CONDENSED CR-30 OPERATING INSTRUCTIONS

CAUTION: DO NOT USE THIS CONDENSED SHEET UNTIL THE COMPLETE INSTRUCTIONS HAVE BEEN THOROUGHLY READ.

Thereafter this condensed sheet may be used as a convenient reminder as to the typical sequence of operations.

1. Connect the CR-30 to the line and allow to heat for 1 minute.

2. Throw all levers to the "WORK" position.

3. Depress the "VTVM Zero Check" push button and adjust the "VTVM Zero Adjust" knob until the meter pointer reads at zero.

4. Set Controls A, B, C, D and E in accordance with the roller chart.

5. Connect the cable and clip to the CR tube and set the "Adjust Line" control such that the meter pointer coincides with the "Adjust Line" indication on the meter scaleplate.

6. The first check is the leakage/Piament Continuity test. Throw each lever individually to the "H" position, and then back to "NOM." Watch for a steady neon lamp glow. Glow should be obtained only on the "Pil. Cont." numbers and/or on specifically indicated additional numbers.

7. Do not perform further tests if short indications are obtained.

8. Set the levers for "Beam" test and depress "READ METER" push button. See instructions under "Meter Scale" (Page 8) for interpretation of the Meter Readings.

9. Reset the levers for "Anode" or "D Plates" tests as the case may be.

NOTE 1: The colored limit sectors are to be used only in "Beam" tests. All other supplementary tests for Anodes and Deflection Plates are low current continuity tests, wherein continuity is indicated by an UPWING of the meter pointer.

NOTE 2: See instructions for Deflection Plates Tests (Page 10).

NOTE 3: Wherever Switch "A" is in position 5, the alligator clips on either of the two cables may be at above-ground potentials up to 900 volts AC. Always return Switch "A" to position other than No. 5 before handling the alligator clip. Do not touch the cones of Metal tubes whenever switch "A" is in position 5.

PRECISION APPARATUS COMPANY, INC.
92-27 HORACE HARDING BLVD.  ELMHURST, NEW YORK
<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensed Instructions</td>
<td></td>
</tr>
<tr>
<td>Specifications</td>
<td>1</td>
</tr>
<tr>
<td>Basic Functioning of CR Tubes</td>
<td>2</td>
</tr>
<tr>
<td>Electrostatic Types</td>
<td>2</td>
</tr>
<tr>
<td>Magnetic Types</td>
<td>3</td>
</tr>
<tr>
<td>Elimination of Ion Beam</td>
<td>4, 5</td>
</tr>
<tr>
<td>Principles of CR-30 Operation</td>
<td>5</td>
</tr>
<tr>
<td>Functions of Panel Components</td>
<td>6</td>
</tr>
<tr>
<td>General Operating Instructions</td>
<td></td>
</tr>
<tr>
<td>Mechanical and Electrical Tube Defects</td>
<td>7</td>
</tr>
<tr>
<td>The Meter Scale</td>
<td>8</td>
</tr>
<tr>
<td>Supplementary Tests</td>
<td>8</td>
</tr>
<tr>
<td>Specific Operating Instructions</td>
<td>9</td>
</tr>
<tr>
<td>Deflection Plates Tests</td>
<td>10</td>
</tr>
<tr>
<td>Service Data</td>
<td>11</td>
</tr>
<tr>
<td>General Notes</td>
<td>11, 12</td>
</tr>
<tr>
<td>Handling of CR Tubes</td>
<td>12</td>
</tr>
</tbody>
</table>

Prepared By

THE ENGINEERING DEPARTMENT

PRECISION APPARATUS COMPANY, INC.
92-27 Horace Harding Blvd.,
Elmhurst, L.L., N.Y.
SPECIFICATIONS AND FEATURES

1. The Precision CR-30 Cathode Ray Tube Tester is a complete, self-contained instrument, designed and engineered to test proportionate screen brightness (via BEAM Current), including tests for accelerating anodes and deflection plate elements.

2. Checks all modern Cathode Ray tubes: Electrostatic and Magnetic, TV Picture tubes, and individual types. In addition, high filament voltages are included in anticipation of future developments.

3. True Beam Current Test Circuit checks all Cathode Ray tubes for proportionate screen brightness by qualitative measurement of the Electron BEAM. Checks the critical central area of the cathode, in addition to the controlling action of the first grid.

4. Voltage Regulated, Calibrated, Vacuum Tube Voltmeter: The heart of the CR tube quality indicating circuit. The super sensitive, bridge type VTVM is designed so that the instrument meter will not be overloading by unusually large values of Beam or element current that might arise due to CR tube defects.

5. 14 Lever, Four Point Element Distribution System: This important PRECISION feature makes CR 30 independent of multiple element base pin connections, internal connections and floating element terminations in present CR tubes and in tubes to come.

