

Anchor loss - technical and operational challenges and recommendations

DNV GL, Gard and The Swedish Club

March 2016

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Anchor loss – prevention - Content

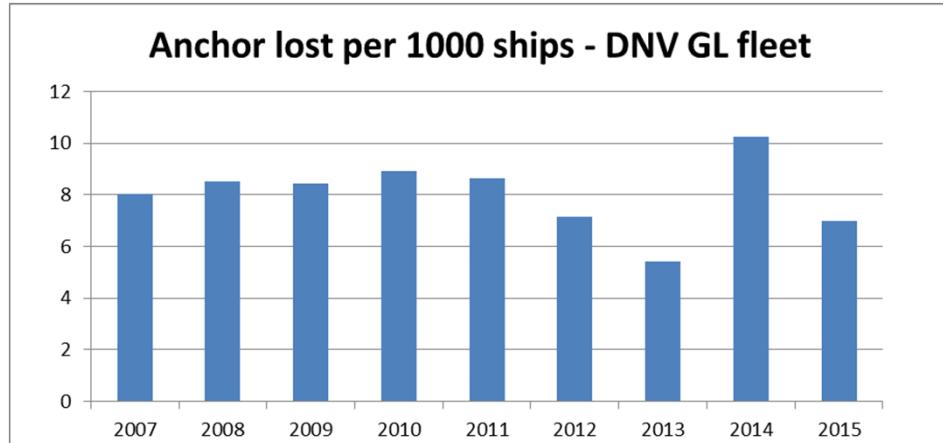
- Background
- Technical issues and recommendations
- Operational issues and recommendations
- Legal notice

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Why focus on anchor loss - lost per year?

Anchors lost per 100 ship year since 2007

- DNV GL has observed a relatively high number of anchor losses with 8-10 anchors lost per 1000 ships per year and a negative trend in 2014/2015



DNV GL Anchors lost per 100 ship year (DNV GL fleet)



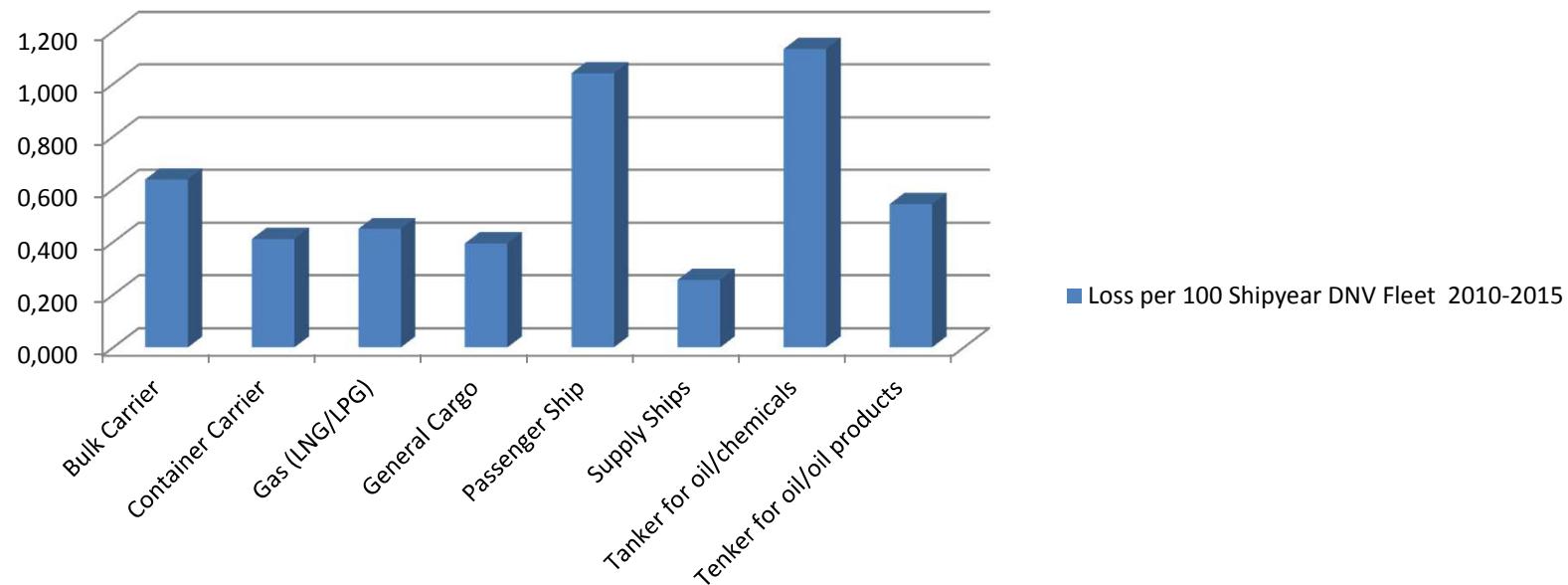
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Anchor losses per ship type

Anchors lost per 100 ship year & ship type

- Tanker for oil and Passenger Ships more exposed
- Reflecting the ship type trading pattern?

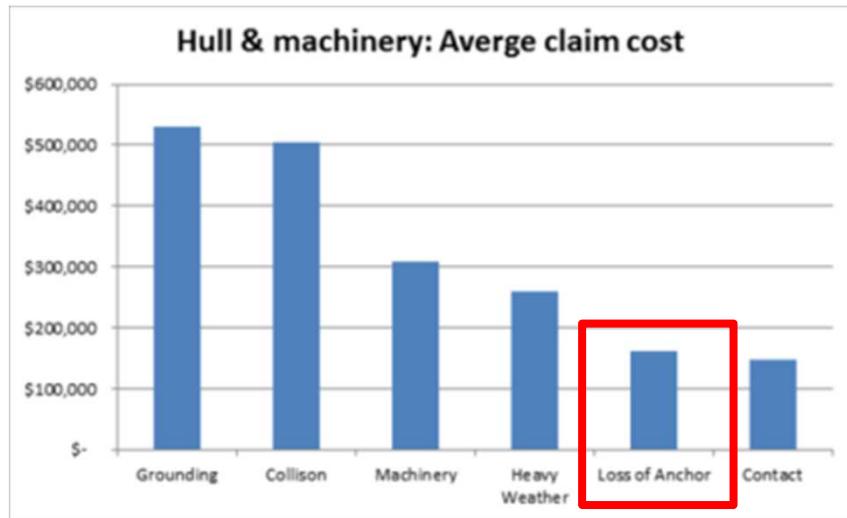
Anchor losses per 100 ship-year and ship type



DNV GL Anchors lost per 100 ship year & ship type (DNV fleet)

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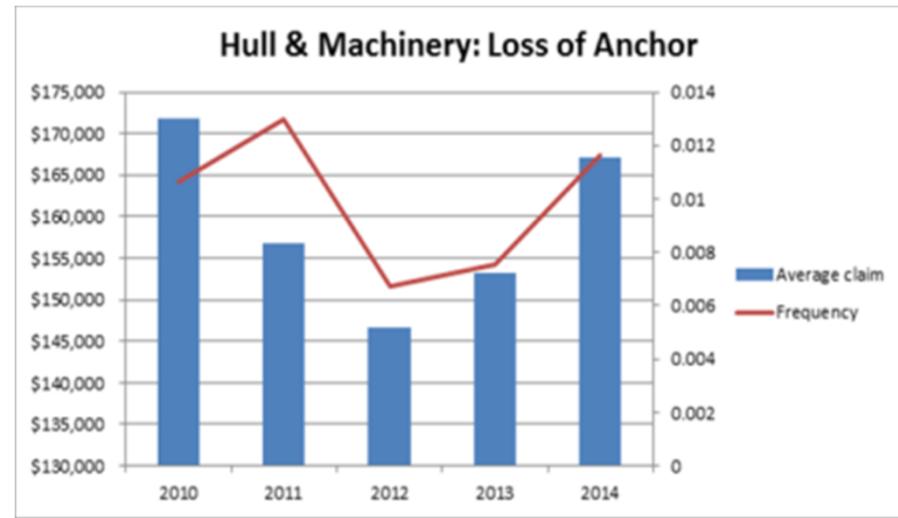
Costs involved with loss of anchors



Swedish Club claims including deductible – loss of anchor

- Direct cost to replace lost anchor and chain
- Gard has seen increasing costs related to recovering lost anchors amounting up to USD 50 000
- Delays and off-hire
- Cost due to grounding / collision / damage to subsea equipment etc.

