



An ISO 9001
Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

ENQUIRY		Phone: +91 431 257 4237	
NOTICE INVITING TENDER		Email : spsy@bheltry.co.in	
		Web : www.bhel.com	
TWO PART BID	Enquiry Number:	Enquiry Date:	Due date for submission of quotation:
Tender to be submitted in two Parts	2711600001	10.09.2016	14.10.2016
You are requested to quote the Enquiry number date and due date in all your correspondence. This is only a request for quotation and not an order. Please note that under any circumstances both delayed offer and late offers will not be considered. Hence vendors are requested to ensure that the offer is reaching physically our office before 14.00 hrs on the Date of tender opening.			
Item	Description		Quantity
10	Tube Layer Cutting Saw as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)		1 No.
Important points to be taken care during submission of offer			
1. Compliance Form No: TRY/ IMP/ 01 & TRY/ IND/ 01A to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation. 2. Delivery required: 10 months from the date of Purchase Order. 3. Commissioning, Demonstration/ Performance prove out of the equipment shall be done at BHEL, Trichy by the vendor. 4. Time period required for E&C is 6 weeks from the date of intimation. 5. The capacity/supply details as required in clause 17.0 (for TRY/ IMP/ 01) and clause 15.0 (for TRY/ IND/ 01 A) of the compliance form for commercial terms acceptance is to be enclosed 6. In line with the mandatory requirement of Government of India, the integrity pact is to be executed by BHEL and its suppliers. Hence we are enclosing the scanned copy of integrity pact. We request you to kindly download the attached integrity pact and affix your signature and seal in all the pages. In the page no. 8 of 8, in addition to your signature and seal please get the witness signature and seal. The witness signature may be from any one of your organisation. Duly filled integrity pact shall be submitted along with the tender. 7. The tender will be monitored by IEM – Mrs. Pravin Tripathi, IA and AS (Retd.)			
Address: D-243, Anupam Gardens, Lane IB, Neb Saraj Sainik Farms New Delhi – 110068 Ph: +91 11 29533206 / 29531715 Email: pravin.tripathi@gmail.com			



An ISO 9001
Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

8. Applicable EMD for this tender will be (INR) : 2,00,000.00
9. All updates, amendments, corrigenda, etc., (if any), for each tender will be posted only on the above websites from time to time, as and when required, until each tender is opened. There will be no publication of such updates, amendments, corrigenda, etc., through newspapers or any other media.

BHEL's General guidelines / instructions (refer MM/CE/GENL/001 - EMD), compliance form and technical specification can be downloaded from BHEL web site <http://www.bhel.com> or from the Government tender website <http://tenders.gov.in> (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2711600001".

Tenders should reach us before 14:00 hours on the due date
Tenders will be opened at 14:30 hours on the due date
Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present

Yours faithfully,

For BHARAT HEAVY ELECTRICALS LIMITED

Sr.Engineer / Capital Equipment / MM

C. SARANYA
Senior Engineer
MM / Capital Equipment
BHEL / Tiruchirappalli - 620 014,

PART – A – QUALIFYING CONDITIONS**Tube Layer Cutting Circular Saw for Hot Mill****SECTION- 1: Qualifying Criteria**

The BIDDER has to compulsorily meet the Qualifying Criteria indicated in **Section 1** to get qualified. Otherwise the technical offer will not be considered.

S NO.	REQUIREMENTS	VENDOR'S RESPONSE
1.1	The BIDDER / VENDOR (OEM) shall have a minimum TEN Years of Continuous Experience in Design, Manufacture & Supply of “ Tube Layer Cutting Circular Saw for cutting tubes in Hot Tube mills. ” Vendor shall indicate the actual number of years of experience in the field.	
1.2	Only those vendors (OEMs) fulfilling the following conditions should quote: who have commissioned in the last 10 years (as on the original date of tender opening) at least ONE “Tube layer cutting circular Saw capable of cutting tubes of Carbon & Alloy Steels in diameter range of minimum 31.8mm to 133mm or higher, in a layer width of minimum 800mm, with Carbide tipped circular saw blade, with feed stroke of circular saw blade in vertical direction” EITHER (i) In at least any one country other than the country of origin to establish vendor's global business activity. OR (ii) In India and the referred machine is presently working satisfactorily for more than one year after commissioning (as on the original date of tender opening). The name and contact addresses of the customers to whom the above mentioned machines were supplied to be furnished with details.	
1.3	Vendor has to submit at least ONE PERFORMANCE CERTIFICATE from their customers in India or from the customers to whom the machine was supplied outside the country of origin, for satisfactory performance of the machine, referred under clause 1.2 above, for a minimum period of one year from the date of commissioning (as on the original date of tender opening). Performance certificate as Original Certificate or E-mail directly from the customer may be submitted. The original certificate may be returned after verification by BHEL, if required. For obtaining the Performance certificate, a suggestive format is provided at the end of Part A.	
1.4	BHEL reserves the right to verify the information provided by the Vendor for the referred Tube Layer Cutting Saw at their referred customer's works. It shall be the responsibility of the vendor to facilitate the visit of BHEL's team at their referred customer works. The Travel, Board and Lodging expenses for BHEL Personnel shall be borne by BHEL. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected. BHEL reserves the right to accept or reject the OEMs based on the assessment of their technical and financial capability.	

SECTION - 2:

The BIDDER / VENDOR are requested to provide the following information:-

S NO.	REQUIREMENTS	VENDOR'S RESPONSE
2.1	The BIDDER / VENDOR to furnish Reference List of Customers, with complete address, details of contact person, where Tube Layer Cutting Saw has been supplied in the past.	
2.2	Specify details of Tube Layer Cutting Saw supplied to other units of BHEL, if any (Year of commissioning with details etc.	
2.3	Details on SERVICE-AFTER-SALES Set-up in India including the Address of Agents / Service Centres in India.	
2.4	Any Additional data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

SECTION – 3:

The BIDDER to note:

S NO.	REQUIREMENTS	VENDOR'S RESPONSE
3.1	The BIDDER / VENDOR shall submit the offer in TWO parts. 1. Technical Offer [with PART A & PART B] 2. Commercial Offer and Price bid.	
3.2	The Technical Offer shall contain complete details against all clauses of Technical Specifications given by BHEL.	
3.3	The Technical Offer shall be supported by copies of product Catalogues, Data Sheets and technical details of Bought- Out- Items.	
3.4	The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation.	

Suggestive Format of Performance Certificate:

The Performance should be certified by the customer on **Customer's Letter Head** and submitted along with the offer.

PERFORMANCE CERTIFICATE

1.0	Tube Layer Cutting Saw Supplied by : (Manufacturer's name)	
2.0	Make & Model number of the Machine	
3.0	Month & Year of Commissioning	
4.0	Application for which The Machine is used	
5.0	Machine Details	
5.1	Max /Min Tube Diameter can be cut on the machine.	
5.2	Max /Min Tube Thickness can be cut on the machine	
5.3	Tube materials (Carbon steel/Alloy Steel or any other)	
5.4	Maximum / minimum tube layer width	
5.5	Blade used (Carbide tipped)	
5.6	Direction of feed stroke of SAW blade	
6.0	Performance of the Machine (Please tick the appropriate option)	Satisfactory
		Not Satisfactory
7.0	Service after sales (Please tick the appropriate option)	Satisfactory
		Not Satisfactory
8.0	Other remarks (if any)	
Date:		Signature & Seal of the Authority Issuing the Performance Certificate

PART B – TECHNICAL SPECIFICATION
TUBE LAYER CUTTING CIRCULAR SAW FOR HOT MILL

Note:-

- 1.0** The Column “Vendor’s offer with Technical details & Remarks” of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous or unsustainable information against any of the clauses of the specifications / requirements shall be treated as non-compliance.
- 2.0** The offer and all documents enclosed with offer should be in **English language** only.

Name & Address of the Vendor:	Name & Address of the Indian agent:
Telephone no.:	Telephone no.:
Fax no.:	Fax no.:
e-mail:	e-mail:

- 3.0** Scope: - Design, Manufacture, Supply, Erection & Commissioning of

Tube Layer Cutting Circular Saw for Hot Mill in Seamless Steel Tube Plant at BHEL, Tiruchirappalli – 1 No.

for BHEL complying with the specification as below.

