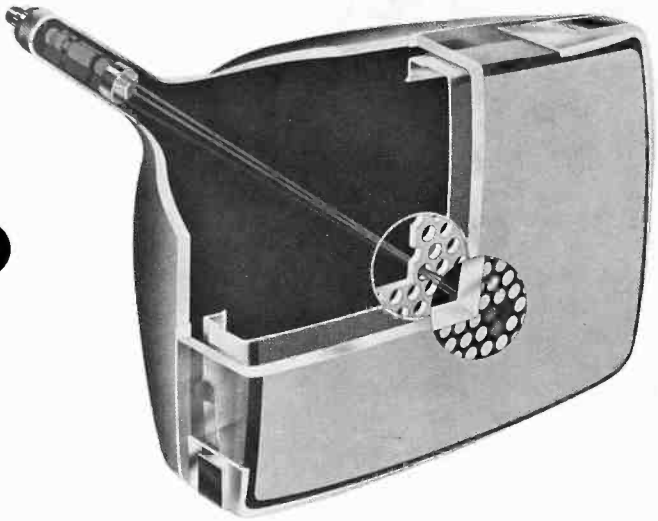
SYLVANIA
NEWS
TECHNICAL INFORMATION OF INTEREST TO THE INDEPENDENT RADIO/TV SERVICE TECHNICIAN
Editor: M. N. Wildemann

PLAIN FACTS ABOUT MATRIX-TYPE SCREENS



More and more commonly these days in the service industry we hear such terms bandied about as dark surround, non-matrix, matrix, and positive and negative guard bands. We find advertisements, trade magazines, and technical service literature increasingly using them. Since the technician can inevitably expect to be dealing more frequently with the newer screen types, this article will attempt to make his life a bit easier by dispelling some of the mystery that might be associated with them.

In this discussion we'll concern ourselves only with the more common delta-gun, tri-dot screen, 90°-deflection CRTs. In a future issue of **Sylvania News** we'll examine some of the other recent picture tube delevopments—such as slotted masks, striped screens, in-line guns, 30-kV anode types, 110° deflection, etc.

Three main categories of screen construction exist. These are the non-matrix (conventional) screen, positive guard band matrix screen, and negative guard band matrix screen. Each will be discussed separately.

Non-Matrix Screens

Non-matrix is the older type of screen employing the conventional, tri-color phosphor dot pattern with which we are all familiar. Figure 1 illustrates this type of screen, only one aperture mask hole and one complete (red) phosphor dot being shown. Even in this case a guard band exists. The guard band is defined as the difference in diameter between the beam landing and the phosphor dot.

Although the electron beam from the gun assembly is always actually larger than three aperture mask holes, in the case of non-matrix types the individual beam landing is intentionally made smaller than the phosphor dot. In this way "red" electrons, for example, are prevented from exciting green or blue dots due to mechanical and electrical tolerances, which could cause marginal color purity. A shift in the beam landing anywhere within the guard band will not reduce brightness.

Positive Guard Band Matrix Screens

The positive guard band screen differs less from non-matrix screens than does the negative guard band screen and consists of a black opaque (dark surround) material deposited on the face panel. This material is then processed, and holes are opened in the dark film. One hole is provided for each phosphor dot. Finally, the tri-color phosphor dot screen is printed in the holes in a delta pattern. Figure 2 shows this type of screen.

The beam landing is about the same size as that for the non-matrix tube, and it also excites only a portion of the dot, leaving a positive guard band of phosphor around the beam landing. Note also that the hole in the dark surround material is larger than the excited area. Thus, a portion of the positive guard band of phosphor can be excited by the beam and can be seen from the front of the tube. Imperfect landing of the beam can be tolerated within this positive guard band without loss of light (brightness). Color contamination by a further shift in beam landing is prevented by the black surround, though in this case there would be a loss of light. The positive guard band tolerance scheme avoids an extra manufacturing process which is required by the negative guard band screen.

In practice, the black opaque material serves to reduce internal and external reflected light, thereby improving contrast ratio. Some of this gain in contrast may then be sacrificed to permit use of a higher light transmission face panel, which in turn provides an increase in brightness.

Negative Guard Band Matrix Screens

The negative guard band system also involves a black opaque matrix, but in this case the beam landing size (as seen from the front of screen) is limited by the matrix hole size. This is shown in Figure 3. Since the beam bundle is larger than the matrix hole, its landing may vary within the illustrated negative guard band without loss of light. As with the positive guard band screen, the beam bundle could land beyond the guard band without causing color contamination, but there would be a loss of light in those areas where this occurred.

The same comments pertaining to contrast and brightness of the positive guard band screen also apply to the negative guard band tube.

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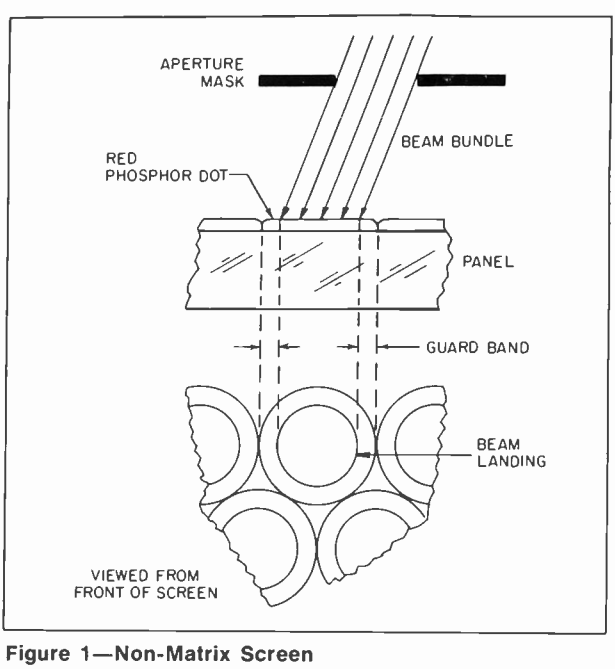


Figure 1—Non-Matrix Screen

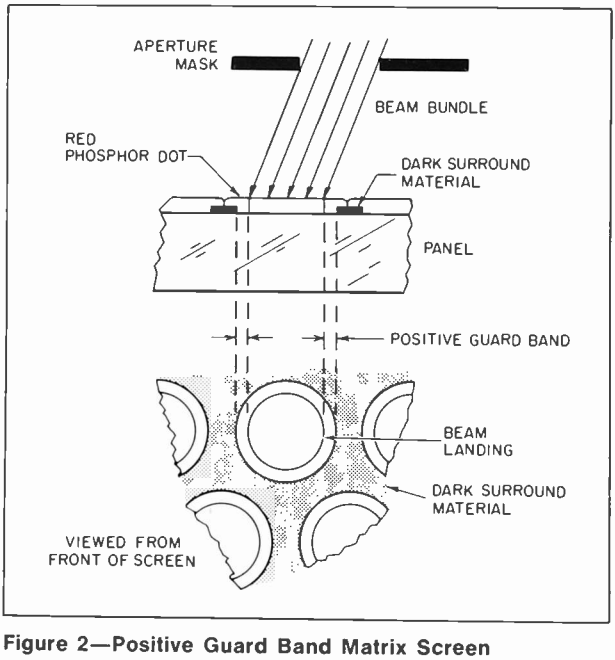
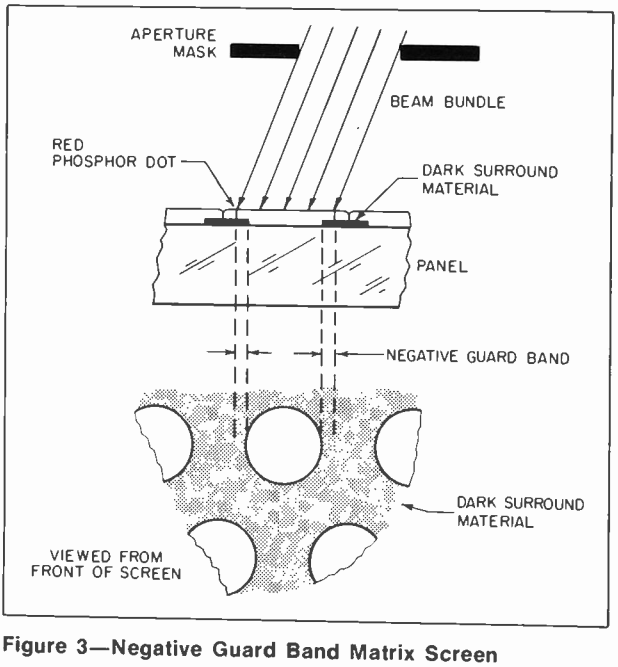


Figure 2—Positive Guard Band Matrix Screen



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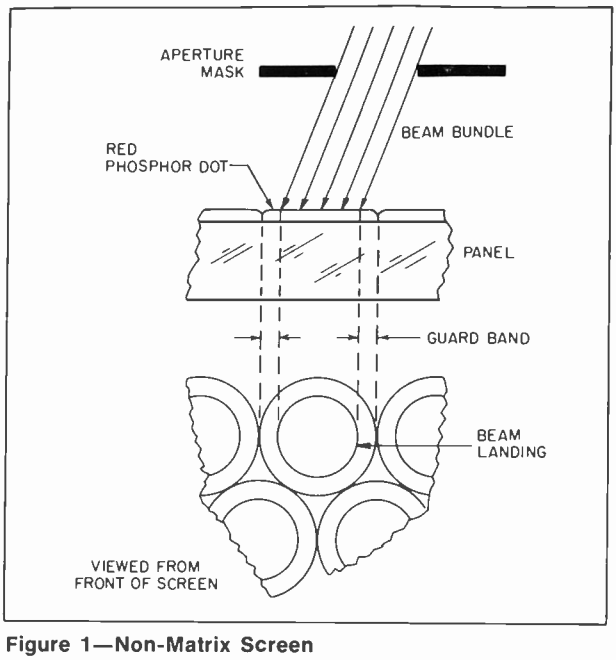


Figure 1—Non-Matrix Screen

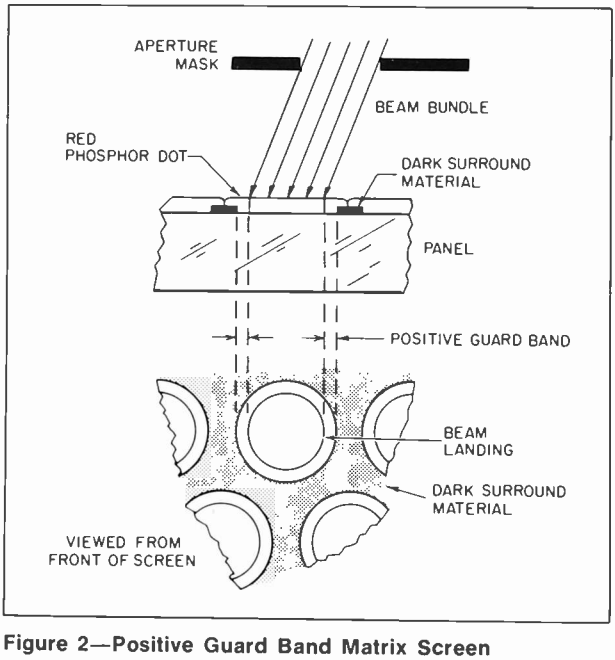


Figure 2—Positive Guard Band Matrix Screen

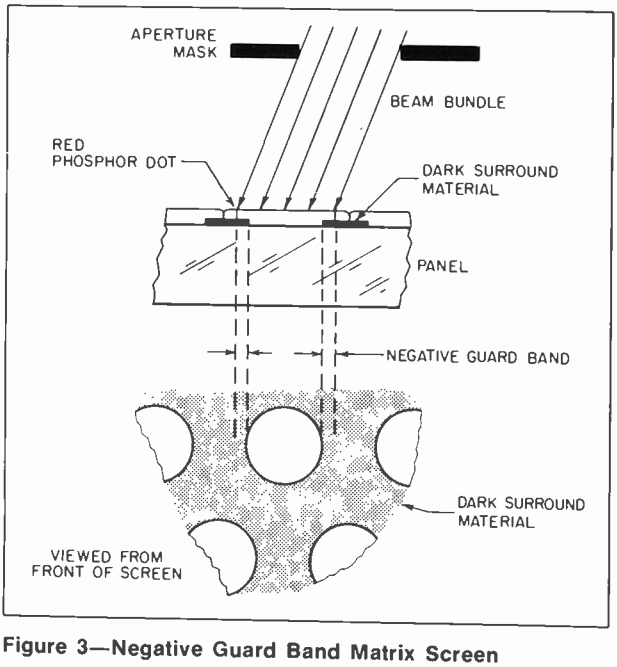
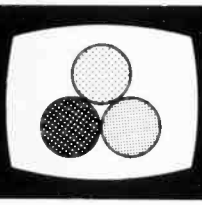


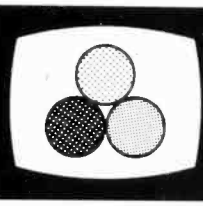
Figure 3—Negative Guard Band Matrix Screen

A New Grade AA Black Matrix Tube

Worth noting here is the fact that Sylvania has recently marketed a broad, top-quality line of replacement matrix tubes which is identified under the trade mark Chromatrix™. A replaceability guide for use of these tubes is included later in this issue of **Sylvania News.** Chromatrix tubes feature all new components and materials, including new glass envelope, and may be either positive or negative guard band screen types. More sizes and types will regularly be added to the line.



Color Picture Tubes



COLOR TUBE GENERAL REPLACEMENT CONSIDERATIONS

We're all familiar with picture tube type designations—perhaps a little less so with the bewildering variety of individual manufacturer's tube prefixes and special names. This information can be useful to the serviceman who is trying to decide on the quality level he wishes and how to go about choosing the best tube to serve his purpose. Here we'll try to sort out some of these factors and make some sense of them.

Tube Line Designations

Below are the tube lines and descriptions currently in effect related to Sylvania brand color picture tube products. Each of these tube lines has its own set of factory test specifications to which it must rigidly adhere, and each line corresponds to one of the tube grades presently required by the California and Florida labeling laws. By offering this multi-line coverage, Sylvania is able to meet the majority of replacement needs in the most economical manner possible. While other renewal tube manufacturers offer a variety of competing products, few provide three tube lines to correspond with the three Sylvania lines.

Color Screen 85

- Rare-earth phosphor system
- New electron gun assembly
- Screen blemish and electrical specifications slightly wider than for original equipment manufacture tubes
- Used glass
- White-field uniformity specification—slightly wider than RE Color Bright 85®
- Most economical tube in the product line

XR Color Bright 85®

- Manufactured to OEM specifications
- All-new, X-ray inhibiting glass
- New screen with high brightness, MV phosphor system

RE Color Bright 85®

- Rescreened using rare-earth phosphor screen
- New electron gun assembly
- New or used aperture mask
- Used glass
- White-field uniformity specification—slightly wider than OEM specifications

The "grade" system for denoting quality level is required only in California and Florida; manufacturers' prefixes are a guide for tubes which are not labeled by grade. An explanation of the significance of tube prefixes and type numbers is given in subsequent paragraphs of this article.

Tube Type Designations and Prefixes

A concise statement of the kinds of information provided by tube type designations and prefixes follows:

PREFIX

- **Assigned by tube manufacturers**

a) Identify quality levels within a type

b) Distinguish auxiliary benefits, such as special warranties

c) Allow the manufacturer to apply unique promotional identification to this product

TYPE DESIGNATION

- **Assigned by Electronic Industries Association**

a) Define mechanical and screen viewing diagonal dimensions

b) Define electrical characteristics

c) Define screen construction

d) All tubes using this type designation must be interchangeable.

Example:

RE **21FJP22A**

The tube in this example is a Sylvania-manufactured, middle-line (all-new, except glass) version of Type 21FJP22A and will function satisfactorily in any set requiring a tube from the family of 21FJP22's, regardless of grade of tube being replaced.

Interchangeability Procedures

When replacing any picture tube, be sure the replacement tube is the right type. Do this by observing the following criteria:

Use the same type designation as the original installation whenever possible. **Note that this is mandatory when replacing a tube type made of X-radiation glass.** For other than X-radiation glass tubes, use the nearest interchangeable type if the original type is not available. Periodically, Sylvania publishes a revision to its Interchangeability Guide in order to make the most recent replacement information available to the field.

The quality level you desire may be selected by noting the tube grade, which will be labeled in states where this practice has become accepted. Where grade labeling is not used, the manufacturer's prefix can be used as a guide to achieve the desired quality level.

In any event, the following quality guidelines can be used: Sylvania's XR prefix tube is the best quality level available. It will not only replace any other "all-new" tube in the market place, but it will also supersede any of the prior Sylvania prefixes used for OEM tubes. There are few tube offerings in the market place that correspond to the Sylvania RE prefix quality level; RE tubes are among the best available at this level. They offer an unique opportunity to obtain XR quality at a price savings. Sylvania's Color Screen 85 tubes will replace any comparable-quality level (regunned) tube currently on the market and deliver excellent performance at a further economy.

Special Considerations for X-Radiation Glass

Special glass is used in more recent color picture tubes to keep X-radiation to prescribed levels. The Electronic Industries Association "Safety Guidelines" specify that: "These tubes have special designations and must be replaced with exact types to maintain safe operation."

Sylvania makes it easy to comply with this caution by using a system of identifying its picture tubes manufactured with X-radiation type of glass which is both simple and foolproof: all such renewal tubes are clearly designated by the "XR" prefix appearing before the tube type number.

Note that in considering X-radiation glass, we actually have a one-way compatibility situation, i.e., an appropriate X-radiation glass tube type may always be used for replacement purposes even when the original installation did not use it; however, when the tube application being considered originally uses an X-radiation glass tube type, the replacement must be **only an exact type.**

NEW—CHROMATRIX™ COLOR PICTURE TUBES

Give you Today's Broadest Matrix Replaceability

Here for your convenience is an interchangeability guide listing matrix-type and conventional-screen tubes that may be replaced by the new Sylvania Chromatrix line. This tube is a Grade AA, dark-surround matrix type specifically intended for those applications in the replacement market in which absolute, uncompromised performance is desired. Among Chromatrix tube features are:

- MV rare-earth phosphor system in combination with dark-surround matrix screen for balanced contrast and color purity at the brightest viewing levels
- All new materials and components, including all new X-radiation glass
- Manufactured to OEM specifications
- Fast set-up time
- Temperature-compensated shadow mask
- Sylvania's latest-design, sharp-focus electron gun

Chromatrix tubes are available from your Sylvania Distributor.

CHROMATRIX INTERCHANGEABILITY GUIDE

Now In Receiver	Chromatrix Replacement
*17VAEP22	XR17VAEP22
*19VBRP22	XR19VBRP22
*19VCBP22	XR19VCBP22
*19VCFP22	XR19VCFP22
19VCRP22	XR19VBRP22
19VCTP22	XR19VBRP22
19VCWP22	XR19VCXP22
*19VCXP22	XR19VCXP22
19VCYP22	XR19VCYP22
*19VDFP22	XR19VBRP22
19VDWP22	XR19VCYP22
21VACP22	XR21VAQP22
21VAFP22	XR21VAQP22
*21VAQP22	XR21VAQP22
*21VAUP22	XR21VAQP22
*21VAWP22	XR21VAQP22
23EGP22	XR23VATP22
23EGP22A	XR23VATP22
23VABP22	XR23VATP22
23VACP22	XR23VBAP22
23VADP22	XR23VBAP22
23VAHP22	XR23VATP22
23VAJP22	XR23VATP22
*23VALP22	XR23VATP22
23VAMP22	XR23VBAP22
23VANP22	XR23VATP22
23VAQP22	XR23VBAP22
23VAQP22/ 25BHP22	XR23VBAP22
23VARP22	XR23VATP22
*23VASP22	XR23VATP22
*23VATP22	XR23VATP22
*23VAUP22	XR23VATP22
*23VAWP22	XR23VBAP22
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23VAYP22	XR23VBAP22
23VAZP22	XR23VATP22
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23VBCP22	XR23VBAP22
23VBDP22	XR23VBAP22
23VBEP22	XR23VATP22
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23VBNP22	XR23VBAP22
23VBRP22	XR23VBAP22
23VBSP22	XR23VATP22
23VBTP22	XR23VBAP22
23VBWP22	XR23VBAP22
23VBYP22	XR23VBAP22
25ABP22A	XR23VATP22
25ADP22	XR23VBAP22
25AEP22	XR23VATP22
25AFP22	XR23VATP22
25AGP22	XR23VBAP22
25AJP22	XR23VBAP22
25ANP22	XR23VATP22
25AP22/ 25XP22	XR23VATP22
25AP22	XR23VATP22
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25AQP22	XR23VATP22
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25AXP22	XR23VBAP22
25AZP22	XR23VBAP22
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*25BCP22	XR23VATP22
25BDP22	XR23VBAP22
25BFP22	XR23VBAP22
25BGP22	XR23VATP22
25BHP22	XR23VBAP22
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*25VAYP22	XR25VBEP22
25VAZP22	XR25VACP22 or XR25VBUP22
*25VBCP22	XR25VBEP22
*25VBDP22	XR25VBEP22
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25WP22	XR23VATP22
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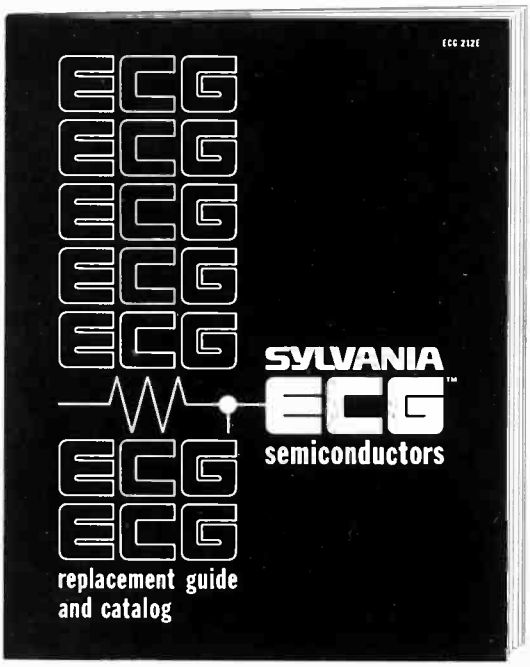
25YP22	XR23VATP22
25YP22/ 25BP22	XR23VATP22
25ZP22	XR23VATP22
*26AP22	XR25VABP22
*26DP22	XR25VACP22 or XR25VBUP22
26FP22	XR25VABP22
26GP22	XR25VACP22 or XR25VBUP22
*26KP22	XR25VABP22

*Matrix Type

NOW AN EVEN BIGGER ECG™ SEMICONDUCTOR REPLACEMENT GUIDE. . . OVER 75,000 TYPES LISTED . . .

