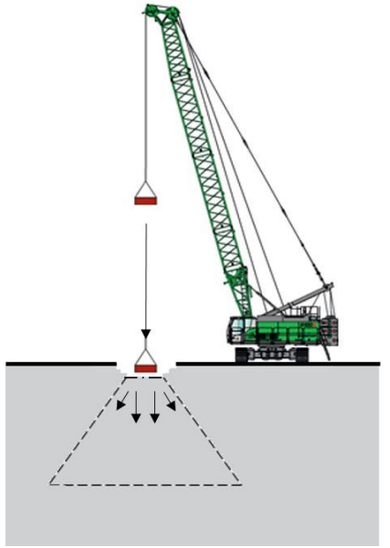
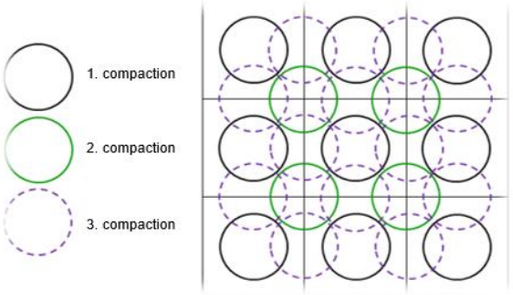
SENNEBOGEN Duty Cycle Cranes for Dynamic Compaction

SENNEBOGEN

Soil Compaction with Freefall-Plate

- Deep compaction or dynamic compaction is one of the oldest methods for substrate improvement
- Principle:
  - Compaction is achieved by means of a drop weight (freefall plate) which is dropped from a great height onto a surface of a compressible substrate
  - The dynamic compression effect is created by the impact. Thanks to the great impact energy the method reaches a compression into great depths
  - The process is applied and repeated (5-20 times) at various compaction points in line with a rectangular pattern (defined in advance base on soil parameters and required degree of compaction). Thereby horizontal tension is created, which results in further compaction

