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REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED	APPROVED

OWNER



VIETNAM OIL AND GAS GROUP (PVN)

OWNER'S CONSULTANT

FICHTNER
GmbH & Co. KG

FICHTNER



PVPOWER PCC

EPC CONTRACTOR



PETROVIETNAM CONSTRUCTION JOINT
STOCK CORPORATION (PVC)

EPC CONSTRUCTOR'S CONSULTANT



WORLEYPARSONS

POWER ISLAND PACKAGE SUPPLIER



SOJITZ CORPORATION

DAELIM

DAELIM INDUSTRIAL CO., LTD.

PROJECT TITLE

THAI BINH 2 THERMAL POWER PLANT 2 x 600MW

DRAWING / DOCUMENT TITLE

SCR SYSTEM INSTALLATION MANUAL INSTRUCTION

Vendor's Logo:



FUNCTION

NAME

SIGN

DATE

DRWN

S.J.KANG

21.Sep.2015

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21.Sep.2015

APPD

S.H.YANG

21.Sep.2015

DOCUMENT NO: TB2-SDC.VP124-00100-M-M1A-SIN-0001

No of page:

31

Scale

Rev.B

P.O NO.	110180-29-124-001-A01
ITEM NO.	124
ITEM DESCRIPTION	De-Nox System
DOCUMENT NO.	TB2-SDC.VP124-00100-M-M1A-SIN-0001
DOCUMENT TITLE	SCR SYSTEM INSTALLATION NAMUAL INSTRUCTION
REV NO.	B

Daelim's Approval Status

Daelim Industrial Co., Ltd.	
Job No.	110180
	A - APPROVED
	B - APPROVED WITH COMMENTS
	C - RETURNED FOR CORRECTION
	D - REJECTED
	N - NOT APPLICABLE(REFERENCE ONLY)
SIGNED BY : _____ DATE : _____	
DIC'S PERMISSION TO PROCEED OR REVIEW TAKEN ON VENDOR PRINTS SHALL NOT RELIEVE VENDOR FROM ITS RESPONSIBILITIES OR LIABILITIES UNDER THE PURCHASE ORDER.	

VENDOR'S LOGO:



Thai Binh 2 Thermal Power Plant Project - PEB Comment for Transmittal Ref. No TB2-SDC-PEB-

Document Review Comment Sheet			TB2-PEB-SDC-M1A-TVI-07671			
No.	Document No.	Rev	Title	Purpose	Approval Status	
					In	Out
1	TB2-SDC.VP124-00100-M-M1A-SIN-0001	A	SCR Erection Drawings	RE		R
No	TB2PEB's Comments	Item status	Contractor's Response			
I	GENERAL COMMENTS					
1	For next submittal of all erection drawings, please submit individual drawings and not all drawings under one document title and document project number. We need to file and manage each drawing individually.	NOTE	Confirm. The drawings in this document already submit and approved except for E-drawing. Hence we exclude those drawings from this document. Please confirm. We will submit E-drawing as separately for approval.			
2	All revisions for the next submittal will be identified by a revision cloud and revision status triangle.	NOTE	Confirm.			
II	DETAILED COMMENTS					
1	TB2-SDC.VP124-00100-M-M1A-SIN-0001					
1.1	Based on the General Comments above, submit the first nine (9) pages, or written portion of the document, separately.		Confirm. The drawings in this document already submit and approved except for E-drawing. Hence we exclude those drawings from this document. Please confirm. We will submit E-drawing as separately for approval.			
1.2	General Arrangement Dwgs - Drawing titles must be very specific. "General Drawing x/xx" is not acceptable.		General arrangement drawing is already approved by end user. And all drawings are giben specific drawing titles.			
1.3	E-drawing for SCR shop drawing of inlet/outlet duct and reactor (E-000 ~ 017) - Provide Project Drawing Numbers. "E-XXX" is not acceptable.		Confirm. E-drawings will submit with project drawing numbers as separately.			
1.4	E-drawing for SCR shop drawing of inlet/outlet duct and reactor (E-000 ~ 017) - Drawings have no notes. Please add appropriate notes.		Confirm. We will submit with approrate notes.			
1.5	E-drawing for SCR shop drawing of inlet/outlet duct and reactor (E-000 ~ 017) - Drawings have no signatures and not dated. Please provide.		Confirm. We will submit with approrate notes.			
1.6	E-drawing for SCR shop drawing for structure (E-000 ~ 030) - See previous three (3) comments and revise accordingly.		Confirm.			

Thai Binh 2 Thermal Power Plant Project - PEB Comment for Transmittal Ref. No TB2-SDC-PEB-

No	TB2PEB's Comments	Item status	Contractor's Response
No	OWNER's Comments	Item status	Contractor's Response
1	GENERAL COMMENTS		
1	The title name should be "SCR system – installation manual instruction" according to the content of document.		Confirm.
2	The scope of guide only apply for inlet/outlet duct, reactor and platform. To supplement and submit the erection manual for all equipment of SCR which specified in the equipment/valve/piping list such as ammonia equipment, ammonia piping, AIG, steam, water...		Confirm.
3	The tolerance of erection work shall be added or referred to the applicable standard for SCR system.		Confirm.
4	To add the detail drawing of terminal point interface of SCR system.		Confirm.
5	PVC to submit related document for erection work as per requirement of Appendix 5, including site erection procedure (item 1.23); site test procedure (item 1.24); site erection/installation drawing (item 1.27); installation manual (item 1.32) for SCR system.		Confirm.

Legend

Contractor Purpose:

A = For Approval
 RE = For Reference
 FC = For Construction
 AB = As Built
 INFO = For Information

TB2PEB Approval Status:

For AP:

A = Approved
 B = Approved with Comments
 C = Returned for Correction
 D = Rejected

For RE:

I=Accepted for Reference
 IB=Accepted for Reference with comment
 R= Returned for Correction

1. Introduction

1.1 Objective

This document is to provide the erection guideline of SCR(Selective Catalytic Reduction of NO_x) inlet & outlet duct, reactor, and platform to erector.

1.2 Definitions

Erector : Any erection company employed by customer

SCR manufacturer or supplier : S&TC

Boiler(BLR) manufacturer or supplier : Any boiler supplier awarded a contract by customer

Customer / Power island package supplier : Dalim Industrial Co. Ltd., / Solitz Corporation

EPC contractor : Petrovietnam Construction Joint Stock Corporation / Worleyparsons

Owner : Vietnam Oil and Gas Group (PVN) / Fichtner

2. General Background Specification of SCR Duct, Reactor, and Platform

Erector is recommended to know about the general background knowledge including overall shape, material of construction, installation position, quantity of SCR inlet & outlet duct and reactor with platform in order for they to understand this system generally before see installation method. Refer to the following general background knowledge of SCR.

2.1 Overall Shape after Erection

3-D modeling showing overall shape of SCR inlet & outlet duct, reactor, and platform structure are shown below. Please refer to the followings.

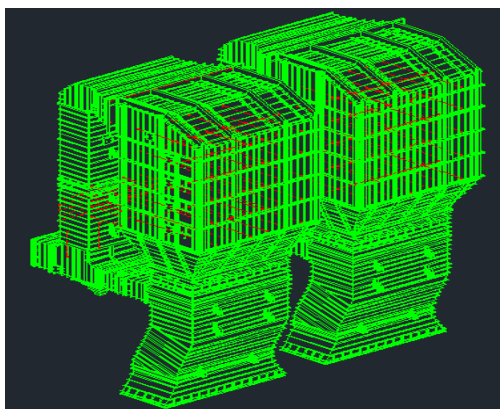


Figure 1. Two(2) Chambers of SCR Inlet Duct & Reactor (For BLR 1unit)

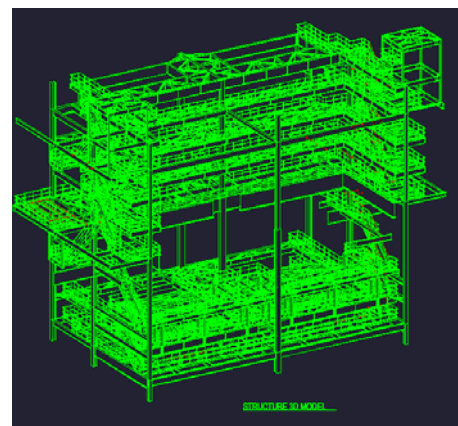


Figure 2. 3D Model of Platform Structure for SCR Duct & Reactor

2.2 Installation Position

SCR inlet duct is installed from outlet of duct flowing flue gas generated from boiler furnace during coal combustion. Other side of SCR inlet duct is connected to reactor. In addition, SCR reactor is located on between SCR inlet duct and outlet duct which is located on expansion joint above APH (Air Pre-heater) system.

2.3 Quantity of SCR Inlet Duct & Reactor Casing

Boiler duct arranged from furnace outlet is divided from one to two paths at any spot before SCR inlet duct. Please refer to the BLR layout for further information through the BLR equipment layout drawing. So, two(2) sets SCR inlet & outlet duct and reactor are needed and supplied for one(1) BLR unit. So, there are total four(4) sets SCR inlet & outlet duct and reactor for total two(2) BLR units.

3. Erection

3.1 Preparation Activities for Erection

Erector must do some preparation activities before beginning the site construction work to prevent defaulting installation. In this section, guideline complied by erector necessarily before erection is introduced.

Si. No.	Description on Preparation Activities before erection
1.	Inspecting and checking technical specification, quantity, and damage status such as corrosion, erosion, etc. of material delivered from shop by comparing with related document and drawing.
2.	Investigating the work space for site pre-assembly and temporary holding space near to erection spot.
3.	Checking whether scaffold is needed or not by considering around existing structure. Erector shall prepare the scaffold, if required.
4.	After finishing site pre-assembly and final erection, Erector shall inspect the spot needed touch-up painting and apply it in accordance with painting procedure. So, prepare the proper touch-up paint.

3.2 Erection General Sequence

Erection work of SCR inlet & outlet duct, reactor is processed by connecting or combining between the pre-shop assemblies as like frame, beams, brackets, plates, and girders at construction site in

order to form the site assembly at first as like Figure 3 showing some SCR reactor parts. The others including SCR inlet/outlet ducts also should be made as site assembly part unit and then installed step by step.



Figure 3 Site Assembly of SCR duct and reactor

The pictures shown on Figure 3 to 5 were taken during experience projects executed by S&TC. It could be helpful for erector to understand general erection concept and process.

After finishing site pre assembly work, erector to arrange the site pre assemblies. At first, duct to be installed and then reactor parts to be connected step by step. Furthermore, erector to determine the order what should they do at first between inlet and outlet ducts by considering site condition. If boiler duct connected with SCR inlet duct was installed erector can install the SCR inlet duct at first. Refer to the following description on installation method of SCR reactor.

The first site assembly part of SCR reactor should be laid down on outlet duct at above of APH is lifted and putted down on proper erection location in compliance with erection drawing and then second site assembly part is lifted and putted down on first site assembly part as like Figure 4.

