**CNC Under floor wheel lathe**

รายละเอียด Specification ดังเอกสารแนบ Appendix 2เปรียบเทียบอุปกรณ์ ในเอกสารสัญญาก่อสร้างก่อนทำ VE Specification 1 และ รายละเอียดอุกรณ์ที่ทำ VE แล้ว Specification 2 มีดังนี้

Here is a comparison of the technical specifications for the two CNC Underfloor Wheel Lathes, presented in a table format.

New Specification

| Feature | ตามข้อกำหนดสัญญา | ที่นำเสนอ | Remark |
|---|---|---|---|
| | Specification 1 | Specification 2 | |
| **Wheel Set Dimension** | | | |
| Track gauge | 1,000 mm | 1,000 mm | ตามข้อกำหนดสัญญา |
| Max. wheel tread diameter | 1,110 mm | 1,110 mm | ตามข้อกำหนดสัญญา |
| Min. wheel tread diameter | 700 mm | 700 mm | ตามข้อกำหนดสัญญา |

New specification

| Feature | ตามข้อกำหนดสัญญา | ที่นำเสนอ | Remark |
|---|---|---|---|
| | Specification 1 | Specification 2 | |
| Distance between inner wheel or tyre faces | 927+3/−1 mm | 927+1/−2 mm | ดีกว่าข้อกำหนดสัญญา |
| Tyre or wheel width | 120-130 mm | 120-135 mm | ดีกว่าข้อกำหนดสัญญา |
| Axle length | 1,500 – 2,100 mm | 1,500 – 2,100 mm | ตามข้อกำหนดสัญญา |
| Centre angle | 60° | 60° | ตามข้อกำหนดสัญญา |
| Max. wheel set weight | 1,750 Kg | 2,000 Kg | ดีกว่าข้อกำหนดสัญญา |
| Tensile strength of wheel or tyre | 94-110 Kgf/mm2 | 94-107 Kgf/mm2 | ดีกว่าข้อกำหนดสัญญา |
| **Locomotive and Rolling Stock Dimension** | | | |
| Max width | 2,900 mm | 2,900 mm | ตามข้อกำหนดสัญญา |
| Wheel diameter | 820-914 mm | 820-1,110 mm | ดีกว่าข้อกำหนดสัญญา |
| No. of axles per bogie | 2-3 | 2-4 | ดีกว่าข้อกำหนดสัญญา |
| Bogie Wheel base | 2,000-3,700 mm | 2,000-3,700 mm | ตามข้อกำหนดสัญญา |
| Axle space in one bogie | 1,650-1,850 mm | 1,650-1,850 mm | ตามข้อกำหนดสัญญา |
| Total wheel base | 12,370-20,100 mm | 12,370-20,100 mm | ตามข้อกำหนดสัญญา |
| Distance between center pivots | 10,410-17,500 mm | 10,410-17,500 mm | ตามข้อกำหนดสัญญา |
| Max overall length | 20,000 mm | 25,000 mm | ดีกว่าข้อกำหนดสัญญา |
| Max tare weight | 120,000 Kg | 120,000 Kg | ตามข้อกำหนดสัญญา |
| Max axle load | 20.0 Ton | 20.0 Ton | ตามข้อกำหนดสัญญา |
| Max. axle distance of coupled wheel set | 2,300 mm | 2,300 mm | ตามข้อกำหนดสัญญา |
| Min. axle distance of coupled wheel set | 1,300 mm | 1,500 mm | ดีกว่าข้อกำหนดสัญญา |
| Max. axle distance of non coupled wheel set | 2,500 mm | 2,500 mm | ตามข้อกำหนดสัญญา |
| Min. axle distance of non coupled wheel set | 1,440 mm | 1,440 mm | ตามข้อกำหนดสัญญา |
| **Power Supply** | | | |
| Operating Voltage & Frequency (3Ø, 4-wire) | 380V, 50 Hz | 380V, 50 Hz | ตามข้อกำหนดสัญญา |
| Control voltage (main circuit) | 220V, 50 Hz | 220V, 50 Hz | ตามข้อกำหนดสัญญา |
| Control voltage (auxiliary circuit) | 24V | 24V | ตามข้อกำหนดสัญญา |
| Voltage fluctuation | ±10% | ±10% | ตามข้อกำหนดสัญญา |

