

Look to PHI, the Industry Leader in Tube and Pipe Bending Equipment

The PHI tube and pipe benders, are designed to meet a wide variety of customer requirements, from small production or prototype job shop to the high end user. PHI offers the right machine for the right application providing a full complement of machines. From manually operated machines, where precision bending and portability are required, to more sophisticated higher production machines, that require hydraulic bending and programmability for precision forming. This provides accurate repeatability from part to part.

PHI is also known for quality products such as tube end finishing machines for flaring, squaring and deburring and bead forming the ends of tubes. Pipe flanging machines and automated multi-head welding systems are among the family of specialized products offered by PHI.

PHI has led the industry in terms of such refinements as drop-away clamps to allow the bending of more complicated shapes, and pressure die assists that provide the operator with more precise control over wall thickness issues.

As manufacturers of production equipment, PHI has taken special care to design safety and reliability into each Tube and pipe bender.

Every PHI bending machine is warranted for parts and labor, for one year from date of delivery. Expert service specialists are available for travel to all parts of the world for consultation and service.

**PHI is the leader
in bending equipment
- for a reason.**

Manual Bending Systems

410/411 Manual Bending Machines

The ideal bending machines for prototype departments, small machine shops and operations where cost is a factor and when only a few bends are needed per piece. The compact design permits a great deal of mobility, as well as flexibility of location. They're lightweight and require less than four square feet of bench space -including the bend arm sweep. With tube forming capabilities up to 1.0" diameter x .065 W.T. These machines offer a great return for the investment.

420 Precision Bending Machine

The model 420 is a totally flexible and precise manually operated "Draw" or "Rotary Die" type machine. It has a special gear-operated bend arm that will increase leverage 4 to 1 when bending heavier tubes. The model 420 may be set up for either right or left hand bending. This machine can be purchased in a bend head only configuration or as a complete system for those jobs requiring multiple bends on a different axis. This is the ideal system for forming tube sizes up to 1.5 diameter x .065 W.T.

Hydraulically Operated Systems

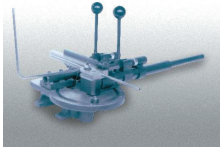
PHI's family of synchronized bending machines, models 210, 220 and 233 Synchro offers three axis bending with one powered axis for degree of bend (DOB). Our modular design offers a basic machine with many options allowing each machine to be custom.

PHI's user-friendly programmable digital controllers are specifically designed for bending and are logically laid out for proper bending sequencing. It has a capacity for 100 programs consisting of 1 to 10 degree of bends per program. The optional carriage system allows mechanical presetting of up to 10 planes of bend (POB) and distance between bends (DBB). When incorporated with the controller, the machine will synchronize and interlock all three functions to ensure correct tube alignment before bending can occur. This ensures easily repeatable bent tube shapes and scrap-free production.



Two bench-mounted machines for economical bends of tube up to 1" OD and pipe 1/2" IPS

PHI's draw bending machines let you bend tube and pipe at extremely low cost. When you only need to make one or two bends per piece, you can save time and energy by using these efficient bench-mounted manual machines.



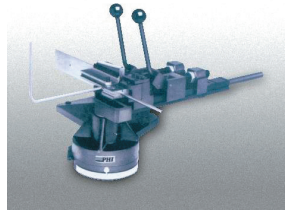
The compact design permits a great deal of mobility, as well as flexibility of location. They're light-weight and require less than four square feet of bench space - including the bend arm sweep.

The tube or pipe length capacity is unlimited, allowing you to use longer lengths with fewer joints.

That means another savings on labor and material costs required to join sections.

Both models give you precision bends with minimal wall thinning and ovality, particularly when optional mandrels are used.

The 410 and 411 benders are the ideal machines for prototype departments, small machine shops, and operations where cost is a factor and when only a few bends are needed per piece.



RELIABLE PERFORMANCE.

Few moving parts, all mechanical operation.

HIGHLY MOBILE.

These light-weight machines can be set-up-anywhere. There is no electrical or hydraulic hook-up required.

COMPACT SIZE.

Less than 4 sq. ft. (1.1m²) of bench space required.

PRECISE BENDS.

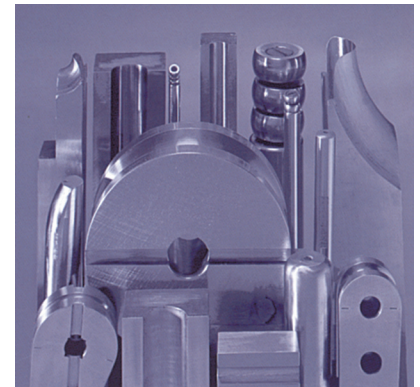
The DOB dial, in 1° increments, permits accurate bends within 1°.

REVERSIBLE DIRECTION.

You can bend clockwise and counter-clockwise, permitting the production of complex parts (Model 410 only).

Tooling Offers the User These Benefits

- The PHI Adaptive Tooling System permits bending a wider range of material diameters on one machine. Conversely, it makes a single item of tooling usable on a number of different PHI bending machines.
- Wiper dies are machined to achieve best tangential fit with bend dies (Model 411 only).
- Follower blocks are designed for precise alignment with the radius block.
- PHI tooling is manufactured in conformance with the requirements of military specifications MIL-I-45208A and MIL-C-45662A.
- Clamp blocks are designed for maximum grip of the tube and have a typical length of four times the Tube Outside Diameter.

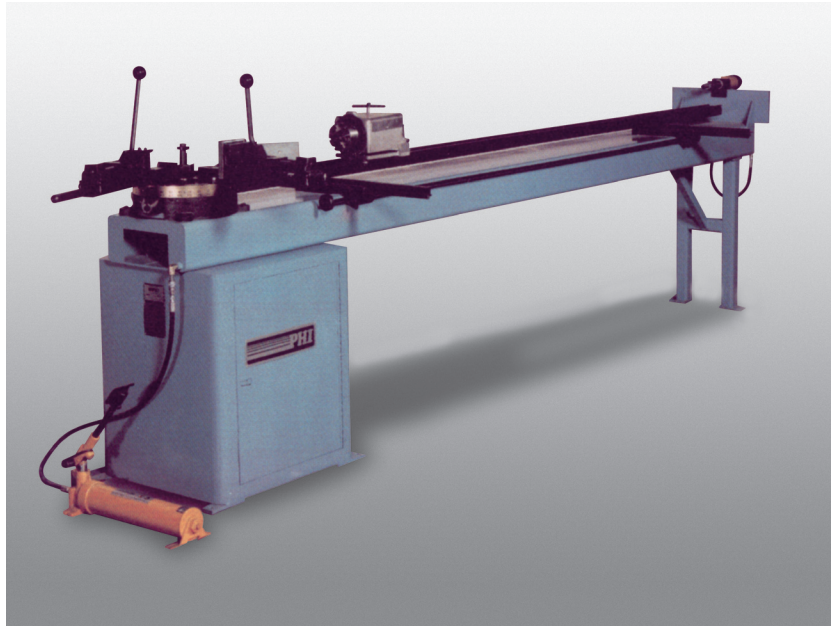


	MODEL 410	MODEL 411
Capacity - Tube	3/4" (10 mm) OD X .065 (1.65 mm) WT maximum X 2D minimum CLR	1" (25 mm) OD X .065 (1.65 mm) WT maximum X 2D minimum CLR
- Pipe	3/8" (10 mm) IPS X Sched 40 max. X 3D minimum CLR	1/2" IPS (13 mm) IPS X Sched 40 max. X 3D minimum CLR
Material - Tube	35,000 psi (930 M Pa) yield	35,000 psi (930 M Pa) yield
Direction of Bend	Reversible (clockwise or counter-clockwise)	Clockwise standard, counter-clockwise if specified
Radius of Bend (CLR)	Minimum 2D - Maximum 6" (152 mm)	Minimum 2D - Maximum 6" (152 mm)
Maximum Bend Arm Movement	195°	195°
Tube Length	Unlimited	Unlimited
Machine Bench Space (including bend arm sweep)	20" X 13" (508 mm X 330 mm)	24"X21" (610 mm X 533 mm)
Shipping Weight	100 lb (45 kg)	175 lb (79 kg)
Tooling Post	1/2" diameter (13 mm)	1" diameter (25 mm)
Mandrel Rods Available	Specify thread size	Specify thread size
Mandrel Rod Bracket Available	Machine or bench mounted	Bench mounted only

All necessary wrenches and one appropriately sized tooling post are furnished with each machine. Other sizes are available.

