



Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

An ISO 9001
Company

ENQUIRY	Phone: +91 431 257 70 49 Fax : +91 431 252 07 19 Email : csguna@bheltry.co.in Web : www.bhel.com
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	Enquiry Number:	Enquiry Date:	Due date for submission of quotation:
	2710800002	16.09.2008	14.11.2008

You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order

Item	Description	Quantity	Delivery (Item required at BHEL on)
10	SRM Roll Grooving Machine as per the technical specification & commercial terms and conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	1 No.	30.10.2010

Note:

1. A pre-bid Meeting is proposed to be conducted with prospective vendors to discuss, under stand, clarify and interact w.r.t any clause of the tender document. Modifications, if any, would be carried out to the tender document based on the pre-bid discussion and this will form the basis for inviting techno-commercial offer and price bids subsequently.
2. Pre-Bid Meeting will be held on the date, time, and venue as given below
DATE OF PRE-BID MEETING: 30th September & 01st October 2008
TIME: 10.00 Hrs. IST onwards
**VENUE: Administrative Building Conference Hall,
BHEL, SSTP, Trichy - 620014**

BHEL commercial terms & conditions with Price Bid and Bank Guarantee formats along with technical specifications 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 "2710800002".



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CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

NOTICE INVITING FOR PRE-BID MEETING

TENDER NOTICE: No 2710800002 dated 16.09.2008

1. BHEL Tiruchirappalli has invited a Tender for supply of “SRM Roll Grooving Machine”
2. A pre-bid Meeting is proposed to be conducted with prospective vendors to discuss, understand, clarify and interact w.r.t any clause of the tender document. Modifications, if any, would be carried out to the tender document based on the pre-bid discussion and this will form the basis for inviting techno-commercial offer and price bids subsequently.
3. The preliminary tender document on which pre-bid discussions will be held is displayed in our Web Site www.bhel.com under the head Tender Notices as well as in <http://tenders.gov.in> (public sector units > Bharat Heavy Electricals Limited page under enquiry reference “2710800002”)
4. Prospective bidders are requested to study the preliminary tender documents and submit their request for clarification, if any, in the format shown below so as to reach Sr. Manager, MM ,Capital Equipment (csguna@bheltry.co.in) Phone +91 431 257 7049 positively before the date of Pre-Bid Meeting viz. 30th September 2008. Subsequently on 30th September & 01st October 2008 interested vendors can participate in the pre bid meeting and discuss the points of the specifications.

Sl. No	PART A / PART B of Tender Document and Commercial terms and conditions	Page No	Clause No	Subject	Query / Clarification Required

5. Prospective bidders can attend the Pre-Bid Meeting on the date and venue mentioned. They are requested to come prepared for stay at Tiruchirappalli for a



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period of 2 days. Pre-bid Meeting will be held in the presence of all the prospective bidders or their authorized representatives, in which case authorisation from the principals shall be produced prior to attending the meeting.

6. Tender documents, with modifications if any, consequent to the Pre-bid Meeting, will be posted in our web site by **15.10.2008** and the techno-commercial bid and price bid shall be submitted complying with the Tender documents hosted in the web after the Pre Bid Meeting.
7. Prospective bidders are requested to furnish the contact person's name, phone number, fax number, e-mail ID etc
8. Pre-Bid Meeting will be held on the date, time, and venue given below
DATE OF PRE-BID MEETING: 30th September & 01st October 2008
TIME: 10.00 Hrs IST onwards
VENUE: Administrative Building Conference Hall, BHEL, SSTP, Trichy – 620014.

<p>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</p>	<p>Yours faithfully, For BHARAT HEAVY ELECTRICALS LIMITED</p> <p>Sr. Manager / MM / Capital Equipment</p>
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PART – A

SECTION-I

QUALIFYING CRITERIA FOR SUPPLY OF SPECIAL PURPOSE CNC ROLL GROOVING MACHINE.

S. No.	PARTICULARS	VENDOR RESPONSE
1.0	a. 1. Vendor must be an Original Equipment Manufacturer (OEM) of ROLL GROOVING MACHINE (RGM). (or) 2. Vendor must be an Original Equipment Manufacturer (OEM) of SEAMLESS STEEL TUBE MILLS and installed the above ROLL GROOVING MACHINE (RGN), as a part of Seamless Steel Tube Manufacturing Mills supplied by them. b. Above OEM Vendor must have supplied and commissioned at least THREE RGMs for machining of SRM Roll-stands in a Seamless Steel Tube Manufacturing Mill. c. Above RGMs should be presently working satisfactorily for at least Two years after commissioning (on the date of opening of Tender).	
1.1	Following information should be submitted by the vendor about the Companies, where similar machines have been supplied, with specific reference to supplies made to any Customer in INDIA, for qualification of their Offer.	
1.1.1	a. Name of the Customer / Company where similar Machine installed.	
	b. Complete Postal Address of the Customer	
	c. Month and Year of commissioning	
	d. Application for which the Machine supplied.	
	e. Name, Designation , Phone, FAX, Email of the contact person of the Customer.	
	f. Performance Certificate from the Customer regarding satisfactory performance of supplied Machine.	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	VENDOR RESPONSE
2.0	Offers of those Vendors, who meet the above Qualifying Criteria (1.0 and 1.1) shall only be considered for further evaluation	
3.0	BHEL reserves the right to verify the information provided by Vendor. In case, any information provided by Vendor is found to be false / incorrect, Offer shall be rejected.	

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ROLL GROOVING MACHINE

SECTION – II

Vendors are requested to provide the following details

S. No.	PARTICULARS	VENDOR RESPONSE
1.0	Number of Years of Experience of the BIDDER/ VENDOR in the field of Design, Manufacture, Supply, Erection & Commissioning of RGMs / Seamless Steel Tube Mills..	
2.0	Number of RGMs supplied, installed and commissioned till date	
3.0	Number of RGMs supplied, installed and commissioned till date in the QUOTED MODEL	
4.0	Details of : a. SERVICE-AFTER-SALES set-up in India b. Address of Agents / Service Centre in India c. Address of Agents / Service Centre in Asian Region.	
5.0	Any Additional Data to supplement the manufacturing capability of the BIDDER for the Roll Grooving Machine.	

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ROLL GROOVING MACHINE

SECTION – III

Vendor has to comply with the following:

S. No.	REQUIREMENTS	VENDOR COMPLIANCE
1.0	BIDDER / VENDOR shall submit the offer in TWO PARTS – 1. Part-I .. Technical (Part – A & Part – B), Commercial and Un-Priced Price Bid 2. Part II .. Price Bid	
2.0	Offer shall contain a comparative statement of Technical Specifications given by BHEL and the Offer Details submitted by the Bidder, against each clause. Where details are required, a mere ‘CONFIRMED’ or ‘COMPLIES’ or ‘YES’ or ‘NO-DEVIATION’ or similar words in the Technical Comparative Statement may lead to disqualification of the Technical Offer.	
3.0	BIDDER / VENDOR shall assure continuous support for SPARES and SERVICE for TEN Years, from the date of commissioning of the equipment at BHEL Works.	
4.0	Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details of ‘Bought-Out-Items’ with copies of Product Catalogue and Selection Criteria	
5.0	Commercial Offer (to be submitted along with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation	
6.0	BIDDER has to indicate the Country of Origin for the supply of equipment.	
7.0	Reference List of Customers shall be accompanied with the details (Phone Number /E-Mail ID) of the CONTACT PERSON for cross reference by BHEL if required.	

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PART - B**TECHNICAL SPECIFICATION FOR SUPPLY OF SPECIAL PURPOSE CNC ROLL-GROOVING MACHINE**

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
1.0	PREAMBLE		
1.0.1	SSTP/BHEL/TRICHY Seamless Steel Tube Plant (SSTP) is manufacturing Seamless Steel Tubes and Pipes – both Hot Finished and Cold Drawn in Carbon and Low Alloy Steel grades in a wide range of sizes. It is catering to the need of Boiler Tubing and Piping, Petrochemical, Oil & Gas and many more industrial segments.		
1.0.2	HOT MILL/SSTP Hot mill uses classic Push Bench process with Rotary Hearth Furnace, Vertical Piercing Press, Elongator and Push Bench - to make shell out of billet. Down stream, we have Reeler & Extractor to loosen and to remove Mandrel from the Shell and further closed end of the shell is cut in Hot Saw. Further it is reheated to around 930-1000 Deg. C and rolled in Stretch Reducing Mill (SRM) to make Hollows and Hot Finished Tubes & Pipes.		
1.0.3	SSTP now proposes to install a Special Purpose CNC Roll Grooving Machine to meet the new caliber machining requirements..		

