

BHARAT HEAVY ELECTRICALS LTD.
HEEP, Hardwar - 249403
WORKS ENGG. & SERVICES DEPTT.
WEX/CNC DIVISION

Ref.No.:WEX/CNC/WC/EN/1-118

Annexure-A

RETROFITTING OF SKODA CNC HORIZONTAL RAM BORER PLAN No. 1-118, Block-3

Requirement:

Skoda CNC Horizontal Ram Borer W200 HB NC with SEA60 Rotary table from M/s. SKODA, Czech. With following Specifications is to be retrofitted with Sinumerik 840D Power line system along with Siemens 1FT6 series AC servomotors and AC servo drives for table Rotary (B) & Transverse (W) axis along with Heidenhain position Feed back system for axes & spindle. All existing features and functions of the machine need to be retained as such.

Broad Specifications:

CNC Horizontal Borer W200 HB NC from M/s. SKODA, Czech

Spindle Diameter	200mm
Ram size	520*520
Spindle extension	2000mm
Ram extension	1600mm
Head stock vertical traverse(Y)	5370mm
Column horizontal traverse(X)	12640mm
Table traverse (W axis)	2500mm
Spindle rpm	0.8 to 800
No. of gear ranges	4
Spindle & ram feed	1 to 3000mm/min
Headstock & Column feed	1 to 6000mm/min
Spindle & ram rapid	3000mm/min
Headstock & Column	6000mm/min

CNC System	SIEMENS Sinumerik 850 MEC
PLC	SIEMENS Simatic 5S, ZG 150U

Feed motor's For W axis SIEMENS 1HU3138—0AF01---Z A31 Z=G45 Y60 115Nm, 8.8 Kw, 170V, 59 Amp, 1800rpm
For B axis SIEMENS 1HU3138—0AF01---Z A31 Z=G45 Y60 115Nm, 8.8 Kw, 170V, 59Amp, 1800rpm

Feed Drives

For B & W axis

SIEMENS 6RA2674---6MV30—0

Input 190v, 143Amp

Output 200v, 175Amp

Measuring system for X Axis	Heidenhain Scale LB326 (12640mm).
Measuring system for Y Axis	Heidenhain Scale LB326 (5370mm).
Measuring system for Z Axis	Heidenhain ROD 426 , (2000 Pulses)
Measuring system for Spindle	Heidenhain ROD 426 , (1024 Pulses)
Measuring system for W Axis	Heidenhain Scale LB326 (2500mm)
Measuring system for B Axis	Heidenhain ROD 700 , (18000 Pulses)

NOTE: Machine is already fitted with Siemens 1FT6—series servomotors and Siemens Simodrive for X, Y and Z axes and Siemens Simoreg DC Drive 6RA7081 for spindle motor (details as below).The existing AC servomotors and LT modules for X,Y and Z axis and DC spindle drive and spindle motor will be retained and interfaced with new system.Existing Controller modules (6SN1118—0NH01—0AA0) will be replaced with controller modules of 6SN1118—0DJ23-0AA- for X,Y and Z axis.

For X Axis SIEMENS 1FT6136---6AB71---1AA2 115Nm, 1500rpm LT Module 6SN1123—1AA00—0EA1 (160Amp)
For Y Axis SIEMENS 1FT6136---6AB71---1AA2 115Nm, 1500rpm LT Module 6SN1123—1AA00—0EA1 (160Amp)
For Z Axis SIEMENS 1FT6136---6AB71---1AA2 115Nm, 1500rpm LT Module 6SN1123—1AA00—0EA1 (160Amp)

SIEMENS Simodrive I/R Module 6SN1145—1BA01—0DA1 (55/71 Kw), Controller module (6SN1118—0NH01—0AA0) for each axis.

Spindle Drive SIEMENS Simoreg 6RA7081—6DV62—0

Power Supply: 415V +/-10%, 50 Hz +/- 3%, 3 wire, 3 Phase, 250 KVA

A. SCOPE OF SUPPLY

S.No.	Item	Qty	Vendor's Remarks	Accepted (Yes/No)
1.0	<p>The CNC controller Sinumerik 840D power line with PC version PCU50.3 or higher , NCU573.5 or Higher with Windows XP Operating System.(Latest version , should be supplied.) with standard features. The system should have OP 15 A Operators Panel with TFT colour display (15 inch or more) ,Full Qwerty keys keyboard & Mouse/Trackball housed in a sliding tray, COM1(V.24) , COM2(V.24) , VGA, MPI Interface & USB ,2 Channels and Expansion slots. Network ready with LAN and preinstalled system software & other required softwares etc. All standard features should be listed in technical offer.</p> <p>Also all available optional features of Sinumerik 840 D CNC system as mentioned below should be offered and included in the offer.</p>	01 Set.	Vendor to provide details & comply.	
1.1	The CNC System should have the following features:			
1.2	Pentium -IV processor 1 GHz or of highest rating available with Siemens at the time of order.			
1.3	Hard disk of 40GB (easily replaceable) or of highest rating available with Siemens at the time of order			
1.4	512 MB SDRAM or of highest rating available with Siemens at the time of order			
1.5	16GB USB Pen drive - 2 Nos.			
1.6	Access lock on operator panel.			
1.7	Co-ordinate system transformation			
1.8	Co-ordinate system rotation.			
1.9	Look ahead of 70 blocks.			
1.10	Helical/ Spline interpolation			
1.11	Scaling			
1.12	Mirroring			
1.13	Solid Tapping			
1.14	All standard milling cycles.			
1.15	Cylindrical interpolation.			
1.16	Background editing.			
1.17	Tool management			
1.18	5 axes continuous path control system for milling/boring operations			
1.19	Resolution of 0.001 mm			
1.20	Facility to store up to 999 subroutines & 9999 part programmes			
1.21	Block search with calculations in automatic mode			
1.22	Facility to store at least 20 zero offsets & 2 additive zero-offsets			