A universal pressure die slide-plate is furnished with the Model 411. A wiper-die support bracket can be furnished with the Model 411.

Designed and Engineered for the needs of Aircraft Maintenance



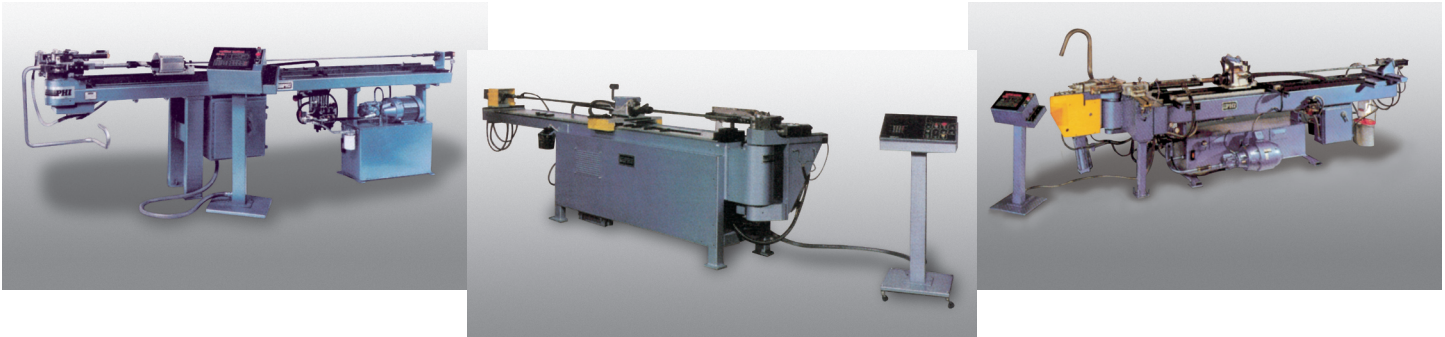
SPECIAL FEATURES

- Self-contained - needs no outside power source.
- Hydraulic foot operated mandrel extractor.
- Precision bends - equipped for wiper die and ball mandrel capabilities.
- Plane of bend carriage with adjustable chuck.
- 1/2" and 1" diameter tool post. All necessary wrenches and one operator's manual are included with the machine.

MODEL 420	
Capacity - Tube - Pipe	1-1/2" (37.5 mm) OD X .065 wall thickness X 2D minimum CLR 1" (25 mm) OD X schedule 80 X 2D minimum CLR
Material - Tube - Pipe	35,000 psi (930 M Pa) yield, 35% elongation ASTM A-587 or equivalent
Direction of Bend	Reversible (clockwise or counter-clockwise)
Center Line Radius (CLR) Maximum Bend Arm Movement	Maximum 8" (200 mm) standard, 12" (300 mm) optional 195°
Maximum Over-Mandrel Tube Length	10 feet (3.3 m)
Machine Floor Space	12 feet (3.6 m) long X 40" (100 cm) wide 40" (100 cm) high
Shipping Weight	900 lb (409 kg) approximately

Our Model 420 is a totally flexible and precise manually-operated "draw" or "rotary die" type machine. It has a special gear-operated bend arm that will increase leverage 4 to 1 when bending heavier tubes. The bender head is bolted to a machine table which is mounted on a tooling storage cabinet. The Model 420 may be set up for either right or left hand bending. Since it requires no outside power source, your maintenance team can now make precise and accurate bends anywhere in the field.

Synchronized bending machine with microprocessor/programmable digital controller for semi-automatic bends up to 3" OD



PHI's synchronized bending machine, Model 210, 220 and 233, offers three-axis bending with one powered axis for the degree of bend (DOB). When configured as shown, the 200 Series provides high-speed production of simple and complex bent tube shapes up to 3" outside diameter (OD) and pipes up to 2" OD.

Configurations range from a slim head and bed profile with spacious underbed clearance to minimize bending interference, a drop-away clamp (Models 220 & 233 only) which speeds production of complex parts by dropping the clamp away from the bend head prior to retracting the clamp and positioning it for the next bend. This eliminates the problem of pipe getting in the way of the clamp and bend die in its retraction cycle. Our modular design – a basic machine with many

options – allows each machine to be custom fitted to best meet your needs.

PHI's user-friendly programmable digital controller, is specifically designed for bending and is logically laid out for proper bending sequencing. It has a capacity for 100 programs consisting of 1 to 10 bends (DOB's) per program.

The optional carriage allows mechanical presetting of up to 10 planes of bend (POB) and distance between bends (DBB). When incorporated with the controller, the machine will synchronize and interlock all three positions (POB, DOB and DBB) to ensure correct tube alignment before bending can occur. This ensures easily repeatable bent tube shapes and scrap free production.

QUALITY OUTPUT.

Perfect part duplication, scrap-free production, quality tooling, positive POB stops and DBB stops.

LABOR SAVINGS.

Single setup for multiple bend parts.

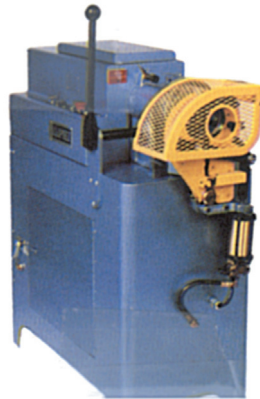
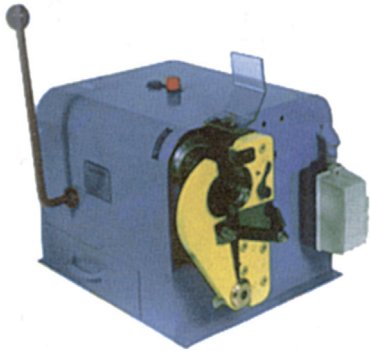
RELIABLE PERFORMANCE.

Heavy-duty construction and extra-large electric motors.

PERFORMANCE-ENHANCING FEATURES.

Precision PHI tooling to help reduce wall thinning and ovality. Synchronized interlock positioning for accurate, scrap-free parts.

