

UNOLS RVSS APPENDIX A TRAINING WORKSHOP

Rope and Cable Safe Working Standards

October 2016



Presenting key aspects of attaining Appendix A compliance
See the appendix for all the details

Agenda

- General
- Equipment Requirements
- Deck Safety
- Testing and Maintenance
- Operator Training and Record Keeping
- Logbooks
- Encouraged Actions, but not expressly Req'd
- Waiver Procedures

Purpose of Appendix A

The major purposes of RVSS Appendix A are:

- 1.To establish safe and effective operating limits for vessels in the UNOLS fleet for tension members loaded beyond traditional shore-side limits
- 2.To define the requirements, which must be adhered to during over-the-side deployments in order to maintain a safe working environment for all personnel aboard.
- 3.To minimize damage to tension members and handling equipment, and the loss of scientific equipment, while still permitting the science objective to be met.

Application of Appendix A

1. Appendix A applies to steel tension members only.

2. There are sections reserved for synthetic tension members, but they have not been added to date.

Limitations

- 1. Appendix A places limits on the amount of tension one may place on a wire rope/cable during a deployment.**
- 2. Loading limitations are expressed in terms of Factor of Safety (FS) on Assigned Breaking Load (ABL)**
- 3. Limits may not be used where other regulations are applicable**
- 4. This standard assumes that the tension member is properly used for its intended purpose.**

Actions

1. **Appendix A dictates actions that must occur before, during, and after a deployment takes place**
2. These include administrative, operational, and maintenance actions

- Acronyms and definitions will be provided as we progress through the presentations.
- There are definitions at the beginning of Appendix A and some of these are also used for Appendix B.
- A list of Acronyms is listed at the end of RVSS

Appendix A and Appendix B

- Appendix A is the Rope and Cable Safe Working Standards (Is the rope or cable selected, strong enough, maintained, and operated to safely conduct science?)
- Appendix B is the Load Handling Design Standards (Is the overboarding system selected, strong enough, maintained, and operated to survive a fouled payload?)

The Limit for Rope or Cable Tension

- Safe Working Tension (SWT):
- The maximum tension that is allowed to be applied to the tension member during normal operation.
- “Tension member” is the generic name used to describe a rope or cable in service for over the side work

Load Terms:

- **Tested Breaking Load (TBL)**
- The actual load required to pull a tension member to destruction as determined by testing.
- Depending on the intended use of the tension member testing may need to be done under “fixed end” and “free to rotate conditions”.

Load Terms:

- **Nominal Breaking Load (NBL)**
- Manufacturer's minimum published breaking load for a rope or cable.

Load Terms:

- **Assigned Breaking Load, (ABL)**
- The lowest of the Nominal Breaking Load and Tested Breaking Load.
- In practice ABL will be equal to NBL used unless testing shows TBL to be less than NBL.
- An ABL that is greater than the NBL may never be used.

Fixed Ends and Free to Rotate

- **Fixed Ends:** Both ends of the tension member being fixed without the ability to swivel.
- Most wire rope and cable NBL values are based on FE.
- An example of a fixed end application is towing a MOCNESS.

Fixed Ends and Free to Rotate

- **Free to Rotate:** The end of the tension member is free to rotate either because a swivel is at the end of the tension member or the package at the end of the tension member can rotate freely.
- Typically have a NBL below the fixed end NBL. An example of a free to rotate application is a lowered CTD package.

Factor of Safety (FS)

- Factor of Safety is the ratio of the maximum stress that a structural part of other piece of material can withstand to the maximum stress estimated for it in the use for which it is designed.
- For the purposes of this standard, FS shall be considered the value selected by the operator.

Factor of Safety (FS)

- Three FS levels are available for cable, and four for wire rope.

Factor of Safety

5 or greater	Both
Less than 5 to 2.5	Both
Less than 2.5 to 2.0	Both
Less than 2.0 to 1.5	Wire Rope

Safe Working Tension (SWT)

- The maximum tension that is allowed to be applied to the tension member during normal operation.
- $SWT = ABL / FS$
- Because there may be two different ABLs (fixed end & free to rotate) there may be two SWTs.

Extenuating Circumstances

- Ship operators and their seagoing staff must understand that if, by force of circumstance or by the desire to maintain scientific operations while on a cruise, when they do not meet the operating requirements as described in tables 8.1 through 8.4, they are embarking on a potentially dangerous activity.

Extenuating Circumstances

- The consequences of this activity could be:
- loss of valuable equipment
- damage to the vessel and its equipment
- injury to personnel.

Extenuating Circumstances

- Extenuating Circumstance Plan:
- Operators shall develop a procedure on how, and under what circumstances, the vessel will safely continue operations in the event the operating requirements are not met.

Extenuating Circumstances

- Extenuating Circumstance Plans:
- **RV Barnes** developed initial plans for 4 emergency scenarios while overboarding science gear including: tension member in propeller, package stuck on the bottom, winch failure, and loss of ship's power.

Extenuating Circumstances

1. Tension Member in Screw

- a. All science party off aft deck.
- b. Notify bridge
- c. Drop Anchor
- d. Pay out wire
- e. Buoy Wire and cut if necessary
- f. Call Divers

2. Package Stuck on Bottom

- a. All science party off aft deck.
- b. Notify bridge
- c. Pay out wire
- d. Buoy Wire and cut if necessary
- e. Call Divers

3. Winch Faliure

- a. All science party off aft deck.
- b. Notify bridge
- c. Pay out wire
- d. Buoy Wire and cut if necessary
- e.

4. Loss of Ship Power

- a. All science party off aft deck.
- b. Notify bridge
- c. Pay out wire
- d. _____

