function diagnostics, machine parameters data page with 500 programmed values and functions and complete alarm list with definitive alerts. Updateable machine software with USB (requires optional importation software).

Numerical Control

Virtual simulation with three-dimensional visualization tube application anti-collision system to view bending process and movement of tube, machine, and tube to floor restrictions. Other features include integrated diagnostics, multi-language interface, tooling database for easy recall, and automate calculation of material springback and anticipated mandrel movement programming.

Machine Axes



#	Axis	Name	Unit	Repeat	Max Speed
1	Y1	Linear (DBB)	mm/inch	(+/-) 0.1mm	650 mm/s
2	B	Rotation (POB)	°	(+/-) 0.1°	100 °/s
3	C	Angle (DOB)	°	(+/-) 0.1°	4.9 °/s
4	X1	Horizontal head (CLR)	mm/inch	(+/-) 0.1mm	640 mm/s
5	X2	Pressure die	mm/inch	(+/-) 0.5mm	160 mm/s
6	Y2	Booster	mm/inch	(+/-) 0.5mm	410 mm/s
7	Y3	Mandrel	mm/inch	(+/-) 0.5mm	434 mm/s

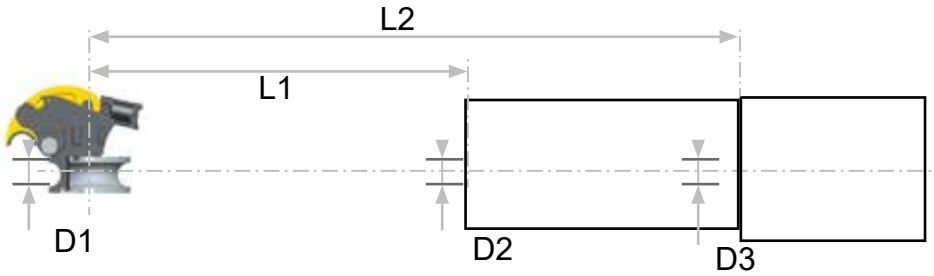
KST system (patented)

One small cylinder moves clamp from open position to pre-close position.
The main cylinder, while closing, is locked by gravity on the structure and acts on clamp to close tube.
Clamping stroke is short.
Action on clamp cylinder uses longer lever increasing clamping force.
Compact for maximum efficiency.

CML kit KST 4

KST:
No bend arm.
Bend die is directly fixed on bend shaft.
No tooling set up, fast tool changing.
Clamping effort is directly proportional to cylinder pressure.
System compact, high efficiency.
Use shorter clamp (reduce distance between bends).