	MODEL 210	MODEL 220	MODEL 233
Capacity	- Tube 2" (50mm) OD x .035" (.88mm) wall thickness x 3D minimum CLR or 1 1/2" (37.5mm) OD x .065" (1.63mm) wall thickness x 2D minimum CLR	2" (50mm) OD x .125" (3.17mm) wall thickness x 2D minimum CLR	3" (75mm) OD x .188 (4.7mm) wall thickness x 2D minimum CLR
Material	- Pipe 1" (25mm) OD x schedule 40 x 3D minimum CLR	1 1/2" (37.5mm) OD x schedule 40 x 3D minimum CLR	2" IPS (60mm) OD x schedule 80 x 3D minimum CLR
	- Tube 35,000 psi (930 MPa) yield, 35% elongation	35,000 psi (930 MPa) yield, 35% elongation	35,000 psi (930 MPa) yield, 35% elongation
	- Pipe ASTM A-587 or equivalent	ASTM A-587 or equivalent	ASTM A-587 or equivalent
Direction of Bend	Clockwise (Counter-clockwise rotation is available on special order)	Clockwise (Counter-clockwise rotation is available on special order)	Clockwise (Counter-clockwise rotation is available on special order)
Center Line Radius (CLR)	8" (200mm) standard, 12" (300mm) optional	10" (254mm) standard,	15" (381mm) standard
Maximum Bend Arm Movement	195°	180° and springback allowance	195°
Maximum Over-Mandrel Tube Length	10 feet (3.0m) standard, Longer lengths optional	10 feet (3.0m) standard, Longer lengths optional	10 feet (3.0m) standard, Longer lengths optional
Machine Floor Space	15 feet (4.5m) long x 44" (110cm) wide x 49" (122.5cm) high	15 feet (4.5m) long x 51" (110cm) wide x 49" (122cm) high	18 feet (5.5m) long x 73" (183cm) wide x 52" (130cm) high
Shipping Weight	1400 lbs. (636 kg), approximate	3500 lbs. (1588 kg), approximate	6600 lbs. (3000 kg), approximate



Model 2C, 2CP, and 2CPV

These models are designed for smaller-diameter tubes and pipes.

Model 2C features manual clamping for easy-to-form materials and low production requirements. Model 2CP has air-cylinder clamping for higher production rates and more difficult-to-form materials. Both models have two-speed spindles, allowing you to choose the most efficient speed for the function you are performing.

The 2CPV capacities are the same as the 2CP. In addition, the 2CPV has a variable-speed drive (0-2000 RPM) with a 3/4 HP motor and digital RPM readout.

Model 3CPV

The Model 3CPV extends the range of the PHI end-finishing machines to include tubes and pipes with outside diameters up to 3".

As in the case of the other PHI models, flares are formed to standard 37° and 45° angles, meeting MS33584 and SAE specifications. Beads are formed within the tight specifications called for in Military Specification MS33660.

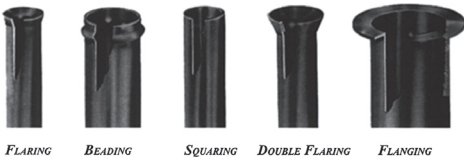
Features of the Model 3CPV include pneumatic clamping, and cabinet stand with tooling shelf. A variable-speed motor allows the operator to select a slower speed for extended blade life when deburring stainless steel.

Model 8CPV

Model 8CPV is the largest in the family of PHI end-finishing machines and can be used to flare, bead, deburr, and square tubes or pipes with outside diameters up to 8 inches.

An air cylinder with heavy-duty linkage holds the tube or pipe firmly in place during each operation, preventing slippage and ensuring that all forming is done within appropriate specifications.

The Model 8CPV also features a variable-speed drive for efficient operation regardless of material or wall thickness. Hard materials such as stainless steel can be deburred at slower speeds, for example, without undue wear of the blades.



FLARING BEADING SQUARING DOUBLE FLARING FLANGING

Models 2C, 2CP, 2CPV, 3CPV, and 8CPV

form a family of machines for preparing the ends of tube or pipe for joining with other tube or pipe sections, valves, T-joints, or machinery.

The ends can be prepared with a bead or flare, or simply deburred and squared. Each machine is capable of performing all of these functions; a change of tooling is all that is required to switch from one function to another.

Squaring, Deburring, & Flaring

Flared joints form liquid-tight, air-tight connections at the ends of tubing or pipe.

To obtain an effective, long-lasting seal, each end of the tube or pipe must be formed to the exact shape of the matching flare fittings.

Tooling supplied by PHI meets this objective. And in almost every case, the same end-finishing machine can be used to perform the required squaring and deburring of the cut end—before the flare is formed.

Typical Applications: Hydraulic systems and fuel lines in the aircraft, automotive, heating, and cooling industries.

Beading

Beading is a versatile end-finishing technique that can be applied to a variety of industrial applications.

In conjunction with an o-ring, for example, beaded joints can be used to interconnect exhaust tubes or low-pressure fuel lines. Beads can also be used to dampen vibration in solid lines or to increase the effectiveness of the seal when a rubber or fabric sleeve is clamped to a metal duct.

Typical Applications: Low-pressure air, exhaust, and liquid systems in the automotive, appliance, and boating fields.

Double flaring

Double-lap flares provide added-strength joints which are more resistant to fatigue and provide a better seal than single-thickness flares.

Double-lap flares formed by PHI machinery and tooling are free of cracks and pitmarks. The joint is also designed so that the inside

surface of the flare has a larger diameter than the inside diameter of the tube or pipe and, therefore, does not interfere with flow characteristics of the system.

Typical Applications: Thin-wall tubing connections that are subject to shock, vibration, or high internal pressures such as automobile brake lines and critical aircraft hydraulic lines.

Flanging

Pipe-flanging machines permit the joining of pipe sections without the need for costly welded flanges and the associated temporary tack welding, slag removal, and X-ray inspection.

A prefabricated slip flange is placed against the assembly on an adjacent pipe section. A disc-shaped rubber seal placed between the two formed flanges prevents any leaks. Problems in lining up bolt holes are eliminated with the use of slip flanges which rotate freely on the pipe. Standard flanges can still be used.

Typical Applications: Chemical plants, petroleum refineries, power plants, and pipelines.

PHI end-finishing machines are the end result of more than forty years experience in producing tube-processing equipment (as Leonard Precision until 1969 and as Conrac's Machine Tool Division until 1985).

There is a standard machine in the PHI line for almost any tube or pipe end-finishing requirement— flaring, double flaring, beading, squaring, deburring, or flanging—for applications ranging from 1/8" light-wall tubing to heavy 8" pipe.

To increase efficiency, every PHI machine features simplified setup procedures with minimum time loss in small-lot production changeover. The PHI designs also permit new operators to run the machines at near top efficiency after a very short training period.

All of PHI's production machinery is manufactured on our own premises, assuring you that our rigid quality specifications are met on every item we ship.

	2C, 2CP & 2CPV	3CPV	8CPV
Flaring	Annealed ferrous & stainless steel: 1/8"-2" OD x .049" max.WT Nonferrous: 1/8"-2" OD x .065" max.WT	Annealed ferrous & nonferrous: 1/8"-3" OD x .125" max.WT Stainless steel: 3/8"-3" OD x .125" max.WT	Annealed ferrous, non-ferrous, & stainless steel: 1-1/4" - 8" OD x .125" max. WT
Beading	Annealed ferrous & nonferrous: 1/4"-3/8" OD x .035" max.WT Annealed ferrous & stainless: 1/2"-1-1/2" OD x .049" max.WT Nonferrous: 1/2"-1-1/2" OD x .065" max.WT	Annealed ferrous & nonferrous: 1/4"-3/8" OD x .035" max.WT 1/2"-1-1/2" OD x .065" max.WT Stainless steel: 1/2"-1-1/2" OD x .065" max.WT	Annealed ferrous, nonferrous, & stainless steel: 1-1/4"-8" OD x .065" max.WT Bead ht. adjustable 3/8" max Semi-automatic bead cycle 1-1/4" OD and up.
Squaring & Deburring	Annealed ferrous, nonferrous, & stainless steel: 1/8" - 2" OD	Annealed ferrous, nonferrous, & stainless steel: 1/8" - 3" OD	Annealed ferrous, nonferrous, & stainless steel: 1-1/4" - 8" OD
Spindle Speed	2C & 2CP: 2-speed spindle 500 and 1500 RPM 2CPV: Vari-speed motor 0-2000 RPM	Vari-speed motor 10-1750 RPM	Vari-speed drive 70-550 RPM
Clamping	2C: Manual lever 2CP & 2CPV: Semi-automatic air cylinder clamping with "PROTEC JAWS." Air supply 1-1/2 CFM at 75-100 PSI required.	Semi-automatic air cylinder clamping with "PROTEC JAWS." Air supply 1-1/2 CFM at 75-100 PSI required.	Pneumatic cylinder Heavy-duty overhead jaw linkage
Electrical	2C & 2CP: 1/2 HP motor 2CPV: 3/4 HP motor	3 HP motor	3 HP motor Magnetic starter Fused disconnect
Dimensions	28" x 18" x 15" (LxWxH)	39" x 28" x 45" (LxWxH)	68" x 35" x 54" (L x W x H) Floor-to-spindle C/L, 41"
Shipping Weight	2C: 300 pounds 2CP & 2CPV: 350 pounds	850 pounds	2200 pounds
Options	Cabinet stand	Semi-automatic powered beading cycle to 3" OD Manual beading cycle to 3" OD Digital display to read motor RPM	

DF MACHINE

The Model DF is a high-production unit, allowing the production of up to 600 double flares per hour. The machine is operated by a single lever which activates the two steps required to form a double flare. No electricity is required. All operations are pneumatically powered.

