*Annexure- 1*

## RECONDITIONING OF LAHR DEEP HOLE DRILLING MACHINE (ITEM NO: 25/A/2001) OF HCM DIVISION Spec No: 25A2001, Rev: 0

**NECESSITIES:**

LAHR Deep Hole Drilling Machine is a CNC machine to drill holes on the components that are required for Hydro and Nuclear Products of BHEL-HEP, Bhopal. This machine was installed in the year 1979 and is being used for this application since then. This was retrofitted with Siemens Sinumerik during year 1997. Since recently, there was an accuracy issue in the machine. Hence it is proposed to Recondition the machine so that required accuracy will be attained. Considering application and the accuracy requirement, the committee laid down few necessities for reconditioning as enumarated below-

i. Reconditioning required to be executed by a Vendor, who has experience in handling such 3 axis machines. Machine tool manufacturer can also be considered.

ii. The reconditioning required to be handled by a single vendor and it should not be splitted.

iii. Most of the components and attachments that are required to be replaced are to be fabricated, which needs investment from the vendor. Hence the vendor required to be financially strong to manage the required fund.

iv. Few critical attachments/assemblies like, CNC Controller, required to be retained.

v. Few components which are available in-house need to be made use off during reconditioning

| | | Vendor to Confirm | Deviation (if any) | Remarks |
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| **A** | **MACHINE:**<br>**A.1** Make: G A Gray Company, Cincinnati, Ohio<br>A.2 Type: Deep Hole Drilling machine<br>A.3 Machine Model Number: 0682SDR2<br>**A.4** Machine Serial Number: **9791**<br>**A.5** Column Traverse (X Axis): **8 feet**<br>**A.6** Headstock Traverse (Y Axis): **6 feet**<br>**A.7** Drilling Spindle Traverse (Z Axis): **30 inches**<br>**A.8** Drilling Spindle: **2 numbers**<br>**A.9** Spindle rotation: **3000 RPM** (max)<br>**A.10** Rapid traverse X, Y, Z Axes: **3000 mm/min**<br>**A.11** Motor rotation X, Y, Z Axes: **3000 RPM**<br>**A.12** Spindle pitch plate range: **140** mm to **168.25** mm | | | |

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| **B** | **REQUIREMENTS** | | | |
| B 1 | Machine should be reconditioned suitably so that the geometrical accuracies of the machine are restored within the admissible values mentioned in the Test Chart attached in Annexure 1A. | | | |
| B 2 | The retrofitted machine should be able to meet the positioning accuracies as mentioned in Clause F in the working area of X Axis ≥ 2300 mm, Y Axis ≥ 1700 mm and Z Axis ≥ 650mm. | | | |
| B 3 | Existing Sinumerik 840D CNC controller with PLC, Simodrive 611D AC Servo Drives & 1FT6 AC Servo Motors of Siemens make together with the Spindle Motors, Inverters and the electrical cabinet with switchgear will be retained. | | | |
| B 4 | Existing ball-screw and nut assembly of X, Y & Z axes will be replaced with brand new and compatible ball-screw and nut assemblies (of NSK, Japan make), to be supplied by BHEL. | | | |
| B 5 | Existing linear scales (LS 503 of Heidenhain make) for X & Y axes will be replaced with brand new and compatible linear scales (LB 382C of Heidenhain make), to be supplied by BHEL. | | | |
| B 6 | Rotary Encoder (ROD 486 of Heidenhain make) for Z Axis will be retained. | | | |
| B 7 | The existing cutting oil system to be replaced with a brand new system of same or higher capacity, for filtering, cooling and pressurizing of the Cutting oil. | | | |
| B 8 | The reconditioned machine should have capacity to drill at cutting speed of 35 m/min with feed of 0.03 mm/rev on forged stainless steel (Grade: SA182 F316L, Tensile strength - 486 MPa) jobs with latest generation single lip coated carbide gun drill of 12.76 mm diameter. | | | |
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| **C** | **SCOPE OF SUPPLY:** | | | |
| C 1 | New Spindle assemblies along with housing & front guide bush with mounting box for both the top and bottom spindle. The spindle assemblies & guide bushes are to be procured from any reputed machine tool spindle manufacturer. The accuracies of the spindles are to be as per test chart attached in Annexure 1. | | | |
| C 2 | Planetary gearbox/belt pulley arrangements (Ratio 5:1) for X & Y axes. | | | |