Equipment Requirements for Factor of Safety Selection

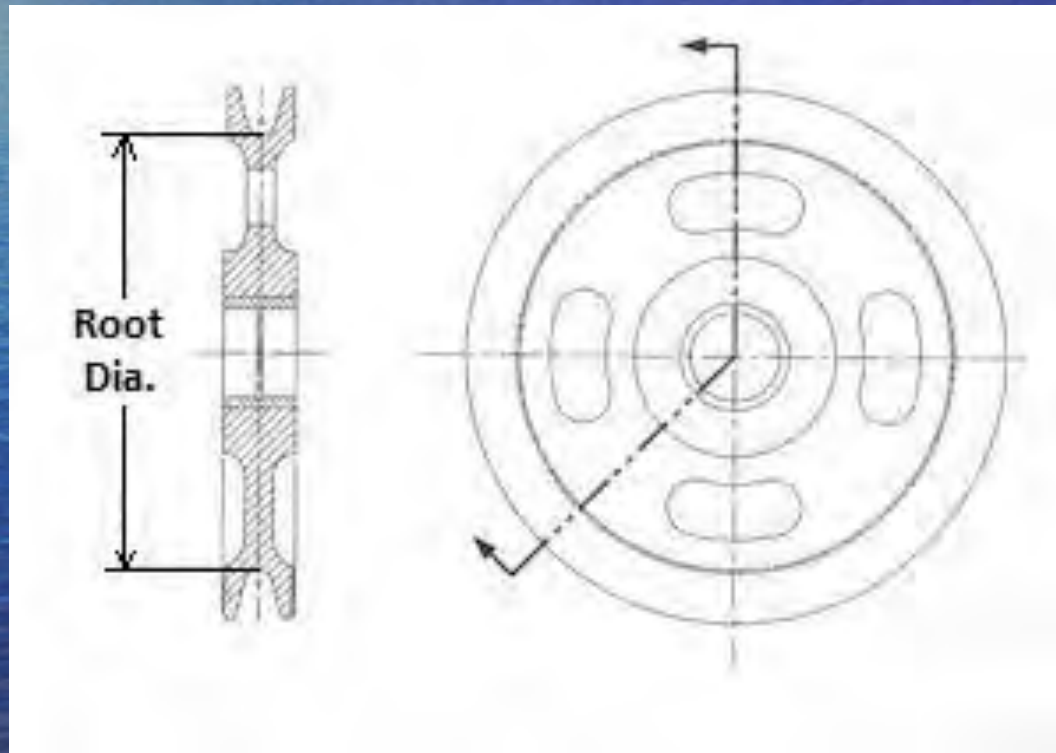
- Sheaves and Rollers
- Tension Monitoring
- Alarms

Equipment Requirements for FS Selection: Sheaves

- Minimum Sheave Diameter:
 - For $FS > 5.0$: as large as practicable
 - For $FS < 5.0$: D at least $40*d$
 - : D at least $400*d_1$
 - Whichever greatest

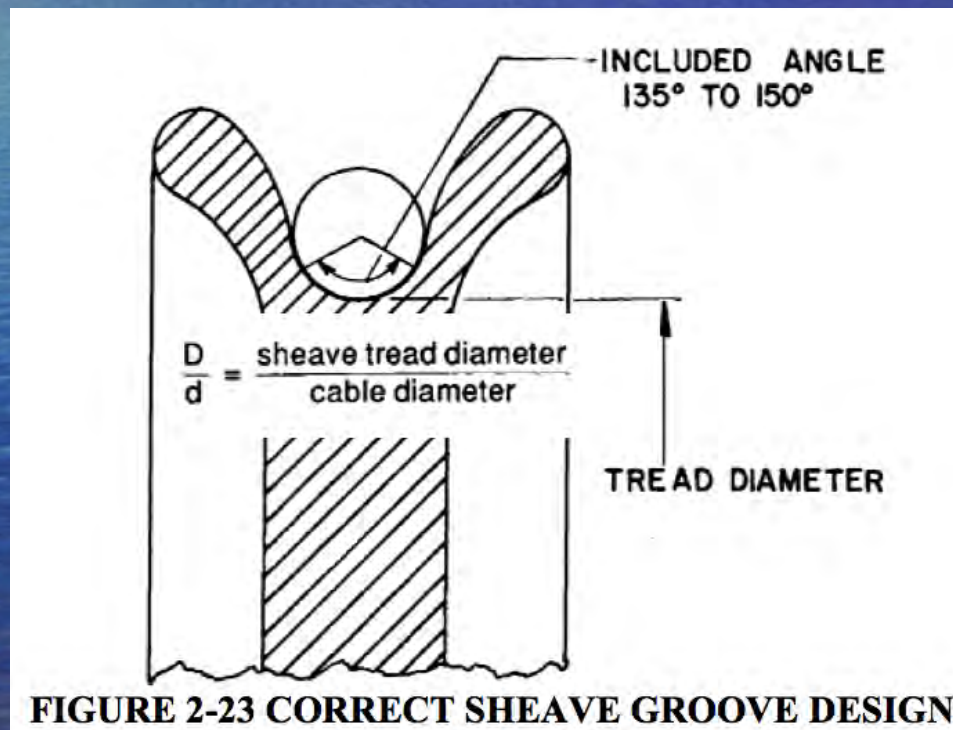
Equipment Requirements for FS Selection: Sheaves

- Minimum Sheave Diameter: D or Root Dia.



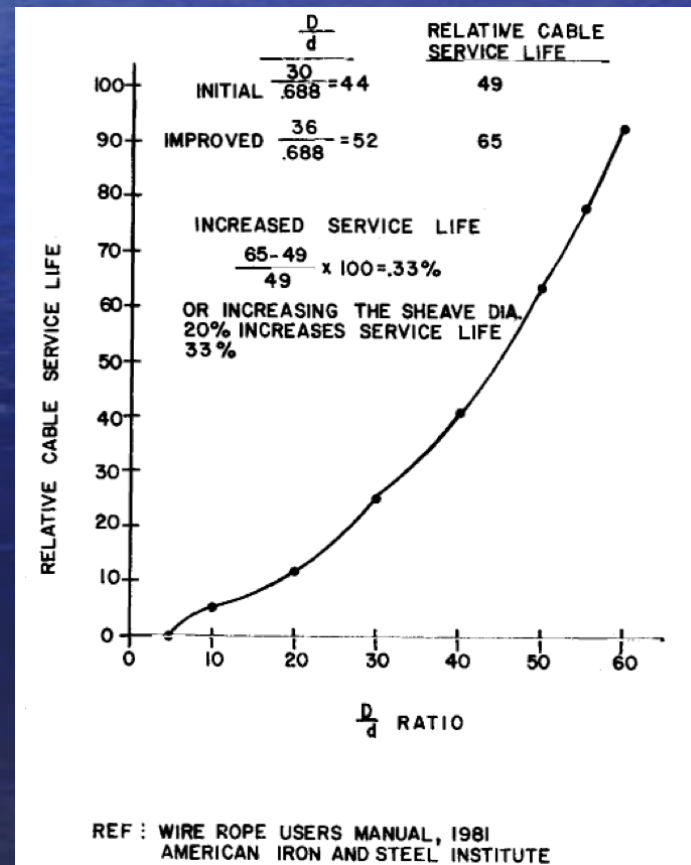
Equipment Requirements for FS Selection: Sheaves

- Minimum Sheave Diameter: or Thread Dia.



