

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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**OPERATOR'S MANUAL  
BORING MACHINE, ENGINE CYLINDER,  
PORTABLE, 3 1/2 TO 7 1/2 BORE DIAMETER,  
18 INCH DEPTH OF BORE, 110-VOLT, 60-CYCLE,  
SINGLE-PHASE  
(CEDAR RAPIDS ENGINEERING COMPANY MODEL FL)  
(4910-223-9734)**

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<p><b>This reprint includes all changes in effect at the time of publication; change 1.</b></p>
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**HEADQUARTERS, DEPARTMENT OF THE ARMY  
NOVEMBER 1965**

Change }  
No. 1 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 17 January 1973

**Operator's Manual  
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PORTABLE, 3-1/2 TO 7-1/2 BORE  
DIAMETER, 18 INCH DEPTH  
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SINGLE-PHASE  
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MODEL FL)  
(4910-223-9734)**

***This change is current as of 14 November 1972***

TM 9-4910-459-10, 10 November 1965, is changed as follows:

1. This change identifies the type of catalog maintenance action taken in connection with the updating of previously published data.
2. This change is separated by additions, deletions, and changes and is a list of items added, deleted, and/or changed since the last previously published data.
3. All Federal stock numbers and reference numbers, additions, deletions, and changes should be made to the indexes.
4. Parts included with end item and considered a component or part of the item configuration are listed on the following table. The part numbers listed are for (Cedar Rapids Engineering Company Model FL).

Part	Part No.	Part	Part No.
ADAPTER, CONNECTOR: plastic, dielectric, 2 fl parallel male contacts and grounding lead w/term. one end, 2 fl parallel and 1 U female contacts other end, ac/dc, 125-V, 15 amp	07137:2516	HOLDER, TOOL: tool bit, extra lg, 3-3/8, w/spring plunger, roughing	11140:FL-1041
BIT, BORING TOOL: special carbide	11140:FL-1158	HOLDER, TOOL: tool bit, lg, 2-7/8, w/spring plunger, finishing	11140:FL-1026
BODY, ANCHOR:	11140:FL-451	HOLDER, TOOL: tool bit, lg, 2-7/8, w/spring plunger, roughing	11140:FL-1025
BOLT, ANCHOR: shoulder, special, 1/2-13 thd	11140:F-452-8C	HOLDER, TOOL: tool bit, short, 2-5/32, w/spring plunger, finishing	11140:FL-1022
BOLT, ANCHOR: shoulder, special, 1/2-20 thd	11140:F-452-8F	HOLDER, TOOL: tool bit, short, 2-5/32, w/spring plunger, roughing	11140:FL-1021
BRUSH, TOOL HOLDER: bristle, 3/8 rd	11140:H8289	HOLDER, TOOL: tool bit, special, 4-1/2 lg o/a, finishing	11140:FL-1039
BUSHING, ANCHOR BODY: lg	11140:FL-472	HOLDER, TOOL tool bit, special, 4-1/2 lg, o/a, roughing	11140:FL-1038
BUSHING, ANCHOR BODY: short	11140:FL471	HOOK, LIFT: S special	11140:FL
CASE, CARRYING: steel	11140:FL-561	JIG, LAPPING: roughing	11140:FL-555
CLAMP, ANCHOR: No. 2	11140:FL-462	JIG, lapping, swivel hd	11140:FL-551
CLAMP, ANCHOR: No. 3	11140:FL-463	MICROMETER, INSIDE: tool setting, 3-1/2 to 7-1/2 measuring range, w/lockscrew	11140:FL-621G
CLAMP, ANCHOR: No. 4	11140:FL-464	OIL LAPPING DISC: "Stadoil," 4 oz bottle	83658:BCG-T27
CLAMP, ANCHOR: No. 5	11140:FL-465	PLATE, SPACING:	11140:FL-190
CLAMP, ANCHOR: No. 6	11140:FL-466	ROD, EXTENSION: lg	11140:FL-474
CLAMP, ANCHOR: No. 7	11140:FL-467	ROD, EXTENSION: short	11140:FL-473
CLAMP, ANCHOR: No. 8	11140:FL-468	SCREW, CENTERING: extra lg, for 5-1/2 to 7 bore	11140:FL-458
CLAMP, ANCHOR: No. 9	11140:FL-469	SCREW, CENTERING: lg, for 4 to 5-1/2 bore	11140:FL-457
CLAMP, ANCHOR: No. 10	11140:FL-470	SCREW, CENTERING: short, for smaller than 4 in. bore	11140:FL-456
COLLAR, ANCHOR BOLT:	11140:FL-477	SCREW, CENTERING: special, for 7 in. and up bore	11140:FL-458G
COUPLING, EXTENSION ROD:	11140:FL-476	SPIDER, CENTERING:	11140:FL-455
FINGER, CENTERING: No. 1	11140:FL-361		
FINGER, CENTERING: No. 2	11140:FL-362		
FINGER, CENTERING: No. 3	11140:FL-363		
FINGER, CENTERING: No. 5	11140:FL-364		
FINGER, CENTERING: No. 5	11140:FL-365		
FINGER, CENTERING: No. 6	11140:FL-366		
GAGE, ANCHOR: lg, U shape	11140:FL-459-2		
HOLDER, TOOL: tool bit, extra lg, 3-3/8, w/spring plunger, finishing	11140:FL-1042		

Page 16, appendix. Section II is superseded as follows:

## Section II. BASIC ISSUE ITEMS LIST

(1) Source maint. and recov. Code			(2) Federal stock no.	(3) Description	(4) Unit of Issue	(5) Qty. inc. in unit	(6) Illustration	
(a) Source	(b) Maint.	(c) Recov.					(a) Fig. No.	(b) Item No.
C	O/C		5120-240-5292	BASE ISSUE ITEMS LIST -- SECTION II BIIL is a list in alphabetical sequence of items which are furnished with, and which must be turned in with, end item.	EA	1	10	49
C	O/C		5120-198-5392	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, 1/8 across fl, 2-1/4 nom arm lg	EA	1	10	50
C	O/C		5120-240-5300	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, 5/32 across fl, 2-1/2 nom arm lg	EA	1	10	51
C	O/C		5120-240-5274	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, 3/16 across fl, 2-3/4 nom arm lg	EA	1	10	52
C	O/C		5120-277-1253	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, 5/16 across fl, 3-3/4 nom arm lg	EA	1	10	40
				WRENCH, OPEN END, FIXED: sgle-hd type, 15 deg angle, Engr. style, 7/8 opng, 8 in. nom lg o/a, 1/2 thk hd				

By Order of the Secretary of the Army:

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DCSLOG (3)  
CNGB (1)  
TSG (1)  
COE (5)  
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OS Maj Comd (2)  
LOGCOMD (2)  
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WECOM (10)  
MUCOM (2)  
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Armies (3) except  
    Seventh USA (5)  
    Eighth USA (5)  
Corps (2)

Instl (2) except  
    USAECFB (4)  
    Ft Monmouth (5)  
APG (1)  
USMA(1)  
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Army Dep (2) except  
    LEAD (10)  
    TOAD (10)  
USARMIS (3)  
MAAG (Iran, ARMISH) (2)  
USA Team Rsch Comd (2)  
Ft Knox FLDMS(10)  
4th USASA Fid Sta (1)  
Units org under fol TOE: -2 ea.  
    9-357  
    11-587

*ARNG & USAR:* None.

For explanation of abbreviations used, see AR 310-50.

TECHNICAL MANUAL }  
 No. 9-4910-459-10 }

HEADQUARTERS  
 DEPARTMENT OF THE ARMY  
 WASHINGTON, D.C., 10 November 1965

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## CAUTION

### READ COMPLETELY BEFORE ATTEMPTING TO OPERATE MACHINE

#### SPEED AND FEED COMBINATIONS

Speed Control Lever Position	Motor Shift Lever Position	Boring Head rpm	Travel Inches/min. Feed Plunger Position			
			1	2	3	4
Up	Down	83	.127	.249	.393	.564
Up	Up	142	.217	.426	.670	.966
Down	Down	297	.455	.891	1.400	2.000
Down	Up	505	.772	1.515	2.380	3.380

#### OPERATING PROCEDURE:

1. Place speed control in neutral or horizontal position.
2. Start motor.
3. Move motor shift lever to selected position. (See table.)
4. Select feed plunger position. (See table.)
5. Move feed control lever to down position.
6. Push speed control lever down or up. (See table.)

Allow time for the feed plunger to engage. If the feedscrew does not start turning, move the feed plunger slightly up or down to allow the key to engage.

