

**Reconditioning & Retrofitting of Horizontal boring machine make-USSR
Model-2657, Plan No. 0-204 of Block-2 (Spindle dia 150 mm)**

NIT No. : 03/WEX/MCR/0-204/Bl.2/ 2010-11/ Dt.20.10.2010/01/Dt. 16-04-2011

MACHINE SPECIFICATIONS:

1. Make : Russian STANKOIMPORT
2. Model : Horizontal Borer 2657
3. Overall dimensions : L =10900 mm, W= 7100 mm, H = 6000 mm
4. Boring Spindle Dia : 150mm
5. Spindle taper : MT80
6. Spindle motor : 14kw,1450 rpm
7. Axial spindle travel(Z-Axis) : 1240mm
8. Traverse rate : 2.4-3200mm/min
9. Head stock vertical travel (Y-Axis) : 2000mm
10. Traverse rate : 1.2-1600mm/min
11. Column travel (X-Axis) : 3200mm
12. Traverse rate : 1.2-1600mm/min
13. Facing head radial tool
slide maximum traverse : 240mm
14. Feed drive motors for headstock,
column and spindle feed and
table carriage : 4.2 kW, 1600/3600 rpm
15. Feed drive motors for
radial tool slide : 1.3kw,1500rpm
16. Head stock clamp drive motor : 1 kw,1300 rpm
17. Column carriage clamp drive motor : 1 kw,1300 rpm
18. Total no. of spindle rpm steps : 22 (7.5 to 950 rpm)
19. Total no. of facing head rpm steps : 18 (3.75 to 192 rpm)
20. Machine Weight : 52200 kgs.

Scope of Work & Supply

Clause No.	Description	Vendor's Remarks
1	<u>Mechanical Reconditioning Work</u>	
1.1	Complete reconditioning and accuracy restoration as per OEM test chart.	
1.2	Dismantling of all units, cleaning, and identification of damaged parts for rebuilding / replacement.	
1.3	Machining and grinding of guide ways of bed, column, table carriage and their matching slides etc.	
1.4	Pasting of Turcite on slides if needed.	
1.5	Scraping of sliding parts for desired surface contact and accuracy.	
1.6	Reconditioning/Replacement of Main Spindle	
1.6.1	Main spindle shall be checked after dismantling and shall be repaired to the extent feasible to achieve the accuracies. Spindle repair shall include grinding of solid spindle, grinding of hollow spindle (sleeves) and Nichrome/ Chrome coating.	
1.6.2	If found beyond repairable limits , the spindle along with sleeve completed completed with all parts shall be replaced by new one.	
1.6.3	Decision to opt for (1.6.1) or (1.6.2) shall be taken during joint inspection at vendor's works.	
1.6.4	Vendor shall separately quote for new spindle along with sleeves.	
1.7	Replacement of Nitrided bushes of spindle.	
1.8	Replacement of all lead screws and their matching nuts.	
1.9	Reconditioning of all feed gear boxes.	
1.10	Reconditioning of clamping systems of X, Y & Z axes and table.	
1.11	Replacement of all bearings of the machine as per the bearing list attached (Annexure-A). Replacement of spindle bearings shall be decided after joint inspection. Vendor shall quote separately for spindle bearings (Sl. No. 47 to 49 of Annexure-A).	
1.12	Replacement of all oil seals & O-rings.	
1.13	Rebuilding of the machine, replacements/repair of worn out parts.	
1.14	Complete reconditioning of table including scraping, matching to achieve desired geometrical accuracy as per OEM test chart.	
1.15	Pulley of Head Stock Gear box shall be modified to suit new ZF Gear Box. Suitable arrangements shall be made by the vendor for balancing overhang of pulley .	

