

# Instructions for 90912 Cathode Ray Oscilloscope

## 1. DESCRIPTION

The 90912 is a small panel mounting basic cathode-ray oscilloscope intended for instrumentation. It is complete with bezel and panel control of intensity, focus, vertical centering, and horizontal centering. The 90912 uses the 2BP1 or 2BP11 cathode-ray tube. This oscilloscope produces unusually sharp traces with moderate acceleration voltage.

A sharp trace is made possible by the use of a very efficient mu-metal magnetic shield, the MILLEN No. 80802-A.

The panel space required is only 3 x 5 inches. The oscilloscope complete with tube weighs 1 $\frac{3}{4}$  pounds.

Eight turret lug terminals are available on the side panels to connect the signal source to

the vertical deflection plates, the sweep source to the horizontal plates, the acceleration voltage, and the heater voltage.

The No. 90912, a basic oscilloscope, provides intensity, focus, and centering controls but no amplifiers, sweep, or power supply. Both horizontal and vertical deflection sources, as well as heater and acceleration voltages are to be taken from the equipment on which the oscilloscope is mounted. Since no amplifiers are normally supplied with the oscilloscope, the frequency response is good through the VHF band. The MILLEN No. 90202 Plug-In High Voltage Power Supply is a miniature power supply available for use with the 90912 in applications where heater and accelerating voltages are not already available.

## 2. APPLICATION

The No. 90912 Oscilloscope is intended for a wide variety of monitoring and adjustment applications. Since an oscilloscope shows wave shape as well as magnitude it may be used in many applications where voltmeters and milliameters have had to suffice in the past due to the size and cost limitations of oscilloscopes. Such applications include:

- Lissajous frequency comparator
- Null indicator
- Klystron mode indicator
- Pulse jitter indicator
- Neutralization indicator
- Tuning indicator
- Voltage output indicator
- Power output indicator
- Per cent modulation indicator
- Phase shift indicator
- Frequency drift indicator
- and many, many others

One of the chief advantages of an oscilloscope over a moving coil meter is that an oscilloscope may be used for many indications whereas a meter is usually used for only one indication. The oscilloscope responds immediately, does not require damping and does not load the circuit to which it is connected. Because the No. 90912 is a "basic" oscilloscope with single-ended deflection, its cost is kept to a minimum. The user can readily add any auxiliary circuits which may be required for his particular application without having to carry the cost burden of unnecessary circuit refinements.

## 3. INSTALLATION

A mounting template, drawing No. K-90912-2, is included with this instruction book. The nine holes which must be drilled in the panel are:

- 1—2 $\frac{1}{4}$  inch diameter hole for the tube.
- 4— $\frac{3}{8}$  inch diameter holes for the controls.
- 4—No. 28 drill holes for mounting the oscilloscope and bezel to the panel.

After the panel holes are drilled, remove the two Phillips head screws which hold the bezel

to the oscilloscope. Using an Allen wrench remove the four miniature bar knobs. Remove the two screws which hold the etched panel to the oscilloscope, remove the etched panel, and discard the paper spacer shipped with the oscilloscope. Insert the oscilloscope controls through the panel from the rear, and place the etched panel on the front of the panel. Mount the oscilloscope and etched panel to the panel by means of two screws through the panel into the tapped holes in the

magnetic shield brackets. Use the upper left and lower right holes or the lower left and the upper right holes. Plug a 2BP1 cathode-ray tube into the shield from the front, leaving the tube base clamp open. Plug the socket onto the tube base. Mount the bezel on the front of the panel by means of the two Phillips head screws through the two remaining holes. The bezel is square so it may be mounted either way.