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION				VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]																																																																													
1.0	<u>JOB DESCRIPTION:</u> Seamless Steel Tubes made by hot rolling in long lengths in the Hot Mill need to be cut to length suitable for shipment by means of an automated heavy duty cutting machine of sufficient capacity to meet the requirement of this specification. The tubes are delivered to the cutting machine as a set of tubes in a layer. The parameter of the material to be processed in the machine are tabulated below:																																																																																		
2.0	JOB DETAILS																																																																																		
2.1	Tube Outer Diameters	<table><tr><th><u>S.No</u></th><th><u>OD</u> <u>in mm</u></th><th><u>Mim/Max.</u> <u>THICKNESS</u> <u>in mm</u></th><th></th><th><u>S.No</u></th><th><u>OD</u> <u>in mm</u></th><th><u>Mim/Max.</u> <u>THICKNESS</u> <u>in mm</u></th></tr><tr><td>1</td><td>31.8</td><td>4.0 / 4.57</td><td></td><td>11</td><td>57.0</td><td>4.19 / 14.0</td></tr><tr><td>2</td><td>33.4</td><td>5.59 / 7.11</td><td></td><td>12</td><td>63.5</td><td>3.81 / 12.7</td></tr><tr><td>3</td><td>38.1</td><td>4.57/ 11.0</td><td></td><td>13</td><td>69.85</td><td>4.57 / 14.0</td></tr><tr><td>4</td><td>41.3</td><td>7.4 / 8.2</td><td></td><td>14</td><td>76.1</td><td>4.57 / 5.5</td></tr><tr><td>5</td><td>42.4</td><td>4.57/ 9.1</td><td></td><td>15</td><td>88.9</td><td>4.0/10.0</td></tr><tr><td>6</td><td>44.5</td><td>4.19 / 10.92</td><td></td><td>16</td><td>108</td><td>8.0/12.5</td></tr><tr><td>7</td><td>47.63</td><td>5 / 10</td><td></td><td>17</td><td>114.3</td><td>4.0/11.13</td></tr><tr><td>8</td><td>48.3</td><td>6.6 / 8.1</td><td></td><td>18</td><td>127</td><td>8.0/12.5</td></tr><tr><td>9</td><td>51.0</td><td>4.19 / 10.0</td><td></td><td>19</td><td>133</td><td>8.0/12.5</td></tr><tr><td>10</td><td>54.0</td><td>9.14 / 13.49</td><td></td><td></td><td></td><td></td></tr></table>				<u>S.No</u>	<u>OD</u> <u>in mm</u>	<u>Mim/Max.</u> <u>THICKNESS</u> <u>in mm</u>		<u>S.No</u>	<u>OD</u> <u>in mm</u>	<u>Mim/Max.</u> <u>THICKNESS</u> <u>in mm</u>	1	31.8	4.0 / 4.57		11	57.0	4.19 / 14.0	2	33.4	5.59 / 7.11		12	63.5	3.81 / 12.7	3	38.1	4.57/ 11.0		13	69.85	4.57 / 14.0	4	41.3	7.4 / 8.2		14	76.1	4.57 / 5.5	5	42.4	4.57/ 9.1		15	88.9	4.0/10.0	6	44.5	4.19 / 10.92		16	108	8.0/12.5	7	47.63	5 / 10		17	114.3	4.0/11.13	8	48.3	6.6 / 8.1		18	127	8.0/12.5	9	51.0	4.19 / 10.0		19	133	8.0/12.5	10	54.0	9.14 / 13.49					
<u>S.No</u>	<u>OD</u> <u>in mm</u>	<u>Mim/Max.</u> <u>THICKNESS</u> <u>in mm</u>		<u>S.No</u>	<u>OD</u> <u>in mm</u>	<u>Mim/Max.</u> <u>THICKNESS</u> <u>in mm</u>																																																																													
1	31.8	4.0 / 4.57		11	57.0	4.19 / 14.0																																																																													
2	33.4	5.59 / 7.11		12	63.5	3.81 / 12.7																																																																													
3	38.1	4.57/ 11.0		13	69.85	4.57 / 14.0																																																																													
4	41.3	7.4 / 8.2		14	76.1	4.57 / 5.5																																																																													
5	42.4	4.57/ 9.1		15	88.9	4.0/10.0																																																																													
6	44.5	4.19 / 10.92		16	108	8.0/12.5																																																																													
7	47.63	5 / 10		17	114.3	4.0/11.13																																																																													
8	48.3	6.6 / 8.1		18	127	8.0/12.5																																																																													
9	51.0	4.19 / 10.0		19	133	8.0/12.5																																																																													
10	54.0	9.14 / 13.49																																																																																	
2.2	Outside diameter tolerance	- 0.1 to +0.4 mm																																																																																	

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION				VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
2.3	Tube Wall Thickness	Minimum : 3.0 mm Maximum : 14.0 mm				
		S.No	OD range in mm	Mim/Max. THICKNESS in mm	Material Spec	
		1	31.8 to 133	3.0/12.5	Carbon Steel	
		2	31.8 to 133	3.0/12.5	Alloy Steel	
		3	33.4 to 114.3	5.0/11.00	SA213 T91	
2.4	Layer Width	Minimum : 200 mm Maximum : 800 mm (max. nos. of tubes: 24)				
2.5	Infeed Length of tubes	Minimum : 5000mm Maximum : 65000mm				
2.6	Longitudinal straightness deviation	Around 2mm/metre, not exceeding 15mm over a length of 12 metres				
2.7	Finished Length	Minimum : 4000mm Maximum : 24000mm				
2.8	Tube Temperature	Maximum : 70 deg C				
2.9	Head Scrap piece length	Minimum : 100mm Maximum: 3000 mm				
2.10	Tail Scrap piece length	Minimum : 100mm Maximum: 3000 mm				

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
2.11	Material Grade	a) Carbon Steel: SA192, SA210Gr.A1, SA210 Gr.C TS : 485 MPa YS: 275 MPa BHN: 179 b) Alloy Steel : SA213 T11, SA213 T22 TS : 415 MPa YS: 205 MPa BHN: 165 c) 9Cr Alloy Steel : SA213 T91 TS : 590 MPa YS: 410 MPa BHN: 250 Note: The TS (Tensile Strength), YS (Yield Strength) and BHN (Brinell Hardness) values are properties of tubes to be cut.	
2.12	Cycle time for one cutting	Around 60 Seconds for SA213 T22 (Cycle time includes clamping, cutting and declamping) Vendor to specify. Vendor to specify the cycle time for one cutting of SA213 T91	
3.0	GENERAL TECHNICAL DESCRIPTION OF TUBE LAYER CUTTING CIRCULAR SAW MACHINE		
3.1	The machine shall be of vertical type i.e. feed direction of circular SAW shall be vertical. Vendor to confirm.		
3.2	The machine shall have horizontal and vertical clamping at the inlet and at the outlet for Clamping the tube layers. The horizontal & vertical clamping shall be rigid enough to keeps tube layer in position during cutting. Vendor to confirm & specify.		
3.3	The machine shall be designed for optimum size of saw blades to minimize cost of cutting. The mounting arrangement of saw blade shall be of simple and easy to mount to minimize the blade changing time. Vendor to specify.		
3.4	The machine is intended to be positioned in the existing seamless steel tube mill. The old existing layer saw shall be replaced with this machine. Therefore, the machine to fit into the space and location shown in layout in Annexure-I. Vendor to confirm.		
3.5	Machine shall have necessary vibration damping and guiding system to reduce chatter marks on cut edges. Vendor to specify the method and system of vibration damping & guiding system.		