6. Hot Cathode and Inter-electrode Leakage Short Tests: Quickly reveals leakage paths and/or shorts in the gun structure at appropriately high sensitivity. Actual leakage path indicated by the RTMA numbered 14 lever element selector system employed. Open filament tests are automatically included in the leakage short tests.

7. Special Low Current Element Continuity Tests: Elements which do not directly contribute to the Beam Current Tests, such as Deflection plates, accelerating anodes, etc., are positively checked by a special high sensitivity supplementary check. This special facility is capable of indicating minute element currents. A change in current of only 1/10th of one microammere produces a meter variation of approximately 5 divisions.

8. Multiple Test Sensitivities, (as required to properly accommodate ALL CR types) is effected through use of dual potentiometers in the input system of the Vacuum Tube Voltmeter, plus selectable element test potentials.

9. Accuracy of the tube test circuit (including the Vacuum Tube Voltmeter) is closely maintained by the use of individual calibrating controls, factory adjusted and sealed.

10. 4 5/8" Full Vision Meter, with scale especially designed to meet the requirements of CR Tube Testing. Incorporates double-jewelled D'Arsomval, high sensitivity movement.

11. Only two Master Extension Cables permit convenient test of all CR tubes directly in or out of the chassis, cabinet, or carton.


13. Micro-Line Voltage Adjustment provided by continuously variable heavy-duty line voltage potentiometer. Meter monitored at filament supply winding.

14. Test Circuits completely transformer isolated from power line.

15. Extractor Fuse Post panel mounted.

16. Telephone-cabled, plastic insulated wiring, moisture resistant. Assures "Precision" quality performance under adverse climatic conditions.

17. Heavy Gauge Aluminum Panel: Etched and Anodized for long lasting service.

18. PLUS many other details and features too lengthy to list, which, (with the above), add up to the highest calibre workmanship, quality of components, performance and accuracy synonymous with the name "PRECISION".
The PRECISION Series CR-30 Cathode Ray Tube Tester fulfills the long recognized need for an effective, service type tester for reliable field, shop and warehouse testing of Television, Oscilloscope and Radar type Cathode Ray tubes.

This versatile instrument provides rapid portable facilities for test of TV Picture tubes not only on-the-bench or in cartons, but directly in the TV set without necessitating removal of the tube! The CR-30 therefore eliminates the necessity for laborious installation of unwieldy CR tubes into "test" chassis or 'scopes to determine the tube condition.

It is obviously the only convenient answer to the ever-present question of "Defective Picture Tube or Defective Chassis?", particularly in on-the-spot set failure analysis. The PRECISION CR-30 Cathode Ray Tube Tester, by eliminating the question Mark from CR tube quality determination, becomes another invaluable time and cost saving adjunct to the modern electronic Service Lab.

BASIC FUNCTIONING OF CR TUBE

In order to efficiently and completely analyze the test results obtained with the CR-30, it is necessary that the operator become familiar with the basic operating principles of both Electrostatic and Magnetic types of Cathode Ray tubes.

Fig. 1 illustrates a typical Electrostatic type of CR tube. It will be first noted that the Control

Grid (usually referred to as G1) bears no physical resemblance to its counterpart in usual radio receiving type tubes but consists of a cylinder closed at one end by a washer type disc which has a very small aperture which permits electrons to pass through to the rest of the gun structure.

Electrons emitted from the Cathode must pass through the G1 aperture; their flow can therefore be influenced by potentials applied to G1, comparable in action to the control grid effect in radio receiving tubes. This electron flow originates from a relatively tiny area in the center of the cathode disc. (See Figs. 1, 2, 3 and 4). The electron stream in a CR tube must be "guided" or focused into a sharp beam so that it eventually strikes the fluorescent screen of the tube in a manner basically similar to the focusing effect of light in a camera. The electron beam, after it passes through the grid aperture, must converge and produce a sharp beam at the screen surface of the tube. This convergence is accomplished by the sequential action of G2 ("First Anode" or focusing anode) and G3 ("Second Anode" or accelerating anode). G2 operates at a lower potential than G3: the combination of the two electric fields of dissimilar strength produces a lens effect which creates the required convergence of the electron stream.

The converging electron stream then passes through the two sets of deflection plates which further act upon the already focused beam to provide horizontal and vertical beam deflection.
In the case of the Magnetic type CR tube, the filament, cathode and O1 assembly is similar to the electrostatic type tube. However, from that point on, the two types are quite dissimilar. Referring to Figs. 2, 3 and 4, it is seen that the electron stream (flowing through the O1 aperture) passes into the field of O2, sometimes referred to as the "Accelerator Grid." This grid also takes the form of a cylinder which is capped at one end with a small perforation in the disc.

This accelerator grid (which is normally operated at a relatively low potential of approximately 250 volts), aids in pre-accelerating additional electrons up through the gun structure. It further tends to isolate O1 from the High Voltage O3 electrode (in similar fashion as the screen grid in receiving type tubes), and contributes to pre-focusing of the electron beam.