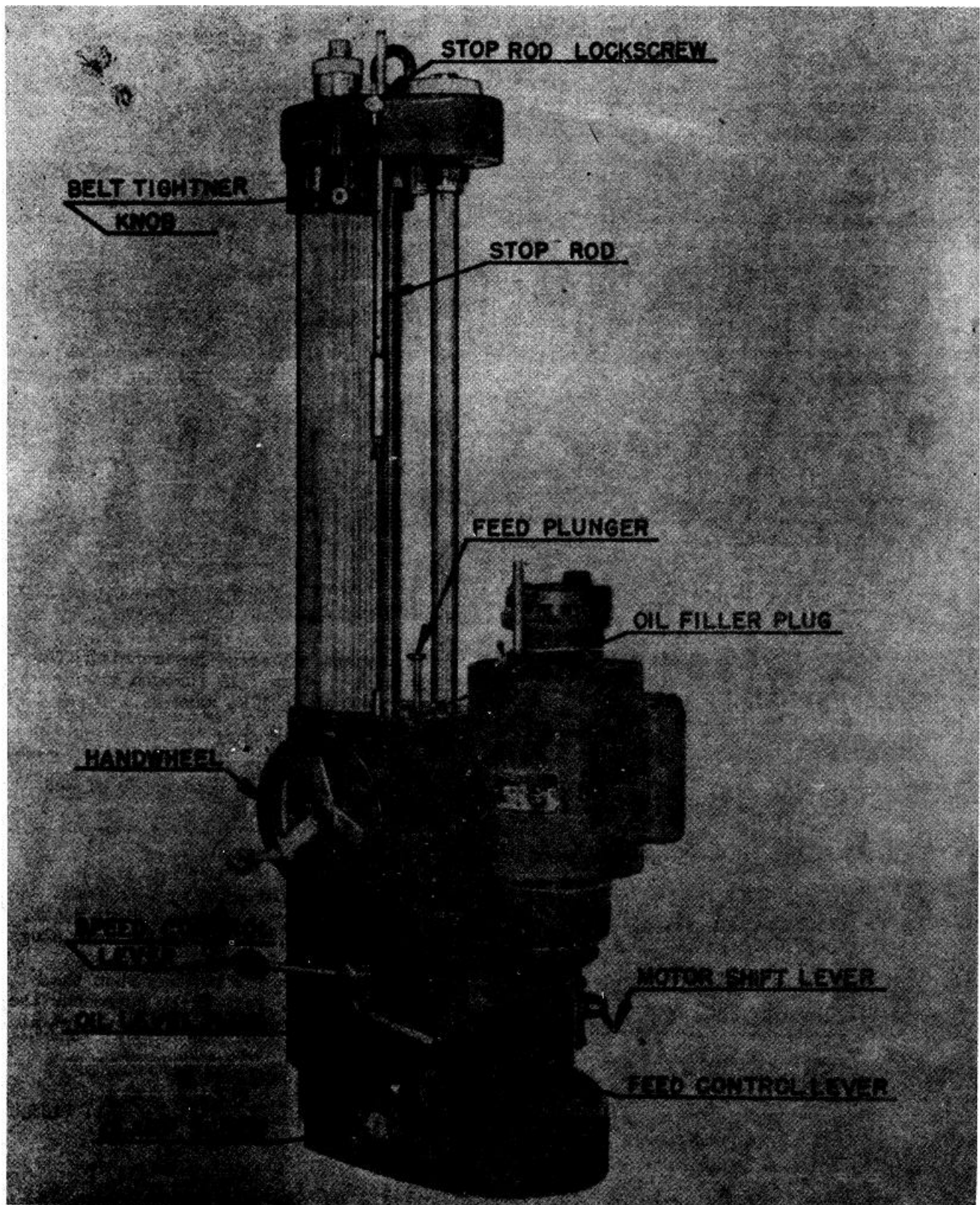
#### NEVER MOVE FEED CONTROL LEVER TO "UP" POSITION WITHOUT FIRST DISENGAGING HANDWHEEL.

(Pull handwheel out to disengage - push in to engage for hand feed.)

When boring cylinders larger than 6-3/4", parallel bars (available as extra equipment) must be used. Centering fingers and boring tool must be watched during retraction so they will not strike the base of the machine. Remove centering fingers immediately after centering so that during the remainder of the boring operation only the tool bit will have to be kept in the correct position.

**BELT TENSION:** On heavy rough boring cuts it will be necessary to turn the belt tightner knob in a clockwise direction to increase tension on the belt. On light finish cuts it may be necessary to release the tension on the belt to eliminate any shadow patterns in the finished bore.

The stop rod is a device for measuring and controlling the travel of the boring head. However, it is not advisable to leave the machine unattended as it reaches the end of the boring stroke.



**INSTRUCTIONS FOR OPERATING**  
**THE KWIK-WAY MODEL "FL" CYLINDER BORING MACHINE**

**STANDARD EQUIPMENT**  
**(CHECK EQUIPMENT AGAINST THIS LIST IMMEDIATELY)**

- 1 - Boring Machine with Motor
- 1 - Tool Setting Micrometer
- 1 - Anchor Gage
- 1 - Standard Anchoring Assembly
- 9 - Anchor Claws
- 1 - Extra-Long Threaded Extension with Hex Coupling
- 3 - Extra Centering Screws, Oval Head - Long
- 3 - Extra Centering Screws, Oval Head - Extra Long
- 6 - Sets of Centering Fingers (3 per set)
- 1 - Swivel Lapping Jig
- 1 - Roughing Lapping Jig for 4R
- 2 - Short Tool Holders
- 2 - Long Tool Holders
- 4 - Tool Bits
- 1 - Micrometer Hole Cleaning Brush
- 4 - Socket Head Setscrew Wrenches
- 1 - Single Open End wrench
- 2 - Special Short Anchor Bolt
- 1 - Box for Accessories

**VERY IMPORTANT**

**CLEAN MACHINE:**

Clean the machine thoroughly, removing all dust and grit collected in transit. The rust preventative used on the machine and all parts may be quickly removed with a cloth dampened in gasoline. Clean bottom of machine base in like manner.

**LUBRICATION:**

Before starting the machine, be sure to oil it properly, using a good grade of medium motor oil in all oil cups.

There is some oil in the main transmission.

To check oil level in the transmission, remove the oil filler plug just in front of the motor and the oil level plug just below the speed control lever. Pour S.A.E. 30 oil in the upper hole until it runs out of the lower one. Then replace both plugs.

Oil the sleeve main bearing by putting a few drops of oil in the keyway, when the sleeve is in the "UP" position. This will saturate the lower felt which surrounds the sleeve at the bottom. Keep the upper felt saturated by putting oil around sleeve at top.

Oil the feedscrew and drive shaft occasionally.

**CAUTION**  
**DO NOT OVER-LUBRICATE AND WIPE ALL SURPLUS OIL TO PREVENT V-BELT SLIP.**

**MOTOR CURRENT:**

Be sure the motor is of the proper voltage and cycle for the current available. The motor nameplate will give this information.



## **INSTALLATION OF STOP ROD**

Clean stop rod and remove round head machine screw in small end of rod. Insert through hole in belt guard as illustrated on Page 1, and replace round head machine screw. Remove stop rod lock screw and brass plug from bag attached to stop rod. Insert plug (flat end first) into tapped hole in belt guard, screw in stop rod lock screw and adjust rod to desired length.

## **INSTALLATION OF ANCHORING DEVICE**

The anchoring device is generally located in the cylinder next to the one to be bored. In some blocks it may be the second one. This depends entirely upon the motor being bored.

To install the anchor, select the longest length of clamp which will freely enter the bore when in the inverted position shown in Figure 1. Then if the shoulders 'A-A' allow more than 1/16" endwise movement of the clamp, loosen the two adjusting screws until the endwise movement is between 1/32" and 1/16". Then fasten this clamp to the anchor body by means of the clamp pivot pin, in the position in Fig. 2.

Before inserting the anchoring device, examine the bottom of the cylinder bore to determine the best position in which to clamp. Whenever possible, the clamp should be set crosswise of the cylinder block, but if ribs or sloping walls interfere, use the nearest to a crosswise location which provides sufficient flat surface on which to hook the clamp.

Turn the centering screws in, if necessary, (keeping each one as nearly central with the centering spider as possible) until the device will freely enter the cylinder and yet have but little side play in any direction. Select the proper anchor bolt, insert device in cylinder as shown in Figure 2, slide U-shaped anchor gage under bolt head and, while holding anchor clamp up against bottom of cylinder, tighten anchor bolt down against anchor gage, as shown in Figure 3.

