

 <b>ENAP</b>  <b>KT</b>  <b>TECNIMONT</b>	<b>PLANTA DE RECUPERACIÓN DE AZUFRE Y PLANTA DE TRATAMIENTO DE AGUAS ÁCIDAS EN REFINERÍA ACONCAGUA</b>	KT Document Code K484-0000-0000-MR-4100-01-C3808- CA5015-0001
		Client identification code -
		Rev 1
<b>TOPSOE</b>	Vendor Document Code: A5015	

## STANDARD SPECIFICATIONS FOR WSA CONDENSER

 <b>KT</b>  <b>TECNIMONT</b>	 <b>ENAP</b>	<b>CONTRACTOR APPROVAL CODE</b>
		<input type="checkbox"/> <b>1 REJECTED</b> <input type="checkbox"/> <b>2 APPROVED WITH COMMENTS</b> <input type="checkbox"/> <b>3 APPROVED WITHOUT COMMENTS</b> <input checked="" type="checkbox"/> <b>4 FOR INFORMATION ONLY</b>
<b>PROJ:</b> K484		<b>U.O.:</b> KT S.p.A.
<b>OWNER:</b> ENAP		<b>BY:</b> AL
<b>CONTRACTOR:</b> KT / TCM Chile		<b>DATE:</b> 11/03/25
<b>MR N°:</b> 4100		
<b>PO N°:</b> 7500113900		
<b>EQUIPMENT:</b> C-3808		
<b>KT Doc. CODE:</b> K484-0000-0000-MR-4100-01-C3808-CA5015-0001		Rev. 1

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Ref. no. 80.01-02

WSA Condenser  
Item no. C-3808

# Specification for erection

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	Dec 13, 2023	ELAS	GARG	GC

SOPHIA document no.: TT-1451-EN version: 5

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## 1 General

This specification describes the erection of the WSA condenser.

### 1.1 Erection sequence

The recommended erection sequence is the same as the index numbers in this specification.

Some activities may overlap each other or be carried out in another sequence, if found appropriate, in view of the actual project erection time schedule.

Details must in each case be coordinated with the Topsoe supervisor.

### 1.2 Requirements to field welding

The following requirements apply with respect to field welding and inspection/test of field welds.

In general, all pressure bearing welds and structural steel welds must be fully welded. See the relevant drawings for details.

In general, the quality of pressure bearing welds must be in accordance with EN ISO 5817, Class C.

Pressure bearing welds must be carried out by welders certified for the applicable material and welding method.

All pressure bearing welds must be gas/air tight. See also 1.2.1.

Welding symbols on the drawings are based on ISO 2553.

### 1.3 PT – Liquid penetrant test

All pressure bearing welds must be 100% liquid penetrant (PT) tested.

Either a color contrast or a fluorescent penetrant may be used.

If possible, the liquid penetrant must be applied to the internal side of the welds, and the development must take place on both sides of the welds.

No indications are allowed.

### 1.4 Estimated time and manpower

The estimated time and manpower required for the erection are indicated in Topsoe spec. - Ref. No. 85.02.

This information is only intended as guidelines for the contractor's detailed erection planning.

### 1.5 Reference drawings

In the description of the erection, reference to Topsoe drawings/parts is indicated in parenthesis, where applicable in relation to the item and/or activity described.

The reference drawings/parts are identified by their reference number - "Ref. No.".

In Appendix A, all client drawings, which are referred to in relation to the description of the erection, are listed chronologically

## **2 Casing (02.52, 02.16)**

The erection sequence as per 2.1 - 2.8 is recommended.

The parts required for the work are indicated on the referenced drawings.

Any paint on places where site welds have to be carried out should be removed before the erection is commenced.

The following Topsoe specifications must be adhered to in relation to assembly/erection of the casing:

Ref. No. 58.01 General Tolerances for Steel Parts

Ref. No. 60.01 Inspection Forms, Steel Parts and Internal Insulation

### **2.1 Acid Collector Casing (03.02)**

The acid collector casing section is mounted, aligned and bolted onto the foundations.

### **2.2 End Wall Panel Type 1 (02.70, 02.16-Detail "A")**

The end wall panel type 1 is mounted on the acid collector casing

The end wall must be temporarily maintained in position until the next panels are mounted.

### **2.3 Side Wall Panels Type 1 and Type 2**

(02.74, 02.75, 02.16-Details "A", "B", "C", "D", "E")

The side wall panels can be mounted on the acid collector casing one at a time, starting at the end wall panel type 1 already mounted in order to stabilise the assembly, or preferably the entire side walls can be pre-assembled on the ground, including site welds, and mounted as complete side wall panels on the acid collector casing.

Horizontal pre-assembly of the panels on the ground will be advantageous with regard to performing the site welds. However, it must be ensured that the completed side walls are not distorted during the welding activities etc.

Additional temporary stabilising of the assembly may be required as the erection progresses

### **2.4 End Wall Panel Type 2 (02.71, 02.16-Detail "A")**

The end wall panel type 2 is mounted on the acid collector casing and connected to the side walls.

At this stage the alignment of the parts mounted so far should be checked and adjustments made if required.

## **2.5 Casing Internal Site Welds (02.16)**

The remaining site welds on the side wall panels are carried out at this stage.

## **2.6 Partitions/walkways (04.52)**

The supports for the partitions/walkways are mounted. These must be positioned carefully according to the drawings (02.52, 04.52).

The partitions/walkways are mounted, but not bolted onto the supports at this stage. The manholes in the partitions/walkways must be located at the end wall panel type 2.

The ladders are mounted.

## **2.7 Top Frame (02.32, 02.16-Details "D", "E", "F", 05.01)**

The top frame section is mounted and bolted onto the assembly.

The top frame must be aligned to accommodate the required slope of the support frames (05.01).

A final check of the complete casing with regard to alignment, rectangularity, etc. is carried out, and adjustments made if required.

The remaining casing site welds are carried out - see 02.16.

The partitions/walkways are bolted onto the supports - see 04.52.

## **2.8 Supports for Davit (02.26, 02.16-Detail "G")**

The supports for davits are mounted and welded onto the casing - see drawings 02.52 and 02.16.

## **3 External platforms and stairways**

The external platforms and stairways should be erected at this stage in order to ease the remaining erection work.

## **4 Painting**

It is recommended that touch-up painting of the casing externals and internals be carried out at this stage, in order to avoid corrosion, which will make it more difficult to obtain a proper painting later.

## **5 Internal Insulation (07.51)**

The parts required for the work are specified on the drawing.

The following installation sequence applies:

The profiles (07.51 - pos. 5) are tack welded to the inside of the casing on the whole circumference.

The insulation (07.51 - pos. 1) is mounted.

The insulation cover plate (07.51 - pos. 2, 3) is installed, covering the entire insulation surface, by riveting (07.51 - pos. 6) onto the profiles. Cutting and fitting of the cover plates is required.

The profiles (07.51 - pos. 8) are riveted (07.01 - pos. 6) onto the insulation cover plates on the casing end walls at the exact elevations indicated on the drawing.

All connections between the insulation cover plates and the partitions/walkways are sealed with silicone rubber (07.51 - pos. 7).

**Note:**

The bottom horizontal part of the insulation and insulation cover plate (07.51 - pos. 4) close to the bricklining must not be installed before the bricklining has been completed

## **6 Acid Collector – Bricklining**

The bricklining of the acid collector is carried out.

This work must be carried out and supervised by the supplier of the bricklining materials with whom co-ordination of the detailed installation procedure must be carried out.

The required preparations for the bricklining work is described in the Mobilisation Manual issued by the supplier of the bricklining materials.

## **7 Acid Concentrator – Bricklining and Assembly (03.40)**

### **7.1 Bricklining**

The bricklining of the acid concentrator sections is carried out.

This work must be carried out and supervised by the supplier of the bricklining materials with whom co-ordination of the detailed installation procedure must be carried out.

The bricklining work should take place in a suitable location close to the casing.

The bricklined acid concentrator sections must be covered by a tarpaulin and protected from damage until assembly can take place.

### **7.2 Assembly**

The assembly of the acid concentrator sections must be supervised by Topsoe and the supplier of the bricklining materials.

It is recommended to pre-assemble the acid concentrator before it is installed on the acid collector.

Preferred assembly sequence:

- The two main sections are bolted together. PTFE gasket and mortar need to be applied before the sections are finally connected.

Typically the top section is lifted and placed on the bottom section suitably supported on the ground. The lifting must be done very carefully to avoid the bricklining slipping out of the steel casing. The lifting lugs must be used for lifting.

- The air/gas inlet duct is bolted onto the main assembly. PTFE gasket and mortar need to be applied before the inlet duct is finally connected.
- The air/gas inlet flange is bolted onto the air/gas inlet duct.
- The ceramic supports are installed on the support beams in the top main section.
- The ceramic packing is filled into the packed bed.

## 8 Acid Concentrator – Installation

The installation of the bricklined acid concentrator can be carried out after the acid collector has been bricklined.

Installation sequence:

- The acid concentrator is positioned below the acid collector.
- The lifting lugs on the acid concentrator is connected to the lifting lugs on the acid collector via suitable chain hoist.
- The acid concentrator is lifting and bolted onto the acid collector flange. PTFE gasket and mortar need to be applied before the sections are finally connected.
- The ceramic packing is topped up, if required, from the acid collector.

## 9 Ducting

The ducting around the WSA condenser should be erected at this stage.

However, it is recommended that easy access to the inlet nozzle in the acid collector is provided, ie the process gas inlet flange and the gas inlet duct should not be erected at this stage.

## 10 Internals

The erection of the internals is carried out as per Topsoe Spec. - Ref. No. 80.03.

## 11 Davits (36.01)

The davits are mounted as indicated on the drawing.

It is important that the slide rings (36.01 - pos. 7) are installed as indicated, in order to allow the davits to turn in the bearing

## 12 Process gas inlet flanges

The process gas inlet flange(s) is erected (01.21 - Detail "D").

It is important that the expanded PTFE gaskets are mounted as indicated.

For further instructions, reference is made to the Topsoe standard nos. SP-403 and SP-406 – Guidelines/illustrations for installation of expanded PTFE gasket and bellows, as well as the supplier's installation instructions.

The opening must closed air tight when installation is completed to avoid ingress of humid air, water etc.

Note:

The bellow between the duct and the flange should not be installed at this stage, but during the commissioning phase after cleaning of ducts have been completed.

Care must be taken not to damage the fabric bellow during and after the installation.

Assembly/installation of the process gas inlet flange must always be supervised by Topsoe.

## 13 External insulation (40.01, 41.05)

The external insulation of the top covers (40.01) is carried out.

When the process gas duct has been connected to the process gas inlet flanges, the external insulation (41.05) can be carried out.

## Appendix A

### List of reference drawings

Article Ref.	Doc. Ref. No.	Description
1.	58.01 60.01 85.02	General Tolerances for Steel Parts Inspection Forms, Steel Parts and Internal Insulation Estimated Time and Manpower
2.	02.52 02.16 03.02 02.70 02.74 02.75 02.71 04.52 02.32 05.01 02.26	Casing Assembly Drawing Casing, Field Assembly Details Acid Collector Casing Casing, End Wall Panel Type 1 Casing, Side Wall Panel Type 1 Casing, Side Wall Panel Type 2 Casing, End Wall Panel Type 2 Partitions / Walkways Casing, Top Frame Adjustable Support Frame for Upper Tube Plate Casing, Support for Davit
5.	07.51	Internal Insulation
6.	03.40	Acid Concentrator, Casing
7.	03.60	Acid Concentrator, Hot Air/Gas Inlet Flange
10.	80.03	Specification for Erection of Internals
11.	36.01	Davit for Top Covers
12.	01.21 SP-403 SP-406	Assembly Details Guidelines/Illustrations for Installation of Expanded PTFE Gasket Guidelines/Illustrations for Installation of Bellows
13.	40.01 41.05	Top Covers, External Insulation Process Gas Inlet, External Insulation

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Ref. no. 80.03-UNC

WSA Condenser  
Item no. C-3808

# Specification for erection of internals

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	Dec 13, 2023	ELAS	GARG	GC

SOPHIA document no.: TT-1445-EN version: 6

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## 1 General

This specification describes the erection of the internals for the WSA condenser, which is based on the tube modules being completely pre-assembled, on or close to site, in horizontal position before installation in the casing.

The internals for the WSA condenser comprise:

- Tube module(s), incl. tubes with internals
- Top cover(s)
- Internal covers (sealing between module(s) and casing)

In view of the special handling and erection requirements, which apply in relation to some of the internals for the WSA condenser (see 1.4), the installation of the tube module must be carried out as late as possible in relation to the erection schedule for the complete plant.

This in order to avoid unnecessary damages.

The assembly of the tube modules can be carried out independently of other erection activities.

The Topsoe supervisor must be present on site during all of the erection activities described in this specification.

It is recommended to use the same crew(s) of workers dedicated to the erection work described in this specification. This in view of the special work to be carried out and the special handling and erection requirements to be adhered to (see 1.4).

### 1.1 Conditions for erection

The installation of the tube modules in the casing should only be commenced when the following erection activities have been completed as specified in Topsoe Spec. - Ref. No. 80.01:

- Casing with internal steel parts and internal insulation
- External platforms and stairways
- Bricklining
- Ducting

### 1.2 Erection sequence / time schedule

The required erection sequence is the same as the index numbers in this specification.

In addition, the erection sequence is indicated in the time schedule, Topsoe Doc. - Ref. No. 86.12.

The time schedule is based on the average time - by experience - needed for the various activities in view of the recommended available manpower and other conditions as mentioned in Note 1.

Some activities may overlap each other, if found applicable, in view of the actual manpower available, in order to reduce the overall time needed for the erection.

Details must in each case be coordinated with the Topsoe supervisor(s).

### 1.3 Reference drawings

In the description of the erection reference to Topsoe drawings/parts is indicated in parenthesis in relation to the item and/or activity described where applicable.

The reference drawings/parts are identified by their reference number - "Ref. No.".

In Appendix A, all client drawings are listed chronologically, which are referred to in relation to the description of the erection.

### 1.4 Coated parts

Special handling and erection requirements apply in relation to coated parts, and therefore the following documents must be adhered to and implemented on site before the erection of internals is commenced:

- Topsoe Spec. - Ref. No. 81.01, Specification for Handling and Erection related to Coated Parts.

### 1.5 Handling and installation of complete tube module(s)

In relation to handling and installation of complete tube module(s) – ref. 3.8 – the following requirements must be observed:

In case the module(s) is assembled in a workshop or similar, and need to be transported to the site before installation, the vehicle used for transporting the module(s) must be

- designed to carry at least the weight of the module(s) (min. 12 ton)
- provided with adequate suspension and shock absorption to avoid excessive impact loads on the module(s)
- sufficiently rigid to avoid deformation of the module(s)

The crane(s) used for handling and installing the module(s) must be a modern type crane, and be large enough to ensure a safe and stable handling of the module(s). Slow and accurate positioning and lifting is required.

### 1.6 Illustrations

Appendix B contains illustrations (Figures 1-10), which are intended to facilitate the understanding of the description of the erection activities.

## 2 Preparation of tubes

### 2.1 Main tubes

The main tubes supplied have already been provided with spirals, demisters and lock tubes.

#### 2.1.1 Replacement of demisters and lock tubes

In case replacement of demisters and lock tubes is required, the procedures described below apply.

The spare demisters are delivered covered with plastic, which must be removed at the same time the demister is pushed into the demister holder at the tube end.

In case of D-mist type demisters are installed, these consist of two parts both covered with plastic – the monofil part is installed first, followed by the glass fiber part.

The lock tube is mounted between the two bulges inside the demister holder.

The lock tube is correctly mounted, when it can be "rolled" between two fingers.

## 2.2 Drain tubes

### 2.2.1 Bushings/strainers

The bushings/strainers are installed in the drain holes in the upper tube plate.

The drain tubes are installed as per 3.7.

The PTFE lock pin must be installed in the bushing/strainer, when the drain tubes have been installed.

## 3 Tube modules (10.50)

This article describes the erection of the tube modules, comprising tube plates, baffle plates, side plates, tubes, and miscellaneous accessories.

### 3.1 Preparations

The following preparations must be carried out before the actual erection work can be commenced:

#### 3.1.1 Working area

A suitable working area must be prepared located as close to the WSA condenser as possible.

This will minimize the extent of handling/transportation when the module needs to be installed in the WSA condenser casing.

The working area must be "sealed off" with warning tape and cleaned for all foreign materials.

Only the parts required for the work and the necessary tools and accessories must be located on the working area.

### 3.2 Side plate type 1 and baffle plates

The side plate type 1 and the baffle plates are assembled in horizontal position as indicated.

The long side of the side plate must be facing downwards.

The stainless steel baffle plate must be located at the upper level on the side plate.

Should it prove difficult to attach the baffle plates to the angle irons, due to distortions of the side plate, the bolts retaining the angle irons can be loosened and re-tightened after the baffle plate has been attached to the angle iron (10.50 - Detail "B").

The assembly must be supported by wooden beams, preferably in a level position in order to facilitate the succeeding erection work.

### **3.3 Bushings in baffle plates**

The bushings for the baffle plates are installed, which can be carried out by hand. No tools are required.

It must be ensured that the bushings are properly fixed in the baffle plate holes, i.e. the collars on the bushing must be in contact with the hole edge on the whole circumference.

Note:

The bushings to be installed in the two corner holes for the drain tubes must be modified by cutting away the internal lip. A sharp pocket or utility knife can be used.

### **3.4 Side plate type 2**

When all the bushings have been installed in the baffle plates, the side plate type 2 is connected to the assembly.

The long side of the side plate must be facing downwards.

Should it prove difficult to attach the baffle plates to the angle irons the bolts can be loosened and re-tightened as mentioned in 3.2.

### **3.5 Assembly structure(s) (98.50)**

The assembly structure(s) is/are assembled and placed on the working area behind the tube boxes.

The assembly structures should be placed on concrete plinths or a common concrete slab, and aligned to ensure that the two horizontal beams supporting the tube module are level. The structures should be fixed by anchor bolts to the concrete plinths/slab.

The side plate/baffle plate assembly is positioned onto the assembly structure, the side plate type 1 located approx. 250 mm from the horizontal U-beams. The ø30mm holes in the side plate must match the holes in the U-beams.

The adjustment bolts (16.01) are mounted between the side plate/baffle plate assembly and the U-beams and the assembly is aligned. The assembly can be aligned by strings mounted between the corner holes in the top and bottom baffle plates.

### **3.6 Tube plates**

The box(es) with tube plates is/are placed as close to the "tube module working area" as possible.

The tube plates are coated, therefore the special requirements as per 1.4 must be observed.

### 3.6.1 Upper tube plate

The upper tube plate is provided with a special additional protection, which should not be removed during the installation of the upper tube plate, in order to minimize the risk of damage to the coating. The protection can be fixed to the tube plate with adhesive tape.

#### 3.6.1.1 Connection to side plate/baffle plate assembly

Step 1

Two lifting lugs (98.11) are bolted onto the two long sides of the tube plate in the pair of threaded holes located 700mm from the centerline of the tube plate.

Step 2

The lifting accessories (98.10) are assembled and connected to the lifting lugs.

Step 3

The tube plate is lifted out of the packing, elevated approx. 1.5m, and turned 90 degrees - the drain holes pointing upwards - and positioned in front of the side plate/baffle plate assembly.

Step 4

The tube plate is positioned so that the threaded holes in the brackets underneath the tube plate match the holes in the side plates.

The side plates must be located on the outside of the brackets.

The side plates are connected to the upper tube plate (10.50 - Detail "A"), and the lifting accessories and lifting lugs are removed.

### 3.6.2 Lower tube plate

The lower tube plate is provided with a special additional protection, which must be removed before the plate is removed from the packing.

#### 3.6.2.1 Connection to side plate/baffle plate assembly

The connection of the lower tube plate to the side plate/baffle plate assembly follows the same procedure as for the upper tube plate (3.6.1.1 - Step 1 to 4).

However, the following special details apply for the lower tube plate:

- The two blue bushings for the drain tubes must be facing upwards.
- The side plates must be located on the inside of the stiffeners.
- The bolts connecting the lower tube plate to the side plates must be located in the middle of the slotted holes in the side plates.
- The sealing strips (17.01) are placed between the side plates and the stiffeners (10.50 - Detail "C").
- The lifting lugs (98.11) should not be removed at this stage, as these have to be used later.

The tube module alignment is checked after the tube plates have been installed, and adjustments are made, if required.

When the installation of the tube plates is completed the tube module should be covered by a tarpaulin to protect it from dust/debris, rain, etc.

### **3.7 Tubes**

#### **3.7.1 Preparations**

##### **3.7.1.1 Cleaning**

The tube module assembly must be thoroughly cleaned for any dust or debris before the installation of tubes is commenced.

The working area must be cleaned for all foreign materials and tools.

##### **3.7.1.2 Special tools and accessories**

The special tools and accessories listed in Appendix F must be provided by the erection contractor, except for the items where "Topsoe supply" is indicated.

Warning signs (as per 81.01) must be placed at possible access ways to the working areas.

##### **3.7.1.3 Tube boxes**

The preparation/exchange of main tube boxes must be carried out each time a box is emptied for tubes.

The wooden boards on top of the box are removed as well as the foam plates.

The tubes are now accessible.

In case the tubes are dirty or dusty they must be cleaned with water.

When a box is empty, the wooden boards and the foam plates are placed in the empty box, which is then removed from the working area

### **3.7.2 Protection**

In case of excessive dust in the air, measures must be taken to protect the working area from contamination.

If this is not possible, it is recommended to postpone or suspend the installation work

### **3.7.3 Precautions**

In case of temperatures below approx. 20°C, it is recommended to provide a cover around the tube module(s) and heat up the inside to approx. 15-20°C with a suitable hot air blower.

This in order to facilitate the installation work.

Handling of the tubes made of glass must be carried out with great care.

The tubes must only be taken out from the top of the box.

The tubes should be carried with a solid grip (suitable gloves should be used) around the tube.

Never lift the tubes by holding inside the ends.

### 3.7.4 Installation

The installation of tubes in the module should be commenced in the top row and working downwards row by row. This sequence will facilitate the installation work in case a tube breaks or a guide cone is dropped.

Before the installation is commenced, the special protection on the upper tube plate is removed, i.e. the plywood plates and the expanded PE.

The frame protecting the tube plate edges should not be removed until the installation work is completed.

When the tube installation is completed in a module, the module should be cleaned and inspected (3.7.5) and covered immediately after until the final installation in the casing.

#### 3.7.4.1 Main tubes (01.21 - Details "E", "F", "G")

Five (5) persons per crew are recommended for installation of tubes:

- 1 person for taking out the tubes from the box
- 1 person located in front of the tube module at the upper tube plate
- 1 person for heating the bushings in the upper tube plate, providing the tubes with a guide cone and cleaning/lubricating the tubes with soap water
- 1 person located behind the tube module at the lower tube plate for heating the bushings in the lower tube plate and removing the guide cones from the tube.
- 1 person for providing tools, transporting guide cones etc.

The installation of the tubes is carried out according to the following typical sequence:

1.

The special heating tool is placed in the bushing in the upper tube plate.

The special heating tool is placed in the bushing in the lower tube plate.

2.

The tube is taken out of the box, handed over to the person in front of the tube module and provided with a guide cone.

3.

The heating tool is moved to the next bushing in the upper tube plate.

4.

A clean cloth dipped in soap water is wrapped around the tube and the tube is inserted through the tube and baffle plates.

The cloth must be wrapped around the tube during the whole insertion.

The insertion speed of the tube must be reduced before the tube end (guide cone) reaches the lower tube plate.

5.

The heating tool is moved to the next bushing in the lower tube place just before the tube (guide cone) reaches the lower tube plate.

6.

The guide cone is removed.

#### **3.7.4.2 Drain Tubes (01.21 - Details "H", "F", "G")**

The installation of the drain tubes follows in principle the same procedure as for the main tubes except that the guide cone is left out.