Solder a pair of leads from the 6.3 volts a.c. source to the terminals marked "6.3" on the right panel. Solder a lead from the horizontal deflection signal source to the terminal marked "HOR." on the right panel. The other horizontal deflection plate is grounded. Solder a lead from the vertical deflection signal source to the terminal marked "VERT." on the left panel. The other vertical deflection plate is grounded. The grounded terminals are connected to the ground point on the oscilloscope voltage divider. Solder a lead from the positive terminal of the acceleration voltage source (often near ground potential) to the lower front terminal marked "+" on the right panel. This point is separated from the grounded deflection plate terminals by the cen-

tering voltage; the "+" terminal and the grounded deflection plates should not be connected to the same point in the supply circuit. The grounded deflection plate terminals are not connected to the panel or frame of the oscilloscope so it is not essential that the deflection plate terminals be grounded to the supply circuit. Should the spot widen out as it is deflected near the edge of the tube, it will be necessary to connect the frame to "+" or the grounded deflection plate terminals. Solder a lead from the negative terminal of the high voltage accelerating voltage source to the lower front terminal marked "-" on the left panel. The total supply voltage may be any value between 500 and 875 volts d.c. The maximum current drawn at 875 volts is 3.2 milliamperes. The higher acceleration voltages result in sharper traces and greater range of horizontal and vertical positioning but lower deflection sensitivity. Use care in soldering to the terminal lugs on the panels to avoid any possible short circuit or leakage path between terminals.

Rotate the cathode-ray tube for proper orientation of the trace and close the tube base clamp to prevent rotation of the tube.

#### 4. OPERATING PRECAUTIONS

As with any cathode-ray oscilloscope, the phosphor coating on the inside face of the tube can be burned by excessive intensity of trace, therefore always use the minimum intensity which yields a satisfactory trace, and always turn the intensity control full counter-clockwise when the trace is not viewed. In some monitoring applications it may be advisable to install a

spring-return push switch which will automatically blank out the trace when it is not being viewed. Only a small limiting resistor is included in the design so that it will be possible to obtain adequate illumination for fast writing rates. At normal writing rates it is possible to advance the intensity control to a point where a fixed trace would burn the phosphor.

#### 5. MEASUREMENT OF PERCENTAGE OF MODULATION OF RECEIVED SIGNALS

Couple the plate of the last I.F. amplifier in the receiver to the vertical input on the oscilloscope and to the horizontal input terminal through approximately 50,000 ohms. Ground the low input terminals to the receiver chassis. Retune the last I.F. transformer.

An unmodulated carrier will appear as an ellipse. Modulation will cause the line to widen to a ribbon leaving a dark oval in the center. At exactly 100% modulation the dark oval in the center decreases to zero. With over-modulation a bright spot appears at the center.

Let A equal the overall outside length of the ellipse.

Let B equal the length of the dark oval.

The per cent modulation equals  $(A-B)/(A+B) \times 100$ .

The signal must be relatively free from interference for this measurement to be accurate.

## 6. TECHNICAL SUMMARY

### Power Supply

500 to 875 Volts D.C. at 3.2 Milliampères  
6.3 Volts A.C. at 0.6 Amperes.  
Millen No. 90202 Plug-In High Voltage Power  
Supply provides 705 to 750 Volts D.C.  
and 6.3 Volts A.C.

### Tube Complement

1—2BP1—2 Inch Cathode-Ray Tube.

### Physical Dimensions

Height—3 Inches.  
Width—5 Inches.  
Depth—7¼ Inches Behind Panel.

### Sensitivity (Using Millen No. 90202 Power Supply).

Vertical—56 to 59 Volts Peak to Peak Per  
Inch.  
20 to 21 Volts R.M.S. Per Inch.  
Horizontal—84 to 90 Volts Peak to Peak Per  
Inch.  
30 to 32 Volts R.M.S. Per Inch.