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Swedish Club claims including deductible



Lost chain picked up by another ship

Consequences of anchor loss/dragging of anchor

Example of follow up events from dragging anchor:

- Ship anchored in bad weather during night time
 - Wind force 8-9
 - Waves 4,5m Hs
- Ship dragged anchor and grounded
- Consequence of damage:
 - 250 tons HF oil spilled
 - Polluting 37 protected areas of 120 km coastline
 - Cost of salvage 70 mill. USD
 - Out of service for 10 months
- Captain and 3rd mate sentenced to jail



Vessel grounded due to dragging of anchor

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Anchor losses technical issues

Technical issues

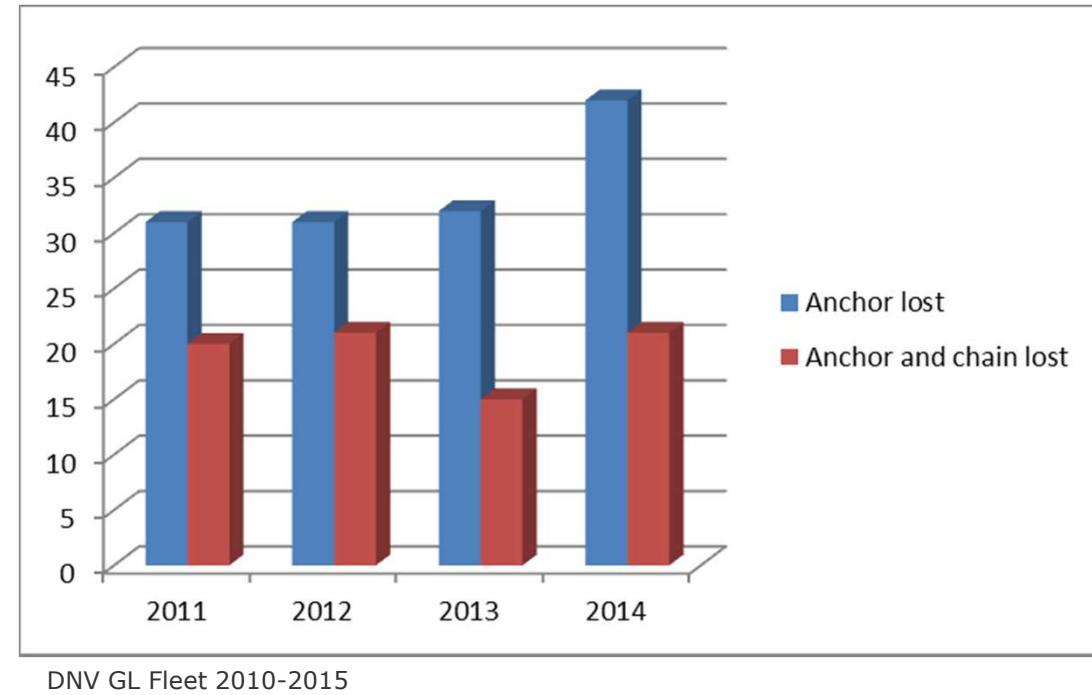
Anchor loss due to failure of:

- D-Shackle
- Swivels
- Chain
- Kenter shackles

Anchor and chain lost due to technical failure of:

- Windlass motor
- Windlass brakes
- Chain stoppers

Loss of anchor vs. loss of anchor and chain



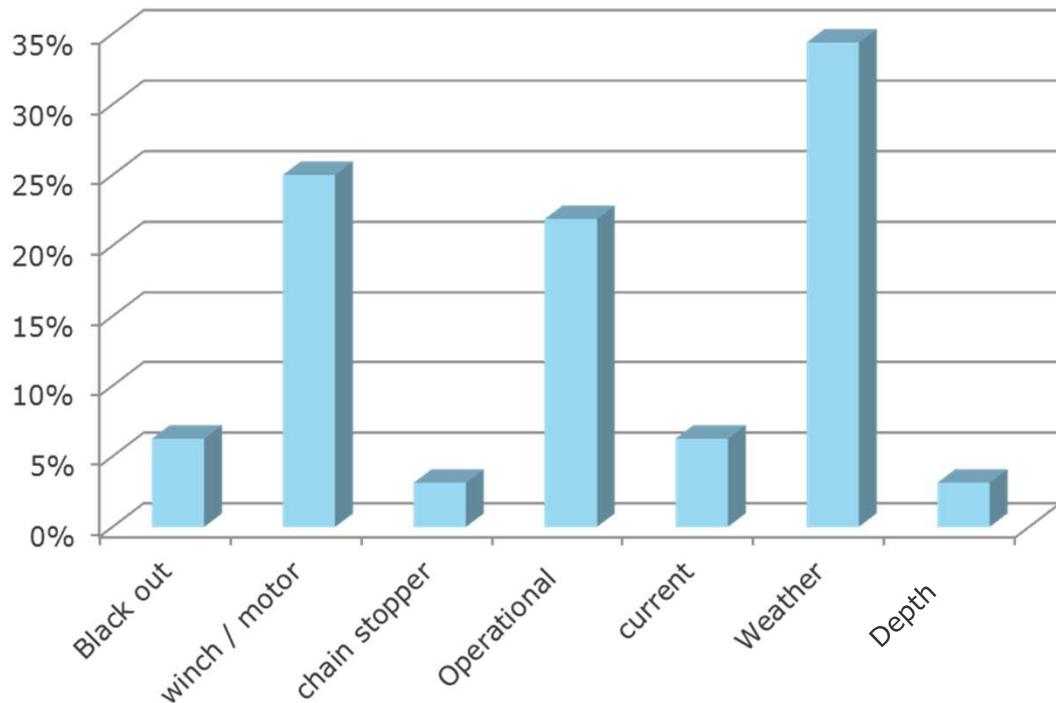
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Anchor losses due to operational issues

Operational issues:

- Dropping of anchor
- Use of brake
- Heaving the anchor
- Securing the anchor
- Anchor watch
- Lack of attention to bad weather

Events causing loss of anchor/chain



Source: The Swedish Club

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When are anchors lost?

1. During normal anchoring in port anchorages.
 1. When vessel has too much speed during anchoring.
 2. When dropped without control by the brake
 3. When dropping anchor in too deep water
 4. When dragging. (Sometimes this may also cause damage to cables and pipelines and cause collisions)
2. When clutch disengages accidentally during anchoring operations
3. When anchor is stuck or fouled
4. When the hydraulic motor is engaged and the chain is pulled out by the vessel's movements
5. Breakdown of windlass motor and the anchor and chain needs to be cut
6. On voyage, if the chain not properly secured
7. In connection with emergency anchoring to avoid grounding & collisions



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What are the design loads for anchor, anchor chain and windlass?

- Wind speed?
- Strength of current?
- Wave height?
- Water depth?



Bulk Carrier grounded off Newcastle wind force 9, waves 4-6 meters

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Anchoring equipment defined by equipment number

A1
cont'd

Table 1 Anchoring equipment

E.N.	Stockless bower anchors		Stud link chain cable for bower anchors			Min. dia.
	No. *	Mass per anchor (kg)	Total length (m)	Min. dia.		
				Mild steel Gr. 1 (mm)	Special quality Gr. 2 (mm)	Extra special quality Gr. 3 (mm)
1	2	3	4	5	6	7
205-240	3	660	302.5	26	22	20.5
240-280	3	780	330	28	24	22
280-320	3	900	357.5	30	26	24
320-360	3	1020	357.5	32	28	24
360-400	3	1140	385	34	30	26
400-450	3	1290	385	36	32	28
450-500	3	1440	412.5	38	34	30
500-550	3	1590	412.5	40	34	30
550-600	3	1740	440	42	36	32
600-660	3	1920	440	44	38	34
660-720	3	2100	440	46	40	36
720-780	3	2280	467.5	48	42	36
780-840	3	2460	467.5	50	44	38
840-910	3	2640	467.5	52	46	40
910-980	3	2850	495	54	48	42
980-1060	3	3060	495	56	50	44
1060-1140	3	3300	495	58	50	46
1140-1220	3	3540	522.5	60	52	46
1220-1300	3	3780	522.5	62	54	48
1300-1390	3	4050	522.5	64	56	50
1390-1480	3	4320	550	66	58	50
1480-1570	3	4590	550	68	60	52
1570-1670	3	4890	550	70	62	54
1670-1790	3	5250	577.5	73	64	56
1790-1930	3	5610	577.5	76	66	58
1930-2080	3	6000	577.5	78	68	60
2080-2230	3	6450	605	81	70	62
2230-2380	3	6900	605	84	73	64
2380-2530	3	7350	605	87	76	66
2530-2700	3	7800	632.5	90	78	68
2700-2870	3	8300	632.5	92	81	70
2870-3040	3	8700	632.5	95	84	73
3040-3210	3	9300	660	97	84	76
3210-3400	3	9900	660	100	87	78
3400-3600	3	10500	660	102	90	78
3600-3800	3	11100	687.5	105	92	81
3800-4000	3	11700	687.5	107	95	84
4000-4200	3	12300	687.5	111	97	87