The installation tool can be used for pressing the upper part of the drain tube into the bushing.

The special drain tube box is opened by removing all the wooden boards on top of the box.

The foam plates on top of the tubes are removed, making the tubes accessible.

#### **3.7.5 Inspection / Check**

When a module has been completely provided with tubes and the upper tube plate, baffle plates and lower tube plate have been cleaned (if required) the following inspections must be carried out:

##### **3.7.5.1 Visual inspection for damages on:**

- Coated/lined surfaces
- Glass tubes
- Bushings

##### **3.7.5.2 Visual inspection for proper positioning of:**

- Glass tubes
- Spirals
- Demisters and lock tubes

##### **3.7.5.3 Check of coating on upper tube plate by spark testing (optional).**

In case of accidents or similar events during the installation procedure, which might have caused damage to the coating on the upper tube plate, the Topsoe supervisor(s) can decide to carry out a spark test to check if the coating is damaged

### **3.8 Installation in casing**

Before installation of the tube module can take place, the inside of the casing must be thoroughly cleaned.

All foreign materials must be removed and the internal partitions/walkways and the bricklining must be vacuum cleaned.

The casing openings must be covered with tarpaulins in case there is a risk of rain water, dust, etc. entering the casing.

#### **3.8.1 Installation sequence**

##### **3.8.1.1 Step 1 – Preparation of casing**

The edges of the bricklining walls, i.e. the PTFE sheeting on top of the bricklining walls, are provided with PTFE gasket - expanded type 20x7.

The gasket (centre line) must be placed approx. 25 mm from the edge of the top of the walls.

The bolts (5/8"UNCx150) are installed in the support frame (05.01), except for the four bolts located 700mm from the centerline of the long sides of the support frame corresponding to the location of the guide lugs for the upper tube plate.

Four guide rods (20.01-pos. 2) are mounted on the support frame in the holes corresponding to the location of the guide lugs on the upper tube plate, i.e. 700mm from the centerline of the long sides of the support frame.

The support frame is provided with PTFE gasket - expanded type 17x6.

The gasket (centre line) must be placed approx. 10 mm from the inner edges of the frame.

The guide plates (23.02) are installed on the support frame.

##### **3.8.1.2 Step 2 - Preparation of tube module**

The lifting device (98.20) is connected to the upper tube plate. Note that the lifting device must be connected to the upper tube plate to accommodate the slope (25mm) of the plate.

The lower tube plate is connected to the lifting rig (98.10-pos. 5) via the two steel wires (98.10-pos. 2).

The adjustment bolts (16.01) are removed.

The tube module is raised to vertical position, and the lifting accessories are removed from the lower tube plate.

##### **3.8.1.3 Step 3 - Installation**

The module is lifted to the top of the casing and positioned so that the drain holes in the upper tube plate are located opposite the elevated side of the support frame.

The module assembly is lowered down through the support frame opening until the upper tube plate is approx. 1m above the support frame.

The PTFE plugs are installed in the lower tube plate.

Two guide lugs for lower tube plate (21.02) are bolted onto each stiffener on the lower tube plate located at the guide rods on the acid collector.

The threaded holes not used in the stiffeners on the lower tube plate are provided with bolts (5/8"UNCx25) – on the module sides located at the casing end walls.

The guide plates are removed from the support frame.

The module assembly is lowered until the guide lugs on the lower tube plate catch the guide rods on the acid collector and further lowered until the guides on the lifting device catch the guide rods on the support frame.

The module assembly is lowered to its final position.

The lifting lugs on the lifting device are disconnected from the upper tube plate one at a time.

At the same time, a guide lug (20.01-pos. 1) is connected to the tube plate and the guide rod in the support frame is replaced with a studbolt (5/8"UNCx150).

The 4 x 2 threaded holes in the upper tube plates, which are not used, are provided with plugs (14.10).

When the installation of the tube module is completed, the top cover (ref. 5.) should be installed immediately after.

### **3.8.1.4 Step 4 - Tightening clamps (06.01, 06.03, 01.21 - Detail "B")**

Installation and tightening procedure for initial installation:

- All clamps are installed as indicated on the drawings, but not tightened at this stage.

The threads must be well lubricated with copper grease before the nuts are mounted and tightened.

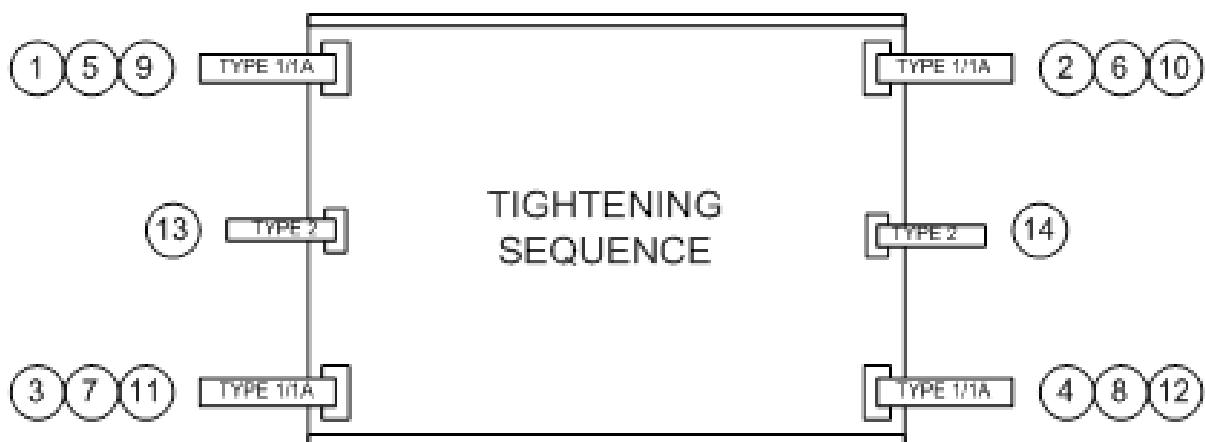
The protection sheets and the protection plates must be placed between the clamps and the lower tube plate.

- The nuts must be tightened as much as possible using a standard wrench of the size corresponding to the nut size.

A standard wrench is considered to have a length of approx. 500 mm.

1. One clamp type 1/1A is tightened to approx. 1/3 of the max. torque.

2. The clamp type 1/1A on the opposite side of the module/lower tube plate is tightened to approx. 1/3 of the max. torque.
3. The other clamp type 1/1A on the same side is tightened to approx. 1/3 of the max. torque.
4. The last clamp type 1/1A is tightened to approx. 1/3 of the max. torque.
5. The above is repeated for 2/3 and the max. torqued.
6. Finally, the clamps type 2 are tightened.



All tightening clamps must be re-tightened after the first heating-up of the plant on hot air – the clamps can in this case be fully torque one at a time.  
This is carried out in connection with the internal inspection of the WSA Condenser.

### 3.8.1.5 Step 5 - Adjustment bolts

The bolt assemblies (02.70-pos.16-18 and 02.71-pos. 8-10) are mounted between the clamps (02.70/02.71-pos.7) and the side plates (01.21- Detail "J").

The bolt assemblies (16.01) are mounted between the side plates of each module.

In case the tube module is not completely in alignment after it has been finally installed in the casing, i.e. the tubes are not completely straight, the module must be aligned (if possible) by the bolt assemblies as described above.

The modules at the casing end walls must be aligned first.

## 4 Internal covers

This article describes the installation of the internal covers, which are foreseen to close all the gaps between the module(s) and the casing, and between the module(s) and the partitions/walkways.

#### **4.1 List of parts (34.01, 35.51)**

All the parts required for this work are specified on the drawing.

#### **4.2 Installation, internal covers part 1 (34.01)**

The covers, part 1, are installed by pushing or pulling (using a rope) the plates into the two opposite located slits on the side plates and on the casing end-wall insulation, respectively.

When the plate is positioned in the slits, the plate ends are bent down, flush with the side plate edges and the cover plates on the casing and walls, respectively.

The plates have to be installed at two elevations between the module and the casing end-walls.

#### **4.3 Installation, internal covers part 2 (35.51)**

The position of the various cover types, part 2, is indicated on the drawing.

The vertical positioned covers must be mounted first.

It is important that the contact surfaces are provided with silicone immediately before the covers are mounted.

When all the covers are mounted, all of the remaining gaps must in addition be closed with silicone mastic.

### **5 Top cover(s)**

This article describes the installation of the top cover(s).

The special requirements as per 1.4 must be observed.

#### **5.1 Preparations**

##### **5.1.1 Cleaning**

Before installation of the top cover(s) is commenced, the protection plates must be removed and the covers part 1 and 2 separated. See also 5.2.1. The protection plate on the outlet nozzle should be removed later.

All coated surfaces are wiped off with clean cloth.

The gasket faces on the upper tube plate must be wiped off with clean cloth as well.

##### **5.1.2 Sight glasses (01.21 - Detail "L")**

The sight glasses are installed on the cover part 1.

The PTFE gaskets (centre line) - expanded type 14x5 - must be placed approx. 10 mm from the edge of the glass.

The tightening of the bolts must be carried out with care in order not to break the glass.

The bolts must be tightened until the gasket thickness is approx. 1 mm.

### 5.1.3 Lifting Lugs

The four lifting lugs are mounted on the cover part 2.

These lifting lugs must only be used for lifting the cover part 2 alone.

## 5.2 Installation

The upper tube plate is provided with expanded PTFE gasket type 20x7, placed in the centreline of the raised gasket face.

A guide rod (39.10) is installed and tightened in four corner holes in the support frame.

The cover part 1 is lifted to the top of the module, positioned and lowered down guided by the guide rods until it rests on the upper tube plate.

DN 15 /  $\frac{1}{2}$ " pipes – approx. 0.5 m long – can be used for initial positioning of the guide rods in the four corner holes.

The nuts are tightened to 180-200 Nm (well lubricated).

### 5.2.1 Cover part 2 (01.21 - Detail "K")

The cover part 2 is bolted onto the cover part 1.

The PTFE gasket (centre line) - expanded type 17x6 - must be placed on the cover part 1 approx. 15 mm from the inner edges.

The nuts are tightened to 180-200 Nm (well lubricated).

The outlet nozzle on the top cover is connected to the ducting.

In case this is not possible immediately after the top cover installation, the outlet nozzle must be protected and covered in order to avoid damage to the coating and to prevent rain water and dust from entering.

## 6 Closing of casing

When all the previously described work, check, and inspection are carried out, the inside of the casing including acid collector must be vacuum cleaned.

After acceptance from the Topsoe supervisor(s), the casing can be closed

### 6.1 Manholes (01.21 - Detail "C")

PTFE gasket - expanded type 14x5 - is placed on the flange approx. 10 mm from the inner edges.

The insulation box (07.51 - Detail "A") is installed and the cover closed.

The bolt assemblies (02.70-pos.11-13) are mounted and tightened.

The nuts are tightened to 80-100 Nm (well lubricated)

## 6.2 Process gas inlet(s)

If the process gas inlet flange(s) is/are not installed at this stage (ref. 80.01) the nozzle(s) in the acid collector must be covered to prevent rain water and dust from entering.

## 7 Replacement of tubes

In cases where tubes have to be replaced in a module, the following procedures apply.

However, when a large number of tubes need replacing, it should be considered to remove the entire module, and replace the tubes in horizontal position.

The cover part 2 on the top cover is removed and kept hanging in the davit (36.01) clear of the module.

The maintenance platform is mounted on the cover part 1 close to the tubes, which need to be replaced.

The succeeding actions to be carried out depend upon the number of tubes to be replaced.

Procedure 1 applies when a large number of tubes must be replaced, while procedure 2 applies for a small number of tubes.

Procedure 1 is more time consuming than procedure 2 with respect to provision of access, while procedure 2 is more time consuming than procedure 1 with respect to the removal of tubes.

### 7.1 Procedure 1

Access is provided to the acid collector.

The tubes to be replaced are pushed up from underneath and removed from the top.

A new bushing is mounted in the upper tube plate using the special installation tool (65.01).

A new tube is inserted without use of a guide cone, which may be dropped and not recovered.

Heating of the bushings is not required if the insertion of the tube is carried out with care. Cleaning and lubrication of the tubes must, however, be carried out.

When the replacement work is completed the maintenance platform is removed and the cover part 2 is re-installed.

## 7.2 Procedure 2

The tube to be replaced is removed directly from the top by pulling the tube by a firm grip around the demister holder. Alternatively a piece of rope can be wrapped around the demister holder and used for pulling.

A new bushing is mounted in the upper tube plate using the special installation tool (65.01).

A new tube is inserted without use of a guide cone, which may be dropped and not recovered.

Heating of the bushings is not required if the insertion of the tube is carried out with care. Cleaning and lubrication of the tubes must, however, be carried out.

## 7.3 Completed replacement

When the replacement work is completed the maintenance platform is removed and the cover part 2 is re-installed.

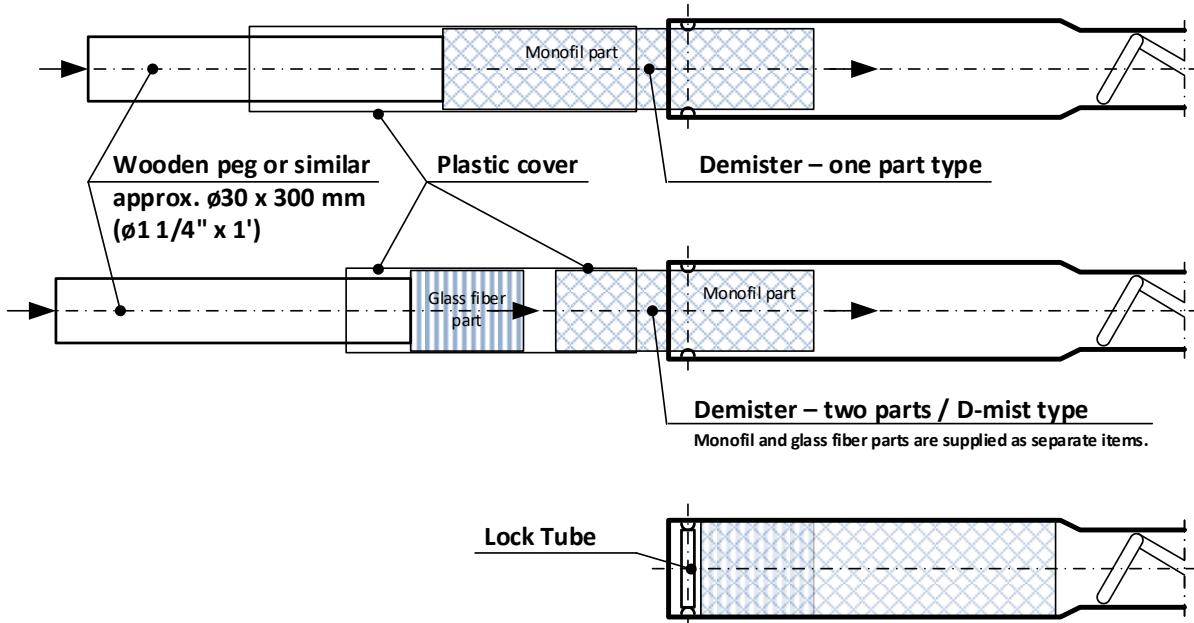
## Appendix A

### List of Reference Drawings

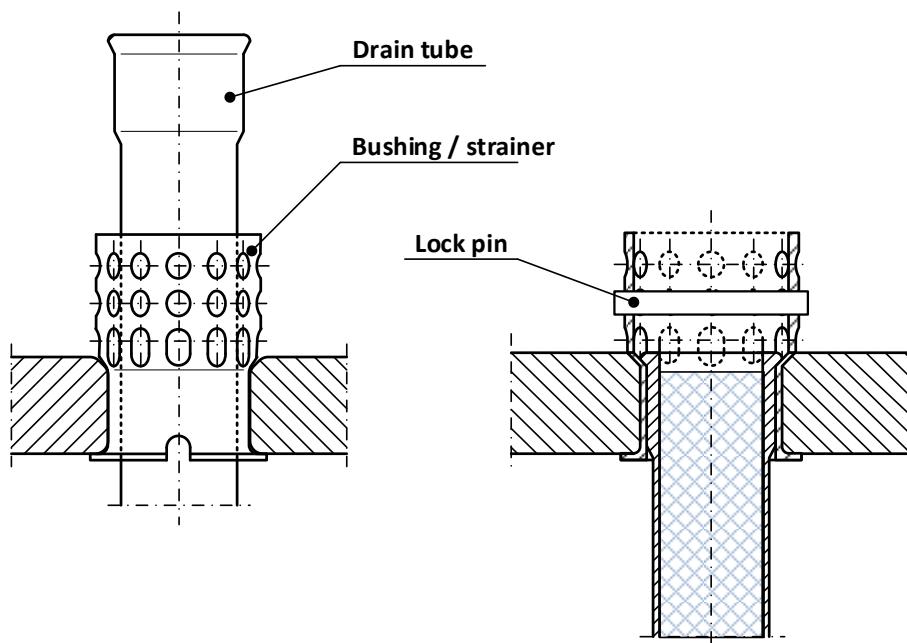
Ref.	Doc. Ref. No.	Description
1.	80.01	Specification for Erection
	86.12	Erection of Internals, Time Schedule
	81.01	Specification for Handling and Erection Related to Coated Parts
3.	10.50	Tube Module, Assembly and Details
	05.01	Adjustable Support Frame for Upper Tube Plate
	06.01	Tightening Clamp Type 1 for Lower Tube Plate
	06.03	Tightening Clamp Type 2 for Lower Tube Plate
	02.52	Casing Assembly
	02.70	Casing, End Wall Panel Type 1
	02.71	Casing, End Wall Panel Type 2
4.	34.01	Internal Covers, Part 1
	35.51	Internal Covers, Part 2
6.	07.51	Internal Insulation
7.	36.01	Davit for Top Cover

## Appendix B

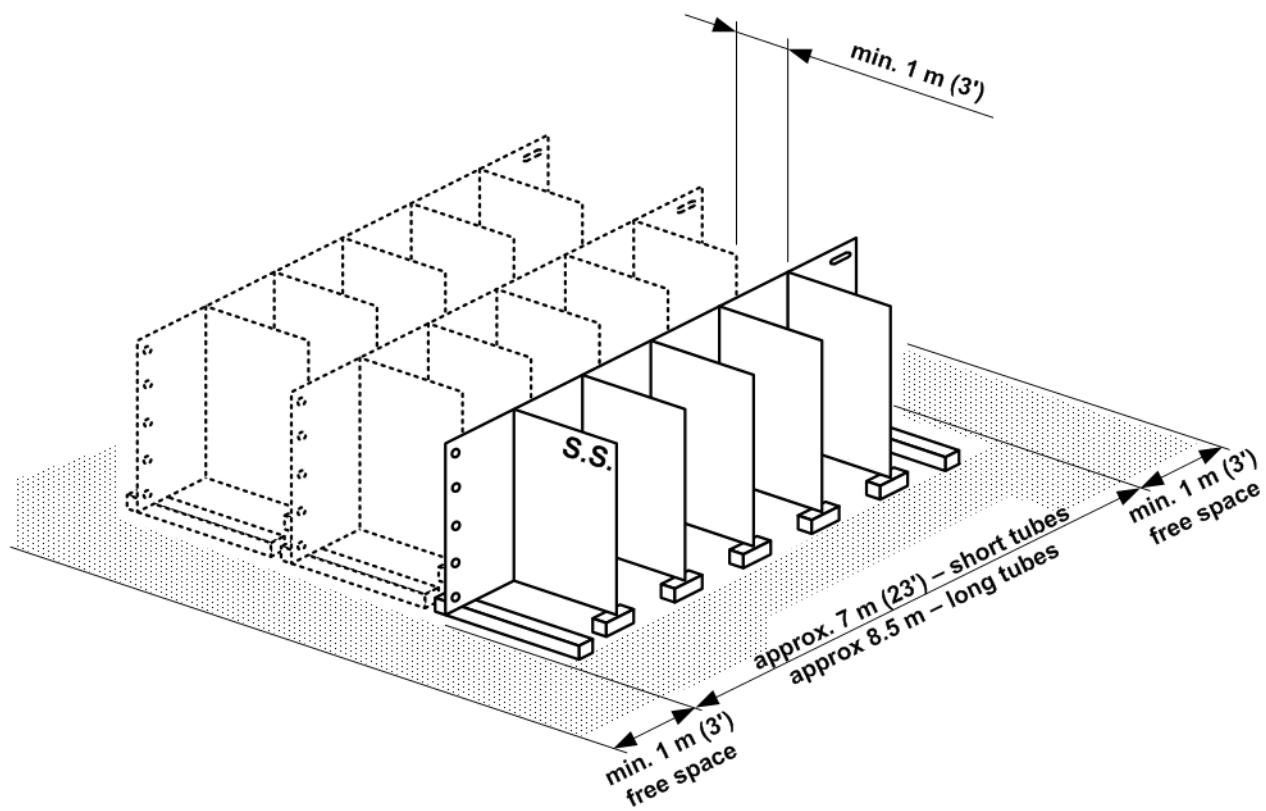
### Illustrations



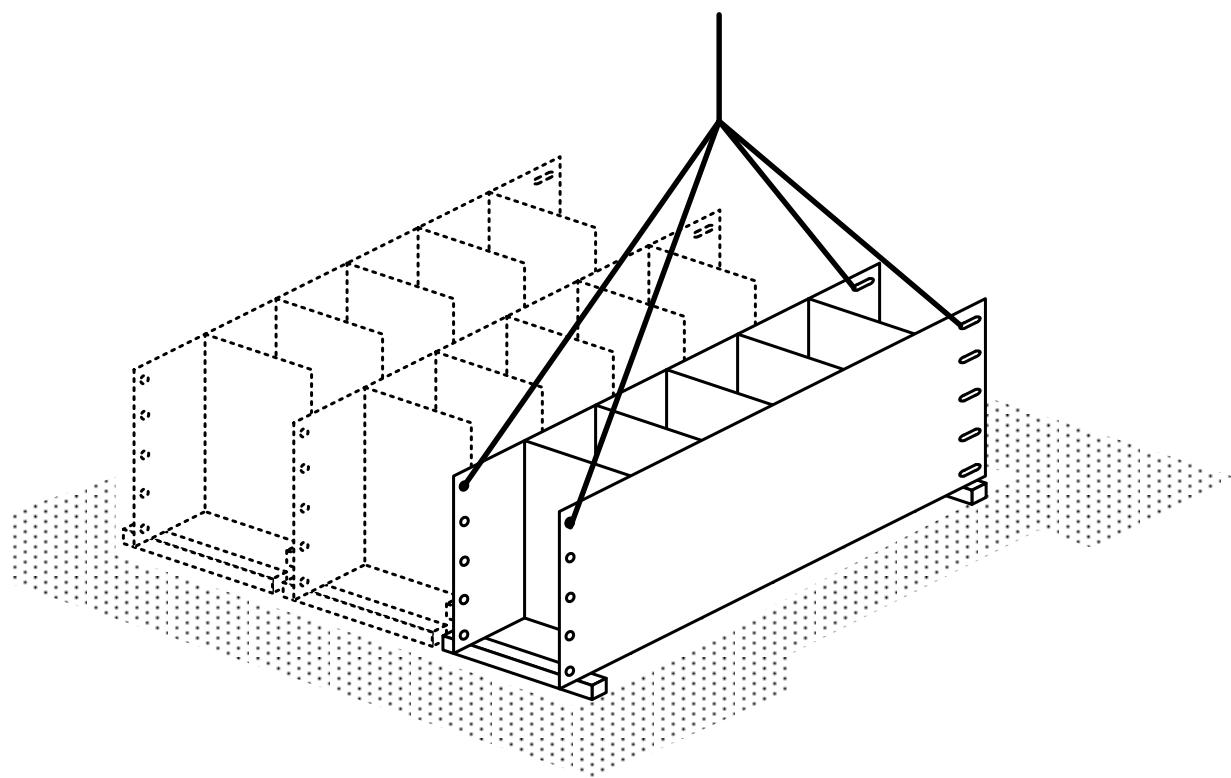
**Fig. 1**  
**Main Tube Internals**  
**Demister and Lock Tube**



