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REISHAUER

EC DECLARATION OF CONFORMITY FOR MACHINERY

(Directive 98/37/EC, Annexe II, Sub. A)

Manufacturer : REISHAUER AG

Address : Industriestrasse 36, CH-8304 Wallisellen

Herewith declares that

THE CNC GEAR GRINDING MACHINE TYPE REISHAUER RZ 303C, N° 79023

- is in conformity with the following EEC directives
  - Machinery Directive - 98/37/EEC
  - PVD – 97/23/EG
  - LVD - 73/23/EEC
  - EMC- 89/336/EEC

and furthermore declares that the following (parts/clauses of) standards and specifications have been applied

EN ISO 12100-1 und -2, EN 418, EN 953, EN 954-1, EN 982, EN 983, EN 1050, EN 13218
EN 60204-1, EN 61000-6-2, EN 61000-6-4

Wallisellen, 12 October 2007

REISHAUER AG

W. Niederer
Deputy manager

Concept, Function, Technical Data

Overview

View of Machine

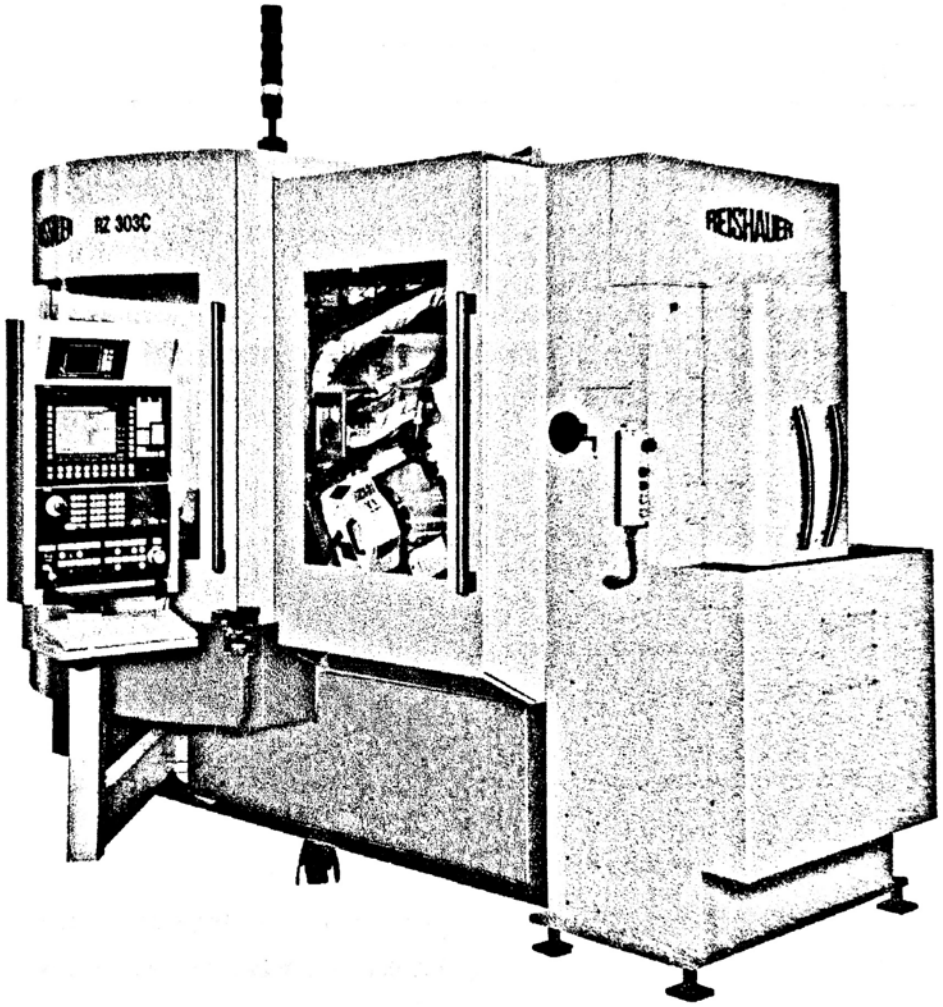


Fig. 9: RZ 303C

Type Designation

The designation RZ 303C stands for Reishauer Gear Grinding Machine, capable of grinding cylindrical gears up to a nominal diameter of 300 mm.

Grinding Method

The RZ 303C is a CNC controlled gear grinding machine employing the continuous generating method and applying a dressable cylindrical grinding wheel.

Machining Possibilities

- The RZ 303C is capable of grinding disk-shaped as well as shaft-shaped workpieces. Appropriate workpiece fixtures are required.

Machine Concept

The development within the gear and power train industry requires, besides the demand of constant reduction of costs at increased accuracy within the production, the possibility of the to a large extent free modification of the gear tooth geometry for the optimization of the running-, strenght and noise properties of a gear.

Reishauer has taken these aspects during the development of their new gear generation grinding systems into consideration. The machines of the RZ-range are designed as future-oriented open machines and technology systems for the small and mass production applications.

During the development of the machine concept the following points were particularly considered:

- Large versatility concerning the workpiece spectrum.
- High flexibility for the generation of different gear tooth geometries and gear tooth modifications respectively, but also with regards to the application of different grinding cycles and dressing methods.
- Reduced, ancillary times, which are very important in conjunction with the very short grinding times achieved today.
- Simplified re-settings together with short setup times for an easier handling of small lot sizes.
- Low proportionate tooling costs, which represent in the unit cost price structure an important role and are often a neglected factor.
- Service friendly as a condition for a high machine availability.
- The machine concept contains naturally also the characteristics of the successful Reishauer Gear Grinding Machines.
- Outstanding grinding- and dressing processes with reserves for the constantly rising requirements of the tool development.
- High precision and constant quality of the ground gear teeth.
- High reliability and longevity due to high level of mechanical engineering.
- Comfortable operation and high safety standard due to modern control engineering.
    - Quick workpiece change by loader, which is integrated in machine.

Structure of Machine

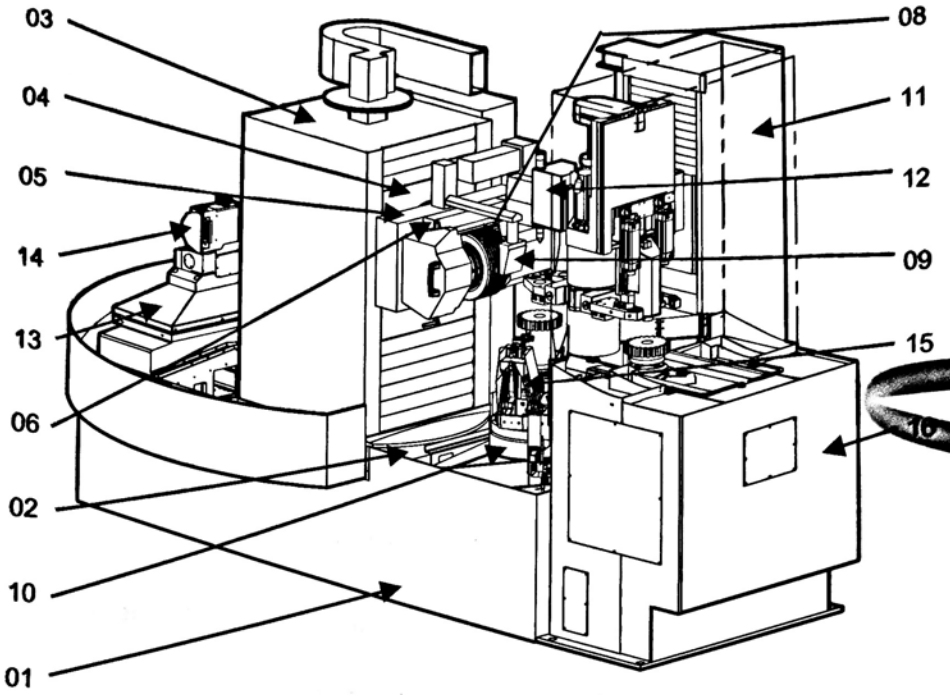


Fig. 10: Structural components of the machine RZ 303C

01	Machine base
02	X-slide
03	Turret
04	Grinding slide
05	Grinding head support
06	Shift slide
08	Grinding wheel
09	Coolant nozzle
10	Workpiece spindle
11	Counter support
12	Tailstock
13	Dressing support
14	Dressing device
15	Meshing probe
16	Integrated loader RL 300NC

Structural Components of the Machine

The RZ 303C has been designed and build according to ergonomic principals. The machine is build-up on a flat, very rigid basis, the **Machine base (01)**, which allows optimal manual and visual access to the set-up locations of the machine. The machine base is a welded steel structure with torsionally stiff cell structure and large material cross sections in the carrying zones. Proper covers shield the machine against thermal influence from the outside. Several coolant loops inside the machine base keep constant temperature in quality relevant sections.

The **Workpiece spindle (10)** (C'-axis), including complete drive and workpiece fixture, is situated stationary on the right side of the machine base (seen from the operator location). The workpiece spindle unit is also temperature stabilized by cooling oil loops. A Reishauer designed multiple contact friction wheel planetary gearing (patent pending) ensures a smooth and even transmission of high torques.

Tailstock (12) (W-axis) and **Counter support (11)** are machine options. With the integrated workpiece fixtures of the RZ 303C a machining of gears, even without these building groups, is possible.

The **Counter support (11)** is fixed to the machine base. The **Tailstock (12)** (W-axis) is mounted in a vertical guide on the counter support and can be moved by a spindle. At a workpiece change the entire tailstock will be moved in the counter support guide and warrants this way a high rigididy of the center sleeve at large center sleeve motions. The applied clamping force to the tailstock center, when clamping a workpiece, is adjustable in the setup program within a large range. The tailstock is integrated into the cooling oil loop of the machine. The counter support is insulated against outside temperature variations by an additional cover.

The **X-slide (02)** (X-axis) moves on preloaded and very rigid linear roller guides along the machine base. The upper part of the X-slide, the so-called **Tool holder (03)**, is pivot-mounted about a vertical axis (C1-axis) for the swiveling to the grinding- or dressing position. A high precision mechanical indexing device serves to exactly place, without backlash, the tool holder in both working positions.

The **Grinding slide (04)** (Z1-axis), at the front side of the tool holder, moves vertically on preloaded linear roller guides.

The **Grinding head support (05),** fixed to the vertical front side of the grinding slide, can be swiveled around a horizontal axis (A1-axis). The grinding head support can be tilted to the required swivel angle of the grinding spindle for creating a particular tooth helix angle. Automatic clamping takes place after the position is reached.

The grinding head support carries the **Grinding head**, which consists primarily of the **Shift slide (06)** (Y1-axis) and the **Grinding spindle (07)** (B1-axis). The shift slide motion is used for grinding and also for the lead generation during the dressing of the grinding wheel. The Y1-slide travel is designed, so that the dressing of the grinding wheel, including the entry- and exit distances and the maximum dressing tool width, will be covered.

The grinding spindle is designed as a motor spindle, allowing a compact design and resulting in enormous drive rigidity. The grinding spindle itself is equipped with high precision and rigid spindle bearings. For maintaining true measurements of the ground gears, the grinding spindle unit is temperature stabilized by 3 coolant loops:

1. loop: Inner cooling of rotating grinding spindle
2. loop: Outer cooling of front spindle bearings
3. loop: Outer cooling of grinding motor stator

An **Automatic balancing unit** is considered standard equipment. The grinding wheel is mounted to the grinding wheel flange which in turn is mounted to the grinding spindle. The balancing head is located in the center of the grinding wheel flange and serves for the static balancing of the grinding wheel. Contactless transmission of the signals to the balancing head are accomplished via a transmitting- / receiving unit.

The grinding head support holds the **Coolant nozzle (09)** (P1-axis) with the automatic, radial tracking feature. The coolant nozzle are designed to ensure that the oil flow covers the entire contact area between grinding wheel and gear. Various nozzle inserts are available for different module range and a bayonet-type fitting allows an easy exchange. The coolant nozzle is adjustable and allows an optimal flow angle, suitable for the grinding process.

The coolant nozzle is radially adjusted after a dressing of the grinding wheel and insures an optimal coolant supply.

The **Grinding wheel guard (07)** is part of the grinding head. The wheel guard swivels automatically and covers the otherwise unprotected area of the grinding wheel, thus avoiding any contact of the operator with the grinding wheel during the manual loading and unloading of workpieces.

The RZ 303C is equipped, as a standard, with an automatic **Meshing device (15)**. The meshing device allows the swiveling and the exact positioning of a **Meshing probe** from a parking position into a working position. The contact-less measurement of the workpiece gear teeth position makes an accurate meshing of the gear teeth with the grinding wheel start possible.