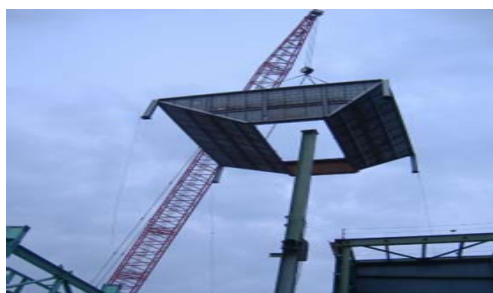
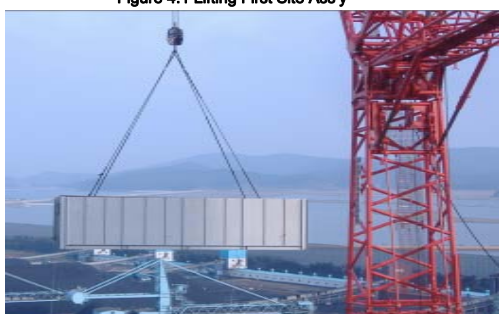


Figure 4.1 Lifting First Site Ass'y



Figure 4.2 Dropping First Site Ass'y



4.3 Lifting Second Site Ass'y



Figure 4.4 Dropping Second on First Site Ass'y.

Finally, the connection work between site assembly parts is fulfilled by bolting and welding as like Figure 5. The other site assembly parts are also putted and combined accordingly.



Figure 5.1 Internal Connecting between two site ass'y parts



Figure 5.2 Enlargement of 'Figure 5.1'



Figure 5.3 External Connecting between site ass'y parts

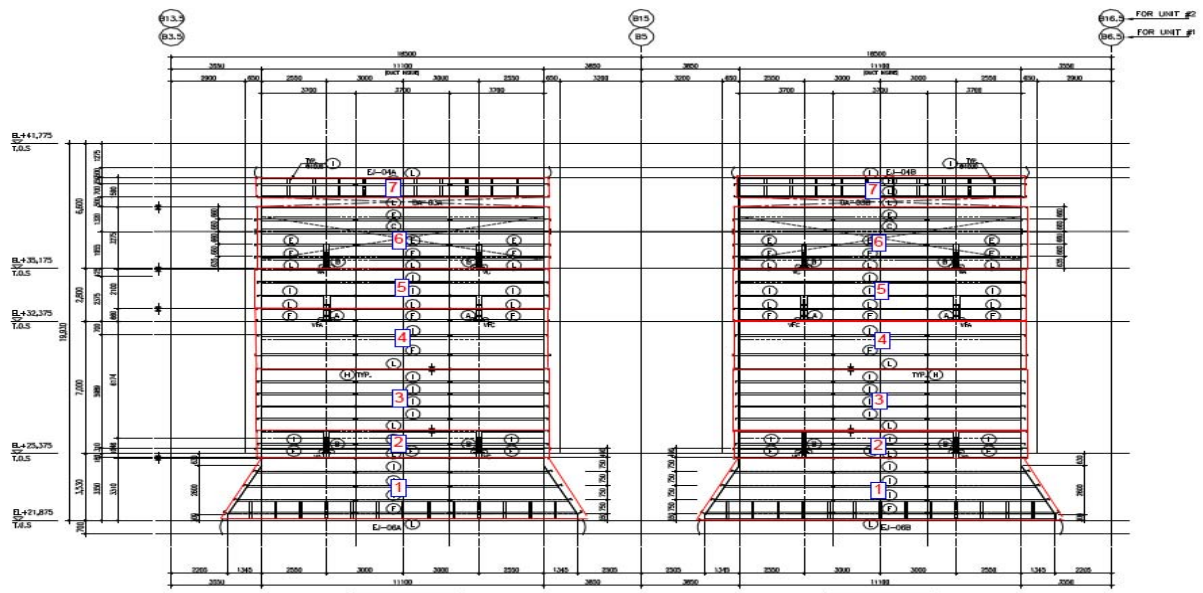
In case of platform, shop assembly beams are connected at existing boiler structure directly without site pre-fabricated work stage as like making site assembly parts. Erector can install the platform structure by connecting between beams and existing by referring to E-drawing in Attachment #1.

3.3 Erection Method

As stated Section 3.2 above, SCR duct, reactor and platform are erected by making pre site assemblies or connecting at existing boiler structure supplied by others. In this document, detail erection method is not described as its construction work can be conducted through erection reference drawings shown in the '3.4 Guideline Drawing for Erection', '3.5 Reference Erection Drawings' and typical method such as bolting, welding, etc.

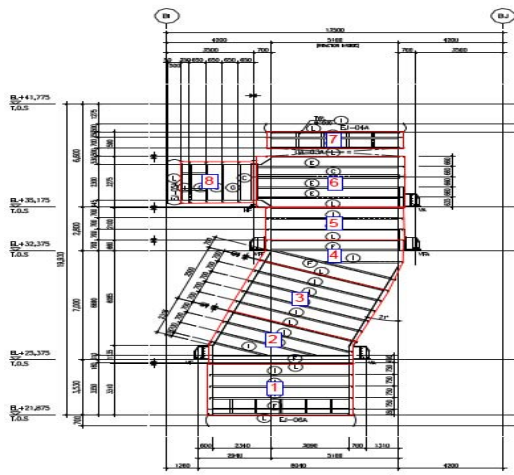
3.4 Guideline Drawing for Erection

There are captured drawings showing the erection position of site assembly parts for SCR duct, reactor. Please refer to the followings.

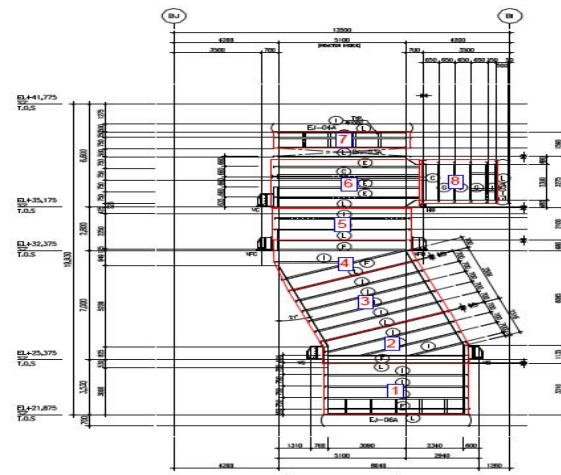


① FRAMING ELEVATION AT BJ LINE
OUTLET DUCT CASING
SCALE : 1/80

Figure 6.1 Site Assembly Parts of Outlet Duct



① FRAMING ELEVATION AT B3.5, B13.5 ROW
OUTLET DUCT CASING
SCALE : 1/80



② FRAMING ELEVATION AT B5, B15 ROW
OUTLET DUCT CASING
SCALE : 1/80

Figure 6.2 Site Assembly Parts of Outlet Duct

The above drawings are shown the number of site assembly parts for SCR outlet duct. Erector should put down site assembly parts from No.1 step by step after finishing the fabrication of site assembly part. Expansion joints shall be located between No.6 and No.7. So, don't put No.7 down on No. 6 directly. The relating drawing No. is TB2-SDC.VP124-00HTA-M-M1A-DGA-0001 ~ 0010 and TB2-SDC.VP124-00HTA-M-M1A-DID-0001 ~ 0048 for shown part no above Figure 6.2.

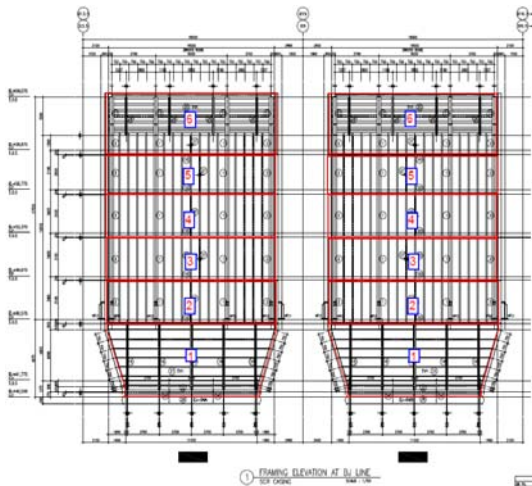
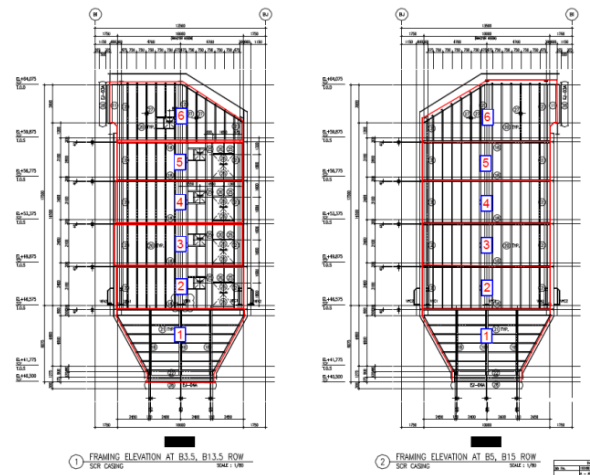


Figure 6.3 Site Assembly Parts of Reactor

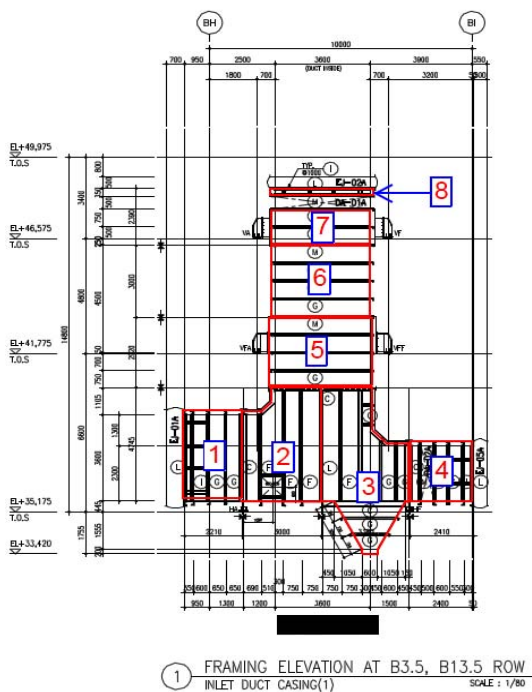


6.4 Site Assembly Parts of Outlet Duct

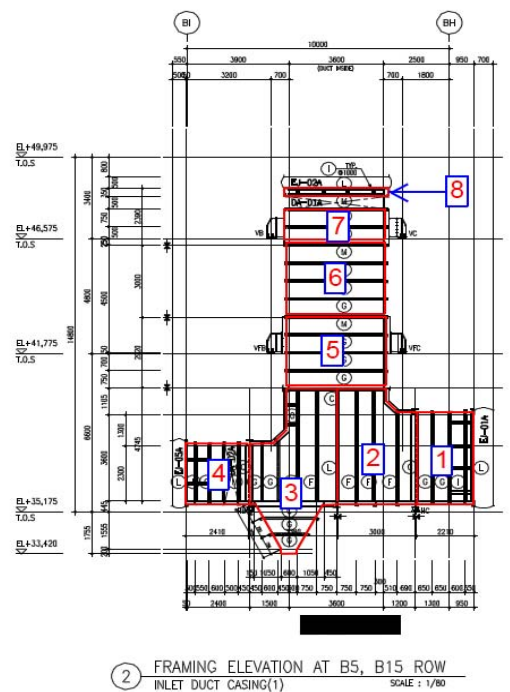
The above drawings are shown the number of site assembly parts for SCR reactor. Erector should put down site assembly parts from No.1 step by step after finishing the fabrication of site assembly part.

The site assembly part for SCR reactor should be putted down on expansion joint at over part no.7 of site assembly for SCR outlet duct. The relating drawing No. is TB2-SDC.VP124-00HSD-M-M1A-DGA-0001 ~ 0043 and TB2-SDC.VP124-00HTA-M-M1A-DID-0001 ~ 0048 for shown part no above Figure 6.3 and 6.4.

