



COLOR TELEVISION - COLORIMETRY - II

In the last issue the nature of light was explained. Subtractive and additive primaries were described and the results of mixing various colors. In this issue the chromaticity diagram will be explained.

COLOR DIMENSIONS

Before venturing further into colorimetry, a few definitions are in order. To be completely catalogued a color must be described three-dimensionally. The three dimensions are hue, saturation and luminosity.

1. Hue = dominant wavelength.

No matter what primaries are used to make a color, the resulting color or hue cannot be resolved into its component parts. This new color has a dominant wavelength which would correspond to that hue when seen on the visible spectrum.

2. Saturation = color purity.

This is an indication of the spectral purity of a color or, in other words, the amount of white light present along with the dominant wavelength. As an example of the effect saturation can have on a hue, compare fire-engine red with baby pink. The only difference between the two is saturation. Fire-engine red is a highly saturated color because it contains very little white light in addition to its dominant wavelength. Baby pink, on the other hand, has the same dominant wavelength but also has a good amount of white light contaminating this hue. As might be expected, 100% saturation indicates a pure spectral hue while 0% saturation of any color is white.

3. Luminosity = brightness.

This indicates the amount of light energy which is contained within a given hue. There are certain factors concerning the brightness of a color which should be mentioned.

(A) The total brightness of a mixture is equal to the sum of the individual brightnesses of all colors in the mixture.

(B) If a color match is obtained at one brightness level, the match will be maintained over a wide range of brightness levels.

CHROMATICITY DIAGRAM

The last fact concerning color match is very helpful because it will

allow the use of a two-dimensional "road map" for color determination. Color has three factors — hue, saturation and brightness, as previously stated. To lay out a two-dimensional representation of color, one variable must be held constant. Because hue and saturation are unaffected by variations in brightness, it is possible to hold brightness constant and show two-dimensionally the remaining two variables — hue and saturation.

This representation of the colors visible to the human eye is commonly called the Chromaticity Diagram, and is the result of exhaustive investigation on the part of the International Commission on Illumination who, in order to standardize colors and color-mixtures, developed a psychophysical system of color specification. The system makes use of the "Standard Observer" and a standard light source. This means that any experiment can be dupli-

cated at any time without the result being dependent on the visual characteristics of a single individual.

It will be recalled that when three-primary-color reproduction was first discussed, it was implied that all visible colors could be matched by the proper proportions of the primaries. This is not true. The chromaticity diagram will be very useful in visualizing the limitations of this color reproduction system.

Figure 6 is a black and white representation of the ICI Chromaticity Diagram. Starting at the lower left corner of the horseshoe-shaped boundary and moving clockwise, the eye passes a familiar gamut of colors. The horseshoe-shaped boundary does indeed represent the spectrum of visible colors. The boundary itself is indicative of 100% saturated colors. In about the center of the area bounded by the horseshoe

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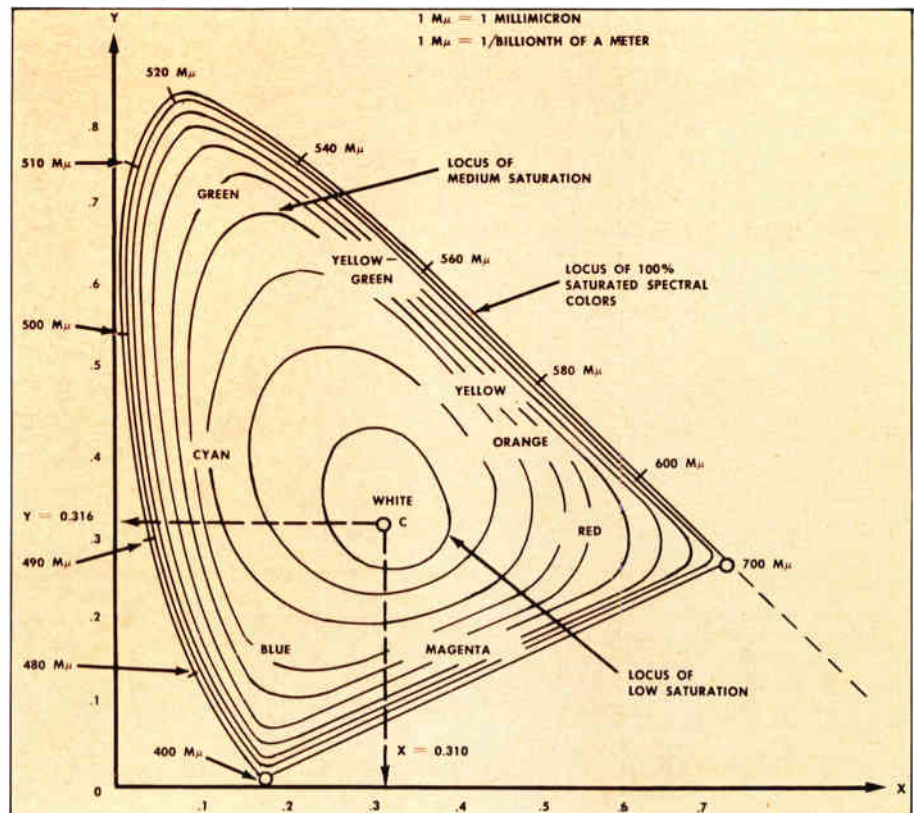
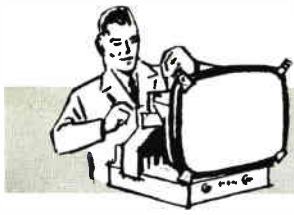


Fig. 6 — STANDARD XYZ CHROMATICITY DIAGRAM: Any color completely defined by two numerical quantities specifying chromaticity (hue and saturation) plus brightness information.