New Specification

| Feature | ตามข้อกำหนดสัญญา | ที่นำเสนอ | Remark |
|---|---|---|---|
| | Specification 1 | Specification 2 | |
| **Climate Conditions in Thailand** | | | |
| Maximum ambient temperature | 43 ℃ | 45 ℃ | ดีกว่าข้อกำหนดสัญญา |
| Maximum relative humidity | 100% | 100% | ตามข้อกำหนดสัญญา |
| Average relative humidity | 74% | 75% | ดีกว่าข้อกำหนดสัญญา |
| **Working Accuracy** | | | |
| Difference in tread diameter of two wheels on the same axle | ≤ 0.1 mm | ≤ 0.1 mm | ตามข้อกำหนดสัญญา |
| Radial Run-out of wheel tread on any wheel | ≤ 0.1 mm | ≤ 0.1 mm | ตามข้อกำหนดสัญญา |
| Lateral wobbles of wheel tread on any wheel | ≤ 0.2 mm | ≤ 0.2 mm | ตามข้อกำหนดสัญญา |
| The profile inaccuracy | ≤ 0.2 mm | ≤ 0.2 mm | ตามข้อกำหนดสัญญา |
| The difference between wheel diameters of any two wheels on the same bogie | ≤ 0.3 mm | ≤ 0.3 mm | ตามข้อกำหนดสัญญา |
| Surface finish of machined wheel (Ra) | ≤ 0.012 mm | ≤ 12 µm (equivalent to 0.012 mm) | ดีกว่าข้อกำหนดสัญญา |
| Surface finish inner and outer wheel faces | ≤ 0.025 mm | - | ดีกว่าข้อกำหนดสัญญา |
| Surface finish (Rz) | N/A | ≤ 63 µm | ดีกว่าข้อกำหนดสัญญา |
| Surface roughness of brake disc (Rz) | N/A | ≤ 16 µm | ดีกว่าข้อกำหนดสัญญา |
| Surface roughness of brake disc (Ra) | N/A | ≤ 4.5 µm | ดีกว่าข้อกำหนดสัญญา |
| **Wheel Machining Capacity** | | | |
| Reprofiling capacity per 8-hour shift (at 85% efficiency) | ≥ 9 wheel-sets | ≥ 10 wheel-sets | ดีกว่าข้อกำหนดสัญญา |
| Turning wheels with tensile strength | up to 94-110 Kgf/mm2 | up to 94-107 Kgf/mm2 | ดีกว่าข้อกำหนดสัญญา |

**STATE RAIL WAY OF THAILAND TENDER**

**SPECIFICATION FOR**

**CNC UNDERFLOOR WHEEL LATHE**

**AT KAENG KHOI NEW DEPOT**

## SCOPE

This specification covers the supply and delivery of one unit of CNC Underfloor Wheel Lathe including installation of the CNC Underfloor Wheel Lathe for State Railway of Thailand (hereafter referred to as SRT).

The CNC Underfloor Wheel Lathe shall be a heavy-duty machine of the latest and modern design for railway application. It shall be supplied complete in every detail with all equipments, accessories. The delivery of the CNC Underfloor Wheel Lathe shall be fully assembled including its complete installation for operation at Kaeng Khoi newdepot.

## Proposals

Technical description features and specification of the proposed CNC Underfloor Wheel Lathe shall meet all the terms and requirements in this specification and shall be submitted with the proposal for consideration accompanied with diagram, illustrations and general arrangement drawing(s) of the machine.

Only the CNC Underfloor Wheel Lathe with good performance and successfully operation record will be considered. Tenderer shall supply along with his proposal the certified documents for quality and efficiency of the proposed CNC Underfloor Wheel Lathe.

*SRT reserve the rights to investigate all the document that bidder submitted*

## GENERAL FEATURES

The CNC Underfloor Wheel Lathe shall be operated in full automatic, semi-automatic and manually. And it shall have high production output, high accuracy, least vibration and noise level, and economical manner regarding material saving turning together with energy saving. The lathe shall feature an automatic measurement system to measure the wheel tread wear and wheel running diameter. The measurement system should be protected in a suitable enclosed housing when not in use.

The CNC Underfloor Wheel Lathe shall be suitable for re-profiling (wheel tread, flange and chamfer) the worn or rough finish profile of wheel or solid wheels of the wheel set of locomotives, railcars, passenger coaches and freight cars as shown in the attached drawing in Clause 4. And it shall be suitable for machining the inner and outer faces of wheel, cutting away of rolled-over material (Aris formation removal) at the chamfer area, facing of brake discs situated between wheels on wheel set axle.

Simultaneous re-profiling of both wheels of an axle of meter gauge locomotives, railcars, passenger coaches and freight cars wheel set, attached drawing Clause 4, in a single machining session without removing bogie brake gear, axle box covers or any other component of locomotives, railcars, passenger coaches and freight cars.

Simultaneous re-profiling of both wheels of an independent single wheel set with either outboard or inboard axle boxes fitted using suitable hold-down device. Machining of wheel, tread and flange including the inside face of the flange in continuation of the tread profile turning in accordance with the SRT profile drawing. The CNC Underfloor Wheel Lathe shall be able to be operated by one operator and one helper.

The CNC Underfloor Wheel Lathe and its' system shall be designed so that the cutting chips will not interfere with the operation and not cause wear to parts of the machine. And the cutting chips shall be removed from the system for disposal simply and easily. Safety and comfort to operator, and time saving operation shall be listed among top priority requirement.

