## CUTTING MACHINE TABLE FRAME
for
**LINDE**
**CM-15-36**
**MACHINE**

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*Be sure this information reaches the operator. You can get extra copies through your supplier.*
A. Preliminary Considerations

The CM-15-36 Cutting Machine is a precision mechanism. It has been carefully designed and carefully built to perform clean, accurate shape-cutting on steel plate. Carelessness in choosing a location or in installing the machine table frame will result in most of this machine's precision being lost. In order to take full advantage of the capabilities of the CM-15-36 Machine, careful thought should be given to the following factors before installation is begun:

1. Floor Space Requirements

   Enough space should be available around the machine site to allow easy handling of work material of all sizes and shapes. The operator should have ready access to the machine.

   If the machine is to be set up for cutting on both sides of the table, two work areas will be required as shown in Figure 1. The clearance envelope (see Figure 1) will be 13-feet 6-3/4-inches by 12-feet 7-1/2-inches in this case. A minimum of 2-feet extra clearance on all sides is recommended. The over-all floor space should, therefore, be at least 17-feet 7-inches by 16-feet 7-inches, with the machine located as shown in Figure 1 and 2. An additional 6-feet should be added to the 16-feet 7-inches dimension for each table frame extension added to the original table.

   For cutting on one side of the machine only, the recommended over-all floor space is 12-feet 8-1/2-inches by 16-feet 7-inches.

2. Electrical Requirements

   The machine is equipped with a 115 volt motor and two tubular lamps for illuminating the tracing area. These require approximately 250 watts for operation. It is definitely recommended that the machine be operated on alternating current, between 110 and 120 volts, at 25 or 60 cycles. If a power supply of this sort is not available, suitable equipment such as a transformer or converter should be installed on the line to make the required change.

3. Gas Requirements

   If possible, the machine should be located near pipeline stations for both oxygen and fuel gas. In any event, two separate oxygen supply outlets must be available for connection to the machine - one for preheat and one for cutting. These sources can be on the same pipeline, but separate regulators must be used.

4. Material Handling Facilities

   If the machine is to be used for cutting heavy pieces, a crane should be available at the machine site.

5. Vibration

   Accuracy and smoothness of operation depend on a firm, rigid foundation. The machine should be remote from any heavy vibrating machinery or power presses. Vibration will result in uneven cuts and eventually in misalignment of the table frame. When possible, the foundation should be insulated from other flooring or foundations by earth, as shown in Figure 2.

6. Foundation Requirements

   The foundation should be completed well before the machine is installed. This will give the concrete time to dry and set firmly. Specifications for a recommended foundation of poured concrete, reinforced with steel rods, are shown in Figures 2, 3 and 4.

7. Work Supports

   The type and placement of work supports will naturally depend on the work being handled. Before the supports are designed and installed, a thorough study should be made of the types and quantities of work which the machine will process.

   For general cutting, a standard Work Support (Part No. 30V93) is available. Three of these supports are used for each cutting area. Each support can be fastened to a base plate, if desired, making it portable as well as stable. This will permit shifting the supports to accommodate work of various sizes and shapes. If the type of work to be handled requires supports securely anchored in the foundation, these standard supports can be permanently installed. Grouting and anchor bolts similar to those for the table frame should be used. Permanently installed supports may prove inconvenient, however, if there is much variation in the size (particularly the thickness) of the work pieces.

   For special work, satisfactory supports can be made by spacing structural steel members such as I-beams across the work area. These should be faced with copper on the top edges. The copper facing provides a lasting surface, since it will not be cut by the oxy-acetylene flame. Use copper sheet, bent to fit and peened or clamped in place.

   A method preferred by some mills is to use lengths of angle iron spaced at intervals across the work area. Placed with the angle upward these support...
FIG. 1 - Clearance Plan

NOTE
MACHINE FOR SINGLE SIDE OPERATION WILL HAVE ONLY ONE CUTTING AREA. CLEARANCE ENVELOPE WILL EXTEND 46° AND MINIMUM FLOOR SPACE RECOMMENDED WILL EXTEND 48° FROM CENTER LINE OF TABLE AREA ON SIDE OPPOSITE CUTTING AREA.