The **Electrical enclosure** of the RZ 303C is attached to the rear side of the machine and remains also there during the transportation of the machine. This concept will reduce the line lengths and the required number of plug connections. The reliable functionality of the machine is this way substantially improved.

Coolant medium

The sub-units of the RZ 303C are equipped with different coolant loops and mediums. The grinding oil of the machine serves mainly as the coolant medium for these loops. All return lines lead to the machine base and the oil is collected and transported with the grinding oil from the process cooling to the coolant filtration unit for replenishment (filtering and cooling).
In addition the machine is equipped with a separate spindle cooling system with a closed loop. The cooling oil (hydraulic oil) circulates in a closed circuit and contamination is, therefore, practically eliminated.
The specification of the grinding oil and hydraulic oil are to be found in CHAPTER *Concept, Function, Technical Data / Utilities.*

Operating Panel

The machine is being operated mainly via the **Operating Panel**. The integrated loader RL 300NC has an additional **Operating Keyboard**. Only the set-up and the change of tools and workpiece fixtures must be carried out inside the machine area, all other machine settings and operations can be handled via the controller. The operating panel consists of a flat screen monitor including softkeys and NC keyboard, machine control panel and operator panel. The operating panel can be swiveled by the operator always to an ergonomically most favorable position for grinding as well as for dressing.

Dressing Device

The **Dressing Support (13)** carrying the **Dressing Device (14)** is fixed to the left side of the machine base.

The dressing device is stationary during the dressing cycle, ensuring easy access when the diamond dressing tool goes into mesh with the grinding wheel start. Dressing support and dressing device are temperature stabilized via coolant loops. More details concerning dressing devices see CHAPTER *Concept, Function, Technical Data / Dressing Device.*

Workpiece Loader RL 300NC

Integrated in the RZ 303C is the workpiece loader RL 300NC with double gripper and is located on a special foundation on the right side of the machine and allows the loading and unloading of workpieces.
The workpiece loader RL 300NC can be utilized as a flexible automation building block for manual as well as automatic workpiece handling.

The three main axes of the loader for the stroke unit (ZL), the swivel unit (CL) and also for the grippers 1 and 2 are designed as NC-axes.
The controller of the loader is integrated in the machine controller.
The workpiece loader RL 300NC can be equipped, in addition (option), with an oil centrifuge station. The grinding oil for cleaning the loader is provided by a separate line from the machine. The ground gear goes thru a spin-off cycle and this oil together with the grinding oil for cleaning the loader, flow back to the machine base in a return line. The oil mist, resulting from the spin-off cycle, will be collected by the oil mist extractor.

Axes Designation Machine RZ 303C

The plus signs ("+") in the figure below indicate the positive direction of movement of the respective axis, according to the machine coordinate system (see lower right corner of figure).

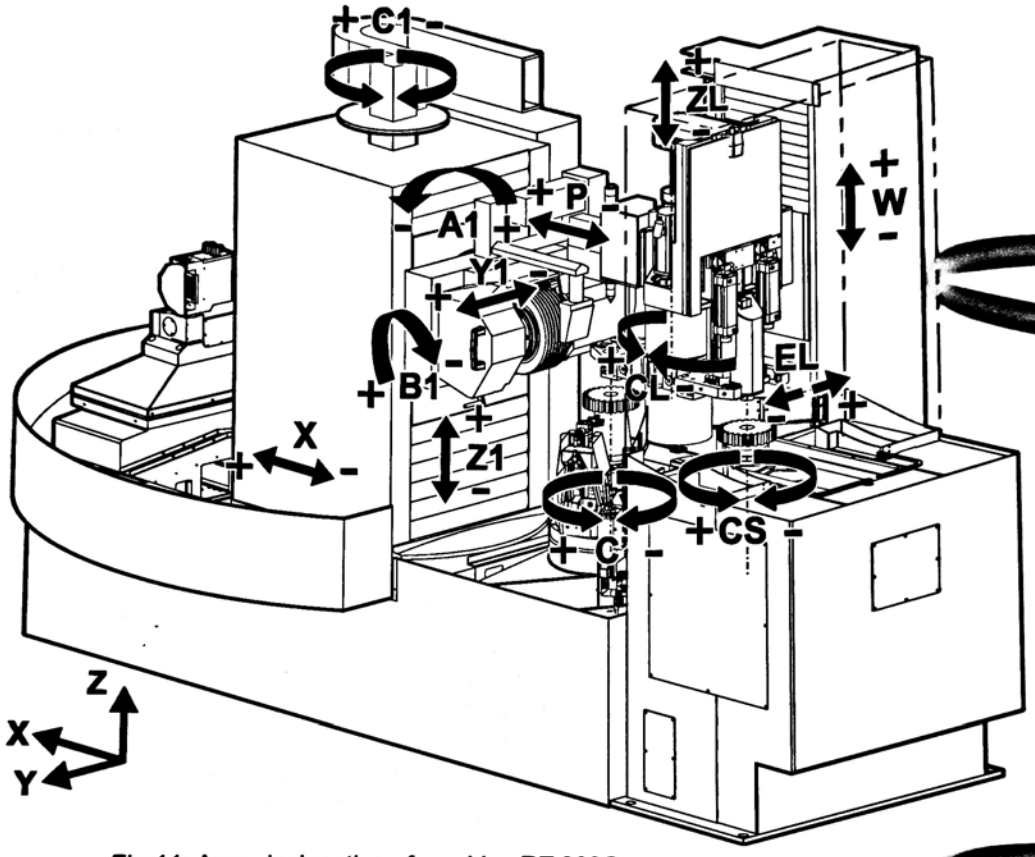


Fig 11: Axes designation of machine RZ 303C

Axis	Designation	Measuring system
A1	Grinding head (swivel)	rotative indirect
B1	Grinding spindle	rotative direct
C'	Workpiece spindle	rotative direct
C1	Tool holder (swivel)	rotative indirect
P	Coolant nozzle (linear)	Stepping motor
W	Tailstock (linear)	Rotative indirect
X	X-slide	Linear direct
Y1	Shift slide	Linear direct
Z1	Feed-in slide	Linear direct
CL	Swivel unit	rotative indirect
CS	Oil centrifuge	rotative direct
EL	Gripper	rotative indirect
ZL	Stroke unit	indirect

Axes Definition

The designation of the axes of the RZ 303C is based on definitions of ISO 841/DIN 66217.

As per definition of an NC-axis, either a linear or a rotative unit can be moved or rotated via program/control relative to its base or support. Elements of an NC axis are: a movable unit/slide, drive/drive motor including servo amplifier and a measuring system giving the feedback to the control. Very precise NC axes are equipped with absolute measuring systems while auxiliary axes are sometimes equipped with incremental measuring systems.

In case of a stepping motor, there is normally no need for a separate measuring system with feedback to the control.

Working Range

Workpiece

The RZ 303C, in conjunction with the workpiece loader RL 300NC, is capable of grinding gear teeth within the below mentioned working range.

The clamping conditions need to be checked if required!

Note

Many parameters need be taken into consideration for clarification of the grindability of a gear, in particular around the borderline of the working range. Please contact Reishauer for clarification in regard to working range and grindability of gears in case of uncertain conditions.

Parameter	Symbol	Range
Outside workpiece diameter	d_a	25 – 300 mm
Max. root diameter	d_f	298 mm
Number of teeth	z	6 – 600
Z1-grinding slide stroke	b	0 – 300 mm
Distance between centers (with workpiece loader RL 300NC)		00...480 mm See fig. clamping range
Max. length of workpiece		400** mm
Location of gear		See fig. min. clamping height
Module range grindable	m_n	from 0.8* to 5.5 mm (6 mm)
Module range with automatic meshing	m_{AEZ}	0.8 to 6 mm
Pressure angle	α_n	14 – 30 °
Helix angle possible working range	β	– 45 °..0 °.. + 45 °.. See fig.
Max. weight of workpiece (with workpiece loader)	M	12 kg

* smallest possible module depending on gear teeth geometry and dressing tools

** Shaft type gears with a lenght of 400 mm and 12 kg weight do have a maximum shaft diameter of approx. 80 mm.

Workpiece Fixture

Designation	Technical data
Workpiece spindle nose	Face surface Ø 180 mm with internal taper similar to DIN 69063 with nominal diameter Ø 106 mm
Workpiece fixture	Customized design to suit the individual workpiece, inner- or outer chucking. Mounted to the workpiece spindle nose or by means of quick change fixtures.

Force of tailstock sleeve (option)	F_P 100 ... 999 N

Workpiece Clamping Configuration

The following sketch is showing schematically the working range of the RZ 303C machine.

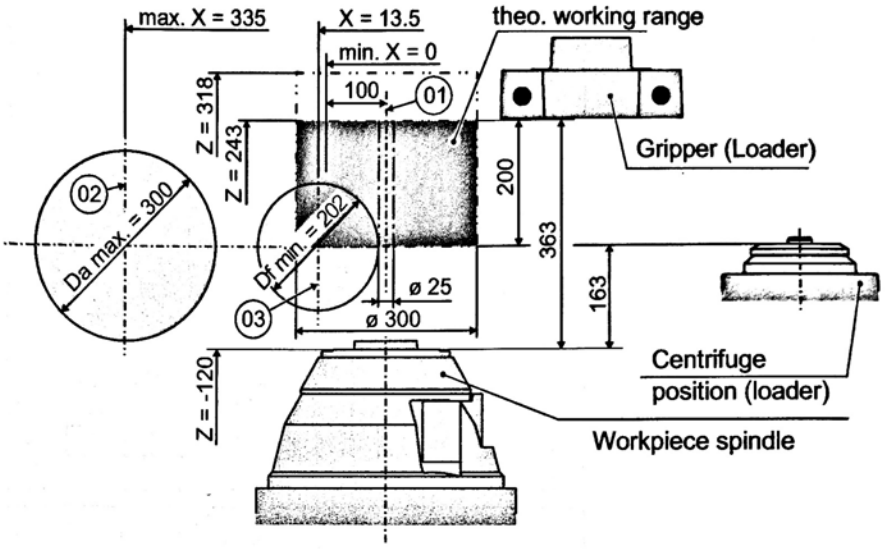


Fig. 12: Clamping concept, workpiece length

01 Workpiece axis	02 Grinding spindle axis in all backward position
03 Grinding spindle axis position at Df = 202	

Hydraulic and Pneumatic Unit

The RZ 303C machine is equipped with a separately placed, combined hydraulic and pneumatic unit.

Mechanical Concept

Picture is exemplary, deviations according to options possible.

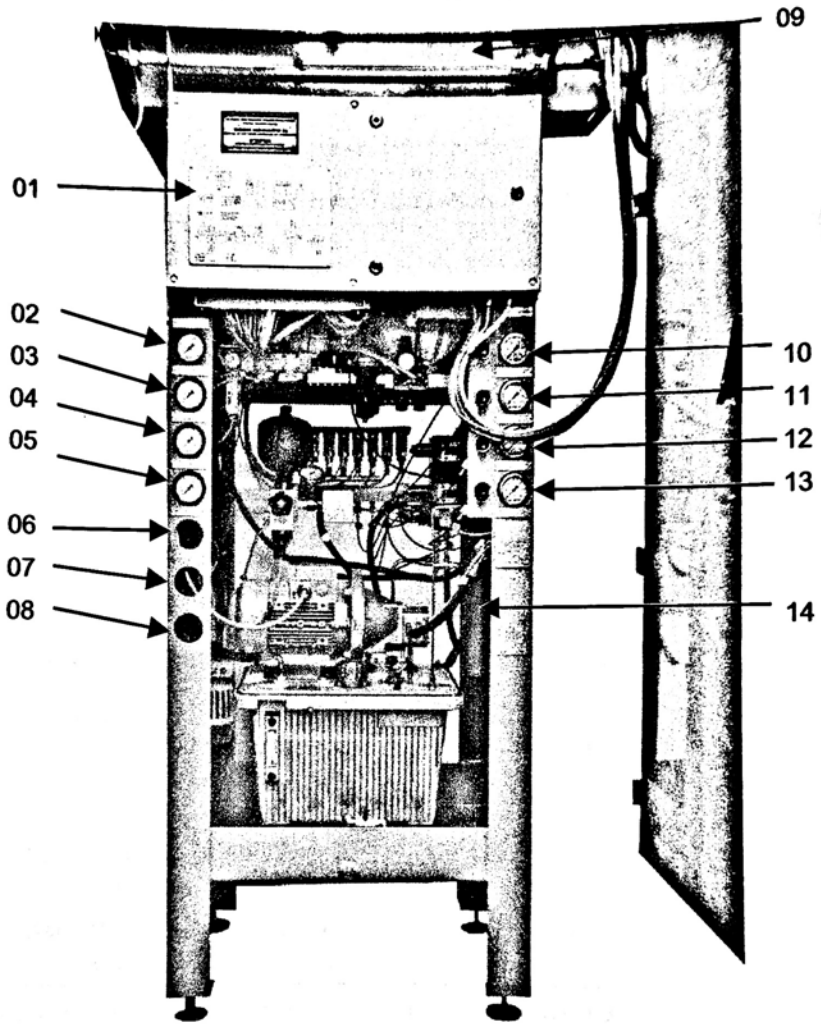


Fig. 19: Hydraulic- and pneumatic unit

01	Layout tag pneumatic	02	Pressure gauge pneum. system
03	Pressure gauge purged air	04	Pressure gauge relief C12-axis
05	Pressure gauge relief of A1-axis	06	Pressure gauge (Reserve)
07	Pressure gauge (Reserve)	08	Pressure gauge (Reserve)
09	Oil mist seperator (option)	10	Pressure gauge hydr. system P1
11	Pressure gauge hydraulic system P2	12	Pressure gauge for workpiece fixture
13	Pressure gauge for workpiece fixture; additional function	14	Hydraulic fine filter with contamination display