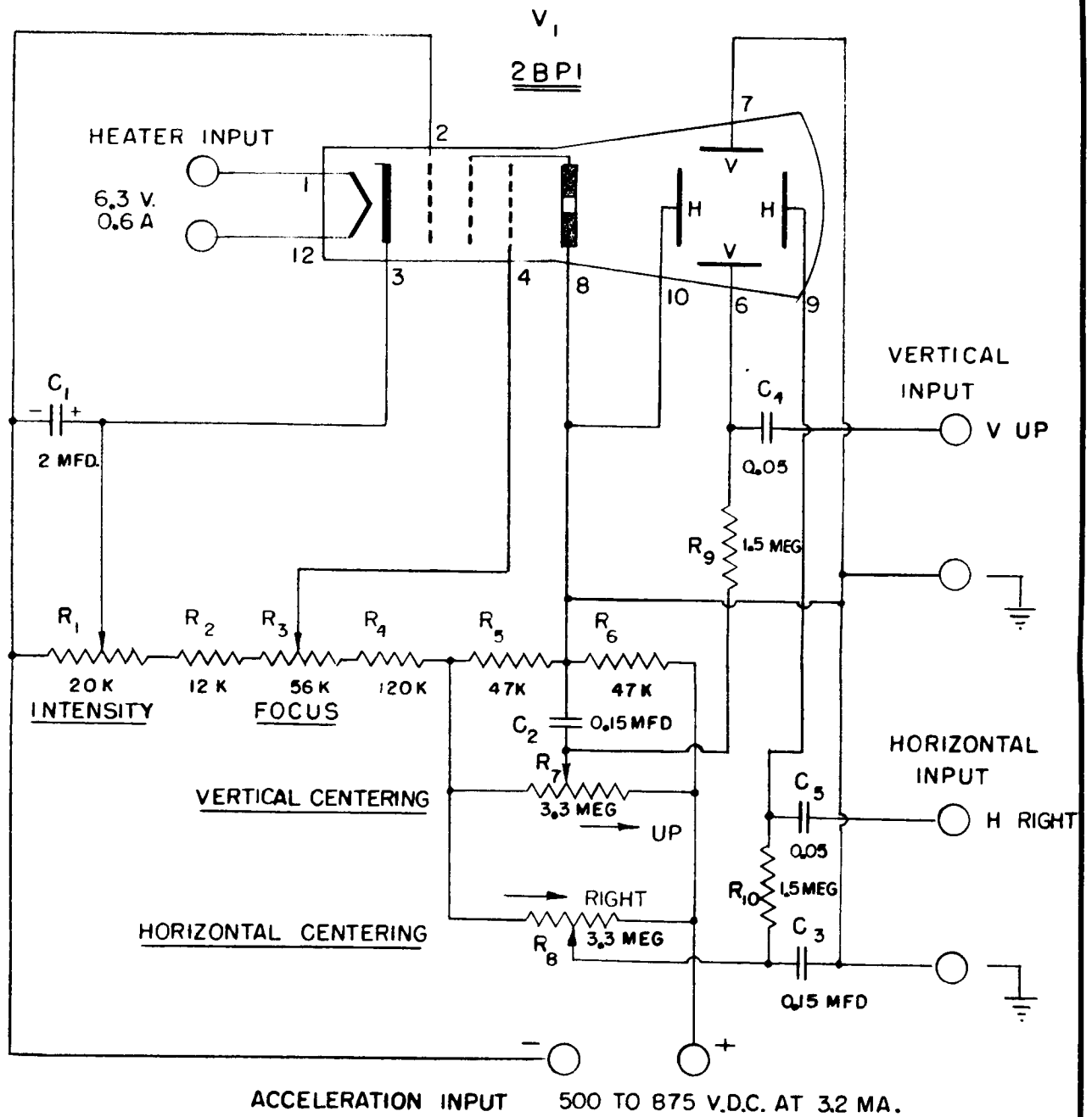
### Panel Controls

Intensity.  
Focus.  
Vertical Centering.  
Horizontal Centering.

### Weight

1¾ Pounds.

R.W.C.—7/19/57



ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

2" INSTRUMENTATION OSCILLOSCOPE

FIRST MADE FOR

DESIGNED BY R. W. C.

CHECKED BY R. W. C.