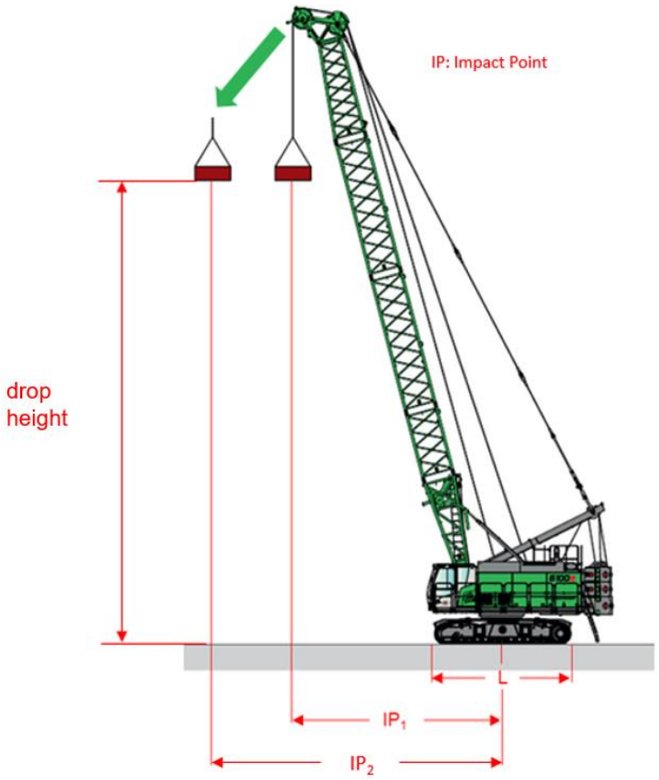




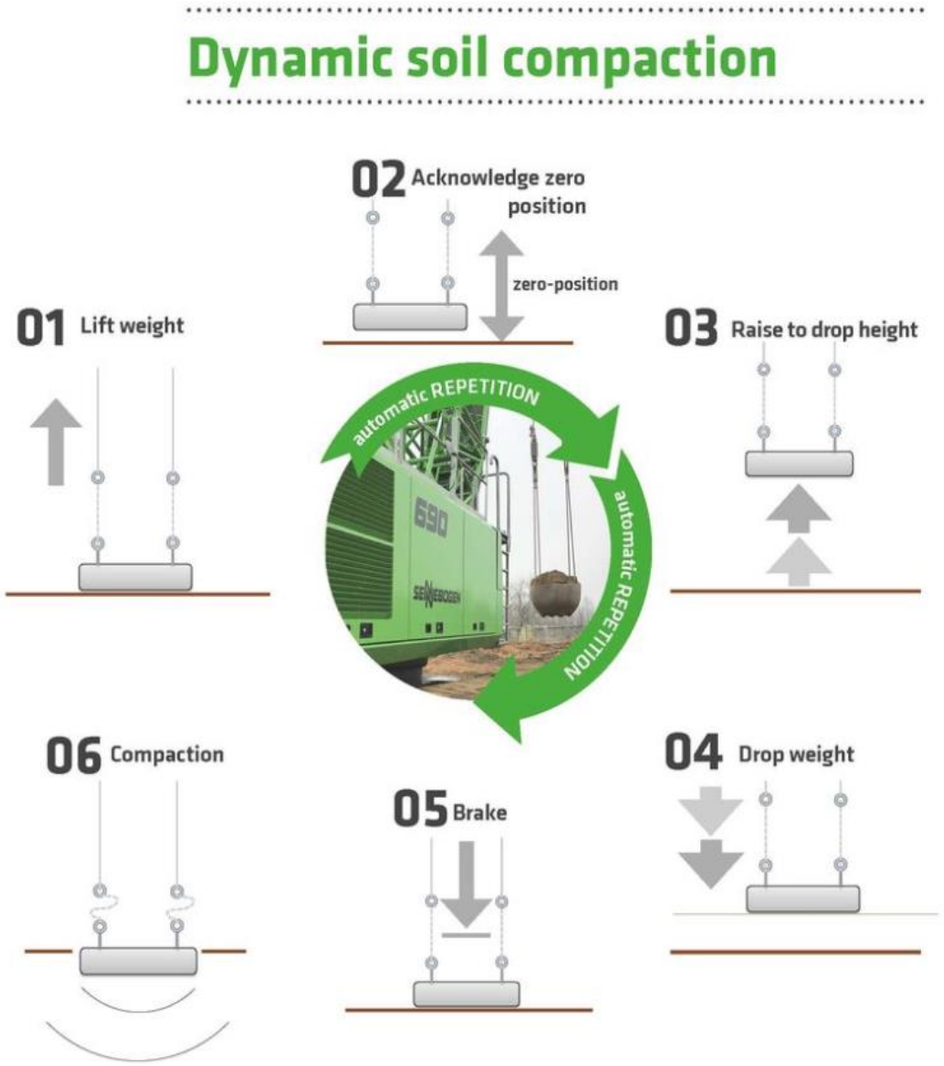
SENNEBOGEN HD-Cranes for Soil Compaction

