



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

FACE SHEET TO ACCOMPANY THE TENDER DOCUMENTS

- A. 1. Name and full address of the Contractor
to whom the Tender Documents are issued. :
2. Whether registered with Engineering (Civil)
Department, if so, class of registration. :
3. If not registered, reference to the letter of the Chief
Engineer authorising issue of the tender Documents. :
4. Date of issue of Tender Documents. :

Assistant Exec. Engineer (Account)

- B. 1. Name of work: **Supplying, Installing, Testing and Commissioning of Air
Monitoring Analyzers at Different Locations in Port Areas**
2. Cost of each set of Tender Documents : Rs. 10,000/-
3. Date of Sale of Tender Documents : From : 22/08/2016
To 20/09/2016 upto
15.00hrs.
4. Date of receipt of tender and time : 21/09/2016 at 15.30 hrs
5. Amount of E.M.D. : Rs.1,31,500 /-
6. Date of opening of tender and time : On 21/09/2016
at 15.30 hours.
- 7 a) Whether E..M.D. received : Yes/No.
b) if so, in which shape : Demand Draft
8. Form of contract : Item rate
9. Whether tender received in duplicate : Yes/No
10. Whether rates have been quoted in : Yes/No.
the tenders both in words and figures.
11. Total No. of Tenders received for the work :

Dy. CAO (CWC)

EXECUTIVE ENGINEER (P&C)



**MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT**

TENDER No. CE/72/2016

**Name of Work : Supplying, Installing, Testing and Commissioning of Air
Monitoring Analyzers at Different Locations in Port Areas.**

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**MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT**

TENDER No. CE/72/2016

**Name of Work :- Supplying, Installing, Testing and Commissioning of Air
Monitoring Analyzers at Different Locations in Port Areas**

TECHNICAL BID (F I R S T C O V E R)

(TO BE SUBMITTED IN SEPARATE SEALED ENVELOPE / COVER)



MORMUGAO PORT TRUST
SERVING THE NATION SINCE 1885
ENGINEERING (CIVIL) DEPARTMENT
www.mptgoa.com

NOTICE INVITING TENDER

TENDER NOTICE NO.CE/N-72/2016

TENDER No. CE/72/2016

Name of Work : - Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas

Tenders in the prescribed form in sealed covers superscribing the Tender No. and due date and time are invited by the Chief Engineer for the above work as per the details given in the table below:

Cost of tender document	Estimated cost	Tender Sale From/To	Submission on	Opening on
EMD	Completion Time	Pre Bid Meeting		
Rs.10,000/- (Rupees Ten thousand only)	Rs. 1,31,50,000 /-	22.08.2016 To 20.09.2016 Upto 15.00 hrs.	21.09.2016 Upto 15.00 hrs.	21.09.2016 At 15.30 hrs. Technical Bid (Cover No.I)
Rs. 1,31,500 /- (Rupees One lakh Thirty One Thousand Five Hundred only)	Two (2) Months	30.08.2016 Upto 15.30 hrs.		

Detailed tender notice along with complete tender documents can be downloaded from our website www.mptgoa.com on or before the last date of sale of tender document. Tenders are also available for sale at the Civil Engineering Department of Mormugao Port Trust.

For further details and general enquiries, prospective bidders may contact the Executive Engineer (Planning), telephone no. 0832 2594611, mobile 09764006075, during working hours before the last date and time of sale of tender document.

[sd/-]
Chief Engineer



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work : - Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

PART – I (i) - UNDERTAKING BY THE TENDERER

To,
The Trustees of the PORT OF MORMUGAO,

I/We, M/s _____ have gone through the tender document carefully and hereby confirm as under:

The complete tender set i.e. First Cover and Second Cover in sealed cover separately and together in a separate cover is returned WITHOUT any defacement, addition, alternation or interpolation. All such addition or alteration has been indicated separately in our tender covering letter with all the relevant Annexures and Proformae duly filled in.

I/We have submitted our tender alongwith Earnest Money Deposit separately enclosed in the Envelop. I/We have not indicated anywhere in the first cover the amount of our price bid.

I/We have not made counter stipulation and conditions and same are enclosed in Technical Bid . Rate quoted by me/us in the schedule of quantities along with other submission will remain valid for the period of 180 days from the submission of the tender.

I/We hereby declare that, all information furnished by me/us with this tender is true to best of my/our knowledge, belief and in case, if it is found that, the information furnished is not true or partially true or incorrect, I/We agree that, my/our tender shall be summarily rejected without prejudice to the right of the Board of Trustees of PORT OF THE MORMUGAO to take further action into the matter.

Witness's :
Signature : _____
Name : _____
Designation : _____
Address : _____
Tel. No. : _____
Date : _____

Tenderer's :
Signature : _____
Name : _____
Designation : _____
Address : _____
Tel. No. : _____
Date : _____



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

PART I (ii) DETAIL NOTICE INVITING TENDER

TENDER NOTICE NO.CE/N-72/2016

TENDER No. CE/72/2016

Name of Work : - Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

- 1 SALE OF TENDER COMMENCES : **On all working days between 22/08/2016 to 20/09/2016 from 9.30 hrs. to 12.00 hrs. and 14.00 hrs. to 15.00 hrs.**
2. LAST DATE FOR SALE : **Upto 15.00 hrs. on 20/09/2016**
- 3 PRE BID CLARIFICATION : **30/08/2016 at 15.30hrs.**
MEETING
4. LAST DATE FOR SUBMISSION : **Upto 15:00 hrs. on 21/09/2016**
OF TENDER (DUE DATE)
5. OPENING DATE FOR FIRST : **At 15:30 hrs. on 21/09/2016**
COVER (Technical Bid)

Note: Any clarification on the bid document bidders may contact the Executive Engineer (Planning), telephone No. 0832 2594611, mobile 09764006075, during working hours before the last date and time of sale of tender document. Port's website [www. mptgoa.com](http://www.mptgoa.com).

MORMUGAO PORT TRUST

Civil Engineering Department,
Administrative Office Building
Headland – Sada. 403804,
Tel: 0832 252 1160

CHIEF ENGINEER
MORMUGAO PORT TRUST

Tender submitted by : _____

Tender submitted against

* Earnest Money Deposited with this tender

- Delete whichever is not applicable



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

1. INVITATION

1.1 Mormugao Port Trust (MPT) invites *sealed tenders in original under two cover bidding procedure and specifications of the machines described by the Central Pollution Control Board (CPCB) referred directly in this tender document and on Item rate basis for the work of " **Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas**".

* "Sealed" shall mean sealed with wax or closed with gum, to the satisfaction of authority opening the tender.

1.2. **Eligibility Criteria for tendering will be as follows:**

(A) Financial Criteria :

- i) The average annual financial turnover during the last three years ending 31st March 2015 of the tenderer should be at least **Rs.39.45lakhs.**

Note: The above information shall be submitted along with documentary proof i.e. Income Tax Returns, Audited Statement of Accounts duly certified by the Statutory Auditors of the firm. Copy of Appointment Order/ Resolution in respect of Statutory Auditors also to be submitted.

(B) Technical Criteria

- (ii) The firm shall have experience of successfully completing the "similar works" during last seven years ending 31st March, 2016, in either of the following:

(a) **Three similar works each costing not less than Rs.105.20lakhs.**

OR

(b) **Two similar works each costing not less than Rs.65.75lakhs.**

OR

(c) **One similar work costing not less than Rs.52.60lakhs.**

Note : (i) **“Similar Works” means the firm manufacture/assembles CAAQMS equipment or successfully implemented Commissioning work of CAAQMS as per Technical specifications of the station, shall confirm to Guidelines for Sampling and Measurement of notified Ambient Air Quality Parameters (NAAQS 2009), Volume – I for manual analysers and Volume – II for CAAQMS issued by CPCB, Ministry of Environment and Forest, Government of India.**

1.2.1 The Tenderer should have executed works in the Railways/ Public Sector Govt. Undertakings/ State Governments / Private Sector/ Port Authorities.

1.2.2 Mode of Selection of Contractor:

Tenderer shall have to satisfy minimum Financial and Technical eligibility Criteria mentioned in the tender at 1.2 above. Tenderers who satisfy criteria mentioned in 1.2 and 1.2.1 above will be qualified for opening of Cover No.2 (Price Bid). Lowest Price offer is the sole criteria for award of work among qualified tenderers. In Bill of Quantities, tenderer shall have to quote unit Price in words and figures as per details. In case of difference in value of unit rate in words and figures, the lowest rate will be considered.

1.2.3 The contractor shall submit the list of documents mentioned in Clause 4.4 of Part – II (i).

1.2.4 The tenderer shall furnish relevant information in respect of their firm etc. to ascertain their Financial Capabilities as mentioned at Clause 1.2 (A) (i) and Technical Capabilities in terms of Work/Purchase Order and Completion Certificate.

1.2.5 Offers received from the tenderer with counter stipulation and conditions will be summarily rejected and such offers will not be evaluated and considered at all.

1.2.6 Unregistered contractors can submit the tender provided, the firm fulfils minimum eligibility criteria specified in the tender. Successful tenderer shall have to register with the Department in due course of time.

1.3 Brief Scope of the work :

The proposed work comprises of:

- a) Supply, Installation, Testing and Commissioning of the Continuous Ambient Air Quality Monitoring Station (CAAQMS) for measurement of SO₂, NO_x, PM^{2.5} and PM¹⁰ station.
- b) Supply, Installation, Testing and Commissioning to the existing CAAQMS analyzers to measure of SO₂, NO_x.
- c) Supply & Installation of LED display board size (6x4 ft) for CAAQMS including supporting structure and establishing link between CAAQMS with display unit.
- d) Supplying & Installation of New Ambient Air Quality Analyzers at different locations manual type to monitor SO₂, NO_x, PM^{2.5} and PM¹⁰.
- e) Supply, Installation, Testing and commissioning of 5.5 KVA Offline Inverter with 4 hours backup and with 8 nos. of batteries, 12V, 180 AH for the new

CAAQMS.

- f) Supply, installation, testing & commissioning of Air Conditioners (split type), 3 star energy efficiency, 1.5 tonne.
- g) Supply & installation of FRP Porta cabin of size 3.0mx3.0mx2.4m (LxBxH) of 3.0 mm thickness outer side, 3.00 mm thickness inner side, 30 mm wall thickness both side finish including electrical accessories inside the Porta cabin.
- h) Providing power supply to the porta cabin from nearest source

The work is required to be carried out strictly as per the Guidelines for Sampling and Measurement of notified Ambient Air Quality Parameters (NAAQS 2009), Volume – I for manual analysers and Volume – II for CAAQMS issued by CPCB, Ministry of Environment and Forest, Government of India, and as described in Specifications and Schedule of Quantities and Rates contained in this tender document with approved quality of materials.

- 1.4 The estimated cost of the work is **Rs.1,31,50,000/-**.
- 1.5 The scope of services is extended till training of operating staff as regards to operation of the monitoring system Duration of training shall be maximum 03 days, total 5Nos. staff to be trained. It shall be ensured that the trained staffs are competent to operate, and replace the consumables required.

2. PROCEDURE FOR OBTAINING TENDER DOCUMENTS

- 2.1 The tender documents can be obtained in person from the Office of the Chief Engineer, Mormugao Port Trust, Administrative Office Building, Headland Sada, Mormugao, 403804. Telephone No.0832 2594628 during working hours from 9.30 hours to 12.00 hours & 14.00 hours to 15.00 hours on any working day upto the last day stipulated for the sale of tender documents, on submission of an application in writing on the firm's letterhead and on payment of the prescribed charges set out below:

a) for the complete set including drawings : **Rs 10,000/- per set**

The above charges are NON-REFUNDABLE.

- 2.2 The interested firms may alternatively download the tender documents from the Mormugao Port Trust web site www.mptgoa.com. The payment of Rs. 10,000 /- (Rupees Ten Thousand only) will have to be made in that case, in the form of Demand Draft drawn in favour of ' FA & CAO , MPT ' on any branch of a scheduled Bank within the Jurisdiction of State of Goa, along with Technical cover. **Volume I containing the General Conditions of Contract can also be downloaded from the Port's website. Volume – I shall also form the part of Cover No. I.**
- 2.3 The above prescribed charges should be paid in cash or by Demand Draft drawn in favour of "FA&CAO, M P T" on any branch of a Scheduled Bank within the jurisdiction of State of Goa.
- 2.4 Tender sets will not be sent by Post OR Courier Service.

2.5 The tender documents are NOT TRANSFERABLE.

3. **EARNEST MONEY TO BE DEPOSITED FOR THIS TENDER:**

The Earnest Money to be deposited in respect of this tender is Rs.1,31,500/- (Rupees One Lakh Thirty One Thousand Five Hundred only) shall be in the form of Demand draft of any Nationalised or Scheduled Bank within the jurisdiction of State of Goa payable at Vasco - Da - Gama.

4. **NUMBER OF COPIES OF TENDER TO BE SUBMITTED:**

The tenderer shall submit one copy (original) each of First cover and Second cover separately as indicated in Part II (i) of Instructions for Preparations and Submissions of Tenders.