1.23	It should be possible to store 128 tool offsets			
1.24	Automatic tool offset loading facility			
1.25	Display of NC & PLC Alarms			
1.26	Part program renaming & copying facility			
1.27	Oriented Spindle stop			
1.28	Measuring system & lead screw compensation			
1.29	The Siemens 840 controller at point 1.0 shall be supplied along with following hardware			
1.29.1	SITOP power, DC-UPS Module 15 with AKKU module for back-up of the PCU50.3 for Automatic unattended shutdown in the case of power failure or if machine switches OFF.			
1.29.2	Machine control panel MCP483C (6FC5203—0AF22—0AA2) suitable for 5 axis & 1 spindle			
1.29.3	Siemens make PLC S7-300 (Siemens make Input Card , Output Card & Interface Card) shall be supplied with approx 240 nos. of Inputs, 104 nos. of Outputs are to be programmed in the PLC maintaining the existing logic.			
1.29.4	Channel Relay boards (13 No.) each consisting of 8 relays preferably Phoenix contact make should be provided for driving the PLC outputs to the machine. All PLC outputs to be routed to the machine through these Relay boards			
1.29.5	DC Regulated Power Supply 24V DC of suitable capacity should be provided for CNC system , PLC I/Os and other auxiliaries. Independent power supplies for CNC system , PLC Inputs and PLC Outputs shall be provided.			
1.29.6	A hand held unit , Type B-MPI of Siemens make 6FX2007—1AE14 with distribution box 6FX2006-1BH01 with selector switches for manual operations(jog and All incremental) of all axis and spindle.			
1.30	The Siemens 840 controller at point 1.0 should be supplied along with following software loaded with licensed copies. a. SINUMERIK 840DI/840D / SL SOFTWARE HMI ADVANCED FOR PCU SW-VERSION 7.6 b. SINUMERIK 840D CNC-SOFTWARE 6.5 ON PC CARD; c. SINUMERIK FM-NC/840D/DE TOOL MANAGEMENT VARIABLE CODING AND SETPOINT CODING d. SINUMERIK FM-NC/840D/DE MEASURING CYCLES,CURRENT SOFTWARE VERSION e. SINUMERIK 840D TOOLBOX CURRENT SW VERSION f. SINUMERIK SIMATIC S7, STEP7 V5.5 SP1 ON DVD SINGLE LICENSE FOR SINUMERIK HARDWARE (for display of PLC ladder on 840D monitor)			
2.0	AC SERVO DRIVES		Vendor to provide details & comply	
2.1	Synchronous AC Servo motor of 1FT6 , 115Nm, 100K, 1500 RPM , Natural air cooling. should be provided. The AC Servo motor should be Siemens 1FT6136—6AB71—1AA2 .	02No.		

2.2	SIEMENS 611 CONVERTER SYSTEM INFEED/REGENERATIVE FEEDBACK MODULE WITH INTERNAL COOLING 55/71 KW TYPE NO: 6SN1145-1BA01-0DAx	01 No.		
2.3	Line filter for 55/71 Kw I/RF module	01 No.		
2.4	HF commutating reactor for 55 KW I/RF module	01 No.		
2.5	Simo drive 611 Power Module 1 axis , internal cooling, motor rated currents :feed=56A, Main Spindle=60A 6SN1123---1AA00—0EAx).	02 No.		
2.6	Simodrive 611 Digital control , loop block high performance 1 axis sin/cos 1 vpp directmeasuring system NC software, required from 06.04.09 6SN1118---0DJ23--0AAx	05 No.		
2.7	Simodrive 611 Digital Closed loop control 2 axes hydraulic closed loop control HLA with direct measuring system and voltage signals. 6SN1115—0BA11--0AAx	01 No.		
2.8	Simodrive 611 monitoring module , with housing for 211/288mm depth 6SN1112—1AC01—0AAx	01 No.		
2.9	Over voltage limiter module for infeed modules for simodrive 611 6SN1111—0AB00-0AAx	01 No.		
2.10	Simodrive (Accessories) Incr. Rotary encoder with 1-V sinus 1024 pulses, synchro flange , 6mm shaft, oprat. Voltage 5V universal cable outlet axial/ radial with connector 6FX2001—3CB02	01 No.		
2.11	Simodrive (Accessories) Incr. Rotary encoder with 1-V sinus 2500 pulses, synchro flange , 6mm shaft, oprat. Voltage 5V universal cable outlet axial/ radial with connector 6FX2001—3CC50	01 No.		
2.12	Simodrive 611-A/D unit BUSF.2-Tier module assembly, lengt 1.5M 6SN1161—1AA00—0AA1	01 No.		
2.13	Simodrive 611 DC Link adapter for two tier mounting , for modules<300mm set of 2 6SN1161—1AA01—0BA0	01 No.		
2.14	Universal Empty Housing for mounting dual axis ANA Card 6SN1162—1AA00—0AA0	01 No.		
2.15	Signal cables for Motor Encoder cables of suitable length with end connectors(for B axis & W axis) approx 40 M Length.	02 No.		
2.16	MOTION –CONNECT Power cables of suitable length for motor with end connectors (for B axis & W axis)	02 No.		
2.17	Any other material viz. Shield terminal plates , interconnecting cables including Drive bus, Systembus & Profibus, DC link etc. related to the entire drive system to complete the project.	01 Set		
3.0	MEASURING SYSTEM		Vendor to provide details & comply	
3.1	LB382C scale of 12640 mm Measuring length complete with scanning head AE LB382C(1 Vss output) & Adapter cable of Heidenhain make with +/- 5 micron per meter accuracy grade for X axis .	01 No.		
3.2	LB382C scale of 5370 mm Measuring length complete with scanning head AE LB382C(1 Vss output) & Adapter cable of Heidenhain make with +/- 5 micron per meter accuracy grade for Y axis .	01 No.		