The selection of anchor equipment is based on the Equipment Number EN defined as follows:

$$EN = \Delta^{\frac{2}{3}} + 2.0hB + \frac{A}{10}$$

where:

Δ = moulded displacements [t], to the summer load waterline

B = moulded breadth [m]

h = effective height [m], from the summer load waterline to the top of the uppermost house

A = area [m^2] in profile view, of the hull, superstructures, and houses above the summer load waterline

$\Delta^{\frac{2}{3}}$ represents the current forces

$2.0hB + \frac{A}{10}$ represents the wind force

Regulatory framework – IACS UR A1 (Unified Requirement)

- Class Rules based on IACS UR A1 – Anchoring equipment:
 - Designed for temporary mooring in harbour or sheltered area
 - Current velocity: max 2.5 m/s
 - Wind velocity: max 25 m/s
 - **No waves**
- Equivalent condition including wave loads:
 - Current velocity: max 1.5 m/sec
 - Wind velocity: max 11 m/sec
 - Significant **wave height max 2 m**
- Length of paid out chain
 - Scope of cable of 6-10
 - Good holding ground



Polluted coast line as result of anchor dragging

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Windlass design load

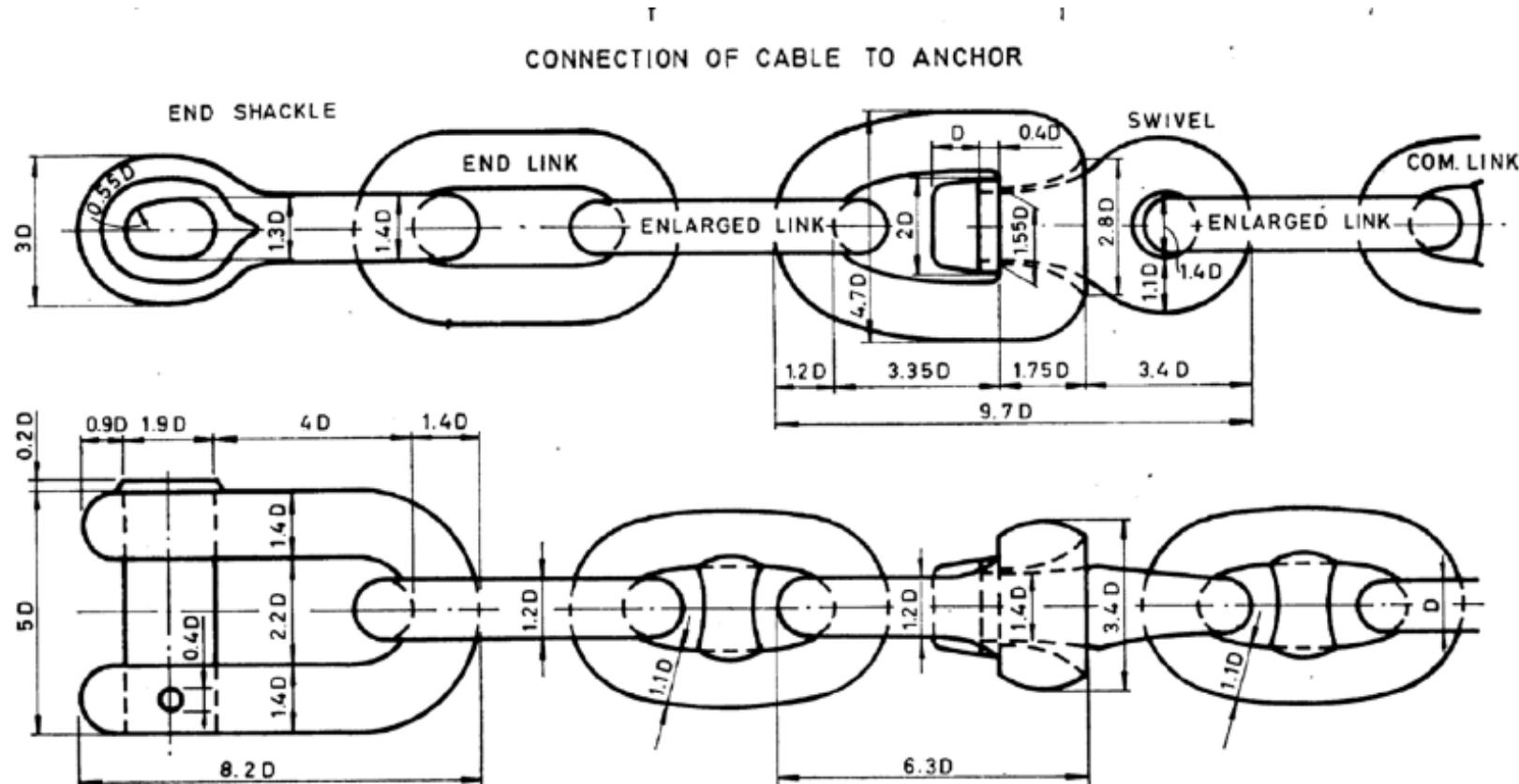
- **Anchor winch motor** performance:
 - Minimum lifting capacity of 3 lengths of chain, i.e. 82,5m and the anchor
- **Windlass brakes** design load:
 - 45% of chain breaking load when a chain stopper is installed
 - 80% of chain breaking load when no chain stopper is installed



Windlass and chain stopper with guillotine bar

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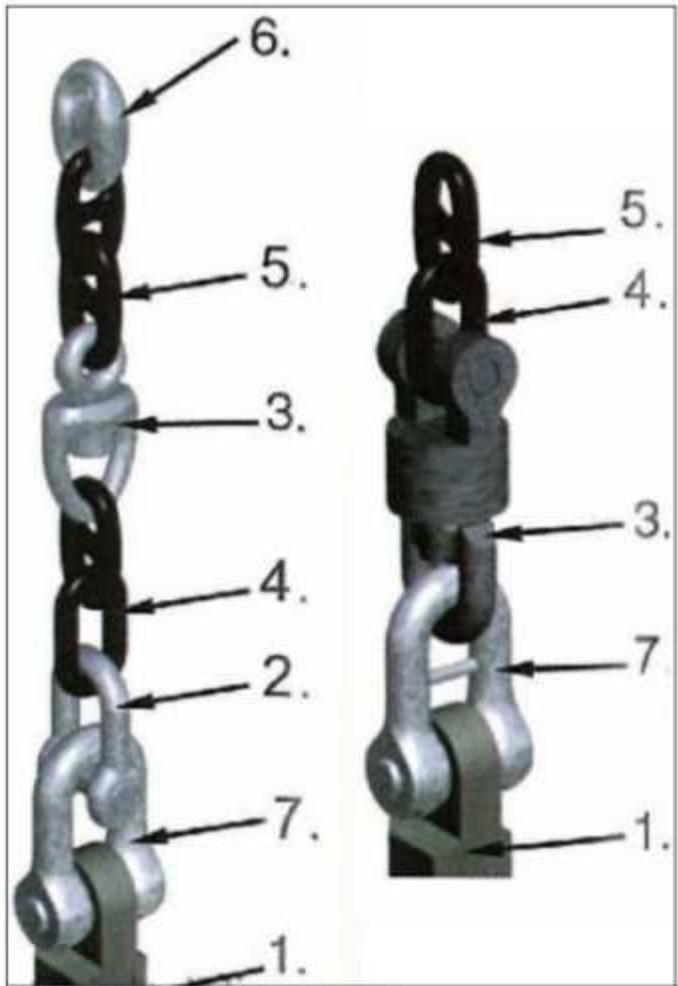
Anchor chain – conventional arrangement



