STEVTENSIONER IN PRAXIS

ADVANTAGES, USE AND CLASS RULES

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STEVTENSIONER®

GENERAL WORKING PRINCIPLE AND THE ACOUSTIC COMMUNICATION FOR HIPAP SYSTEMS

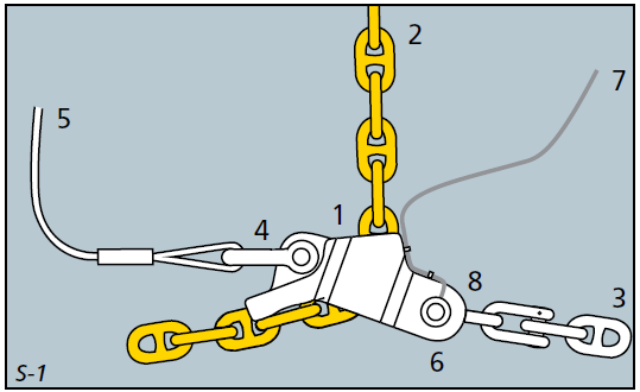
STEVTENSIONER® REFERENCE LIST

- Since 1980s, water depths from <10m to >1400m, loads up to ~1000T so far...
- CALM buoys, FPSOs, FOWTs, construction, etc.
- Can be used on any anchor type as long as there is chain to work on.

Vryhof Anchors Reference List Stevtensioner

Principal	Location	Tensioning force	Mooring Object	Water depth
acergy / apl	vincent field, australia	592 mt	vincent fpso with 9 x 21mt stevpris mk5	354 m
acergy / prosafe	van gogh field, australia	183 - 201 mt	ningaloo vision fpso with 9 x 12 mt stevshark mk5	350 m
alam hidro / petrofac / misc	cendor field pm304, malaysia	340 mt	cendor fso with 10x17 mt stevpris new generation	64 m
boskalis offshore marine contracting	equatorial guinea	325 mt	zafiro producer fpso, 2 x 20mt stevpris mk6 anchors	152 - 188 n
bouygues offshore	papua new guinea, kutubu project	295 mt	spm / 6 mooring piles	25 m
brightwaters energy ltd.	lekki nigeria	251 mt	spm buoy	22-25 m
brown & root	australia, wandoo project	250 mt	fpso / 12 stevpris anchors	55 m
cds korea / sk corporation	ulsan refinery, south korea	291 mt	calm buoy #3 with 6 piggy-backed mag anchors	28 m
cds korea / sk corporation	ulsan refinery, south korea	250 - 270 mt	calm buoy with 6 piggy-backed mag anchors	26 - 27 m
clough helix joint venture	huizhou field, china	315 mt	nan hai fa xian fpso with 8 x 22 mt drag anchors	116 m
dsnd subsea as	offshore uk, curlew field	130 mt	fpso / 6 piles	92 m
etpm	argentina, hidra field	125 mt	loading buoy / 6 stevpris anchors	50 m
etpm / bluewater	colombia, covenas	140 + 275 mt	2 pipeline marine teminals / 2x6 mooring piles	27 - 40 m
etpm / ongc	bombay high	300 mt	plem / 6 mooring piles	80 m
fluor daniel/ bp trinidad	noel project, southeast coast, trinidad	210 mt	noel sbm mooring with 6x14 mt stevshark mk5	26 m
franklin offshore korea/s-oil	ulsan oil, refinery south korea	600 mt	calm buoy with 6 pair of 25mt stevpris mk6 anchors	34 m
geocean sas	chittagong bangladesh	200 mt	moheshkhali fsru - 3 x 7mt stevshark rex anchors	36-41m
grandi lavori fincosit	venice mose project, venice italy	160 mt	malamocco inlet 8 x 10mt stevshark mk 5 anchors	15 -20 m
grandi lavori fincosit	venice mose project, venice italy	160 mt	lido san nicolo inlet 8 x 10 mt stevshark anchors	9-13 m
gulf dredging	persian gulf, kuwait	204 mt	mina al zhour calm buoy - 6 x driven piles	20-25 m
harada	kamaishi, japan	300 mt	fow demonstration	140-160 m
hsl constructer pte ltd	sakra jetty singapore	30 - 70 mt	exxonmobil / swp stpof sakra mooring	13 m
intermoor	uk sector north sea	723 mt	culzean fpso - 12 x 35mt stevshark mk5 anchors	86 m
inyanga maritime ltd.	sem-rev, le croisic, france	275 - 342 mt	eolink fowt	30-40 m
ios intermoor	norwegian sector, north sea	309 mt	crossbill field pre-laid mooring, 15mt stevpris mk6	353 m
jumbo offshore	north sea, uk	425-518 mt	enquest fpso with 3 x 3 driven piles	76-81 m
jumbo offshore	offshore, egypt	297-512 mt	el hamra calm system	24-27 m
leighton contractors	mangalore, india	300 mt	mrpl spm with 6 x driven piles	34 m
leighton contractors	visakh refinery spm system for hpcl	200 mt	spm / 6 mooring piles	35 - 36 m
mcdermott	malaysia, dulang field	320 mt	sp turrent mooring / 6 mooring piles	70 m
micoperi	italy, rospo mare	500 mt	fpso / 6 mooring piles	72 m
mtc engineering	malaysia	204 mt	ksme spm with 6 x 12,5 mt drag	83 m
national petroleum construction co.	kingdom of saudi arabia	51 mt	spm buoy	37 - 43 m
nippon steel construction	thailand, pogo project	690 mt	calm / 6 piles	70 m
nippon steel construction	thailand, star project	290 mt	calm / 6 anchors	26 m
nippon steel construction	thailand, unocal phase 17 project	370 mt	calm / 6 piles	60 m
nippon steel corporation	malaysia, mrc project	204 mt	calm / 6 anchors	37 m
nortrans singapore	gulf of suez	295 mt	fpso / 6 stevpris anchors	55 m
nortrans singapore	indonesia, camar field	270 - 300 mt	fpso / 6 stevpris anchors	62 m
ocean installer	marsaxlokk, malta	206 mt	fsu stormsystem, 4x stevpris mk6, 4x stevshark mk5 anchors	12 -19 m
omega / nippon kokan	venezuela, orinoco estuary	235 mt	iron ore transfer station / 10 stevpris anchors	62 m
pancanadian petroleum	panuke location, offshore nova scotia	235 mt	calm / 6 stevpris anchors	35 m
petrobras	brasil, campos basin	295 mt	3 spm's / 3x8 hook anchors	120 m
petroleum development consultants / apl	puffin field, southern timor sea - australia	380 - 465 mt	puffin fpso with 6 x 31mt stevshark mk5 + ballast	102.5 m
principle power	agucadoura, portugal	210 mt	windfloat with 4 x 9,5 mt stevshark anchors	45 m
prosafe	polvo field - campos basin, brazil	404 mt	polvo fpso with 6 x 21mt stevpris mk5 + ballast	100 m
saipem	black sea, russia	109 mt	cpc spm with 6 x suction piles	58 m
saipem	cbi - st. eustatius	200 mt	spm / 6 stevpris anchors	40 m
saipem	colombia, covenas project	310 mt	calm / 6 piles	28 m
saipem	livorno, italy	651-678 mt	fsru 4 x 38 mt drag anchors	120 m
saipem	nigeria, escravos project	175 mt	calm / 6 piles	42 m
saipem	sudan, mugland oil basin development project	175 mt	calm / 6 stevpris mk5 anchors	56 m
saipem	thai oil spm - sri racha thailand	150 mt	spm / 6 stevpris anchors	27 - 29 m
saipem / eni oil	mellitah calm buoy, mellitah libya	200 mt	calm buoy with 6 driven piles	29 m
saipem s.p.a.	republic of congo	300 mt	anchor test	36 m
sapura energy	india	350 mt	b127 pipeline cluster calm buoy - 6 x driven piles	45 m
seaway heavy lifting	monaco port extension	354 mt	pier / 10 piles	40 m - 75 m
solstad shipping	cptl c 137b fpso, libia	640 mt	fpso, 9 stevshark mk5 anchors	90 m
sonsub (saipem uk)	offshore livorno, italy	430 mt	fsru, 6 x 20 mt stevpris mk6	112 m
subsea 7	south china sea	120 mt	fpso xijiang wire replacemet cnooc/conocophillips	100 m
technip oceania	benchamas field, gulf of thailand	120 mt	benchamas field fso wire replacemet chevron	70 m
thien nam offshore services jsc	vietnam	350 mt	dai hung fpu, 1 x 37mt stevshark mk5 anchor	110 - 113 m
thien nam offshore services jsc	vietnam	180 mt	dai hung calm buoy 8 x 20mt stevshark mk5 anchors	110 -113 m
total e&p south africa	south africa	235 mt	brulpadda 1ax field pre-lay, 16mt stevshark mk5 anchor	1430 m
toyo	petrovietnam - dung quat spm - Vietnam	314 - 122 mt	spm / 12 mag anchors	26 - 31 m
unison engineering & construction	south pars field, iran	930 mt	cyrus fpso, 12 x 27mt drag embedment anchors	68 m
vtti terminal support services	us virgin islands	112 mt	mooring buoy, 6 x 9.5mt stevshark mk5 anchors	40 m
windstaller alliance	norwegian north sea	342 mt	ocean fish farm with 15mt stevpris mk5 and mk6 anchors	154 m
west african ventures ltd.	nigeria	176 mt	calm buoy	23 m

