



Spec. No.	CF001-D0401
Rev.No	02
Date	August 22. 2003

# SPECIFICATION FOR APPROVAL

Customer : \_\_\_\_\_

CRT (Cathode Ray Tube)

MODEL : 4FNG45

Presented by :

Approved by :

\_\_\_\_\_  
C.S.Group  
VFD Team  
SAMSUNG SDI CO.,LTD



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## SPECIFICATION

CRT (Cathode Ray Tube)

MODEL : 4FNG45

Revision	Issue Date		Charged Person
00	November.21. 2002	Written	T.H.Kim
01	June 18,2003	Check	-
02	August 22, 2003	Approval	M.K.Park

## 1. GENERAL

This specification covers 4 inch Black and White flat CRT to be supplied by SAMSUNG SDI.

## 2. RANGE OF APPLICATION

2-1 The CRT of SAMSUNG SDI (Hearafter SDI) shall satisfy this specification.

Application : Monitor, TV door-phone, Home automation

2-2 Outgoing inspection shall be made on the items of specified test condition in this specifications.

2-3 In the event of conflict of interpretation of the specified item, negotiation shall be held and decided between CUSTOMER and SDI.

2-4 SDI is responsible for furnishing the reference samples to defect (Brightness uniformity, focus, black spot, bubble, pin hole, etc) in case of necessary. The negotiation shall be held and decided if desired.

2-5 Validity of this specification

2-5-1 This specification shall be effective by Customer's approval.

2-5-2 The validity of this specification shall be effective for 12 months after the final shipment from SDI. This means quality assurance shall be effective one year.

### 2-6 Quality Assurance

Statistical sampling and inspection will be performed in accordance with ANSI/ASQC Z1.4-1993 INSPECTION LEVEL II. The acceptable quality level (AQL) is as specified below.

MAJOR DEFECTS : AQL 1.0 %


MINOR DEFECTS : AQL 1.5 %

2-6-1 Major defect item is defined as follows

Effected item for fundamental function of CRT such as air leak, broken glass and open/short display.

2-6-2 Minor defect item is defined as follows.


Effected item for validation used of CRT's such as , focus, black spot, bubble, outside scratch and blemish out of display surface

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### 3. ELECTRICAL SPECIFICATION

Items	Code	Measured Condition	MIN	TYP	MAX	Unit
Anode voltage	Eb	Against G1 (G1 GND)	5	6	7	kV
G3 voltage	Ec3		400	—	900	V
Dynamic focus voltage	Dfv		14	—	45	V
G2 voltage	Ec2		150	500	630	V
	Ec2	Ek = 50V	190	—	550	
G1 drive	Ec1			Adjust		V
Cathode voltage	Ek	Against G1 (G1 GND)			Against G1	
Positive peak					300	V
Positive bias					200	V
Negative peak					0	V
Negative bias					-2	V
G1 cutoff voltage (fig.4 & 5)	Ec1co	Spot cut off	35	—	75	V
Cathode voltage	Ek		5	100	135	V
Cathode current	Ik		—	18	36	μA
heater voltage	Ef		0.57	0.6	0.63	V
Heater current	If	Ef=0.6V (Effective value)	255	280	310	mA

Items			Data	Unit
Heater			Direct heated cathode	—
Focus method			Dynamic	—
Deflection method			Magnetic	—
Deflection angle	Horizontal	Upper	38	degree
		Lower	67	degree
	Vertical		12	degree
Capacity				
Cathode and other electrodes			5	pF
G1 and other electrodes			6	pF

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#### 4. PHOTO OPTICAL SPECIFICATION

##### 4-1. Under Typical operation condition

Items		Code	Conditions	MIN.	TYP.	MAX.
Brightness		Br.		23.2ft-L	-	-
Resolution (Center)	H	Rh	Ik = 18 $\mu$ A, Display size = 81.2 × 59.0 mm	350 TV LINE	-	-
	V	Rv		220 TV LINE	-	-
Halation			Signal : Window	-	0	2mm
Horizontal spot position		SP (H)	H def.off Remove 2 pole magnets	-4.5mm	0mm	4.5mm
Vertical shift position		SP(V)	Vdef. off Remove 2 pole magnets	-11mm	0mm	11mm

##### 4-2. Optical data

Items		Data
Transmittance of front glass		91%
Surface of front glass		Polished
Phosphor	Type	P45(White)
	Chromaticity	x=0.250, y=0.315 (tolerance : $\pm 0.02$ )

#### 5. Deflection Yoke (D.Y.) DATA

##### Horizontal deflection coil

Inductance ----- 480 $\mu$ H  $\pm$  0.5%

Resistance ----- 2.0 $\Omega$   $\pm$ 10%


##### Vertical deflection coil

Inductance ----- 8mH  $\pm$  7%

Resistance ----- 12.5 $\Omega$   $\pm$  7%

(Note: Mounting of the D.Y.

When mounting deflection yoke onto the tube neck, it is recommended to apply fixing tape at the tightening area. To obtain sufficient gripping with small tightening torque, cotton tape (Nitto Co., Type No.160, 0.3 mm thick, or equivalent) is recommended.)