Beyond O2 is located O3. This usually takes the form of a relatively long hollow tube incorporating a disc cap with a relatively large hole or aperture. This O3 is electrically connected to the internal anode coating by means of spring supports illustrated in Figs. 2 and 3. The combination of O3, and the inner coating constitutes the High Voltage anode of the CR tube. Connection to this High Voltage Anode is made through the ball or recessed cavity in the case of glass tubes, or through the metal cone in the case of metal type CR tubes.

Focusing of the beam in the magnetic type tube is usually accomplished by a suitable focus coil and/or permanent magnet positioned around the neck of the tube. Beam Deflection is produced by the familiar Horizontal and Vertical Deflection coils.
The cathode of a CRT tube emits not only electrons but also negative ions of various composition. These negative ions, if allowed to reach and bombard the fluorescent screen, will result in burned spots of various sizes.

There are several methods employed in modern Picture Tubes to eliminate bombardment of the screen by these negative ions:

**Method No. 1**, illustrated in Fig. 3, employs a "slant" gun type of structure. The slanted angle produced by the construction of G₂ and G₃ produces a slanted field which acts as a tilted "lens". This tilted lens bends the stream of electrons and the ions. An ion trap magnet or "Beam Bender" assembly, properly located on the neck of the tube will effectively bend only the ELECTRONS back into line with the neck of the tube. The heavy ions, however, are relatively unaffected by the ion trap and continue on in a slanted line to hit the walls of G₃. The ions are thus separated from the electron stream.

It is desirable to stress, at this point, the importance of proper adjustment of the ion trap or "Beam Bender". Should the trap be maladjusted, the gun structure will be bombarded by the electron stream resulting in overheating of the anode with consequent release of gas.

**Method No. 2**, illustrated in Fig. 2, utilizes the "bent gun" technique. In the bent gun, both the ions and electrons stream away from the cathode to strike the walls of G₂. The less heavy Electron stream, however, is bent back into line with the axis of the gun, to continue on up to the screen.

**Method No. 3** does not require the use of bent or "slant" guns or ion traps. This method, illustrated in Fig. 4, utilizes a thin aluminized film deposited over the fluorescent screen coating. This film prevents the ions from reaching the screen material but does not materially impede penetration by the high velocity electron stream.
ALUMINIZED SCREEN TYPE
MAGNETIC DEFLECTION

PRINCIPLES OF OPERATION OF THE CR-30 CATHODE Ray TUBE TESTER

Electrons emitted from the cathode of a CR tube must pass through the small aperture in the 01 structure in order to pass up through the gun and reach the fluorescent screen. An examination of Fig. 4 will reveal that the greater part of this useful electron stream of "Beam Current" comes from the central portion of the cathode directly in line with the grid aperture. An appreciable quantity of the electrons emitted from the periphery or outer edges of the cathode are not in line with the grid aperture and do not contribute to the Beam Current passing through the 01 aperture. Therefore it can be seen that the most efficient circuit for qualitatively checking the magnitude of the useful electron stream in a CR tube must be one which checks the Beam passing through the 01 aperture, and not the total emission from the complete cathode emitting surface area.

The CR-30 has been designed around the principle of Beam Current indication, which analyzes the magnitude of the useful electron stream. The intensity or magnitude of Beam Current determines the degree of screen brightness thereby becoming the most significant factor in the determination of tube condition. In addition, the unique combination of the Beam Current test circuit with a special VTVM type of current measuring circuit, (for positive indication of electrode currents down to a fraction of one microampere) provides all facilities for complete CR tube testing.

The basic Beam Current test circuit in the CR-30 applies metered filament voltage to the CR tube filament; places the cathode at ground potential; throws 01 either directly to ground or to ground potential through appropriate series resistance; and applies proper test potential to 02 or 03 (as the particular case may require) through the VTVM measuring circuit. The Beam Current produced by the CR tube under test is applied to either of 2 selected input networks of the built-in VTVM circuit, resulting in a meter indication proportional to the Beam Current of the CR tube.

The CR-30 also provides special test circuits for additional supplementary checks to reveal intermittent or open connections between base pins and deflection places in the case of Electrostatic types, and intermittent or open circuits in the 03-anode-side cap circuit of Magnetic types. The extremely high sensitivity of the measuring circuit permits positive element continuity indications even in the case of the side cap-intensifier ring circuit wherein the electron current reaching the intensifier ring under test in the CR-30 is considerably less than 1 microampere.
In the aforementioned continuity tests, the appropriate other elements (between the cathode and the anode under test) are utilized as accelerating electrodes to intensify the beam current to the point wherein it can be collected by the deflection plates, intensifier rings, etc.

A hot-cathode inter-element leakage/short test at appropriately high sensitivity, not only permits the operator to check each element individually against all other elements but automatically reveals the actual leakage path by virtue of the RTMA numbered master lever assembly.