### **CAUTION**

**Never allow the clamp to project to a position where the boring tool could strike it.**

Push the machine over the open end of the U-shaped anchor gage first, as this allows removing the gage after the bolt head engages the T-slot in the machine.

## **ANCHORING DEVICE**

Furnished with the anchoring device are different lengths of clamps, centering screws and anchor bolts. The capacities of these different parts are as follows:

### **CLAMPS**

NO. 2 - 3-1/4" to 3-3/4"  
NO. 3 - 3-3/4" to 4-1/4"  
NO. 4 - 4-1/4" to 4-3/4"  
NO. 5 - 4-3/4" to 5-3/4"  
NO. 7 - 5-3/4" to 6-1/4"  
NO. 8 - 6-1/4" to 6-3/4"  
NO. 9 - 6-3/4" to 7-1/4"  
NO. 10 - 7-1/4" to 7-3/4"

### **CENTERING SCREWS**

Short Set - Smaller than 4" Bore  
Long Set - 4" to 5-1/2"  
Extra Long Set - 5-1/2" to 7"  
Special Long - 7" & up

### **BUSHINGS & EXTENSIONS**

Short Bushing Only - 6-1/8" to 8-1/4"  
Long Bushing Only - 8-1/8" to 10-1/4"  
Short Bushing & Long Extension - 9-3/4" to 13-1/2"  
Short Bushing & Standard Extension - 9-3/4" to 11-13/16"  
Long Bushing & Standard Extension - 11-3/4" to 13-5/8"  
Long Bushing & Long Extension - 11-3/4" to 15-3/8"  
Short Bushing & Both Extensions - 13-7/8" to 17-5/8"  
Long Bushing & Both Extensions - 15-7/8" to 19-5/8"

## CAPACITY OF CENTERING FINGERS

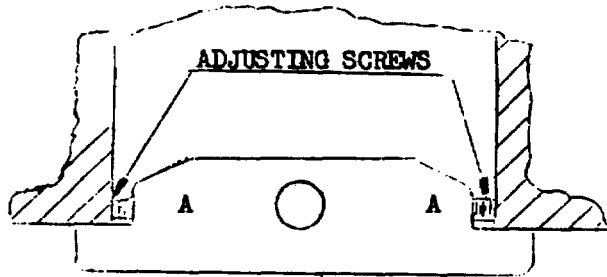
The cylinder sizes covered by each set of centering fingers are as follows:

NO. 1 2-31/32" to 3-13/16"  
NO. 2 3-3/4" to 4-9/16"  
NO. 3 4-1/2" to 5-5/16"

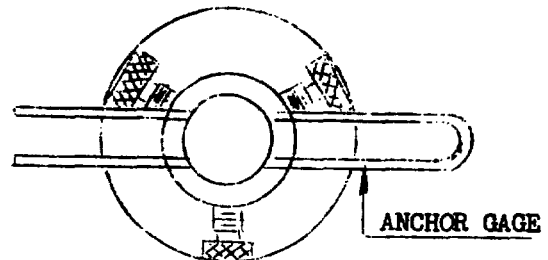
NO. 4 5-1/4" to 6-1/16"  
NO. 5 6" to 6-13/16"  
NO. 6 6-3/4" to 7-9/16"

### **CAUTION**

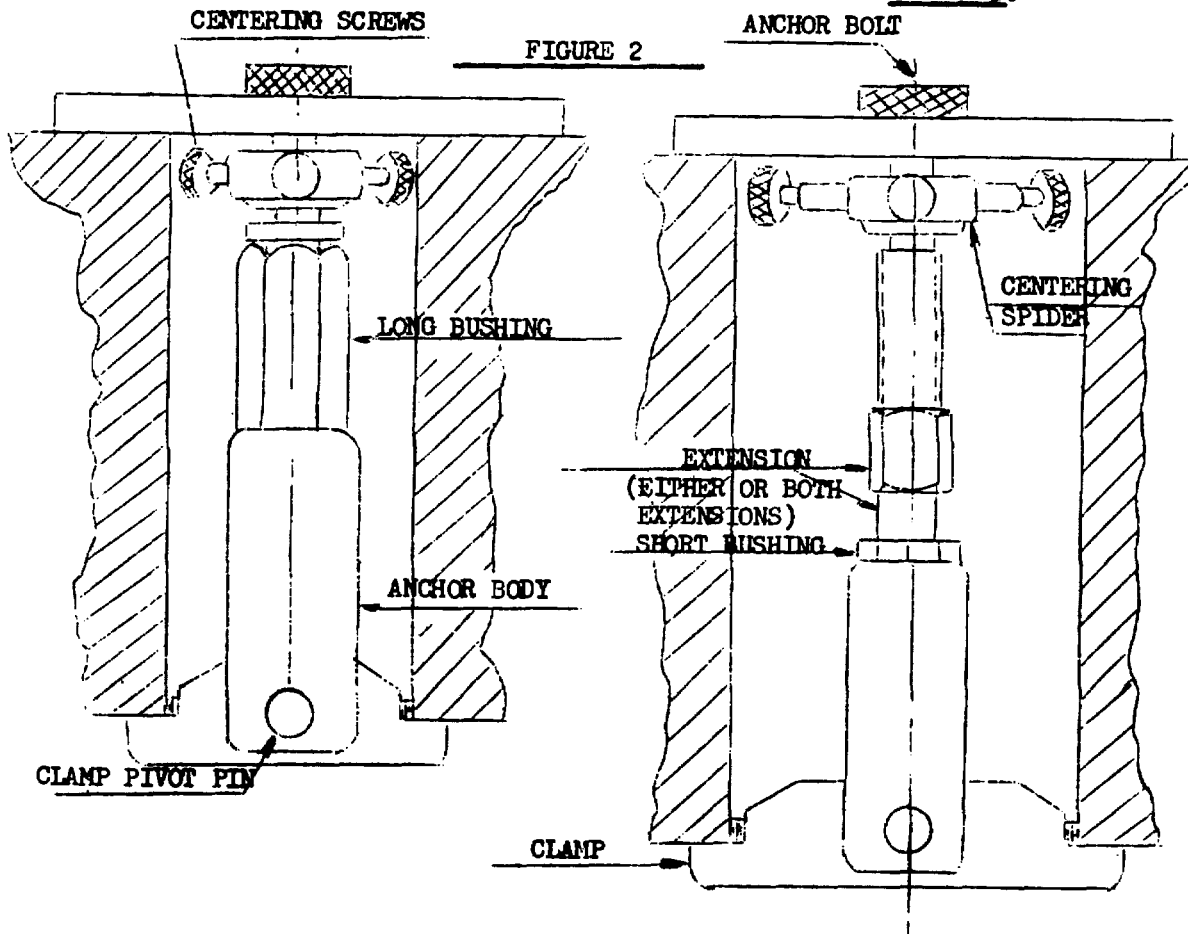
Insert the pointed ends of the centering fingers in the boring head. Inserting the rounded ends in the boring head first will scratch and groove the centering cone and destroy the accuracy of the centering operation.



**FIGURE 1**



**FIGURE 3.**



## OPERATION PROCEDURE

CYLINDER BLOCK PREPARATION	Remove all studs. Clean carbon and oil from top of block. File top of block to remove burrs. Mike all cylinders for largest worn diameter.
INSTALLING ANCHOR BOLT	Select the proper length clamp, anchor bolt and centering screws (See Page 3.) Locate and adjust anchoring device in hole. (Fig. 1 and 2). Adjust anchor bolt head down against anchor gage. (Fig. 1 and 3).
CENTERING AND CLAMPING	Wipe machine base clean. Place machine in position over anchor bolt and remove anchor gage. (See Page 3). Select proper centering fingers and insert in head. (See Page 4). Move feed control lever to neutral position. Lower sleeve to desired position for centering - using handwheel. Tighten centering handwheel (at extreme top of bar) until fingers are tight against the cylinder wall. Swing base of machine on block to center on anchor bolt. Clamp machine to block by using screw (hexhead) on side of base. (Use wrench furnished - a longer wrench will clamp too tight). Loosen centering handwheel. Disengage handwheel. Start motor and move feed control lever to "UP" position - thus raising bar out of cylinder.
ROUGH BORE	Lap Roughing "R" Tool (See Page 7). Set Micrometer to rough bore size desired (See Page 10) Set Tool Holder Spring Plunger (Page 10) Insert "R" Tool Holder in head. Set Tool with micrometer (See Page 11) and lock in place. Remove micrometer. Lower sleeve manually until tool is slightly above top of block. Disengage handwheel. Set stop rod according to bore length. (See Page 3). Move feed control lever to "DOWN" position. Set feed plunger and motor shift lever. Engage speed control lever according to speed desired. See Speed and Feed Table. Lap finishing "F" tool while machine rough bores. (See Page 8). When machine stops at bottom of cylinder, be sure handwheel is disengaged. Raise feed control lever thus returning the sleeve to original position.
FINISH BORE	Remove roughing tool and install finishing "F" tool. Set micrometer to desired finished size and proceed as before. When bore is completed, turn the knurled handwheel at top of the drive shaft so that index mark on the nut below the centering handwheel is to the front of the machine. This prevents tool bit marking cylinder. Disengage handwheel. Move feed control lever to retract sleeve. Unclamp machine - move to next hole, and proceed in same manner.

