MÜLLER-vibrators.
The ideal solution for driving and extracting.

HOESCH SPUNDWAND UND PROFIL
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MÜLLER
Ramm- u. Ziehtechnik

ThyssenKrupp GfT Bautechnik

ThyssenKrupp

Contents.

Integrated services.
For driving and extracting.

Using the right machinery and equipment is the key to cost-effective pile driving and extracting. As an integrated supplier we provide not only the piling materials but also the required hardware to meet all technical and environmental requirements.

Machines for port and civil engineering solutions.

ThyssenKrupp GfT Bautechnik has many years of experience in all areas of port and special civil engineering.

Our specialists operate around the world, applying the very latest methods and technologies. They analyze all relevant parameters to determine the ideal machines for customer projects and thus ensure the highest levels of cost-efficiency.

Our strengths.

- Tailored, project-oriented solutions
- Specialist applications advice
- Worldwide availability of our machinery
- Recognized reliable service
- High-quality products

Our philosophy.

System solutions from a single source. For us, that means making our success your success to guarantee high customer satisfaction.

Our service in detail.

- Sheet piling and sheet pile structures as system solutions for securing excavations and for use in port and canal construction projects. Steel piles as foundations for port and bridge structures, industrial buildings and high-rises.
- Driving, extracting, drilling and impacting equipment, quiet and powerful, even in extreme conditions, therefore particularly kind to the environment.
- Anchor equipment for all soils and rock for the highest possible safety standards.
- Interchangeable modular elements for the reliable securing of trenches and shafts.
- Trench sheeting sections, strong frame and trench box systems, lightweight aluminum trench boxes and trench struts.
- Flood protection: permanent TKR glass wall system, sheet pile walls and temporary TKR aluminum stop log system, fold-up systems, structures for waterproofing doors and windows.
- Construction machinery and equipment such as hydraulic hammers, demolition cutters, pipe pullers, cutters, compressors, soil compactors and sand removal equipment.

MÜLLER vibrators.
Specialists for driving and extracting technology.

Driving and extracting are central construction tasks. Customer requirements in this area are rightly high as in addition to the project-related technical conditions, aspects such as cost efficiency and environmental impact play an important part.

The principle of vibratory pile driving.

Vibratory pile driving is based on the principle of converting the soil to a quasi-fluid state. This is achieved by vibrating the pile as it impacts the soil. Surface friction on the pile is reduced significantly by the vibrations, permitting rapid rates of penetration.

For the correct selection of a vibrator, parameters such as soil condition, piling weight, length and shape, and the pile driving location playing a major role.

Centrifugal force and eccentric moment are fundamental parameters for classifying an application. Together they overcome the friction between pile and soil.

Advantages of MÜLLER vibrators.

MÜLLER vibrators meet high quality requirements. They are user-friendly, low-maintenance and long-lasting. For almost every application there is a tailored solution, including free-riding systems, excavator-mounted vibrators and leader-mounted units.

Compared with other techniques, MÜLLER machines are low on noise emissions and vibrations.

The heart of each vibrator is the exciter block. It is fitted with counter-rotating eccentrics mounted in pairs in special heavy-duty bearings. A spring suspension unit located at the head of the vibrator absorbs the vibrations generated in the exciter block, isolating them from the carrier.

MÜLLER vibrators with resonance-free starting and infinitely variable amplitude as well as “two-in-one” vibrators with stepwise variable eccentric moment and frequency offer advantages in that they can be adapted to suit different working conditions.

Our strengths – your advantages.

We offer:

- 24-hour emergency service
- 24-hour spare part service
- and lots more.

The ideal combination.
Proven vibrators with state-of-the-art technology.

MÜLLER vibrators have a proven track record in civil engineering stretching back more than 50 years. As leading-edge vibratory products they meet all market requirements. Suitable for a wide range of applications, their reliability and constant development make them a relevant market factor.

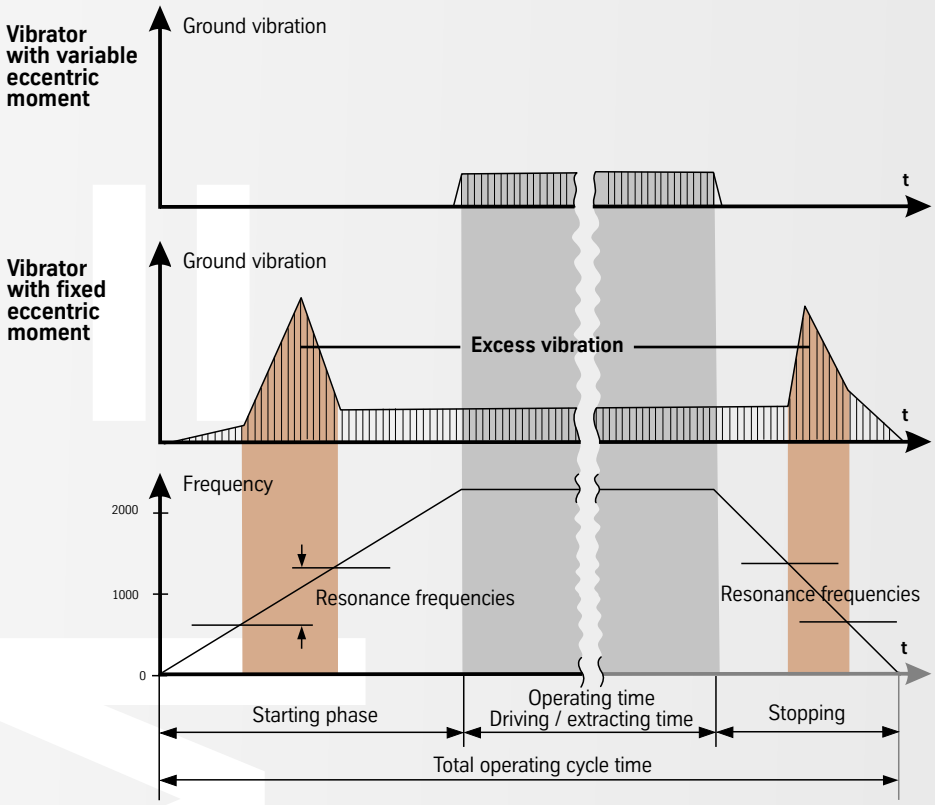
How MÜLLER vibrators work.

MÜLLER vibrators with fixed eccentric moment (H series).
The vibrators are fitted with eccentrics which generate a fixed eccentric moment. For continuous use or use in extreme climatic conditions, vibrators can be equipped with a forced lubrication system including oil cooling (H3 series).

High-frequency MÜLLER "two in one" vibrators with stepwise variable eccentric moment (HHF series).
The vibrators in the HHF series are suitable for a broad range of applications. The eccentric moment can be increased or reduced in steps by adding/removing additional weights, allowing one vibrator to achieve different amplitudes and frequencies. Very high eccentric moments of up to 190 kgm can be generated.

High-frequency MÜLLER vibrators with variable eccentric moment (HFV series)
When starting these vibrators, the eccentrics are arranged in such as way as to mutually balance out the centrifugal forces they generate and thus prevent any vibration. Once the required frequency has been reached, the eccentrics are turned counter to each other so that the centrifugal forces act in the same direction and generate vibration. This makes it possible to avoid passing through the resonance frequency of the soil (approx. 10 to 25 Hz depending on soil type) during starting and stopping.

Principle of resonance-free starting and stopping.



The operating cycle can be broken down into three phases: the starting phase, the working phase and the stopping phase. The starting and stopping phases are similar in terms of vibration propagation in the soil. With a non-variable eccentric moment, the machine passes through the soil's resonant frequency during starting and stopping.

This causes the ground around the driving area to oscillate and reinforces the vibrations. This is represented by vibration peaks. If the arrangement of the eccentrics is varied during starting and stopping, the counter-rotating eccentrics balance each other out, eliminating the resonance. The settings of the eccentrics are changed when a target frequency is reached. Vibrations are only transferred into the soil by the pile during the working phase. The difference between the natural frequency range of the soil and that of the vibrator is so great that the transfer of vibrations is minimized. The spring suspension unit is activated and absorbs the vibrations that could be transferred to the carrier.

Ensuring top performance.
Parameters, equipment selection and operating principle.

Choosing the right equipment is key to the economic and technical success of any vibration driving job. Parameters such as the size and drive output of the vibrator must be matched to the length and weight of the pile and the soil conditions.

Vibrator selection.

The graphic below provides help in determining the required centrifugal force or in selecting the right vibrator based on soil conditions, pile weight and driving depth. Mark a point on the left-hand side of the table representing the maximum driving depth, and another point on the right-hand side marking the maximum pile weight.

At the point where this line crosses the soil data line for your project, draw a vertical line to the vibrator models. This provides an overview of the units which can be considered for your requirements. This service offers an orientation guide; however, selections should always be confirmed by specialists.

