ACTION RESEARCH PROJECT

Review of Indian Standard

IS 13384 Part 1 & 2

Cathode ray tube based data display monitor - Specification,

Part 1 Colour,

Part 2 Monochrome

Bureau of Indian Standards

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1. Introduction

The Indian Standard "IS 13384: 1992-Cathode ray tube based data display monitor - Specification, Part 1 colour", adopted by BIS in 1992 and has since not been revised/reviewed.
The project aims to review the Indian Standard following an Action Research based approach.
Further the Indian Standard "IS 13384: 1997-Cathode ray tube based data display monitor - Specification, Part 2 monochrome", adopted by BIS in 1997 and has since not been revised/reviewed.
The project aims to review the Indian Standard following an Action Research based approach.

The broad objectives of the project include:

1. To review the Status of Standard(s) from which assistance had been drawn in the formulation of IS 13384 part 1 and 2.

2. To review the status of standards referred in IS 13384: 1992 part 1 and 2.

3. To find any other national/international standards available related to the subject & scope of the Indian Standard.

4. To find any technical comments/suggestions/ Changes required in the standard through comparison with other national/international available standards, interaction with licensees/Labs/associations/manufacturers/ R and D organizations and other relevant stakeholders etc.

5. To find out/study the issues that may arise out of changes in any relevant IS or due to formulation of new Indian Standard/revision of the standard.

6. To find out any consequential changes to be considered in other related/similar IS.

2. Research Methodology

1. Detailed study of the Indian Standard and the cross-referred Indian standards.
2. Study and analysis of the relevant available International Standards and literature survey with respect to the product.
3. Study of the product design and characteristics.
4. Analysis of the product vis-à-vis the latest product available in the market.
5. Study of the technological advancements in the field of this product.
6. Interaction with industries on the current practices, changes in technologies, manufacturing techniques.
7. Getting the views of test Labs/R and D center views.

3. Overview of the Standard

1. **Indian Standard**:
   a) IS 13384: 1992- Cathode ray tube based data display monitor - Specification: Part 1 colour
   b) IS 13384: 1997- Cathode ray tube based data display monitor - Specification: Part 2 Monochrome
2. No. of amendments: 0
3. Licenses/Applications: Nil
4. Technical Committee: LITD 36- Computer hardware, Peripherals, Office equipment and User Interfaces
5. The above Indian Standards were adopted by Bureau of Indian Standards in 1992 and 1997 after the draft had been finalized by then Computer Media Sectional Committee and had been approved by the Electronics and Telecommunication Division Council.
6. The objective of these standards is to laydown general and performance requirements for cathode ray tube based colour and monochrome data display monitors.
7. These standards cover only Cathode ray tube based data display monitor.
8. In the preparation of this standard, assistance has been derived from DOE/STQC/COMPUTER/6/92 - Specifications for Monochrome Video Monitor issued by the Standardization, Testing and Quality Certification (STQC) Directorate of Department of Electronics.

4. Cathode Ray Tube

The Cathode ray tube (CRT) is a display screen which produces images in the form of the video signal. It is a type of vacuum tube which displays images when the electron-beam through electron gun strikes on the phosphorescent surface.

In other Words, the CRT generates the beams, accelerates it at high velocity and deflects it for creating the images on the phosphorous screen so that the beam becomes visible.

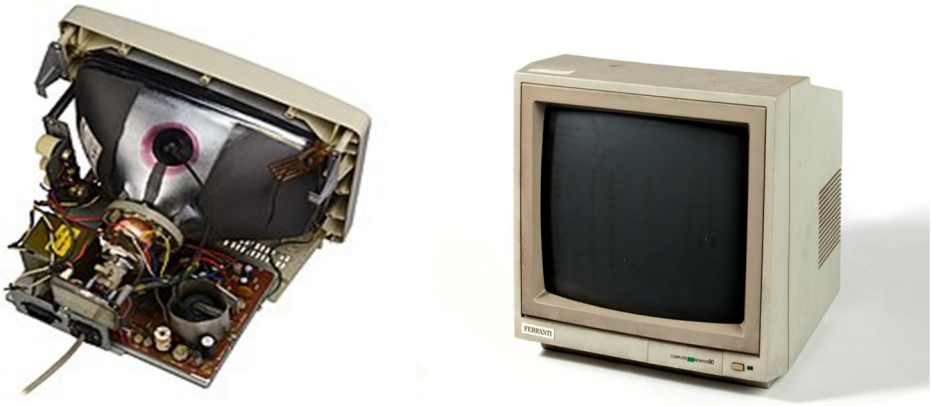
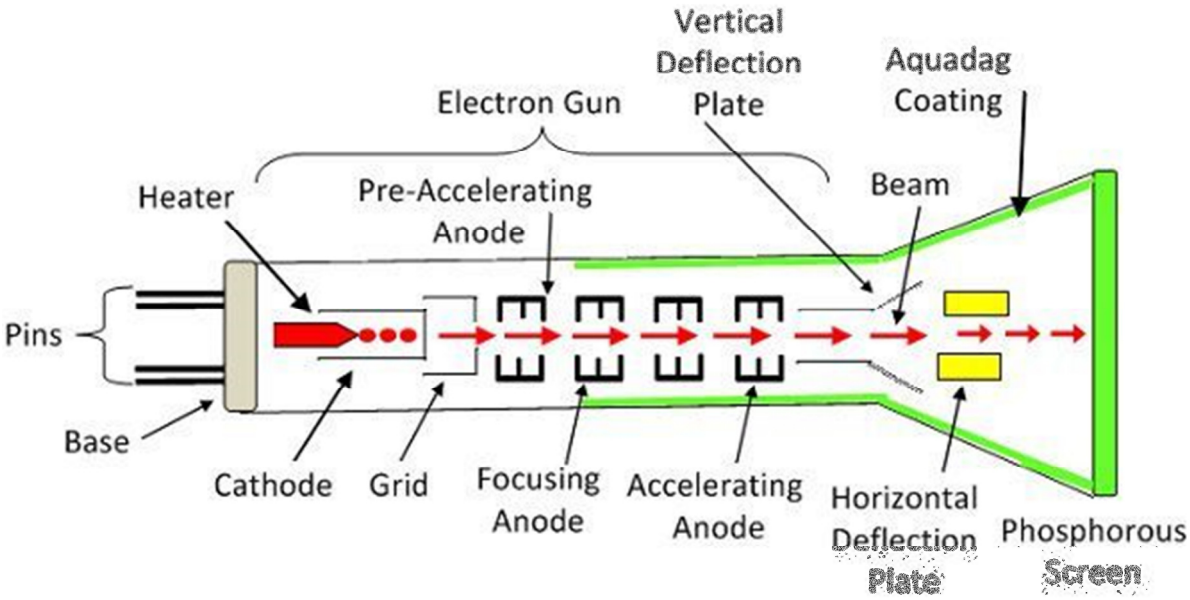


Figure 1: Cathode Ray Tube Monitor

After exiting from the electron gun, the beam passes through the pairs of electrostatic deflection plate. These plates deflected the beams when the voltage applied across it. The one pair of plate moves the beam upward and the second pair of plate moves the beam from one side to another. The horizontal and vertical movement of the electron are independent of each other, and hence the electron beam positioned anywhere on the screen. The working parts of a CRT are enclosed in a vacuum glass envelope so that the emitted electron can easily move freely from one end of the tube to the other.

