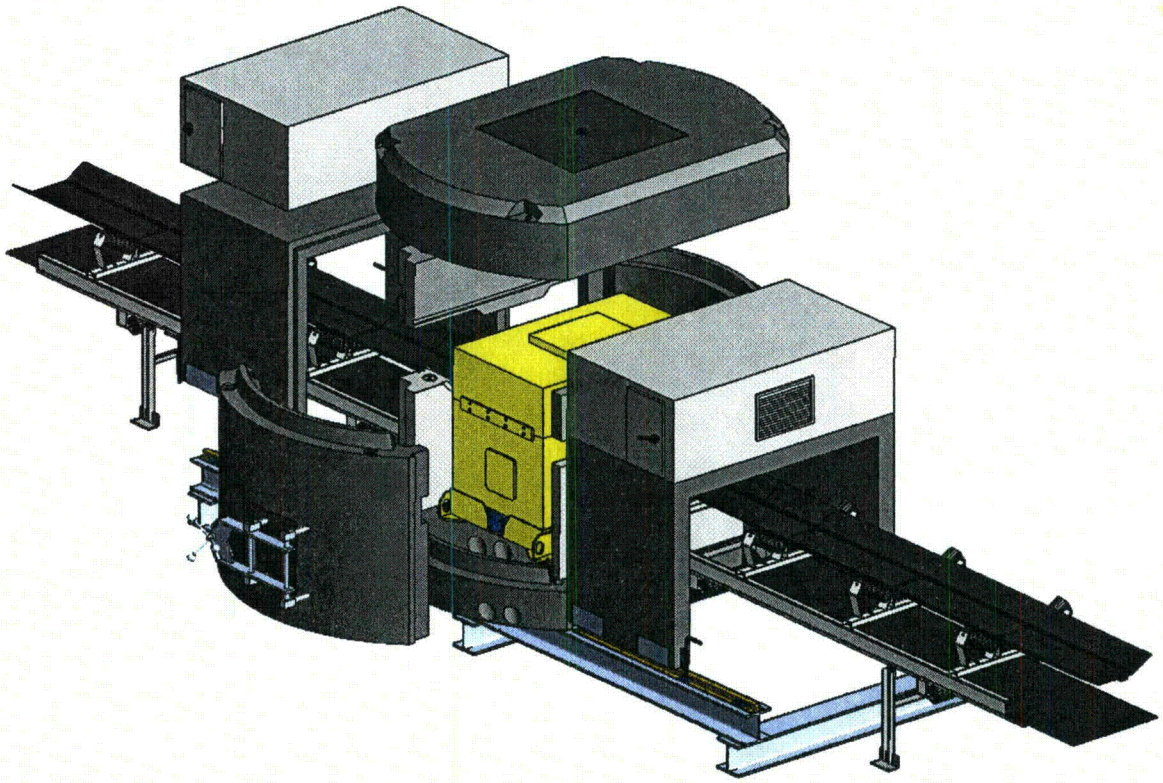
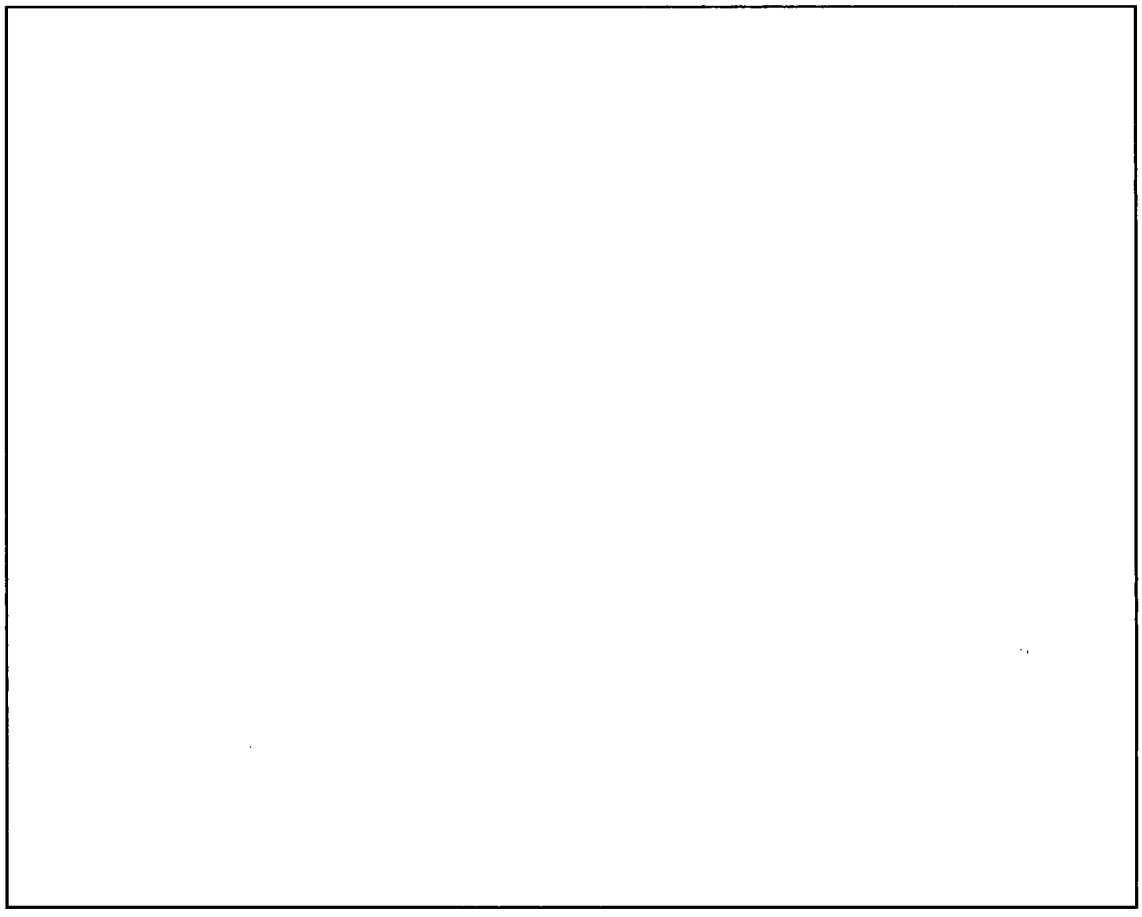
POLAB® CNA



POLAB® CNA

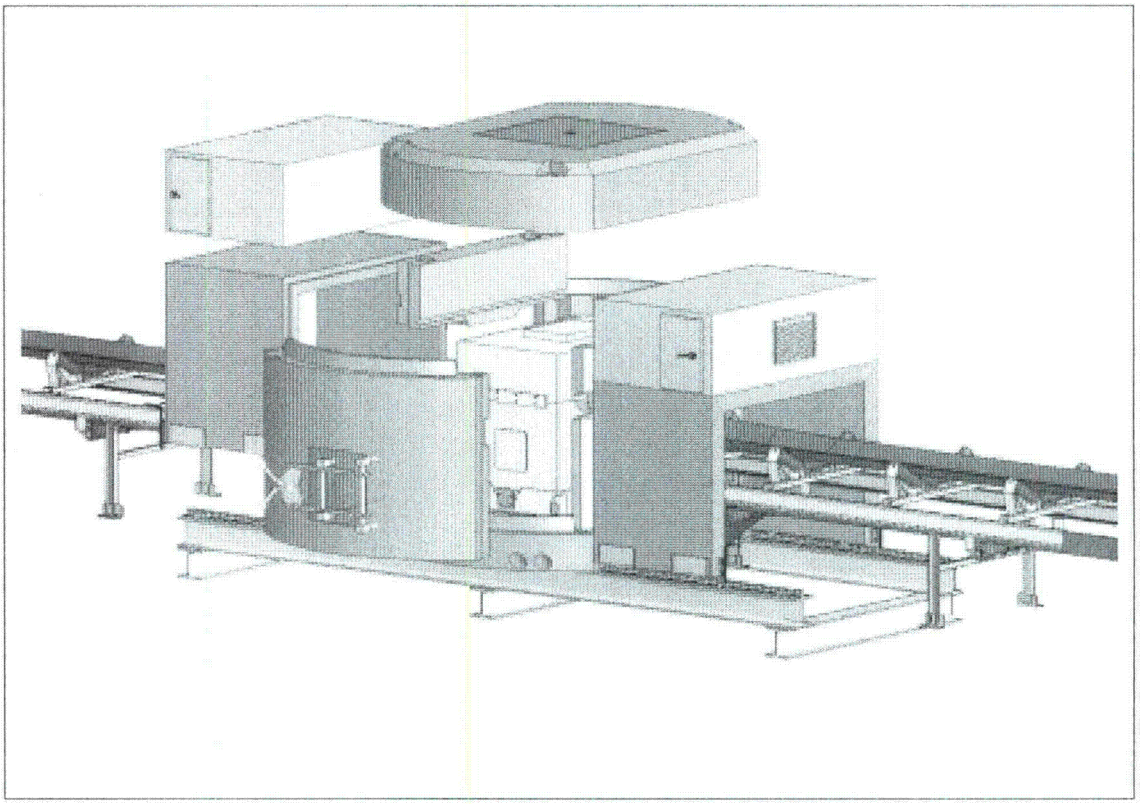


Customer

Order number

AAT item number

POLAB® CNA



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Order number

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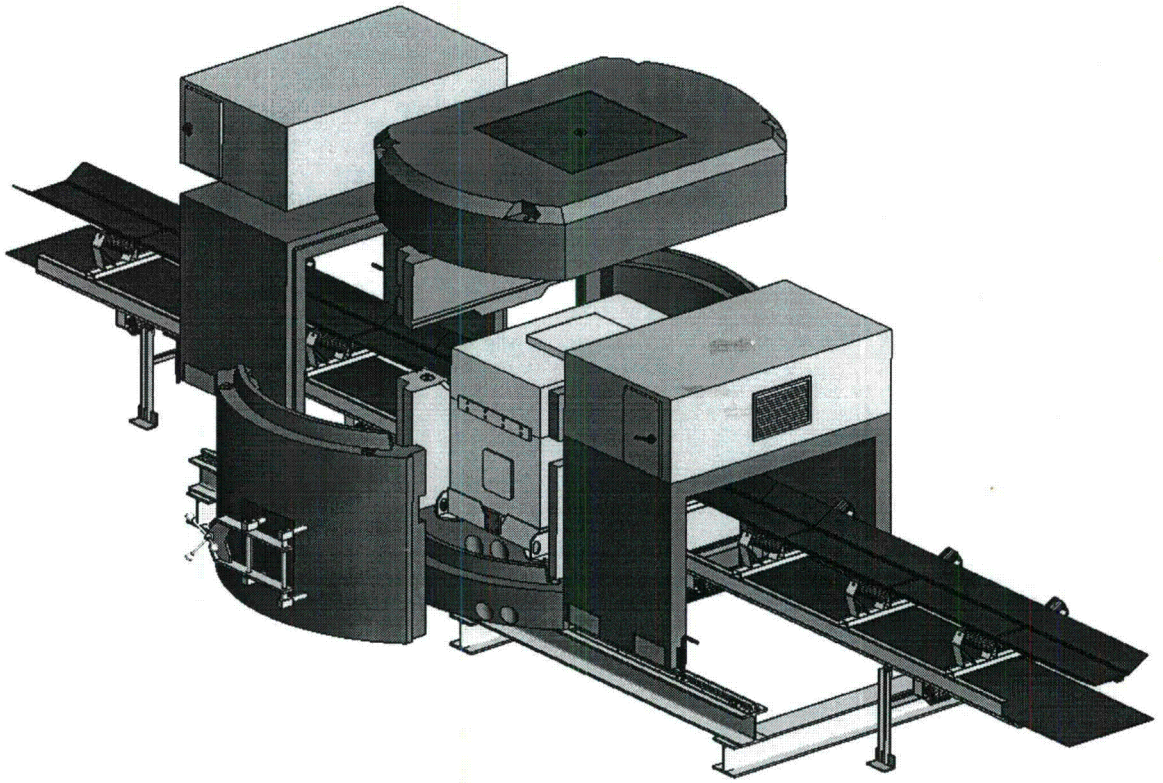

3 Transport

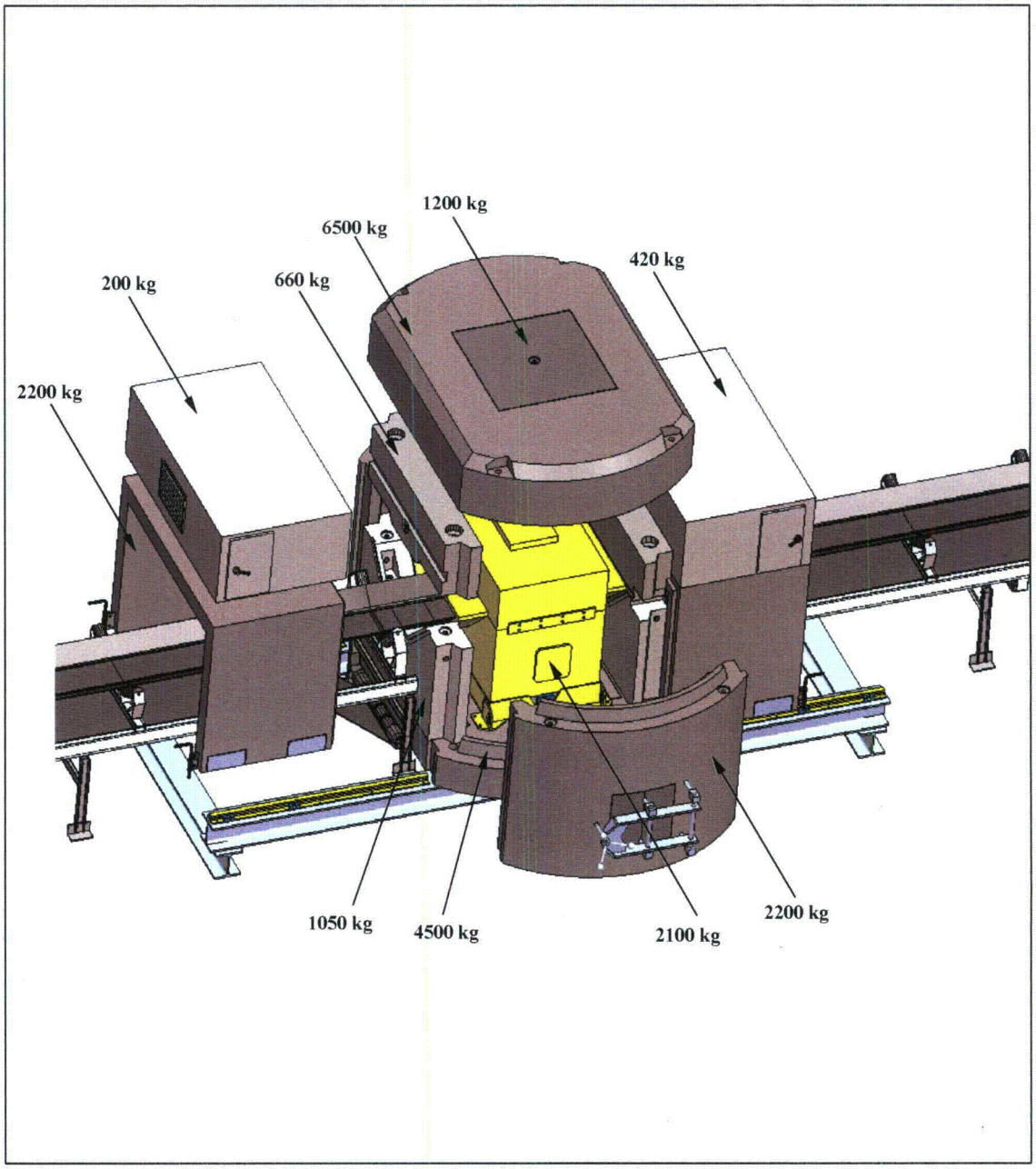

Figure 11 - Weights of the individual parts

3.1 Transport and storage requirements

After delivery to the plant site, all boxes and unit packs must be inspected for transport damage.

3.1.1 Radiation protection enclosure

To ensure safe and space-saving transportation, the radiation protection enclosure is supplied in ready-assembled form on a stable pallet with wooden crate. The enclosure is covered with a plastic film. Make absolutely sure that the enclosure is protected against effects of the weather during storage and right up to its assembly.

Dimensions of the
ready-assembled enclosure (L x W x H) ..... 3000 x 2140 x 2310

Weight of the
ready-assembled enclosure ..... 20200 kg

Weights of the individual parts ..... see Figure 11

If possible, transport the ready-assembled enclosure to its place of installation on the pallet only. Disassemble the enclosure again to enable installation.

Make absolutely sure that the the individual concrete parts are only lifted and moved by means of the transport eyebolts specially supplied together with the unit. These transport eyebolts must be screwed into the special threaded inserts in the concrete parts of the enclosure.

CAUTION
Never lift the entire ready-assembled enclosure with the transport eyebolts attached to the top cover slab. If it is at all necessary to lift the entire enclosure, do so by using belts, which you must place in the provided grooves under the floor slab.

3.1.2 Tunnel

The two tunnels are supplied, like the radiation protection enclosure, on a pallet with wooden crate. The same transportation and storage conditions apply as in the case of the radiation protection enclosure.

Dimensions per tunnel (L x W x H) ..... 2100 x 1240 x 1465

Weight per tunnel 2100kg

3.1.3 Machine components

The machine components are supplied in a separate wooden crate, together with the mounting kit. Make absolutely sure that the components are protected against effects of the weather during storage and right up to its assembly.

As soon as you open the crate, check the shipment for completeness in accordance with the parts list.

3.1.4 Air-conditioner

The air-conditioner with integrated control cabinet for the control and regulation system is a compact module for mounting on the respective tunnel of the radiation protection enclosure.

You must store the air-conditioner in a closed room that is suitable for the purpose. Transport the air-conditioner using the provided transport eyebolts.

Dimensions (L x W x H)	2100 x 1240 x 660
Weight	420 kg
Storage temperature	-20 to +45 °C
Humidity	0-95 % non-condensing

3.1.5 Measurement chamber

The measurement chamber is packed in a wooden case. The total weight is 2,040 kg. The gross weight including the case is 2,200 kg.

Make absolutely sure that the measurement chamber is only transported by a crane, using the transport eyebolts included in its blue lower part. Never use the 4 holes on the top of the measurement chamber to transport the entire measurement chamber. These rings are only for transporting the upper part of the measurement chamber.

The measurement chamber, inside the case or outside, must not be tilted by more than 18°. Make sure that the transport case is moved only with a forklift truck which has forks longer than 1.3 meters.

Shocks must be less than 100 g/10 ms.

During storage, ensure that the measurement chamber is not subjected to temperatures below -20 °C or above 45 °C. Differential expansion inside the measurement chamber may break some mechanical parts if they are exposed to temperatures outside these limits.

It is important to shade the measurement chamber from direct sunlight at all times.

Make sure that relative humidity is kept between 0 and 95 %. Do not expose the measurement chamber to rain.

Protect the measurement chamber against saline or corrosive atmosphere.

3.1.6 Detectors

Detectors are the most fragile part of the CNA. We recommend that you keep them inside their transport case, which is designed to protect them against shocks and temperature variations, until their installation.

The detectors are packed in a wooden case.

The external dimensions of this case are:

length ..... 60 cm

width ..... 50 cm

height ..... 50 cm

The gross weight is about 40 kg with the case.

Handling precautions

- Shocks on the case must be less than 75 g/10 ms.
- Store the detectors inside their closed transport case. During storage, ensure that the detector case is not subjected to temperatures below -10 °C or above 50 °C.
- Differential expansion inside the detectors may break some mechanical parts if they are exposed to temperatures outside these limits.
- It is important to shade the measurement chamber from direct sunlight at all times.
- Make sure that relative humidity is kept between 0 and 95 %. Do not expose the detector's case to rain.
- Protect the detector's case against saline or corrosive atmosphere.

3.1.7 MEN (Modul Emitting Neutrons)

All the safety regulations described in the MEN 16G safety instructions are applicable to the MEN even during transportation. See annex 1.

The MEN is packed in a wooden case. Preserve the case, in order to send the MEN back to SODERN at the end of its life.

Be sure never to drop the MEN

During storage, ensure that the MEN is not subjected to temperatures below -10°C or above 50 °C. It is important to shade the MEN from direct sunlight at all times. Make sure that relative humidity is kept between 0 and 95 %. Do not expose the MEN or its transport case to rain.

Ensure that the MEN, even inside its transport case, is protected against saline or corrosive atmosphere.

3.1.8 Cables

Transport box

The cables are packed into a non-reusable cardboard box.

The external dimensions of this box are :

length ..... 1.2 m

width ..... 0.8 m

height ..... 0.8 m

The gross weight is about 60 kg with the case.

During storage, ensure that the cable box is not subjected to temperatures below -20°C or above 50 °C.

It is important to shade cables from direct sunlight at all times. Make sure that relative humidity is kept between 0 and 95 %. Do not expose the detector's case to rain. Ensure that the cable box, even inside the transport container, is protected against saline or corrosive atmosphere.

3.1.9 Control cabinet

The dimensions of the control cabinet are :

length ..... 94 cm

width ..... 86 cm

height ..... 2.1 m (without transport eyebolts ; 2.15 m with transport eyebolts)

The cabinet is delivered with a 100 mm base, 4 transport eyebolts, but without rollers.

The weight of the cabinet is about 400 kg (TBC).

During transport, cables are not plugged in. In this case, the cabinet is not watertight and has a protection number of 01 (EN60529). Do not expose the cabinet to rain or direct sunlight.

Move and lift the cabinet by its transport eyebolts. Make sure that it is kept vertical +/-30°.

Always store the cabinet in a vertical position.

During storage, ensure that the cabinet is not subjected to temperatures below -10°C or above 50 °C. It is important to shade the control cabinet from direct sunlight at all times.

Make sure that relative humidity is kept between 0 and 95 %. When the cabinet is not installed, cables are not plugged in. In this case, the cabinet is not watertight and has a protection number of 01 (EN60529). Do not expose the cabinet to rain or direct sunlight.

Protect the cabinet against saline or corrosive atmosphere.

4 Safety instructions

The Continuous Neutron Analyzer, called POLAB-CNA, operates with a MEN 16G neutron emitting module. The MEN 16G neutron emitting module includes a SODITRON neutron tube. The object of this document is to inform the user about safety instructions related to that device.

The SODITRON neutron tube is a sealed tube with tritium inside, working like a small accelerator. When high voltage is applied to the tube, 14 MeV neutrons are emitted in the CNA in a pulsed mode, with an average output of 5.10^7 n/s, and X rays/γ rays are also emitted.

As a consequence, different safety procedures and safety devices are taken into account in the CNA:

- for protecting personnel against ionizing radiations,
- for protecting personnel against electrical hazards,
- for protecting personnel and hardware in case of tube defect (or associated module defect).

It is mandatory to understand clearly these points, and to know how to handle the module MEN 16G.

The neutron tube inside the MEN 16G has been designed to meet the requirements concerning a sealed tritium source and concerning a tube emitting fast neutrons. Nevertheless, the system safety responsibility lies solely with the user (especially the radiation protection). In this chapter, SODERN and POLYSIUS give advice, in order to make the user protection easier.

For correct and safe use of the MEN 16G in the CNA, it is essential to follow the generally accepted safety procedures in addition to the safety precautions which are specified in this manual.

In case of doubt about safety, it is mandatory to switch off the installation, to secure against unauthorized switching-on, and to inform the safety officer.

4.1 Radiation protection measures

When the neutron generator is operated, it generates

- fast and thermal neutrons
- gamma and X-rays
- alpha and beta rays, both of which are of such low energy that they cannot leave the inner zone of the neutron tube.

The neutron radiation in particular can be very dangerous if the necessary safety instructions are not observed.

The neutron radiation in particular can be very dangerous if the necessary safety instructions are not observed.

Observance of the following regulations is mandatory when working with the POLAB® CNA:

- The owner of the plant is responsible for ensuring observance of officially-imposed conditions and compliance with safety instructions.
- It is strictly forbidden to wilfully open or damage the radiation source (MEN).
- Only specially authorised personnel are permitted to switch on and operate the POLAB® CNA.
- It is strictly forbidden to modify the safety systems or render them unserviceable.

4.1.1 The radiation protection concept of the POLAB® CNA

The radiation-generating components are installed inside a massive protection enclosure made of special concrete. Due to lack of space, it is not possible for persons to stay inside the enclosure (prohibited area). Due to the highly effective radiation protection enclosure, it is totally safe for personnel to be present in the close vicinity of the CNA unit, even when it is in operation.

The analyser design ensures that the maximum dose equivalent (Neutron and χ radiation) at the outer edge of the radiation protection enclosure does not exceed a value of **2.5 µSv/h**.

A special, boronic concrete shielding ensures that the dose equivalents in the vicinity of the analyser do not exceed this limit value in nominal operation. The radiation protection enclosure consists of modular prefabricated sectionsmade of the special concrete. The wall thicknesses are between 30 and 54 cm. The thickest shielding of 54 cm is located directly above the detectors. The design of the shielding provides optimum safety and is made up of modular components to enable easy assembly and maintenance. Access is gained to the detectors and the neutron tube through specially designed and secured doors (red). The access plug in the roof above the detector unit has a total weight of more than 250 kg and can therefore only be lifted by crane and can not be opened manually.

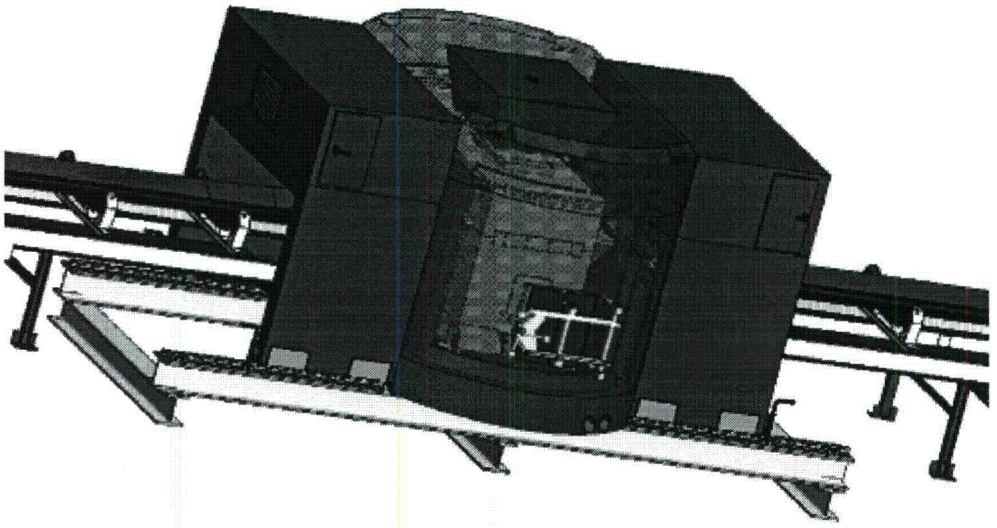

Figure 6

4.1.2 Description of the active components for the radiation generation

In the POLAB®CNA a small particle accelerator is used for producing monochromatic neutron radiation. This is a neutron generator of type GENIE 16G supplied by Messrs. SODERN, Paris.