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## 6. Heater voltage consideration for flyback pulse supplying system

- 6-1. The frequency reliability of volt meter should be considered if customer use a volt meter indicating effective voltage value.
- 6-2. For precise keeping of heater voltage, appropriate value of resistor is added in series to the heater circuit. Using diode is not recommendable.
- 6-3. Protective circuit for the heater should be provided so that even on a circuit breakdown the receiver should not operate with the heater voltage over 110% of rating value.

## 7. MECHANICAL SPECIFICATION

Items		MIN	TYP	MAX	Unit
CRT dimensions (Not including frit, just glass)	Length	187	190	193	mm
	Width	98.5	100.4	101.5	mm
	Thickness	29.6	30.7	31.7	mm
	Neck diameter	12.6	13.0	13.4	mm
	Gun seal twist	-4°	-	+4°	degree
	Weight	280	290	300	g
Screen dimensions	Horizontal	81.0	81.2	81.4	mm
	Vertical	58.8	59.0	59.2	mm
	Diagonal	100.1	100.4	100.7	mm
Anode button		EIA No.J1-32S			
Bulb		S/P	-----	S 7301	
		FU	-----	L0F04	

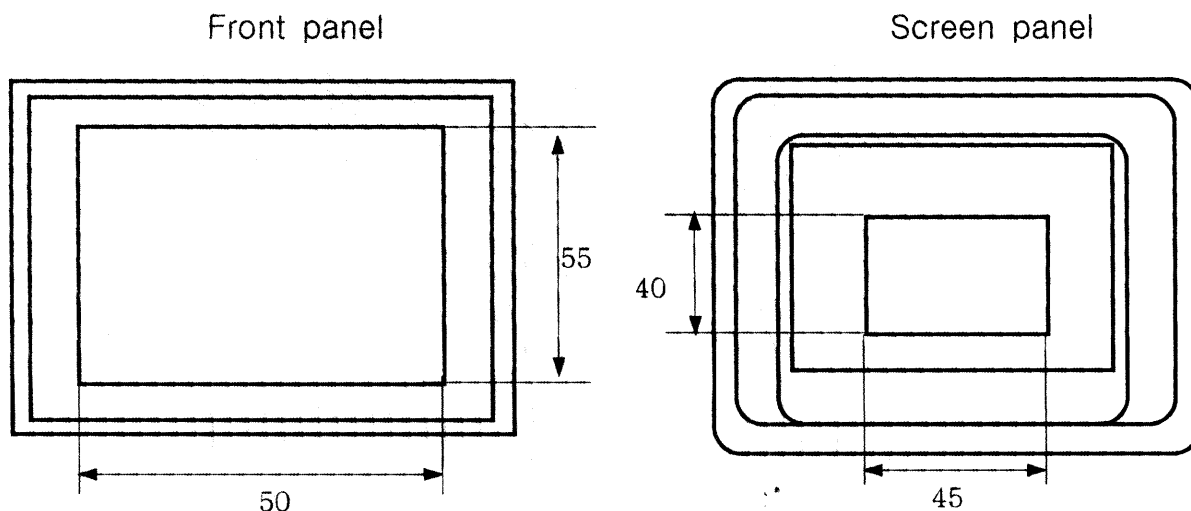
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## 8. SPECIFICATION OF INSPECTION CRITERIA

### 8-1. Standard observation condition

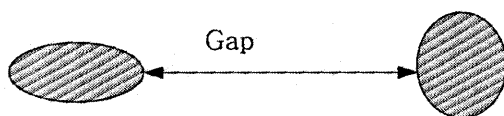
- Eye sight is 1.0
- At a distance of 30cm from the tube
- Standard test signal,  $I_k = 18/\mu A$
- 10% overscan

### 8-2. Zone



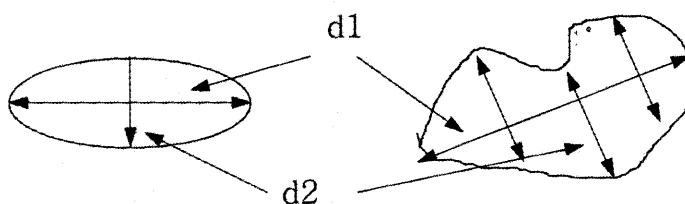
	A ZONE	B ZONE
Front Panel (F/P)	50mm×55mm	Outside of A ZONE including sealing
Screen Panel (S/P)	40mm×45mm	Outside of A ZONE

### 8-3. Minimum separation



### 8-4. Average diameter of defects

Definition of Average diameter =  $(d1+d2)/2$




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# 8-5. SPECIFICATION OF SCREEN DEFECT

	Defect items		Acceptable Criteria		unit
			Front panel	Screen panel	
A  Z O N E	Bubble (including Opaque open bubble)		φ 0.20~0.35	φ 0.20~0.35	mm
	Black spot, dust, pin hole		φ 0.20~0.30	φ 0.20~0.30	mm
	Stain		φ 0.20~0.35	φ 0.20~0.35	mm
	Elongated air blister	Width	0.1 ~ 0.2	0.1 ~ 0.2	mm
		Length	0.2 ~ 1.0	0.2 ~ 1.0	mm
	Allowable number		5		EA
B  Z O N E	Bubble (including opaque open bubble)		φ 0.25 ~ 0.40	φ 0.25 ~ 0.40	mm
	Black spot, dust, pin hole		φ 0.30 ~ 0.50	φ 0.30 ~ 0.50	mm
	Stain		φ 0.35 ~ 0.55	φ 0.35 ~ 0.55	mm
	Elongated bubble	Width	0.1 ~ 0.2	0.1 ~ 0.2	mm
		Length	0.3 ~ 1.0	0.3 ~ 1.0	mm
	Allowable number		8		EA
Minimum separation			5	10	mm
Total allowable number			10		EA
* Note 1 : Defect sizes smaller than above specified will be neglected.					
* Note 2 : Size below 0.2mm will be acceptable regardless of its quantity.					