BENCH NOTES

SPEAKER REPAIR

While servicing television and radio sets, I find many speakers with damaged cones. Where the damage is not so excessive so as to require replacing the cone, I have found that it can be repaired quickly and inexpensively by using plastic rubber.

This compound can be purchased in almost any store handling hardware items. It is wet when applied but will dry soft and elastic within 24 hours. This makes it ideal to apply to speaker cones, even at the outer edge, because it does not hinder the free movement or stiffen the cone which is the case when other cements are used.

The product I use comes in a 4 oz. tube retailing for about \$1.00. The brand name is Duro Plastic Rubber manufactured by the Woodhill Chemical Co., Cleveland, Ohio.

*William A. Pierce
122 Wesley Ave.
Cherry Hill, N. J. 08034*

SOLDER REMOVAL

In regard to the trouble (bugaboo), of removing components with multiple leads from printed circuit boards, I recently stumbled on to a system, which has, anything yet devised beat by a country mile.

Secure an air storage tank. The kind oil stations use for emergency inflation of flat tires on the road. Equip the tank with about 6 to 10 feet of hose and a hand operated squeeze valve or blow gun. On the gun fasten on a piece of copper tubing with the opening on the end cut down to about 1/16 of an inch or slightly larger. Inflate tank to about 140 lbs. of pressure.

When terminal is heated, a short burst of air, not only loosens the connections, but, completely cleans out the holes, so that, after all the terminals are loosened, the part will fall out by itself.

The only precaution to be taken, is to clean the board, for about an inch radius of the part, as a very fine spray of solder will cling to the board.

*F. B. Callahan
J. P. Scherrman, Inc.
Farley, Iowa*

FUSE SAVER

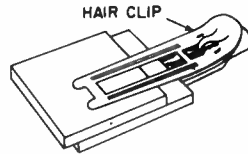
On the new line of Color TV, instead of using circuit breakers as in the past, manufacturers are now using plug in fuses.

If on a job and you find the fuse blown, instead of plugging in a new fuse, I made up a circuit breaker by taking the old plug in fuse pins and soldering them to a breaker. I plug in this breaker until I find what is causing this fuse to blow. When repaired I plug in regular fuse. This way you can save many fuses until you find the short.

*Jay Kohler
171 Franklin Ave.
Hubbard, Ohio*

INEXPENSIVE HEAT SINK

Women's flat hair clips, bent to appropriate shape for the job, make excellent clamps to hold small components



together for soldering. They also serve as a heat sink.

*S. Clark
Box 2162
East Bradenton, Florida 33507*

EASY OFF

When a can of soldering paste gets messed up, it's a job to pry the lid off. This becomes easy when a cuphook is soldered onto the top cover and used as a handle.

*Harry J. Miller
Advance Television-Radio
991 Forty-Second St.
Sarasota, Florida*

HORIZONTAL SYNC

Philco TV-8II25 (and other sets using diodes for phase comparators in horiz. sync.)

We have had several Philcos wherein the horiz. would suddenly lose sync and the horiz. frequency would change drastically. A readjustment of the horiz oscillator would return the set to normal, however, at any moment it would do as stated. It appeared that the oscillator was at fault, however, a measurement of the diode pack showed one section as apparently open. The diodes were replaced with GE 1N538 and in each case stability has been perfect.

*Leonard Chioma
2020 Natalen Rd.
Winter Park, Fla.*

ARCING COLOR TV

Most color televisions employ a high voltage supply of approximately 25 KV (25,000 volts).

There may be some crackling that is normal due to moisture in air and dust collection.

If you encounter a color television that arcs repeatedly, replace the high voltage regulator tube 6BK4 — many manufacturers use this tube as a regulator.

Due to its high power most tube checkers cannot check this tube, and turning brightness control shows everything operative.

Direct replacement will usually correct trouble because when this tube fails voltage rises to about 27 KV which can cause the excessive arcing and corona discharge.

*Bernard H. Serota
2502 S. Philip Street
Philadelphia, Pa. 19148*

INSULATE SCREWDRIVERS

When working on radios, T.V.s and other devices where you need insulated screwdrivers, don't go out and buy a set. Just take your favorite screwdriver and measure the diameter of the shank. Find a piece of spaghetti the same diameter and slip it over the shank. This, as you can see, is a very inexpensive way to insulate and you can leave it on permanently or just slip it on when you need it. You can also reinsulate your old torn insulated screwdrivers this way.

*Ed LaPour
908 Hayward
Bremerton, Wash.*

FREING COIL SLUGS

Often coil slugs are stuck so that any attempt to turn them will result in a cracked slug or stripped hole or stripped alignment tool.

If on the first tug the slug doesn't turn easily don't force it, insert an ice pick into the hole and apply heat to the ice pick with a soldering gun as near to the coil as is practical for about one minute.

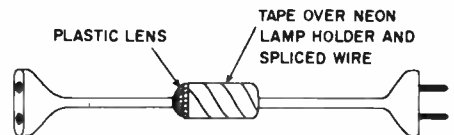
Remove the ice pick and insert the alignment tool into the slug and it will turn freely.

I have used this method for some time on IF's, ratio detectors etc. with almost 100% success.

*William J. Praetz
59-23 Cooper Ave.
Glendale 27, N. Y.*

OUTLET TESTER

I've found one out of about forty dead or intermittent TV sets to be victims of poor electrical outlet contacts or a blown fuse. One neat way to detect this "TV fault" is to permanently



wire a neon test light on to your cheater cord. Before I pull the back off of a set, I plug in my "cheater indicator". With this device, I know the relative condition of my customer's electrical source immediately with no extra effort. The "cheater indicator" is used as a conventional cheater, as soon as the set's back is off.