The brief of the above design and arrangement shall be submitted together with the proposal. The preferable CNC Underfloor Wheel Lathe shall be given to modern design that shows advantage in the above matters and simpler movement in operation. All rotating systems are to be guarded by suitable movable and fixed guards. The movable guards shall be interlocked to stop access when the lathe is turning. The operator shall be able to see the machining operation of both wheels directly from the operation position.

**TECHNICAL DATA**

The specification of the proposed CNC Underfloor Wheel Lathe

shall be based upon the following technical data:

Wheel set dimension:

| | | |
|---|---|---|
| Track gauge | 1,000 | mm. |
| Max. wheel tread diameter | 1,110 | mm. |
| Min. wheel tread diameter | 700 | mm. |
| Distance between inner wheel or tyre faces | 927+1/-2 | mm. |
| Tyre or wheel width | 120-135 | mm. |
| Axle length | 1,500 – 2,100 | mm. |
| Centre angle | 60 ° | |
| Wheel set weight, max. | 2,000 | Kg. |
| Tensile strength of wheel or trye | 94-107 | Kgf/mm2 |

Locomotive and Rolling stock dimension

| | | |
|---|---|---|
| Max width | 2,920 | mm. |

| | | |
|---|---|---|
| Wheel diameter | 820-1,110 | mm. |
| No. of axles per bogie | 2-4 | mm. |
| Bogie Wheel base | 2,000- 3,700 | mm. |
| Axle space in one bogie | 1,650-1,850 | mm. |
| Total wheel base | 12,370-20,100 | mm. |
| Distance between center pivots | 10,410-17,500 | mm. |
| Max overall length | 25,000 | mm. |
| Max tare weight | 120,000 | Kg. |
| Max axle load | 20 | Ton. |
| Max. axle distance of coupled wheel set | 2,300 | mm. |
| Min. axle distance of coupled wheel set | 1,500 | mm. |
| Max. axle distance of non coupled wheel set | 2,500 | mm. |
| Max. axle distance of non coupled wheel set | 1,440 | mm. |

| | |
|---|---|
| Power supply: | |
| Operating Voltage & Frequency (3Ø, 4-wire) | 380V,50 Hz |
| Control voltage | |
| - for main circuit | 220V,50 Hz |
| - for auxiliary circuit | 24V |
| Voltage fluctuation | ±10% |
| Climate conditions in Thailand | 45 °C |
| Maximum ambient temperature | 35 °C |
| Maximum relative humidity | 100% |
| Average relative humidity | 75% |

Working accuracy of the required Underfloor Wheel Lathe that the machined wheel set should meet following standards:

| | | |
|---|---|---|
| Difference in tread diameter of two wheels on the same axle. | ≤ 0.1 | mm. |
| Radial Run-out of wheel tread on any wheel | ≤ 0.1 | mm. |
| Lateral wobbles of wheel tread on any wheel | ≤ 0.2 | mm. |
| The profile inaccuracy when measured with a standard profile gauge. | ≤ 0.2 | mm. |
| The difference between wheel diameters of any two wheels on the same bogie | ≤ 0.3 | mm. |

| | | |
|---|---|---|
| Surface finish (Ra) | ≤ 12 | µm. |
| Surface finish inner and Outer wheel faces | - | mm. |
| Surface finish (Rz) | ≤ 63 | µm. |
| Surface roughness of brake disc (Rz) | ≤ 16 | µm. |
| Surface roughness of brake disc (Ra) | ≤ 4.5 | µm. |

Wheel Machining Capacity

The machine shall be capable of re-profiling minimum 10 wheel-sets per 8 hour shift working at 85% efficiency (allowing 15% for tool changing and other machine/operator requirements).

The machine shall be capable of turning wheels with tensile strength up to 94-107 Kg/mm2 without vibrations or chatter at all loads.

Details of each time element – loading, set-up, machining and unloading along with cutting parameters indicating the type and make of tools, speeds, feeds shall be furnished.

**APPLICATION DRAWINGS**

The drawing and diagrams listed below are relevant locomotive, railcar, passenger and freight wheel sets used in SRT.