Conventional connection between anchor and chain

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Alternative solution to attach anchor to chain



Conventional and "Super Swivel" connection



Anchor with fouled chain

1. Anchor shank
2. D-shackle
3. Swivel
4. Open link
5. Enlarged link
6. Kenter shackle
7. Anchor shackle (Crown shackle)

Class involvement with inspection of anchor and anchor chain

Class inspections:

- All materials to be certified by class
- Anchor windlass to be certified
- 5-yearly inspection intervals
- Thickness measurements from 10 years
- “Guidance for anchoring equipment in service” – IACS Recommendation 79
- Anchoring is a class matter not covered by IMO conventions



Anchor chain in dock

16-176

No. 79

Guidance for Anchoring Equipment in Service

1. General

1.1 This document gives guidance for maximum usage levels of anchor cable fittings, joining materials, the presence of studs with anchor bolts and the returning to working of studs that have suffered damage to studs, plates, bolts or nuts in service.

2. Anchor cable fittings

2.1 Where concerned, assessing, pricing damages, compensation and other costs/benefits should be gauged at their point of greatest reduction. Compensation should be given to replacement when the cost is 10% greater than original.

2.2 Where a Kester pinning element is present, need should be had to ensure that the tapered locking pin is in good condition. This steel securing pin is to be held in position by lock nuts, the former in place to maintain a fit.

2.3 In the case of anchor located near a base, some compensation should be given to replacement - where the maximum lateral movement equates to 2% of the rated load capacity.

Figure 1: Bolted system

3.1. Anchor Pin Wear/loss

3.1 An anchor pin should not exceed 10% wear/loss. Where the wear/loss of the pin exceeds 12% less of diameter, compensation should be given by pin replacement.

3.2 Increase the pin housing witness strength and if there is available resistance compensation may be given to a witness connection between pin and housing in order to constrain the relative movement of pin and witness.

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IACS Rec. 79

http://www.iacs.org.uk/document/public/Publications/Guidelines_and_recommendations/PDF/REC_79_pdf219.pdf

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Technical issues

Anchor chain typical failures and focus areas

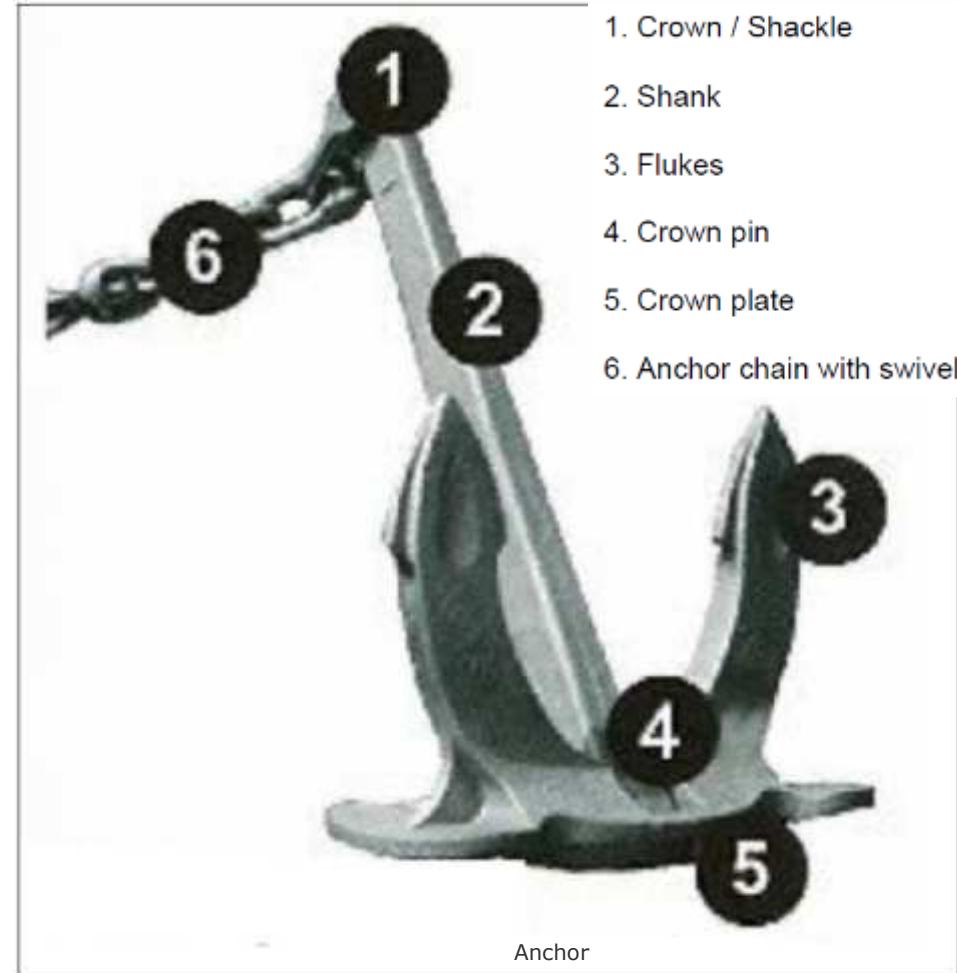
1. Anchor
2. Connection anchor to chain
3. Swivel
4. Anchor chain
5. Chain stopper
6. Windlass
7. Securing in hawse pipe



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1. Anchor terminology and critical parts

- The crown shackle is made of forged steel. The bolt is forged in place
- The anchor shank, flukes and crown plate is normally of cast steel
- A solid crown pin or pivot of forged steel linking shank to crown
- Class Societies have rules for the testing of anchors at the manufacturer
- Certificates to be kept on-board

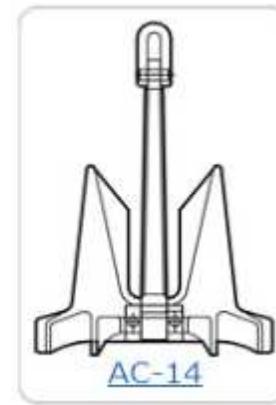
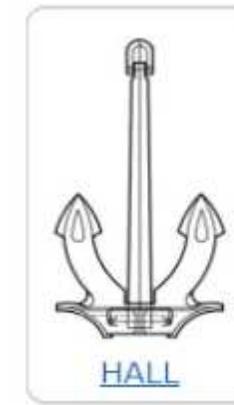
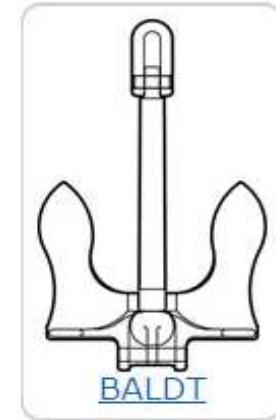
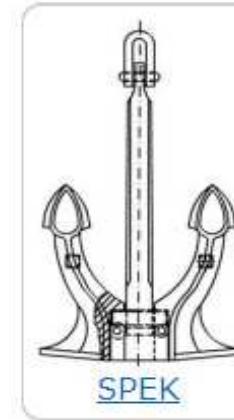


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1. Anchor types

Some typical anchor types:

- Spek, Baldt and Hall anchors hold basically by their mass
- The AC-14 is a high holding power and can be reduced in weight, by class rules.



