



**TECHINT**

COMPAGNIA TECNICA INTERNAZIONALE

FOR

DONGKUK POHANG WORKS

No. 2 PLATE MILL

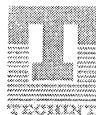
ROLL GRINDER

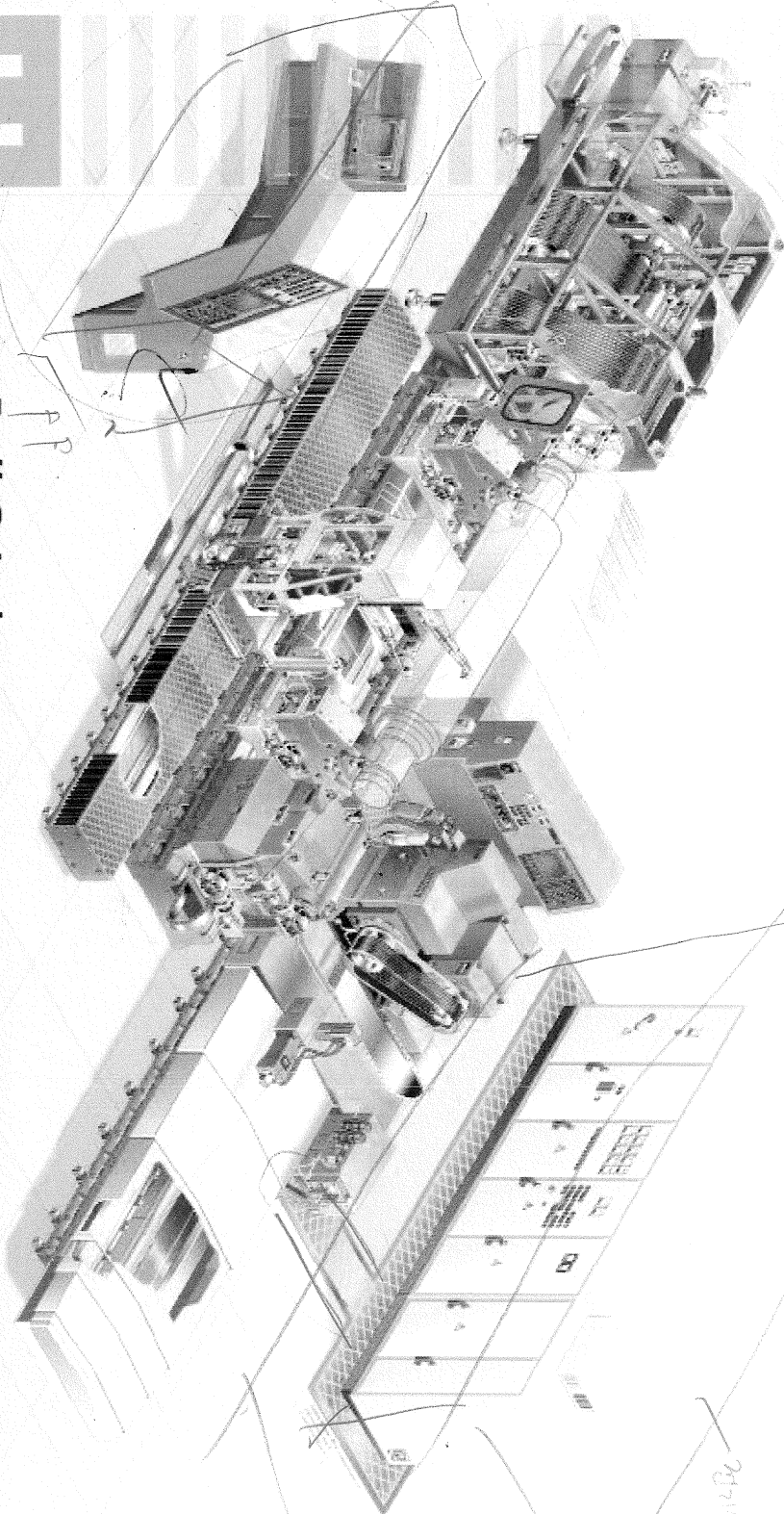
2005. 03. 04

Machinery & Equipment Division

**POMINI**

*Roll Grinders*

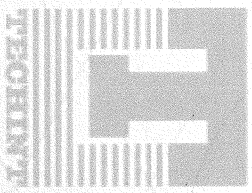




**Roll Grinder**  
**Technical Specification**  
**for DONGKUK Steel**  
**n.2 Plate Mill**

*a trademark of the Techint Group*

**POMINI**



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ANNEX 1

INTRODUCTION AND BASIC DATA

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## 1. INTRODUCTION

### *Equipment model*

#### **HD 425-2-7L (2200x11000mm)**

HD	– Heavy Duty roll grinding machine
425	– Wheelhead type 425
2	– Headstock type 402
7L	– Front bed type 407L
2250	– maximum roll diameter [mm]
11000	– maximum distance between centres [mm]

The quoted Roll Grinder is fully automatic CNC driven machine equipped with the state of the art technology available in the grinding field.

Among other features, our proposed Roll Grinder is equipped the most flexible cambering system able to grind any kind of curves standard and non standard, symmetrical and non symmetrical, as well as concave/convex complex contour and special shapes including Crown, Sine, CVC, CVC<sup>PLUS</sup>, UPC, Back-up roll Chamfer, Radius, etc. and is equipped with the unique and patented on line independent measuring unit for diameters, shape, cylindricity, runout, roundness, barrel taper, stock removal (independent caliper) with the function of roll pair and a powerful data management system, which is used to store all the information of the ground rolls.

The digital CNC adopted is the most up to date from Siemens, one of the most qualified manufacturer and experienced in this field. The system can interpolate up to five axis and fully comply with the rules and restrictions of the importing Country.

### *References*

The POMINI roll grinders are generally suitable for grinding rolls of plate mills, hot mills, cold mills, foil mills, caster, roll makers and other special application for carbon steel, stainless steel, aluminum, copper, and paper. References all over the world witness the POMINI roll grinders capability and flexibility (please see attached reference list).

### *Service*

The TECHINT/POMINI headquarter is located in Castellanza, Italy, from where are directed all operations all over the world also providing assistance to all the Customers with the dedicated Remote Service connecting, as a first aid, to the computer of each roll grinder for online assistance, maintenance and update of the relevant software.

Due to the fast growth of the Chinese market several years ago TECHINT established a service center in China, located in Beijing, with dedicated service engineers available for assistance and all the necessary support to Chinese and Asian Customers.

### *Customization*

For this particular project the roll grinder will be a combination roll grinder designed and customized to fulfill your requirement of grinding finishing and roughing mill work rolls with and without chocks mounted on and back up rolls without chock mounted on.

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## 2. ROLL DATA

Table 1 **Roll main data**

No	Roll names	Roll sizes (mm)				Roll weight (t)		Number of installed rolls (pieces)	Stock removal (mm)	Annual rolling quantity (pieces)
		Max. diameter	Min. diameter	Barrel length	Overall length of roll	Without chocks	With chocks			
1	BUR	2150	2000	4300	9560	161	t.b.d.	t.b.d.	1 ✓	t.b.d.
2	WR	1120	1020	4300	8554	45	t.b.d.	t.b.d.	0.5 ✓	t.b.d.

Note: t.b.d. = to be defined

• Top Chuck : 6.5 Ton  
 • Bottom " : 3.8 Ton  
 • Coupling : 5 Ton

上: 88 } → √60  
 下: 62-6 } → √65  
 ⊗

Table 2 **Roll surface accuracy**

No.	Roll names	Roll surface curve	material	Roll surface hardness (Shore C)	Roll surface accuracy			
					Roundness in cylinder (mm)	cylindricity (mm/m)	Roughness (um)	Crowning (mm/m)
1	BUR	t.b.d.	Alloy Cast Steel	40-50 45~55	t.b.d. 0.05	t.b.d. 0.05	t.b.d. /	t.b.d. 0.05
2	WR	t.b.d.	Indef. Chill alloy Cast Iron	70-80	t.b.d. 0.05	t.b.d. 0.05	t.b.d. /	t.b.d. 0.05

Note: t.b.d. = to be defined

→ < 0.025 ~ /mm Rm >

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### 3. STANDARD TECHNICAL FEATURES

#### Main data

maximum diameter that can be ground with a new wheel of 1066mm Ø	2200 mm
minimum diameter that can be ground with a new wheel of 1066mm Ø	800 mm
minimum diameter that can be ground with a worn (scrap) wheel of 670 mm Ø	1000 mm
maximum distance between centres for model	11000 mm
maximum roll convexity obtainable on the Ø	+ 10 mm
maximum roll concavity obtainable on the Ø	- 10 mm

#### Headstock

work speed	5 to 50 rpm
maximum centre Ø (metric type)	160 mm
motor power <sup>↳ center</sup>	200 kW

*150 mm, Max 200 mm*

#### Footstock

maximum centre Ø (metric type)	160 mm
quill Ø	260 mm
stroke of quill (with motorization)	750 mm
length of footstock on bed	1300 mm
stroke of footstock	8000 mm



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## Wheelhead

full size wheel Ø

1066 mm *915 mm*

wheel bore

508 mm *304.8 mm*

width of wheel (range)

from 76 to 152 mm *100 mm*

worn wheel (scrap)

670 mm *550 mm*

spindle bearing Ø

254 mm

length of wheel spindle

1695 mm

grinding wheel feeding speeds:

a. continuous wheel infeed (U axis - on radius)

0 to 0.35 mm/min

b. rapid wheel infeed (X axis)

0 and 830 mm/min

c. micrometric infeed resolution by electronic handwheel (U axis)

0.00001 mm/division

d. maximum micrometric infeed travel (U axis - on radius)

10 mm

*stroke of X axis*

*<1> Dia 890mm ⇒ stroke: 1065mm*

940 mm

wheel motor power (A.C.)

*<2> Dia 890 + wheel 4072*

130 kW

maximum wheel surface speed (due to wheel's limits)

*⇒ stroke: 1065mm*

45 m/sec

wheel speed range

*1pi > 5 m/min*

400 - 1100 - 1600 rpm

wheel cutting speed

*2pi: 15 m/min*

infinitely variable

## Wheelhead carriage

carriage speed range

0 to 6000 mm/min

width between ways of carriage

1500 mm

overall length of carriage on ways

3385 mm

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**Machine dimensions**

The following data are approximate only:

weight	130000 kg
length	19500 mm
width	5500 mm
height	3200 mm 214351
foundation depth	3800 mm 214351

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#### 4. UTILITIES

Average and maximum demands at Take Over Point for the following items:

##### **Water system**

- Quality requirement: industrial

##### **Plant compressed air system**

- Flow: 30 [Normal m<sup>3</sup>/h]  
- Pressure: 0.4 ~ 0.6 [MPa]  
- Temperature range: +5°C ~ +45°C ✓  
- Quality requirement: dried and lubricated

##### **Electric requirement**

- Main supply: 440 [V] ± 10% max  
60 [Hz] ± 5% max  
3 phases

- Services supply: 220 [V] ± 10% max  
60 [Hz] ± 5% max  
single-phases

- Power: 358 [kVA] (installed)  
264 [kVA] (in use)

##### **Roll shop environmental conditions**

- Temperature range: +5°C ~ +45°C ✓ (-10°C ~ 35°C)  
- Humidity: 85% max

##### **Communication**

- Phone line type: ISDN ✓

**ANNEX 2**

**TECHNICAL SPECIFICATION**

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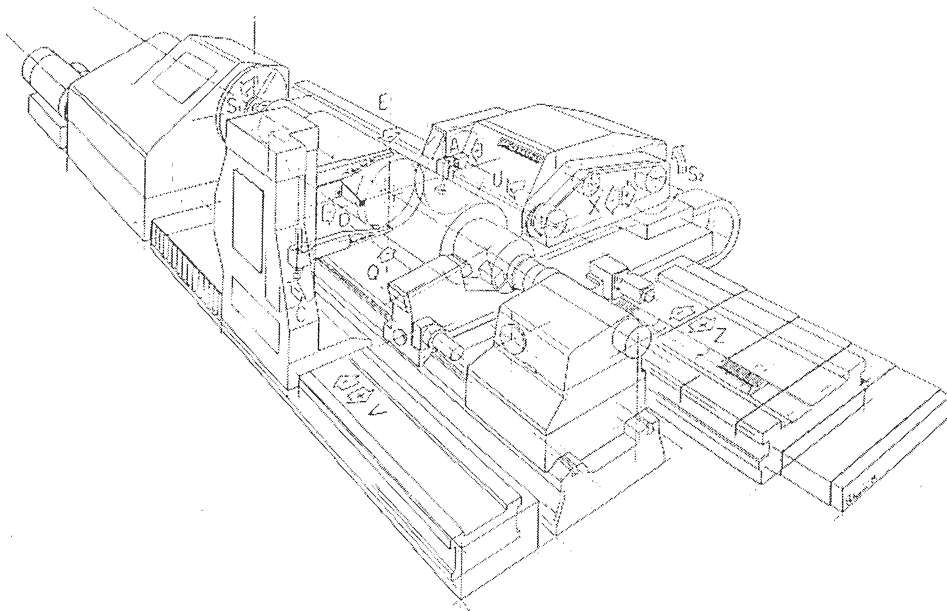


Roll Grinders



**1. ROLL GRINDER DESCRIPTION**

- No. 1 "POMINI" HEAVY DUTY MOVING WHEEL ROLL GRINDER**  
**Mod. HD 425-2-7L (2200x11000 mm)**  
suitable for precision rough and finish grinding on straight and crowned rolls



The above axonometric view shows the roll grinding machine in all its basic parts including also some accessories and optional parts with the main CNC controlled axis (with the position accuracy indicated in brackets), the system can control a maximum of 11 axis at the same time:

- |    |                             |   |   |
|----|-----------------------------|---|---|
| Z  | wheel carriage on rear bed  | V | caliper carriage on independent caliper bed |
| X  | wheelhead on wheel carriage | C | caliper arms                                |
| U  | fine infeed                 | E | upper caliper arm glass scale               |
| A  | wheel probe                 | Q | lower caliper arm glass scale               |
| S1 | headstock spindle           | D | Inspektor arm                               |
| S2 | wheel spindle               |   |   |

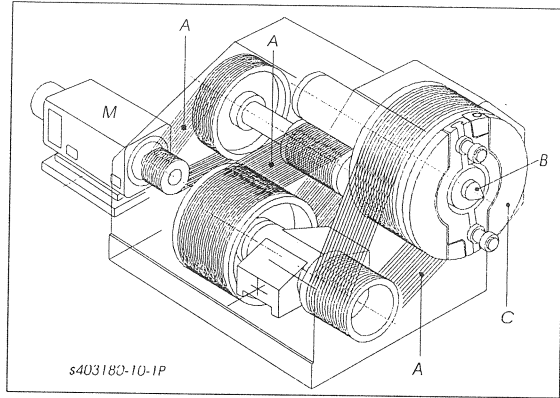
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## 1.1. Headstock

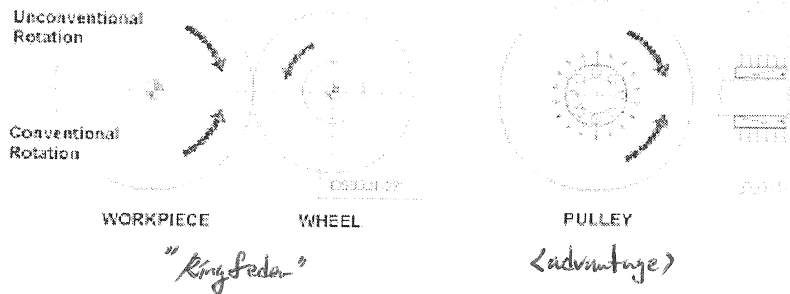
The headstock body, made in cast iron, has an heavy duty design for the maximum torque with one single motor (M) with no gear boxes and a work center (B) that can, as a standard feature, support rolls between centers without the need of any modification.

For normal grinding operation the center is protected by a bumper to control the axial roll movement.

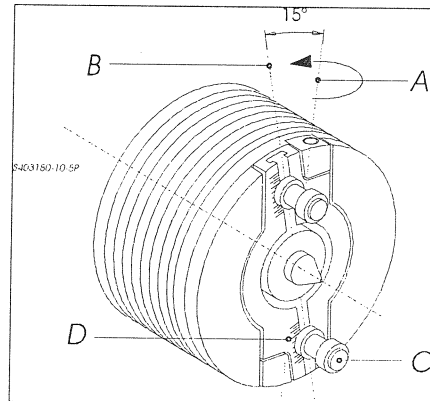
A set of three multiple V-belts (A) smoothly drives the faceplate (C).



No keys are used. The pulleys are fixed on their shafts by means of Ringfeder devices, in order to allow bi-directional rotation without backlash.



The equalizing faceplate (D) has 15° angle between faceplate rotating axis (A) and driving line (B) where the two adjustable drive dogs (C) are mounted.



Parts included:

- 1 work center
- 1 bumper
- 2 driving dogs
- 1 driving collar

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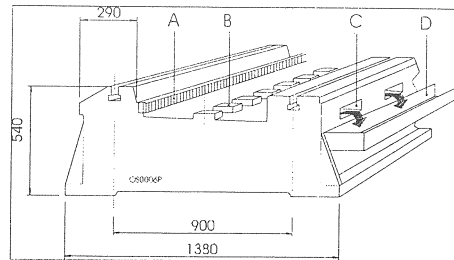
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### 1.2. Front bed (Work piece)

The front bed construction, in cast iron, is designed with rigid box heavily ribbed for strength, rigidity and stability essential for maintenance of alignment and precision work. The ways are one "V" and one flat.

The rack (A) is used to move along the bed both neckrests and footstock. The design include built-in steps (B) for footstock and a slope along all the bed length to drain the coolant water (C) into the channel (D) for filtering.



For reference only

All finished surfaces are accurately machined.

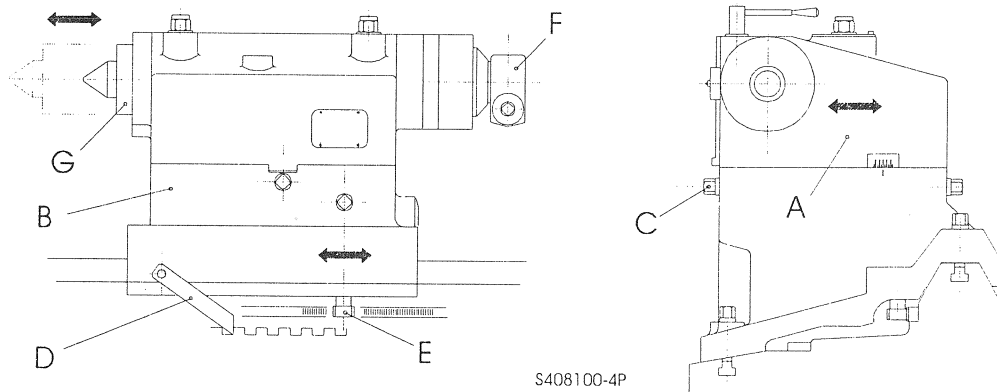
The bed is stress-relieved to remove casting stresses that might cause future distortion.

### 1.3. Footstock (Tailstock)

The footstock body (B) is made of cast iron, the manual traverse (E) provides adjustment on the front bed, the center (A) may offset (C) from headstock center for alignment and the quill (G) is provided with manual retraction.

As a standard feature, the center can support rolls between centers without the need of any modification. For normal grinding operation the center is protected by a bumper to control the axial roll movement-

Reference marks for each roll will be indicated on the front bed to speed up the footstock positioning.



Parts included:

- 1 work center
- 1 bumper
- 1 dresser device with diamond (2kt) and diamond holder

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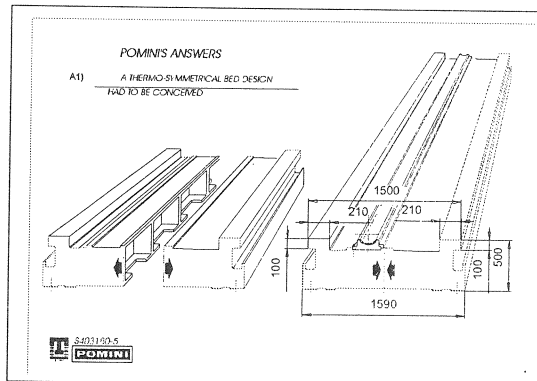


### 1.4. Back bed ( *Carriage Bed* )

The back bed construction, in cast iron, is designed with rigid box heavily ribbed for strength, rigidity and stability essential for maintenance of alignment and precision work.