### **CAUTION**

**Always clean out micrometer hole with brush before inserting micrometer.**

## ROUGH BORED CYLINDER WALL

These figures show the four angles to be lapped on the Roughing Tool Bit Faces 1, 2, 3R and 4R.

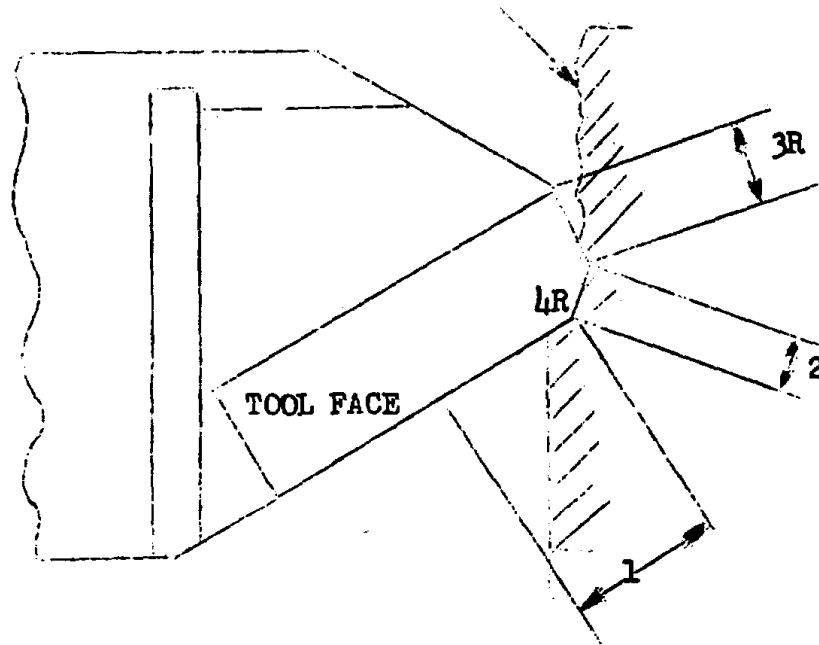


FIG. 4 (ROUGH BORING TOOL BIT) IN CUTTING POSITION

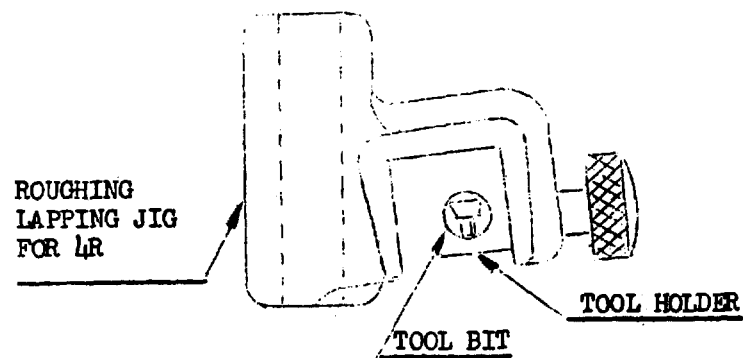


FIG. 5 LAPPING JIG FOR LAPPING ROUGH BORING TOOL BIT IN POSITION 4R

## LAPPING THE ROUGHING TOOL

On the roughing tool (Fig. 4) a part of Portion 1, and all of Portion 2 remove the metal in boring and are, therefore, the parts of the tool which wear and must be reconditioned. The lapping operations will be as follows:

1. The first operation is to lap the tool face (Fig. 4) by using the lapping jig shown in Fig. 5. Lap only until you have removed all built-up material from the face of the tool.
2. Then place the tool holder in the Swivel Head Lapping Jig as shown in Fig. 6 and set the swivel casting which holds the tool to position 1 as illustrated. Lap in this position until portion 1 (Fig. 4) is smooth.

Shift swivel casting to position 2 (Fig. 6) and lap portion 2 (Fig. 4) until portion 2 is in good condition.

Shift to position 3R (Fig. 6) and lap portion 3R (Fig. 4) until Portion 2 has the proper width. For the roughing tool this width could be eight thousandths for the average size bore.

Examine the tool after each hole to check its condition.

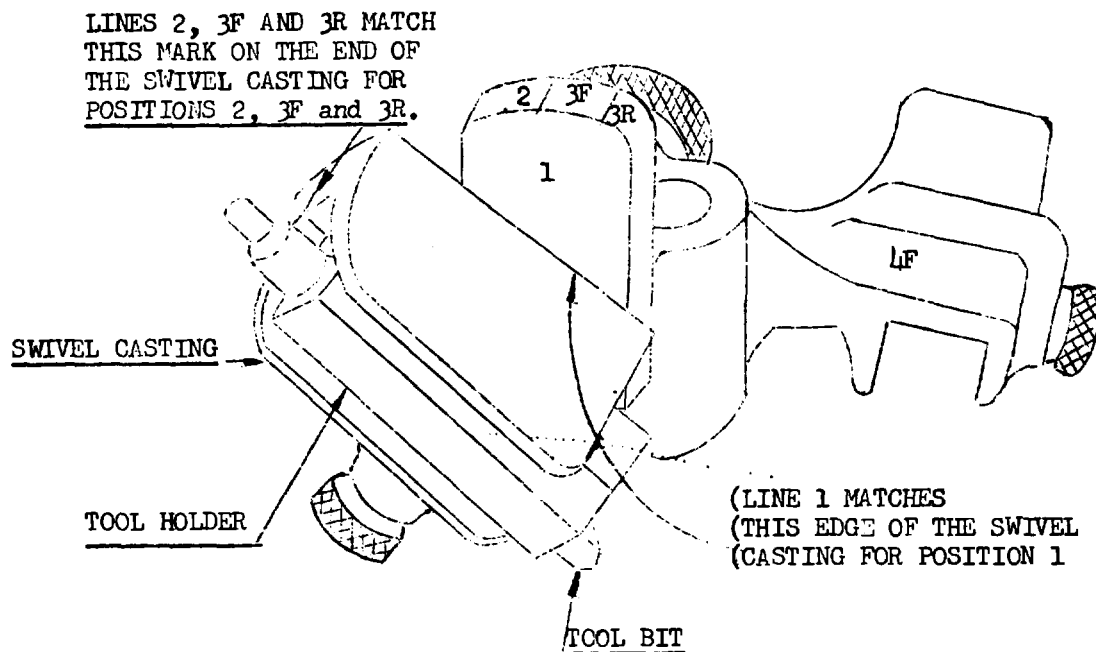


FIGURE 6 SWIVEL HEAD LAPPING JIG SHOWING THE DIFFERENT POSITIONS FOR LAPPING THE TOOL

## LAPPING THE FINISHING TOOL

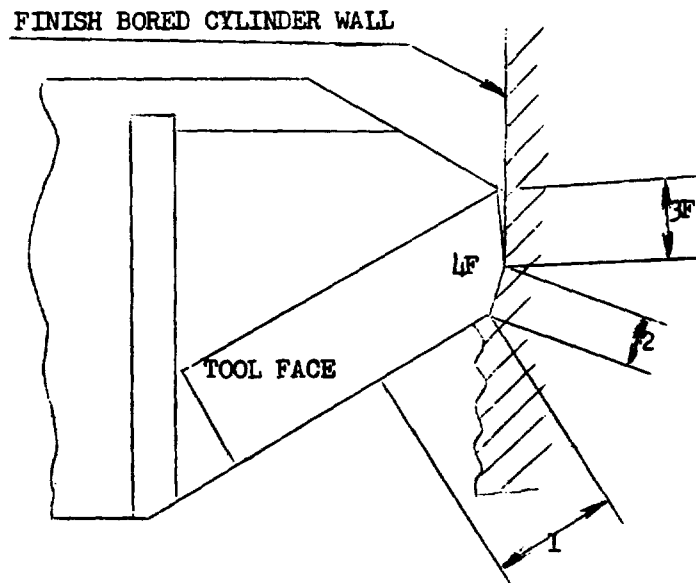
On the finishing tool (Fig. 7) portion 2 is the part that produces the finish cut. The condition of portion 2, therefore, determines the final finish. The finishing tool bit is lapped only in the swivel head jig and in positions 4F, 1, 2 and 3F.

