C-12013/24/2014-Tech/Sr. No.3

EXPRESSION OF INTEREST FOR PROJECT

"Development of Software for Real Time Air Quality Monitoring Program (RT-AQMP) in India"

Firms interested to take up the project should go through the entire document and should provide their comments on project plan, methodology, schedule, technology, specifications etc. These firms should submit EOI to the Member Secretary on or before 13/07/2015 5:00 PM at Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi -32. No copy of firm's document is to be submitted along-with EOI. The firm is expected to submit suggestions for successful implementation of project in a time frame.Date of opening EOI offers is 15-07-2015 at 11:00 am at CPCB,Delhi (Contact : Shri A.Sudhakar, I/C IT Div. 8800326699, asudhakar.cpcb @nic.in, Shri Aditya Sharma, Sc. 'C', 9911328120, aditya.cpcb@nic.in)

ELIGIBILITY CRITERIA

The software consultants/firms/consortium of firm should fulfill the following criteria:

a. Must be in existence from last three years with software development activity. Firm must be registered.

b. Firm should have a valid ISO certification for software development/IT enabled services/ data management of process industries. The firms having SEI-CMM level 3 and above certificate shall be preferred.

c. Firm should have at least 25 (twenty five) software professionals engaged in various software development activities.

d. Firm should have turnover of at-least Two Crores (cumulative) during last three financial years (2012-13 & 2013-14 & 2014-15) from software development activity only.

e. The firm should also have executed:

   1) **at least one project** of similar nature in last three years worth **Rs. 50/- (Fifty Lakhs)** OR
   2) at least **two projects of Rs. 30 Lakhs** (Thirty Lakhs) **each** of similar nature in last three years OR
   3) at least **three projects of Rs. 20 Lakhs (Twenty Lakhs) each** of similar nature in last three years

f. Fields in which firms should have worked are

   i.1 Have developed operational software implementing communication protocols like http, ftp etc. and thereby making real time data available from different locations and its web display using maps with statistical analytics

   Or

i.2 Having developed software for data communication without human intervention with web display using maps with statistical analytics

Or

i.3 Have developed ERP kind of software through which maintained activities of another institution with web portal display & statistical analytics

Or

i.4 Have integrated GPRS/GSM tracking systems to manage data availability at a specific location and displayed it through web display using maps with statistical analytics

Or

i.5 Have developed software systems using SCADA by integrating measuring parameters desired and data transmitted to a central location for web display using maps with mathematical analytics.

Note: The system should have been developed using standard practices of software engineering: Feasibility study, Software Requirement Study, System analysis, System Design, Prototype product development, Testing, Implementation, Maintenance, Review.

4) The firm must have its office in Delhi or NCR region.

In case of Consortium

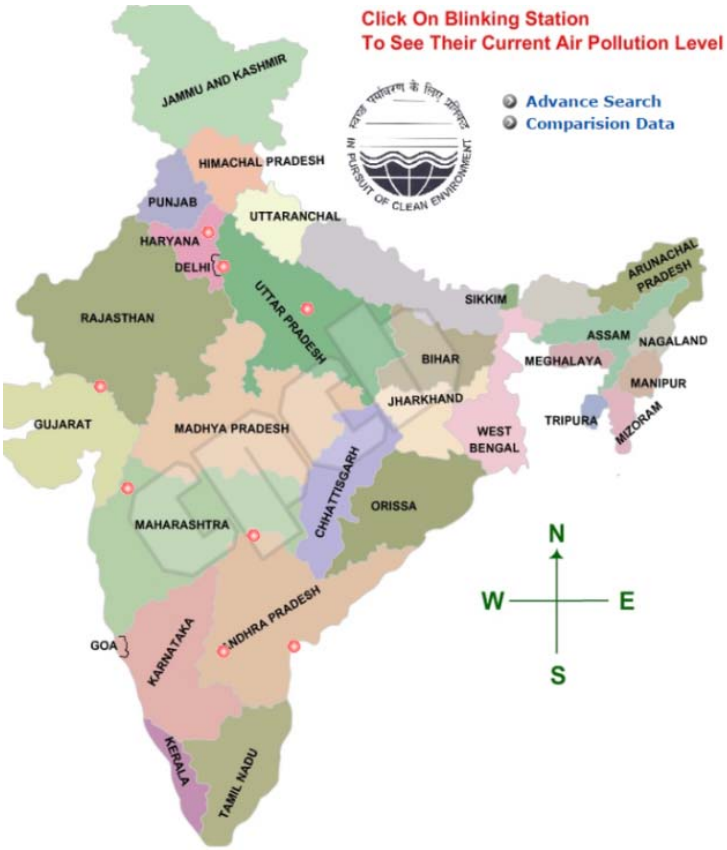
A consortium of firms not more than two, having agreement in between them clearly defining their liabilities may be considered for eligibility to carryout the project work. These firms may be from specific background of Instrumentation and software development.

The eligibility conditions in such case will be assessed for software firm all purposes, wherein the lead partner (either in the firms) will be solely responsible for the entire project work.

DERAILED PROJECT REPORT (DPR)

on

Development of Software for Real Time Air Quality Monitoring Program (RT-AQMP) in India



Central Pollution Control Board
(Ministry of Environment, Forest and Climate Change)
Delhi

April 27, 2015

INDEX

1. INTRODUCTION

With the exponential increase in anthropogenic activities, a large number of pollutants are being discharged into environment in the form of Air Pollution or Water Pollution. It is necessary to have cost effective and accurate pollution monitoring systems with a mechanism for real time data acquisition, handling and dissemination of environmental parameters for successful pollution mitigation measures as well as safe guarding the public health. The data can also be used to meet various objectives of deriving Indices like Air Quality Index (AQI) or Decision Supporting Systems (DSS) for planning.

CPCB has started National Air Quality Monitoring Programme (NAMP) in 1980s to assess the present status of air pollution, to determine the effectiveness of pollution control programmes and to analyse air quality trends. Information collected by CPCB is sometimes unreliable due to involvement of many organisations having varied capabilities and absence of proper validation mechanism. CPCB felt the need to modernize and augment the system according to international standards.

Internationally, the use of automatic monitoring stations is widely recommended for its accuracy, reliability and the possibility to develop alert systems. The system can be further strengthened for incorporating decision making tools and forecasting techniques.

Most of pollution monitoring programs in the country is also trending towards the development of continuous data collection by online real time analysers and their real time data transmission. CPCB started its first CAAQM station in 1988 at Delhi and spread the network to other States by involving the SPCBs. SPCBs/PCCs/other organisations were encouraged to get involved in continuous pollution monitoring and in subsequent planning of pollution abatement programs. CPCB has helped these organizations to share the responsibility of monitoring ambient air quality in different cities.

