Stevmanta VLA installation

Introduction
The Stevmanta VLA consists of an anchor fluke which is connected with wires to the angle adjuster. The angle adjuster is responsible for changing the anchor from the installation mode to the vertical (or normal) loading mode.

There are many options to install VLA anchors. The most efficient methods are based on two different principles:
• Double line installation method using the fixed angle adjuster.
• Single line installation method using the shear pin angle adjuster.

The double line installation method is typically used when it is preferable to install the anchor with a steel wire rope installation line instead of using the actual mooring line (for example polyester).

The following three typical methods for installing the Stevmanta VLA are discussed:
• Single line installation method.
• Double line installation method.
• Double line installation method using the Stevtensioner.

It is also possible to use the Stevtensioner with the single line installation method, however because this is very similar to the double line installation method with Stevtensioner, it is not presented here.
Stevmanta VLA installation

**Single line installation procedure**
This procedure requires only one AHV for installation of the Stevmanta. The Stevmanta is deployed with the shearpin angle adjuster. The mode of the anchor changes when the shearpin breaks at a load equal to the required installation load. When the shear pin breaks, the Stevmanta changes from the installation mode to the normal (vertical) loading mode (*fig. 3-64 and fig. 3-65*).

**Installation procedure**
In the installation procedure an optional tail has been included on the Stevmanta. The tail assists in orientation of the Stevmanta on the seabed. Connect the installation/mooring line to the angle adjuster on the Stevmanta on the AHV. Lower the Stevmanta overboard. The Stevmanta will descend tail first, i.e. the tail will be the first part to reach the seabed (*fig. 3-66*).

When the Stevmanta is on the seabed, an ROV can optionally inspect the anchor (position and orientation). The AHV starts paying out the installation/ mooring line while slowly sailing away from the Stevmanta (*fig. 3-67*).
**Stevmanta VLA installation**

When enough of the installation/mooring line has been paid out, the AHV starts increasing the tension in the installation line. The Stevmanta will start to embed into the seabed *(fig. 3-68)*.

When the predetermined installation load has been reached with the AHVs bollard pull, the shearpin in the angle adjuster fails, triggering the Stevmanta into the normal (vertical) loading mode. This can be clearly noticed on board the AHV, as the AHV will stop moving forward due to the sudden increase in holding capacity. Now that the Stevmanta is in the normal (vertical) loading mode, the AHV can continue to increase the tension in the (taut-leg) installation/mooring line up to the required proof tension load *(fig. 3-69)*.
**Stevmanta VLA installation**

After the Stevmanta has been proof tensioned to the required load, the installation/mooring line can be attached to the floater. In case of a pre-laid mooring, the mooring line can be buoyed off, for easy connection later on (*fig. 3-70*).

**Stevmanta retrieval**

The Stevmanta is easily retrieved by pulling on the ‘tail’. Connection to the tail can be achieved either with a grapnel or by using an ROV (*fig. 3-71*).
Stevmanta VLA installation

Alternatively the Stevmanta can be equipped with an optional recovery system. The recovery system consists of two special sockets which connect the front wires to the fluke.

To recover the anchor, the mooring line is pulled backwards, i.e. away from the centre of the mooring. Once the mooring line has been pulled back, the front sockets will disconnect from the fluke (fig. 3-72).

The Stevmanta VLA is now pulled out of the soil using just the rear wires. This reduces the resistance of the anchor, so that it can be retrieved with a load equal to about half the installation load (fig. 3-73).
Stevmanta VLA installation

**Double line installation procedure**
This procedure requires two AHVs. The Stevmanta is deployed with the fixed angle adjuster. The mode of the anchor (installation mode or normal (vertical) loading mode) is chosen by pulling on either the installation line or the mooring line.

The Stevmanta is in the installation mode when the installation line is tensioned, i.e. the line on the front of the angle adjuster (fig. 3-74).

The Stevmanta is in the normal (vertical) loading mode when the *mooring line* is tensioned, i.e. the line on the rear of the angle adjuster (fig. 3-75).

During the installation AHV1 handles the steel installation line and AHV2 handles the *mooring line*, for instance polyester (fig. 3-76).

