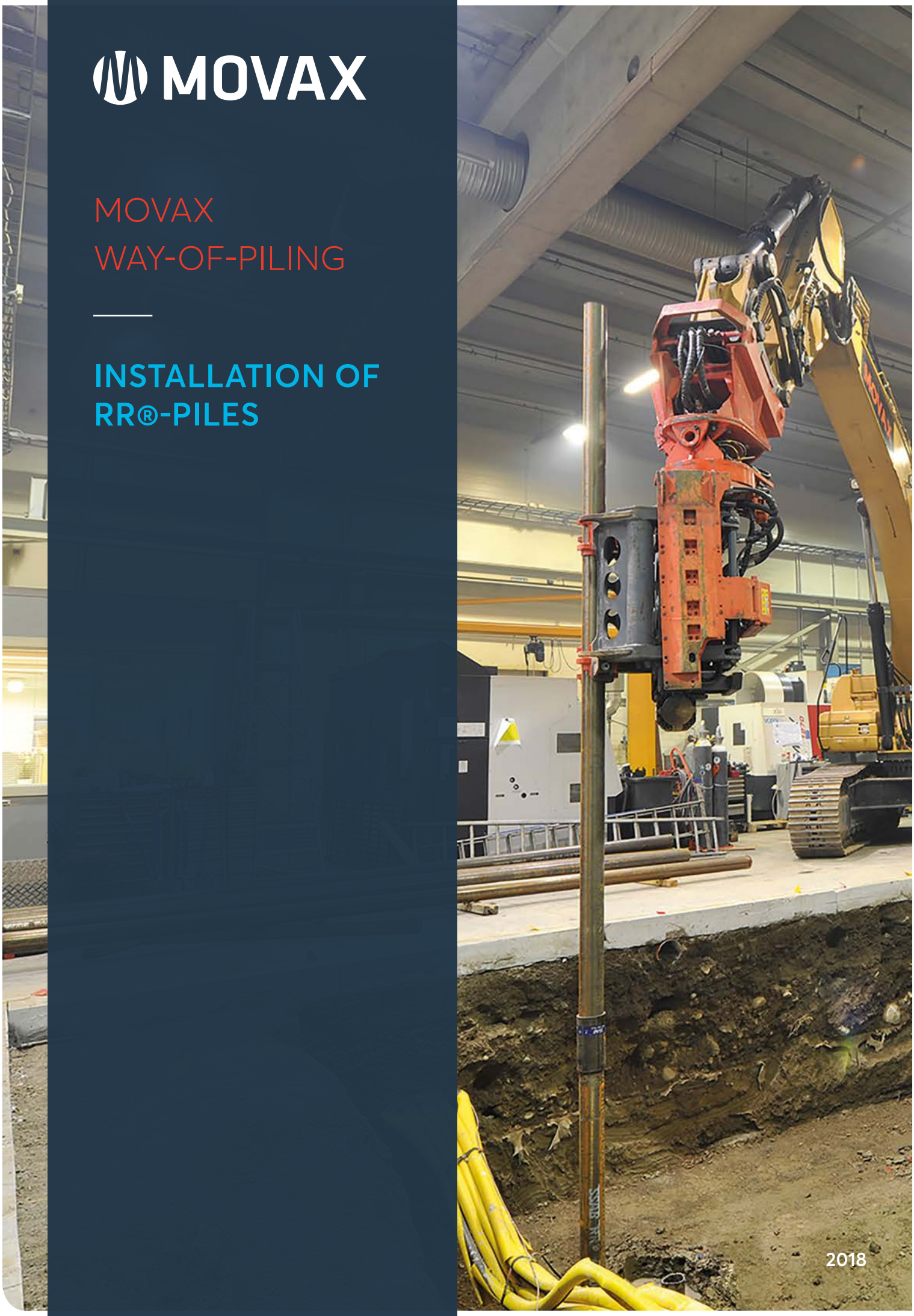
MOVAX

MOVAX WAY-OF-PILING

INSTALLATION OF RR®-PILES



2018

INTRODUCTION

THE MOVAX WAY-OF-PILING

The total range of MOVAX piling equipment and solutions includes vibratory-type, side grip PILE DRIVERS, impact-type, hydraulic PILING HAMMERS, PRE-AUGERS and telescopic PILING DRILLS, all controlled with the MOVAX Control System and complemented by the MOVAX Information Management System utilised for reporting and documenting the piling works and managing and monitoring the MOVAX piling equipment fleet.

MOVAX Side grip pile drivers are the optimum solution for a wide range of piling requirements and a variety of site and soil conditions - especially when a high-degree of precision is required, and for piling in sensitive environments and when limited space or access is available. The same unit can handle, pitch and drive piles and is capable of accomplishing the whole process without the need of manual handling or assisting machinery.

MOVAX Piling hammers are utilised to drive load-bearing piles and to assist in sheet pile driving, even in the most difficult soil conditions. MOVAX piling hammers are the optimum solution to complete a pile installation after reaching refusal with a side grip pile driver or when load testing is required.

The excavator-mounted MOVAX piling equipment can be changed fast and flexibly to handle multiple and varying tasks and a wide range of different type of piles. All MOVAX piling equipment are controlled with the same MOVAX Control System for maximum flexibility and ease-of-operation. The MOVAX Information Management System provides essential information about the piling process (works) and the MOVAX piling equipment.

INSTALLING RR PILES WITH MOVAX PILING EQUIPMENT

A combination of MOVAX side grip pile drivers and piling hammers provide the optimum solution for driving RR-piles. The MOVAX vibratory side grip pile driver is utilized to handle, pitch and drive the RR-pile – without any assisting machinery or additional manpower. When needed the installation is completed with the MOVAX hydraulic double acting drop-type piling hammer. The RR-pile driving process is recorded with the MOVAX Information management System utilizing the mLogbook™ documentation and reporting tool.