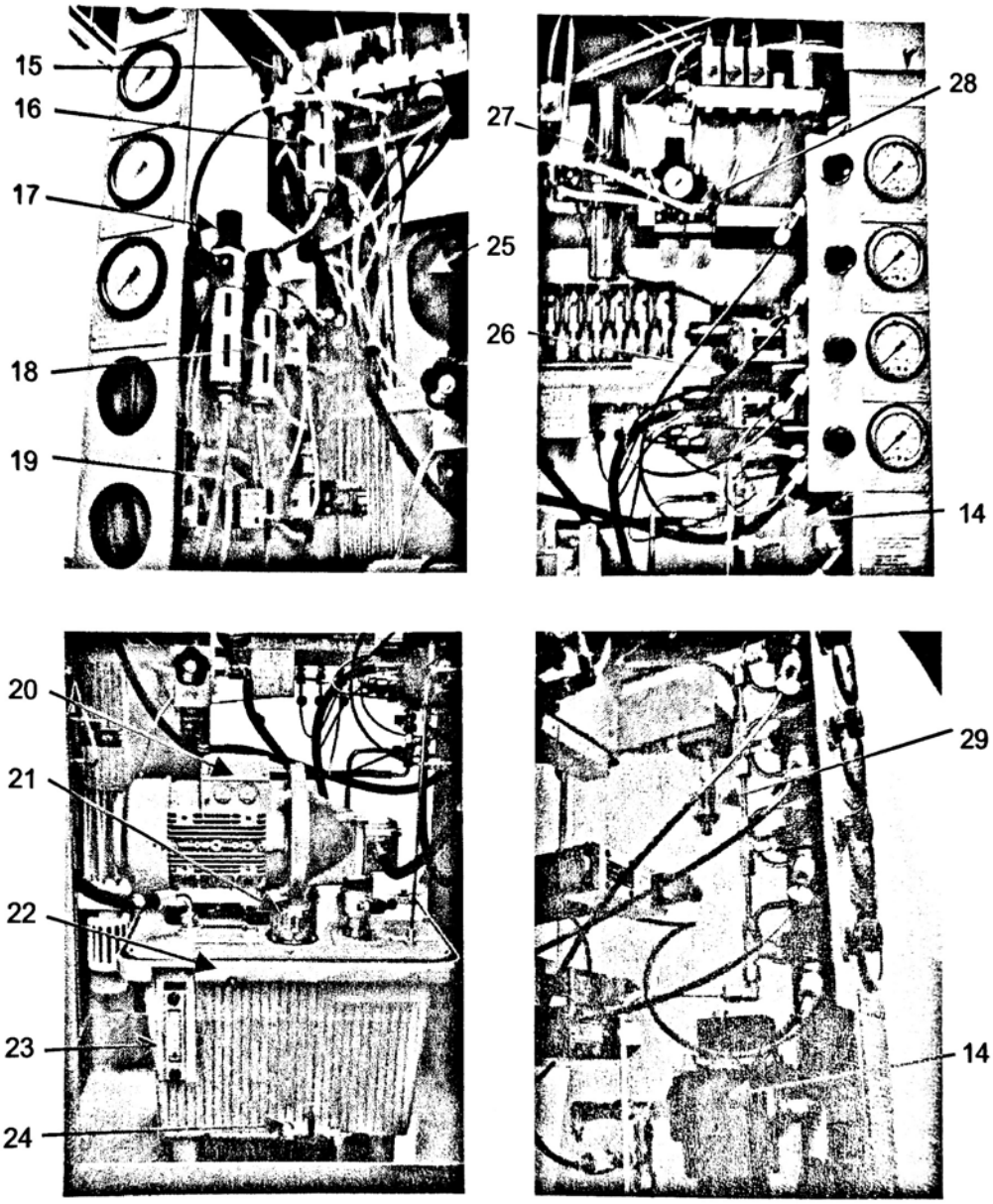


Fig. 20: Hydraulic- and pneumatic unit, details

15	Stop valve pneumatic unit	16	Pressure regulation valve with filter
17	3 point support monitoring fine filter	18	3 point support monitoring activated-carbon filter
19	3 point support monitoring activated-carbon filter Dynamic pressure switch	20	Hydraulic motor with gear pump
21	Hydr. oil filler nipple / breather filter	22	Hydraulic oil tank
23	Hydraulic oil Level – and temperature display	24	Hydraulic oil outlet faucet
25	Hydraulic accumulator 1.4l	26	Hydraulic valve block
27	Fine filter purged air measuring system	28	Pressure regulating valve A1/ C1-axes

29 Oiler pneumatic / level display	

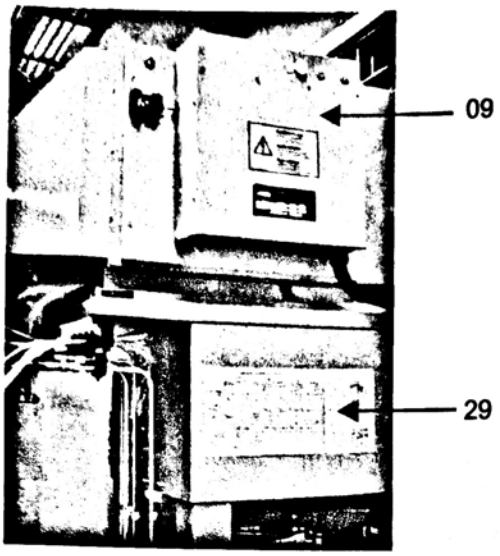


Fig. 21: Hydraulic opil unit; back side

09 Oil mist seperator (option)	29 Maintenance plan of hydraulic unit

Hydraulic Functions

The hydraulic unit has a pressure circuit with 4 MPa and an auxiliary pressure circuit with 20 Mpa.

Following functions of the RZ 303C are operated hydraulically

• Relief of A1-axis clamping	20 MPa-Circuit
• Relief of C1-axis clamping	20 MPa-Circuit
• Fine positioning of C1-axis	4 MPa-Circuit
• Workpiece clamping, i.e. collet	4 MPa-Circuit
• Weight compensation for Z1-axis	20 MPa-Circuit

Hydraulic oil specification see CHAPTER *Concept, Function, Technical Data / utilities.*

Pneumatic Functions

The machine is supplied by several separate pneumatic lines, which support the following functions:

1. **Purged air,** free of oil, with highest filtering of 0,01 µm for sealing of the measuring systems and spindles.
2. **Compressed air,** free of oil, for pneumatic functions (controlling of solenoid valves).
3. **Compressed air,** with lubricant, for air cushion when swiveling the C1- and the A1-axis.

4. Measuring air (option), free of oil, with highest filtering of 0,01 µm, with dynamic pressure switch for measuring purposes.

Following functions of the RZ 303C are operated pneumatically

- Compressed air for lubrication when swivelling of A1-axis
- Compressed air for lubrication when swivelling of C1-axis
- Compressed air for cleaning of meshing probe
- Compressed air for swivelling of meshing probe
- Compressed air for auxiliary functions (i.e. of integrated loader)
- Purged air for measuring systems of X-, Y-, Z-, B1- and C'-axis
- Purged air for sealing purpose of bearings on grinding spindle and dresser spindle
- Measuring air for the 3-point support monitoring and ejection monitoring (option)

Balancing System

The balancing system is for fine balancing of the grinding wheel on the machine in one plane (= static balancing).

Imbalance of Grinding Wheel

There are two different reasons for imbalance of the grinding wheel:

- **Systematic portion of imbalance**
  The systematic portion of imbalance is caused by geometry of a one-start grinding wheel (worm). This portion varies as the grinding wheel gets smaller in diameter due to dressing. Multiple start grinding wheels (worm) do not have a systematic imbalance.
- **Casual portion of imbalance**
  The casual portion of imbalance is caused by the material characteristics of the grinding wheel:
  - Grinding wheels are basically not homogeneous.
  - Porous grinding wheels will absorb coolant at a varying rate caused by uneven density.
  - Eccentric clamping of the grinding wheel on the flange caused by the tolerance of the grinding wheel bore.
  - Uneven deformation of the grinding wheel caused by centrifugal force.
  - Uneven wear of the grinding wheel.

Both portions of imbalance will vary in the course of grinding and do require balancing in certain intervals.

Note

New grinding wheels, particularly such of bigger module, high RPM and high accuracy, must be dynamically balanced on a balancing machine before mounting them on the RZ series grinding machine. This is accomplished with a balancing arbor and balancing weights adjustable in the groove of both flanges, see CHAPTER *Machine Operation / Balancing of grinding wheel.*

Note

For optimal grinding results it is necessary to fine balance the grinding wheel on the RZ 303C by means of the integrated balancing unit.
The static portion of the imbalance of the grinding wheel will be automatically compensated.

Mechanical Concept

The balancing unit is located in the center bore of the grinding spindle flange at the front end of the spindle. Balancing weights inside the balancing head are displaced via two motors with the corresponding gears and compensate this way the residual imbalance which has been determined by the pickups on the grinding wheel housing. The signal transmission and also the supply of the drives are done contact-less.

Balancing and Touch Detector

This is a short description of the balancing unit of "Balance Systems" supplied with the RZ 303C. The more elaborate and original operator manual can be found in DOCUMENTATION *"Sub-supplier devices"*.

Type VM24 of the VM20 Series

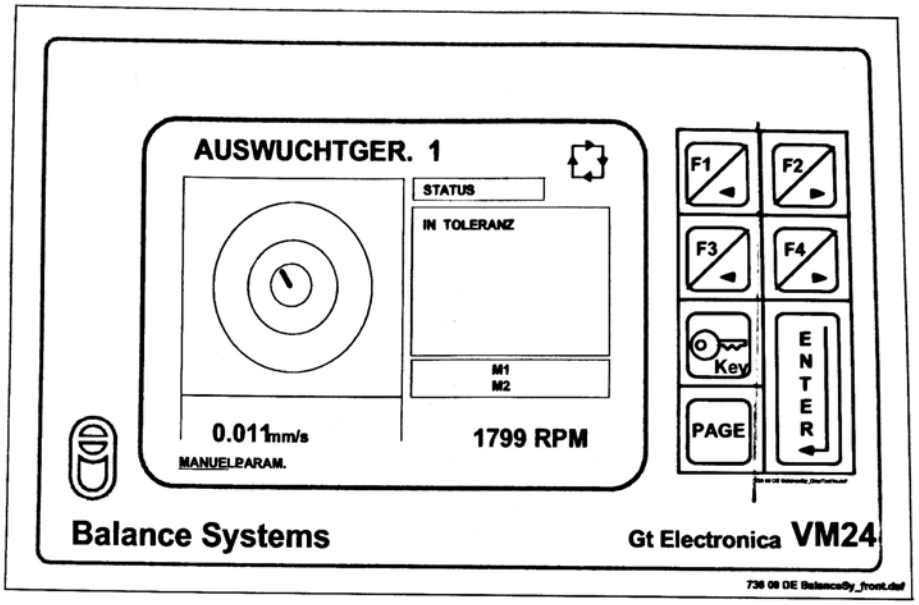


Fig. 22: Display and keyboard, type VM24

Access levels

The type VM24 can be operated via four (4) access levels, designated for different user levels. Each level has full access to all lower levels and the hierarchy is as follows:

- Observer
  - Display of of balancing condition and touch detector, saving of data, adjustment of contrast, access to passwords
- Operator
  - Same as observer, plus modification of parameters for touch detection
- Programmer
  - Same as observer, plus modification of parameters for balancing
- Installer
  - Same as observer, plus set-up and calibration of the system

Concept

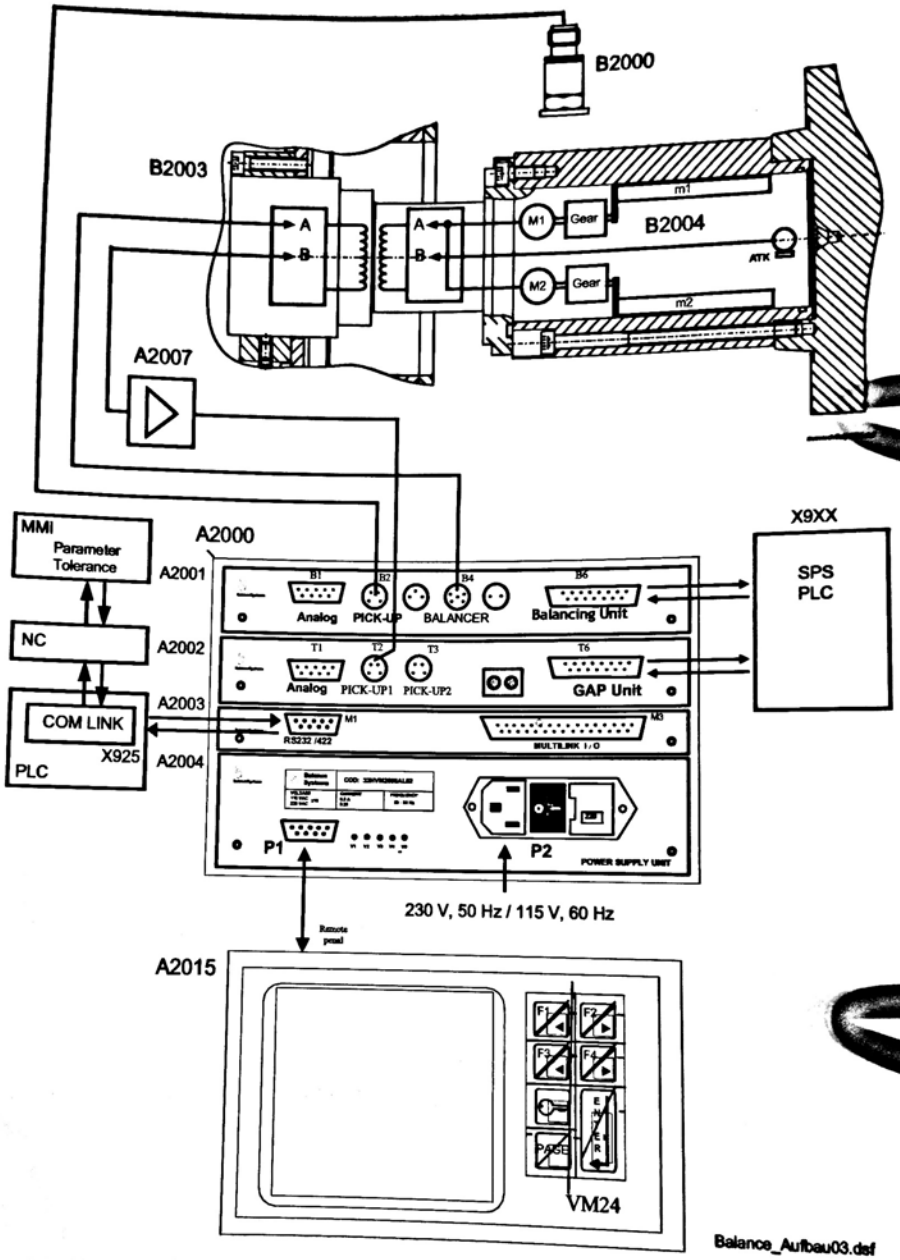


Fig. 23: Concept balancing and touch detector of the Balance Systems

B2000	Vibration transducer (pick-up)
B2003	Transceiver unit, with transmitter / receiver
B2004	Balancing head, with transmitter/receiver, servomotor, acoustic sensor
A2000	Rack with components with evaluation electronic
A2001	Balancing unit
A2002	Touch control unit
A2003	Communication unit
A2004	Power supply

A2007	Amplifier for acoustic sensor
A2015	Operator panel and display unit

Function of Balancing System

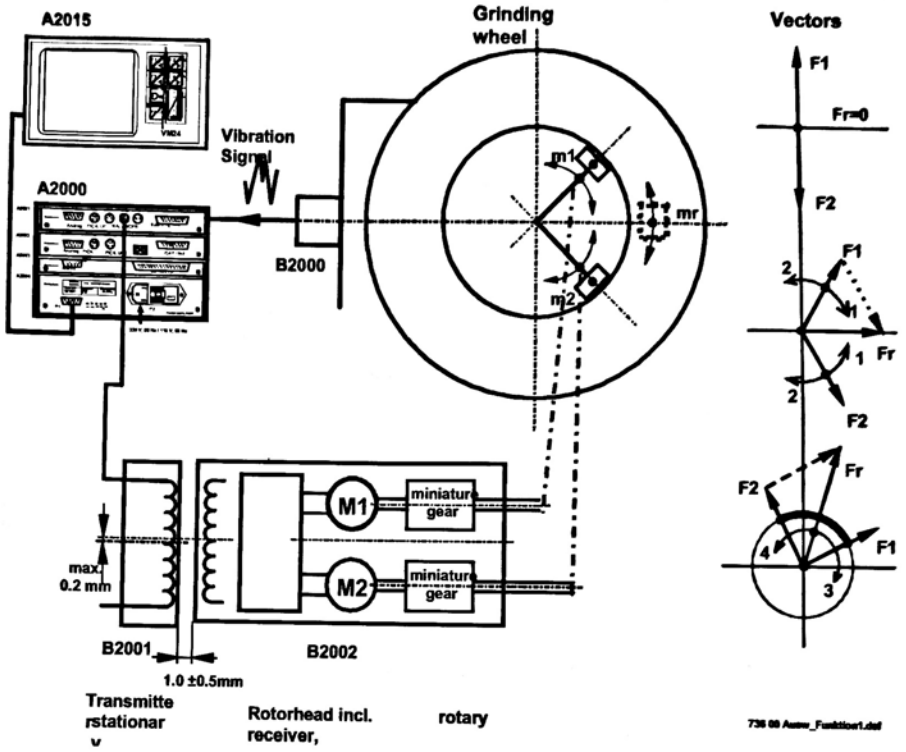


Fig. 24: Function balancing unit, vectors

Description

The vibration transducer (pick-up, B2000) recognizes vibrations of the grinding wheel. Signals from the PCB (A2003) will actuate servomotors M1 and M2 inside the rotor head (B2004). A miniature gearbox will displace the weights m1 and m2, either together or opposite, thus counteracting any existing imbalance of the grinding wheel to a tolerable limit. The movement of the weights will change the vectors (angular position and/or size, see upper right corner figure "Vectors"). The movement 1 and 2 will change the size of Fr, movement 3 and 4 will change the angle of Fr, thus compensating the imbalance. In automatic balancing mode, the masses m1 and m2 are being shifted according to predefined program until the vibrations, which are measured by B2000, are reduced below a preset limit value. The residual imbalance and the movement of the balancing mass are shown at the display of the operating unit (A2015).

Balancing weight displacement, display	
Movement of force vector Fr	**Display**
Increase or decrease	M1 – – M2
Turn angular position	– M1 – M2
Movement blocked	M1 * * M2

The length of the bars is proportionate to the angular velocity of the balancing weight.

Movement blocked

Movement blocked indicates that both balancing weights are touching each other. The balancing capacity is reached. If this happens during balancing then the grinding wheel must be dynamically balanced on an external balancing machine.

Approach neutral position

Within the function "Neutral" - Approach neutral position - the stars "*" will momentarily appear at the moment, when both balancing weights are touching each other (stop). The neutral position will be approached afterwards by half the time which it takes to travel from one stop to the other stop.

General Remarks for Balancing

Static balancing

The balancing on the RZ 303C is a fine balancing in one plane, approx. at mid facewidth (static balancing).

Dynamic balancing

The grinding wheel must be pre-balanced in two planes – on both faces of the wheel – on an external balancing machine (dynamic balancing).

Learning cycle

Every time the speed (RPM) has changed, a learning cycle will be performed prior to balancing in order to determine the effectiveness of the balancing weight movement and thus to optimize the balancing.

RPM recognition

A sensor of the balancing head will detect the speed which will be displayed on the screen. Without this balancing-head internal speed signal no imbalance signal can be displayed.

Note

The grinding wheel must be pre-balanced outside the machine prior to the mounting on the machine. Otherwise the balancing capacity of the unit might not be sufficient. The balancing capacity corresponds to the maximum imbalance which the unit (B2004) can handle.

System Components

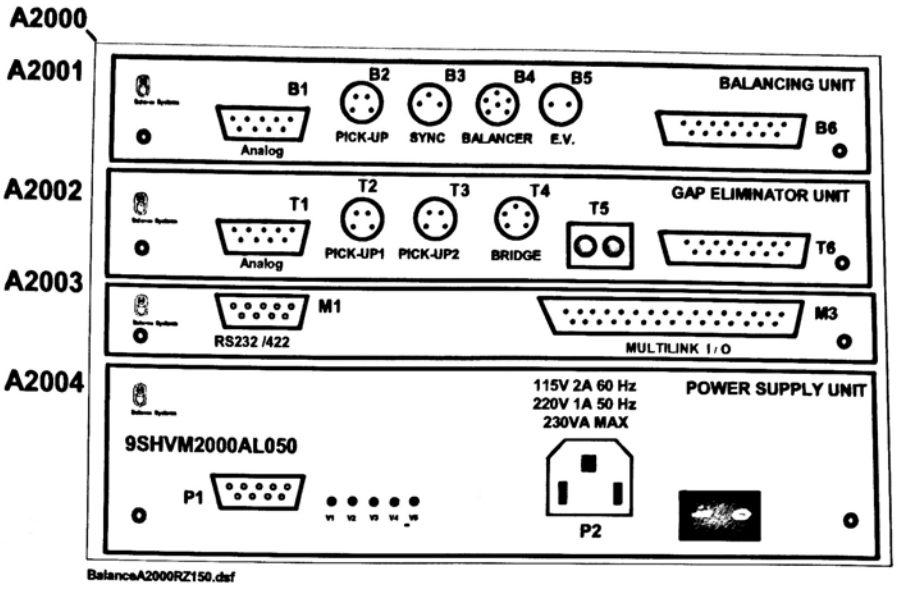


Fig. 25: System VM24

A2000	Rack with data bus is inside the control cabinet
A2001	• Balancing unit • Automatic and manual balancing of a rotating grinding wheel in one plane. • Moves weights in neutral position, 180° opposite each other. • RPM being recognized in B2003 and displayed (B2015). • Communication of status/error messages to CNC control via plug B6.
A2002	Touch detector (TD) • Process observation and display of TD signal during dressing and grinding. • Communication with CNC control via plug T6.
A2003	Communication unit (RS232C/422 MULTILINK I/O). • Programmable serial link to RS232C/422. • Parallel link to PLC via multilink.
A2004	• Power supply (VM20 9SHVM2000AL 050). • Power supply with multiple voltage output for supply of PCB's and operator panel. • Rating 117 W, 80-240 V AC ±10% , 50-60 Hz.