## SCRATCH

Width	Length of single scratch
$W < 0.05$	No limit
$0.05 < W < 0.10$	25
$0.05 < W < 0.15$	12
$0.15 < W$	None allowed

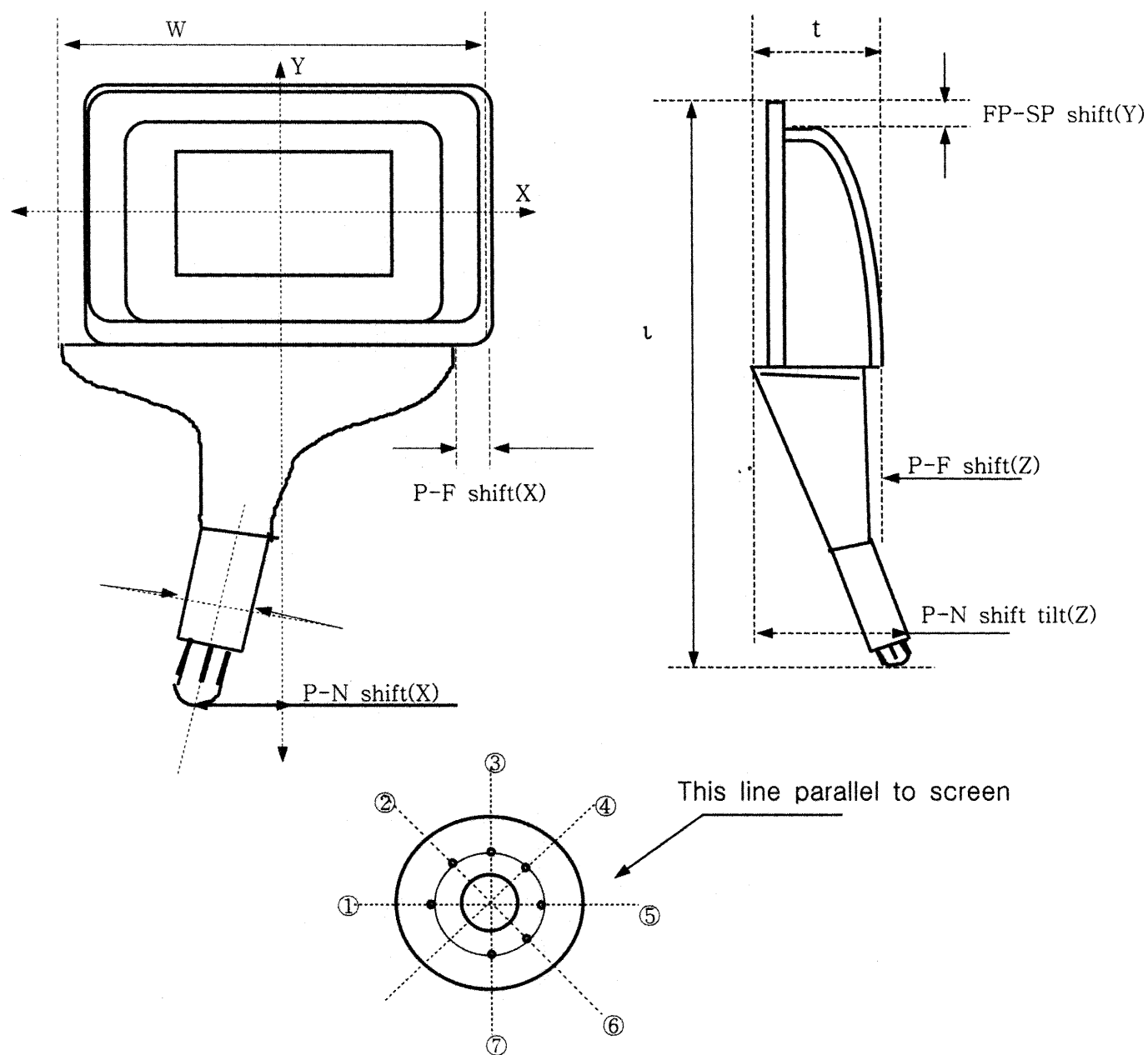
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## 8-6. SPECIFICATION OF DIMENSIONS

Items	P-F shift(X)	P-F shift(Z)	P-N shift tilt(Z)	FP-SP shift (Y)	P-N shift(X)
Acceptable tolerance	$\pm 1.0$ MAX	$\pm 1.0$ MAX	$22.5 \pm 2.5$	$\pm 1.0$ MAX	$\pm 1.8$ MAX

\* NOTE : P ( Screen panel and Front panel), N ( Neck )  
 SP ( Screen panel ), FP ( Front panel), F ( Funnel )