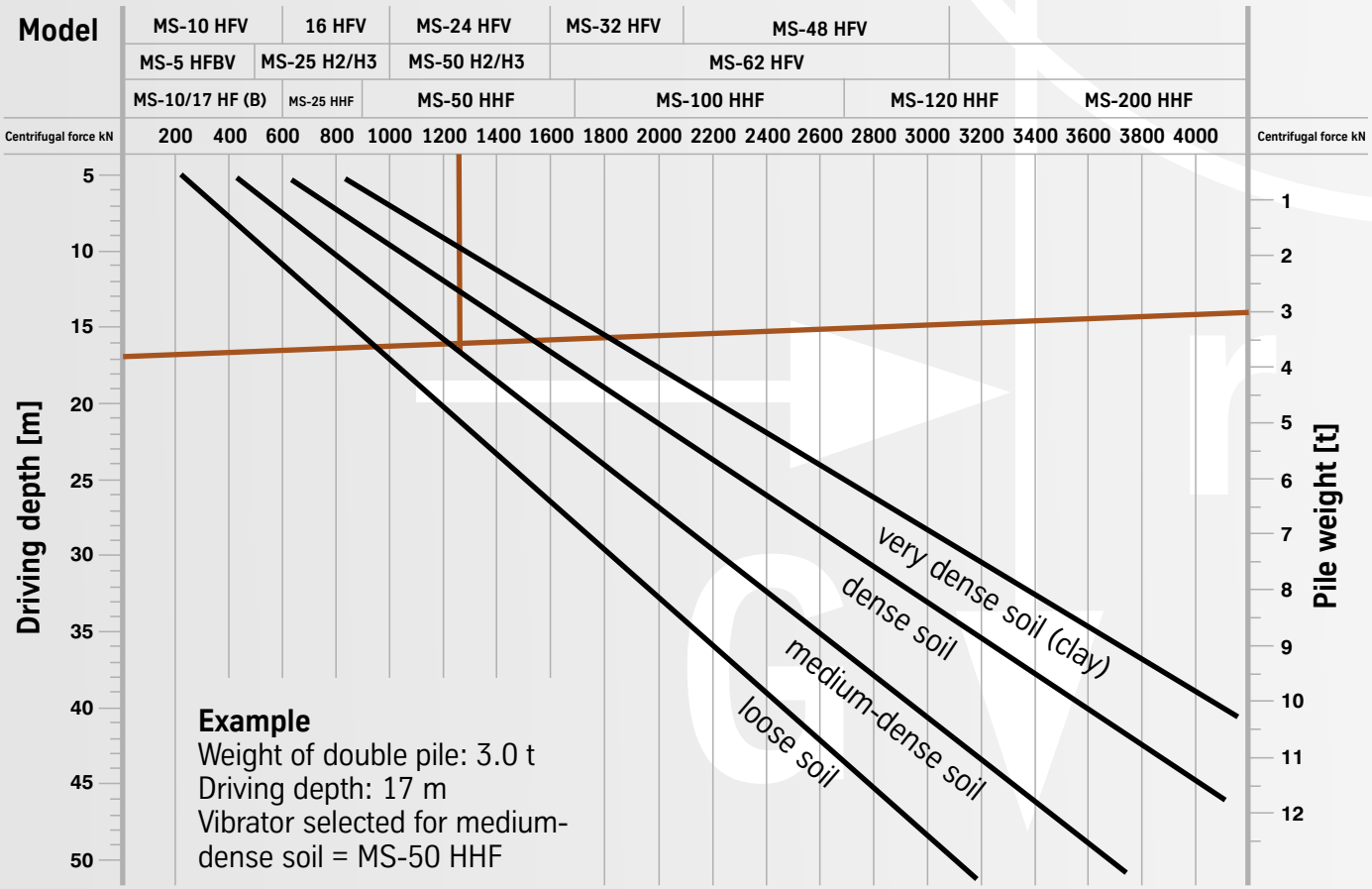
To determine the exact model, we can offer competent advice taking account of site-specific, geological and technical requirements.

Important details.

- For high-frequency vibrator applications, the centrifugal forces determined in this way should be 30% higher.
- Use of additional aids such as flushing pipes or preparatory drilling can significantly increase the driving performance of a vibrator.

Key vibration technology data.

Choosing the right vibrator for the job mainly depends on pile size, driving depth and soil conditions. The greater the driving depth and the harder or more compact the soil, the higher the centrifugal force and amplitude required. Centrifugal force and amplitude need to be high enough to overcome the surface friction and tip resistance between the pile and the surrounding soil. Key vibrator data in this context are shown in the following descriptions and formulae.

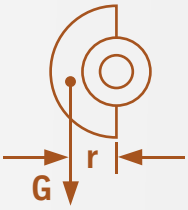


Key vibration technology data.

Eccentric moment

M [kgm]

$M = G \cdot r$



The eccentric moment is the measure of unbalance. As a determining factor for amplitude it is a key parameter for driving operations.

Speed (frequency) n [rpm]

The speed dictates the vibration frequency of the system. The vibrations are transferred via the pile to the surrounding soil, significantly reducing the surface friction between pile and soil. High frequencies counter the unwanted spread of vibrations in the soil.

Centrifugal force

$F = M \cdot \omega^2$

F [N] $F = M \left(\pi \cdot \frac{n}{30}\right)^2$

The centrifugal force must be high enough to overcome surface friction between pile and soil.

Centrifugal force plays a major part in reducing surface friction and provides impact force to overcome tip resistance.

Total amplitude S [m]

$$S = 2s = \frac{2 \cdot M_{stat}}{\Sigma\, G_{dyn}} \frac{[kgm]}{[kg]}$$

Together with centrifugal force, amplitude is a measure of driving performance. A large "stroke" and high "impact force" ensure good driving progress. When driving and extracting in cohesive soils, the elastic connection between pile and soil can only be broken if the amplitude is high enough.

Acceleration a [m/sec²]

$a = s \cdot \omega^2$ with $\omega = \pi \cdot \frac{n}{30}$

Transmission of the pile acceleration to the surrounding soil causes the displacement of the particle structure and reduces particle friction and soil resistance. Acceleration is indicated as the ratio of acceleration to gravity:

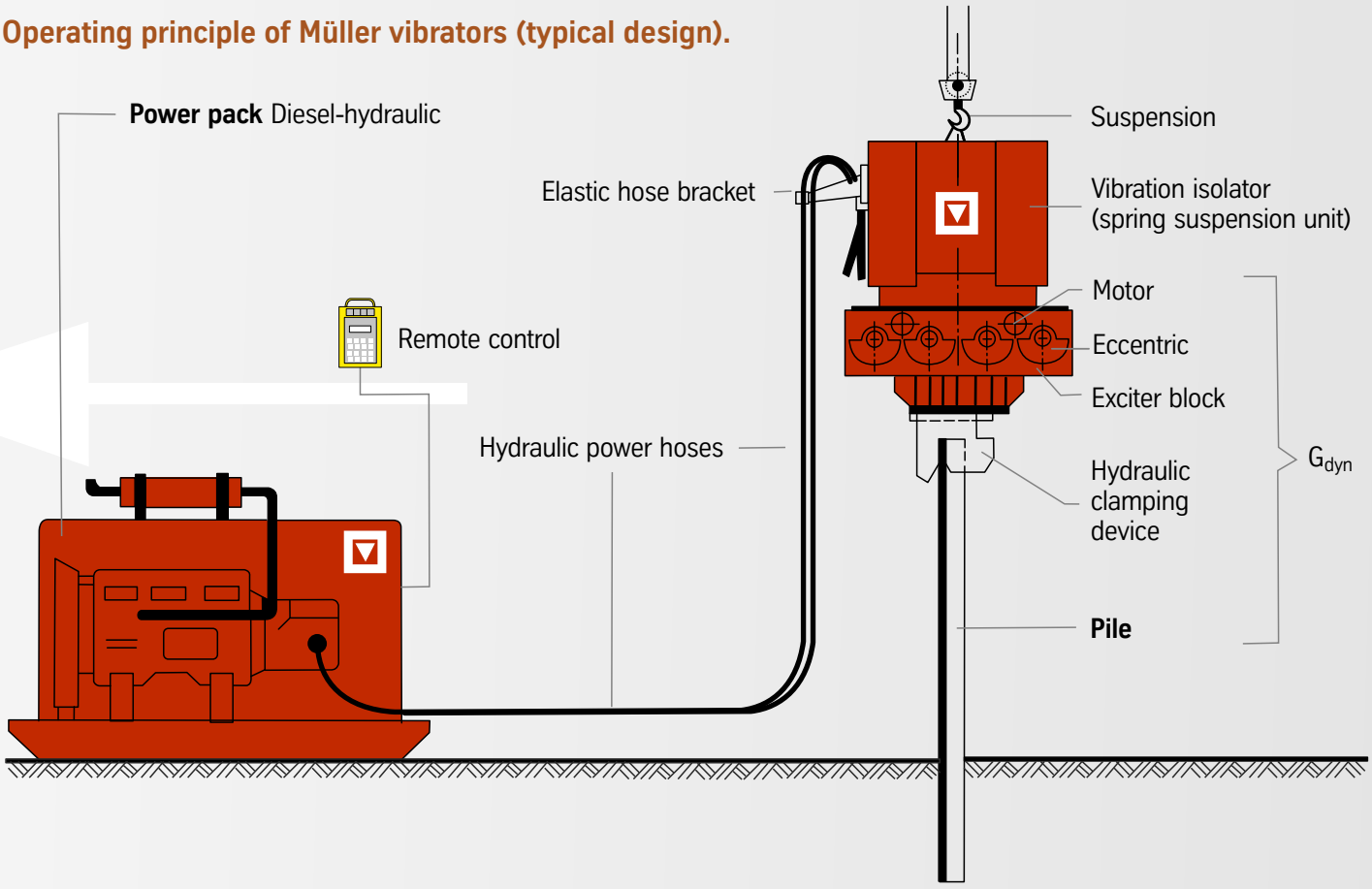
$\omega = \frac{a}{g}$ This ratio corresponds to: $\eta = \frac{F \cdot 10^{-1}}{G_{dyn}}$

The value can lie between 10 and 30.

