KEL-VERA
The Compact High-Precision Cylindrical Grinding Machine
The versatile grinding system

**Constructional variants**
- Universal type
- Production type

**C-axis**
For unround components and threads (option)

**Table concept**
Individual table configuration

**Platform concept**
Optimal arrangement of the wheelhead in relation to the workpiece

**Dressing systems**
- independent interface at table
- pivotable unit for chucked work
- rigid diamonds
- Form and profile dressers

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**The truth of the highest precision**
KEL-VERA – a 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 20 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 750 mm.

The concept is based on platforms for the table slide and wheelhead supports. The 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 for the axes 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.
The versatile grinding system

Workhead with direct drive
- n 1-500 min⁻¹ with direct drive big
  750 Nm (553 lbf ft) Chucked work
- n 1-1000 min⁻¹ with direct drive small
  320 Nm (236 lbf ft) Chucked work

Tailstock with Micro-adjustment
- Morse taper 4
- Retraction of sleeve 50 mm (1.96 inch)
- optional Retraction of sleeve 80 mm (3.14 inch)
  Adjustment range +/- 150 µm (6 µinch)

Water-cooled precision-balanced drive motors

Hydrostatics with holding device
- X- und Z-guideways
- No stick slip
- Good damping
- High dynamics

Cooling system
for a thermically 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

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.

- excellent roundness and dimensional accuracy thanks to pre-tensioned high-precision antifriction bearings
- Roundness of the workpiece dR < 0.4 µm (< 0.016 µinch) on chucked work
- Belt or direct drive

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

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 (up to 300 kg / 660 lbs)
- sensitive sleeve pressure adjustment

Options
- Increased coolant pressure up to 10 bar
- Interface for fire extinguisher system
- Automatic door drive
- Loading systems
**UNIVERSAL** type of machine

### Universal wheelheads

- ![Universal wheelhead](image)
- ![Universal wheelhead](image)
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- ![Universal wheelhead](image)

### Spindle bearings
- Hydrodynamic multi-surface spindle bearings

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**Universal Cylindrical Grinding Machine**

The universal model is designed for the grinding of small and medium-sized batches of components. It will be delivered with 250 mm (9.84 inch) height of centres, optionally with 300 mm (11.81 inch). 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 (13.6 hp)
- Infinitely variable drive of OD grinding spindles
- Grinding wheel Ø 400 x 63 (16 x 2.5 inch) or 500 x 80 mm (20 x 3.15 inch)

**Diagonal wheelheads**
- Motor output 2 x 10 kW (13.6 hp)
- Infinitely variable drive of OD grinding spindles
- Grinding wheels up to 2 x Ø 500 x 80 mm (20 x 3.15 inch)
Hydrostatic B-axis
- pre-tensioned hydrostatic guide
- the direct drive is wear-free
- 180° swiveling in one second

Direct drive system
- the water-cooled high-torque motor guarantees a high level of torque
- the rotary encoder is integrated in the absolute measuring system of the machine and requires no referencing

Clamping
- the B-axis can be clamped in any position without any deformation
- the large dimensions of the clamps guarantee high clamping moment

KEL-SET
- automatic grinding wheel measuring system
- EU patent No. EP 0 542 674 B1
- US patent No. 5,335,454

Contour B+
- Machining also possible in unclamped state
- short cycle times
- new machining methods
- high flexibility

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
- 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

Tandem-type wheelheads
- Motor output 2 x 10kW (13.6 hp)
- Infinitely variable drive of OD grinding spindles
- Grinding wheels 2 x Ø 500 x 80 mm (20 x 3.15 inch)
- High-frequency ID grinding spindles
  - MFM 1224-24
  - MFM 1242-60
  - MFM 1290

Hydrostatic B-axis
Full-fledged NC-axis with pre-tensioned hydrostatic guideway and direct drive.

The pre-tensioned hydrostatic is the basis for higher accuracy and better surface quality. Steps of 0.0001° can be traveled with ease.

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.
PRODUCTION type of machine

Wheelhead for production

Pos. 0°

Pos. 30°

Grinding wheel
- Grinding wheel up to Ø 600 x 150 mm (24 x 5.9 inch)
- Standard 45 m/sec. (8860 ft/min)
- Optionally up to 80 m/sec. (15750 ft/min)

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 250 mm (9.84 inch) 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 adjustment devices mounted on the tailstock or the workhead.

Wheelhead for production
- Motor output up to 20 kW (27.2 hp)
- Infinitely variable drive of OD grinding spindle
- Grinding wheel up to Ø 600 x 150 mm (24 x 5.9 inch)

Performance table

<table>
<thead>
<tr>
<th>Drive motor</th>
<th>15kW</th>
<th>20kW</th>
<th>20kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>m/s</td>
<td>50</td>
<td>63</td>
<td>80</td>
</tr>
<tr>
<td>ft/min</td>
<td>9840</td>
<td>12400</td>
<td>15750</td>
</tr>
<tr>
<td>Grinding wheel Ø mm</td>
<td>500/600</td>
<td>500/600</td>
<td>500</td>
</tr>
<tr>
<td>Ø inch</td>
<td>20/24</td>
<td>20/24</td>
<td>20</td>
</tr>
</tbody>
</table>

- The high-precision C-axis is available as an option
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 0.0001° 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.