Proceed as follows:

1. The first operation is to lap the tool face 4F (Fig. 7) with the tool in position 4F (See Fig. 6) of the swivel head lapping jig. Lap only until you have removed all built-up material from the face of the tool.
2. Then place the tool holder in the swivel head lapping jig as shown in Figure 6, and set the swivel casting which holds the tool to position 1 as illustrated. Lap in this position until portion 1 (Fig. 7) is smooth.
3. Shift the swivel casting to position 2 and lap portion 2 until it is smooth.
4. Then shift to position 3F and lap portion 3F until Portion 2 has the proper width. This should be from .020" to .60", depending on the bore size, as explained on Page 9 under "Most Important Part of the Tool".

Lap the finishing tool as outlined above, after every hole.

To fully understand the purpose of each lapping operation, carefully study the enlarged views of the tool, at the same time holding one of the tools in your hand in the position shown in these views.



**FIGURE 7.  
(FINISH BORING TOOL BIT)  
(IN CUTTING POSITION)**

### MOST IMPORTANT PART OF THE TOOL

The Portion "2" is by far the most important part of the tool and its width and condition will determine absolutely the quality of cylinder wall finish left by the tool in boring. The following rules apply to this part of the tool and if observed, will provide the best results possible.

1. Portion "2" is widened by lapping operation No. 2 and narrowed by either 1 or 3 (F or P) Preferably 3, because it is faster.
2. Widening Portion "2" improves the finish but at the same time increases the tendency of the tool to chatter. The width of Portion 2 must therefore be watched carefully.
3. The correct width of Portion 2 depends on the diameter of cylinder to be bored. For holes up to 4i", the width on "F" tool should be about .040". For holes larger than 4" (and longer than 9") it will be necessary to reduce this width somewhat, the amount depending on the tendency to chatter at the bottom of the hole. For the largest holes, the width should be about .020".
4. One pass boring: On long and large bore cylinders where chatter is a problem when trying to obtain a satisfactory finish, the following method of lapping the tool is recommended:  
Lap Positions 1, 2, and 3F with the swivel head jig. Lap 4R with roughing lapping jig.  
The width of the 2 face can be increased to obtain desired finish.

Careful examination of the tool before lapping will show a gray line along Portion 2. This is the wear that takes place on this keen edge after it has bored a hole. In lapping you must remove this gray line in order to restore keen cutting edge which is of vital importance in getting a good finish. The keenness of the edge of portion 2 is especially important.

### MISCELLANEOUS SUGGESTIONS ON LAPPING

In all lapsing operations lower the jig very carefully to the lapping disc. If the tool is dropped in the disc both tool and disc are apt to be damaged.

To get the best results in lapping, oscillate the tool with a short quick movement.

Never lap any more than is necessary, to facilitate lapping operations. Keep the steel filed away from the tungsten carbide similar to a new tool.

The lapping at Positions No.s 2 and 3 should be done toward the center of the disc. The lapping at Positions 1 and,4 should be toward the edge.

Care of the Disc. Keep the Felt Wick in the lapping disc guard saturated with special lapping disc oil. If the disc is used dry, the tungsten carbide pulls the diamond powder out of the disc and will shorten its life. The free use of oil on the disc not only improves the results but greatly prolongs disc life. Occasionally the lapping disc will become "gummed up" and appear "dull". Cleaning with gasoline will improve its cutting quality.

### SETTING THE TOOL IN THE BORING HEAD

Determine the size to bore and set the micrometer (Fig. 8). Each graduation of the micrometer body, or one revolution of the thimble, represents .050". In Fig. 8, the micrometer setting is 5.300".

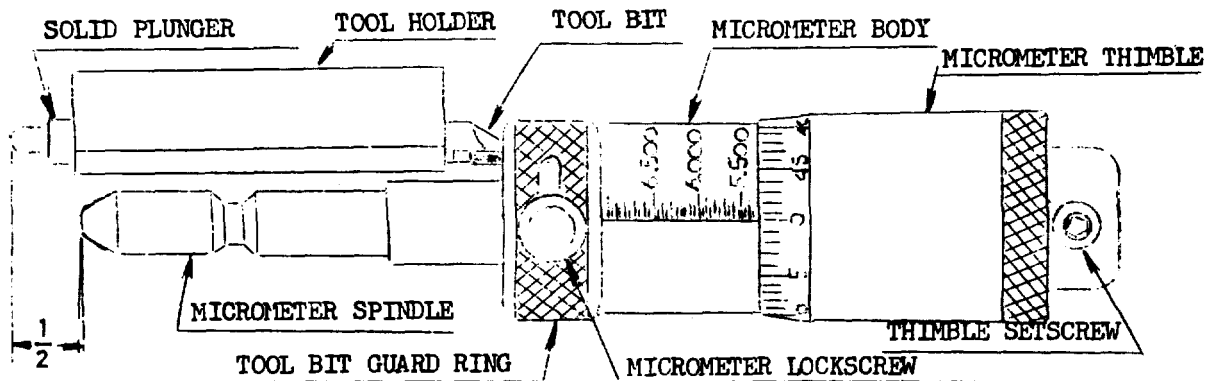


FIGURE 8

### SETTING PLUNGER IN TOOL HOLDER

For the roughing cut, the micrometer should be set .002" smaller than the desired finished size. .002" is the proper amount for the finish cut. After setting the micrometer, lock it with the micrometer lockscREW.

To determine the approximate position of the spring plunger in the tool holder, set the micrometer to the desired bore size, measure the distance from the face of the micrometer to the end of the micrometer stem and add 1/2". This is the approximate length of the tool (tip of tool bit to end of spring plunger) required for setting the tool to that bore size. See Figure 8.

### **CAUTION**

**Unless the plunger is properly set it will be impossible to maintain uniformity of bore sizes.**

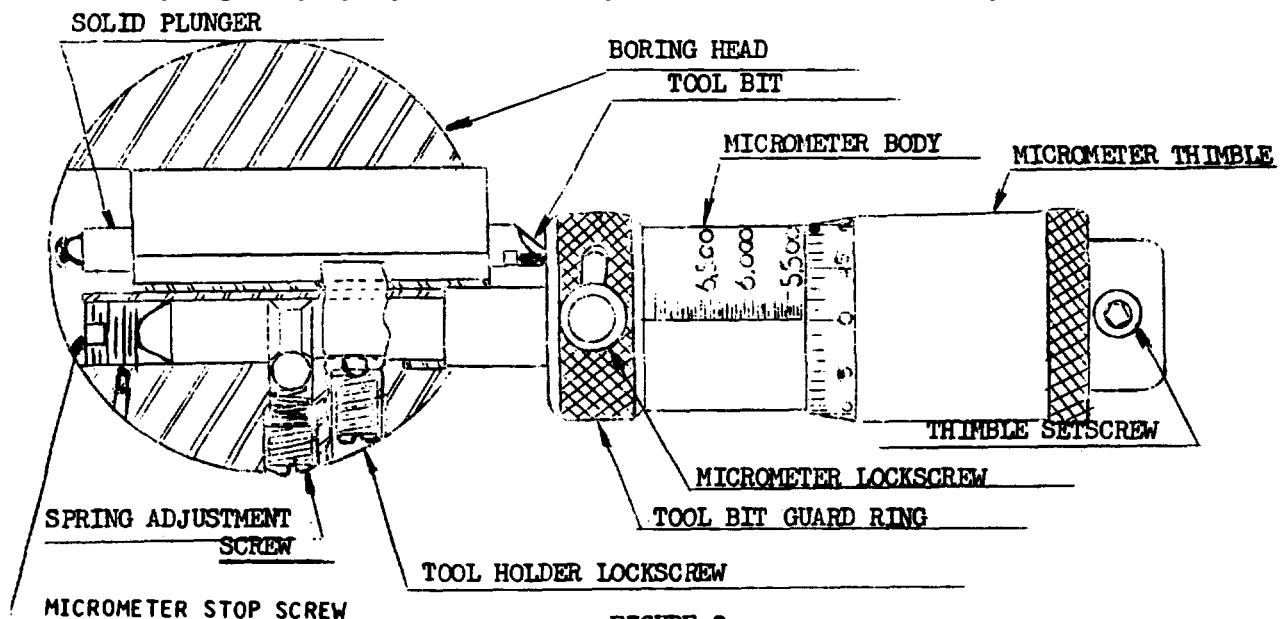


FIGURE 9.