Drive output P [kW]

The drive unit must be powerful enough to generate the moment needed to maintain the centrifugal force of the vibrator, even in difficult ground. The drive output should be 2 kW per 10 kN centrifugal force.

Operating principle of Müller vibrators (typical design).

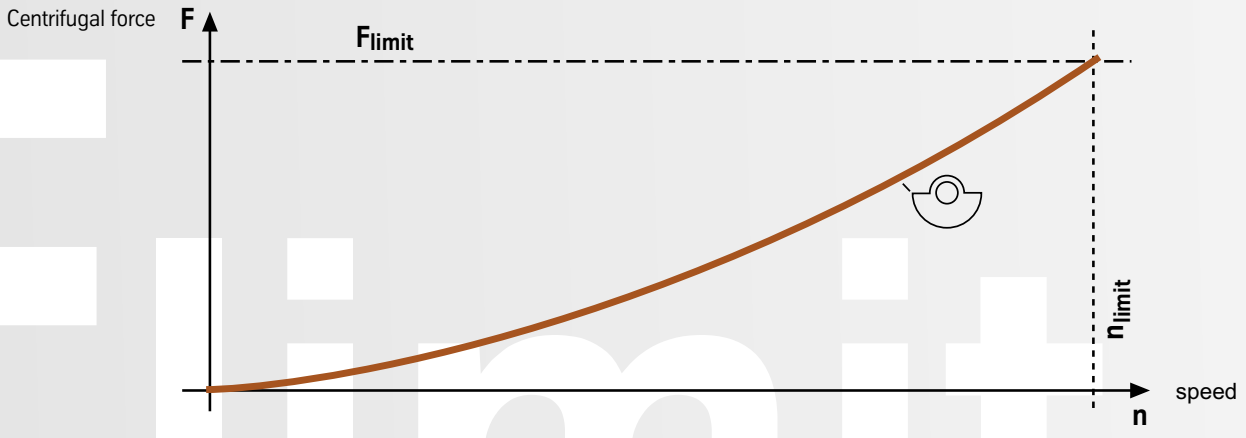


Müller vibrators.
H series with fixed eccentric moment.

The vibrators in this series are extremely robust and suitable for driving in loose to medium-dense soils. The “stretched” base plate in particular is ideal for driving and extracting pipes for in-situ concrete piles. The clamping devices on the base plate can be steplessly adjusted to allow a simple changeover to different pipe diameters on site.

Vibrator			MS-25 H2	MS-25 H3	MS-35 H3	MS-50 H2	MS-50 H3	MS-65 H3
Centrifugal force	F (max.)	**kN**	774	774	834	1430	1430	1670
Eccentric moment	M stat	**kgm**	25	25	32.5	50	50	65
Speed	n (max.)	**rpm**	1680	1680	1530	1615	1615	1530
Frequency	f (max.)	**Hz**	28.0	28.0	25.5	26.9	26.9	25.5
Pulling force	F pull (max.)	**kN**	400	400	400	500	500	500
Weight (dynamic)	without clamping device	**kg**	1930	2550	2660	3340	3820	4200
Weight (total)	without clamping device	**kg**	3200	3600	3600	6300	8050	8200
Amplitude	without clamping device/pile	**mm**	25.9	19.6	24.4	29.9	26.2	31.0
Displacement	Q Motor (max.)	**l/min**	425	425	463	719	719	680
Pressure	p (max.)	**bar**	350	350	350	350	350	350
Power consumption	p (max.)	**kW**	248	248	270	419	419	397
Dimensions	Length L	**mm**	2200	2200	2200	2600	2800	2800
	Width B	**mm**	681	777	777	696	722	737
	Height H	**mm**	1685	1745	1745	2035	2105	2105
	Throat T	**mm**	402	402	402	450	490	520
Power pack		**MS-A**	260	260	260	420	420	420
Single clamping device	Type	**MS-U**	100	100	100	180	180	200
	alternative Type	**MS-U**	150	150	150	150	-	250
Double clamping device	Type	**MS-U**	2 x 54	2 x 54	54	2 x 90	2 x 90	100
	alternative Type	**MS-U**			2 x 90/100	2 x 100	2 x 100	

Fixed eccentric moment.



Driving of 2.65 m diameter pipes weighing 100 to 160 tons for Germany's first offshore wind project. To ensure verticality, the first meters were driven with an MS-200 HHF and a special bracket to which the clamps were mounted. The pipe was sunk to final depth with a hydraulic hammer. Vibratory driving can be used for a wide variety of wind turbine foundation designs.

Source: Alpha Ventus Press picture

MÜLLER vibrators in action.
Project alpha ventus.
Pioneering achievement on the high seas.

alpha ventus.
A world first: electricity from wind power on the high seas.

The construction of the alpha ventus wind farm represents a whole new, daring chapter for the energy sector.

Wind farms have been set up in shallow waters around the coasts of Denmark, Sweden, the Netherlands and Great Britain. But the first German wind farm, "alpha ventus", is being built in 30 m of water some 45 km north of the island of Borkum.

This marks the beginning of a new era in wind energy. The 12 turbines of this wind farm, each with an output of 5 MW, will eventually supply electricity for about 50,000 people. The first wind turbine was completed on 15 July 2010. The intention is to install about 10,000 MW of power in German waters by 2020 – up to 25 000 MW in total. The offshore wind turbines are connected to a transformer station at the south-east corner of the wind farm, from where a 16 cm underwater cable connects them to the onshore electricity grid.

Facts & figures.

Client
EWE, E.ON, Vattenfall

Detailed engineering design
DOTI GmbH

Contractor
Multibrid GmbH

Plant
MS-200 HHF
Centrifugal force 4,000 kN
Eccentric moment 190 kgm
with incremental moment adjustment

Piles

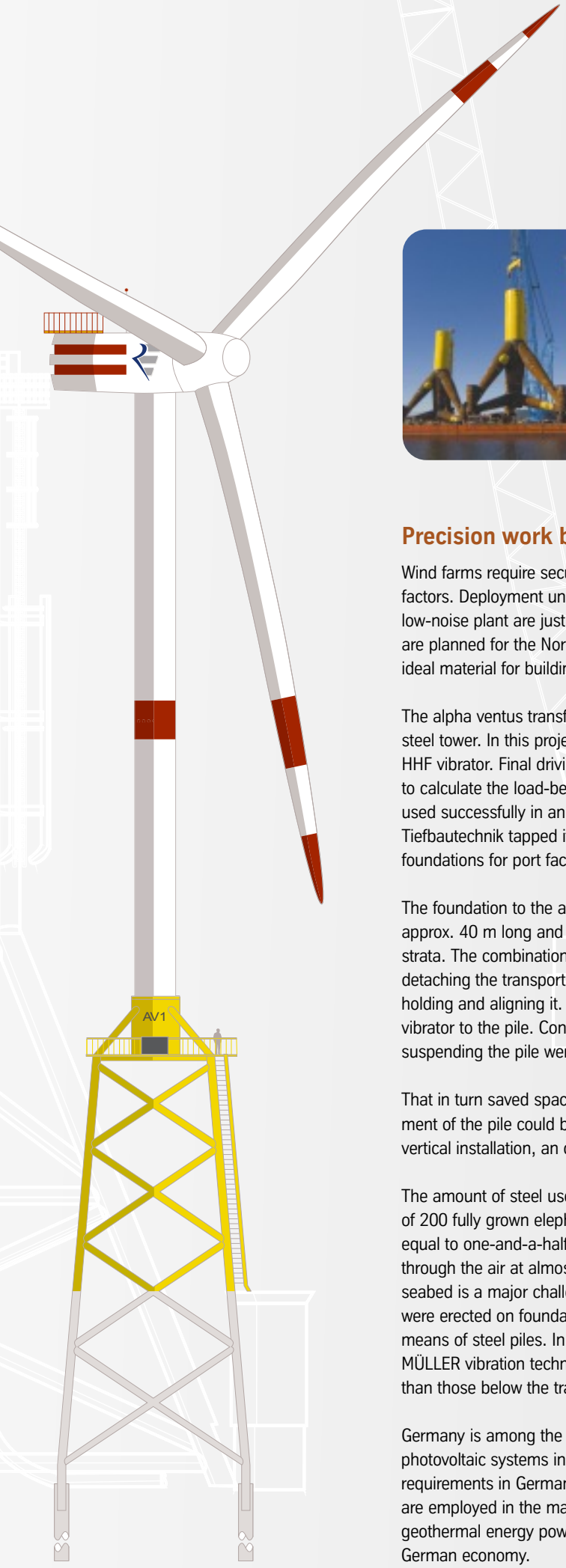
Length	40.00 m
Weight	approx. 110 to
Diameter	2.650 m
Driving depth	approx. 10 m by vibration
Driving to design depth	impact-driving with hydraulic hammer

A challenge for people and materials.