Still the Standard of the Industry



The new **Sylvania ECG Semiconductor Replacement Guide** lists some 34,000 more types than the last edition, far more than you'll find in any other guide. Domestic and foreign solid-state devices are cross referenced to the ECG semiconductors which replace them. Industrial ECG types are now included in the guide so that applications include all major replacement market segments—entertainment, industrial and commercial equipment.

The comprehensive line of ECG devices includes broad coverage for some of the most recent types of transistors, diodes and rectifiers, integrated circuits, color oscillators and burst filter crystals, SCR's, TRIAC's, special-purpose devices, and transistor and IC accessories. Included in the guide are replacement considerations, basings, outlines, and specifications for each ECG device—every possible aid to make the replacement job that much easier for the technician.

To ensure the highest possible degree of accuracy of all data used in compiling the replacement guide, an unique, triple-verification computer program was designed and employed in accomplishing this awesome task (over one-million characters were generated for the replacement section alone). All of this was done for but one purpose—to provide the best possible replacement guide for use with the semiconductor line that you have come to trust—ECG replacement semiconductors.

The **Sylvania ECG Semiconductor Replacement Guide** (ECG212E) and complete line of semiconductors are available from your nearest Sylvania Distributor.

ALL NEW—ECG™ INTEGRATED CIRCUIT REPLACEMENT GUIDE

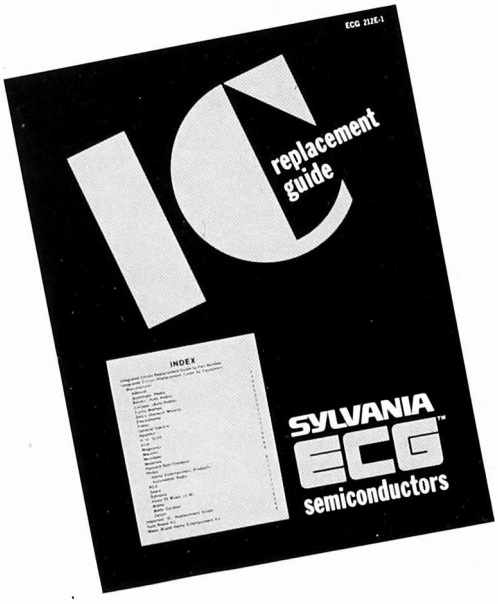
Here's another helpful adjunct to use of the popular line of Sylvania ECG replacement semiconductors. This new guide cross references over 1,700 linear and digital IC types used by 25 domestic manufacturers in all types of consumer entertainment equipment to the ECG devices which replace them.

Features of the guide include:

- Replacement guide by IC part numbers
- Replacement guide by equipment manufacturers
- Replacement guide for imported IC's

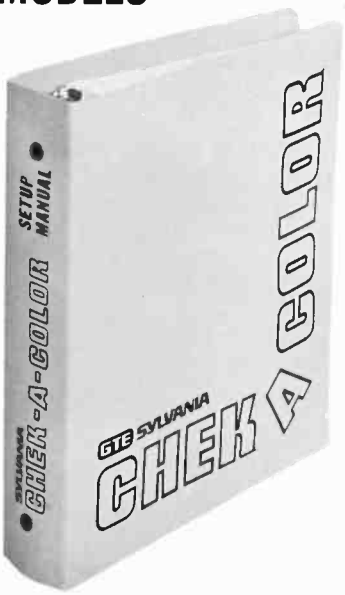
Lists of the ECG IC's comprising an Auto Repair kit for service of popular domestic auto receivers as well as those in a Major Brands Home Entertainment kit are also included in the guide. To make the ECG line of IC's even more useful to you, your Sylvania Distributor can make up custom IC kits to cover the sets of a given equipment manufacturer at your request.

The **Sylvania ECG Integrated Circuit Replacement Guide** (ECG212E-1) and the complete line of ECG semiconductors are available from your Sylvania Distributor.



Chek-A-Color

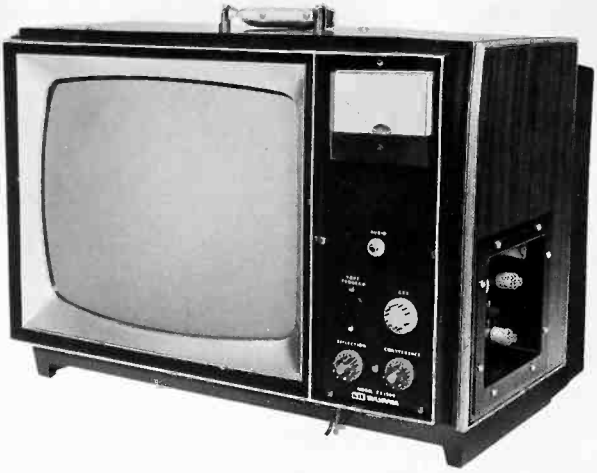
NEW REVISION TO CHEK-A-COLOR™ TEST JIG SETUP MANUAL NOW LISTS OVER 7,000 MODELS



This steadily growing manual now includes over 7,000 color TV receiver models of 48 different brands which may be tested with the Sylvania Chek-A-Color Receiver Test Jig—industry's truly versatile test jig. The manual lists specific adapters, extensions, and setups by chassis used in conjunction with the Chek-A-Color when servicing different TV makes and models. The setup manual and the valuable adjunct supplement program are provided to keep you up to date on new models as they appear on the market.

Features of the Chek-A-Color unit include:

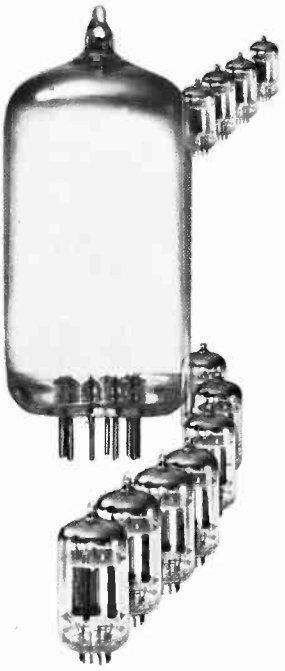
- Tests solid-state, hybrid, and tube chassis
- Adapts to 90° and 70° picture tubes of all presently available sizes using high and low focus voltage
- All up-front connections; portable
- Includes 14"V color picture test tube, dynamic and static convergence, blue lateral and purity magnets, deflection yoke, cabinet; high-voltage and ground leads, and setup manual
- Broad line of adapters and extensions—line periodically expanded to keep abreast of new sets
- Range of options available—yoke programmer kits, high-voltage meter, speaker, accessory roll-about table



Chek-A-Color CK1500X
Solid-State and Tube Color Receiver
Test Jig
See your Sylvania Distributor for full details.

Receiving Tubes

LATEST RECEIVING TUBE ADDITIONS



Listed below are the most recent additions to the Sylvania line of quality receiving tubes—the line the service industry has come to trust for its replacement needs.

See your Sylvania Distributor for the ones that provide domestic and foreign type coverage with minimum inventory requirements.

1AY2A	**6ME6**	**12DW4A**	**25CT3**
4GJ7	**7KY6**	**12FQ7**	**25DK3**
4GX7	**8KR8**	**12JF5**	**26LW6**
4KT6	**9AM10**	**17DW4A**	**30MB6**
5JW8	**10LD6/LL802**	**17JF6**	**31LZ6**
6AK10	**10T10**	**19DQ3**	**36MC6**
6DT3	**11CH11**	**19FX5**	
6HA5-S	**11MS8**	**25CK3**	

SYLVANIA NEWS
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70 EMPIRE DRIVE
WEST SENECA, NEW YORK 14224

IN THIS ISSUE

Sylvania News is sent free of charge. Each issue contains information of value to the independent radio/TV service dealer. Helpful servicing techniques, new processes, and the latest products are described. Sylvania thus offers its readers an important means of keeping tabs on some of the ever-changing complexities of the electronic servicing industry.

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yLVANIA
NEWS
CHNICAL INFORMATION OF INTEREST TO THE
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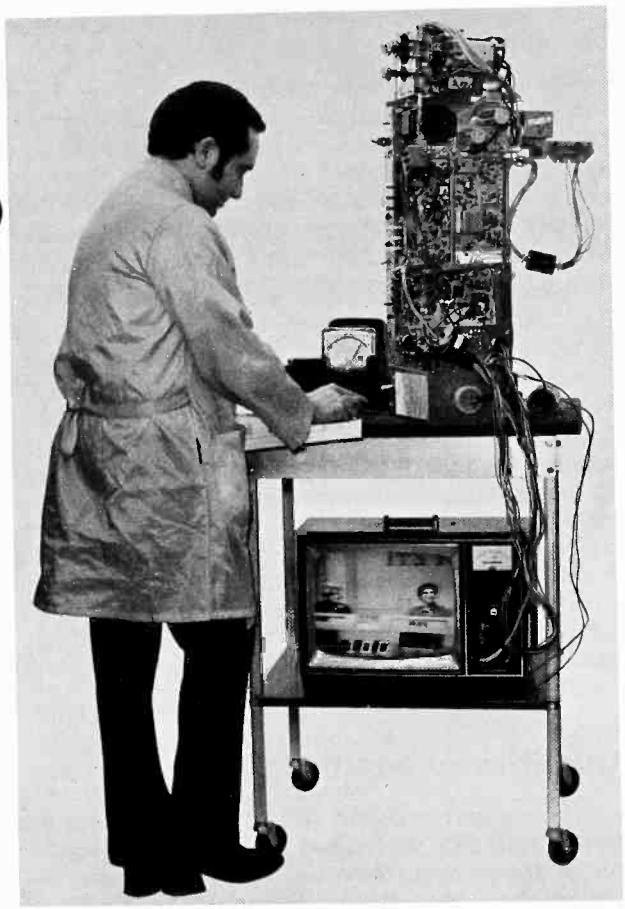
Editor: M. N. Wildemann

VERSATILITY — KEY WORD IN A COLOR TV TEST JIG

by

J. Warren Bosiger



The independent service technician who owns and uses a good, versatile color test jig must regard it as one of his most valuable tools. It can save considerable time and make his work much lighter. Using the test jig as a monitor permits him to shop service a color receiver chassis without transporting the heavy, bulky cabinet with picture tube and accessories out of

the home. This has the further advantage of precluding the possibility of damage to delicate components. The jig also allows the technician to work on the top or bottom of the chassis in the least encumbered fashion. Finally, and perhaps most important, is the fact that use of the jig enables the return of the repaired chassis to its cabinet without the picture tube, deflection yoke, and convergence assembly ever having been disturbed. This avoids the need for performing a complete convergence procedure in the home.

Less important, but still worth mentioning, is use of the test jig in the home as a substitute for the TV set's picture tube and neck components; used in this manner, malfunctions may be quickly isolated to the chassis, CRT, or related neck components. Serving in this capacity, of course, requires the color test jig to be portable.

an "Ultimate" Test Jig

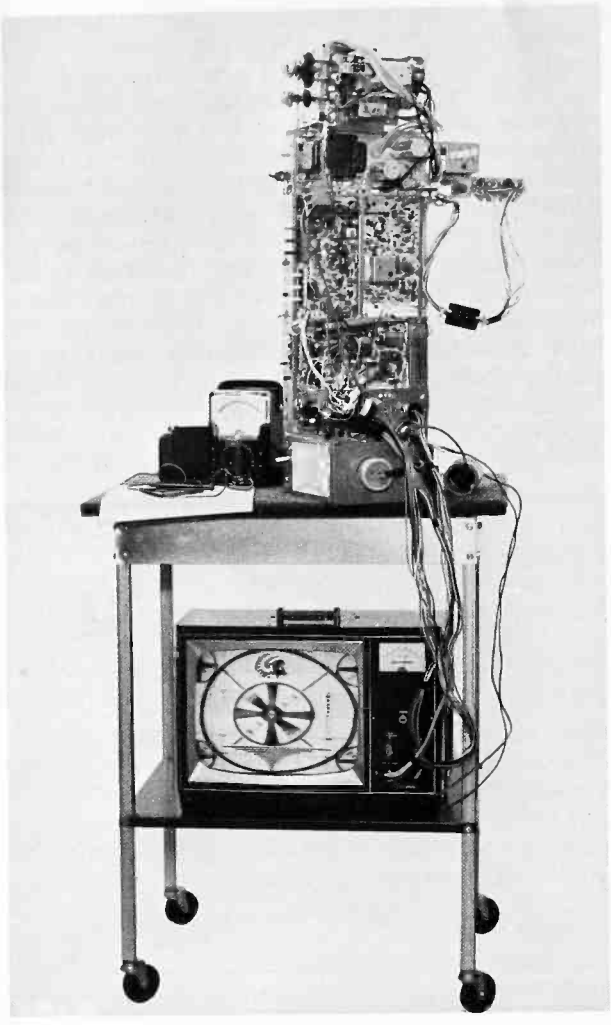
Ideally, the "ultimate" test jig would be a portable, closed cabinet with all external connections, easily and quickly adaptable to almost any color receiver in sight. Versatility is the magic word! Certainly, the technician who does not own a good jig, or who is getting along with an assembly of accumulated parts, must have a great desire to own the best, most versatile unit available.

Maximum versatility means the jig must have the capability of quickly adapting, both physically and electrically, to 70° and 90° deflection systems, high and low focus voltages, a variety of yoke inductances to match SCR, Transistor, hybrid, and tube deflection circuits, and any size CRT. A convenient means to accomplish static and dynamic convergence should be provided.

A bewildering variety of plugs and sockets is used by the myriad of TV receiver models in the field to interconnect picture tube, deflection, convergence, and other circuit components; each arrangement requires a specific combination of adapters and extensions to connect the receiver to the test jig. For the test jig to be of value, it is essential that the adapters and extensions required to accomplish this be readily available from distributor stock. Equally important is the availability of a periodically updated setup manual which clearly provides the instructions necessary to select and connect these adapters and extensions from receiver to test set.

Qualities of Available Jigs

One can imagine the variety of forms the home-built jigs would present, but how well are all of these requirements met by the commercially available units? Surprisingly, here too variety is about the only constant, as these jigs come in the widest imaginable range of quality, form, and versatility. They come complete or partial, assembled or in kits, open or closed cabinets, with or without picture tube, with and without a subscription setup manual, etc., etc. This being the case, it would be well for the technician who is considering the purchase of a color test jig to carefully compare specifications, capabilities, and features among the competing brands so that he will be certain of getting the



Sylvania Chek-A-Color Model CK1500X Test Jig connected to a typical large-screen, 90°, hybrid color TV chassis. Shown are the few up-front, plug-in connections required for CRT base and deflection, convergence, and HV circuits. Note use of isolation transformer—a good, standard safety practice.

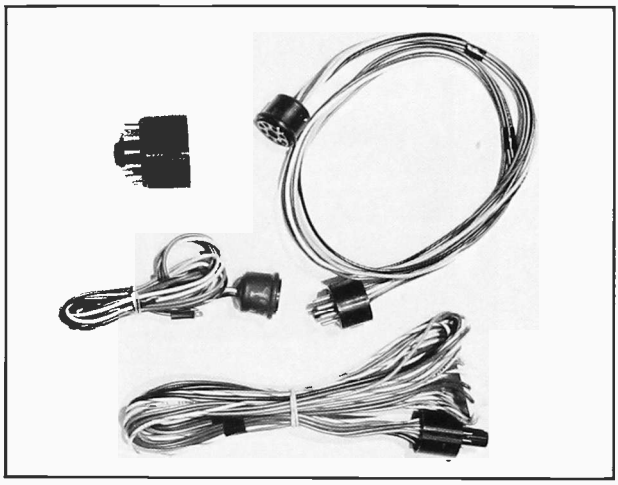
one that offers the maximum versatility per dollar spent. Nothing is more frustrating than buying a new piece of test gear which ends up sitting in a dark corner of the shop month after month gathering dust.

The limitations as well as the features of each brand should be closely examined when choosing a test jig. What makes, chassis, and models will the unit adapt to? How versatile is it? Exactly what types of chassis will it accommodate? Tube-type? How about solid-state and hybrid? Broad yoke mismatches may be tolerated by tube-driven sweep, but this is not true of solid state.

the Jig that has "It"

While the Sylvania Model CK1500X Chek-A-Color™ test jig may not adapt to every single color receiver ever marketed, it does enjoy several exclusive features that make it the nearest thing to the ultimate in service versatility. The present edition of the setup manual lists some 45 brands of color sets and thousands of individual models that the Chek-A-Color jig will adapt to. That's versatility! About the only types of receivers which the CK1500X will not adapt to are those employing Trinitron, in-line, and 110° picture tubes.

By far the most useful feature in its arsenal has to be the Yoke Programmer System (Patent Applied For). By inserting a selected plug into the Yoke Program socket on the front panel, the operator can choose any of ten horizontal yoke inductances. Six of these plugs are furnished with the Model CK1500X to provide inductances of 0.5 mH, 1 mH, and 3 mH for solid-state sweep and 7 mH, 12 mH, and 16 mH for tube-driven sweep. Three vertical inductances are required for today's receivers—6 mH, 25 mH, and 35 mH. These and others are provided by the CK1500X jig. As other inductances for solid state are required by future chassis, additional plugs to meet these needs will be made available.



Representative Adapter/Extension Kits for Chek-A-Color Test Jig. Upper photo shows universal kit—used with most chassis—while lower photo is that required for the chassis of one typical receiver make.

Another significant feature of the Chek-A-Color jig is that it is internally prefocused and will therefore adapt to any focus voltage supply. This alone adds many hundreds of TV models to its capability. The CK1500X is a portable, totally enclosed unit with all "up-front", plug-in connections for ease of use. Protection against accidental damage to the CRT neck is also afforded by the cabinet. Convergence adjustments are side mounted and recessed to protect coils and controls. A 14"V (diagonal measure) CRT, dynamic and static convergence, blue lateral and

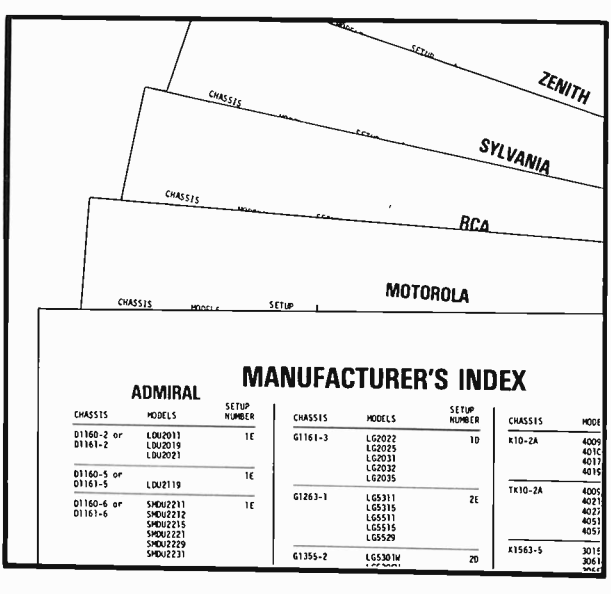
purity magnets, loud speaker for monitoring, and setup manual are all standard equipment. A comprehensive line of adapter and extension kits is also available.

An accurately calibrated, front-panel mounted, 35-KV meter is internally connected and always in the circuit. Though this meter is obviously useful in monitoring and adjusting high voltage, it is perhaps even more useful in another way. After all connections have been made and checked, and it is time to turn on the set, "watch the meter". In about 25 seconds, the high voltage should start to rise. If it advances steadily to 20-25 KV, your connections have been proofed (properly connected). You can anticipate a picture in about five more seconds.

However, if the meter stops short of 20 KV, turn the receiver off and recheck all adapters and connections. Particularly, check for a possible cross connection of deflection and convergence. Without the in-circuit meter, an operator would have to wait for the picture to prove proper connections. By the time he decided that something was wrong, damage could already have occurred.

Finally, no test jig could be really versatile without a continuing support program for obtaining information on new receivers and a well-planned system for connecting these sets to the jig. To accomplish this, Sylvania continuously monitors new types of production receivers of various manufacture. The necessary adaptation is documented in the Chek-A-Color jig setup manual. Supplementary pages to this manual listing connections to these new chassis are periodically supplied to registered owners of the CK1500X. If new adapters are required, they are manufactured and marketed through Sylvania Electronic Tube Distributors. All of these adapters are tried, proven designs.

So when comparing capabilities among different brands of color TV test jigs, remember the feature that's most important to you—having a jig that connects quickly and easily to the greatest possible number of chassis types. That's versatility!



Reproduction of page from Chek-A-Color Setup Manual. 45 TV receiver brands and several thousand models are listed. Test jig can be only as useful as number of sets for which connection instructions are provided.

NOW—INDUSTRIAL ECG SEMICONDUCTORS

Sylvania has recently expanded the popular entertainment ECG replacement semiconductor line to add a comprehensive selection of industrial types. Included is a wide range of Zener Diodes, Silicon Rectifiers, SCR's, Triacs, Diacs, Silicon Switches, and Unijunction Transistors to meet the myriad replacement needs of industrial and commercial applications. Each family of device is offered in a broad series of voltage, current, and power handling capabilities, as well as in a variety of package designs.