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
2.0	PURPOSE:		
2.0.1	Special Purpose CNC Machine shall groove/machine, by using ceramic / carbide tipped tools, to the required profile of the three Rolls assembled at 120 Deg. apart, in a rectangular type Roll-Stands. These Roll Stands are used in Stretch Reducing Mill (SRM) for manufacture of Seamless Steel Tubes.		
2.1.	Product Range(of SRM):		
2.1.1	Outside Diameter -- Min.	31.80 mm.	
2.1.2	Outside Diameter -- Max.	133.00 mm.	
2.1.3	Wall Thickness – Min.	3.20 mm.	
2.1.4	Wall Thickness – Max.	14.00 mm.	
3.0	MACHINE SPECIFICATION		
3.1.	Roll Material to be machined :: 1. SG Iron Rolls (44 HRC) and/or 2. Steel Rolls (52 to 54 HRC)	Vendor to confirm	
3.2.	Type of Caliber (Profile) to be machined.:: 1. Round, 2. Oval, 3. Round with Tangential 4. Round with Parabolic <u>To facilitate for all 4 above :</u> 1. Side Relief 2. Flat Groove 3. Edge Rounding.	Vendor to confirm	
3.3.	Caliber to be grooved in 300mm Nominal diameter Rolls (3 Rolls assembled in stands 120 deg. apart.).	31.80 mm - 100.00 mm.	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
3.4.	Caliber to be grooved in 380mm Nominal diameter Rolls (3 Rolls assembled in stands 120 deg. apart.).	100.00 mm - 143.00 mm.	
3.5	Tolerance on Caliber (Roll Pass Ø) – for both 300 and 380 stands.	+/- 0.04 mm.	
3.6.	Roll Diameter deviation within three Rolls of the Stand.	Max. 0.20 mm.	
3.7	Roll Speed range	60 rpm to 400 rpm	
3.8	Cutting Speed range	90 m/min to 180 m/min	
3.9	Feed Rate	0 to 0.5 mm/rev.	
3.10	Rapid Travel of Tool Carriage	Max. 10 m/min.	
3.11	Depth of Cut	0.2 mm to 2.00 mm.	
3.12.	Maximum weight of Stand loaded on the Machine for machining.	900 Kg.	
3.13	Surface Finish of Roll after grooving	Ra 1.6 microns.	
3.14	Rating and Control System of electric Motors for Main Drive.	Vendor to specify	
3.15	Auxiliary Drive and Control System, if any, with details	Vendor to confirm	
3.16	Control System for three axis motion	Vendor to specify	
3.17	Machine shall have provision for aligning the Roll-Stand in all axis..	Vendor to Confirm	
3.18	Machine shall have provision for Hydraulic Clamping of Roll-Stand in all axis.	Vendor to Confirm	
3.19	Tool Arbors suitable for holding three tips of each of Diameter 12.7mm / 19.05 mm – to cover entire range of product-mix. (Annexure-I).	Vendor to specify	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
3.20	Provision for simultaneous loading, unloading and machining of Roll-Stands (at any point of time :: 1. One Roll-Stand shall be in loading condition 2. One Roll-Stand shall be in un-loading condition 3. One Roll-Stand shall be under machining process.)	Vendor to confirm	
3.21	4-Position Tool Turret size	Vendor to specify.	
3.22	Suitable Chip Conveyor	Vendor to specify	
3.23	Pendent Operator Panel-Unit (with complete details) for : 1. Job Setting 2. Operational Purposes.	Vendor to specify	
4.0	MACHINE LIGHTS:		
4.1	Machine Lights (CFL) with sufficient illumination covering complete working area should be provided for clear visibility.	Vendor to Confirm	
5.0	UPS FOR CNC SYSTEM:		
5.1	UPS of 30 minutes rating for CNC system with :: 1. In-built Cooling 2. Charge Status Display.	Vendor to Specify	
6.0	SUB SYSTEM OF THE MACHINE		
6.1	HYDRAULICS		
6.1.1	Hydraulic system should be centralized and separate from the machine. Hydraulic Tank shall preferably be located at floor level. All hydraulic pipelines to be neatly laid out	Vendor to Confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
6.1.2	Brand/Make of products. Preferable makes :: 1. Bosch Rexroth 2. Vickers Sperry / 3. Denison / 4. Parker Hannfin (For other makes, complete details to be furnished)	Vendor to specify	
6.1.3	Hydraulic Hose end-fittings shall be of suitable material with female swivel nut and 24 deg cones. Hoses shall preferably be of GATES make. (For other makes, complete details to be furnished).	Vendor to specify	
6.1.4	Hydraulic Circuits shall be designed with minimum number of control valves and to suit oil of ISO VG 68 only. Also minimum number of check-points to be provided, wherever pressure is required to be read for setting and trouble-shooting. MINIMESS Pressure Gauge - 1 No with Connecting Hose to be provided.	Vendor to confirm	
6.1.5	Solenoids shall be provided with Indication Lamp / LED. Control voltage for all solenoid operated valves.	24 V DC	
6.1.6	Filtration System.	Vendor to specify	
6.1.7	Hydraulic Failure indication	Vendor to specify	
6.1.8	Hydraulic Pump capacity (flow / pressure)	Vendor to specify	
6.1.9	Pump Motor Power in kW	Vendor to specify	
6.1.10	Hydraulic Tank Capacity	Vendor to specify	
6.1.11	Each Pump shall have an independent Motor. .	Vendor to specify	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
6.1.12	All Hydraulic Pumps for the Power Pack should be loaded only during requirement and should run unloaded during idle running.	Vendor to Confirm	
6.1.13	All Hydraulic Pumps / Motors shall have stand-by Pump / Motor.	Vendor to Confirm	
6.1.14	Heat Exchanger to be provided for cooling the Hydraulic Oil.	Vendor to specify	
6.1.15	Oil High Temperature Alarm and safety interlock	Vendor to Confirm	
6.1.16	Oil Low Level Alarm and safety interlock	Vendor to Confirm	
6.2	PNEUMATIC SYSTEM:		
6.2.1	Pneumatic operated elements of the machine shall work efficiently with BHEL Compressed Air supply at a pressure of 4 to 6 Kg / cm²	Vendor to confirm	
6.2.2	BHEL will provide compressed air. Vendor shall provide suitable 1. Filter-Regulator-Lubrication (FRL) unit 2. Drier.	Vendor to confirm	
6.2.3	Volume (flow) of Compressed Air required for the machine	Vendor to Specify	
6.3	LUBRICATION :		
6.3.1.	Oil Lubrication and Grease Lubrication arrangement shall be provided for all rotating and moving components.	Vendor to Confirm	
6.4	ELECTRICAL:		
6.4.1.	BHEL shall provide power supply : 415V +/-10% 50Hz +/- 6% 3 Phase AC (3 wire system without neutral)	Vendor to note.	
6.4.2	Control Voltage :: 230V AC from separate Isolation Control Transformer of suitable capacity with MCB protection	Vendor to confirm.	
6.4.3	All Solenoids and PLC system :: 24V DC – Two separate sources shall be used for Solenoid and PLC.	Vendor to confirm	

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S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
6.4.4	Interposing relays shall be provided between PLC Output and field elements. Rating : 24V DC, 2A.	Vendor to confirm	
6.4.5	Tropicalization: All electrical / electronic equipment shall be tropicalized.	Vendor to confirm	
6.4.6.	All electrical & electronic control cabinets & panels shall be :: 1. Dust proof 2. Vermin proof	Vendor to confirm	
6.4.7.	All electrical components in the cabinets shall be mounted on DIN Rail	Vendor to confirm	
6.4.8	All electrical and electronic panels including operator panels shall be provided with :: 1. Fluorescent Lamps for sufficient illumination 2. Power Receptacles of 230Volts, 5 / 15 Amp AC. 3. All adapters /receptacles should have compatibility with Indian equivalents.	Vendor to confirm	
6.4.9	Motors & other electrical components shall conform to IEC or Indian Standards	Vendor to confirm	
6.4.10	All Electric enclosures shall have IP 43 protection	Vendor to confirm	
6.4.11	Motors : Siemens / ABB make or such reputed makes only conforming to IS / IEC Standards (Vendor shall indicate make and type in the Offer)	Vendor to confirm	
6.4.12	Drives : Siemens / Allen Bradley / ABB make or such reputed makes only conforming to IS / IEC Standards (Vendor shall indicate make and type in the Offer)	Vendor to Confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
6.4.13	CNC : Fanuc / Siemens make or such reputed makes only conforming to IS / IEC Standards (Vendor shall indicate make and type in the offer)	Vendor to Confirm	
6.4.14	PLC : Siemens / Fanuc / Allen Bradley / ABB make or such reputed makes only conforming to IS / IEC Standards (Vendor shall indicate make and type in the offer)		
7.0	FAULT DIAGNOSTIC SYSTEM :		
7.1	Diagnostic system with required hardware and software shall be supplied and installed on the equipments. This shall include customized auto-diagnostic system with supporting hardware and software, which shall indicate detailed cause & remedy for the faults related to mechanical and electrical maintenance.	Vendor to confirm	
8.0	SAFETY ARRANGEMENTS:		
8.1	Following safety features in addition to other standard safety features should be provided on the equipments.	Vendor to confirm	
8.2	Equipments shall have adequate and reliable safety interlocks / devices to avoid damage to the equipment, work piece and the operator due to malfunctioning or mistakes. Equipments functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages shall be made available.	Vendor to specify	
8.3	All the pipes, cables etc. on the equipment shall be well supported and protected, which shall not create any hindrance to movement of equipment operators.	Vendor to Confirm	