Conventional Anchor types

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1. Anchor – typical defects

- Anchor crown (and anchor shank) may be damaged during the dropping of an anchor if hitting rock
- Excessive wear of the anchor crown pin, and material defects in the anchor flukes and anchor shank
- Anchor shackle bent and bolt loose
 - Anchor shackle bolt is normally forged in place while D-shackle bolts are secured with a tapered pin
 - Bent shanks can be straightened according to class approved procedure
- Flukes may break off if stuck in-between rocks during pulling



Anchor crown broken



Worn out anchor shackle to be scrapped



Anchor shank bent, fluke broken



Bent anchor shank may be straightened

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1. Anchor defects

- Anchor shank is of cast steel and the material properties are critical
- Tests of material are carried out to obtain Class Certificate.
- Several anchors have been lost due to breakage of metal
 - Problem is assumed to be linked to insufficient annealing at manufacturer
 - Test pieces may be sufficiently annealed due to smaller mass than main object, and may have given good results during testing
 - Poor annealing may thus not be detected.
- Dropping of anchor at height at rocky bottom increase the risk for such failures



Anchor shank broken



Broken anchor shank due to brittle material

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1. Second hand anchors

- Second hand anchors can be used, but must be in good condition, compatible with the ship and certified by class
- Keeping a spare anchor can save a lot of time and money in case of an anchor loss
- Class may re-certify second hand anchors based on visual survey, MPI, weighing and proof load testing



Two anchors of the same ship are of different types , hence one is a second hand anchor



Class approved anchors to be used

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2. D-shackle

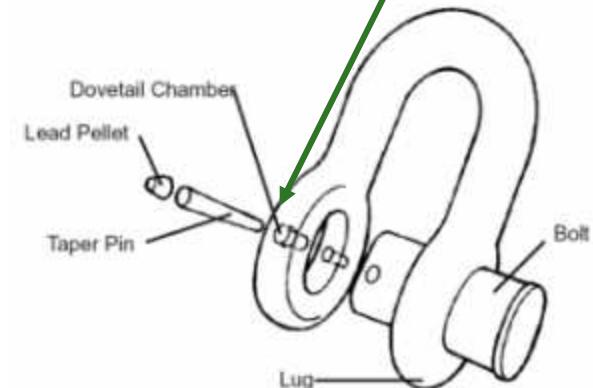
- This shackle connects the chain to the anchor ring.
- Detached taper pin of the D-shackle is a common reason for loss of anchors
- Pin and hole must be manufactured for a perfect match.
- Pin must be secured by hammering-in a lead pellet. If lead is melted and poured in, it will shrink when cooled and may not jam the pin



Remember to check the taper pin on opposite side !



D-link bolt almost lost due to missing securing pin



Sketch of securing of D-link bolt by tapered pin

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2. How to prevent detachment of D-shackle?

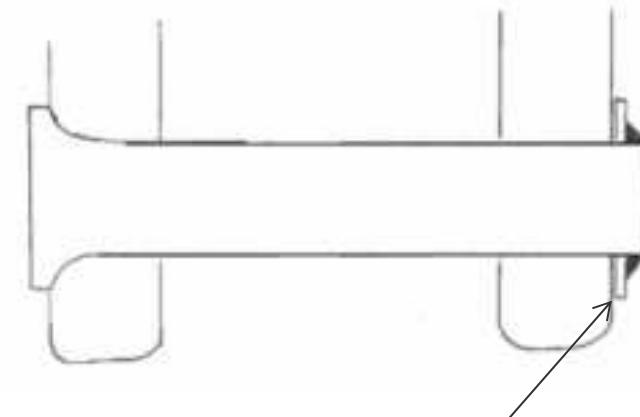
- Proper securing of the bolt by good fit between the securing pin and the D-shackle
 - securing by hammering in the lead pellet
- The bolt may be further secured by a washer plate and this is subject to Class approval
- Frequent inspections of securing of the D-shackle bolt
- Tight securing of the anchor in the hawse pipe during voyage to avoid excessive vibrations



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Anchor lost and D-Link securing bolt loose



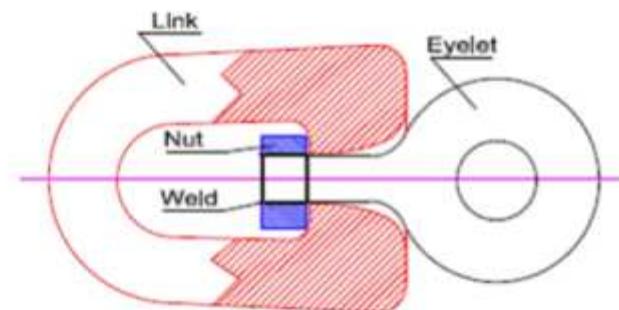
Additional securing of the D-Link securing bolt by a welded washer plate

3. Swivel

- Purpose of swivel is to avoid anchor chain twisting/shortening if vessel swinging around while at anchor
- There has been reported some cases where the swivel has detached due to excessive wear and tear
- Swivel is often not measured when ranged in dry dock
- If the slack between the eyelet axle pin and the link is more than 5% of the diameter the swivel should be replaced
- If chain needs to be renewed, renew also the fore-runner, swivel included



Anchor lost due to detached eyelet axle pin



IACS Recommendation 79 maximum wear of the axle pin

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4. The anchor chain

- Thickness reduction due to wear and tear of the anchor chain must be carefully monitored
- The maximum allowable reduction of chain diameter is 12%
- If the chain is close to the limit special precaution is recommended to avoid excessive loads on chain
- It is recommended to measure the chain also at dry-dockings for intermediate survey
- Chain lengths with dislocated or missing studs should in general be replaced
- Do not purchase second hand chain without class certificates
- Be aware of fake certificates



Loose and dis-located studs



Heavily worn and bent anchor chain links

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4. The anchor chain

- The studs which are there to keep the shape of the anchor links may come loose or fall out
 - If a stud is missing, the strength of the chain may be reduced by some 30%
 - Until this is rectified proper care must be exercised to avoid use in heavy weather
- Chain with loose / detached studs are recommended to be replaced
- Re-conditioning of chain with loose studs in certified workshops in accordance with a Class approved welding procedure including suitable heat treatment may be an alternative
- Un-authorized welding like seen on the lower right side is not allowed!



Stud with excessive gap



Un-authorized welding of stud

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4. Kenter shackle

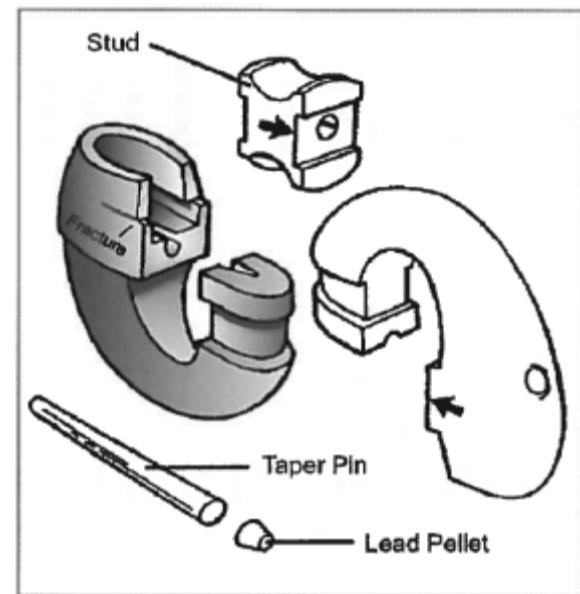
- Used to connect the chain lengths of 27,5 meters
- The Kenter shackle will normally not come apart provided the taper pin is properly fitted and sealed by a lead pellet
- Proper assembly of the Kenter shackle is essential
- When old chain is renewed its recommended to change the Kenter shackle as well



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Broken Kenter shackle



Conventional build up of Kenter shackle

5. Chain stoppers

- Strong chain stoppers are installed between windlass and hawse pipe and are designed to absorb the pull of the chain
- Chain stoppers are to be engaged while at anchorage and during voyages
- The chain stopper is designed for 80% of breaking strength of chain



Conventional chain stopper arrangement



Guillotine bar broken

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5. Chain stopper issues

- Guillotine bar or pawl may not fit
- Guillotine bar hinge pin may be heavily wasted and come loose
- Hinge pins and securing pins are often bent, reduced by corrosion or even missing
- Proper inspection and maintenance is needed



Chain stopper hinge pin severely deformed
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The pawl does not fit the chain



Guillotine bar engaged

6. Anchor windlass

- Minimum lifting capacity for the anchor windlass is three lengths of chain (82,5m) and anchor submerged
- The brake must be able to hold 45% of breaking strength of chain (80% if no chain stopper)
- Many incidents with loss of anchor and chain due to anchoring in deeper waters often combined with excessive sea loads (waves)
- Fatal accidents reported due to explosion of hydraulic motor due to rendering of the chain cable during hoisting operations in heavy weather



