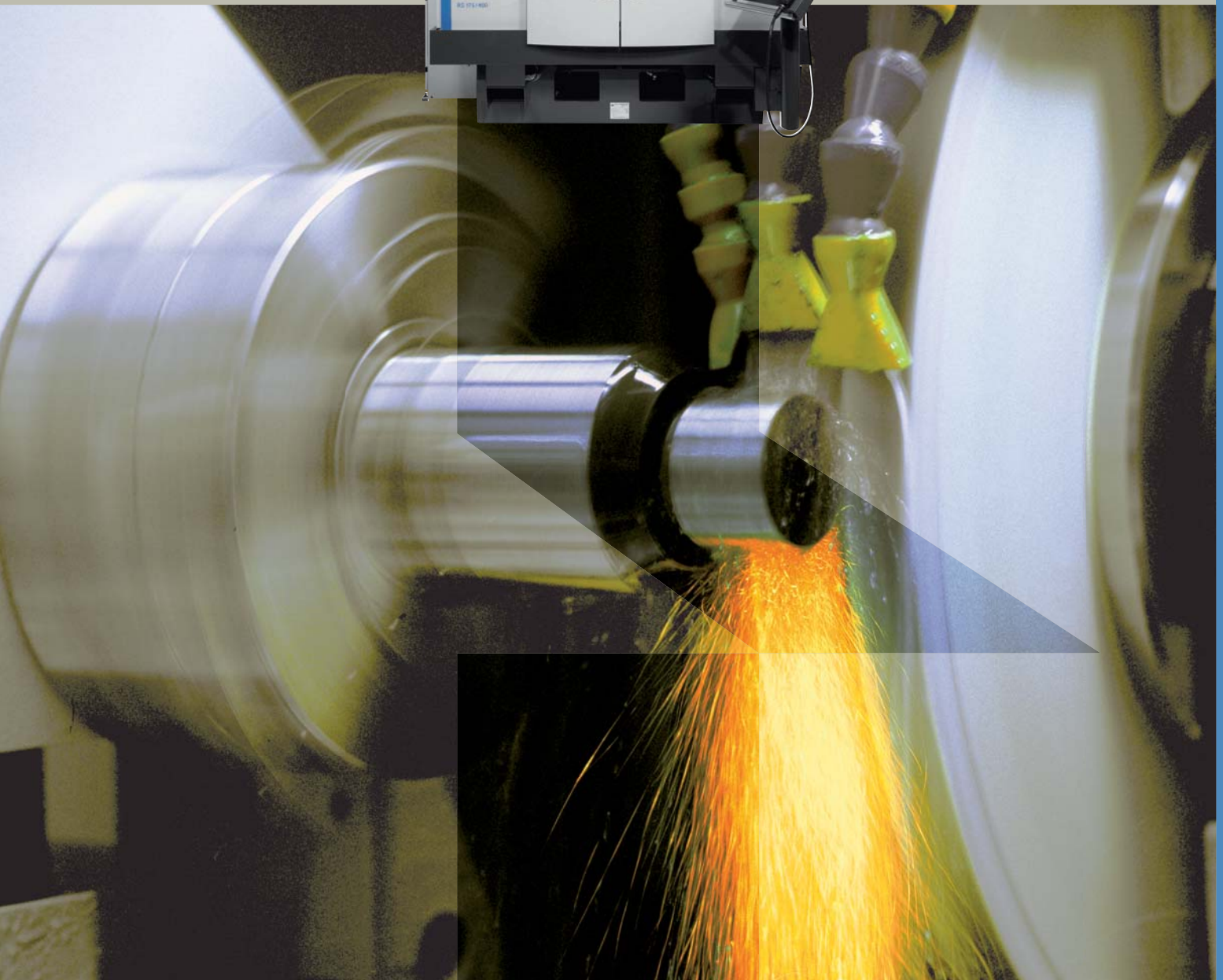


KEL-VERA

The Compact High-Precision Cylindrical Grinding Machine

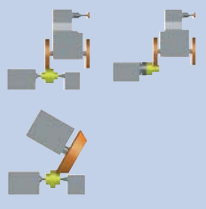


TURNING MILLING GRINDING WORKHOLDING
www.kellenberger.net

 **KELLENBERGER**[®]
EXPECT MORE[™]

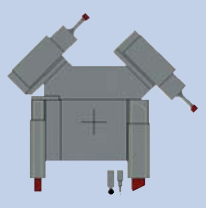
The innovative grinding system

2



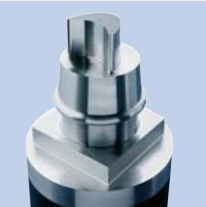
Constructional variants

- Universal type
- Universal type for flanged components
- Production type



different wheelheads

- Universal
- Diagonal
- Tandem types
- Production type



C-axis

For unround components and threads (option)

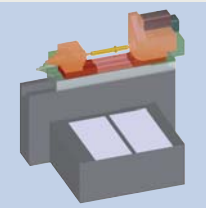
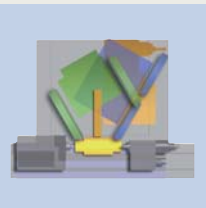


Table concept

Individual table configuration based on lower table



Platform concept

Optimal arrangement of the wheelhead in relation to the workpiece

The truth of the highest precision

KEL-VERA – the on-going consequent development has led to the introduction of this extremely compact machine which is based on a visionary modular concept. The new design of the hydrostatic guideways is meeting even the extremest requirements on universal as well as on production grinding.

Building-up on their experience of more than 15 years with hydrostatic guideways, KELLENBERGER is launching a completely new range of machines. The objective rigorously striven for had been to develop a compact machine which

can be used for the grinding of any kind of components with a length of up to 400 mm.

The concept is based on platforms for the table slide and wheelhead supports, and also for applications where the table slide is the direct starting basis. The new machine models are offered in their standard configuration. Application- and customer-specific versions, however, are also available.

Highly dynamic and rigid guiding and driving systems

The new very rigid hydrostatic guideways provide the basis for higher performance and dynamics in the X- and Z-axes. Further, the productivity and precision on unround grinding are significantly enhanced.

Stronger drives fort he axes of the KEL-VERA are permitting rapid speeds of up to 30 m/min. on the longitudinal axis, and of 15 m/min. on the infeed axis, both movements with higher accelerations.