The unique thermo-symmetrical rear bed design shows two equal flat ways, whereby if a straight line is drawn through the centre, one side would be the mirror image of the other, thus being equal in reaction to a temperature variation, i.e. thermo-symmetrical.

(Prior design of roll grinders universally used a combination of a flat way and a positive or negative “V” way, in this case, no even expansion or contraction would occur over a temperature range that has been proven detrimental to maintain geometrical bed alignment).

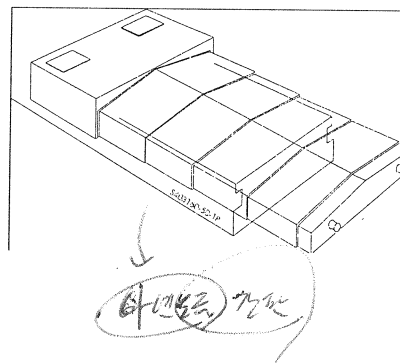


Telescopic steel way covers, walk-on type (when not moving), keep the oil reservoir covered, excluding foreign matter and preventing contamination of the oil.

The cast iron bed ways are protected by blue spring steel bands that avoid any wear due to the contact with the roller bearings of the telescopic steel covers.

The bed, the principal castings of the carriage and the units mounted on the carriage are all stress-relieved to remove casting stresses that might cause future distortion.

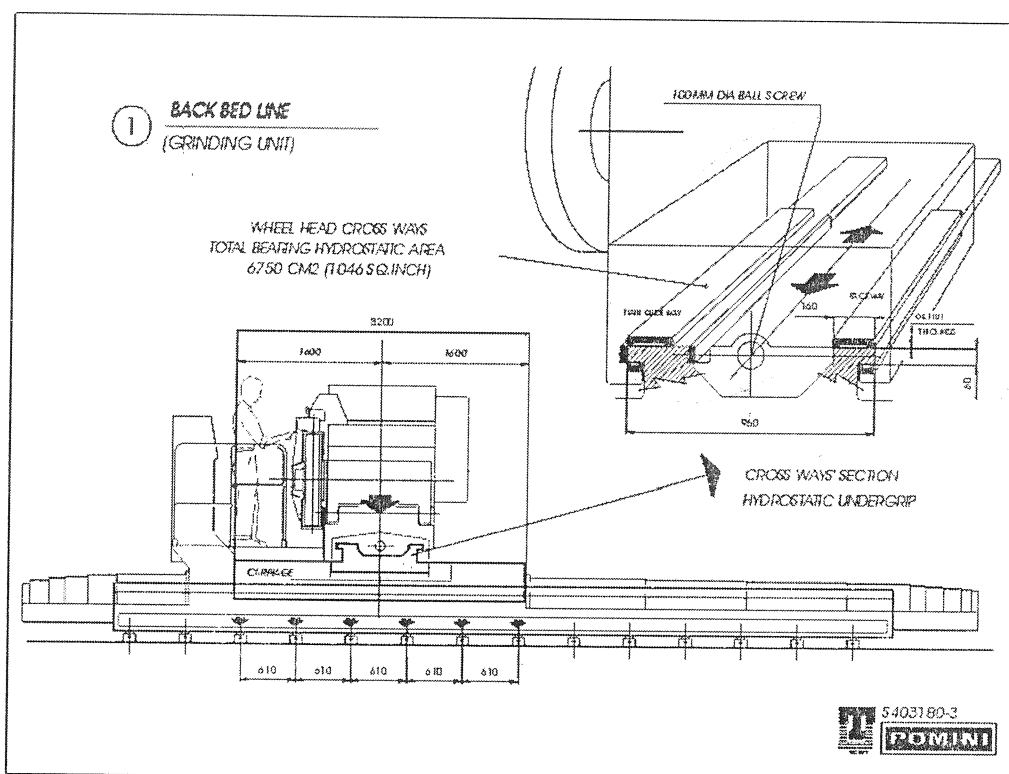
All finished surfaces are accurately machined.



## 1.5. Thermo-symmetrical wheel carriage

Main dimensions:

- |   |         |
|---|---------|
| - width of each sub-base flat way                   | 160 mm  |
| - thickness of the counter way/undergrip (gib area) | 60 mm   |
| - external width of ways/cross wheel travel         | 950 mm  |
| - diameter of ball screw                            | 100 mm  |
| - carriage length on the bed                        | 3385 mm |



## Carriage Ways with Undergrip

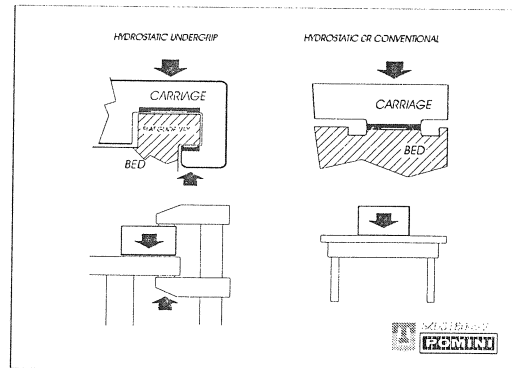
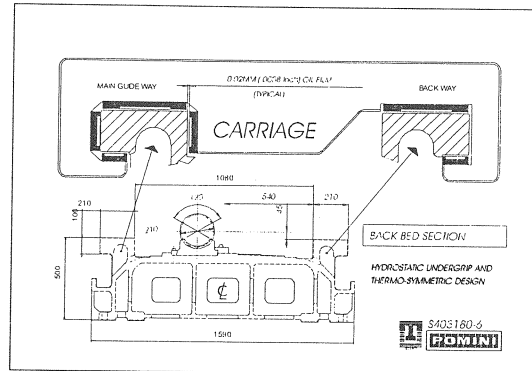
The wheel carriage ways are **hydrostatically lubricated with undergrip** with the following advantages:

- a. no starting friction and extremely low running friction
- b. no metal-to-metal contact at any operating speed
- c. no ways wearing at all

Moreover, the undergrips provide the maximum and constant stiffness of the guiding system under any working condition and under any set of grinding forces, due to their feature of automatically react to any external force that tries to alter the thickness of lubricating oil film.

Therefore, the undergrip system acts as a vice on the carriage bed guideways, providing the same contrast force in all directions, upwards and downwards.

The conventional systems, even if hydrostatic, cannot provide the same contrast force upwards and downwards as well.



Centralized automatic lubrication system for carriage and sub-base, hydrostatic type, complete with motors, pumps, filters, piping and hydraulic unit. This unit is located "off machine" to eliminate detrimental vibrations from affecting grinding.

The ways are automatically pressure-lubricated, oil being supplied in a continuous cycle by a separate motor driven pump. This system is interlocked with the grinder control so that no machine components may be started unless oil pressure is established in the ways system. Flow meters and pressure meters are used for this purpose.

The ways of POMINI grinders show no distinguishable wear after years of operation. This is an extremely important factor in preserving original accuracy throughout the life of the machine.

### Longitudinal Carriage Drive System

This mechanism is unique.

It consists of a precision high contacting worm and a high precision Rotorack. There are 10 leads with a lead of 120° angle providing full contact.

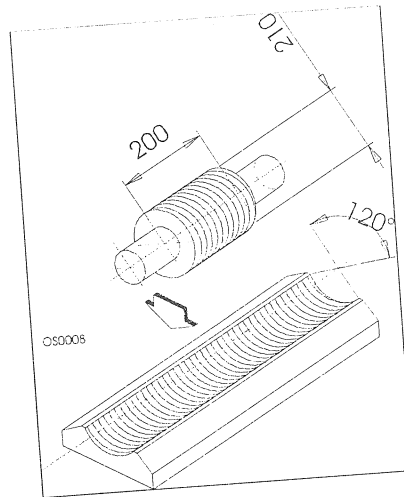
There is no high point of contact as in our competitors' design, which is rack and pinion.

The traverse is flat along the bed section; there is neither deflection due to compression when travelling in a positive direction nor deflection due to lifting when travelling to negative direction.

Due to the high contact and low load, wearing is minimum and translation of the movement is stable and even.

Parts included:

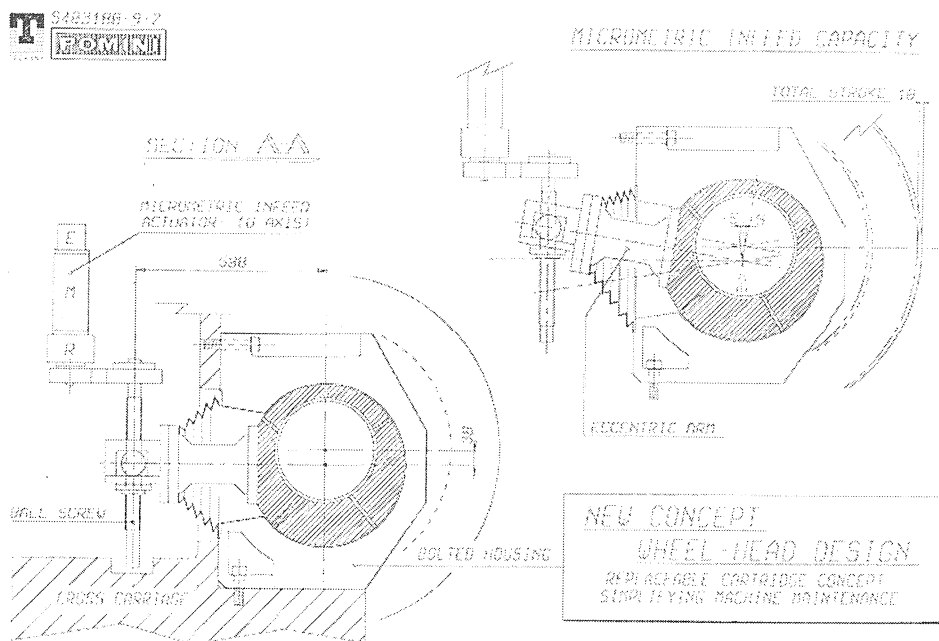
- operator's lamp
- hydraulic unit



**1.6. Wheelhead**

POMINI roll grinders incorporate the most significant improvement developed in recent years in the field of grinders.

As a matter of fact, they are equipped with a special device, which makes the **wheelhead tilting through an eccentric instead of sliding on ways** during the fine infeeds.



This device, using the same support and driving system used for crowning, ensures the highest accuracy obtainable and, moreover, being this system free of backlash, allows the maximum wheel movement accuracy in both directions.

Previously, accuracy was limited because of friction due to wheelhead ways and, therefore, fine infeeds resulted less accurate and with variable rate.

The eccentric infed system has also made possible the development of completely automated machines, which eliminate the human element in roll grinding, depending on the extent to which the machine is automated.

Wheel infed is therefore divided into two systems, (1) wheelhead sliding base infed and (2) wheelhead eccentric infed.

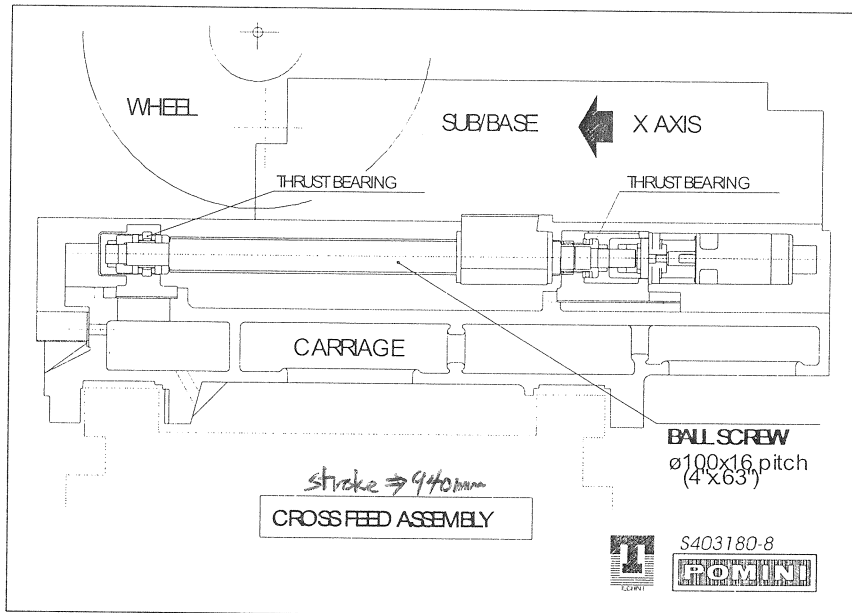
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The wheelhead sliding base infeed is used only to position the grinding wheel near the workpiece, even if the resolution of the correspondent X axis is 0,0001mm. As a matter of fact, the other functions of micrometric fine infeed and micrometric continuous infeed require a higher resolution.



In and out movement of the wheelhead and sliding base is provided by a pushbutton controlled electric drive.

The eccentric infeed system is designed and provided for final wheel approach to the workpiece and for maintaining the desired cut when the wheel is in contact.

The eccentric infeed is initiated by setting the precision feed selector at one of three modes provided, manual, continuous or kW. Manual mode permits the use of an electronic handwheel.

Parts included:

- electronic handwheel 1 div. = 0.00001 mm
- subbase ways and operator's splash guards are provided
- sub-base ways protected by way wipers and fixed covers
- power track with one end fixed to the wheel carriage for electric services, oil and coolant supply
- coolant system, complete with pipings on machine, but not including coolant settling system and metallic or abrasive particle filtering
- eccentric retract system used for retracting the wheel in case of power failure

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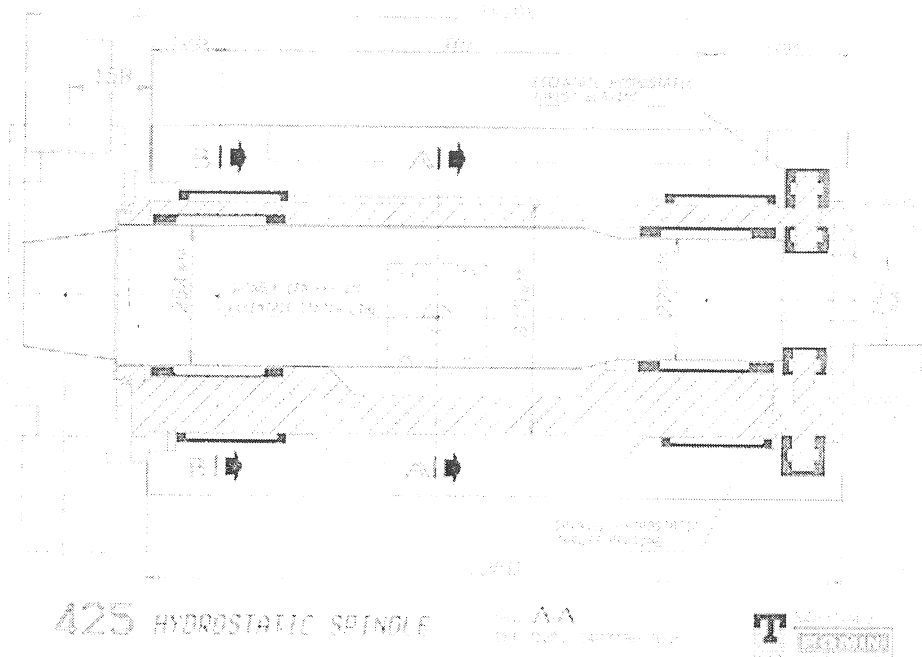
**POMINI**

Roll Grinders



### 1.7. Hydrostatic spindle

The wheel spindle, grinding wheel and V-belt drive are made in cast iron with heavy duty rigid “box section” design for. The wheelhead is attached to its sliding base through a trunnion pivot, thus providing independent movement.

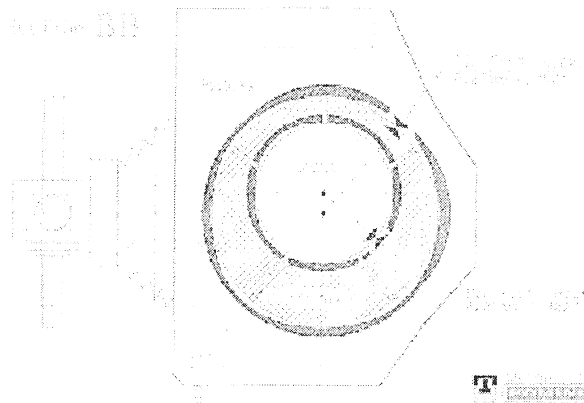


Hydrostatic wheel spindle and bearings are supplied as standard equipment.

The spindle is made of selected alloy steel and is machined to exacting tolerances and it is designed with two large bearings, thus providing rigidity under grinding load.

The use of hydrostatic bearings assures:

- high load carrying capacity at all speeds
- no starting friction and extremely low running friction
- no metal-to-metal contact at any operating speed or load
- no bearing clearance adjustment required



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- less maintenance

The lubrication system for the hydrostatic bearings incorporates a gas charged accumulator, filled with oil, which will evacuate and maintain a hydrostatic condition while the wheel spindle coasts to a stop in the event of a power failure.

The wheel spindle is driven by a multiple V-belt drive from a variable speed, precision balanced, motor.

Spindle speeds are infinitely variable by rheostat control. Spindle rpm are monitored via an instrument located on the operator console. A kWmeter is furnished to indicate spindle drive motor current draw during the grinding operation.

Wheel overspeed limiting devices are supplied as standard equipment.

Hydrostatic, lubricating oil is supplied to the wheel spindle from an A.C. motor driven pump.

Pump and grinder controls are interlocked to insure that proper lubrication is established before the grinding wheel motor can be started.

Pressure and flowmeters are located in the system to prevent insufficient fluid supply from damaging the spindle.

There are limit temperature switches that must be set to a minimum and maximum temperature. The grinder will not operate if the system is not within the specified temperature range. **A cooling system (refrigerator) is used to cool the spindle oil.**

Parts included:

- Adjustable grinding wheel drive and overspeed limiting devices.
- KWmeter monitoring grinding wheel load mounted at carriage position.
- Pumping unit for hydrostatic fluid is located "off machine" to eliminate detrimental vibrations from affecting grinding.
- The unit includes a heat exchanger to maintain oil viscosity and safety oil accumulator.
- One wheel flange to accommodate grinding wheels
- Wheel guard supplied with internal teflon coating and flushing inlet line to prevent swarf build up. (Abrasion resistant and adherence resistant).
- A wheel guard

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*Roll Grinders*





## 2. HYDRAULIC SYSTEM

### 2.1. Oil lubrication

The machine is equipped with a complete hydraulic system for the hydrostatic lubrication with undergrip of all guide ways for wheel carriage (Z axis), wheelhead (X axis) and for the hydrostatic pockets of grinding wheel spindle bearings.

The above system is complete including also the hydraulic units, on-machine and off-machine pipes and cable and safety sensors for monitoring pressure and temperature of the system.

#### Hydraulic units

Spindle oil unit: for hydrostatic spindle lubrication (line pressure 60bars, flow rate approx. 70l/min).

Ways oil unit: for hydrostatic ways lubrication (line pressure 10bars for Z axis, 20bars for X flow rate approx 10l/min).

Neckrests oil unit: for hydrodynamic lubrication of work roll shoulder on neckrests' hydrodynamic bearing shoes (lubrication is activated by the CNC and always when the headstock rotates the roll).

for hydrostatic lubrication of back up roll necks on neckrests' hydrostatic bearing

All units are equipped with Rexroth components and are complete in all respects including filters, connections, pressure and temperature gauges, relative pumps and control valves.

Safety measures are always provided where needed (i.e. gas charge accumulator to prevent metal to metal contact in spindle bearings in case on power failure).

### 2.2. Grease lubrication

For roller bearings lubrication and where needed the machine is provided with proper pins for grease injection with standard manual pump. They are located in strategic spots for easy maintenance.