2.	<u>Modification of Head Stock:</u>	
2.1	Head stock shall be modified to suit new requirement with AC spindle motor with gear box (as per clause no. 6.1 of annexure -1) and hydraulic gear shifting. After modification there shall be only four steps covering all the speed ranges. After modification maximum rpm at four steps shall be 71, 273, 284 & 10929 (this is indicative and can be reworked by the vendor and proposed). first two rpm(71 & 273) shall be achieved ZF gear box selected in 1:1 step and another two rpm(284& 1092) shall be achieved with ZF gear box selected in 1:4 step. A suitable power pack shall be provided at a convenient place. All elements of power pack shall be of latest version Vickers/ Parker/ Rexroth/ Hydac make. Cutting power and torque at the spindle shall be ensured by the vendor as per original capacity. <u>Kinematic Diagram For Spindle Rotation (rpm) is Enclosed (Annexure-B)</u>	
2.2	Counter weight wire ropes shall be replaced and system shall be overhauled.	
2.3	New drive belts for spindle of Fenner/Dunlop/ Yule/ Goodyear make shall be fitted.	
3.	<u>Modification of Lubrication System:</u> Separate lubrication units of adequate capacity of Willy Vogel make shall be provided for-	
3.1	Head stock(gears, bearings, Z-Axis lead screw, Z-Axis guideways etc.). There is an existing casted body on the machine headstock which is used as the oil reservoir for headstock lubrication. Same shall be retained. However, all hydraulic elements like pump , motor, valves etc. along with new piping and nozzles shall be installed.	
3.2	Y-Axis lead screws & nut, Y-Axis guideways.	
3.3	X-Axis guideways , rack & pinion arrangement for X-Axis	
3.4	Rotary table, table carriage guideways and rack & pinion arrangement for table traverse.	
4.	<u>Guideways Protection System:</u>	
4.1	Polyurethane guideways wipers of Sur Hennig/ Hennig mak shall be fitted on all guideways of the machine.	
4.2	Sturdy telescopic covers of walk on type and having polyurethane wipers shall be provided on both sides of saddle to protect guideways of the machine bed.	
4.3	Bellows shall be provided on both sides of headstock to protect column guideways.	
5.	<u>Work To Be Decided During Joint Inspection :</u> Replacement of following items shall be decided at the time of joint inspection at vendor's works. Vendors have to quote separately for these items.	
5.1	New Spindle along with sleeve completed with all parts as per para 1.6.3	
5.2	Spindle Bearings as per attached bearing list , Sl. No. 47 to 49.	
5.3	Casting repair (if any)	

6	<u>Electrical Work :</u>	
6.1	Retrofitting of Siemens (1PH7) or equivalent Rexroth-Bosch make AC spindle motor, 17kW, $n_{rated}=1000rpm$ & $n_{max}=8000rpm$ along with suitable signal and power cables in place of existing induction motor along with a two speed planetary gear box of ZF make type 2K250 to provide speed steps of 1:1 and 1:4.	
6.2	Retrofitting of Siemens(1FT6086) or equivalent Rexroth-Bosch make AC Servo Motors of $n_{rated}=3000rpm$, $M_o=27Nm$ rating along with pre assembled signal and power cables for X-axis, Y-axis, Z-axis & table carriage.	
6.3	Retrofitting of Siemens(1FT6064) or equivalent Rexroth-Bosch make AC Servo Motor of $n_{rated}=2000rpm$, $M_o=9.5Nm$ rating along with suitable signal and power cables for facing head radial tool slide.	
6.4	3 phase induction motor of Siemens/ABB/Baldor/Leroy Somer make, 1kW, 1500rpm for Head stock clamp and Column carriage clamp.	
6.5	Testing of other induction motors of machine and their repair by revarnishing, vacuum impregnation and replacement of bearings if required.	
6.6	Retrofitting of Siemens (Sinamics S120) or equivalent Rexroth-Bosch make AC Servo drive system for Spindle rotation, X-axis, Y-axis, Z-axis, radial tool slide and table carriage complete with Line Filters, Line Reactors, control modules and motor modules. Each drive shall have at least 4DI, 4DO, 2AI & 2AO	
6.7	Retrofitting of DRO system of Heidenhain make for X, Y, Z axes comprising of 3-Axis DRO unit, linear scales of suitable length, scanning heads, signal cables of suitable length. DRO unit shall accept 5V TTL/ $1V_{pp}$ signals. Linear scales must have accuracy not lesser than $\pm 10 \mu m$ per meter	
6.8	Retrofitting of DRO system for radial tool slide comprising of 1-axis DRO unit of Electronica make. This DRO unit shall accept 5V TTL signals. Motor encoder pulses of radial slide motor shall be utilized for DRO display and therefore AC servo drive for this axis must have interface for simulation of TTL incremental encoder.	
6.9	Metallic cable drag chain covered on both sides of Kabelschlepp or Elektromag make with guiding tray shall be provided for carrying electrical cables from electrical cabinet to machine.	
6.10	New operator panel to be mounted on machine platform incorporating all required machine controls including those of tables, DRO units, spindle load meter etc. Operator panel should have following features- <ul style="list-style-type: none"> • Axes selection for X, Y, Z, radial tool slide and table through a selector switch. • Directional Push Buttons for axis movement. 	