3.3	ROD486 (2000 pulses) encoder of Heidenhain make for Z axis .	01 No.		
3.4	ROD880C (36000 pulses) encoder of Heidenhain make B axis .	01 No.		
3.5	LB382C scale of 2500 mm Measuring Length complete with scanning head AE LB382C(1 Vss output) & Adapter cable of Heidenhain make with +/- 5 micron per meter accuracy grade for W axis .	01 No.		
3.6	ROD 486 (1024 pulses) encoder (apart from motor encoder) of Heidenhain make for spindle position .	01 No.		
3.7	Signal cables of required length for supplied linear scales & encoders (At point 3.1 to3.6 of measuring system) couplings & all necessary interface required to interface the position feedback with the offered CNC controller /Machine.	01 Set.		
4.0	Electrical cabinets of RITTAL make having sufficient space to mount the existing X,Y &Z axis feed drives ,spindle drive & new axis feed drives of B &W axis along with all switch gears of drives ,PLC and other accessories. The panel shall be stand alone floor mounting type. It should be a single unit with multiple doors (The present arrangement can be studied by the vendor). The components should only be mounted on the front side only; Rear part of the panel should not have doors/ covers .Cable entry shall be from the bottom. Suitable eye hooks shall be provided for lifting the panel. Lighting with CFL lamps and one 5A , 3pin socket with on/off switch shall be provided in each section.	01 Set.	Vendor to comply	
5.0	Siemens/ABB/ Schneider Electric/Klockner make Power disconnecter with rotary handle kit of suitable rating as per the new scheme (25% over-rated to maximum load) for switching on the power supply of panel & machine.	01 No.	Vendor to provide details & comply	
6.0	Operator Control panel Rittal make swivel type along with the horizontally extended & swivel type arm (similar to the existing type) incorporating the CNC Controller, MCP and selector switches for other functions as required. Front side should have handles for rotating by hand, The rear door should be on hinges with lock and not on screw mounted . One 220 VAC/ 5 Amp 3-pin service socket and switch. (Operation features as per para A.1.0.1)	01 No.	Vendor to comply	
7.0	Complete switchgears of the machine including overloads, relays, contactors, MPCBs etc. for feed drives(X,Y,Z,B &W), Spindle drive and all the auxiliary motors , all accessories and to cover all other machine functionalities. Contactors used on the machine shall be overrated by at least 25% than the required capacity.	01 Set	Vendor to comply	
8.0	Portable machine lamp with magnetic base operating at 24V DC , 70Watts with 5 meter cable with conduit to be supplied.	01 Set	Vendor to comply	
9.0	Machine illumination light (150W metal halide single ended) mounted at the top of column for the full illumination on the working area of reputed make with well-guarded from chips and coolant.	01 Set.	Vendor to comply	
10.0	2 number of Door mounted Air conditioners of ADVANCE make with suitable/sufficient capacity and proper drainage pipes for condensate are to be provided in Electrical Panels (each 1500Watt.) and 1 for Operator control panel .	01 Set.	Vendor to provide details & comply	

11.0	1. Mounting brackets, mounting plates ,couplings & all necessary interface for mounting of scales, transducers, external encoders of all axes/ spindle and other items required for ensuring accuracy & repeatability of the feed axes movement & spindle RRM. 2. All the Mechanical Fittings , Intermediate flanges , pulleys, belts, Brackets etc. required for the mounting of CNC controller , feed motors , Drives.	01 Set.	Vendor to comply	
12.0	Hydac/IFM make digital pressure switches and float switches to replace existing elements for hydrostatic ,axes clamping system , tool clamping & table. Baluff/Euchner/Tecknic/Schneider/Honeywell make limit switch/proximity switches to replace existing limit switches/proximity switches in Head stock.	01 Set.	Vendor to comply	
13.0	Control cables , Power cables ,signal cables, conduits of suitable length for cables & field wiring, connectors, Lugs, Terminal Blocks, ferrules etc. required to interface the CNC/PLC system with servomotors, Spindle motor , drives and field devices to successfully complete the project.	01Set.	Vendor to comply	
14.0	Movable metallic drag chain sliding along the bed (X axis) of Kabel Schlepp make approx length 10.0 Meter & Bending radius 425 mm approx for cables & hydraulic pipes going to the machine.	01 Set.	Vendor to comply	
15.0	Motor with gear box , electrical control box and Independent manual hanging pendant for up, down, forward & reverse movement for the existing Jib crane of 750 Kg capacity mounted on the column of the machine.	01 Set.	Vendor to provide details & comply	
16.0	Program conversion software .(As per Para A.1.0.2) to convert existing part programs with their sub programs having use of R-parameters & other mathematical/ logical functions etc. and cycles(CYCLE81 to CYCLE 89) of the existing Sinumerik 850 CNC system as per the offered CNC system. The converted programs shall be able to run directly on the offered CNC system and retrofitted machine without any difficulty for the required machining	01 Set	Vendor to provide details & comply	
17.0	Diagnostic device FLUKE Multimeter Model No. 28--II	01 No.	Vendor to comply	
18.0	Spares:		Vendor to comply	
18.1	Control Card as offered against the Point No. 2.6	02No.		
18.2	Power Module as offered against the Point No. 2.5	02 No.		
18.3	Scanning Head AE LB382C as offered against the Point No 3.1	02 No.		
18.4	PCU as offered against the Point No. 1.0	01 No.		
18.5	HLA Control card as offered against the Point No. 2.7	01 No.		