FUNCTIONS OF THE CONTROLS, SWITCHES, ETC., ON THE CR-30 PANEL

1. Switch "A": This switch selects the required anode potentials, correlated input resistance to the VTVM, and simultaneously provides proper accelerating voltage for special low current element continuity checks.

2. Switch "B": Filament Return Switch: This switch selects any one filament base pin and applies one side of the selected filament voltage source.

3. Switch "C": Filament Voltage Selector Switch: This switch selects the proper filament voltage for the tube under test. Voltage ranges from 2.5 to 25 volts are available through use of this switch. Although modern CR tubes do not require filament potentials above 6.3 volts, the additional voltage ranges are an important obsolescence-proof feature for future CR tube developments.

4. Control "D" : This control provides the relatively low input load resistance to the VTVM measuring circuit for those CR tests requiring same.

5. Control "E" : This control provides a much higher VTVM input resistance required for test indications of extremely low current-carrying elements.

6. The 16-Position Element Distribution Lever Switch: This lever network, (whose numbering system corresponds to the standard RTMA bose system), distributes each CR tube element to any one of the five test circuits, as follows:

   Position 1: open circuit position. Any lever thrown to this position opens circuits corresponding to the tube element. This row eliminates all possibilities of instrument obsolescence resulting from multiple tube element terminations.

   Position 0:
   (1) With switch "A" in positions 1 through 5, any lever thrown to this "0" position applies the corresponding tube element to ground potential through an appropriate series resistance.

   (2) With switch "A" in position 6, any lever thrown to position "0" applies the corresponding tube element to an accelerating potential through appropriate series limiting resistance, independent of the metering circuits.

   Position "H": Leakage tests and Quality or Beam Current position. With the "READ METER" button depressed, any lever thrown to position "H" throws the corresponding numbered tube element to the leakage/short test circuit. Should excessive leakage exist between the selected tube element and any other gun element, the neon bulb will glow. Should a leakage indication be obtained on (for example) element 10, the operator can determine the leakage path by also throwing all other levers individually to position "H". If the neon glow disappears when (for example) lever 2 is also thrown to position "H", the leakage path is identified as being between element 2 and 10 (between 01 and 02 in the case of a 10BP4 or similarly based CR tube).

   With the "Read Meter" button DEPRESSED, any lever thrown to the "H" position connects the corresponding tube element into the test potential-metering circuit.

   Position "NORM": levers left in the "NORM" (normal) position, automatically connect the corresponding tube elements directly to ground potential.

IMPORTANT NOTE: After test of a particular tube has been completed, ALL LEVERS MUST BE RETURNED TO THE "NORM" POSITION!

7. "Line Adjust" Control: After switches and controls A, B, C, D and E have been set to the proper position as detailed by the roller chart, and the CR tube under test has been connected to the instrument cable, the "Line Adjust" control is rotated until the meter pointer coincides with the "Adjust Line" indication on the meter scale plate. This control provides for accurate filament and other test potential adjustments throughout a line voltage range of from approximately 90 to 190 volts, 50/60 cycles AC.

8. "VTVM Zero Check" Button, and "VTVM Zero Adjust" control. The VTVM zero check push button permits the operator to check the VTVM for proper balance at left hand Zero (0) on the calibrated meter scale. Should the meter pointer read other than zero with the Zero Check button
depressed (after at least a one minute instrument warm-up period) the "VTVM Zero Adjust" knob should be rotated until the meter pointer reads at Zero.

**NOTE:** The zero balance of the VTVM can be checked before each tube is tested, to insure highly accurate quality readings. Because the VTVM circuit is both voltage regulated and bridge type, it is not frequent that zero adjustment has to be reset once initial setting has been made.

* * * * * * * * * *

**GENERAL OPERATING INSTRUCTIONS**

Before detailing specific operating instructions for the CR-30, it is important that the operator becomes familiar with the significance of the test results, and the importance of the various tests to be performed.

It is obvious that CR tubes with apparent exterior mechanical defects should not be tested by the CR-30, unless the defect can first be corrected.

**Obvious defects which automatically classify a CR tube as defective include the following:**

1. Broken glass envelope or screen.
2. Broken bakelite socket.
3. Bad air leaks (sometimes evidenced by a white coating in the neck of the tube).

Other possible causes for tube rejection are listed as follows:

1. Peeling of the outside coating on cone shaped sides of glass tubes.
2. Dust dirt and/or grease leakage paths between the high voltage anode side cap (on glass tubes) and the outer coating. This uncoated circular area around the anode side cap must be free of foreign material.

ALWAYS CAREFULLY WIPE THE EXTERIOR SURFACES OF EACH TUBE WITH A SOFT DRY CLOTH BEFORE TESTING OR RETURNING TO USE. Do not neglect the possibility of dirt leakage paths between base pins of the CR tube.