Anchor and chain lost due to windlass failure – damage to the chain locker in way of bitter end release

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6. Windlass brakes

- The windlass brake is essential to control the pay-out of the chain
- The conventional design is with brake bands but there are also disc brake systems
- Corrosion of the drum and wear of the brake band lining reduce the brake capacity
- It is essential that the tension of the brakes is adjusted and liners replaced as per makers instructions
- Alternate use of port and starboard anchors reduce risk for excessive corrosion / wear on one windlass
- Brake holding test is recommended at regular intervals



Windlass in poor condition



Brake band jack up test



Applying the brakes while lowering the anchor

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6. Windlass with high pressure hydraulic motors

- Fatal accidents has been reported with explosion of hydraulic motors due to rendering of the chain during heavy weather

Pay attention to:

- Pressure relief valves
- Cleanliness of hydraulic oil
- Corrosion on the housing
- Protection cover could be considered to reduce risk for flying debris



Hydraulic motor exploded during heaving anchor in heavy weather



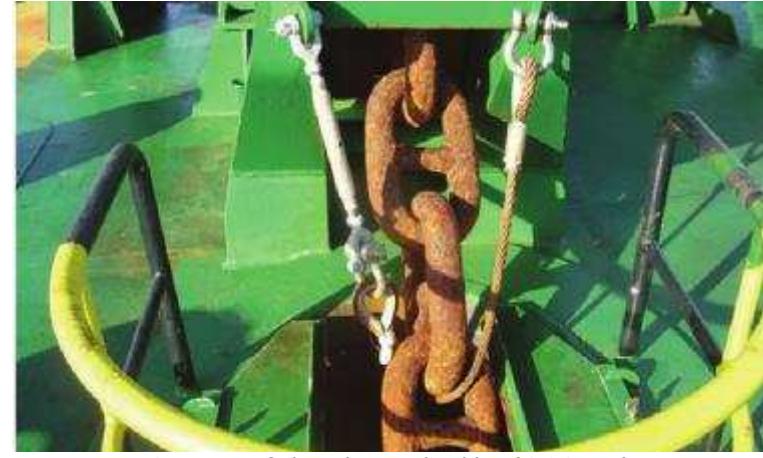
Hydraulic motor with broken cover plate

http://www.mardep.gov.hk/en/msnote/pdf/msin155_1.pdf

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7. Chain cable tensioners

- Chain cable tensioners are installed for the purpose of avoiding slamming of the anchor in the hawse pipe
- Tensioners of whatever type may be damaged and worn and should not be trusted alone to hold a stowed anchor at sea
- Excessive vibrations of the anchors may cause loosening of securing pins in anchor shackles
- Broken claws, hooks etc. of cable tensioners should not be repaired by welding, but renewed



Securing of chain by turnbuckles (©OCIMF)



Securing of chain by Devils Claw(source ©OCIMF)

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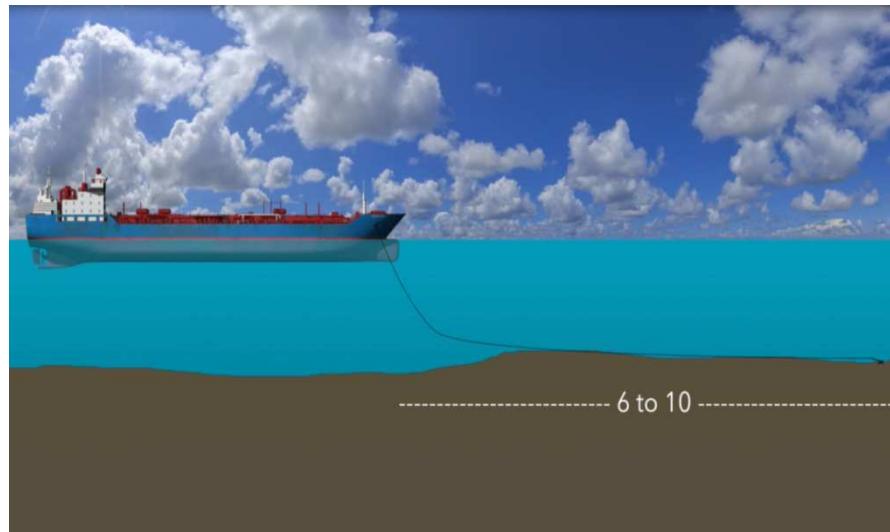
Operational issues

Operational recommendations

1. Preparing for anchorage
2. Dropping of anchor
3. At anchorage
4. Heaving the anchor
5. Preparing for voyage



Ship at anchorage



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Lowering by the windlass

1. Preparing for anchorage

- Suitable anchoring location considering:
 - Traffic and congestion in the area & backup option
 - Have a plan b
 - The water depth
 - Windlass may not be able to recover more than three lengths of anchor chain (82,5m)
 - Safe distance to underwater cables and pipelines
- Master and Chief need to discuss if there is planned overhaul of machinery or essential equipment for ship navigation
- Nature of the sea bed & holding power
 - Clay gives best holding power but “sucking effect” to be considered for prolonged anchorage
 - Shingle and sand may have good holding power
 - Pebbles and cobbles have low holding power
 - Rocky bottoms and slopes are poor anchoring grounds where the anchor may be stuck

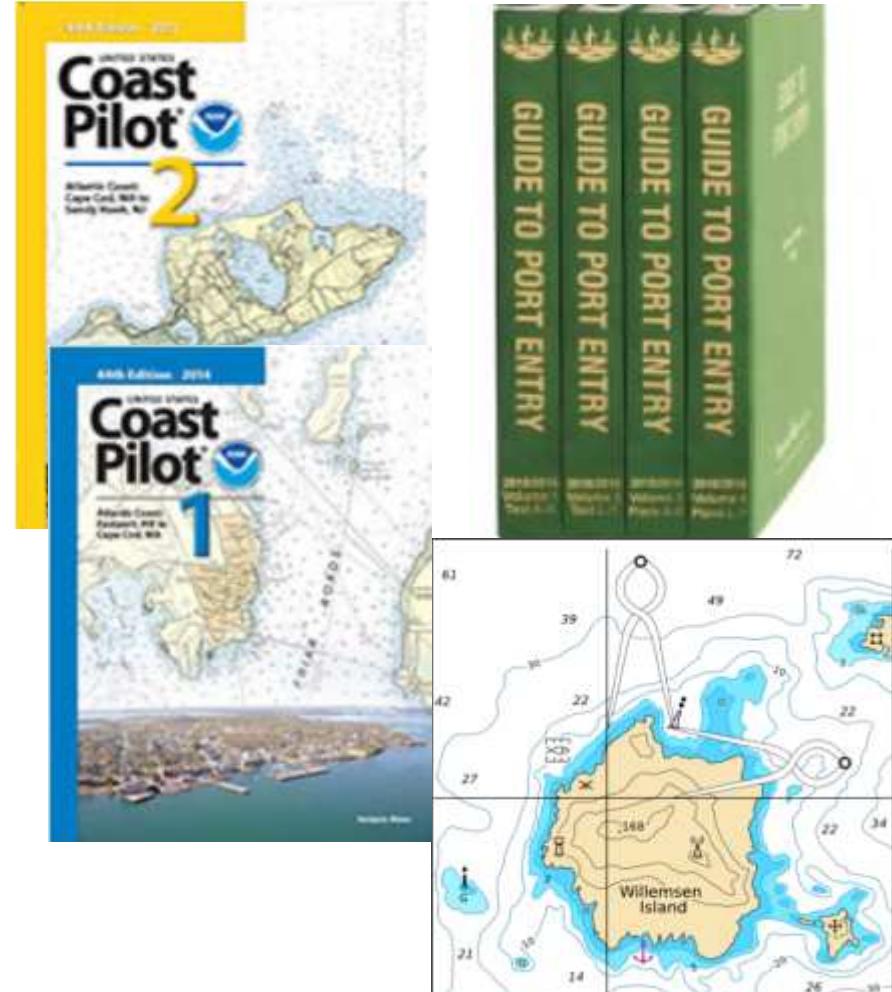


Anchoring in congested waters needs proper planning

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1. Preparing for anchorage

- Take into account available port specific information
 - Pilot books
 - “Guide to Port Entry”
 - Large scale charts
 - ECDIS
- Weather forecast for the anchoring period
- Pre anchoring brief with all involved parties, where all possible risks are evaluated



