

Specifications of Baggage Scanner

1. Resolution: 42 SWG or better.
2. **Tunnel Size:** on Shall be minimum 600mm X 400mm with 10% variation only higher side.
3. Penetration: ≥ 30 mm Steel.
4. Voltage: 180 - 260 V, 50) Hz single phase
5. **Conveyer Belt.**
 - Speed should be at least 0.2 meters per second or better.
 - Maximum load should be 160 Kg.
 - Conveyor belt height should be at least 750 mm.
 - Facility of bi-direction scanning be available.
 - Idle SS rollers to be provided with input/out frames at both ends of the tunnel.
6. **X-Ray Generator**
 - Cooling - Sealed oil bath.
 - Anode Voltage ≥ 160 KeV
 - Tube Current ≤ 1 mA
 - Beam divergence - 60 degrees. The x-ray beam divergence should be such that the complete image of maximum size of bag is displayed without corner cuts.
7. **Image Processing**
 - Sensor - Folded array
 - Grey Levels ≥ 4096
 - Display - High resolution SVGA, 22" TFT, LED Colour monitors, Flicker-free, minimum 1920 X 1080 pixels full HD display 30 watt and low radiation.
 - Beam divergence - 60 degrees.
8. **Computer configuration for image Storing and archiving.**
 - Latest generation compatible with X-Ray machine having the following minimum features or better.
 - **Processor: Core i3 or better available in market.**
 - **Hard Disk: 350 GB or better.**
 - CD/DVD Drive R/W
 - RAM 3 GB or better.
 - UPS. Reputed make online UPS, with minimum 30 minutes backup on full load by using SMF batteries.
 - Capacity - Commensurate capacity as per load.
 - Voltage range - 180-260 V, 50 Hz single phase.
 - Output voltage - 230 VAC $\pm 1\%$
 - Transfer Time - 0 ms
9. Zoom facility should be available to magnify the chosen area of an image eight times (X8) or more. Image features shall be key board controller.
10. The machine should be film safe.
11. The machine should have features of multi energy X-ray imaging facility (140 Kev approx.) where materials of different atomic number will be displayed in different colors to distinguish between organic and inorganic materials. With this method should be possible to distinguish high density organic materials including explosives. Machines should have variable color or material striping to facilitate the operator to monitor images of organic materials for closure scrutiny. **All suspicious items (explosives, high**

density material, narcotics) should be displayed in one mode and that should be online.

12. Facility for variable contrast must be incorporated to allow enhancement of lighter and darker portion of the image.

13. If the machine fails to penetrate an item, then an alarm (visual and audio both) should be generated to notify the operator.

14. The threat image projection (TIP) system software to be incorporated as per details given below:

- TIP software facility shall be incorporated in the offered x-ray machines to assist supervisors in testing the operator alertness and training X-ray screeners to improve their ability in identifying specific threat object. The system will create a threat object and the same will be superimposed on monitor screen while a bag is being screened. To acknowledge that the operator has seen the false object, operator must press the control panel key that will cause the computer-generated threat object to disappear from X-rayed bag image on the VDU screen. Each operator's action shall be recorded in the hard disc of the computer for the auditing purpose by the supervisor or other authorized person.
- **Design of the System.**
- TIP software should be compatible with other X-ray technologies such as automatic reject unit, dual x-ray screen technologies, automatic threat recognition system etc. All x-ray image functions must be available at the same time along with the TIP.
- **Image Library.**
- The TIP facility should have an image library containing at least 100 explosive devices, 100 knives and 100 firearms in various sizes, shapes, locations and orientations. However, the system shall have facility to expand the library to incorporate additional images by user without assistance of the manufacturer.
- The image library should contain images of threats at different orientation both plane and end on orientation should be used. Although these will be assigned different file names and reference, it must be possible to cross reference these as the same threat. All threat images protection images must be realistic - representative and non-distinguishable from real threat items.
- **Time Interval.**
- Programming facility shall be available to project threat images in different intervals. The time period for threat image as well as image mix in percentage shall be user programmable e.g. software shall select 40% images of explosive devices, 35% of fire arms & 25% of knives or random items etc.
- Once the screener has responded to identity the computer generated threat image, it should remain on the screen for a predefined user programmable time for analysis. The image should be highlighted, upon identification and feedback message shall be visible to the screener.
- **System Administration.**
- The threat image projection facility shall have details of user data base such as Venue of function, Name of organization, Name of Screener, user ID number, level of access such as screener, Administrator, Maintenance schedule and password etc.
- Access to start up menu should be restricted only to the authorized individuals. A log in procedure by means of password or security key could achieve restricted access to each of the comment. The log in procedure should not take longer than 20 second. The system should have facility to bypass the TIP facility, if programmed so by the system administrator. It is to be ensured that

