

# CRT

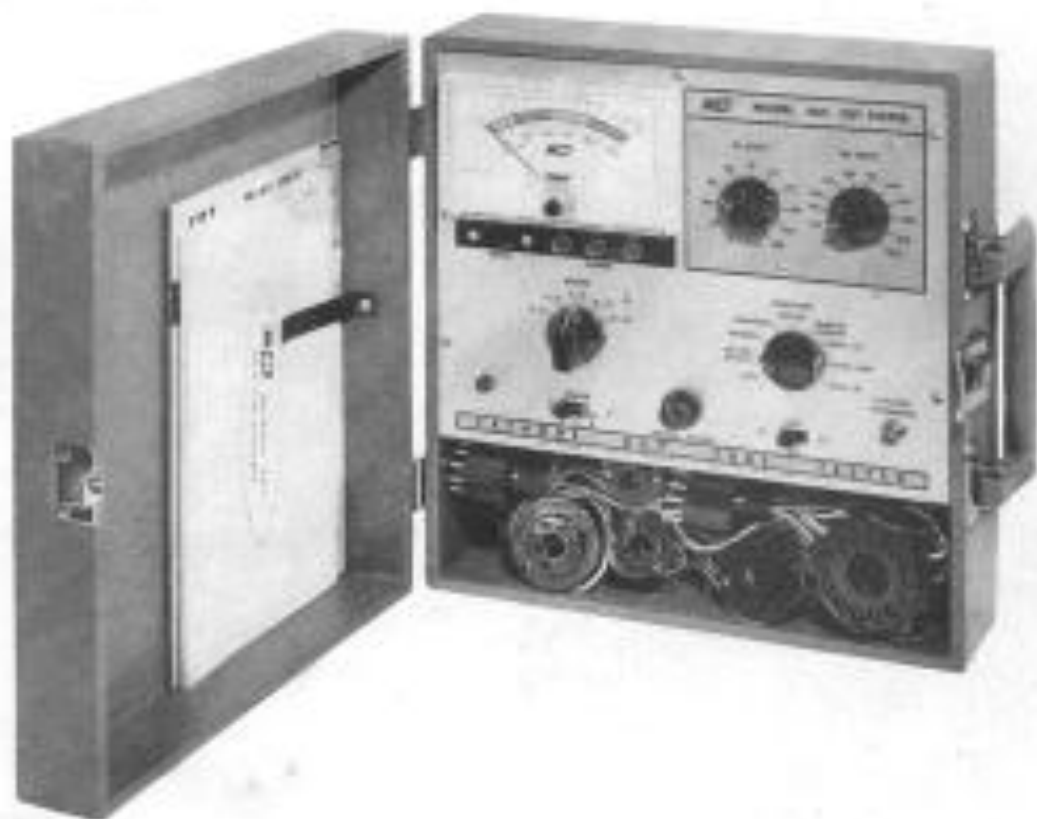
# CATHODE RAY TUBE TESTER



INSTRUCTION MANUAL

MODEL

465



DIVISION OF DYNASCAN CORPORATION

1801 W. Belle Plaine Ave., Chicago, Illinois 60611

# **OPERATING INSTRUCTIONS**

**FOR YOUR**

## **Model 465**

# **CATHODE RAY TUBE TESTER**

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**B & K DIVISION OF DYNASCAN CORP.**  
**1801 West Belle Plaine Avenue**  
**Chicago, Illinois 60613**

## GENERAL INFORMATION

This fine quality, easy to use cathode ray tube tester has been designed by B & K to accurately evaluate the condition of virtually any television cathode ray tube.

The Model 465 not only incorporates the essence of its predecessors, but includes many important advances. For example, a continuously variable heater voltage control assures you of precise heater adjustment and effectively protects the instrument from obsolescence by the appearance of new heater voltages in the future. The voltages to grid 1 and grid 2 are also continuously adjustable permitting a tube to be checked under conditions similar to the operation of a tube within a receiver. Abundant storage space, extra large meter, plus functional panel layout, provide you with the utmost of operating convenience. Rejuvenation voltage is available in three separate steps, and it is automatically timed to avoid accidental damage to a tube. Finally, transformer coupling from the line affords you with additional safety. These are several of the reasons we feel you will be proud of your Model 465.

Please note that the operating power is stated on the panel. Do not use this tester on any other type of power.

In order to keep your Set-Up Chart up to date, it is recommended that you subscribe to the B & K Chart mailing service. These mailings will occur in May and in November. New charts will be complete in that they will list all of the tubes presently contained in your chart plus all of the new types of tubes that have come out since the last mailing.

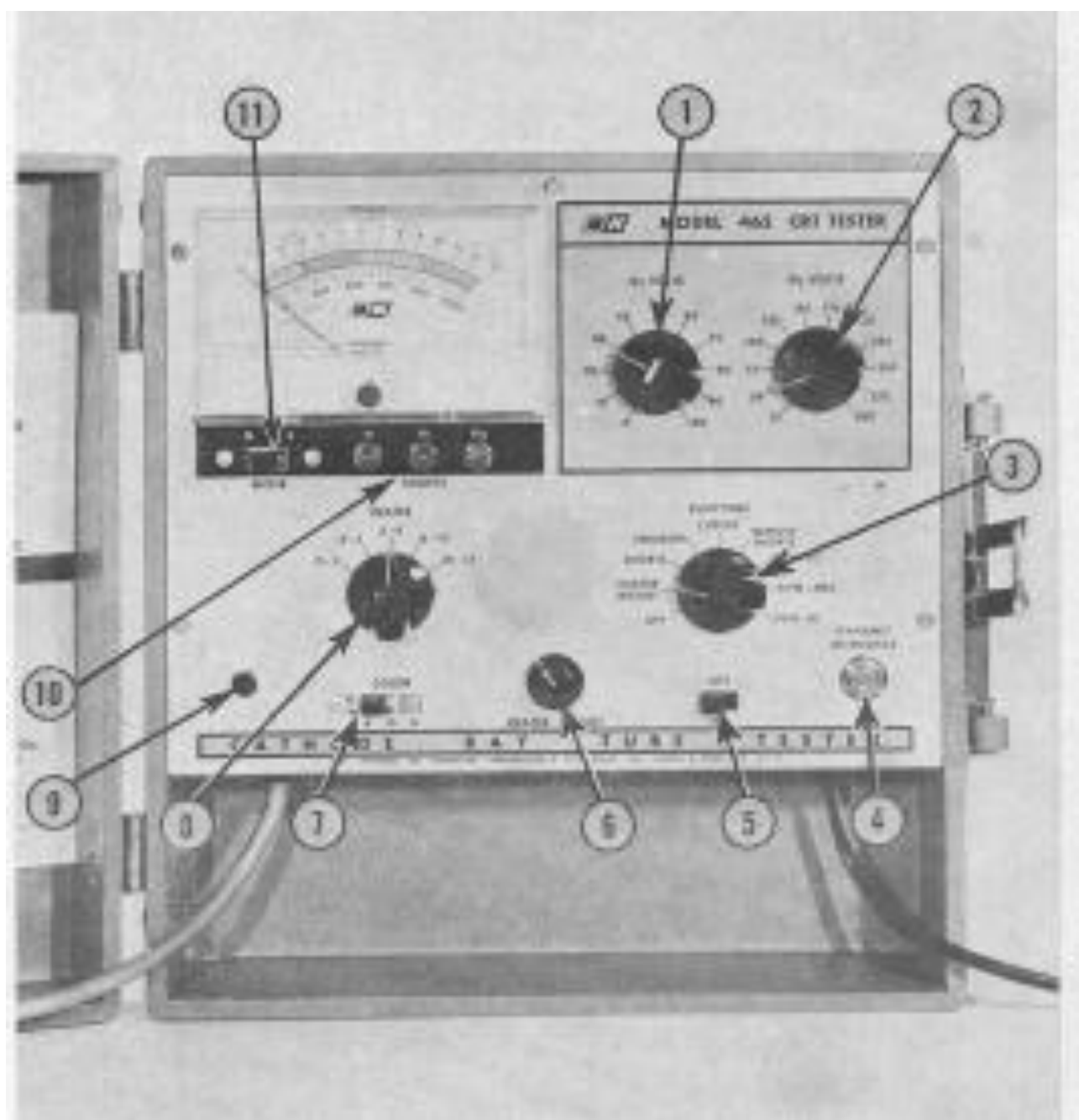
If you wish to take advantage of this service, remit to:

B & K Division of Dynascan Corporation  
1801 W. Belle Plaine Ave.  
Chicago, Illinois 60613

and you will be placed on the subscription service. No C.O.D.'s please.