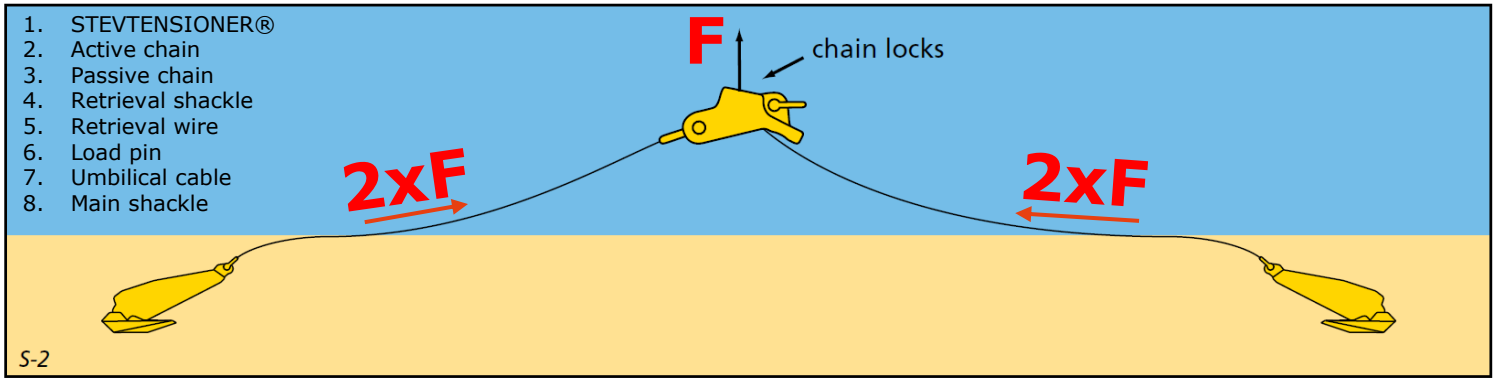
How does it work?



- **Horizontal tension > 2x vertical tension**
- **4 MBL ranges: 450mT, 600mT, 1000mT, 1250mT**
- **range of chain sizes: 64-170mm chain**
- **No need for 2 vessels for high tensions**
- **No top fuel bills for long high bollard pull time**

Youtube

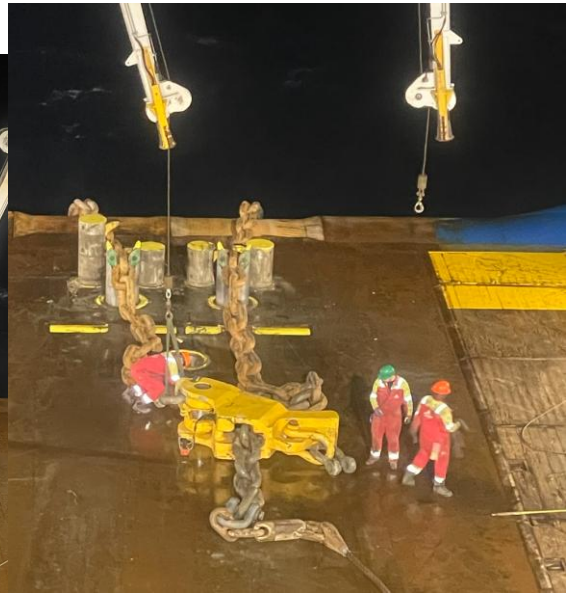
how does it work



Easy transportation by Truck / Vessel /Plane

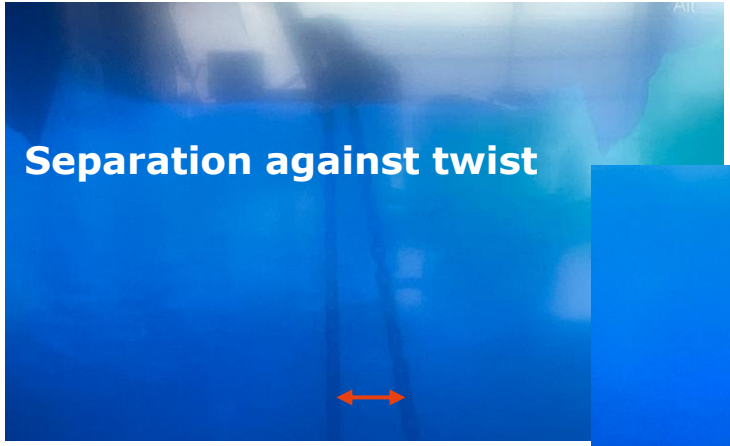
10ft container with tools, spare cables and winch
For airlift items are put in crates