4.1 Construction of Cathode Ray Tube

The Electrons Gun Assembly, Deflection Plate Assembly, Fluorescent Screen, Glass Envelope, Base are the important parts of the CRT. The electron gun emits the electron beam, and through deflecting plates, it is strikes on the phosphorous screen.



4.2

Figure 2: Cathode Ray Tube

4.2 Electrons Gun Assembly

The electron gun is the source of the electron beams. The electron gun has a heater, cathode, grid, pre-accelerating anode, focusing anode and accelerating anode. The electrons are emitted from the highly emitted cathode. The cathode is cylindrical in shape, and at the end of it, the layer of strontium and barium oxide is deposited which emit the high emission of electrons at the end of the tube.

The electron passes through the electron in the small grid. This control grid is made up of nickel material with a centrally located hole which is coaxial with

The beam is focused by focusing anode. The accelerating and focusing electrodes are cylindrical in shape which has a small opening in the centre of each electrode. After exiting the focusing anode, the beams pass through the vertical and horizontal deflecting plates.

The pre-accelerating and accelerating anode are connected to the positive high voltage of about 1500V and the focusing anode are connected to the lower voltage of about 500V.There are two methods of focusing the electron beam. They are the Electrostatic Focussing Beam and the Electromagnetic Focusing.

4.3 Electrostatic Deflection Plates

The deflection plate produces the uniform electrostatic field only in the one direction. The electron beam entering into the deflection plates will accelerate only in the one direction, and hence electrons will not move in the other directions.

4.4 Screen for Cathode Ray Tube

The front of the CRT is called the face plate. The face plate of the CRT is made up of entirely fibre optics which has special characteristics. The internal surface of the faceplate is coated with the phosphor. The phosphorous converts the electrical energy into light energy. The energy level of the phosphorous crystal rises when the electron beams strike on it. This phenomenon is called cathodoluminescence.

The light which is emitted through phosphorous excitation is called fluorescence. When the electron beam stop, the phosphorous crystal regain their original position and release a quantum of light energy which is called phosphorescence or persistence.

4.5 Aquadag

The aquadag is the aqueous solution of graphite which is connected to the secondary of the anode. The aquadag collects the secondary emitted electrons which are necessary for keeping the CRT screen in the state of electrical equilibrium.

4.6 Colour Cathode Ray Tube based Monitor

Color CRTs use three different phosphors which emit red, green, and blue light respectively. They are packed together in stripes or clusters called "triads". Color CRTs have three electron guns, one for each primary color, (red, green and blue) arranged either in a straight line (in-line) or in an equilateral triangular configuration (the guns are usually constructed as a single unit). (The triangular configuration is often called "delta-gun", based on its relation to the shape of the Greek letter delta Δ.)

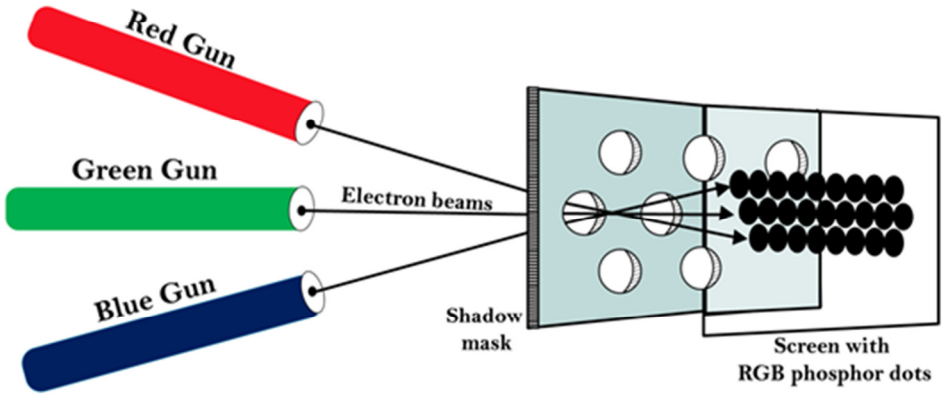


Figure 3: Cathode Ray Tube for Colour monitor

Shadow-mask methods are commonly used in raster scan systems (including colour TV) because they produce a much wider range of colours than the beam penetration method. A shadow-mask CRT has three phosphor colour dots at each pixel position. One phosphor dot emits a red light, another emits a green light, and the third emits a blue light. This type of CRT has three electron guns, one for each colour dot, and a shadow mask grid just behind the phosphor-coated screen. Figure 3 illustrates the delta-delta shadow-mask method, commonly used in colour CRT systems. The three electron beams are deflected and focused as a group onto the shadow mask, which contains a series of holes aligned with the phosphor-dot patterns. When the three beams pass through a hole in the shadow mask, they activate a dot triangle, which appears as a small colour spot on the screen. The phosphor dots in the triangles are arranged so that each electron beam can activate only its corresponding colour dot when it passes through the shadow mask. Another configuration for the three electron guns is an in-line arrangement in which the three electron guns, and the corresponding red-green-blue colour dots on the screen, are aligned along one scan line instead of in a triangular pattern. This in-line arrangement of electron guns is easier to keep in alignment and is commonly used in high-resolution colour CRTs.(See figure 4)

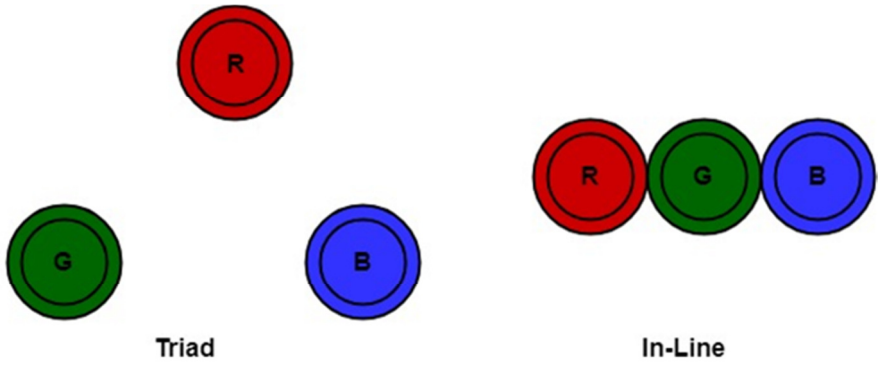


Figure 4: Triad and in-line arrangement of RGB electron guns of colour CRT

The Beam-penetration method for displaying colour pictures has been used with random-scan monitors. Two layers of phosphor, usually red and green, are coated onto the inside of the CRT screen, and the displayed colour depends on how far the electron beam penetrates into the phosphor layers. A beam of slow electrons excites only the outer red layer. A beam of very fast electrons penetrates through the red layer and excites the inner green layer. At intermediate beam speeds, combinations of red and green light are emitted to show two additional colours, orange and yellow. The speed of the electrons, and hence the screen colour at any point, is controlled by the beam-acceleration voltage. Beam penetration has been an inexpensive way to produce colour in random-scan monitors, but only four colours are possible, and the quality of pictures is not as good as with other methods.