FIG. 2 - Foundation Plan

NOTES
1. ONLY ONE OF THE WORK AREAS SHOWN NEED BE PROVIDED IF CUTTING IS TO BE DONE FROM ONE SIDE ONLY OF THE MACHINE.

2. ANCHOR BOLTS FOR BASE PLATES SHOULD BE LOCATED BEFORE REINFORCING ROD IS LAID.

SEE FIG. 4 (E-3450-5) FOR DETAIL OF PLATE & ANCHOR BOLT

1/2" COLD TWISTED SQ. STEEL BARS

REINFORCING RODS @ 4" INTERVALS 68" (12 EQUAL SPACINGS)

CONCRETE

SECTION "B-B"

SECTION "A-A"
shaped cast-iron spikes which in turn support the workpiece. The spikes straddle the angle and provide a clearance of three of four inches between the workpiece and supporting angle iron. The advantage of this method is that the spikes not only resist being cut by the jet, but also can be shifted and arranged for optimum support of the work.

For handling large workpieces, and for making three-dimensional cuts, it is desirable to have a pit in the floor in which to rest the work. The pit can be covered with a removable steel plate when not in use. This allows normal cutting to be done, using the plate as a working surface for placing work supports. The pit should be designed to be easily cleaned of slag and scrap. Arrangements must be made, also, for an adequate supporting structure for the steel cover plate.

Production of items in quantity can be increased by using special jigs or fixtures to handle and place the material. In every case, the work should be located so that the scrap will drop free.

Regardless of the type of support used, it should be separate from the machine table frame. If the support is connected to the table frame in any way, the machine will eventually be thrown out of alignment by the jarring which occurs during handling of the workpieces.

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**TABLE**

<table>
<thead>
<tr>
<th>AMT. REQD.</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>12</td>
<td>ANCHOR BOLT</td>
</tr>
<tr>
<td>12</td>
<td>5/8-11-HEX STEEL NUT</td>
</tr>
<tr>
<td>12</td>
<td>3/4&quot; 4&quot; STD WROUGHT IRON WASHER</td>
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**Fig. 3** RECOMMENDED FOUNDATION BOLT

**Fig. 4:** NOTE THAT THE MOUNTING STUD IS TO ONE SIDE OF THE CENTER. THIS SIDE SHOULD BE PLACED TOWARD THE CENTER OF THE FOUNDATION.

**NOTE:** GROUTING SHOULD BE APPLIED AFTER THE TABLE FRAME HAS BEEN INSTALLED AND LEVELLED.

**Fig. 3 & 4 – Foundation Details.**
Figure 5 shows the assembled table frame. "Item" references in the text apply to this illustration.

All joints in the table frame are bolted joints. Each joint uses a 5/8-in. -11 hex head steel bolt and a 5/8-in. -11 steel standard hex nut. A 5/8-in. U.S.S. plain steel washer is used under the head of the bolt. A 5/8-in. U.S.S. plain steel washer and a 5/8-in. S.A.E. standard lock washer are used under the nut. Figure 6 illustrates the proper assembly order.

The proper length bolt to use at each joint is given in the instructions to follow.

In addition to this hardware, the joints between Items 1 and 4 (see Figure 2) and between Items 1 and 5 use a 5/8-in. x 1-1/2-in. x 1-1/2-in. malleable iron beveled washer. This washer fits against the inner surface of Item 1. (See Figure 13.)

Tools and Materials Required:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
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<tbody>
<tr>
<td>1</td>
<td>7/32-in. drill</td>
</tr>
<tr>
<td>1</td>
<td>3/16-in. drill</td>
</tr>
<tr>
<td>1</td>
<td>No. 3 taper reamer</td>
</tr>
<tr>
<td>1</td>
<td>No. 4 taper reamer</td>
</tr>
<tr>
<td>2</td>
<td>10-in. or 12-in. adjustable wrench</td>
</tr>
<tr>
<td>1</td>
<td>3/16-in. hex wrench</td>
</tr>
<tr>
<td>1</td>
<td>8-in. mill file—No. 2 cut</td>
</tr>
<tr>
<td>1</td>
<td>8-in. bastard round file</td>
</tr>
<tr>
<td>1</td>
<td>screwdriver</td>
</tr>
<tr>
<td>1</td>
<td>precision level</td>
</tr>
<tr>
<td>2</td>
<td>V-blocks, 90-degrees</td>
</tr>
<tr>
<td>1</td>
<td>straight-edge 6-ft., with parallel faces</td>
</tr>
<tr>
<td>2</td>
<td>lengths of piano wire, each 15-ft. long</td>
</tr>
<tr>
<td>6</td>
<td>C-clamps</td>
</tr>
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as needed shim stock .005-in. and .010-in.