## **WHAT THE MODEL 465 CATHODE RAY TUBE TESTER WILL DO**

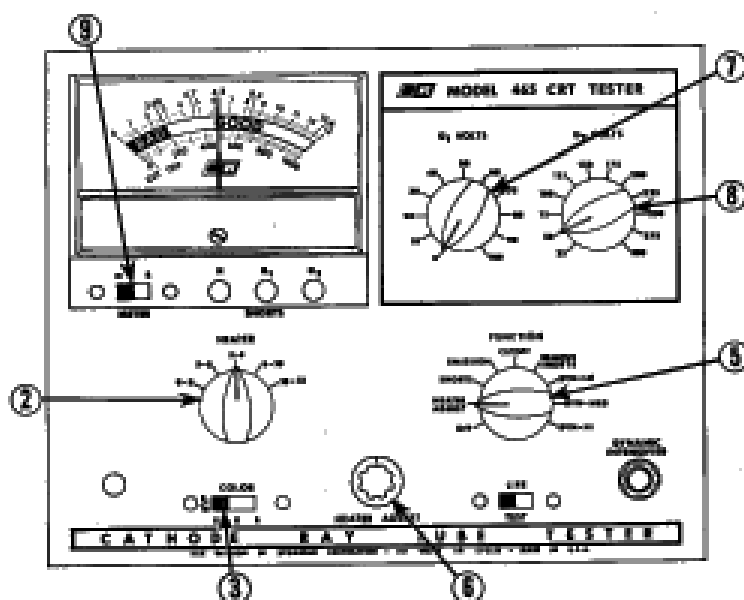
1. The Model 465 Cathode Ray Tube Tester will test a cathode ray tube for all of the important factors which determine the quality of the tube. The Model 465 will check for shorts or leakage between the elements in the tube (up to several megohms). The Model 465 will also indicate between which tube elements the fault exists.
2. The Model 465 will check for the amount of emission from the cathode of a tube.
3. The Model 465 will check the cutoff characteristics of a tube.
4. The Model 465 will also repair most of the common faults in cathode ray tubes, such as shorts between elements, open connections to elements, and inter-element leakage.
5. The Model 465 will rejuvenate picture tubes which have low emission.
6. The Model 465 will also predict the probable useful life of a picture tube.
7. The Model 465 will perform all of the above tests and repairs on old and new tubes, including the "low G2" tubes that require 50 volts or less of G2 potential and tubes operating at low emission currents.



## WHAT THE CONTROLS DO

1. **G-1 VOLTS** — This control is used to determine if the tube under test will cut off at the proper grid voltage.
2. **G-2 VOLTS** — Voltage to the G2 element is selected with this control, providing an accurate test regardless of the G2 voltage required.
3. **FUNCTION SWITCH** — Selection of the various tests and repair operations is accomplished with this switch.
4. **DYNAMIC INTENSIFIER** — When the Function switch is in the Dyn-Lo, Dyn-Med, or Dyn-Hi position, this switch is used to rejuvenate tubes which have weak emission. When the Function switch is in the Remove Shorts position, this switch is used to burn out shorts and repair open elements.
5. **LIFE TEST SWITCH** — Probable useful life of a picture tube is determined by the use of this switch.
6. **HEATER ADJUST** — When used in conjunction with the voltmeter scale on the meter, this control permits accurate fine adjustment of the heater voltage.
7. **COLOR SWITCH** — This 3-position slide switch permits separate tests and rejuvenation of each of the three guns (Red, Green and Blue) of a color picture tube. When testing a Black and White tube, this switch must be in the B/W position (extreme left).
8. **HEATER SWITCH** — The range of the heater voltage applied to the tube under test is selected with this switch.
9. **PILOT LIGHT** — The red indicator is lit when the unit is on.
10. **SHORTS H-G1-G2 LIGHTS** — When these indicator lights are lit, they indicate element shorts within the picture tube and between which elements the short exists.
11. **METER SWITCH** — This switch controls meter sensitivity. Most tubes are tested in "N" or the Normal position. To adequately test some tube types, higher meter sensitivity is required. This is obtained in the "S" or Special position of the switch.

## PREPARING TO TEST



1. Connect the line cord to a power outlet.
2. Set the Heater switch to the proper output voltage range as indicated in the Set-Up Chart for the tube under test.
3. Set the Color switch to the "B/W" position when testing a black and white tube, or the "R" position when testing a color tube.
4. Connect the proper socket to the CRT under test. The "Regular test" socket is the socket at the end of the multiconductor cable. The Black and White adaptor sockets are marked with the letter shown in the Set-Up Chart, and, unless otherwise noted, the color adapter sockets are identified as Large or Small.
5. Rotate the Function Switch from Off to the Heater Adjust position.
6. Rotate the Heater Adjust control until the meter reads the correct heater voltage as indicated on the CRT Set-Up Chart.
7. For both color and black and white tubes, set the G1 Volts control to zero.
8. For a black and white tube, set G2 Volts to the position shown on the Set-Up Chart. For a color tube, set G2 Volts to zero.
9. Set Meter switch to position indicated on the Set-Up Chart.
10. **ALLOW THE TUBE TO WARM-UP FOR A MINIMUM OF THREE MINUTES BEFORE PROCEEDING WITH THE SHORTS TEST.**

**NOTE:** As the tests in this instruction manual are performed, the control settings from the previous test should not be changed unless so stated.

For abnormally low line voltages conditions, the correct heater voltage can be obtained by using the next highest step of the Heater switch.

**COMMENTS:** The figure shows the correct settings of the controls for the following black and white tube on the Set-Up Chart:

TUBE TYPE	HEATER	TEST SOCKET	G-2	G-1 RANGE
21CP4	6.3	Regular	50	28-50

## SHORTS TEST

1. Set the Function Switch to the Shorts position.
2. Interpret the Shorts lights using the table shown below. This table is also shown in the Set-Up Chart.

	H	G1	G2	
	○	○	○	Good
<b>Key:</b>	●	○	○	Bad (H to K Short)
● = on.	●	●	○	Bad (H to G1 Short)
○ = off.	●	○	●	Bad (H to G2 Short)
	○	●	○	Bad (K to G1 Short)
	○	●	●	Bad (G1 to G2 Short)
	○	○	●	Bad (K to G2 Short)

3. When testing a Color tube, repeat the above for each position of the Color Switch, R, G and B.
4. If the tube shows no shorts, go on to the Emission test. If there is a short in the CRT refer to a later section on Removing Shorts, page 10.

**COMMENTS:** Tap the tube lightly while making the shorts test. It is possible that one or more of the shorts lights will flicker indicating an intermittent connection within the tube.

A short can be distinguished from leakage by the relative brightness of the neon lamp. A faint light indicates leakage while a bright light indicates a direct short.

Leakage can be caused by dust accumulation at the base pins of the CRT socket. Cleaning the tube base with a nontoxic, nonconductive solvent, such as methyl alcohol, will frequently eliminate this problem.



## EMISSION TEST FOR COLOR TUBES

1. Set the Function Switch to Cut Off position.
2. Set the Color Switch to the "R" position to test the Red gun.
3. Adjust G1 Volts to the value shown on the Set-Up Chart.
4. Slowly rotate G2 Volts from zero until the meter pointer rests over the Cut Off mark on the dial. If you do not reach the Cut Off mark, the tube is weak and should be rejected.
5. Set the Function Switch to the Emission position and read emission on the dial.
6. If the meter reads in the Bad area, reject the tube. If the meter reads in the Good area, record the reading.
7. Repeat the above procedure for the green and blue guns.
8. If the highest gun reading is no more than  $1\frac{1}{2}$  times the lowest reading, the tube is good. For example: The red gun reads 600

The green gun reads 750

The blue gun reads 800

$1\frac{1}{2}$  times the lowest reading is  $600 \times 1\frac{1}{2} = 900$

Therefore, since the highest reading, 800, is less than 900, the tube is good.

**COMMENTS:** If the customer complaint concerns a variation in the black and white picture while the receiver is warming up, refer to the supplemental test on page 11.

## EMISSION TEST FOR BLACK AND WHITE TUBES

1. Set the Function Switch to the Emission position.
2. If the meter reading is in the Good area, go on to Step 3. If the meter reading is in the Bad area, refer to a later section on Restoring Emission, page 10.
3. Set the Function Switch to the Cut Off position.
4. Slowly rotate G1 Volts from zero until the meter pointer rests over the Cut Off mark. Do not rotate G1 Volts Control any further.
5. If the G1 Volts setting is within the range given in the Set-Up Chart, the tube is satisfactory. If the G1 Volts setting is not within the range given in the Set-Up Chart, the tube should be rejected because the contrast range of a cathode ray tube is directly related to the cutoff characteristic. The lower the bias voltage needed to cut off the tube, the greater will be the contrast of the picture on that tube.

**COMMENTS:** A zero reading when the Function Switch is in the Emission position indicates an open G2 or K element. A reading in the Cut Off position that does not change as the G1 Volts control is varied, indicates an open G1 element.

The G2 Volts control should be set carefully so that erroneous readings and tube damage may be avoided.

## LIFE TEST

1. Set the Function Switch to the Emission position.
2. Slide the Life Test Switch to the right while watching the Emission meter. Note the length of time before the meter starts to fall toward zero.
3. When testing a color tube, repeat step 2 for all three color guns.
4. If the meter pointer momentarily remains fixed or slightly increases and then slowly drops to zero, the tube is acceptable. If the meter reading begins to slump toward zero rapidly, the tube cannot be expected to last much longer.

**COMMENTS:** In this test, the useful life of a picture tube is approximately predicted by the mass of emitting material that is on the cathode of the picture tube and also by the amount of gas present in the tube. When the meter reading falls rapidly to zero, there is probably excess gas in the tube, or there is only a small mass of active emitting surface left. Therefore, the tube cannot be expected to last much longer. (A gassy picture tube cannot be repaired.)

## REMOVING SHORTS

1. Set the Function Switch to Remove Shorts position.
2. Wait 5 to 10 minutes so that the CRT tube filament may cool. In this position, filament voltage is not applied to the tube.
3. When repairing a color tube, set the Color Switch to the gun that has the short. For a black and white tube the Color Switch must be in the "B/W" position.
4. Press the Dynamic Intensifier button momentarily.
5. Repeat the Shorts test on page 7 to determine whether the short has been removed. Repeat the Emission test on page 8 or 9 to determine the quality of the tube.

**COMMENTS:** When the tube in the Shorts test shows a cathode to filament short, do not attempt to repair it. If the tube functions properly in the set, it is unnecessary to do any more to it. However, if the picture is bad (possible hum in picture or no control of brightness), the picture tube can still be used if a 1:1 filament isolation transformer is wired into the set.