DRAWN BY R. KAROSAS

APPROVED

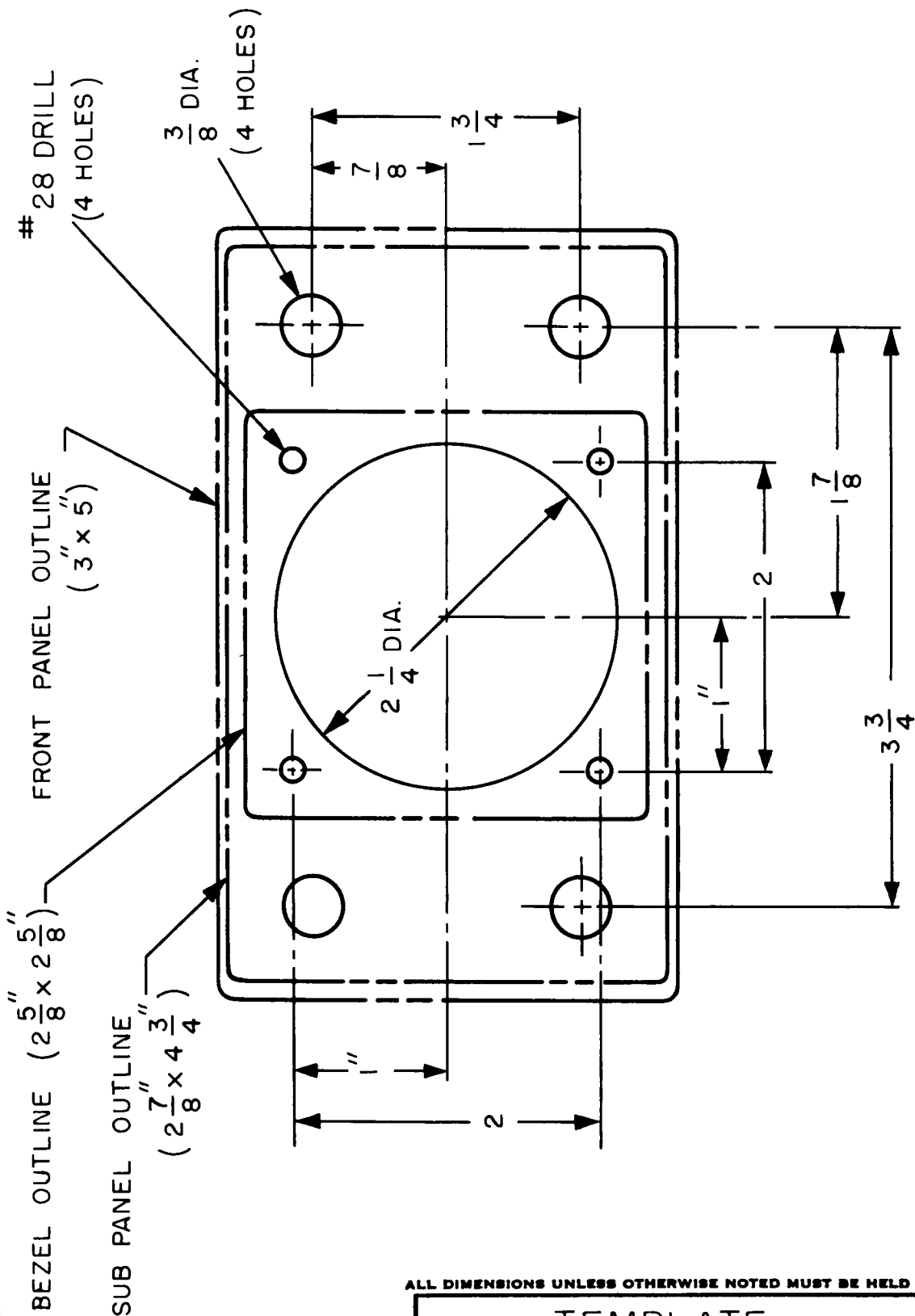
JAMES MILLEN MFG. CO., INC.  
MALDEN, MASS., U.S.A.