Fig. 9 shows the tool holder in the boring head ready to be locked in position. The small spring plunger is partly compressed, thus pushing the tool holder and tool bit out against the face of the micrometer body with a light spring pressure.

1. Before inserting micrometer spindle in boring head, clean micrometer hole in boring head with bristle brush furnished.
2. Insert the tool holder in the boring head. Turn guard ring on micrometer to the left (to protect tool bit and micrometer). Insert the micrometer spindle in boring head, and push it in until it "clicks" into place.
3. Turn the tool bit guard ring back to the right, allowing the tool bit point to gently contact the micrometer face.
4. Lock the tool holder in place. Remove micrometer.

#### **NOTE**

**For best uniformity of tool setting, use the same part of the mike face in contact with the tool bit for all settings. This is easily done by keeping the micrometer lock screw in the same position each time.**

#### **CAUTION**

**When removing the tool holder from the boring head, have one hand on the tool to prevent its flying out.**

The finishing tool is set in the boring head in exactly the same way, after setting the micrometer for the desired finished size.

#### **IMPORTANT**

Be sure the setting of the boring machine micrometer corresponds with the inside micrometer used in measuring the cylinders. If necessary to reset the tool setting micrometer, proceed in the following manner.

First, set the boring tool with the tool setting micrometer to take a light cut, and lock the knurled thumbscrew to retain the micrometer setting. Bore about an inch down. Then measure the hole with the inside micrometer. Then loosen the setscrew in the hub of the thimble of the tool setting "mike". Turn the thimble to correspond with the measured size of the hole, and lock the setscrew. After thus adjusting the micrometer thimble, set the micrometer to a size 5 or 10 thousandths larger, bore again and recheck. If further adjustment is necessary, reset the thimble and check again. Repeat until the two micrometers read alike.

#### **MISCELLANEOUS SUGGESTIONS**

**OPERATING THE MACHINE WITH HAND FEED:** The machine may be used with the hand feed such as for facing, counterboring, or chamfering, by setting the feed handle in neutral position and pushing the handwheel in to engage the gear on the feedscrew. Note that this handwheel turns at a very rapid rate during power retraction and should be pulled out of engagement before retraction.

#### **MICROMETER SPINDLE LOCK ADJUSTMENT**

In setting the boring tool for size, the micrometer is automatically held against a stop in the boring head by spring pressure on a ball which enters a groove in the micrometer spindle. The spring pressure on the ball is adjustable by means of a setscrew in the side of the boring head. (See Fig. 9).

In setting the tool holder in the boring head, the spring pressure on the ball must overcome the spring pressure of the plunger in the tool holder so as to hold the tool holder in the proper position while being locked in the boring head. The spring pressure in the tool holder will vary according to the position of the plunger in the tool holder.

If the setscrew for adjusting the pressure on the ball is backed out too far, it will be possible that the shoulder of the micrometer spindle will not be held against the stop on the front of the head. This will cause the machine to bore oversize at times and make it impossible to secure uniformity of bore sizes.

Whenever difficulty is encountered in sizes or uniformity of bore sizes, this adjustment should be checked. The setscrew should be screwed in until it stops, and should then be backed out one half turn. There should be a distinct click when the ball enters the groove of the micrometer spindle and thrusts the shoulder of the spindle against the stop in the boring head.

### ADJUSTMENT OF THE MICROMETER

In setting the micrometer to the desired size, it is not necessary to depend on the sense of feel for accuracy; consequently, the adjustment should be such that there is a noticeable drag when the thimble is turned, as contrasted with the conventional outside mike. The drag is adjustable by means of a round nut which is accessible by removing the thimble.

In several instances, the difficulty as to bore sizes has been traced to a loosely adjusted micrometer. Any end play between the screw and body of the micrometer can affect the size of the bore. If the screw or spindle is worn to the extent that a nice adjustment as to drag cannot be had over the complete range, the micrometer should be returned to the factory for repair.

After making any adjustment on the micrometer, it should be checked before the machine is used to bore a good block. Take a light cut about one inch down in a scrapped or demonstrating block and measure the bore with an inside micrometer. If the setting of the boring machine micrometer does not compare with the inside "mike", loosen the setscrew in the hub of the thimble of the boring machine mike, turn the thimble to correspond with the measured size of the hole and lock the setscrew in the thimble. (See preceding page under heading "Important.")

### ADJUSTING THE BORING BAR SLEEVE MAIN BEARING

An improper adjustment of the main sleeve bearing on the KWIK-WAY Cylinder Boring Machine may cause trouble in the operation of the machine. The adjustment should be checked frequently. The actual adjusting of the sleeve bearing is a delicate operation and too much stress cannot be laid upon it. The process used at the factory and recommended for use in the field is as follows:

Four sets of adjustment screws are provided for this bearing, Four large clamping screws and four smaller locking screws. The adjustment is made by setting each set of screws separately, beginning with the bottom set and working up to the top.

First loosen all four sets of screws.

Tighten the bottom clamping screw while moving the handwheel back and forth until a considerable drag is felt on the handwheel. Tighten the lockscrew of this set. This should leave a slight drag on the handwheel when moving the boring sleeve up and down. Should this adjustment leave no drag or too great a drag after tightening

the lock screw. Loosen the lock screw and reset the clamp screw.

Tightening these screws too tight will distort the bearing and cause uneven wear.

The adjustment at the bottom of the bearing is most important and should be properly made before proceeding with the rest of the adjustment.

Adjust the next set of screws in the same manner, the top set last, increasing the drag on the handwheel, slightly after locking each set of screws.

We have been informed of several instances where boring machines have arrived at destination with the small screws loose in both bearings. This is, no doubt, the result of vibration in transit, but there is nothing which can be done about it other than to make sure that the screws are properly adjusted before the machine is used.

**STOP ROD:** A stop rod, graduated in inches, is provided in the pulley bracket assembly at the top of the machine. Set the stop rod according to the length of bore desired and machine will stop automatically when cutting tool has passed through cylinder.

### IMPORTANT

The "FL" machine is equipped with a special adjustable micrometer stop screw in the back of the boring head. (See Page No. 10). This stop screw should not be moved to correct micrometer setting and adjusting as moving it in any way will require a re-adjustment of the micrometer as discussed in Page 11 under heading "IMPORTANT".

"Micrometer Spindle Lock Adjustment" (page 11) explains the principle of the ball and spring pressure applied to the groove in the micrometer stem. This special stop screw is adjusted so the ball that applies pressure to the groove in the micrometer stem just brooks over the edge of the groove and holds the micrometer tight against this stop screw. If at any time it is necessary to change micrometers or if the micrometer screw develops and play in boring head, this screw can be reset to position the ball properly at the edge of the groove on the stem so the micrometer will snap into the boring head and be hold firmly without and play. Whenever a readjustment of this screw is necessary, it is extremely important that the bar be set up on a scrap block and the micrometer again be reset as explained in the paragraph under the heading "IMPORTANT" (Page 11).

## LAPPING SPECIAL ONE PASS BRING TOOL

The tool holders (3-3/8" long) that are included with this Cylinder Boring Machine are equipped with two special carbide tool bits that are particularly well adapted to boring large diameter long bores, or high alloy hard sleeves. The tools can be identified with the Figure "8" that is stamped on the flat of the tool and both of these tools are dressed in a special lap referred to as a "one pass lap".

The advantage of lapping the tool in this manner is that it will take a reasonably heavy roughing cut and still produce a good finish, or it can be used for a light cut and a better finish. The instructions for lapping the tool would be identical to the instructions under the heading "Lapping the Roughing Tool" on Page 7 of the Instructions Manual.

The only change in this instruction would be the last paragraph which should read as follows:

"Shift to position 3F (Figure 6) and lap portion 3F (figure 7, Page 8) until the portion 2 has the proper width. For the one pass boring tool this width may be .010 to .015 for the average size bore."

The tool described above, fitted with this special carbide is designated as FL-1158 and although the tools are dressed by the one pass method, they can be redressed to use as a roughing tool or a finishing tool if the operator so desires.

## BORING CYLINDERS LARGER THAN 6-3/4"

Special equipment is included with the accessories for boring cylinders larger than 6-3/4". The parallel bars are placed on top of the cylinder block to raise the cylinder boring machine so that the boring tool might pass under the base in working on large bores. There is also a special collar furnished which will slide over the anchor bolt and allow the operator to raise the anchor assembly high enough to engage the clamp in the base of the machine and still retain the centering screws in the bore.