1. Install the adjustable base plates on the foundation anchor bolts. Note that the mounting stud is to one side of the center of the mounting plate. Place each plate in position so that this side is toward the center of the foundation. Each plate must be leveled, and all plates must be in the same horizontal plane. Allow approximately 1/2-inch clearance between the plate and the foundation.
2. Install the six channel legs in position on the base plates as shown in Figure 7.

![FIG. 7 - Channel Legs in Position](image)

3. Assemble the lower longitudinal braces (Item 3) and transverse braces (Item 4) as shown in Figure 8. Figures 9, 10 and 11 are detail views of the joints on sections I, II and III respectively. Use 1-3/4-in. long bolts on the transverse braces and 1-1/2-in. long bolts on the longitudinal braces.

![FIG. 8 - Braces Installed](image)

![FIG. 9 - Bolted Joint - Section I](image)

![FIG. 10 - Bolted Joint - Section II](image)

Note that the lower transverse and longitudinal braces on section I are upside down with respect to those on section III. (The extra set of holes in the end frame channel legs are for use in installing extensions to the table frame.)
4. Install the upper transverse braces (Item 5), using 1-3/4-in. long bolts. (See Figure 12). Figure 13 is a detail view of the joint, showing how the beveled washer is used to provide a level bearing surface for the bolt head.

5. Bolt two support clips (Item 7) to each end of both longitudinal table-top supports (Item 6). Use 2-in. long bolts. (See Figure 14).
6. Bolt each of the two assemblies (assembled in step 4) into place between the upper transverse braces (Item 5) (See Figure 15) using 1-1/2-in. bolts. Tighten all bolts.

![FIG. 15 – Table-Top Support Bars in Place](image)

7. Mount the upper rail support angles (Item 2) in place, using 2-in. long bolts. (Figure 16). Mount them loosely enough to permit adjustment by tapping. The top surfaces of the angles must be flush with, or slightly above, the tops of the upper transverse braces (Item 5). Under no circumstances should they ever be below the transverse braces. (Figure 17.)

![FIG. 16 – Rail Support Angles Installed](image)

8. Check the alignment of the frame. Proceed as follows:

   a. The transverse sections (I, II and III) should be in line with each other. Check this by stretching a length of piano wire along each side of the table frame assembly, just below the rail support angles (Item 2). Clamp the wires to the two end sections (I and III), and note if the wires contact the middle transverse section (II) on both sides. The channel legs can be shifted on their base plates to obtain correct alignment.

   b. The tops of the rail support angles (Item 2) should be in one level plane. This is achieved by adjusting the base plate leveling screws and by adjusting the position of the rail support angles on the side of the channel legs.
When leveled, the following conditions should exist:

(1) Each of the four rail support angles should be level. This should be checked by a precision level placed lengthwise on top of the angle. (Figure 18).

(2) The top surfaces of the rail support angles on the two sides of the table, should be at the same level. Check this by resting a straight-edge across the table frame on top of the two rail support angles, then placing a precision level lengthwise on top of the straight-edge. Make this check at the middle and at both ends of the table frame. (Figure 19).

(3) The top surface of each rail support angle should be transversely level. This is checked by placing a precision level cross-wise on the top of the angle. If the angle is not level in this direction, level it by inserting shims between it and the channel legs.

(4) The butt joint between the two rail support angles (Item 2) on the same side of the table frame should be smooth. That is, the two ends should meet snugly, and neither angle should be higher than the other. Check this by sliding a rectangular steel block with sharp square corners back and forth across the joint.

c. After the table frame is leveled, tighten all bolts securely. Then tighten the nuts on the foundation bolts. The two nuts holding each base plate should be tightened in small increments, alternately, to avoid pulling the frame out of line.

d. Recheck the entire frame for levelness as described in "b" on page 8.
C. Mounting the Machine Rails and Table Top

The rails are now mounted on the rail support angles: V-rails on one side of the table, flat rails on the other. This placement of the rails will decide which way the machine faces. In the complete machine installation, the V-rail will be on the right-hand side of the table frame as viewed when facing the forward end of the carriage. (The forward end is that end on which the tracing head and controls are located.)