## RESTORING EMISSION

1. Set the Function Switch to Dyn-Lo (Dynamic Intensifier-Low) position.
2. When repairing a color tube, set the Color Switch to the gun that is to be rejuvenated. For a black and white tube, the Color Switch must be in the "B/W" position.
3. Press the Dynamic Intensifier button momentarily.
4. Repeat the Emission test on either page 8 or 9. If the meter reads in the Good area, you have successfully rejuvenated the tube. If the Emission is still low, place the Function Switch in Dyn-Med position and allow 15 seconds for the heater to come up to operating temperature. Press the Dynamic Intensifier button. If the Emission is still low, repeat this procedure in the Dyn-Hi position.

**COMMENTS:** Any attempt to bring back the emission by rejuvenating a tube should be done very cautiously, AND ONLY AFTER IT HAS BEEN DEFINITELY DETERMINED THAT THE TUBE IS NO LONGER USEFUL IN ITS PRESENT CONDITION. When rejuvenating a Color tube, make sure you attempt rejuvenation of the defective gun only.

It is not generally advisable that you attempt rejuvenation of an "in-warranty" tube.

## SUPPLEMENTAL COLOR TUBE TEST

To determine whether changes in black and white tracking as the receiver warms up is caused by the tube or by the receiver, the following test should be performed.

Allow the tube to cool for 30 minutes. Connect the tube to the Model 465 and perform the Emission Test on page 8 after 2 minutes and after 4 minutes. Record all six readings. For a tube to be acceptable:

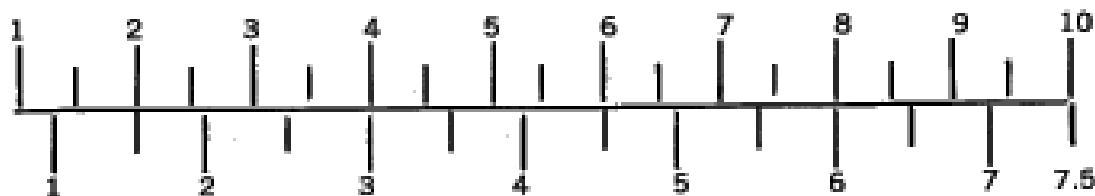
1. Readings obtained in the 4 minute test must be in the Good area of the scale, and the highest gun reading should be no more than 1.5 times the lowest reading.
2. The meter reading for each gun in the 2 minute test must be at least 75% of the reading obtained for the same gun in the 4 minute test.

If, for example, the following readings had been obtained:

Gun	2-Minutes	4-Minutes	75% of 4 Minute Read.
Red	500	800	600
Green	700	800	600
Blue	750	850	637

The Green and Blue guns have 2-minute readings greater than 75% of the 4-minute readings and are acceptable. The 2-minute reading of the Red gun, however, is below 75% of the 4-minute reading which indicates slow warm-up of the Red gun.

This chart may be used to obtain 75% of the 4-minute reading.



Locate the 4-minute reading on the top scale. 75% of this reading is found on the bottom scale.

## REPAIRING OPEN ELEMENTS

If the tube has an open G1 or G2 element, the probable cause is a bad solder connection at the base pins. For an open element, the first step is to try resoldering the pins on the base of the picture tube. If the tube has an open cathode, it may actually be a break in the weld between the cathode and its connecting tab or very weak emission from the cathode. First try restoring emission, as discussed in a preceding section. If that does not work, you can attempt to weld the cathode tab as follows:

Turn the Function Selector Switch to Dyn-Hi position. With the non-metallic handle of a screw-driver, tap lightly on the neck of the tube. Watch carefully as you press the Dynamic Intensifier button while tapping. If the weld takes, you will see a bright flash. Retest the tube to be sure it will function satisfactorily.

## **MAINTENANCE**

A control for calibrating the meter for heater voltage is located internally. This control can be set by first placing an accurate voltmeter across pin No. 1 and pin No. 12 of the regular socket and then, with the Function Switch in Heater Adjust position, by adjusting the Model 465 meter to the reading of the standard voltmeter.

## **WARRANTY SERVICE INSTRUCTIONS**

1. Service information is available from the factory at the address shown below.
2. Defective parts removed from the unit which are within the warranty period should be sent to the factory prepaid with the model and serial numbers of product from which they were removed. Also, include the date your Model 465 was purchased. These parts will be exchanged at no charge.
3. If you are unable to correct a difficulty, pack the product securely (preferably double packed). A detailed list of troubles encountered must be enclosed as well as your name and address. Forward prepaid (express preferred) to the nearest B & K authorized service agency.

Contact your local B & K Distributor for the name and location of your nearest service agency, or write to

**Service Department**

**B & K DIVISION OF DYNASCAN CORP.**

**1801 West Belle Plaine Avenue**

**Chicago, Illinois 60613**

## WARRANTY

"B & K warrants that each product manufactured by it will be free from defects in material and workmanship under normal usage and service for a period of ninety days after its purchase new from an authorized B & K distributor. Our obligation under this warranty is limited to repairing, or replacing any product or component which we are satisfied does not conform with the foregoing warranty and which is returned to our factory or our authorized service contractor, transportation prepaid, and we shall not otherwise be liable for any damages, consequential or otherwise. The foregoing warranty is exclusive and in lieu of all other warranties (including any warranty of merchantability), whether express or implied. Such warranty shall not apply to any product or component (i) repaired or altered by anyone other than B & K or its authorized service contractor (except normal tube replacement) without B & K's prior written approval; (ii) tampered with or altered in any way or subjected to misuse, negligence or accident; (iii) which has the serial number altered, defaced or removed; or (iv) which has been improperly connected, installed or adjusted otherwise than in accordance with B & K's instructions. B & K reserves the right to discontinue any model at any time or change specifications or design without notice and without incurring any obligation. The warranty shall be void and there shall be no warranty of any product or component if a B & K warranty registration card is not properly completed and postmarked to the B & K factory within five days after the purchase of the product new from an authorized B & K distributor."



**B & K DIVISION OF DYNASCAN CORPORATION**

1801 W. BELLE PLAINE AVE. • CHICAGO, ILL. 60613

# B & K MODEL 465 PARTS AND PRICE LIST

## CAPACITORS

SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.	DEALER'S NET
C-1) C-2)	5 MFD @ 450V Tubular Electrolytic .....	021-006-9-001	each .69
C-3) C-4)	50 MFD @ 450V Tubular Electrolytic .....	021-003-9-006	each 1.08

## CONTROLS & RESISTORS

R-8	2.4K Ohm 7 watt 5% glass Resistor.....	003-007-5-242	.52
R-12	50K Ohm Carbon Potentiometer .....	008-001-9-023	1.35
R-21	15K Ohm Wire-Wound Potentiometer .....	009-001-9-004	1.35
R-23	20K Ohm Trim Potentiometer .....	008-056-9-003	.39
R-25	110 Ohm 2% 1/2W Metal Film Resistor .....	011-102-4-111	.27
R-29	3 Ohm Wire-Wound Potentiometer .....	009-016-9-001	4.63

## SWITCHES

SW-1	Function Switch, 10 Pole, 10 Position .....	083-060-9-001	4.00
SW-2	Dynamic Intensifier Switch, SPDT .....	088-002-9-001	1.25
SW-3	Meter Switch, SPDT .....	084-001-9-001	.21
SW-4	Color Switch, 4PTT .....	084-001-9-008	.75
SW-5	Heater Switch, 1 Pole, 5 Position .....	083-061-9-001	1.80
SW-6	Life Test Switch, SPDT .....	091-003-9-001	.54

## MISCELLANEOUS

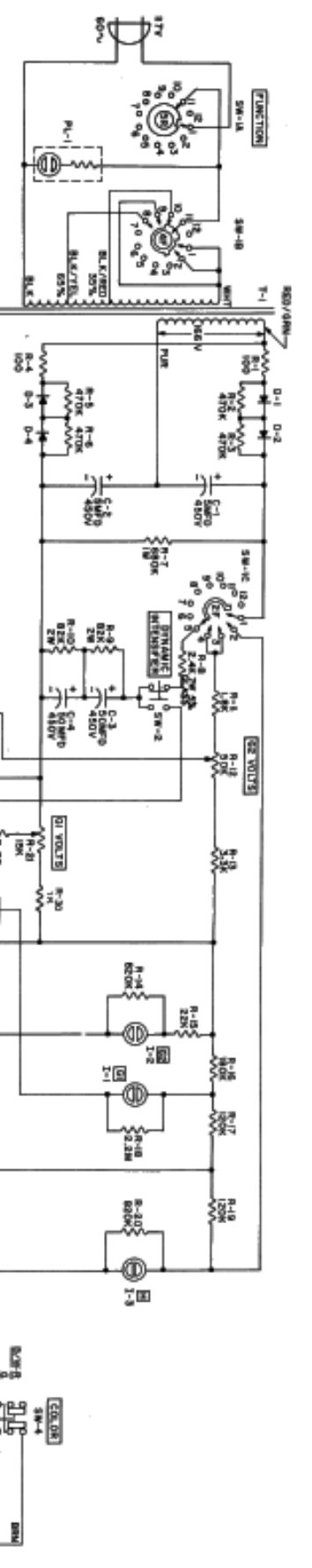
SCHEMATIC SYMBOL	DESCRIPTION	B & K PART No.	DEALER'S NET
D-1, D-2, D-3, D-4, D-6	Silicon Diode 500 PIV 500 Ma. ....	112-501-0-501	each .66
D-5	Germanium Diode 20 PIV 10 Ma. ....	150-001-9-006	.21
M-1	Meter .....	320-010-9-002	12.48
T-1	Transformer .....	065-040-9-001	6.00
I-1 I-2 I-3	Shorts Indicator, NE-2 Neon Lamp .....	401-002-9-003	each .18
PL-1	Pilot Lamp .....	401-001-9-002	.25
	Case and Lid .....	270-006-9-001	10.00
	Line Cord .....	420-001-9-007	.45
	Knob, Heater Adjust .....	751-002-9-003	.27
	Knob .....	751-010-9-001	.15
	Red Lens with Tinnerman Nut for Pilot Light....	750-003-9-001	.18
	White Lens with Tinnerman Nut for Shorts Light.	750-003-9-002	.18
	Cable Assembly, 9 Conductor .....	522-032-9-001	2.80
	Black and White Adapter Assembly .....	521-051-9-001	5.55
	Color Adapter Assembly .....	521-052-9-001	6.45
	Carton and Fillers (503-017-9-001) .....	500-119-9-001	1.00
	Instruction Manual .....	480-071-9-001	1.00
	Tube Chart Clip .....	741-023-9-001	.24