The neutron generator consists of three components:

- a neutron tube,
- a high-voltage generator,
- and an electronic control unit.

No open radioactive materials are used.

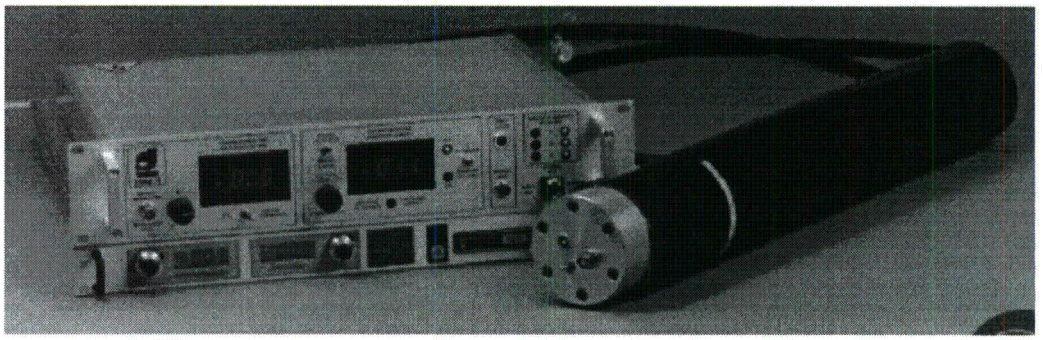

Figure 7

The three above-mentioned components are shown in this photo. The neutron tube is part of the black cylindrical component shown on the right-hand side of the photo. Its design is described in the following section.

The MEN (Module Emission Neutronique)

The neutron-emitting component is also called the **MEN** after the French name given by the manufacturer (**M**odule **E**mission **N**eutronique = Neutron-Emitting Module). This is a tube with a length of approx. 740 mm and a diameter of 100 mm made of steel. The total weight of the MEN is approx. 6 kg. The MEN does not actually become a neutron generator until connected up with the electronic control unit and supplied with high voltage. For reasons of clarity, the following text always means the black cylindrical component illustrated in the following diagram when it refers to the MEN.

Figure 8

Material and thickness of the outer casing

The outer casing of the MEN is made of 0.2 mm stainless steel.

Material and thickness of the radiation beam window

The SODITRON tube has no beam window.

Type of sealing

The soditron is asealed device.

Mechanical, thermal or chemical effects

Due to its being embedded in an airtight stainless steel casing, the tube containing tritium is well protected against mechanical and chemical influences.

The SODITRON neutron tube

Inside the MEN is the actual active component; the SODITRON neutron tube. The neutron tube manufactured by SODITRON is a sealed, metal-ceramic tube containing a vacuum ($1.3 \cdot 10^{-3}$ Pa or 10^{-5} Torr). The SODITRON tube is the key component of the installed neutron generator.

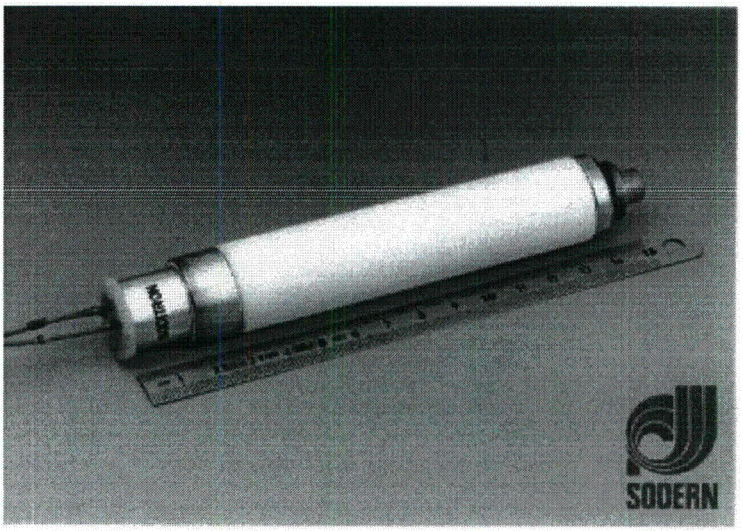

Figure 9 Photo of a SODITRON neutron tube

In combination with a special electronic unit and when connected to a high-voltage supply, the tube generates either a pulsed or a continuous radiation flux of practically monochromatic high-energy 14 MeV neutrons. The tube is only approx. 15 cm long, has a diameter of 2.5 cm and develops a total power of only 2W. Therefore, in contrast to X-ray tubes, no special cooling is required.

4.2 Operating modes of the POLAB® CNA

4.2.1 Normal (regular) operation

During normal operation of the system, all safety circuits are engaged, material conveyance through the analyser is ensured and all the signals and devices required for operation of the system are ready for use. For normal operation, the two operating modes **standby mode** and **measuring mode**are important.

Standby mode

In the standby mode, all systems of the analyser are ready for operation, only the neutron generator is de-energized, so that no emission of neutrons is taking place.

The preconditions for start-up of the analyser are:

- all safety circuits are engaged,
- no fault signals are received.

Thus, in standby mode no neutron radiation is generated, but the system can at any time be switched into operation within a few minutes. Select this mode if, for instance, in order to avoid unnecessary generation of radiation if there is a lengthy stoppage of the raw material preparation line. If no 24-hour operation of the unit is planned, the standby mode will be the second most frequent mode after the actual measuring mode.

Measuring mode

The system is fully functional and the neutron flux is nominal. You can perform analyses with the CNA unit. You can switch the unit back into the standby mode at any time, also by using the control system, .

4.2.2 Abnormal (irregular) operation

Under the so-called abnormal operation of the analyser we distinguish between situations where further chemical analysis is impossible or makes no sense, and situations where the chemical analysis can be continued in a restricted form.

If a warning message is received e.g. weighbelt failure, the operator decides whether it is sensible to continue the analysis. One example for abnormal operation would be failure of a detector component which affects the analytical efficiency of the system, but has absolutely no effect on the safe operation of the CNA unit.

Upon occurrence of a serious fault that leads to the selected working range being exceeded, the analyser either switches itself into standby mode or is totally shut down.

4.2.3 Belt conveyor stoppage

The POLAB® CNA software has no provision for automatically switching off the neutron radiation if the conveyor belt stops. However, the operating personnel can see from the screen display indications (belt speed, tonnage) that the belt has stopped and can therefore take the necessary steps.

4.2.4 General power failure

If there is a general power failure or short-term voltage fluctuation in the mains power network, a UPS (uninterruptible power system) ensures that the CNA unit is properly shut down without loss of data. A total power failure does not affect radiation safety, since it leads to a shutdown of the neutron generator, but it is a data security problem, causing a loss of analysis result data, and and must therefore be avoided.

4.2.5 Service interruption

The neutron flux is automatically monitored with a special ^{3}He meter. If the flux exceeds or falls below the control range, or if other malfunctions occur, the radiation generation is automatically interrupted.

Various fault messages within the electronic generator control unit also lead to an interruption of the neutron flux.

4.3 Dose equivalent and radioactivation phenomena

4.3.1 Dose equivalent in the vicinity of the unit

The design of the system ensures that a total dose value of 2.5µSv/h is not exceeded at the edge of the radiation protection enclosure in nominal operation.

Only when measuring directly at the entry and exit points of the belt conveyor into the analyser is it possible to register a maximum dose equivalent of up to 15µSv/h, if there is no material on the conveyor belt. In normal operation, meaning that the conveyor belt is loaded with material, the dose at the belt entry and exit points also decreases - depending on the amount of material on the belt - to values under 10 µSv/h.

This means that it is safe to work in the immediate vicinity of the unit, even when it is in operation.

4.3.2 Activation phenomena

People often ask whether the material on the belt is becomes active during operation of the CNA unit.

The design of the analyser minimizes all radioactivation phenomena of every nature.

Activation of the unit itself

After the analyser has been in operation for a long time, internal components of the measuring chamber, as well as the inside of the radiation protection enclosure, become slightly activated. However, the selected materials of the structural components (plastic, graphite, boron, special concrete) ensure that after some minutes decay time no residual radioactivity is measurable on these components.

This is, of course, particularly significant with regard to disposal of the components at the end of the unit's service lifetime. Aside from these aspects of radiation safety, long-term radioactivation of the unit also has to be avoided because of its effects on the measuring efficiency. In the course of time, the radiation from the activated machine components would overlay the spectral data of the material being analysed and cause a decrease in the unit's analytical performance. The detector systems employed for analysis of the gamma radiation emitted by the material are so sensitive - much more sensitive than, for instance, the type of commercial radiation meter used for radiation protection - that the activation radiation of the components would enormously affect the actual spectral evaluation of the prompt gamma radiation from the material. This was in itself reason enough for awarding maximum priority to minimizing radioactivation of component parts.

Activation of material

Due to the low neutron flux and the very short retention time of the material in the analyser (belt speeds of up to 4m/s), the radioactivation of the material on the conveyor belt is several classes lower than that permitted by International standards.

After continuous static irradiation lasting up to 24 h, no significant radioactivation could be measured in samples of rock that are typical for the cement industry. This means that sample material with normal compositions for the cement manufacturing process shows no residual radioactivity after irradiation for the usual period of time. This has been proved by radioactivity measurements of numerous materials. Industrial operating experience with PGNAA-analyser units (working with ^{252}-Cf sources) has also confirmed this point. The quality of the analysed materials is in no way compromised by the radiation effects.

Analysis in the POLAB® CNA therefore produces no radioactive waste.

Radioactivation of the belt material

The belt conveyors carrying the material through the analyser are normally made of rubber, textile or mixtures of the two. The conveyor belt is always irradiated together with the material. The main elements of the belt material are C, H, N, and O. These display hardly any radioactivation phenomena, and when they do the half-life is negligibly low. Even static measurements with the belt stopped show no degree of belt radioactivation that might be relevant from a radiation protection point of view. Theoretically, the belt material deactivates at a factor of 1000 per minute.

4.3.3 Discharging of radioactive substances into the environment

Operation of the neutron generator leads to no continuous discharge of radioactive substances into the air or into water. The sealed neutron tube is returned to the manufacturer after expiry of its service life, but at the latest ten years after it was purchased.

In spite of the fact that the neutron tubes are comparable to sealed radioactive sources, the possible contamination of the various modules and structural components by the tritium contained in the tubes by deuterium-tritium reaction (D-T reaction) should also be taken into account.

The SODITRON neutron tube in the MEN 16G contains up to 1.2×10^{11} Bq of tritium.

This tritium is retained under the form of a metal hydride which begins to decompose at temperatures above 150 °C. The walls of the neutron tube prevent the gas from escaping in the event of the temperature increasing.

WARNING

Opening of the MEN 16G or the tube is strictly prohibited.

WARNING

In the event of a leakage or breaking a of the tube's insulating walls, the stainless steel must be considered as possibly contaminated, in spite of the computed value, which indicates a non-detectable level.

Always remember that tritium gas, like hydrogen gas, may migrate through any bulk material. The leakage rate is very low but never equal to zero.

As a consequence:

- when the MEN 16G is in operation, fresh air can circulate around the housing of the tube in the CNA,
- the storage box of the tube is not air-tight,
- The MEN 16G must be handled with polyethylene protective gloves to ensure that the high-coltage connectors are kept clean. After handling, turn the gloves inside out, place them in a plastic bag and seal the bag. Store the bag in the MEN 16G box until return of the MEN 16G and gloves to the manufacturer.
- avoid any shocks, stresses, or pressure over 5 bar around the MEN 16G.

4.4 Theft or loss of the neutron tube

In case of theft or loss of the MEN 16G, it is mandatory for the user to advise SODERN, and to declare it to CIREA when used in France.

You can optionally provide additional protection against unauthorised opening of the front service cover directly at the radiation protection enclosure by attaching a chain and padlock.

In addition to a door in the enclosure, this provides extra protection against theft of the neutron tube. Moreover, removal of the neutron tube requires the use of tools, i.e. it is not a simple matter for unauthorised persons to remove the radiation-generating components from the inner measuring chamber.

4.5 Warning notices and information

The CNA unit will be have the officially stipulated warning notices (signs). A flashing lamp should always be installed in the near vicinity of the unit to optically signalize that radiation generation is taking place. The location of the flashing lamp depends on the local situation. The flashing lamp is a component of the safety circuit.

4.6 Safety circuits

The safety concept allows for the installation of several emergency off buttons in series. As standard, one button is installed on the outside of the control cabinet, which is located at a distance of up to 12 m from the analyser. Additional emergency off buttons can be mounted as required at other positions around the CNA unit. After an emergency stop has been tripped, the system can only be restarted by local acknowledgement via a key operated switch.

The operating concept also includes various other safety circuits for interrupting the neutron generation.

The operator can instantaneously shut off the unit's power supply or interrupt the radiation generation, either locally at the control cabinet or from the remote operating terminal via a glass fiber cable system.

The neutron flux is automatically monitored with a special ^{3}He meter. If the flux exceeds or falls below the control range, or if other malfunctions occur, the radiation generation is automatically interrupted.

Various fault messages within the electronic generator control unit also lead to an interruption of the neutron flux.

When the front service cover is unlocked, the door contact is inevitably broken and immediately stops the radiation generation. It is impossible for the CNA unit to operate when the door is open.

4.7 Sources of electrical hazard

When undertaking maintenance work of whatever nature, make absolutely sure that the main power plugs are disconnected and that the capacitors of the high voltage section are discharged.

Always strictly obey the applicable safety rules concerning high voltage, as the high voltage applied to the tube may reach 120 kV in nominal use.

4.7.1 High-voltage generator

In the CNA, the MEN 16G is powered by a generator, which is compliant with the European Standard EN61010-1.

The mandatory protection system against very high voltage (VHV) electrical hazards consists of:

- an interruption-proof earthing (grounding) circuit connected to the plant's general earth (ground) line, which provides the potential equalisation for the VHV generator and the power supply cabinet.
- A capacitor-discharge system integrated in the VHV generator, for the event of an interruption of the mains power network.

WARNING

When power is switched off or is accidentally interrupted, the capacitors are discharged, but it may take a few seconds (or more) until voltage reaches less than 120 V.

WARNING

Before carrying out any kind of work on the MEN 16G, make absolutely sure that the system is switched off and the power line is disconnected.

4.7.2 Changing the neutron tube

You have to replace the MEN when it has reached the end of its service lifetime. To do this, shut down the CNA unit and then open the front access door. The MEN can be exchanged by the plant's personnel themselves.

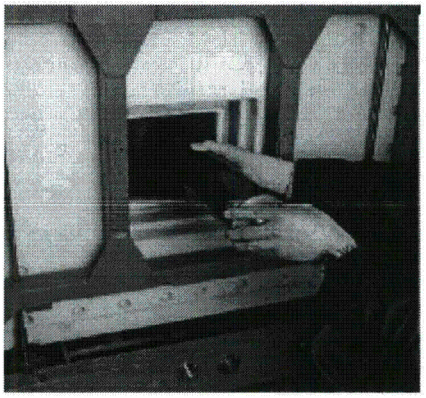

Figure 10

Before taking out the tube after a lengthy operating time, be sure to leave a decay time of 60 minutes.

The CNA may be operated by any authorised person, but make absolutely sure that the MEN 16G is only handled by qualified personnel (see below).

In general, stricktly ensure that the following minimum precautions are imposed:

- ❑ the handling of the MEN 16G is exclusively restricted to personnel qualified in both the field of radiation protection and trained for working on installations carrying very high voltages,
- ❑ the person responsible for the CNA unit hasauthority to enforce the observation and respect of standing rules and regulations,
- ❑ opening or damaging the MEN 16G is strictly forbidden,
- ❑ the MEN 16G is handled with the utmost care to prevent any breakage, and with polyethylene protective gloves to ensure cleanliness of the high-voltage connectors and absolutely exclude any risk of contamination from tritium on its external surface,

- ❑ the key for the main switch on the generator (MC 16G module) is kept secure, so that no unauthorised person can use it,
- ❑ the MEN 16G is installed in the CNA in conformity with instructions,
- ❑ standard safety signs are never removed from the equipment,
- ❑ a faulty unit is never put back into use,
- ❑ the mandatory safety systems of the CNA are never disconnected or modified,
- ❑ safety anti-radiation procedures are regularly checked and verified by approved specialists,

4.7.3 Final ending of service life

When the MEN 16G is finally taken out of service, or after 10 years have expired since the delivery date, it has to be sent back to SODERN inside the delivered boxes, to the following address:

SODERN
20 avenue Descartes
94451 Limeil-Brévannes Cedex
France
Phone : 33.1.45.95.70.00
Fax : 33.1.45.95.71.77

4.8 Sources of chemical hazard

The materials used for the CNA present no source of chemical hazard.

4.9 In case of accident

4.9.1 Fire

In case of fire, the neutron tube inside the MEN 16G may be destroyed and may release a tritium quantity of up to 1.2×10^{11} Bq.

You must act on the assumption of atmospheric and surface contamination, in spite of the small quantity of tritium involved. Make sure that the relevant national regulations are applied.

The gas inside the container is not inflammable.

You must inform SODERN in writing about the circumstances of this incident.

4.9.2 Breakage

The MEN 16G is a ruggedized module. Nevertheless, breakage of the tube can never be entirely ruled out. If this occurs, the tube will stop operating and the VHV generator will trip.

In case of tube breakage, parts will be contaminated with tritium. A small amount of tritium will be released, as soon as the parts are no longer heated. Most of the radioactivity (= 1.2×10^{11} Bq) will remain on these parts.

If the tube is inside the closed MEN, do not open the MEN and place it in a double plastic envelope. Then place the envelope in a metal box, carefully seal the box and send it back to SODERN for reprocessing and legal destruction of the tube.

If the tube is out of the MEN, you must place all parts in a double plastic envelope, using polyethelyene gloves. Carefully ensure that each envelope is properly sealed. Either place the used gloves in the same envelope as the parts, or in another sealed plastic envelope. Then place the envelope(s) and the gloves in a metal box, carefully seal the box and send it back to SODERN for legal destruction.

The gas inside the container is not toxic.

5 Assembly

5.1 Assembly aids

The place of installation must be accessible by crane truck. The maximum weight of the heaviest component to be assembled is 8,500 kg.

All components to be assembled are either equipped with tap holes, allowing lifting eyebolts to be screwed in, or are directly equipped with lifting eyebolts.

The standardized lifting eyebolts stipulated for the concrete parts are included in the scope of supply.

Tools and aids required for the assembly work:

- 1 motor crane with suitable jib length and load bearing capacity (min. 8,500 kg).
- 4 hydraulic cylinders 20 t, piston height 100 mm
- 4 hand lever pumps
- 2 winches 5 t
- 2 chain blocks 1.5 t, with 5 m chain
- 1 open-end spanner 55 mm
- 1 ring spanner box end wrench 55 mm
- 2 double t-beams IPB 240, 5000 mm long
- 1 U-steel U 160, 5000 mm long
- (only necessary if the unit is to be installed in inlined position)
- diverse packing shims and compensation material.

5.2 Preparatory work on the conveyor framework

- ❑ The conveyor framwork must be cut through at the point of installation. Suitably support and, if necessary reinforce, the steel structure at this point. You will also have to interrupt any pull cords for emergency off switches and any cable trays running beside the conveyor belt, or reroute them to run under the CNA.

Figure 17 - Conveyor framwork

- On one side of the conveyor belt there must be a sufficiently large space for assembly and installation purposes.

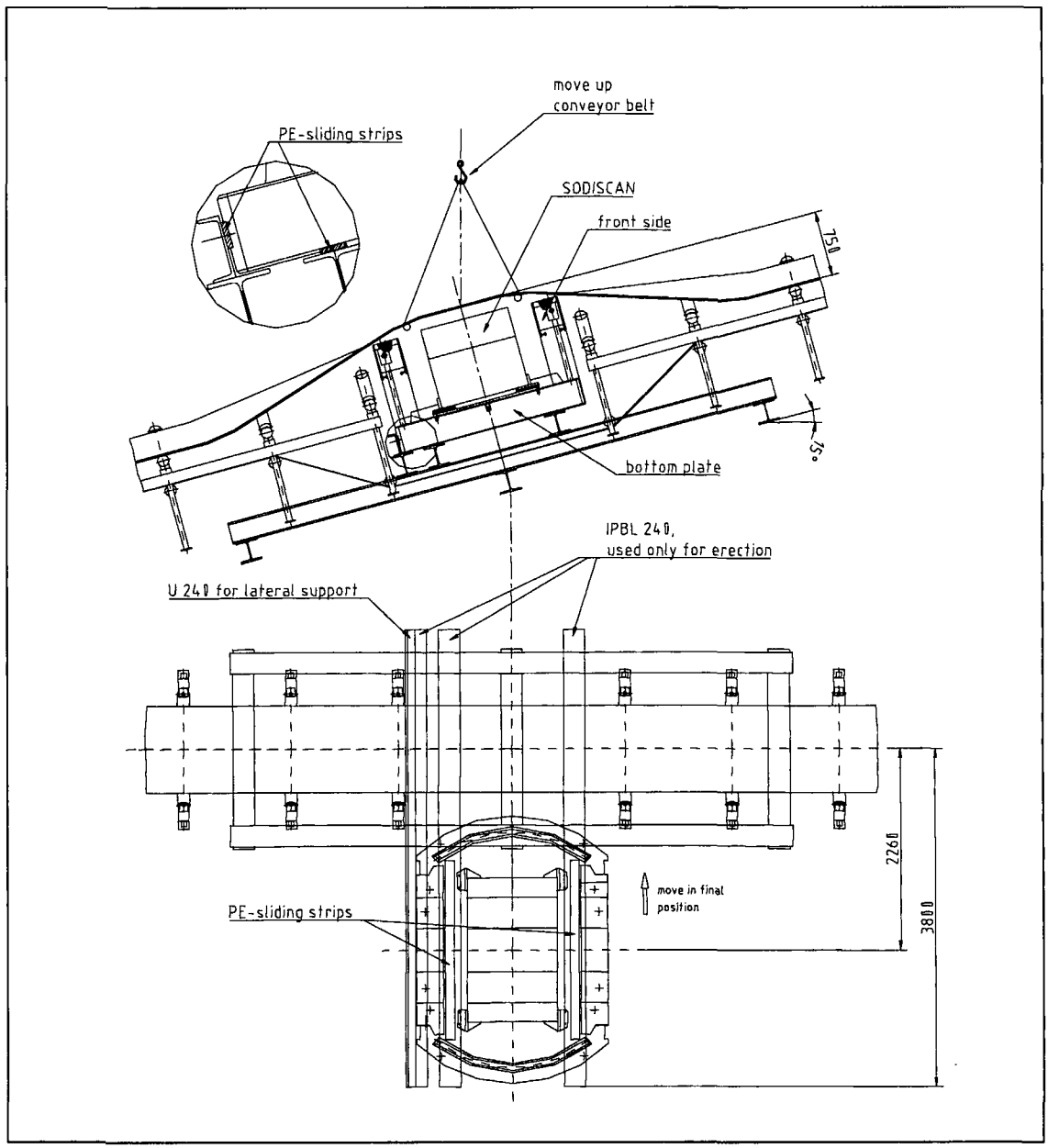

Figure 18 - Space requirement for assembly and installation purposes

❑ *You must pass the lower strand of the conveyor belt underneath the analyser.* To permit this, you will first have to mount corresponding deflection rollers on the conveyor framwork. If necessary, consult the conveyor belt manufacturer about the location and design of the deflection rollers.

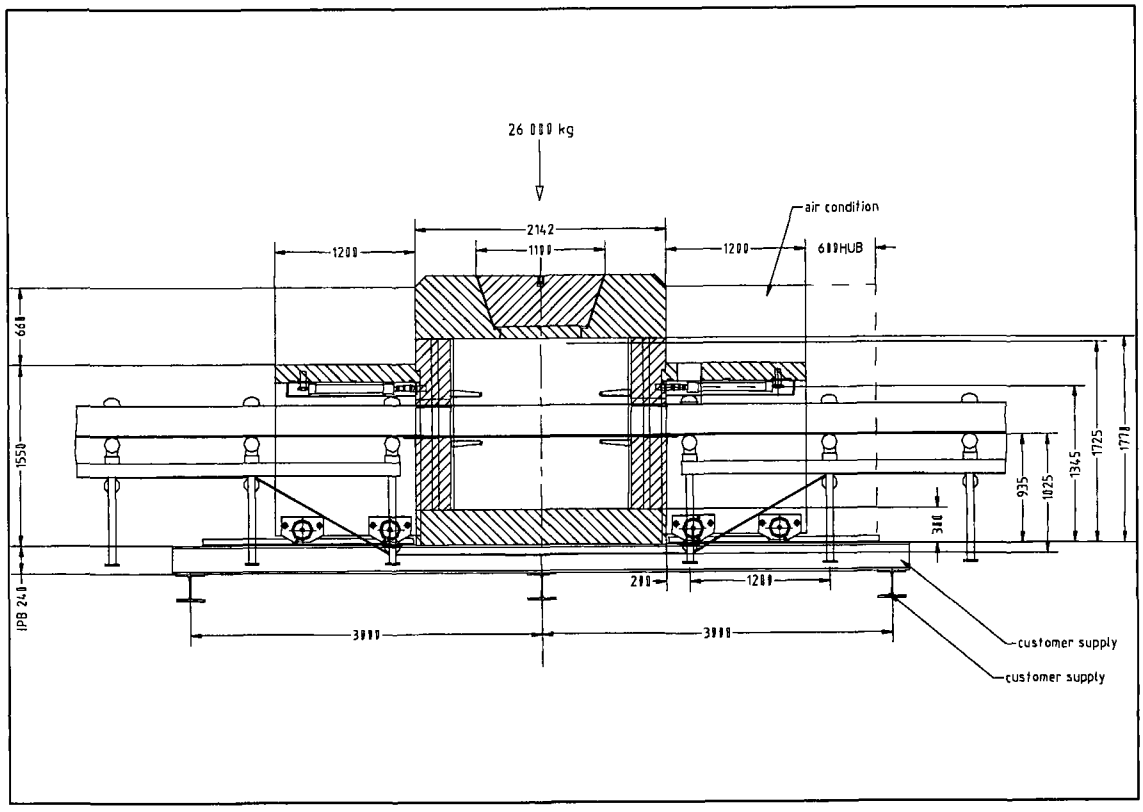

Figure 19 - CNA and conveyor framwork with deflection rollers (dimension drawing)

- You have to prepare the platform or foundation structure for the CNA installation.The figure shows a proposal for a possible solution.

