SMART COMPACTION: VARIOCONTROL.
UNIQUE BOMAG TECHNOLOGY FOR SINGLE DRUM ROLLERS.
MILLIONS OF KILOMETRES BEAR OUR MARK.

Any contractor involved in building roads, landscaping, or other earthworks projects needs to be able to do one thing above all: compact. And to help you achieve the best results, we build the best machines. These range from our compact, manoeuvrable single drum roller to a 28 tonne heavy-weight model. For over 60 years, our company has helped write road construction and compaction technology history.

And with our cumulative expertise we drive innovation and set the pace of an entire industry. At the same time, we have developed a variety of new technologies. Measuring systems such as VARIOCONTROL, which monitors and optimises compaction in real time, have revolutionised asphalt compaction. Our specialists working around the world and our partners in more than 120 countries are on hand to support you, from the fitting out of machines to solving the most demanding challenges.

We owe our power of innovation to more than 2,500 committed employees worldwide. This expertise has made us the world market leader in compaction. Driven by our unconditional commitment to quality: during product development and production, in training our employees, and in providing a level of service which guarantees only the best on site support.
ONE SOLUTION FOR THE MOST VARIED CONSTRUCTION SITES.

What about having smart technology in your single drum roller which not only improves the efficiency of compaction work, saves time and energy, minimises inspection work, but also documents compaction results? And what if you could increase the versatility of your single drum roller as well by being able to make use of this feature on any type of construction site? This is exactly what BOMAG VARIOCONTROL will do.
Technologies such as VARIOCONTROL have made BOMAG the leading global provider in compaction technology, and also in surface covering dynamic compaction control with BOMAG Compaction Management BCM 05.

Increasing quality requirements and the pressure of constantly rising costs and raw material prices mean companies are continually faced with ever greater challenges. Being a contractor you want to make sure that there will be no expensive remedial work later on, but this often means a lot more effort is required with standard compaction machinery. This reduces profit and your competitive edge when tendering for contracts. Furthermore, a high risk still remains when carrying out construction work.

But there is a solution to all of this: BOMAG VARIOCONTROL for single drum rollers.
MULTIPLE CAPABILITIES IN ONE SYSTEM.

VARIOCONTROL FEATURES AT A GLANCE:

**ECONOMICAL**
- Thicker layers and fewer passes

**ACCURATE**
- Total accuracy – thanks to the BVC directed vibrator
- A perfect fit – thanks to the infinitely variable, automatic adjustment

**TRANSPARENT**
- It is there to see – compaction progress is shown in real-time.
- Verifiable – documentation if required
SMART
- Optimised compaction power – with automatically controlled amplitude

FLEXIBLE
- One machine, many applications – from sensitive compaction to full depth effect
- Sensitive – using oscillation mode
- Powerful – with directed oscillation

INTUITIVE
- Manual or automatic – just one selection switch
The compaction energy is automatically and smoothly adjusted as conditions dictate. This applies to all materials used in soil and rock construction. Adaptation of compaction energy is provided by a specially designed exciter system, which continuously varies the vibration direction of the drum. The direction ranges from horizontal oscillation for highly sensitive compaction of surfaces in oscillation mode, to vertical oscillation for maximum depth effect.

VARIOCONTROL is operated using a rotary switch in the cab. Here the driver sets the required target value for compaction, which is then automatically controlled by the system. During operation, the system indicates when no further passes are required. Overcompaction of the soil and unwanted drum bounce are prevented.

- Higher compaction output (m³/h)
- Enhanced depth effect
- Reduction of passes
- Uniform compaction
- Early detection of soft spots
- Better surface quality
- Reduction of unwanted vibrations
- Oscillation mode

VARIOCONTROL automatically adjusts the amplitude to the degree of compaction.

VARIOCONTROL automatically adjusts the amplitude to the degree of compaction.