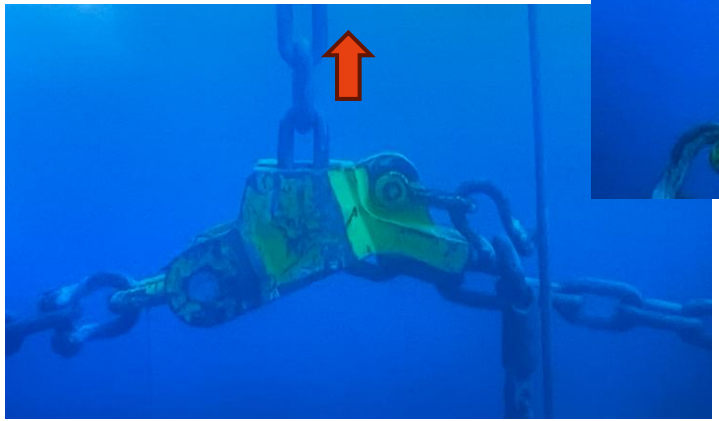
STEVTENSIONER deployment

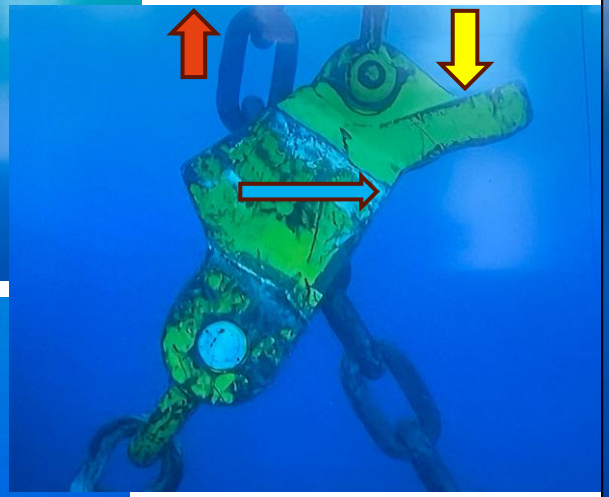


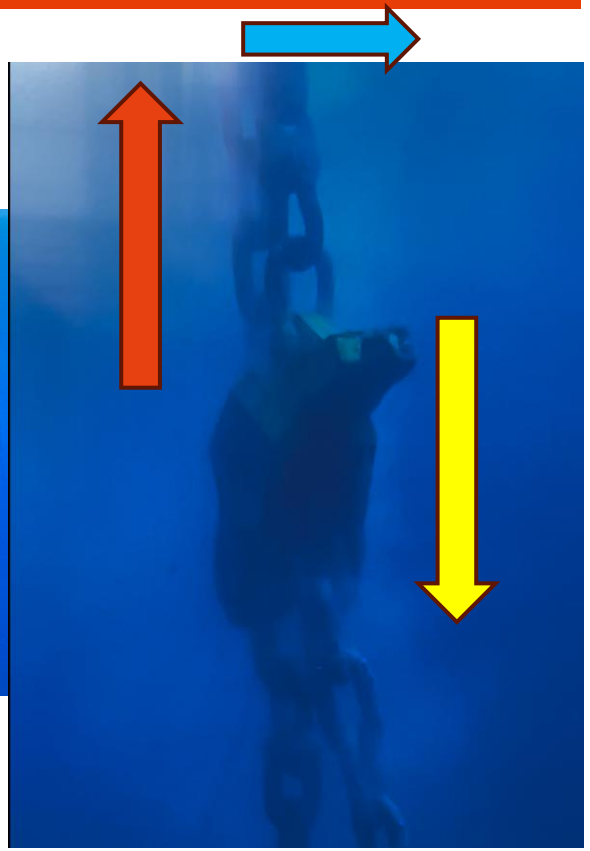
- Secure both chain ends in shark jaws
- Pull STEVTENSIONER in position using tugger winch
- Pull through active chain and connect to winch
- Connect passive chain to STEVTENSIONER main shackle
- Connect retrieval wire, haul some active chain and deploy STEVTENSIONER

