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Chapter 1

Road Paver

Aerial Photograph of the Joseph Vögele AG in Ludwigshafen/Rh.
A Road Paver is a construction machine, available either tracked or wheeled driven (depending on market or manufacturer also with rubber tracks), mainly used for laying asphalt, but also sand, gravel or concrete.

Special Equipment, based on modified conventional pavers are also available such as “Spray Jet”, “InlinePave” or “Slope Paver”.

1.1 General Information
### 1.2 Types of Paving

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<td>Placing all kinds of pavement layers for roadways and paths. Pavers are available in various performance classes and combine with varieties of screed options to handle these paving jobs.</td>
<td>Extending Screeds can be set up for paving a large variety of special profiles thanks to their systems for adjustment. Special slip forms are available for paving farm tracks. When combining the height adjustment of the extensions with the crown profile adjustment, M-profiles and W-profiles are possible.</td>
<td>Apart from construction of conventional roads with gradients (uphill or downhill), road pavers can also be used for special applications, such as paving on a slope for dam construction, retaining walls, etc. In general, only slight conversion of the paver is required for handling these kind of jobs. For application under extreme conditions (steep slope), a special Slope Paver can be used.</td>
<td>By using special formwork, tracks for agricultural roads or rail track construction can be done.</td>
<td>As an alternative to paving in a vertical direction, pavers also work in a horizontal direction. In general such applications require no more than slight conversion of the paver. Paving work like this is also often found in the field of dam or canal construction.</td>
<td>Even banked corners, like on race tracks, can be done with special formworks. In that case parabolic screeds can be used.</td>
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1 Push Rollers
The truck wheels touch the push rollers and rotate during the paver pushes the truck forward.

2 Height Adjustment via Tow Point Cylinders
Paving depth can be controlled and irregularities in the base are reduced by changing the height of the tow point cylinders.

3 Traction Drive
By using adjustable hydraulic pumps, either tracks or wheels are driven.

4 Paving Functions
Paving functions like screed freeze, screed hold or screed assist are achieved by using the screed raising/lowering cylinders.

5 Screed
Screed weight and compaction devices on the screed are affecting the pre-compaction of the laid material and profiling the new asphalt layer can be achieved.

6 Hopper
The transfer of the material takes place between feeding lorry and hoppers in front of the paver.

7 Conveyors
Two conveyors are used to bring the mix from the hoppers back to the screed (exception: SUPER 600/800 – only one conveyor)

8 Spreading Augers
Augers are used for uniform distribution of the mix in front of the screed.

9 Screed Heating
To prevent the material from sticking to the screed, heating rods are fitted on the screed plates, tampers and pressure bars.
1.4 Drive Concept

Advantages of a Wheeled Paver
- Driving in public traffic on its own axles, up to 20 km/h
  - no need for a transportation truck
- Steering movements won’t harm the base
- Screed follows directly steering signals
- Passover fresh laid base or binder course is possible
- Single driven, hydrostatic rear wheel drive
- Smooth running when laying asphalt wearing course
- Highly manoeuvrable, tight turning radius (narrow or curved areas)
- Permanent ground contact of at least two of three axles by the static 3-point support steering system
  (Irregularities in the base are transferred mitigated to the chassis)

Advantages of a Tracked Paver
- High traction force
  (larger contact area of the crawler track chains)
- Large paving width above 8,5 m, up to max 16 m
- Use of high compaction screeds (TP2)
- Use of SB screeds
- Ideal or paving vertical slope (landfill site, water reservoir)
  (Large vertical and horizontal slope is possible)
- 3D Levelling System can be used
- Hopper Inserts (InlinePave; Feeders)
- Electronically controlled directional stability
  (no permanent steering during paving)
- Better access for service and maintenance work
<table>
<thead>
<tr>
<th>SUPER Series</th>
<th>Machine Class</th>
<th>Type</th>
<th>Weight</th>
<th>Basic Width</th>
<th>Maximum Width</th>
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<td>1600 t/h</td>
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<td>5.8 m</td>
<td>700 t/h</td>
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</table>

| Highway Class | Tracked Paver VISION 5200-2 | 19.4 t | 3.0 m | 8.6 m | 1200 t/h |
|               | Wheeled Paver VISION 5203-2 | 18.5 t | 3.0 m | 7.8 m | 1200 t/h |

<table>
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<tr>
<th>Power Feeder Series</th>
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<th>Type</th>
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<td>-</td>
<td>1200 t/h</td>
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### 1. Advance Drive
Advance Drive to move the road paver is carried out either by crawler tracks or rubber wheels.
At the tracked paver, the two crawler tracks are driven independently. The wheeled pavers are equipped with three axles. Optional both front axles can be provided with front wheel assist.

### 2. Material Transfer
Mix is dumped from the feed truck into the paver's material hopper.
The feeding lorries are pushed by push rollers.

### 3. Material Conveyance
From the hopper the mix is transferred longitudinal to the rear in front of the screed via two adjustable, separate conveyor chains (S 700/800 only one)

### 4. Material Distribution
Spreading the mix to both sides of the screed via two adjustable, separate augers.
They can be operated manually or automatically with either mechanic or Ultra sonic sensors. Additionally the height of augers can be adjusted to fit to the paving depth.

### 5. Tow Point Adjustment
Paving depth control and levelling out irregularities is done by adjusting the screed tow points in height, which is changing the screed angle of attack. Therefore hydraulic rams can be controlled either manually or automatically.

### 6. Cylinder Functions
Screed Float, Screed Hold, Screed Freeze and Screed Assist are depending on the control of the „Screed Raising/Lowering Cylinders“.

### 7. Electrical Screed Heating
Heating to heat up the Screed Plates, the Tampers and (optional) the pressure bars to prevent the screed from sticky material

### 8. Compaction Devices
Weight of the screed and the energy of the compaction devices are significantly involved reaching the desired compaction.
Compaction is essentially influenced by:
- Conveyors
- Augers
- Tampers
- Weight of Screed
- Pressure Bars
- Vibration
1. Advance Drive
- Avoiding hard docking of the feed lorries (imprints in the surface)
- Keeping push rollers clean (guarantees directional stability)
- Obtain steering reference (Straight Joints!)
- Constant Speed, matching with the material supply from the plant
- Push rollers can be changed in distance to match different truck sizes

2. Material Transfer
- Checking asphalt temperature
- Checking for segregation coming from plant or delivery
- Reduce hopper movement
- Avoid spilling material
- Keep track clean (using plough, if necessary)
3. Material Conveyance

- Application corresponding setup of the paddle sensors
- Avoid overfilling of screed
- Keeping conveyors always covered with mix
- Feed ratio of conveyor and auger sensors

Higher head of material
lower head of material
(at the same auger height)

Head of material can be set either in the display (screen 1.3) of the main control desk or in the corresponding screed control display.
4. **Material Distribution**
- Setup of auger sensors
- Ensure constant head of material
- Ensure continuous flow of material
- Feed ratio of conveyor and auger sensors
- Setup right auger height
- Avoiding segregation in the lateral areas
- if necessary: use of auger extensions and tunnel plates

5. **Tow Point Adjustment**
- Changing the tow points will change the screed angle of attack
- Changing the screed angle of attack will change paving depth
- Reduce changing of tow points to achieve evenness
- Tow arms fish plates can be changed in position for larger paving thickness
6. Cylinder Functions

Main Function of the two rear mounted cylinders:

- **Screed Raising and Screed Lowering**
  
  Screed lowering should not be carried out by using the screed float button on the two screed controls.

Additional Functions are:

- **Screed Float**
  
  Is the condition of the screed normally used during paving. The screed is only connected to the tow point cylinders via the screed arms and is floating on the laid material.

- **Screed Hold / Float Off**
  
  Prevents the screed from sinking when stopping during paving.

- **Screed Freeze**
  
  Works against the floating up of the screed and therefore reduces possible "Start Up Bumps" when resuming paving after a paving stop.

- **Screed Assist**
  
  Using Screed Assist can influence hydraulically the weight of the screed to get a positive impact to the screed angle of attack.
7. **Electrical Screed Heating**

- Prevents material from sticking to the screed when paving bitumen bounded material
- Insufficient heated up screed will influence the surface structure negatively and will lead to a poor float behaviour of the screed
- Automatic temperature control is optionally available

8. **Compaction and Compaction Devices**

- Wrong setup of material sensors can be negative for the pre-compaction of the asphalt
- Continuously, slow rotation of the augers
- Tamper speed must be adjusted according to pave speed, stroke and shape of the tamper
- Screed weight can be influenced by screed assist
- Setup of pressure bars must be adjusted according to jobsite
- Vibration can be used to improve surface structure
Short irregularities in the base are levelled out through the self-levelling property of the floating screed.

When passing over long irregularities, the height of the screed tow points changes automatically because the paver leaves its horizontal position. Chassis and tow points will raise, thus leading to a change in the layer thickness.

Depending on the screed angle of attack, more or less mix is packed under the screed as the paver advances, and the layer thickness gradually changes over a longer distance.

The response of the screed to such changes depends on:
- Paving speed
- Change in height of the tow points
- Screed angle of attack
- Properties of the mix (compactability, bearing capacity)

Taking into account different length for the different paver types, consisting of tow arms length and the depth of screed plates, an average ratio about 5 : 1 results as far as compensation of short irregularities in the base is concerned.

Long irregularities in the base can only be levelled out by actively controlling the height of the screed tow points.
Due to the design of the front axles of the paver, two axles have always contact with the base even when passing over irregularities. When the rear wheel (3rd axle) passes over the irregularity, the tow points are far ahead of the obstacle and will not affect the result anymore.

Although the wheeled paver by design will run over lumps and bumps without adversely effecting the floating screed self levelling qualities. It is still poor paving practice not to clean up dropped material in line with the wheel tracks. A poor paving finish can still be the end result.
Hydraulic Circuits and Symbols

Example: SUPER 1800-3i

Screed „Raising“

- Tank
- 30 bar
- max. 180 bar

Screed „Lowering“

- Tank
- 30 bar
- max. 40 bar

Screed „Freeze“

- Tank
- 30 bar
- X

Screed „Assist“

- Tank
- max. 40 bar
- X

Screed „Floating“

- Tank
- X

Screed „Hold“/ „Not Floating“

- Tank
- X
1. Screed “Raising”

- Push-button for raising the screed
- Symbol
- Tank
- max. 180 bar

- The screed is raised with hydraulic pressure
- Max pressure for “Raising” : \( p = 180 \) bar (depends on paver type)
- Positioning of the paver in “Positioning Mode” only and the screed raised (Screed locks are not mandatory for short distances when positioning the paver). When positioning the paver in “Pave Mode” the screed would be in float and selected automatic function active.
2. Screed “Lowering”

- Lowering the screed is carried out with an aid pressure of 30 bar on the rod side of the hydraulic cylinders.
- A One-way restrictor on the rod side of the cylinders allows an adjustable lowering speed.
- The screed is lowered “controlled” (no twisting of the screed and reduced risk for accidents).
- Due to the use of the one-way restrictor a feeding of air or vacuum in the hydraulic system is avoided.
3. Forces on a Road Paver

When the screed is floating on the laid material, the following described forces are present.

The forces can influence the float behaviour of the screed and therefore pre-compaction and paving depth.

---

**Traction Force - Resistance**

The traction force of the paver must always be higher than the resistance created by the material laying in front of the screed.

Changing the traction force (paving speed) or resistance (head of material) will lead to a change in the paving depth as well as the pre-compaction.

---

**Horizontal Forces**

- **R** (Resistance)
- **T** (Traction Force)

**Vertical Force**

- **W** (Weight)
- **U** (Uplift)

---

**Bearing Capacity – Screed Weight**

As long as there is a equilibrium between bearing capacity and the screed weight, the screed will move parallel to the towing direction. Increasing the uplift force will result in an up-float of the screed until a new equilibrium is achieved.
4. Screed “Float”

Symbol

The Float symbol (≈) in the display of the screed controls or the green LED in the screed float button are active as soon the screed is in “Float Position”.

- "Screed Float" is the circuitry of the hydraulic cylinders for raising/lowering, used for paving.
- "Screed Float" means, the screed is floating freely on the laid material.
- When “Screed Float” is active, the screed raising/lowering cylinders will not influence the uplift of the Screed positive or negative.
5. Screed “Hold”

Screed “Hold” – in Pave Mode:
When stopping the paver during paving “Screed Hold” is activated automatically.
The function prevents the screed from sinking in the asphalt.

When positioning the paver in “Pave Mode” with screed lifted and not locked, the screed will drop as soon the machine moves!

Screed “Hold” – not in Pave Mode
The function allows the screed to be raised quickly for re-positioning of the paver.

When positioning the paver locking the screed is not mandatory.
To prevent the screed from sinking when running out of material at the end of a path, the operator can push and hold the “Float off Key-switch”. As long the switch is pushed, screed float is deactivated.

The paving thickness can be maintained even with less material under the screed.

A loss of compaction, starting with activating the function, must be expected!

**Recommendation:**
Only on flat lanes/areas.
6. Screed “Freeze”

What is “Screed Freeze”?
The function involves a hydraulic function intended to minimize the upwards movement of the screed after a break in paving and thus the risk of a step in the pavement. The “Screed Float” is deactivated for a short time.

How does it work?
With a hydraulic pressure (30 bar) on the piston side of the cylinders (1) and the hydraulic locking by magnetic valves (2) on the rod side, the screed is locked hydraulically when “Screed Freeze” is activated. The screed tow point rams (3) are also locked for the period fixed.

The automatic screed freeze function can be activated or deactivated in the display of the main control desk.
6. Screed “Freeze”

When paving below 3m/min:
Screed freeze is active for 10 seconds maximum, depending on the parameter setting in the protected area.

When paving 3 m/min and above:
Screed freeze is active for 0.5 m paving length. Afterwards, in both cases, “Screed Float” will be automatically active.

Note:
When screed freeze is activated but not needed temporally, the function can be turned off by using the “Float Button” on the screed control. When resuming paving after a following stop, the function is active again.
7. Screed “Assist”

Hydraulic Components

- Symbol
- Tank
- 0 - 40 bar

It is possible to provide both cylinders for screed raising/lowering with hydraulic pressure on the rod side, independently from each other.

The pressure is influencing the weight force of the screed and will decrease the screed weight depending on the set assist pressure.

Pressure-dependent

Vertical Movement

Display Main Control Desk

Display Screed Control: Adjustment **Balance lh/rh**

Display Screed Control: Adjustment System Pressure **Left = Right**
7. Screed “Assist”

The screed assist function can be used when paving asphalt base course or asphalt binder course - but also for paving cemented material such as hydraulic threated base courses (abbr. CTB).