VARIOCONTROL provides automatic adjustment of compaction energy to match the prevailing ground conditions. The stiffness of the soil under the drum is measured in a fraction of a second to calculate how much energy is required for optimal compaction.
If vibration is operated in oscillation mode, heavy rollers can be used in urban environments or near buildings. With VARIOCONTROL, the amplitude can be adjusted exactly to the requirements of the site. The environment is protected from unwanted vibrations, without wasting compaction power. When the amplitude is increased to maximum, the single drum roller meets the performance of its weight class, and also handles applications for heavier machines.

For example, the BW 213 BVC-5 uses directed oscillation to achieve an amplitude value of more than 2 mm. This corresponds to the compaction power of a 16t standard roller and is therefore producing 20% higher performance than standard rollers with circular exciters in the 13t class. With VARIOCONTROL, thicker fill layers can be compacted or for the same layer thickness, the number of passes can be reduced.

Another issue which every roller operator knows well can be solved by VARIOCONTROL: the vibration direction is automatically switched to the driving direction. Material is no longer pushed in a bow wave in front of the roller, but is always pulled under the drum. This also improves traction. Furthermore, amplitude is automatically set to minimum during standstill, which prevents the drum from digging in.

In forward or backward travel: VARIOCONTROL automatically controls the vibration direction.

- Optimal adjustment of compaction power to the needs of the job and surroundings: sensitive compaction in the vicinity of buildings, full depth effect on difficult earthworks
- Thicker fill layers and fewer passes
Uniform compaction under the most difficult conditions.

All under control: ergonomic travel lever with integrated functions.
INTUITIVE:

ONE SWITCH FOR EVERYTHING.

For manual or automatic: just one switch is needed with VARIOCONTROL. No technical complexity or guesswork. The driver always has everything under control.

OPTIMUM COMPACTION: AUTOMATIC MODE.

In VARIOCONTROL automatic mode, the driver chooses a target value $E_{VIB}$ in MN/m² simply using the rotary switch. $E_{VIB}$ correlates directly with the $E_{V1}$ and $E_{V2}$ values of the plate load test. The automatic function compares the actual measured values continuously with the specified target value. If the deviation is large, the exciter system will automatically adjust to a high amplitude. At the start of compaction this provides fast compaction progress and efficiency. As measured values come closer to the target value, the amplitude is reduced. This results in uniform compaction over the entire area, even with different starting conditions. In addition, the automatic system prevents overcompaction, which could cause loosening of the surface and crushing of aggregate. Once the target value is reached or a compaction increase is no longer possible, the driver will be advised via the display. Unnecessary passes are prevented. Manual mode is generally selected to limit the vibration load on the surrounding area. For example, in urban areas where pipes are installed underground and where vibrations may cause damage. Standard rollers in this situation are often only able to use static compaction. VARIOCONTROL, on the other hand, offers the best strategic compaction with minimal vibrations to the surroundings.

- Automatic adjustment of amplitude on the basis of the measured compaction value
- Prevents overcompaction
- Optimum compaction with minimum vibration to the surrounding area in oscillation mode

SYSTEMATIC COMPACTION: MANUAL MODE.

With the VARIOCONTROL in manual mode, the driver sets a fixed amplitude using the rotary switch. There are six steps available. The amplitude is maintained at the chosen value; there is no adjustment to the measured $E_{VIB}$ value. The driver always has the option available of controlling the $E_{VIB}$ values via the terrameter and thus the increase in compaction.

For manual or automatic compaction: just one switch for all functions.
In earthworks, the stiffness of the material, measured with a pressure plate, is often used as a criterion. However, load plates only measure specific points and are expensive to use. BOMAG has taken technology one step further: with TERRAMETER.

This measuring system allows BOMAG single drum rollers to become rolling pressure plates: surface covering, in real time. TERRAMETER measures the level of stiffness $E_{\text{Vib}}$ in MN/m². As $E_{\text{Vib}}$ correlates directly with the $E_{\text{V1}}$ and $E_{\text{V2}}$ values of the plate load test, the driver is shown the trend, and a specific, absolute measuring value. The driver can directly work towards the required stiffness level specified in the contract.