operation

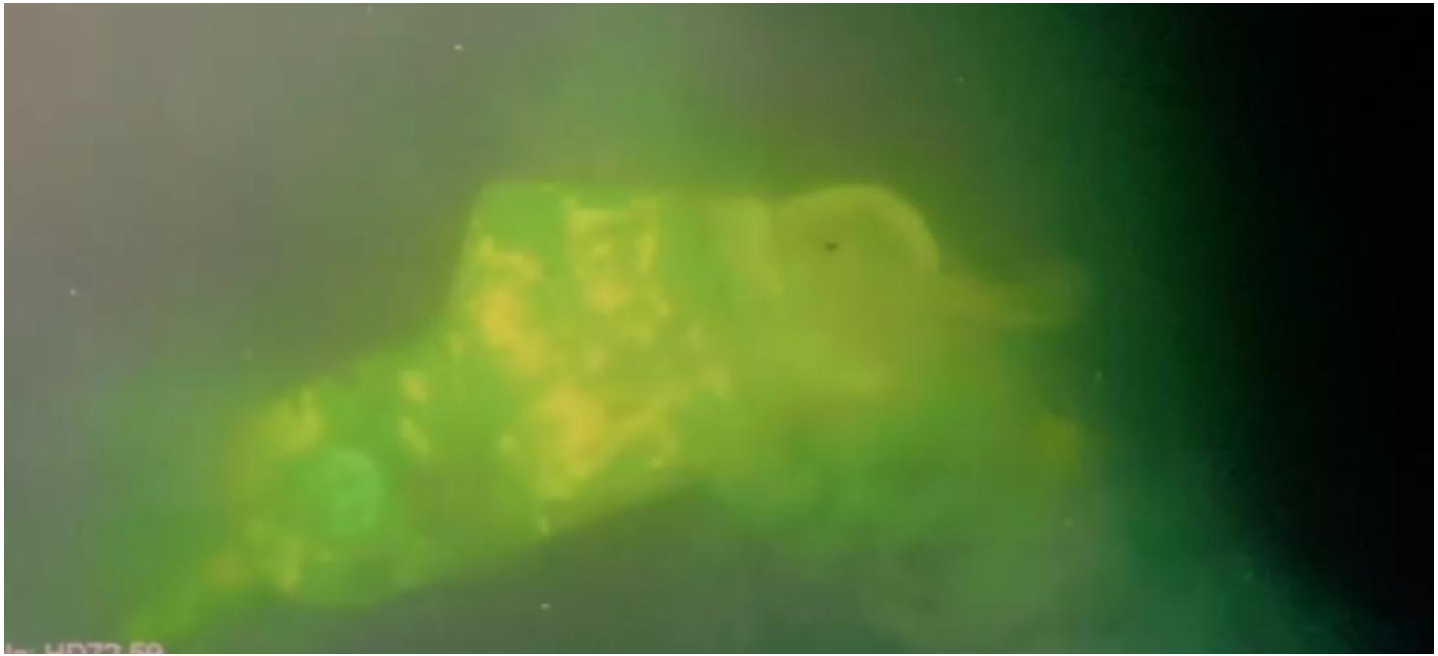






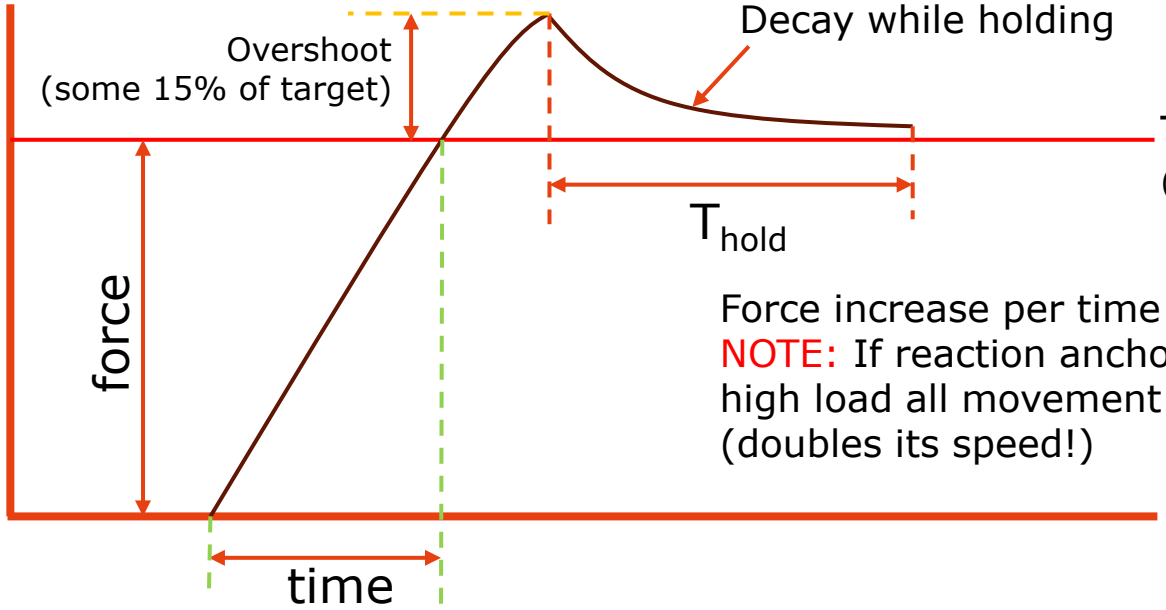


STEVTENSIONER sliding down after a heave….



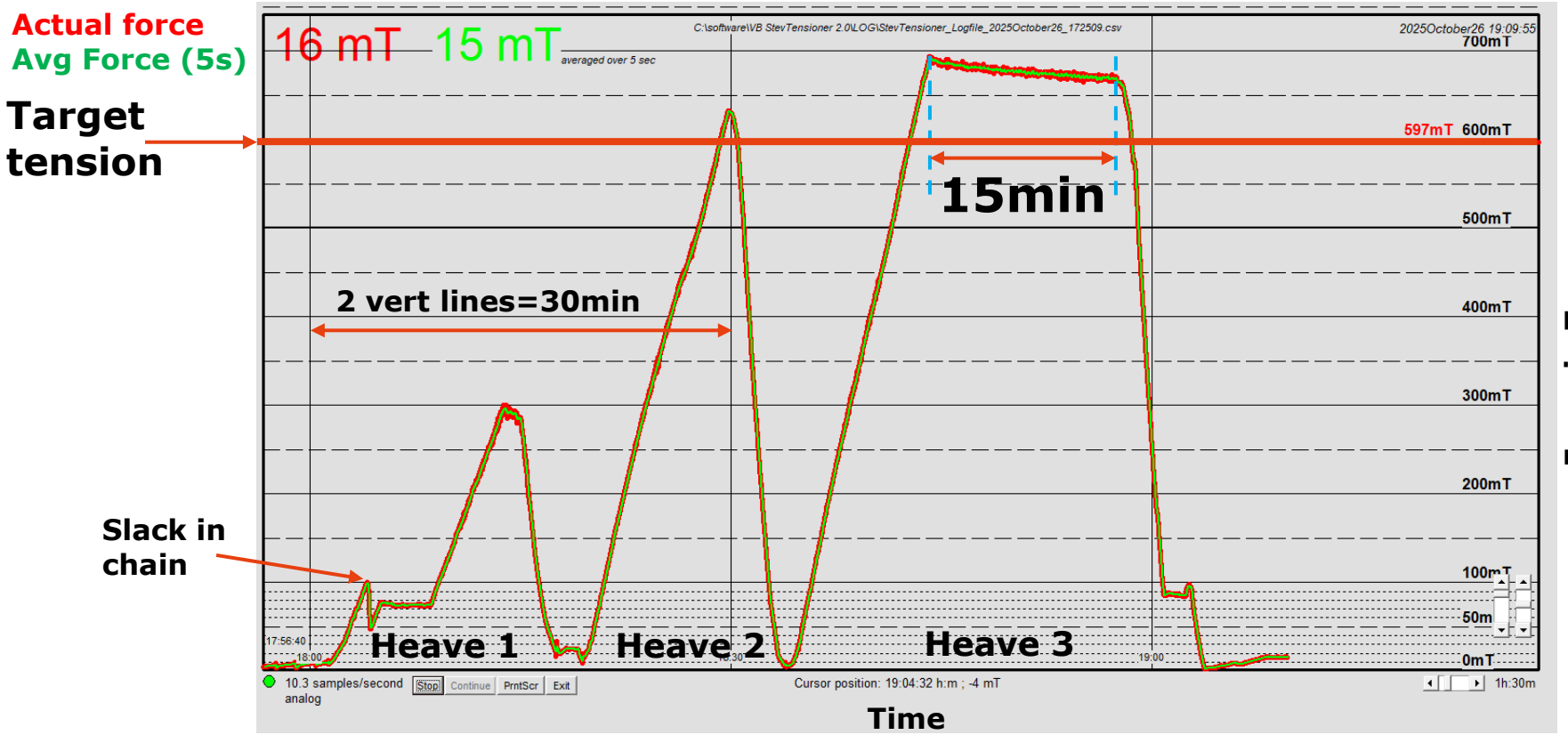
STEVTENSIONER Parameters:

- Amount of overshoot above target line
- Length of hold period
- Speed of force incline (winch speed, reaction anchor used before at high tension or not?)
- Continue by raising some more or complete new heave?