**Heidenhain control system
GRINDplusIT**

- Windows XP
- 2-processors control system



**Fanuc control system
GE Fanuc 310 is**

- Windows CE
- 2-processors control system



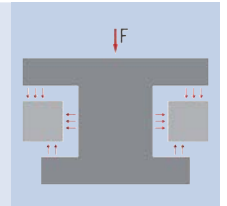
B-axis / KEL-SET

Automatic grinding wheel measuring system (option)



Hydrostatics with holding device

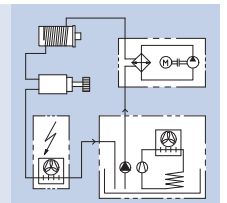
- X- und Z-guideways
 - No stick slip
 - Good damping
 - High dynamics



Cooling system

for a thermally stable machine

- Hydrostatics
- Wheelhead
- Spindles



Advantages of hydrostatics

- Extremely fine correction possibilities
- Excellent dimensional accuracy on interpolating the X- and Z-axes, both for contour grinding and form dressing
- Even after years of use, no wear on the guideways
- Excellent damping and extremely smooth operation

Cooling system

A complete cooling system is ensuring an even thermal economy for the machine. The hydrostatics, wheelhead, internal grinding spindles and the heat exchanger of the electrical cabinet are included in this cooling cycle.

Equipment

- The infrastructure is modular in design, easy to service and easily accessible, with all important functions being monitored
- Connecting plates for steady-rests / dressing spindles / measuring units
- Prepared for the use of oil as a coolant

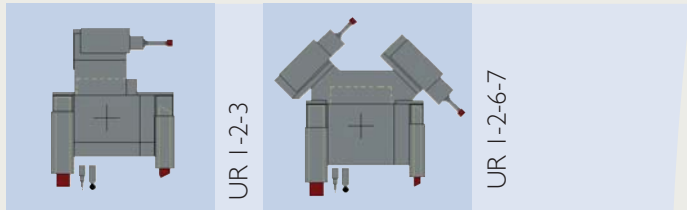
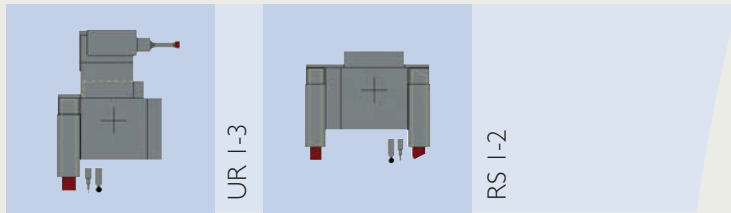
Options

- Increased coolant pressure up to 10 bar
- Interface for fire extinguisher system
- Automatic door drive
- Loading systems