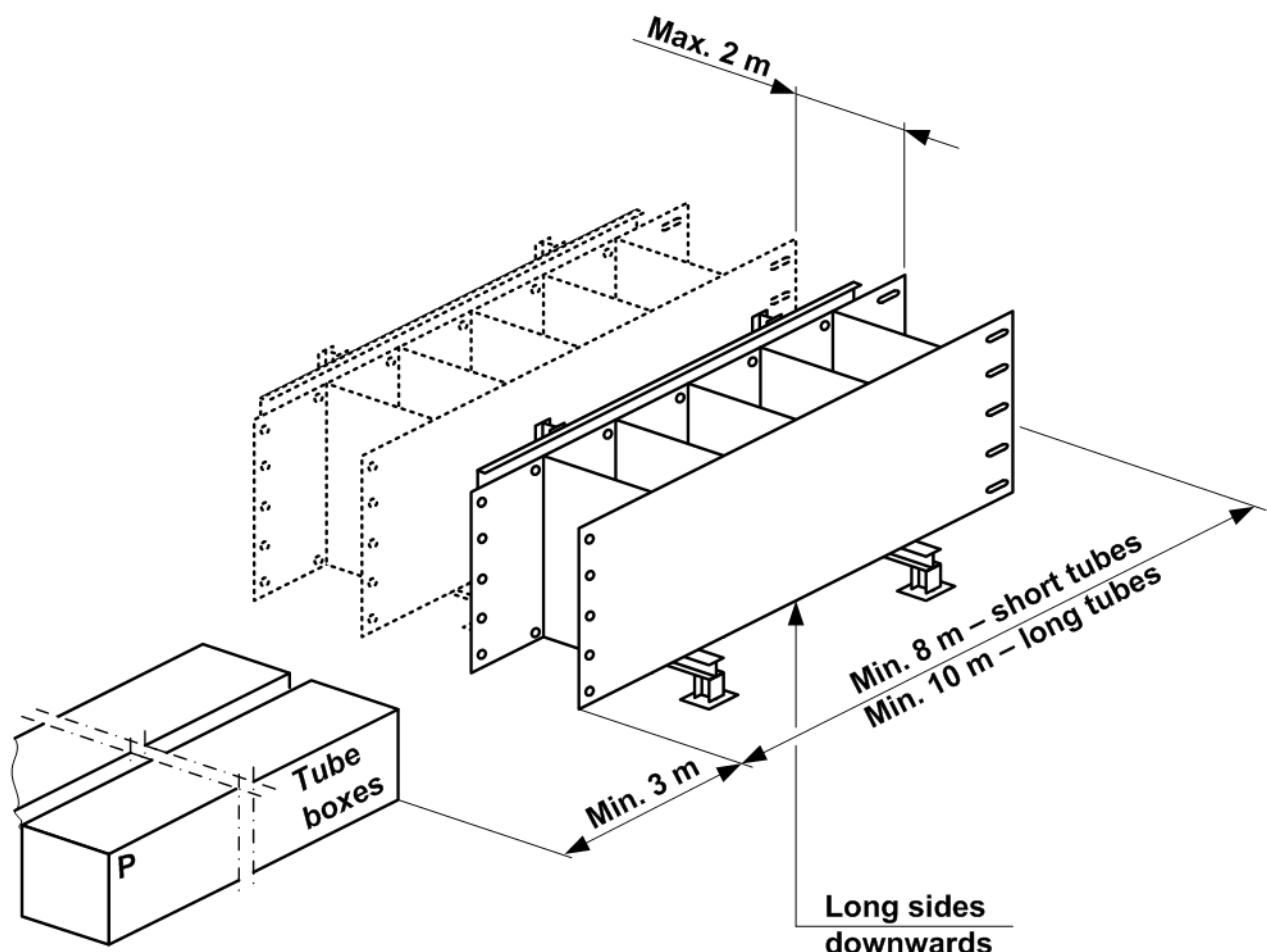
**Fig. 2**  
**Drain Tubes**  
**Bushing / Strainer**



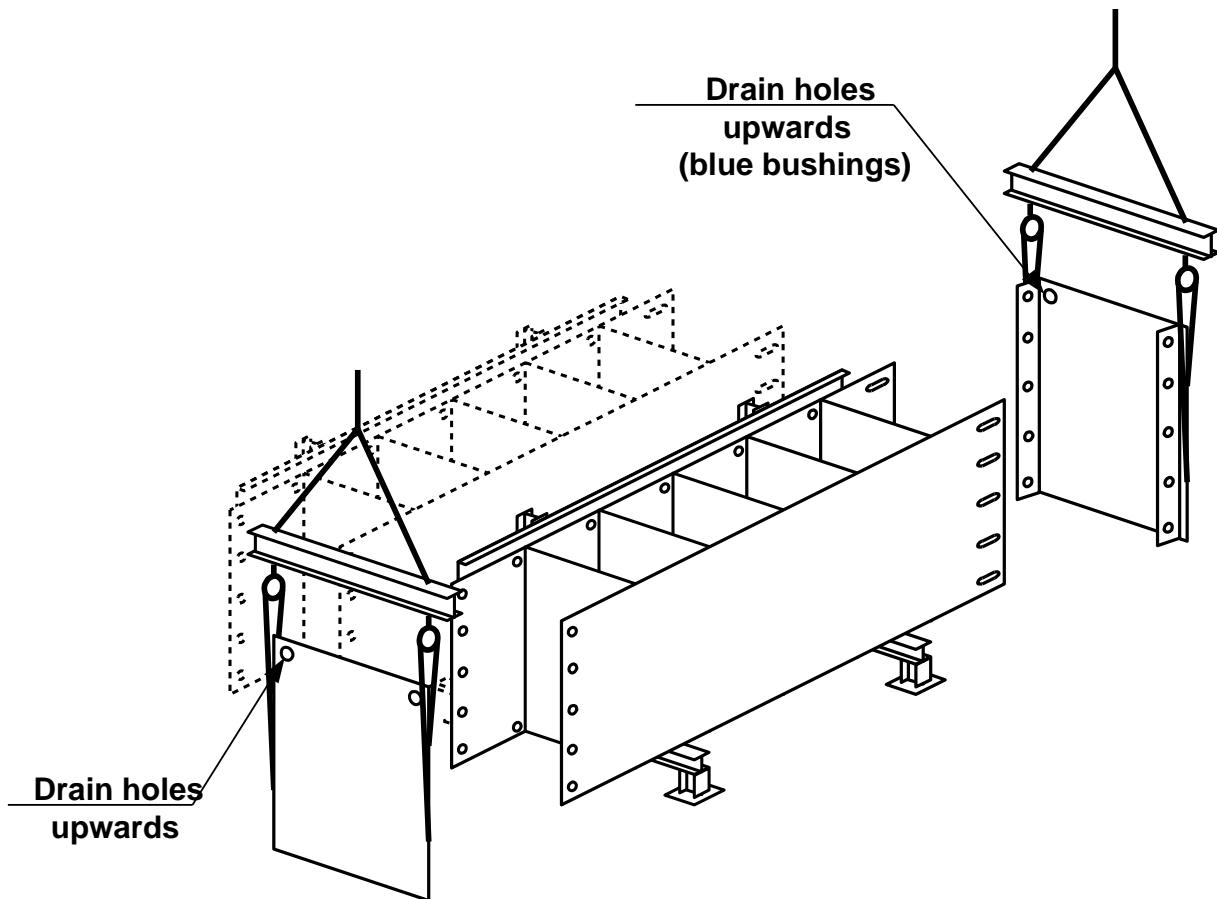
**Fig. 3**  
**Tube Modules**  
**Side Plates Type 1 and Baffle Plates**  
**Bushings in Baffle Plates**



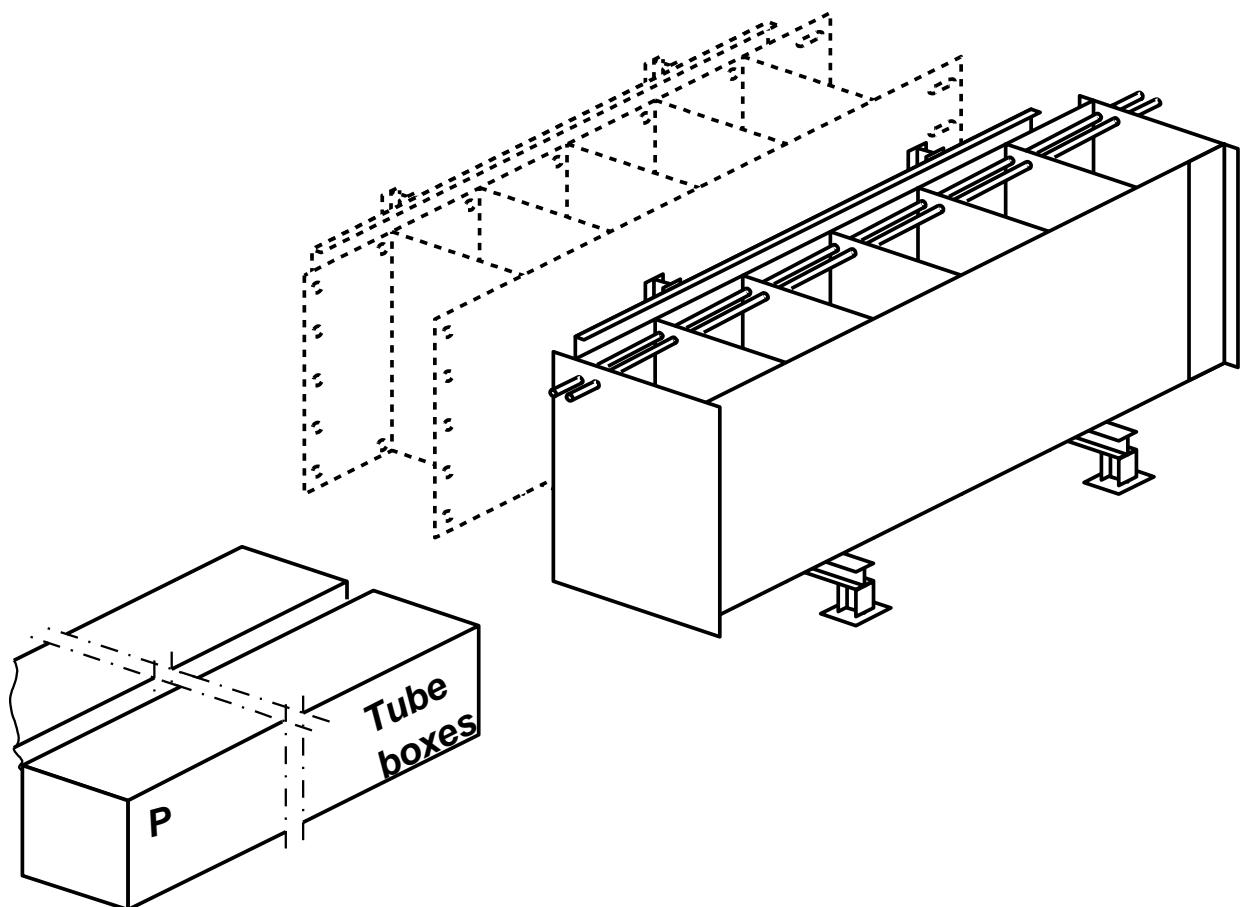
**Fig. 4**  
**Tube Modules**  
**Side Plates Type 2**



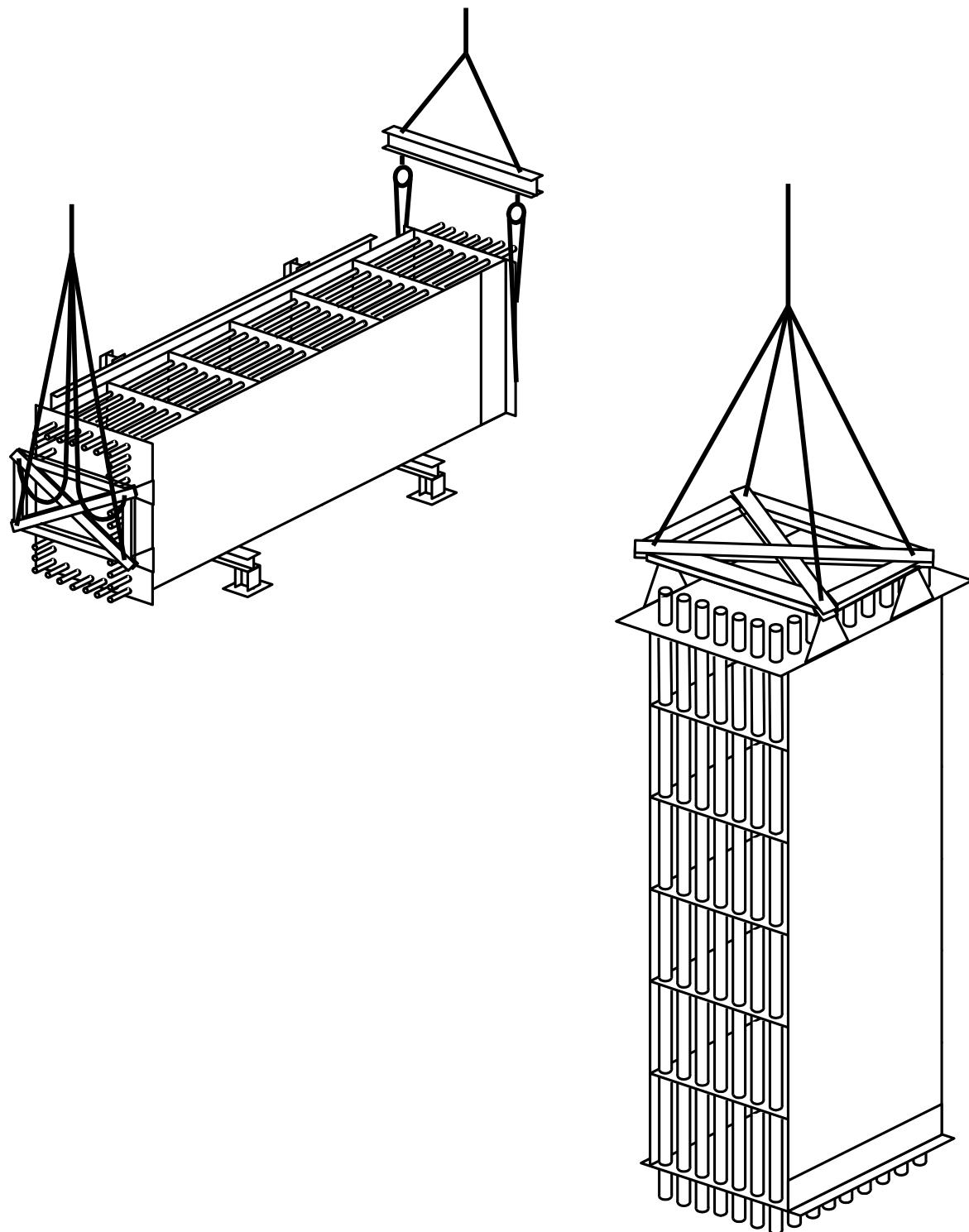
**Fig. 5**  
**Tube Modules**  
**Side Plate/Baffle Plate assembly**  
**1. Alignment**



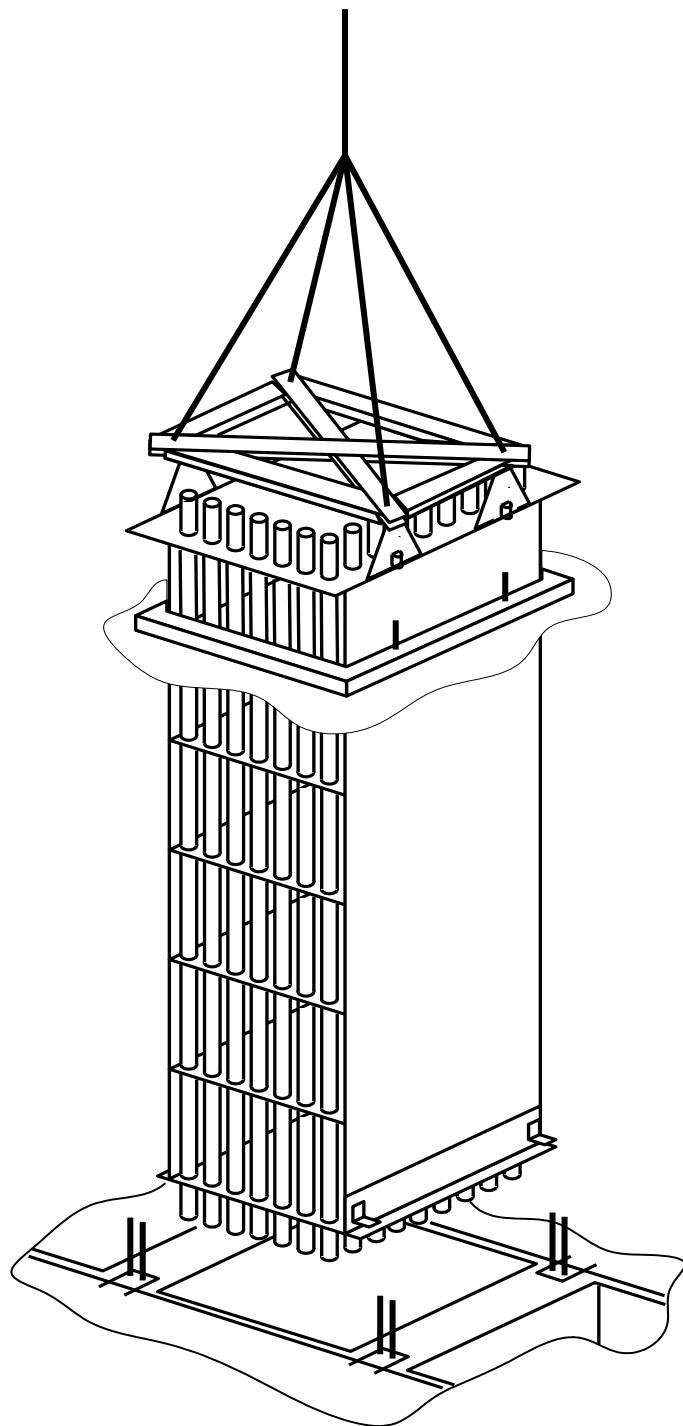
**Fig. 6**  
**Tube Modules**  
**Upper and Lower Tube Plates**  
**2. Alignment (check)**



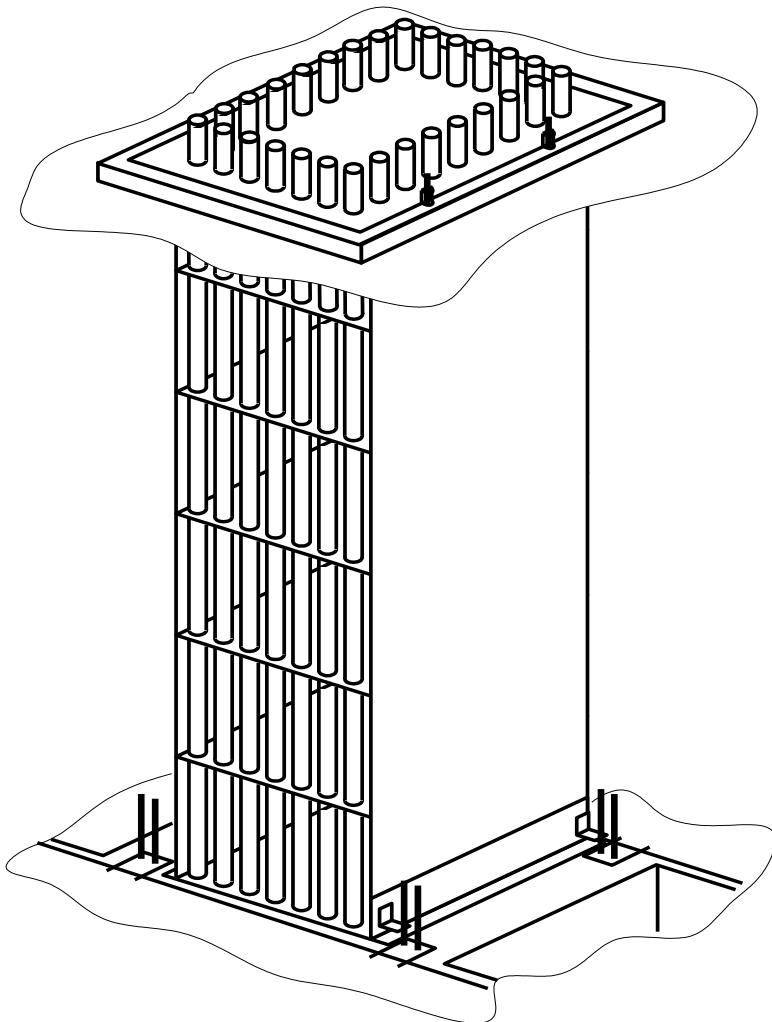
**Fig. 7**  
**Tube Modules**  
**Installation of Tubes**



**Fig. 8**  
**Tube Modules**  
**Lift to Vertical Position**



**Fig. 9**  
**Tube Modules**  
**Installation in Casing**  
**Step 3**



**Fig. 10**  
**Tube Modules**  
**Installation in Casing**  
**Step 3**

## Appendix C

### Special Tools and Accessories

#### Check List

Erection of Internals		
Item	Nos.	Remarks
Tarpaulin	1 pc per module	Size 4 x 10 m
Alignment Kit	1 set per assembly structure	
Liquid Soap	5 liter per assembly structure	
Bucket 10 l	2 pcs per assembly structure	
Hot Air Blower (for Bushings)	See MTO / packing list	Topsoe Supply
Nozzle for Hot Air Blowers	See MTO / packing list	Topsoe Supply
Installation Tool for Bushings - Upper Tube Plate - Lower Tube Plate	See MTO / packing list	Topsoe Supply
Installation Tool for Drain Tubes	See MTO / packing list	Topsoe Supply
Walkie Talkies	1 set per assembly structure	
Hot Air Blower (for Heating of Casing)	Min. 1 pc per acid collector	Optional – only in case of low ambient temperatures

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Ref. no. 85.02

WSA condenser  
Item no. C-3808

## Erection of WSA condenser Estimated time & manpower

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	Dec 13, 2023	ELAS	GARG	GC

SOPHIA document no.: TT-1436-EN version: 4

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The table shows the estimated time and manpower for erection activities for 1 pc. WSA condenser with 3 modules.

Erection activity	No. of working days	Manpower		Notes
		No. of crews	No. per crew	
Casing – prefabricated in sections	10	1	6-8	1.
Platforms and stairways, external	10	1	6-8	2.
Painting, touch-up	2	1	1-2	2.
Internal insulation	10	1	4-6	3.
Bricklining – Acid Collector	30	1	-	4.
Bricklining – Acid Concentrator	15	1	-	4.
Tube module – assembly	12	1	5	
Tube module and top cover – Installation	3	1	4	
Internal covers	6	2	2	
Davits	2	1	2-3	
Process gas inlet flange				

**Notes:**

1. Min. 4 welders recommended.
2. Details to be specified by others.
3. Min. 2 welders recommended.
4. To be co-ordinated with the bricklining supervisor – ref. Mobilisation Manual.

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Ref. no. 98.30

WSA Condenser  
Item no. C-3808

# Specification for replacement and maintenance of tube modules

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	Dec 13, 2023	ELAS	GARG	GC

SOPHIA document no.: TT-1432-EN version: 5

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## Appendices

A	List of reference drawings
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## 1 General

This specification describes the procedure for replacement of complete tube modules in the WSA condenser, the procedures for replacing damaged parts in the modules, and the procedures for assembly of new modules.

The special assembly structure located close to the WSA condenser is required for these activities, reference is made to Topsoe Doc. - ref. no. 98.50.