### 2.3. Compressed air

Compressed is used for the following:

- to activate valves (i.e. coolant water)
- caliper (to clean the roll surface when measuring)

### 3. ELECTRICAL EQUIPMENT

#### 3.1. MAIN ELECTRICAL EQUIPMENT

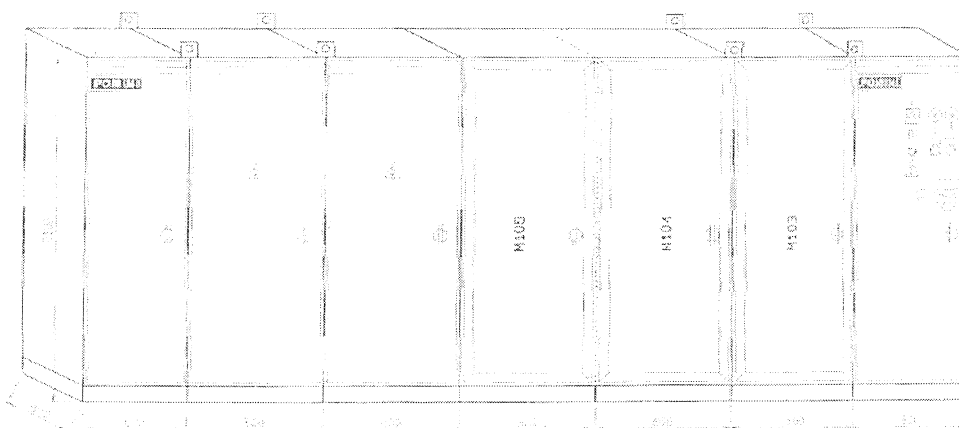
It includes the electrical cabinets and, depending on the automation degree, the floor pulpit

##### 3.1.1. ELECTRICAL CABINET

It is made by modular metal enclosures,  $l \times h \times d = 800 \times 2000 \times 800$  mm each, totally enclosed, IP 55 insulation.

The cooling is by means of an air conditioner.

The electrical cabinet, sectioned into two parts to facilitate its transportation, are installed on the floor level.



*Electrical cabinets view – for reference only*

The electrical cabinet includes the main circuit breakers, the transformers, the drives, the NC if any, the programmable logic and anything else needed for the correct machine operation. Moreover, it includes terminal strips and connectors for the connection to the various machine parts.

Two power supplies are connected to the electrical cabinet, at customer care:

- The main 3-phase supply shunted from the general distribution network of the shop

**440 V ( $\pm 10\%$ ) – 60 Hz ( $\pm 2\%$ )**

- The supply for the lighting circuit and service taps.

**220 V – 60 Hz.**

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The following voltages necessary to feed the various devices are generated inside the main board:

A. Supply of PC, etc.	:	220 V/ 60 Hz
B. For AC auxiliary circuits	:	110 V/ 60 Hz
C. For the supply of PLC I/O, solenoid valves, brakes:	:	24 V D.C.

The main components included in the electrical cabinet are described herebelow and may change according to the scope of supply:

## CABINET N.1 – MAIN SWITCH

Main switch	MOELLER brand
Circuit breakers	SIEMENS brand
Fuses	SIEMENS brand
Contactors	SIEMENS brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.

## CABINET N.2 – WHEEL MOTOR CONVERTER

Wheel motor power converter	SIEMENS brand
Circuit breakers	SIEMENS brand
Fuses	SIEMENS brand
Contactors	SIEMENS brand
Air conditioner	RITTAL brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.

## CABINET N.3 – HEADSTOCK MOTOR CONVERTER

Power supply	SIEMENS brand
Axis module	SIEMENS brand
Filter module	SIEMENS brand
Circuit breakers	SIEMENS brand
Fuses	SIEMENS brand
Air conditioner	RITTAL brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.

## CABINET N.4 – AXES INVERTERS AND CNC

CNC SINUMERIK 840D	SIEMENS brand
Power supply	SIEMENS brand

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Axis modules	SIEMENS brand
Filter module	SIEMENS brand
Circuit breakers	SIEMENS brand
Fuses	SIEMENS brand
Air conditioner	RITTAL brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.

## CABINET N.5 – PLC

PLC S7	SIEMENS brand
Interface module	SIEMENS brand
Digital I/O modules	SIEMENS brand
DMP Analog I/O	SIEMENS brand
Circuit breakers	SIEMENS brand
Thermostat	RITTAL brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.

## CABINET N.6 – MOTOR STARTERS

Contactors	SIEMENS brand
Circuit breakers	SIEMENS brand
Fuses	RITTAL brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.

## CABINET N.7 – CONNECTORS

Connectors	HARTING brand
------------	---------------

### 3.1.2. FLOOR PULPIT

In addition to a carriage mounted control panel (a standard SIEMENS machine operator panel) enabling the operator to control the machine operation can be supplied a additional floor pulpit, as option.

Totally enclosed, provided with an air conditioner or fan ventilation system.

Both a PC for storing the roll data, managing the measuring unit data etc. and a colour printer giving the grinding data report on A4 format paper are provided besides the NC operator's panel, the machine pushbutton panel, the indicators and the auxiliary drives.

The main components included in the floor pulpit are described herebelow and may change according to the scope of supply:

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## FLOOR PULPIT

Personal Computer	COMPAQ brand
Monitor	COMPAQ brand
Colour printer	HP brand
CNC Pushbutton	SIEMENS brand
Connector bus	SIEMENS brand
Thermostat	RITTAL brand
Miscellanea	TELEMECANIQUE, RITTAL, etc.



### 3.2. MACHINE-MOUNTED ELECTRICAL SYSTEM

It includes the wheel and headstock motors, the axes motors, the A.C. motors, the pushbutton panels, the position sensors, the transducers of different physical units and their relevant connections.

#### 3.2.1. GRINDING WHEEL MOTOR

**130 kW - A.C.**

- ⇒ A.C. asynchronous motor with squirrel cage rotor
- ⇒ Controlled by digital power converter
- ⇒ Self-ventilated
- ⇒ Pulley shaft extension
- ⇒ Continuous duty
- ⇒ Enclosure IP 55
- ⇒ High precision dynamic balance
- ⇒ Class of insulation F
- ⇒ Speed controlled

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- ⇒ Overload protected
  - ⇒ Short circuit protected
  - ⇒ Field losses protected
  - ⇒ Tachometric losses protected
  - ⇒ Overspeed protected
  - ⇒ Compact design with high power density
  - ⇒ Almost maintenance-free
  - ⇒ Almost servo quality
- ⇒ Dimensions in accordance with European standards

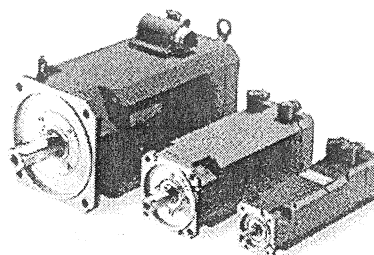
### 3.2.2. HEADSTOCK MOTOR

#### 200 kW - A.C.

- ⇒ A.C. asynchronous motor with squirrel cage rotor
- ⇒ Controlled by digital power converter
- ⇒ Radially assisted ventilation
- ⇒ Pulley shaft extension
- ⇒ Continuous duty
- ⇒ Enclosure IP 55
- ⇒ High precision dynamic balance
- ⇒ Class of insulation F
- ⇒ Incremental transducer for speed and position control
- ⇒ Overload protected
- ⇒ Short circuit protected
- ⇒ Field losses protected
- ⇒ Tachometric losses protected
- ⇒ Overspeed protected
- ⇒ Compact design with high power density
- ⇒ Almost maintenance-free
- ⇒ Almost servo quality
- ⇒ Dimensions in accordance with European standards

### 3.2.3. AXES MOTORS

The main machine movements are driven by brushless A.C. servomotors handled as axes by a SIEMENS SINUMERIK 840D NC.



*Axes motors – for reference only*

Their main features are:

- ⇒ A.C. motor
- ⇒ Speed controlled
- ⇒ Variable frequency
- ⇒ High dynamic performance
- ⇒ Low cabling requirements
- ⇒ Integrated incremental encoder for speed and position control
- ⇒ Improved motor smooth running by sinusoidal current principle
- ⇒ Developed for digital control technology
- ⇒ Total enclosure IP 64

The motor axis included in the roll grinder are described herebelow:

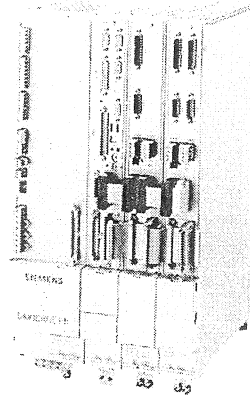
Axis	Function	Brand	Type	Torque (Nm)	Speed (rpm)
Z	Carriage translation	SIEMENS	1FT6 086-8AC71	23	0/2000
X	Wheelhead translation	SIEMENS	1FT6 082-8AC71	11.4	0/2000
Y	Crowning	SIEMENS	1FT6 041-4AF71	2.15	0/3000
U	Micrometric infeed	SIEMENS	1FT6 041-4AF71	2.15	0/3000
A	Wheel approach	SIEMENS	1FT6 041-4AF71	2.15	0/3000
C	Caliper arms	SIEMENS	1FT6 041-4AF71	2.15	0/3000
V	Caliper carriage	SIEMENS	1FT6 041-4AF71	2.15	0/3000
A1	Inspektor system	SIEMENS	1FT6 041-4AF71	2.15	0/3000

Please note that the number of motors supplied may change according to the scope of supply. The motors of functions not included in the scope of supply, of course, will not be supplied.

### 3.2.4. CONVERTER

The axis motors are controlled by a modular digital power converter SIEMENS SIMODRIVE 611.

With this converter system individual drive assemblies can be combined thus enabling fast and flexible synchronization of the drive performance and number of machine axes



*Converter – for reference only*

The main features of the modular power converter are:

- ⇒ A drive module activates every motor
- ⇒ Each module carries out a different task
- ⇒ Modular transistor pulse-controlled converter
- ⇒ Compact system for several axis as well as drive combination solutions
- ⇒ Is adaptable to every motor with its performance modules
- ⇒ Can be implemented with analog or digital setpoint interface with closed-loop plug-in units
- ⇒ Common mains supply modules
- ⇒ Can be expanded whenever required

### 3.2.5. A.C. MOTORS

For secondary machine operations like pump drives, cover openings, rough movements.

Their main features are:

- ⇒ Total enclosure IP 54
- ⇒ Contactors driven
- ⇒ Overload protection
- ⇒ Short circuit protection
- ⇒ Dimensions according to European standards.

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Where necessary, variable frequency drives for speed control are provided.

The main A.C. motors included in the roll grinder are described herebelow. Additional A.C. motors may be included in the scope of supply if optional accessories are selected.

Function	Brand	Power (kW)	Speed (rpm)
Carriage, sub-base and caliper ways' oil pump	SIEMENS	3	1500
Hydrostatic spindle oil pump		5.5	1500
Oil recirculation pump	SIEMENS	1.1	1500

### 3.2.6. AUXILIARY DEVICES

A set of devices like limit switches, proximity switches, flow controllers, pressure switches, solenoid valves and others are fitted to the machine for the control of the various functions; normally, they are connected to I/O of the PLC that drives the machine.

The main devices installed on the roll grinder are:

Proximity switches	SIEMENS, etc
Handwheel	EUCHNER brand
PLC pushbutton	TELEMECANIQUE brand
Solenoid valves	PARKER, REXROTH, etc
Pressure switches	SQUARE-D, etc
Vibration sensor	BRUEL & KJAER

### 3.2.7. PUSHBUTTON PANELS

They are placed on some machine sides (headstock, footstock, neckrests, carriage) and are used for the local manual drive of the relevant machine part.

CNC pushbutton	SIEMENS brand
Handwheel	EUCHNER brand
Panels pushbutton	TELEMECANIQUE brand

### 3.2.8. ELECTRICAL CABLES

The connections among the electrical cabinets, the floor pulpit and the various

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machine parts are made by connectors to facilitate the assembling /  
disassembling operations.

The main cables installed on the roll grinder are:

Special cables	SIEMENS brand
Standard cables	Various brands
Connectors	HARTING brand
Profibus	SIEMENS, etc
Optical fibres	SIEMENS, etc

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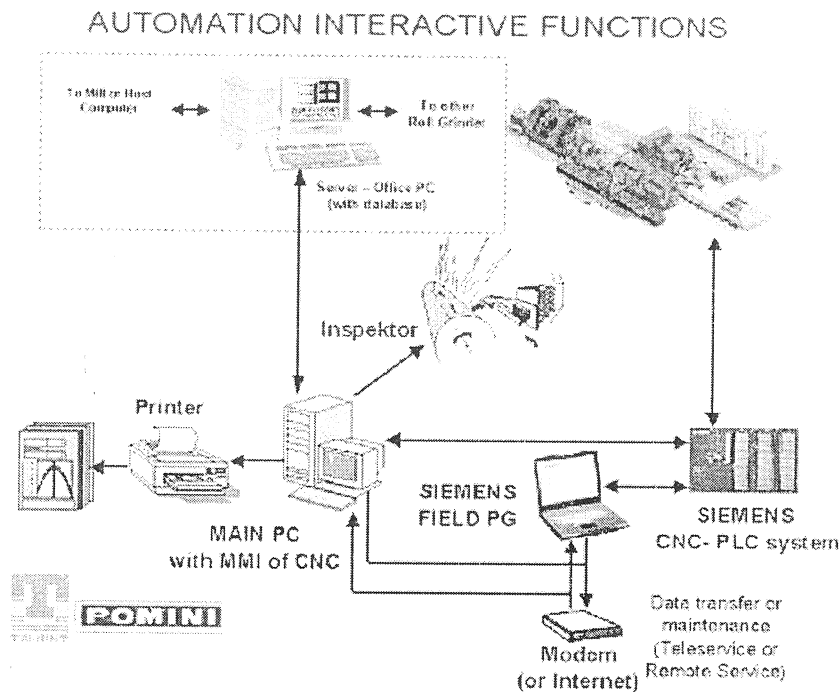
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**POMINI**

*Roll Grinders*



#### 4. AUTOMATION SYSTEM



#### 4.1 SIEMENS CNC AND PLC

##### 4.1.1. CNC

The roll grinder is supplied with a **SIEMENS SINUMERIK 840D digital CNC basic model**.

The CNC is used for:

- ⇒ Regulation of the axes speeds and positions.
- ⇒ Speed regulation of the spindles.
- ⇒ Management and implementation of programs containing the commands for sequential operations and movements of grinding cycles, measures and works.

The SIEMENS SINUMERIK 840D is a CNC control that is used for most technologies and is widely used across the globe.

This system is a modular 32-bit microprocessor CNC continuous-path control for grinding machines, as well as for handling of up to 10 mode groups, 10 channels, 31 axes/spindels and integrated powerful PLC.

With up to 10 possible machining channels it is possible to appreciably reduce idle times and execute part programs in the individual channels both simultaneously and asynchronously

The CNC 840D is based on a NCU 573.2 with Intel Pentium II processor with 2.5 MB NC memory and up to 288 KB PLC memory, for up to 10 mode groups / 10 channels / 31 axes (12 axes/spindles per channel)

The CNC basic model is suitable for crowning any type of symmetrical and non-symmetrical, standard and non-standard profile as well as special shapes such as CVC, UPC, etc.

The supplied CNC main features are:

**No. 1 CNC SIEMENS SINUMERIK 840D**  
NCU 573.2  
Intel Pentium II processor  
2.5 MB NC memory

The system may be upgraded with faster CPU, RAM memory according to the market developments.

The main **STANDARD FUNCTIONS** of SIEMENS 840D CNC are:

- ⇒ Optimum, complete digital solution with SIMODRIVE 611 D digital
- ⇒ Up to 10 mode groups, 10 channels and 31 axes/spindels
- ⇒ OEM-open NCK software
- ⇒ Feedrate and rapid traverse: 0.001 mm/min to 999 m/min
- ⇒ Endlessly rotating rotary axes
- ⇒ Spindle package with extensive range of functions, for example oriented spindle stop
- ⇒ Spline interpolation
- ⇒ Polynomial interpolation
- ⇒ Axes and spindle motions from synchronized actions
- ⇒ Programmable acceleration
- ⇒ Tool length compensation
- ⇒ Backlash compensation
- ⇒ Safety routines permanently active for measuring circuits, overtemperature, battery, voltage, memory, limit switch, fan monitoring
- ⇒ Software limit switch
- ⇒ Spindle monitoring
- ⇒ Diagnostics functions from interface, PLC and NC with plaintext displays on screen
- ⇒ Safety Integrated
- ⇒ Jerk limitation function, reducing wear on the mechanical parts and optimizing traversing

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- behavior.
- ⇒ User-oriented, hierarchical access protection
  - ⇒ Customized user interfaces can be added to operating areas
  - ⇒ Operator interface open to OEM, configurable under Windows
  - ⇒ Displays in 7 languages, switchover function between two languages. Other languages on request

The advantage of using CNC, PLC, CONVERTERS and MOTORS, supplied by only one global supplier such as SIEMENS, is the implementation of integrated safety functions that allow highly-effective person and machine protection

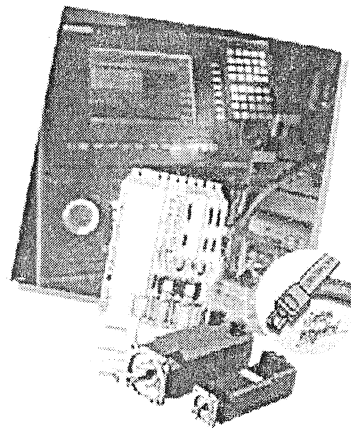
Therefore due to the complete integration into the controller and drive technology, the safety functions become a fixed component of the basic system.

All of the safety functions meet the requirements of safety category 3 in accordance with EN 954-1 and are an integral component of the basic system. No additional sensors or evaluation units are required. This means: Reduced installation costs on the machine and slimline switching cabinet.

The process variables and safety-relevant system data are cross-monitored. Safety-oriented software and hardware functions are checked through automated forced speed up at defined intervals of time.

Generally, all safety-relevant errors in the system result in safe stopping of the dangerous movement or in rapid electrical separation of the motor.

The electrical separation between converter and motor required in this special error case is performed without contacts and can be initiated for specific axes at a very short response time.



*Integration of CNC, PLC, CONVERTERS and MOTORS – for reference only*

The main **SAFETY INTEGRATED FUNCTIONS** of SIEMENS 840D CNC are:

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- ⇒ Functions for safe monitoring of speed and standstill
- ⇒ Safe travel range limitation and range identification
- ⇒ Safe stopping process: Leads the drives safely from the movement to zero speed when addressing a monitor or sensor (e.g. light barrier).
- ⇒ Safe operational stop: Monitors the drives in zero speed for a settable tolerance window. The drives remain closed-loop position controlled.
- ⇒ Safe standstill: Pulse suppression of the drives and thus safe electronic separation of the power supply
- ⇒ Safely reduced speed: Monitoring of configurable speed limit values, e.g. for setup mode without enable key.
- ⇒ Safe limit switches: Variable travel range limitation, configurable for specific axes
- ⇒ Safe software cams: Range identification
- ⇒ Safe programmable logic control: Direct connection of safety-oriented signals and internal logic combination

The main **PROGRAMMING FUNCTIONS** of SIEMENS 840D CNC are:

- ⇒ User-friendly programming language editor to DIN 66025 with comprehensive range of high-level language elements
- ⇒ Dimension input metric, inch
- ⇒ Fast NC-PLC data exchange via dualport RAM
- ⇒ SinuTrain, easy-to-understand, field-oriented CNC training
- ⇒ Up to 1.5 MBytes NC user memory (RAM) for part programs, translations

The **OPERATING MODES** of SIEMENS 840D CNC are:

- ⇒ AUTOMATIC
- ⇒ JOG (setup)
- ⇒ MDA (process manually entered block)

#### 4.1.2. PLC

The CNC SIEMENS SINUMERIK 840D is fully integrated with the programmable logic control (PLC)

The PLC is used for:

- ⇒ Implementation and constant verification of logical operations.
- ⇒ This logic, in the form of a PLC program, supervises and controls all the operating functions of the machine.

The supplied PLC main features are:

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## No. 1 PLC SIEMENS SIMATIC S7 type

CPU 315-2 DP

Program and data memory 32Kb (expandable up to 288 KB)

STEP 7 programming language

I/O modules expandable to 2048 digital inputs/outputs

Up to 4096 flags, 128 timers, 64 counters

Servo or step motor PLC positioning axis

S7-HiGraph programming

Distributed I/Os via PROFIBUS-DP

Functions specific to roll grinding technology have been implemented by TECHINT/POMINI in the CNC thanks to the fact that the SIEMENS SINUMERIK 840D is open in every way, from the NC kernel right through to the user interface, allowing a complete freedom of action.