S. No	SPECIFICATION/DESCRIPTION		VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
4.0	MACHINE PARAMETERS		
4.1	Maximum Force	Vendor to specify	
4.2	Maximum Pressure	Vendor to specify	
4.3	Minimum and Maximum Cutting Speed	Vendor to specify	
4.4	Minimum and Maximum RPM of saw blade	Vendor to specify	
4.5	Tube working Height - from ground level to bottom of the tube : 620 mm	Vendor to confirm	
4.6	Main Pump Motor power in kW	Vendor to specify	
4.7	Main Pump Motor flow in LPM	Vendor to specify	
4.8	Total Power Requirement in kVA	Vendor to specify	
5.0	MACHINE COLUMN		
5.1	Machine column shall be rigid and strong construction to absorb vibration and distortion. Vendor to specify the construction details with any specific technology adopted to reduced / absorb the vibrations. Vendor to provide a typical GA drawing of the machine column. Vendor to specify whether the		
6.0	HEAD		
6.1	The head casing shall be rigid and stress relieved structure. Vendor confirm.		
6.2	Vendor to provide the details of main spindle bearing.		
6.3	Gears: The gears shall be hardened and ground. Vendor to provide the details of gear box such as make, gear reduction ratio etc.		
6.4	Vendor to provide the details of lubrication system used for spindle bearing and gears.		
6.5	The machine shall be driven by three phase motor preferably with toothed belt or any sturdier system like direct drive etc. A continuous speed control system through VFD shall be provided. Vendor to specify.		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
6.6		The head shall have contactless SAW blade retraction system. Vendor to confirm & explain in detail.	
6.7		Vendor to specify the Counterbalancing arrangement incorporated for the head. Vendor to provide detail.	
7.0	FEED MECHANISM		
7.1		Vendor to provide the details of feed mechanism in the machine. The Ball Screw arrangement is preferred for cutting feed arrangement.	
7.2		Hardened guide rails need to be used for sliding area. Vendor to confirm.	
7.3		Programmable and semi-automatic feed mechanism for rapid idle feed, cutting feed and rapid return feed without manual interventions to reduce the total cutting cycle time. The measurement of the width of layer and layer height (tube diameter) by suitable measuring device, shall be taken as input for feed mechanism. Vendor to confirm and provide the details. Vendor to confirm & explain in detail.	
7.4		Guide ways and other accessories shall be lubricated automatically by centralized lubrication system. Vendor to confirm.	
8.0	DAMPENING SYSTEM		
8.1		Dampening system shall be provided to dampen vibrations in the saw blade. Vendor to confirm and provide the details.	
9.0	BRUSH EQUIPMENT		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
9.1	An electric motor driven brush on either side of the blade for blade cleaning (to remove the chips from gullets of the blade teeth) and does not impair the quality of the cutters shall be provided. Vendor to confirm and provide the details.		
10.0	SAW BLADE SPRAY LUBRICATION		
10.1	Spray lubrication with nozzle-system shall be provided. Necessary controls shall be provided for adjusting the quantity of oil sprayed. Vendor to specify whether the system is electrically operated or pneumatically operated. In case of pneumatically operated, the system should function at an air pressure of around 4 to 5 bar. Vendor to confirm and provide the details.		
11.0	BLADE COOLING EQUIPMENT		????
11.1	For the cooling of saw blade disc, necessary cooling systems to be provided. The pneumatic system if any should function at an air pressure of 4 to 5 bar. Vendor to confirm and provide the details.		
12.0	LUBRICATION:		
12.1	Machine lubrication: Automatic centralized lubrication system with timer control and suitable metering cartridges to be supplied. Vendor to confirm.		
12.2	First filling of Lubrication Oil and grease to be supplied by the supplier. Indian equivalent shall be mentioned.		
12.3	The lubrication lines shall be mounted on the machine such that they are not projecting out and prone for damage.		
13.0	CLAMPING UNIT		
13.1	The machine shall have horizontal and vertical clamping at the inlet and at the outlet for clamping the tube layers. The clamping unit shall be rigid. Vendor to confirm.		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
13.2		Protection units are to be incorporated, for protecting the clamping unit in the inlet and outlet. These protection units shall be strong enough to absorb the hits of the tubes.	
13.3		The clamping system to be hydraulic.	
13.4		Vendor to describe in general the working mechanism of horizontal & vertical clamping.	
14.0		SAW BLADE	
14.1		The saw blade used shall be of BRAZED CARBIDE TIPPED design. The details of blade including probable suppliers shall be provided, which includes: 1. Diameter of the saw blade 2. Cutting speed of Carbide tip in m/min 3. Suitability for cutting different grades of material up to 13% Cr steels. (T91) 4. Approximate blade life in terms of number of cuttings and number of regrinding that can be done. 5. Method of reconditioning and facility required for the regrinding. 6. Insert specification for brazed type. 7. Blade material specification, chemistry, hardness value and grade of insert used. 8. Drawing for the saw blade with the above details and dimensions. 9. Sources for the procurement of disc & inserts.	
14.2		The saw blades designed for using in the machine shall be of standard type and shall be available in the regular market. Vendor to confirm.	
14.3		CONSUMABLE for COMMISSIONING & PROVE OUT TRIAL : 15 Nos of SAW blades with carbide inserts to be supplied with the machine. Vendor to confirm & quote	