Figure 20 - Mounting frame

- Protect the CNA against direct effects of the weather and prevent access by unauthorised persons. It would be wise to provide a simple accommodation for the CNA unit. In this case, do not forget to provide an installation opening in the roof of the accommodation.

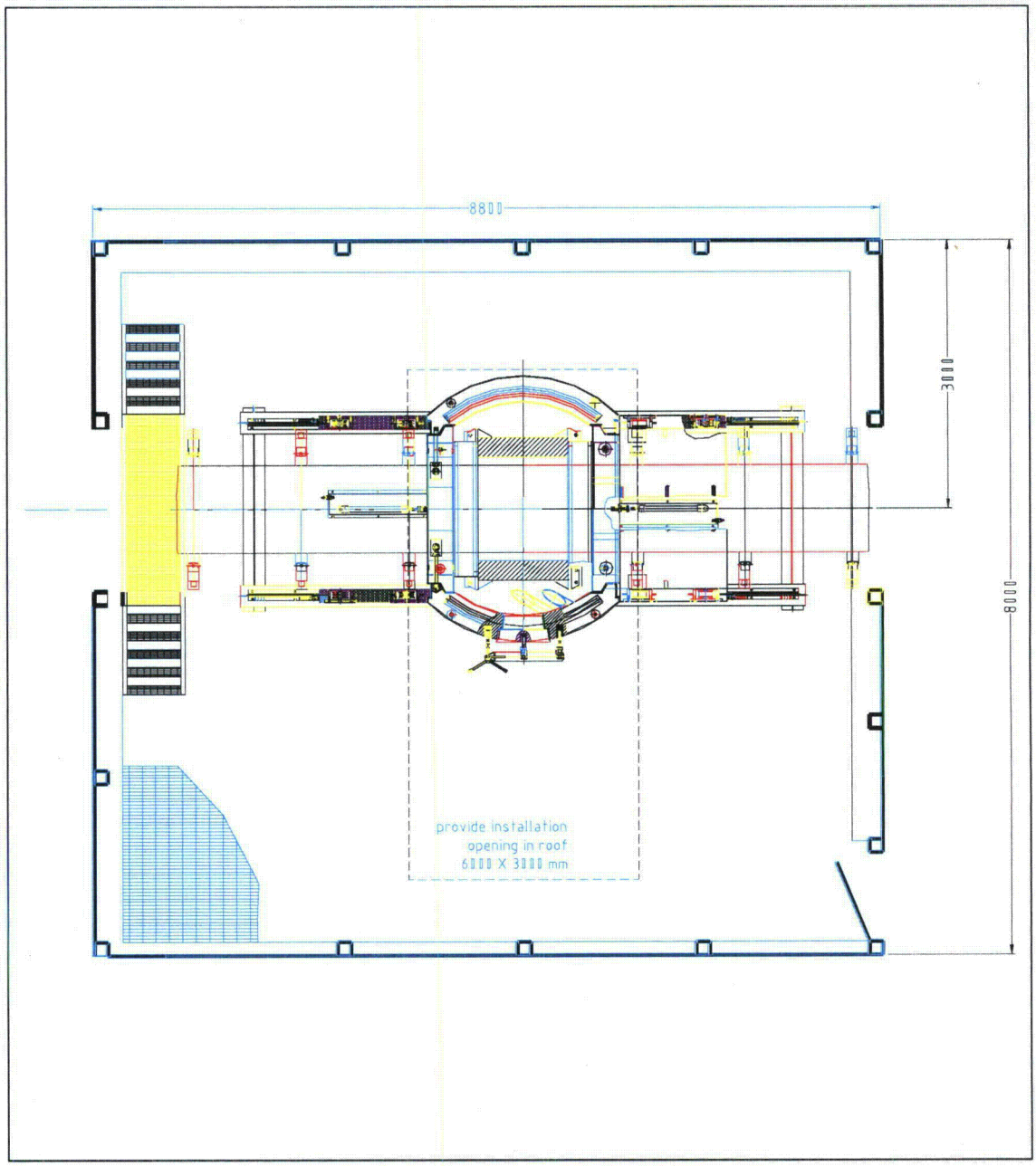

Figure 21 - Installation opening

- ❑ To enable the performance of maintenance work, a rail crane is necessary (load bearing capacity 1.5 t). The crane must be able to lift the closure plug out of the cover slab and transport the standard samples.
- ❑ You will need an auxiliary structure made of double T-beams and U irons for assembling the CNA unit (see Figure 22).
- ❑ Provide a crossover bridge, so as to be able to easily reach the other side of the conveyor belt.
- ❑ Mount true-run switches on the conveyor belt before the analyser (looking in the belt-running direction. The max. permissible skewing of the belt inside the analyseris ± 50 mm.
- ❑ The analyser has to be protected against an excessively high layer of material on the belt because the height of the passage opening is limited. You will have to install a layer height monitor at the conveyor belt. Select the position of the monitor in accordance with the braking distance of the conveyor belt, so as to ensure reliable protection of the analyser against impact.

5.3 Assembly of the radiation protection enclosure and the measuring cell

5.3.1 Constructing an assembly aid

The assembly aid will only be needed if the CNA unit is to be installed at an existing conveyor, and if there is the requirement for the belt not to be cut.

The assembly aid enables correct positioning of the CNA components that have to be mounted between the lower and upper strands.

Position 2 double-T-beams at an angle of 90° to the conveyor belt. Make absolutely sure that the beams are suitably supported to accept the weight of the floor slab, the measuring cell and the two lower shaped elements. (8.4 t).

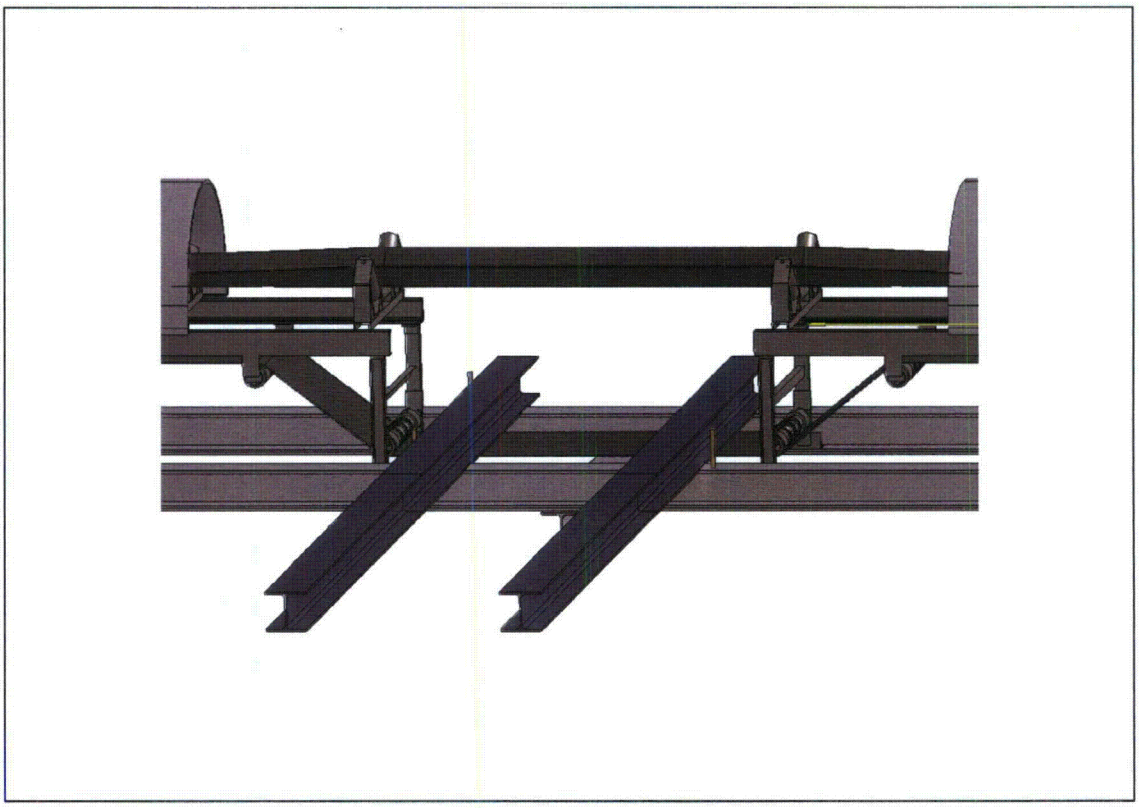

Figure 22 - Assembly aid for horizontal installation

Make sure that the surface of the beams is as smooth and even as possible. Grease the surfaces onto which the floor slab is to be set down, so that it will slide better.

If the CNA is to be installed at an inclined conveyor belt, you will have to provide extra support with a U-beam.

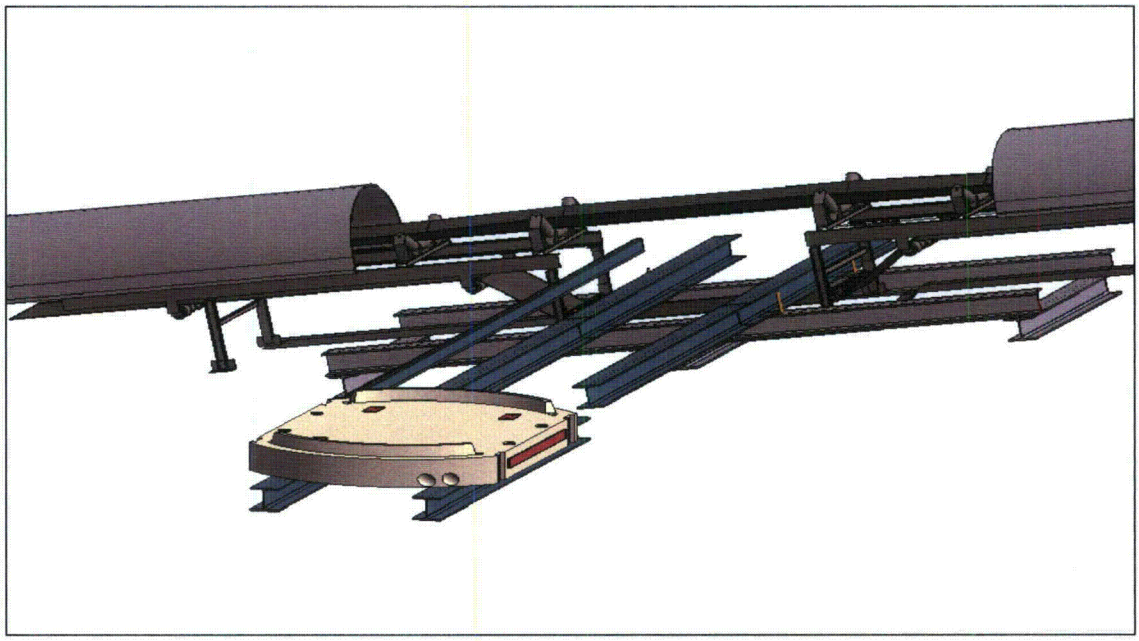

Figure 23 - Assembly aid for inclined installation

5.3.2 Preassembly of the floor slab

CAUTION
The concrete parts must only be lifted by means of the supplied transport eyebolts.

- ❑ Place and fix the PE sliding strips in the provided grooves in the underside of the floor slab. For inclined installation of the CNA, also insert the PE sliding strip on the face of the floor slab.
- ❑ Align the floor slab, so that the cable-protection pipes emerge at the correct side in conformity with the general arrangement drawing. Lower the floor slab onto the assembly aid.

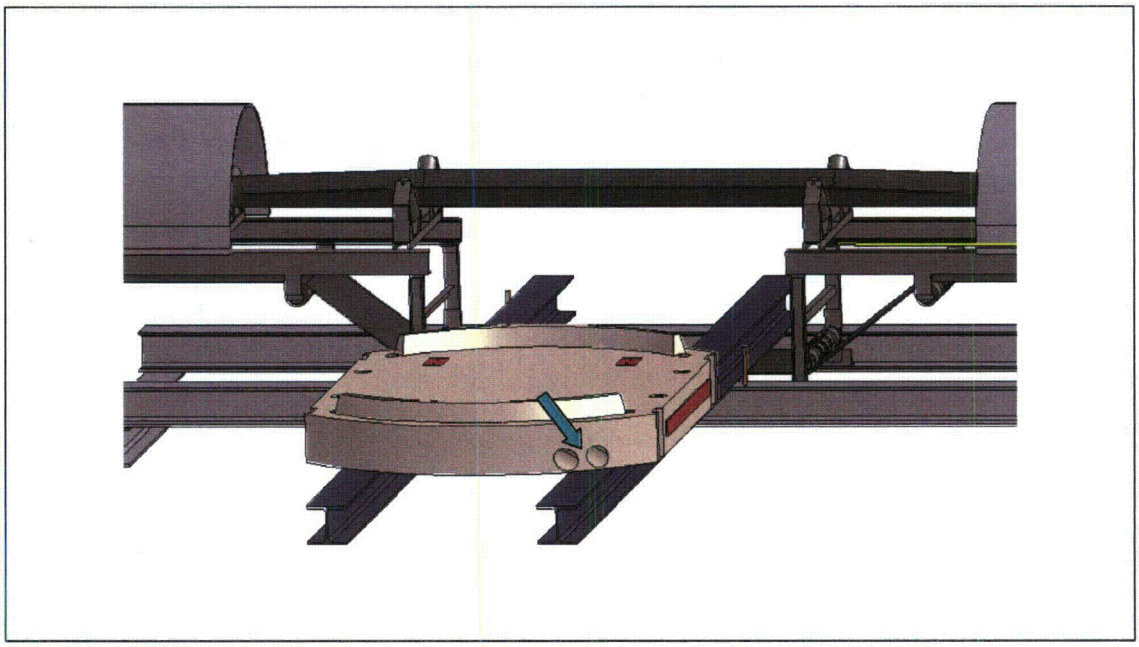

Figure 24 - Preassembly of the floor slab

For inclined installation of the CNA, we recommend preassembling the floor slab on a horizontal surface and subquently lowering it onto the assembly aid.

- ❑ Screw the M36 threaded rods into the floor slab to fasten the lower shaped elements.
- ❑ Next, lower the lower shaped elements onto the floor slab and bolt together.

NOTE
Be absolutely sure to install the shaped part with the recesses for the air ducts of the air-conditioner on the correct side.

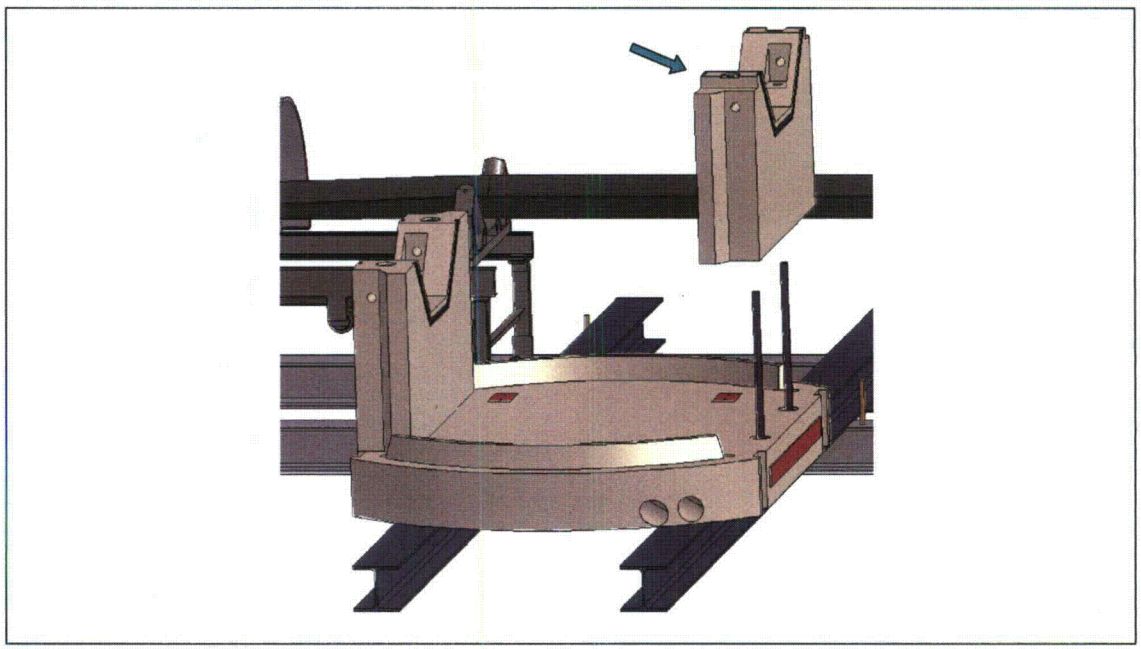

Figure 25 - Floor slab with lower shaped elements

To be able to mount the lower part of the measurement chamber on the floor slab, you must first adapt the PE flange of the seal to the upper and lower parts of the measuring cell.

❑ Drill the holes to fix the structure of the seal tunnel, and fix the structure .

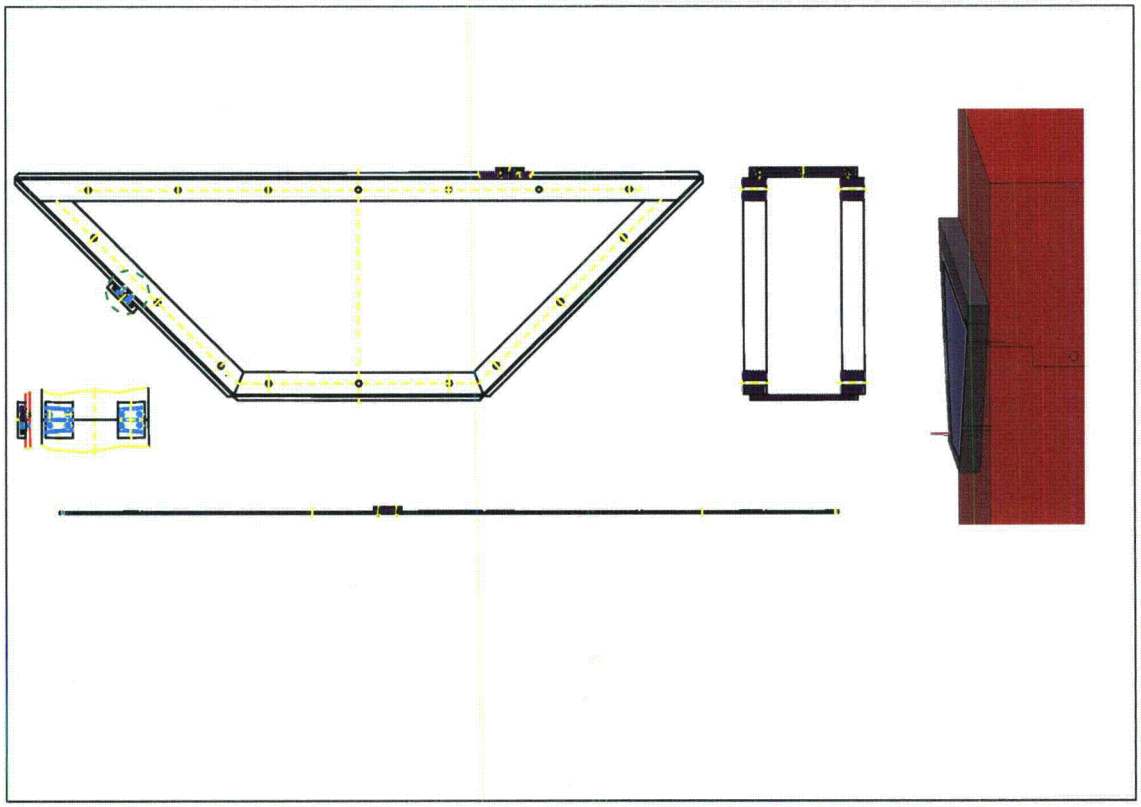

Figure 26 - PE flange with seal

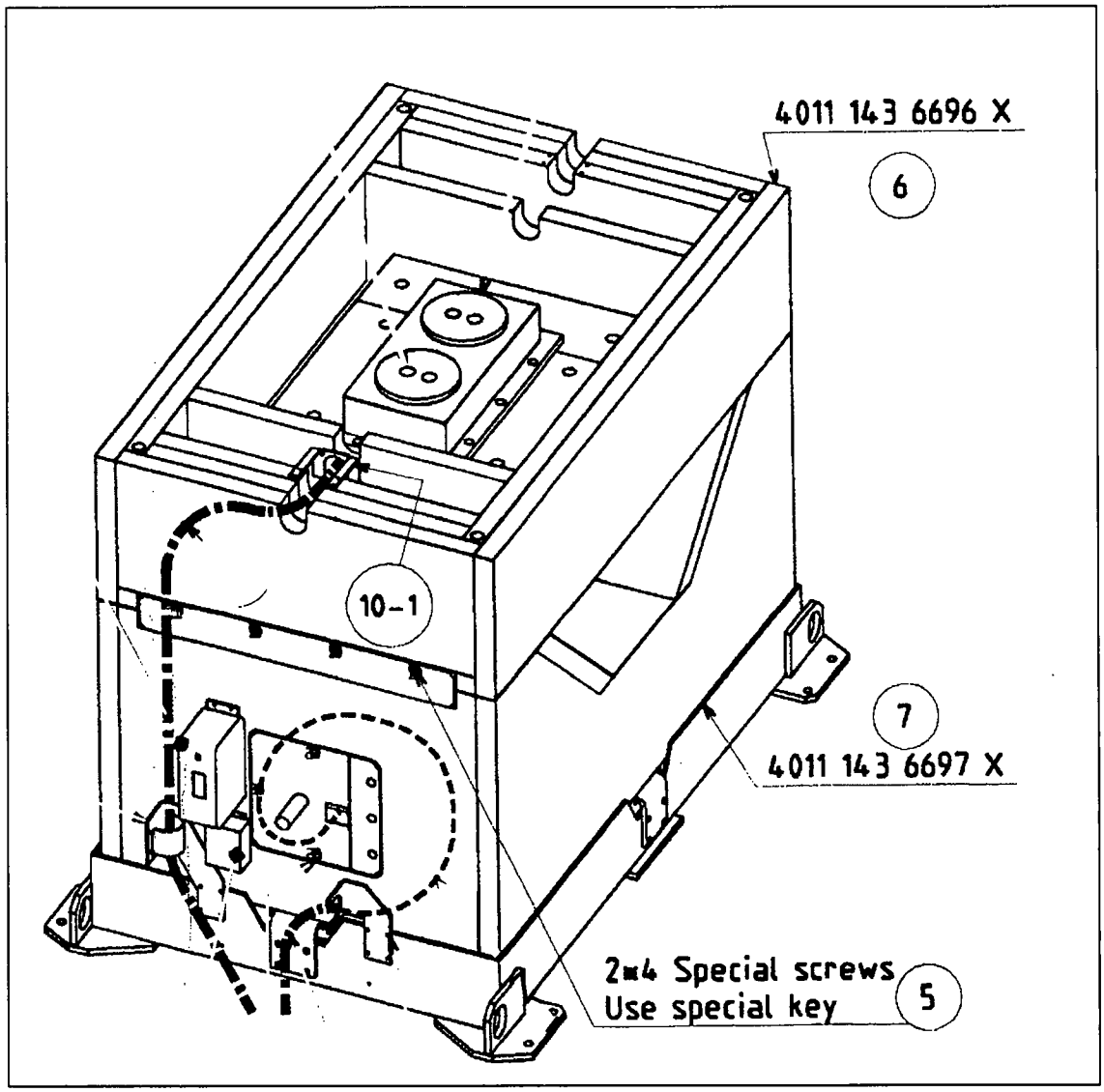

Figure 27 - Measurement Chamber

- ❑ Unbolt the upper part from the lower part. Use the special key to unscrew the 4 upper bolt s (Figure 27 reference mark 5) on each side. The special key is delivered in the « kit of accessories » box.
- ❑ Screw the 4 red lifting eyebolts into the holes in the upper part of the measurement chamber. The lifting eyebolts are delivered in the « kit of accessories » box.
- ❑ Use a crane to lift and move the upper part of the measurement chamber (Figure 27, reference mark 6) and lay on blocks, in order to avoid laying the detection unit on the ground. The weight of the upper part is 470 kg.

❑ Unbolt the lower part from the bottom of the transport container

The weight of the lower part is about 1,610 kg (+/-40 kg, depending on the belt size). Handling precautions see Figure.

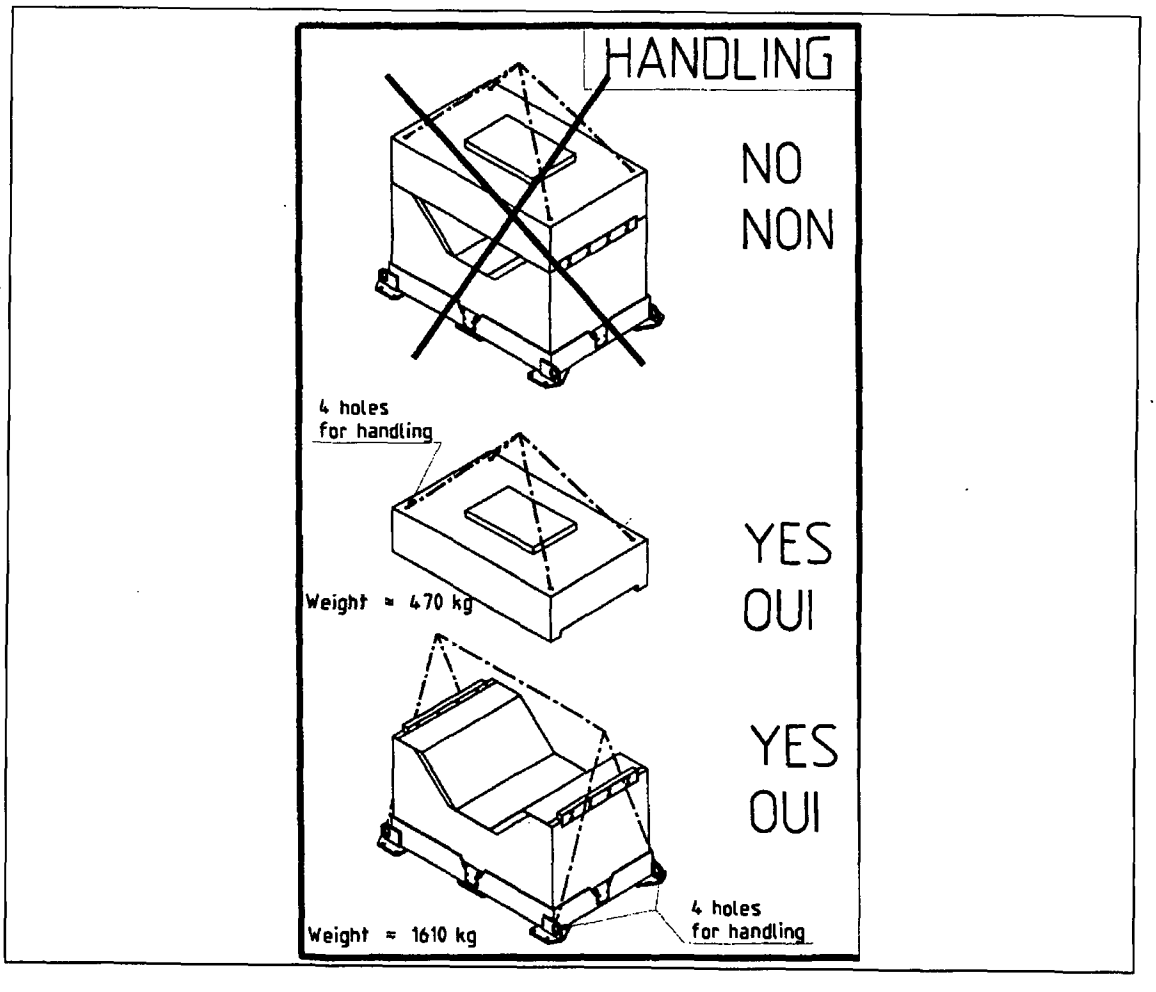

Figure 28 - Handling of Measurement Chamber

- ❑ Place the lower part of the measuring cell onto the floor slab and align it.

