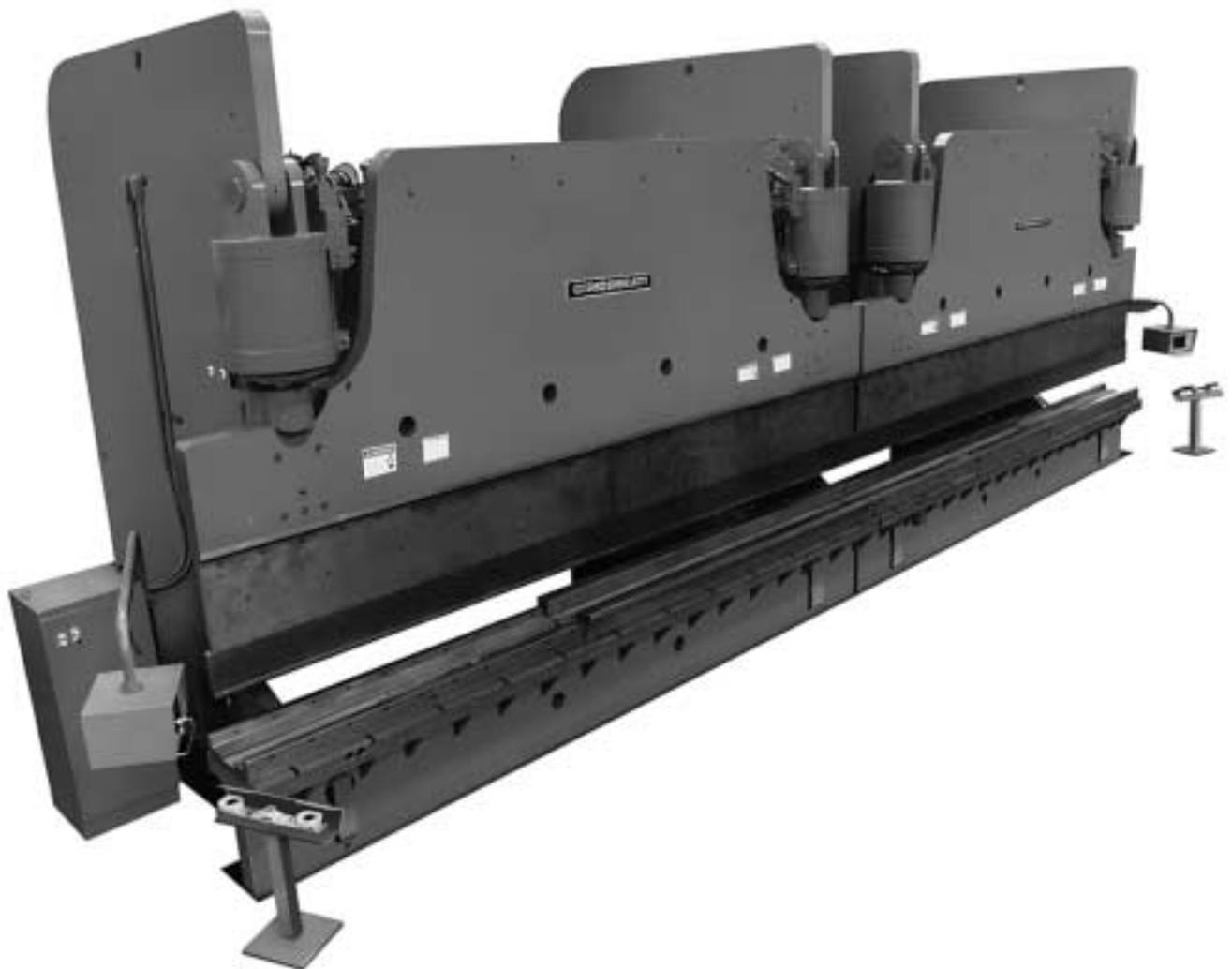


TANDEM AUTOFORM[®]

SET-UP AND OPERATION SUPPLEMENT MANUAL FOR THE CINCINNATI TANDEM AUTOFORM[®] CNC FORMING CENTER



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TANDEM AUTOFORM® SET-UP AND OPERATION

This supplement manual describes the special controls and procedures required for AUTOFORM tandem operation. The description only covers items that are unique to tandem operation. For a description of standard operation of the AUTOFORM, refer to the Operation, Safety, and Maintenance manuals (EM-408 or EM-338) provided with the machines. The reader is to have a basic knowledge of the operation of the CINCINNATI AUTOFORM Press Brake.

