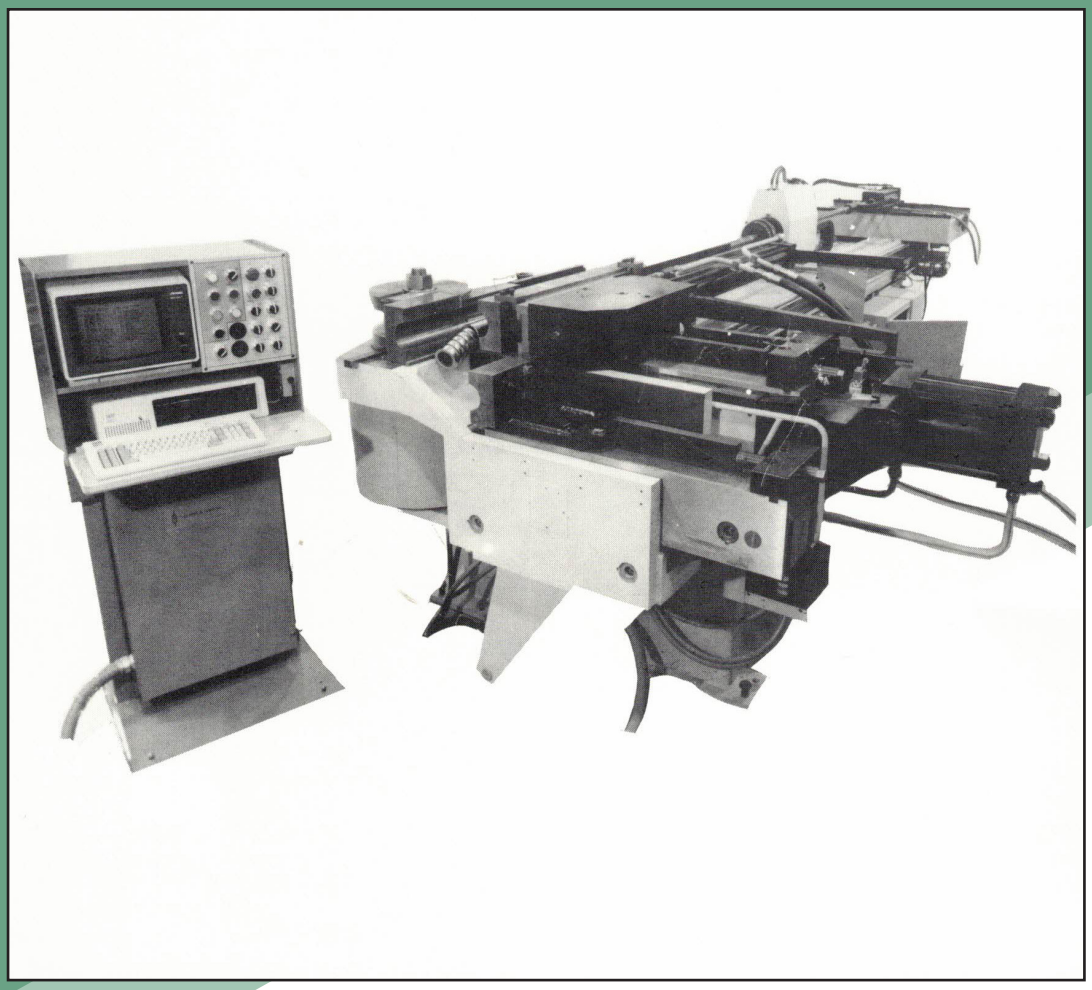
# Rotary Hydraulic Precision
# CNC TUBE BENDERS



ULTIMATE TUBE BENDER PARTS PLUS, INC.

