ESC VINYL SHEET PILES

Installation Guide

DELIVERING HIGH QUALITY VINYL SHEET PILING SOLUTIONS TO THE GLOBAL MARKET

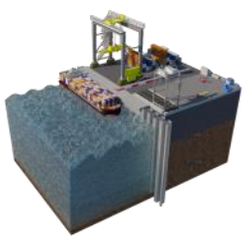
www.escpvcsheetpiling.com

ESC VINYL SHEET PILES INSTALLATION

INTRODUCTION

ESC recommends that the installation of its vinyl sheet piles to be completed in compliance with the engineer's plan, drawings and project documentation. This guide is intended to be a general guide to the main aspects of vinyl sheet piling installation. The selection of the best profile by ESC should be completed by a competent structural engineer or designer familiar with both the piling materials, site conditions and project requirements. While there are a lot of parallels to be drawn with the installation of steel sheet piles, the installer should also be aware of the subtle differences involved.

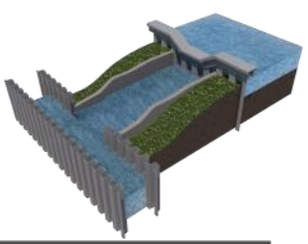
There are a wide range of applications of vinyl sheet piles which include



MARINE STRUCTURES

FLOOD CONTROL

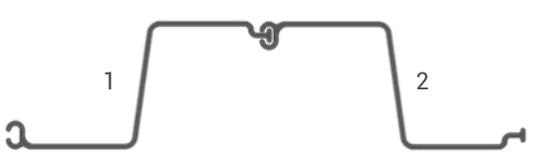
CUTOFF & CONTAINMENT



WATER CONTROL

ESC VINYL SHEET PILE SERIES

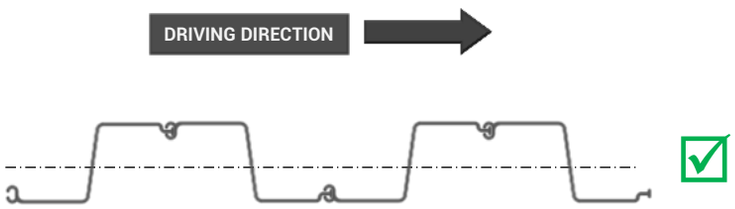
Section	Width mm	Height mm	Thickness mm	Weight Per Pile kg/m	Shape
ESC-VU25	500	160	6	7.2	Omega
ESC-VU40	600	230	7.5	11.1	Omega
ESC-VZ437-10.5	437	254	10.5	12.6	Z
ESC-VZ610-9.0	610	230	9.0	13.2	Z
ESC-VU695-8	695	180	8.0	14.6	Omega
ESC-VU695-9	695	180	9.0	16.5	Omega
ESC-VU695-11	695	180	11.0	19.2	Omega
ESC-VU703-7.5	703	180	7.5	12.4	Omega
ESC-VU740-6	740	180	6.0	11.1	Omega
ESC-VZ565-9.0	565	245	9.0	15.3	Z
ESC-VZ580-7.0	290	240	7.0	6.1	Z
ESC-VZ580-9.0	290	240	9.0	6.5	Z
ESC-VZ580-11.0	290	240	11.0	7.9	Z