**No black-boxes are supplied !**

The SINUMERIK 840D is equipped with a Pentium-PC with DOS/Windows platform, so that the NC control programs and the PC-based special software developed by TECHINT/POMINI can now easily be integrated. The same goes for hardware modules, for remote diagnostics, measured data acquisition, networking or machine and production data acquisition, for example, which can quickly be connected via the PCI/ISA adapter.

The integral PC of the SINUMERIK 840D, the Windows-based human-machine interface (MMC) and the facility for implementing compile cycles make TECHINT/POMINI independent of the control manufacturer.

Thanks to this integration the new CNC control system is supplied without a MMC interface or operator panel since CNC video pages are displayed directly on PC LCD TFT monitor supplied together with the floor pulpit.

### 4.1.3. PERSONAL COMPUTER

The PC supplied together with the floor pulpit is herebelow indicated and may be upgraded with faster CPU, RAM memory and hard disk capacity according to the market developments

The PC is used for:

- ⇒ Data introduction by means of a standard keyboard and mouse.
- ⇒ Data storage (archives) on the internal hard disk or on CD-ROM and the transfer of stored programs and data to/from the PLC and CNC.
- ⇒ Generate hardcopy reports of the grind results to be used for quality control. All data coming from the grinders measuring system, displayable on the PC monitor can be printed out on the printer.
- ⇒ Store in its memory all the help files and equipment documentation
- ⇒ Exchange of information with the HOST (roll shop/mill) computer directly or through network (if applicable).

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These components, CNC, PLC, PC and PRINTER work as an integrated system.

## **No. 1 PC COMPAQ EVO W4000 MIDI-TOWER/DESKTOP – P4 1,7 GHz/400**

System Architecture PCI/AGP Compaq,  
Microprocessor Intel Pentium IV 1.7 GHz  
Chipset Intel 485  
Base Memory 256 Mb SDRAM RIMM  
Hard disk 40 GB (7200rpm) Ultra ATA/100  
Floppy disk 1,44Mb (3,1/2)  
2 Serial Interfaces, 1 parallel ECP-EPP, 4 USB  
No. 5 slot expansion PCI + 1 agp  
Audio Controller, Screen controller NVIDIA Quadro2-EX  
Internal CD-RW  
Ethernet Integrated Interface Intel Pro/100  
Extended International keyboard, Mouse Compaq

## **No.1 UPS system (option)**

## **No.1 MONITOR 17" LCD TFT type**

## **No.1 PRINTER Hewlett Packard DeskJet 840C - Colours**

Max Resolution. 600x600 dpi  
Centronics parallel Interface and USB

### **4.1.4. SPECIAL CABLES**

In order to guarantee the ideal connection of NC with servo motors and main spindles are used only SIEMENS preassembled power and signal cables.  
EMC compatibility, standards-compliant insulation and production processes, as well as extremely robust cables ensure trouble-free operation and long cable life

### **4.1.5. SERVICE**

In addition to the benefits of service supplied by TECHINT/POMINI the Customer can benefit also of the following advantages:

- ⇒ Worldwide stocking of spare parts by SIEMENS
- ⇒ Worldwide service supplied by SIEMENS
- ⇒ Lower spare parts prices purchasng directly by SIEMENS
- ⇒ Extensive documentation supplied by SIEMENS

### **4.2 CNC AXIS**

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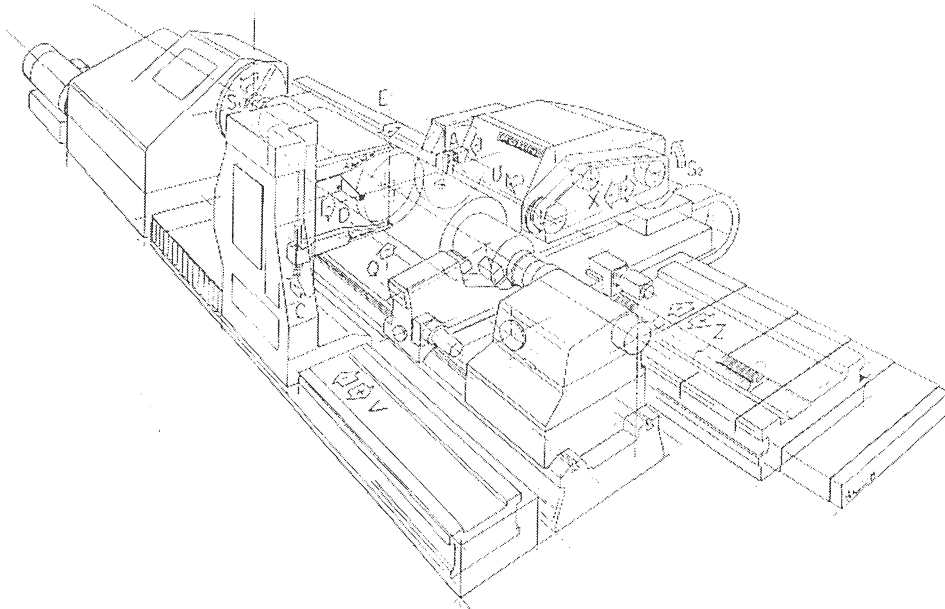
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Roll Grinders







*The CNC constantly controls the precise position and speed of each axis using servo motors, rotary encoders and other related controls.*

*The main axes controlled by CNC are:*

Z	wheel carriage on rear bed	S2	wheel spindle
X	wheelhead on wheel carriage	V	caliper carriage on independent caliper bed
U	crowning infeed	C	caliper arms
A	wheel probe	E	upper caliper arm glass scale
S1	headstock spindle	Q	lower caliper arm glass scale
		A1	Inspektor arm

⇒ **Z AXIS – WHEEL CARRIAGE**

Located on the rear bed. For longitudinal movement of the grinding WHEEL CARRIAGE on the hydrostatic ways of the grinders' rear bed.

⇒ **X AXIS – WHEEL CARRIAGE SUB-BASE**

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Located on the rear beds' wheel carriage. For transversal movement (towards and away for the machine/roll center) of the wheelhead on the hydrostatic ways of the wheel carriage sub-base.

⇒ **U AXIS – MICROMETRIC WHEEL INFEEED AND CROWNING**

Located on the rear beds' wheel carriage sub-base. For transversal micrometric movement (towards and away for the machine/roll center) of the wheelhead. This motion is accomplished using an eccentric spindle mechanism. One of the main functions of the U axis is to compensate for wheel wear hence its' direction of movement is related to the centerline of the wheel.

Another of the main functions of the U axis is to move the wheel along the desired profile in conjunction with the Z axis its' direction of movement is related to the centerline of the machine/roll

⇒ **A AXIS – WHEEL APPROACH (optional)**

Located on the rear beds' wheel carriage sub-base, aligned parallel to the side of the wheel. For transversal movement (towards and away from the wheel center) of the wheel probe used for:

- ⇒ automatically approaching the grinding wheel to the roll or dressing diamond
- ⇒ continuously monitoring the wheel diameter to control the constant Surface Feet Per Minute (SFPM), Meters per Second for metric machines (M/S) of the wheel
- ⇒ the initial alignment of the roll
- ⇒ in manual alignment function to indicate horizontal roll position in conjunction with the X axis

⇒ **S2 AXIS – WHEEL SPINDLE**

Located on the rear beds' wheel carriage wheel head. For rotation of the grinding wheel and in conjunction with wheel diameter feedback from the wheel probe (A axis) it regulates the surface speed of the wheel, keeping the surface speed constant whilst the wheels diameter changes due to consumption.

The CNC displays the RPM of the wheel and also the surface speed of the wheel once the wheel probe has been calibrated.

⇒ **S1 AXIS – HEADSTOCK SPINDLE**

Located on the front bed. For rotation of the roll and regulation of roll RPM.  
The CNC displays the RPM of the roll.

⇒ **V AXIS – INDEPENDENT CALIPER CARRIAGE (optional)**

Located on the caliper bed. For longitudinal movement of the caliper carriage on the ways of its independent bed.

⇒ **C AXIS – CALIPER ARMS (optional)**

Located on the caliper carriage they are mounted in a housing (column) that is hydraulically rotated 90 degrees to allow them to be rotated to the “on” or “off” roll positions, facilitating measuring and eventual parking of the caliper.

The C axis opens and closes the caliper arms which are used in conjunction with the E and Q axes for the measurement of roll profile, roundness and diameters. It is also used in the manual alignment function to indicate the rolls vertical position and the rolls diameter at each of the alignment positions (headstock and footstock ends).

⇒ **E AXIS – UPPER CALIPER ARM (optional)**

Located inside the upper caliper arm. For measurement of roll profile variations and roundness with the upper caliper arm. In conjunction with axis Q they measure the profile and roundness, they also measure the runout of the roll body with respect to the neckrest supported roll neck.

⇒ **Q AXIS – LOWER CALIPER ARM (optional)**

Located inside the lower caliper arm. For measurement of roll profile variations and roundness with the lower caliper arm. In conjunction with E axis they measure the profile and roundness, they also measure the runout of the roll body with respect to the neckrest supported roll neck.

⇒ **A1 AXIS – DEFECT INSPECTION PROBE (optional)**

Located on the caliper carriage, mounted between and in line with the caliper arms it is aligned to the machine centerline. For transversal movement towards and away from the roll surface of the eddy current roll surface inspection probe.

**NOTE:** Optional axes will be supplied only if the accessories they are provided for are included in the scope of supply. Additional axes may be included in the scope of

supply if necessary.

All axes can be moved in JOG mode by means of SIEMENS Operator Control Panels located on the wheel carriage and on the floor pulpit (if supplied). Axes can be traversed using the direction keys +/- or through the handwheel.

### 4.3 TECHINT/POMINI AUTOMATION

For TECHINT/POMINI automated grinders the automation of the roll grinding process means:

A fully automated operation that can consistently replicate the actions normally carried out by a skilled operator without the need for constant operator attention. With the TECHINT/POMINI automation concept the operator is required only to predefine the work to be performed and start the machines operation. Once started the grinder will continue working independently either until the predefined work has been completed or on occasion until some anomaly occurs that requires human intervention.

During the automatic operation the operator may supervise the work being carried out by evaluating the data collected in process by the machine. If the operator is not present during the actual working the data can be automatically printed out and reviewed at a later point-all of the data available for printout is also stored in a local database and can be reviewed at any time after the operation has been completed.

The operator can override the predefined work “ON THE FLY” to adjust the operation for needs unforeseen prior to starting the work without the need to stop and restart the machine. The Man Machine Interface of the TECHINT/POMINI automatic roll grinder has been specifically designed with this “ON THE FLY” concept in mind to allow the maximum flexibility to the operator for those cases where the operator may want to intervene during automatic operations.

Depending upon the options purchased, the grinder may be equipped to reach our highest level of automation: TECHINT/POMINI systems supplied with TECHINT/POMINI automatic loading systems and sufficient optional measuring instruments are capable of working from a predefined grinding production schedule. This system is capable to grind one roll after another continuously following the predefined production schedule. Upon completion of each grind the machines automation will evaluate all of the process data collected and will only unload the roll and start on the next roll once the current roll meets or exceeds all of the predefined quality requirements.

There are three ways the automation system may be used:

⇒ **MANUAL DATA INPUT**

In this method of operation the operator uses the automatic motion and measuring systems of the grinder (if included in the scope of supply) but chooses not to predefine the operating process variables but instead inputs all of the data “ON THE FLY”. This method is the least productive use of the operators time! It is however the point from which the other operating methods are born. For it is in this method of operation that we develop and empirically refine the process settings that will be used for the other three operating methods.

⇒ **MANUAL CODES SELECTION**

After initial trials using the Manual Data Input Automatic method of operation a knowledge base of process settings will be established.

This base of knowledge includes some settings that may be permanent such as the rolls' maximum and minimum diameter, the start and end of the rolls' body, the type and size of the grinding wheel to be used.

It will also include some settings that may be variable such as how to dress the wheel for each finish application of a given roll, the finishing grinding parameters for each application of a given roll or possibly the profile type for each application of a given roll.

The TECHINT/POMINI system has been designed to allow this process knowledge to be memorized by the automation system so that it can be used over and over again.

The system divides and memorizes the data in four primary groups – roll, grinding program, profile information and wheel dressing information. When the operator chooses to memorize data for future use - he must assign a code number which is used by the system to identify and organize the saved data. Each of the groups is assigned an identifying code number as follows:

ROLL CODE	contains all of the information required by the automatic process regarding a specific rolls' geometry and tolerances.
PROGRAM CODE	contains all of the information required by the automatic process regarding grinding technology for a specific rolls application, for example; wheel speeds, carriage speeds, roll speeds
PROFILE CODE	contains all of the information required by the automatic process regarding definition of the shape to be ground on the roll in question
DRESS CODE	contains all of the information required by the automatic process regarding wheel dressing technology for the specific rolls' application

Once this primary data has been established and memorized it is available for use in

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# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 2 – Technical Specification

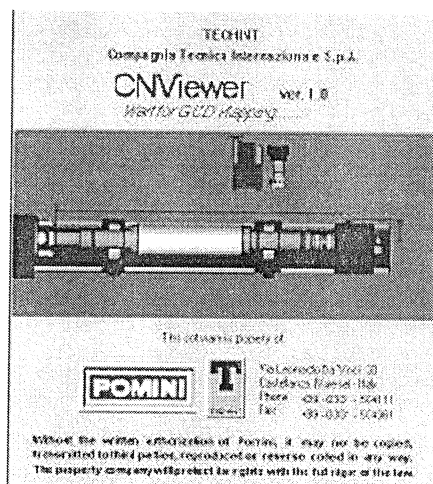
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subsequent grinding operations.

If the operator chooses this method of operation the relevant codes are input at the start of grinding and the machine recalls from memory and executes all of the predefined settings.

## ⇒ ROLL SHOP COMPUTER GRIND SPECIFICATIONS

### 4.4 TECHINT/POMINI PROGRAMS AND FUNCTIONS



The interface between the CNC and the operator is TECHINT/POMINI CNVIEWER<sup>®</sup>. CNVIEWER<sup>®</sup> is organized in user-friendly video pages that are visualized on the PC monitor. By means of this video pages the operator can easily supervise all the grinding phases and check the data introduced by means of a standard keyboard and mouse.

During the grinding cycle, for example, the operator can continuously control wheel load, wheel speed, headstock speed, carriage speed and many other parameters of programs and functions under execution.

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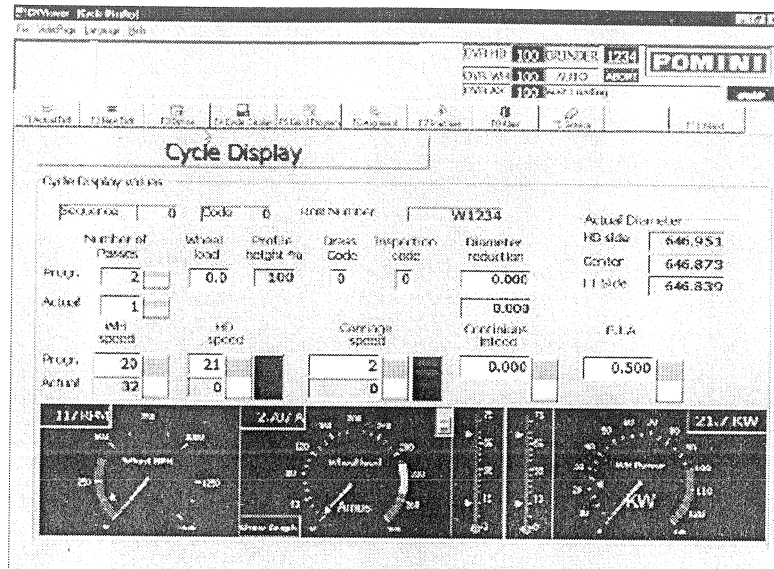
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A2 - 35

**POMINI**

Roll Grinders

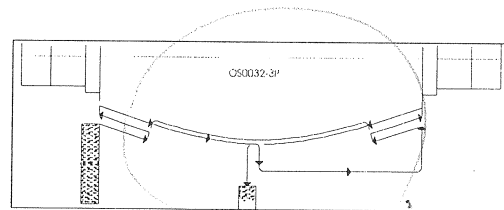




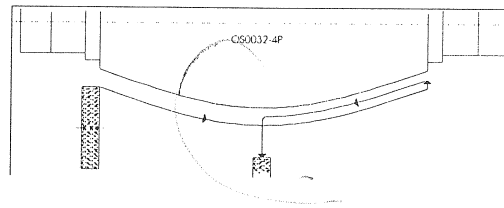
The machine has as standard features the following programs and functions that can be included in the grinding cycle in order to be executed automatically:

⇒ **Profile grinding** (any shape produced with PROFIWIN®)

⇒ **Short stroking**



⇒ **Double half pass.** Allowing to avoid spiral marks during last finishing pass in rolls with high crown values.



⇒ **Constant wheel peripheral speed control.**

⇒ **Wheel retraction for overloading or power failure**

⇒ **Automatic error and misalignment compensation** without using expensive and low reliable solutions like bearing shoes motorizations.

⇒ **Profile error compensation**

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- ⇒ Grind to mate
- ⇒ Grind to aim diameter
- ⇒ Vertical and horizontal alignment of roll
- ⇒ Chamfer (any shape produced with PROFIWIN®)
- ⇒ Plunge
- ⇒ Wheel dress (any shape produced with PROFIWIN®)
- ⇒ Wheel wear compensation
- ⇒ Load control infeed hysteresis
- ⇒ Load control retraction hysteresis
- ⇒ Wheel speed self dress time
- ⇒ Spindle speed sinusoidal variation
- ⇒ Automatic taper compensation
- ⇒ Inspektor EC calibration (option)
- ⇒ Inspektor EC measure (option)
- ⇒ Demagnetizer (option)
- ⇒ Grind to aim defect (option)
- ⇒ Ultrasound calibration (option)
- ⇒ Ultrasound measure (option)
- ⇒ Caliper calibration (option)
- ⇒ Caliper park (option)
- ⇒ Profile measure (option)
- ⇒ Taper measure (option)
- ⇒ Diameter measure (option)





- ⇒ **Roundness measure** (option)
- ⇒ **Runout measure** (option)
- ⇒ **Wheel balancing** (option)
- ⇒ **Vibration measure** (option)
- ⇒ **Roughness measure** (option)
- ⇒ **Hardness measure** (option)
- ⇒ **Automatic wheel approach** (option)
- ⇒ **Wheel probe calibration** (option)
- ⇒ **Neckrests and footstock automatic positioning** (option)
- ⇒ **Automatic unmanned grinding** (option)
- ⇒ **Automatic loader condition** (option)

#### 4.5 TROUBLESHOOTING AND MAINTENANCE

The reduction of machine downtimes thanks to a fast diagnosis and efficient maintenance planning is a very important factor for the machine availability.

The PC-based alarm diagnosis concept on our machines reduces the troubleshooting time and improves the maintenance planning quality.

##### ⇒ **ALARMS AND MESSAGES**

The alarms or messages displayed on PC monitor are identified by number, appearing date and time and description.

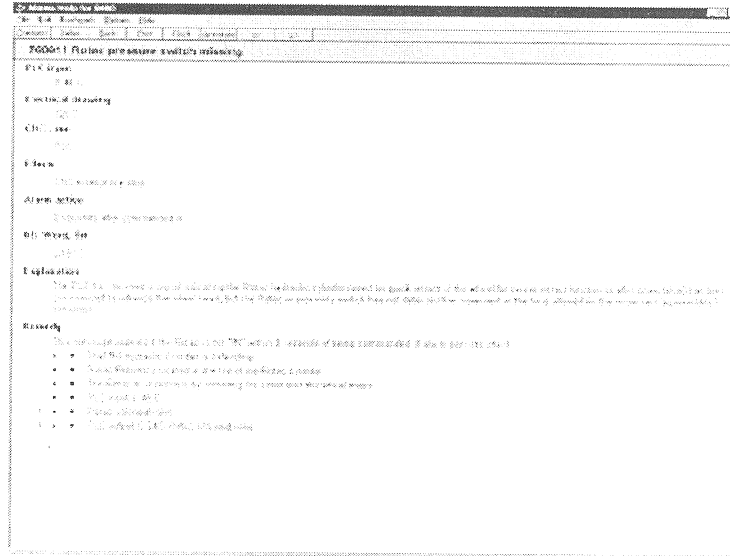
The alarms listed can be related to :

- ⇒ NCK alarms
- ⇒ MMC alarms/messages
- ⇒ Drives alarms
- ⇒ PLC alarms/messages

A alarm help file that includes the complete SIEMENS and machine alarm list is stored in the PC and it is available at any time.