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| Capacity | Machine Model<br>CL-200 CNC<br>*UTB CL-200 CNC* | CL-200 HD CNC<br>*UTB CL-200 HD CNC* | CL-300 CNC<br>*UTB CL-300 CNC* | CL-300 HD CNC<br>*UTB CL-300 HD CNC* | CL-400 CNC<br>*UTB CL-400 CNC* |
|---|---|---|---|---|---|
| Round Tube -<br>25,000 psi-YP, non-ferrous<br>40,000 psi-YP, ferrous<br>60,000 psi-YP, stainless steel | <br>1.5" X .188"<br>1.5" X .109"<br>1.5" X .049" | <br>2.5" X .203"<br>2.5" X .109"<br>2.0" X .125" | <br>3" X .210"<br>3" X .120"<br>3" X .065" | <br>4" X .203"<br>4" X .109"<br>4" X .065" | <br>6" X .250"<br>6" X .165"<br>6" X .125" |
| Schedule 80, steel pipe, IPS | 1<br>(1.315" X .179") | 1 -1/2<br>(1.9" X .2") | 2<br>(2.375" X .218") | 2 -1/4<br>(2.875" X .276") | 4<br>(4.5" X .337") |
| Round bar, mild steel | 1 -1/8" | 1 -3/8" | 1 -7/8" | 2 -1/4" | 3 -1/2" |
| Centerline radius, (max.) std. | 10" | 10" | 12" | 12" | 24" |
| Tube length over mandrel, (std.) | 10' | 10' | 10' | 10' | 12 -1/2' |

## Specifications

| | | | | | |
|---|---|---|---|---|---|
| Maximum bend angle | 180º + 15º Overbend Allowance | | | | |
| Hydraulic drive, standard | 5 HP | 10 HP | 10 HP | 15 HP | 15 HP |
| Bend arm speed, (max.) adjustable | 15 RPM | 10 RPM | 5 -1/2 RPM | 3.8 RPM | 2.3 RPM |
| Plane of bend | Continuous either direction, rotation 0 - 359.9º | | | | |
| Degree of bend | Resolution 0.1º , Repeatability ±0.1º | | | | |
| Plane of bend | Resolution 0.1º , Repeatability ±0.1º , Speed 10 RPM | | | | |
| Distance between bends | Resolution 0.01º , Repeatability ±0.01º , Speed 360 IPM | | | | |
| Controls | 3-axis CNC and Manual DOB (2 stops), DBB and POB dial positioning | | | | |
| Approx. shipping weight,<br>(less oil and tools) | 3300 lbs. | 3600 lbs. | 5400 lbs. | 5800 lbs. | 14800 lbs. |
| Power | 240/460 3ø 60 Hertz | | | | |

**OPTIONS**

1. Bend arm clockwuse or counterclockwise rotation.
2. Mandrel extrator.
3. Wiper die support.
4. Direct acting pressure die.
5. Pressure die boost.
6. Drop away clamp.
7. Draw compound mandrel injector.
8. Vertical die closer.
9. Overarm support.
10. Extended bed length.
11. Extended centerline radius.
12. Oscillating Mandrel.
13. Safety mats.
14. Movable safety post.
15. Water cooled spindle for hot bending.
16. Addtional HP.

**STANDARD FEATURES**

1. Automatic lubricator slides and toggles.
2. Swinging arm safety plates.
3. J.I.C Standards.
4. Hardened and ground slides.
5. Hard steel toggle pins on hard steel bearings.
6. Heattreated alloy spindle on taper roller bearings.
7. Low noise hydraulics.