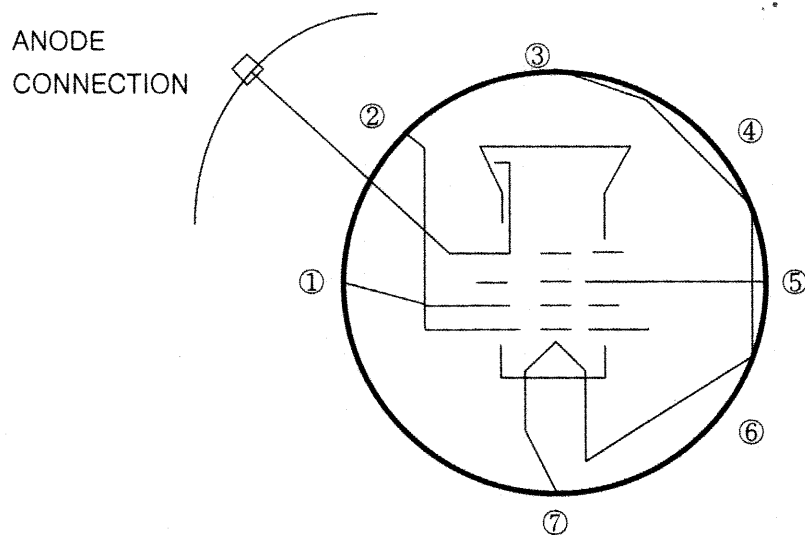


Bottom view of stem pins

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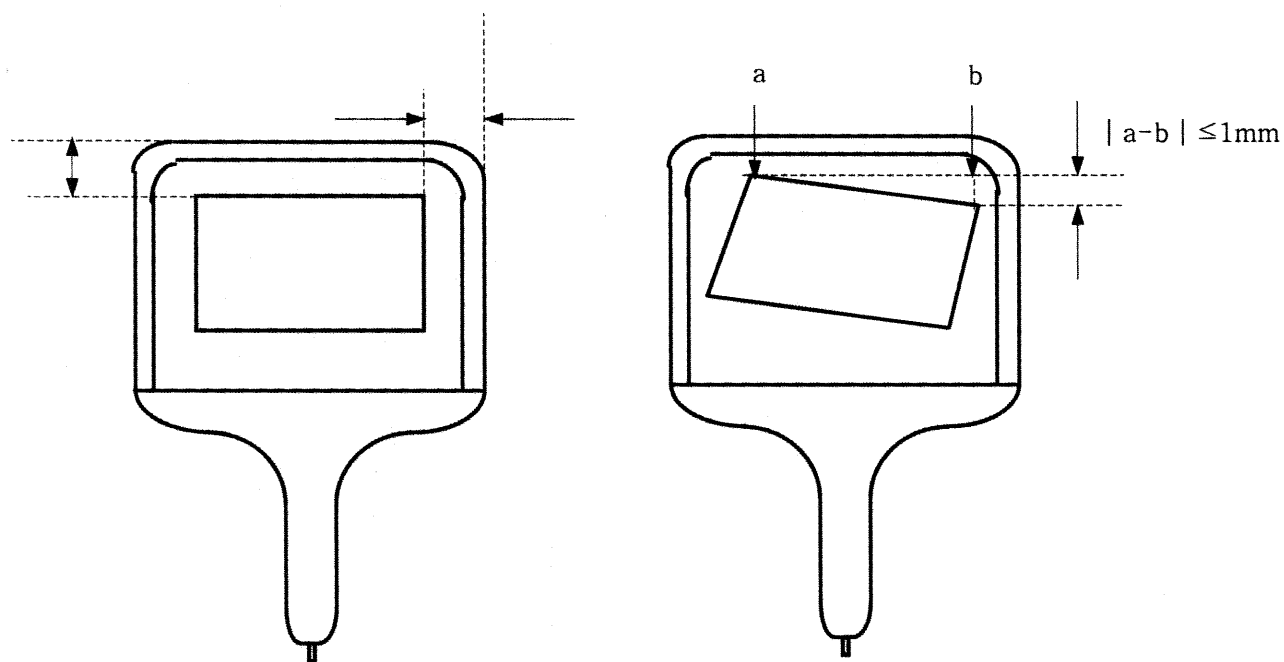
## 9. STEM PIN CONNECTION

PIN No.	1	2	3	4	5	6	7	8
	GRID 2	GRID 1	HEATER	NC	GRID 3	GRID 1	HEATER	GRID 4 (ANODE)



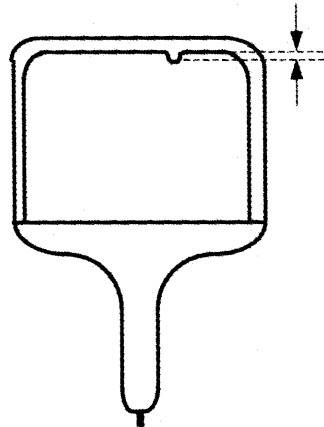
BOTTOM VIEW

## 10. EFFECTIVE SCREEN



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### 11. Shape of Frit



Inside of CRT  
0.5mm MAX

12. Chamfer of front panel : 0.2mm Min.

### 13. NOTICES

13-1. It is recommended to regulate the heater voltage at 0.6V, so as to secure good emission characteristics through the life.

If the heater is fed from the windings in the flyback transformer, the requirement in the page 4 should be applied.