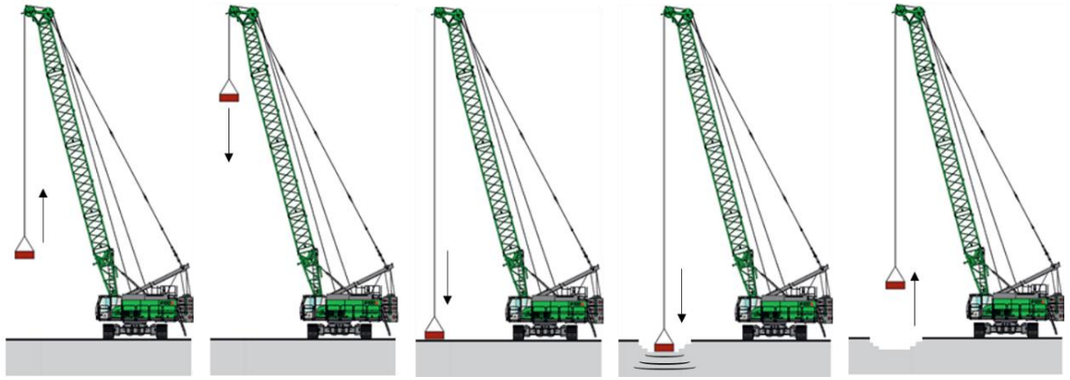
- SENNEBOGEN HD-Cranes are used as carrier for the free-fall plate
- The drop plates have a weight of 10-30 tons (surface area approx. 3-4 m^2) and are dropped from heights between 5 and 25m
- The size of the machine depends on the weight of the drop plate, the work radius and the required drop height
- For optimal use we recommend to use a machine of 100ton capacity and above (SENNEBOGEN 6100, 6140 and 6300)

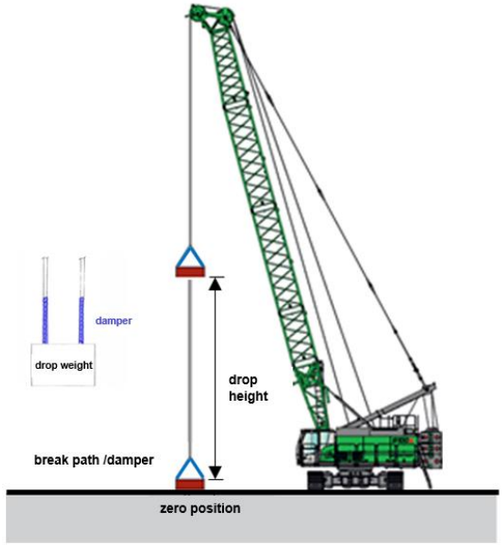
  → to guarantee the stability of the crane the distance between the machine and the point of impact needs to be sufficiently large



Dynamic Soil Compaction Process

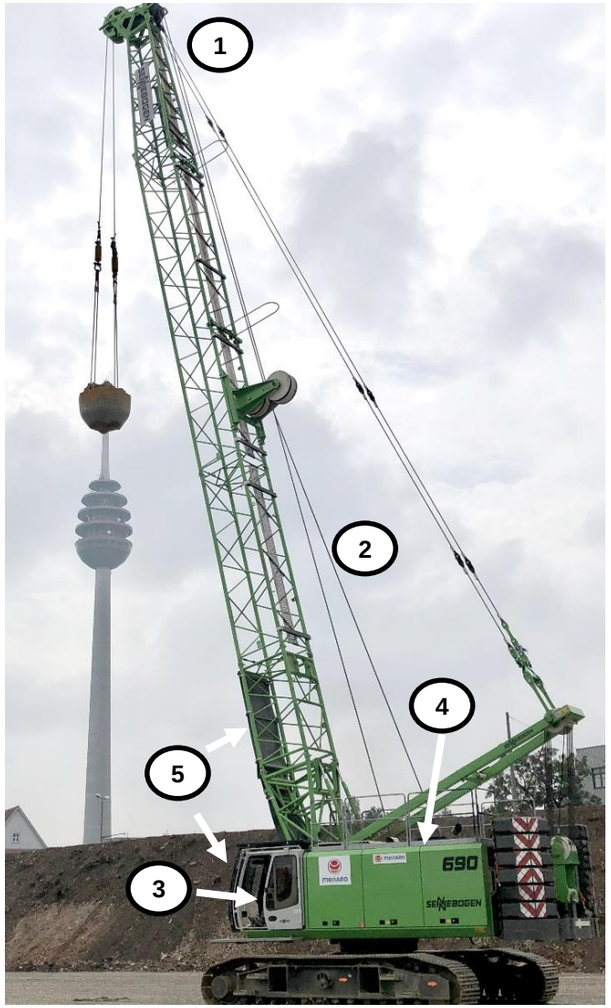






SENNEBOGEN HD-Cranes for Soil Compaction

SENNEBOGEN only uses first-class technology / components for its HD-cranes to resist the dynamic loads arising of this application