**Side effect:**
When laying material with a poor bearing capacity the use of screed assist will optimize the angle of attack of the screed. Thereby the wear and tear of screed plates, tamper bars and pressure bare is reduced significant.

**Possible causes are:**
- Low pre-compaction from the tamper
- Consistency of the material

When paving Profiles (e.g. Slope or levelling course) it can happen that on the “thicker” side a bigger angle of attack is needed or the angle of attack on the thinner side is getting negative.

**Consequential:**
Different pre-compaction with eventual irregularities and, depending on the depth, even a twisting of the screed can occur. In that case screed assist can be applied on the “thicker” side.

**Possible causes are:**
- Large paving depth (here: 400 mm HGT)
- Poor bearing capacity (observable at a very high angle of attack)
7. Screed “Assist”

Attention
When using the hydraulic screed assist function, the float behaviour of a screed is actively influenced. When changing the screed assist pressure, the angle of attack and the paving depth must be observed.

When paving less than the minimum paving width of the screed, usually cut-off shoes can be mounted to the screed. Alternatively, screeds also can be filled with material on one side only in order to achieve a smaller paving width. The unfilled screed side, due to the missing uplift force, will sink in the material. The one-sided use of screed assist pressure will prevent the screed from sinking.

Important Recommendation
Using screed Assist on thin layers is not recommendable. Due to the small tolerance area of the angle of attack there is the risk that the screed planning angle runs to flat and, in the worst case, the screed is paving in a “negative” position. That will lead inevitably to irregularities in the new layer.

Roundabouts / Tight Turns
When paving tight turns (e.g. roundabouts) different speeds on both screed sides will be present:
inner Radius = lower forward movement
outer Radius = faster forward movement

Due to that behaviour plus the equal tamper revolution across the screed width a different pre-compaction will occur. The lower uplift on the outside can be compensated by using the screed assist function.

Additionally the reduced weight of the screed on the outside has a positive influence to the traction drive tracks or wheels – improvement of the traction force.
If Automated Grade and Slope Control is used for paving, the desired elevation of the screed can be maintained by increasing the angle of attack, but pre-compaction will not remain constant.

**General**

If the pave speed is increased without simultaneously increasing the tamper speed, the load bearing capacity of the mix will be reduced and the screed lay a thinner layer at a steeper angle of attack.

**Paving with Automated Grade and Slope Control**

If Automated Grade and Slope Control is used for paving, the desired elevation of the screed can be maintained by increasing the angle of attack, but pre-compaction will not remain constant.

**After Compaction by Rolling**

When the roller passes over the mix, the amount of extra compaction will differ on account of varying pre-compaction and result in irregularities in the surface.
Increasing the paving speed without matching the Tamper speed will result in a change of the uplift of the screed (uplift will drop) and therefore the paving depth will drop as well.

Due to the increasing angle of attack a height offset will occur between main screed and extensions.

Raising the tamper speed will result in an increase of the pre-compaction and therefore a change in the paving depth, as long there is no readjustment of other parameters such as the paving speed.

**Recommendation**
To ensure an even pre-compaction following rule applies: when changing the paving speed, it is mandatory to adapt the Tamper revolutions.
Positive angle of attack for 40 mm paving depth: between 40 und 80 mm on the Scale

Negative angle of attack for 40 mm paving depth: less than 40 mm on the Scale
### 1.11 Screed Planning Angle (Angle of Attack)

- An increased angle of attack will allow more material under the screed. As a result the paving depth will increase as long as the balance of screed weight and bearing capacity is achieved again.

- Raising the tow points relative to the ground will cause an increase of the screed angle of attack ($\alpha$) and therefore the paving depth will also change.

- For paving the angle of attack is set to a value on the scale between 0% and 100% bigger then the paving depth

- The value indicated on the scale is summary of „paving depth“ plus „angle of attack”

- That will guaranty the optimum efficiency of the compaction aggregates to the asphalt

- Wear and tear on tamper, screed plates and pressure bars will be reduced

- Optimum angle of attack = optimum position of the tamper

- The screed weight has a good impact to the material
1.12 Head of Material

- Overfilling of the screed should be avoided
- Changing head of material can influence the floating behaviour of the screed
- Reducing the head of material leads to the screed sinking, increasing the head of material will lead to the screed raising
- Head of material should be constant right from the beginning - during paving material flow can be controlled by sensors

Attention!
Changing head of material can lead to an up and down movement of the screed and therefore irregularities can appear.

Recommendation:
With a wheeled paver it is important to maintain a low and constant head of material to prevent the paver from losing traction.

This should be avoided!
When changing the tow arm lugs for thicker layers, the “0”-point is moved downwards. When adjusting the angle of attack the displayed value has to be reduced by that difference.

Adjustment when the setting-range of the tow point cylinders is not enough to achieve the desired depth.

When the screed is mounted „deeper“ on the screed flanges, paving below the level of the paver crawler tracks is possible. A higher mounting of the screed to the flanges allows paving of thicker layers.
"Standard"

For common asphalt types.

"Standard" and "To the Rear"

Enlarged distance between Augers and screed. Can eliminate the eventual appearance of segregation when paving coarse-gained material or when the amount of binder is less.

"Higher Angle of Attack"

When laying material with a poor bearing capacity it can happen that the tow points are not able to realize the required angle of attack. In that case the front part of the screed arms can be relocated to achieve a larger angle of attack.

"Higher Angle of Attack" and "To the Rear"

Combined with the "Higher Angle of Attack" when paving thicker layers (e.g. base course) the area in front of the screed and therefore the amount of material is increased.

With additional material in front of the screed the resistance is getting bigger, more traction force is needed.
1.15 Paver Operation

The “Emergency Stop Button” is to stop the paver immediately in case of a dangerous situation!

It is not its function to turn off the engine when the job is done!

All “Emergency Stop Buttons” should be checked for function on a regular base.

On a wheeled paver additional switches for Indicators, Side lights, Head light and High beam are provided.

**Tracked Paver:**
- Reversing traction drive Crawler track
- Deflector crawler tracks
- No function

**Wheeled Paver:**
- Pivot Steer in Positioning or Pave gear
- Not available
- Road Mode
### Operating and Setting Elements – Segment 1

1. Hydraulic Auger Height Adjustment
2. Reversing Conveyors (0.5m)
3. Automatic Filling of the screed
4. Cleaning/Pre-heat Function
5. Reversing Crawler Tracks
6. Setting Paving Speed
7. “Execute Button”
8. Autoset Functions
9. Selecting Mode
10. Parking brake Indicator
11. Traction Main Switch
12. Auger, rh, Manual/Auto
13. Conveyor, lh, Manual/Auto
14. Auger, lh, Manual/Auto

All paving functions and paving parameters can be set either from the main control desk or the lateral screed controls.

**INFO**

To ensure finishing a jobsite after occurrence of minor problems (e.g. failure of a screed control or sensors) the actuation of paving functions or setting of parameters is “redundant”. That means the functions can be set from different switches or screens.
Operating and Setting Elements – Segment 2

1. Electrical Screed Heating On/Off
2. Tow Point Cylinder, lh
3. Hydraulic Screed Lock
4. Tow Point Cylinder, rh
5. Hydraulic Screed Assist On/Off (Option)
6. Extend/Retract Screed, rh
7. Raising/Lowering Screed
8. Extend/Retract Screed, lh
1. Beacon
2. Working Lights 24 Volt
3. Screen Wiper / Cleaner (Option)
4. Steering Trim
5. Crawler Track Deflector
6. PaveDock Assistant
7. Hopper Right Side
8. Front Apron + Both Hopper Sides
9. Hopper Left Side
10. Steering Lever
11. Horn
12. Speed Adjustment Diesel Engine
13. Start/Stop Diesel Engine

Deflector also can be operated from the screed control

**Truck – Dock**
Truck drives revers to paver.

**Truck – Stop**
Truck shall stop or has docked (Signal from push-roller sensor).

**Truck – Raise Dump Box**
Truck raises the dump box and starting the transfer the material

**Truck – Lower Dump Box**
Truck lowers the dump box

**Truck – Move Away**
Truck shall move away from the paver.

**„Paver in Motion“**
The signal is shown, when paver is moving in pave mode.
The signal is displayed combined with the other signals.
“Enter”, “Escape” and “Scrolling” push-buttons

The three functions have status indicators. Push-buttons are active, when LEDs are illuminated.

Basically the screens of tracked and wheeled pavers are identical. Only a few differences must be considered.
Colored Display

- Travel speed in m/min (Pave Mode or Positioning Mode)
- Travel speed in km/h (Transportation Mode)
- Eco Plus Modus active
- Conveyor Material Level, left-hand side
- Conveyor Material Level, right-hand side
- Position Tow Point Cylinder, left-hand side
- Position Tow Point Cylinder, right-hand side
- Actual Time
- Actual Page Number
- Status Indicator – Pre-heating Diesel Particular Filter (DPF)
- Activated Function Autoset „Paving Programs“
- Fine Steering/Radius Pre-selection
- Status Indicator Pave Dock Assistant
1.17 Display Screen Pages – Main Control Desk

**Start Screen “1.0”**

- **F1** Screed Settings
- **F2** Tamper
- **F3** Conveyors
- **F4** Vibration
- **F5** Spreading Augers
- **F6** Pressure Bars (Option)
- **F8** Automatic Steering (Option)
- **M1** Warning Icons
- **M2** - unassigned -
- **M3** - unassigned -
- **M4** Machine Data

[F7] Front Wheel Assist  ➔ wheeled Pavers only

**Start Screen “2.0”**

- **F1** Engine Rpm, ECOplus, Regeneration Diesel Particle Filter
- **F2** Autoset Paving Functions
- **F3** Electric Screed Heating
- **F4** - unassigned -
- **F5** - unassigned -
- **F6** - unassigned -
- **F7** Service Area
- **F8** Display Brightness
- **M1** Warning Icons
- **M2** - unassigned -
- **M3** - unassigned -
- **M4** Machine Data
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<th>Water Separator Full</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>Low Fuel Level</td>
<td>c</td>
<td>Alternator or „D+“ faulty</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Low Grease Level (Centralized Lubrication System)</td>
<td>e</td>
<td>Clutch , Splitter Gearbox</td>
</tr>
<tr>
<td></td>
<td>f</td>
<td>Low Coolant Level</td>
<td>g</td>
<td>Coolant Temperature too High</td>
</tr>
<tr>
<td></td>
<td>h</td>
<td>Engine Oil Pressure</td>
<td>i</td>
<td>Low Engine Oil Level</td>
</tr>
<tr>
<td></td>
<td>j</td>
<td>Air Filter Clogged</td>
<td>k</td>
<td>Suction/return Filter Clogged</td>
</tr>
<tr>
<td></td>
<td>l</td>
<td>Leakage Oil Filter Clogged</td>
<td>m</td>
<td>Diesel Engine Fault / Stop Diesel Engine</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>False Software/Hardware recognized (No Engine Start!)</td>
<td>o</td>
<td>Automatic Steering / Brake Pressure too low</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>Emergency Stop Tripped</td>
<td>q</td>
<td>Fault in Regeneration System (Type „i“ Machines)</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>Interlock Regeneration System (Type „i“ Machines)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Information**

Instead of the warning “Automatic Steering Fault” (o) on a wheeled paver

„Brake Pressure too low“ will appear in this field.
Once icons are displayed besides F1-F8 the corresponding key buttons are active. Blank fields are indicating: key button not assigned.

In the navigation block the key buttons Enter, Escape and scrolling are located. When the corresponding key switch is active, the respective LED is illuminated green.

Pushing Escape will switch back to the previous page, purpose of Scrolling/Arrows is the selection or adjustment of values. To erase inactive fault messages in the fault memory or confirm a selection the enter key switch is used.

Valid for all screens:
F2  Screed Freeze
Button F2 activates the screed freeze function. When screed freeze is active, the rams for raise/lower screed are subjected to 30bar on the piston side and blocked on the rod side for 0.5m when starting up. The screed automatically switches to floating position after 0.5m, at least 1 second and not more than 10 seconds. Actuation of the tow point rams is likewise blocked both manually and by NiveltronicPlus during the blocking distance / time. This prevents the screed rising. When screed freeze is deactivated, the screed moves into floating position immediately when the paver starts up.

F3  Auger Height
With the function activated, the augers will raise automatically, simultaneously with Screed raising.

F4  Floating position OFF (op)
When F4 is pressed and held down, the solenoid valves on the rod side of the rams for raise/lower screed close and interrupt the float function. The screed is held in position. When the button is released, the screed resumes its floating position.

F6  Setting the screed assist pressure (option)
The function must be activated via F6 for this purpose; the arrow buttons are enabled for adjustment as soon as the indicator lights up green.

F8  Adjusting assist pressure balance, right and left
The function must be activated via F8 for this purpose, as soon green LED is on the arrow buttons can be used to set values.
**Tamper „Manual Mode“**
Tamper rotates with the speed set by the arrow buttons, regardless to position of the traction main switch - displayed beside F6 -

**Tamper „Automatic Mode“**
Tamper rotates with the set speed, set by the arrow button, when traction main switch is set to “F” respectively „Forward“ in Pave Mode.

F5  Adjustment Conveyor, left-hand side
F6  Adjustment Conveyor, right-hand side

With „F5“ for the left and „F6“ for the right conveyor the required side can be chosen. The values in percentage can be set by the arrow buttons.
F2  Vibration „Manual Mode“
Vibration rotates with the speed set by the arrow buttons Regardless to position of the traction main switch - displayed beside F6 -

F4  Vibration „Automatic Mode“
Vibration rotates with the revolutions, set by the arrow buttons, when traction main switch is set to “F”, respectively „Forward“ in Pave Mode.

F3  Reversing Auger, left-hand side

F4  Reversing Auger, right-hand side

The augers are reversed and deliver material inwards when buttons F3 / F4 are actuated. This is a non-locking function and cannot be activated permanently. Automatic mode is deactivated when the augers are reversed.

Display „Auger position above the ground“ - besides F5 -
**Adjustment Screen „1.6“ - Pressure Bars**

- **F2 Pressure Bars „Manual Mode“**
  Functions works with the value set by the arrow buttons Regardless to the Traction Main Switch position.

- **F4 Pressure Bars „Automatic Mode“**
  Pressure Bars only work in „Pave Mode“ and Traction Main Switch actuated.

- **F6 Adjustment of the pressure for the system**
  Adjustment with the arrow buttons

- **F8 Balance P2**
  Adjustment of values with arrow switches (influences only the rear pressure bar P2, P1 will not be changed).

---

**Adjustment Screen „1.8“ – Automatic Steering**

- **Automatic Steering** (Option for tracked pavers only!)
  Steering control can be activated or deactivated by F2

- **Sonic steering sensor adjustment**
  When the sonic steering sensor is selected, button F7 is used to calibrate the steering sensor (Zeroed).