To ease the replacement job, also available are the companion ECG212D-2 **Industrial Supplement Replacement Guide,** which cross references some 7200 industry type numbers to the ECG device numbers that replace them, and the ECG212D-2A **Industrial Supplement Technical Data,** which provides full electrical and mechanical data on these devices. The entire ECG semiconductor line is available at your nearest Sylvania Electronic Tube Distributor.

Reproduced below from the ECG212D-2A **Industrial Supplement** is a handy selection guide for the ECG Zener Diodes listed by ECG type number.

ECG ZENER DIODES

NOTE: 10-watt and 50-watt Zeners listed have anode connected to stud. Add suffix letter "K" to ECG number for cathode connected to stud.

Voltage (±10%)	ECG TYPE NUMBER				
				STUD MOUNT	
	(Axial Lead) ½ Watt	(Axial Lead) 1 Watt	(Axial Lead) 5 Watt	(DO-4 Case) 10 Watt	(DO-5 Case) 50 Watt
2.4	ECG5000	ECG5061	—	—	—
2.5	ECG5001	ECG5062	—	—	—
2.7	ECG5002	ECG5063	—	—	—
2.8	ECG5003	ECG5064	—	—	—
3.0	ECG5004	ECG5065	—	—	—
3.3	ECG5005	ECG5066	ECG5111	ECG5172	ECG5238
3.6	ECG5006	ECG134	ECG5112	ECG5173	ECG5239
3.9	ECG5007	ECG5067	ECG5113	ECG5174	ECG5240
4.3	ECG5008	ECG5068	ECG5114	ECG5175	ECG5241
4.7	ECG5009	ECG5069	ECG5115	ECG5176	ECG5242
5.0	—	ECG135	—	—	—
5.1	ECG5010	—	ECG5116	ECG5177	ECG5243
5.6	ECG5011	ECG136	ECG5117	ECG5178	ECG5244
6.0	ECG5012	ECG5070	ECG5118	ECG5179	ECG5245
6.2	ECG5013	ECG137	ECG5119	ECG5180	ECG5246
6.8	ECG5014	ECG5071	ECG5120	ECG5181	ECG5247
7.5	ECG5015	ECG138	ECG5121	ECG5182	ECG5248
8.2	ECG5016	ECG5072	ECG5122	ECG5183	ECG5249
8.7	ECG5017	ECG5073	ECG5123	ECG5184	ECG5250
9.1	ECG5018	ECG139	ECG5124	ECG5185	ECG5251
10.0	ECG5019	ECG140	ECG5125	ECG5186	ECG5252
11.0	ECG5020	ECG5074	ECG5126	ECG5187	ECG5253
11.5	—	ECG141	—	—	—
12.0	ECG5021	ECG142	ECG5127	ECG5188	ECG5254
13.0	ECG5022	ECG143	ECG5128	ECG5189	ECG5255
14.0	ECG5023	ECG144	ECG5129	ECG5190	ECG5256
15.0	ECG5024	ECG145	ECG5130	ECG5191	ECG5257
16.0	ECG5025	ECG5075	ECG5131	ECG5192	ECG5258
17.0	ECG5026	ECG5076	ECG5132	ECG5193	ECG5259
18.0	ECG5027	ECG5077	ECG5133	ECG5194	ECG5260
19.0	ECG5028	ECG5078	ECG5134	ECG5195	ECG5261

(Cont'd page 7)

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Advertising Services Center
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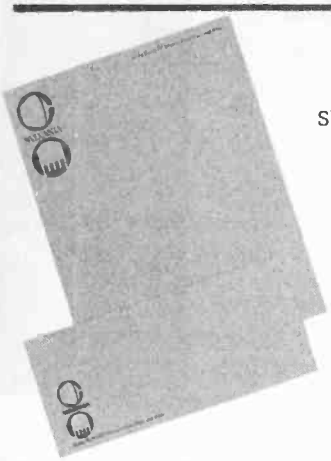
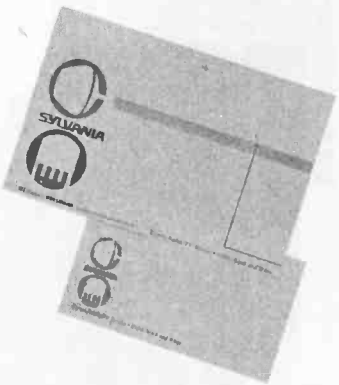


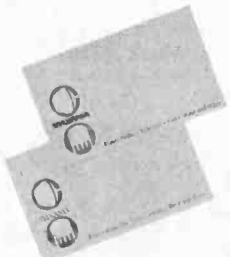
STATIONERY ET-1320/ **$6.00***

ENVELOPES (9½" x 4 1/8")
ET-1322/ **$7.00***

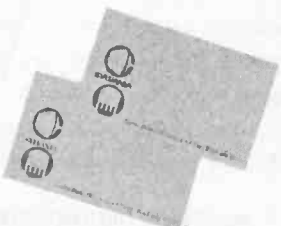


SERVICE BILLHEAD
ET-1323/ **$7.00**

ENVELOPES (6½" x 3 5/8")
ET-1321/ **$6.00***



BUSINESS CARDS ET-1324/ **$5.50**



DEALER IDENTIFICATION STICKER.
Provides your customer with a permanent record of your name and address.
ET-1153/ **$6.00***

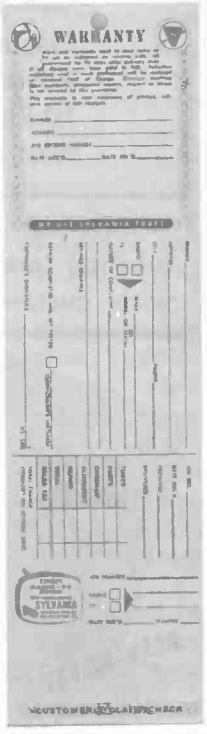
***Add $2.75 for each 500 imprint.**

BUSINESS AIDS

DEALER DOORKNOB HANGERS.

No one home? Leave this memo. It provides your customers with an opportunity to call again for new appointment. NOTE: includes phone number.

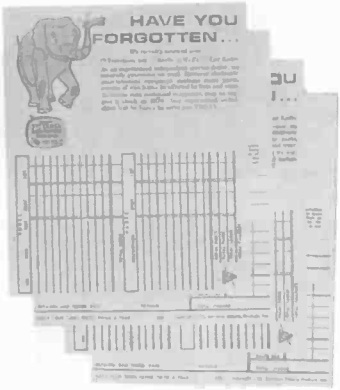
ET-2952/ imprinted $17.00 per 1,000. Plain $11.25



JOB RECORD CARDS.

Provides up-to-date records of service calls and charges; while serving as receipts and guarantees of work done.

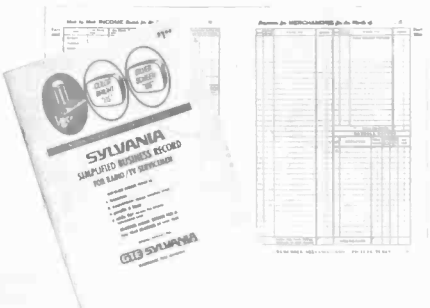
ET-1305/ $7.50 per 1,000. Imprint add $5.50.



3-IN-1 BUSINESS SERVICE FORMS.

Does 3 important jobs: Invoice and guarantee for customers, your job record, and follow-up post card.

ET-1306/ $8.75 per 500 or $16.00 per 1,000.



BUSINESS RECORD BOOK.

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ET-6330/ $1.00.

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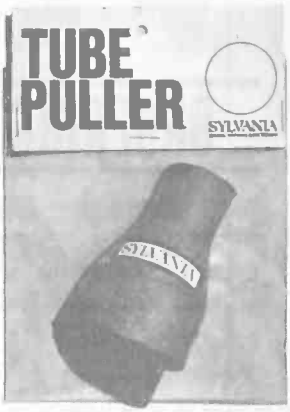
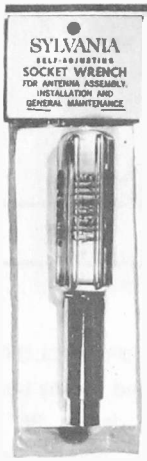
SERVICEMEN'S DROP CLOTH.
An indispensable aid for the busy, on-the-go service dealer. 36" x 28" 10 gauge vinyl, polyurethane foam backing, flame and dirt resistant.
ET-1185/ $2.50 each.

TUBE PULLER.
The safe and sure way to remove tubes from sockets.
ET-1838/ $ .75.



ELECTRO PROBE.
Plunger releases spring steel fork tongue gripper. Carries dc, sine waves and pulses to 5,000 volts peak. Handle takes banana plugs or bare wire test lead. Use it to make a shielded probe. Flexible shaft.
ET-1839/ **$1.75.**

BUSINESS BUILDERS FOR GTE SYLVANIA SERVICE DEALERS



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Self adjusting and is perfect for antenna assembly, installations and general servicing. Just press and turn—automatically adjusts from ¼" to 7/16". Takes bolt extensions up to 1½".
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Watch the TV picture from the back of the set with this handy mirror.
ET-1850/ $1.00.

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When ordering from GTE Sylvania, be specific. List item number, quantity, and imprinting instructions when necessary. Enclose check or money order, payable to GTE Sylvania to cover full amount. Postage charges are prepaid by GTE Sylvania.

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QTY.	ITEM NO.	DESCRIPTION	COST
		TOTAL	

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Company or Name_____

Street_____

City_____ State_____ Zip_____

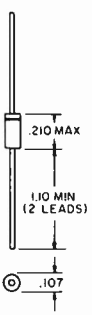
Phone No._____

ECG ZENER DIODES (cont'd)

NOTE: 10-watt and 50-watt Zeners listed have anode connected to stud. Add suffix letter "K" to ECG number for cathode connected to stud.

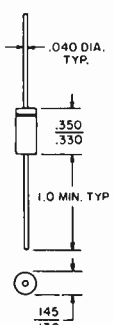
Voltage (±10%)	ECG TYPE NUMBER (Axial Lead) ½ Watt	(Axial Lead) 1 Watt	(Axial Lead) 5 Watt	STUD MOUNT (DO-4 Case) 10 Watt	STUD MOUNT (DO-5 Case) 50 Watt
20.0	ECG5029	ECG5079	ECG5135	ECG5196	ECG5262
22.0	ECG5030	ECG5080	ECG5136	ECG5197	ECG5263
24.0	ECG5031	ECG5081	ECG5137	ECG5198	ECG5264
25.0	ECG5032	ECG5082	ECG5138	ECG5199	ECG5265
27.0	ECG5033	ECG146	ECG5139	ECG5200	ECG5266
28.0	ECG5034	ECG5083	ECG5140	ECG5201	ECG5267
30.0	ECG5035	ECG5084	ECG5141	ECG5202	ECG5268
33.0	ECG5036	ECG147	ECG5142	ECG5203	ECG5269
36.0	ECG5037	ECG5085	ECG5143	ECG5204	ECG5270
39.0	ECG5038	ECG5086	ECG5144	ECG5205	ECG5271
43.0	ECG5039	ECG5087	ECG5145	ECG5206	ECG5272
45.0	—	—	—	ECG5207	ECG5273
47.0	ECG5040	ECG5088	ECG5146	ECG5208	ECG5274
50.0	—	—	—	ECG5209	ECG5275
51.0	ECG5041	ECG5089	ECG5147	ECG5210	ECG5276
52.0	—	—	—	ECG5211	ECG5277
55.0	—	ECG148	—	—	—
56.0	ECG5042	ECG5090	ECG5148	ECG5212	ECG5278
60.0	ECG5043	ECG5091	ECG5149	ECG5213	ECG5279
62.0	ECG5044	ECG149	ECG5150	ECG5214	ECG5280
68.0	ECG5045	ECG5092	ECG5151	ECG5215	ECG5281
75.0	ECG5046	ECG5093	ECG5152	ECG5216	ECG5282
82.0	ECG5047	ECG150	ECG5153	ECG5217	ECG5283
87.0	ECG5048	ECG5094	ECG5154	ECG5218	—
91.0	ECG5049	ECG5095	ECG5155	ECG5219	ECG5284
100.0	ECG5050	ECG5096	ECG5156	ECG5220	ECG5285
105.0	—	—	—	ECG5221	ECG5286
110.0	ECG5051	ECG151	ECG5157	ECG5222	ECG5287
120.0	ECG5052	ECG5097	ECG5158	ECG5223	ECG5288
130.0	ECG5053	ECG5098	ECG5159	ECG5224	ECG5289
140.0	ECG5054	ECG5099	ECG5160	ECG5225	ECG5290
150.0	ECG5055	ECG5100	ECG5161	ECG5226	ECG5291
160.0	ECG5056	ECG5101	ECG5162	ECG5227	ECG5292
170.0	ECG5057	ECG5102	ECG5163	ECG5228	—
175.0	—	—	—	ECG5229	ECG5293
180.0	ECG5058	ECG5103	ECG5164	ECG5230	ECG5294
190.0	ECG5059	ECG5104	ECG5165	ECG5231	ECG5295
200.0	ECG5060	ECG5105	ECG5166	ECG5232	ECG5296

Axial Lead (½, 1 Watt)



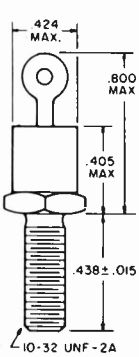
COLOR BAND DENOTES CATHODE

Axial Lead (5 Watt)

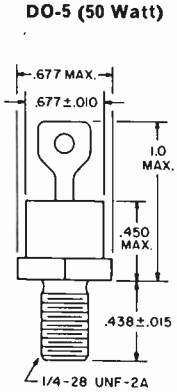


COLOR BAND DENOTES CATHODE

DO-4 (10 Watt)



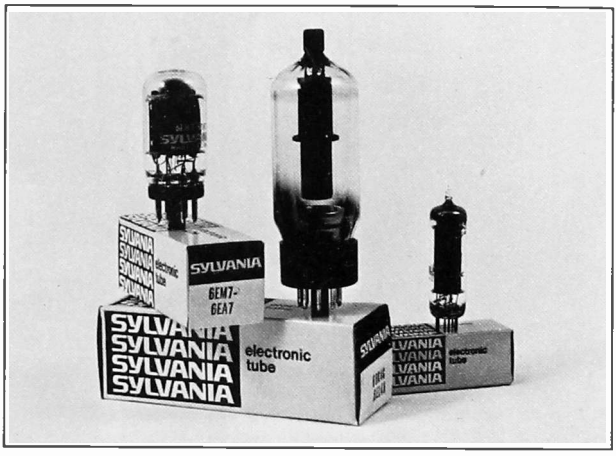
DO-5 (50 Watt)



REDUCE RECEIVING TUBE INVENTORY WITH SYLVANIA MULTI-TYPES

Now you can reduce your receiving tube inventory, space, and investment requirements yet have maximum type coverage for popular domestic and foreign tubes.

The Sylvania Multi-Type Electronic Tube line is designed to fill the broadest possible range of television, radio, and audio replacement needs with the fewest possible types. Multi-Type Electronic Tubes are available from Sylvania Electronic Tube Distributors.



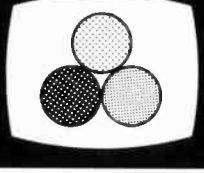
Sylvania Multi-Type Receiving Tube Replacement Guide

Type Replaced	Sylvania Multi-Type
OZ4 OZ4A OZ4G	OZ4/OZ4A
1B3GT	1G3GTA/ 1B3GT
1BK2	1BK2/1RK41
1BX2	1X2C/1BX2
1G3GT	1G3GTA/ 1B3GT
1J3 1K3	1K3A/1J3
1RK41	1BK2/1RK41
1S2 1S2A	1S2A/DY87
1X2 1X2A 1X2B	1X2C/1BX2
2AF4 2AF4A 2AF4B	2DZ4/2AF4B
2AH2 2AS2 2AS2A 2BU2	2BU2/2AS2A/ 2AH2
2DZ4	2DZ4/2AF4B
2FQ5 2GK5	2GK5/2FQ5
3AF4 3AF4A 3AF4B	3DZ4/3AF4B
3BC5	3BC5/3CE5
3BS2B 3BT2A 3BT2B	3BW2/3BS2B/ 3BT2A
5BR8 5CL8A 5FV8	5FV8/5BR8/ 5CL8A
5HG8	5HG8/LCF86
5U4GB	5U4GB/5AS4A
5U9	5U9/LCF201
5V3	5V3/5AU4
6AB8	6AB8/ECL80
6AF4 6AF4A	6DZ4/6AF4A
6AK5	6AK5/EF95
6AK8	6AK8/EABC80
6AL3	6AL3/EY88
6AQ5A	6AQ5A/6HG5
6AQ8	6AQ8/ECC85
6AX8	6U8A/6AX8/ 6KD8
6BA6	6BA6/EF93
6BC5	6BC5/6CE5
6BC8	6BC8/6BZ8
6BE3	6BE3/6BZ3
6BE8	6FV8A/6BR8A
6BK4 6BK4A 6BK4B 6BK4C	6BK4C/6EL4A
6BL8	6BL8/ECF80
6BM8	6BM8/ECL82
6BN6	6BN6/6KS6
6BQ5	6BQ5/EL84
6BQ6GT 6BQ6GTA 6BQ6GTB	6BQ6GTB/ 6CU6
6BQ7 6BQ7A	6BQ7A/6BZ7
6BR3	6RK19/6BR3
6BR8 6BR8A	6FV8A/6BR8A
6BW3	6CG3/6BW3
3BU8	3GS8/3BU8
3BW2	3BW2/3BS2B/ 3BT2A
3CB6	3CB6/3CF6
3CE5	3BC5/3CE5
3CF6	3CB6/3CF6
3CY3 3DB3	3DB3/3CY3
3DZ4	3DZ4/3AF4B
3EH7	3EH7/XF183
3EJ7	3EJ7/XF184
3GS8	3GS8/3BU8
3HA5 3HM5	3HA5/3HM5
4BL8	4BL8/XCF80
4BQ7 4BQ7A	4BQ7A/4BZ7
4BU8	4GS8/4BU8
4BZ7	4BQ7A/4BZ7
4GS8	4GS8/4BU8
4HA5	4HA5/PC900

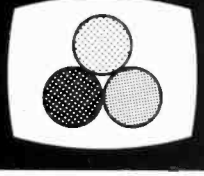
Type Replaced	Sylvania Multi-Type
4HA7 4HC7	4HA7/4HC7
4KN8 RHH8	4RHH8/4KN8
5AR4	5AR4/GZ34
5AS4A	5U4GB/5AS4A
5AU4	5V3/5AU4
6BX6	6BX6/EF80
6BX8	6BC8/6BZ8
6BZ3	6BE3/6BZ3
6BZ7	6BQ7A/6BZ7
6BZ8	6BC8/6BZ8
6CA7	6CA7/EL34
6CB6A	6CB6A/6CF6
6CD3 6CE3	6CE3/6CD3
6CE5	6BC5/6CE5
6CF6	6CB6A/6CF6
6CG3	6CG3/6BW3
6CG7	6CG7/6FQ7
6CJ3	6CJ3/6DW4B
6CQ4	6DE4/6CQ4
6CU6	6BQ6GTB/ 6CU6
6CW5	6CW5/EL86
6DA4 6DA4A	6DA4A/ 6DM4A
6DE4	6DE4/6CQ4
6DG6GT	6W6GT/ 6DG6GT
6DM4 6DM4A	6DA4A/ 6DM4A
6DQ6 6DQ6A 6DQ6B	6DQ6B/6GW6
6DW4 6DW4B	6CJ3/6DW4B
6DX8	6DX8/ECL84
6DZ4	6DZ4/6AF4A
6EA7	6EM7/6EA7
6EB8	6GN8/6EB8
6EH7	6EH7/EF183
6EJ7	6EJ7/EF184
6EL4A	6BK4C/6EL4A
6EM7	6EM7/6EA7
6ES8	6ES8/ECC189
6FG6	6FG6/EM84
6FQ5 6FQ5A	6GK5/6FQ5A
6FQ7	6CG7/6FQ7
6FV8 6FV8A	6FV8A/6BR8A
6GB5	6GB5/EL500
6GJ7	6GJ7/ECF801
6GK5	6GK5/6FQ5A
6GN8	6GN8/6EB8
6GW6	6DQ6B/6GW6
6GW8	6GW8/ECL86
6GX6 6GY6	6GY6/6GX6
6HA5	6HA5/6HM5
6HA6 6HB6	6HB6/6HA6
6HE5	6JC5/6JB5/ 6HE5
6HG5	6AQ5A/6HG5
6HG8	6HG8/ECF86
6HK8	6BC8/6BZ8
6HM5	6HA5/6HM5
6HU6	6HU6/EM87
6HU8	6HU8/ELL80
6J10	6J10/6Z10
6JA8	6GN8/6EB8
6JB5 6JC5	6JC5/6JB5/ 6HE5
6JE6 6JE6C	6JE6C/6LQ6
6JW8	6JW8/ECF802
6K11	6K11/6Q11
6KD8	6U8A/6AX8/ 6KD8
6KG6A	6KG6A/EL509
6KN8	6RHH8/6KN8
6KS6	6BN6/6KS6
6LH6A 6LJ6A	6LJ6A/6LH6A
6LQ6	6JE6C/6LQ6
6LX8	6LX8/LCF802
6Q11	6K11/6Q11
6RHH8	6RHH8/6KN8
6RK19	6RK19/6BR3
6U8 6U8A	6U8A/6AX8/ 6KD8
6V4	6V4/EZ80
6W6GT	6W6GT/ 6DG6GT
6X9	6X9/ECF200
6Z10	6J10/6Z10
7HG8	7HG8/PCF86
8CG7	8CG7/8FQ7
8EB8	8GN8/8EB8
8FQ7	8CG7/8FQ7
8GJ7	8GJ7/PCF801
8GN8 8JE8	8GN8/8EB8
9A8	9A8/PCF80
10CW5	10CW5/LL86
10DX8	10DX8/LCL84
10LD6	10LD6/LL802
11Y9	11Y9/LFL200
12AT7	12AT7/ECC81
12AU7 12AU7A	12AU7A/ ECC82
12AX7 12AX7A	12AX7A/ ECC83/7025
12AY3 12AY3A	12AY3A/ 12BS3A
12BQ6GT 12BQ6GTA 12BQ6GTB	12BQ6GTB/ 12CU6
12BR3	12RK19/ 12BR3
12BS3 12BS3A	12AY3A/ 12BS3A
12BV7 12BY7 12BY7A	12BY7A/ 12BV7/12DQ7
12C5 12CU5	12C5/12CU5
12CU6	12BQ6GTB/ 12CU6
12DQ6 12DQ6A 12DQ6B	12DQ6B/ 12GW6
12DQ7	12BY7A/ 12BV7/12DQ7
12DZ6 12EA6 12EK6	12EK6/12DZ6/ 12EA6
12GN7A	12GN7A/ 12HG7
12GW6	12DQ6B/ 12GW6
12HG7	12GN7A/ 12HG7
12RK19	12RK19/ 12BR3
13GB5	13GB5/XL500
13J10 13Z10	13J10/13Z10
15CW5	15CW5/PL84
16AQ3	16AQ3/XY88
17AB10	17AB10/17X10
17AX4GT 17AX4GTA	17AX4GTA/ 17DM4A
17AY3 17AY3A	17AY3A/ 17BS3A
17BE3	17BE3/17BZ3
17BR3	17BR3/17RK19
17BS3 17BS3A	17AY3A/ 17BS3A
17BZ3	17BE3/17BZ3
17C5 17CU5	17C5/17CU5
17DM4 17DM4A	17AX4GTA/ 17DM4A
17DQ6 17DQ6A 17DQ6B	17DQ6B/ 17GW6
17EW8	17EW8/HCC85
17GW6	17DQ6B/ 17GW6
17RK19	17BR3/ 17RK19
17X10	17AB10/17X10
18GV8	18GV8/PCL85
19CL8 19CL8A 19JN8	19JN8/19CL8A
24JE6 24JE6A 24LQ6	24JE6A/ 24LQ6
25BQ6G 25BQ6GA 25BQ6GT 25BQ6GTB 25CU6	25BQ6GTB/ 25CU6
25L6GT 25W6GT	25L6GT/ 25W6GT
27GB5	27GB5/PL500
34CD3 34CE3	34CE3/34CD3
40KG6A	40KG6A/PL509
42EC4	42EC4/PY500
7025	12AX7A/ ECC83/7025