The following installation methods are recommended when using MOVAX vibratory side grip pile drivers (SG) and MOVAX hydraulic impact-type piling hammers (DH) for the installation of RR-piles. These instructions are based on - and in full compliance with - SSAB's "RR and RD piles, Design and installation manual".

MOVAX PILING EQUIPMENT

SIDE GRIP PILE DRIVERS

The following MOVAX side grip pile driver models are suitable for driving RR-piles:

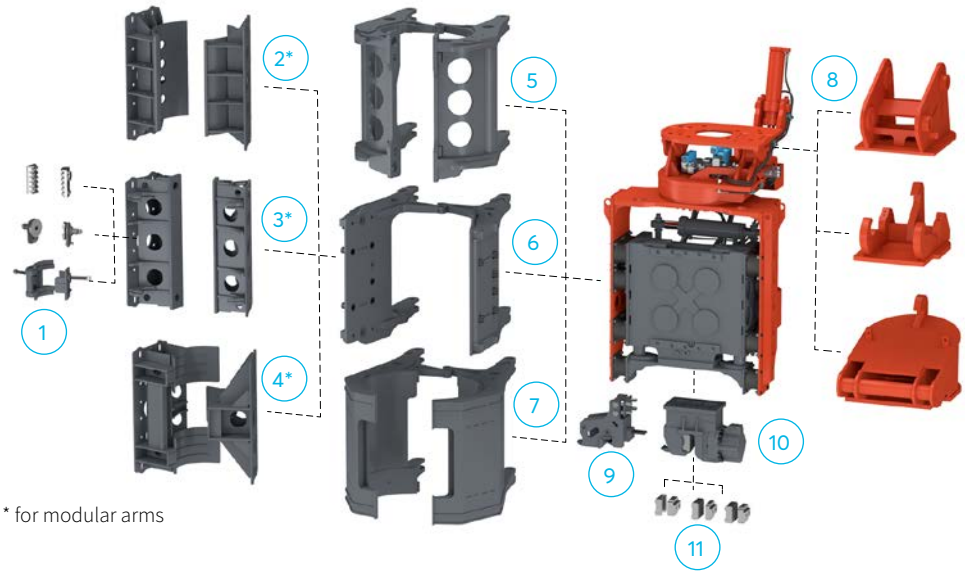
Excavator size	33 - 40 ton	28 - 32 ton	23 - 28 ton	20 - 24 ton	17 - 21 ton	13 - 16 ton	7-11 ton
Pile size (length / weight)							
6 m / 2 800 kg 12 m / 1 900 kg 16 m / 1 300 kg	SG-75 SG-75V						
8 m / 2 300 kg 12 m / 1 800 kg 16 m / 1 200 kg		SG-60 SG-60V	SG-50 SG-50V	SG-45 SG-45V			
6 m / 1 200 kg 8 m / 1 000 kg 10 m / 900 kg					SG-40	SG-30	
4 m / 400 kg 6 m / 200 kg							SG-15
Suitable piles							
RR-piles	Ø 90–762 mm				Ø 90–457 mm		Ø 80 - 323 mm
NOTE! Preliminary selection. When making the final selection excavator engine size and hydraulic system design (oil pump arrangement, oil flow rate/pressure etc) as well as soil and site conditions shall be taken into account.							

Table 1. MOVAX side grip pile drivers, selection chart (For detailed technical information about MOVAX side grip pile drivers, please refer to Appendix 1.)

MOVAX side grip pile drivers are excavator-mounted, high frequency, vibratory-type pile drivers - available with fixed or variable eccentric moment.

MOVAX side grip pile drivers are based on the MOVAX Modular System (MMS™) - with interchangeable arms, clamps and pads - which means that the same side grip pile driver can be utilised to handle a wide range of different type of piles ranging from sheet piles, tube piles and H-beams to timber piles.

1	Pads
2	Tube pile clamps*
3	Sheet pile clamps*
4	Timber pile clamps*
5	Sheet pile arms
6	Modular arms
7	Tubular pile arms
8	Adapters
9	4th jaw
10	Bottom clamp
11	Pads



Picture 1. MOVAX Modular System

For driving RR-piles the MOVAX side grip pile driver can be equipped with modular arms and tube clamps, sheet pile arms and tube pads or special tube arms.

When driving small RR-piles up to 250 mm in diameter a MOVAX side grip pile driver with sheet pile arms and tube pads is recommended.

Picture 2b. MOVAX SG pile driver with Sheet pile arms and tube pads

When driving larger RR-piles up to 610 mm in diameter a MOVAX Side grip pile driver with modular arms and tube pile clamps is recommended.

Picture 2a. MOVAX SG pile driver with modular arms and tube pile clamps

For the largest RR-piles up to 762 mm in diameter a MOVAX side grip pile driver with special tube arms is recommended.

Picture 2c. MOVAX Side grip pile driver with tubular arms

The MOVAX modular system offers a wide range of alternatives for driving different size of RR-piles in order to provide maximum flexibility and versatility. For detailed information about possible alternate MOVAX modular arms/clamp/pad systems suitable for RR-piles please refer to Appendix 2.

MOVAX PILING HAMMERS

The following MOVAX piling hammers are suitable for driving RR-piles:

Excavator size ( ) to be checked	 (20) 23 - 50 ton	 (28) 30 - 50 ton	 (33) 35 - 50 ton	 (38) 40 - 50 ton
Pile size (length / weight)				
max pile length based on excavator reach and stability	DH-15	DH-25	DH-35	DH-45
Suitable piles				
Tube piles	Ø 90-457 mm	Ø 90-762 mm	Ø 90-762 mm	Ø 90-762 mm
NOTE! Preliminary selection. When making the final selection the required bearing load capacity and pile length/weight shall be taken into account. Local laws, rules and regulations must be taken into account when selecting the piling hammer for a specific excavator.				

Table 2. MOVAX piling hammer selection chart (For detailed information about MOVAX piling hammers, please refer to Appendix 3.)