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2. Dropping the anchor

Three ways of lowering the anchor:

Vessel speed close to zero over ground

- **Let go of anchor**

- Anchor being let go from the hawse pipe or from sea level
 - Suitable for shallow waters (up to 20-25m) with soft sea beds

- **Lowering by the windlass and let go controlled by brake**

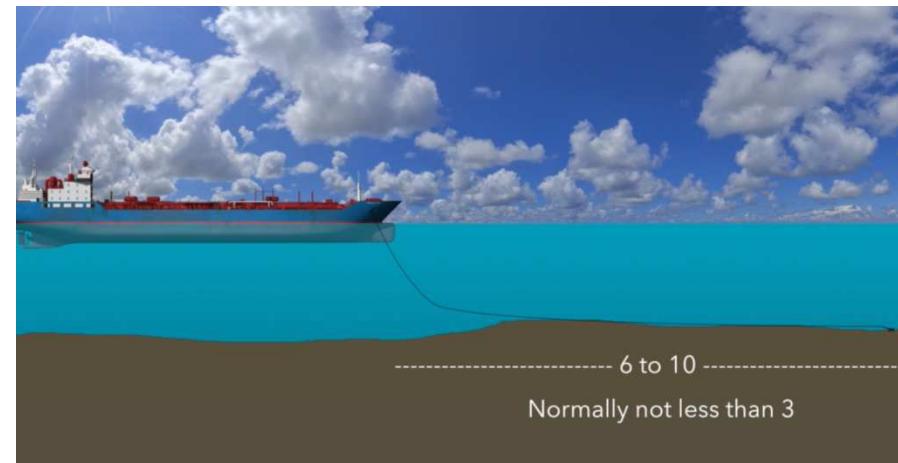
- The anchor is lowered by the windlass until 10-15 meters from bottom and then let go controlled by the brakes
 - Suitable for depth range 25 to 50 meter and for hard and rocky bottom where impact may damage the anchor



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2. Dropping the anchor cont.

- **Lowering down by the windlass to bottom**
 - Anchor chain is lowered by the windlass motor to the bottom
 - Suitable for depths more than 50 meters and when the sea bed is rocky
- **Length of laid out anchor chain**
 - If the anchor is “walked out” by the ship engine it is essential that the astern speed is not exceeding the speed of the anchor winch Normally max 0,3 knots
 - In order to ensure maximum holding power of the anchor, the chain on the seabed needs to be horizontal
 - Class guidance to ensure this is a scope of 6-10



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3. At anchorage

- Define the limiting wave / wind exposure based on the current at the location
- Monitor the weather forecast
 - In case heavy weather approaching, leave the anchorage in time
- When the anchor has been laid out, the chain stopper should be engaged and gear disconnected from the motor.
- Use all navigational equipment to ensure that the vessel is not dragging
- If vessel stays at anchor for a long time and current and wind swing the vessel, heave the anchor to avoid knotting the chain and fouling the anchor with own chain



Class rule environmental conditions:

- Current 2.5 m/sec
- Wind 25 m/sec
- **No waves**

Alternative environmental conditions:

- Current 1.5 m/sec
- Wind 11 m/sec
- Significant **wave height 2 m**

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4. Heaving the anchor

- **Leave anchorage in time!**
 - Heaving anchors up in strong wind and high seas is extremely challenging
 - Mistakes can easily lead to grounding or collision
- Minimize the tension in the chain keep the chain as vertical as possible
- In windy weather conditions or strong current the rudder and engine must be fine tuned to prevent too high tension in the chain and overload of the windlass motor
- Close communication between bridge and anchor watch on deck is essential

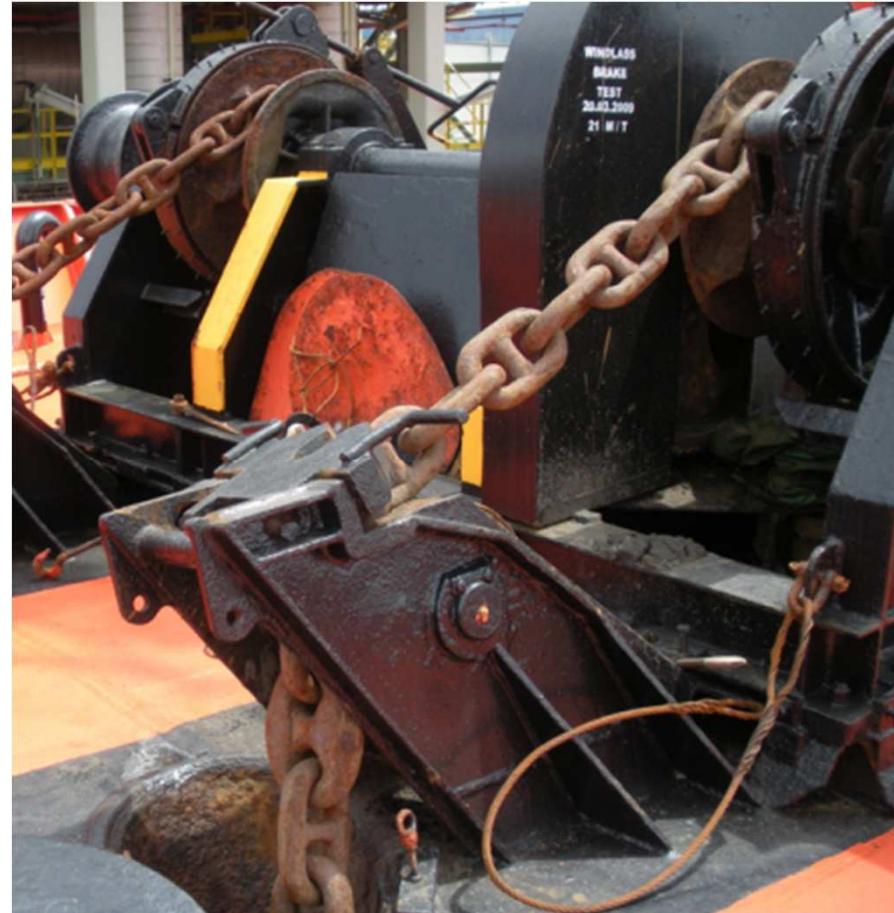


Proper attention to weather forecast is essential. Heaving anchor in heavy weather involves significant risks

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5. Preparing for departure

- Ensure the anchor is safely secured before sailing
 - The anchor to be securely stowed in the hawse pipe
- Excessive slack may cause “hammering” of the anchor to the ship hull and loss of the D-shackle securing pin.
 - Winch brakes have to be applied
 - Chain stoppers to be engaged
 - Further secured with lashings with turnbuckles or other similar fasteners
 - Windlass clutch has to be disconnected from the gear at sea to avoid risk of damage