The colour variations in a shadow-mask CRT is obtained by varying the intensity levels of the three electron beams. By turning off the red and green guns, we get only the colour coming as the blue phosphor. Other combinations of beam intensities produce a small light spot for each pixel position,

since our eyes tend to merge the three colours into one composite. The colour we see depends on the amount of excitation of the red, green, and blue phosphors. A white (or grey) area is the result of activating all three dots with equal intensity. Yellow is produced with the green and red dots only, magenta is produced with the blue and red dots, and cyan shows up when blue and green are activated equally. In some low-cost systems, the electron beam can only be set to on or off, limiting displays to eight colours. More sophisticated systems can set intermediate intensity levels for the electron beams, allowing several million different colours to be generated.

4.7 Monochrome Cathode Ray Tube based Monitor

A monochrome picture tube is a specialized CRT that produces a black and white image on the screen of the tube by the action of an electron beam. The screen of the tube consists of a layer of phosphor that produces light when a high-velocity beam strikes it.
A picture tube basically acts as a transducer that changes electrical video signals into corresponding light variations to generate an actual image on the screen.

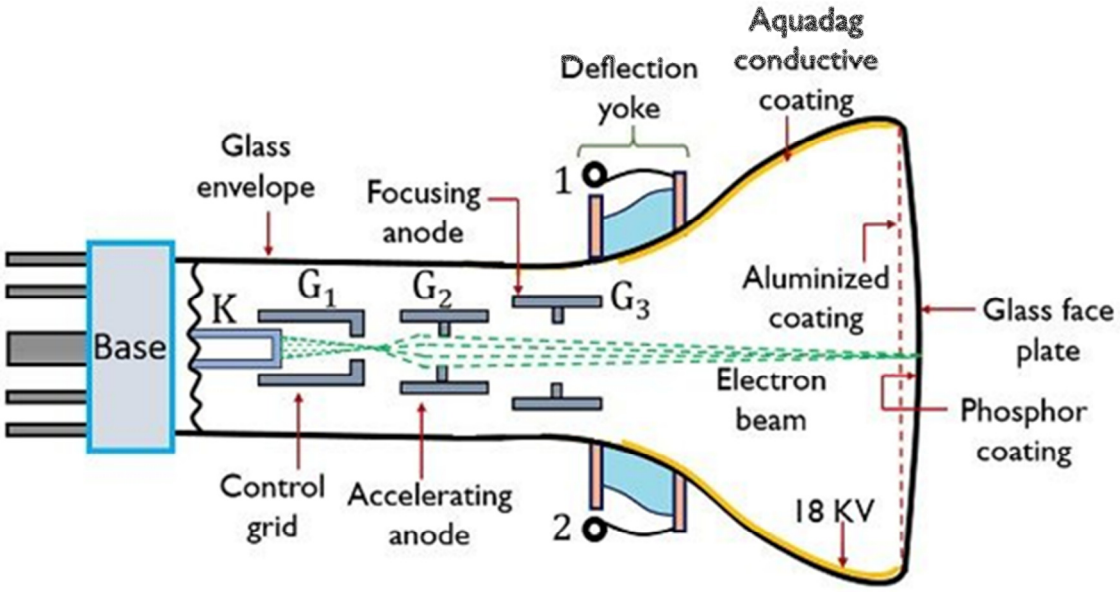


Figure 3: Cathode Ray Tube for Monochrome monitor

The picture tube is a special form of cathode ray tube, the face plate of which serves as a screen of the television receiver. The cathode ray tube (CRT) is housed in a bell-shaped glass enclosure. A filament heats a cathode that emits electrons. The negatively charged electrons are attracted and accelerated by positive-bias voltages on the elements in an electron gun assembly. The electron gun also focuses the electrons into narrow beam.

A control grid that is made negative with respect to the cathode controls the intensity of the electron beam and brightness of the spot it makes. The beam is accelerated towards the screen by a very high voltage applied to an internal metallic coating called aquadag. The face or front of the picture tube is coated internally with a phosphor that glows and produces white light, when it is struck by the electron beam.

Around the neck of the picture tube is a structure of magnetic coils called the deflecting yoke. The horizontal and vertical current linear saw tooth waves generated by the sweep and synchronizing circuits are applied to the yoke coils. This produces the magnetic field inside the tube that influences the position of the electron beam. When the electrons flow, a magnetic field is produced around the conductor through which the current flows. In a CRT, the electron beam is moved or deflected by the magnetic field produced by the deflection coils in the yoke. Thus the electron beam is swept across the face of the picture tube.

As the beam is being swept across the face of the tube to trace out the scene, the intensity of the electron beam is varied by the luminance or Y signal. The Y signal is applied to the cathode or in some cases to the control grid. The control grid is an element in the electron gun that is negatively biased with respect to the cathode. By varying the grid voltage, the beam can be made weaker or stronger, thereby varying the intensity of the light spot produced by the beam, when it strikes the phosphor. Any shade of grey from white to black can be reproduced.

4.8 Applications of CRT Monitors:

While CRTs had declined dramatically in the late 2000s, they are still widely used by consumers and some industries. CRTs do have some distinct advantages over other newer technologies. Because a CRT doesn't need to draw a full image and instead uses interlaced lines, a CRT is faster than an LCD which draws the entire image.

CRTs are also able to correctly display certain resolutions, such as the 256x224 resolution. This is also an example of the most common usage of CRTs by consumers, retro video gaming. Some reasons for this include: CRTs are able to correctly display the often 'oddball' resolutions that many older consoles use. CRTs have the best quality when watching analog programming such as on VHS or through an RF signal.

Some industries still use CRTs because it is too much effort, downtime, and/or cost to replace them, or there is no substitute available; a notable example is the airline industry. Planes such as the Boeing 747-400 and the Airbus A320 used CRT instruments in their glass cockpits instead of mechanical instruments. Airlines such as Lufthansa still use CRT technology.

CRTs also tend to be more durable than their flat panel counterparts, though specialized LCDs that have similar durability also exist.

5. Present status of the standard:

5.1 Status of standard(s), if any from which assistance had been drawn in the formulation of this IS.

In the preparation of this standard, assistance has been derived from largely based on document DOE/STQC/COMPUTER/6/92 - Specifications for Monochrome Video Monitor issued by the Standardization, Testing and Quality Certification (STQC) Directorate of Department of Electronics.
The Indian Standard for CATHODE RAY TUBE BASED DATA DISPLAY MONITOR – SPECIFICATION PART 1 COLOUR is formulated in the year 1992 and for CATHODE RAY TUBE BASED DATA DISPLAY MONITOR – SPECIFICATION PART 2 MONOCHROME were adopted by Bureau of Indian Standards in 1992 and 1997 after the draft had been finalized by then Computer Media Sectional Committee and had been approved by the Electronics and Telecommunication Division Council and till date no amendment or revision has been issued. However due to amendment in the referred standards the necessary changes may be incorporated in the standard.