2. PRESENT STATUS OF CONTINUOUS AMBIENT AIR QUALITY MONITORING

Continuous ambient air quality is being monitored by various State and Central organisations in the country has a network of 62 stations. Some of these stations are established on 50:50 cost sharing basis by CPCB and SPCBs. Operation of the stations

in a State is entrusted to the respective SPCB. Table 1 provides the present status on continuous ambient air quality monitoring stations.

TABLE 1 STATUS OF CONTINUOUS AMBIENT AIR MONITORING

S.No.	State/ U.T.	CAAQMS	Cities	Remarks
01	Andhra Pradesh (03)	03	Vijayawada, Visakhapatnam, Tirupathi	APPCB owns & operates all three stations.
02	Bihar (03)	03	Patna, Gaya, Muzafarpur	SPCB owns Gaya & Muzafarpur Stations
03	Gujarat (01)	01	Ahmedabad	---
04	Haryana (04)	04	Faridabad, Gurgaon, Rohtak, Panchkula	SPCB owns Rohtak, Panchkula and Gurgaon Stations.
05	Jharkhand (01)	01	Jharia	Station is installed in 2015
06	Karnataka (01)	05	Bengaluru	SPCB owns one station in the city.
07	Maharashtra (04)	08	Mumbai, Pune, Sholapur, Chandrapur	NMMC owns & operates two stns in Mumbai.
08	Rajasthan (02)	02	Jodhpur, Jaipur	SPCB owns Jaipur Station
09	Tamil Nadu (05)	07	Chennai, Thoothukudi, Manali, Ranipet, Cuddalore	SPCB owns Ranipet, Manali & Cuddalore Stations.
10	Telangana (01)	06	Hyderabad	SPCB owns 05 stations in the city.
11	Uttar Pradesh (04)	06	Lucknow, Kanpur, Agra, Varanasi	---
12	West Bengal (04)	05	Kolkata, Haldia, Howrah,Durgapur	One mobile Station operates in Kolkata
13	Delhi (01)	11	Delhi	DPCC operates 06 stations in Delhi

(Number of cities having CAAQM stations is given in brackets)

The data from the stations owned together by CPCB and SPCB is available on common platform developed by CPCB. However, the data displays gaps and delays. SPCBs also utilise the data in a limited manner in view of operational difficulties experienced by them.

Installation and operation of Continuous Ambient Air Quality Monitoring Stations is a challenging task. Most of the equipment and instruments used in monitoring are imported and the supporting software is patented by foreign organizations. There are number of manufacturers supplying instrumentation operating on different principles and the software suitable exclusively to the equipment/ instruments supplied. CPCB desires

to collect monitored air quality status from all CAAQM Stations operating in the country on real time basis without human intervention.

3. OBJECTIVES

It has been proposed to strengthen CAAQM network in all States and Union Territories and publish Air Quality Index (AQI) for State Capitals and the cities having million plus population in the country. The overall objectives of the Project are:

- ✓ Display of Air Quality Index (AQI) at CAAQM Stations and on CPCB website.
- ✓ Networking of existing & new CAAQMS in the country.
- ✓ Development of National Air Quality Database meeting International Standard on 24x7 basis.
- ✓ Development of software application for collection, transmission, check & dissemination of data.
- ✓ Ensuring Real Time Data without data gaps and delays.
- ✓ Data collection from heterogeneous systems.
- ✓ Implementation of Validation Protocols.
- ✓ Incorporating delayed checks in system.
- ✓ Maintaining all databases for next 10 years.
- ✓ Providing customized data reports on web for SPCBs/PCCs/MoEFCC.
- ✓ Providing query based system for generating dynamic reports.
- ✓ Development of mobile based APP for AQI.

4. PROPOSED NETWORK OF MONITORING STATIONS

The network is being proposed for expansion to include all cities with million plus population (Map). In addition, all State Capitals are also proposed for continuous ambient air monitoring. The list of cities identified for continuous monitoring is provided at Table 2. The cities with million plus population are 46 as per 2011 census and CAAQM stations are installed in 19 of these cities. The number of stations in each city varies from one to eleven. The State and Union Territory Capitals, having population less than a million are 20 and none of the cities are continuous monitoring.

The present network of 62 stations being operated by various organisations will be expanded substantially once the new stations are established. The present infrastructure is capable of handling the data from the existing stations. However, the

increased data flow from new stations requires better hardware and improved software for seamless flow and data management.

In the following sections the detailed requirements are explained to meet the objectives of the present project work.