3. Burned screen surfaces. The fluorescent screen of questionable CR tubes should be visually examined for evidence of obvious brown or burned spots or areas. The screen of High Brilliance tubes, such as projection type STP4, may in certain cases, turn objectionably brown over the entire raster area before its Beam Current falls below the reject point.

4. Loose or broken elements, particularly loose getters. The getters of CR tubes (a gas-absorbing element) occasionally break loose within the tube. Should a broken getter lodge within the gun structure, it will short the elements and render the tube useless. Tubes should be gently shaken before testing to reveal the presence of loose elements.

**NOTE:** See Safety Measures to be taken when handling CR Tubes, Page 12.

5. Slow heaters: Reduced Beam Current (in older tubes) is often attributable to slow heaters. In such cases, the technician should watch for a gradual increase in the CR-30 Beam Reading. If a tube requires more than approximately 2 minutes for its cathode to stabilize, it can be considered objectionably slow.

6. Occasional cases of incorrect type number branding may be encountered. Should a tube which has been rejected in the field check out as a good tube through both a visual inspection and test on the CR-30, the operator should examine the gun structure and other revealing details of the tube to ascertain the possibility of incorrect type number branding.

7. Magnetized Metal Cones. CR tube manufacturers usually demagnetize the cones of Metal type CR tubes. Metal cones can become magnetized in use and will evidence itself by partial picture distortion and/or a dark area at the edges of the raster.

* * * * * * * * * *

The basic Quality determining test in the CR-30 is the "Beam Current" test. In a series of extended corroboration tests by Precision Engineers in cooperation with the engineers of leading CR tube manufacturers and experienced field service technicians, useful-life limits of CR tubes were accurately related to Beam Current values resulting in the revealing non-linear distribution of the 3 colored areas of your CR-30 Meter.

A good understanding of this non-linear scale and the interrelation of screen brightness with Beam Current, can be of great assistance to the operator in analyzing tube condition at readings in-between the limit points on the scale:
THE METER SCALE.

NEW Magnetic CR tube production limits for Beam Current, as set up by CR tube manufacturers, are relatively wide range, and as a result, produce CR-30 readings between approximately 60 to 120 on the meter scale. All NEW tubes which read above approximately 65 can be considered to be of equal merit irrespective of differences in numerical readings. High beam current tubes usually level off at lower values after a few hours of usage.

NEW, unused CR tubes which read below approximately 60 can be immediately suspected to be defective in manufacture and can be dealt with accordingly.

Most CR tubes which have been subjected to considerable use in the field, produce a Beam Current reading below approximately 65 on the meter scale as a result of gradual cathode deterioration.

It is important to note, however, that USED CR tubes which produce readings above approximately 95 up to higher than full scale can be suspected as gassy tubes.

USED tubes which read in the range from approximately 65 on the meter scale down to 35, can be considered quite satisfactory for continued use, with the following qualification: Within the range between approximately 45 down to 35, USED picture tubes will exhibit sufficient overall brilliance for general continued usage. However, the intensity of the peak white (or bright scene highlights) begins to reduce in brightness below 35 on the scale. Whether or not this reduction of peak white intensity is to be of concern in any one particular case, depends wholly upon the reaction or degree of observation of any particular TV set owner. Experience indicates that the average TV set owner will, in many cases, find this degree of peak white intensity reduction quite tolerable should be even be aware of the condition, particularly when weighed against the alternative of replacing a tube which exhibits satisfactory overall brightness. The use (by some TV set owners) of various kinds of filters would tend to substantiate the wide latitude of peak whites they accept as desirable.

The next portion of the meter scale to be considered is that sector titled "Dim to Bright" (15 to 35 on the 0-120 scale). As the meter reading progresses from 35 down to 15, it will be noticed that the meter pointer gradually passes over a predominantly green area into a yellow area. Analysis of USED tubes falling into this "Dim to Bright" sector will depend, in most instances, (in the case of picture tubes) upon the attitude of the particular TV set owner. In general, it may be stated that USED tubes falling into the upper half of the "Dim to Bright" sector can be considered "usable" tubes, in those cases where the set owner is not particularly discriminating and is willing to tolerate reduced overall brilliance and loss of highlights.

USED tubes falling into the lower half of the "Dim to Bright" sector can generally be classified as low limit tubes suitable for rejection except in those rare individual cases wherein set owners are willing to tolerate low brilliance and loss of highlights for an additional period of time.

IMPORTANT NOTE: It should be remembered that there is no hard and fast all-inclusive rule for interpretation of the "Dim to Bright" meter readings. The above interpretation of this sector is offered only as a general guide in those cases wherein a definite opinion of the individual set owner is not forthcoming.

The RED sector (labelled "Dark to Bright") is a definite reject area: USED or NEW Picture tubes which fall into this sector are definite rejects.