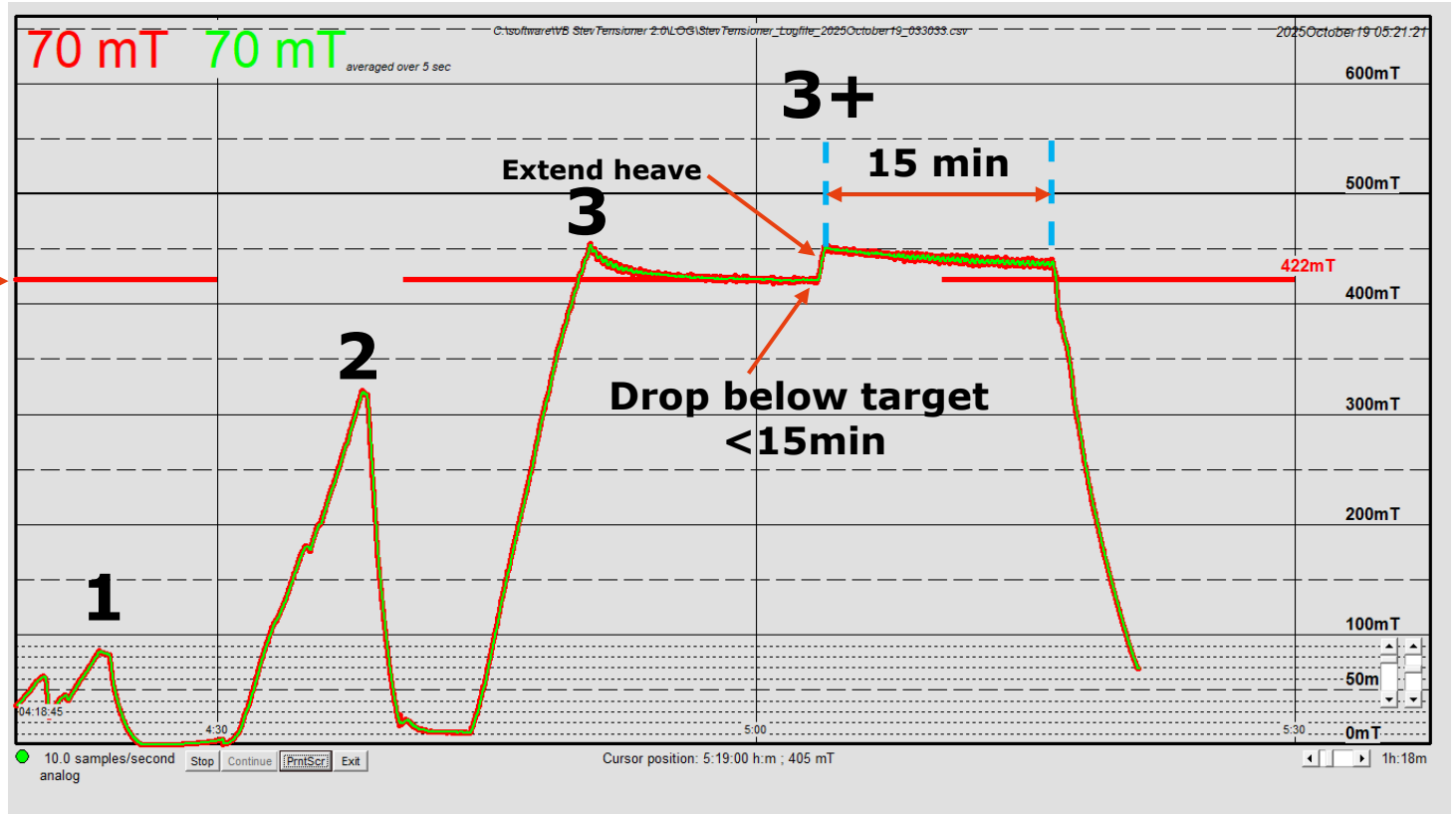


Force increase per time unit (for 1 or 2 anchors)
NOTE: If reaction anchor has been used before to high load all movement comes from mooring anchor (doubles its speed!)

Good STEVTENSIONING result:

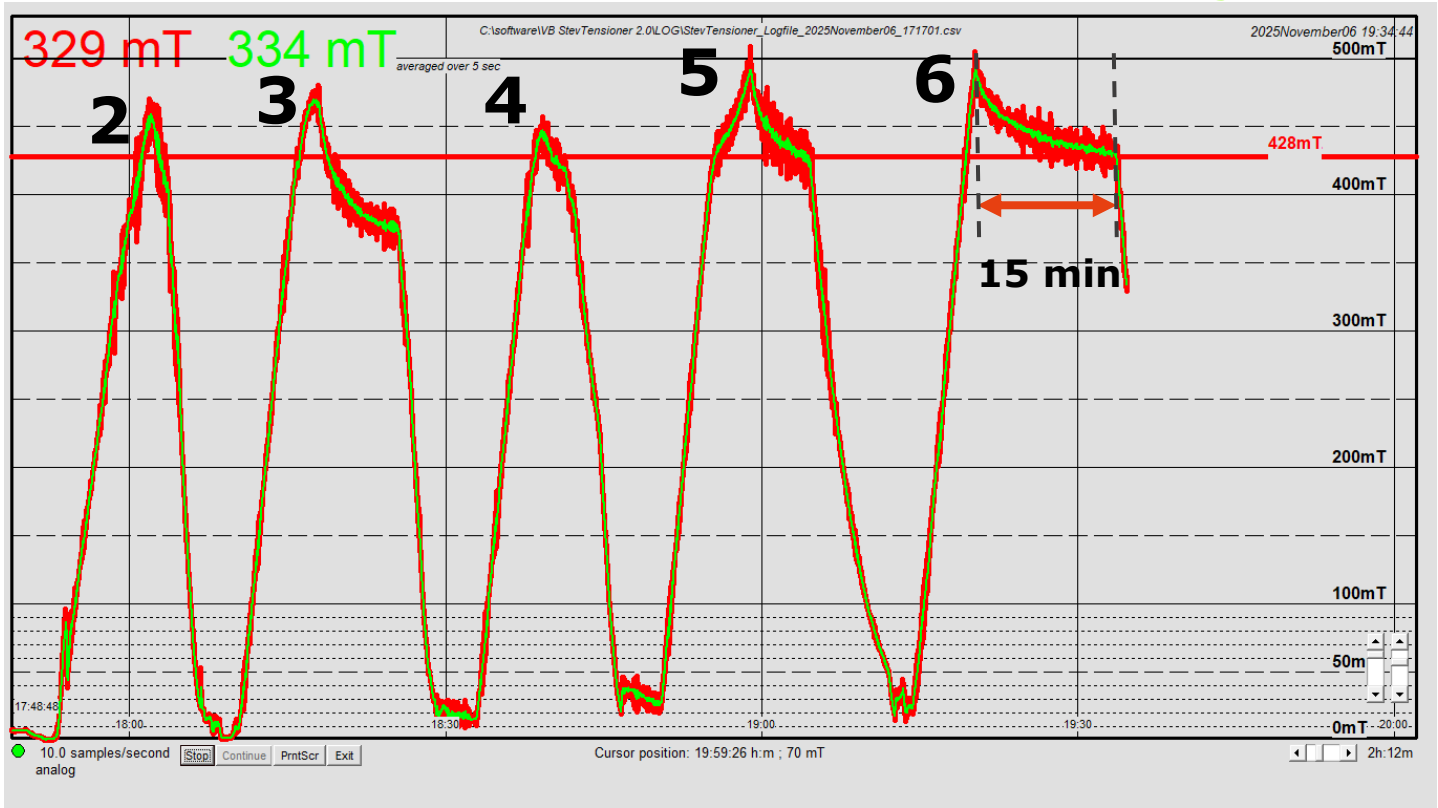


Good STEVTENSIONING result using still available heave height:



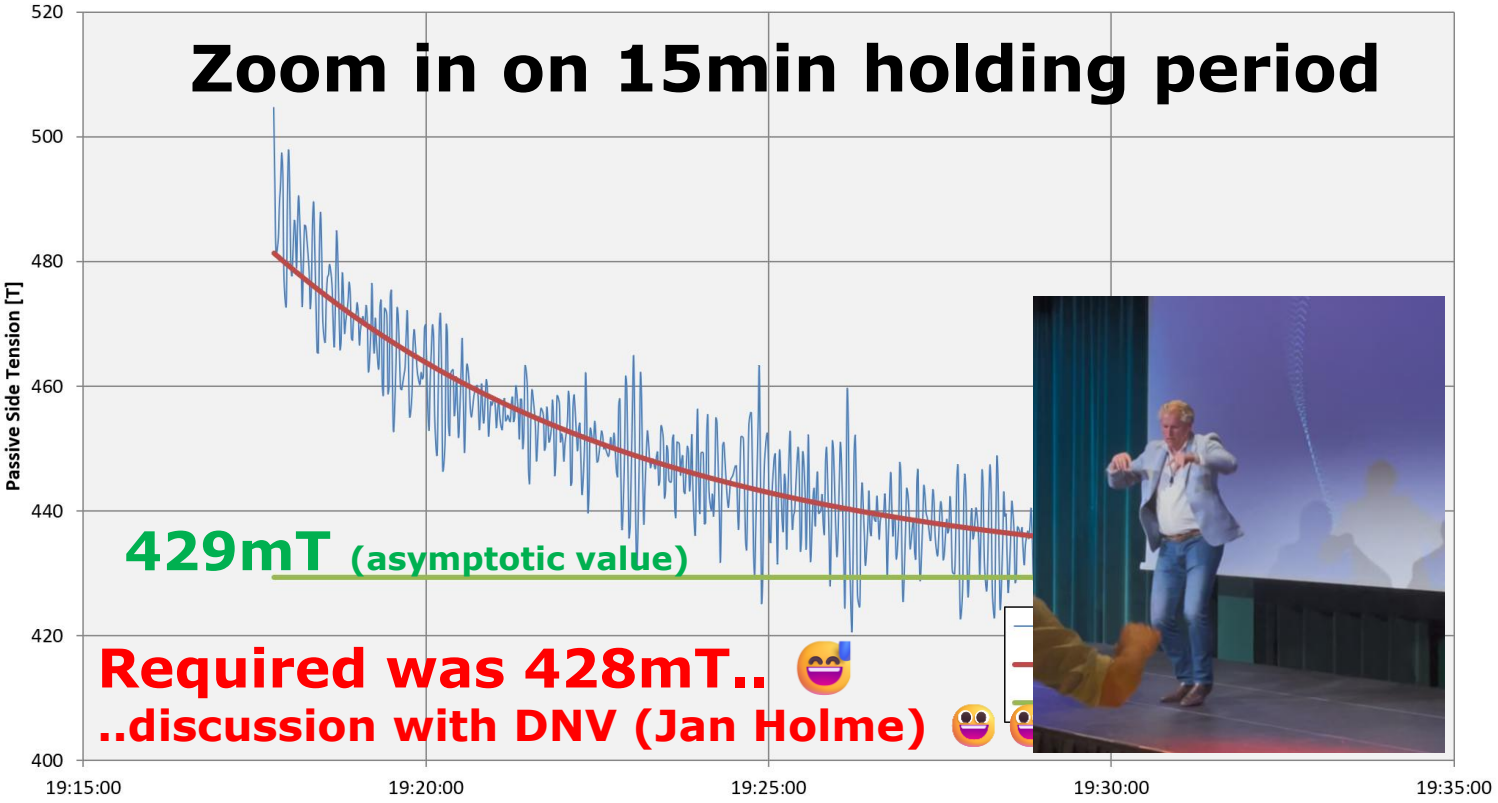
Approved!! (but no good at all ….?)

Note: red line is actual load cell value
Green line is average over 5 sec

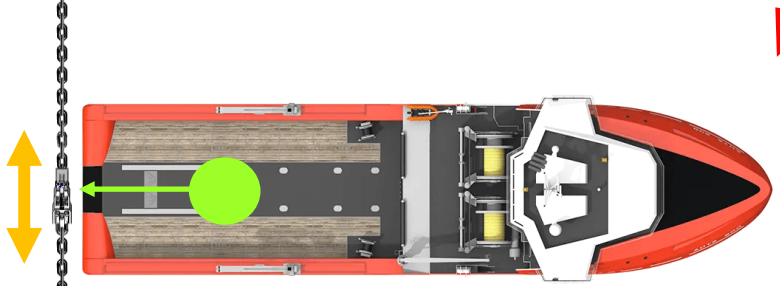


DELMAR

Estimation of Asymptotic Exponential Decay (least square method)



Sway and movement of vessel on DP during high tension (like >300t on winch)



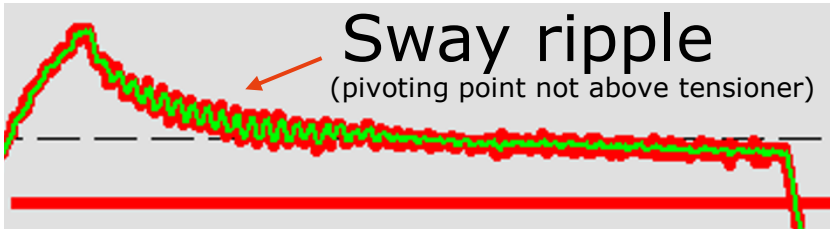
Heading
+/- 10°

Kongsberg response to sway issue:

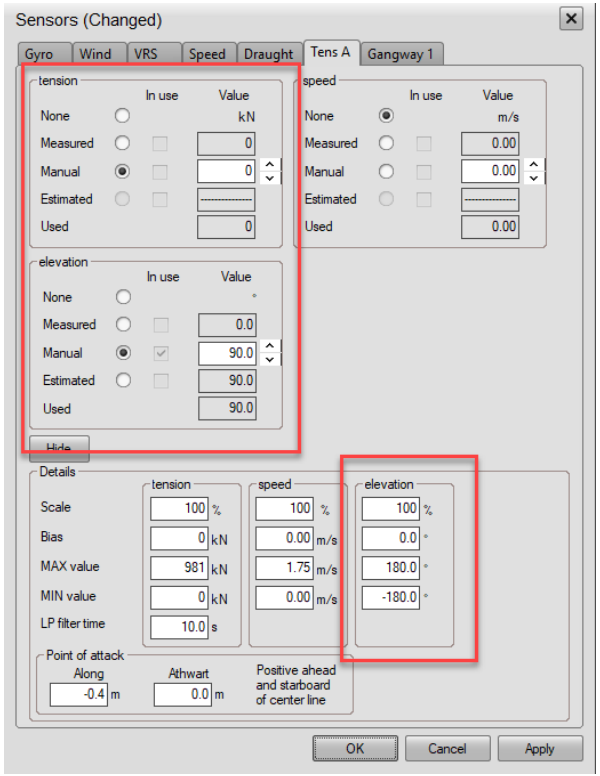
- Tension interface available on vessel
- Adjust the values to be as close as possible to the working situation

Kongsberg advise:

- try to have a low gain as possible
- or: custom gain and low in that axis that you see get the most problem.



Info from Kongsberg support



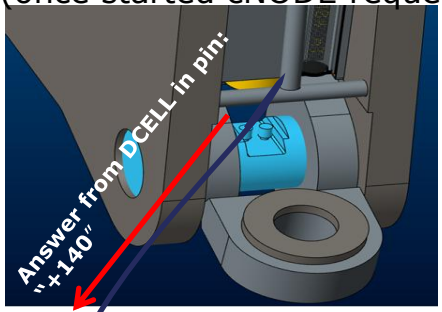
Stevtensioner VA84 acoustic test South Africa (2016)

- With TOTAL E&P SA
- Waterdepth **1440m**
- 2 vessels
- 22ton STEVSHARK Mk5

Maersk Seeker: 210t BP

STEVTENSIONER® communications

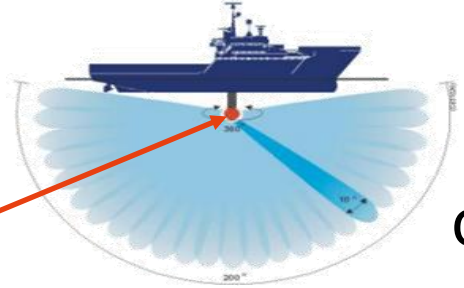
Looping request/answer continuously
(once started cNODE requests data at 1 Hz)



Display ON for 5 min. when light activated by ROV

Data request
from cNODE @ 1Hz

HiPAP 501 Vessel*



or

HiPAP 501 / cPAP30 communication:

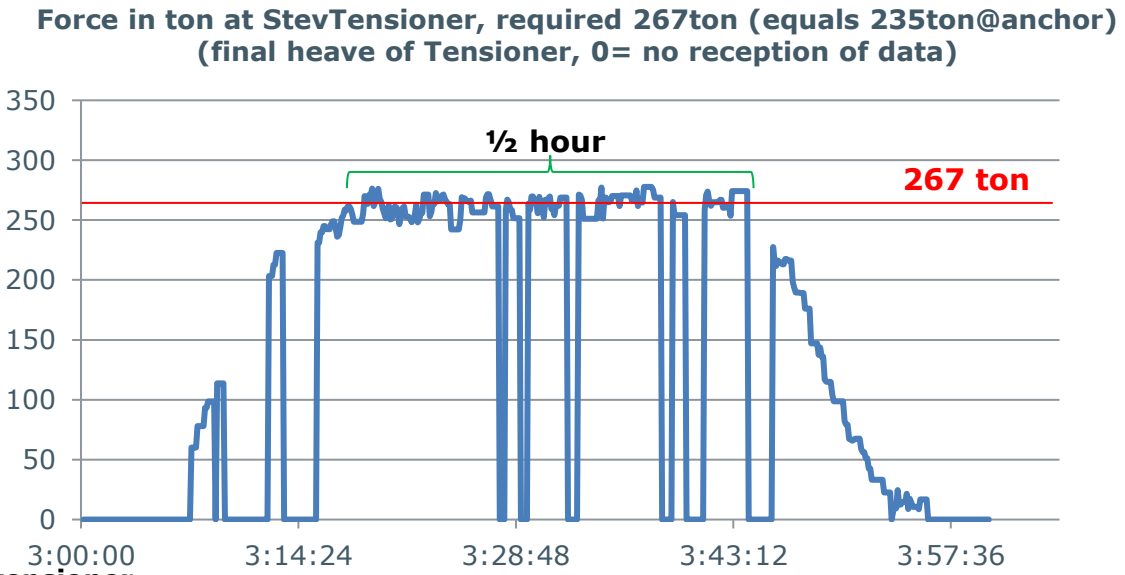
- activate cNODE on M-channel
- activate sensors (power on externally)
  - Strain from pin
  - Tilt sensor cNODE
- enable **local logging @ 1Hz,** with each positioning request the latest sensor data is retrieved from buffer and displayed through APOS
- deactivate sensors before boarding through APOS
- APOS update rate: 1 sec + 1 sec for every 750m below 500m

*HiPAP 501 typically available on vessels build 2007 or newer

cPAP30 display layout (= trend graph on HiPAP display on vessel bridge)

STEVTENSIONER VA84

South Africa project data: February, 2016
Data as recorded by Kongsberg cPAP30 @ topside and cNODE Midi 180-Si on Stevtensioner <u>@1440m WD</u>

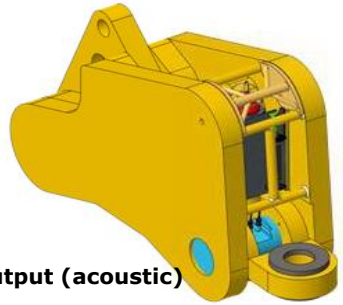


Max. BP Maersk Seeker: 210ton
Load on Stern roller +/- 210 ton using Stevtensioner

Stevtensioner Family

VA-84

Dimensions:	
Length	*2754mm*
Width	*615mm*
Height	*1250mm*
Weight in air	*5.8mT*
Weight in water	*5.0mT*
Specifications:	
Rated load	*600ton*
Power supply	

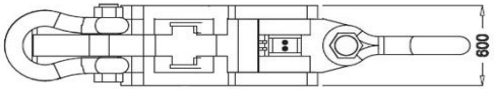


Calibrated loadpin with digital output (acoustic)
Suits chain sizes:
84mm chain with slim line Kenter links