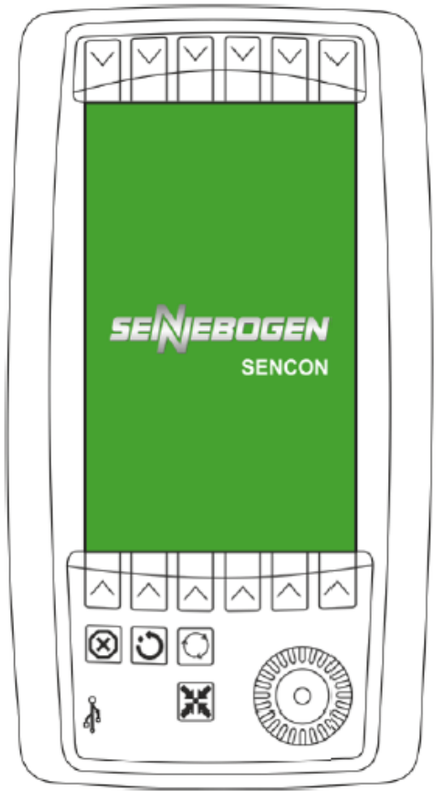
Recommended machine specification:

1. Boom head with steel sheaves and sheave shield
2. One hoist rope with rope suspension / two hoist ropes
3. Dynamic Soil Compaction Control
4. Powerful free-fall winches with winch synchronization
5. Protection for cabin and boom

SENNEBOGEN HD-Cranes for Soil Compaction

Dynamic Soil Compaction Control

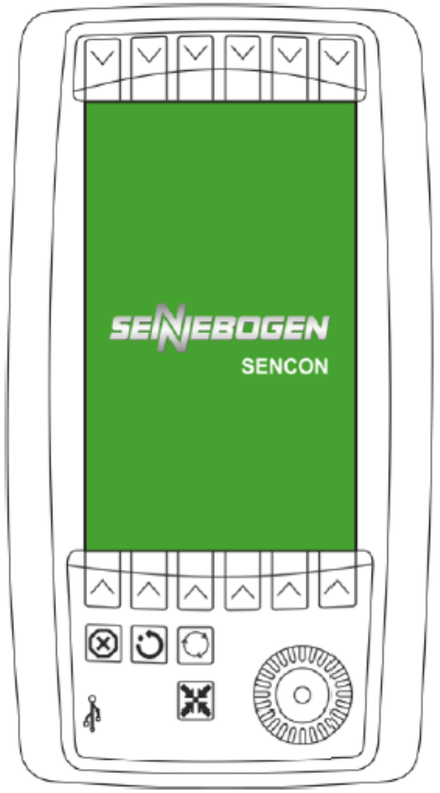
- Special control software integrated in the SENNEBOGEN CONTROL SYSTEM (SENCON)
- Machine-Requirements:
  - SENNEBOGEN Control System (SENCON)
  - Pre-adjustable freefall speed (standard on SENNEBOGEN HD-Cranes)
  - Winch synchronization with depth measurement function incl. position compensation