Z TYPE

OMEGA TYPE

SHEET PILE ORIENTATION

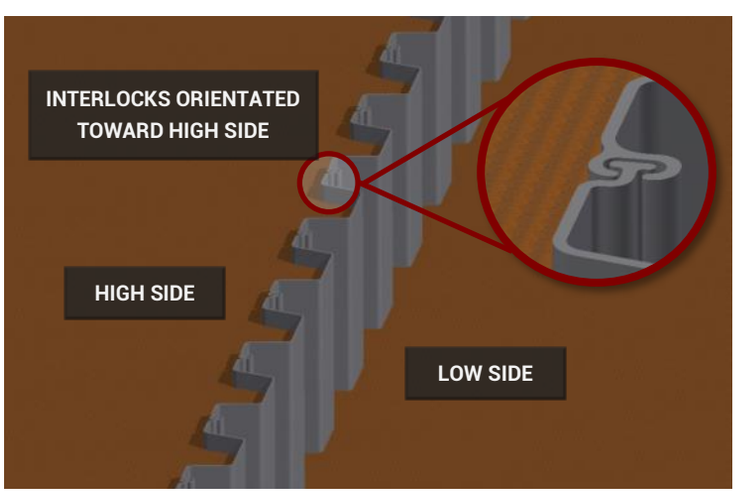


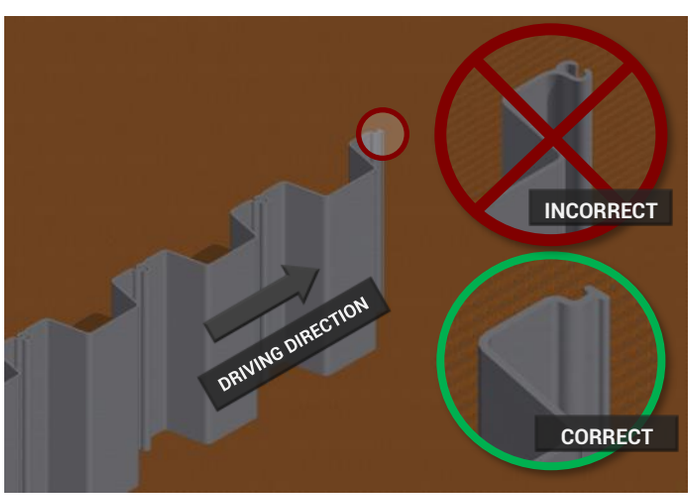
This is the correct orientation, for Z piles the piles should be driven with the female interlock leading. A driving guide should be used to ensure the Z remains straight especially if they are driven in singles.

Unless incorporated in the engineers' design, the 'Jagged' Z Pile orientation should not be used. This provides up to 20% wider unit width on the sheet pile and a shallower depth of wall, but the bending capacity decreases drastically.

This is the correct orientation, for Z piles the piles should be driven with the female interlock leading. A driving guide should be used to ensure the Z remains straight especially if they are driven in singles.

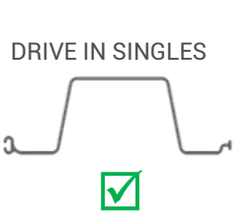
While this configuration theoretically increases the combined bending strength of the wall, this is not recommended as the flanges of the sheet pile do not align hence there may be localised bending of the interlock.





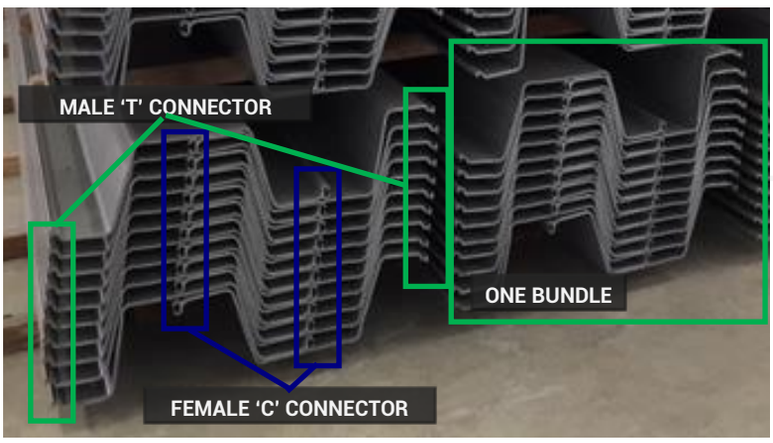
DRIVING IN SINGLES OR PAIRS

It is generally recommended that Omega Type Piles are driven in singles, whilst Z type piles are driven in pairs. Pairs are preferable from an alignment perspective and are less confusing but they can also be driven in singles to increase the applied driving load capacity per pile.