It is recommended to use the same crew of workers dedicated to the activities described in this specification. This in view of the special work to be carried out and the special handling requirements to be adhered to.

A crew of 5-6 people is recommended for replacing complete modules.

Several of the procedures referred to in this specification are described in Topsoe spec. - ref. no. 80.03, "Specification for erection of internals".

Therefore, in order to fully understand the procedures described in this specification, the content of this specification must be well known.

As a general guideline, 1 pc. complete new module is recommended to be assembled and stored, in order to be prepared for replacing a damaged module on a short term basis.

The module should be covered with a tarpaulin or similar to protect from rain, dust, etc.

The maintenance and replacement of tube modules involves a potential risk of exposure to sulphuric acid, and the safety measures described in the safety manual (part of the operating manual) must be observed.

### 1.1 Reference drawings

In the description of the procedures, reference to Topsoe drawings/parts is indicated in parentheses in relation to the item and/or activity described where applicable.

The reference drawings/parts are identified by their reference number - "ref. no."

In Appendix A, all client drawings referred to in relation to the description of the procedures for replacement, repair and assembly of tube modules are listed chronologically.

### 1.2 Coated parts

Special handling requirements apply in relation to coated parts, and therefore the following documents must, in general, be adhered to and implemented by the maintenance personnel.

Topsoe Spec. - ref. no. 81.01 Specification for handling and erection related to coated parts.

## 2 Preparations and conditions

This article describes the preparations and conditions required in order to carry out the activities related to replacement and maintenance of tube modules in a proper and safe way.

### 2.1 Working area

A suitable permanent working area must be located as close to the WSA condenser as possible.

This working area is to be used for installation of internals in the tubes and for assembly of new modules, if required.

The working area should be "sealed off" with fences or similar, and must be free from any foreign materials.

Only the parts required for the work and the necessary tools and accessories must be located on the working area.

### 2.2 Protection and precautions

Especially, in cases where strong winds are present on the top of the WSA condenser, it can be dangerous to handle the modules, and protection must in such cases be provided around the working areas.

In case of excessive dust in the air, measures must be taken to protect the working areas from contamination when installing new tubes in the modules and/or installing new modules in the WSA condenser.

If this is not possible, it is recommended to postpone or suspend the installation work.

In case of heavy rain, the replacement of modules should be suspended and all openings to the WSA condenser must be closed or covered with tarpaulins.

In case of temperatures below approximately 20°C, it is recommended to provide a cover around the module(s) and heat up the inside to approx. 20-25°C with a suitable hot air blower.

Handling of the tubes made of glass must be carried out with great care.

The tubes must only be taken out from the top of the box.

The tubes should be carried with a solid grip (suitable gloves may be used) around the tube.

Never lift the tubes by holding inside the ends.

### 2.3 Assembly of new modules

The assembly of new modules in the assembly structure follow the same procedures as apply for the original assembly.

### 3 Removal of modules

Removal of complete modules (10.50) from the WSA condenser should only be carried out when:

- Parts of the module are damaged to an extent making repair inside the WSA condenser not feasible.
- The time required to repair and/or replace the damaged part(s) is longer than the time required for replacing the complete module.

The time required to replace a complete module is approx. 8 hours per crew.

#### 3.1 Procedure

The following procedure applies for removal of complete modules:

Removal of top cover:

- The external insulation (40.01) is removed.
- The cover part 2 is removed.
- The gas outlet nozzle is disconnected from the outlet pipe.
- The four corner bolts are removed from the lower flange on the cover part 1 and replaced by guide rods (39.10).
- The nuts and washers on the remaining bolts are removed.
- The cover part 1 is removed.
- The guide rods (39.10) are removed.

The internal cover plates (34.01, 35.51) are removed.

The adjustment bolts (16.01, 02.70-pos.16-18 and 02.71-pos. 8-10 ) are removed.

The tightening clamps (06.01, 06.03) are removed.

The four guide lugs (20.01-pos. 1) on the upper tube plate and the bolts at the guide lugs are removed one at a time, and replaced by the guide rods (20.01-pos. 2) and the lifting/guide lugs (98.20).

The plugs in the threaded holes must be re-used in case the upper tube plate is to be re-used. The lifting frame (98.20) is connected to the lifting/guide lugs (98.20), and the module is removed from the WSA condenser.

The module is placed on an assembly structure (98.50) in case the module can be repaired and re-used, or on the ground in case no parts of the module are to be re-used.

The lifting rig (98.10-pos. 5) and the two steel wires (98.10-pos. 2) are used for getting the module from vertical to horizontal position.

#### **4 Installation of new modules**

The following procedure applies for installation of new modules, which have been pre-assembled in the assembly structure.

##### **4.1 Procedure**

The casing is prepared (80.03).

The new module is prepared for lifting (80.03).

The new module is installed in the casing (80.03), and the various parts removed are re-installed.

The top cover is re-installed according to the reverse sequence as is described previously.

#### **5 Replacement of module parts**

Two main options apply with respect to the damaged module(s) removed from the WSA condenser:

The module is damaged to an extent making it impossible to re-use any of the parts.

In this case the module should be put on the ground at a convenient area, the parts disassembled and disposed of.

Only some parts of the module are damaged and need to be replaced.

In this case the module is placed in the assembly structure for replacing the damaged parts.

When the module has been removed from the WSA condenser and placed in the assembly structure, the following is carried out:

The lifting device (98.20) and the lifting accessories (98.10) are removed.

The lifting lugs (98.11) need not to be removed from the lower tube plate in case the lower tube plate is to be re-used.

The adjustment bolts (16.01) are installed.

The module is thoroughly cleaned externally and inside the tubes with water.

The following describes the various procedures that apply depending on which damaged parts need to be replaced.

## 5.1 Tube internals

The damaged internals are removed directly from the tubes and disposed of.

New internals are installed in the tubes.

## 5.2 Tubes

The damaged tubes are removed and disposed of.

The internals, which can be re-used, should be carefully stored, or preferably installed in new tubes immediately after they have been removed from the damaged tubes.

Check the module alignment, and adjust the alignment via the adjustment bolts, if required.

New bushings are installed in the upper tube plate and in the lower tube plate.

The special installation tools must be used for installing the new bushings in the tube plates.

New tubes are installed (80.03).

In case new tubes need to be installed in the middle of the tube bundle, the guide cone should not be used. The guide cone cannot be recovered if it is dropped during the installation of a tube.

## 5.3 Upper tube plate

All the tubes are removed.

The tubes that can be re-used should be carefully stored in a tube box.

The upper tube plate is removed from the module using the lifting accessories (98.10) according to the reverse sequence of the installation.

The new upper tube plate is mounted (80.03).

Check the module alignment, and adjust the alignment via the adjustment bolts if required.

New bushings are installed in the lower tube plate with the special installation tool.

New tubes are installed (80.03).

## 5.4 Lower tube plate

All the tubes are retracted approximately 1 m from the upper tube plate, i.e. the tube ends are located away from the lower tube plate.

Damaged tubes are removed.

The lower tube plate is removed from the module using the lifting accessories (98.10) according to the reverse sequence of the installation (80.03).

The new lower tube plate is mounted (80.03).

Check the module alignment, and adjust the alignment via the adjustment bolts if required.

New bushings are installed in the upper tube plate with the special installation tool where damaged tubes have been removed.

New tubes are installed where damaged tubes have been removed (80.03).

The tubes are pushed towards the upper tube plate to their final position.

The new bushings in the upper tube plate and the bushings in the new lower tube plate must be heated before the tubes are pushed through the bushings.

## 5.5 Baffle plates and side plates

The tubes and the upper and lower tube plates are removed as described in 5.3 and 5.4.

The undamaged parts are temporarily stored for later use.

The side plate/baffle plate assembly is dismantled and the undamaged parts are temporarily stored for later use.

## Appendix A

### List of reference drawings

Article – ref.	Doc. ref. no.	Description
1.	98.50	Assembly structure
	80.03	Specification for erection of internals
	81.01	Specification for handling and erection related to coated parts
3.	10.50	Tube module, assembly and details
	40.01	Top covers, external insulation
	34.01	Internal covers part 1
	35.51	Internal covers part 2
	02.52	Casing Assembly
	02.70	Casing, End Wall Panel Type 1
	02.71	Casing, End Wall Panel Type 2
	06.01	Tightening clamp type 1 for lower tube plate
	06.03	Tightening clamp type 2 for lower tube plate

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Ref. no. 60.01

WSA Condenser  
Item no. C-3808

Inspection forms  
steel parts and internal insulation  
(Topsoe supply)  
MW 2110

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	Dec 22, 2023	ELAS	GARG	GC

SOPHIA document no.: TT-1452-EN version: 2

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## 1 General

The attached check lists/non-conformity list are intended to be used in connection with work shop and/or site inspections of WSA Condenser parts.

The check list/non-conformity list must be filled in and signed by the Purchaser's inspector(s).

The check lists and non-conformity lists (if required) must be enclosed in the main inspection report.

This specification should be submitted to the supplier for information.

## 2 Inspection check list

The inspection check list (Appendix A) specifies the WSA Condenser parts to be inspected and describes the related subject to be checked.

The check list provides the possibility of keeping record and status of all the inspection activities related to the supply of WSA Condenser parts.

## 3 Dimensional check list

The dimensional check list (Appendix B) includes main and critical dimensions of large parts, which are directly related to the erection/assembly and performance of the WSA Condenser. These dimensions must always be checked as a minimum.

In case "spot check" is indicated above "No. of", only the specified number of items out of the total number need to be checked. See also 4.

Dimensional check of smaller parts must in general be carried out as a 100% check, however, in case of several identical items - only of a suitable number (indicated as "spot" in the inspection check list). See also 4.

## 4 Non-conformity list

In case non-conformities are detected, these must be recorded in the non-conformity list (App. C) for repair.

Items subject to spot check must be marked with "No. X of Y", i.e. item number of total number for identification.

In case non-conformities are detected in connection with spot check, the inspection/check must be extended to cover all the items.

Other discrepancies found, which are not covered by the Inspection-/Dimensional Check List must be reported in the main inspection report.

## 5 Reference documents

Apart from the drawings and specifications referred to in the check lists, the following documents must be adhered to:

- |                                |  |
|--------------------------------|--|
| Topsoe spec. - ref. no. 46.02, | Technical specification for steel parts and internal insulation. |
| Topsoe spec. - ref. no. 58.01, | General tolerances for steel parts.                              |
| Topsoe spec. - ref. no. 75.02, | Material take-off  |

## Appendix A

### Inspection Check List

#### Steel Parts

and

Internal Insulation

Inspection Check List		Purchase Order No.:	Supplier:					
Doc. Ref. Nos.	Item	Subject	Workshop	Site	Non-conformity No.	Note No.	Completion Date	Accepted
02.52 02.16 (02.70) (02.71) (02.74) (02.75) (02.26) (02.32)	Casing Assembly	Dimensional - ref. Appendix B	X	X				
		Casing Details	X	X				
		Welding Details (spot)	X	X				
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Material certificates	(X)					
		Welders certificates	(X)					
		Test records	(X)					
		Painting incl. test record	(X)					
		Packing / Expediting	X					
03.02 55.01 56.03	Acid Collector Casing	Dimensional - ref. Appendix B	X	X				
		Welding details (spot)	X	X				
		No. of parts	X	X				
		Internal surfaces and roundings	X	X				
		Inspection plan	(X)					
		Packing / Expediting	X					
03.40	Acid Concentrator Casing	Dimensional - ref. Appendix B	X					
		Welding details (spot)	X					
		No. of parts	X	X				
		Internal surfaces and roundings	X					
		Inspection plan	X					
		Material certificates	X					
		Welders certificates	X					
		Test records	X					
		Painting incl. test record	X					
03.60	Acid Concentrator Hot air inlet flange	Dimensional - ref. Appendix B	X					
		Welding details (spot)	X					
		No. of parts	X	X				
		Material certificates	X					
		Welders certificates	X					
		Test records	X					
04.52	Partitions / Walkways and Ladders	Dimensional - ref. Appendix B	X	X				
		Welding details (spot)	X	X				
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Priming	X	X				
		Packing / Expediting	X					

Inspection Check List		Purchase Order No.:	Supplier:					
Doc. Ref. Nos.	Item	Subject	Workshop	Site	Non-conformity No.	Note No.	Completion Date	Accepted
05.01	Support Frames	Dimensional - ref. Appendix B	X	X				
		Welding details	X	X				
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Packing / Expediting	X					
06.01 / 06.03	Tightening Clamps	Dimensional - ref. Appendix B	X	X				
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Priming	X	X				
		Packing / Expediting	X					
06.05	Guide Rod Assemblies	Dimensional - ref. Appendix B	X	X				
		No. of main parts	X	X				
		Priming	X	X				
		Packing / Expediting	X					
06.11	Protection Plates	Dimensional (spot)	X					
		No. of Parts	X	X				
		Galvanizing	X					
		Packing / Expediting	X					
07.51	Internal Insulation	Insulation type	X	X				
		Insulation thickness (spot)	X	X				
		Insulation boxes - trial-fitted	X	X				
		Distance - top of frame to ref. line 14 / 3270 ± 6	X	X				
		Distance - between ref. lines 14 / 2560 ± 6	X	X				
		Distance - between pos. 6 / 2 ± 0.5	X	X				
		Insulation details	X	X				
		Packing / Expediting	X					
15.51/ 15.52	Side Plates Type 1 and 2	Dimensional - ref. Appendix B	X					
		Tack welding , nuts pos. 5 (spot)	X					
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Marking	X					
		Priming	X					
		Packing / Expediting	X					

Inspection Check List		Purchase Order No.:	Supplier:					
Doc. Ref. Nos.	Item	Subject	Workshop	Site	Non-conformity No.	Note No.	Completion Date	Accepted
16.01	Adjustment Bolts	Dimensional (spot)	X					
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Galvanizing	X					
		Packing / Expediting	X					
20.01	Guide Lugs and Guide Rods	Dimensional	X					
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Galvanizing	X					
		Packing / Expediting	X					
21.02	Guide Lugs	Dimensional	X					
		No. of Parts	X	X				
		Packing / Expediting	X					
23.02	Guide Plates	Dimensional	X					
		No. of Parts	X	X				
		Packing / Expediting	X					
34.01 / 35.51	Internal Covers	Dimensional (spot)	X					
		No. of parts	X	X				
		Packing / Expediting	X					
36.01	Davit	Dimensional - ref. Appendix B	X	X				
		Welding details (spot)	X	X				
		No. of parts	X	X				
		Painting incl. test records	(X)					
		Packing / Expediting	X					
38.07 55.01 56.04 57.02	Top Cover	Dimensional - ref. Appendix B	X					
		Casing Details	X					
		Welding details	X					
		No. of main parts	X	X				
		No. of spare parts	X	X				
		Marking covers part 1 and part 2	X					
		Internal surfaces and roundings	X					
		Blindflanges installed	X					
		Dye-penetrant test	(X)					
		Inspection plan	(X)					
		Material certificates	(X)					
		Welders certificates	(X)					
		Test records	(X)					
		Packing / Expediting						

Inspection Check List		Purchase Order No.:	Supplier:					
Doc. Ref. Nos.	Item	Subject	Workshop	Site	Non-conformity No.	Note No.	Completion Date	Accepted
39.07	Maintenance Platform	Dimensional (trial fitted on top cover)	X					
		Packing / Expediting	X					
39.10	Guide Rod	Dimensional (spot)	X					
		No. of parts	X	X				
		Galvanizing	X					
		Packing / Expediting	X					
43.01	Lifting Device	Dimensional	X					
		No. of parts	X	X				
		Packing / Expediting	X					
98.50	Assembly Structure	Dimensional	X					
		No. of parts	X	X				
		Packing / Expediting	X					
98.10	Lifting Accessories	Dimensional	X					
		No. of parts	X	X				
		Packing / Expediting	X					
98.11	Lifting Lugs	Dimensional (spot)	X					
		No. of parts	X	X				
		Packing / Expediting	X					
98.20	Lifting Device	Dimensional	X					
		No. of parts	X	X				
		Packing / Expediting	X					

## Appendix B

### Dimensional Check List

#### Steel Parts

and

Internal Insulation

Dimensional Check List					
Ref. No. 02.52		Item: Casing assembly	No. 1 of 1		
Ref. / Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date	Accepted
	Height - ref. line 1 to ref. line 2	7750 ± 8			
	Distance – between CL of modules	2110 ± 4			
	Length - outside casing	6470 ± 8			
	Width - outside casing	3590 ± 6			
	Height 1 - ref. line 1 to ref. line 8	1350 ± 4			
	Height 2 - ref. line 1 to ref. line 8	2630 ± 6			
	Height - between ref. lines 8	2560 ± 6			
03.02	Distance - CL modules to tightening clamps	800 ± 3			
05.01	Width - inside support frame (opening)	1950 ± 2			
05.01	Length - inside support frame (opening)	2310 ± 2			
05.01	Diagonals - inside support frame (opening)	D1-D2 = ± 3			
05.01	Planeness – support frame	Max 2 mm gap			
	Distance - CL module to ref. line 12	1090 ± 4			
	Height - ref. line 1 to ref. line 13	1300 ± 4			
	Height - between ref. lines 13	1280 ± 4			
	Dimensions - air inlet nozzles	700 ± 3 x 1700 ± 4			
	Dimensions - air outlet nozzles	Flange DN 1200			
02.74	Height - ref. line 2 to CL air outlet	650 ± 3			
02.74	Height - CL air outlet to CL air inlet	6400 ± 8			
	Distance - CL module row to face air inlet	2200 ± 6			
	Distance - CL module row to face air outlet	2200 ± 6			
	Distance - CL module row to ref. line 11	1145 ± 6			
	Positioning - supports for davit	-			
	Dimensions - bearing for davit	-			
	Dimensions - guide for davit	-			
	Positioning - manholes	-			
	Positioning - lifting lugs	-			

Dimensional Check List				
Ref. No. 03.02		Item: Acid collector casing	No. 1 of 1	
Ref. / Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date
	Height - baseplate to ref. line 2	2450 $\pm$ 6		
	Length - inside casing	6530 $\pm$ 4		
	Width - inside casing	2670 $\pm$ 6		
	Diagonals - inside casing	D1-D2 = $\pm$ 21		
	Distance - CL acid outlet to face gas inlet	1425 $\pm$ 4		
	Distance - CL casing to CL acid outlet	2000 $\pm$ 3		
	Height - CL gas inlet to ref. line 2	1100 $\pm$ 3		
	Height - CL gas inlet to face acid outlet	1300 $\pm$ 4		
	Dimensions - gas inlet flange	DN 1850		
	Dimensions - acid outlet flange	OD 1470 $\pm$ 4 BCD 1420 $\pm$ 4 44 holes Ø19		
	Distance - CL casing to CL baseplate	3000 $\pm$ 3		
	Distance 1 - CL baseplate to CL bolt holes	1950 $\pm$ 4		
	Distance 2 - CL baseplate to CL bolt holes	100 $\pm$ 2		

Dimensional Check List					
Ref. No. 03.40		Item: Acid Concentrator casing	No. 1 of 1		
Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date	Accepted
1	Height – top section	1350 ± 3			
1	Dimensions 1 – top section	Ø1320 ± 4 x 10			
1	Dimensions 2 – top section	Ø1120 ± 3 x 10			
2	Dimensions flange 1 – top section	OD 1470 ± 4 BCD 1420 ± 4 44 holes Ø19			
13	Dimensions flange 2 – top section	OD 1270 ± 4 BCD 1220 ± 4 36 holes Ø19			
1	Height – bottom section	1200 ± 3			
1	Dimensions – bottom section	Ø1120 ± 3 x 10			
1, 12	Distance – CL bottom section to face pos. 12	600 ± 3			
13	Dimensions flange 1 – bottom section	OD 1270 ± 4 BCD 1220 ± 4 36 holes Ø19			
12	Dimensions flange 2 – bottom section (gas/air inlet)	OD 895 ± 3 BCD 840 ± 3 24 holes Ø19			
4	Dimensions flange 3 – bottom section (acid outlet)	OD 597 +/- 3 BCD 540 +/- 3 16 holes Ø29			
4, 5	Height – bottom plate to face pos. 4	100 ± 2			
11	Dimensions – gas/air inlet duct	Ø711 ± 3 x 6			
11	Length - gas/air inlet duct	600 ± 3			
11	Height - gas/air inlet duct	300 ± 3			
11, 12	Angle - gas/air inlet duct	45° ± 3°			
12	Dimensions flanges – gas/air inlet duct	OD 895 ± 3 BCD 840 ± 3 24 holes Ø19			
14	Dimensions and locations of lifting lugs	-			

Dimensional Check List					
Ref. No. 03.60		Item: Acid Concentrator Hot Air Inlet	No. 1 of 1		
Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date	Accepted
1-3	Height – flange face to flange face	200 ± 2			
1	Dimensions – flange pos. 1	OD 895 ± 3 BCD 840 ± 3 24 holes Ø19			
3	Dimensions – flange pos. 3	OD 483 ± 3 BCD 432 ± 3 12 holes Ø19			
2	Dimensions – pipe pos. 2	Ø324 ± 2 x 4			
4	Dimensions and holes in sleeve pos. 4	-			
10	Insulation between pipe and sleeve	-			



Dimensional Check List			Spot check		
Ref. No. 06.01, 06.03, 06.05		Item: Tightening clamps and guide rods	No. of		
Ref. / Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date	Accepted
06.01 – Type 1					
	Complete assembly - trial-fitted	-			
	Distance – inside acid collector casing to edge pos. 4	206 ± 5			
	Height – top acid collector casing to edge pos. 4	20 ± 1			
06.03 – Type 2					
	Complete assembly - trial-fitted	-			
	Distance – inside acid collector casing to edge pos. 4	205 ± 5			
	Height – top acid collector casing to edge pos. 4	10 ± 1			
06.05					
	Height – top acid collector casing to top guide rod support	25 ± 1			
	Distance 1- CL module to guide rod	1100 ± 4			
	Distance 2 – CL module to guide rod	1005 ± 3			

Dimensional Check List			Spot check	
Ref. No. 15.51, 15.52		Item: Side plates	No. of	
Ref. / Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date
1	Length - short side	7690 ± 8		
1	Length - long side	7715 ± 8		
1	Width	2290 ± 4		
1	Diagonals	D1-D2 = 23 ± 3		
1	Distance - CL to CL holes Ø23/Ø30	500 ± 1		
1	Distance - edge to CL holes Ø23/Ø30	25 ± 0.5		
1	Distance - CL to CL slotted holes Ø30	500 ± 1		
1	Distance - edge to CL slotted holes Ø30	55 ± 0.8		
1	Distance - ref. line 6 to CL holes Ø30	1330 ± 4		
1	Distance - between CL holes Ø30	1280 ± 4		
1	Distance - CL to CL holes Ø30	1090 ± 3		
1,3	Distance - ref. line 6 to ref. line 9	1386 ± 4		
1,3	Distance - between ref. lines 9	1280 ± 4		
1,2	Distance - ref. line 6 to ref. line 14	3300 ± 6		
1,2	Distance - between ref. line 14	2560 ± 6		
2	Distance - between pos. 2	2 ± 0.5		

Dimensional Check List					
Ref. No. 36.01		Item: Davit(s)	No. of		
Ref. / Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date	Accepted
1	Dimensions - pipe	$\varnothing 168 \times 10$			
1	Length - bottom to CL horizontal part	$5500 \pm 8$			
1,4	Distance - CL to CL lifting hole	$2530 \pm 6$			
2	Distance - bottom to ref. line A	$1250 \pm 4$			
2	Dimensions - resting ring	$\varnothing 265 \pm 2 \times 30$			
3	Distance - bottom to protection sheet	$100 \pm 2$			
3	Dimensions - protection sheet	$\varnothing 172 \pm 2 \times 200$			

Dimensional Check List					
Ref. No. 38.07		Item: Top cover(s)	No. of		
Ref. / Pos. No.	Description	Dimension	Non-conformity / Note No.	Completion Date	Accepted
1	Length - inside casing	2290 $\pm$ 6			
1	Width - inside casing	1930 $\pm$ 4			
1,2,3	Height - cover part 1	1600 $\pm$ 4			
1,2	Diagonals - inside casing	D1-D2 = $\pm$ 10			
3,4	Bolt holes - part 1 and part 2 trial-fitted	-			
3,4	Planeness - flanges part 1 and part 2	max 2 mm gap			
5,6	Height - bottom to CL nozzle	940 $\pm$ 3			
5,6	Distance - CL to face nozzle	1600 $\pm$ 4			
6	Dimensions - gas outlet nozzle	DN 1100			

## Appendix C

### Non-conformity List

#### Notes

#### Steel Parts

and

#### Internal Insulation



Notes:

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Ref. no. 75.02-UNC

WSA condenser  
Item no. C-3808

## Material take-off Topsoe supply

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	Dec 13, 2023	ELAS	GARG	GC

SOPHIA document no.: TT-1542-EN version: 5

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## 1 General

This Material take-off specifies the parts to be delivered by Topsoe for 1 pc WSA condenser – 3 modules.