(Prices subject to change without notice)

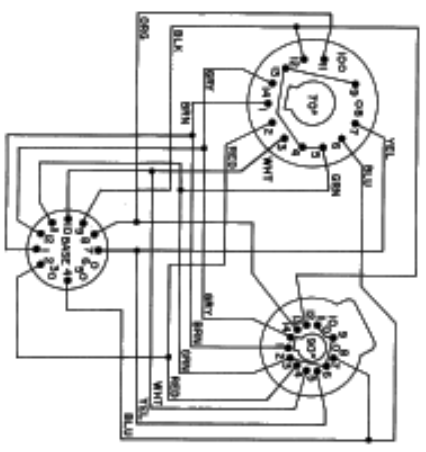
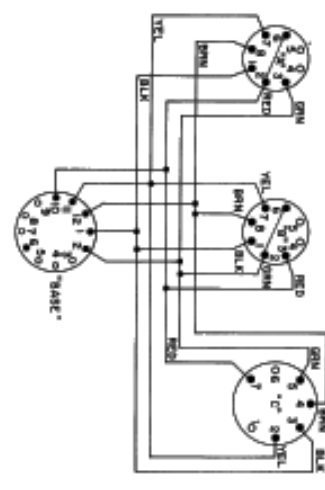
Specify serial number when ordering replacement parts.

Minimum charge \$1.00 per invoice. Orders will be shipped C.O.D. unless previous open account arrangements have been made or remittance accompanies order. Advance remittance must cover postage or express.





- NOTE:  
 1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS IN OHMS, OH., 1/2 WATT.  
 2. SWITCH SW-1 WAGERS VIEWED FROM FRONT, SWITCH SW-8 WAGERS VIEWED FROM REAR.  
 3. SWITCH POSITIONS  
 SW-4 - R  
 SW-2 - OFF  
 SW-3 - NORMAL  
 SW-6 - ON  
 SW-5 - NORMAL  
 SW-8 - ON  
 SW-9 - ON
4. FUNCTION SWITCH SW-1 PANEL WARNING  
 1 HEATER ADJUST 7 DIN-LIM  
 2 SHORTS 8 DIN-MED  
 4 EMISSION 9 DIN-HSH  
 5 CUTOFF
5. HEATER SWITCH SW-2 PANEL WARNING  
 2 O-2 5 R-10  
 4-2-5 7 R-13  
 5-5-8
6. AC VOLTAGES AYC PWR.  
 1 LAST "V" SW-20  
 2 LAST "V" SW-4  
 3 LAST "V" SW-4  
 4 LAST "V" SW-4



488(053) 9 001	
REV.	DESCRIPTION
1	ORIGINAL
2	REVISION
3	REVISION
4	REVISION
5	REVISION
6	REVISION
7	REVISION
8	REVISION
9	REVISION
10	REVISION

MODEL 465  
 CRT TESTER  
 488-053-9-001

ADAPTER TO XV-1

ADAPTER TO XV-4

## SHORTS TEST CHART

	H	G1	G2	
Key:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Good
● = on.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Bad (H to K Short)
○ = off.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Bad (H to G1 Short)
	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Bad (H to G2 Short)
	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Bad (K to G1 Short)
	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Bad (G1 to G2 Short)
	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Bad (K to G2 Short)



**MODEL 465  
SET-UP CHART**

TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range
5AXP4	6.3	Regular	300	22-72	11CP4	6.3	B	300	25-94	12CAP4	6.3	B	50	28-55
7DP4	6.3	Regular	250	18-58	11DP4	6.3	B	50	24-49	12CBP4	6.3	C	30	20-40
7RP4	6.3	Regular	250	18-58	11EP4	6.3	B	300	24-94	12CDP4	6.3	ΔCR-57 Blk	140	24-49
8DP4	6.3	Regular	150	10-35	11FP4	6.3	B	300	24-94	12CEP4	12.6	ΔCR-57 Blk	100	23-50
8HP4	6.3	Regular	300	22-72	11GP4	6.3	B	135	22-43	12CFP4	4.2	ΔCR-57 Blk	200	23-60
8LP4	6.3	C	300	28-72	11HP4	6.3	B	150	24-49	12CHP4	6.3	ΔCR-57 Blk	300	23-74
8MP4	6.3	Regular	300	22-72	11JP4	6.3	B	50	24-45	12CNP4	4.2	ΔCR-57 Blk	200	20-55
8NP4	6.3	Regular	300	22-72	11KP4	6.3	B	50	24-49	12CQP4	6.3	B	40	23-50
8QP4	6.3	Regular	300	22-72	11LP4	6.3	B	300	24-78	12JF4	6.3	B	250	18-58
8XP4	6.3	Regular	300	22-72	11MP4	6.3	B	135	24-50	12KP4	6.3	Regular	250	18-58
8YP4	6.3	C	300	22-72	11QP4	12.6	ΔCR-57 Blk	100	25-50	12KPA	6.3	Regular	300	22-72
9QP4	5	Regular	200	22-52	11RP4	6.3	ΔCR-57 Blk	140	24-49	12LPA	6.3	Regular	250	18-58
9SP4	6.3	B	300	26-77	12AYP4	6.3	B	300	24-78	12LPA	6.3	Regular	250	18-58
9TP4	6.3	B	50	29-53	12AZP4	6.3	B	300	24-78	12LPA	6.3	Regular	250	18-58
9UP4	12.6	ΔCR-57-Blk	100	28-55	12BAP4	6.3	B	300	24-78	12QPA	6.3	Regular	250	18-58
9VP4	12.6	ΔCR-57 Blk	100	30-84	12BDP4	6.3	B	40	24-50	12QPA	6.3	Regular	300	22-72
9WP4	12.6	ΔCR-57 Blk	100	26-50	12BEP4	6.3	C	30	20-40	12RPA	6.3	Regular	250	18-58
10ABP4	6.3	Regular	300	30-62	12BFP4	4.2	ΔCR-57 Blk	200	22-77	12TP4	6.3	Regular	250	18-58
10ABP4A	6.3	Regular	300	30-62	12BGP4	6.3	B	50	28-55	12UP4	6.3	Regular	300	22-72
10ABP4B	6.3	Regular	300	30-62	12BHP4	6.3	B	180	25-44	12UP4A	6.3	Regular	300	22-72
10ABP4C	6.3	Regular	300	30-62	12BJP4	4.2	B	300	18-60	12UP4B	6.3	Regular	300	22-72
10ADP4	8.4	Regular	300	30-72	12BKPA	6.3	B	50	28-55	12XPA	6.3	Regular	250	18-58
10AEP4	6.3	Regular	300	30-62	12BLPA	6.3	B	30	23-45	12YPA	6.3	Regular	250	22-68
10BP4	6.3	Regular	250	18-58	12BMP4	6.3	ΔCR-57 Blk	140	22-49	12ZPA	6.3	Regular	250	18-58
10BP4A	6.3	Regular	250	18-58	12BNP4	6.3	B	250	28-65	12ZPA	6.3	Regular	250	18-58
10BP4C	6.3	Regular	250	18-58	12BNP4A	6.3	B	250	28-65	13APA	6.3	B	50	28-55
10BP4D	6.3	Regular	250	18-58	12BQP4	6.3	B	50	20-45	13BP4	6.3	B	50	28-55
10CP4	6.3	Regular	250	22-72	12BRP4	12.6	ΔCR-55	30	20-35	14ACP4	6.3	Regular	125	32-80
10DP4	6.3	Regular	250	29-84	12BSP4	6.3	B	300	27-77	14AEP4	6.3	Regular	110	25-50
10FP4	6.3	Regular	250	18-58	12BTP4	12.6	B	50	28-55	14AJP4	6.3	B	250	19-64
10FP4A	6.3	Regular	250	18-58	12BUP4	6.3	B	50	29-49	14ARP4	6.3	Regular	50	28-50
10RP4	6.3	Regular	300	22-72	12BVP4	12.6	ΔCR-57 Blk	50	29-49	14ASP4	6.3	B	300	22-72
10SP4	6.3	Regular	200	14-48	12BWP4	6.3	B	35	20-45	14ATP4	8.4	Regular	300	20-69
11AP4	6.3	B	150	23-49	12BXP4	6.3	B	50	26-53	14AUP4	6.3	Regular	50	24-50
11BP4	6.3	B	150	28-55	12BZP4	12.0	ΔCR-57 Blk	100	25-49	14AVP4	6.3	B	300	22-72

ΔTest Socket Available as an Optional Accessory.

\*Meter Switch Must Be in "S" Position.

TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>2</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>2</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>2</sub> Range
14AWP4	6.3	Regular	50	25-47	16ABP4	6.3	Regular	300	22-72	16BVP4	6.3	B	300	34-70
14AZP4	6.3	Regular	300	28-72	16ACP4	6.3	Regular	250	22-63	16BWP4	6.3	B	300	22-60
14BAP4	6.3	Regular	300	22-72	16AEP4	6.3	Regular	300	22-72	16BXP4	6.3	C	35	20-50
14BDP4	6.3	Regular	300	26-77	16AFP4	6.3	Regular	300	19-62	16BYP4	6.3	B	100	24-49
14BP4	6.3	Regular	300	22-72	16AKP7	6.3	Regular	300	26-75	16BZP4	6.3	B	150	29-54
14BP4A	6.3	Regular	300	22-72	16ANP4	6.3	B	300	26-70	16CAP4	6.3	B	300	31-94
14CP4	6.3	Regular	300	22-72	16AP4	6.3	Regular	300	22-72	16CEP4	6.3	B	300	30-94
14CP4A	6.3	Regular	300	22-72	16AP4A	6.3	Regular	300	22-72	16CFP4	6.3	ΔCR-57 Blk	140	24-49
14CP4B	6.3	Regular	300	22-72	16AP4B	6.3	Regular	300	22-72	16CGP4	6.3	E	50	24-49
14DP4	6.3	Regular	250	18-58	16AQP4	6.3	B	300	26-70	16CHP4	6.3	B	30	23-45
14EP4	6.3	Regular	300	22-72	16ASP4	6.3	B	300	34-70	16CJP4	6.3	B	300	25-94
14GP4	6.3	Regular	300	22-72	16ATP4	6.3	B	50	23-49	16CKP4	6.3	B	300	31-94
14HP4	6.3	Regular	300	22-72	16AUP4	6.3	B	300	23-95	16CLP4	6.3	B	300	33-80
14HP4A	6.3	Regular	300	22-72	16AVP4	6.3	C	35	20-50	16CMP4	6.3	B	300	30-94
14KP4	6.3	Regular	250	23-60	16AWP4	6.3	B	150	23-50	16CMP4A	6.3	B	300	22-60
14KP4A	6.3	Regular	250	23-60	16AXP4	6.3	B	300	32-72	16CNP4	12.0	ΔCR-57 Blk	100	24-49
14NP4	6.3	Regular	300	22-72	16AYP4	6.3	B	300	22-60	16CP4	6.3	Regular	250	18-58
14NP4A	6.3	Regular	300	22-72	16AZP4	6.3	B	150	23-50	16CQP4	6.3	ΔCR-57 Blk	140	27-49
14QP4	6.3	Regular	250	19-64	16BAP4	6.3	B	50	28-55	16CTP4	6.3	B	300	24-94
14QP4A	6.3	Regular	250	19-64	16BCP4	6.3	C	30	20-50	16CUP4	6.3	B	300	24-94
14QP4B	6.3	Regular	250	19-64	16BDP4	6.3	B	300	22-60	16DP4	6.3	Regular	250	18-58
14RP4	6.3	Regular	300	21-70	16BEP4	6.3	B	50	23-48	16DP4A	6.3	Regular	250	18-58
14RP4A	6.3	Regular	300	21-70	16BFP4	6.3	B	300	24-94	16EP4	6.3	Regular	300	22-72
14SP4	6.3	Regular	300	22-72	16BGP4	6.3	B	300	22-60	16EP4A	6.3	Regular	300	22-72
14UP4	6.3	Regular	300	22-72	16BHP4	6.3	B	300	28-72	16EP4B	6.3	Regular	300	22-72
14WP4	6.3	Regular	300	22-72	16BJP4	6.3	B	300	28-72	16FP4	6.3	Regular	300	22-72
14XP4	6.3	Regular	300	22-72	16BKP4	6.3	B	50	28-55	16GP4	6.3	Regular	300	22-72
14XP4A	6.3	Regular	300	22-72	16BLP4	6.3	B	50	28-55	16GP4A	6.3	Regular	300	22-72
14ZP4	6.3	Regular	300	22-72	16BNP4	6.3	B	300	24-95	16GP4B	6.3	Regular	300	22-72
15AP4	6.3	Regular	250	18-58	16BNP4	6.3	B	50	28-65	16GP4C	6.3	Regular	300	22-72
15CP4	6.3	Regular	250	18-58	16BQP4	6.3	B	300	32-95	16HP4	6.3	Regular	300	22-72
15DP4	6.3	Regular	250	18-58	16BRP4	6.3	B	300	30-95	16HP4A	6.3	Regular	300	22-72
15DP4A	6.3	Regular	250	18-58	16BSP4	6.3	B	50	28-65	16JP4	6.3	Regular	250	18-58
15EP4	6.3	Regular	300	19-62	16BTP4	6.3	B	50	25-50	16JP4A	6.3	Regular	250	18-58
15JP4	6.3	B	50	28-55	16BUP4	6.3	B	100	24-49	16KP4	6.3	Regular	300	22-72

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TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>2</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>2</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>2</sub> Range
16KP4A	6.3	Regular	300	22-72	17BP4D	6.3	Regular	300	22-72	17DHP4	6.3	B	300	29-72
16LP4	6.3	Regular	300	22-72	17BRP4	6.3	B	300	22-72	17DJP4	6.3	Regular	300	28-72
16LP4A	6.3	Regular	300	22-72	17BSP4	6.3	Regular	300	22-72	17DKP4	6.3	B	300	29-78
16MP4	6.3	Regular	300	22-72	17BTP4	6.3	Regular	300	32-80	17DLP4	6.3	B	300	17-72
16MP4A	6.3	Regular	300	22-72	17BUP4	6.3	Regular	300	22-72	17DOP4	6.3	C	50	24-49
16QP4	6.3	Regular	250	18-58	17BVP4	6.3	C	300	28-72	17DRP4	2.68	A	300	28-72
16RP4	6.3	Regular	300	22-72	17BWP4	6.3	C	300	28-72	17DSP4	6.3	B	300	31-90
16RP4A	6.3	Regular	300	22-72	17BYP4	6.3	C	300	28-72	17DTP4	6.3	B	300	22-72
16RP4B	6.3	Regular	300	22-72	17BZP4	6.3	B	300	22-72	17DWP4	6.3	Regular	300	22-72
16SP4	6.3	Regular	300	22-72	17BZP4A	6.3	B	300	22-72	17DXP4	6.3	B	300	29-78
16SP4A	6.3	Regular	300	22-72	17CAP4	6.3	B	300	28-72	17DZP4	6.3	B	300	22-72
16TP4	6.3	Regular	300	22-72	17CBP4	6.3	Regular	300	22-72	17EBP4	6.3	B	300	29-72
16UP4	6.3	Regular	250	18-58	17CDP4	8.4	B	300	22-72	17EFP4	6.3	B	300	35-90
16VP4	6.3	Regular	250	18-58	17CEP4	6.3	Regular	300	22-72	17EHP4	6.3	B	50	26-55
16WP4	6.3	Regular	250	18-58	17CFP4	6.3	Regular	300	22-72	17EKP4	6.3	Regular	300	26-77
16WP4A	6.3	Regular	250	18-58	17CGP4	6.3	Regular	300	22-72	17ELP4	6.3	B	55	28-50
16WP4B	6.3	Regular	250	18-58	17CKP4	6.3	B	300	22-72	17EMP4	6.3	B	50	26-45
16XP4	6.3	Regular	250	18-58	17CLP4	6.3	Regular	300	22-72	17FP4	6.3	Regular	300	22-72
16YP4	6.3	Regular	300	22-72	17CMP4	6.3	Regular	50	28-50	17FPA4	6.3	Regular	300	22-72
16ZP4	6.3	Regular	300	22-72	17CNP4	6.3	Regular	50	28-50	17GP4	6.3	Regular	300	22-72
17AP4	6.3	Regular	300	22-72	17CP4	6.3	Regular	300	22-72	17HP4	6.3	Regular	300	22-72
17ASP4	6.3	Regular	300	22-72	17CP4A	6.3	Regular	300	22-72	17HP4A	6.3	Regular	300	22-72
17ATP4	6.3	Regular	300	22-72	17CRP4	6.3	Regular	50	24-50	17HP4B	6.3	Regular	300	22-72
17ATP4A	6.3	Regular	300	22-72	17CSP4	6.3	C	300	28-72	17HP4C	6.3	Regular	300	22-72
17AVP4	6.3	Regular	300	22-72	17CTP4	6.3	B	300	28-72	17JPA	6.3	Regular	300	22-72
17AVP4A	6.3	Regular	300	22-72	17CUP4	6.3	Regular	300	28-72	17KP4	6.3	Regular	300	22-72
17BJP4	6.3	Regular	300	22-72	17CVP4	6.3	B	300	28-72	17KP4A	6.3	Regular	300	22-72
17BKP4	6.3	Regular	300	22-72	17CWP4	6.3	B	300	24-92	17LP4	6.3	Regular	300	22-72
17BKP4A	6.3	Regular	300	22-72	17CXP4	6.3	Regular	50	25-47	17LP4A	6.3	Regular	300	22-72
17BMP4	6.3	Regular	110	25-50	17CYP4	6.3	Regular	300	25-100	17LP4B	6.3	Regular	300	22-72
17BNP4	6.3	Regular	110	25-50	17CZP4	6.3	Regular	300	25-100	17QCP4	6.3	Regular	300	22-72
17BP4	6.3	Regular	300	22-72	17DAP4	2.68	A	300	28-72	17QP4	6.3	Regular	300	22-72
17BP4A	6.3	Regular	300	22-72	17DBP4	6.3	Regular	300	28-72	17QPA4	6.3	Regular	300	22-72
17BP4B	6.3	Regular	300	22-72	17DCP4	6.3	Regular	300	28-72	17QP4B	6.3	Regular	300	22-72
17BP4C	6.3	Regular	300	22-72	17DEP4	2.34	A	300	29-72	17RP4	6.3	Regular	300	22-72