5. **TIME FOR COMPLETION OF THE WORK:**

The total completion period for the work is **Two (2) months** including monsoon from the date of receipt of acceptance letter or from the date of release of site, whichever is later.

Time is essence of the contract. If the tenderer stipulates a completion period longer than the one stipulated above, the same is liable for rejection.

6. **MAINTENANCE PERIOD:**

The free maintenance period is 1 (one) year including cost of consumables except Taps for CAAQMS and filter paper & media for (SO₂, NO_x) for all the items covered under this contract from date of completion of the entire work as certified by the Chief Engineer / Engineer's representative.

7. **EXPENSES INCURRED BY THE TENDERER:**

Mormugao Port Trust will not reimburse any costs or expenses incurred by the tenderer in connection with the preparation or delivery of this tender, including costs and expenses related to visit the site.

8. **DEADLINE FOR RECEIPT AND OPENING OF TENDER:**

8.1. The tenders duly completed in accordance with the "Instructions for preparation and submission of tenders" contained in this tender document should be placed in the tender box kept outside the cabin of the Assistant executive Engineer (Accts), Engineering Civil Department, Mormugao Port Trust, upto due date as indicated in NIT.

The First Cover – Technical Cover will be opened at 15.30 hrs. on the due date in the presence of such of the tenderers who may wish to remain present.

8.2 The tenders whether sent by post or by hand delivery must reach this office on or before the due date and time. OFFERS RECEIVED LATE WILL NOT BE CONSIDERED EVEN THOUGH POSTED BEFORE THE DUE DATE AND TIME.

8.3 Offers sent by telex/telegram/fax will not be considered.

8.4 Unsigned tenders will not be considered.

9. **PROCEDURE FOR SUBMISSION OF TENDERS:**

The tenders are required to be submitted in accordance with procedure set out at Part II (i) of Instructions for Preparation and Submission of tenders.

10. Further to provision to this contract the other recoveries shall also include deduction of Income Tax at source, works contract tax, cess, etc. as may be applicable as per the prevailing rules and regulations. Service tax if applicable shall be paid extra.

11. Tax at source as applicable on the value of works contract in terms of Section 28 of Goa Value Added tax (Act) 2005. The present rate of such tax is 5% on the value of the work contract will be deducted from the bill(s) payable to the contractor. The contractor should indicate the registration number with all the applicable statutory authorities regarding service tax, VAT, Sale tax (LST & CST), Entry tax, Octroi, etc.

12. **VALIDITY OF THE TENDER:**

The tenders shall remain valid for a period of 180 days from the date of submission of Bid offer.

CHIEF ENGINEER
MORMUGAO PORT TRUST
MORMUGAO – GOA

Mormugao, Headland Sada.

Dated: _____



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

Part (I) iii - FORM OF TENDER

**The Chief Engineer,
Mormugao Port Trust,
MORMUGAO HEADLAND SADA (GOA).**

I/We _____ do hereby offer to execute the work comprised in the annexed Tender Notice '**Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas**' in strict accordance with the Instructions to Tenderers, General Conditions of Contract (GCC), Specifications, etc. at the rate entered in the attached Schedule of Quantities and Rates.

2. I/We undertake to complete the work included in the Schedule of Quantities and Rates within **Two months** from the date receipt of work order or date of release of site whichever is later. I/We also agree that this tender will remain open for acceptance until disposed off by the competent Authority. I/We have independently considered the question of the amount of loss or damage likely to result to the Trustees from the delay on my/our part in the performance of the contract and I/We agree that the Liquidated damages at the rate of 0.5% of the contract price per week or part thereof's delay in work subject to a maximum ceiling at 5% of the contract price represents a fair estimate of the loss likely to result from the delay.

3. I/We enclose herewith a sum of **Rs.1,31,500/- (Rupees One Lakh Thirty One Thousand Five Hundred only) towards Earnest Money Deposit** in the form of Demand draft as proof of my/our willingness to enter into the contract if my/our tender is accepted.

4. In the event of my/our tender being accepted, I/We agree to enter into a contract in the prescribed form with such alterations or additions thereto which may be necessary to give effect to the acceptance of this tender and such contract shall contain and give full effect to the specifications, Schedule of Quantities and Rates attached to this tender.

5. I/We also agree, if awarded the contract that the earnest money lodged with this tender will be retained by the Trustees towards part of the Security Deposit and to make further deposit by cheque/demand draft of a Bank Guarantee, within fourteen days or such extension of the period permitted by the Chief Engineer, in writing, after receipt of information that my/our tender has been accepted by the Port Trust.

6. I/We further agree, if awarded the contract, to lodge the Retention Money equivalent to 5% of the contract price of my/our tender by way of deductions from my/our bills at the rate of 10% of the gross value of work certified in each bill till the amount of 5% of the contract price is accumulated.

7. Should this tender be accepted, I/we hereby agree to abide by and fulfil all the terms and conditions of the said tender annexed hereto, so far as applicable or in default thereof to forfeit and pay the Board of Trustees and/or its assignees, the sum of money mentioned in the said conditions and to execute and agreement in the prescribed form with the Mormugao Port Trust within 30 days of the award of the contract, or in default thereof, to forfeit the Earnest Money deposited by me/us. Unless and until, a formal agreement is prepared and executed, this tender together with your written acceptance thereof shall constitute a binding contract between us.

8. I/we undertake, if our tender is accepted, to commence the work within 15 days of receipt of the Chief Engineer's orders to commence and to complete and deliver the whole of the work comprised in the contract within the time allowed for the work.

9. A sum of **Rs.1,31,500/-** has been deposited by me/us with the Financial Adviser and Chief Accounts Officer of Mormugao Port Trust as Earnest Money, the full value of which is to be absolutely forfeited to the Board of Trustees without prejudice to any other rights or remedies of the said Board, should I/we fail to commence the work specified in the above mentioned memorandum, otherwise the said sum of **Rs.1,31,500/-** shall be detained by the Port Trust as a part of the Security Deposit as aforesaid.

10. I/we agree to abide by this tender to be valid for the period of six months from the date fixed for receiving/opening the same and it shall remain binding upon me/us and may be accepted any time before the expiration of that period.

11. I/we further agree that if I/we withdraw the tender before the expiration of this period of six months, or fail to execute an agreement in the form aforesaid within 30 days from the date of award of contract, the Earnest Money deposited shall be forfeited to the Board.

12. I/we understand that the Board is not bound to accept the lowest or any tender you may receive and may reject the same (the lowest) or any other tender without assigning any reason therefore.

13. "I have read and understood the General conditions and specification of the work which are printed in Volume – I supplied to me by the Department which will form a part of tender and this shall remain binding on me".

14. I /we have enclosed herewith the following documents as required under instructions to tenderers:-

- a) Organisation Chart.
- b) List of clients with similar stations supplied and installed by me/us.
- c) Bar Chart.
- d) Installation requirement and procedures.

15. The name and address of our Banker is ** _____

16. My/our permanent Income Tax Accountant No. is _____.

Witness's	Tenderer's
Signature _____	Signature _____
Name _____	Name _____

Address _____	Address _____
_____	_____

Tel. No. _____	Tel	No.

Mobile No. _____ email address :- _____

Date _____	Date _____
------------	------------

N. B. : Strike out whichever is not applicable.

** Here the Name of the Bank should be stated.

NAME AND ADDRESS OF TENDERER:-

SIGNATURE OF TENDERER

Witness: - _____

Date: _____ Day of _____ 2016

Witness: - _____

Witness: - _____



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

APPENDIX- I

Name of work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

Part I (iv) APPENDIX TO THE TENDER NOTICE - I

The following Clauses shall be read in conjunction with respective Clauses of General Conditions of Contract (GCC)

Sr. No.	Particulars	Clause of G. C. C.	
1.	Amount of initial security and time	11(1)	Five percent of the contract price and 20 months.
2.	Period for commencement from the Chief Engineer's orders to commence.	38	7 days
3.	Period of Completion	40	3 (Three) months
4.	Amount of liquidated damages.	43	Calculated at 0.5% value of the contract per week of seven days, or part thereof subject to a ceiling of 5% value of the contract.
5.	Free maintenance period.	45(1)	One Year
6.	Percentage of retention from each running account bill	54(1)	10%.
7.	Limit of Retention Money	54(1)	5% value of the contract.
8.	Total initial Security Deposit and Retention Money.	11(1) 54(1)	10% value of the contract.
9.	Minimum amount of interim Certificate.	54(1)	Rs.5,00,000/-.
10.	Time within which payment to be made after contractor's submission of the bill based on the joint measurement.	54(1)	100 % within 15 working days
11.	Mobilisation Advance	N.A	N.A
12.	Interest rate on mobilization advance.	N.A	N.A

13.	Mode of recovery of Mobilisation Advance	N.A	N.A
14.	Variation in price of labour and materials.	70	N.A
15.	Arbitration Clause	66	N.A
16.	Minimum amount of third party Insurance.	Cl. No.13 to 15 of Special Instructions	5% of the tendered amount.
17.	Lease rent.	Cl. No.9 to 11 of Special Instructions	Refer Appendix III

Dated this ----- day of ----- 2016

Signature ----- in the capacity of _____

----- duly authorised to sign tender for and

on behalf of -----.

(IN BLOCK LETTERS)

ADDRESS : -----

Witness : _____

Occupation : _____



APPENDIX- II

**MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT**

TENDER No. CE/72/2016

Name of Work: Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

MATERIALS TO BE SUPPLIED BY THE DEPARTMENT FOR THE WORK

Sr. No.	Description of materials	Approx. qty. to be supplied	Unit	Rate in Figures/Words	Place of Delivery
1.	Water	--	Cubic Metre	Rs.44/m3 (Rupees Forty Four only)	Ref. Clause No.9.19 of Special Conditions – Vol.I
2.	Electric Power	----	KWH	Electric supply as per the relevant rate applicable and supply point will be indicated by the CME's Department.	Ref.Clause No.9.20 of Special Conditions – Vol.I
3.	Harbour Entry Permit (HEP)	--	--	As applicable	To be Collected from Traffic Department

SIGNATURE OF THE CONTRACTOR



APPENDIX- III

MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

ESTATE RENTAL CHARGES

Name of Work: Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

Sr. No.	Description	Rate		Remarks
		Rs.	Ps.	
1.	Licence fees on Port land for maintenance office buildings and other structures.	Rate will be charged as per scale of rates prevailing during period of contract.		Payment shall be made in advance to CDC Section, Finance Dept.

NOTE:- At suitable Location subject to availability to be decided by the Chief Engineer.

* Rate per 10 sq. m. or part thereof per calendar month or part thereof.

SIGNATURE OF THE TENDERER



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

PART II (i) - INSTRUCTIONS FOR PREPARATION AND SUBMISSION OF TENDER

1. EARNEST MONEY DEPOSIT (EMD) :

- 1.1 The Earnest Money shall be lodged by the tenderer on the understanding that in the event of the tenderer withdrawing his tender before the expiry of the tender validity period stipulated in the Tender Notice, the Earnest Money deposited by the tenderer shall be forfeited.
- 1.2 Earnest Money Deposit will be accepted only in the form of Demand Draft issued from any Nationalised or Scheduled Banks having office in the State of Goa. The same shall be drawn in favour of "FA&CAO/MPT" and payable at Vasco -de- Gama. EMD in cash or in the form of Bank Guarantee will not be accepted.
- 1.3 For Two cover bidding procedure i.e. one is Technical Bid and other is Financial Bid, the E.M.D. should be placed in a third cover. All the three covers shall be placed in fourth cover properly sealed. The inner envelopes should be separately marked "EMD", "Technical bid" and "Price Bid". The outer envelope should bear identifications such as (i) Tender No., (ii) Description of work, (iii) Bidders Name and Address and (iv) Time and Date of Bid opening.
- 1.4 Bids if not accompanied by the requisite Earnest Money Deposit (EMD) and in the manner described at 1.2 and 1.3 above is liable to be rejected at the discretion of the Port.
- 1.5 Tenderers exempted from depositing Earnest Money Deposit (EMD) by the Competent Authority shall attach with the tender, a copy of the letter exempting him/them from lodging the Earnest Money Deposit (EMD). This letter should be placed in a separate cover marked as E.M.D. as indicated at 1.3 above.
- 1.6 Proper receipt for having received the Earnest Money Deposit (EMD) shall be issued to the bidders after opening the bids.

1.7 **Refund of Earnest Money Deposit:**

Mormugao Port Trust will return, generally within 10 days of the opening of the price covers of the tenders; the Earnest Money Deposits lodged by all tenderers except for those whose offers are ranked as the first three lowest acceptable tenders. Such tenderers are requested to contact the Assistant Executive Engineer (Account), Engineering (Civil) Department in the Administrative Office for claiming.

1.8 E.M.D. of other tenderers, i.e. any two among the first three lowest tenderers will be refunded to them only after acceptance of work order by successful tenderer. E.M.D. of successful Contractor will be retained as part of Initial Security Deposit (I.S.D.)

1.9 The return of Earnest Money will be effected either by way of returning the Banker's cheque lodged by the tenderers or by issuing a cheque drawn on the State Bank of India. The Mormugao Port Trust will not be responsible for reimbursing to the tenderers the Banker's commission for en-cashing the cheque.