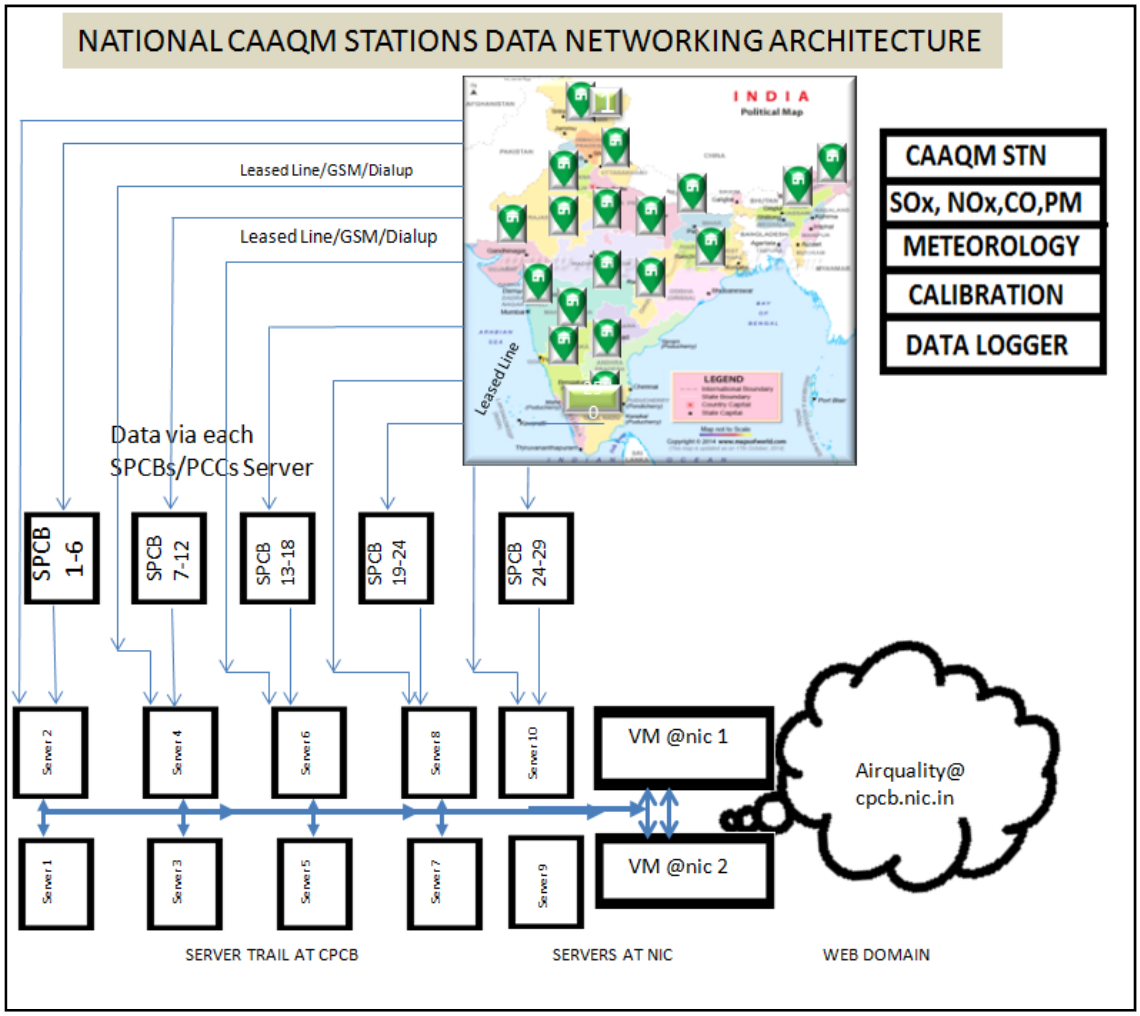
MAP ON PROPOSED NEW CITIES FOR CAAQM STATIONS

MILLION+ CITIES --- 46 (16 STATES & 01 UT)
STATE CAPITALS --- 20 (< MILLION POPULATION)
(14 STATES & 06 UTs)

TABLE 2 CITIES IDENTIFIED FOR CONTINUOUS AMBIENT AIR QUALITY MONITORING

S.No.	State/ UT	Cities with Million plus population	State Capital (with less than a million population)	Total Cities
01	Andhra Pradesh	Visakhapatnam Vijayawada (C)	---	02
02	Arunachal Pradesh	---	Itanagar	01
03	Assam	---	Dispur/ Guwahati	01
04	Bihar	Patna (C)	---	01
05	Chhattisgarh	Raipur (C)	---	01
06	Goa	---	Panjim	01
07	Gujarat	Ahmedabad, Surat, Vadodara, Rajkot	Gandhinagar	05
08	Haryana	Faridabad	---	01
09	Himachal Pradesh	---	Shimla	01
10	Jammu & Kashmir	Srinagar (C)	---	01
11	Jharkhand	Dhanbad, Ranchi (C)	---	02
12	Karnataka	Bengaluru(C)	---	01
13	Kerala	---	Thiruvanatha-puram	01
14	Madhya Pradesh	Indore, Bhopal (C), Jabalpur, Gwalior	---	04
15	Maharashtra	Mumbai (C), Pune, Nagpur, Thane, Pimpri-Chichwad, Nashik, Kalyan-Dombivali, Vasai-Virar, Aurangabad, Navi Mumbai	---	10
16	Manipur	---	Imphal	01
17	Meghalaya	---	Shillong	01
18	Mizoram	---	Aizwal	01
19	Nagaland	---	Kohima	01
20	Odisha	---	Bhubaneswar	01
21	Punjab	Ludhiana, Amritsar	---	02
22	Rajasthan	Jaipur (C), Jodhpur, Kota	---	03
23	Sikkim	---	Gangtok	01
24	Tamil Nadu	Chennai (C), Coimbatore, Madhurai	---	03
25	Telangana	Hyderabad (C)	---	01
26	Tripura	---	Agartala	01
27	Uttar Pradesh	Lucknow (C), Kanpur, Agra Ghaziabad, Meerut, Varanasi, Allahabad	---	07
28	Uttarakhand	---	Dehradun	01
29	West Bengal	Kolkata (C), Howrah		02
30	Andaman and Nicobar Island	---	Port Blair	01
31	Chandigarh	---	Chandigarh	01
32	Dadra and Nagar Haveli	---	Silvassa	01
33	Daman and Diu	---	Daman	01
34	Lakshadweep	---	Kavaratti	01
35	Delhi – NCR	Delhi	---	01
36	Puducherry	---	Puducherry	01

The proposed network architecture is shown in Figure 1. Approximately 500 Stations are expected to be part of this network in a span of 2-3 years. Environmental parameters, Meteorological parameters alongwith instrumental diagnostics will be transmitted from each station. The data will be polled at an interval of 15 Minutes & Data checks will be performed on daily basis for immediate updation.



5. METHODOLOGY

All CAAQM Stations have capability to generate data on real time basis and transmit data to multiple destinations without any time loss. It is proposed to setup a system, where data from heterogeneous systems operating at various locations is collected seamlessly, incorporating online data validation, delayed checks and a National Database could be generated to visualize the air quality of the country on a single portal. A software application will be developed for the purpose. The proposed software will work on the International Standard ISO 7168-1:1999(E). Air Quality – Exchange of Data file format. It will be installed in NIC domain on Virtual Machines with data connectivity

from Central Servers at CPCB. The Central Servers at CPCB shall remain connected with Servers at SPCBs/PCCs and in parallel with remote air quality monitoring stations. Data from Continuous Ambient Air Quality Monitoring Stations (CAAQMS) will be transmitted at an interval of 15 minutes with a flexibility to reduce or increase the time interval.

Proposed Software will also develop a plug-in-software based on ISO 7168 file format which will enable SPCBs to perform delayed data checks. Respective SPCBS/PCCs/Other Agencies involved in operation of CAAQMS within their jurisdiction will perform delayed data checks. Real time data checks shall be performed by the system itself like removal of negative values, out of range data etc. CPCB will extend all the help in developing Reference Guidance notes to perform such operations of data checks to generate a data repository at National Level.

The reports on current data and historical time-series data will be disseminated through this software on web portal. Web software will reside at Virtual Machines kept at NIC datacenter. The Proposed Software herein referred as Real Time -- Air Quality Monitoring Program (RT-AQMP) will generate final database that could be used as National Database after all kinds of data checks and validation.