VA-600-02 & VA-600-03

Dimensions:
Length - 2205mm
Width - 600mm
Height - 830mm
Weight in air – 3.7 tonnes
Weight in water – 2.9 tonnes

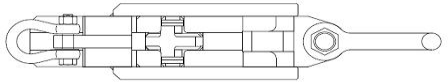
Specifications:
Rated load – 450 tonnes
Main shackle – 135mm bow
Recovery shackle – 125mm bow
Water depth - unlimited
Suits chain sizes:
76-84mm with Kenters
76-87mm without Kenters



VA-64 (former VA-600-01)

Dimensions:
Length - 2205mm
Width - 600mm
Height - 1250mm
Weight in air – 3.8 tonnes
Weight in water –3.0 tonnes

Specifications:
Rated load – 450 tonnes
Main shackle:
300mT - 135mm bow
Recovery shackle:
85mT - 75mm bow
Water depth – 1000m
Suits chain sizes:
64mm with slim-line Kenters



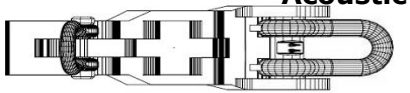
VA-1000-01 & VA-1000-02

Dimensions:
Length - 3150mm
Width - 835mm
Height - 1800mm
Weight in air – 7 tonnes
Weight in water – 6 tonnes

Specifications:
Rated load – 1000 tonnes
Main shackle – 135mm bow
Recovery shackle – 125mm bow
Water depth - unlimited

Suits chain sizes:
102-117mm with Kenters
102-135mm without Kenters

Acoustic pack available



Stevtensioner Family VA-1250

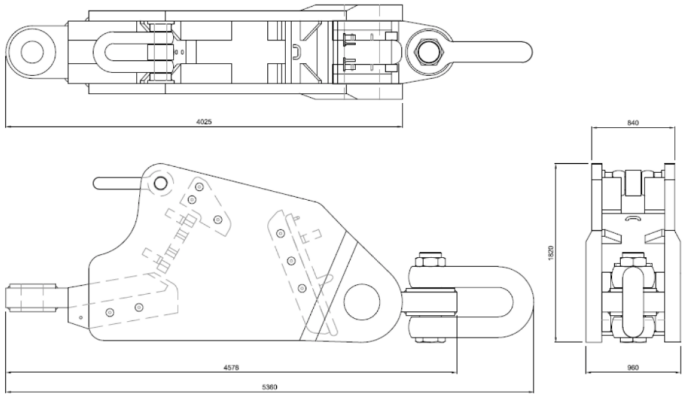
STEVTENSIONER® VA1250-01

Chain tensioning device for cross-tensioning anchor points either as opposed pairs or against a reaction anchor; using applied vertical force to generate horizontal installation load at anchor.

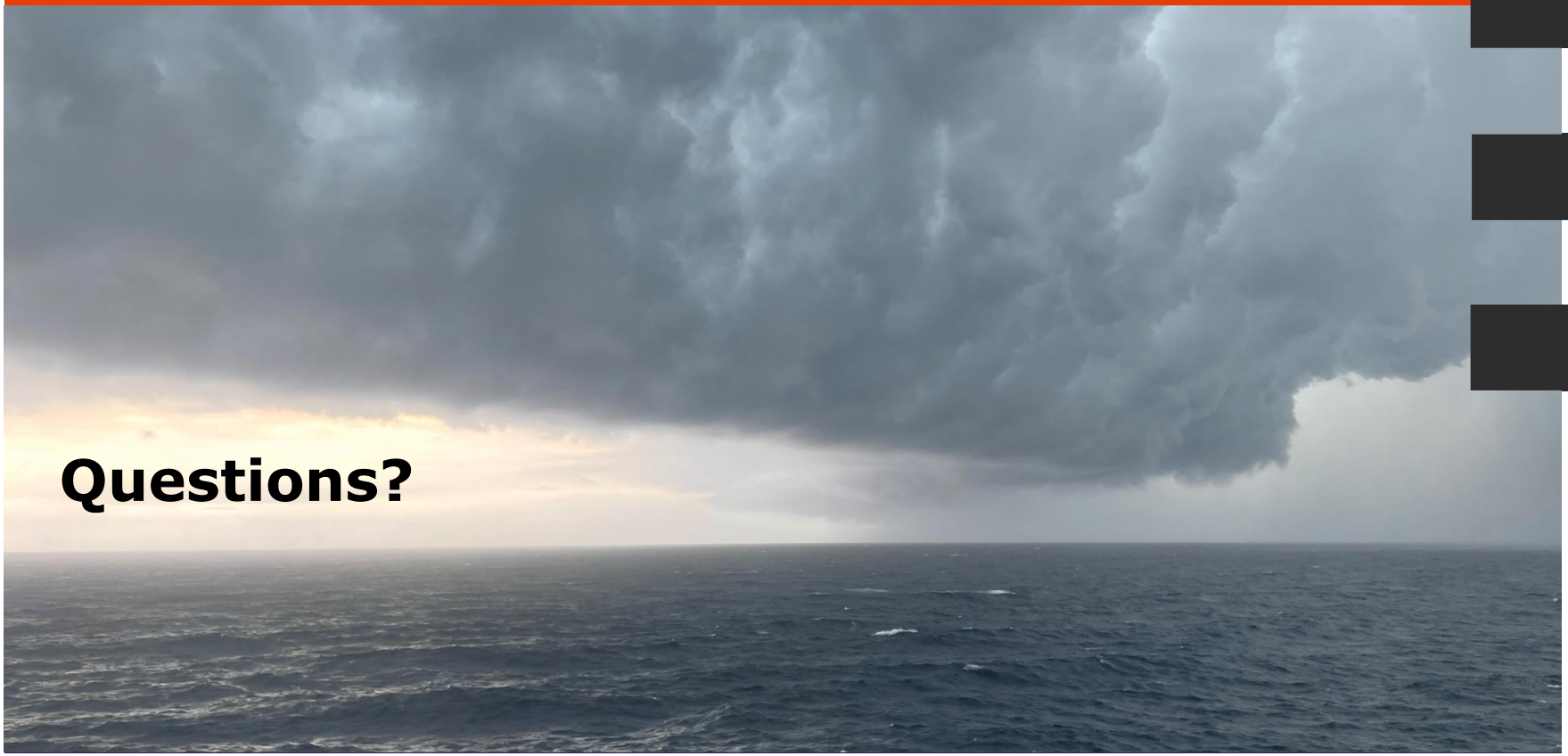
Dimensions:
Length - 4578mm
Width - 960mm
Height - 1820mm
Weight in air – 17 tonnes
Weight in water – 15 tonnes

Specifications:
Rated load – 1250 tonnes
Main shackle – 210mm bow
Recovery shackle – 120mm bow
Water depth - unlimited

Suits studlink chain sizes:
114-132mm with Kenters
114-152mm without Kenters
Suits studless chain sizes:
Up to 170mm without Kenters



Exchangeable insert plates


Questions?