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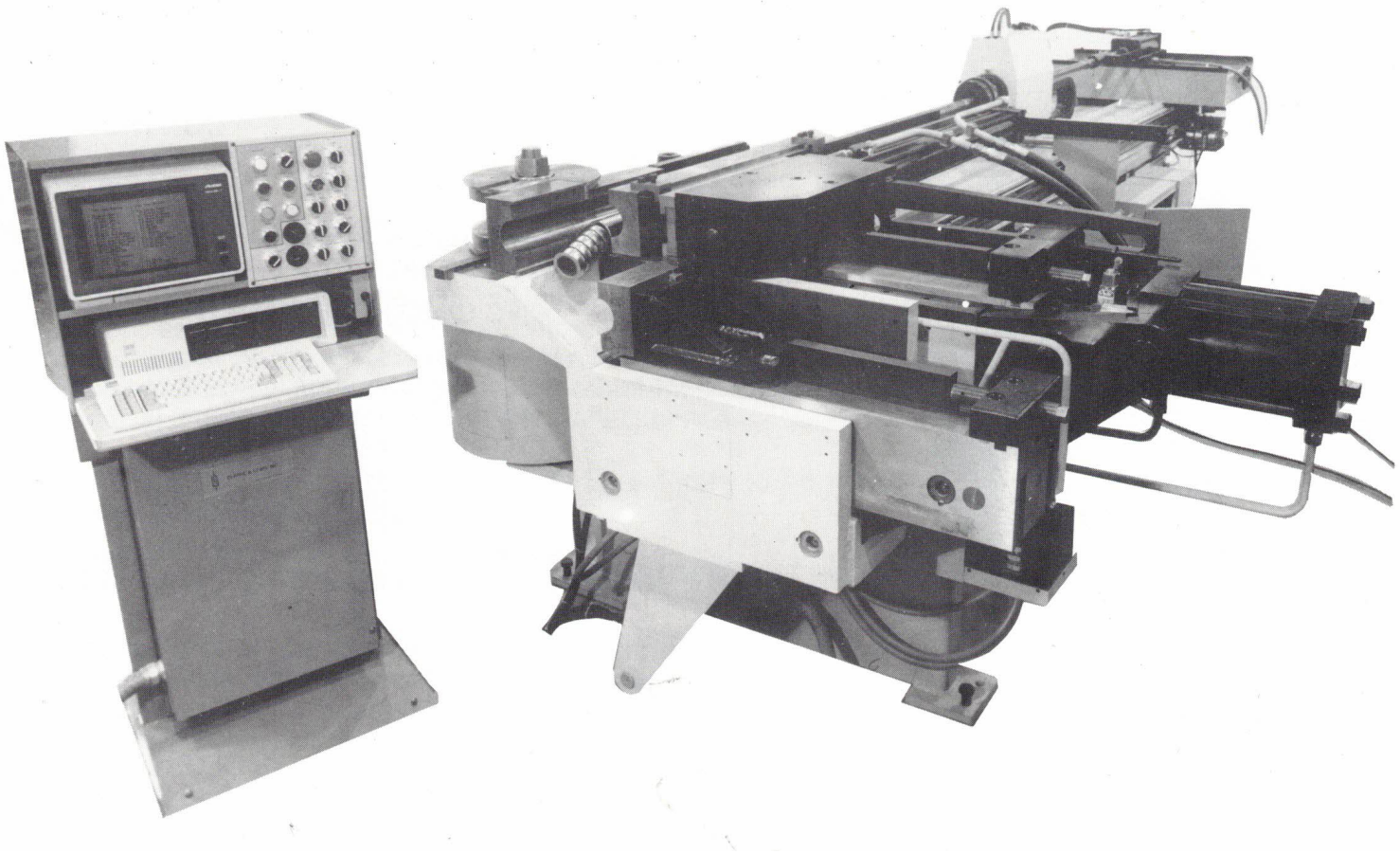

The Clarke and Lewis series of CNC rotary tube benders provide capability of thin wall bending of aluminum, mild steel, stainless steel, inconel, titanium, etc.

The CNC control system enables full automatic bending of multi-bend workpieces and also provides a manual back- up system for full and separate manual operation.

The CNC control system uses a" PC" type computer with commercially available LED isolated input and output buffers. The unit features in depth diagnostics and ease of altering system control parameters.

The bend sequence can be altered from the system key board (featuring a self- prompting display) and data can be saved on a diskette. Alternatively, data can be recorded on a "library" disc and the operator can call up any required drawing/configuration at will.

The CNC control system features a "MAIN MENU" list of options selectable by the user. Menu selections include selection of manual or automatic operation, entry of bend sequence, save or delete library sequences, select diagnostic mode or system utilities.

The diagnostic mode displays input/output signal conditions for all operations of the control and machine and enables rapid isolation of any problems by an electrician or any non-computer oriented technician. System utilities allow the system parameters to be changed and access is guarded by use of a password.

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**MANUAL CONTROLS**
Clamp - Fwd/Off/Ret
Presssure die - Fwd/Off/Ret
Mandrel - Fwd/Off/Ret
Bend arm- Bend/Return
Auto lube- Man/Off/ Auto
POB- CW/Off/CCW
DDB- Fwd/Off/Ret
POB- Speed
DBB- Speed
Manual DOB- Select 1-2
Collet- Open/Close

**CONTROLS**
Power - ON/OFF
Manual/Automatic

**AUTOMATIC CONTROLS**
Reset
Auto Cycle
Step Cycle
Hold
Release

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**CNC CONTROLS MAIN MENU**

1. Manual Operation
2. Automatic Operation
3. Enter Bend Sequence
4. Save Bend Sequence in Library
5. Get Bend Sequence/ Library
6. Delete Bend Sequence/ Library
7. Enter Diagnostic Mode
8. Systems Utilities (password guarded)

COMPLETE SELF-PROMPTING IN ALL MODES

1. In "MANUAL OPERATION", the axes positions are displayed. If any axis is moved too fast, (overrun encoder) a FAULT condition is displayed requiring manual adjustment to reference point.