In the installation procedure an optional subsea recovery buoy can be included in the installation line. The recovery buoy is connected to the installation line via a delta plate at approximately 90 m from the Stevmanta (fig. 3-77).
Stevmanta VLA installation

Connect the installation line to the angle adjuster on the Stevmanta on board AHV1.
Pass the *mooring line* from AHV2 to AHV 1 and connect it to the angle adjuster.
Lower the Stevmanta VLA overboard by keeping tension on both the installation line (AHV1) and the *mooring line* (AHV2).
When the Stevmanta is on the seabed, an ROV can inspect the anchor’s position and orientation. AHV2 slackens the tension in the *mooring line* and AHV1 starts paying out the installation line while slowly sailing away from the Stevmanta *(fig. 3-78).*

When enough of the installation line has been paid out, AHV1 starts increasing the tension. The Stevmanta will start to embed into the seabed. AHV2 keeps the *mooring line* slack by keeping the same distance from AHV1. If more bollard pull is required than one AHV can deliver, AHV2 can buoy off the *mooring line* and pull with AHV1 in tandem.

When the predetermined installation load has been reached, the breaking device in the installation line fails (break shackle connecting the installation line to the delta plate), freeing the installation line from the Stevmanta *(fig. 3-79).*

If the optional recovery buoy is used, the breaking device is placed on the delta plate connecting it to the installation line and AHV1. AHV1 is now no longer connected to the Stevmanta and the installation line can be recovered on deck *(fig. 3-80).*
Stevmanta VLA installation

AHV2 can now start increasing the tension in the *mooring line*. If AHV2 cannot generate enough bollard pull to reach the required proof tension load, AHV1 can be connected in tandem to AHV2 to generate additional bollard pull.

After the Stevmanta has been proof tensioned to the required load, the *mooring line* can be attached to the floater.
In case of a pre-laid mooring, the *mooring line* can be buoyed off, for easy connection later on (fig. 3-81).

**Stevmanta retrieval**
The Stevmanta is recovered from the seabed by returning to ‘installation mode’ instead of the normal (vertical) loading mode. The AHV picks up the recovery buoy from the seabed and by pulling on the installation load at an angle of approximately \(45^\circ\) with the seabed, the anchor is easily retrieved (fig. 3-82).
**Stevmanta VLA installation**

**Single line installation with Stevtensioner**

The Stevmanta VLA is deployed with the shearpin angle adjuster. The mode of the anchor changes when the shearpin breaks at a load equal to the required installation load. When the shearpin breaks, the Stevmanta VLA changes from installation mode to the normal (vertical) loading mode.

In the installation procedure a tail (approximately 30 m length, consisting of a length of wire with approximately 5 m of chain on the end) has been included on the Stevmanta VLA. The tail assures correct orientation of the Stevmanta VLA on the seabed.

Connect the tail to the rear of the fluke of the Stevmanta VLA #1. Connect the forerunner to the angle adjuster of the Stevmanta VLA on the AHV.

Lower Stevmanta VLA #1 overboard (fig. 3-83). The Stevmanta VLA will be going downwards tail first, i.e. the tail will be the first part that reaches the seabed.

Connect the tensioning chain to the forerunner on Stevmanta VLA #1 using the subsea connector and pass the other end through the Stevtensioner. This end of the chain is terminated with a male part of the subsea connector.
Stevmanta VLA installation

Connect the forerunner of Stevmanta VLA #2 to the passive side of the Stevtensioner. As part of the forerunner a tri-plate is included with a breaklink between the Stevtensioner and the tri-plate. The male part of a subsea connector is connected to the third hole of the tri-plate. Connect the AHV work-wire to the tail of Stevmanta VLA #2 using a subsea connector.

Deploy the Stevtensioner and Stevmanta VLA #2 overboard by slacking the AHV workwire ([fig. 3-84 and fig. 3-85]).
Stevmanta VLA installation

When the tail of Stevmanta VLA #1 touches the seabed, the resistance of the tail will orient the Stevmanta in the heading of the AHV which is moving forward slowly. The AHV places the Stevmanta on the seabed and continues with the deployment of the rest of the system (Stevtensioner and Stevmanta VLA #2) (fig. 3-86).

