Annexure I

SCOPE OF SUPPLY AND COMMISSIONING FOR RENOVATION OF SKODA RAM BORER, MODEL: W250HC, MACHINE S. NO. OB 22075; YEAR OF MANUFACTURE: 1980, PLAN NO. 2-387, BLOCK-III

A. SCOPE OF SUPPLY:

A.1 MACHINE HEADSTOCK:

Description of Material	Qty
i.) Milling spindle with matching Boring (hollow) spindle along with all spindle bearings & peripheral parts.	-1 set
ii.) Spindle RPM step changing mechanism, including gear shifters, gears, bearings and seals	-1 set
iii.) New lubrication pump with piping, filters, monitoring devices (pressure switch, float switch) for main drive gear box	-1 set
iv.) Ball screws and nuts for ram and spindle movements, associated peripheral parts including bearings	-1 set
v.) New Biplast lining, wedges and adjusting screws for ram	-1 set
vi.) Parts for overhauling of Z-axis gear box with clutches, bearings, brake and limit switches, seals and O rings	-1 set
vii.) New lubrication system for Z-and Y-axis guideways by dosers	-1 set
viii. New electronic flow switches for lubrication of main gear box and feed gear box of Z-and W-axes	-1 set
ix.) Feedback assembly comprising of Z+W leadscrews and nuts, including dogs/cams,limit switch blocks, sprocket wheel and chain	-1 set
x.) Front cover with wipers for ram and spindle	-1 set
xi.) Boring (hollow) spindle wiper and lubricating sponge	-1 set

Note:

1. Spindle dia is 250 mm. Spindle shall have MT140 as internal taper. Existing accessories, boring and milling heads and tools presently used on the machine with MT140 taper should be usable with the new spindle as well.
2. Details of the following items shall be mentioned in the offer:
    - i.) Size, accuracy and make of all the bearings
    - ii.) Length, accuracy grade, pitch and make of the ball screws
    - iii.) Details of all gears, gear shifters
3. Spindle shall be balanced and dynamically tested. QC certificate to that effect shall be submitted by the Vendor
4. Spindle out-travel is 2000 mm. Ram out-travel is 1600 mm. Z+W axes out-travel is 2000 mm. The same shall be maintained after the renovation work.
5. Spindle is powered by 80 kW Skoda DC motor. The same shall be retained after the renovation work.

A.2.0 MACHINE ROTARY TABLE (S60B):

OBJECTIVE:

Existing table of the machine which is having a single drive motor for both linear and rotary movements shall be upgraded to have separate drive systems for V- and B-axes after removing the clutch-based system. Table accuracies shall be restored and demonstrated as per Skoda Protocol Ob 1298T. B-axis gear box shall be reconditioned and its parts such as bearings, gears, worm gears shall be replaced with new ones. Rotary table shall have Heidenhain DRO system for both linear and rotary movements.

Following items/assemblies shall be supplied by the vendor for the upgradation and reconditioning of the Rotary table:

A.2.1 V-AXIS:

	Description of Material	Qty
1.0	New ball screw and nut for V-axis having length of traverse of 3500 mm	- 1 no.
1.1	Seating/Brackets for installation of the ball screw	- 1 set
1.2	Bearings for V-axis ball screw mounting	- 1 set
1.3	Bracket for installation of the ball screw nut	- 1 no.
1.4	New planetary gear box for V-axis feed system.	- 1 no.
1.5	Parts for installation of planetary gear box	- 1 set
1.6	Flange for installation of V-axis AC servomotor	- 1 no.
1.7	New Lubrication system for V-axis ball screw, nut and guideways	- 1 set
1.8	New hydraulics control for V-axis clamping units	- 1 set
1.9	Seals for V-axis clamping unit	- 1 set
1.10	Wipers for V-axis guideways	- 1 set
1.11	New plastic lining “Biplast”, glue, adjusting screws and wedges for V-axis guideways.	- 1 set
1.12	New Heidenhain linear measuring scale for V-axis having distance-coded Reference marks	- 1 set
1.13	Assembly for blocking V-axis traverse. This shall also include a Baluff/ Euchner limit switch block having limit switches for +/- Overtravel. Necessary cams/dogs on an Aluminium rail shall also be part of this assembly.	- 1 set

A.2.2 B-AXIS:

1.0	Parts for servo adaptation required for mounting of the B-axis AC Servomotor	- 1 set
1.1	Parts for modification of gear box comprising of gears, worm gears, wheels, bearings etc for backlash-free movement of B-axis	- 1 set
1.2	Set of bearings for central seating of the clamping plate of table	- 1 set
1.3	New hydraulics control for B-axis clamping units	- 1 set
1.4	Set of seals for repair of B-axis clamping units	- 1 set

1.5 New hydraulics control for B-axis locking device - 1 set
1.6 Set of seals for repair of B-axis locking device - 1 set
1.7 New plastic lining "Biplast", glue and adjusting screws for B-axis guideways. - 1 set
1.8 New Heidenhain rotary encoder for B-axis - 1 no.
(*Note: There is no rotary encoder for the table presently*)
1.9 New parts for mounting of B-axis encoder - 1 set

A 2.3 ELECTRICALS, DRIVES, HEIDENHAIN DRO FOR ROTARY TABLE:

1.0 Electrical cabinet fitted with Siemens Simodrive 611U drive system comprising of HF Choke, I/R module, LT and control modules, switching contactor and semiconductor fuses for V-and B-axes of the table.
(*Note: Size of the offered cabinet should be just sufficient to accommodate the above mentioned drive system for table V-and B-axes. Existing electrical cabinet shall also be retained which has got following switchgear of the machine*

- *Simodrive 611U system for the machine axes*
- *Simatic S7-300 PLC system and 8-channel relay modules*
- *Electrical switchgear such as motor protection circuit breakers (MPCBs), contactors, MCBs and machine MCCB for the entire machine and table.*
- *Siemens Distributed Input /Output modules ET 200L are placed on the machine column and inside Operator's pendant. These are connected to S7-300 PLC CPU in the electrical cabinet through Profibus cable*

1.1 Siemens 1FT6 AC servomotors for V-and B-axes
1.2 Pre-assembled power and signal cables for V-and B-axes servomotors.
(*These cables shall be terminated at the new drive electrical cabinet supplied as per Para A 2.3/1.0 which shall be installed beside the existing Machine electrical cabinet.*)
1.3 2-axis Heidenhain DRO
1.4 DRO shielded signal cables of length approx 80 m each
1.5 Siemens Operator Panel OP77 for interfacing with existing S7-300 PLC CPU for viewing of PLC inputs,outputs and messages
1.6 Potentiometers (5 nos.) *having anti-log or exponential characteristic* with knobs for setting speed set point of various axes. (*It may be noted that linear characteristic potentiometers are not suitable for speed setting at low feeds*.)

A 2.4 MISCELLANEOUS ITEMS:

1.1 Coolant collecting & drain system including new collection trays preferably of thick walls so as to prevent deformation in subsequent use for long time
1.2 Flexible power track assembly
1.3 Other small parts for modifications

Note: *If any material/item/device other than those mentioned in the scope above (A 2.1 to A 2.4) is required for successful upgradation of the table as outlined in the objective of the project at A 2.0, the same should be included in the technical bid submitted by the vendor. No additions shall be permissible after the placement of the Purchase Order.*

A 3.0 DOCUMENTATION

Following documents shall be supplied by the Vendor in three copies

1.1 New mechanical assembly drawing of the headstock
1.2 New mechanical assembly drawings of the table
1.3 New lubrication schematic of the modified system of main drive gear box lubrication and Z-and Y-axes guide ways, and the Rotary Table
1.4 New hydraulic schematics of the modified system of table
1.5 Detailed drawings of balllead screws and nuts of ram and spindle
1.6 Detailed drawing of balllead screw and nut of V-axis
1.7 New Kinematic diagram of the linear and rotary movements of the table
1.8 New electrical schematic of the table and its controls including new arrangement of the drives for V-and B-axes
1.9 New PLC program in soft copy and also in hard copy
1.10 Details of lubricating and hydraulic oils such as grades, quantity required and their Indian equivalents
1.11 List of Bearings, seals, gears etc used in the upgradation work
1.12 Service and operation manuals of all Bought-out items used in the renovation and modification of headstock and the Rotary table
1.13 Composite O&M manual of the Table including Preventive maintenance instructions and maintenance guidelines

B. QUALIFYING CONDITIONS:

1. Only those vendors, who have done mechanical reconditioning/ accuracy restoration/complete overhauling of at least 1 no. Skoda Ram Borer of spindle dia 250 mm as per Skoda test protocols in the past five years (on the date of opening of tender) and such machine is presently working satisfactorily for more than six months after commissioning (on the date of opening of tender), shall quote.