2. **INSPECTION OF SITE**

Tenderers are advised to inspect the site before tendering and fully acquaint themselves about the nature and scope of the works to be carried out and other factors relating to the performance of the contract as no claims or complaint/s will be entertained after award of the contract in this context.

3. **PROCEDURE FOR PREPARATION OF TENDERS BY TENDERERS:**

3.1 The tenderer shall complete the annexed Tender, Schedule of Quantities and Rates and insert all the information called for therein, sign and date them. Unsigned tenders will not be considered. The tenderer shall furnish with the tender a xerox copy of the Power of Attorney, or other acceptable authorisation of the person/s signing the tender, unless such copy is already registered with the Mormugao Port Trust.

3.2 Tenderers must return the complete tender set duly filled all the information, signed and stamped each page. The tender documents shall not be defaced or detached. Additions and alterations or interpolations shall not be made in the tender document.

3.3 The prices and amounts quoted by the tenderer shall allow for all costs including, labour, material, equipment, transport.

3.4 Unless otherwise stipulated in the Tender Notice, the tenderer shall submit his tender strictly based on the specifications.

4. **SUBMISSION OF TENDER:**

The tenderer is required to submit his tender in the manner described below.

4.1 Tenders invited under Two cover system:

4.1.1 The tender is required to be submitted in Two cover system and First cover shall contain:

- (a) **Tender document i.e. Part I to Part III including the required information of the tenderer in TECHNICAL BID (Cover No. I). Schedule of Quantities and Rates i.e. Part IV in PRICE BID (Cover No. II) is to be sealed separately in Second Cover.**
- (b) **The First sealed cover shall be superscribed with the Tender Number, Name of Work, Due Date and with the words “TECHNICAL BID (Cover No.1)–To Chief Engineer” and should bear in the bottom left corner, the Name of Tenderer.**
- (c) **Tenderer shall have to submit Audited Statement of Accounts for year ending 31.03.2016 and Copy of current Income Tax Return Acknowledgment.**
- (d) **Tenderer shall have to submit duly executed power of attorney in the name of Bidders authorised representatives to act on behalf of Bidder in case of Firms/ Partnership duly authenticated by a Notary Public.**
- (e) **Tenderer shall have to submit EPF Number issued by Provident Fund Department and ESI Number issued by Employees State Insurance Department.**
- (f) **Tenderer shall have to submit Permanent Account Number issued by Income Tax Department.**
- (g) **Tenderer shall submit the methodology of the installation of station along with requirements if any. Technical specifications of the station, shall confirm to Guidelines for Sampling and Measurement of notified Ambient Air Quality Parameters (NAAQS 2009), Volume – I for manual analysers and Volume – II for CAAQMS issued by CPCB, Ministry of Environment and Forest, Government of India.**
- (h) **Tenderer shall submit the Itemwise Make/Brand/Series of all Items to be proposed to use and for which rate is submitted in the Price Bid (Cover No.2).**
- (i) **Tenderer shall submit Itemwise the Make/Brand/Series and details of peripherals of hardware and softwares compatible with stations (machines) for which rate is submitted in the Price Bid (Cover No.2) if applicable.**
- (j) **The performance certificate from the firms who have installed the CAAQM Station.**

- 4.1.2 The Second sealed cover shall contain Preamble to Schedule of Quantities and Rates, Schedule of Quantities and Rates as described in Clause No.4.1.1(a) above as the case may be. The Second sealed cover shall be superscribed with the Tender Number, Name of the work, Due date and with the words "Price Bid – (Cover No.2)" and should bear in the bottom left corner, the Name of the Tenderer.
- 4.1.3 The Tenderer must ensure that his tendered amount or rates are not mentioned, either directly or indirectly in any of the papers enclosed in the First cover. If any such mention is made there, the tender is liable to be treated as invalid and will not be considered.

5.1 **Delivery of Tenders**

- 5.1.1 The tenders duly completed in accordance with the "Instructions for preparation and submission of tender" contained in this tender document should be placed in the Tender Box kept outside the cabin of the Assistant Executive Engineer (Account) , Civil Engineering Department, Administrative Office Building, Mormugao Port Trust, Headland Sada, Mormugao, 403804, Tel: 0832 2594628. upto 3.00 pm on due date as indicated in NIT and First cover Chief Engineer, Mormugao Port Trust offers will be opened at 3.30 p.m. on the same date in the presence of such of the tenderers who may wish to be present.
- 5.1.2. The tenders addressed to the Chief Engineer/MPT whether sent by post or by hand delivery must reach the office of the Assistant Engineer (Account) Civil Engineering Department, Mormugao Port Trust, Administrative Office Building ,Headland Sada , Mormugao ,403804, on or before the due date and time. **OFFERS RECEIVED LATE WILL NOT BE CONSIDERED EVEN THOUGH POSTED BEFORE THE DUE DATE AND TIME.**
- 5.1.3. Offers sent by Telex/Telegram/FAX will **not** be considered.
- 5.1.4 Unsigned tenders will not be considered.

6. **OPENING OF TENDERS:**

- 6.1 The tender will be opened at the time and date notified in the Tender Notice, in the presence of such of the tenderers who may wish to be present.
- 6.2 In the case of Two cover tenders, only the First cover marked to Chief Engineer, (MPT) will be opened at the time and date notified in the Tender Notice.
- 6.3 The Second cover i.e. "**Price Bid**" of non-qualified bidders will be retained unopened and no correspondence on this decision will be entertained. The Price covers of only those tenderers, who are found to be eligible, will be opened later. The date and the time of opening the Second cover will be notified to the concerned tenderers and the Second cover will be opened in the presence of such of those tenderers who may wish to be present.

7. **VALIDITY PERIOD OF TENDERS**

- The validity period of the tender shall be 180 days after the submission of the Bid Offer. Tenders with a shorter validity period shall be rejected.
8. Tenderers should not send revised or amended offer after the closing day and the time of tender.
9. The contractor shall take special care to protect and support at their own cost the underground service like electrical cables, telephone cables, water-mains, drainage pipelines and other services lines etc. coming in the way of works.
10. Further clarification, if any, can be obtained from the Executive Engineer, (P&C Section) Engineering Civil Department, Mormugao Port Trust or by contacting the officer designated in the Tender Notice.
11. The tenderers are not allowed to fill in the tender or seal the tender in the MPT premises.

CHIEF ENGINEER
MORMUGAO PORT TRUST

Mormugao, Headland Sada.

Dated: _____



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

FORM OF AGREEMENT

THIS AGREEMENT made this _____ day of _____ two thousand six BETWEEN the Board of Trustees of the Port of Mormugao, a body corporate under the Major Port Trusts Act. 1963 (herein under referred to as “the Board” which expression shall unless repugnant to the context or meaning thereof mean and include their successors and assigns) of the ONE PART of M/s. _____, having their registered office at _____ (hereinafter referred to as “the contractor”, which expression shall unless repugnant to the context or meaning thereof, mean and include their heirs, executors, administrators, representatives and assignees or successors in office) of the OTHER PART.

WHEREAS the Board is desirous of executing the work of “ _____ ” on the terms and conditions stipulated in the contractor’s tender dated _____ and read with the conditions contained in the tender documents attached to the above mentioned tender.

AND WHEREAS the contractor by their above mentioned tender has offered to execute, complete and maintain such work, which tender has been accepted by the Board and such tender with correspondence, specifications, schedule. Amendments and acceptance thereof will constitute abiding contract between the Board and the contractor.

AND WHEREAS the contractor has furnished to the Board, a Bank Guarantee No. _____ dated _____ for a sum of Rs. _____ (Rupees _____)

_____ only) as Initial Security for the due performance and observance by the contractor of the terms and conditions of this Agreement.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

01. In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the conditions of contract herein after referred to.

02. The following documents shall be deemed to form and be read and construed as part of this agreement.

(A) **COVER No. - I**

- a. Contents of Tender Document
- b. Undertaking by the Tenderer
- c. Tender Notice
- d. Clause of General Conditions of Contract.
- e. Appendix I
- f. Appendix II (Materials to be supplied by Department)
- g. Appendix III (Estate rental)
- h. Instructions for preparation and submission of tender.
- i. Additional special instructions.
- j. Scope of Work
- k. Form of Bank Guarantee for EMD and Security Deposit and Form of Agreement (Annexures I & II)
- l. A printed set containing Instructions to tenderers, General and special conditions of contract. (VOLUME –I)

(B) **COVER No. II**

- i) Preamble to Schedule of Quantities and Rates
- ii) Schedule of quantities and rates
- iii) Tender Form
- iv) Contractor's acceptance letter No. _____ dated _____.

- iv) Any other relevant correspondence exchanged upto the issue of work order which has not been specifically mentioned above.
 - v) All additional drawings, specifications and written Instructions when issued by or approved in writing by the Chief Engineer as per clause No.9 of the General Conditions.
03. The contractor hereby covenants with the Board to construct, complete and maintain the work in conformity in all respects with the provisions of the contract.
04. The Board hereby covenants to pay to the contractor the contract price in consideration of the construction, completion and maintenance of the work, at the times and in the manner prescribed by the contract.
05. IN WITNESS WHEREOF THE PARTIES HAVE placed their hand and seals, the day, month, year first above written

THE COMMON SEAL OF THE TRUSTEES OF

THE PORT OF MORMUGAO HAS HEREUNTO
AFFIXED AND THE CHAIRMAN THEREOF CHIEF ENGINEER
HAS HEREUNTO SET HIS HAND IN THE
PRESENCE OF

- 1.
- 2.

SIGNED AND SEALED BY THE CONTRACTOR
IN THE PRESENCE OF

- 1.
- 2.



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

FORM OF BANK GUARANTEE FOR SECURITY DEPOSIT

1. In consideration of the Board of Trustees of the Mormugao Port Trust (hereinafter called "The Board") having offered to accept the terms and conditions of the proposed agreement between _____ and _____ (hereinafter called "the said Contractor(s)" for the work _____(hereinafter called "the said agreement") having agreed to production of an irrevocable Bank guarantee for Rs. _____ (Rupees _____ only) as a security/guarantee from the Contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement.
2. We _____ (hereinafter referred to as the "Bank") hereby undertake to (indicate the name of the Bank) pay to the Board an amount not exceeding Rs. _____ (Rupees _____ only) on demand by the Board.
3. We _____ do hereby undertake to pay the amounts due and payable (indicate the name of the Bank) under this Guarantee without any demur, merely on a demand from the Board stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs. _____ (Rupees _____ only).
4. We, the said Bank, further undertake to pay to the Board any money so demanded notwithstanding any dispute or disputes raised by the

Contractor(s) in any suit or proceeding pending before any Court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder, and the Contractor(s) shall have no claim against us for making such payment.

5. We _____ further agrees that the Guarantee herein contained shall (indicate the name of the Bank) remain in full force and effect during the period that would be taken for the performance of the said agreement, and it shall continue to be enforceable till all the dues of the Board under or by virtue of the said agreement have been fully paid, and its claims satisfied or discharged, or till the Engineer-In-Charge, on behalf of the Board, certifies that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s), and accordingly discharges this Guarantee.

6. We _____ further agree with the Board that the Board (indicate the name of the bank) shall have the fullest liberty without our consent, and without effecting in any manner our obligations hereunder, to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Board against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement, and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Board or any indulgence by the Board to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

7. This guarantee will not be discharged due to the change in the Constitution of the Bank or the Contractor(s).

8. We _____ lastly undertake not to revoke this Guarantee except with (indicate the name of the Bank) the previous consent of the Board in writing.
9. This Guarantee shall be valid upto _____ unless extended on demand by the Board. Notwithstanding anything mentioned above, our liability against this Guarantee is restricted to Rs. _____ (Rupees _____ only), and unless a claim in writing is lodged with us within six months of the date of expiry or extended date of expiry of this Guarantee all our liabilities under this Guarantee shall stand discharged.