(Cont'd page 10)

Type Replaced	Sylvania Multi-Type
DY87	1S2A/DY87
EABC80	6AK8/EABC80
ECC81	12AT7/ECC81
ECC82	12AU7A/ ECC82
ECC83	12AX7A/ ECC83/7025
ECC85	6AQ8/ECC85
ECC189	6ES8/ECC189
ECF80	6BL8/ECF80
ECF86	6HG8/ECF86
ECF200	6X9/ECF200
ECF801	6GJ7/ECF801
ECF802	6JW8/ECF802
ECL80	6AB8/ECL80
ECL82	6BM8/ECL82
ECL84	6DX8/ECL84
ECL86	6GW8/ECL86
EF80	6BX6/EF80
EF93	6BA6/EF93
EF95	6AK5/EF95
EF183	6EH7/EF183
EF184	6EJ7/EF184
EL34	6CA7/EL34
EL84	6BQ5/EL84
EL86	6CW5/EL86
EL500	6GB5/EL500
EL509	6KG6A/EL509
ELL80	6HU8/ELL80
EM84	6FG6/EM84
EM87	6HU6/EM87
EY88	6AL3/EY88
EZ80	6V4/EZ80
GZ34	5AR4/GZ34
HCC85	17EW8/HCC85
LCF86	5HG8/LCF86
LCF201	5U9/LCF201
LCF802	6LX8/LCF802
LCL84	10DX8/LCL84
LFL200	11Y9/LFL200
LL86	10CW5/LL86
LL802	10LD6/LL802
PC900	4HA5/PC900
PCF80	9A8/PCF80
PCF86	7HG8/PCF86
PCF801	8GJ7/PCF801
PCL82	16A8/PCL82
PCL85	18GV8/PCL85
PL84	15CW5/PL84
PL509	40KG6A/PL509
PL500	27GB5/PL500
PY500	42EC4/PY500
XCF80	4BL8/XCF80
XF183	3EH7/XF183
XF184	3EJ7/XF184
XL500	13GB5/XL500
XY88	16AQ3/XY88



Color Picture Tubes



REPLACING NON-BONDED COLOR PICTURE TUBES WITH BONDED-SHIELD TYPES

Listed below are several Sylvania Color Bright 85®XR color picture tubes which will directly replace the older, standard types shown when it is desired to upgrade performance over the original equipment tube. Color Bright 85XR, our top-of-the-line renewal tube, features all-new components and materials—including X-ray inhibiting glass and our high-brightness "MV" phosphors.

Note that in all cases, however, the XR tube includes bonded-shield, glass plate implosion protection while the type being replaced does not include such a plate; protection for these older types is provided by a glass safety plate which is mounted in the front of the television cabinet. When replacing these types with an XR tube, therefore, the receiver's glass safety plate is no longer required and should be removed and discarded. If this is not done, the picture tube screen must be viewed through an extra layer of glass (the tube's bonded shield plus the set's safety plate), with consequent deterioration of perceived picture quality.

TUBE BEING REPLACED (Non-Bonded)*	COLOR BRIGHT 85XR REPLACEMENT TYPE (Bonded Shield Glass Plate)
19EXP22	XR18VAHP22
21FBP22A	XR19VABP22
25BP22	XR23VANP22

***Remove and discard separate glass plate from receiver cabinet**

CAUTION ON REPLACING PICTURE TUBES HAVING X-RAY INHIBITING GLASS

Special glass is used in more recent color picture tubes to keep X-radiation to prescribed levels. The Electronic Industries Association "Safety Guidelines" specify that: **"These tubes have special designations and must be replaced with exact types to maintain safe operation."**

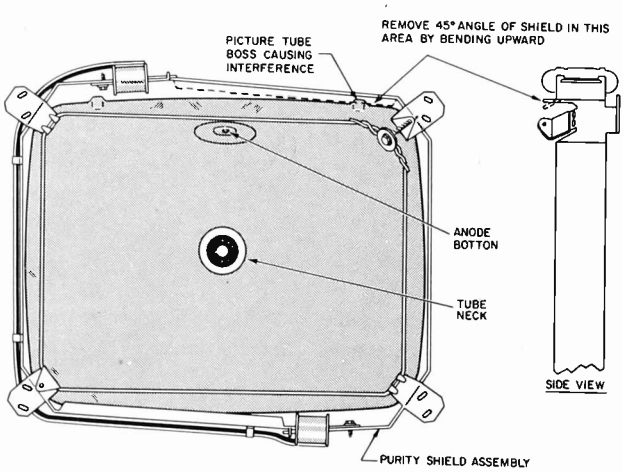
Sylvania picture tubes manufactured with X-radiation type of glass are designated by the "XR" suffix appearing before the tube type number. To comply with this caution, install the finest—Sylvania Color Bright 85®XR.

A FIX FOR 14VAHP22 AND 14VADP22 MOUNTING PROBLEM IN SYLVANIA SETS

A glass supplier has changed their process for making the funnel portion of bulbs used by the industry in the manufacture of 14VAHP22 and 14VADP22 color picture tubes. The result is a tube with a fuller bulb in the area where the mounting wire rests and a higher boss in the sealing area. This larger boss interferes with the purity shield in Sylvania receivers as shown in the illustration, preventing proper installation of the tube.

Should the service technician encounter this condition when replacing a 14VAHP22 or 14VADP22 in a Sylvania set, he should provide clearance in the shield for the higher picture tube boss. If this is not done, the shield will be distorted, the tube mounting wire will be too tight, and there will be a large gap between the tube face and the cabinet mask.

This clearance is easily provided by bending the trailing edge of the purity shield upward (away from the boss), in the area where the tube boss contacts it, to remove the 45° angle. This is shown in the illustration. Remove the purity shield from the cabinet for this procedure. With this clearance provided, the tube will seat properly within the shield and cabinet. Tube installation may now proceed in a conventional manner.



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IN THIS ISSUE

Sylvania News is sent free of charge. Each issue contains information of value to the independent radio/TV service dealer. Helpful servicing techniques, new processes, and the latest products are described. Sylvania thus offers its readers an important means of keeping tabs on some of the ever-changing complexities of the electronic servicing industry.

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SYLVANIA
NEWS
TECHNICAL INFORMATION OF INTEREST TO THE INDEPENDENT RADIO/TV SERVICEMAN
Editor: M. N. Wildemann

AGC, ATC, AFC, ETC

Part 1

As a boon to the TV viewer (and sometimes a curse to the technician), present day TVs include more and more automatic features, such as AGC, ATC, AFC, APC, etc. Left to the serviceman is the certain knowledge that he can not forever avoid these circuits—even though they be AAC through AZO in legion.

This article makes those automatics now with us a little easier to understand so that when necessary to service them, the problem can be more rapidly resolved with a little less imagination (instead of know-how) required.

The things we'll discuss about these automatics are:

- How do they work?
- What usually goes out of whack on them and how do we troubleshoot and service them?
- How can we check and adjust them for proper operation?

Automatic Frequency Control

Let's look first at tuner AFC (Automatic Frequency Control). The purpose of tuner AFC is to "lock" the tuned picture by keeping the tuner oscillator from shifting or changing frequency, which would result in a mistuned picture. Since the frequency of the oscillator is determined by certain amounts of L and C, changing any of the L or C will change its frequency. If either L or C could be changed automatically in case of a shift in the oscillator frequency, it would accomplish what we want.

Most tuner AFC's today employ a varactor diode as part of the oscillator circuit. A varactor diode is a diode with a junction capacitance which changes a known amount with a change in the DC voltage impressed across it. This characteristic permits us to utilize appropriate circuitry to achieve our goal. A basic varactor circuit is shown in **Figure 1.** To obtain correcting DC voltage for the varactor, we employ a discriminator and a DC amplifier. In block form, it would look like the illustration shown in **Figure 2.** Input to the discriminator is from the IF system. The discriminator is tuned to 45.75 MHz, which is the IF frequency of the video carrier.

As long as the receiver is tuned properly (oscillator on frequency), the output of the discriminator circuit is 0. The normal voltage at the output of the DC amplifier is applied across the varactor diode, determining its mean capacitance. If, however, the oscillator should drift either above or below its proper frequency, the discriminator's output will change accordingly, providing a corrective positive or negative voltage. This voltage is applied to the DC amplifier, which will in turn change the voltage across (and therefore the capacitance of) the varactor, restoring the tuner oscillator to its correct frequency.

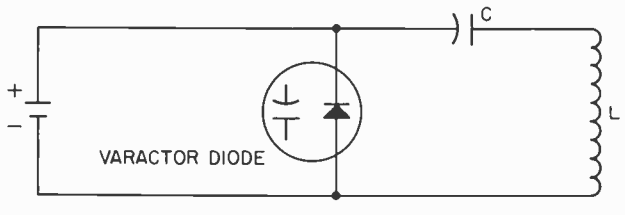

Figure 1. Basic Varactor Diode Circuit

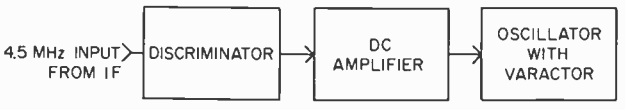

Figure 2. AFC Block Diagram

The main adjustment for proper operation of tuner AFC is the alignment of the discriminator coil. It should be aligned so that when the tuner is fine-tuned manually, engagement of the AFC will not cause a change. This will indicate 0 correction volts out of the discriminator. Normally, minor adjustment of the coil can be done by observation of the picture or metering of the AFC line.

Things to look for when troubleshooting are:

- Proper alignment of the discriminator coil
- Varactor diode itself
- AFC diodes
- Transistors

Automatic Gain Control

In order to maintain a relatively constant video output over a wide range of signal input levels, we use AGC (Automatic Gain Control). This is a closed loop system that controls RF and IF signal gain. The system is designed so that when the incoming signal is strong, the gain of the RF and IF is reduced, and vice versa.

Present day AGC's are "keyed" AGC's, that is, they are turned on by keying pulses. One of these pulses is taken from the flyback. The sync pulse of the incoming signal is the other keying

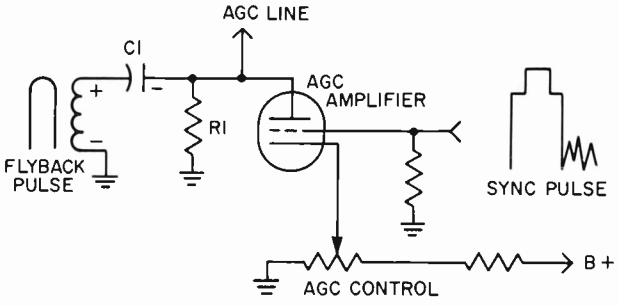

Figure 3. Simple Triode AGC Circuit

pulse. Both appear at a horizontal frequency rate. Essentially, the AGC is a rectifier with some means provided for controlling the amount of rectification. Note the simple triode system shown in **Figure 3.** The pulse from the flyback winding is applied to the plate of the tube through capacitor C1. Since the amplitude of this pulse remains constant, conduction, and therefore the amount of rectification, will be determined by the setting of the AGC control and the amplitude of the incoming sync pulses. When the tube conducts, C1 charges as shown. During the time the tube is cut off, C1 discharges through R1 and provides us with our negative AGC voltage. There are, or course, other resistors, capacitors, etc. for further filtering and distribution.

Now let's examine the AGC systems employed in several representative chassis. One form of AGC system is composed of a pulse winding, a gate and an amplifier. A simplified sche-

matic is shown in **Figure 4.** When the flyback and sync pulses are applied, current will flow in the circuit. The path is from the winding, through SC302, through the gate, Q304, up through C302 (charging it), and back to the winding. The DC voltage thus obtained at C302 is applied to the base of the amplifier transistor Q300.

It is readily seen that in this AGC system, the setting of the AGC control and the amplitude of the incoming sync pulses (in this case negative in polarity) will both cause the gate to be more or less open, and will, therefore, control the amount of current flow in the circuit. This will in turn control the amount of charge of C302 and, hence, our AGC voltage.

As stated, the voltage of C302 is applied to the base of Q300, the amplifier. This will also cause the voltage at the emitter to change. The emitter voltage is our AGC voltage.

As in most AGC systems, the AGC control is adjusted on the strongest station received until picture "jumps" or the end of control rotation is reached; the control is then backed off until picture becomes steady.

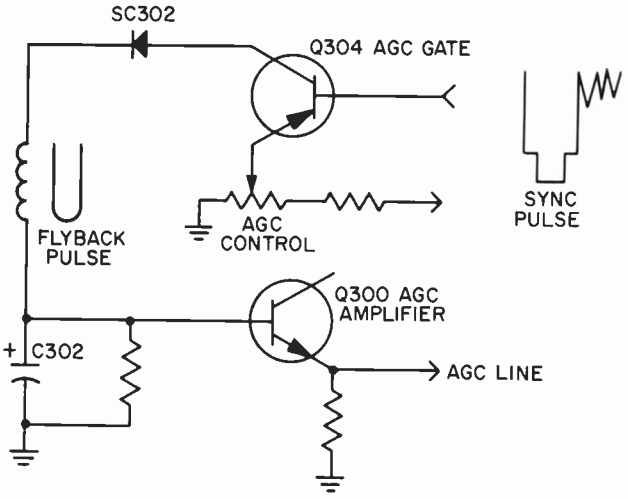

Figure 4. Basic AGC Circuit

In troubleshooting, the following items should be checked:

- Is the horizontal pulse present?
- Does the AGC control change the voltage at the emitter of the gate? At the base of the amplifier? At the emitter of the amplifier?
- Is the sync pulse present?

Common problems are transistors, the diode, or C302 open or shorted.

Another AGC circuit version also employs a pulse winding, a gate, and an amplifier. There is, however, a difference in its application in order to obtain AGC voltage. A simplified schematic is shown in **Figure 5.** As you can see, with the exception of Q304 we have a straight forward, halfwave rectifier. The DC output of the rectifier is applied to the base of the amplifier, Q302. Q304, the "gate," acts more as a damping resistor across the pulse winding. Q304 will be more or less of a load across the pulse winding, depending again on the setting of the AGC control and the ampli-

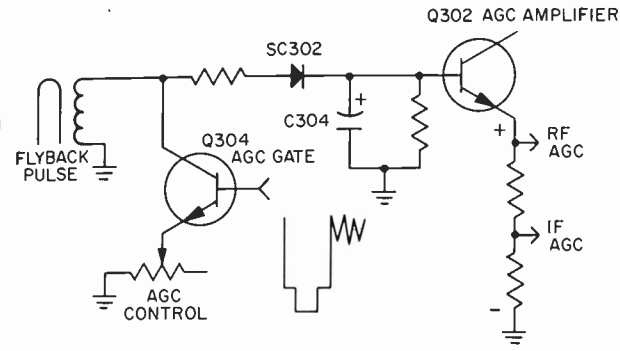

Figure 5. Variation of AGC Circuit

tude of the incoming sync pulse. Note that here too the sync pulse is negative in polarity, but because the transistor is an NPN rather than a PNP type, a strong signal will cause Q304 to conduct less. This will result in less loading of the pulse winding and consequently a greater pulse amplitude across C304. This will provide more DC voltage to the base of the amplifier. Action of the amplifier Q302 is the same as in that previously described. Note that RF and IF AGC voltages are available directly from the amplifier.

Troubleshooting this AGC system is similar to that for the system previously discussed, one exception being the ground connection from the pulse winding. This can sometimes cause AGC problems.

Another form of AGC system presents us with yet another method of accomplishing our goal of maintaining RF and IF gain. Here we again employ a pulse winding, an AGC gate, an AGC amplifier, and an added stage, the AGC driver. Functions of these differ from those described earlier, so let's see what we have. A simplified schematic of this system is shown in **Fig. 6.** Unlike the previous systems where a DC voltage was provided by the AGC amplifier, in this circuit it is used as a variable resistor in the emitter circuit of the first IF to control its gain, as shown in **Figure 7.** When Q300, the AGC amplifier, is in saturation, R307 is shorted out, and R308 is effectively at ground potential. This will allow

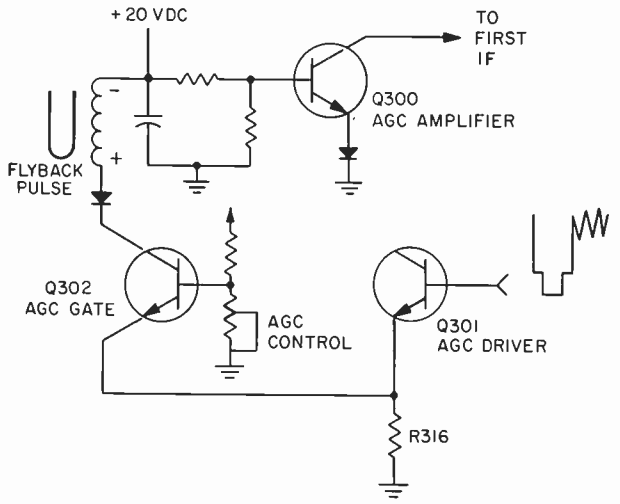

Figure 6. AGC with Driver Stage

the IF's to operate at maximum current gain. As signal increases, the base voltage of Q300 goes *down,* lowering the current through it and thus raising the emitter resistance of the IF's. The increase of resistance will increase the emitter voltage of Q200, the first IF, reducing its forward bias and thus its gain.

The change in base voltage at the AGC amplifier is accomplished in this fashion. Referring again to Figure 6, R316 is the common emitter of both Q301, the AGC driver, and Q302, the AGC gate. When the sync pulse of the incoming signal is applied to the base of the driver, it will lower its conduction. This will cause the voltage across R316 to decrease. As a result of this, the forward bias of Q302, the AGC gate, will *increase,* increas-

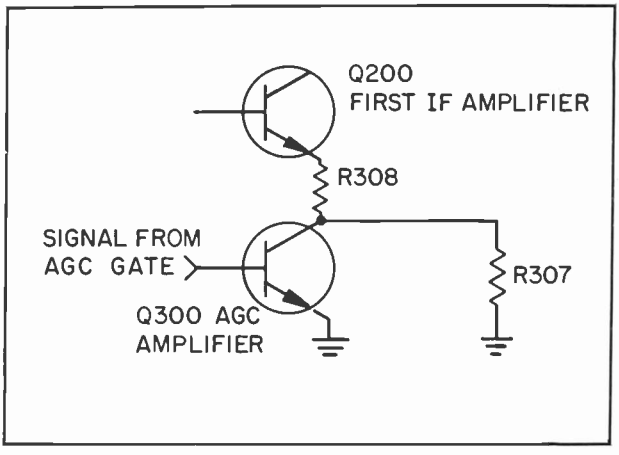

Figure 7. AGC—Controlled IF Stage

ing its conduction. The AGC control, as part of a voltage divider network tied to the base of the gate, is also a determining factor in its conduction. Current from the pulse winding now flows down through C302, up through the gate, and back to the pulse winding. As in the case described earlier, the amount of current is determined by the gate.

Note that C302 is charged negatively relative to ground. Thus, the stronger the incoming signal, the *less* the base voltage at the AGC amplifier will be. The resulting increase in its impedance will decrease the gain of the IF's as just described.

Adjustment of the AGC control is the same as for any other AGC system, as are troubleshooting procedures.