- **Sensor selection**
  Button F8 is used to choose between the mechanical and sonic steering sensors.
Adjustment Screen „2.1“ – Engine, ECOplus and DPF

In-depth:

VÖGELE ECOplus

Less Fuel Consumption
Less Emission
Less Costs

Splitter gearbox with clutch
Pumps for traction, conveyors and augers as well as compaction are disengaged from the gearbox when the paver is stationary.

Energy-optimized tamper drive
The tamper motors are driven by a variable displacement pump instead of a fixed gear pump. The pump delivers as much oil as needed for the motor, thus preventing any loss of oil.

Controlled hydraulic oil cooler
The hydraulic oil only flows through the hydraulic oil cooler when its temperature exceeds 50°C. At a lower temperature the oil is bypassed to the hydraulic tank.

Variable-speed fan
A viscous coupling adjusts the fan speed in accordance with the engine data, the air intake temperature and the hydraulic oil temperature automatically.
Adjustment Screen “2.2” – Autoset “Positioning Functions”

When Execute Switch is operated, screen „2.2“ automatically appears

Execute key switch
**AutoSet Positioning Functions**
(Main Control Desk)

Save status / position of the functions
The positions and status of the individual functions can be saved by pushing key button M2. Storing the values and settings possible in pave mode only.

- The functions are set to their limit position or to positioning position.
- The functions are set to their stored position for paving.
- When the tick appears, the corresponding function has reached its positioning condition for job site movements or the stored position in pave mode.

Function is selected for Autoset
Function is not selected for Autoset
F2 Deflector up/down
F3 Augers up/down
F4 Front Apron up/down
F6 Screed lock/unlock
F8 Temporary reversing of the conveyors
Screed raising/lowering (not selectable)
Left and right tow point cylinder same position (not selectable)

With this function the paver is quickly prepared for repositioning on a job site. The adjustment of working positions will be stored. Therefore no data will get lost during the change between paving and positioning of the paver.
With this functions paving parameters and job sit conditions /information can be stored and, when needed on a similar, new jobsite, recalled and re-used.

Information like…
- Project name
- Type of Layer such as base course, binder course or wearing course
- Load class
- Grain size
- Paving depth
- Paving width
...can be stored via a pop-up menu

- Paving Speed
- Tamper revolution / Stroke
- Pressure bar setting / Vibration revolution
- Auger height
- Screed freeze on/off
- Conveyor settings
- Position Tow Point Cylinders
- Screed assist Pressure and Balance

Those values are taken and stored from the actual paving process and therefore available for the next, similar job site.

All data can be changed or modified anytime in order to compensate issues appearing due to minor differences.
**F2  Alternating mode, screed heating**
When alternating mode is active, the screed is permanently heated on both sides as long as the traction main switch is set to neutral. When the traction main switch is actuated in pave mode, the right and left-hand sides are heated alternately at 30 second intervals. Both sides of the screed are always heated permanently when the function is deactivated.

**F4  Temperature control, screed heating**
Activation of the function: temperature control, screed heating. The temperature is set via F6

**F6  Setting the screed temperature (option)**
The status indicator lights up green when F6 is actuated. The arrow buttons are now used to adjust the required screed temperature between 0° C and 180° C.

**F8  Actual screed temperature**
The actual temperature of the screed is indicated here.
Selection Screen “2.7” – Service Area

F1 Display Info Pages
F2 Advanced Conveyor Settings
F3 Crown Adjustment
F4 Advanced Auger Settings
F5 Service Area (Password-protected)
F6 Traction drive mode „manual“/ Emergency operation SGB Clutch
F7 Error Messages, Service
F8 Set of Date, Time and Language

Adjustment Screen “2.7.3” – Screed Crown Profile

Adjustment of Screed crown profile
Is also carried out in the Main desk display on screen “2.7.3, besides key switch F6. The required value can be set with the arrow switches of the navigation block (from -2,5% to +5,0%).

Currently installed software version: 59 1.17
The paver operator’s console is illustrated graphically here. Once a button on the console is actuated, the corresponding circle will turn black and indicates hereby the functionality of the switch.

Key switches are shown as a black circle, locking switch keys are indicated, when actuated, with a cross in the centre. In the fields for traction main switch and steering lever values between 0 and 230 (digits) displayed. The value is changing depending on the position of the potentiometer dial. All key switches can be checked for functionality.

Displayed here the status of the CAN bus members. Therefore it can be checked whether the CAN bus member is recognized from the system or not.

Meaning of the numeric „0“ and „1“ (ID):

1 = CAN Bus Member is operational
0 = CAN Bus Member is not recognized

Additional errors in CAN O and Can 1 of the power PC are shown.
On this page the operator can set advanced functions or emergency operations for paving, e.g. appearance of a failure with paddle sensor.

F3  Conveyor Manual mode, left-hand side
When the conveyor is switched to manual mode, it runs permanently and independently of the traction main switch at the speed set via F5.

F4  Conveyor Manual mode, right-hand side
When the conveyor is switched to manual mode, it runs permanently and independently of the traction main switch at the speed set via F6.

F5  Conveyor Adjustment, left-hand side
The feed rate or respectively the speed in manual mode, can be set here. By pushing F5 the function is activated and can be used, when the green status LED is illuminated.

F6  Conveyor Adjustment, right-hand side
The feed rate or respectively the speed in manual mode, can be set here. By pushing F6 the function is activated and can be used, when the green status LED is illuminated.

Emergency operation!

F7  Deactivating Conveyor Sensor left-hand side
When the sensor is deactivated and manual mode is switched OFF, automatic mode ON, the conveyor runs at the speed set via F5 with the traction main switch set to “forward”. The Conveyor stop when the traction main switch is set to “neutral”.

Emergency operation!

F8  Deactivating Conveyor Sensor, right-hand side
When the sensor is deactivated and manual mode is switched OFF, automatic mode ON, the conveyor runs at the speed set via F6 with the traction main switch set to “forward”. The conveyor stop when the traction main switch is set to “neutral”.

1.17 Display Screen Pages – Main Control Desk
By pushing the key switches F3 or F4, the corresponding function is activated and the augers are rotating reverse.

**F4 Revolution Auger, left hand side**
The feed rate or respectively the speed in manual mode, can be set here. By pushing F4 the function is activated and can be used, when the green status LED is illuminated.

**F5 Revolution Auger, right hand side**
The feed rate or respectively the speed in manual mode, can be set here. By pushing F5 the function is activated and can be used, when the green status LED is illuminated.

**Emergency operation!**

**F7 Deactivating Auger Sensor left hand side**
When the sensor is deactivated and manual mode is switched OFF, automatic mode ON, the auger runs at the speed set via F5 with the traction main switch set to “forward”. The auger stop when the traction main Switch is set to “neutral”.

**Emergency operation!**

**F8 Deactivating Auger Sensor, right hand side**
When the sensor is deactivated and manual mode is switched OFF, automatic mode ON, the auger runs at the speed set via F6 with the traction main switch set to “forward”. The auger stop when the traction main Switch is set to “neutral”.

---

F1 Auger, Manual mode left hand side
When the auger is switched to manual mode, it runs permanently and independently of the traction main switch at the speed set via F5.

F2 Auger, Manual Mode right hand side
When the auger is switched to manual mode, it runs permanently and independently of the traction main switch at the speed set via F6.

F3 Reversing the Auger, left hand side
F3 Reversing the Auger, right hand side
F2  Traction Drive Mode „manual"
If the sensors of traction drive fail, the machine will come
either to a complete stop or moves with a very low speed.
In order to finish a job site, the sensors can be faded out.
The paver is moving now with reduced speed, but unregulated!

Wheeled Pavers only:
Steering angle sensor and Brake pedal sensor signals are also faded out when they are out of the taught-in threshold values.

F4 Emergency Operation Splitter gear box clutch
Pushing F4 the splitter gearbox clutch can be engaged manually.

Attention
Before engaging manual the function ECO Plus must be deactivated!

Recommendation
The required pressure of 20 bar must be controlled with a gauge!
F2  Language:
After pushing F2 the language can be changed.

F6  Time:
F6 is activating the function to set the time

F8  date:
F8 is activating the function to set the date.

Attention! These adjustments are only possible, when the diesel engine is off.

F4  Brightness of Display
To adjust the brightness, Switch F4 must be pushed.
Now the green status LED is illuminated and the arrow buttons are active to adjust the brightness.
Chapter 2

Screeds
Screeds are available in two versions:
- Extendable Screeds (AB)
- Fixed Screeds (SB)

The purpose of the screed, which is the working tool of the paver, is to pre-compact the mix uniform across the complete paving width and create an evenly, homogeneous surface structure. The compaction devices of the screed should produce the highest possible pre-compaction in order to reduce the influence to the rolling value, during the final compaction, when paving various paving depths.

To gain pre-compaction various compaction aggregates can be provided to the screeds.

Description and acronyms:

**T** = Tamper (the tamper is brought to a vertical movement by an eccentric shaft).

**V** = Vibration (the vibration is realized with an unbalanced shaft, transverse to the direction of travel).

**P** = Pressure bars (the pressure bars are pressed with a hydraulic frequency of ~ 68 Hz and a maximum pressure of ~ 130 bar into the mix).
  - **P1** = Screed model with one pressure bar
  - **P2** = Screed model with two pressure bars
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Paving Width</th>
<th>Basic Width</th>
<th>Hydraulically adjustable</th>
<th>Bolt-on Extensions</th>
<th>Cut-off Shoes</th>
<th>Crown Profile</th>
<th>Compaction devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB 220-3</td>
<td>for SUPER 700-3/800-3</td>
<td>0,5 m – 3,5 m</td>
<td>1,2 m</td>
<td></td>
<td>0,65 m</td>
<td>0,5 m – 1,2 m</td>
<td>-2% to + 4%</td>
<td>Tamper, Vibration</td>
</tr>
<tr>
<td>AB 340-3</td>
<td>only for Compact-Class Paver</td>
<td>0,75 m – 5 m</td>
<td>1,8 m</td>
<td></td>
<td>up to 3,4 m</td>
<td>25 cm, 40 cm (V), 55 cm (TV), 80 cm (TV)</td>
<td>-2,5% to + 4,5%</td>
<td>Tamper, Vibration</td>
</tr>
<tr>
<td>AB 500-3</td>
<td>for Pavers of the Universal and Highway Class</td>
<td>2,55 m – 8,5 m</td>
<td>2,55 m</td>
<td></td>
<td>up to 5,0 m</td>
<td>25 cm, 75 cm, 125 cm</td>
<td>-2,5% to + 5%</td>
<td>Tamper, Vibration, Pressure bars</td>
</tr>
<tr>
<td>AB 600-3</td>
<td>for Pavers of the Universal and Highway Class</td>
<td>3 m – 9,5 m</td>
<td>3,0 m</td>
<td></td>
<td>up to 6,0 m</td>
<td>25 cm, 75 cm, 125 cm</td>
<td>-2,5% to + 5%</td>
<td>Tamper, Vibration, Pressure bars</td>
</tr>
</tbody>
</table>
Hydraulically extendable extension
As an option, hydraulically extendable bolt-on extension (HEE) can be provided to the SB Screeds. With that add-on part the paving width can be infinitely adjusted from 0 to 0,75m on each side.

Attention:
It can not be attached directly to the main screed! At least a “1,0m” or a “1,5m” bolt-on extension must be placed between the main screed and the hydraulically extendable bolt-on extension.
### 2.3 Special Equipment

<table>
<thead>
<tr>
<th>Model</th>
<th>Paving width</th>
<th>Basic width</th>
<th>Hydraulically adjustable</th>
<th>Bolt-on extensions</th>
<th>Crown profile</th>
<th>Compaction device</th>
<th>Gully Profile</th>
<th>Slope of Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VF 500</strong></td>
<td>2,45 m – 5,95 m</td>
<td>2,45 m</td>
<td>up to 4,75 m</td>
<td>30 cm und 60 cm</td>
<td>-2% to + 5%</td>
<td>Vibration</td>
<td>30 cm, 45 cm, 60 cm</td>
<td>up to 10 %</td>
</tr>
<tr>
<td><strong>VF 600</strong></td>
<td>3,05 m – 7,75 m</td>
<td>3,05 m</td>
<td>up to 5,95 m</td>
<td>30 cm, 45 cm, 60 cm</td>
<td>-2% to + 5%</td>
<td>Vibration</td>
<td>30 cm, 45 cm, 60 cm</td>
<td>up to 10 %</td>
</tr>
<tr>
<td><strong>VR 600</strong></td>
<td>2,55 m – 8,6 m</td>
<td>3,05 m</td>
<td>up to 6,0 m</td>
<td>65 cm</td>
<td>-2,5% to + 5%</td>
<td>Vibration</td>
<td>up to 10 %</td>
<td></td>
</tr>
</tbody>
</table>
2.4 Compaction Devices

- The tamper provides the compaction of the mix.
- Driven by an eccentric shaft the Tamper is pre-compacting the laid mix.
- The better the pre-compaction done by the tamper, the better the screed floats on the laid mix.

- The Vibrations brings the screed plates (SB Screed) or the screed frame (AB Screed) to vibrate and therefore achieving an optimum grain / bitumen distribution on the surface of the mix.
- Vibration has a large impact to the surface structure, less to the pre-compaction.

- Pressure bars are driven by an “Impulse Generator”.
- With the pressure bars the mix, pre-compacted by tampers and screed
- Weight, is getting redensification.

<table>
<thead>
<tr>
<th>Tamper</th>
<th>Vibration</th>
<th>Pressure Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tamper provides the compaction of the mix.</td>
<td>The Vibrations brings the screed plates (SB Screed) or the screed frame (AB Screed) to vibrate and therefore achieving an optimum grain / bitumen distribution on the surface of the mix.</td>
<td>Pressure bars are driven by an “Impulse Generator”.</td>
</tr>
<tr>
<td>Driven by an eccentric shaft the Tamper is pre-compacting the laid mix.</td>
<td>Vibration has a large impact to the surface structure, less to the pre-compaction.</td>
<td>With the pressure bars the mix, pre-compacted by tampers and screed</td>
</tr>
<tr>
<td>The better the pre-compaction done by the tamper, the better the screed floats on the laid mix.</td>
<td></td>
<td>Weight, is getting redensification.</td>
</tr>
</tbody>
</table>
Tampers, driven by an eccentric shaft, are provided to the screed to achieve pre-compaction in order to improve the bearing capacity of the mix – the screed can float on the mix.

The better the float of the screed, the less angle of attack for paving is needed.
Raising the tamper revolutions will result in a higher pre-compaction.