Note: Complete breakup of all the constituent items with Siemens type number for CNC system and drive modules shall be provided

Para A.1.0.1

OPERATIONAL FEATURES:

The Operator Control panel (**Rittal make**) swivel type along with the horizontally extended & swivel type arm (similar to the existing type) on the operator platform moving along with the Y axis incorporating the CNC Controller should have the following operational features on the MCP and provided additionally as existing on the machine.

- Axes selection keys (Separate for each axis.)
- Directional keys + & - for axis movement in jog (Separate for each axis.)
- Rapid traverse key.
- Emergency stop.
- Reset key.
- Single block switch.
- Dry run switch.(Dry run freely executable during program run in automatic)
- Coolant ON / OFF switch/key. (coolant should be switch on/off during Auto/Jog mode irrespective of the definition in the part program).
- spindle continuous/inch selector switch
- spindle Forward/Reverse selector switch
- Spindle orientation switch
- A pushbutton/soft key should be provided on the MCP for activating “Delete distance to go”.
- chip conveyer forward/reverse push button
- mode selector switch
- Feed override switch
- Spindle override switch
- Spindle gear selector switches with light.
- Machine illumination switch
- Feed release switch
- Pre selection of Ram or Spindle Or Ram Reference.
(**RAM and Spindle feed (Z-Axis) are connected to a common servo motor and position encoder . Selection of RAM or Spindle feed is through a clutch.**
Existing method of RAM reference prior to spindle reference is to be adapted to the new CNC control as per the old CNC control .
Z-axis position updation on CNC is common to both RAM or spindle feed depending on selection)
- Green , Yellow & Red lights for machine in order , failure & failure-stop.

PROGRAMMING FEATURES:

1. ISO code (G&M mode type) programming.
2. Absolute/incremental programming.
3. Decimal point programming.
4. Linear & circular interpolation on both axes.
5. Programmable dwell.
6. Scaling, Mirroring, rotation & work offset transformation

7. Storage of user defined subroutine independent of the main program.
8. Variable parametric programming with mathematical functions including trigonometric & logic functions.
9. Programmable software limits.
10. Arc-programming with radius & end-point.
11. Conditional & unconditional jump.
12. Programmable tool offset.
13. Programmable zero offset.
14. Two Programmable additive zero offset.
15. Subroutine nesting up to 3 levels.
16. Programmable skip.
17. Facility of inclusion of message in the part programme.
18. Corner rounding & chamfering. (e.g. RND, CHF and ANG).
19. Canned cycles for:
 - Drilling, deep drilling, Boring and Tapping (both solid and flexible) cycles
 - Pocket milling (rectangular and circular)
 - Thread whirling
 - Thread Milling
21. Tool nose radius compensation G41, G42
22. Coolant on/off should be programmable.
23. Programming of primary, auxiliary & existing functions through M, S, T codes.
24. A cycle/program for determining work offset at any rotation of table angle with respect to a defined work offset on the job for machining of angular details on the job.
25. Axis replacement with GEOAX command.
26. On screen graphic simulation.
27. Programming with polar coordinates.

Para A.1.0.2

(CONVERSION OF NC PROGRAMS IN USE WITH EXISTING CNC SYSTEM TO EQUIVALENT NC PROGRAMS FOR CNC SYSTEM TO BE RETROFITTED)

1.0 INTRODUCTION:

The existing CNC programs for the earlier CNC System in the retrofitted machine were prepared and then finalized by actual machining of the component requiring a great deal of time and effort. These proved programs, whose accuracy has been established, are of great importance to the programmer and the operator of the machine. Therefore, with the retrofitting of the machine with the new CNC system, it is very important that the effort and time spent earlier is not repeated and the equivalent programs for the new CNC System are available for machining of the component without any further delay leading to productive use of machine.

2.0 SCOPE OF WORK :

The Conversion Software shall be developed incorporating all logic and features so that all the existing proved NC programs of the earlier CNC system are successfully converted into equivalent NC programs for the new retrofitted CNC system. Further, the conversion software shall meet all the requirements as mentioned at point no. 2.1 and shall be tested & approved as mentioned at point no. 2.2 & 2.3.

2.1 Requirements :

- a) The conversion software shall be Windows XP based.
- b) 100 % conversion of program regarding program numbers sequence numbers, operator messages /instructions, G & M coded, F/S/T/D codes with their values, Axes values suitable for the new CNC system.
- c) Preferably 100% conversion of remaining part of CNC Program like Subprogram/Cycle Parameters, Subprogram/Cycle call Code, Special feature/Code pertaining to any attachment or machine's application. In case of any constraint, minor editing after conversion is permissible at the discretion of BHEL and such data should be retained as it was earlier with identifiable comment so as to enable editing after the conversion.
- d) The Program conversion should be without any data loss and the converted data should be acceptable to new CNC System without any Syntax/Format error.
- e) Two sample existing CNC programs shall be provided by BHEL and the vendor can discuss/clarify all their queries with BHEL before start of development work to avoid repeated modifications/changes later on leading to delays.
- f) The development of the conversion software shall be done either at site or off-site at the expense and suitability of the vendor.

2.2 Testing & Acceptance of the Software :

The vendor shall install the conversion software on a BHEL PC and demonstrate conversion of two sample programs provided earlier to him as per point no. 2.1 (e). The testing of the conversion software shall be done by BHEL Engineers through visual checking of the two sample converted programs whose decision shall be final regarding the correctness of the converted programs. The programs shall be checked with respect to all the requirements mentioned above at pt no. 2.1.

Additionally, the two sample converted NC programs shall be loaded on the machine and following testing shall be done:

- Block search from the start to the end block which should not generate any syntax or data format error.
- Checking of converted program (including editing as per 2.1.c) by graphic simulation feature on the retrofitted CNC system.