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TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range
17RP4C	6.3	Regular	300	22-72	198HP4	6.3	B	300	17-61	19DFP4	6.3	B	65	32-94
17SP4	6.3	Regular	250	22-61	198LP4	6.3	B	300	24-94	19DHP4	6.3	B	50	28-55
17TP4	6.3	Regular	300	22-72	198MP4	6.3	B	300	24-94	19DJP4	6.3	B	300	28-78
17UP4	6.3	Regular	250	22-61	198NP4	6.3	B	50	25-50	19DKP4	6.3	B	300	32-94
17VP4	6.3	Regular	300	22-72	198QP4	6.3	B	50	25-50	19DLP4	6.3	B	50	28-55
17VP4B	6.3	Regular	300	22-72	198RP4	6.3	B	300	28-72	19DNP4	6.3	B	300	28-72
17YP4	6.3	Regular	300	22-72	198SP4	6.3	B	300	28-78	19DP4	6.3	Regular	250	18-58
19ABP4	2.68	A	300	28-72	198TP4	6.3	B	300	28-78	19DP4A	6.3	Regular	250	18-58
19ACP4	6.3	B	50	28-50	198UP4	2.2	B	100	36-60	19DQP4	6.3	B	300	22-62
19AEP4	12.6	B	100	25-47	198VP4	6.3	B	300	31-95	19DRP4	6.3	B	300	22-62
19AFP4	6.3	B	300	28-72	198WP4	6.3	B	300	31-95	19DSP4	6.3	B	50	25-50
19AHP4	6.3	B	300	27-63	19CAP4	6.3	B	300	29-78	19DUP4	6.3	B	50	26-45
19AJP4	6.3	C	50	24-49	19CDP4	6.3	C	50	28-50	19DVP4	6.3	B	150	29-54
19ALP4	6.3	B	300	31-95	19CEP4	6.3	B	300	28-72	19DWP4	6.3	B	300	37-98
19ANP4	6.3	B	300	29-78	19CFP4	6.3	B	50	24-49	19DYP4	6.3	B	50	25-50
19AP4	6.3	Regular	300	22-72	19CGP4	6.3	Regular	300	28-72	19DZP4	6.3	B	150	28-60
19AP4A	6.3	Regular	300	22-72	19CHP4	6.3	B	50	25-50	19EAP4	6.3	B	50	25-50
19AP4B	6.3	Regular	300	22-72	19CJP4	6.3	B	300	48-100	19EBP4	6.3	B	300	26-94
19AP4C	6.3	Regular	300	22-72	19CKP4	6.3	B	50	29-54	19ECP4	6.3	B	150	29-54
19AP4D	6.3	Regular	300	22-72	19CLP4	6.3	Regular	35	20-40	19EDP4	6.3	B	300	32-95
19AQP4	6.3	B	300	30-72	19CMP4	6.3	B	30	22-45	19EFP4	6.3	B	50	28-55
19ARP4	6.3	B	300	28-72	19CMP4A	6.3	B	30	22-45	19EGP4	6.3	B	50	28-55
19ASP4	6.3	B	300	28-72	19COP4	6.3	C	50	20-50	19EHP4	6.3	B	300	28-72
19ATP4	6.3	B	300	29-78	19CRP4	6.3	Regular	35	20-50	19EHP4A	6.3	B	300	28-72
19AUP4	6.3	B	300	28-72	19CTP4	6.3	B	300	28-78	19EJP4	6.3	B	30	23-45
19AVP4	6.3	B	300	24-94	19CUP4	6.3	B	65	33-56	19EKP4	6.3	C	45	28-50
19AXP4	6.3	B	300	24-94	19CVP4	6.3	B	50	25-50	19ELP4	6.3	B	300	24-94
19AYP4	6.3	B	300	24-94	19CWP4	6.3	B	300	18-62	19EMP4	6.3	B	300	34-78
19AZP4	6.3	B	300	17-72	19CXP4	6.3	C	45	28-50	19ENP4	6.3	B	50	25-50
19BAP4	6.3	B	300	28-72	19CYP4	6.3	B	300	24-94	19ENP4A	6.3	B	50	25-50
19BCP4	6.3	B	300	28-72	19CZP4	6.3	B	300	32-94	19EP4	6.3	Regular	250	17-58
19BDP4	6.3	Regular	50	24-49	19DAP4	6.3	B	300	32-94	19ERP4	6.3	B	300	24-78
19BEP4	6.3	B	300	28-78	19DBP4	6.3	C	40	28-50	19ESP4	6.3	B	50	25-55
19BFP4	6.3	Regular	300	24-94	19DCP4	6.3	B	300	26-94	19ETP4	6.3	B	50	25-50
19BGP4	6.3	Regular	300	24-94	19DEP4	6.3	B	300	29-54	19EUP4	6.3	B	300	26-94

ΔTest Socket Available as an Optional Accessory.

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TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range
19EVP4	6.3	B	300	25-94	19QP4	6.3	Regular	300	22-72	21AMP4A	6.3	Regular	300	22-72
19EWP4	6.3	B	300	24-94	19XP4	6.3	B	300	24-94	21AMP4B	6.3	Regular	300	22-72
19EZP4	6.3	C	45	28-50	19YP4	6.3	B	300	29-78	21AMP23A	6.3	Regular	300	22-72
19FAP4	6.3	B	300	22-62	19ZP4	6.3	B	300	17-72	21ANP4	6.3	Regular	300	22-72
19FBP4	6.3	B	50	28-55	20BP4	6.3	Regular	300	19-62	21ANP4A	6.3	Regular	300	22-72
19FCP4	6.3	B	50	25-49	20CP4	6.3	Regular	300	22-72	21AP4	6.3	Regular	300	22-72
19FDP4	6.3	B	300	23-78	20CP4A	6.3	Regular	300	22-72	21AQP4	6.3	Regular	300	22-72
19FEP4	6.3	B	30	24-45	20CP4B	6.3	Regular	300	22-72	21AQP4A	6.3	Regular	300	22-72
19FEP4A	6.3	B	30	24-45	20CP4C	6.3	Regular	300	22-72	21ARP4	6.3	Regular	300	22-72
19FEP4B	6.3	B	30	24-45	20CP4D	6.3	Regular	300	22-72	21ARP4A	6.3	Regular	300	22-72
19FGP4	6.3	B	300	29-78	20DP4	6.3	Regular	300	22-72	21ASP4	6.3	Regular	300	22-72
19FHP4	6.3	B	300	25-94	20DP4A	6.3	Regular	300	22-72	21ATP4	6.3	Regular	300	22-72
19FJP4	6.3	B	300	25-94	20DP4B	6.3	Regular	300	22-72	21ATP4A	6.3	Regular	300	22-72
19FJP4A	6.3	B	300	25-76	20DP4C	6.3	Regular	300	22-72	21ATP4B	6.3	Regular	300	22-72
19FKP4	6.3	B	300	28-72	20DP4D	6.3	Regular	300	22-72	21AUP4	6.3	Regular	300	22-72
19FLP4	6.3	B	300	29-94	20ETP4	6.3	Regular	300	28-75	21AUP4A	6.3	Regular	300	22-72
19FNP4	6.3	B	300	22-62	20FP4	6.3	Regular	300	22-72	21AUP4B	6.3	Regular	300	22-72
19FP4	6.3	Regular	250	18-58	20GP4	6.3	Regular	300	22-72	21AUP4C	6.3	Regular	300	22-72
19FQP4	6.3	B	50	25-50	20HP4	6.3	Regular	300	22-72	21AVP4	6.3	Regular	300	22-72
19FRP4	6.3	B	300	29-94	20HP4A	6.3	Regular	300	22-72	21AVP4A	6.3	Regular	300	22-72
19FSP4	6.3	B	50	28-55	20HP4B	6.3	Regular	300	22-72	21AVP4B	6.3	Regular	300	22-72
19FTP4	6.3	B	300	25-94	20HP4C	6.3	Regular	300	22-72	21AVP4C	6.3	Regular	300	22-72
19FUP4	6.3	B	50	28-55	20HP4D	6.3	Regular	300	22-72	21AWP4	6.3	Regular	300	22-72
19FVP4	6.3	B	50	28-55	20HP4E	6.3	Regular	300	22-72	21AWP4A	6.3	Regular	300	22-72
19FWP4	4.2	B	300	27-77	20JP4	6.3	Regular	300	22-72	21AWP4B	6.3	Regular	300	22-72
19FYP4	6.3	B	300	29-78	20LP4	6.3	Regular	300	22-72	21BAP4	6.3	Regular	300	22-72
19GAP4	6.3	B	300	23-72	20MP4	6.3	Regular	300	22-72	21BCP4	6.3	Regular	300	22-72
19GBP4	6.3	B	300	30-70	21ACP4	6.3	Regular	300	22-72	21BDP4	6.3	Regular	300	22-72
19GCP4	6.3	B	30	24-45	21ACP4A	6.3	Regular	300	22-72	21BNP4	6.3	Regular	300	22-72
19GFP4	6.3	B	300	27-94	21AFP4	6.3	Regular	300	22-72	21BSP4	6.3	Regular	300	22-72
19GJP4A	6.3	B	300	22-62	21ALP4	6.3	Regular	300	22-72	21BTP4	6.3	Regular	300	22-72
19GKP4	6.3	B	300	22-62	21ALP4A	6.3	Regular	300	22-72	21CBP4	6.3	Regular	300	22-72
19GMP4	6.3	B	50	25-50	21ALP4B	6.3	Regular	300	22-72	21CBP4A	6.3	Regular	300	22-72
19GCP4	6.3	Regular	250	18-58	21AMP4	6.3	Regular	300	22-72	21CBP4B	6.3	Regular	300	22-72
19JP4	6.3	Regular	300	22-72						21CDP4	6.3	Regular	300	22-72

ΔTest Socket Available as an Optional Accessory.