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S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
8.4	All the rotating parts used on equipments shall be Statically & Dynamically balanced to avoid undue vibrations and suitably guarded.	Vendor to Confirm	
8.5	Emergency Switches at suitable locations shall be provided as per International Norms.	Vendor to Confirm	
8.6	All lubricated parts shall have provision for collecting the used Lubrication Oil from equipments and preventing them from spilling over on to the ground.	Vendor to Confirm	
8.7	Pressure relief valve in hydraulic circuit	Vendor to Confirm	
9.0	ENVIRONMENTAL PERFORMANCE OF THE EQUIPMENT: Equipment shall conform to following factors related to environment:		
9.1	Maximum noise level shall be 85 dB (A) at normal load condition, one meter away from the equipment with correction factor for background noise. This will be measured as per International Standards like DIN 45635-16. Vendor to demonstrate compliance to noise level, if required.	Vendor to Confirm	
9.2	If any other safety / environmental protection enclosure are required, same shall be provided in the equipment.	Vendor to confirm	
10.0	PRODUCTION TOOLING:		
10.1	List of tools required for normal operation of machine for one year to be provided (with the detailed Drawings) for machining the profile to cover entire range of SSTP product-mix. (Unit-Rate for each item to be indicated in the Price Bid – optional for ordering).	Vendor to Specify	
10.2	Expected Life of each tool to be indicated.	Vendor to specify.	

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S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
11.0	TOOLS FOR ERECTION, OPERATION & MAINTENANCE:		
11.1	Vendor shall bring Special Tools and Equipments required for erection of the proposed equipments. List of such Tools to be furnished along with the Offer.	Vendor to confirm	
11.2	Vendor shall bring Any Test equipments required for checking & alignment of the equipments, components etc.	Vendor to confirm.	
11.3	Vendor shall bring Laser and optical equipments, if required, for checking, aligning and positioning.	Vendor to Specify	
11.4	Vendor shall furnish a List of Tools required for normal Operation & Maintenance of the proposed equipments.	Vendor to Specify	
12.0	SPARES:		
12.1	Recommended & Mandatory Spares of Mechanical, Hydraulic, Electrical and Electronic items required for 2 years of trouble free operation on three shifts basis. (Unit Rate of each item of spare to be indicated in Price Bid – optional for ordering)	Vendor to specify	

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S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
12.2	<p>Items other than Recommended / Mandatory Spares.</p> <p>Vendor to specify Technical details (along with details of Recommended Vendors) for the following:</p> <p>a) Mechanical & Hydraulic Spares: All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses, etc.</p> <p>b) Electrical /Electronic Spares: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Encoders, Optical Sensors, Spares for PLC (I/O card, Digital to Analog card, CPU card, Power Supply Board, etc.), Display unit, HMI , Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives, etc.</p>	Vendor to Specify	
12.3	<p>Vendor to confirm that Spares for Equipment and Accessories shall be made available for at least ten years after commissioning of the Equipments.</p> <p>If any Part and/or Control is likely to become obsolete during the above 10 year period, vendor shall inform BHEL sufficiently in advance and provide all necessary Technical Details and Drawings of parts / details of spares & Source of Vendors, to enable BHEL to procure these in advance, if required</p>	Vendor to confirm	
12.4	Vendor to provide complete List of Spares, along with Item Part No. / Detailed Specification / Type / Model, Name & Address of the Sub-Vendors.	Vendor to confirm	

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S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
13.0	DOCUMENTATION:		
13.1	<p>Vendor to furnish Documentation, as listed below (13.1 to 13.13) ::</p> <p>a. <u>Along with Equipments :</u> One set (Hard copy) in English language.</p> <p>b. <u>After completion of Erection and Commissioning :</u></p> <ol style="list-style-type: none"> Three sets of as-built-Drawings and Updated Manuals (Hard Copy) shall be supplied - including Bought-out items. One set of above Documents in Soft-copy. Licensed software for PLC Programming. Programme UPLOAD/DOWNLOAD device for PLC/CNC is to be provided. 	Vendor to confirm	
13.2	Operating Manuals of Equipment	Vendor to confirm	
13.3	Programming Manuals of Equipment	Vendor to confirm	
13.4	<p>Detailed Maintenance Manuals of equipment with all Drawings of equipment / Tool-assemblies / Sub-assemblies / Parts, including Electrical / Pneumatic/ Hydraulic circuit-diagrams.</p> <p>All Assembly/ Sub Assembly Drawings shall also be supplied with the part list.</p>	Vendor to confirm	
13.5	Maintenance, Interface & commissioning manuals for CNC system, & Feed Drives.	Vendor to confirm	
13.6	Catalogues, O&M Manuals of all bought-out items including drawings, wherever applicable.	Vendor to confirm	

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13.7	Detailed specification of all :: 1. Rubber items 2. Hydraulic items 3. Lub. fittings	Vendor to confirm	
13.8	PLC program printouts with comments in English (after commissioning the equipments).	Vendor to confirm	
13.9	1. CNC data on CD / Flash Memory 2. PLC program on CD / Flash Memory 3. PLC data on CD / Flash Memory	Vendor to confirm	
13.10	Vendor shall submit complete Master List of parts used in the machine.	Vendor to confirm	
13.11	All the above documentation on CD	Vendor to confirm	
13.12	General arrangement Drawing & foundation drawing – 3 Copies	Vendor to confirm	
13.13	Drawings for Tools (Hard copy and soft copy)	Vendor to Confirm	
14.0	TRAINING:		
14.1	BHEL shall depute two of its Engineers for inspection and training at Vendor works. Vendor shall train BHEL Engineers in Operation / Maintenance (Mechanical, Electrical/ Electronics system and CNC system) of the machine for a period of 10 days. (Total 20 man-days).	Vendor to confirm	
14.2	Vendor shall impart training to BHEL Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Electrical/ Electronics and CNC System) after the commissioning of the Machine at BHEL works for not less than 10 working days.	Vendor to confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
14.3	The training shall include specialized coaching in 1. Safety 2. Setting and Operation of the Equipments 3. Trouble-Shooting, 4. Software Application 5. All special features of the equipment 6. Electrical / Mechanical / Electronics systems 7. CNC Programming machine operation 8. PLC Programming	Vendor to Confirm	
14.4	Airfare, Boarding & Lodging for the Trainees (deputed to Vendor Works) shall be borne by BHEL.	Vendor to note	
14.5	Vendor shall arrange Competent English speaking experts, during training for satisfactory & effective training of BHEL personnel	Vendor to Confirm	
15.0	FOUNDATION:		
15.1	Vendor shall submit the Preliminary Layout Drawing for BHEL approval, within one month from the date of Letter of Intent (LOI), taking into consideration of other existing Equipments / Layout at SSTP.	Vendor to Confirm	
15.2	Vendor shall submit Foundation details, viz. Static / Dynamic Load details, etc. and Final Layout Drawings, within three months after BHEL approval of Preliminary Layout Drawings.		