Operator panel

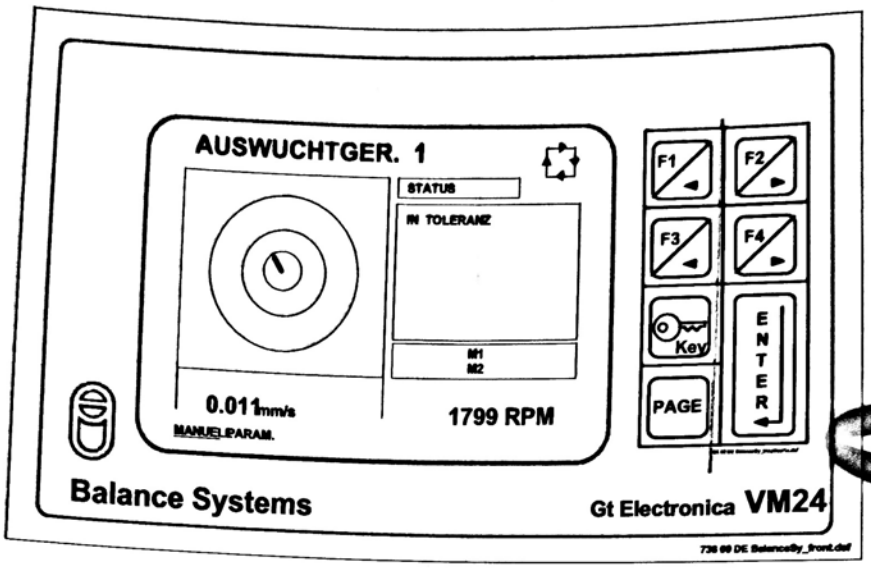


Fig. 26: Operator panel A2015

A2015	Operator panel • The operator panel is located on top of the control panel. On the left side is the display (monitor), on the right side is the keyboard for the operation of the unit. The display shows the imbalance and the acoustic signal strength. • The keyboard allows also the operation in manual mode and the programming of the system.
B2000	Vibration transducer, (pick-up). • Measures the imbalance caused by vibrations of the grinding spindle.
B2001	Transceiver unit with transmitter/receiver. • Transmitting servo signals for balancing motors and receiving acoustic signals.
B2002	Balancing head • Receiving servo signals for balancing motors and Transmitting acoustic signals.
Amplifier	Amplifier for acoustic sensor (TD-sensor A2007), incorporated in tool holder of machine.

Balancing procedure

Balancing serves the purpose of minimizing radial and axial runout of the grinding wheel, caused by the imbalance, at grinding speed. The pointer (vector) on the screen indicates amplitude and direction of the measured imbalance during the balancing process.

Imbalance and tolerance- limit value

Possible pictures after balancing.

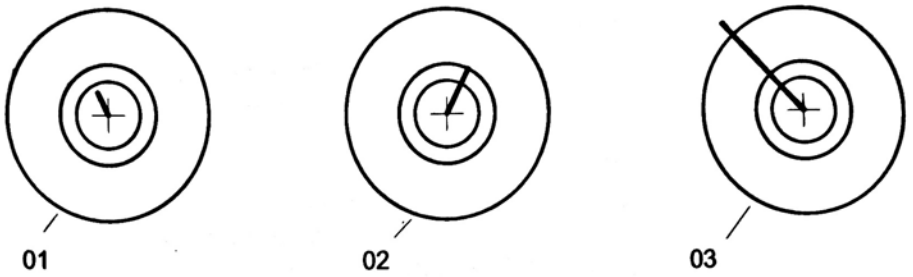


Fig. 27: Display balancing

01 Below minimum tolerance, extremely good balanced.	03 Above tolerance, balancing necessary at next available chance.
02 Below mean tolerance, balanced after timeout.	

Parameters, example for balancing quality

Category		Standard operation(MMI-value)	Start-up
Max. vibration	[mm/s]	2	2
Min. tolerance	[mm/s]	0.020	0.100
Max. tolerance	[mm/s]	0.100	0.300
Mean tolerance	[mm/s]	0.060	0.100
Timeout mean tolerance	[s]	10	10

Maximal admissible vibration

The machine is being stopped when this limit is exceeded.

Minimal tolerance

The balancing unit tries first to reduce the imbalance to this value.

If this is possible, then the machine is balanced to its best result and the balancing operation will stop.

Timeout mean tolerance

If balancing is not successful within the specified "timeout mean tolerance", then balancing will take place according to "mean tolerance". The balancing operation will be stopped when "mean tolerance" is achieved.

In case balancing to "mean tolerance" can not be achieved within 180 seconds, then the operation is truncated and restarted. In case that the second try is not successful either, then balancing will be permanently truncated and an error message will appear.

Maximal tolerance

In case the max. tolerance is exceeded, then the grinding wheel must be balanced on an external balancing machine.

Operating mode start-up / standard operation and max. vibration

The grinding spindle is monitored during start-up. In case the "maximal tolerance" has been exceeded, start-up will be interrupted and balancing will take place at this particular RPM. After obtaining balancing tolerance, start-up will be continued. In order to save time, higher tolerances ("maximal tolerance") will be allowed during start-up as compared to standard operation (for spin cycle and enable grinding, see table).

Note

The start-up mode is illustrated on the BS display screen by 2 imbalance circles (mean tolerance = minimal tolerance) and the balancing mode is illustrated by 3 imbalance circles.

In case the "max. tolerance" is exceeded, then the machine will make an EMERGENCY STOP.

Function Touch Detector (TD)

The integrated vibration transducer (pick-up) (see figure "concept balancing and touch detection Balance System") measures the generated structure-born noise in the balancing head when grinding and when dressing. The sound level can be displayed on the screen of operator panel (A2015) and can be evaluated.

AM- Automatic Meshing Device

AM is the abbreviation for "**A**utomatic **M**eshing".
The automatic meshing device is to position the gear teeth in relation to the grinding wheel. The position of the gear tooth is based on measuring tooth thickness and tooth gap at the tip of the tooth of the workpiece. This measurement allows the determination of the meshing position in regard to a reference measurement of an already ground gear.

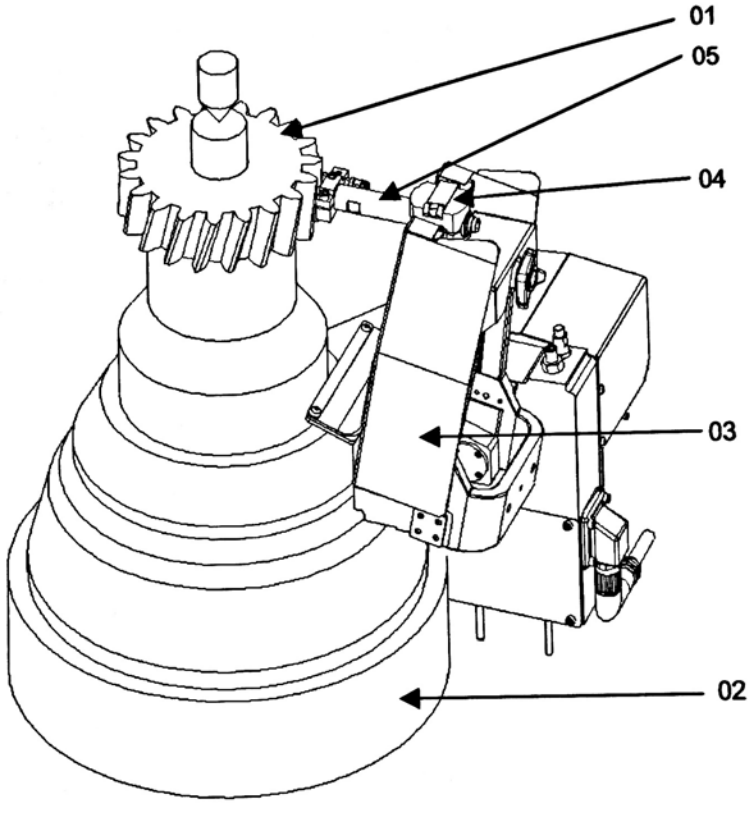


Fig. 28: AM device in measuring position

01 Workpiece	02 Workspindle
03 Swivel arm	04 AM probe holder
05 AM probe	

The AM device consists of swivel arm (03), probe holder (04) and probe (05) and device is fixed to the housing of the workspindle.

The swivel arm of the AM device has two positions, the park position and the measuring position.
The meshing probe has to be vertically adjusted to mid-facewidth while the swivel arm is in measuring position. The meshing probe has to be radially adjusted to a distance of approx. 0.2 mm to the tip diameter of the gear

The swivel arm swings from parking position to measuring position and brings the meshing probe to measuring position. Mechanical stops and damping elements ensure constant positioning of the meshing probe in measuring position.

Function

The meshing process determines the position of the gear teeth in relation to the grinding wheel. The probe measures tooth thickness and tooth gap during one revolution and determines the angular position of the premachined workpiece.

The valid meshing position for the workpiece will be calculated on the basis of a reference measurement. This reference measurement will be performed as a learning cycle on an initial workpiece, which was manually brougth into mesh and ground and furthermore, this measurement will be executed immediately after the grinding process but before the synchronization between grinding spindle and workspindle will be interrupted. The measuring of the AM-probe ensures, from now on, the exact determination of the meshing position of each following workpiece for the grinding process.

The meshing position is determined in such a way as to ensure an even material removal of both flanks.

Workpiece Loader RL 300NC

Concept and Function

Code for Type Designation

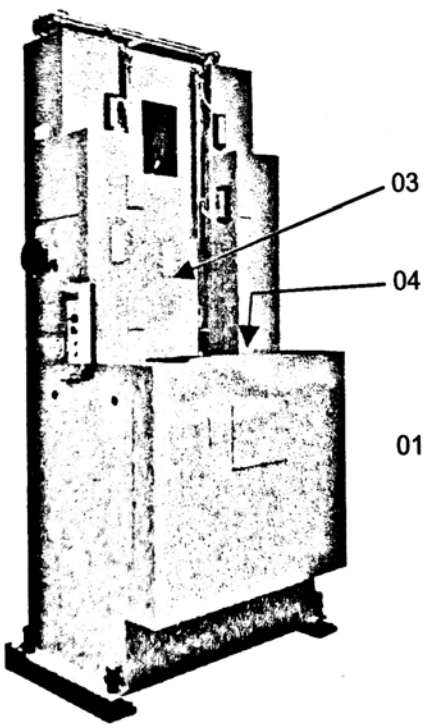
- **RL** means **R**eishauer **L**oader.
- **300** indicates the maximum outside diameter of the workpiece, which can be handled by the loader.
- **NC** means **N**umerical **C**ontrol and indicates that at least the 4 main axes CL, CS, EL and ZL are numerically controlled.

The **RL 300NC** is an integrated part of the CNC Gear Grinder RZ 303C.

The loader can be loaded depending upon is requirements by hand or be attached to an additionally automated loading system.

To a large extend the cycles, such as grinding of an unmachined part or the oil centrifuging of a ground workpiece, are performed parallel to achieve the smallest possible workpiece change times. The employment of the integrated loader permits a substantial productivity increase.

On the machine side and also on the loader side available safety locks offer additional safety for the operator when moving the loader axes.



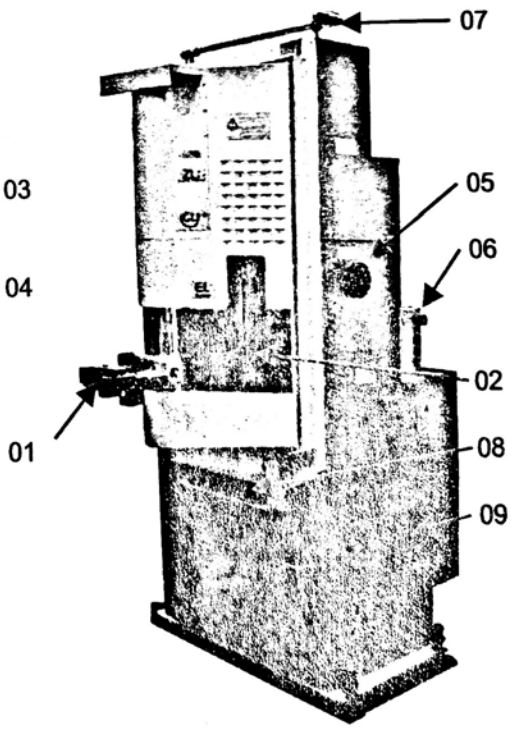


Fig. 29: Loader operating side Loader side towards machine

01	Gripper stroke and rotating unit	02	Material lock on the machine side
03	Material lock on the operating side	04	Loading station with horizontal slide
05	Center sleeve handwheel for oil centrifuging station (option)	06	Operating unit
07	Flush line for centrifuging station	08	Flush oil return line to machine