K90912

DATE

2-26-57

THIRD ANGLE PROJECTION



MOUNTING TEMPLATE FOR  
MILLEN NO. 90912 2" OSCILLOSCOPE

ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

TEMPLATE

FIRST MADE FOR

DESIGNED BY *P. A. E.*

DRAWN BY *R. L. Parker*

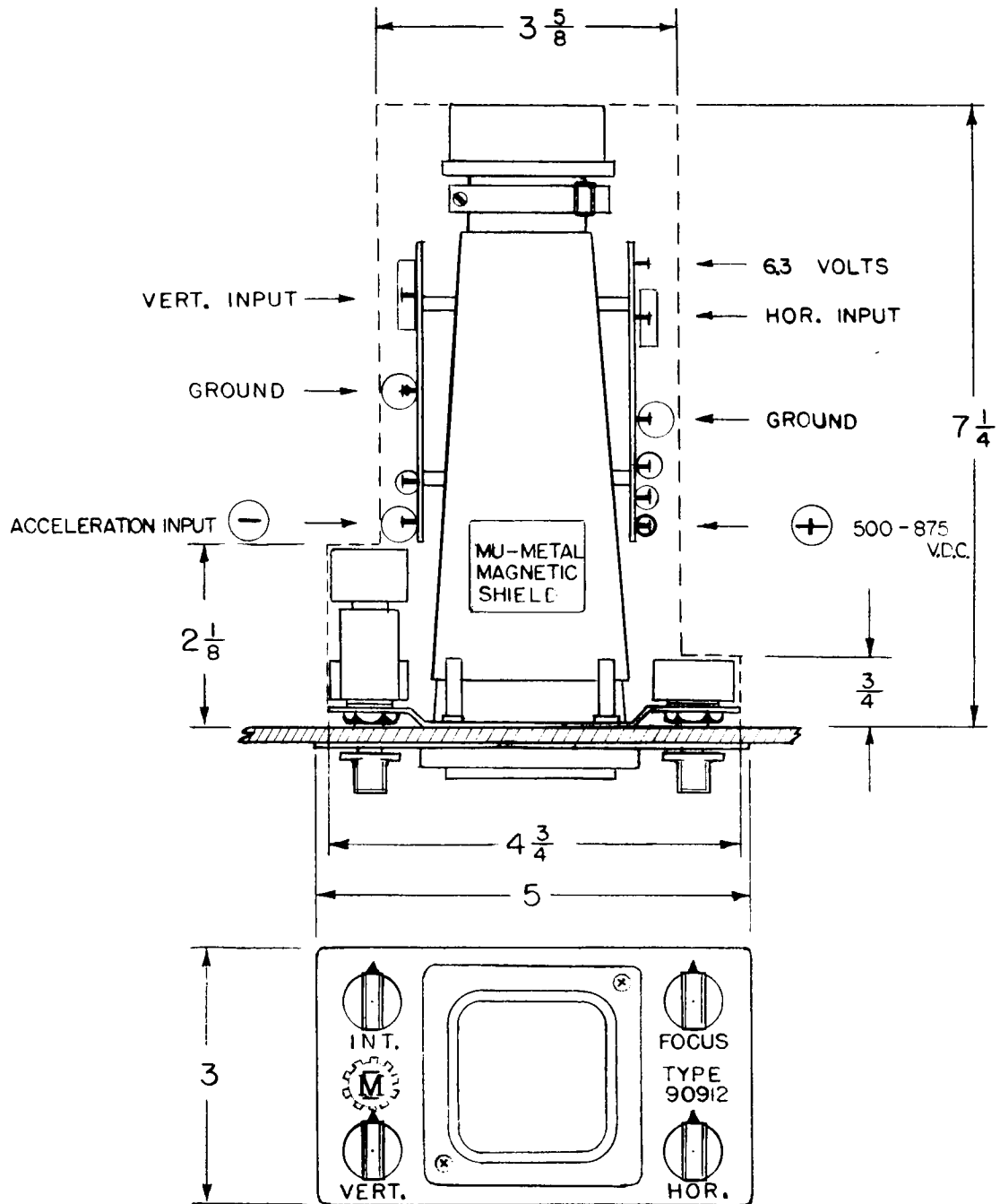
CHECKED BY *R. W. C.*

APPROVED

JAMES MILLEN MFG. CO., INC.  
MALDEN, MASS., U.S.A.

K-90912-2

DATE  
16 JULY, '57



SCALE - 2 : 1

ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

2" INSTRUMENTATION OSCILLOSCOPE  
FIRST MADE FOR 2 BPI

DESIGNED BY R.W.C.  
DRAWN BY R. KAROSAS

CHECKED BY R.W.C.  
APPROVED \_\_\_\_\_

JAMES MILLEN MFG. CO., INC.  
MALDEN, MASS., U.S.A.

K-90912-3

DATE  
7-30-57