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
15.0	CUTTING DATA OF SAWING MACHINE		
15.1	Vendor to submit the details of recommended cutting parameters, cutting cycle time, and tool life time for the offered SAW blades for all the material specified in clause 2.11		
16.0	Vendor to note that the offered machine shall be compatible with existing end cutting stoppers & length positioning system. Dimension of the existing Layer SAW is - Breadth – 1000 mm, Width – 850 mm, Scrap tilting table length at machine exit – 2900 mm. Vendor to confirm and specify the dimension of offered machine.		
17.0	CHIP REMOVAL SYSTEM		
17.1	A chain type chip conveyor to transports the chips into a chip bin outside the sawing area shall be provided. . Vendor to provide the detail of chip conveyors.		
17.2	Vendor to supply required chip bin and submit the details.		
18.0	HYDRAULICS		
18.1	The System should be centralized, modular / stacked valve construction having minimum number of pipes / pipe joints and all elements should be located at suitable location with easy accessibility of components for maintenance. It should be possible to replace hydraulic elements like valves, manifolds etc. without disturbing the associated pipelines. Vendor to Furnish Details		
18.2	All hydraulic elements shall be of EATON VICKERS / BOSCH REXROTH / PARKER DENISONS make or any other reputed make acceptable to BHEL.		
18.3	Pumps, valves, accessories etc. shall be of BOSCH-REXROTH /EATON VICKERS/ PARKER DENISONS or any other reputed make acceptable to BHEL. (Details to be submitted). The seals used in cylinders shall be of MERKEL / PARKER / BUSHAK + SHAMBAN / HUNGER / SIMRIT make or any other reputed make acceptable to BHEL. Vendor to confirm & furnish details.		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
18.4	Suitable filtration system should be provided with Duplex / standby filter units. It is preferable to use re-usable type of filter elements in the system. The filter unit shall be of HYDAC / PARKER / BOSCH REXROTH or any other reputed make acceptable to BHEL. Vendor to confirm & furnish details.		
18.5	The flexible hoses used in the system shall be of GATES / AEROQUIP / PARKER or any other reputed make acceptable to BHEL. Vendor to specify		
18.6	All the pipe / hose end fittings shall be of standard weld nipple with O-ring seating type (DIN 3865 or equivalent) of suitable material. No ferrule joints are to be used in the hydraulic system. All threaded connections shall be of metric sizes. Vendor to confirm and specify. Make: PARKER / BOSCH REXROTH / EATON VICKERS		
18.7	The maximum pressure of the system should preferably not to exceed 310 bar. Vendor to specify		
18.8	Each pump should have an independent motor. Tandem pumps shall be avoided. Main pump shall have standby pump provision. Vendor to confirm.		
18.9	Failure indication for oil level, temperature, pressure, filter clogging should be provided. Vendor to confirm & furnish details		
18.10	Automatic shut off provision during hose failures, chiller failure, low oil level etc. Pump unloading feature during idle running to be provided for energy conservation. Details should be submitted. Vendor to specify		
18.11	Vendor to provide hydraulic Oil chiller unit - Refrigeration type for required tank capacity to maintain oil temperature not exceeding 50°C. – Vendor to provide details of Oil Chiller. Make: WERNER FINLEY/DAIKIN/RITTAL/RITE TEMP or any other reputed make acceptable to BHEL.		
18.12	All oil pipelines shall be of seamless steel and should undergo pickling process. Vendor to confirm		
18.13	The hydraulic oil to be used shall be of standard ISO Viscosity Grades – 46 / 68 only. Vendor to confirm. Hydraulic circuits shall be designed with minimum number of control valves and to suit the hydraulic oil.		
18.14	Hydraulic power pack and Oil tank shall be separate from the Machine and positioned behind the machine conveniently to attend to any maintenance problems. Vendor to confirm.		
18.15	Vendor to specify the size of Hydraulic oil tank, capacity in litres		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
18.16	Hydraulic oil will be supplied by vendor during pre-dispatch inspection at supplier's works and commissioning at BHEL works. Vendor to confirm		
18.17	Sufficient number of check-points to be provided wherever pressure is required to be read for setting and trouble shooting. Minimes Pressure Gauge - 1 No with Connecting Hose to be provided.		
18.18	All cylinders used in the machine should have standard bore and rod sizes. The piston rod shall be hard chrome plated. Vendor to furnish details		
18.19	The control voltages for all the Solenoids of the valves shall be of 24 V DC and all solenoid operated DC valves should have manual over-ride provision and light indicating solenoids. Vendor to specify		
18.20	The pipelines to be painted with standard colours as per the colour coding accepted internationally for hydraulic systems. Vendor to furnish details		
18.21	All hydraulic pipelines, hoses and electrical control cables to be neatly laid out with proper clamps and flexible hose conveyors wherever required. Vendor to confirm		
18.22	Suitable leakage oil collection metallic tray to be provided wherever required. Vendor to confirm		
18.23	The Power pack should be designed taking into account the energy efficiency (Hi-low pump system, proper unloading during idling, etc.). The motor used for pumps shall be LATEST energy efficient ones. Vendor to furnish details		
18.24	All the components in the hydraulic power pack shall be provided with identification numbers, as per the hydraulic circuit and should be pasted with metallic identification number plates. Anodized hydraulic circuit- 1 No shall be mounted in suitable area for ready reference/trouble shooting. Vendor to confirm		
19.0	PNEUMATIC SYSTEM:		
19.1	The pneumatic operated elements of the machine shall work efficiently by a centralised pneumatically actuating system with BHEL compressed air supply at a pressure of around 4 to 5 bar through 1" line.		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
19.2	BHEL will provide compressed air at only one point near / on the machine. Vendor shall provide suitable filter-regulator-lubrication (FRL) unit at this point. Vendor to confirm		
19.3	Hydraulic, Pneumatic & Lubricating oil piping should be preferably metallic except places where flexible piping is essential. All the pipes required for the same shall be included in the standard scope of the machine. Vendor to confirm		
19.4	Pneumatic components shall be of FESTO / SMC / NORGREN or any other reputed make acceptable to BHEL. make only. Vendor to Specify		
20.0	ELECTRICAL SYSTEM:		
20.1	Main Voltage : 3 Phase - 415 VAC $\pm$ 10% + PEN / 50Hz $\pm$5%, TN-C-Network (Terra-Neutral-Combined-Network) Power supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All cables, connections, circuit breakers etc. required for connecting BHEL's power supply to the machine shall be in the scope of vendor. Vendor to note and confirm.		
20.2	Wiring: All electrical motors, limit switches etc, on the machine shall be Wired using PVC sheathed cable running in conduits to cable ducts to common terminal block. External wiring from / to control panel, control desk, external motors etc shall be by means of screened multi-core cables.		
20.3	Encoders, limit switch, feedback devices shall be suitably placed for easier accessibility rigidly. Vendor to confirm		
20.4	All alarm tripping logics and control logics incorporated in the machine to be listed out by the vendor.		
20.5	Control circuit voltage should be 24 V DC. Vendor to confirm		
20.6	Control panel shall have built in 230V, 5 amps, 3 pin plug. Vendor to confirm		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
20.7	All electrical panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220 Volts, 5/15 Amp AC. All adapters /receptacles should have compatibility with Indian equivalents.		
20.8	All electrical control cabinets & panels should be vermin and dust proof. All Electric enclosures shall have IP 54 protection. Vendor to confirm		
20.9	Air Conditioners with Dehumidifiers of suitable capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions. Make: Rittal / Werner & Finley or any other reputed make acceptable to BHEL. Detailed specifications to be submitted		
20.10	All components (except the PC) are connected via Profibus with a central CPU. The PC is connected with the CPU via TCP/IP.		
20.11	The switch cabinet is to be designed for installation of all devices of the plant including inlet & out let conveyors. BHEL will supply and to install all field electrical equipment of the devices, which were manufactured by BHEL and automation of complete system is in the scope of supplier. Vendor to confirm		
20.12	Motors and drives shall be of ABB/ SIEMENS / MITSUBISHI / GE or any other reputed makes conforming to IS / IEC Standards and acceptable to BHEL. Vendor to confirm and indicate make and type in the offer		
20.13	All electrics shall be of reputed make like SIEMENS / ALLEN BRADLEY /SCHNEIDER or any other reputed makes conforming to IS / IEC Standards and acceptable to BHEL. Vendor to confirm		
20.14	All components/devices/terminals are to be incorporated with ferrules. Vendor to confirm		
20.15	All the modules shall be connected with PROFIBUS. Vendor to confirm		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
20.16	All necessary cables among switch cabinets, operator desk, terminal boxes, hydraulic station, sawing machine and local sensors shall be in supplier scope. The wiring work and all necessary cables among switch cabinets, operator desk, terminal boxes, hydraulic station, sawing machine and local sensors under supplier's scope of supply will be done by them. Cable length up to a maximum length of 30m shall be included between control cabinets and field boxes. Vendor to confirm		
20.17	In order to achieve the reliability in signal transmission, the length of the servo cables shall be limited upto maximum 50 meter. Vendor to confirm		
20.18	Vendor should ensure the proper earthing for the machine and its peripherals. Earth electrode with connecting conductors with suitable earth resistance value (preferably less than 1.5 ohm) shall be supplied with the machine. The location for earth pit shall be indicated in the machine foundation drawing. Accordingly Earth pit will be provided by BHEL. Earth Electrode maintenance shall be mentioned in the O&M manual.		
21.0	MACHINE OPERATING CONTROL SYSTEM FEATURES:		
21.1	Control shall be PC based latest PLC based system. Details to be provided by vendor.		
21.2	Operator's control panel having complete machine control system with suitable display unit of required configuration with 17" TFT screen, shall be provided for convenient and efficient operation. All switches should be within reach of operator. All displays/indications should also be conveniently placed (Layout showing complete details should be submitted with the offer) Provisions for Push buttons/indications to be provided on the control desk in order to integrate the Roller conveyers and other accessories as finalized during technical discussion with BHEL before placement of order.		
21.3	Machine shall be operated in three modes viz., Manual, Semi-Automatic and Automatic.		
21.4	The following parameters shall be programmable by the operator and limits shall be available for each of the parameters internally to prompt in case of the parameters are wrongly programmed exceeding the limits. 1. Cutting Speed 2. Feed Speed 3. Tube size 4. Material specification		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
21.5	PC based PLC SYSTEM & FEATURES		
21.5.1	Make: Preferred Make – Fanuc / Siemens / Allen Bradley or Any other reputed makes acceptable to BHEL . Vendor to confirm & specify		
21.5.2	Model (suitable and latest version, as available at the time of purchase order placement, shall be supplied). Vendor to confirm & specify		
21.6	Remote access to the machine through network - internet for remote tele-diagnosis. Vendor to confirm		
21.7	USB Ports for connectivity to be provided. Vendor to confirm.		
21.8	Protection against virus and malwares should be provided without compromising the system performance. Vendor to confirm.		
21.9	Additional external standard 104key Keyboard and Optical Mouse. Vendor to confirm.		
21.10	The computer shall have CD / DVD read and write drive. Vendor to confirm		
21.11	One additional hard disk fully loaded with complete software and clearly written Instructions to take back-up and reloading of a new hard disk to be provided		
21.12	Power failure backup module for smooth shutdown of the system.		
21.13	Details of Standard features. Vendor to specify		
21.14	Details of optional features, recommended by vendor. Vendor to specify.		
21.15	All components are connected with Profibus. CPU's cycle times shall be of less than 15ms. Only a basic knowledge of the program must be sufficient for modifications in existing program parts or for construction of new program parts.		
21.16	The system should have full alphanumeric keyboard, display of suitable size, RS232C serial interfaces, parallel interface for printer, compact disc drive unit for data input/output, hard disk of sufficient capacity, pre-installed system software and other associated / required soft wares, etc . (Details shall be furnished by the Vendor in the TECHNICAL OFFER)		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
21.17	Latest version Laptop with pre-loaded software for PLC for maintenance to be supplied with the machine.		
21.18	The hardware includes • CPU • Digital IN/OUT modules • 15% spare I/O • Interfacing modules connection including IN/OUT modules • All the frequency converters/speed controllers and servo drive-modules should be of reputed make.		
21.19	For all the sub systems' in buyer's scope (like inlet conveyor, exit conveyors, transferring facilities etc) automation will be in the scope of supplier. Supplier has to communicate with sub-systems to the main PLC via hard wire signal. BHEL will provide the details of the above mentioned sub-systems. The cables will be laid and connected by the BHEL. Please refer Annexure-2 for details of present subsystem Input / output details. Vendor to note & confirm.		
22.0	DRAWING APPROVAL		
22.1	GA drawings, Machine detailed constructional (main & sub assembly) drawings with dimensions Hydraulic / Pneumatic / Lubrication / Electrical / Electronic circuits with detailed BOM, are to be submitted within 45 days from the date of ordering (in case of an order) for approval by BHEL before start of manufacturing. BHEL shall provide approval within 15 days after all the clarifications sought have been submitted by supplier.		
23.0	FOUNDATION DRAWING		
23.1	Supplier to submit Civil Foundation layout drawing with details of static & dynamic loads, within one month after BHEL approval of manufacturing drawings. The shop floor at BHEL works has 200mm concrete thickness with M15 concrete mix. Based on the submitted foundation layout, BHEL shall prepare Civil Foundation drawing. Civil foundation work is under the scope of BHEL. If there is NO foundation, then the machine shall be placed on anti-vibratory pads		

24.0	DOCUMENTATION:	
24.1	The following documents in English language should be supplied along with the machine: Hard Copies - 3 Sets Vendor to confirm In CD form - 1 Set 1. GA Drawing of the complete Tube Layer Cutting Circular Saw. 2. GA Drawing of Individual Mechanisms 3. GA & Sub-Assembly Drawings for sub-systems for maintenance purpose. 4. Operating manuals of Machine & its PLC System 5. Saw blade specification and drawings 6. Programming manuals of Machine & its PLC System 7. Maintenance manuals with all drawings of machine assemblies / sub-assemblies with parts list 8. All Electrical circuit diagrams with bill of materials 9. Hydraulic circuit diagrams with bill of materials 10. Pneumatic circuit diagrams with bill of materials 11. Maintenance & Interface manuals for Machine Control System 12. Preventive Maintenance check list for Electrical and Mechanical System 13. Trouble shooting chart for Main and all sub systems 14. Complete PCB Schematics indicating check points for Electronic controls. 15. Catalogues, O&M manuals for all bought out items used in the machine. 16. Operating Manuals, Maintenance Manuals & Catalogues for all supplied Accessories. 17. Detailed specification of all rubber items / hydraulic / lubrication fittings 18. PLC program print-outs with comments in English 19. PLC program and data on CD, Flash Memory Card(EEPROM). 20. Complete back up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back up and reloading of a new hard disk. 21. Complete list of Alarm log, Error code, error messages & remedies and on line fault diagnostics to be provided by the vendor. 22. Complete list of spares for machine, along with item part no /specification / type / model and make & address of the sub-vendor wherever possible. Note: 1. All the Drawings shall be in DWG format in soft copy wherever possible. 2. Operating manual shall clearly specify feed setting for different grades, outer diameter and wall thickness with cutting cycle time	