B



① FRAMING ELEVATION AT B3.5, B13.5 ROW
INLET DUCT CASING(1)
SCALE : 1/80



② FRAMING ELEVATION AT B5, B15 ROW
INLET DUCT CASING(1)
SCALE : 1/80

Figure 6.5 Site Assembly Parts of Inlet Duct (No.1 ~ 8)

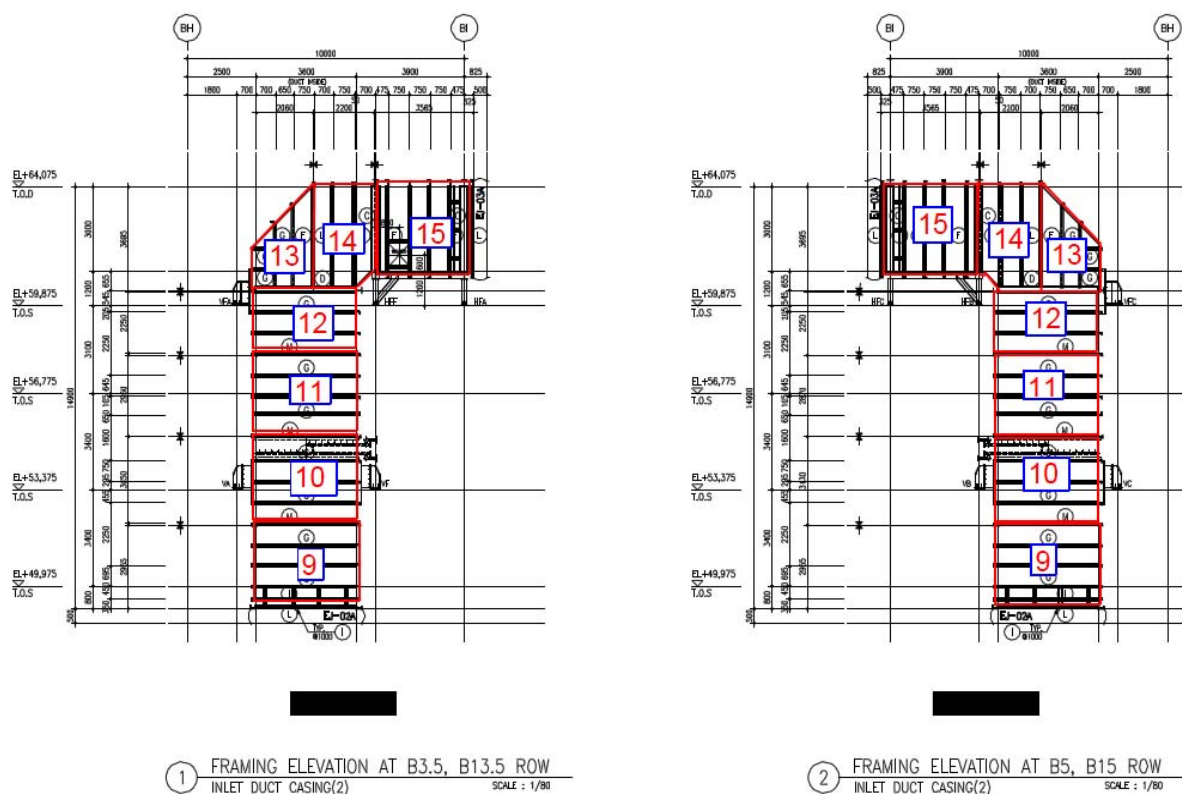


Figure 6.6 Site Assembly Parts of Inlet Duct (No.9 ~ 15)

The above drawings are shown the number of site assembly parts for SCR inlet duct. Erector should install assembly parts from No.1 up to No.15 step by step after finishing the fabrication of site assembly part. Expansion joints shall be located between No.7 and No.8 of assembly parts for SCR inlet duct, No.8 and No.9 of assembly parts for SCR inlet duct. In addition, there are expansion joints between inlet duct and others like outlet duct, reactor either as like the followings.

Between No.4 of assembly parts for SCR inlet duct and No.8 of assembly parts for SCR outlet duct, No.15 of assembly parts for SCR inlet duct and No.6 of assembly parts for SCR reactor. The relating drawing No. is TB2-SDC.VP124-00HTA-M-M1A-DGA-0001 ~ 0010 and TB2-SDC.VP124-00HTA-M-M1A-DID-0001 ~ 0048 for shown part no above Figure 6.4 and 6.5.

3.5 Reference Erection Drawing

There are reference drawings for erection for SCR duct, reactor, and platform formally issued by S&TC for Thibinh 2 PJT. Erector must necessarily check and take into account them during site construction work for SCR duct, reactor, and platform. The drawing number and description of them are like followings.

Drawing Number	Drawing Title	Description
TB2-SDC.VP124-00HSD-M-M1A-DGA-0001 ~ 0010	General arrangement drawing	These drawings shown on general arrangement of inlet/outlet duct, reactor, and platform for SCR.
TB2-SDC.VP124-00HTA-M-M1A-DRD-0001 ~ 0061	SCR of flue gas duct detail drawing	These drawings shown general arrangement of SCR inlet/outlet duct and field welding points between site assembly parts of SCR inlet/outlet duct.
TB2-SDC.VP124-00HSD-M-M1A-DRD-0001 ~ 0043	SCR of SCR reactor assembly & Detail drawing	These drawings shown on general arrangement of SCR reactor and field welding points between site assembly parts of SCR reactor.
TB2-SDC.VP124-00HTA-M-M1A-DID-0001 ~ 0017	E-drawing for SCR shop drawing of inlet/outlet duct and reactor	These drawings shown on site combination of SCR inlet/outlet duct and reactor by indicating the part number of shop assembly.
TB2-SDC.VP124-00HTA-M-M1A-DID-0018 ~ 0048	E-drawing for SCR shop drawing for structure	These drawings shown on combination of shop assemblies for SCR structure by indicating the part number of shop assembly on finished erection status.
TB2-SDC.VP124-00100-M-M1A-DPS-0001 ~ 0024	Reactor and Duct Support Detail.	These drawings shown the reactor and duct support detail.
TB2-SDC.VP124-01HSD-M-M1A-DRD-0001	Interfacing and Terminal Point Details for Unit 1	Detail dimension is shown on this drawing between boiler economizer flange and SCR inlet duct ion flange.
TB2-SDC.VP124-01HSD-M-M1A-DRD-0002	Interfacing and Terminal Point Details for Unit 2	Detail dimension is shown on this drawing between boiler economizer flange and SCR inlet duct ion flange.

Erector can see these drawings by requesting their owner or through the 'Attachment #1' in this document. In addition, they can also get the information on material specification of components of shop assembly product via bill material list shown on these drawings as well as erection method. Erector must consider the material specification for their erection work either.

3.6 Caution

- 1) Don't try to do construction work during not only wild weather such as heavy rain, snow, and wind but also, natural disaster including earthquake, flood, typhoon, and lighting strike.
- 2) Prepare the necessary transportation equipment including crane for construction work.
- 3) Choose firmed and dry area for temporary storage in order to prevent and protect material damages during storage out of environment factors such as storm water, dust, etc. which cause rusty, stain, etc. during construction work.
- 4) The workers working on construction site must be equipped with minimum personal protective equipment as below:
 - Safety Helmet.
 - Safety shoes.
 - Full body hardness.
 - High visibility vest.
 - Safety gloves.



3.7 Erection Tolerance

The erection tolerances are shown as following table per kinds of supplied material type.

No.	Type of supplied material	Allowable erection tolerance (mm)
1	Reactor and duct Frame	-5 ~ +5
2	Equipment and Skids.	-2 ~ +2 (Anchoring point)
3	Steel structure	-5 ~ +5
4	Expansion joint	-6.35 ~ +6.35
5	Piping	-3 ~ +3

During installation the erection tolerance exceed above allowable erection tolerance, immediately notify to the supplied before erection work. The allowable erection tolerance are based on S&TC experience.

3.8 Ammonia Storage Tank

Ammonia storage tank is very large and heavy. Therefor very careful to handling of ammonia

storage tanks when installation. Before installation of ammonia storage tank take care of selection the crane capacity. If possible the crane locates as possible as close to installation position of ammonia storage tank for safe installation. During lifting of ammonia storage tank at least two(2) workers hold the rope that is tied on the ammonia storage tank to prevent un expected large movement caused by wind or inertia.

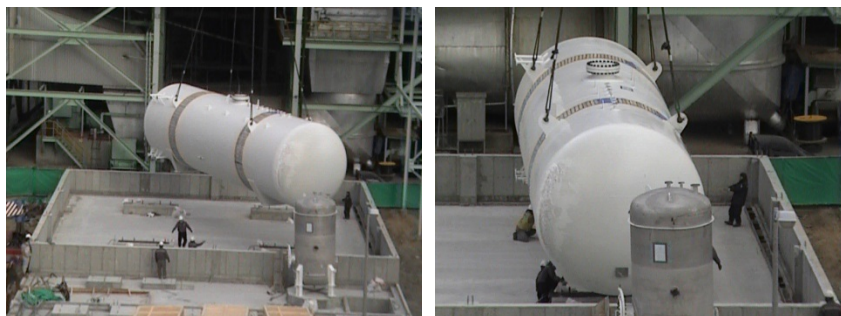
- 1) Tie the wire lope with lifting lugs on the ammonia storage tanks. During tie the wire rope on the lifting lugs, take caution because the wiring work perform at high elevation.



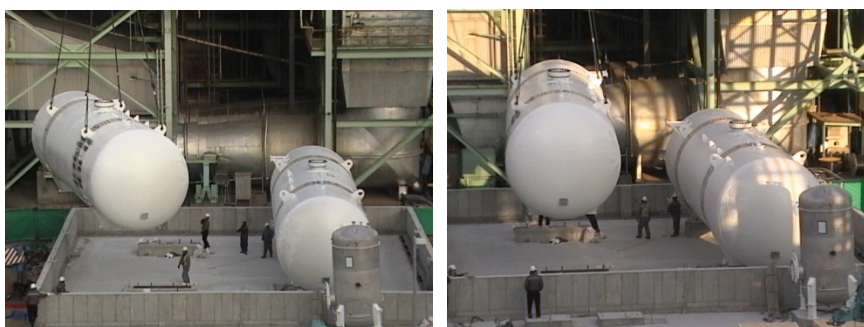
- 2) After than lift the ammonia storage tank by crane. The sequence of lifting from far side of ammonia storage tank from crane.



- 3) Stop the moving at the above of ammonia storage pedestals.
- 4) At the each side of anchor point the installation worker shall be locate to proper installation of ammonia storage tank without any damage or accident caused by miss landing on the pedestals.



- 5) After located worker at each point the crane goes down the ammonia storage tank as per worker signal to exact landing of ammonia storage tank on the pedestal.



- 6) Before set the position of ammonia storage tank use a shim plate to keep the horizontality of ammonia storage tank if needed. Important thing is keep the design elevation of ammonia storage tank to avoid miss matching of nozzles.
- 7) After confirm of ammonia storage tank horizontality separate wire rope from ammonia storage tank.
- 8) Finally tighten the nuts to finalize installation of ammonia storage tank.
- 9) After finish of ammonia storage tank settling install the platforms for ammonia storage tanks.

3.9 Skid Equipment

Skid equipment is same as below table. All skid equipment installed as same method described in this manual.

