

# **GS Automatic® GS8100**

## **Cargo and Vehicle Inspection**

### Technical Proposal

**Shenzhen General Systems Co., Limited.**

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### **Revisions**

With continual development of our products, Safeway Inspection System reserves the right to amend specifications without notice.

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## 1. System Introduction

Accelerated X ray container/vehicle inspection systems are non-intrusive scanning equipment for conventional cargo and container trucks. Through fast scanned images, we can define whether there're illegal contrabands or smuggled goods which don't conform to the customs' declaration. Accelerated X ray container/vehicle inspection systems are applicable for ports and borders, airports, military and government, freight forwarding, high profile location, overall transportation, and travel industry etc.

### 1.1 Overview

GS8100 container/vehicle inspection systems are designed and manufactured for fast scanning and out-of-box inspection of small and big vehicles including container trucks. The tunnel size is 2.6mW\* 4.6m H, which is big enough for various sizes of

vehicles including container trucks.

GS8100 container/vehicle inspection systems are widely applicable in ports, transportations, road gates, and bonded area, helping the local customs and police fast scan and 100% inspect the cargo and containers, trucks.



**Picture 1**

**Outside view of GS8100 container/vehicle inspection systems**



Picture 2

Product view of GS8100 container/vehicle inspection systems

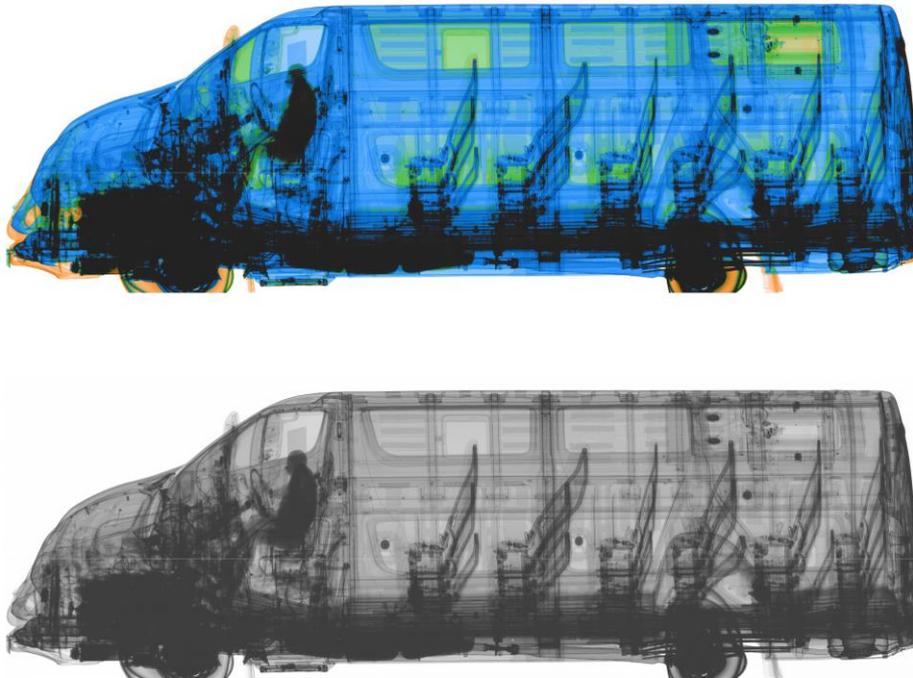


Installation reference of GS8100 container/vehicle inspection systems



**Installation reference of GS8100 container/vehicle inspection systems**

GS8100 container/vehicle inspection system, based on the X ray radiography technology, employ high energy Beta-Tron accelerator and newly developed high performance detector. It comes with superior penetration, massive detective sensibility, and high-quality imaging combined with most reliable radiation safety. During inspection, the vehicle stands still at a specific location, then our inspection equipment glides on the fixed curve to complete vehicle inspection from all the perspectives.



Picture 3

Scanned images of GS8100 container/vehicle inspection systems

## 2. System Features

### High scanning speed

40 units of 40GP each hour, no dead angle, vehicle inspection of all the perspectives.

### Superior penetration and high-quality images

Due to our newly developed accelerator and detector, the inspection system can produce high quality scanned images, far more outstanding compared with other systems'

performance. The max. Penetration is 300 steel.

### **Make sure no image distortion**

The inspection system will change the scanning speed automatically, to match the speed of the inspected vehicles, ensuring no distortion of the scanned images.