	<ul style="list-style-type: none"> • Rapid traverse operation in Jog. • Setting/inching operation in Jog • Continuous Feed with spindle running for actual machining on the machine • Illuminated Pushbuttons (total 4 nos.) one for each gear step with LED lamps to command gear change • Provision to operate the Table from the operator pendant in inch & continuous mode in CW/CCW direction. • Emergency stop. • Alarm Reset Push button. • Hydraulic pump ON push-button/key. • Main motor ON push-button/key. • Coolant ON / OFF push-button/key. • Indicators for main motor ON, Oil pump ON, Axes slides clamped/unclamped. • RPM meter & load meter for spindle. • DRO display shall be installed on operator panel. • All indicating lamps shall be of LED type. 	
6.11	PLC system of Siemens/ABB/GE Fanuc make having 64 digital inputs and 64 relay type digital outputs. PLC system shall have facility of downloading & uploading of PLC program.	
6.12	<p>A dust-and vermin proof Electrical cabinet having following</p> <ul style="list-style-type: none"> • Servo drive system • PLC system • Switchgear for machine control of Siemens/ Schneider/ Fuji/Mitsubishi/ABB make • Panel tube lights with door bypass switches • Exhaust fans with air flow 1800 m³/hr of ebm NADI make • Service socket with switch of 220V, 5 Amp. • MCB DB 3phase, 30 Amp 	
6.13	Machine work light with halogen lamp of 100W, 24VDC and flexible arm for illumination of work area.	
6.14	Complete rewiring of machine with wires/cables of LAPP/SAB/IGUS make only.	
7	<u>Monitoring & Safety Features</u>	
7.1	Any abnormality in the machine should be indicated by indicating lamps, PLC alarms & message prompts.	
7.2	PLC alarms & messages should include the device number and /or the operand.	
7.3	Fuses & Overloads of appropriate ratings for all primary & auxiliary circuits.	
7.4	Limit switches & sensors to avoid over-travel & collision of any part of the machine.	
7.5	Float & pressure switches to ensure proper functioning of hydraulic & lubrication systems.	
8.	<u>Dismantling of Machine For Despatch To Vendor's Works:</u>	
8.1	Vendor shall carry out and record all the accuracy tests as per test	