SENNEBOGEN HD-Cranes for Soil Compaction

SENCON

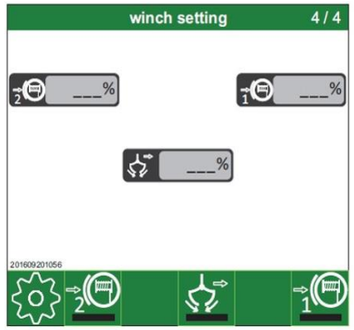
- Diagnostic and control system installed in standard in all new SENNEBOGEN cranes (small screen installed in the front right area of the cab)
- Enables the control of current machine operating data to be recorded and statistically evaluated as required
- Allows the operator to configure various machine parameters and to conduct trouble shooting
- For dynamic compaction SENCON contains the Dynamic Soil Compaction Control for setting parameters and monitoring the compaction process

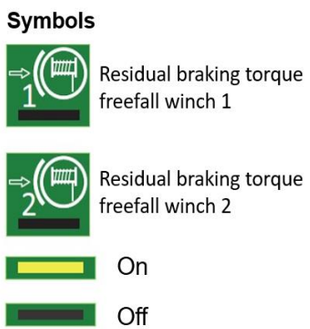


SENNEBOGEN HD-Cranes for Soil Compaction

Pre-adjustable freefall speed:

- Function to regulate the residual braking torque of the freefall winches
- Setting of the residual braking torque is handled over SENCON
- Required function to control the freefall velocity of the drop-weight what allows the operator to react to different ground conditions
- Breaking torque is set separately and independent for each winch as a percentaged value (0% means maximum freefall speed)
- The greater the breaking effect the lower the freefall velocity

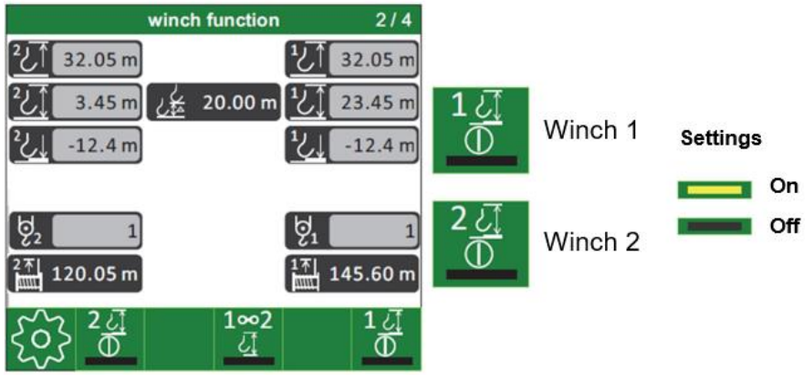




SENNEBOGEN HD-Cranes for Soil Compaction

Winch synchronization with depth measurement

- Tool that displays the height of the load / of the drop weight (height depends on a zero point reference set by the operator)
- Allows the operator to set switch off (stop) points in both directions (up/down)
- Required when lifting the drop weight with two hoisting ropes and ensures a synchronized movement of both winches
- Position compensation (winches in different positions and layers) is executed automatically
- Controlled via SENCON



SENNEBOGEN HD-Cranes for Soil Compaction

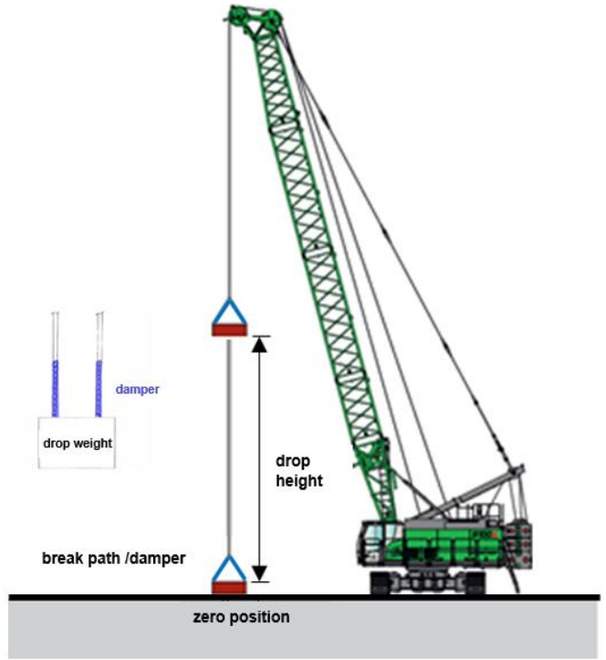
Dynamic Soil Compaction Control

- SENCON allows the operator to set the parameters for operating the HD-crane in dynamic soil compaction (number of impacts required, zero point, drop height, weight and the braking point)