5.2 Status of standards referred in Indian Standard:

Referred standards (No. & Title)	**Title**	**IS No. of this standards since revised**	**Changes that are of affecting the standard under review**	**Action proposed**
1885 (Part 52/ Sec 1 to 15)	Electrotechnical vocabulary : Part 52 Data processing	IS 1885 (Part 52/ Sec 2,3,7, 10,11,13,14 and 15)	IS 1885 (Part 52 /Sec 1,4,5,6,8,9, 12 are withdrawn and no other standards are referred.	IS 1885 (Part 52/Sec 1,4,5,6,8 ,9,12 are withdrawn and no other standards are referred, thus the same may be amended as 1885 (Part 52/ Sec 2,3,7,10,11,13,14 and 15)
3722 (Parts 1 and 2)	Letter symbols and signs used in electrical technology: Part 1 General guidance on symbols and subscripts (first revision) Part 2 Reference tables for symbols and subscripts (fist	--	--	--

	revision)			
4545 Part 1: 1983 Part 3 : 1983 Part 4: 1983	Methods of measurement o n receivers for television br oadcast transmissions: Part 1 general consideration s Part 3 geometrical the pict ure Part 4 synchronizing quality	IS 4545: Part 1:2008/ IEC 6 0107-1: 1997	This revision has been undertaken to align the stan dard with the lat est international practices dealing with methods of measurements o n television recei vers as given in I EC 60107-1:199 7.	May be revised to IS 4545 (Par t 1) : 1983 has been revised to IS 4545: Part 1 :2008/ IEC 601 07-1: 1997 -- Part 4 synchro nizing quality (Comment: not mentioned in t he standard ho wever referred at sl. No. 5 of Table 1)
6842 : 1977	Limits for electromagnetic i nterference (first revision)	--	Standard is with drawn	Standard is wit hdrawn) IEC 6 1000-3:2021, Electromagneti c compatibility (EMC) - Part 3 : Limit - ALL PARTS may b e referred for t he same.
9000 Part2/Sec4: 1977 Part 3/Sec 5: 1977 Part 5/Set 2 : 1981 Part 7/Sec 2: 1979 Part 8 : 1981	Basic environmental testing procedures for electronic an d electrical items Cold test, Section 4 Cold te st 1977 for heat dissipating items with gradual change o f temperature Part 3 Dry heat test, Section 5 Dry 1977 heat test for hea t dissipating items with grad ual change of temperature Part 5 Damp heat (cyclic) te st, Section 1981 2 12 + 12h cycle Part 7 Impact test, Section 2	--	--	--

	Bump 1979 Part 8 Vibration (sinusoidal) test			
12032 (Parts 2 to 11)	Graphical symbols for diagr ams in the field of electrote chnology	--	--	--
10673 : 198 3	Sampling plans and procedu res for inspection by attribut es for electronic items. (stan dard is withdrawn)	--	--	--
IS 13252 : 1 991 , IECPu b950 (1986)	'Safety of Information Tech nology Equipment includin g Electrical Business Equipment'	--		--

5.3 ANY OTHER STANDARDS AVAILABLE RELATED TO THE SUBJECT AND SCOPE OF THIS STANDARD:

On study of the available and updated standards available specifically for CRT based Monitors in order to accordingly update the standard under review i.e. **Cathode ray tube based data display monitor - Specification, Part 1 colour, Part 2 monochrome**, no other International/ regional/ other national standards/ documents were found available.

The standard on monitors available with the major international standardization bodies is IEC 62563-1 which is specific to Medical electrical equipment – Medical image display systems, which include CRT based monitors.

6. Technical Comments on the Standard

On study of the available national/international standards, relevant literature in the field and interaction with the end users of CRT based monitors in India, user Industries and Laboratories it has been found that only CRT based monitors are getting obsolete at a very fast pace. OLED, LED and LCD based display panels have replaced CRT based monitors. The use of such monitors is rare and their manufacturing is almost negligible in the country as per the study conducted for this action research. The reasons are given below:

1. Because of the CRT in a CRT monitor the physical size is much larger than available options of LCD, LED, OLED panels and usually awkward on small desks.
2. Comparatively Lighter weights of LCD, LED, OLED panels with respect to CRT based display units.
3. LCD advantages over CRT: power consumption and heat generation, higher refresh rates (up to 360 hz), higher contrast ratios.
4. CRT advantages over LCD: Better color reproduction, no motion blur, multi-syncing available in many monitors, i.e., CRT monitors are often capable of displaying sharp images at several resolutions, thus still in medical fields the CRT display units are used, however the number is declining day by day with the advent in the newer display technologies.
5. CRT monitors can still outperform LCD and OLED monitors in input lag, as there is no signal processing between the CRT and the display connector of the monitor. Thus preferred by professional video gamers who are miniscule in count.

In view of above the committee members of the LITD 36 were also requested to give their valuable comments about the same. One of the members had commented that the above standards may be withdrawn however another member commented that CRT based display units are still being used in the medical fields. Upon further studying about their use in medical filed it is observed that use of CRT based display in medical field is very less, also replaceable modules of LCD and LED panels are available in the market.

7. Information available on technical developments that have taken place (on product/processes/practices/use or application/ testing/ input materials, etc)

Upon analysis of the available national/international standards, study of the relevant literature and technological advancements in the field of display monitors it was found that:

i. No other International/regional/other national standards were found available specifically for CRT based display monitors.

ii. The use of CRT based display monitors as display unit is at present negligible/very minimal as LCD/LED/OLED technology is now being predominantly used for the display monitor. Because of its well-established properties such as low cost, light weight, decreasing cost, variety of sizes available, energy efficiency, cause less eye fatigue etc.

In view of the above initial study, major stakeholders in the field including leading manufacturers in the country, end users, and labs were referred on the subject matter.

As found out from the study, the major manufacturers of display monitors in India have stopped manufacturing the production of CRT based display monitors. Further no laboratory is found which is still continuing the testing of CRT based display monitor. Further upon discussion with the end users in various industries undersigned visited, nobody is using them and has replaced them with newer technologies of LCD or LED display panels at their office/ workstations. Further CCTV display units used by them are also predominantly LCD/ LED display units.

8. Issues arising out of changes in any related IS or due to formulation of new Indian Standard

Related IS and its Title (revised or new)	Provision in the IS under review that would be impacted & the clause no. or addition of new clause/provision	Changes that may be necessary in the Standards under review	Action proposed
Cathode ray tube based data display monitor - Specification, Part 1 colour,	Pl. see enclosed draft standard incorporating the changes due to amendment in the referred standard	Editorial changes due to observed typographical error and amendment due to revision of referred standards are required. The same are mentioned and highlighted in the enclosed draft, further a comment is placed in front of the changes proposed, mentioning the reason for changes. Please refer enclosed draft of the standard in the annexures.	The necessary changes may be incorporated in the standard.
Cathode ray tube based data display monitor - Specification, Part 2 monochrome	Pl. see enclosed draft standard incorporating the changes due to amendment in the referred standard	Editorial changes due to observed typographical error and revision of referred standards are required. The same are mentioned and highlighted, further a comment is placed in front of the changes proposed, mentioning the reason for changes. Please refer enclosed draft of the standard in the annexures.	The necessary changes may be incorporated in the standard.

9. Any consequential changes to be considered in other IS

Related IS to get impacted	Requirements to be impacted
NA	

Indian Standard

CATHODE RAY TUBE BASED DATA DISPLAY MONITOR - SPECIFICATION

PART 1 COLOUR

1 SCOPE

This standard specifies the general and performance requirements for Cathode Ray Tube based Colour Data Display Monitor.

2 REFERENCES

The Indian Standards given in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

For the purpose of this standard the terms and definitions given in IS 1885 (Part 52/Sec 2, 3, 7, 10, 11, 13, 14 and 15) (comment: IS 1885 (Part 52/Sec 1,4,5,6,8,9,12 are withdrawn) and IS 4545: Part 1:2008/ IEC 60107-1: 1997 (comment: IS 4545 (Part 1) : 1983 has been revised to IS 4545: Part 1:2008/ IEC 60107-1: 1997) shall apply.