The Model DF is a double-lap flaring machine which produces a double-thickness flare. It will also produce a single-thickness flare and an upset bead.

The machine forms double-lap flares to precise 37° and 45° dimensions within MS and SAE specifications. Single flares and beads are also done with precision and within specifications — every time.



MODEL DF	
CAPACITY	DOUBLE LAP FLARING: 1/8" to 1/2" OD, annealed ferrous or nonferrous tubing. SINGLE FLARING: 1/8" to 3/4" OD, annealed ferrous or nonferrous tubing. BEADING: 3/16" to 1/2" OD, annealed ferrous or nonferrous tubing.
OPERATION	Single lever operated, entirely pneumatically powered.
AIR SUPPLY	75/100 PSI air supply required. Air-consumption approx. 1-1/2 CFM at 100 PS1G. No electrical connection.
STANDARD TOOLING	For MS and SAE Flare Specifications.
DIMENSIONS	Length 28" - Width 18" - Height 42"
SHIPPING WEIGHT	480 pounds

M343 & M369 Machine

1/2" TO 8" IPS

Models M343 and M369 Flanging Machines cold-form pipe ends to a 90° flange. The machines are simple in design and simple to operate. Skilled labor is not needed to operate the machine, nor to bolt the flanges together — entirely eliminating the need for skilled labor in joining pipe sections.

A complete tooling change can be performed in just minutes. Once the pipe is in place, the flange is formed in minutes. The whole operation — install tooling (if required), insert pipe, form the flange, remove the pipe — requires a maximum of 5 minutes. This compares favorably to the approximately 45 minutes required to weld a flange onto the pipe.



MODEL 343	
CAPACITY	Pipe Schedules 5, 10, and 40 from 1/2" to 4" IPS Schedule 80 from 1/2" to 2" IPS
POWER DRIVE & CONTROL	5HP, geared head motor with brake. , Pneumatic operation, 3 CFM required.
OPERATION	Pipe is clamped in machine jaws and remains stationary while rotary spinner head forms flange.
DIMENSIONS	Length 60" - Width 30" - Height 58"
SHIPPING WEIGHT	2200 pounds

MODEL M369	
CAPACITY	Pipe Schedules 5, 10, and 40 from 1-1/2" to 8" IPS Schedule 80 from 1-1/2" to 4" IPS
POWER DRIVE & CONTROL	15HP, self-contained hydraulic system
OPERATION	Pipe is clamped in machine jaws and remains stationary while rotary spinner head forms flange.
DIMENSIONS	Length 102" - Width 44-1/2" - Height 67-1/2"
SHIPPING WEIGHT	4500 pounds

... PHI Precision Tube End-finishing Machines are the answer!

H FRAME PRESSES

MODEL 50HD-M-7

Hydraulic Presses are versatile Shop Presses. The H Frame is ideal for:

- **Assembly**
- **Straightening**
- **Bending**
- **Product Testing**
- **Forming**
- **Various other applications**

Press Frames are constructed of heavy duty steel plates. Cylinders are double-acting operating at 3000 psi for lower hydraulic system pressure and greater reliability.

Ram attachments for hydraulic lifting of the table to required height position.

Workhead has a manually actuated horizontal travel over heavy duty roller bearings.

Press includes pendant control hand switches enabling operator to view the work from all sides as he controls the ram travel.



SPECIFICATIONS

Model	Capacity (Tons)	Width Between Uprights	Vertical Uprights	Width Between Table Channels	Horizontal Movement of Head	Stroke	Ram Speed Advance	Ram Speed Pressing	Motor HP	Floor Space	Height	Weight
50HD-M-7	50	30"	7"-42"	8'	16"	14"	29"/min	3.5"/min	2	65"x36"	89"	1600 lbs

ACCESSORIES

Press includes as standard a plunger set and a table lift chain attachment. Additional accessories such as Support Plates, V Blocks, Plunger Sets and Punches are available.

MANUAL COMPRESSION PRESSES

Model PW 220C — 20 ton capacity

20, 30, & 50 TON

For over 50 years, PHI Manual Compression Presses have been the unquestioned industry standard. Today, thousands of these compact, efficient presses are in industrial and laboratory service around the world.

Highly versatile, PHI manual compression presses are ideal for short run plastic and rubber molding, batch testing, materials development and evaluation, briquetting, adhesive bonding, printed circuit board laminating and numerous other laboratory and light production applications.

Regardless of model or capacity, each PHI press is designed and ruggedly constructed for years of heavy duty service. The finest hydraulic, electrical and mechanical components, controls and safety devices are used, and all components are conveniently located for ready access for operation and maintenance. Featuring flexible "building block" design and construction, the many standard and optional features available on PHI manual compression presses allow you to easily and economically tailor your press to meet your individual testing or production requirements.





Model PW 220C with optional cure and cooling timers with auto press opening



Model Q - 240C
30 ton capacity

PROVEN DESIGN FEATURES

UNITIZED FRAME—In PHI manual compression presses, the heavy duty frame columns are wide, solid steel plates structurally joined to the solid steel bolsters. Bolsters are ground, and the frame is carefully aligned to insure accurate platen parallelism. The moving bolster is fully guided. This remarkably strong, rigid design affords minimal deflection, assures accurate mold mating and uniform pressure application under all operating conditions.

TWO-STAGE HYDRAULIC PUMP—The PHI patented, manual high/low pressure pump is the most efficient and reliable ever developed. It automatically converts from low pressure/high volume to high pressure/low volume for ease of operation and accurate control throughout the range from 0 lbs. to full press capacity, with optional low pressure instrumentation.

DUMP/DECOMPRESSION VALVE—The two-stage PHI decompression and dump valve enables the operator to adjust pressure to laboratory accuracy. The two-stage design permits precisely bleeding off pressure as required, in the event of pressure overshoot. In addition, the valve provides gradual decompression and fast or slow press opening.