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| C 3 | New hydraulic power pack of make Hawe/Rexroth/Yuken/Vickers/Hydac and of suitable rating, with all pressure regulating valves, solenoid valves, piping's, control switches & other accessories. | | | |
| C 4 | All hydraulic pistons to lock the guide with job, machine locking pistons, hoses and seals used in the machine are to be replaced with new one. | | | |
| C 5 | Lubrication system for X, Y, Z Axes & spindles along with all piping. | | | |
| C 6 | All bearings which include Spindle bearings, Linear bearings, Ball screw end bearings etc. of the machine are to be replaced with new. The bearings should be of SKF/FAG/TIMKEN/ NSK/NTN/INA makes. | | | |
| C 7 | Turcite/Biplast anti friction liners coating for slides. | | | |
| C 8 | Telescopic antirust metallic covers of X & Y guideways. Fabric Bellow cover for Z axis guides. | | | |
| C 9 | Cutting Oil System (including filtration and chilling unit), capable of discharge of min 60 GPM at 80kg/cm² per spindle. A variable (settable) flow control mechanism to achieve points of flow and pressure at different load is to be provided. Cleanliness of the oil after filtration should be 5-10 microns and the cutting oil temperature should be maintained within 40 degrees Celsius. The existing cutting oil is Servo Cut 253. | | | |
| C 10 | Apparatus for measuring the cleanliness of the cutting oil, has to be supplied by the supplier at the time of testing of the machine. | | | |
| C 11 | Rotary unions (of Deublin/Rotex/Johnson make) for both spindles. | | | |
| C 12 | Chip conveyor of 130 mm width for metallic chips to be replaced in place of the existing one. | | | |
| C 13 | Documents consisting of | | | |
| | O&M manual Coolant system – 3 sets | | | |
| | O&M manual for Lubrication system – 3 sets. | | | |
| | Details of all mechanical modifications & fittings with drawings – 3 sets. | | | |
| C 14 | For job prove-out, 4 Nos Gun Drill and 4 Bushes shall be provided by the supplier. | | | |
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| **D** | **SCOPE OF WORK:** | | | |
| D 1 | The machine should be reconditioned to achieve positioning accuracies & repeatability as mentioned in Clause F and perform job prove-out in line with Clause H. | | | |

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| D 2 | Dismantling of the machine as per requirement. This includes removal of machine assemblies, motors, scales, controllers and wiring of electrical systems. | | | |
| D 3 | Grinding/scrapping of all guideways and slides of the machine. | | | |
| D 4 | Turcite/Biplast coating along with wipers are to be applied on the machine slides. | | | |
| D 5 | Replacement of ball-screw and nut assemblies of X, Y & Z axes with those supplied by BHEL. | | | |
| D 6 | Replacement of feed gearboxes of X & Y axes with planetary gearbox/belt pulley arrangements. | | | |
| D 7 | Replacement of the belt-pulley arrangement along with encoder mounting of the Z axis. | | | |
| D 8 | Replacement of the Spindle assemblies along with housing & front guide bush with mounting box for both the top and bottom spindle. | | | |
| D 9 | Replacement of the linear scales of X & Y axes and reorientation of X Axis scale from horizontal to vertical mounting. | | | |
| D 10 | Replacement of the New Cutting oil system along with all accessories and rotary unions. | | | |
| D 11 | Replacement of lubrication system for X, Y & Z Axes. | | | |
| D 12 | Replacement of the power pack of the machine, with all pressure regulating valves, solenoid valves, piping's & other accessories. | | | |
| D 13 | Replacement of all the hydraulic pistons and hoses. | | | |
| D 14 | Installation of telescopic covers for X & Y Axes and bellow cover for Z Axis. | | | |
| D 15 | Replacement of the existing chip conveyor and installation of a new one in the gap between the bedplate and machine bed so as to maximise the Y Axis traverse. | | | |
| D 16 | Reassembly of the entire machine with reconnection of wirings of electrical & control systems. All the wires & cables will be provided by the BHEL. | | | |
| D 17 | Painting of the entire machine using RAL 6011 Reseda Green (Polyurethane Paint) | | | |
| D 18 | Establishing the machine accuracy in line with Clause F. | | | |
| D 19 | Job prove out in line with Clause H. | | | |
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| **E** | **GENERAL OPERATING CONDITIONS:** | | | |
| E 1 | Temperature: 5 to 50 degree Celcius | | | |
| E 2 | Humidity: 0 - 95% RH | | | |
| E 3 | Power Supply: 415V +/-10%, 50 Hz +/- 3%, 3 Phase, 3wire without neutral. | | | |
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| **F** | **MACHINE ACCURACY:** | | | |
| | Machine should be able to meet the positioning accuracies & repeatability measured as per VDI/ DGQ3441/ ISO 230-2 (Latest Revision) using Laser interferometer. | | | |
| F 1 | Positional uncertainty (P) in X, Y & Z axes: ≤ 0.04 mm. | | | |
| F 2 | Positional scatter (Ps) in X, Y & Z axes: ≤ 0.01 mm. | | | |
| F 3 | Positional deviation (Pa) per 1000 mm for X, Y & Z axes: ≤ 0.02 mm. | | | |
| F 4 | Positional deviation (Pa) for entire travel: X ≤ 0.08mm, Y≤ 0.06mm, Z ≤ 0.05mm. | | | |
| F 5 | Reversal error (U) in X & Z axes: ≤ 0.015 mm | | | |
| F 6 | The geometrical accuracy of the machine shall be checked as per ISO 3070 test chart. | | | |
| F 7 | All these tests should be performed by the vendor at BHEL Bhopal. | | | |
| F 8 | Vendor should arrange for personnel from CMTI, Bangalore for carrying out the accuracy test on the machine. The entire cost of deputation of CMTI personnel would be borne by the vendor. | | | |
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| **G** | **JOB ACCURACY:** | | | |
| G 1 | Hole size: 12.76 mm + 0.05/-0.00 mm | | | |
| G 2 | Hole finish: 1.6 Ra or Better | | | |
| G 3 | Drill Drift: ≤ 0.1 mm (for 150 mm drilling depth) | | | |
| G 4 | Drill drift shall be measured by optical telescope. | | | |
| G 5 | Hole size to be measured at 3mm from the front face, 3 mm from the rear face and 3 locations at equal intervals | | | |
| G 6 | Hole ID shall be measured from 2 point micrometer & 3 point micrometer to check ovality | | | |
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| **H** | **JOB PROVE-OUT:** | | | |
| H 1 | The machine will be tested by making 25 number holes of size 12.76mm in 150 mm thick Forged Stainless Steel plate from Spindle 1 & Spindle 2 respectively, at BHEL works. | | | |
| H 2 | In addition to this, 50 Number of holes in 150 mm thick forged stainless Steel Plate, by using both the spindles at the same time will be done. | | | |
| H 3 | Only after all these holes are found as per the Job Accuracy (mentioned above in Clause G), the Job prove-out will be deemed as successful. | | | |
| H 4 | The job prove-out shall be done according to the drawing (Sketch-1) attached with the specification. | | | |