| | | |
|---|---|---|
| Structure and loading profile | Dwg.No. | 1966-36 |
| Bogie arrangement | Dwg.No. | 6.40-130.01-00 |
| Bogie arrangement | Dwg.No. | 218-100.01-00 |
| Bogie | Dwg.No. | 1-08-14.00.44-028 |
| Bogie | Dwg.No. | 1-08-14.00.44-029 |
| Journal box ass'y | Dwg.No. | 1-1101DRC2-002 |
| Wheel set II | Dwg.No. | 628-112.01-00 |
| Journal box | Dwg.No. | D-45315 |
| Axle box | Dwg.No. | MA-390-001 |
| Truck asm | Dwg.No. | 41R990141 |
| Journal axle box and roller | | |
| bearing for passenger cars | Folio No. | F/P 0007/1 |
| Journal box assembly | Dwg.No. | 1-9BNS2-002 |
| Axle box assembly | Dwg.No. | P2-2192 |
| Arrangement for axle box | Dwg.No. | G2-2005/2 |
| Bearing assembly | Dwg.No. | 1-4TG2-002/1 |
| Arrangement for axle box | Dwg.No. | 1-24Ga2-002 |
| Wheel tyre contour | RSR Dwg.No. | MM2-2036 |

| | | |
|---|---|---|
| Wheel tyre contour | RSR Dwg.No. | MM2-2037 |
| Wheel tyre contour (Vidura contour) | RSR Dwg.No. | MM2-2029 |
| P8 wheel contour | RSR Dwg.No. | MM2-P8 |
| Wheel tyre contour | RSR Dwg.No. | MM2-2031 |
| Layout of Bangsue depot wheel shop | Dwg.No. | 3627-61 |
| Layout of Bangsue depot wheel shop | Dwg.No. | 3627-60 |
| Wheel and axle | Dwg.No. | 511D1-2010 |
| Wheel and axle | Dwg.No. | 611D1-1038/1 |
| Wheel set | Dwg.No. | 1-4001D1-001 |
| Standard axle with axle-box assembly | Dwg.No. | TR8025132 |
| Wheel and axle | Dwg.No. | 2L107230-3021 |
| Wheel and axle mounting | Dwg.No. | 84D705067 |
| Axle detail | Dwg.No. | C61819 |
| Wheel set | Dwg.No. | 2-3001D1-003 |
| Driving Wheel set complete | Dwg.No. | 1-08-12.10.46 |
| Wheel set I/III | Dwg.No. | 628-111.01-00 |
| Axle | Dwg.No. | 218-111.11-01 |
| Wheel and axle (D) | Dwg.No. | 1-1101DRC1-001 |
| Detail of axle (Power) | Dwg.No. | 1110118 |
| Assembly of wheel set (Power & Trailer) | Dwg.No. | 5030368 |
| Wheel and axle assembly | Dwg.No. | TR200013 |
| Wheel & axle regauging | Dwg.No. | JRW-DR2-0009 |
| Wheel & axle | Dwg.No. | 1-6TP1-001/3 |
| Wheel & axle | Dwg.No. | 1-12TP1-001 |
| Wheel & axle with retyring rolled disc wheels | Dwg.No. | P1-2439/1 |
| Wheel & axle | Dwg.No. | PG1-2106 |
| Wheel & axle (Type IV AP) | Dwg.No. | PG1-2151 |
| Wheel & axle | Dwg.No. | JR-W1-001A |
| Wheel & axle (Type V AP) | Dwg.No. | G1-2257/1 |
| 2900 PS. Diesel Electric Locomotive | Dwg.No. | D23 |
| General Arrangement of Air Condition First Class Day and Night Coach | Dwg.No. | 1-4ANF3-002 |
| Air Condition Power Diesel Railcar with Driving Cab 285 HP. | Dwg.No. | APD.1 |
| Bogie Container Flat Wagon | Dwg.No. | BGF.14 |

| | | |
|---|---|---|
| Solid Mono Block Wheel | Dwg.No. | P1-2606/2 |
| Axle | Dwg.No. | P1-2607/1 |
| Solid (Mono Block) Wheel & Axle | Dwg.No. | P1-2608/1 |
| Bogie (CW750) | Dwg.No. | CCKZ76-00-000 |
| Bogie Station Drawing | Dwg.No. | CCKZ76-00-000PZ |
| EQC – MO2 Type Bogie | Dwg.No. | ECZ37-00-00-000 |
| Roller Bearing assembly | Dwg.No. | ECZ37-10-00-000 |
| Axle | Dwg.No. | ECZ37-10-01-002 |
| General layout | Dwg.No. | QS49-00-00-000 |
| Axle box assambly | Dwg.No. | QSJZ24-20-10-000 |
| Wheel set | Dwg.No. | QSJZ24-20-20-001 |
| Axle box (1) | Dwg.No. | QSJZ24-20-11-000 |
| Axle box (2) | Dwg.No. | QSJZ24-20-12-000 |
| Axle box (3) | Dwg.No. | QSJZ24-20-13-000 |
| Axle box (4) | Dwg.No. | QSJZ24-20-14-000 |
| Axle box (5) | Dwg.No. | QSJZ24-20-15-000 |
| ARRANGEMENT OF AUTOMATIC COUPLER & DRAFT GEAR | Dwg.No. | LV5 – 2047/7 |
| General layout | Dwg.No. | QSJ61-00-00-000S1 |
| General layout | Dwg.No. | QSJ61-00-00-000S2 |
| Axle Box Assembly | Dwg.No. | QSJZ35-20-10-000 |
| Axle Box (1) | Dwg.No. | QSJZ35-20-11-000 |
| Axle Box (2)(4) | Dwg.No. | QSJZ35-20-12-000 |
| Axle Box (3)(5) | Dwg.No. | QSJZ35-20-13-000 |
| Axle Box Body | Dwg.No. | QSJZ35-20-11-001 |
| Wheel set | Dwg.No. | QSJZ35-20-20-000 |

