



CAB2000
Technical Description

**TECHNICAL DESCRIPTION
FOR
TRUCK & CONTAINER INSPECTION SYSTEM**

MOBILE CAB 2000

MOBILE - SINGLE VIEW – UP TO 2500 KEV



Table of Content

1. INTRODUCTION.....	3
1.1. The most advanced X-ray imaging technology available.....	4
1.2. Superior reliability.....	4
1.3. Outstanding team of qualified personnel.....	4
1.4. Qualified service support.....	4
2. HEIMANN MOBILE CAB 2000.....	6
2.1. System description.....	7
2.2. Performance data.....	15
2.3. Components X-ray system.....	16
2.3.1. <i>HiTraX Image Processing system.....</i>	<i>16</i>
2.3.2. <i>Electronic rack.....</i>	<i>18</i>
2.3.3. <i>Supervisor panel / process visualisation.....</i>	<i>18</i>
2.3.4. <i>X-ray generator unit.....</i>	<i>19</i>
2.3.5. <i>X-ray detector unit.....</i>	<i>19</i>
2.4. Transport vehicle.....	21
2.5. Operation module.....	21
2.6. Retractable boom.....	21
2.7. Power generator.....	21
2.7.1. <i>Remote control.....</i>	<i>21</i>
2.7.2. <i>Battery charging and control device.....</i>	<i>21</i>
2.8. Air-conditioning system.....	22
2.9. Floor heating.....	22
2.10. Illumination.....	22
2.11. Safety equipment.....	22
2.11.1. <i>Video system.....</i>	<i>22</i>
2.11.2. <i>“X-ray on” indicators.....</i>	<i>22</i>
2.11.3. <i>Emergency stop system.....</i>	<i>23</i>
2.11.4. <i>Traffic light.....</i>	<i>23</i>
2.12. Control desk.....	23
2.12.1. <i>Chair.....</i>	<i>23</i>
2.13. External power supply.....	23
2.14. Barcode Scanner.....	24
2.14. Color Printer (Option).....	24

1. INTRODUCTION

This document is the technical description of the **Heimann Mobile CAB 2000** (hereafter referred to as "**Mobile CAB 2000**"), proposed by Smiths Heimann.

X-ray systems are probably the most efficient and effective way of screening imported and exported goods in the constant battle to defeat smugglers. Speed of operation, penetration, fine spatial resolution and equipment reliability are all key advantages our customers expect and enjoy. We believe that Heimann offers an exceptionally broad range of systems with a proven track record of performance and ongoing product development.

The Mobile CAB 2000 is a medium energy mobile X-ray system operating with a new electron accelerator HI-PACC at up to 2.5MeV achieving an X-ray intensity of approx. 1.5 rad/min (at 1m distance from the focal spot). The system is unique in several important aspects:

- It is fully mobile, set-up in less than 60 minutes
- Very modular design, easily adaptable to customer needs and constraints
- High throughput (up to 30 objects per hour)
- Low space requirement
- Low object X-ray dose

1.1. THE MOST ADVANCED X-RAY IMAGING TECHNOLOGY AVAILABLE

As a leader in the field of x-ray screening technology for more than 50 years, with more than 30,000 installations world-wide, Smiths Heimann is able to offer the Customer the most advanced screening technology available. Smiths Heimann is constantly improving the performance and quality of its systems by investing almost 10% of our revenue in Research and Development.

The Mobile CAB 2000 is able to image loaded containers and trucks.

- ⇒ Optimised x-ray compact accelerator HI-PACC
- ⇒ Unique crystals for optimised detection
- ⇒ Outstanding image quality with HiTraX electronics
- ⇒ Good penetration with low radiation dosage
- ⇒ Low space requirement (safety zone max. 15m by 15m)

1.2. SUPERIOR RELIABILITY

In 1991 Smiths Heimann successfully installed the world's first x-ray screening system dedicated solely for the inspection of cargo containers. Today Smiths Heimann currently maintains the largest installation base of Cargo Inspection Systems with 147 low dosage - conventional X-ray sources and compact accelerators based- and 56 medium resp. high energy -linear accelerator based- HCV systems world-wide. Most of these systems are operated on a 24 hours / day basis adhering to very tight inspection schedules.