1. Place the V-rails on the two rail support angles (Item 2) on the side of the table frame selected. The tapped holes for the bumper stops on each rail should be on the outside of the table. Align the rails carefully by eye so that they lie parallel with the inner edge of the rail support angles. (The center lines of the rails should be approximately 3-3/4-in. from this inner edge. Closer adjustment will be made later on.) Butt the inner ends of the rails tightly together. The rails will overhang the rail support angles slightly at each end of the table frame. Adjust the rails to secure the same amount of overhang at each end.

2. Fasten the V-rails lightly in place, using the 1/4 in. -20 x 1-1/2-in. socket head cap screws and the lockwashers and nuts supplied.

3. Stretch a length of piano wire along the V-surfaces on both sides of the V-rail. Anchor the wire at the ends of the rails by means of V-blocks. These blocks are placed on top of outer rail-ends and held in place with clamps. (Figure 20).

Check that the rails are tightly butted together, then align the rails. Tap the rails into line, so that the piano wires contact the rails at all points along both sides of the rails.

If the V-surfaces of the rails do not align smoothly at the butt joint, adjust the alignment by loosening the rail support angle bolts slightly and tapping upward or downward on the rail support angles. It is not necessary that the tops of the V-rails be level at the joint, but the V-surfaces must meet smoothly. Check this by sliding a rectangular steel block with sharp square corners back and forth across the joint on the machined V-surfaces on each side of the rail. (Figure 21).

4. When the V-rails are properly aligned they can be fastened tightly to the rail support angles.

5. The flat rails are then installed in the same manner as the V-rails, except that the piano wire is stretched across the top of the rail, and the top surfaces of the two rails must align smoothly at the butt joint. The flat rail must be parallel to the V-rail, and their center-lines must be 45-3/4-in. apart. (Figure 22).
6. Before fastening the flat rail to the rail support angle, recheck the centerline distance between the two rails. Check at both ends and at the middle of the table frame.

7. Fasten the flat rails tightly in place.

8. Test the table frame as a unit. Test for levelness of each rail section by placing a precision level lengthwise on the top surface of each rail.

   Check to see that the top surfaces of the two sets of rails are in the same level plane. This is done by placing a straight-edge across the table frame so that it rests on the top surfaces of the V- and flat rails. Then place a precision level on the top of the straight-edge. Make any final adjustments required to obtain lengthwise and crosswise levelness of the rails, by adjusting the base plate leveling screws and/or by shifting the rail support angles, (Item 2).

9. Inspect the table frame to see that the upper transverse braces (Item 5) are approximately level with the rail support angles. No part of the braces or of the channel legs should extend above the rail support angles.

10. After correct leveling and alignment of the rails has been achieved, and the rail joints are blended as smoothly as possible*, the rail support angles (Item 2) are doweled to the channel legs (Item 1), as shown in Figure 23. A No. 4 taper pin is used at each joint between these members. To make the dowel holes use a 7/32-in. drill and a No. 4 taper reamer. The lower longitudinal braces are doweled to the channel legs using No. 3 x 1-in. taper pins. Use a 3/16-in. drill and a No. 3 taper reamer to make these dowel holes.

11. Dowel each end of each rail section to the rail support angles with a No. 3 taper pin. Use a 3/16-in. drill and a No. 3 taper reamer to make the dowel holes. (Figure 24).

12. Place the table plate on the table frame. Center it between the rails. Locate the plate so that its ends are square with the ends of the rails. Clamp the plate securely in place.

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* Smoothness of the joint may be improved by careful draw filing.
13. Fasten the table plate to the table frame, using the hold-down clips, as shown in Figure 25.

14. Install the bumper stops (Item 8) on the outside of the V-rails. (18-1/4-in. from the front end of the rail and 20-1/2-in. from the rear end of the rail). Use 1/4-in. -20 x 1/4-in. long socket-head cap screws.

15. The clearance spaces between the base plates and the foundation should now be grouted. Fill the spaces completely. Do not use the table frame until the grouting has set firmly.

Fig. 26 shows the completed table frame.