Special profile

Special Tamper profiles are available and can be used on screeds, e.g. for paving concrete or railway ballast.
Also InlinePave requires a special tamper in order to meet the required high compaction.
2 mm Tamper Stroke
is usable for:
Thin layers with a paving depth < 30 mm.

4 mm Tamper Stroke
usable for:
All paving depth from 30 mm to 120 mm.

7 mm Tamper Stroke
Usable for:
Paving depth > 120 mm.

On TP screeds the stroke of the tamper can be changed, on TV screeds it is available as an option. The tamper must be set across the complete screed width to the same stroke.

Changing Tamper stroke:
1. Remove clamping bolt [3].
3. Mounting clamping bolt [3].
2.5 Tamper (T)

Tamper Shield Adjustment

- The spring steel strip closes the gap between tamper and tamper shield.
- With a clearance too big, mix can penetrate between tamper and tamper shield.
- With a clearance too less the tamper could be clamped.

**Note**

The proper adjustment of the tamper shield is achieved when the spring steel plate fits across the total width. Optimum is an even clearance of approx. 0.5mm. The rear of the tamper should flush with the wearing bar across its entire width.
The Vibrations brings the screed plates (SB Screed) or the screed frame to vibrate and therefore achieving a optimum grain distribution on the surface of the mix.

Identically to the tamper the vibration frequency can be set by changing the revolutions of the drive shaft via the operating consoles.

**Note**

Comparatively to the tamper following rule applies: When paving thin layers with a small grain size a low speed (frequency) should be set or the vibration can even be turned off completely.

**Paving Tip:**

Turning off vibration when laying open porous material.
2.7 Pressure Bars (P)

On high compaction screeds, one (TP1) or two TP2) impulse-hydraulic driven pressure bars are attached to the screed.

The pre-compaction of a TP1 screed is higher than with a TV screed but lower then with a TP2 screed.

The impulse pressure for the drive is infinitely adjustable from 40 to 130 bar.

The Impulse frequency is set to approx. 68 Hz and should only be changed in exceptional circumstances.

The two pressure bars are differently shaped:
P1= „Pointed“ (⇒ compaction)
P2= „Flat“ (⇒ structure)

On a „P1-Screed“ only the „Flat“ shape is used.
Example: AB 500-3/600-3:

The spindles of the crown adjustment are driven by hydraulic motors. Controlling is carried out by the respective key buttons on the screed control or main control. Simultaneously the actual profile is displayed on the screen (in %). The adjustment mechanism allows profiles from -2.5% up to +5%.
Available sizes for Bolt-on extensions are:
0,25 m, 0,75 m und 1,25 m

In terms of the design the bolt-on extension are identical to the main screed and extensions (tamper, vibration, pressure bars and heating elements).

Available bolt-on extensions are listed in the corresponding machine documentation.

Also mentioned there are necessary accessories (e.g. deflector plates, bracing, tunnel plates).

At the „-3“ screed generation additional weight can be added.
The quick-installation aid [1] must be positioned horizontally.
- Loosen locknut on eccentric bolt [2].
- Check functionality of eccentric bolt [2].
- Turn eccentric bolt lugs upwards.
- Rest screed on wooden blocks.
- Mount bolt-on extension using the quick-installation aid [1].
- Fold the quick-installation aid [1] down vertically.
- Tighten locking pins up to the position of the head.
- Attach flange to system.
- Align the bolt-on extensions and screed plates with one another with the eccentric bolts [2]. (see Sec. 6.3)
- Adjust locknuts.
- Tighten locking pins.

Use the eccentric bolt [1] to adjust the bolt-on extensions so that the front edge of the screed plate is 0.5mm higher per mounted bolt-on extension. The rear edge must be flush across the full width.
2.9 Bolt-on Extensions

Preparing the Curved Tooth Coupling
- Push down on the fixing screw of the curved tooth coupling [1] and slide the curved tooth coupling all the way back [1].
- The arrow on the curved tooth coupling [1] must be aligned with the positioning notch [2] of the gearwheel [3].

Locking the Curved Tooth Coupling
- Once the bolt-on extensions have been adjusted, the curved tooth coupling [1] has to be slid smoothly over the gearwheel [3] until the fixing screw locks the coupling in place.
- The coupling must display axial play.

In order for the pressure bars of the bolt-on extension to be able to be lowered in parallel, they must be connected to the extending unit. Connect the pressure bars [1] of the bolt-on extension with inner hex bolts [2] and supporting blocks [3] to the pressure bars of the extending screed. The pressure bars must be flush with the bottom and rear edges on the same level across the entire width.
When mounting bolt-on extensions, the pressure lines of the pressure bars must be connected with one another. Additionally, the leakage oil line must be switched from the lower position to the upper position. The leakage oil line must be connected at the lower position on the outermost bolt-on extension or during removal. This ensures that the pressure bar can vent autonomously via the aperture.

**Note:** if the aperture is missing, the pressure bar can only reach a maximum pressure of approx. 60 bar.

**Meaning of BE = Bolt-on Extension**
Standard on AB 500-3 / AB 600-3 are mechanically adjustable side plates. These are adjusted in height by spindles. Optional hydraulically adjustable side plates can be mounted to the screed. In that case the height of the side plates can be set individually by a switch. The connection takes place by using hydraulic quick release couplings and electrical connectors.
When the screed is heated up insufficiently, asphalt can stick on screed plates, tampers or pressure bars. In that case streaks and lines in the asphalt surface will appear when the, mostly fine parts/grains, fall off. A change in the surface structure will also be visible.

Until the screed is heated up to the desired temperature the screed float could change – which also can lead to a change in paving depth.
2.12 Three-Point-Guidance System

Main Screed

Telescopic Tube

Guidance tubes, inside

Torque Restrain System

Extension

Extension
2.12 Three-Point-Guidance System
To ensure parallel extending and retracting, the extensions are “guided” at three positions.

Compared to the main screed, the extensions are located in the rear. Due to the necessary angle of attack Main screed and Extensions would pave different heights and leaving longitudinal offsets on the surface.

To prevent the extensions from twisting, sliding blocks are used for limiting a possible, unwanted movement.

As a prevention the height of the extensions can be changed.

**Paving position:**
Compared to the main screed the extensions must be set higher in position. The height difference depends on the angle of attack.
Basic width of the fixed screed SB 250 is 2,50 m. By adding bolt-on extensions or hydraulically extendable bolt-on extensions, a maximum paving width of 13,00 m can be reached.

Basic width of the fixed screed SB 300-2, made for the SUPER 3000-2 paver is 3,0 m. By adding bolt-on extensions or hydraulically extendable bolt-on extensions, a maximum paving width of 16,00 m can be reached.

<table>
<thead>
<tr>
<th>Width</th>
<th>2,5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>1,14 m</td>
</tr>
<tr>
<td>Weight</td>
<td>1,65 t (TV, T)</td>
</tr>
<tr>
<td></td>
<td>1,88 t (TP1)</td>
</tr>
<tr>
<td></td>
<td>2,02 t (TP2)</td>
</tr>
<tr>
<td></td>
<td>2,1 t (TVP2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Width</th>
<th>3,0 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>1,14 m</td>
</tr>
<tr>
<td>Weight</td>
<td>2,26 t (TV, T)</td>
</tr>
<tr>
<td></td>
<td>2,41 t (TP1)</td>
</tr>
<tr>
<td></td>
<td>2,75 t (TP2)</td>
</tr>
</tbody>
</table>
2.14 Design of a Fixed Screed

- Tamper with heating rod
- Main Screed
- Fixed Bolt-on Extension
- Pressure Bar with heating rod
- Unbalanced Vibration
- Screed Plate with heating rod
2.15 Compaction Devices on SB Screeds

<table>
<thead>
<tr>
<th>TV</th>
<th>Tamper and Vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>Tamper &amp; one Pressure bar</td>
</tr>
<tr>
<td>TP2</td>
<td>Tamper &amp; two Pressure bars</td>
</tr>
<tr>
<td>TVP2</td>
<td>Tamper, Vibration and two Pressure bars</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>All common Mixes</td>
</tr>
<tr>
<td>Less compressible Materials or very thin courses</td>
</tr>
<tr>
<td>Less complexity necessary for redensification</td>
</tr>
<tr>
<td>Application with preferably constant paving widths and large radii</td>
</tr>
</tbody>
</table>
When the Extensions are mounted to the screed on a levelled ground, the vertical bracing must be without strain.

To compensate the bearing capacity on the outsides the screed should have (in raised position) a sag. How much sag depends on the paving width. Adjustable via the vertical bracing.

Rear edge of the screed plates should be flash over the complete width. Front edge of the extensions should be 0.5mm higher per extension.

To avoid bending caused by the force of the material in front of the screed a horizontal bracing should be mounted without strain on the rear of the screed.
The upper switch on the navigation block is used to switch between „Niveltronic Settings“ and „Paving Parameters“.

The arrow buttons are used to scroll between the screens.

Using „Escape“ in a sub menu will call the previous screen.
### Tamper Settings

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Selection Tamper „Automatic Mode“</td>
</tr>
<tr>
<td>F2</td>
<td>Selection Tamper „Manual Mode“</td>
</tr>
<tr>
<td>F4</td>
<td>Decreasing Tamper Revolutions</td>
</tr>
<tr>
<td>F5</td>
<td>Increasing Tamper Revolutions</td>
</tr>
</tbody>
</table>

### Vibration Settings

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Selection Vibration „Automatic Mode“</td>
</tr>
<tr>
<td>F2</td>
<td>Selection Vibration „Manual Mode“</td>
</tr>
<tr>
<td>F4</td>
<td>Decreasing Vibration Revolutions</td>
</tr>
<tr>
<td>F5</td>
<td>Increasing Vibration Revolutions</td>
</tr>
</tbody>
</table>

**Option:** Display Tamper Revolutions

**Option:** Display Vibration Frequency
### Adjustments of Pressure Bars

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Selection Pressure Bars „Automatic Mode“</td>
</tr>
<tr>
<td>F2</td>
<td>Selection Pressure Bars „Manual Mode“</td>
</tr>
<tr>
<td>F3</td>
<td>Submenu Balance P1 / P2</td>
</tr>
<tr>
<td>F4</td>
<td>Decrease of Pressure</td>
</tr>
<tr>
<td>F5</td>
<td>Increase of Pressure</td>
</tr>
</tbody>
</table>

### Balance Setting P2

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>Increasing Pressure of P2 – max. 20bar</td>
</tr>
<tr>
<td>F3</td>
<td>Reset Balance 1:1</td>
</tr>
<tr>
<td>F4</td>
<td>Decreasing Pressure of P2 – max. 20 bar</td>
</tr>
</tbody>
</table>

**Note:**

*Balance only influences the rear pressure bars (P2)!*
2.17 Screed Operation

Adjustment: Screed Assist Pressure

F1 Selection Screed Assist: Automatic / Off
F3 Submenu „Balance“ Screed Assist
F4 Decreasing Screed Assist Pressure
F5 Increasing Screed Assist Pressure

Pre-set assist pressure in %.
max. 40 bar actual Screed assist pressure for both sides.

Adjustment: Balance Screed Assist

F2 Left-hand side: decreasing screed assist pressure
F3 Reset Balance to 1:1 (0%)
F4 Right-hand side: increasing screed assist pressure
+/- 50 % Screed Assist Pressure for the left-hand side
or the right-hand side
### Momentary “Screed Float Off”

<table>
<thead>
<tr>
<th>F1</th>
<th>Screed „Not Floating“</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>As long F1 is pushed and hold, the screed float of the screed is deactivated and the screed is held.</td>
</tr>
</tbody>
</table>

### Info Screen: Paving Speed Paving Distance

<table>
<thead>
<tr>
<th>F1</th>
<th>Reset the Distance Counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3</td>
<td>Submenu Service</td>
</tr>
</tbody>
</table>

**Display** of the paving speed and a distance counter, which is counting the distance (in meter), covered in „Pave Mode“.
### Matrix Screed Control

![Matrix Screed Control](image)

| Light bulbs / LED Function check | Screed Control, Niveltronic Sensor, Auger Sensor |

### Pin Assignment of Socket “Grade Control”

![Pin Assignment](image)

**F1**  Light bulbs / LED Function check  
Screed Control, Niveltronic Sensor, Auger Sensor

**Service Screen „Automatic Grade Control“**  
All inputs and outputs of the levelling socket can be checked here
Display of actual and set value of the screed plate temperature.

**Service Screen Auger Sensor**

All inputs and outputs of the auger sensor socket can be checked here.

**Electrical Screed Heating**

The electrical screed heating can be turned On or OFF via F1.

Display „Set value“ (adjustable up to 200°C)

Display „Actual value“
2.17 Screed Operation

**Float Position „Deflector Crawler Track“**

With switch **F1** the deflector plates of the crawler tracks can be lowered and raised.

When the function is activated, the deflectors are in „float position“. When the function is deactivated, the deflectors are in the upper end position.

**Auger Height Adjustment**

Shown is the distance between auger plate bottom and screed front bottom.

*Rule of Thumb:*
Paving depth + 5 to 10 cm

Adjustable at Screed Control or Main Control
2.17 Screed Operation

Controlling the Augers

F1 Auger sensor ON/OFF

Crown Profile Adjustment

Screed crown profile in %

F3 Submenu „Calibration“

Adjustment is carried out via the Switches on the screed control or in the display (service menu) of the Main control desk.

Adjustment Auger Sensor
As soon as the auger sensor is activated, the display change and the operator can „calibrate“ the sensor via „F3“ (Actual value = Set value).
Submenu: Calibration of the Crown Profile Display

- **F2** Decreasing displayed value
- **F3** Set displayed value to „0“
- **F4** Increasing displayed value

Controlling the Conveyors

Adjustment of the material supply of the conveyors. When changing the value shown in the display, the switch-off point of the sensors will be moved.

- **F4** Decreasing the material supply of the conveyor
- **F5** Increasing the material supply of the conveyor

Adjustment for the individual sides.
Description of NiveltronicPlus-Screen

- **Position tow point - cylinder, l/h side**
- **Display Slope**
- **Status Screed Assist**
- **Position tow point - cylinder, r/h side**
- **Set value Niveltronic**
  - **l/h side**
- **Actual value Niveltronic**
  - **l/h side**
- **Sensor type**
  - **l/h side**
- **Calibration**
  - **l/h side**
- **Sensor selection**
  - **l/h side**
- **Sensitivity**
  - **l/h side**
- **Submenu Settings**
- **Set value Niveltronic**
  - **r/h side**
- **Actual value Niveltronic**
  - **r/h side**
- **Sensor type r/h side**
- **Calibration r/h side**
- **Sensor selection r/h side**
- **Sensitivity r/h side**
By pushing "F3" the submenu "Parameters" can be called.