The Ref. Nos. indicated in the tables must for this specification be regarded as part identification numbers.

## 2 Steel Parts

No. of	Description	Ref. No. / Pos. No.	Remarks
	Parts for 1 pc Casing Assembly Comprising:		
1	Acid Collector Casing, including	03.02	
12	Tightening Clamp Type 1	06.01/pos. 1	
6	Tightening Clamp Type 2	06.03/pos. 1-2	
4	Guide Rod Assembly	06.05	
1	End Wall Panel Type 1	02.70	
1	End Wall Panel Type 2	02.71	
3	Side Wall Panel Type 1	02.74	
3	Side Wall Panel Type 2	02.75	
2	Support for Davit	02.26	
1	Top Frame, incl. adjustable support frames	02.32, 05.01	
10	Plate 25x6, L = 2200	02. 52/pos. 14	
1	Acid Concentrator Casing	03.40	
1	Acid Concentrator, hot air inlet flange	03.60	
5	Partition/Walkway	04.52	
1	Ladder Type A	04.52	
1	Ladder Type B	04.52	
20	Support	04.52/pos. 3	
10	Support	04.52/pos. 4	
10	Support	04.52/pos. 13	
12	Retainer plate	06.01/pos. 2	
12	Tightening clamp	06.01/pos. 3-5,10-12	
12	Clevis Pin with split	06.01/pos. 6	
12	Stud bolt with cone	06.01/pos. 7	
6	Tightening clamp	06.03/pos. 3-5	
12	Protection plate	06.11/Type 1	
6	Protection plate	06.11/Type 2	
200 m <sup>2</sup>	Internal Insulation Comprising:		
175 m <sup>2</sup>	Insulation, 100 mm mineral wool	07.51/pos. 1	
80 m <sup>2</sup>	Cover Plate, t = 1 mm, carbon steel	07.51/pos. 2	
10 m <sup>2</sup>	Cover Plate, t = 1 mm, stainless steel	07.51/pos. 3	
150 m	Cover Plate, t = 1 mm, SS, perforated	07.51/pos. 4	
2500	L 100 x 50 x 3	07.51/pos. 5	
8	Hex self-tapping screw Ø4.8 x 19	07.51/pos. 6	
4	L 25 x 25 x 4, L = 2290 mm	07.51/pos. 8	
	Manhole Cover	07.51	
3	Side plate, type 1	15.51	
3	Side plate, type 2	15.52	
35	Spacer	15.51/15.52/pos. 8	
35	Spacer	15.51/15.52/pos. 10	

No. of	Description	Ref. No. / Pos. No.	Remarks
12	Guide lug	20.01/pos. 1	
4	Guide rod	20.01/pos. 2	
8	Guide lug	21.02	
2	Guide plate	23.02/pos. 1	
2	Guide plate	23.02/pos. 2	
4	Plate	34.01/pos. 1	
4	Plate	34.01/pos. 2	
4	Plate	35.51/pos. 1	
4	Plate	35.51/pos. 2	
24	Plate	35.51/pos. 3	
24	Plate	35.51/pos. 4	
12	Plate	35.51/pos. 5	
10	Plate	35.51/pos. 6	
15	Plate	35.51/pos. 7	
10	Plate	35.51/pos. 8	
1500	Hex self-tapping screw Ø5.5 x 25	35.51/pos. 9	
2	Davit – 2 sections	36.01	
1	Maintenance platform	39.07	
4	Guide rod	39.10	
2	Support for assembly structure	98.50/pos. 1, 3, 10	
2	Top part of support for ass. structure	98.50/pos. 1, 10	
1	Beam for assembly structure, upper	98.50/pos. 2	
1	Beam for assembly structure, lower	98.50/pos. 2	
1	Platform for assembly structure	98.50/pos. 7-9	
2	Steel wire with eyes	98.10/pos. 2	
2	Single snatch block with hook	98.10/pos. 3	
2	Shackle	98.10/pos. 4	
1	Lifting rig	98.10/pos. 5	
4	Lifting lug	98.11/pos.1 - 4	
1	Lifting device, complete	98.20	

**3 Bolts – to be supplied as loose parts**

No. of	Description	Ref. No. / Pos. No.	Remarks
25	Stud bolt 5/8"UNC x 320, 8.8-ELZ	16.01	
25	Stud bolt 5/8"UNC x 150, 8.8-ELZ	02.70, 02.71	
150	Stud bolt 5/8"UNC x 150, A4-70	05.01	
20	Bolt 3/4"UNC x 75, A4-70	36.01	
35	Bolt 3/4"UNC x 60, A4-70	98.50	
160	Bolt 5/8"UNC x 55, 8.8-ELZ	02.52	
40	Bolt 5/8"UNC x 30, 8.8-ELZ	15.51, 15.52	
40	Bolt 5/8"UNC x 25, 8.8-ELZ	15.51, 15.52	
40	Bolt 5/8"UNC x 25, 8.8-ELZ	21.02	
125	Bolt 1/2"UNC x 45, 8.8-ELZ	02.70, 04.52	
10	Bolt 1/2"UNC x 40, A4-70	98.11	
50	Bolt 1/2"UNC x 30, 8.8-ELZ	04.52	
50	Bolt 1/2"UNC x 30, A4-70	20.01, 98.20	
200	Bolt 5/16"UNC x 25, 8.8-ELZ	15.51, 15.52	
120	Bolt 5/8"UNC x 75, 8.8-ELZ	03.40, 03.50, 03.60	
30	Nut 1 1/4"UNC, A4-70	06.01	
75	Nut 3/4"UNC, A4-70	06.03, 36.01, 98.50	
350	Nut 5/8"UNC, 8-ELZ	02.52, 02.70, 02.71, 06.03, 16.01	
150	Nut 5/8"UNC, A4-70	05.01, 06.03	
225	Nut 1/2"UNC, 8-ELZ	02.70, 04.52	
170	Nut 5/16"UNC, 8-ELZ	15.51, 15.52	
120	Nut 5/8"UNC, 8-ELZ	03.40, 03.50, 03.60	
20	Washer 1 1/4", A4	06.01	
115	Washer 3/4", A4	06.03, 36.01, 98.50	
350	Washer 5/8", STEEL-ELZ	02.52, 21.02	
140	Washer M16-XL, STEEL-ELZ	02.70, 02.71, 16.01	
150	Washer M16-XL, A4	05.01	
300	Washer 1/2", STEEL-ELZ	02.70, 04.52	
40	Washer 1/2", A4	20.01, 98.11	
350	Washer 5/16", STEEL-ELZ	15.51, 15.52	
240	Washer 5/8", STEEL-ELZ	03.40, 03.50, 03.60	

#### 4 Top Cover

No. of	Description	Ref. No. / Pos. No.	Remarks
3	Top cover part 1 and part 2 - coated	38.07	
6	Slip-on flange, 8" Class 150#	38.07/pos. 11	
12	Lifting lug	38.07/pos. 19	
55	Stud bolt 3/4"UNC x 100, A4-70		
140	Stud bolt 5/8"UNC x 130, A4-70		
30	Bolt 5/8"UNC x 55, A4-70		
55	Nut 3/4"UNC, A4-70		
300	Nut 5/8"UNC, A4-70		
55	Washer 3/4", A4		
225	Washer 5/8", A4		
140	Washer M16-XL, A4		

#### 5 Bricklining

No. of	Description	Ref. No. / Pos. No.	Remarks
1	Acid resistant bricklining materials	03.13	
1	Acid Concentrator - acid resistant bricklining materials	03.50	

#### 6 Tube Module Parts

No. of	Description	Ref. No. / Pos. No.	Remarks
3	Upper tube plate – coated – with Bushings	11.01, 30.10	
12	Baffle plate – C.S	12.02/pos.1	
3	Baffle plate – S.S	12.02/pos.2	
3	Lower tube plate – coated – with Protection sheet and bushings	13.02, 14.01, 32.02, 32.03	

## 7 PTFE / PP Parts

No. of	Description	Ref. No. / Pos. No.	Remarks
15	PTFE sheet 210 x 60 x 2 mm	06.10/Type 1	
8	PTFE sheet 110 x 60 x 2 mm	06.10/Type 2	
60	Plug for tube plates	14.10	
6	PTFE sealing strip 2290x160	17.01	
25	Bushing/upper tube plate – spare	30.10	
100	Bushing for baffle plate – spare (min)	31.10	
16600	Bushing for baffle plate	31.10	
25	Bushing/lower tube plate – spare	Main-32.02	
1	Bushing/lower tube plate - spare	Drain-32.03	
1	Bushing,strainer for drain tube - spare	33.20	
8	Bushing,strainer for drain tube	33.20	
8	PTFE slide ring Ø265/Ø175 x 5 mm	36.01/pos. 7	
25	Guide cone – PP	91.01	
1	Installation tool	65.01	
1	Installation tool	66.01	
1	Installation tool	94.01	

## 8 Tubes

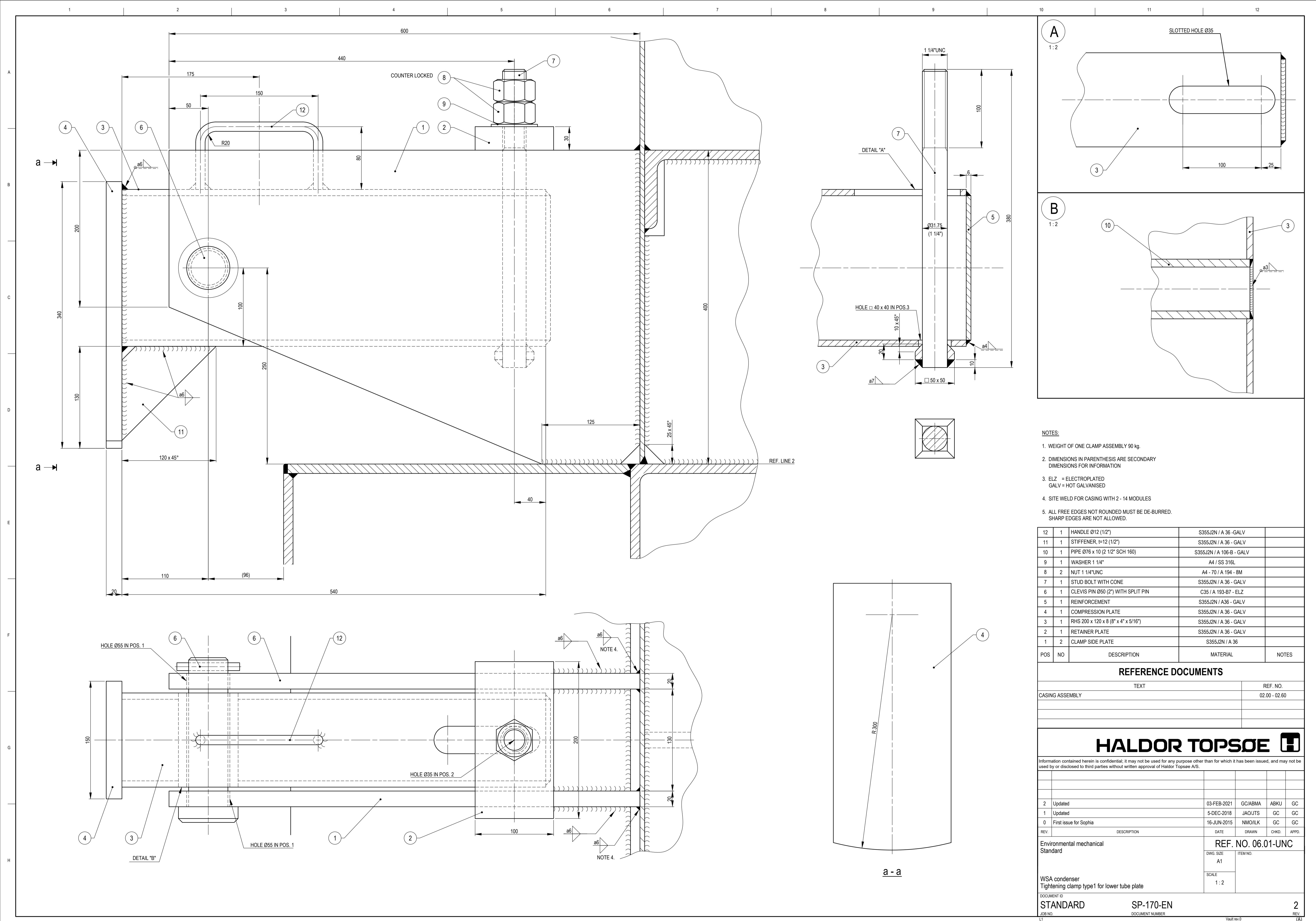
No. of	Description	Ref. No. / Pos. No.	Remarks
3325	Main tubes with internal spirals, demister and lock tube	29.02	
10	Drain tubes with internal spirals, demister and lock tube		

## 9 Inlet flange and bellows

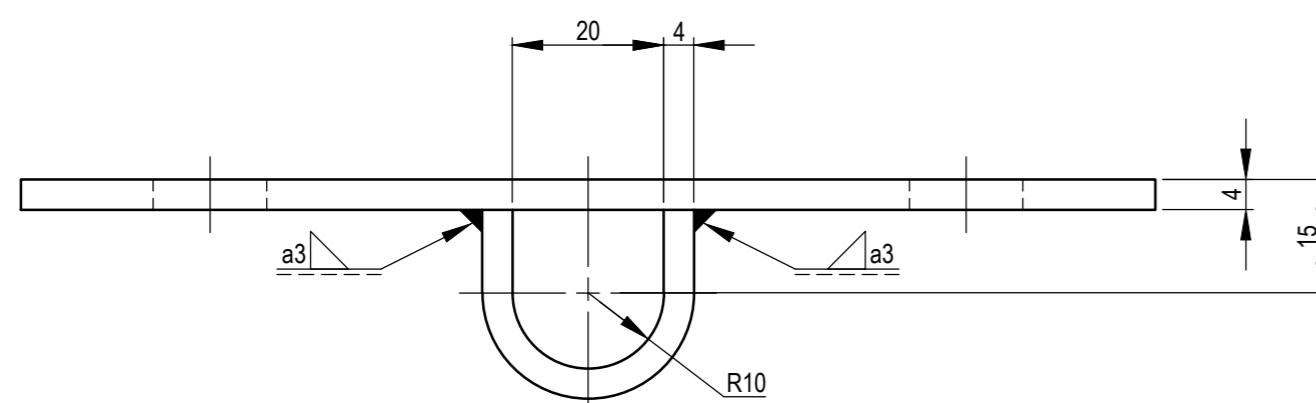
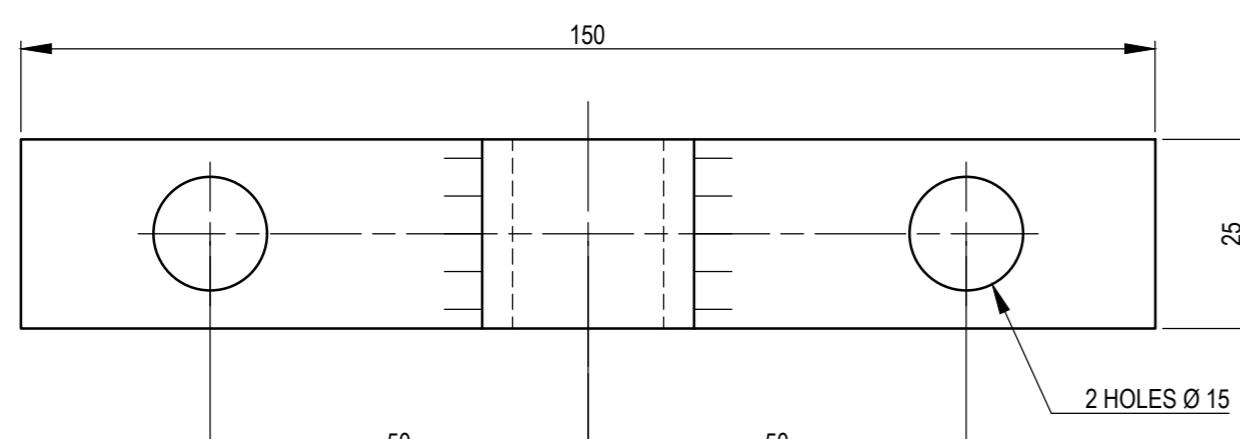
No. of	Description	Ref. No. / Pos. No.	Remarks
1	Process gas inlet flange, lined	37.05/pos. 1-3, 7-8	
1+1	Bellow for process gas inlet flange	37.05/pos. 4-6	
130	Bolt 5/8"UNC x 80, A4-70	37.05/pos. 9	
130	Nut 5/8"UNC, A4-70	37.05/pos. 10	
260	Washer 5/8", A4	37.05/pos. 11	

## 10 Other Parts

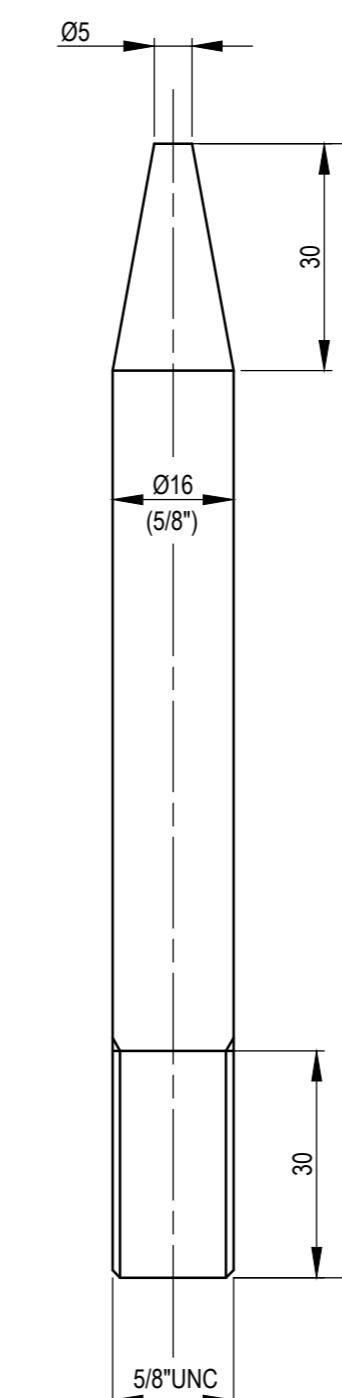
No. of	Description	Ref. No. / Pos. No.	Remarks
8	Sight glass Ø265 x 30 mm	38.07/pos. 12	
125 m	PTFE gasket 20x7		
150 m	PTFE gasket 17x6		
25 m	PTFE gasket 14x5		
40	Silicone rubber – tubes 300 ml		
4	Injection gun		
4	Hot air blower		
4	Nozzle for hot air blower		



POS. 1



POS. 2

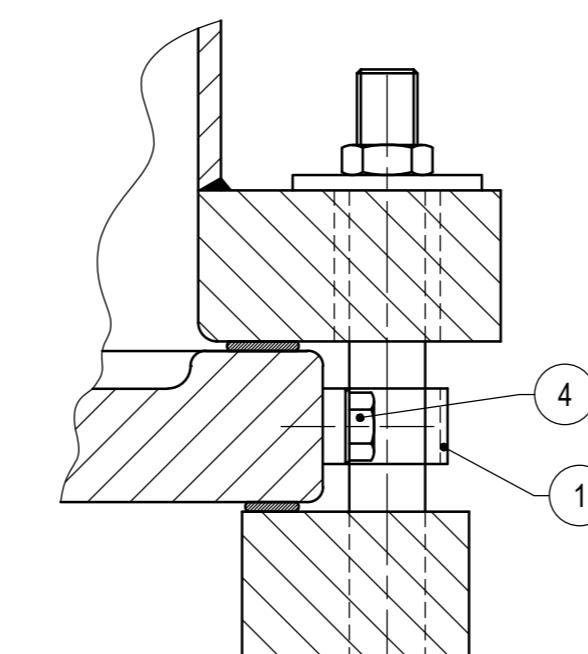
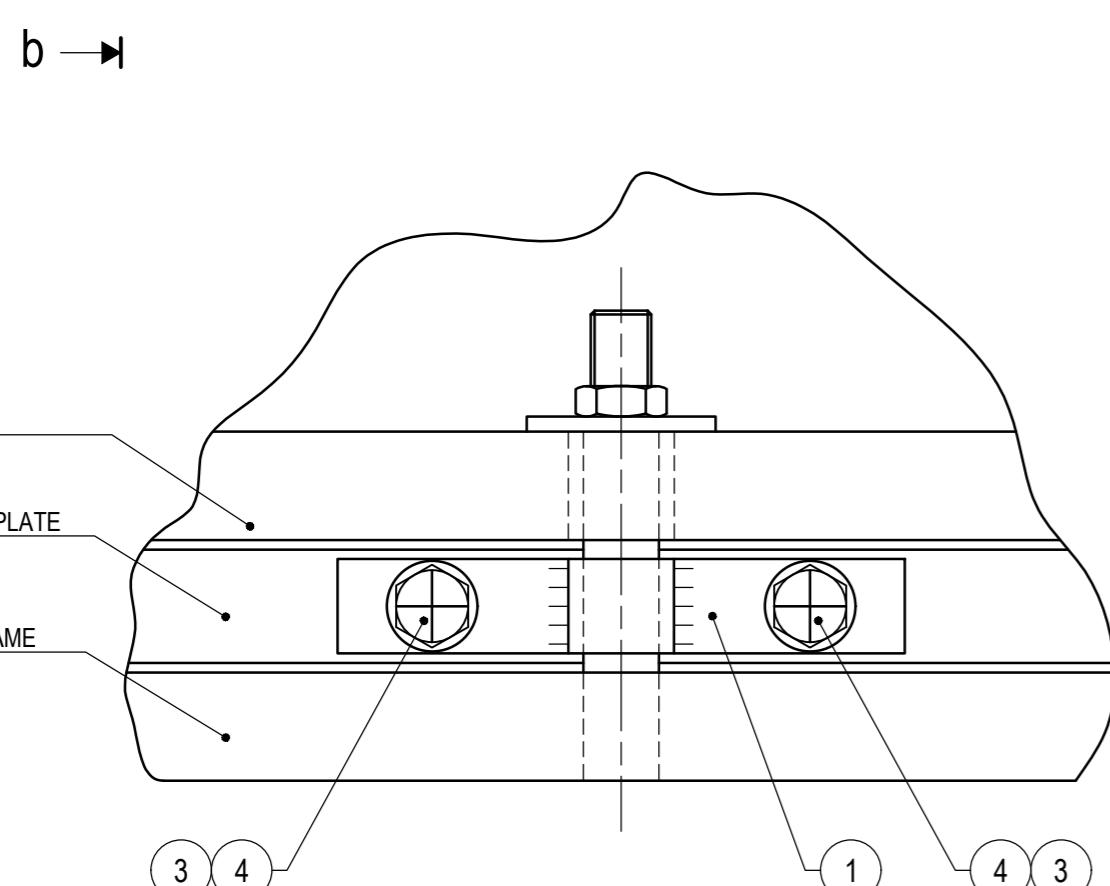


## NOTES:

1. GALV = HOT GALVANISED
2. ALL FREE EDGES NOT ROUNDED MUST BE DE-BURRED. SHARP EDGES ARE NOT ALLOWED.

## FINAL ASSEMBLY DETAIL

1:2



POS	NO	DESCRIPTION	MATERIAL	NOTES
4	2	BOLT 1/2"UNC x 30	A 193-B8M / A4 - 70	
3	2	WASHER 1/2"	AISI 316L / A4	
2	1	GUIDE ROD	S235 - GALV	
1	1	GUIDE LUG	STAINLESS STEEL	

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 1 Updated 01-FEB-2021 GC/SHIJ ABKU GC  
 0 First issue in Sophia 18-JUN-2015 NMO/ILK GC GC  
 REV. DESCRIPTION DATE DRAWN CHKD APPD.

