

# *CNC UNDER-FLOOR WHEEL LATHE*

## *TECHNICAL SPECIFICATION*



# Technical Specification

## 1. In General

The name of this machine is “CNC Under floor wheel lathe” and it is an equipment which cuts and manufactures the wheel.

This equipment to restore the form of the worn wheel and can perform the cutting operation without removing the wheel from the rail or vehicle.

Suggests the economical depth to restore the wheel’s profile calculating and detecting automatically, and performs the operation in “One pass cutting” mode which performs the treading and flange cutting in a sequential order.

### 1.1 Scope of Supply

#### (1) Main body of CNC Wheel lathe manufacturing

- Machine base
- Machine column
- Out-board axle box support device
- Out-board axle box hold down unit
- Tool slide & AC Servo motor
- Guide roller & column
- In & out rail system
- Wheel measuring device

#### (2) Auxiliary equipments manufacturing

- Hydraulic & auto lubricating system
- Winch
- Electric control panel
- Operating panel
- CNC controller
- Chip disposal device
- Exhausting device
- Wheel management device
- Drain pump

(3) Machine & Electric installation (According to condition of contract)

(4) Provide Technical data

- Basic technical data
- Basic drawings (Layout / Foundation / Machine assembly ).
- Operating manual
- Maintenance manual
- Interface & utility information

(5) Provide Spare & consumable parts

- Spare parts
- Consumable parts

(6) Provide tools

- General tools for maintenance
- Special tools for maintenance

## 2. Technical Specification

### 2.1 Basic Data

- (1) Rail gauge : According to customer needs
- (2) Diameter of profiling wheel
  - Maximum wheel diameter : 1,400 mm
  - Minimum wheel diameter : 700 mm
- (3) Width of cutting wheel tire : 140 mm
- (4) Maximum allowed axle load : 30 ton

### 2.2 Functional Specifications

- (1) Cutting for : CNC shelf manufacture
- (2) Measurement method
  - Diameter measurement : Disk rotation contact form
  - Flange form measurement : Scan roller rotation contact form
- (3) Adjustment scope by composition
  - Cutting speed adjustment scope : 0~100 mm/min  
(step-less speed change)
  - Transportation speed adjustment scope : CNC Auto Control System  
0~3 mm/rev  
(step-less speed change)
- (4) Self load of the machine : Approx 26,000 kg

### 2.3 Specifications

- (1) Cutting area : Max. 10 mm<sup>2</sup>  
(Cutting area of the wheel when removed scars as abrasion, desquamation, etc)
- (2) Cutting depth : Max. 10 mm  
(On the wheel which has been removed scars as abrasion, desquamation,  
with transportation speed under 1mm/rev)
- (3) Degree of precision of manufacture  
Difference between both diameters of wheel  
: 0.2 mm

## 2.4 AC Operation system

- (1) AC Motor : 37 kW × 2 Units
- (2) Difference of total motor's wheel diameter : 0.2 mm
- (3) Total motor capacity : 74 kW
- (4) Rotation scope : 0 ~ 1,500 rpm (Constant Torque)  
: 1,500 ~ 6,500 rpm (Constant Power)
- (5) Torque : 236 Nm
- (6) Quantity : 2 Units

## 2.5 Tool slide drive system

- (1) X Axis motor's capacity : AC Servo Motor 2.92 kW × 2 Units  
(Rated Power)
- (2) Z Axis motor's capacity : AC Servo Motor 2.92 kW × 2 Units  
(Rated Power)
- (3) Total motor capacity : 11.68 kW
- (4) Rotation scope : Max 3,000 rpm (Rated speed)
- (5) Torque : 9.3 Nm (Rated torque)
- (6) Quantity : 4 Units

## 2.6 Centering system

- (1) Driving roller : 2 sets each for left and right
- (2) Guide roller : 2 sets each for left and right
- (3) Axle box support device : 1 set each for left and right
- (4) Axle box hold down unit : 1 set each for left and right

## 2.7 Electrical data

- (1) Main power : AC 380V, 3Ø, 60Hz
- (2) Allowed voltage difference : +10% / -10%
- (3) Allowed frequency difference : +2% / -2%
- (4) Installation capacity : Approx. 130 kW  
(127.02kW)

## 2.8 Hydraulic pump- motor capacity

- (1) Three-phase motor main pump : AC 380V, 3Ø, 60Hz, 11kW x 6P
- (2) Quantity : 1 EA
- (3) Three-phase motor Sub. Pump : AC 380V, 3Ø, 60Hz, 3.7kW x 4P
- (4) Quantity : 1 EA