For any alarm the operator can find the detailed explanation of what happened and also

possible solutions and remedy to the problem, starting from the simplest to the most complicated one.



*Troubleshooting – for reference only*

The alarms help gives also information for each alarm and message about the PLC input or PLC memory that has generated the alarm, the relevant electrical drawing page and the effect the alarm has on the current cycle (cycle stop, cycle interrupt, emergency stop etc.).

⇒ **MAINTENANCE VIDEO PAGE**

In order to improve the maintenance planning the CNC control the status of several maintenance tasks. The operator can easily control all the maintenance tasks status.

Nr.	Preset	Actual	Status	Description	MAINTENANCE	Grinder 1
2	24	12	<input type="checkbox"/>	Check: Hydrostatic spindle unit		<input type="checkbox"/>
3	150	0	<input type="checkbox"/>	Actuate: Hydrostatic spindle unit		<input type="checkbox"/>
4	1000	0	<input type="checkbox"/>	Fill: Hydrostatic spindle unit		<input type="checkbox"/>
5	3000	0	<input type="checkbox"/>	Clean or replace: Hydrostatic spindle unit		<input type="checkbox"/>
6	5000	0	<input type="checkbox"/>	Replace: Hydrostatic spindle unit		<input type="checkbox"/>
7	24	0	<input type="checkbox"/>	Check: Caliper hydrostatic ways unit		<input type="checkbox"/>

Enter 3 to clear the maintenance, if requested !

*Maintenance video page – only for reference*

Each maintenance task has a PRESET maximum interval between operations. During normal machine operation the time, elapsed from the latest maintenance performance, is constantly updated.

After expiring the maximum maintenance interval the machine informs the operator that maintenance is required. This condition happens when the ACTUAL field value overpasses the PRESET field value.

Each maintenance task also contains a maintenance window time factor, which allows the continued operation of the machine for a supplementary period of time after the maximum interval has expired.

#### 4.6 TECHINT/POMINI GRINDWIN® SOFTWARE (Basic Version)

The PC-based GRINDWIN® software Basic Version is completely developed by TECHINT/POMINI and provides a standard Windows interface for use during:

- ⇒ CNC connection
- ⇒ Database connection (local or remote)
- ⇒ Printing

#### 4.7 TECHINT/POMINI INSPEKTOR® SOFTWARE (Basic Version)

The PC-based INSPEKTOR® software Basic Version is completely developed by TECHINT/POMINI and provides a standard Windows interface for use during:

- ⇒ CNC connection
- ⇒ Database connection (local or remote)
- ⇒ Printing
- ⇒ Wheel balancing
- ⇒ Vibration measure

#### 4.8 TECHINT/POMINI PROFIWIN® SOFTWARE (Full Version)

The TECHINT/POMINI Profile Generator for Windows (PROFIWIN®) is a Windows Application that is used to define Roll or Dress Profiles to be used in Pomini Roll Grinder Machines.

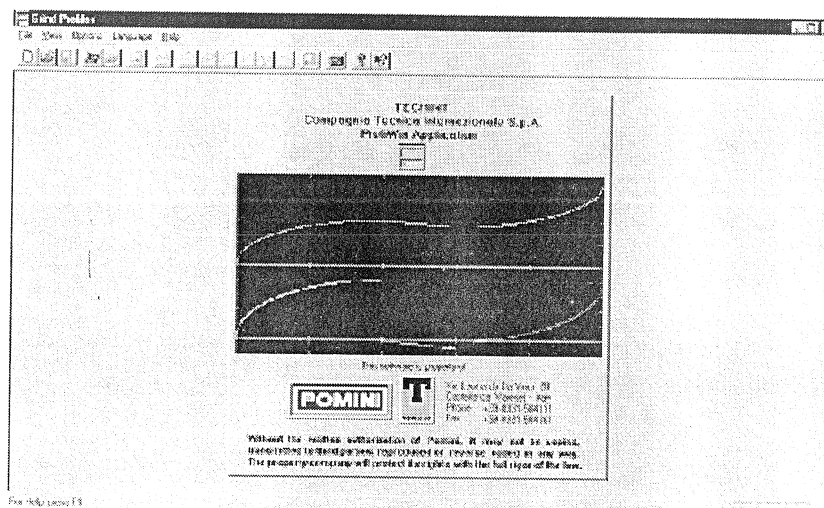
The profiles generated and stored in the PC can be passed directly to the Siemens 840D numerical control that will use them to grind the rolls or to dress the wheel.

The profile generator lets the user define various parts of a profile; the different parts get then combined (added) to form the completed profile.

The various profile parts that can be combined are:

- ⇒ Sinusoidal profiles, which are parts of a sinusoidal curve.

- ⇒ CVC profiles, which are 7th degree polynomials.
- ⇒ Arc profiles, which are parts of a circumference of a specified radius.
- ⇒ Straight profiles, which can be ramps with positive or negative slopes.
- ⇒ Interpolation profiles, which are derived from a series of points using a C-Spline interpolator.
- ⇒ Half Sinusoidal profiles, which are parts of a sinusoidal curve starting from the middle.



## 4.9 VIBRATION MEASUREMENT

The system employs a high-sensitivity, wide-band accelerometer and amplifier. It is possible to use this equipment to measure 'real-time' vibration spectra whilst the grinder is actually in operation or out of grind cycles. This function allows a user to collect, store and retrieve vibration spectra recorded at predetermined or new places on and around the equipment, for maintenance purposes.

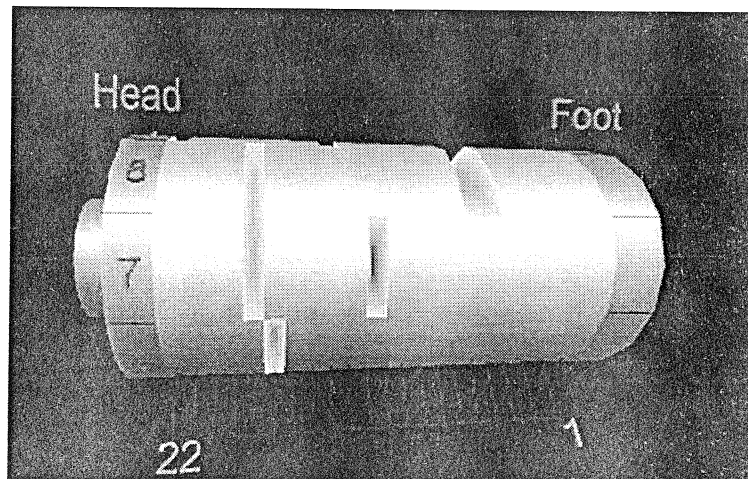
## 4.10 FULL AUTOMATION PACKAGE

TECHINT/POMINI Full Automation Package includes:

- ⇒ **SIEMENS SINUMERIK 840D CNC Full Version**
- ⇒ **Floor pulpit** that allows to the operator to supervise the automatic grinding cycle for one or more grinders
- ⇒ The **TECHINT/POMINI GRINDWIN® software Full Version** that provides a standard Windows interface for use during:

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- ⇒ CNC connection
  - ⇒ Database connection (local or remote)
  - ⇒ Printing
  - ⇒ Profile measure
  - ⇒ Roundness measure
  - ⇒ Roughness measure
  - ⇒ Hardness measure
- ⇒ The TECHINT/POMINI INSPEKTOR® software Full Version that provides a standard Windows interface for use during:
- ⇒ CNC connection
  - ⇒ Database connection (local or remote)
  - ⇒ Printing
  - ⇒ Wheel balancing
  - ⇒ Vibration measure
  - ⇒ Inspektor EC calibration
  - ⇒ 2D and 3D Inspektor EC measure
  - ⇒ Structure measure
  - ⇒ Magnetism detection
  - ⇒ Ultrasound calibration
  - ⇒ 2D and 3D Ultrasound measure



With the Full Automation Package and provided that the necessary accessories are included in the scope of supply is possible to have the following functions **included in the automatic grinding cycle**:

- a. Automatic motion of work centres at beginning and end of each cycle.

- b. Automatic approach of wheel to the roll by means of the wheel probe.
- c. Roughing stage with first automatic roll alignment by means of the wheel probe.

During the first pass the wheel probe measures the roll misalignment and sends to CNC this value that will be added by CNC to the crown value.

- d. Automatic taper compensation included in the roughing cycle, during which the caliper, controlled by CNC, in a separate phase measures the roll and, according to the detected taper value, gives to CNC the differences between the two barrel ends that will be added to the crown of the roll, if any, in order to have the wheel compensating the remaining misalignment.
- e. Automatic continuous roll inspection during the roughing operation.

This means that the machine keeps on roughing as long as crack detection system finds defects on roll barrel, exceeding the values stated as minimum allowable level.

Automatic roll diameter, taper, barrel profile and roundness measurement when grinding stages are over.

The detected values are colour printed on A4 paper format .

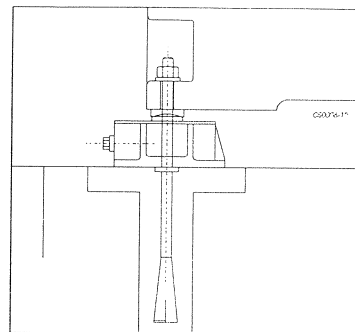
- **840D CNC Full Version** is used for the following functions:

- a. It can continuously visualize crowning shape, which is being executed, as well as values measured by crack/bruise detector compared with theoretical ones thanks to the Windows based dedicated software developed by TECHINT/POMINI such as GRINDWIN® and INSPEKTOR®.
- b. Wheel dressing operation is included in grinding cycle, without making the operator wait. Dressing can, therefore, be an actual stage of grinding cycle.
- c. Integrated diagnostics of faults allows the operator to easily monitor all machine functions and alarms.
- d. The machine could be connected to the central computer of the plant for direct transmission of production data and for automatic statistic management of the roll park (Hardware: Ethernet, Software: TCP/IP).  
**The roll data are stored in a databases and can be managed trough ODBC queries connecting the Roll Shop network to the grinder PC.**  
Necessary connection cables for computer communication with Mill computer are at Customer's care.

## 5. EQUIPMENT FOR ERECTION

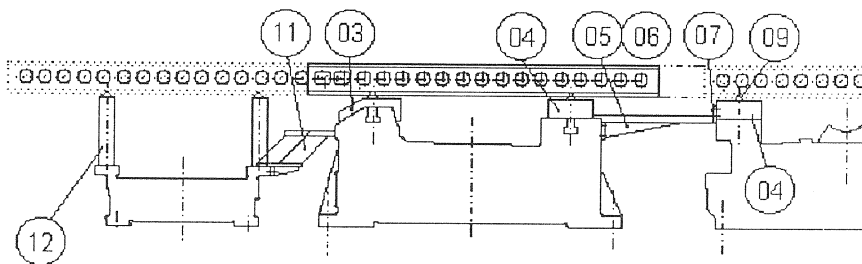
### 5.1. Wedges

One complete set of adjustable wedges for machine bed leveling, including anchor bolts and nuts



### 5.2. Special tools

- One complete set of service wrenches including bridges and sliding base for bed alignment
- Arbour and stand for static wheel balancing
- Levelling blocks
- Parallel pins
- Thickness
- Positioning brackets
- Reference rule
- Complete sets of tools for electronic parts



### 5.3. First filling of grease

The machine, as described in the quotation, is complete in all aspects, with the exception of the first filling oils which will be supplied at Customer care.

For start-up the machine the Buyer shall provide the first oil fillings as follows:

→ lubrication of wheel spindle:

800 kg of oil are required.  
Normally we use MOBIL OIL DTE 24.  
Yearly change.

→ lubrication of wheel carriage, sub-base and caliper ways:

800 kg of oil are required.  
Normally we use MOBIL VACTRA OIL 2.  
Yearly change.

Remark: tables showing the above oils and the corresponding ones produced by other manufacturers will be given after order signature.

→ coolant oil:

on the market there are several products suitable for cooling of part while grinding. Therefore we suggest that the customer submits the problem to your usual suppliers of lubricant oils. Anyhow some suggestion from our side will be give based on the experience made with our valuable Customers.

### 5.4. Commissioning spare parts

A set of commissioning spare parts is also included in the scope of supply of the Seller to be use during the commissioning period. Should the above parts not be used in that period they will remain to the Buyer for his own use.



6. ACCESSORIES

✓ 6.1. Special neckrests *W/R*

One set of two special hydrodynamic neckrests, two bearing shoe type, capable of supporting in principle work rolls with or without chocks mounted on.

The above neckrests also include:

- one (1) set of four (4) special bearing shoes for predetermined roll neck diameters
- low pressure auto-roll neck lube
- manually adjustable gibs
- fast bearing shoes' positioning system
- chock discharging device to support the roll chock weight during grinding

Please note that finishing work rolls chock will be turned 90° by the chock tilter on machine.

This item is subject to the final detailed drawings of chocks, rolls and work rolls with chocks.

Note

*The possible misalignment of the roll is automatically compensated by the CNC. Indeed the caliper is automatically measuring the out of alignment of the roll and calculating the compensation by means of the wheel micrometric infeed.*

*This feature allows better tolerances and represents a state of the art solution used by us since ten years ago.*

*Thanks to this feature it is no longer necessary to have the neckrest's upper part movable in cross direction via a servo motor, which is an old-fashioned way to compensate misalignment.*

6.2. Hydrostatic neckrests *BWR*

One set of two special hydrostatic neckrests, two bearing shoes type, including four special bearing shoes to support the back-up rolls without chocks mounted on. A suitable hydraulic unit shall be also provided. *2 type 4EA*

This item is subject to the final detailed drawings of rolls.

6.3. Soft landing for back up rolls

One set of two soft landing device for back-up rolls without chocks mounted on.

This item is subject to the final detailed drawings the back up rolls.

**6.4. Soft landing for work rolls**

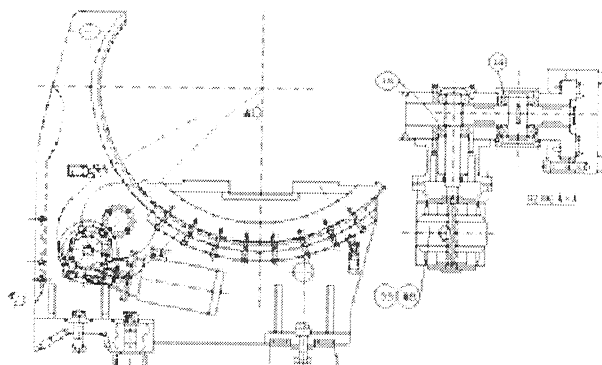
One set of two soft landing device for work rolls with chocks mounted on.

This item is subject to the final detailed drawings of chocks, rolls and work rolls with chocks.

**6.5. Chock tilter**

Two automatic chock tilter devices to be mounted on the front bed, at headstock side and footstock side, to index the work roll's chocks from horizontal to vertical position and from vertical to horizontal.

This item is subject to the final detailed drawings of chocks, rolls and work rolls with chocks.



**6.6. Footstock body motorization**

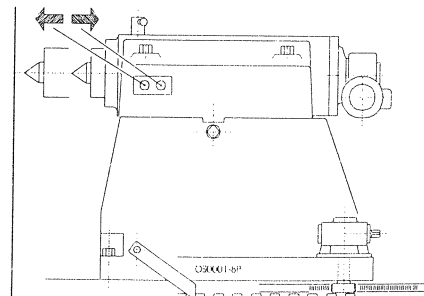
Footstock body motorization along the front bed including hydraulic powered automatic unclamping device.

**6.7. Footstock quill motorization**

Motorised quill stroke of 750mm.

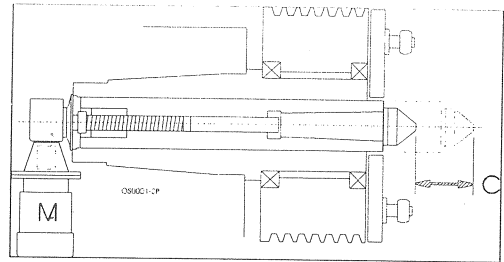
This function give the possibility to speed up the roll set up on the machine.

Furthermore it is highly recommended when grinding with chocks mounted on.



**6.8. Headstock quill motorization**

Motorised quill stroke of 150mm.  
This function give the possibility to speed up the roll set up on the machine.  
Furthermore it is highly recommended when grinding with chocks mounted on.

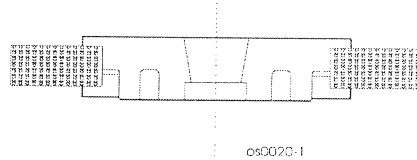


**6.9. Diamond holder**

One additional standard diamond holder, including diamond 2 kt (one diamond is included in the basic machine).

**6.10. Wheel flange**

One additional wheel flange with quick change device (one flange is already included in the basic machine).

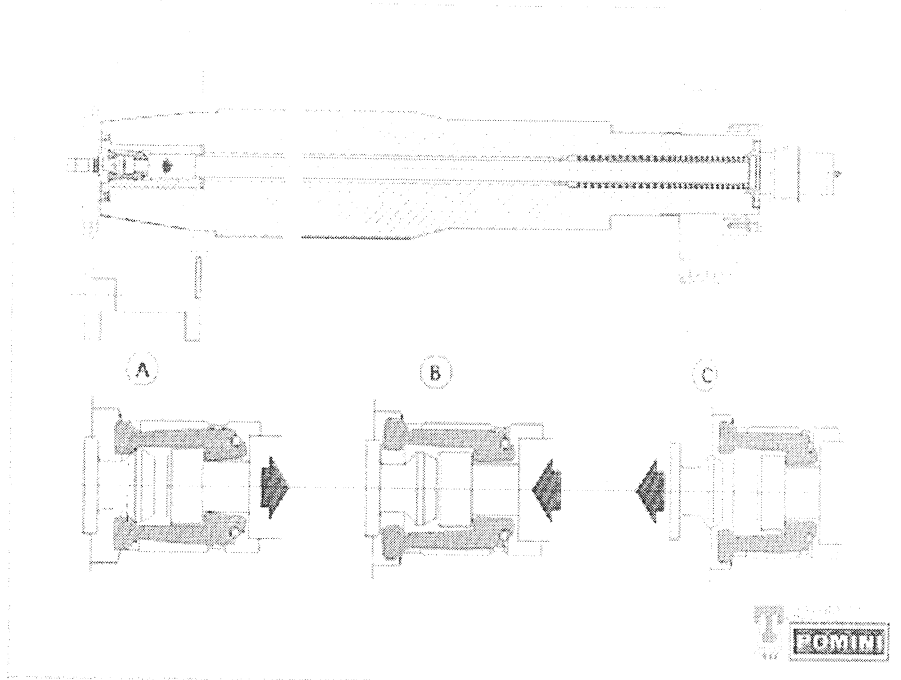


**6.11. Wheel dynamic balancing**

One electronic device (electromagnetic type) for wheel dynamic balancing, which can be employed without removing the wheel. Precision: 0.2  $\mu\text{m}$  (standard); 0.1  $\mu\text{m}$  (max).

**6.12. Wheel quick change device**

A wheel quick change device is included to fasten the wheel changing operation. Kindly note that, for safety reason, we are also including a motorised wheel cover provided with safety interlocks.

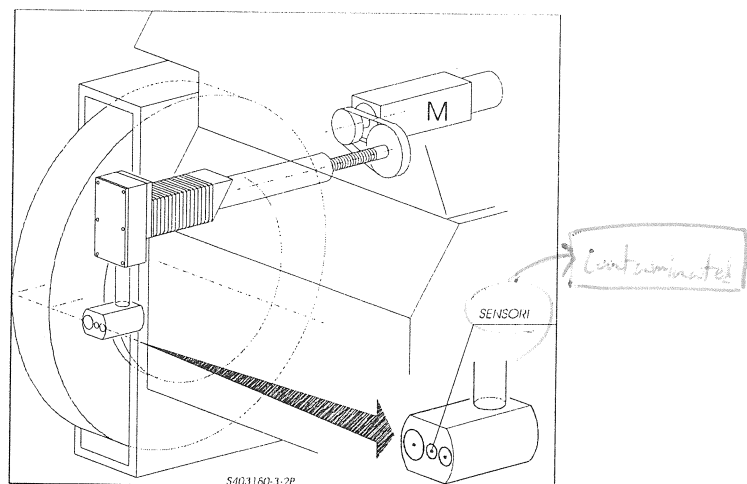


**6.13. Automatic wheel approach**

Device for automatic three-speed approach of wheel to the roll (wheel approach): fast - slow - micrometric (non contact type).