<table>
<thead>
<tr>
<th>Submenu: Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F1</strong>  Sensor Calibration</td>
</tr>
<tr>
<td><strong>F2</strong>  Sensitivity</td>
</tr>
<tr>
<td><strong>F4</strong>  Advanced Parameter</td>
</tr>
<tr>
<td><strong>F5</strong>  Brightness</td>
</tr>
</tbody>
</table>
**2.17 Screed Operation**

### Submenu: Calibration “Displayed Value”

![Image of displayed value calibration interface]

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.0</td>
<td>+0.0 cm</td>
<td>??</td>
<td>??</td>
<td></td>
</tr>
</tbody>
</table>

F1 / F2 / F4 / F5 can be used to customize the displayed „Actual value“.

By pushing the +/- switches together, the offset value will be reset. That means: the original sensor value is shown.

The function is used to match the displayed value from the slope sensor with the „manual measured value“ of the slope of the application.

### Submenu: Sensitivity

![Image of sensitivity adjustment interface]

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pushing F1 or F2 will change the sensitivity of the left-hand side.

Pushing F4 or F5 will change the sensitivity of the right-hand side.

- **Standard setting** = 5
- **Niveltronic „sluggish“** = 0
- **Niveltronic „aggressive“** = 9
2.17 Screed Operation

**Submenu: AdvancedSettings**

**Submenu: Working Window**

<table>
<thead>
<tr>
<th>F1</th>
<th>Call Working Window Niveltronic Plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>„Locking“ Operation Side</td>
</tr>
</tbody>
</table>

Operation of “NiveltronicPlus” and “Manual Tow Point Adjustment” can be blocked for the other screed console by pressing F2. If two screed consoles are shown, both sides can be operated, when only one is indicated means that only one side can be operated. The function can be activated and deactivated from either side.

Using F1 or F2 will change the working window for the automatic grade control, left-hand side. Using F4 or F5 will change the working window for the automatic grade control, right-hand side.
Chapter 3

Automatic Grade and Slope Control
3.1 Levelling Sensors

In general linguistic usage **Levelling** means:

- levelling something
- planning something
- to even something
- bringing something to the same level
- getting differences out

### Available Sensor types

- Mechanical sensors
- Contact-free, acoustic Sensors
- Contact-free, optical Sensors
- 3D-System NavitronicPlus
3.2 Fundamentals in Operation

Initial situation:
Left-hand side reference via a mechanical grade sensor, maintaining an adjusted slope, controlled by a slope sensor.

The basic principle
When sampling a reference the up and down movements of the screed will be transmitted to the mechanic grade sensor. Deviation between actual value and Set value will lead to an automatically control of the screed position carried out by the automatic levelling system.

Deviation to the Reference
The automatic grade sensor [1] recognizes a deviation in the adjusted reference.

Left hand side Control
The height of the sensor facing the tow point cylinder [2] is changing its position as long the grade sensor (3) is back in its initial position.

The other tow point cylinder will be only controlled, when the Slope sensor (4) determines a deviation to the set value.

Right hand side Control
The right tow point [5] gets control signals as long the adjusted set value is reached.
3.3 Mechanic Sensors

Advantages of a mechanic sensor:

- Insensitive against external influences such as moisture, wind, temperature
- Measurement is carried out „visible“. That means, it is visible has the sensor a „stabile“ contact to the reference and it is „visible“ where at the reference the sensor has contact.

- Ground sampling with mechanic skis (0.3 m, 0.8 m or 2.0 m in length).
- The “0.3 m” ski is suitable particularly for tight turns and roundabouts (the height level is copied with the short ski almost 1:1).
- When only minor irregularities in the reference must be levelled out, the use of the 0.8 m or 2.0 m ski is recommended.
- When bigger irregularities must be levelled out, the use of an average beam is useful.
The slope Sensor can be used, in combination with other grade sensors, for paving widths up to a maximum of 6 meter. The slope of the screed is measured with a fluid-filled sensor, comparable to a spirit level, and can measure slopes of +/- 10%.

(Slope Sensor on the bar between the tow arms - shown enlarged)
The functional principle of acoustic sensors is identical:
A ultrasonic signal is emitted, reflected and received again. The time between emitting and receiving is an indication about the distance to the used reference.
The ultrasonic-single sensor is emitting one sound beam. Thereby the reference is transferred 1:1, without an averaging.

The sensor is suited especially for:

- Tight turns
- Winding roads with small turning radiuses
- When paving two lanes parallel (either „Hot-on-Hot“ or „Hot-on-Hold“)
- Copying of speed humps or similar applications

Short irregularities can be levelled out by using an average value out of the 3 signals (in ground mode).

The sensor also can be used on a levelling wire or a tensioned string line. In that case 5 signals are used (string mode), but only the signal reaching the reference first is used for the Automatic Control.
Because Sound Waves move different at changing environment temperature, a compensation of this inconvenient behaviour is required.

For compensation a reference point measurement with a defined distance takes place continuously. By using a metal bow, mounted in a fixed distance to the sensor cell, the measuring is carried out. Basically the first reflected signal is used for the temperature compensation, following reflected signals are used for levelling.

When the time from sending and receiving is changing due to a change in the environment temperature, the signal to the Niveltronic will be corrected.

**Info**

**Sound Wave Speed**
- at 0° C = 331 m/sec
- at 30° C = 349 m/sec
### Functional Principle

#### Niveltronic (Ground Mode)
- 3 active sensors
- Average determination
- Adjustable working window
- Adjustable sensibility
- Position: longitudinal to lane

#### Multiplex Bigski (Ground Mode)
- 5 active sensors
- Average value out of 3 signals
- Adjustable working window
- Position: longitudinal to lane

#### Niveltronic and Multiplex BigSki (String Mode)
- 5 active sensors
- No average determination
- First signal reflected back from reference (string) is utilized
- Adjustable sensibility
- Adjustable working window

Variable Working Range:
- Niveltronic: 250 – 650 mm
- Multiplex Bigski: 250 – 1000 mm

Working window: ±25 mm

String Range: Min 2.5 mm

Position: Longitudinal to lane
Obstacles, outside of an adjustable tolerance, will be ignored and not included in the average determination (shuffle, big rocks, ...).

Note

Possible configuration of a BigSki:
- Sampling with 3 Sensors
- String line sampling with only 1 Sensor

In-depth: Big Multiplex Ski

The extendible beam enables variable sampling lengths of 5 m to 13 m.

Three ultrasonic-wide-range sensors, each with five sensor cells to form an averaged value for the Niveltronic, are connected to the Big-Ski.

Each sensor sends its measurement results to the central unit.

In the control unit the 3 measured values are averaged.
3.4 Acoustic Sensors

In-depth: Big Multiplex Ski

Connecting the Multiplex Bigski

- Standard Cable
- CAN Cable with 2x 120 Ohm Terminating Resistors
- Standard Cable
- Analogue Sensor Connection Cable
- Sensor connectors
- Sonic-Ski CAN
3.4 Acoustic Sensors

In-depth: Big Multiplex Ski

Central Unit Big-Multiplex-Ski

Sensor detection
Each Sensor station that is used the first time is first identified via LED. In addition sensor configurations or error messages are shown in the LCD display.

Sensor Acknowledgement
When the Big-Ski has been connected the first time or if the sensor combination has changed, the sensor detection must be acknowledged.

The displayed numbers flashes before the confirmation. After confirmation (pressing any key) the display is continuously on.

Set Value Calibration
The sensors must be calibrated before starting the first time or when fundamental changes in settings took place.

When the “Set”-button is pressed, the calibration is done and “SET” appears in the display.

Calling Parameter (Working Window)

Call "Working Window".
The value corresponds to the permissible measurement range of sensors around the calibration point (Value 6 = +/- 3cm)

Change (in increments of 1cm between 4.0 and 20.0) or deactivate the range (bigger 20.0 = OFF).
3.4 Acoustic Sensors

*In-depth: Big Multiplex Ski*

- Sampling within the paving width
- Sampling outside of the paving width
**Instruction for installation 1:**

„Distance A“ should be equal with „Distance B“!

**Instruction for installation 2:**

Approved is also an approximation of the two pivot points / break over points of Paver and BigSki beam.

**Explanation:**
The pivot or break over point of the paver is approximately the position for the center sensor of the BigSki.

The position also has a positive influence, e.g. when paving or sampling against an edge.
3.4 Acoustic Sensors

In-depth: Big Multiplex Ski

**Centre Sensor „Centric“**

As long the system is working within the Working Window, the up and down movement of the BigSki beam will not influence the signals to the Tow Point Cylinders due to the centric installation of the center sensor.

\[ \text{Sensor } 1 + \text{Sensor } 2 + \text{Sensor } 3 \quad \frac{20 \text{ mm} + 0 \text{ mm} + (-20 \text{ mm})}{3} = 0 \text{ mm} \quad \text{(no controlling done by the BigSki)} \]

**Centre Sensor „Off- Center“**

Due to the “Off- center” position of the center sensor, false signals can occur and sent to the Tow Point Cylinders during up and down movements of the BigSki beam.

\[ \text{Sensor } 1 + \text{Sensor } 2 + \text{Sensor } 3 \quad \frac{20 \text{ mm} + 10 \text{ mm} + (-20 \text{ mm})}{3} = 3,3 \text{ mm} \quad \text{(controlling by the BigSki)} \]
Application Tip – Paving towards an edge

Proceeding
(Example Picture: Sampling „Bigski, left hand side”):

Before the first sensor reaches the edge:
Turning off the Niveltronic on the screed control [1]!

As soon the first sensor is on the new level, the new reference must be confirmed by pushing „F1“[2] and then the Niveltronic must be turned on again [1].

This setting can be done without a paving stop!

NOTE
No additional setting needs to be done on the central unit of the BigSki, as long the working window there is set to „Off“.
When paving crests or depressions, the first sensor sends a false signal or leaves the reference line. That behaviour can lead to false signals or even to an interruption of the sampling which would stop the automatic grade control.

**Installation Instruction for both cases:**

For both paving examples the front sensor should be mounted besides the front edge of the crawler track or besides the first axle of a wheeled paver.
The use of a laser receiver is especially applicable when paving large areas with a constant longitudinal and transverse slope such as Sport stadiums, parking lots or storage areas.

No height adjustment during paving is needed for the mast on the paver (bracket for laser receiver) due to the large measuring range.

Compared to Ultrasonic sensors the optical sensors are working with laser beams.

**Advantages:**
- Signals will not be influenced by wind or temperature
- Large range of laser beams

A laser transmitter is generating a “Plane” due to a rotating laser beam. The plane is determined by a receiver, attached to the paver.

The use of a laser receiver is especially applicable when paving large areas with a constant longitudinal and transverse slope such as Sport stadiums, parking lots or storage areas.

No height adjustment during paving is needed for the mast on the paver (bracket for laser receiver) due to the large measuring range.

**Attention**

Fog, Rain, Mirror Finished Building facades can influence the quality of the laser signal negative.
### 3.5 Optical Sensors (Laser)

#### Laser Receiver LS300

<table>
<thead>
<tr>
<th>Display</th>
<th>Meaning</th>
<th>Positioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Display" /></td>
<td>The laser receiver has just been switched on; no laser signal is reaching the receiver.</td>
<td></td>
</tr>
<tr>
<td><img src="image2" alt="Display" /></td>
<td>In the long-distance range, the laser beam is targeting much too low; i.e. &gt;105mm below the centre of the sensor</td>
<td>Move Sensor downwards (or transmitter upwards)</td>
</tr>
<tr>
<td><img src="image3" alt="Display" /></td>
<td>In the long-distance range, the laser beam is targeting too low; i.e. &gt;90mm and &lt;105mm below the centre of the sensor</td>
<td>Move Sensor downwards (or transmitter upwards)</td>
</tr>
<tr>
<td><img src="image4" alt="Display" /></td>
<td>At a close range the laser beam is targeting too low; i.e. &gt;60mm and &lt;90mm below the centre of the sensor</td>
<td>Move sensor carefully downwards (or transmitter upwards)</td>
</tr>
<tr>
<td><img src="image5" alt="Display" /></td>
<td>The laser is dead on target; i.e. +/- 60 mm</td>
<td>Optimum Sensor position</td>
</tr>
<tr>
<td><img src="image6" alt="Display" /></td>
<td>At a close range the laser beam is targeting too high; i.e. &gt;60mm and &lt;90mm above the centre of the sensor</td>
<td>Move sensor carefully upwards (or transmitter downwards)</td>
</tr>
<tr>
<td><img src="image7" alt="Display" /></td>
<td>In the long-distance range, the laser beam is targeting too high; i.e. &gt;90mm and &lt;105mm above the centre of the sensor</td>
<td>Move sensor upwards (or transmitter downwards)</td>
</tr>
<tr>
<td><img src="image8" alt="Display" /></td>
<td>In the long-distance range, the laser beam is targeting much too high; i.e. &gt;105mm above the centre of the sensor</td>
<td>Move sensor upwards (or transmitter downwards)</td>
</tr>
<tr>
<td><img src="image9" alt="Display" /></td>
<td>Incorrect reflection respectively no explicit laser beam or electrical fault (e.g. defective amplifier). Proper measurements are impossible!</td>
<td></td>
</tr>
<tr>
<td><img src="image10" alt="Display" /></td>
<td>No laser beam detected on the receiver!</td>
<td></td>
</tr>
</tbody>
</table>
NavitronicPlus is a 3D-Machine Control System for reference-wire-less navigation of a Road paver. Controlling is carried out with a external computer, connected to the paver via an interface.
Chapter 4

Application
4.1 Paving Asphalt

Asphalt Layers and their Purposes

About technical and economical reasons, asphalt layers are subdivided in different layers:
- asphalt base course,
- asphalt binder course and
- asphalt wearing course.
Each layer has its special function and is needed, according to its depth and position, to achieve the required bearing capacity of the complete construction.

A strong and durable bond of the layers is required.

Function of an Asphalt Base Course:

- Within the scope of performing the construction, the base course has to prevent the sub base from precipitation in order to maintain the bearing capacity.
- To get an even and stable base for the following layers such as Binder and Wearing Course.
- During its service life the base course should be in a fixed bond with Binder and Wearing course to absorb the forces of traffic and derive them evenly to the sub base.

Reference (Text in the following light-blue/red framed text boxes):
German Asphalt Association (DAV)
www.asphalt.de
### 4.1 Paving Asphalt

#### Asphalt Binder Course

At roads with heavier traffic (e.g. construction class III and higher, fully bonded pavement and special operational demands starting construction class IV) a binder course between base course and wearing course is mandatory.

**Function of a Asphalt Binder Course:**
- Reducing existing irregularities in the base course to ensure the production of asphalt layers in uniform depths and required evenness.
- In particular the main function is to absorb the high shearing stress from the traffic in that area of the pavement and avoiding deformation.