**EQUIPMENT OF THE MACHINE**

**General**

The machine shall be of robust construction capable of withstanding severe duty over long years of service. All major castings shall be close-grained cast iron or high quality steel or welded

All guide-ways shall be designed for long service life and shall be properly protected to prevent ingress of swarf. The machine configuration shall ensure easy accessibility of all vital sub-assemblies for operation and maintenance. Detail of any solid lubrication points should be clearly labeled with the type of solid lubrication that is to be used. All electrical terminal boxes that can be accessed shall be marked with a warning shield and the value of the voltage. The integration of an automatic solid lubrication system for the lubrication of the guideways. The solid lubrication reservoir is to be refilled.

**Hauling System**

A suitable winch arrangement to haul locomotives onto the machine and out of the machine after re-profiling shall be provided. The device shall be capable of hauling locomotives with tare weight up to 140.0 T.

The hauling device shall also be provided with a hand actuated emergency operation system such as a hand crank, with can be used in the event of failure of the hauling device. Arrangement shall be provided to ensure that the motor remains disengaged when the hand actuated system is being used.

An arrangement ( traffic lights or similar )to signal and assist the operator to position the wheel at the correct machining position shall be provided.

**Lifting and Positioning System**

A hydraulic lifting system shall be provided to raise the vehicle axle load from the retracting rails to enable their withdrawal and measure the applied axle load to ensure the optimal retention force is applied to the wheelset. The retraction of the rail bridge shall be power operated, controlled by lathe’s control system PLC. Where coupled wheelsets shall be fitted to the vehicle the second wheelset shall be lifted up from contact with the track by means of suitable hydraulic lifting jacks.

A suitable wheel centering and positioning device with a set of two rollers on each side shall be provided for locating the wheel set on wheel flanges or treads. All four rollers shall be geometrically aligned and their movement synchronized to ensure true centering of wheels. The machine shall have facility to re-profile wheel-sets with reference to axle box-bearing center. Suitable lateral wheel-set holding arrangement shall be incorporated.

**Drive System**

Each machining head shall be provided with an independent drive unit. Both the drive units shall be fully synchronized. Drive to the wheels shall be through a set of two drive rollers on either side. Drive rollers shall be of suitably heat-treated alloy steel, hardened and ground. It shall be possible to change the speed of the drive rollers during machining without stopping the machine to facilitate cutting through work hardened spots. Drive rollers shall be fully floating type to enable follow the worn-out tread profile without losing contact. Drive rollers shall be of suitably heat-treated alloy steel, hardened and ground. It shall be possible to change the speed of the drive rollers during machining without stopping the machine. The drive rollers shall follow the worn-out tread profile without losing contact.

**Second axle elevation system**

The machine shall equip with elevation system to allow the free rotation of the coupled axle that is not going to be mechanized. The system shall be composed of four hydraulic cylinders (2 on each side) to keep a range of different wheel bases.

**Measuring System**

Automatic operator guidance system. An automatic operator guidance system shall be offered with the machine. This system shall comprise of:

Determine the tread of Diameter and evaluate the state of wear of the wheelsets before machining. Take the intermediate measurements of the tread diameter.

Determine and verify that the re-profiled wheel matches the CNC profile selected by the operator. Machining proposal system to calculate and offer selections the optimal machining strategy. The operator may choose to accept or modify. Computer based data acquisition and storage system to capture and store each wheel set machining parameters vehicle base measurement. Before and at the completion of re-profiling.

The operator guidance system shall be capable of printing a record of following measurements as Computer based data acquisition and storage system to capture and store each wheel set machine parameter before and at the completion of re-profiling.

- Distance between inner faces
- Tread diameter
- Wheel gauge
- Flange thickness
- Flange height
- Tread profile

**Cutting depth determination System**

The operator shall be able to print in hard copy a complete report showing pre-measurement for both wheels and the completed re-profiled measurements, together with operator name, wheel set and vehicle identification date and reason for the job etc.

The machine shall be provided with a CNC based system to determine minimum metal removal strategy to achieve the required profile. The system shall be capable of comparing the wear pattern of all the wheels of each bogie and decide the precise machining diameter with minimal metal removal. The system shall also ensure that the machined profile is within the defined maximum permissible variation on tread diameter of two wheels on the same axle, any two wheels on the same bogie and any two wheels of the coach. Reduce flange thickness options shall be offered within restrictions set by the SRT. Wheelset types may be defined, including pre-sets for profile, tread width and minimum permitted diameter.