1.3. OUTSTANDING TEAM OF QUALIFIED PERSONNEL

Smiths Heimann employs a specialised department dedicated solely to the implementation of such turnkey contracts.

This department is manned with highly qualified professionals: PhDs, Engineers and Technicians having the experience referring to cargo inspection systems all over the world. Their unique experience is the guarantee of the quality of the work as well as of the time to complete. Until now, no contract suffered from a delay or from a lack of quality or performance Vs specifications.

From the beginning, a Project Manager is assigned to the project and is in daily contact with the customer. The final design of the system will be closely monitored with the customer and its architects in order to adapt our systems to his specific needs and constraints.

Certified ISO 9001 since 1994, we are using project management methods together with up-to-date project management software. If requested, our customers can be deeply involved in the project implementation with some regular progress reports and factory & site visits.

1.4. QUALIFIED SERVICE SUPPORT

With more than 30,000 x-ray systems installed throughout the world, our company has its own regional and local service centres throughout in the 5 continents. Even if the reliability of the proposed systems allows a light maintenance program, it is necessary to have a professional and educated service centre structure close to the system installation.

2. **HEIMANN MOBILE CAB 2000**

Medium energy, low dosage mobile X-ray Inspection System for trucks and containers.



**Mobile CAB 2000
(Example)**

2.1. SYSTEM DESCRIPTION

The *Mobile CAB 2000* is a mobile medium energy / low dosage X-ray inspection system designed for quick and high efficient detection of illegal consignments inside trucks and containers.

The concept of the system allows the integration into nearly every existing examination procedure and infrastructure.

The operation module is mounted on a swap body platform class C 745 (EN 284). In addition it is equipped with a hydraulic container lift system for easily lifting down and up.

The transport of the system to another location is easily possible by a standard truck who can carry swap bodies class C 745 (EN 284) for standard ISO container (ISO 668).



For the set-up of the system the container is released from the truck and can be lifted down to the required operational floor height by the hydraulic container lift system.



In the next steps the detector boom (swivel arm) can be moved hydraulically to the operational position.