This device includes a high precision retractable probe that controls the approach speed of the wheel to the roll and reduces it from fast to slow and to micrometric motion (tilt infeed), until when the wheel automatically stops when touching the roll.

While grinding, the probe automatically aligns with the wheel and compensates the wheel wear by retraction.



#### 6.14. Independent caliper

There is no doubt that the quality of the produced steel depends very closely on the roll quality.

The need of certifying the geometrical condition of each roll after the grinding is a must.

The basic capital information that has to be checked is different from the work rolls, where diameter, shape and cylindricity are the important data and the back-up roll, where we need to know cylindricity, shape and, very important, the eccentricity of the barrel with respect to the morgan bearings.

Considering the industry requirements, we have designed an independently mounted measuring station holding both the above caliper and the crack and bruise detection system mounted in front of the machine.

For this feature - representing a major innovation in the roll grinding technology - we have obtained an international patent already released to us in Europe and in North America, with application field in Japan.

This innovative caliper is suitable for automatic roll alignment, printing roll shape on a A4 report form and printing roll diameter, roundness and eccentricity showing:

- a. CVC profile and delta on cartesian diagrams
- b. Positive crown profiles on cartesian diagrams
- c. Roundness, headstock side and centre of barrel, on cartesian diagrams
- d. Roundness, footstock side on cartesian diagram and roundness measured at headstock side, centre of barrel, footstock side, by means of upper caliper arm only (i.e. eccentricity), lower caliper arm only and both caliper arms shown on a polar diagram

*Very important:*

We point out that the above caliper is a two arm system having one encoder and two glass scales feed back for measuring at once:

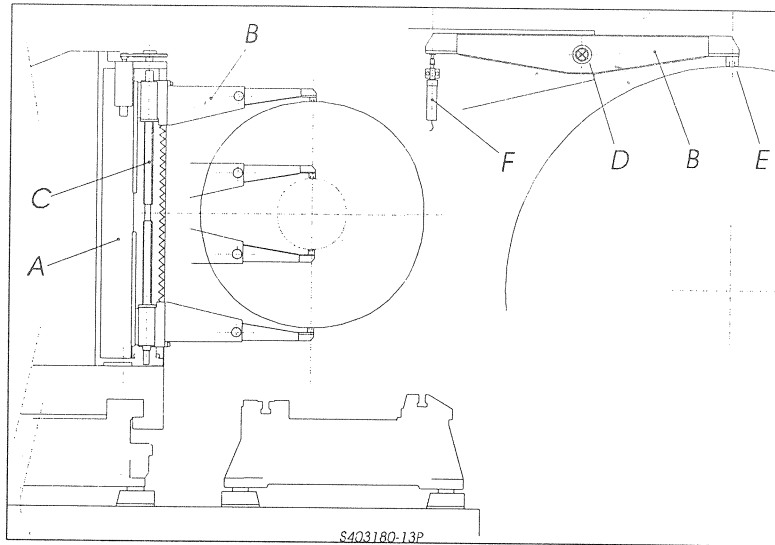
- profile or shape
- roundness
- eccentricity with respect to the neck support
- eccentricity with respect to the opposite of the neck support (important for back-up rolls)
- diameter.

# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 2 – Technical Specification

TP.39.03.05/0



- |                       |  |
|-----------------------|--|
| A – caliper column    | D – pivoting spring                              |
| B – caliper arm       | E – feeler roll                                  |
| C – double ball screw | F – glass scale (E, Q axis, resolution 0.0005mm) |

Maximum measurable diameter	2250 mm
Minimum measurable diameter	1000 mm $\Rightarrow$ 870mm

TECHINT/POMINI is the only manufacturer in the world offering a real 100% roll inspection and measurement during grinding operation.

Our independent caliper offers great advantages and time gain under two aspects of grinding operation.

- *Roll measurement:*

the caliper is no longer mounted on the grinding support; for this reason any and all complicated, unnecessary and heavy support structures can be avoided. The eventual vibrations originated by a defective grinding wheel or by wrong grinding parameters cannot affect the roll measurement any longer.

The caliper arms are located in horizontal sense, which enables a real excentricity measurement, whereas the contact points of the arms on the roll are better protected against water splashes and grinding as well as abrasive sludge.

- *Roll inspection:*

the caliper can carry the Eddy Current and the Ultrasound Detection system "Inspektor" (optional). This offers many great advantages: in fact, this is the only way to inspect 100% of the roll table during the grinding operation without prolonging grinding times. In case the inspection system is mounted on the grinding support, it is not possible to grind and detect contemporarily (especially during rough grinding), as the optimal speed of the support is totally different for the two operations.

Machinery & Equipment Division

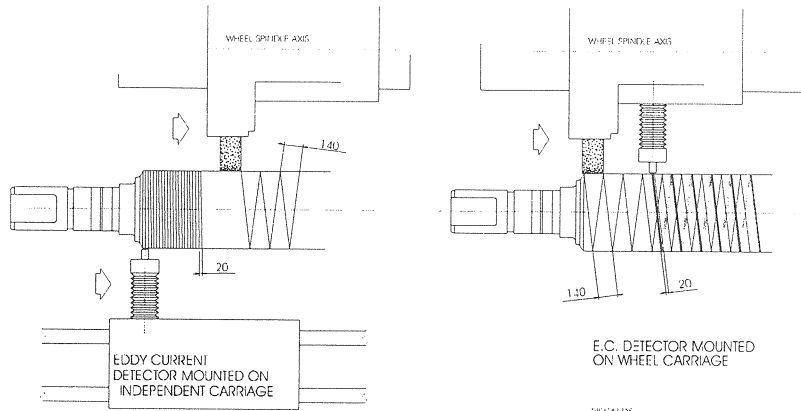
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Roll Grinders



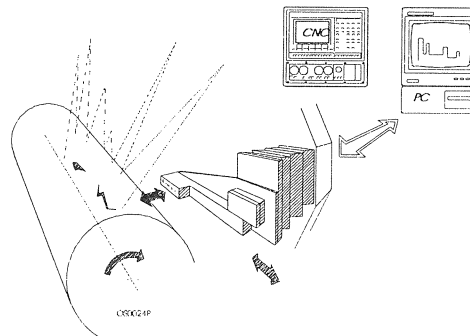


The above mentioned caliper is complete with all respects including also:

- lubrication circuit
- compressed air circuit and nuzzles
- electrical wiring, connectors, instruments and motors
- calibration frame

### 6.15. Inspektor

The requirements of detecting cracks and bruises on rolls and consequently removing them with the grinding operation has led us to the application of an Eddy Current scanning system, integrated to machine CNC and PC system, mounted on the above quoted TECHINT/POMINI worldwide patented independent caliper.



The Inspektor includes also the degauss device.

**Repeatability:** improved with signal/noise ratio up to 10 to 1.

**Resolution:** 0.01mm

Probe type	Coil diameter	Crack min length	Crack min depth	Scanning speed
Standard	5 mm	2.5 mm	0.1 mm	20 mm/rev

Advantages of the POMINI Inspektor cracks and bruises detection system:

- Unique resolution and repeatability: optical fibers are used to reduce the background noises (ratio signal/noises = 10/1)
- Self-diagnose capability of software: PC-CNC communication, all inputs, outputs and internal data exchanges are monitored second per second directly by the application and all the information is displayed in the LOG window, data exchange with the database is

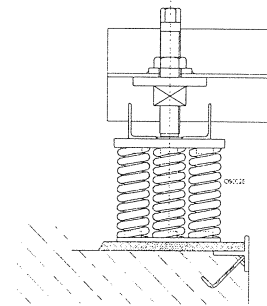
monitored as well.

- Extremely high archiving capacity: the barely infinite number of scans that can be saved on the database and the easy accessibility of all data give the possibility to have the complete history of the defects on each roll.
- User-friendly software: Windows based software allows multilingual display (including Chinese) and multi format defect representation (map of values, 2D histograms graphic, 3D graphic on plane; 3D graphic on roll).

### 6.16. Spring foundation

One set of insulator units for spring foundation.

It is important to underline that the correct and accurate positioning of these units is essential for machine accuracy and this activity will be therefore carried out under our direct supervision.

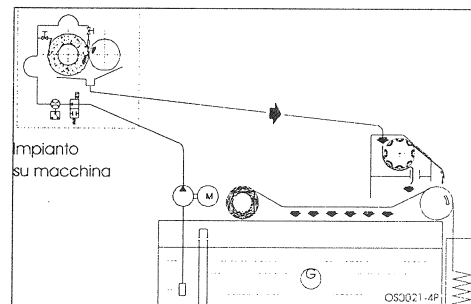


### 6.17. Coolant separation system

One double action (magnetic and paper) coolant separation system on ground level (or in foundation pit), complete with pumps to supply the machine and paper filter roll.

Flow rate	320 l/min
Tank capacity	12000 l
pump A.C. motor	3 kW
filter A.C. motor	0.12 kW

The settling tanks and the connection pipings from the take over points to the system will be built by the customer according to the drawings supplied by the vendor after the contract signature (for coolant tank a proper connection with pump for coolant waste will be designed).



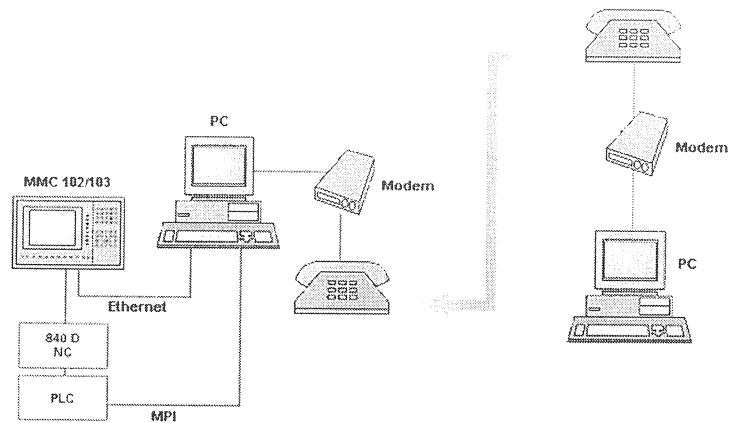
### 6.18. Jib crane

Basic data for one jib crane 1000kg capacity dedicated to the grinding wheel changing operation.

### 6.19. Remote Service

TECHINT/POMINI unique “Remote Service” package (not to be confused with the old fashioned teleservice) which can be used during both commissioning and warranty period.





#### 6.20. Communication to mill

A suitable software is developed for the data communication between roll grinder database and mill computer; a table available in the roll grinder database will be accessed by the mill computer to read the necessary data.

#### 6.21. Carriage pulpit

A carriage pulpit (without printer) will be installed on the machine carriage to be used alternatively to the remote pulpit located in the control room, but with the same functions.

#### 6.22. Programmer

One notebook is supplied with the function of a programmer, for the maintenance of the machine's CNC and PLC. The software HMI Advanced, Step 7 and PC Anywhere are installed on the notebook instead of on the machine computer. The relevant authorizations will be also provided.

#### 6.23. Grinding wheel 100mm

Two grinding wheels 100mm width suitable for the application.

#### 6.24. Grinding wheel 150mm

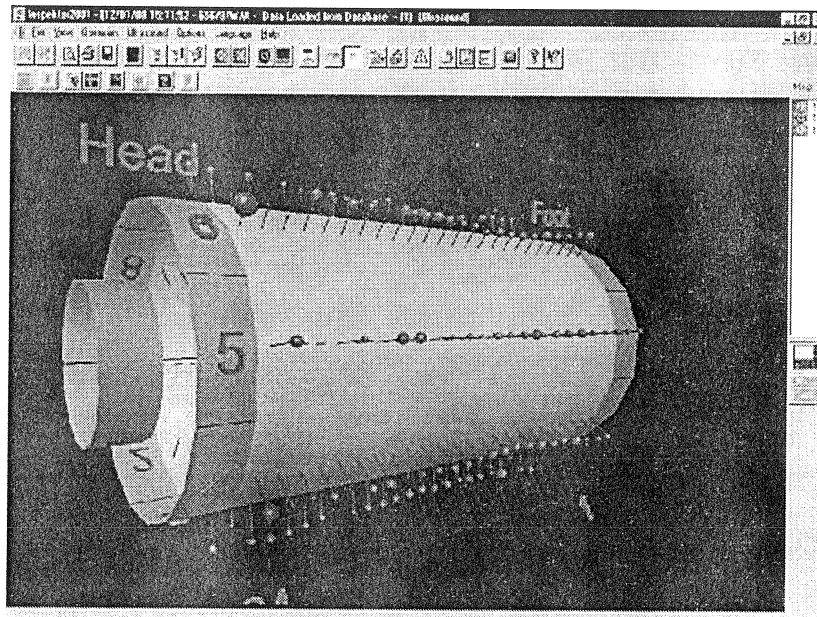
Four grinding wheels 150mm width suitable for the application.

**6.25. Light turning device**

One light turning device to be mounted at wheelhead side for light turning operation on the rolls.

**6.26. Automatic ultrasonic system**

Fully integrated with the INSPEKTOR system and the roll grinder automation.  
The automatic ultrasonic system can detect the subsurface defects until a depth of 180 mm.



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 3 – Division of Design and Scope of Supply

TP.39.03.05/0

## ANNEX 3

### DIVISION OF DESIGN AND SCOPE OF SUPPLY

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**POMINI**

*Roll Grinders*



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 3 – Division of Design and Scope of Supply

TP.39.03.05/0

## 1. SCOPE OF SUPPLY LIST

All the listed items refer to the relevant appendixes of the technical specification and are supplied by TECHINT/POMINI which guarantee the equipment is complete in all respects.

(B) = delivered by Buyer to Seller (S) = delivered by Seller to Buyer

Item Nr.	Description <b>HD 425-2-7L (2200x11000 mm)</b>	Design					Supervision		Rem
		Q.ty	BD	BE	DE	SUP	Erection	Com miss	
<b>1.</b>	<b>BASIC MACHINE</b>								
1.1	Headstock including also: - equalising face plate with driving dogs - work center with bumper - driving collar	1 set	S	S	S	S	S	S	
1.2	Front bed	1 set	S	S	S	S	S	S	
1.3	Footstock (tailstock) including also: - wheel dressing device and diamond holder with diamond - work center with bumper	1 set	S	S	S	S	S	S	
1.4	Back bed including also: - telescopic covers	1 set	S	S	S	S	S	S	
1.5	Thermosymmetrical carriage including also: - complete centralized hydraulic power unit (used also for caliper ways) - carriage illumination system	1 set	S	S	S	S	S	S	
1.6	Wheelhead including also: - electronic handwheel - subbase ways and operator's splash guards - sub-base ways wipers and fixed covers - power track - coolant system - eccentric retract system	1 set	S	S	S	S	S	S	
1.7	Hydrostatic spindle including also: - operator's panel with kWmeter - hydraulic unit for spindle with heat exchanger - one wheel flange - wheel guard with internal Teflon coating	1 set	S	S	S	S	S	S	
2	Hydraulic system (complete)	1 set	S	S	S	S	S	S	
3	Electrical equipment including also: - electrical cabinets and remote pulpit with air conditioning in central control room - AC motors for grinding wheel and headstock - CNC axis motors with encoders - AC motors for auxiliaries - converters - low voltage switches - sensors	1 set	S	S	S	S	S	S	
4	Automation system (including CNC Siemens Sinumerik 840D)	1 set	S	S	S	S	S	S	
5.	Equipment for erection								
5.1	Levelling wedges including:	1 set	S	S	S	S	S	S	

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Roll Grinders



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 3 – Division of Design and Scope of Supply

TP.39.03.05/0

Item Nr.	Description <b>HD 425-2-7L (2200x11000 mm)</b>	Design					Supervision		Rem
		Q.ty	BD	BE	DE	SUP	Erection	Com miss	
	- anchor bolts and nuts								
5.2	Special tools - one set of service wrenches - arbour and stand for static wheel balancing - levelling tools (incl. bridges and sliding base) - two set electronic tools	1 set	S	S	S	S	S	S	
5.3	First fill of grease First fill of oil	1 set 1 set	S S	S S	S S	S B	S S	S S	
5.4	Commissioning spare parts	1 set	S	S	S	S	S	S	
<b>6</b>	<b>ACCESSORIES (included)</b>								
6.1	One set of two special <u>hydrodynamic</u> neck rests for finishing in principle WR with (and without) chocks including also: - one (1) set of four (4) special bearing shoes for pre-determined roll neck diameters - low pressure auto-roll neck lube - fast bearing shoes positioning system - chock discharging device	1 set	S	S	S	S	S	S	
6.2	One set of two special <u>hydrostatic</u> neck rests for finishing in principle BUR without chocks including also: -one (1) set of four (4) special bearing shoes for pre-determined roll neck diameters	1 set	S	S	S	S	S	S	
6.3	Soft landing for back up rolls	1 set	S	S	S	S	S	S	
6.4	Soft landing for work rolls	1 set	S	S	S	S	S	S	
6.5	Two chock tilter devices	1 set	S	S	S	S	S	S	
6.6	Footstock body motorization	1 set	S	S	S	S	S	S	
6.7	Footstock quill motorization	1 set	S	S	S	S	S	S	
6.8	Headstock quill motorization	1 set	S	S	S	S	S	S	
6.9	Diamond holder	1 set	S	S	S	S	S	S	
6.10	Wheel flange	1 set	S	S	S	S	S	S	
6.11	Wheel dynamic balancing (electromagnetic)	1 set	S	S	S	S	S	S	
6.12	Wheel quick change device incl. mot. cover	1 set	S	S	S	S	S	S	
6.13	Automatic wheel approach	1 set	S	S	S	S	S	S	
6.14	Independent caliper	1 set	S	S	S	S	S	S	
6.15	Inspektor for Eddy Current inspection	1 set	S	S	S	S	S	S	
6.16	Spring foundation	1 set	S	S	S	S	S	S	
6.17	Coolant separation system (incl. paper roll)	1 set	S	S	S	S	S	S	
6.18	Jib crane	1 set	S	B	B	B	B	B	
6.19	Remote service	1 set	S	S	S	S	S	S	
6.20	Communication to mill	1 set	S	S	S	S	S	S	
6.21	Carriage pulpit	1 set	S	S	S	S	S	S	
6.22	Programmer	1 set	S	S	S	S	S	S	
6.23	Grinding wheel 100mm width	2 pcs	S	S	S	S	S	S	
6.24	Grinding wheel 150mm width	4 pcs	S	S	S	S	S	S	
6.25	Light turning device	1 set	S	S	S	S	S	S	
6.26	Automatic ultrasonic measuring device	1 set	S	S	S	S	S	S	

NOTE: The accessories included in the scope of supply shall be defined during next technical meeting.