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
25.0	DELIVERY SCHEDULE UNTIL DATE OF SHIPPING		
25.1	The vendor shall submit the delivery schedule indicating the time frame for all the major stages (like drawing submission & approval, manufacturing, assembly, pre dispatch inspection, etc.) in the contract execution up to the dispatch of machine. Separate preliminary schedule for erection & commissioning including training & prove out shall be submitted.		
26.0	SPARES		
26.1	List of spares with itemized break-up of mechanical, hydraulic, pneumatic, electrical and electronic spares used in the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis shall be furnished by vendor along with offer.		
26.2	All types of spares for total machine and accessories shall be available for at least ten years after supply of the machine. Vendor to confirm. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required		
27.0	AMBIENT CONDITIONS & THERMAL STABILITY		
27.1	Total machine and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Ambient Conditions: Temperature: +5 to +50 Degree Celsius and Relative Humidity: 90% maximum, both do not occur simultaneously. Vendor to confirm		
27.2	The entire equipment shall be Tropicalized in Design and Construction. Vendor to confirm.		
27.3	The offered equipment, Hydraulic system has to work in a normal fabrication shop environment in ambient conditions.		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
27.4		The machine, including attachments and accessories, should be suitable for Continuous operation to its full capacity for 24 hour a day and 7 days a week throughout a year. Vendor to ensure and confirm the same.	
28.0	ENVIRONMENTAL PERFORMANCE OF THE MACHINE:		
28.1		Maximum noise level shall be 85 dB (A) at normal load condition, 1 metre away from the machine with correction factor for back ground noise, if necessary. Vendor to confirm	
28.2		If any safety / environmental protection enclosure is required it shall be built in the machine by the vendor. Vendor to confirm	
28.3		Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant. Vendor to confirm	
29.0	IN-BUILT SAFETY ARRANGEMENTS		
29.1		If any safety / environmental protection enclosure is required it shall be built in the machine by the vendor. Vendor to confirm	
29.2		All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine. Vendor to confirm	
29.3		Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, work piece and the operator due to the malfunctioning or mistakes. Vendor to specify	
29.4		Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on the display and operator panels) should be available. Vendor to confirm	
29.5		All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations and suitably guarded. Vendor to confirm	
29.6		Emergency Switches should be provided at suitable locations as per International Norms. Vendor to confirm & specify	

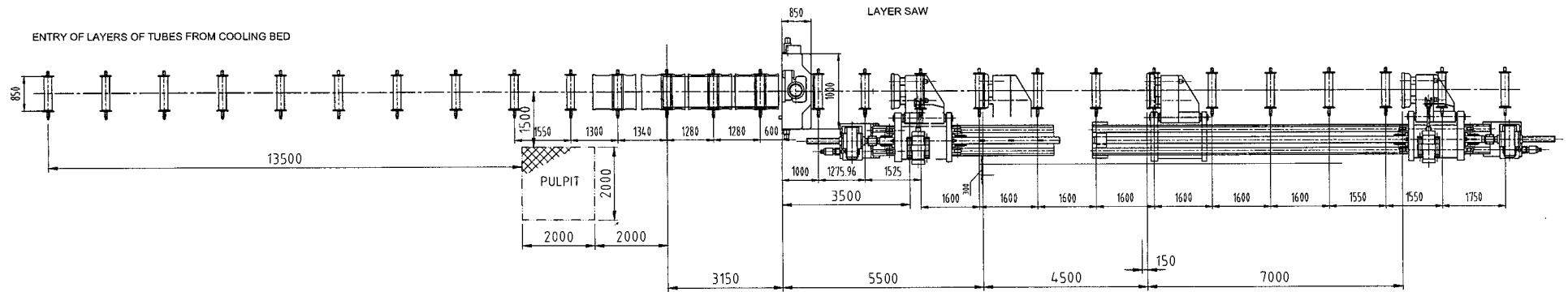
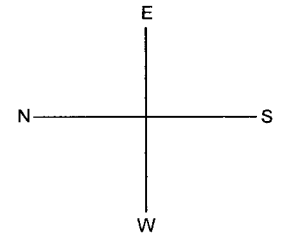
S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
30.0	MACHINE PRE-DISPATCH INSPECTION AND ACCEPTANCE AT SUPPLIER'S WORKS: (Test /Activities to be performed at vendor's work.		
30.1	Complete machines shall be assembled and offered for inspection and performance trials to test the design capabilities of the machine, by BHEL Engineers before Dispatch at Supplier's works. <u>Acceptance Criteria during pre-dispatch inspection:</u> a) Physical Inspection and Design/Constructional/Dimensional Compliance as per the approved drawings. b) All the features of the machine construction shall be operated and shown in good working condition as per the Technical Specification and Drawings approved by BHEL. c) The system performance shall be checked on a Layer of tubes, which will be provided by the supplier for 1) Minimum size for hard grade material SA 213 T91 – 10 cutting operations 2) Maximum size for hard grade material SA 213 T22/SA 213 T91 – 10 cutting operations		
30.2	Airfare, board & lodging for the BHEL Engineers who will be visiting supplier's works for pre-dispatch inspection and training, shall be borne by BHEL.		
31.0	ERECTION & COMMISSIONING		
31.1	Supplier to take full responsibility for Supervision of the erection and for start up, testing and commissioning of machine, its controls and accessories along with Synchronization of existing end cutting stoppers & length positioning system. Supplier shall send suitable qualified Engineers for supervision of Erection and Commissioning of the machine at BHEL works. Commissioning Engineers who will be deputed to BHEL shall be English speaking or else English interpreters have to be arranged by the supplier for the entire duration from start of erection till the machines are commissioned and handed over to BHEL with complete training. Manpower required for erection & installation shall be provided by BHEL.		
31.2	Standard western lunch on working days during erection & commissioning of the machine, shall be provided by BHEL free of cost at their company guest house for the Supplier's Commissioning Engineers / Supervisors.		
31.2	Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by Vendor in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
31.3	Successful proving of BHEL components by the Vendor shall be considered as part of commissioning. All tests, as mentioned (Machine Acceptance) shall form part of the commissioning activity.		
31.4	Commissioning spares, required for commissioning of the machine shall be supplied free of cost		
31.5	Test Mandrels, Instruments and other necessary equipment including Laser equipment, if required, to carry out all above activities should be brought by the Vendor.		
31.6	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the Vendor should supply sufficient quantity of touch-up paint of various colours of paint used.		
32.0	MACHINE INSPECTION AND TESTS TO BE CARRIED FOR COMMISSIONING AT BHEL WORKS		
32.1	After the machine has been erected and energized, a few idle runs have to be done to demonstrate the good working condition of the machine. Successful proving of BHEL components by the Vendor shall be considered as part of commissioning. <u>Acceptance Criteria during commissioning:</u> a) Physical Inspection and Design/Constructional/Dimensional Compliance. Ensuring proper working of all components and accessories of the machine erected. b) Prove out trials to be conducted on the tubes given by BHEL with the toolings supplied along with the machine for any two sizes mentioned in Clause 2.1 to check the cycle time as specified by the vendor. c) Actual jobs shall be loaded to see the performance of the machine during running for 24 hrs continuously.		
33.0	TRAINING:		
33.1	The supplier shall train TWO BHEL Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and Programming) of the Machine for THREE working days at supplier's works after the Pre-Dispatch Inspection of TWO Days . Total duration of PDI & Training : FIVE days . Vendor to confirm		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
33.2	The Supplier shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Hydraulics, Electrical/ Electronics and PLC System) during commissioning of the Machine at BHEL works for five working days. Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel. Vendor to confirm		
33.3	The training shall include specialized coaching in i) Safety ii) Operation of the machine iii) PLC based System & Operation, iv) Trouble-Shooting, v) Software Application vi) All special features of the machine vii) Electrical / Mechanical / Hydraulics / Electronics systems		
34.0	PAINTING:		
34.1	Painting of entire Machine / Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)		
35.0	MACHINE PACKING:		
35.1	Sea worthy & rigid packing for all items of complete machine, PLC System, all accessories and other supplied items to avoid any damage/loss in transit. When machine is dispatched in containers, all small loose items shall be suitably packed in boxes		
36.0	GUARANTEE: Performance Guarantee to be given for 12 months from the date of commissioning OR 18 months from the date of dispatch whichever is earlier.		