Dated the _____ day of _____ For _____

(indicate the name of the Bank)



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

PART – III (i). SCOPE OF WORK AND DRAWINGS

The proposed work comprises of:

1. Supply, Installation, Testing and Commissioning of the Continuous Ambient Air Quality Monitoring Station (CAAQMS) for measurement of SO₂, NO_x, PM^{2.5} and PM¹⁰ station.
2. Supply, Installation, Testing and Commissioning to the existing CAAQMS analyzers to measure of SO₂, NO_x.
3. Supply & Installation of LED display board size (6x4 ft) for CAAQMS including supporting structure and establishing link between CAAQMS with display unit.
4. Supplying & Installation of New Ambient Air Quality Analyzers at different locations manual type to monitor SO₂, NO_x, PM^{2.5} and PM¹⁰.
5. Supply, Installation, Testing and commissioning of 5.5 KVA Offline Inverter with 4 hours backup and with 8 nos. of batteries, 12V, 180 AH for the new CAAQMS.
6. Supply, installation, testing & commissioning of Air Conditioners (split type), 3 star energy efficiency, 1.5 tonne.
7. Supply & installation of FRP Porta cabin of size 3.0mx3.0mx2.4m (LxBxH) of 3.0 mm thickness outer side, 3.00 mm thickness inner side, 30 mm wall thickness both side finish including electrical accessories inside the Porta cabin.
8. Providing power supply to the porta cabin from nearest source

NOTE: Tenderer shall have to enclose in Technical Bid (Cover No.1) the following:

- a) **Methodology of the installation of station along with requirements if any.**
- b) **Technical specifications of the station, shall confirm to Guidelines for Sampling and Measurement of notified Ambient Air Quality Parameters (NAAQS 2009), Volume – I for manual analysers and Volume – II for CAAQMS issued by CPCB, Ministry of Environment and Forest, Government of India.**

- c) Tenderer shall submit the Itemwise Make/Brand/Series of all Items to be proposed to use and for which rate is submitted in the Price Bid (Cover No.2).**
- d) Tenderer shall submit Itemwise the Make/Brand/Series and details of peripherals of hardware and softwares compatible with stations (machines) for which rate is submitted in the Price Bid (Cover No.2) if applicable.**
- e) The performance certificate from the firms who have installed the CAAQM Station.**



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

Part III (ii) ADDITIONAL SPECIAL INSTRUCTIONS

1. Tenderers are required to sign with date the Schedule of Quantities and Rates and the form of tender and fill in all the particulars and details called for therein. Unsigned tenders, without the details called for are liable for rejection.
2. **Measurements**
The quantities provided for in the Schedule of Quantities and Rates are only approximate and are given to provide a common basis for tendering. The actual quantity may differ from those provided for in the Schedule in view of the special and complex nature of the work. Payments will be made according to the actual quantities of work ordered and carried out, jointly measured by the representative of Chief Engineer and the contractor.
3. **Rates and Prices to be inclusive.**
The rates entered in the Schedule of Quantities by the tenderer shall include the provision of all supporting special equipment, labour of required skill, supervision, materials, overheads and profits, watch and ward, insurance charges, during execution and every incidental and contingent costs and charges, whatsoever, including sales tax on works contract, Entry tax, Octroi, etc. if any, for compliance with conditions of contract and specification. Service tax if applicable shall be paid extra.
4. The tenderer shall inspect the site and fully study the work involved vis-à-vis the specifications etc. before tendering for the work.
5. Any damage to the property of Port should be made good or compensated by the contractor.
6. After completion of the days, work / contract period the contractor shall clean, clear the work site to the satisfaction of the Chief Engineer or his site representative.
7. Permission for working beyond the normal working hours of the Port or on Sundays and Public Holidays as stipulated under Clause No.43 of the General Conditions of Contract, volume – I of the tender document will be given to the contractor subject to his agreeing to bear the cost of overtime, if any, which may have to be paid to the Port's supervisory staff.

8. The contractor and his workers / agents shall be required to obtain from MPT and display a Photo Identity Card during entry, stay and exit from the Port security areas guarded by CISF personnel.
9. Subject to the availability, land for construction of temporary sheds/stores/labour hutments, etc. will be given to the contractor in Port areas at Headland. The contractor shall clear away all the temporary structures built within a period of fourteen days after completion of the work and leave the whole of the site clean to the satisfaction of the Chief Engineer. In case the contractor fails to vacate the Port area / premises allotted to him for site office / store within the stipulated period after the completion of the work, the Board shall have the right to debar such defaulting contractors for future contracts of the Board by blacklisting him and shall also be charged penal lease rental at the prescribed rates.
10. Lease rent shall be charged to the contractors for the area allotted for construction of their temporary sheds for site office/store/labour hutments required in the contract works. The licence fee shall be as per Port's scale of Rates vide item (i) and (ii) of Part-I (Appendix-III).
11. No temporary structures/sheds which are constructed to house the contractor's office/store/labour hutments shall be permitted to be retained during the period of maintenance.
12. Electrical power and water required for the work shall be supplied as per the availability at the Port's Scale of Rates vide Item No. I & II of Part - I (Appendix - II).
13. Contractor may submit the following information in order to refund the EMD'S, BG'S/SECURITY DEPOSITS/ RETENTION MONEY, payment of bill's etc.
 - a. NAME OF BANK
 - b. PLACE
 - c. ACCOUNT No.
 - d. TYPE OF A/C No.
 - e. MICR / RTGS / IFS No.
 - f. Permanent Account Number
14. Bidder has to enclose attested copy of the Service Tax Registration certificate along with the tender if applicable. Service Tax has to be claimed extra as applicable while submitting the bills.
15. The Additional Special Instructions given above shall prevail over those stipulated elsewhere in the tender documents forming part of the contract. The volume containing the Instructions of Tenderers, the General conditions, Special conditions and Specifications forms an integral part of the tender document and the same shall be submitted along with the Volume-I of the tender documents all duly signed by the tenderer.



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

Name of Work :- Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas.

PART III (iii) PROFORMA OF PRE CONTRACT INTEGRITY PACT

General

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on _____ day of the month of _____ 2016, between, on one hand, the Board of Trustees of Mormugao Port Trust acting through Shri. _____, (Designation of the Officer), Mormugao Port Trust (hereinafter called the 'EMPLOYER', which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part and M/s. _____ represented by Shri. _____, Chief Executive Officer (hereinafter called the "BIDDER" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the 'EMPLOYER' has invited bids for the project of “**Supplying, Installing, Testing and Commissioning of Air Monitoring Analyzers at Different Locations in Port Areas**” (hereinafter referred to as the “**Project**”) and the BIDDER is submitting his bid for the project and

WHEREAS the BIDDER is a Private Limited company/Public Limited company/Government undertaking/registered partnership firm/ constituted in accordance with the relevant law in the matter and the 'EMPLOYER' is Mormugao Port Trust.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the EMPLOYER to obtain the desired said stores/equipment/ services/works at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortion impact of corruption on public procurement, and

Enabling BIDDERS to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the 'EMPLOYER' will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

Commitments of the 'EMPLOYER'

1.1 The 'EMPLOYER' undertakes that no official of the 'EMPLOYER', connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organisation or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

1.2 The 'EMPLOYER' will, during the pre-contract stage, treat all BIDDERS alike and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERS.

1.3 All the officials of the 'EMPLOYER' will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2. In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the 'EMPLOYER' with full and verifiable facts and the same is prima facie found to be correct by the 'EMPLOYER' necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the 'EMPLOYER' and such a person shall be debarred from further dealings related-to the contract process. In such a case while an enquiry is being conducted by the 'EMPLOYER' the proceedings under the contract would not be stalled.

Commitments of BIDDERS

3. The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:-
 - 3.1 The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the 'EMPLOYER' connected directly or indirectly with the bidding process, or to any person, organisation or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.
 - 3.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the 'EMPLOYER' or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Government for showing or forbearing to show favour or disfavour to any person in relation to the contract or any other contract with the Government.
 - 3.3* BIDDERS shall disclose the name and address of agents and representatives

and Indian BIDDERS shall disclose their foreign principals or associates.

- 3.4* BIDDERS shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract.
- 3.5* The BIDDER further confirms and declares to the 'EMPLOYER' that the BIDDER has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the EMPLOYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.
- 3.6 The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the 'EMPLOYER' or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.
- 3.7 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 3.8 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 3.9 The BIDDER shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the 'EMPLOYER' as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

- 3.10 The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.
- 3.11 The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.
- 3.12 If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of the 'EMPLOYER' or alternatively, if any relative of an officer of the 'EMPLOYER' has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of tender.
The term 'relative' for this purpose would be as defined in Section 6 of the Companies Act 1956.
- 3.13 The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the 'EMPLOYER'.

4. Previous Transgression

- 4.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify bidder's exclusion from the tender process.
- 4.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5. Earnest Money (Security Deposit)

- 5.1 While submitting commercial bid, the BIDDER shall deposit an amount _____ (to be specified in Bid Document) as Earnest Money/Security Deposit, with the 'EMPLOYER' through any of the following instruments:
- (i) Bank Draft or a Pay Order in favour of _____
 - (ii) A confirmed guarantee by an Indian Nationalised Bank, promising

payment of the guaranteed sum to the 'EMPLOYER' on demand within 3 working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the 'EMPLOYER' shall be treated as conclusive proof of payment.

(iii) Any other mode or through any other instrument (to be specified in the Bid Document).

5.2 The Earnest Money/Security Deposit shall be valid up to a period of _____ months or the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the EMPLOYER, including warranty period, whichever is later.

5.3 In case of the successful BIDDER, a clause would also be incorporated in the Article pertaining to Performance Security in the Project Contract that the provisions of Sanctions for Violation shall be applicable for forfeiture of Performance Security in case of a decision by the EMPLOYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.4 In case of the successful BIDDER a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of Sanctions for violation shall be applicable for forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.5 No interest shall be payable by the 'EMPLOYER' to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

6. Sanctions for Violations

6.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the 'EMPLOYER' to take all or any one of the following actions, wherever required:-

(i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

(ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the 'EMPLOYER' and the 'EMPLOYER' shall not be required to assign any reason therefore.

(iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

(iv) To recover all sums already paid by the BUYER, and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

(v) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the EMPLOYER, along with interest.

(vi) To cancel all or any other Contracts with the BIDDER. The BIDDER shall, be liable to pay compensation for any loss or damage to the 'EMPLOYER' resulting from such cancellation/rescission and the 'EMPLOYER' shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

(vii) To debar the BIDDER from participating in future bidding processes of the Government of India for a minimum period of five years, which may be further

extended at the discretion of the 'EMPLOYER or take action as per the procedure mentioned in the “Guidelines on Banning of Business dealings.” Copy of the Guidelines on Banning of business dealings” is annexed and marked as Annexure.

(viii) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the EMPLOYER with the BIDDER, the same shall not be opened.

(ix) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.

(x) Forfeiture of Performance Guarantee in case of a decision by the 'EMPLOYER' to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.2 The 'EMPLOYER' will be entitled to take all or any of the actions mentioned at para 6.1(i) to (x) of this Pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the 'EMPLOYER' to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes of this Pact.

7. Failure Clause

7.1 The BIDDER undertakes that it has not performed/is not performing similar project at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found

at any stage that similar project was performed by the BIDDER to any other Ministry/Department of the Government of India or a PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the 'EMPLOYER', if the contract has already been concluded.

8. Independent Monitors

- 8.1 The 'EMPLOYER' has appointed the following Independent Monitors (hereinafter referred to as Monitors) for this Pact in consultation with the Central Vigilance Commission.
SHRI AJIT RAIZAD, Retd. IAS
- 8.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.
- 8.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.
- 8.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/bidding, including minutes of meetings.
- 8.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the EMPLOYER,
- 8.6 The BIDDER(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the EMPLOYER, including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

8.7 The EMPLOYER, will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

8.8 The Monitor will submit a written report to the designated Authority of EMPLOYER within 8 to 10 weeks from the date of reference or intimation to him by the EMPLOYER/ BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

9. Facilitation of Investigation

In case of any allegation of violation of any provisions of this pact or payment of commission, the EMPLOYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

10. Law and Place of Jurisdiction

This Pact is subject to Indian Law.' The place of performance and jurisdiction is the seat of the EMPLOYER

11. Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

12. Validity

12.1 The validity of this Integrity Pact shall be from date of its signing and extend up to 5 years or the complete execution of the contract to the satisfaction of both the EMPLOYER and the BIDDER, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity

Pact shall expire after six months from the date of the signing of the contract.

12.2 Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

12.3 If the BIDDER is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

13. The parties hereby sign this Integrity Pact at _____ on _____

EMPLOYER

BIDDER.

Name of the Officer.

CHIEF EXECUTIVE OFFICER

Designation

Deptt./MINISTRY/PSU

Witness

Witness

1. _____

1. _____

2. _____

2. _____,

* Provisions of these clauses would need to be amended/ deleted in line with the policy of the EMPLOYER in regard to involvement of Indian agents of foreign bidders.



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

**Name of Work :- Supplying, Installing, Testing and Commissioning of Air
Monitoring Analyzers at Different Locations in Port Areas.**

Part III (iv) TECHNICAL SPECIFICATIONS (For Reference Only)

Technical Specifications are from 'Guidelines for Sampling and Measurement of notified Ambient Air Quality Parameters (NAAQS 2009) – Volume – II.

Guidelines for Automatic Measurement of Particulate Matter (PM_{2.5} and PM₁₀) in ambient air (Beta Attenuation Method)

1.0 Purpose

The purpose of this protocol is to provide guidelines for monitoring of particulate matter (PM_{2.5} and PM₁₀) in ambient air.

2.0 Principle

The Dust monitor automatically measures and records airborne particulate concentration levels (in milligrams or micrograms per cubic meter) using the principle of beta ray attenuation. Each hour, a small C₁₄ (Carbon-14 or Krypton 85) element emits a constant source of high-energy electrons (known as beta rays) through a spot of clean filter tape. These beta rays are detected and counted by a sensitive scintillation detector to determine a zero reading. The Monitor automatically advances this spot of tape to the sample nozzle, where a vacuum pump then pulls a measured and controlled amount of dust-laden air through the filter tape, loading it with ambient dust (PM_{2.5} or PM₁₀, depending upon the sampling head). At the end of the hour, this dirty spot is placed back between the beta source and the detector thereby causing an attenuation of the beta ray signal which is used to determine the mass of the particulate matter on the filter tape and the volumetric concentration of particulate matter in ambient air.