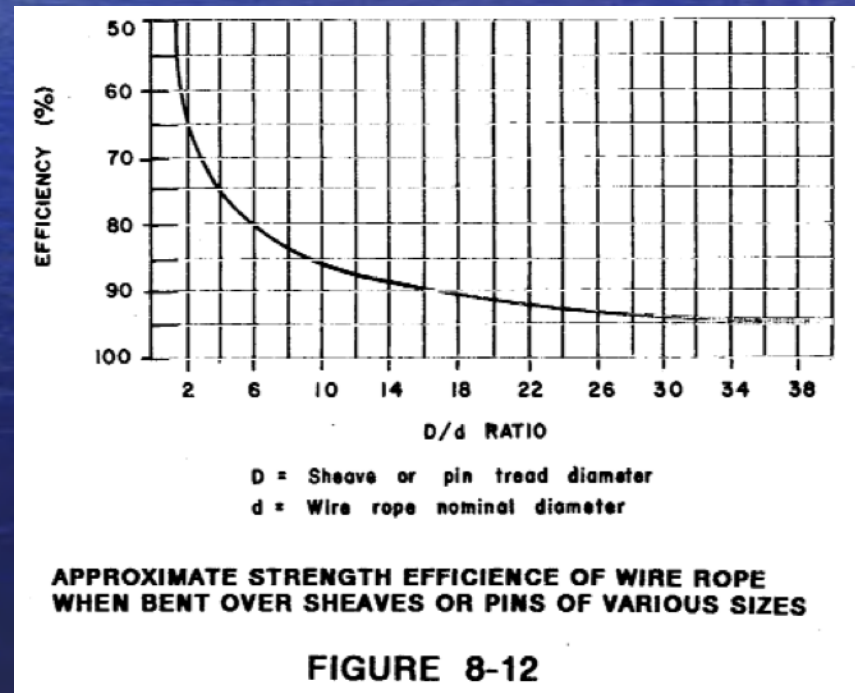
Equipment Requirements for FS Selection: Sheaves

- Importance of Sheave Diameter:
- Service Life:
- i.e. 20% Dia.
- SL 33%



Equipment Requirements for FS Selection: Sheaves

- Importance of Sheave Diameter:
- Strength Efficiency:
- Statically Loaded
- Dynamically Less



Equipment Requirements for FS Selection: Sheaves

- Sheave Diameters for some UNOLS

tension members:

- With $FS < 5.0$

- Note: Mfgr 0.681

- Recommends 48"

1/4" 3x19	12.4"
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1/2" 3x19	23.2"
-----------	-------

9/16 3x19	26.4"
-----------	-------

0.322"	15"
--------	-----

0.680"	27.2"
--------	-------

0.681"	27.24"
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Equipment Requirements for FS Selection: Rollers

- Rollers have same diameter requirements as sheaves.
- Rollers do not support the tension member as well as the groove in sheaves and the tension member cross section deforms to become elliptical.
- Thus wrap angles should be minimized.

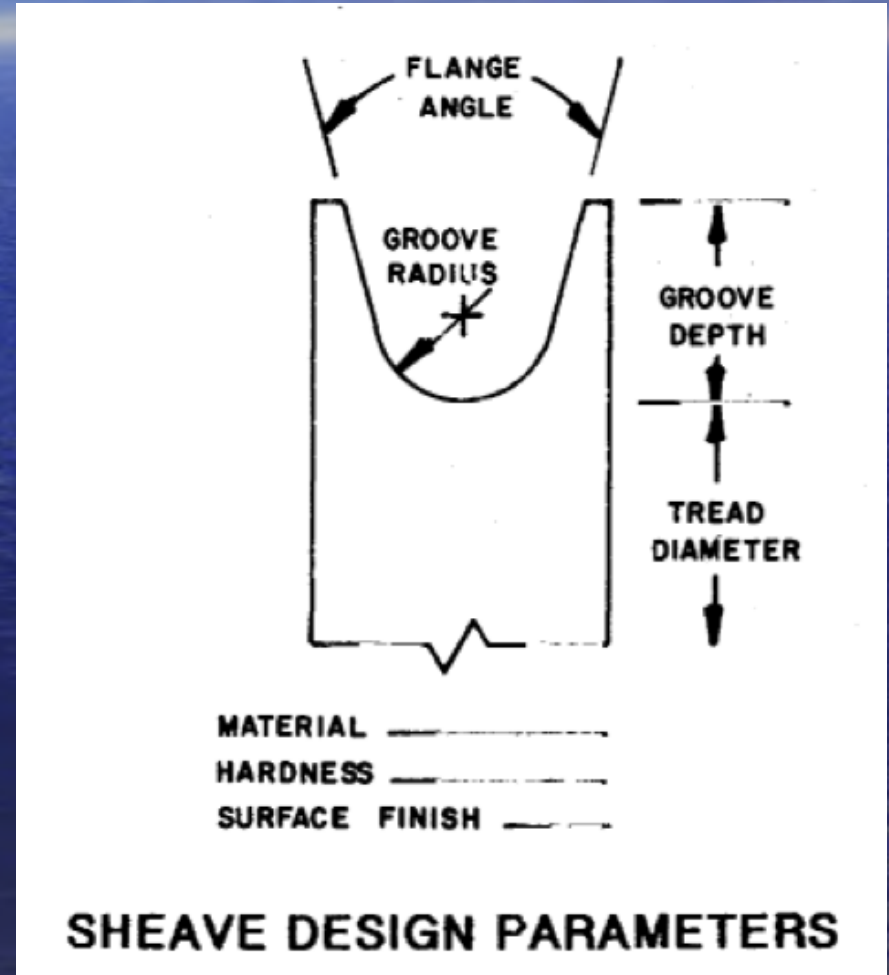
Equipment Requirements for FS Selection: Rollers

- Sense rollers, capture rollers, & guides do not need to meet the Diameter requirements.
- The cable does not bend around them while under load.



Equipment Requirements for FS Selection: Sheaves

- Sheave Grooves:
- Provides support 135 to 150 degrees
- Groove radius not too large or too small.



Equipment Requirements for FS Selection: Sheaves

- Limited to FS of 5.0



Equipment Requirements for FS Selection: Sheaves



Equipment Requirements for FS Selection: Sheaves

- Grooves in sheaves and drums should be slightly larger than the rope:
- In order to avoid pinching and binding of the strands.
- To permit the tension member to adjust itself to the radius of curvature.

Equipment Requirements for FS Selection: Sheaves

- Grooves of too large diameter do not properly support the rope, and permit it to become elliptical.