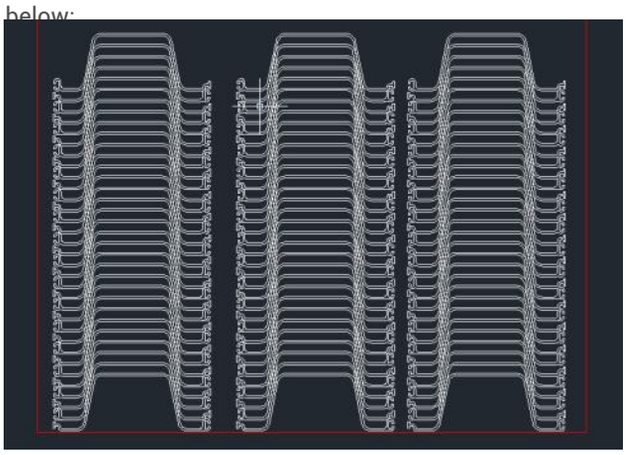


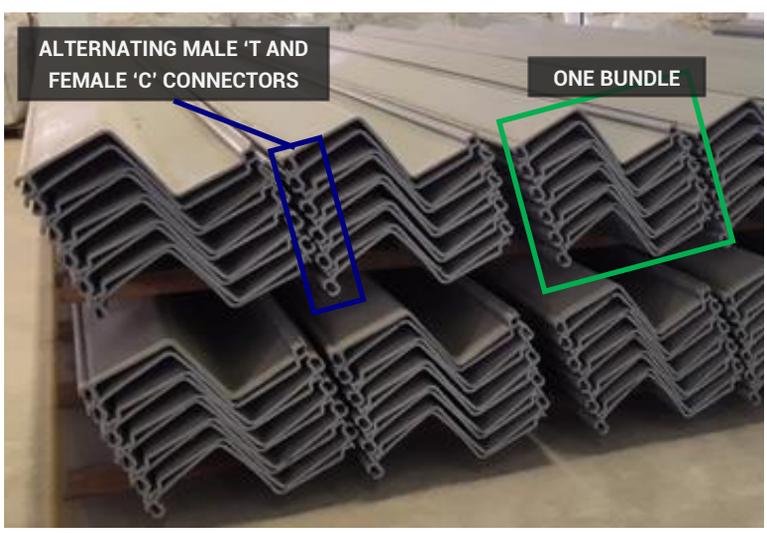
LOADING & UNLOADING

Vinyl sheet piles should be properly handled to avoid unnecessary damage prior to and during installation. Sheet piles can be effectively stacked to minimize storage and logistical volume thus saving handling costs whilst keeping the piles orderly.



For ESC-VU25 & ESC-VU40 Omega Piles as shown on the left, the most effective stacking configuration is shown, where 2 columns of sheet piles are stacked together. The Female 'C' Connectors are kept on the inside and the Male 'T' Connectors are orientated to the outside. For other Omega Piles, the stacking should be as shown below:





For Z shape sheet piles, the piles are typically stacked diagonally, with alternating connectors. This also makes driving more straightforward as the piles are progressively picked up from one side and are in the correct orientation.

Wooden supports are recommended evenly spaced out in 1-2 metre intervals to prevent unnecessary sagging and potential deformation during storage. This is especially important for the thinner section piles.

Soft webbing slings should also be used over chain slings to prevent pile damage during lifting and handling. Where possible a minimum of two webbing slings should be used to safely lift a bundle of vinyl sheet piles.

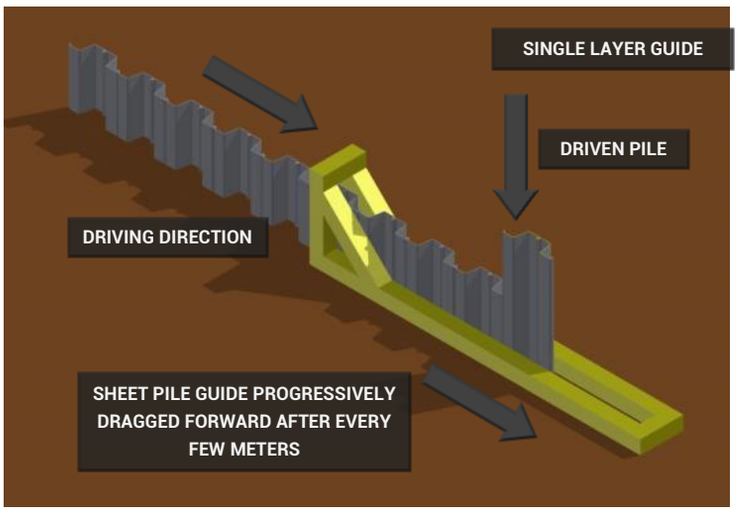
Unnecessary exposure to sunlight for long periods of time during storage should also be avoided where possible. While ESC's vinyl sheet piles contain additives to increase UV resistance, it is still recommended to minimise UV exposure when possible during storage.