### **The big tunnel size suitable for various container vehicles.**

The tunnel size for scanning is 2.6mW\*4.6mH, enough for various kinds of container trucks. For

extremely long vehicles, the inspection can be completed by different times and the scanned images received from each time can be put together for a complete image.

### **Reliable anti-radiation safety Measures**

To reduce the radiation for the environment and operator, Safeway® AT8100 container/vehicle inspection systems adopt effective anti-radiation measures, all the radiation data reach the minimum level of international standards and fulfill the anti-radiation requirements of WHO and IAEA, without radioactive remains.

### **Design for compact module, with small space occupied**

The whole system with compact module design, and small space occupied, the maxi. Width is 6m. The compact module design makes it convenient for the whole system to relocate. Meanwhile, after the relocating, it's easy to assemble, debug and install according to the existing surroundings.

### **Powerful Image Processing**

Image check station have powerful image processing tools, including zoom in, zoom out, edge enhancement, pseudo color transformation, contrast control, multi-image comparison, image format changing, image mosaicking and so on, which make it convenient for the operator to identify all illegal contrabands and mark the suspicious

### **Friendly operate system**

Support Multi-touch, help the operator to identify the images quickly

Superior capability both for the technology integration and procedure customization

Safeway System, with its own intellectual properties, integrate the critical technology like vehicle ID identification, container ID identification, under vehicle and vehicle roof surveillance, radiation monitor, driver physical scan, driver's ID identification and CCTV etc., to offer a one stop solution for clients. Furthermore, we can customize the whole solution according to the customers' needs.

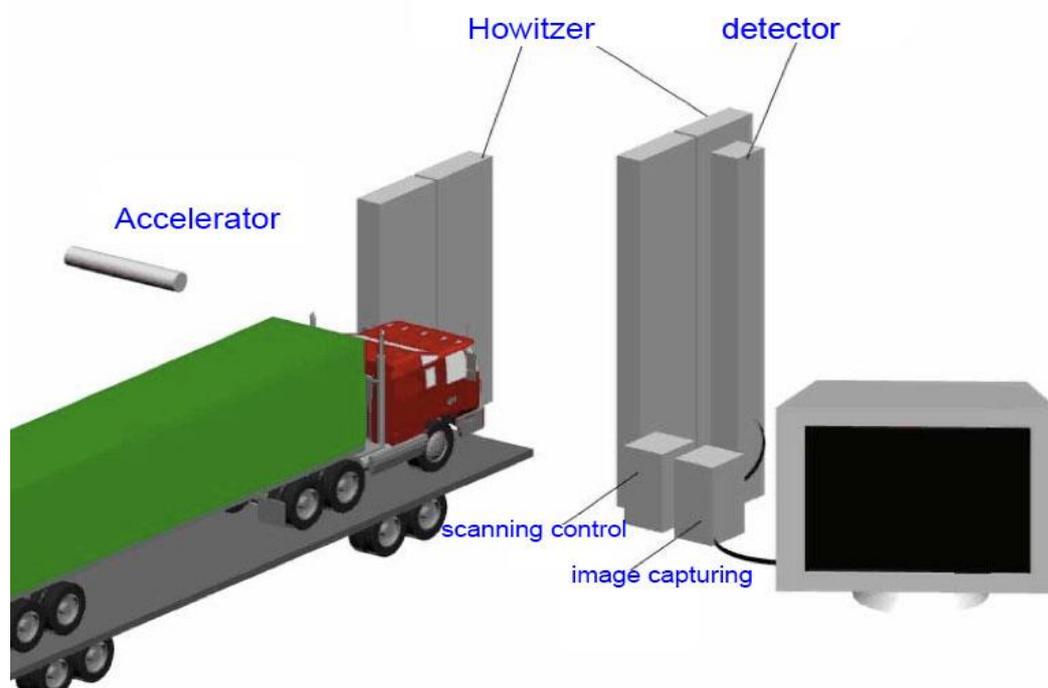
## **3. System Description**

### 3.1 System composition and working principle

Safeway AT8100 container/vehicle inspection system include:

#### X ray imaging system

Being the core part of the whole system, composed by accelerator, detector and imaging system, X ray imaging system produce X ray penetrated images. The whole process is: when the container/vehicle is being inspected, the accelerator generates high energy X ray pulse to penetrate the inspected cargo, based on X ray received by the high sensitivity detector, the image receiving and analyzing system will produce a series of digital images signals. After the whole process is done, the complete images of container and vehicle will show on the operator interface. Please refer to the picture below,



Picture 4

X ray imaging system of Safeway® AT8100 container/vehicle inspection systems

#### Scanning subsystem

The scanning subsystem include the accelerator cabinet, equipment cabinet an cantilever crane system. The accelerator cabinet is for installing the accelerator in, the equipment cabinet is for imaging capturing equipment, and the crane system is for storing the detector.