## 2.9 Winch system

- (1) Three-phase motor main pump : AC 380V, 3Ø, 60Hz, 7.5kW x 4P
- (2) Quantity : 1 EA

## 2.10 Chip crusher

- (1) Chip crusher motor : AC 380V, 3Ø, 60Hz, 11kW x 4P
- (2) Quantity : 1 EA

## 2.11 Chip conveyor

- (1) Chip conveyor motor : AC 380V, 3Ø, 60Hz, 3.7kW x 4P
- (2) Quantity : 1 EA

## 2.12 Chip box

- (1) Chip conveyor motor : Volume 1.2 m<sup>3</sup> x Capacity 400 kg/ea
- (2) Quantity : 2 EA

## 2.13 Exhausting Device

- (1) Electrical capacity : AC 380V, 3Ø, 60Hz, 3.7kW
- (2) Capacity : 60 m<sup>3</sup>/min x 230mmAq
- (3) Type : Bag filter
- (4) Quantity : 1 EA

## 2.14 Drain pump

|                     |   |                           |
|---------------------|---|---------------------------|
| (1) Pump motor      | : | AC 220V, 1Ø, 60Hz, 0.75kW |
| (2) Capacity        | : | Developed head 12 m       |
| Discharged quantity | : | 24,000 l/hr               |
| (3) Quantity        | : | 1 EA                      |

## 3. Specification for each part

### 3.1 Machine base

A welded structure which is the base of fixing of each part of the machine, which in the upper part each elements are firmly fixed and installed to support every load during the cutting operation.

### 3.2 Machine column

The Machine column is a special casted component which is fixed in the upper left/right of the machine base and supports each operation parts, and in its inside there is installed a chute carriage of slip guide for vertical ascent and descent.

The chute carriage is a special casted component which vertically guides the ascension and descent of the axle box hold down unit, and its front/rear and left/right guidance surface is assembled to contact with the machine's column guidance to maintain the proper ascending operation.

### 3.3 Driving head system

The driving head is a device to rotate the wheel and the driving head is fixed in the machine column with the hinge shaft using the LM stroke bearing, and it ascends or descends through the hydraulic cylinder installed in the lower part of the front.

In the front of the driving head there is installed a driving roller to contact with the lower part of the wheel profile and rotates the driving roller, and with the friction it rotates the whole wheel.

The hydraulic cylinder is manufactured with a structure to maintain a proper and regular ascending strength to increase the friction-contact during the wheel manufacture.

### 3.4 Axle box support device

It is installed in the front of machine column to fix and support the bearing housing of the wheel and ascends/descends through hydraulic motor and TM screw. The support body is a special casted component which is fixed in the guide roller column. In the cutting and measurement of the wheel the AC servo motor and CNC controller accurately transport the servo motor transportation part, and it is composed by X axis and Z axis slides structure.

Due to the frequent transportation during the wheel processing, the friction assembled part is manufactured to maintain enough strength and precision.

### 3.5 Axle box hold down unit

It is a device to fix the bearing housing by fixing in the upper part of the chute carriage which performs front/rear and ascend/descending movements.

In the upper front part there can be installed a hold down claw bracket.

### 3.6 Tool post & slider

The tool post is composed by vertical tool slider and Horizontal tool slider for mutual independence and simultaneous performance. The power transference reduces the fast rotation speed of servo motor in the gear box, transfers it to roller screw to change it into a lineal alternating motion and thus activates the tool slider.

The slide base of vertical tool slider for vertical operation is installed in the guide roller column which is located in the rear of the tool post as a dove-tail, and the slide base which is a tool for horizontal operation is installed in the vertical tool slider to allow the left/right horizontal movement of the tool slider.

In the friction assembly part there is installed a slide bearing to allow proper performance and absorb the shock and there is also composed a gap adjustment part to prevent abrasion and relaxation.

In each sliding and moving part there is installed an in-gate for lubricant to allow automatic fuelling. In the upper part of the tool slider for horizontal operation, there are composed bite holder for cutting and wheel outline measurement device which uses the contact roller.

### 3.7 Guide roller system



2 sets of guide roller system are installed in the left and right wheels to prevent the axial vibration due to the cutting load in case of wheel cutting process.