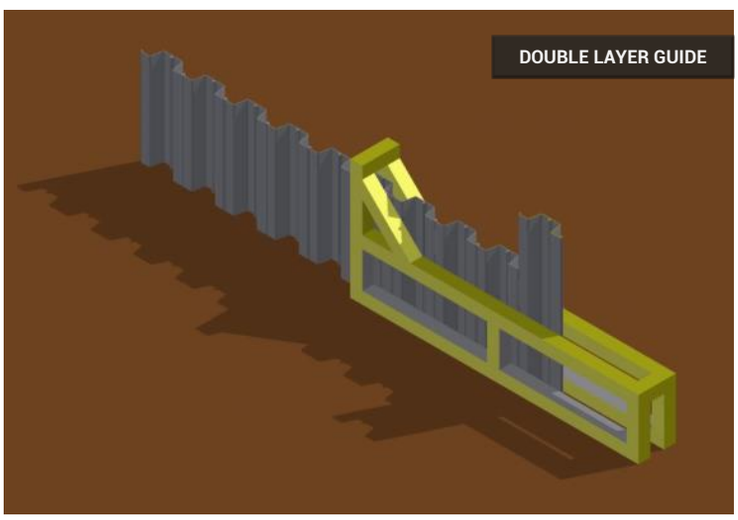
DRIVING GUIDES

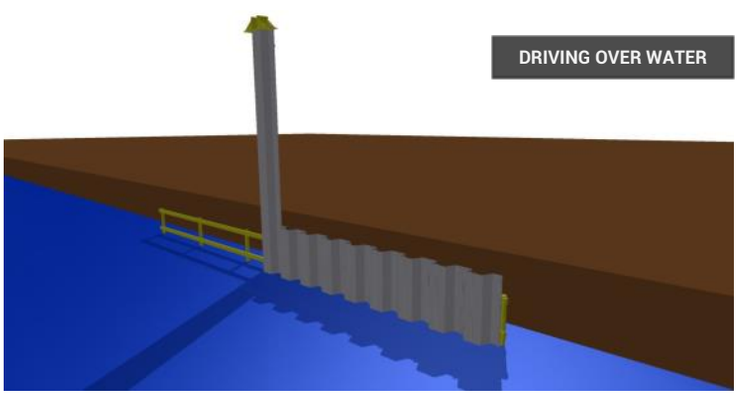
ESC recommends driving guides in general as they improve the appearance of the driven line of sheet piles. Typically the driving guides are constructed of either steel sections (channels or beams) welded together with a spacing slightly wider than the depth of the sheet pile profile being driven. Driving guides should typically be able to align with at least 8 pairs of Z piles or 8 U piles for maximum efficiency whilst using the previously driven piles to help maintain alignment. Shown on the right are typical driving guides which may be dragged progressively along. A single layer driving guide is generally recommended for piles with less than 1 meter of exposed length and double layer for greater than 1 meter exposed height. The driving guide can further be reinforced from movement by driving small steel beams to stop it shifting laterally. Spirit level should also be checked on the guide to ensure it is sufficiently flat. Wood or steel chocks can be used to adjust levelling as well, but these may sink if the ground is too soft or the chocks are too small.

When constructing over water, vertical steel or wood beams can be driven on the land side of the sheet pile wall with horizontal beams spot welded or wooden planks nailed onto the vertical members. For optimal straightness over water, this can also be repeated over the water side, but the installer must be careful not to have enough of a gap for the sheet piles to be driven through. The vertical guide beams should also be checked for verticality in both planes prior to installing the horizontal members.

A similar driving guide for marine installation to the land based guides, but must be properly pitched to ensure verticality.







INSTALLATION METHODS

EXCAVATOR COMPRESSION

In some cases of soft soil, utilising just the backhoe of an excavator pressing and hammering against the vinyl sheet pile is sufficient to drive it to design depth. A steel pile head is typically used to protect the pile top and also distribute the excavator pressing load.