 Environmental mechanical Standard  
 REF. NO. 20.01-UNC

DWG. SIZE	ITEM NO.
A2	
SCALE 1:1, 1:2	

 DOCUMENT ID  
 STANDARD SP-182-EN

JOB NO. DOCUMENT NUMBER

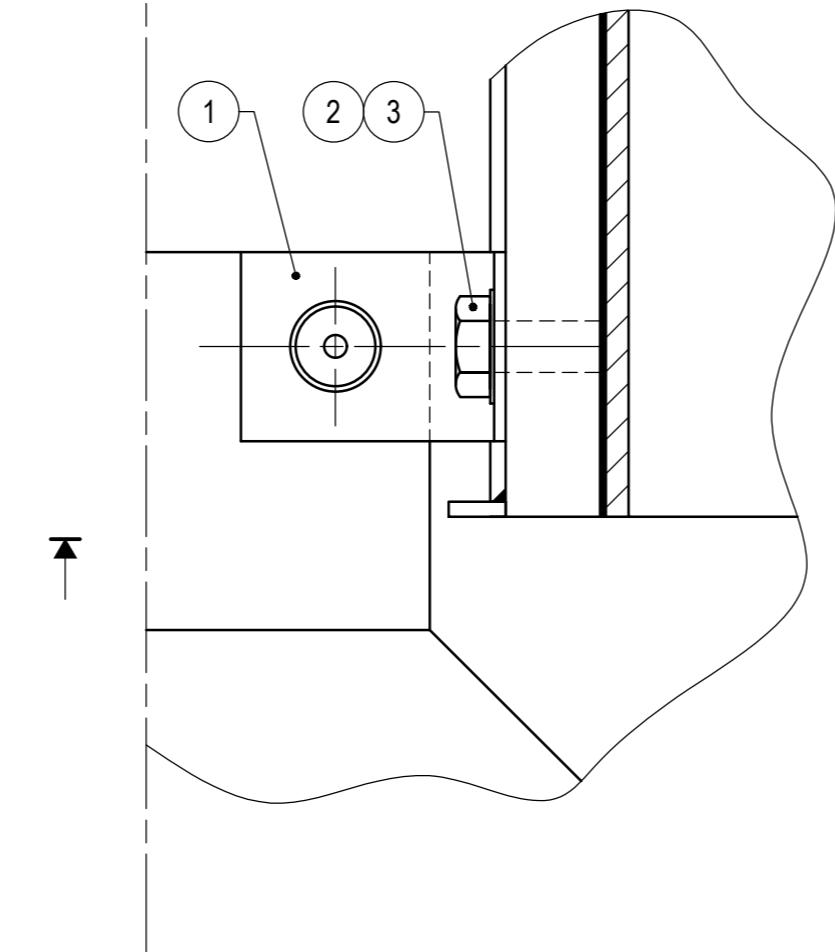
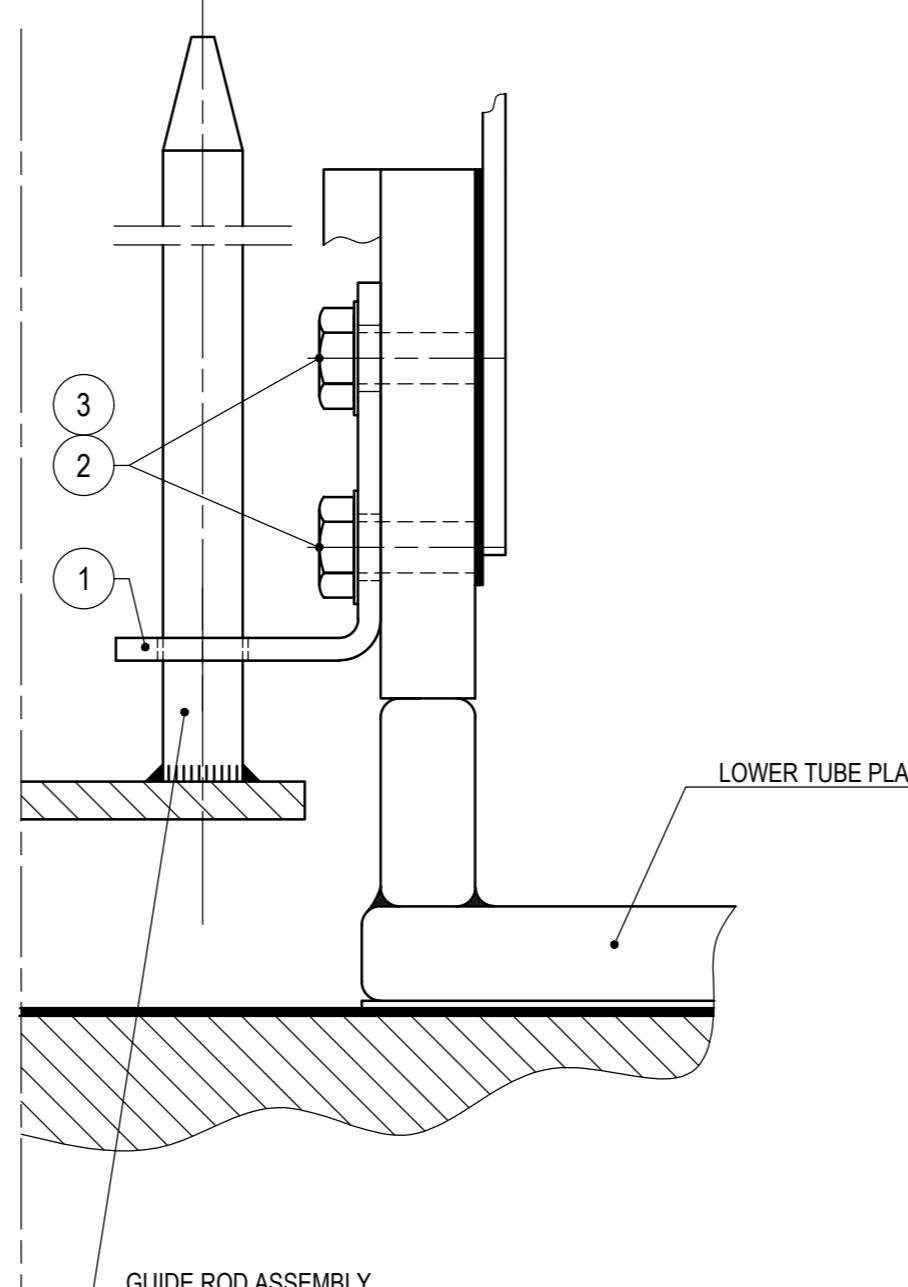
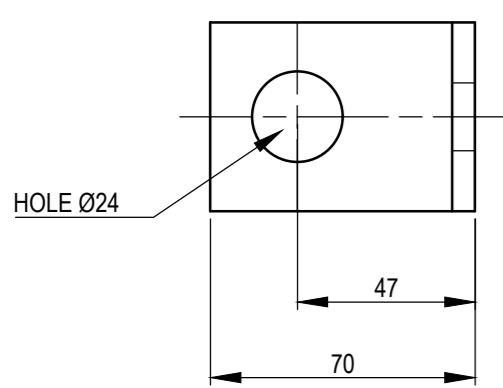
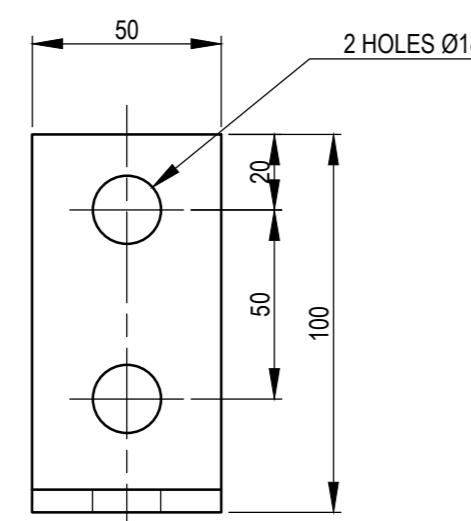
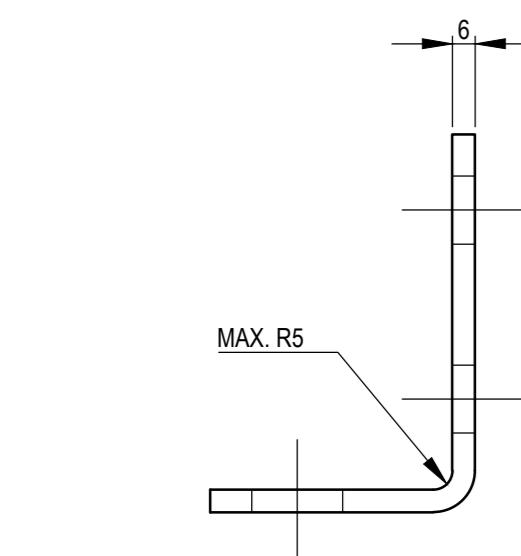
1

REV.

(A)

Vault rev.0

POS. 1

ERCTION AND FINAL  
ASSEMBLY DETAIL

## NOTES:

1. BOLTS POS. 2 ALSO TO BE INSTALLED, WHERE GUIDE LUGS ARE NOT FORESEEN AT CASING END WALLS.
2. WEIGHT ONE ASSEMBLY 1 kg.
3. ELZ = ELECTROPLATED  
GALV = HOT GALVANISED
4. ALL FREE EDGES NOT ROUNDED MUST BE DE-BURRED.  
SHARP EDGES ARE NOT ALLOWED.

POS	NO	DESCRIPTION	MATERIAL	NOTES
3	2	WASHER 5/8"	STEEL - ELZ	
2	2	BOLT 5/8"UNC x 25	A 193-B7 - ELZ / 8.8 - ELZ	1)
1	1	GUIDE LUG	S355J2N - GALV	

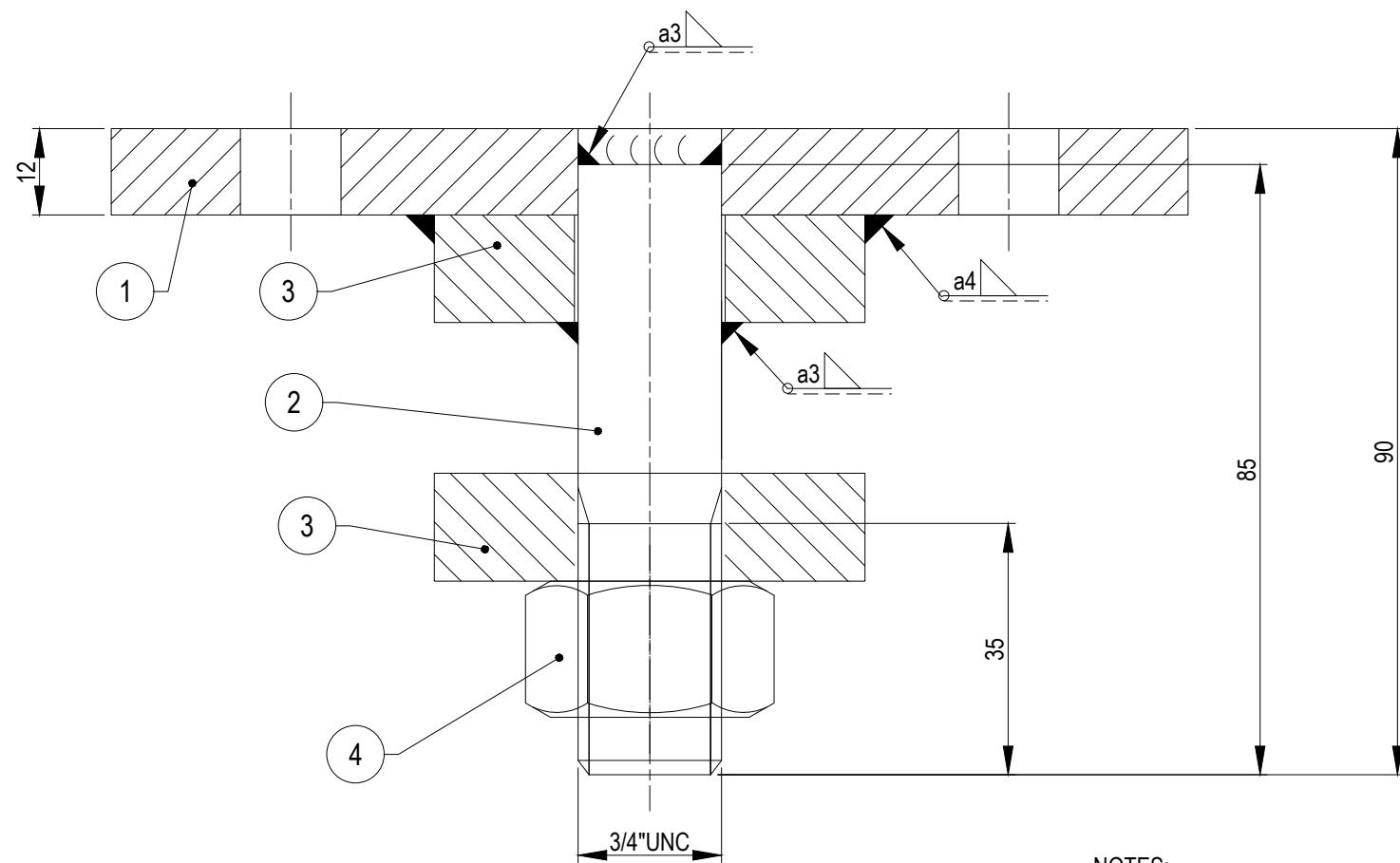
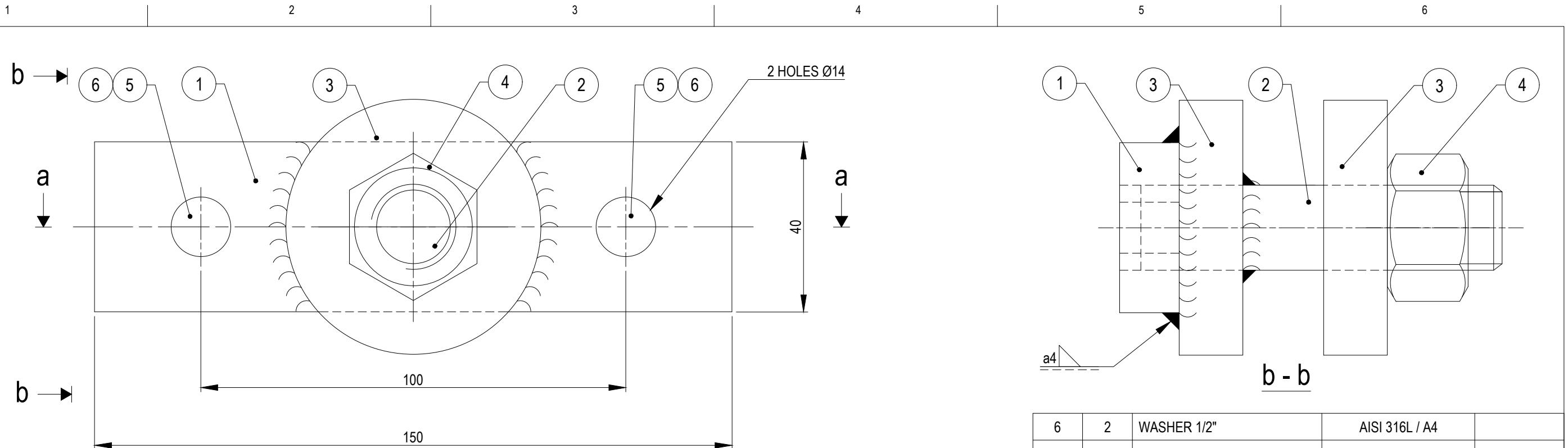
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1	Updated	01-FEB-2021	GC/SHIJ	ABKU	GC
0	First issue in Sophia	18-JUN-2015	NMO/ILK	GC	GC
REV.	DESCRIPTION	DATE	DRAWN	CHKD.	APPD.

Environmental mechanical Standard	REF. NO. 21.02-UNC
WSA Condenser Guide lug for coated lower tube plate	DWG. SIZE A2
	SCALE 1 : 2

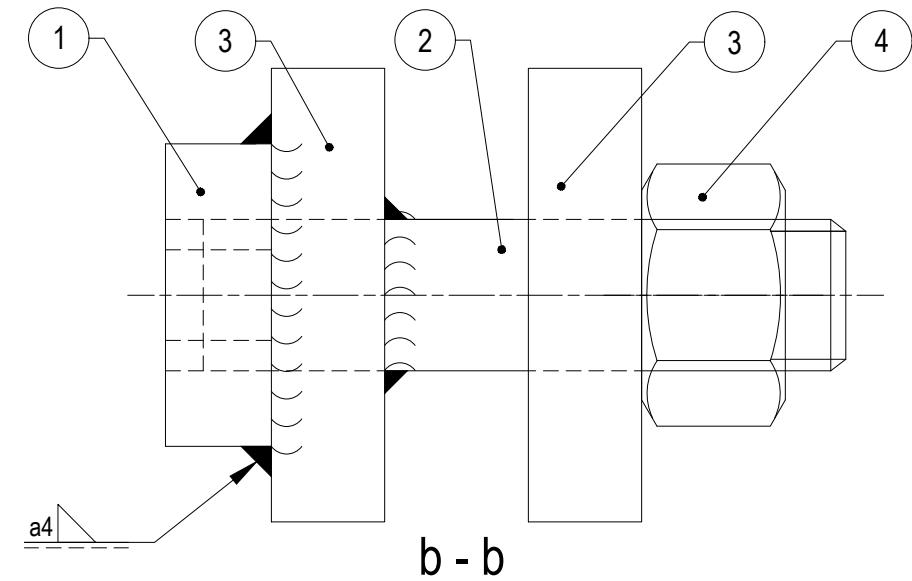
 DOCUMENT ID  
**STANDARD** SP-184-EN  
 JOB NO. DOCUMENT NUMBER  
 L1  
 Vault rev.0  
 REV. (A)



a - a

NOTES:

- 1) CERTIFICATE 2.2/EN10204 OR SIMILAR REQUIRED.
- 2) "WLL 1500kg" (SAFE WORKING LOAD) TO BE SPECIFIED ON LIFTING LUG.
- 3) ALL FREE EDGES NOT ROUNDED MUST BE DE-BURRED. SHARP EDGES ARE NOT ALLOWED.



POS.	NO.	DESCRIPTION	MATERIAL	NOTES
------	-----	-------------	----------	-------

**REFERENCE DOCUMENTS**

TEXT	REF. NO.
UPPER TUBE PLATE	11.01
LOWER TUBE PLATE	13.02

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1	Updated	02-FEB-2021	GC/ALAM	ABKU	GC
0	First issue in Sophia	13-JUL-2015	NMO/ILK	GC	GC

REV.	DESCRIPTION	DATE	DRAWN	CHKD.	APPD.
------	-------------	------	-------	-------	-------

Environmental mechanical Standard	REF. NO 98.11-UNC	
	DWG. SIZE A3	ITEM NO.
WSA Condenser Tube module, lifting lug for Upper and lower tube plate	SCALE 1 : 1	

DOCUMENT ID	STANDARD	SP-191-EN	1
JOB NO.	DOCUMENT NUMBER		REV.

DESCRIPTION / ERECTION ACTIVITY	MANPOWER		TIME IN WEEKS / DAYS, 1)							
	NO. OF CREWS	NO. PER CREW	1	2	3	4	5	6	7	8
A	1	5								
	1	4								
	2	2								