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
15.3	Layout shall consist of all requirements pertaining to complete equipment, including space requirement for any other accessories. BHEL shall design and construct complete Foundation for the equipments as per the recommendation of Vendor. Vendor shall also indicate detailed specifications of Grouting Compounds, Grouting Procedure, etc., for Foundation Bolts of the equipments.		
15.4	List of Foundation / Anchorage material.	Vendor to specify	
16.0	ERECTION & COMMISSIONING		
16.1	Vendor to take full responsibility for Supervision of the Erection, Start up, Testing and Commissioning of Equipments, along with accessories. BHEL shall provide Service requirements, like Power, Air & Water, Crane and Personnel for helping	Vendor to confirm	
16.2	Vendor to prove out the specified products (Ref: 19.4), as per the Tender Specification on :: 1. rate of production 2. product quality.	Vendor to confirm	
16.3	Vendor shall bring Tools, Test Mandrels, Instruments and other necessary Equipment, including Laser / Optical equipments, required to carry out all Erection and Commissioning activities.	Vendor to confirm	
16.4	Vendor shall bring (on returnable basis) Spares / Tools required for commissioning of the equipment within stipulated time..	Vendor to confirm	
16.5	Vendor shall furnish a Schedule of Erection and Commissioning along with offer.	Vendor to confirm	
16.6	Vendor shall furnish Charges, Duration, Terms & Conditions for Erection & Commissioning (with break-up details), along with offer.	Vendor to confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
17.0	ACCURACY TESTS		
17.1	GEOMETRICAL ACCURACY		
17.1.1	Geometrical Accuracy Tests shall be in accordance with applicable standard recommended by the Vendor. Vendor shall submit Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, along with the offer.	Vendor to confirm	
17.1.2	All other accuracies shall conform to Vendors Test chart.	Vendor to confirm	
17.1.3	Vendor shall demonstrate all the above accuracies to BHEL during :: 1. Pre-acceptance at Vendors works 2. Erection & Commissioning at BHEL Works.	Vendor to confirm	
17.2	POSITIONING ACCURACY & REPEATABILITY:		
17.2.1	Positioning accuracy	±0.016 mm	
17.2.2	Repeatability	± 0.008 mm	
17.3	Vendor shall demonstrate all the above accuracies to BHEL during :: 1. Pre-acceptance at Vendors works 2. Erection & Commissioning at BHEL Works.	Vendor to confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
18.0	AMBIENT CONDITIONS & THERMAL STABILITY:		
18.1	Total equipment(s) shall work trouble-free and efficiently under following operating conditions and shall deliver specified accuracies. <u>Power Supply:</u> Voltage: 415 V +/- 10%, Frequency: 50 Hz +/- 3%, No. of phases : 3 <u>Equipments shall be suitable for ::</u> Ambient Temperature :: 45 ° C Relative Humidity :: 90 % (However, both do not occur simultaneously).	Vendor to confirm	
18.2	Weather conditions are tropical, Atmosphere is dust laden.	Vendor to note	
18.3	Vendor to ensure trouble free operation and Thermal Stability of the equipments, keeping in view of the specified ambient conditions and accuracy requirements of BHEL.	Vendor to confirm	
18.4	Equipments, including attachments and accessories, shall be suitable for continuous operation to its full capacity for 24 x 7x 365.	Vendor to confirm	
19.0	PROVE-OUT OF BHEL COMPONENTS:		
19.1	Prove-out/ Performance trial shall be conducted at BHEL for assessing the Productivity, Accuracy, Surface Finish, etc.	Vendor to confirm	
19.2	For conducting the prove-out/Performance trial, Vendor shall provide :: 1. RAAN 120700 (Dia 12.70 mm) - 30 Nos. 2. RAAN 190700 (Dia 19.05 mm) - 30 Nos. Above shall be provided with suitable holders and cartridges to match all range of roll-passes.	Vendor to confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
19.3	Vendor shall establish an output of at least 6 stands in 8 hour shift. (Machining of stand means - machining a stand from one caliber to another, say diameter 42.4 mm to diameter 48.3 mm. Caliber sizes are enclosed in Annexure - II)	Vendor to confirm	
19.4	Following sizes shall be proved by conducting performance trials: a. 31.8 mm b. 44.5 mm c. 51.0 mm d. 63.5 mm e. 88.9 mm f. 114.0 mm g. 127.0 mm	Vendor to confirm	
20.0	MACHINE ACCEPTANCE:		
20.1	Tests/Activities to be carried out on the machine at Vendor Works in presence of BHEL Engineers before dispatch of Roll Grooving Machine:		
20.1.1	Geometrical Accuracies as per applicable Standard Test Chart recommended by the Vendor	Vendor to confirm	
20.1.2	Positioning Accuracy and Repeatability as per specification	Vendor to confirm	
20.1.3	Demonstration of all features of the Machine, Control system & Accessories	Vendor to confirm	
20.2	Tests / Activities to be carried out at BHEL works while commissioning the machine:		
20.2.1	Geometrical accuracies as per applicable Standard Test Chart recommended by the Vendor	Vendor to confirm	
20.2.2	Positioning accuracy and Repeatability as per specification	Vendor to confirm	
20.2.3	Full Load Test to demonstrate the maximum capacity of the machine.	Vendor to confirm	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
20.2.4	Demonstration of all features of the Machine, Control System & Accessories to the satisfaction of BHEL for efficient and effective use of the Machine	Vendor to confirm	
20.2.5	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to confirm	
20.2.6	Prove-out trials as per Clause 19.0	Vendor to confirm	
20.2.7	After Prove-out, one week supervision by Vendor for independent operation of Machine by BHEL. (to run concurrently with training at BHEL)	Vendor to confirm	
21.0	PACKING:		
21.1	Vendor shall arrange to provide Sea worthy, rigid, pest & vermin proof and phyto-treated/certified packing for all items / complete equipments, all accessories, to avoid any damage / loss in transit. When equipments are dispatched in containers, all small / loose items shall be suitably packed in boxes and put inside the Containers.	Vendor to confirm	
22.0	GUARANTEE:		
22.1	24 months from the date of acceptance of the machine at BHEL Works.	Vendor to confirm	
23.0	GENERAL:		
23.1	Machine Model No.	Vendor to specify	
23.2	Total Connected Load (KVA):	Vendor to specify	
23.3	Floor area required (Length, Width, Height) for complete Machine & Accessories	Vendor to specify	
23.4	Machine Lubrication Automatic Centralized Lubrication System.	Vendor to specify	

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ROLL GROOVING MACHINE

S. No.	PARTICULARS	BHEL SPECIFICATIONS	BIDDER's OFFER [With Complete Technical Details]
23.5	Painting of Machine / Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)	Vendor to specify	
23.6	Total weight of the Machine	Vendor to specify	
23.7	Weight of heaviest part of Machine	Vendor to specify	
23.8	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to specify	
23.9	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to specify	
23.10	Vendor to furnish Detailed Catalogues, Sketch / Photographs of the Machine and accessories / attachments, along with the Offer.	Vendor to confirm	
23.11	Hydraulic, Pneumatic & 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	
23.12	All feedback systems & field sensors, limit switches, proximity switches, pressure switches, temperature controllers, should be for heavy duty application and wired up with flexible PVC insulated screened cables. All field elements shall have easy accessibility for maintenance.	Vendor to confirm	
23.13	Vendor shall furnish clear and legible General arrangement drawing showing the machine & associated systems with salient dimensions.	Vendor to Confirm	
23.14	The supplier should describe in the offer any additional optional accessories that are likely to enhance the productivity of the machine.	Vendor to Specify	

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ROLL GROOVING MACHINE

Price schedule

S. No.	PARTICULARS	PRICE
1	ROLL GROOVING MACHINE	
2	Set of Tools required for the product range indicated in Annexure - I (Item-wise breakup of each Tool is to be furnished)	
3	Set of Maintenance Spares for two-years trouble-free operation (Item-wise break up price to be furnished)	
4	OPTIONAL : Any other accessories, which shall enhance Performance / Productivity of the Machine.	

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Annexure-I

OUTPUT PRODUCT SIZES (SRM)				
CARBON STEEL TUBES				
SL No	OD (mm)	Finished tube Wall Thickness (mm)	Spec	Length of Single tube (Mtr)
1	26.7	2.87, 3.91, 5.56	Gr B	6
2	31.8	3.2, 3.5, 4, 4.5, 6	A1	10, 12.15
3	33.4	3.38, 4.55, 6.35, 9.09	GrB	6
4	38.1	3, 3.2, 3.6, 4, 4.5, 5, 5.3, 6.1	A1,C	10, 11, 12.15, 12.8, 13.8
5	44.5	4, 4.5, 5, 7.1, 9, 11	A1,C	12.15
6	47.63	3.4, 3.6, 5, 8.6, 10, 11	GrC	12.15
7	48.3	3.68, 5.08, 7.14	GrB	6
8	51	11	A1,C	11.5, 12.15
9	54	4, 4.5, 5, 6, 9	A1,C	10, 11.5, 12.15
10	57	6, 6.6, 8.8	A1,C	12.15
11	60.3	3.91, 5.54, 8.70, 9.4, 11.07	GrB, C	6, 7.5, 11, 11.5, 12.15
12	63.5	3.66, 4, 4.8, 5.6, 6, 6.3, 7.1, 10.16, 13	SA192, A1, GrC	10, 11.5, 12.15
13	73	5.16, 7.01, 9.53	GrB	6,7
14	76.1	3.2, 3.6, 4, 4.5, 6.3, 7.1, 12.5	SA192, A1, GrC	11, 11.5, 12.15
15	82.5	3.6, 4, 4.5	SA192, A1	8
16	88.9	4, 5.49, 6.3, 7.62, 11.13, 12.5	GrB	6.5, 7.5, 9.5
17	108	4, 8, 12.5	A1, GrB	6, 10, 11.5
18	114.3	4, 6.02, 8.56, 11.13	GrB	7, 9, 10, 11, 11.5
19	127	4, 8, 12.5	GrB	7, 9, 10, 11, 11.5
20	133	4, 10, 13	GrB, GrC	5.5, 6.5, 8, 9

ALLOY STEEL TUBES				
SI No	OD (mm)	Finished tube Wall Thickness (mm)	Spec	Length of Single tube (Mtr)
1	28.58		T12	11, 11.50, 12.15
2	31.75	5.59	T12	11, 11.50, 12.15
3	38.1	3.6, 4.57, 8.13	T11, T12, T22	11, 11.50, 12.15
4	44.5	4.5, 5, 5.60, 6.1, 7.16, 8, 9, 10.8	T12, T91, T11, T22	11, 11.50, 12.15
5	47.63	4.5, 5, 6, 6.6, 8.6, 10, 8	T11, T22	11, 11.50, 12.15
6	51	4, 4.5, 5, 5.6, 6.3, 7.1, 6.43, 12, 9, 10, 11	T91, T11, T22	11, 11.50, 12.15
7	54	4, 4.5, 5, 6.3, 12	T1, T11	11, 11.50, 12.15
8	57	6, 8	T11,T22	11, 11.50, 12.15
9	63.5	4, 4.2, 4.5, 5, 6.3, 7.1, 12, 7.62	T11, T12, T22, T91	11, 11.50, 12.15

Annexure - II

<u>Caliber sizes for Roll Grooving</u>	
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(Page No. 1 of 6)

		in mm					(A/B)	mm			
SI. No.	STAND No.	PASS (Dia)	A	B	RR	RHO (%)	ALFA	WD	WA	2 x B	2 x A
Basic Standards for Dia 42.40 and 48.30 mm.											
0	0	132.00	-	-	-	-	-	-	-	-	
1	S 380	127.38	65.24	62.14	380	3.50	1.0499	135.02	36.66	124.28	130.48
2	S 480	121.01	62.27	58.74	380	5.00	1.0601	129.96	39.98	117.48	124.54
3	S 580	113.50	58.67	54.83	380	6.21	1.0700	123.54	42.76	109.66	117.34
4	MO 680	106.17	54.84	51.33	380	6.46	1.0684	115.51	41.72	102.66	109.68
5	MO 780	100.22	51.82	48.40	380	5.60	1.0707	109.49	41.91	96.80	103.64
6	MO 880	94.70	48.86	45.84	380	5.51	1.0659	102.95	39.91	91.68	97.72
7	S 980	89.49	46.16	43.33	380	5.50	1.0653	97.32	39.18	86.66	92.32
8	S 1080	84.57	43.60	40.97	380	5.50	1.0642	91.92	38.25	81.94	87.20
9	S 900	79.92	41.19	38.73	300	5.50	1.0635	86.51	31.41	77.46	82.38
10	S 1000	75.52	38.90	36.62	300	5.51	1.0623	81.70	30.69	73.24	77.80
11	S 1100	71.37	36.75	34.62	300	5.50	1.0615	77.22	30.08	69.24	73.50
12	S 1200	67.45	34.72	32.73	300	5.49	1.0608	72.98	29.45	65.46	69.44
13	S 1300	63.74	32.80	30.94	300	5.50	1.0601	68.96	28.82	61.88	65.60
14	S 1400	60.24	30.99	29.25	300	5.49	1.0595	65.17	28.19	58.50	61.98
15	S 1500	56.92	29.27	27.65	300	5.51	1.0586	61.55	27.48	55.30	58.54
16	S 1600	53.79	27.65	26.14	300	5.50	1.0578	58.14	26.79	52.28	55.30
17	S 1700	50.83	26.12	24.71	300	5.50	1.0571	54.93	26.13	49.42	52.24
18	S 1800	48.03	24.67	23.36	300	5.51	1.0561	51.86	25.39	46.72	49.34
FINISHING STAND CALIBERS FOR DIA 38.00 MM.											
1	SN 1805	41.43	21.25	20.18	300	5.45	1.0530	44.61	23.39	40.36	42.50
2	SN 1806	39.36	20.00	19.36	300	5.00	1.0331	41.21	17.99	38.72	40.00
3	SN 1807	38.38	19.30	19.08	300	2.49	1.0115	39.00	10.45	38.16	38.60
4	SN 1808	38.19	19.12	19.07	300	0.50	1.0026	38.33	4.96	38.14	38.24
FINISHING STAND CALIBERS FOR DIA 42.40 MM.											
1	S 1801	45.63	23.38	22.25	300	5.00	1.0508	48.93	23.69	44.50	46.76
2	S 1802	43.80	22.33	21.47	300	4.01	1.0401	46.28	20.66	42.94	44.66
3	S 1803	43.31	21.87	21.44	300	1.12	1.0201	44.51	14.47	42.88	43.74
4	S 1804	42.83	21.52	21.31	300	1.11	1.0099	43.41	10.07	42.62	43.04
FINISHING STAND CALIBERS FOR DIA 44.50 MM.											
1	SN 1605	47.04	23.810	23.23	300	4.89	1.0250	48.66	16.67	46.46	47.62
2	SN 1606	45.21	22.730	22.48	300	3.89	1.0111	45.90	10.92	44.96	45.46
3	SN 1607	44.76	22.395	22.37	300	1.00	1.0013	44.84	3.77	44.73	44.79
4	SN 1608	44.72	22.360	22.36	300	0.09	1.0000	44.72	0.00	44.72	44.72
FINISHING STAND CALIBERS FOR DIA 48.30 MM.											
1	S 1501	54.02	27.75	26.27	300	5.09	1.0563	58.28	26.49	52.54	55.50
2	S 1502	51.75	26.51	25.24	300	4.20	1.0503	55.39	24.64	50.48	53.02
3	S 1503	50.25	25.62	24.63	300	2.90	1.0402	53.06	21.74	49.26	51.24
4	S 1504	49.26	24.88	24.38	300	1.97	1.0205	50.64	15.34	48.76	49.76
5	S 1505	48.66	24.33	24.33	300	1.22	1.0000	48.66	0.00	48.66	48.66

Annexure - II

<u>Caliber sizes for Roll Grooving</u>	
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		in mm					(A/B)	mm			
Sl.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
Basic Stands for OVAL CALIBERS											
0	0	143.00	-	-	-	-	-	-	-	-	
1	180	138.83	71.87	66.96	380	2.92	1.0733	150.86	44.86	133.92	143.74
2	280	133.50	67.75	65.75	380	3.84	1.0304	138.25	28.76	131.50	135.50
3	380	127.47	66.30	61.17	380	4.52	1.0839	140.59	47.62	122.34	132.60
4	480	119.57	61.84	57.73	380	6.20	1.0712	130.16	43.48	115.46	123.68
5	580	112.60	58.28	54.32	380	5.83	1.0729	123.02	43.58	108.64	116.56
6	680	106.17	54.84	51.33	380	5.71	1.0684	115.51	41.72	102.66	109.68
7	780	100.22	51.82	48.40	380	5.60	1.0707	109.49	41.91	96.80	103.64
8	880	94.70	48.86	45.84	380	5.51	1.0659	102.95	39.91	91.68	97.72
9	900	89.66	46.28	43.38	300	5.32	1.0669	97.21	32.97	86.76	92.56
10	1000	84.79	43.78	41.01	300	5.43	1.0675	92.13	32.81	82.02	87.56
11	1100	80.34	41.39	38.95	300	5.25	1.0626	86.86	31.22	77.90	82.78
12	1200	76.22	39.31	36.91	300	5.13	1.0650	82.74	31.44	73.82	78.62
13	1300	72.38	37.25	35.13	300	5.04	1.0603	78.17	29.89	70.26	74.50
14	1400	68.81	35.45	33.36	300	4.93	1.0626	74.60	30.07	66.72	70.90
15	1500	65.47	33.67	31.80	300	4.85	1.0588	70.68	28.71	63.60	67.34
16	1600	62.34	32.10	30.24	300	4.78	1.0615	67.59	28.97	60.48	64.20
17	1700	59.42	30.52	28.90	300	4.68	1.0561	64.00	27.23	57.80	61.04
Basic Stands for ROUND CALIBERS											
0	0	143.00	-	-	-	-	-	-	-	-	
1	180	138.83	70.31	68.52	380	2.92	1.0261	143.01	26.76	137.04	140.62
2	280	133.50	67.07	66.43	380	3.84	1.0096	134.99	16.17	132.86	134.14
3	380	127.47	64.69	62.78	380	4.52	1.0304	132.07	28.60	125.56	129.38
4	480	119.57	60.55	59.02	380	6.20	1.0259	123.31	26.14	118.04	121.10
5	580	112.60	57.01	55.59	380	5.83	1.0255	116.13	25.67	111.18	114.02
6	680	106.17	53.72	52.45	380	5.71	1.0242	109.37	24.69	104.90	107.44
7	780	100.22	50.70	49.52	380	5.60	1.0238	103.23	24.17	99.04	101.40
8	880	94.70	47.89	46.81	380	5.51	1.0231	97.49	23.45	93.62	95.78
9	900	89.68	45.51	44.17	300	5.30	1.0303	93.02	22.13	88.34	91.02
10	1000	85.02	43.12	41.90	300	5.20	1.0291	88.10	21.45	83.80	86.24
11	1100	80.68	40.90	39.78	300	5.10	1.0282	83.54	20.85	79.56	81.80
12	1200	76.65	38.84	37.81	300	5.00	1.0272	79.31	20.26	75.62	77.68
13	1300	72.89	36.92	35.97	300	4.91	1.0264	75.37	19.69	71.94	73.84
14	1400	69.39	35.13	34.26	300	4.80	1.0254	71.68	19.05	68.52	70.26
15	1500	66.10	33.44	32.66	300	4.74	1.0239	68.17	18.22	65.32	66.88
16	1600	63.03	31.88	31.15	300	4.64	1.0234	64.98	17.79	62.30	63.76
17	1700	60.13	30.40	29.73	300	4.60	1.0225	61.93	17.19	59.46	60.80
FINISHING STAND CALIBERS FOR DIA 51.00 MM.											
1	MR 1800	56.71	29.11	27.60	300	4.56	1.0547	61.01	26.50	55.20	58.22
2	SR 1801	54.25	27.7	26.55	300	4.34	1.0433	57.49	23.18	53.10	55.40
3	SR 1802	52.32	26.61	25.71	300	3.56	1.0350	54.84	20.54	51.42	53.22
4	SR 1803	51.44	25.74	25.70	300	1.68	1.0016	51.55	4.27	51.40	51.48
5	SR 1804	51.38	25.69	25.69	300	0.12	1.0000	51.38	0.00	51.38	51.38

Annexure - II											
Caliber sizes for Roll Grooving											
(Page No. 3 of 6)											
		in mm					(A/B)	mm			
Sl.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
FINISHING STAND CALIBERS FOR DIA 54.00 MM.											
1	MR 1701	56.91	29.08	27.83	300	4.22	1.0449	60.41	23.98	55.66	58.16
2	MR 1702	55.37	27.93	27.44	300	2.71	1.0179	56.69	14.88	54.88	55.86
3	MR 1703	54.76	27.50	27.26	300	1.10	1.0088	55.40	10.39	54.52	55.00
4	MR 1704	54.54	27.29	27.25	300	0.40	1.0015	54.65	4.23	54.50	54.58
5	MR 1705	54.54	27.29	27.25	300	0.00	1.0015	54.65	4.23	54.50	54.58
FINISHING STAND CALIBERS FOR DIA 55.00 MM.											
1	MR 1706	57.65	29.46	28.19	300	2.98	1.0451	61.20	24.12	56.38	58.92
2	MR 1707	56.36	28.46	27.90	300	2.24	1.0201	57.87	15.88	55.80	56.92
3	MR 1708	55.74	27.98	27.76	300	1.10	1.0079	56.33	9.91	55.52	55.96
4	MR 1709	55.55	27.80	27.75	300	0.34	1.0018	55.68	4.71	55.50	55.60
5	MR 1710	55.55	27.80	27.75	300	0.00	1.0018	55.68	4.71	55.50	55.60
FINISHING STAND CALIBERS FOR DIA 60.30 MM.											
1	MR 1501	63.24	32.240	31.000	300	3.41	1.0400	66.63	23.35	62.00	64.48
2	MR 1502	61.67	31.195	30.475	300	2.48	1.0236	63.60	17.75	60.95	62.39
3	MR 1503	61.06	30.650	30.410	300	0.99	1.0079	61.69	10.19	60.82	61.30
4	MR 1504	60.79	30.415	30.375	300	0.44	1.0013	60.89	4.15	60.75	60.83
5	MR 1505	60.75	30.375	30.375	300	0.07	1.0000	60.75	0.00	60.75	60.75
FINISHING STAND CALIBERS FOR DIA 63.50 MM.											
1	MR 1401	66.52	33.830	32.690	300	3.33	1.0349	69.58	22.10	65.38	67.66
2	MR 1402	65.00	32.790	32.210	300	2.29	1.0180	66.53	15.72	64.42	65.58
3	MR 1403	63.80	32.002	31.798	300	1.85	1.0064	64.33	9.31	63.60	64.00
4	MR 1404	63.53	31.780	31.750	300	0.42	1.0009	63.61	3.56	63.50	63.56
5	MR 1405	63.50	31.750	31.750	300	0.05	1.0000	63.50	0.00	63.50	63.50
FINISHING STAND CALIBERS FOR DIA 70.00 MM.											
1	MR 1201	73.24	37.190	36.050	300	3.91	1.0316	76.23	21.59	72.10	74.38
2	MR 1202	71.66	36.150	35.510	300	2.16	1.0180	73.31	16.17	71.02	72.30
3	MR 1203	70.91	35.570	35.340	300	1.05	1.0065	71.50	9.67	70.68	71.14
4	MR 1204	70.70	35.370	35.330	300	0.30	1.0011	70.80	4.02	70.66	70.74
5	MR 1205	70.70	35.370	35.330	300	0.00	1.0011	70.80	4.02	70.66	70.74
FINISHING STAND CALIBERS FOR DIA 73.00 MM.											
1	MR 1101	77.01	39.270	37.740	300	4.14	1.0405	81.02	24.79	75.48	78.54
2	MR 1102	74.85	37.840	37.010	300	2.80	1.0224	76.99	18.26	74.02	75.68
3	MR 1103	73.96	37.110	36.850	300	1.19	1.0071	74.62	10.18	73.70	74.22
4	MR 1104	73.73	3								

(Page No. 3 of 6)											
		in mm					(A/B)	mm			
Sl.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
FINISHING STAND CALIBERS FOR DIA 54.00 MM.											
1	MR 1701	56.91	29.08	27.83	300	4.22	1.0449	60.41	23.98	55.66	58.16
2	MR 1702	55.37	27.93	27.44	300	2.71	1.0179	56.69	14.88	54.88	55.86
3	MR 1703	54.76	27.50	27.26	300	1.10	1.0088	55.40	10.39	54.52	55.00
4	MR 1704	54.54	27.29	27.25	300	0.40	1.0015	54.65	4.23	54.50	54.58
5	MR 1705	54.54	27.29	27.25	300	0.00	1.0015	54.65	4.23	54.50	54.58
FINISHING STAND CALIBERS FOR DIA 55.00 MM.											
1	MR 1706	57.65	29.46	28.19	300	2.98	1.0451	61.20	24.12	56.38	58.92
2	MR 1707	56.36	28.46	27.90	300	2.24	1.0201	57.87	15.88	55.80	56.92
3	MR 1708	55.74	27.98	27.76	300	1.10	1.0079	56.33	9.91	55.52	55.96
4	MR 1709	55.55	27.80	27.75	300	0.34	1.0018	55.68	4.71	55.50	55.60
5	MR 1710	55.55	27.80	27.75	300	0.00	1.0018	55.68	4.71	55.50	55.60
FINISHING STAND CALIBERS FOR DIA 60.30 MM.											
1	MR 1501	63.24	32.240	31.000	300	3.41	1.0400	66.63	23.35	62.00	64.48
2	MR 1502	61.67	31.195	30.475	300	2.48	1.0236	63.60	17.75	60.95	62.39
3	MR 1503	61.06	30.650	30.410	300	0.99	1.0079	61.69	10.19	60.82	61.30
4	MR 1504	60.79	30.415	30.375	300	0.44	1.0013	60.89	4.15	60.75	60.83
5	MR 1505	60.75	30.375	30.375	300	0.07	1.0000	60.75	0.00	60.75	60.75
FINISHING STAND CALIBERS FOR DIA 63.50 MM.											
1	MR 1401	66.52	33.830	32.690	300	3.33	1.0349	69.58	22.10	65.38	67.66
2	MR 1402	65.00	32.790	32.210	300	2.29	1.0180	66.53	15.72	64.42	65.58
3	MR 1403	63.80	32.002	31.798	300	1.85	1.0064	64.33	9.31	63.60	64.00
4	MR 1404	63.53	31.780	31.750	300	0.42	1.0009	63.61	3.56	63.50	63.56
5	MR 1405	63.50	31.750	31.750	300	0.05	1.0000	63.50	0.00	63.50	63.50
FINISHING STAND CALIBERS FOR DIA 70.00 MM.											
1	MR 1201	73.24	37.190	36.050	300	3.91	1.0316	76.23	21.59	72.10	74.38
2	MR 1202	71.66	36.150	35.510	300	2.16	1.0180	73.31	16.17	71.02	72.30
3	MR 1203	70.91	35.570	35.340	300	1.05	1.0065	71.50	9.67	70.68	71.14
4	MR 1204	70.70	35.370	35.330	300	0.30	1.0011	70.80	4.02	70.66	70.74
5	MR 1205	70.70	35.370	35.330	300	0.00	1.0011	70.80	4.02	70.66	70.74
FINISHING STAND CALIBERS FOR DIA 7											

		in mm					(A/B)	mm			
SI.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
FINISHING STAND CALIBERS FOR DIA 54.00 MM.											
1	MR 1701	56.91	29.08	27.83	300	4.22	1.0449	60.41	23.98	55.66	58.16
2	MR 1702	55.37	27.93	27.44	300	2.71	1.0179	56.69	14.88	54.88	55.86
3	MR 1703	54.76	27.50	27.26	300	1.10	1.0088	55.40	10.39	54.52	55.00
4	MR 1704	54.54	27.29	27.25	300	0.40	1.0015	54.65	4.23	54.50	54.58
5	MR 1705	54.54	27.29	27.25	300	0.00	1.0015	54.65	4.23	54.50	54.58
FINISHING STAND CALIBERS FOR DIA 55.00 MM.											
1	MR 1706	57.65	29.46	28.19	300	2.98	1.0451	61.20	24.12	56.38	58.92
2	MR 1707	56.36	28.46	27.90	300	2.24	1.0201	57.87	15.88	55.80	56.92
3	MR 1708	55.74	27.98	27.76	300	1.10	1.0079	56.33	9.91	55.52	55.96
4	MR 1709	55.55	27.80	27.75	300	0.34	1.0018	55.68	4.71	55.50	55.60
5	MR 1710	55.55	27.80	27.75	300	0.00	1.0018	55.68	4.71	55.50	55.60
FINISHING STAND CALIBERS FOR DIA 60.30 MM.											
1	MR 1501	63.24	32.240	31.000	300	3.41	1.0400	66.63	23.35	62.00	64.48
2	MR 1502	61.67	31.195	30.475	300	2.48	1.0236	63.60	17.75	60.95	62.39
3	MR 1503	61.06	30.650	30.410	300	0.99	1.0079	61.69	10.19	60.82	61.30
4	MR 1504	60.79	30.415	30.375	300	0.44	1.0013	60.89	4.15	60.75	60.83
5	MR 1505	60.75	30.375	30.375	300	0.07	1.0000	60.75	0.00	60.75	60.75
FINISHING STAND CALIBERS FOR DIA 63.50 MM.											
1	MR 1401	66.52	33.830	32.690	300	3.33	1.0349	69.58	22.10	65.38	67.66
2	MR 1402	65.00	32.790	32.210	300	2.29	1.0180	66.53	15.72	64.42	65.58
3	MR 1403	63.80	32.002	31.798	300	1.85	1.0064	64.33	9.31	63.60	64.00
4	MR 1404	63.53	31.780	31.750	300	0.42	1.0009	63.61	3.56	63.50	63.56
5	MR 1405	63.50	31.750	31.750	300	0.05	1.0000	63.50	0.00	63.50	63.50
FINISHING STAND CALIBERS FOR DIA 70.00 MM.											
1	MR 1201	73.24	37.190	36.050	300	3.91	1.0316	76.23	21.59	72.10	74.38
2	MR 1202	71.66	36.150	35.510	300	2.16	1.0180	73.31	16.17	71.02	72.30
3	MR 1203	70.91	35.570	35.340	300	1.05	1.0065	71.50	9.67	70.68	71.14
4	MR 1204	70.70	35.370	35.330	300	0.30	1.0011	70.80	4.02	70.66	70.74
5	MR 1205	70.70	35.370	35.330	300	0.00	1.0011	70.80	4.02	70.66	70.74
FINISHING STAND CALIBERS FOR DIA 73.00 MM.											
1	MR 1101	77.01	39.270	37.740	300	4.14	1.0405	81.02	24.79	75.48	78.54
2	MR 1102	74.85	37.840	37.010	300	2.80	1.0224	76.99	18.26	74.02	75.68
3	MR 1103	73.96	37.110	36.850	300	1.19	1.0071	74.62	10.18	73.70	74.22
4	MR 1104	73.73	36.890	36.840	300	0.31	1.0014	73.86	4.46	73.68	73.78
5	MR 1105	73.73	36.890								

		in mm					(A/B)	mm			
SI.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
FINISHING STAND CALIBERS FOR DIA 54.00 MM.											
1	MR 1701	56.91	29.08	27.83	300	4.22	1.0449	60.41	23.98	55.66	58.16
2	MR 1702	55.37	27.93	27.44	300	2.71	1.0179	56.69	14.88	54.88	55.86
3	MR 1703	54.76	27.50	27.26	300	1.10	1.0088	55.40	10.39	54.52	55.00
4	MR 1704	54.54	27.29	27.25	300	0.40	1.0015	54.65	4.23	54.50	54.58
5	MR 1705	54.54	27.29	27.25	300	0.00	1.0015	54.65	4.23	54.50	54.58
FINISHING STAND CALIBERS FOR DIA 55.00 MM.											
1	MR 1706	57.65	29.46	28.19	300	2.98	1.0451	61.20	24.12	56.38	58.92
2	MR 1707	56.36	28.46	27.90	300	2.24	1.0201	57.87	15.88	55.80	56.92
3	MR 1708	55.74	27.98	27.76	300	1.10	1.0079	56.33	9.91	55.52	55.96
4	MR 1709	55.55	27.80	27.75	300	0.34	1.0018	55.68	4.71	55.50	55.60
5	MR 1710	55.55	27.80	27.75	300	0.00	1.0018	55.68	4.71	55.50	55.60
FINISHING STAND CALIBERS FOR DIA 60.30 MM.											
1	MR 1501	63.24	32.240	31.000	300	3.41	1.0400	66.63	23.35	62.00	64.48
2	MR 1502	61.67	31.195	30.475	300	2.48	1.0236	63.60	17.75	60.95	62.39
3	MR 1503	61.06	30.650	30.410	300	0.99	1.0079	61.69	10.19	60.82	61.30
4	MR 1504	60.79	30.415	30.375	300	0.44	1.0013	60.89	4.15	60.75	60.83
5	MR 1505	60.75	30.375	30.375	300	0.07	1.0000	60.75	0.00	60.75	60.75
FINISHING STAND CALIBERS FOR DIA 63.50 MM.											
1	MR 1401	66.52	33.830	32.690	300	3.33	1.0349	69.58	22.10	65.38	67.66
2	MR 1402	65.00	32.790	32.210	300	2.29	1.0180	66.53	15.72	64.42	65.58
3	MR 1403	63.80	32.002	31.798	300	1.85	1.0064	64.33	9.31	63.60	64.00
4	MR 1404	63.53	31.780	31.750	300	0.42	1.0009	63.61	3.56	63.50	63.56
5	MR 1405	63.50	31.750	31.750	300	0.05	1.0000	63.50	0.00	63.50	63.50
FINISHING STAND CALIBERS FOR DIA 70.00 MM.											
1	MR 1201	73.24	37.190	36.050	300	3.91	1.0316	76.23	21.59	72.10	74.38
2	MR 1202	71.66	36.150	35.510	300	2.16	1.0180	73.31	16.17	71.02	72.30
3	MR 1203	70.91	35.570	35.340	300	1.05	1.0065	71.50	9.67	70.68	71.14
4	MR 1204	70.70	35.370	35.330	300	0.30	1.0011	70.80	4.02	70.66	70.74
5	MR 1205	70.70	35.370	35.330	300	0.00	1.0011	70.80	4.02	70.66	70.74
FINISHING STAND CALIBERS FOR DIA 73.00 MM.											
1	MR 1101	77.01	39.270	37.740	300	4.14	1.0405	81.02	24.79	75.48	78.54
2	MR 1102	74.85	37.840	37.010	300	2.80	1.0224	76.99	18.26	74.02	75.68
3	MR 1103	73.96	37.110	36.850	300	1.19	1.0071	74.62	10.18	73.70	74.22
4	MR 1104	73.73	36.890	36.840	300	0.31	1.0014	73.86	4.46	73.68	73.78
5	MR 1105	73.73	36.890	36.840	300	0.00	1.0014	73.86	4.46	73.68	73.78
FINISHING STAND CALIBERS FOR DIA 76.10 MM.											
1	MR 1106	77.83	39.260	38.570	300	3.12	1.0179	79.58	16.45	77.14	78.52
2	MR 1107	77.09	38.670	38.420	300	0.95	1.0065	77.72	9.88	76.84	77.34
3	MR 1108	76.72	38.380	38.340	300	0.48	1.0010	76.82	3.95	76.68	76.76
4	MR 1109	76.60	38.300	38.300	300	0.16	1.0000	76.60	0.00	76.60	76.60