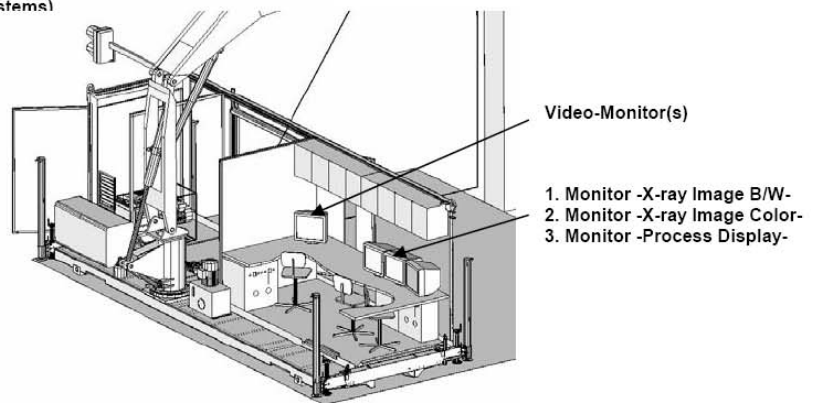
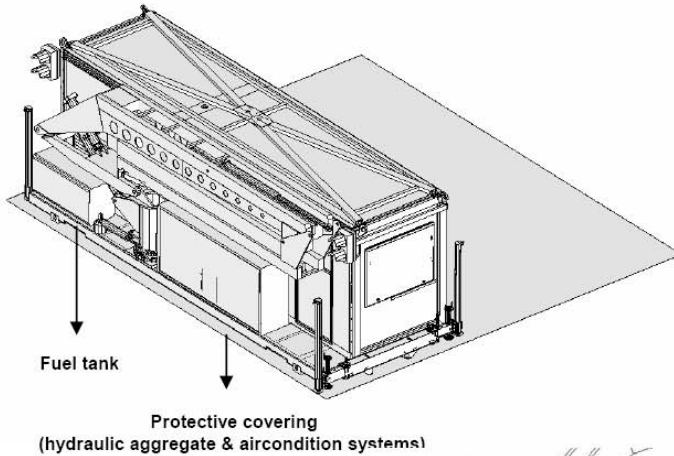
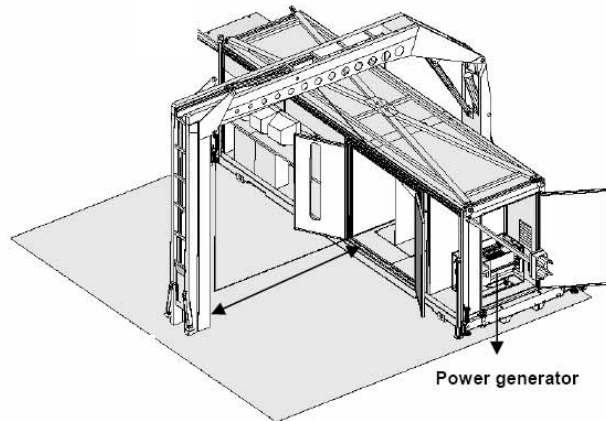
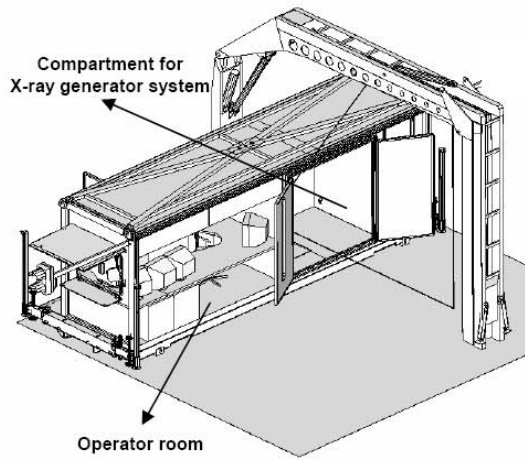
System layout (transport mode)



System layout (operational mode)

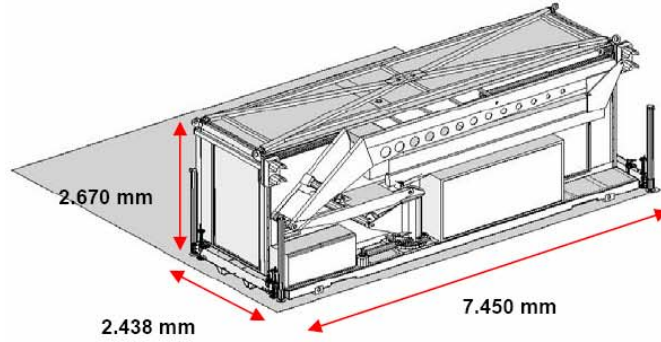


The system is divided into a compartment for the operator, a compartment for the X-ray generator, and a compartment for the electrical power generator.

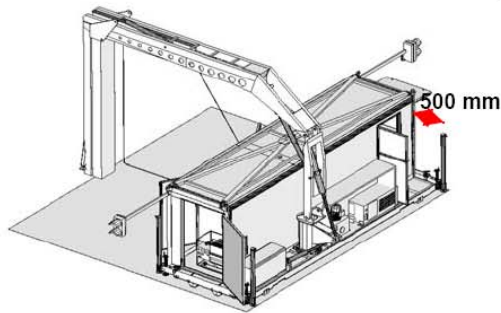
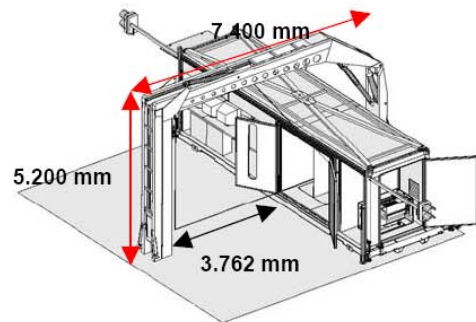
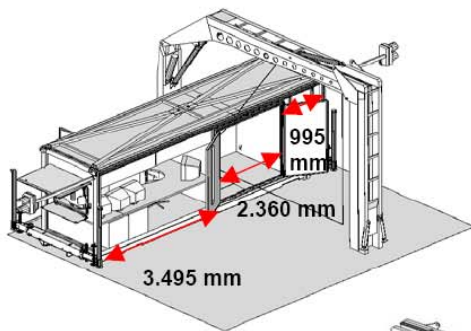