2. "AUTOMATIC OPERATION" shows DOB and POB angles and Distance of Bend. In "AUTO OPERATION", DOB, POB and DBB are displayed, as is the command position. The display also verbally displays the machine action at any given time, i.e. CARRIAGE MOVING, POB POSITION, COLLET CLOSE, BENDING, etc. Operator prompt messages are included, i.e., RESET, PRESS AUTO CYCLE or PRESS STEP CYCLE, etc.

3. "ENTER BEND SEQUENCE" enables the operator to enter the bend reference(drawing) number together with reference information on TOD/CLR/WALL/MATERIAL/CUT LENGTH, Required entries are springback constant and slope. The degree of bend prior to mandrel oscillation can also be entered. Provision is provided for DBB, DOB and POB entries for 10 complete bends.

**ENTER BEND SEQUENCE**

Drawing# _____
TOD= _____
CLR=_____
WALL= _____
MATERIAL= _____
CUT LENGTH= _____

Springback Constant _____
Springback Slope% _____
Load Position (DBB) _____
Mandrel Oscillation _____

| Bend # | DBB | POB | DOB |
|---|---|---|---|
| 1. | _____._____ | _____._____ | _____._____ |
| 2. | _____._____ | _____._____ | _____._____ |
| 3. | _____._____ | _____._____ | _____._____ |
| 4. | _____._____ | _____._____ | _____._____ |
| 5. | _____._____ | _____._____ | _____._____ |
| 6. | _____._____ | _____._____ | _____._____ |
| 7. | _____._____ | _____._____ | _____._____ |
| 8. | _____._____ | _____._____ | _____._____ |
| 9. | _____._____ | _____._____ | _____._____ |
| 10. | _____._____ | _____._____ | _____._____ |

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4. "SAVE THE BEND SEQUENCE" enters the "ENTER BEND SEQUENCE" in library storage. The library is capable of storing over 1000 bend sequences in library storage. The use of library diskettes enables unlimited bend sequence storage.

5. Selection of"GET BEND SEQUENCE FROM THE LIBRARY" displays the recorded drawing numbers. The display can be scrolled up and down for inspection, or the operator can call out any drawing by entering the drawing number. Only significant drawing numbers need to be entered.

6. "DELETE A BEND SEQUENCE" is used to remove a bend sequence previously stored in the library.

7. In "ENTER DIAGNOSTIC MODE" all inputs and outputs are displayed on the display screen in the same pattern as the isolator modules are mounted in the electrical box below. The operator can alter each output signal via the keyboard and observe that signal change on the screen and on the isolator module. Each input signal can be varied and the resultant change observed on the isolation module and screen. Thus, all inputs and outputs can be readily checked by non-computer personnel.

8. "SYSTEM UTILITIES" allow the system parameters to be modified. After entry of the password, the following menu will appear:

**SYSTEM UTILITY MENU**

1. Modify the System Parameters.
2. Save the System Definition File.
3. Exit to Controller Operation.
4. Exit to MS : DOS.