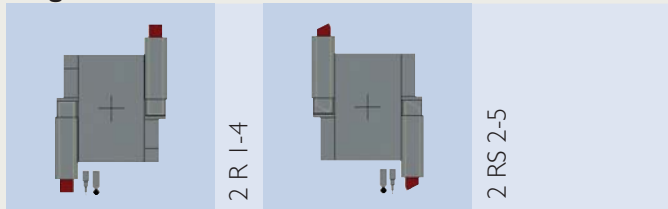
UNIVERSAL type of machine

4

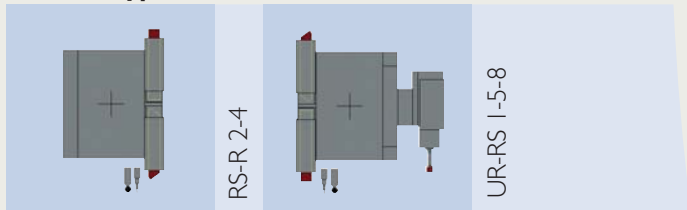
Universal wheelheads



Diagonal wheelheads

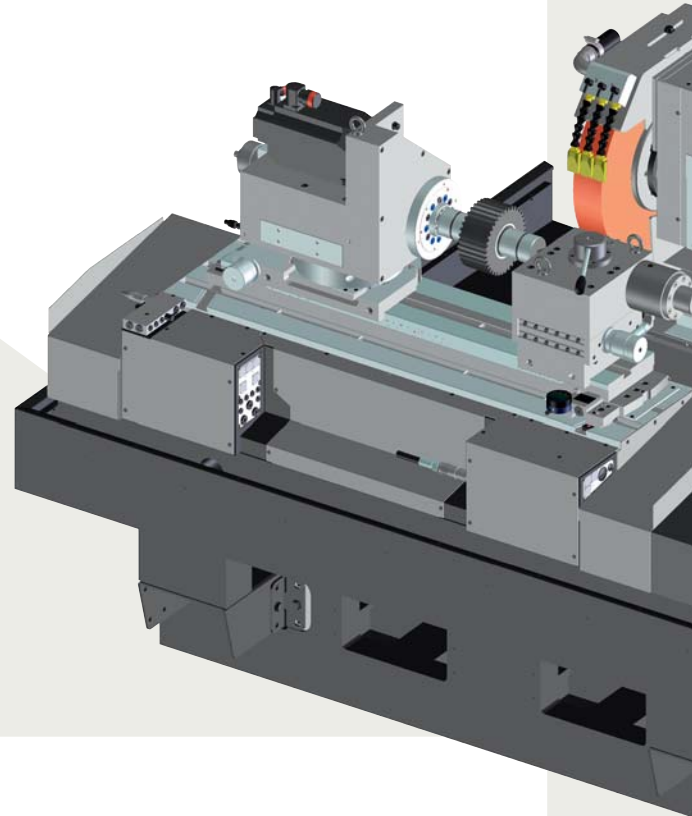


Tandem-type wheelheads



Spindle bearings

- hydrodynamic multi-surface spindle bearings



Universal Cylindrical Grinding Machine

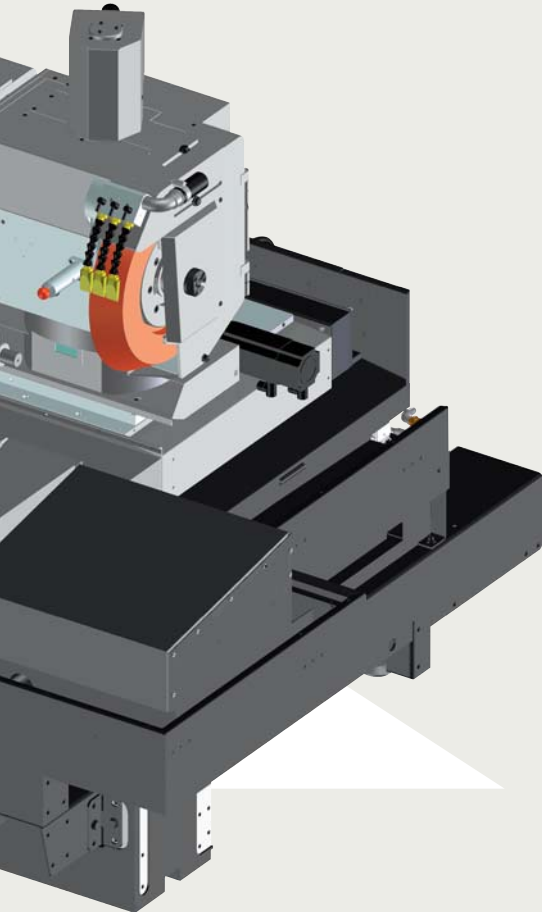
The universal model is designed for the grinding of small and medium-sized batches of components. Equipped with table slide and upper table for cylindricity corrections it can be delivered with 175 mm height of centres. Both external and internal contours can be ground. Different wheelhead configurations, different swivel devices and their corresponding table assemblies are available so that shafts and flanged parts with different contours and profiles can be manufactured in one setting. Our high-precision B- and C-axes complete the application range.

Universal wheelheads

- Motor output 10kW
- Infinitely variable drive of OD and ID grinding spindles
- Grinding wheel $\varnothing 400 \times 63$ or 500×80 mm

Diagonal wheelheads

- Motor output 2×10 kW
- Infinitely variable drive of OD and ID grinding spindles
- Grinding wheels $2 \times \varnothing 400 \times 63$ or 500×80 mm



Tandem-type wheelheads

- Motor output 2 x 10kW
- Infinitely variable drive of OD and ID grinding spindles
- Grinding wheels 2x Ø 400 x 63 mm
- High-frequency ID grinding spindles

B-axis

The B-axis permits automatic positioning of the wheelhead at any angle. A precision worm gear and distortion-free clamping ensure the ultimate in positioning accuracy. The user is supported by comprehensive software. The measuring system provides a resolution of < 0.1 sec.

KEL-SET

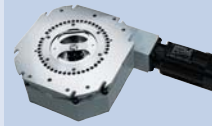
Automatic grinding wheel measuring system. Movements to the measuring ball and to the grinding wheels occur automatically, with their position information being stored in the control system. When swiveling the wheelhead into any angle, the positions of the grinding wheel edges are automatically taken account of.

Advantages for the user

- Programming takes place with the actual dimensions according to the components drawings and independently of the swivel angle of the wheelhead

B-axis

- Automatic infinitely variable positioning of the wheelhead
 - Direct measuring
 - Indirect measuring



KEL-SET

- Automatic grinding wheel measuring system
- EU patent No. EP 0 542 674 B1
- US patent No. 5.335.454

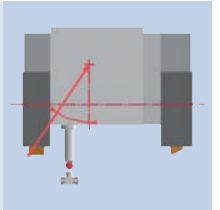
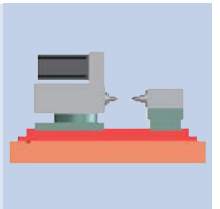


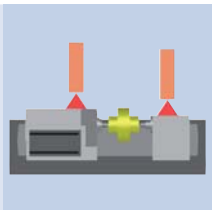
Table concept

- Lower table
- Upper table can be swiveled
 - Height of centers 175 mm
- Dressing device on WH and TS



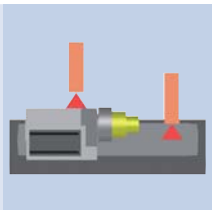
Dressing concept Shafts
(up to 400 mm in length)

- Wheel left, behind WH
- Wheel right, behind TS



Dressing concept Flanges
(up to 50 mm in length)

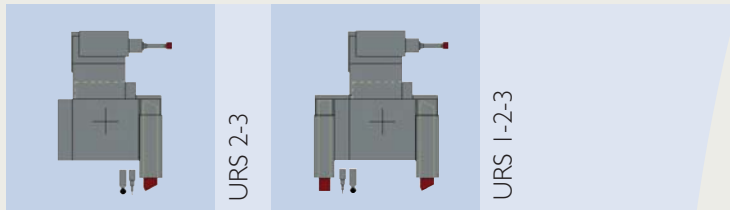
- Wheel left, behind WH
- Wheel right and internal grinding wheel, behind WH or on upper table



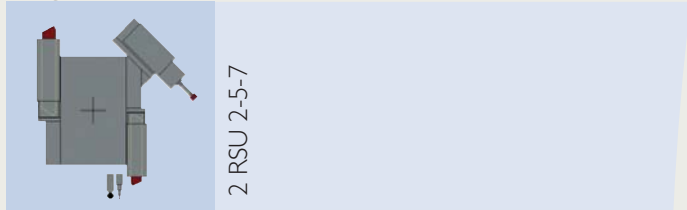
- No need for renewed calibration of the swiveled grinding wheel
- Simple and fast acquisition of the grinding wheel data when retooling the machine
- Integrated tool management for external, face- and internal grinding

UNIVERSAL type of machine for flanged parts (URF)