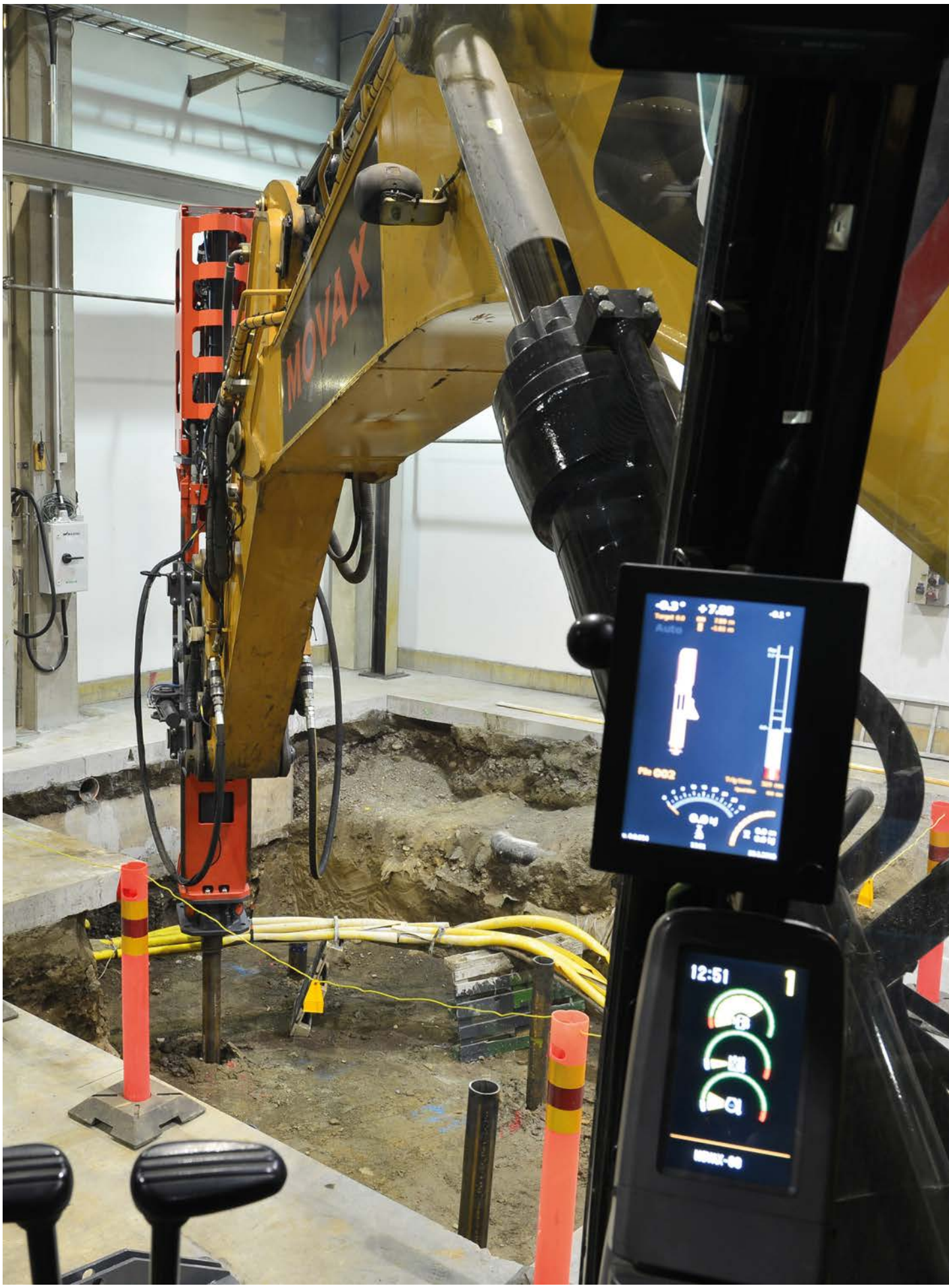
MOVAX Piling Hammers are excavator-mounted, hydraulic impact-type, double acting drop hammers.

Picture 3. MOVAX DH piling hammer

For driving RR-piles the MOVAX piling hammer is equipped with a drive cap suitable for the pile size in question.

DRIVE CAP max	DRIVE CAP midi	DRIVE CAP min
RR-piles Ø 559-762 mm	RR-piles Ø 273-508 mm	RR-piles Ø 75 - 220 mm (DH-15, DH-25) RR-piles Ø 140 - 320 mm (DH-35, DH-45)
		

Table 3. MOVAX Piling hammer drive caps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MOVAX CONTROL SYSTEM