#### Asphalt Wearing Course

Asphalt wearing course is the top layer and therefore the most stressed area of the pavement and, thereby, subject to direct influence of traffic, weather and de-icing agent.

**Function of a Asphalt Wearing Course:**
- As a “Use-surface” they shall provide a permanent, roadworthy and good passable or walkable surface.
- As a “Sealing Layer” the layers below shall be prevented from the influences of weather and traffic.
4.1 Paving Asphalt

Combined Asphalt Base and Surface Layer

It is a combination between asphalt base course and asphalt wearing course. They are developed for comparatively thin pavements in rural road construction. This type of layer is used when the required dimension is sufficient (e.g. 80 – 100 mm), but the layers can not be subdivided in base course and wearing course without falling below the construction related minimum layer depth.
Checklist “Paving”

To ensure a smooth operation on a job site, it is mandatory to have a working logistic referring to the paving process. Beside the actual application also the calculation of the material supply from the plant, the preparation of the job site and the road paver is necessary.

NOTE
Cold weather and long distances from plant to job site can cause problems since the temperatures of the asphalt can reach the minimum limits when arriving on the job site!

4.1 Paving Asphalt

Preparation of the Job Site
- Necessary equipment on-site?
- Job site secured?
- Number of workers sufficient for the job?
- Supply trucks circulation calculated?
- Base prepared (evenness, tack coat)?
- References (for height, slope and Direction) defined?

Preparation of the Road Paver
- Machine operational?
- Necessary equipment mounted (sensors, screed controls)?
- Screed heated up?
- Paving parameters coordinated and set?

Paving Process
- Compliance of all relevant safety rules
- Compliance of all application related rules
- Communication between paver driver and screw men
- Control measurements (depth, width, slope)

After Treatment
- All necessary rectifications should be done immediately
- Obtaining rolling rules
1. Checking of: Motor Oil Level; Coolant Level; Oil Level PDO, Auto Greaser and Hydraulic Oil

2. Mounting of Screed Controls (with Ignition OFF)

3. Starting the engine and leave it run for at least 3 minutes in idle (NO functions on!)

4. Lowering the screed a few mm above the ground and turning on Screed Heating.
   While heating up the screed for about 20 minutes add mountings like auger and Grade sensors

5. Turn on Pre-heating function and let it run for 15 more minutes (still with screed heating on)

6. Pre-heating function off; Engine RPM’s to MAX and Tampers 100% in Manual Mode: running the Tampers until maximum Speed is reached.

7. Setting the Paving Function on Automatic and also setting of required Values

8. Positioning of the Paver and lowering the screed; Adjustment of Auger Height and Tow Point Position.

9. Filling up the Screed with Material
   (waiting another 5 minutes to warm up the Tamper shield with the heat of the material)

10. Set up the paving Speed – Start Paving
### 4.1 Paving Asphalt

<table>
<thead>
<tr>
<th>Recommended Settings</th>
<th>Type of Layer</th>
<th>Asphalt - Acronyms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paving Speed</strong></td>
<td></td>
<td><strong>Abbreviations for asphalt mixes and asphalt grades</strong></td>
</tr>
<tr>
<td>m/min</td>
<td>Wear Course</td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>Binder</td>
<td>SMA</td>
</tr>
<tr>
<td></td>
<td>Base Course</td>
<td>MA</td>
</tr>
<tr>
<td><strong>Tamper Speed</strong></td>
<td></td>
<td>PA</td>
</tr>
<tr>
<td>m/min</td>
<td><strong>Stroke mm</strong></td>
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<td>2 – 4</td>
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<td>500 – 800</td>
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<td>800 – 1200</td>
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<tr>
<td></td>
<td>1200 – 1800</td>
<td></td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>revs/min rpm</td>
<td>Wear Course</td>
<td></td>
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<td></td>
<td>Binder</td>
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<td></td>
<td>Base Course</td>
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<td></td>
<td>50 – 80</td>
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<td>70 – 90</td>
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<td></td>
<td>1200 – 2000</td>
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<td>1500 – 2500</td>
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<tr>
<td></td>
<td>2000 – 3000</td>
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<tr>
<td><strong>Pressure Bars</strong></td>
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<tr>
<td>bar</td>
<td>Wear Course</td>
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<td>Binder</td>
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<td></td>
<td>Base Course</td>
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<td>45 – 70</td>
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<td>60 – 90</td>
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<td>90 – 110</td>
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<td>58 – 68</td>
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<td></td>
<td>58 – 68</td>
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<tr>
<td><strong>Compacting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature °C</td>
<td>Wear Course</td>
<td></td>
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<td></td>
<td>Binder</td>
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<td>Base Course</td>
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<td></td>
<td>&gt; 120</td>
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</tr>
</tbody>
</table>
4.1 Paving Asphalt

Subgrade Preparation

- The subgrade level of an unbound base must be even, stable and properly compacted in order to ensure the uniform bearing capacity of the pavement for a long time.
- It is recommendable to allow paving after an approval to assure that bearing capacity, height, evenness as well as longitudinal and transverse slope are corresponding with the requirements of the planning of the job site.
- When paving a asphalt layer on top of a bonded base the new layer should be like the unbounded base even, stable and compacted. Pre-profiling is mandatory when significantly irregularities are present.

Function of a Asphalt Base Course:

- Within the scope of performing the construction, the base course has to prevent the sub base from precipitation in order to maintain the bearing capacity.
- To get an even and stable base for the following layers such as binder and wearing course.
- During its service life the base course should be in a fixed bond with binder and wearing course to absorb the forces of traffic and derive them evenly to the sub base.

Base should be free of irregularities. Preparation must be done in order to achieve evenness in the top layer.
Subgrade Preparation

Level Regulating Measures Before Placing Base Course

The layer thickness should remain constant over the full pave width to the greatest possible extent. If it does not, it is recommended to level out major differences beforehand in order to achieve uniform pre-compaction and uniform extra compaction by rolling.

- The type of mix used for such level regulating purposes should be adapted to the layer depth.
- This material can be laid either by hand or (preferably) with the paver.
- Good pre-compaction of the level regulating layer is very important.

Layer Thickness and Grain Size of the Mix

The layer thickness should be at least three times the largest grain size in the mix!

If this is not the case, grains may be crushed and the screed begin to bounce due to the impact of its compacting systems. When the colour of the crushed stone appears on the surface, grains have been destroyed. This is quickly revealed, as all constituents in the mix are normally coated with black bitumen. In addition, the screed may be unable to maintain the required elevation and the layer thickness will increase.
To avoid positive or negative influence to the float behaviour of the screed, the head of material should be even and constant. Therefore strike-off plates or tunnel plates should be used and can be mounted to the road paver according to the paving width. Additionally segregation can be avoided as well as the material will not cool down too early.
Ten Steps After Paving

Time required approx. 30 minutes

1. Step: Prior dumping the last truck: turn off screed heating and wash down the hoppers and augers with cleaning agent.

2. Step: Before raising the screed, turn off the Automatic Grade and Slope Control and move the tow points to the same height (to avoid twisting of the screed frame).

3. Step: Raising the screed and put the screed arms in the screed locks.


5. Step: Extend the screed completely and switch to Drive Mode Neutral “N”

6. Step: Cleaning of the quick cooling parts of paver and screed
   (End gates; Strike-off Plates; Tunnel Plates; Augers; Push Rollers).

7. Step: Change to Drive Mode Positioning and activation of Cleaning Function.

8. Step: Wash down of all parts getting in contact with mix
   (Spray down Tampers from the rear, Pressure bars from the top).

9. Step: Retracting the screed; Turning of the engine; Ignition off.

10. Step: Remove added Parts (like Sensors), protecting remaining parts (like controls and dash) with the designated covers.
### Paving without Grade and Slope Control

When paving without automatic levelling, the required paving depth is achieved by manual adjustment of the tow point cylinders. Once the depth is reached, further, unnecessary adjustment should be avoided. It is also important to maintain the parameters for paving, such as paving speed, tamper revolutions and head of material during paving. Changing the parameters can lead to a change in paving depth and therefor a change of the tow point position will be required.

### Paving with Slope

In Road construction Slope or Cross-slope is indicating the transversal slope of a lane (in a right angle to the axis of the lanes). Slope ensures the drainage of surface water and hereby the penetration of water in the asphalt layers will be avoided.

Therefor …

a) …damages due to baring by water, respectively frost damages are reduced.

a) …aquaplaning or drizzle is minimized.

An increased slope profile at the inside of a turn also works against the centrifugal forces, appearing when driving in the turn.

| Picture 1: Paving wearing course on milled ground. | Picture 2: Paving a asphalt base course with slope |
# Paving and Checking of Paved Result

## Paving with “Crown Profile”

Compared to “Slope” this type of profile is measured from the center of the road, or better: from the centre of the screed to the outsides.

The required profile is achieved by “Kinking” the main screed. Possible is either positive or negative crown adjustment.

E.g. when paving negative crown profile, the drainage of water is towards the center of the lane.

Typical field of application:

Slow traffic roads, footpaths or pedestrian areas.

## Measuring “Crown Profile”

### Example 1:
Paving with 1% crown, measured with a digital spirit level

**Prior measurement:**
- Digital spirit level “calibrated” before use
- Same height level on both sides respectively a slope of +/- 0%

### Example 2:
Paving with 1% Crown, measured with a digital spirit level

**Prior measurement:**
- Digital spirit level „calibrated“ before use
- different height level on both sides, respectively a slope of +1%

![Display: -1%](image1)
![Display: +1%](image2)

![Display: +0%](image3)
![Display: +2%](image4)
4.2 Paving and Checking of Paved Result

**Measuring “Percentages”**

With spirit level (1,0 m length)

**Meaning of the Prefixes**

+ 0
- in terms: plus/minus 0 Percent -
  means, the measured lane has no slope.

+ 1%
- in terms: plus one Percent -
  means, the measured lane has a slope of 1 % **to the right**
  in travel direction of the paver.

- 1%
- in terms: minus one Percent –
  means, the measured lane has a slope of 1 % **to the left**
  in travel direction of the paver.

The indication of slope is Percentage (%).
1% Slope correspond, measured on 1,0 meter, to 1centimeter height difference. Therefor it is recommended to use a spirit level with a total length of 1,0 meter.
Measuring “Slope”

**Spirit Level and Straight Edge**

To get an exact measuring result, the use of a straight edge is recommended.

When checking e.g. the slope, following rule applies:

\[
\text{Measured distance} = 4 \text{ cm} \\
4 \text{ (cm)} : 4 \text{ (m), length of straight edge} \\
\text{= 1% Slope}
\]
Use of a Digital Spirit Level

Three things should be considered, when using a digital spirit level:

- The measure tool MUST be calibrated (according to the manufacturer information) prior each job site to ensure a correct measuring result.
- The measure tool should not be stored on he screed (due to vibrations and possible high temperatures)
- The units (grade, percentage) must be set!

1% … correspond, measured on 1 meter, to 1,0 cm height difference!

1° … correspond, measured on 1 meter, to 1,0 cm height difference!

When confounding Grade and Percentage, the required slope would be almost doubled.

Mathematical Explanation

On a triangle with two equal short sides, the long side has an incline of 45° (degrees) – here shown with a set square. 45° (degrees) is equal with a mathematical slope of 100%.

Information:
For the conversion Percentage/Gradient following formula applies:

$$\tan \alpha = \frac{\text{Percentage Value}}{100}$$

For illustration:

- $1° \cong 1.75 \%$
- $45° \cong 100\%$
- or
- $1\% \cong 0.57°$
- $100\% \cong 45°$
### 4.3 Influencing Parameters

<table>
<thead>
<tr>
<th>Asphalt Temperature</th>
<th>Asphalt Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Cold material is less compactable</td>
<td>▪ Mix characteristics are influencing the float behaviour of the screed</td>
</tr>
<tr>
<td>▪ Bearing capacity is changing</td>
<td>▪ Material supply must be adjusted to the mix</td>
</tr>
<tr>
<td>▪ Surface structure is changing</td>
<td>▪ Compaction devices must be adjusted to the mix</td>
</tr>
<tr>
<td>▪ Asphalt should have a continuous, homogenous temperature</td>
<td>▪ Asphalt mix with less binder content, e.g. asphalt base course, tend more to segregation than mixes with a high content of binder</td>
</tr>
<tr>
<td>▪ Cooled down material in corners or nocks should be avoided</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bearing Capacity</th>
<th>Grain Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ A changing composition of the material can influence the bearing capacity</td>
<td>▪ 1/3 of paving depth = maximum (optimum) Grain size</td>
</tr>
<tr>
<td>▪ Reduced bearing capacity will lead to a larger screed angle of attack to achieve the required paving depth</td>
<td>▪ need to be observed especially when paving very thin layers!</td>
</tr>
<tr>
<td>▪ Increased Resistance against the screed when laying material with good bearing capacity</td>
<td></td>
</tr>
</tbody>
</table>
### Influencing Parameters

<table>
<thead>
<tr>
<th>Tamper</th>
<th>Paving Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bigger Tamper stroke = higher pre-compaction</td>
<td>• Paving speed should be chosen according to the material supply from the feeding trucks in order to avoid paving stops</td>
</tr>
<tr>
<td>• Tamper stroke and Tamper revolution are influencing the screed planning angle</td>
<td>• Higher paving speeds require sufficient material supply</td>
</tr>
<tr>
<td>• Depending to the screed type, tamper stroke can be changed to be suitable for different job site conditions</td>
<td>• Paving speed is influencing angle of attack, pre-compaction and surface structure</td>
</tr>
<tr>
<td></td>
<td>• Paving speed is determining the efficiency of the compaction devices</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Head of Material</th>
<th>Vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Higher head of material = bigger uplift of the screed</td>
<td>• Used to achieve a uniform surface structure</td>
</tr>
<tr>
<td>• Constant head of material = balanced float behaviour of the screed</td>
<td>• When using vibration, the fines and binder in the mix will come up to the surface of the laid asphalt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure Bars</th>
<th>Rigidity of the Screed</th>
</tr>
</thead>
<tbody>
<tr>
<td>• When using pressure bars, the pre-compaction can be increased and the rolling paths can be reduced</td>
<td>• Big or one-sided changes of the angle of attack can lead to a twisting of the screed, due to the rigidity of the screed, the opposite side will be also influenced</td>
</tr>
<tr>
<td>• Operation pressure for pressure bars can be adjusted according to the job site</td>
<td>• When using bolt-on extensions, the respective bracing should be used to ensure the rigidity of the screed</td>
</tr>
<tr>
<td>• Pressure should not be too high (uneven pre-compaction and crushed stones can occur)</td>
<td></td>
</tr>
</tbody>
</table>
4.4 Sources of Errors