13-2. To prevent noise, ripple voltage(at heater B+ and stainless metal voltage) should not exceed 20Vrms and containment of ripple should be minimized if possible.


13-3. The specified focus voltage is the range necessary to obtain optimum focus at the screen with beam current of 18uA.

For good focusing over the whole screen, application of dynamic focusing voltage shown in fig.6 is necessary.

(Dynamic focus voltage = corner focus voltage - center focus voltage)

13-4. For minimizing resolution spread, the constant grid No.1 cut-off volt. operation is recommended. As for the constant grid No.2 voltage operation, the following specification is applicable.

Grid No.1 voltage for raster cutoff (against constant grid No.2 voltage of 350V) ----- -35V to -75V

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## 14. WARNINGS

### 14-1. Flash over

With the use of high voltage, internal flash over may occur, which may cause damage to the cathode of tube and various circuit components on the chassis. Therefore it is necessary to provide protective circuits using spark gap etc, which should be connected as illustrated in fig.1.

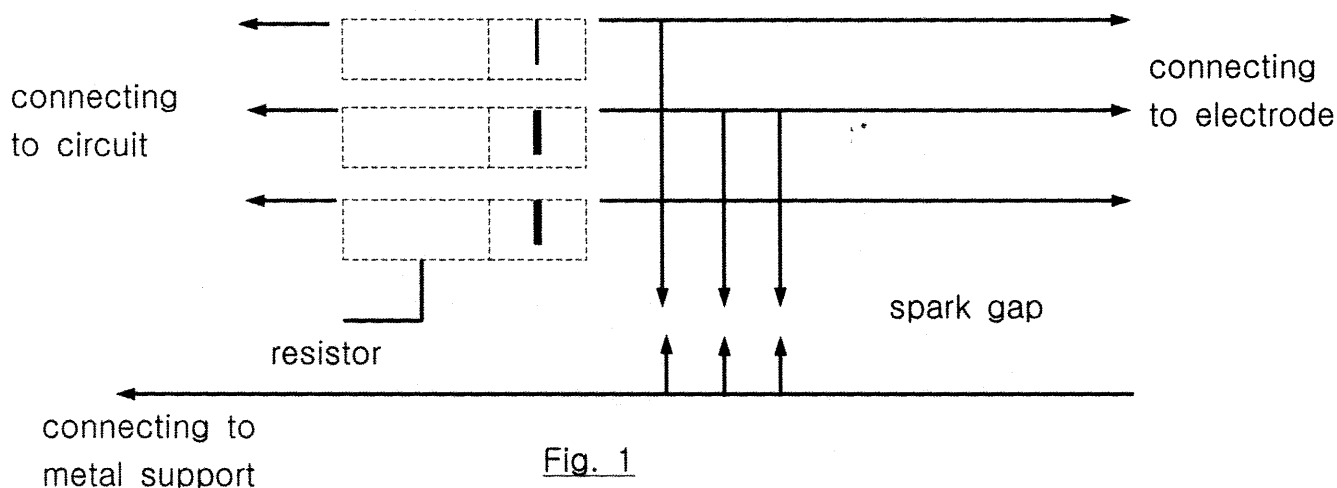


Fig. 1

14-2. It is recommended to keep tube within protective box until the last moment before installation. Also recommended is to wear safety gloves and goggles with side shields during handling.

The above-mentioned precautions are recommended against possible injury by flying glass when tube break.


14-3. Tube should be carefully handled not to cause scratch on glass and dropping to the floor.

14-4. Impacts over 30G must not be given to the tube during handling and delivery and storage, etc.

14-5. If workers contact and eat the material of broken tube, he can be injured or poisoned. Workers should not touch and eat it.

14-6. Worker should not use tube for any other usage, such as hammer, tube can be broken easily for that cause.

14-7. If tube is exposed to humidity and salt environment, it can be eroded and be out of order, please do not use tube in such environment.

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#### 14-8. Shock hazard

The high voltage at which the tube is operated may be very dangerous. Design of the equipment should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high voltage circuit.

Caution must be exercised during the replacement or servicing of the tube since a residual electrical charge may be contained on the high voltage capacitor formed by the external and internal conductive coatings of the tube funnel. To remove any undesirable residual high voltage charge from the tube, "bleed off" the charge by shorting the anode contact button, located in the tube funnel, to the grounded frame before handling in the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard.

#### 14-9. X-Radiation

This cathode ray tube does not emit X-Radiation more than internationally accepted exposure-rate of 0.5mR/h, when it is operated within its maximum rating values. But when a tube is operated on abnormally high voltage, it may cause X-Radiation. In equipments where there is such possibility extra shielding should be provided in the set.

The X-Radiation characteristics of the tube are shown in Fig.3


This tube incorporates integral X-Radiation shielding and must be replaced with the same type tube or a recommended replacement type to assure continued X-Radiation safety.

14-10. When a Tube is being kept and used at high temperature over 80°C, high voltage(current), it can be cause of out of order.

14-12. Heavy impact and vibration can cause outer appearance damage of tube by breaking.

14-13. Metal material can cause short and mis-operation of tube between pins after connecting to SET.