Equipment Requirements for FS Selection: Sheaves

- Sheave Groove diameters for FS levels
- FS >5.0: none specified
- $2.5 < FS < 5.0$: No larger than $1.5d$

Equipment Requirements for FS Selection: Sheaves

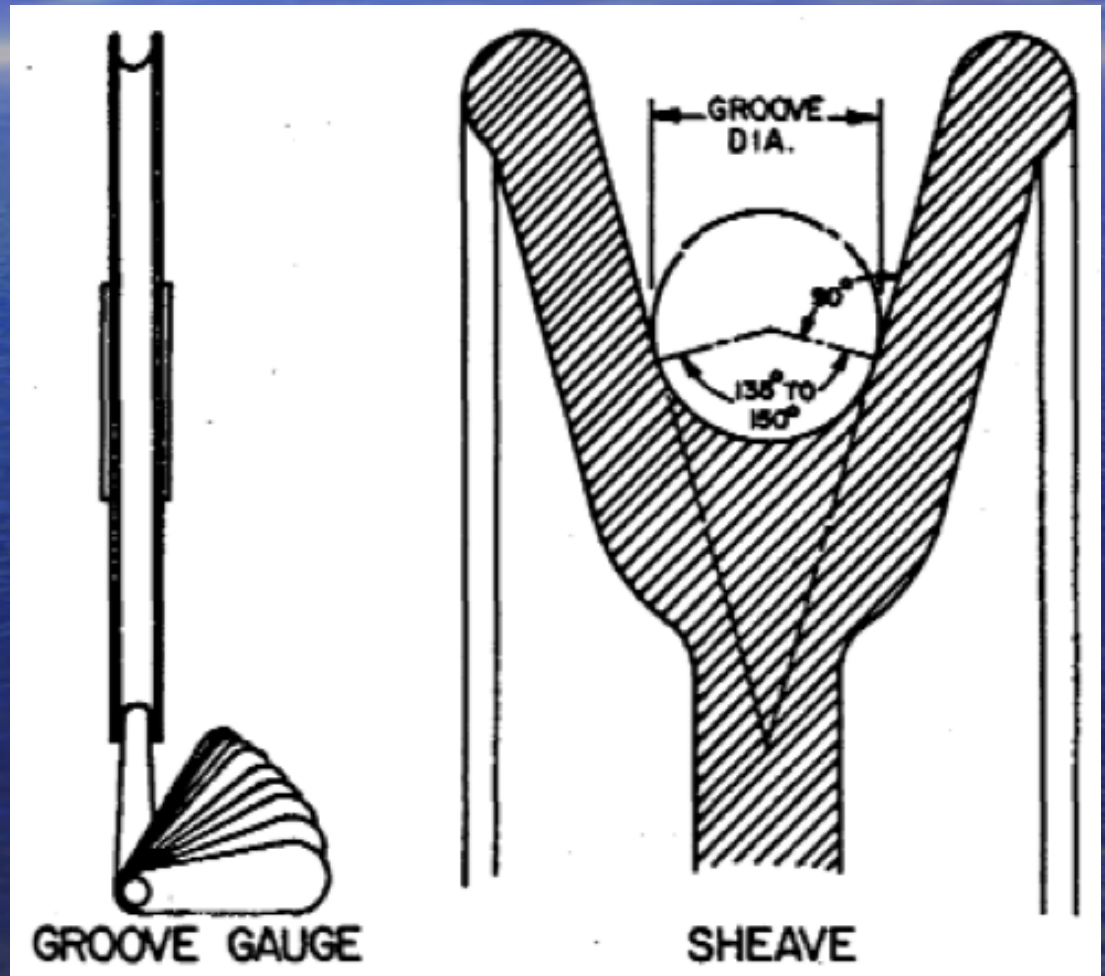
- Sheave Groove diameters for $FS < 2.5$

**Tolerance Groove Diameter Should Exceed
Nominal Rope Diameter**

<u>Nominal Diameter of Rope in Inches</u>	<u>Minimum (%)</u>	<u>New or Remachined Grooves (%)</u>
0 to 1/8	4	8
Over 1/8 to 3/16	3.5	7
Over 3/16 to 1/4	3	6
Over 1/4	2.5	5

Equipment Requirements for FS Selection: Sheaves

- Sheave Groove Gauge



Equipment Requirements for FS Selection: Sheaves



Equipment Requirements for FS Selection: Sheaves

Wire Pool
Groove Gauge
For UNOLS
Wire Rope

Tension Member	Safety Factor	Condition	Units	Radius	Diameter
1/4	1.5<SF<5	Worn Min Radius	inches	0.129	0.258
1/4	1.5<SF<2.5	New Min Radius	inches	0.133	0.266
1/4	1.5<SF<2.5	New Max Radius	inches	0.138	0.276
1/4	2.5<SF<5	Max Rad	inches	0.188	0.376
3/8	1.5<SF<5	Worn Min Radius	inches	0.192	0.384
3/8	1.5<SF<2.5	New Min Radius	inches	0.197	0.394
3/8	1.5<SF<2.5	New Max Radius	inches	0.206	0.412
3/8	2.5<SF<5	Max Rad	inches	0.281	0.562
1/2	1.5<SF<5	Worn Min Radius	inches	0.256	0.512
1/2	1.5<SF<2.5	New Min Radius	inches	0.263	0.526
1/2	1.5<SF<2.5	New Max Radius	inches	0.275	0.550
1/2	2.5<SF<5	Max Rad	inches	0.375	0.750
9/16	1.5<SF<5	Worn Min Radius	inches	0.288	0.576
9/16	1.5<SF<2.5	New Min Radius	inches	0.295	0.590
9/16	1.5<SF<2.5	New Max Radius	inches	0.309	0.618
9/16	2.5<SF<5	Max Rad	inches	0.422	0.844

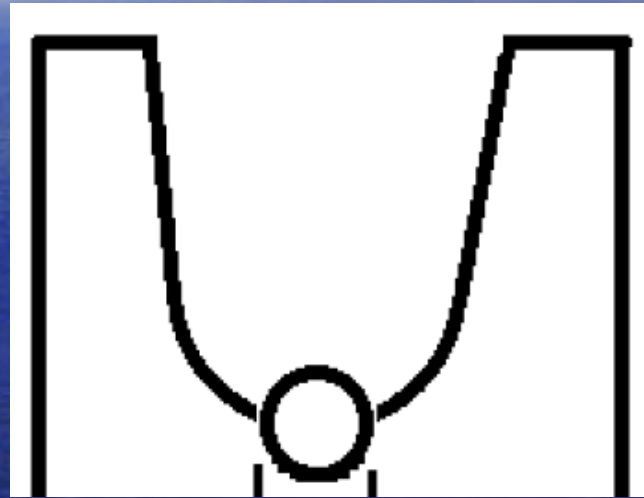
Equipment Requirements for FS Selection: Sheaves