### **Scanning controlling subsystem**

To make sure the whole subsystem working, and control the whole system, This controlling system have user-friendly operating interface, which makes the operating conveniently, any unexpected can be dealt with timely.

### **Image check station subsystem**

Provide the powerful image checking tools, analyze and manage the scanned images of cargo and vehicle. The subsystem includes: data processing center, images check station and data managing server.

Safeway® AT8100 container/vehicle inspection system are user-oriented product, with user-friendly operating interface, easy for use. It comes with a software package, providing powerful scanning and controlling software, data processing software, image editing software and data base software, also with good extendibility. The operator can easily and quickly identify the little difference between the images by our image editing software.

### **Radiation safety subsystem**

Because the X ray is harmful to human body, the radiation safety is very important. The radiation safety subsystem makes sure the whole inspecting system works successfully and safely. It makes the accelerator stop in case of any dangerous. It'll ignore or reject every illegal order from the controlling station. In case of any unexpected, it'll cut off the power supply of the accelerator.

The radiation safety subsystem is composed by:

1. Safety lock module
2. Emergency stop button
3. Video and audio monitor
4. Detection of environment radiation
5. Detection of personal radiation

If you press the emergency stop button, it will cut off the accelerator and scanner. Also it's with self-lock function, once you press it, it is unable to reset by itself, until the operator uses the key to restart.

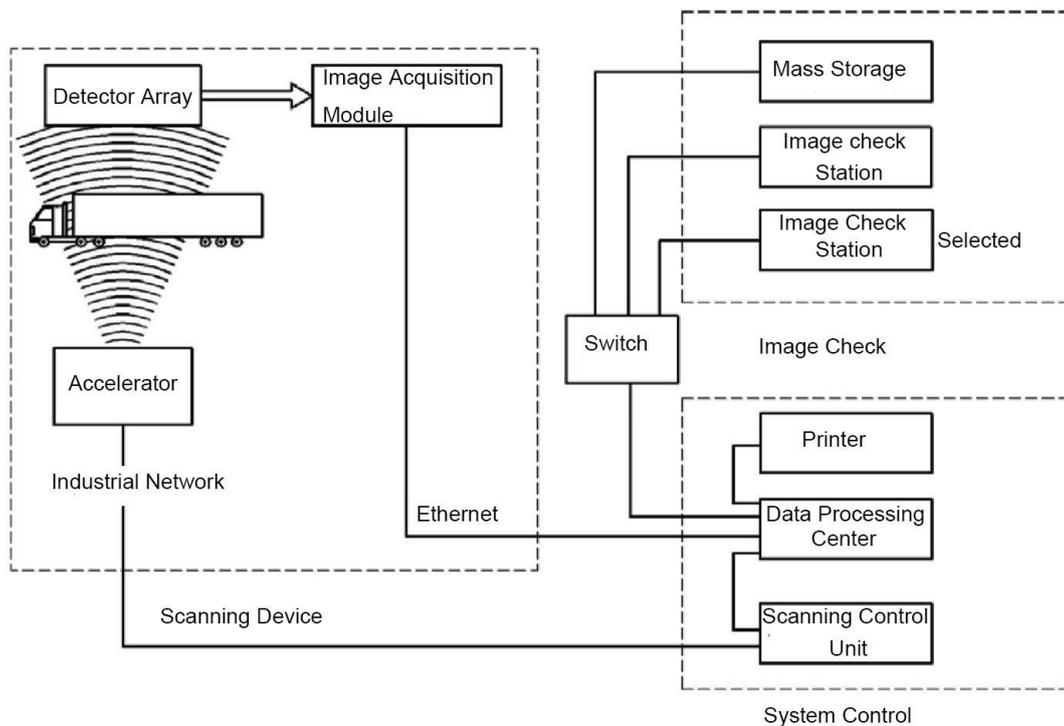
The source for safety concern for the operator and surrounding people is X ray. The micro wave by accelerator also influent the environment and people. To prevent any kind of unexpected, Radiation safety control is the important part of product design.