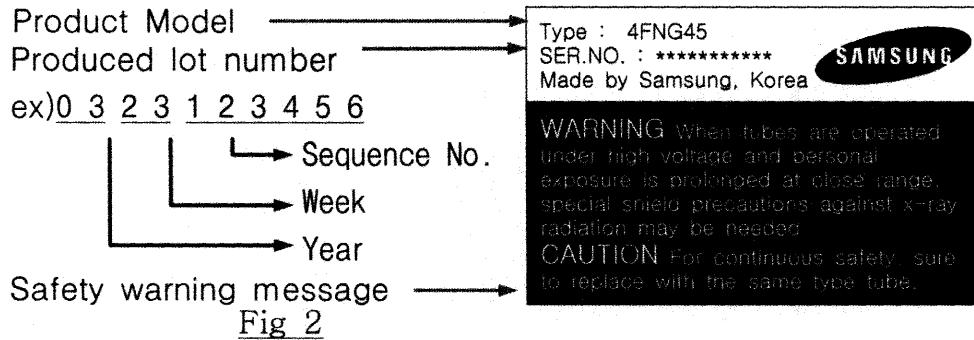
14-14. VPT is made by Glass and sealed Vacuum inside bulb. Please take care handle with it.

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#### 14-15. Tube label

The label is stoke on the back side of tube in fig.2.

Model and produced lot number and warning phrase is included.