MCS PRO+AUTO

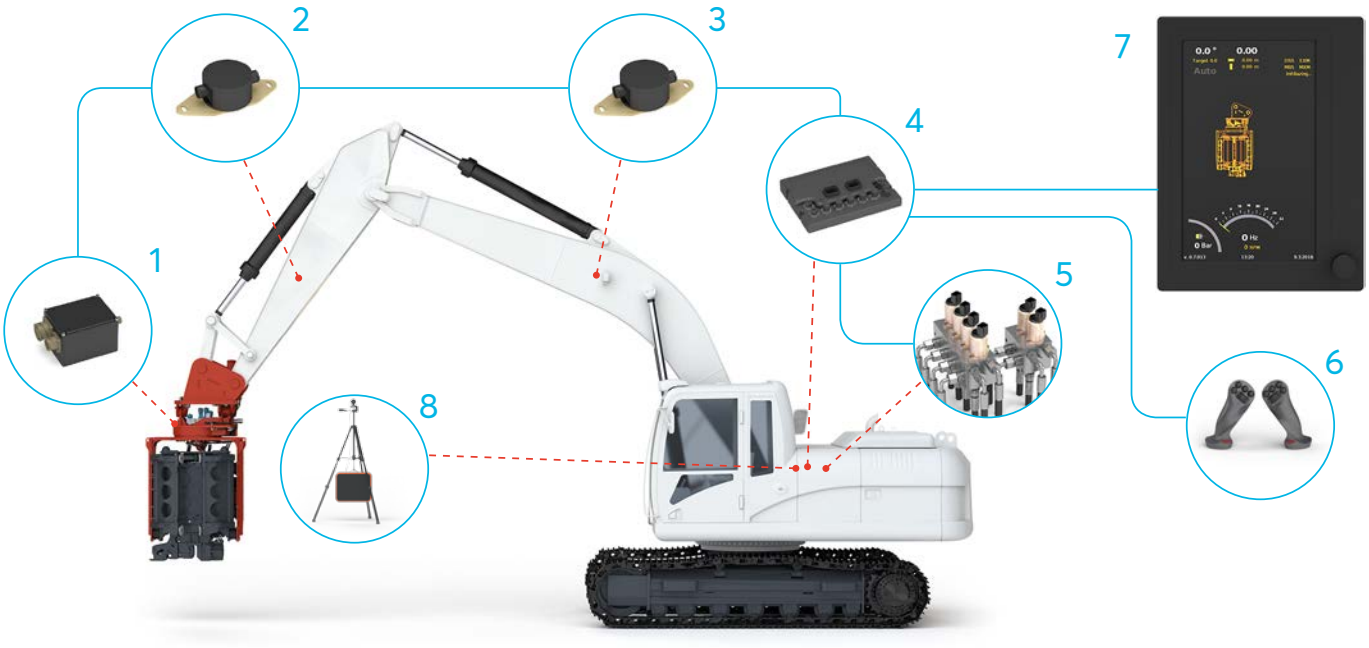
MOVAX Control Systems, MCS Pro+auto and MCS Pro, are advanced, state-of-the-art control system for easier, precise and more productive and efficient operation.

The visual user interface auto is based on a 7" display with easy-to-read graphical symbols for the position, vibro frequency or piling hammer impact energy rate, and hydraulic pressure. It has user-friendly menus for calibrating and optimising the performance of both the MOVAX piling equipment and the excavator hydraulics. The MCS Pro+auto and MCS Pro control systems provide full system diagnostics directly on the screen and can be set to remind the operator of critical maintenance tasks, such as changing oil and oil filter.

The control grips with proportional rollers are ergonomically shaped and designed for simultaneous control of multiple operations. The grips have a large number of switches and rollers to accommodate non-MOVAX functions as well.

The MCS Pro+auto auto control feature makes the excavator mounted MOVAX side grip pile drivers and piling hammers travel in a straight line by taking over a demanding part of the boom control. The system is based on angle sensors on the excavator and the MOVAX piling equipment and proportional pilot valves mounted on the excavator. The smart user interface allows the operator to switch the automatic control on or off at any time while keeping his/her hands on the controls at all times.

MCS Pro+auto and MCS Pro can both be upgraded to meet different needs. Versatile connectivity makes it possible to add pressure sensors, a boom mounted camera or a wireless site camera for top-level safety, productivity and accuracy.



1. MOVAX module
2. Stick boom sensor / 3. Main boom sensor / 4. Excavator module / 5. Valve Block / 6. Grips / 7. Display
8. Camera (optional)

Picture 4. MOVAX Control System, MCS Pro+auto


-3.5°
+7.16
0.9 °
Tavoite 0.0
7.16 m
-1.13 m
Auto
Paalu 000
Läpäisuika
140 ms
6.3 kJ
Σ
678
0.1 m
x̄ 40.0 kJ
15.2.2016

MOVAX INFORMATION MANAGEMENT SYSTEM

mLOGBOOK

The piling information is measured, collected and stored by the MOVAX Control System (note! the MCS Pro or MCS Pro+auto versions of the control system is required). To report the piling works the operator only has to input the pile number, the system will take care of the rest. The data stored in the MOVAX control system is simply copied onto a USB-memory drive and transferred to a PC equipped with the mLogbook-software for further analysis. Data concerning site and pile information can be added as required and the system will generate illustrative, ready-made reports - including both measured and calculated data - which provide essential information about the piling process and its quality.

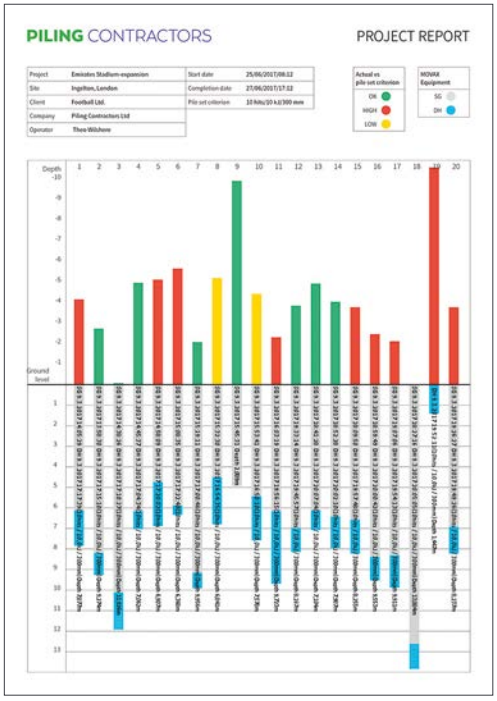


Chart 1. Piling summary report

Specific reports are generated for both the MOVAX side grip pile driver (SG) and the MOVAX piling hammer (DH). The MOVAX side grip pile driver report includes information about the verticality and penetration rate whereas the MOVAX piling hammer report includes information related to the load bearing capacity of the pile.