	chart before dismantling of machine.	
8.2	Vendor shall dismantle the machine at BHEL, Haridwar in transportable lots for further transportation of the machine.	
9.	<u>Painting Of The Machine After Reconditioning:</u>	
9.1	Moving units/parts of the machine shall be painted in Satin Blue (RAL 5012) Shade.	
9.2	Non-moving units shall be painted in Phirozi Blue (RAL 5017) shade after reconditioning.	
9.3	Putty to prepare the surface for painting shall be applied on machine surfaces before painting.	
10.	<u>Pre-Despatch Inspection:</u> Inspection of the machine after reconditioning shall be carried out by BHEL at vendor's works to check functioning of machine and to check geometrical accuracies as per para no. 10.1 of acceptance criteria. Only after the clearance given by BHEL, shall the machine be dispatched to BHEL, Hardwar.	
11.	<u>Erection And Commissioning:</u> Erection and commissioning shall be done by the vendor at BHEL, Haridwar. Vendor shall depute its personnel within 15 days of intimation to this effect by BHEL.	
12	<u>Acceptance Criteria:</u>	
12.1	Accuracy test as per manufacturer's test chart for geometrical accuracies of Bed, Saddle, Column, Headstock, Face Plate and Spindle shall be demonstrated at vendor's works before dispatch of machine to BHEL, Hardwar. Mandrel test will also be shown at vendor's works before dispatch of machine.	
12.2	All accuracy tests of the machine including tests under point 9.1 as per manufacturer's test chart shall be demonstrated at BHEL, Hardwar at the time of Erection & commissioning.	
12.3.	Machine shall be accepted after performance test on one test piece at BHEL Hardwar by representatives of the vendor. BHEL shall provide all necessary jobs, tooling, material handling facilities and operator and inspection aid for the same.	
13.	<u>Period of Reconditioning:</u>	
13.1	Period of reconditioning of the machine as per the scope of work at vendor's works shall be eight (8) months maximum from the date of joint inspection of machine at vendor's works.(period between receipt and dispatch)	
13.2	Vendor shall intimate date of receipt of the machine at their works to BHEL, Hardwar.	
13.3	Vendor shall depute their manpower within 7 days of intimation for erection and commissioning of the machine at BHEL, Hardwar.	
13.4	The erection and commissioning work should be completed within 30 days from the date of start of erection and	

	commissioning at BHEL, Haridwar.	
14.	<u>LATE DELIVERY:</u> LD of 0.5% of the total cost of works per week, subject to a maximum of 5% shall be imposed on delay in delivery from scheduled delivery date and delay in commissioning from scheduled commissioning date. Delay in commissioning due to reasons attributed to BHEL shall not attract LD.	
15.	<u>OTHER TERMS & CONDITIONS:</u>	
15.1	List of all parts repaired or replaced to be furnished to BHEL along with reconditioned machine.	
15.2	Old parts, which would be replaced by new ones, shall be returned to BHEL Hardwar properly tagged.	
15.3	Vendor shall arrange comprehensive insurance of the machine during reconditioning at their works. Beneficiary of policy shall be BHEL, Hardwar.	
15.4	Any material or any activity if not covered in the scope of supply and scope of work but necessary for proper reconditioning of the machine should be offered and quoted by the vendor. No price additions shall be allowed after placement of the Work Order and the supply of all such material and activities shall be the responsibility of the vendor.	
15.5	Vendor shall bring all tools and manpower for dismantling, erection & commissioning of the machine at BHEL, Hardwar.	
16.	<u>Defects Liability Period – Performance Bank Guarantee</u>	
16.1	Vendor shall submit performance bank guarantee of 10% of total work order value for the entire guarantee period of one year from the date of successful commissioning of the machine.	
16.2	Vendor shall attend the machine free of cost during the guarantee period.	
16.3	Vendor shall replace/repair any defective part/item free of cost during the guarantee period.	
17.	<u>Transportation & Insurance:</u>	
17.1	Transportation & transit insurance will be on BHEL account.	
17.2	Transportation by BHEL approved Transporters only.	
17.3	Road permit, Form '31' & Form 'C' will be provided by BHEL.	
18.	<u>Bank Guarantee:</u> For shifting of machine outside the premises of BHEL, Hardwar for execution of the work of reconditioning and retrofitting, a bank guarantee of Rs. 15 Lakh for salvaged value of machine shall be submitted by the vendor on the Performa provided in Annexure -C.	
19.	<u>Documents:</u> <ul style="list-style-type: none"> • Electrical schematic of the machine: 3 sets • PLC program in ladder form with symbols and comments in English: 3 sets. • O&M manuals for PLC, drives, and Heidenhain measuring system: 3 sets. 	