   OR

   Only those vendors, who have manufactured, supplied, and commissioned at least 1 no. Ram Borer of min. spindle dia 200 mm in the past five years (on the date of opening of tender) and such machine is presently working satisfactorily for more than six months after commissioning (on the date of opening of tender), shall quote.

2. Following information should be submitted by the vendor about the companies where similar machines have been supplied or reconditioning work has been carried out. This is required from the vendor for qualification of the offer.

i.) Name of the customer(s) / company(s) where the machine(s) is/are installed.
ii.) Complete postal address of the customer.

iii.) Name, designation, Phone, FAX no. and e-mail id of the contact person of the customer.
iv.) Month & Year of commissioning.
v.) Broad specifications of the machine(s) supplied/reconditioned and application.
vi.) Performance certificate from the customers regarding satisfactory performance of machine (Original Certificate or through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.

3. BHEL reserves the right to verify information submitted by the vendor. Vendor shall agree to arrange a visit of BHEL expert(s) to the customer's premises for verification purposes, should BHEL so desire. In case, the information is found to be false/incorrect, the offer shall be rejected.

4. M/S Skoda MT, Czech Republic being OEM of the subject machines are technically qualified to bid for the tenders.

Annexure II

A. SCOPE OF WORK:

A.1. MACHINE HEADSTOCK

i.) Geometrical accuracies related to spindle shall be measured and recorded before taking up the renovation work.
ii.) Existing spindle including hollow spindle assemblies along with their bearings, leadscrews for ram and spindle, spindle RPM step changing mechanism, feedback assembly of Z+W axis shall be disassembled by the Vendor.
iii.) Joint inspection of all the visible parts shall be done and an assessment for replacement/repair shall be made. Such repair/replacement shall be carried out by the Vendor with spare parts supplied/arranged by BHEL.
iv.) New milling and boring spindles shall be assembled in the headstock by the Vendor.
v.) New ball screws and nuts, peripheral parts including bearings for ram and spindle shall be fitted by the Vendor.
vi.) Z-and W-axes guideways shall be lined with new Biplast, wedges and adjusting screws.
vii.) New spindle RPM step changing mechanism including new shifters, gears, bearings and seals shall be installed by the Vendor.
viii.) New lubrication pump for main drive gear box with piping, filters and monitors shall be installed and commissioned.
ix.) Z-and W-axes gear box shall be overhauled replacing all the seals, electromagnetic clutches, bearings, brake and limit switches.
x.) New lubrication system using dosers shall be installed and commissioned for Z-and Y-axes guideways.
xi.) New electronic flow switches for monitoring of lubrication of main gear box and Z-and W-axes feed gear box shall be installed and commissioned.
xii.) New Z+W feedback assembly shall be installed by the Vendor.
xiii.) Geometrical accuracies related to spindle shall be measured and recorded after the renovation work. These shall conform to the spindle-related accuracies of the Skoda protocol Ob1122T

A.2 MACHINE ROTARY TABLE (S60B):

1.0 The table will be inspected at the beginning of reconditioning job and measured as per its standard inspection chart and all accuracy deviation will be recorded to inspection chart as to the existing state. All existing major troubles will be noted and vendor's engineers will work out the plan to remedy the same to the best condition possible.
1.1 Disassembly of the table
1.2 Levelling of bed
1.3 Machining and scraping for mounting of new ball screw for V-axis and new Heidenhain linear scale.
1.4 Mounting of ball screw and nut of V-axis

1.5 Mounting of new planetary gear box for V-axis
1.6 Installation of Heidenhain linear scale for V-axis
1.7 Repair of B-axis gearbox for backlash-free movement
1.8 Installation of adaptation parts for existing feed box for B-axis
1.9 Mounting of new Siemens AC servomotors for V-and B-axes
1.10 Installation of rotary encoder for B-axis
1.11 Installation of coolant collecting and drain system
1.12 Installation of plastic lining (Biplast) of the guiding in V-and B-axes
1.13 Replacement of seals of V-axis clamping unit with new ones
1.14 Replacement of seals of B-axis clamping unit with new ones
1.15 Replacement of seals of B-axis locking device with new ones
1.16 Installation of the new hydraulic clamping system
1.17 Laying of all the required cables, including servo power and signal cables and their connections in the electrical cabinet. Laying of DRO feedback cables of V- and B-axes
1.18 Program of existing Siemens Simatic S7-300 PLC system shall be appropriately amended by the Vendor to incorporate the control and monitoring functions necessitated by the modifications carried out on the table.
1.19 Commissioning of Drives of V-and B-axes
1.20 Installation and commissioning of Heidenhain DRO system for V-and B-axes.
1.21 Calibration of DRO readings of V-and B-axes with standard measurements shall be ensured by the vendor.
1.22 Table shall be painted afresh.