- Setting:

    1. Move the machine in starting position
    2. Place weight on the ground and define zero position
    3. Enter parameters into SENCON (see next slide)
    4. Starting the dynamic compaction process

    → Dynamic Soil Compaction Control carries out the process automatically



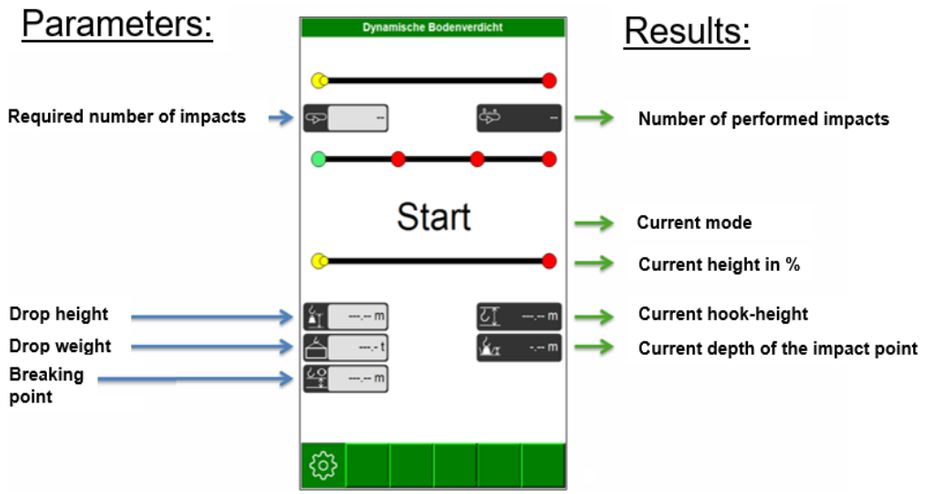
SENNEBOGEN HD-Cranes for Soil Compaction

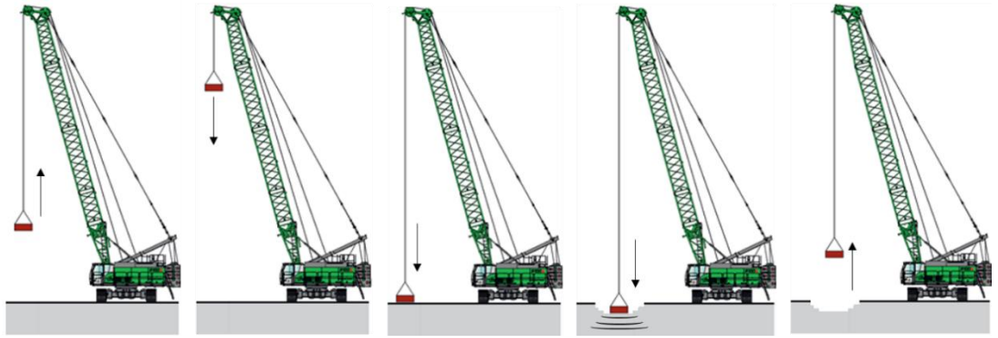
Dynamic Soil Compaction Control

- Process (automatically):

  1. Weight is lifted to drop height
  2. Weight is released and drops
  3. Soil compaction
  4. Braking
  5. Automatic set of a new zero point
  6. Monitoring
  7. Weight is lifted to new drop height
     (= old drop height - funnel depth)

  → Process is automatically repeated until the specified number of impacts has been reached





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