The vertical operation part is composed by guide roller ascend/descend cylinder and vertical lock unit, and the horizontal operation part is composed by guide roller advance/reverse cylinder and horizontal lock unit.

### 3.8 In & Out rail system

The I/O rail system is a composition to control the wheel orientation rail to enter and release of the vehicle.

In case of entrance until the cutting location of the wheel I/O rail shall be "Closed", and when releasing the vehicle which the cutting is finished, it shall be "Opened"

The open-close operation is performed with the hydraulic cylinder composition and it is interlocked to perform the further processes according to the open-close status of I/O rail.

### 3.9 Wheel measuring device

#### (1) Wheel diameter measuring unit

This is a unit which the measuring disc rotates/contacts with the wheel tread to measure. It is composed in the guide roller column in front of the user, and from the inside of the wheel supported by the guide roller it measures to a fixed distance.

The measurement point shall be composed reflecting and considering the characteristics of the target wheel profile.

#### (2) Wheel profile measuring unit

As the device to verify the form/shape of the abraded wheel, it measures the profile from the wheel flange top point to the designated wheel tread part.

It moves to the axial direction when the probe roller rotates/contacts with the wheel, and scans the image during the movement.

#### (3) Wheel location inspection unit

This is a composition of measurement/inspection to verify the location of X and Z coordinates of the prepared wheel before the image scanning of the wheel.

After the verification of virtual wheel tread, it inspects the flange back side of the wheel and calculates automatically the actual standard point of the wheel diameter measurement.

### 3.10 Hydraulic & auto lubricating system

#### (1) Hydraulic system

As the secondary power source of the Lathe for wheel re-profiling it is composed by power switching part, power control part and power generation part.

As the characteristics of the oil pressure system, it is composed with particular power switching part, and in the Head stock's left/right backside there is composed the power controlling part.

The oil pressure which the pressure, direction and speed is controlled, is transferred to the operation part of left and right. There is a control device for safety and operation feature for the load and it is safer with the composition of Inter-lock.

In the oil pressure unit there are composed various oil cleaner and oil temperature controllers to prevent the degeneration of the pressure oil and perform an accurate operation.

#### (2) Auto lubricating system

There is composed automatic lubricant in the left/right side head stock.

In the tool post slide part which requires accurate friction, the lubricant is automatically spread.

The cycle and quantity of lubrication can be modified according to the adjustment and the users can randomly spread the lubricant.

The auto lubricating system detects the filling volume of the lubricant, and displays the charge (lubricant) message on the operating panel.

### 3.11 Winch system

The winch system is the equipment which lifts the vehicle to the exact location to re-profile in the right position.

The winch system is composed by winch body, wire lope, hook, pulleys, shackle and other machines and by the operation controller. The vehicle lifting will be performed only when satisfied the I/O Rail "Close" status which cancels the brake of the vehicle.

In the main body there is installed a light bar which allows the visual inspection of the possibility of vehicle lifting, and the operation status and Inter-lock status can also be verified in the operating panel.

- (1) Electric capacity : AC 380V, 3Ø, 60Hz, 7.5kW
- (2) Lifting speed : 6 m/min
- (3) Target vehicle : 320,000 kgf x for T.L.C car

### 3.11 Electric Control Panel

The electric control panel is composed by power module and CNC control part, PLC control part, and other electrical relay devices.

The power module provides the proper power for CNC control part and PLC control part, from the secondary power/electricity provided from voltage regulator.

In case of the CNC control part, it is composed by control drive which controls the servo motor and spindle motor assembled in the main body.

In the PLC control part, except the servo mechanism, there are composed electric & hydraulic actuator's sequential operation and delayed operation, PLC drive with inter-lock programming, and for the stable and efficient operation of the motor and electric devices it is composed by safety/electrical products as relay, power supply, circuit breaker, EOCR.

### 3.12 Operating panel

It is the panel operated by the user to process the wheel.

The user may verify the operation of the machine through the operating panel display, and also can verify the wheel data before/after cutting.

As the value entry switch is composed, there can be entered the cutting value according to the measured value and the value also can be modified.

It is composing the automatic/manual operation panel switch, and also counts with the emergency stop button which can stop every operation in case of emergency.

The operation status and failure can be verified in real-time in the monitor.

### 3.13 CNC Controller

The CNC (Computer Numerical Control) is a system which operates/controls the operation of each machine according to the data and servo mechanism.

In the Lathe for wheel re-profiling, the measured value of the wheel to process is calculated, and reveals the size before/after wheel cutting and profile in the operating panel.