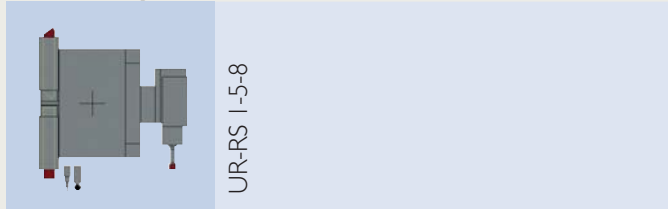
Universal wheelheads



Diagonal wheelhead



Tandem-type wheelhead



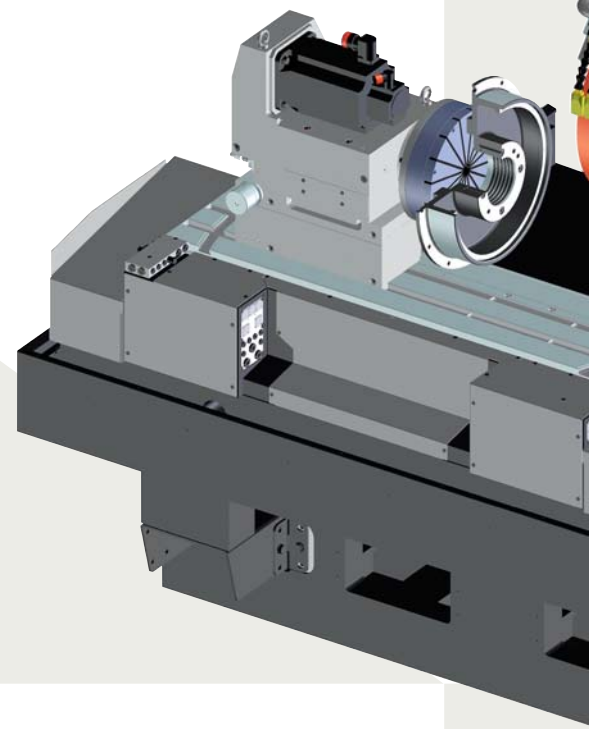
HF ID grinding spindles

- MFM 1224-42
- MFM 1242-60
- MFM 1290
- Frequency converter



Drive motors

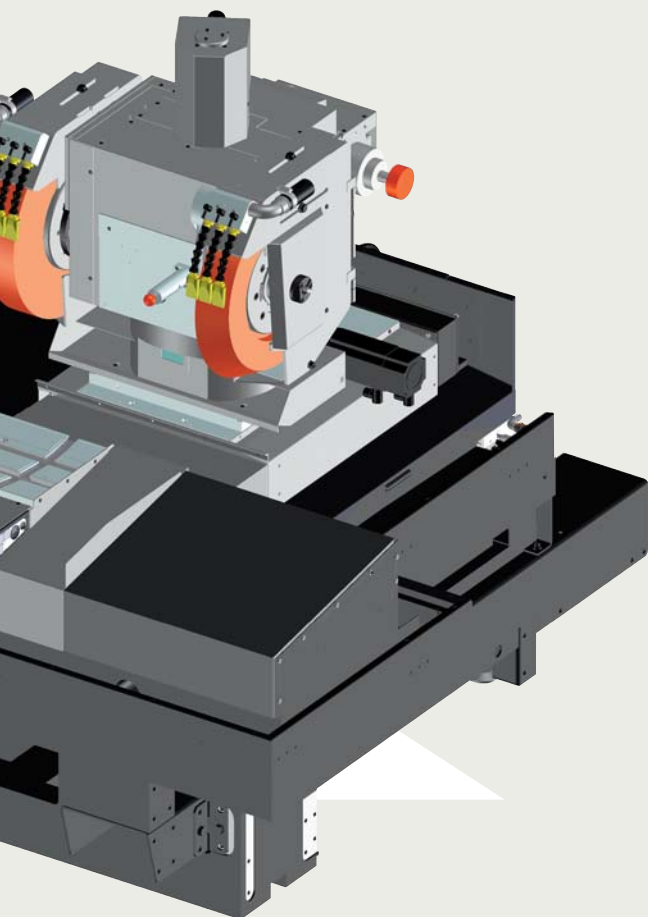
- Water-cooled precision-balanced drive motors



Universal Cylindrical Grinding Machine for Flanged Parts (URF)

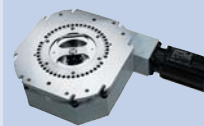
In contrast to the universal model, the URF model is designed specifically for flanged parts up to 500 mm. Internal and external grinding operations can be completed in one single setting. Even larger components can be ground, without any loss of performance, by mounting the workhead directly onto the table slide. Application specific solutions are given, as e.g. for measuring and dressing units, since the relevant equipment can be fixed onto the table slide in different optional positions.

The high-precision B- and C-axes are available for this machine version also.



B-axis

- Automatic infinitely variable positioning of the wheelhead
 - Direct measuring
 - Indirect measuring



KEL-SET

- Automatic grinding wheel measuring system
- EU patent No EP 0 542 674 B1
- US patent No 5.335.454

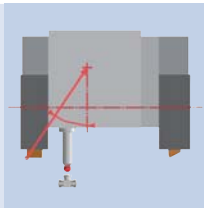
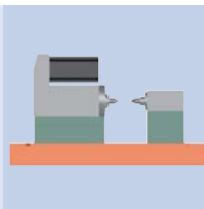


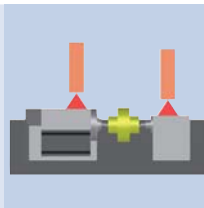
Table concept

- Lower table
 - Intermediate plate for mounting of devices with interface for dressing units
 - Height of centers 250 mm



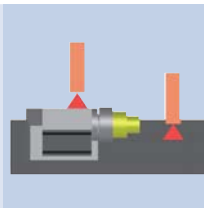
Dressing concept Shafts
(up to 400 mm in length)

- Wheel left, behind WH
- Wheel right behind TS



Dressing concept Flanges
(up to 150 mm in length)

- Wheel left, behind WH
- Wheel right and internal grinding wheel on lower table



Dressing concept

The unique table concept used in this extremely compact grinding machine makes applications possible which use up to four grinding wheels. The dressing concepts as tailored to the three configuration variants permit the use of different dressing tools.

The location of the wheelhead, adjusted optimally to the component and the dressing unit, can be achieved by using the ideal position for attaching the wheelhead-slides and of the B-axis (various positions provided for), in accordance with the wheelhead variant and the wheel diameter selected.

Advantages for the user

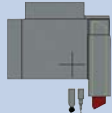
- optimal utilization of space available
- short strokes on automatic feeding
- high productivity
- good grinding wheel utilization



PRODUCTION type of machine

8

Wheelhead for production




- Pos. 0°

RS 2



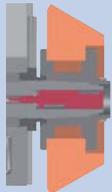
- Pos. 30°

RS 2




Grinding wheel

- Grinding wheel up to $\varnothing 600 \times 150$ mm
- Standard 45 m/sec.
- Optionally up to 80 m/sec.