DESCRIPTION

TANDEM MACHINE CONTROLS

The Tandem selector switch is on the front of the right machine's main electrical enclosure. The switch positions are marked "SINGLE", "OFF" and "DUAL". The purpose of this switch is to interlock the RAM-UP and EMERGENCY STOP buttons for the two machines when the switch is in the "DUAL" position (tandem operation) and to isolate the Ram-up and Emergency Stop circuits of the two machines when the switch is in the "SINGLE" or "OFF" positions (normal independent operation). The switch and status lamps are shown in Figure 1. The left machine has the same status lamps but no keyswitch. The lamps on the left machine should always be in the same state as the lamps on the right machine (when both machines are on).

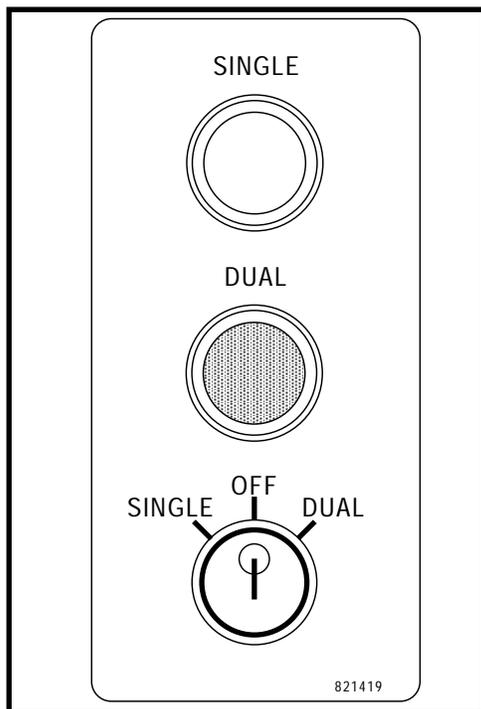


FIGURE 1 – Tandem Selector Switch

Note: If this switch is in the "DUAL" position (tandem mode) and one of the machines is switched off (main disconnect turned off), the other machine main drive motor(s) will be disabled until this switch is changed to the "SINGLE" or "OFF" position, or until the other machine is turned ON (main disconnect).

The only other difference in machine controls between the tandem and single AUTOFORM is that the left machine has the main electrical enclosure and pendant mounted on the left side of the machine instead of on the right side.

While the machines are operating in the tandem mode, only one pendant is active and it is used to control both machines. Only the MODE SELECT keylock switch on the active pendant is used to determine the operating mode. The MODE SELECT keylock switch on the inactive ("slave") control is ignored.

All footswitches and palmbutton stations on both machines are available for use in tandem mode, provided that the combined maximum of two palmbutton stations and/or three footswitches is not exceeded. The palmbutton stations and footswitches are enabled by their respective keylock selector switches on both machine pendants.

TANDEM MACHINE LIMITATIONS

While Tandem AUTOFORM operation is easy and straight forward, there are some limitations on the tandem mode of operation. The tandem mode is valid only for machine operation in calibration, quick bend and run modes.

The tandem mode of operation is valid for machine calibration only when both machines are **not calibrated**. If one machine is not calibrated (due to being turned off, encoder zero pulse error, etc.), that machine must be calibrated in the independent (single) mode of operation before tandem operation may resume.

Tandem operation is **not** operable for the following:

- ◆ Adaptive bending
- ◆ Operation in setup mode
- ◆ Releveling (out-of-tilt condition)
- ◆ "Footswitch Only" stroke mode in single stroke operation

TANDEM MACHINE PROGRAMMING

All programming of the machines for tandem operation is done on the active ("master") control. Programming for tandem operation is nearly identical to programming a standard AUTOFORM. Only the differences are described below.

Note: For optimum operation in tandem mode the workpiece should be centered between the two machines so each machine shares equally in the work load. Failure to follow this recommendation may result in poor quality work or damaged tools. The guidelines presented here for tandem operation and programming require the workpiece to be centered. For available tonnage across the two machines see chart in Figure 2.

Tandem operation is set up using the TANDEM MODE screen, which is accessed from Page 2 of the MAIN MENU. This menu has two entries, one called TANDEM OPERATION and the other called CONTROL CONFIGURATION. The entry selected for editing is highlighted. To select either entry, press any field select key. The field select keys toggle between the two entries.

The tandem CONTROL CONFIGURATION entry is used to setup which control will be used to program and cycle both machines while operating in the tandem mode. Only one control can be configured as the "MASTER", the other **must** be configured as the "SLAVE". The selection of the "MASTER" or "SLAVE" configuration is done by pressing the respective softkey. See Figure 3.