The database available at individual station will be used for display AQI (Air Quality Index) at each CAAQM Station for which LED panels will be installed visible to the public. A software for displaying AQI at each station will be developed. A Workstation (High end computer) will be procured and installed alongwith CAAQM Station for this purpose. The AQI values are displayed on continuous basis for the local population.
The Schematic representation of the data flow under RT-AQMP is shown in Figure 2. RT-AQMP needs to compare results on real time basis with the CPCB Prescribed Standards for each monitored parameter in different locations. The system will generate reports on exceedance of CPCB prescribed standards.

The software will depict the real time data in spatial domain over maps and data collected in the portal will be used for the calculation of Air Quality Index. This will facilitate all SPCBs/PCCs/CPCB to monitor ambient air quality of the area under their jurisdiction and will also help in preparing Air Quality Management Plans.

The proposed software system should also generate meaningful reports based on finished data. These reports shall contain various tables, graphs, texts, formulae, etc.

using standard statistical tools. It will include Mean, Mode, Median, Daily, Yearly, Monthly, Diurnal variation etc. Since, meteorology plays a significant role in identifying the sources of pollution, the software should also generate wind rose and pollution rose.

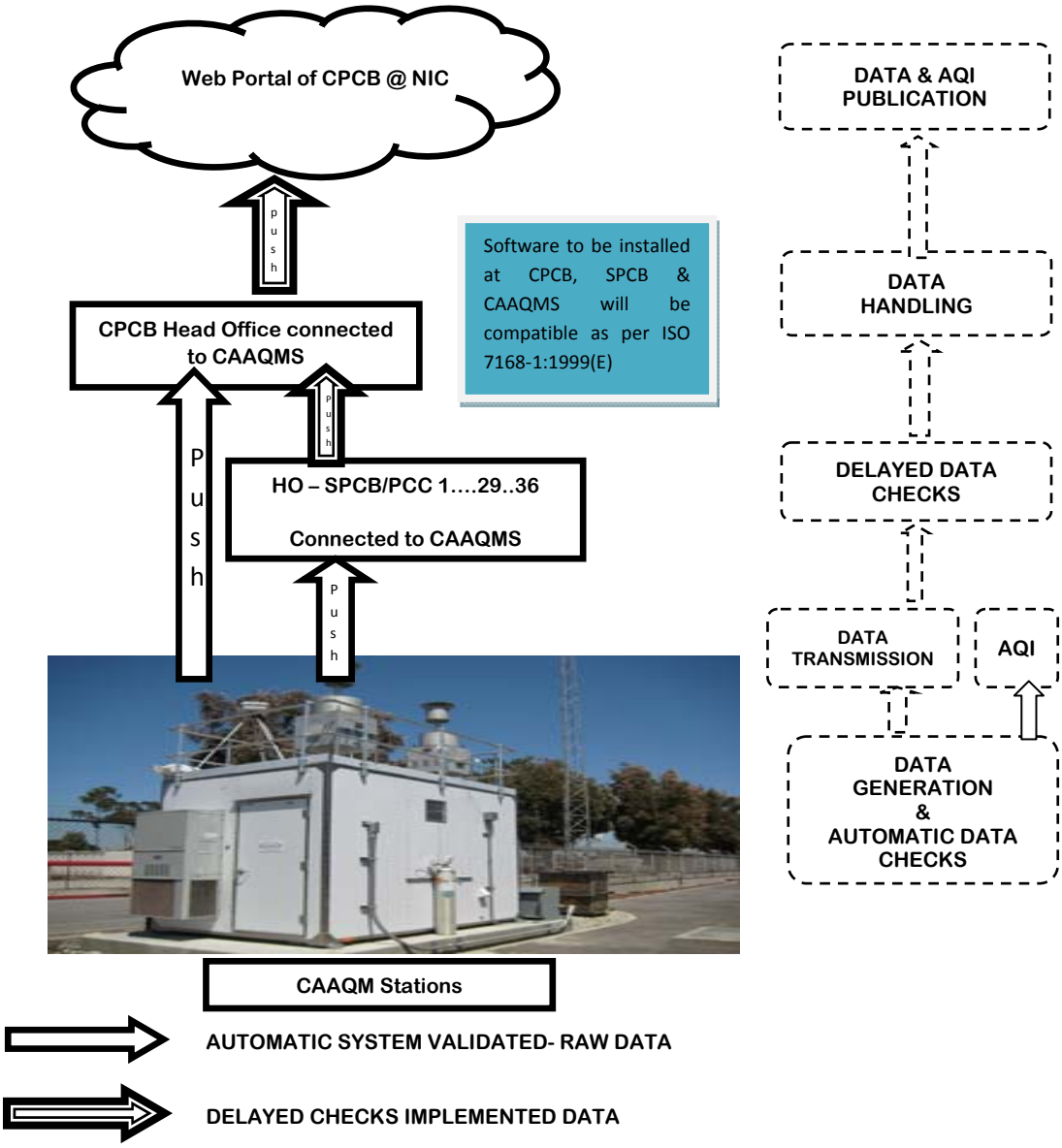


Figure 2: Schematic presentation of Data flow under RT-AQMP

5.1 Data Acquisition from CAAQM Stations

Continuous ambient air quality monitoring stations are operating on 24x7 basis and generate data every second. The data is collected into different databases like sql, oracle, mysql etc. CAAQMS are being operated by different OPERATORs supplying instrumentation. These OPERATORs operate the monitoring systems alongwith Data Acquisition System (DAS) which can provide output in the form of data file updating

dynamically every second and averaged upto a desired interval. These OPERATORs are responsible to generate a data file compatible with ISO-7168 format dynamically at an interval of 15 minutes.

Once this 15 minutes average data file is available at the station, it will be picked-up and transmitted to CPCB Central Server on real time basis. Finally it will be integrated in database of Central Server at CPCB. Delays, errors will be recorded in the system. Standard Protocol ISO -7168 will be followed for any operation.

5.2 Data Acquisition from Data Acquisition & Handling Centers (DAHC) at SPCBs/PCCs

Data at SPCBs is collected with the help of DAS installed at CAAQMS and data base is built at SPCB/PCC servers. Protocols containing delayed data checks will be implemented on the data bases at SPCBs/PCCs and modified data will update the database of State Central server as well as CPCB Central server dynamically.

5.3 Data Collection at CPCB Central Servers

Windows based system having ORACLE - RDBMS (Relational Database Management System) will be installed at Central servers CPCB. It is estimated that ten servers are required and cluster of five data collection points will be created. Each data collection point will contain two servers in Fail-Safe mode. Each data point will cater 100 CAAQM stations.