STANDARD FEATURES:

- Rigid, all-steel construction
- Electric, water cooled, ground steel platens
- Platen sizes from 8" x 8" to 18 1/2" x 18 1/2"
- Thermal insulation between bolsters and heated platens
- Patented two-stage manual hydraulic pump
- Two-stage dump/ decompression valve
- Up acting, single acting, low friction ram
- Removable adapter for increased daylight
- Unitized frame construction
- Digital temperature controllers
- Easy-to-read, accurate pressure gage
- Enclosed, contamination-free hydraulic system
- Quiet, trouble-free operation

MANUAL OPERATION	20 TON CAPACITY		30 TON CAPACITY		50 TON CAPACITY		
	P-21 SERIES	PW-22 SERIES	Q-23 SERIES	Q-24 SERIES	B-23 SERIES	B-24 SERIES	B-25 SERIES
Platen Size (inches)	8x8	12 1/2 X 9 1/2	12 1/2 X 12 1/2	18 1/2 X 12 1/2	12 1/2 X 12 1/2	18 1/2 X 12 v	18 1/2 X 18 1/2
Watts per Platen	800	1500	2000	3000	2000	3000	4000
Press Electric Service	120V 240V	AS SPECIFIED PER CUSTOMER ^①					
Maximum Temperature (°F)	600	600	600	600	600	600	600
Heat Rise (°F/Min)	8	8	8	8	8	8	8
Ram Diameter (inches)	4	4	5	5	6 1/2	6 1/2	6 1/2
Ram Stroke (inches)	4	4	4	4	6	6	6
Daylight (adjustable) (inches)	4 to 8	4 to 8	4 to 8	4 to 8	6 to 10	6 to 10	6 to 10
Control Range (tons)	3 to 20	3 to 20	3 to 30	3 to 30	5 to 50	5 to 50	5 to 50
Height (inches)	33"	33"	30"	36"	31"	36"	44"
Base Dimensions (inches)	28x 16	28x24	31 x 17	37x 17	31 x 17	37x 17	37x 19
Weight (lbs)	340	465	730	965	930	1220	1500

^①As specified: 208V-single or 3 phase; 240V-single or 3 phase; 380V-3 phase; 460V-3 phase; either 50 or 60 cycle service

OPTIONAL

- High pressure precision readout gauges
- Low pressure precision readout gauges
- Solid state, adjustable timers
- Intermediate platen for increased productivity
- Steam heated steel platens
- Aluminum platens
- Plain (non-heated) steel platens
- Stainless steel – high temperature platens - 600°F, 800°F and 1000°F
- Rapid platen heating rates
- T-slot platens
- Peripheral platen insulation
- Floor standing bases
- Programmable temperature controllers
- Motorized hydraulic systems



Model B 240C
50 ton capacity with
optional motorized
system & cure timer

PHI HYDRAULIC COMPRESSION PRESSES

for high quality, high production plastic and rubber molding bonding and laminating.

“BUILDING-BLOCK” DESIGN AND CONSTRUCTION

To most efficiently and economically meet the increasingly varied operating and production needs of the plastic, rubber and electronic industries, PHI has developed a versatile/ standardized “building-block” system for the design and construction of its compression presses,

The basic “building-blocks” include a wide range of standard frames/ platens, heating systems, hydraulic power supplies and electric cycle controls. Utilizing these basic “building-blocks” in various combinations, PHI can quickly and inexpensively supply compression presses with capacities, controls, features and capabilities tailored to your specific needs,

With this proven, pro-engineered “building-block” technique, press users now have the opportunity to select presses with “special” capabilities at realistic, economical “standard” prices. Lead time is greatly reduced, and deliveries of most presses can be made in a few weeks.

Whether Strain Rod or Unitized Frame, all PHI compression presses are carefully engineered and ruggedly built for years of heavy duty service. Only the finest hydraulic, electrical and mechanical components, controls and safety devices are used. Components are conveniently located to afford maximum accessibility for ease of operation, inspection and maintenance.

Special compression press, 75 ton capacity, provides precise pressure control utilizing PHI's advanced control instrumentation. Press includes 3 pressure control ranges, electrically heated platens, microprocessor based temperature programmer.



CAPACITY (tons)	STRAIN ROD FRAME NO.	UNITIZED FRAME NO.	DIE SPACE (in.)	RAM DIA. (In.)	RAM STROKE (in.)	STRAIN ROD ADJ. DAYLIGHT* (in.)		UNITIZED FIXED DAYLIGHT* (in.)	WEIGHT** (lbs.)	HEIGHT** (in.)	FLOOR SPACE (in.)
						MIN.	MAX.				
20	20R	20U	8x8	4	4	4	8	4 or 8	550	52	45 x 20
	20R	20U	12 1/2 X 9 1/2	4	4	4	8	4 or 8	650	52	45 x 20
	20R	20U	12 1/2 x 12 1/2	4	4	4	8	4 or 8	800	52	45 x 20
30	30R	30U	12 1/2 x 12 1/2	5	4	4	8	4 or 8	900	54	45 x 20
	30R	30U	18 1/2 x 12 1/2	5	4	4	8	4 or 8	1050	54	45 x 20
	30R	30U	18 1/2 x 18 1/2	5	4	4	8	4 or 8	1250	54	45 x 20
50	50R	50U	12 1/2 x 12 1/2	6 1/2	6	6	10	6 or 10	1100	56	55 x 20
	50R	50U	18 1/2 x 12 1/2	6 1/2	6	6	10	6 or 10	1300	56	55 x 20
	50R	50U	18 1/2 x 18 1/2	6 1/2	6	6	10	6 or 10	1600	56	55 x 20
75	75R	75U	18 1/2 x 12 1/2	8	8	8	12	8 or 12	2900	70	55 x 20
	75R	75U	18 1/2 x 18 1/2	8	8	8	12	8 or 12	3300	70	55 x 20
	75R	75U	24 1/2 x 18 1/2	8	8	8	12	8 or 12	3700	70	60 x 26
	75R	75U	24 1/2 x 24 1/2	8	8	8	12	8 or 12	4100	70	60 x 26
100	100R	100U	18 1/2 x 18 1/2	9	10	10	15	10 or 15	3600	72	55 x 20
	100R	100U	24 1/2 x 18 1/2	9	10	10	15	10 or 15	4100	72	60 x 26
	100R	100U	24 1/2 x 24 1/2	9	10	10	15	10 or 15	4400	72	60 x 26
125	125R	125U	18 1/2 x 18 1/2	10 1/2	10	10	15	10 or 15	3800	72	55 x 20
	125R	125U	24 1/2 x 18 1/2	10 1/2	10	10	15	10 or 15	4300	72	60 x 26
	125R	125U	24 1/2 x 24 1/2	10 1/2	10	10	15	10 or 15	4600	72	60 x 26
	125R	125U	30 1/2 x 24 1/2	10 1/2	10	10	15	10 or 15	5200	72	70 x 33
150	150R	150U	24 1/2 x 18 1/2	11 1/2	12	12	17	12 or 17	5600	75	60 x 26
	150R	150U	24 1/2 x 24 1/2	11 1/2	12	12	17	12 or 17	7200	75	60 x 26
	150R	150U	30 1/2 x 24 1/2	11 1/2	12	12	17	12 or 17	8200	75	70 x 33
	150R	150U	30 1/2 x 30 1/2	11 1/2	12	12	17	12 or 17	10600	75	70 x 33
200	200R	200U	24 1/2 x 24 1/2	13	12	12	17	12 or 17	7800	75	60 x 26
	200R	200U	30 1/2 x 24 1/2	13	12	12	17	12 or 17	9000	75	70 x 33
	200R	200U	30 1/2 x 30 1/2	13	12	12	17	12 or 17	11200	75	70 x 33
	200R	200U	36 1/2 x 30 1/2	13	12	12	17	12 or 17	12200	75	80 x 33
250	250R	250U	24 1/2 x 24 1/2	15	14	14	19	14 or 19	9900	78	60 x 26
	250R	250U	30 1/2 x 24 1/2	15	14	14	19	14 or 19	11900	78	70 x 33
	250R	250U	30 1/2 x 30 1/2	15	14	14	19	14 or 19	14000	78	70 x 33
	250R	250U	36 1/2 x 30 1/2	15	14	14	19	14 or 19	16000	78	80 x 33
	250R	250U	36 1/2 x 36 1/2	15	14	14	19	14 or 19	18200	78	80 x 40
300	300R	300U	24 1/2 x 24 1/2	16 1/2	14	14	19	14 or 19	10600	80	60 x 26
	300R	300U	30 1/2 x 24 1/2	16 1/2	14	14	19	14 or 19	13900	80	70 x 33
	300R	300U	30 1/2 x 30 1/2	16 1/2	14	14	19	14 or 19	14800	80	70 x 33
	300R	300U	36 1/2 x 30 1/2	16 1/2	14	14	19	14 or 19	17500	80	80 x 33
	300R	300U	36 1/2 x 36 1/2	16 1/2	14	14	19	14 or 19	19200	80	80 x 40

NOTES: * Special Stroke and/or Daylight Available
 ** The weights and dimensions shown are approximate, and are for Strain Rod frame presses. Unitized frame presses are slightly lighter and smaller.