The accelerator is an equipment without power supply inside, it is unable to produce X-ray without the power supply. So the accelerator is safe by itself. The radiation safety can be achieved by safety interlock system.

In order to reduce the X ray dose as much as possible during beaming and scanning, The X ray is emitted out from a very narrow gap. All other parts of the accelerator are tightly sealed by screening lead or tungsten material. Meanwhile, behind every detector, there's a lead board specially for X ray screening.

To ensure the radiation safety of relevant people, and reduce the radiation as much as possible for the environment and people, our whole system is designed on higher safety standards than normal, so the people can work with our system like in all nature environment.

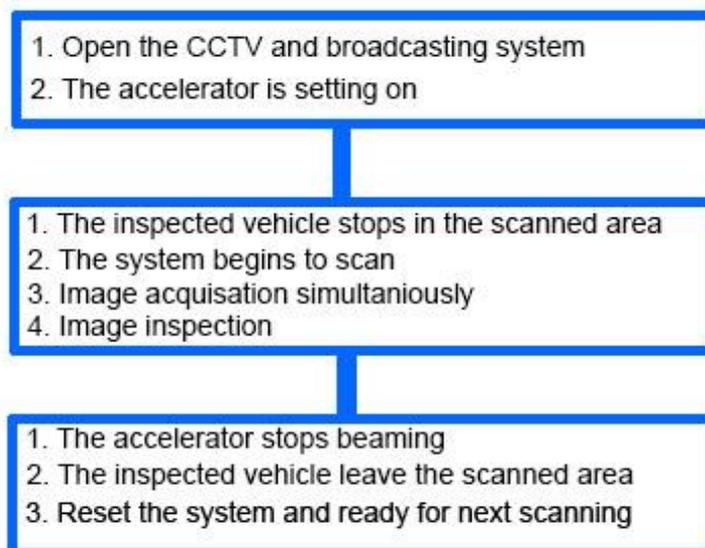
The system's logic structure:



Picture 5 Composition and logic structure

X ray imaging system of Safeway® AT8100 container/vehicle inspection systems

## 3.2 The inspection procedure



Picture 6

### Inspection flow of X ray imaging system of Safeway® AT8100 container/vehicle inspection systems

1. The inspected vehicle stops on the scanned area, and the driver leave the radiation protection area and wait.
2. The operator confirms there's no people in the inspected area, start the alarming system and the scanning begins.
3. During the automatic scanning, the vehicle stays still, the scanning equipment moves, the accelerator generate high energy X ray pulse, which penetrate the inspected vehicles.
4. High sensitive detector array receives X ray and convert to digital signals, the image capturing subsystem simultaneously produce series of images signals. After the scanning process finished, the system controller station will get the complete images of the inspected vehicles, which is transferred to the image check station.
5. The image inspector will check the scanned images, make sure if there's suspicious articles, based on the result, the decision will be made to let the vehicle go or make open the box inspection.

### Remark:

If choosing the vehicle head dodging model, the driver can stay in the driving cabin, which will not be scanned. After the driving cabin go over the accelerator's beam location, the

system begins to beam, and scan the container. After the first container vehicle go over the inspection tunnel, X ray will stop automatically. The system is ready for next vehicle's inspection

## 4. Radiation Safety

GS8100 container/vehicle inspection systems use the low dose cyclotron as the X ray source, which has the safety interlock system. When the power supply is cut of, there's no radiation emitting. Only after all the subsystem and interlock system are ready, and the requested high voltage is fulfilled, the accelerator will beam. Meanwhile, the accelerator's low dose X ray and the system's self-protection screening design, ensure the safety of the operators and surrounding people. There's no radiation remains on the inspected cargo. It can ensure the food and photosensitive material safe free of radiation. Our system's marginal dose, the dose absorbed each single scan are all better than the standards of WHO, IAEA, ICRP.

Our inspection system uses the following measures to improve the safety standards.

### 1) transmitter monitor

The inspection system monitors all the transmitters automatically, which can find all the breakdown in time. Conduct redundant design for important transmitter to ensure the reliability of the whole system.

### 2) X ray shielding

There's X ray shielding settings both on the accelerator and the detector

### 3) Acoustooptical warner

The inspection system has warning lights and buzzer, which can indicate the status of the system. When the beaming is on, the red warning lights and buzzer work, reminding all the people out of the restricted area.