The centering fingers and boring tool must be watched during retraction so they will not strike the base of the machine and the centering fingers should be removed immediately after centering so that during the remainder of the boring operation only the tool bit will have to be kept in the correct position.

**APPENDIX**  
**BASIC ISSUE ITEMS LIST**

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**Section I. PREFACE**

**1. General**

This appendix is a list of basic issue items. It is composed of those items which make up the major end item of equipment and the operator's tools and equipment that are issued with the equipment and are required for stockage.

**2. Requisitioning a part to which FSN has not been assigned**

When requisitioning a C source (local procurement) item identified only by a manufacturer's part number, it is mandatory that the following information be furnished the supply officer:

a. Manufacturer's code number (5 digit number preceding the colon in the descriptive column).

b. Manufacturer's part number (the number (the number, and sometimes letters, following the colon, (a) above). Dashes, commas, or other marks must be included exactly as listed.

c. Nomenclature exactly as listed below herein, including dimensions, if necessary.

d. Name of manufacturer of end item (from cover of TM or manufacturer's name plate).

e. Federal stock number of end item (from TM).

f. Manufacturer's model number (from TM or name/data plate, preferably name/data plate).

g. Manufacturer's serial number (from name/data plate).

h. Any other information such as type, frame number, and electrical characteristics, if applicable.

i. If DD Form 1348 (DOD Single Line Item Requisition System Document (Manual)) is used, fill in all blocks except 4, 5, 6, and Remarks filed in accordance with AR 725560. Complete form as follows:

- (1) In blocks 4, 5, and 6, list- manufacturer's code, and manufacturer's part

number (as listed in description column).

- (2) In "Remarks" field, list noun name (repair part), end item application (FSN of end item), manufacturer, model number (end item), serial number (end item), and any other pertinent information such as frame number, type, etc.

**3. Explanation of Columns**

a. *Source, Maintenance, and Recoverability Code (col 1).*

- (1) Material numerical codes (col 1a). This column is not required.
- (2) Source (col 1b). This column indicates the selection status and source for the listed item. Source code used in this list is:

Code  
C

*Explanation*

Obtain through local procurement. If not obtainable from local procurement, requisition through normal supply channels with a supporting statement of nonavailability from local procurement.

- (3) Maintenance level (col 1c). This column indicates the category of maintenance authorized to install the listed item. Maintenance level code used in this list is:

Code  
O/C

*Explanation*

Operator or crew maintenance

- (4) *Recoverability (col 1d).* This column indicates whether- unserviceable items should be returned for recovery or salvage. When no code is indicated, the item will be considered expendable. Recoverability code used in this list is:

Code  
R  
direct

*Explanation*

Items which are economically repairable at and general support maintenance activities and are normally furnished by supply on an exchange basis.

- b. *Federal Stock Number (col 3).* Self explanatory.

c. *Description (col 3).* This column indicates the Federal item name (shown in capital letters) and any additional description required for supply operations. The manufacturer's code and part number are also included for reference.

<i>Code</i>	<i>Explanation</i>
11140:	Cedar Rapids Engineering Co.
74545:	Hubbell-Harvy Inc.
83658	Storm-Vulcan Inc.

d. *Unit of Issue (col 4), Quantity Authorized (col 5), and Illustration (col 6).* Self explanatory.

#### 4. Abbreviations

amp ..... ampere (s)  
 c..... cycle (s)  
 deg..... degree(s)

fl ..... flat  
 hdl..... handle(d) (s)  
 hd ..... head  
 nom ..... nominal  
 o/a ..... overall  
 ptb ..... portable  
 rd ..... round

#### 5. Errors, Comments, and/or Suggestions

Reports of errors, comments, and/or suggestions are encouraged. They should be submitted on DA 2028 (Recommended Changes to DA Publications) and forwarded direct to: Commanding General, Headquarters, U. S. Army Weapons Command, ATTN: AMSWE-SMM-P, Rock Island Arsenal, Rock Island, Ill. 61202.

### Section II. BASIC ISSUE ITEMS

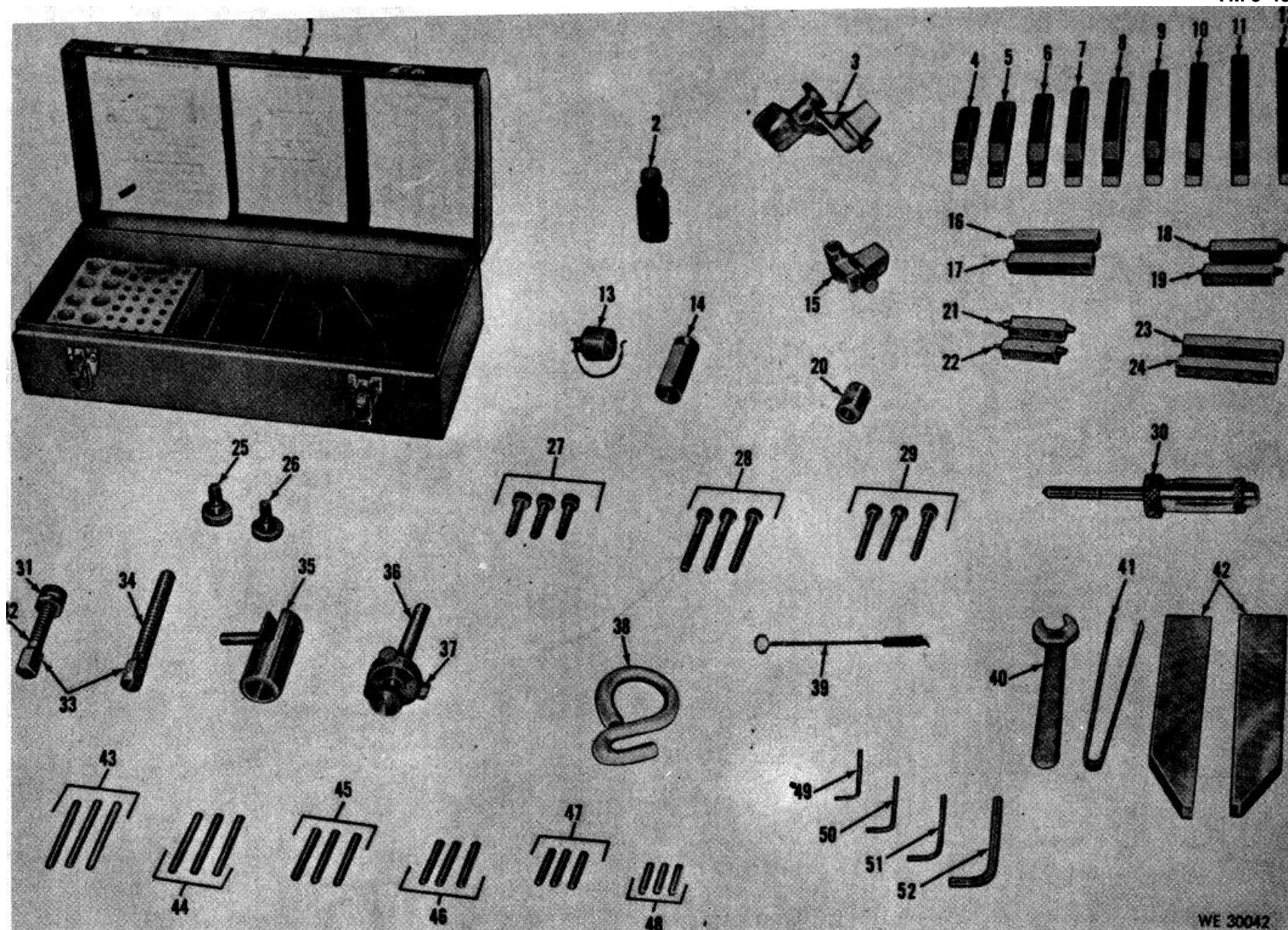
(1) Source, Maintenance, and Recoverability Code				(2)  Federal stock No.	(3)  Description	(4)  Unit of issue	(5)  Quantity author- ized	(6) Illustration	
(a)	(b)	(c)	(d)					(a)	(b)
Material Code	Source	Mainten- ance level	Recover- ability					Figure No.	Item No.
			R	4910-223-9734	MAJOR COMBINATION The major combination listed below is requisitioned for initial issue only. BORING MACHINE, ENGINE CYLINDER: - ptbl, 3 1/2 to 7 1/2 bore dia, 18 in. depth of bore, ac, 110-v, 60-c, sgle-ph (Cedar Rapids Engineering Company Model FL) (4910-223-9734). COMPONENTS OF MAJOR COMBINATION None authorized SPARE PARTS None authorized TOOLS AND EQUIPMENT FOR: BORING MACHINE, ENGINE CYLINDER (11140:FL)				
	C	O/C		593-45-3886	ADAPTER, CONNECTOR: plastic, dielectric, 2 fl parallel male contacts and grounding lead w/term one end, 2 fl parallel and 1 U female contacts other end, ac/dc, 125-v, 15 amp (74545:5273L).	ea	1	10	13
	C	O/C			BIT, BORING TOOL: special, carbide (11140:FL-1158)	ea	4		
	C	O/C			BODY, ANCHOR: (11140:FL-451)	ea	1	10	35
	C	O/C			BOLT, ANCHOR: shoulder, special, 1/2-13 thd (11140:F-452-8C).	ea	1	10	25
	C	O/C			BOLT, ANCHOR: shoulder, special, 1/2-20 thd (11140:F-452-8F).	ea	1	10	26