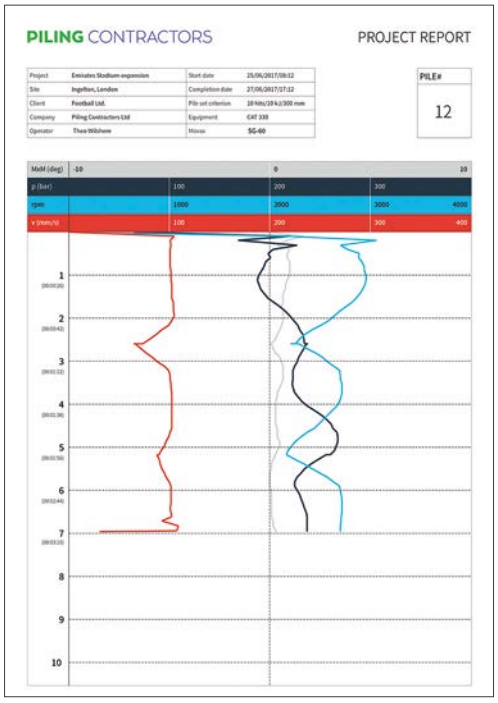


Chart 2. SG pile report

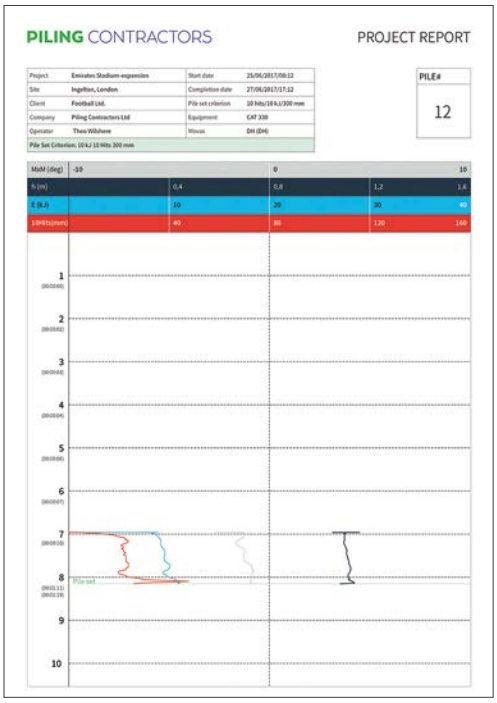


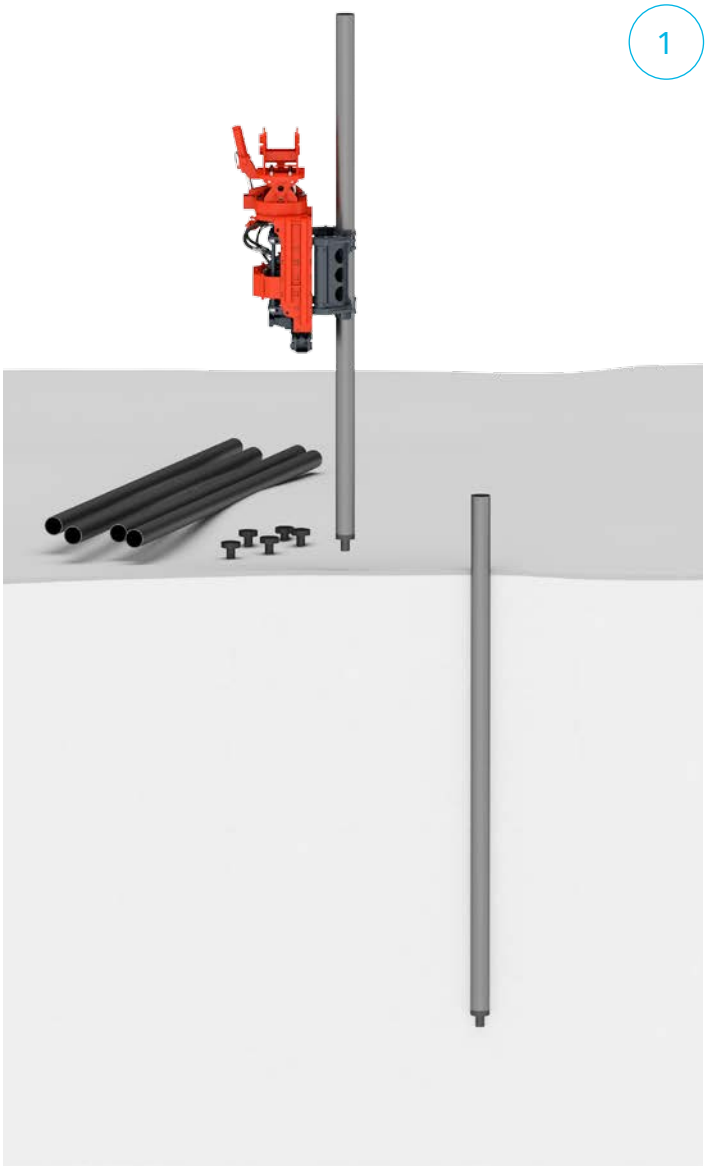
Chart 3. DH pile report

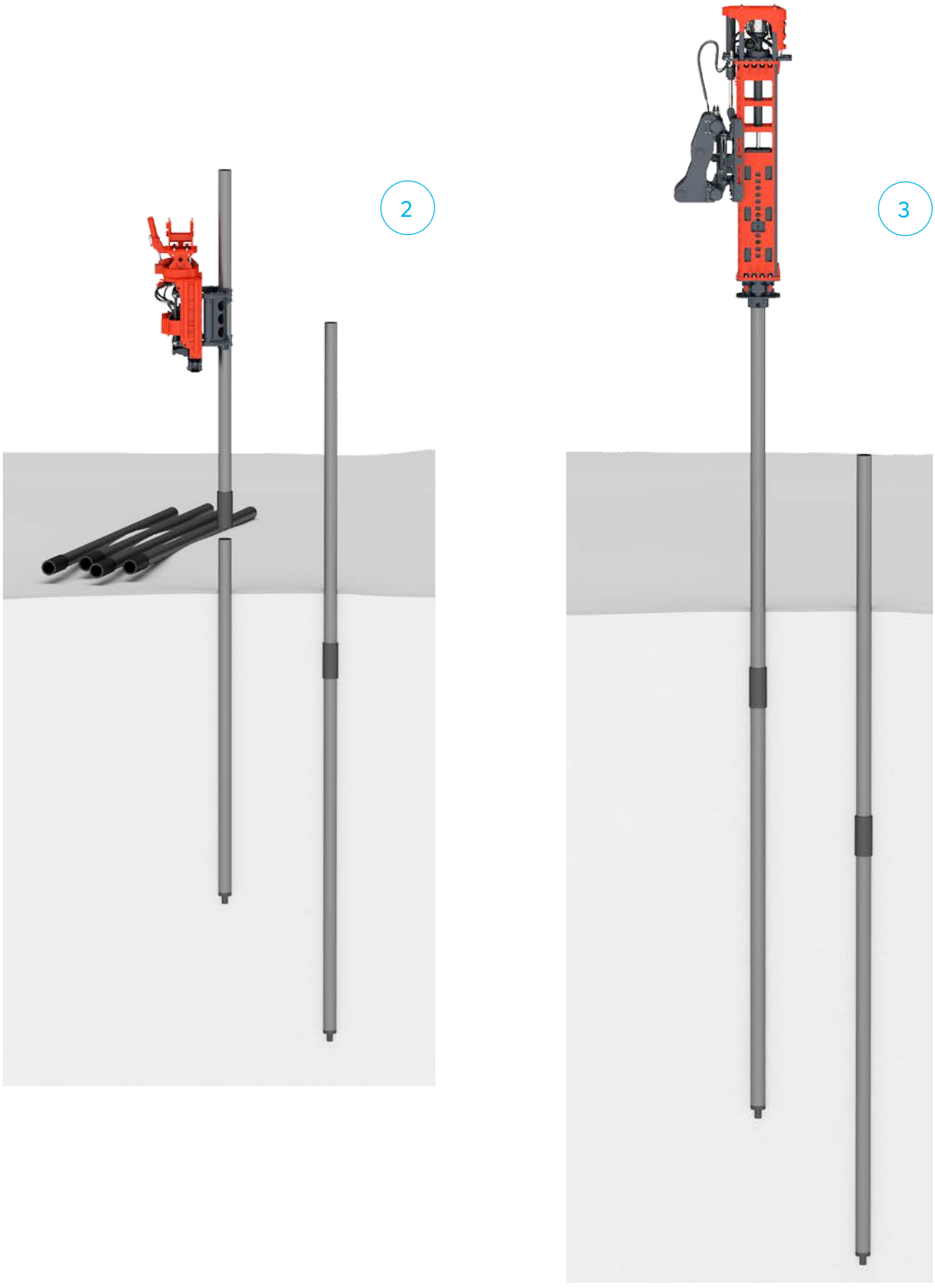
INSTALLATION OF RR-PILES

Before installation a shoe (bottom plate or rock shoe) is attached to the bottom of the pile. MOVAX recommends the following two alternate methods when driving RR-piles. Both methods are in full compliance with SSAB's RR and RD, Design and Installation Manual.

Installation of RR-piles (alt a)

1. The driving of RR-piles is started with the MOVAX side grip pile driver utilising an unspliced pile section - for example, a piece cut-off earlier or a full length unspliced pile.
2. The pile driving is continued with a spliced pile with the external splice sleeve at the bottom of the pile utilizing the MOVAX side grip pile driver.
3. The pile driving is completed utilizing the MOVAX hydraulic impact-type (drop) hammer.