3.0 DELIVERABLES

- Installable CD

B. SCOPE OF WORK

S. No.	Activities	Vendor to comply	Accepted (Yes/No)
1.0	Dismantling and removal of all drives(X,Y,Z,B,W & Spindle) , switch gears ,CNC, PLC, along with old cabling and wirings, cable trays etc. in the existing Electrical cabinet(s). Dismantling of B & W axis feed motors , all linear scales ,all encoders and field devices.		
2.0	Dismantling of old swivel type CNC operator Control panel and Installation of new swivel type CNC operator control panel.		
3.0	Installation of all drives(X,Y,Z,B,W & Spindle) , PLC, CNC , switch gear , Main Rotary switch etc in the New electrical cabinet(s) with required new cable trays , rails etc. (Switch gear and electrical system details as per PARA B.2.0.1)		
4.0	Mounting and installation of feed motors (B & W), Incremental linear scales for X , Y, W axis , Incremental encoders for Z , B and spindle. Design, Modification / re-engineering, manufacturing of pulley , flanges and encoder couplings etc. for feed motors , position feedbacks as per requirement.		
5.0	Cabling and wiring of CNC, PLC, Drive system, control panels and field devices. Entire Cabling including Position Feedback of the machine is to be replaced with the new cabling. Laying and routing of new conduits, cables from electrical cabinet to machine and CNC operator panel through new conduits. Refurbishment and rewiring of all the terminal boards, Junction Boxes as per requirement Removal of the old metallic drag chain .Installation of new metallic drag chain. Routing of the new cables through drag chain . The cables passing through the drag chain shall be inside the conduits of reputed make.		
6.0	Interfacing of new swivel type CNC operator control panel.		
7.0	Interfacing of the existing coolant unit, Main hydraulic unit, chip conveyer & hydraulic unit of Table with the new scheme.		
8.0	Installation, Interfacing & commissioning of the CNC, PLC, Position feedback, , spindle & Feed drives systems, Machine lights , portable lamps , all air conditioners .		
9.0	Installation of jib crane motor with gear box , electrical control box and interfacing of manual hanging pendant on the existing beam.		
10.0	Modification & rewiring of PLC program as per the new CNC controller and implementation on machine. Existing electrical logic has to be retained in the new PLC Program. In case the vendor perceives that more Inputs/Outputs are required for completion for the work as per their designed and conceived electrical scheme, the same should be included in the scope of supply.		
11.0	Laser calibration of X ,Y, W ,B & Z axes and generation of compensation data for pitch error and backlash from a reputed agency.		

12.0	Prove-out of all the main functions (axes & spindle) .		
13.0	Prove-out of all existing auxiliary functions (Axes Clamping system, Tool clamping ,Coolant system, hydraulics & hydrostatics , lubrication, chip conveyer etc.).		
14.0	Prove-out of the network LAN function (Part program & parameter transfer).		
15.0	Manual Control of Machine independent of MDI/ CNC Part Program : Presently, following operations can be performed manually independent of MDI/ CNC Part Program. Same status is to be maintained after retrofitting also: a. Start (CW/CCW) & Stop of spindle rotation b. Inching (CW&CCW) of spindle rotation c. Regulation & Indication of spindle speed d. Start, Stop, Regulation & Indication of feed, fast traverse, inching in X ,Y ,W ,B & Z.		
16.0	Prove out and demonstration of all existing machine functions and programming features of new CNC System including manual control of the machine. Siemens expert intervention will be ensured by the party wherever party itself is not able to meet the requirement related to application or program.		
17.0	After successful demonstration of all the operational and programming features of the machine, subsequent to completion of total scope of work, one BHEL component (time cycle 3-4 days) shall be machined by BHEL under the supervision of vendor on the machine using either converted program (using supplied conversion software) or new program prepared by BHEL for new retrofitted system. Trouble-free running of the machine & CNC system in compliance to WO requirements during this period shall be taken into consideration for final acceptance.		
18.0	Machine should have provision to switch from direct position feedback system to indirect position feedback system (built in motor encoder) through PLC/ Custom screen which is required for service purpose only		
19.0	a). Customized screen for displaying the status of all the axis unclamp, unbrake ,slides lubrication & gear lubrication b). Customized screen for selection of Table On/OFF for both the axis of table (B & W) through soft keys . c). Customized screen for entering the manual feed rate for individual axis & spindle RPM .		
20.0	Alarms and message should be displayed on CNC along with full remedial description through help guide loaded for system and user defined alarms & messages . PLC alarms & messages should include the device number and/or the operand .		

PARA B.2.0.1

SWITCH GEAR AND ELECTRICAL SYSTEM:

1. **In the new** electrical panel(s) all feed drives , spindle drive , PLC, all switch gear, relay, contactors, overloads, fuses, MCB's should be suitably positioned and all compartments should be illuminated for ease of maintenance and proper air conditioning ensured for the cooling of the devices.
2. The switchgear (MCBs, Overloads, Contactors, Relays etc) should be of any one of the following makes:
Siemens, Schneider, Telemecanique or ABB.
3. Operator control Panel should be of **Rittal** make with proper air conditioning and vermin proof.
4. The operator's control panel , should be suitably positioned in the existing location for ease of operation & maintenance.
5. All the panels, Junction boxes, devices should have nomenclatures and individual wires ferruled as per the electrical schematics. The field devices if found unhealthy will be replaced by the party.
6. The wiring of the entire machine should be replaced by new ones of adequate capacity and reputed make preferably Lapp make.
7. 220VAC, 5A plug points should be provided in the Electrical Cabinet and 220 VAC, 5 A plug point on the Operator Panel. & 15 A plug point on the operator platform.
8. All existing pressure switches , float switches & flow switches (Approx 6 Nos. each) in the hydrostatic system and clamping system shall be replaced by Hydac/IFM make **digital pressure switches** ,float switches & flow switches. The Limit switches/ proximity switches of the Headstock shall be replaced with Baluff/Euchner/tecknic/Schneider/Honeywell make limit switches /proximity switches