No.	Equipment Name	Skid No.
1	Unloading Compressor	
2	Vaporizer	
3	AFCU	
4	Dilution Air Blower	

- 1) Before installation of skid check the exact position put the skid. After than start the work of installation.
- 2) Select proper crane capacity take in to consideration of skid weight and distance from foundation to crane.
- 3) Take care to prevent damage of instrument which is installed at the skids.
- 4) Keep in horizontality between pedestal/steel structure and skid. Take care of nozzle elevation.
- 5) After than tighten the nuts to fix skid on the pedestal/steel structure.
- 6) After finished tighten the nuts connection each pipe lines.

3.10 Accumulator

Accumulator install on the pedestal. Basically the installation procedure same as ammonia storage tanks installation procedure.

- 1) Before installation if skid check the exact position. After than start the work of installation.



- 2) After check of installation position, lift the accumulator carefully. The accumulator center of gravity is high.
- 3) Tie the wire rope with lifting lugs top of the accumulator. After tie check again the condition of tie.
- 4) After than lift slowly and move to the above accumulator pedestal.
- 5) Carefully going down near elevation where to locate.
- 6) Installation worker on the ground check the location of hole on the accumulator legs matching or not with anchor bolt. If not the ground worker shall give the sign to the crane operator where to move the accumulator.
- 7) If the holes of accumulator legs with anchor bolt, put on the pedestal with leveling.
- 8) After leveling tighten the nuts to fix accumulator on the pedestal.
- 9) After finish of tightening of nuts attach the insulation on the accumulator wall.



10) After finish insulation attach finish with lagging sheet.

3.11 Piping

Piping installation perform in accordance with ISO drawing and piping arrangement drawing. Small size piping (Below DN50) installed at the site. The materials will be delivered as law materials. Large bore piping (Over DN65) will be delivered as spool.

For small bore piping will be installed at the site in accordance with ISO drawing and piping arrangement drawing. The piping work shall be done after installation of all equipment positioned. The type of connection between pipe and equipment, piping and piping shall be checked before installation work. The welding method for DN50 or smaller, in stainless steels GTAW shall be used for the root of all butt welds.

For large bore piping (Over DN 65) is quite heavy compare than small bore piping. Therefore ensure the safety for installation work and handling. In generally, installed the pipe support in advance after than put on the piping spool on the pipe support. And connection or welding with another piping spools.

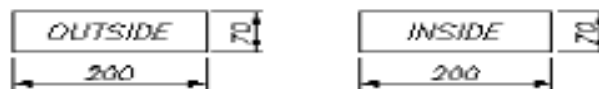
In case of flange connection piping, secure the tightness of connection bolts and check the gaskets.

3.12 Expansion Joint

The following preassembly steps should be taken prior to installation of nonmetallic expansion joints.

- 1) Duct inspection
 - a. Confirm that the expansion joint assembly size and tag number is correct for the proposed location.
 - b. Confirm that the ducting on each side of the opening is aligned within $-6.35 \sim +6.35\text{mm}$. Although fabric expansion joints are quite flexible, there are definite movement limitations.
 - c. Expansion joints should not be used to adjust for duct misalignment unless specified by the design conditions.
 - d. Confirm that the opening (face to face dimension) for which the joint was designed does not exceeds $-6.35 \sim +6.35\text{mm}$ of nominal. If the duct opening exceeds this tolerance, notify manufacturer at once for disposition.

- e. The attachment edges or flanges of the ductwork should be smooth, clean and parallel to each other.
 - f. Clear the area around the ductwork of all sharp objects, protrusions and debris. Any which are not removable should be tagged or roped off so they can be avoided.
- 2) Expansion Joint Inspection.
- a. Expansion joints and components should remain packaged until just prior to installation, particularly if the expansion joint must be moved.
 - b. Once the shipping container or packaging materials are removed, the expansion joint should not be moved, except during actual installation.
 - c. Using manufacturer's manufacturing drawings and/or shipping documents, confirm that all components are present and in good condition.
 - d. The expansion joint shall be marked "Out side" at outer surface and "In side" at inner surface of the bellows. And then site inspector shall be check these mark.
 - e. The expansion joint shall be marked "OUT SIDE" at outer surface and "IN SIDE" at inner surface of the bellows, and then site inspector shall be check these mark.



3) Field Assembled Frame on the Ground.

Prepare an assembly area for the expansion joint adjacent to the duct opening or on the ground at the site. If possible, transportation joint components in the original shipping containers to assembly location. If not, use nylon straps, rope or other rigging to transportation joints.

- a. Identify and separate upstream and downstream duct frame. Arrange each of duct frame on the ground so they are level and plane.
 - b. Verify match markings at all weld points. And then full welding the frame.
 - c. Back-up bras are factory drilled and normally required no modification to match the attachment flanges. Each expansion joint assembly required two sets of back-up bars.
 - d. Clean up surrounding area and remove any debris which may damage the expansion joint.
 - e. The expansion joint now assembled and ready for installation. Product bellows from damage during remaining erection process, taking care to remove any temporary covers and/or construction dust prior to start up.
- 4) Installation
- a. The belt is normally spliced at the mid-point of the long side or short side. Find the mid-point of the duct flange on the long side. Start at this point and unfold the belt around the duct, keeping the side marked "Outside", to the outside.

- b. On horizontal ducts always splice on top or side, never on the bottom.
- c. Keep belt supported on a platform while unfolding and positioning. Do not hang belt hokes, as its weight could tear the holes.
- d. When in place and lined up correctly, the belt can held in place using screw clamps, strong pinching tongs etc.
- e. Position back-up bar correctly on the expansion joint flange and secure it with screw clamps.
- f. Drill through the belt using back-up bar and duct flange as drill guide. It is very important that the screw clamps (on both sides of the hole) hold the materials tight and keep them fastened in place.
- g. Locate the attachment in the bellows using a drill bit or punch equal to or slightly larger than the belt diameter.
- h. Attach belt to flanges with back-up bars and bolts, tightening by hand or impact wrench. The installer must ensure that bolts are installed with the nut positioned on the back-up bar side. Confirm from the corner along the side and install the back-up bars. Remove all peripheral slack as the belt is bolted around the frame. Do not install the back-up bars 1829 to 2438 mm. either side of the splice.
- i. Beginning at a corner nearest where the splice will occur, bolt the fabric belt and back-up bars in place around the frame. Always position the beginning of the belt of the mid-point of a back-up bar section.
- j. Splicing the belt by erector with splicing procedure as attached.
- k. Bolt the final section of back-up bar in place after completion of the splice.
- l. Final-tighten all bolts to 47 to 61N-m using torque wrench.

3.13 Ash Soot Blower

The ash soot blower cleaning system that has been supplied for SCR reactor has been specifically designed and engineered to meet the unique demands of SCR application. It is imperative that it be installed. Operated and maintained properly to assure trouble-free operation and adequate cleaning of the SCR catalyst. Refer to the installation drawings for specific installation and operational instructions. If it becomes necessary to make any modification to the location of the acoustic cleaners, please contact supplier for recommendations. Horn placement is cortical to the effective operation of the cleaning system. Any deviation from the installation drawing provided for ash soot blower system should be reviewed / approved by supplier.

The installation drawing shall be refer to " TB2-SDC.VP124-00HTA-SPC-0003".

The following items should be reviewed prior to start-up of a system.

a. Air piping

Proper airflow to the acoustic cleaner is critical to sounding verify that existing or piping

design is sized per the installation drawing provided for this system.

b. Air pressure

70 to 90 psi is the recommended pressure to sound the horns. Check the air pressure before and during sounding of the acoustic cleaners. Ideally the air pressure will be about 80psi which is the middle of stated pressure requirements.

c. Verify operation

Prior to make sure that the acoustic cleaners are sounding properly, User should hear a definite "foghorn" tone and may even feel some resonance in user feet or body when the acoustic cleaner sounds. If the horn makes a very high pitched squeal or doesn't sound at all, refer to the trouble/shooting section of this manual or contact GE for assistance.

d. Verify sounding sequence

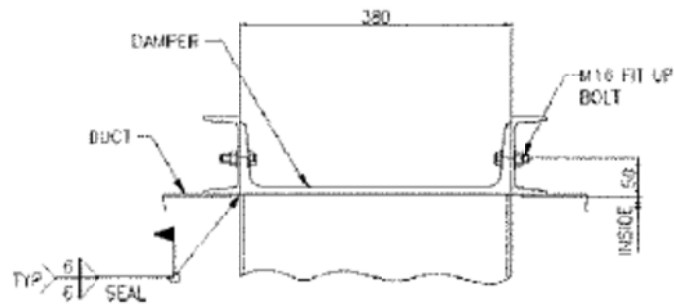
The actual sounding sequence of the acoustic cleaners should be checked to make sure that the proper operating sequence is being employed.

Once installed, the horn should be placed into operation as soon as possible. An unused horn is subject to build up problems that may obstruct the bell and prevent the horn from sounding. Each sounding of the horn will purge any material that might migrate in to the bell.

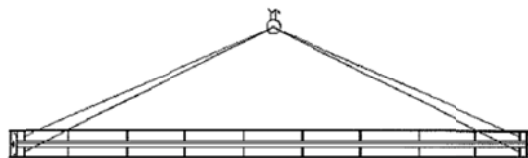
3.14 Damper

- a. Check the installation location is match with drawing and the tag number also.
- b. Set the position of damper blade as full close and fix the linkage.
- c. Before installation of damper, check the tolerance between duct and damper flange for diagonal and angle.
- d. There is no problem of diagonal and angle difference between duct and damper flange start installation.
- e. Clean up the flange face of damper and duct.
- f. Lift damper by crane and set the position of damper in accordance with flow direction of the duct.
- g. Joint for four(4) corner of damper and duct, ever 1000mm distance. But not tighten of all bolt and nuts.
- h. Check the coincidence between damper and duct lines. If the damper and duct lines well fit, the bolt and nut fasten tightly.
- i. When fasten the bolt and nuts in sequence of opposite angle and symmetry to prevent joint force equalization.
- j. Checks the installation status by visual after finalizes of fasten.
- k. Is there no problem of installation, start the damper to check operation status.
- l. If find any problems of installation, un fasten the bolt and nuts again from a~j.

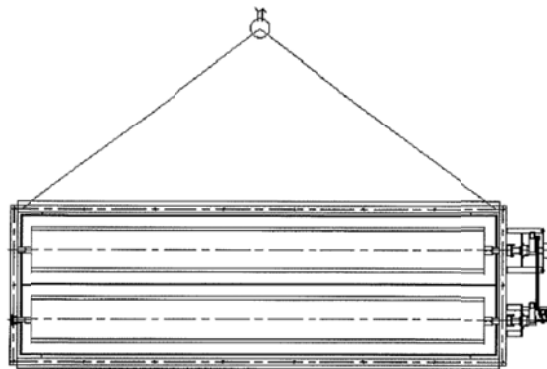
- m. Fasten all of damper connection bolt and nut after operation status check if there are no problems.
- n. All of damper connection bolts fasten as sequence of above i.
- o. After fasten all of connection bolts, seal welding of all gaps between damper and duct flange.
- p. After welding, finalize installation.
- q. After finish installation, check again the operating status of damper.



For proper operation and absorption of thermal expansion the idle side assembled as cover bearing. Therefore, necessary pay close attention for transportation and handling. The drive side and idle side always keep same elevation. Please refer to following handling drawing of damper. As shown at below drawing, the bearing side always keeps the horizontality during handling. If not keeping the horizontality during handling and transportation cause blade can be one side weighted. It makes interference between blade and damper frame that is high possibility of malefaction at high temperature operation circumstance.



In case of installed on vertical duct.