*M. L. Shapiro
75 Hunting Rd.
Needham Hts., Mass. 02194*

Note:

Those desiring to have letters published in this column should write the Editor, Techni-Talk, Electronic Components Division, General Electric Company, Owensboro, Kentucky. For each such letter selected for publication you will receive \$10.00 worth of General Electric tubes. In the event of duplicate or similar items, selection will be made by the Editor and his decision will be final. The Company shall have the unlimited right without obligation to publish or otherwise use any idea or suggestion sent to this column. Caution: The ideas and suggestions expressed in this column are those of the individual writers. These ideas and suggestions have not been tried by the General Electric Company and therefore are not endorsed, sponsored or recommended.

RECEIVING TUBE POPULARITY LISTING

Listed below are the 267 most popular tube types based on distributor usage. One list is in order by usage and the other by alpha-numerical sequence. The figure

following each tube indicates popularity. Number 1, 5U4GB/5AS4A had the highest volume; Number 2, 50C5 was next, etc.

LISTING BY VOLUME

5U4GB/5AS4A 1	6EM7 38	6B6 76	6BL7GTA 114	6JH8 153	6DE7 192	6EJ7/EF184 231
50C5 2	6CM7 39	6B6 76	6JH8 153	6DE7 192	6EJ7/EF184 231	
6CB6A/6CF6 3	6JS6A 40	6GM6 77	1R5 115	6FH5 193	6ES8/ECC189 232	
6DW4B 4	3AT2 41	6CU5 78	6BN4A 116	6HF8 194	6EW7 233	
6JE6A 5	5Y3GT 42	6CX8 79	6CX8 117	6HQ5 195	6J5 234	
6AQ5A/6HG5 6	6V6GTA 43	5CG8 80	6DA4A/6DM4A 118	11KV8 196	6U10 235	
6DQ6B/6GW6 7	12AX4GTB 44	6CY5 81	6GY6/6GX6 119	12SN7GTA 197	8BQ5 236	
6AX4GTB 8	12AV6 45	6X4 82	6KT8 120	17D4 198	10GK6 237	
35W4 9	1X2A/B 46	17DQ6B/ 45	6SL7GT 121	22BW3 199	12AQ5 238	
6BQ7A/6BZ7 10	3BZ6 47	17GW6 46	8AW8A 122	7025/12AX7A 200	12AV5GA 239	
6SN7GTB 11	1V2 48	1K3 47	25L6GT 123	3BN6 201	12DT8 240	
6AU6A 12	5U8 49	5AN8 48	2AV2 124	6CB5A 202	12SA7 241	
6EA8 13	6BK7B 50	6AS5 49	4BQ7A/4BZ7 125	6ER5 203	12SK7 242	
6BZ6 14	12DQ6B/ 50	6AU8A 50	5CL8A 126	12DT5 204	12W6GT 243	
6GH8A 15	12GW6 51	6JU8 88	6EA7 127	1U5 205	1AD2 244	
6FQ7/6CG7 16	1G3GT/1B3GT 52	6KZ8 89	6H58 128	4DT6 206	4EJ7 245	
6CG8A 17	6CD6GA 53	6JH6 129	6JH6 129	6CY7 207	5BR8 246	
0Z4 18	6L6GC 54	33GY7 91	6C6 92	6EU7 208	6BH11 247	
6U8A/6KD8/ 19	6J6A 55	6AF4A/6DZ4 92	6C6 92	6H5 209	6BK5 248	
5KD8 19	6AV6 56	6AM8A 93	6GN8 93	6AB4 171	6JN6A 210	
3A3A/3CA3/ 20	6T8A 57	6JC6 94	6JM6A 133	6JZ8 172	6BX7GT 250	
3AW3 20	6AF4 58	6KA8 57	6B10 134	6BS8 173	12BL6 212	
6AW8A 21	6DE4 59	6BC8 58	6BJ6A 135	6CN7 174	13DR7 213	
12AX7/ECC83 22	6GH6 60	6BN6/6KS6 59	6BN8 97	6CS6 175	17BE3 214	
12AU7A/ECC82 23	6S4A 61	6EM5 60	6CW4 98	6CS7 176	19AU4GTA 215	
12BY7A 24	35C5 62	3DG4 61	6FM7 99	6DS4 177	19T8 216	
6AU4GTA 25	6DT6A 63	6BQ6GTB 100	7AU7 139	6W4GTA 178	22JU6 217	
12BA6 26	6EB8 64	6BR8A/6FV8A 62	8FQ7/8CG7 101	12AT6 179	23Z9 218	
12BE6 27	3CB6/3CF6 65	6C4 102	12AD6 102	12AV7 180	35L6GT 219	
6BK4A 28	6BU8 66	6GE5 103	12GN7A 142	12CA5 181	1U4 220	
12BH7A 29	6GK5/6FQ5A 67	6HZ6 104	5AM8 143	12SQ7 182	2AS2 221	
12AT7/ECC81 30	2CW4 68	6K6GT 105	6AF3 144	13EM7/15EA7 183	2F55 222	
6AL5 31	4BZ6 69	12B4A 106	6AL3 145	2GK5/2FQ5A 184	2GK5/2FQ5A 223	
6X8A 32	6AY3B 70	17JZ8 107	6DK6 146	6AF11 185	3CY5 224	
6EW6 33	6CL8A 71	50EH5 108	6DN7 147	6BA8A 186	3DT6 225	
6GF7A 34	10DE7 72	50L6GT 109	6EV5 148	6BA11 187	4CB6 226	
6GU7 35	35Z5GT 73	6DE6 110	6FG7 149	6BG6GA 188	5EA8 227	
6BQ5/EL84 36	6AN8A 74	6CQ8 111	6GJ7/ECF801 150	6BQ6GA/6CU6 189	6AT8A 228	
6DQ5 37	6BA6/EF93 75	6DR7 112	6GK6 151	6CA4 190	6BY8 229	
		12AZ7A 113	6HB7 152	6CZ5 191	6CU8 230	