The preceding discussion of limits applies primarily to Magnetic type Picture tubes (the predominant type), and also to Electrostatic type CR tubes with the following qualifications:

1. NEW, good, Electrostatic tubes of certain types may not read as high into the "Bright" sector as do magnetic types.

2. Certain oscillograph type CR tubes may still be sufficiently visible for a further period of use even with a meter indication below the #15 meter scale calibration. In such cases, the roller chart will list the proper lower reject point.

SUPPLEMENTARY TESTS

1. In addition to the basic "Beam Current" test, a supplementary test for magnetic types of picture tubes provides a positive check for continuity of the complete G3-Anode side-caps circuit. For this important continuity test, the CR-30 provides accelerating voltages to the elements preceding G3 and places the High voltage mode in the High Sensitivity metering circuit. Inasmuch as this check is solely a positive continuity check, the Magnitude of the Meter Reading is of no consequence. ANY UPWING OR THE METER POINTER (TOWARDS THE GREEN SECTOR) IN THIS TEST PROVES THE CONTINUITY OF THE H.V. ANODE CIRCUIT.

2. In the case of electrostatic types, the design of the tubes are such that when tested in the CR-30 certain elements do not directly contribute to the Current Reading. In such cases, the high sensitivity element continuity test is included as a supplementary test; continuity being indicated by an upwing of the Meter pointer.
3. As noted previously, O1 is switched to ground potential, through suitable resistance, for the Beam Current test of most tubes. O1 therefore has a controlling effect on the Beam Current indication. The magnitude of control is such that an open-circuited O1 will depress the reading approximately 10%. In the case of a tube with normal Beam Current, but which has developed an internally open-circuited O1, the meter reading will read lower than another comparably good tube with an intact O1, but may not read down into the red sector.

It is therefore quite important to check for open O1 as a routine supplementary check, by moving the corresponding O1 lever from its "O" position to the OPEN CIRCUIT POSITION ("#"), and observing whether or not a difference in Beam Current reading is obtained. Should O1 be open-circuited within the tube, no difference in meter reading will be obtained with the O1 lever in the "#" position, as compared to the "O" position. A continuous or intact O1 will produce a noticeable difference in meter reading as O1 is thrown from the "O" position to the "#" position.

**SPECIFIC OPERATING INSTRUCTIONS**

First examine the tube for obvious mechanical defects as discussed on Page 7.

1. Connect the instrument to a 110-120 volts 50/60 cycles line source, unless this instrument has been specifically furnished for other voltage and/or frequency.

2. Return all levers to the "NORM." position.

3. Allow the instrument to warm up for approximately 1 minute.

4. Depress the "VTVM Zero Check" push button and note the Meter reading. If the meter pointer does not read zero (at the "VTVM Zero Adj." arrow) adjust the "VTVM Zero Adjust" knob until the pointer reads at zero.

   **NOTE:** Once the VTVM has been adjusted, it will not be necessary to frequently readjust, unless the setting has been disturbed.

5. Set Knobs A, B, C, D and E to the proper positions as detailed on the roller chart for the particular tube to be tested.

   As an example, it will be assumed that magnetic type 10BP4 is to be tested.

6. Insert the 15 pin VME connector plug into the CR-30 and connect its female cap onto the socket of the 10BP4. Removal of the ion trap (Beam Bender) is not necessary. Connect the alligator clip to the High Voltage Anode terminal at the side of the CR tube. If the tube being tested has not been removed from its chassis, make sure that the chassis or set is not turned on.

   **CAUTION:** In the case of metal cone tubes, connect the alligator clip to the cone at the point of junction between the cone and the glass face plate. Do not touch the cone or clip during the CR-30 test inasmuch as the cone will be at approximately 400 volts potential above ground!!!

7. Rotate the "ADJUST LINE" control until the meter pointer coincides with the "Adjust Line" indication on the meter scale plate.

8. Next throw each numbered lever individually to the "H" position, and then back to "NORM." position; observe the neon lamp for continuous glow as each lever is thrown to the "H" position. A bright light will be obtained as the levers, corresponding to the filament terminations (1 and 12 in the case of 10BP4), are thrown to "H" position. Neon lamp glow on levers other than filament levers, reveals shorts or elements or leakage paths. (EXCEPT in those cases where the roller chart note indicates specific internal connections). Tubes should be rejected without further testing whenever short indications are obtained.

   **NOTE:** Disregard momentary neon flashes as the levers are thrown to "H" position. These flashes result from condenser discharge and have no bearing on the Short test.

9. If the tube has passed the short test, set the levers for the "Beam" test as indicated on the roller chart. For this example case, (type 10BP4), the lever No. 2 is the O1 lever, and lever No. 10, is the L2 or collecting element lever. Lever No. 2 is therefore thrown to "O" position and lever No. 10 is thrown to "H" position.