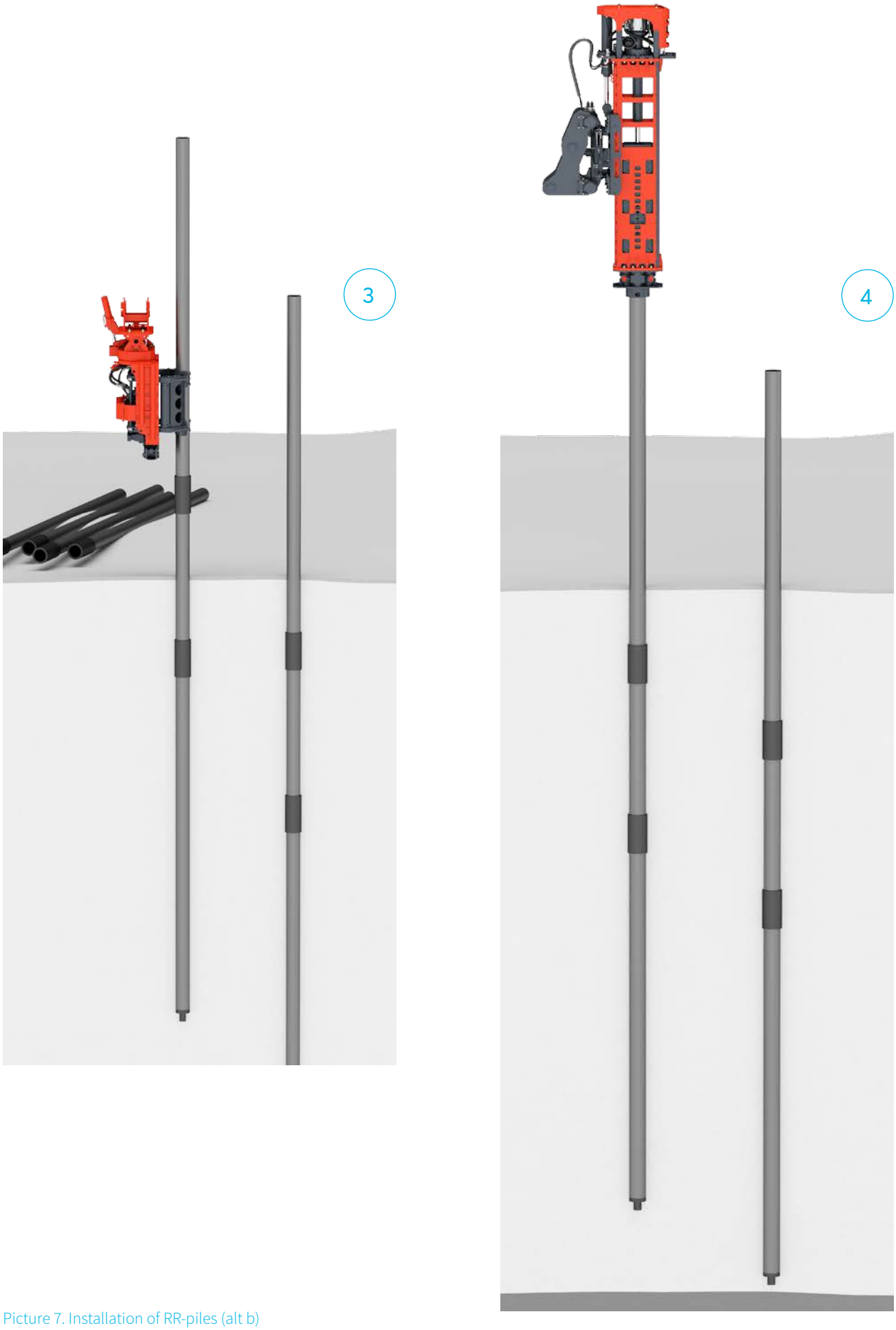




Picture 6. Installation of RR-piles (alt a)

Installation of RR-piles (alt b)

1. The driving of piles is started with the MOVAX side grip pile driver utilising a spliced pile section with the external splice sleeve at the top.
2. The pile driving is continued with the MOVAX side grip pile driver utilizing an unspliced pile section - for example, a piece cut-off earlier (or a full length unspliced pile).
3. The pile driving is continued with the MOVAX side grip pile driver utilising a spliced pile section with the external splice sleeve at the bottom.
4. The pile driving is completed utilizing the MOVAX hydraulic impact-type (drop) hammer.



Picture 7. Installation of RR-piles (alt b)

MOVAX SIDE GRIP PILE DRIVERS

Technical specification

- Suitable for a wide range of applications
- Suitable for different site and soil conditions, including sensitive environments and when a high degree of precision is required or when limited space is available
- Excavator-mounted - available for different excavator models/sizes, for crawler and wheeled excavators, railroaders etc; designed to work on a standard excavator with normal auxiliary hydraulics
- Available in different models & sizes to meet a wide range of piling needs
- Available for a wide range of piles including sheet piles, trench sheets, H-piles, tubular steel piles, RR-piles, timber piles etc
- Available with fixed or variable eccentric moment
- Based on the MOVAX Modular System (MMS™) which enables the use of the same unit on multiple different piling work
- Controlled with the MOVAX Control System (MCS™)
- Available with the MOVAX Information Management System (MIMS™)

SG MODELS

		SG-75	**SG-60**	**SG-50**	**SG-45**	**SG-40**	**SG-30**	**SG-15**
Weight (excl. adapter)	kg	3330-3588	2460-2691	2327-2558	2322-2553	1814	1400	750
Height	mm	2560	2478	2478	2478	2021	2021	1600
Depth	mm	1115	1180 - 1436	1180 - 1436	1180 - 1436	1187	1187	930
Width	mm	1270	1193	1193	1193	1193	1193	850
Excavator class	t	33-40	28-32	23 - 28	20 - 24	17-21	13-16	7-11
Engine power, min	kW	184	134	125	100	86	65	39
Return pressure, max	bar	5	5	5	5	5	5	5
Pressure setting	bar	350	350	350	350	350	350	200
Frequency	1/min	2300-3000	2300-3000	2300-3000	2300-3000	2300 - 3000	2300 - 3000	2300 - 3000
Eccentric moment	kgm	7,6	6,1	5,1	4,6	4,1	3,1	1,6
Centrifugal force, max	kN	750	600	500	450	400	300	150
Ground vibration		normal	normal	normal	normal	normal	normal	normal
Resonance-free start/stop		no	no	no	no	no	no	no
Driving method		vibration	vibration	vibration	vibration	vibration	vibration	vibration
Swing/tilt angle	°	360 / ± 30	360 / ± 30	360 / ± 30	360 / ± 30	360 / ± 30	360 / ± 30	360 / ± 30

SG-V MODELS

		SG-75V	**SG-60V**	**SG-50V**	**SG-45V**
Weight (excl. adapter)	kg	3450-3708	2560-2791	2427-2658	2422-2653
Height	mm	2560	2478	2478	2478
Depth	mm	1115	1180 - 1436	1180 - 1436	1180 - 1436
Width	mm	1270	1193	1193	1193
Excavator class	t	33-40	28-32	23 - 28	20 - 24
Engine power, min	kW	184	134	125	100
Return pressure, max	bar	5	5	5	5
Pressure setting	bar	350	350	350	350
Frequency	1/min	2300-3000	2300-3000	2300-3000	2300-3000
Eccentric moment	kgm	7,6	6,1	5,1	4,6
Centrifugal force, max	kN	750	600	500	450
Ground vibration		low	low	low	low
Resonance-free start/stop		yes	yes	yes	yes
Driving method		vibration	vibration	vibration	vibration
Swing/tilt angle	°	360 / ± 30	360 / ± 30	360 / ± 30	360 / ± 30

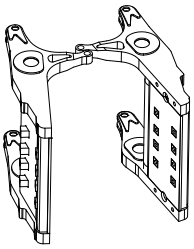
MOVAX SIDE GRIP PILE DRIVERS

MOVAX Modular System

MOVAX side grip pile drivers (SG-models) are available with the following standard, interchangeable arm-, clamp- and pad options suitable for driving RR-piles. Customised arm and clamp solutions are available upon request. All SG-models are equipped with a bottom clamp as a standard.

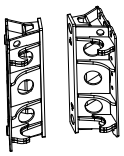
Modular arms

Modular arms are can be equipped with the following type of tube pile clamps / tube pads suitable for driving RR-piles:



TUBE PILE CLAMPS

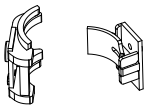
Ø 90 - 610 mm
Ø 90 - 457 mm (SG-30, SG-40)
Ø 80 - 323 mm (SG-15)



SHEET PILE CLAMPS

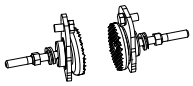
Sheet pile clamps can additionally be utilised for sheet piles, H-beams and smaller tubes.