	<ul style="list-style-type: none"> • O&M manuals for ball screws and ball nuts: 3 sets. • Modified kinematic and assembly diagrams of the main motion drive: 3 sets • Manual for the new Hydraulic system: 3 sets • Manual for Lubrication system: 3 sets. • A parts list of all new items/parts installed in the m/c 3 sets. • Drawings and details of all mechanical modifications & fittings : 3 sets. 	
20.	<p><u>Payment Terms :</u> No advance payment shall be made to the vendor. Part payment will be made after completion of following milestones-</p>	
20.1	First payment of 30% of total work order value shall be made After dismantling and joint inspection at vendor's works on submission of bank guarantee of the like amount which shall be valid for the duration of reconditioning.	
20.2	Second payment of 60% of total work order value along with 100% Taxes and Duties will be made after successful commissioning and job prove out at BHEL, Hardwar.	
20.3	Final payment of 10% of total work order value will be made After post commissioning successful running of the machine for one month at BHEL Haridwar.	
20.4	All the payments shall be made through e-payment after submission of following documents along with first bill- i. E-payment form duly filled.(form will be provided by BHEL) ii. Bar chart of the machine showing the milestones iii. Income tax exemption letter(if applicable) iv. Receipt from the vendor that machine has been received by them at their works	
21.	<p><u>Offer:</u> The offer should be submitted in the following manner.</p>	
21.1	Techno-commercial bid containing technical details and commercial terms & conditions.	
22.2	Price bid containing total price along with the price break-up for all the major items and for the items to be decided at the times of joint inspection . The price bid containing any terms & conditions are liable to be rejected.	
22.3	Price bid shall be opened of only techno commercially accepted offers.	
22.4	<i>Point-wise compliance of this scope of work is to be given by vendors while submitting their offer.</i>	
23.	<p><u>Computation of L-1:</u> Items covered under para 5. shall also be considered for computation of L-1.</p>	
24.	<p><u>Qualifying Criteria:</u> The vendors meeting any of the following criteria would only be considered:</p>	

24.1	Who have manufactured at least one no. Horizontal Boring Machine of spindle diameter 150mm or more during last ten years and the same is working satisfactorily for last six months on the date of opening of tender.	
24.2	Who have reconditioned and retrofitted at least one no. Horizontal Boring Machine of spindle diameter 150mm or more with rectification / replacement of main spindle and replacement of spindle bearings during last ten years and the same is working satisfactorily for last six months on the date of opening of tender.	
24.3	The vendor shall submit "Performance Certificate(s)" of the machine(s) from the end user along with the offer and should agree to arrange the visit of BHEL team for verification at the end user's works, if BHEL so desires.	
25.	<u>Earnest Money Deposit (EMD):</u>	
25.1	Vendors have to deposit Rs. 2 Lakh as the EMD. EMD may be deposited in cash, through pay order in favor of BHEL, Hardwar or through demand draft only.	
25.2	EMD shall be converted to security deposit if the work is awarded.	
25.3	EMD of unsuccessful bidders shall be refunded back normally within fifteen days of acceptance of award of work by the successful bidder.	
25.4	EMD shall not carry any interest.	
26.	<u>Security Deposit(Sd):</u> Successful vendor shall deposit security.	
26.1	The rate of security deposit will be as below: For work Up to ` 10 Lakhs: 10% Above ` 10 Lakhs upto ` 50 Lakhs: ` 1 Lakh + 7.5% amount exceeding ` 10 Lakhs Above ` 50 Lakhs: ` 4 Lakhs + 5% amount exceeding ` 50 Lakhs	
26.2	The security deposit should be submitted before the start of work in the following forms: i) Cash (As permissible under the Income Tax Act) ii) Pay Order, Demand Draft in favour of BHEL, Hardwar iii) Local cheques of Scheduled Banks, subject to realization. iv) Bank Guarantee from Scheduled Banks/Public Financial Institution as defined in the companies Act. The Bank guarantee format should have the approval of BHEL.	
26.3	Security Deposit shall not carry any interest.	
26.4	EMD of successful tenderer can be converted and adjusted against the Security Deposit.	
26.5	<u>100% of the Security Deposit amount shall be refunded to the vendor after post commissioning successful running of the machine for one month.</u>	
27.	<u>Vendors shall submit detailed scheme of modification in gear shifting system along with drawings and ketches for technical evaluation of BHEL. Functioning of modified system shall be the responsibility of the vendor.</u>	

28.	<u>Vendors are strongly advised to visit BHEL, Hardwar and study machine documents in detail on any working day between 8am to 5 pm before submitting their offer.</u>	
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TECHNICAL COMMITTEE:-

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