ALPHA-NUMERICAL LISTING

0Z4 18	5U4GB/5AS4A 1	6BK7B 50	6DE6 110	6GU7 35	6W6GT 90	12FX5 265
1AD2 244	5U8 49	6BL7GTA 114	6DE7 192	6GY6/6GX6 119	6X4 82	12GN7A 142
1G3GT/1B3GT 52	5Y3GT 42	6BN4A 116	6DK6 146	6HB7 152	6X5GT 155	12SA7 241
1K3 84	6AB4 171	6BN6/6KS6 97	6DN7 147	6HE5 209	6X8A 32	12SK7 242
1R5 115	6AF3 144	6BN8 136	6DQ5 37	6HF8 194	7AU7 139	12SN7GTA 197
1U4 220	6AF4 58	6BQ5/EL84 36	6DQ6B/6GW6 7	6HQ5 195	8AW8A 122	12SQ7 182
1U5 205	6AF4A/6DZ4 92	6BQ6GA/6CU6 189	6DR7 112	6HS8 128	8B10 260	12W6GT 243
1V2 48	6AF11 185	6BQ6GTB 100	6DS4 177	6HZ6 104	8BQ5 236	13DR7 213
1X2A/B 46	6AH6 160	6BQ7A/6BZ7 10	6DT6A 63	6J5 234	8FQ7/8CG7 140	13EM7/15EA7 183
2AS2 221	6AK5/EF95 161	6BR8A/6FV8A 101	6DW4B 4	6J8 55	8JV8 261	13GF7A 166
2AV2 124	6AL3 145	6BS3A 249	6EA4 252	6JC6 94	10CW5 262	15KY8A 156
2BN4A 168	6AL5 31	6BS8 173	6EA7 127	6JE6A 5	10DE7 72	17AX4GTA 157
2CW4 68	6AM8A 93	6BU8 66	6EA8 13	6JH6 129	10GK6 6	17AY3A 158
2F55 222	6AN8A 74	6BX7GT 250	6EB8 64	6JH8 153	11KV8 196	17BE3 214
2GK5/2FQ5A 223	6AQ5A/6HG5 6	6BY6 251	6EH7/EF183 253	6JM6A 133	12AB5 263	17D4 198
3A3A/3CA3/ 3AW3 20	6AS5 86	6BY8 229	6EJ7/EF184 231	6JN6A 210	12AD6 210	17DQ6B/ 17GW6 83
3AT2 41	6AS8 162	6BZ6 14	6EM5 98	6JS6A 40	12AF3 164	12AQ5 238
3BN6 201	6AT8A 228	6C4 102	6EM7 38	6JT8 164	12AV3 179	17JZ8 107
3BZ6 47	6AU4GTA 25	6CA4 190	6ER5 203	6JZ8 88	12AT6 179	19AU4GTA 215
3CB6/3CF6 65	6AU6A 12	6CB5A 202	6ES8/ECC189 232	6JZ8 211	12AT7/ECC81 30	19T8 216
3CY5 224	6AU8A 87	6CB6A/6CF6 3	6EU7 208	6K6GT 105	12AU6 91	21GY5 159
3DG4 99	6AV6 56	6CD6GA 53	6EV5 148	6KA8 95	12AU7A/ECC82 23	22BW3 199
3DT6 225	6AW8A 21	6CG8A 17	6EW6 33	6KE8 257	12AV5GA 239	22DE4 167
3GK5 79	6AX3 163	6CL6 131	6EW7 233	6KT8 120	12AV65 45	22JG6A 266
3V4 184	6AX4GTB 8	6CL8A 71	6FG7 149	6KZ8 89	12AV7 180	22JU6 217
4BQ7A/4BZ7 125	6AY3B 70	6CM7 39	6FH5 193	6L6 258	12AX4GTB 44	23Z9 218
4BZ6 69	6B10 134	6CN7 174	6FM7 138	6L6GC 54	12AX7/ECC83 22	25DN6 267
4CB6 226	6BA6/EF93 75	6CQ8 111	6FQ7/6CG7 16	6LF8 165	12AZ7A 113	25L6GT 123
4DT6 206	6BA8A 186	6CS6 175	6FS5 254	6S4A 61	12B4A 106	33GY7 130
4EJ7 245	6BA11 187	6CS7 176	6FV6 255	6SJ7 154	12BA6 26	35C5 62
5AM8 143	6BC8 96	6CU5 78	6GC5 256	6SL7GT 121	12BE6 27	35L6GT 219
5AN8 85	6BE6 76	6CU8 230	6GE5 103	6SN7GTB 11	12BH7A 29	35W4 9
5AT8 169	6BG6GA 188	6CW4 137	6GF7A 34	6SQ7 259	12BL6 212	35Z5GT 73
5BR8 246	6BH11 172	6CX8 117	6GH8A 15	6T8A 57	12BY7A 24	50C5 2
5CG8 80	6BK5 248	6CY5 81	6GJ7/ECF801 150	6U8A/6KD8/ 5KD8 19	12CA5 181	50EH5 108
5CL8A 126	6BK7B 50	6CY7 207	6GK5/6FQ5A 67	6U10 235	12DQ6B/ 12GW6 51	50L6GT 109
5EA8 227	6BK4A 28	6CZ5 191	6GK6 151	6V6GTA 43	7025/12AX7A 200	7025/12AX7A 200
5KE8 170	6BK5 248	6DE4 59	6GN8 132	6W4GTA 178	12DT5 204	12DT8 240



GENERAL ELECTRIC



EXPERIMENTER HOBBYISTS KIT

Easy to assemble and wire simple electronic circuits.

