ABRIDGED INVITATION FOR BIDS (IFB)

NTPC LIMITED
(A Govt. of India Enterprise)

SSC COAL MINING, RANCHI

INVITATION FOR BIDS (IFB)

FOR

"INTEGRATED COAL MANAGEMENT SYSTEM"

FOR

NTPC COAL MINING PROJECTS

(Domestic Competitive Bidding)

IFB No. : SSC/C&M/2022-23/ICMS **Date: 06.09.2022**

NTPC Limited (NTPC) invites online bids on **Single Stage Two Envelope bidding basis (Envelope-I: Techno-Commercial Proposal & Envelope-II: Price Proposal)** from eligible bidders under the subject Package for its various Coal Mining Projects as described in Technical Specifications (copy enclosed).

Tentative Brief Scope of Work: Brief Scope of Work covered under the subject package is as under:

1. Automation of Weighbridge System
2. RFID Based Access Control at Check Post, Loading Points.
3. Software for integration of weighbrige data and Access Control
4. GPS based Tracking and Geo fencing.
5. Web Based Application and Mobile Applications
6. User Interface/Dashboard, reports
7. Comprehensive Maintenance for all the systems/ equipment/ devices and software provided as a part of Integrated coal management system for a period of three years (03), from the date of successful commissioning of the complete system.

Bidding Document shall be on Sale tentatively from **15.09.2022.**

Tentatively both Techno-Commercial Bids and Price Bids shall be received upto 1430 hrs (IST) on 06.10.2022 and Techno-Commercial Bids shall be opened on 08.10.2022 at 1430 hrs (IST). The date and time for opening of Price Bids shall be intimated separately after opening of Techno- Commercial Bids.

A complete set of Bidding Documents may be downloaded by any interested Bidder after Document sale start date from NTPC e-tender website https://eprocurentpc.nic.in or may contact Sr. Manager (C&M Services) / Addl. General Manager (C&M Services), NTPC Limited, SSC-Coal Mining, Coal Mining

HQ, Ginni Plaza, Ranchi, Jharkhand, India-834001 on Mobile No. 9650990770 / 9650992016 or on e-mail: pranaysharma@ntpc.co.in / ksudhakar@ntpc.co.in

NTPC reserves the right to cancel/withdraw the NIT for the subject package without assigning any reason whatsoever and in such case no bidder/intending bidder shall have any claim arising out of such action.

NTPC Limited

(A Government of India Enterprise)

NTPC COAL MINING PROJECT

TECHNICAL SPECIFICATION

FOR

INTEGRATED COAL MANAGEMENT SYSTEM

BID DOCUMENT NO :

CONTENTS

1.0.0.0 INTENT OF SPECIFICATION

This specification is intended to cover the activities and services in respect of the execution of INTEGRATED COAL MANAGEMENT SYSTEM at NTPC Coal Mining projects. Details of coal mining projects under this package shall be described in subsequent clauses. The scope of work shall include

a)

i. Design/ engineering, manufacturing, supply, proper packing for transportation including transit insurance, customs clearance/ port, if required
ii. Receipt, unloading, storage, preservation, conservation, and insurance of equipment at site.
iii. Associated civil and Electrical works
iv. Providing engineering data, drawings, Commissioning procedures and O & M manuals, etc. for the Employer's review,
v. approval and records.
vi. Installation, commissioning and putting the System as mentioned in specification together with all accessories, auxiliaries and associated equipment in a fully operational condition and in the manner acceptable to the Employer
vii. Successful demonstration of functional requirements specified herein complete in all respects to the Employer during Performance Guarantee Test before handing over.
viii. Reconciliation with custom authorities, if applicable.
ix. Satisfactory completion of the contract.

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b) The equipment, and services to be furnished and installed and works to be carried out as required in this technical specification shall also meet all the requirements as stated in "General Conditions of Contract" (GCC), " Special Conditions of Contract" (SCC) and "Bid Form & Procedures" which shall be considered as a part of this technical specification as bound herewith. All requirements, conditions, appendices, etc., stated in the contract documents shall be considered as a part of this volume as completely as if bound herewith.

c) The Bidder shall be responsible for providing all material, equipment, and services, specified or otherwise which are required to fulfill the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification.

d) Bidder is required to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should reach Employer at least 15 days before the scheduled date of the opening of the bids. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions.

e) Before submitting his bid, the Bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground , quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Owner.

f) Bidder shall take all necessary precautions to protect all the existing equipment,

structures, facilities and buildings etc. from damage. In case any damage occurs due to the activities of the bidder on account of negligence, ignorance, accidental or any
other reason whatsoever, the damage shall be immediately made good by the bidder at his own cost to the satisfaction of the Employer.

g) The interpretation of the Employer in respect of the scope, details, and services to be performed by the Bidder shall be binding unless specifically clarified otherwise by the Employer in writing. Therefore, Bidder is advised to seek all such clarifications as required by him, prior to submitting of the techno- commercial bid proposal. It shall be the responsibility of the Bidder to coordinate with Employer and offer the system to meet the all functional, operational and safety requirements of the Coal Mining area and furnish a complete system. Wherever interfacing is required with employer's existing facilities that integration shall be in the scope of bidder.

2.0.0.0 LOCATION AND APPROACH OF PROJECTS:

Integrated Coal Management system shall be implemented in Pakri Barwadih Coal Mine, Chatti Bariatu , Talaipalli and Dulanga Coal Mine .

Pakri Barwadih Coal Mine Project	
State	Jharkhand
District	Hazaribagh
Nearest Airport	Ranchi
Nearest Railway Station	Ranchi (Approx. 70 km

Chatti Bariatu Coal Mine Project	
State	Jharkhand
District	Hazaribagh
Nearest Airport	Ranchi
Nearest Railway Station	Ranchi (Approx. 70 km

Talaipalli Coal Mine	
State	Chattisgarh
District	Raigarh
Nearest Airport	Jharsuguda (103 km)

Nearest Railway Station	Raigarh (Approx. 60 km)

DULANGA Coal Mine Project	
State	Odisha
District	Jharsuguda
Nearest Airport	Jharsuguda
Nearest Railway Station	Jharsuguda (Approx. 40 km

3.0.0.0 DETAILS ABOUT WEIGHBRIDGE RAILWAY SIDING, ENTRY, EXIT

Pakri Barwadih Coal Mine	In Pakri Barwahdih site, Coal is being transported through conveyor system as well as by the trucks. By conveyors system coal is being transported up to TP -10 (Transfer point -10) and stacked near TP-10 through chute arrangement. From TP-10 coal is being transported to Bandag railway siding by Truck. Further coal is also transported from mine end to railway siding by trucks. At railway siding end entry and exits for truck from TP-10 as well as from mining end is common.

A	**Mining Side**	
1	Nos of Weigh Bridges (WB) Platform	6 number WB EXISTING + 2WB (Proposed) Platforms BIDIRECTIONAL
2	Location	East quarry Stacker (4-Platforms), West Quarry Nagri (2-Platforms) + 2 platform proposed west quarry Nagri side
3	Entry Gate at East quarry stacker end	1 no.
4	Exit gate at East quarry stacker side	1 no.
5	Loading point at East quarry side	2 nos (Stacker1 and Stacker2)
6	Loading Exit Gate at stacker side	2 nos (Stacker 1 and Stacker2)
7	Entry Gate at West Quarry	1 no.
8	Exit Gate at West Quarry	1 nos.
9	Loading point at west quarry side and its coordinates	1+ 1* (Proposed)

10	Loading Exits Gate at West side	1+ 1* (proposed)
B	**Railway Siding -Banadag**	25-30 Km from Mining side
1	Nos of weigh bridges	6 WB EXISTING + 2WB (Proposed) Platforms BIDIRECTIONAL
2	Location	South side (4-Platforms), Norh Side (2-platforms), Extended siding (2 - Platform Proposed)
C	**TP-10 to Banadag railway Siding Banadag**	TP-10 1 km approx. from Bandag railway siding
1	TP 10 side entry	1 no
2	TP-10 side exits	1 no

Talaipalli Coal Mine	
Mining Side	
Nos of weigh bridges plat form	2WB + 2WB Platforms BIDIRECTIONAL
Location	2 WB platform AT South pit and 2 WB platform at west pit
Entry Gate	1 no. at south pit +1 no at west pit
Exit gate	1 no. at south pit +1 no at west pit
Loading point	1 no. at south pit +1 no at west pit
Loading exits gate	1 no. at south pit +1 no at west pit

Dulanga Coal Mine	
Mining Side	
Nos of weigh bridges plat form	2WB + 2WB Platforms BIDIRECTIONAL
Entry Gate	1 no.
Exit gate	1 no.
Loading point	1 no. +1 no
Loading exits gate	1 no. +1 no

Chatti Bariatu Coal Mine Project	
Mining Side	
Nos of weigh bridges	2WB Platforms BIDIRECTIONAL

Location	N-2643690.86,E-304422.18 (at one location)
Entry Gate	1 no.
Exit gate	1 no.
Loading point	1 no.
Loading exits gate	1 no.
Railway siding side	Approx. 15 km from Mining side
Nos of weigh bridges	2WB (Proposed) Platforms BIDIRECTIONAL
Location	Shivpur Railway Siding
Entry at railway siding and coordinates	1 no.
exits gate railway siding and coordinates	1 no.

Typical Layout of Weighbridge

Weighbridge Platform-1	**WEIGH BRIDGE OPERATOR ROOM**	Weighbridge Platform-2

4.0.0.0 GENERAL REQUIREMENT

It shall be the responsibility of the Bidder to coordinate with Employer and offer the system to meet the all functional, operational and safety requirement and furnish a complete system. Work shall be in compliance with all applicable codes, standards, guides, statutory regulations, safety requirements and also DGMS regulations/recommendations, in force. If the proposed system requires any deliberation with DGMS authority, it is also to be done prior to installation and commissioning of the system.

All equipment, systems and accessories furnished under this specification including , weighbridge Controllers ,RFID readers camera , Boom barriers, servers etc. for integrated coal management system shall be from the latest proven product range of a reputed experienced manufacturer, whose successful performance has been established in at least one installation for similar application.

The equipment provided by the Contractor under this package shall deploy latest state of the art technology to guard against obsolescence. The operating system (OS) used for the must be current and have full mainstream support from the manufacturer. All current service packs and other OS updates shall be installed at the time of system delivery. For Wireless Based Connectivity , Bidder shall include all necessary equipment and all licenses, statutory clearances in his scope. Bidders are also advised visit the project site and collect data on local site conditions.

In the event of conflict between requirements of any two clauses of specification documents, the more stringent requirements shall apply unless otherwise confirmed by the Employer in writing before the award of this contract, based on a written request from the Contractor for such clarification.

5.0.0.0 SCOPE OF WORK

The integrated Coal management system envisaged for the project shall consist of the following components/Subsystems:

1. **Automation of Weighbridge System**
2. **RFID Based Access Control of Check Post, Loading Points.**
3. **Weighbridge Integration Software**
4. **Coal Transport Vehicle Management and Access control Software**
5. **GPS based Tracking and Geo fencing.**
6. **Web Based Application and Mobile Applications**
7. **Third party integration**
8. **User Interface/Dashboard, reports**

5.0.1.0 Automation of Weigh Bridges

In NTPC coal mining projects, coal dispatch process is given here:

1) The tippers/ trucks etc. reach mine entry gate, get verified there. Loading slip is generated and after that it enters into mining/loading area.
2) The tipper now reaches to loading area, where it gets verified as per loading slip and loads the coal.
3) Weighment of coal loaded tipper is done, Challan slip, forest slip, **weighment** slip are generated at mine end. The tipper's driver collects these slips and moves for Railway Siding.
4) At Railway siding area, its weighment is done and then it gets unloaded. Then, again the tipper moves for mine entry gate. Further steps are

repeated again as per point 1) to point 4) above.

Note: Process from point 1 to 4 mentioned above may slightly vary from Site to site. In some site Tare weight is measured after point no1 above.

5.0.1.1. NTPC has already installed the weighbridges at mine and Railway siding area. To avoid the human interaction and better control while generating the Trip sheets, the weighbridges are to be fully automated. The functionality of weighbridge should be **as under:**

5.0.1.2 Each vehicle before and after loading of the coal must go in for weighment and the truck will be guided by announcer and traffic light with boom barrier at the weighbridges. Only authorized trucks having FASTag will be allowed for weighment. These need to be integrated with the existing workflow of the proposed application. CCTV cameras to be installed at entry and exit point of weighbridge. IR sensors to be installed and integrated with the proposed system, which will help in guiding the vehicle to be aligned in correct position for weighment at weighbridge. Traffic lights are to be installed at weighbridge to guide the driver and it should work on a predefined logic. Boom barrier should be placed at exit point of weighbridge. The operation of Boom barriers should be initiated by the FASTag Reader for authorized vehicles.

5.0.1.3 A display should be placed in front of weighbridge to show the actual weighment. Announcer & amplifier: PA system at the weighbridge will assist the vehicle for correct alignment. IP based CCTV cameras should be installed at weigh bridges snapshot of truck number and body top view, and driver. After successful completion of weighment, the weighbridge system should guide the vehicle to Challan point. At challan point, challan is generated by govt portal and printed with QR code. This QR code has vehicle number and net weight (gross - tare) of truck. Offered system should read this QR code (printed) and validate that the vehicle details and net weight as mentioned in challan are in line with net weight as measured by weighbridge for that vehicle. This validation shall be just after the challan being generated. This validation can be done offline also. (i.e; when connectivity between local /centralized server and weighbridge controller is interrupted)

5.0.1.4 It is envisaged that all printing activities like printing of challan, weighment slip (with QR code) , issuing of forest slip and consignment slip are done at one place and handed over to driver after weigh bridge .Printing of weighment slip (with QR) shall not depend on network availability between local /centralized server and weighbridge controller . This weighment slip shall contain the weighment details, vehicle details, Contractor name, truck owner name, driver name, DL information, date, time, etc. and a QR code containing the same. A copy of

	weighment slip shall be saved in pdf format in Server also with time stamping and duplicate watermark and printed on Date will be marked if print is taken.
5.0.1.5	The Manual/remote operation of Boom Barrier should be locked in normal operation. In case of Boom barrier being opened manually/remote, an alert shall get generated and the same shall be recorded including the period of Boom Barrier opening. Also, in case of power failure of any gadget, alert should get generated.
5.0.1.6	The system shall be designed in such a way that in case of unavailability of network (disconnection between weighbridge controller and local/central server) , all transactions , events, data, weighment are stored locally and pushed to local sever when network is available.
5.0.1.7	Supply, installation, commissioning, testing of Boom barrier FASTag reader, controller , CCTV ,position sensors ,traffic lights , PA system , PC and other hardware , network devices, storage and connectivity up to employer's network switch , software, etc to achieve above functionality is in bidder's scope. Civil works associated with installation of boom barrier, traffic lights, display pillar, camera and Sensors, readers and another bidder's equipment shall be in bidder's scope. Weighbridge operator room are excluded from scope of bidder**.**
5.0.2.0	**RFID Based Access Control of Check Post, Loading Points**
5.0.2.1	FASTag technology for identification of the vehicles through readers shall be deployed at entry . The functionality of RFID access control at check post (Entry, Exit gate) at Mine , loading points and railway siding end shall be as follows:
5.0.2.2	Only authorized vehicles should be allowed at Entry gate/check post by opening Boom Barriers. CCTV c**ameras to be installed at check post.** Vehicle should be stopped at Entry gate in case unloading is not done in the previous trip. **. IP based CCTV cameras should be installed at check post (IN/OUT) , loading point .** Snapshots of authorized vehicle number and top view of the truck body, driver are to be taken at both check-posts (IN and OUT) at Mine area. At loading entry and exit point driver image should also be captured though CCTV. At entry check-post of mine, truck should not be allowed if snapshot is not taken at designated points after unloading mineral in the previous trip. Boom barrier should not open and the alert is to be displayed in the computer including sending SMS/notification in such cases. Only authorized coal carrying vehicles and authorized loader should be allowed in mine area. FASTag cards will be available in all dispatch vehicles and other temporary vehicles at the time of entry. Traffic lights are to be installed at check points , loading points to guide the driver and it should work on a predefined logic A large LED based display should be placed near loading area and it should display the vehicle details of authorized vehicle going for loading . LED display should be rugged in construction and suitable for working in high dust environment as exist in mining and coal loading area. An automatic wiping system shall be provided to clean the Display periodically.

5.0.2.3 If any unauthorized vehicle tries to enter the mine/loading /siding area then real-time notification should be generated at the control room. Arrival and departure should be tracked. If any vehicle does not arrive at its pre- determined location (Mines/Siding/loading area) within a certain time frame, then notification shall be generated.