B

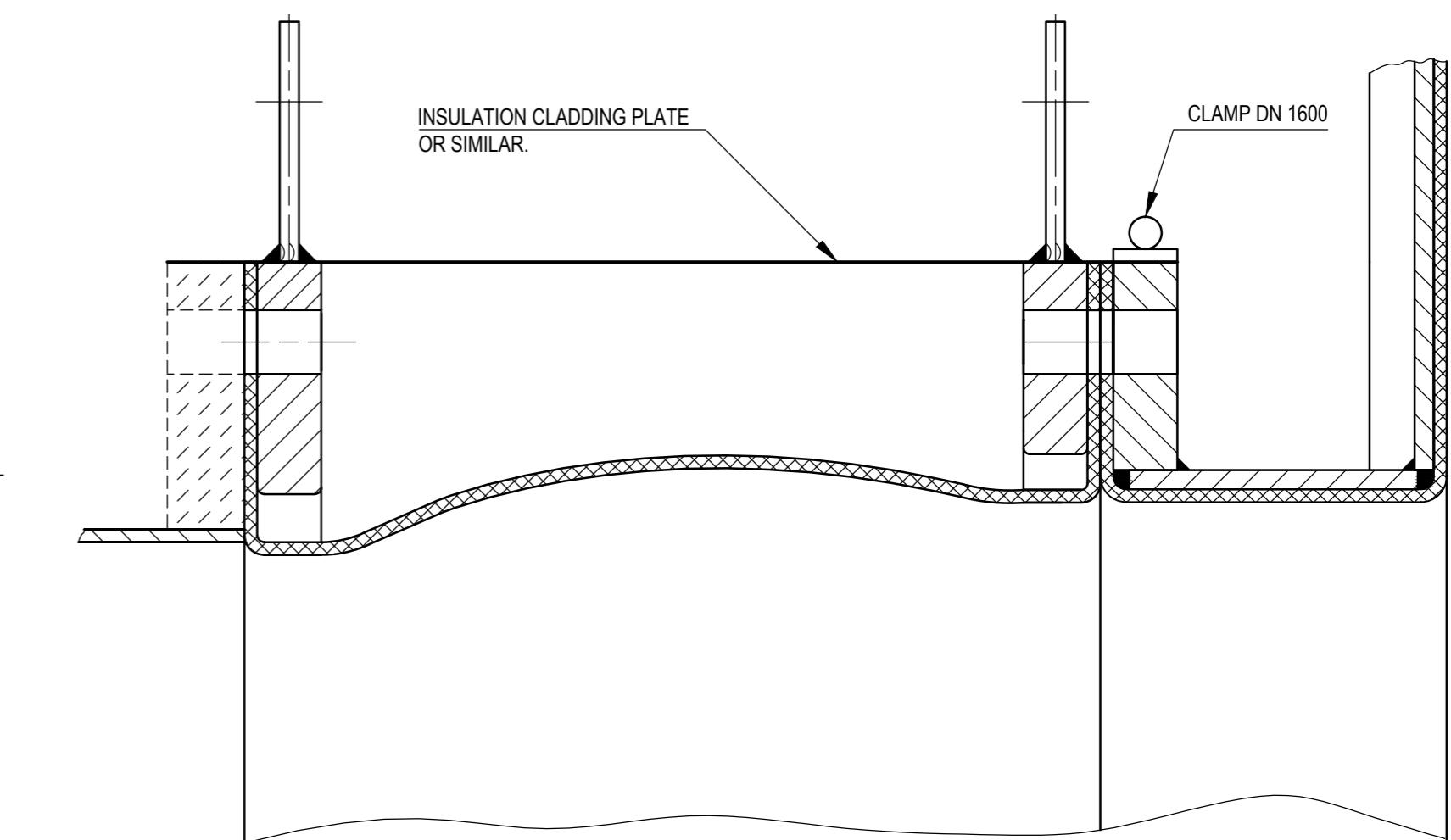
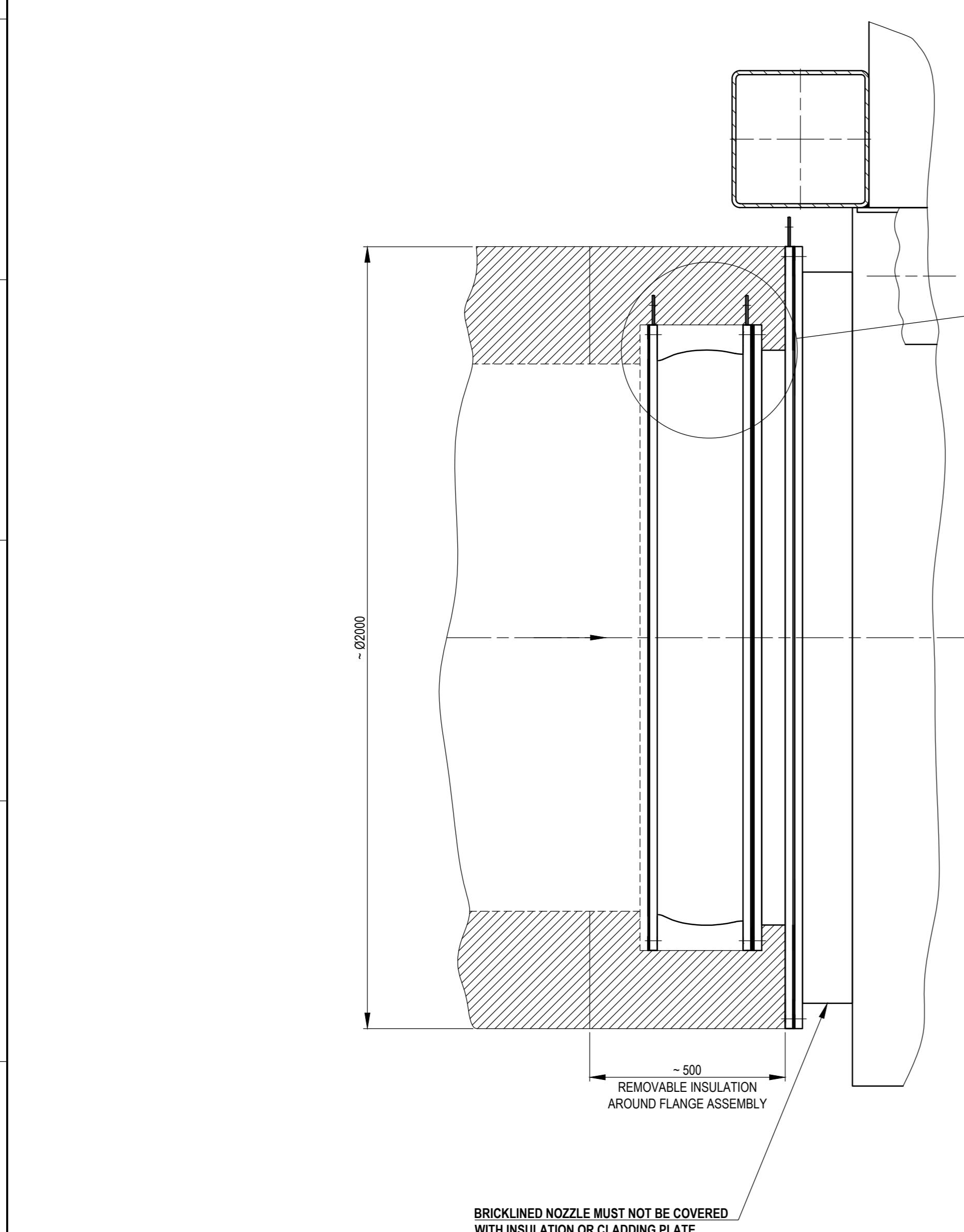
C

## NOTES:

1. TIME SCHEDULE BASED ON:
  - AVAILABLE MANPOWER AS INDICATED
  - ONE HTAS SUPERVISOR PER WSA CONDENSER BEING EQUIPPED WITH INTERNALS
  - ONE WEEK = FIVE WORKING DAYS OF EIGHT HOURS (NOMINAL)
  - CRANE, TOOLS AND ACCESSORIES AVAILABLE WITHIN MAX.TWO HOURS
  - SEE ALSO SPEC. - REF. NO. 80.03

				
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0	First issue in Sophia	30-JUN-2015	NMO/ILK	GC
REV.	DESCRIPTION	DATE	DRAWN	CHKD.
0	Environmental mechanical Standard	REF. NO. 86.12		
DWG. SIZE	A3			ITEM NO.
SCALE				
DOCUMENT ID	STANDARD	SP-200-EN	0	REV.
JOB NO.		DOCUMENT NUMBER		

A



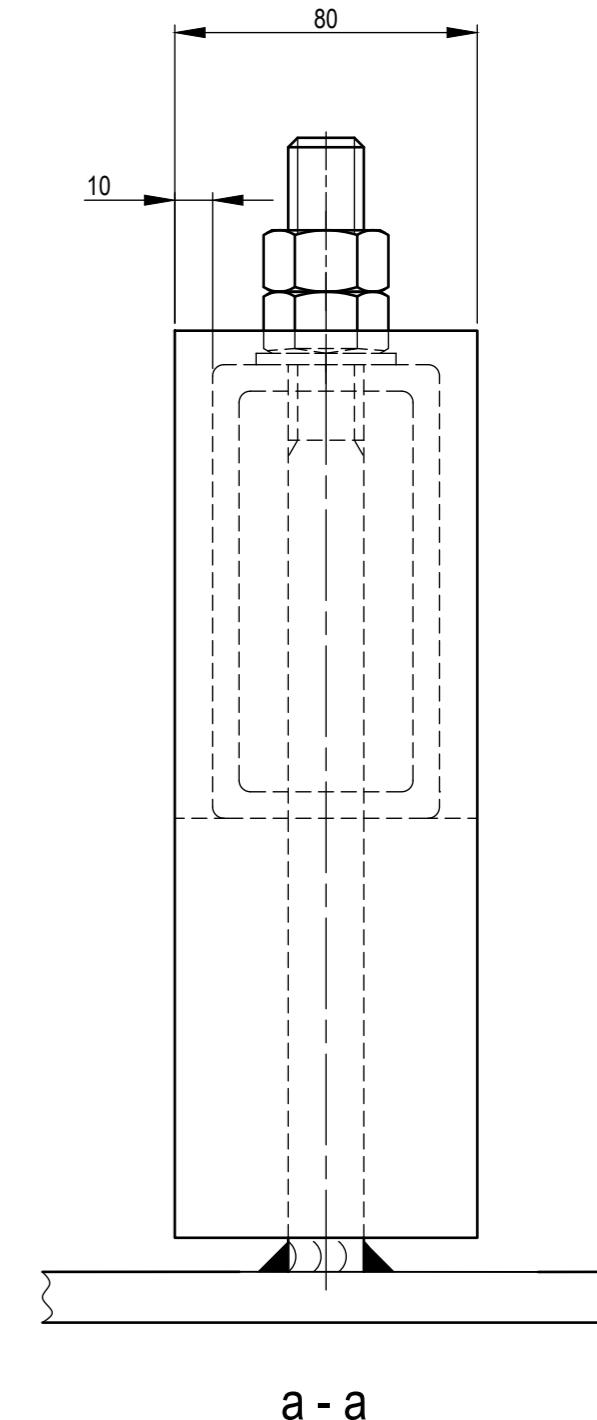
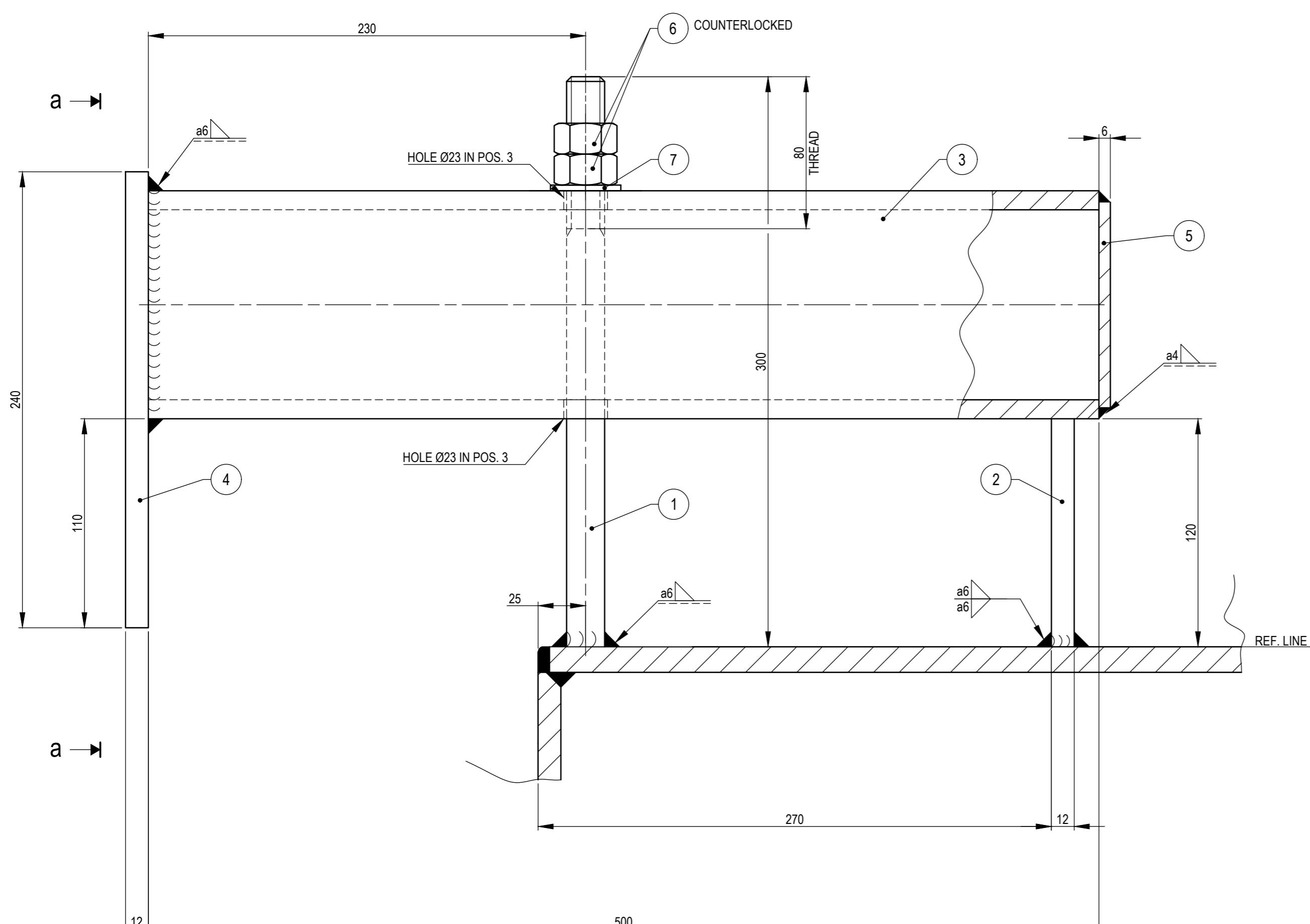
NOTES:

1) INSULATION THICKNESS (DUCT NOMINAL) - 300mm.

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0	First issue in Sophia	25-JUN-2015	NMO/ILK	GC	GC
REV.	DESCRIPTION	DATE	DRAWN	CHKD.	APPD.
Environmental mechanical Standard					REF. NO. 41.05
WSA Condenser Process gas inlet External insulation					DWG. SIZE A2
DOCUMENT ID	STANDARD	SP-201-EN	DOCUMENT NUMBER	SCALE 1 : 10, 1 : 2	ITEM NO.



## NOTES:

1. WEIGHT OF ONE ASSEMBLY 10 kg.
2. GALV = HOT GALVANISED
- 3) ALL FREE EDGES NOT ROUNDED MUST BE DE-BURRED.  
SHARP EDGES ARE NOT ALLOWED.

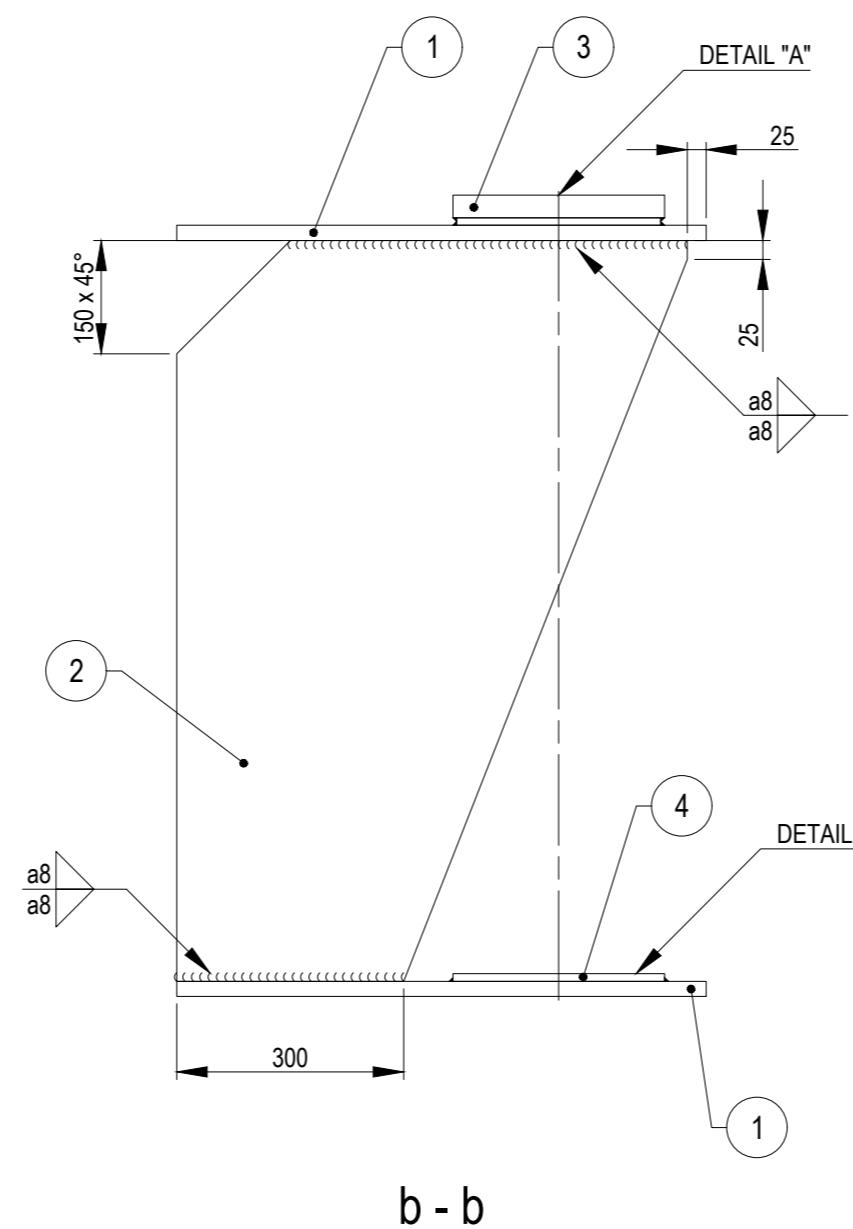
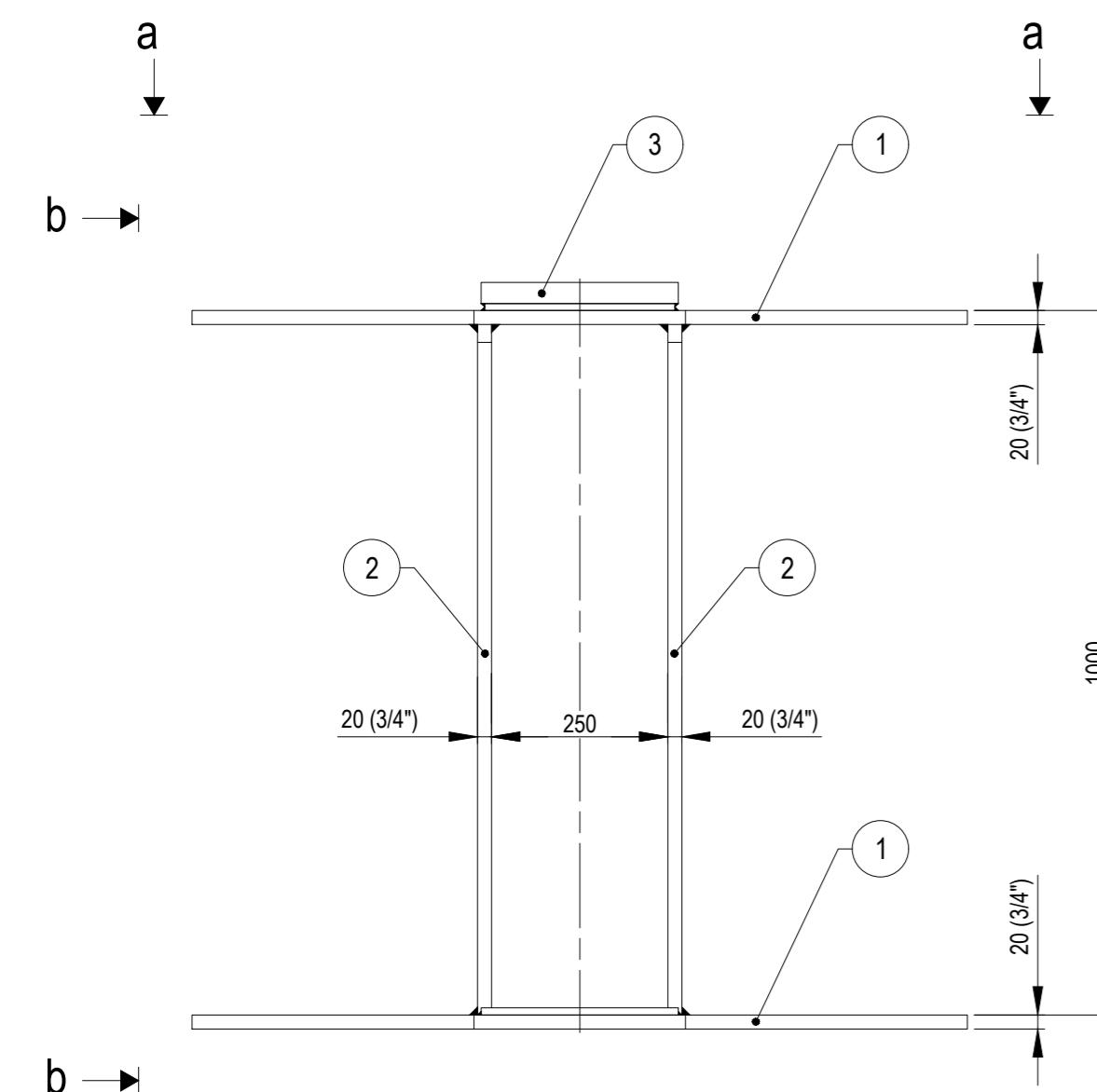
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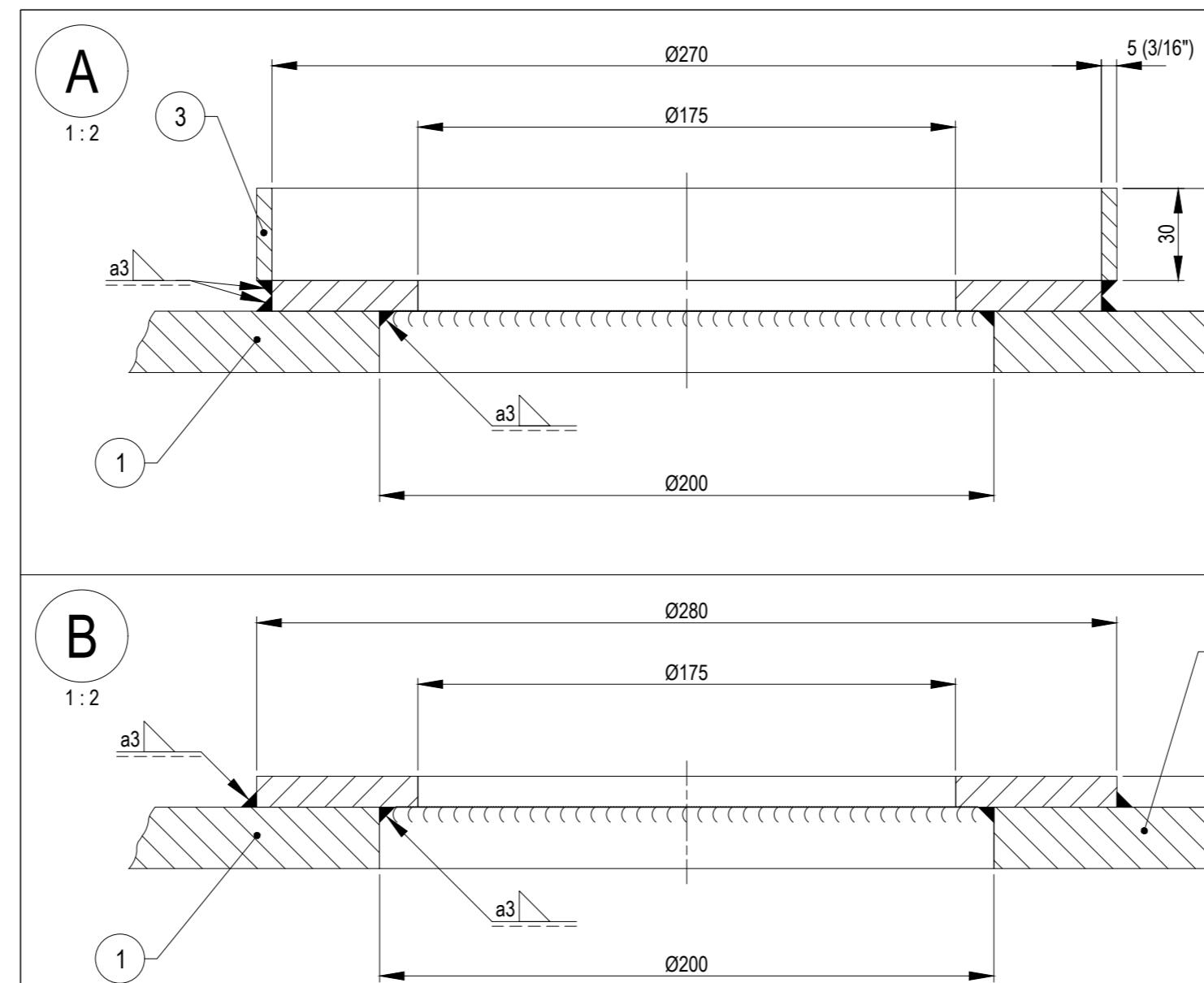
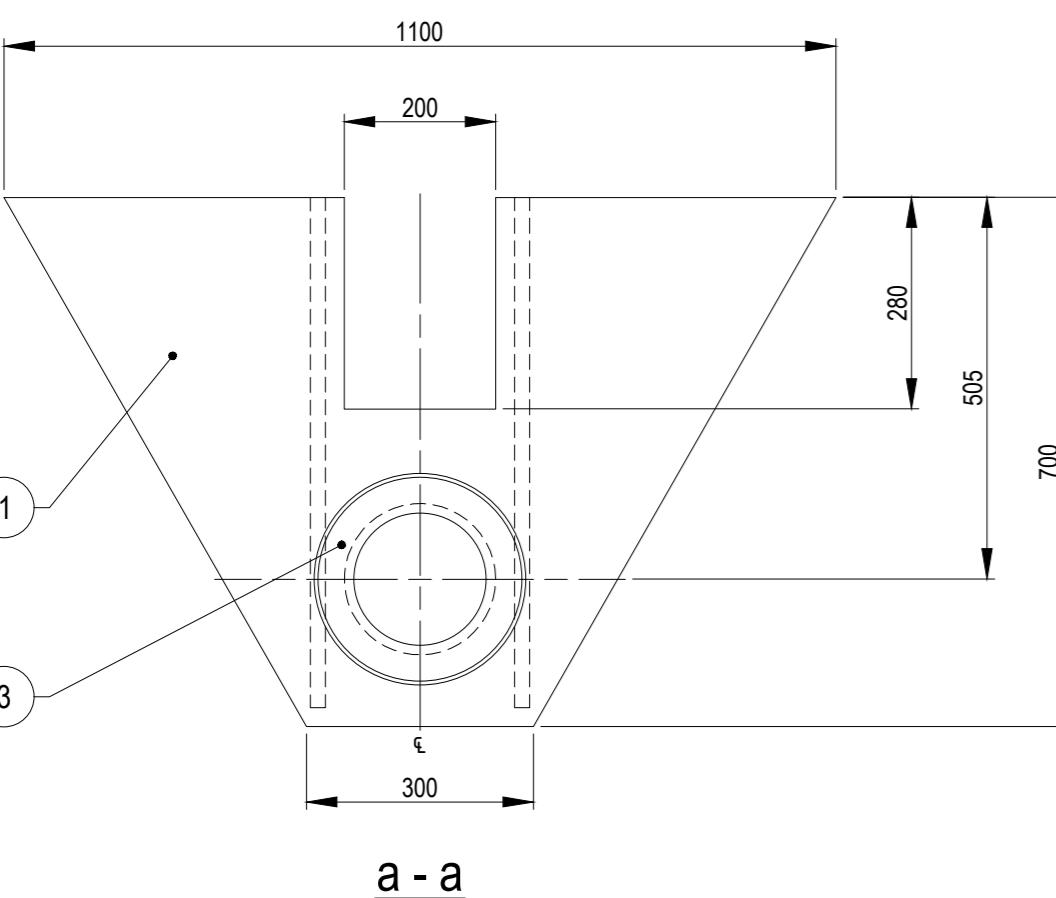
1	Updated	03-FEB-2021	GC/ABMA	ABKU	GC
0	First issue in Sophia	17-JUN-2015	NMO/ILK	GC	GC
REV.	DESCRIPTION	DATE	DRAWN	CHKD.	APPD.