Asphalt

- Segregation
- Composition
- Temperature
- False Choice of Material
4.4 Sources of Errors

Machine Operators

- Missing Knowledge about Paving
- New Technologies
- Time Pressure
- No clear Instructions
- Faulty Machine Operation
4.4 Sources of Errors

Paver and Screeds

- Wrong Settings
- Missing Service
- Missing Maintenance
- Wear and Tear
Choosing the right paver or screed size
- Screed size must be right for the job site
- Restricted guidance of the screed should be avoided

Preparation of the base
- Base must be even
-Depressions must be filled and mix must be compacted prior paving
- Layer thickness must correspond with grain size

Tack coat and Bitumen Emulsion
- Unnecessary passing over the tack coat is unwanted
- Spray pattern must be closed and uniform to ensure the bonding between the layers
- Excessive tack coat can come up to the surface (possible over fatting)
Considering Weather and Environment temperature
- Water, Snow and a cold sub base can lead to a rapid cooling down of the asphalt mix
- Water will reduce the function of tack coat (result: no bonding of layers)
- Recommended temperatures should be observed

Preparation of Levelling and Steering References
- Distance between pins: max 6 m (about possible sag)
- Diameter of string line/guide wire: minimum 2,5 mm
- Observing the alignment and tension of string line or guide wire

Using Sensors according to the application
- Observance of Sensor position (Auger sensor or levelling sensor)
- Installation of the sensor prior paving
- Especially when paving with a fully retracted screed the position of the auger sensor need more attention
- Using appropriate sensors for sampling, e.g. when copying a gutter
4.6 Possible Faults During Paving

Cleanliness during paving
- Impurities during paving should be avoided
- Checking paver and screed for leakages prior paving

Adapting Screed Settings
- Correct alignment of bolt-on extensions
- Observance of uneven wear and tear on bolt-on extensions
- Ensure the proper function of the electric screed heating

Selection and Adjustment of Grade and slope Sensors
- Sensors must be appropriate for the application
- Observance of settings
- Adaption of ski length
- When needed, changing sensitivity of the Niveltronic
4.7 Possible Faults After Paving

Obtaining Rolling Rules

- Selecting the right roller size and type
- Observing rolling pattern
- Activating sprinkler system
- Observing asphalt temperature
- Avoiding stops with the rollers on warm asphalt
- Rolling always as close as possible to the paver
- If possible rolling with light turns at the end of a path, not straight (possible appearance of bow waves)
- Reducing steering movements on asphalt
### 4.8 Summary of Potential Paving Faults

**Roller**
- Wrong Roller (Weight)
- Stops
- Wrong Rolling Pattern
- False Parameter
- Steering Movements

**Screed**
- Torque Restrain System
- Telescopic Tubes
- Wear and Tear
- Bracings (SB Screed)

**Levelling / Reference**
- False Sensor
- Bracket of Sensor (loose)
- Position of Sensor
- String/wire Sag
- Gutter Sampling
- Faulty Operation
- Climatic Influences

**Mix**
- Too Hot
- Too Cold
- Wrong Grain Size
- Changing Head of Material

**Paver**
- Loose or missing Screw Fittings (tow arms)
- Traction Drive (chain tension/air pressure)
- Mechanic/hydraulic Problems
- Missing Tunnel Plates/ Auger Extensions

**Feeding Lorries**
- Hard docking of the Trucks
- Braking

**Operator**
- False Parameters
- Paving Stops
- Steering Reference Flouted
- Stopping with Speed Dial

**Ground**
- Wet Ground
- Irregularities in Ground
- Poor Compaction
### 4.9 Frequent Errors when Paving

<table>
<thead>
<tr>
<th>Passing over Mix</th>
<th>Irregularities due to a High Angle of Attack</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Fault / Cause**
Material with a poor bearing capacity can lead to a high screed angle of attack in order to reach the required depth. A high angle of attack is pandering irregularities in the asphalt layer.

**Remedy**
- Increasing tamper speed
- Decreasing paving speed
- Changing tamper stroke
- Raising head of material
- Screed assist (with a low, constant pressure)

**Recommendation**
No screed assist when laying asphalt wearing course.

---

**Fault / Cause**
Passing over mix in the area of the crawler tracks

**Remedy**
- Avoiding mix in front of paver, respectively removing
- Use of the plough of a tracked paver
## 4.9 Frequent Errors when Paving

### Irregularities when Resuming Paving

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| „Bulge“ occurs when resuming paving | Every stop disturbs the floating screed's equilibrium of forces. Due to the positive angle of attack, the screed has the tendency to float up when resuming paving. The longer a paving stop, the bigger the to expected irregularity! | Activating “Screed Freeze“  
Keeping paving stops short  
Using remaining mix in hoppers for short pulls, standstill time can be distributed to more paving stops. |

### Short Irregularities in Transverse Direction

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| Small irregularities appear at short intervals. | Here the screed planning angle is negative. As a result, only the tamper bar and the front part of the screed plate are actually in contact with the mix. The small contact area is not sufficient to level out the irregularities in the surface. | Reducing compaction energy (tamper)  
Increasing paving speed  
Ensure the basic screed extension settings |
### Periodic Irregularities in Longitudinal Direction

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause / Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement irregularities at almost constant intervals.</td>
<td>Wear in the torque restraint system.</td>
</tr>
<tr>
<td>The irregularities are more pronounced in the area of the extending units than behind the basic screed.</td>
<td>Brass block adjustment: “Pressure-less &amp; Gap-free”</td>
</tr>
<tr>
<td>Gap in the height adjustment</td>
<td>Gap in the height adjustment</td>
</tr>
<tr>
<td>Lock screws loose</td>
<td>Lock screws loose</td>
</tr>
<tr>
<td>Adjustment of gaps according to manufacturer specifications</td>
<td>Adjustment of gaps according to manufacturer specifications</td>
</tr>
<tr>
<td>After adjustments: tightening of lock screws!</td>
<td>After adjustments: tightening of lock screws!</td>
</tr>
<tr>
<td>Excessive wear in the telescopic tubes (Teflon tapes)</td>
<td>Excessive wear in the telescopic tubes (Teflon tapes)</td>
</tr>
<tr>
<td>Keeping tubes free from rust and scratches</td>
<td>Keeping tubes free from rust and scratches</td>
</tr>
<tr>
<td>Always keep them greased with silicon grease</td>
<td>Always keep them greased with silicon grease</td>
</tr>
<tr>
<td>Replacing of worn out or damaged wiping seals on the tubes</td>
<td>Replacing of worn out or damaged wiping seals on the tubes</td>
</tr>
</tbody>
</table>

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4.9 Frequent Errors when Paving

**Periodic Irregularities in Longitudinal Direction**

**Fault**
- Pavement irregularities at almost constant intervals.
- The irregularities are more pronounced in the area of the extending units than behind the basic screed.

**Cause / Remedy**
- Wear in the torque restraint system.
- Brass block adjustment: “Pressure-less & Gap-free”
4.10 Segregation

Segregation Transverse to the Lane

Mixes with a big difference in grain size and also with a low content of binder are particularly vulnerable for segregation.

- Mix with big differences in grain size (e.g. base course)
- Low amount of binder
- Low amount of support grain
- Insufficient head of material
- Segregation in hopper

Strips of segregated material appear in the pavement transverse to the direction of travel after every change of feed truck.

**Cause**
Segregation is always promoted by a poor condition of the mix (not enough bitumen, not sufficiently homogeneous). It is also promoted by operation of the hopper sides when the hopper is almost empty, with the result that segregated material is moved to the auger tunnel.

**Remedy**
- Conveyors should always be covered with mix
- Hopper movement „On Demand“
- Continuously supply of mix to ensure that the movement of the hopper walls is reduced.
Segregation in the Center of the Lane

**Cause**
Head of material in front of the screed too less, resp. too low

**Remedy**
Adapting the auger height to paving depth. Rule of thumb:
Auger bottom edge approx. 50 mm above the screed plate bottom.

Depending to the paver type, the inner auger blade can be rotated to influence the material flow, mix can be pushed to the inside or the outside.

Also tried and tested is moving the screed to the rear.

The position can be achieved by using the second hole pattern on the lugs of the tow arms. The distance between paver and the screed is increased 80 mm.
4.10 Segregation

**Segregation in the Lateral Areas**

Appearance of segregation in the lateral areas when paving with a large paving width.

**Cause**
Unequal head of material in front of the screed across the complete paving width.

**Remedy**
- Use of Material Guide Plates (tunnel plates, deflectors), mounting as wide as possible.
- Sensors for Auger control should be on the outside, mounted on the side plates.
- Checking the material sensors, readjustment/optimizing, if needed.

**Patches of Mix in the Surface Texture**

Changes in the surface texture appear sporadically while paving. The surface is smoother or smeared with bitumen.

**Cause**
Fine grains with a high content of bitumen are coming from the plant to the job site – or the screed heating is insufficient.

**Remedy**
- Function check Screed Heating System.
- Cleaning Paver and Screed and checking the adjustment
- Informing the plant about the material issues.
- Reducing Tamper speed.
### Imprints from the Rear Edge of the Screed

The rear edge of the screed leaves an imprint transverse to the trackway.

**Cause**
- Angle of attack too high
- Hard docking of the truck to the paver
- Hydraulic valves on the screed raising/lowering cylinders

**Remedy**
- Optimizing the angle of attack
- Avoidance of hard docking of the truck
- Function check of the hydraulic valves

### Imprints from the Front Edge of the Screed

The front edge of the screed leaves an imprint transverse to the trackway.

**Cause**
- Tamper mechanical wrong adjusted (too low)
- Tamper „Overtravel“ or „Rotates to early“
- Operators fault (Stopping the paver with the speed dial)

**Remedy**
- Checking the mechanical adjustment of the Tampers
- Checking the electrical parameters/adjustments
- Stopping the paver only by using the Traction Main Switch only, during application in “Pave Mode”
Chapter 5
Service and Maintenance
<table>
<thead>
<tr>
<th>Operating Instructions</th>
<th>Maintenance Charts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance Charts for the respective machine can be found in the Operating Instructions.</td>
<td></td>
</tr>
<tr>
<td>Observing the mentioned intervals is recommended to avoid any lost of warranty claims and to ensure the machine is always operational.</td>
<td></td>
</tr>
</tbody>
</table>

**ATTENTION!**

The following description of Service or Maintenance work is exemplified and can vary depending the types of machinery. Base for all Service and Maintenance work is always the corresponding Operating Instruction.
### Recommended checks prior paving on a daily base:

- Visual check of Platform, Ladders, Glass panes and Canopy
- Function check Safety installations – Emergency stop buttons, Horn
- Motor oil Level
- Hydraulic Oil Level
- Splitter Gear Box- Oil Level
- Engine Coolant Level
- Fuel Level
- Centralized Lubrication System
- Air Filter
- Cooling Fin
- Battery Poles
- Leaks in Hydraulic System
- Push bar and Push Rollers

All necessary checks and intervals can be found in the **Maintenance charts**.

### Particular spots on a Paver should be checked every 50 working hours (weekly):

- Chain tension Auger Drives
- Chain tension Conveyor Drives
- Chain tension Crawler Track
- Loose Bolts
- Hydraulic Hosing

Part of the Operating Instruction: **Lubrication Charts**

Recommended Lubricants are shown in the chart to inform the operator about usable oils and grease for the machine.
If one or both speed sensors should fail, the speed will be reduced to 1.5 m/min. The machine can travel at half the maximum speed by switching over to traction drive in manual mode.

Located on the bottom of the seat valves of the screed raising/lowering cylinders, a manual actuation is located. In the case of a failure, the "screed Float" can be actuated here manually by turning the set screw.

Risk of Accident!

Especially when lowering the screed manually, it is important to ensure that no other persons are in the danger area around the screed.
These connections should not be plugged, but must be connected to the return flow (R).

To bleed the grease pump, fill in approx. 100ml of gear oil, open the delivery line at the pump and let the pump run until the mixture of oil and grease emerges without bubbles. Then fill the grease reservoir with high temperature grease.

The centralized lubrication system greases the bearings of the drive shafts of the conveyors and the auger bearings. The system is always activated when at least one of the material supply functions is activated either in manual or automatic mode.

When auger extensions are fitted, the connections for the outer bearings are located at the back of the machine.
Emergency Manual Override of Hydraulic Valves

Most of the hydraulic valves can be overridden manually. With an appropriate tool the set piston of the valve can be actuated thus the function is carried out.

**Important Requirement:**
Unplugging the electrical control!

Keep in mind:
Depending on the function it could be, that two valves are needed to run a function (e.g. „Oil supply“ and „Direction“).

8.2.4 Fuses

In the Operating Instruction a description of the fuses is given (hedged function and rated current size).

At the new “-3” paver generation all fuses, except the 3 main fuses mentioned above, are located on the main printed circuit Board (PCB). Depending to the paver type the PCB is either under the platform or below the bonnet.

Example: SUPER 1900-3/2100-3
5.2 Information for Operators

Aided Starting

After connecting the cables:
- Starting the donation vehicle.
- Attempting starting the defective vehicle.
- After a successful start let the engine run for a while.
- Turn on a few strong consumer such as working light etc. to prevent the electrical system from overload.

After that the donation vehicle can be turned off.
If the engine of the defective machine shuts off, there is not enough charging voltage from alternator / voltage regulator.

Towing a Paver

In order to release the parking brake manually, adjust the hand lever and apply pressure with the hand pump until the force no longer increases and the pressure limiting valve in the pump block is tripped or a pressure of 50 bar is measured at the measuring port with a pressure gauge. Unscrew the high pressure valves (4 valves) in the traction drive system by 3-4 turns! This enables the hydraulic oil to circulate between pump and motor!

The paver should not be towed further than 300m.
The maximum towing speed should not exceed 10m/min.

Use of a towing bar is recommended!
If welding needs to be carried out on the paver, following precautions must be considered in order to prevent electronic parts from damages such as overvoltage or voltage peaks!

It is highly recommended to:

- Disconnect the paver operator’s console from the on-board supply.
- Unplug connectors X1 and X2 from controllers 2 and 3.
- Unplug the two screed controls.
- Disconnect the voltage regulator.
- Disconnect WIFMS / Vitos.
- Disconnect the set of signal lights on the right and left-hand side.
- Disconnect the frequency converter.
- Disconnect D+ of the alternator.
- Unplug the machine connector from the Cummins ECM.
- Disconnect the ground terminal from the batteries.
- Directly connect the ground cable of the welding machine as close as possible to the working area (do not connect it above rotating components, e.g. bearings)
- Do not place the welding cables parallel to electrical cables.

The same precautions must also be taken during plasma welding and plasma cutting!