3.0 Instrument/Equipment

3.1 Beta Ray Attenuation - for measurement of particulate matter (PM_{2.5} and PM₁₀) in air

The monitor consists of three basic components: the detector / logger, the pump and a sampling inlet (PM_{2.5} or PM₁₀). Each of these components is self – contained and may be easily disconnected for servicing or replacement. The Beta Ray Attenuation monitor shall meet the performance specifications as prescribed.

4.0 Calibration

4.1 Factory Calibration Method

The entire particulate matter monitor is tested to traceable standards and then operated in a chamber with dust laden atmosphere. The results of this testing provide data points that are used in the data regression and final calibration. The built in membrane calibrator is tested to assure conformity during test period.

4.2 Automatic Calibration Method

The monitor has a built in Mass Membrane Calibrator. The membrane is automatically moved into the beta Pathway to determine the 'mass' of the membrane each hour or when the filter tape advances. Each membrane has a factory verified mass and that value is stored in the monitor. When the hourly membrane calibration is made, the computed value is compared to the stored factory value to determine proper operation.

4.3 Zero testing

Zero testing of blank filter paper is performed at the beginning and end of each sample period to insure the stability of the measurement system. Zero testing is based on the ability of the monitor to hold a constant output when measuring blank filter paper. If the difference between the two values exceeds a preset limit a data error message is logged in the error log and the digital value is marked.

5.0 Operation of the Particulate Matter Monitor

5.1 Normal Operation Mode

Every cycle of the normal operation mode consists of three main parts, automatic calibration, sampling, counting and calculation. Logging of data collected occurs after each calculation.

5.2 Operation Cycle

The particulate matter monitor uses a sampling algorithm that optimizes the total time required to complete a cycle. The basic cycle always includes an automatic calibration that is performed during the sampling period, but at a different point on the filter, as the data is being sampled. The process is as follows:

- i) The initial measurement of clean filter tape (I_0) is performed at the beginning of the cycle for a period of four minutes.
- ii) The filter tape is advanced 50 mm approximately and the sampling (depends upon the sampling head $PM_{2.5}$ or PM_{10}) begins on the spot in which I_0 was just measured. Air is drawn through this spot on the filter tape for 50 minutes.
- iii) At the same time the second measurement (I_1) occurs (at a point on the tape 50 mm back) for a period of four minutes. The purpose for this measurement is to perform verification for instrument drift caused by varying external parameters such as temperature and relative humidity. A third measurement (I_2) occurs with the reference membrane extended over the same place on the tape. The sample time should be chosen greater than or equal to 5 minutes, so as allow for overlapping Auto calibration time. The purpose of this measurement is to verify that the instrument is operational.
- iv) The tape is moved back app. 50 mm to measure the beta ray absorption through the section that has collected dust (I_3). Finally the concentration calculation is performed to complete the cycle.
- v) A new measurement cycle then begins.

5.3 Sampling

During the sampling period incoming dust – laden air may be pumped through an optional external PM₁₀ (or PM_{2.5}) inlet head to remove particles greater than 10 (or 2.5) µm in diameter. The air then goes through the filter tape, where particles less than or equal to 10 (or 2.5) µm in diameter are deposited. First the filter tape is advanced 50 mm approximately from the counting station to the sampling nozzle. Next the nozzle is lowered to the tape surface and the vacuum pump is turned ON. At the end of the sampling period the pump is turned OFF, the nozzle is raised and the tape is moved backward the same distance of 50 mm approximately.

5.4 Counting and Calculation

The final part of the operation mode is the counting of the beta particles through the dusty section of tape and then the calculation and logging of the dust concentration. The tape is then advanced 12.5 mm approximately to begin the next cycle.

5.5 Logging

Data that is computed every sample period is logged in the local memory for the current day. Normal measurement mode starts immediately after the operation mode of the meter is set ON by the operator, cycling indefinitely until the mode is set OFF.

5.6 Software Description – Setup Mode

The monitor saves various setup parameters needed to perform the desired calculations. These includes date, time, Average reference membrane mass density (ABS), Background concentration (BKGD), Regression factor (K), Absorption coefficient (μ_{sw}), Pressure flow proportionality (C_v), Flow offset (Q_o) and the sample period t_s . Once stored these numbers do not need to be reloaded. ABS, BKGD, K, μ_{sw} , C_v and Q_o are constants established at the factory by extensive test and calibration.

5.7 Calculations

The software uses the constant and the input variables available with each monitor to calculate the output data. The output data is used for to calculate daily statistics. The monitor measures the beta ray attenuation at several times during the sampling cycle.

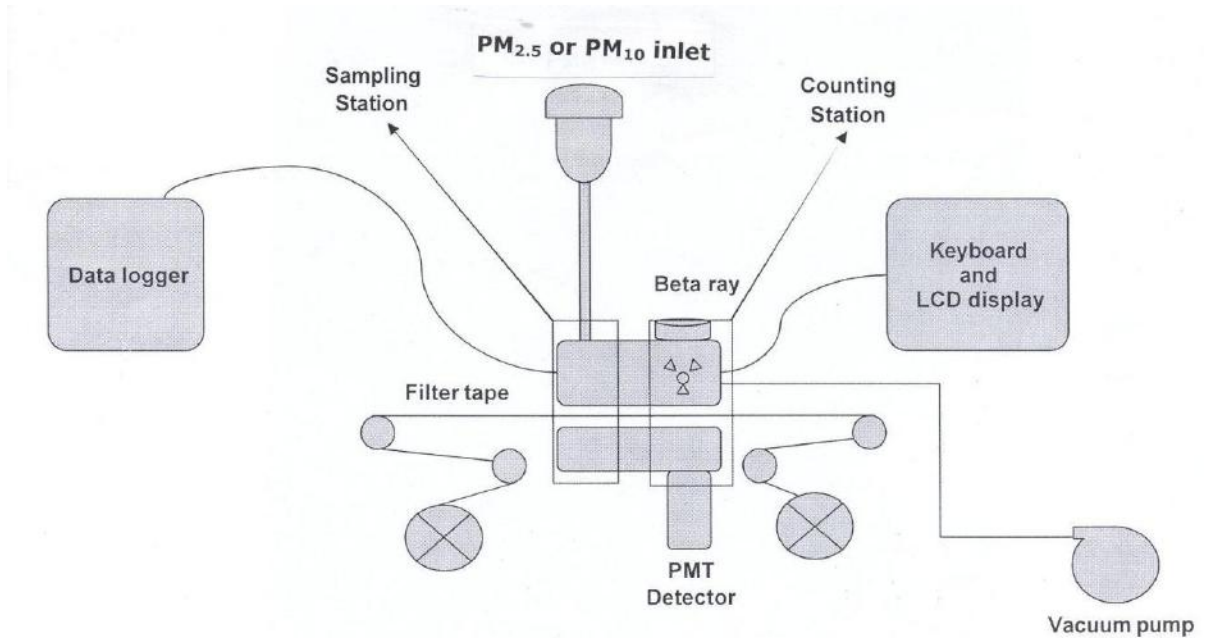
6.0 Record

The time to time calibration record of each particulate matter monitor with details like calibration data, calibration equation, monitor identification number, location, calibration foil used and their traceability used shall be maintained by the concerned laboratory staff.

7.0 References

1. Designated as an Automated Equivalent Methods: EQPM-0308-170 for PM_{2.5} and EQPM-0798-122 for PM₁₀ by USEPA

Schematic Flow Diagram of Particulate Matter (PM_{2.5} or PM₁₀) Monitor



TECHNICAL SPECIFICATIONS OF CONTINUOUS AMBIENT AIR QUALITY MONITORING STATIONS (CAAQMS) FOR REFERENCE ONLY.

1. The instrument shall be based on the principle Beta Ray Attenuation by particulate sampled through the instrument and collected on fibreglass tape. Before and after sampling beta ray attenuation, scintillation/GM counter majors the radiation. An internal microprocessor handles all sequences and automatically calculates the concentration of suspended particulate matter (SPM).
2. Principle is continuous measurements of PM¹⁰ and PM^{2.5} separately in ambient air.
3. Measuring range 0 to 10,000 micro gram per cubic metre.
4. Resolution is 1% of concentration.
5. Half life of source 5730 years.
6. Detector; Gieger Mueller Counter Tube.
7. Calculation Mode; Linear Regression.
8. Time constant, lowest 30 minutes maximum 24 hours.
9. Minimum detectable limit is 2 microgram per cubic metre.
10. Air flow rate shall be 1 cubic metre per hour, mass flow controlled. US-EPA requires non adjustable flow at 1 cubic metre per hour.
11. Filter material shall be glass fibre file with nominal porosity 0.3 micron.
12. Calibration; Internal calibration (TB/cal), plus separate calibrations standard supplied with instrument.

13. Filter tape/paper roll – length shall be 30 mtr/45 mtr.
14. Measuring result is 1 hour average or shorter.
15. Ambient conditions; temperature -20° centigrade to +50° centigrade, air humidity 10% to 95%. Air Pressure 450 to 1100 hPa.
16. Measuring outputs ; analog, linear, concentration range freely selectable to any range over the total range of the instrument.
17. Output voltage and current; 0 to 10 volts and 4 to 20 mA.
18. 2 serial interfaces (RS 232), one for data storage and another for instrument control, status signals and concentration.
19. Measurement and data storage, sample cycle value, 4 hour value, 8 hour value, 24 hour value, 72 hour value.
20. Storage with RAM expansion. Concentration (1/2 hour, daily, error events) for 1 year.
21. The analyser is 19" rack mounting type with facilities for fixing the analyser from front side.
22. The ON/OFF switch is on the front panel. The flow, concentration are displayed on LED/LCD display.

The above specifications are broad based for guidance only. Tenderer shall have to submit specifications pertaining to their CAAQMS in detail and stating Brand/Make Series etc.

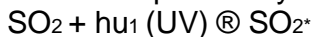
Guidelines for Automatic Measurement of Sulphur Dioxide in ambient air (UV fluorescence method)

1.0 Purpose

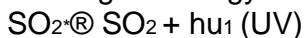
The purpose of this protocol is to provide guidelines for monitoring of Sulphur Dioxide (SO₂) in ambient air.

2.0 Principle

The UV fluorescence method is based on the fluorescence emission of light by SO₂ molecules previously excited by UV radiation. The first reaction step is:



Then in the second step, the excited SO₂* molecule returns to the original ground state, emitting an energy $h\nu_1$ according to the reaction:



The intensity of the fluorescent radiation is proportional to the number of SO₂ molecules in the detection volume and is therefore proportional to the concentration of SO₂.

Therefore: $F = k [\text{SO}_2]$

Where:

F = is the intensity of fluorescence radiation;

K = is the factor of proportionality;

[SO₂] = concentration of SO₂

The air sample flows into the inlet of the analyser where it is scrubbed to remove any interference by aromatic hydrocarbons that may be present. A hydrocarbon scrubber device usually accomplishes this. Then the air sample flows into a reaction chamber, where it is irradiated by UV radiation with a wavelength range of (200-220) nm. The UV fluorescence light, in the wavelength range of (240-420) nm, is optically filtered and then converted to an electrical signal by a UV detector, for example, a photomultiplier tube. The response of the analyser is proportional to the number of SO₂ molecules in the reaction chamber. Therefore, either temperature or pressure has to be kept constant, or if variation of these parameters is expected, the measured values Air Laboratory CPCB (May 2011) have to be corrected. For this UV fluorescence method to yield accurate concentration measurements, it must be calibrated against some primary standard (see clause 5.4).

3.0 Instrument/Equipment

3.1 UV fluorescence Analyser - for measurement of Sulphur Dioxide in air

The analyser should be complete with analyser section, sample pump, detector amplifier/control section, meter, and recording system. The UV fluorescence analyser shall meet the performance specifications as prescribed. The main components are described below.

3.2 Selective Traps for Interfering Agents

One or more selective traps should be used before the reaction chamber to remove interfering gases such as aromatic hydrocarbons. These selective traps shall not retain any SO₂ and shall be changed in accordance with manufacturer's instruction manual. If high concentrations of H₂S are expected in the ambient air, a selective scrubber should be used.

3.3 Optical Assembly and Fluorescence Cell

The UV lamp emission may be pulsed electronically or mechanically for synchronous detection and amplification of the signal. The lamp shall have a stabilised power supply to ensure a stable emission of light. An optical filter is used to restrict the wavelengths to a range, which allows excitation of the SO₂ molecule and yet minimise the interference of water vapour, aromatic hydrocarbons or nitric oxide.

The UV detector, for example, the photomultiplier tube, detects the fluorescence light emitted by the SO₂ molecules in the reaction chamber. A selective optical filter placed in front of the UV detector, reduces the signal due to scattering of the incident light. The reaction chamber shall be made of material inert to SO₂ and UV radiation. The cell should be heated above the dew point to avoid water condensation, and temperature fluctuations. The optical trap of the chamber prevents reflection of the exciting UV radiation. The optical assembly should be placed in a heated enclosure.