PROGRAM: ABC123	TANDEM MODE	3 MAY 91 12:00 PM
TANDEM OPERATION ON		
CONTROL CONFIGURATION . . . MASTER		
STATUS:		
Master	Slave	

FIGURE 3 – Tandem configuration selection

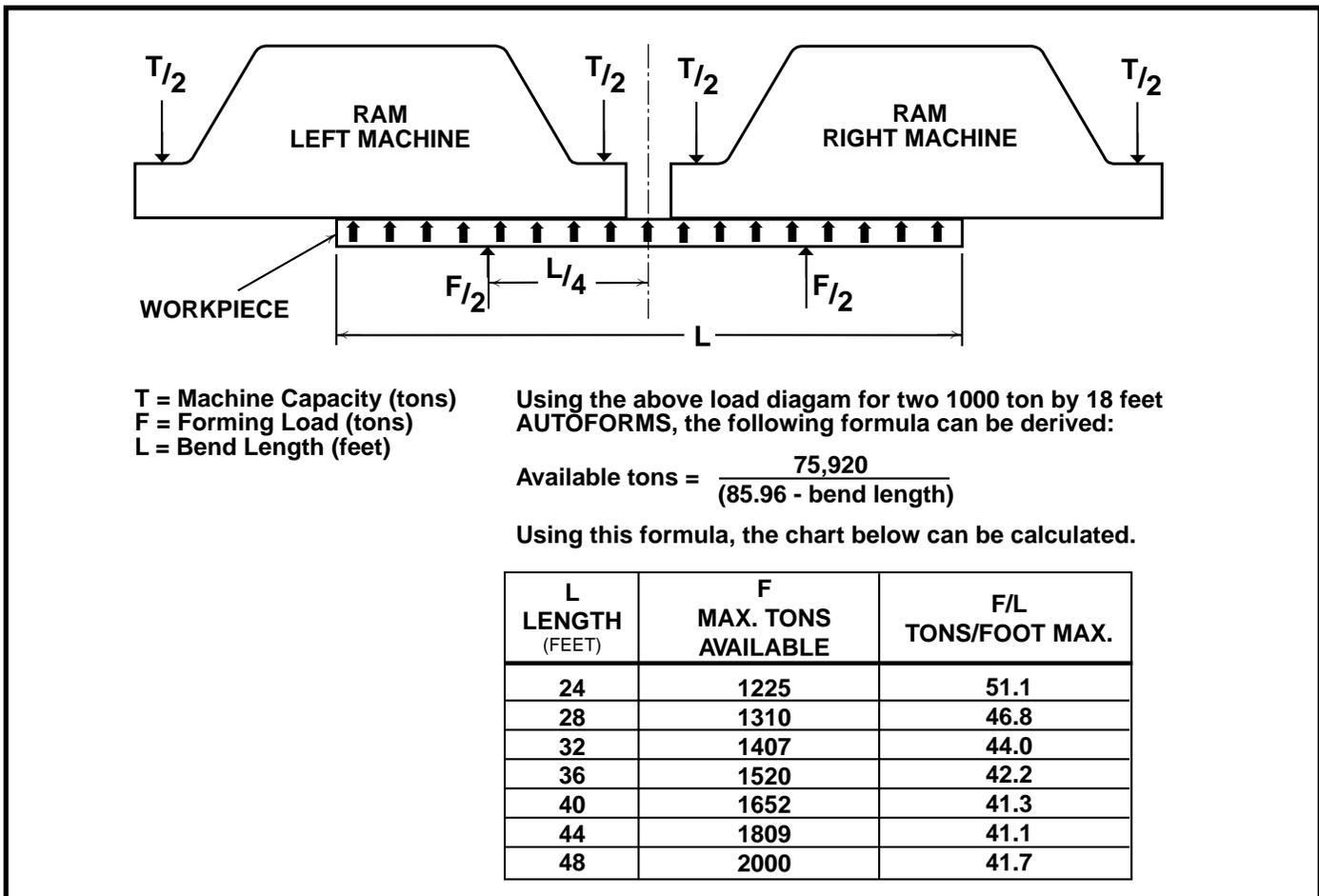


FIGURE 2 – Machine loading diagram and capacities

The Tandem Operation entry is for enabling or disabling tandem mode. The selection of this entry is accomplished using the “On” and “Off” softkeys. The status of this entry affects the programming of certain parameters (maximum tonnage, maximum bend length and ram tilt). These parameters are affected by whether the machine has the tandem mode enabled or not. This entry must be set to “ON” on both machines to operate the machines in the tandem mode. See Figure 4.