(1) Source, Maintenance, and Recoverability Code				(2)	(3)	(4)	(5)	(6) Illustration	
(a)	(b)	(c)	(d)	Federal stock No.	Description	Unit of issue	Quantity Incorporated in unit	(a)	(b)
Material Code	Source	Mainten- ance level	Recover- ability ability					Figure Number	Item Number
					TOOLS AND EQUIPMENT FOR: BORING MACHINE, ENGINE CYLINDER (11140:FL) -Continued				
	C	O/C	----	----	BRUSH, TOOL HOLDER: bristle, 3/8 rd (11140:H8289)	ea	1	10	39
	C	O/C	----	----	BUSHING, ANCHOR BODY: lg (11140:FL-472)	ea	1	10	14
	C	O/C	----	----	BUSHING, ANCHOR BODY: short (11140:FL-471)	ea	1	10	31
	C	O/C	----	----	CASE, CARRYING: steel (11140:FL-61)	ea	1	10	1
	C	O/C	----	----	CLAMP, ANCHOR: No. 2 (11140:FL-462)	ea	1	10	4
	C	O/C	----	----	CLAMP, ANCHOR: No. 3 (11140:FL-463)	ea	1	10	5
	C	O/C	----	----	CLAMP, ANCHOR: No. 4 (11140:FL-464)	ea	1	10	6
	C	O/C	----	----	CLAMP, ANCHOR: No. 5 (11140:FL-465)	ea	1	10	7
	C	O/C	----	----	CLAMP, ANCHOR: No. 6 (11140:FL-466)	ea	1	10	8
	C	O/C	----	----	CLAMP, ANCHOR: No. 7 (11140:FL-467)	ea	1	10	9
	C	O/C	----	----	CLAMP, ANCHOR: No. 8 (11140:FL-468)	ea	1	10	10
	C	O/C	----	----	CLAMP, ANCHOR: No. 9 (11140:FL-469)	ea	1	10	11
	C	O/C	----	----	CLAMP, ANCHOR: No. 10 (11140:FL-470)	ea	1	10	12
	C	O/C	----	----	COLLAR, ANCHOR BOLT: (11140:FL-477)	ea	1	10	20
	C	O/C	----	----	COUPLING, EXTENSION ROD: (11140:FL-476)	ea	2	10	33
	C	O/C	----	----	FINGER, CENTERING: No. 1 (11140:FL-361)	ea	3	10	48
	C	O/C	----	----	FINGER, CENTERING: No. 2 (11140:FL-362)	ea	3	10	47
	C	O/C	----	----	FINGER, CENTERING: No. 3 (11140:FL-363)	ea	3	10	46
	C	O/C	----	----	FINGER, CENTERING: No. 4 (11140:FL-364)	ea	3	10	45
	C	O/C	----	----	FINGER, CENTERING: No. 5 (11140:FL-365)	ea	3	10	44
	C	O/C	----	----	FINGER, CENTERING: No. 6 (11140:FL-366)	ea	3	10	43
	C	O/C	----	----	GAGE, ANCHOR: lg, U shape (11140:FL-459-2)	ea	1	10	41
	C	O/C	----	----	HOLDER, TOOL: tool bit, extra lg, 3 3/8, w/spring plunger, finishing (11140:F1-1042)	ea	1	10	16
	C	O/C	----	----	HOLDER, TOOL: tool bit, extra lg, 3 3/8, w/spring plunger, roughing (11140:FL-1041)	ea	1	10	17
	C	O/C	----	----	HOLDER, TOOL: tool bit, lg, 2 7/8, w/spring plunger, finishing (11140:FL-1026)	ea	1	10	18
	C	O/C	----	----	HOLDER, TOOL: tool bit, lg, 2 7/8, w/spring plunger, roughing (11140:FL-1025)	ea	1	10	19
	C	O/C	----	----	HOLDER, TOOL: tool bit, short, 2 5/32, w/spring plunger, finishing (11140:FL-1022)	ea	1	10	21
	C	O/C	----	----	HOLDER, TOOL: tool bit, short, 2 5/32, w/spring plunger, roughing (11140:FL-1021)	ea	1	10	22
	C	O/C	----	----	HOLDER, TOOL: tool bit, special, 4 1/2 lg o/a, finishing (11140:FL-1039)	ea	1	10	23

## Section II. BASIC ISSUE ITEMS

(1) Source, Maintenance, and Recoverability Code				(2)	(3)	(4)	(5)	(6) Illustration	
(a)	(b)	(c)	(d)	Federal stock No.	Description	Unit of issue	Quantity Incorporated in unit	(a)	(b)
Material Code	Source	Mainten- ance level	Recover- ability ability					Figure Number	Item Number
					TOOLS AND EQUIPMENT FOR: BORING MACHINE, ENGINE CYLINDER (11140:FL) -Continued				
	C	O/C	----	-----	HOLDER, TOOL: tool bit, special, 4 1/2 lg o/a, roughing (11140:FL-1038)	ea	1	10	24
	C	O/C	----	----	HOOK, LIFT, S: special (11140:FL)	ea	1	10	38
	C	O/C	----	----	JIG, LAPPING: roughing (11140:FL-555)	ea	1	10	15
	C	O/C	----	----	JIG, LAPPING: swivel hd (11140:FL-551)	ea	1	10	3
	C	O/C	----	5120-540-5299	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, 1/8 across fl, 2 1/4 nom arm lg.	ea	1	10	49
	C	O/C	----	5120-540-5392	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, 5/32 across fl, 2 1/2 nom arm lg.	ea	1	10	50
	C	O/C	----	5120-240-5300	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, :3/16 across fl, 2 3/4 nom arm lg.	ea	1	10	51
	C	O/C	----	5120-240-5274	KEY, SOCKET HEAD SCREW: hex-type, L-type hdl, M16 acrss fl, 3 3/4 nom arm lg.	ea	1	10	52
	C	O/C	R	----	MICROMETER, INSIDE: tool setting, 3 1/2 to 7 1/2 measuring range, w/lockscrew (11140:FL-621G)	ea	1	10	30
	C	O/C	----	----	OIL, LAPPING DISC: "Stadoil," 4 oz bottle (83658: BCG-T27)	oz	1	10	2
	C	O/C	----	----	PLATE, SPACING: (11140:FL-190)	ea	2	10	42
	C	O/C	----	----	ROD, EXTENSION: lg (11140:FL-474)	ea	1	10	34
	C	O/C	----	----	ROD, EXTENSION: short (11140:FL-473)	ea	1	10	32
	C	O/C	----	----	SCREW, CENTERING: extra lg, for 5 1/2 to 7 bore (11140:FL-458)	ea	3	10	29
	C	O/C	----	----	SCREW, CENTERING: lg, for 4 to 5 1/2 bore (11140:FL-457)	ea	3	10	27
	C	O/C	----	----	SCREW, CENTERING: short, for smaller than 4 in. bore (11140:FL-456)	ea	3	10	37
	C	O/C	----	----	SCREW, CENTERING: special, for 7 in and up bore (11140:FL-468G)	ea	3	10	28
	C	O/C	----	----	SPIDER, CENTERING: (11140:FL-455)	ea	1	10	36
	C	O/C	----	5120-277-1253	WRENCH, OPEN END, FIXED: Sgle-hd type 15 deg angle, Engr. style, 7/8 opng, 8 in nom lg o/a, 1/2 thk hd.	ea	1	10	40





WE 30042

Figure 10. Tools and equipment.

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    LEAD (10)  
    TOAD (10)  
USACDCEC (10)  
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NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320-50.

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# The Metric System and Equivalents

## Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

## Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 dekagram = 10 grams = .35 ounce  
 1 hectogram = 10 dekagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

## Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

## Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

## Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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