➤ View Interior (Example)

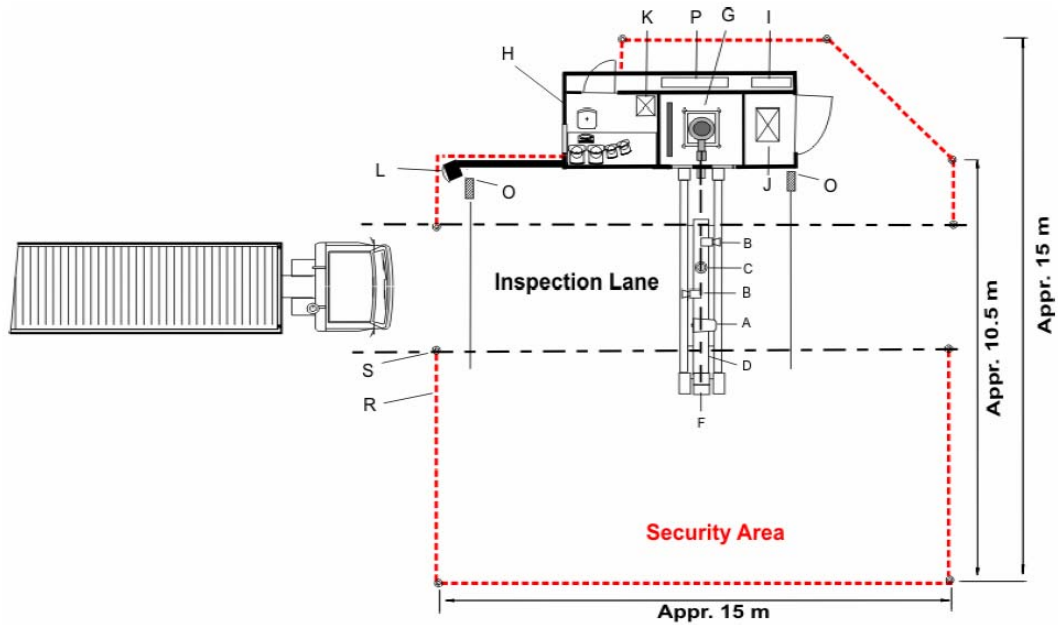
Dimensions of the operation module:



Weight: approx.14 tons



The space required for the security area is max. 15 m by 15 m.



Legend

- | | |
|--------------------------|---------------------------|
| A X-ray Warning System | K Electronic Rack |
| B Video Camera | L Traffic Light |
| C X-ray Warning Beacon | O Light Barrier |
| D L-shaped Detector Line | P Air-Conditioning System |
| F Retractable Boom | R Safety Chain |
| G X-ray Generator Unit | S Chain Post |
| H Operation Module | |
| I Fuel Tank | |
| J Power Generator | |

All required system components are fixed for transport and will be set up from the system operators at the requested area.

Several electrical and mechanical devices will help to set up the system.

The detector line unit (D) is secured in a steel scaffolding swivelling boom at the platform of the operation module.

Video cameras (B), optical (C) and acoustical X-ray warning signals (A) are mounted on the detector boom.

The X-ray generator unit (G) is placed in a special compartment inside the operation module.

An integrated electrical power generator (J) incl. fuel tank (I) ensures the independence of an external power supply. Based upon a remote control, the power generator can be controlled from the operators desk. The liquid cooled engine at the power generator is equipped with a inline heat exchanger.