(To be continued in next issue)

POPULAR ECG LINEAR IC REPLACEMENT LINE GROWS AGAIN

Over the past few years the service technician has seen the ever-widening application of integrated circuits in home entertainment equipment; this trend is likely to increase, in view of the advantages afforded by these sophisticated, highly-miniaturized components. Increasing use, however, has not always necessarily lead to increased availability.

Sylvania has evolved a broad line of replacement types for the majority of these original equipment IC's to meet this need. Applications include color and monochrome TV, AM and FM radio, stereo, and tape recorders. A complete list of these Sylvania ECG linear IC's, including several new types just added to this line, follows; also included is a replacement guide which cross references the industry IC type to be replaced to the equivalent ECG, device.

In addition to IC's, the complete line of Sylvania ECG semiconductors includes transistors, FET's, diodes and rectifiers, solid-state high-voltage triplers, color oscillator crystals, and various solid-state accessories—everything needed to do that repair job quickly and correctly the first time. The fast-moving ECG semiconductor line significantly reduces dealer and distributor inventory requirements and has been met with wide industry acceptance since its introduction.

Undoubtedly the most useful tool associated with the ECG semiconductor line is the ECG212D Semiconductor Replacement Guide, now in its fifth edition and continually expanded to keep abreast of new industry types as they are added. The ECG212D cross references over 41,000 manufacturers', JEDEC, and foreign part numbers to the ECG types which replace them and is the most comprehensive guide available.

The entire ECG replacement line of semiconductors and the ECG212D Semiconductor Replacement Guide, are available from your Sylvania electron tube distributor.

ECG LINEAR INTEGRATED CIRCUITS

ECG 370	AGC/Squelch Amplifier
ECG 371	RF/IF Amplifier
ECG 372	AM Receiver Subsystem
ECG 703/703A	RF/IF Amplifier, Mixer, Oscillator
ECG 704	TV Sound IF Amplifier and Discriminator
ECG 705A	Chroma Demodulator
ECG 706	TV/FM Sound IF/Detector
ECG 707	Chroma Demodulator
ECG 708	TV/FM Sound IF/Detector
ECG 709	FM Sound IF/Detector for Mobile/Portable Equipment
ECG 710	TV/FM Sound IF/Detector
ECG 711	Automatic Fine Tuning System
ECG 712	TV/FM Sound IF/Detector with Electronic Attenuator
ECG 713	Chroma Demodulator
ECG 714	Color Subcarrier Regenerator
ECG 715	Chroma IF Amplifier
ECG 716	Audio Amplifier
ECG 717	1-Watt Audio Power Amplifier
ECG 718	FM Stereo Processor
ECG 719	FM Stereo Processor
ECG 720	FM Stereo Processor with Adjustable Stereo-Channel Separation
ECG 721	Dual Low-Noise Audio Preamplifier
ECG 722	FM Stereo Processor
ECG 723	FM IF Amplifier/Detector for High Fidelity and Communications Receivers
ECG 724	RF/IF Amplifier
ECG 725	Dual Low-Noise Operational Amplifier
ECG 726	TV/FM IF Amplifier
ECG 727	Four Independent A C Amplifiers for Stereo Preamplifiers, Tape Recorders, Playback Amplifiers, Magnetic Pickups.

ECG INTEGRATED CIRCUIT CROSS-REFERENCE GUIDE

Industry IC to be Replaced	Sylvania ECG Replacement	Industry IC to be Replaced	Sylvania ECG Replacement
020-1114-007	ECG703 ECG703A	036001	ECG703 ECG703A
020-1114-008	ECG703 ECG703A	09-308004	ECG703 ECG703A
020-1114-009	ECG720		

Industry IC to be Replaced	Sylvania ECG Replacement
1E703E	ECG703
	ECG703A
4-009	ECG720
13-1-6	ECG703
	ECG703A
13-9-6	ECG703
	ECG703A
13-10-6	ECG703
	ECG703A
13-11-6	ECG703
	ECG703A
13-26-6	ECG718
13-27-6	ECG711
13-28-6	ECG706
13-29-6	ECG712
14-2007-00	ECG705A
15-26587-1	ECG703
	ECG703A
15-33201-1	ECG712
15-34005-1	ECG727
15-34048-1	ECG708
15-34049-1	ECG722
15-35059-1	ECG712
19-020-079	ECG703
	ECG703A
21A101-001	ECG706
21A101-002	ECG711
32-23555-1	ECG704
32-23555-2	ECG704
32-23555-3	ECG704
32-23555-4	ECG704
46-5002-1	ECG703
	ECG703A
46-5002-2	ECG717
46-5002-3	ECG703
	ECG703A
46-5002-4	ECG703
	ECG703A
46-5002-6	ECG711
51S10276A01	ECG704
51S10302A01	ECG703
	ECG703A
51S10408A01	ECG710
51S10432A01	ECG717
57C28	ECG704
57C29-1	ECG706
57C29-2	ECG706
57L103-13	ECG717
86X0024-001	ECG704
86X0027-001	ECG704
88B7258	ECG709
99S022	ECG703
	ECG703A
99S042	ECG710
99S053	ECG722
133-001B	ECG726
133-002	ECG710
133-003	ECG724
133-004	ECG725
221-32	ECG703
	ECG703A
221-34	ECG708
221-36	ECG705A
221-37	ECG705A
221-39	ECG705A
221-40	ECG707
221-42	ECG714
221-43	ECG715
221-46	ECG713
221-48	ECG712
417-119	ECG704
431-26551A	ECG722
442-9	ECG720
442-10	ECG705A
442-16	ECG722
880-101-00	ECG703
	ECG703A
2434	ECG710
2445	ECG711
3502	ECG704
45380	ECG718
45381	ECG722
80053	ECG704
80070	ECG704
80071	ECG704
80073	ECG704
80074	ECG704
80081	ECG704
80083	ECG704
80090	ECG704
80094	ECG704
80114	ECG706
118361	ECG704
119609	ECG704
122199	ECG704
126604	ECG711
126871	ECG706
129871	ECG710
183013	ECG718
183014	ECG722
612002-2	ECG717
612005-1	ECG712
612006-1	ECG722
612007-1	ECG708
612008-2	ECG725
612021-1	ECG718
1462434-1	ECG706
4082664-0001	ECG726
4082665-0001	ECG723
7311325	ECG709
CA3011	ECG726
CA3012	ECG726
CA3013	ECG704
CA3014	ECG704

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IN THIS ISSUE

Sylvania News is sent free of charge. Each issue contains information of value to the independent radio/TV service dealer. Helpful servicing techniques, new processes, and the latest products are described. Sylvania thus offers its readers an important means of keeping tabs on some of the ever-changing complexities of the electronic servicing industry.

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SYLVANIA
NEWS
TECHNICAL INFORMATION OF INTEREST TO THE INDEPENDENT RADIO/TV SERVICEMAN
Editor: M. N. Wildemann

COMPLEMENTARY SYMMETRY POWER AMPLIFIERS

The output transistors of most push-pull power amplifiers are a matched pair of NPN or PNP power transistors.

The drive to the output stage is normally through an interstage transformer supplying the correct signal phase to each of the push-pull sections (see Figure 1).

Base Current/Collector Current Transfer Curve

A look at the dynamic transfer curve (Figure 2) for a given pair of power transistors indicates crossover distortion occurring during the turn-off and turn-on points of the Class B transistor amplifiers. The crossover distortion is a result of one transistor cutting off before the other tran-

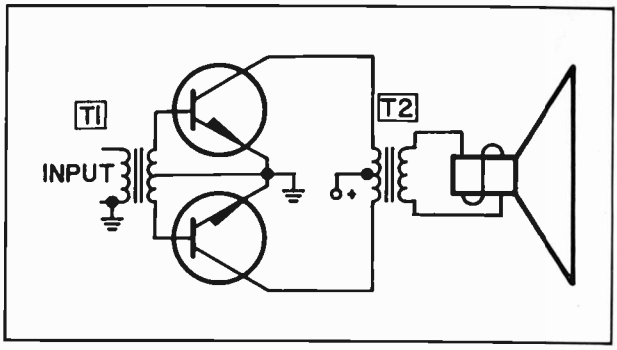


Figure 1. Class B Push-Pull Amplifier

sistor begins conduction. Normally a Class B amplifier is biased to zero collector current. However, the transistor Ib/Ic curve resembles the diode curve, where small changes in voltage near cutoff do not change the conduction measurably. The larger signal swing voltage must go through the low conduction level, turning on once the junction is forward biased sufficiently. This low conduction level area in the transistor amplifier causes second-harmonic distortion to the output current waveform.

Crossover Distortion

Crossover distortion is a discordant sound, due to second-harmonic generation. It is a product of the non-linear current amplification in the device, causing a non-linear current waveform in its output (Figure 3).

This distortion is overcome by shifting the bias point (Figure 4) of the amplifiers. Each transistor is forward biased by a small amount of base current. The voltage causes a shift in the bias point and gives a distortionless energy transfer to the load from either transistor during the crossover from turn-off to turn-on. Actually, the amplifier is now operating somewhere between Class A and Class B. Under these circumstances the operational conditions make the amplifier Class AB (Figure 5).

These push-pull amplifiers have given way to a newer type. Complementary symmetry amplifiers (Figure 6) eliminate the use of transformers for phase inversion and impedance matching to the load.

Complementary Amplifiers

This type of amplifier (Figure 6) operates in the Class AB area. Both of the output NPN

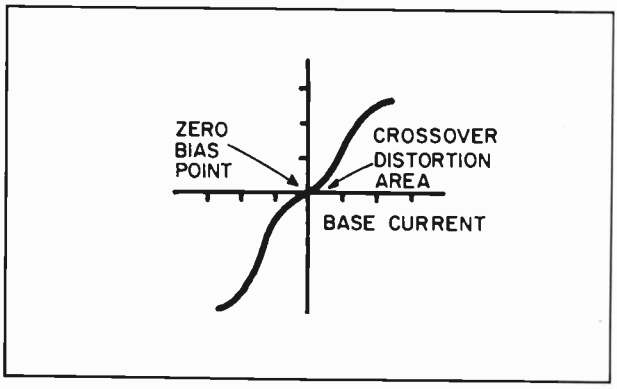


Figure 2. Dynamic Transistor Curve—Class B Amplifier

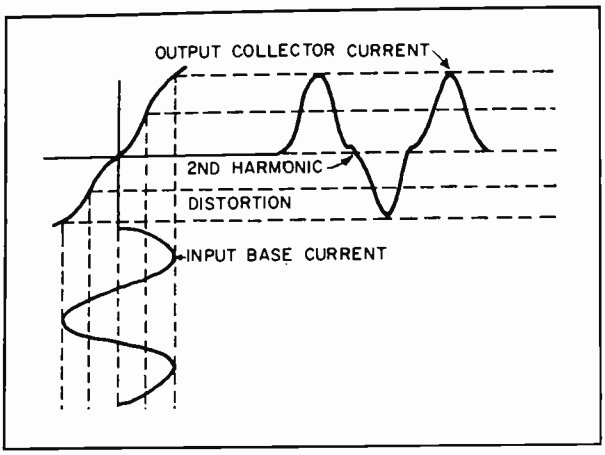


Figure 3. Crossover Distortion

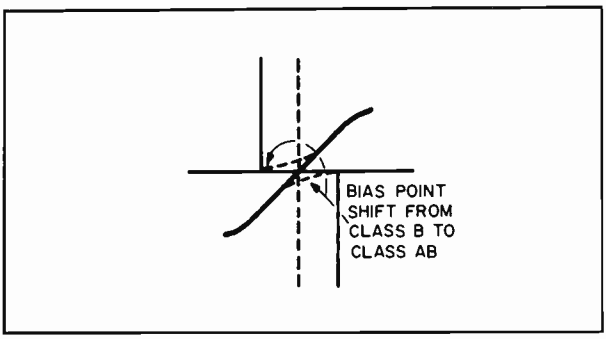


Figure 4. Bias Point Shift

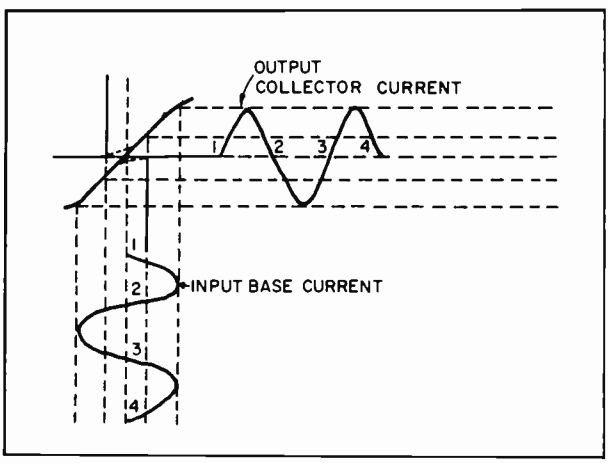


Figure 5. Class AB Operation

and PNP transistors are biased on to an established idling current for the specific transistors. The bias network, driver transistor Q406, and resistors R444, R442, connected in series from ground to B+, turn on the power amplifiers. The driver transistor in this network operates Class A for linear bias swings applied to the power output stages. The driver's conduction, under no signal condition, produces the voltage across R444 and R442. These IR drops, in conjunction with Q410 emitter voltages, set the idling current level of the output transistors.

The R446 voltage drop lowers the emitter voltage to approximately 15.9 volts, providing about 1/10-volt forward bias to the PNP stage Q410. Q408 emitter voltage is 16 volts, developed by the center bus. The voltage drop across R444 raises the base voltage to 16.1 volts, providing 1/10-volt forward bias to the NPN stage. The 1/10-volt provides the bias point shift from Class B

operation to a linear crossover, eliminating the crossover distortion and/or second-harmonic generation.

Center Bus Voltage

A look at the complementary symmetry circuit reveals the direct coupling from the pre-driver stage to the output. The output stage emitters are at a center bus voltage. When the system is not driven, the center bus voltage is approximately one-half the collector voltage of the transistor, which is connected to full B+ (see Figures 6 and 7).

The pre-driver stage Q404 is an inverted configuration PNP transistor with the emitter at half B+ and the collector grounded through a 5.6 K ohm resistor. A negative signal swing increases conduction through this stage, increasing the voltage drop across R438. This IR drop is positive in polarity, turning on the driver stage Q406. The increased driver conduction lowers the collector voltage. This voltage change is direct-coupled to the PNP power stage Q410 and represents an increase in forward bias. Simultaneously, the voltage decrease on the NPN stage Q408 represents a decrease in forward bias, lowering the conduction. C424-a 100 mFd/15 volt capacitor—supplies the B+ to the collector of Q410 during its conduction. The capacitor charges up to some value of voltage, depending upon the conduction of Q410.

When a positive signal swing decreases conduction through the pre-driver stage Q404, the voltage drop across R438 decreases. The IR drop is less positive, turning down the driver Q406. A decrease in driver conduction raises its collector voltage. The voltage change is coupled directly to the Q410 base, representing a decrease in forward bias on the PNP transistor. Simultaneously, the voltage increase to the NPN stage represents an increase in forward bias. As the conduction path for Q408 at idle was through Q410, now decreasing conduction, C424 discharges through the NPN power stage, supplying conduction current along with the current from Q404.

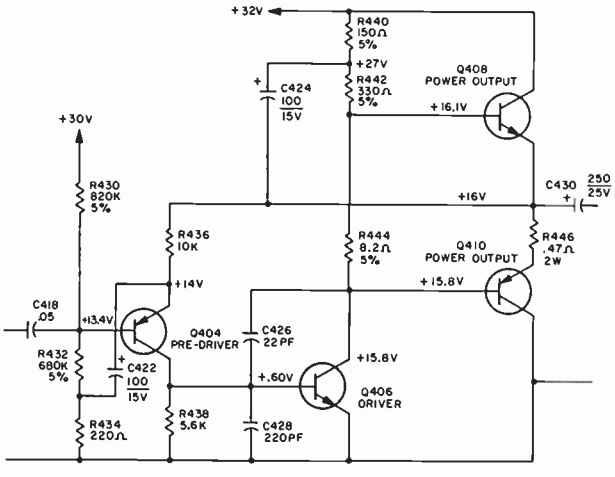


Figure 6. Germanium Complementary Symmetry Power Amplifier

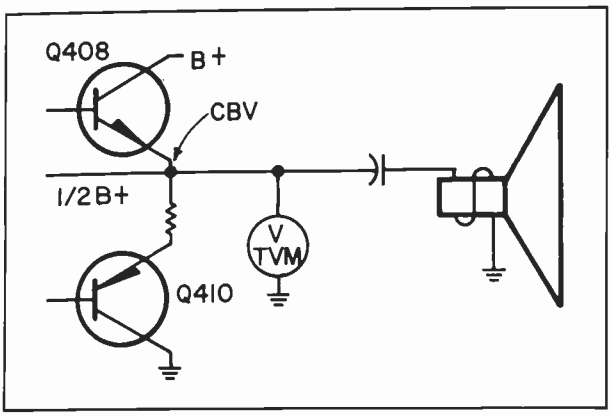


Figure 7. Center Bus

Silicon Complementary Amplifiers

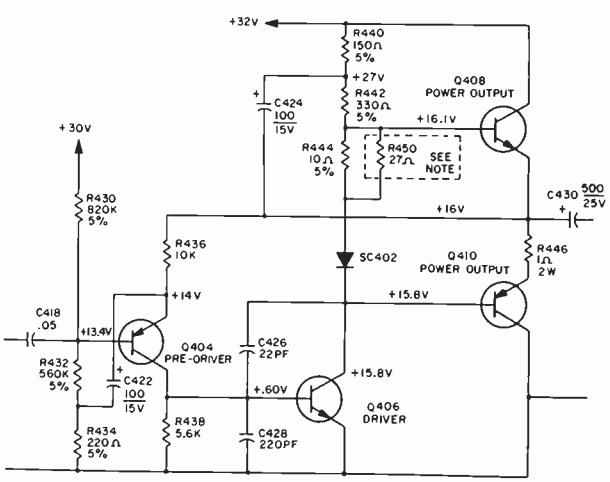
The use of silicon power transistors provides higher reliability and higher power dissipation. However, the bias networks take on a different look with the addition of a silicon diode (SC402—Figure 8) for both temperature stabilization and bias. The D.C. bias voltage developed across the transistor-diode-resistor network controls the idling current of the NPN and PNP output transistors.

The diode has a non-linear current-voltage relationship, the diode voltage drop falling less rapidly than the current flow through it. This characteristic matches that of the output transistors, providing a linear compensation. The temperature compensation of the diode lowers the forward bias on the transistor, where increased temperature causes increased diode conduction.

The diode has low resistance to audio currents and has less effect on the output stage swings than the series bias resistor in the network. Since the driver current flows through the diode, only the voltage drop across it becomes important when considering power stage forward bias.

Interpreting Center Bus Voltage

Normally, the complementary amplifiers center bus voltage is approximately one-half B+. C.B.V. (Center Bus Voltage) measurements pro-



NOTE - R450 ADDED ACROSS R444 TO ADJUST THE OUTPUT TRANSISTOR IDLE CURRENT TO UNDER 12 MA.

Figure 8. Silicon Complementary Symmetry Power Amplifier

vide positive clues to abnormal conditions or transistor malfunctions (see Figure 9). The trouble shooting chart shown indicates two types of transistor failure: shorted junctions and open junctions.

Q404 Pre-Driver

Short	*C.B.V.	Open	*C.B.V.
BC	1	B	B+
CE	1	C	B+

Q406 Driver

EB	21	E	½B+
BC	0	B	½B+
CE	1	C	½B+

Q408 PNP Power

EB	B+	E	B+
BC	—	B	B+
CE	½	C	B+

Q410 NPN Power

Short	*C.B.V.	Open	*C.B.V.	Vc	Vb	Ve
EB	4.5	E	15.5	0	15	15.5
BC	12	B	16	0	11	16
CE	10	C	16	0	15	16

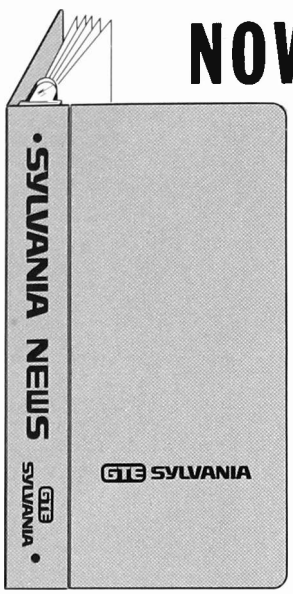
*C.B.V. (Center Bus Voltage)

Figure 9. Trouble Shooting Chart

NOTE: Sylvania markets a broad line of replacement solid-state devices known as the *Sylvania ECG Semiconductor Replacement Line.* These devices include a variety of ever-more-popular silicon plastic power transistors, a number of which are ideally suited for use in replacing audio power amplifier output stages of complementary

symmetry amplifiers. For convenience a quick selection guide, as well as a cross-reference listing to these ECG silicon plastic power transistors, is included in the *Sylvania ECG212D Semiconductor Replacement Guide and Catalog;* this catalog lists *over 41,000 industry types replaced by their 124 ECG semiconductor equivalents.* The quick selection guide (which was reprinted in the

1971 June/July issue of *Sylvania News*) provides a ready source of the basic electrical parameters together with package configuration and outline information on these silicon power types. The *Sylvania ECG Semiconductor Replacement Line* has built a reputation over the years of being *the* line to use when working with solid-state, home entertainment equipment; the ECG line and replacement guide are available from your local Sylvania Electronic Tube Distributor.



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Perhaps you aren't quite sure what comprises a "Service Hint." It should be nothing more than a simple method or device used to solve irritating or time-consuming service problems. It could be that you have obtained a simple, but unique, method for servicing a remote section of a chassis without removing it from the cabinet; maybe you have solved an electrical problem peculiar to a particular chassis—such as a remote component being responsible for the difficulty encountered in the section being serviced.

Any "Service Hint" *YOU* feel will be of value to others should be mailed to Technical Publications, GTE Sylvania Incorporated, Johnston Street, Seneca Falls, N.Y. 13148, Attn. Editor.