Axes Data

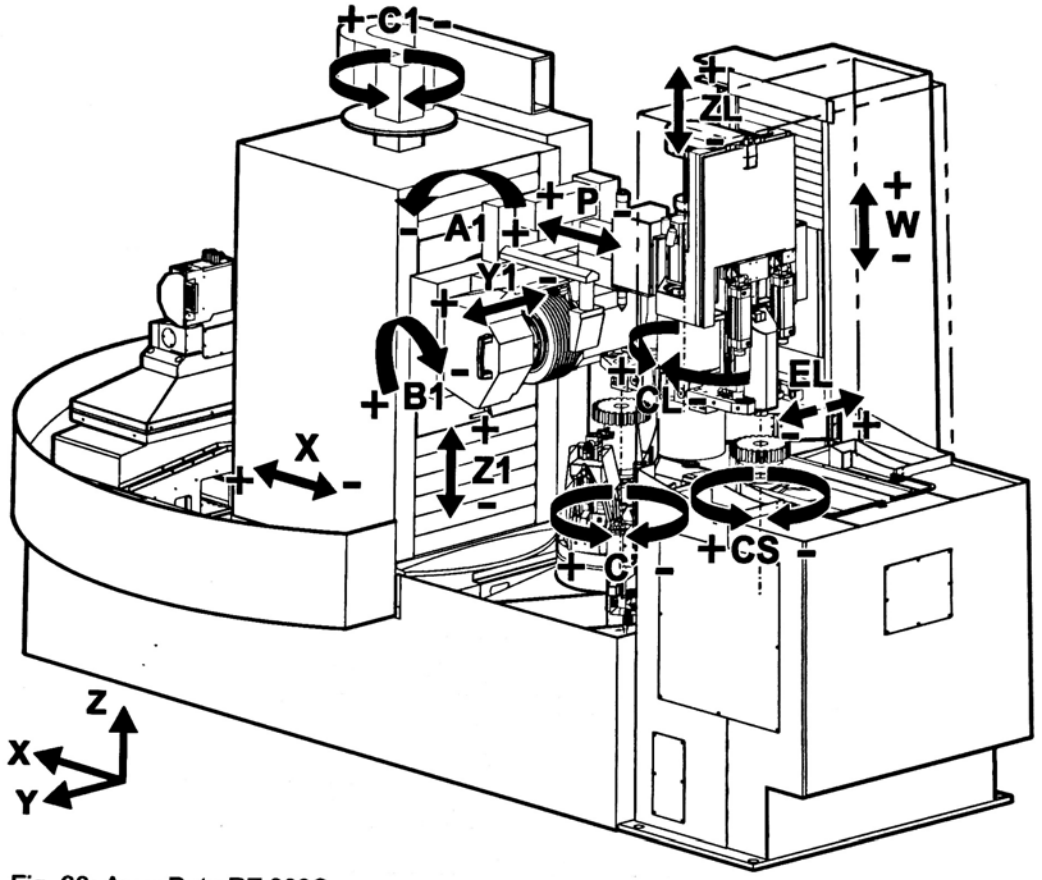


Fig. 30: Axes Data RZ 303C

Linear Axes

X-axis (grinding wheel infeed) [X-slide]		
	Travel range	490 mm
	Rapid travel	15 m/min
Y1-axis (Shift feed) [shift slide]		
	Travel range	220 mm
	Rapid travel	5 m/min
Z1-axis (grinding wheel feed) [grinding slide]		
	Travel range	300 mm
	Rapid travel	5 m/min
P1-axis (coolant nozzle)		
	Travel range	80 mm
	Rapid travel	4.8 m/min
W- axis (tailstock)		
	Travel range	640 mm
	Rapid travel	12 m/min

W1- axis (meshing probe height setting)		
	Travel range	250 mm
	Rapid travel	45 m/min
ZL- axis (loader RL 300NC, gripper stroke unit)		
	Travel range	180 mm
	Rapid travel	30 m/min

Rotary and swivel axes

A1-axis (helix angle setting) [grinding head]		
	Swivel angle	± 48 degrees
	RPM	28 degrees/s
B1-axis (grinding spindle)		
	Power	10 kW
	RPM	up to 4770 RPM (limited to 4010 RPM in Japan)
	Circumferential speed of grinding wheel at ∅ 300 mm and 4770 RPM	75 m/s (limited to 63 m/s in Japan)
C'-axis (workpiece spindle)		
	Torque	180 Nm
	RPM	0 to 600 RPM
C1-axis (tool holder)		
	Swivel angle	90 / 180 degrees
	RPM	60° degrees/s
CL-axis (loader RL 300NC, gripper swivel unit)		
	Swivel revolutions	21'600 RPM
	Revolution range	360 deg/sec
	Swivel angle	200 degrees
CS-axis (loader RL 300NC, spindle oil centrifuge)		
	Revolution (range)	3'000 RPM
	Center sleeve stroke Position adjustable	100 mm
EL-axis (loader RL 300NC, gripper drive for open / close)		
	Swivel revolutions max.	21'600 RPM
	Revolution range	360 deg/sec
	Rotation angle spline shaft	12 degrees

Note

In case a brand of coolant is used which is not recommended by Reishauer, then the following points should be carefully observed.

Viscosity

- a higher viscosity results in better surface finish and a longer tool life of the grinding wheel.
- a higher viscosity reduces the efficiency of cooling.
- a lower viscosity reduces the material removal rate.
- a lower viscosity results in excessive oil mist.
- a higher viscosity reduces the efficiency of purification if the filtration is accomplished by means of a centrifuge.

Additives

- EP additives must only be active during the grinding process.
- Materials of the machine and paint must not be effected by additives.

Solid matter additives

- Solid matter additives increase the wettability of the coolant. But they must not have any negative side effects, such as:
- Porous parts of the grinding wheel must not get clogged and grinding swarfs and sludge must not be held back,
- Aging of the grinding oil must not be increased and there should not be any additional consumption of coolant caused by wetting.

Possibly little foaming

- Even at extensive use it is of advantage. Heavy foaming (air in oil) reduces the oil pressure and oil quantity at the nozzle and subsequently the grinding result:
- Reduced material removal rate, increased grinding time,
- Shorter tool life of grinding wheel,
- Thermal rim zone damage to ground gear flanks.

Oil mist formation

- Must not become bothersome, even under extreme grinding conditions.

Characteristic	Specification
Recommendet grinding oil	Sintogrind 353
Viscosity at 40 °C (DIN 51562)	8,4 mm^2/s
Density at 15 °C	0,82 g/cm^3
Flash point (DIN ISO 2592)	170 °C
Water risk factor	1
Filling location	Coolant filtration unit
Supplier	Oil-Held (AVIA)

Characteristic	Specification
Recommended grinding oil	Diagrind 535
Viscosity at 40 °C (DIN 51562)	9,8 mm^2/s

Density at 15 °C	0,884 g/cm^3
Flash point (DIN ISO 2592)	146 °C
Water risk factor	2
Filling location	Coolant filtration unit
Supplier	Oil-Held (AVIA)

Characteristic	Specification
Recommendet grinding oil	Dascolene 617
Viscosity at 40 °C (DIN 51562)	18 mm^2/s
Density at 20 °C	0,87 g/cm^3
Flash point (DIN ISO 2592)	> 170 °C
Water risk factor	1
Filling location	Coolant filtration unit
Supplier	STUART GmbH

Hydraulic Oil

Characteristic	Specification
Recommended hydraulic oil	Mobil DTE 25
Lubricant type (DIN 51524/2)	H-LP
Viscosity type according to ISO	VG 46
Viscosity at 40 °C (DIN 53015)	44 mm^2/s
Density at 15 °C	0.877 g/cm^3
Flash point (DIN 51758)	219 °C
Pour point	– 27 °C
Water risk factor	2
Filling location	Hydraulic tank
Supplier	Mobil Oil
Quantity	33 Liters

Grease

Grease for high RPM

Note - Grease for high RPM

Grinding spindle and dressing spindle bearings are sealed high precision ball bearings and greased for life. There is no way and no need to regrease the bearings.

Characteristic	Specification
Recommended grease	Arcanol® L-210
Temperature range	– 40 to 160 °C
NLGI consistency class (DIN 51818)	3

Basic oil viscosity (n40)	65 mm²/s
Dripping point (DIN 2176)	240 °C
RPM value (n x d_m)	1.000.000 mm/min
Application	Grinding spindle (motor spindle) Harmonic drive gear box
Supplier	FAG
Quantity	Permanent lubrication

Grease for low speed application

Note - Grease for low speed application

This grease is recommended for linear bearings and for grease of the central lubrication.

Characteristic	Specification
Recommended grease	Klüberplex® BEM 34-132
Temperature range	– 35 to 140 °C
Density at 20 °C	ca. 0,9 mm²/s
NLGI consistency class (DIN 51818)	2
Dripping point (DIN 2176)	> 220 °C
Flow pressure at – 35 °C (DIN 51805)	0,14 MPa
RPM characteristic (n x d_m)	400 m/min
Application	• Friction bearings • Ball spindles • Other bearings of low RPM
Supplier	Klüber
Quantity	Permanent lubrication

Traction Liquid

Recommended traction liquid for workpiece drive

It is imperative to apply the traction oil "Santotrac 50" specified by Reishauer AG for the lubricant for the workspindle drive.

Denotation	Technical data
Specified lubricant	SANTOTRAC 50
Color	Yellow liquid
Boiling point	310 °C
Steam pressure	12 mm Hg at 177 °C
Viscosity at 18 °C (DIN 53015)	5.120 mm²/s
Density at 15 °C	0.90 g/cm³
Flash point (DIN 51758)	163 °C

Denotation	Technical data
Pour point	– 37 °C
Water risk factor	1, very low, water soluble
Application	Friction wheel of workspindle drive
Filling location	Workspindle drive
Manufacturer	Monsanto
Quantity	1.8 l

Lubricant – Pneumatic Unit

Characteristic	Specification
Recommended lubricant	Mobil Vactra Oil No. 2
Lubricant type (DIN 51524/2)	CLGP
Viscosity class according to ISO	VG 68
Viscosity at 40 °C (DIN 53015)	65 mm^2/s
Density at 15 °C	0,884 g/cm^3
Flash point (DIN 51758)	230 °C
Pour point	– 13 °C
Water risk factor	2
Filling location	pneumatic air oiler
Supplier	Mobil oil
Quantity	0,2 l

Equivalent Oil and Grease

Note

In case other utilities are used by a customer, the unit must be completely drained and cleaned prior to using a different working material. The product used must correspond to specifications mentioned.

The utilities used at Reishauer during test runs and commissioning is **highlighted** in the following table. Regulating devices on the machine are adjusted accordingly.

Supplier	Hydraulic oil	Lubricant	Grease, high RPM	Grease, low RPM
Mobil Oil	DTE 25	Vactra Oil No. 2	–	Mobilplex 47
Aral	GF–46	–	Aralub HLP 2 for Harmonic-Drive gearbox	–
Avia	Fluid RSL ISO 46	RSU ISO 68	–	–
BP	Energol HLP–D46	Maccurat 68	Energrease LS-EP 2 for Harmonic-Drive gearbox	–
Elf	Elfolna DS 46	–	–	–
Esso	Nuto H 46	FEBIS K 68	Beacon EP 2 for Harmonic-Drive gearbox	–
FAG	–	–	**Arcanol L-210**	Arcanol L-75

Utilities

Supplier	Hydraulic oil	Lubricant	Grease, high RPM	Grease, low RPM
Klüber	Lamora HLP 46	Lamora D 68	**Isoflex LDS 18 Special A**	Klüberplex BEM 34-132
Shell	Tellus 46	Tonna S68	Alvania EP (LF) 2 for Harmonic-Drive gearbox	–
Tamoil	TAM HYDRO 46	TAM WAY 68	–	–
Texaco	RANDO HA 46	–	Multifak EP 1 for Harmonic-Drive gearbox	–

Filling Gas

Note

Filling gas for hydraulic accumulator

Characteristic	Specification
Nitrogen bottle filled with	10 MPa
Temperature range	– 10 to 80 °C
Class	4.0 pure
Composition	99,99 Vol-% N_2

Workpiece, Grinding Wheel

Workpiece

See also in this CHAPTER *"Working range, Workpiece"*.

Workpiece

Workpiece orientation	vertical
Grinding feed	0 - 5.0 mm/revolution
Workpiece RPM during grinding	max. 600 RPM
Workpiece RPM during runout check (JOG mode)	50 RPM

Grinding Wheel

Warning - Danger of injury caused by wheel breakage

The use of incorrect grinding wheels can cause severe injury.

The grinding wheel can burst!

On the RZ 303C only grinding wheels, which are certified for peripheral speed of min. 75 m/s, must be applied.

Use exclusively dressable grinding wheels with the following specifications:

Specification grinding wheel, general

Outside diameter	max. 300....min. 206 mm
Max. width	145 mm
Bore diameter (tolerance of locating flange: g6)	160 - H7 mm
Face runout	0.2 mm
Module, max.	5.5 mm (6 mm)
No. of starts of grinding wheel, lead max. 32 mm	1 ... 5
Total weight at max. width (incl. flange)	approx. 35 kg
Max. peripheral speed of grinding wheel	75 m/s (limited to 63 m/s in Japan)

Specification of aluminum oxide grinding wheel

Abrasive	Vitrified aluminum oxide, special vitrified mixtures
Grain size	120 mesh (Rz< 3.2 µm) to 80 mesh (Rz< 6.3 µm). Coarser mesh is for larger module
Grade (hardness)	H - J (L for not hardened steel)
Bonding	vitrified
Structure	Highly porous, fine pores

RP 1F Dressing Device

- **RP 1** for dressing of the grinding wheel with one dressing tool, e.g. with a composite roll.