the TIP software shall not be hindrance to normal functioning of the x-ray machine.

- When the operator logs in or logs out, message should be displayed on the Video Display unit (VDU) screen to confirm that he/she has been correctly logged in or logged out.

- **Feedback Report**

- The threat image projection should be capable of giving feedback HIT MISS or FALSE Alarm message. No message will be presented if a screener correctly passed as clear bag.
 - A HIT message to be presented when a screener has correctly identified a threat image projection image. A MISS message shall be presented when screener fails to identify the TIP image. A False alarm message shall be given when screener incorrectly indicate TIP image when in fact no threat image projection is present. The feedback should clearly indicate in a screen that a TIP object has been correctly identified/ TIP object has been missed/no TIP object was present. Information should be recorded in the data base.
 - Different colour coding shall be used for feedback to the screener. It is recommended that colour code RED for MISS, Green for HIT and Yellow to False Alarm or interrupt be used.
 - The system shall automatically prepare the daily log of events for each shift and for each screener performance. TIP log shall include particulars of Venue, XBIS, Name of Screener, Time and date of threat image, whether threat image was successfully identified or missed etc.
 - The report on threat image projection system may have date and time (from - to -) as per requirement, Screener particulars and decision/outcome i.e. MISS, HIT or False Alarm in percentage as well in absolute numbers, number of bags screened, categories such as explosive devices knife or weapon etc.
 - As a standard practice, daily/weekly/monthly report shall be retrieved. Report shall be for any given time and period, as per command.
 - All data should be stored on the system for a minimum of two months after it has been downloaded. No individual regardless of access rights to the threat image projection components would delete or amend any of threat image projection data or time i.e. threat image projection data on the actual X-ray machine will be read only file.
15. Control desk with security housing and locking provision should be available. The entry of operator personal identification number should be possible through keyboard.
 16. Maintenance reminder should be available.
 17. Display: Date and Time and Operator ID.
 18. Baggage counter preferred.
 19. Inverse video.
 20. Black and white image.
 21. Facility of image enhancement should be available.
 22. Machine should be capable of recalling 15-20 previous images.
 23. It should have the capability of archiving 3000-4000 images.
 24. In case of defective diode arrays, scanning should be disabled and error message should be displayed on the screen.
 25. Copy of all software's including x-ray software with recovery CD and passwords should be provided.
 26. All software features of machine should be online and password protected.
 27. System should work on one software only. All software features should be controlled from key board of machine only. Keyboard function should be user friendly. To enable/disable the software features, system should not be rebooted.

28. All models should have online recording facility and images can be recorded in external media like USB drive.
29. All models should have software-controlled diagnosis report facility and system should be able to give printout.
30. The machine should be so designed that software enhancement can be easily implemented to take care of new technique in image processing and pattern recognition.
31. The operating temperature should be 0° C to 40° and storage temperature-20° C and 50°.
32. Anti rodent and dust proof cover must be provided.
33. The company manufacturing the equipment should have ISO certification for manufacturing and servicing of x-ray screening machines.
34. **Safety**

- The machine must comply with requirement of health and safety regulations with regard to mechanical, Electrical and radiation hazards. The supplier/manufacturers should furnish Test Certificate from Atomic Energy Regulatory Board of India regarding radiation safety.
- The radiation level should not exceed accepted health standard (0.1 mR/Hr) at a distance of 5 cms from external housing.
- Lead impregnated safety screens should be available at either ends of the tunnel.
- Dosimeter be provided for radiation checking.