EXCAVATOR MOUNTED VIBROHAMMER

Suitable vibrohammers for the installation of vinyl sheet piles are typically in the small to medium range. Excavator mounted vibrohammers are an excellent option because of their versatility and the fact that generally the excavator is utilised in other activities prior to and/or after the sheet pile installation such as excavation or soil compaction. The operator has to be mindful of verticality during driving, since unlike the crane, the vibrohammer has to follow the hinge trajectory of the excavator. For tougher soil conditions a mandrel can be used in conjunction with this system—see “Mandrels” section of this installation guide.

CRANE MOUNTED VIBROHAMMER

Crane mounted vibrohammer is advantageous over excavator mounted vibrohammer installation as it can effectively handle much longer pile lengths. Also the vibrohammer can effectively rest its weight and force directly on top of the clamped sheet pile which results in better verticality. However, the cost for driving is typically higher than the excavator options due to the extra mobilisation cost of a crane.

DROP HAMMER

A drop hammer is a mechanically simple driving method for driving vinyl sheet piles by lifting and releasing a falling drop hammer weight at low frequency.

WATER JETTING

Water jetting may be used in conjunction with other installation methods where the soil is very compacted or cohesive. A high pressure jet of water (or sometimes air) is expelled from the base of the sheet pile loosening the soil as the sheet pile is driven through.

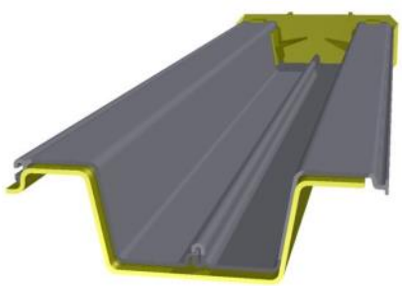
MANUAL INSTALLATION

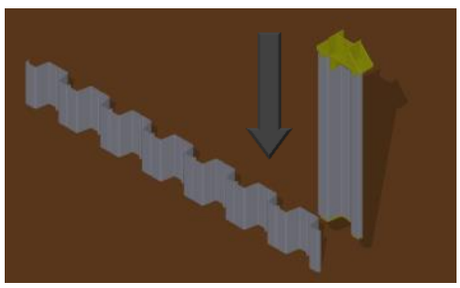
For extremely soft soils and low driving depths, simple manual tooling can be used to pitch and hammer down the sheet piles with just a few labourers.

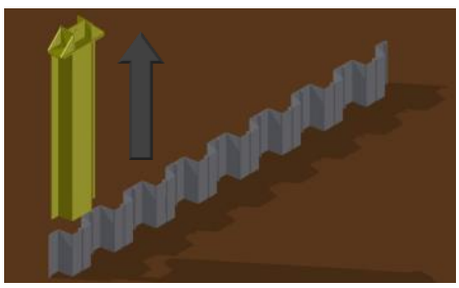
INSTALLATION MANDRELS

SLEEVE MANDREL

Description	A steel sleeve welded to a steel pile head that fits over the Z pile pair or single Omega pile. The sheet pile is typically horizontally slid onto the sleeve and clamped on by screw. Then it is lifted over and driven down. Once the design depth is reached or further penetration is refused, the steel mandrel is withdrawn leaving the vinyl sheet pile in place.
Equipment Required	Vibrohammer (excavator or crane mounted), Crane or Excavator.
Suitable For	Slightly more difficult soil conditions where driving the vinyl sheet pile directly is not possible. Also suitable for longer sheet piles with thinner profiles.
Advantages	Can penetrate more difficult soils without potentially damaging the vinyl sheet pile
Disadvantages	During withdrawal, vinyl sheet pile can potentially pull up with steel mandrel