Use of a "Welding Shield for Motor Vehicles" is NOT sufficient!
<table>
<thead>
<tr>
<th>DPF Condition</th>
<th>Indicators / Warnings on Screen</th>
<th>System response</th>
<th>Operator action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal load</td>
<td>None</td>
<td></td>
<td>Machine can be operated without restriction.</td>
</tr>
<tr>
<td>Regeneration active</td>
<td>Regeneration indicator lights up</td>
<td></td>
<td>If possible, do not switch off diesel engine until regeneration is complete.</td>
</tr>
<tr>
<td>Low load</td>
<td>DPF Error indicator lights up</td>
<td>Error: 4-3251-15 Diesel particulate filter must be regenerated – low level</td>
<td>Ensure that the switch blocking regeneration has not been activated. Direct action is not required, work can continue. If necessary, undertake stationary regeneration when possible. DPF is gradually filling up.</td>
</tr>
<tr>
<td>High load</td>
<td>DPF Error indicator flashes</td>
<td>Error: 4-3251-16 Diesel particulate filter must be regenerated – middle level</td>
<td>Ensure that the switch blocking regeneration has not been activated. Direct action is not required, work can continue. Undertake stationary regeneration as soon as possible. DPF is almost full. Performance may decline.</td>
</tr>
<tr>
<td>Critical load</td>
<td>DPF error indicator flashes + acoustic alarm sound</td>
<td>Error: 4-3251-0 Diesel particulate filter must be regenerated – maximum level Reduced diesel engine output</td>
<td>Ensure that the switch blocking regeneration has not been activated. Undertake stationary regeneration immediately! DPF is full. Distinct deterioration in performance. - Take machine out of operation on the job site. - Only manual regeneration is now possible.</td>
</tr>
<tr>
<td>Overload</td>
<td>Motor Stop indicator flashes + acoustic alarm sound</td>
<td>DPF load is excessively high -Reduced diesel engine output -No further regeneration by the system</td>
<td>Switch engine off without delay as soon as it is safe to do so. Further operation may damage the DPF. Contact a service technician.</td>
</tr>
<tr>
<td></td>
<td>Regeneration Lock indicator lights up</td>
<td>Regeneration has been blocked by the operator</td>
<td>Regeneration may only be blocked for as long as an elevated exhaust gas temperature constitutes a hazard. As soon as high load has been reached, regeneration must be re-enabled or the diesel engine switched off.</td>
</tr>
</tbody>
</table>
Checking Oil level should be carried out when the Diesel engine is cold and Off.

At the dip stick [1] the oil level must be between the Min and Max marks.

When needed open the cap [2], top up the oil according to the machine lubrication chart.

Insert dip stick [1] back and close the lid [2]

Let the Diesel Engine run for a short time

Check the oil level again

---

Open filler cap [1].

Top up with fresh coolant, aided by a funnel.

Close filler cap [1].

Let the engine run and heat up until the thermostat is tripped (approx. 95 °C).

Turn off the engine.

Check the coolant level in view glass [2] when the engine is cold and top up until the coolant reaches the middle of the view glass [2], if required.
5.3 Service on a “Dash 3” - Paver

- Paver needs to be parked on even ground
- View glass [1] of the Splitter Gear Box indicates the Oil level

- Remove Breather [2] of the Splitter Gear Box
- Top up Gear box oil according to the manufacturer specifications
- Checking again oil level at the View glass [1]
- Screw the Breather [2] back in
Tensioning of the Crawler Track Chains

- The crawler track chains [1] must be correctly tensioned.
- The safety valve is maintenance-free.
- Slide the coupling of the grease gun over connection [2].
- Squeeze the trigger on the grease gun until grease emerges from the outlet on tensioning block [4].
- Always tension both crawler track chains.

Tensioning of the Auger Drive Chain

- The drive chain is tensioned by adjusting the bracket [1].
- Remove cover plate [5].
- Check the chain tension behind the cover plate [5].
- The sag of the drive chain should not exceed 5 to 6 mm.
- Loosen the four screws [2] securing the bracket [1].
- Unscrew the lock nut [4] of the adjusting screw [3].
- Adjust the screw [3] until the chain tension is correct.
- Tighten the lock nut when the chain is correctly tensioned.
- Tighten down the screws [2] securing the bracket [1].
- Refit and screw down the cover plate [5].

Releasing Tension of the Crawler Track Chains

- Unscrew safety valve [3] until grease emerges from the Relief outlet [5].
- Overload protection for spring elements = 1,000 bar
- Overload protection for tensioning the crawler track chains = 250 bar

- Check tension of the conveyor chain [6] between the two wear plates (distance lower edge of chain [6] and lower edge of chassis [4]).
- The chain is optimally tensioned when the distance between conveyor chain [6] and lower edge of the chassis [4] equals 10 mm.

### Tension conveyor chain

- Unscrew the locking plates [2] of the adjusting screws [1].
- Adjust the screws [1] until the chain tension is correct.
- Turn the adjusting screw clockwise to tension the conveyor chain.
- Turn the adjusting screw anticlockwise to relax the conveyor chain.
- Tension must be uniformly adjusted via both adjusting screws [1].
- Refit the locking plates [2] of the adjusting screws [1].

---

The drive chain is tensioned by adjusting the bracket.

- Remove the cover plate. Remove chain guard [5].
- The drive chain [4] is now accessible.
- Check the chain tension in the measuring range. The sag should not exceed 12 mm.
- Loosen the four screws [1] securing the flange, do not remove them.
- Adjust the screw [2] until the chain tension is correct.
- Turn the adjusting screw counterclockwise to tension the drive chain.
- Turn the adjusting screw clockwise to relax the drive chain.
- Tighten the lock nut [3] when the chain is correctly tensioned.
- Tighten down the screws [1] securing the flange. Fit chain guard [5].
- Refit the cover plate.
Maintenance Charts for the respective machine can be found in the Operating Instructions.

Observing the mentioned intervals is recommended to avoid any lost of warranty claims and to ensure the machine is always operational.
Daily Maintenance

Recommended checks prior paving (immediate after paving)

Cleaning of:
- Front plates
- Tamper bars
- Screed plates
- Pressure bars
- Deflector plates
- Side plates (also ensuring functionality!)

Function Check of:
- Plugs and Sockets
- Screed Heating System
- Working / Paving Functions
- Safety Devices (Emergency Stop buttons, Horn, Lights)

Information and recommendation about mandatory and recommended checks can be found in the Instruction Manuals!

Weekly Maintenance

Certain points on a screed should be checked every 50 working hours (weekly):
- Crown Adjustment
- Extension – Height adjustment
- Bolted connections
- Leakages in the hydraulic system
- Greasing according to the manufacturer specifications

Lubrication Charts for the respective machine can be found in the Operating Instructions. Observing the recommended lubricates to avoid any lost of warranty claims and to ensure the machine is always operational.
The height of the tamper has to be set in such a way that with a stroke of 4 mm, the tamper bar overlaps the lower screed plate edge by 1 mm at the lower dead point.  
Note: the two tampers of the basic screed work in opposite directions.  
With a stroke of 2 mm, they are offset by 180°.
Value \(X\) =
- Tamper stroke 2 mm = 0 mm
- Tamper stroke 4 mm = 1 mm
- Tamper stroke 7 mm = 2.5 mm

- Loosen the attachment bolts on the shaft bracket.
- Loosen the height adjustment locknut.
- Lowering shaft bracket downwards by turning the adjusting bolt.
- Ensure the tamper is at the lower dead centre.
- Check the tamper stroke.
- Rotate the shaft bracket back up using the adjusting bolt until the tamper height is set.
- Tighten the attachment bolts on the shaft bracket.
- Check the height again.
To ensure that the tamper bar has a sufficiently large contact surface during operation, a wearing bar is mounted on the screed frame. The contact surface of the wearing bar on the screed frame is milled after painting, in order to achieve a high degree of dimensional accuracy.

The bottom edge of the wearing bar must be flush with the screed plate.

**Note**

Another purpose of the wear bar is the avoidance of cold shut between tamper and screed plates!
Screed plates on the screed frame of the main screed must be mounted with a minimum clearance of 5 mm. This clearance is required when a positive crown adjustment is applied to the screed. As the pivot point (middle bolt) is located over the two screed plate edges, the clearance here is smaller when a positive crown is set.

When mounting the screed plates on the screed extensions, care must be taken that these do not extend beyond the outer side frames of the extending units or bolt-on extensions. To ensure the correct mounting, make sure that the flanged sides of the extending units or bolt-on extensions can be added gap-free.

The screed plates are attached to the screed frame using the spot-welded rigid bolts. The use of spacing sleeves ensures that all threaded connections retain the correct torque. The size M12 special nuts have integral screw retention via microencapsulation and they are defined for a “One-time Use”. The tightening torque for this threaded connection is 60Nm.
The contour of the tamper shield is designed in such a way that the mix slides down it. The spring steel strip prevents the mix being pulled into the gap. If the gap is too large, mix can slip between the tamper and the tamper shield. This extends the time required for heating and can cause the connecting lines of the tamper heating rods to be torn off. If the gap is too narrow, the tamper operation may possibly be impaired, i.e. the load exerted by the pressure of the mix on the tamper shield could cause the tamper to operate irregularly, or even jam. The spring steel strip must be set at a positive angle to the tamper. The angle can be adjusted via the holes of the threaded bolts.

NOTE
The tamper shield must be set so that the spring steel strip fits lightly across the entire tamper length (0.5mm gap). The rear of the tamper should fit flush against the wearing bar across its entire width.

Adjusting the Tamper Shield
The tamper shield is adjusted via the threaded bolts and secured with locknuts.

1. Loosen locknuts with suitable tool.
2. Adjust spring steel strip of tamper shield via threaded bolts so that it fits lightly against the tamper (0.5mm gap).
3. Tighten the locknuts.
### Adjustment Height of Pressure bars

- Loosen hydraulic connection on ram (1).
- Unscrew the nut (2) with anti-twist device (3) on the hydraulic ram (1) for the pressure bar.
- Turn the hydraulic ram (1) to adjust the height of the pressure bar.
- The clearance (7) between pressure bar and bottom edge of the screed plate should be 4mm.
- Ensure the hydraulic ram for the pressure bar has contact with the block (5) when retracted.
- Set the spring pre-tension (6) of 5.5mm with the nut (4), respectively a clearance (8) of 59.5mm.
- Re-secure the hydraulic ram (3) for the pressure bar.
- Retighten the hydraulic connection on the ram (1).

### Pressure Bars Guidance

- The gap between the rear edge of the screed and the pressure bar can be closed, resp. set by aligning the steel angle plate (1).
- There should be only a clearance of 0.5 to 1.0 mm in order to prevent the rear of the screed from getting impacts from the pressure bar.
- The nuts (2) of the screed plate threaded bolts must be loosened to carry out the adjustment.
- The pressure bar must fit against the Steel angle plate (1).
- The guide blocks (3) are limiting the distance the pressure bar can move horizontal. They can be set via the eccentric bolt located on the guide block.
- The setting for the Spring Steel strip (4) is yielded due to the setting of the previous steps.
### 5.5 Service on “Dash 3” - Screeds

#### Position of Pressure Bar Guide

- In an unloaded condition, the pressure bar [4] must have approx. 1mm gap between pressure bar and bar guide [3].

#### Guidance Adjustment

- Unscrew locking pin [2].
- Unscrew locking screw on eccentric bolt [1].
- Adjust gap via eccentric bolt [1].
- Tighten locking screw on eccentric bolt [1].
- Tighten locking pin [2].
### Adjustment Of Sliding Blocks

- Lower the screed onto the locking pins.
- Move both screed tow point rams to the same height.
- Check gap of sliding blocks [2] and sliding rail [1].
- Unscrew the locknut [4] of the upper eccentric bolt [3].
- Adjust the upper sliding block only!
- Use the eccentric bolt [3] to adjust the sliding block [2] and sliding rail [1].
- Adjustment: “Gap-free” and “Pressure-less”
- With the locknut still loose, fully retract and extend the screed once in order to optimize the setting.
- Secure the setting with the locknuts [4].

### Adjustment of the Height Adjustment Spindles

- Lower the screed.
- Open the chain [2] by removing the master link.
- Rotate the adjusting spindles [3] down to ensure that their leading edges [5] fit snugly with the flange surface of the screed frame.
- Loosen the inner hex bolt [1] in the flange.
- Loosen the threaded bushing [4] by 45°, until the hole for the locking bolt is unobstructed.
- Tighten the inner hex bolt [1].
- Always set all four spindles for each screed extension.
<table>
<thead>
<tr>
<th>Setting the Planning Angle of the Screed Extensions</th>
<th>Preparation</th>
</tr>
</thead>
</table>

- The play between the sliding blocks and sliding rail has been checked and/or set.
- The height of the adjusting spindles has been checked and/or set.
- Raise the screed and put it onto the locking bolts.
- Extend both screed tow point rams to the lowest position.
- The crown is set to 0%.
- Loosen the height adjustment clamping screw.
- Set the height adjustment of the extending screed to “0”, indicated on the scale between the upper and lower extension boxes.
### Setting the Planning Angle of the Screed Extensions

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fully retract the screed.</td>
</tr>
<tr>
<td>2. Use ruler [4] under the screed plate approx. below the outer height adjustment spindles.</td>
</tr>
<tr>
<td>3. Set the screed extension via the height adjusting mechanism until the ruler has contact with the three points [1], [2] and [3].</td>
</tr>
<tr>
<td>4. Approx. 30 mm behind the wearing bar must be a gap of approx. 1 mm between the ruler and screed plate.</td>
</tr>
<tr>
<td>5. Open the chain by removing the master link, required adjustment can be done by turning the adjusting spindles.</td>
</tr>
<tr>
<td>6. Set the front adjusting spindle with an appropriate tool.</td>
</tr>
<tr>
<td>7. Measure the gap and repeat setting if necessary.</td>
</tr>
</tbody>
</table>

### Setting the Outer Screed Planning Angle of the Extension

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Extend the screed until the adjusting spindles are positioned beneath the sliding blocks of the torque restrain system.</td>
</tr>
<tr>
<td>2. Use ruler [4] under the screed plate approx. below the outer height adjustment spindles.</td>
</tr>
<tr>
<td>3. Set the screed extension via the height adjusting mechanism until the ruler has contact with the three points [1], [2] and [3].</td>
</tr>
<tr>
<td>4. Approx. 30 mm behind the wearing bar must be a gap of approx. 1 mm between the ruler and screed plate.</td>
</tr>
<tr>
<td>5. Break chain by removing the master link, required adjustment can be done by turning the adjusting spindles.</td>
</tr>
<tr>
<td>6. Set the front adjusting spindle with an appropriate tool.</td>
</tr>
<tr>
<td>7. Measure the gap and repeat setting if necessary.</td>
</tr>
</tbody>
</table>