4 MARKING

4.1 Each product shall be legibly and indelibly marked with at least the following:

a) Manufacturer's name or trade-mark,

b) Model designation and serial number,

c) Additional markings for safety such as high voltage points with their voltage range,

d) Country of manufacture,

e) Mains supply voltage range and mains frequency,

f) Fuse and its rating,

g) Input/output points, and

h) Maximum power consumption.

4.2 Letter symbols and Graphical symbols used in the markings shall be as per IS 3722 (Parts 1 and 2) and IS 12032 (Parts 2 to 11) respectively. Symbols not defined in the standards mentioned and all other markings shall be clearly identified by the manufacturer in the manual supplied with the equipment.

4.3 A precautionary note as follows, shall appear on the outer surface of the back cover prominently :

'Do not remove the back cover without totally disconnecting mains supply.'

5 GENERAL REQUIREMENTS

5.1 Power Supply Requirements

5.1.1 The power supply shall be an integral part of the monitor and shall be capable of giving regulated output for mains voltage 240 V ± 10 percent with mains frequency 50 Hz ±3 percent.

5.1.2 The maximum power consumption shall be specified by the manufacturer.

5.2 Controls

5.2.1 The following controls normally accessible to the user shall be provided :

a) Brightness

b) Contrast

c) Power On-Off switch

5.2.2 The following Pre-set controls may also be provided for adjustment at the time of servicing:

a) Focus

b) Sync control — horizontal and vertical

c) RGB gain control

d) Width control

e) Linearity control — horizontal and vertical

f) Height control

g) Black level control for red, blue and green

5.3 Degaussing : Automatic at switch-on

6 SAFETY REQUIREMENTS

The monitor shall conform to the following safety requirements. These tests shall be carried out in accordance with IS 13252 : Part 1:2010/ IEC 60950-1:2005 (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005) and shall meet the requirements specified therein.

a) Ionizing (X-Ray) Radiation (4.3.13.2 of IS 13252 : Part 1:2010/ IEC 60950-1:2005) (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

b) Protection against electric shock and energy hazards (2.1 of IS 13252 : Part 1:2010/ IEC 60950-1:2005) (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

c) Insulation (2.9 of IS 13252 : Part 1:2010/ IEC 60950-1:2005). (Comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

d) Mechanical strength of cathode ray tubes and protection against effects of implosion (4.2 of IS 13252 : Part 1:2010/ IEC 60950-1:2005) (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

e) The monitor tube should have an antiglare coating or other treatment to prevent glare of the operator.
NOTE — In case of availability of certificate regarding implosion proof ness from picture tube manufacturer. This test may not be carried out.

~~7 EMI/EMC REQUIREMENTS~~
~~The conducted emission and radiated emission shall be limited to the requirements specified in Table 16 and Table 18 respectively for Class A equipment in IS 6842 : 1977 (with Amendment 2). However, the equipment shall meet the limits for Class B equipment if is to be used in residential areas.~~ (IS 6842 is withdrawn and no other

standard is referred, however IEC 61000-3:2021, Electromagnetic compatibility (EMC) - Part 3: Limit - ALL PARTS may be referred for the same.)

8 PERFORMANCE REQUIREMENTS

The performance requirements of the video monitor shall be in accordance with Table 1.

9 OPERATING AND INSTRUCTION MANUAL

An operating and instruction manual containing information relating to installation, operation, routine maintenance and safety precautions shall be made available with each monitor. The manufacturer would particularly specify the particular component for which adequate care needs to be taken to ensure proper replacement at the time of servicing.

10 TESTS

10.1 Classification of Tests

10.1.1 Type Tests

The tests specified in Table 2 shall constitute type tests and shall be carried out in the sequence mentioned therein.

10.1.1.1 Number of samples

For types tests, number of samples shall be three of the same model, type and make of the monitor selected preferably at random from a regular production lot. The samples shall be distributed for various tests as specified in Table 2.

10.1.1.2 Criteria for acceptance

There shall be no failure in any of the type tests. In case of failure, twice the number of samples shall be taken and subjected to the tests in which failure has occurred and other tests that have a bearing on the test results. No failure shall be permitted in the re-tests.

Table 1 Performance Requirements

Sl. No.	Characteristics	Requirements
1)	a) Visual examination	The monitor shall be free from workmanship defects, sharp edges, burrs, scratches, nicks, power-on blemishes, missing phosphor dots, bubbles and any other visible defect. All fasteners shall be fixed properly. All steel chassis parts shall be coated

		to prevent rust and corrosion. All frame parts shall have conductive surfaces.
	b) Controls	All external controls shall perform intended functions and shall be clearly and indelibly marked.
2)	Geometric distortion a) Picture outline distortion b) Non-linearity due to scanning	Not more than 6 percent in each direction (vertical and horizontal) to be tested in accordance with 4.4 of IS 4545 (Part 3) : 1983. Total distortion not more than 10 percent in each direction. To be tested in accordance with 4.3 of IS 4545 (Part 3).
3)	Ripple distortion due to mains	0.5 percent of picture tube width for a difference of 1 Hz between mains and frame frequency to be tested in accordance with 4.2 of IS 4545 (Part 3) : 1983.
4)	Picture size stability	Better than 3 percent in both directions over range of brightness control to be tested in accordance with 2.1 of IS 4545 (Part 3) : 1983
5)	Hum-bar	Not more than 5 percent when measured as a percentage of voltage amplitude of video signal to be tested in accordance with 15 of IS 4545 (part 4): 1983
6)	EHT voltage	Not more than 30 kV.

7)	Power interrupt response	The monitor shall meet the functional performance requirements after the following sequence : i) Switch on the power ii) Interrupt the power to the monitor 100 times at the rate of 6 operations per minute. iii) Check functional performance. NOTE — Other performance requirements may be agreed to between the manufacturer and the buyer.

10.1.2 Routine Tests

The following shall constitute routine tests:

i) Check for operation of the monitor

ii) Check safety requirements as per 6

iii) Check for performance requirements as per 1, 2 and 4 of Table 1.

10.1.3 Acceptance Tests

The following shall constitute acceptance tests :

i) Check for operation of the monitor,

ii) Check as per 4, 5 and 6.

iii) Check as per 1, 2, 4 and 7 of Table 1.

The sampling plan and AQL shall be as agreed to between the manufacturer ~~and the buyer and shall be selected from IS 10673 : 1983.~~(standard is withdrawn)

11 ENVIRONMENTAL TESTS

11.1 Bump

The monitor shall be subjected to bump test carried out in accordance with IS 9000 (Part 7/Sec 2) : 1979 in packed condition, with the following severities :

a) Number of bumps: 1 000 ± 10

b) Peak acceleration: 40 g

c) Number of attitudes: 1 (Normal axis as indicated by an arrow or by indicating the side which is "up" on the packing.)

11.2 Vibration

The monitor shall be subjected to vibration test in packed condition at a frequency of 10 to 55 Hz, and acceleration 2 g for 105 minutes in accordance with IS 9000 (Part 8): 1981.