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| H.5 | The Geometrical tests as per OEM test charts will be done at suppliers works, prior to dispatch of the machine | | | |
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| **I** | **COMPLETION:** | | | |
| I 1 | Upon completion of the scope of supply and scope of work, successful job prove-out shall constitute the FINAL HAND-OVER of the machine and completion of the project. | | | |
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| **J** | **PERIOD OF RECONDITIONING:** | | | |
| J 1 | Four (4) months maximum from the date of release of machine. Upon receipt of the Work Order, the party must plan out the procurement of materials, transportation (if required) and execution of the work with a detailed project schedule. The date of release of the machine will be decided on mutual consent of BHEL and the party. | | | |
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| **K** | **GUARANTEE:** | | | |
| K 1 | Vendor shall stand guarantee for smooth functioning of the machine, including all the materials supplied and workmanship, for a period of one year from the date of FINAL HAND-OVER of the machine. | | | |
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| **L** | **REPLACEMENT MATERIAL TO BE SUPPLIED BY BHEL** | | | |
| L 1 | Ball-screw & ball-nut assembly for X Axis. Make: NSK; Pitch: 6mm; Dia:63 mm; Overall Length: 3130 mm; Threaded Length: 2808 mm; Class: C3 | | | |
| L 2 | Ball-screw & ball-nut assembly for Y Axis. Make: NSK; Pitch: 6mm; Dia:63mm; Overall Length: 3085 mm; Threaded Length: 2130 mm; Class: C3 | | | |
| L 3 | Ball-screw & ball-nut assembly for Z Axis. Make: NSK; Pitch: 6mm; Dia:50 mm, Overall Length: 1550 mm; Threaded Length: 1256 mm Class: C3 | | | |
| L 4 | Linear sealed scale for X Axis. Make: Heidenhain; Type: LB 382C; ML = 2440mm | | | |
| L 5 | Linear sealed scale for Y Axis. Make: Heidenhain; Type: LB 382C; ML = 1840mm | | | |
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| **M.1** | **Technical Qualifying Requirement for MSME & Non-MSME Vendors :** | | | |
| **M.1.1** | Only those vendors who have successfully Manufactured / Reconditioned at least one CNC machine (As mentioned in Clause M.1.2) during last 7 years as on date of opening of the Tender and the referred machine (As mentioned in Clause M.1.2) should be presently working satisfactorily at their customer works.<br><br>The party must submit copy/copies of Purchase/Work Order(s) for award of work(s) and Performance Certificate(s) of the machine(s) from the customer's along with the offer. The performance certificate should have been issued within ONE year from the date of opening of tender.<br><br>The vendor shall coordinate the visit of BHEL team (if required) for verification at the customer's works. | | | |
| **M.1.2** | (1) **CNC** Deep Hole Drilling Machine having minimum Bed Length of **2000 mm** & minimum Column Height **1500 mm** and minimum Z-Axis Travel: **500 mm**<br>**OR**<br>(2) **CNC** Horizontal Boring Machine / **CNC** Horizontal Machining Center of minimum Spindle Diameter 100 mm, minimum X-Axis Travel: 2000 mm, minimum Y-Axis Travel: 1500 mm and minimum Z-Axis Travel: 500 mm | | | |
| **M.2** | **Financial Qualifying Requirement for Non-MSME Vendors :** | | | |
| **M.2.1** | The average **Annual Financial Turnover** during last 3 years ending 31.03.2019 should be at least **29.24 Lakhs**. | | | |
| **M.2.2** | The vendor should have experience of **successfully** executed Purchase Order / Work Order for similar works (As mentioned in Clauses M.1.1 & M.1.2) in any of the following ways :<br>(a) **One** similar completed work of order value not less than **Rs. 77.98 Lakhs OR**<br>(b) **Two** similar completed works of order value not less than **Rs. 48.74 Lakhs each OR**<br>(c) **Three** similar completed works of order value not less than **Rs. 38.99 Lakhs each.**<br><br>Copy of Purchase Order/Work Order along with Completion Certificate /Performance Certificate from end user to be submitted in Technical bid.<br><br>**Note:** Similar work is defined in **Clause M.1.1 & M.1.2** | | | |