Some typical circuits can be found in the new G E Hobby Manual, ETR-3960.

Rubber feet (4) — fasten with self-tapping screws to each corner.

Push-In terminals (15) — fit board holes. Serrated slots go on top.

3 1/2" x 4 1/2" terminal board will fit many small metal boxes or can be cut to size.

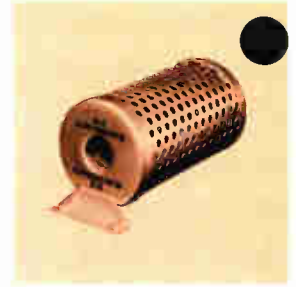
ETR-4288 Cost \$.98



SOLDERING GUN OR ELECTRIC DRILL HOLDER

This G E Soldering Gun or Electric Drill Holder prevents burns and damage to instruments, wires and service manuals. Holds an electric drill in a safe, ready-to-use position. It can be easily mounted to any surface with clamps and screws supplied with units.

ETR-2582 Cost \$0.75



SOLDERING IRON HOLDER

Made to mount on bench edge or bench top. Will accommodate soldering irons up to 3/4" in diameter. Protects your hands, wires, diagrams, other tools from burns. Cadmium aluminum finish resists heat discoloration. Holes in both inside and outside cylinders provide maximum air circulation.

ETR-2790 Cost \$1.70



FIRE EXTINGUISHER

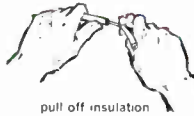
Effective against all types of fires — grease, gasoline and electrical. Chemical contents is an electrical "non-conductor." It won't "short out" line circuits.

Small enough to carry in service case and economical enough to have one in shop, home, car and service truck.

Needs no inspection or recharging — does not corrode or deteriorate. Guaranteed for 20 years.

Effectiveness of chemical makes it possible to extinguish a fire very quickly — as fast as three seconds — reducing fire damage.

ETR-4500 Cost \$3.95



WIRE STRIPPER

Four cutting edges for most wire sizes. Select cutting edges slightly smaller than outside dimension of insulation. Press insulated wire fully into cutting channel.

Rotate wire stripper completely around wire and pull.

ETR-2376 COST \$0.65

BENCH MIRROR

A mirror that saves you valuable time because it's designed specifically for the TV workbench. Adjusts quickly to any desired height.

ETR-1275 Cost \$3.60



TUBE PULLER

Never be without it on your workbench or in your service case. It protects you against burns, cuts and shocks — no matter how firmly the tubes may be wedged in their socket. Fits all regular glass types, all metal tubes, plus seven- and nine-pin miniatures, and compactrons.

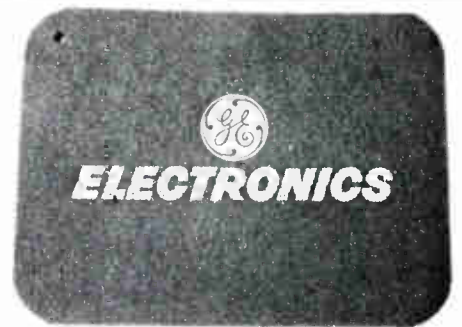
ETR-1094 Cost \$0.35



SAFETY GLASS PULLER

It's exactly what you need to remove safety glass quickly, easily — and safely! Prevents cracking, chipping and other damage while you remove the glass. The three-inch suction cup holds firmly, is easily removed from the glass by unique vacuum release tip. Won't leave marks on glass.

ETR-1592 Cost \$0.95



PICTURE TUBE PILLOW

This 1/2" thick foam-plastic cushion provides the surest possible protection against scratches on the tube face and edges. Order at least one for every technician in your shop. Never lay a picture tube on anything else.

ETR-1469 Cost \$0.75

SERVICE AIDS

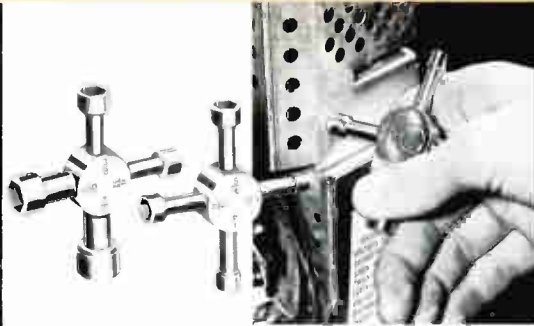
specifically engineered and field-tested
for the TV/radio service dealer



SERVICE DROP CLOTH

A rugged, hard-wearing plastic sheet that does double duty: It protects furniture and floor coverings, even against hot solder. It serves as a protective cover for radio and TV cabinets when moving them to or from the home.

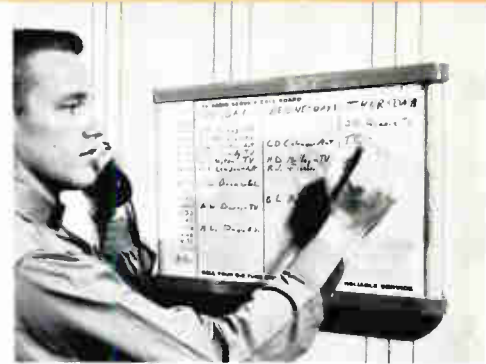
ETR-1021 Cost \$1.95



TWIN-X-WRENCH SET

The two wrenches in this set actually do the work of eight hex-head socket wrenches, save plenty of space and weight in your repair kit. They're designed especially for TV and radio service work, where you need to get maximum leverage, often in very close quarters.

ETR-752 Cost \$3.45



SERVICE CALL BOARD

In a single glance, this easy-to-use rolling chart tells you where your work stands — shows you your work schedule for days or weeks in advance — enables you to schedule work immediately. Marking pencil and complete instructions included.