5.4 Data Dissemination

Windows based TWO Servers (4 CPU, 16 Core, 64GB RAM, 1TB HDD, 1TB Auto Backup) will be sourced from NIC. MS-SQL -- RDBMS (Relational Database Management System) will be installed on the servers for continuous building the databases. Eight MBPS leased circuit connectivity with security firewall will be managed through NIC.

5.5 Data Collection at CAAQMS for AQI Depiction

Data collection through ISO 7168 format file will be done on a separate Workstation computer. Software for this purpose will be developed and data will be integrated in AQI software on the station itself. This workstation will be connected to LCD screens placed at CAAQM Stations.

5.6 Internet Connectivity

It is proposed to have a 512 KBPS leased line at each CAAQM Station for Internet connectivity. In the absence of leased line, Broadband connection will be opted. At SPCBs and PCCs, a dedicated One-MBPS leased line is proposed, while a dedicated eight MBPS leased line is required for smooth data flow.

6.0 TASKS INVOLVED IN SOFTWARE DEVELOPMENT

Following five software modules will be developed:

1. **Bridge Software (BS)**
2. DAHC State Software- **Delayed Data Checks Software (DDCS)**
3. DAHC Central Software- **Main Software at CPCB- DAHCC**
4. Web Software – at NIC –WEB
5. AQI Software at CAAQMS and on Web.

6.1 Details of Bridge Software (BS) Requirements

Using ISO 7168 file format, Bridge Software (BS), also called Client Server based data pushing software, will be developed and installed. This BS will fetch real time data dynamically as generated from the CAAQM Software. The Instrument supplier will provide an output file in ISO – 7168 format at each CAAQMS with 15 minutes' interval and will store these files at station for two years in the folder c:\data\state\city\stationname\yr\month\day. Some of the salient features of the software are listed here.

a. The BS will pick up data continuously and push to Central Server, CPCB at every 15 minutes interval. The Central server will issue an acknowledgement for respective location for specific time file for data receiving only after integration of data into the database.
b. If for any reason data integration into database fails, the Central software at CPCB will request for retransfer of data from BS at CAAQMS then again acknowledgement process will continue till data is received. If this process fails for more than 10 times, then failure of data will be recorded at Central server as well as at respective CAAQMS. All records of such data failures will be available at Station Computer and at CPCB Central server.
c. If there is any failure of data transmission continuously for more than two hours, then SMS & email will be generated and sent to concerned officials.
d. Delay in data transmission (starting from 15 minutes) from each location will also be recorded at Station and at CPCB. An API (Application Programming Interface) will be available for operator at CAAQMS and at CPCB for rectification of the problem. The reasons for data delay and failure of attempts made by the software will be recorded.
e. A report on exceedances with respect to the prescribed standards will be developed.

6.2 DAHC State Software- Delayed Data Checks Software (DDCS)

A Software module at SPCB Server will be developed and installed. This software will provide access to database at State Level. Instrument Suppliers will provide the access and the software developer will connect to database through this software. The functionalities of the software are identified here.

a. Software will collect the data from database and convert it to dynamic average values for 15 minutes duration. This data will be made visible to SPCB officials (any number of officials simultaneously) on LAN or at Workstations through API.
b. Data reports will be based on Tabular and graphical formats for data, diagnostics and calibration data for specific duration. This will work as guidance to the user for taking suitable decisions on validity of data.
c. Meteorological data reports including wind roses will be developed.
d. Data reports with respect to pollution roses will be created, helping the validation teams in easy understanding and for proper assessment of pollution reach at ground level. The software will facilitate identification of industries or activities responsible for increase of pollutants for specific time interval.
e. A search will be created for data verification and validation purpose.
f. The user will access data on multi-parameter/multi-station basis and on different time domain basis.
g. Data correction procedure will be developed through software interface, which will provide individual value correction, correction of a range of data with mathematical calculator, record of data correction, time stamping & recording procedure.
h. Any data correction will be marked as corrected data for that particular duration and will reside in separate folder c:\corrdata\state\stationname\year\month at SPCB Server.
i. The same file will be sent to Central Server CPCB with similar functioning of BS into the respective directory (ISO 7168 file format) and thereafter it will be integrated into the database. Synchronization of corrected data similar to the functioning of BS from CAAQMS to Central Server CPCB will be done.
j. The details of corrected data of each station at State server and CPCB Central Server will be recorded. The software interface will show all the data corrections proposed/done at each SPCB for any location.
k. The updation in database will be possible for any number of times, but the reversal of updation done will be possible only at CPCB end.

l. Dashboards will be created to pick up the information of interest quickly from the data received during time-specific intervals, such as last week.
m. A dashboard for identification of instrument failures will be developed to enable responsible officials to identify the faulty instruments.
n. Reports on exceedances of prescribed standards at city level/station level will also be available for customized time periods.

6.3 DAHC Central Software- Main Software at CPCB- DAHCC

The software will be developed and installed at Central Server CPCB. Software will collect data on real time basis from CAAQMS directly through Bridge Software installed at each CAAQMS and from DDCC installed at State Server continuously. This software is heart of the system, capable of all functions desired to have online and delayed checks for validation and publishing the data.

a. Data acquisition is done continuously with corresponding dates and time. API displaying data availability will be prepared.
b. All delays in data acquisition will be recorded (beyond 15 minutes or any pre-defined time period). API displaying delay in data from different locations based on specific state/city will be prepared.
c. Acknowledgement mechanism of data received from BS and DAHCC will be developed.
d. Collection of data for air quality parameters from ISO-7168 file format.
e. Collection of specific information on health of instruments and API for display in customizable format. It will include operational status, error status etc.
f. Collection of calibrations' specific information and API to convert the information in user specific format. The software interface will connect environmental parameters data with calibration data and diagnostic data. This will include type of calibration, calibration data, calibration frequency, calibration results, pre and post calibration information, etc.
g. API for parameter based comparisons for a specific time domain of a single station, multi stations, multi parameters etc.
h. Statistical analysis of parameters using 4 in 1 graphs, 4 in 4 graphs, tabular formats etc.
i. Display of current data through tabular and graphical formats.
j. Display of current configuration of each instrument at a particular CAAQMS.
k. Data validation procedure as applied at SPCB will also be made available for dynamic data validation and of delayed data checks as performed at State level.