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| **M.3** | **No Financial Qualifying Requirement for MSME Vendors.**<br>**Note:** This is to comply the relaxation as per the prevailing guidelines issued by Government Of India | | | |
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| **N** | **BANK GUARANTEE** | | | |
| | The Bank Guarantee to be submitted by the vendor before taking the machine to their works to be of Rs 52 Lakhs. | | | |
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| **O** | **PACKING ,TRANSPORTATION & TRANSIT INSURANCE** | | | |
| | The To & Fro transportation & transit insurance of the machine from BHEL to contractors works will be in BHEL scope.<br>Packing of the machine from BHEL to Contractor's works will be in BHEL Scope.<br>After reconditioning, the contractor has to pack the machine & send it through BHEL approved transporter | | | |
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| **P** | **NOTES:** | | | |
| 1 | Parties are required to examine the machine 'as-is-where-is' condition at BHEL, Bhopal works & study it thoroughly along with its documents and the replacement material to be supplied by BHEL (as per Clause L, D16. B3 to B6), before submitting their offer. The vendor is responsible for carrying out the Reconditioning & prove out the machine as per Scope. | | | |
| 2 | In case the machine tool or any part thereof is required to be shifted outside the premises of BHEL, Bhopal for execution of the reconditioning work, Comprehensive Insurance together with Bank Guarantee should be provided by the bidder, based on the salvaged value of the items (to be indicated by BHEL). | | | |
| 3 | In case, machine is shifted out of BHEL for reconditioning, BHEL team may inspect the machine prior to dispatch of the same back to BHEL Bhopal. | | | |
| 4 | The standard payment terms of BHEL Bhopal are as under: - | | | |
| 4.A | 30% of the contract value shall be paid after joint inspection by BHEL and contractor. This payment would be released on receipt of Bank Guarantee of like amount which should be valid till the completion of reconditioning work. | | | |

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| 4.B | 60% of the contract value together will 100% taxes and duties, shall be paid after the completion of the reconditioning and final HAND-OVER of the machine for production. | | | |
| 4.C | 10% of the contract value to be paid after release of Performance Certificate by production and maintenance personnel of BHEL. This payment shall be released against the BG of like amount. The BG should be valid till the expiry of the warranty period. | | | |
| 4.D | LD clause shall be applicable as 0.50% (Half Percent) per week of the Contract Value. The LD shall be deducted if the final hand-over of the machine is delayed beyond the agreed period for reconditioning. The maximum amount of the LD shall be 10% (Ten Percent) of the Contract Value. | | | |
| 5 | The machine will be given to the supplier in fully running condition and it will be the responsibility of the supplier to restore the machine back to full functionality after the reconditioning work. | | | |

**Sign & Seal of the contractor**