The required diameter shall be indicated on the screen for the operator to take corrective action, if required. Based on this decision, the CNC system shall calculate the economical number of roughing and finished cuts.

In case the operator over-rides the calculated diameter, the system shall do a safety check of all parameters to avoid any collision of the tool post with the job.

The CNC Screen shall indicate. The tread diameter of both wheels before and after turning.

The CNC system shall be capable of performing cutting cycle integration with operator guidance system and/or in process measuring system.

**Control Profiling System**

The machine shall be provided with a CNC based continuous path control profiling system. The right hand and the left hand tools feeds shall be synchronized and/or independent. The profiling unit shall be capable of independent rapid traverse and slow feed motions. It shall also be capable of automatic simultaneous machining of both wheels of a wheel set assembly.

**Chip Disposal System**

The chip disposal system comprises a chip mill, conveyor and swarf bin. The chip mill is integrated into the machine, beneath the working area and serves to cut the swarf/chips into smaller pieces before they drop onto the chip conveyor. The conveyor transports the chips away from the machine at pit level to a dedicated swarf bin at finished floor level.

The swarf bin must have 2 bins, one inside the machine area and one outside the machine area. The swarf bin will be designed for lifting by crane and transporting by forklift truck.

**Power Supply**

Power Supply shall conform to the specification detailed as below :

- The UWL will be designed for 380V, 3 ph, 50Hz power supply, with a connected load of not less than 120kVA
- The shunting vehicle battery charger will be designed for Thailand power supply (380V, 3ph, 50Hz. or 220V, 1 ph, 50Hz).
- All motors will have protection against over current.
- Under and over voltage protection is provide within the machine switchboard for machine element protection.
- All wiring integral to the control console and the equipment will be factory wired.
- All other wiring will be completed on site during installation.
- All equipment will be suitably earthed.

**CNC CONTROL**

The automatic machining shall greatly relieve the operator of mundane tasks thereby simplifying the operation of the machine. The machine shall be provided with one micro processor based CNC control system over the number of axes adequate to meet the machine capability mentioned at Parameters above. The machine shall be operated via one central control panels and one screen located at the UWL so that the operator has the most favorable position, access, visibility to turning process and operators safety and optimum working position CNC system shall conform to the specification detailed as below :

- Simultaneous control over these axes shall be available.
- A screen of at least 12 inches size shall be provided.
- Output status indicating automatic operation mode selected, manual operation mode selected, automatic operation status, program edit status, axis movement/dwell status, auxiliary function, spindle speed, feed rate, tool offset, emergency stop etc. shall be shown on the screen.
- The CNC control shall perform various diagnostic checks and display error status in English text.
- Data protection key shall be provided. It shall prevent the program offset parameters, data etc. from being registered, modified or deleted erroneously.
- Part program editing and background editing shall be available.
- It should be possible to store minimum of 50 registered programs.
- Program search facility using program name or program number shall be available.
- It shall be possible to store program number and program name for identifying the program.
- It shall be possible to program angles, chamfers, corners, rounding off values etc. from machining drawings by direct input of these values.
- It shall be possible to use decimal point programming.
- It shall be possible to move the machine tool along any axis in incremental mode. The increment shall be selectable (0.001mm, 0.01mm, 0.1mm, and 10mm). Automatic tool withdrawal facility in the event of power failure.
- For spindle speed, feed rate and rapid traverse, manual over-ride shall be available from 0-120%.
- The program should accept input data in metric system.
- Linear/circular interpolation shall be available.
- Feed rate command shall be available in mm/min.
- CNC control cabinets shall be suitably air-conditioned.
- The part program shall be protected in the event of power failure.
- Automatic tool withdrawal facility in the event of power failure shall also be available.
- Data storage/backup should be provided ,USB stick, CF card, hard disk, network.

- CNC control should indicate run hours.
- Constant surface speed programming shall be available for brake disk turning.
- Emergency stop button shall be fitted at least 2 positions should stop all the machine movements if operated.
- Self diagnostic like fault messages, internal status of PLC, counter monitory, spindle monitoring and display of operator's message should be available.

**Tooling**

Throwaway carbide inserts with built-in chip breakers shall be used for all machining operations. The location of cutting tools shall be between the two driver rollers. The tool posts shall be mounted on a common cross beam for maximum stability.

**Hydraulic System**

The hydraulic power pack, reservoir, pumps, valves, gauges etc. shall be conveniently located to facilitate maintenance. The hydraulic power pack and all hydraulic elements shall be of compatible makes.

The hydraulic system shall necessarily have the following:

- Pressure gauges wherever pressure is to be set or monitored.
- Safety valves if the relief valve does not fulfill this function.
- Temperature indicators wherever temperature is to be monitored.
- Clogging indicator for filters.