ETR-2144 Cost \$1.49



FUSE AND HEATER CHECKER

Pocket-size — yet it will check virtually all tubes used in series-string TV sets and radios (AC, DC, and portable), including compactrons, novars and picture tubes. Also tests pilot lamps and fuses. Rugged construction. Battery powered. Actual size — 4" x 2 3/4" x 1 3/4".

ETR-981 Cost \$2.95



COMPACTRON SOCKETS

Two 12-pin sockets for compactron devices in each package. New feature — a raised "key" ridge between pins 1 and 12 to help when inserting the compactron in hidden locations. The pins are numbered on the bottom of each socket.

ETR-2976 Cost \$0.39



CAPACITOR TAB ADJUSTER

Simplifies removal and installation of twist-prong electrolytic capacitors and also some types of variable controls. Hollow tip fits perfectly over mounting tabs. With a twist you break off old tab . . . lock in new.

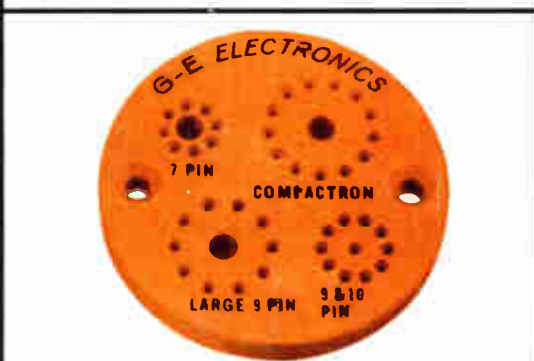
ETR-2958 Cost \$1.00



REAR CONTROL EXTENSION

Permits quick, sure adjustment of TV controls without removing back of set. One end tapered to fit snugly over knurled control shafts. Pin in other end fits slotted shafts and, unlike screwdrivers, cannot slip off.

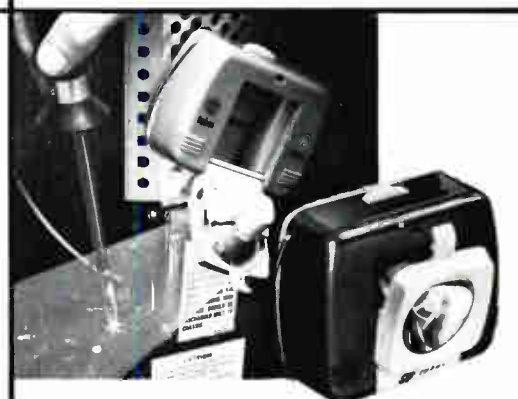
ETR-2089 Cost \$0.35



MULTI-TUBE PIN STRAIGHTENER

Straightens pins in a jiffy. Helps to eliminate tube damage caused by bent pins. New small size just right to slip into trouser or shirt pocket. Red-orange color makes it easy to find.

ETR-3200 Cost \$0.60



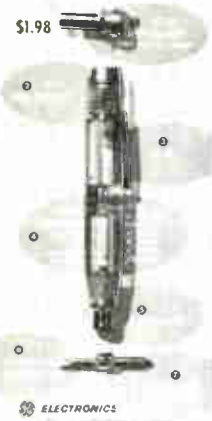
MAGNETIC SWING-BEAM SERVICE LIGHT

This TV Service Light has a magnet that holds it firmly to the chassis, leaving both hands free for work. The front of the lamp swings out to any desired angle, allowing you to aim the beam exactly where you need it.

ETR-1593 Cost \$2.25

Multi Purpose
POCKET TOOL

\$1.98



POCKET TOOL

Here is a practical and useful tool that will make servicing easier and faster. This new pocket tool will enable you to remove the back of any receiver regardless of the type of fastening without opening your tool or service case.

Lightweight pocket tool clips to a shirt pocket and contains Phillips and standard screw driver; 1/4", 5/16" and 3/8" hex sockets; high voltage tester and level.

Use screwdriver end as prod, neon bulb in handle indicates presence of high peak voltage at plate of horizontal output tube or high voltage rectifier.

Lay unit flat with G E monogram down to use as a level when installing phonographs, air conditioners, etc.

ETR-3594

Cost \$1.98



PRINTED CIRCUIT BOARD CUTTING TOOL

This new G E Service Aid is a real time saver when servicing printed circuit boards. This versatile tool makes Printed Circuit trouble shooting easy. Use tool to cut through — make test — then flow solder across cut.

Blade slides horizontally — adjusts to cut "paper thin." In this position tool cuts only the printed circuit and does not weaken board.

Handy for opening packages and numerous other daily tasks. Blade retracts — safe to carry in pocket or service case.

Uses standard single-edge blade.

ETR-3896

Cost \$0.25



Part Holder

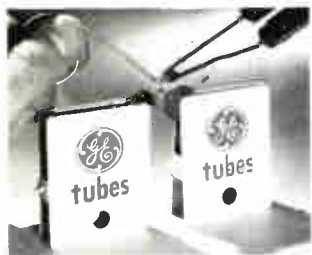
\$1.35

PART HOLDER

The General Electric Part Holder is designed to stand upright or attach to edge of service bench. Many times a "third hand" is needed to hold parts in position particularly while soldering. Other times something is needed to hold a piece of solder or some other item when both hands are being used. More than one G-E Part Holder can be used to hold different parts in a fixed position until solder "sets."

ETR-3851

Cost \$0.35



FIVE-IN-ONE COMBINATION TOOL

Here is a new lightweight tool that will save time either on the bench or on home service calls.

It is five tools in one with a pocket clip. Contains No. 1 Phillips screwdriver and standard screwdriver; 1/4", 5/16" and 3/8" hex sockets.