3.4 Pressure Regulator

The output signal of the analyser depends on the pressure in the reaction chamber and is therefore proportional to the density of SO₂ (number of SO₂ molecules) present in the reaction chamber. Variations of internal pressure shall be measured and the signal corrected or controlled by means of a regulator. The Air Laboratory CPCB (May 2011) signal may have to be corrected also for external pressure and temperature fluctuations. Significant pressure corrections are due to synoptic meteorological changes (up to + 3%) or by the attitude of the measurement site (about 10% decrease in pressure for an 800 m rise in attitude).

Note: One of the main causes of a reduced pressure in the reaction chamber is a pressure drop in the sample line.

3.5 Flow Rate Controller and Indicator

It is recommended that the flow rate be kept constant by means of a flow controller. A flow rate indicator should be included in the instrument.

3.6 Air Pump

A pump, which draws air through the analyser, is placed at the end of the sample flow path. If the use of UV lamp produces ozone, it is recommended to vent this ozone outside the room and far away from the sampling inlet, or a suitable charcoal filter may trap it.

4.0 SO₂ Calibration Gas Mixtures

4.1 Primary Calibration Method - Several equivalent methods for primary calibration can be used:

- static volumetric dilution
 - permeation tube sources
 - TCM – Tetra-chloromercurate method
 - gravimetric preparation of gas mixture in combination with various dilution systems
- Several methods for generating SO₂ calibration gas standard mixtures are proposed below. Whatever method is chosen, it is recommended that it be compared periodically against another independent traceable calibration method. The range of SO₂ calibration concentrations selected shall be in between 10% to 90% of the SO₂ concentration range in use.

4.2 Transfer Standard Calibration Method

Other methods to prepare calibration standard gases may also be used, if they are compared to one or more of the above mentioned methods. Even though any of the primary calibration methods may be used as transfer standards, in practice, it is easier to use a laboratory calibrated permeation source or cylinder of SO₂. Latter may be used either directly (with cylinders containing 0.1 mg/m³ to 10.0 mg/m³ (0.03 ppm to 5 ppm) of SO₂ in air), or with appropriate quantitative dilution (using cylinders containing ten to several hundred mg/m³ of SO₂ in air).

Note: Gas cylinders shall be made of an inert material or have been passivated to ensure stability of +/-3% for the period of use expected. Low concentration cylinder must be checked regularly against primary standards.

4.3 Operational (Field) Span Check

To aid in the quality control of the routine operation of the analyser on-site, span checks may be performed regularly (e.g. daily or weekly). For example, an internal permeation device may form an integral part of the apparatus, or an external calibrated cylinder, with appropriate dilution if necessary, may be used. The described span check system is suitable for quality control in routine operation to verify that the analyser is operating correctly, but may not be suitable for proper calibration as described in 5.1. The span check system should regularly be compared to a laboratory-based calibration system as described in 5.1.

4.4 Zero Gas

Zero air used in the calibration of the analyser should not contain a concentration of SO₂ detectable by the analyser under calibration. The concentration of O₂ in the zero air shall be within +/-2% of the normal composition of air (20.9%).

4.5 Span Gas (Calibration Gas)

The span gas must be capable of providing an accurate, stable and reliable concentration of measured gas.

4.6 Multipoint Calibration

Multipoint calibration consists of three or more test concentrations including zero concentration. A concentration between 80% and 90% of the full-scale range of the analyzer under calibration, and one or more intermediate concentrations spaced approximately equally over the scale range are required. Multipoint calibrations are used to establish or verify the linearity of analyzer on initial installation and after any major repair. If a non-linear analyzer is being calibrated, additional calibration points should be included to adequately define the calibration relationship, which should be a smooth curve. Multipoint calibrations are likely to be more accurate than two point's calibration because of the averaging effect of the multiple points. The analyzers have zero and span adjustment controls, which should be adjusted based on the zero and highest test concentration to provide the desired scale range within the analyzer's specifications. Zero and span controls adjustment often affect the zero/span value, so the adjustments may have to be repeated several times to obtain consistent values i.e. zero or span concentrations.

5.0 Physical Zero and Span adjustments

All ambient monitoring analyzer have provision for zero and span adjustments. These adjustments are used to obtain the desired nominal scale range, to provide convenient scale units, and to periodically adjust the analyzer response to correct for calibration drift. Zero and span adjustments must always be followed by a calibration. Allow sufficient time between the adjustments and the calibration for the analyzer to stabilize.

1.0 Quality Control

There should be a quality control plan, which allows for modification of the frequency and number of points required for calibration. Such a quality control program assures the accuracy and reliability of the air quality data collected. The calibration program must include information of dates of calibration, atmospheric conditions, control setting and other pertinent data.

The analyzer should be calibrated or re-calibrated:

- (a) on its initial installation;
- (b) following its relocation;
- (c) after every repair or service;
- (d) if an interruption in operation of more than a few days; and
- (e) on detection of malfunction or changing of the analyzer in calibration.

In routine operation calibration of analyzer should be checked periodically defining period (once a week) to maintain close agreement between the calibration values used to convert analyzer responses to concentration measurements and the actual response of the analyzer. The frequency of routine periodic calibration is a matter of judgment and is a trade-off among several considerations, including:

- (i) the inherent stability of the analyzer under the prevailing conditions of temperature, pressure, line voltage, etc. at the monitoring site;
- (ii) the quality of the ambient measurement needed;
- (iii) the risk of collecting invalid data because of a malfunction or invalid data or response problem with the analyzer that would not be discovered until the calibration is carried out.

When a new monitoring instrument is installed, zero and span calibration should be very frequent, may be daily. After obtaining enough data on the drift performance of the analyzer, the calibration frequency can be adjusted to provide a suitable compromise among the various considerations mentioned above. To facilitate the process of determining calibration frequency, it is strongly recommended that control charts should be used to monitor the zero and span drift performance of each analyzer. If the drift becomes excessive, then the corrective action has to be taken.

7.0 Precautions

- a) Operate the analyser in air- conditioned and dust proof room
- b) Follow standard safety practices for the handling and storage of calibration gas cylinders & the installation and use of the analyser.
- c) Do not expose calibration cylinders to direct sunlight or excessive heat.
- d) Maintain the same sample cell flow rate during sampling and calibration.
Use the same sample pump.

8.0 Sampling

When sampling the outside ambient from an enclosure, utilize a sampling line or probe extending at least 1 metre from the enclosure, and protected against the entry of precipitation. Place the analyser in an enclosure with atmospheric control so the temperature remains constant within $\pm 5^\circ\text{C}$. Record the temperature and pressure of the atmosphere sample.

9.0 Operation of the analyzer

Install the instrument in a suitable location. Follow the manufacturer's operating instructions to set the various parameters correctly, including UV source lamp intensity, sample flow rate, and (if applicable) the activation of the electronic temperature/pressure compensation. Check to ensure that the manufacturer's performance specifications are met or exceeded. If necessary, the location shall also be temperature controlled to minimise the effect of the temperature dependence of the instrument. Sample air through the instrument and record the SO_2 concentration by means of a suitable recording device (for example, chart recorder, electronic data acquisition system, etc.). During continuous operation of the instrument, checks of the instrument zero, span, and operational parameters shall be made at least one a week. In order to ensure optimum analyser performance, follow the maintenance schedule as detailed in the manufacturer's instruction manual. It is recommended that the analyser be fully either serviced every 6 month or annually as appropriate based on the performance of the

analyser. A full calibration of the instrument should be carried out before and after this service.

10.0 Calibration System and Equipment

10.1 Requirements – Prior to Calibration or Zero/Span Check

- a) The analyzer under calibration should be in operation for at least overnight so that it is fully warmed up and stabilized.
- b) Allow the analyzer to sample test atmosphere with known concentration of pollutants.
- c) During calibration, the analyzer should be operating in its normal sampling mode and it should sample the test atmosphere through all filters, scrubbers, conditioners, and other components used during normal ambient sampling and through as much of the ambient air inlet system as is practicable.
- d) Complete all operational adjustments of the analyzer.

10.2 Preparation of Primary Test Gases

10.3 Static Injection System

Static calibration mixtures are prepared by introducing a known volume of pure gas into a given volume of dilution gas. The use of static injection system greatly reduces the possibilities of error. The only disadvantage with this system is availability of a small quantity of air for analysis. The availability of air quality depends on the size of the container and the maximum permissible excessive pressure. Generally, glass bottles and flasks are used for static injection system. The exact determination of volume of the container is a basic prerequisite for static injection. The exact volume of glass bottle can be determined by filling the bottle with distilled water and then measure the volume of water by taking out from the bottle. The bottle volume is again determined by increasing the glass bottle pressure by 1.0 bar. The excess pressure allows the water to pass through a calibrated wet gas meter.

The volume of gas obtained from glass bottle should be corrected to normal conditions (25°C at 1013 hPa). A precision measuring manometer with a tolerance of 0.1% or an electronic pressure calibration standard may be used to ascertain the exact pressure of the container.

The glass bottle is evacuated and filled with dilution gas (zero gas) and a measured quantity of pure gas (100%) is injected by calibrated syringe (micro syringes) directly into the glass bottle through the septum. The gases (pure and dilution) are mixed inside the glass bottle by an externally controlled stirrer. This gas mixture is now used for calibration of analyzers.

10.5 Calculation

The concentration by volume of a pure gas can be calculated from the following equation:

$$\text{Calibration concentration} = \text{Concentration of pure gas} \times \frac{\text{Volume of Injection}}{\text{Volume of Dilution Gas}}$$

10.6 Permeation System

A permeation device is a gas source, which permanently emits a constant known quantity of a pure gas. It consists of a small container with a permeable wall, typically consisting entirely of PTFE (Teflon) or of stainless steel with a small PTFE wafer. The gases to be used (SO₂, NO₂, H₂S etc.) to generate standard gas mixture of variable concentration, is kept pure in liquid form. Since the compound is liquid, it will always have a constant vapour pressure, if temperature is constant.

Gravimetric method is used for calibrating the permeation tube at different flow rate. The pre-weighted permeation tube (SO₂, NO₂, H₂S etc.) are kept in permeation oven for constant temperature. After an interval of about 10 days, the tubes are taken out and

weighed. The permeation rate of tubes is calculated by dividing the weight loss by time period.

10.7 Calculation

$$\text{Permeation Rate (PR)} = \frac{\text{Difference in Weight (mg)}}{\text{Time Period (Min)}}$$

$$\text{Concentration (C)} = \frac{\text{Permeation Rate (mg / min)}}{\text{Dilution Gas Flow (m}_3\text{ / min)}}$$

$$\mathbf{C = mg / m}_3$$

10.8 Procedure for Calibration with Permeation Tube

- i) Take a new permeation tube and put it into permeation oven of a calibration unit for stabilisation at least for 48 hours.
- ii) After the stabilisation take the initial weight (w_1) of permeation tube in a balance, which can measure up to 5 decimal value and record date & time (t_1). Put back the tube again in permeation oven in same condition as earlier.
- iii) Take out the permeation tube from oven approximately after 10 days and weight it again (w_2) and note down the date & time (t_2) and put back the tube into permeation oven.
- iv) Calculations:

$$\text{Permeation Rate (PR)} = \frac{\text{Difference in Weight (}w_1 - w_2\text{) gms}}{\text{Difference in Time (}t_2 - t_1\text{) min}}$$

$$\text{SO}_2 \text{ Concentration} = \frac{\text{Permeation Rate (PR) (mg / min.)}}{S^* \times \text{Dilution Flow (m}_3\text{ / min)}}$$

S^* = SO₂ Concentration at 25 Degree Centigrade,
1.0 ppb = 2.618 mg / m₃

10.9 Example

Let us take the permeation tube of Sulphur dioxide for calibration:

Date = 20.05.09, Time = 11 a.m. (t_1)

Weight of permeation tube = 0.05250 gms. (w_1)

Date = 31.05.09, Time = 10.30 a.m. (t_2)

Weight of permeation tube = 0.04936 gms. (w_2)

Difference in weights ($w_1 - w_2$)

0.05250 – 0.04936 = 0.00314 gms

Time Difference ($t_2 - t_1$)

10 days, 23 hrs., 30 minutes = 15810 minutes

$$\text{Permeation Rate} = \frac{0.00314 \text{ gms.}}{15810 \text{ minutes}} = 0.199 \text{ mg / min.}$$

Sulphur Dioxide concentration at different flow rates:

$$\begin{aligned} 50 \text{ liters / hr.} &= \frac{0.199 \text{ mg / min.}}{0.833 \times 10^{-3} \text{ m}_3\text{ / min} \times 2.618 \text{ mg / m}_3} \\ &= 91.25 \text{ ppb} \end{aligned}$$

100 litres / hr. = 45.52 ppb

150 litres / hr. = 30.83 ppb

200 litres / hr. = 22.83 ppb

11.0 Calibration of the Ambient SO₂ Analyser

11.1 Principle - During this procedure, the ambient SO₂ analyser shall be operated at its normal flow rate and temperature. The calibration includes measurements of zero air, span gas and at least five SO₂ concentrations (using a primary calibration gas standard described in section 11.3 & 11.6) which shall be spaced to cover the ambient range. For all calibrations, flow of calibration gases to the manifold shall exceed, by at least 20%, the total flow required by the instrument attached to the manifold, with the excess appropriately vented at atmospheric pressure.