Standard air actuated presses that incorporate phi's specialized platen designs and advanced Pneumatic/Air over Oil systems into a precision four post press, intended for applications requiring accurate control of pressure, temperature and parallelism.

FORCE

Standard models with capacity rated from 2000 lbs. to 60/000 lbs.

DIE SPACE

Standard models with die space, or platen size/ from 8" x 8" to 18" x 18",

PHI design is based on a building block concept that allows customers to select for a given capacity and die space/ the platen design most suitable to their application.

No matter which platen design is selected parallelism of .001"/ft. of span will be achieved utilizing surface ground plates/ guided on ball bushings and chrome plated strain rods with fine threads for optimum parallelism alignment.

TEMPERATURE CONTROL

PHI Precision Presses are designed to operate with a variety of platens, steam or electrically heated, with or without cooling, depending on your application. As different applications call for different temperature ranges, heat rise, temperature uniformity and heating modes; we at PHI have designed a complete line of platens ranging from standard industrial platens to exotic high temperature platens for laboratory applications. No matter what your application, proven PHI platens are the answer

All PHI platens utilize special thermocouples, one for each platen, and time proportioning temperature controllers to prevent over-shoot and to provide uniform, predictable heating.



MODEL	TS-21	AS-21	GS-21	RA-22	DA-22	CA-23	CA-24	HA-24	JA-25	QA45
Capacity (lbs.)	2000	3000	5000	4000	7000	9000	9000	16000	22000	60000
Platen Size (in. x in.)	8x8	8x8	8x8	12x9	12x9	12x12	18x12	18x12	18x18	18x18
Stroke and Daylight (in.) ^①	6	6	6	6	6	6	6	6	8	8
Ram Area (sq. in.)	24	36	36	50	50	113	113	113	154	154
Ram Equiv. Diameter (in.)	5.5	6.8	6.8	8.0	8.0	12.0	12.0	12.0	14.0	14.0
Operating Pressure (psi)	85	85	140	80	150	80	80	150	150	390
Air Supply (psi)	90	90	90	90	90	90	90	90	90	90
Air Booster	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes
	PNEUMATIC			AIR OVER OIL HYDRAULICS						
Dimensions (LxWxH-in.)	32x16x32	32x18x34	32x30x34	40x24x42	40x32x56	40x22x56	47x24x58	47x30x58	47x30x68	47x30x68
Weight (lbs.) ^②	250	275	350	625	725	1075	1425	1675	2800	3100
Initial Air Consumption (scfm)	6	9	75	12	66	30	30	95	110	200
Closing Speed (ipm)	60	60	60	60	60	60	60	60	60	60

Notes: ① with Platens installed ② with "U" type platens installed (typical)

OPTIONS AVAILABLE:

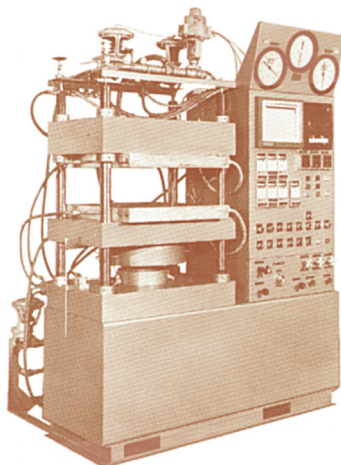
We at PHI are aware that special applications may require special features in a press, above of what is offered in the standard Precision Presses. For these special applications we have developed features such as nickel alloy platens for temperatures up to 1200°F, special heaters for heat rise up to 50°F/Min., 1/4% accuracy temperature controllers, controlled platen cooling and many others. We solicit your special applications,

STEAM/ELECTRIC LAMINATING PRESS

This 75 ton press was designed for laboratory applications where exact pressure and temperature controls are required to establish optimum process parameters.

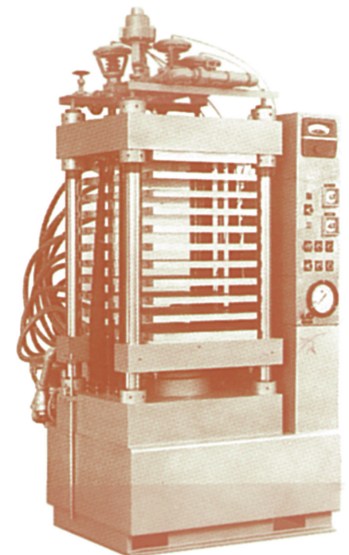
Major features are:

- Combination steam/ electric heating
- Precise control and operation in three pressure ranges
- Auxiliary ram mounted air pistons for ultra low pressure control



CREDIT CARD LAMINATING PRESS

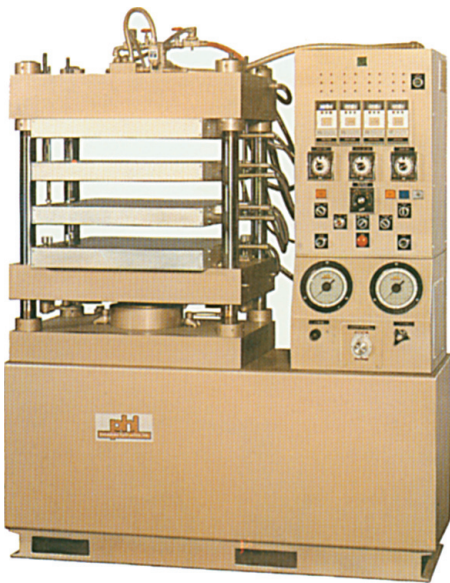
A production rate of 13,000 standard size credit cards per hour can be achieved using this 200 Ton Laminating Press. Designed specifically for the high production of credit cards the 11 steel platens, 30" x 24", are cored for steam heating to achieve a fast heat-up rate and a temperature uniformity of ± 5°F.



For years PHI has been the world's leading manufacturer of Multilayer Laminating Presses. The exacting mechanical accuracy exceptionally precise controls and advanced operating features of PHI presses have made them first choice of printed circuit board manufacturers the world over.

In these new and advanced models, PHI engineers have incorporated scores of important new features... many immediately obvious... many others not so readily apparent ...until you start production. Each of these new features and improvements has been designed to give you superior operating performance and to significantly increase the quality and production of your multilayer laminates.

Obviously the more accurately time, temperature and pressure can be controlled, the more consistent and close to perfection will be the multilayer laminates, In these new PHI presses, these parameters,, time, temperature and pressure... can be precisely controlled with exceptional accuracy and repeatability, Press operation is far smoother and quieter, and the array of controlling, monitoring, and readout components include the most advanced, sensitive and reliable instruments available.



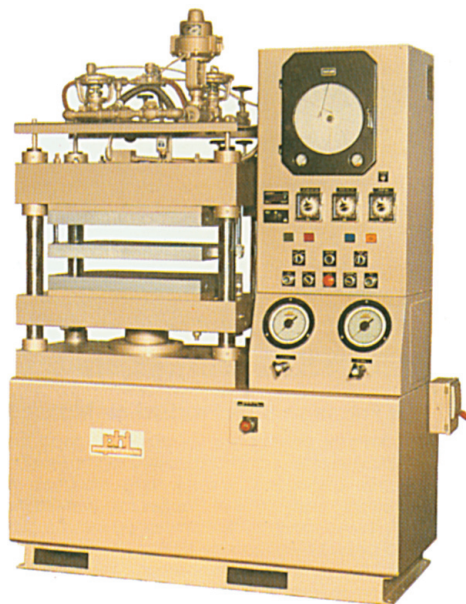
Pictured is
Model No. 100R2424-4
Electrically heated platens

ELECTRICALLY HEATED PLATENS

Electrically heated presses feature PHI special design platens and digital setpoint temperature controllers with time proportioning and automatic reset for uniform and predictable platen heating.