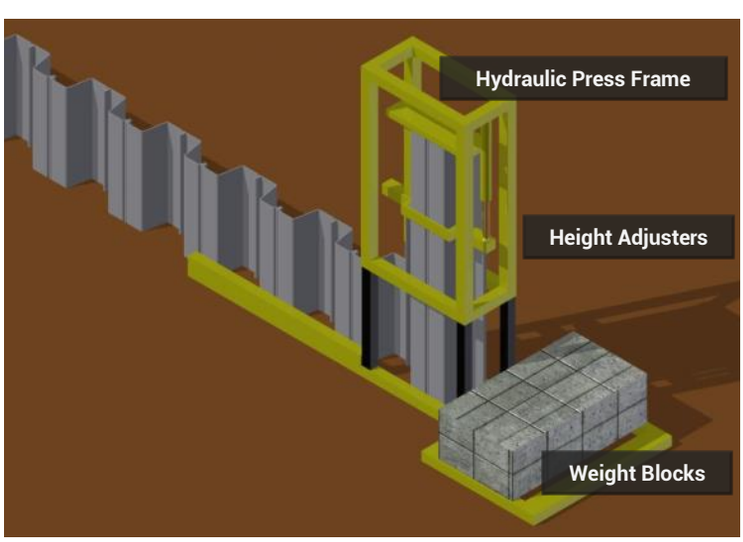






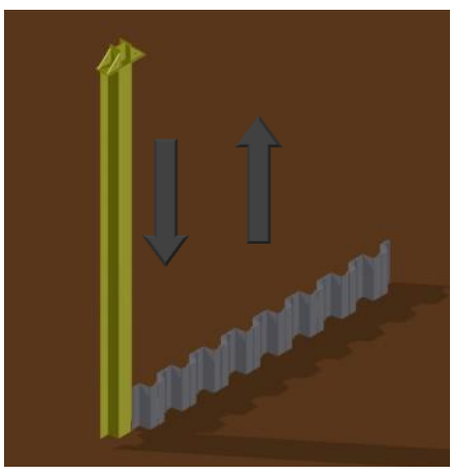
HYDRAULIC PRESS FRAME

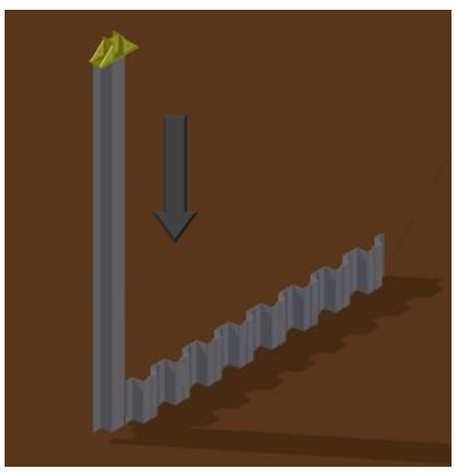
Description	The frame consists of a hydraulic cylinder which can be connected to a pile head sleeve. The cylinder has a stroke of typically 1 metre or less, so the frame must be progressively lowered in stages as the pile is pressed down. The height adjuster is used to lower the hydraulic press frame. A counterweight is also used to prop the frame down to react against the downward pressing force.
Equipment Required	Crane, Hydraulic Press Frame, Counterweights & Hydraulic Powerpack,
Suitable For	Shorter pile lengths and where an excavator and/or vibrohammer is not freely available or economical.
Advantages	Fast for shorter piles and only requires a crane to move the frame and sheet piles.
Disadvantages	Limited stroke per cylinder means that for each pile, the cylinder is retracted and the frame is lowered multiple times, which can slow down the installation process especially for longer piles.



CUTTING MANDREL

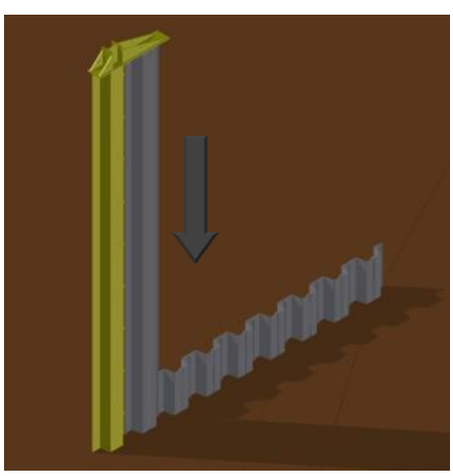
Description	The steel mandrel which follows the profile of the sheet pile is used to cut and loosen the soil. Following withdrawal of the steel mandrel, the vinyl sheet pile is driven in its place. This steel mandrel can be a simple bent sheet metal following the profile of the steel mandrel. This sheet can directly be clamped onto the vibrohammer.
Equipment Required	Vibrohammer (excavator or crane mounted)
Suitable For	Cohesive soils and if the installer wants a simple to fabricate mandrel.
Advantages	Can penetrate more difficult soils without potentially damaging the vinyl sheet pile. Also it is a simply fabricated steel sheet.
Disadvantages	Potentially slower that sleeve mandrel because the mandrel is withdrawn and changed out with the sheet pile