5.0.2.4 The system shall be designed in such a way that in case of unavailability of network (disconnection between access controller and local/central server) , all transactions , events, are stored locally and pushed to local sever /central server when network is available. In case of unavailability of network also, loading slip with QR code having info like truck number , owner name ,trip number) date , time , unique trip number can be generated. The Manual/remote operation of Boom Barrier should be locked. In case of Boom barrier being opened manually/remote, an alert shall get generated and the same shall be recorded including the period of Boom Barrier opening. Also, in case of power failure of any gadget, alert should get generated.

Further system should be designed in such a way that RFID based access should not be affected in case of failure of network ((disconnection between access controller and local/central server.

5.0.2.5 Supply, installation, commissioning, testing of Boom barrier FASTag /RFID reader, controller , CCTV , traffic lights , PA system , PC , (if required) QR scanner ,printer and other hardware , network devices, storage and connectivity up to employer's network switch , software, etc to achieve above functionality is in bidder's scope. Civil works associated with installation of boom barrier, traffic lights, display pillar, camera and Sensors, readers and another bidder's equipment shall be in bidder's scope. Security Room at Gate entry exit is not in Bidder's scope . PC shall be kept in Security Room.

5.0.3.0 Weighbridge Automation and Integration Software

Weighbridge Automation and Integration software shall automate the weighment process and reduce turnaround time of trucks from entry point of mine/ loading area to exit at Railway Siding areas. It should have all capabilities, features to achieve functionalities as mentioned at clause no. **5.0.1.2 to 5.0.1.7.**

It should have extensive reporting and data management capabilities. It shall integrate all the weighbridges of each projects, provide exhaustive details of truck trips, consolidated reports on hourly, shift wise, daily, weekly, monthly, yearly basis. It should have reporting, sorting capabilities based on user define duration, element selected (like trucks, weighbridge, duration of trip, challan no, loading slip no, incomplete trip exceptions etc.). It should be able to carry out comparison between weight reported from loading site weighbridges and railway side weighbridge, shall generate various reports related to comparison, exceptions defined. It should also give alert to define user based on exception

rules defined. It should have provision to interface with CCTV for image capturing. CCTV pictures captured at weighbridges; check post shall also be used for various reporting. It should also maintain the weighment slip in PDF format (tamper proof) for at least 12 months. It should maintain extensive database related to above functionalities.

It should also maintain data base of all coal transport vehicles, its RC details, insurance details, registration authorized in govt portal for mineral transport etc, fast tag , RFID tags and provide alerts in cases when some documents are missing or expired. It should also maintain the data base of type of trucks, tippers, its tare weight , allowed maximum gross weight etc.

Offered software should be easy to use, intuitive, user friendly, scalable. It should have facility of adding unlimited nos weighbridges, its related details (trucks, tippers details , RFIDs , camera etc) . Addition of new weighbridge modules (inter alia including various data capturing like CCTV), vehicles details and other information as when required shall be easy and can be done with easy user interface. The same can be done through web access, mobile applications etc. Offered software should be integrated with all other software of bidder's scope.

5.0.4.0 **Vehicle Management and Access Control Software**

Vehicle Management and Access Control Software shall automate the entry, exit of vehicle at check post and loading area and reduce turnaround time of trucks from entry point to exit at Railway Siding areas. It should have all capabilities, features to achieve functionalities as mentioned at clause no. **5.0.2.1 to 5.0.2.5.** It should have extensive reporting and data management capabilities**.** It should have reporting, sorting capabilities based on user define duration, element selected (like trucks, duration of trip, loading slip no, challan no, exceptions etc). It should also give alert to define user based on exception rules defined. It should have provision to interface with CCTV for image capturing. CCTV pictures captured at check post loading points shall also be used for various reporting. It should also maintain the loading slip in PDF format (tamper proof) for at least 12 months. It should maintain extensive database related to above functionalities.
It should also maintain data base of all coal transport vehicles, its RC details, insurance details, registration authorized in govt portal for mineral transport etc, fast tag , RFID tags and provide alerts in cases when some documents are missing or expired . It should also maintain the data base of type of trucks, tippers, its tare weight, allowed maximum gross weight etc.
Offered software should be easy to use, intuitive, user friendly, scalable. It should have facility of adding unlimited nos access points, its related details (trucks, tippers details , RFIDs , camera etc) .Addition of access points , vehicles details and other information as when required shall be easy and can be done with easy user interface . The same can be done through web access, mobile applications etc. Offered software should be integrated with all other software of bidder's scope.

5.0.5.0 **GPS based Tracking and Geo fencing**

Presently GPS device are installed in each truck /tipper by the transporter. Transporters have their own platform/application to track the truck/tippers movement in defined routes. Bidder has to use either GPS signal or API based solution based on availability to implement real time GPS based tracking. Exact implementation shall be finalized after award of contract. Approx 1500 vehicle GPS tracking is to be done with total 4500 trips.

The Bidder shall prepare a map file, route map (from mine end to railway siding) using the static map/Mine map with geographical locations. Map, Route map should have certain important location marked on it. These important points shall be as per site condition and shall be decided after award of contract. Offered tracking software shall superimpose truck /vehicle movement on this map for location tracking. For geofencing, Area should be demarcated in zones and if a vehicle enters outside the defined zone, route an alert to be generated to the control room/appropriate authority. Immobility alert shall also be implemented.

GPS based tracking should be enabled based on certain predefined rules to avoid unnecessary tracking of vehicle when it is not being used by employers. Tracking details must have time and date details across route, map. Offered system shall store the tracking history of all vehicles for at least 15 days. Offered GPS based tracking software should be seamlessly integrated with all other software, applications, database of bidder's scope.

Offered software should be easy to use, intuitive, user friendly, scalable. It should have facility of adding unlimited nos vehicle , customization of route map , creation of new route maps , its related details (trucks, tippers details etc) .Addition of vehicles, creation of route map , customization of route map , vehicles details and other information as when required shall be easy and can be done with easy user interface. Web based and mobile based application shall be provided for Real time monitoring of trucks, viewing tracking history, associated alarm, exceptions of vehicles etc

5.0.6.0 **Web Based Application and Mobile Applications**

Bidder shall provide web-based application. The application will be hosted in a centralized redundant server in Coal mining HQ Ranchi/ or at any other location as decided by owner. The Bidder will provide application for data entry, report display and graphical display on User Interface. The bidder will configure all the alerts and train all the users who will be using the system. Master Data as mentioned in scope of work shall be implemented. Migration of old details in database shall be done by the bidder. Bidder has to maintain database as per scope of work. The software will have different User Access Level.

The requirement study and design of the web-based application shall be carried out by the vendor in consultation with NTPC. Designing of the system includes Process flow, Wire frames, Architecture Design etc. During requirement study and design phase following points shall be considered.

The Application will be web based therefore apart from home screen ,all other screen shall be available after proper authentication by user-id and password. The change password and forgot password option (through OTP) should be there. In the web app module different users should have different access level. Accordingly, access shall be controlled through the application itself. The web app shall be developed using Visual Studio/Dotnet HTLM5/CSS3/JS with JQuery Mobile/ Bootstrap/ Angular JS and server end coding with Java. The web-app should be responsive so that it should run smoothly in any type of screen size and in any popular browser (like IE, Chrome, Fire Fox). The solution architecture should be able to address the future scalability requirements, in terms of both application (to add new services) and infrastructure. The solution architecture should be highly available and in harmony with the back end systems.
The solution should enforce security, traffic to be encrypted using secured connectivity and the web services shall be used through https secured connection.
Compatible mobile apps (Android and iOS based) to be developed which will have almost all functionality of the web version. User Authentication based on Employee No. & OTP.

Access control for the users:
Type1 users are the Application admin users.
Type2 Data Entry Operators for entry checklist data, defined site data and approvers for approving checklist data
Type3 General user

LOGIN -user can login using employee id, password.
Feature of Application

Following requirement/Feature at user interface are indicative and It may change as per site requirement/Instruction during the execution.

a) Executive Dashboard
b) Project wise Dashboard
c) Live View Tracking Dashboard
d) Masters (Admin) Menu
e) MIS Reports
f) Shift Reports
g) Search
h) Notification and Alert

Dash board shall also consist of details like annual, quarterly, monthly, daily coal production target, actual coal production (shift , day , weekly ,

Yearly) ,mobilization of equipment for coal production, asking rate of coal production , Coal dispatch planning details including rake details , quantities dispatch etc. Asking rate of coal production, nos and type of equipment required to deploy, nos of of truck, racks required for achieving coal dispatch shall be automatically calculated in system based on certain formula, algorithm etc.

Data which is not automatically captured in the system and required to implement the dashboard shall be provided by the employers. Suitable application (web as well as mobile app) shall be designed by the bidder for entering these data. Data base management of these entered information shall be in bidder's scope. Dashboard will have charts/visualizations for important metrics.

5.0.7.0 All the software license must be perpetual. (No License renewal should be required).The special or general tools required for installation shall be supplied by the firm. The Bidder shall maintain Software package in multi user level environment at NTPC.

6.0.0.0 POWER SUPPLY

Single Phase 240VAC,50Hz raw power will be provided by NTPC near to weighbridges, entry, exit and loading points and railway siding This nearest point may be 50 mtr away from loading points, exit , entry points. All extension including cabling required to extend the power source up to the Bidder's devices shall be done by bidder. During the extension of power supply, all effort shall be made by the bidder to execute the work as per existing DGMS electrical safety regulation.

MIN 3 KVA UPS Supply with battery 1 hour of back up shall be provided by the bidder. NTPC shall not provide any infrastructure like room etc for UPS.

7.0.0.0 NETWORK INTERFACE AND WEIGHBRIDGE INTTERFACE:

NTPC shall provide internet leased line-based network near to weigh bridge, entry, exit points. This nearest point may be 20 m away in case of loading points, exit, entry points. All network cabling from nearest point to Bidder's equipment is in the bidder's scope. Bidder shall provide local sever/servers at site and centralized server at NTPC Coal mining HQ Ranchi or, at any other location as decided by owner. All the master data Modifications are to be done in the central data base only. If modifications are detected on central server, data has to synced with respective site's local server/servers. In case of disruption in network connection to central server (Database and image server), local server should be able to save the data locally and sync when network establishes A back up GSM based connectivity between local server and centralized server is in bidder's scope.

Weighbridges at sites are installed with load cells, digitizer, and PC. Weighbridge Controller envisaged under this package shall interface with existing Digitizer through RS-232 interface or another hardwired interface. Wherever Spare RS-232 interface is not available in digitizer, Bidder has to

provide suitable hardware for interfacing between existing digitizer and weighbridge controller envisaged under this package.

8.0.0.0 COMPREHENSIVE MAINTENENCE

The Contractor shall provide on site unlimited Comprehensive Maintenance for all the systems/ equipment/ devices and software provided as a part of Integrated coal management system for a period of three years (03) , from the date of successful commissioning of the complete system. All required hardware & software, software updates and running cost till Comprehensive Maintenance shall be in the scope of the Bidder. Those associated costs shall be included in the quoted price. SIM Card running cost /Internet connectivity charges (If applicable) till Three year Comprehensive Maintenance period shall be included in the quoted price.

Total 4 number of manpower shall be deployed across NTPC coal mining sites for Three year Comprehensive Maintenance period. Manpower deployment charges including boarding and lodging etc. during Comprehensive Maintenance period shall be included in quoted price by the bidder.

8.0.0.1 Replacement /Repairing of items during Comprehensive Maintenance period

If any item supplied fails during Three Year warranty period, it shall be repaired or replaced to the satisfaction of EIC. However, during repairing period, an alternate arrangement shall be provided. Vendor shall maintain sufficient spares at site for the same. If the item is beyond repairable it shall be replaced within 2 days with new one of same make of same or better specification as of original or of equivalent make as per approval of EIC.

For outside repair where bidder has to take material outside the site, Bidder shall provide alternate arrangement for the time being and bidder has to bear all the cost incurred due to transportation and rectification of material.

8.0.0.2 On site Manpower deployment during Comprehensive Maintenance

The bidder shall exclusively depute ONE skilled personnel (Resident Engineer) at site for the entire Comprehensive Maintenance period of Three years for providing comprehensive on site Comprehensive Maintenance services. The resident engineer (RE) posted at site should be engineering graduate or 3 year full time diploma with experience in maintenance/troubleshooting/repair of of network , boom barrier and other components of the system.

The vendor shall post qualified personnel to the approval of EIC. The vendor shall ensure that all necessary statutory clauses such as ESI, etc are covered for the staff engaged for this job .Vendor shall provide all type of PPEs & safety gadgets applicable for Mine area to its personnel deployed against this contract, at their

own expense before commencement of the job. Safety of the vendor's personnel shall be the responsibility of the vendor. Accommodation and transportation of the resident engineer is in the scope of the bidder.

Changes in manpower shall be intimated to EIC in written communication at least 10 days in advance & new manpower shall be posted only after approval of EIC .

Uptime of the all the items covered under this Contract should be more than95%.

Scope of work for person deployed during Comprehensive Maintenance will include as under but NOT limited to following:

1. Day to Day maintenance of System
2. Updating of data base
3. Technical Support to users
4. In case of any system crash, system is to be restored in working condition
5. Proper stock of spares for Regular maintenance.
6. Preventive and regular maintenance of System.
7. Follow up with OEM for Comprehensive Maintenance support

Any other job not specifically mentioned but reasonably implied to be executed for satisfactory completion of the job in all respects shall have to be carried without any extra cost. Decision of EIC shall be final and binding in all respect.

Working hours for deployed persons will be from 09:00AM to 06:00PM on all working days(excluding Sunday and holiday) . However Resident engineer may be called by EIC after working hour in case of emergency.

The Resident engineer shall not leave the site without prior permission of EIC. If the resident engineer has to proceed on leave for more than 4 days, an alternate engineer has to be deputed at site in the absence of Resident engineer.

8.0.0.3 **ANNUAL MAINTENANCE CONTRACT (AMC)**

After end of Three year Comprehensive Maintenance period, Coal Mining Project site may further place AMC as per site requirement.

9.0.0.0 **INTERFACE WITH EMPLOYER FURNISHED EQUIPMENT/ SYSTEMS**

The offered system should have an appropriate interface through which it can be integrated with SAP/ERP at the application level. Bidder shall provide API/SDK of it's offered system, If it is required for any interfacing during Comprehensive Maintenance Period.

10.0.0.0 OTHER SOFTWARE REQUIREMENTS

Security and Audit trails
The application should have message unicast/ multi cast/ broadcast facility to users for proper information dissemination.
The proposed solution should have facility to maintain audit log of changes carried out .
Should be able to export logs as a file OR syslog for analysis,supporting log file formats such as RAW, .CSV, etc.
All system generated reports should be compatible to be printed on industry standard printers.
The application should be configured such that the access to the customer information must support user level authentication and access rights.
The application should be configured to enforce role-based access based on users, groups, roles, etc. The application should beconfigured to setup users, groups, roles, and their permissions.
The application should be configured to manage and provide access control to different modules so that not all users should be able to access all the modules.
The application should be implemented to delegate some additional functionality at the user level, e.g.: change password functionalityshould be given to user.
Complete and comprehensive security from unauthorized access andmisuse should be available along with necessary audit trail detailing every user's activity.
The successful bidder shall get Application Security testing (vulnerability testing and penetration testing) done from CERT-In or CERT-In Empaneled agency.
Solution Capabilities
The Solution should have an appropriate interface through which it can be integrated with SAP/ERP at the application level.

Workflow should be an integral part of the solution and should interface with e-mail systems supporting SMTP and IMAP
The product/ solution should have the ability to generate report output directly in excel, PDF, text and XML
The system should have the ability to allow users to Select column, Apply filters and sort orders, apply Aggregate functions, Drill down / drill up for creating their own views or reports and charts with ease wherever necessary.
The future versions of the solution should support functionalities provided in the earlier versions
Ability to support remote operation of System administration
Client software for system users should be browser based or smart client based supporting Microsoft Internet Explorer/MozillaFirefox/Google Chrome.
System should provide APIs for interoperability of the product withother systems
The proposed solution should provide role-based user level configuration and administration facility must be available in the proposed system.
Configuration of workflow, dashboards & searches should be possible in the proposed solution.
User interface design should cover addition of fields, controls, tabs &grouping into flexible sets of functions on each form.
Web Portals
Must be able to extend capability to support secure (encrypted) accessto the portal over the Internet/Intranet
User Access and Security
User friendly GUI based user administration.
Ability to group the customer based on commodity.

Should support single sign-on and encrypt user password.
Ability to configure the number of permissible log-in attempts
Ability to configure automatic time out for entry transaction
Ability to configure automatic time out (log out) for user
Should maintain error log.
Password policies should be configurable in the proposed solution.
Scalability
The system should be scalable to allow increase in the number ofusers to at least 5 times the current number of users.
The proposed application & infrastructure should have ability to On-demand storage enhancement.
As per data retention policy the system should have provision of dataarchive.
Localization
The system should have adequate localization to handle specificrequirements of Indian Laws and regulations (Central and state), taxes and duties, and other regulations applicable.
Others
All software licenses (If required) to be used (e.g. Database license) shall be procured by the bidder in the name of NTPC Ltd cost of which should be included in application development.
All the software / tools, etc. used in the solution should be genuine and licensed.