In case of installed on horizontal duct

GM32 Measuring Probe Version

Simultaneous or individual measurement of SO_2 , NO, NO_2 and NH_3 as well as temperature and pressure

Intended purpose

The GM32 gas analyzer serves for continuous measurement of gas concentrations of SO_2 , NO, NO_2 and NH_3 as well as the reference values of temperature and pressure in industrial plants.

As in-situ measuring device, the GM32 determines the measured values directly in the gas carrying duct from the measuring gas spectrum.

Versions

The GM32 provides simultaneous multi-component measurement (combinations of measuring components) as well as single-component measurement. The following measuring probes are available for optimized adaptation of the measuring device to the measuring point:

- GMP measuring probe with open measuring aperture for use with high dust loads in the measuring gas
- GPP measuring probe with gas-permeable ceramic filter in the measuring gap.

The GM32 gas analyzer comprises the following components:

- Sender/receiver unit
- Measuring probe, GMP or GPP
- Connection unit
- Purge air unit (for GMP probe)
- Mounting flange
- SCU operating unit (option)



SICK

Sensor Intelligence.

Project planning and preparation

Project planning of the measuring device is very important to ensure unrestricted function and efficient start-up. The main requirements and preparations at the installation site as well as a wiring example with connection options are described in the following.

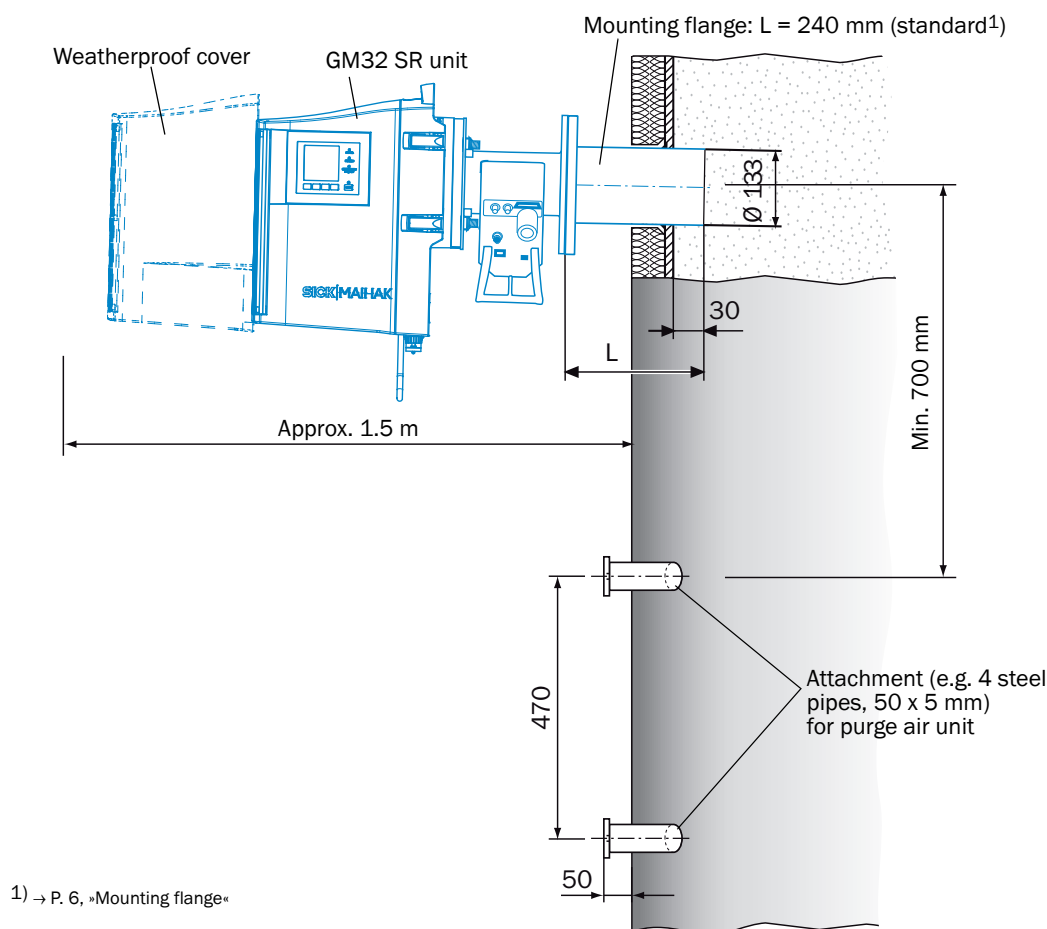
Requirements at the installation site

- Determination of measuring point
 - Provide for an unhindered inlet and outlet paths.
 - Provide for calibration openings at easily accessible places. Ensure that the measuring device and the calibration probe do not influence each other; provide for a calibration socket of min. 0.5 m in flow direction before the measuring device.
 - Provide for an opening with suitable size for the tube of the mounting flange.
 - Provide for adequate clearance for installation and maintenance activities for the duct insulation cut-out.
 - Provide for adequate clearance, e.g. for swiveling out the sender/receiver unit and pulling out the probe.
 - Ensure that the ambient temperature is in the specified temperature range; → P. 4
 - For outdoor installation, provide for adequate weather protection for the device components.
 - Check whether the required power supply (connection unit, purge air unit, etc.) is available → P. 4
 - Provide for sufficiently long signal cables to the measuring device connection unit.
 - The fitting location on the duct/stack must be capable of holding approx. 40 kg on each side.

Preparations for installation

Mounting suggestion for the GM32 device components on a vertical duct/stack.

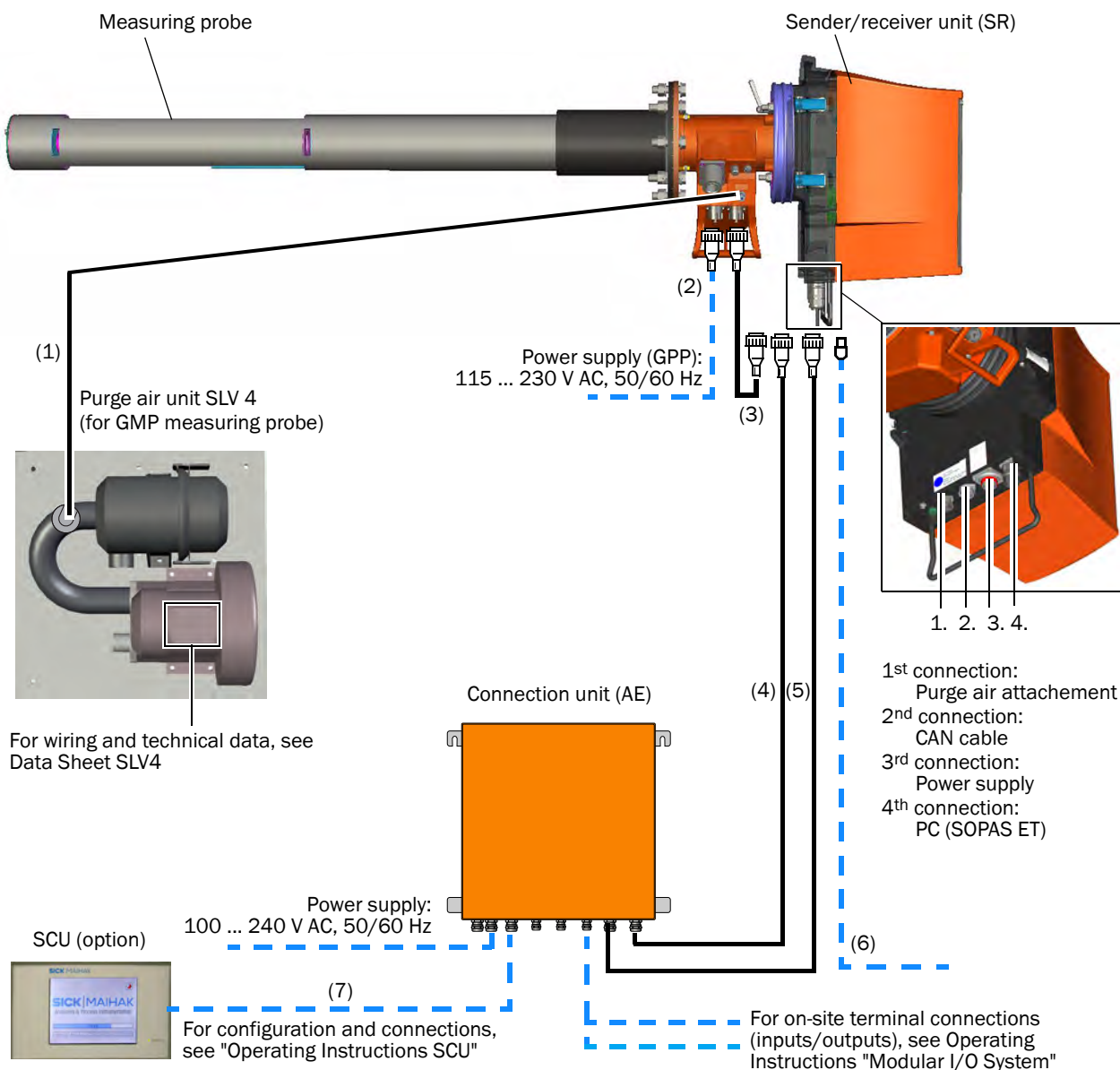
Fig. 1 Example: Mounting options for the measuring probe, mounting flange and purge air unit version



Wiring and connections

The Figure below shows a wiring example with the connections of the GM32 components. See the Operating Instructions for details for the concrete connection assignments, e.g. from the connection unit.

Fig. 2 Wiring example: Measuring probe version



No.	Signal cable for connection	Length	Order no.	Remark
(1)	Filter monitoring	5 m	2032143	Included in the purge air attach. (probe)
(2)	GPP probe power supply	10 m	2017519	Included in the GPP probe
(3)	SE – purge air attachment (CAN cable)	0.8 m	2023704	Included in the Purge air attachment (probe)
(4)	AE – SR (CAN cable)	10 m 20 m	2028786 2045422	Order separately
(5)	Power supply SR (Standard)	10 m 20 m	2046548 2046549	Order separately
(6)	Ethernet cable – PC/network		-	No, on-site
(7)	CAN cable – SCU		-	No, on-site