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**FOMINI**

Roll Grinders



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 3 – Division of Design and Scope of Supply

TP.39.03.05/0

## 2. DIVISION LIST

*Take Over Point*

Item Nr.	Description	Design					Supervision		Rem
		Q	BD	BE	DE	SUP	Erection	Com miss	
	<b>HD 425-2-7L (2200x11000 mm)</b>								
	<b>ROLL GRINDER</b>								
	- Roll grinder	1 set	S	S	S	S	S	S	
	- Instruments	1 set	S	S	S	S	S	S	
	<b>Utilities and coolant piping</b> (coolant, potable water, air and cooling water)								
	- Coolant and swarf tanks	1 set	S	S	S	B	S	S	
	- Attached piping of Roll Grinder	1 set	S	S	S	S	S	S	
	- Pipes from T.O.P to the machine	1 set	S	S	S	S	S	S	
	- Pipes outside T.O.P.	1 set	S	B	B	B	B	B	
	<b>Electrical equipment</b>								
	- Operation & control panel (included in H/W, S/W)	1 set	S	S	S	S	S	S	
	- Attached cable between electrical cabinet roll grinder and main control pulpit	1 set	S	S	S	S	S	S	
	- Power cables to T.O.P	1 set	S	B	B	B	B	B	
	<b>Civil works and installation</b>								
	- Foundation civil execution, pre and post embedded parts, cable trays	1 set	S	S	S	B	B	B	
	- Reinforcement bars for foundation	1 set	S	S	S	B	B	B	
	- Floor steel plates to cover electrical channels and every part around the machine	1 set	S	S	S	B	B	B	
	- Fences and handrails around grinder area	1 set	S	S	S	B	B	B	
	<b>Others</b>								
	- Spare parts	1 set	S	S	S	S	-	-	

Note: T.O.P for electrical parts is located at the main switch of the electrical cabinets

Remarks:

(1) 50 tons over head crane availability with operator. The only foundation part supplied buy the Seller will be:

- Levelling wedges
- Anchor bolts
- Insulator units

Machinery & Equipment Division

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Roll Grinders



**ANNEX 4**  
**SPARE PARTS LIST**

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# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 4 – Spare Parts

TP.39.03.05/0

## 2. TWO YEAR SPARE PARTS

Item	LOCATION IN MACHINE	REFERENCE No.	DESCRIPTION and MANUFACTURER	Q'ty	DELIVERY
1	Caliper	---	Lateral bellow	1	4 months
2	Caliper	---	Central bellow	1	4 months
3	sub-base	00277905-370-1	MULTIPLE LIMIT SWITCH 5X8MM - Euchner	2	2 months
4	carriage	00277905-367-1	MULTIPLE LIMIT SWITCH 4X8MM – Euchner	3	2 months
5	caliper	00277905-364-7	MULTIPLE LIMIT SWITCH 3X8MM – Euchner	3	2 months
6	wheelhead	00277905-361-2	MULTIPLE LIMIT SWITCH 2X8MM – Euchner	3	2 months
7	caliper	00277905-290-0	LIMIT SWITCH N01 8MM – Euchner	3	2 months
8	caliper	00277905-292-6	BALL LIMIT SWITCH N01 8MM – Euchner	4	2 months
9	footstock	00277905-291-8	WHEEL LIMIT SWITCH N01 8MM – Euchner	3	2 months
10	caliper	277905-816-9	LIMIT SWITCH – Honeywell	3	3 months
11	push button strip	00271002-152-2	BLACK PUSHBUTTON – Telemecanique	4	2 months
12	push button strip	00271002-151-4	MUSHROOM PUSHBUTT – Telemecanique	2	2 months
13	electrical board	276485-109-1	CONTACTOR 3TF33 OO-OAG2	1	2 months
14	electrical board	276485-253-5	AUX CONTACTOR 3TH30 31-OBB4	1	2 months
15	electrical board	276485-701-4	AUX CONTACT FOR 3TX4 010-2A	1	2 months
16	miscellanea	277904-101-0	FCP XS1-M30PB370 – Telemecanique	1	1 month
17	miscellanea	277904-166-5	FC11 IISIC.EL.NP1- 628AS – Euchner	1	2 months
18	electrical board	271044-099-1	CN-840D MACHINE CONTR. PANEL – Siemens	1	2 months
19	A, A1, C, U axis	271039-161-3	MOTOR 1FT6-2,15NM-3000 (-3AD5) - Siemens	1	4 months
20	Hydraulic unit	1LA51066AA91!!	MOTOR 100L6 480V – Siemens	1	3 months
21	Miscellanea	00268120-117-6	PRESSURE GAUGE	2	2 months
22	Caliper	425-251-701-01A	TWIN NON-RETURN VALVE	2	2 months
23	Caliper	425-251-702-01A	TWIN FLOW CONTROL VALVE	2	2 months
24	Caliper	425-251-703-01A	SOLENOID VALVE	2	2 months
25	Caliper	425-713-001-01A	SOLENOID VALVE	2	2 months
26	ways ctr. Unit	---	VANE PUMP	1	4 months
27	Miscellanea	00241441-234-6	O-RING 266,29X3,53 PRK 2-275	6	1 month
28	Miscellanea	00241441-227-3	O-RING 183,74X3,53 PRK 2-263	4	1 month
29	Miscellanea	00241441-232-2	O-RING 240,89X3,53 PRK 2-272	4	1 month
30	Miscellanea	00241441-236-2	O-RING 278,99X3,53 PRK 2-276	4	1 month
31	Miscellanea	00241421-064-6	O-RING 3043 10,78 X 2,62	8	1 month
32	Miscellanea	00241421-214-2	O-RING 4487 123,40 X 3,53	2	2 months
33	Miscellanea	00241421-087-5	O-RING 3137 34,6 X 2,62	2	1 month
34	Miscellanea	00241421-192-8	O-RING 171 68,26 X 3,53	2	1 month
35	Miscellanea	00241421-206-1	O-RING 4387 98,02 X 3,53	8	1 month
36	Miscellanea	00241421-064-6	O-RING 3043 10,78 X 2,62	24	1 month
37	Miscellanea	00241421-011-5	O-RING 108 8,73 X 1,78	8	1 month
38	Miscellanea	00241421-074-3	O-RING 3075 18,72 X 2,62	10	1 month
39	Miscellanea	00241421-069-7	O-RING 119 15,08 X 2,62	10	1 month

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Roll Grinders





# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 4 – Spare Parts

TP.39.03.05/0

Item	LOCATION IN MACHINE	REFERENCE No.	DESCRIPTION and MANUFACTURER	Q'ty	DELIVERY
40	Hydr. circuits	268414-469-6	Pressure switch square D ACW-6-1 – Rexroth	4	4 months
41	Miscellanea	277905-613-1	Proximity limit switch NC M12x1 + PIN – Siemens	1	1 month
42	Miscellanea	277905-605-0	Proximity limit switch NA M18x1 + PIN – Siemens	1	2 months
43	Miscellanea	277905-604-2	Prox.lim.sw. NA M12x1 with PIN – Siemens	8	1 month
44	Miscellanea	277905-331-0	Wheel lever limit switch 8mm – Euchner	2	2 months
45	X, Y axis	277905-364-7	Limit switch	2	2 months
46	Caliper arm	277905-612-3	Proximity limit switch NC M12 – Siemens	2	1 month
47	Wheelhead	277905-744-8	Proximity M5x1x25 NA – Pepperl+Fuchs	1	2 months

**Note 1:**

All above spare parts reference numbers and descriptions could change according to the actual scope of supply at the time of the order and update with notice to the Customer at the time of their delivery

**Note 2:**

The delivery column is only for reference and shall be applied only for purchased separate from the main equipment.

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**POMINI**

Roll Grinders



**ANNEX 5**

**TECHNICAL DOCUMENTS AND DELIVERY  
OF BUYER AND SELLER**

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1.2 ELECTRICAL SECTION.....	3
1.3 COMMERCIAL SECTION .....	6
1.4 AUTOMATION SECTION .....	6
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# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 5 – Technical Documentation

TP.39.03.05/0

## 1. ROLL GRINDER MANUAL LIST

### 1.1 MECHANICAL SECTION

#### VOLUME 1

- (1) Preliminary (typical) → <sup>2</sup>1 month after coming into force of the contract
- (2) Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine

Section 1	-	Machine Specifications
Section 2	-	Description of Assemblies and Drives
Section 3	-	Grinding Techniques
Section 4	-	Maintenance (including hydraulic and lubrication system)

#### VOLUME 2

- (1) Preliminary (typical) → 1 month after coming into force of the contract
- (2) Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works (plus a **transparent** copy)  
→ 1 copy to be shipped with the machine

Section 5	-	Documentation (General assembly drawings and assembly drawings of every machine's main parts)
	-	Wearable parts drawings (manufacturing drawings on Autocad format)

#### VOLUME 3

- (1) Preliminary (typical) → 1 month after coming into force of the contract
- (2) Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine

Section 6	-	Erection Instructions
	-	Transport
	-	Lifting
	-	Erection
	-	Certificates

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**POMINI**

Roll Grinders



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 5 – Technical Documentation

TP.39.03.05/0

## 1.2 ELECTRICAL SECTION

### ELECTRICAL DIAGRAMS

#### VOLUME 4

- (1) *Preliminary (typical) → 1 month after coming into force of the contract*
- (2) *Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine*

Section 0	-	Index
	-	Specifications
	-	Instructions for Readout
Section 1	-	Single wire diagram
Section 2	-	Circuit Diagram

#### VOLUME 5

- (1) *Preliminary (typical) → 1 month after coming into force of the contract*
- (2) *Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine*

Section 3	-	Cabinet and Console Layout and Materials
	-	Carriage Wiring Diagram and Materials
	-	Wheelhead Wiring Diagram and Materials
	-	Headstock Wiring Diagram and Materials
	-	Footstock Wiring Diagram and Materials
	-	Neckrest Wiring Diagram and Materials
	-	Caliper Wiring Diagram and Materials
	-	Hydraulic Station Wiring Diag. and Materials
	-	Grounding
Section 5	-	Cable List
	-	Cable routing
Section 6	-	Plates' Drawings

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**POMINI**

Roll Grinders



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 5 – Technical Documentation

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## ELECTRICAL DEVICE SPECIFICATIONS

### VOLUME 6

- (1) Preliminary (typical) → 1 month after coming into force of the contract
- (2) Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine

Section 1	-	Wheel AC Motor
Section 2	-	Headstock AC Motor
Section 3	-	Axis Motors
Section 4	-	Three-phase AC Motors
Section 5	-	Protective Devices: - Thermistor Motor Protection
Section 6	-	Optical Transducers: - Digital Length Gauge - Interpolation and Digitising Electronics
Section 7	-	Instruments - Digital Thermometers
Section 8	-	Command Devices: - Analog Proximity Switches - Proximity Switches - Limit Switches - Precision Limit Switches - Precision Multiple Limit Switches
Section 9	-	Air conditioners

### VOLUME 7

- (1) Preliminary (typical) → 1 month coming into force of the contract
- (2) Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine

- Roll Inspection System - User Manual
- Roll Inspection System - Technical Manual

Machinery & Equipment Division

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**POMINI**

Roll Grinders



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 5 – Technical Documentation

TP.39.03.05/0

## CNC AND DRIVE MANUALS



(1) *Final: → CD-ROM must be available on site 1 month before the machine arrival at customer's works*

DESCRIPTION	LANGUAGE
<b>Simodrive:</b>	
Description	en
Instruction manual	en
Wiring manual	en (*)
(*) as soon as this language, for this manual, is available from Siemens	
<b>Sinumerik 840D Planning guide:</b>	
Interface description part:1	en
Interface description part:2	en
Universal interface	en
PLC CPU	
Function macros	en
Part program ISO Language	en
<b>Sinumerik 840D Installation guide:</b>	
Software lists	en
Software instr.	en
<b>Sinumerik 840D Programming guide:</b>	
Software	en
Cycles, ASM	en
<b>Sinumerik 840D Operator's guide:</b>	
Software	en
Instruction manual	en

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**POMINI**

Roll Grinders



# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

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## 1.3 COMMERCIAL SECTION

### VOLUME 8

- (1) *Preliminary (typical) → 1 month coming into force of the contract*
- (2) *Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine*

Commercial Catalogue Cut-Sheets  
Brochures of grinding wheel suppliers will be also included

## 1.4 AUTOMATION SECTION

### INSTRUCTION MANUAL

### VOLUME 9

- (1) *Preliminary (typical) → 1 month after coming into force of the contract*
- (2) *Final: → (6) copies must be available on site 1 month before the machine arrival at customer's works  
→ 1 copy to be shipped with the machine*
- (3) *"As built": → (1) copies on paper, A4 format, 1 month after machine commissioning*

- Operator's Manual

### VOLUME 10

- (1) *Final: → CD-ROM must be available on site 1 month before the machine arrival at customer's works*

- Machine PLC Program  
- List of Operands  
- Cross Reference List

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**POMINI**

Roll Grinders



## 2. FOUNDATION DRAWINGS

The following is the list of drawings, with delivery schedule of Buyer and Seller, concerning the foundation pits and trenches in roll shop area for the new Roll Grinders supplied by the Seller.

The Buyer shall furnish the Seller with all layout drawings relative to the roll shop area where the roll grinder will be installed, including also:

- piling location, if any, or soil conditions
- existing equipment outline (location and dimensions)
- environmental conditions

all above drawings shall be in electronic format.

(B) = delivered by Buyer to Seller (S) = delivered by Seller to Buyer

Item	Description	Schedule	Supply
1.	Roll shop area drawings and soil and geological report from Buyer	2 weeks after contract coming into force	B
2.	Layout drawings “for approval” from Seller	1 month after Seller’s receipt of roll shop area drawings by Buyer	S
3.	Layout drawings approval from Buyer	2 weeks after Buyer’s receipt of proposed layout drawings by Seller	B
4.	Foundation drawings “for approval” from Seller	2 months after Seller’s receipt of Buyer’s layout approval	S
5.	Foundation drawings approval from Buyer	2 weeks from Buyer’s receipt of foundation drawings by Seller	B

Kindly note that the foundation drawings (item 4 of the above table) include the following:

- layout
- cross sections
- detail drawings
- concentrated and distributed loads
- floor steel plates
- static and dynamic loads
- civil engineering drawings (framework/reinforcement/pre-embedded parts and concrete type and parameters)
- T.O.P. including heights and diameters of pipes, earthing
- drawings of the coolant and swarf tanks
- drawings of the driving collars
- drawings of the bearing shoes
- requirements for water/oil proof condition of the foundation parts

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Roll Grinders





# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 5 – Technical Documentation

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- electrical cabinets heat exchanger requirements

*All drawings listed above shall be delivered in*

*- (6) paper copies*

*- (1) CD ROM*

### 3. ROLL DRAWINGS

The Buyer shall supply to the Seller all detail final drawings of each roll within one week after coming into force of the contract; all drawings shall be in electronic format.

### 4. PAINTINGS

Within two months after coming into force of the contract the Buyer shall select and communicate to the Seller the machine's painting colours based on the standard paintings given by the Seller.

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**POMINI**

Roll Grinders



# TECHINT

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## General Note

It is understood that POMINI machine (roll grinder and auxiliary equipment) design drawings will be dimensioned using the Metric system of dimensions.

It is understood that the POMINI machine (roll grinder and auxiliary equipment) foundation drawings will be dimensioned using the Metric system of dimensions.

It is understood that all documents prepared for this roll grinder project will be in English language.

If any other language is utilised on any document, a complete and accurate English translation will be provided by POMINI.

It is understood that all Caution, Warning and Instruction labels, plates, signs, etc., affixed to the roll grinder and/or to its auxiliary mechanical and electrical equipment will be in English language.

If any other language is utilised on a label, plate, sign, etc. a complete and accurate English translation will also be provided on it.

It is understood that mechanical and electrical parts will be purchased and manufactured in Europe and according to European standards.

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**POMINI**

Roll Grinders



ANNEX 6  
STANDARDS

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1. STANDARDS AND NORMS.....	2
1. STANDARDS FOR ROLL MEASURING.....	4



## 1. STANDARDS AND NORMS

Generally the codes and standards applied by the Seller for the design, engineering, material selection, equipment manufacturing, inspections and testing refer to:

- ISO standards.
- DIN or equivalent European Standards (EN Standards).
- DIN Standards for piping.
- IEC for electrical equipment.
- ASME for welding.

It is understood that POMINI machine (roll grinder and auxiliary equipment) design drawings will be dimensioned using the Metric system of dimensions.

It is understood that the POMINI machine (roll grinder and auxiliary equipment) foundation drawings will be dimensioned using the Metric system of dimensions.

It is understood that all documents prepared for this roll grinder project will be in English language.

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If any other language is utilised on a label, plate, sign, etc. a complete and accurate English translation will also be provided on it.

It is understood that mechanical and electrical parts will be purchased and manufactured in Europe and according to European standards.

### Mechanical Standards

<b>UNI</b>	Italian National Standardisation
<b>ISO</b>	International Standard Organisation
<b>FEPA</b>	European Federation of Wheel Manufacturers Safety Code (AFNOR E 62-114 equivalent)

### Electrical Standards

The machine electrical system, including the main board, the control console and the relevant documentation, is made in accordance with CEI/IEC standards for the machines to be supplied to the Italian, European or Asiatic markets and ANSI/NEMA/CSA for the machines to be supplied to the North American market, in particular:

CEI 17-13/1 EN 60439-1/IEC 439-1 NEMA-ICS2/CSA 22.2-5	for the in-shop manufactured equipment for voltages not higher than 1000 V
CEI 44.5 IEC 204-1 JIC ECP-1/JIC EMP-1/NFPA 79 CSA C22.2-73/105	for the industrial machine equipment
IEC 617 (steps 1 through 13) IEC 750 NEMA ICS-1 part. 101	for graphic symbols, diagram realization, colouring of driving and signalling elements and for component itemization.

### Standards paintings

The machine is normally painted with the following colors:

Machine parts:	BLUE (RAL 5015)
Caliper:	SAFETY YELLOW (RAL 1005)
Electrical cabinets and floor pulpit:	GREY (RAL 7032)

For machine parts other colors can be selected at the kick-off meeting.

### Note:

It is understood that ISO, DIN, UNI, IEC, ASME norms are protected under the relevant international copyright laws. It is therefore impossible for the Seller to provide the Buyer with any of the above-mentioned norms, either in original or copy.

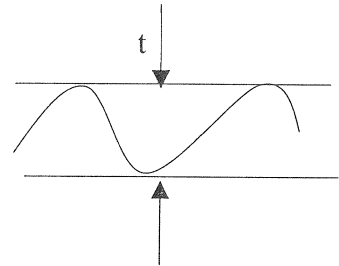
## 1. STANDARDS FOR ROLL MEASURING

The guaranteed machine's tolerances are based on the TOLERANCES STANDARDS in accordance to DIN/ISO regulations, as described as follows

### STRAIGHTNESS (or CYLINDRICITY)

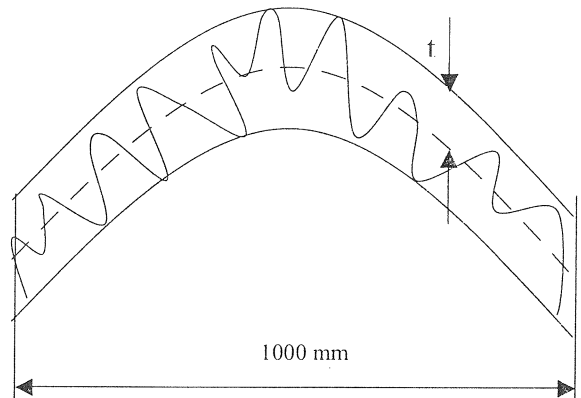
The tolerance zone when projected in a plan is limited by two parallel straight lines a distance  $t$  apart.

Any portion of length 1000 mm of any generator of the rolls' cylindrical surface shall be contained between two parallel straight lines  $t$  apart in a plane containing the roll's axis.



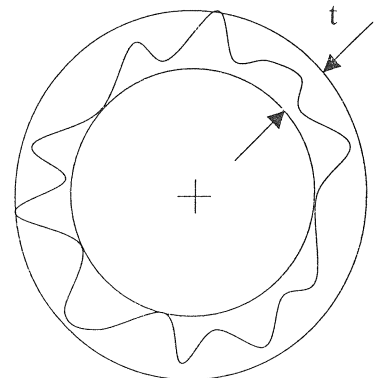
### CAMBERING (or CROWNING)

The tolerance zone when projected in a plan is limited by two lines having a distance  $t$  apart from the theoretical selected crown, considering the length of 1m of roll table.



### OVALITY (or ROUNDNESS)

The tolerance zone is limited within any plane of measurement perpendicular to the axis by two concentric circles a distance  $t$  apart, the center of which coincides with the datum axis.



ANNEX 7  
SERVICE

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1.2 SUPERVISION TO MACHINE COMMISSIONING .....	2
1.3 TRAINING .....	2
1.3.1 Training at "TECHINT/POMINI" site ( <i>free of charge</i> ).....	2
1.3.2 Training at Buyer's site.....	3



**1. SERVICES**

**1.1 Supervision to machine erection**

Carried out by our personnel, for a total of 10 man weeks.

During this period, at least 2-3 Customer's people, plus one interpreter if needed will help our personnel.

Travelling, lodging and living expenses are at TECHINT/POMINI charge and care.

**1.2 Supervision to machine commissioning**

Carried out by our personnel, for a total of 4 man weeks.

Travelling, lodging and living expenses are at TECHINT/POMINI charge and care.

**1.3 Training**

**1.3.1 Training at “TECHINT/POMINI” site (free of charge)**

The basic machine price includes the training for Buyer's technicians (including operator, mechanical, electrical/electrical and interpreter) in our plant, for a period of 1 week.

In detail, the training will be:

*Operator and Mechanical:*

- for maintenance
- for machine operation.