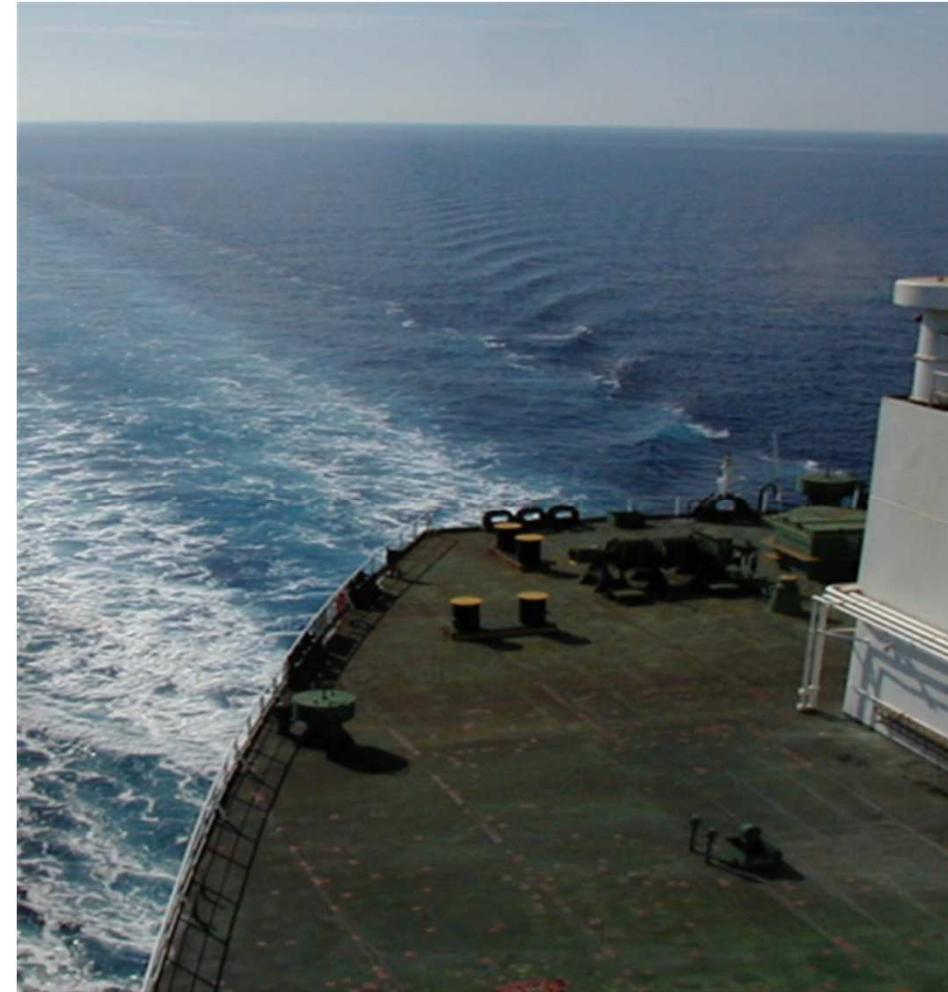


Chain stopper arrangement

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Main learnings!

- The environmental limitations
- The depth limitations
- Securing of the D-shackle
- The condition of the anchor winch brakes
- Well implemented routines for anchoring operation
 - Planning the anchorage
 - Dropping the anchor
 - At anchorage
 - Heaving the anchor



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For further guidance...



Oil Companies International Marine Forum

Anchoring Systems and Procedures

First Edition - 2016

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46 DNV GL © 2016

29 February 2016

Loss of anchors and chain

Gard News 201, February (page 6) 2011

Loss of anchor and chain

Loss has occurred as a result of anchor failure. This Club experienced similar cases prior with ships of our own size, these resulted in significant damage to the ship and the cost of repair was high.

Another anchor lost - this time a drogue

(Photo courtesy of the Torme AG)

Most "near miss" stories involving anchor failure are not serious. Major (and more) port callatory messages that have been issued from this year point to the same basic "check anchor" issues again. "Droge deployed" issues are those most related to port safety and efficiency, perhaps owing to the long periods of deployment involved, longer than the applicable regulations.

The unbroken rule

It has been the case for many years that "An anchor must be paid out, never paid back" (unless it has been dropped). This is a common sense rule, serving the interest of owners, charterers, managers, and all those through "owning" of the ship itself. The unbroken rule may break and, accordingly, who The author would warn:

It follows that, only applying as the "unbroken" rule is not strong, and when a part of the load losses it may be due to weak connection or in case of damage to the part. Good insurance practice and common sense has it that the anchor should always be paid out and that the time to pay attention is always part of the anchor deployment. This is the case when the anchor is deployed in a chain, or when the anchor is deployed over deck parts to ensure that they do not pierce the ship's bottom. Care is however not required if the unbroken rule is followed, as the anchor will always be deployed in the correct way, and a timely offing to port is a part of the discipline.

Some important details to the reader: the anchor must be paid out and the anchor's connection of

http://Gard Newsletter 2011



Appendix – Safety Scenario Loss of Anchor (The Swedish Club)

- Case study loss of anchor
- Monthly Safety Scenario - Loss of Anchor – The Swedish Club



Monthly Safety Scenario
(October 2015)

Loss of anchor

The vessel was waiting for its berth to become available so it was decided to anchor. A pre-anchor briefing was held on the bridge where how many shackles to be used was discussed; and what different tasks the crew had during the anchoring operation. One week earlier the master had inspected the windlass including the brake linings and had reported that all was in good condition.

The weather forecast warned about rough weather the following day. The master informed the bridge team that he would decide what to do later on.

The anchoring party consisted of the chief officer, bosun and two ABs. The bosun was controlling the boat; the chief officer was reporting what was happening to the bridge, and giving orders to the bosun and ABs. This was the first time the crew had anchored at this anchorage.

The vessel approached the dedicated anchor position that the VTS had given them. When the vessel was fully stopped the chief officer ordered the bosun to walk the anchor out using the stanchion model. When the anchor was about half a shackles above the seabed the anchor was let go. All went well and the crew reported their normal duties when the vessel was safely secured.

During the night the weather deteriorated. The DOW noticed that the vessel started to move and realized that the vessel was dragging. He called the master who came up on the bridge. The weather was now rapidly deteriorating and the master woke up the chief officer and told him to assemble the anchor party to deal with the anchor.

The weather had now increased and the sea was churning high waves. Suddenly, while the anchor heaved up the windlass motorized officer could see smoke coming from motor. It was obvious that it had not fired straight away. At the weather was deteriorating even further that the anchor chain had broken. When the chain had been cut the anchor and shifted in a safe compartment.

The anchor and chain was lost. I allowed to continue its journey and chain had been replaced. It took several days.

The port authorities who dorm anchor should be recovered. A sub-hire was hired to retrieve the lost anchor.

Discussion

Go to the "File" menu and select "Save as..." to save the pdf-File on your computer. You can place the marker below each question to write the answer directly into the file.

1. What were the immediate causes of this accident?

2. Where does the chain of events start?

3. What is the risk of this type of accident happening to our vessel?

4. Are our anchoring procedures sufficient to deal with problems like this?

5. Is maintenance for anchoring equipment in the PMIS sufficient?

6. What are the environmental parameters for leaving the anchorage?

7. What is the maximum depth that our anchoring equipment is designed for?

8. How could this accident have been prevented?

9. What actions of our SMS were breached if any?

10. Is our SMS sufficient to prevent this accident?

11. If procedures were breached, why do you think this was the case?

12. Do we have Risk Assessment procedures in place that address these risks?

13. Would a work permit have identified these risks?

14. What do you think is the root cause of this accident?

http://www.swedishclub.com/media_upload/files/Loss%20Prevention/MSS%20Cases/Loss%20of%20Anchor_October%202015.pdf

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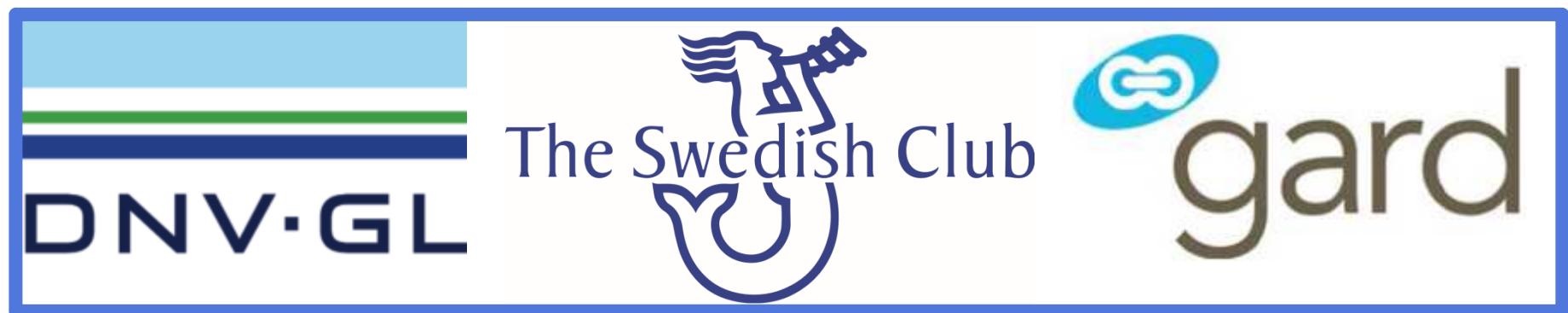
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