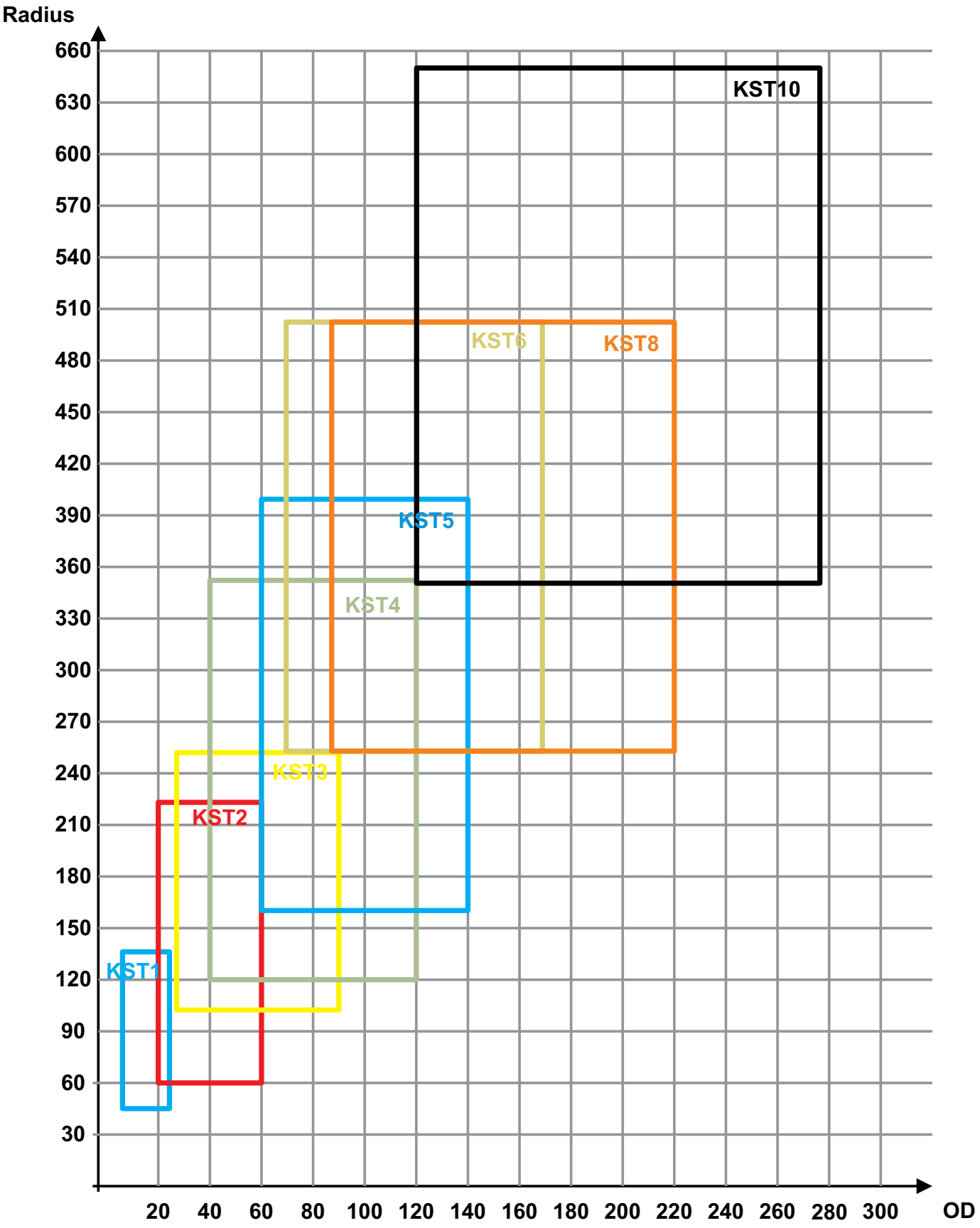
Dimensions



L1	in	178.5
L2	in	252
D1	in	7
D2	in	6.9
D3	in	7.3

Power supply:	kW	35
Hydraulic oil capacity:	gal	105
Noise level	dB	65

KST selection guide



Giga Bender Features for Bending Heavy Tube and Profiles

Bend Head

New patented bending head concept travels horizontally to adjust for bending radius. GB series bending head is manufactured from GS 500 spheroidal cast iron to absorb vibrations during the bend cycle providing maximum stability with high torque.

Clamp System

Clamp integrates to the top of bend die allowing more space to position the tube while providing optimal clamp pressure. Safely eliminates swing arm movement, reduces flexing and minimizes tooling setup and change over.

Booster Function

Booster function pushes the tube into bending die to minimize tube thinning in the extrados and prevent movement in clamp. Booster with adjustable speed features recapture function for deep angles ensuring the booster pressure throughout the bend length. Boost position monitored with digital encoder and is adjustable through programming eliminated manual adjustments.

Tailstock Carriage

Tailstock features large pass enabling control to program recapture of longer tube as necessary for the customer application. Segmented collets clamp securely with dual hydraulic cylinders. Y-axis with radial slide moves during the bend cycle accommodating radial growth and reduces pressure on linear axis.

Machine Structure

Ercolina GB series have a patented machine frame system working in flexion providing increased stability and accuracy with reduced weight. The tube axis positioned inside machine structure unlike conventional bending machines, which use weight to compensate for design.

Mandrel Retract System

Mandrel position is controlled with encoder and adjustable with software, eliminating manual positioning. Program features anticipated mandrel retraction and positioning for better bend quality. Mandrel rod installed or removed with easy release locking pin for faster tooling change. Mandrel rod can be stationary or can rotate as required.