Just the dimensions alone are staggering: The hub of each turbine is 90 m above sea level. And added to that is another 30 m below water, down to the seabed. Including the rotor blades, the total height of a wind turbine is about 155 m, almost as high as Cologne Cathedral. In the North Sea wind speeds can reach 90 kmh, and in such weather huge waves are normal. Wind and weather dictate timetables and place great demands on crews and equipment.

The extreme ambient conditions were a constant concern during the planning of the alpha ventus project – for both the construction and service phases. Therefore, meteorologists, with the help of satellites, observe and analyse the weather situation constantly during the construction work. Before the project started, the ThyssenKrupp GfT Tiefbautechnik installation personnel from Alsfeld had to undergo the safety training for work on offshore platforms and are now available for all projects concerned with wind power installations.

The customer benefited because that meant 24-hour on-site services – necessary in order to complete the project within the very small time slot allocated.



Source: Alpha Ventus Press picture

Precision work between storms and waves: vibration technology.

Wind farms require secure foundations which place high demands on dimensional accuracy and other factors. Deployment under difficult weather conditions at sea, deployment underwater and relatively low-noise plant are just some of the advantages of vibration technology. More than 60 wind turbines are planned for the North Sea alone in the coming years. The good properties of steel make it an ideal material for building such installations.

The alpha ventus transformer station is founded on four tubular steel piles which support a tubular steel tower. In this project the piles were vibratory driven down to a depth of 10 m with an MS-200 HHF vibrator. Final driving of the piles was carried out with a hydraulic hammer in order to be able to calculate the load-bearing capacity. This was the first time that vibration technology had been used successfully in an offshore project. To achieve this pioneering performance, ThyssenKrupp GfT Tiefbautechnik tapped its vast stock of knowledge gained from recent projects involving underwater foundations for port facilities.

The foundation to the alpha ventus transformer station makes use of four tubular steel piles, each approx. 40 m long and weighing up to 110 t. The subsoil here consists of dense to very dense sand strata. The combination of vibration and impact-driving enabled several conditions to be fulfilled. After detaching the transport apparatus, the vibrator could be supported directly on the steel pile, thus holding and aligning it. A mounting bracket with two clamp grips was used to transfer the force of the vibrator to the pile. Consequently, neither a costly and elaborate guiding frame nor an apparatus for suspending the pile were necessary.

That in turn saved space on the already very congested installation platform and the vertical alignment of the pile could be achieved with simple means. A pile-mounted vibrator results in simple vertical installation, an optimum, fast driving time and extremely good economics, too.

The amount of steel used in a wind turbine structure is about 1000 t, which corresponds to the weight of 200 fully grown elephants or 22 railway carriages! The rotor catches the wind from an area roughly equal to one-and-a-half football pitches. At maximum r.p.m., the tips of the rotor blades are cutting through the air at almost 320 kmh! It is quite obvious that anchoring this installation securely to the seabed is a major challenge. Once the transformer station had been constructed, six wind turbines were erected on foundations comprising so-called tripods – frameworks anchored to the seabed by means of steel piles. In this project three piles were driven into the seabed per tripod with the help of MÜLLER vibration technology. The tubular steel piles weigh approx. 130–160 t each – even heavier than those below the transformer station.

Germany is among the leaders in terms of worldwide sales of renewable energy (wind turbines and photovoltaic systems in operation). Renewable energy now accounts for about 10% of total energy requirements in Germany, and just over 15% of the electricity consumption. Some 280,000 people are employed in the manufacture of wind turbines and solar power installations, in biomass or geothermal energy power plants. This industry is evolving into an important growth sector of the German economy.

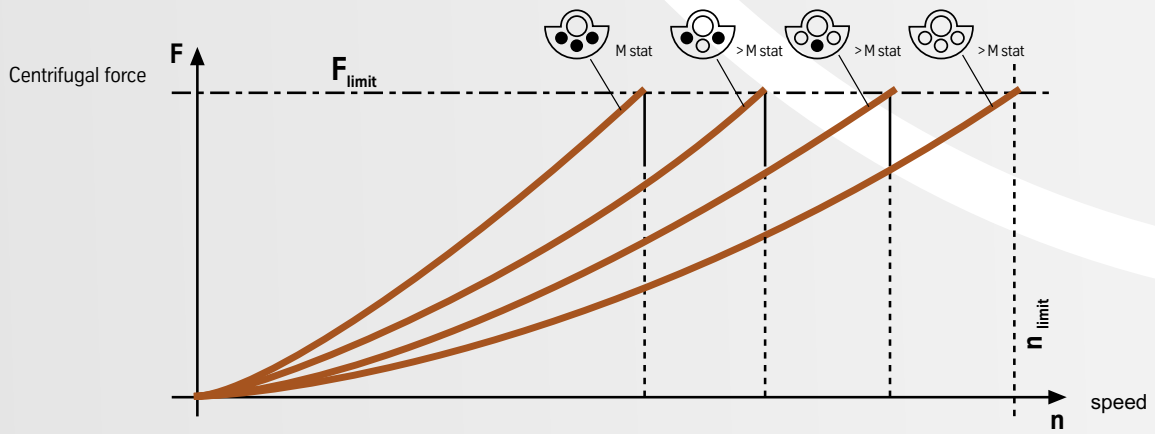
Müller “two in one” vibrators.
HHF series with stepwise variable eccentric moment – two in one.

The vibrator can be adapted quickly to different soil conditions by a simple system of adding or removing weights, allowing the eccentric moment to be varied. For example, if high frequency is required for work in loose sand, the additional weights can be removed simply on site to achieve high frequencies with the same centrifugal force.

Vibrator			MS-25 HHF	MS-50 HHF	MS-100 HHF	MS-120 HHF	MS-200 HHF
Centrifugal force	F (max.)	**kN**	750	1500	2500	3003	4000
Eccentric moment	M stat (max.)	**kgm**	25	50	100	116	190
Steps		**kgm**	12/15/20/25	24/30/40/50	48/60/80/100	80/94/110/116	(98)/110/115/190
Speed steps	n (max.)	**rpm**	2170/2113/1830/1637	2362/2113/1830/1637	2160/1920/1670/1500	1850/1700/1570/1536	(1800)/1800/1560/1371
Frequency steps	f (max.)	**Hz**	39.3/35.2/30.5/27.3	39.3/35.2/30.5/27.3	36/32/27.8/25	30.9/28.3/26.2/25.6	30/26/22.9
Pulling force	F pull (max.)	**kN**	280	500	600	1200	1200
Weight (dynamic)	without clamping device	**kg**	2900	4500	7700	8900	11750
Weight (total)	without clamping device	**kg**	3700	6100	10900	15500	18500
Amplitude	without clamping device/pile	**mm**	8.3/10.3/13.8/17.2	10.7/13.3/17.8/22.2	12.5/15.6/20.8/26.0	18.0/21.1/24.7/26.1	16.7/18.7/25.5/32.4
Displacement	Q Motor (max.)	**l/min**	470	610 964	1045 1286	989 1150 1534	1435 1680
Pressure	p (max.)	**bar**	350	350	350	350	350
Power consumption	P (max.)	**kW**	274	356 562	610 750	577 671 895	837 980
Dimensions	Length L	**mm**	1800	2260	2410	2300	2300
	Width B	**mm**	813	888	843	1200	1430
	Height H	**mm**	1885	2465	3235	4135	4170
	Throat T	**mm**	360	350	660	832	832
Power pack		**MS-A**	260	420 570*	700 840*	840 1050*	840 1050*
Single clamping device		**MS-U**	90	180	360	360	
	alternative	**MS-U**	100	200			
Double clamping device		**MS-U**	2 x 54	2 x 90	2 x 150	2 x 180	2 x 250
	alternative	**MS-U**	2 x 70	2 x 100	2 x 180		

*Combination for increased performance

Stepwise variable moment.

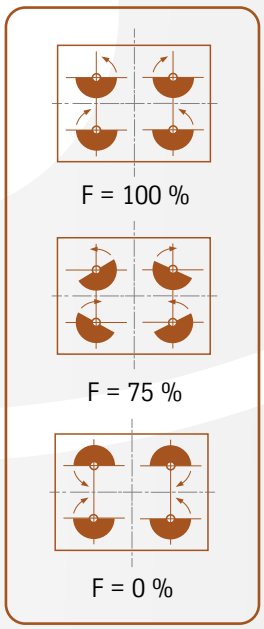


MÜLLER vibrators.
HFV series with variable frequency and amplitude for resonance-free starting and stopping.