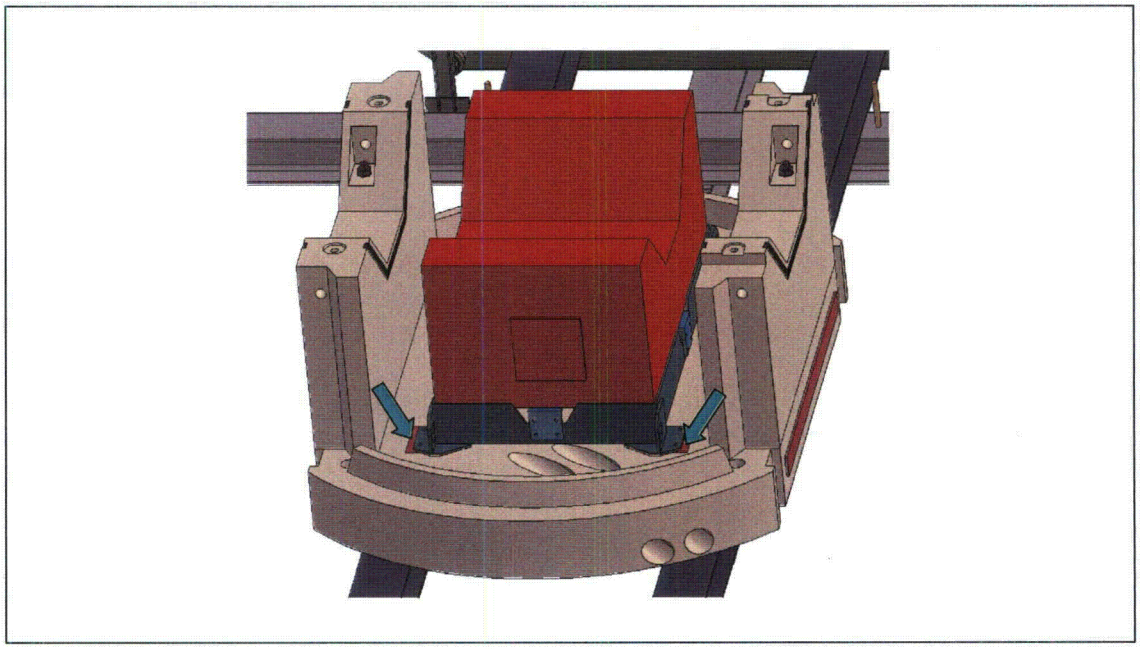

Figure 29 - Floor slab with measuring cell

- ❑ Make absolutely sure that the cable-protection pipes of the floor slab are on the same side as the entries to the pipes.
- ❑ Compensate any difference in installation height relative to the shaped elements with packing plates. (Use cord or leveling board)
- ❑ Bolt the measuring cell onto the floor slab.

- ❑ Mount the angle brackets for the wear protection onto the outside of the lower shaped elements.

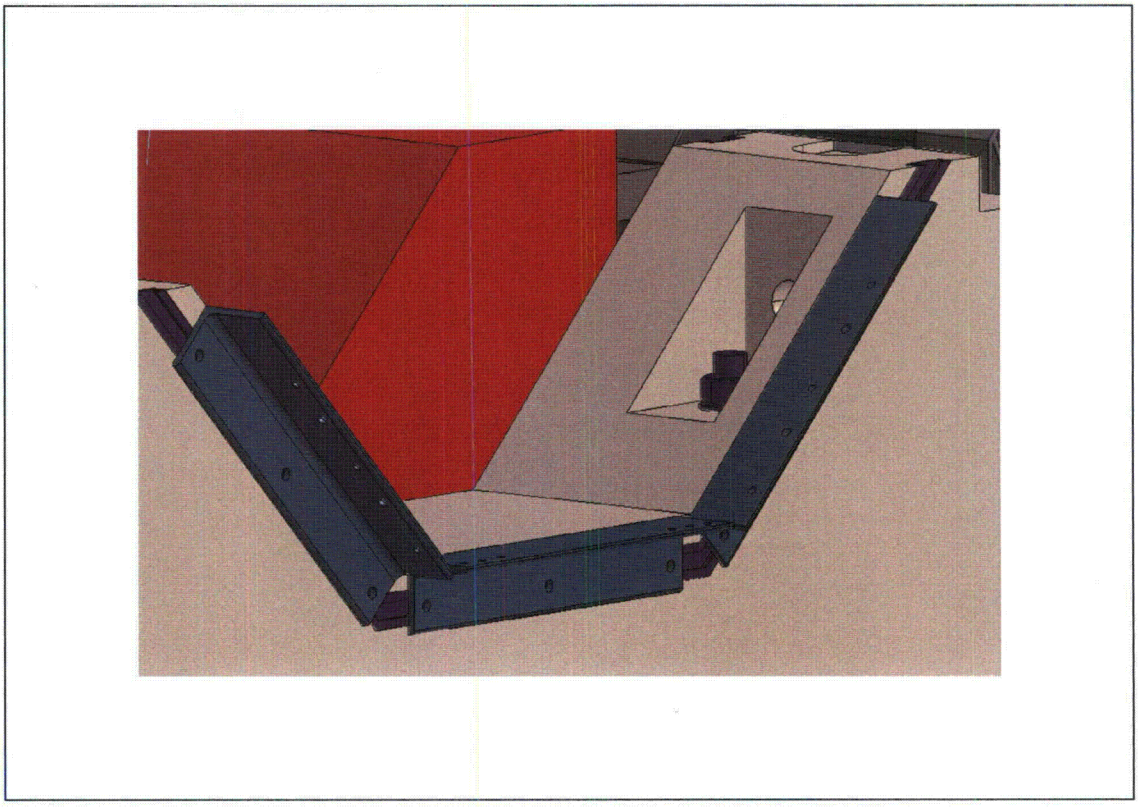

Figure 30 - Angle bracket for the wear protection

5.3.3 Positioning the floor slab

❑ Raise the upper strand of the conveyor belt far enough to enable the floor slab with the parts mounted on it to be pulled in so that it is aligned with the belt axis.

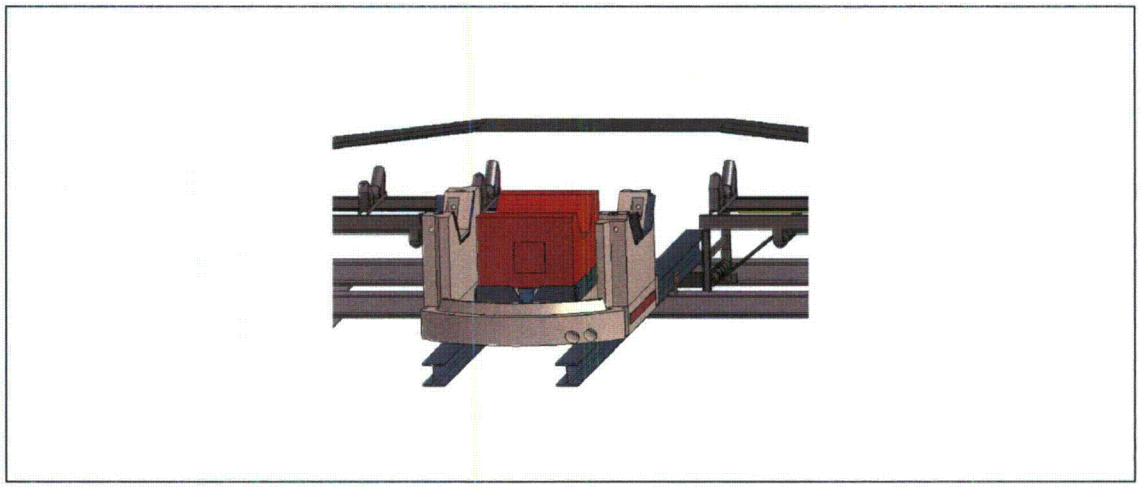

Figure 31 - Raising the conveyor belt

❑ Position the floor slab.

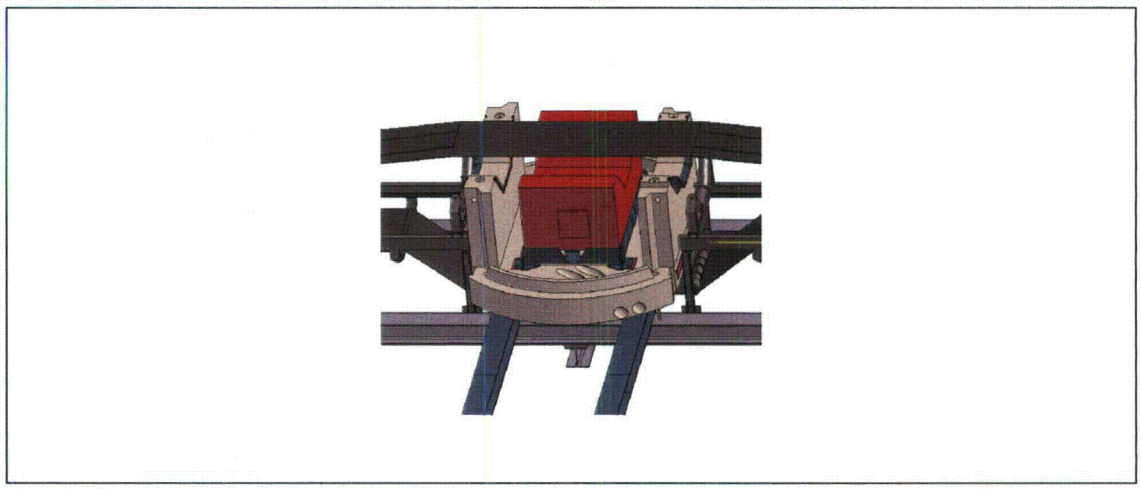

Figure 32 - Floor slab in position

❑ Lift the floor slab with the assembly crane and then remove the assembly aid. Remove the PE sliding strips. Align the floor slab on the mounting frame and lower it onto the holding-down bolts.

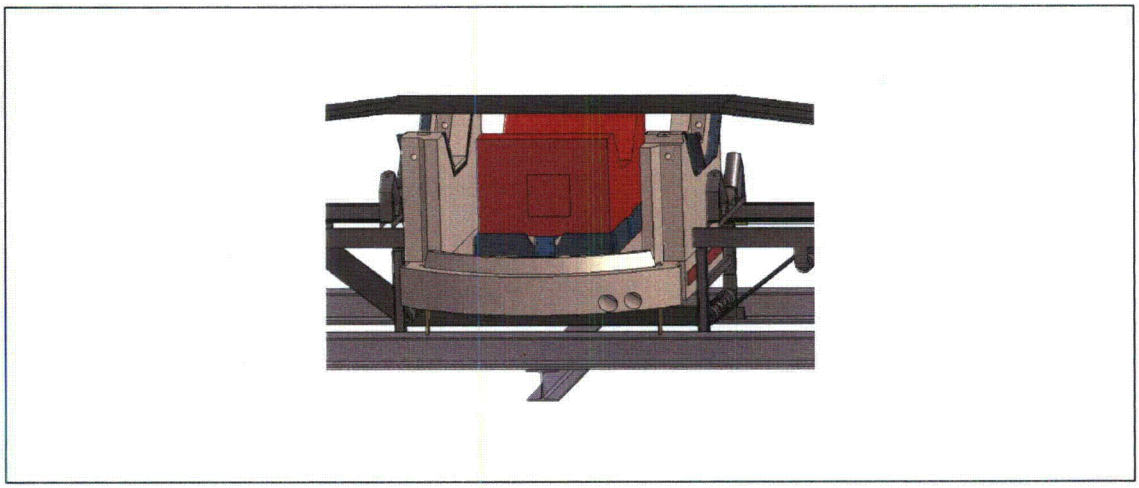

Figure 33 - Removing assembly aid

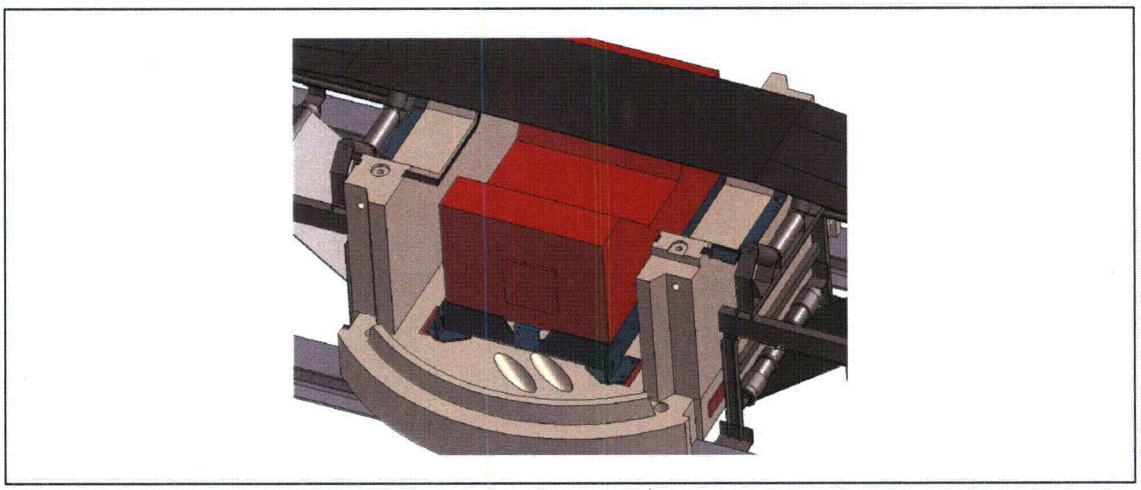

Figure 34 - Floor slab on the mounting frame

CAUTION
Precise alignment with the conveyor belt is of crucial importance. Make absolutely sure that it is carried out very carefully.

❑ Insert the lower wearing plate and screw it onto the end face in the direction of running. You cannot mount the lateral wearing plates until the side walls have been bolted together.

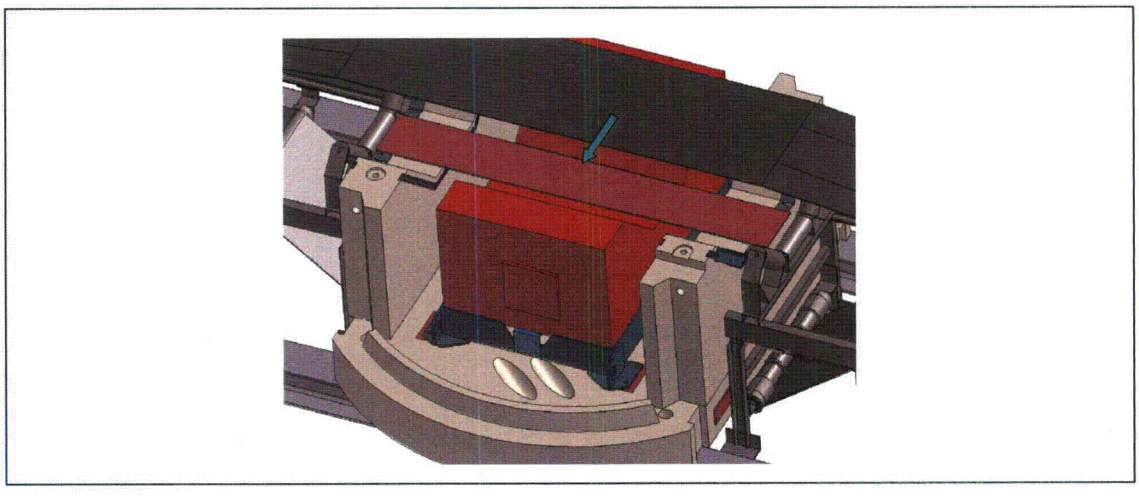

Figure 35 - Lower wearing plate

NOTE

Only attach the wearing plates on one-side with the supplied special screws. The screw heads are countersunk.

❑ Now lay the upper strand of the conveyor belt in the belt trough of the CNA enclosure.

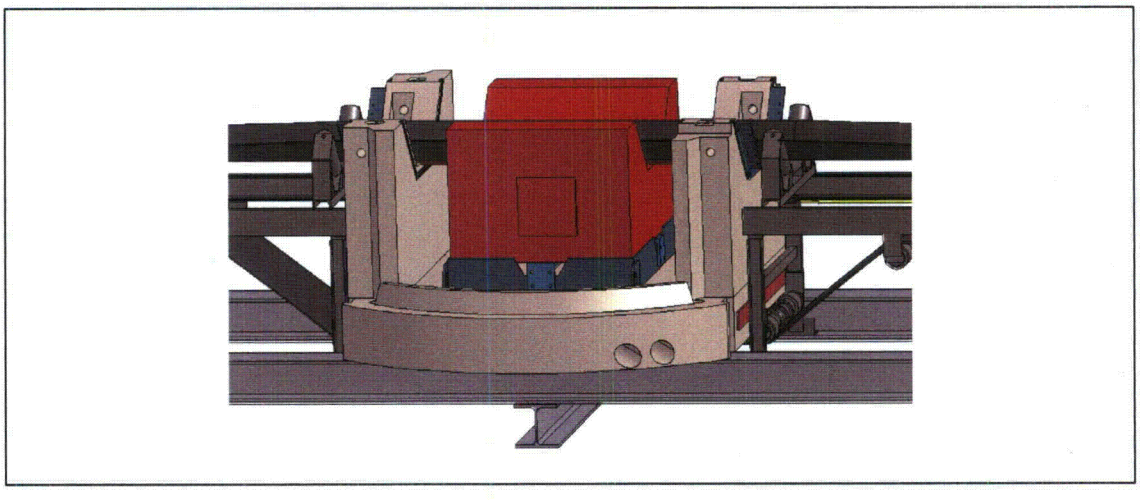

Figure 36 - Lowering the conveyor belt

- ❑ Fill the holes in the floor slab for the holding-down bolts with the supplied filler compound.

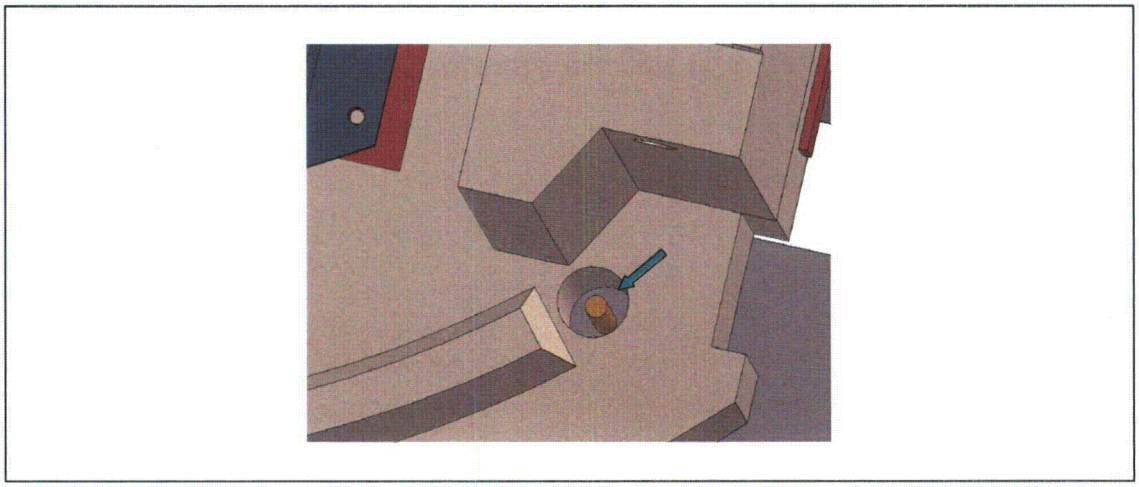

Figure 37 - Filling the foundation bolt holes

5.3.4 Assembling the upper shaped elements and the measuring cell

- ❑ Use a crane to lift the upper part (see Figure 27, reference mark 6) onto the lower part. Make absolutely sure that the hanging system for the cable (see Figure 27, reference mark 10-1) is in the same direction as the access hatch for the MEN.
- ❑ Bolt the upper part onto the lower part. Use the special key to screw in the 4 upper bolts (see Figure 27, reference mark 5) on each side. The special key is delivered in the « kit of accessories » box. Remove the red lifting eyebolts from the upper part.

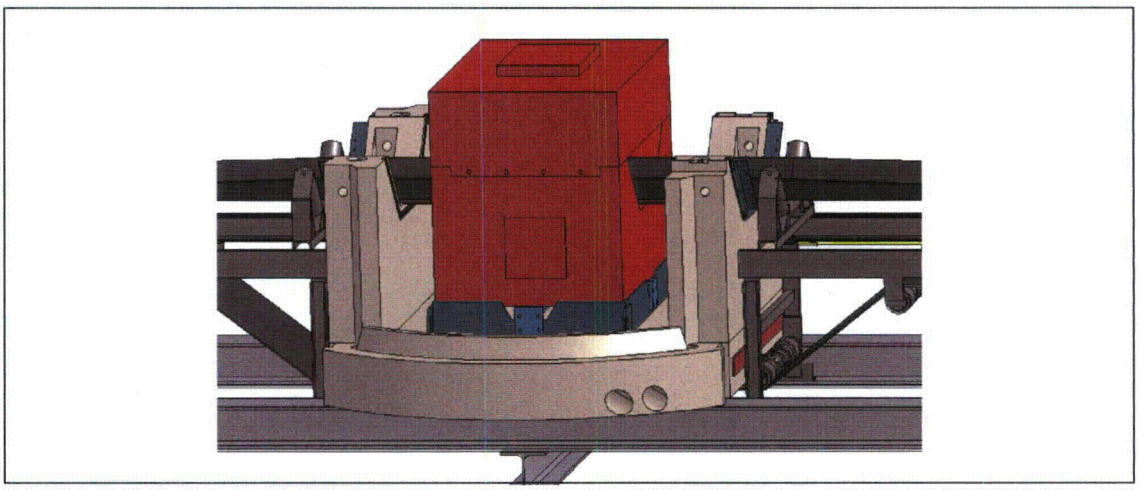

Figure 38 - Upper part of measuring cell

❑ Next, lower the upper shaped elements onto the lower part and bolt together.

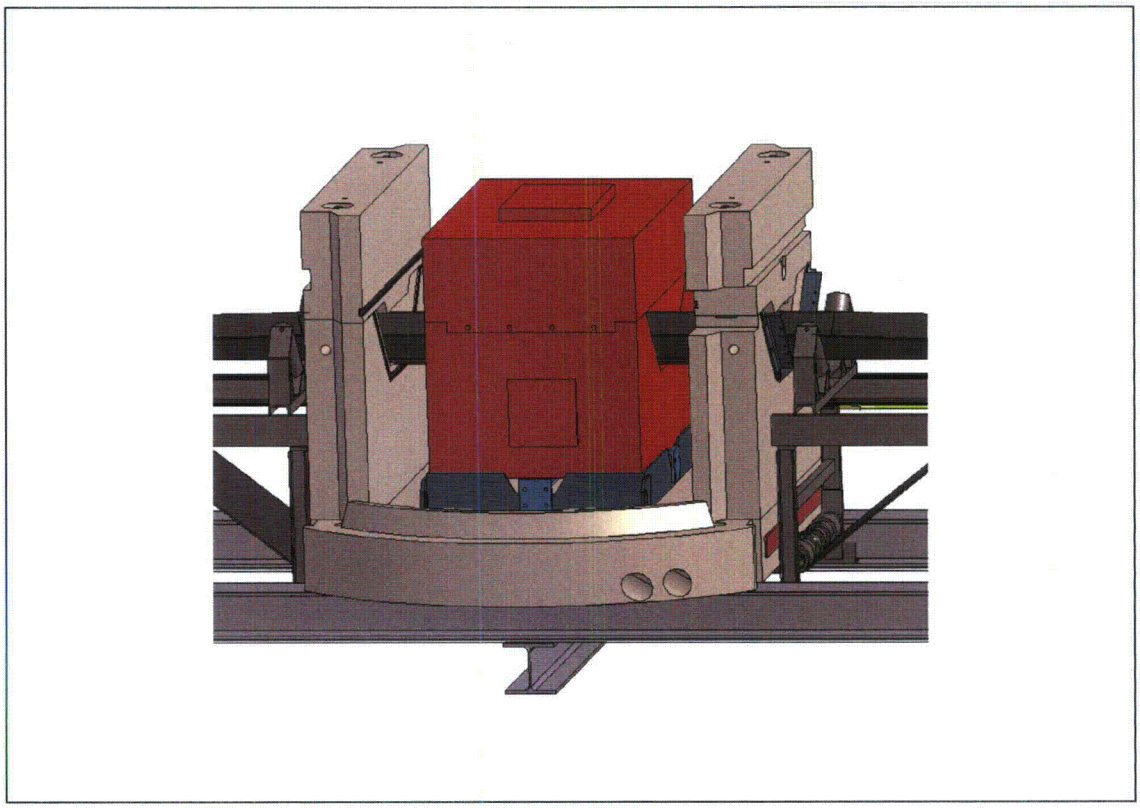

Figure 39 - Upper shaped elements

5.3.5 Installing the seal

The inside of the radiation protection enclosure is a self-contained chamber. Therefore, take great care with the fitting of the seal, in order to prevent the ingress of dust. Good fitting of the seal is also essential for proper functioning of the air-conditioner.

❑ Mount the PE flange for the seal on the inside of the shaped elements and on both sides of the measuring cell.