Type designation codes

- **RP** stands for **R**eishauer **P**rofiling device. As a company neutral term, all RP units receive the designation **Dressing device**.
- **1** stands for the number of horizontal dressing spindles.
- **F** stands for fixed (not swivelable).

Drive, cooling, purge air for spindle

A motor spindle serves as drive for the dressing tools. The revolutions are frequency-controlled and can be preselected via the data input. Grinding oil is applied for the cooling of the dresser spindle motor and can also be used for the wet profiling. The stator of the dresser motor spindle will be cooled with a separate, closed oil loop. Compressed air as an air purge sealing system protects the motor spindle and its bearings against entering of grinding oil and grinding sludge.

RP 1F

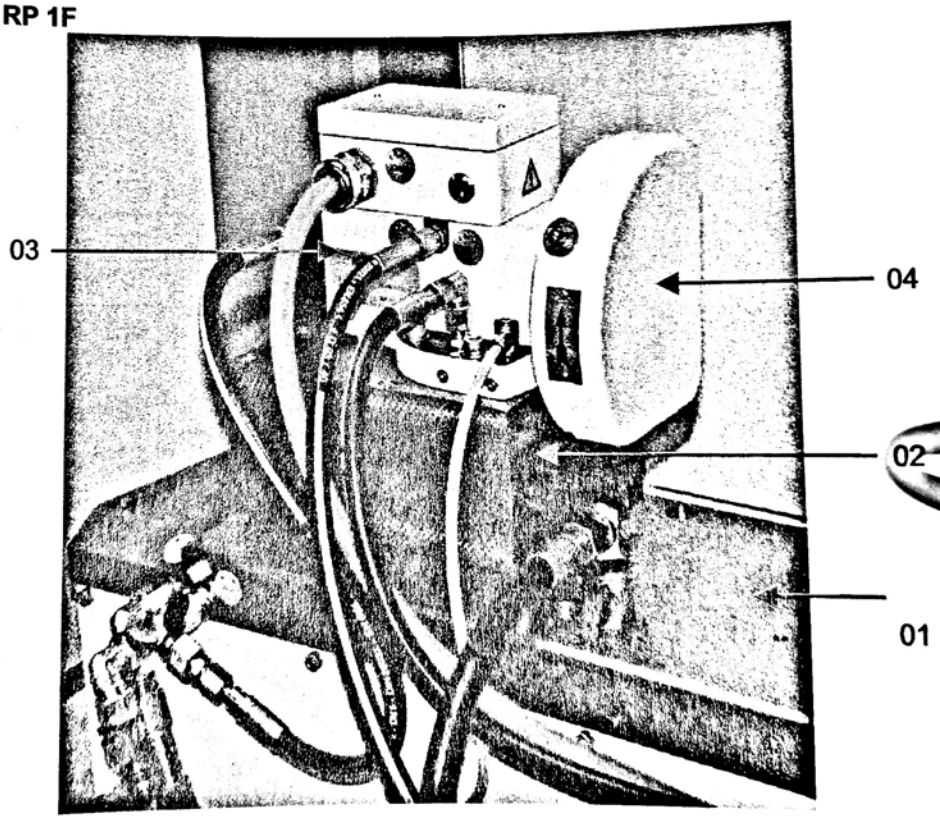


Fig. 31: Dressing device RP 1F

01	Base plate on machine
02	Adaptor plate
03	Dresser motor
04	Dresser spindle incl. dressing tool

Concept

This dressing device consists of the adaptor plate and the left dresser spindle with the spindle drive.

Function

Since there is only one dresser spindle available, the mounted dressing tool must be capable of generating both flanks of the grinding wheel profile and the outside diameter of the grinding wheel, either in one or more passes.

Oil Mist Prescreener mechanical

When the machine is attached to a central oil mist extraction system, then a mechanical oil mist pre-screener can be added.

This item is installed between the oil mist exit pipe and the centralized oil mist suction pipe on the plant side.

The liquid particles in the oil mist are separated in the mechanical oil mist pre-screener and are returned to the cooling oil circuit. This way the centralized oil mist extraction will be relieved.

Warning Through-ignition of flames in case of a fire

The grinding oil applied is in principle flammable.

The mechanical oil mist pre-screener cannot avoid a through-ignition of an explosive flame in to the centralized suction pipe.

Oil Mist Extraction via Central Unit RZ 303C (Option)

Data for central oil mist extraction

Characteristic	Quantity
Required Nominal suction rating	3000 m^3/h
Pipe connection, diameter	ø 300 mm

Grinding Oil Unit (Option)

Hoffmann HSF ...

Function

The grinding oil unit serves 4 main functions:

- Regeneration/purification of the contaminated grinding oil.
- Cooling of the regenerated grinding oil.
- Supply of regenerated and cooled coolant to oil nozzles of the grinding head and to the dressing device, as well as supply of various coolant circuits in the machine.
- Cooling of the workpiece spindle drive, grinding spindle drive, and dressing device with regenerated and cooled grinding oil

The grinding oil unit consists of a filter and a cooling unit.

The **Suction band filter**

The grinding oil flows through synthetic fabrics, which lays on top of a suction chamber of a circulating filter band, and the contamination itself is deposited as filter cakes. Via the filter band the contaminated filter sludge is transported to the sludge cart.

- Filtration without auxiliary filtering aids *
- Fully automatic and low maintenance mode of operation.

Afterwards the grinding oil will be cooled in the cooling unit to the working temperature and fed back to the machine circuit.

- Automatic mode of operation without any additive requirements
- Low-maintenance function
- Reduction of grinding oil discharge

The **Cooling unit**

Is equippes with of 2 cooling circuits

- Cooling circuit 1 for cooling of the cleaned grinding oil
- Cooling circuit 2 for cooling of the workpiece spindle drive, grinding spindle drive, and dressing device. The regenerated and cooled grinding oil circulates in a closed circuit and contamination is, therefore, practically eliminated.

Note

Detailed information concerning the grinding oil preparation are to be found in separate documentation "*HOFFMANN DOCUMENTATION*".

* Optional – machining of cast iron – the grinding oil unit can be equipped with an automatic metering station for auxiliary filtering aids.

Fire Extinguisher Unit

Concept

The fire extinguisher unit consists of:

- Steel cabinet for compact extinguisher unit with CO_2-bottle on weighing device, individual PLC, signal light (red), siren, operator panel with status display.
- Emergency power supply via accumulators.
- Manual release button on machine panel.
- Piping for extinguishing liquid and extinguisher nozzles in the machining area of the machine.
- Optical infrared flames detector.
- Temperature maximum detector 70 °C, in air exit duct and on dressing side.
- Automatically actuated air flap in air exit duct.

Note

A detailed description of the fire extinguisher unit can be found in separate manufacturer documentation in FOLDER *Sub-supplier devices / fire protection*: Small extinguisher unit FB704 (Kraft & Bauer Brandschutzsysteme GmbH).

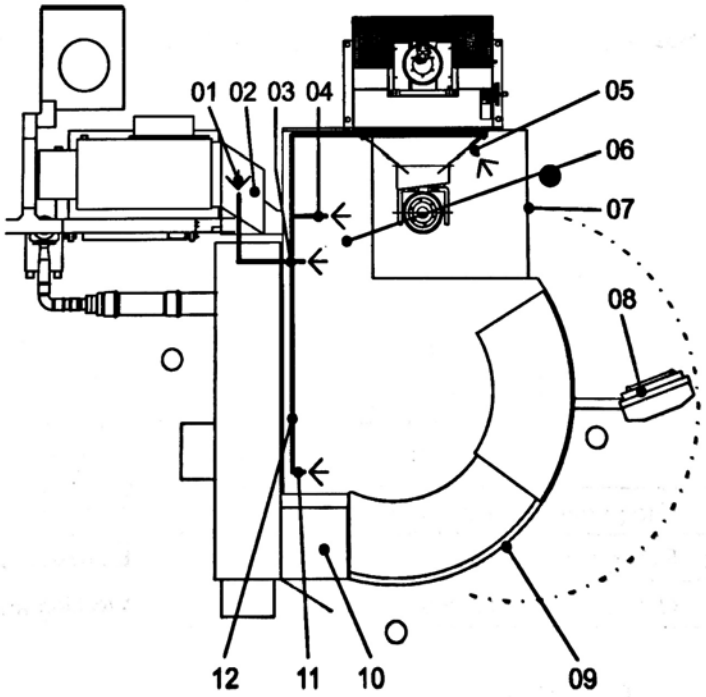


Fig. 32: Floor plan of entire equipment exemplary

01	Extinguisher nozzle air exit duct
02	Automatically actuated air flap, pneumatic cylinder with spring-actuated reset and limit switch for message "flap open".
03	Extinguisher nozzles in rear of working area
04	Extinguisher nozzle in working area

05	Optical infrared flames detector, in front of working area.
06	Heat sensor
07	Door working area
08	Hand release button
09	Circular door
10	Steel cabinet for compact extinguisher unit with CO_2-bottle and PLC
11	Extinguisher nozzle and temperature maximum detector 70 °C dressing side
12	Piping for fire extinguisher unit

Sensors and Extinguisher Nozzles

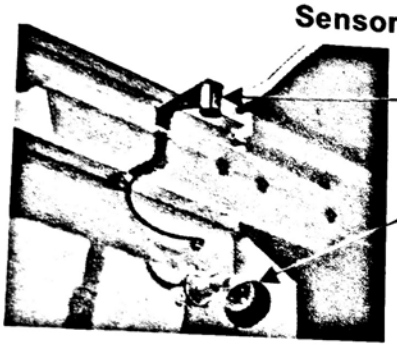
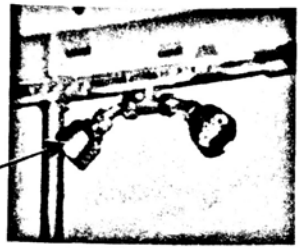
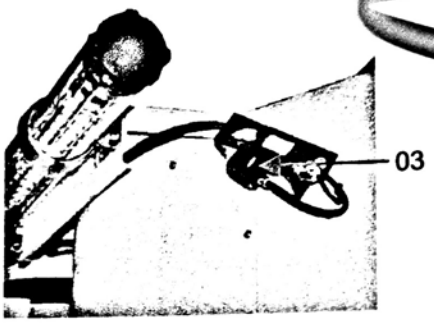


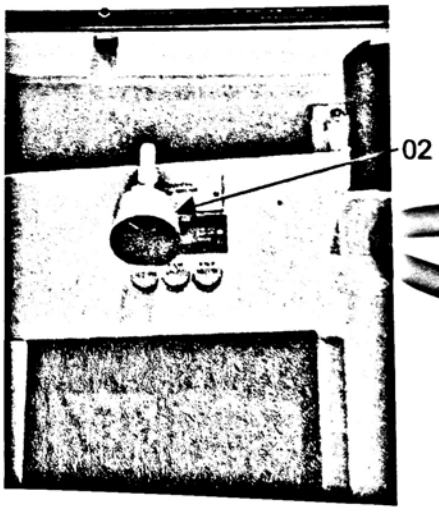
Fig. 33: Dressing side (11)



Rear of working area (03)



Front of working area (05)



Working area (04)

01	Temperature maximum detector 70 °C
02	Extinguisher nozzle
03	Optical infrared flames detector

Function

The fire alarm is initiated by the optical infrared flames detector, maximum temperature detector 70 °C or by the manual alarm pushbutton. The following sequence takes place after the fire alarm is activated.

- Optical and acoustic alarm via signal lamp and siren.
- Release the EMERGENCY STOP of the machine.
- Pneumatic switches off.

- Air flap of oil mist extractor closes.
- After the alarm and with a short delay, CO_2 gas disperses via nozzles into the working area and air exhaust duct.

Secure fuctional readiness

> Check if on the operating field of the fire extinguisher unit the toggle switch is set to On.

> Check if on the operating field of the fire extinguisher unit the green LED On is illuminated.

Display and Operating Elements Fire Extinguisher Unit

Manual release button

Note

The fire extinguisher unit operates under normal circumstances automatically, with the machine doors closed.

The **manual alarm** should be actuated only in case of emergency, in case that the automatic release does not work.