Technical Data

Technical Data		GM32		
Measuring Parameters				
Measuring principle	Differential Optical Absorption Spectroscopy (DOAS)			
Measured components	SO ₂ , NO, NO ₂ , NH ₃ thereof TÜV-tested for suitability: SO ₂ , NO			
Available measuring ranges (calibration ranges)	Min.	Max.	TÜV tested for suitability at T = 140 °C and active measuring path = 1.86 m	
	SO ₂ :	0 ... 40 mg/m ³ _{Operation} • m	0 ... 20,000 mg/m ³ • m	0 ... 75 mg/m ³ _{Standard}
	NO:	0 ... 50 mg/m ³ _{Operation} • m	0 ... 2,500 mg/m ³ • m	0 ... 70 mg/m ³ _{Standard}
	NO ₂ :	0 ... 100 mg/m ³ _{Operation} • m	0 ... 2,000 mg/m ³ • m	-
	NH ₃ :	0 ... 25 mg/m ³ _{Operation} • m	0 ... 50 mg/m ³ • m	-
Measuring distance	Active measuring path → P. 7, Fig. 4 and → P. 7, Fig. 5			
Measurement uncertainty	• ±2 % with SO₂, NO, NH₃ • ±5 % with NO₂			
System response time t ₉₀	• GMP measuring probe: ≥5 s, adjustable; > 30 s (TÜV tested for suitability) • GPP measuring probe: ≥120 s s (TUV tested for suitability)			
Measuring Conditions				
Measuring temperature	≤ 500 °C; higher temperatures on request			
Process pressure	±60 hPa (relative)			
Ambient Conditions				
Ambient temperature	-20 ... +55 °C; temperature change max. 10 K/h			
Storage temperature	-20 ... +55 °C			
Rel. humidity	max. 96 % rF			
Moisture condensation	Moisture condensation on optical interfaces not allowed			
Shock & vibration	According to EN 61010-1			
Approvals				
Compliances for SO ₂ and NO components	• TÜV-tested for continuous emission control according EC regulations (2001/80/EC, 2000/76/EC) • EN 15267-3, EN 14181 and DIN ISO 14956			
Electrical safety	CE			
Protection class	IP 65, IP 69K			
Input/Output Signals, Interface		Modules can be selected and extended as required		
Analog outputs (option)	2 outputs ¹): 0/4 ... 22 mA, load max. 500 Ω; electrically isolated; max. power dissipation (for 24 V): 1.10 W; max. 16 outputs			
Analog inputs (option)	2 inputs ¹): 0/4 ... 22 mA, input resistance max. 100 Ω; max. power dissipation (for 24 V): 0.25 W			
Digital outputs (option)	4 outputs ¹) (max. 8): 48 V AC/DC, make-contact, 1.0 W (for 24 V); 0.5 A max. switching current, max. switching capacity (for 24 W): 25 VA; max. 8 outputs			
Digital inputs (option)	4 inputs ¹): approx. 3.9 V at open contact, <4.5 mA with closed contact, 0.55 W			
Interfaces	• Serial: RS232 (internal) • Ethernet • Extendable via optional SCU operating unit			
Bus protocol	• OPC • TCP/IP via Ethernet (optional interface module)			
Power supply	• 100 ... 250 V AC, 50/60 Hz; 260 VA max. power input • Purge air unit SLV4, see Operating Instructions Separate power supply of GPP probe: 115/230 V AC; 50/60 Hz, max. 150 VA power input			

Technical Data GM32	
General information	
System components	• Sender/receiver unit • Measuring probe with purge air fixture – Type GMP with open measuring aperture or – Type GPP, gas diffusion probe • Flange (option) • Purge air unit with GMP probe: See Operating Instructions SLV4 • SCU operating unit: See Operating Instructions SCU
Dimensions (L x W x H) (see Dimensions)	• Sender/receiver unit (including purge air fixture): 586 x 315 x 580 mm • Measuring probes: See → P. 7, Fig. 4 • Connection unit: 450 x 400 mm, → P. 8, Fig. 7 • Purge air unit SLV4: 550 x 550 x 270 mm; see Operating Instructions SLV4
Weight	• Sender/receiver unit: approx. 20 kg • Purge air attachment: 7 kg • Connection unit: 16 kg • Measuring probes – GMP: 25 kg max. – GPP: 45 kg max. • Purge air unit: 14 kg; see Operating Instructions SLV4
Control function	• Internal zero point control, contamination correction • Check cycle for zero and reference point, equivalent to QAL3 (option)

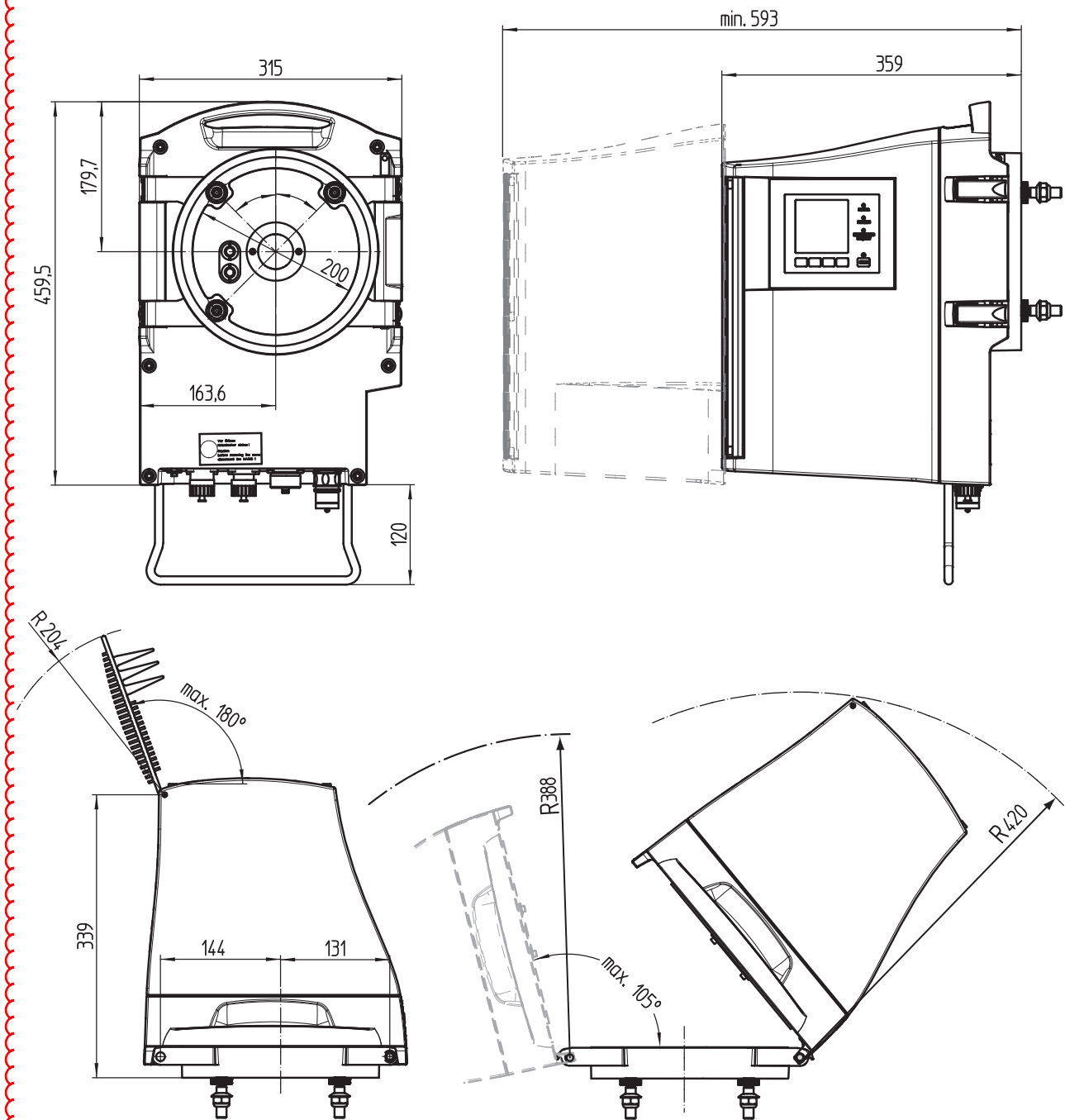
¹⁾ per module



For more information and technical information on the GM32 system and its components, see the following documents:

- Data Sheet GM32, Cross-Duct Version, Part No. 8012710
- Operating Instructions GM32, Cross-Duct Version, Part No. 8012704
- Operating Instructions GM32, Measuring Probe Version, Part No. 8012707
- Technical Information GM32, Cross-Duct Version, Part No. 8011085
- Technical Information GM32, Measuring Probe Version, Part No. 8011513
- Operating Instructions Purge Air Unit SLV4, Part No. 8008088
- Operating Unit SCU: See Operating Instructions SCU, Part No. 8011910
- Technical Information Modular I/O System, Part No. 8011913

Fig. 3 GM32 sender/receiver unit



The housing of the sender/receiver unit can be swiveled open to the left or right of the device flange (max. 120°).