11.2 Calibration Procedure

11.3 Zero Calibration – Switch on the analyzer at ZERO mode and zero gas from internal source will be measured by the analyzer. After the reading has stabilized, check the display of the zero value. In case of derivation, adjust the zero value.

11.4 Span Calibration – After the ZERO calibration has been done, switch the analyzer at SPAN mode. SO₂ span gas (pre-determined concentration) from permeation tube, kept in permeation oven, would be measured by the analyzer. In case of any deviation in the displayed value and the span gas concentration adjust the reading of analyzer to the span value. Repeat ZERO and SPAN calibration for atleast three times or till stable and true values are indicated.

After ZERO and SPAN calibration, switch the analyzer at SAMPLE mode. Now, analyzer will measure SO₂ present in the ambient air.

11.5 Field Calibration Procedure with a Transfer Standard - A two-point calibration of the analyser with a transfer standard calibrated previously against a reference calibration system is acceptable in field conditions.

12.0 OPERATIONAL CHECKS

12.1 Zero and Span Settings

If the required zero and span corrections performed in accordance with calibration procedure are greater than 80% of the range, have the analyser serviced.

12.2 Sample Flow Rate

If the sample flow rate has changed by more than + 20% of the initial value, check the particulate filter for blockage, and the sample pump for proper operation. Check the filter monthly by measuring the flow rate with and without the filter in place. Replace the filter if the drop is more than 5%.

12.3 Temperature Control

Check the temperature of the shelter or room in which the analyser is located. If, it has changed by more than + 5°C, have the heating-cooling system serviced.

13.0 Record

The calibration record of analyzer with details like calibration data, calibration equation, analyzer identification, analyzer location, calibration standards used and their traceability, identity of calibration equipment used shall be maintained by the concerned laboratory staff.

14.0 References

1. ISO 10498.2. 1999 Ambient Air - Determination of Sulphur Dioxide - Ultraviolet Fluorescence method.
2. CPCB DOC: CB/CL/SOP/5.6/8, Issue No. 01, Issue date: 17.07.2003, Procedure for calibration of ambient air quality monitoring analyzers

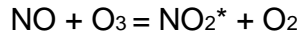
Guidelines for Automatic Measurement of Oxides of Nitrogen (NO – NO₂ - NO_x) and Ammonia (NH₃) in ambient air (Chemiluminescence Method)

1.0 Purpose

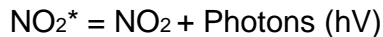
The purpose of this protocol is to provide guidelines for monitoring of oxides of nitrogen (NO – NO₂ – NO_x) and Ammonia (NH₃) in ambient air.

2.0 Principle

The measurement method is based upon the chemiluminescent reaction between Nitric oxide (NO) with Ozone (O₃) in a reaction chamber.



A portion of the resultant Nitrogen dioxide (NO₂) is produced in a highly excited energy state (NO₂^{*}) and subsequently decay to the ground level state emitting light in broad frequency band with a peak of 1200 nm.



The intensity of the light emitted is linearly proportion to the NO concentration and is measured by a photo-multiplier tube. The instrument is designed for the measurement of total Oxides of Nitrogen (NO_x), Nitric Oxide (NO) and indirect determination of Nitrogen Dioxide (NO₂) and Ammonia (NH₃). The NO₂ and NH₃ calculated by subtraction of NO from NO_x and NO_x from NO_y.



$$\text{NO}_2 = \text{NO}_x - \text{NO} \text{ -----(1)}$$



$$\text{NH}_3 = \text{NO}_y - \text{NO}_x \text{ -----(2)}$$

3.0 Instrument/Equipment

3.1 Chemiluminescence Analyser - for measurement of oxides of nitrogen and ammonia in air

The Chemiluminescence analyzer is a combination of NH₃ converter and an NO-NO₂-NO_x analyzer. Ammonia in the air sample is oxidized to nitric oxide (NO) with a converter. Sample air is drawn at a flow rate of 0.6 L/min from the converter into the NH₃ analyzer through a particulate filter, a glass capillary, and a solenoid valve. The solenoid valve routes the sample either directly into the reaction chamber (NO mode), through the molybdenum converter and the reaction chamber (NO_x mode), or through the ammonia converter and the reaction chamber (Nt mode).

3.2 Converters - For the accurate determination of nitrogen dioxide it is essential that the instrument converters have a high degree of efficiency (95 %+) for the conversion of NO₂ to NO. The converters employed in commercially available instruments are of two basic types.

Thermal Converters are made of a high grade stainless steel and operate at elevated temperatures, 600-800°C. At these temperatures the breakdown of NO₂ into NO and O₂ occurs readily. These converters, though adequate for the breakdown of NO₂ to NO, have the obvious disadvantage of converting ammonia into NO.

Chemical converters are to be found in the majority of Chemiluminescence instruments used for ambient monitoring. These converters have the advantage of a much lower operating temperature, 200-400°C, with efficient NO₂ conversion. Molybdenum and carbon converters have been in general use and are available in commercial instruments.

NH₃ – NO Converter consists of a ceramic cylinder bearing a heating resistor. This cylinder is surrounded by glass wool. It contains the quartz tube filled with quartz wool in

order to improve the efficiency of NH₃ to NO conversion. The temperature range of these tubes is in between 950 – 1000 °C.

3.3 Air Inlet Filter - A Teflon filter capable of removing all particulate matter greater than 5 mm in diameter.

3.4 Sample Lines – The sample lines and all parts of the instrument that come in contact with the sample stream should be made of glass, Teflon or stainless steel.

3.5 Vacuum Pump - A pump capable of a minimum vacuum of 78 kPa.

4.0 Calibration Standards

The nitric oxide (NO) in N₂ and NH₃ in air is used to calibrate the Analyser. These standard gases should be traceable to a National or International Standard. Selection of the NO and NH₃ standards concentration are dependent on the operating range of the analyzer to be calibrated and on the dilution capability of the calibration system. NO cylinders normally used are in the 25-59 + 2% ppm v/v range in N₂. The NO calibration cylinder must be free of any nitrogen dioxide, and should be re analysed on a regular basis, preferably every six months.

4.1 Zero Gas

The air supply must be free of contaminants that would cause a detectable analyzer response, or react independently with NO.

4.2 Span Gas (Calibration Gas)

The span gas must be capable of providing an accurate, stable and reliable concentration of measured gas.

4.3 Multipoint Calibration

Multipoint calibration consists of three or more test concentrations including zero concentration. A concentration between 80% and 90% of the full-scale range of the analyzer under calibration, and one or more intermediate concentrations spaced approximately equally over the scale range are required. Multipoint calibrations are used to establish or verify the linearity of analyzer on initial installation and after any major repair. If a non-linear analyzer is being calibrated, additional calibration points should be included to adequately define the calibration relationship, which should be a smooth curve. Multipoint calibrations are likely to be more accurate than two point's calibration because of the averaging effect of the multiple points.

The analyzers have zero and span adjustment controls, which should be adjusted based on the zero and highest test concentration to provide the desired scale range within the analyzer's specifications. Zero and span controls adjustment often affect the zero/span value, so the adjustments may have to be repeated several times to obtain consistent values i.e. zero or span concentrations.

5.0 Physical Zero and Span adjustments

All ambient monitoring analyzer have provision for zero and span adjustments. These adjustments are used to obtain the desired nominal scale range, to provide convenient scale units, and to periodically adjust the analyzer response to correct for calibration drift. Zero and span adjustments must always be followed by a calibration. Allow sufficient time between the adjustments and the calibration for the analyzer to stabilize.

6.0 Quality Control

There should be a quality control plan, which allows for modification of the frequency and number of points required for calibration. Such a quality control programme assures the accuracy and reliability of the air quality data collected. The calibration programme must include information of dates of calibration, atmospheric conditions, control setting and other pertinent data.

The analyzer should be calibrated or re-calibrated:

- a. on its initial installation;
- b. following its relocation;
- c. after every repair or service;
- d. if an interruption in operation of more than a few days; and
- e. on detection of malfunction or changing of the analyzer in calibration.

In routine operation calibration of analyzer should be checked periodically defining period (once a week) to maintain close agreement between the calibration values used to convert analyzer responses to concentration measurements and the actual response of the analyzer. The frequency of routine periodic calibration is a matter of judgment and is a trade-off among several considerations, including:

the inherent stability of the analyzer under the prevailing conditions of temperature, pressure, line voltage, etc. at the monitoring site;
the quality of the ambient measurement needed;
the risk of collecting invalid data because of a malfunction or invalid data or response problem with the analyzer that would not be discovered until the calibration is carried out.

When a new monitoring instrument is installed, zero and span calibration should be very frequent, may be daily. After obtaining enough data on the drift performance of the analyzer, the calibration frequency can be adjusted to provide a suitable compromise among the various considerations mentioned above. To facilitate the process of determining calibration frequency, it is strongly recommended that control charts should be used to monitor the zero and span drift performance of each analyzer. If the drift becomes excessive, then the corrective action has to be taken.

Precautions

- (a) Operate the analyser in air- conditioned and dust proof room
- (b) Follow standard safety practices for the handling and storage of calibration gas cylinders & the installation and use of the analyser.
- (c) Do not expose calibration cylinders to direct sunlight or excessive heat.
- (d) Maintain the same sample cell flow rate during sampling and calibration.
Use the same sample pump.

7.0 Sampling

When sampling the outside ambient from an enclosure, utilize a sampling line or probe extending at least 1 metre from the enclosure, and protected against the entry of precipitation. Place the analyser in an enclosure with atmospheric control so the temperature remains constant within $\pm 5^\circ\text{C}$. Record the temperature and pressure of the atmosphere sample.

8.0 Operation of the analyser

Press ON/OFF switch of the analyzer to ON;

Check that the sampling tube is connected with sampling glass manifold and the suction pump is in operation;

Let the analyzer warm up and stabilize for atleast 30 minutes or as specified in the manual;

Do not change the programme or configuration of the analyzer as they are preset;

and

After the warm up period, put the analyzer on SAMPLE mode by pressing the sample key.

9.1 Requirements – Prior to Calibration or Zero/Span Check

The analyzer under calibration should be in operation for at least overnight so that it is fully warmed up and stabilized.

Allow the analyzer to sample test atmosphere with known concentration of pollutants.

During calibration, the analyzer should be operating in its normal sampling mode and it should sample the test atmosphere through all filters, scrubbers, conditioners, and other components used during normal ambient sampling and through as much of the ambient air inlet system as is practicable. Complete all operational adjustments of the analyzer.

10.0 Calibration System and Equipment

In the procedure that follows, NH₃, NO and NO₂ calibrations are performed using a dynamic dilution system. Ammonia and Nitric oxide calibrations are performed by dynamic flow dilution of a NH₃ & NO standard with a clean air stream. Nitrogen dioxide calibrations are performed by the rapid gas phase reaction between NO and O₃ to provide a stoichiometric quantity of NO₂, equal to the decrease in the NO concentration. The reaction is the same as shown as Section 3.0, except that the NO remains in excess rather than the ozone as described in 3.0. This reaction is commonly referred to as Gas Phase Titration (GPT). An alternative NO₂ calibration is the generation of known test atmospheres by means of a NO₂ permeation device.

10.1 Calibration System- All components in the calibration system should be made of glass, Teflon or stainless steel. The system is designed to provide dynamic dilution for NO, NH₃ and GPT for NO₂. The dilution section comprises two independent flow controls that can be varied individually to provide a dilution ration of up to 1,000 to 1. The GPT section comprises a current-regulated ozone generator through which a portion of the dilution air flows even when the ozonator is not in operation. For dynamic dilution, the metered NO combines with this portion of the dilution air and passes through the reaction chamber. It then combines with the balance of the dilution air and passes through the sampling manifold. For GPT the flow path is the same except that a portion of the oxygen in the air passing through the ozone generator is converted to ozone.

10.2 Air Flow Controller - A device capable of maintaining constant clean-air flow up to 5 L/min within + 2% of the required flow rate.

10.3 Air Flowmeter - A calibrated flowmeter capable of measuring air flow rates within + 2%.

10.4 Nitric Oxide Flow Controller - A device capable of maintaining constant NO flow within + 2% of the required flow rate.

10.5 Nitric Oxide Flowmeter - A calibrated flowmeter capable of measuring NO flow rates within + 2%.

10.6 Two-Stage Regulator - The two-stage pressure regulator for the standard NO and NH₃ cylinders must be of stainless steel to prevent any reaction of the external gas.

10.7 Ozone Generator - The generator must be capable of generating stable levels of O₃ for the GPT of NO to provide NO₂ concentrations throughout the calibration range.

10.8 Reaction Chamber - The chamber used for the reaction of O₃ with excess NO should be of sufficient volume that the residence time is not less than 2minutes (11).

10.9 Mixing Chamber - A chamber used to allow thorough mixing of reaction products and dilution air.

11.0 Procedure of Calibration

Prior to start of calibration, for safety purposes, insure proper venting of the analyzer exhaust and the calibration system have excess flow. Insure that the analyzer and the calibration system have been on for a time sufficient to provide stable operation.