Tube pads



Ø 90-250 mm

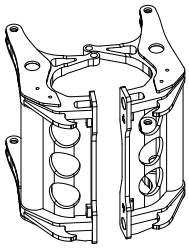
Standard pads



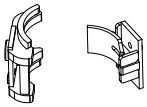
For sheet piles and H-beams

Sheet pile arms

Special sheet pile arms aequipped with tube pads are suitable for driving RR-piles.

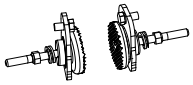


Tube pads



Ø 90-273 mm

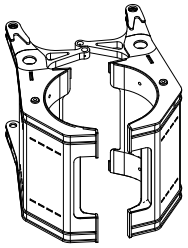
Standard pads



For sheet piles and H-beams

Tubular pile arms

Special tubular pile arms are utilised to drive larger RR-piles.



Ø 300 - 762 mm
Ø 90 - 457 mm (SG-30, SG-40)
Ø 90 - 323 mm (SG-15)

Table 2. MOVAX Modular System for RR-piles

MOVAX PILING HAMMERS

Technical specification

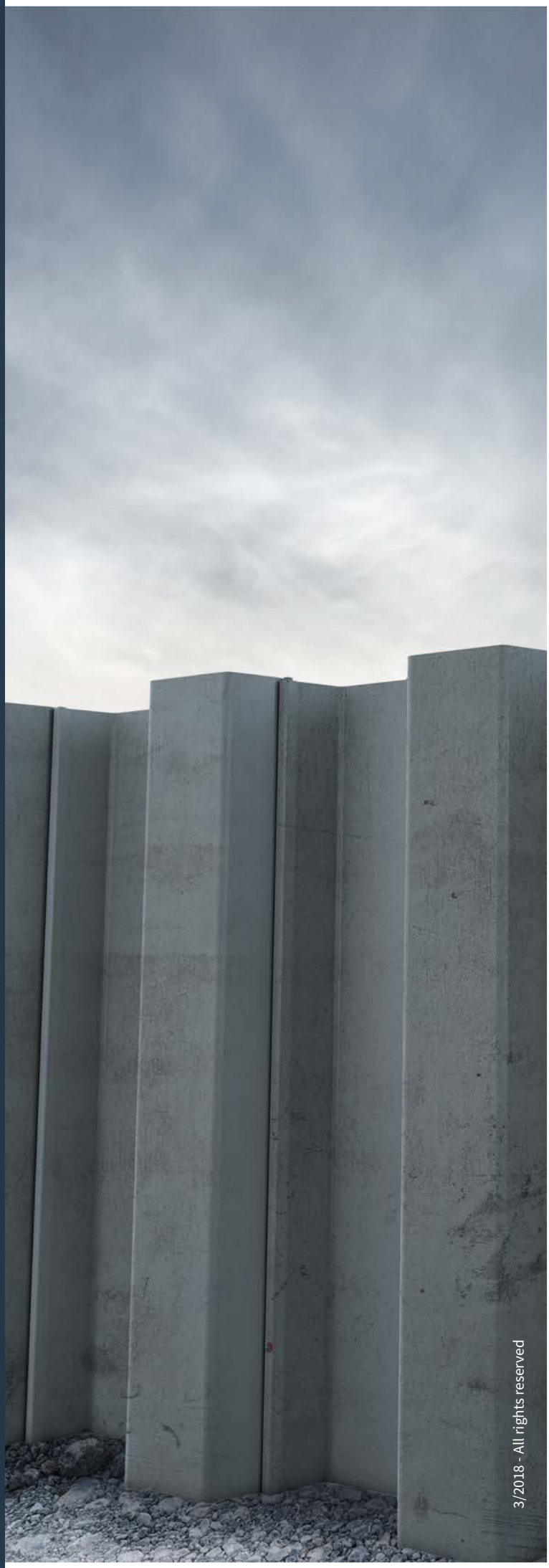
- Suitable for different site and soil conditions
- Suitable for a wide range of piles including sheet piles, H-beams, tubular steel piles, RR-piles, timber piles, concrete piles etc.
- Suitable for load testing of piles
- Excavator mounted or excavator leader mast mounted; designed to work on a standard excavator with normal auxiliary hydraulics
- Tilt +/- 15 °
- Available with rotation device +/- 60 ° (optional, for DH-15 and DH-25 only)
- Controlled with the MOVAX Control System (MCS™)
- Available with the MOVAX Information Management System (MIMS™)

DH- MODELS

		DH-15	**DH-25**	**DH-35**	**DH-45**
Total weight (excl. adapter) with tilt device	kg	3500	4400	5750	6700
Total weight (excl adapter) with tilt+rotation device	kg	3800	4700	NA	NA
Ram weight	kg	1360	2060	3000	4000
Blows per minute	1/min	0-100	0-100	0-100	0-100
Impact energy	kNm	0-15	0-25	0-35	0-45
Drop height	m	0-1,2	0-1,2	0-1,2	0-1,2
Pressure relief set max	bar	350	350	350	350
Operating pressure	bar	150	200	250	250
Oil flow rate	l/min	120	120	120	120
Tilt angle	°	+/- 15	+/- 15	+/- 15	+/- 15
Rotation angle	°	+/- 60	+/- 60	NA	NA
Total height	mm	3850	4460	4460	4930
Frame width	mm	500	500	650	650
Transport width	mm	1200	1200	1200	1200
Transport depth	mm	1870	1870	1870	1870
Excavator class					
Excavator mounted	t	(20) 23-50	(28) 30-50	(33) 35-50	(38) 40-50
Excavator leader-mounted	t	30-50	35-50	35-50	NA
Leader stroke	m	0,7	1,3	1,3	1,3

THE MOVAX WAY-OF-PILING

Higher productivity and significant savings



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