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IN THIS ISSUE

Sylvania News is sent free of charge. Each issue contains information of value to the independent radio/TV service dealer. Helpful servicing techniques, new processes, and the latest products are described. Sylvania thus offers its readers an important means of keeping tabs on some of the ever-changing complexities of the electronic servicing industry.

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HENRY ZIMMERMAN
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SYLVANIA
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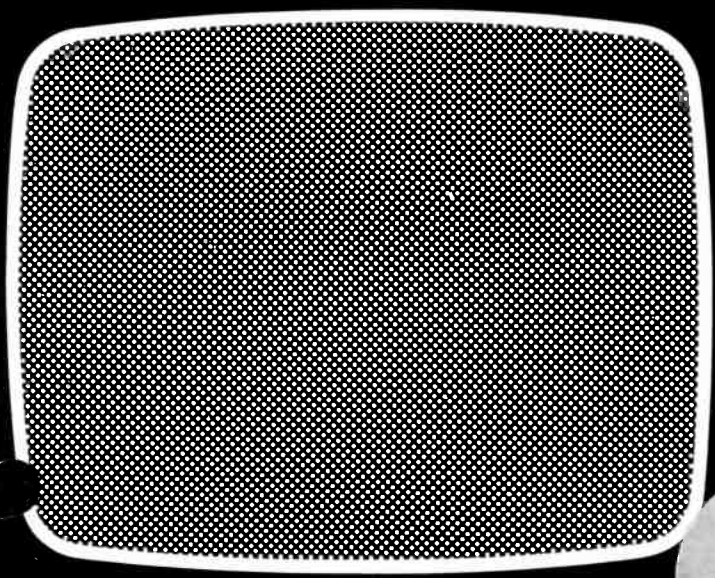


SERVICE INSPECTION OF COLOR PICTURE TUBE SCREENS

Occasionally a serviceman will receive a complaint from a customer about "dark spots" on the screen of a newly-replaced picture tube. This article describes the nature of these screen blemishes and their origin, general standards for the technician to apply in judging acceptability, and guidelines to follow in answering the customer's questions about these spots. Armed with a few of these facts beforehand, the serviceman will generally have little difficulty in satisfying the customer in the majority of cases *without the need of "pulling" the tube.*

Nature of Screen Blemishes

Screen imperfections fall into two general categories. The first type, in which one or more apertures of the shadow mask is blocked by a foreign particle, is usually due to excessive shocks occurring in transportation or handling.

The second type is that of some missing or partially missing phosphor dots. Since there are about one million phosphor dots on a screen, it is intrinsic to the screening process that there will always be a few of these dots lacking on any screen. This is true of any tube, regardless of manufacturer. In this sense, *there is no such thing as a perfectly uniform* screen.

Acceptance Considerations

The standards developed by the picture tube industry for judging screen quality are based on large numbers of tests in which observers' reactions to controlled screen defects under normal home viewing conditions were noted. Among the factors determined to be most significant are the size of the spot, the number of spots and their relative spacing (the further apart one spot from another the less objectional in viewing), the distribution of spots (the most critical area is that comprising approximately the central one-fourth area of the screen), and the contrast of the spot (high contrast spots appear black; medium contrast spots appear gray or as a lower brightness area).

The Sylvania Quality Control Program includes a rigid set of screen quality standards based on all of these and other performance factors —a program second to none in the industry in the exacting requirements demanded of every Color Bright 85® and Color Screen 85 tube shipped from our factory. Screen characteristics, as well as color purity, ease of set up, and other electrical parameters of the tube, are closely inspected at least two times on unique test sets for conformance to these demanding standards. Additionally, several further visual examinations of the screens are performed at various stages of manufacture; specially designed screen gages are employed to measure the precise limits of any screen blemish in determining acceptability of the tube. With the many refinements in design and manufacturing techniques developed over the years, these screen blemish tolerances have been repeatedly narrowed and are now only a fraction of the values then permitted.

Blocked Apertures

The blocked aperture can only be detected on the screen with a tube in operating condition since, when one or more apertures is blocked, portions of the electron beam are prevented from striking the screen and exciting the phosphors in one or more triads of color dots. The result is a dark spot on the screen of varying size, depending on the number of blocked apertures in the shadow mask.

Most blocked apertures result from a minute particle of internal coating or some other foreign substance being dislodged by a severe jar in transportation and falling forward onto the shadow mask. Blocked apertures may also be caused by the high voltage on the mask frame attracting these particles. Frequently, they may be removed from the mask by tilting the tube (or set) back so that the neck of the tube slants downward and giving the face of the tube a gentle tap with the open hand in the area of the spot. This often will dislodge the particle from the shadow mask and the spot will disappear.

Partially Missing Phosphor Dots

The second source of blemishes is that of missing or partially missing phosphor dots. These are usually found upon close examination of the face of the picture tube, such as might occur when the face of the tube is being cleaned. The tube, in this case, is unexcited and the missing dots appear as dark spots in the screen. These spots are usually not visible at the normal viewing distance of six feet or more. Also, the majority of these are not detectable when the picture tube is being operated and the screen is illuminated by the electron beam. Further, these imperfections are almost completely undetectable when a TV signal is displayed on the screen. *For these reasons, the color picture tube should always be inspected for screen blemishes only when the set is operating.*

Special Marks On Round Tube Screens

There are two unique aspects when considering the 21″ 70° round tube screen. One of these is best described as a crease or a streak in the glass that is easily mistaken for a scratch. This crease is actually a "shear" mark caused by the glass supplier's mold during panel manufacture and characteristically appears to one degree or another in all 21″ round tube screens. This shear mark, however, is outside the viewing area of the screen (the mark always appears within the area covered by the receiver bezel) and is therefore of no practical significance **(see Figure 1).**

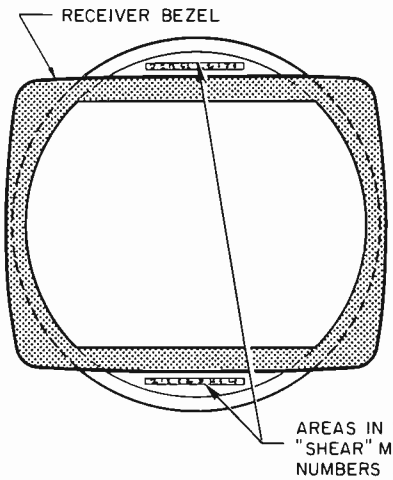


Figure 1. Location of Special Marks on 21″ 70° Round Tubes

The second characteristic unique to the 21″ round screen is that a series of numbers will sometimes be seen towards the outside of the screen. These are code numbers used for identification purposes during manufacture and again these appear outside of the viewed area and are therefore of no consequence.

Customer Considerations

Once a customer has become aware of spots on a color screen, human nature asserts itself and he tends to become hypercritical and objects to the slightest imperfection. Forearmed with the necessary knowledge, at this point it is extremely important for the technician

to carefully inform the customer of the factors considered in arriving at the generally accepted industry screen standards and that every picture tube shipped by Sylvania has passed a battery of screen quality inspections which are among the most demanding in the industry. Further, it should be explained that the intrinsic nature of the screen with its approximately one million phosphor dots means that no screen of any manufacturer, as a practical matter, is completely free of blemishes.

When checking the customer's complaint of a screen blemish, the tube should always be observed at normal viewing distance under usual room lighting conditions and with a TV signal displayed on the screen. This procedure ensures that the evaluation is performed under realistic viewing conditions—the only meaningful standard upon which to judge acceptability. Experience has shown that by following these guidelines, the serviceman will have little difficulty in quickly resolving the majority of screen quality complaints.

Further Sylvania Screen Inspection Aid

Since actual application of Sylvania's screen quality inspection standards to determine acceptability of a given tube is a precise procedure requiring the use of special gages, space does not permit including the information here. For more specific details of these procedures, contact your local franchised Sylvania Electronic Tube Distributor.

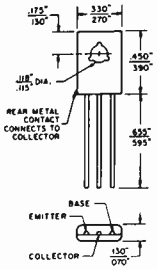
QUICK SELECTION GUIDE TO ECG SILICON PLASTIC POWER TRANSISTORS

The great variety of plastic power transistor configurations more and more commonly found in entertainment equipment can pose a serious challenge to the service technician faced with the problem of finding a suitable replacement. These devices appear in a seemingly endless array of different styles, shapes, sizes, and electrical characteristics. The Sylvania ECG semiconductor line now goes a long way to ease this problem for the serviceman by offering a few, carefully-designed plastic transistor types which provide replacement coverage in the majority of these cases.

On the facing page is a convenient guide to these ECG devices to facilitate selection of the appropriate replacement transistor for your application. The chart provides package outlines for rapid visual identification plus major electrical parameters of the ECG device. A few handy service hints to aid in the replacement job follow. The full ECG replacement line of semiconductors is available from your local, franchised Sylvania Electronic Tube Distributor.

In general, it is recommended that transistors in push-pull, parallel, complementary sym-

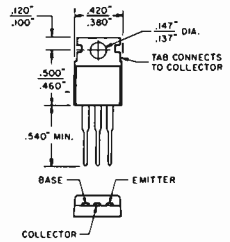
Quick Selection Guide To ECG Silicon Plastic Power Transistors

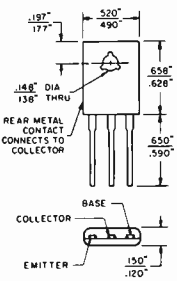


ECG157-NPN
300V, 500mA, 20W

ECG184-NPN } **C.P.***
ECG185-PNP
60V, 4A, 40W

ECG152-NPN } **C.P.***
ECG153-PNP
60V, 4A, 40W

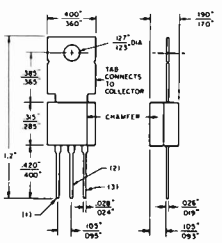


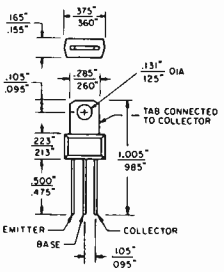


ECG182-NPN } **C.P.***
ECG183-PNP
80V, 10A, 90W

ECG171-NPN
(1) Emitter
(2) Base
(3) Collector
300V, 100mA, 6W

ECG186-NPN } **C.P.***
ECG187-PNP
(1) Base
(2) Collector
(3) Emitter
60V, 3A, 12.5W





ECG188-NPN } **C.P.***
ECG189-PNP
80V, 1A, 5W

ECG190-NPN
180V, 1A, 8W

ECG191-NPN
300V, 1A, 1W

C.P.*—These Devices may be used as Complementary Pairs.

metry, and "quasi"-complementary symmetry circuits be replaced in pairs. Following this practice simplifies balancing of the circuit as well as improving performance and reliability of the job. NPN/PNP types suitable for replacing in complementary pairs are noted in the chart.

After selecting a suitable ECG device from the guide on the basis of space and electrical considerations, compare the basing arrangement of the original transistor to the replacement

type. The pins of the ECG package may be formed as required for the specific application; however, *certain precautions must be observed when bending the pins of these plastic semiconductors,* as the internal connections of the pins to their junctions may be easily disrupted if subjected to axial force (outward pull from the plastic body).

To avoid pulling when bending a pin, always restrain the pin firmly by holding with a pair of needle-nosed pliers or tweezers located at least ⅛ inch away from the transistor body **(see Figure 1).** Maintain about a 1/16 inch bend radius. Avoid twisting and repeated bending of the pins. By following these procedures, the pins may be safely bent in any required direction. Cut the pins to length and insulate if necessary to prevent short circuits. Mount the transistor *before* soldering the pins.

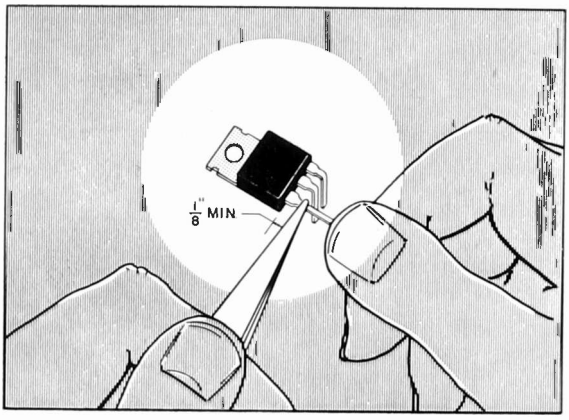


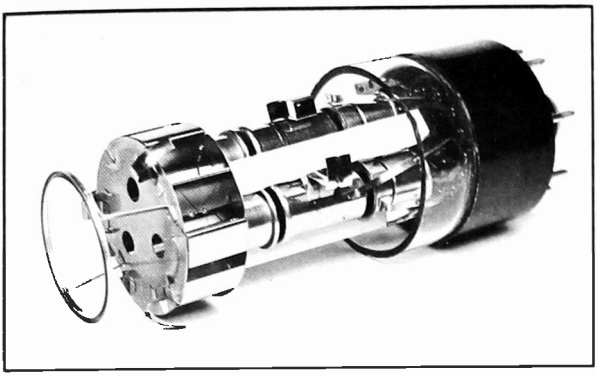
Figure 1. Bending Plastic Transistor Pins

Use the appropriate mounting hardware called for by the specific application—insulating bushings, mica washers, etc. When an insulating washer is required, apply a thin even layer of ECG 406 silicone grease to both sides of the washer to ensure maximum thermal transfer. The ECG line includes a variety of heat sinks and insulator kits for this purpose. Exercise care that the tool used to tighten the transistor retaining bolt or nut does not contact the transistor body. Do not use more than six inch pounds torque. (An average male can exert about 50 inch pounds torque with a screwdriver).

After mounting the transistor, connect the pre-formed transistor pins to their respective circuit connections, observing the precautions previously stated. The pins may be carefully wrapped to wire leads and terminals—again, *if pulling forces on the pin are avoided.* Check to be sure that the circuit connections do not exert "pull" on the pins. Solder the connections following good solid-state practice: use a small, hot iron, rosin-core solder, and provide a heat sink such as pliers between the transistor body and joint to conduct heat away from the device. Solder as quickly as possible.

To complete the replacement job, the transistor bias in high-power applications should always be checked and adjusted as necessary to prevent excessive dissipation and to minimize distortion. Follow the instructions provided by the equipment manufacturer for this procedure.

THE CASE OF THE BROKEN NECK . . .



Here's a simple little service hint that could well save you from replacing a color picture tube *two times* some day—a needless and expensive procedure, you'll agree. In the above photograph you see a picture from an actual case history in our files of what met the eyes of one technician who was called back by the customer not long after the picture tube had been replaced. Complaint was sound but no raster —small wonder!

What happened? Note the clean-cut edges along the picture tube neck. It looks almost as though this tube had a glass-cutter "operate" on it, but not quite. During installation of this replacement tube, a few tiny particles of foreign material had been lodged between the blue lateral magnet and the picture tube neck. During set up of the tube, the magnet was rotated about the neck; those little particles acted as "cutters", neatly scoring the glass and setting up local stress patterns. Subsequent heating and cooling of the tube during operation then resulted in the condition seen in the photograph. Longitudinal or diagonal scratching of the glass surface could also give similar results.

To prevent this condition, a simple procedure during removal and installation of any picture tube is in order:

1. *Completely* loosen all clamps securing components to the picture tube neck before moving any parts. Carefully slide all parts straight out from the neck when removing, being careful not to exert any "bending" forces on the neck by cocking of the components.

2. Make a check of the inner surfaces of all neck components, including shims, for freedom from burrs and foreign matter your standard procedure. Wipe all parts, including the tube neck, with a clean cloth; remove burrs from neck components as necessary.

3. Before installing neck hardware on a tube, check that any required shims are in place. Reverse the procedure of step one, aligning shims with their respective components. Do not overtighten clamps.

The few seconds taken in following these easy steps can well prevent you from personally encountering a "case of the broken neck".

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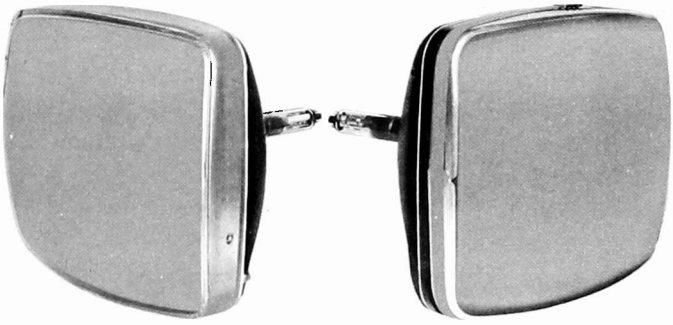

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23VAUP22 Westinghouse Astro-Brite	25BZP22
23VAXP22 Zenith Chromacolor	25BP22A
23VBEP22	25CBP22
23VBGP22 Admiral Solarcolor	25CP22
23VBHP22	25FP22
25AP22A	25GP22
25ABP22A	25RP22
25AEP22	25SP22
25AFP22	25VP22
25ANP22	25WP22
25AQP22	25XP22
25BAP22 Zenith Chromacolor	25YP22
25BCP22 RCA Matrix	25ZP22

XR23VAQP22/SRE25BHP22 Replaces Industry Types

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23VADP22	25ASP22
23VAQP22	25AWP22
23VAWP22 Westinghouse Astro-Brite	25AXP22
23VAXP22 Zenith Chromacolor	25AZP22
23VBAP22 Zenith Chromacolor	25BHP22
25ADP22	25BSP22
25AGP22	25BWP22

REPLACING 21" ROUND COLOR TUBE TYPES 21AXP22A AND 21CYP22A WITH XR19VABP22

The recently-published Sylvania Color Bright 85 XR Interchangeability Guide (ET-1170-71W) refers to an article entitled "Color Fidelity for Older Color Receivers," which describes a tube-mounting modification procedure to permit replacement of the older 70° round 21AXP22A and 21CYP22A types with the XR19VABP22. This article appeared in the 1965 Summer-Fall issue of Sylvania News. A reprint of this article can be obtained from

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The regular subscription period is from May through April. Literature available and ordering information are tabulated below.

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1971/1972 Subscription (Covers 1972 Models)	$8.00
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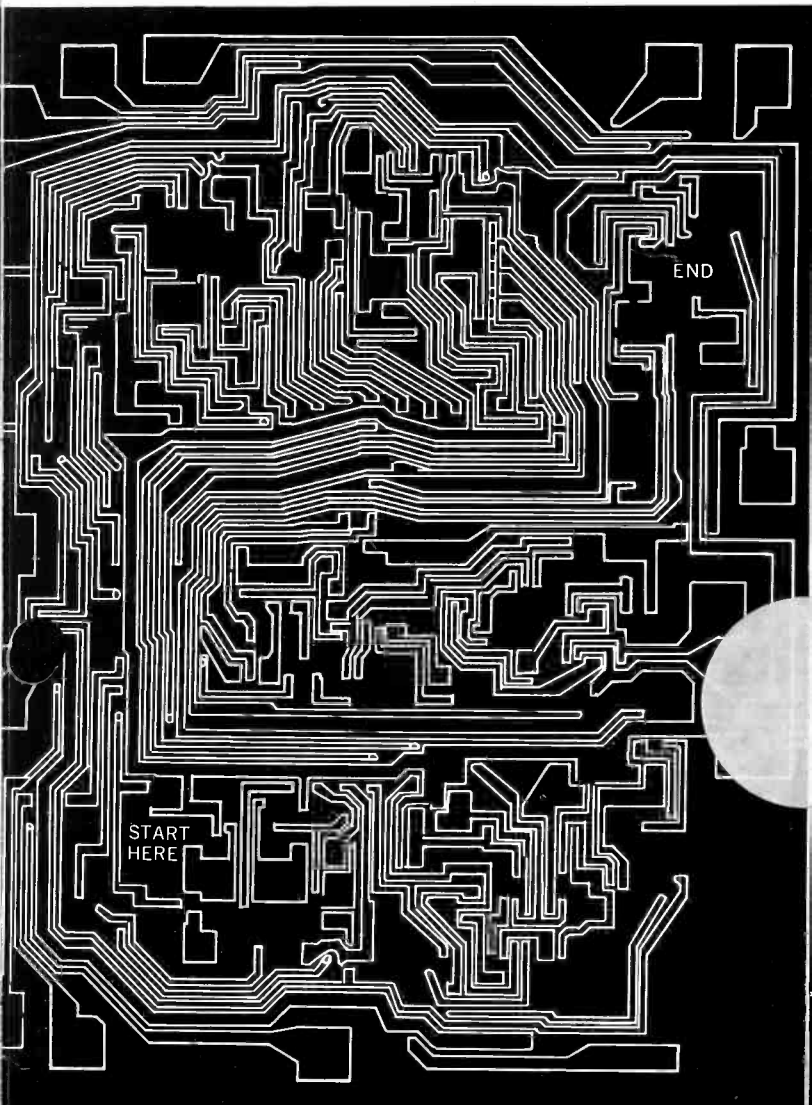
SYLVANIA
NEWS
TECHNICAL INFORMATION OF INTEREST TO THE INDEPENDENT RADIO/TV SERVICEMAN



Logical Troubleshooting Saves You Time

Time is the "name-of-the game" in servicing. In order to operate profitably, valuable service time must be used in the most efficient manner possible. To achieve this, many technicians are seeking new troubleshooting methods to become more proficient at their jobs and do more in a shorter time. This approach is essential to survival in the television service business. Too often television servicing problems are approached without logic. Today, sophisticated color television circuits demand a logical approach to service due to their complexity. This article relates some basic logic rules to general service problems.

Let's look closely at color television service logic **(Figure 1)**. The tuner, an electro-mechanical

device that appears quite complicated, does the same job in every television set. It selects the signal of the desired station, amplifies it, then converts it to an intermediate frequency the set is designed to accept. All tuners perform this same function, regardless of whether they are tube or transistor circuits, switch or strip tuner.