10. Depress the "Read Meter" push button and observe the Beam Current reading on the meter. If the meter pointer continues to rise as the "READ METER" button is held in the depressed position, the operator should allow further time for the cathode to reach operating temperature. If a considerable length of time is required for the cathode to stabilize into the "Bright" sector, the tube can be classified as a "slow heater" and dealt with accordingly. (See Page 6).

11. If the tube passes the "Beam" test, the O1-anode-side cap circuit and structure must be tested for continuity as detailed on the roller chart as 10BP4 "Anode" test.
Set the levers as listed on the roller chart for "Anode" test. (For 1084, Switch A is set to position 5, lever No. 10 is thrown to "G" position and lever No. 13 is thrown to "N" position). Depress the "Read Meter" push button. An unscale reading (towards the green sector) IRRESPECTIVE OF MAGNITUDE, reveals anode circuit continuity.

IMPORTANT NOTE: Whenever switch "A" is set to position 5, and No. 13 lever is thrown to position "H", the alligator clip is above ground up to 400 volts AC. ALWAYS RETURN ALL LEVERS TO "NORM." POSITION BEFORE HANDLING THE ALLIGATOR CLIP!

Should the tube be suspected to be an intermittent type, the tube can be CAREFULLY tapped with the knuckles (NOT WITH A HARD OR HEAVY TOOL!) to reveal the intermittent. With the "Read Meter" button held in the depressed position.

Intermittent connections in the Anode circuit of the tube will be revealed by meter fluctuations towards zero, as the tube is being tapped. DO NOT TOUCH THE METAL CONE OF METAL TYPE TUBES, DURING THIS TEST: THE CONE IS AT 400 VOLTS AC POTENTIAL ABOVE GROUND, WHEN "READ METER" BUTTON IS DEPRESSED.

After the electrical tests detailed above are completed, the tube should be again visually inspected to insure detection of physical defects which may have been overlooked in the original inspection.

The test procedure for Electrostatic type tubes is basically the same as for magnetic types with the exception of the continuity tests for Deflection plates.

NOTE: It is important that the tube to be tested is not placed too close to the CR-30 in the following test: The magnetic field of the CR-30 power supply may affect the very low current electron beam in Electrostatic type, unless the tube is spaced away from the CR-30 by the length of the connecting cable.

1. Deflection Plates Test: On Page 6 it was noted that position 5 of Switch "A" converts the "G" row of the lever switches to an ACCELERATING VOLTAGE row. All elements thrown to "G" position (when "A" switch is at No. 5), act as accelerating electrodes. In the Deflection plates continuity test, A1, A2 and all four (or in some tubes only 2) Deflection plates are first thrown to the "G" position. One of the Deflection plate levers is then thrown to "H" position, and the "Read Meter" button is depressed. An unscale reading of the meter reveals continuity of the Deflection plate. The "Read Meter" button is released, the Deflection plate lever is then thrown back to "G" position, and the procedure is then repeated for the next Deflection plate. The process is repeated until all separately available Deflection plates have been checked.

2. The "Anode" tests as listed on the roller chart for Electrostatic type tubes, are performed in the same fashion as the EMF TEST: HOWEVER, these "Anode" tests are continuity tests, continuity being indicated by any unscale of the meter when the "Read Meter" button is depressed.

IMPORTANT NOTE 1: Continuity of Deflection plates, Anodes, etc. is indicated by an unscale reading of the meter. Ignore the colored sector limits of the meter in these continuity tests.

IMPORTANT NOTE 2: The operator should bear in mind that New or Good electrostatic picture tubes, such as type 7274, may not read as high up in the "Bright" sector as will magnetic type tubes of comparable condition. Experience will indicate therefore, that tubes of this type, which read in the upper portion of the "Dim to Bright" sector, may be passed more readily than magnetic types falling in this same region of the scale plate.

GENERAL TV SERVICE TECHNIQUE NOTE: When dark or dim rasters are encountered in the service field, the first trouble-shooting check will of course be a test of the picture tube. In those cases wherein the tube tests "Bright", the next logical test would be measurement of the TV set High voltage supply.

For this purpose, the Precision Series TV High Voltage Safety Test Probe (used in conjunction with Precision 20, 000 Microvolt meter testers or Precision Series EV-20 or EV-10A-VTVM) provides high sensitivity high voltage facilities combined with a maximum of safety features for the technician. For further details see your Precision dealer or consult the Precision catalog of test equipment products.
SERIES CR-30 (12-50) 11

SERVICE DATA

The PRECISION Series CR-30 Cathode Ray Tube Tester has been designed to accurately indicate the merit of CR tubes and is ruggedly constructed to withstand the abuses of general field use. All components have been exhaustively sample-tested by PRECISION'S Test Engineering Laboratory and have been approved for general long-life usage. Generous mechanical and electrical design is a major PRECISION precept.

However, ----- it is impossible to fully control the two major contributors to inoperative instruments, namely:

1. Occasional components failure after instruments have passed PRECISION performance Test Department.

2. Damages caused by poor handling in transportation from factory to customer. Claims for such damage should be assessed against the carrier involved.