Heavy duty bolsters, insulated from hot platens, and large diameter ram insure that deflection is kept to a minimum while providing lower hydraulic system pressure resulting in reduced hydraulic maintenance requirements.

Selector switches and timers are provided for either manual or automatic operation,



Pictured is
Model No. 75R2418-3
Steam heated platens

STEAM HEATED PLATENS

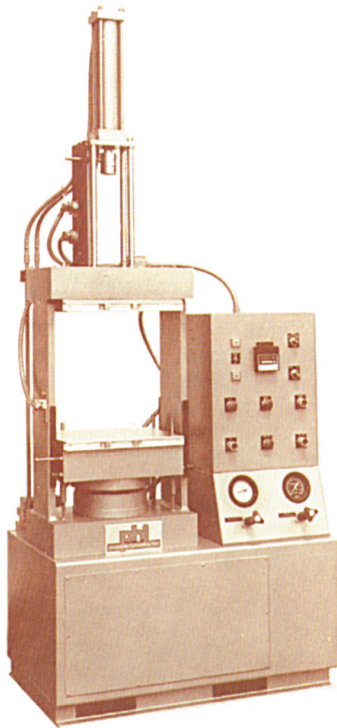
Steam heated presses are supplied as standard with steam temperature controller, by-pass valves, steam traps, inlet and outlet manifolds and all components required for a complete system.

Controller includes proportional band adjustment plus automatic reset and will control each platen to within $\pm 4^{\circ}\text{F}$ of desired set point in an area one inch in from the platen outer periphery.

Digital display of platen temperature is included to monitor individual platen temperature or all platen temperatures automatically in a scanning mode, as selected by operator,

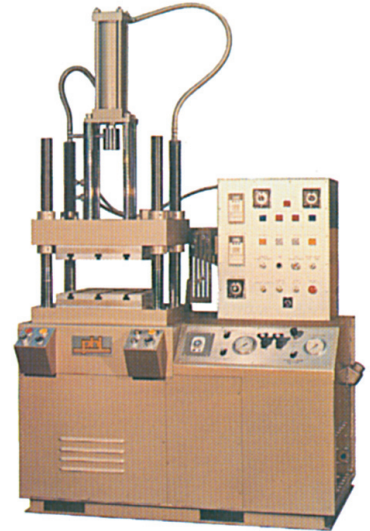
FOR PROTOTYPE AND LOW VOLUME PRODUCTION

These transfer presses are of simple, rugged, unitized frame design with columns fabricated from wide steel plate. Intended for use in laboratories or production departments for low volume molding of thermosetting resins or elastomers. Options available include lower or higher transfer force, T-slotted platens and plungers in a variety of sizes.

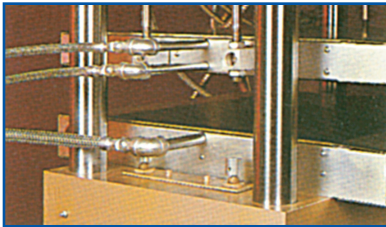


FOR PRECISION HIGH PRODUCTION MOLDING

PHI transfer presses are specially designed for precision/ high production molding and encapsulation of semiconductors, integrated circuits, capacitors, resistors and countless other electrical and electronic components. Presses are constructed for rugged, heavy duty service and are fully equipped with precision time, temperature and pressure controls for both manual and semi-automatic operation. Virtually every key operating feature you could want or need has been carefully engineered into the press system, and are standard on all models.

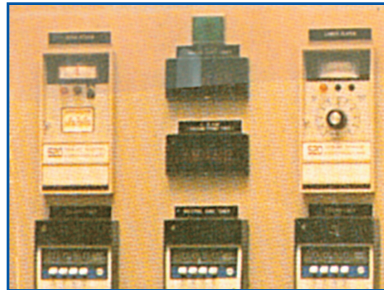


OPTIONS AVAILABLE:



Counterbalance

Included is a four-point counter-balance system for each intermediate platen. The counterbalance system eliminates the effect of platen weight on pressure in each opening



Digital Display of Pressure

LED digital display gauges provide accurate setting and readout of pressure



Digital Display of Platen Position

A Linear variable displacement transducer (LVDT) is used to sense distance between the top platens. Actual displacement is displayed on a digital readout gauge.



Microprocessor Based Program Controller

Programmed cycling is achieved using a setpoint programmer that allows programming of temperature and pressure as function of time.



Provision for Additional Platens

This provision insures that as production requirements increase the press capacity can be expanded accordingly.



Temperature and Pressure Recorder

A 24 point strip chart recorder with one point pre platen to record platen temperature and two points to record low and high pressure.

For Fast Fabrication of Quality “H” Beams...

You can now manufacture custom beams continuously with minimum delays for changing beam sizes or shapes. The PHI Automatic Steel Beam Welder gives your operation higher productivity, on both straight and tapered steel beams. It automatically welds both flanges of the beam at once, delivering the penetration you need on up to 1/2" steel web and 1-1/2" flange—all in one operation, one pass, and from one side. The PHI system produces a fillet weld between the web and flange. Welds are uniform and of the quality demanded by construction codes.

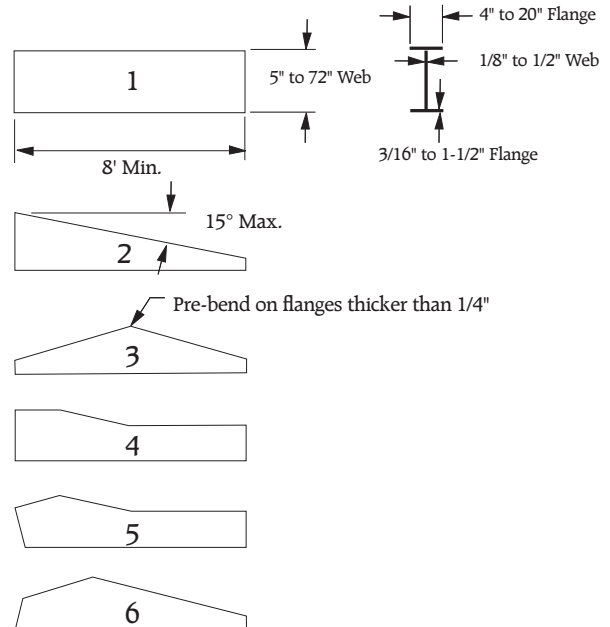
Working at a convenient push-button console, the operator presses the start button. The machine automatically holds the steel in position, while the work piece is fed under the two weld heads. Pressure and guide rollers maintain accurate alignment of web and flanges. All guides are easily adjustable to match the dimensions of the beam section. Welding is performed by a pair of submerged twin-arc welders.

The system automatically dispenses and removes flux, reducing manpower requirements and cutting material costs through recycling of the flux.



WIDE VARIETY OF BEAM SHAPES

Typical beam configuration which can be welded on PHI Automatic Steel Beam Welders.



MACHINE CAPACITY

Web Thickness:	1/8" to 1/2"
Web Width:	5" min. to 72" max.
Web Taper:	15° max.
Flange Thickness:	3/16" min. to 1-1/2" max.
Flange Width:	4" min. to 20" max.
Beam Length:	8 ft. min.
Beam Section:	325 lbs./ft. max.
Beam Weight:	12,000 lbs. overall, max.
Weld Fillet Size:	1/8" min. to 5/16" max.
Welding Speed:	20" to 120" per minute
Typical Welding Speed:	
1/8" fillet on 10 ga. material 80" to 100"/min.	
3/16" fillet on 1/4" material 60" to 70"/min.	
5/16" fillet on 3/8" material 25" to 30"/min.	