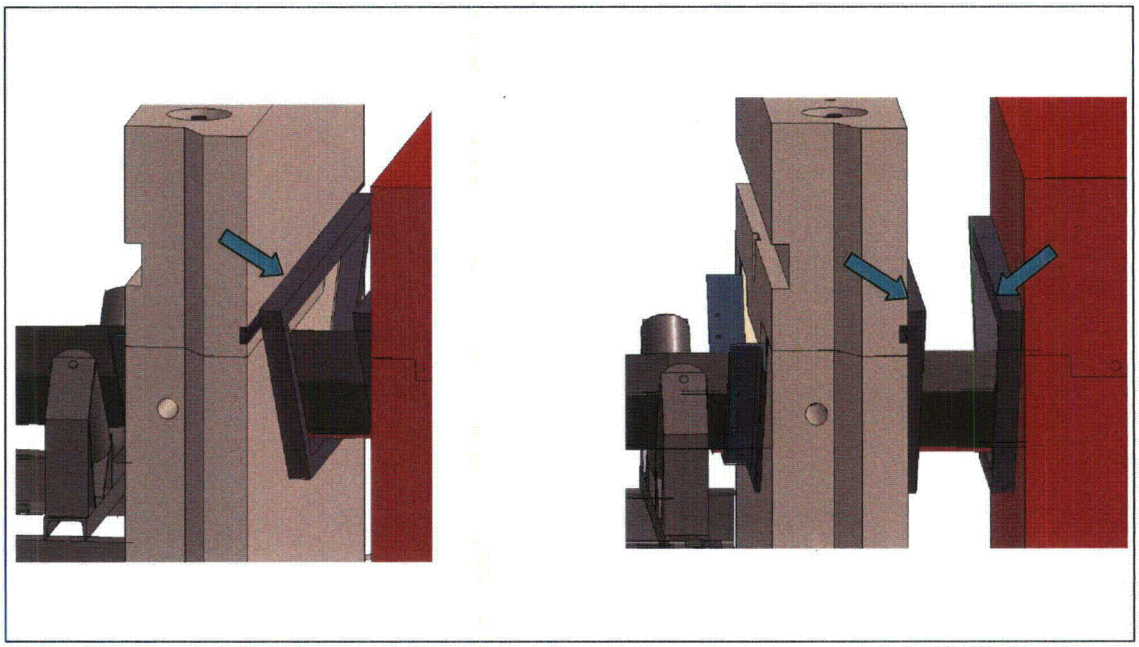

Figure 40 - PE flange

❑ Fit self-adhesive foam rubber seals all around the PE flange.

❑ Now place the PE sealing plates, which were previously connected by lugs, around the flange and pull them together using the tensioning device.

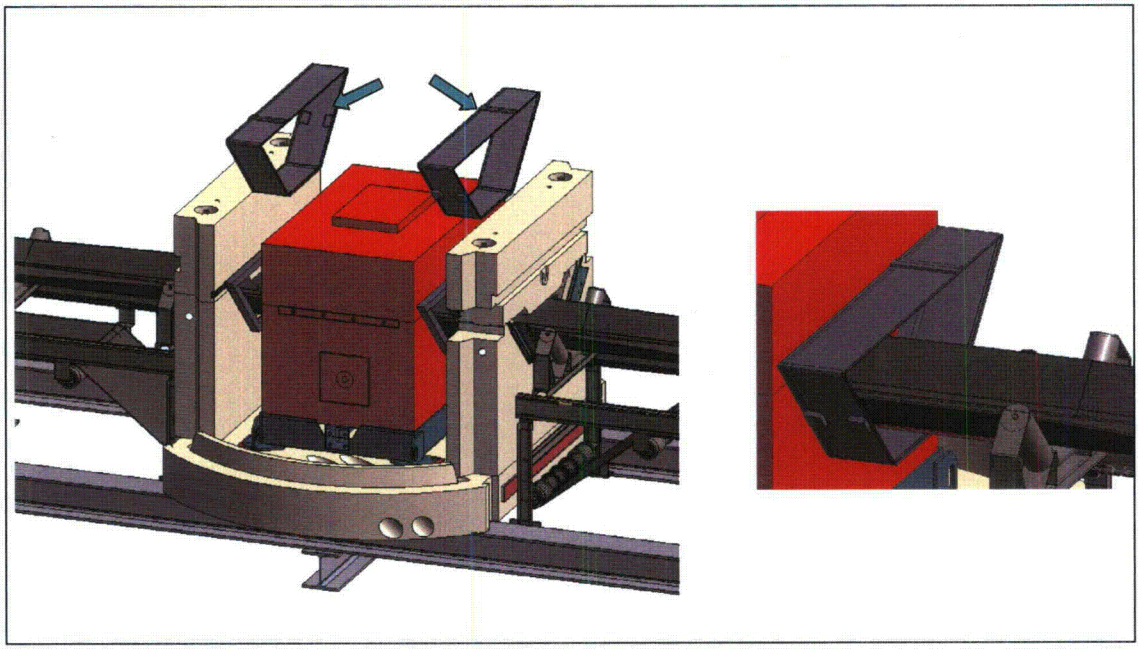

Figure 41 - Sealing plates

- This forms a seal enclosing the conveyor belt and sealing off the inside of the radiation protection enclosure from the environment.

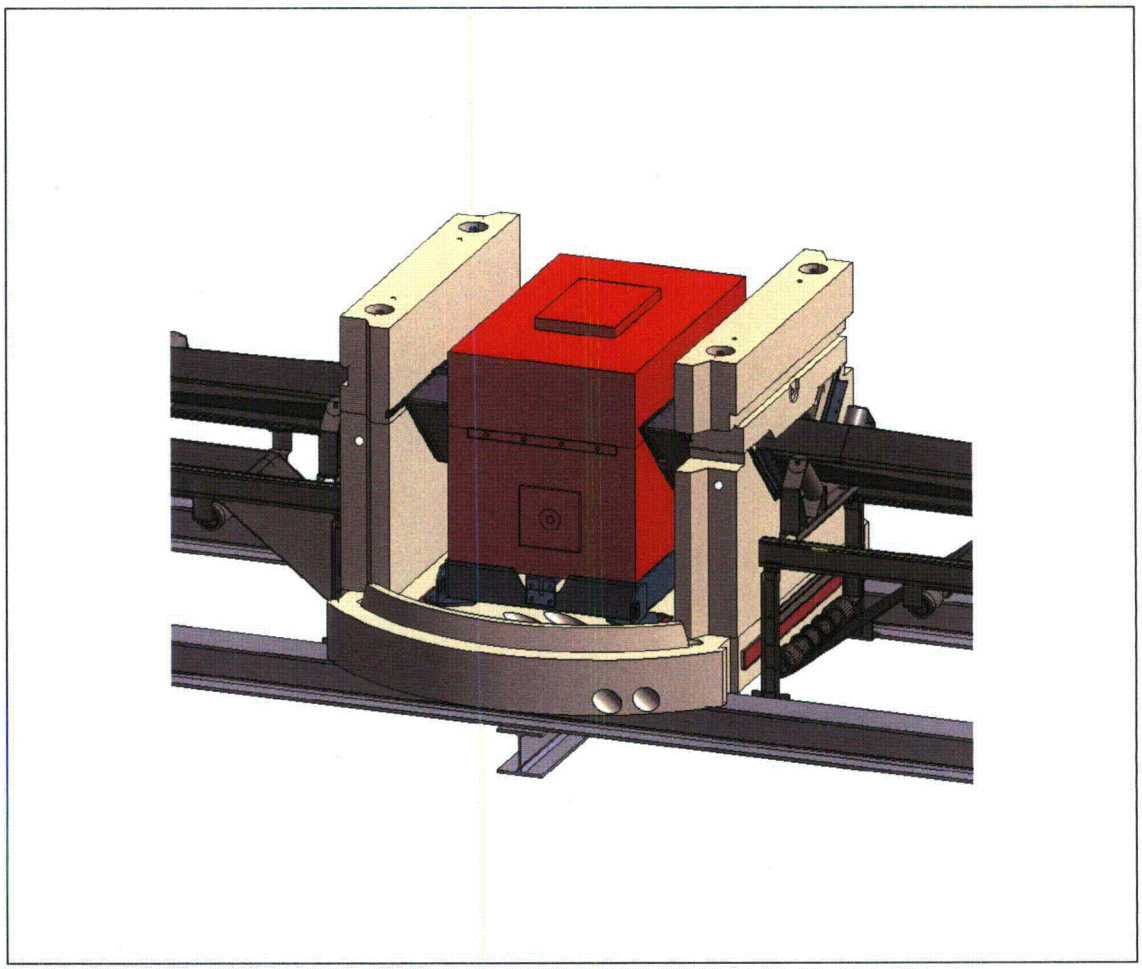

Figure 42 - Seal installed

- For insulation purposes, place a 20 mm thick foamed plastic strip around the PE sealing plates, and bond it together at the joint.

5.3.6 Cabling

Cables are in two sheaths. The first sheath is called the MEN sheath : it goes from the cabinet to the lower part of the measurement chamber. The second sheath is called the detectors' sheath. It goes from the cabinet to the upper part of the measurement chamber. There are labels on the sheaths to indicate which side goes to the shielding, and which side goes to the cabinet.

The available length between the rear of the cabinet and the two cable holes in the shielding is 12 meters. Choose a way for cables compatible with this maximum length.

Install cables so that they cannot be walked on by personnel or run over by vehicles. Don't place any heavy objects on the sheaths. Cables must not be installed where they can be covered by water. During installation, take care that water doesn't get inside the sheath. To install cables, pull out by the sheath and not by the cables.

Do not bend the cables or the sheath too much, even for a short time during installation.

The minimum radius must not be less than 350 mm.

5.3.7 Measurement chamber (Electrical Installation)

❑ Install the neutron counting electronic box (see Figure 43, reference mark 4 and Figure 44). This box and the screws are delivered in the « kit of accessories » box.

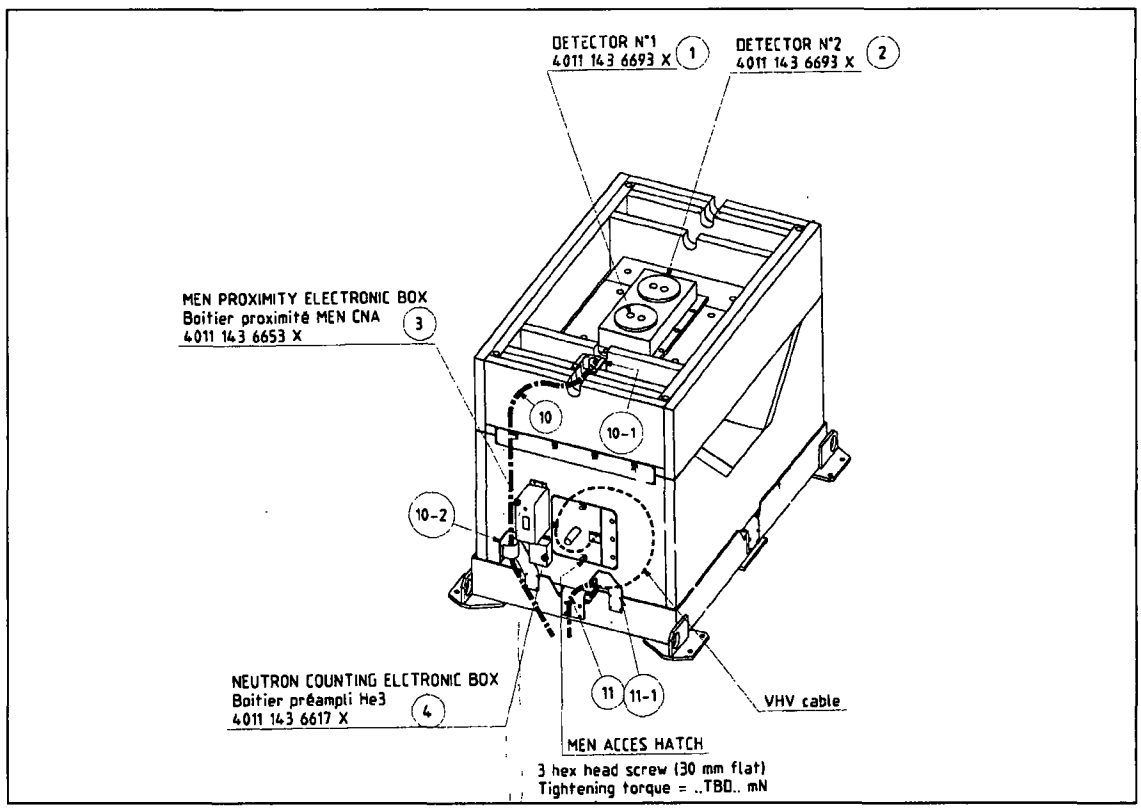

Figure 43 - Measurement Chamber, Electrical Installation

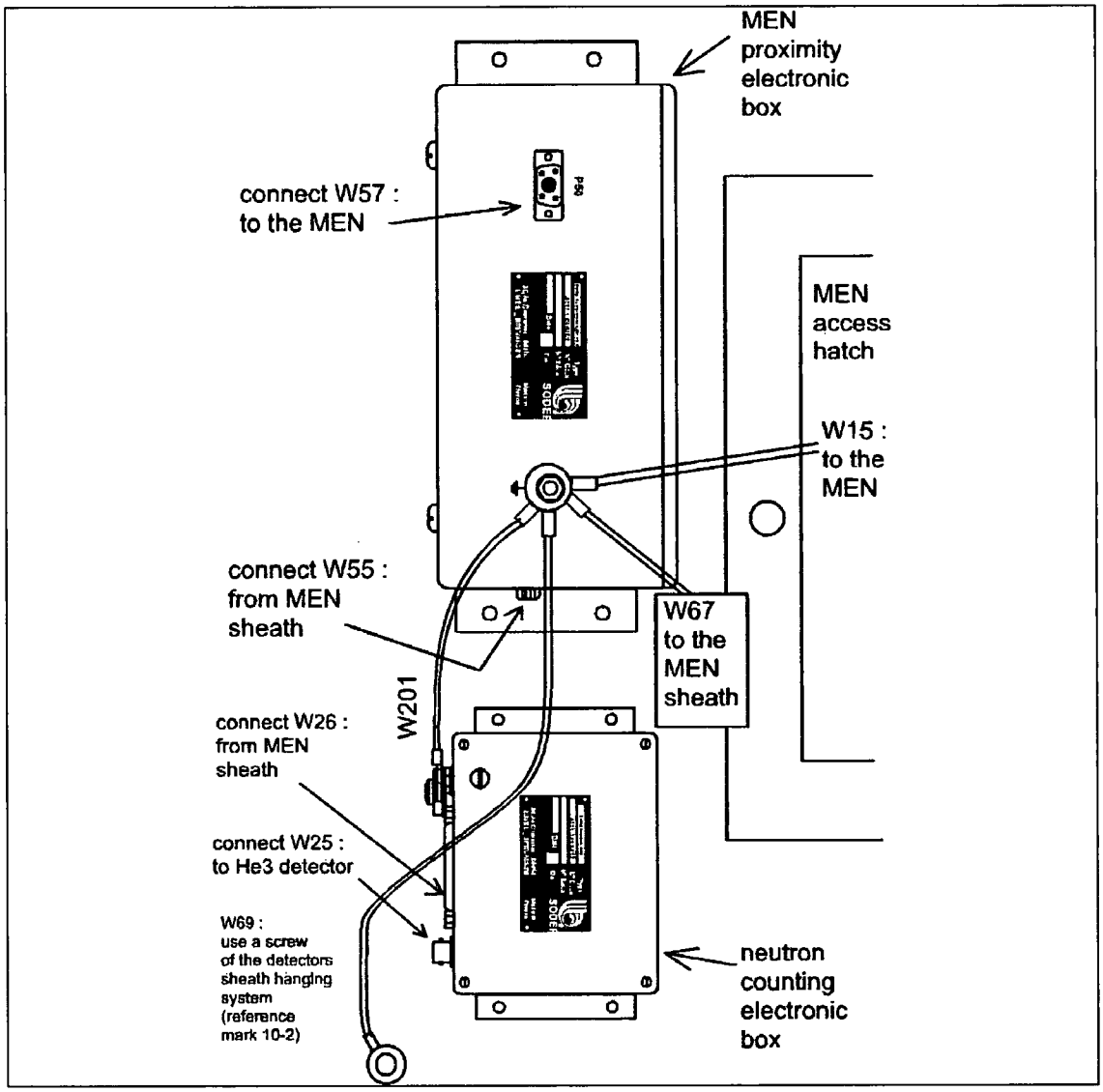

Figure 44 - Measurement Chamber, Electronics Boxes

- ❑ Install the MEN proximity electronic box (Figure 43, reference mark 3 and Figure 44). This box and the screws are delivered in the « kit of accessories » box.
- ❑ Install the two hanging systems for cables (Figure 43, reference mark 10-2 and 11-1). These systems and the screws are delivered in the « kit of accessories » box.
- ❑ Pass the detectors' sheath through the left-hand hole of the shielding. Make absolutely sure that it is the right way round : There is a label at each sheath end to indicate the shielding end and the cabinet end. The detectors' sheath should reach about 1.5 meters beyond the shielding. The socket and the nut for the detectors' sheath are delivered in the « kit of accessories » box.

- ❑ Pass the detectors' sheath (Figure 43, reference mark 10) through the first hanging system (Figure 43, reference mark 10-2) and fix it to the second hanging system (Figure 43, reference mark 10-1).
- ❑ Pass the MEN sheath through the right-hand hole of the shielding. Make absolutely sure that it is the right way round : There is a label at each sheath end to indicate the shielding end and the cabinet end. The MEN sheath should reach about 0.5 meters beyond the shielding. The socket and the nut for the MEN sheath are delivered in the « kit of accessories » box.
- ❑ Fix the MEN sheath (Figure 43, reference mark 11) to its hanging system (Figure 43, reference mark 11-1).
- ❑ Connect the earth on the MEN proximity-electronic box : W67 from the MEN sheath, W69 to the mechanical structure and W201 to the neutron-counting electronic box (Figure 44). W201 and W69 are delivered in the « kit of accessories » box. See details .
- ❑ Connect all the cables (Figure 44) .
- ❑ Connect W25 to connector P25 of the neutron-counting electronic box (Figure 43 reference mark 4).
- ❑ Connect W26 to connector P28 of the neutron-counting electronic box (Figure 43 reference mark 4).
- ❑ Connect W55 to connector P47 of the MEN proximity electronic box (Figure 43 reference mark 3)
- ❑ Remember, and make allowance for the fact that other cables are still to be connected (W62 for the safety loop, W107 and W117 for the air conditioner).

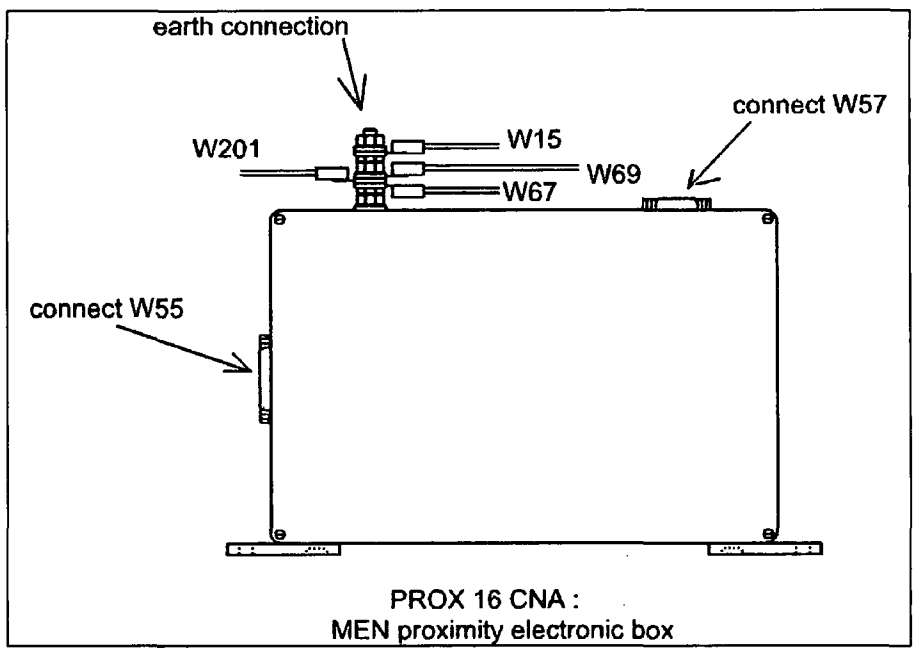

Figure 45 - Earth (ground) connection of the PROX 16G

5.3.8 Detectors

NOTE
The detectors must always be installed in the presence of the commissioning engineer, or by the commissioning engineer himself. After the closure plug in the cover slab has been removed, the further procedure is straightforward.

CAUTION
Detectors are very fragile, very expensive, and heavy. Be sure to handle them with the utmost care. Detectors can be broken by shocks or temperature variations.

Temperature variations at the detectors should be less than 5 °C per hour. This is very important to avoid destruction of the detectors. The only way to limit the temperature variation to this very small amount is:

- ❑ Place the closed detectors box near the shielding, at least 24 hours before installation. If the CNA is to be installed in the open air, place the box in the open air (but protected against rain and sun). If the CNA is to be installed inside a building, place the box in this building.
- ❑ Do not open the detector box until you everything is ready for installation of the detectors.
- ❑ Install the detectors (as described later) as quickly as possible and protect if necessary against rain and sun until the shielding has been closed.

NOTE
Always hold the detectors by the provided handles only.

After opening the box, proceed in the order stipulated below:

- ❑ Remove the plastic bubble sheeting around one of the detectors.
- ❑ Take out the grey resin pot and place the detector upright on a flat surface.
- ❑ Remove the red cover from the detector hole on top of the measurement chamber. If the label on the detector has the number « 1 », remove the front cover (MEN access hatch side). If the label on the detector has the number « 2 », remove the rear cover (opposite to the MEN access hatch).
- ❑ Place the resin pot in the hole.
- ❑ Take the detector by the two handles and place it in the hole. Center it carefully, so that it fits in the resin pot. Make sure that the white cover of the detector is at the same level as the white cover of the detector box.

- ❑ Repeat items 1 to 5 with the second detector.
- ❑ Connect up cable W1 on the detector with label 1, and cable W2 on the detector with label 2. Lock the two screws of each connector.
- ❑ Protect detectors against rain and sun until the shielding has been closed.

5.3.9 MEN and He 3 Detector

NOTE
The MEN must always be installed in the presence of the commissioning engineer, or by the commissioning engineer himself. After the maintenance door in the side wall has been removed, the further procedure is straightforward.

DANGER
All the security regulations described in the «MEN 16G Neutron Emitting Module safety instructions» are applicable to the MEN, even during transportation. See annex 1.

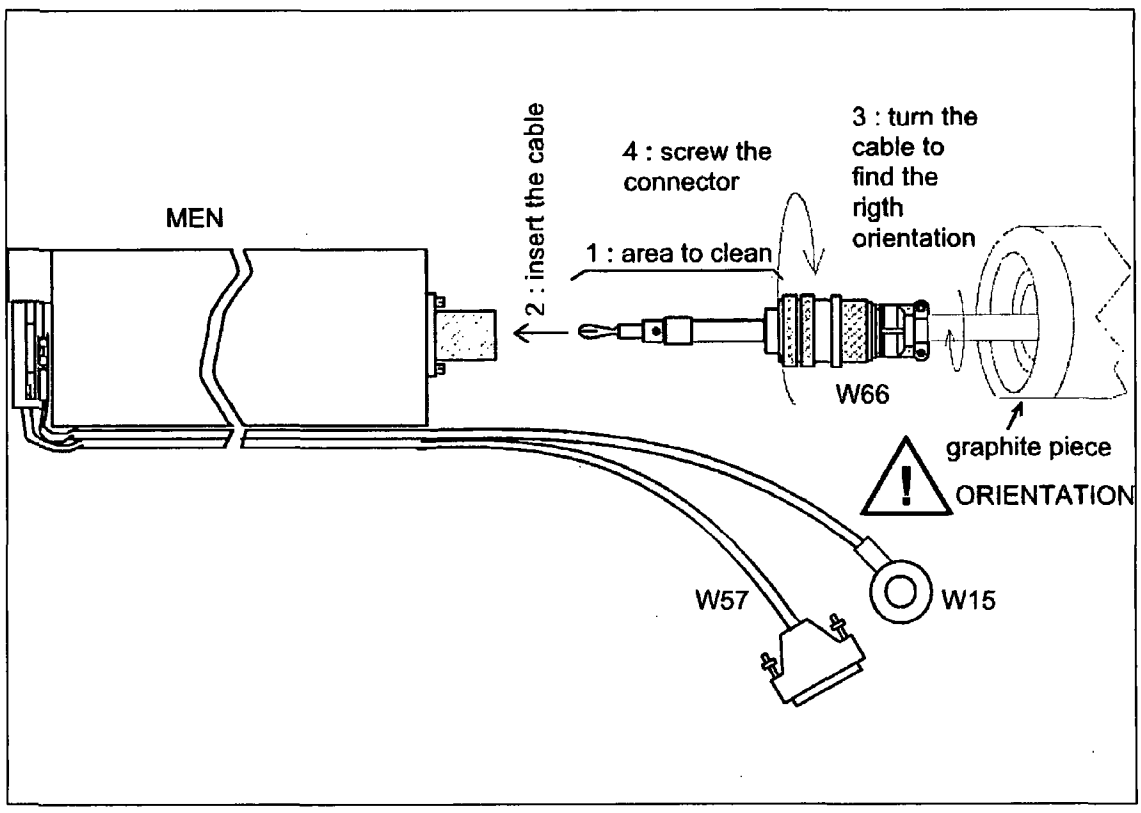

Figure 46 - Installation and cabling of the MEN

Installation

- ❑ Check that the high voltage cable (W66) is not connected to the cabinet.
- ❑ Take the small graphite piece in the « kit of accessories » box and pass the cable W66 through this piece. This piece is very fragile. Make absolutely sure that it is the right way round (see Figure 46).
- ❑ Clean the end of the high voltage cable (W66) with a clean non-fluffy rag, and with alcohol.

NOTE

This point is extremely important. The MEN can be destroyed if the VHV cable is not clean.

- ❑ Remove the red cover on the VHV connector of the MEN and check that no foreign matter has entered the hole.
- ❑ Insert the high voltage cable (W66) into the high voltage connector of the MEN. Turn the cable, in order to put the connector in the right position (see Figure 46).
- ❑ Always turn and grip the connector with your hand (NEVER USE ANY TOOL). It should reach to about the middle of the socket (if this is not possible, contact KRUPP POLYSIUS).
- ❑ Insert the MEN into the hole. Turn it, so that cables W15 and W57 are below the MEN and are placed in the groove. Push on the MEN until it reaches the bottom of the hole.
- ❑ Insert the small graphite piece : make sure that it is aligned with the main graphite piece.
- ❑ Connect the He3 detector to the cable W25. The He3 detector and the cable W25 are delivered in the « kit of accessories » box. Take the utmost care because the detector is very fragile.