The standard set values (for DIN $E_{\text{V2}}$) of 45, 80, 100 and 120 MN/m² are shown on the display as a compression ratio. This allows the target achieved to be quickly displayed.

- Compaction measurement in real time
- Clear visual indicator on the display
- Gives an absolute definite measuring value

Key information: permanent display of compaction values with TERRAMETER.
For an initial on site evaluation, the printer is a logical optional addition to the TERRAMETER. It documents the $E_{\text{VIB}}$ curve on paper directly on site and provides key figures, such as minimum, maximum and average.

This tablet, suitable for construction sites, communicates with the BOMAG roller, thereby also processing $E_{\text{Vib}}$ and ECONOMIZER values. In conjunction with a GPS receiver, it creates a real map of compaction values, enabling surface covering dynamic compaction control.
Due to the counter-rotation, the individual centrifugal forces overlap so that the force produced is only effective on one plane. This produces directed vibration. The effective direction of this vibration is changed by slewing the complete exciter unit. Thus the drum is able to vibrate in a vertical or horizontal direction, or any angle in between. This change in direction of vibration is equivalent to a change in the vertical amplitude and therefore to the compaction energy transferred into the material.

In order to determine the optimal amplitude, two acceleration transducers permanently measure the movement of the drum on the ground. This signal is then used to calculate the dynamic stiffness of the soil $E_{\text{Vib}}$ in MN/m². If the dynamic stiffness of the soil increases — in other words, the degree of compaction — the ground contact force will also increase. The movement of the drum then changes, which the sensors detect.

Based on these measuring values, the system will calculate and adjust the optimal amplitude in fractions of a second.

- Strategic compaction using directed oscillation
- Using permanent measurement, results in a second, and setting optimal amplitude

**ACCURATE:**

**YOU SET THE DIRECTION OF VIBRATION.**

Only BOMAG is able to generate vibration with directed oscillation via the BVC exciter system in the drum. The exciter system consists of counter-rotating eccentric weights.

Horizontal effect: minimal compaction energy for surface compaction in oscillation mode.

Angular position: adjusted compaction energy.

Vertical effective direction: maximum compaction energy for deep compaction.

The BVC directed vibrator with BVC exciter system.
**Costing for earthwork building project example**

<table>
<thead>
<tr>
<th>OPTIMAL LAYER THICKNESS</th>
<th>SPECIFIED LAYER THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination of equipment excluding wages and surcharges</td>
<td>Combination of equipment excluding wages and surcharges</td>
</tr>
</tbody>
</table>

### DESCRIPTION OF CONSTRUCTION PROJECT

**Soil compaction, normal density requirements**
Soil type: Gravel 100,000 m³

**Soil compaction, high load bearing capacity required**
Building materials: Anti-frost layer 20,000 m³

### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>BW 213 D</th>
<th>BW 213 BVC</th>
<th>BW 213 D</th>
<th>BW 213 BVC</th>
</tr>
</thead>
</table>

### Formula for output calculation $L_t$

\[ L_t = 60 \times (b-c) \times \frac{v_a \times h_d}{n} \]

- $b$: 2.13 m drum width
- $c$: 0.13 m coverage of tracks
- $v_a$: 50 m/min working speed, but for compaction only 75%
- $h_d$: 0.5 and 0.8 m layer thickness
- $n$: 6 passes

### Layer thickness in m

<table>
<thead>
<tr>
<th>Layer thickness in m</th>
<th>0.5</th>
<th>0.8</th>
<th>0.3</th>
<th>0.3</th>
</tr>
</thead>
</table>

### Number of passes

<table>
<thead>
<tr>
<th>Number of passes</th>
<th>6</th>
<th>6</th>
<th>8</th>
<th>6</th>
</tr>
</thead>
</table>

### Calculation of $L_t$ in m³/h

<table>
<thead>
<tr>
<th>Calculation of $L_t$ in m³/h</th>
<th>60 (2.13-0.13) 0.75 x 50 x 0.5/6</th>
<th>60 (2.13-0.13) 0.75 x 50 x 0.8/6</th>
<th>60 (2.13-0.13) 0.75 x 50 x 0.3/8</th>
<th>60 (2.13–0.13) 0.75 x 50 x 0.3/6</th>
</tr>
</thead>
</table>