3. Damage of components due to misoperation, accidental or otherwise, including failure to observe prescribed operating procedures. Therefore, in order to expedite rehabilitation of your instrument should the need arise, the two most commonly encountered possible failures and recommended remedial measures are listed as follows:

A) Instrument does not become energized when line toggle switch is thrown:
   a) Remove 3AG, 1 ampere fuse from panel-mounted fuse holder. If blown, replace with same size and type fuse, only if the cause for blowing of fuse is known and has been remedied.

Reasons for fuse blowing may be:

   1. Failure to Short-Check a tube before attempting Quality tests.
   2. Shorted power transformer windings or other internal shorts.

B) "Line" Adjustment is erratic:
   a) Examine Line Potentiometer for shorted, open or worn turns. Unsolder the three leads to the potentiometer and check for continuity with an ohmmeter. If defective, contact Precision's Service Department.

IMPORTANT NOTE:

Should the instrument become inoperative for reasons other than those listed above, it is advisable to contact Precision's Service Department before attempting to replace components. Accurate calibration of the instrument can be maintained only by using exact factory duplicates when replacing burned-out components.

Repair and recalibration of the meter of the Series CR-30 is a delicate and highly specialized operation. DO NOT ATTEMPT TO REPAIR AN INOPPERATIVE METER. Always contact Precision's Service Department when your meter appears defective or damaged.

SPECIAL NOTE RE REPAIR SERVICE

When returning a Precision instrument for repair-recalibration service, ALWAYS pack carefully in a strong oversized corrugated shipping container, using a generous supply of padding, such as excelsior, shredded paper or crumpled newspaper. The original container and filling pads (if available) are ideal for this purpose. Please ship via Railway Express PREPAID, and mark for:

PRECISION APPARATUS COMPANY, INC.
92-27 Horace Harding Blvd.,
Elmhurst, L.I., N.Y.

ATT: Service Division

A FRAGILE label should appear on at least four sides of the carton. NEVER return an instrument unless it is accompanied by full explanation of difficulty encountered. The more explicit the details, the more rapidly your instrument can be handled and processed.

GENERAL NOTES AND INFORMATION

1. The CR-30 is supplied with 2 master cables for interconnection of the CR tubes under test and the CR-30.

   A) Duodecal cable (12 contact socket): This cable provides connecting facilities for the vast majority of Television picture tubes in use today.
B) Universal Cable (0-14 cable): This cable eliminates the necessity for maintaining an inconvenient and expensive assortment of cables for use on the variety of less popular CR tube bases. The specially designed "grip tip" terminations of the 14 conductor Universal Cable provides obsolescence proof connecting facilities for all types of CR tube bases not accommodated by the more frequently employed Duodecal cable.

In an individual case wherein the operator regularly encounters a particular tube base which requires use of the Universal Cable, he may, if he so desires, assemble a special cable (using the required socket) from standard available parts. The wiring of such a cable is quite simple; i.e., pin No. 1 of the socket wires to pin No. 1 of a 15 terminal male Jones plug; pin No. 2 to pin No. 2, etc. A flexible lead terminating in an alligator clip should be soldered to pin No. 13 of the male Jones plug. This clip will then be used to connect to side caps, intensifier rings, etc.

2. Roller chart: New roller charts, including data for the latest type CR tubes are printed periodically and are issued free of charge, as a Precision service. UPON INDIVIDUAL REQUEST.

It is important that such requests list the following information:

A) Model and Serial Number of instrument (on nameplate).

B) Form number of your present roller chart (printed at the upper left-hand corner of every roller chart).

3. A guarantee-registration card is enclosed with this instrument. Mail at once for registration.

HANDLING OF CATHODE RAY TUBES

Improper or careless handling of Cathode Ray tubes can result in serious physical injuries and irreparable damage to expensive tubes;:

Always observe the following precautions when handling CR tubes:

1. Wear gloves and safety goggles.

2. To remove tubes from their cartons: With the tube face upwards, lift the tube by gripping its sides. When inserting or removing tubes from a chassis, support the tube by the funnel-shaped side, not by the relatively fragile neck. The neck may be held for guidance purposes only.

3. Never set a tube face down on the service bench or floor without using a protective rubber mat or equivalent pad of soft material.

4. When disposing of defective tubes, first seal the tube in its carton, then break tube by driving a heavy tool through the side of the carton.

5. Wherever possible, discharge the high voltage anode lead in the TV or scope chassis before removing the tube. ALSO discharge the accumulated high voltage charge on the tube itself before removing it from the chassis. If such is not done, the possibility of shock while handling the tube can prove to be dangerous and may result in involuntary dropping of the tube.

** Precision Apparatus Company, Inc. **

92-27 Morse Harding Blvd.,
Elmhurst, L.I., N.Y.