A.3 OPERATOR'S PENDANT:

Existing operator's pendant shall be retained. However, required modifications shall be carried out by the vendor in accordance with the needs of operating switchgear for two table axes viz. V-and B-axes.

New Heidenhain DRO for V-and B-axes shall be mounted on the front plate of the Operator's pendant. Heidenhain signal cables supplied by the Party as per Para A2.3/1.4 of Scope of Supply shall be laid through the pendant hosepipe. It is estimated that about 80 m length of cable shall be required for each axis. Party shall ensure that DRO signal is strong enough for this length. Otherwise appropriate signal amplifiers should be supplied and installed.

A.4. ACCEPTANCE CRITERIA:

i.) Prove out of all functions and features of spindle and the table
ii.) Vendor shall demonstrate that with the installation and commissioning of the material supplied as per scope of supply (Paras A.1 to A.2) and work executed as per Scope of Work (Paras A.1 to A.3) respectively, accuracies of the spindle and ram are restored. Geometrical accuracies of the spindle shall

be demonstrated as per Skoda protocol Ob 1122T clauses relevant to spindle.

iii.) Spindle shall be tested on load with actual machining and boring on a workpiece provided by BHEL.

iv.) Geometrical accuracies of the table shall be demonstrated as per Skoda Test protocol Ob 1298 T.

A.5. WARRANTY:

Vendor shall offer warranty for all the material supplied and work carried out for a period of 18 months from the date of successful commissioning of the machine at BHEL, Hardwar

A.6. SPECIAL INSTRUCTIONS:

1. Existing minimum and maximum velocities of V-and B-axes of table shall be ensured after carrying out the modifications.

2. Following details shall be submitted by the Vendor along with the offer:

2.1 Name plate details of the AC servomotors and servodrive modules proposed to be installed by the vendor.

2.2 Size, length, make , accuracy grade of the ball lead screws of ram, spindle and V-Axis of table.*****

2.3 Details of all the parts proposed to be supplied for reconditioning of the B-axis gearbox such as gears, wormgears, wheels and bearings*****

2.4 Quantity, numbers, sizes of bearings of the central seating of the clamping plate

2.5 Details of the Heidenhain DRO, linear scale and rotary encoder such as model no., length of the scale, Type of signal output (1 V pp, HTL, etc.) accuracy, and number of pulses per revolution of the rotary encoder

2.6 Specifications and make of the planetary gearbox for V-axis

2.7 Lengths of servo power and signal cables, Heidenhain cables

2.8 Route sketch of Heidenhain signal cables from V-axis scale and B-axis rotary encoder to Heidenhain DRO on the Operator's Pendant shall be submitted.

2.9 Quantity, numbers, make and sizes of bearings of the milling and hollow spindles

2.10 Schematic of the proposed new lubrication system for Z-and Y-axis guideways by dosers

* *These details may be submitted after the placement of P.O. but before starting the work.*

3 ***A compliance statement indicating agreement/deviation against each para of scope of supply and scope of work shall be submitted by the vendor along with the offer.***

4 Any off-loading activity shall be mentioned in the offer

5 A sealed two part-bid shall be submitted by the vendor – one techno-commercial bid and another price bid.

6 ***Charges for Material mentioned in Annexure-I and charges for work as mentioned in Annexure-II shall be quoted separately in the Price bid. Charges for the work shall be quoted lump sum and not on daily/weekly or hourly basis.***

7 Any special tools/mandrels required for accuracy measurement shall be brought by the Vendor.

8 Delivery period of the material and the total downtime required for upgradation shall be mentioned by the vendor in the offer. An activity chart with reference to time taken shall be pasted at the site before taking up the reconditioning work.

9 Machining facilities, to the extent available at BHEL, Hardwar plant, shall be made available to the Vendor. All required machining shall be done under supervision of Vendor's experts. Preparation of drawings shall be the responsibility of the vendor.

10 Parties are advised to visit the site to assess various requirements such as lengths of the feedback cables required, machining needs etc before submitting their bids