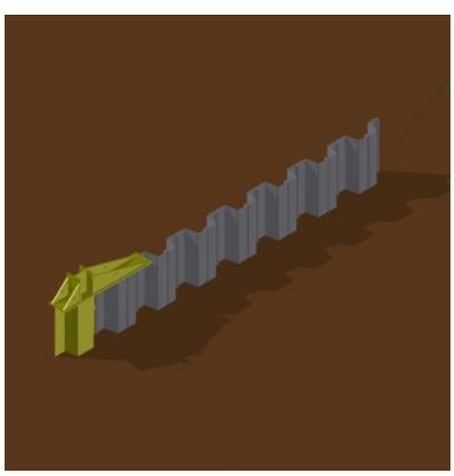


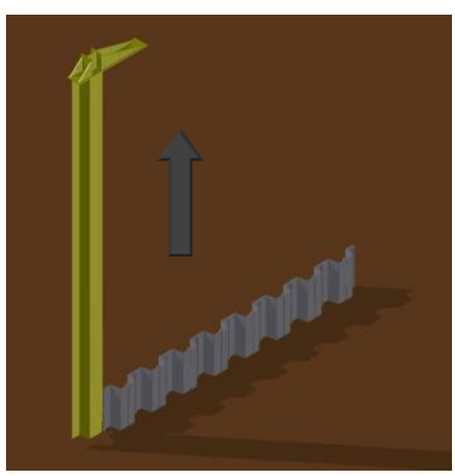


SIDE MANDREL

Description	Mandrel consists of a leading steel mandrel the same length as the sheet pile with a sleeve template for a preceding vinyl sheet pile. When the mandrel is driven to depth, a cut for the next sheet pile is made in the soil, whilst the adjacent sheet pile is driven. Upon extraction of the mandrel, the vinyl sheet pile remains in place.
Equipment Required	Vibrohammer (excavator or crane mounted)
Suitable For	Large installations that justify the cost of this type of mandrel. Also typically the fasted installation mandrel because of its dual purpose (cuts and drives at the same time).
Advantages	Efficient as the leading steel mandrel cuts the soil for the next pile whilst driving the vinyl sheet pile in the previously cut soil area.
Disadvantages	Driving direction has to follow mandrel. Sometimes the vinyl sheet pile may pull up as the mandrel is being withdrawn.



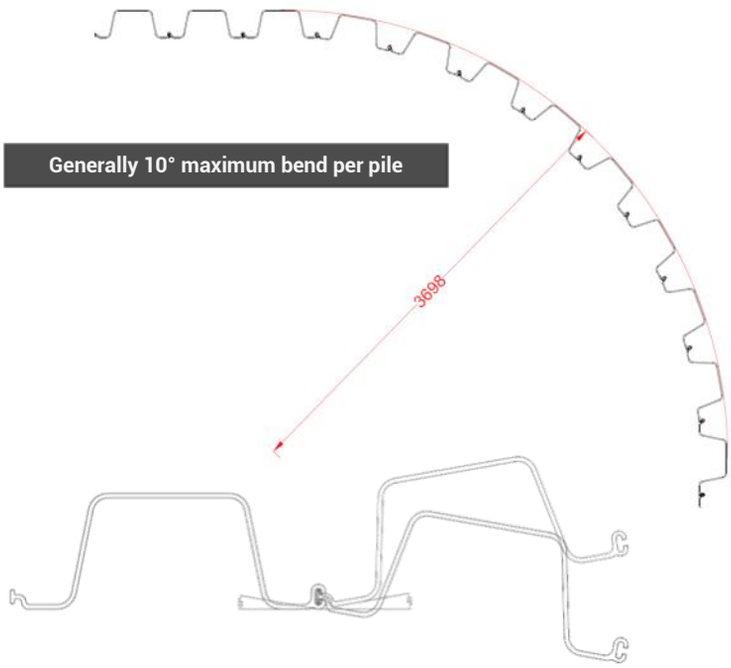




CORNERS AND BENDS

Corners and bends in the driving line of ESC vinyl sheet piles can easily be accommodated via the use of special corner pieces or connectors or just varying the angle gradually between each standard pile.. If a gradual bend is used, typically the minimum bend radius is 6x the pile width (so for example the ESC-VU610-9.0 has a bend radius of approximately 3.6m). It is highly recommended to consult with ESC for the recommended corner configuration.