#### X-Radiation Characteristics

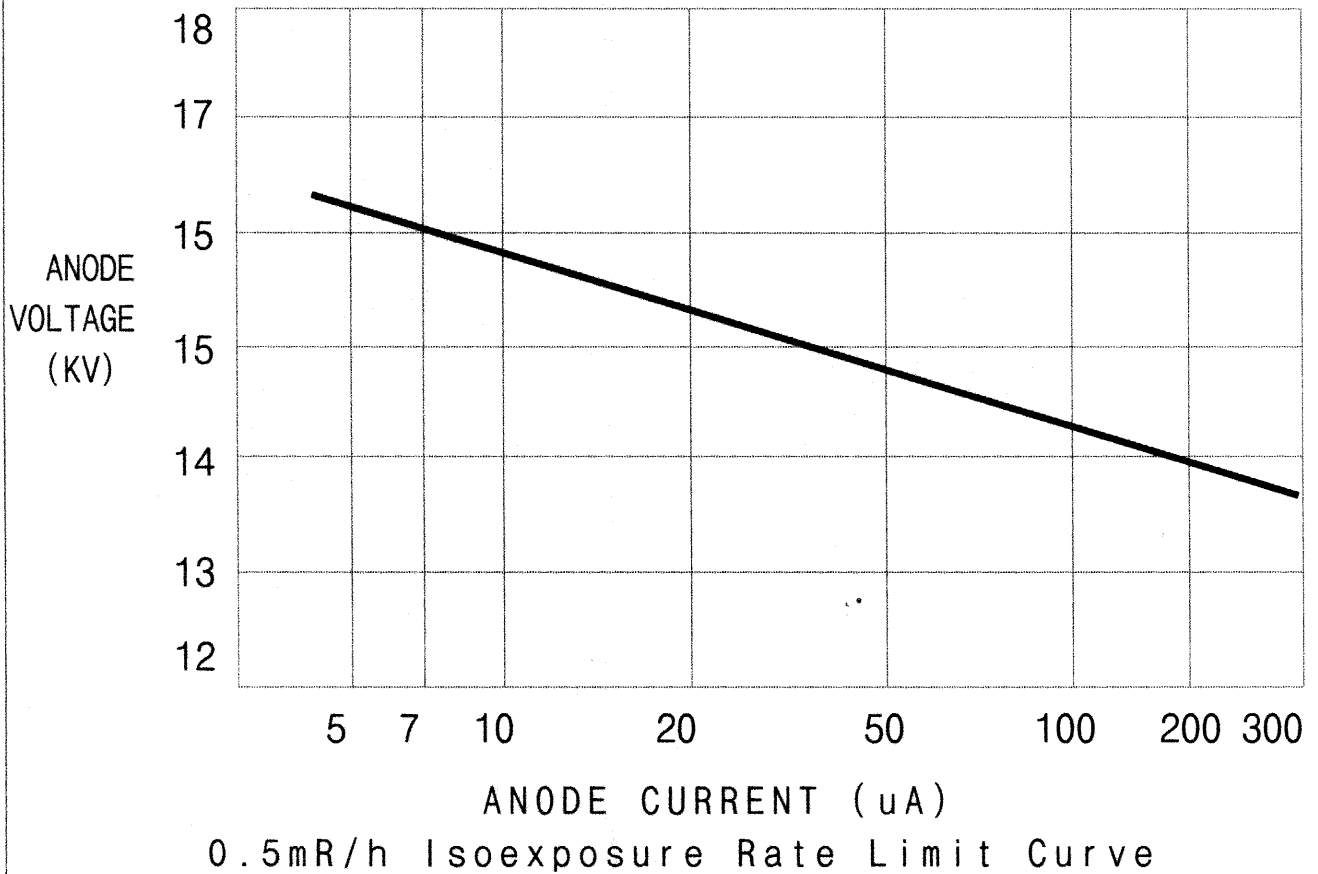


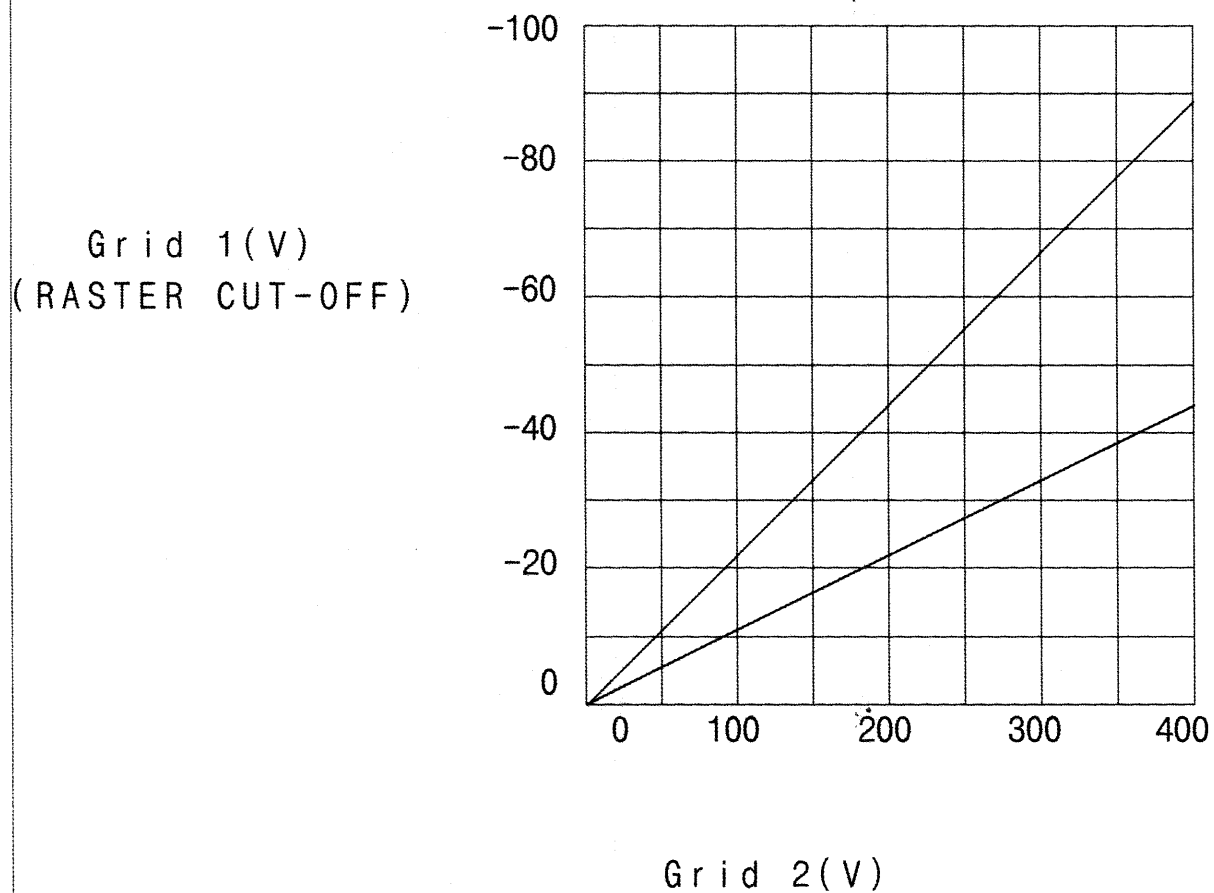
Fig. 3 X-Radiation limit curve at constant anode Current of 250uA

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FIG 4. CUT-OFF DESIGN GRAPH

Condition
·Heater voltage=0.6V
·Grid 3 voltage = focusing
·Anode voltage=5.0~7.0KV

RASTER CUT-OFF GRAPH



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Fig. 5 TYPICAL CATHODE DRIVE CHARACTERISTICS

Heater voltage = 0.6 v

Grid No.2 voltage = Adjust

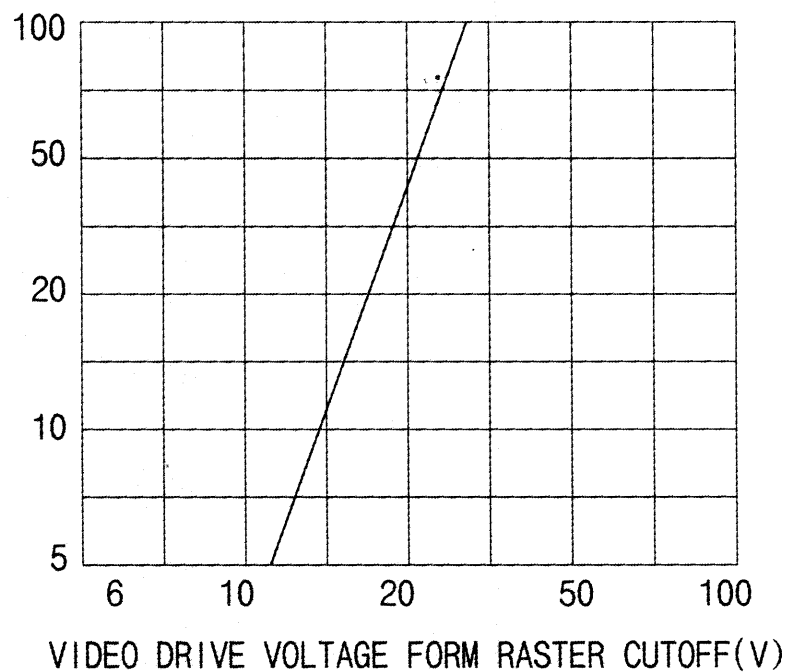
(Raster cutoff at grid No.1

voltage = -53 v)