The hydraulic oil sump shall have the following:

- Dust proof cover.
- Indicator for minimum and maximum oil levels in the sump.
- Filters to prevent ingress of dust/dirt into the hydraulic system.
- Drainage connection to drain out hydraulic oil without disconnecting any pipe

A suitable maintenance free, plate type heat exchanger shall be provided to maintain hydraulic oil temperature below 60 °C. Arrangement shall be provided to automatically connect the hydraulic system to the heat exchanger whenever oil temperature exceeds 55 °C

**Lubrication System**

Adequate lubrication shall be provided to ensure lubrication of all points requiring lubrication.The lathe manufacturer shall indicate the type of lubrication selected and the measures taken to ensure its correct performance.The methods chosen may include solid lubrication, forced or splash liquid lubrication or a combination of methods as best suited for the application. Relevant alarms or similar shall indicate when the lubrication system fails and the machine shall be shut down if necessary to maintain the integrity and safety of the equipment.

Following shall be displayed on the machine:

- Periodicity of cleaning/replacement of filters.

- Periodicity of replenishing lubricating oil in the sump.
- Other necessary information.

**Swarf disposal System**

The machine shall a suitable conveyor swarf disposal system along with a chip crusher with serves to cut the swarf/chips into smaller pieces before they drop onto the chip conveyor. The chip crusher shall be a counter rotating blade type from a reputable manufacturer and integrated and pre-mounted together with a conveyor belt into the lathe design. Suitable and free access for replacement, inspection and repair of the blades shall be considered. The swarf container shall be located on “0” track level.

The swarf bin shall be designed for lifting by crane or forklift truck.

**Safety Features**

The machine design shall ensure safety of the operator and the machine of all times. The operator shall be well protected against flying chips during machining. All machine systems shall be to be guarded and interlocked to the highest EN or EC safety of machinery standards.

The following safety features shall necessarily be provided:

- Protection against movement of vehicle when retracting rails are not locked.
- Automatic tool retraction device to withdraw the tool in the event of sudden power failure.
- Arrangement to ensure adequate support to the vehicle in the event of sudden power failure of failure of the hydraulic system. In these eventualities, the vehicles shall continue to be securely supported.
- Protection against faulty sequence of operation.
- Two mushroom type emergency stop buttons on both sides to enable stopping of the machine in an emergency. The emergency stops shall override all other controls.

**Hold-down Device**

A suitable hold-down device – one on each column – for machining of loose wheel sets with axle box fitted shall be provided, the device shall precision guided and shall have vertical movement through hydraulic system. These cylinders shall be designed to provide adequate load on the axle box for machining loose wheel sets.

The underfloor wheel lathe is provided with a suitable hold down device for wheelsets with externally mounted axle-boxes. The hold down device consists on two (2) dedicated devices. Fixed to the machine frame (One on each side), mounted in between the wheel drive rollers. Each device includes: A support structure, fixed to the machine frame. Lifting system with a threaded spindle for vertical adjustment. Lifting system for support from below the axle bearing housing. Horizontal guide. One (1) set of custom-designed fixing clamp for one (1) type of wheelsets. One (1) control unit on each side of the machine. The fixing clamps are fitted to the horizontal guides, and then put in the correct axial position manually by the operator (axial position will depend on each wheelset design).

**Noise Level**

Noise level of the machine under full load shall not exceed 80 dB when measured at a distance of 1 meter from the machine. The lathe manufacturer shall show the measurement position proposed for the verification of this requirement.

**INSTALLATION**

The wheel lathe shall be installed at Kaeng Khoi new depot wheel shop. The contractor shall be responsible for the following undertakings at his own expense. Commissioning of the CNC Underfloor Wheel Lathe, checking the operation and the full functioning of its associated components. They shall be assured of satisfactory functioning of the CNC Underfloor Wheel Lathe as per specification under the contract.

**TOOL AND SPARE PART**

The scope of supply shall include all equipment and accessories required to make the machine fully functional when connected to a power source. It shall also include but not limited to the supply of the following accessories.

| | |
|---|---|
| The machine shall come with air compressor and outlets for cleaning gun. | |
| Hand held profile measuring device | - 1 set |
| Hand held wheel diameter measuring device | - 1 set |
| First fill of oils and lubricants | |
| Maintenance tools | - 1 set |
| Retractable rails with drive | - 1 set |
| Roller | - 4 pcs. |
| Hauling device | - one set |
| Tooling | |
| tool holders | - 2 pcs |
| tool insert of each type | - 50 pcs |
| Uninterruptible Power Supply | - 1 pc |
| Hydraulic hold-down device | - 2 pcs. per one axle box type |
| Brake disc machineing tools and holder | - 1 set |
| Spare set of drive rollers<br>(in addition to Those fitted on the machine) | - 2 set |

| | |
|---|---|
| Conveyor type swarf disposal system,<br>including three chip containers with sufficient<br>capacity for one working shift. The chip conveyor shall be fed by the lathe integrated chip crusher with crusher | - one set |
| Laptop and wheelset management database and<br>accessory for maintenance and necessary software using for inspection | - one set |

Hydraulic hold-down device

Hydraulic hold-down device must cover at every types of axle box used in the SRT.