Air-conditioners for temperature sensitive components in the operator (floor heating) and the X-ray generator compartment allow to handle the system in a wide temperature range.

A further air-conditioning (P) provides constant climate conditions inside the detector line unit. Sensors for temperature and humidity will indicate the condition at the operators desk.

The area for operating the system is a prohibited zone and marked by means of a yellow/black safety chain (R), fixed on stands (S). A traffic light (L) indicates the drivers, if the system is ready (green) or not ready (red) to be passed. Several light barriers (O) control the scanning process to improve a maximum of radiation safety.

Video cameras (B) on the detector boom help the operator to secure the prohibited zone and control the flow of the traffic.

To check truck, the driver has to pass the system through the inspection lane. When the drivers cabin has passed the X-ray generator unit (light barrier LS3 is interrupted), the radiation will be switched on and the loading area of the truck will be penetrated. A collimator inside the X-ray generator unit limits the radiation to a thin vertical layer.

In that moment, the truck leaves the detection line, the radiation will be switched off immediately.

The light barriers (LS1 - LS3) are responsible to control the scanning process.

Only if the light barriers are interrupted in the correct direction and time, the radiation will start.

During the scanning process, the system operators have to secure, that nobody will step into the prohibited zone.

Radiation, which is not absorbed from the load, reaches the detector line, where it is converted to electrical signals to generate a video image. The operator inside the compartment can evaluate this image on video monitors. To identify single objects, the operator can modify the image by means of digital image processing functions.

A truck with 18 m length is scanned after 13 seconds by a nominal speed of approx. 5 km/h

Based upon the light barrier safety cycle, the collimator and the low-energetic radiation, there is no danger for the driver.

When the operators set up the system, they have to ensure, that all safety devices are in their correct position and under full functional conditions. All safety components can be controlled from inside the operators compartment by means of indicators and video cameras.

To increase the radiation safety, the X-ray generator unit, detector line unit and the operator compartment is lead-shielded. Interrupted light barriers before starting the system prevent the radiation to be switched on.

A time-out safety circuit ensures a maximum radiation-time.

Outside the vehicle, two warning beacons and a buzzer, mounted on the retractable boom, indicate the emission of X-rays.

2.2. PERFORMANCE DATA

Maximum truck size:	
Width:	2,6 m
Height:	4,5 m (clearance height)
Length:	20 m
	The image data held in memory can be reviewed on monitor.
Height of X-ray beam:	approx. 600 mm
Penetration (in beam direction):	160 mm of steel
X-ray dose per inspection:	0,3 μ Sv (0,03 mrem) typical (at 5 km/h speed)
Throughput:	20-30 vehicles per hour
Film safety: ISO 1600 (33 DIN)	Guaranteed, also for films with sensitivity level up to
Radiation safety:	complies with all applicable radiation and health standards. Leakage radiation in control room and around the security area less than 1 μ Sv/h (0.1mrem/h)
Climatic conditions:	operating temperature: -10°C to +40°C storage temperature: -25°C to +60°C
Standards:	system conforms to national and international DIN/VDE/UVV standards and requirements
Safety to magnetic data carriers:	No computer memory media, e.g. cassettes, disks or semiconductor memories will be harmed when applied by X-rays, (reference: NSB Special Publication 500-1011)
Safety to food:	The system is not harmful to any type of food when applied to this X-ray dose

2.3.1.2. Image Evaluation Function (Online and real-time operation)

- ZOOM: 1-, 2-, 3-8 times magnification,
freely positioning of the zoom-window;
permanent overview window
- REVIEW: scrolling back and forth of long objects like vehicles which
cannot be totally displayed
- HIGH: improved representation of highly absorbing objects
-
- LOW: improved representation of low absorbing objects
- NEG: inverse representation of grey levels
- SEN: Super-Enhancement
- VARI: objects with a particular absorption can be emphasized

2.3.1.3. Image Management System (IMS)

- digital storage of up to 3000 X-ray images on local hard-disk,
- display of recalled X-ray images on systems monitors
- backup of images via integrated ZIP drive or download via ethernet LAN interface