- ❑ Install the He3 detector in the hole near the MEN. Passthe cable W25 out of the measurement chamber, using the hole in the access hatch of the MEN.

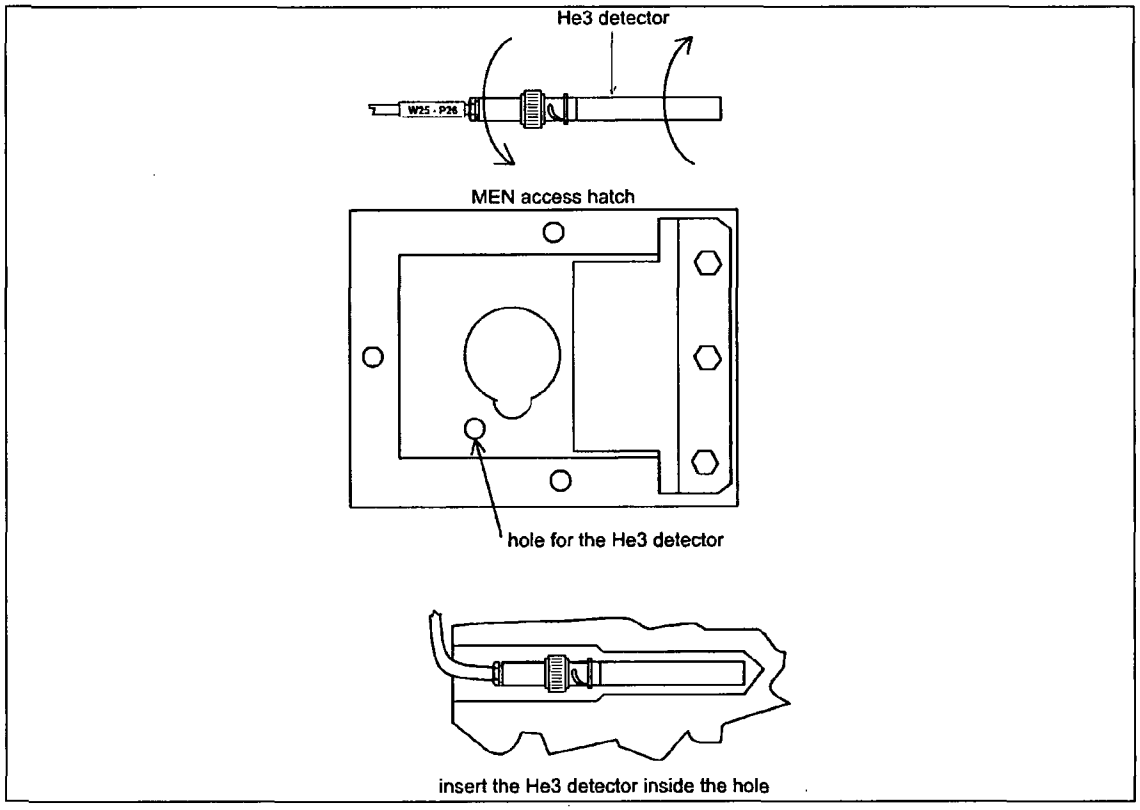

Figure 47 - Installation of the He3 detector

- ❑ Close the MEN access hatch. The left part and the screws are delivered in the « kit of accessories » box. Make sure that the cables (3 for the MEN and 1 for the He3 detector) pass through the hole of the hatch. Be careful with the nylon screws, they are fragile. Their maximum tightening torque is 50 N.m.
- ❑ Connect the earth (ground) cable (W15) to the earth (ground) point of the MEN proximity-electronic box.
- ❑ Connect W57 to P50 of the MEN proximity-electronic box (see Figure 44).

5.3.10 Mounting the side walls

- ❑ Position the side wall without a door, using the assembly crane. If the CNA is being installed in an inclined position, adapt the length of the carrying rope to the angle of installation.
- ❑ Align the side wall and slide it into the fitting piece of the floor slab.

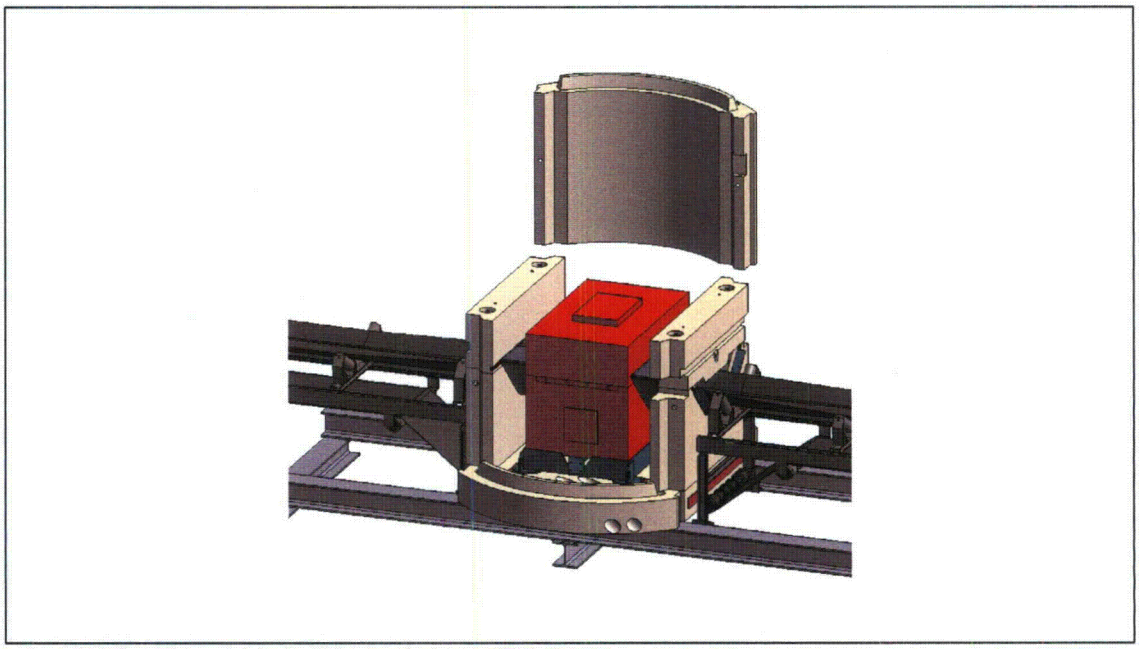

Figure 48 - Side wall without door

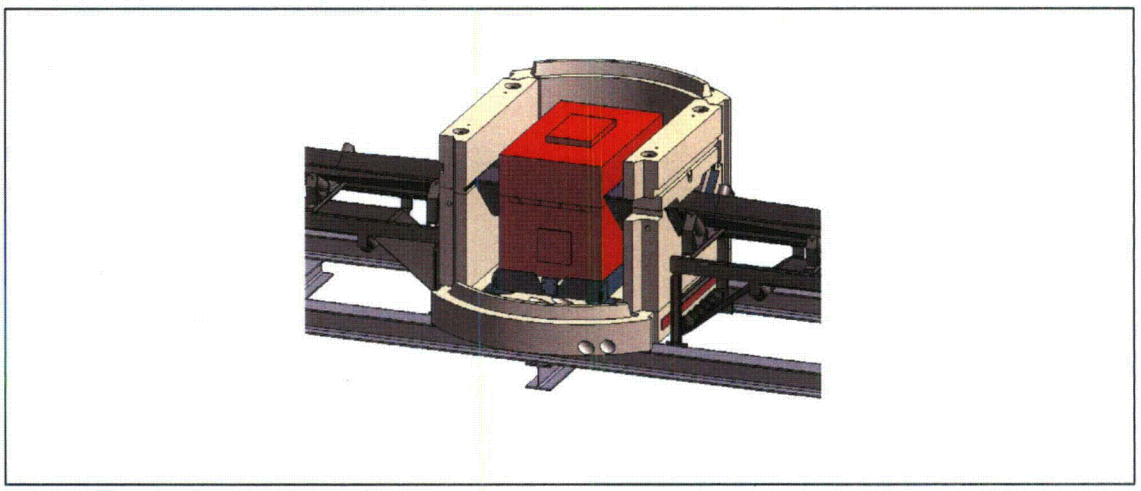

Figure 49 - Side wall without door, installed

- ❑ Insert the M36 threaded rods laterally through the lower shaped elements into the side wall and tighten it using the washers and nuts.

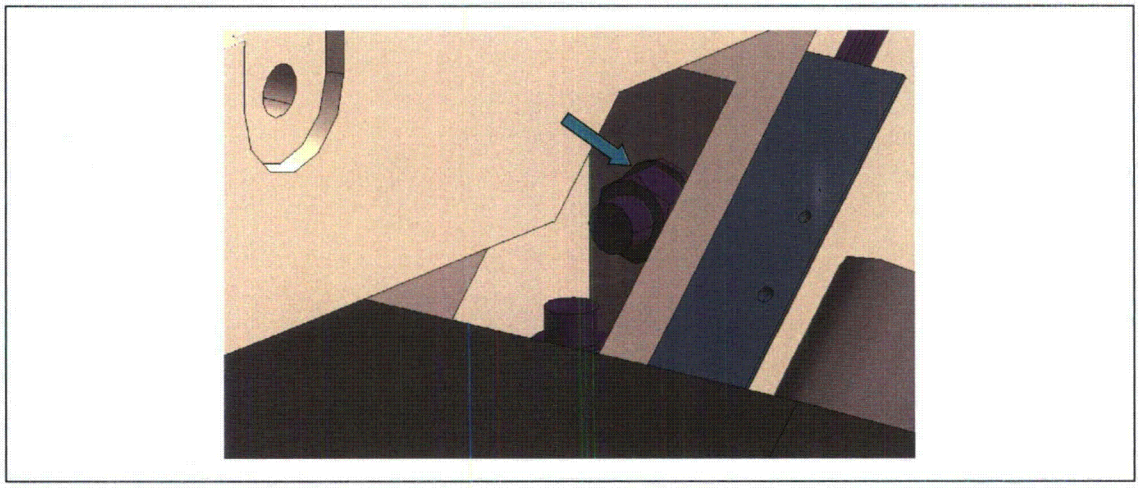

Figure 50 - Bolting side walls together

- ❑ Now mount the side wall with a door in the same sequence (Figure 51 and Figure 52). The maintenance door provides access to the tube.

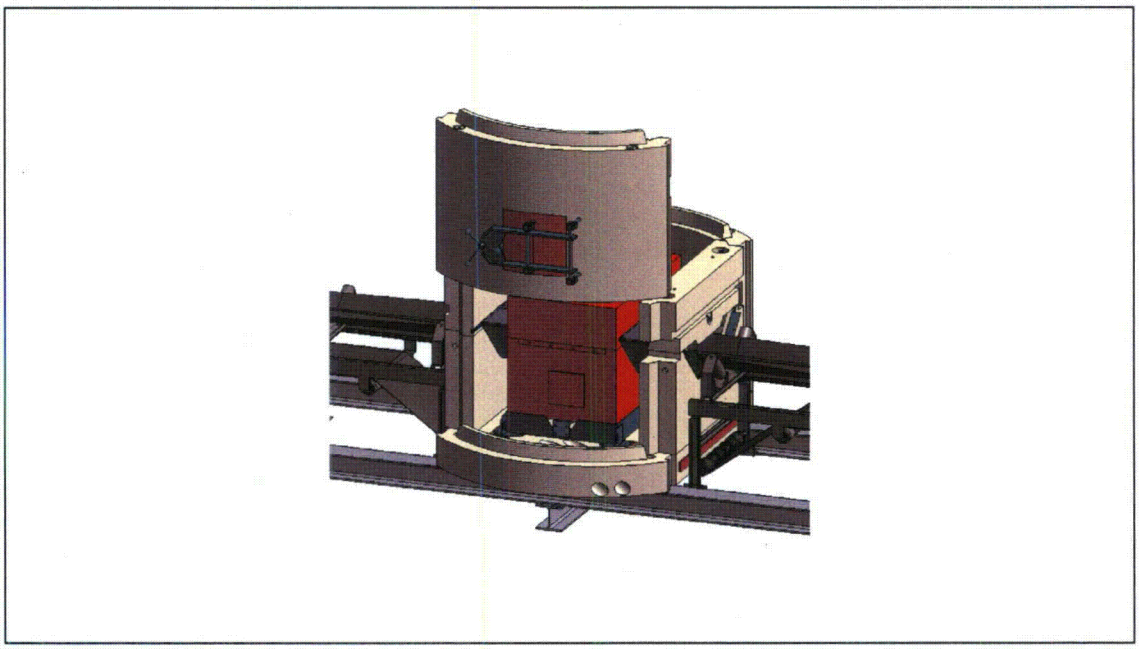

Figure 51 - Side wall with door

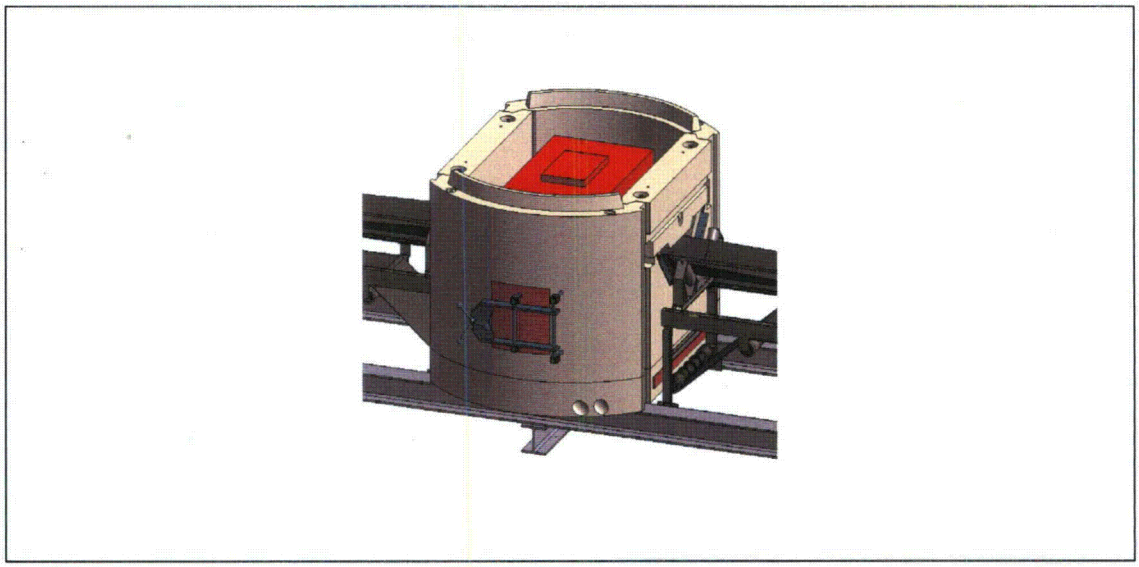

Figure 52 - Side wall with door, installed

- ❑ Connect W62 to the safety switch installed on the MEN access hatch.
- ❑ Connect the switches so that the loop is opened if the shielding is opened more than 5 mm.

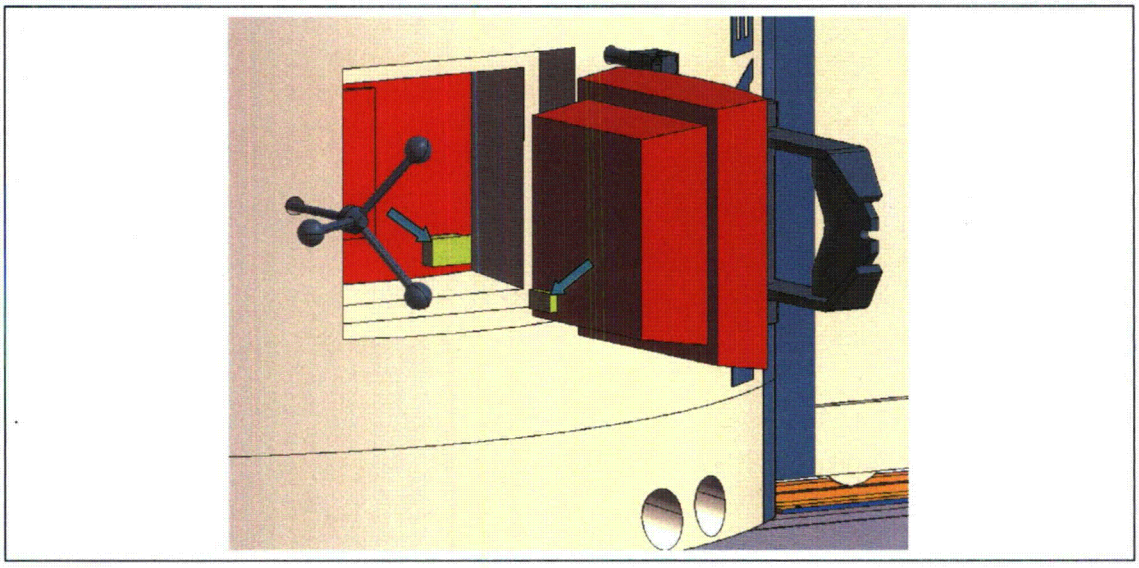

Figure 53 - Safety limit switch

5.3.11 Mounting compensating plates and lateral wear protection

❑ In the case of conveyor belt widths 800 and 1000 mm, the respective compensating plates have to be bolted onto the angle brackets of the lower shaped elements.

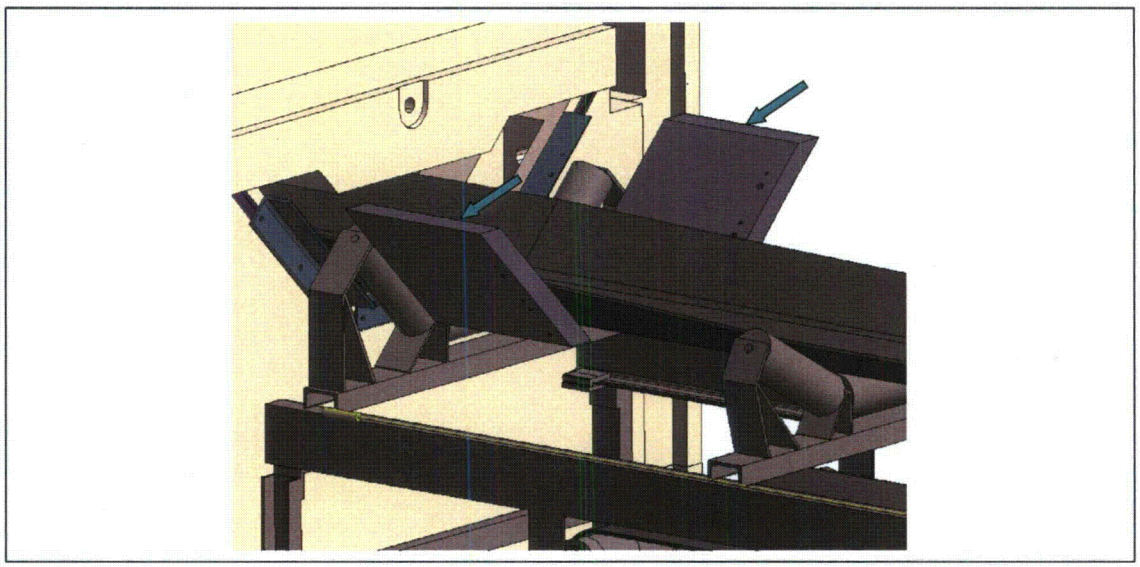

Figure 54 - Compensating plates

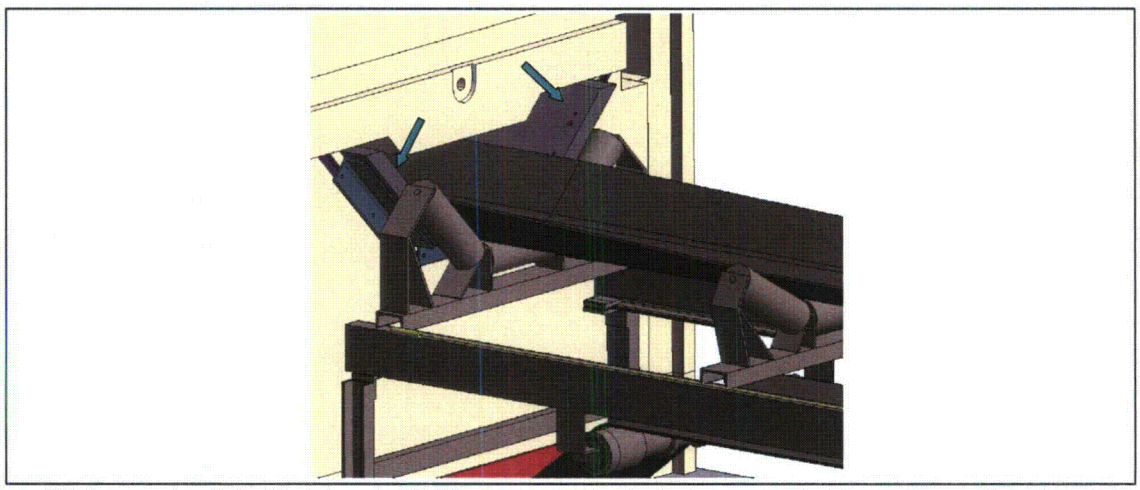

Figure 55 - Compensating plates installed

❑ Then insert the lateral wear-protection plates into the analyser housing and bolt them on. To simplify this procedure, raise the conveyor belt a little.

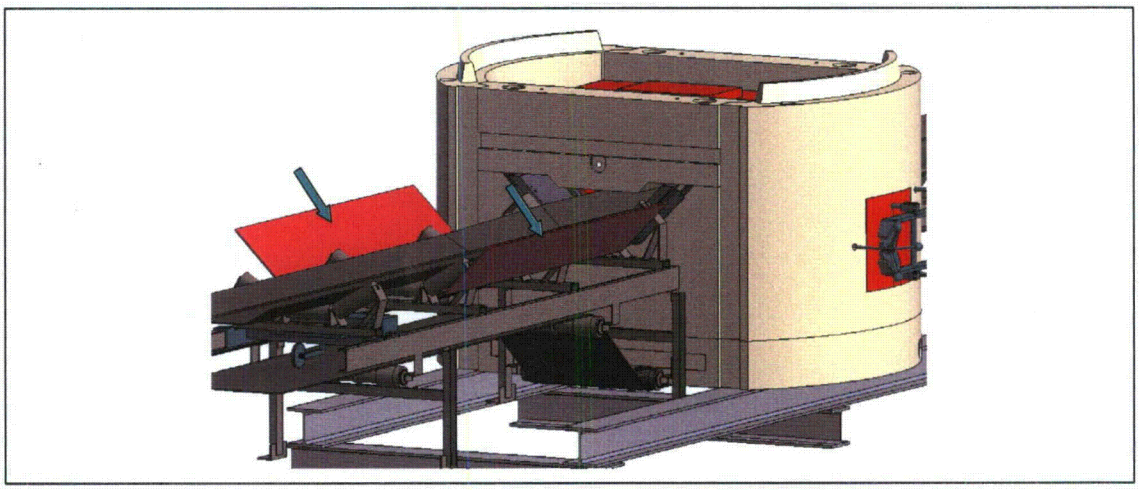

Figure 56 - Wear protection

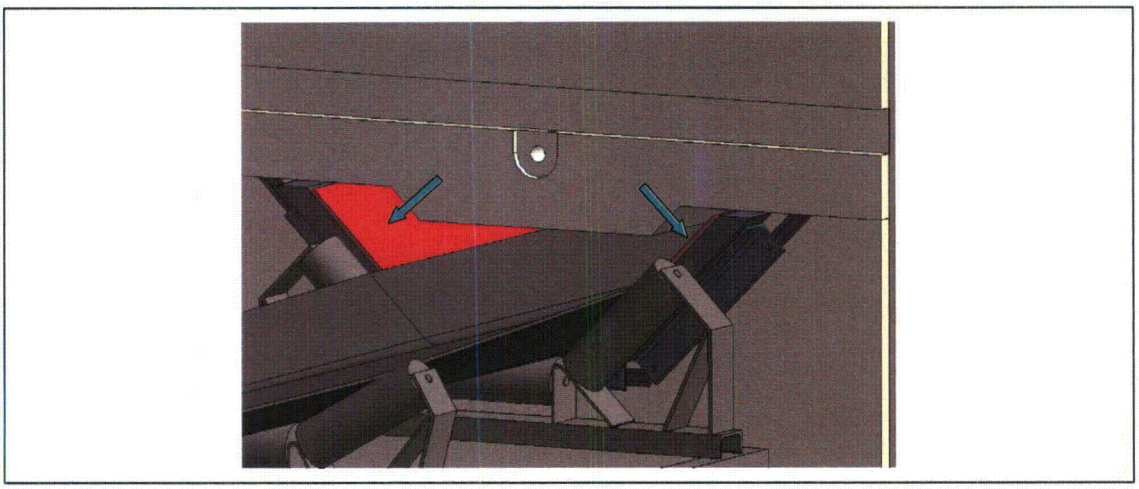

Figure 57 - Wear protection, installed

CAUTION

Only attach the wear-protection plates on one-side in the direction of running.

5.3.12 Aligning conveyor belt and trial run

- ❑ Mount an idler stand with 45° idler inclination up-belt and down-belt of the analyser. Set the height of the idler stand up-belt of the analyser so that the conveyor belt runs into the analyser at a height approx. 10 mm above that of the wear protection. This ensures that vulcanization points or uneven areas of the belt cannot damage the wear protection.