Fig. 4 GM32 measuring probe, type GMP – open measuring probe

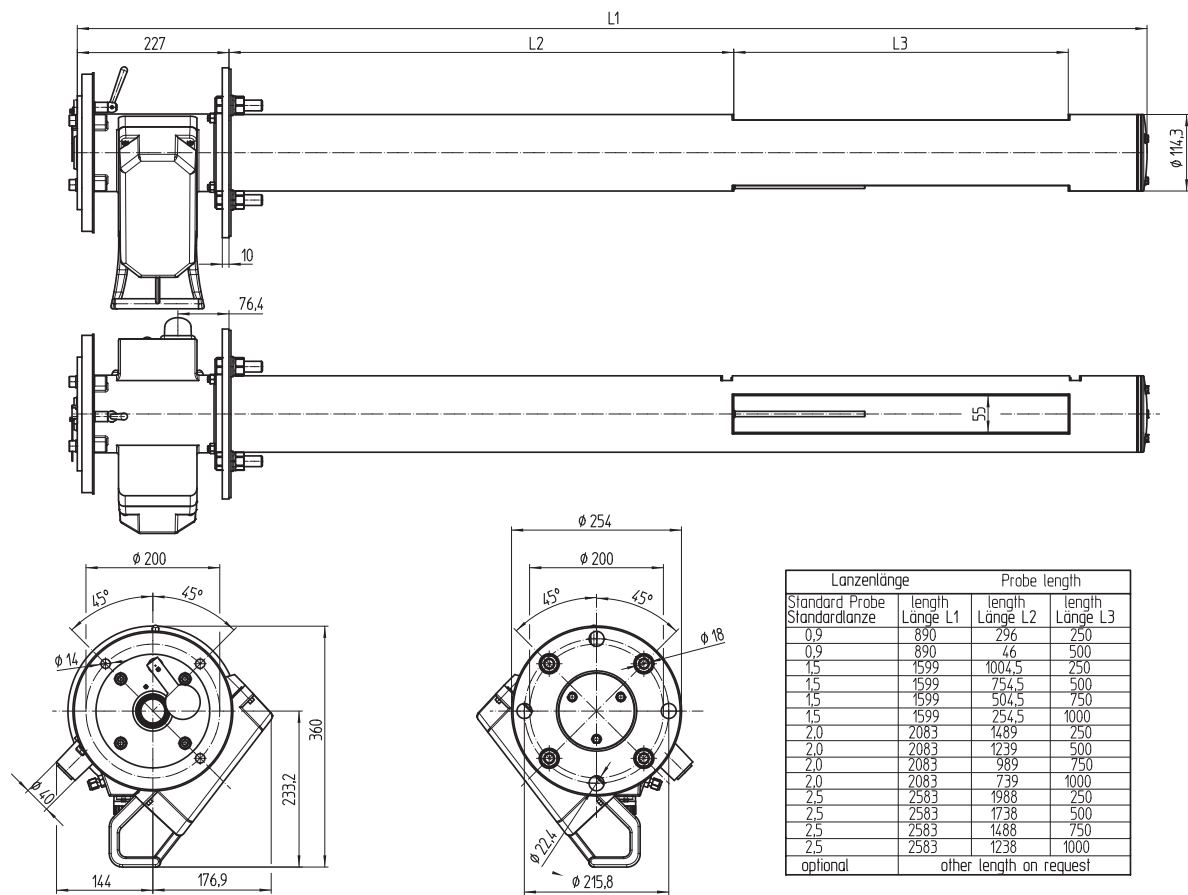


Fig. 5 GM32 measuring probe, type GPP – gas diffusion probe

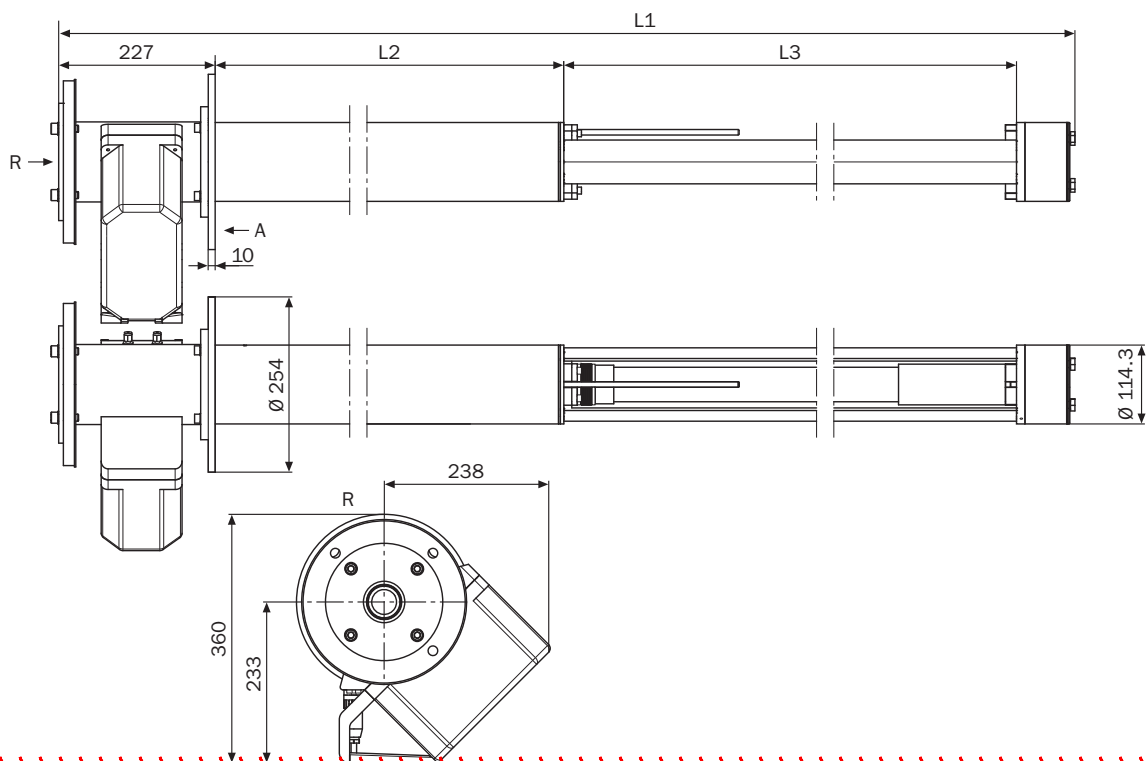


Fig. 6 Mounting flange

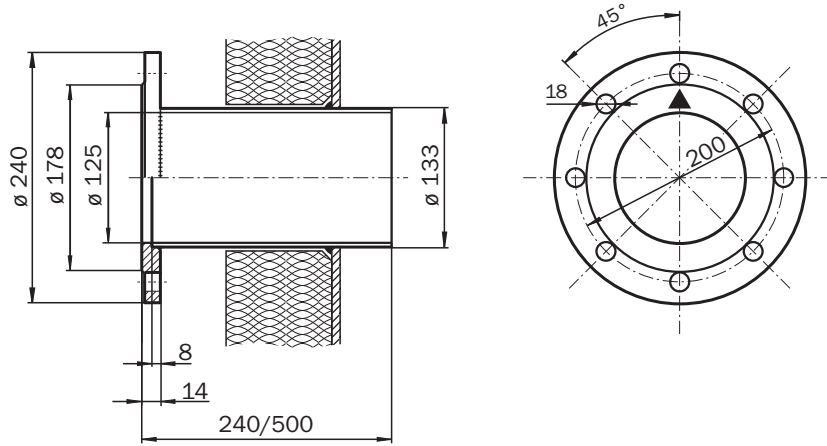
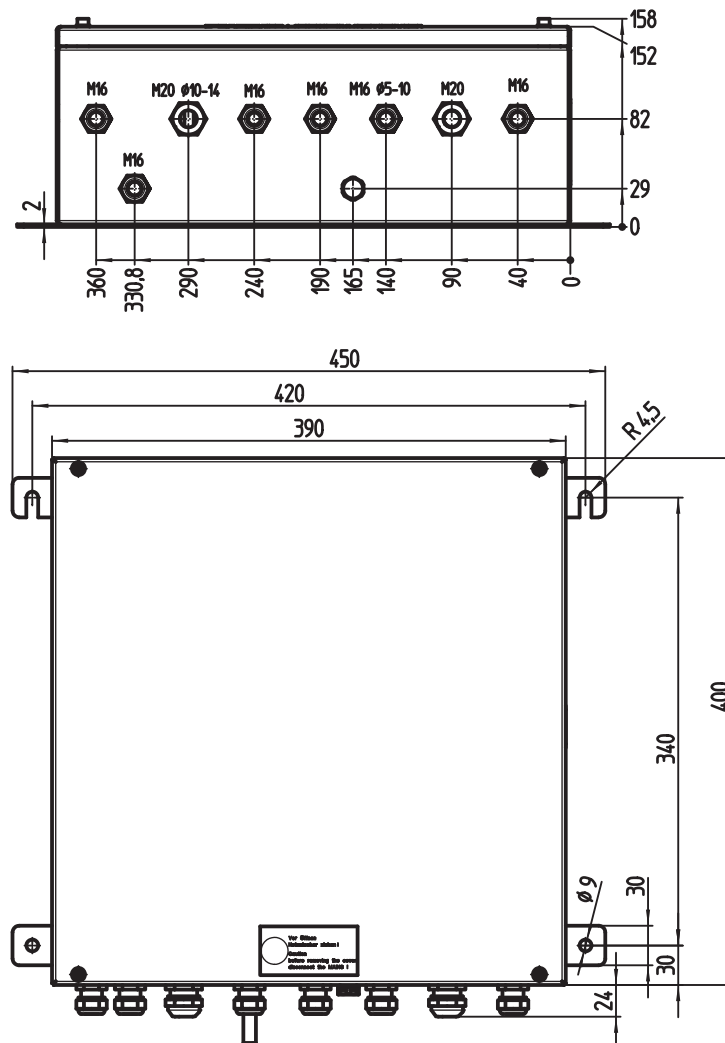


Fig. 7 Connection unit



SOLUTION

BEST



ZIRKOR 5200 -

Oxygen Analyzer System for power plants

The power plant system ZIRKOR 5200 is designed for the measurement of O₂ in exhaust gases from power plants, waste incinerators and cement plants even in high dust applications and depending on the probe type, up to 600° C (with cooling tube temperatures up to 1400 °C are admissible).

The rugged ZIRKOR 5200 probe is fitted with a protective tube and filter head so that it can even be mounted horizontally. Various different probe lengths from 520 mm, 950 mm and 1865 mm are available to exactly match the installation conditions (other lengths are also available).

The associated microprocessor-based electronics unit is mounted in a rugged industrial sheet steel enclosure, with a viewing window. It includes the reference air supply with reference air pump and a flow meter. Customer supplied instrument air can be connected as an alternative when ordered with the corresponding pneumatic unit.

This system is self-starting. A large digital display with self-explanatory menu texts, easy operation with the use of softkeys, full automatic calibration with solenoid valves and two freely-programmable O₂ measuring ranges are just some of the features of this system.

The ZIRKOR 5200 System consists of the following components:

- 1. Probe** with protective tube, filter head and solenoid valve and the probe flange
- 2. Microprocessor electronics** with integrated pneumatics for test gas and reference air
- 3. Interconnecting cable** between probe and electronics (maximum length 150 m)

Technical Data

Zirkonoxide Oxygen measuring probe

Length:	520 to 1865 mm
Flue gas temp.:	600 °C - 1400 °C
Meas. principle:	Zirkonoxide
Material:	1.4571/1.4301stst
Flange:	similar to DN65 PN6
Filter element:	sintered metal 20 µm
Protection plug:	IP 65

Electronics unit in sheet steel enclosure with window

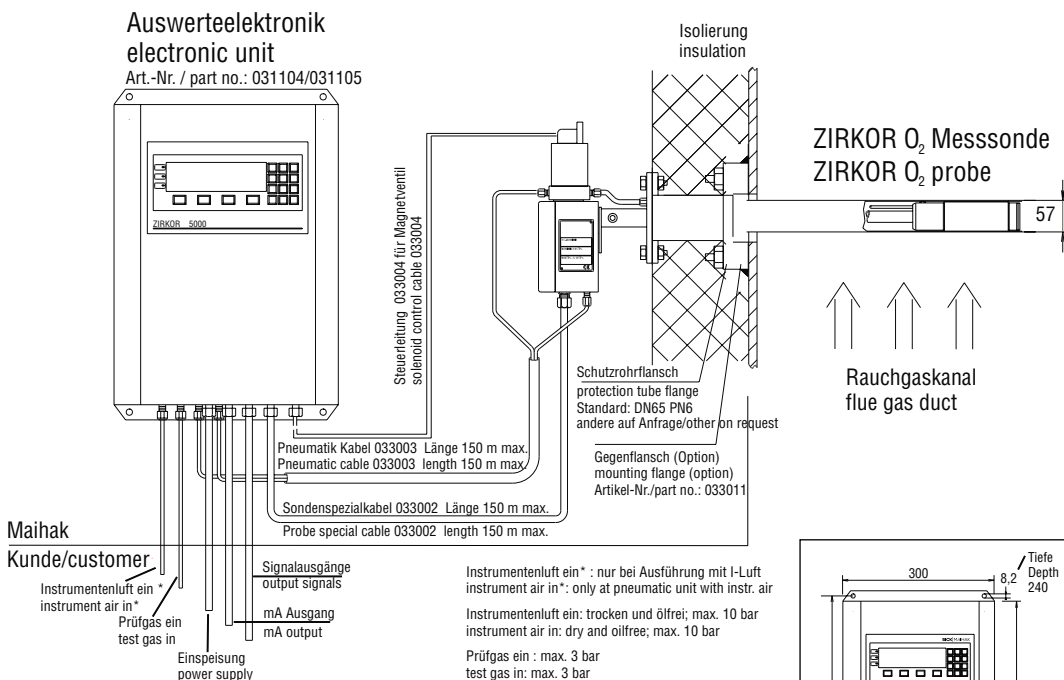
Protection:	IP 65
Dimensions:	HxWxD 300x400x225 mm
Weight:	approx. 14 kg
Line voltage:	115/230 V / 50 - 60 Hz +/-10 %
Power cons.:	400 VA during warm-up, < 200 VA continuous operation
Ambient temp.:	-20 °C up to +55 °C (instrument air) -20 °C up to +40 °C (pump version)
EMI tested:	acc. EN 50081-2 and EN 50082-2
Meas. ranges:	2, key selectable, each programmable from 0 - 2 % O ₂ to 0 - 25 % O ₂
Output:	0/4 - 20 mA programmable potential-free, load 500 Ohm max.
Interface:	RS232, RS485, bus-interface on request
Accuracy:	± 0.2 % of reading (± 0.01 % O ₂), with monthly calibration
Operation:	with soft keys, menu control, self-explanatory
Displays:	LCD-display LED-illuminated 240 x 64 dots
Spectrum:	actual values, parameters, system functions, system status
Language:	display texts in German and English
Alarm display:	LED status for alarm, service, fault
Relay outputs:	system fault, service, O ₂ range, solenoid valve probe, 2 O ₂ limits min/max
Digital inputs:	release auto. cal., test gas status, O ₂ range select
Value memory:	on/off during calibration
System test:	with air and/or test gas
Calibration:	single point or two point with air and/or with test gas bottle
Auto. cal.:	active by time selection
Auto. start-up:	with auto calibration and air
Pneumatics:	integrated for instrument air or with pump and flow control