There can be verified the spindle speed and feed rate, and according to the characteristics of the process objective its speed can be adjusted.

There can be verified the transported location of the tool rest through the servo motor and drive, and randomly can operate the transportation location.

There can be saved information as machine data for operation and control, manufacture program of the wheel and information of the wheel, and can be linked with the wheel management device data.

### 3.14 Chip Disposal Device

The chip disposal device is a device which transports the chip from the lower part of the main body to the chip box (location where the files are collected), and is composed with chip crusher, chip conveyor, chip box.

#### (1) Chip crusher

The chip crusher is installed in the lower part of Lathe for wheel re-profiling main body and cuts the chip produced during the cutting to ease the transportation in the chip conveyor.

- Operation-method : Gear speed reduction
- Power : AC 380V, 3Ø, 60Hz
- Motor power : 11kW x 4P
- Smashing blade : Diameter-Ø295, thickness-15mm
- Axis rotation speed : High speed axis 18.9 rpm,  
Low speed axis 9.13 rpm

## (2) Chip conveyor

The chip conveyor is a device which transports the chip from the chip crusher to the chip box (location where the files are collected).

It is a conveyor where there is installed a pipeline and the link chain installed inside with a proper distance composed by the right angled round plates, which make a pipe type chain conveyor.

- Motor power : AC 380V, 3Ø, 60Hz, 3.7kW x 4P
- Chip process capacity : 400 kg/hr
- Transportation speed : 10 m/min
- Sizing : 6 " (Pipe)

## (3) Chip box

- Volume : 1.2 m<sup>3</sup>
- Capacity : 400 kg/ea
- Quantity : 2 sets

## 3.15 Exhausting Device

It is a device which operates the suction of the cutting fume of the wheel. The back of the main body is composed with suction hood, and it is composed to form an exclusive dust collector. With the filter changing method, there is not composed a second / particular exhaust pipe line. The filter disposes the fine dust and sparks produced during the cutting, and with the porous fiber and activated carbon, it collects the odor.

- Electrical capacity : AC 380V, 3Ø, 60Hz, 3.7kW
- Air flow : 60 m<sup>3</sup>/min
- Rated voltage : 230 mmAq

### 3.17 Wheel Management Device

The wheel management device is composed by exclusive personal computer, monitor, printer, management program, and the measuring data before/after the wheel process and the daily manufacture data can be recorded/saved in it.

The recorded/saved wheel data may also be edited, and through the network can be connected with the data of the integral management system of the factory.

The PC composing the system has the following specifications, and shall be composed with the latest specification in the moment of delivery.

|                        |                         |
|------------------------|-------------------------|
| (1) S/W                | : Windows 7 or newer.   |
| (2) CPU                | : Core 2 quad or better |
| (3) Memory             | : 4GB or more           |
| (4) HDD                | : 1TB or more           |
| (5) Monitor            | : 20" Color             |
| (6) CD-Rom             | : DVD-Multi             |
| (7) Printer            | : Laser, A4 Size        |
| (8) Communication port | : LAN                   |

### 3.18 Drain Pump

There shall be installed under the machine room, the Water pool, and there shall be composed drain pump for underwater. To protect the equipment from the rainwater and washing water flooded into the machine room, the drain pump may not exceed the level of water pool and if it exceeds it shall automatically drain the flooded water.

|                |                                     |
|----------------|-------------------------------------|
| (1) Pump motor | : AC 220V, 1Ø, 60Hz, 0.75kW         |
| (2) Capacity   | : Developed head 12 m x 24,000 l/hr |

## 5. Spare & consumable parts & Tool

Recommended perishable and non-perishable spares required for two years normal maintenance to cover complete range of mechanical, hydraulic and electrical equipments (including controls) are supplied along with the machine.

## 6. Inspection and Testing

The supplier confirms that all facilities to carry out factory acceptance test are available and can be used by the inspecting authority.

A sample inspection chart is supplied along with the bid. The inspection chart indicates all tests that are carried out during manufacture.

A copy of the quality assurance followed at the manufacturer' works for ensuring quality of the product is offered.

A full load capacity test is carried out at the manufacturer' works to the satisfaction of the appointed Inspector or Inspecting Agency.

Machine capability in regard to productivity and accuracy is established during factory acceptance test.

## 7. Training

The supplier trains adequate number of personnel in operation and maintenance of the machine. The training covers all mechanical, hydraulic, electrical and electronic equipment.