\*Meter Switch Must Be in "S" Position.

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TUBE TYPE	Heater Voltage	Test Socket	G <sub>2</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>2</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>2</sub>	G <sub>1</sub> Range
21CDP4A	6.3	Regular	300	22-72	21ENP4	6.3	Regular	300	29-72	21WP4	6.3	Regular	300	22-72
21CEP4	6.3	B	300	22-72	21EP4	6.3	Regular	300	22-72	21WPA4	6.3	Regular	300	22-72
21CEP4A	6.3	B	300	22-72	21EP4A	6.3	Regular	300	22-72	21WPA4B	6.3	Regular	300	22-72
21GSP4	6.3	Regular	110	25-50	21EP4B	6.3	Regular	300	22-72	21XP4	6.3	Regular	300	22-72
21GHP4	6.3	Regular	110	25-50	21EP4C	6.3	Regular	300	22-72	21XPA4	6.3	Regular	300	22-72
21GKP4	6.3	Regular	300	22-72	21EQP4	6.3	B	300	29-78	21XP4B	6.3	Regular	300	22-72
21GLP4	6.3	Regular	300	28-75	21ERP4	6.3	B	300	29-72	21YP4	6.3	Regular	300	22-72
21GMP4	6.3	Regular	300	22-72	21ESP4	6.3	B	300	17-72	21YPA4	6.3	Regular	300	22-72
21GQP4	6.3	C	300	28-72	21EVP4	2.68	A	300	28-72	21YPA4B	6.3	Regular	300	22-72
21GSP4	6.3	C	300	28-72	21EWP4	6.3	Regular	300	22-72	21ZP4	6.3	Regular	300	22-72
21GUP4	6.3	Regular	300	22-72	21EXP4	6.3	B	300	29-78	21ZPA4	6.3	Regular	300	22-72
21GVP4	6.3	Regular	300	22-72	21EYP4	6.3	Regular	300	22-72	21ZPA4B	6.3	Regular	300	22-72
21GWP4	6.3	Regular	300	22-72	21EZP4	6.3	B	300	28-69	21ZP4C	6.3	Regular	300	22-72
21GXP4	6.3	Regular	50	28-50	21FAP4	6.3	B	300	29-78	22AP4	6.3	Regular	300	22-72
21GZP4	6.3	B	300	22-72	21FCP4	6.3	B	300	27-63	22AP4A	6.3	Regular	300	22-72
21DAP4	6.3	B	300	22-72	21FDP4	6.3	A	300	28-72	23ABP4	6.3	B	300	25-94
21DEP4	6.3	B	300	22-72	21FLP4	6.3	Regular	300	22-72	23ACP4	6.3	Regular	300	28-72
21DEP4A	6.3	B	300	22-72	21FMP4	6.3	B	50	25-49	23ADP4	6.3	B	300	25-94
21DFP4	6.3	B	300	22-72	21FP4	6.3	Regular	300	22-72	23AEP4	6.3	B	300	25-91
21DHP4	6.3	B	300	28-72	21FP4A	6.3	Regular	300	22-72	23AFP4	6.3	Regular	300	28-72
21DJP4	6.3	Regular	300	28-72	21FP4C	6.3	Regular	300	22-72	23AHP4	6.3	Regular	300	24-94
21DKP4	6.3	B	300	28-72	21FP4D	6.3	Regular	300	22-72	23AKP4	6.3	B	300	29-78
21DKP4A	6.3	B	300	28-72	21FUP4	6.3	B	50	28-55	23ALP4	6.3	B	300	24-94
21DLP4	6.3	Regular	300	22-72	21FVP4	6.3	B	300	24-78	23AMP4	6.3	B	300	24-94
21DMP4	6.3	B	300	24-92	21FWP4	6.3	B	300	24-78	23ANP4	6.3	Regular	50	28-50
21DNP4	6.3	Regular	300	28-72	21FXP4	6.3	B	300	23-72	23AQP4	6.3	B	300	30-94
21DP4	6.3	Regular	300	22-72	21FZP4	6.3	B	300	26-93	23ARP4	6.3	B	300	28-72
21DQP4	6.3	Regular	300	28-72	21GAP4	6.3	B	30	24-45	23ASP4	6.3	Regular	300	24-94
21DRP4	6.3	Regular	300	22-72	21GBP4	6.3	B	150	29-54	23ATP4	6.3	Regular	50	28-50
21DSP4	6.3	Regular	50	25-50	21GCP4	6.3	B	300	31-93	23AUP4	6.3	Regular	300	24-94
21DVP4	6.3	Regular	300	22-72	21JP4	6.3	Regular	300	22-72	23AVP4	6.3	B	300	28-72
21DWP4	6.3	B	300	31-100	21JPA4	6.3	Regular	300	22-72	23AWP4	6.3	Regular	50	29-54
21EAP4	2.34	A	300	28-72	21KP4	6.3	Regular	300	22-72	23AXP4	6.3	B	300	28-72
21ELP4	6.3	Regular	300	31-100	21KPA4	6.3	Regular	300	22-72	23AYP4	6.3	B	300	28-72
21EMP4	6.3	B	300	31-100	21MP4	6.3	Regular	300	22-72	23AZP4	6.3	Regular	300	24-94

△Test Socket Available as an Optional Accessory.

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TUBE TYPE	Heater Voltage	Test Socket	G <sub>2</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>2</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>2</sub>	G <sub>1</sub> Range
23BAP4	6.3	B	300	31-100	23CXP4	6.3	B	300	29-78	23EMP4	6.3	Regular	300	34-78
23BCP4	6.3	B	300	28-72	23CZP4	6.3	Regular	300	32-76	23ENP4	6.3	Regular	50	29-54
23BDP4	6.3	Regular	300	31-95	23DAP4	6.3	B	50	28-55	23EP4	6.3	△D	50	25-50
23BEP4	6.3	B	300	28-72	23DBP4	6.3	B	50	29-54	23EQP4	6.3	B	300	22-62
23BEP4A	6.3	B	300	28-72	23DCP4	6.3	B	50	28-55	23ERP4	6.3	B	300	34-78
23BGP4	6.3	B	50	25-50	23DEP4	6.3	B	300	28-78	23ESP4	6.3	B	300	29-54
23BHP4	6.3	B	50	25-50	23DFP4	6.3	B	300	28-78	23ETP4	6.3	B	300	22-62
23BJP4	6.3	Regular	50	29-54	23DGP4	6.3	B	300	29-94	23EWP4	6.3	B	300	32-94
23BKP4	6.3	Regular	50	29-54	23DHP4	6.3	B	300	24-78	23EWP4A	6.3	B	300	32-94
23BLP4	6.3	Regular	50	29-54	23DJP4	6.3	B	300	24-78	23EYP4	6.3	Regular	50	20-50
23BMP4	6.3	Regular	300	28-72	23DKP4	6.3	Regular	300	28-72	23EZP4	6.3	B	50	28-55
23BNP4	6.3	B	300	43-100	23DLP4	6.3	Regular	50	29-54	23FAP4	6.3	B	300	33-96
23BP4	6.3	B	300	31-100	23DLP4A	6.3	Regular	50	29-54	23FBP4	6.3	Regular	50	29-54
23BQP4	6.3	B	300	28-72	23DNP4	6.3	Regular	35	20-50	23FCP4	6.3	B	50	27-49
23BRP4	6.3	B	300	29-78	23DP4	6.3	B	300	29-78	23FDP4	6.3	B	50	27-52
23BSP4	6.3	B	300	28-72	23DQP4	6.3	B	65	33-56	23FGP4	6.3	B	300	29-94
23BTP4	6.3	Regular	300	28-78	23DRP4	6.3	B	300	21-78	23FHP4	6.3	B	50	25-50
23BVP4	6.3	Regular	300	28-72	23DSP4	6.3	B	65	33-56	23FJP4	6.3	B	300	29-94
23BXP4	6.3	Regular	300	28-72	23DSP4A	6.3	B	65	33-56	23FKP4	6.3	B	300	31-95
23BYP4	6.3	B	300	29-78	23DTP4	6.3	B	300	32-76	23FMP4	6.3	B	300	22-62
23BZP4	6.3	Regular	300	24-94	23DVP4	6.3	B	300	32-94	23FNP4	6.3	Regular	300	28-72
23CAP4	8.4	Regular	300	28-72	23DVP4A	6.3	B	300	32-94	23FP4	6.3	B	300	31-100
23CBP4	6.3	B	300	28-72	23DWP4	6.3	B	200	25-49	23FP4A	6.3	B	300	31-100
23CDP4	6.3	Regular	300	28-72	23DXP4	6.3	B	300	29-94	23FRP4	6.3	B	50	28-55
23CEP4	6.3	B	300	28-72	23DYP4	6.3	B	300	29-54	23FSP4	6.3	B	300	26-94
23CGP4	6.3	Regular	300	30-95	23DZP4	6.3	B	300	32-94	23FTP4	6.3	Regular	50	28-50
23CMP4	6.3	B	300	28-72	23EAP4	6.3	Regular	300	28-72	23FUP4	6.3	B	300	28-72
23CP4	6.3	B	300	28-72	23EBP4	6.3	B	300	29-94	23FVP4	6.3	B	300	29-94
23CP4A	6.3	B	300	28-72	23ECP4	6.3	Regular	35	20-50	23FVP4A	6.3	B	300	29-54
23CQP4	6.3	B	300	31-100	23EDP4	6.3	Regular	300	28-72	23FWP3	6.3	Regular	50	29-54
23CSP4	6.3	B	300	29-78	23EFP4	6.3	B	50	27-49	23FWP4A	6.3	Regular	50	29-54
23CTP4	6.3	Regular	300	28-72	23EHP4	8.4	Regular	300	24-78	23FXP4	6.3	Regular	300	34-78
23CUP4	6.3	B	300	29-78	23EJP4	6.3	B	300	29-94	23FYP4	6.3	Regular	50	28-55
23CVP4	6.3	B	300	29-78	23EKP4	6.3	Regular	300	24-78	23FZP4	6.3	B	300	32-95
23CWP4	6.3	B	300	29-78	23ELP4	6.3	Regular	300	34-78	23GAP4	6.3	B	300	29-94

△Test Socket Available as an Optional Accessory.