Observations as remarks made by the team performing delayed data checks will also be incorporated into the database.

l. Data transfer from validated database at CPCB to NIC domain will be done dynamically.
m. Software will store raw data received from CAAQMS on server database.
n. Software will store delayed data checks implemented data in database.
o. Report procedures will be developed to get current data and stored data.
p. Dynamic procedures will be developed for researchers specifically for the advance data analysis.
q. The display of data will be done using digital maps of Survey of India or Google.
r. Integration procedure will be created for integrating new stations into the system based on longitude & latitude details of the location.
s. Mechanism will be developed to integrate geographical layers of data.
t. Database optimizations will be carried out every month.
u. Database cleaning will be done every month to remove bad data from the database.
v. This software will work in cluster and fail-safe management environment.
w. The software will support all the network management tools, such remote operations.

6.4 Web Software – at NIC -WEB

Data display or dissemination is done in simple and easy-to-understand formats through on a web portal. The web software will be installed at Virtual Machine (VM) at NIC datacenter for continuous display of real time data and generating alerts. This software will contain many statistical tools and reports for all stakeholders.

a. Software will provide current data and historical time-series data at website of CPCB.
b. The data will be made available for Air Quality Index being operational at www.aqi.iitk.ac.in:9000.
c. Security audits through CERT-in empanelled vendors will be done annually.
d. Reports for average, minimum, maximum, hourly, daily, weekly, monthly, seasonal, yearly etc. will also be developed.
e. Multi parameter reports, multi station reports, reports with respect to meteorological parameters will be made available.

f. Reports of exceedances in comparison to prescribed standards for each pollutant will be developed.
g. The web portal will also have a dashboard specific to end user like category of Researchers, Public, Policy makers, decision-makers and the users involved in maintaining system.
h. It will have records on hits, successful hits etc. as standard user hit details on any website.
i. Digital maps of SoI or Google will be used for data display on website. The reports on maps (20 types of reports) will be displayed in various forms like:
    1) Map with single parameter showing current levels in a specific state, i.e. Bar charts of SO_2 level on 25.04.2015 in Uttar Pradesh.
    2) Map showing current levels of multi parameters in a specific state, i.e. Bar charts of SO_2, NO_2, CO, PM_{10}, $PM_{2.5}$ in Bihar.
    3) Map with multi-station parameters for one day i.e.25.04.2015 showing exceedances of prescribed standard values for any of the parameters in a city with multiple stations, i.e. bar charts showing all parameters in different colours having exceedances for 25.04.2015 in Kolkata city.
    4) Dynamic colour coding of data based on exceedance values will be shown on maps.
    5) Map showing all AQI levels at single map for a state or city or for entire country.
j. Data reports comparing different days.
k. Reports existing on the present system available at www.cpcb.gov.in/caaqm
l. Dynamic query based reporting system, where expert users like to take the data reports.
m. Wind rose, Pollution rose reports, etc.
n. Development of Mobile Apps of Web Software.
o. Strong data search based on specific parameter or specific value in entire database will be developed to facilitate data mining.

6.5 AQI Software at CAAQMS and on Web

The station software on Air Quality Index will facilitate calculation of Indices and sub-indices for displaying on a Display Board. The software will pick up the data values from the database created at station continuously and apply the calculator to arrive at the index values. It will reside in the workstation at CAAQM Station and perform the simple data calculation and push the final values for display.

The Web software, developed and deployed by IIT, Kanpur will be used for displaying the data from NIC domain. The network will be expanded in a time-frame to bring more cities. Dynamic tools will be incorporated for data display.

7.0 BUDGET

The budget estimates are prepared based on the configuration proposed for various activities. These estimates are limited to hardware and software planned for generation of comprehensive databases and for publishing the Air Quality Index for all the identified cities.

The total cost has been estimated separately for 200 stations and 500 stations. The cost for a network of 200 stations is about Rs 42.85 lakhs towards hardware and about Rs 50 lakhs for software. The hardware cost will go upto Rs. 62.75 lakhs for a network of 500 stations.

S. No.	Item Description	Quantity (500/200)	Rate (in Rs.₹)	ESTIMATED COST (in ₹)	
				500 CAAQMS	200 CAAQMS
1	Rack Servers	10/06	350000	3500000	2100000
2	42 Rack	1/1	80000	80000	80000
3	USB 2TB External Disk	5/5	2000	10000	10000
4	Windows Server 2012	10/6	40000	400000	240000
5	Database Software	10/6	100000	1000000	600000
6	5KVA ONLINE UPS	1/1	150000	150000	150000
7	Microsoft Office	5/3	15000	75000	45000
8	KVM Switch (Rack)	1/1	10000	10000	10000
9	Precision Air Conditioners	2/2	500000	1000000	1000000
10	Managed Cisco Switches	1/1	50000	50000	50000
			TOTAL(in Rs.₹)	6275000	4285000

8.0 TIME FRAME

The project components proposed will be executed in a span of 13 months. The system will be ready for launch by January 2016. All the existing stations will be integrated by February 2016 and the new stations in a time-period of 3 to 4 months. A detailed schedule for execution of the identified works is annexed.

9.0 SCHEDULE OF 'SOFTWARE DEVELOPMENT FOR CAAQMS NETWORKING' - 2015-16

(Scheduled time should be based on practical approach)

S. No.	Activities to be carried out	May'15	June'15	July'15	Aug'15	Sept.'15	Oct.'15	Nov.'15	Dec.'15	Jan.'16	Feb.'16	Mar.'16	Apr'16	May'16
1.	Advertisement & Tendering & Finalization													
2.	SRS Development													
3.	Development of Bridge Software													
4.	Development of DDCS –State Central Software													
5.	Development of DAHCC- CPCB Central Software													
6.	Development of Web Software													
7.	CERT in Certification - Obtaining VM-NIC - Hosting													
8.	Procurement of Servers													
9.	Installation of Leased Line													
10.	User Testing													
11.	System Ready for Launch													
12.	Connectivity with existing CAAQMS.													
13.	Connectivity with New CAAQMS - in 02 days@each station -- As & when system installed.													