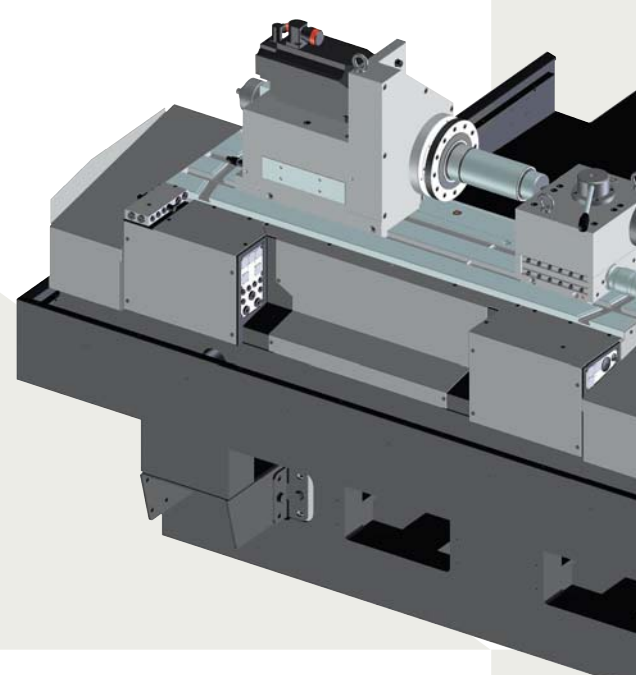
Integrated balancing

- balancing head inside the grinding spindle
- separate GAP sensor



Spindle bearings

- high-accuracy spindle bearings, pre-stressed



Cylindrical Grinding Machine for Production

The production model is designed for medium and large-sized batches of components. The height of centers of 175 mm from the lower table guarantees the highest stiffness.

External contours can be ground exclusively, using a grinding wheel on the righthand side at 0°/30°. The machine does not have an upper table. The processing forces are thus operating close to the guideways, resulting in greater performance and productivity. Any cylindricity deviations can be corrected by means of the appropriate fine adjust-

ment devices mounted on the tailstock or the workhead.

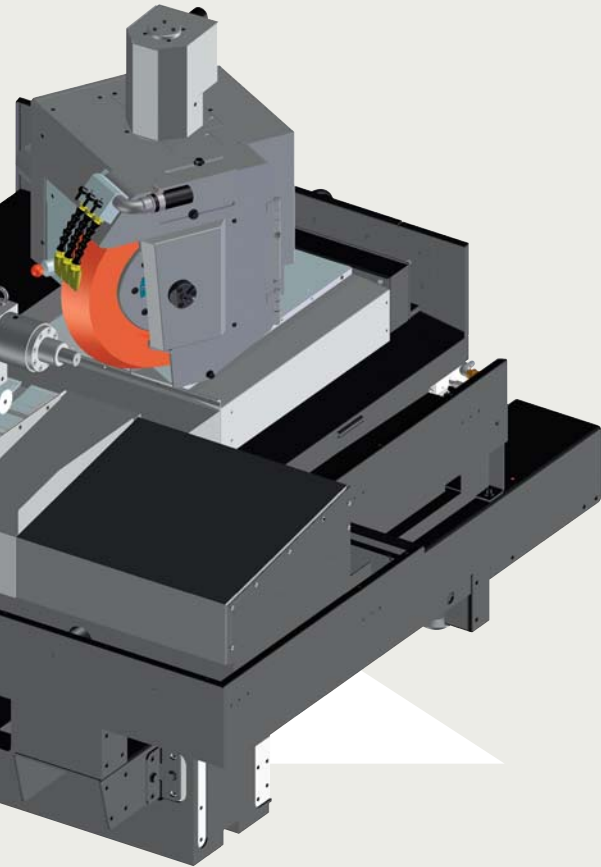
Wheelhead for production

- Motor output up to 20 kW
- Infinitely variable drive of OD grinding spindle
- Grinding wheel up to $\varnothing 600 \times 150$ mm

Performance table

Drive motor	15kW	20kW	20kW
m/s	50	63	80
Grinding wheel			
Ø mm	500/600	500/600	500

- The high-precision C-axis is available as an option

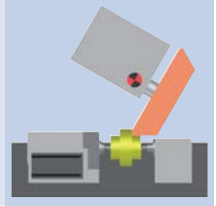


Applications

- High removal rate and lower wear rate using 600mm grinding wheel diameter
- The permissible wheel width of up to 150 mm allows workpiece processing in one operation or multiple O.D.s with wheel sets
- Short change-over times for straight and angular infeed grinding
- Customized dressing units are available

Manual swiveling

- Can be swiveled manually
 - 0° / 30°
 - Pneumatic relief



Center of rotation

- Short wheel edge stroke

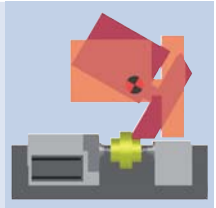
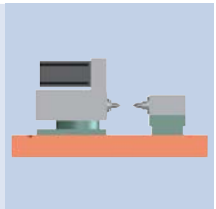


Table concept

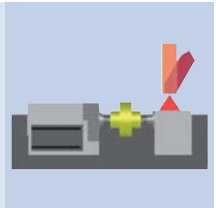
- Lower table
- Height of centers 175 mm



Dressing concept Shafts

(up to 400 mm in length)

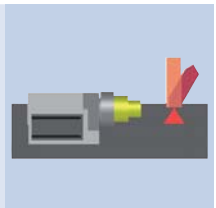
- Wheel straight, behind TS
- Angular wheel, behind TS



Dressing concept Flanges

(up to 200 mm in length)

- Wheels straight and angular on upper table right hand side



Workhead and C-axis, Tailstock

10



Workhead

- 1-800 min-1
- Roundness on workpiece dR < 0.5µm



Workhead with rotating spindle, only

- 1-800 min-1



Tailstock

- Morse taper 4
- Retraction of sleeve 50 mm



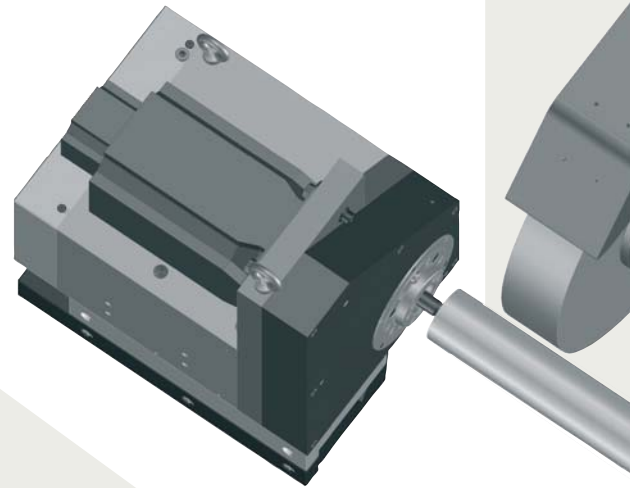
Micro-adjustment of tailstock

- Adjustment range +/- 150 µm



Swivel angle display

- For manual swiveling of the workhead



Workhead

Robust and rigid design on a solid base. Strong motor. Infinitely variable spindle speed. Airlock seals prevent ingress of dirt or water as well as the formation of condensation.