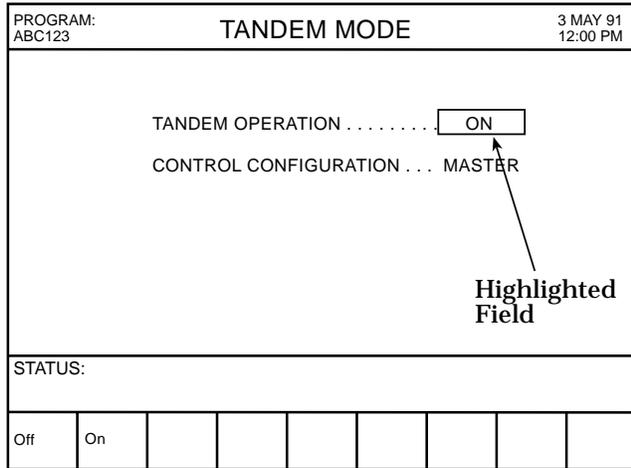


FIGURE 4 – Tandem operation selection

In tandem mode, both machine controls must have the TANDEM OPERATION entry set to “ON” and one control must have the CONTROL CONFIGURATION entry set to “MASTER” and the other must be set to “SLAVE”. The slave (inactive) control must remain in the TANDEM MODE screen. Leaving this screen at any time (on the slave control only) will terminate tandem operation. The “MASTER” control can leave the TANDEM MODE screen after the Tandem Mode entries have been set (TANDEM OPERATION = ON and CONTROL CONFIGURATION = MASTER). This allows programming in the JOB DATA, RAM DATA, GAGE DATA, or QUICK BEND screens. Tandem operation continues (on the master control) until disabled in the TANDEM MODE screen.

The areas in tandem programming which are different from the standard AUTOFORM are bend length, reversal tonnage and ram tilt.

The bend length and reversal tonnage (in Tonnage Reversal mode) are different in that the maximum allowed values are the total capacities of both tandem machines

added together. In order for these maximum values to be in effect, both tandem machines must be turned on, the tandem hardware (for communications) must be installed and functioning properly, and the tandem mode must be enabled. The configuration should be set to “MASTER” in the tandem screen for the active (master) control. The tandem maximums will only be present for programming on the control configured as the “master”.

The ram tilts in TANDEM mode are programmed on the “master” control independently for the “RIGHT MACHINE” (R.H. for right-hand) and “LEFT MACHINE” (L.H. for left-hand). The tilts in TANDEM mode are referenced differently than on the standard AUTOFORM. The tilt is a measure of the difference between the machine’s left and right encoders. Positive tilts result in the right end of the ram being lower than the left end, and negative tilts result in the right end of the ram being higher than the left end. On the standard AUTOFORM the tilt is applied about the vertical axis at the center of the ram, so the absolute reversal position of the center of the ram is unaffected by the application of ram tilt, only the right and left ends are affected. See Figure 5. In like manner, when tilt is applied to a machine in the tandem mode it is applied in such a way that the center of the combination of both machines is unaffected. The vertical axis about which the ram(s) are tilted lies at the point equidistant between the inboard ends of the two rams. See Figure 6.