11.0.0.0 WORK SCHEDULE

The contractor shall complete all the activities of the Integrated coal management system in fully operational condition and meeting all the requirements specified under various clauses of this specification within **five (5) months** from the date of award of this contract .After completion of successful

installation and commissioning of system the bidder has to maintain the system for Three year.

	Activity	Time Schedule
1	Zero Date	Date of award of LOA
2	Site Visit and finalization of BOQ	20 days from Zero Date
4	Proposed Network Architecture Submission and approval of EIC	30 days from Zero Date
5	Supply of material	60 days from Zero Date
6	Installation and commissioning, implementation entire system and Security Audit	150 days from Zero Date
7	Comprehensive Maintenance of the system for Three year after installation and commissioning of the system	3 year after installation and commissioning of the system.

12.0.0.0 TRAINING OPERATION & MAINTENANCE TRAINING

The bidder shall provide training for technical persons of owner about Operation and Maintenance of all supplied system free of cost . If required, course shall include hands on experience on a similar system.

13.0.0.0 INSTALLATION AND COMMISSIONING

Installation and commissioning of all equipment shall be done as per NTPC prevailing practices with safety measurements. Bidder shall coordinate with EIC for smooth erection and commissioning. After successful erection and commissioning, Bidder shall demonstrate the product to EIC and will submit the commissioning protocol. Based on EIC satisfaction, however the Comprehensive Maintenance clause will be prevailing after installation and commissioning of the system till Comprehensive Maintenance period..

14.0.0.0 PERFORMANCE GUARANTEE TEST AND SITE TRIAL

The Bidder during performance guarantee tests shall prove compliance of the equipment to performance parameters, specifications, service features etc. After successful completion of performance guarantee tests the equipment shall be on trial operation for 30 days during which period the availability figure of 99.9 % shall be established. In case the guaranteed availability figure of 99.9 % is not established during trial operations the contractor shall be given opportunity to rectify / replace the equipment so as to comply with the guaranteed Availability Figure with in the mutually agreed period failing which the owner reserves to reject the equipment .

In the event of rejection of the equipment, the contractor shall arrange to remove all his equipment from site after payment of all money received from the owner and all the other expenses incurred by the owner.
All cost for modifications including labor ,materials and the cost of additional testing to prove that the equipment meets the guarantees shall be borne by the bidder. Trial operation is a part of performance guarantee test.

15.0.0.0 PERFORMANCE BANK GURANTEE

The successful bidder has to submit Performance Bank Guarantee in the form of BG for 3% of the total PO value from any banks listed by NTPC against any manufacturing defects / poor workmanship / poor performance and incase of any deficiency are found during this period the same shall be repaired / rectified /replaced free of cost .The BG shall be valid for the Comprehensive Maintenance Period plus 3 months i.e. Three Years Comprehensive Maintenance + 3 Months for invocation from the date of acceptance of the Integrated Coal Management system after installation and commissioning at Coal Mining Project .

16.0.0.0 Liquidated Damages (LD)

The timely execution of the contract is the essence of the contract. In the event of vendor's failure to Installation, commissioning and implementation of entire system within the stipulated period of five months from award of PO(purchase order), the liquidated damages are payable by the vendor @ 0.5% (zero point five percent) per week of delay or part thereof on the quoted price(Excluding Comprehensive Maintenance price) . However, the total liability of the Vendor under this clause shall not exceed 10 % of the quoted price (Excluding Comprehensive Maintenance price) .

17.0.0.0 TECHNICAL SPECIFICATION

All the equipment offered shall be rugged in construction and suitable for high dust coal mining environment. Specification mentioned here are minimum only, Bidder to offer the equipment to meet the actual requirement. Offered weighbridge controller, access controller, display controller , network switches PC etc should be suitable to operate in NON Airconditioned environment .

17.0.0.1 Boom Barrier

1: The length of the Boom Barriers shall be finalized by the employer after award of contract to suit the site specific requirement .

2. In case of power failure or emergency situation the Boom Barrier shall remain closed unless envisaged otherwise as per the defined standard operating

procedures (SOPs). In such situations provision for manual control of the Boom Barrier with Push Button shall be available.
3: The Boom Barrier shall close either after the vehicle has passed or after the user definable open-wait time in case the vehicle chooses not to pass through.

Specification	**Remarks**
Power Supply	AC 220-240V
Power Frequency	50 Hz +/-10%
Electro-motor	DC brushless
Duty Cycle	100% suitable for intensive use
Opening closing Time	Less than 4s
Boom arm	SS 304 / Aluminium with suitable IP rating
Operating Temperature	-20°C to +55°C
Humidity	10% to 95% (Non-Condensing)
MCBF (Mean Cycles Between Failure)	1,000,000 or more
Communication	Relay Interface to connect with any Access Control or R.F. Identification Reader device.
Protection class	IP 55 or higher
Flashing light with Bracket	To be provided .
Certification	CE /UL Certified, EMC norms
Safety	Photo Cell Sensor or Loop Sensor

17.0.0.2 **Traffic Light**

Specification	**Remarks**
Power	12VDC
Rating	IP56 or higher
Power Consumption	Not more than 8W
Temperature	0 to 55 degree Celsius
Colour	Full Red, Full Green, Red Cross, & Full Yellow
Brightness	8500 MCD to 12000 MCD
Interface	Digital Output/ RS232/ RJ45 Ethernet Port

17.0.0.3 **High Definition PTZ camera (IP based)**

Specification	Remarks
Image Sensor	1/2.8-1/3" Progressive scan CMOS
Sensitivity(at 6dB)	color mode 0.6 lux , B/W mode 0.04lux @30IRE, F1.6)
Image Resolution	2 megapixel (1920 x 1080) HD resolution at 25/30 IPS
Lens	4.45-4.7 /89-94.0 mm focal length
Iris Range	F1.6-F2.9
Day & night	IR 50M
Day/Night selection	Auto On-Off
IR illuminator	The camera shall have a built-in active infrared illuminator. Bidder may offer such IR illuminator as separate hardware as well.
Optical zoom	20x better
Wide dynamic range	Yes
Horizontal Angle of view	55.4 deg(wide)- 3.5 deg (Tele) minimum
Backlight compensation	YES
Video compression	H.264 / MJPEG
Frame rate	30fps (1920 x 1080), 30fps (1920 x 1080)
Image settings	Saturation, brightness, contrast adjustable, Digital Zoom through client software
Alarm trigger	Motion detection, tampering alarm
Protocols	TCP, UDP, HTTP, HTTPS, DHCP, PPPoE, RTP, RTSP, IPv4, Ipv6, DNS,DDNS, NTP, ICMP, ARP, IGMP, SMTP, FTP, UpnP, SNMP, Bonjour
POE	Yes
Onboard Storage	Built-in Micro SD / SDHC / SDXC card slot, up to 64 GB
Vandal proof	Yes
Pan	360 360 Deg Continuous
Preset Pan Speed	280 deg/sec min
Preset Tilt Speed	160 deg/sec min

17.0.0.4 Bullet Camera (IP based)

Specification	Remarks
Image Sensor	Progressive scan CMOS
Min. illumination	Color: 0.1 lux at F2.0 (30 IRE, 2400°K); B/W: 0 lux (IR LED on)
Image Resolution	2 megapixel (1920 x 1080) HD resolution
Lens	Varifocal f2.8mm-12mm
Day & night	IR 50M
Wide dynamic range	Yes
Backlight compensation	YES
Video compression	H.264 / MJPEG
Frame rate	30fps (1920 x 1080), 30fps (1920 x 1080)
Image settings	Saturation, brightness, contrast adjustable, Digital Zoom through client software
Alarm trigger	Motion detection, tampering alarm
Protocols	TCP, UDP, HTTP, HTTPS, DHCP, PPPoE, RTP, RTSP, IPv4, Ipv6, DNS,DDNS, NTP, ICMP, ARP, IGMP, SMTP, FTP, UpnP, SNMP, Bonjour
POE	Yes
Onboard Storage	Built-in Micro SD / SDHC / SDXC card slot, up to 64 GB
Vandal proof	Yes

Note : All the outdoor cameras and accessories are to be housed in Weather Proof IP 66environmental housing made of aluminium and Sun shroud.

17.0.0.5 Long Range RFID Reader

Specification	Remarks
Reading Distance	8-10 Meters with Integrated Mounting holes
Operating Frequency	865 – 868 MHz or 900-928 Mhz as per EPC Gen 2 standards
Communication interface	: RJ45/ Serial port- RS232/ RS485/ Wiegand/ 12 pin screw terminal connector or any other interface as per system requirement
Network Protocol	should support DHCP, TCP/IP, DNS, SNMP, SNTP, IPV4, IPV6 or as per system requirement

IP Rating	IP67
Operating Temperature	-4 deg C to +55 deg C
Humidity	(non-condensing): should be able to work at 90% RH maximum.
Approval	CE & FCC. Suitable approval/license to be taken from WPC as applicable.
Features	• Interference elimination. • High data speed and anti-collision for multi tag reading • Advanced Anti-Jamming • RFID Reader should have built-in Antenna and should be compact. The system should work well in dirty, electrically noisy, and metallic environments
RF Antenna	• No polarization constraints. Capable of reading tags in any orientation. • Read range of 0-8 meters. • Built in Protection against lightning should be provided on antenna post of the RFID. • Rugged design to operate in dusty & metallic environment •
Mounting	Pole Material: GI Powdered coated / Mild steel . RFID reader may be mounted in any pole used for Bidder's equipment mounting .

17.0.0.6 **RFID Tags**

Specification	**Remarks**
Type	Passive Tags Write once Read Many Reading range 8 meter or better
Frequency	Compatible with offered Long range RFID reader
Data Transfer	At least 512 kbps

Rate	
Protocol	EPC Gen 2, ISO 18000-6C
Material	Plastic substrate with printed antenna
Tamper Proof RFID Label	Any attempt to rip or tamper label should result in disabling the functionality of the tags to ensure a unique one to one relationship between the tag

17.0.0.7 PDA (Personal Digital Assistant)

Specification	**Remarks**
Operating System	Android/windows
Display	WVGA LCD Display, Outdoor readable, trans missive, Gorilla glass
Touch panel	Capacitive touch
Battery	2500mAH or above
Storage	64 GB min
Expansion Slot	16 GB or above microSD slot
CPU	1.3 GHz Quad core processor
Memory	2 GB
Network Connections	USB 2.0 High Speed, WLAN,WWAN and Bluetooth,/GSM
IP Rating	IP65
Camera	To be provided
Operating Temperature	-20 to 55 degree C
Radio Frequency Band	Supports As per Indian standards
Software	As required + Application software to read QR code etc

17.0.0.8 Centralized Server (For Data base and Application Server)

Specification	**Remarks**

Operating System	Windows server 2019 Std Edition
Database	Sql server express licensed (Licensed in Name of NTPC)
Architecture	Intel
Form Factor	4U Rackable Tower
Processor	Up to 2x Intel Xeon Platinum processors, up to 125 W
Memory	Up to 1.5TB in 12x DIMM slots using 128GB DIMMs; 2666MHz TruDDR4
Ram Speed	3200
Optical Drive	DVD R+W
Expansion Slots	Up to 6x PCIe 3.0 (with 2x processors)
Drive Bays	Up to 16 SFF (including 4 NVMe) or 8 LFF bays, PLUS up to 4 SFF (in optical bay) & 2x internal M.2 boot
HBA/RAID Support	Software RAID (8x ports) std; opt. hardware RAID (up to 24x ports); up to 16-port HBAs
Network Interface	2x 1GbE ports std; optional 1GbE, 10GBASE-T, and 10Gb SFP+; 1x dedicated 1GbE management port

17.0.0.9 3KVA UPS with Battery1 hour full load backup

Specification	**Remarks**
Type	Online
Input Nominal Voltage	160 to 280 V AC
Power Factor	0.9
Output Voltage	230V AC +/- 5%, ,50Hz
Battery Type	Sealed Maintenance Free (SMF)
Total Efficiency	=>90%
Protection	Overload & short-circuit DC : Over voltage /under voltage
Environment: Temperature	: 0°C to 50°C
Cable of proper Size	To be supplied along with UPS for proper installation
Any other accessories (stand etc.)	Required for installation & proper operation of UPS to be Provided

18.0.0.0 **BILL OF MATERIAL**

S.No	Item	Quantity	Units of Measurement
1	Check Post Entry or Exit Points automation system hardware including installation ,Commissioning etc	18	set
2	Weighbridge automation system hardware including installation , Commissioning etc	28	set
3	Loading Points automation system hardware including installation, Commissioning etc	8	set
4	Software (As per the scope of work)	1	set
5	Site/local Servers	10	nos
6	Central GPS Tracking server	1	no.
7	Central servers for images	1	nos
8	Central servers for database including one backup server	2	nos
9	GPS vehicle tracking integration	1	set
10	Common Implementation at central server level	1	set
11	Implementation at site	4	set
12	CMC of hardware and software	3	set
13	Network cabling in meter	10000	Meters
14	4 Nos manpower for 3 years across all sites	3	years
15	4G modems	20	nos
16	4G modem running cost	20	nos
17	RFID cards to give access to temporary vehicles	500	nos
18	NVR for video Recording with 4 tb hard disk(32 channel)	10	Nos
19	PTZ IP camera including installation	10	Nos
20	Mobile Application	1	set
21	Miscellaneous items (Keyboards, mouse , switch boards, media converters for OFC and 6 no PC tables)	1	set

Check Post Entry or Exit Points automation system hardware including installation, commissioning etc : 1set

Sl no	Description	UoM	Quantity
1	Automatic Boom Barrier including Civil Works like foundation etc.	No	1
2	9U indoor server rack	No	1
3	Industrial Grade PoE Switch (16 ports Min)	No	1
4	Bullet Camera with Pole installation	No	2
5	FASTag Reader & antenna	No	1
6	Laser Printer	No	1
7	Display Screen , VOIP& speaker	No	1
8	Signal Light (Green/Red)	No	1
9	PVC pipe and cable for device fixing(2core,3core,4core,lan cable)	LPS	1
10	Boom Barrier and Traffic light signal Controller	No	1
11	UPS 3kva with Infrastructure for installation		1
12	PC at check POST	No	1

Any Other items for completeness of the system shall be in bidder's scope

Weighbridge Automation System hardware including installation, commissioning etc -1SET

Sl no	Description	UoM	Quantity
1	Automatic Boom Barrier including Civil Works like foundation etc.	No	1
2	9U indoor server rack	No	1
3	Industrial Grade PoE Switch (16 ports Min)	No	1
4	Positioning Sensors	Set	4
5	Bullet Camera including poles	No	4
6	FASTag Reader & antenna	No	1
7	Mic & Speaker System	No	1
8	Laser printer	No	1
9	Signal Light (Green/Red)	No	1
10	Unmanned Weighbridge Controller	Set	1
11	PVC pipe and cable for device fixing(2core,3core,4core,lan	LPS	1
12	UPS 3kva with Infrastructure for installation	No	1
13	PC , QR scanner for weighbridge	no	1

Any Other items for completeness of the system shall be in bidder's scope

Loading Points automation system hardware including installation, Commissioning etc (1set)

Sl no	Description	UoM	Quantity
1	Automatic Boom Barrier including Civil Works like foundation etc.	No	2
2	LED Display , display controller with Pillar including Civil Works like foundation etc. Display Size 8'*6'	No	1
3	Industrial Grade PoE Switch (16 ports min)	No	1
4	Bullet Camera in the poles	No	4
5	FASTag Reader & antenna	No	2
6	Signal Light (Green/Red)	No	2
7	PVC pipe and cable for device fixing(2core,3core,4core,lan cable)	LPS	1
8	Boom Barrier and Traffic light signal Controller	No	2
9	Ups 3kva with Infrastructure for installation	No	1
10	PID device for scanning QR code and WIFI	No	1

Any Other items for completeness of the system shall be in bidder's scope .

CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) – IP Based									
Attributes / Characteristics — Item Components / Sub System Assembly	Make, Model, Type, Rating, TC®	Dimension/constructional requirement®	Functional/operational check®	Switching capability and sequence®	No. of inputs/outputs, display®	Provision for connectivity with the LVS®	Pan range/speed, tilt/tilt speed®	Operational check from key board/control panel®	Commands from LAN Switch/Network Switch®
LAN Switch/Network Switch	Y		Y	Y	Y	Y			
Key boards	Y		Y						
Cameras	Y	Y	Y						
Lens	Y	Y	Y						
Camera Housing	Y	Y	Y						
Pan & Tilt unit	Y	Y	Y				Y		
Media Converter	Y		Y						
Monitor	Y	Y	Y						
Software	Y		Y						
Server, Work Station, Storage Device	Y		Y						
Complete System	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note : 1) This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure alongwith relevant supporting documents.

R –Routine Test Y -Test Applicable

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
1.00.00	**INTRODUCTION**
	This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in the Technical Specifications and the Technical Data Sheets.
2.00.00	**BRAND NAME**
	Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.
3.00.00	**BASE OFFER & ALTERNATE PROPOSALS**
	The Contractor's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice may also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.
4.00.00	**COMPLETENESS OF FACILITIES**
4.01.00	Contractors may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the Integrated coal management system shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered Integrated coal management system is provided.
4.02.00	All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.
5.00.00	**CODES & STANDARDS**

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
5.01.00	In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / Integrated coal management system / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following: (a.) Bureau of Indian Standards (BIS) (b.) Indian electricity act (c.) Indian electricity rules (d.) Indian Explosives Act (e.) Indian Factories Act and State Factories Act (f.) Indian Boiler Regulations (IBR) (g.) Regulations of the Central Pollution Control Board, India (h.) Regulations of the Ministry of Environment & Forest (MoEF), Government of India (i.) Pollution Control Regulations of Department of Environment, Government of India (j.) State Pollution Control Board. (k.) Rules for Electrical installation by Tariff Advisory Committee (TAC). (l.) Any other statutory codes / standards / regulations, as may be applicable.
5.02.00	Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply: (a.) Japanese Industrial Standards (JIS) (b.) American National Standards Institute (ANSI) (c.) American Society of Testing and Materials (ASTM) (d.) American Society of Mechanical Engineers (ASME) (e.) American Petroleum Institute (API) (f.) Standards of the Hydraulic Institute, U.S.A. (g.) International Organisation for Standardization (ISO)

	(h.) Tubular Exchanger Manufacturer's Association (TEMA) (i.) American Welding Society (AWS) (j.) National Electrical Manufacturers Association (NEMA) (k.) National Fire Protection Association (NFPA) (l.) International Electro-Technical Commission (IEC) (m.) Expansion Joint Manufacturers Association (EJMA) (n.) Heat Exchange Institute (HEI)
5.03.00	Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Contractor shall furnish, alongwith the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Contractor shall furnish specifically the variations and deviations from the standards mentioned else where in the specification together with the complete word to word translation of the standard that is normally not published in English.
5.04.00	As regards highly standardized equipments National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB etc shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.
5.05.00	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.
5.06.00	Two (2) English language copies of all-national and international codes and/or standards used in the design of the Integrated coal management system , equipment, civil and structural works shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.
5.07.00	In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.
6.00.00	**EQUIPMENT FUNCTIONAL GUARANTEE**
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given elsewhere in the technical specification. These guarantees shall supplement the

	general functional guarantee provisions covered under General Conditions of Contract.
6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.
7.00.00	**DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS**
7.01.00	**Design of Facilities**
	All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.
	The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.
7.02.00	**Maintenance and Availability Considerations**
	Equipment/facilities offered shall be designed for high availability, low maintenance and ease of maintenance. The Contractor shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Contractor shall also furnish details of availability records in the reference Integrated coal management system s stated in his experience list.
	Contractor shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the major equipment in the Integrated coal management system, clearly defining the spare parts and man-hour requirement for each stage.
	Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the contractor for handling of any equipment during erection and maintenance activities.
	Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.
8.00.00	**DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR**
8.01.00	Contractors may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the Integrated coal management system and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required ensuring a completely engineered Integrated coal management system

shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope.

Each main and auxiliary equipment/item of the Integrated coal management system including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheets etc. KKS tag number of the equipment/item/instrument etc. as applicable shall be indicated.

The Contractor shall furnish engineering data/drgs. in accordance with the schedule of information as specified in Technical Specification and data sheet.

8.02.00 The number of copies/prints/ CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I. Distribution schedule shall be informed to successful Contractor.

8.03.00 The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following :

8.03.01 **INSTRUCTION MANUALS**

The Contractor shall *make first submission o*f Instruction Manuals for all the equipments covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Employer the Instruction Manuals shall be submitted as indicated in Annexure-I. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.

(a.) Erection Manuals

The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

a) Erection strategy.

b) Sequence of erection.

c) Erection instructions.

d) Critical checks and permissible deviation/tolerances.

e) List of tool, tackles, heavy equipments like cranes, dozers, etc.

f) Bill of Materials

g) Procedure for erection.

h) General safety procedures to followed during erection/installation.

i) Procedure for initial checking after erection.

j) Procedure for testing and acceptance norms.

k) Procedure / Check list for pre-commissioning activities.

l) Procedure / Check list for commissioning of the system.

m) Safety precautions to be followed in electrical supply distribution during erection

(b.) Operation & Maintenance Manuals

The O&M manual shall have the following Chapters:

1 0 Integrated coal management system **Description**

(To contain the following sections specific to the equipment supplied).

1.1 Description of operating principle of equipment/ system with schematic drawings/layouts.

1.2 Functional description of associated accessories/ controls. Control interlock protection write-up.

1.3 Integrated operation of the equipment along with the intended system.

(This is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated equipment suppliers).

1.4 Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment along with its accessories and auxiliaries.

1.5 Design data against which the Integrated coal management system performance will be compared.

1.6 Master list of equipments, Technical specification of the equipment/ system and approved datasheet.

1.7 Identification system adopted for the various components (It will be of a simple, process linked tagging system).

1.8 Master list of drawings (as built drawings) (Drawings be enclosed in Separate volume).

2.0 Integrated coal management system Operations

(To contain the following sections specific to the equipment supplied) :-

2.1 Protection logic provided for the equipment along with brief philosophy behind the logic, drawings etc.

2.2 Limiting values of all protection settings.

2.3 Various settings of annunciation/ inleterlocks provided.

2.4 Start up and shut down procedure for equipment along with the associated systems in step by step mode.

2.5 Do's & don't on the equipments.

2.6 Safety precautions to be taken during normal operation. Emergency instructions on total power failure condition/ lubrication failure/ any other condition.

2.7 Parameters to be monitored with normal values and limiting values.

2.8 Equipment isolating procedures.

2.9 Trouble shooting with causes and remedial measures.

2.10 Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.

2.11 Routing operational checks. Recommended logs and records.

2.12 Changeover schedule if more than one auxiliary for the same purpose is given.

2.13 Preservation procedure on long shut down.

2.14 System/ Integrated coal management system commissioning procedure.

3.0 Integrated coal management system Maintenance

(To contain the following sections specific to the equipment supplied).

3.1 Exploded view of each of the equipments. Drawings along with bill of material including name, code number and population.

3.2 Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagrams to be given).

3.3 List of Special Tools and Tackles required for Trouble shooting including special testing equipment required for calibration etc.

3.4 Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. along with exploded views, Clearances to be maintained etc.

3.5 Preventive Maintenance schedules linked with running hours/ calendar period along with checks to be done.

3.6 Tolerances for fitment of various components.

3.7 Details of sub-vendors with their part no. in case of bought out items.

3.8 List of spare parts with their part no., total population, life expediency & their interchangeability with already supplied spares to NTPC. Storage & preservation procedure of spares.

3.9 List of mandatory and recommended spare parts list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.

3.10 Lead time required for ordering of spares from the equipment supplier.

3.14 (a) Instructions for Storage and preservation of spares.

3.11 General information on the equipment.

3.11.1 Modifications carried out in the equipment from its inception.

3.11.2 Equipment population in the country/ foreign country.

3.11.3 List of utilities where similar equipments have been supplied.

8.03.02 **Project Completion Report**

The Contractor shall submit a Project Completion Report at the time of handing over the Integrated coal management system .

8.03.03 **DRAWINGS**

(a.) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annxure-I . The soft copies shall be uploaded by the vendors in c-folders, a web based system of NTPC ERP, for which user name and password will be allotted to the new vendor by NTPC.

Similarly vendor can downloaded the drawing/documents, approved/commented by NTPC, through above site.

The soft copies of identified drawings/documents shall be in pdf format, whereas attachments/reply to the submitted document(s) can be in .doc, .xls,. dwg, or .std formats.

(b.) Final copies of the approved drawings along with the requisite number of hard copies shall be submitted as per Annexure-I.

(c.) All documents/text information shall be in latest version of MS Office.

(d.) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.

(e.) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

(f.) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful Contractor so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.

(g.) The Contractor shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Employer in line with engineering information flow schedule (to be tied up with successful Contractor). Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".

(h.) Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be *marked* "FOR APPROVAL" or "FOR INFORMATION" prior to submission.

Further space shall be identified on each drawing for approval stamp and electronic signature.

(i.) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect Integrated coal management system layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer / Project Manager

shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.

(j.) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.

(k.) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.

(l.) Any software used by the contractor shall be given to the project manager and concerned engineer of employer. The contractor shall make the engineer of the employer aware of the programme. Any computer aided programme shall be approved subject to giving entire detail to the project manager.

(m.) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.

(n.) All drawings shall be reviewed and approved by Engineering coordinator, including the following drawings / data which require specific approval.

1. Data sheets for various equipments / systems.
2. Field testing procedures for various equipment.
3. Pre commissioning / commissioning procedures
4. Guarantee test procedures (including model tests, if any).
5. Any other drawings that may be required by the Engineer from time to time.)

6. Data furnished in the bid shall be binding on the contractor even if superior to the technical specification requirement and any revision shall be done with the Employer's agreement.

(p.) Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorised and approval accorded in one of the following categories :

CATEGORY I Approved

CATEGORY II Approved subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments

CATEGORY III Not approved. Resubmit revised drawings for approval after incorporating comments/modification as noted.

CATEGORY IV For information and records.

(s.) Vendor shall resubmit the drawings approved under Category II and III within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number enclosed in a triangle (eg. 1, 2, 3 etc).

In case Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC 'EC' for consideration. In all such cases vendor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

It is responsibility of the Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

Vendor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the vendor shall resubmit the drawing identifying the changes for Employer's review and approval.

(t.) If Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing.

These comments will be taken care by the contractor while submitting the revised drawing.

(u.) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the

contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.

(v.) As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to “as built” conditions.

8.04.00 ENGINEERING INFORMATION SUBMISSION SCHEDULE

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule/ *Master Drawing List* shall be tied up with the Employer. For this, the Contractor shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

1. Information that shall be submitted for the approval of the Employer before proceeding further, and Information that would be submitted for Employer’s information only.

   Master Drawing List(MDL) shall be updated periodically and submitted to Employer, highlighting the change made in MDL.

The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.

8.05.00 ENGINEERING COORDINATION PROCEDURE

Identification of Principal Engineering Coordinators

8.05.01 The following principal coordinators will be identified by respective organisations at time of award of contract

EMPLOYER’S COORDINATORS

NTPC Engineering Coordinators (NTPC EC)

Name :

Designation :

Address :

a) Postal :

b) Telegraphic :

TELEX :

FAX : TELEPHONE :

NTPC SITE CO-ORDINATOR (NTPC SC)

Name :

Designation :

Address :

a) Postal :

b) Telegraphic :

TELEX :

FAX : TELEPHONE :

VENDOR ENGINEERING CO-ORDINATOR (VENDOR EC)

Name :

Designation :

Address :

a) Postal :

b) Telegraphic :

TELEX :

FAX : TELEPHONE :

8.05.02 All engineering correspondence shall be in the name of above coordinators on behalf of the respective organisations.

8.05.03 Vendors Drawings

(a) The contractor shall furnish, discuss and finalise with the Employer, the engineering information flow schedule at the time of award of the contract. The dates for submission of drawings as finalised in the above engineering schedule, shall be strictly adhered to. This is essential for the timely completion of the project.

(b) A detailed instrument list shall be furnished along with the tender. Further instrument/equipment in the Employer's format shall be submitted to the Engineering coordinator within 60 days from the date of award of the contract.

(c) In any case, in order to achieve the project completion dates, the contractor must strictly comply with engineering schedules.

(d) Final distribution copies of all approved drgs. (in Cat. I & IV) shall be submitted by the contractor to the Engineer within two (2) weeks of the approval.

(e) Copies of all approved drgs. (in cat. I & IV) shall be submitted incorporating all site modifications, if any, during construction, erection, commission stages and performance and guarantee testing (till its continuous operation) as 'As Built Drgs'.

(f) The contractor shall use a single transmittal for drgs. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom are all the copies being sent drg. numbers and titles, remarks or special notes if any etc.

(g) All manufacturing and fabrication work in connection with the equipments prior to the approval of the drg. shall be at contractors risks.

(h) Approval of contractor's drgs. or work by the Engineer shall not relieve the contractor of any of his responsibilities or liabilities under the contract.

8.05.04 **Erection/installation Drawings**

(a) Contractor shall furnish erection/installation drawings for the guidance of his/ Employer's site staff at least 4 weeks before scheduled commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawings, assembly, clearance, data requirements etc. The drawings shall contain details of components/ equipment with identification numbers, match marks, bills of materials, assembly procedures etc.

(b) For all major equipment apart from above details, assembly sequence and instructions with check lists shall be furnished in the form of erection manuals

8.06.00 ENGINEERING PROGRESS AND EXCEPTION REPORT

8.06.01 Report giving the status of each engineering information including

A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission Drawings which were not submitted as per agreed schedule.

8.06.02 The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.

8.07.00 TECHNICAL CO-ORDINATION MEETING

8.07.01 The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.

8.07.02	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.
8.07.03	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.
8.07.04	Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.
8.07.05	Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.
8.08.00	**DESIGN IMPROVEMENTS** The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.
8.09.00	**DELETED**
8.10.00	**DELETED**
8.11.00	**DELETED**
8.12.00	**DELETED**
8.13.00	**Material of Construction**
8.13.01	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.
8.14.00	**DELETED**

8.15.00 **TOOLS AND TACKLES**

The Contractor shall supply with the equipment one complete set of following special tools and tackles required for the erection, assembly, disassembly and proper maintenance of the Integrated coal management system and equipment and systems. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.

8.16.00 **Welding**

8.16.01 If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.

8.17.00 **DELETED**

8.18.00 **DELETED**

9.00.00 **QUALITY ASSURANCE PROGRAMME**

9.01.00 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001.A quality assurance programme of the contractor shall generally cover the following:

a). His organisation structure for the management and implementation of the proposed quality assurance programme

b). Quality System Manual

c). Design Control System

d). Documentation and Data Control System

e). Qualification data for Contractor's key personnel.

f). The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

g). Control of non-conforming items and system for corrective actions and resolution of deviations.

h). Inspection and test procedure both for manufacture and field activities.

i). Control of calibration and testing of measuring testing equipment.

j). System for Quality Audits.

k). System for identification and appraisal of inspection status.

l). System for authorising release of manufactured product to the Employer.

m). System for handling, storage and delivery.

n). System for maintenance of records, and

(p) Quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

9.02.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

9.02.01 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Contractor and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award. Monthly progress reports on MQP/FQP submission/approval shall be furnished on enclosed format No. QS-01-QAI-P-02/F1

9.02.02 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through c-folder, a Web based system of NTPC ERP in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

9.02.03	Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site.
9.02.04	The Contractor shall also furnish copies of the reference documents/Integrated coal management system standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.
9.02.05	No material shall be despatched from the manufacturer's works before the same is accepted by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate(MDCC) / CHP Clearance. (a) The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The sub-vendors name which are not in NTPC provided list shall be deemed to be considered in DR category.relieve the contractor from any obligation, duty or responsibility under the contract. (b) NTPC follows a well defined sub-contractor's/sub-vendor assessment and approval process, the broad contours of which are also defined at NTPC website www.ntpctender.com alongwith a FAQ which answers most of the queries on the subject. (c) An indicative list of sub-vendors which has been accepted by NTPC in the past for Corporate Awarded similar packages based on the respective Technical Specifications are enclosed in the tender specification for reference purpose only. The purpose of this list is to provide general guidance to the prospective Bidders / Main Contractors for this package only. Further, this list is indicative in nature and may undergo revision for future packages based on the performance feedback received from NTPC sites / other agencies about the supplier / sub vendors / supplied material. However, it is not the intention to limit the sub-vendor to only such names appearing in the above list and Main contractor is free to propose additional sub-vendors in his bid offer which will be subject to NTPC sub-vendor assessment system upon receipt of requisite details in a time bound mutually agreed schedule. . Moreover listed suppliers may or may not be able to supply the material as per current Tech Specifications for the present package. Bidder is

	required to enquire before finalizing the suppliers / sub vendors for the present contract to meet provisions of the current Tech Specs. (d) The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors and shall be submitted to the Employer for approval within a time bound schedule drawn during detailed engineering process. Such sub-vendor proposed in his bid offer shall be deemed to be identified in DR category and upon final acceptance by NTPC in writing, contractor can place order on such accepted sub-vendor only. (e) Monthly progress reports on sub-contractor detail submission / approval shall be furnished as per Engineering Co-ordination Procedure. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract. Sub-vendor whose details are not submitted within the agreed cut-off date, shall be deemed to be withdrawn by the contractor.
9.02.06	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. With in three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract. **
9.02.07	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.
9.02.08	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.
9.02.09	Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in

	service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
9.02.10	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
9.02.11	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.
9.02.12	**Environmental Stress Screening** Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be furnished for owner acceptance
9.02.24	The Contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site to effectively implement the field quality plan (FQP) requirement for site activities. The contractor shall submit the details of proposed FQA set-up (Organization set up & manpower) depending upon the scope of work involved for Employer's approval. The FQA set up shall be in place at least one month before the start of site activities.
9.02.25	**Software Reliability / Quality Certification** Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β-version and offered software is also free from all known bugs as on date of approval of systems documents by THDC as a part of quality documentation review and approval process during detail engineering.
9.03.00	**QA DOCUMENTATION PACKAGE** The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (?) mark.
9.03.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing. The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.
9.03.02	Typical contents of QA Documentation is as below:- a). Quality Plan

b). Material mill test reports on components as specified by the specification and approved Quality Plans.

c). Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

d). All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).

e). CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.

f). Certificate of Conformance (COC) wherever applicable.

g). MDCC

9.03.03 Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

9.03.04 Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.

9.03.05 **TRANSMISSION OF QA DOCUMENTATION**

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.

9.04.00 Project Manager's Supervision

9.04.01 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC of Vol. I, the Contractor shall proceed to comply with the Project Manager's decision.

9.04.02 The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

a). Interpretation of all the terms and conditions of these documents and specifications:

b). Review and interpretation of all the Contractor's drawing, engineering data, etc:

c). Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract :

d). Inspect, accept or reject any equipment, material and work under the contract:

e). Issue certificate of acceptance and/or progressive payment and final payment certificates

f). Review and suggest modifications and improvement in completion schedules from time to time, and

g). Supervise Quality Assurance Programme implementation at all stages of the works.

9.05.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

9.05.01 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

9.05.02 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to

	inspect as if the works were manufactured or assembled on the Contractor's own premises or works.
9.05.03	The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.
9.05.04	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect ten (10) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within ten (10) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Failure on the part of Project Manager / Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract
9.05.05	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.
9.05.06	In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.
9.05.07	The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.
9.05.08	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold

	Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.
9.05.09	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.
9.06.00	**ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME:**
9.06.01	Subcontractor approval Schedule Status / Exception Format No.:QS-01-QAI-P-02/F1-R2
9.06.02	Quality Plan Schedule Status/ Exception Format No.: QS-01-QAI-P-02/F2-R2
9.06.03	DELETED
9.06.04	Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R1
9.06.05	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1
9.06.06	The above format are enclosed as Annexure-III to VI.
10.00.00	**PRE-COMMISSIONING AND COMMISSIONING FACILITIES**
	a). As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included elsewhere in the Technical Specifications.
	b). The Contractor's pre-commissioning/ commissioning specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete Integrated coal management system .
	c). The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
	d). The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning

Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] approved by the Employer.

e). On completion of all pre commissioning activities / tests and as a part of commissioning the complete facilities shall be put on 'Trial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests

(f.) The Trial Operation shall be considered successful, provided that each item/part of the facility can operate continuously at the specified operating characteristics, for the period of Trial Operation with all operating parameters within the specified limits and at or near the predicted performance of facility/equipment. Period of trial operation shall as per OEM recommendation

(g.) A Trial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Trial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during trial operation shall also include the dates of start and finish of the Trial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Trial Operation. Based on the observations, necessary modifications/repairs to the Integrated coal management system shall be carried out by the Contractor to the full satisfaction of the Project Manager to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission

(h.) Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain

(1.) Experience of the Commissioning Engineers.

(2.) Role and responsibilities of the Commissioning Organisation members.

(3.) Expected duration of posting of the above Commissioning Engineers at site.

10.01.00 Guarantee Tests

(a) The final tests as to the guarantees shall be conducted at Site, by the Contractor. The Contractor's Commissioning Engineers shall make the unit ready for such tests. Such test will be commenced, within a period of three (3) months after the successful completion of Trial Operation. Any extension of time beyond the above three months shall be subject to Employer's approval.

(b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the performance guarantee.

(c) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.

(d) The guarantee figures and design/performance parameters of the equipment shall be proved by the Contractor during theswe Guarantee Tests/ and or during the 'Trial operation' as detailed out elsewhere. Should the results of these tests show any deterioration from the guaranteed values, the Contractor shall modify the equipment as required to enable it to meet the guarantees. In such case, the Guarantee Tests shall be repeated and all cost for modifications including labour, materials and the cost of additional testing to prove that the equipment meets the guarantees, shall be borne by the Contractor.

(e) The specific tests to be conducted on equipment have been brought out in the technical specification.

10.02.00 **DELETED**

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11.00.00 **TAKING OVER**

Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be with held nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

12.00.00 **TRAINING OF EMPLOYER'S PERSONNEL**

12.01.00 The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering a suitable training module. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, Integrated coal management system visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc.

12.02.00 Contractor shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Employer's approval.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
12.03.00	Exact details, extent of training and the training schedule shall be finalised based on the Contractor's proposal within two (2) months from placement of award.
12.04.00	In all the above cases, wherever the training of Employer's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Employer's personnel shall be at the cost of Contractor.
12.05.00	Take off price (product wise) should be indicated by the bidder in the Bid proposal sheets. Employer reserve the right to include or exclude these item(s) during placement of Award.
13.00.00	**SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION** In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover: a). Working platforms should be fenced and shall have means of access. b). Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.
14.00.00	**NOISE LEVEL** The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment / machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA.
15.00.00	**PACKAGING AND TRANSPORTATION** All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & pre-assembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.
16.00.00	**ELECTRICAL ENCLOSURE** All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specification,

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS
17.00.00	**INSTRUMENTATION AND CONTROL**
	All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.
17.01.00	All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plug-in connection at rear.
17.02.00	All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.
18.00.00	**ELECTRICAL NOISE CONTROL**
	The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-801- 2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems.
19.00.00	**DELETED**
20.00.00	**DELETED**
21.00.00	**ELECTRONIC MODULE/COMPONENT DETAILS**
	The Contractor shall have to furnish all technical details including circuit diagrams, specifications of components, etc., in respect of each and every electronic card/module as employed on the various solid state as well as microprocessor based systems and equipment including conventional instruments, peripherals etc. It is mandatory for the Contractor to identify clearly the custom built ICs used in the package. The Contractor shall also furnish the details of any equivalents of the same.
22.00.00	**JUNCTION BOXES**
	The junction boxes shall be made of minimum 2 mm thick sheet steel. Gland plates shall be removable type and made of 3 mm thick sheet steel. The boxes shall be provided with detachable cover or hinged door with captive screws. Top of the box shall be arranged to slope towards the rear of the box. The box shall be hot dip galvanized and shall be provided with suitable neoprene gaskets to achieve degree of protection of IP-55 as per IS: 2147. Adequate spacing shall be provided to terminate the external cables. The boxes shall be suitable for mounting on various types of steel structures. The terminal blocks provided shall be of 650 V grade, rated

	for 10 A for control cables. Suitable numbering for terminal blocks shall be done. In case of junction box for power cable, the box shall be rated for maximum current carrying capacity. Terminal blocks shall be of one piece, klippon RSF-1 or ELMEX CSLT-1 type with insulating barriers.
23.00.00	**DELETED**
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ANNEXURE-I

S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS	NO. OF CD-ROMs
1.	Integrated coal management system DEFINITION MANUAL	2 sets	4 CD-ROMs
2.	Drawings "FOR APPROVAL"		
	(i) Lay out Drawings/ Schemes	6	2CD-ROMs
	(ii) Other Drawings	2	2 CD-ROMs
3.	Drawings "FOR INFORMATION"	2	2 CD-ROMs
4.	Drawings "FINAL DRAWING"	15	4 CD-ROMs
5.	Drawings "AS BUILT "	15	4 CD-ROMs
6.	DATASHEETS,DESIGN CALCULATIONS, PURCHASE SPECIFICATIONS, etc and other type of documents		
	i) For Approval	2	2 CD-ROMs
	ii) FINAL	15	4CD-ROMs
	iii) Analysis reports of equipments/ systems employing software packages as detailed in the specifications	2	2 CD-ROMs
7.	Erection/installation manual "1st Submission"	4 Sets	2 CD-ROMs
8.	Erection/installation manual "FINAL"		3CD ROMS
9.	Operation & Maintenance manual "1st Submission"	4 sets	2 CD-ROMs
10.	Operation & Maintenance manual "FINAL"	4 sets	4CD ROMS
11.	Integrated coal management system Hand Book "1st Submission"	4 sets	2 CD-ROMs
12.	Integrated coal management system Book "FINAL"	4 sets	4CD ROMS
13.	Commissioning and Performance	4 sets	2 CD-ROMs

	Procedure manual "1st Submission"		
14.	Commissioning and Performance Procedure manual "FINAL"	4 sets	2 CD-ROMs
15.	Performance and Functional GURANTEES TEST REPORT	4 sets	4CD ROMS
16.	Project completion report	15	4CD ROMS
17.	QA programme including organization for implementation and QA system manual(with revision-servicing)	1	1 CD-ROMs
18.	Vendor details in respect of proposed vendors including contractor's evaluation report.	1	1 CD-ROMs
19.	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, PQR etc.		
	i) For review/comment	2	2 CD-ROMs
	(ii) For final approval	2	2 CD-ROMs
20.	Storage & preservation manuals		
	1st Submission	4 sets	2 CD-ROMs
	Final	4 sets	4CD-ROMs
21.	QA Documentation Package for items / equipment manufactured and dispatched to site	2 sets	4CD ROMS
22.	QA Documentation Package for field activities on equipment / systems at site	2 sets	4CD ROMS

Annexure-II

	Project : **Stage :** **Package :** **Supplier :** **Contractor No. :**	**LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL** **SUB-SYSTEM :**	**DOC. NO.:** **REV. NO.:** **DATE :** **PAGE : OF**

S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list alongwith the condition of approval, if any.

DR – For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED.'

2. **QP/INSPN CATEGORY**:

CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

Annexure-III

	Project : Stage :: Package : Contractor : Contractor No. :	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL	DOC. NO.: REV. NO.: DATE : PAGE : OF

S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-missio n	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approva l Status	Sub-supplier detail submission schedule	Remarks

FORMAT NO.: QS-01-QAI-P-02/F2-R2 1/1 Engg. Div. / QA&I

Annexure-V

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN	PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : *SUB-SYSTEM:*	QP NO.: REV.NO.: DATE: PAGE: …. OF….

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE Norms	Format of Record					REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.		11.

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER, **N**: NTPC **P:** PERFORM **W**: WITNESS AND **V:** VERIFICATION. AS APPROPRIATE, **CHP:** NTPC SHALL IDENTIFIED IN COLUM "N" AS ' W"

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	FOR NTPC USE	DOC. NO.: REV…… CAT…..		
SIGNATURE			REVIEWED BY	APPROVED BY	APPROVAL SEAL

Format No.: QS-01-QAI-P-09/F1-r1 1/1 Engg. Div./QA&I

Annexure-VI

MFGR.'s LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV.NO.:	CONTRACT NO. :
		SUB-SYSTEM :	DATE:	MAIN-SUPPLIER:
			PAGE: …. OF….	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR;

'A' SHALL BE WITNESSED BY NTPC FQA, **'B'** SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND **'C'** SHALL BE WITNESSED BY ERECTION SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	FOR NTPC USE
SIGNATURE		

DOC. NO.: REV……		
REVIEWED BY	APPROVED BY	APPROVAL SEAL

Format No.: QS-01-QAI-P-09/F2-r1 1/1

Engg. Div./QA&I

ERECTION CONDITIONS OF CONTRACT

1.00.00 GENERAL

1.01.00 The following provisions shall supplement the conditions already contained in the other parts of these specifications and documents and **shall govern that portion of the work of this contract which is to be performed at site.** The erection requirements and procedures not specified in these documents shall be in accordance with the recommendations of the equipment manufacturer, or as mutually agreed to between the Employer and the Contractor prior to commencement of erection work.

1.02.00 The Contractor upon signing of the Contract shall, in addition to a Project Co-ordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and co-ordination of the Works to be performed at Site. Such a person shall function from the Site office of the Contractor during the pendency of Contract.

2.00.00 REGULATION OF LOCAL AUTHORITIES AND STATUTES

2.01.00 In addition to the local laws and regulations, the Contractor shall also comply with the Minimum Wages Act and the Payment of Wages Act (both of the Government of India) and the rules made there under in respect of its labour and the labour of its sub-contractors currently employed on or connected with the contract.

2.02.00 All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully payable to any other statutory laws and its amendments from time to time during erection in respect of the plant/system equipment ultimately to be owned by the Employer, shall be to the account of the Employer. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor or his Sub-Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor.

3.00.00 CODE REQUIREMENTS

The erection requirements and procedures to be followed during the installation of the equipment shall be in accordance with the relevant codes and accepted good practices, the Employer's Drawings and other applicable Indian recognised codes and laws and regulations of the Government of India.

4.00.00 ELECTRICAL SAFETY REGULATIONS

4.01.00 In no circumstances will the Contractor interfere with fuses and electrical equipment belonging to the other Contractor or Employer.

4.02.00 Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contractor or Employer, he shall:

(a.) Satisfy the Employer that the appliance is in good working condition;

(b.) Inform the Employer of the maximum current rating, voltage and phases of the appliances;

(c.) Obtain permission of the Employer detailing the socket to which the appliances may be connected.

The Employer will not grant permission to connect until he is satisfied that

(a) The appliance is in good condition and is fitted with a suitable plug.

(b) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

4.03.00 No electric cable in use by the other Contractor/ Employer will be disturbed without permission. No weight of any description will be imposed on any such cable and ladder or similar equipment will rest against or be attached to it.

4.04.00 No repair work shall be carried out on any live equipment. The equipment must be declared safe by the Employer and a permit to work issued before any work is carried out.

4.05.00 The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.

5.00.00 REMOVAL OF MATERIAL

No material brought to the Site shall be removed from the Site by the Contractor and/or his Sub-Contractors without the prior written approval of the Employer.

6.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

The provisions of the clause entitled Inspection, Testing and Inspection Certificates given in Part - C of the Technical Specification, shall also be applicable to the erection portion of the Works. The Employer shall have the right to re-inspect any equipment though previously inspected and approved by him at the Contractor's works, before and after the same are erected at Site. If by the above inspection, the Employer rejects any equipment, the Contractor shall make good for such rejections either by replacement or modification/ repairs as may be necessary to the satisfaction of the Employer. Such replacements will also include the replacements or re-execution of such of those works of other Contractors and/or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor's work.

7.00.00 ACCESS TO SITE AND WORKS ON SITE

7.01.00 Suitable access to site and permission to work at the Site shall be accorded to the Contractor by the Employer in reasonable time.

7.02.00 In the execution of the Works, no person other than the Contractor or his duly appointed representative, Sub-Contractor and workmen, shall be allowed to do work on the Site, except by the special permission, in writing by the Employer or his representative.

8.00.00 CONTRACTOR'S SITE OFFICE ESTABLISHMENT

The Contractor shall establish a Office at the Site and keep posted an authorised representative for the purpose of the Contract. Any written order or instruction of the Employer or his duly authorised representative shall be communicated to the said authorised resident representative of the Contractor and the same shall be deemed to have been communicated to the Contractor at his legal address.

9.00.00 CO-OPERATION WITH OTHER CONTRACTORS

9.01.00 The Contractor shall co-operate with all other Contractors or tradesmen of the Employer, who may be performing other works on behalf of the Employer and the workmen who may be employed by the Employer and doing work in the vicinity of the works under the Contract. The Contractor shall also arrange to perform his work as to minimise, to the maximum extent possible, interference with the work of other Contracts and their workmen. Any injury or damage that may be sustained by the employees of the other Contractors and the Employer, due to the Contractor's work shall promptly be made good at his own expense. The Employer shall determine the resolution of any difference or conflict that may arise between the Contractor and other Contractors or between the Contractor and the workmen of the Employer in regard to their work. If the work of the Contractor is delayed because of the any acts of omission of another Contractor, the Contractor shall have no claim against the Employer on that account other than an extension of time for completing his works.
Employer shall have full access to visit the contractor's site at any time for inspection and surveillance checks.

9.02.00 The Employer shall be notified promptly by the Contractor of any defects in the other Contractor's works that could affect the Contractor's Works. The Employer shall determine the corrective measures if any, required to rectify this situation after inspection of the works and such decisions by the Employer shall be binding on the Contractor.

10.00.00 DISCIPLINE OF WORKMEN

The Contractor shall adhere to the disciplinary procedure set by the Employer in respect of his employees and workmen at Site. The Employer shall be at liberty to object to the presence of any representative or employee of the Contractor at the Site, if in the opinion of the Employer such employee has misconducted himself or is incompetent, negligent or otherwise undesirable then the Contractor shall remove such a person objected to and provide in his place a competent replacement.

11.00.00 CONTRACTOR'S FIELD OPERATION

11.01.00 The Contractor shall keep the Employer informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the Employer shall not relieve the Contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Employer or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant/system and equipment and his erection methods.

11.02.00 The Contractor shall have the complete responsibility for the conditions of the Work-Site including the safety of all persons employed by him or his Sub-Contractor and all the properties under his custody during the performance of the work. This

	requirement shall apply continuously till the completion of the Contract and shall not be limited to normal working hours. The construction review by the Employer is not intended to include review of Contractor's safety measures in, on or near the Work-Site, and their adequacy or otherwise.
12.00.00	**PHOTOGRAPHS AND PROGRESS REPORT**
12.01.00	The Contractor shall furnish three (3) prints each to the Employer of progress photographs of the work done at Site. Photographs shall be taken as and when indicated by the Employer or his representative. Photographs shall be adequate in size and number to indicate various stages of erection. Each photograph shall contain the date, the name of the Contractor and the title of the photograph.
12.02.00	The above photographs shall accompany the monthly progress report detailing out the progress achieved on all erection activities as compared to the schedules. The report shall also indicate the reasons for the variance between the scheduled and actual progress and the action proposed for corrective measures, wherever necessary.
12.03.00	The Contractor shall submit the progress of work in video cassettes (2 copies) quarterly highlighting the progress and constraints at site.
13.00.00	**MAN-POWER REPORT**
13.01.00	The Contractor shall submit to the Employer, on the first day of every month, a man hour schedule for the month, detailing the man hours scheduled for the month, skill-wise and area-wise.
13.02.00	The Contractor shall also submit to the Employer on the first day of every month, a man power report of the previous month detailing the number of persons scheduled to have been employed and actually employed, skill- wise and the areas of employment of such labour.
14.00.00	**PROTECTION OF WORK**
	The Contractor shall have total responsibility for protecting his works till it is finally taken over by the Employer. No claim will be entertained by the Employer or the representative of the Employer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings. Should any such damage to the Contractor's Works occur because of other party not being under his supervision or control, the Contractor shall make his claim directly with the party concerned. If disagreement or conflict or dispute develops between the Contractor and the other party or parties concerned regarding the responsibility for damage to the Contractor's Works the same shall be resolved as per the provisions of the as specified at clause no 20.00.00- of this chapter entitled "Co-operation with other Contractors." The Contractor shall not cause any delay in the repair of such damaged Works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.
15.00.00	**EMPLOYMENT OF LABOUR**

15.01.00	In addition to all local laws and regulations pertaining to the employment of labour to be complied with by the Contractor pursuant to GCC, the Contractor will be expected to employ on the work only his regular skilled employees with experience of the particular work. No female labour shall be employed after darkness. No person below the age of eighteen years shall be employed.
15.02.00	All travelling expenses including provisions of all necessary transport to and from Site, lodging allowances and other payments to the Contractor's employees shall be the sole responsibility of the Contractor.
15.03.00	The hours of work on the Site shall be decided by the Employer and the Contractor shall adhere to it. Working hours will normally be eight (8) hours per day - Monday through Saturday.
15.04.00	Contractor's employees shall wear identification badges while on work at Site.
15.05.00	In case the Employer becomes liable to pay any wages or dues to the labour or any Government agency under any of the provisions of the Minimum Wages Act, Workmen Compensation Act, Contact Labour Regulation Abolition Act or any other law due to act of omission of the Contractor, the Employer may make such payments and shall recover the same from the Contractor's Bills.
16.00.00	**FACILITIES TO BE PROVIDED BY THE EMPLOYER**
16.01.00	**Space** The Contractor himself shall arrange the space required for construction of his office, storage area, pre-assembly and fabrication areas, labour and staff colony area, toilets, etc. as well for his Sub-Contractor's use at his own cost.
16.02.00	**Electricity** Construction power required for construction/erection activities of the system shall be arranged by the bidder at his own cost. However, for commissioning of the system NTPC shall provide the required power.
16.03.00	**Water** Contractor shall make all arrangements himself for the supply of construction water as well as potable water for labour and other personnel at the worksite/colony.
16.04.00	**Communication** The Employer will extend the telephone facilities, if available at Site, for purposes of Contract. The Contractor shall be charged at actuals for such facilities.
17.00.00	**FACILITIES TO BE PROVIDED BY THE CONTRACTOR**
17.01.00	**Contractor's site office Establishment**

The Contractor shall establish a site office at the site and keep posted an authorized representative for the purpose of the contract, pursuant to GCC.

17.02.00 Tools, tackles and scaffoldings

The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, installation, testing, commissioning and conducting Guarantee tests of the equipments covered under the Contract. He shall submit a list of all such materials to the Employer before the commencement of pre-assembly at Site. These tools and tackles shall not be removed from the Site without the written permission of the Employer. The Contractor shall arrange Dozer, Hydra, Cranes, Trailer, etc. for the purpose of fabrication, erection and commissioning.

17.03.00 Testing Equipment and Facilities:

The contractor shall provide the necessary testing, equipment and facilities.

17.04.00 Site laboratory for civil works:

Contractor shall provide and maintain a site laboratory for the testing of construction material under the direction and general supervision of employer.

17.05.00 First-aid

17.05.01 The Contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site. Enough number of Contractor's personnel shall be trained in administering first-aid.

17.05.02 The Employer will provide the Contractor, in case of any emergency, the services of an ambulance for transportation to the nearest hospital.

17.06.00 Cleanliness

17.06.01 The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of Contract. The Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by the Employer. Materials and stores shall be so arranged to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.

17.06.02 Similarly the labour colony, the offices and the residential areas of the Contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of the Employer. Proper sanitary arrangements shall be provided by the Contractor, in the work-areas, office and residential areas of the Contractor.

18.00.00 LINES AND GRADES

All the Works shall be performed to the lines, grades and elevations indicated on the drawings. The Contractor shall be responsible to locate and layout the Works. Basic horizontal and vertical control points will be established and marked by the

Employer at Site at suitable points. These points shall be used as datum for the works under the Contract. The Contractor shall inform the Employer well in advance of the times and places at which he wishes to do work in the area allotted to him so that suitable datum points may be established and checked by the Employer to enable the Contractor to proceed with his works. Any work done without being properly located may be removed and/or dismantled by the Employer at Contractor's expense.

19.00.00 FIRE PROTECTION

19.01.00 The work procedures that are to be used during the erection shall be those which minimise fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the Site at least once each day. Fuels, oils and volatile or flammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Untreated canvas, paper, plastic or other flammable flexible materials shall not at all be used at Site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the Site, the same shall be removed and replaced with acceptable material before moving into the construction or storage area.

19.02.00 Similarly corrugated paper fabricated cartons etc. will not be permitted in the construction area either for storage or for handling of materials. All such materials used shall be of water proof and flame resistant type. All the other materials such as working drawings, plans etc. which are combustible but are essential for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.

19.03.00 All the Contractor's supervisory personnel and sufficient number of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the Contract.

19.04.00 The Contractor shall provide enough fire protection equipment of the types and number for the warehouses, office, temporary structures, labour colony area etc. Access to such fire protection equipment, shall be easy and kept open at all time.

20.00.00 SECURITY

The Contractor shall have total responsibility for all equipment and materials in his custody stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss. All materials of the Contractor shall enter and leave the Employer Site only with the written permission of the Employer in the prescribed manner.

21.00.00 CONTRACTOR'S AREA LIMITS

The Employer will mark-out the boundary limits of access roads, parking spaces, storage and construction areas for the Contractor and the Contractor shall not trespass the areas not so marked out for him. The Contractor shall be responsible to ensure that none of his personnel move out of the areas marked out for his operations. In case of such a need for the Contactor's personnel to work out of the

areas marked out for him the same shall be done only with the written permission of the Employer.

22.00.00 CONTRACTOR'S CO-OPERATION WITH THE EMPLOYER

In case where the performance of the erection work by the Contractor affects the operation of the system facilities of the Employer, such erection work of the Contractor shall be scheduled to be performed only in the manner stipulated by the Employer and the same shall be acceptable at all times to the Contractor. The Employer may impose such restrictions on the facilities provided to the Contractor such as electricity, etc. as he may think fit in the interest of the Employer and the Contractor shall strictly adhere to such restrictions and co-operate with the Employer. It will be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems which are erected by him. The Contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment furnished and installed by him, so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in documents and specifications.

23.00.00 PRE-COMMISSIONING AND COMMISSIONING ACTIVITIES

23.01.00 GENERAL

23.01.01 The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the equipment/systems ready for safe, reliable and efficient operation on sustained basis. All pre-commissioning/commissioning activities considered essential for such readiness of the equipment/systems including those mutually agreed and included in the Contractor's quality assurance programme as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the contractor.

23.01.02 The pre-commissioning and commissioning activities including Guarantee tests, checks and trial operations of the equipment/systems furnished and installed by the contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at site during such operations.

23.01.03 The following activities shall be carried out by the contractor, prior to schedule date of commissioning of the equipment/systems installed by him.

(a.) The contractor shall furnish the organization chart of his operation and commissioning engineers for the acceptance of employer. Adequate number of operation and commissioning engineers shall be deployed by the contractor to effectively meet the requirement of round the clock operation in shifts also, till the plant/system is taken over by the employer.

(b.) The contractor shall submit the bio-data containing the details of experience of his operation and commissioning engineers for the acceptance of employer.

(c.) The contractor shall furnish the deployment schedule of his operation and commissioning engineers for the acceptance of the employer.

(1.) Apart from above, contractor shall ensure deployment of sufficient skilled/semi-skilled/unskilled manpower during pre-commissioning and commissioning activities.

23.01.04 It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment/systems which are installed by him.

23.01.05 The Contractor shall also be responsible for flushing and initial filling of all oils and lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications and documents.

23.02.00 COMMISSIONING DOCUMENTATION

23.02.01 The contractor shall submit the commissioning documentation, comprising of Standard checklists, pre-commissioning procedures, testing schedules, commissioning schedules and commissioning networks for various equipment/systems covered under the contract, for the approval of employer.

23.02.02 Standard checklist, as the name suggests, shall be a fairly general documents, containing the list of all checks required to be carried out for similar and repetitive type of equipment to ensure consistent and thorough checking. An indicative list of such equipment is enclosed as Annexure I.

23.02.03 The testing schedule is a document, designed for safe and systematic commissioning of individual equipment/sub-system Commissioning schedule is a document envisaged for commissioning of a system The testing/Commissioning schedule shall have a standard format in order to maintain consistency of presentation, content and reporting. A brief write up on the contents of the Testing Schedule/Commissioning Schedule is enclosed as Annexure-II.

23.02.04 The contractor shall submit the list of commissioning documentation to be submitted by him, along with their submission schedule for various equipment/systems covered under the contract, with in 6(six) month from the date of award of contract, for the acceptance of employer.

23.02.05 The Contractor shall submit the commissioning documentation, for various equipment/covered under the contract, for the approval of employer, at least three (3) months before the scheduled date of commissioning of the equipment/systems.

23.03.00 COMMISSIONING ACTIVITIES

23.03.01 Upon completion of pre-commissioning activities/tests, the contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carry out system checking and reliability trials on various parts of the facilities.

23.03.02	Contractor shall carry out the checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified.
23.03.03	Before the plant/system/system is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant/system/system is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.
23.03.04	Other tests shall be conducted, if required by the Employer, to establish that the plant/system/system equipment are in accordance with requirements of the specifications.
23.03.05	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all electrical equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied and installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI)
23.04.00	**Initial Operation** Upon completion of system checking/Tests as above and as a part of commissioning of facilities, complete plant/system/system/facilities shall be put on initial operation as stipulated in General Technical Requirements.
24.00.00	**MATERIALS HANDLING AND STORAGE**
24.01.00	All the equipments furnished under the Contract and arriving at Site shall be promptly received, unloaded and transported and stored in the storage spaces by the Contractor.
24.02.00	Contractor shall be responsible for examining all the shipment and notify the Employer immediately of any damage, shortage, discrepancy etc. for the purpose of Employer's information only. The Contractor shall submit to the Employer every week a report detailing all the receipts during the week. However, the Contractor shall be solely responsible for any shortages or damage in transit, handling and / or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
24.03.00	The Contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the Employer.
24.04.00	All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc. shall be used for unloading and/or handling of the equipment without the specific written permission of the Employer. The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at Site.

24.05.00	All electrical panels, controls gear, motors and such other devices shall be properly dried by heating before they are installed and energised. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.
24.06.00	All the electrical equipment such as motors, etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values maintained by the Contractor. Such records shall be open for inspection by the Employer.
24.07.00	The Contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before the equipment are installed.
24.08.00	The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.
24.09.00	All the materials stored in the open or dusty location must be covered with suitable weatherproof and flameproof covering material wherever applicable.
24.10.00	If the materials belonging to the Contractor are stored in areas other than those earmarked for him, the Employer will have the right to get it moved to the area earmarked for the Contractor at the Contractor's cost.
24.11.00	The Contractor shall be responsible for making suitable indoor storage facilities to store all equipment which require indoor storage. Normally, all the electrical equipments such as motors, control gear, exciters and consumables like electrodes, lubricants etc. shall be stored in the closed storage space . The Employer, in addition, may direct the Contractor to move certain other materials, which in his opinion will require indoor storage, to indoor storage areas which the Contractor shall strictly comply with.
25.00.00	**CONSTRUCTION MANAGEMENT**
25.01.00	The field activities of the Contractors working at Site, will be coordinated by the Employer and the Employer decision shall be final in resolving any disputes or conflicts between the Contractor and other Contractors and tradesmen of the Employer regarding scheduling and co- ordination of work. Such decision by the Employer shall not be a cause for extra compensation or extension of time for the Contractor.
25.02.00	The Employer shall hold weekly meetings of all the Contractors working at Site, at a time and place to be designated by the Employer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Employer and shall strictly adhere to those decisions in performing his Works. In addition to the above weekly meeting, the Employer may call for other meeting either with individual Contractors or with selected number of Contractors and in such a case the Contractor if called, will also attend such meetings.
25.03.00	Time is the essence of the Contract and the Contractor shall be responsible for performance of his works in accordance with the specified construction schedule. If

at any time, the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such actions in writing to the Employer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

25.04.00 The Employer shall however not be responsible for provision of additional labour and/or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

26.00.00 FIELD OFFICE RECORDS

The Contractor shall maintain at his Site Office up-to- date copies of all drawings, specifications and other Contract Documents and any other supplementary data complete with all the latest revisions thereto. The Contractor shall also maintain in addition the continuous record of all changes to the above Contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other Engineering data to indicate as installed conditions of the equipment furnished and erected under the Contract. Such drawings and Engineering data shall be submitted to the Employer in required number of copies.

27.00.00 CONTRACTOR'S MATERIALS BROUGHT ON TO SITE

27.01.00 The Contractor shall bring to Site all equipment, components, parts, materials, including construction equipment, tools and tackles for the purpose of the Works under intimation to the Employer. All such goods shall, from the time of their being brought vest in the Employer, but may be used for the purpose of the Works only and shall not on any account be removed or taken away by the Contractor without the written permission of the Employer. The Contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.

27.02.00 The Employer shall have a lien on such goods for any sum or sums which may at any time be due or owing to him by the Contractor, under, in respect of or by reasons of the Contract. After giving a fifteen (15) days notice in writing of his intention to do so, the Employer shall be at liberty to sell and dispose off any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid.

27.03.00 After the completion of the Works, the Contractor shall remove from the Site under the direction of the Employer the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the Employer. If the Contractor fails to remove such materials, within fifteen (15) days of issue of a notice by the Employer to do so then the Employer shall have the liberty to dispose off such materials as detailed under as specified at clause no 38.02.00- of this chapter and credit the proceeds thereto to the account of the Contractor.

28.00.00 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

28.01.00 The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of the Employer and the employees of other Contractors and Sub-

Contractors and all public and private property including structures, building, other plant/system/systems and equipments and utilities either above or below the ground.

28.02.00 The Contractor will ensure provision of necessary safety equipment such as barriers, sign - boards, warning lights and alarms, etc. to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the Employer and the Employers of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his Works and shall make all necessary arrangements with such Employers, related to removal and/or replacement or protection of such property and utilities.

29.00.00 PAINTING

All exposed metal parts of the equipment including pipings, structure railings, etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least two coats of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting and the same being inspected and approved by the Employer for painting. Afterwards, the above parts shall be finished painted with three coats of allowed resin machinery enamel paints. The minimum thickness of paint film shall not be less than 100 microns. The quality of the finish paint shall be as per the standards of Bureau of Indian Standards (BIS) or equivalent and to be of the colour as approved by the Employer.

30.00.00 INSURANCE

30.01.00 In addition to the conditions covered under the Clause entitled “Insurance” in Section General Conditions of Contract (GCC), the following provisions will also apply to the portion of works to be done beyond the Contractor’s own or his Sub-Contractor’s manufacturing Works.

30.02.00 Workmen’s Compensation Insurance

This insurance shall protect the Contractor against all claims applicable under the Workmen’s Compensation Act, 1948 (Government of India). This policy shall also cover the Contractor against claims for injury, disability disease or death of his or his Sub-Contractor’s employees, which for any reason are not covered under the Workmen’s Compensation Act, 1948. The liabilities shall not be less than the following:

Workmen's Compensation	-	As per Statutory Provisions
Employee's Liability	-	As per Statutory Provisions

30.03.00 Comprehensive Automobile Insurance

This insurance shall be in such a form to protect the Contractor against all claims for injuries, disability, disease and death to members of public including the Employer’s men and damage to the property of other arising from the use of motor vehicles

during on or off the Site operations, irrespective of the Ownership of such vehicles. The liability covered shall be as herein indicated :

Fatal Injury	:	Rs.100,000 each person
	:	Rs.200,000 each occurrence
Property Damage	:	Rs.100,000 each occurrence

30.04.00 Comprehensive General Liability Insurance

30.04.01 The insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members of public or damage to property of others, due to any act or omission on the part of the Contractor, his agents, his employees, his representatives and Sub-Contractors or from riots, strikes and civil commotion. This insurance shall also cover all the liabilities of the Contractor arising out of the Clause entitled “Defence of Suits” in Section General Conditions of Contract (GCC).

30.04.02 The hazards to be covered will pertain to all the Works and areas where the Contractor, his Sub-Contractors, his agents and his employees have to perform work pursuant to the Contract.

30.05.00 The above are only illustrative list of insurance covers normally required and it will be the responsibility of the Contractor to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the Contract.

31.00.00 UNFAVOURABLE WORKING CONDITIONS

The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects during inclement weather conditions, like monsoon, storms, etc. and during other unfavourable construction conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the Contractor in a proper and satisfactory manner in the performance of such Works and with the concurrence of the Employer. Such unfavourable construction conditions will in no way relieve the Contractor of his responsibility to perform the Works as per the schedule.

32.00.00 PROTECTION OF MONUMENTS AND REFERENCE POINTS

The Contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc. which he may come across during the course of performance of his Works either during excavation or elsewhere, are properly protected and handed over to the Employer. Similarly the Contractor shall ensure that the bench marks, reference points, etc., which are marked either with the help of Employer or by the Employer shall not be disturbed in any way during the performance of his Works. If, any work is to be preformed which disturb such reference, the same shall be done only after these are transferred to other suitable locations under the direction of the Employer. The Contractor shall provide all necessary materials and assistance for such relocation of reference points etc.

33.00.00 WORK & SAFETY REGULATIONS

33.01.00	The Contractor shall ensure proper safety of all the workmen, materials, plant/system/system and equipments belonging to him or to Employer or to others, working at the Site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required both by the relevant legislation and the Employer as he may deem necessary.
33.02.00	The Contractor will notify well in advance to the Employer of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. The Employer shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contractor shall strictly adhere to and comply with such instructions. The Employer shall have the right at his sole discretion to inspect any such container or such construction plant/system/system/equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by the Employer and the Employer shall not entertain any claim of the Contractor towards additional safety provisions/conditions to be provided for/constructed as per the Employer's instructions. Further, any such decision of the Employer shall not, in any way, absolve the Contractor of his responsibilities and in case, use of such a container or entry thereof into the Site area is forbidden by the Employer, the Contractor shall use alternative methods with the approval of the Employer without any cost implication to the Employer or extension of work schedule.
33.03.00	Where it is necessary to provide and/or store petroleum products or petroleum mixtures and explosives, the Contractor shall be responsible for carrying-out such provision and/or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosives Act, 1948, and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of the Employer. In case, any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the Contractor shall be responsible for obtaining the same.
33.04.00	All equipment used in construction and erection by Contractor shall meet Indian/International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipments shall be strictly operated and maintained by the Contractor in accordance with manufacturer’s operation Manual and safety instructions and as per Guidelines/Rules of Employer in this regard.
33.05.00	Periodical Examinations and all tests for all lifting/ hoisting equipment & tackles shall be carried-out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity Act 1910 and associated Laws/Rules in force from time to time. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by Employer or by the person authorised by him.
33.06.00	The Contractor shall be fully responsible for the safe storage of his and his Sub-Contractor’s radioactive sources in accordance with BARC/DAE (Bhabha Atomic Research Centre/ Department of Atomic Energy, Govt. of India) Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in connection with use, storage and handling of such material will be taken by Contractor.

33.07.00 The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by Employer who will also have right to examine these safety equipments to determine their suitability, reliability, acceptability and adaptability.

33.08.00 Where explosives are to be used, the same shall be used under the direct control and supervision of an expert, experienced, qualified and competent person strictly in accordance with the Code of Practices/Rules framed under Indian Explosives Act pertaining to handling, storage and use of explosives.

33.09.00 The Contractor shall provide safe working conditions to all workmen and employees at the Site including safe means of access, railings, stairs, ladders, scaffoldings etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection, good and standard quality of material only shall be used by the Contractor.

33.10.00 The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Employer or other Contractors under any circumstances, whatsoever, unless expressly permitted in writing by the Employer to handle such fuses, wiring or electrical equipment.

33.11.00 Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contactor or Employer, he shall:

(a.) Satisfy the Employer that the appliance is in good working condition:

(b.) Inform the Employer of the maximum current rating, voltage and phases of the appliances;

(c.) Obtain permission of the Employer detailing the sockets to which the appliances may be connected.

33.12.00 The Employer will not grant permission to connect until he is satisfied that;

(a.) The appliance is in good condition and is fitted with suitable plug;

(b.) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

33.13.00 No electric cable in use by the Contractor/Employer will be disturbed without prior permission. No weight of any description will be imposed on any cable and no ladder or similar equipment will rest against or attached to it.

33.14.00 No repair work shall be carried out on any live equipment. The equipment must be declared safe by the Employer and a permit to work shall be issued by the Employer before any repair work is carried out by the Contractor. While working on electric lines/equipments whether live or dead, suitable type and sufficient quantity of tools will have to be provided by Contractor to electricians/workmen/officers.

33.15.00 The Contractors shall employ necessary number of qualified, full time Electricians/ Electrical Supervisors to maintain his temporary electrical installations.

33.16.00	The Contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ atleast one full time officer exclusively as Safety Officer to supervise safety aspects of the equipments and workmen, who will co- ordinate with the Employer Safety Officer. In case of work being carried out through sub-Contractors, the Sub- Contractor's workmen/employees will also be considered as the Contractor's employees/workmen for the above purpose. The name and address of such Safety Officer of Contractor will be promptly informed in writing to Employer with a copy to Safety Officer-Incharge before he starts work or immediately after any change of the incumbent is made during currency of the Contract.
33.17.00	In case any accident occurs during the construction/ erection or other associated activities undertaken by the Contractor thereby causing any minor or major or fatal injury to his employees due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the Employer in prescribed form and also to all the authorities envisaged under the applicable laws.
33.18.00	The Employer shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipments. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary appeal against the order of stoppage of work to the Employer within 3 days of such stoppage of work and decision of the Employer in this respect shall be conclusive and binding on the Contractor.
33.19.00	The Contractor shall not be entitled for any damages/ compensation for stoppage of work due to safety reasons as provided in para 44.18.00 and the period of such stoppage of work will not be taken as an extension of time for completion of the facilities and will not be the ground for waiver of levy of liquidated damages.
33.20.00	The Contractor shall follow and comply with all Safety Rules of the Employer, relevant provisions of applicable laws pertaining to the safety of workmen, employees plant/system/system and equipment as may be prescribed from time to time without any demur, protest or contest or reservation. In case of any inconformity between statutory requirement and Safety Rules of the Employer referred above, the later shall be binding on the Contractor unless the statutory provisions are more stringent.
33.21.00	If the Contractor fails in providing safe working environment as per the Employer's Safety Rules or continues the work even after being instructed to stop work by the Employer Manager as provided 44.18.00, the Contractor shall promptly pay to the Employer, on demand by the Employer compensation at the rate of Rs. 5,000/- per day or part thereof till the instructions are complied with and so certified by the Employer. However, in case of accident taking place causing injury, to any individual, the provisions contained in paragraph 44.22.00 shall also apply in addition to compensation mentioned in this paragraph.
33.22.00	If the Contractor does not take all safety precautions and/or fails to comply with the Safety Rules as prescribed by the Employer or under the applicable law for the safety of the equipment and plant/system/system and for the safety of personnel and

the Contractor does not prevent hazardous conditions which cause injury to his own employees or employees of other Contractors, or the Employer's employees or any other person who are at Site or adjacent thereto, the Contractor shall be responsible for payment of compensation to Employer as per the following schedule:-

1	Fatal injury or accident These are causing death applicable	Rs. 1,00,000/-	These are applicable for death/ injury to any person whomsoever.
2	Major injuries or accident causing 25% or more permanent disablement to workmen or employee	Rs. 20,000/-	

Permanent disablement shall have same meaning as indicated in Workmen's Compensation Act. The compensation mentioned above shall be in addition to the compensation payable to the workmen/employees under the relevant provisions of the Workmen's Compensation Act and rules framed thereunder or any other applicable laws as applicable from time to time. In case the Employer is made to pay such Compensation then the Contractor is liable to reimburse the Employer such amount in addition to the compensation indicated above.

33.23.00 If the Contractor observes all the Safety Rules and Codes, Statutory Laws and Rules during the currency of Contract awarded by the Employer and no accident occurs then the Employer may consider the performance of the Contractor and award suitable "ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme as may be announced separately from time to time.

34.00.00 **FOREIGN PERSONNEL**

34.01.00 The Contractor shall submit to the Employer data on all personnel he proposes to bring into India from abroad for the performance of the Works under the Contract, at least sixty (60) days prior to their departure to India. Such data will include for each person the name, his present address, his assignment and responsibility in connection with the works, and a short resume of his qualification, experience etc. in relation to the work to be performed by him.

34.02.00 Any person unsuitable and unacceptable to the Employer shall not be brought to India. Any person brought to India, if found unsuitable or unacceptable by the Employer, the Contractor shall within a reasonable time make alternate arrangements for providing a suitable replacement and repatriation of such unsuitable personnel.

34.03.00 No person brought to India for the purposes of the works shall be repatriated without the consent of the Employer in writing, based on a written request from the Contractor for such repatriation giving reasons for such an action to the Employer. The Employer may give permission for such repatriation provided he is satisfied that the progress of work will not suffer due to such repatriation.

34.04.00 The cost of passports, visas and all other travel expenses to and from India, incurred by the Contractor shall be to his account. The Employer will not provide any residential accommodation and/or furniture for any of the Contractor's personnel including foreign personnel and Contractor shall make his own arrangements for such facilities in the area allotted at Site, to him by the Employer for that purpose.

34.05.00	The Contractor and his expatriate personnel shall respect all Indian Acts, Laws, rules and regulations and shall not in any way interfere with Indian political and religious affairs and shall conform to any other rules and regulations which the Government of India and the Employer may establish from time to time, on them. The Contractor's expatriate personnel shall work and live in close co-operation and coordination with their co-workers and the community and shall not engage themselves in any other employment neither part-time or full-time nor shall they take part in any local politics.
34.06.00	The Employer shall assist the Contractor, to the extent possible, in obtaining necessary permits to travel to India and back, by issue of necessary certificates and other information needed by the Government agencies.
35.00.00	**FOUNDATION DRESSING & GROUTING FOR EQUIPMENT/ EQUIPMENT BASES**
35.01.00	The surfaces of foundations shall be dressed to bring the top surface of the foundations to the required level, prior to placement of equipment/equipment bases on the foundations.
35.02.00	All the equipment/ equipment bases, shall be grouted and finished as per these specifications unless otherwise recommended by the equipment manufacturer.
35.03.00	The concrete foundation surfaces shall be properly prepared by chipping, grinding as required to bring the top of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength.
35.04.00	**Grout** The grout shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm2 at 28 days. The grout shall be chloride - free, cement based, free flowing, non-metallic grout. The Grout shall have good flowability even at very low water/ grout powder ratio. The Grout shall have characteristics of controlled expansion to be able to occupy its original volume to fill the voids and to compensate for shrinkage. Grout shall be of pre-mix variety so that only water needs to be added before use. The mixing of the Grout shall conform to the recommendations of the manufacturer of the Grout.
35.05.00	**Placing of Grout**
35.05.01	After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout, a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back & forth to push the grout into every part of the space under the base.
35.05.02	The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space

below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.

35.05.03 In addition to the above, recommendations of Grout manufacturer shall also be followed.

35.06.00 Finishing of the Edges of the Grout

The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothened with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.

35.07.00 Checking of Equipment After Grouting

After the grout is set and cured, the Contractor shall check and verify the alignment of equipments, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings, etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during such post grouting check- up and verifications. Such pre and post grout records of alignment details shall be maintained by the Contractor in a manner acceptable to the Employer.

36.00.00 SHAFT ALIGNMENTS

All the shafts of rotating equipment shall be properly aligned to those of the matching equipments to as perfect an accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. The vibration level of rotating equipments measured at bearing housing shall not exceed forty (40) microns and shall conform to VDI 2056.All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

37.00.00 DOWELLING

All the motors and other equipment shall be suitably doweled after alignment of shafts with tapered machined dowels as per the direction of the Employer.

38.00.00 CHECK OUT OF CONTROL SYSTEMS

After completion of wiring, cabling furnished under separate specification and laid and terminated by the Employer, the Contractor shall check out the operation of all control systems for the equipment furnished and installed under these specifications and documents.

39.00.00	**COMMISSIONING SPARES**
39.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However. such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.
39.02.00	These spare will be received and stored by the Contractor atleast 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilised as and when required. The unutilised spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.
40.00.00	**CABLING**
40.01.00	All cables shall be supported by conduits or cable tray run in air or in cable channels. These shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turn made of symmetrical bends or fittings. When cables are run on cable trays, they shall be clamped at a minimum intervals of 2000mm or otherwise as directed by the Employer.
40.02.00	Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the Contractor), at every 5 meter run or part thereof and at both ends of the cable adjacent to the terminations. Cable routing is to be done in such a way that cables are accessible for any maintenance and for easy identification.
40.03.00	Sharp bending and kinking of cables shall be avoided. The minimum radii for PVC insulted cables 1100 V grade shall be 15 D where D is the overall diameter of the cable. Installation of other cables like high voltage, coaxial, screened, compensating, mineral insulated shall be in accordance with the cable manufacturer's recommendations. Wherever cables cross roads and water, oil, sewage or gaslines, special care should be taken for the protection of the cables in designing the cable channels.
40.04.00	In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop fault at a later date.
40.05.00	Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to the Employer's approval. Multicore control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, as far as possible, to the point of the first conductor branch. The insulated conductors from which the jacket is removed shall be neatly twined in bundles and terminated. The bundles shall be firmly but not tightly tied utilising plastic or nylon ties or specifically treated fungus protected cord made for this purpose. Control cable conductor insulation shall be securely and evenly cut.

40.06.00 The connectors for control cables shall be covered with a transparent insulating sleeve so as to prevent accidental contact with ground or adjacent terminals and shall preferably terminate in Elmex terminals and washers. The insulating sleeve shall be fire resistant and shall be long enough to over pass the conductor insulation. All control cables shall be fanned out and connection made to terminal blocks and test equipment for proper operation before cables are corded together.

41.00.00 EQUIPMENT DELIVERY AND ERECTION

41.01.00 General Requirements

(a.) This part covers Contractor's responsibilities for packing, shipping, ware-housing and the installation of all equipment and materials furnished and installed under this specification.

(b.) The Contractor shall submit for Employer's approval draft manual for Equipment Delivery and Erection (EDE Manual) covering detailed instructions, write up, technical data, drawings, check-lists, documentation formats for all activities after equipment manufacture upto installation of equipment. This manual shall cover general instructions for all equipment and specific instructions for individual equipment wherever required and shall include at least the following :

(1.) Instructions for packing, shipping, receiving handling, ware-housing and storage.

(2.) Instructions for location and installation of equipment furnished by this specification.

(3.) Installation drawings for field mounted equipment, panels, cubicles and other equipment covered under this specification.

(4.) Instruction relating installation of piping/ tubing, support and routing drawings of impulse pipes/signal tubes and tube/cable trays.

(5.) Check lists and quality assurance hold points.

(6.) Format for all related documentation.

(c.) The EDE Manual shall conform to the requirements of this specification, all applicable codes and standards, recommendations of equipment manufacturers and accepted good engineering practices and shall be subject to Employer approval during detailed engineering.

(d.) The Contractor shall ensure that all work under this part shall be performed as per the requirements of this specification, Employer approved EDE Manual and drawing/documents approved by the Employer during detailed engg.

41.02.00 Crating

(a.) All equipment and materials shall be suitably coated, wrapped, or covered and boxed or crated for moist humid tropical shipment and to prevent damage or deterioration during handling and storage at the site.

(b.) Equipment shall be packed with suitable desiccants, sealed in water proof vapour-proof wrapping and packed in lumber of plywood enclosures, suitably braced, tied and skidded. Lumber enclosures shall be solid, not slatted.

(c.) Desiccants shall be either silica gel or calcium sulphate, sufficiently ground to provide the required surface area and activated prior to placing in the packaging. Calcium sulphate desiccants shall be of a chemical nature to absorb moisture. In any case, the desiccant shall not be of a type that will absorb enough moisture to go into solution. Desiccants shall be packed in porous containers, strong enough to withstand handling encountered during normal shipment. Enough desiccant shall be used for the volumes enclosed in wrapping.

(d.) Review by the Employer of the Contractor's proposed packaging methods shall not relieve the Contractor of responsibility for damage or deterioration to the equipment and materials specified.

(e.) All accessory items shall be shipped with the equipment. ; Boxes and crates containing accessory items shall be marked so that they are identified with the main equipment. The contents of each box and crates shall be indicated by markings on the exterior.

(f.) All boxes, crates, cases bundles, loose pieces, etc. shall be marked consecutively from No.1 upward throughout all shipments from a given port to completion of the order without repeating the same number.

(g.) An itemized list of contents shall be enclosed inside each case and one other copy securely fastened to the outside of the case in a tin or light weight sheet metal envelope or pocket. The lists shall be plainly marked and placed in accessible locations to facilitate receipt and inspection. The packing list shall indicate whether shipment is partial or complete and shall incorporate the following information on each container, etc., according to its individual shipping number :

1. Export case markings
2. Case number
3. Gross weight and net weight in Kilograms
4. Dimensions in centimeters
5. Complete description of material

(h.) Packaging or shipping units shall be designed within the limitations of unloading facilities and the equipment which will be used for transport. Complications involved with ocean shipment and the limitations of ports, railways and roads shall be considered. It shall be the Contractor's responsibility to investigate these limitations and to provide suitable packaging to permit safe handling during transit and at the job site.

(i.) Electrical equipment, control and instrumentation shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, motor pump shafts, bearing and like items shall be thoroughly

cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

(j.) Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures.

(k.) Coated surfaces shall be protected against impact, abrasion, discolouration and other damage. Surfaces which are damaged shall be repaired.

(l.) All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be closed with forged steel plugs. All pipings, tubing, and conduit equipment and other equipment openings shall be sealed with metallic or other rough usage covers and tapped to seal the interior of the equipment piping, tubing, or conduit.

(m.) Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the plant/system/system site.

(n.) Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

(o.) While packaging the material, care shall be taken for the limitation from the point of view of availability of railway wagon sizes in India.

41.03.00 Factory Assembly

(a.) Instrument enclosures shall be supplied and erected completely in the factory with instrument, air supply and blow down piping with necessary valves, fittings, etc. and also all electrical wiring between the instruments and the enclosure terminal blocks. Control panel and cubicles shall also be fully wired in the factory. Control panel mounted equipments are to be dismounted from the panels before shipment and individually packed for shipment. Electronic control modules of the plug-in type are to be removed from equipment racks after factory checkout are individually packed for shipment. Other equipment shall be fully assembled at the factory, except for necessary shipping splits in panels.

(b.) All separately packaged accessories items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip, indicating what is in that carton only, shall be attached to the outside and inside of each container used for packing.

A master packing slip covering all accessories items for a given piece of equipment which are shipped in separate containers, shall be attached to one container.

41.04.00 Equipment Installation

(a.) **General Requirements**

The Contractor shall furnish all construction materials, tools and equipment and shall perform all work required for complete installation of all control and instrument equipment furnished under this specification.

Contractor shall prepare detailed installation drawings for each equipment furnished under this specification for Employer's approval. Installation of all equipment/systems furnished by this specification shall be as per Employer's approval.

Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. The procedures shall be acceptable to the Employer.

The Contractor shall coordinate his work with other suppliers where their instruments and devices are to be installed under specifications.

(b.) **Installation Materials**

All materials required for installation, testing and commissioning of the equipment shall be furnished by the Contractor.

(c.) **Regulatory Requirements**

All installation procedures shall confirm with the accepted good engineering practice and with all applicable governmental laws, regulations and codes.

(d.) **Cleaning**

All equipment shall be cleaned of all sand, dirt and other foreign materials immediately after removal from storage and before the equipment is brought inside the CHP building/area or to other installation sites. All piping and tubes shall be air blown.

(e.) **Equipment Assembly**

Equipment installed under these specifications shall be assembled if shipped unassembled. The equipment shall be dismantled and reassembled as required to perform the installation and commissioning work described in these specifications.

(f.) **Equipment Setting**

Field mounted instruments and accessories shall be bracket or sub panel mounted on the nearest suitable firm steel work or masonry. The brackets, stands, supports and other miscellaneous hardware required for mounting instruments and accessories such as receiver gauge, air set, valve manifold, purge-meter etc. shall be furnished and installed. No field mounted instruments shall be installed such that it depends for support or rigidity on the impulse piping or on electrical connection to it.

Indicating type field mounted instruments shall be installed in such a way that centre of indicating dial shall be about 1600-1800mm from operating floor level. Non-indicating type field instruments shall be installed such that operating handle of manifold block / isolating cock comes within 1600 mm from operating floor level.

All free standing instrumentation cabinets and panels shall be located within the construction tolerances of +/- 3 mm of the location dimensions indicated on the Employer's plant/system/system arrangement drawings.

(g.) **Free-Standing Equipment**

Free-standing Cabinets shall be attached to the floor, concrete equipment bases or supporting steel as indicated on the manufacturer's drawings and the Employer's Plant/system/system Arrangement Drawings. The cabinets shall be shimmed for proper alignment before bolting them to the floor. Adjacent enclosures shall be shimmed to maintain mutually level appearance before they are attached to floor. Vibration dampening mounts shall be installed between supporting structures and panels when specified.

(h.) **Non-free Standing Equipment**

Non-free standing local enclosures and cabinets shall be mounted in accessible locations on columns, walls, or stands in locations as indicated on the Employer's Plant/system/system Arrangement Drawings. Bracket and stands shall be fabricated as required to install the local enclosures and cabinets in a workman like manner.

Rough edges and welds on all fabricated supports shall be ground smooth. The supports shall be finished with two coats of primer and two coats of paint as specified in this part.

(i.) **Equipment Location**

All individual items of equipment not located in cabinets or on panels and racks are located approximately according to the floor elevation and the nearest building column designated by the Employer.

Solenoid valves not located in enclosures or mounted on valves shall be mounted in easily accessible protected locations near the components with which they are associated.

All brackets, stands, supports and other miscellaneous hardware required for mounting devices shall be furnished and installed.

Thermometers shall be installed in the process lines and ducts as required and adjusted for ease in reading.

Permanent temperature wells on the main steam, hot reheat and cold reheat piping shall not be installed until steam blowing has been completed. Temporary temperature wells shall be installed in the main and reheat steam piping during steam blow and discarded after completion.

Any required adapting hardware such as pipe bushings, nipples, drilled caps and the like shall be provided for complete installation of control devices into process connections.

For location of C&I related equipment/devices, the requirement specified elsewhere in the technical specification may be referred.

(j.) **Installation of Field Mounted Instruments and Devices**

The Contractor shall submit installation drawings for all field mounted equipment furnished under this specification for Employer's approval. These drawings shall meet the requirements of this specification, installation drawings, applicable codes and standards and recommendations of manufacturers of instruments/devices. All installation work under this specification shall be strictly as per installation drawings approved by the Employer during detailed engineering stage.

In addition to above relevant Portion as specified elsewhere in technical specification may be referred.

(k.) **Piping Connections**

All equipment having piping connections shall be levelled, aligned and wedged in place but shall not be grouted or bolted prior to the initial fitting and alignment of connecting piping. All equipment shall, however, be grouted or bolted to its foundation prior to final bolting or welding of the connection piping.

All flanged joints shall be checked and retightened after approximately 10 days of operation at normal operating temperature.

(l.) **Equipment Checkout**

All equipment shall be cleaned after installation. Equipment subject to pressure differentials shall be checked for leakage.

After erection, all equipment having moving parts, having electrical apparatus, or subject to pressure differentials shall be trial-operated.

(m.) **Defects**

All defects in erection shall be corrected to the satisfaction of the Employer and the Project Manager. The dismantling and reassembly of Contractor furnished equipment to remove defective parts, replace parts, or make adjustments shall be included as a part of the work under these specifications.

The removal of control and instrument equipment in order to allow bench calibration, if required, and the re-installation of the said equipment after calibration shall also be included as a part of the work under these specifications.

(n.) **Equipment Protection**

All equipment to be erected under these specifications shall be protected from damage of any kind from the time of contract award until commissioning of each unit.

The equipment shall be protected during storage as described herein.

Equipment shall be protected from weld spatter during construction.

Suitable guards shall be provided for protection of personnel on all exposed rotating or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy removal and maintenance.

Equipment having glass components such as gauges, or equipment having other easily breakable components, shall be protected during the construction period with plywood enclosures or other suitable means. Broken, stolen, or lost components shall be replaced by the Contractor.

Machine finished surfaces, polished surfaces, or other bare metal surfaces which are not to be painted, such as machinery shafts and couplings shall be provided temporary protection during storage and constructional periods by a coating of a suitable non- drying, oily type, rust preventive compound.

42.00.00 WELDING - SPECIAL REQUIREMENTS

If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed under separate specifications, the requirements shall be submitted to the Project Manager in advance of commencement of erection work.

43.00.00 DEVIATIONS DISPOSITIONING:

Any deviation to the contract and employer approved documents shall be properly recorded in the format prescribed by NTPC. Al the deviations shall be bought to the knowledge of employer's representative for suitable dispositioning.

44.00.00 NON-DESTRUCTIVE TESTING (NDT):

The contractor shall record results of NDTs carried out at site in the format acceptable to employer. All the radiographs & its report duly signed & correlated to the job shall be handed over to the employer. Sensitivity of all the test equipment shall be compatible to the job & acceptance norms agreed.

45.00.00 TESTING EQUIPMENT & FACILITIES:

Contractor shall provide the testing equipment and facilities necessary to carry out tests & inspections.

ANNEXURE-I

STANDARD CHECKLIST (TYPICAL)
COMMISSIONING / TESTING ESSENTIAL PRE-REQUISTE

(a.) **MECHANICAL**

Sl. No. DESCRIPTION

VALVES

(i.) Manually operated valve

(ii.) Electrically operated valve

(iii.) Pneumatically actuated valve

(iv.) Hydraulically actuated valve

(v.) Safety valve

(vi.) Butterfly valve(electrically operated)

(vii.) Butterfly valve (manually operated)

(viii.) Butterfly valve(four way-electrical)

(ix.) Non-return valve (including hydraulic/pneumatic FCNRVS)

(x.) Relief valve

(xi.) Differential pressure regulating valve

(xii.) Float operated valves

PUMPS

(xiii.) Pump Low Pressure Centrifugal (Motor Driven)

(xiv.) Pump up to 350 HP (260 Kw)

(xv.) Pump Sump Installation

(xvi.) Gear Pump/Screw Pump

PIPE WORK SYSTEM

(xvii.) Water services

(xviii.) Oil Resistant Fluid System

(xix.) Air services (compressor)

(xx.) High pressure services

(xxi.) Constant load support

(xxii.) Spring supports

(xxiii.) Hangers and other supports

STRAINER AND FILTER

(xxiv.) Strainer/Filter Basket Type

Heat Exchanger (Scoop Coupling)

(xxv.) Heat exchanger (general)

(xxvi.) Heat Exchanger-Oil/Water

FANS AND COMPRESSORS

(xxvii.) Fans-Non-pressure Lubricated

(xxviii.) Fans-Axial flow pressure Lubricated

(xxix.) Compressors-General

GATES

(xxx.) Manually operated gate

(xxxi.) Electrically operated gate

DUCT WORK

(xxxii.) Ventilation ducting

(xxxiii.) Expansion Joints

(xxxiv.) Observations & Access Door

HOISTS AND ELEVATORS

(xxxv.) Electric Hoist / Elevator

(xxxvi.) Travel Support Structure For Hoists / Elevator

(xxxvii.) Long travel & cross traverse motion of hoists

(xxxviii.) Main aux. Hoist motion

POWER TRANMISSION

(xxxix.) Power transmission gear box

(xl.) Bearing

(xli.) Fluid Couplings

(b.) **ELECTRICAL**

(i.) D.C. Motor

(ii.) HV squirrel cage induction motor

(iii.) 415 V squirrel cage induction motor

(iv.) Motor operated actuators

(v.) HT Switchgears

(vi.) LT Switchgears/MCC

(vii.) Standard Checklists for all types of relays used in Switchgears Protection System

(viii.) PT Carriage and Cubicles

(ix.) Cable/Bus Duct/Bus Bars

(x.) Contractor Module

(xi.) Switch fuse module

(xii.) Master Panel of Lube Oil Panel

(xiii.) Feeder panel of lube oil panel

(xiv.) Space heater and cable module

(xv.) HT Circuit Breaker

(xvi.) 415 V Circuit Breaker

(xvii.) Power cable

(xviii.) Auxiliary cable

(xix.) D.C. cable

(xx.) Explosion Proof Electrical Equipment

(xxi.) Junction box

(xxii.) Control transformer module

(xxiii.) Soot blower sequence panel

(xxiv.) Brush gear assembly

(xxv.) Aux. Control and relay panel desk

(xxvi.) Indicating instrument

(xxvii.) Recording instrument

(xxviii.) Integrating instrument

(xxix.) Level switch (float actuated)

(xxx.) Level switch (electrode type)

(xxxi.) Level Switch Displaced actuated)

(xxxii.) Level Indicator (Float/Pulley Type)

(xxxiii.) Local temperature indicators including test procedure

(xxxiv.) Resistance Thermometer Element including Test Procedure

(xxxv.) Thermocouple element and connecting cable

(xxxvi.) Thermocouple and Resistance Thermometer Convertor/Transmitter including Test Procedures.

(xxxvii.) Temperature Switch/Thermostat including test procedures

(xxxviii.) Cold Junction Boxes

(xxxix.) Pressure and Vacuum Gauge

(xl.) Pressure And Vacuum Switch Including Test Procedure

(xli.) Differential Pressure Transmitter including test procedure

(xlii.) Differential Pressure switch including test procedure.

(xliii.) Flow Indicator(variable area)

(xliv.) Orifice plate

(xlv.) Tachometer

(xlvi.) Vibration measurement

(xlvii.) Digital indicator

(xlviii.) Moving coil indicator including test procedure

(xlix.) Recorder including test procedure

(l.) Electrical auto manual control station

(li.) Push button module

(lii.) Alarm annunciator equipment including test procedure

(liii.) Test procedure for electronic Modules of DDCMIS

Note: The items which are not part of this specification may not be considered as not applicable.

ANNEXURE-II

BRIEF WIRE UP ON THE CONTENTS OF TESTING SCHEDULE / COMMISSIONING SCHEDULE

Testing Schedules should be designed to ensure that the plant/system/system area, equipment or apparatus are tested and commissioned and will operate as per the employer's specifications and good engineering practices.

Testing Schedule/Commissioning Schedule is required to be of a standard format in order to maintain consistency of presentation, content and reporting.

Testing Schedule/Commissioning Schedule should contain the following sections to make the document a self contained one:

(c.) Plant/system/system Details/Design data

(d.) Testing Objective/Proposals

(e.) STATE OF THE PLANT/SYSTEM/SYSTEM

Erection Status with respect to Mech. Elect

AVAILABILITY OF THE SERVICES REQUIRED

SAFETY REQUIREMENTS AS PER MANUFACTURER'S

(f.) Test method including completion/acceptance criteria

(g.) RESULTS

(h.) APPENDIX

TESTING PROGRAMME

Mech/Elect–Plant/system item completing list

List of Drawing/documents required for carrying out the testing.