S. No	PARTICULARS	SPECIFICATION/DESCRIPTION	VENDOR'S OFFER / CONFIRMATION [with Complete Technical Details]
37.0	GENERAL: The following technical details for the Saw shall be provided by Vendor		
	MACHINE DATA		
37.1	Machine Model No.	Vendor to specify	
37.2	Total connected load (KVA):	Vendor to specify	
37.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to specify	
37.4	Total weight of the machine (approx)	Vendor to specify	
	Flange Diameter (in mm)	Vendor to specify	
	SAW BLADES		
37.5	Maximum saw blade diameter (in mm)	Vendor to specify	
37.6	Thickness (in mm)	Vendor to specify	
37.8	Blade revolution (RPM)	Vendor to specify	
37.8	No. of tooth	Vendor to specify	
	MAIN DRIVE DATA THREE PHASE MOTOR		
37.10	Nominal power (in Kw)	Vendor to specify	
37.11	Rated speed (RPM)	Vendor to specify	
37.12	Infinitely output speed range (RPM)	Vendor to specify	
	FEED MOTOR AC SERVO MOTOR		
37.13	Nominal power (in Kw)	Vendor to specify	
37.14	Infinitely feed speed (RPM)	Vendor to specify	
37.15	Rapid return (RPM)	Vendor to specify	

ANNEXURE - 1
EXISTING LAYOUT OF LAYER SAW



ANNEXURE-2 SUBSYSTEM INPUT LIST

S.NO	Description	FUNCTION	IO DESIGNATION
1	CS1_MPB1	CS1_E-stop PB_CS1-B1	I 0.0
2	CS1_KS1	CS1_Control On Key s/w_CS1-B1	I 0.1
3	CS1_PB1	CS1_CES Up PB_CS1-B1	I 0.2
4	CS1_PB2	CS1_CES Down PB_CS1-B1	I 0.3
5	CS1_PB3	CS1_Length stop Up PB_CS1-B1	I 0.4
6	CS1_PB4	CS1_Length stop Down PB_CS1-B1	I 0.5
7	HS2_MPB1	HS2_E-Stop PB_LS-B1	I 0.6
8	HS2_KS1	HS2_Control On Key s/w_LS-B1	I 0.7
9	CS1_PB5	CS1_CES Fwd PB_CS1-B1	I 1.0
10	CS1_PB6	CS1_CES Rev PB_CS1-B1	I 1.1
11	CS1_PB7	CS1_Length stop Fwd PB_CS1-B1	I 1.2
12	CS1_PB8	CS1_Length stop Rev PB_CS1-B1	I 1.3
13	CS1_PB9	CS1_RC On PB_CS1-B1	I 1.4
14	CS1_PB10	CS1_RC Off PB_CS1-B1	I 1.5
15	CS1_PB11	CS1_Saw Auto Start PB_CS1-B1	I 1.6
16	CS1_PB12	CS1_Saw Auto Stop PB_CS1-B1	I 1.7
17	CS1_PB13	CS1_Saw Declamp PB_CS1-B1	I 4.0
18	CS1_SS1	CS1_Sel s/w setting mode_CS1-B1	I 4.1
19	HS2_FH1	HS2_Oil Level Float s/w_HS2-JB4	I 4.2
20	CS1_PB14	CS1_Lamp test PB_CS1-B1	I 4.3
21	CS1_SS2-1	CS1_RC Rev Sel s/w_CS1-B1	I 4.4
22	CS1_SS2-2	CS1_RC Fwd Sel s/w_CS1-B1	I 4.5
23	CS1_SS3-1	CS1_RC Sel s/w Position 1_CS1-B1	I 4.6
24	CS1_SS3-2	CS1_RC Sel s/w Position 2_CS1-B1	I 4.7
25	CS1_SS3-3	CS1_RC Sel s/w Position 3_CS1-B1	I 5.0
26	CS1_SS3-4	CS1_RC Sel s/w Position 4_CS1-B1	I 5.1
27	CS1_SS3-5	CS1_RC Sel s/w Position 5_CS1-B1	I 5.2
28	CS1_PB15	CS1_Saw On PB_CS1-B1	I 5.3
29	CS1_PB16	CS1_Saw Off PB_CS1-B1	I 5.4
30	LS_MPB1	LS_E-Stop PB_LS-B1	I 5.5
31	LS_KS1	LS_Control On Key s/w_LS-B1	I 5.6
32	HS2_SE1	HS2_Shut Off Valve1 East Limit s/w_HS2-JB4	I 5.7
33	CS1_MPB2	CS1_E-Stop PB from Post_CS1-P1	I 8.0
34	CS1_SS4	CS1_Auto Sel s/w_CS1-P1	I 8.1
35	CS1_PB17	CS1_Saw On PB_CS1-P1	I 8.2
36	CS1_PB18	CS1_Saw Off PB_CS1-P1	I 8.3
37	CS1_PB19	CS1_Clamp On PB_CS1-P1	I 8.4
38	CS1_PB20	CS1_Declamp On PB_CS1-P1	I 8.5
39	CS1_PB21	CS1_Saw Down PB_CS1-P1	I 8.6
40	CS1_PB22	CS1_Saw Up PB_CS1-P1	I 8.7
41	LS_RLY1	LS_All clamps released f/b_LS-B1-MCC	I 9.0
42	CS1_SS5	CS1_Saw Rapid Sel s/w_CS1-P1	I 9.1
43	CS1_PB24	CS1_Coolant On PB_CS1-P1	I 9.2
44	HS2_IPB1	HS2_Recirculation Pump On PB_LS-B1	I 9.3
45	HS2_PB1	HS2_Recirculation Pump Off PB_LS-B1	I 9.4
46	HS2_IPB2	HS2_Main Pump1 East On PB_LS-B1	I 9.5
47	HS2_PB2	HS2_Main Pump1 East Off PB_LS-B1	I 9.6
48	LS_SE1	LS_T-Table Up Limit s/w_LS-JB2	I 9.7
49	CS1_SE1	CS1_Vertical clamp Up limit s/w_CS1-JB1	I 12.0
50	CS1_SE2	CS1_Horizontal clamp Open limit s/w_CS1-JB1	I 12.1
51	CS1_SE3	CS1_Saw Up limit s/w_CS1-JB1	I 12.2
52	CS1_SE4	CS1_Saw Down limit s/w_CS1-JB1	I 12.3
53	CS1_SE5	CS1_Saw Rapid limit s/w_CS1-JB1	I 12.4
54	CS1_FD1	CS1_Horizontal Clamp Pressure s/w_CS1-JB1	I 12.5
55	LS_SS1-1	LS_RC Fwd Selector s/w_LS-B1	I 12.6
56	LS_SS1-2	LS_RC Rev Selector s/w_LS-B1	I 12.7
57	CS1_SE6	CS1_CES up Limit s/w_CS1-JB1	I 13.0

ANNEXURE-2 SUBSYSTEM INPUT LIST

S.NO	Description	FUNCTION	IO DESIGNATION
58	CS1_SE7	CS1_Length Stop Up limit s/w_CS1-JB3	I 13.1
59	CS1_SE8	CS1_T-Table Up limit s/w_CS1-JB1	I 13.2
60	CS1_SBE1	CS1_Length Stop FWD limit s/w_CS1-JB3	I 13.3
61	CS1_SE9	CS1_Length Stop REV limit s/w_CS1-JB3	I 13.4
62	HS2_SE2	HS2_Shut Off Valve2 West Limit s/w_HS2-JB4	I 13.5
63	LS_PB1	LS_T-Table Up PB_LS-B1	I 13.6
64	LS_PB2	LS_T-Table Down PB_LS-B1	I 13.7
65	CS2_MPB1	CS2_E-Stop PB_CS2-B1	I 16.0
66	CS2_KS1	CS2_Control On Key s/w_CS2-B1	I 16.1
67	LS_PB3	LS_CES Up PB_LS-B1	I 16.2
68	LS_PB4	LS_CES Down PB_LS-B1	I 16.3
69	CS2_PB1	CS2_Length Stop Up PB_CS2-B1	I 16.4
70	CS2_PB2	CS2_Length Stop Down PB_CS2-B1	I 16.5
71	HS2_IPB3	HS2_Main Pump2 West On PB_LS-B1	I 16.6
72	HS2_PB3	HS2_Main Pump2 West Off PB_LS-B1	I 16.7
73	CS2_PB3	CS2_Length Stop FWD PB_CS2-B1	I 17.0
74	CS2_PB4	CS2_Length Stop REV PB_CS2-B1	I 17.1
75	LS_PB5	LS_CES Fwd PB_LS-B1	I 17.2
76	LS_PB6	LS_CES Rev PB_LS-B1	I 17.3
77	CS2_PB5	CS2_Ejector 1 Up PB_CS2-B1	I 17.4
78	CS2_PB6	CS2_Ejector 1 Down PB_CS2-B1	I 17.5
79	LS_PB7	LS_Ejector Up PB_LS-B1	I 17.6
80	LS_PB8	LS_Ejector Down PB_LS-B1	I 17.7
81	CS2_PB7	CS2_RC On PB_CS2-B1	I 20.0
82	CS2_PB8	CS2_RC Off PB_CS2-B1	I 20.1
83	CS2_PB9	CS2_Setting_CS2-B1	I 20.2
84	CS2_PB32	CS2_TT Up PB_CS2-B1	I 20.3
85	CS2_SS1-1	CS2_RCS REV On Sel switch_CS2-B1	I 20.4
86	CS2_SS1-2	CS2_RCS FWD On Sel switch_CS2-B1	I 20.5
87	CS2_SS2-1	CS2_RC Sel s/w 1st position_CS2-B1	I 20.6
88	CS2_SS2-2	CS2_RC Sel s/w 2nd position_CS2-B1	I 20.7
89	CS2_SS2-3	CS2_RC Sel s/w 3rd position_CS2-B1	I 21.0
90	CS2_SS2-4	CS2_RC Sel s/w 4th position_CS2-B1	I 21.1
91	CS2_PB10	CS2_Saw On PB_CS2-B1	I 21.2
92	CS2_PB11	CS2_Saw Off PB_CS2-B1	I 21.3
93	CS2_PB12	CS2_Auto Start PB_CS2-B1	I 21.4
94	CS2_PB13	CS2_Auto Off PB_CS2-B1	I 21.5
95	CS2_PB14	CS2_Declamp PB_CS2-B1	I 21.6
96	CS2_PB15	CS2_Lamp Test PB_CS2-B1	I 21.7
97	LS_SE2	LS_CES Up Limit_LS-JB2	I 24.0
98	CS2_SE1	CS2_Length Stop Up Limit	I 24.1
99	CS2_SE2	CS2_Tilting Table Up Limit	I 24.2
100	LS_SBE3	LS_CES Fwd Limit s/w_LS-JB2	I 24.3
101	LS_SE3	LS_CES Rev Prox s/w_LS-JB2	I 24.4
102	CS2_SE3	CS2_Length Stop FWD Limit	I 24.5
103	CS2_SE4	CS2_Length Stop REV Limit	I 24.6
104	CS2_PB16	CS2_Rapid On_CS2-P1	I 24.7
105	CS2_SE5	CS2_Vertical clamp Limit	I 25.0
106	CS2_SE6	CS2_Horizontal clamp Open Limit	I 25.1
107	CS2_SE7	CS2_Saw Up Limit	I 25.2
108	CS2_SE8	CS2_Saw Down Limit	I 25.3
109	CS2_SE9	CS2_Saw Rapid Limit	I 25.4
110	2-PRESSURE SWITCH	CS2_Pressure switch	I 25.5
111	LS_IPB1	LS_RC On PB_LS-B1	I 25.6
112	LS_PB9	LS_RC Off PB_LS-B1	I 25.7
113	CS2_SS3-1	CS2_Spindle sel s/w pos1_CS2-B1	I 26.0
114	CS2_SS3-2	CS2_Spindle sel s/w pos2_CS2-B1	I 26.1