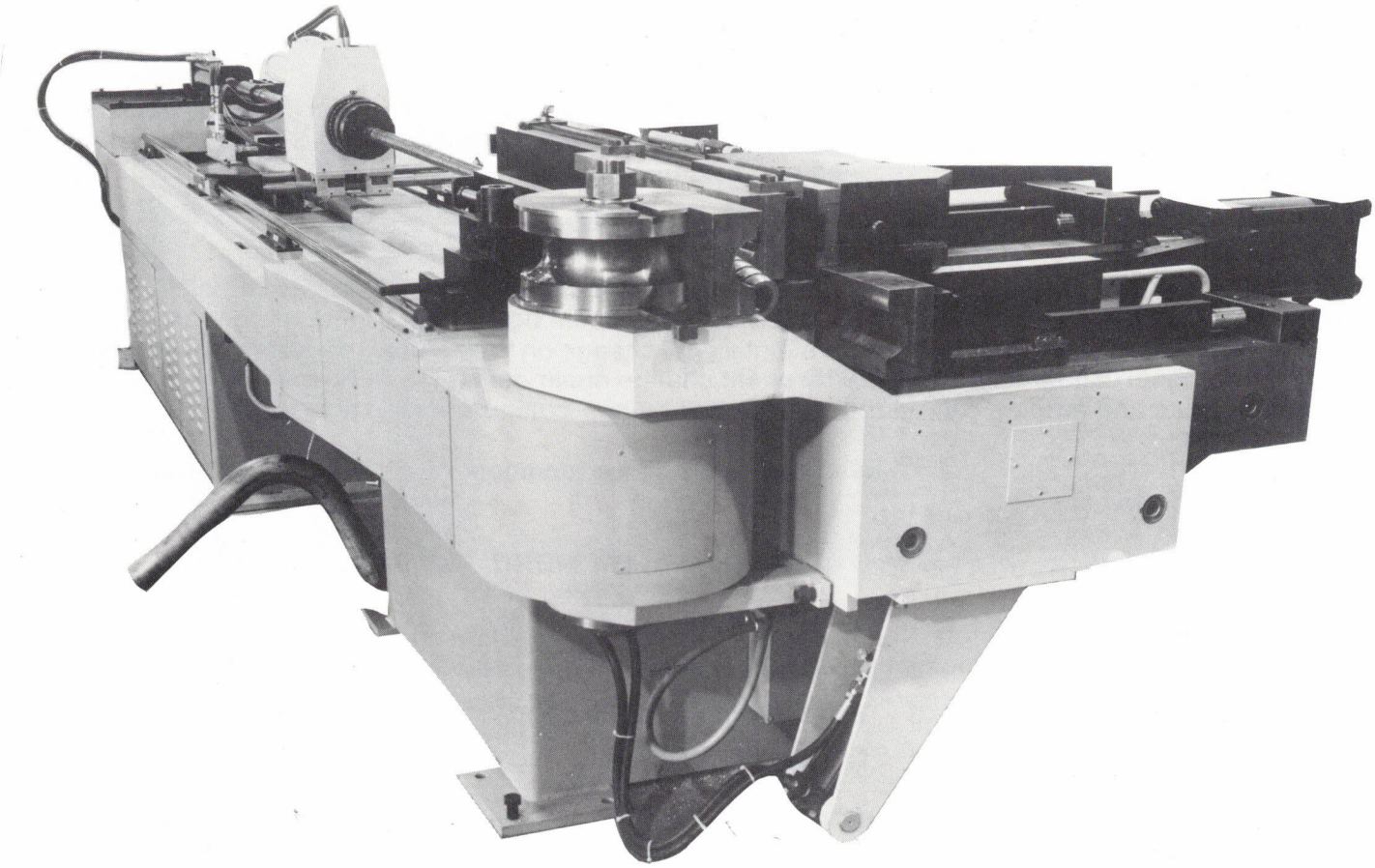
1. "MODIFY THE SYSTEM PARAMETERS" provides for change of background and text for color intensity. A library disc can be selected to A or B to allow a larger number of library entries on a dedicated library. Modification is also provided for bend axes speeds and position of speed transition (i.e., slow to fast). Delays are also resettable for completion of collet open/close, clamp and pressure die motions together with carriage motion in the interference zone.

1. Password.
2. Display color select-intensity.
3. DBB velocity control parameter.
4. POB velocity control parameter.
5. DOB velocity control parameter.
6. Delays.
7. Maximum encoder rate.
8. Clock rate.
9. Scale factors.
10. Zero reference.
11. Fault detection limits.

2. "SAVE THE SYSTEM" option allows the system parameters to be stored after modification.

3. "EXIT TO CONTROLLER OPERATION" causes the MAIN MENU to reappear.

4. "EXIT TO MS: DOS" causes MS: DOS to be booted and used to back-up or transfer the Bend Sequence Library.



**MACHINE HYDRAULIC CONTROLS**
J.I.C. standards.
Constant volume pump.
J.I.C. cylinder (Miller or Parker Hannifin)
J.I.C. solenoid valves (Vickers or Parker Hanifin)
Oil level gauge.
Hi-temp shut down and alarm.
Gasketed oil tank with clean-out drains and vents.
Flow control for bend speed.
Direct acting pressure die.
- Pressure reducing valve.
- Flow control for speed.
- Accumulator, pressure stabilizer:.
- Limit switch to set stroke.

Mandrel extractor.
- Flow control for speed.
- Limit switch to set stroke.

Booster control.
- Pressure reducing valve to set force.
- Flow control to limit speed.

System pressure.
- Relief valve to set maximum system pressure.

**CARRIAGE ZONE INTERFERENCE**
Limits set by operator set limit switch. When carriage enters this area, the clamp closes when bend control is operated. Collet opens and carriage backs out of interference zone. Pressure die closes and bend is completed. Upon completion of the last bend, the mandrel retracts, clamp and pressure dies open and the operator releases collet.