### Output in m³/h

<table>
<thead>
<tr>
<th>Output in m³/h</th>
<th>375</th>
<th>600</th>
<th>165</th>
<th>225</th>
</tr>
</thead>
</table>

### Total costs/hour in €/h (without labour costs)

<table>
<thead>
<tr>
<th>Total costs/hour in €/h</th>
<th>35</th>
<th>38</th>
<th>35</th>
<th>38</th>
</tr>
</thead>
</table>

### Total costs/hour in € (without labour costs and surcharges)

<table>
<thead>
<tr>
<th>Total costs/hour in € (without labour costs and surcharges)</th>
<th>9,333</th>
<th>6,333</th>
<th>4,242</th>
<th>3,378</th>
</tr>
</thead>
</table>

### CONCLUSION

**Costs reduced by single drum rollers with VARIOCONTROL:**

- **30%**
  - From greater compaction power (higher layer thickness)

**Savings in equipment costs using single drum rollers with VARIOCONTROL:**

- **20%**
  - From greater compaction power (fewer passes)
BOMAG leads in cost-effectiveness. Because in compaction work all costs must be taken into account. With VARIOCONTROL, these costs are reduced.

- Higher maximum compaction power
- Thicker fill layers
- Avoids unnecessary passes
- Greater flexibility
- Higher utilisation of the machine
- Reduced testing work

Every contractor should also take account of the risk of poor workmanship and possible liability for defects. VARIOCONTROL and the integrated measuring systems minimise these risks significantly.

- Uniform compaction
- Documentation of compaction quality
- Targeted analysis of weak spots
- Low vibration compaction

All series 5 single drum rollers are equipped with the innovative BOMAG ECOMODE as standard. State-of-the-art engine management regulates the engine speed in relation to the current load, reducing fuel consumption by as much as 30%. There are no grease nipples on any BOMAG single drum rollers. Extended maintenance intervals and excellent access to all service points cut maintenance costs.

- For fuel consumption cut thanks to ECOMODE
- Progressive maintenance concept with longer service intervals
- Long service life and maximum reliability
## MODEL OVERVIEW

<table>
<thead>
<tr>
<th>MACHINE TYPE</th>
<th>WEIGHT CLASS</th>
<th>WORKING WIDTH</th>
<th>ENGINE OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW 177 BVC-5</td>
<td>7 t</td>
<td>1.686 mm</td>
<td>55 kW</td>
</tr>
<tr>
<td>BW 213 BVC-5</td>
<td>13 t</td>
<td>2.130 mm</td>
<td>115 kW</td>
</tr>
<tr>
<td>BW 213 BVC+P-5</td>
<td>13 t</td>
<td>2.130 mm</td>
<td>115 kW</td>
</tr>
<tr>
<td>BW 219 BVC-5</td>
<td>19 t</td>
<td>2.130 mm</td>
<td>150 kW</td>
</tr>
<tr>
<td>BW 226 BVC-5</td>
<td>26 t</td>
<td>2.130 mm</td>
<td>150 kW</td>
</tr>
<tr>
<td>BW 226 DI-5</td>
<td>26 t</td>
<td>2.130 mm</td>
<td>150 kW</td>
</tr>
<tr>
<td>BW 226 RC-5</td>
<td>26 t</td>
<td>2.130 mm</td>
<td>150 kW</td>
</tr>
</tbody>
</table>

Technical modifications reserved. Machines may be shown with optional accessories.
ROLLING INTO THE FUTURE – WITH THE NO. 1 IN COMPACTION.

Decades of experience, expertise and a commitment to quality has made us who we are today: Leaders in compaction technology. And with a clear focus: our customers. We aim for 100 percent performance from all our products and services. With specific training courses, and individual on site support. Always improving. Always innovating. You plus BOMAG – a successful team.