ANNEXURE-2 SUBSYSTEM INPUT LIST

S.NO	Description	FUNCTION	IO DESIGNATION
115	CS2_SS3-3	CS2_Spindle sel s/w pos3_CS2-B1	I 26.2
116	CS2_SS3-4	CS2_Spindle sel s/w pos4_CS2-B1	I 26.3
117	CS2_PB30	CS2_Spindle Up CMD_CS2-B1	I 26.4
118	CS2_PB31	CS2_Spindle Down CMD_CS2-B1	I 26.5
119		SPARE	I 26.6
120		SPARE	I 26.7
121		SPARE	I 27.0
122		SPARE	I 27.1
123		SPARE	I 27.2
124		SPARE	I 27.3
125		SPARE	I 27.4
126		SPARE	I 27.5
127		SPARE	I 27.6
128		SPARE	I 27.7
129	CS2_PB17	CS2_E-Stop PB_CS2-P1	I 28.0
130	CS2_PB18	CS2_Auto PB_CS2-P1	I 28.1
131	CS2_PB19	CS2_Saw On PB_CS2-P1	I 28.2
132	CS2_PB20	CS2_Saw Off PB_CS2-P1	I 28.3
133	CS2_PB21	CS2_Clamp/Auto Start PB_CS2-P1	I 28.4
134	CS2_PB22	CS2_Declamp On PB_CS2-P1	I 28.5
135	CS2_PB23	CS2_Saw Down PB_CS2-P1	I 28.6
136	CS2_PB24	CS2_Saw Up PB_CS2-P1	I 28.7
137	LS_SS3-1	LS_RC Sel s/w Position 1_LS-B1	I 29.0
138	CS2_PB25	CS2_Coolent On PB_CS2-P1	I 29.1
139	LS_SS3-2	LS_RC Sel s/w Position 2_LS-B1	I 29.2
140	LS_SS3-3	LS_RC Sel s/w Position 3_LS-B1	I 29.3
141	LS_SS3-4	LS_RC Sel s/w Position 4_LS-B1	I 29.4
142	LS_SS3-5	LS_RC Sel s/w Position 5_LS-B1	I 29.5
143	CS2_PB26	CS2_T-Table Up PB_CS2-B1	I 29.6
144	CS2_PB27	CS2_T-Table Down PB_CS2-B1	I 29.7
145	HS2_MPB2	HS2_E-Stop PB_HS2-P1	I 30.0
146	HS2_KS2	HS2_Control On key s/w_HS2-P1	I 30.1
147	HS2_PB4	HS2_Recirculation On PB_HS2-P1	I 30.2
148	HS2_PB5	HS2_Recirculation Off PB_HS2-P1	I 30.3
149	HS2_PB6	HS2_Pump1 East On PB_HS2-P1	I 30.4
150	HS2_PB7	HS2_Pump1 East Off PB_HS2-P1	I 30.5
151	HS2_PB8	HS2_Pump2 West On PB_HS2-P1	I 30.6
152	HS2_PB9	HS2_Pump2 West Off PB_HS2-P1	I 30.7
153	CS1_PB25	CS1_T-Table Up PB_CS1-B1	I 31.0
154	CS1_PB26	CS1_T-Table Down PB_CS1-B1	I 31.1
155	HS2_FBK1	HS2_Recirculation pump On Cont f/b_MCC 13	I 31.2
156	HS2_FBK2	HS2_Pump1 East On Cont f/b_MCC13	I 31.3
157	HS2_FBK3	HS2_Pump2 West On Cont f/b_MCC13	I 31.4
158	CS2_PB28	CS2_Ejector 2 Up_CS2-B1	I 31.5
159	CS2_PB29	CS2_Ejector 2 Down_CS2-B1	I 31.6
160	HS2_FT1	HS2_Temperature Cntrl_HS2-P1	I 31.7

ANNEXURE-2 SUBSYSTEM OUPUT LIST

S.NO	Description	FUNCTION	IO DESIGNATION
1	CS1_IL1	CS1_Tilting Table Up indn_CS1-B1	Q 32.0
2	CS1_IL2	CS1_Saw Motor On indn_CS1-B1	Q 32.1
3	CS1_IL3	CS1_Auto On lamp indn_CS1-B1	Q 32.2
4	CS1_IL4	CS1_Control On indn_CS1-B1	Q 32.3
5	LS_IL1	LS_RC Fwd On indn_LS-B1	Q 32.4
6	LS_IL2	LS_Control On indn_LS-B1	Q 32.5
7	CS1_IL5	CS1_Saw in Auto indn_CS1-P1	Q 32.6
8	CS1_IL6	CS1_Saw Motor On indn_CS1-P1	Q 32.7
9	LS_KA1	LS_RC Drv1 On_DRV1	Q 33.0
10	LS_KA2	LS_RC Drv1 Fwd_DRV1	Q 33.1
11	LS_KA3	LS_RC Drv1 Rev_DRV1	Q 33.2
12	LS_KA4	LS_RC Drv2 On_DRV2	Q 33.3
13	LS_KA5	LS_RC Drv2 Fwd_DRV2	Q 33.4
14	LS_KA6	LS_RC Drv2 Rev_DRV2	Q 33.5
15	LS_IL3	LS_RC Rev On indn_LS-B1	Q 33.6
16	LS_IL4	LS_Tilting Table Up indn_LS-B1	Q 33.7
17	CS1_KA1	CS1_CES Down Valve On_MCC13	Q 36.0
18	CS1_KA2	CS1_CES Fwd On_MCC13	Q 36.1
19	CS1_KA3	CS1_CES Rev On_MCC13	Q 36.2
20	CS1_KA4	CS1_Length Stop Down Valve On_MCC13	Q 36.3
21	CS1_KA5	CS1_Length Stop Fwd On_MCC13	Q 36.4
22	CS1_KA6	CS1_Length Stop Rev On_MCC13	Q 36.5
23	CS1_KA7	CS1_T-Table Up Valve On_MCC13	Q 36.6
24	CS1_KA8	CS1_T-Table Down Valve On_MCC13	Q 36.7
25	CS1_KA9	CS1_Coolant On_MCC13	Q 37.0
26	CS1_KA10	CS1_Saw Drive Cntl On_DRV7	Q 37.1
27	CS1_KA11	CS1_Ready to On to RAT_CS1-RAT	Q 37.2
28	CS2_KA1	CS2_RC Behind Saw Rev	Q 37.3
29	CS1_KA12	CS1_Guide roll Up_CS1-MCC13	Q 37.4
30	LS_KA7	LS_RC On indn_B1	Q 37.5
31	CS2_KA2	CS2_Guide roll up_CS2-MCC13	Q 37.6
32	CS2_KA3	CS2_Guide roll Down_CS2-MCC13	Q 37.7
33	LS_KA8	LS>Loading valve On_MCC13	Q 40.0
34	LS_KA9	LS_CES Up Valve On_MCC13	Q 40.1
35	LS_KA10	LS_CES Motor Fwd On_MCC13	Q 40.2
36	LS_KA11	LS_CES Motor Rev On_MCC13	Q 40.3
37	LS_KA12	LS_T-Table Up Valve On_MCC13	Q 40.4
38	LS_KA13	LS_T-Table Down Valve On_MCC13	Q 40.5
39	LS_KA14	LS_Ejector Up Valve On_MCC13	Q 40.6
40	LS_KA15	LS_Ejector Down Valve On_MCC13	Q 40.7
41	LS_KA16	LS_RC DOL1 Fwd_MCC14	Q 41.0
42	LS_KA17	LS_RC DOL1 Rev_MCC14	Q 41.1
43	CS1_KA13	CS1_RC DOL2 Fwd_MCC14	Q 41.2
44	CS1_KA14	CS1_RC DOL2 Rev_MCC14	Q 41.3
45	CS1_KA15	CS1_RC DOL3 Fwd_MCC14	Q 41.4
46	CS1_KA16	CS1_RC DOL3 Rev_MCC14	Q 41.5
47	CS2_KA4	CS2_RC DOL4 Fwd_MCC12	Q 41.6
48	CS2_KA5	CS2_RC DOL4 Rev_MCC12	Q 41.7
49	CS1_KA17	CS1_Saw 1st Speed_DRV7	Q 44.0
50	CS1_KA18	CS1_Vertical clamp down Valve On_CS1-JB2	Q 44.1
51	CS1_KA19	CS1_Vertical clamp Up Valve On_CS1-JB2	Q 44.2
52	CS1_KA20	CS1_Horizontal Clamp Valve On_CS1-JB2	Q 44.3
53	CS1_KA21	CS1_Horizontal Clamp Inc Pres Valve On_CS1-JB2	Q 44.4
54	CS1_KA22	CS1_Saw down Valve On_CS1-JB2	Q 44.5
55	CS1_KA23	CS1_Saw Up Valve On_CS1-JB2	Q 44.6
56	CS1_KA24	CS1_Saw Rapid Down Valve On_CS1-JB2	Q 44.7
57	CS1_KA25	CS1_Horizontal Declamp Valve On_CS1-JB2	Q 45.0