2.3.2. ELECTRONIC RACK

19" Cabinet Rack
contains

- HiTraX electronic hardware
- **mains distribution** with:
 - fuses (automatic circuit breaker)
 - fault-current protection switch
 - over voltage relay
 - under voltage relay
 - mains relay
- video system power supply

2.3.3. SUPERVISOR PANEL / PROCESS VISUALISATION

SUPERVISOR PANEL

- key switch "POWER"
- push button with indicator "POWER ON"
- key switch "X-RAY SYSTEM"
- push button with indicator "X-RAY SYSTEM ON"
- emergency stop push button
- START and STOP/PREHEAT push buttons
- selector switch
 - "POWER GENERATOR"/ "EXTERNAL SUPPLY"

PROCESS VISUALISATION

19" Color monitor indicates e.g.:

- light barriers
- collimator remote control
- gauge for voltage
- gauge for AMP
- power generator remote control with:
 - oil pressure gauge
 - cooling water temperature gauge
 - battery voltage
- various indicators for temperature and humidity
- fuel level indicator

2.3.4. X-RAY GENERATOR UNIT

2.3.4.1. X-ray Generator (Compact Accelerator HI-PACC)

- up to 2500 keV
- pulsed beam (400 Hz)
- collimator with electrical adjustment device
- radiation safety shielding
- control devices

2.3.4.2. X-ray Generator Control Device

The remote control electronics for the X-ray generator are integrated in the electronic rack at the operator room.

The power supply is located at the X-ray generator compartment.

2.3.5. X-RAY DETECTOR UNIT

- line sensor box in weather protected housing
- L-shaped detector line
- solid state detectors with photodiodes and scintillator crystals
- single detector modules with 64 photodiodes
- housing built in aluminium sandwich technique
- mounted on a swivelling boom
- fixed at the roof of the operation module for transportation
- rotating and lifting into operation position
- hydraulic system for the handling of the swivelling boom
- radiation safety shielding (lead protection for active beam)

2.3.5.1. Air-Conditioning System

to maintain the correct operating conditions of the line sensor unit

- operating modes
 - cooling
 - heating
 - dehumidifying
- climate sensors for temperature and humidity detect the actual values, visualized on the process monitor in operator room

2.4. TRANSPORT VEHICLE

Standard road transport vehicle equipped with a swap body platform (class C 745, EN 284)

Standard Specifications (e.g. Mercedes ACTROS):

- Left or right hand drive
- max. speed 80 km/h (according to traffic regulations)
- wheel basis: 4.800 mm
- gross vehicle weight: 25.000 kg
- permissible rating for front axle: 7.100 kg
- permissible rating for rear axle: 18.000 kg
- 6 cylinder inline
- 4 stroke diesel engine direct injection
- total displacement: 11.946 cm³
- output 230 kW (313 PS) at 1.800 rpm
- water cooling system with thermostat
- full synchronized 16 speed gear box
- electrical 24 V
- power steering
- brake system
 - disc at front and rear axle
 - asbestos free type
- pneumatic shock absorption
- frame for swap body loading

2.5. OPERATION MODULE

- steel scaffolding on a swap body (class C 745, EN 284) platform
- cased with hot-galvanized sheets with trapezoidal corrugations, plastic laminated
- isolation with 50 mm high integrated PU-foam as sandwich element, local foamed
- compartments for operator (lead for radiation safety); X-ray generator; electrical power generator incl. fuel tank, hydraulic aggregate and other accessories (safety chain, posts etc.)
- four hydraulic powered supports "container lift" (one at each corner) to lift up and down the operation module

2.6. RETRACTABLE BOOM

connects the operator compartment with the detector unit and contains all the cables to supply the detector unit, cameras, warning beacons and buzzer

- lift up and down supported by hydraulics
- swing out to operation position supported by motorized driven wheel(s)
- clearance height 4.5 m

2.7. POWER GENERATOR

Diesel Power Generator incl. fuel tank (approx. 300 l) for the supply of all integrated components