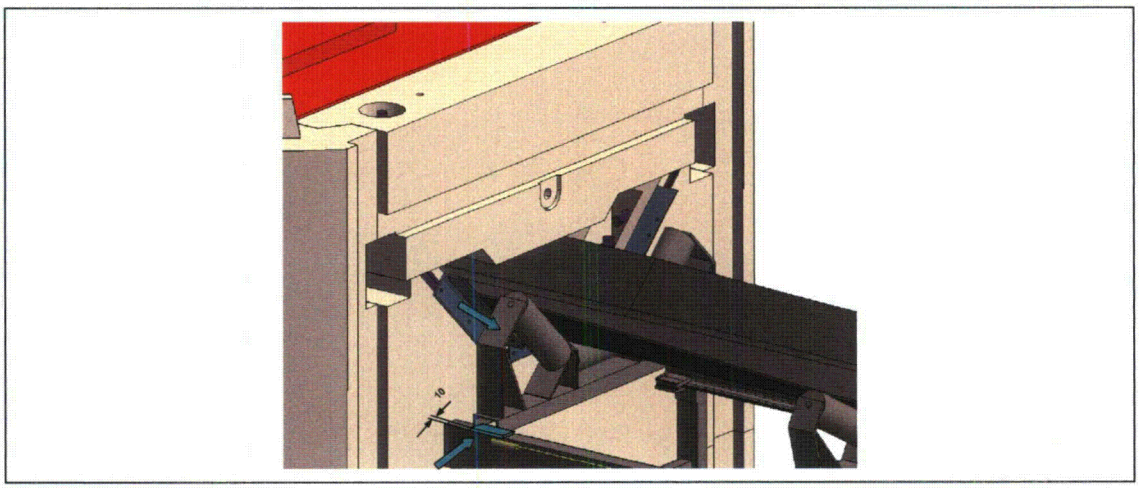

Figure 58 - Aligning idler stand

- ❑ Do a trial run of the conveyor belt.
- ❑ Set the misalignment stop switch and check for correct functioning.
- ❑ The max. permissible skewing of the belt is ± 50 mm.

5.3.13 Mounting of the cover slab

❑ Screw the 4 M36 threaded rods into the side walls. Position the cover slab using the assembly crane. With the threaded rods passing through the holes in the cover slab, insert the slab into the fitting pieces of the side walls. Bolt the cover slab and the side walls together.

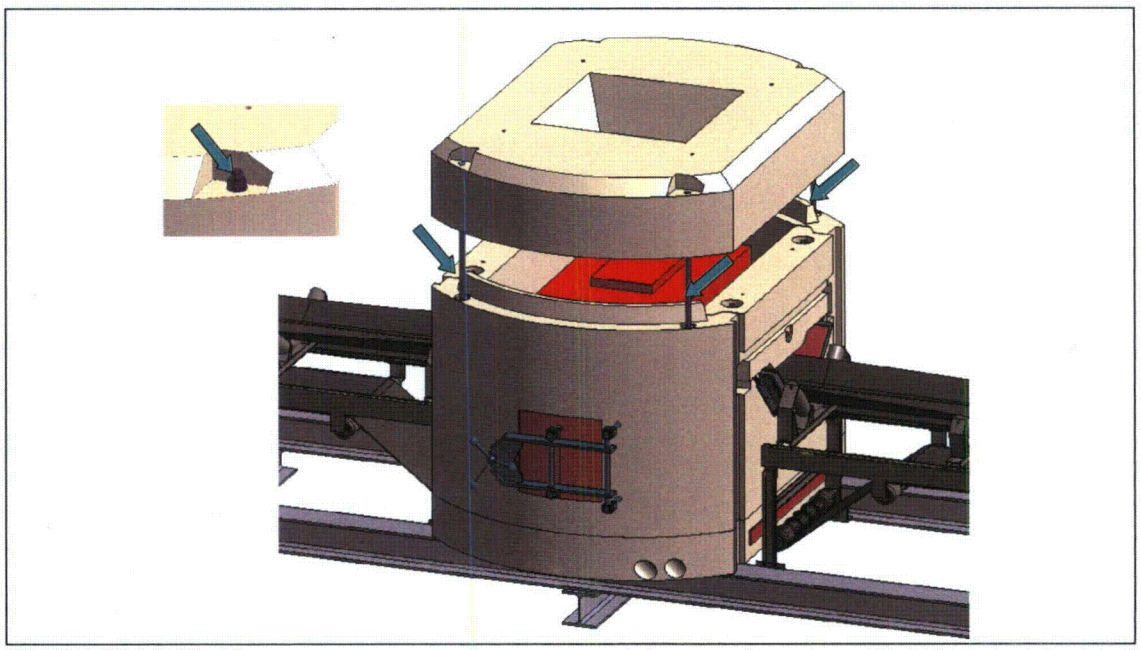

Figure 59 - Cover slab

❑ Insert the PE plug into the maintenance opening and then cover the opening by inserting the closure plug.

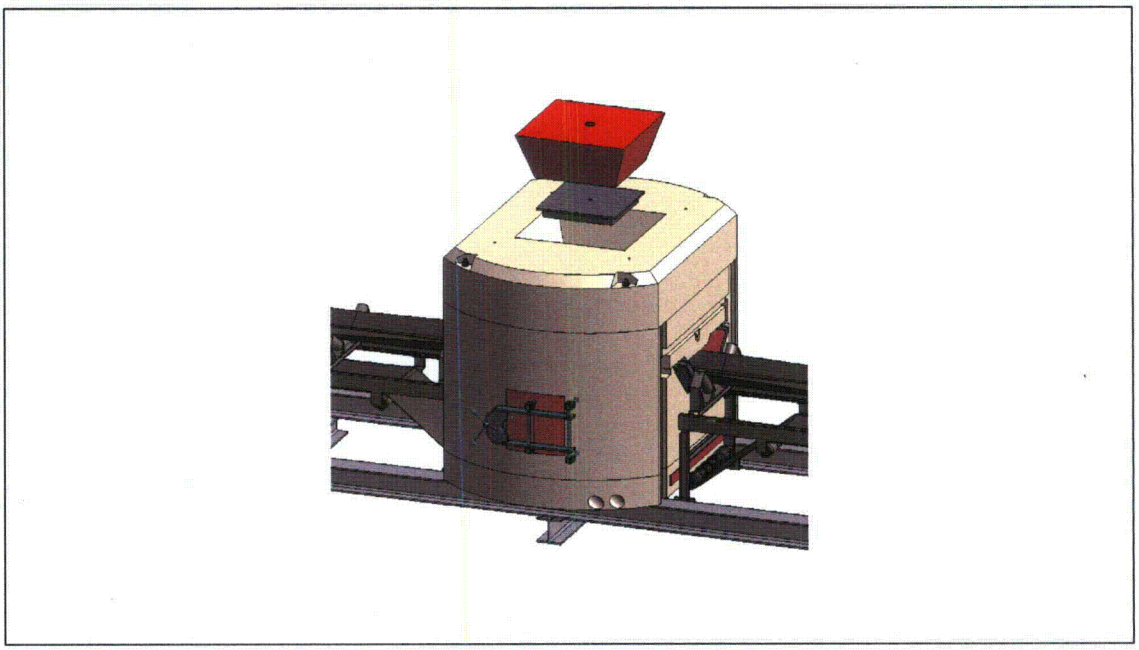

Figure 60 - Cover slab with closure plug

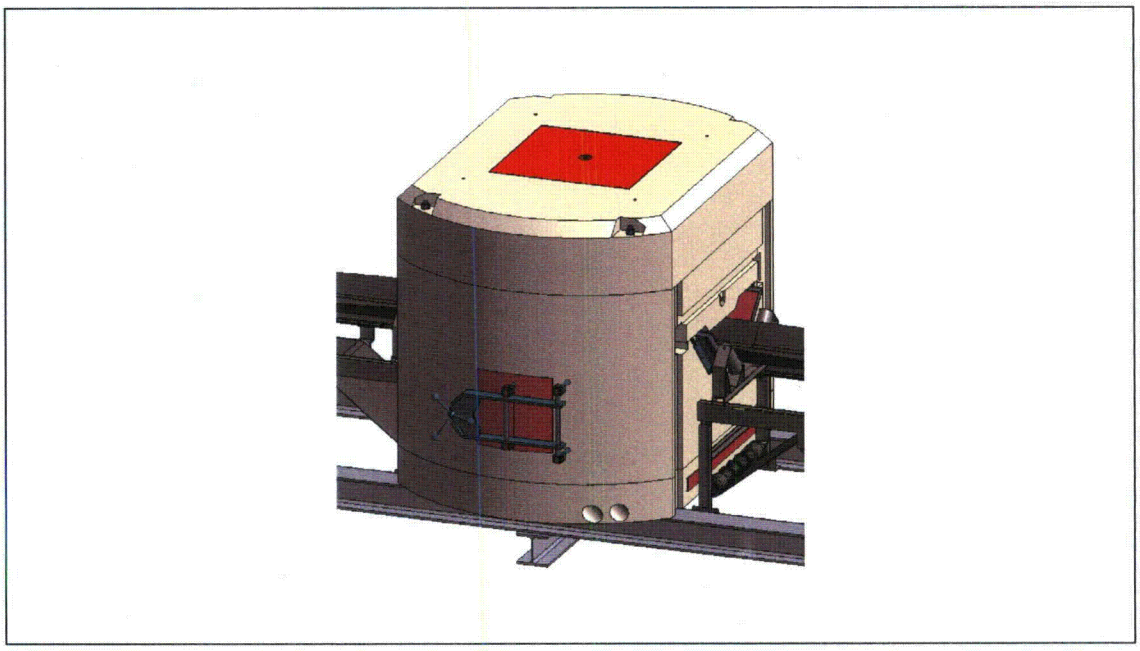

Figure 61 - Mounted cover slab with closure plug

5.3.14 Mounting of the tunnel

- ❑ Align the rails in conformity with the drawing, but don't bolt them onto the foundation frame.

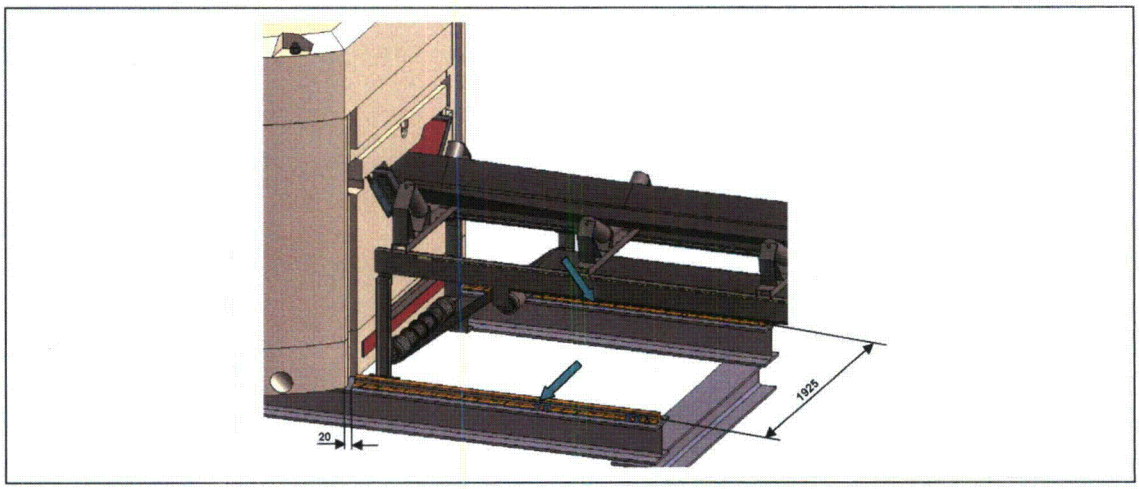

Figure 62 - Rails for tunnel

- ❑ Lift the tunnel using the assembly crane and mount the wheel sets.
- ❑ The height of the wheel sets is adjustable, so you can adapt the height of the tunnel to that of the radiation protection enclosure.
- ❑ Mount the end position interlock device at the ends of the tunnel.
- ❑ If the CNA is being installed in an inclined position, mount a hydraulic cylinder on the tunnel roof, to permit movement of the tunnel for maintenance purposes. In the case of horizontal CNA installation, the tunnel can be moved manually.

- ❑ Screw the cylinder support into the M36 threaded insert in the tunnel roof. Attach the hydraulic hoses to the cylinder and make the connection to the plug couplings of the cover trough. Mount the cover trough on the tunnel roof.

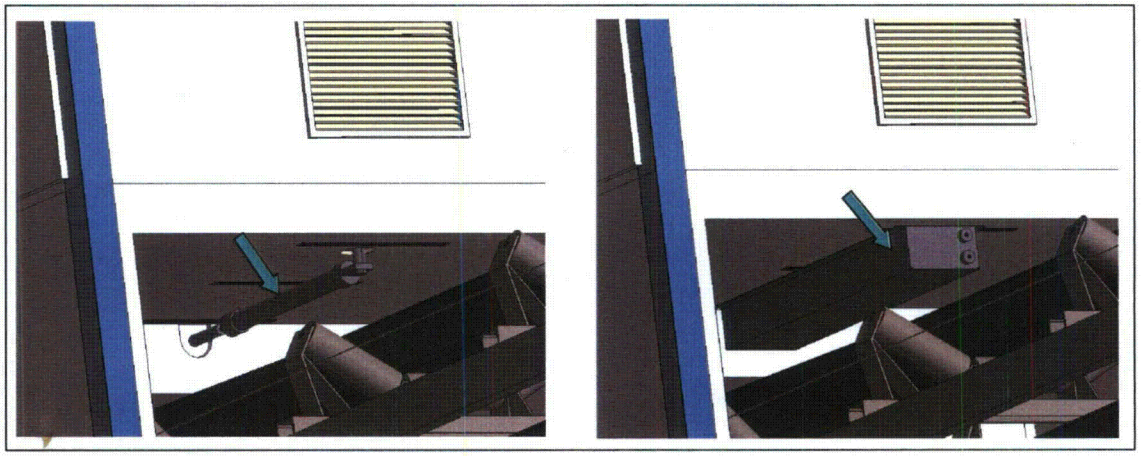

Figure 63 - Hydraulic drive unit with protective cover

- ❑ You must use the supplied special screws for fastening the trough.

NOTE
Be sure always to mount the tunnel with the recesses for the air-conditioner on the right, when looking at the front (maintenance door).

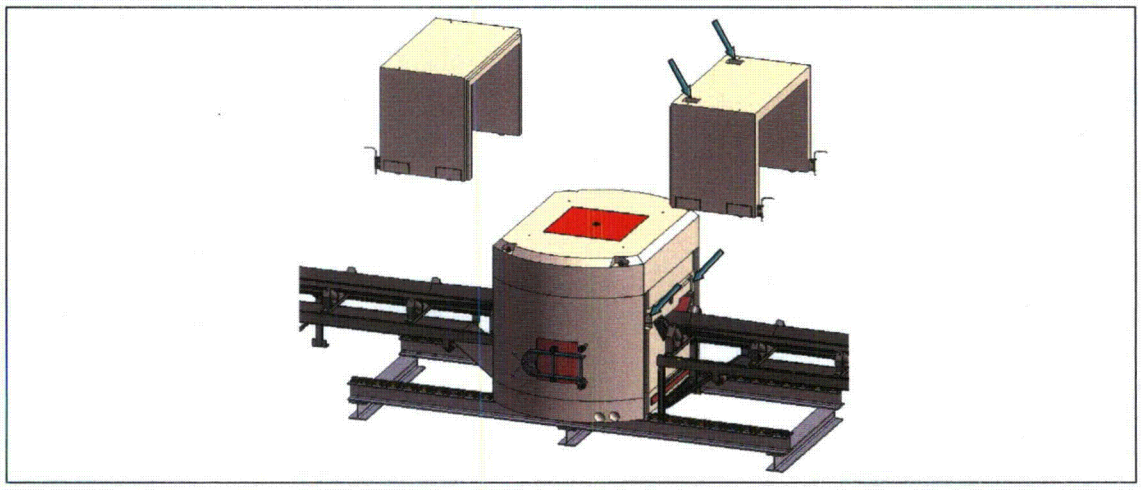

Figure 64 - Tunnel

❑ Place the tunnel on the rails and lock in its moved-out position.

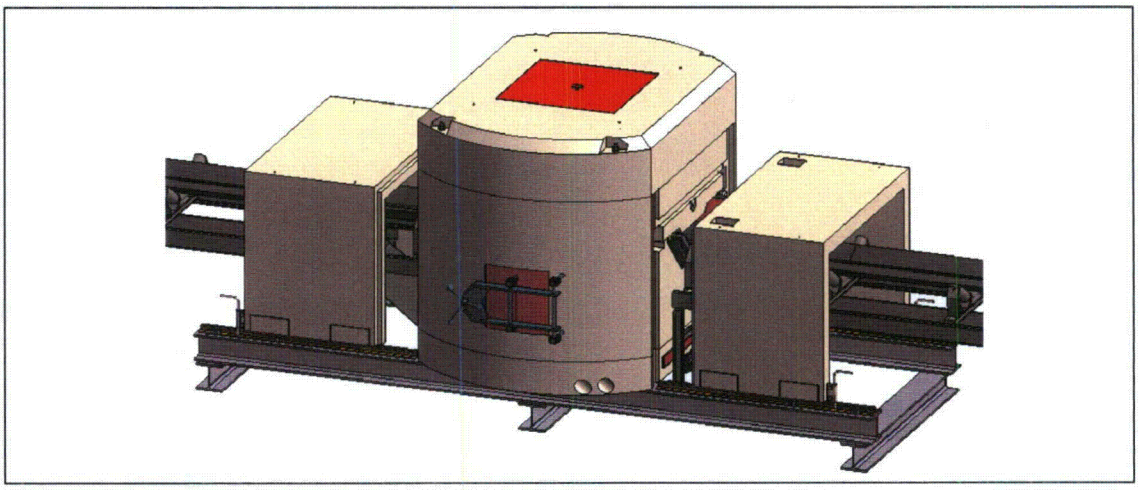

Figure 65 - Tunnel mounted on the rails

❑ Dismount the fork head of the hydraulic cylinder from the piston rod and screw it into the M36 threaded insert in the upper shaped part. Connect the hydraulic power unit and extend the cylinder. Insert the piston rod in the fork head and put in the bearing bolts. Adjust the length in the M36 tap hole and then fix with the nut.

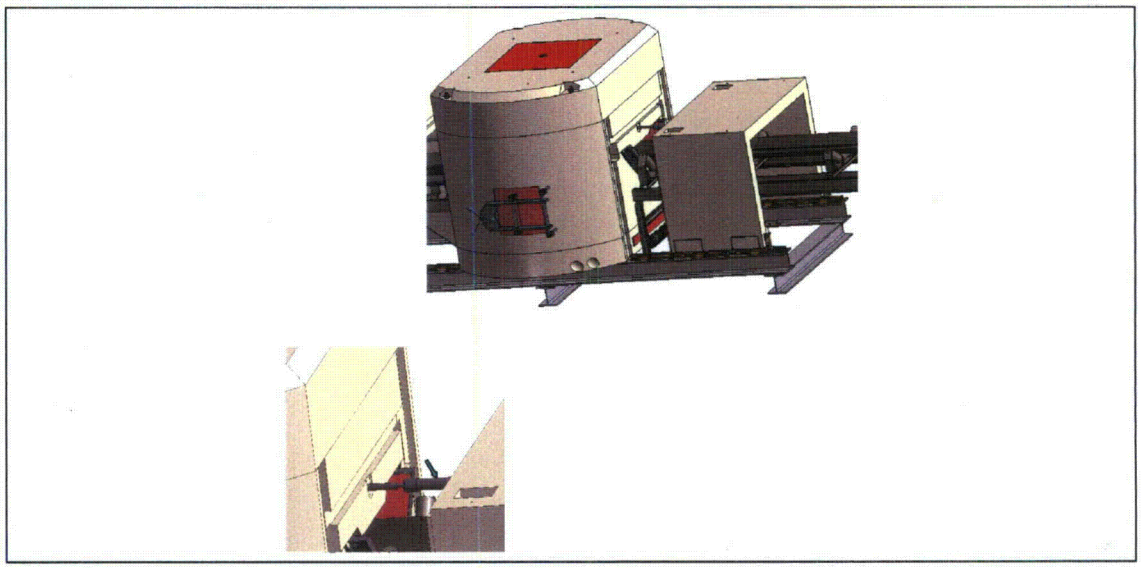

Figure 66 - Hydraulic drive unit for tunnel

❑ Move the tunnel and check both end positions.

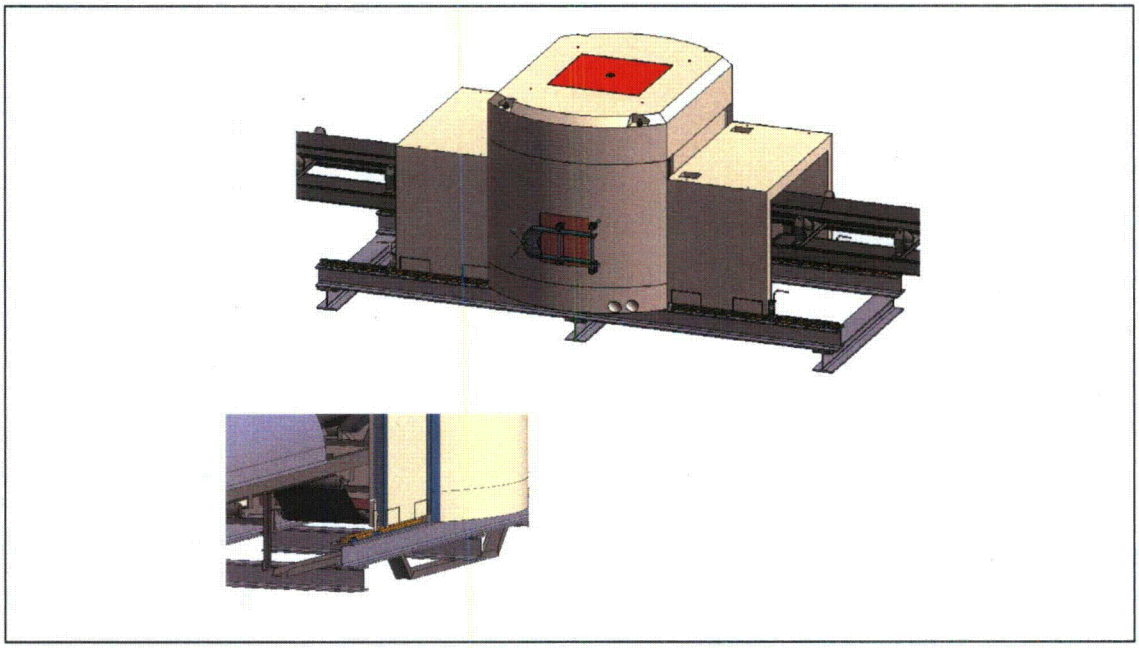

Figure 67 - Tunnel completely mounted

❑ Follow the same procedure for installing the second tunnel.

5.3.15 Mounting the air-conditioner

Place the air-conditioner on the tunnel with the recesses and align it.

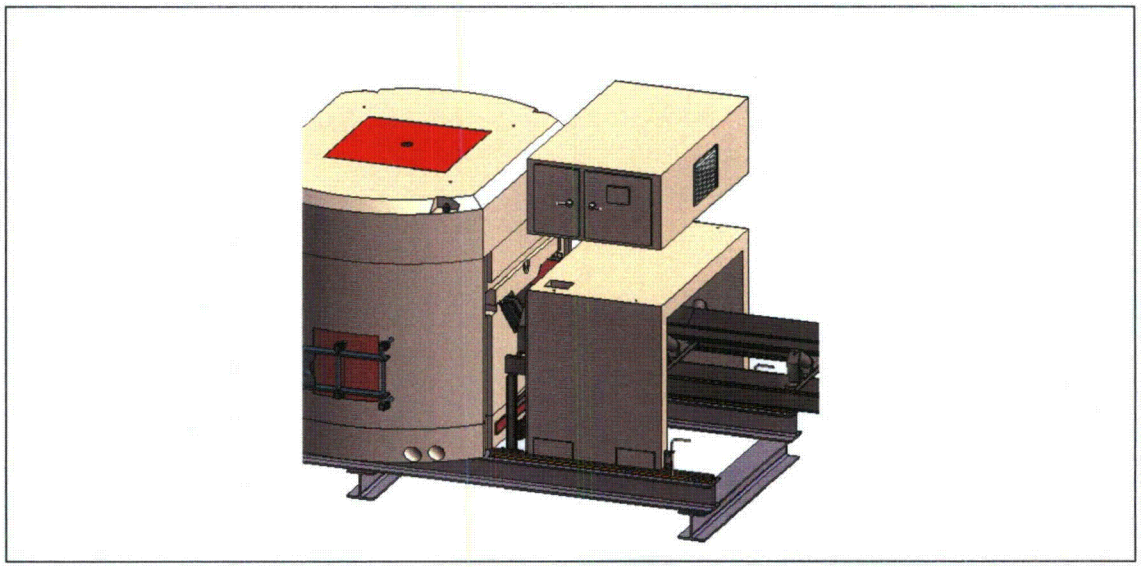

Figure 68 - Air-conditioner

NOTE

Make absolutely sure that the compressor of the refrigerator only operateswhen in horizontal position. If the CNA is being installed in an inclined position, you will have to adapt the mounting position of the compressor at the plant site.

- ❑ Screw the air-conditioner onto the tunnel (10 mm dowel ∅ with suitable screws).
- ❑ Insert the air ducts for the supply and exit air into the recesses in the tunnel roof and fix and seal them with adhesive mounting foam.

Figure 69 - Vertical air ducts

❑ Insert the horizontal air ducts into the recesses in the lower shaped element and precisely align with the two vertical air ducts. When the tunnel is moved in, the air ducts must connect with each other tightly.

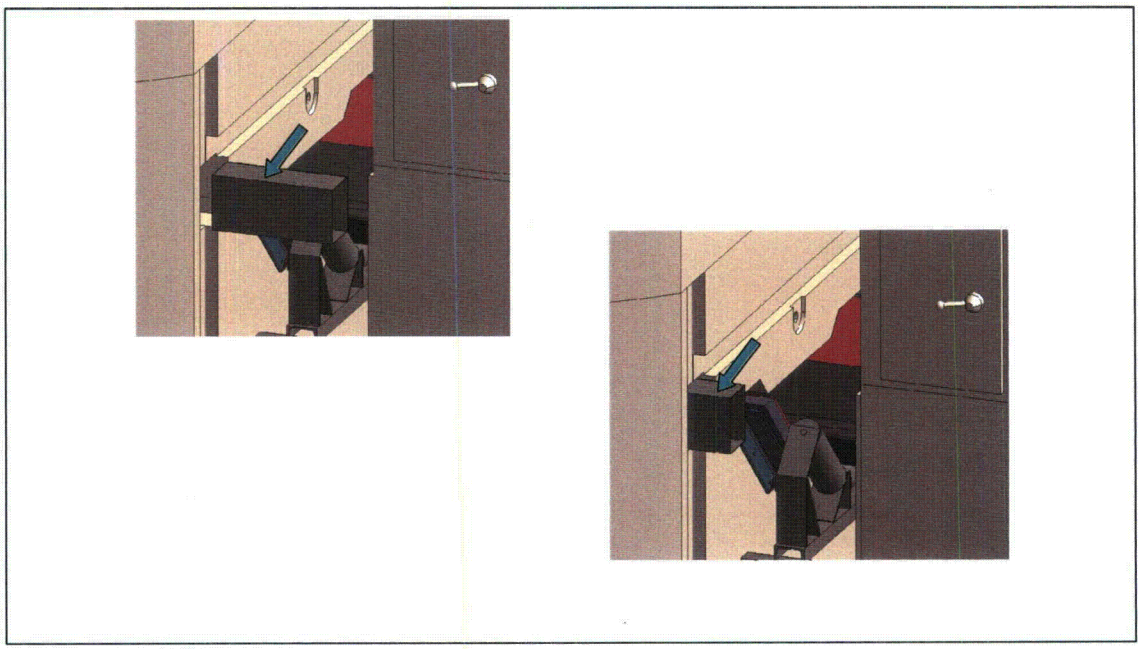

Figure 70 - Horizontal air ducts

❑ Pass the connecting cables for the air-conditioner out of the radiation protection enclosure through the additional recess next to the left-hand air duct and then through the tunnel roof into the control box from below. Make the electrical connection as follows:

❑ Power supply to the shielding air conditioner with W117. Never switch on the cabinet before connecting W117. You can have dangerous voltage on the wires of this cable.