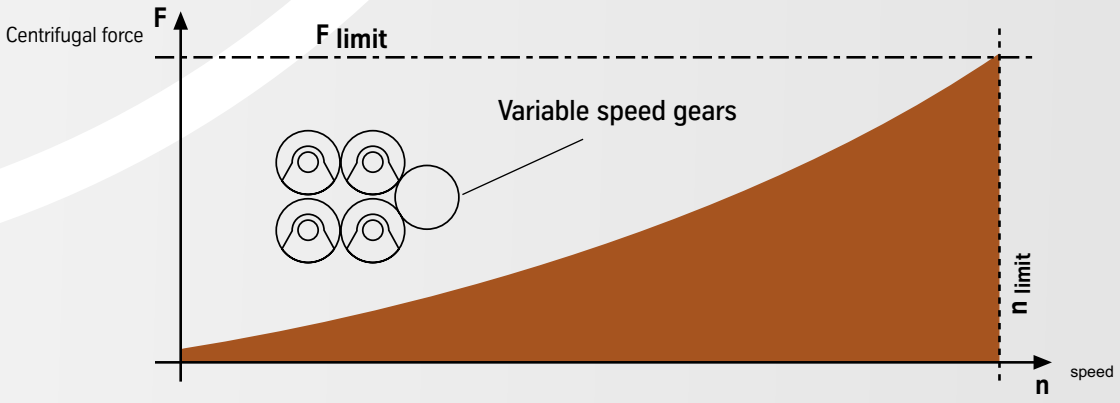
The need to avoid vibration and noise emissions e.g. on inner-city sites is becoming increasingly important. Our range of state-of-the-art variable vibrators with resonance-free starting and stopping was designed specially for this. These machines deliver exceptional performance while minimizing noise and vibrations. They allow frequency and amplitude to be matched optimally to the soil conditions. The precision programmable controller enables several functions to be combined and carried out with just one command. The controller can also be set so that frequency does not fall below a preselected level.

Vibrator			MS-10 HFV	MS-16 HFV	MS-20 HFV	MS-24 HFV	MS 28 HFV	MS-32 HFV	NEW! MS-40 HFV	MS-48 HFV	MS-62 HFV
Centrifugal force	F (max.)	**kN**	610	968	1230	1480	1473	1980	2006	2960	2998
Eccentric moment	M stat (variable)	**kgm**	0 – 10	0 – 16	0 – 19.5	0 – 24	0 – 28	0 – 32	0 – 39.2	0 – 48	0 – 62
Speed	n (max.)	**rpm**	2358	2350	2400	2350	2190	2375	2160	2350	2100
Frequency	f (max.)	**Hz**	39.3	39.2	40.0	39.2	36.5	39.6	36.0	39.0	35.0
Pulling force	F pull (max.)	**kN**	180	300	300	400	500	600	600	600	800
Weight (dynamic)	without clamping device	**kg**	1700	2600	2530	2900	3120	4850	4870	6520	6805
Weight (total)	without clamping device	**kg**	2300	3500	3600	5050	5320	7250	7280	9700	11165
Amplitude	without clamping device/pile	**mm**	11.8	12.3	15.4	16.5	18.0	13.2	16.1	14.7	18.2
Power consumption	P (max.)	**kW**	147 203	220 294	413	404 551	428 514	570 685	630 756	682 823	980 735
Displacement	Q Motor (max.)	**l/min**	253 348	378 504	708	693 945	734 880	1045 1175	1080 1296	1170 1410	1680 1260
Pressure	p (max.)	**bar**	350	350	350	350	350	350	350	350	350
Dimensions	Length L	**mm**	1635	1930	2080	1920	1920	2371	2371	2371	2371
	Width B	**mm**	732	757	782	893	893	800	880	1123	1180
	Height H	**mm**	1530	2010	2060	2145	2240	2455	2455	2525	2525
	Throat T	**mm**	330	350	350	451	451	345	345	860	860
Power pack		**MS-A...V**	170 260*	260 420*	420	420 570*	420 570*	570 700*	700 840*	700 840*	1050
Single clamping device	Type	**MS-U**	MS-U 72	MS-U 150	MS-U 150	MS-U 180	MS-U 180	MS-U 250	MS-U 250	MS-U 360	MS-U 360
	alternativ	**MS-U**	MS-U 100								
Double clamping device	Type	**MS-U**	2 x 54	2 x 70	2 x 90	2 x 90	2 x 90	2 x 150	2 x 150	2 x 180	2 x 180
	alternativ	**MS-U**	2 x 70	2 x 90	2 x 100	2 x 100	2 x 100		2 x 180		

*Combination for increased performance



Variable eccentric moment.



MÜLLER excavator-mounted vibrators.
Powerful, compact, user-friendly and reliable.

Vibratory pile driving is based on the principle of reducing the cohesion of soils through vibration, effectively fluidizing the soil. When the soil is in this condition, installing the piling requires only little force. The dead weight of the piling and the applied force are enough to drive the piling to the required depth quickly, quietly and efficiently. The same applies when extracting the piling. The required pulling force is minimized due to the reduced friction. The link between the piling and the vibrator is the clamping device, which forms a firm connection and releases it again after driving.

Applications.

Excavator-mounted vibrators can be used to perform general driving, extracting and compacting work (MS-2 HFB to MS-7 HFB). With a modified clamp arrangement the vibrators MS-4 HFB, MS-6 HFB and MS-7 HFB are suitable for pipe driving. Jobs in vibration-sensitive or inner-city areas are carried out reliably with the vibrators MS-5 HFBV and MS-8 HFBV, which feature resonance-free starting and stopping. The MS-1 HFB was specially designed for installing plastic sheet piles, wooden piles and lightweight sections. The high-performance vibrators MS-9 HFB and MS-17 HFB are needed for jobs in heavy soils.

Selection.

Choosing the right vibrator for a job depends on soil conditions, the type of pile and the driving depth. The vibrator also has to be matched to the excavator (oil flow, pressure). If the excavator cannot supply enough power, the vibrators can be driven by separate MÜLLER hydraulic power packs. The vibrator is controlled conveniently by the excavator operator via remote control (cable or radio).

Mounting and operation.

Excavator-mounted vibrators are fitted to the excavator stick by means of a connecting fork. We offer forks matched to your excavator. A rotary joint allows easy alignment of the vibrator with the piling. The high-strength push head allows additional forces to be applied from the excavator to the vibrator, boosting driving performance. The vibrator is operated by the excavator “tilt stick” control.

The vibrator is connected to the boom's hydraulic connections by two hoses. A third hose, the leak oil line, completes the simple hydraulic connection. Integrated in the vibrator is a control system that ensures that when the control lever in the excavator is swung out a clamp grips the pile firmly and then holds the clamping force constant at the required level. A governor limits rpm to the maximum allowed level – irrespective of the oil flow supplied by the excavator – and thus ensures longer vibrator life.

The advantages at a glance.

- Extremely low height allows driving of long piles
- High push/pull forces increase driving performance
- All vibrators are fitted with a safety circuit
- All clamps can be rotated 90° to allow face working
- Double clamping devices can be fitted for pipe driving
- Simple mounting with three hoses
- User-friendly design with one-lever operation
- Long life

An overview of the most common excavator types with their performance data and recommended vibrators is available online as a PDF file (www.thyssenkrupp-gft-tiefbautechnik.com).

This service offers an orientation guide; however, selections should always be confirmed by specialists.

MÜLLER excavator-mounted vibrators.
Overview of technical data.

Type			MS-1 HFB	MS-2 HFB	MS-3 HFB	MS-4 HFB	MS-6 HFB	MS-7 HFB	MS-9 HFB
Centrifugal force	F (max.)	**kN**	90	245	296	374	464	604	606
Eccentric moment	M stat (max.)	**kgm**	0.7	2.2	3	4.2	6.5	7	8.5
Frequency	f (max.)	**Hz**	56	53.1	50	47.5	42.5	46.7	42.5
Speed	n (max.)	**rpm**	3360	3185	3000	2850	2550	2800	2550
Pulling force	F pull (max.)	**kN**	34	60	60	120	120	150	150
Push down	F push (max.)	**kN**	34	40	40	80	80	80	80
Power consumption	P (max.)	**kW**	60	61	70	100	119	130	133
Total weight (incl. clamping device)		**kg**	350	815	830	1230	1240	1300	1380
Dyn. weight (incl. clamping device)		**kg**	230	570	585	940	950	950	990
Amplitude		**mm**	6.1	7.7	10.3	8.9	13.7	14.7	17.2
Displacement	Q Motor (max.)	**l/min**	102	105	120	171	204	224	229
Length	L	**mm**	761	1024	1024	1174	1174	1174	1174
Width	B	**mm**	472	623	623	742	742	742	742
Height, incl. clamping device	H	**mm**	761	1024	1024	1249	1249	1249	1249
Width at throat	T	**mm**	230	260	260	340	340	340	340
Standard clamping device		**MS-U...**	MS-U 12	MS-U 40	MS-U 40	MS-U 60	MS-U 60	MS-U 72	MS-U 72
Recommended power pack		**MS-A...V**				MS-A 110	MS-A 110	MS-A 170	MS-A 170