The tuner output is fed to the IF amplifiers for further amplification. Most color receivers trap the sound carrier at the 3rd picture IF amplifier, using other traps further along the video circuit to eliminate sound from the picture.

Should the set lose sound, yet still have a good picture, most technicians go straight to the sound circuit.

But suppose video is lost; then the sound becomes even more important. If good sound is present, then all circuits up to the 3rd IF are eliminated. It would take a very unusual problem to eliminate video and still pass good sound farther back. Many technicians tend to overlook the video **(Figure 2)** detector for this trouble because most of the black and white sets they have serviced for years have the sound take-off point after the video amplifier, and detector failures, in this case, would affect the sound.

Since video loss is a common problem, let's continue. If the set has good sound and no video, then the next logical step in isolating the problem is to determine if chroma is present at the CRT. If it is, the color will be present even without video as the chroma control is advanced. This tells us much more, because the chroma signal is usually separated from the video in the 1st or 2nd video amplifier **(Figure 3)**. In certain chassis, chroma is taken from the emitter of the 1st video amplifier. This further eliminates the circuitry up to the 1st video amplifier. If chroma is not present at the CRT, then we have actually isolated the problem to a point between the 3rd IF and the 1st video amplifier (and without any test equipment to this point!). Of course, the assumption is that a known color cast or a standard color bar generator is the signal source.

Should the problem be a complete loss of color with a good video signal present at the CRT, then time is wasted checking anything before the 1st video amplifier. The fact that we have good video tells us everything is fine up to that point. Problems such as misalignment, causing loss of color, are few, and a different subject all together. Here we are assuming the set in question was operating satisfactorily, then failed all at once. This article does not deal with alignment problems, but is intended for the usual shop repair job.

Discussing complete loss of color a little further, the color difference amplifiers can be eliminated, because a failure here would also affect the black and white picture. We could probably also eliminate the demodulators, because both demodulators would have to fail to completely kill all color. Otherwise, one or more colors would be present. Also, the 3.58-MHz oscillator and reactance control circuits can be eliminated, because a failure here with the rest of the chroma circuitry operating would give a green or purple cast to the picture, depending on the phase of the demodulators. In other words, some color would still be present at the CRT. Now we have isolated the problem

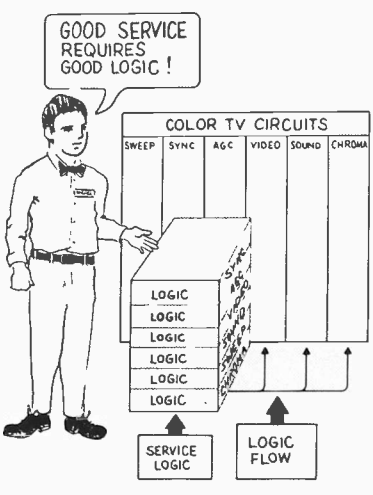


Figure 1

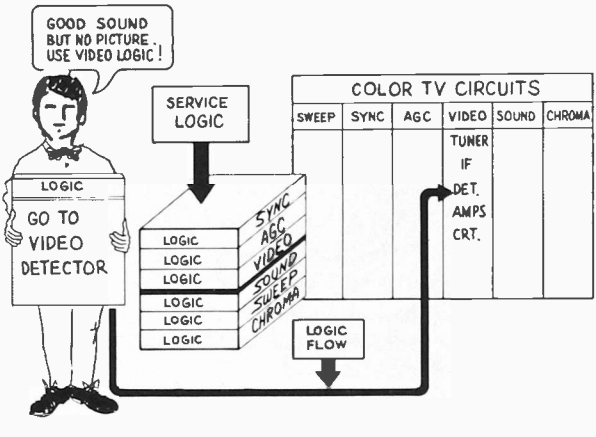


Figure 2

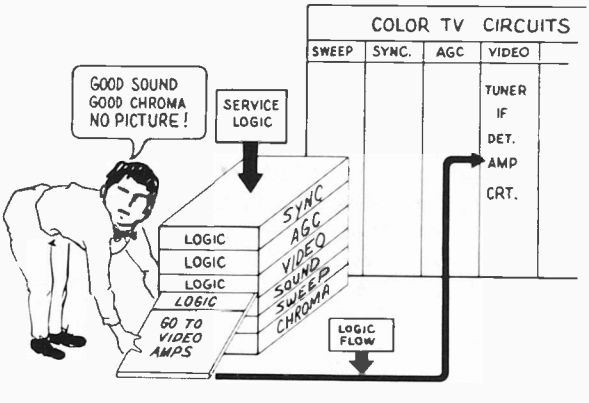


Figure 3

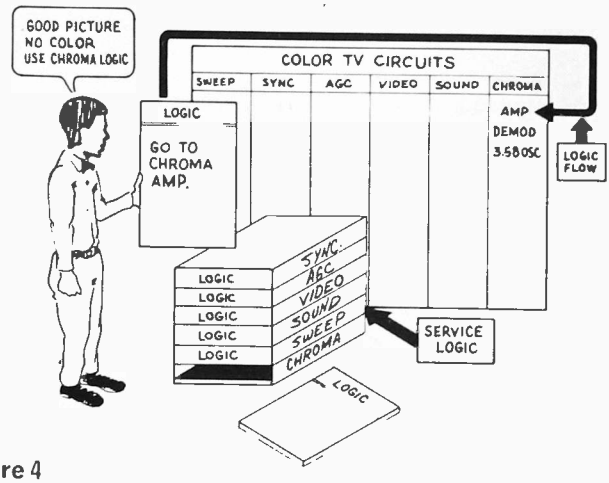


Figure 4

between the 1st **(Figure 4)** video amp and the demodulators—without any equipment, just logic.

Probably the least understood circuit, and the most difficult to troubleshoot, is the AGC circuit. Today the better sets use a gated or keyed AGC circuit; it is a little more complicated than some ordinary AGC circuits but it is by far the best. Also, it is probably easier to trouble-shoot—*once its function is understood.* In certain chassis, a gating pulse from the flyback transformer is used to turn on the AGC gate at just the right time. This pulse is always constant and is an excellent reference signal. Some AGC circuits operate on changes in the video level, but the best system uses the station sync signal, because any change in the signal strength will directly change the amplitude of the sync pulse. If the video signal were used, changes in picture contrast would affect AGC.

In the keyed AGC system, the amplitude of the sync pulse is compared with the flyback pulse, and any changes in sync pulse amplitude result in a different conduction level in the AGC amp. This causes a change in the AGC voltage applied to the tuner, at a certain point, and forward biases the AGC threshold diode, causing the 1st IF amp to conduct through the diode instead of through the emitter resistor, thereby changing the gain in the 1st IF amp **(Figure 5)**.

To properly troubleshoot the AGC circuit, it is necessary to determine if the flyback pulse and sync pulses are present. Once this is established, then DC measurements should locate the trouble.

To summarize, *before you spend too much time convincing yourself how complicated the set is*, spend a few minutes checking the schematic to determine the operation of the set. *This is the most logical starting point.* If familiarity with a circuit is required, a few minutes reading the circuit description in the front section of the service literature should save quite a bit of time **(Figure 6)**.

In most cases, just five to ten minutes familiarizing yourself with the circuit in question will save an hour or more probing around in an unfamiliar circuit. If we apply more knowledge and better logic, real tough dogs become just routine repair jobs **(Figure 7)**.

Repairing Record Changers

Most record changer troubles are one of the following types: Changer runs too slow or not at all, will not reject, will not shut off after the last record; bad stylus or defective cartridge. Other troubles can arise, but those mentioned are the most common.

A slow turntable can be caused by a worn idler wheel, oil-slick turntable, insufficient lubrication, or an over-heated motor. Check the idler wheel for slick and worn spots. If the turntable thumps while revolving, the idler wheel has a flat spot on it. Replace the wheel. The turntable can be cleaned with a variety of approved cleaning fluids. Check the motor pulley to see if it is in the correct vertical position.

Rumble in the amplifier may be caused by a turntable in one of several ways. The motor

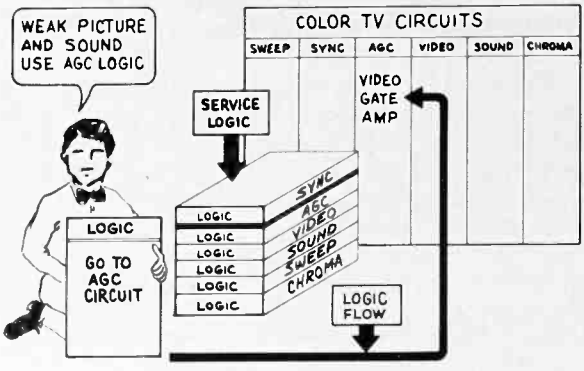


Figure 5

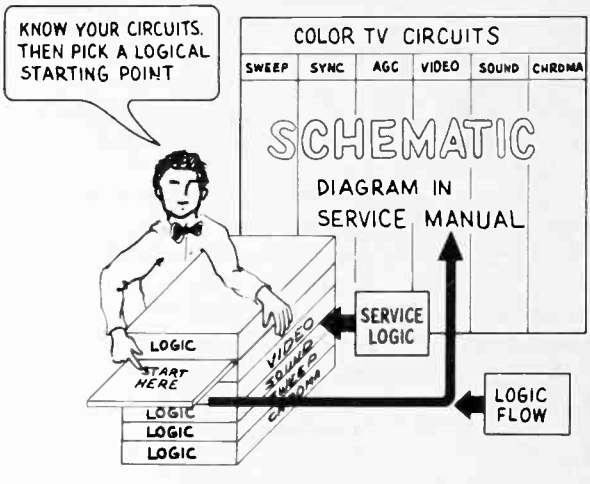


Figure 6

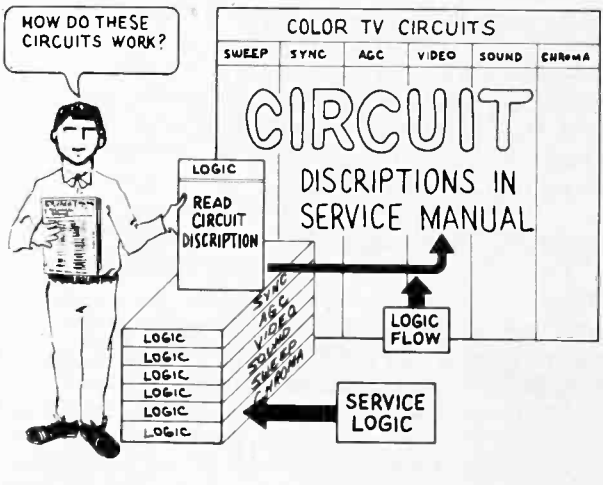


Figure 7

suspension may not be free and could be bearing on a solid part of the mounting frame. A dirty and hardened or cracked idler wheel tire may also produce this symptom. If the motor shaft is out of alignment, replace the motor.

A slow motor is usually caused by friction in dry bearings and drive wheel bearings. Lubrication hints are given later in this article. If the motor gets very hot after being run for two hours and slows down, replace it with a new motor assembly.

Sometimes a turntable bearing will become dry and freeze to the spindle shaft assembly. Look for small metal shavings in and around the bearing. Check the reject mechanism for lubrication and bent levers. Make certain that the reject system works freely.

Another changer problem is shutting off when only part way through the last record. On some changers, the arm that holds the record down against the spindle determines the shutoff point when the last record is played. Only the thickness of the last record will hold the trip up so that the last record will play its required time. Usually, the trouble here is that the owner will pull on the stabilizer arm of the spindle shaft. In time this will spring the arm and cause the changer to shut off before the last record is played.

The stabilizer arm is also frequently left off to the right and is not in position on the record. This will cause the changer to play the last record over and over again. If bent, the arm should be straightened and the owner notified on how to handle it properly to prevent recurrence.

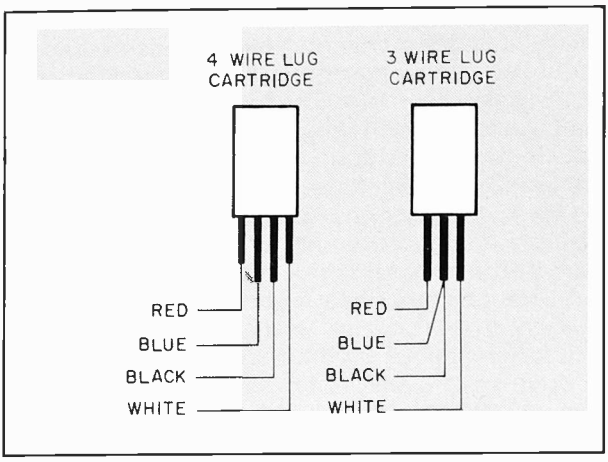
An oily spot, uneven, or unbalanced turntable will cause "wow." Wow is a variation in pitch that takes place very slowly—less than 10 Hz. It is the same as flutter except that wow variations are at a slower rate. The turntable should be removed and the motor pulley, idler wheels and turntable inside rim should be wiped clean and dry with a cloth. The turntable should be balanced and the records checked for uniformity. The hole should be in the exact center. Make sure it has not been damaged or frayed.

The usual points to check for a groove-skipping complaint are: improper tracking force, damaged stylus, excessive friction at tone arm base, tone arm lead dress, or defective record. If, after checking these, you find that the groove-skipping persists, try replacing the cartridge.

Cartridge and Stylus

A diamond stylus will last much longer than sapphire before it begins to damage records. Also, any stylus will begin to gouge away at record grooves before it causes distortion and noise. Give your customers the facts about stylii and let them decide which kind they prefer.

A defective cartridge will cause distortion, mushy audio, intermittent audio, no sound, low volume, or poor stereo balance. Poor balance occurs when the voltage output on one channel of the stereo cartridge is up or down, as compared to changes in the other side. If you observe intermittent changes in audio, check the stereo cartridge first. A defect in the cartridge can often be made to show up by placing a small amount of pressure on the tip of the pickup arm—varying the pressure up and down. Make sure there are no loose or shorting connections at the cartridge or the turntable.



Weak or no volume cartridge symptoms are diagnosed by turning the volume full on. You will hear more-than-normal hum pickup. Touch the ungrounded side of the cartridge connection and a loud hum will be heard.

When a symptom of intermittent phono audio on either or both channels develops, it is generally caused by a defect in a preamplifier stage or a bad connection at the head of the tone arm. Troubleshooting in these areas will reveal the cause of the problem, thus avoiding unnecessary cartridge replacement.

Heating, cooling and tapping techniques will usually reveal an intermittent transistor or component in the preamp circuits. Oxidation, tarnish, or weak pressure on the silvered cartridge mounting contacts may cause distortion or intermittent audio.

Here are some tips to remember when replacing a stylus or cartridge. 1) Place a small white cloth or handkerchief under the pickup arm to catch all small screws that may drop. A major "dog" job can develop when a tiny screw falls down under the changer and into the amplifier section. 2) Handle the cartridge with extreme care. 3) Be exceptionally careful when changing that stylus. 4) Use a slotted-wedge screw driver to hold the screw into position when you install a new cartridge and do not drop the cartridge! 5) Use an exact replacement cartridge or the nearest one that you can find to the original.

When substituting a replacement cartridge for the original, check the output voltages and weights. Match them as closely as possible.

If you are replacing a three-wire cartridge with a four-wire cartridge (see illustration), or vice versa, remember that the center wire on the three-wire and the middle two wires on the four-wire system are ground. Avoid soldering directly to a cartridge by using the miniature terminals available especially for this purpose.

The tone or pickup arm should be secured in a safe position when working on the changer or when the stereo player is being delivered to the customer. Tie the arm to the center post or snap the arm into its holder, if one is provided.

Lubrication

Relubrication of a changer is normally not needed for the first two years of use. All important bearings are usually provided with oil retainers and sintered bearings. If lubrication should be needed, use those designed specifically for the purpose. Different lubricants are normally specified for a) motor and sintered bearings,

b) sliding and bearing points, c) turntable and drive wheels, d) points of greater pressure and friction, and e) cueing compensation mechanism.

Lubricate the motor bearings, idler wheel, small turret drive wheels and turntable bearings. Use a minimum of lubricant on the moving parts! If you apply too much oil, it will eventually work into the moving rubber parts and cause the turntable to slow down due to slippage. To prevent this, run the motor for an hour or two; then wipe off the excess oil or grease from the moving parts. It is of primary importance that no oil or grease get on the friction surfaces of the drive wheels and motor pulleys. Avoid touching these parts with dirty or greasy tools or fingers.

ECG Semiconductor Replacement Line Expands

Listed below are the most recent additions to the expanding line of ECG semiconductors and some of the types they replace. The new types include B and W and color set deflection transistors, damper diodes, high voltage triplers, and linear integrated circuits for color TV sets.

Included among these new ECG replacement devices are many types for imported sets, which can be so difficult to find. Undoubtedly the most useful tool associated with the ECG semiconductor line is the ECG212C *Semiconductor Replacement Guide*, now in its third edition and continually revised as the need warrants.

The entire ECG replacement line of semiconductors, as well as the 74-page ECG212C *Semiconductor Replacement Guide*, are available from your Sylvania electron tube distributor.

ECG162
NPN—Silicon Power Transistor for Vertical Deflection and Audio Power Output

Replaces
Magnavox—64N1, 610064-1
Motorola—A1C, M4900, Q-1H
HEP—707
Sylvania—13-33182-1
Zenith—121-449

ECG163
NPN—Silicon Power Transistor for Horizontal Deflection

Replaces
Magnavox—610063-1, 63N1
Motorola—A1D, A3H, M4901, M4995
Q6F-Q7F "Quasar"
Zenith—121-452
Sony—2SC41, 2SC41 TV

ECG164
NPN—Silicon Power Transistor for Vertical Deflection. For Large Screen Color and Black and White TV

Replaces
Zenith—121-758, 121-758X, 121-821, DTS0713, ZSC-1004A
Used in Imported Sets as Type Numbers:
2SC642A, 2SC936, 2SC1004, 2SC1004A

ECG165
NPN—Silicon Power Transistor for Horizontal Deflection. For Large Screen Color TV

Replaces
Sylvania—13-33181-1
Zenith—121-759, 121-759X, 121-831
Used in Imported Sets as Type Numbers:
2SC643A, 2SC937, 2SC1005, 2SC1005A, 2SC1170, 2SC-1170A, 2SC1172, 2SC1172A

ECG171
NPN—Silicon Power Transistor for Audio, Video Amplifiers, etc.

Replaces
This unit is a higher rated replacement for:
Sylvania—13-33174-1, 13-33176-1
Zenith—121-822

ECG172
NPN—Silicon "Darlington" Amplifier, for Low-Level, High-Gain, Low-Noise Audio Pre-Amplifiers

Replaces
Decca—2N5308, 16P2881
Zenith—2N5525, 121-752, 964-2209, 964-22009
Sylvania—13-29775-1, 13-33175-1
Telex-Phonola—16P3367, 42-22009, 22009
Truetone—16P3367, 55-641, D16P2, MA10
Sears, Phonola—42-22009
Arvin, Sears—95296
Penncrest D16P2
Columbia Rec'ds—IC-101, MA10
Symphonic—TX123

ECG173
5000 Volt Silicon Damper Diode

Replaces
RCA—010, 120818
IR—D818
Workman—S5000

ECG174
Germanium Damper Diode for use in Small Screen Portable TV Sets. *Exclusive in Sylvania ECG Line*

Replaces
Sylvania, GE, Airline, Crown 1S689, 1S689A
Toshiba—1S1465, 23115016
Triumph—1S1657
Hitachi—0575048
Sylvania—0575048H
Midland—15-085042
Sears—46-86104-3
Admiral—2093B41-33
AMC—A2424
GE—ES16X10
Sharp—SI-Rect-48
Airline—TV24218, TV24649, DG-14

ECG175
NPN—Silicon Audio Power Amplifier

Replaces

2N3441	2SC680A	HEP241
2N3483	2SC830	HEP703
2N3766	2SC830A	GE-23
2N3767	2SC840	GE-24MP
2N3879	2SC840A	(Use 2)
2N4231	2SD125	MJ2249
2N4232	2SD144	MJ2250
2N4233	2SD145	MJ3101
2N5050	2SD152	MJ4101
2N5051	2SD154	MJ4102
2SC487	2SD226	SJ811
2SC488	2SD226A	SJ1172
2SC489	2SD226B	SJ3447
2SC490	13-23543-1	SK3026
2SC680	34-1026	SK3028 (Use 2)

ECG176
PNP Germanium Transistor for Audio High-Power Amplifier

Replaces
Such types as 2SB492

ECG177
Silicon General Purpose Diode for Detector, Switching, Clipper, Gating, Blanker and Damping Applications for TV/Radio/Stereo. The ECG-177 has controlled switching time to ensure operation in "fast" circuits.

Replaces
DC Restorer, Gating Diodes, etc.

ECG178MP
Matched pair of Silicon diodes for AFC, AFT, Detector, Color Killer Applitions, etc.

Replaces
Such types as 1N4092, 1N4093

ECG500
Silicon 30-Kilovolt Tripler

Replaces
Sylvania—32-29778-1, 2, 3, 4 32-33057-3, 32-33094-5
Zenith—212-102, 212-103

ECG501
Selenium 30-Kilovolt Tripler Plus External Focus Capacitor (10,000 Volt—2500 pF)

Replaces
Zenith—212-108, 212-109, 212-110
Wells-Gardner—66X0045-001

ECG502 High Voltage Rectifier—11,000-Volt P.R.V.	**Replaces** Motorola—48S137081 Zenith—212-66, 212-67
ECG503 High Voltage Rectifier—13,000-Volt P.R.V.	**Replaces** Magnavox—530119-1 Motorola—48S137082
ECG504 High Voltage Rectifier—18,000-Volt P.R.V.	**Replaces** Zenith—212-95
ECG505 High Voltage Rectifier—20,000-Volt P.R.V.	