Wire Pool Groove Gauge For UNOLS Cable

Tension Member	Safety Factor	Condition	Units	Radius	Diameter
0.322	2.0<SF<5	Worn Min Radius	inches	0.165	0.330
0.322	2.0<SF<2.5	New Min Radius	inches	0.169	0.338
0.322	2.0<SF<2.5	New Max Radius	inches	0.177	0.354
0.322	2.5<SF<5	Max Rad	inches	0.242	0.484
.680/.681	2.0<SF<5	Worn Min Radius	inches	0.349	0.698
.680/.681	2.0<SF<2.5	New Min Radius	inches	0.357	0.714
.680/.681	2.0<SF<2.5	New Max Radius	inches	0.374	0.748
.680/.681	2.5<SF<5	Max Rad	inches	0.510	1.020

Equipment Requirements for FS Selection: Sheaves

Groove Radius
gets smaller
with use:



Equipment Requirements for FS Selection: Sheaves

The tension member should not contact other surfaces:



Equipment Requirements for FS Selection: Sheaves

Groove Radius gets smaller with use:

Caution when installing new tension members.

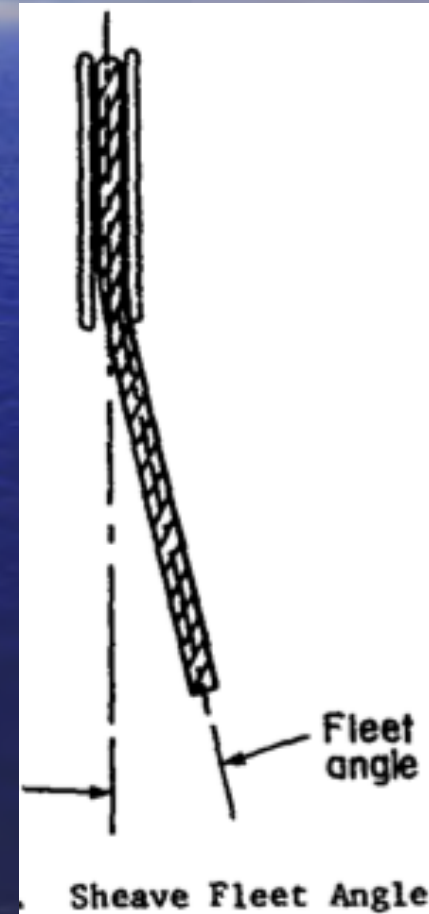
Caution when end or ending tension members

Caution when planning for deep casts

Associated Sheave Info: Not an Appendix Requirement

Sheave Fleet Angle
typically less the 1 ½
degrees.

Must have the correct
flange (or throat)
angle.



Associated Sheave Info: Not an Appendix Requirement

Sheave Fleet Angle
typically less than 1 ½
degrees.

Too Much Angle:



Equipment Requirements: Tension Monitoring and Alarms

Increasingly stringent as FS decreases.

For FS 5 or greater.

Tension monitoring not required, but if not available then estimated maximum tension (EMT) must be determined by calculation and FS must be 5 or greater during operations.

i.e. be confident $EMT < SWT$

Equipment Requirements: Tension Monitoring and Alarms

Estimated Maximum Tension (EMT):

An estimate of the greatest line tension that will occur during a given deployment.

It's calculated using specific properties of the OHS, the science package, and other factors.

Equipment Requirements: Tension Monitoring and Alarms

The EMT is the sum of:

static loads (package weight, sample weight, tension member weight),

quasi-static loads (drag force),

transient loads (pull out forces), and

dynamic loads (the effects due to accelerations from heave).

Equipment Requirements: EMT for FS of 5.0 if no monitoring

This is an assessment of the maximum tension that a payload can exert on a tension member during a deployment. The EMT is the sum of static loads (package weight, sample weight, tension member weight), quasi-static loads (drag force), transient loads (pull out forces), and dynamic loads (the effects due to accelerations from heave).

Equipment Requirements: EMT for FS of 5.0 if no monitoring



Equipment Requirements: EMT for FS@5.0 if no monitoring

<i>A grab is planned on 500m of 0.25" 3x19 wire rope using a FS of 5.0.</i>		
Assigned Breaking Load (Free to Rotate)	6,750	
Factor of Safety	5	
Safe Working Tension = ABL/FS	1,350	
Weight of Grab (in seawater)	175	
Weight of Sample (in seawater)	25	
Weight of wire rope (in seawater) = 0.284 lbs/m x 500m	142	
Static Total		342
Quasi-Static Load (drag)		35
Pound-mass of Grab (in air)	200	
Pound-mass of Entrained Mud (in air)	50	
Pound-mass of 500m of wire rope (in air) = 0.327 lbs/m x 500m	164	
Total Mass of System	414	
Dynamic Load (multiply Mass Total by 0.75 for g=1.75)		310
Transient Load Pull Out Load	100	100
Estimated Maximum Tension Pounds-force		787
<i>Because the estimated maximum tension of 787 pounds is less than the SWL of 1,350 pounds it is acceptable to proceed with this grab.</i>		

Equipment Requirements: Tension Monitoring and Alarms

FS less than 5 to 2.5:

Tension monitored at the operator's station with display refresh rate of 3 Hz.

Capable of logging tension data @ 3 Hz

Fitted with audible and visual alarms and activate at $FS=2.8$.

Alarm conditions automatically included in logged data.

Equipment Requirements: Tension Monitoring and Alarms

FS less than 5 to 2.5:

The tension measuring system must be calibrated at a minimum of every 6 months at load equal to the imposed at the selected FS.

Equipment Requirements: Tension Monitoring and Alarms

FS less than 5 to 2.5:

The tension measuring system must be maintained with an accuracy of 4% of the applied load.

i.e. Is the monitoring system staying within tolerance limits?

Equipment Requirements: Tension Monitoring and Alarms

Is the
monitoring
system staying
within
tolerance
limits?