Type			MS-17 HFB	MS-5 HFBV*	MS-8 HFBV*	MS-4 HFBS	MS-6 HFBS	MS-7 HFBS
Centrifugal force	F (max.)	**kN**	604	400	585	378	464	604
Eccentric moment	M stat (max.)	**kgm**	17	0 - 5	0 - 8	4.2	6.5	7
Frequency	f (max.)	**Hz**	30	45	43	47.5	42.5	46.7
Speed	n (max.)	**rpm**	1800	2700	2580	2850	2550	2800
Pulling force	F pull (max.)	**kN**	140	120	150	120	120	150
Push down	F push (max.)	**kN**	170	80	150	80	80	80
Power consumption	P (max.)	**kW**	158	95	165	100	119	130
Total weight (incl. clamping device)		**kg**	2208	1580	1815	1360	1370	1380
Dyn. weight (incl. clamping device)		**kg**	1453	1130	1295	1110	1120	1130
Amplitude		**mm**	23.4	8.8	12.4	7.7	11.6	12.4
Displacement	Q Motor (max.)	**l/min**	270	162	283	171	204	224
Length	L	**mm**	1386	1423	1460	1175	1175	1175
Width	B	**mm**	917	706	758	697	697	697
Height, incl. clamping device	H	**mm**	1036	1498	1583	1250	1250	1250
Width at throat	T	**mm**	340	440	409	–	–	–
Standard clamping device		**MS-U...**	MS-U 72	MS-U 60	MS-U 72	MS-U 60	MS-U 60	MS-U 72
Recommended power pack		**MS-A...V**	MS-A 170	MS-A 110 V	MS-A 170 V	MS-A 110	MS-A 110	MS-A 110

*Option: with three or five connecting hoses

MÜLLER excavator-mounted vibrators.
Products for special uses.

The variable-moment excavator-mounted vibrators MS-5 HFBV and MS-8 HFBV with resonance-free starting and stopping are designed primarily for inner-city use and particularly vibration-sensitive projects. To adjust the eccentrics for resonance-free starting and stopping, a further excavator function, “rotate grab”, is necessary in addition to “tilt stick”.

For this, the vibrator is connected to the excavator stick with two additional hoses.

The patented control system on the variable-moment vibrators of the series HFBV3 allows a simple hydraulic connection with three hoses and simplified “one-lever operation” from the excavator, similar to conventional vibrators.

The MS-1 HFB was developed specifically for installing plastic sheets and piles.

Its applications lie in the construction of waterfront structures and jetties. It can be used to install wood and very small piles, soil nails and reinforcement cages for cast-in-situ piles.

The MS-1 HFB can be mounted on mini or compact excavators upward of an installed rating of approx. 54 HP.

MÜLLER leader-mounted vibrators.
For attachment to leaders.

MÜLLER leader-mounted vibrators in combination with proven variable moment control are ideal for driving and extracting steel sections such as pipes, sheet piles and beams and for use in foundation work such as the construction of compacted gravel or sand piles etc.

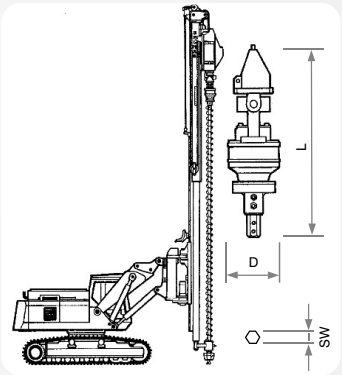
They are slim enough to drive and extract small single piles and to work in tight conditions.

Resonance-free starting and stopping protects both the surrounding area and the carrier from damaging vibrations and emissions.

Type			MS-16 HFMV	MS-20 HFMV
Centrifugal force	F (max.)	**kN**	986	1160
Eccentric moment	M stat	**kgm**	0 - 16	0 - 20
Speed	n (max.)	**rpm**	2376	2340
Frequency	f (max.)	**Hz**	39.5	38.4
Pulling force	F pull (max.)	**kN**	180	180
Total weight	incl. clamping device	**kg**	3980	4110
Dimensions	Height (incl. clamping device) H	**mm**	1710	1710
	Throat T	**mm**	455	455
Standard clamping device		**MS-U**	150	150

*The operating pressure for all leader-mounted vibrators is max. 350 bar.

MÜLLER drill drives.
Various mounting options.



Drilling equipment for mounting in vibrator clamping devices.

Low-noise, vibration-free drill drives from MÜLLER are available in three different mounting versions:

- on the guide slide of a leader
- in the clamp of a vibrator
- on the stick of an excavator

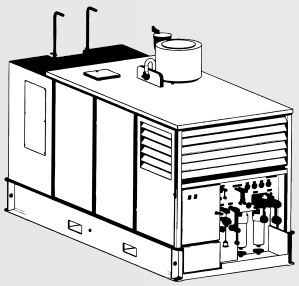
Selecting the right drilling method allows pressure-relief and preparatory drilling to be carried out quickly and cost-efficiently, particularly in very dense soil.

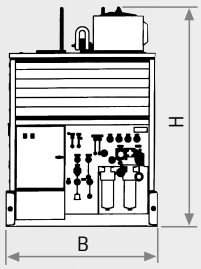
Type Attachment to leader slide = 1 Clamping in vibrator clamp = 2 Connection to excavator stick = 3			RHA 101 RHA 102 RHA 103	RHA 141 RHA 142 RHA 143	RHA 201 RHA 202 RHA 203	RHA 281 RHA 283	RHA 401 RHA 403
Torque	(max.)	**da Nm**	1000	1400	2000	2800	4000
Speed	(max.)	**rpm**	125	115	110	100	70
Oil pressure	(max.)	**bar**	300	300	300	300	300
Displacement	(max.)	**l/min**	260	350	460	600	600
Diameter	smallest drilling diameter	**mm**	200	200	400	400	400
Diameter	largest drilling diameter	**mm**	700	900	1200	1400	1600
Drill depth	with smallest drilling diameter (max.)	**m**	20	25	14	16	20
Drill depth	with largest drilling diameter (max.)	**m**	4	4	2	2	2
Auger connection	Standard distance across flats*	**mm**	70	70	80	100	120
Weight	without auger/without stand approx.	**kg**	300	360	440	600	760

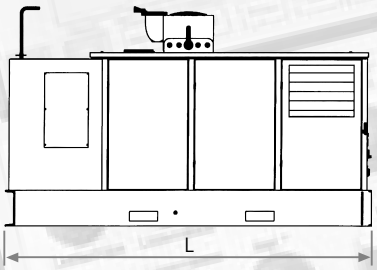
*Options available on request

MÜLLER power packs and control system.
Power supply: economical and ecological.

The energy supply to the vibrators is not only important from an economic point of view. Increasingly, questions of ecological compatibility are coming to the fore, e.g. energy efficiency and pollution through noise and CO_2 emissions.







The hydraulic vibrators are powered by power packs, in which diesel engine-driven hydraulic pumps deliver a flow of pressurized oil to the hydraulic motors on the vibrator.

All power packs are silenced and are controlled by a specially adapted programmable controller and constantly monitored during operation.

The vibrator is operated via a cable remote control, or optionally by radio remote control. The operating parameters of the vibrator can be monitored via an online connection. Should a problem occur, our experts can analyze the operating parameters and provide immediate assistance by phone.

Power packs			MS-A 110 (V)*	MS-A 170 (V)*	MS-A 260 (V)*	MS-A 420 (V)*	MS-A 570 (V)*	MS-A 700 (V)*	MS-A 840 (V)*	MS-A 1050 (V)*
Diesel motor			CAT	CAT	CAT	CAT	CAT	2 x CAT	2 x CAT	2 x CAT
Exhaust certification		**ATAAC**	C 4.4	C 6.6	C 9	C 15	C 18	C 13	C 15	C 18
Exhaust certification		**EU / EPA**	IIIA / Tier 3	IIIA / Tier 3	IIIA / Tier 3	IIIA / Tier 3	IIA / Tier 2	IIIA / Tier 3	IIIA / Tier 3	IIIA / Tier 3
Power	P (max.)	**kW**	106	168	261	433	571	708	866	1044
Speed	n (max.)	**rpm**	2200	2200	2200	2000	1800	2100	2100	2100
Hydraulics										
Feed rate	Q (max.)	**l/min**	270	310	525	740	1050	1180	1480	1680
Operating pressure	p (max.)	**bar**	380	380	380	380	380	380	380	380
Fuel tank capacity		**l**	400	400	550	900	1050	1400	2200	2200
Hydraulic tank capacity		**l**	250	250	250	280	440	500	600	600
Weight without fuel		**kg**	4000	4000	5000	6200	8500	10300	12500	13500
Dimensions:	Length L	**mm**	3000	3000	3700	4250	4750	4800	5300	5300
	Width B	**mm**	1400	1400	1490	1700	2000	2200	2400	2400
	Height H	**mm**	2100	2100	2340	2435	2360	2430	2570	2570