C.	<u>DOCUMENTATION:</u>	Vendor to comply	Accepted (Yes/No)
	<i>Following documents shall be supplied with above supply</i>	Qty.	
	Documents consisting of <input type="checkbox"/> Electrical circuit diagram <input type="checkbox"/> PLC printout in ladder form with symbols & comments in English <input type="checkbox"/> O&M manuals (hard copy) for CNC, PLC, Drives, Measuring systems & BOI . <input type="checkbox"/> Programming manual (hard copy) for CNC system . <input type="checkbox"/> Machine data (NC, PLC, Setting & Alarm texts), Ghost back up , Drives data , PLC program , Electrical circuit diagram & BOI (soft copy) <input type="checkbox"/> Details of all mechanical modifications & fittings with drawings .	3 sets. 3 sets. 1 set. 3 sets. 1 set 3 sets.	
D.	<u>WARRANTY:</u>	Vendor to comply	Accepted

			(Yes/No)
	Party shall stand warranty for all the supplied material and work for a period of one year from the date of successful commissioning of the material and final acceptance (clause –F)		
E.	<u>TRAINING:</u>	Vendor to comply	Accepted (Yes/No)
	Party shall impart training to BHEL staff for programming (1Person) , maintenance (1Person) and operations (3 Persons), of the system at the Vendor/manufacturers works for 1 week in each area. Expenses for boarding & lodging of BHEL personal during training shall be borne by BHEL.		
F.	<u>FINAL ACCEPTANCE:</u>	Vendor to comply	Accepted (Yes/No)
	Final Acceptance shall be at HEEL, BHEL, Haridwar after: a) Upon completion of the scope of supply and scope of work at BHEL. b) Final acceptance shall include clearance of all pending issues related to the work contract. c) Successful Commissioning & Demonstration of various cycles and control functions as envisaged in the technical scope. After settlement of all pending issues related to work and supply, a certificate for Completion of works in all respect shall be released within 15 days by Production and Maintenance personnel of BHEL which will be the referred document for Final Acceptance and final payment to the vendor.		
G.	<u>DELIVERY:</u>	Vendor to comply	Accepted (Yes/No)
1.	Material: Max. 5 months from the date of award of contract. Early delivery shall be acceptable.		
2.	Work : Within 45 days from the date of release of machine for work.		
H.	<u>LATE DELIVERY PENALTY (LD) CLAUSE:-</u>	Vendor to comply	Accepted (Yes/No)
1.	Late delivery @ ½% per week subject to a maximum of 10% of the material cost including spare parts shall be applicable for delay in deliveries.		
2.	In case of delays in commissioning after handing over the machine as per clause G(2) penalty @ 2% per week subject to a max. of 10% of the Commissioning Charges shall be applicable for delay beyond scheduled commissioning date for reasons attributed to the party. Net delay for the purpose of calculating late commissioning will be considered as the delay in commissioning.		
3.	However total LD on account of clause H1 & H2 will be limited to 10% of work awarded value.		

4.	The time period from invitation date for Pre dispatch inspection from vendor to the date of arrival of pre dispatch team to vendor's works and any other reasons attributed to BHEL will not be accounted in delivery period. This period will be excluded for the purpose of calculating LD. Vender should intimate regarding PDI, 7 days in advance.		
I.	<u>PRE-DISPATCH INSPECTION</u>	Vendor to comply	Accepted (Yes/No)
1.	Pre-dispatch inspection of all the items covered under Scope of Supply at Para (A) shall be carried out physically by BHEL at party's works.		
2.	Supplier shall invite BHEL for carrying out pre- inspection.		
3.	Deputed BHEL persons shall do pre acceptance at vendor works and give despatch clearance.		
4.	Expenses of Boarding and lodging of BHEL personnel during PDI shall be borne by BHEL.		
J.	<u>SUBMISSION OF BILL OF MATERIAL (BOM)</u>	Vendor to comply	Accepted (Yes/No)
	Before inviting BHEL for Pre-dispatch inspection, vendor shall submit to BHEL the new Electrical Schematic & Bill of Material (BOM) for scrutiny.		
K.	<u>EARNEST MONEY DEPOSIT (EMD):</u>	Vendor to comply	Accepted (Yes/No)
1.	Vendors have to deposit Rs.2,00,000/- as EMD .EMD may be deposited through pay order or through demand draft in favor of Account officer, HEEP, BHEL, Hardwar payable at Haridwar.		
2.	EMD shall be converted to security deposit if the work is awarded.		
3.	EMD of unsuccessful bidders shall be refunded back normally within fifteen days of acceptance of award of work by the successful bidder.		
4.	EMD shall not carry any interest.		
5.	EMD by bidder will be forfeited as per tender document, if		
i)	After opening the tender, the tenderer revokes his tender within the validity period or increases his earlier quoted rates		
ii)	The tenderer does not commence the work within the period as per LOI/contract.		
6.	Offers without EMD will be rejected and will not be considered for evaluation. However in special cases at discretion of BHEL HARDWAR management, Govt. of India / Central & State PSUs / State Govt. entities / Small Enterprises with validity of registration (under NSIC for similar type of work) on tender opening date may be exempted from submission of EMD and tender documents cost.		