- output approx. 16,5 kVA
- 230/400 VAC, three phases, 50 Hz
- heavy duty version for continuous (24h) operating time
- special design as built-in version for coaches, mounted on metal-rubber shock absorbers
- water cooling system with heat exchanger
- compartment air-exchange by turbo-fan
- heavy duty muffler
- 12 V starter battery 100 Ah
- battery charging alternator
- automatic electronically controlled voltage and frequency circuits
- automatic motor safety shut down devices by
 - high water temperature
 - low oil pressure
- start/stop and preheat switches
- counter for operating hours

2.7.1. REMOTE CONTROL

located at the supervisor panel (2.3.3)

2.7.2. BATTERY CHARGING AND CONTROL DEVICE

additional automatic battery control/charging unit to compensate the self-discharge of the battery in operation whenever the system is powered

- voltage 230 V / 50 / 60 Hz
- max current 20 mA

2.8. AIR-CONDITIONING SYSTEM

for cooling / heating of the Operators Compartment with 2 step fan and thermostat

2.9. FLOOR HEATING

for the Operators Compartment

2.10. ILLUMINATION

The system can also be operated during night using the two floodlights mounted on the detector boom. All compartments inside the operation module are illuminated.

2.11. SAFETY EQUIPMENT

for monitoring the system and providing protection against accidents for personal and driver including

- light barriers for controlling the correct position of the X-ray generator unit and the detector unit
- light barriers for controlling the scanning process
- yellow/black chain to mark the security area
- warning devices (X-ray "ON" indicator)
- X-ray shielding
 - lead protection for active beam and leakage radiation at the detector unit
 - lead protection inside the control room walls for leakage radiation

2.11.1. VIDEO SYSTEM

CAMERA

- Four (4) black and white CCD- cameras for observing the prohibited zone, including weather protection housing and shutter in front of the lens (two at the detector boom, one at the left side to observe the area behind X-ray generator and detector line)

MONITOR

- Four (4) 12" CCTV monitors located at the control desk

2.11.2. "X-RAY ON" INDICATORS

- two warning beacons and one buzzer on the detector boom
- two orange LED's at the keyboard
- indicators on the monitor of the process visualisation

2.11.3. EMERGENCY STOP SYSTEM

- one emergency stop push button on the supervisor panel (2.3.3)
- one emergency stop push button in the X-ray generator compartment
- one emergency stop push button at the rear side of the detector boom

2.11.4. TRAFFIC LIGHT

In operation mode the traffic light is pulled out at the entrance of the inspection lane, and indicates to the driver when he is allowed to pass through the inspection lane.

2.12. CONTROL DESK

ergonomically designed desk secured inside operator's compartment including

- monitor displaying black and white X-ray image
- monitor displaying color X-ray image
- monitor for process visualisation
- keyboard for the operation of the inspection system
- control and supervisor panel (2.3.3)
- CCTV video monitors
- cupboard / shelf

2.12.1. CHAIR

comfortable roller office chair with armrest to enable a tireless working of the operator

2.13. EXTERNAL POWER SUPPLY

- CEE socket, 32 A, 400 VAC, three phases, 50 Hz,
- one cable drum, 5 wire, length 25 m

2.14. BARCODE SCANNER

The begin of the loading area (start of scanning) is manually selectable via a barcode reader device in combination with reusable magnetic resp. self-adhesive barcode identification tags.

The barcode scanner device itself is located in the X-ray generator housing (2.3.4.1)

2.15. COLOR PRINTER

Post Script (level 2) printer with Ethernet LAN Interface

Three different modes of operation are available:

- Screen print
- Printing of last scanned object
- Printing of previous stored X-ray images



If you would like further Information about ELAMAN,
or would like to discuss a specific requirement or project, please contact us at:

Elaman GmbH
German Security Solutions
Seitzstr. 23
80538 Munich
Germany

Tel: +49-89-24 20 91 80
Fax: +49-89-24 20 91 81
info@elaman.de
www.elaman.de