INTEGRATED CIRCUITS

ECG712 TV Sound IF Detector/and Electronic Attenuator	**Replaces** Sears—13-29-6 Sylvania—15-33201-1 Zenith—221-48
ECG713 Chroma Demodulator	**Replaces** Zenith—221-46
ECG714 Color Subcarrier—Regenerator	**Replaces** Zenith—221-42
ECG715 Chroma I.F. Amplifier	**Replaces** Zenith—221-43

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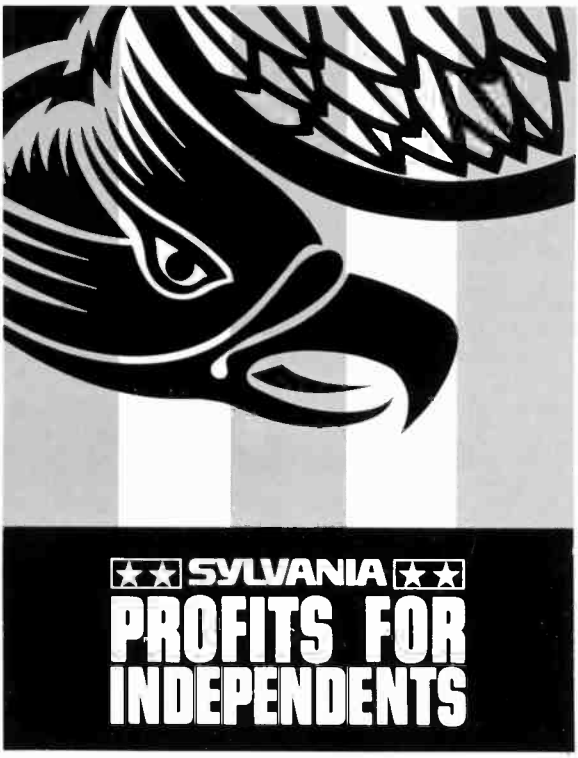

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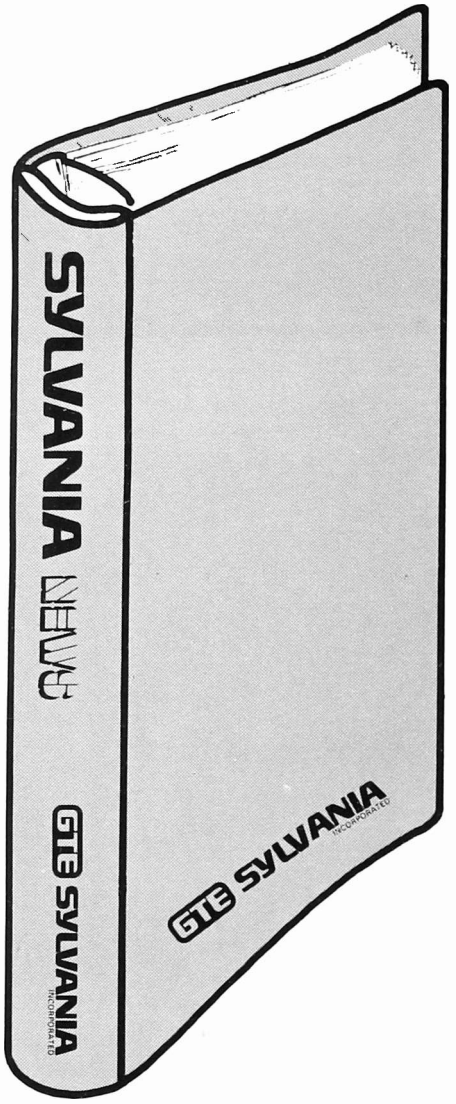

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SYLVANIA
NEWS
TECHNICAL INFORMATION OF INTEREST TO THE INDEPENDENT RADIO/TV SERVICEMAN

A Solid-State Quick Checker

The simple circuit described in this article, used in conjunction with any standard service scope, provides a rapid, convenient method of checking diode and transistor junctions, both in circuit (unpowered) and out. With some practice to gain familiarity with typical junction displays, the tester can greatly reduce troubleshooting time. For our purpose, interest centers in the well-defined, sharp-cornered waveform which is characteristic of a good junction; conversely, the tell-tale rounded waveform, when displayed on the scope, is an immediate indicator of trouble.

The following components are required to construct the circuit: a 110 to 6.3 VAC filament transformer, one 300-ohm and one 3000-ohm resistor, a pair of insulated probes, a two-

pole, single-throw switch, some wire, a mounting panel, and a case. Wire the circuit as shown in **Figure 1**.

Essentially, the tester applies a 60-Hz, 6.3 VAC sine wave to the junction under test so that its response may be observed on the scope. **Figure 2** shows some typical Go characteristics for junctions checked out-of-circuit.

No-Go characteristic displays show either straight lines or rounded corners, as shown in **Figure 3**. When checking solid-state junctions in circuit, however, Go characteristics can be masked by circuit capacitance, resistance, and inductance; it is here that some time invested in practice-reading of known good devices in-circuit will pay off in time saved later on, avoiding confusion and the replacement of semiconductors unnecessarily. These circuit parameters will cause some modification to the junction characteristics displayed on the scope. Some typical in-circuit junction characteristics are shown in **Figure 4**. Even in circuit, a sharp corner somewhere on the curve, indicating an abrupt current change, is still the tip off to a Go junction.

In using this tester, signal polarization is not important, as in these Go—No-Go checks the sharp corner of the diode curve is the determinant to a good or bad junction. Each transistor has three checks with this method: one for each junction plus the collector to emitter test (points 1, 2, and 3 on **Figure 5**).

In some collector to emitter tests, an apparent No-Go diode characteristic may actually be due to an improperly dressed transistor or one which is incorrectly soldered into the circuit. Here again, a bit of practice is the answer to making recognition of this type of problem quick and easy. Breakdown can occur from collector to emitter, collector to base, and base to emitter; each breakdown shows a specific type of pattern. However, check the base-emitter junction first, as most breakdowns occur here. Typical Go junction displays for the three checks are shown in **Figure 6**. Watch for the sharp-cornered waveform.

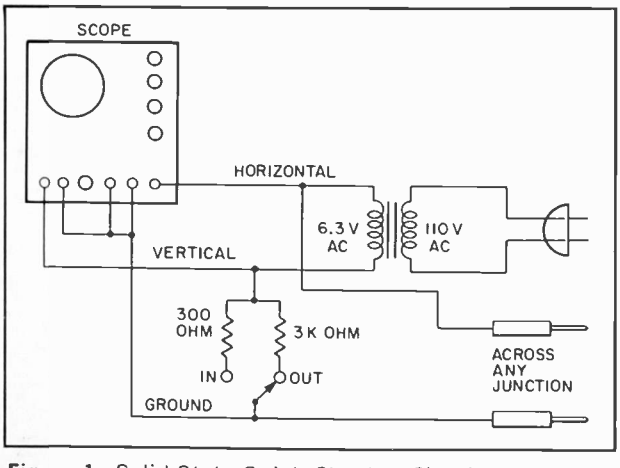


Figure 1—Solid-State Quick Checker Circuit.

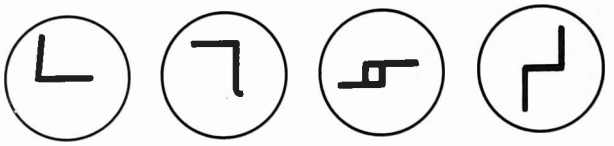


Figure 2—Go Characteristics—Out-of-Circuit.

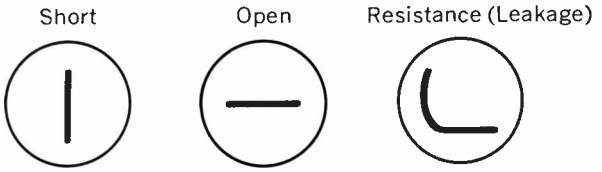


Figure 3—No-Go Characteristics.

Figure 4—Go Characteristics—In Circuit.

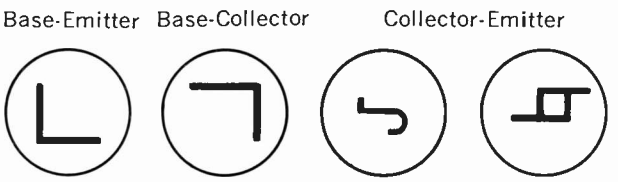


Figure 6—Typical Go Displays.

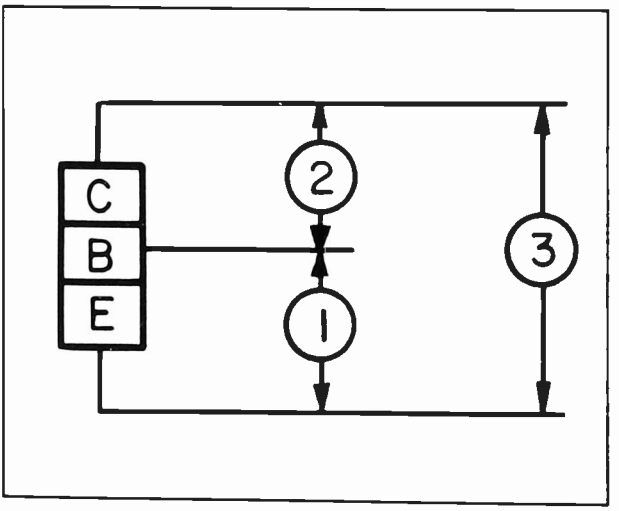


Figure 5—Transistor Go—No-Go Checks.

Reduce Transistor Call Backs With ECG Heat Sinks

One way the service technician can increase the reliability of a solid state repair job is to make installation of a heat sink standard procedure, if space permits, when replacing a transistor. This is particularly important if the original equipment does not provide a sufficient thermal interface, as may be the case when the transistor is mounted to a printed circuit board. Among the more common "sockets" susceptible to failure from excessive heat, and therefore naturals for heat sinks, are TV deflection drivers and amplifiers, audio driver, and audio output stages.

ECG heat sinks are designed to provide maximum cooling of the transistor in the minimum possible space—particularly important when a component-jammed printed circuit board is involved. This line of heat sinks includes styles to fit most popular transistor package configurations; also included in the line are transistor insulator kits and silicone grease—everything required to "complete the job" and all available at your Sylvania Electronic Tube Distributor. Following is a listing of ECG heat sinks and insulator kits:

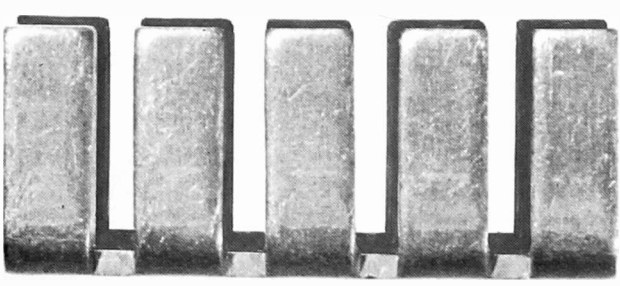
Transistor Heat Sinks and Compound

ECG400	1.9-watt Heat Sink (2/package) for TO-5 style transistors
ECG401	3.0-watt Heat Sink (2/package) for TO-5 style transistors
ECG402	Heat Sink (2/package) for plastic power transistors
ECG403	Heat Sink (2/package) for plastic power transistors
ECG404	Heat Sink for TO-66 style transistors (especially suited for PC boards)
ECG405	Heat Sink for TO-3 style transistors (especially suited for PC boards)
ECG406	Heat Sink Compound, ½-oz. tube
ECG410	Heat Sink (2/package) for TO-1 style transistors
ECG411	Stud-mount Heat Sink (2/package) for TO-5 style transistors
ECG412	Heat Sink (2/package) for TO-18 style transistors

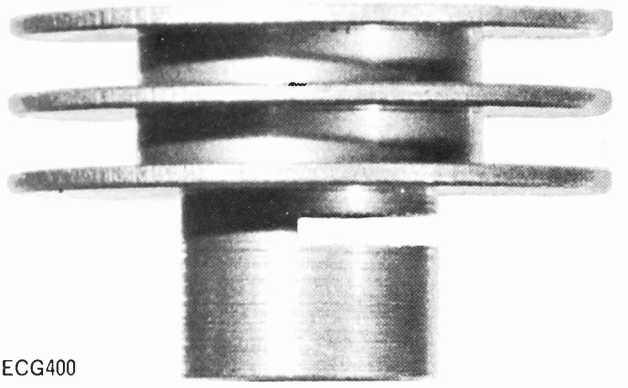
Transistor Insulator Kits*

ECG413	Insulator Kit for TO-3 style transistors
ECG414	Insulator Kit for TO-36 style transistors
ECG415	Insulator Kit for TO-66 style transistors

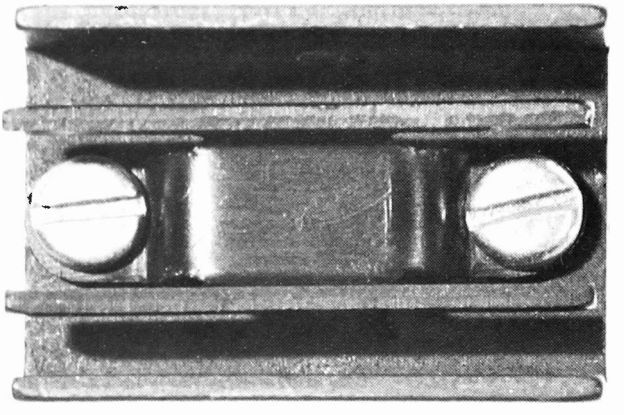
*Each kit includes one mica insulator and two nylon bushings.



ECG402



ECG400



ECG404

Testing The Focus Rectifier

One problem confronting the TV technician is finding an effective and practical test to check color TV focus rectifiers both in the home and shop. Normally, the technician checks the raster scan line sharpness while adjusting the focus to determine the rectifier's merit, then moves on to the next decision. There are times when substitution of another rectifier "believed" to be good will not correct the original symptom. The test described here provides a convenient method for determining the merit factor of the focus rectifier.

Circuit tests for a focus rectifier are somewhat different than a power diode or signal diode due to the high voltage required to forward bias the cells into conduction. Thus, an in-circuit testing procedure other than the visual CRT inspection is needed.

There is a focus rectifier testing circuit built into every color TV chassis which permits the rectifier's merit to be determined. This is done simply by using the circuit formed by the horizontal transformer, focus rectifier, and voltage divider in the following manner:

Step 1—Remove the horizontal output tube.

Step 2—Shunt a 100K ohm (one to two watts) resistor across the divider (resistors R1 and R2 in **Figure 7**) to ground.

Step 3—Place a voltmeter across the 100K ohm

resistor (test point A to ground). Use the 500VDC scale as a protective measure.

Step 4—Turn on the TV power.

Step 5—Note the voltage drop across the 100K ohm resistor.

Step 6—Move the voltmeter probe to the rectifier's other (anode) end (test point B). Note the voltage.

Step 7—The focus rectifier's merit factor should be over 60 percent as figured in the following way:

$$\frac{E\ 100K\ ohms}{E\ Anode} = F\ MERIT \times 100 = F\ MERIT\ \%$$

The rectifier with the highest merit factor is the best.

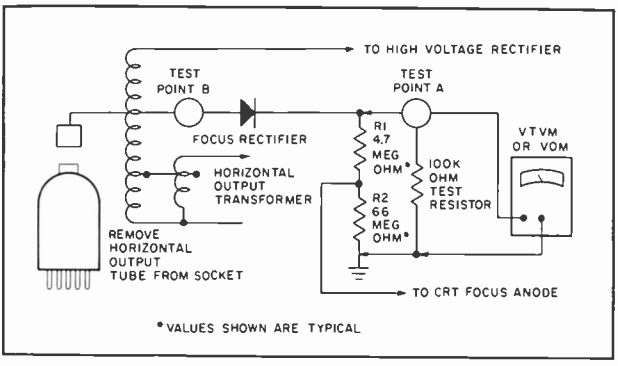


Figure 7—Circuit for Testing Focus Rectifier.

ECG Direct Replacement Linear Integrated Circuits

Over the past few years the service technician has witnessed the ever-widening application of integrated circuits in home entertainment equipment; this trend is likely to increase, in view of the many advantages afforded by these sophisticated, highly-miniaturized components. Increasing use, however, has not always necessarily lead to increased availability.

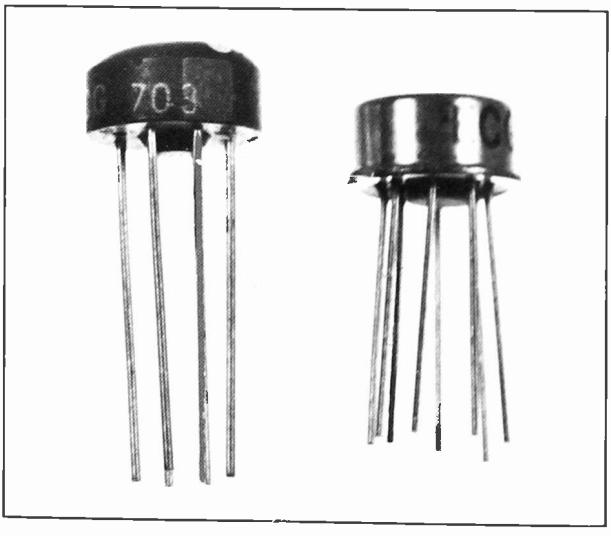
Sylvania has evolved a broad line of direct replacement types for the more commonly required IC's to meet this need and is now making them available through your Sylvania Electronic Tube Distributor. These IC's are presently being used in various manufacturers' color and monochrome TV, AM and FM radio, and tape recorders. New types are added to the line from time to time. Presently included in the line are the following types:

- ECG370 AGC Squelch Amplifier
- ECG371 RF/IF Amplifier
- ECG372 AM IF Amplifier
- ECG703 RF/IF Amplifier/Oscillator/Mixer
- ECG704 TV Sound-IF Amplifier and Detector
- ECG705 Color TV Chroma Demodulator
- ECG706 TV and FM IF Amplifier/Limiter/Detector/Audio Driver
- ECG707 Color TV Chroma Demodulator
- ECG708 FM and TV Sound IF/Detector and Limiter (for 12 VDC Operation)
- ECG709 FM and TV Sound IF/Detector and Limiter

- ECG710 TV and FM IF Amplifier/Limiter/ Detector/Audio Driver
- ECG711 Color TV Automatic Fine Tuning System (Wide-Band Amplifier/Phase Detector/Output Amplifiers)
- ECG716 Audio Amplifier

IC Type To Be Replaced	Sylvania ECG Replacement
09-308004 (Midland)	703
13-10-6 (Sears)	703
15-26587 (Sylvania)	703
19-020-079 (Sonar)	703
32-23555-1 (Sylvania)	704
32-23555-2 (Sylvania)	704
32-23555-3 (Sylvania)	704
32-23555-4 (Sylvania)	704
46-5002-4 (Philco)	703
51S10276A01 (Motorola)	704
51S10302A01 (Motorola)	703
51S10408A01 (Motorola)	710
86X0024-001 (Arvin)	704
86X0027-001 (Arvin)	704
99S022 (Packed Bell)	703
221-32 (Zenith)	703
221-34 (Zenith)	708
221-37 (Zenith)	705
221-39 (Zenith)	705
221-40 (Zenith)	707
1000-25 (Lafayette)	703
3502 (RCA)	704
80053	704
80070	704
80071	704
80073	704
80074	704
80081	704
80083	704
80090	704
80114	706
118361 (RCA)	704
119609 (RCA)	704
122199 (RCA)	704
126604 (RCA)	711
126871 (RCA)	710
1462434 (RCA)	706

IC Type To Be Replaced	Sylvania ECG Replacement
CA3013	704
CA3014	704
CA3041	706
CA3042	710
CA3044	711
CA3044V1	711
DM-11 (Delco)	709
HEP591 (Motorola)	704
LM370	370
LM371	371
LM372	372
LM703E	703
MC1314G	704
N5111 (Signetics)	708
N5111A (Signetics)	708
QA703E (Midland)	703
R3502 (RCA)	704
SK3022 (RCA)	704
SK3023 (RCA)	704
T1A (Motorola)	704
T1H (Motorola)	710
U5B771639X	716
U8B770339X	703
U8B7746394	705
UA703E	703
UA716C	716
UA737E	705
UA746C	707
UA746E	705
ULN2111	708
ULN2111A	708
ULN2111N	708
ULN2113	709
ULN2113A	709
ULN2114	707
ULN2114K	707
ULN2114W	705



New—Color Bright 85® XR Picture Tubes

- Our Brightest Yet
- X-Ray Inhibiting Glass
- Replace Many Industry Types
- All At *No Cost Increase*

XR23VANP22/SRE25BGP22
XR23VADP22/SRE25BHP22

Our recently-developed "MV" phosphor system is now used in these two new Color Bright 85 tube types—resulting in the brightest replacement tube we have yet offered. The "MV" system incorporates basic changes in the phosphors themselves, as well as new developments in the manufacturing processes. Additionally, these and all other tubes in the premium Color Bright 85 XR line now include X-ray inhibiting glass as a standard feature.

The effect of the "MV" phosphors is a tube that is directly competitive with the "black-screen" types, but without the added complexity and cost. These two new types also fully meet Original Equipment Manufacture specifications—as does the rest of the companion Color Bright 85 XR line.

23V Kimcode

The following table lists the industry types replaced by these two new tubes:

Color Bright 85XR Type	Replaces Industry Types
XR23VANP22/SRE25BGP22	RCA Matrix—25BCP22 Zenith Chromacolor—25BAP22 25AP22A, 25AQP22 25ABP22, 25ANP22 25AEP22 25AFP22, 25BJP22 25BP22A 25BMP22, 25CP22 25BGP22 25GP22A, 25SP22 25RP22 25VP22, 25WP22 25XP22, 25ZP22 25YP22
XR23VADP22/SRE25BHP22	25ADP22 25AGP22 25AJP22 25ASP22 25AWP22 25AXP22 25AZP22 25BHP22

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