*Electrical/Electrical:*

- for CNC
- for general application.

We suggest that the customer that his electrical/electrical dedicated technicians have to be familiar with Siemens electrical/electrical equipment, which will consists of:

- CNC mod. 840 D
- D.C. motors and drives (digital type) for headstock and wheelhead
- A.C. brushless motors and variable frequency drives (digital type) for all machine axes

Furthermore, they have to know:

- Step 7 programming language



- CNC programming language

All training and relative material will be in English.

The above training is **free of charge** and includes airport pick-up, working day transportation between accommodation and site, working lunch.

Travelling from Buyer's Country to Seller Country, lodging and living expenses are at Buyer's charge and care.

### 1.3.2 Training at Buyer's site

#### *Mechanical Training:*

It is sufficient that the mechanical maintenance people follow the erection and commissioning of the machine in Buyer's shop.

#### *Operator's and Electrical/Electronic Training:*

This training will be carried out by our personnel, for a total of 2 man week and will be done after the machine commissioning.

Travelling, lodging and living expenses are at TECHINT/POMINI charge and care.



**ANNEX 8**

**GUARANTEE FIGURES  
AND ACCEPTANCE TEST**

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<b>2. TESTS PROCEDURE AND STANDARDS .....</b>	<b>6</b>
2.1. TESTS AT TECHINT/POMINI PLANT .....	6
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<b>3. MACHINE WARRANTEE .....</b>	<b>8</b>

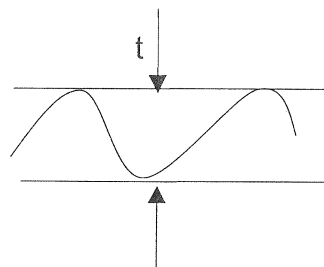
## 1. GUARANTEED MACHINE'S TOLERANCES

The guaranteed machine's tolerances are based on the TOLERANCES STANDARDS in accordance to DIN/ISO regulations, as described as follows

### STRAIGHTNESS (or CYLINDRICITY)

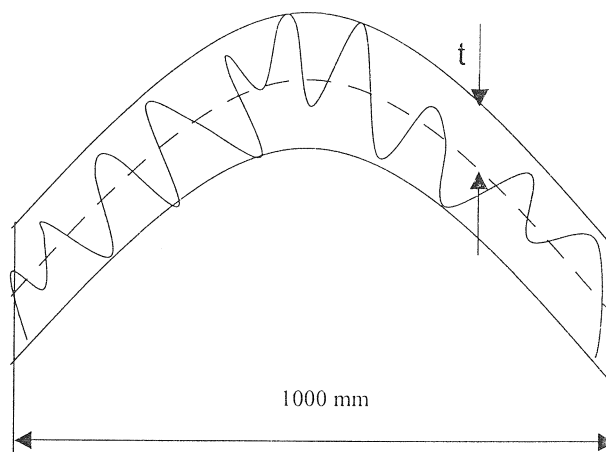
The tolerance zone when projected in a plan is limited by two parallel straight lines a distance  $t$  apart.

Any portion of length 1000 mm of any generator of the rolls' cylindrical surface shall be contained between two parallel straight lines  $t$  apart in a plane containing the roll's axis.



### CAMBERING (or CROWNING)

The tolerance zone when projected in a plan is limited by two lines having a distance  $t$  apart from the theoretical selected crown, considering the length of 1m of roll table.



# TECHINT

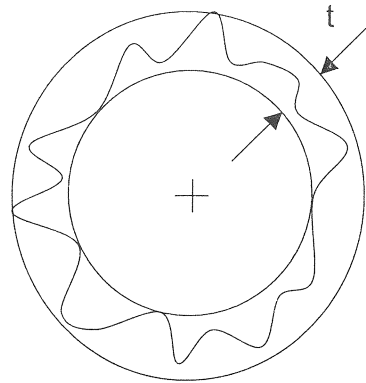
COMPAGNIA TECNICA INTERNAZIONALE

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## OVALITY (or ROUNDNESS)

The tolerance zone is limited within any plane of measurement perpendicular to the axis by two concentric circles a distance  $t$  apart, the center of which coincides with the datum axis.



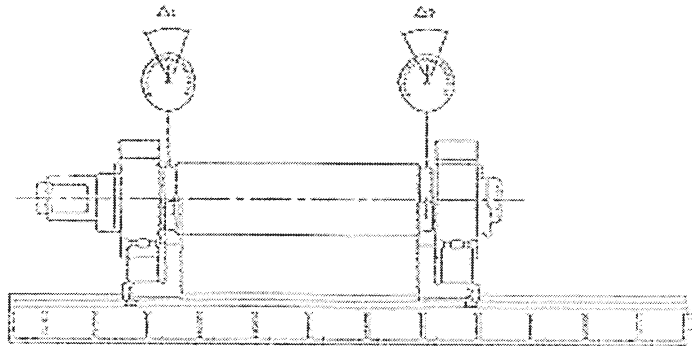
**MACHINE'S ACCURACY (\*)**

straightness	0.001-0.002	[mm/m]
roundness	0.001-0.002	[mm]
excentricity	0.002	[mm]
profile for crown height up to 0.1mm ✓	±0.002	[mm/m]

Surface finishing without chatter marks and no feed marks after finishing grinding stage (eyes check).

**Note:**

the above tolerances are added to the errors of resting and supporting journals / bearings, as follows:



As an example, for ovality (roundness), also applicable to eccentricity etc, if we read:

$\Delta_1$ : from  $[-1\mu\text{m}]$  to  $[+1\mu\text{m}]$  that means  $[2\mu\text{m}]$  in absolute value

$\Delta_2$ : from  $[0\mu\text{m}]$  to  $[-1\mu\text{m}]$  that means  $[1\mu\text{m}]$  in absolute value

the *maximum necks' absolute error* will be  $\approx 3\mu\text{m}$

and therefore the *total guaranteed ovality* will be:

(*machine's guaranteed ovality* + *maximum necks' absolute error*), i.e.  $(2\mu\text{m} + 3\mu\text{m}) = 5\mu\text{m}$

*Conditions for guaranteed performances.*

- Machine accuracy shall be measured on a roll without chocks and supported on the necks in the machine steady rests;
- Machine accuracy shall be tested on a test roll with cylindrical barrel shape;
- Machine accuracy shall be tested without grinding time pressure.
- Above tolerances allow environment temperature changes up to 2 °C per hour and up to 9°C per 12 hours;
- Coolant temperature must be constant and homogeneous, with maximum deviation of  $\pm 5^{\circ}\text{C}$  with respect to environmental temperature;
- The difference of temperature of roll necks must be smaller than  $(\pm 2^{\circ}\text{C})$  and the necks must have constant and homogeneous temperature;
- Barrel temperature must be homogeneous and constant, with maximum deviation of  $\pm 2^{\circ}\text{C}$  with respect to environmental temperature;
- During acceptance the environmental indoor temperature shall be between  $+15^{\circ}\text{C}$  and  $+30^{\circ}\text{C}$ . 15 ~ 30°C
- During normal production operation the environmental indoor temperature shall be between  $+5^{\circ}\text{C}$  and  $+40^{\circ}\text{C}$ .
- Assembly, start-up and commissioning are carried out under POMINI supervision and following instructions and information of POMINI personnel;
- a proper foundation for the machine is provided according to information and specification of POMINI;
- the foundation has been built following good construction practice, especially allowing the concrete to dry for at least one month and carrying out the embedding of the anchors and tie rods with non-shrinking, fast drying grouting material;
- if assembly of the machine does not start immediately after the arrival on final assembly site, the machine must be stored in a warehouse with internal temperature between  $+5^{\circ}\text{C}$  and  $+40^{\circ}\text{C}$ , free from dust and dry;
- assembly and installation site shall be dry, dust-free and clean, with environmental temperature between  $+5^{\circ}\text{C}$  and  $+40^{\circ}\text{C}$ . The machine is meant for indoor use only.
- ✓ During assembly the temperature on site shall not change more than  $\pm 3^{\circ}\text{C}$  per hour and  $\pm 10^{\circ}\text{C}$  per day.
- The machine shall not be exposed to direct air from outside the Roll Shop, direct sunlight and heating radiation sources.

## 2. TESTS PROCEDURE AND STANDARDS

### 2.1. Tests at TECHINT/POMINI plant

#### Geometrical tests

This test shall be performed during machine assembling, according to the “TECHINT/POMINI testing certificate”.

The testing reports will be delivered to the Customer.

#### Functional tests

The functional tests are meant to verify that the machine has been correctly assembled and that all connections to electrical, compressed air and water utilities have been properly executed.

All the functions shall be according to the descriptions in Appendix 1.

Machine functions shall be tested, at no load, before the Grinding tests.

No.	Machine functions
	<b>Functions included in Basic Machine</b>
1	Short stroking ✓
2	Double half pass
3	Wheel speed control
4	Tilt retract system
5	Roll misalignment compensation
6	Roll taper compensation
7	Mate rolls function
8	Chamfer grinding ✓
9	Profile generator
10	Autodiagnostic system
11	Next roll parameters
12	Actual roll parameters
13	Profile parameters
14	Grinding parameters
15	Geometrical roll parameters
16	Cycle display
17	Spindle speed sinusoidal variation
18	Wheel load control infeed power hysteresis
19	Wheel load control retract power hysteresis
20	Wheel speed self dress time
21	Scheduled maintenance clock
22	Dressing parameters
23	Roll alignment function
24	Final report function

No.	Machine functions
25	Program selection function
	<b>Functions included in Fully Automatic Machine</b>
26	Automatic motions of centers in cycle
27	Automatic wheel approach in cycle
28	Automatic roll alignment in cycle
29	Automatic taper compensation in cycle
30	Automatic roll inspection for defects in cycle
31	Automatic roll measurement in cycle
32	Automatic wheel dressing in cycle

### Grinding tests

The grinding tests could be done at TECHINT/POMINI plant in presence of the Customer.

For this test TECHINT/POMINI could either use a suitable roll available in the shop, that fits beds, neckrests and bearing shoes included in the proposed machine, or alternatively a roll supplied by the Customer.

Considering that the roll grinders mounted in the TECHINT/POMINI shop are not properly anchored to the floor, the test will be held with low power and no grinding time check.

The testing reports shall be delivered to the Customer.

### 2.2. Tests at Customer Site

#### ✓ Geometrical tests

This test shall be performed during machine assembling (only for components subject to re-assembling at site) according to the “TECHINT/POMINI testing certificate” (see attached samples).

The testing reports shall be delivered to the Customer.

#### ✓ Performance tests ⇒ No load Test

Machine functions shall be tested, before the Acceptance tests.

The Seller shall guarantee that the machine has no defects and can reach all the described functions. Should the Seller fail to reach the above functions than the Seller has the right to repair or change the relevant part.



Acceptance Tests

+ 가동률 + 선버의 특장. ✓

The acceptance tests shall take place at Customer's works, immediately after the completion of the installation (erection and commissioning).

This test will be carried out grinding 4 rolls in total.

Work Roll  
BDR

3. MACHINE WARRANTY

Considered that the plant will be put in operation according to our prescriptions and will be operated by competent personnel sufficiently skilled and trained, the seller under his standard conditions undertakes to replace or repair those parts that have crackings or operation anomalies due to machining and/or engineering defects.

✓ This guarantee excludes:

- parts subject to wear according to the standards in use;
- parts realized according to the client indications without our technical approval;
- parts tampered for negligence or for the intervention of unskilled personnel.

The period of guarantee has a term of:

- 12 months after the date of putting into production with a max. of 18 months after the date of the F.O.B. delivery if delay is not imputable to TECHINT/POMINI, whichever is earlier.

✓ The guarantee immediately declines if:

- the damage occurred owing to shocks ✓
- the damage occurred owing to tampering
- the damage occurred owing to an incorrect use by the final client

**ANNEX 9**

**TIME SCHEDULE**

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**1. PROJECT SCHEDULE**

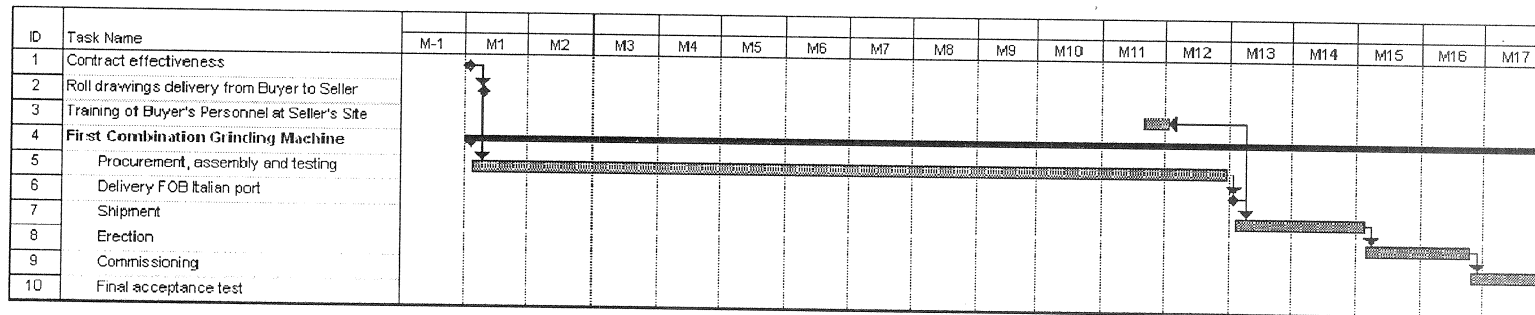


# TECHINT

COMPAGNIA TECNICA INTERNAZIONALE

ANNEX 10 – Time Schedule

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NOTE: The above Preliminary Time Schedule is only for reference and may change according to the Seller's backlog of orders at the time of order placement.

Machinery & Equipment Division



Roll Grinders





Roll Grinder 사양 비교

구 분	당사 Request	Herkules (독일)	Waldrich (독일)	Pomini (Italy)	Karatsu(일본)	비고
가공 정밀도						Radius 기준
원통도 (mm)	0.001	0.0035	0.001	0.001	0.001	
편심도 (mm)	0.002	0.0015	0.002	0.002	0.002	
진원도 (mm)	0.001	0.002	0.001	0.001	0.001	
Crown 정밀도 (mm)	0.002	0.0025	0.002	0.002	0.002	
가공 범위						
직경 (Max./Min. mm)	2,200 / 2,000	2,150 / 550	2,200 / 500	2,200 / 1,000	2,200 / 435	
길이 (Max. mm)	10,000	10,000	10,000	11,000	10,000	
중량 (Max. Ton)	200	200	200	200	200	
Head Stock						
Movement (mm)	可能	可能 (1,000)	可能	可能 (150)	可能 (150)	
Torque (Nm)		60,000	38,000	78,500	93,300	
Speed (rpm)	4 ~ 40	4 ~ 40	4 ~ 40	5 ~ 50		
Main Drive (kW)	56.25	130	88	200	75	
(rpm)	500~1500	210 ~ 2,100			80 ~ 3,200	
Auxiliary Drive	無 (감속기)	有 / 4kW	有 / 4kW	無 (감속기)	無 (감속기)	
Tail Stock						
Movement (mm)	可能	可能	可能	可能	可能	
Wheel Dresser	有	有	有	有	有	
Calibration device	無	有	有	有 (Caliper 부착)	有	
Grinding Wheel Head						
Wheel Head 구동방식	Tilting Type	Direct infeed	Direct infeed	Direct infeed	Direct infeed	
Spindle 유압방식	Hydrostatic	Hydrostatic&dynamc	Hydrostatic	Hydrostatic	Hydrostatic	
Motor (kW)	75	135	135	130	75	
Motor Speed (rpm)	750~1500	720 ~ 2,880	350 ~ 1,750	400 ~ 1,600	700 ~ 1,700	
Grinding Speed (m/s)	Max. 43	Max. 45	Max. 45	45	Max. 60	
Grinding Capa. (kg/h)				120		
Grinding Wheel						
Diameter (Max./Min.)	915 / 550	915 / 550	1,066 / 620	1,066 / 670	1,065 / 500	
Bore (mm)	304.8	304.8	508	508	304.8	
Width (mm)	100	100	100	152	100	
Steady rest	WR/BUR 개별	WR/BUR 개별	WR/BUR 개별	WR/BUR 개별	WR/BUR 개별	
Position	Roll Neck	Roll Taper	Roll Taper	Roll Neck	Roll Neck	
Hydraulic type	Hydrostatic(BUR) Hydrodynamic(WR)	Hydrostatic	Hydrostatic	Hydrostatic(BUR) Hydrodynamic(WR)	Hydrostatic	
Grinding Carriage						
Z Axis						
구동 방식	Double Pinion	Double Pinion	Two servo drive	Double Pinion	Double Pinion	
Carriage Speed		10 ~ 5,000	6 ~ 12,000	0 ~ 8,000	1 ~ 5,000	
Drive Motor (kW)	3.37		6.3 x 2	5.7	9	
Torque (Nm)		62	40	23		
Speed (rpm)	75~1500	0 ~ 1,200	3 ~ 3,000	0 ~ 2,000	3,000	
Resolution (mm)		0.001	0.1	0.005		
X Axis						
Infeed Speed		1 ~ 1,000	1 ~ 1,000	0 ~ 830	1 ~ 1,000	
Drive Motor (kW)	0.75				9	
Torque (Nm)		10.4	6	11.4		
Speed (rpm)	0 ~ 1440	0 ~ 3,000	5 ~ 5,000	0 ~ 2,000	3,000	
Resolution (mm)	0.25	0.0001	0.078	0.0001	0.001	
U Axis						
Feed Rate	없음	Soft (C Axis)	50	0 ~ 18	없음	
Torque (Nm)			2	2.15		
Speed (rpm)			1 ~ 4,000	0 ~ 3,000		
Resolution (mm)		0.00001	0.0000238	0.00001		
Crown Height (mm)		Max. 5	Max. 3	±10		
Roll 측정설비						
Type	One point caliper	Two point caliper	Two point caliper	Two point caliper	Two point caliper	
On-working Measure	不可	可能	可能	不可	不可	
Range (mm)		800 ~ 2,150	500 ~ 2,200	1,000 ~ 2,250	1,000 ~ 2,250	
Accuracy (mm)		0.001	???	0.025	± 0.005	
Eddy Current System						
Range (mm)	없음	800 ~ 2,150	500 ~ 2,000	500 ~ 2,000	500 ~ 2,000	
Accuracy (mm)		0.1(D) / 10 (L)	3.0 (D)		0.3(D)	
Roll DB System						
Level II Sys. 연계	不可	可能	可能	可能	可能	
Electronic Equipment						
Computer		the newest version	P-IV 2.8GHz	the newest version		
Operation System			Windows XP			
UPS (min / VA)		10 / 1,000	5 /	10 / 1,000	사양상 필요 없음	
Drive Unit	???	Siemens	Siemens	Siemens	FANUC	
Alarm system						
On-line Troubleshooting	없음	Alarm Screen	GDS system	可能	Alarm Screen	
Auxiliary Equipment						
Coolant Equipment						
Water tank (Liter)	8500	8,000	1,000	12,000	4,000	
Water Pump (Kw)	370l/mi	400l/min	150l/min	3	1.5	
Drum filter (l/min)	???	400	???	320	500	
Utility						
Electrical (kVA, Hz)	440(±10), 60	440(±10), 60	???	440(±10), 60	440(±10), 60	
Water (m3)	???	25	8		3~5	
Noise (dB)	???	???	Max. 80	80		
Air (Bar / Liter)	???	5~6 / 100	5 / 50	4 ~ 6	4~5 / ???	
Delivery (months)		12	14	14	20	
Reference		2,000대 이상 공급 '04년 POSCO 2후판 수주	2,000대 이상 공급 POSCO 8대 및 국내 다수 납품	240여대 공급 POSCO 열연 및 中 안산, 난정 납품	2,000여대 공급 POSCO 열연 등 국내 납품실적 有	

1. 각 공장별 자료 요청

구분		단위	2003년	2004년	2005년 상반기	2005년 하반기 (계획)
에너지	B-C	kl				
	LNG	천Nm³				
	전력	Mwh				
	구입비용(A)	백만원				
	매출액(B)	백만원				
	생산량	TON				
	에너지비용(A/B)	%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
용수	수자원 용수	m³				
	포항시 용수	m³				
	생활 용수	m³				
	사용량 계	m³				
	단가					
에너지 활동 절감 실적(3-8월까지)					58	백만원