Options

- Roundness of the component dR < 0.2 µm on chucked work
- Microadjustment for quick and easy cylindricity corrections on chucked work
- Swiveling base
- Positioned spindle Stop
- Swivel-angle display

C-axis

The option of interpolating the X- and C-axes makes it possible to use the cylindrical grinding machine also for unround shapes such as polygons, free contours and eccentric forms. The rotary encoder with a resolution of 0.001° is installed directly on the workhead spindle. The non-circular movement is superimposed on the grinding movements so that the grinding machine can use all the grinding cycles on unround grinding too, including the handwheel release for the X-axis.

Tailstock

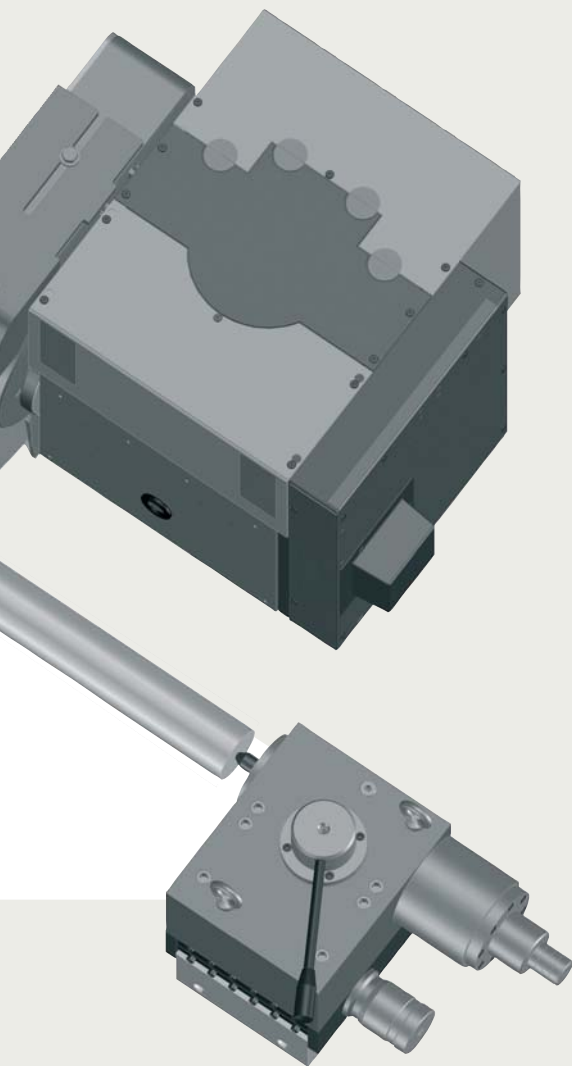
The tailstock features a large and heavy design. The nitride-coated sleeve runs in sturdy ball-bush bearings.

- Excellent rigidity makes it possible to achieve high rates of infeed even with heavy workpieces
- Sensitive sleeve pressure adjustment

Options

- Hydraulic or pneumatic sleeve retraction
- Micro-adjustment for fast and easy cylindricity corrections
- Air-cushioning for ease of tailstock repositioning

Loading systems



Portal loader

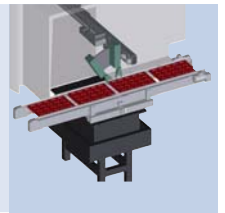
- Collision-free loading
- Universal solution with feeding cycleband
- Integrated assembly with machine including coolant return
- High dynamics with short change-over times
- Cost-optimized solution
- Short change-over times using teach functions and parametric cycles

Robot cell

- High flexibility with a 6-axis robot
- Individual gripping arrangements possible
- Individual palette systems can be considered
- High autonomy
- Cell unit mounted to the side without limiting ease of use
- Short change-over times using teach functions and parametric cycles
- Integration of additional operations inside the robot cell

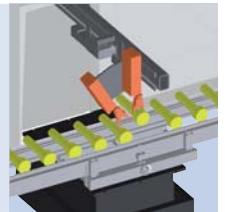
Portal loader

- Integrated portal on machine
- Two pneumatic lifting modules
 - NC drive longitudinally



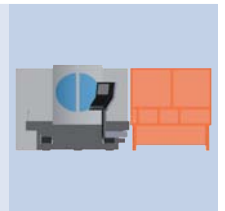
Loading cell

- Fixed to the machine
- Fixed cycle feed for shaft parts
 - Extendable with palettes



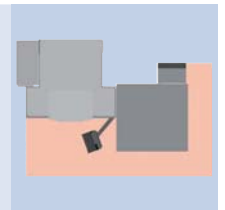
Robot cell

- Loading cell mounted to the side
- Accessibility without limitation



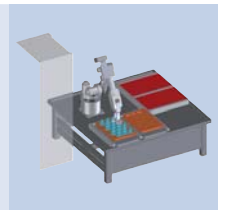
Free access

- For setting
 - For process monitoring
 - For single component grinding



Loading

- Standardized palette concepts
- Platform for individual applications



Heidenhain control system GRINDplusIT

12



Monitor

- 15" TFT
- Softkeys
- Expanded process data display



Keypad

- Mobile hand panel with handwheel / emergency stop / confirmation key



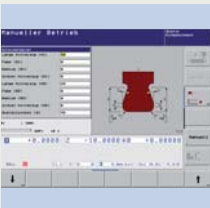
KEL-PROG

- Operator-controlled ISO programming
- Cycle selection via Softkeys
- Form editor
- TNC editor



KEL-GRAPH

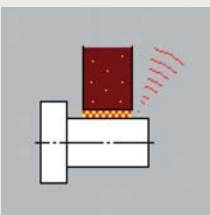
- Graphical programming
- Cylinders, cones
- DXF import via KEL-ASSIST