L.	<u>SECURITY DEPOSIT (SD):-</u>	Vendor to comply	Accepted (Yes/No)
1.	Successful vendor shall deposit security. The rate of security deposit will be as below:		
	<ul style="list-style-type: none"> • For work Up to ₹ 10 Lakhs : <u>10% of work order value</u> 		
	<ul style="list-style-type: none"> • Above ₹ 10 Lakhs upto ₹ 50 Lakhs : <u>₹1 Lakh + 7.5% amount exceeding ₹ 10 Lakhs</u> 		
	<ul style="list-style-type: none"> • Above ₹ 50 Lakhs: <u>₹ 4 Lakhs + 5% amount exceeding ₹ 50 Lakhs</u> 		
2.	The security deposit should be submitted before the start of work in the following forms:		
	i) Pay Order, Demand Draft in favour of Account officer, HEEP, BHEL, Hardwar payable at Haridwar		
	ii) 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.		
3.	Security Deposit shall not carry any interest.		
4.	EMD of successful tenderer can be converted and adjusted against the Security Deposit.		
5.	100% of the Security Deposit amount shall be refunded to the vendor after final acceptance of the machine. SD shall be released after the submission of Performance Bank Guarantee(PBG) by the vendor		
M.	<u>Performance Bank Guarantee (PBG):</u>	Vendor to comply	Accepted (Yes/No)
1.	Vendor shall be required to submit a performance bank guarantee(PBG) for 10% of the total work order value which shall be valid for a period of 12 months from the date of Final acceptance of machine .		
2.	The PBG shall be submitted on a non-judicial stamp paper of value not less than Rs.100/- issued by any one of the nationalised banks.		
N.	<u>PAYMENT TERMS:</u> (Note : No advance payment shall be made to the vendor.)	Vendor to comply	Accepted (Yes/No)
1.	Part payment will be made after completion of following milestones		
i)	First payment of 80% of material cost along with 100% taxes & duties shall be payable after receipt of material at HEEP, BHEL, Hardwar. Vendor to ensure that all relevant documents are submitted.		
ii)	Final payment of balance 20% of material cost, 100% of commissioning cost including service taxes as applicable amount and refund of 100% of the Security Deposit amount will be made after final acceptance, subject to submission of PBG as per para 'M'		
2.	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)	Income tax exemption letter(if applicable)		
3.	Excise duty & CST/VAT will be paid on material cost and service tax will be paid on commissioning charges at actual. Related original documents to be submitted for availing MODVAT credit by BHEL.		

O	<p><u>Risk Purchase Clause:</u>In case of delays in supplies / defective supplies or non-fulfillment of any other terms & conditions given in the work order the purchaser may cancel the work order in full or part thereof and may also make the purchase of the material / service from elsewhere / alternative source at the risk and cost of supplier. Vendor does not agree to above clause , their offer is liable to be rejected. In case any vendor accepts risk purchase clause initially and subsequently declines to honor the term in the eventuality of RISK PURCHASE, they may be banned for banned for business with BHEL.</p>		
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P.	<u>COMMERCIAL TERMS :-</u>	Vendor to comply	Accepted (Yes/No)
1.	Prices shall be quoted on “Firm Price” basis only. The prices should only on F.O.R BHEL, Haridwar basis inclusive of Packing & Forwarding charges. Applicable % of ED & Sales Tax, Freight & Insurance, Installation & Commissioning Charges should be clearly indicated in attached Price bid format as per “ Annexure-B ”		
2.	Validity of offer shall be for a minimum period of 120 days from the date of Tender Opening		
3.	Freight & transit insurance charges from Dispatching station to BHEL, Haridwar shall be borne by party.		
Q.	<u>QUALIFYING CRITERIA:-</u>	Vendor to comply	Accepted (Yes/No)
	The vendors meeting following criteria would only be considered:		
1.	The average annual turnover during the last three years ending March 31 st 2012 should be at least RS.40.0Lac. Audited balance sheets for the last three years should be submitted.		
2.	<p>2.1 The Party has retrofitted a CNC Horizontal Borer / HMC having min 5 axis with Siemens 840-D CNC system , Feed drives & Measuring system in the past Five years from the date of tender notice .</p> <p>2.2 Party has carried out in last 5 years from the date of tender notice</p> <p>a. Three projects of CNC Horizontal Borer / HMC/Milling machine with Siemens 840-D CNC system with each project costing not less than RS.35.0 Lacs.</p> <p style="text-align: center;">OR</p> <p>b. Two projects of CNC Horizontal Borer / HMC/Milling machine with Siemens 840-D CNC system with each project costing not less than RS.45.0 Lacs.</p> <p style="text-align: center;">OR</p> <p>c. One project of CNC Horizontal Borer / HMC/Milling machine with Siemens 840-D CNC system with the project costing not less than RS.80.0 Lacs.</p> <p>List of the customers along with respective contracting executive officers addresses (including phone No. / E-mail ID) for</p>		

	whom machines were retrofitted shall be enclosed with the offer.		
3.	Machines previously retrofitted by the party should be running satisfactorily for at least 6 months prior to the date of tender enquiry. 6 months period will be calculated on the basis of commissioning certificates provided. Vendor to provide P.O./ W.O copies and commissioning/ performance certificates for satisfactory operation of the above retrofitted systems along with name, address & contact details of their customer. BHEL reserves the right to verify the information provided.		
R.	<u>BHEL'S OBLIGATION:</u>	Vendor to comply	Accepted (Yes/No)
1.	Existing electrical schematic of the machine shall be provided by BHEL to the vendor.		
2.	Crane facility and lifting tackles like slings, rope, D-Shackles shall be made available while working in BHEL premises only.		
3.	Facilities of minor welding , brazing , minor machining facility required for rectification/fitting of supplied material, subject to the extent available in BHEL, shall be provided in BHEL premises only.		
4.	Any civil work required for the erection of panel shall be done by BHEL.		
5.	Electricity, water & air shall be provided by BHEL at one point only.		
6.	The above requirements should be informed by the vendor in advance.		
S.	<u>GENERAL CONDITIONS</u>	Vendor to comply	Accepted (Yes/No)
1.	<u>A point wise compliance statement shall be submitted for above scope of supply and work.</u>		
2.	Complete specifications such as Model/Type of the CNC, PLC, Heidenhain scales & encoders, motor and drive controllers etc shall be stated in the offer by the party. Ordering brochure/catalogue should be attached in which offered parts are highlighted.		
3.	Parties are requested to visit the site before making an offer.	Information	
4.	Any material not specified in scope of supply but required for successful commissioning shall be provided by the vendor free of charge.		
5.	Material to be used should be of reputed make or as per IS standards.		
6.	Party shall bring all types of hand tools including pneumatic/electrical drill machines, Laser equipments, and grinders along with general purpose measuring instruments and testing equipment with them during erection and commissioning.		
7.	The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com .		