Options
- hydraulic or pneumatic sleeve retraction
- automated cylinder correction
- enlarged travel, 80 mm (3.14 inch)
- reinforced design

Workhead
- Standard, n 1-1000 min-1
- Spindel nose ISO 702-1, size 5
- as desired, with fixed or rotating center

Workhead with direct drive
- n 1-1000 min-1 with direct drive 200
  Spindel nose ISO 702-1, size 5
- n 1-500 min-1 with direct drive 300
  Spindel nose ISO 702-1, size 8

Tailstock
- Morse taper 4
- Retraction of sleeve 50 mm (1.96 inch)

Synchronized tailstock
- with integrated sleeve
  - Morse taper 4
  - Retraction of sleeve 50 mm (1.96 inch)

Micro-adjustment
- Adjustment range +/- 150 µm (6 µinch)
- optionally with automatic cylinder correction
Heidenhain control system GRINDplus 640

**Monitor**
- 19˝ TFT Multitouch
- expanded process data display

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

**KEL-PROG**
- dialog based ISO programming
- Cycle selection via Softkeys

**KEL-FORM**
- Standard non-circular contour

**KEL-GRAF**
- graphical programming
- Cylinders, cones, radii
- DXF import

**KEL-TOOL**
- Tool administration
- local dressing devices
- Standard wheel definition

**OPTIONS**

**Contact-Sensor**
- GAP control with up to 6 sensors
- Operation and display integrated in the control system

**Balancing-Device**
- semi-automatic or automatic balancing of the grinding wheels
- Operation and display integrated in the control system

**In-process gauge system**
- up to 4 gauge heads
- interrupted diameters
- non-interrupted diameters
- passive longitudinal positioning
Monitor
- 19” TFT Touch
  - expanded process data display

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

KEL-PROG
- dialog-controlled ISO programming
  - Cycle selection via Softkeys

KEL-FORM
- Standard non-circular contour

KEL-GRAF
- graphic programming
- Cylinders, cones, radii
  - DXF import
- Visualization of the grinding process

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

KEL-SOFT OORG
- 3D software for creating non-circular grinding programs
- Algorithms for error detection and correction. Contour and grinding analysis
- Animation of non-circular motion and profile programmes

KEL-SOFT Profil
- Contour-grinding or profile-dressing programmes
- CAD import, thread, clearing cycles

Remote diagnostics
- Reduced standstill and maintenance times
- Reduction in costs for service and maintenance
- Easy operation
- Highest IT security standard
## Technical data

<table>
<thead>
<tr>
<th><strong>Technical data</strong></th>
<th><strong>Universal</strong></th>
<th><strong>Production</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control system</td>
<td>GRINDplus 640 / GE FANUC 31i</td>
<td></td>
</tr>
<tr>
<td>Distance between centres</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td>Centre height</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td>Mains voltage required</td>
<td>3 x 400V / 50 Hz / 3 x 460V / 60 Hz</td>
<td></td>
</tr>
<tr>
<td>Power consumption depending on equipment</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Space required (length x width)</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td><strong>Weight of workpieces</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between centres</td>
<td>kg</td>
<td>lbs</td>
</tr>
<tr>
<td>Load on chucked work</td>
<td>Nm</td>
<td>lbf</td>
</tr>
<tr>
<td><strong>Longitudinal slide: Z-axis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td>Rapid traverse speed</td>
<td>m/min</td>
<td>ipm</td>
</tr>
<tr>
<td>Resolution</td>
<td>µm</td>
<td>µinch</td>
</tr>
<tr>
<td><strong>Wheelslide: X-axis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>mm</td>
<td>inch</td>
</tr>
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</tr>
<tr>
<td>Resolution</td>
<td>µm</td>
<td>µinch</td>
</tr>
<tr>
<td><strong>Swivel devices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swivel range</td>
<td>Grad</td>
<td>degree</td>
</tr>
<tr>
<td>Resolution B-axis</td>
<td>sec</td>
<td>sec</td>
</tr>
<tr>
<td><strong>Wheelhead</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types</td>
<td>Universal / Diagonal / Tandem</td>
<td>Production</td>
</tr>
<tr>
<td>Drive motor</td>
<td>kW</td>
<td>hp</td>
</tr>
<tr>
<td>Peripheral grinding wheel speed</td>
<td>m/s</td>
<td>ft/min</td>
</tr>
<tr>
<td>Grinding wheels</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td><strong>Workhead</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotational spindle speed</td>
<td>min-1</td>
<td>upm</td>
</tr>
<tr>
<td>Drive torque</td>
<td>Nm</td>
<td>lbf</td>
</tr>
<tr>
<td>Internal taper</td>
<td>MK 5 / ASA 5</td>
<td></td>
</tr>
<tr>
<td>Lower part</td>
<td>Fix / Micro-adjustment lower part</td>
<td></td>
</tr>
<tr>
<td><strong>Tailstock</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal taper</td>
<td>MK 4</td>
<td></td>
</tr>
<tr>
<td>Retraction of sleeve</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td>Lower part</td>
<td>Micro-adjustment</td>
<td></td>
</tr>
</tbody>
</table>

All specifications and designs are subject to alterations without notice.
Space-assignment plan KEL-VERA

Coolant outlet

Easy transport
Competence and a world-wide partnership

Over the years the Hardinge Group has constantly evolved its range of products and areas of activity. As globally active and diversified company, the Hardinge Group has production sites in North America, Europe and Asia. In addition to the development and construction of turning machines and work-holding fixtures, with Bridgeport the Hardinge Group also has a manufacturer of machining centers.

The Hardinge Group is a major global provider of customer-specific solutions for grinding applications. The Hardinge Grinding Group encompasses all activities in the areas of cylindrical, surface and jig grinding, and includes the well known brands of Kellenberger, Hauser, Tschudin, Jones & Shipman, Usach and Voumard. The Hardinge Grinding Group has a global network of partners with trained staff in sales, service and application engineering. This guarantees competent advice and support for evaluation, purchase, and use of the grinding systems.

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