KEL-TOOL

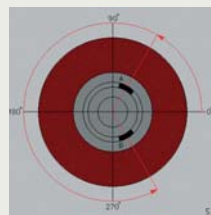
- Tool administration
- Local dressing devices
- Standard wheel definition

KEL-TOUCH



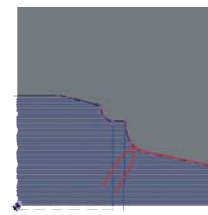
- GAP control with up to 3 sensors
- Operation and display integrated in the control system

KEL-BALANCE



- Semi-automatic balancing for 1 or 2 wheel/s
- Fully automatic balancing for 1 wheel
Operation and display integrated in the control system

KEL-ASSIST



- SW package for the preparation of contour-grinding or profile-dressing programmes
- DXF-import, threads, cleaning cycles



GE FANUC control system 310is

13



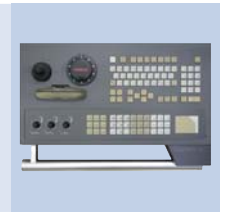
Monitor

- 15" TFT
- Softkeys
- Expanded process data display



Keypad

- Handwheel with confirmation key
- Travel stick
- Mobile handpanel as an option



KEL-PROG

- Operator-controlled ISO programming
- Cycle selection via Softkeys
- Form editor



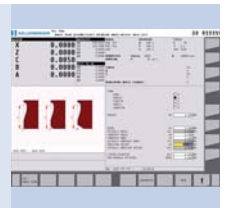
KEL-GRAPH

- Graphic programming
- Cylinders, radii, facets, tapers and contours
- DXF import via KEL-ASSIST

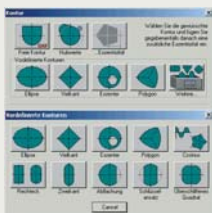


KEL-TOOL

- Tool administration
- Local and global dressing devices
- Standard wheel definition with multiple reference points



KEL-POLY



- SW package for the preparation of unround-grinding programmes
- Correction of deviations in heights of centres

Movomatic



- Control unit ESZ 400
- Maximum 4 digital measuring heads
- Display and operation on ancillary panel

Marposs

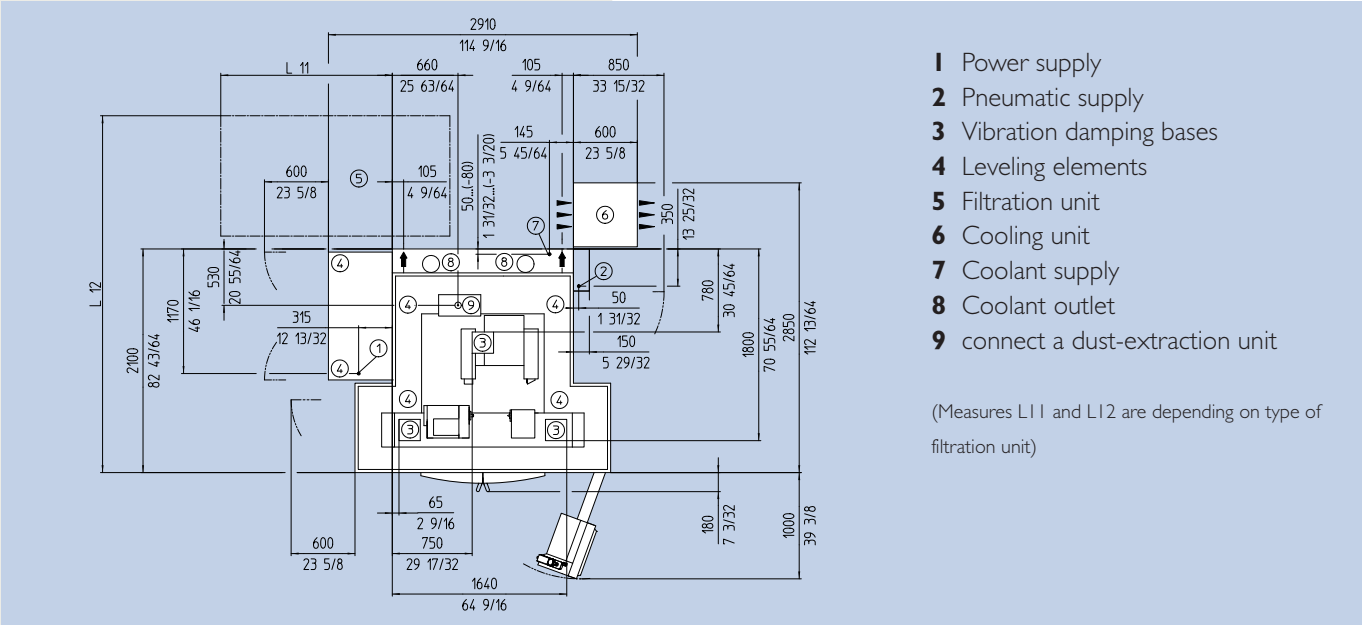


- Control unit P7 ME
- Maximum 4 analogue measuring heads
- Display and operation on ancillary panel