When Stevmanta VLA #2 is near the seabed, the AHV stops the winch and increases the tension in the mooring system (fig. 3-87). This will start to embed Stevmanta VLA #1. When a tension of approximately 1000 kN has been reached, the AHV can lay down Stevmanta VLA #2 on the seabed. The purpose of the applied tension is to ensure that Stevmanta VLA #1 is embedding properly and to take the slack out of the system.
When Stevmanta VLA #2 has been placed on the seabed, the AHV continues to deploy the work wire until the tail and the subsea connector are on the seabed. When this has been accomplished, the AHV stops paying out the work wire and the ROV is sent down to disconnect the subsea connector from the tail on Stevmanta VLA #2. The female part of the subsea connector (connected to the work wire) is then moved to the male part of the subsea connector connected to the tensioning chain above the Stevtensioner (fig. 3-88).

With the work wire now connected to the tensioning chain, the AHV can start the tensioning operation. This will generally consist of 4 to 7 yo-yo procedures to reach the required tension at the anchors. (fig. 3-89 and fig. 3-90).
Stevmanta VLA installation

When the tension in the system reaches the break load of the shear pins in the angle adjuster of the Stevmanta VLAs, these will break and trigger the Stevmanta VLAs to their normal loading mode (fig. 3-91). When the AHV continues to increase the tension in the system, the anchors will be proof loaded in their normal loading mode. After the proof loading of the anchors, the AHV increases the tension in the system up to the point were the breaklink connecting the passive line to the Stevtensioner fails. The tensioning of the anchors is now complete.

With the tensioning of the anchors completed, the ROV disconnects the subsea connector between Stevmanta VLA #1 and the Stevtensioner (fig. 3-92). The anchor forerunners are now no longer connected to the Stevtensioner. The AHV can start recovering the Stevtensioner with the tensioning chain by winching in the work wire (fig. 3-93). The ROV can be used to connect the mooring lines (with separate female connectors) to the male connectors on the anchor forerunners.
Stevmanta VLA installation

Double line installation with Stevtensioner

The Stevmanta is deployed with the fixed angle adjuster. The mode of the anchor (installation mode or normal (vertical) loading mode) is chosen by pulling on either the installation line or the mooring line. The Stevmanta is in the installation mode when the installation line is tensioned, i.e. the line on the front of the angle adjuster (fig. 3-94).

The Stevmanta is in the normal (vertical) loading mode when the mooring line is tensioned, i.e. the line at the rear of the angle adjuster. During the installation AHV1 handles the installation line (preferably chain and steel wire) and AHV2 handles the mooring line, for instance polyester (fig. 3-95).

The installation procedure with the Stevtensioner requires a reaction anchor (the typical use of the Stevtensioner is presented in the next chapter). In this case the reaction anchor can be either a Stevpris or Stevmanta. For now a Stevpris is shown as reaction anchor and is to be on the active side of the Stevtensioner.
Stevmanta VLA installation

Connect the installation line to the angle adjuster on the Stevmanta on AHV1. Pass the *mooring line* from AHV2 to AHV1 and connect it to the angle adjuster.

Lower the Stevmanta to the seabed by keeping tension on both the installation line and *mooring line*.

Connect the installation line to the passive side of the Stevtensioner. A break link can be installed between the Stevtensioner and the installation line on the passive side (*fig. 3-96*).

Connect the installation line to the reaction anchor. Pass the installation line through the Stevtensioner (*fig. 3-97*).
Stevmanta VLA installation

Sail to set-down position of the reaction anchor (AHV1 only). AHV2 stays above the Stevmanta. During the movement of AHV1, the installation line of the Stevmanta has to be paid out (fig. 3-98).

Lower the Stevtensioner and reaction anchor to the seabed (fig. 3-99).

Buoy off the retrieval line (or mooring line) of the reaction anchor. AHV1 sails to tensioning point and starts taking in the slack of the tensioning line (fig. 3-100).
Start the tensioning procedure (yo-yoing) \((\text{fig. 3-101})\).

The break link will break on the Stevmanta when the required installation load has been reached \((\text{fig. 3-102})\).
Stevmanta VLA installation

Recover the Stevtensioner, the installation line and the reaction anchor to AHV1.

AHV2 can now proof tension the Stevmanta and then buoy off the mooring line. Installation of the Stevmanta is now complete (fig. 3-103).

Instead of using a reaction anchor, two Stevmantas can also be installed at the same time. After completion of the tensioning (yo-yoing), AHV2 proof tensions one Stevmanta while AHV1 recovers the Stevtensioner and disconnects it from the installation line of the other Stevmanta. This Stevmanta can then also be proof tensioned (fig. 3-104).