The system comes complete

The PHI Automatic Steel Beam Welder comes complete with welding equipment, flux dispenser and recovery systems, dust collectors, wire turntables, and hydraulic system. Installation supervision and operator and maintenance personnel training is available.

SEAM WELDER

The Seam Welder is used to join separate web sections with a 100% welded seam and to fabricate long webs from short sections or to join sections of different thickness.

The two pieces to be joined are aligned against an edge guide and clamped in position by means of air cylinders. The grooved copper back-up plate is brought to seam tightly against the lower side of the joint. The welding head travels along the joint and welds it by single-wire submerged arc.

Clamps are released and web is conveyed to the tacking fixture. Welding equipment consists of welding head with flux hopper, travel carriage, controls and 1,000 Amp. power source.

A flux recovery system is provided to dispense and recover welding flux. The Seam Welder Hydraulic Power Unit and Electric Controls are also used to drive the conveyors at entrance and exit of the Seam Welder.



TACKING FIXTURE

The tacking fixture is used to assemble the beam prior to the Main Welder.

The web and flanges are brought in from the seam welder and flange storage racks respectively, transported to the tacking fixture and positioned prior to tacking the leading edge of the beam.

Loading of the flanges on the conveyors can be done manually by an operator or automatically, using PHI's flange-loading Gantry.

The two flanges are placed on the conveyor section on opposite sides of the web, rotated into the vertical position and held by magnetic guide rollers. The three pieces are advanced into position against a retractable stop and hydraulically clamped in their proper relative position.

The operator manually tack welds them together. Clamps are released, and the tack-welded beam is conveyed to the welder.

After initial adjustment of clamp positions for the first beam, the operator controls all material movement from the control panel for all subsequent beams of the same size.



ELECTRIC CONTROLS

The Electrical Control Panel on the Main Welder provides maximum system control flexibility. The Welder can be operated in either Manual Mode or Automatic Mode.

In Manual Mode, the sequence of operations is achieved by using individual controls located on the control panel. Welding parameters also are set individually on each welding head controller.

In Automatic Mode, the PLC control increases "arc-on" time by eliminating manual operations.

Using the "IN" conveyor, operator brings the beam to the starting position, chooses one of the preset welding programs (welding speed, wire speed and voltage), and pushes the "START" button.

Total sequence of operations, including movement of the beam with welding speed, positioning of the welding heads, start and stop of the welding process on stationery and moveable sides, activation of web holding, copper back-up assemblies and pressure cylinders, and STOP of the operation will be accomplished automatically.

The PLC provides the accuracy, reliability, versatility quality, and quick change of the parameters for different welding applications.

The interface between operator and machine is through an Allen Bradley Panel View, which has been programmed by PHI to display all parameters of a welding program, and to display on different screens input/output status for troubleshooting and diagnostics.

Programming of welding parameters for different beam sections is also accomplished through the panel view screens.

CONVEYORS

The Seam Welder, Tacking Fixture and Automatic Welder are interconnected by means of a Conveyor System, to form a complete production line that allows continuous Steel Beam production.



Conveyors are located at the entrance and exit of Seam Welder, Tacking Fixture and Automatic Welder, and are hydraulically operated. The controls at each of these stations determine the movement, direction, and speed of the adjacent conveyors.

A typical layout system includes a total of 18 conveyor sections. Six are motorized, driving the rollers by means of sprockets and chains. Ten are driven, connected by chains to adjacent motorized sections. Two are idle. Each conveyor section measures 10' in length, 94" width and 30" height. Rollers are heavy duty designed for handling heavy steel plates and are spaced on 22" centers.

Load capacity for each conveyor section is approximately 4,000 lbs. Conveyor speeds are synchronized with welder input speeds to minimize conveyor wear resulting from friction between the turning roller and slower-moving beam at the welder entrance.

PRODUCTION CAPACITY

The main characteristic of PHI's Automatic Steel Beam Welder System is its ability to produce beams continuously, beam after beam, with minimum down time for changing welding parameters or beam sizes.

While actual production capacity will depend on the size and type of beams to be fabricated, typical output is 2,000 tons of steel per month in one eight-hour shift employing only three operators.

OPTIONS AVAILABLE:

1) Computer Control System

This option includes a computer-control system with touch-screen programming and operation. It utilizes an industrial PC and machine-interface software for user-friendly operation.

It features easily accessible diagnostics indicators, message display and custom graphics, including electrical and hydraulic schematics and functional diagrams. Program input can be made via touch screen or keyboard.

Welding programs may be downloaded remotely from a connected PC or network. It also includes a one-day data logger to provide a record of the machine operation.

2) Maximum Web Size Of 84"

This option allows for the manufacture of beams with maximum size of 84", instead of the standard 72". All elements of the system are modified to accommodate the larger web sizes.

3) Welding Heads For Manufacturing Crane Beams

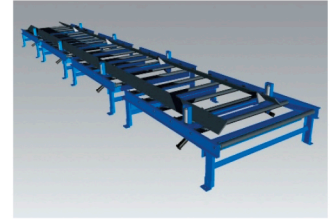
A special welding head design is available for the manufacturer of crane beams. In crane beams, the top flange is a "C" channel with the short sides directed inwards to the beam.

4) Mezzanine on Main Welder

This option includes a platform with rail guards and stairs for easy access. The platform is used for storage of flux and wire and allows room for the operator to load flux hopper, and change wire drums and reels.

FLANGE TILTING DEVICE

PHI, world famous for its steel beam welding systems, announces the launch of their new Flange Tilting Device

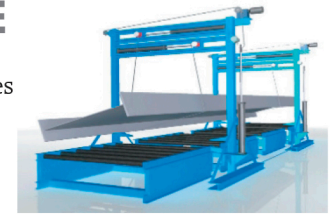


Used during the manufacturing of "H" beams, the flanges are automatically tilted to a vertical position against magnetic rollers prior to assembly with the web at the tacking fixture. Done in the past manually by one or two operators, this can now be done automatically, reducing manpower requirements.

This tilting system is intended for use in welding lines without automatic tilting systems provided originally by PHI. This New Flange Tilting System is a self contained system that can easily be installed by the customer as an add-on option

BEAM TURNING DEVICE

PHI, world famous for its steel beam welding systems, announces the launch of their new Beam Turning Device. This new option will enable you to increase production by rotating the beam and welding on both sides of the beam which is required by some building codes.



The turning system consists of frame that straddles the conveyors with lifting cylinders, and a chain driven gear motor. Two frames are provided, one is fixed, the other movable by motor on rails along the length of the conveyors. Maximum travel from the fixed frame will be sufficient to accommodate 15m long beams. The system will be operated from a hydraulic power unit with 15 GPM and 20 HP, with manifolds and valves.

Maximum beam size for turning is: 12.5mm thick web, 1830mm wide. 15m long and 16,000 lbs.

5) Flange Tilting Assemblies

This option, when incorporated in the conveyors leading to the Tacking Fixture, allows the automatic tilting of flanges to a vertical position in preparation for beam pre-assembly. This system includes two flange tilting assemblies, one on each outbound side of the conveyors.

The Flange Tilting Assemblies can be opened to a position 37° from vertical or to a fully horizontal position depending on the material handling system used. If flanges are transferred by pushing from adjacent storage racks, the 37° open position is preferred. If flanges are transferred by means of a gantry type loader, the fully horizontal position is recommended.

The tilt assemblies utilize the tacking fixture's hydraulic power unit. Controls are conveniently located at the tacking fixture control station.