11.1 Flow Conditions - Insure that the air and gas flow systems are calibrated under the conditions of use against an authoritative standard. Different output calibration gas concentrations are obtained simply by changing the ratios of flow rates between the NO & NH₃ and dilution air channels. It is preferable to maintain a constant dilution air-flow and to vary the NO and NH₃ flow. The total flow required at the sampling manifold should equal the analyzer demand plus at least 50% excess. The following equations can be used to pre-calculate the specific gas dilution air-flow rates required for the desired calibration points, usually 20, 40, 60 and 80% of the instrument range.

$$S = \frac{STD \times FS}{FS + FD} \quad (1)$$

Where :

S = desired output concentrations of NO in ppm

STD = NO standard cylinder concentration in ppm

FS = NO standard cylinder flow rate

FD = dilution air flow rate in cm³/min.

Solving equation (1) for the NO or NH₃ standard flow rate (FS) that will produce the desired concentration for a given dilution flow rate (FD) gives:

$$FS = \frac{S \times FD}{STD - S} \quad (2)$$

11.2 Zero Calibration - Activate the zero air source and allow the analyzer to sample the zero air until a stable zero response is obtained. Adjust the analyzer NH₃, NO_x, NO and NO₂ zero controls as described in the instrument manual. It is good practice to recheck the zero at the end of the multipoint calibration, especially if large span adjustments were made.

11.3 Preparation for the NO and NO_x Calibration - Set the zero air and NO standard flow rates as determined in 12.1 for generating a NO concentration at 80% of the instrument range setting. Sample this NO concentration for a minimum of 15 minutes or until the NO and NO_x responses are stable.

11.4 NO and NO_x Span Adjustment - Adjust as necessary the analyzer NO and NO_x span controls to obtain recorder responses equal to the NO (NO_x in this case as well) concentration generated.

11.5 Preparation for the NO₂ Calibration - Set the dilution air and NO standard flow rates as determined in 12.1 for generating a NO concentration of about 80% of the instrument range setting. Sample this NO concentration for a minimum of 15 minutes or until the NO, NO_x and NO₂ recorder responses are stable. Record the readings.

Note: The NO₂ calibration is conveniently performed by re-establishing the 80% of scale NO-NO_x calibration point, using the same dilution air and NO standard flow rates used in 12.3.

11.6 Gas Phase Titration - Activate the ozone generator and adjust the ozone output so as to decrease the NO concentration by approximately 80%. The decrease must not exceed 90% of the NO concentration being sampled prior to the GPT. Sample this NO-NO₂ mixture for a minimum of 15 minutes or until the NO, NO_x and NO₂ recorder responses are stable. Record the readings. Calculate the indicated NO₂ concentration as per Section 11.1.

11.7 Nitrogen Dioxide Span Adjustment - Adjust as necessary the analyzer NO₂ span control to obtain a recorder response equal to the calculated NO₂ concentration. Generate at least two additional calibration points evenly spaced across the remainder of the instrument operating scale by decreasing the O₃ output while maintaining the dilute air and NO standard flow rates constant. For each calibration point generated, calculate the NO₂ concentration, and insure that the NO₂ recorder responses are correct.

11.7 Determination of Converter Efficiency of NO₂ - Calculate the analyzer converter efficiency as per Section 13.2 for the NO₂ concentration generated in Section 12.6. The converter efficiency must be 95% or greater to be acceptable

11.8 Preparation for the NH₃ Calibration - Set the zero air and NH₃ standard flow rates as determined in 12.1 for generating a NH₃ concentration at 80% of the instrument range setting. Sample this NH₃ concentration for a minimum of 15 minutes or until the NH₃ response is stable. Adjust as necessary the analyzer NH₃ span control to obtain recorder responses equal to the NH₃ concentration generated.

11.9 Determination of Converter Efficiency of NH₃ – It is necessary to check the efficiency of the NH₃ converter every 6 months at least. In this case it is necessary to inject NH₃ gas and to check the read value with the known (span) concentration.

12.0 Calculations

12.1 Calculation of NO₂ concentration

$$NO_x = NO + NO_2$$

$$NO_2 = NO_x - NO \text{ ----- (1)}$$

$$NO_Y = NO + NO_2 + NH_3$$

$$NH_3 = NO_Y - NO_x \text{ ----- (2)}$$

12.2 Calculation of NO₂ Converter Efficiency (CE)

$$\text{Converter Efficiency} = \frac{[NO_x]}{[NO_x]_{GPT}} \times 100$$

12.3 Calculation of NH₃ Converter Efficiency (CE)

$$\text{Converter Efficiency} = \frac{[\text{NH}_3] \text{ measured}}{[\text{NH}_3] \text{ target}} \times 100$$

13.0 Calibration with Permeation System

A permeation device is a gas source, which permanently emits a constant known quantity of a pure gas. It consists of a small container with a permeable wall, typically consisting entirely of PTFE (Teflon) or of stainless steel with a small PTFE wafer. The gases to be used (SO₂, NO₂, NH₃, H₂S etc.) to generate standard gas mixture of variable concentration, is kept pure in liquid form. Since the compound is liquid, it will always have a constant vapour pressure, if temperature is constant. Gravimetric method is used for calibrating the permeation tube at different flow rate. The pre-weighted permeation tube (SO₂, NO₂, H₂S etc.) are kept in permeation oven for constant temperature. After an interval of about 10 days, the tubes are taken out and weighed. The permeation rate of tubes is calculated by dividing the weight loss by time period.

13.1 Calculation

$$\text{Permeation Rate (PR)} = \frac{\text{Difference in Weight (mg)}}{\text{Time Period (Min)}}$$

$$\text{Concentration (C)} = \frac{\text{Permeation Rate (mg / min)}}{\text{Dilution Gas Flow (m}_3\text{ / min)}}$$

$$C = \text{mg} / \text{m}_3$$

13.2 Procedure for Calibration with Permeation Tube

Take a new permeation tube and put it into permeation oven of a calibration unit for stabilisation at least for 48 hours. After the stabilisation take the initial weight (w₁) of permeation tube in a balance, which can measure up to 5 decimal value and record date & time (t₁). Put back the tube again in permeation oven in same condition as earlier. Take out the permeation tube from oven approximately after 10 days and weight it again (w₂) and note down the date & time (t₂) and put back the tube into permeation oven.

Calculations:

$$\text{Permeation Rate (PR)} = \frac{\text{Difference in Weight (w}_1 - \text{w}_2) \text{ g}}{\text{Difference in Time (t}_2 - \text{t}_1) \text{ min}}$$

$$\text{NO}_2 \text{ Concentration} = \frac{\text{Permeation Rate (PR) (mg / min.)}}{N^* \times \text{Dilution Flow (m}_3\text{ / min)}}$$

N* = NO₂ Concentration at 25°C,

1.0 ppb = 1.88 mg / m₃

or NH₃ Concentration at 25°C,

1.0 ppb = 0.758 µg / m₃

13.3 Example

Let us take the permeation tube of Nitrogen Dioxide for calibration:

Date = 20.05.09, Time = 11 a.m. (t₁)

Weight of permeation tube = 0.05250 gms. (w₁)

Date = 31.05.09, Time = 10.30 a.m. (t₂)

Weight of permeation tube = 0.04936 gms. (w₂)

Difference in weights ($w_1 - w_2$)
 $0.05250 - 0.4936 = 0.00314 \text{ g}$
Time Difference ($t_2 - t_1$)
10 days, 23 hrs. 30 minutes = 15810 minutes

Permeation Rate = $\frac{0.00314 \text{ g}}{15810 \text{ minutes}} = 0.199 \text{ mg / min.}$

Nitrogen Dioxide concentration at different flow rates:

50 liters / hr. = $\frac{0.199 \text{ mg / min.}}{0.833 \times 10^{-3} \text{ m}^3 / \text{min} \times 1.88 \text{ mg / m}^3}$
= 127 ppb
100 litres / hr. = 63.5 ppb
150 litres / hr. = 42.3 ppb
200 litres / hr. = 31.6 ppb

Ammonia concentration at different flow rates:

50 liters / hr. = $\frac{0.199 \text{ mg / min.}}{0.833 \times 10^{-3} \text{ m}^3 / \text{min} \times 0.758 \text{ mg / m}^3}$
= 315 ppb
100 litres / hr. = 157.5 ppb
150 litres / hr. = 105 ppb
200 litres / hr. = 78 ppb

14.0 OPERATIONAL CHECKS

14.1 Zero and Span Settings

If the required zero and span corrections performed in accordance with calibration procedure are greater than 80% of the range, have the analyser serviced.

14.2 Sample Flow Rate

If the sample flow rate has changed by more than + 20% of the initial value, check the particulate filter for blockage, and the sample pump for proper operation. Check the filter monthly by measuring the flow rate with and without the filter in place. Replace the filter if the drop is more than 5%.

14.3 Temperature Control

Check the temperature of the shelter or room in which the analyser is located. If, it has changed by more than + 5o C, have the heating-cooling system serviced.

15.0 Record

The calibration record of each analyzer with details like calibration data, calibration equation, analyzer identification, analyzer location, calibration standards used and their traceability, identity of calibration equipment used shall be maintained by the concerned laboratory staff.

16.0 References

1. ISC Method No. 416, 3rd Edition, 1989
2. USEPA Environmental Technology Verification (ETV) Programme
3. CPCB DOC: CB/CL/SOP/5.6/8, Issue No. 01, Issue date: 17.07.2003, Procedure for calibration of ambient air quality monitoring analyzers

PART – III (v). CHECK LIST FOR SUBMISSION OF TENDER



Sr. No.	Particulars	Yes	No
1	Have you purchased / downloaded the tender document from internet for submission by your firm?		
2	Have you submitted cost of tender document in the form of DD or cash receipt, in case you have downloaded from internet?		
3	Have you submitted the tender in the Mormugao Port Trust's Form?		
4	Have you furnished full postal address, telephone number/Fax number, email?		
5	Have you kept your offer valid for 180 days as specified?		
6	Have you attended Pre-Bid meeting?		
7	Have you downloaded Pre-bid clarifications from Port web site?		
8	Have you submitted Demand Draft pertaining to Earnest Money? i. DD No. _____ dated drawn on bank _____ payable at _____ amounting to Rs.1,31,500/-		
9	Have you submitted documents pertaining to status/ contribution of the firm, partnership deed and power of attorney?		
10	Have you submitted Audited Statement of Accounts for year ending 31.03.2013, 31.03.2014, 31.03.2015?		
11	Have you submitted Copy of Income Tax Return Acknowledgment for year ending 31.03.2013, 31.03.2014, 31.03.2015?		
12	Have you submitted Work/Purchase Order and Completion Certificate in support of Technical Eligibility Criteria?		
13	Have you submitted Bar Chart/CPM chart?		
14	Have you submitted signed copy of Integrity Pact and enclosed in Technical Bid (Cover No.1)?		
15	Have you submitted EPF Number issued by Provident Fund Department?		
16	Have you submitted ESI Number issued by Employees State Insurance Department?		
17	Have you submitted Permanent Account Number issued by Income Tax Department?		
18	Have you submitted the methodology of the installation of Air Monitoring station along with requirements, if any?		
19	Have you submitted Itemwise Make/Brand/Series of all Items to be proposed to use and for which rate is submitted in the Price Bid (Cover No.2).		

Sr. No.	Particulars	Yes	No
20	Have you submitted Itemwise the Make/Brand/Series and details of peripherals of hardware and softwares compatible with stations (machines) for which rate is submitted in the Price Bid (Cover No.2) if applicable.		
21	Have you submitted Performance Certificate from the firms who have installed the CAAQM Station.		
22	Have you Signed and seal on every page of tender document submitted?		
23	Have you attested all the corrections?		
24	Have you signed and filled details in Vendor Registration Form		
25	Have you submitted Price Bid in separate Cover?		

NOTE:

The above Checklist is not exhaustive. The tenderer must go through carefully the entire Booklet and submit the tender compliance of all the conditions/ provisions instructions mentioned therein irrespective of the fact that they have been highlighted in the Check list or not.

Signature _____

Name of the Tenderer

Seal:

Date:



MORMUGAO PORT TRUST
ENGINEERING (CIVIL) DEPARTMENT

TENDER No. CE/72/2016

**Name of Work :- Supplying, Installing, Testing and Commissioning of Air
Monitoring Analyzers at Different Locations in Port Areas.**

VENDOR REGISTRATION FORM

1. Name of the Organization : _____
2. Address (In Detail) : _____

3. Telephone Number : _____
4. E-Mail Id : _____
5. Permanent Account Number (PAN) : _____
6. Bank Name : _____
7. Bank Branch Address (In Detail) : _____

8. Bank Branch Code : _____
9. Bank Account Number : _____
10. Bank Account Type : _____

-
11. Magnetic Ink Character Recognizer (MICR) : _____
 12. Tax Identification Number (TIN) : _____
 13. Service Tax Registration Number : _____
 14. Service Tax Registration Code : _____
 15. CST Registration Number : _____
 16. Employee Provident Fund (EPF) Registration Number : _____
 17. Employee State Insurance Scheme (ESIS) Registration Number : _____
 18. IFSC Code : _____