Annexure - II

Caliber sizes for Roll Grooving

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		in mm					(A/B)	mm			
SI.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
Modified OVAL CALIBER Stands											
0	0	143.00	-	-	-	-	-	-	-	-	
1	MO 180	138.83	71.87	66.96	380	2.92	1.0733	150.86	44.86	133.92	143.74
2	280	133.50	67.75	65.75	380	3.84	1.0304	138.25	28.76	131.50	135.50
3	380	127.47	66.30	61.17	380	4.52	1.0839	140.59	47.62	122.34	132.60
4	480	119.57	61.84	57.73	380	6.20	1.0712	130.16	43.48	115.46	123.68
5	580	112.16	58.05	54.11	380	6.20	1.0729	122.55	43.54	108.22	116.10
6	680	105.10	54.29	50.81	380	6.29	1.0684	114.38	41.66	101.62	108.58
7	780	98.49	50.93	47.56	380	6.29	1.0707	107.64	41.75	95.13	101.85
8	880	92.30	47.62	44.68	380	6.28	1.0659	100.39	39.67	89.36	95.24
9	900	89.49	46.19	43.30	300	3.04	1.0669	97.04	32.98	86.59	92.39
10	1000	85.11	43.95	41.17	300	4.89	1.0675	92.47	32.83	82.33	87.89
11	1100	80.94	41.70	39.24	300	4.90	1.0626	87.49	31.27	78.48	83.40
12	1200	76.89	39.66	37.23	300	5.00	1.0650	83.45	31.51	74.47	79.31
13	1300	73.04	37.59	35.45	300	5.00	1.0603	78.87	29.95	70.90	75.18
14	1400	69.36	35.73	33.63	300	5.04	1.0626	75.18	30.11	67.26	71.46
15	1500	65.87	33.88	32.00	300	5.03	1.0588	71.10	28.75	63.99	67.75
16	1600	62.74	32.31	30.43	300	4.75	1.0615	68.02	29.03	60.87	64.61
17	MO1700	59.92	30.78	29.14	300	4.50	1.0561	64.54	27.32	58.28	61.55
Modified ROUND CALIBER Stands											
0	0	143.00	-	-	-	-	-	-	-	-	
1	180	138.83	70.31	68.52	380	2.92	1.0261	143.01	26.76	137.04	140.62
2	280	133.50	67.07	66.43	380	3.84	1.0096	134.99	16.17	132.86	134.14
3	380	127.47	64.69	62.78	380	4.52	1.0304	132.07	28.60	125.56	129.38
4	480	119.57	60.55	59.02	380	6.20	1.0259	123.31	26.14	118.04	121.10
5	580	112.16	56.79	55.37	380	6.20	1.0256	115.69	25.70	110.74	113.58
6	680	105.10	53.20	51.90	380	6.29	1.0250	108.38	25.06	103.80	106.40
7	780	98.49	49.83	48.66	380	6.29	1.0240	101.49	24.18	97.32	99.66
8	880	92.30	46.68	45.62	380	6.28	1.0232	95.05	23.38	91.24	93.36
9	900	89.49	45.40	44.09	300	3.04	1.0297	92.75	21.89	88.18	90.80
10	1000	85.11	43.12	41.99	300	4.89	1.0269	87.95	20.62	83.98	86.24
11	1100	80.94	41.00	39.94	300	4.90	1.0265	83.64	20.25	79.88	82.00
12	1200	76.89	38.94	37.95	300	5.00	1.0261	79.44	19.84	75.90	77.88
13	1300	73.04	36.99	36.05	300	5.00	1.0260	75.48	19.55	72.10	73.98
14	1400	69.36	35.11	34.25	300	5.04	1.0251	71.62	18.94	68.50	70.22
15	1500	65.87	33.33	32.55	300	5.03	1.0240	67.94	18.23	65.09	66.65
16	1600	62.74	31.74	31.00	300	4.75	1.0238	64.71	17.91	62.00	63.48
17	1700	59.92	30.30	29.62	300	4.50	1.0230	61.75	17.36	59.24	60.60
FINISHING STAND CALIBERS FOR DIA 70.00 MM.											
1	MR 1201	73.70	37.572	36.128	300	4.15	1.0400	77.52	24.35	72.26	75.14
2	MR 1202	71.59	36.180	35.410	300	2.86	1.0217	73.59	17.77	70.82	72.36
3	MR 1203	70.88	35.570	35.310	300	0.99	1.0074	71.54	10.28	70.62	71.14
4	MR 1204	70.57	35.318	35.252	300	0.44	1.0019	70.74	5.17	70.50	70.64
5	MR 1205	70.52	35.270	35.250	300	0.07	1.0006	70.57	2.85	70.50	70.54

Annexure - II											
Caliber sizes for Roll Grooving											
(Page No. 6 of 6)											
		in mm					(A/B)	mm			
Sl.	STAND	PASS	A	B	RR	RHO	ALFA	WD	WA	2 x B	2 x A
FINISHING STAND CALIBERS FOR DIA 60.30 MM.											
1	MR 1501	63.24	32.240	31.000	300	3.99	1.0400	66.63	23.35	62.00	64.48
2	MR 1502	61.67	31.156	30.514	300	2.48	1.0210	63.38	16.74	61.03	62.31
3	MR 1503	61.06	30.646	30.414	300	0.99	1.0076	61.67	10.02	60.83	61.29
4	MR 1504	60.77	30.400	30.370	300	0.47	1.0010	60.85	3.59	60.74	60.80
5	MR 1505	60.75	30.380	30.370	300	0.03	1.0003	60.78	2.07	60.74	60.76
FINISHING STAND CALIBERS FOR DIA 54.00 MM.											
1	MR 1701	57.40	29.26	28.14	300	4.20	1.0400	60.53	22.67	56.27	58.53
2	MR 1702	55.20	27.87	27.33	300	3.83	1.0196	56.65	15.59	54.66	55.74
3	MR 1703	54.66	27.43	27.23	300	0.98	1.0075	55.20	9.57	54.46	54.86
4	MR 1704	54.44	27.25	27.19	300	0.40	1.0021	54.59	5.01	54.38	54.50
5	MR 1705	54.40	27.21	27.19	300	0.07	1.0006	54.44	2.67	54.38	54.42
FINISHING STAND CALIBERS FOR DIA 76.10 MM.											
1	MR 1106	77.83	39.260	38.570	300	3.84	1.0179	79.58	16.45	77.14	78.52
2	MR 1107	77.09	38.670	38.420	300	0.95	1.0065	77.72	9.88	76.84	77.34
3	MR 1108	76.72	38.380	38.340	300	0.48	1.0010	76.82	3.95	76.68	76.76
4	MR 1109	76.20	38.100	38.100	300	0.68	1.0000	76.20	0.00	76.20	76.20
FINISHING STAND CALIBERS FOR DIA 88.90 MM.											
1	MR 801	90.80	45.820	44.980	300	1.63	1.0187	92.86	17.38	89.96	91.64
2	MR 802	89.88	45.100	44.780	300	1.01	1.0071	90.66	10.72	89.56	90.20
3	MR 803	89.52	44.772	44.748	300	0.40	1.0005	89.58	2.93	89.50	89.54
4	MR 804	89.50	44.750	44.750	300	0.02	1.0000	89.50	0.00	89.50	89.50
FINISHING STAND CALIBERS FOR DIA 114.30 MM.											
1	MR 381	121.26	61.820	59.440	380	4.87	1.0400	127.15	32.60	118.88	123.64
2	MR 382	117.58	59.530	58.050	380	3.03	1.0255	121.21	25.85	116.10	119.06
3	MR 383	115.70	58.100	57.600	380	1.60	1.0087	116.91	15.01	115.20	116.20
4	MR 384	115.18	57.606	57.574	380	0.45	1.0006	115.26	3.79	115.15	115.21
5	MR 385	115.15	57.575	57.575	380	0.03	1.0000	115.15	0.00	115.15	115.15