\*Meter Switch Must Be in "S" Position.

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TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range
23BP4	6.3	B	300	32-95	23HUP4	6.3	B	30	24-45	24AUP4	6.3	Regular	300	28-72
23CP4	6.3	B	50	28-55	23HUP4A	6.3	B	30	24-45	24VPA	2.34	A	300	28-72
23DP4	6.3	B	300	24-94	23HVP4	6.3	B	300	20-45	24VPA4A	2.34	A	300	28-72
23FP4	6.3	B	300	32-85	23HP4	6.3	B	50	28-55	24WPA	6.3	B	300	22-72
23GHP4	6.3	B	200	25-49	23KPA	6.3	B	300	22-62	24XPA	6.3	B	300	28-72
23JPA	6.3	B	50	28-55	23HP2PA	6.3	B	300	22-62	24BAP4	6.3	B	50	25-47
23JPA4A	6.3	B	50	28-55	23JAP4	6.3	B	50	25-50	24BCP4	6.3	Regular	300	24-94
23KPA	6.3	B	300	28-72	23JP4	6.3	C	50	28-50	24BEP4	6.3	A	300	28-72
23GMP4	6.3	Regular	300	28-72	23KP4	6.3	B	300	17-72	24BP4	6.3	Regular	300	22-72
23GNP4	6.3	Regular	300	28-72	23KPA4A	6.3	B	300	17-72	24BPA4A	6.3	Regular	300	22-72
23GP4	6.3	B	300	22-72	23MP4	6.3	B	300	24-94	24CP4	6.3	Regular	300	22-72
23GRP4	6.3	Regular	300	28-72	23MP4A	6.3	B	300	24-94	24CP4A	6.3	Regular	300	22-72
23GSP4	6.3	B	300	22-62	23NP4	6.3	B	50	27-49	24CP4B	6.3	Regular	300	22-72
23GTP4	6.3	B	300	22-62	23RP4	6.3	B	300	29-78	24DP4	6.3	Regular	300	22-72
23GUP4	6.3	B	50	27-52	23SP4	6.3	B	300	28-72	24DPA4A	6.3	Regular	300	22-72
23GVP4	6.3	B	45	28-50	23TP4	6.3	Regular	300	22-72	24QP4	6.3	Regular	300	22-72
23GWP4	6.3	B	50	26-45	23UP4	6.3	B	300	28-72	24TP4	6.3	Regular	300	22-72
23GXP4	6.3	B	300	28-72	23VP4	6.3	B	300	31-100	24VPA	6.3	Regular	300	22-72
23GYPA	6.3	Regular	50	29-54	23WP4	6.3	B	300	28-72	24VPA4A	6.3	Regular	300	22-72
23GZPA	6.3	Regular	300	28-72	23XP4	6.3	Regular	300	28-72	24XPA	6.3	Regular	300	22-72
23HAP4	6.3	Regular	50	29-54	23YP4	6.3	Regular	300	28-72	24YPA	6.3	Regular	300	22-72
23HBP4	6.3	B	300	28-72	23ZPA	6.3	Regular	50	28-50	24ZPA	6.3	Regular	300	22-72
23HCP4	6.3	B	300	29-74	24ADP4	6.3	Regular	300	22-72	25DP4	6.3	B	300	25-60
23HFP4	6.3	B	300	22-62	24AEP4	6.3	Regular	300	22-72	25EP4	6.3	B	300	25-60
23HFP4A	6.3	B	300	22-62	24AHP4	6.3	B	300	22-72	25HP4	6.3	B	50	28-55
23HGP4	6.3	B	300	22-62	24AJPA	6.3	Regular	50	28-50	25JP4	6.3	B	300	25-60
23HJP4	6.3	B	300	28-72	24ALP4	6.3	B	300	22-72	25KP4	6.3	B	300	25-60
23HMP4	6.3	B	150	29-78	24AMP4	6.3	C	300	28-72	25LP4	6.3	B	300	24-94
23HLP4	6.3	B	300	22-62	24ANP4	6.3	Regular	300	28-72	25MP4	6.3	B	300	29-78
23HMP4	6.3	B	300	22-62	24AP4	6.3	Regular	300	22-72	25NPA	6.3	B	300	24-66
23HNP4	6.3	B	150	29-50	24AP4A	6.3	Regular	300	22-72	27ABP4	6.3	B	300	28-72
23HP4	6.3	B	300	28-72	24AP4B	6.3	Regular	300	22-72	27ACP4	6.3	Regular	300	32-80
23HP4A	6.3	B	300	26-94	24AQP4	6.3	B	300	28-72	27ADP4	6.3	B	300	29-74
23HRP4	6.3	B	30	22-45	24ASP4	6.3	Regular	300	28-72	27AEP4	6.3	B	300	28-72
23HSP4	6.3	B	30	24-45	24ATP4	6.3	Regular	50	27-49	27AFP4	6.3	B	300	29-74

△Test Socket Available as an Optional Accessory.

\*Meter Switch Must Be in "S" Position.

TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	G <sub>1</sub> Range	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>	TUBE TYPE	Heater Voltage	Test Socket	G <sub>1</sub>
27AGP4	6.3	B	300	23-72	11SP22	4.6	△CR-58	40	21FJP22	6.3	Large	40
27AP4	6.3	Regular	300	22-72	14BCP22	6.3	Large	40	21FJP22A	6.3	Large	40
27EP4	6.3	Regular	300	22-72	15KP22	6.3	Small	40	RE21FJP22	6.3	Large	40
27GP4	6.3	Regular	300	22-72	15LP22	6.3	Small	40	21FKP22	6.3	Large	40
27LP4	6.3	Regular	300	22-72	16CDP22	6.3	Small	40	RE21FKP22	6.3	Large	40
27MP4	6.3	Regular	300	27-73	17EJP22	6.3	Large	40	22EP22	6.3	Large	40
27NP4	6.3	Regular	300	22-72	17ENP22	6.3	Large	40	22JP22	6.3	Small	40
27RP4	6.3	Regular	300	22-72	19EXP22	6.3	Small	40	22KR22	6.3	Small	40
27RP4A	6.3	Regular	300	22-72	RE19EXP22	6.3	Small	40	22QP22	6.3	Small	40
27SP4	6.3	Regular	300	22-72	19EYP22	6.3	Small	40	23EGP22	6.3	Small	40
27UP4	6.3	Regular	300	22-72	RE19EYP22	6.3	Small	40	25AF22	6.3	Small	40
27VP4	6.3	Regular	300	22-72	REA19EYP22	6.3	Small	40	25AP22A	6.3	Small	40
27WP4	6.3	Regular	300	32-80	19FMP22	6.3	Small	40	RE25AP22A	6.3	Small	40
27XP4	6.3	Regular	300	24-94	RE19FMP22	6.3	Small	40	REA25AP22A	6.3	Small	40
27YP4	6.3	Regular	300	22-72	19FXP22	6.3	Small	40	25BP22	6.3	Small	40
27ZPA	6.3	B	300	28-72	19GVP22	6.3	Small	40	25BP22A	6.3	Small	40
30BP4	6.3	Regular	300	22-72	19GWP22	6.3	Small	40	RE25BP22A	6.3	Small	40
*140AB4	12.6	△CR-57 Red	300	20-77	19VP22	6.3	Large	40	25CP22	6.3	Small	40
*140CB4	12.6	△CR-57 Red	300	20-77	21AXP22	6.3	Large	40	RE25CP22	6.3	Small	40
210EB4	12.6	B	300	26-77	21AXP22A	6.3	Large	40	REA25CP22	6.3	Small	40
210FB4	12.6	B	50	15-40	21CYP22	6.3	Large	40	25FP22	6.3	Small	40
230AB4	6.3	△CR-57 Bik	300	24-75	21CYP22A	6.3	Large	40	25GP22	6.3	Small	40
*230DB4	12.6	△CR-57 Bik	50	20-77	21EP22	6.3	Large	40	25WP22	6.3	Small	40
*230EB4	12.6	△CR-57 Bik	150	10-30	21FBP22	6.3	Large	40	25XP22	6.3	Small	40
*230HB4	12.6	△CR-57 Red	150	20-77	21FBP22A	6.3	Large	40	25YP22	6.3	Small	40
310CB4	12.6	B	300	28-94	RE21FBP22A	6.3	Large	40	400KB22	6.3	Large	40
310WB4	12.6	△CR-57 Bik	300	22-72								
*A2310W	12.6	△CR-57 Red	150	20-77								
*CT468	12.6	△CR-57 Red	150	20-77								
SF17	2.68	A	300	22-77								
SF21A	2.34	A	300	22-77								

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