11.3 Burn-In

The monitor shall be subjected to Burn-in at ambient temperature for 240 hours with power on and with test pattern as given below:

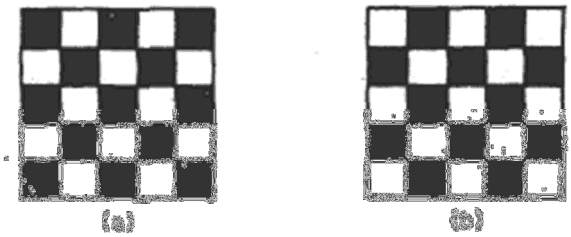


Fig. 1 Burn-in Pattern

The pattern shall alternate between (a) and (b) at least once every ten seconds.

11.4 Dry Heat

The monitor shall be subjected to dry heat test under power-on condition with severity 40 degree centigrade for 16 hours in accordance with IS 9000 (Part 3 /Sec5):1977.(comment: typographical error in the standard)

11.5 Damp Heat Cyclic

The monitor-shall be subjected to damp heat cyclic test in power off condition carried out in accordance with IS 9000 (Part 5/Sec 2) : 1981 at a temperature of 40 degree centigrade for two cycles.

Table 2 Schedule for Type Tests

(Clause 10.1 and 10.1.1.1) (Comment: only Clause 10.1was not mentioned)

Group	Test	Clause Reference	No. of samples
0)	Check for marking requirements	4	3
	Check for genera) requirements		
	Check for safety requirements	5	3
	Check-for EMI/EMC requirements	6	3
		7	3
	Check for performance requirements	8 (Table 1)	3
1)	Bump	11.1	1

2)	Vibration	11.2	1
	Dry Heat	11.4	1
	Damp Heat	11.5	1
	Cold	11.6	1
3)	Burn-in	11.3	1

11.6 Cold

The monitor shall be subjected to Cold test in power-off condition with severity minus 10 degree centigrade for two hours carried out in accordance with IS 9000 (Part2/Sec4):1977.

11.7 Functional Checks

After each environmental/durability test, the performance of the monitor shall be checked using s tandard test patterns of the type specified in 3.13 of IS 4545 : Part 1:2008/ IEC 60107-1: 1997.(Comment: IS 4545 part1 : 1983 is revised to IS 4545 : Part 1:2008/ IEC 60107-1: 1997) At the e nd of all environmental/ durability tests, performance check shall be conducted as per 1, 2 and 4 of Table 1.

ANNEX A

(Clause 3)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title
1885 (Part 52/ Sec 2,3,7,10,11,13,14 and 15) (comment: IS 1885 (Part 52/Sec 1, 4,5,6,8,9,12 are withdrawn)	Electrotechnical vocabulary : Part 52 Data processing
3722 (Parts 1 and 2)	Letter symbols and signs used in electrical technology: Part 1 General guidance on symbols and subscripts (first revision) Part 2 Reference tables for symbols and subscripts (fist revision)
4545 Part 1:2008/ IEC 60107-1: 1997	Methods of measurement on receivers for television broadcast tra nsmissions: Part 1 general considerations

Part 3 : 1983 Part 4: 1983	Part 3 geometrical the picture Part 4 synchronizing quality (Comment: not mentioned in the standard however referred at sl. No. 5 of Table 1)
6842 : 1977	Limits for electromagnetic interference (first revision) (Comment: Standard is withdrawn) Comment: IEC 61000-3:2021, Electromagnetic compatibility (EMC) - Part 3: Limit - ALL PARTS may be referred for the same.
9000 Part2/Sec4: 1977 Part 3/Sec 5: 1977 Part 5/Set 2 : 1981 Part 7/Sec 2: 1979 Part 8 : 1981	Basic environmental testing procedures for electronic and electrical items Cold test, Section 4 Cold test 1977 for heat dissipating items with gradual change of temperature Part 3 Dry heat test, Section 5 Dry 1977 heat test for heat dissipating items with gradual change of temperature Part 5 Damp heat (cyclic) test, Section 1981 2 12 + 12h cycle Part 7 Impact test, Section 2 Bump 1979 Part 8 Vibration (sinusoidal) test
12032 (Parts 2 to 11)	Graphical symbols for diagrams in the field of electrotechnology
10673 : 1983	Sampling plans and procedures for inspection by attributes for electronic items. (standard is withdrawn)
IS 13252 : 1991 , IECPub950 (1986)	'Safety of Information Technology Equipment including Electrical Business Equipment'

ANNEX B
TYPES OF COLOUR MONFTORS AND THEIR CHARACTERISTICS

B-2 DIMENSIONS

B-2.1 (Comment; In the standard, due to typographical mistake it is mentioned as B2.2) The diagonal screen of the video monitor may have one of the following dimensions :

a) 304.8 mm (12 in)
b) 355.6 mm (14 in)
c) 482.6 mm (19 in)

B-3 OTHER CHARACTERISTICS

B-3.1 Table 3 details the characteristics of the following types of colour video monitors depending on the graphic adaptor used:

a) C.G.A (Colour Graphic Adaptor)

b) E.G.A (Enhanced Graphic Adaptor)

c) V.GA (Video Graphic Adaptor)

Table 3

Characteristic	C.G.A	E.G.A.	V.G.A
1) Resolution (Min) Horizontal (pixels) x vertical (lines)	640 x 200 (optionally for specific applications 320x200)	640x300	640x480
2) Tube dot pitch {Max) mm	0.51	0.38 for 12 in screen 0.39 for 14 in screen 0.47 for 19 in screen	0.31 for 12 in screen 0.39 for 14 in screen 0.47 for 19 in screen
3) Video input	TTL	TTL	Analog with 0.7 RGB
4) Sync	Composite sync (TTL level negative) or separate sync (TTL level)	Composite sync (TTL level negative) or separate sync (TTL level)	Composite sync (TTL level negative) or separate sync (TTL level) or sync on green (-ve 0.3 V)
5) Connector	9pin D type or 15 pin D type or BNC	9pin D type or 15 pin D type or BNC	9pin D type or 15 pin D type or BNC
6) Horizontal frequency	15.5 KHz ± 0.5 KHz	21.8 KHz ± 0.5 KHz	31.5 KHz ± 0.5 KHz
7) Vertical frequency	60 Hz	60 Hz	50/60/70 Hz
8) Band width (min)	10 MHz	20 MHz	30 MHz
9) Brightness (at maximum setting of brightness control)	Greater than 40 Nits	Greater than 40 Nits	Greater than 40 Nits

Indian Standard

CATHODE RAY TUBE BASED DATA DISPLAY MONITOR - SPECIFICATION

PART 2 MONOCHROME

1 SCOPE

This standard specifies general and performance requirements for cathode ray tube based monochrome data display monitor.

2 REFERENCES

The Indian Standards given in Annex B are necessary adjuncts to this standard.

3 TERMINOLOGY

For the purpose of this standard the terms and definitions given in IS 1885 (Part 52/Sec 2, 3, 7, 10, 11, 13, 14 and 15) (comment: IS 1885 (Part 52/Sec 1,4,5,6,8,9,12 are withdrawn) and IS 4545: Part 1:2008/ IEC 60107-1: 1997 (comment: IS 4545 (Part 1) : 1983 has been revised to IS 4545: Part 1:2008/ IEC 60107-1: 1997) shall apply.

4 GENERAL REQUIREMENTS

4.1 Power Supply Requirements

4.1.1 The power supply shall be an integral part of the monitor and shall be capable of giving regulated output for mains voltage 24OV±10 percent with mains frequency 50 Hz ± 3 percent.