GAS ANALYSIS

ZIRKOR 5200 O₂-Analysing System

Auswerteelektronik electronic unit

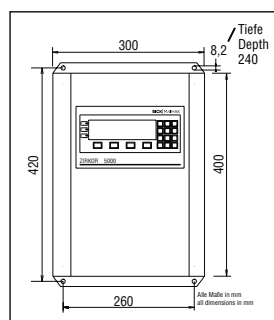
Art.-Nr. / part no.: 031104/031105



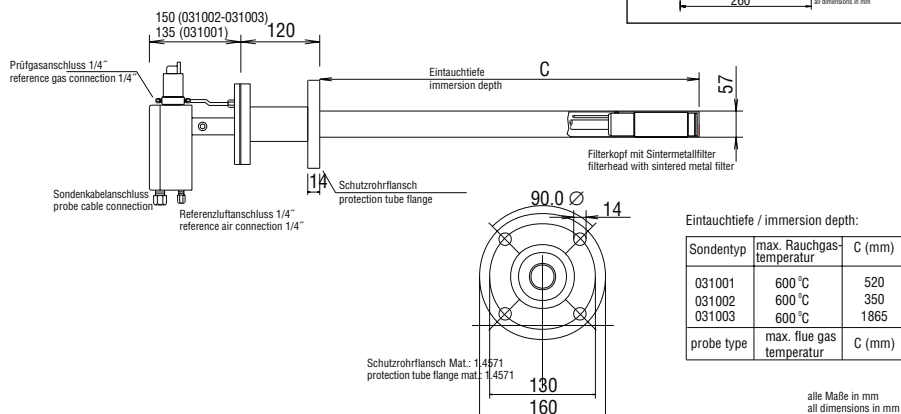
Maihak

Kunde/customer

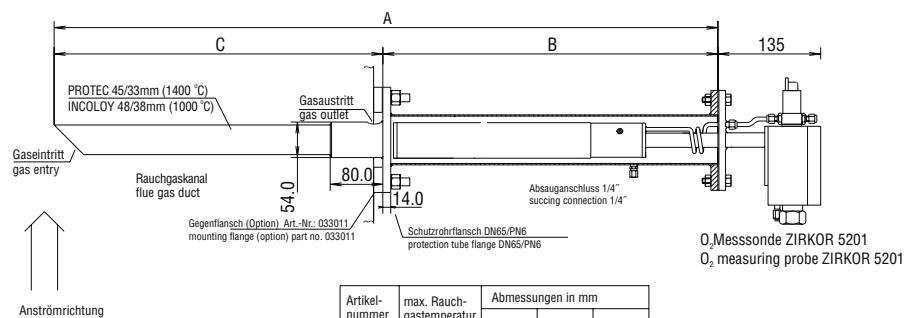
Electronic Unit



Probe 600 °C



Probe 1000 °C Probe 1400 °C



GM700 Laser Gas Analyzer

Measurement of gaseous components
under difficult conditions
In-situ and extractive technology



GM700

Sophisticated Gas Analysis "brought into Line"

The GM700 series offers new possibilities to measure difficult and selective gas components such as HF, HCL or NH₃ with all-time flexibility – without the need of test gases. Using direct laser spectroscopy with a precisely adjusted spectral line the GM700 allows high-resolution measurements, free of cross-interference, drift and the necessity for any calibration.

AREAS OF APPLICATIONS

- Emission monitoring in the fertilizer production, waste incineration, aluminium and ceramics industry
- NH₃ slip monitoring in DeNOx plants
- Glass industry
- Scrubber monitoring in the iron and steel industry
- Plastics processing
- Chemical and petrochemical industry
- Automotive applications

GM700 CROSS DUCT

- Representative results due to the measurement across the entire duct cross-section
- Main application for measurement of HF
- Drift- and calibration-free
- Particularly low maintenance

GM700 MEASURING PROBE

- Drift- and calibration-free
- One side duct access
- Easy installation
- Integrated zero point path
- Measurement performance independent from the channel dimensions

GME700 EXTRACTIVE

- Hot-wet analyzer
- Drift- and calibration-free
- Easy integration into existing extractive systems
- Applicable without limits using the appropriate gas conditioning (e. g. high pressures and temperatures)

KEY FEATURES

- Broad field of applications due to the choice of extractive or in-situ analyzer design
- Precise and drift-free by the direct spectroscopy – no calibration with problematic test gases necessary, means high cost saving
- High selectivity due to very high spectral resolution – no cross-interference from other gases
- Fast response
- Applicable in harsh conditions
- Very low maintenance requirements and long servicing intervals

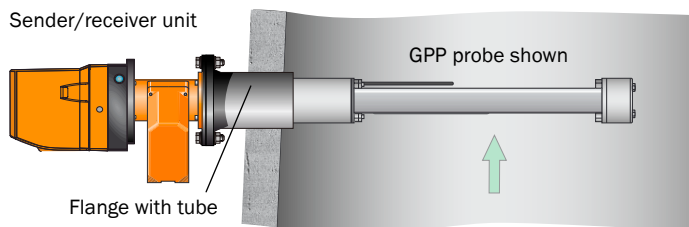




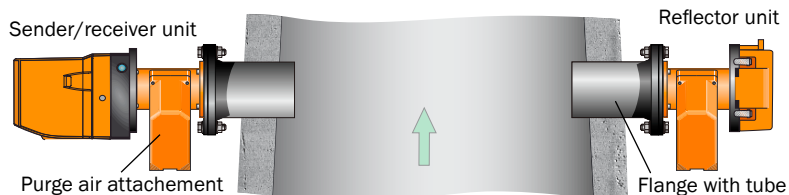
SYSTEM COMPONENTS

The GM700 system offers the following models for best adaption to the measurement task:

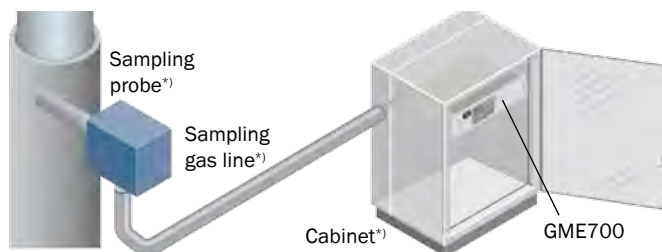
- **GM700 model with measuring probe**
 - Sender/receiver unit with the optical and electronical modules
 - Probe as a version with an aperture (GMP) or as a gas diffusion probe (GPP)
 - AWE unit for processing, control and output of measuring data



- **GM700 cross duct model**
 - Sender/receiver unit with the optical and electronical modules
 - Reflector unit with triple reflector and a purge air attachment
 - AWE unit (see above)



- **GME700 extractive analyzer**
 - Compact 19" unit (4 HU) with integrated analyzer and evaluation unit as well as a heated cell



^{*)} Not covered by the standard scope of delivery

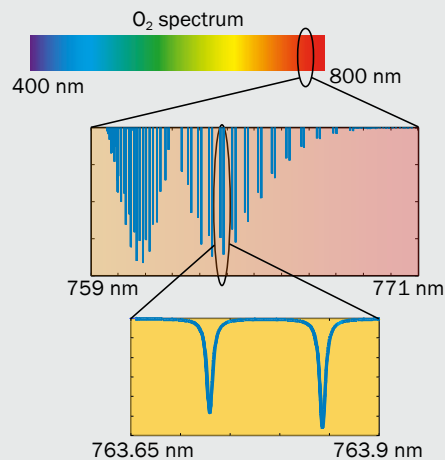
Optional components

- Purge air unit (for GMP probe and cross duct) for protection against contamination
- Weather proof covers
- Flanges with tube for mounting

TUNABLE LASER DIODE SPECTROSCOPY (TDLS)

A laser beam is sent from the sender through the measuring gas onto the reflector, that aims the beam back to a highly sensitive photo diode in the sender/receiver unit. The laser diode wavelength is tuned to one absorption line of the measuring gas component. This line is scanned by modulating the wavelength, and then the transmission signal is recorded by the photo diode.

An appropriate signal evaluation delivers the size of the absorption line from which the gas concentration is calculated. The TDLS method allows therefore the selective measurement in a gas mixture. Measuring gas components of the GM700 are NH_3 , HF, HCl and O_2 for example.



Technical Data		GM700 series	
Model	GM700 Probe model	GM700 Cross duct model	GME700 Extractive analyzer (19")
Measuring parameters			
Measuring principle	TDLS (Tunable Diode Laser Spectroscopy)		
Measuring component	NH ₃ , HF, HCl, O ₂		
Available measuring range	Minimum measuring range ¹⁾	Maximum measuring range ¹⁾	Minimum measuring range ²⁾
NH ₃	0 ... 10 ppm	0 ... 5000 ppm	0 ... 5 ppm
NH ₃ /H ₂ O	0 ... 5 vol%	0 ... 100 vol%	0 ... 2.5 vol%
HF	0 ... 2 ppm	0 ... 2000 ppm	0 ... 1 ppm
HCl	0 ... 10 ppm	0 ... 3000 ppm	0 ... 5 ppm
HCl/H ₂ O	0 ... 10 ppm/0 ... 50 vol%	0 ... 3000 ppm/0 ... 100 vol%	0 ... 5 ppm/0 ... 25 vol%
O ₂	0 ... 3 vol%	0 ... 100 vol%	0 ...1.5 vol%
Accuracy	<2 ...< 5 % of measuring value, dependent on the relevant application		
Measurement conditions	Probe model	Cross duct model	Extractive analyzer
Meas. gas temperature	-40 ... +430 °C	-40 ... +430 °C; higher on request	Heated cell up to 200 °C
Meas. gas pressure	- GMP probe: depend. on purge air - GPP probe: < ±120 hPa	Dependent on purge air	Dependent on gas conditioning
Ambient conditions			
Ambient temperature	-40 ... +50 °C; in 4 ranges adjustable		0 ... +50 °C
Approval			
Conformities	EMV according to EN 61326		
Protection class	IP65		IP20
Electrical safety	CE		
Inputs, outputs, controls via AWE evaluation unit			
Analog outputs	3 outputs: 0/4 ... 20 mA, max. load 500 Ω; electrically isolated		
Analog inputs	1 input: 0 ... 20 mA; optional for gas temperature and pressure		
Digital outputs	3 outputs: potential-free; 48 V AC/DC Status signal: malfunction (normally closed contact), maintenance request (normally open contact), Function control (normally open contact)		
Digital inputs	3 inputs for the connection of floating contacts; for 24 V		
Interfaces	RS232 (service)		
Bus protocoll	PROFIBUS (optional)		
General	Probe model	Cross duct model	Extractive analyzer
System components	- Sender/receiver unit - Measuring probe - AWE evaluation unit - Purge air for GMP probe - Flange with tube	- Sender/receiver unit - Reflector unit - AWE evaluation unit - Purge air unit(s) - Flange with tube	19" unit
Check function	Integrated check cycle for zero and span check		
Mounting	1 installation location on the duct	2 installation locations opposite on the duct	19" installation

¹⁾ At 20 °C, 1000 hPa, 1 m measuring path. The maximum measuring ranges are subject to conditions on-site and on the individual configuration.

²⁾ Maximum measuring range of the GME700 refer to GM700