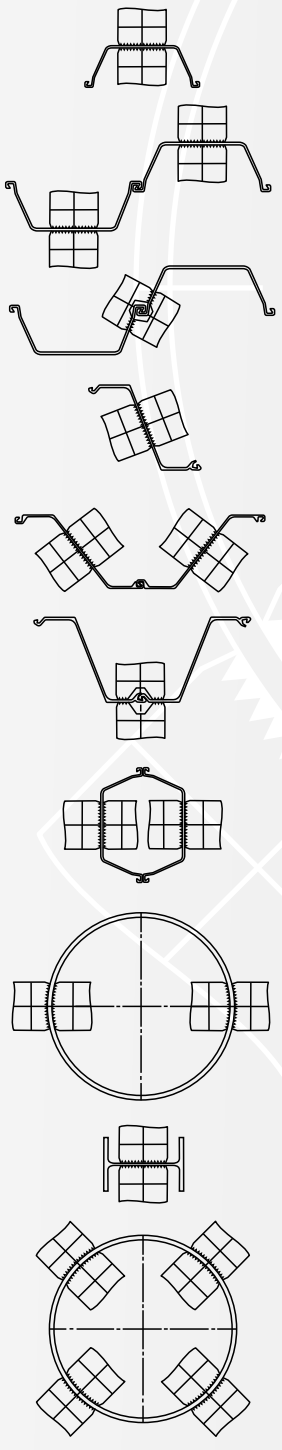
*optionally with variable amplitude

MÜLLER clamping devices and safety grippers.
Vibration-proof connections.

The clamping device connects the vibrator with the pile. It has a clamping piston which creates a firm connection for driving and then releases the pile when it is in place. All clamps can be rotated 90° to allow face working.

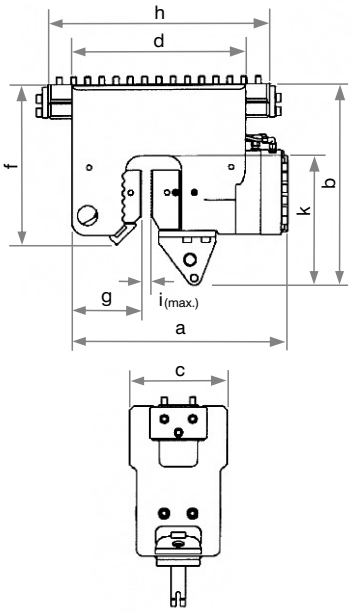
Arrangement of clamps

as single clamping devices, double clamps for U- and Z-type sheet piles, I-beams and pipes. Special clamping devices are available for special applications, e.g. for wooden piles, concrete piles, small-diameter pipes.



The clamping devices provide a vibration-proof connection between piles, beams and pipes and the vibrator. The clamping force (kN) of the clamping devices must be at least 1.2 times higher than the centrifugal force (kN).

All MÜLLER vibrators can be fitted with a variety of adapter plates to allow numerous different clamping device arrangements. Special clamping devices are also available for driving double piles and pipes.



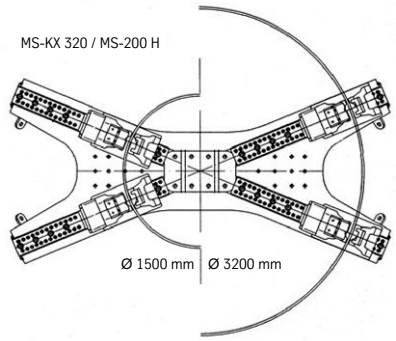
MÜLLER safety grippers.

Available in different sizes, the safety grippers are the ideal solution for quick pile pick-up. They guarantee simple and safe working when uprighting sheet piles and other steel sections.

Type	Pulling force	Weight
SSZ-3B	30 kN	15 kg
SSZ-4B	40 kN	24 kg
SSZ-5B	50 kN	26 kg

X – bracket

Special design for driving large-diameter, heavy pipes.



Clamping devices.

Type MS-U	Clamping force US ton	Dimensions in a	c	d	f	g	h	i. max.	IPBmin	Weight lbs
12*	122	225	195	195	223	95	—	15	120	50
40*	370	508	260	475	285	175	—	40	120	190
54**	540	650	270	515	690	200	730	22	180	440
60*	600	600	320	480	350	220	—	40	140	260
70**	700	770	340	580	525	290	780	36	180	615
72*	720	600	320	480	350	220	—	40	140	260
90**	900	770	340	580	525	290	780	28	180	620
100**	1000	751	345	610	530	275	780	50	280	680
150*/***	1500	890	340	640	550	320	780	45	320***	770
180*/***	1800	954	390	745	592	325	780	80	320***	1250
200*	2000	1010	380	880	800	430	—	48	450	1600
250*/***	2500	1340	400	870	840	410	1150	63	450	2400
360*	3600	1255	460	1180	950	520	—	80	400	3130

* for direct bolting ** shiftable on clamping bar *** IPB 300 possible with special equipment

MS – EDGR. (MÜLLER System – Electronic Data Geological Report). Computer-aided recording of installation data during pile driving and extraction.

Recording the installation parameters – such as frequency, pressure, depth – when driving piles with vibratory hammers has become extremely important in specialized civil engineering. This data acquisition provides a reliable, fast and simple method of revealing unforeseeable deviations from the design parameters, e.g. obstructions and changes in the anticipated subsoil conditions.

How does the system work?

The MS EDGR system is integrated in the power pack control unit.
Using a computer, the user can retrieve the data via

- a serial port (cable)
- the GSM network
- the ISDN network
- or via a GPRS internet connection

Owing to clients' varying needs and differences in the output formats, the data can be transmitted in a variety of formats.

Advantages of electronic data acquisition:

- Optimum system compatibility – electronic data acquisition and vibration unit direct from the manufacturer
- No loss of data
- Precise parameter acquisition – also beyond the standard values
- Simplified data log output
- Remote diagnostics
- Permanent monitoring of operating parameters
- Automatic vibrator control for compliance with DIN 4150 values
- Possibility of logging parameters exceeding the standard values

Online data retrieval. What data can be viewed?

Regardless of the form of computer-aided connection, i.e. via the internet, phone line or manual cable connection, the following parameters are displayed:

Power pack management

- Engine speed
- Engine temperature
- Gear oil temperature
- Hydraulic oil temperature
- Hydraulic oil level
- Diesel tank level
- Operating pressure
- Internal voltage
- Hydraulic pump filling pressure

Installation parameters

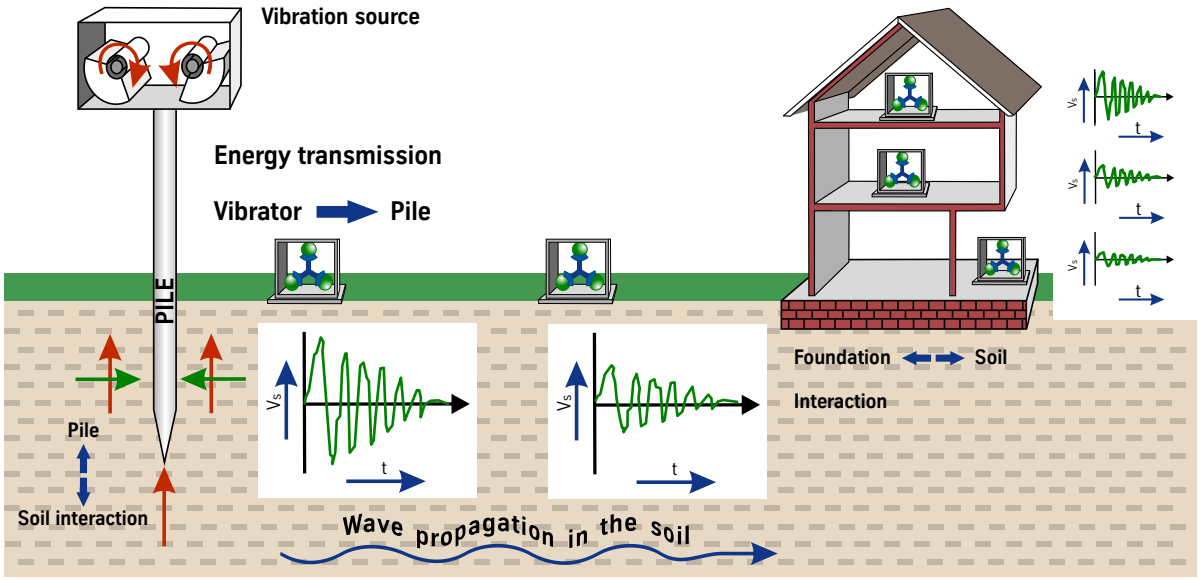
- Vibrator frequency
- Unbalance position (on adjustable vibrators)
- Amplitude
- Driving depth
- Geophone x/y/z axes
- 3 analog inputs

This logging facility allows all the necessary data to be stored per project within the broad range of applications. For instance, it is possible to show vibration propagation in an inner-city location. During the driving of a thin diaphragm wall, data such as the quantity of injected material and injection pressure can be recorded, thus simplifying logging.

Controlled pile driving depending on vibration propagation.