4.1.2 The maximum power consumption shall be specified by the manufacturer.

4.2 Controls

4.2.1 The following controls normally accessible to the user shall be provided:

a) Brightness,

b) Contrast, and

c) Power On-Off switch.

4.2.2 The following pre-set controls may also be provided for adjustment at the time of servicing:

a) Focus,

b) Sync-control - horizontal and vertical,

c) Width control,
d) Linearity control - horizontal and vertical, and
e) Height control.

5 SAFETY REQUIREMENTS

The monitor shall conform to the following safety requirements. These tests shall be carried out in accordance with IS 13252 and shall meet the requirements specified therein:

a) Ionizing (X-Ray) Radiation (4.3.13.2 of IS 13252 : Part 1:2010/ IEC 60950-1:2005) (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

b) Protection against electric shock and energy hazards (2.1 of IS 13252 : Part 1:2010/ IEC 60950-1:2005) (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

c) Insulation (2.9 of IS 13252 : Part 1:2010/ IEC 60950-1:2005). (Comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005). And

d) Mechanical strength of cathode ray tubes and protection against effects of implosion (4.2 of IS 13252 : Part 1:2010/ IEC 60950-1:2005) (comment: IS 13252: 1991 has been revised to IS 13252 : Part 1:2010/ IEC 60950-1:2005).

NOTE — In case of availability of certificate regarding implosion proof ness from picture tube manufacturer. This test may not be carried out.

~~6 EMI/EMC REQUIREMENTS~~

~~The conducted emission and radiated emission shall be limited to the requirements specified in Table 16 and Table 18 respectively for Class A equipment in IS 6842 : 1977 (with Amendment 2). However, the equipment shall meet the limits for Class B equipment if is to be used in residential areas.~~ (IS 6842 is withdrawn and no other standard is referred, however IEC 61000-3:2021, Electromagnetic compatibility (EMC) - Part 3: Limit - ALL PARTS may be referred for the same.)

7 PERFORMANCE REQUIREMENTS

The performance requirements of the video monitor shall be in accordance with Table 1.

8 OPERATING AND INSTRUCTION MANUAL

An operating and instruction manual containing information relating to installation, operation, routine maintenance and safety precautions shall be made available with each monitor. The manufacturer would particularly specify the particular component for which adequate care needs to be taken to ensure proper replacement at the time of servicing.

9 TESTS

9.1 Classification of Tests

9.1.1 Type Tests

The tests specified in Table 2 shall constitute type tests and shall be carried out in the sequence mentioned therein.

Table 1 Performance Requirements
(Clause 7)

Sl. No.	Characteristics	Requirements
8)	i) Visual examination	The monitor shall be free from workmanship defects, sharp edges, burrs, scratches, nicks, power-on blemishes, missing phosphor dots, bubbles and any other visible defect. All fasteners shall be fixed properly. All steel chassis parts shall be coated to prevent rust and corrosion. All frame parts shall have conductive surfaces.
	ii) Controls	All external controls shall perform intended functions and shall be clearly and indelibly marked.
9)	Geometric distortion b) Picture outline distortion	Not more than 6 percent in each direction (vertical and horizontal) to be tested in accordance with 4.4 of IS 4545 (Part 3) : 1983. Total distortion not more

	b) Non-linearity due to scanning	than 10 percent in each direction. To be tested in accordance with 4.3 of IS 4545 (Part 3).
10)	Ripple distortion due to mains	0.5 percent of picture tube width for a difference of 1 Hz between mains and frame frequency to be tested in accordance with 4.2 of IS 4545 (Part 3) : 1983.
11)	Picture size stability	Better than 3 percent in both directions over range of brightness control to be tested in accordance with 2.1 of IS 4545 (Part 3) : 1983
12)	Hum-bar	Not more than 5 percent when measured as a percentage of voltage amplitude of video signal to be tested in accordance with 15 of IS 4545 (part 4): 1983
13)	EHT voltage	Not more than 20 kV.
14)	Power interrupt response	The monitor shall meet the functional performance requirements after the following sequence : a) Switch on the power b) Interrupt the power to the monitor 100 times at the rate of 6 operations per minute. c) Check functional performance. NOTE — Other performance requirements may be agreed to between the manufacturer and the buyer.

NOTE - Other performance requirements may be agreed to between the manufacturer and the buyer.

9.1.1.1 Number of samples

For types tests, number of samples shall be three of the same model, type and make of the monitor selected preferably at random from a regular production lot. The samples shall be distributed for various tests as specified in Table 2.

9.1.1.2 Criteria for acceptance

There shall be no failure in any of the type tests. In case of failure, twice the number of samples shall be taken and subjected to the tests in which failure has occurred and other tests that have a bearing on the test results. No failure shall be permitted in the re-tests.

9.1.2 Routine Tests

The following shall constitute routine tests:

i) Check for operation of the monitor

ii) Check safety requirements as per 5

iii) Check for performance requirements as per (i), (ii) and (iv) of Table 1.

9.1.3 Acceptance Tests

The following shall constitute acceptance tests :

i) Check for operation of the monitor,

ii) Check as per 11, 4 and 5.

iii) Check as per Sl. No. (i), (ii), (iv) and (vii) of Table 1.

The sampling plan and AQL shall be as agreed to between the manufacturer ~~and the buyer and shall be selected from IS 10673 : 1983.~~(standard is withdrawn)

Table 2 Schedule for Type Tests
(Clause 9.1 and 9.1.1.1)

Group	Test	Clause Reference	No. of samples
0)	Check for marking requirements	11	3
	Check for genera) requirements	4	
	Check for safety requirements	5	3
	Check-for EMI/EMC requirements	6	3
			3
	Check for performance requirements	7 (Table 1) (comment: table 1 was not mentioned)	3
1)	Bump	10.1	1
2)	Vibration	10.2	1
	Dry Heat	10.4	1

	Damp Heat Cold	10.5 10.6	1 1
3)	Burn-in	10.3	1

10 ENVIRONMENTAL TESTS

10.1 Bump

The monitor shall be subjected to bump test carried out in accordance with IS 9000 (Part 7/Sec 2) : 1979 in packed condition, with the following severities :

a) Number of bumps : 1 000 ± 10

b) Peak acceleration : 40 g

c) Number of attitudes : 1 (Normal axis as indicated by an arrow or by indicating the side which is "up" on the packing.)

10.2 Vibration

The monitor shall be subjected to vibration test in packed condition at a frequency of 10 to 55 Hz, and acceleration 2 g for 105 minutes in accordance with IS 9000 (Part 8): 1981.