Grid No.3 voltage = Adjust for focus

Anode voltage = 4.0 to 7.0 kv

ANODE CURRENT  
( $\mu\text{A}$ )

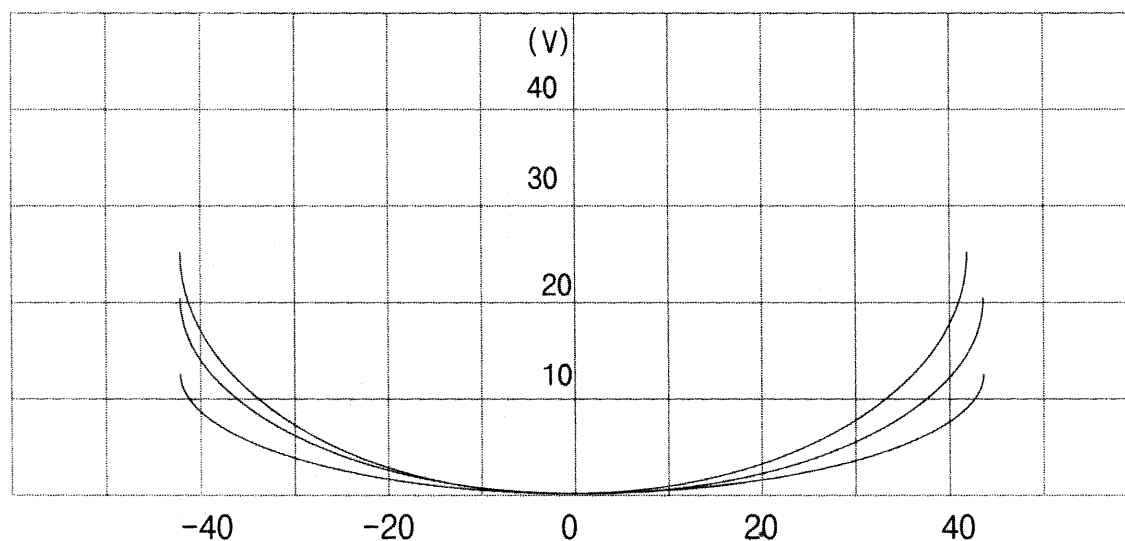


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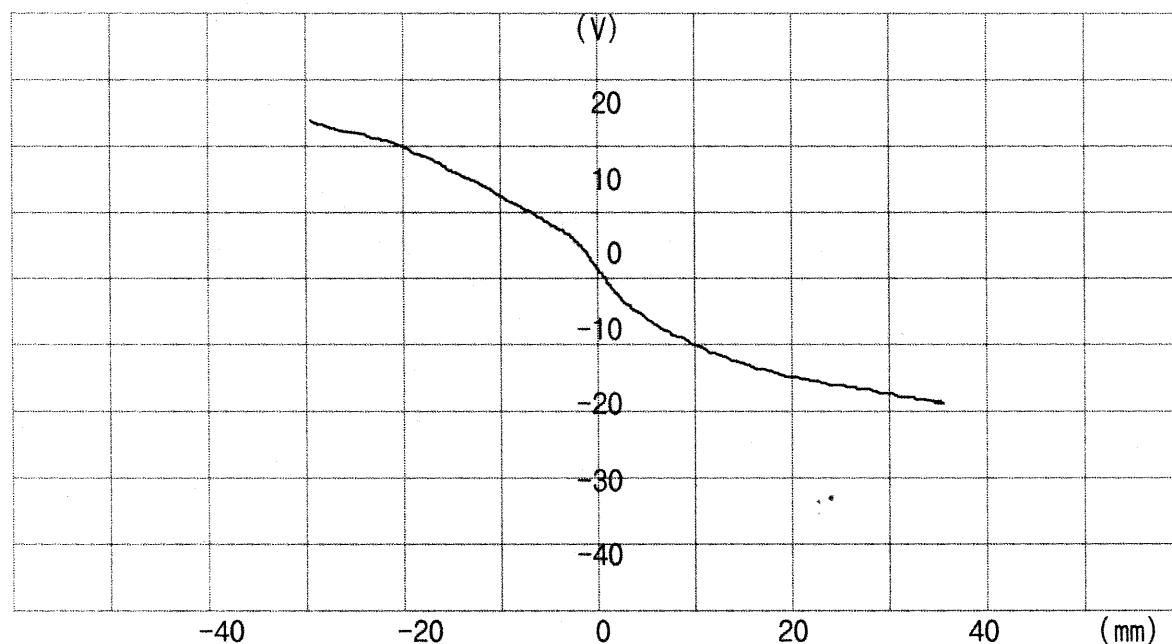
Fig. 6 Dynamic Focusing Design Chart

### Horizontal Dynamic Focusing Characteristics




(Left direction) Distance from the center of the screen (Right direction)

### Vertical Dynamic Focusing Characteristics



(Lower direction) Distance from the center of the screen (Upper direction)

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