PART 'B'

ITEMWISE TECHNICAL SPECIFICATIONS OF PROPOSED ITEMS for RTAQMP

(IT IS PROPOSED THAT BOTH HARDWARE AND SOFTWARE BE PROVIDED BY THE SYSTEM INTEGRATOR)

Item No.:RT-AQMP 1 Server

Technical Specification RACK SERVER

Sr.No	Specifications	
1.	**CPU**	Single CPU, Intel Xeon Quad Core 5600 series 2.40 GHz or higher, 12MB L3 Cache per socket or higher, 1333 MHz/1600 FSB.or latest. The Mother Board shall support Dual Sockets.
2.	**Memory**	32 GB (32 GB support for each CPU) DDR-III, 1066MHz, ECC Memory, upgradable to 64 GB
3.	**Chipset**	Intel 5520 or higher
4.	**HDD**	6*1 TB SATA or 3*2 TB SATA
5.	**Ethernet Port**	2 *Dual port Gigabit NIC Cards with autosensing and on copper (total 4 ports). All four ports supporting iSCSI protocol to connect to iSCSI based SAN storage
6.	**PCI Slots**	Provision for 2 *PCI express, 2 *PCIe X2, or more Slots to accommodate additional FC / Gigabit Cards Graphics Adaptors
7.	**CTD**	Internal / external 2 TB
8.	**Optical Drive**	DVD R/W 16X Drive, External USB based
9.	**Form Factor**	2U rack model with rail kit
10.	**Key board**	Standard Keyboard same as OEM
11.	**Mouse**	Standard Optical Mouse same as OEM
12.	**I/O ports**	4 *USB ports, 1 VGA Port, 1 external SAS, 1* Serial, 1 *DVI
13.	**Monitor**	21" Wide LCD TFT Color monitor
14.	**RAID Controller**	RAID 5
15.	**Wireless adapter**	USB Wireless adapter x 2 nos.

Sr.No	Specifications	
16.	**Antivirus**	Standard Antivirus (McAfee / Norton / Trend Micro) for duration of 3 years
17.	**Redundant Power Supply & Fans**	Redundant Power Supply 1+1, Redundant Fans
18.	**Warranty**	Warranty is comprehensive 24x7 on site including spares for 3 / 3 / 3 years with 4 hours support

Item No.: RT-AQMP- 2

Technical Specifications: 42U Industrial Rack

Sr. No	Specifications	QTY / site
1	**19" Industrial Rack, 42U , Color Black Consisting of:-**	**1**
2	Steel Enclosure, 9 Folded profile of dimensions 800 mm width * 1000 mm Depth * 42 U height, supporting 1000 Kgs load. Bottom cover with knock out holes for cable entry to be provided. Three pairs of horizontal support shall be fitted on both right and left sides.	1
3	Foldable Front & Rear Door to its half size while opening, shall be of 100% perforated. Provision for mounting fans on Rear door with concealed AC wiring.	2
4	Fan 230V, 90 CFM to be mounted on Rear Door.	4
5	AC Main Channel vertical two nos., 12x 5/15 Amps SockRT-AQMP Make: Anchor with 32 Amps MCB make : Northwest	2
6	Horizontal Cable Manager	20
7	Vertical Cable Manager	10
8	Copper based Electrical Grounding / Earthing Strip . Provision for Fifteen (15) points.	1 Set
9	Each set of: a) Castor with Brake -- 2 Nos.	1 Set
	b) Adjustable screw legs --4 Nos. OR	
	c) Base frame – 1 No.	
10	Light provision activation in the rack up on opening of the front/rear door.	1

Sr. No	Specifications	QTY / site
11	H/W Packet of 20 SRT-AQMP.	2
12	Eye bolts on the top for lifting the rack	4

If anything else is required to setup the system, vendor need to have provision at the time of quoting.

Item No.: RT-AQMP - 3

Technical Specifications: USB 2 TB External Disk

USB 3.0 compliant 5 (Five) TB or higher size External Expansion Disk

Capacity : 2 TB

Connectivity : USB 3.0

Form Factor : Desktop

OS Supported : Windows 7 and Above

External Power Required : No

Warranty : 3 Years Warranty

Item No.: RT-AQMP - 4

Technical Specifications: Windows Server 2012 R2 or Higher version

Windows Server 2014

Microsoft Windows Server 2012 (Standard) -10 licenses

Item No.: RT-AQMP – 5

Technical Specifications: Database Software

Database Software

The Database software should be compatible for the Windows Server 2012 R2

1. **SQL** for 1 CPU, 2 core **(SQL 2014 or latest version)** with license and Media.

Item No.: RT-AQMP - 6

Technical Specification: Standalone 5 KVA Online UPS (1 hour battery backup)

Sr.No	Specifications	
1	**Capacity**	5 KVA for 1 hour battery backup **(Surge Protection)**
2	**Input Frequency**	50 Hz ± 6%
3	**Input Voltage range**	160 – 280 V
4	**Output Voltage Tolerance**	<±5%
5	**Output Voltage**	230 V
6	**Protection**	Short Circuit, Overload, Low Battery etc.
7	**Output Waveform**	True Sine Wave
8	**Bypass**	Built-in Bypass (Automatic and Manual)
9	**Battery**	Sealed maintenance free batteries
10	**Cabinet**	Battery bank in covered cabinet of MS Powder Coated
11	**Warranty**	3 years Comprehensive onsite including spares

Item No.: RT-AQMP - 7

Technical Specification: Microsoft Office

Sr.No	Specifications	
1	**Microsoft Office Std.**	Microsoft Office Std. 2013 Single OLP or latest

Item No.: RT-AQMP - 8

Technical Specification: KVM Switch (Rack)

Sr. No	Specifications	
1	**Capacity**	SWITCHING CAPACITY FOR 10-12 SERVERS
2	**Input Voltage range**	160 – 280 V
3	**Installation**	Rack based

Item No.: RT-AQMP - 9

Technical Specification: Precision Air Conditioner (07 TR Capacity)

DESIGN CRITERIA FOR Precision AIR CONDITIONING PACKAGE UNIT OF 7 TR CAPACITY

The air-cooled AC Pkg unit should be designed as per following conditions:

1. Rated capacity : 7 TR (Sensible cooling capacity)
2. Flow direction : Downward flow
3. Air inlet temp. (Return Air) : 21 °C (DB) at 50% RH
4. Saturated Suction Temp. : Between 10 °C and 11 °C
5. Minimum Super heat : 2 °C
6. Saturated discharge Temperature : Maximum 53 °C (at ambient of 43 °C)
7. Ambient air design temperature (Entering the condenser) : 43 °C (However the system should be able to work with ambient temp. upto 50 °C)
8. Air Quantity : Air quantity : ≥550 CFM/TR
9. Total static pressure : 35 mm of WG between inlet and outlet of Blower i.e. across the blower.
10. Filters : EU – 2 Filter to be provided on the Package unit
11. Face velocity across the Cooling coil : ≤ 2.5 m/sec
12. Type of load : The exchanges are having high sensible heat Load (Sensible Heat factor ≥ 0.95)
13. Minimum C.O.P. : 2.90

SPECIFICATIONS OF A.C. PACKAGE UNIT

1.0 CABINET

1. The unit construction shall be enables to access all the main components of the machine from the front for installation purposes and routine servicing. With this feature, the machines can be installed side by side, or in between cabinets for other technical applications (racks). Outside panels shall be coated with grey epoxy-polyester paint, which guarantees the long-term durability of their original features. The front panels are attached to the framework by means of rapid-

coupling "fasteners". The standard panels are lined on the inside with heat- and sound-proofing insulation to class 1.