35. Combined Test Piece (CTP): The manufacturer shall provide one set of CTP per machine for checking serviceability of the machine by the operator. The details of CTP are given below.

- Combined Test Piece Requirements.
- **Single wire Resolution (Test No. 1):** The requirement is to display 42 SWG wire not covered by step wedge. A tick will indicate the visibility of appropriate wire. A set of un-insulated tinned copper wire of size 26, 30, 35, 38, 40 and 42 SWG should be placed on a Perspex sheet. The wires to be laid out in S Shaped curves. The wires should be placed behind varying thickness of aluminum. Metallic marker should be provided using high density material, so that SWG numbers in the Video Display Unit (VDU) are clearly visible.
- **Useful Penetration (Test No.2):** The test defines what level of details can be seen behind a thickness of known material. The CT P should have different gauges of wire behind varying thickness of aluminum. The requirement of this test is that the 26 SWG wire is seen under second step wedge (5/16"). Tick on log sheet will indicate what wires are visible.
- **Material discrimination (Test No.3):** The requirement is that different colours be allocated to the sample of organic and inorganic substances. With multi energy X-Ray it should be possible to distinguish between materials of different average atomic number. This means that organic and inorganic substances can be differentiated. The use of sugar and salt samples encapsulated on the test piece and various materials used in the construction of CTP should check the material discrimination facility. A tick should indicate that the sugar/salt samples are shown in different colour.
- **Sample Penetration (Test No.4):** The requirement is that the lead be visible beneath 26 mm of steel. This test defines what thickness of steel the machine should be able to penetrate. The steel step wedge on the CTP should have steps of at least 2 mm from 16 mm to 30 mm with a lead strip to check that the machine is above or below the requirement. A tick in log sheet should indicate where a lead strip is visible.

- **Spatial Resolution (Test No.5):** The requirement is that vertical and horizontal grating to be seen. This test defines the ability of the system to distinguish and display objects, which are close together. The CTP should have at least 16 copper gratings at right angles to each other. A tick in the log sheet should indicate the gaps in the gratings are visible.

- **Thin Metal Imaging (Test No.6):** This tests the machine's ability to image thin metal. A number of thin metal strips of various thicknesses should be placed in row.

- **Method**

- The CTP is to be used as a quick routine test carried out daily to ensure that equipment is working properly and satisfactory image is obtained. The results of the tests should be recorded.

- The CTP should be placed on the belt and passed through the belt at least once in a day before the baggage is screened or after the x-ray equipment is switched on to ensure that the equipment is working properly. If the image is satisfactory the equipment may be used.

- The CTP may be viewed by using image enhancing facility till the operator is satisfied that the machine is working properly. The optimum position of CTP on the belt will depend on x-ray source and detector arrangements. This may be ascertained from the service engineer, if need arises.

- **Results**

- The best results taking both colour and black and white images into account should be recorded for a particular machine.

- The results of test should be recorded giving information like date, time, machine number and type, supervisors name and other remarks.

- Supervisory officer should carry out the tests once in a week and compare the results with daily test sheets. In case the images are not up to the standard, service engineer must be asked to rectify the fault. The machine may not be used when its performance is in doubt or not satisfactory in the opinion of the supervisor.

- The record must be kept by the operator for one year. The records may be checked by the inspecting officers during this period.

36. Warranty & Maintenance - 3 years Warranty and Annual Maintenance Contract for 07 years. Sufficient spares should be available in stock with the supplier and certificate for availability of spares in Delhi for at least 7 years after the warranty period.

37. Miscellaneous: The firm should be able to provide the following along with the equipment:

- (i) One Test Sample (CTP) for each machine for testing during commissioning and during maintenance.
- (ii) Suitable voltage stabilizer with isolation transformer.
- (iii) Training tools - charts, slides, training brochure, training work model, blow up diagram, video films on demonstrations and use etc.
- (iv) Technical manual giving full description of the item. Practical training for at least 4 times in a year and continuing during the warranty period.
- (v) User's handbook and literature on preservation/maintenance as applicable.
- (vi) Procedure for packing, handling, transportation and storage.