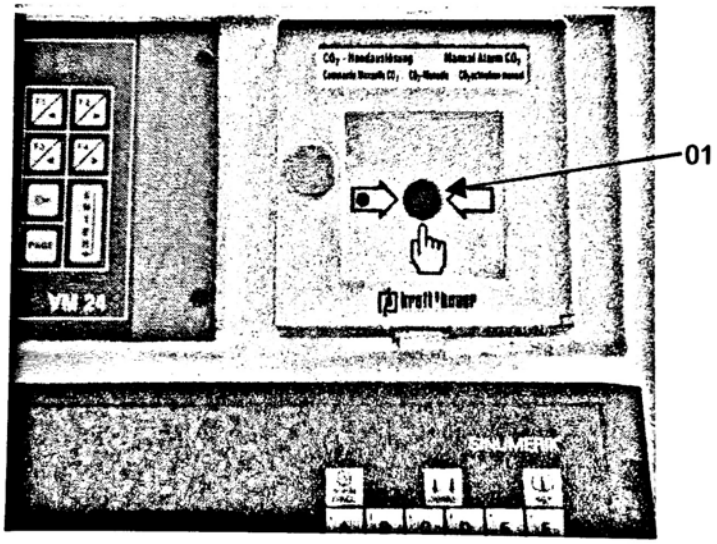


Fig. 34: Manual alarm pushbutton (01) on machine panel

Stack lights

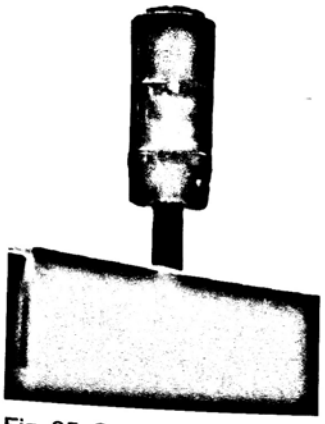


Fig. 35: Stack lights on top of steel cabinet Fire extinguisher unit

Operating field and status display

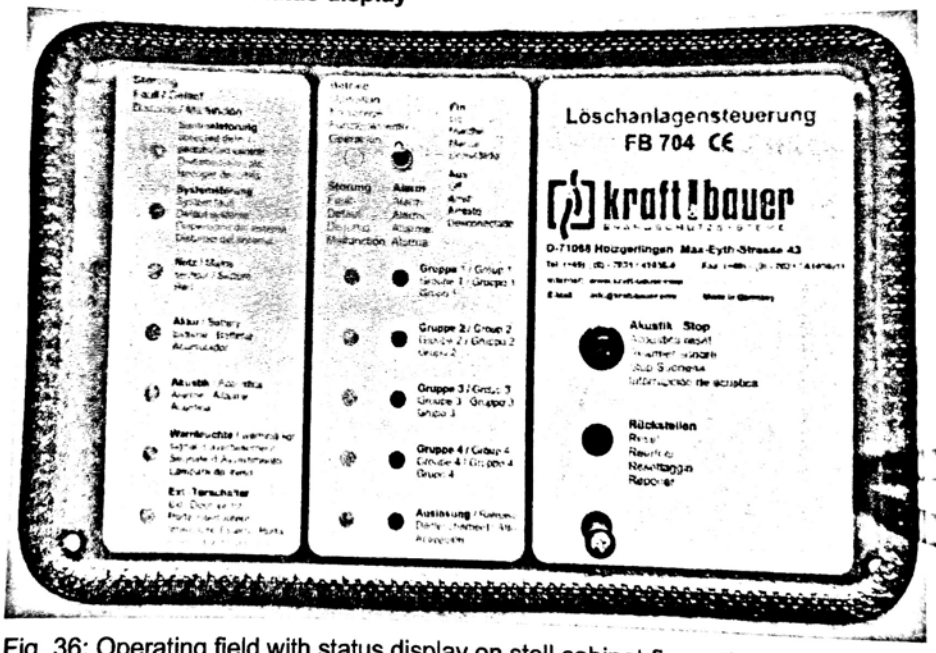


Fig. 36: Operating field with status display on stell cabinet fire extinguisher unit

In Case of Fire

Danger - Loss of oxygen

In case of actuating the fire extinguishing unit CO_2 will disperse. This way the air oxygen in the area of the extinguisher nozzles will be displaced.

In case of actuating the fire extinguishing unit, a safety distance to the working area of minimum 5 m must be kept.

After completion of the extinguishing, it is imperative, to efficiently vent the working area, the environment of the machine and the nearby, lower located rooms.

Connections

Specification for Mains Supply

Not included in the standard delivery are:

- Mains supply lines for the machinery
- Piping outside of the machinery

Quality requirement of mains supply

Quality criteria	Tolerance
Voltage fluctuation	± 10 %
Voltage drop (% of nominal voltage)	15 %
Duration of voltage drop	0.5 s
Frequency fluctuation	2 %

Electrical connection, electrical enclosure

Characteristic	Category	Value
Three-phase current voltage, frequency 3 × 400 V, 50 Hz 3 × 440 ...480 V, 60 Hz	Power	36 kW
	Nominal amperage	52 A
	Fuse max.	80 A
Three-phase current other voltages require an external transformer	Transformer rating	50 kVA
	Main voltage	as specified
	Secondary voltage	as specified
Terminal size	3P + E	max. 50 mm^2

Electrical Connection Grinding Oil Unit Hoffmann

Type HSF 100 SE / K for 1 pcs. machine

Characteristics	Category	Value
Three phase current, standard voltage, frequency 3 × 400 V, 50 Hz	Power	32.5 kVA
	Nominal current	74 A
	Pre fuse	125 A
Connection to main switch Ground terminal size	3/PEN	

Grinding Oil Connection Quality Requirements

The following specifications must be fulfilled in order to match the Reishauer AG quality requirements.

Requirements

Characteristic	Value
Oil purity class according to ISO 4406	22 / 19 / 15
Permissible oil temperature	+ 18 °C ...+ 28 °C
Permissible temperature variation of oil supply	2 °C (± 1 °C)
Nominal flow capacity; grinding oil to coolant oil nozzles, (per machine)	80 ... 160 l/min at 2.0 MPa
Nominal flow capacity; grinding oil to cooling circuits, (per machine)	40 l/min at 0.6 MPa

No. of particles in oil filtrate acc. to ISO 4406, purity class 22 / 19 / 15

Particle size	Purity class	Nbr. of particle per 1 ml
4 ... 6 µm	22	20'000 - 40'000
6... 14 µm	19	2'500 - 5'000
> 15 µm	15	160 - 320

Note

Larger and/or variations of ambient and coolant temperature will deteriorate the size consistency of the ground gears. Use warm-up program!

Reishauer must be consulted for a detailed layout of the installation.

Grinding Oil Connections for Hoffmann HSF 100 SE/K unit

Connections

Floor plan exemplary

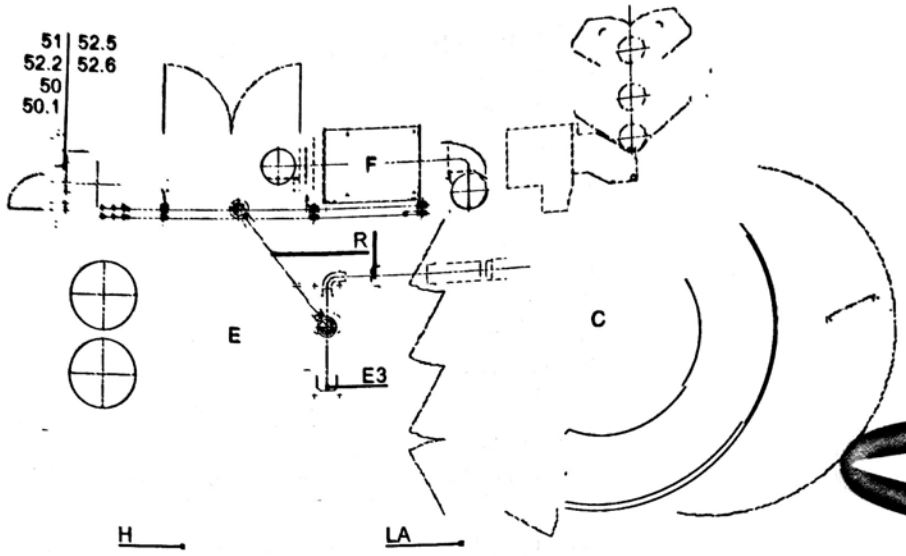


Fig. 37: Grinding oil connections Hoffmann HSF 100 SE/K with 1 pcs. RZ 303C

Pos	Function	Value [l/min]	Pressure [MPa]
50	Tangential nozzle grinding process cooling	...160	0,8 ...2,0
50.1	Flushing work area	...160	ca. 0,8
51	Cooling dressing device, Process cooling	ca. 40	0,5
52.2	Cooling machine base and cooling dresser motor spindle	30	0,5
52.5	Spindle coolant supply line	ca. 15	ca. 0,5
52.6	Spindle coolant return line	ca. 15	ca. 0,5
R	Return cooling media	Max. 200	0
C	Machine		
E	Filter Hoffmann		
E3	Return pump pump		
F	Oil Mist Prescreener mechanical		
H	Filter Hoffmann – Sludge cart		
LA	Fire Extinguisher Unit		

Compressed Air Connection Machine

Pressure	0.6 MPa
Consumption	13.2 m^3/h

For the air consumption of the loader, see separated manual.

Compressed Air Connection Grinding Oil Unit Hoffmann

Characteristics	Value
Pressure	0.6 MPa
Average air consumption	approx. 14 m³/hrs.

Specification of Machine and Accessories

Dimension of machine and accessories	Dimension
Maschine RZ 303C	
Length (incl. air conditioner on electrical enclosure)	3784 mm
Width	2760 mm
Height	2500 mm
Hydraulic and pneumatic unit	
Length	808 mm
Width	608 mm
Height	1906 mm

Weight of machine and accessories	Weight
Subunits	
Maschine RZ 303Cwith tailstock (W-axis) with workpiece loader RL 300NC	13'180 kg
Maschine RZ 303Cwithout tailstock (W-axis) without workpiece loader RL 300NC	11'680 kg
Hydraulic and pneumatic unit, without oil filling	ca. 400 kg
Electrical enclosure	Included
Miscellaneous small units and parts	approx. 100 kg

Tank capacity	Liters
Utilities	
Hydraulic oil	33 liters
Lubricant	0.2 liters
Traction oil	1.8 liters

Specifications of utilities see in this section CHAPTER *Utilities*.

Workpiece loader type RL 300NC; Technical Data	
Characteristic	**Value**
Type	RL 300 NC
Weight	approx. 1500 kg
Location	free standing, to the right of the RZ 303C
Loader principle	flexible automation building block
Cleaning oil for centrifuge station	returned to grinding oil loop
Automation rate	100 % automated
Workpiece change time	5 +/- 1 sec. (work spindle OFF to ON)

Grinding oil unit Hoffmann HSF100 SE / K; Technical Data	
Characteristics	**Value**
Type overall equipment	HSF100 SE / K
Type suction filtering unit	HSF100 SE
Weight – empty (overall equipment)	Ca. 2440 kg
Tank capacity for grinding oil – initial filling	2500 l
Location	separated
Power rating	32,5 kW
Operating voltage	400 V / 50 Hz
Filter	
Filter principle	Suction band filter
Cooling	
Type	Immersion recirculation cooler ERK 210-V-2 (L-C)
Temperature constant control accuracy	2 °C (±1 °C).
Cooling media	R 407C
Cooling media filling capacity	12 kg
Max. room temperature	40 °C
Separate spindle- and motor cooling	regenerated, cooled grinding oil in a separate and closed circuit
Cooling capacity	3.0 kW
Temperature constant control accuracy	2 °C (±1 °C).
Cooling mode	Plates heat exchanger
Tank capacity for cooling oil (grinding oil) – initial filling	45 l

Note

Detailed information about grinding medium (see SUB-CHAPTER *Working material* in the operating manual CHAPTER *Concept, Function, Technical Data)*

RP 1F Dressing device (option)	
Parameter	**Technical data**
Spindle motor M8601 (M45)	
Power rating	1.4 kW
Nominal RPM	7'600 RPM
RPM range	1'000 to 11'500 RPM
Voltage	400 V
Amperage	3.6 A
Frequency	267 Hz

Specification of Machine and Accessories

RP 1F Dressing device (option)	
Parameter	**Technical data**
Bore of dressing tool	52 mm
Nominal diameter of dressing tool, max.	160 mm
Cooling	Grinding oil and air
Weight	28.7 kg

Fire extinguisher unit (option); Technical data	
Characteristic	**Value**
Power supply	230/400 V AC, 50/60 Hz
Amperage in stand-by mode	120 mA
for alarm approx.	250 mA
Extinguishing agent	CO_2
Quantity	30 kg
Tripping	Automatic; sensor in machine Manual alarm; pushbutton on operator panel machine
Max. accu capacity	7 Ah