10.3 Burn-In

The monitor shall be subjected to Burn-in at ambient temperature for 240 hours with power on and with test pattern as given below:

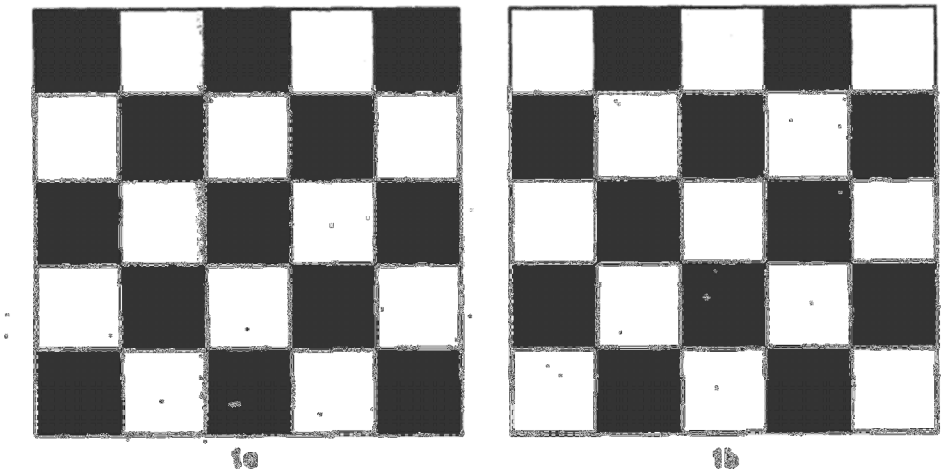


Fig. 1 TEST PATTERN FOR BURN-IN TEST

The pattern shall alternate between 1(a) and 1(b) at least once every ten seconds.

10.4 Dry Heat

The monitor shall be subjected to dry heat test under power-on condition with severity 40 degree centigrade for 16 hours in accordance with IS 9000 (Part 3 /Sec5):1977.(comment: typographical error in the standard)

10.5 Damp Heat Cyclic
The monitor-shall be subjected to damp heat cyclic test in power off condition carried out in accordance with IS 9000 (Part 5/Sec 2) : 1981 at a temperature of 40 degree centigrade for two cycles.

10.6 Cold

The monitor shall be subjected to Cold test in power-off condition with severity minus 10 degree centigrade for two hours carried out in accordance with IS 9000 (Part2/Sec4):1977.

10.7 Functional Checks

After each environmental/durability test, the performance of the monitor shall be checked using s tandard test patterns of the type specified in 3.13 of IS 4545 : Part 1:2008/ IEC 60107-1: 1997.(Comment: IS 4545 part1 : 1983 is revised to IS 4545 : Part 1:2008/ IEC 60107-1: 1997) At the e nd of all environmental/ durability tests, performance check shall be conducted as per Sl. No. (i), (ii), (iv) of Table 1.

11 MARKING

a) Source of manufacturer,
b) Model designation and serial number,
c) Additional markings for safety such as high voltage points with there voltage range.
d) Mains supply voltage frequency,
e) Fuse and its rating,
f) Input/ Output points,
g) Power consumption, and
h) Country of manufacture.

11.2 Letter, symbols and Graphical symbols used in the markings shall be as per IS 3722 (Parts 1 and 2) and IS 12032 (Parts 2 to 11), respectively. Symbols not defined in the standards mentioned and all other markings shall be clearly identified by the manufacturer in the manual supplied with the equipment.

11.3 A precautionary note as follows, shall appear on the outer surface of the back cover prominently: `Do not remove the back cover without totally disconnecting mains supply. '

11.4 The monitor may also be marked with the Standard Mark.
11.4.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act. 1986 and the Rules and Regulations made thereunder. Details of conditions under which a license for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standard.

ANNEX A

(Foreword)

TYPES OF COLOUR MONFTORS AND THEIR CHARACTERISTICS

A-l GENERAL

A-1.1 This Annex is intended for providing general information on the common types of colour video monitors and their characteristics. The types covered are not comprehensive but have been chosen in view of their usage in the country. It is recommended that the different types of Colour Video Monitors conform to the characteristics as specified in this Annex.

A-2 DIMENSIONS

The diagonal screen of the video monitor may have one of the following dimensions :

a) 304.8 mm (12 in)

b) 355.6 mm (14 in)

c) 482.6 mm (19 in)

A-3 OTHER CHARACTERISTICS

Table 3 details the characteristics of the following types of colour video monitors depending on the graphic adaptor used:

a) C.G.A (Colour Graphic Adaptor)

b) E.G.A (Enhanced Graphic Adaptor)

c) V.GA (Video Graphic Adaptor)

Table 3

Characteristic	C.G.A	E.G.A.	V.G.A
1) Resolution (Min) H orizontal (pixels) x ve rtical (lines)	640 x 200 (optionally for specific applicatio ns 320x200)	640x300	640x480
2) Tube dot pitch {Ma x) mm	0.51	0.38 for 12 in screen 0.39 for 14 in screen 0.47 for 19 in screen	0.31 for 12 in screen 0.39 for 14 in screen 0.47 for 19 in screen

3) Video input	TTL	TTL	Analog with 0.7 RGB
4) Sync	Composite sync (TTL level negative) or sep arate sync (TTL level)	Composite sync (TTL level negative) or sep arate sync (TTL level)	Composite sync (TTL level negative) or sepa rate sync (TTL level) or sync on green (-ve 0.3 V)
5) Connector	9pin D type or 15 pin D type or BNC	9pin D type or 15 pin D type or BNC	9pin D type or 15 pin D type or BNC
6) Horizontal frequen cy	15.5 KHz ± 0.5 KHz	21.8 KHz ± 0.5 KHz	31.5 KHz ± 0.5 KHz
7) Vertical frequency	60 Hz	60 Hz	50/60/70 Hz
8) Band width (min)	10 MHz	20 MHz	30 MHz
9) Brightness (at maxi mum setting of bright ness control)	Greater than 40 Nits	Greater than 40 Nits	Greater than 40 Nits

ANNEX B

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title
1885 (Part 52/ Sec 2,3,7,10,11,13,14 and 15) (comment: IS 1885 (Part 52/Sec 1, 4,5,6,8,9,12 are withdrawn)	Electrotechnical vocabulary : Part 52 Data processing
3722 (Parts 1 and 2)	Letter symbols and signs used in electrical technology: Part 1 General guidance on symbols and subscripts (first revision) Part 2 Reference tables for symbols and subscripts (fist revision)
4545 Part 1:2008/ IEC 60107-1: 1997 Part 3 : 1983 Part 4: 1983	Methods of measurement on receivers for television broadcast tra nsmissions: Part 1 general considerations Part 3 geometrical the picture Part 4 synchronizing quality (Comment: not mentioned in the stan

	dard however referred at sl. No. 5 of Table 1)
~~6842 : 1977~~	~~Limits for electromagnetic interference (first revision)~~ (Comment: Standard is withdrawn) Comment: IEC 61000-3:2021, Electromagnetic compatibility (EMC) - Part 3: Limit - ALL PARTS may be referred for the same.
9000 Part2/Sec4: 1977 Part 3/Sec 5: 1977 Part 5/Set 2 : 1981 Part 7/Sec 2: 1979 Part 8 : 1981	Basic environmental testing procedures for electronic and electrical items Cold test, Section 4 Cold test 1977 for heat dissipating items with gradual change of temperature Part 3 Dry heat test, Section 5 Dry 1977 heat test for heat dissipating items with gradual change of temperature Part 5 Damp heat (cyclic) test, Section 1981 2 12 + 12h cycle Part 7 Impact test, Section 2 Bump 1979 Part 8 Vibration (sinusoidal) test
12032 (Parts 2 to 11)	Graphical symbols for diagrams in the field of electrotechnology
10673 : 1983	Sampling plans and procedures for inspection by attributes for electronic items. (standard is withdrawn)
IS 13252 : 1991 , IECPub950 (1986)	'Safety of Information Technology Equipment including Electrical Business Equipment'