ANNEXURE-2 SUBSYSTEM OUPUT LIST

S.NO	Description	FUNCTION	IO DESIGNATION
58	CS1_KA26	CS1_Horizontal Declamp Pres Inc Valve On_CS1-JB2	Q 45.1
59	CS1_KA27	CS1_Guide Roll Down_CS1-MCC13	Q 45.2
60	CS1_DRV1	CS1_Saw 2nd Speed_DRV7	Q 45.3
61	HS2_IL1	HS2_Recirculation On indn_HS2-B1	Q 45.4
62	HS2_IL2	HS2_Pump1 East On indn_HS2-B1	Q 45.5
63	HS2_IL3	HS2_Pump2 West On indn_HS2-B1	Q 45.6
64	HS2_IL4	HS2_Oil Level OK indn_HS2-B1	Q 45.7
65	CS2_IL1	CS2_Control On indn_CS2-B1	Q 48.0
66	CS2_IL2	CS2_RC On indn_CS2-B1	Q 48.1
67	CS2_IL3	CS2_Saw in Operation indn_CS2-B1	Q 48.2
68	CS2_IL4	CS2_Tilting table Up indcn_CS2-B1	Q 48.3
69		SPARE	Q 48.4
70	CS2_IL7	CS2_Saw motor On indn_CS2-B1	Q 48.5
71	CS2_KA40	CS2_Saw Drive Cntl On_DRV8	Q 48.6
72		SPARE	Q 48.7
73		SPARE	Q 49.0
74	CS2_IL5	CS2_Saw motor On indcn_CS2-P1	Q 49.1
75	CS2_IL6	CS2_Saw in Auto indcn_CS2-P1	Q 49.2
76	CS1_RC ON	CS1_RC On indn_CS1_B1	Q 49.3
77	HS2_IL5	HS2_Control On indn_HS2-B1	Q 49.4
78	HS2_KA1	HS2_Recirculation Pump On_MCC13	Q 49.5
79	HS2_KA2	HS2_Pump1 East On_MCC13	Q 49.6
80	HS2_KA3	HS2_Pump2 West On_MCC13	Q 49.7
81	CS2_KA49	CS2_CES Down	Q 52.0
82	CS2_KA6	CS2_Length Stop Down	Q 52.1
83	CS1_KA28	CS1_T-Table Guide Up Valve On_MCC14	Q 52.2
84	CS1_KA29	CS1_T-Table Guide Down Valve On_MCC14	Q 52.3
85	CS2_KA7	CS2_Length Stop FWD	Q 52.4
86	CS2_KA8	CS2_Length Stop REV	Q 52.5
87	CS2_KA9	CS2_Tilting Table Up	Q 52.6
88	CS2_KA10	CS2_Tilting Table Down	Q 52.7
89	CS2_KA11	CS2_Group 1 FWD On	Q 53.0
90	CS2_KA12	CS2_Group 1 REV On	Q 53.1
91	CS2_KA13	CS2_Group 2 FWD On	Q 53.2
92	CS2_KA14	CS2_Group 2 REV On	Q 53.3
93	CS2_KA15	CS2_Group 3 FWD On	Q 53.4
94	CS2_KA16	CS2_Group 3 REV On	Q 53.5
95	CS2_KA17	CS2_Coolent On	Q 53.6
96	CS_LOADING VALVE ON	CS_Loading valve On	Q 53.7
97	CS2_KA18	CS2_Vertical Clamp Up	Q 56.0
98	CS2_KA19	CS2_Vertical Clamp Down	Q 56.1
99	CS2_KA20	CS2_Horizontal Clamp Close	Q 56.2
100	CS2_KA21	CS2_Horizontal Clamp Open	Q 56.3
101	CS2_KA22	CS2_Saw Down	Q 56.4
102	CS2_KA23	CS2_Saw Up	Q 56.5
103	CS2_KA24	CS2_Rapid Down	Q 56.6
104	CS2_KA25	CS2_Horizontal clamping press_CS2-JB1	Q 56.7
105	CS2_KA26	CS2_Horizontal declamping press_CS2-JB1	Q 57.0
106	CS2_KA27	CS2_Saw On CMD	Q 57.1
107	CS2_KA28	CS2_Saw 1st speed_DRV8	Q 57.2
108	CS2_KA29	CS2_Saw 2nd speed_DRV8	Q 57.3
109	2 RAISE/FALL DN		Q 57.4
110	CS2_KA30	CS2_Ejector1 Up Valve On_MCC13	Q 57.5
111	CS2_KA31	CS2_Ejector1 Down Valve On_MCC13	Q 57.6
112	CS2_KA32	CS2_Ejector2 Up Valve On_MCC13	Q 57.7
113	CS2_KA33	CS2_Ejector2 Down Valve On_MCC13	Q 60.0
114	CS1_KA30	CS1_RC Drv3 On_DRV3	Q 60.1

ANNEXURE-2 SUBSYSTEM OUPUT LIST

S.NO	Description	FUNCTION	IO DESIGNATION
115	CS1_KA31	CS1_RC Drv3 Fwd_DRV3	Q 60.2
116	CS1_KA32	CS1_RC Drv3 Rev_DRV3	Q 60.3
117	CS1_KA33	CS1_RC Drv4 On_DRV4	Q 60.4
118	CS1_KA34	CS1_RC Drv4 Fwd_DRV4	Q 60.5
119	CS1_KA35	CS1_RC Drv4 Rev_DRV4	Q 60.6
120	CS2_KA34	CS2_RC Drv5 On_DRV5	Q 60.7
121	CS2_KA35	CS2_RC Drv5 Fwd_DRV5	Q 61.0
122	CS2_KA36	CS2_RC Drv5 Rev_DRV5	Q 61.1
123	CS2_KA37	CS2_RC Drv6 On_DRV6	Q 61.2
124	CS2_KA38	CS2_RC Drv6 Fwd_DRV6	Q 61.3
125	CS2_KA39	CS2_RC Drv6 Rev_DRV6	Q 61.4
126	HS2_IL6	HS2_Control On indn_HS2-P1	Q 61.5
127	LS_KA18	LS_T-Table Guide Up Valve On_MCC13	Q 61.6
128	LS_KA19	LS_T-Table Guide Down Valve On_MCC13	Q 61.7
129	CS2_KA41	CS2_Spindle1 Up	Q 62.0
130	CS2_KA42	CS2_Spindle1 Down	Q 62.1
131	CS2_KA43	CS2_Spindle2 Up	Q 62.2
132	CS2_KA44	CS2_Spindle2 Down	Q 62.3
133	CS2_KA45	CS2_Spindle3 Up	Q 62.4
134	CS2_KA46	CS2_Spindle3 Down	Q 62.5
135	CS2_KA47	CS2_Spindle4 Up	Q 62.6
136	CS2_KA48	CS2_Spindle4 Down	Q 62.7
137		SPARE	Q 63.0
138		SPARE	Q 63.1
139		SPARE	Q 63.2
140		SPARE	Q 63.3
141		SPARE	Q 63.4
142		SPARE	Q 63.5
143		SPARE	Q 63.6
144		SPARE	Q 63.7