**AUTO STEP CYCLE**
Each operation in bend cycle is completed and awaits step command.

**AUTO OPERATIONS HOLD**
In manual or auto mode, the hold push-button will stop a cycle pending a new start command.

**EMERGENCY STOP**
Emergency stop is initiated by stop button which stops all operation or by operator stepping on safety mat (optional) or by bend arm rotation into safety post (optional).

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## OPTIONS

**Mandrel Extractor and Support**
Required for thin wall bending with mandrels. The mandrel extractor automatically advances the mandrel to pre-set bend position and retracts mandrel after bending. Mandrel extractor assembly includes anti- rotation device, rod length adjustment and limit switches for mandrel stroke adjustment. Mandrel rod support retains the mandrel and rod at the correct height in the bend, clamp, and pressure dies. The support is laterally adjustable to accommodate different centerline radii.

**Pressure Die Boost**
Provides an axial force to the pressure die to offset frictional forces induced by mandrel and wiper die. Reduces clamp force and bending torque, permitting closer and tighter radius bends. Speed and force applied by the pressure die to the tube are hydraulically controlled. This feature reduces wall thinning.

**Wiper Die Holder**
Provides adjustments necessary to align and maintain wiper die position. Allows removal of wiper die without changing set- up. Provides vertical, horizontal and axial adjustments with locking capability.

**Vertical Die Closer**
Utilizes a hydraulic cylinder to apply adjustable vertical force to compress bend dies used in bending extrusions. Located under the nose of the bender, operation is simultaneous with the clamp die action.

**Direct-Acting Pressure Die**
Provides direct hydraulic operation of the pressure die by a direct-acting hydraulic cylinder applying force at the tube centerline. Force is independent of pressure die position and variations in tube diameter or wall thickness. Established pressures for given size/type of tubing are easily duplicated thereby reducing set-up time when rerunning the same part.

**Drop-Away Clamp**
Allows clamping mechanism and clamp die to retract into the bend arm. After completion of a bend and opening of the clamp die, the slide moves back and down to position the clamp die below the tube. The bent tube can then be advanced without raising the tube vertically. This feature speeds bending operations and reduces tube marking.

**Mandrel Draw Compound Injector**
Provides draw compound to the inside of the tube being bent during the bending operation, conserving compound and reducing spillage. Compound is hydraulically supplied through a hollow mandrel rod and mandrel lube hole to the work area. Consisting of a pump, hose and fitting, the injector will pump all draw compounds including heavy oils and water base compounds.

**Overarm Support**
Manual swivel clamp to couple stationary arm to bend post for applications requiring high bend and clamp forces. Applicable to tight radius bends in tubes, solids or sections where extreme rigidity of bend die and clamp die is required.

## EXCLUSIVE FEATURES OF CLARKE & LEWIS BENDING MACHINES

1. CNC control system uses a standard IBM P/C with no unique modifications or changes. Local P/C service is available world wide. The CNC is fully backed up by an alternate manual system.
2. Clamp and pressure die slides are fabricated from alloy steel, hardened and ground. Slides are mounted in adjustable and replaceable gibs.
3. Main drive to bend arm features a drive drum (not spocket) and leaf chain fastened to drive drum providing a stronger, more compact drive system.
4. The main bend spindle is fabricated from heat treated alloy, ground and mounted in pre-loaded Timken Tapered Roller Bearings that are lubricated for life.
5. The main bend cylinder is single ended, eliminating the long return bend chain and idler, and providing minimal maintenance on cylinder by reduction in number of seals.
6. The hydraulic oil tank is sealed except for filtered (porous metal) breather. There are no hydraulic valves or elements in tank area. There is no requirement to enter the tank except when changing oil thus reducing the chance for contamination of the oil.
7. All hydraulic valves are manifolded and located outside of oil tank All hydraulic control elements are standard J.I.C. and available world wide.
8. Motor and hydraulic pump are mounted on vibration isolators and the pump connected to the system by high pressure hoses to reduce vibration and noise.
9. The height of the pressure die bolster is kept low to reduce machine interference.
10. One year full warranty parts and labor.

## TOOLING

Clarke and Lewis designs and manufactures top quality tooling to bend round or shaped tubing, pipe, extrusions, square and rectangular sections. Heart shaped tooling is available for "empty" bending. Tooling is available made from steel, alloy steel and ampco bronze with hardness to suit cost/life considerations.

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