Fabricated Corner Sheet Pile

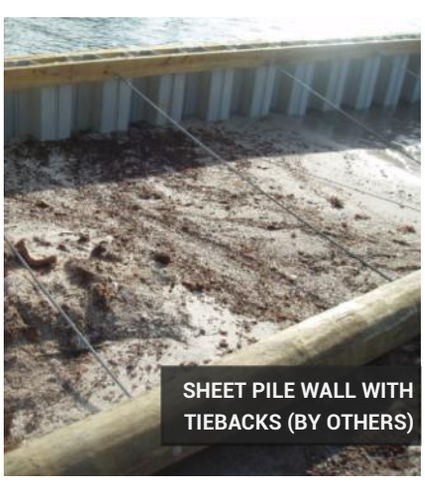


ANCHORING

Vinyl Sheet Piles can be anchored for applications which have a retaining purpose higher than which a cantilevered sheet pile can resist. These are typically anchored via steel threaded bars that can be tensioned against anchor piles or blocks behind the slip plane of the soil. These anchor piles or blocks are typically made of reinforced concrete, PVC or timber. To effectively transmit the dispersed retaining loading to the anchor rods and pile/block a waling channel on the sheet pile side is used.

It is very important that the anchors are situated sufficiently far back from the slip plane or active wedge of the soil. This plane is the natural angle the dirt settles too if unsupported and the anchor must be behind that plane. The design engineer typically specifies in the plan drawings how far back and the size and frequency of these anchors. It is important the installer ensures that there is safe access to the anchor attachments at both ends (and possibly in between if there is a turnbuckle in the middle).


SHEET PILING WITH 2 LEVELS OF ANCHORING


SHEET PILE WALL WITH TIEBACKS (BY OTHERS)

CONCRETE CAPPING

Frequently, a concrete capping beam is installed after the vinyl sheet piles are driven to distribute the load amongst the sheet piles and maintain the straightness of the installed piles despite uneven loading. This follows normal practice to steel sheet pile capping.


Rebar Tying

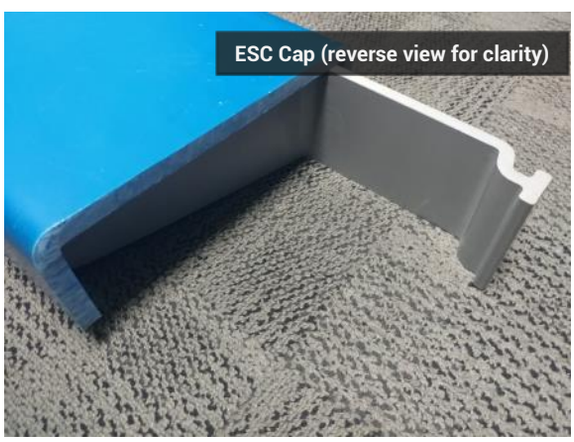

Formworks


Concrete Cap Completion

VINYL CAPPING

A fast method of capping is utilising the ESC vinyl caps, which come in standard lengths and can be spliced to make a continuous cap. Note that different piles have different cap sizes due to the pile depth. Stainless Steel fixing bolts are typically threaded through from one side of the capping to the other to fasten the cap to the sheet pile. These standard caps can easily be cut diagonally to produce corner pieces or cut to length for wall ends.


ESC Cap (reverse view for clarity)


ESC Cap (reverse view for clarity)

SUPPLY OF INSTALLATION GUIDES & EQUIPMENT

ESC is a professional supplier of the following generic and specially designed systems for effective vinyl sheet pile installations:

- Installation Mandrels—side, cutting, sleeve
- Hydraulic Press Frame Sets
- Driving Guides
- Pile Heads
- Bumper Fenders
- Geotextiles

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