### 4) Infrared alarm

During beaming, the infrared alarm starts to work if someone get close to the restricted area.

### 5) Safety interlock system

Urgent stop button will cut off the accelerator's power supply if any emergency.

### 6) Keys switch, the accelerator stop beaming when this switch is off.

### 7) Micro wave control

When the inflated voltage is lower than normal value, the system will cut off the power

supply, and stop to produce the micro wave.

8) CCTV surveillance

The operator station has CCTV and broadcasting system, can monitor the whole situation of inspected area and broadcasting if needed

9) There's no waste gas, water or industrial residue in the whole process

The inspection system will not produce and waste gas, water or industrial residue, and have no bad influence to the surroundings.

## 6. System Technical Specification

### X ray Imaging Subsystem

- Energy level of X ray source: 6MeV
- Scanning speed: 200mm/s ~ 400mm/s
- Typical throughput: 20 units of 40GP/h
- Max. Dim. Of scanned vehicle: height 4500mm, width 2600mm
- Max. penetration: 300mm steel
- A/D conversion: 16 bit (65536)
- Image acquisition mode: Real- time, synchronized

### General Specifications

- Equipment covering area:  $\leq 50,000\text{mm} \times 30,000\text{mm}$  (L\*W)
- Time of continuous operation: 24h
- Operating temperature:  $-15\text{C} \sim + 55\text{C}$
- Storage temperature:  $-20\text{C} \sim + 55\text{C}$
- Humidity range: 0-95%
- Voltage: 380V, 3-phase 5 line
- Frequency: 50 Hz

### Radiation Safety:

- X ray dose per scan: 20 SV
- Max. dose rate on the system boundary:  $3 \mu\text{SV/h}$
- Max. dose for operator: 1m SV/year

### Image Inspection Subsystem:

- Monitor: 21 inch above
- Monitor resolution:  $1280 \times 1024$  or above
- Memory of computer: 1GB
- Storage of local hard disk: 500GB
- Storage of mass storage system: 2TB
- Image grey level: 65536

- Image processing functions: Pseudo-color, linear transformation, logarithmic transformation, histogram equalization, edge enhancement, image enlargement, reduction etc.
- A/D conversion: 16 bit (65536)

#### **Image Check Station Configuration and Function:**

- Computer monitor: 19 inch / 22 inch
- Image printer: A4 color printer
- Image pixel depth: 65536
- Image tools: Edge enhancement, light correction, local processing, image anti-color, width and position changing, contrast adjustment, inspection record, area calculation
- Image format conversion: IMG, JPEG, TIFF, PNG
- Image enlargement: continuous zoom
- Image list: 100 historical image list
- Image searching: according to different conditions, retrieve and browse the scanned historic images

## **7. optional hardware and software**

### **7.1 Detector of radioactive substances**

Radioactive substances/special nuclear material detection system can fast and efficiently detect the special nuclear material natural radioactive sources and gamma/neutron from medical or industrial radioisotope, with no impact to the vehicle or passengers

### **7.2 Vehicle ID identification**

Can capture the vehicle's ID and featured images, and compared with the scanned images

### **7.3 Under vehicle scanning**

can be integrated with under vehicle scanning system

### **7.4 Support RFID**

Automatically read and write the RFID content upon the request of clients

### **7.5 All perspective camera surveillance**

Provide all perspective surveillance, know about the restricted area, can choose several fixed full color camera or flexible PTZ camera, and support the night working model

### **7.6 Access system**

Measure the size and weight of the container, which can be used to compare with the scanned images, as reference for the image inspection. for the image inspection. for the image inspection. It can be installed in a suitable place

### **7.7 Screen**

Installed in a suitable place, as a reminder for inspected container vehicle and the waiting drivers. Supply with multi-languages, display as still, glide or flashing modes, and can be typed in words by keyboard, updated the latest information

### **7.8 X ray dose monitor**

To measure the dose inside the operating room, to ensure the safety for the operator

### **7.9 Drivers ID capturing information system**

To capture and record the physical and ID information, combined with the cargo and vehicle

### **7.10 Surveillance presetting**

Remind the operator for the container and vehicle which entered into the black list

### **7.11 Internet information exchange interface**

Support the exchange of the e files, when the system connects the internet, exchange the information for customers