Environmental mechanical Standard	REF. NO. 06.03-UNC	
	DWG. SIZE A2	ITEM NO.
	SCALE 1:2	
WSA Condenser Tightening clamp type 2 for lower tube plate		
DOCUMENT ID STANDARD	SP-205-EN	DOCUMENT NUMBER
JOB NO.		

POS	NO	DESCRIPTION	MATERIAL	NOTES
<b>REFERENCE DOCUMENTS</b>				
		TEXT	REF. NO.	
		CASING ASSEMBLY	02.00 - 02.60	

NOTES:

- 1) CERTIFICATE 2.2 / EN 10204 OR SIMILAR REQUIRED.
- 2) WEIGHT 300 Kg.
- 3) PAINTING: SEE SPEC. - REF. NO. 46.00 - 46.10
- 4) ALL FREE EDGES MUST BE DE-BURRED. SHARP EDGES ARE NOT ALLOWED.



POS	NO	DESCRIPTION	MATERIAL	NOTES
4	1	GUIDE	STAINLESS STEEL	
3	1	BEARING	STAINLESS STEEL	
2	2	GUSSET	S355J2N / A36	1)
1	2	SUPPORT	S355J2N / A36	1)

**REFERENCE DOCUMENTS**

TEXT	REF. NO.
CASING ASSEMBLY	02.00 - 02.10 / 02.50 - 60

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1	Updated	02-FEB-2021	GC/ALAM	ABKU	GC
0	First issue in Sophia	12-JUN-2015	NMO/EWJ	GC	GC
REV.	DESCRIPTION	DATE	DRAWN	CHKD.	APPD.

Environmental mechanical Standard	
WSA condenser Casing Support for davit	
DOCUMENT ID	REF. NO. 02.26
DWG. SIZE	A2
SCALE	1 : 10, 1 : 2

STANDARD SP-208-EN  
JOB NO. DOCUMENT NUMBER  
1 REV. (A)

Environmental mechanical  
Standard

WSA Condenser  
Adjustment bolt for side plate

**HALDOR TOPSOE** 

DOCUMENT ID

**STANDARD**

JOB NO.

**SP-258-EN**

0

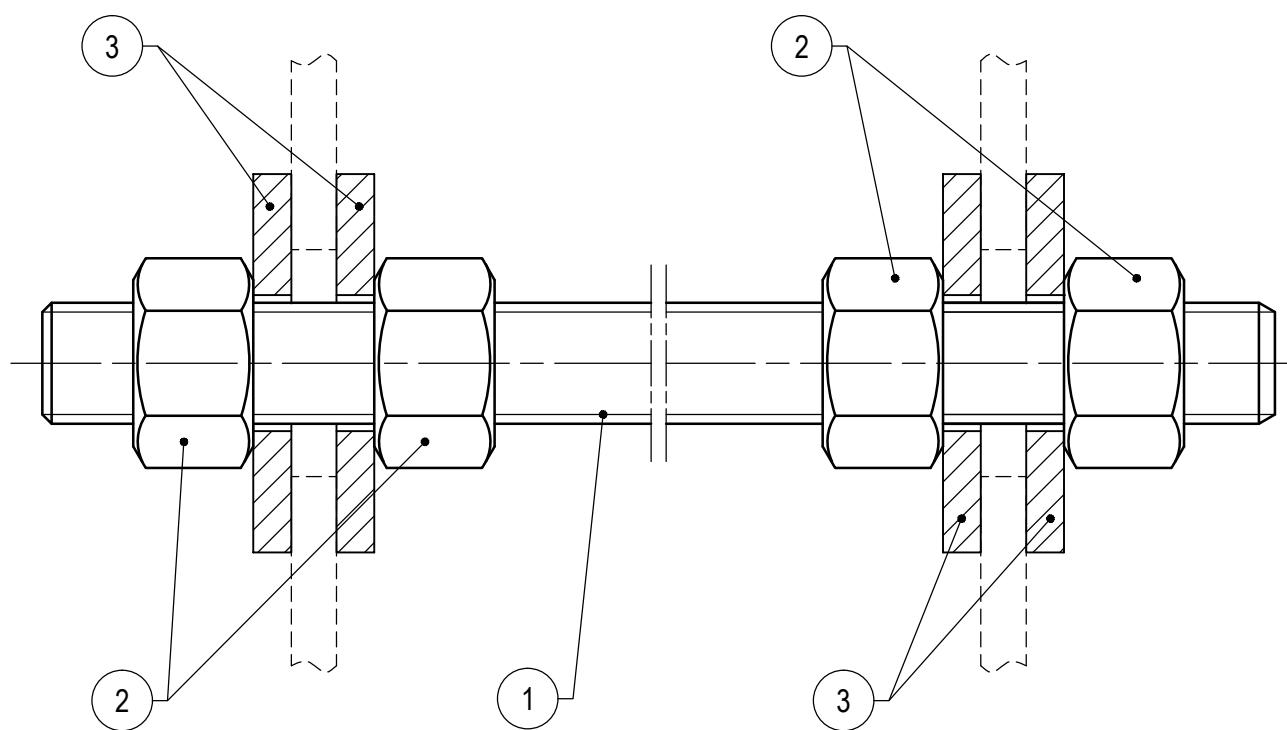
DOCUMENT NUMBER

ITEM NO.

SHEET 1 OF 1

SCALE 1:1

**REF. NO. 16.01-UNC**



NOTES:

1) ELZ = ZINC ELECTROPLATED

(A) L1

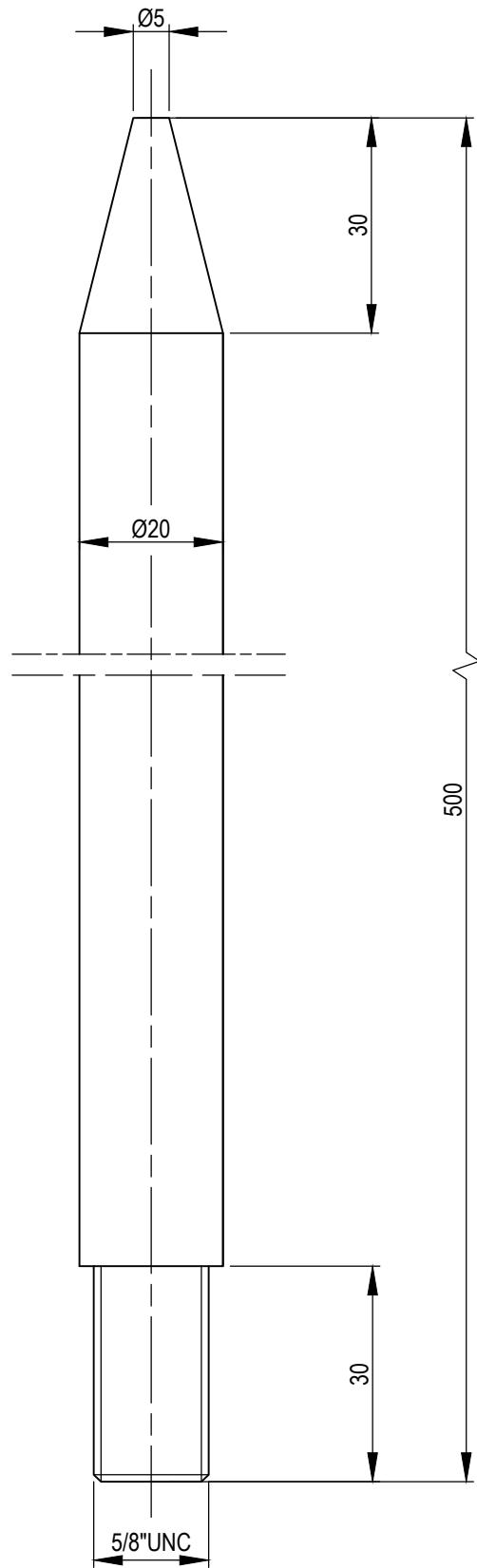
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POS.	NO.	DESCRIPTION	MATERIAL	NOTES
3	4	WASHER M16-XL	STEEL - ELZ	EN ISO 7094
2	4	NUT 5/8"UNC	A 194 - 2H / 8 - ELZ	
1	1	STUDBOLT 5/8"UNC x 320 (12.5")	A 193 - B7 / 8 - ELZ	

Environmental mechanical  
StandardWSA Condenser  
Guide rod for top cover

SCALE 1:1

REF. NO. 39.10-UNC



(A) L1  
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0	First issue in Sophia
REV.	
	DESCRIPTION

DATE

DRAWN

CHKD.

APPD.

.

Ref. no. 00.20

WSA Condenser

## 00.20 Description of the document reference number system

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue in SOPHIA	17-JUL-2015	GC	NMO	GC

SOPHIA document no.: SP-376-EN version: 8

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**Contents**

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1. General	3
2. Document Reference Numbers	Error! Bookmark not defined.

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## 1 General

This specification describes the use of the document reference number system, which is implemented in the documentation for the WSA Condenser.

The purposes of the reference number system are to facilitate the identification of documents, which is advantageous for cross-references within the documentation, as well as to facilitate the identification of the various parts for the WSA Condenser, in relation to the erection and maintenance.

In addition, the reference numbers indicate the chronological sequence for using the documents in relation to the project execution, i.e. design/fabrication, procurement, inspection packing, and erection.

## 2 Documents reference numbers

Each document is apart from the drawing/specification number identified by a reference number "Ref. No."

The Ref. No. is different for each document.

The Ref. Nos. consist of a main number (2 digits), a sub-number (2 digits), and for certain documents a sub-division (2 digits) of the sub-number, i.e. "XX.XX-XX".

Where reference drawings/specifications are indicated in the documentation these reference drawings/specifications are identified by the 4 digit Ref. No. only, i.e. "XX.XX". The last 2 digits (if any) are not indicated.

The relation between the drawing/specification numbers and the reference numbers for a specific project is indicated in typical project documents as follows:

- List of Documents
- Document Transmittals
- Request's for Bid
- Purchase Orders

In computer generated "List of Documents" the Ref. Nos. for each document are indicated in the column "Item No." in connection with the main Item No., i.e. "Item No./ Ref. No".

### **Note:**

Cross-reference between documents by using Ref. Nos. can only be carried out if the job numbers on the documents are identical, or the documents referred to are standard documents, i.e. Job No. is "STANDARD" or named "BASIC SPECIFICATION".

Ref. no. 81.01

WSA condenser

## 81.01 Specification for handling and erection related to coated parts

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue in SOPHIA	28-OCT-2015	GC/NMO	SKYA	GC

SOPHIA document no.: SP-394-EN version: 8

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<b>3</b>	<b>Arrival on site / storage</b>	<b>4</b>
<b>4</b>	<b>Conditions for unpacking and handling/erection</b>	<b>4</b>
<b>5</b>	<b>Unpacking</b>	<b>5</b>
<b>6</b>	<b>Basic handling requirements</b>	<b>5</b>
<b>7</b>	<b>Basic erection requirements</b>	<b>6</b>
<b>8</b>	<b>Appendix A</b>	<b>7</b>
<b>9</b>	<b>Appendix B</b>	<b>8</b>
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<b>12</b>	<b>Appendix E</b>	<b>11</b>

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**1 General**

This specification describes the basic requirements for the handling and erection of coated parts.

This specification must be read by all parties involved in handling and/or erection activities comprising coated parts before any such parts arrives on site.

Topsoe shall mean the Topsoe Supervisor or a representative appointed by Topsoe.

The extent of the requirements outlined in this specification to be implemented on site, must in each case be determined by Topsoe, in view of the actual conditions on site.

Before any erection activities are commenced, all personnel to be involved in handling and/or erection related to coated parts should have participated in a site instruction meeting held by Topsoe.

The names of the participants in this instruction meeting should be written down (ref. Appendix C), and these persons only will be authorised for handling and/or erection related to coated parts.

Topsoe must be present at all handling and erection activities.

Spot checks will be made during the erection activities regarding use of non-authorised personnel.

Topsoe reserves the right to dismiss non-authorised personnel participating in handling/erection of coated parts, as well as authorised personnel neglecting the instructions specified.

The contractor responsible for any damage caused during erection/handling must carry all responsibility for the repair.

The site checklists - ref. Appendix A. - will be filled in by Topsoe.

In case transport damages are detected before Topsoe arrives on site, Topsoe must be informed about this immediately.

In case of any damage is detected during handling and/or erection, Topsoe must be informed about this immediately.

The special tools and accessories as per Appendix D must be provided by the erection contractor except for the items where "Topsoe Supply" is indicated.

**2 Coated parts**

The packing for coated parts are all marked as per Appendix B upon arrival at site.

The following handling/erection activities comprise coated parts in which only authorized personnel should be used:

- Unpacking of coated parts.
- Installation of tube modules
- Installation of glass tubes
- Installation of top covers
- Installation of coated parts in general

The coating materials are sulphuric acid resistant fluoropolymers, vinylesters or similar, which are very soft and can easily be damaged.

In case of even small damages in the coating, e.g. a small invisible penetration from a sharp piece of tool, glass piece or similar, the steel part behind the coating will be attacked by corrosion immediately during operation.

Repair of the coated surfaces on site is normally only possible to a limited extent. If the damage is too extensive it will be necessary to return the part to the coating supplier for re-coating.

**3 Arrival on site / storage**

Upon arrival on site of coated parts, the packages must immediately be identified (ref. Appendix B) and the packing case inspected to ensure that it is intact.

In case the erection activities are not commenced immediately after arrival of the parts the unpacked packages must be stored properly.

Do not unpack any coated part until immediately before the erection of the part is required.

**4 Conditions for unpacking and handling/erection**

Before any unpacking and handling/erection activities are commenced the foreseen working areas must be thoroughly cleaned for all foreign materials, tools, etc.

Only authorized personnel should be allowed direct access to the working areas when unpacking and handling/erection activities are in progress.

Warning signs should be placed at all access ways to the working areas as per Appendix E.

The number of possible access ways to the working areas should be minimized by appropriate closing of the areas, e.g. by using warning tape.

The working areas must be properly protected against contamination of any kind.

A suitable number of strong vacuum cleaners with soft nozzle must be available.

## **5 Unpacking**

The unpacking must take place as near to the place of erection as possible at a cleaned "closed" area as per section 4.

Before lifting to the unpacking area the packages must be thoroughly cleaned.

The parts must be unpacked very carefully without penetrating the packing with the tools used.

After unpacking the parts must be inspected by Topsoe for damages and cleaned immediately after.

## **6 Basic handling requirements**

To minimize the risk of damages the following basic requirements must be adhered to:

- When lifting or transporting the unpacked parts, only use the foreseen lifting devices. Reference must be made to the relevant Topsoe drawings.

When lifting or transporting pipe or duct sections, the straps must be wrapped around the pipe/duct, not through the pipe/duct.

Edges and similar exposed areas must be protected by clean soft felt and wood or similar during lifting or transportation.

- No hard objects, tools or other metal pieces must at any time come into contact with a coated surface.

Personnel working with coated parts are not allowed to carry tools, which are not to be used directly for the handling or erection activities.

Tools not in use must not be carried by the working personnel but have to be stored in a safe place.

- Smoking is not allowed at the working areas.
- Do never step or sit on an unprotected coated surface.

If such actions are necessary, use clean soft felt and wood or similar for protection.

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- A coated surface must never be placed directly of the ground, platforms or similar, always use clean soft felt and wood or similar for protection.
- If handling or erection activities have to be interrupted the parts must be carefully protected and covered.

## **7 Basic erection requirements**

Surfaces with coating must at all times during the erection activities be kept absolutely clean from all foreign materials, dust, sand, glass pieces, etc.

A number of strong vacuum cleaners with soft nozzles must be available at all times for quick and gentle removal of such materials.

Welding, grinding, sandblasting or similar activities are not allowed in the vicinity of the working areas.

Welding, grinding, or similar activities developing heat are not allowed on a coated piece of equipment, or on other parts connected to a coated part.

When an erection activity comprising coated parts has ended, the part must immediately after be thoroughly inspected by Topsoe for damage.

This final inspection comprises a 100% visual check and, if determined by Topsoe, a 100% check using high voltage pore testers.

No indications are allowed.

The gasket surfaces on flanged equipment must be thoroughly wiped off with clean cloth before the gasket is mounted.

The joining part must be cleaned in the same manner immediately before the parts are assembled.

**8 Appendix A****Site inspection check list**

<b>Job No.:</b>		<b>Coated Parts</b>	
<b>Inspection Activity</b>	<b>(Check)</b>	<b>Remarks</b>	<b>Date/Signature</b>
<b>Arrival on site</b> - Packing damage			
<b>Storage</b> - Storage facilities - Package storing			
<b>Conditions for Erection</b> - Condition of working areas - Warning signs - Protection of working areas - Special tools and accessories			
<b>Unpacking</b> - Area for unpacking - Cleaning before unpacking - Damage - Cleaning, unpacked equipment - Acceptance of parts			
<b>Basic Handling Requirements</b> - Spot checks regarding fulfilment of basic requirements			
<b>Basic Erection Requirements</b> - Spot checks regarding fulfilment of basic requirements  - Gasket surfaces before appliance of gasket (100%)  - Gasket surfaces before joining of the parts (100%)  - Final inspection for damage at end of erection activities (100%)			
<b>Working Personnel</b> - Spotchecks regarding use of Authorized Personnel			

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# **ATTENTION**

**THIS PACKAGE CONTAINS**

# **COATED PARTS**

**UNPACKING TO BE CARRIED OUT BY  
AUTHORIZED PERSONNEL ONLY**



**HALDOR TOPSOE A/S**

DK-2800 Lyngby, Denmark

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**10****Appendix C****Site instruction meeting****Job No.:****Basic requirements for  
handling and erection  
related to coated parts**

Meeting held by:

DATE:

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**NAME OF PARTICIPANTS****COMPANY****SIGN.**

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The participants have been instructed about the basic handling and erection requirements related to coated parts as described in Topsoe Spec. - Ref. No. 81.01 and are classified as Authorized Personnel.

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Date

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Signed

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**11****Appendix D****Special tools and accessories check list**

<b>Job No.:</b>		<b>Coated Parts Handling / Erection</b>
<b>Item</b>	<b>Nos.</b>	<b>Remarks</b>
- Warning signs		
- Warning tape		
- Vacuum cleaners with soft nozzle		
- Clean soft felt or similar		
- Clean wooden boards		Size 150x25 / 6"x1" x 3 m
- Tarpaulins		Size 2 x 3 m
- High Voltage pore-testers		Topsoe Supply
- Clean rags		

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# **WARNING**

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## **CLOSED WORKING AREA**

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**ONLY AUTHORIZED PERSONNEL  
ARE ALLOWED ACCESS  
TO THE WORKING AREA**



**HALDOR TOPSOE A/S**

DK-2800 Lyngby, Denmark

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Ref. no. 95.01

WSA Condenser

## **95.01 Inspection and maintenance**

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue in SOPHIA	21-JUL-2015	GC/NMO	SKYA	GC

SOPHIA document no.: SP-399-EN version: 6

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**1. General**

This specification describes the recommended inspection and maintenance to be carried out of the WSA Condenser(s) in Topsoe WSA/SNOX plants.

**2. Inspection at Commissioning**

The WSA Condenser must be thoroughly inspected for any irregularities on the shell side and tube side, after first heating with air has taken place.

The tightening clamps (06.01-03) must be checked/re-tightened at this inspection.

Topsoe must participate in this inspection.

**3. Inspection after Initial Start-up**

A thorough inspection of both the shell side and the tube side of the WSA Condenser must in addition be carried out after around two to three months of operation.

The tightening clamps (06.01-03) must again be checked/re-tightened at this inspection.

Topsoe should participate in this inspection.

**4. Inspection during Normal Operation**

After the initial period of operation, the normal inspection schedule should be established in accordance with the "Inspection Check List".

The "Inspection Check List" is a check list, which is intended to form basis for the customer's own inspection and maintenance lists.

It is recommended that the customer modifies and up-dates these lists in accordance with the actual operational experience gained from the plant.

This in view of the fact that the maintenance and inspections and the intervals between the related activities, depend to a great extent on the actual operational conditions in the plant.

**Inspection Check List**

Item/Pos. No.	Description of Inspection	Interval
WSA Condenser	Visual inspection through sight glasses on Top Covers for: <ul style="list-style-type: none"><li>- Broken glass tubes (local discolouration of Demister Pads, intensive acid mist)</li><li>- Shrunken and/or discoloured Demister Pads</li><li>- Signs of corrosion damage (iron sulphate, bulges in coating/lining on Top Covers).</li><li>- Visual inspection for leaks at the Upper Tube Plate / Top Cover connections.</li></ul>	Every day/ Every week Note 1
WSA Condenser	Dismantling of Top Covers (Covers Part 2), provision of access to Acid Collector(s), opening of manholes. Visual inspection for corrosion damage and other failures on: <ul style="list-style-type: none"><li>- Upper Tube Plates</li><li>- Lower Tube Plates</li><li>- Baffle Plates</li><li>- Top Covers</li><li>- Acid Resistant Brick Lining</li><li>- Process Gas Inlet Flange</li><li>- Tubes and tube internals</li><li>- Demister Pads</li><li>- Check / re-tightening of tightening clamps for Lower Tube Plates</li><li>- Shell side steel parts in general</li></ul>	Every year

Note 1: Inspection every day is only required during the initial operating period of one to two weeks after the initial start-up and after a long shutdown (plant cooled down).

During normal operation, inspection is recommended every week.

**5. Maintenance**

Any irregularities observed during the regular inspections - ref. inspection check list - must be recorded in order to enable preparation of the necessary replacements/repairs at the next shutdown.