Machining of brake disks

Shaft or wheel brake disks of built-in wheel sets can be machined with special brake disk machining tools (1) on the machine. These are adapted to the dimensions and geometry of the brake disks to be machined. The wheel sets are accepted, centered and driven in the same way as for profile machining. Exact axial fixing of the wheel sets is required to keep within parallelity and flat running tolerances. Profile machining must be performed before the brake disks are machined in order to ensure concentricity of the wheel set The direction of machining depends on the arrangement and the design of the brake discs. As a rule, the machining is performed from outside in. When machining wheel brake disks lying behind the tyres it may be necessary to machine from inside outwards.

Shaft brake disk machining tool.

The shaft brake disk machining tool is equipped with a short clamp holder (2) for clamped reversible cutting plates (1). Standardised carbide metal reversible cutting plates are used The basic frame (3) is inserted in the tool holder of the piston tool block (4). Depending on the position of the shaft brake disks, the tools for wheel brake disk machining can possibly also be used for this machining operation.

Data Processing Equipment.

An equipment for measurement data processing and storage shall be provided The computer shall be industrial grade and placed in a dust-proof cabinet printer and uninterrupted power supply shall be included.

Any other accessory considered essential for efficient operation of the machine.

SRT shall have a right to use the software with full function in anytime. All software shall come with licenses, and shall be granted to SRT to use one or more copies of software.

**INSTRUCTION AND SHOP MANUALS**

At least 4 copies and 2 USB Drive of instruction and shop manuals for the Underfloor Wheel Lathe operations, maintenance and part catalogs as well as other useful technical manuals that benefit the user shall be submitted in English with the wheel lathe and one copy in proposal. The necessary equipment, maintenance tools and all software for the Underfloor Wheel Lathe shall also be provided.

**TRAINING**

Necessary local training program for SRT's operators (not less than 10 staffs) for proper maintenance and operation of the Underfloor Wheel Lathe shall be submitted with quotation. Training document shall be supplied in Thai language. The training program shall be approved by SRT before departure of its staff. All expenses of this training shall be borne by the contractor.

**SERVICING ENGINEER**

Successful tenderer (or Contractor) shall provide at least one qualified service engineer for servicing in Thailand and also to assist the SRT on the operation and maintenance of the Underfloor Wheel Lathe, at a period of not less than one year beginning from the date of arrival in Bangkok of the Underfloor Wheel Lathe. The service engineer doesn't have to stay in Thailand all the time, but while staying in Thailand, shall also represent the Contractor to fulfill all commitments on the guarantee under contract of the supplied the Underfloor Wheel Lathe. All expenses incurred for this provision of service engineer shall be borne by the Contractor.

Contractor shall provide technical support and troubleshooting within 2 (two) years after final acceptance by the SRT.

**INSPECTION**

Inspection of the supplies shell be carried out by the SRT inspecting engineers at the place of manufacture for all stages of production to determine conformance with the referenced and relevant specifications and drawings if they are deemed necessary. The supplies are to be to the satisfaction of the SRT inspecting engineers whose decision shall be final and binding on the contractor in all cases. Nevertheless, these inspections do not in any way relieve the contractor of the warranty and his responsibility to deliver in the stipulated time such work or materials as is in accordance with the drawings and the relevant specification

**CONTRACTOR'S RESPONSIBILITY**

The contractor is to be entirely responsible for the efficient and assured performance and operation of the Underfloor Wheel Lathe not withstanding any approval or acknowledgement by the SRT or of test carried out either by SRT authority or by the contractor. Required parts to be replaced shall be supplied free of charge within the period of guaranty.

The contractor shall guarantee for workmanship and quality or materials. Should any defect be found within 2 (two) years after final acceptance by the SRT due to faulty materials, or bad workmanship, the contractor shall bear to replace free of charges and pay all expenses incurred or to remit to the SRT the cost of repair or to refund the amount paid for such defective material including all other charges if such expenses shall have been paid by the SRT, within 60 days from date of notification. The defective materials, if required, shall be delivered to the contractor at his own expenses.

**PACKING AND SHIPPING**

The Underfloor Wheel Lathe shall be carefully packed, preserved and protected for sea voyage and shipped. On arrival in Bangkok and transfer to Kaeng Khoi new depot at Saraburi province, if damages are found to have been caused by improper packing or protection, the Contractor shall replace the defective parts free of all costs to the SRT with the least possible delay.

All packing cases are to be clearly marked in black with the initial letter "SRT", the order number and date, the Contractor's (or manufacturer's) name, the gross and net weights and port of destination. Each package shall be given a serial number corresponding to the number in shipping specification. Cost of packing is to be included in the contracted price .