ETR-3910

Cost \$0.98



Adjustable Door Clock

\$1.50

DOOR CLOCK SIGN

Let your customers know when — you are OPEN, you are CLOSED, you will be BACK.

It can be used to hang on front door or in a visible location. Hands movable to time of return when leaving for lunch — for the day — for service calls — for emergencies. Sign turns around so OPEN is visible when you return.

ETR-3826

Cost \$0.50

WILL RETURN at



ELECTRONICS
Best for any set!

PROMPT - EFFICIENT SERVICE

OPEN

ELECTRONICS
Best for any set!

GENERAL ELECTRIC

regress in lectronics



NEW G E TUBE AND PARTS CABINET

Here is the answer to your tube and parts storage problem. Dress up your store with one or more for over-the-counter stock. Save time by having another at the bench to hold servicing supplies.

Six shelves provide over twelve feet of storage space. The pegboard hanger holes on each side give additional capacity for numerous items such as capacitors, semiconductors, tape, etc.

Cabinets can be mounted side by side or stacked one above the other.

Designed for shipping via parcel post. Can be assembled in a few minutes. All parts snap into place without use of nuts or bolts.

ETR-3803

Cost \$11.75

TELEVISION

**CB — 23" CHASSIS
INSUFFICIENT WIDTH**

This problem may result from several conditions which should be investigated in proper order as follows. If step 1 or 2 corrects the condition, do not perform step 3.

1. Check value of yoke capacitors C-121, C-122.

ET77X91 Transformer used in chassis stamped EN151 and lower in conjunction with C121, C122 @ 260 pf in Deflection Yoke. ET77X93 Transformer used in chassis stamped EN 152 and higher in conjunction with C121, C122 @ 470 pf in Deflection Yoke.

Yoke - Deflection. In ET76X42 and ET76X47, C121 and C122 are 260 pf. In ET76X44 and ET76X46, C121 and C122 are 470 pf. ET76X47, used as a general replacement, is supplied with both 260 pf and 470 pf capacitors with instructions.

2. Adjust line voltage to 117 volts and check Horizontal Deflection alignment as given below:

Horizontal Deflection Alignment

Test equipment connections:

GENERAL — Tune receiver to signal and synchronize the picture.

MILLIAM METER — Open the jumper and insert a 0-500 ma. meter between pin 2 (cathode) of V103 (Horizontal Output) and ground. Bypass meter with .47 uf. capacitor at the tube socket. See Fig. 1 and 2.

VACUUM TUBE VOLT METER — Connect to high voltage anode lead through high voltage probe at picture tube.

Use Order Coupon Below

ORDER COUPON

Order from your local G E electronic components distributor or mail this form to:

General Electric Company
Department "B"
3800 N. Milwaukee Ave.
Chicago, Ill. 60641

Enclosed is money order or check payable to General Electric Company for:

Quantity		Price
.....	ETR-15M Essential Characteristics	\$ 2.00.....
.....	ETR-752 Twin-X Wrench Set.....	3.45.....
.....	ETR-981 Fuse and Heater Checker.....	2.95.....
.....	ETR-1021 Service Drop Cloth.....	1.95.....
.....	ETR-1094 Tube Puller35.....
.....	ETR-1275 Bench Mirror	3.60.....
.....	ETR-1469 Picture Tube Pillow.....	.75.....
.....	ETR-1592 Safety Glass Puller.....	.95.....
.....	ETR-1593 Magnetic Swing-Beam Service Light.....	2.25.....
.....	ETR-2089 Rear Control Extension.....	.35.....
.....	ETR-2144 Service Call Board.....	1.49.....
.....	ETR-2376 Wire Stripper65.....
.....	ETR-2582 Soldering Gun or Electric Drill Holder.....	.75.....
.....	ETR-2790 Soldering Iron Holder.....	1.70.....
.....	ETR-2968 Capacitor Tab Adjuster.....	1.00.....
.....	ETR-2976 Compactron Sockets39.....
.....	ETR-3200 Multi-tube Pin Straightener.....	.60.....
.....	ETR-3594 Pocket Tool	1.98.....
.....	ETR-3803 Tube and Parts Cabinet.....	11.75.....
.....	ETR-3826 Door Clock Sign.....	.50.....
.....	ETR-3851 Part Holder35.....
.....	ETR-3896 Printed Circuit Board Cutter.....	.25.....
.....	ETR-3910 Five-in One Combination Tool.....	.98.....
.....	ETR-3960 Electronic Components Hobby Manual.....	1.50.....
.....	ETR-4288 Experimenter Hobbyist Kit.....	.98.....
.....	ETR-4500 Fire Extinguisher	3.95.....
.....	(Include applicable state and local tax) \$.....	
.....	TOTAL \$.....	

NAME.....

STREET ADDRESS.....

CITY, STATE and ZIP CODE.....

(Please Print)

Alignment Procedure

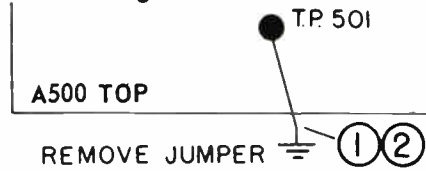


Fig. 1

STEP 1: Short jumper from TP501 to ground. Adjust horizontal hold control R130 to the center of its range. See Fig. 3.

FRONT CONTROLS

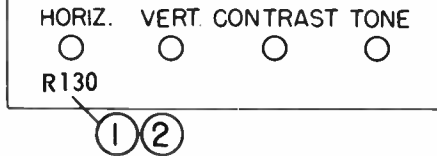


Fig. 2

STEP 2: Adjust L502 slug until picture drifts very slowly and sides are vertical. Remove TP501 jumper. Check R130 at both ends.