❑ Connect W107 to the signals of the air conditioner (take care not to lose the markers on the wires)

- wire n°9 to the temperature measurement,
- wire n°10 to the temperature measurement setpoint,
- wire n°11 to the humidity measurement,
- wire n°12 to the humidity measurement setpoint,
- wire n°13 : 24V from the CNA cabinet,
- wire n°14 : air conditioner status : must be connected to 24 V when air conditioner is OK.
- black wire without marker : shielding of the cable.

- ❑ Fix and seal both horizontal air ducts with adhesive mounting foam.
- ❑ Mount the empty housing on the left-hand tunnel. The cabinet can be used e.g. for storing spare parts.

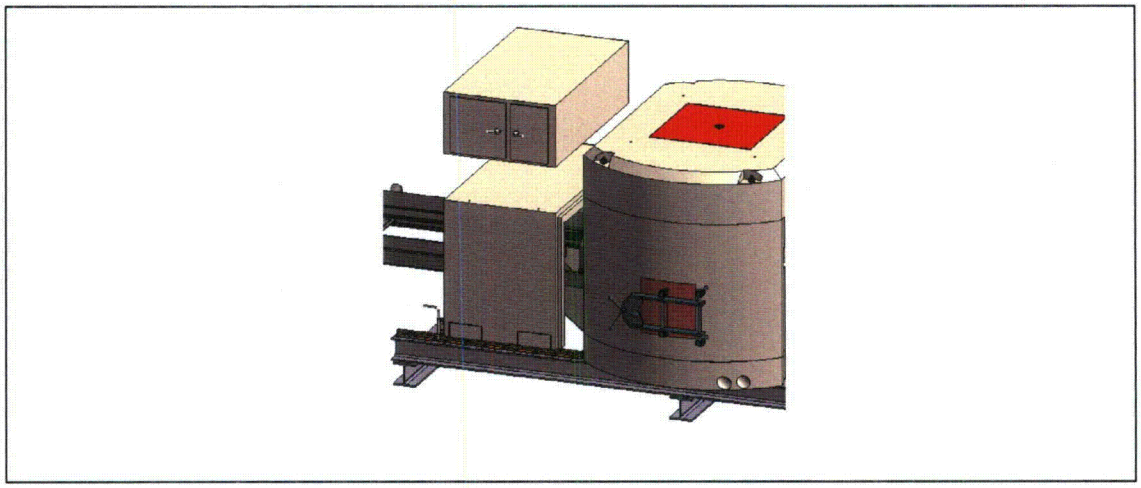

Figure 71 - Cabinet for spare parts

5.3.16 Sealing the radiation protection enclosure

- ❑ To seal the inside of the radiation protection enclosure as effectively as possible, inject silicon sealing compound into the joints between the individual concrete parts.

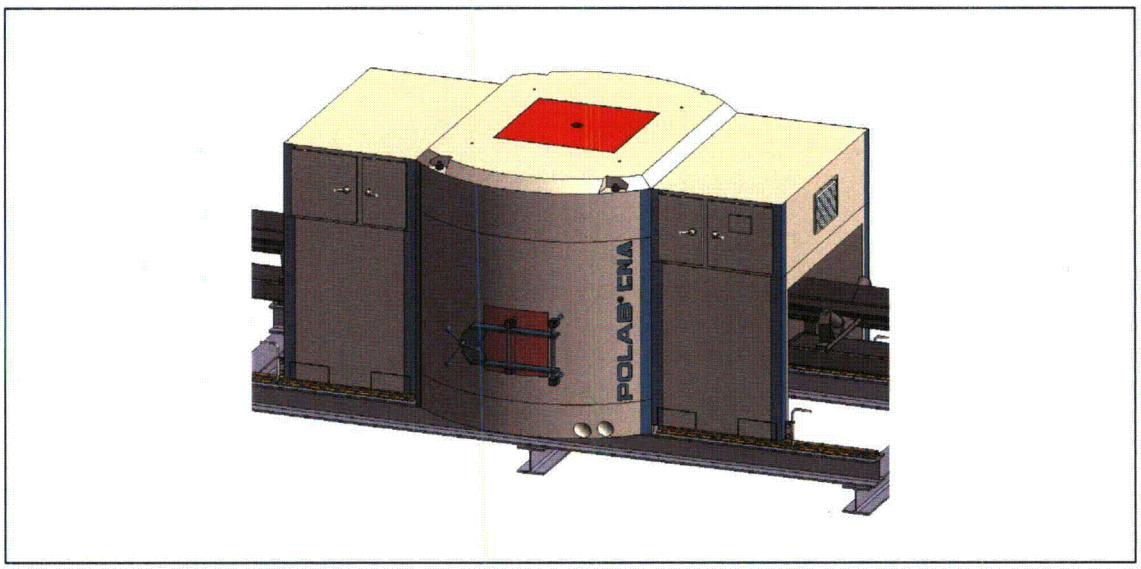

Figure 72 - Radiation protection enclosure completely assembled

5.4 Control cabinet installation

5.4.1 Where

Install the cabinet in a vertical position.

Locate it where it is easily possible to open the front and the rear door (600 mm free space around the cabinet). The position of the cabinet relative to the shielding is limited by the length of the cable. The available length between the rear of the cabinet and the two cable holes in the shielding is 12 meters.

Install the cabinet at a location that is not subjected to temperatures below -20 °C or above +45 °C.

Make sure that relative humidity is kept between 0 and 95 %. Do not expose the cabinet to rain or direct sun. Protect the cabinet against saline or corrosive atmosphere.

When the cables are plugged the cabinet has a protection number of 54 (EN60529), if doors are closed. This means that the cabinet is protected against dust and water.

If just the front door is opened, the cabinet has a protection number of only 31. This means that it is protected against particles bigger than 2.5 mm, but not against dust. It is protected against vertically falling water. Always keep the front door closed when you don't need access to the computer for servicing.

If the rear door is opened, the cabinet has a protection number of 00. This means that the rear door must only be opened to connect the cables, and must be closed even when cable installation is interrupted for a short time only.

View of cabinet, front and rear (see Figures).

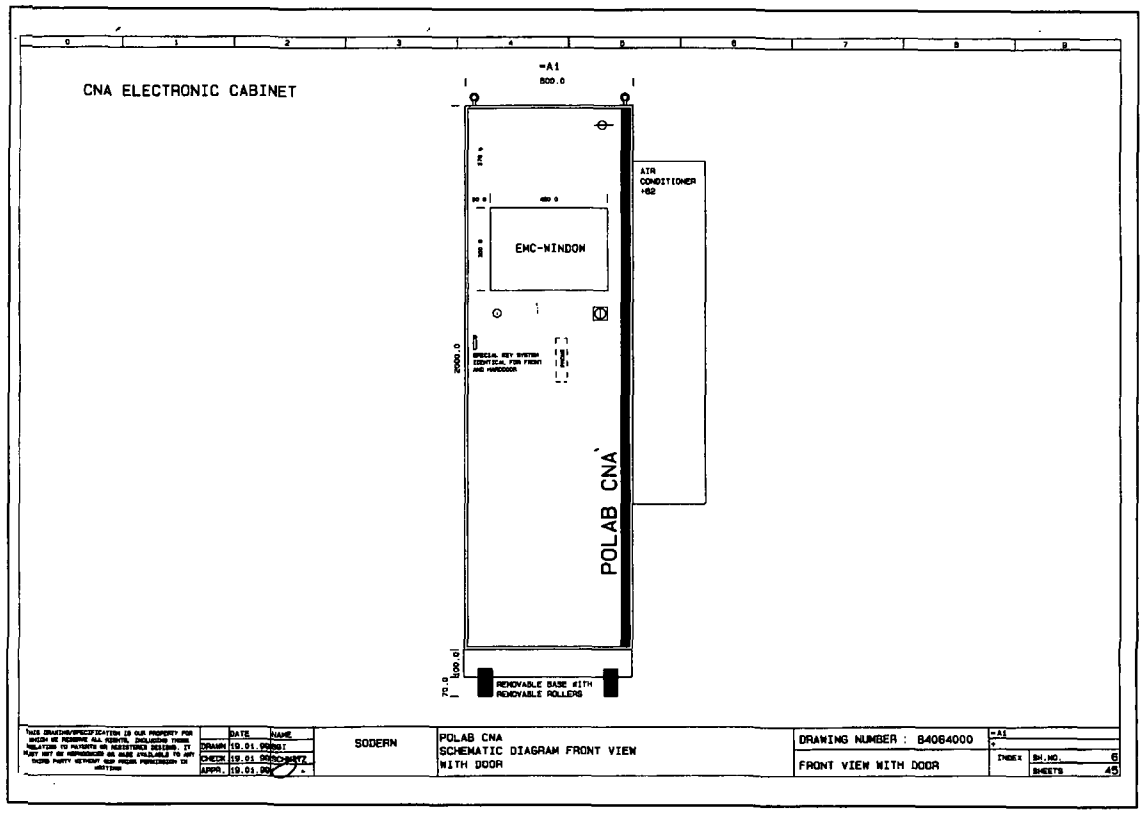

Figure 73 - Electronic cabinet front view

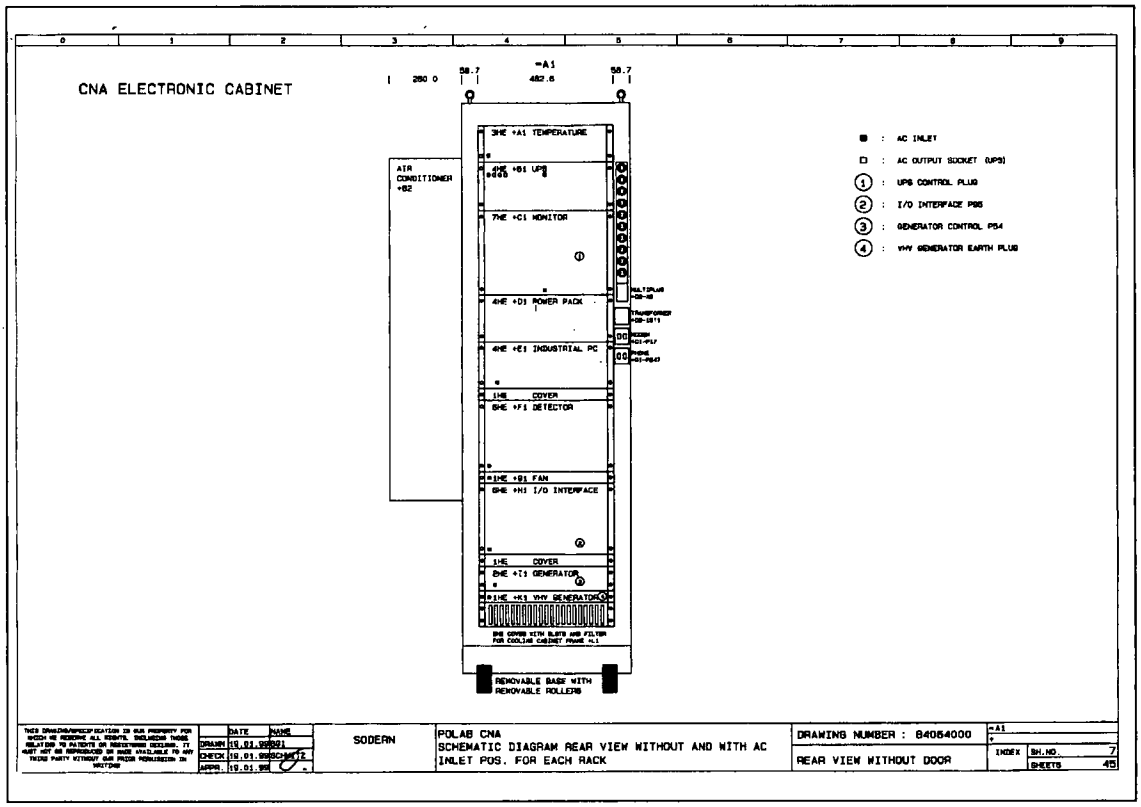

Figure 74 - Electronic control rear view

5.4.2 How

Connecting to the measurement chamber

- ❑ Check that the cabinet is disconnected from the main power supply.
- ❑ Open the front door
- ❑ Unscrew the VHV generator at the bottom of the cabinet (4 screws)
- ❑ Pull the VHV generator out by 15 cm.
- ❑ Unscrew the I/O interface rack (8 screws).
- ❑ Pull the I/O interface rack out by 30 cm.
- ❑ Prepare the MEN sheath near the hole close to the center of the cabinet (at the bottom of the rear side of the cabinet), and remove any protection.
- ❑ Clean the end of the high voltage cable (W66) with a clean non-fluffy rag, and with alcohol. This point is extremely important. The VHV generator can be destroyed if the VHV cable is not clean.
- ❑ Open the rear door of the cabinet.
- ❑ Check that no foreign matter has entered the VHV hole of the VHV power supply.
- ❑ Pass all the cables from the MEN sheath through the centre hole.
- ❑ Insert the high voltage cable (W66) into the high voltage connector of the VHV generator. Turn the cable, in order to put the connector in the right position.
- ❑ Always turn and grip the connector with your hand (NEVER USE ANY TOOL). It should reach to about the middle of the socket. If this is not possible, contact KRUPP POLYSIUS.
- ❑ Unscrew the nut of the earth (ground) point at the rear of the VHV generator. There should be two cables connected from this point : one to the earth (ground) point of the cabinet, and one to the generator control electronic rack (MC16G) : keep these cables in place and add W67 (coming from the MEN sheath). Screw the nut back on.
- ❑ Connect W55 to J211 at the rear of the MC16G (generator rack).
- ❑ Open the H2 box at the rear of the cabinet. Pass W62 through the hole in the H2 box. Connect W62 between points 15 and 16 of the H2 box (connect the shielding to a PE point) . Close the H2 box.
- ❑ Push in the VHV generator and screw it on (4 screws).
- ❑ Screw the MEN sheath onto its socket.
- ❑ Open the left-hand cable channel at the rear of the cabinet.
- ❑ Pass W26 through the left-hand cable channel and connect it to P27 at the rear of the acquisition rack.
- ❑ Prepare the detectors' sheath near the right-hand hole and remove any protection. Pass all the cables from the detectors' sheath through the right-hand hole.
- ❑ Screw the detectors' sheath onto its socket.

- ❑ Pass W1 through the left-hand cable channel and connect the short end to P1 at the rear of the acquisition rack, and the long end to P37 at the rear of the thermal control rack.
- ❑ Pass W2 through the left-hand cable channel and connect the short end to P3 at the rear of the acquisition rack, and the long end to P82 at the rear of the thermal control rack.
- ❑ Pass W107 through the left-hand cable channel and connect it to P143 at the rear of the I/O interface rack.
- ❑ Pass W117 through the left-hand cable channel and connect it to P240 at the rear of the power rack.
- ❑ Push the I/O interface rack in and screw it on (8 screws).
- ❑ Check that all the connectors are screwed on and locked.
- ❑ Close the left-hand cable channel.
- ❑ Close the rear door and the front door.

External connections

View of external connection boxes (see Figures).

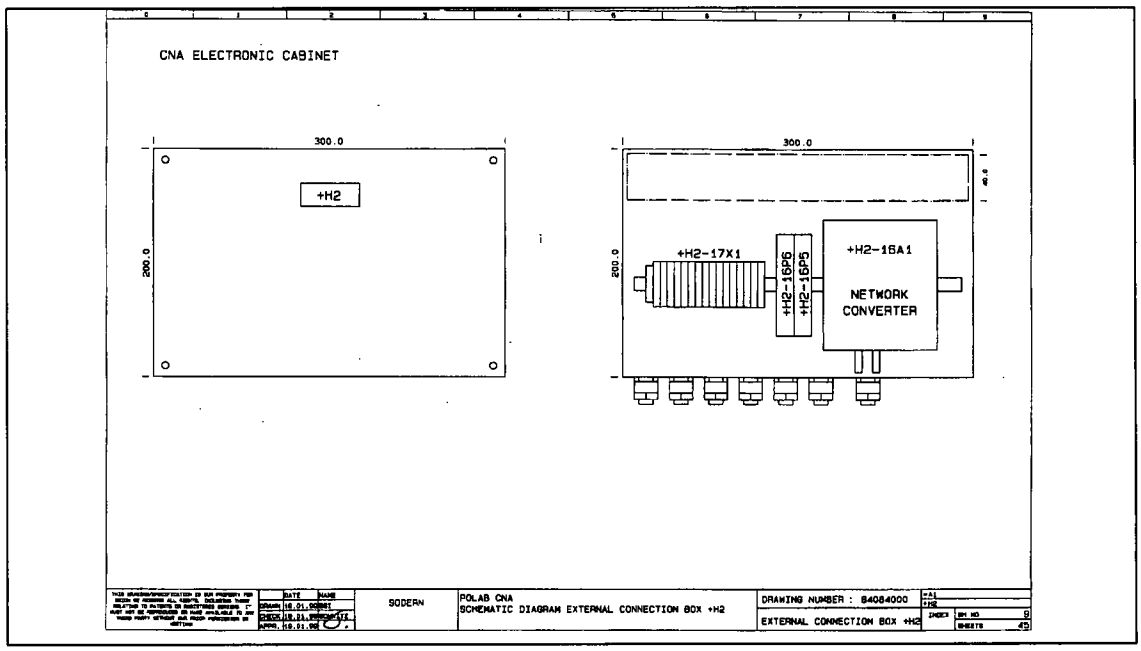

Figure 75 - External connection box H2

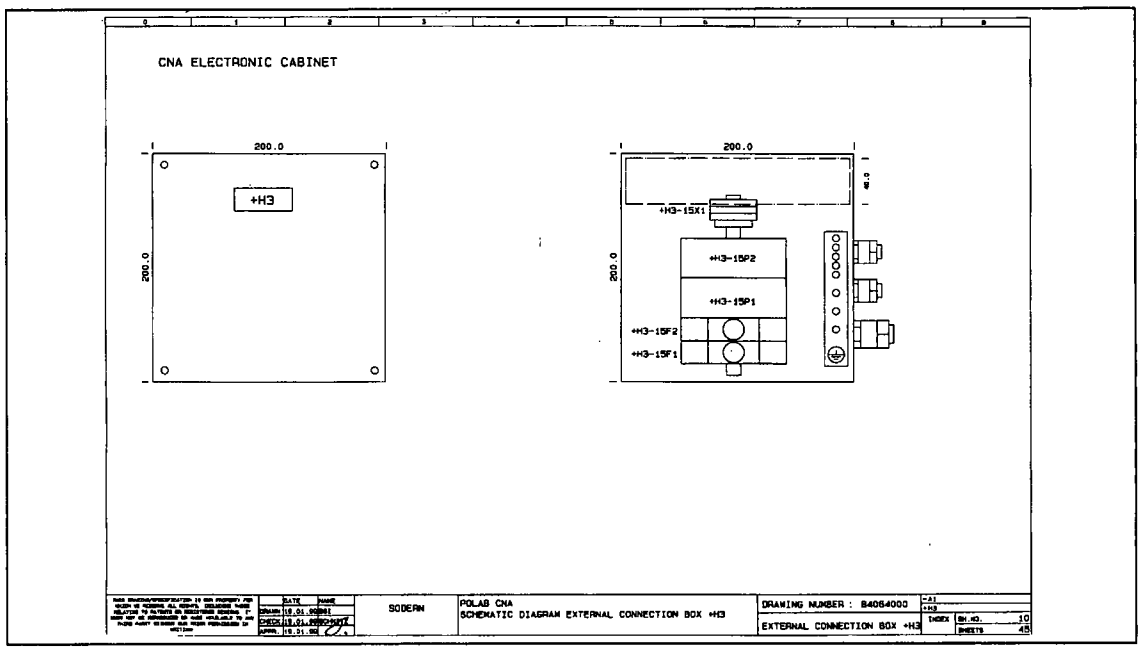

Figure 76 - External connection box H3

There are two types of cables to connect : signals cables and power supply cables. Begin with the signals cables :

- ❑ Open the H2 external connection box.
- ❑ Pass the weight feeder cable through the left-hand cable back shell. Connect the weigh feeder input to the terminals inside the left-hand part of H2. This is a 4-20 mA input. The impedance is 50 ohms. The current must enter by the terminal n°1 (+) and go out from terminal n°2 (-). The shielding of the cable must be connected to terminal n°3.
- ❑ Pass the conveyor belt status cable through one cable back shell. Connect the conveyor belt status input to to the terminals inside the left-hand part of H2. This is a dry contact input. The contact must be closed when the conveyor is running. It must be opened when the conveyor is not at the right speed. The contact must be connected between terminal n°4 and terminal n°5. The shielding of the cable must be connected to terminal n°6.
- ❑ Pass the emergency stop cable through one cable back shell. Connect the emergency stop input to the terminals inside the left-hand part of H2. This is a dry contact input. The contact must be closed when everything is OK. It must be opened if at least one of the emergency stop buttons is pressed. The contact must be connected between terminal n°7 and terminal n°8. The shielding of the cable must be connected to terminal n°9.
- ❑ Pass the safety loop cable through one cable back shell. Connect the safety loop input to the terminals inside the left-hand part of H2. This is a dry contact input. The contact must be closed when everything is OK. It must be opened if at least one of the safety switches is opened. The contact must be connected between terminal n°14 and terminal n°16. The shielding of the cable must be connected to a yellow/green terminal.
- ❑ Pass the phone cable through one cable back shell. Connect the phone wires to module H2P6 inside H2. It must be a standard analogue line : 48 V for line and 75 V for ringing. The maximum voltage must be less than 100 V. The line must be connected between terminal n°1 and terminal n°2 of H2P6.
- ❑ Pass the modem cable through one cable back shell. Connect the modem wires to module H2P5 inside H2. It must be a standard analogue line : 48 V for line and 75 V for ringing. The maximum voltage must be less than 100 V. The line must be connected between terminal n°1 and terminal n°2 of H2P5.
- ❑ Pass the optical network cable through the right-hand cable back shell. It must be a dual multi-mode optical fiber, with ST connectors. The fiber must have a size of 62/125 µm. Connect the TX fiber to the left ST connector inside H2 . The TX fiber transmits data from the CNA cabinet to the cement plant network. Connect the RX fiber to the right ST connector inside H2 . The RX fiber transmits data from the cement plant network to the CNA cabinet.
- ❑ Close the H2 external connection box.

Installing power supply cables

- ❑ Open the H3 external connection box.
- ❑ Check that the power supply cable is disconnected from the main power supply. Pass the power supply cable through the lowest cable back shell. The cabinet must be supplied from a network with the following characteristics :
  - Voltage : 230 V +/-10%,
  - Frequency : 47 to 63 Hz,
  - Power consumption : maximum 32 A,
  - Single phase and one neutral externally connected to earth (ground).
  - Use a 3 x 6 mm^2 cable : one wire for the phase, one wire for the neutral and one wire for the earth (ground). Connect the phase to fuse F1 inside H3. Connect the neutral to fuse F2 inside H3. Connect the earth (ground) to the earth (ground) point inside H3.
- ❑ Pass an earth (ground) wire through the middle cable back shell. Use, at least a 16 mm^2 yellow/green wire. Connect it to the earth (ground) point inside H3. This wire must be connected to the earth (ground) point of the building in1.which the cabinet is installed.
- ❑ Pass the tube emission signal cable through the upper cable back shell. Use a 3 x 1.5 mm^2 cable. This signal is used to supply a lamp when the tube is ON. In this case, the CNA supplies 230 V for an external lamp, at the same frequency as the network. The power consumption must be between 100 W and 500 W. Connect the cable to terminals 1 and 2 on the upper part of H3. Connect the earth (ground) to the yellow/green terminal. Never connect this cable, without connecting the other end to a load. The CNA supplies this cable with dangerous voltage.
- ❑ Close the H3 external connection box.
- ❑ Check that the main power switch of the cabinet is OFF.
- ❑ Connect the supply cable to the main supply.

The installation is now finished. Look at the user's manual for details of the first tests.

5.5 Summarised general assembly sequence

No.	Designation	Subsection
1	Constructing an assembly aid.	5.3.1
2	Preassembly of the floor slab, (lower shaped elements, measuring cell and mounting)	5.3.2
3	Raising the upper strand of the conveyor belt and finally positioning the floor slab with the previously mounted parts.	5.3.3
4	Lifting the floor slab, removing the assembly aid and lowering the floor slab onto the prepared supporting structure. Mounting the lower wear-protection plate.	5.3.3
5	Lowering the conveyor belt and aligning.	
6	Filling the holding-down bolt holes	5.3.3
7	Lowering upper section of Sodiscan onto lower section and bolting together.	5.3.4
8	Bolting together the upper and lower shaped elements.	5.3.4
9	Fitting the seals on the belt inlet and outlet.	5.3.5
10	Passing in and connecting the cables. (Passing out the cables for the air-conditioner)	5.3.7
11	Installing and connecting the tube and detectors.	5.3.9
12	Inserting and bolting together the side walls. Mounting the safety limit switches of the maintenance door.	5.3.10
13	Mounting the lateral wear protection.	5.3.11
14	Aligning the idler stands. Trial run of the conveyor belt. Setting the true-run switch.	5.3.12
15	Mounting the cover slab and closure plug.	5.3.13
16	Aligning and fixing the rails.	5.3.14
17	Mounting the hydraulic cylinder with protective hood on the tunnel.	5.3.14
18	Placing the tunnel on the rails.	5.3.14
19	Attaching the piston rod of the hydraulic cylinder to the upper shaped element and adjusting the stroke.	5.3.14
20	Mounting the air-conditioner on the correct tunnel.	5.3.15
21	Inserting, adjusting and sealing the exit air ducts.	5.3.15

No.	Designation	Subsection
22	Mounting the empty housing on the other tunnel.	5.3.15
23	Sealing the outside of the radiation protection enclosure with silicon sealing compound.	5.3.16
24	Setting up and cabling the electronics cabinet at the planned location.	5.4