2.0 COMPRESSOR (SCROLL)

1. Units shall have scroll type single compressor with single circuit or twin compressor with twin circuit
2. The compressor shall be of hermetic sealed type.
4. Compressor Motor should be suitable for operation on 415 V, 50 Hz, 3 phase, AC supply system.
5. The compressors should be located in such a way that removal of one Compressor should not affect the operation of the other circuit (for twin circuit Units).
6. Compressors should be installed on spring mounted floating platform/rubber Pads or manufacturers recommended approved mounting.
7. Overload protection should be provided in compressor.
8. Gauge Ports should be provided at appropriate location to measure suction And discharge pressures.

3. EVAPORATOR SECTION

Heat exchanger (evaporator coil) shall be designed with an ample front surface area in order to ensure a low air flow velocity through the exchanger so as to prevent the entrainment of droplets of condensation, reduce the air's load losses and ensure a more efficient heat exchange during both the cooling and the dehumidifying processes. The exchanger is composed of copper tubes mechanically expanded on aluminum fins, complete with able to reduce surface tension between the water and the metal surface, thus favoring film-wise condensation. The exchanger is situated upstream from the fans to ensure unhindered air distribution and is complete with a GI condensate tray with a flexible conduit for its drainage and an incorporated trap. Coils should be fully accessible from front and **V or A shape type of coil not acceptable.**

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3.2 Blower Section

Unit must be provided with **direct drive backward curved EC fans each running**, the fans should be aligned and balance statically and dynamically.

Units shall be factory balanced in accordance with Section 15071, Mechanical Sound and Vibration Control.

Only direct drive fans to be provided in offered units and centrifugal fans with belt drive is strictly not acceptable.

Noise Level: 70 db from 1 MT of unit in free filed conditions. Standard forward curved blower with traditional Belt driven motor arrangement not acceptable.

Precise humidification feature

Immersed electrode humidifier having precision drainage and feed, steam supply matching the demand and minimal disruption in steam production should be provided as an inbuilt feature of the package unit.

4.0 REFRIGERANT PIPING

4.1 There should be single refrigerant circuits for single compressor or twin compressor with two independent refrigerant circuit in each package air Conditioner machines.

4.2 Each refrigerant circuit should be suitable for operation on R 407C and should include the following items :-

a. Electronic/Thermostatic Expansion Valve
b. Removable liquid line filter drier with hand shut off valves
c. Liquid Line sight Glass with Moisture indicator
d. Suitable charging valves

4.3 The serviceable/removable components should have union connections for easy removal/assembly.

4.4 All pipe works should be carried out with refrigerant quality copper tubes and where bends are required these should be completed using either a proprietary bending tool or radius fittings. The minimum thickness of pipe should be 18 gauge.

5.0 ELECTICAL SYSTEM

5.1 A main incoming MCB of suitable rating for each AC package unit should be provided on the unit.

5.2 Within the panel individual power loads should be distributed equally across the three phases.

5.3 All individual wires should be of copper and colour coded or should be numbered at their point of termination to facilitate servicing.

5.4 Low voltage control wiring and power wiring should be segregated from each other.

5.5 Heaters shall be suitably provided with insulators with safety thermostats and contactors of suitable ratings.

5.6 The following shall be incorporated :-

i.) MCB of suitable rating for each sub-circuit.
iii.) Overload protection for individual 3 phase motors.
iv) Single Phase Preventer at the incoming supply of each package unit.

6.0 AIR COOLED CONDENSER.

6.1 For each packaged air conditioner unit (with twin circuits) there should be two air cooled condenser units; each having a matching heat rejection duty for one refrigerant circuit.

6.2. condenser unit should incorporate the followings :-

a) A heat rejecting coil block constructed from copper tubes of not less than 0.3 mm thick expanded on to straight aluminum fins. Approximately 13 to 14 number of Fins/inch should be provided. Fin thickness should not be less than 0.1 mm with Hydrophilic coating.

b) Minimum two propeller fans shall be provided for each condenser unit and Should be selected for low speed quiet operation. The condenser unit should

be suitably designed for noise level ≤75 db at a distance of 1 meter away from O/D unit.

6.3 The condenser should be vertical mounting type with horizontal throw of air, ensuring even air flow over the coil block. Suitable GSS collar shall be provided at fan outlet.

6.4 Condenser body should be made out of 1.6 mm G.I. sheet powder coated or casing of condenser may be made of marine grade aluminium and stainless steel hardware and thickness of casing may be 1.2mm.

6.5 The entire assembly should be supported by a corrosion treated frame.

6.6 Separate MCB of suitable rating for each condesor near its vicinity in suitable weather proof enclosure should be provided.

7.0 CONTROLS

Following controls should be provided :-

1. High pressure trip – Manual reset (for each compressor)
2. Low pressure trip – Auto /Manual reset (for each compressor)

The auto reset for LP trip shall get disenabled if the refrigerant circuit is operated on LP trip for more than three times.

8.0 SAFETY INTERLOCKS

8.1 Interlock between condenser fan motor and compressor motor to prevent starting of compressor without condenser fan in operation.

8.2 Condenser fan should stop along with compressor.

8.3 Provision should also be made to operate the evaporator fan without the operation of condenser and compressor.

9.0 CONTROLLER :

Microprocessor based controller for individual package unit shall have following broad features

- Unit control , communication and monitoring of package unit .
- May be used to combine with multiple package units into a team that operates as a single entity.
- Menu driven display for all programming functions on each connected package units.
- This display can be used to control a single package unit or any package unit on a network , regardless of how it is connected – either integrated into a package unit or simply connected to the network and mounted remotely .
- The status menu shows the status of the conditioned space , such as room temperature and humidity , temperature and humidity set points , alarm status and settings , event histories and the current time.

• Password protected for authorized access alone.

• Arrow/control buttons for navigation and value adjustment.

• Programming of AC units shall be based on the site requirements. It should be possible to analyze the sites with the maximum run hours of AC units and sites with maximum alarms.

Item No.: RT-AQMP - 10

Technical Specification: Managed CISCO switch (Rack mountable)

24 port managed fast/ gigabit Ethernet Cisco Switch with LAN and WAN ports of latest series