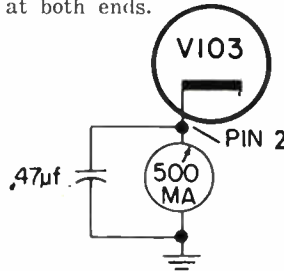


Fig. 3

STEP 3: Adjust L520 for minimum current dip on the millimeter in the cathode of V103. See Fig. 4.

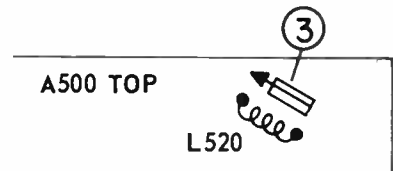


Fig. 4

STEP 4: Adjust R140 for 25 kilovolts at the anode of the picture tube with minimum brightness. Check V102 regulator operation by adjusting brightness from minimum to normal. High voltage should not vary more than 300V to 400V over this brightness range.

Be certain to replace jumper when millimeter is removed.

3. Add an 82pf, 6KV Capacitor (ET18X579) from junction of L-105 and C-107 to ground. (See C-117, on 21" CB schematic.) Check for sufficient size while operating set on 107V line, horizontal size should fit screen at this line voltage.

**COLOR TELEVISION
COLORIMETRY - II**

Continued from Page 1

is Illuminant C. This is the color specified by the color television standards as white. Its coordinates on the chromaticity diagram are $x = 0.310$, $y = 0.316$. This point, then, corresponds to 0% saturation of any color. As might be expected, between this point (Illuminant C) and the outer periphery (100% saturated spectral hues) the colors will range from low to high saturation. Thus, the ICI Chromaticity Diagram gives the desired results. First, the hue is determined by the point on the outer boundary of the horseshoe curve. Second, saturation is determined by the position between Illuminant C (white) and the 100% saturated

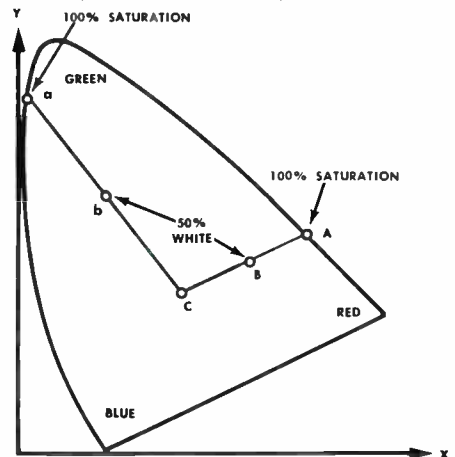


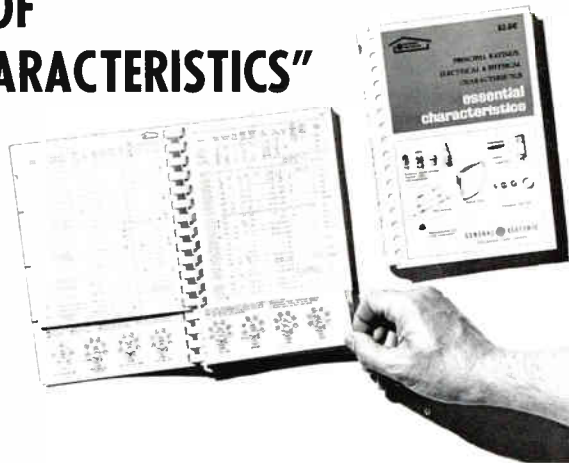
Fig. 7 — The Meaning of Saturation: The distance from point "C" determines the saturation or purity.

boundary. For illustration, Figure 7 shows two separate hues whose saturation is varied. Color A and color B have the same hue, but vary in the amount of white light contamination. Color a is the same saturation as A since it is on the outer boundary but is different in hue. Color b is the same hue as a but lower in saturation.



LEADERSHIP IN ELECTRONICS!
LEADERSHIP IN SERVICE AIDS . . . and here is another

1967 EDITION OF "ESSENTIAL CHARACTERISTICS" NOW AVAILABLE



The 360 page twelfth edition of "Essential Characteristics" (ETR-15M), the General Electric handbook on receiving, five-star and special-purpose tubes, compactrons, thyratrons, gas filled diodes, ceramic tubes, television picture tubes, reed switches, photoconductive cells, photoconductive cell-lamp combinations and replacement capacitors, now is available from your General Electric tube distributor.

New tube characteristics added to this edition bring to 3287 the total number of tubes, including 741 monochrome and color picture tubes.

The new edition contains a number of improvements which will make this booklet easier to use and even more practical in electronic servicing.

One such improvement which first appeared in ETR-15K is the rearrangement of base diagrams which have been enlarged to make them easier to read. All tube types using the same base drawing are listed with each diagram.

Also, the basing diagrams are arranged in numerical-alphabetical order with four on each individual page. The base diagram portion of each page has been cut so the basing can be viewed

at the same time as the tube characteristics. First the base diagram number is located in the "Base Connections" column for any tube type. Then, without turning the top section, the appropriate base diagram can be located in the lower section and opened so both the electrical characteristics and base drawings are visible at the same time.

The listing of all tube types using the same base diagram should be of considerable value particularly when servicing older model receivers. If a tube type is not available, a check of the electrical characteristics for other tubes with the same basing will enable the technician to determine whether or not a substitute can readily be made with another type.

As before, the book includes typical characteristics curves, tube outline drawings, circuit diagrams showing typical applications of receiving tubes and capacitors, and construction data for speaker enclosures.

Tube classification charts have been expanded to facilitate reference to similar types. Cross-reference listings of prototypes for five-star and special-purpose types and a listing of Foreign Types and American near-equivalents are included.

New additions include outline drawings, characteristics for reed switches and photoconductive cells.

Get the new ETR-15M from your distributor — or if he is unable to supply you, use order coupon on page seven. The price is \$2.00.



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