8.	RULES AND REGULATIONS OF THE CENTRAL/STATE GOVERNMENT: In the event of award of any contract, vendor will have to comply and abide by all the laws/enactment of state and central government. Documents regarding registration with Sales Tax and Excise authorities may also to be forwarded along with income tax clearance.		
9.	The award of works will be made on basis of the total of material cost, commissioning charges & all taxes , duties as applicable (Total Cost to BHEL). The vendor should submit their best price at this stage itself and they will not be allowed to revise the price. Any revision/discount given by the vendor subsequently will be ignored.		
T.	<u>OFFER :-</u> The offer should be submitted in two parts and in following manner.		
1.	<u>Techno-commercial Bid :</u>	Vendor to comply	Accepted (Yes/No)
i)	The envelop shall contain the Techno-commercial Bid (ANNEXURE 'A') with technical details and commercial terms & conditions along with Unpriced priced bid as per ANNEXURE 'B' with clear undertaking that no deviation from BHEL's price bid format , relevant documents like copies of ESI, PF code, PAN No., Service Tax Reg. No., TIN No., CST No., Experience Certificates, Audited Balance Sheet of last 3 years, Tender fees, EMD and Check list as per ANNEXURE 'C' (Demand draft for tender document cost shall also be accompanied in case tender documents are down loaded from BHEL website. Offers without the EMD and DD towards Tender documents cost will not be considered)		
ii)	The envelop shall be super scribed with "Techno-Commercial Bid", Name of work & NIT No. and Date of opening		
iii)	Point-wise compliance of this scope of supply and work is to be given by vendors while submitting their techno-commercial offer in the format provided by BHEL. Each page of the compliance list has to be ink signed & stamped by the vendor.		
iv)	The vendor must note that no prices are to be quoted/mentioned in the techno-commercial offer.		
2.	<u>Price Bid :</u>	Vendor to comply	Accepted (Yes/No)
i)	The second envelope shall contain only the price bid with separate price for material & work on Price Bid Format as per <u>ANNEXURE 'B'</u> .		
ii)	Any other information in the price bid shall not be considered and the quotation is likely to be rejected. Price bid document shall be ink signed by the bidder at the bottom of each page.		
iii)	The envelope shall be sealed and super scribed with "Price Bid", Name of work & NIT No.		
iv)	Price bids of only techno commercially accepted vendors shall be opened.(In presence of available vendors at the time of opening)		
3.	Both the above two envelopes shall be kept in another sealed cover. The cover shall be super-scribed with "Quotation for (name of work), NIT No. & due date and shall be submitted in the Tender box kept in the tender room of purchase department at the 4 th floor of the Main Administrative Building of HEEP, BHEL, Haridwar -249403 and it should also contain vender's name & contact details.		

ANNEXURE 'B'

PRICE BID FORMAT

Name of Work: RETROFITTING OF SKODA CNC HORIZONTAL RAM BORER PLAN No. 1-118, Block-3

NIT NO. & Date:

Bidders Offer No. & Date:

Sl. No.	Description of item	Unit	Qty	Basic Rate (in Rs.)	Excise Duty (in %)	VAT/CST (In %) (VAT with FORM-17 or CST with C-FORM)	Service Tax (In %)	Value (in Rs.)	
1	Material	Set	01		%	%		Rs.	
2	Spares	Set	01		%	%		Rs.	
3	Installation & Commissioning	Set	01				%	Rs.	
4	Packing & Forwarding charges in both % and Lamp sum (in Rs.)							%	Rs.
5	Transportation Charges F.O.R.HEEP, BHEL, Haridwar (in Rs.)								Rs.
6	Transit insurance charges, in both percentage and Lamp sum (in Rs.)from Dispatching station to HEEP,BHEL, Haridwar							%	Rs.
	TOTAL COST								Rs.

Signature & Seal of Vendor

ANNEXURE 'C'

CHECK LIST FOR TENDER

NIT No. & Date:

Vendor shall ensure that following documents / particulars have been enclosed with tender. This check list shall be enclosed with Techno-commercial Bid.

Sl. No.	Particulars	Yes/No	Remarks
1.	Sealed (Techno-commercial Bid+ Unpriced price bid) as per clause T-1-i of Annexure 'A' of NIT		
2.	Sealed Price Bid as per Annexure 'B' of NIT		
3.	Compliance to all the points of the Annexure 'A' of NIT		
4.	Audited balance sheets for the last three years should be submitted required as per Clause Q-1 of Annexure 'A' of NIT.		
5.	P.O. copies and commissioning/ Performance certificates required as per Clause Q-2 of Annexure 'A' of NIT		
6.	Name, address & contact details of their customer required as per Clause Q-3 of Annexure 'A' of NIT		
7.	Tender Fee enclosed.		
8.	Earnest Money Deposit (EMD) required as per Clause K of Annexure 'A' of NIT		
9.	Complete specifications such as part no. / Model / type of Siemens system, drive and servo motors, power, torque, rated and max RPMs, Rated and max. Currents of servo motors. Ordering brochure/catalogue should be attached required as per Clause S-2 of Annexure 'A' of NIT.		

(Signature & Seal of Vendor)