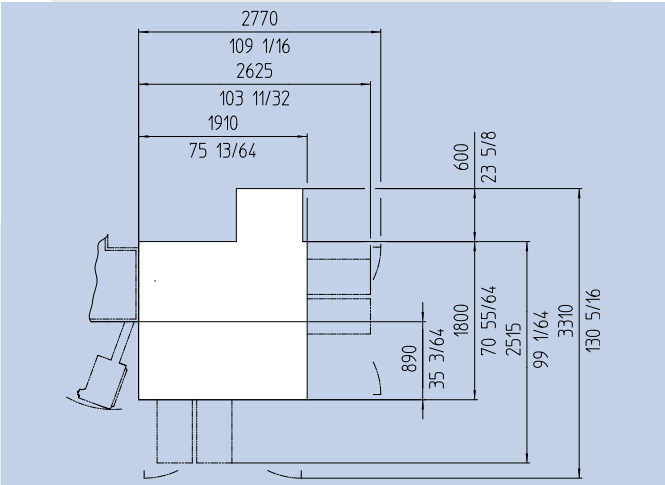
Technical data

14

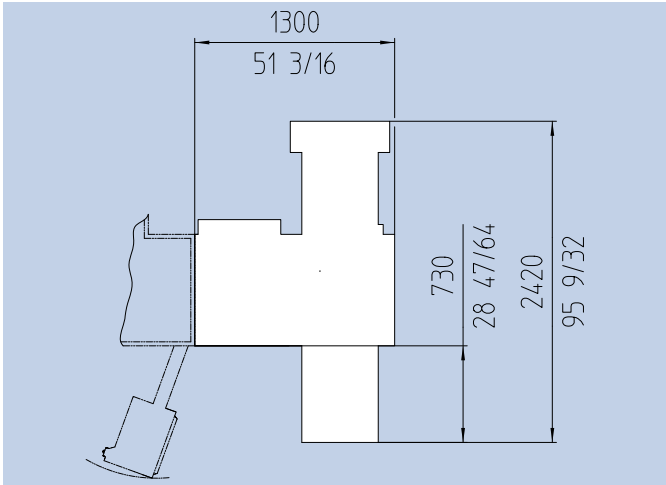
Technical data		Universal	Universal for Flanged Parts (URF)	Production
Main specifications				
CNC control system		GRINDplusIT / GE FANUC 310is		
Distance between centres	mm	400		
Centre height with upper table	mm	175		
Centre height without upper table	mm		250	175
Mains voltage required		3 x 400V / 50 Hz / 3 x 460V / 60 Hz		
Power consumption depending on equipment	A	35 - 80		
Space required	mm	2700 x 2100		
Weight of workpiece				
Between centres	kg	150	250	150
Load on chucked work	Nm	160	320	160
Longitudinal slide: Z-axis				
Travel	mm	600		
Rapid traverse speed	m/min	30		
Resolution	µm	0.1		
Upper Table				
Swiveling range of upper table	Grad	9		
Wheelslide: X-axis				
Travel	mm	350		
Rapid traverse speed	m/min	15		
Resolution	µm	0.1		
Swivel devices				
Swiveling range	Grad	240	240	0 / 30
Resolution B-axis	sec.	0.1	0.1	
Wheelhead				
version		Universal / Diagonal / Tandem		Production
Drive motor	kW	10		15 / 20
Peripheral grinding wheel speed	m/s	45		< 80
Grinding wheel dimensions	mm	Ø 400 / 500		Ø 500 / 600
Workhead				
Rotational spindle speed	min-1	1 - 800		
Driving torque spindle	Nm	60		
Spindle nose / internal taper		MK 5 / ASA 5		
Base part		Fix / adjustment / Micro-adjustment		
Tailstock				
Internal taper		MK 4		
Retraction of sleeve	mm	50		
Base part		Fix / Micro-adjustment		
Clamping area upper table				
Table mounted units	mm	195 x 1100		
Clamping area table slide				
Table mounted units	mm		195 x 1300	
Upper table front side	mm		90 x 1300	
Clamping area cross slide				
Support on cross-slide	mm	430 x 710		



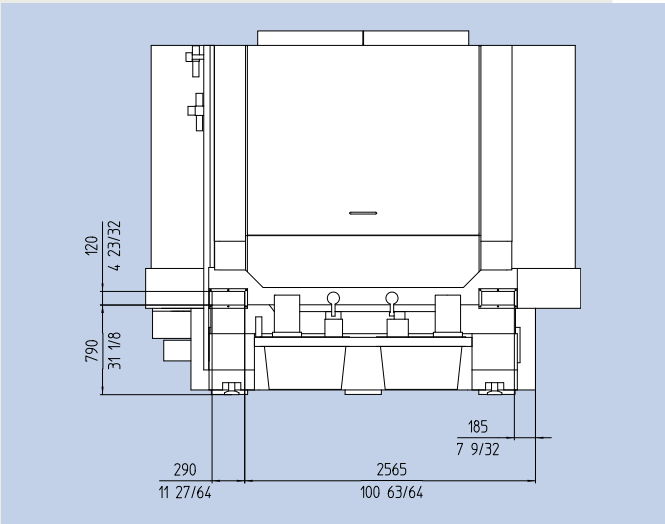
Space-assignment



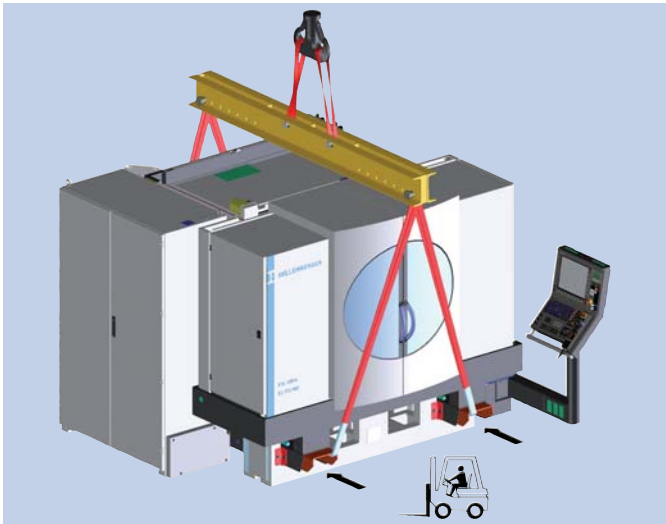
Space-assignment plan including Robot cell



Space-assignment plan including Gantry-type loader



Coolant outlet



Easy transport

Competence and a world-wide partnership



First-class sales and service organization for all the major international markets with local well-trained staff. **KELLENBERGER** guarantees expert advice and support for evaluation, purchase, installation and services of her high-quality grinding systems.

L. Kellenberger & Co.AG

Heiligkreuzstrasse 28
9009 St.Gallen / Switzerland
Phone +41 (0) 71 242 91 11
Fax +41 (0) 71 242 92 22
www.kellenberger.net
info@kellenberger.net

Sales and service in USA and Canada:

Hardinge Inc.

One Hardinge Drive
P.O. Box 1507
Elmira, New York 14902-1507 USA
Phone +1 (607) 734 2281
Fax +1 (607) 735 0570
www.hardinge.com
www.kellenberger.com
info@kellenberger.com

Sales and service in Great Britain and The Republic of Ireland:

Hardinge Machine Tools Limited

Silverton Road, Matford Park,
Marsh Barton, Exeter,
Devon EX2 8NN
Phone +44 (01) 392 208 181
Fax +44 (01) 392 208 199
www.hardinge.com



Your local KELLENBERGER Partner:

