MISHRA DHATU NIGAM LIMITED (MIDHANI)

BAR & ROD MILL PROJECT

TECHNICAL SPECIFICATION

SEPTEMBER 2019

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DRAWINGS

SECTION - I – GENERAL

1.0 GENERAL

The Wire Rod Mill complex will be located in the existing premises of MIDHANI at Hyderabad. It will be capable of rolling special steels, stainless & alloy steels, titanium alloys, super alloys and low alloy steels. Cast/ Forged billets from the existing facility of MIDHANI will be used as input material for the Wire Rod Mill.

1.1 This specification covers the Design, Engineering, manufacture, supply, erection & commissioning, supervision of commissioning and Demonstration of Performance of Mill mechanical equipment, including electrical, automation along with interconnecting piping, associated lubrication, hydraulic, pneumatic system, reheating furnace, Roll Shop equipment, Manipulator, water system including supply & installation of HT & LT power and control cables & special cables for automation system within the battery limit for the Wire Rod Mill complete with electrical equipment, automation system, instrumentation and other auxiliary system. This specification forms a part of the tender documents and shall be read in conjunction with General Conditions of Contract and Instruction to the Tenderer for supply, erection and commissioning of the plant and equipment.

1.2 The following drawing enclosed show the proposed layout of the Wire Rod Mill:

Drawing 28785-000-000-PRR-0001, Rev.0 - Wire Rod Mill – Proposed Mill Layout

The layout and equipment described in this specification are representative of present ideas.

1.3 The Tenderer shall note that the Wire Rod Mill will be located in a site surrounded by existing plants, and the movement of incoming billets and outgoing finished products will have to be as shown in the drawings referred in Clause 1.2. The Tenderer may suggest modifications to the mill layout keeping this in view.

1.4 The Tenderer shall study the specification and satisfy himself thoroughly regarding the workability of the equipment and shall take full responsibility for the guaranteed operation of the Wire Rod Mill equipment as regards output, performance, quality and smooth reliable and safe working. If the tenderer feels that any dimension and/or design data for the equipment described hereinafter in his opinion are unsuitable, he shall indicate this specifically and submit an alternative proposal on the basis of the design data he considers suitable and capable of meeting the required operating and duty requirements.

1.5 All items of equipment shall be complete in all respects and any item not covered in this specification but essential for the proper design, operation and maintenance shall be included in the tender.

1.6 **Source of Supply**

1.6.1 The tenderer shall specify the items from foreign and Indian sources, together with the name of the agency against the respective items. It shall be the responsibility of the successful tenderer to coordinate the supply of equipment from foreign and Indian sources and execute the contract within the agreed time schedule. The tenderer shall submit along with the tender, a list of items to be imported as called for in the Invitation to Tender.

1.7 **Delivery**

The tenderer shall note that the delivery is the essence of this tender. The tenderer shall clearly indicate his requirements to meet the delivery schedule stipulated elsewhere in Notice Inviting Tender (NIT).

2.0 STANDARDS

2.1 The bidder may follow the latest standards of the Standards Institution, Institution of Electrical and Electronics Engineers, USA (IEEE), National Electrical and Manufacturer's Association, USA (NEMA), International Electro Technical Commission (IEC), European Standards, standards covered by EURONORM or National Standards Institution of the country where they are manufactured.

In cases, where the specification deviates from the specified standards, the bidder shall indicate the standards proposed to be adopted by him along with details thereof and the reasons for the deviation.

2.2 Wherever Indian standards do not exist, the components of all equipment shall be designed, assembled and tested in accordance with the latest standards of the Standards institution, Institution of Electrical and Electronics Engineers, USA (IEEE), National Electrical and manufacturer's Association, USA (NEMA), International Electrotechnical Commission (IEC) or national Standards Institution of the country where they are manufactured.

2.3 All items of equipment shall be given final coat of paint and all the structural items shall be given prime coat of paint before despatch to site.

2.4 All items of equipment shall comply with the latest regulation and the stipulation of Inspectorate of Factories and other applicable statutory bodies of the Government of India and the Government of Telengana State, wherever applicable. Where required by regulations, the successful tenderer shall have to obtain necessary approvals from statutory authority/authorities and other concerned agencies relevant storages, pipework, fittings etc. and any changes required shall be to the account of the successful tenderer. All cost on this account shall be borne by the successful tenderer.

2.5 In cases, where the offer deviates from the specified standards, the tenderer' shall indicate clearly in his offer the standards proposed to be adopted by him along with details thereof and the reasons for the deviation.

2.6 Each exception to the specification or other parts of the tender documents shall be listed separately by the tenderer. If exceptions are not clearly listed as such, they will not be considered by the Purchaser later.

3.0 OTHER REQUIREMENTS

3.1 General Information on site

3.1.1 The proposed Wire Rod Mill will be located within the campus of MIDHANI Complex, Kanchanbagh Hyderabad, Telangana, India.

3.2 Meteorological Data

3.2.1 Temperature

	Winter Summer March to June	Monsoon July to October	November to February
Average temp.	30.5 deg.C	25.1 deg.C	22.1 deg.C
Max. temp.	45 deg.C	34.0 deg.C	23.1 deg.C
Min. temp.	12.0 deg.C	15.5 deg.C	6 deg.C

3.2.2 Relative Humidity : 83% max
: 30% min

3.2.3 Avg. Yearly Precipitation : 76.5 cm

3.2.4 Maximum hourly precipitation : 6.0 cm

3.2.5 **Maximum flood levels**
The maximum flood level of Hyderabad is 490 metre.

Frequency of occurrence of flood : There is no history of flood in and around the present site

3.2.6 **Wind Speed and Direction**
Prevalent wind direction

April mainly from : South East and South West West and North West

May to September mainly from : West and South West

Rest of the year mainly from : North East, East and South East

Mean wind velocity : 12.6 km/hr

Maximum wind velocity : 84 km/hr

Absolute Maximum Wind velocity : 144 km/hr

3.3 **Seismic Conditions**

3.3.1 Details of earthquakes in the area : Nil

3.3.2 Zones as per Indian standard : Hyderabad is situated in a moderate seismic zone and load will be considered as per zone-II of latest seismic maps.

3.4 **Design Conditions**

All equipment in general, shall be designed for smooth, efficient and trouble-free operation in tropical humid climate for a maximum temperature of 45 deg.C and maximum humidity of 83%. The maximum temperature and maximum humidity, however, are not expected to occur simultaneously.

3.5 **Airport**

The nearest airport is at Hyderabad, which is located about 21 km from the proposed plant site.

3.6 **Railway Station**

The nearest Railway Station is at Nampally Railway Station, Hyderabad, which is about 12 km from plant site.

3.7 **Road**

The site is well connected by road and the national highway NH-765 is 5 km away from the proposed plant site.

3.8 **Sea Port**

The nearest seaport is at Krishnapatnam, which is about 475 km from plant site.

3.9 **Quality and Workmanship**

Workmanship and materials shall be of good quality suitable for the purpose intended and in accordance with the highest standards and practices for equipment of the class covered by the specification.

3.10 **Safety**

3.10.1 All equipment shall be complete with approved safety devices wherever a potential hazard to personnel exists, and with provision for safe access to personnel, to and around equipment for operational and maintenance functions. These items shall include not only those usually furnished with elements of machinery but also the additional covers, guards, cross-overs, stairways, ladders, platforms, handrails etc which are necessary for safe operation of the plant. The offer shall include all safety items including, but not be limited to the following:

3.10.1.1 ***Coupling guards***: All coupling are to be covered with an approved guard fabricated from welded plate and structural steel.

3.10.1.2 ***Belt and pulley guards***: Where belt drive is unavoidable and is provided with Purchaser's approval, belt and pulley guards shall be provided with approved provisions to facilitate inspection,

adjustment, replacement and general servicing.

3.10.1.3 ***Gearing and chain guards***: All gearing and chain drives shall be covered with substantial oil-tight covers made of welded plate and structural steel or castings. Covers are to entirely enclose the gearing and be so arranged that they can be readily removed and replaced. They shall be provided with inspection openings with oil-tight covers.

3.10.1.4 ***Guards***: Guards, protections and/or shields shall be provided, where required, to protect operators and sensitive equipment from deleterious sprays of water, oil, heat/flame, live electrical parts etc.

3.10.1.5 ***Access ladders & platforms***: Provision shall be made for access ladders and platforms with handrails as necessary to provide operator's safe access to inspection holes, lubrication fittings, locally mounted instruments, take-off points, valves, snap couplings for hoses, and positions from which readings must be taken inspection made or material jams cleared.

3.10.1.6 ***Cross-overs***: Cross-overs shall be provided to permit the operators to cross the unit at locations suitable from the performance of their normal and emergency duties. Cross-overs shall also be provided to permit access to areas closed in by drive shafts or items of machinery. Where necessary, these cross-overs must be readily removable in sections to permit removal of shafts etc.

3.10.1.7 ***Protective screens***: All ventilation and force draft openings shall have suitable screen protections. When screens are provided on top of equipment, means shall be provided to protect these from falling objects.

3.10.1.8 ***Handrails and guardrails***: Handrails in three rows at three levels shall be provided, wherever necessary to prevent personnel from falling from staircases, other elevated areas or into open pits. Guard rails of heavier section shall be provided to protect particularly exposed equipment from damage by nearby vehicular traffic.

3.10.1.9 ***Toe board***: The board shall be provided on every platform, at the turnings of staircase and at any other place where there is chance of slipping for men and materials.

3.10.1.10 ***Fencing***: Fencing shall be provided for electrical equipment having degree of protection IP 00 and as required by the Electrical Inspector.

3.10.1.11 ***Interlocks***: Interlocks shall be provided wherever necessary to preclude damage to equipment and injures to personnel.

3.10.1.12 ***Work bench***: Work bench, wherever required, are to be provided for keeping maintenance and operation tools.

3.10.2 Equipment shall be supplied in minimum number of sub-assemblies weighing preferably not more than crane capacity with handling hooks at convenient location.

3.10.3 All the exposed piping, cabled conduits, hoses etc at the mill stands shall be well protected from cobbles occurring in the mill.

3.11 **Standardisation**

3.11.1 Standardisation in design and construction of equipment and system intended for identical tasks and duties shall be preferred. All like parts on the equipment furnished, or on the duplicate equipment, are to be interchanged.

4.0 EQUIPMENT SPECIFICATION

4.1 The specification for the equipment and facilities for the Wire Rod Mill are given in the following sections:

Section No.		Description
SECTION-I	-	General
SECTION-II	-	Process and Mechanical
SECTION-III	-	Reheating Furnace
SECTION-IV	-	Electrics, Automation Instrumentation, CCTV, Communication and fire detection and alarm system
SECTION-V	-	Utilities and Auxiliary Systems
SECTION-VI	-	Water System
SECTION-VII	-	Roll Shop & Laboratory
SECTION-VIII	-	Civil & Structural
SECTION-IX	-	Cranes & Hoists
SECTION-X	-	Quality Assurance Plan
SECTION-XI	-	Erection testing and Commissioning
SECTION-XII	-	Performance Guarantee
SECTION-XIII	-	Drawings and Documents
SECTION-XIV	-	Implementation Schedule
SECTION-XV	-	List of Enclosure

These sections have been discussed in detail in this specification.

5.0 SPARES

5.1 The tenderer shall submit with his tender, quotation for various spares in accordance with the relevant clauses of the Invitation to Tender and General Conditions of Contract. Manufacturing drawings for wearing parts to be furnished. The offer for spares shall include the following:

5.2 Commissioning Spares

5.2.1 All spares required for commissioning of the equipment and for all efficient operation until provisional acceptance after demonstration of satisfactory performance in accordance with the guarantees shall be included. These items shall be based on the tenderer's experience in commissioning similar plants in the past. The commissioning spares are to be included in the main offer and must be at site along with the main equipment. The list of commissioning spares shall be included in the offer.

5.2.2 The successful tenderer shall be responsible for having the required items at site in sufficient quantities which will be finalised with him. The unit prices of the items of commissioning spares shall be indicated by the tenderer.

5.3 Maintenance Spares for Two Years' Normal operation

5.3.1 The tenderer shall submit his offer for spare parts for two years' normal operation of the plant after provisional acceptance of the plant after demonstration of satisfactory performance in accordance with the relevant clauses of the Invitation to Tender and General Conditions of Contract.

5.3.1.1 For imported spares, the offer shall include recommended spares list for two years' operation along with part numbers, catalogues, specification and unit prices.

5.3.1.2 For indigenous electrical equipment items, spare parts for two years' operation shall be quoted as above.

5.3.1.3 For other indigenous items, the successful tenderer shall furnish within three (3) months of order placement complete list of all indigenous spares indicating sub-supplier's name, model numbers, specification etc. to enable the Purchaser to purchase the spares directly from them.

5.4 **Insurance spares**: Insurance spares based on tenderer's experience shall be included in the offer.

6.0 TOOLS AND TACKLES

6.1 The tenderer shall include in his tender quotation for supply of special tools and tackles for normal operation and maintenance of the equipment as per relevant clauses of the Instruction to the Tenderer and General Conditions of Contract.

7.0 INITIAL FILL AND OPERATING SUPPLIES

7.1 The offer shall include information on the specifications including equivalent Indian brand names and correct/exact quantities of all initial fill materials such as lubricants, hydraulic fluids etc. required during yearly requirement for normal operation and supply as mentioned in General Conditions of Contract. The tenderer shall furnish clearly the list of operating supplies required for normal operation of the plant based on his experience of such plants.

8.0 TESTS

8.1 All necessary tests shall be carried out by the successful tenderer to demonstrate whether the materials and equipment offered conform to the relevant standards and specifications. The tenderer shall include and provide for in his offer all facilities, which shall enable inspection by the Purchaser or his authorised representatives in accordance with the relevant clause of the General Conditions of Contract.

8.2 The equipment shall be shop assembled for checking the accuracy of parts and alignment, except where assembling is to be done at site. If disassembly is required for shipment/transport, parts shall be adequately marked, where necessary, with permanent match markings to facilitate reassembly at site.

8.3 Test certificates for bought-out items include electrics, instruments, hydraulic and pneumatic equipment etc shall be supplied along with the supply of equipment.

9.0 INSTALLATION OF EQUIPMENT, COMMISSIONING AND PERFORMANCE GUARANTEE TESTS

9.1 The successful tenderer shall be required to provide the personnel for erection, start-up and putting into commission including performance guarantee test of all plant, machinery and equipment supplied by him, as well as those that may be procured from/fabricated by others based on his drawings, specifications and bill of quantities to ensure that the work is being carried out in accordance with the tenderer's design and other requirements. The services to be provided shall be in accordance with the Instruction to the Tenderer and General Conditions of Contract.

9.2 In this connection the tenderer shall submit with his offer the necessary details as called for in the Invitation to Tender.

10.0 MANNING AND TRAINING OF PURCHASER'S PERSONNEL

10.1 Manning

Tenderer to include in the offer the manpower giving break-up required for running the Wire Rod Mill.

10.2 Training

10.2.1 The Purchaser intends to have a nucleus of personnel will be trained by the successful tenderer so that these personnel will be able to efficiently commission the mill along with the commissioning engineers of

the successful tenderer and subsequently operate and maintain mill & its auxiliaries. The nucleus group of personnel in turn will train and guide the rest of the Purchaser's mill crew for early attainment of full production of the mill.

10.2.2 The tenderer shall suggest the number of Purchaser's managerial, operation and maintenance personnel to be trained, the duration of the training and the system of training programme comprising both theoretical and practical courses. The tenderer shall indicate the name and location of the plant/training establishment where the training is proposed to be imparted. The training shall cover operation and mechanical/electrical/ electric maintenance in a similar mill.

10.2.3 The training programme will be finalised with the successful tenderer after mutual agreement on the system and terms.

11.0 PERFORMANCE GUARANTEE

Refer Section-XII

12.0 DELIVERY

12.1 The tenderer shall indicate his earliest and best delivery.

12.2 The offer shall be accompanied by a time schedule showing individual time periods required for submission of drawings, procurement, manufacture, shipment, as well as times for erection, start-up, putting into commission and performance tests.

12.3 Refer section XIV in this regard.

13.0 SCOPE OF WORK BY SUCCESSFUL TENDERER

The scope of work by the successful tenderer shall be generally as follows:

a) Basic and Detailed Engineering for items of work as mentioned under specific sections.

b) Supply of plant and equipment, spares, special tools and tackles, consumables etc work as mentioned under specific sections.

c) Erection and supervision of erection and commissioning.

d) Demonstration of PG.

e) Submission of drawings and documents as per relevant specification.

f) CCTV & Communication system, Fire Alarm & Detection System **is not in the scope** of the Bidder

13.1 **Erection, Testing and Commissioning**

13.1.1 Tenderer is required to include erection, testing and commissioning of the complete plant & equipment, including technological structure etc. Shipping, transportation, loading, unloading, storage at site are in the scope of tenderer.

13.1.2 Painting of all plant and equipment after erection are in the scope of work of tenderer.

14.0 WORK BY OTHERS

The following facilities/work will be provided/executed by the Purchaser/other agencies and are excluded from the scope of work of the tenderer.

14.1 All foundation work, civil engineering work and building structures including building lighting except for Control pulpit.

14.2 Fabrication of embedments made of ordinary grades of steel as per successful tenderer's drawings.

14.3 Electric feeders, earth pits, utilities and services supply lines up to the battery limit/TOP as specified in the specification or as finalised with the successful tenderer.

14.5 EOT cranes.

14.6 Ventilation systems except those specifically included in the specification.

14.7 Central chilled water plant.

14.8 Fire fighting equipment, Fire Alarm & Detection system, CCTV & Communication system.

15.0 LIST OF APPROVED MAKE

15.1 The list of vendors for manufacture and supply of equipment/item and other supplies shall be as per the attached list of approved make as Annexure-1.

16.0 STABILITY CERTIFICATE AND STATUTORY CLEARANCE

16.1 Successful tenderer shall assist Purchaser for providing all necessary drawings/documents/data required for obtaining all statutory clearances from statutory authorities like Directorate of Factories, Central Electricity Authority, Inspectorate of Explosive, Inspectorate of Boilers etc.

17.0 PROGRESS REPORT

17.1 The successful tenderer shall submit the Monthly Progress Report, which will primarily consists of:

i) Project Time Schedule

ii) Status of Engineering

Basic

Detail

ii) Procurement Status

Order Plan

Actual Ordering

iv) Inspection and Manufacturing Status

v) Shipping Plan

vi) Erection Status

17.2 The successful tenderer shall submit a completion report along with final drawings as well as assist Purchaser in the codification of all drawings.

18.0 CONTENT OF TECHNICAL BID

18.1 The tenderer shall confirm concurrence with the tender specification requirement, and design norms and provide a write up on each section, as required. Tenderer shall highlight special features of his offer. Normally no deviations or exclusions are acceptable. However, the tenderer shall specify separately in case of any deviations or exclusions in his offer.

19.0 INFORMATION TO BE FURNISHED WITH THE TENDER

19.1 The information furnished shall include the following:

19.1.1 General description of the equipment offered specifying the important features and materials of construction etc including weight of equipment in division list to enable the Purchaser to have a proper understanding of the equipment offered and its operation.

19.1.2 The offer shall be accompanied by necessary drawings as called for in the Instruction to the Tenderer and General Conditions of Contract.

19.1.3 The tenderer shall furnish all the preliminary data regarding the various requirements of power, utility and water at the agreed battery limit with the offer and also indicate the capacity and number of cranes in each aisle of Wire Rod Mill.

SECTION - II – PROCESS AND MECHANICAL

1.0 DESIGN BASIS

1.1 The Wire Rod Mill shall produce wire rods in the size range of 5.5 to 12 mm dia in coil and bars in the size range of 12 to 80 mm dia in straight length.

1.2 The size-wise distribution of total production from the mill shall be as given below:

Product	**Size range (dia meter)**	**Share of total production**
		%
Wire rod	5.5	6.0
	6.5	6.0
	9	6.0
	10	6.0
	12	6.0
Bar	12	7.0
	16	7.0
	20	7.0
	25	7.0
	30	7.0
	40	7.0
	50	7.0
	60	7.0
	70	7.0
	80	7.0
Total	**..**	**100.0**

1.3 The grades to be rolled in the mill will comprise of super alloys, titanium alloys, stainless steels, low alloy steels and special steel. It is envisaged that the average grade-wise distribution of total production from the new mill will be as follows:

Grade	**Share of total production, %**	**Tensile strength**
Low alloy (DIN 15CDV6, EN8, EN 24, etc)	40	600 MPa
Stainless steel (AISI 330, AISI 316, 304, etc)	20	650 MPa
Titanium alloy (Grade1, Grade2, Grade 5, etc) ;<550 MPa	20	550 MPa
Super alloy(Inconel 718, Nimonic 80A, etc.)	20	1500 Mpa
Total	100	

1.4 The grades to be rolled shall include those given in Performance Guarantee Test , Chapter –XII.

1.5 The finished product tolerance to be achieved by the mill will conform to the applicable International Standard/MIDHANI's existing product specification.

1.6 Straight length bars shall be finished in lengths of 3 to 9 m and shall be made into bundles, if required. The bundles and coils will be strapped manually and weight of wire rod coil will correspond to the input of weight of the billet.

1.7 All the latest technological features shall be incorporated to ensure lowest rejections of the finished products.

1.8 The input material to the mill shall be forged billets from the existing Forge Shop of MIDHANI. Prior to feeding these billets to the new mill, the billets will be conditioned as required in the existing conditioning facilities of MIDHANI. The size of forged and conditioned input billet will be either 125 mm sq. or 120 mm. The length of input billet will range between 1.5 – 3 m. The Tenderer shall indicate the length of input billet corresponding to different products to suit the reheating and rolling requirement with minimum material loss.

1.9 The Tenderer will also indicate the required dimensional tolerances for above billet in cold condition:

a) Sides
b) Length
c) Twist
d) Bulging
e) Rhomboidity
f) Camber

1.10 The material yield expected from the mill is 95% (minimum). However, the tenderer shall design the mill and the rolling process suitably to achieve higher yield which will be indicated in the offer.

1.11 Annual planned operating days for the mill shall be as follows:

Calendar days	.. 365
Maintenance shutdown days (annually and weekly)	.. 65
No. of operating days per year	.. 300
No. of operating shifts per day	.. 3

1.12 The mill will produce a wide variety of grades in very small lot sizes. Different grades of materials have different heating cycles and the furnace will have flexibility for heating of different material grades. For this purpose, one number of batch type, reheating furnace shall be provided keeping space provision for two more furnaces for future. Furnace will be designed to enable heating of 3 to 4 tons of materials per batch. The tenderer will locate the furnace with space provision for future furnaces depending on the available area and his mill configuration, logistics, loading

and unloading facilities. **Furnace shall be designed to achieve temperature uniformity as per standard AMS- 2750E and adequate number of R type thermocouples shall be provided to demonstrate the temperature uniformity as per afore said standard.**

1.13 Due to the nature of some specific materials in the production programme, slow process requirement and resultant temperature losses, continuous rolling of input billet to smaller size bars and wire rods may not be feasible. In such cases, input billets may need to be reheated and rolled to intermediate sizes. The intermediate sizes will be cut and reheated again as required for further rolling to smaller bars and wire rods. Considering the above rolling concepts, product-mix, input billet specification and batch type reheating furnace, the minimum annual production from the mill shall be 2000 tons based on 250 operating days and 1 shift production. The Tenderer shall furnish a production calculation to demonstrate the capacity of the mill for the same. However, the Tenderer shall also submit a calculation to indicate maximum production capability of the mill in 300 operating days with 3 shifts operation without any furnace restriction and all other design parameters remaining same.

1.14 The mill shall be installed at $\pm$ 0.0 m level**.**

2.0 DETAILS OF SCOPE OF SUPPLY

The scope of supply for the equipment shall include, but not be limited to the following:

a) Billet charging and discharging equipment.

b) Billet handling manipulator for charging and discharging of billets from fixed hearth batch type reheating furnace.

2.1 Mill equipment

2.1.1 Reversing roughing stands, intermediate stands and finishing stands complete with rolls, chocks, bearings, drive spindles, spindle supports, pinions, reduction gears, couplings, etc.

2.1.2 Special tackles including static guides, roller guides, guards, boxes and rest rebar, etc.

2.1.3 Rolls and stands changing equipment including special tools, tackles, accessories, optical roll & guide setting devices, changing area equipment, washing/cleaning equipment, etc.

2.1.4 Special tools, tackles and accessories for assembly and dismantling of finishing rolls/rings as required.

2.1.5 Rolls and guides cooling system.

2.1.6 Pinch rolls, guide tubes, guide troughs, bridging troughs, bridging plates, roller tables, manipulator and tilters as necessary.

2.1.7 Stand tilting device in case H/V configurations are followed covering all stand sizes.

2.1.8 Loopers.

2.1.9 Mill shears with shear blades and blade changing equipment & tools as required.

2.1.10 Scrap collection and removal arrangement including scrap bucket.

2.1.11 Online induction heater, if required.

2.1.12 Bidder shall supply two (2) sets of grooved rolls (fitted with necessary labyrinth rings, inner races, seals etc.) chocks, bearings, shear blades, guides, guide internals, pinch rolls and similar operating parts etc.

2.1.13 Templates/gauges (2 sets) for checking grooves on rolls and guides (guide rollers & static guides) along with drawings for templates; detailed rolling schedules; roll pass design including roll groove drawings and groove distribution drawings; manufacturing drawings including material specification, requirements of heat treatment and patterns, if any, of rolls, chocks, all rolling tackles including pre-funnels, static guides, roller guides, guards, boxes & rest bar, guide rollers, guide internals, shear blades, etc. for covering the entire product range.

2.1.14 Bidder shall furnish list of quantity of all operating consumables required for one year smooth production of the envisaged product-mix.

2.2 Finishing facilities

2.2.1 In-line water cooling facilities for bars and wire rods complete with all accessories wherever required.

2.2.2 Dividing and chopping shears complete with shear blades, blade changing equipment and scrap collection facilities.

2.2.3 Bar cooling facilities and collecting table with approach roller table and required transfer device.

2.2.4 Pneumatic hand strapping equipment (1 no.) for bundles and coils.

2.2.5 Bar feeding system to wire rod line complete with roller feed tube, pinch roll etc.

2.2.6 Finishing blocks preferably 8 to 10 stands of cantilever design for twist free rolling.

2.2.7 Laying head with pinch roll.
2.2.8 Coil cooling conveyor system.
2.2.9 Reform tub with coil collecting facilities
2.2.10 Coil tilting and transferring device.
2.2.11 Coil turnstile (four arms).
2.2.12 Foundation bolts, embedments, grouting under base plates for all equipment & facilities under bidder's scope of supply.

2.2.13 Technological structures and simple parts including safety guards, platforms, handrails, stairs, supports, steel cross-overs, trench & pit covers etc. related to equipment & facilities under bidder's scope of supply.

3.0 EQUIPMENT SPECIFICATION

3.1 Billet Charging Equipment

3.1.1 The billets will be stored in the dedicated storage area in the mill aisle. A billet charging manipulator car will charge the billets from the storage area to the batch type reheating furnace. After reheating of the billets, the hot billet will be unloaded from the reheating furnace by the billet charging manipulator and charged on the inlet roller table of the roughing mill stand.

3.1.2 The billet charging manipulator shall be capable of feeding and emptying the billet to and from the reheating furnace. The manipulators shall be designed to handle also the intermediate sizes to enable multiple reheating. The manipulator should be designed to maneuver inside the mill aisle suitably with short turning radius, keeping in considerations of space constraints in the mill layout (No. 28785-000-000-PRR-0001, Rev.0).

3.1.3 Due to the nature of some specific materials in the production programme, slow process requirement and resultant temperature losses, continuous rolling of input billet to smaller size bars and wire rods may not be feasible. In such cases, input billets may need to be reheated and rolled to intermediate sizes. The intermediate sizes will be cut and reheated again as required for further rolling to smaller bars and wire rods. The tenderer will review the above concept with respect to the envisaged product-mix and select the mill configuration accordingly. In this regard, the mill configuration shown in the layout drawing is indicative and not binding for the tenderers.

3.1.4 The tenderer will indicate the type and number of stands considered by him for each rolling group (roughing, intermediate, finishing etc). All stands will be of latest design.

3.2 Mill Equipment

3.2.1 All stands (roughing, intermediate and finishing stands) shall be of rigid design and individually driven. Suitable arrangement for quick changing of roll grooves and their quick alignment in the pass line shall be provided. Roll gap setting shall be by motorized screw down mechanism. Roll balancing for the stands shall be done hydraulically

or mechanically as per stand design. For accurate adjustment of roll gap, it is preferred to have symmetrical roll separating arrangement in these stands. Vertical stands, if provided, shall be of top driven design. The connecting and disconnecting arrangement of these stands, rolls, spindle, coupling, hoses etc shall be of quick changing devices. The Tenderer shall provide mechanized arrangement for changing of stands, rolls etc.

3.2.2 The wire rod finishing block shall be of suitable design. The finishing block shall be of no-twist type, each block shall have cantilevered rolls and alternative roll pairs shall be at 90 deg. to each other and at 45 deg. to the horizontal surface.

3.2.3 The finishing block roll shall be disks type of tungsten carbide, each with one or two groups.

3.2.4 The finishing block shall be designed to roll twist free wire rods.

3.2.5 The block shall be equipped with all necessary internal piping and flexible hoses for lubrication, hydraulic and water systems.

3.2.6 The finishing block shall be totally covered by hinged covers for the protection of the operating personnel from cobbles.

3.2.7 Rolling tackles including pre-funnels, static guides, roller guides, guards, boxes and rest bar shall permit rapid assembly/dis-assembly and accurate alignment and they shall be simple in design for manufacturing.

3.2.8 Facilities for water cooling of rolls, roll passes and guides shall be provided as required. The rolls and guides cooling facilities shall include flow & pressure monitoring systems.

3.2.9 Wherever required, pinch rolls, guide tables, guide troughs, bridging troughs, roller tables shall be provided. Loopers shall be provided between the stands wherever necessary for tension free rolling. Shear of suitable design shall be provided wherever required for chopping, cropping and dividing operations. The scrap bucket to be provided and shall be designed to be handled by overhead crane.

3.2.10 A suitable induction heater shall be provided in the rolling line, if required, for specific grades of materials for heating the stocks before finish rolling.

3.2.11 A scale flume running below the mill line shall carry the mill scale to the centralised scale pit located in the western side of the mill as shown in the enclosed layout.

3.2.12 Lubrication and hydraulic systems as required to serve the mill equipment shall be provided.

3.2.13 All pipes, cable conduits, hoses etc. shall be guarded against damage from cobbles.

3.2.14 The sequence of operation, pass schedule, speed cone, temperatures, torques, kilowatt requirements, spindle torque, hourly output, entry & exit speeds, cooling curves covering the entire product range for roughing, intermediate and finishing stands shall be submitted.

3.2.15 The bidder shall also submit detailed rolling schedules, roll pass design, roll groove drawings, shear blades etc. Roll data sheet giving details of roll size, pass life, hardness (Shore C) shall be submitted by the bidder. Similar data for guides and guide rollers shall also be furnished.

3.3 Finishing Facilities

3.3.1 The mill shall have water cooling sections wherever required for necessary cooling of bars and rods products.

3.3.2 An inclined loop laying head with mount-in laying tube shall be provided. It shall be complete with all necessary delivery pipes and guides and shall have a direct drive through a gear reducer and a variable speed motor.

3.3.3 A dividing shear/s shall be provided after the finishing train for dividing the finish-rolled bar to cooling bed length.

3.3.4 Necessary facilities will be provided for cooling of the bar products before collecting the same in the cradles. The Tenderer will ensure the straightness of the bar during cooling operation. The cooled bar will be collected in the cradles and shall be handled by the shop EOT crane.

3.3.5 The mill shall have a conveyor to cool the wire rod convolutions and simultaneously transport the wire rod convolutions to the coil reforming chamber.

3.3.6 At the end of loop conveyor, a coil reforming chamber shall be located which will form wire rod coils from rod convolutions and deliver the same in the eye vertical condition on a roller table.

3.3.7 A coil tilting and transferring device shall be provided at the end of the roller table to tilt the coil from the vertical to horizontal axis. The tilted coil will be loaded on to each arm of this four arm turnstile. The coil will be handled by shop EOT crane.

3.3.8 The formed bundles and coils of finished bars shall be tied by steel straps by manual strapping machines.

3.3.9 Bidder shall provide necessary facilities for setting, assembly and dis-assembly of the stands, rolls, rings, guides etc in the mill. Further machining of the rolls, rings, guides etc will be off loaded.

4.0 LAYOUT CONSIDERATIONS

4.1.1 The main mill will be installed in a single bay in an area of approximately 25 m width and 120 m length the side of the existing billet conditioning bay at MIDHANI between existing building and existing plant road. An additional space of approximately 14.5 m width and 8 m length will also be available for the main mill facilities on the south-eastern side of the existing auto grinding shop.

4.1.2 A layout drawing (28785-000-000-PRR-0001, Rev.0) of the proposed wire rod mill is enclosed. The layout has been prepared considering the above space availability. However, the building and mill configuration shown in the layout are indicative only and not binding for the Tenderer.

4.1.3 The mill layout shall be planned with adequate road connections from existing plant roads for transportation of billet, finished products, scrap rolls and all other materials which need to be transported and out of the mill building.

4.1.4 Separate areas for storage of billets, intermediate sizes, finished bars and wire rod coils will be shown in the layout.

4.1.5 No separate roll shop is planned for the wire rod mill. It is proposed that processing of rolls, rings, guides etc. will be sub-contracted. However, the layout shall have a dedicated stand preparation area with necessary facilities for setting, assembly and disassembly of stands and rolls, rings and guides as required.

4.1.6 Scale pit, electrical control rooms, hydraulic and lubrication rooms etc. as required for the mill shall have to be accommodated in the space available for the main mill. The enclosed layout shows the scale pit on the south-western side of the existing conditioning shop. This area may also be utilised by the Tenderer.

SECTION - III – REHEATING FURNACE

1.0 DESIGN BASIS

1.1 One (01) No. fixed hearth furnace is proposed to be installed for the reheating of the forged billet of 125 sq.mm or 120 mm dia billets of 1.5 to 3 m length. The furnace of capacity 3-4 Ton in batch operation shall be suitable for heating the billets up to a maximum temperature of 1250 ^{0}C. The required basic engineering data to be provided by Mill Supplier. The charging and discharging of the billets will be carried out by manipulator car supplied by others.

1.2 The furnaces shall be designed to fulfill the following requirements:

No. of furnace required	One & Space provision for another two
Type of furnace	Fixed hearth furnace
Charging device	Manipulator car
Discharging device	Manipulator car
Materials to be heated	As per product-mix appearing in SECTION – II
Charge Size	125 sq.m x 1.5 to 3 m long billet and 120 mm dia x 1.5 to 3 m long billets
Type of Loading	Single/Double Row
Capacity of the furnace (Billet supports weight to be considered while deciding capacity of furnace)	To match with the mill requirement
Mill floor level, m	$\pm$ 0.00
Billet temperature at input, ^{0} C	Ambient
Rate of heating, ^{0} C/hr	150 at full load
Furnace Design temperature ^{0} C	1300 (max)
Furnace Temperature uniformity	.. $\pm$ 10 ^{0} C
Temperature control accuracy	.. $\pm$ 2 ^{0} C
Fuel ..	LPG

2.0 EQUIPMENT SPECIFICATION

2.1 **Furnace structural**

The fixed hearth furnace shall be fabricated from mild steel plates of minimum 6 mm thickness, reinforced by the rolled steel sections in the form of buck-stays, horizontal binding members, etc. The door opening periphery

on the furnace shall be made of heat resistant cast alloy DIN 1.4832/ASTM 310. Necessary platforms, ladders, handrails for safety and easy maintenance/operation, support for piping, ducting, etc shall be provided.

2.2 **Doors**

One (1) electro-mechanically operated rise and fall type door shall be provided for each furnace. The door shall be suspended from an overhead structure. The door driving unit complete with motor, reduction gear unit, electromagnetic brake, limit switch shall be installed on the overhead structure. Door shall be fabricated from plates of adequate thickness and reinforced with structural steel members. The door frame and door opening periphery shall be made of heat resistant cast alloy DIN 1.4832/ASTM 310. Necessary sealing arrangement shall be provided by using pneumatic cylinders to minimize heat loss through the door opening. Sand sealing is not allowed.

2.3 **Combustion system**

2.3.1 The combustion system shall be designed for efficient heating of the billet with required flexibility for adjusting the parameters depending upon the mill operational requirement.

2.3.2 The burners shall be suitable for firing with LPG. The burners shall be of low emission/low NOx type. The acceptable make of the burners is as per make list provided in Annexure – 1(Approved make list)

2.3.3 The capacity of the burners shall be at least 20% more than that required on the basis of the peak fuel consumption calculated based on the maximum furnace loading. The burners shall be complete with pressure regulating device, pressure gauge, pressure relief valve etc.

2.3.4 Fuel fired furnace shall be supplied with sufficient number of combustion air blowers with stand by blower. The blower shall be of centrifugal type and heavy duty steel plate construction. Blower speed shall be limited to 1500 RPM and VFD driven. The blowers shall be considered for acoustic insulation to restrict the sound level to 85db at 1 m from source The capacity of each combustion air blower shall be 20% higher than the volume of air required for peak fuel consumption rate considering 10% excess air. The furnace air fuel ratio should be settable from 1:27 to 1:34.

2.2.5 **Refractories and Insulating Material**

2.5.1 One (1) set of refractories and insulating materials shall be provided for furnace. The suggested type of lining is indicated hereinafter. The tenderer shall specify the type of lining and thickness of layers used in the different regions of the furnace.

2.5.2 The sidewalls, backwall, roof and door shall be lined with ceramic fibre modules of density 192 kg/m3 or above , Grade - 1425^0 C HTZ backed up by fiber blanket. Stainless steel foils may be applied over the back up lining to prevent the access of corrosive gases to the fibre blanket. Necessary fixing arrangement of the lining shall have to be provided by the Tenderer.

2.5.3 The hearth shall be lined with abrasion resistant high alumina bricks backed up by insulating bricks and insulating castable

2.5.4 The waste gas flue duct/channel shall be lined with insulating castable/Ceramic fiber module.

2.5.5 Metallic anchors shall be made of AISI 310 for furnace box and of AISI 304 for other areas.

2.5.6 The outside skin temperature shall not exceed 50^0C above ambient temperature at any point on the shell, except in the region of 1 m from any opening.

2.5.7 Adequate quantity of refractories and insulating material shall be supplied so that there is no interruption of laying work at site due to wastage during transport, handling and laying.

2.6 Waste Gas Exhaust System

2.6.1 Products of combustion of the fuel fired furnace shall be exhausted through underground/overground metallic flue duct leading to chimney. The ID fan (if required) shall be with VVVF drive. It shall be considered acoustic insulation to restrict the sound level to 85db at 1 m from source. Most efficient waste heat recovery system as applicable (such as recuperative/regenerative burner or recuperator, etc) from flue gas will be provided. Tenderer to consider chimney size suitable for connection to three similar furnaces. The steel chimney shall be self supporting type and conform to IS: 6533-1989, IS: 875-1987 and CPCB regulations.

2.6.2 Damper for automatic furnace pressure control shall be located in the waste gas flue and the same shall be made of heat resistant material to withstand the waste gas temperature.

SECTION - IV - ELECTRICS, AUTOMATION, INSTRUMENTATION, CCTV COMMUNICATION AND FIRE DETECTION ALARM SYSTEM

1.0 GENERAL

1.1 Scope of Work

1.1.1 The scope of work covered by this specification shall include design, manufacture, testing, supply, loading/unloading at site, storage at site, handling, erection, testing and commissioning of the electrical, instrumentation and automation equipment described below under Clause 4.0 – Scope of Work Division List of the Tenderer for the Wire Rod Mill. It stipulates the scope of supply, basis of design and the specification of equipment to be supplied by the Tenderer. The design basis and the technical features of the equipment are described later under Clause 6.0.

1.1.2 The electrical equipment offered shall be complete in all respects to achieve smooth and efficient integrated operation of the entire mill. Any item of the equipment not included in this specification but essential for proper installation, operation and maintenance of the mill shall be included by the Tenderer in his offer and reasons for such inclusion shall be clearly stated in the offer.

1.1.3 The Tenderer shall be responsible for final tuning of the application software for the drives and automation systems offered.

1.1.4 List of approved make (Vendor) list of Midhani for the equipment/devices is a part of this specification Tenderer shall finally select one of them. Tenderer will also submit a list of preferred make for their equipment, not covered in the above mentioned approved make list. Where necessary, Purchaser reserves the right of selecting the manufacturer of electrical equipment, automation equipment, instruments and control or any other specialised item from reputed sources and the successful Tenderer shall agree to supply equipment of the particular make in the interest of standardization, as required.

1.2 Standards

1.2.1 The equipment and accessories covered under this specification shall be designed, manufactured and tested in accordance with the latest relevant standards and codes of practices published by the Bureau of Indian Standard (BIS) wherever available, in order that specific aspects under Indian conditions are taken care of.

1.2.2 In case where Indian Standard is not available, the equipment and accessories shall conform to the latest standards and codes of practice published by any other recognised National Standards Institution or latest publications of International electrotechnical Commission (IEC).

1.2.3 All electrical equipment shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation and operation of electrical plants.

1.2.4 All equipment shall comply with the statutory requirements of the Government of India and the Government of Telangana.

1.2.5 All electrical equipment and installation shall also conform to National Electrical Code, as regards safety, earthing and other essential provisions specified therein for installation and operation of plants.

1.3 Site Conditions

1.3.1 Ambient conditions

The electrical equipment proposed shall be suitable for operation under the following local conditions;

Altitude of site : <1000M (above sea level)

Ambient temperature:

i) Furnace Area : 55^{O}C
ii) Shop Floor Area : 45^{O}C
iii) Electrical switch gear Room : 30^{O}C
iv) Drive, PLC, Computer UPS control room and Control pulpit : 25 $\pm$ 2^{O}C (air conditioned)
v) Under direct incidence of sunrays : 50^{O}C (Outdoor)
vi) Relative humidity : 83%

NOTE:

(1) Although ECR, Control pulpits have ventilation/AC, all Drive/Electronic and automation equipment shall be designed for an ambient temperature of 40◦C. The power equipment like, HT Equipment, transformers, MCCs, Distribution Boards, isolators, ACB/MCCBs, motors etc. shall be designed for an ambient temperature of 45◦C. Apart from this, for the switchboards, the in-panel temperature as per the enclosure used shall also be considered for derating.

1.3.2 Voltage and Power Supply Conditions

1.3.2.1 System Parameters

	11 kV	**415 V**
Nominal system voltage	11 kV	415 V
Highest system voltage	12 kV	433 V

	11 kV	415 V
No. of phases	3 phase	3 phase, 4 wire
System frequency	50 Hz	50 Hz
Voltage variation	$\pm$ 10%	$\pm$ 10%
Frequency variation	$\pm$ 5%	$\pm$ 5%
Combined voltage and Frequency variation	$\leq \pm$10%	$\leq \pm$10%
System earthing	Resistance earthed	Solidly earthed
Type of circuit-breaker	Vacuum	ACB/MCCB
Rated short-time withstand capacity of circuit breaker and its duration	40 kA for 3 second	50 kA for 1 second
Power frequency withstand voltage	28 kV RMS	2.5 kV RMS
Impulse withstand voltage	75 kV peak	-
Short circuit level in MVA	750	-

2.0 CONTROL VOLTAGE

i) 415 V Air Circuit breaker operation : 240 V, 1-phase, 50 Hz

ii) AC contactor coil, auxiliary relays etc : 110 V, 1-phase, 50 Hz

iii) Cluster LEDs for indication : 110 V AC

iv) Normal single/double solenoid valves : 24 V DC, Unearthed

v) PLC Digital Input isolation) : 24 V DC (galvanic

vi) Digital Output : 24 V DC (relay output, fuse protected)

Control circuit for adjustable speed drive system will be designed to operate satisfactorily (safe shutdown) considering transient voltage dip (to Zero voltage) lasting for half cycle.

Shielding shall be provided between primary and secondary windings of control transformers and converter supply transformers.

3.0 BATTERY LIMIT

Power feeding to the WRM battery limit i.e. terminal point of Tenderers main distribution board from outgoing terminals of employers 11 kV and 415 V switch boards (described under Clause No.5 below) including supply and installation of cables will be under Employers' scope of work.

Further distribution and conversion of power supply to all equipment/devices (supplied by Tenderer) and converter transformer, if any, are included in the scope of Tenderer.

4.0 SCOPE OF WORK DIVISION LIST

The materials, equipment and services to be supplied shall include, but not be limited to the following:

(T – Tenderer, P – Purchaser, BD - Basic Data,
BE – Basic Engineering, DE – Detail Engineering,
SUP – Supply, E & C – Erection, Testing & Commissioning)

Sl. No.	Item	BD	BE	DE	SUP	E & C
1.	11 kV & 415 V switchboards to be installed at LBSS	T/P (1)	P	P	P	P
2.	Power feeding to the Wire Rod Mill battery limit from outgoing terminal of Employer's 11 KV & 415V switchboards.	T/P	P	P	P	P
3.	Control cabling for transmitting alarm, trip signals as well as interlocking to the Employer's upstream 11 kV switchboards at MRSS including supply of cables.	P	P	P	P	P
4.	Power Distribution equipment covering 11 kV/415 V load center substations (LCSS') comprising incoming isolation breakers (as applicable), power transformers, switchboards etc. for process loads of Tenderer.	T	P	P	P	P
5.	Main drive system with AC motors and accessories including motor ventilation equipment, associated converter transformers and power supply equipment, necessary regulation, control, protection, indication and power circuit devices	T	T	T	T	T

Sl. No.	Item	BD	BE	DE	SUP	E & C
6.	In-line auxiliary adjustable speed AC system with motors and accessories including motor ventilation equipment where required, associated converter transformers and power supply equipment, necessary regulation, control, protection, indication and power circuit devices	T	T	T	T	T
7.	Fixed speed AC motors and accessories, motor control centers (MCCs) and power distribution boards	T	T	T	T	T
8.	Field mounted devices, sensors, transducers and special instruments / machines	T	T	T	T	T
9.	Level 1 Automation system complete with all required hardware, software, networking, printers and peripherals, necessary programming & debugging tools, as well as final tuning of application software for the entire Package.	T	T	T	T	T
10.	Establishing communication links with the automation systems of Purchaser's Higher Level automation system and other systems as required.	T	T	T/P	T/P	P/T
11.	Instrumentation controls as part of basic control level (Level-1) including Field mounted instruments comprising primary measuring elements, transmitters, converters, switches, control/on-off/ safety shut-off valves with actuators, line mounted indicators etc. as required	T	T	T	T	T
12.	VOID.					
13.	Uninterrupted Power Supply system (UPS) including battery, power supply distribution boards, as required. UPS requirement for reheating furnace system shall be met from the mill UPS	T	T	T	T	T`

Sl. No.	Item	BD	BE	DE	SUP	E & C
14.	Control desks, local control posts/ stands and local control boxes.	T	T	T	T	T
15.	Control pulpits	T/P	T	P	P	P
16.	Air-conditioning and illumination system for Control pulpits.	T/P	P	P	P	P
17.	All interconnecting Power & control cabling within the supplier's battery limit, complete with accessories viz. junction boxes, termination kits etc as required for proper installation & commissioning of all equipment. Supply of all standard Power & control and screened (for 4-20 mA) cables shall in the scope of the Tenderer.	T (6)/P	T	T	T	T
18.	All interconnecting cabling for screened power, data communication (UTP, fiber optic, profibus), video & signal cables, thermocouple compensating cable, load cell cable, for instrumentation, automation system, CCTV and communication system, FDA system and complete with accessories viz. junction boxes, termination kits etc as required for proper installation of all equipment.	T (6)/P	T	T	T	T
19.	Closed Circuit Television (CCTV) and Communication System.	T	P	P	P	P
20.	DG power feeding (If any) from outgoing terminal of Employer's 415V DG switchboards up-to Tenderers' switchboard including supply of cables.	T/P (1)	P	P	P	P
21.	Any special equipment lighting excluding CCTV lighting.	T	T	T	T	T
22.	Passive fire protection measures for the Tenderer's panels and cables as elaborated later under electrical specification within the Tenderer's battery limit.	T	T	T	T	T
23.	Supply of furniture like desk top consoles, printer tables, book shelf / cabinet, operator's chairs etc for	P	P	P	P	P

Sl. No.	Item	BD	BE	DE	SUP	E & C
	the pulpits and automation rooms.					
24.	All special testing equipment / instrument required for commissioning including performance test.	-	-	-	T	-
25.	Crane power supply	T	P	P	P	P
26.	Air Conditioning & Ventilation System including electrics.	P/T (4)	P	P	P	P
27.	Fire Detection and Alarm (FDA) System.	T	P	P	P	P
28.	Illumination System	P/T (5)	P	P	P	P
29.	Lightning protections	P	P	P	P	P
30.	Supply of Commissioning Spares	-	-	-	T	-
31.	Special tools and tackles	-	-	-	T	-
32.	Submission of all basic and detail engineering drawings for Tenderer's equipment system including as-built drawings.	-	-	-	T	-
33.	Participation of Purchaser's personnel during application software development for the automation system of the Tenderer.	-	-	-	T/P	-
34.	Main earthing Grid i.e. primary earthing grid of the Mill area for equipment earthing.	P	P	P	P	P
35.	Safety and electronic earthing including earth electrodes, earthing materials, copper cables for electronic earthing for the Tenderer's equipment and interconnection with the main earth mat of Purchaser	T	T	T	T	T
36.	Transformer Neutral earthing,	P	P	P	P	P
37.	Safety equipment such as protection guard, thimbles, pit covers, shock treatment chart, HV hand gloves, rubber mat, danger boards etc as applicable **for Tenderer's supplied equipment**	T	T	T	T	T

Sl. No.	Item	BD	BE	DE	SUP	E & C
38.	Platforms and access ladders to access different equipment for maintenance purpose as applicable.	T	T	T	T	T
39.	Temporary power distribution equipment & construction lighting for construction & erection work from Employer's construction power switchboard.	T	T	T	T	T
40.	Supply of all consumables as required like paper, printer cartridge, CD/DVD, oil, etc for electrical and automation system upto issue of Provisional Acceptance Certificate (PAC).	-	-	-	T	-
41.	Electrics & Controls for the sump pumps including the power distribution for WRM area & WRM Electrical control rooms.	T	T	T	T	T

NOTES:

(1) Tenderer to furnish quantities, loading, Max demand, peak demand of required feeders.

(2) Tenderer shall coordinate with Employer for establishing successful terminations

(3) Tenderer shall coordinate with Employer for establishing successful communication

(4) Tenderer will indicate heat load data and requirement of CCTV & Communication and FDA system for their equipment in Mill area, ECRs & Control rooms

(5) Tenderer to indicate their recommended illumination levels in ECRs, Control rooms and Mill area.

(6) Tenderer to furnish Cable specification with BOQ, Cable & JB schedule, interconnection diagram and cable routing drawing for all types of cables. Termination of special cables like FO cables shall be in the Tenderer scope.

(7) Tenderer to submit preliminary overall SLD

(8) Tenderer to indicate the requirement of emergency power (load list) & power factor of the load.

(9) Tenderer to participate for coordination with other suppliers/ Employer for successful implementation of the emergency scheme.

(10) Preliminary motor list to be submitted.

5.0 DESIGN BASIS

5.1 Existing 11 kV switchboards located at MRSS have been augmented by the Employer for catering power for expansion projects.

5.2 The required power will be drawn over 11 kV XLPE cables and feed a 11 kV new switchboard at a suitable centralized location near expansion project site wherein a 11 kV Load Block Distribution Station (LBDS) will be established. This new LBDS will supply WRM as well as the other loads of auxiliary plant units which shall be coming during expansion.

5.3 This new 11 kV switchboard feeding fluctuating and steady loads of WRM, is proposed to be located in the new LBSS building. This switchboard will be fed over fully rated duplicate cable feeders from upstream existing 11 kV switchboard at MRSS. A number of 11 kV feeders will be made available from these switchboards, mentioned above, to the Tenderer for feeding downstream mill and furnace loads.

5.4 The controls for the Wire Rod Mill and Reheating Furnace shall be designed as an integrated system considering applications of drives, instrumentation and automation systems.

5.5 The motors and controls shall be provided to suit the main mechanical equipment as well as the process line control requirements. Drives which require speed control, positioning and co-ordinated operation shall be provided with AC motors fed from adjustable speed drive system. All other drives, where speed control is not required, such as pumps, blowers etc shall be provided with constant speed AC motors and controlled from motor control centers. The controls shall be designed for easy interfacing with other processors.

5.6 Criteria for selection of voltage levels for fixed speed motors

Type of motor & rating	**Arrangement of powering**
AC squirrel cage induction motor of rating up to 110 kW.	415V, 3 phase, 50Hz with DOL. However 415V, 3 phase, 50Hz with soft starter shall be used for the high inertia motors up to 110 kW as per process requirement.
AC squirrel cage	415V, 3 phase, 50Hz with soft

induction motor of rating above 110 kW and up to 315 kW.	starter.
Motors of rating above 315kW and up to 1000 kW	11kV with DOL starting.
Motors of ratings above 1000 kW and up to 2000 kW.	11kV with independent assisted starting.

5.7 The basic level automation (Level-1) system required for interlocking, sequencing, switching, mill controls, instrumentation controls for reheating furnace, billet tracking, storage of rolling schedules as look-up tables for manual mill set-up when required, diagnostics and alarm functions, data acquisition of important parameters of equipment/process etc. shall be carried out by distributed control philosophy through programmable controllers (PLC), microprocessor based systems and PCs. The PLCs shall be of one make only for the entire WRM under scope of work of the Tenderer.

5.8 Power supply to the automation equipment as well as to the processors for all electronic/microprocessor based equipment and instruments as well as intercommunication PA system and CCVM system, FDA system, shall be fed from the uninterrupted power supply systems (UPS).

5.9 A typical power single line diagram, Drawing Nos. 28785 -000-000-ELEI-0001and an indicative configuration diagram Drawing No. 28785-000-000-ELI-0001 are enclosed for reference.

6.0 EQUIPMENT/SYSTEM SALIENT TECHNICAL FEATURES

6.1 Converter Transformers (for feeding Converters of AC Drives)

6.1.1 For main and adjustable speed auxiliary drives, converter grade indoor cast resin (AN) transformers with 11 kV primary, preferably 2-winding shall be considered for feeding the common converter of main and auxiliary AC Drives. For transformers rated 300 kVA and below, 415V primary supply shall be selected. Transformer shall conform to IEC 60076, IEC 61378, IS 11171, IS 2026 for various design and test features. Rated 4 MVA & above shall be oil immersed type transformer. Primary side off-circuit taps of ± 5% in steps of ± 2.5% shall be provided by fully rated links. Rating of the transformers shall be selected based on the loading of the common converter catering to the inverters of the selected group of motors having class of insulation F with temperature rise of winding limited to 85°C as measured by resistance over an average ambient of 45°C. Number of type of converter transformers for main drives as well as for auxiliary drives shall be selected to a minimum. The duty classes of converter transformers shall meet converter loading Class IV with respect to nominal load as per IEC 60146-1-1 as: 1.0 p.u - continuous, 1.25 p.u - 2 hrs, 2.0 p.u - 10 sec. Earth

plate (shield) shall be provided between primary and secondary windings. Transformers shall be provided with PT 100 embedded temperature sensors, temperature scanner for winding temperature monitoring. For winding temperature ALARM & TRIP signals, thermistors (1 working & 1 standby per phase) shall be provided in addition to the PT 100 for temperature monitoring.

6.1.2 All standard accessories as per relevant IS/IEC shall be provided for cast Resin and oil filled transformers. Other features are as mentioned above for AN (Cast resin) type power transformer except neutral grounding.

6.1.3 The vector groups of the converter transformers shall be so selected to achieve overall 12-pulse rectification at the upstream bus.

6.1.4 Like distribution transformers, Emergency trip PB with status indication lamps of upstream breaker shall also be provided for converter transformers with 11 kV primary for tripping upstream circuit breaker where applicable.

6.2 Main Drive Motors with Controls

6.2.1 Main AC Motors

6.2.1.1 The AC main motors for the stands shall be squirrel cage induction motors and designed, manufactured and tested in accordance with IEC-60034 as applicable. The overload capabilities of the mill motors shall be as per NEMA standard for hot rolling mill applications or as recommended by the mill supplier based on their past experience for similar mills. For the later case, the Tenderer shall specifically indicate in the offer the references considered by them. The motors shall be specially designed for feeding from variable voltage variable frequency semiconductor based inverters without causing overheating and insulation damage for the specified application. The rating with speed range shall be as per the Mill builder's Motor List. Over speed above rated top speed shall be 20%. Individual motor shall be selected for each stand with number of frame sizes restricted to a minimum as practicable. Other features are:

i) The motors shall be provided with Class F insulation with temperature rise (measured by resistance method) limited to Class B at 100% loading.

ii) The enclosure protection shall be IP54.

iii) Individual motor ventilation unit shall be mounted on the respective motor with necessary instruments. The type of ventilation adopted with necessary details shall be clearly indicated in the offer.

iv) The motors shall be complete with all accessories including pulse encoders, vibration sensors for mill motor, space heaters, embedded temperature sensors (PT 100) for windings/phase (1

working, 1 stand-by), temperature sensors (PT 100) for each oil lubricated bearing (for large motors), insulated bearings etc. including motor mounted ventilation system with necessary instruments.

v) Also temperature signals for the motor winding and bearing temperatures (where applicable) shall be hooked up with the automation system for monitoring apart from standard alarm and trip functions to be realised in drive system.

6.2.2 AC Main Drive System

6.2.2.1 AC drive system, forming groups, for feeding the main stand AC motors shall be considered. For each group, regenerative type common converter (4-quadrant), common DC Bus (Copper) fed individual vector controlled PWM Inverters shall be considered for individual stand motors of the group. Proper care shall be taken for regenerative mode of operation to avoid device failure while delivering power to the bus. The converter shall be capable of maintaining rated DC voltage at all values of load current including short time service current rating at 90% rated AC voltage considering incoming voltage fluctuation as stipulated. Active Front End (AFE) type converter may be considered to achieve power factor close to unity.

6.2.2.2 Design and construction features for converter and inverter viz. overload capability, regulation system, protection, indication, annunciation, programming/parametering & diagnostics, connectivity to the Level-1 automation etc. Also the available overload capacity for converter & inverters shall meet the overloads specified by Mill Builder.

6.2.2.3 Drive regulation (open loop/closed loop) shall be suitable for the following:

Speed regulation range	:	1% ~ 100% speed
Speed reg. Accuracy (Steady state)	:	$\pm$0.1% (min) of 100% speed within speed regulation range
Impact speed drop (Dynamic response)	:	Not more than 0.25 percent-sec (for mill stands)

6.2.2.4 Single line diagram showing motor–inverter – common converter–converter transformer along with power circuit devices and approximate rating shall be included in the offer.

6.2.2.5 Special requirement, if any, for the cables between inverter to motor (flexible copper conductor cable with copper screen etc.) shall be indicated considering no failure of the motor bearings due to common mode voltage.

6.2.2.6 Full height matching empty cubicle with with-drawable folding table, 240 V 5A socket outlet, reading lamp for use of Lap

top PADT and keeping document/drawings shall be provided, one number for a group of drive line-up.

6.3 Auxiliary Adjustable Speed Drive Motors and Controls

6.3.1 Adjustable Speed AC Motors

6.3.1.1 AC squirrel cage induction motors shall be selected and the motors shall be designed, manufactured and tested in accordance with the requirements for the mill duty applications conforming to IEC 60034. The motors shall be designed for feeding from PWM voltage source inverter type power supply units. Other features are: IP55 enclosure protection, Class F insulation with temperature rise limited to Class B, two (2) Nos. ETDs (one working, one stand by), overload 150% (min) for 60 secs (apart from overload as specified in Mill builder's Motor List), Over speed 20% over top rated speed, two separate earthing terminals on motor body for earthing in compliance with Indian Electricity Rules. Motors for roller table application shall be specially designed for that application with sufficient stall time capability as per the process requirement and the same is to be indicated in the offer.

6.3.1.2 For geared motors with integral brake used for position adjustment applications, DC EM disc type brake shall be provided with 100% braking torque.

6.3.1.3 All accessories like Digital tacho/Pulse encoder, brakes etc as required shall be provided. Motor ventilation shall be IC 411 and/or IC 416 as required. Suitable motor ventilation system with air-to-water heat exchanger shall be provided where required with required monitoring devices. Motor cooling at low speed operation with rated power output shall be ensured. Motor cooling in IC number shall be clearly mentioned. The number of frame sizes of motors shall be kept to minimum as far as practicable.

6.3.1.4 For all in-line auxiliary motors (excepting roller table motors) PT 100 embedded temperature sensors shall be considered and the signals shall be hooked up with the automation system for apart from standard alarm and trip functions to be realised in drive system.

6.3.2 Adjustable Speed AC Drives

6.3.2.1 Regenerative (4-quadrant operation) AC inverter drives with microprocessor based digital regulation and control shall be provided for precise speed and torque control as per the application requirement. For shears, special control system shall be provided for accurate cut operations. The basic structure of the AC system shall be in line with the arrangement mentioned for AC main drive system forming separate groups with each group comprising common converter feeding DC bus and individual vector controlled PWM Inverter drive for each motor. The total drive system including the converter transformer shall be designed such that momentary overload of any motor or motors of the group e.g. shear motors shall not cause malfunctioning of other drives of the group due to fluctuation of DC bus voltage. If required, unit type drive system

may be considered for such application. Active Front End (AFE) type converter may be considered to achieve power factor close to unity.

6.3.2.2 Based on the application, standard V/F controlled adjustable speed drives fed from standard 415 V, 3-phase supply system may be considered. Where group feeding is considered e.g. roller table applications, individual motor protection shall be provided. In such case, local boards of IP 54 enclosure shall be formed for a group of motors with incoming MCCB (without protection elements) to work as isolator and requisite number of outgoing feeders, each having individual shunt operated MPCB with S/C & O/L protection, E/F (if motor is rated above 5.5 kW), indications on each compartment for ON/OFF/TRIP/ Thermistor trip/EF trip (as applicable). Group fault signal and status of each motor shall be annunciated in the automation system. Minimum two (2) spares shall be considered in each distribution board.

6.3.2.3 Design and construction features for converter and inverter viz. overload capability, regulation system, protection, indication, annunciation, programming & diagnostics, connectivity to the Level-1 automation etc. Also the available overload capacity for converter & inverters shall meet the overloads specified by Mill Builder.

6.3.2.4 Drive regulation (open loop / closed loop) shall be suitable for the following:

Speed regulation range : 1% ~ 100% speed

Speed reg. Accuracy (Steady state) : +0.1% (min) of 100% speed within speed regulation range

6.3.2.5 Single line diagram showing motor–inverter – common converter – converter transformer along with power circuit devices and approximate rating shall be included in the offer.

6.3.2.6 Regarding use of special cables between inverter to motor, refer to clause 6.2.2.5 above.

6.3.2.7 Regarding provision of empty cubicle, refer to clause 6.2.2.6 above.

6.4 Fixed Speed AC Motor and Controls

6.4.1 AC Motors

The AC motors shall be totally enclosed, 3-phase squirrel cage induction motors. Voltage level of the motors shall be selected based on the motor rating as specified. The motors shall be continuous duty, totally enclosed fan cooled (TEFC) having degree of enclosure protection of IP55, Class F insulation with temperature rise limited to class B. The speed of all motors shall be restricted to 1500 rpm as far as feasible. The continuous duty motors shall be energy efficient type (IE3~~1~~) for rating upto 200 kW as per IS: 12615-2011/IEC60034-30. Direct on line (DOL) method of starting shall be adopted unless where variable speed drives

may be preferred for energy saving Total number of frame sizes shall be kept to minimum as far as practicable. Other design and construction features of the motors shall be as per IS: 325/IEC60034.

6.4.2 AC Motor Controls

6.4.2.1 Motor Control Centres (MCCs) for 415 V Motors

6.4.2.1.1 The MCCs shall be provided for LT motor control as well as for power and control supply feeders for downstream equipment. The MCC shall be designed for 415 V, 3-phase, 4-wire, 50 Hz with 50 kA for 1 sec fault level. The MCC shall be single front, non-draw out type, compartmentalized suitable for extending on either side and will have a number of standard panels containing the required components. Loading shall preferably be restricted within 800 Amps. Busbars material shall be of aluminum with insulation sleeves. The MCC shall have one incoming feeder (except for furnace and oil lubrication system) and requisite numbers of outgoing motor feeders and power supply feeders as required. MCCs for furnace and oil lubrication system shall have double incomers. Ammeters shall be considered in the local control stations for pump and fan motors where required from the operational philosophy of the respective system. Electronic soft starters with external bypass circuit shall be considered for fixed speed motors rated 132 kW and upto 200 kW.MCC incomer shall work as an isolator only. For incomer ACB/MCCB shall be with out releases. Energy meter shall be considered at the incomer of MCC.

Motors rated above 200 kW shall be fed from 11 kV supply.

6.4.2.1.2 MCCBs used in the MCCs shall be with positive isolation feature as per IEC 60947.

6.4.2.2 High Voltage Motor Control Centres (HVMCCs) for HV Motors

6.4.2.2.1 In case of 11 kV motors HV MCC of 11 kV, 3-phase, 3-wire, 50 Hz with 40 kA for 3-sec fault level shall be provided. The HV MCC shall be single front, draw out in construction suitable for extending on either side and will have a number of standard panels containing the required components. The HV MCC shall have one incoming feeder and requisite numbers of outgoing motor feeders.

6.4.2.2.2 However, where only one or two motors are involved, they may be directly controlled by remote operated HT circuit breakers, provided the motors are not required for frequent start/stop operation.

6.4.2.3 Energy Saving Scheme – V/F Control

6.4.2.3.1 Where output is variable based on the process requirements, Tenderer offer AC variable speed drive system (constant V/F control) over open loop control with digital regulation system for higher rated pumps and fans/blowers instead of conventional DOL starting. Such an arrangement shall ensure energy savings in case of pump application by matching the flow to the process requirement without throttle valves and in case of fan application by matching the load output to process requirement without dampers.

6.4.2.3.2 The general technical features shall be similar to those described for auxiliary adjustable speed drive motors and controls in clause 6.4 above and these applications shall be suitably grouped with the same. The Tenderer shall clearly identify such applications in the offer.

6.5 Control Desks and Posts

6.5.1 Requisite type and number of operator's control desks and posts shall be provided for proper control and operation of Wire Rod Mill. The control desks and posts shall be strategically located. For auxiliary systems, the operation shall generally be carried out from HMI with local control box for maintenance shall be located near the respective equipment. The list of desks/stands/posts shall be furnished along with the offer.

6.5.2 The control desks and posts shall have minimum number of control devices like line selector switches, emergency push buttons, safely lock-out switches etc. Generally for important desks, operation through HMI keyboard shall be adopted. Intercom device shall also be mounted on the desktop. All important control stations where more than one desk section may be required, the layout of the desk sections as well as the devices on the desks shall be ergonomically designed to provide maximum operator's comfort as well as un-hindered view of the controlled line equipment. The LCD monitor type touch screen operator interface where provided at local control desks/stations, the same shall be designed considering the hostile environmental conditions prevailing, at the same time without sacrificing the ease and flexibility of operation. Apart from the control desks, other equipment such as PC based operator's terminals, printers, other VDU monitors, etc shall also be located at the pulpits, as applicable, adopting suitable mounting arrangement as well as moveable trolleys, as required.

6.5.3 The constructional features of the mill control desks shall match with the existing plants other desks, if provided, in pulpits. All control desks and posts shall be provided with scratch resistant stainless steel facia/top plate. For the control desks/stands located on the shop floor, protective transparent shields shall be provided where frequent operations are not required. Enclosure protection of control desks/stands/boxes shall be minimum IP 31 when located inside pulpit/control room and IP 54 when located in shop floor.

6.5.4 Apart from the Fast Stop and Emergency Stop, local lockable key switch shall be considered on control desks and stands strategically located in the mill for inhibiting operations of all equipment, hydraulic cylinders in a zone covered by the lock-out switch to carry out maintenance work safely. Like Emergency switch, the lock-out switch signals shall be hardwired. Local control box with Start (inching)/Stop (press-to-lock, turn-to-release) push button stations shall be provided near each DOL start motors. Also 'Control available' signal for authorisation of local operation from HMI shall be provided at the local desks/stations.

6.6 Uninterrupted Power Supply (UPS) System

6.6.1 The Uninterrupted Power Supply (UPS) system considering 100% hot stand-by arrangement with auto-changeover facility shall be provided to feed clean uninterrupted power to microprocessor controllers of drives,

automation systems, special machines including instruments as well as loudspeaker system. The two units of the UPS shall normally operate in parallel load sharing principle. It shall be designed, manufactured and tested in accordance with the technical requirements**.** The storage battery shall be lead acid Sealed Maintenance Free type (SMF) and shall be common for both the units with 30 minutes battery back-up time. Battery low voltage signal shall be made available for initiating safe shut down of PC based automation system.

6.6.2 The UPS shall be provided with two incomers with changeover arrangement. The UPS power supply (240 V, AC, 50 Hz, 1-ph/N shall be distributed over suitable distribution boards to cater all the loads. The outgoing feeders shall be provided with suitably rated Moulded Case Circuit Breakers (MCCBs) and Miniature Circuit Breakers (MCBs), as applicable with reasonable spare feeders. Enclosure protection of IP31 (min) shall be considered for the UPS system. Tenderer shall furnish UPS block diagram along with proposed distribution single line diagram in the offer.

6.7 Cables

6.7.1 L.V. Power Cables

6**.**7**.**1.1 1100 Volt grade, 90°C rating under normal condition and 250°C under short circuit condition, heavy duty power cables with stranded aluminium conductor, XLPE insulation, pressure extruded PVC inner sheath, round steel wire armour (if applicable) and pressure extruded FRLS PVC overall sheath(Only in heat zone area), as per following guidelines:

1100 V grade, 90 Deg.C rating heavy duty, XLPE power cable (A2XWY) conforming to following requirement and in line with IS:7098, IS: 5831, IS: 8130 & IS: 3975.

1.1	Conductor	Stranded and compacted plain aluminium conductor of grade H2 and class 2 of IS: 8130 and stranded, high conductivity annealed plain copper generally conforming to IS: 613 – 1964
1.2	Insulation	Extruded XLPE conforming to IS: 7098 (Part-I)
1.3	Core Identification (for three core cables)	By coloured strips applied on cores
1.4	Inner sheath	Pressure extruded PVC compound conforming to type ST2 of IS: 5831 for multi-core cables. Single core cables shall have no inner sheath.
1.5	Armour	Galvanised single round steel wire armour for twin and multicore cables as per IS - 1554(Part 1).
		Non-magnetic hard drawn aluminium

		single round wire conforming to H4 grade of IS: 8130 for single core cables.
1.6	Overall sheath	Pressure extruded FRLS PVC compound conforming to type ST2 of IS: 5831
1.7	Drum	Conforming to IS: 10418

6.7.2 Control Cables

6.7.2.1 1100 Volt grade, 90°C rating under normal condition and 250°C under short circuit condition, control cables with stranded copper conductor, XLPE insulation, pressure extruded PVC inner sheath, round steel wire armour (if applicable) and pressure extruded FRLS PVC overall sheath, as per following guidelines.

1100V grade, 70 Deg.C rating, PVC control cable (YWY) conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.

2.1	Conductor	Stranded, non-compacted & circular, high conductivity annealed tinned copper, generally conforming to IS: 8130 & IS: 613.
2.2	Insulation	Extruded PVC compound conforming to type A of IS: 5831.
2.3	Inner sheath	Extruded PVC compound conforming to type ST1 of IS: 5831 for three core cables. Single core cables shall have no inner sheath.
2.4	Armour	Galvanised single round steel wire armour for twin and multicore cables as per IS -1554(Part 1)
2.5	Overall sheath	Pressure extruded FRLS PVC compound conforming to type ST1 of IS:5831
2.6	Drum	Conforming to IS:10418

6.7.2 All special cables including screened, twisted pair, data link cables, FO cables, etc as required for interconnection of Tenderer's equipment/system Mill shall be included in the Tenderer's scope.

6.7.3 The supplier shall provide all cabling accessories for all cables covering cable trays, supports, exposed conduits, glands, lugs, , etc. as required for completeness of the installation.

6.7.4 Cross-sectional areas of multi-core and single-core power cables shall not exceed 300 sq mm and 630 sq mm respectively. For cables laid fully in conduit system generally single-core cables shall be used. Cables laid partly in trench and partly in GS pipes could be either 3-core or 3 single-core cables depending on the cross-sectional area of the cable selected.

However, preference shall be given for use of number of multi-core cables over use of single-core cables.

6.7.5 Minimum cross-sectional area of power cable shall be 10 sq mm in case of aluminium conductor and 2.5 sq mm in case of copper conductor.

6.7.6 All power and control cables shall be of stranded type.

6.7.7 The sizes of power cables shall be selected on the basis of current loading, ambient temperature condition, method of installation and permissible voltage drop in each circuit. The minimum cross-section of the cable shall be determined on the basis of available short-circuit current and tripping characteristics of the circuit protective devices.

6.7.8 The control cables shall be multi-core, heavy duty type, XLPE insulated, PVC sheathed, armoured having number of cores of 3, 5, 7, 10, 14, 19, 27 and 37 with copper conductors. For 3 and 5-core control cables, only 2 and 4-core shall be utilised and others shall be left as spares. For control cables having cores from 7 upward about 20 per cent or minimum 2 cores shall be kept as spare for future use. The cross-sectional area for the control cables shall be either 1.5 sq mm or 2.5 sq mm with copper conductors. For cabling within a plant unit, generally 1.5 sq mm cables shall be adopted unless specifically required by control power requirement when 2.5 sq mm cable shall be used. For inter-plant cabling the control cables adopted shall have cross-sectional area of 2.5 sq mm.

6.8 Cabling Materials

6.8.1 Cable Trays and Accessories

6.8.1.1 Factory made ladder type/perforated type cable racks/trays shall be used for laying of cables in cable tunnels, trenches, basement floors and cellars and while routing of cable along technological structure.

6.8.1.2 The pre-fabricated cable racks/trays shall be made of 2 mm thick galvanized sheet steel. The factory made system of cable racks/trays shall be complete in all respects with all standard accessories like reducers, bends, tees, risers etc and shall be suitable for bolted type assembly at site so as to avoid any welding.

6.8.1.3 The cable racks/trays shall be of widths 300 mm. 450 mm and 600 mm. The ladder type racks shall be used for power cables while the perforated trays shall be used for control and instrumentation cables.

6.8.1.4 The cable tray system shall be complete with vertical and horizontal supports made of structural steel with ISMC-100 channel for vertical members and 50 x 50 x 6 mm angles for horizontal members. The supports shall be provided at an interval of not exceeding 1500 mm for horizontal runs and 1000 mm for vertical runs and shall be welded to the embedded insert.

6.8.1.5 In general, vertical spacing between cable racks shall be 250/300 mm. Normally, 300 mm spacing shall be provided. In case

where 300 mm spacing can not be provided due to shortage of space, 250 mm spacing shall be provided for small distances.

6.8.2 Generally HDPE pipes adopted for routing cables embedded through concrete foundations/floors/walls for laying the cables. Cable routing shall be planned such that cables are not exposed to heat to the extent possible. If it is unavoidable, necessary protections need to be considered as per safety guidelines.

6.8.3 GS conduits shall generally be used for exposed cabling along building walls/structures etc in both plant and non-plant buildings These shall be of galvanised steel, screwed type conforming to IS 9537 (Part 2). Conduit accessories and fittings shall be of standard types conforming to IS 3837 and IS 2667.

6.8.4 Where a number of conduits are run in a bunch adequate number of spare pipes (minimum two Nos.) of comparable diameters shall be provided for any unforeseen use.

6.8.5 The termination of conduits to rotating or other equipment subject to vibration or connection/disconnection at intervals shall be made by means of flexible metallic conduits. The use of flexible metallic conduits in outdoor locations shall be avoided as far as practicable.

6.8.6 Flexible pipes shall be liquid tight, galvanised heavy duty interlocked type with extruded PVC jacket on top generally conforming to IS 3480.

The adapter for coupling flexible conduit to rigid pipes/ equipment shall be of cast aluminium, screw/gland type. Alternatively, steel wire reinforced PVC hose may be used with matching adapters.

6.8.7 All fabricated pull/junction boxes shall be made of minimum 1.6 mm thick sheet steel, painted as specified. The pull boxes shall be sized to suit the largest recommended bending radius of the cables to be accommodated. Larger boxes (generally exceeding 600 mm in length) shall be fabricated with standard steel sections.

6.8.8 Terminal blocks provided within the junction boxes shall be of non-tracking moulded plastic having cadmium plated brass links, clamping washers and screws. The terminal block shall be of single unit type and group of terminals shall be mounted on galvanised sheet steel channel.

6.8.9 In corrosive atmosphere, PVC pipes shall be used for cables up to 1.1 kV grade. Recommended sizes of PVC pipes to be used for power wiring are 20 mm, 25 mm, 32 mm, 40 mm, 50 mm and 63 mm (outside dia) manufactured in accordance with IS 9537 (Part 3).

6.9 Earthing

6.9.1 Main earthing ring and the earthing stations around the shop building and ECRs for general purpose earthing shall be provided by Purchaser.

6.9.2 Earthing of all equipment/ system in scope, by forming secondary earth mat and to connect to the Purchaser mat including supply of conductors, all necessary installation materials will be in scope of Tenderer.

6.10 The method adopted for system as well as equipment earthing shall be in accordance with the Code of Practice for earthing IS 3043. It shall also comply with the relevant clauses of Indian Electricity Rules. All earthing shall be subject to the approval of the Chief Electrical Inspector, Government of Talangana.

6.11 All non–current carrying metallic parts of various electrical equipment as well as cable armouring, metallic conduit/GI pipe system, cable racks/trays, brackets, supporting structures etc. shall be effectively earthed. Earthing of medium and high voltage equipment shall be done by means of two separate earth continuity conductors connected either directly to earth electrodes or to an earthing ring irrespective of use of armoured cable or metallic conduit/GS pipe. Low voltage equipment, 125V and above shall have also two earthing points. However, equipment 125V and below upto 24V may have single earthing. Building/technological steel structures, metallic utility pipes shall not be used as earth continuity conductor.

6.12 Cable screens and armours shall be bonded to earthing system in accordance with IS:1255. Also, metal pipes and conduit systems carrying cables shall be bonded and effectively earthed.

6.13 Earth conductors for system and equipment earthing shall be kept electrically separated from the metal work of surface pipes which are carrying gases or inflammable liquids.

6.14 The minimum size of galvanised steel flat/wire for earthing of various equipment shall be as follows:

i) 415 V switchgear of 2000 KVA load centre substation .. 75 mm x 10 mm

ii) 415 V switchgear of 1000 KVA and 1600 KVA load–centre substations .. 65 mm x 8 mm

iii) 415 V switchgear of 630 KVA load–centre substations .. 65 mm x 6 mm

iv) Motor control centres, auxiliary power distribution boards, Auxiliary drive panel etc.

a) When located away from sending end switchgear fed from:

	(a) 2000 KVA transformer	.. 75 mm x 10 mm
	(b) 1600 KVA transformer	.. 65 mm x 8 mm
	(c) Less than 1600 KVA transformer	.. 50 mm x 6 mm
b)	When located near sending end switchgear	.. Same as that for sending end switchgear
v)	11 KV AC motors	.. 50 mm x 6 mm
vi)	LT AC motors from 150 KW upto 200 KW	.. 50 mm x 6 mm
vii)	LT AC motors from 110 KW upto 132 KW	.. 40 mm x 6 mm
viii)	LT AC motors from 55 KW upto 90 KW	.. 25 mm x 6 mm
ix)	LT AC motors from 15 KW upto 45 KW	.. 25 mm x 3 mm
x)	LT AC motors from 3.75 KW upto 11 KW	.. 16 sq mm stranded
xi)	LT AC motors from 0.75 KW upto 2.2 KW	.. 6 sq mm stranded
xii)	Control desk, control post	.. 50 sq mm stranded
xiii)	Push–button station, limit switches, switch boxes, isolator and socket outlet upto 16 A	.. 6 sq mm stranded
xiv)	Isolator and socket outlet above 16 A upto and including 100 A	.. 50 sq mm stranded

6.15 Separate earthing grid shall be provided for the electronic earthing system and associated power devices as per equipment supplier's recommendation.

7.0 LEVEL-1 AUTOMATION & INSTRUMENTATION

7.1 Scope

7.1.1 The scope of work of the tenderer shall include design and engineering, manufacture, software development, testing, supply, erection, loop testing, calibration and commissioning of Level-1 Automation system & Instrumentation.

7.1.2 The Level-1 Automation system shall be developed based on Programmable logic controllers (PLC) with client-server architecture & Engineering stations. The system shall be OPC compliant to facilitate interface with Automation system for other units of the plant. Refer Automation Configuration Diagram (Drg. No.28785-000-000-ELI-0001) attached with the specification.

7.1.3 The scope of supply of the Tenderer for Level-1 Automation system & Instrumentation shall include the following:

7.1.3.1 Programmable Logic Controllers (PLCs).

7.1.3.2 Remote I/O units where the I/O bus shall be fiber optic if required based on distance between PLC and Remote I/O unit.

7.1.3.3 At least two (2) Nos. PC based HMI units in each Control pulpit. The quantity of HMI may vary from pulpit to pulpit based on operational requirement.

7.1.3.4 Level 1 Server, PC based Engineering stations, one (1) No. A3 colour laser printer in Level-1 room of ECR.

7.1.3.5 A dedicated Process Data Acquisition (PDA) and analysis system shall be considered for monitoring of all important electrical including temperature and vibration signals as applicable and process parameters with necessary analysis software for generation of alarm, tracing of signals, trending etc. The system shall be designed for very high-speed data collection and analysis. The system shall provide real time recording of data, real time on-line display, off-line display of collected data, off-line analysis of collected data, mass storage of data etc.

7.1.3.6 Ethernet ring network interconnecting PLCs, Servers, HMI units, Engineering stations and printers. Ethernet network shall use managed type layer 2 network switches. 1 GBPS backbone shall be envisaged in between switches. Connectivity from switch to individual Servers, PCs and PLCs shall be 100 Mbps. Switches shall have 20% spare UTP port after installation of the complete system. Ethernet cable outside Pulpits / ECR shall be fiber optic. Required number of fibre optic ports shall be available in the switches, to meet the system requirement as well as for interface with other package Automation system. Further, overall 20% spare FO port shall be provided in the system.

7.1.3.7 One (1) No. laptop based PLC programming terminal with required software.

7.1.3.8 Latest proven version of WINDOWS operating system and application software packages. Engineering station shall have HMI development cum runtime software and PLC programming software. All requisite software for Servers and HMI units shall be included. Anti-virus, MS office etc, and other software as required for realization of functions and completeness of the system shall be envisaged. The requisite number of licenses for all software shall be considered.

7.1.3.9 Coil weighing system, interfaced with Level-1 Automation system over Profibus or hardwired. Measured value and diagnostic parameters of weighing

system shall be available in HMI. Calibration equipment for the weighing system shall be included.

7.1.3.10 Field instruments, analysers, measuring and sensing devices, local gauges, control valves, solenoid actuated valves etc. Sensors / instruments shall be hardwired to Remote I/O units. Profibus DP (or equivalent) measuring devices and Profibus PA (or equivalent) transmitters may also be considered. All the instruments which are communicating to the PLC through Profibus or other Communication cables shall be supplied along with the GSD files.

7.1.3.11 Portable CO leakage detectors – two (2) Nos.

7.1.3.12 Measuring instruments at TOP, for measurement of pressure and temperature compensated flow of all utilities as well as flow of water. These shall be displayed in HMI and isolated (4-20 mA DC) signal for all these parameters are to be made available by the Tenderer, for Purchaser's use.

7.1.3.13 Interfacing of Level 1 automation system to Purchaser's other package automation system over OPC.

a) For the above interface, Level 1 automation system shall have provision for transmitting required data as available in the Level 1 system to other package automation system through OPC (OLE: Object Linking & Embedding for Process Control) over 1GBPS Ethernet TCP I/P network.

b) To facilitate data transmission to SCADA, the tenderer shall supply and install licensed OPC server software (OPC Data Access Ver 3.0 or higher server software) with required hardware in the proposed network of Level 1 automation. The Level-1 automation supplier shall also provide one (1) No. 1 GBPS uplink UTP port in the network switch for the above connectivity.

7.1.3.14 Profibus DP and Profibus PA network (or equivalent) if applicable.

7.1.3.15 Power Distribution Panel comprising of 3-phase to single phase conversion, stabilizing and distribution units, set of double pole MCBs as required for feeding power to all the equipment supplied by the tenderer. UPS power shall be used for power supply to all Servers, PCs, network switches, PLCs, Remote I/O units, CCTV and Communication system, Printers, weighing system, Profibus DP / PA (or equivalent) devices and microprocessor based instruments.

7.1.3.16 All required cables – screened cables, control cables, power supply cables and special cables, such as cables for Automation system, instrumentation cables, UTP cables, Fibre optic cables, Profibus cables etc.

7.1.3.17 Installation accessories for field instruments, measuring and sensing devices : mounting brackets, impulse pipes and fittings, nipples, root valves, ball valves, piping accessories, matching flanges, companion flanges, matching stubs, thermowells, cable glands, field instrument mounting stands, transmitter cubicles, canopies, installation materials etc.

7.1.3.18 Junction boxes for all types of cables.

7.1.3.19 Conduits, cable trays, tray supports, cabling materials and accessories as required for cable laying and termination of the cables. GI perforated trays shall be used for screened, compensating and special cables.

7.1.3.20 Necessary filters, pressure regulators and other accessories for instrument air connection to instruments and pneumatic valves.

7.1.3.21 Separate electronic earthing arrangement, including earthing cable and earth pit materials.

7.1.3.22 Panel earthing connected to Electrical earth grid, including earthing cable.

7.1.3.23 Control room/pulpit furniture – Desk top CRCA Consoles, printer tables, operator chairs. CPUs of Servers and PCs, network switches shall be housed inside a panel, Monitors, key board, mouse shall be desk-top. KVM extenders as required shall be included.

7.1.3.24 Special tools and tackles.

7.1.4 For all types of cables, complete cable engineering (cable & JB schedule, interconnection diagram, cable routing etc.) shall be included in tenderer's scope.

7.1.5 Tenderer shall submit BOQ for erection work, cabling materials and erection materials during engineering.

7.1.6 Any item or accessories not included in this specification but essential for proper functioning of the offered system shall be included by the tenderer in his offer.

7.1.7 Tenderer shall carry out Testing at manufacturers' works and at Site as per test procedure to be furnished by them for approval of Purchaser. The Tenderer shall provide required personnel, equipment and all test programs and documentation for the purpose of testing.

7.1.8 Tenderer shall indicate in their offer, details of Training proposed for Purchaser's personnel, indicating duration, location and topics of training etc. Further, participation of Purchaser's engineers during software development, testing and implementation shall also be included.

7.1.9 Supply of drawing/documents as per clause no. 15.0 of Section VI.

7.2 Design Basis

7.2.1 Level 1 Automation system shall be designed to control the plant & equipment and monitor all significant variables & status in accordance with the process requirement, provide all operating requirement and necessary sequencing, interlocking and safety functions including alarms for abnormal conditions. Diagnostic functions as well as fault/event logging, trending

of variables etc. shall also be available. Tenderer shall include in the offer, the Control function map, indicating PLC wise distribution of control functions envisaged.

7.2.2 The Automation system shall be designed so as to achieve the following modes of operation.

i) Semi- automatic Control mode

ii) Remote – manual interlocked mode

7.2.3 Instrumentation and Level–1 automation system shall be based on the latest 'State-of-the art' technology and spare parts & service support shall be available for a period of at least ten (10) years from the time of Contract.

7.2.4 All energy consumption data, utility & water consumption data shall be stored.

7.2.5 The main functions to be performed by the basic automation system for Furnace shall cover but not be limited to the following:

i) Temperature control for each zone.

ii) Gas flow control for each zone.

iii) Gas-combustion air ratio control for each zone. Control function shall be achieved through either PID control with modulating type pneumatic control valve or pulse firing ON-OFF control with pneumatic ON-OFF valve.

iv) Furnace pressure control.

7.2.6 The main functions to be performed by the basic automation system for Mill shall cover but not be limited to the following:

i) Material tracking

ii) Automatic sequencing

iii) Speed control

iv) Referencing and set up of drives

v) Tension control

vi) Temperature control

7.2.7 The Level-1 Automation system shall have client-server architecture.

7.2.8 Voltage levels for Level-1 Automation and Instrumentation shall be as follows:

i) PLC interrogation voltage	:	24V DC
ii) PLC power supply	:	230V AC, 50Hz.
iii)Power supply for Automation equipment	:	230V AC, 50Hz.
iv) Solenoid valves	:	110V AC/24V DC

7.2.9 Remote I/O panels shall be suitable for shop floor environment and shall have at least IP 54 protection class.

7.2.10 For each type of I/O, 10% spare channels after commissioning shall be available at each location (including at least one card of each type completely spare) for Purchaser's future use and these shall be wired up to the marshalling terminals. In addition, the I/O cabinets shall be provided with spare I/O slots so that 10 per cent input and output modules can be added in future. The memory of the system shall be provided in such a way that a spare capacity of 50 per cent is kept for Purchaser's use after complete programming of the system. CPU average loading shall not exceed 50%. I/O cards shall have hot swapping features. There shall be a limitation that one Power Supply module shall be there for 8 no's I/O modules.

7.2.11 Digital input / outputs shall be 24 VDC. Analog input and output shall be 4-20 mA DC isolated signals. Digital outputs shall be potential free through relay, except for lamps. Digital outputs for lamps shall be wet type. Interrogation voltage for digital inputs and loop power supply for 2-wire transmitters shall be from I/O panels. 4-wire transmitters (if any) shall be powered from PDB (Power Distribution Box).

7.2.12 Each I/O panel shall have power supply module for I/O racks, I/O interrogation and 2–wire transmitters. These units shall be SMPS type. Selected rating of power supply units shall have at least 25% spare capacity.

7.2.13 All live terminals at the Marshalling Cabinets of I/O panels shall be fuse protected with LED indication. Terminal blocks shall be provided with different colour codes for different types of I/Os and/or voltage levels. 20% spare terminals shall be provided.

7.2.14 Accuracy of the individual equipment and the measurement loop as a whole shall be consistent with overall process requirement.

7.2.15 All PLCs shall be of same make and latest series.

7.2.16 In order to reduce field cables, remote I/O units shall be used as far as possible.

7.2.17 All special gauges/instruments which may operate stand-alone, shall be connected to Automation system.

7.2.18 Application programs for all PLCs including small PLCs with dedicated functionalities shall be up-loadable / down-loadable to Engineering station to enable modification/ diagnosing the programs.

7.2.19 Servers, PCs, Laptop and other hardware shall have latest architecture as available at the time of engineering

7.2.20 The transmitters shall have built-in configurable local LCD display and zero & span setting switches.

7.2.21 On-line Magnetic Flow meters / Vortex Flow meters etc. shall have non integral (separate) electronics unit with LCD display.

7.2.22 Electro–Pneumatic Shut off Valves shall have limit switches (for both open and closed positions).

7.2.23 Control valves shall have electro-pneumatic positioner and position feedback signal.

7.2.24 Single mode fiber optic cable and CAT-6 UTP cable shall be used for Automation system. For control & instrumentation, 1.1 kV grade multi core control cable and 600 V grade multi-pair screened cable shall be used, armoured type, with stranded copper conductors.

7.2.25 Signals having different voltage levels shall not be mixed up in same cable or same tray.

7.2.26 20% spare cores shall be provided for all multi-core cables.

7.2.27 Instrumentation and Level 1 Automation equipment shall be selected from Purchaser's Approved list of makes.

7.3 Equipment Specification

7.3.1 General

7.3.1.1 The hardware and related sftware to be supplied shall have the features/facilities equal or better than those indicated below. These shall be well tried latest one of reputed make.

7.3.1.2 All the hardware, software (original licensed version) and firmware shall be of the latest version of the same family at the time of engineering. All the processors indicated hereinafter are the minimum requirement. All the software in suitable media shall also be supplied. No pre-loaded software shall be supplied.

7.3.1.3 All operating supplies like DVDs, CD ROMs, printing stationary etc. shall be made available till successful commissioning of the system.

7.3.2 Server

Processor Type	Server grade (Xeon four core or higher)

Motherboard	Server Chipset with latest clock speed
Graphics	Integrated video standard with 16MB Video RAM
RAM	16 GB expandable to 64 GB or more
Hot swappable HDD drive	Effective 1 TB with hardware RAID featu with RAID 1 or 0+1 Quantity of HDD: As per RAID selection
Power supply and fan	Redundant
Other accessories	
Mouse	Optical-Scroll type
Keyboard	Standard type
DVD-cum-CD Drive	Read/Write type
Ethernet interface card	10/100/1000 Base Quantity as technical specificati requirement.
Other ports	USB
Colour monitor	23'' diagonal LED Backlit Monitor
Server Management software	Converged management of servers, storag and network for IT service automation a infrastructure simplicity

7.3.3 Engineering Station / HMI

Processor Type	4th Generation Intel® Core™ i7 Processors better with latest clock speed
Graphics	HD graphics
RAM	8 GB RAM expandable upto 64 GB
HDD drive	Minimum 1TB Hard disk along with installed spare one, for easy replaceme whenever corrupted
Other accessories	
Mouse	Optical-Scroll type
Keyboard	Standard type
DVD-cum-CD Drive	Read/Write Type
Ethernet interface card	10/100/1000 Base T

	Quantity as technical specificati requirement
Additional ports	USB
Colour monitor	23'' diagonal LED Backlit Monitor

7.3.4 Laptop

Processor	Intel i7 Processor or higher with latest clo speed
Motherboard	Mobile Intel Chipset
Main Memory	8 GB RAM
HDD	Min. 1 TB HDD
Optical Drives	DVD RW
Display	High Definition (HD) wide screen type
Network Adapter	On board 10/100/1000 base T Giga Ethernet card, Modem, Wi-Fi, 802.11a/b wireless
Key Board & Mouse	Keypad and integrated Touch Pad/ Pointi device. Additional 1 (one) no. external U mouse
Display Card/ Sound Card	Built in Video Graphics display and sou card
In built card reader	Yes
Operating System	Windows 10 Professional or latest
Anti Virus	Reputed
Ports	Minimum 3 USB, 1 RJ-45 (NIC), 1 RJ- (Modem)
Batteries & Power Adaptor	Lithium-Ion Re-chargeable battery pack w estimated 8 hrs battery life or higher
Accessories	1) Carry bag 2) Three years extended Warranty

7.3.5 Switch

The network shall be designed and selected considering the following:

i) Required number of computers in a network, supporting an open system protocol capable of interfacing with other external open systems.

ii) The network switch with the minimum features indicated below:

a) Manageable type with Layer 2 Switch

b) Required no. of 10/100/1000 BaseT FO/UTP interface with 20% spare ports of each type in each device.

7.3.6 Software

Latest proven version of WINDOWS operating system and application software packages. Engineering station shall have HMI development cum runtime software and PLC programming software. All requisite software for Servers and HMI units shall be included. Process Data Acquisition (PDA) system software for very high-speed data collection, tracing of signals, trending and analysis shall be provided. Anti-virus, MS office etc, and other software as required for realization of functions and completeness of the system shall be envisaged. The requisite number of licenses for all software shall be considered. Licensed software and application programs (In English language only) backup shall be provided in CD.

7.4 Specific features of Furnace Instrumentation & Control system

7.4.1 Heating System: Zone temperature shall be independently controlled by single loop temperature controllers/ alternatively through PLC. Temperature controller of each zone shall measure temperature from control thermocouple and proportionally give output to the pulse controller in case of pulse firing. Pulse controller shall switch ON and OFF the individual burner control units in a sequential manner. These burner control units, in turn, shall open and close the air and gas solenoid valves. Orifice plates and Differential Pressure Transmitters shall be provided in main gas and combustion air pipe lines for measurement of total air and gas flows. The ratio shall be settable from 1:27 to 1:34 for processing different super alloys (to be finalized in consultation with Technology supplier). The furnace shall be preferably divided into temperature control zones equally length-wise.

7.4.2 All the furnace operations including starting, operation of all mechanical systems, Instrumentation and controls, shutdown of the furnace shall be possible through computer interface. Two separate PLCs shall be provided for Electrical and Instrumentation controls. Required Hardware (PLC), Licensed software shall be supplied. All the inputs, outputs modules with 20% spare capacity (fully wired) shall be supplied. Thermocouples shall be connected directly to the controllers/PLC, without using mV/mA converters in view of stringent furnace uniformity requirement. Original SCADA and PLC Run time license of latest version to be provided along with supply.

7.4.3 There shall also be a temperature transducer provided to measure the temperature of the flue gas entering the chimney.

7.4.4 R type thermocouples made of 1 mm wire shall be provided conforming to special tolerance as per IPTS 90 standards. Duplex TCs for each zone shall be used for controlling, recording and simplex thermocouple for over temperature (Safety). The thermocouples shall have a projection of not less than 400mm over the furnace shell to avoid heating of thermocouple head. The

continous inner 4-hole bead and outer sheath shall be made of recrystallized high Alumina (KER710 grade).

7.4.5 Thermocouples on the roof shall be positioned for easy accessibility for maintenance and field measurements. In addition to control and safety thermocouples R type thermocoples shall be provided on the roof at every one meter to access the furnace uniformity during running condition. These thermocouples are also shall be of same specification mentioned for control and safety thermocouples

7.4.6 Compensating cables shall be suitable for R type thermocouples. Cables shall be multi- stranded, flexible type, Teflon lined, sleeved of sufficient length with omega connectors on both ends. Cables shall be laid on perforated trays with proper clamping. K type thermocouples shall be provided for monitoring hot air temperature during running of the furnace. Multi core 6 pair K type cable shall be laid from furnace to control room and to be connected in the recorder.

7.4.7 Temperature controller: Microprocessor based programmable controller (96 mm ×96 mm). Detail specification is given below:

Sl. No.	**Parameter**	**Value**
1	Type	Microprocessor based
2	Input	Universal Inputs required. Programmable for T/c's, RTD,0 & 4-20 mA, 0-2VDC/0-10VDC
3	Control output	DC output (Voltage/ current output) (load impedance 400 ohms minimum)
4	Output high / low limit	0-100%
5	Re-transmission output	Required (Programmable for SV, PV, Output) load impedance 400 Ohms (minimum)
6	Ramp up/ ramp down	Required for set point
7	Auto / Manual Selection	To be Provided
8	Alarm Contacts	2 Nos, Rating 230 VAC, Minimum 1Amp
9	Communication	Ethernet/ Profibus

Alternatively, this function shall be implemented in PLC & HMI system.

7.4.8 Ratio controller: Micro processor based ratio controllers with valve position indication shall be provided for each zone. Alternatively this function shall be implemented in PLC & HMI system.

7.4.9 Temperature compensator shall be provided along with RTD for each zone. RTD in each zone shall be used to measure the temperature of preheated combustion air. The compensator unit shall compensate the air flow signal for the temperature variation of combustion air sensed by RTD. Compensation block may be included in the ratio controller. Alternatively this function shall be implemented in PLC.

7.4.10 Temperature Recorder: One no. 24 point 180mm chart width microprocessor based programmable paper less recorder shall be provided. Data acquisition cable shall be supplied for connecting paperless recorder to nearest Ethernet node for intranet connectivity. Detail specification is given below :

Sl. No.	**Parameter**	**Value**
1	No of inputs	24 Nos.
2	Screen size	10”Minimum
3	Display	TFT Colour LCD
4	Inputs	DC Volts, (+/-20V minimum), All types of TCs, RTDs, DC Current (Field Programmable)
5	Measuring interval	125 ms or better for all channels (Shall be programmable)
6	Internal memory	96 MB (minimum)
7	External memory	CF Card 4GB (with Media)
8	Programming	Through front keypad/Tourch panel and PC software
9	Communication	Ethernet and USB Port
10	Protocols	FTP, Web Server, Modbus Server, HTTP, SNTP etc,
11	Linear scaling	Required for all inputs including decimal point, Engineering unit and Scaling, limits etc
12	T/c burnout	Shall be programmable for all inputs
13	Moving average	Required
14	Other displays	Group display, Display color, Bar graph display, Digital Indication, Alarm summary display, Message summary Display, Memory information, Report information, Log Display, Tag display, Trend display etc., are required
15	Event function	Required for all inputs
16	Security function	Shall have login/key lock function for each key with Password and user name
17	Real time clock	Required
18	Reference junction compensation	INT/EXT Selectable for all Channels
19	Recorder shall have	integrator/counter facility and mathematical functions (including exponential) Available for 36 mathematical functions
20	Accuracy	+/- 1.0 % or better
21	CMRR	120 dB or better
22	Recorder operation	through touch screen / keypad
23	NMRR	40 dB or better

Sl. No.	Parameter	Value
24	Power supply	100 to 240 VAC, 50 Hz
25	Mounting	Flush Panel mounting
26	Standard software	Software for connecting to PCs, Report software, Review software along with the instrument and database software (for reviewing data) to be supplied along with instrument
27	Protection	These recorders will be used in dusty and explosive areas. Recorder shall be with IP65 protection (entire recorder) without additional enclosures. Certificate to be enclosed.
28	Manual	Hard copy of Operational & Maintenance Required.

Alternatively, this function shall be implemented in PLC & HMI system.

7.4.11 Safety temperature controller: Microprocessor based ON/OFF controller for safety shall be provided for each zone. Detail specification is given below :

Sl. No.	Parameter	Value
1	Type	Microprocessor based
2	Input	Universal input programmable for T/Cs, RTD, 0 &4-20mA, 0-2VDC / 0-1VDC
3	Temperature range	Field programmable
4	Cold junction compensation	Automatic
5	Control output	Relay output contact rating 230VAC 2Amps
6	Re-transmission Output	0 and 4-20mA programmable for PV, SV, Output with 650 Ohms load
7	Alarms	2 Nos, shall be programmable for deviation and process (230VAC 2Amps)
8	Power supply	90 to 270VAC 50HZ
9	Dimensions	96X96 mm
10	Mounting	Flush panel mounting
11	Hard copy of Operational & Maintenance Manual	Required

Alternatively, this function shall be implemented in PLC & HMI system.

7.4.12 Differential pressure transmitters (SMART) along with orifice plates shall be provided for measuring the air and gas flow into the

furnace. Transmitters shall have configuration facility through HART communication. One HART communicator to be supplied for calibrating the transmitters.

7.4.13 Type of firing shall be Pulse Firing System / Proportional High Low (cross limit control)

a) Pulse firing : As per the design each burner shall be provided with air and gas solenoid valves, ignition transformer and flame monitoring system (Ionisation rod based) for switching on and off the burners. Provision shall be made to switch on the burners from PLC as well as from the field/locally (near to burner). Flame failure indication shall be displayed in HMI.

b) Proportional High low (cross limit control) : Electrical Servomotors and valves: Each zone shall be provided with adjustable port valves in Air & Gas lines of suitable size for taking care of Air and gas flows, are to be regulated through adjustable port valves of rated capacity for better ratio control, heating rate, safe operation of the furnace during heating and soaking conditions. Electric Servomotors (with valve position feedback) for actuating the servo valves are to be supplied with proper mountings and linkages. Valve position feedback shall be through two slide wires system, one for control and one for indication. Provision shall be made for remote manual control of valves from Instrument panel / PLC with auto-manual control switches.

7.4.14 All the servomotors, adjustable port valves, orifice plates shall be positioned at convenient places away from hot zone with proper working platforms. This point has to be considered while designing orifice plates and piping.

7.4.15 In view of on non availabiity of instrument grade Air, use of pneumatic operated valves are to be avoided .

7.4.16 Mass flow meter has to be provided for measuring total gas consumption of the furnace. Flow meter reading has to be displayed in HMI screen and also to be shown in paperless recorder. The communication facility for the mass flow meter shall be through HART.

7.4.17 Pressure/flow switches: Pressure switches and flow switches in different process lines (gas and combustion air) for safe operation and annunciation shall be provided with suitable ranges. The pressure switches shall have proper enclosure as per the safety rules.

7.4.18 Furnace pressure controller (with damper position indication), furnace pressure transmitters (- 5 to +5 mm WC) and servomotors shall be provided for damper control. Provision shall be made for remote manual control of damper from Instrument panel / PLC with auto-manual selection switch. VFD to be provided for the ID Fan.

7.4.19 Audio visual annunciation shall be provided with test/accept/reset facility, first fault identification facility and electronic hooter. Annunciation is required for the following conditions:

a. Over temperature
b. Low combustion air pressure
c. Low gas pressure
d. Low instrument air pressure
e. Any other critical parameters for safe operation of furnace.

7.4.20 Interlocking: Safety interlocks shall be provided to shut off the fuel line under the following conditions:

a. Low gas pressure
b. Low Combustion air pressure
c. I.D. Fan fault
d. Any other interlocks for safe operation of the furnace to be included

7.4.21 Flue gas analyzer: online oxygen measuring instrument shall be supplied along with indication and alarm shall be provided to monitor oxygen content during running condition. The flue gas analyzer shall be suitable for the highest operating temperature.

7.4.22 Flue gas temperature measurement: Suitable thermocouples shall be provided and connected to recorder for measuring the temperature of flue gas before and after recuperator, along with all safety controls.

7.4.23 Emergency stop button shall be provided in the control room and at local to the furnace to make the furnace trip in case there is problem. Additional instruments, controls required if any to be offered for safe and satisfactory running of the furnace.

7.4.24 Instrumentation Panel: One floor mounted type instrumental panel shall be provided which shall be fabricated from 2 mm thick sheet steel. The panel shall house all the controlling instruments, auto-manual selection switches as mentioned above and shall be duly wired up to the terminals. Zone wise instruments and controls shall be provided with isolators and MCBs. The instruments shall be located on the top portion which will have front fixed and rear hinged door. Terminal strips shall be arranged in convenient groups such as power supply, solenoid valve output, field interlocks, compensating cables etc. with space in between each terminal strip. Cable entry shall be through gland plate at bottom of panel. The signal cables shall be shielded type. A separate MCCB shall be provided for receiving incoming supply from the power panel of the furnace. Panel shall be dust proof with required rubber beadings. Necessary mountings/hardware for installation of the panel also has to be included in the scope of supply.

7.4.25 1.5 Sq mm flexible multi strand cable shall be used for control wiring of the panel. Suitable flexible multi strand cable shall be used for power wiring. Different colors to be used for phase (Red), Blue (Return cable from the field), green for ground, Yellow for annunciation cables, Black for neutral. PVC cable trays (minimum 50mm) to be used in the panel for laying cables.

7.4.26 Pulse firing modules shall be isolated from ignition transformer and solenoid valves and servo motors through 24V DC relays.

7.4.27 All the wires shall be properly tagged with transparent sheet protection for easy identification. Legends for various instruments, lamps, start and stop buttons etc., to be provided with quality screen printing distinctly for better visibility.

7.4.28 PVC insulated cables lugs to be provided for connections. Cables on the instruments end also to be lugged and nominclature to be marked for easy connection. Arrangement for proper earthing of panel to be provided.

7.4.29 Proper earthing facility to be ensured for trouble free running of ionisation flame rod sensing devices. Separate earth pits for PLCs & instrumentation panel to be provided by the supplier as Midhani has equipment like Arc furnaces which create unbalanced loads and high voltage fluctuations. The Instrument panel shall be light grey outside and brilliant white inside. The panel shall be effectively double earthed in accordance with the relevant clauses of Indian Electricity Rule.

7.4.30 All panels shall be supplied with suitable rated panel AC.

8.0 CCTV & COMMUNICATION SYSTEM **(NOT IN THE SCOPE OF BIDDER)**

8.1 General

8.1.1 This Section covers the design basis, scope of work, equipment specification of plant communication and Closed Circuit Tele Vision (CCTV) system of Wire Rod Mill area. Plant communication system comprises of Loudspeaker Intercommunication (LSIC) system and Telephone network of the plant.

8.1.2 Any item/device or accessories not included in this Section but essential for proper functioning of CCTV & Communication systems, shall be included by the Bidder in his scope of work.

8.2 Design Basis

8.2.1 Wire Rod Mill area shall be provided with various communication systems and Closed Circuit TV system as depicted below to meet the operational requirement.

8.2.2 Loudspeaker Intercommunication (LSIC) System

8.2.2.1 Page-Party type two-channel Loudspeaker Intercommunication (LSIC) shall be provided for independent two way communication network for point to point communication among the subscribers as well as for making general announcement. Subscribers shall be distributed in Mill floor, ECR and control pulpits etc as and where required for process communication.

8.2.2.2 The system shall work on decentralized amplifier scheme. Each LSIC subscriber station shall have its own external loudspeaker and amplifier.

8.2.3 Closed Circuit Television (CCTV) system

8.2.3.1 IP based Closed Circuit TV system (CCTV) shall be provided for viewing and monitoring critical process areas in Mill and Furnace areas. IP cameras shall be provided in furnace charging area, Mill entry, Mill exit and cooling bed area etc as and where required for process monitoring from Control pulpit.

8.2.3.2 The operation of the CCTV System shall be software based. Selection, control, monitoring and recording shall be done though menu-based operation by PC-keyboard and mouse. The user HMI shall be loaded with required application software with licenses for viewing/controlling of all cameras on a PC based 32" LED monitor. The application Software shall have provision for multi-level authorized access as permitted by system administrator.

8.2.3.3 The Video Management System (VMS) application software shall be modular and structured with high security measures and shall work on ONVIF open platform for interfacing with any third-party equipment on the same platform and shall support both Unicast and Multi-cast Video Streaming. All IP cameras shall also be ONVIF compliant.

8.2.3.4 The VMS software shall be provided with required licenses for operator workstations and cameras and shall also allow seamless replacement with any third-party ONVIF compliant cameras/encoders without the need for any additional licenses.

8.2.3.5 The server cum recorder of Mill CCTV system shall store the video feed of all cameras. However, in case of non-functioning of the server cum recorder, the Operator PC shall continue live viewing and independent selection & control of cameras from operator PCs shall not be affected. As such operator PC shall not be dependent on the server cum recorder for selection/control/viewing.

8.2.3.6 Required approach facilities for maintenance of Cameras including working platform with railing and approach ladders shall be provided, as applicable.

8.2.3.7 CCTV system shall comprise of required numbers of IP PTZ cameras, PC based monitors, PC based server cum recorder, active and passive network components including fiber and copper patch panel, network rack, I/O boxes etc, independent cable network based on single mode optical fiber cable, UTP cables (min. Cat 6) and other components. Network shall be established on structured cabling practice.

8.2.3.8 All cameras shall be provided with weather proof housing. For cameras located in dusty environment, proper lens cleaning arrangement by instrument grade clean compressed air shall be provided. The cameras located at above 45 deg C ambient, shall be provided with water cooling arrangement.

8.2.3.9 The additional camera electronics, if any, shall be installed in weather proof enclosure. The enclosures located at above 45 deg C ambient, shall have cooling arrangement, as required. Alarm indications for water/air failure shall be available in the CCTV PC based monitor.

8.2.3.10 All network equipment shall be so selected as to ensure minimum 1 GB bandwidth for CCTV network with camera resolution min. CIF4 and frame transmission speed of 25 FPS minimum.

8.2.3.11 All cameras shall be connected to the network switches on optical fiber cable only.

8.2.3.12 CCTV server cum recorder shall have redundant power supply. CCTV cameras shall be ONVIF compliant and UL certified. Camera and application software shall be supplied from same OEM.

8.2.4 Telephone network

8.2.4.1 Telephone network shall be provided within the battery limit of Wire Rod Mill and associated areas for internal communication within the Plant as well as with outside personnel. The network shall be connected to the existing Plant telephone network.

8.2.4.2 Telephone connections shall be provided in the office rooms, Shift offices, Control rooms/pulpits, electrical rooms etc and other manned rooms, as required.Generally, at each location, arrangement shall be made for two telephone connections (i.e. with two rosette blocks and necessary cabling arrangement). For each telephone connection, two (2) pair unarmoured telephone cable shall be provided from end CT box to subscriber location. The capacity of the CT boxes shall be double of the incoming cable capacity, e.g. if 10 pair cable is to be terminated at CT box, CT box capacity should be 20 pair.

8.2.4.3 Wire Rod Mill Telephone network shall be catered by the existing telephone system of the Plant. Purchaser shall identify the required connection points at the MDF or nearest CT box of the existing Plant telephone exchange.

8.2.4.4 The Bidder's scope shall include supply, laying and termination of incoming telephone cable of required pair capacity including all accessories from existing telephone exchange MDF to the main CT box of Wire Rod Mill telephone network. Distribution telephone cable network inside Wire Rod Mill area shall commence from this main CT box.

8.2.4.5 The telephone network shall comprise of required quantity of electronic push button telephone set with rosette box, armoured and unarmoured telephone cable and CT boxes, as required.

8.2.4.6 Integrated testing of the telephone network with Purchaser's telephone exchange shall be included in the Bidder's scope.

8.2.5 All equipment, cables and accessories for Telecommunication systems shall be supplied from Purchaser's preferred make/vendor list.

8.2.6 Following design aspects in addition to others shall be considered by the Bidder while designing/engineering and supply of respective system:

a) All computer peripherals and software shall be of latest and proven technology at the time of supply.
b) All network switches shall be minimum Layer 2 manageable type and shall have required numbers of fiber optic and copper ports with min. 20% spare. All ports including spare ports shall be

populated with transreceiver module. No media converter shall be used at the network switch end.

c) All types of cables shall have minimum 20% spare pair or core, as applicable.
d) All types of software shall be original licensed version only and shall be supplied in CD/DVD. All application software shall have required number of licenses including 20% spare for future expansion.
e) Required authorization to the Purchaser/user in terms of hardware/dongle or software code shall be provided by the Bidder for all types of application software (LSIC and CCTV system) during handing over of respective system enabling the user to take up maintenance in post warranty period.
f) All CCTV & Communication equipment shall be UPS powered.
g) All outdoor equipment shall have protection of minimum IP55 grade.

8.3 Scope of Work

8.3.1 The scope of work of the Bidder shall include but not be limited to design, manufacture, engineering, inspection, supply, unloading and storage at site, erection, testing, commissioning and performance guarantee of CCTV & communication (LSIC and Telephone network) systems as required for efficient and safe operation of the Plant on turn-key basis.

8.3.2 **Loudspeaker Intercommunication (LSIS) System**

8.3.2.1 The two-channel page-party type loudspeaker inter communication (**LSIC**) system shall include but not be limited to the following:

a) Minimum four (04) nos. of Wall mount (outdoor)/Desk top (Indoor) type Subscriber Stations, each with power amplifier, external loudspeaker (outdoor/Indoor), local junction box, function switches and indication lamps, isolation switch etc. In addition, all wall mount type subscriber stations shall be provided with built in microphone and speaker and all desk top type subscriber station shall be provided with goose neck microphone and built-in speaker.
b) Required interface hardware, and cabling for interconnection of this LSIC system with Plant telephone system so that one-way announcement over LSIC system speakers can be made from telephone handset.
c) Subscriber stations in noisy area need to work at an average noise level of 120 dB. Acoustic hood for the subscriber stations at noisy area shall be provided as applicable. Subscriber stations located in open environment shall be provided with protective canopy.
d) UPS power supply from mill UPS shall be provided for LSIC system.
e) Power Distribution Board (PDB) with required incoming feeder, TP MCB, transformer (if required), outgoing feeders (including minimum 20% spare) with DP MCB etc.
f) Independent cable network with all types of required cables (Power, signal, special cables etc)
g) Erection and cabling accessories.
h) Earthing of LSIC System.

8.3.3 **Closed Circuit Video Monitoring (CCTV) System**

8.3.3.1 IP based CCTV system of Mill area shall include but not be limited to the following:

a) Minimum four (04) Nos. of colour, low light sensitive, IP PTZ camera with LAN port, flash/SDRAM memory, motorised pan and tilt head, motorised zoom lens with remote control arrangement. Lens cleaning and water cooling arrangement shall be considered, if applicable.

   All the cameras shall be rugged to suit plant environment, insensitive to shock/vibration with weatherproof housing and shall be provided with mounting frames suitable for mounting the same on wall/column/pedestal as per site condition.

   For cameras with lens cleaning and water cooling arrangement, analog camera with external IP encoder may be considered to accommodate air and water failure alarm signal.

b) Minimum one (01) no. PC based control and monitoring station shall be provided with 32" LED monitor at Control pulpit.
   The PC based monitor shall be suitable for continuous operation (24 x 7 basis).

c) One No. PC based Server cum video recording station of latest and proven configuration with 22" color LED monitor. The hard disc shall have adequate storage capacity so that video feed of all cameras of Wire Rod Mill area can be stored for minimum seven (07) days.

d) Required nos. of network switches (min. layer 2 manageable) and other active and passive network accessories.

e) One No. portable monitor/View Finder (7" diagonal display) with dual power operated (both on 230V AC and 12v DC battery operated) with required accessories and cables for manual adjustment/maintenance of camera from camera locations.

f) All types of software including operating software, application software, anti-virus software etc with required licenses for proper functioning of the system. The application software of CCTV system shall have 20% spare licenses for camera and viewing PC.

g) Power Distribution Boxes (PDB) with transformer (if required), incoming & outgoing MCBs shall be provided for powering all CCTV system equipment. The PDB shall have minimum 20% spare outgoing feeders.

h) Independent cable network comprising of armoured single mode optical fiber cable, UTP cable, power cable, fiber and copper patch panels, fiber and copper patch cords, pig tails, connectors, cabling accessories including cable tray, conduit, route marker, identification tag and other cabling accessories as required etc.

i) All types of erection and mounting hardware including pole, steel structure, stand, JB etc. This shall include mounting ladder and maintenance platform for field equipment, as and where applicable for maintenance purpose.

j) UPS power supply for CCTV system

k) Earthing of CCTV equipment.

8.3.4 Telephone Network

8.3.4.1 Telephone network of Wire Rod Mill area shall include but not be limited to the following:

a) Required numbers of 30/20/10 Pairs CT Boxes equipped with Krone make 2/10 LSA disconnection module including 20% spare pair termination capacity for distribution of telephone cable network within Mill battery limit as well as other associated areas.
b) Required quantities of armoured jelly filled/unarmoured dry core multi-pair telephone cables with 20% spare pair capacity.
c) Supply, laying and termination of armoured jelly filled telephone cable from existing telephone exchange MDF to Wire Rod Mill main CT box.
d) Minimum five (05) nos. telephone set with rossette blocks (RJ11 type) suitable for termination of two (2) pair cable with suitable enclosure and mounting arrangement.
e) All erection and cabling accessories including wall mount bracket, cable tray, conduit, route marker, identification tag, etc.
f) Installation, testing and commissioning of minimum five(5) nos. of telephone sets including integrated testing of the same with the Plant telephone system. Telephone sets shall be free issued by the Purchaser.

8.3.4.2 Purchaser shall identify the connection points of existing Plant telephone exchange MDF from where telephone connections for Wire Rod Mill area are to be obtained by the Bidder.

8.3.5 The scope of work of the Bidder shall also include but not be limited to the following -

a) The successful Bidder shall provide required Commissioning spares, Tools and Tackles and Testing equipment for CCTV & communication systems.

   The minimum tools & tackles for Telecommunication systems shall include the following:

   Wire cutter and stripper, wire wrapping tool, Plier, Wrench, Soldering iron, Allen keys & screw driver set and digital multimeter, one each.

b) The successful Bidder shall provide updates and upgrades for all the Software supplied till the completion of the FAC (Final Acceptance) period.

8.3.6 The items described in the above section are indicative only. However, any other item required for completeness of the CCTV & communication systems shall remain under the scope of the Bidder. Actual location and quantity of various items shall be finalized during engineering phase.

8.4 Equipment Specification

8.4.1 All CCTV & communication (LSIC and Telephone network) system equipment, accessories, cables, installation and cable laying shall generally conform to the following minimum requirement of equipment specification.

8.4.2 Loudspeaker Intercommunication System

8.4.2.1 The minimum technical specification of major equipment/devices shall be as follows:

a) Subscriber Stations

Mounting Type	Desk/ Wall/Column
Input Power	230V AC, 50Hz.through local MCB
Internal Power	From Built In Power Module
Indications	LED based
Functional Switches/buttons	Page, party key switch, mute switch, Volume Control etc.
Amplifier	Line & Power Amplifier Inbuilt-dynamic & noise cancelling type, rating according to loudspeaker rating
Frequency Response	100 to 8000 Hz.+/-3dB
Tone Harmonic Distortion	1% at 1kHz.
Handset	With minimum 2m. coiled cord
Protection Class	Minimum IP 42 for Control Room application, IP 55 or better for outdoor application
Protection Cover	Pilfer-proof Protection Cover, canopy etc as required for outdoor stations.

b) Loudspeakers

Type	Horn/Cone
Frequency Response	100 to 8000 Hz
Power handling Capacity	15 to 40 watt for Horn type speakers considering application and 4 to 6 watt for cone type speakers
Protection	IP65 or better for Horn type and IP 54 or better for Cone type speakers

8.4.2.2 Mains cable shall generally be of 3X2.5 sq.mm. Type of signal and loudspeaker cables shall be as per OEM's recommendations depending on the distance coverage. In case of long distance coverage, additional hardware like signal booster etc, if required, to maintain signal strength, shall be considered.

8.4.3 CCTV System

8.4.3.1 **IP Camera**

The camera shall have following minimum technical requirement:

Video standard	PAL or NTSC
Image sensor	1/3" CCD / CMOS or better
Format	4CIF or better
Min. Illumination	Colour 0.50 lux or better B/W 0.10 lux or better

S/N ratio	50 dB or more
Lens	A). Remote controlled motorized zoom 20 X or higher.
Focus	Automatic
Compression	Min. H.264
Supported Protocols	TCP/IP, SNMP, IGMP, ARP
Pan & Tilt	Pan 360° or adjustable, continuous panning as per requirement, Tilt up to 90°
Network	Minimum 10/100 BaseT, auto sensing, full duplex, RJ 45, Direct FO connectivity prepferable
Operating temperature	0 - 50°C or more
Degree of protection	IP 65 or better
Safety standard	UL

8.4.3.2 **PC (Workstation) based Video Monitor**

PC based video-monitoring stations shall be used for viewing live video, recorded video/ replay from the video servers, controlling PTZ functionality, receiving system alarms etc.

The PC Configuration (CPU, memory, hard disk etc.) shall be selected based on the requirement of the system with the latest and proven technology at the time of supply with the following minimum configuration:

Processor	Intel Core i5-Series or better
RAM	8 GB
Hard Disk	500 GB or higher
Combo Drive	DVD RW
Mouse	Optical-Scroll type
Monitor	LED type 32”
USB Ports	Front & Back
Network Interface	100 Mbps or higher
Operating System	Windows 7 or latest version
Application Software	As required
Form factor	Normal (not SFF)

8.4.3.4 **Server cum Network Video Recorder (NVR)**

Server based video recording shall be used for video recording, archiving & retrieving. The server configuration (CPU, memory, hard disk etc.) shall be selected based on the requirement of the system with the latest and proven technology at the time of supply with the following minimum configuration:

Processor Type	Server grade (Xeon Quad core or higher) or latest version
Quantity	As per process requirement
Motherboard	Server Chipset
RAM	16 GB expandable to 64 GB
Storage	Minimum 4x 500 GB with Raid 1
Power supply	Redundant
Fan	Dual
Network Interface	Min. 2 Nos. 1Gbps
Colour monitor	21”/22" LED
Mouse	Optical-Scroll type
Keyboard	Standard

Combo Drive	DVD RW
Additional ports	Four (4) USB
Operating System	Windows server 2013 or latest version
Application Software	As required

The memory storage shall be adequate to store video feeds of all cameras of the network for a minimum period of 7 days. The storage shall be managed on FIFO basis with auto purging of video data once the storage is full.

8.4.3.5 **CCTV System Network**

8.4.3.5.1 Required IP based network with min.1GB bandwidth shall be provided for communication amongst the system elements. The network shall use Optical Fiber cable, Cat 6 cable, layer 2/3 manageable switches, patch cords and other accessories as required. Armoured cables shall be used for all outdoor application.

8.4.3.5.2 The switch shall be manageable type with minimum Layer2 functionality. The switch shall have required nos. of fiber optic (FO)/SFP and RJ 45 port including 20% spare for each type of port duly populated with transreceiver modules. No media converter shall be used for connecting OFC cable to switches. All the switches shall be powered from UPS.

8.4.3.5.3 The minimum technical requirement of the switch is given below:

Functionality	Layer 2 / Layer 3 manageable type IPV6 Ready
Fiber Optic interface	1 GBPS suitable for direct single mode fiber termination
Ethernet Interface	10/100/1000 BaseT auto negotiation, duplex type
Protocol supported	L2 and L3 protocols, as applicable including SNMP, STP, RSTP, Port based authentication (IEEE 802.1x), Priority queuing (IEEE 802.1p), Link aggregation, Auto fail over protection, multi QoS
Power Supply	Hot redundant (in case of Layer 3 switch)
Mounting	19" rack mountable

8.4.3.6 **CCTV Software**

8.4.3.6.1 Required System and Application software shall be provided for following operation

a) Viewing live video
   i) Single Camera view
   ii) 4/6 view
   iii) Full screen view
   iv) Sequence view of camera pre set positions
   v) Modifying settings for a camera
   vi) Modifying recording settings for a camera
   vii) Adding & deleting of Cameras

b) Recording administration
   The following methods of recording live video shall be supported

   i) User activated
   ii) Event activated

iii) Scheduled
iv) Video Loss alarm

c) Playing back recorded video, search for recording

d) Video Clipping & exporting/writing on CD/DVD

e) PTZ telemetry

f) Alarm events (Alarm Response, Alarm Management, Alarm notification etc.)
g) Administration etc.

8.4.4 Telephone Network

8.4.4.1 **Telephone Cables**

a) Multi pair Jelly Filled Telephone Cables

Multipair Jelly filled armoured telephone cables to be used mainly for main & tie Telephone cable network shall have copper conductor of 0.6 mm diameter, medium density polyethylene insulated, cores colour coded, twisted into pairs, laid up, fully filled with petroleum jelly, cable core applied with poly-aluminium laminate moisture barrier, polyethylene sheathed, compounded double steel tape armoured, overall polyethylene jacketed conforming to DOT Specification No. G/CuG-01/03 and having required pair capacity.

b) Dry Core Telephone Cables

Multipair telephone cables for distribution cable network shall have copper conductor of 0.6/0.5 mm dia, PVC insulated, cores colour coded, twisted into pairs, laid up, screened with aluminium tape along with copper drain wire, PVC taped, PVC sheathed with nylon rip cord, armoured/unarmoured and overall PVC jacketed. The constructional details and other technical features shall generally conform to those stipulated in Specification No. GR/WIR 06/03 dated March 2002 of Indian Posts and Telegraph Department and armouring shall conform to IS: 1554.

c) Jumper Wire

Jumper wires as required for cross jumpering between terminals inside MDF / cable distribution cabinet shall be of twin twisted type having annealed tinned copper conductor of 0.5 mm dia, PVC insulated and cores colour coded. the constructional details and other technical features shall generally conform to those stipulated in specification No. G/WIR-10/02 Dec 94.

8.4.4.2 **Cable Termination Boxes**

8.4.4.2.1 Cable termination boxes are required for terminating incoming multipair (armoured/unarmoured) telephone cables and further distribution from the same to various sub distribution boxes/subscriber points using multipair (armoured/ unarmoured) telephone cables.

8.4.4.2.2 Cable termination/distribution boxes shall be of 10/20/30 pair termination capacity as required for telephone cables of conductor dia 0.6/0.5 mm and shall be suitable for column/wall/flush mounting.

8.4.4.2.3 The cable termination/distribution box shall be of metallic/polycarbonate body having front cover with a safety lock. Inside the box, krone make connectors each of

10 pair capacity shall be mounted on Sheet steel back mounting frame in a row. The CT box shall be provided with knock-out punch type cable entries, earth terminal and fixing holes.

8.4.4.3 **Telephone set**

8.4.4.3.1 Desk/wall mounting type electronic push button telephone handset shall be made of rugged impact resistant thermoplastic material and of dust proof construction. The equipment shall have following minimum features -

i) "Flash" button for call transfer and accessing exchange features
ii) Mute
iii) Last number Redial
iv) Tone/Pulse switchable
v) External Ringer volume control
vi) Incoming ring indication through LED
vii) RJ11 type terminal
viii) Length of handset cord not less than 45 cm in coiled condition

For wall mounting of telephone set, required mounting accessories shall be considered.

8.4.5 Cables and Cabling Accessories

8.4.5.1 For outdoor application all cables shall be armoured type. Unarmoured cable shall be used for wiring inside rooms. All types of cables shall have length marking at every meter.

8.4.5.2 **Single mode fiber optic cable**

Single mode Glass Fibre Optic Cables shall be suitable for data communication. The technical particulars of the cables shall conform to the following and as specified

Type of Cable	Single Mode Low Water Peak Fibre
No. of Cores	06
Standards	TIA –OS#2 (for outdoor) ITU – G.652D IEC – 60793
Type of Construction	For outdoor application – Armoured, Loose tube (jelly filled), (PVC Jacket); For indoor application – Unarmoured, tight buffer
Length marking	In every meter
Optical laser source support	1310 nm / 1550 nm
Core diameter	9 μm
Cladding diameter	125 μm
Colour coding of fiber	As per manufacturer practice and Buffer tubes
Maximum attenuation (dB/km)	0.35 – 0.4 at 1310 nm/ 1550 nm;
Bending radius	20 x outside diameter for installation load and 10 x outside diameter for long term load
Length marking	In every meter

8.4.5.3 **Twisted Pair UTP Cables**

All the UTP cables shall be of Cat-6 variety conforming to ANSI/TIA/EIA 568-B.2-1, 4 pair UL/NEC rated and shall have maximum attenuation of 54.8 dB/100m at 600 MHz.

8.4.6 Laying Of Cables

8.4.6.1 Cables for CCTV & communication systems shall be laid in cable tunnels on dedicated cable trays/on cable trays for auxiliary cables with safety clearance, along wall/structure, in underground etc as per site condition. For underground cabling while crossing road/rail/ service line, if excavation and hume pipe arrangement is not possible in existing area, horizontal direct pipe drilling method shall be used for laying of GMS pipes. In case of surface wiring with unarmoured cables inside rooms, cables shall be laid in Galvanized Mild Steel (GMS) pipes. For concealed wiring, flexible PVC pipes shall be used for cabling. For splicing of optical fiber cable, specialized tools and manpower shall be employed; no manual connectorization shall be done. All cables shall be terminated and no cable shall be left loose.

8.4.6.2 All inter connecting standard power cables, control cables, telephone cables, loop cables, special cables including video cables, OFC cables complete with accessories viz. cable trays, supports, cable glands, tags, tying materials, conduits, underground laying etc to make the installation of all above systems complete in all respect shall be included in the scope of the Bidder.

8.4.6.3 **Optical Fiber Cabling**

8.4.6.3.1 Single length OFC shall be used for every link (LIU to LIU) segment with no splicing/jointing in between. In case of executional hazards like cable cuts, damages etc. if at all splicing/jointing of OFC becomes necessary, the same shall be done with fusion splicing.

8.4.6.3.2 Splicing and termination of OFC at LIUs and to restore any cable cut/damage, shall be made in a neat, workmanlike and approved manner by specialized persons with specialized tools. Only fusion type splicing shall be acceptable and no local/manual connectorisation shall be allowed. Utmost care shall be taken by the successful tenderer to avoid splicing and jointing in the backbone cable route. The tenderer shall furnish details of the splicing kit with the offer.

8.4.6.3.3 In each LIU, each core of armoured OFC shall be terminated with fusion splicing and jointing of pigtail (fixed with adaptor on respective port of LIU) with respective core of the OFC.

8.4.6.3.4 Armoured OFC shall be laid on cable trays, inside tunnel or trenches, along structure and buried underground as required generally for outdoor application. Unarmoured OFC shall be laid in HDPE / GMS pipe generally for indoor application.

8.5 Drawings and Documents

8.5.1 The Bidder shall submit drawings and documents in accordance with the relevant clauses of General Conditions of Contract and as per the list mentioned in subsequent section.

9.0 FIRE DETECTION & ALARM SYSTEM

(NOT IN THE SCOPE OF BIDDER)

9.1 General

9.1.1 This section covers the design basis, scope of work, equipment specification of Fire Detection & Alarm (FDA) system of Wire Rod Mill and associated area.

9.1.2 Any item/device or accessories not included in this Section but essential for completeness and proper functioning of FDA system shall be included by the Bidder in his scope of work.

9.2 Design Basis

9.2.1 The FDA system and all components of the system shall have UL/FM/LPCB/VdS listing/approval. The system shall meet the requirement of Tariff Advisory Committee (TAC). The components of all other equipment shall be designed, manufactured, assembled and tested in accordance with the relevant Standards of National Fire Protection Association (NFPA) and IS 2189.

All equipment shall comply with the regulations and stipulations of the applicable statutory bodies of Government of India and the concerned State Government. Wherever required by regulations, the Bidder shall have to obtain the necessary approval from the statutory authorities and all costs on this account shall be borne by the Bidder.

9.2.2 Intelligent addressable microprocessor based automatic FDA system shall be provided for any possible fire out-break inside Wire Rod Mill and associated area.

The FDA network of Wire Rod Mill area shall be monitored locally through a PC and printer. PC shall be loaded with graphic monitoring software. The Control panel shall have auto dialer for connecting to the telephone network so that in case of fire, pre-decided telephone extension shall be called automatically and recorded fire message shall be heard at the telephone set once call is picked up.
For remote monitoring, the system shall have provision for integrating with existing FDA central monitoring system so that Wire Rod Mill FDA system shall be monitored from the central fire brigade station of the Plant. FDA control panel shall be equipped with required hardware for the said purpose.

9.2.3 The Intelligent Addressable Microprocessor based Automatic Fire Detection and Alarm (FDA) system shall cover but not be limited to the following areas:

a) All Electrical Control Rooms, MCC Rooms, Switch Gear Rooms, Control Pulpits, Transformer Rooms, HT equipment rooms, LT/HT Switchgear rooms etc.
b) Computer Rooms, Control Rooms, PLC Rooms, Server Rooms, HMI Rooms, Laboratories etc.
c) Cable Cellars, Cable Vaults, Cable Basements, Cable Tunnels etc.
d) Hydraulic Rooms/Oil Lubrication Cellars etc.

e) Fire Detection system shall also be considered wherever False Ceiling and False Floor voids exist.

f) For any other area, FDA system shall be considered as per IS 2189 and NFPA-72.

9.2.4 The Automatic Fire Detection & Alarm (FDA) system shall comprise of Intelligent Addressable Microprocessor based control panel, repeater panel, different types of addressable detectors and devices so as to pin point the location of fire and spread out the fire information at suitable locations for safety purpose and taking protective measures. All loop components shall be intelligent addressable type, unless otherwise specified.

9.2.5 The application software of FDA system shall support and take care of change in configuration and system modification during maintenance like replacement/addition of loop card, addition/removal of detectors in the operational loop etc. The successful Bidder shall also supply FDA software dongle (Licensed) for carrying out the above activities by the Purchaser subsequent to the commissioning of the FDA system.

9.2.6 Interlocking of FDA system with ventilation/air-conditioning system to stop air supply as well as tripping off in case of fire shall be included in the scope of the Bidder. FDA system shall also be interlocked with the automatic fire extinguishing system, as applicable.

9.2.7 Type of addressable detectors shall be selected by the Bidder as per application and as per NFPA code of practice. Zoning of coverage area shall be done by the Bidder as per geographical coverage and design consideration.

9.2.8 Fault isolator modules shall be installed suitably to minimize the faulty segment of the loop, in case of network/detector/device fault.

9.2.9 Class A wiring shall be adopted for loop wiring of the system. Cross-zoning of detectors, as required, shall be done during configuration of the FDA system.

9.2.10 In addition to other locations, Manual pull stations shall be distributed suitably in shop floor area also where sensor coverage is not possible in order to strengthen fire safety measures.

9.2.11 All equipment, cables and accessories for FDA system shall be supplied from Purchaser's preferred make/vendor list.

9.2.12 Following design aspects in addition to others shall be considered by the Bidder while designing/engineering and supply of FDA system:

a) All computer peripherals and software shall be of latest and proven technology at the time of supply.

b) All types of cables shall have minimum 20% spare pair or core, as applicable.

c) All types of software shall be original licensed version only and shall be supplied in CD/DVD. The application software shall have

required number of licenses including 20% spare for future expansion.

d) Required authorization to the Purchaser/user in terms of hardware/dongle or software code shall be provided by the Bidder for the FDA application software during handing over of respective system enabling the user to take up maintenance in post warranty period.

e) FDA panels shall have required battery back-up. Other FDA equipment like , as applicable, shall be UPS powered.

f) All outdoor equipment shall have protection of minimum IP55 grade.

9.3 Scope of Work

9.3.1 The scope of work of the Bidder shall include but not be limited to design, manufacture, engineering, inspection, supply, unloading and storage at site, erection, testing, commissioning and performance guarantee of Fire Detection & Alarm (FDA) system as required for efficient and safe operation of the Plant on turn-key basis.

9.3.2 Intelligible addressable automatic Fire Detection and Alarm system of Wire Rod Mill shall essentially include but not be limited to the following:

Item description	Quantity
Intelligent addressable type microprocessor based Control panel having required no. of loops plus one spare loop card, complete with necessary hardware including auto dialer and protocol Converter card, licensed application software and other software, maintenance Dongle, power supply unit with battery and other accessories as required	LOT
Intelligent addressable type fixed cum rate-of-rise heat detector	LOT
Intelligent addressable type photoelectric smoke detector	LOT
Intelligent addressable type multi-criteria detector	LOT
Digital LHS Cable	LOT
Intelligent addressable type manual pull station	LOT
Intelligent addressable type interface modules viz. control modules, monitor modules, fault isolator modules etc as required	LOT
Electronic hooter with strobe	LOT
Response indicator	LOT
Relay/Contactors, local power supply unit etc as required	LOT
PC with required software, Printer, Table for Computer & printer and chair to be located near main FDA control Panel for local monitoring	LOT

Item description	Quantity
Self illuminated EXIT board	LOT
Loop/Control cable (2X1.5 sq.mm)	LOT
Power/Hooter cable (3X2.5 sq.mm)	LOT
Cabling and Erection accessories and consumables	LOT
UPS power supply with PDB for FDA system	LOT
Earthing of FDA equipment	LOT
Any other item required for completeness of the system	LOT

9.3.3 The scope of work of the Bidder shall also include but not be limited to the following -

a) The successful Bidder shall provide required Commissioning spares, Tools and Tackles and Testing equipment for FDA system. The minimum tools & tackles for Telecommunication and FDA systems shall include the following:

Wire cutter and stripper, wire wrapping tool, Plier, Wrench, Soldering iron, Allen keys & screw driver set, digital multimeter and Test magnet along with detector removal telescope handle, one each.

b) The successful Bidder shall provide required dongle or authorization code to the user after commissioning for user access to modification of configuration, trouble shooting etc of the FDA system during post-handing over stage with satisfactory on-site training to the users.

c) Bidder shall provide updates and upgrades for all the Software supplied till the completion of the FAC (Final Acceptance) period.

9.3.4 The items described in the above section are indicative only. However, any other item required for completeness of the FDA system shall remain under the scope of the Bidder. Actual location and quantity of various items shall be finalized during engineering phase.

9.4 Equipment Specification

All Fire detection & alarm system equipment, accessories, cables, installation and cable laying shall conform to the following minimum requirement.

9.4.1 **Multi-criteria (Smoke-Cum-Heat) Detector**

The areas to be protected by smoke-cum-heat detectors shall be Multi-sensor detectors (smoke-cum-heat) to achieve the best results. The detectors continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity. The detector shall be suitable for the areas where ambient temperature is less than 32°C.

Operating Principal	Senses output of both smoke Sensor and Fixed temperature cum Rate-of-rise (ROR) temperature (heat)sensor
Fixed temperature alarm point	57°C
ROR alarm point	8°C
Smoke sensors ambient rating	0 to 300 ± 25 ft/min
Operating Voltage	24V DC
Alarm current	Up to 18mA @ 24 VDC
Standby Current	Up to 400 µA
Design coverage area	shall not exceed 40 Sq.M.
Regulatory approvals	UL/FM/Vds/EN

9.4.2 **Optical/Photoelectric Smoke Detector**

Smoke detector – works as light scattering system and is more responsible to visible particles produced by most smoldering fires, which is like PVC, when overheated, produced mainly large particles to which Photoelectric Detector is more effective. The detector shall be suitable for the areas where ambient temperature is less than and equal to 45°C.

Type	Intelligent Addressable
Operating Principal	Detection of scattering or absorption of light by smoke particle
Minimum nos. of levels of sensitivity	3 Levels
Foot obscuration	0.5 % per foot of smoke obscuration
Smoke sensors ambient rating	0-4000 ft/min
Operating Voltage	24V DC
Alarm current	Up to 18mA @ 24 VDC
Standby Current	Up to 400 µA
Design coverage area	shall not exceed 80 Sq.M.
Regulatory approvals	UL//FM/Vds/EN

9.4.3 **Heat detector**

9.4.3.1 Heat detectors shall be provided in the areas where heat producing equipment (e.g. battery room, hyd. room/cellars, transformer rooms etc.) are used. It continuously monitors the temperature of the air in its surrounding to minimize thermal lag to the time required to process an alarm.

9.4.3.2 Fixed temperature type detector, where the detector is designed to operate when it reaches a pre – selected threshold temperature.

9.4.3.3 Fixed temperature cum Rate of Rise temperature type where the detector is designed to operate on a rapid rise in element temperature

irrespective of the starting temperature as well as it operates at a pre-selected threshold temperature.

Type	Intelligent Addressable
Operating Principal	Fixed temperature cum Rate-of-rise (ROR) temperature Sensing
Fixed temperature alarm point	57°C
ROR alarm point	8°C
Operating Voltage	24V DC
Alarm current	Up to 18mA @ 24 VDC
Standby Current	Up to 400 μA
Design coverage area	shall not exceed 40 Sq.M.
Regulatory approvals	UL/FM/Vds/EN

9.4.4 **Digital LHS Cable**

9.4.4.1 LHS cable shall be considered for cable rooms, cable galleries etc. In cable racks, the LHS cables shall be mounted on both sides of the rack in jig-jag manner so that the system and equipment shall not be affected by RFI or EMC. The entire coverage area shall be segregated into several zones by minimizing the fire zone by providing requisite number of Interface Modules. Each zone shall be addressed individually to achieve the best result. Detection shall be possible at ANY and ALL points along sensor cable length.

9.4.4.2 Digital LHS cable shall consist of two core cable in which the conductors shall be separated by a heat sensitive insulant. When a specified temperature is reached, the cable insulation breaks down; short circuiting the conductors and alarm is indicated. The digital LHS cables shall have required outer shielding such as steel braid etc.

Type	Digital Type
Status to be indicated	“Fire” “Fault” and Normal Operation
Operating voltage	15.2-30Vdc
Operating current	2A
Operating temperature	0°C -49°C
Alarm temperature	Fixed 68 °C
Maximum zone length	1000 Mtrs
Accessories	Fastenings, Sleeves, Clips, EOL box, interfacing relays or modules for indication to FACP.
Application	Cable Vaults, Cable galleries
Regulatory approvals	UL/FM/Vds/EN

9.4.5 **Manual Pull Stations**

9.4.5.1 On each floor/area one or more Intelligent Addressable type microprocessor based manual pull station shall be installed, preferably on the exit routes. Manual Pull

Stations shall be installed at a height of 1.4 meters above the floor at an easily accessible position free of all obstruction.

Operating Principle	Break glass or Manual Pull
LED operation(if break glass type)	Normal/Alarm Status
Operating Voltage	15.2-30Vdc
Activated current	400µA
Operating Temperature	0°C -49°C
Mounting	Wall mounted at least 1.4 m from level. To be fitted on Flush or Surface mount
Approval	UL/FM/Vds/EN

9.4.6 **Intelligent Addressable Control Module**

9.4.6.1 The addressable control modules are provided for interlocking and controlling of the external appliances or equipment during fire e.g. shut-down of Air-conditioning and ventilation system as well as activating operation of fire-fighting equipment.

Type	Intelligent Addressable Microprocessor based
LED Indication	Normal/Alarm Status
Power	Loop powered
Output	Form "c" Contact @ 24Vdc,2A
Operating Temperature	0°C -49°C
Operating Voltage	12 V DC to 24 V DC
Stand by current	Upto 300µA
Approval	UL/FM/Vds/EN
Application	To activate external devices i.e. running Hooters and ventilation tripping

9.4.7 **Intelligent Addressable Fault Isolator Module:**

9.4.7.1 It shall be designed to be used in addressable system communication loop to create a zone of maximum 20 detectors/devices on an average. An integral LED shall be with Fault Isolator Module to indicate the 'Normal' status as well as to indicate a 'Fault' in the loop.

Type	Intelligent Addressable Microprocessor based
LED Indication	Blinks to indicate Healthy/fault status.
Power	Loop powered
Operating Temperature	0-49°C

Operating Voltage	24 V DC
Standby current	Up to 300 µA
Approval	UL/FM/Vds/EN
Application	To isolate the faulty part of the loop

9.4.8 **Intelligent Addressable Monitor Module:**

9.4.8.1 The module shall be suitable for connecting initiating devices such as pressure switches, flow switches, level switches, potential free contacts etc. in the addressable loop. It shall be able to report its unique address to the panel to pin point the exact alarm location. An integral LED shall be built in with Monitor module to indicate the status. It shall be housed in a metallic/high impact plastic enclosure and suitable for indoor/outdoor installation.

Type	Intelligent Addressable Microprocessor based
Operating Principle	Reports the unique pin point Address to the controller by monitoring either two –wire or four wire (third party) initiating devices.
LED Indication	Normal, Open & Short Circuit
Power	Loop powered
Operating Voltage	12 V DC to 24 V DC
Relay contact point	Potential free
Approval	UL/FM/Vds/EN

9.4.9 **Response Indicator**

9.4.9.1 All the detectors in the rooms, below false floor, above false ceiling or generally at hidden locations shall have external response indicators sited at visually accessible places.

9.4.10 **Audio Annunciator (Hooter cum strobe)**

9.4.10.1 The distribution of electronic hooters–cum-strobe shall be such that the alarm shall be available at all sites which can be occupied within the protected area. The electronic hooter–cum-strobe shall be suitable for indoor and outdoor use. The strobe shall be provided with each hooter for visual annunciation.

Type	Hooter with Strobe
Operating Voltage	24V DC
May or may not loop powered	If not loop powered Separate 24v dc power required
Operating Temperature	0-49°C
Volume	85 dB or 5 dB above noise level of the working area
Tone	Minimum two pattern of tones for Alarm and Evacuate

Strobe Flash Rate	1 Flash per second
Approval	UL/FM/Vds/EN

9.4.11 **Siren**

9.4.11.1 The outdoor siren shall be of rugged construction, have weather proof protection of minimum IP65 protection and suitable for outdoor installation. It shall have adequate range to cover a radius up to 2 K.M and shall be dual tone. The operator at the fire station / security control room shall have facility to energies the siren. The siren shall have IP-65 enclosure.

9.4.12 **Micro-Processor based Intelligent Addressable Fire Alarm Control Panels (FACP)**

9.4.12.1 Fire alarm control panel shall be intelligent with its own microcomputer and memory. FACP shall have main processor board, necessary loop modules for detector loops, alarm output modules for external hooters/lamp control output modules for various control functions through relay contacts and communication module for interacting with CPU. In case of CPU failure degrade mode of operation of the system shall be possible.

9.4.12.2 FACP shall have facility to process the input signals and also have facility to control all the input data received from addressable intelligent type detectors, addressable interface unit, located in various loops, at different locations and from different field devices /switches.

9.4.12.3 System software shall be designed specifically for fire alarm and annunciation system applications and shall provide to monitor status, Processing alarms according to priorities, controlling/processing communications with system peripherals synchronizing all system activity.

9.4.12.4 For reason of reliability and preventing inadvertent changes, system software (operating system and data file) shall be maintained in non-volatile memory. System shall permit reprogramming by authorized personnel only.

9.4.12.5 The Fire Alarm Panels shall be provided considering spare loop (Main Loops + one spare loop). The maximum 80% capacity of each loop card shall be utilized for connecting intelligent detector and intelligent module. Intelligent Addressable Microprocessor based detectors/ manual call point and required field devices in the various areas shall be connected to fire alarm control panels by class A wiring to the loop module. However, number of such sensors per loop shall generally be not less than 125 i.e. 125 detectors + 125 devices = 250 Nos. but higher loop capacity is preferable.

9.4.12.6 Fire alarm control panel shall have number of electronic filters to ignore false alarm and increase sensitivity to real fires from sensors. The sensitivity of each addressable intelligent detector shall be automatically raised if detectors are gradually polluted due to dust and other particles entering inside the detector. If detectors are more polluted, the control panel shall give warning /contamination alarm that the detector needs service. The electronic filters shall recognizes the unwanted alarm from detectors due to electrical sparks, smokes from other sources etc. and raise the sensitivity limit accordingly.

9.4.12.7 The FACP shall have separate display area to indicate the address of each device with clear text about the location of alarm/trouble occurrence. Fire alarm panel shall have sturdy enclosure with required grade of protection.

9.4.12.8 Stand-by Battery back-up: Lead-acid SMF batteries with battery charger shall be provided for stand-by back-up of Fire Alarm Panels and associated equipment. The battery back up shall be for at least 24 hours plus additional 5 hour alarm time.

9.4.12.9 **System features:**

a) Logging an alarm, time and action text on printers.
b) Status check of disabled alarm addresses before they are restored.
c) Storing of alarms and the possibility of internal organization of alarms.
d) Required NO/NC contacts for common fire/fault signal of individual loop for sending the information to the 'PLC'/Automation system or other area.
e) Networking capability with other panels on Modbus over TCP/IP protocol/OPC over TCP/IP.
f) Main Fire Alarm Panel shall have provision of transmitting the signal to the remote station, interfacing capability with the other Panels, PLC, BMS, fire suppression systems, ventilation and air-conditioning system etc. All the required signals shall be terminated in separate terminal strips/ points, as required, within the Panel.
g) The configuration software of the control panel shall have the capability to generate addresses/soft-tags building-wise/floor-wise of the Plant area covered under the FDA system and forward the same to other control panel/monitoring workstation, as per the requirement.
h) The possibility of expanding to a bigger system with several control panels and control and information units.
i) Individually controlled, monitored alarm outputs for external hooters, lamps etc.
j) The control panel shall have facility to set date and time and display the same.
k) The FACP shall have mains on, disable fault, pre warning, more alarm (for two or more alarms) LEDs, and flashing fire signs on front panel.
l) The fire alarm control panel shall have facility for Users menu structure for carrying out various events shall be provided in the fire alarm control panel. Brief user guide menu shall be available to enable the operator for proper use of various menu functions.
m) Fire alarm control panel shall have facility for following test features: Lamp test, fault test (earth fault, address fault, battery fault) and sounder test (external & internal hooters) and resetting facility.
n) Auto dialling facilities for immediate information of fire to central monitoring station like security office, fire brigade station etc.

9.4.12.10 Maintenance & Diagnostic Features:

a) It shall be possible to change the sensitivity of each addressable intelligent detector from control panel from normal to low and normal to high. The sensitivity of each intelligent addressable detector shall be displayed in control panel.

b) Each Intelligent addressable detector, interface unit shall be disabled from panel for maintenance purpose and the same shall be restored whenever required.

c) The status check of each detector, interface units for alarm pre warning, trouble, disabling shall be achieved from control panel.

d) Minimum software changes shall be possible from the fire alarm control panel without re-burning the EPROM.

9.4.13 **Intelligent Addressable Repeater Panel**

9.4.13.1 Active Repeater Panel shall be provided with LCD display and in- built buzzer. Repeater panel shall be of wall mounting type with top/bottom entry cable gland plate. It shall have diagnostic LED within built buzzer. Network repeater panel shall be programmable to repeat fire/fault signal of any individual panel or all the panels in the FDA network, as per requirement. The repeat signal shall provide audio-visual indication. Once fire alarm is acknowledged from control panel, the panel hooter shall be off and LEDs become steady.

9.4.14 **Fire Exit Board**

Self illuminated Fire Exit Boards shall be provided indicating escape routes under fire condition. The type of board shall be as per site requirement.

9.4.15 **Graphic Workstation**

9.4.15.1 Graphic Workstation shall be a special purpose computer to be used for central monitoring of the entire fire alarm system. Graphic Workstation shall communicate with various microprocessor based fire alarm control panel peripherals of the system and executes receipt and display of technical alarms, control the activation of outputs.

Graphic Workstation shall also be capable to communicate with Printer and video display unit.

9.4.15.2 Graphic Workstation shall have application graphic software for geographical display of all fire zones so that in event of fire alarm the layout of concerned area under fire shall be able to be displayed.

9.4.15.3 The Graphic Workstation shall be UPS driven.

9.4.15.4 The PC Configuration (CPU, memory, hard disk etc.) of the graphics workstation shall be selected based on the requirement of the system but the minimum technical requirements shall be as follows:

Processor	Intel Core i5 Series (Quad Core) 3rd Generation or higher with latest clock speed
RAM	Minimum 8GB DDR3 (1333 Mhz or better) expandable to 32 GB
Hard Disk	500 GB /1 TB SATA (6 Gbps) or higher
Combo Drive	CD, DVD, CDRW and DVD Writer
Mouse	Optical-Scroll type
Keyboard	Standard 101 type (US layout)
Graphics Card	Nvidia/ATI Radeon Minimum 1GB G-DDR5 RAM Minimum two (2) nos. of display ports (VGA/DVI)

Monitor	Flat Panel minimum 21"/22" LED display with desk/wall mounting arrangement with -170 deg to +170 deg or better viewing angle.
Ports	Front USB (Minimum 2) & Back USB (Minimum 6).
Network Interface	100 Mbps or higher
Operating System	Windows10 or latest version (not preloaded version)
Software	Application Software, Anti-Virus & other software as required

9.4.16 **Printer**

Black and White Laser printer shall be used for print-outs of various reports. The printer shall have the following minimum specification:

Speed	:	52 ppm print
Size	:	A3 and A4
Resolution	:	1200 X 1200 dpi
Memory	:	128 MB or more
Duty Cycle	:	Heavy duty type
Interface	:	Ethernet interface/USB

9.4.17 **Cables for FDA system**

9.4.17.1 The detectors and devices shall be connected with FACP through class – A wiring. Loop shall be planned in such a way in case of a fire in a particular zone /area, other areas shall not be left unprotected. Cables shall be generally fire rated type with following sizes –

a) Signal and control cables – 2C X 1.5 sq.mm
b) Hooter/sounder cables - 2C X 2.5 sq.mm
c) Power cable - 3C X 2.5 sq.mm

9.5 Laying Of Cables

Guidelines for laying of cables shall be similar to that explained in CCTV & Communication section.

9.6 Drawings and Documents

9.6.1 The Bidder shall submit drawings and documents in accordance with the relevant clauses of General Conditions of Contract and as per the list mentioned in subsequent section.

10.0 SPECIAL TOOLS & TACKLES

10.1 Special tools & tackles shall be provided by the supplier for normal maintenance of the plant electrical and automation system. The list shall include, but not be limited to the following:

10.2 Electrics, Instrumentation and Level-1 System

a. ACB racking out Tools for MCC-1 No.

b. AC/DC tong tester – 2 Nos. for low current measurement

c. AC/DC tong tester – 2 Nos. for high current measurement

d. Drive module handling units – as recommended by the drive manufacturer and not less than 2 Nos. Channel storage oscilloscope with thermal printer -1 no.

e. 16 Channel thermal recorder – 2 Nos.

f. Non contact type tachometer – 2 Nos.

g. Insulation tester cum motor checker (capable of measuring resistance, inductance & insulation resistance) – 2 Nos.

h. Digital multi-meters with current protection – 4 Nos.

i. Portable calibrator/configurator for SMART transmitters

j. Service engineers toolkits – 2 Nos.

k. Torque wrench suitable for cable terminations and panels – 1 No.

l. Hydraulic cable lug crimping tool -1 No.

m. Any other special tools required for Operation & Maintenance

11.0 AUTOMATION/ELECTRICAL SYSTEM PERFORMANCE TEST AND ACCEPTANCE CRITERIA

11.1 Tenderer's equipment and systems shall be tested for demonstration of performance at site to the satisfaction of the Purchaser, for provisional and final acceptance. These tests shall be carried out to ensure correct integrated function of the system as a whole after a specified period of operation, to be mutually decided with Employer.

11.2 For the purpose of testing, the successful Tenderer shall furnish test procedure in accordance with the manufacturers recommended testing methods and latest practice for approval of the Purchaser. The tests shall be completely defined and the exact methods of testing, availability calculation, duration as well as the acceptance criteria shall be clearly indicated. The test items and parameters are listed under Questionnaire.

11.3 For the purpose of testing, the successful Tenderer shall provide the required personnel, equipment, special instruments and all test programs and documentation as required.

12.0 PASSIVE FIRE PROTECTIVE MEASURE

12.1 The following fire protection measures shall be carried out by the Mill supplier after installation of all equipment:

12.1.1 Cable trays/ducts through the fire barrier wall between ECRs & cable tunnels as well as within cable tunnels (where applicable), will be provided with:

i) Fire resistant board for closing the gap between the fire barrier wall and trays/ducts (to be cut to size and fixed based on site condition).

ii) Sealing the gap between the fire resistant board and trays/ducts using fire resistant sealant compound.

iii) Applying fire resistant paint on the cables for up to 1.5 M length on both sides of the fire barrier walls.

12.1.2 Where conduits are used for connecting ECR and cable trench/pit, the following shall be provided:

i) Sealing the gap of the conduits at both ends using fire resistant sealant compound.

ii) Applying fire resistant paint on the cables for up to 1.5 M length on both sides of the conduits

12.1.3 Vertical cable trays/ducts at the crossing between two floors shall be provided with:

i) Fire resistant board for closing the gap between the floor and trays/ducts (to be cut to size and fixed based on site condition). For conduits, the gap inside conduits shall be sealed using fire resistant sealant compound on both ends.

ii) Sealing the gap between the fire resistant board and trays/ducts using fire resistant sealant compound.

iii) Applying fire resistant sealant paint on the cables on the outer side of the fire resistant board for up to 1.5M length.

iv) For cable entry to the panels, following will be considered:

v) The panels should be provided with steel gland plates at the bottom with cable glands for fixing armoured power & control cables. As for special unarmoured cables, the same is directly taken through the holes in bottom plate without cable glands.

vi) Fire resistant board and/or fire resistant compound will be provided for special cables for sealing the gap at the cable entrance between the cables and steel gland plate inside the panel

vii) All gaps will be sealed by fire resistant compound from inside the panel.

viii) Applying fire resistant coating around cables up to 1M length below the panel. However, the coating length will be based on the site condition without disturbing the cable tags fixed on the cables.

13.0 PULPITS

13.1 Control pulpits housing the control desks shall be aesthetically and ergonomically designed, made of anodised aluminium frame with shatter proof, double walled thermo-glass screen for viewing. The pulpit shall be complete with false flooring for cables and false ceiling for lighting fitting and air-conditioning ducts. Adequate air-conditioning and illumination system shall be provided with spotlights for the operating personnel. Pulpit shall be complete with double door arrangement, stairs, operator's chairs etc.

13.2 Number and location of pulpits shall be finalised during engineering based on the technological requirement.

14.0 LAYOUT

14.1 It is envisaged that the WRM will be provided with one (1) Main Electrical Control Room (ECR–1) for Mill area and another Electrical Control Room (ECR–2) for finishing area.

14.2 The ECRs will house converter transformers, MCCs, Drive panels, PLCs, Computers, etc. The ECRs will be divided into floors/ rooms to segregate panels based on different applications and different Ventilation/Air conditioning requirements.

14.3 Sizing of ECRs and disposition of equipment in ECRs shall be done in such a way that 20-25% vacant space shall be available for future use.

15.0 DRAWINGS AND DOCUMENTS

15.1 The Contractor shall furnish electrical, instrumentation, automation and communication drawings and documents as per requirement indicated in the following list. Submission schedule will be finalized mutually during contract finalization.

Sl. No.	Description	Category
A.	**Basic Engineering**	
1.	Drawing Numbering System	I
2.	List of Drawings/Documents with Submission Schedule	I
3.	Motors & Component List	I
4.	List of consumers of electrical energy and equipment list	I
5.	Overall Single Line Diagram with number & rating of feeders required, feeder loading including the requirement of Emergency power	A
6.	Single Line Diagram for each system with rating of power circuit devices, loading of feeders, incoming and outgoing cable sizes etc.	A
7.	Design basis/calculation for sizing of systems, equipment, motors, power circuit devices	I
8.	Basic Layout of Electrical Control Rooms (ECR) with limiting dimensions for sizing	A

Sl. No.	Description	Category
9.	Basic layout of Control Pulpits for sizing	A
10.	Earthing and Lightning Protection Scheme with Calculation (as applicable)	A
11.	Heat Load Data of equipment for each premises	I
12.	Data for harmonic distortion & load build up curve for suppliers' equipment	I
13.	Plant layout indicating cable tunnels/trenches	A
14.	P & I Diagrams	A
15.	List of Instruments	I
16.	System feature for each telecommunication system	A
17.	Single Line representation for motor lubrication, air/water flow circuits for cooling systems for motors, CCTV and field mounted devices with relevant data of flow, pressure, temperature, associated equipment and instruments (as applicable)	A
18.	Automation Configuration Diagram identifying all automation equipment i.e. drive levels, Level-1, networking equipment, special purpose equipment and other relevant items with details including links with all external	A
19.	Certified embedded conduit Plans and Sections, Certified floor cut-out drawings for electrical panels for the shop area, ECRs	I
20.	Configuration/Block Schematic Diagram for CCTV & Communication systems.	A
21.	Configuration/Block Schematic Diagram for FDA system.	A
B.	**Detailed Engineering**	
1.	General Arrangement (GA) drawings for motors, transformers with dimensions, rating/diagram plate, foundation details and load data	A
2.	Data sheets / characteristic curves of all motors	I

Sl. No.	Description	Category
3.	General Arrangement (GA) drawings for each equipment / panel / switchboard, automation panel & console, control desk etc. with dimensions indicating front, rear and plan views	A
4.	OGA drawings with foundation, cable entry and cut-out details for each equipment / panel / switchboard	I
5.	Schematic circuit diagrams for each equipment / panel / switchboard / automation panel with all details upto component level and external connection diagrams	I
6.	Internal General Arrangement (IGA) drawings with sectional views indicating mounting location of all major components/devices, cable termination arrangement, clearances etc. for each equipment / panel / switchboard / automation panel along with Bill of Materials	I
7.	Block regulation diagrams for technological control functions with explanation (where applicable)	I
8.	Data sheets, schemes, GA, IGA, I/O lists and External connection (TB) diagrams of all bought-out equipment / devices (as applicable)	I
9.	Facia layout of Control desks, posts and push button stations	A
10.	UPS power distribution diagram	I
11.	Data Sheets for all instruments, indicating detail specification, make and complete model No.	A
12.	Set point schedule for alarms and interlocks	I
13.	Control schematic, Safety logic and sequence interlock diagram	I
14.	Loop Wiring diagram with termination details	I
15.	Functional document (Level-1)	I
16.	List of hardware items with proposed models/ specifications / data sheets and quantities (Level-1)	A

Sl. No.	Description	Category
17.	List of system software and standard software with number of licenses (Level-1)	A
18.	HMI display documents	I
19.	Test procedure document for the individual and complete system along with acceptance criteria (Level-1)	A
20.	Input / Output Lists with external connections details and Cable interconnection diagram showing termination details for the Automation system	I
21.	Documented source code for application software (Level 1)	I
22.	Details equipment layout of ECRs with the actual dimension of the panels	A
23.	Details equipment layout of Control Pulpits with the actual dimension of the panels	A
24.	Electrical, automation & instrumentation equipment location drawings for the complete shop and cellar area including location of all field mounted devices	I
25.	Field instrument installation diagrams with BOM	I
26.	Typical installation procedures	I
27.	Cable routing drawings with details of routes, Cable tray layout drawings with Plan / Sections, Cable Schedules & JB assignment for all equipment with bill of materials, Interconnection Drawings with termination details	I
28.	Layout of safety earthing system and electronic earthing system, if applicable with bill of materials	I
29.	Layout of illumination system with bill of materials (where applicable)	I
30.	Operation and Maintenance Manuals for all	I

Sl. No.	Description	Category
	equipment / systems/application software including those of 3rd party products	
31.	As built drawings and documents for all above after commissioning for all equipment / Systems	I
32.	Test/calibration certificates of all equipment/instruments	I
33.	Data sheet of equipment, Cable & accessories etc. for CCTV & Communication systems	A
34.	General Arrangement drawing of various devices/equipment for CCTV & Communication systems	A
35.	Bill of material (BOM) for each Communication System for CCTV & Communication systems	I
36.	Location drawing of CCTV & Communication systems on plant layout	I
37.	Power Distribution scheme for CCTV & Communication systems	I
38.	Cable routing drawing on Plant layout with Cable Schedule for CCTV & Communication systems	I
39.	Earthing scheme for CCTV & Communication systems	I
40.	Operation/maintenance manual for CCTV system	I
41.	Data sheet of equipment, Cable & accessories etc. for FDA system	A
42.	General Arrangement drawing of FDA equipment	A
43.	Bill of material (BOM) for FDA system	I
44.	Loop wiring drawing of FDA system	I
45.	Cable routing drawing on Plant layout with Cable Schedule for FDA system	I
46.	Operation/maintenance manual for FDA system	I

SECTION-V – UTILITIES & AUXILIARY SYSTEM

This section covers the utility and auxiliary systems, viz. compressed air, fuel gas, lubrication, hydraulic, pneumatic, ventilation & air-conditioning and fire protection systems and utility piping for the new Wire Rod Mill.

1.0 UTILITY SYSTEMS

1.1 General

Interplant distribution piping for compressed air and LPG, which will be required for the new Wire Rod Mill exists adjacent to the location proposed for the Wire Rod Mill. New branch lines for the Wire Rod Mill will be taken from the existing headers in yard and extended to the new Wire Rod Mill shop. The new branch utility lines shall be extended to the new mill building, distributed along the shop columns and terminated with isolation valves at various shop columns as required, and this point shall be considered as T.O.P for the Wire Rod Mill. From this T.O.P., all the utility service lines shall be laid inside the Wire rod mill shop by the bidder for distributing the same to all the consumers of the wire rod mill.

Measuring, recording and controlling instrument with transducers for flow and pressure for each utility service shall be provided by the bidder at T.O.P.

1.2 Design Basis

1.2.1 LPG

1.2.1.1 LPG shall be used as a fuel in the furnaces of Wire rod mill.

1.2.1.2 LPG shall be available in pipeline from purchaser's network at the T.O.P. at the following parameters:

Pressure (Max/Min) : 20 / 2.5 bar(g).
Temperature : Ambient
Calorific value (Net) : 22,500 — 25,000 kcal/Nm^3

1.2.2 Compressed Air

1.2.2.1 Plant grade Compressed air shall be used for process cooling and for various general services/cleaning requirements etc. Dry air shall be used for operation of pneumatic cylinders/actuators, air-oil systems, control valves, field mounted devices like CCTVs, Light Barriers etc.

1.2.2.2 Plant grade compressed air shall be available in pipelines at the T.O.P. with the following parameters:

Pressure (Max/Min) : 7.0/5.0 bar(g)
Temperature : Ambient

1.2.2.3 Dry compressed air, as required for the pneumatic systems and instruments of the new wire rod mill, shall be prepared from the plant grade compressed air supplied from the purchaser's compressed air network. For this, the purchaser shall supply and install a pre-filter and one refrigerant type air dryer inside the new mill building. The quality of dry compressed air shall be as given below:

Pressure (Max/Min)	: 7.0/4.5 bar(g)
Temperature	: Ambient
Pressure dew point	: + 4 °C (or lower)

1.2.2.4 The bidder shall clearly indicate the quality & quantity requirement of dry compressed air and consumers of dry compressed air in the technical offer. The bidder shall also indicate peak, minimum and average flow rate of dry compressed air.

1.2.2.5 The bidder shall clearly indicate the total compressed air consumption and pattern of consumption from the purchaser's network in the technical offer.

1.2.3 **Nitrogen**

1.2.3.1 Nitrogen shall be used for purging of LPG lines. For manual purging of LPG lines near furnaces, nitrogen cylinders shall be used. Necessary purge-in and purge-out connections for nitrogen shall be provided by the bidder.

1.2.3.2 Nitrogen shall be available in high pressure cylinders and the bidder shall provide necessary pressure reducing valves and piping for nitrogen with necessary purge-in and purge-out valves etc. for purging the LPG lines downstream of the T.O.P. for the new wire rod mill.

1.2.4 For all utility services indicated above, the maximum pressure available at T.O.P shall be used for the purpose of mechanical design and the minimum pressure shall be used for system/process design.

1.2.5 If any utility service other than those mentioned above is required bidder shall indicate the same in their offer.

1.2.6 If any utility service is required at the conditions other than those mentioned above, the bidder shall include necessary conversion equipment in their scope.

1.2.7 **Piping**

All the utility piping within the battery limit of the new wire rod mill shall be designed, supplied fabricated, erected, tested and commissioned by the bidder.

1.2.7.1 The utility piping shall include interconnecting piping for each utility service, from purchaser's T.O.P. up to equipment/consumer as well as bay piping for all utility services inside the new wire rod mill shop. The interconnecting piping shall include but not be limited to pipes, valves, fittings, supports, clamps, hoses with hose coupling & clamps, nozzles, safety devices, control valves, filters, traps, pressure regulators, lubricators, special fittings and any instruments & accessories required for proper functioning of the equipment of Wire rod mill. Necessary

drain and vent lines shall be provided by the bidder. The vent lines shall be routed outside the shop building to a height of 2.0 m above the roof level. The purge-out lines shall also be routed outside the shop building to a height of 4.0 m above the roof level.

1.2.7.2 The make of each item shall be as per MIDHANI's list of preferred makes, for utility systems. The successful bidder shall obtain prior approval from MIDHANI on the specification & make of each item, before placing order for the same.

1.2.7.3 The specification of components for the above utility services shall be as below:

Specifications for Compressed Air (Plant air and Dry air)

Sl. No.	**Item**	**Nominal dia DN, mm**	**Specification**
1.0	Pipe	150 and below	IS:1239 (Part I), ERW black, medium
		200 to 450	ERW pipes to API 5L Gr.B or IS:1978, Yst 25
		500 and above	Spirally welded pipes to API 5 LS Gr.B or pipe rolled from plates to IS:3589
2.0	Pipe fittings:		
2.1	Screwed fittings	50 and below	IS:1239 (Part II), black
2.2	Welded fittings:		
2.2.1	Bends	50 and below	Fabricated from pipes by cold bending with radius 3 DN/ forged carbon steel, 3000 lbs, SW, ASTM A105, ANSI B16.11
		65 to 200	Seamless B.W elbow to ASTM A234 Gr. WPB Sch. 40, dimension to ANSI B16.9
		250 and above	Mitred bends with radius 1.5 DN, made from pipes
2.2.2	Tees/reducers	50 and below	Forged carbon steel, 3000 lbs, SW, ASTM A105, ANSI B16.11

Sl. No.	Item	Nominal dia DN, mm	Specification
		65 to 200	Seamless B.W elbow to ASTM A234 Gr. WPB Sch. 40, dimension to ANSI B16.9
		250 and above	Fabricated
3.0	Flanges	All sizes	Plate flanges to IS:6392 Table-11 made from carbon steel plates to IS:2062 Gr.B with bore to suit pipe O.D.
4.0	Gaskets	All sizes	Compressed non-asbestos aramid fibre with NBR bonding, as per ASME B16.21
5.0	Bolting	All sizes	IS:1367
6.0	Valves		
6.1	Isolation (For services other than dry air)	50 and below	Plug valve to IS:10459/CI lubricated taper plug valve similar to `Audco' Fig MW-12/ball valve with 3-piece design
		65 to 300	CI lubricated taper plug valve flanged similar to `Audco' Fig. MW-13 for DN 100 and below and Fig. LW-13 for DN 150 and above with companion flanges of class 150 to ANSI B16.5 Or CI sluice valve generally as per IS:14846, PN 1.6 with SS rising stem and trim, flanged.
		350 to 1200	C.I. sluice valve generally as per IS:14846 PN 1.6 with SS rising stem and trim, flanged
		Above 1200	Class 125, C.I. butterfly valve as per BS:EN593 flanged

Sl. No.	Item	Nominal dia DN, mm	Specification
	Isolation (for dry air)	50 and below	Non lubricated PTFE sleeved cast iron plug valve screwed ends/ ball valve with 3-piece design
		65 to 300	CI sluice valve generally as per IS:14846, PN 1.6 with SS rising stem and trim, flanged
6.2	Throttling	50 and below	Forged carbon steel globe valve with regulating type discs, body to ASTM A 105 trim material to ASTM A 182 Gr.F6 rising stem screwed ends
		65 and above	C.I. throttling globe valve with regulating type discs, S.S. rising stem and renewable seat ring suitable for pressure rating PN 1.6 MPa, flanged.
6.3	Non-return	50 and below	Forged steel lift type check valve body to ASTM A 105, SS trim screwed ends
		65 to 300	C.I. swing check valve as per IS:5312 (Part I), flanged
7.0	Filter	6 to 50	Filter with manual drain, S.S. filtering element, transparent bowl, screwed.
8.0	Hose assembly	All sizes	15 m hose to IS:911 (Type 2) with quick acting claw type couplings. For each hose coupling with male thread at one end and blow nozzle at the other end and hose clamp at both ends.
9.0	Trap	Upto 50	Float type trap, C.I. body, stainless steel internals with drain cock, similar to J.N. Marshall's spirax CA 10 screwed. Or

Sl. No.	Item	Nominal dia DN, mm	Specification
			Electrical timer operated auto drain valve with drain pot
10.0	Strainer	Upto 50	'Y' type strainer having C.I. body and brass screen, similar to J.N. Marshall's spirax strainer Fig-12, screwed.
11.0	Lubricator	6 to 50	Automatic oil-feed lubricator with transparent bowl, screwed.

Specifications for Nitrogen Piping

1.0	Pipes	15 to 150 200 to 600	ASTM A106 Gr. B, seamless, API 5L Gr. B, seamless
2.0	Pipe fittings		
2.1	Bends	50 and below	Fabricated from pipes by cold bending with radius 3 DN
		65 to 200	Seamless B.W. elbow to ASTM A-234 Gr. WPB, Sch. 80, Dimension to ANSI B 16.9
		250 and above	Fabricated from pipes by hot bending with radius 3 DN/BW, carbon steel, seamless, Sch.40, ASTM A234, Gr. WPB, ANSI B16.9
2.2	Tees/reducers	Upto 50	Forged carbon steel, 3000 lb conforming to ASTM A 105, socket weld ends to ANSI B 16.11.
		65 to 600	Materials conforming to ASTM A234, Gr. WPB, Sch.80, seamless, butt weld ends to ANSI B 16.9. Wall thickness equal to pipewall thickness

Sl. No.	Item	Nominal dia DN, mm	Specification
3.0	Flanges	50 and below	Class 300, socket weld raised face, flanges to ANSI B16.5, forged steel conforming to ASTM A 105.
		65 and above	Class 300, slip-on, raised face flanges to ANSI B16.5 forged steel to ASTM A 105, with bore to suit pipe O.D.
4.0	Gaskets	All sizes	Compressed non-asbestos aramid fibre with NBR bonding, as per ASME B16.21
5.0	Bolting	All sizes	Studs: ASTM A193 Gr. B7 Nuts: ASTM A194 Gr. 2H
6.0	Valves		
6.1	Isolation	50 and below	Class 800 forged carbon steel gate valve, body to ASTM A105, trim material to ASTM A182 Gr.F6, bolted bonnet, outside screw and yoke rising stem, socket weld ends to ANSI B16.11
		65 and above	Class 300, cast carbon steel gate valve, body to ASTM A216 Gr. WCB, trim material to ASTM A182 Gr. F6, bolted bonnet, outside screw and yoke rising stem, flanged ends to ANSI B16.5
6.2	Throttling	50 and below	Class 800 forged carbon steel globe valve with regulating type discs, body to ASTM A105,trim material to ASTM A182 Gr. F6, bolted bonnet, outside screw and yoke rising stem, socket weld ends to ANSI B16.11

Sl. No.	Item	Nominal dia DN, mm	Specification
		65 and above	Class 300 cast carbon steel globe valve with regulating type discs, body to ASTM A216 Gr. WCB, trim material to ASTM A182 Gr. F6, bolted bonnet, outside screw and yoke, rising stem, flanged ends to ANSI B16.5
6.3	Non-return	50 and below	Class 800 forged carbon steel lift check valve, body and cap to ASTM A105, socket weld ends to ANSI B16.11
		65 and above	Class 300 cast carbon steel swing check valve, body and cap to ASTM A216 Gr. WCB, flanged ends to ANSI B16.5
7.0	Filter		Strainer with C.S. body, stainless steel bronze/ brass filtering element
8.0	Hose assembly		15 m long hose generally to BS:796 of suitable size, complete with hose connection on one end, hose protector on the other end secured by hose clips
	Specifications for Liquefied Petroleum Gas		
1.0	Pipe	150 and below	ASTM A 106 Gr. B seamless, black, Sch.40.
2.0	Pipe fittings		
2.1	Screwed fittings	40 and below	IS:1239 (Part II), black/ forged, heavy, seamless
2.2	Welded fittings		
2.2.1	Bends	50 and below	Forged carbon steel, socket weld, 3000 lbs to ASTM A 105, dimension to ANSI B 16.11

Sl. No.	Item	Nominal dia DN, mm	Specification
		65 and above	Carbon steel, seamless BW elbow to ASTM A234 Gr. WPB Sch. 40, Dimension to ANSI B 16.9
2.2.2	Tees/reducers	50 and below	Forged carbon steel, 3000 lbs, to ASTM A105, socket weld ends to ANSI B 16.11
		65 and above	Fabricated from pipes/ carbon steel, seamless BW end to ASTM A234, Gr. WPB, Sch. 40, dimension to ANSI B16.9
3.0	Flanges	50 and below	Class 150, forged Carbon steel to ASTM A105, socket weld raised face to ANSI B16.5
		65 and above	Class 150, forged carbon steel to ASTM A 105, slip-on raised face to ANSI B16.5/C.S raised face plate flanges to IS:6392 Table-5, made from plates to IS:2002 Gr.2A with bore to suit pipe O.D.
4.0	Bolting	All sizes	Studs: ASTM A193 Gr. B7 Nuts : ASTM A194 Gr. 2H
5.0	Gaskets	All sizes	Spirally wound graphite with SS316 rings
6.0	Valves:		
6.1	Isolation	50 and below	Class 800, forged steel, wedge gate valve, body and bonnet material to ASTM A105, trim material to ASTM A182, Gr. 304L, bolted bonnet, outside screw and yoke, rising stem, socket weld ends. Or Class 800 forged steel ball valve to BS 5351 body bonnet to ASTM A105 trim to ASTM A182 Gr. 304L socket weld ends

Sl. No.	Item	Nominal dia DN, mm	Specification
		65 to 150	Class 150 cast steel wedge gate valve, body and bonnet material to ASTM A216, trim material to ASTM A 182, Gr. 304L, bolted bonnet, outside screw and yoke, rising stem, ends flanged to ANSI B16.5 or Class 150 cast steel ball valve to BS 5351 body and bonnet to A 216 Gr. WCB, trim A 182 Gr.304L. ends flanged to ANSI B 16.5
6.2	Globe	50 and below	Class 800, forged steel globe valve with regulating type discs, body and bonnet material to ASTM A 105, trim material to ASTM A 182, Gr. 304L, bolted bonnet, outside screw and yoke, rising stem, socket weld ends.
		65 to 150	Class 150 cast steel globe valve with regulating type discs, body and bonnet material to ASTM A 216, trim material to ASTM A 182,Gr. 304L, bolted bonnet, outside screw and yoke rising stem, ends flanged to ANSI B16.5.
6.3	Check	50 and below	Class 800, forged steel check valve, body and cap material to ASTM A105, trim material to ASTM A 182, Gr. 304L. bolted cap. socket weld ends.
		65 and above	Class 150, cast steel swing check valve, body and cap material to ASTM A 216, trim material to ASTM A182, Gr. 304L, bolted cap ends flanged to ANSI B16.5.
7.0	Flash back arrestor		Hydraulic or cartridge type

NOTES:

(1) For LPG Service, use of ball valves of suitable design (instead of gate valves) may be considered.

1.3 **Scope of Work**

1.3.1 **Piping**

1.3.1.1 Design, engineering, procurement and supply of all piping for the above utility services from the T.O.P. up-to the various consuming points/equipments with isolation valves. Sectional isolation valves shall be provided for isolation of section for maintenance/repair of pipe sections and or equipment. The bidder shall include valves or dummy plugs for draining of all pipelines other than gas.

1.3.1.2 Supply of measuring, recording and controlling instruments with transducers for flow and pressure for each utility service at T.O.P.

1.3.1.3 Supply of pressure indicators and temperature indicators for the services, as required.

1.3.1.4 Supply of auto purging facilities for fuel gas (LPG) lines to the reheating furnaces, for meeting emergency situation, complete with necessary valves.

1.3.1.5 Supply of purging and vent connections with necessary valves on LPG lines.

1.3.1.6 Supply of pressure reducing valves, as required, for the above utility services.

1.3.1.7 Providing one (1) no. tapping point for plant grade compressed air inside each oil lube & hydraulic cellar/room for general purpose cleaning.

1.3.1.8 Supply of interconnecting piping from sump pump inside each oil lube & hydraulic cellar/room upto a convenient building column at ±0.00 level with an isolation valve.

1.3.1.9 Providing service tapping points for plant grade compressed air throughout the entire mill including furnace, roll shop and other areas.

1.3.1.10 Necessary air receivers of required quantity & adequate capacity shall be provided by the bidder for both the plant grade compressed air & dry compressed air for supplying air during emergency condition and to meet the sudden peak flow requirement, wherever required for entire wire rod mill.

1.3.1.11 Fabrication, erection, testing and commissioning of all utility piping from T.O.P. to each consumer / equipment.

2.0 **AUXILIARY SYSTEMS**

2.1 **Lubrication Systems**

2.1.1 **General**

2.1.1.1 Suitable oil and grease lubrication systems as required for the equipment for Wire rod mill including reheating furnace covered under this specification, shall be provided by the bidder. Each oil lubrication and grease lubrication system will be complete with all equipment, electrics, piping, instrumentation and controls as required and as specified in this specification.

2.1.1.2 The quantity and quality requirements of each type of lubricant shall be clearly indicated by the bidder.

2.1.1.3 The lubrication systems to be provided shall ensure that all components such as bearings, gears, moving parts etc. served by the systems, shall operate safely below their maximum allowable operating temperatures and without excessive wear.

2.1.1.4 The lubrication systems shall include, but not be limited to, the following systems:

a) Oil lubrication systems for the gear boxes/bearings of roughing stands, intermediate stands, finishing stands, pinch rolls, shears and other equipment of Wire rod mill including furnace, as required.
b) Air-oil lubrication systems for the guides of intermediate and finishing mill stands, loopers and other equipment, as required.
c) Grease lubrication systems for the various equipment of the Wire rod mill including furnace, as required.

2.1.2 **Design Basis**

2.1.2.1 **Oil lubrication systems**

2.1.2.1.1 Centralized oil lubrication systems shall be provided where required to serve the main drive gearboxes and bearings. The number of systems provided shall be determined by the type of oil required, location of the units and operational requirements.

2.1.2.1.2 Air-oil systems shall be provided for the guides of intermediate and finishing mill stands.

2.1.2.1.3 The oil lubrication systems shall be complete with all equipment including electrics, piping, instrumentation and controls.

2.1.2.1.4 The filling of fresh lubricating oil in the tank of oil lubrication systems shall be carried out from barrels/tankers by using portable transfer pump-motor-filter unit. The spent lubricant from the tanks shall be transferred to the barrels/tankers. For small lubrication systems, the system pumps shall be used for unloading the spent lubricant from the tank. For large lubrication system e.g. for gear oil lubrication system / oil-film bearing lubrication system (if any), a separate pump shall be provided for unloading the lubricant from the tank. Necessary isolation valve with limit switch and check valve shall be provided on the fresh and spent oil lines.

2.1.2.1.5 Oil lubrication systems shall include tank with clean-out doors, inspection doors, sloping bottom, baffle plates, tank strainer with magnets, air breathers with silica gel, pouring strainer, level gauge, level switches (high-level, low-level, low-low-level), drain valve in each compartment, thermometers (2 nos.), thermostats, floating suction, sampling cocks, tank heaters, triple-screw pumps (including standby pumps), duplex filters (one working, one standby) with magnets, plate type heat exchangers, pressure tank for supplying oil to the gear

box/bearing during emergency, necessary valves and instruments within the system as well as near the gear boxes/bearings, interconnecting piping within the oil lubrication system units as well as interconnecting piping between oil lubrication systems and lubrication points (gear boxes/bearings), electric motors and control panel. The level gauge and level switches shall be of non–contact type.

2.1.2.1.6 The tanks of the oil lubrication systems shall be adequately sized. The volume of oil tanks shall be selected considering oil in pipe lines; contaminant settling time and heat dissipation time for oil. For oil-film bearing lubrication systems, two (2) tanks (1 working + 1 stand by) shall be provided.

2.1.2.1.7 The filtration fineness of duplex filters of gear oil lubrication systems shall be 50 micron. For oil-film bearing lubrication systems duplex filters of 50 micron fineness shall be provided within the system as well as near the stands. All filters shall be provided with magnets.

2.1.2.1.8 The cooler shall be of plate with sealing gaskets type design. The cooler shall have 20% reserve capacity. The cooler shall be designed for water inlet temperature of 35° C.

2.1.2.1.9 The compact lube units, pressure tanks and centrifuges shall be provided with drip tray and drain valve.

2.1.2.1.10 For each oil-film bearing lubrication system also, one (1) no. centrifuge shall be included. The centrifuges shall be disc type and adequately sized. The centrifuges shall be complete with electric motor, heaters and electrical control panel.

2.1.2.1.11 Necessary isolation valves shall be provided across pumps, across filters, across cooler and on the bypass line across cooler, near pressure tank and on the water inlet and outlet lines to/from cooler. Necessary control valve with electronic pressure controller and valve positioner shall be provided on the overflow line downstream of filters to maintain constant system pressure. Necessary control valve with electronic temperature controller and valve positioner shall be provided on the cooler water inlet line to maintain constant temperature of oil at the outlet of cooler.

2.1.2.1.12 The pressure tank to be included in the system shall be adequately sized. The capacity of pressure tank shall be such that it will supply oil to the gear boxes/bearings of the main equipment to meet emergency requirements in case of power failure. The pressure tank shall be complete with all accessories.

2.1.2.1.13 Each-tank unit, compact lube unit, pressure tank unit and centrifuge unit shall be provided with electrical junction box and shall be pre-wired up-to junction box.

2.1.2.1.14 Necessary pressure gauges and pressure switches (with digital display) shall be included in the system for

monitoring pressure, for automatic starting of stand-by pump and for low-pressure alarm. Pressure gauge with isolation valve shall be included after each pump and across each duplex filter. Filters shall be provided with differential pressure switches for audio-visual alarm for filter clogging. Pressure gauge and pressure switches shall be included with pressure tank. Thermometers shall be included on the oil and water inlet and outlet lines of the cooler and pressure gauge on the water inlet and outlet line from cooler. Necessary strainers of 300 microns shall be included on the water inlet line to cooler. Minimess couplings on oil inlet and outlet lines of cooler shall be provided for pressure measurement. Globe valve, pressure gauge, pressure switch, thermometer and flow switch (thermal dispersion type) shall be included on the oil supply line at the entry to each gear box/bearing. Thermometer and thermostat shall be included on the return line from each gearbox. Sampling valve shall be provided on the return line from each gear box. For oil-film bearing lubrication systems if any, drip-leg shall be provided on the return line from each bearing/stand and water detecting units shall be provided in the tanks and pipeline. Annunciation from all switches shall be provided in control pulpit/desk or at suitable location.

2.1.2.1.15 Necessary pressure control valves with electric pressure controller and valve positioner shall be provided near each stand for oil-film bearing lubrication systems. For Gear oil lubrication systems, necessary pressure reducing valves shall be provided on the oil feed lines to gearboxes.

2.1.2.1.16 All pipes for oil lubrication systems shall be carbon steel seamless pipes as per DIN standard P235TR2+N or ASTM A106, Grade 'B'. All pipes and fittings in wet area shall be of stainless steel as per DIN EN ISO 1127, material X6CrNiMoTi17-12-2 (1.4571) or as per ASTM A312, SS 304L. For air-oil lubrication systems the oil piping shall be of stainless steel as per DIN EN ISO 1127, material X6CrNiMoTi17-12-2 (1.4571) or as per ASTM A312, SS 304L

2.1.2.1.17 Each air-oil lubrication system shall be provided with tank with accessories like air breathers with silica gel, pouring strainer, level gauge, level switches (high level, low level and low-low level), thermometers (two Nos.), drain valve in each compartment, pumps (including stand-by pump), duplex oil filters with electrical switch for filter clogging indication, progressive oil distributors, progressive oil-air distributors, air line connection with isolation valve, filter, regulator with pressure gauge, solenoid valve, pressure gauge & pressure switch on oil & air lines, junction box, interconnecting stainless steel piping between each air-oil system & lubrication points and control panel. Necessary flow switches (thermal dispersion type) shall be provided for each equipment for low flow alarm. The level gauge and level switches shall be of non-contact type. Air-oil lubrication systems will be provided with a filling pump for transferring oil from barrels to the tank of all the air-oil lubrication systems.

2.1.2.1.18 For filling fresh oil to the tank of all oil lubrication systems and isolated gear boxes, one (1) no. mobile motorized transfer pump-motor-filter unit shall be provided for transferring oil from barrels/ tanker located at ±0.0 m level to the tank of lube systems/gearboxes. The fineness of filter shall be 25 micron. The mobile

filling unit shall be complete with electrical starter box, 15 m long cable, 3-pin plug and 15 m long suction and delivery hoses.

2.1.2.1.19 All oil lubrication systems shall be started from MCCs/local control panel of the respective oil lubrication system. Remote control shall also be provided in the control pulpits/desks.

2.1.2.1.20 Audible (as required) and visible alarms shall be provided in the control panel for indicating malfunctioning of any component leading to any of the following conditions:

a) Low pressure in the system
b) Excessive temperature of oil
c) High level of oil in reservoir
d) Low level of oil in reservoir
e) Clogging of filters
f) Low oil flow
g) Motor overload

2.1.2.1.21 For any of the faults mentioned above, necessary audio-visual alarms shall be provided in control pulpit/desk for "FAULT- OIL LUBRICATION SYSTEM".

2.1.2.1.22 The piping shall include piping within the respective oil lubrication and air-oil systems as well as complete interconnecting piping between each oil lubrication/air-oil system and lubrication points. Pickling and flushing of interconnecting piping for oil lubrication and air-oil lubrication systems shall be carried out.

2.1.2.1.23 Adequate number of flushing filter elements shall be provided for flushing of interconnecting piping including systems.

2.1.2.1.24 Sump pump shall be provided for the sump pit inside each oil lubrication cellar. Each sump pump shall be provided with level switch and check valve, isolation valve and pressure gauge at the discharge side of the pump. The discharge line from the sump pump shall be taken outside the cellar/room upto a convenient building column and shall be terminated with an isolation valve at +1200 mm for disposal of oil/water mixture in drums.

2.1.2.1.25 The make of oil lubrication systems/components shall be as per MIDHANI's Preferred Make list for oil lubrication systems. The successful bidder shall obtain prior approval from purchaser on the specification and make of each item, before placing order for the same.

2.1.2.2 **Grease lubrication systems**

2.1.2.2.1 Centralized grease lubrication systems shall be provided for the lubrication of equipment of entire wire rod mill. The grease lubrication systems will be complete with all equipment, including electrics, piping, instrumentation and controls. Separate grease lubrication systems shall be included for the lubrication points in hot zone and cold zone.

2.1.2.2.2 The grease lubrication systems shall be dual-line automatic systems. The systems shall be complete with electrical motor driven main pump, grease reservoir of adequate capacity, check valves, relief valves, pressure gauge and pressure switch on downstream side of main pump, line filters (of 250 microns), line changeover valves, isolation valves on the discharge line and tank return line between pump and line changeover valve, dual-line metering feeders, end-of line pressure switches with pressure gauges and electrical control cabinet. The centralised grease systems shall be complete with pneumatically/electrically operated grease filling pump. Necessary line filter (of 250 micron) shall be provided on the filling line from grease filling pump to reservoir of main pump. The grease system should monitor the end of line pressure (EOL) and make automatic switch over of lines when the pressure is achieved. The system should generate alarm if the EOL pressure is not achieved within stipulated time indicating leakage in the lines. The end-of-line pressure switches and pressure gauges shall be located in an accessible position for maintenance activities without hampering production. On mill equipment, the metering feeders shall be located at safe and accessible locations.

2.1.2.2.3 The reservoirs of the grease main pumps shall have adequate capacity for storage of grease for minimum seven (7) days' requirement. Grease reservoir of each pump shall be provided with follower plate, tell-tale rod, limit switches for high level alarm and grease filling pump cut-off, low level alarm and low-low level alarm & main pump cut-off. The grease filling pumps shall be complete with drum cover, pressure gauge, relief valve and low level limit switch.

2.1.2.2.4 The grease lubrication systems shall be complete with all interconnecting piping between main grease pumping station and lubrication points via metering feeders, interconnecting piping between grease filling pump and main grease pumping station and interconnecting piping for dry air from T.O.P. to grease filling pump. The interconnecting piping for grease lubrication systems shall conform to the high pressure requirement and material compatible with media and pressure of the system

2.1.2.2.5 The main headers for grease systems shall be of carbon steel seamless pipes as per DIN EN 10305-4 (ISO 3304)/ANSI standard. The OD x thk of main headers shall be 30x5/25x4/20x3 (mm x mm) and above depending on system capacity and length of pipeline. The branch lines from main headers to metering feeders shall also be of carbon steel seamless pipes to DIN/ASTM standards and OD x thk of branch lines shall be 20 x 3/16 x 2.5/10x1.5 (mm x mm) depending on length of branch lines. For feed lines from metering feeders to lubrication points 10 x 1 seamless stainless steel pipes as per DIN EN ISO 1127, material X6CrNiMoTi17-12-2 (1.4571)/ANSI standard with stainless fittings shall be used. However, for roller tables in dry area, 10 x 1 seamless SS feed pipes shall be with zinc-plated carbon steel fittings. The main header piping and branch line piping in wet area shall be of stainless steel with stainless steel fittings.

Weld nipple type fittings with 'O' ring or welded fittings shall be used for main headers and branch lines up-to metering feeders. Flareless compression type fittings shall be used only on the feed lines.

2.1.2.2.6 The grease lubrication systems shall be started from its electrical control cabinet located close to the grease pumping stations. Remote control shall also be provided in the control pulpits/desks. The systems shall be automatically operated and monitored with timer control.

2.1.2.2.7 Audible (as required) and visible alarms shall be provided in the control panel for indicating malfunctioning of any component leading to any of the following conditions for grease systems:

a) High level of grease in reservoir and grease filling pump cut-off
b) Low-level of grease in reservoir
c) Low-low level of grease in reservoir and main pump cut-off
d) Low pressure in the system
e) Motor overload
f) Indication of pressure line (A line or B line).

For any of the above faults, necessary audio-visual alarms shall be provided in the control pulpit/desk for "FAULT-GREASE LUBRICATION SYSTEMS".

2.1.2.2.8 Isolated points, which require infrequent lubrication, shall be provided with grease nipples. If more than one manual grease point is envisaged, points shall be suitably piped to a common distributor, placed at an accessible location, for a single point greasing.

Two (2) nos. mobile grease lubricating units shall be provided by bidder for entire wire rod mill including roll shop equipment for lubrication of such points. The mobile greasing unit shall be complete with electric motor operated pump, grease drum with drum cover, low-level switch, check valve, relief valve, pressure gauge, air line filter (5 micron), regulators with pressure gauge and lubricator, (15 m + 15 m) long discharge hose, 15 m long air line hoses, grease gun and trolley.

2.1.2.2.9 The interconnecting piping for grease system shall be pickled and flushed.

2.1.2.2.10 Adequate quantity of flushing filter elements shall be provided for flushing of the interconnecting piping including systems.

2.1.2.2.11 The make of grease lubrication systems/components shall be as per MIDHANI's preferred make list for grease lubrication systems. The successful bidder shall obtain prior approval from Employer on the specification and make of each item, before placing order for the same.

2.1.3 **Scope of Work**

2.1.3.1 Design, Engineering, Procurement, Manufacture, Fabrication, Assembly, Testing and Supply of all oil/air-oil lubrication systems and grease lubrication systems, including interconnecting piping.

2.1.3.2 Supply of all oil lubrication systems for the gear boxes/ bearings of various equipment of wire rod mill, including reheating furnace.

2.1.3.3 Supply of local control panel for each oil lubrication system.

2.1.3.4 Supply of one (1) no. centrifuge complete with electrical heater and control panel for each oil-film lubrication system.

2.1.3.5 Supply of one (1) no. mobile oil filling pump-motor-filter unit for unloading fresh oil from barrels/ tankers to all the tank of oil lubrication systems/isolated gear boxes.

2.1.3.6 Supply of interconnecting piping between each oil lubrication system and lubrication points.

2.1.3.7 Supply of air-oil lubrication systems for the guides of intermediate and finishing of mill stands and other equipment, if required.

2.1.3.8 Supply of one (1) no. filling pump for air-oil lubrication systems.

2.1.3.9 Supply of local control panel for each Air-oil lubrication system.

2.1.3.10 Supply of interconnecting piping between each Air-oil lubrication system and lubrication points.

2.1.3.11 Supply of one (1) set of necessary equipment for checking particle content and water content in lubricating oil.

2.1.3.12 Supply of one (1) No. Ultrasonic filter element cleaning equipment.

2.1.3.13 Supply of all grease lubrication systems for the various equipment of wire rod mill, as required.

2.1.3.14 Supply of one (1) no. grease filling pump for each centralized grease lubrication system.

2.1.3.15 Supply of local control panel for each grease lubrication system.

2.1.3.16 Supply of interconnecting piping between each grease lubrication system and lubrication points via metering feeders and interconnecting dry air piping from T.O.P. to grease filling pump.

2.1.3.17 Supply of two (2) nos. mobile greasing unit for lubrication of isolated points for entire wire rod mill including roll shop equipment.

2.1.3.18 Supply of all expansion type foundation bolts, nuts and washers of “HILTI” make or equivalent for the equipment of all oil lubrication, air-oil and grease lubrication systems, centrifuge unit(s), grease filling pumps and control panels.

2.1.3.19 Supply of adequate number of flushing filter elements for flushing of interconnecting piping including systems for oil lubrication, air-oil and grease lubrication systems.

2.1.3.20 Supply of commissioning spares for oil lubrication, air-oil and grease lubrication systems. A list of commissioning spares comprising of each unit/component for each system will be furnished by the bidder in the technical offer.

2.1.3.21 Supply of sump pump with accessories and interconnecting piping for each oil lubrication cellar/room.

2.1.3.22 Supply of first fill of lube oil and grease for each oil lubrication and grease lubrication system including isolated points till preliminary acceptance (PAC) test.

2.1.3.23 Supply of flushing oil & grease for flushing of interconnecting piping including systems for oil and grease lubrication systems.

2.1.3.24 Erection and commissioning of all equipment for oil lubrication, air-oil and grease lubrication systems, centrifuge units, oil and grease filling pumps, control panels and complete interconnecting piping.

2.1.3.25 Pickling and flushing of interconnecting piping between system and lubrication points for oil lubrication, air-oil and grease lubrication systems.

2.1.3.26 Supply of mechanical hoists over pump-motors and filters for each oil lubrication system.

2.2 Hydraulic Systems

2.2.1 General

Hydraulic systems shall be provided for the actuation of hydraulic cylinders/motors/actuators of the various equipment of the wire rod mill, including for reheating Furnaces, if required. The hydraulic systems shall be complete with all equipment, electrics, piping, instrumentation and controls, as required and as specified in this specification. The quantity and quality requirements of hydraulic oil/fluid shall be clearly indicated in the offer by the bidder.

2.2.2 Design Basis

2.2.2.1 As far as possible centralized hydraulic systems shall be provided for the equipment of the new wire rod mill. The number of systems provided shall be determined by the type of system depending on operational requirement and location of mechanical equipment.

The hydraulic systems shall be complete with all equipment including electrics, piping, instrumentation and controls. Mineral oil, HLP-68 of ISO VG68 grade shall be used in the hydraulic systems. The hydraulic systems shall be designed with filters for achieving and retaining (during operation) the following cleanliness levels (NAS 1638 Class or ISO 4406:1999) depending upon the type of system/criticality of usage & application during operation:

a) Hydraulic systems without Proportional & Servo Valves - NAS 7 (ISO Class 18/16/13)
b) Hydraulic systems with Proportional Valves - NAS 5 (ISO Class 16/14/11)
c) Hydraulic systems with Servo Valves - NAS 3 (ISO Class 14/12/9)

2.2.2.2 The filling of fresh hydraulic oil in the tank of each hydraulic system shall be carried out from the barrels located at ±0.0 m level. Filling line with duplex filters shall be provided in the tank. The spent hydraulic oil from the tanks shall be transferred to the barrels/tankers located at ±0.0 m level. The circulation pumps shall be used for unloading the spent oil from the system tank.

Necessary branch connection shall be provided on the downstream side of circulation pumps. Isolation valve with limit switch and check valve shall be provided on the fresh and spent oil lines.

2.2.2.3 Hydraulic systems shall include tank with clean-out doors, inspection doors, sloping bottom, baffle plates; air breathers of 3 micron fineness with silica-gel, level gauge, level switches (high level, low level and low-low level), thermometers (2 nos.), thermostats, drain valves for each compartment, suction ports etc; two (2) nos. isolation valves for connecting mobile centrifuge/electrostatic liquid cleaner, as and when required; variable displacement type main axial piston pumps (including stand-by pumps); pressure line filters; duplex return line filters (one working & one standby); parallel filtration & cooling system containing triple-screw pumps (including stand-by pumps), duplex circulation filters (one working + one standby), plate type oil coolers; accumulators; hydraulic valve stands containing necessary control valves including proportional/servo valves; hydraulic actuators like cylinders, hydraulic motors etc; instruments and controls; piping within the hydraulic tank-pump station as well as interconnecting piping between hydraulic power pack and hydraulic cylinders/motors via valve stands and accumulator stands; electric motors and control panels. The level gauge and level switches shall be of non-contact type.

2.2.2.4 The tanks of the hydraulic systems shall be adequately sized. The volume of oil tanks shall be selected considering oil in pipe lines; contaminant settling time and heat dissipation time for hydraulic oil. For systems with servo valves the tank shall be of stainless steel.

2.2.2.5 The main pumps shall be variable flow axial piston type. Each main pump shall be provided with an unloading valve. Motors for main pumps shall be selected considering adequate margin (minimum 10%) in pressure over and above relief valve set pressure of the system. Pumps for circulation systems shall be triple screw pumps with built-in relief valve.

2.2.2.6 The filtration fineness of pressure line filters, circulation filters and return line filters shall be of 3 micron, 3 micron and 10 micron respectively for systems with servo valves and 5 micron, 5 micron and 10 micron respectively for systems with proportional valves (and without servo valve). For systems without servo valves or proportional valves, the pressure line filters, circulation filters and return line filters shall be of 10 micron, 5 micron and 10 micron fineness respectively. The circulation filters and returns line filters shall be duplex type with built-in integral changeover valve.

The capacity of filters for each hydraulic system will be as follows:

a. Capacity of pressure line filters - 2 times of pump flow at Δp = 0.7 bar in clean condition with oil ISO VG 68 at 40°C

b. Capacity of circulation filters - 3 times of pump flow at Δp = 0.3 bar in clean condition with oil ISO VG 68 at 40°C

c. Capacity of return line filters - 3 times of maximum return flow at Δp = 0.3 bar in clean condition with oil ISO VG 68 at 40°C

2.2.2.7 The cooler shall be plate with sealing gasket type design. The coolers shall have 20% reserve capacity. The cooler shall be designed considering water inlet temperature of 35 °C.

2.2.2.8 Necessary isolation valves shall be provided across pumps, filters, coolers, on the bypass line across coolers, on the water inlet and outlet lines of cooler. Branch line connection with check valve and isolation valve with limit switch shall be provided on the downstream side of circulation pumps for unloading spent oil from tank into barrels/tankers.

2.2.2.9 Necessary pressure gauges and pressure switches shall be included in the circuit for monitoring pressure and for low-pressure alarm. Pressure gauge with isolation valve shall be provided on the downstream side of each circulation pump and pressure gauge with minimess hose & coupling shall be provided on the downstream side of each main pump. Pressure switch (having lockable arrangement) with minimess coupling & hose shall be included on the downstream side of main and circulation pumps. Sufficient pressure checkpoints shall be included in the circuit at various points for connecting pressure gauge, as and when required. Each filter shall be provided with pressure switch for audio-visual alarm. Thermometers shall be included on the oil inlet and outlet lines of the cooler; on the water inlet and outlet lines of the cooler; pressure gauge on the water inlet and outlet lines of the cooler. Necessary strainer of 300 micron and solenoid valve shall be included on the water inlet line to cooler. For pressure measurement, minimess couplings shall be provided across each filter and at the oil inlet and outlet lines of cooler.

2.2.2.10 Each manifold block of each valve stands shall be provided with isolation valves on the pressure pipeline and check valve on the tank return pipeline and leakage pipeline. Function integrated blocks and modular sub-plate mounted valves shall be used as far as possible. Valve stack on valve tables shall be suitably spaced for easy removal during maintenance.

2.2.2.11 Each pump-motor unit, return line filter unit, circulation filter-cooler unit, valve stand and accumulator stand shall be provided with drip tray and drain valve.

2.2.2.12 The tank units, pumping stations, valve stands and accumulator stands shall be provided with electrical junction box and shall be pre-wired up-to junction box.

2.2.2.13 Anodized circuit plates shall be provided for the tank units, power units, parallel filtration-cooling units, valve stands and accumulator stands.

2.2.2.14 Hydraulic cylinders shall preferably be provided with adjustable end cushions at both ends. Cylinders shall be provided with suitable protections depending on location e.g. hot area etc.

2.2.2.15 The piping of the hydraulic systems shall be designed such that the fluid velocity can be kept as follows:

For hydraulic pressure line - Velocity approx. 4.5 m/sec.

For tank line - Velocity less than 2.0 m/sec.

For suction line - Velocity upto 0.5 m/sec.

All pipes for hydraulic systems shall be seamless pipes as per DIN/ANSI standard. Material & Standard of hydraulic pipes shall be as follows:

For Servo Systems :
Seamless stainless steel pipes as per DIN EN ISO 1127, material X6CrNiMoTi17-12-2 (1.4571) or as per ANSI standard.

For Non-Servo Systems :
Pipes upto 38 mm OD - Seamless carbon steel pipes as per DIN EN 10305-4 (ISO 3304), P235TR2+N or as per ANSI standard.
Pipes above 38 mm OD - Seamless carbon steel pipes as per DIN EN 10220, S355J2H/E355 or as per ANSI standard.

For wet/hot corrosive areas, Seamless stainless steel pipes as per DIN EN ISO 1127, material X6CrNiMoTi17-12-2 (1.4571) or as per ANSI standard.

The interconnecting piping for hydraulic systems shall also include the following:

a) Interconnecting piping for plant grade compressed air from Take Over Point to each hydraulic cellar/room.

b) Necessary valves/instruments shall be included on the pipeline to give alarm in case of hose burst and stop oil flow through the hose.

c) For pipe joints upto 38 mm pipe, walform type or weld nipple type fittings with viton seals shall be used and above 38 mm pipe, SAE flanges with 'O'-ring shall be used for each hydraulic system.

d) Upto 38 mm pipe, welding of pipes and pipe joints will be carried out by TIG welding only. For pipe sizes above 38 mm, the root will be TIG welded and the balance portion will be electric ARC welded. Radiographic Test will be carried out for 10% of welded pipe joints. In case any joint fails, then 100% of the joints shall be radiographed.

e) Heavy duty polypropylene or aluminium clamps (in hot zones) shall be used as pipe support.

2.2.2.16 One (1) No. loose pressure gauge (of each range) with minimess hose and minimess coupling shall be provided for each hydraulic system for measuring pressure at different pressure check points.

2.2.2.17 The hydraulic systems shall be started from MCCs/local control panels inside the hydraulic cellars/ rooms. Remote controls shall be provided in the control pulpits or desks. The hydraulic directional control valves and other electrical valves shall be operated from control pulpits/control desks.

2.2.2.18 Audible (as required) and visible alarms shall be provided in the control panel for indicating malfunctioning of any component leading to any of the following conditions:

a) Low pressure in the system
b) Excessive temperature of hydraulic oil/fluid
c) High level of hydraulic oil/fluid in reservoir
d) Low level of hydraulic oil/fluid in reservoir
e) Low-low level of hydraulic oil/fluid in reservoir and pumps cut-off
f) Clogging of filters
g) Motor overload

2.2.2.19 For any one of the faults mentioned above necessary audio-visual alarms shall be provided in control pulpit/control desk for “FAULT - HYDRAULIC SYSTEM”.

2.2.2.20 The piping shall include the piping within the hydraulic tank-pump stations as well as complete interconnecting piping between hydraulic power packs and actuators via valve stands and accumulator stands. As far as practicable, use of lengthy hydraulic piping shall be avoided. Pickling and flushing of interconnecting piping for all hydraulic systems shall be carried out.

2.2.2.21 Adequate number of flushing filter elements shall be provided for flushing of interconnecting piping including systems.

2.2.2.22 Necessary test kit for proportional and servo valves shall be provided.

2.2.2.23 One (1) no. accumulator charging set complete with manifold block, isolation valve, hose and pressure gauge shall be provided for filling accumulators with nitrogen for each hydraulic system.

2.2.2.24 One (1) no. mobile electrostatic liquid cleaner shall be provided for cleaning hydraulic oil, as and when required. The electrostatic liquid cleaners shall be complete with electrical control cabinet, 15 m long suction & delivery hoses, 15 m long cable and 3-pin plug.

2.2.2.25 One (1) no. mobile nitrogen compressor shall be provided for charging accumulators with nitrogen, in case the initial charging pressure of accumulators is more than 100 kg/cm^2. However, if the initial charging pressure of accumulators is less than 100 kg/cm^2

then the accumulators shall be charged with nitrogen cylinders. The mobile nitrogen compressor shall be complete with 15 m long suction and delivery hoses, pressure gauge, electrical control cabinet, 15 m long cable and 3-pin plug.

2.2.2.26 One (1) no. mobile vacuum dehydrator unit shall be provided, so that the same can be connected to the tank of hydraulic systems, as and when required, for removal of water from oil.

2.2.2.27 For filling fresh oil to all the hydraulic systems, one (1) no. mobile motorized transfer pump-motor-filter unit shall be provided for transferring hydraulic oil from barrels/tankers to the tank of all hydraulic systems. The fineness of filter shall be 5 micron (or 3 micron in case servo hydraulic system is considered). The mobile filling unit shall be complete with 15 m long suction & delivery hoses, electrical control cabinet, 15 m long cable and 3-pin plug.

2.2.2.28 Sump pump shall be provided for the sump pit inside each hydraulic cellar/room. Each sump pump shall be provided with level switch and check valve, isolation valve and pressure gauge at the discharge side of the pump. The discharge line from the sump pump shall be taken outside the cellar/room upto a convenient building column and shall be terminated with an isolation valve at +1200 mm for disposal of oil/water mixture in drums.

2.2.2.29 The make of hydraulic systems/components shall be as per MIDHANI's lists of preferred makes for hydraulic systems. The successful bidder shall obtain prior approval from Employer on the specification and make of each item, before placing order for the same.

2.2.3 **Scope of Work**

2.2.3.1 Design, Engineering, Procurement, Manufacture, Fabrication, Assembly, Testing and Supply of all hydraulic systems including interconnecting piping.

2.2.3.2 Supply of all hydraulic systems for the actuation of hydraulic cylinders, hydraulic motors and actuators for equipment of Wire rod mill including furnace, as required. The hydraulic systems shall include tank units, pump-motor units, circulation units, valve stands and accumulator stands.

2.2.3.3 Supply of all hydraulic cylinders, hydraulic motors and actuators, as required.

2.2.3.4 Supply of local control panel for each hydraulic system.

2.2.3.5 Supply of one (1) no. mobile oil filling pump-motor-filter unit for unloading fresh hydraulic oil from barrels to the tank of all hydraulic systems.

2.2.3.6 Supply of interconnecting piping between each hydraulic tank-pump unit and hydraulic cylinders/actuators via valve stands & accumulator stands.

2.2.3.7 Supply of all expansion type foundation bolts, nuts and

washers of Hilti make or equivalent for the equipment of all hydraulic systems including electrical control panel.

2.2.3.8 Supply of one (1) no. test kit for proportional valves and one (1) no. test kit for each type of servo valve to be used in the hydraulic systems.

2.2.3.9 Supply of one (1) no. mobile electro-static liquid cleaner for all hydraulic systems.

2.2.3.10 Supply of one (1) no. mobile nitrogen compressor, if required, for charging of accumulators with nitrogen.

2.2.3.11 Supply of one (1) no. loose pressure gauge of each range with minimess hose and minimess coupling for each hydraulic system.

2.2.3.12 Supply of one (1) set of accumulator charging set hydraulic systems for filling nitrogen to the accumulators.

2.2.3.13 Supply of anodized circuit plates for tank units, pump-motor-filter units, valve stands and accumulator stands for each hydraulic system.

2.2.3.14 Supply of one (1) set of necessary equipment for checking particle content and water content in hydraulic oil.

2.2.3.15 Supply of sump pumps with accessories and interconnecting piping for each hydraulic cellar/room.

2.2.3.16 Supply of adequate number of flushing filter elements for flushing of hydraulic interconnecting piping including hydraulic systems.

2.2.3.17 Supply of commissioning spares for hydraulic systems. A list of commissioning spares comprising each unit/component & its quantity will be furnished by the bidder.

2.2.3.18 Supply of first fill of hydraulic oil for each hydraulic system up to preliminary acceptance (PAC) test.

2.2.3.19 Supply of flushing oil for flushing of hydraulic interconnecting piping including systems.

2.2.3.20 Supply of one (1) no. mobile vacuum dehydrator unit for hydraulic systems.

2.2.3.21 Erection and commissioning of all equipment of hydraulic systems, oil-filling pumps, control panels, interconnecting piping etc. Pickling and flushing of interconnecting piping between each hydraulic tank-pump unit and hydraulic actuators via valve stands and accumulator stands.

2.2.3.22 Supply of mechanical hoists over pump-motors and accumulators for each hydraulic system.

2.3 Pneumatic Systems

2.3.1 General

The pneumatic systems shall be complete with all equipment, piping, electrics, instrumentation and controls, as required and as specified.

2.3.2 Design Basis

2.3.2.1 The pressure rating of pneumatic components and pipeline shall be designed considering maximum pressure of dry air and the pneumatic cylinders/actuators shall be sized for a pressure of 4 bar(g)for dry compressed air. The pneumatic systems shall be provided complete with isolation valves, air line filter of 5 micron fineness, regulator with pressure gauge, lubricator, solenoid operated directional control valves, speed control valves, silencers, pressure gauge, pressure switch, controls, pneumatic cylinders/actuators, pneumatic motors, interconnecting dry compressed air piping between T.O.P. and pneumatic valve stands and interconnecting piping between pneumatic valve stands and actuators, interlocks and audio-visual alarms for fault indication. Dry compressed air shall be used for the actuation of pneumatic cylinders, pneumatic motors and control valves.

2.3.2.2 Anodized circuit plates shall be provided with pneumatic valve stands.

2.3.2.3 The pneumatic valve stands shall be located at elevated platform level or within oil cellar/room or on platform. The pneumatic valve stands shall be provided with electrical junction boxes and shall be pre-wired up-to electrical junction boxes.

2.3.2.4 Necessary air receivers with pressure regulators shall be provided near equipment, which shall require high air flow for small duration of time. Air receivers shall also be provided near equipment for emergency operation.

2.3.2.5 The pneumatic cylinders shall be provided with adjustable end cushion at both ends.

2.3.2.6 The make of each item /component shall be as per MIDHANI's list of preferred makes for pneumatic systems. The successful bidder shall obtain prior approval from Employer on the specification and make of each item, before placing order for the same.

2.3.3 Scope of Work

2.3.3.1 Design, engineering, procurement, manufacture, fabrication, assembly, testing and supply of all pneumatic valve stands/controls, including interconnecting piping.

2.3.3.2 Supply of all pneumatic valve stands/components.

2.3.3.3 Supply of air receivers.

2.3.3.4 Supply of pneumatic cylinders/actuators/motors.

2.3.3.5 Supply of complete interconnecting piping from T.O.P. to

pneumatic valve stand/component and between pneumatic valve stand/component to cylinders/actuators/control valves.

2.3.3.6 Supply of anodized circuit plate for each pneumatic system.

2.3.3.7 Supply of all expansion type foundation bolts, nuts and washers of Hilti make or equivalent for pneumatic valve stand/components/air receivers.

2.3.3.8 Supply of commissioning spares for pneumatic systems.

2.3.3.9 Erection and commissioning of all pneumatic valve stands/air receivers/components including inter-connecting piping.

2.4 Air conditioning and Ventilation Systems

2.4.1 General

2.4.1.1 This section of specification covers the air-Conditioning and ventilation systems for the various premises of Wire rod mill, its auxiliaries and including it's water system facilities. These systems are intended for creating acceptable room inside condition within the premises for proper equipment cooling and human comfort.

2.4.1.2 Natural ventilation systems shall also be at the structural buildings/shop area by providing roof monitors and air intake louver.

2.4.1.3 All air conditioning and ventilation system design specifications and general requirements should meet the accredited codes such as ARI or the CARRIER HANDBOOK/ ASHRAE/ SMACNA/NFPA.

2.4.1.4 Design ambient condition as given below shall be considered for air conditioning and ventilation systems:

	Summer	**Monsoon**	**Winter**
Dry Bulb Temperature, (°C) ..	41.1	29.4	12.8
Wet Bulb Temperature, (°C) ..	25.6	27.2	8.9
Absolute max. temperature (°C)	45		
Absolute min. temperature (°C)			6
Cooling water temperature (°C)	34		

2.4.2 Design Basis

2.4.2.1 The following room inside conditions shall be maintained in various electrical premises and other premises:

Electrical Switchgear room, LCSS/LBDS room, MCC room		Room inside temp: Below 30°C Relative humidity: 70% maximum by air cooled package air conditioner (PAC) units
Electrical drive & PLC rooms,		Room inside temp: (25 ± 2)°C

UPS		Relative humidity: 70% maximum by air cooled package air conditioner (PAC) units
Control rooms, computer rooms, Control pulpits		Room inside temp: (25 ± 2)°C Relative humidity: 70% maximum by air cooled package air conditioner (PAC) units
Automation and server room		Room inside temp: (25 ± 2)°C Relative humidity: 70% maximum by air cooled package air conditioner (PAC) units
Office and electronic stores inside the ECR building		Room inside temp: (25 ± 2)°C Relative humidity: 70% maximum by air cooled package air conditioner (PAC) units
Transformer room		Dry ventilation to maintain room inside temperature within 5^0C over ambient temperature.
Battery Room		
Cable Vault		
Hydraulic & oil lubrication cellars and rooms		
All pump houses		
Store room, toilet block		

2.4.2.2 **Air Conditioning Systems**

2.4.2.2.1 The air conditioning systems shall be installed to maintain room inside condition of Control Rooms, PLC Rooms, Drive rooms, control pulpits, Automation & server room, Computer Rooms, etc. for maintaining design room inside condition of 25°C ± 2°C and Relative humidity of 70% maximum. MCC rooms, Switch gear Room, LCSS/LBDS, etc. will be provided air conditioning system for maintaining design room inside condition of below 30°C and Relative humidity of 70% maximum. For maintaining above inside condition, air cooled package air conditioner unit (PAC) shall be used with 50% stand-by package air conditioner units.

2.4.2.2.2 The office and electronic stores inside the ECR building will also be provided by PAC units to maintain room inside temperature of 25°C ± 2°C.

2.4.2.2.3 The heater and humidifier shall be provided where rigid control of dry bulb temperature and relative humidity are required.

2.4.2.2.4 Each floor to be air-conditioned shall have its dedicated package air conditioner unit(s) (PAC). If two temperature conditions are to be maintained in any floor, air handling unit(s)/package air conditioner unit(s) to be provided for each

conditioned area. Each of these air handling units/package air-conditioner units shall be installed in a separate room to be provided on respective floor.

2.4.2.2.5 The conditioned air shall be supplied by G.I. duct and distributed within the premises by diffusers/grilles. Return air may be taken back to PAC room through G.I. duct or through the space between true ceiling and false ceiling which shall be used as a return air passage. For air conditioning of ECR building return air shall be drawn through return air ducts into the PAC rooms. All supply air grilles/diffusers shall be provided with volume control dampers. Insulation of these ducts, either indoor or outdoor, shall be provided for full length.

2.4.2.2.6 All PAC units shall be installed on PCC slab.

2.4.2.2.7 Each air-conditioning system shall be interlocked with fire detection panel by the bidder, so that in case of fire the respective units are tripped automatically.

2.4.2.2.8 Under-deck thermal insulation at the roof exposed to sun for all the air-conditioned premises shall be provided.

2.4.2.2.9 Drain line shall be connected to the nearest surface drain

2.4.2.2.10 Thermostat and humidistat to be provided at suitable location of conditioned area.

2.4.2.3 **Ventilation Systems**

2.4.2.3.1 The ventilation air quantity shall be selected either to maintain room inside temperature of 5°C over outside ambient temperature or to have 15 air changes per hour in the ventilated areas, whichever is higher. However, for battery rooms and toilet blocks, ventilation system shall be designed on the basis of minimum twenty (20) air change per hour only.

2.4.2.3.2 Cable vaults shall be provided with tube axial supply and exhaust air fans. The fans here shall be installed on respective building walls.

2.4.2.3.3 Hydraulic & oil lubrication cellars and hydraulic rooms shall be provided with fresh filtered air ventilation system by tube axial supply air fans and exhaust through gravity louvers.

2.4.2.3.4 All pump houses shall be ventilated by providing fresh filtered air supply by tube axial fans. Supply air fans shall have dry air filters. The filtered air shall be supplied near to the pump motors/operating areas by G.I. duct. The air shall be exhausted by providing gravity louvers. Supply air fans shall be installed on the walls along the length of pump houses.

2.4.2.3.5 Battery rooms shall be provided with fixed air intake louvers and belt driven/bifurcated exhaust fans by the bidder. The impeller and inside of the fan casing shall have acid resistant paint.

2.4.2.3.6 The transformer rooms shall be provided dry ventilation system by tube axial exhaust air fan.

2.4.2.3.7 Stores and toilet blocks shall be provided with fixed air intake louvers and propeller type exhaust air fans.

2.4.2.3.8 For spot cooling at non air conditioning spaces, ceiling fans/pedestal fans shall be provided. Man-coolers shall be provided by the bidder at different areas of hot zones of the plant.

2.4.2.3.9 Each ventilation system shall be interlocked with fire detection panel by the bidder, so that in case of fire, the respective units are tripped automatically.

2.4.2.3.10 The capacity of exhaust air system shall be 10% less than the capacity of supply air system to maintain over pressure of 2 to 3 mm WG inside the premises to avoid dust ingress.

2.4.2.4 Wherever any duct crosses wall/ceiling, fire damper shall be provided by the bidder at the separating surface. The fire damper shall be fusible link type having a fire rating of one and half hour. The fusible link shall melt at a temperature of 65-74^{0}C. Return air openings on walls shall also be provided with fire dampers

2.4.2.5 The noise level for each equipment required for air conditioning and ventilation systems shall not exceed 85 dBA at a distance of one (1) meter from source of noise. The noise level within each conditioned area shall be limited to 65 dBA.

2.4.2.6 Filled-in questionnaire to be furnished for air conditioning and ventilation systems in accordance to the specification.

2.4.2.7 The motor rating selected for all the fans shall have adequate margin to take care of drive efficiency.

2.4.2.8 The bidder shall furnish the heat load calculation for selection of each air-conditioning & ventilation equipment during detail engineering. However, while selection of air conditioning equipment, 10% margin over calculated cooling capacity will be considered. Final selection of the equipment shall be on the basis of these approved calculations.

2.4.2.9 If during detail engineering, any other premises require air-conditioning or ventilation system additionally from the process point of view, the same shall be provided by successful bidder, without any commercial implication

2.4.3 **Equipment Details**

2.4.3.1 **Air conditioning systems**

2.4.3.1.1 **Air-cooled packaged type air-conditioners**

2.4.3.1.1.1 The package air conditioner shall be complete with air filter, compressor, air-cooled condenser, evaporator, fan,

electrical equipment, instrumentation and controls, necessary pipe work and other standard accessories.

2.4.3.1.1.2 The air intake filters shall be of HDPE type with large surface area and dust handling capacity. Filters shall be mounted so as to be easily accessible for cleaning and replacement.

2.4.3.1.1.3 The compressors shall be of scroll type, hermetically sealed or semi-hermetically sealed. The compressor shall be mounted on vibration isolators and shall be statically and dynamically balanced to ensure quiet operation. They shall be complete with electric motors and safety devices e.g. HP/LP cutouts and other standard accessories.

2.4.3.1.1.4 The condenser shall be of air cooled with body and finned tube. The body shall be made from tested quality steel plates and tubes shall be integrally finned copper tubes. Fin shall be made from aluminum. The condenser shall be complete with liquid line shut-off valves, safety relief devices etc.

2.4.3.1.1.5 The evaporator shall be of DX type with copper tubes and aluminum fins and shall be complete with Thermostatic expansion valve, distributor and condensate drain pan. Pipe shall be provided for draining of condensate from drain pan. Refrigerants of chlorofluro carbon group (R-22) which have toxic effects on environment shall not be used. Systems using environment friendly refrigerants shall be provided. All refrigerant pipes shall be insulated with proper insulation.

2.4.3.1.1.6 The package air conditioner units shall be provided with fans of suitable capacity driven by electric motors and suitable drives. The fan speed shall be limited to 1500 rpm. Return air grille shall be provided on the unit.

2.4.3.1.1.7 The outdoor units for the air cooled package air conditioners shall be located at a suitable place outside the conditioned area, preferably under shade. The package units shall be provided with volume control damper.

2.4.3.1.1.8 Filter with efficiency of 90% down to 20 micron to be considered for PAC units. The filter Panel type filters shall be used.

2.4.3.1.1.9 For the package unit, for providing required humidity inside the rooms, electrical element heated pan type humidification unit shall be used. These units shall have a low water level cut off switch as a protection device for the heating element.

2.4.3.1.1.10 The package air conditioners shall be either provided with inbuilt electrical heater or shall have electrical heating element at supply air duct.

2.4.3.1.1.11 The package air conditioner units shall be provided with all necessary electrics, instrumentation and controls.

2.4.3.1.2 **Split Type Air Conditioner**

2.4.3.1.2.1 The units shall be complete with air filters, compressor, air-cooled condenser, evaporator, fan, electrical equipment, instrumentation and controls, necessary pipe work and other standard accessories.

2.4.3.1.2.2 The air intake filters shall be of HDPE type with large surface area and dust handling capacity. Filters shall be mounted so as to be easily accessible for cleaning and replacement.

2.4.3.1.2.3 The compressors shall be of rotary type, hermetically sealed. The compressor shall be mounted on vibration isolators and shall be statically and dynamically balanced to ensure quiet operation. They shall be complete with electric motors and other standard accessories.

2.4.3.1.2.4 The condenser shall be of air-cooled with body and finned tube. The body shall be made from tested quality steel plates and tubes shall be integrally finned copper tubes. Fin shall be made from aluminum. The condenser shall be complete with liquid line shut-off valves, safety relief devices etc.

2.4.3.1.2.5 The evaporator shall be of DX type with copper tubes and aluminum fins and shall be complete with Expansion device, distributor and condensate drain pan. Pipe shall be provided for draining of condensate from drain pan. Refrigerants of chlorofluro carbon group (R-22) which have toxic effects on environment shall not be used. Environment friendly refrigerants like R-407C, 410a shall be used. All refrigerant pipes shall be insulated.

2.4.3.1.2.6 The air-conditioning units shall be provided with fans of suitable capacity driven by electric motors and suitable drives. The fan speed shall be limited to 1500 rpm. Return air grille shall be provided on the unit.

2.4.3.1.2.7 The outdoor units shall be located at a suitable place outside the conditioned area. Refrigerant piping length between indoor units & outdoor units shall preferably be of maximum 10 meter.

2.4.3.1.2.8 The air conditioner shall be provided with all necessary electrics, instrumentation and controls.

2.4.3.1.2.9 Split air conditioner shall be star rated. The minimum of the same shall be three.

2.4.3.1.3 **Pipework**

All pipe work for refrigerant and other utility services for air cooled packaged type air conditioning units (PAC units) and split units complete with necessary valves, fittings, supports, instrumentation and controls shall be provided and included in the scope of tenderer.

2.4.3.2 **Ventilation systems**

2.4.3.2.1 Tube Axial Fan

2.4.3.2.1.1 The tube axial fans (variable pitch type) shall be of mild steel conforming to IS: 2062 (Gr. A), heavy duty (3.15 mm thick minimum), industrial type with motor directly coupled to the impeller. These fans shall be supplied complete with cast aluminum alloy impeller, steel casing, motor, supports for total unit and other related accessories as required such as damper, supply and exhaust cowl, bird screen, fan fixing connection piece, fan fixing plates & supports etc. as required for the system. Fan rpm shall be limited to 1500 RPM.

2.4.3.2.1.2 Impeller shall be of propeller type, made of heavy gauge aluminum castings with suitable aerofoil sections for proper flow of air. The number of blades shall be optimized keeping in view the effects of slip, fluid friction and structural rigidity.

2.4.3.2.1.3 Impeller and motor of tube axial fans shall be fully covered by a sheet metal casing with flanged ends to facilitate grouting and fixing.

2.4.3.2.1.4 Tube axial flow fans shall be equipped with amply dimensioned anti friction bearings able to take loads due to the dead weight, unbalance and thrust of the rotating elements and shall conform to the requirements of good engineering practice.

2.4.3.2.1.5 All fans shall be provided with adequate lubrication arrangements for the bearings of the fan and drive motor as per manufacturer's recommendations and good engineering practice.

2.4.3.2.2 Battery rooms shall be supplied with V-belt driven tube axial exhaust fans / bifurcated exhaust fans with drive motors, bird screens and rain protection cowls. The drive motors of the fans shall be located outside the path of airflow. All parts of the fans, rain protection cowls, bird screen coming in contact with acid fumes shall be painted with acid proof paint.

2.4.3.2.3 Stores and toilet blocks shall be provided with fixed air intake louvers and propeller type exhaust fans.

2.4.3.2.4 For spot cooling in hot zones in production and ancillary shops, man-coolers shall be provided by the bidder.

2.4.3.2.5 **Air-Filter**

The air filter shall be 3 ply HDPE (preferably of pleated construction) with GI/Aluminium frame of available standard size of 50 mm thk. The efficiency of filter shall be 90% down to 10 micron dust. The face velocity of filters shall be within 2-2.5 m/sec. The requirement of the filter shall be as per the capacity required for the system.

2.4.3.2.6 **Inlet louvers**

The inlet louvers shall be fitted with with panel type filters having face velocity of 2-2.5 m/s.

2.4.3.2.7 **Gravity louver**

Louver shutters comprises aluminum louvers of light construction, which are opened by over pressure & closed by gravity when the fan is switched off. The face velocity shall be within 4-5 m/s.

2.4.4 **Noise Level**

Inside the air-conditioned room noise level shall not exceed 65dB (A) at 1 m distance from noise source even at the lowest frequency of generation. Silencers and other appropriate sound dampening devices as required shall be incorporated in the equipment offered.

2.4.5 **Vibration**

Mechanical vibration of the fan motor unit shall be restricted according to the relevant clauses of ISO 10816-1-1995 (E). The Tenderers shall consider all possible measures to reduce vibration of fan and supporting structure to a minimum.

2.4.6 **Duct/Splitters/Dampers/Vanes/Grilles/Louvre/ Supports**

2.4.6.1 All necessary ductwork to be carried out as per ducting layout drawings by the successful bidder and shall be complete with supply and return air grills/diffuser with volume control damper, dampers**,** fire dampers, fittings**,** supports etc**.**

2.4.6.2 Ducting material shall be galvanised plain sheet and rectangular in cross section. Elbow shall be such that the throat radius is 75% (Mimimum) of the duct width. In case throat radius is smaller, suitable vane shall be provided. Turning vane shall be provided at the collar of supply outlet.

2.4.6.3 Necessary splitters, dampers, vanes shall be made out of 1.25 mm thick galvanised plain sheet and to be placed at all suitable points inside ducts and branch, besides, wherever applicable.

2.4.6.4 Supply & return air grilles/diffusers, each branch supply air duct shall be provided with volume control dampers (VCD) of opposed blade type. Suitable vanes shall be provided in duct collars to have uniform and proper air distribution. Blank off baffles, wherever required, shall be provided. Unless otherwise specified the grilles/diffuser shall be suitably quoted with powder coating. The air pressure drop across the grilles shall be as low as possible with noise level restricted to 65 dBA at the conditioned space.

2.4.6.5 The fabrication, erection of GI ducts shall be carried out as per ASHRAE/SMACNA handbook.

2.4.6.6 The supply air velocity shall be about 8-9 m/sec in main headers and 5-6 m/sec is branches. However, return air velocity shall be about 7-8 m/sec in main headers & 4-5 m/sec in the branches. The aspect ratio of duct shall be maintained within 1:3.

2.4.6.7 The neck velocity through supply and return air grilles/diffusers shall be 2.5 – 3.5 m/s. The material of construction of diffusers, grilles shall be partly coated anodized aluminum & colour of the same shall match with the interior decoration i.e. false ceiling. Distance between two consecutive grilles/diffuser shall

be kept within 2 to 3 m considering aesthetic point of view with respect to lighting location.

2.4.7 **Insulation**

2.4.7.1 Initial 5m of supply air conditioning duct from the mouth of air package air conditioner unit shall be provided with the acoustic insulation. The acoustic insulation shall be resin bonded glass/mineral wool with density not below 48 kg/m3 & thickness of the same shall be 12 mm, Cladding to be provided over insulation using Al sheet 30 G.

2.4.7.2 Supply and return air conditioning duct shall be insulated up to tail end. The insulation material shall be closed cell nitrile rubber/polyurethane Foam with density of 60±2 kg/m3 and having thickness of 13 mm in conditioned space, 25 mm thickness in unconditioned space.

2.4.8 **Fresh Air**

The capacity of fresh air shall be around 1.0 air changes per hour of room volume. Fresh air system shall be complete with filter with volume control damper and air intake louver, bird screen, rain protection cowl.

2.4.9 **Fire Damper**

Fire damper shall be of fusible link type. Fire dampers shall be provided where duct penetrate walls or floors forming fire barriers. The fire rating of each dampers shall be as per NFPA 90 A and not less than 1-½ hr. The fusible link shall melt at a temperature of 65-74°C.

2.4.10 **Man-coolers**

The capacity of the Man-coolers shall be of 7500 CMH. It shall have protection by chicken wire mesh protection and it should be provided with DOL starter, 3 phase industrial socket and flexible power cables of minimum 15 meters for each unit. Man coolers shall have the provision of winding 15m cable on it. Each man coolers shall have castor wheels for movement. Caster wheels shall be made of Stainless Steel

2.4.11 **Scope of Work**

2.4.11.1 **Air conditioning systems**

2.4.11.1.1 Design, Engineering, Procurement, Fabrication, assembly testing, shop painting, inspection and supply of air-conditioning systems with accessories including duct work and piping for all premises.

2.4.11.1.2 Supply of air-cooled package type air conditioners of various area.

2.4.11.1.3 Supply of split type air-conditioners.

2..4.11.1.4 Erection and commissioning of all air-conditioning systems, equipment, accessories including duct work and piping.

2.4.11.2 **Ventilation Systems**

2.4.11.2.1 Design, Engineering, Procurement, Fabrication, Assembly, Testing and supply of ventilation systems, equipment with accessories and duct work.

2.4.11.2.2 Supply of all fans.

2.4.11.2.3 Erection & Commissioning of all ventilation systems, equipment, accessories including duct work.

2.5 Fire Protection System

2.5.1 General

2.5.1.1 This Specification covers design, engineering, manufacture, testing, packing, supply, unloading of material and storage at site, erection, testing and commissioning of fire extinguishing system for various areas of the new Wire rod mill.

2.5.1.2 All items mentioned in this specification shall be complete in all respects and any item not covered in this specification but essential for proper design and satisfactory operation shall be included by the bidder in the technical offer.

2.5.2 Standards

2.5.2.1 The system and all components of the system shall have UL/FM listing/approval. The components of all other equipment shall be designed, manufactured, assembled and tested in accordance with the relevant Standards of National Fire Protection Association (NFPA), IS, TAC etc. as indicated below:

Sl. No.	Standard	Title
1.	IS:15325	Standards for Water Spray System
2.	NFPA 10	Standards for Portable Extinguishers
3.	NBC	National Building Code
4.	IS:2190	Selection installation and maintenance of first aid fire extinguishers-Code of Practice (Fourth revision)
5.	IS: 15683	Portable Fire Extinguishers – Performance & Construction – Specification
6.	IS: 2878	Portable & Trolley Mounted CO_2 type Fire Extinguishers
7.	IS: 12459	Code of Practice for Fire Safety in Cable Runs.
8.	NFPA 101	Life Safety Code
9.	NFPA 15	Standards for Water Spray System

2.5.2.2 The latest publications of the above Codes & Standards, only, shall be used as applicable. In case of non-availability of national/international standards for certain system/equipment/ component, good engineering practice shall be adopted. Manufacturer's standards may also be followed if found proven and accepted in the Industry with prior approval.

2.5.3 Design Basis

The high velocity water spray system and Fire Extinguishers shall cover but not limited to the following areas:

Sl. No.	Areas	Type of Systems
1.	Hydraulic/ Oil lubrication systems room/cellar	High velocity water spray system
2.	All electrical control buildings/rooms, control pulpits, MCC rooms, PLC rooms, Level-1 & 2 automation and networking equipment room, server rooms, switch gear rooms, transformer rooms, cable gallery/ vaults/ cellars, cable basements, cable tunnels, hydraulic/ lubrication rooms, DG rooms, battery rooms, capacitor rooms, automation room, mill shop area, corridors etc., as applicable	Portable & trolley mounted Fire Extinguishers

2.5.4 **System Description of Fire Protection System**

2.5.4.1 **Automatic High Velocity Water Spray (Hvws) System**

2.5.4.1.1 For hydraulic /lubrication cellars/rooms, the spot detectors upon sensing the fire shall intimate a fire signal to Fire Alarm Control Panel (FACP) first. FACP will generate a signal to open the deluge valve to initiate the water spray system through open nozzles. Where the cellars/rooms are very large in size, the area (hazard zone) may be divided into smaller zones and flooded as required by IS. Every zone shall have separate deluge valves to active the HVWS system.

2.5.4.1.2 A minimum density of 10.2 L/min/m2 of the exposed area, shall be considered for oil/hydraulic cellars/rooms.

2.5.4.1.3 The system shall be hydraulically so designed that the pressure at hydraulically most remote nozzles in the network shall not be less than 3.5 bars. However, pressure at the hydraulically favorable sprayer shall not exceed 5.0 bars.

2.5.4.1.4 Sprayers shall be so positioned that they will not interfere with the lighting, ventilation ducting and detection system anywhere.

2.5.4.1.5 Projectors protecting irregular areas shall be located for the best coverage.

2.5.4.1.6 The detection system shall be designed to cause actuation of deluge valve within 20 seconds under expected exposure condition.

2.5.4.1.7 The deluge valve shall be placed at accessible location with suitable RCC/brick enclosure as per IS. Suitable access and door – lock arrangement shall be provided for the deluge valve rooms.

2.5.4.1.8 Deluge valve local control panel shall be installed inside the deluge valve room in an accessible location.

2.5.4.1.9 **Equipment description for HVWS**

Deluge Valves: A quick opening valve, which admits water automatically to a system of projectors or sprayers and is operated by system detectors. In addition to the automatic operation, a manual start and stop push buttons for operation of respective Deluge valve shall be provided. Also, an emergency Manual override facility shall be provided for actuating the Deluge Valve. The system shall be designed considering individual deluge valve for each zone of the lubrication/hydraulic room/cellars. The deluge system shall be a fixed fire protection system which totally floods an area with pressurized water through a system of piping with open nozzles and/or sprinklers. The system piping shall be empty until the deluge valve is activated by solenoid (electrically) operated system. The size of the gate valves at upstream and down stream of the deluge valve will be same as the size of the deluge valve. A by-pass line alongwith quick-opening butterfly valve shall be provided for maintenance of the deluge valve.

Spray Nozzles: A normally open water discharging device which when supplied with water under pressure will distribute the water in a special directional pattern as per system design. Open type spray nozzles with suitable angle of discharge and other discharge characteristics designed to provide an effective water spray only shall be provided for the spray systems. The nozzles shall be fitted in independent overhead pipe work.

Pressure Switches: The pressure switch will be of non-indicating type with required contact rating for signaling and various interlocking of HVWS system.

2.5.4.1.10 **Equipment**

Equipment related to HVWS system shall include but not be limited to the following:

Item description	Material of Construction
Deluge Valve with basic wet pilot trim with test, alarm trim and drip & drain trim and water gong, solenoid valve, local control panel.	Body - Cast Iron Seat – Bronze Rubber seat – Neoprene rubber Diaphragm – Neoprene rubber Spindle – Stainless Steel
Spray nozzles (open type) with in-built strainer	Nozzle body - Brass Strainer – Copper

Item description	Material of Construction
Pipe	All pipes at downstream of deluge valve shall be galvanized and having threaded connection.
Pipe fittings	Pipe fittings at downstream of deluge valve shall be galvanized and having threaded connection.
Strainer	Y' type strainers with body of cast steel to ASTM A 216 Gr. WCB and stainless steel (SS304) screen, socket weld ends.
Pressure reducing orifice (if required)	Carbon Steel

2.5.4.2 **Fire Extinguishers**

2.5.4.2.1 Portable/Mobile fire extinguishers shall be provided in different areas of the plant area in adequate quantities as per the Design Basis indicated above.

2.5.4.2.2 Portable/Mobile Fire Extinguishers shall be provided for all the areas as per IS 2190 & NFPA-10. While selecting the fire extinguishers in different areas the following type and capacity shall be considered.

CO2 type Fire Extinguishers. - LOT
ABC type Dry Chemical Powder - LOT
FOAM type Fire Extinguishers - LOT

2.5.4.2.3 Each fire extinguisher shall have the instructions for operating the extinguisher on its body itself.

2.5.4.2.4 All fire extinguishers shall be supplied with initial charge and accessories as required.

2.5.4.2.5 Portable fire extinguishers shall be provided with suitable clamps for mounting on walls or columns.

2.5.4.2.6 All fire extinguishers shall have ISI marking and certification.

SECTION - VI – WATER SYSTEM

1.0 GENERAL

1.1 This section covers various categories of water requirement for the new Wire Rod Mill facilities to be supplied in pipeline by Purchaser at take-over-point (T.O.Ps) indicated hereinafter. From the T.O.Ps all the types of water pipework shall be supplied by the bidder for roll cooling, water box, equipment cooling, process and other miscellaneous usages of the Wire Rod Mill.

1.2 The bidder shall indicate system wise water requirement giving flow rates, pressure, temperature and quality for both supply and return water. The bidder shall furnish necessary flow diagrams and P&I diagram for various categories of water. Bidder shall note that economy in usage and consequent flow rates for water shall be considered as an important criteria and as such equipment shall be designed with as minimum requirement as possible

2.0 DESIGN BASIS

2.1 **Indirect Cooling Water System**

2.1.1 Indirect Cooling Water (ICW) will be used for hydraulic oil coolers, lube oil coolers and cooling of any other equipment wherever required.

2.1.2 ICW will be available in pipeline at T.O.Ps near building columns and at approx. 1.5 m height with isolation valves. The available pressure at the TOP will be 4 kscg and temperature of 35^0C. ICW shall be returned at a minimum pressure of 2.5 kscg at the respective T.O.Ps.

2.2 **Direct Cooling Water System**

2.2.1 Direct Cooling Water (DCW) will be used for spray cooling, water box cooling, roller table cooling and other consumers.

2.2.2 DCW will be made available at T.O.Ps. at building columns and at approx. 1.5 m height with isolation valves. The available pressure at the TOP will be 4 kscg and temperature of 35^0C. The return DCW from the mill will be collected in a scale pit (located just outside the new mill aisle) through a scale flume. Further treatment of the same will be in Purchaser's scope.

2.2.3 Wherever the DCW supply pressure is not adequate to meet the pressure requirement of particular consumer, the bidder will provide suitable boosting system to attain the required pressure.

2.3 **Make-up/Service Water**

2.3.1 Make-up/service water will be available in pipeline at T.O.Ps near building columns and at approx. 1.5 m height with isolation valves at a pressure of 1 - 2 kscg.

2.3.2 Typical quality of make-up water available in the plant is given below.

Sl. No.	Description	Unit	Value
1.	Calcium	mg/l	48.0
2.	Magnesium	mg/l	26.0
3.	Sodium	mg/l	100.0
4.	Chlorides	mg/l	152
5.	Sulphates	mg/l	50.0
6.	Nitrates	mg/l	2.5
7.	Fluorides	mg/l	0.9
8.	Carbonate	mg/l	Nil
9.	Bi-carbonate	mg/l	220.0
10.	Total Hardness (as CaCO3)	mg/l	228.0
11.	Total Alkalinity (as CaCO3)	mg/l	180.0
12.	Silica as SiO2	mg/l	5.3
13.	Iron	mg/l	0.48
14.	Total Dissolved solids	mg/l	584.0
15.	Total suspended Solids	mg/l	32.0
16.	pH		8 - 9

2.3.3 The bidder shall note that the quality of ICW & DCW shall be based on three (3) times concentration of the quality of make-up water except TSS (total suspended solids) which will be restricted to 30 mg/l (max.).

2.3.4 If the bidder requires any of the type of water covered above at conditions different from those indicated, the necessary conversion equipment and facilities shall be included by him.

2.4 **Flume Flushing Water**

2.4.1 Supernatant water from the scale pit will be supplied in required amount and pressure from scale pit pumps which will be supplied and installed in the scale pit pump house by Purchaser. The bidder shall supply the flume-flushing header from the discharge header of scale pit pumps. The TOP for flume flushing will be within 10 m from the scale pit pumps discharge. Scope of supply shall include flushing header for entire flume in the mill zone i.e., up to the beginning of furnace flume zone.

2.5 **Pipework**

2.5.1 The water pipework shall include interconnecting piping for each type of water service, from Purchaser's T.O.Ps up to equipment/consumers inside Wire Rod Mill. The interconnecting pipework shall include but not be limited to pipes, valves, fittings, saddles, clamps, hoses with hose coupling & clamps, nozzles, safety

devices, control valves, filters, pressure regulators, boosters, special fittings and instruments & accessories required for proper functioning of the equipment of Wire Rod Mill facility.

2.5.2 For isolation purpose only gate or ball valves shall be used.

2.5.3 Gate valves shall be provided in the pump suction. On delivery side a non-return valve and butterfly valve shall be provided.

2.5.4 All delivery pipes of drainage/dewatering pumps shall be extended to nearest surface drain/scale flume.

2.5.5 Adequate space for operation and maintenance of all equipment, pipes, valves etc to be provided. A general guideline for minimum operating space to be considered is given below:

A. Horizontal spacing

1.	Small pumps (coupled with 3.7 kW or less motor)	:	Mounted on common foundation with suitable centre-to-centre distance.
2.	Medium and large pump (side suction and side delivery type)	:	Minimum 500 mm clearance between suction pipe of one pump and delivery pipe of adjacent pump, for pipe size up to DN 100. Minimum 750 mm clearance between suction pipe of one pump and delivery pipe of adjacent pump for pipe size above DN 100.
3.	Pump or its suction/ delivery header and side wall:		6 m for loading/unloading for truck access.
4.	Access way in front of pump/other equipment	:	Clear 1.5 m (min)

B. Overhead clearance

1.	Over crane walkways, platforms etc to the sofit level inside building	:	2.2 m

2.5.6 Pipe sizes shall be selected as per the design criteria indicated below:

Velocity in m/s to be considered while selecting pipe sizes

Description	Below DN 50	DN 50 to 150	DN 200 and above
Pump Suction	0.8 - 1.2	1.2 - 1.5	1.2 - 1.5
Pump Discharge	1.2 – 1.8	1.8 – 2.1	2.1 – 2.5
Discharge Headers	1.2 – 1.8	1.8 – 2.4	2.1 – 2.5

2.5.7 All necessary structural supports for pipework, operating platform for valves, instruments etc shall be provided by the bidder.

2.5.8 All the components/equipment of water systems shall be standardized for better inventory control.

2.6 **Selection of pump motor**

2.6.1 For selection of motor, 20% margin over pump shaft power shall be considered.

3.0 SCOPE OF WORK

3.1 Design, engineering, manufacturing, procurement, fabrication, assembly, supply, erection, testing and commissioning of all mechanical equipment along with piping, valves, electrical, instrumentation works etc. within battery limit.

3.2 Supply of Measuring, recording and controlling instruments with transducers for flow, pressure and temperature for specific consumers / critical application, if any, to be located at headers inside the mill proper zone.

3.3 Supply of pressure gauge and temperature gauge for the services as required.

3.4 Supply of Pressure Reducing valves and boosters, as required.

3.5 Supply of necessary handling equipment for maintenance.

3.6 Supply of dewatering pumps (1W+1S) along with all accessories in the various sump pits & cable cellars.

3.7 Supply of basic information and basic design of the scale flume and scale pit for the mill DCW system. The scale flume shall be adequately designed for the maximum anticipated flow for direct cooling and flushing water along with scale in a gravity channel.

3.8 Supply of commissioning spares.

3.9 Supply of special tools & tackles.

SECTION - VII – ROLL SHOP AND LABORATORY

1.0 GENERAL

1.1 The bidder is requested to provide the list of required roll shop and laboratory equipment for the proposed Wire Rod Mill.

1.2 The scope will include only the list of all equipments.

1.3 Tenderer to indicate a typical layout for roll shop showing the equipment disposition and also for the laboratory equipment facilities, a layout should be submitted.

SECTION - VIII – CIVIL & STRUCTURAL

1.0 DESIGN DATA REQUIRED FOR RCC FOUNDATION/ SUPERSTRUCTURE OF DIFFERENT UNITS

1.1 Loads & Displacement Parameters

It includes dead load (inclusive of weight of structures, any other permanent load), superimposed load (from equipment and other structures ,weight of stored materials, etc.), live load (conventional live load on floor, roof of Platforms, Buildings, Staircase etc.), any other dynamic load generated during operation as relevant. Position and direction of both static and dynamic load shall be clearly defined with proper tie up dimension.

1.2 Horizontal Load

It includes lateral load in any direction, coming along with the above vertical load. It also includes horizontal load arising from dynamic load as relevant.

1.3 Transient/Occasional Load

It includes wind/seismic load, load arising from conveyors, pulleys, monorail beams.

1.4 Equipment Loads

It includes load (Vertical, Horizontal, Inclined & Rotational) from equipment under static/dynamic, operating , tare, fully/ partially loaded conditions, abnormal operation & their points of applications along with possible combination of loads that is to say their phases of occurrence together or otherwise .

1.5 Car Loads on Tracks

It includes moving load (Vertical , Horizontal, Inclined) on wheels under static/dynamic, operating, tare, fully/partially loaded conditions. It also includes tractive, breaking forces, impact factor, speed of car etc., the load & moment arising from accidental impact on buffers, stoppers.

1.6 Temperature Loads

It includes values of temperature (both operational/ seasonal & day/night), required to calculate the thermal stress for related structures.

1.7 Allowable Displacement

Maximum allowable values of settlement (both total & differential), sway & deflections.

1.8 Any other Load

Force arising from differential settlements, relative displacement for loading items based on permissible displacement/ settlement.

1.9 Typical Civil Foundation Drawings

1.9.1 The tenderer shall furnish along with his offer, typical civil foundation drawings with sections for the major equipment being offered. These shall be from similar projects executed by him earlier and shall serve only as a guideline for planning and estimation of civil work.

1.9.2 Data required from the successful tenderer for preparation of construction drawings for the wire rod mill with required schedule of submission:

Sl. No.	Data/Information to be Obtained	Schedule of Submission	Remarks
1.	Certified drawings (plan & sections showing dimensioned outline with bottom level of equipment foundations, cellars, tunnels and pits etc. with block loading plan of areas covered by equipment	Along with LOI	To release building column foundations adjoining to eqpt. foundation,
2.	Certified load data and detail assign-ment drawings (plans at different levels & sections) showing outline and levels for eqpt. foundation, cellar, pit, tunnel/trench etc.	Within three (3) weeks from LOI	To release cellar based mat and equipment foundations base raft (substructure).
3.	Certified assignment drawing for foundation bolts, embedded inserts, conduits etc with their detail and scope of supply.	Within six (6) weeks from LOI	To release cellar structure above base mat and eqpt. Foundation above base raft (superstructure)
	Certified assignment for technological super-structures/parts (i.e. hatch covers, trench/pit covers, staircase, cross-over, lifting beams, safety cages etc)	within eight (8) weeks from structure & LOI	To release miscellaneous details and other special protective treatment required for floors, walls and foundation surfaces.

2.0 STRUCTURAL WORK

2.1 The tenderer shall furnish a layout indicating the configuration of the different aisles along with crane span including crane rail level and column spacing to be considered for accommodating the equipment of the Wire Rod mill.

2.2 The capacity of the EOT cranes shall also be furnished by the Tenderer along with the mode of handling.

SECTION - IX – CRANES AND HOISTS

1.0 DESIGN DATA REQUIRED FOR PROCUREMENT OF CRANES AND HOISTS

1.1 General

Tenderer shall submit design data for procurement of Cranes and Hoists by the Client. The data shall be sufficient and complete for the purpose of procurement.

1.2 Cranes and Hoists

1.2.1 EOT cranes envisaged for operation and maintenance purpose are shown in the Layout drawing no 28785-000-000-PRR-0001. The following cranes have been considered:

a. 10/5T Double Girder EOT Crane
b. 25/5T Double Girder EOT Crane
c. 5T Double Girder EOT Crane

1.3 Scope of Work

1.3.1 The scope of work for successful tenderer shall include review of cranes considered in the Layout as mentioned above and submission of data for following items as per the format indicated in Section XV-Questionnaire attached to this specification. In absence of the filled up questionnaire, the offer shall be considered as Rejected and shall not be processed further.

a. Double Girder EOT Cranes
b. Single Girder EOT Cranes
c. Jib Cranes
d. Electric Hoists
e. Mechanical Hoists
f. Special Attachments

1.3.2 The scope of work for successful tenderer also includes description of functionality of each crane and hoist and description of handling of various products and equipments by Cranes and Hoists.

1.3.3 The successful tender shall furnish the details of attachment like Lifting Beam, C-hooks, Chain sling to be used for handling billets, bars, Scraps etc.

1.3.4 The successful tender shall furnish the cross section drawing of the building showing cranes and Hoists indicating necessary clearance, hook approaches and lifting heights.

1.4 Data submission schedule

1.4.1 Data required from the successful tenderer for preparation of technical specification of cranes and hoists for the wire rod mill with required schedule of submission as follows:

Sl no	Schedule of Data/ Information to be Obtained	Submission	Remarks
1	Double Girder EOT Crane along with attachments like C-hook, Lifting beam etc.	Within three (3) weeks from LOI	Double girder cranes are long lead items.
2	Single Girder EOT Cranes	Within four (4) weeks from LOI	To prepare Procurement specification of Cranes
3	Jib Crane and Hoists	Within eight (8) weeks from LOI	To prepare Procurement specification of Cranes and Hoists

SECTION - X– QUALITY ASSURANCE PLAN (QAP)

1.0 After placement of Contract/Purchase Order, the successful tenderer shall submit proposed quality assurance plan (QAP) of equipment in requisite formats to the Principal Consultant for further action.

SECTION - XI – ERECTION AND COMMISSIONING

1.0 ERECTION, TESTING & COMMISSIONING

1.1 **General**

1.1.1 The Tenderer shall quote for receipt and storage of equipment at site, erection, preliminary acceptance tests, start-up, commissioning of the plant and equipment, performance guarantee and provisional acceptance tests. The clauses herein shall be read in conjunction with other documents forming the tender.

1.1.2 The successful Tenderer shall be solely responsible to provide competent and adequate supervision to ensure that assembly and erection work are in compliance with the equipment manufacture's drawings and/or instructions. The successful Tenderer shall not make any alteration to equipment to facilitate assembly or erection work, without prior agreement of the equipment supplier and final approval of the Purchaser. The successful Tenderer shall abide by the prevailing Occupational Health and Safety Management System, Statutory safety rules & regulation of Employer.

1.1.3 All assembly and erection procedures adopted by the successful Tenderer shall be open for inspection and approval by the Purchaser. Acceptance of assembly or erection procedures shall not in any way relieve the contractor of his responsibility for proper erection of the equipment

1.1.4 The estimated number of required supervisory personnel and periods of delegation as suggested by successful Tenderer, will only by regarded as an indication based on their experience gained with similar plants.

1.1.5 The Contractor shall make his own arrangement for Construction water along with distribution arrangement to different construction points at his own cost, with the approval of the Engineer. If pipe supply against water if available for Construction Water, it will be provided by EPC Contractor on chargeable basis on which calibrated metering system for water measuring will be included under subcontractor scope. The Contractor shall construct necessary storage vats at his own cost for storing enough water for his two day's requirements.

1.1.6 Construction power will be provided by EPC Contractor at a single point within 200 M radius on chargeable basis on which calibrated metering system for power measuring will be included under Contractor scope. Further connections, distribution, installation of the switch board etc. shall be arranged and maintained by the Contractor through a licensed supervisor and at his own cost with the prior approval of the Engineer. The distribution system shall conform to the requirements of the statutory authorities, with the latest amendments. All wiring from the switch board and meter shall be removed by the Contractor on completion of the Works. He shall reinstate and make good any work disturbed by the temporary power lines at his own cost to the satisfaction of the Engineer.

1.1.7 Below, a basic outline of the tasks and responsibilities is given which might be amended/adjusted/more detailed in case specific requirements and/or circumstances will arise. The successful Tenderer shall furnish the Execution plan in detail before start of execution work.

1.2 Erection

The scope of erection work includes unloading, storage, handling up to work site, erection and alignment, leveling, bolting, welding, grouting, testing, commissioning of Mechanical plant and equipment with mounted electrics including technological structures ,interconnecting piping and refractory work and handing over the same in proper locations and orientations complete as required. The services to be provided shall be in accordance with the Invitation to Tender and other relevant General Specifications pertaining to installation of plant utilities and electrics, cranes and hoists etc and shall be further read in conjunction with the various provisions of the Conditions of Contract, all of which forms part of the Contract.

The scope shall also include supply of Structural steel necessary for pipe supports ,all consumables (oxygen, DA, propane, LPG, electrodes, paints, petrol, other fuels etc.,), materials such as cleaning rags, service bolts, nuts, washers including supply of temporary structures, templates, jigs, manipulators etc., along with all handling equipment like cranes, trailers, etc., tools, tackles, labour and supervision, complete in all respect as required for the work.

The major scope of erection work includes but not limited to the following activities:

1.2.1 Erection of Mechanical equipments

1.2.1.1 Erection, assembly, alignment of all mechanical equipments, auxiliaries including technological structures like platforms, ladders, handrails, crossovers, stairs etc for Mill, Reheating furnace & Roll Shop and conduct cold trial and commissioning of all works complete and on all elevations as per drawings & specifications and as instructed by Employer/Technology or Equipment supplier.

1.2.1.2 Special Tools and tackles based on the recommended list of the equipment supplier shall be received from employer and to be used for erection and commissioning on returnable basis.

1.2.1.3 Equipment may be supplied in segments, small sub- assemblies and components which shall be assembled by the Contractor before erection at ground or in position in sequence. Also, various components of particular equipment may be supplied by different suppliers and they shall be assembled at site by the Contractor before erection. Equipment components, as required or recommended, the contractor shall carry out the assembly work at site in presence and guidance of the Technology/Equipment supplier.

1.2.2 Revisioning, Assembly, Alignment, Lining, leveling and Grouting

1.2.2.1 The top of concrete foundations shall be thoroughly cleaned with air or air and water jet by the Contractor prior to placing of bed plates, cover plates, sole or subsole plates on foundations. All the concrete foundations shall be handed over to the contractor with post-concrete report mentioning the dimensions, centerline, level, pocket orientation etc. However the contractor shall carry out minor chipping etc, if required, to facilitate the equipment erection.

1.2.2.2 The Contractor shall place the bed plates, cover plates, sole or sub-sole plates on the foundations and shim up with the machined steel wedges steel wedges until the equipment is in level so checked with precision machinist's levels.

The Contractor shall be responsible for checking the alignment and levels of foundations and correctness of foundation bolt centres, their projected height above the foundation tops, the length of threading provided and the provision and fitment of nuts for the foundation bolts. These shall be checked well in advance of starting erection work and the Contractor shall be responsible for any consequences for non-compliance thereof. Discrepancies, if any, shall immediately be brought to the notice of employer for his advice.

1.2.2.3 Grouted foundation bolts shall be aligned in three axes within the tolerance limit to suit the base frame of the equipment.

1.2.2.4 Erection Contractor to check the laying of cable conduits as per drawing and for its cleaners. After the inspection of the same, the cable conduits to be protected both the ends by plugging.

1.2.2.5 Before start of erection of equipment the centerlines of the equipment and bench marks will be checked and established in the working area for easy reference.

1.2.2.6 The foundation for equipment will be checked on basis of the foundation drawings for elevation and location of foundation bolts, size and depth of anchor pockets, relative elevations of rough concrete etc.

1.2.2.7 Before placing of the equipment on the foundation, the rough concrete will be dressed up and micro-chipped for proper seating of packing plates. For equipment with leveling screws, the rough concrete directly below the leveling screws will be dressed smooth; blue matching system is required for placement of plates for final alignment.

1.2.2.8 The foundation will be thoroughly cleaned with compressed air and water prior the placement of the equipment.

1.2.2.9 Clearance of approximately 50 mm will be maintained generally unless otherwise specified in the drawings/ documents between the rough concrete and the bottom surface of the equipment for grouting. The clearance for different equipment will be maintained as per the civil drawings. The foundation clearance protocol /report have to be made for

checking the tolerance / clearance with respect to relevant civil drawings.

1.2.2.10 The Contractor, where necessary, shall dis-assemble and re-assemble the supplied equipment if required for erection before placement on foundation. All gear drives and pinion stands shall be dismantled if required, the gear casing shall be leveled and aligned and the gear elements assembled with casing and box up with lubrication pipes etc. and grouted. However, the gearboxes, which are proprietary in nature, shall not be opened.

1.2.2.11 The Contractor shall clean thoroughly all the parts to be assembled including the machined base with a solvent, lubricate and reassemble. Any dents still seen shall be smoothened out and cleaned. The equipment shall be placed over the base plate taking care of the foundation bolts. All doweling wherever necessary, shall be done by the Contractor. Site assembly envisages certain amount of drilling and reaming of dowel holes of various sizes. The Contractor shall arrange to carry out the job including supply of drills and reamers. The equipment shall be then aligned with reference to the axes and leveled with the help of shims or any other suitable devices. The Contractor shall align all the equipment to the accuracy as indicated in the drawing/or Erection manual. The lines, levels, alignments and expansion movements shall be carefully re-checked by the Contractor jointly with the Employer during erection.

1.2.2.12 All required adjustments shall be made by the contractor as directed by the employer after trial run. Where necessary, alignment of running equipment shall be checked to conform to the specified operating tolerances and necessary adjustment shall be made by the contractor. The contractor shall make permanent datum marks on the floors/permanent structures after installation of all equipment. These marks shall be subject to inspection and approval by the Employer and are intended to ensure proper alignment and leveling of equipment during reassembly after maintenance/overhaul etc. However the employer will provide reference centre line and bench mark to the contractor prior to start of the erection.

1.2.2.13 The Contractor shall plumb and level all steelwork and shall thoroughly brace and guy the structures during erection to keep them plumb and rigid till completion. Erected parts of the structure shall be stable during all stages of erection. The stability of structures subject to the action of wind, dead weight and erection forces shall be obtained by observing specified sequences of erection of vertical and horizontal structural members by installing permanent and temporary bracings. As the work progresses, the steel members shall be securely bolted. No permanent bolting, welding or grouting shall be done until proper alignment has been obtained and approved by the Engineer.

1.2.2.14 Field connections of structural steelwork shall be made by site welding unless otherwise directed. Holes of erection joints to be bolted shall be filled with temporary bolts and plugs after mounting the structures. The number of temporary bolts and plugs shall not be less than 50% of the total of holes. In joints where the number of holes is equal to 5 or less, not less

than 3 holes shall be temporarily filled. The number of washers on permanent bolts shall not be more than two (and not less than one) for the nut and one for the bolt head. All nuts shall be locked against turning after tightening.

1.2.2.15 After the equipment/structure etc has been installed, lined, leveled and aligned, the foundation bolts shall be pulled up tightly by tensioning devices and the equipment shall be grouted and grouting cured for seven days by the Contractor. On completion of the final alignment prior to grouting of the equipment, a protocol indicating alignment/levels with reference to the drawing and actual dimensions achieved shall be prepared by the Contractor for Owner's certification/signature.

Grouting shall normally be carried out as specified in the relevant drawings. In case of any dispute the grout & method shall be decided and approved by Engineer. When the grout is thoroughly cured as aforesaid the alignment shall be rechecked if required.

1.2.2.16 Minor rectification on equipment/component/technological structure during erection/assembly/trials may be carried out by the contractor at site by gas cutting, welding, grinding, drilling and tapping of new holes etc. as a part of erection work and as directed by Technology/ Equipment supplier or Employer/Consultant.

1.2.3 **Erection of Mounted electrics**

1.2.3.1 The devices coming under this category will include

1.2.3.2 The Contractor shall install these devices on the supports provided on mechanical equipment and make necessary alignment. After checking the levels, Contractor shall align the shaft and obtain approval of the Employer Subsequently the holding down bolts shall be tightened and couplings will be fixed and aligned.

1.2.4 **Refractory Work**

1.2.4.1 The Contractor shall provide all consumable, installation materials (including supply of temporary structures, templates, jigs etc), impervious paints, polythene sheets, as required, plant and machineries, lighting, scaffolding, instruments, labour and supervision to complete the refractory work in all respects as per drawings, technical documents, specifications and erection instructions.

1.2.4.2 Receiving all refractory materials like refractory bricks and mortars, ramming masses, castables, Ceramic fibre blanket from store, shall be stored properly, to avoid contact with water, lime, clay, sand or any other foreign material.

1.2.4.3 The laying of refractory bricks shall be such as to avoid pressure cracks' resulting from bad workmanship. There should be no open joints. The arrangement of the bricks work shall be such as to offset or break the vertical joints.

1.2.4.4 The water content of fixing cement should be as low as possible to ensure a minimum drying period with the due consideration to the rigid bond desired. The sequence of laying bricks shall be according to the drawings and/or as directed by the Client/ Technology Supplier.

1.2.4.5 Laying of castable/insulation including methodology of mixing, filling in layers and compaction there by, shall be done by following the approved documents/instruction of technology supplier.

1.2.5 **Erection of the Fluid systems**

The Fluid systems , i.e. the Oil & Grease lubrication system consisting of tank ,filters, pump station etc ,the Hydraulic system i.e. Power pack consisting of Tank , Pump station , filters ,heat exchangers, valve stands etc. Pneumatic system , and Direct/ Indirect Water cooling system, starting from the TOP as indicated in the specification and the supply extent, as will be needed to complete the plant ready-for-operation. The units of the fluid systems (Tanks, pump skids , filters , heat exchangers, valve units etc) will be erected on ground floors through hilti bolts (anchor fasteners). The supply of the hilti bolts under the scope of the contractor.

1.2.6 **Pipe work**

1.2.6.1 The Piping Work includes fabrication, erection, cleaning, testing, purging/flushing, insulation, painting and commissioning of pipework along with pipe supports and associated structures.

Piping work also includes internal pipework for the plant and equipment including interconnecting pipe work between different units/systems of the plant as well as connection to Purchaser's utility services and return water systems.

The term 'pipework' referred above and herein generally covers pipes and pipe fittings (such as bends, tees, reducers, plugs, nipples, sockets, unions, flanges, etc.), valves of all types, traps, strainers, drip pots, water seals, hoses, oil and moisture separators, pipe supports (pipe racks, brackets, hangers, U-bolts, clamps, spring supports, etc.) and cold insulation, corrosion protections, painting, measuring and metering instruments.

1.2.6.2 **Flushing and Testing**

On completion of installation, all pipelines shall be tested for the strength and leakage either hydraulically or pneumatically as per technical specification of the order or as per design basis for piping work. During Pressure testing, duration of holding time at test pressure and at working pressure shall be as per design basis for pipe work.

All pipes shall be flushed by water or blowing air/nitrogen to remove all grease, oil, dirt, scales or any other foreign material prior to commissioning. Flushing shall be carried out till cleanliness level of NAS value is achieved.

Purging of pipeline shall be done as per the procedures as described in the Equipment Supplier's Erection Manual or as decided and documented in consultation with Purchaser at site.

Chemical cleaning for hydraulic/lubrication/oxygen pipeline shall be carried out with the scheme approved in advance.

1.2.7 **Erection of Motors and mounted Devices**

1.2.7.1 All installation shall be carried out in accordance with

1.2.7.2 All installations shall conform to the requirements of the

1.2.7.3 All motors and other devices shall have to be made

1.2.7.4 Installation of all electrical equipment to be coupled to the mechanical equipment including all DC and AC motors along with motor mounted ventilation units, tacho-generators, tacho-combination units etc as specified.

1.2.7.5 Installation of mounted devices to be coupled to the mechanical equipment. This shall include items such as brakes, programmable limit switches, position encoders etc. The installation shall be at different levels and shall include fitting of couplings, where required and connected to the associated mechanical equipment.

1.2.7.6 Testing and commissioning, start-up, initial operation and final acceptance in co-ordination with the Employer.

1.2.8 **Clean up and Painting**

1.2.8.1 All the pipes and structures will be painted after the erection with good quality of paint suitable for pipes as per standard procedure and quality to the satisfaction of Client's Engineer.

The Contractor shall be required to do cleaning and touching up of damaged surfaces of equipment etc with paint as may be required.

1.2.8.2 Any steelwork items fabricated by the Contractor at site shall be painted with primer and subsequent coats of final paint as approved and also to attain specified DFT. Surface preparation and painting shall be carried out in accordance with General Painting specification of Technology Supplier / Client's guideline.

1.2.8.3 Throughout the period of the erection work, the Contractor shall perform clean-up on day-to-day basis and in addition:

i) All installed equipment; pipe work etc shall be inspected and cleaned thoroughly as required.

ii) All external surfaces shall be cleaned of all dirt, dust, grease, oil etc.

iii) Before closing or boxing any equipment or work, care shall be taken that small tools, ropes, electrodes, butts beads and any other foreign matter have been completely removed.

1.2.9 The components will be bolted/screwed together, braced, welded together or joined together in a different way on the site and in conformity with the applicable drawing. In part, pipelines, ducting and simple structural steel or plate elements will be prefabricated on the site unless this could be done in the workshop(s).

1.2.10 All weld seams or welded joints will be executed in conformity with the relevant instructions or regulations for execution and treatment given on the drawings. Apart from this, erection will be guided according to Equipment Suppliers' Erection Manuals and recommended Standard wherever applicable.

1.2.11 The successful Tenderer shall also submit the relevant daily/weekly/ monthly progress reports for all site activities during entire period of execution of all plants/Units/ Equipment.

1.2.12 The successful Tenderer shall also provide qualified technical personnel including skilled labours for erection of all plant, machinery and equipment supplied by him, as well as those that may be procured from/fabricated by others based on his drawings, specifications and bill of quantities. The services to be provided shall be in accordance with the Invitation to Tender and the General Specifications of Contract.

1.2.13 The successful Tenderer shall receive and store all equipment at site. The equipment shall be stored in closed or semi-closed type stores according to the protection needed for different types of equipment and parts. Microprocessor based instruments, analytical balance etc need temperature and humidity controlled storage. All special equipment needing air-conditioned storage shall not be stored in non-air-conditioned area or removed from air-conditioned storage area without prior approval of the Employer.

1.2.14 The Contractor shall provide proper handling and transport equipment namely mobile cranes (crawler & tyre mounted) of adequate capacity having telescopic long boom, hoists, winches, derricks, slings, pulley blocks etc. All equipment and rigging shall be examined and checked by him at frequent intervals to prevent accidental failure and consequent damage to the equipment, structures and materials to be installed. For the sensitive equipment and other instruments which are highly sophisticated and delicate in nature, extra precautions shall be taken while handling to prevent accidental failure during loading and unloading operations. Special care shall be taken during transportation of these to avoid damage to the equipment due to vibration. Certificate of competent authority should be obtained regarding fitness of cranes/slings etc.

1.2.15 Erection of equipment shall include necessary grouting of equipment or its supports with foundation. Supply of non shrink grouting material shall also be included. The Tenderer shall obtain Employer's approval of grouting material before procurement of the same.

1.2.16 The Tenderer shall submit with his offer for equipment erection, necessary details such as schedule of erection, category wise deployment of erection personnel etc as called for in the Invitation to Tender and General Conditions of Contract for supply and erection of plant and equipment.

1.2.17 Erection methodology/scheme for all equipments/system will be submitted for approval of Employer well in advance.

1.2.18 Quality assurance plan (QAP) for Erection of all equipment/system to be submitted and all Erection activity shall be carried out following the respective approved QAP.

1.2.19 All Assembling and Erection manuals shall be submitted well in advance before commencement of assembling and Erection work.

1.3 **Tests at Site**

1.3.1 On completion of erection, the Tenderer shall carry out tests at site for preliminary acceptance to prove that each item of equipment of the plant complies with the requirements stipulated and is erected in accordance with this specification and is fit to be operated. Before the plant is put into trial operation, the Tenderer will be required to conduct tests including cold run, with his personnel to demonstrate that each of the items of the plant is capable of correctly performing the functions for which it was specified. The tests may be conducted concurrently with those required under commissioning sequence.

1.3.2 After successful completion of preliminary acceptance test, the plant shall be taken over by the Employer in accordance with the provisions of the General Conditions of Contract. The movements of individual plant components, i.e. horizontal and vertical strokes etc., have to be individually tested, and their mechanical or electrical limitations/confinements such as stops or limit switches have to be set. These activities will be carried out in conformity with the functional description of the plant component concerned in each case as single function tests

1.3.3 The tested and/or set movements of the individual plant components in co-action with higher level functions have to be optimized related to each other, for example through pressure optimization, speed settings or similar actions. These activities have to be carried out in conformity with the functional descriptions of the overall plant and jointly with the electrical equipment supplier as integrated cold trials.

1.3.4 The successful Tenderer shall render all assistance in conducting the cold and hot run tests and be responsible for start-up and commissioning for which necessary supervisory personnel shall be provided by the Tenderer. Employer will provide operating, maintenance personnel.

1.3.5 The successful Tenderer shall ensure and inform that the equipment is fit for conducting performance guarantee tests. The Tenderer shall be responsible for conducting the performance guarantee tests and provide necessary supervisory personnel for the same. The Employer will provide the operating and maintenance personnel.

1.4 **Health and Safety**

The construction work for equipment erection will require the involvement of a large number of construction workers – both skilled and unskilled, supervisory staff, managers, operators of construction machineries, etc. A majority of the unskilled construction workers are generally recruited locally and are likely to be untrained, particularly on safety aspects. Providing safety awareness and training to these construction workers is one of the foremost safety requirements. The project during its construction will need in-built safety requirements to avoid injury to workers involved in various activities. It will be of utmost importance that safety of all personnel be ensured, during construction work of the plant.

In order to fulfil the occupational Health and Safety requirements of workers at construction sites, certain safety guidelines are prepared by the Employer. These guidelines are intended as reference document for the contractors, who are required to develop their HSE assurance plan specific to the work awarded to them covering all the constructions activities and submit the same to Employer for approval. These guidelines may be in form of checklists, Operational Control procedures (OCPs), work permits and protocols for the construction activities associated with the project.

These guidelines provide input for:

i) Identification of the hazards involved in various activities and assessment of the risks associated therein through quantitative and qualitative methods to arrive at the Severity Index and Risk Rating.

ii) Unacceptable risks are mitigated through implementation of approved Operational Control procedures.

iii) Creation of safety awareness in every individual associated with the project.

iv) Formulation and effective maintenance of the accident prevention program of the project.

v) Achievement of the prime objective of “ZERO ACCIDENT”.

Hazard and risk analysis may be performed for all the major items of construction work. Based on the severity of risk involved, operational control procedures may be adopted for those activities having high risk. During construction work Safety checklist has to be strictly followed for all major items of Equipment erection, testing and commissioning work.

SECTION - XII – PERFORMANCE GUARANTEE

1.0 GENERAL

1.1 This document to be read in conjunction with Section-II of Technical Specification No. MIDHANI-01002-PRR-0001 for Wire Rod Mill.

1.2 All plant, machinery and equipment shall be guaranteed for design, materials, workmanship and satisfactory performance as required in this specification and in accordance with relevant clauses of the General Conditions of Contract.

1.3 The successful tenderer shall be responsible for carrying out performance tests on all equipment supplied by him in the presence of the Employer and his authorized representative to demonstrate that the plant, machinery and equipment is capable of achieving the performance guarantees as specified in this Technical Specification and contracted for. Instrument gauges and flow meters installed for normal operation of the plant, machinery and equipment shall be made use of during the performance tests as far as practicable. The successful tenderer shall also provide any additional instrument required. Manning required for the performance tests shall not be more than the man power required for normal plant operation. The performance tests shall be carried out by the successful tenderer as per the terms and conditions given in the General Conditions of Contract.

1.4 Tenderer shall submit the scope, general preconditions, test procedures, guaranteed values and test evaluation methods which shall be finalised during tender discussion.

2.0 PERFORMANCE GUARATEE PARAMETERS

The following parameters shall be guaranteed through performance tests:

A) Equipment Functional Test
B) Product Quality Test

A) EQUIPMENT FUNCTIONAL TEST:

COLD TESTS

The cold tests shall demonstrate all the installed functions in the equipment under no load conditions and meet the specified values as per the detail specification of the equipment. A detailed test report shall be made.

HOT TESTS

The hot tests shall demonstrate the production during the 8 hours (1 shift) period. Based on the billets available during this test, a production schedule and target for 8 hours shall be made

on mutual agreement between successful tenderer and Midhani. Test is considered satisfactory when the target production is achieved.

I. Reheating Furnace

The performance tests shall be to measure the furnace skin temperature, heating rate and furnace & job temperature uniformity.

a. **Job temperature uniformity:** Job temperature uniformity shall be measured in batch mode of operation of the furnace. A reference billet of dimension shall be mutually agreed upon within the billet dimensions indicated.

Cold furnace shall be charged to full with billets. The furnace is then lighted up as per the standard procedure and maintained at target temperatures suitable to achieve 900°C, 1000°C, 1100°C, 1200°C and 1250°C on job. Temperature readings shall be logged over the entire heating cycle of the furnace. Special tools and instruments for testing shall be brought by supplier as required for successful commissioning of the furnace. The following parameters shall be evaluated after attaining the temperature, at each of the selected points:

b. Temperature of furnace and job shall be within ±10°C for each target temperatures of 900°C, 1000°C, 1100°C, 1200°C and 1250°C.
c. Average heating rate ≥150°C per hour shall be achieved with full load of billets along with required charge support.
d. Excess oxygen in the furnace shall be less than 2%.
e. Control accuracy of temperature shall be better than ±2°C.
f. Noise shall be less than 85dB and shall be measured by noise meter at any point 1 m distance from the fans and bumers, when running.
g. Skin temperature shall not be more than 50°C above ambient temperature at maximum operating temperature of furnace. (Measured one meter away from any opening of the furnace).
h. Temperature uniformity shall be measures in the furnace and also in the job.

II. Mill

The mill production rate for the following sizes

Bar	12 mm, 20, 40, 60, 70 and 80 mm dia
Wire Rod	5.5 mm, 9, 10 and 12 mm dia.

shall be guaranteed and demonstrated suitably by the successful Tenderer (as indicated in production calculation table to be

furnished by the Tenderer for the maximum production capability of the mill).

The following performance parameters shall also be guaranteed and demonstrated:

Time required for changing stands/rolls.

B) PRODUCT QUALITY TEST

The Product Quality Test will demonstrate the quality of products rolled in the Bar & Rod Mill. Total 100 numbers billet of 5 different grades with combination of different sizes as detailed below will be tested for product quality tests in Bar & Rod mill. A minimum of 10 billets will be rolled prior to the commencement of PG tests.

The permissible variation in Sectional Dimensions for Round and Square Bars shall be as per AISI 1018 for low carbon steel and as per AISI 1045 for medium carbon steel. Performance test shall be carried out for the following sizes:

Bar : 12 mm, 20 mm, 40 mm, 60 mm, 70 mm and 80mm dia

Wire Rod : 5.5 mm, 9 mm, 10 mm and 12 mm dia.

For each of the above sizes following grades of material shall be rolled during the Performance Guarantee Test.

i) Low alloy (DIN 15CDV6, EN8, EN 24, etc)
ii) Superalloys (Inconel 718, Nimonic 80A, etc.)
iii) Titanium & Titanium Alloys (Titanium Grade 1, Grade 2, Grade 5 etc.)
iv) Special Steel (Maraging steel 250, PH steel, etc)
v) Stainless Steel (AISI 330, AISI 316, etc)

a. Metallurgical as well as mechanical properties of the finished products shall be ensured as per product standards.

b. Minimum 95 % (average) as rolled Yield shall be demonstrated.

c. Bar/Rod finish Rolling Temperature

The Bar/Rod finish rolling temperature is the temperature of the piece leaving the Mill Stand after the last rolling pass, measured at the product centerline.

The target temperature will be as per the requirement of the grade and product.

The Bar/Rod finish temperature will be equal or above the target defined. Test is considered satisfactory if the average measured value is above the minimum target value for the product.

Product Surface Quality

Product surface will be free from rolling defects. Surface quality shall be as per EN 10221, Tab 1, Class D. Test is considered satisfactory when $\geq$ 95% of the products are within the limits specified.

1. Product Straightness: The straightness tolerance of the product shall be according to UNI EN 10060, 2004.

2. Billet Preconditions

i) The billets for performance evaluation will be either forged or as cast condition.

ii) Billets will be surface ground if it is in forged condition.

iii) $\pm$ 5% Dimensional tolerance on the input billet size.

iv) Billets will be reasonably plane

3.0 TEST PROCEDURE, CONDITIONS, TIME PERIOD, ETC.

3.1.1 Preconditions for performance tests

3.1.2 During the performance tests the plant shall be operated under the supervision and guidance of the Contractor. The Employer shall provide operating personnel, water, power and utilities.

3.1.3 The Employer shall also provide raw materials as stipulated under Design Basis of Technical Specification.

3.1.4 Other conditions

3.1.5 Time lost by interruptions in performance tests due to reasons attributable to the Contractor shall be added to the test period.

3.1.6 Should the operation of the plant during the performance test be interrupted due to difficulties either with the plant, machinery and equipment supplied by the successful Bidder or the inadequacy of successful Bidder's supervision of erection, testing and start-up or due to defect in the erection work, as the case may be, then the performance test shall be re-started and run again.

3.1.7 In case of failure in demonstrating the Performance Guarantee during first test, Maximum two (02) Nos. repeat test shall be allowed. However, supplier has to bear the cost of utilities like gas, electricity, grease & oil etc. for any trial & test subsequent to the failure of the First Performance Guarantee Test.

SECTION - XIII – DRAWINGS AND DOCUMENTS

1.0 The tenderer shall submit a list of drawings and documents to be supplied by him under basic engineering scope and detailed engineering scope and shall also indicate the category (Approval or Information) of each drawing/document.

SECTION - XIV– IMPLEMENTATION SCHEDULE

1.0 The total "Time of Completion" of the complete Wire Rod Mill shall be considered as eighteen months from the date of LOA.

2.0 The Tenderer shall submit an overall implementation schedule in the form of a Bar chart for the project indicating the time required to complete major activities like engineering, construction, procurement of equipment, erection, test, trial run and commissioning of the various plant facilities for the complete Wire rod mill.

SECTION - XV– LIST OF ENCLOSURES

1. Drawing No. 28785-000-000-PRR-0001-R0 -
   Proposed layout of Wire Rod Mill

2. Drawing No. 28785-000-000-ELI-0001-R0 -
   Conceptual automation diagram for Wire Rod Mill

3. Drawing No. 28785-000-000-ELE-0001–R0 -
   Typical single-line diagram – Wire Rod Mill

ANNEXURE – I – APPROVED MAKE LIST

A) ELECTRICAL

Sl. No	Component	Make
1	ACB/MCCB	Siemens/ABB /Schneider
2	SFU	Siemens/ABB/L&T
3	MV Variable Frequency Drive (VFD)	ABB/Siemens/GE
4	Converter Transformers	PETE/Schneider/ABB/Siemens/CG/Kirloskar/EMCO/GE
5	SMPS	Siemens/Omron/Allen Bradely/ Phoenix/Rishabh
6	PLC	Siemens/Allen Bradely
7	SCADA	WinCC/Wonderware
8	Soft Starters	Siemens/ABB/Toshibha
9	Power Contactors	Siemens/ABB/L&T/Schneider
10	MPCBs	Siemens/ABB/Schneider
11	MV/LV Motor	SIEMENS/ABB/MARATHON/CGL/WEG/VEM/KEC/IC Baure
12	LV Drive	SIEMENS/ABB/GE/TMEIC/VACON/DANFOS/SCHNEIDER
13	Pyrometer	LAND/IRCON/IMPAC/CHINO
14	HMD's	DELTA/SICK OPTICS/IFM/MODULOCK
15	ENCODERS	HUBNER/LINE&LINDE/BALLUF/BAUR/SIEMENS

B) MECHANICAL

Sl. No	Component	Make
1	CYLINDERS:	FOSSA
		PARKER
		REXROTH
		MONTANHYDRAULIK
		HAINZEL
		ANKER-HOLTH
		VELJAN
		UNITED VEN DER HORST
		OSCAR EQUIPMENTS

Sl. No	Component	Make
		HYSTAT
2	POSITION TRANSDUCERS:	SONY MAGNESCALE
		TEMPOSONIC
		NSD
3	GEAR BOXES:	BONFIGLIOLI
		FLENDER
		ROSSI MOTORIDUTTORI
		VOITH
		SCOLARI
		RENOLDS
		PHILADELPHIA GEARS
4	WORM GEAR BOXES AND SCREW JACKETS:	COSTAMASNAGA
		DUFF NORTON
		FLENDER
		PFAFF
		UNIMEC
5	COUPLINGS AND SPINDLES:	FLENDER
		VOITH
		MAINA
		KOPFLEX
		RENOLD
		VOITH
6	UNIVERSAL SHAFTS	MAINA
		KEMPF
		VOITH
		FLENDER
		RENOLD
7	STEEL AND RUBBER HOSES:	AEROQUIP
		ANGST+PFISTER
		DALMAR
		FLEXIDER
		PARKER
8	BEARING AND BEARING SUPPORTS:	FAG
		KOYO
		NSK
		SKF
		TIMKEN
9	SEALS:	ANGST+PFISTER
		COFI
		GARLOCK
		MERKEL
		TENUTE

Sl. No	Component	Make
		SKF
		WALKER
10	SPRAY NOZZLES:	LECHLER
		EVERLOY
11	ROTARY JOINTS:	ACIES
		COSIL
		DALMAR
		DEUBLIN
		FOSSA
		AEROQUIP
12	SHEAR BLADES:	ASKO
		ROMANI
13	WEAR PLATES and LINERS:	ASKO
		CORTS
14	WHEELS:	FAG
		FARO
		INA
15	THRUST BEARINGS (big size):	FAG
		SKF
		TIMKEN
	Hydraulics, Utility And Lubrication Units	
1	PISTON PUMPS:	REXROTH
		PARKER
2	SCREW PUMPS:	IMO
		KRAL
		SEIM
3	VALVES:	ATOS
		REXROTH
		PARKER
		EATON - VICKERS
4	SERVOVALVES:	MOOG
5	PROPORTIONAL VALVES:	MOOG
		REXROTH
		PARKER
		EATON – VICKERS
6	FLOW DIVIDERS:	CASAPPA
		PARKER – REXROTH
		BUCHER

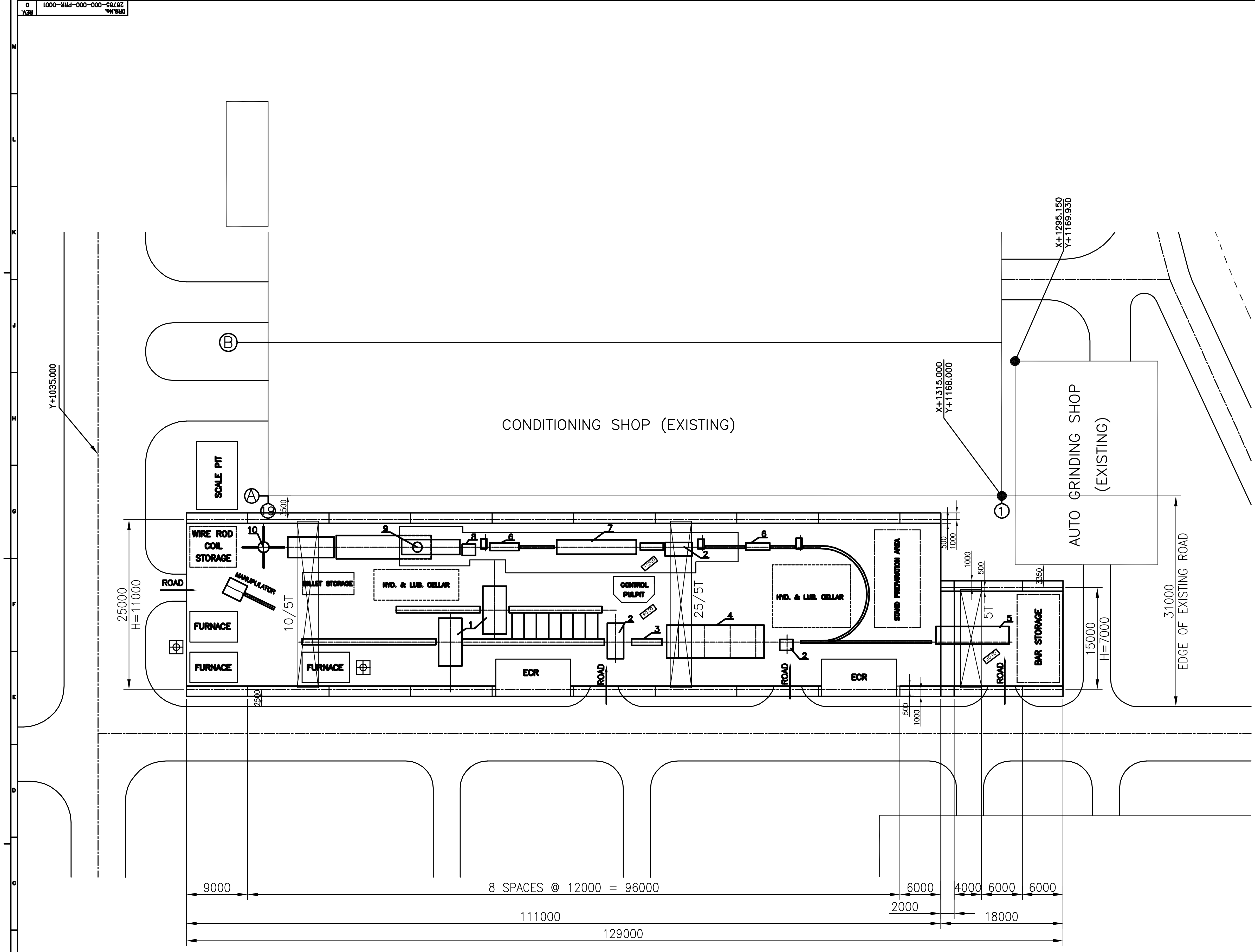
Sl. No	Component	Make
7	WATER / OIL COOLERS:	ALFA-LAVAL
		SWEP
		TRANTER
8	AIR / OIL COOLERS:	HYDAC
		OLAER
9	FILTERS:	HYDAC
		INTERNORMEN
		PALL
10	PRESSURE TRANSDUCERS:	HYDAC
		VIATRAN
		BARKSDALE
		IFM
		NDS
11	PRESSURE SWITCHES:	BARKSDALE
		HYDAC
		REXROTH
		IFM
12	TEMPERATURE SWITCHES:	BARKSDALE
		HYDAC
		IFM
13	TEMPERATURE GAUGES:	NUOVA FIMA
		SACMA
		WIKA
14	PRESSURE GAUGES:	NUOVA FIMA
		SACMA
		WIKA
15	ACCUMULATORS:	HYDAC
		PARKER
16	HIGH PRESSURE BALL VALVES:	ALFA VALVOLE
		ADLER
		HYDAC
		MHA
		RTI
		PARKER
		REXROTH
17	SCREW PUMPS:	ALLWEILER
		IMO
		KRAL
		SEIM
18	GEAR PUMPS:	REXROTH
		MAAG
19	WATER / OIL	ALFA-LAVAL

Sl. No	Component	Make
	COOLERS:	TRANTER
20	FILTERS:	HYDAC
		PALL
		PARKER
21	MANUAL AND AUTOMATIC ON-OFF VALVES:	ALFA LAVAL
		EUROVALVE
		KEYSTONE
		KSB
		JAMESBURY
		FLOWSERVE
		EL-O-MATIC
22	GREASE UNITS and DISTRIBUTORS:	LINCOLN
		DROPSA
23	PNEUMATIC SYSTEMS COMPONENTS:	FESTO
		BOSCH - REXROTH
		ROSS
		SMC
24	DESCALING PUMPS	SCHAFER AND URBACH
		HALBERG
25	CENTRIFUGAL PUMPS	MATHER & PLATT
		GRUNDFOS
		FLOWSERVE
		KIRLOSKAR
		KSB
		WPIL
		RUHRPUMPEN

C) INSTRUMENTS

Sl. No.	Equipment	Make
1	FLOW/PRESSURE TRANSMITTERS	YOKOGAWA/ EMERSON/E&H
2	MICRO PROCESSOR BASED SINGLE LOOP/SAFETY CONTROLLERS	YOKOGAWA/EUROTHERM.
3	ADJUSTABLE PORT VALVES	NORTH AMERICAN/MONT SELLAS
4	LPG PRESSURE REGULATORS	JEAVONS/FISHERS
5	AUTO SHUTOFF VALVES WITH	HONEYWELL/KROMSHRODDER

Sl. No.	Equipment	Make
	MANUAL RESET	
6	THERMOCOUPLES	TC/OMEGA/GORDON/MORGAN ADVANCE MATERIALS
7	PLC & SCADA	SIEMENS/ALLEN BRADLEY
8	SERVOMOTORS/ELEC . ACTUATORS	HONEYWELL/AP MOTRONIX/
9	COMPUTERS	HP/DELL
10	PRESSURE/DIFF. PRESSURE GAUGES	WIKA/WAREE INSTRUMENTS
11	PRESSURE/DIFF. PR. SWITCHES	HONEYWELL/KROMSHRODDER
12	TEMP.GAGUES	WIKA/WAREE INSTRUMENTS
13	THERMOWELLS	TEMPSENS/TOSHINWAL/RADIX
14	TEMP.SWITCH	WIKA/GENERAL INSTS.
15	TEMP. TRANSMITTERS	YOKOGAWA/ EMERSON /EUROTHERM
16	ORIFICE PLATES ASSEMBLIES	ENGG. SPECALITIES/MICRO PRECISION/GENERAL INSTRUMENTS
17	MASS FLOW METERS	YOKOGAWA/ E&H
18	SOLENOID VALVES	HONEYWELL/KROMSHRODDER
19	RATIO CONTROLLERS	YOKOGAWA/EUROTHERM
20	DIGITAL INDICATORS	YOKOGAWA/EUROTHERM/CHINO
21	PAPERLESS RECORDERS	YOKOGAWA/EUROTHERM/
22	DC POWER SUPPLY UNIT	SIEMENS/PHONEIX
23	SIGNAL ISOLATORS	YOKOGAWA/EUROTHERM/CHINO
24	ALARM ANNUNCIATION SYSTEM	MINILEC
25	INST. CONTROL PANEL	RITTAL/PHASETRON/PYROTECH
26	INST. CABLES	FINOLEX/LAPP
27	TC COMPENSATING CABLES	TEMPSENS/TOSHINWAL/NAVIN CORP.
28	GAS ANALYSIS INSTS.	WESTINGHOUSE/YOKOGAWA/EMERSON/FER
29	FLAME MONITORING SYSTEMS	HONEYWELL/KROMSHRODDER
30	IR PYROMETERS	LAND/IMPAC/CHINO
31	SOFTWARE	TIA Portal , Win CC, Rs Logix, Factory Talk
32	PANEL AC	RITTAL, ADVANCE COOLING
33	BURNERS	KROMSCRODER/NOXMAT/ECLIPSE/BLOOM



LEGEND

1. REVERSING STAND
2. SHEAR
3. INDUCTION HEATER
4. FINISHING MILL
5. COLLECTING CRADLE
6. COOLING BOX
7. FINISHING BLOCK
8. LAYING HEAD
9. REFORM TUB
10. COIL TURNSTILE

NOTES :-

1. H = CRANE RAIL HEIGHT
2. ALL DIMENSIONS AND LEVELS IN MM

10 0 10 20

SCALE : METERS

No.	DATE	ZONE	REMARKS	BY	APP.	DRG. No./DETAILS
			REVISION			REFERENCE DRAWINGS

NOTES

APPROVAL

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REV	DEPT	BY	DATE

DASTUR

M. N. DASTUR & COMPANY (P) LTD
CONSULTING ENGINEERS, KOLKATA

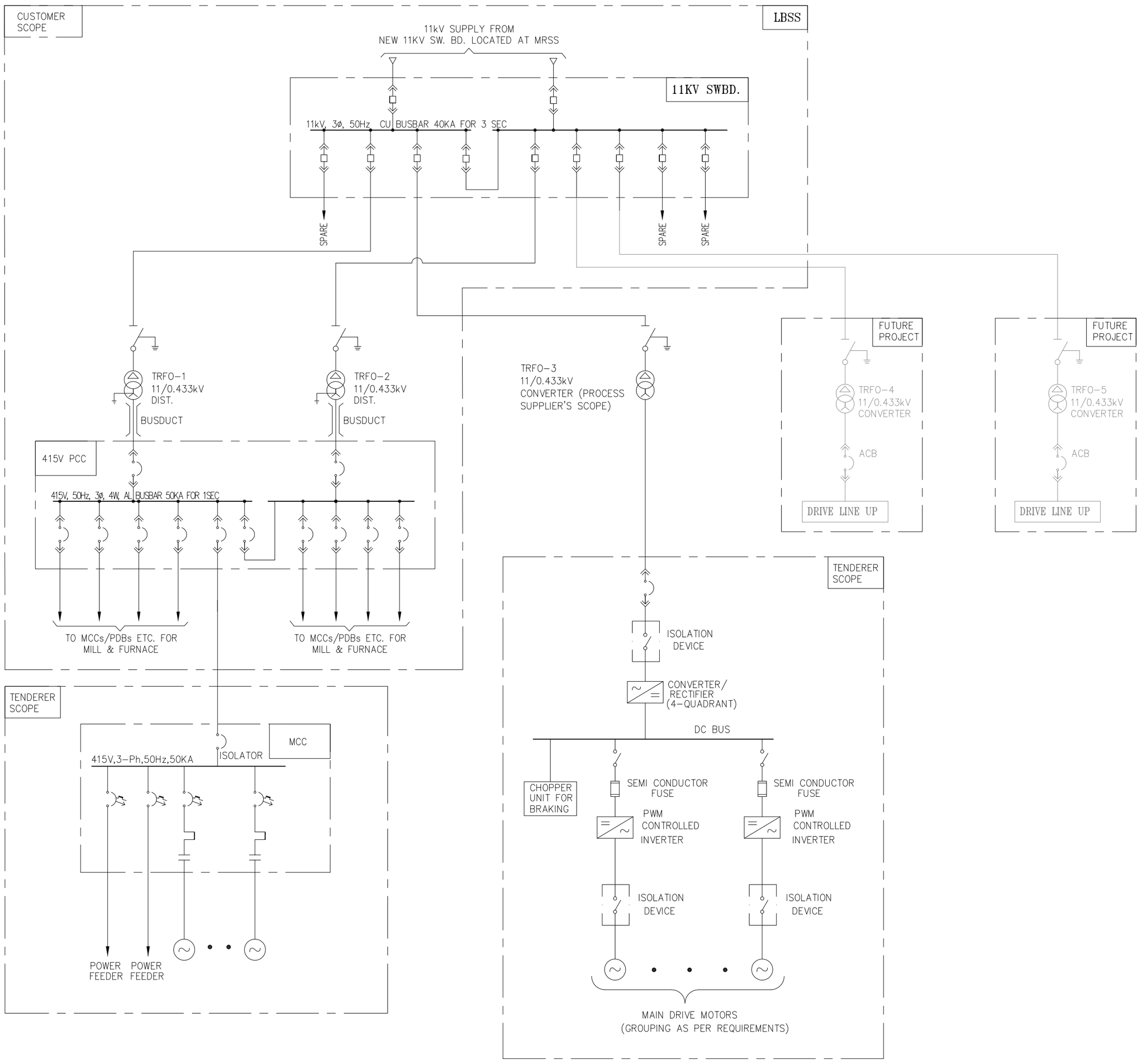
SCALE	1:1	DATE	
DSGND. BY	BJMA	04.07.2018	
DRAWN BY	PDH	04.07.2018	
CHKD. BY	BJMA	04.07.2018	
APPVD. BY	AS	04.07.2018	

FOR MISHRA DHATU NIGAM LIMITED (MIDHANI)
HYDERABAD
EXPANSION OF ROLLING MILL COMPLEX
WIRE ROD MILL
LAYOUT

JOB No. 28785 DRG. No. 28785-000-000-PRR-0001 REV. 0

DRG.No. 28785-000-000-PRR-0001 REV. 0

DRG. No. 28785-000-000-ELE-0001 REV. 0



LEGEND :

- HT. ISOLATOR
- TRANSFORMER
- HT CIRCUIT BREAKER
- DRAWOUT DEVICE
- ACB
- MOULDED CASE CKT. BKR. (MCCB)
- BUSDUCT
- PRESENT PDS SCOPE OF WORK

DISTRIBUTION			
CUSTOMER		COS	
		ENV	
CONTRACTOR		MNB	
CVL		NFE	
ELE		PWR	
IAC		CNT	
LTL		INS	
STR		PRS	
UTL		CON	
WTS			
COB		CHN-	
CRF		CHN-	
IRM		CHN-	
MMH		MUM-	
PML		MUM-	
RLM		PM	
STM		SITE	

No.	DATE	ZONE	REMARKS	BY	APP.	DRG. No./DETAILS

REVISION | REFERENCE DRAWINGS | NOTES

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DASTUR

M. N. DASTUR & COMPANY (P) LTD
CONSULTING ENGINEERS, KOLKATA

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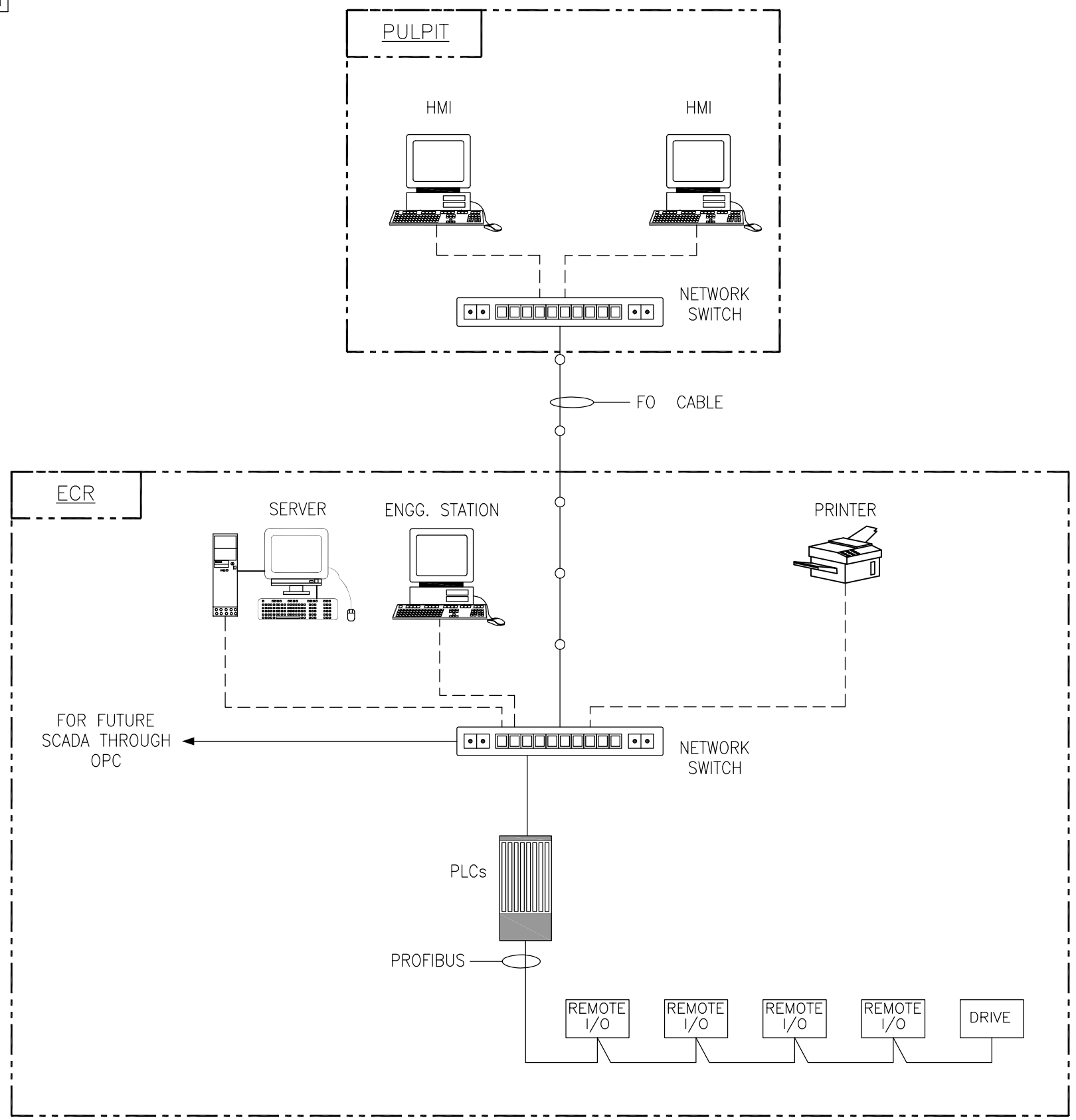
DRAWN BY	SPPO	12.07.2018
CHKD. BY	TRK	12.07.2018
APPVD. BY	SJD	12.07.2018

FOR
MISHRA DHATU NIGAM LIMITED (MIDHANI)
HYDERABAD
EXPANSION OF ROLLING MILL COMPLEX
WIRE ROD MILL
TYPICAL SINGLE LINE DIAGRAM

JOB No. **28785** | DRG. No. **28785-000-000-ELE-0001** | REV. **0**

DRG. No.	REV.
28785-000-000-ELI-0001	0



DISTRIBUTION				
CUSTOMER			COS	
			ENV	
CONTRACTOR			MNB	
CVL			NFE	
ELE			PWR	
IAC			CNT	
LTL			INS	
STR			PRS	
UTL			CON	
WTS				
COB			CHN–	
CRF			CHN–	
IRM			CHN–	
MMH			MUM–	
PML			MUM–	
RLM			PM	
STM			SITE	

No.	DATE	REVISION	BY	APP.	REF. DRAWINGS

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REV	DEPT	BY	DATE

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DSGND BY	SUSR	05.07.2018
DRAWN BY	STLA	05.07.2018
CHEKD BY	ASAR	05.07.2018
APPVD BY	DGH	05.07.2018

FOR **MISHRA DHATU NIGAM LIMITED (MIDHANI)**
HYDERABAD

EXPANSION OF ROLLING MILL COMPLEX
WIRE ROD MILL

CONCEPTUAL AUTOMATION CONFIGURATION DIAGRAM

JOB No.	DRG. No.	REV.
28785	28785-000-000-ELI-0001	0

PRICE BID FORMAT

A: For indigenous offers:

Design, Supply and complete Erection & Commissioning including Supervision of Erection & Commissioning of Bar & Rod Mill

Sl	Description	Unit	Qty	Unit Basic price (including packing, forwarding & insurance)	Total GST amount	Rate of GST (%)	HSN Code	Total Freight (INR) HSN Code…	GST on freight	Total FOR Midhani site price excluding GST (INR)	Total FOR Midhani site including GST (INR)
I	II	III	IV	V	VI	VII	VIII	IX	X	XI = (IV*V)+IX	XII = (IV*V)+VI+IX+X
1	**BAR MILL LINE**										
1a	Fixed hearth re-heating furnace with chimney, ducting, refractory, blowers, etc.										
1b	Billet handling manipulator for charging and discharging of fixed hearth furnace										
1c	Roughing Mill with roller tables, guides, all auxiliary systems										
1d	Intermediate Mill with roller tables, guides, all auxiliary systems										
1e	Finishing Mill with roller tables, guides, all auxiliary systems										
1f	Cooling bed with roller tables, guides, all auxiliary systems										
1g	Motors, drives, electrics & automation, instrumentation etc.										
1h	Complete Erection & Commissioning of 1(a) to 1(g)										
1i	Supervision of complete Erection & commissioning of 1(a) to 1(g)										
1j	Spares for one year for Operation & Maintenance										
1k	Special Tools for repair & maintenance										
	TOTAL for 1 (a) to 1 (k)										

Sl	Description	Unit	Qty	Unit Basic price (including packing, forwarding & insurance)	Total GST amount	Rate of GST (%)	HSN Code	Total Freight (INR) HSN Code…	GST on freight	Total FOR Midhani site price excluding GST (INR)	Total FOR Midhani site including GST (INR)
I	II	III	IV	V	VI	VII	VIII	IX	X	XI = (IV*V)+IX	XII = (IV*V)+VI+IX+X
2	**WIRE ROD MILL LINE**										
2a	Wire Rod Mill with tables, conveyor, shear, all auxiliary equipment and systems										
2b	Motors, drives, electrics & automation, instrumentation etc.										
2c	Laying head, coil stack										
2d	Cooling bed with roller tables, guides, all auxiliary systems										
2e	Complete Erection & Commissioning of 2(a) to 2(d)										
2f	Supervision of complete Erection & commissioning of 2(a) to 2(d)										
2g	Spares for one year for Operation & Maintenance										
2h	Special Tools for repair & maintenance										
	TOTAL for 2 (a) to 2 (h)										

PRICE BID FORMAT

B: For import offers:

Design, Supply and complete Erection & Commissioning including Supervision of Erection & Commissioning of Bar & Rod Mill

Sl	Description	Unit	Qty	Country of origin	Proposed port of shipment	Pice FOB Port of shipment (in USD/EURO/GBP)	Price for other INCOTERMS (in USD/EURO/GBP)	Custom Tariff Code under Harmonised System
I	II	III	IV	V	VI	VII	VIII	IX
1	**BAR MILL LINE**							
1a	Fixed hearth re-heating furnace with chimney, ducting, refractory, blowers, etc.							
1b	Billet handling manipulator for charging and discharging of fixed hearth furnace							
1c	Roughing Mill with roller tables, guides, all auxiliary systems							
1d	Intermediate Mill with roller tables, guides, all auxiliary systems							
1e	Finishing Mill with roller tables, guides, all auxiliary systems							
1f	Cooling bed with roller tables, guides, all auxiliary systems							
1g	Motors, drives, electrics & automation, instrumentation etc.							
1h	Complete Erection & Commissioning of 1(a) to 1(g)							
1i	Supervision of complete Erection & commissioning of 1(a) to 1(g)							
1j	Spares for one year for Operation & Maintenance							
1k	Special Tools for repair & maintenance							
	TOTAL for 1 (a) to 1 (k)							

Sl	Description	Unit	Qty	Country of origin	Proposed port of shipment	Pice FOB Port of shipment (in USD/EURO/GBP)	Price for other INCOTERMS (in USD/EURO/GBP)	Custom Tariff Code under Harmonised System
I	II	III	IV	V	VI	VII	VIII	IX
2	**WIRE ROD MILL LINE**							
2a	Wire Rod Mill with tables, conveyor, shear, all auxiliary equipment and systems							
2b	Motors, drives, electrics & automation, instrumentation etc.							
2c	Laying head, coil stack							
2d	Cooling bed with roller tables, guides, all auxiliary systems							
2e	Complete Erection & Commissioning of 2(a) to 2(d)							
2f	Supervision of complete Erection & commissioning of 2(a) to 2(d)							
2g	Spares for one year for Operation & Maintenance							
2h	Special Tools for repair & maintenance							
	TOTAL for 2 (a) to 2 (h)							