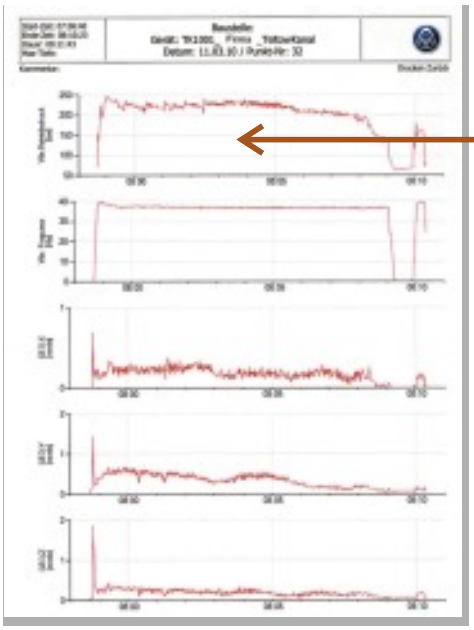
Measurement of vibration propagation

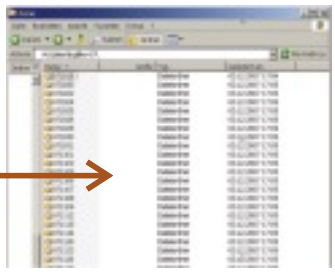
The ability to measure vibration propagation enables frequency to be controlled in accordance with the requirements of DIN 4150 and the effects of vibration on adjacent buildings to be avoided. For vibrators (excavator-mounted units) that do not require a power pack, compliance with specified requirements can be monitored by means of a visual display on a separately installed measuring box with warning lights.



Data management.

Data log output at the click of a mouse





Example of a civil engineering data log with 10 parameters

- Operating pressure
- Frequency
- Amplitude
- Depth
- Vibration in x/y/z directions
- Further channels for the acquisition of:
  - pressure of the injected material
  - quantity of injected material or the like

Automatic data sorting

- Collected data sorted according to project and category
- Automatic generation of folders per work day
- No need to search for data

Greater flexibility thanks to mobile data transfer.

Updating of measured data with a specially set-up server.

The data can be retrieved from any location via the internet and, with suitable software, with the usual standard of data security. The data can be converted into the formats required for the application.

Diagnosis of identifiable faults by means of data transfer.

In addition to contacting our skilled and experienced technicians by phone, remote diagnosis is also possible.

The following can be identified, for example:

- Contaminated filters or coolers
- Filling levels of fuels/fluids
- Operational history

Special equipment.
Custom solutions.

ThyssenKrupp GfT Tiefbautechnik is a competent partner for special vibration technology applications. Our experts in geotechnical and soil engineering, machine design, control technology and electronics are available to support you at all times in the planning and execution of your projects.

Thin diaphragm wall.

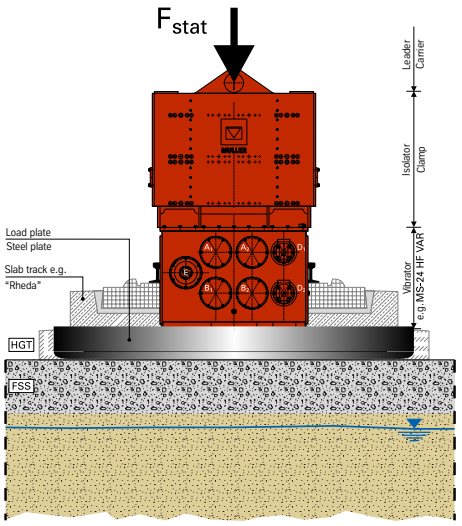
Thin diaphragm walls are an economical way of providing vertical sealing in hydraulic and foundation engineering. This method is mainly used in dikes, dams, landfills and to contain subsoil contamination.

To produce a thin diaphragm wall, a steel beam with a wider bottom end is driven into the ground to be sealed using a MÜLLER vibrator. The steel beam is equipped with flushing or slurry pipes. In this way, the gap created and part of the surrounding soil is filled/mixed with slurry. A roughly 50 cm deep flow trench in the narrow wall axis takes up excess slurry and compensates for slurry losses.

By vibration driving the steel beam with an overlap, a narrow sealing element is created. Depending on the soil quality, wall depths of up to 30 meters are possible.

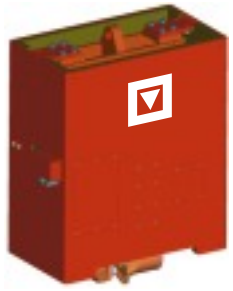
5-fold clamping unit.

Successful market entry with a newly developed adapter plate for five clamping units: The adapter plate makes it possible to arrange five clamping plates on a radius and so clamp and drive 5 straight-web sections simultaneously. It has now been successfully used in India to construct 70 flat cells – an efficient way to counter buckling of the section.



DYSTAFIT©.

Thanks to the patented "Dystafit©" system, necessary ground improvement and rehabilitation measures can now be assessed much more effectively. Load cycles are simulated to predict the stability of ground susceptible to settling, sinking or shifting. Dystafit© can also be used to test the effects of increased speeds on train lines.



MÜLLER vibration driving technology – eco-friendly.

Soundproofing in action.

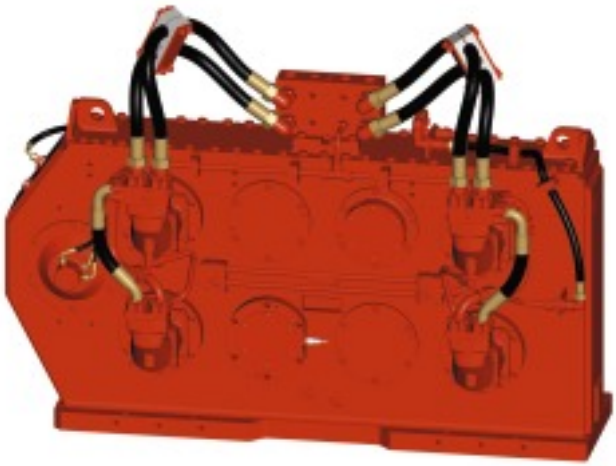
- The enclosure significantly reduces noise emissions
- Special access openings allow maintenance and servicing without removing the sound hood
- The enclosure also serves as an added desirable weight on the spring suspension unit
- The enclosure facilitates easy handling and transportation

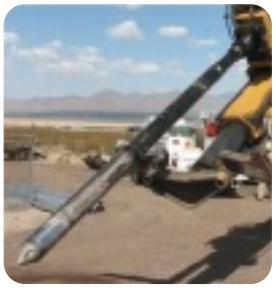
MS-BDE – New electronic unit collects operating data in vibro pile driving.

- Measures, stores and displays operating data: Date, operating time, max. operating temperature
- Suitable for units without an operating hours counter – e.g. excavator-mounted vibrators
- Support in complying with maintenance intervals – for equipment owners and hire companies
- Easy to fit and use
- Joint development by ThyssenKrupp GfT Tiefbautechnik GmbH and a renowned research institute
- Suitable for all makes

MÜLLER vibrator MS-32 HFV – for soil compaction.

- Compaction with a special compacting plate in combination with MÜLLER vibrator MS-32 HFV
- Variable from 0 – 40 Hz
- Integrated sensors for speed measurement and angle recognition during compaction
- Modified for continuous operation and underwater use
- Licensed for 10° gradient in all directions
- Automatic compacting cycle (start, compact, stop)
- Driven by MÜLLER power pack
- Option of radio remote control with display of amplitude and eccentric moment
- Option of visualization via MS-EDGR and webTK



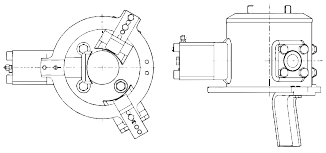


MÜLLER clamping unit MS-U 160 S – New clamping system.

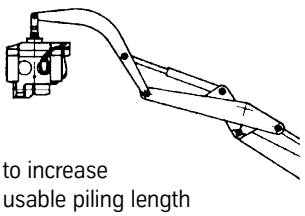
- Developed and designed by ThyssenKrupp GfT Tiefbautechnik GmbH, Alsfeld
- Allows driving and extracting of very small diameter thin-wall pipes
- Allows use of very small diameter pipes (d = approx. 120 mm – depending on wall thickness and length)
- Allows clamping of coated pipes without damaging the coating

PATENT PENDING

Wood pile clamping device.

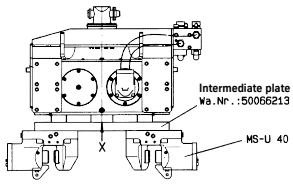


Stick extension ("swan neck")



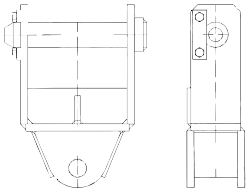
to increase usable piling length

Adapter plate/double clamping devices.



for pipe driving

Connecting fork



for reliable and convenient connection to your excavator

Export
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Spare Part Service: +49 6631 781-126
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Represented by:

Piling sections

Driving and extracting equipment

Anchor equipment

Trench shoring equipment

Flood protection

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