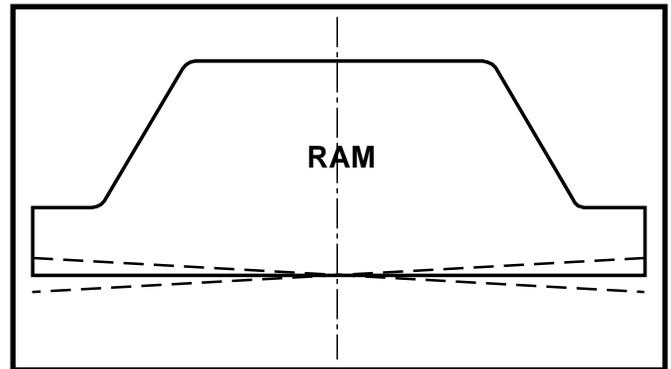


FIGURE 5 – Ram tilt in Single or Independent mode

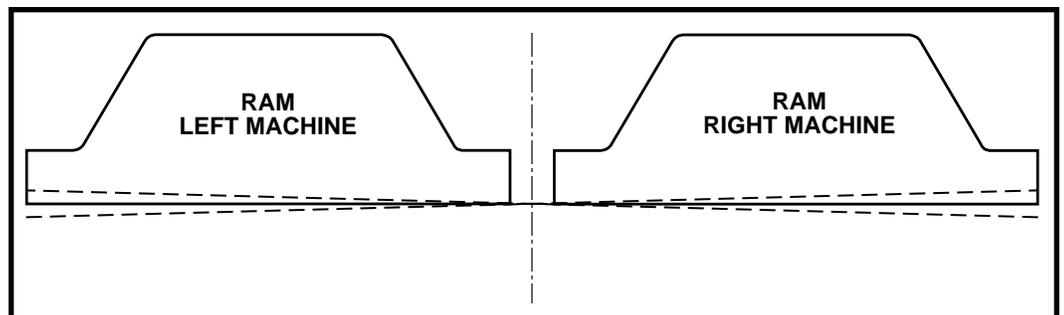


FIGURE 6 – Ram tilt in Tandem or Dual mode

For programming ram tilts for the run mode in a part program the left and right machine tilts are accessed on Page 2 of RAM DATA. The tilt values are not displayed in the Run Mode screen due to a lack of space. Editing the tilt values can only be accomplished on Page 2 of Ram Data. The Quick Bend screen displays both left and right machine tilts when the tandem mode is enabled and these values can be edited as required.

IMPORTANT: *The application of ram tilts greater than 0.25" when operating at the extreme travel limits of the ram may result in bottoming of the outboard hydraulic cylinder and result in incomplete bends and/or various error conditions. Use caution when tilts greater than 0.25" are needed and verify that the travel limits of the ram are not exceeded.*

Programs to be run on the tandem machines may only be entered on the master control. When in "CYCLE ACTIVE" (in either Run mode or in Quick Bend mode) the program is transferred via the special tandem hardware to the slave control so both machines run the same program.

IMPORTANT: *The tools to be used by a tandem program MUST be in each control's tooling library and all tool dimensions must be entered correctly and as accurately as possible. The two tooling libraries need not be identical with regard to number of tools or order of tools in the library.*

TANDEM MACHINE OPERATION

MACHINE CONTROL SET-UP FOR TANDEM OPERATION

To operate the AUTOFORM in the TANDEM mode, the "slave" control must be in the TANDEM MODE screen with the TANDEM OPERATION entry set to "ON" and the CONTROL CONFIGURATION set to "SLAVE". The "master" control must have the Tandem Operation entry set to "ON" and the Control Configuration set to "MASTER", but does not have to remain in the TANDEM MODE screen.

The "SINGLE - OFF - DUAL" selector switch (Figure 1) must be in the "DUAL" position. Both main drive motors and Operator Control keylock switches must be ON. The appropriate palmbuttons and/or footswitches must be ON (maximum of two palmbuttons or three footswitches). The Stroke Selector switch on the "master" control pendant must be in

the "SINGLE STROKE" position. The "master" control must be in a mode which permits tandem operation and the appropriate "Cycle Start" softkeys must be pressed to enable ram motion.

TANDEM CALIBRATION

To calibrate the machine rams in TANDEM MODE, both machines must **not** be calibrated, as it would be after initially turning on the main disconnects (after machines have been shut down). Set the controls on both machines as described above. On the "master" control pendant, go to either the RUN MODE or QUICK BEND screen and press the "Cycle Start" softkey. The status line should indicate that the ram must be calibrated. The "Calibrate" softkey should appear at the extreme left softkey position. Press the "Calibrate" softkey to put both machines into the calibrate mode. Depress the appropriate controls (palmbuttons or footswitches) to initiate ram motion and complete the calibration sequence.

Note: *Releasing the control(s) before **both** rams have completed calibration will cause premature termination of the calibrate sequence. The control(s) should remain depressed until the "master" control automatically terminates calibration mode. This indicates that both machines have successfully completed the calibration sequence. Any error conditions encountered during calibration will be reported as error messages.*

During ram calibration in tandem mode it is normal for the rams to **not** track each other. Once the rams are calibrated, the rams will track each other closely as long the machines are operated in the tandem mode.

TANDEM CYCLE MODES

Once the machines have been calibrated for tandem operation in the Run or Quick Bend modes, setup the controls on the machines as previously described in MACHINE CONTROL SET-UP. Enter the desired program parameters (job data, ram data, gage data for run mode or quick bend data in Quick Bend screen) on the "master" control pendant. Press the appropriate "Cycle Start" softkey in the Run Mode or Quick Bend screen. Use the selected control(s) (palmbuttons or footswitches) to control ram motion similar to standard AUTOFORM operation.