Equipment Requirements: Tension Monitoring and Alarms

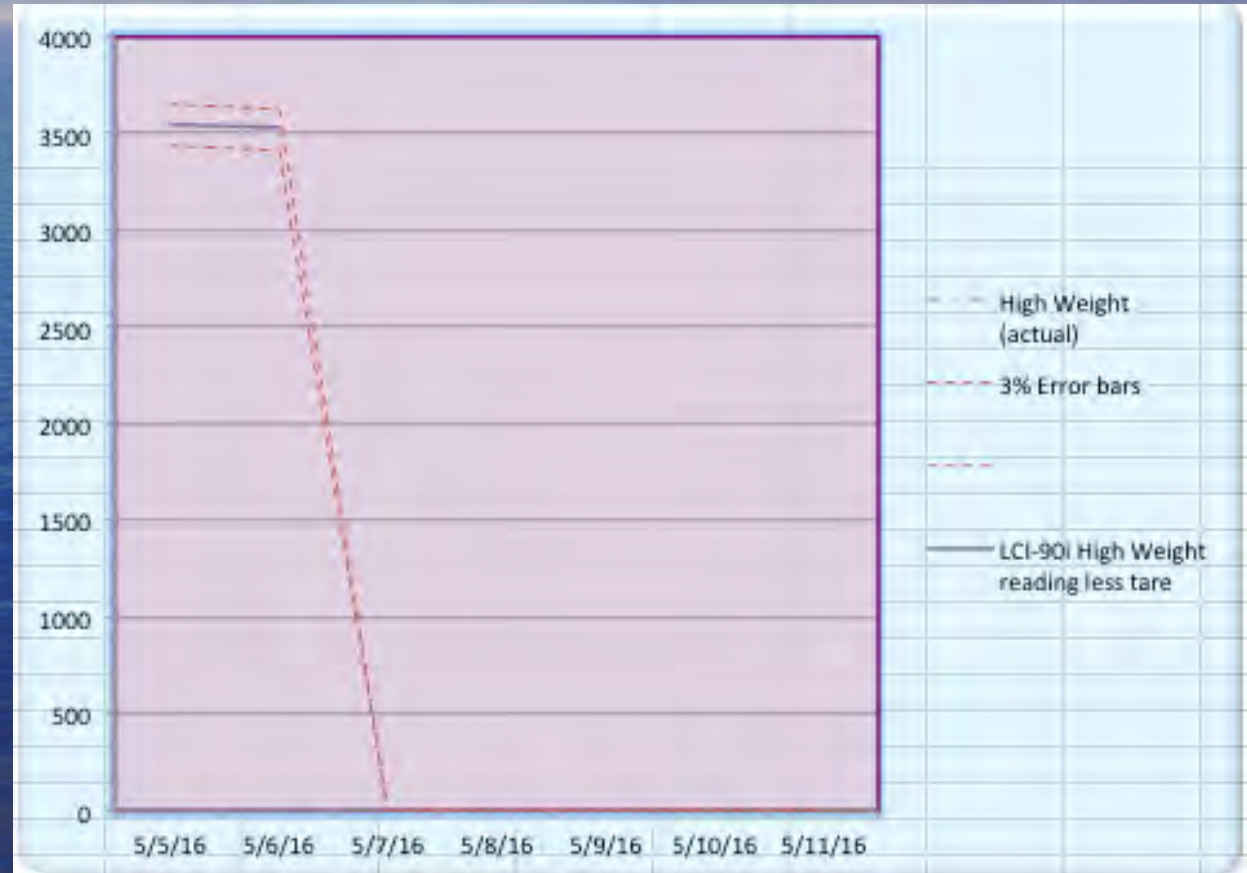
Is the
monitoring
system staying
within
tolerance
limits?

Alternate
Loading.



Equipment Requirements: Tension Monitoring and Alarms

Is the
monitoring
system
staying
within
tolerance
limits?



Equipment Requirements: Tension Monitoring and Alarms

FS less than 2.5 to 2.0:

Tension Trending Graph at the operator's station with display refresh rate of 10 Hz.

Capable of logging tension data @ 20 Hz.

Fitted with audible and visual alarms and activate at FS=2.2.

Alarm conditions automatically included in logged data.

Equipment Requirements: Tension Monitoring and Alarms

FS less than 2.0 to 1.5:

Tension Trending Graph at the operator's station with display refresh rate of 10 Hz.

Capable of logging tension data @ 20 Hz.

Fitted with audible and visual alarms and activate at FS=1.7.

Alarm conditions automatically included in logged data.

Equipment Requirements: Tension Monitoring and Alarms

FS less than 2.5 to 1.5:

The tension measuring system must be calibrated at a minimum of every 6 months at load equal to the imposed at the selected FS.

The tension measuring system must be maintained with an accuracy of 3% of the applied load.

Equipment Requirements: Tension Monitoring and Alarms

Trending Graph
in latest LCI90i
upgrade:



Equipment Requirements: Tension Monitoring and Alarms

Trending Graph
Trevor Young
example from
RVTEC dialog:



Equipment Requirements: Deck Safety:

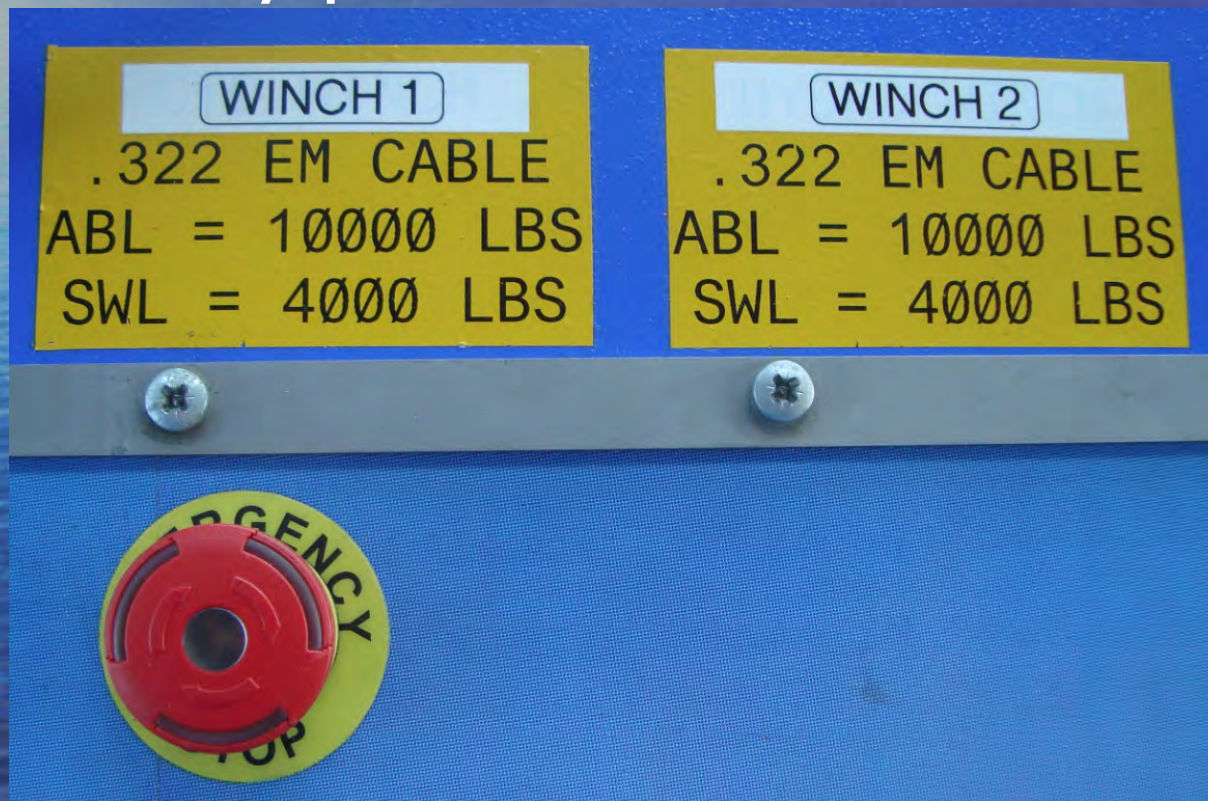
FS 5 or Greater:

Personnel on deck should follow good safety practices when working in the vicinity of tension members during use



Equipment Requirements: Deck Safety:

Good safety practice:



Equipment Requirements: Deck Safety:

FS less than 5:

The Operator should identify “Danger Zones” around ropes, wires and cables under tension.

To the extent possible, all personnel should be excluded from these zones such that a sudden failure cannot result in injury.

Equipment Requirements: Deck Safety: Chained off access



Equipment Requirements: Deck Safety: Safety Zone



Equipment Requirements: Deck Safety: Safety Zone



Equipment Requirements: Deck Safety:

FS 1.5 to 2.5: Additionally

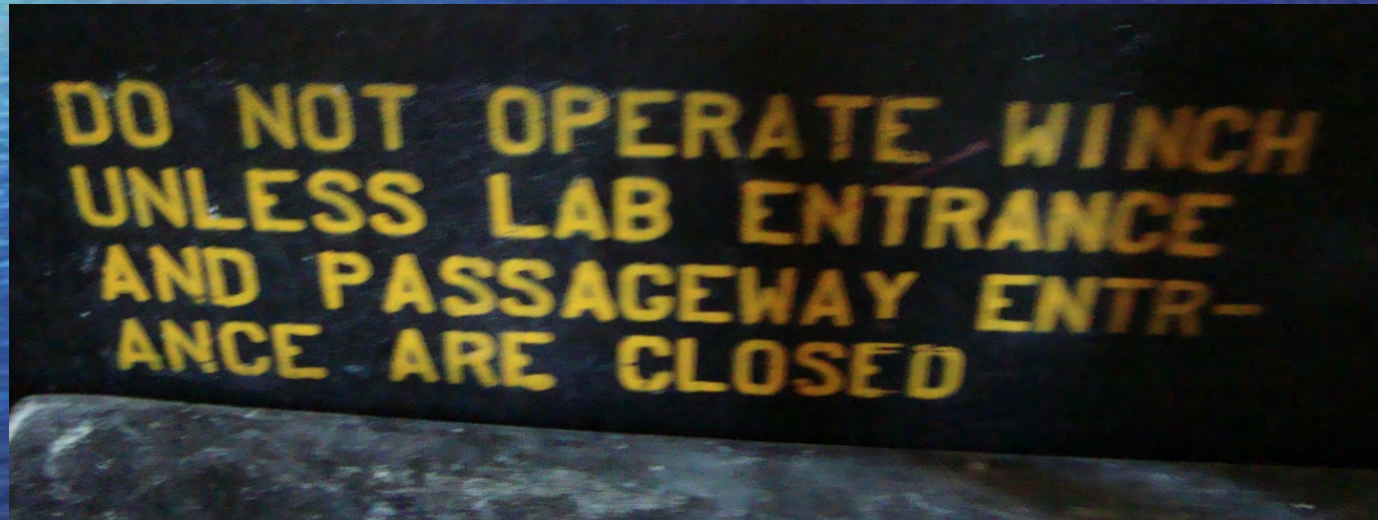
Warning notices should be displayed at points of access indicating the danger.

Physical and/or visual barriers should be erected as needed.

Equipment Requirements: Deck Safety:

FS 1.5 to 2.5: Additionally

Existing doors and accesses to the area should be secured when possible.



Testing and Maintenance:

- FS 5 or greater:
- Tension members shall only be tested every two years to the desired SWT, along with the handling system.
- No routine break testing is required.

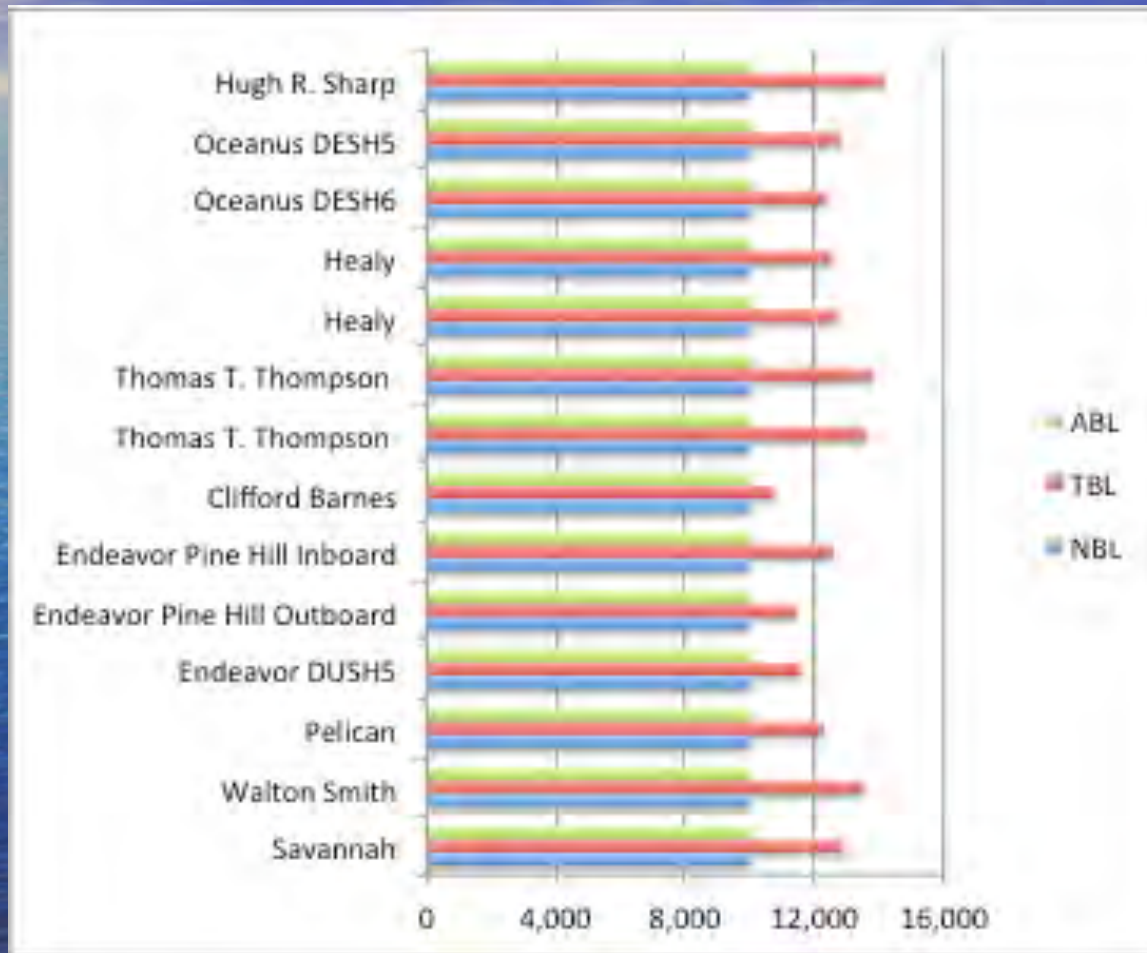
Testing and Maintenance:

- FS 2.5 to 5
- Samples shall be sent for testing every two (2) years. If a 10% decrease in ABL is detected, then the testing shall be increased to annually. Alternately, the Owner may cut back to and re-test a new representative length

Testing and Maintenance:

- FS 2.0 to 5
- Samples shall be sent for testing every two (2) years.
- If a 10% decrease in ABL is detected, then the testing shall be increased to annually.
- Alternately, the Owner may cut back to and re-test a new representative length.

0.322 Cable NBLs, TBLs, & ABLs



Testing and Maintenance:

- FS 2.0 to 5:
- If a 10% decrease in ABL is detected, this would be very unusual.
 - A break test result below ABL is an indicator of a degraded tension member.
 - Evaluate Running Use Log Data
 - Evaluate e-kink test info
 - Contact wire pool

Testing and Maintenance:

- FS 1.5 to 2
- Samples shall be sent for testing every yr.
- If a 10% decrease in ABL is detected, then the testing shall be increased to semiannually.
- Alternately, the Owner may cut back to and re-test a new representative length.

Operator Training and Records

- FS 5 or Greater
- The Owner and the Master of the vessel must deem competent, in writing, all winch operators.

Operator Training and Records

- “Deemed Competent” means that both the Owner and the Captain are confident, given the particulars of the winch and the overall operational scenario (weather conditions, equipment being deployed, etc.), that the Winch Operator has the necessary experience to operate the winch safely.

Operator Training and Records

- FS 5 or Greater
- If there are configuration changes to controls or to the hardware then the operator qualifications must be refreshed and documented.

Operator Training and Records

- FS less than 5
- Operator “Certified Competent” it that the Owner must have written documentation in place showing that the operator has been through and successfully passed a formal owner/operator developed training program on the winch, handling apparatus, and monitoring system.

Operator Training and Records

- The certification must be renewed annually.
- The master shall verify certifications and designate the approved winch operators.
- If there are configuration changes to controls or to the hardware then the operator qualifications must be refreshed and documented.

Logbooks FS 5 or greater

- Logs stay with the tension members upon transfer
- Log of Tension Testing to SWL or Log of wire Break Testing
- Log Cutbacks
- Log Spooling Operations

Logbooks FS 5 or greater

- Log Spooling Operations
- Log of Lubrication Wire Train Description
- Maximum load and payout for each cast by calculation or monitoring.

Logbooks: Atlantic Explorer

- Maximum load and payout for each cast by calculation or monitoring.

Drop #	Drop Date & Time	Maximum Tension Per Cast (Lbs)	Maximum Payout of Each Deployment (Meters)
0	5/5/12 13:45	2987	0
1	5/8/12 2:34	1859	1000
2	5/9/12 2:06	1568	2000
3	5/9/12 22:06	2368	4572
4	5/10/12 2:08	1364	1100
5	5/11/12 2:41	2050	4353
6	5/11/2012 5:14	1502.9	1811.5
7	5/11/2012 19:41	2312.3	4617
8	5/12/2012 3:07	2016.9	4200.3
9	5/12/2012 23:00	1604.7	2000
10	5/13/2012 13:15	2859.1	4614.8

Logbooks for FS less than 5

- Logs stay with the tension members upon transfer
- ~~Log of Tension Testing to SWL or~~ Log of wire Break Testing
- Log Cutbacks
- Log Spooling Operations

Logbooks for FS less than 5

- Log Spooling Operations
- Log of Lubrication Wire Train Description
- Maximum load and payout for each cast by calculation or monitoring.

Logbooks: Sikuliaq Example

Wire Deployment Log:				RV Sikuliaq				
Cruise ID	Cast ID	Duration (HH:MM)	Max Wire Out (m)	Max LineSpeed (m/min)	Max Tension (lbs)	Time (@ max tension)	WireOut (@ max tension)	Events
SKQ201401S	1	2:23	1,011.1	51.0	1,802.9	11/27/14 23:43	-4.9	CTD
SKQ201401S	2	2:00	1,000.9	51.0	1,843.0	12/1/14 19:18	-9.5	CTD
SKQ201401S	3	1:30	1,000.0	54.2	1,642.6	12/2/14 13:44	-9.8	CTD
SKQ201401S	4	0:50	252.6	58.1	1,602.6	12/2/14 15:48	217.2	CTD
SKQ201401S	5	0:55	293.0	61.2	2,003.2	12/3/14 23:07	-4.6	CTD
SKQ201401S	6	1:45	1,385.2	51.0	2,003.2	12/4/14 1:28	-6.5	CTD
SKQ201401S	7	1:20	1,489.9	60.9	1,682.7	12/4/14 2:34	-11.0	CTD
SKQ201401S	8	1:42	1,232.3	60.9	2,003.2	12/6/14 7:03	-5.5	CTD
SKQ201401S	9	2:29	1,477.0	61.6	2,003.2	12/9/14 8:18	-6.1	CTD & wire wash

While Logging Maximum Load and Payout for Each Cast

(Not required by Appendix A)

- Consider also recording amount of tension member deployed where the maximum load occurs (As shown on previous slide).
- Consider referencing this as a distance from the drum end.
- Will not change with cut backs

Retirement of Steel Tension Members, or cutback:

- If the tension member does not meet future scientific mission requirements.
- Peak tension on sheaves at any time exceeds the elastic limit (FS of 1.8 for cable and FS of 1.33 for wire rope).
- ABL deteriorates below 50% of NBL (Close monitoring if TBL below NBL-my words)

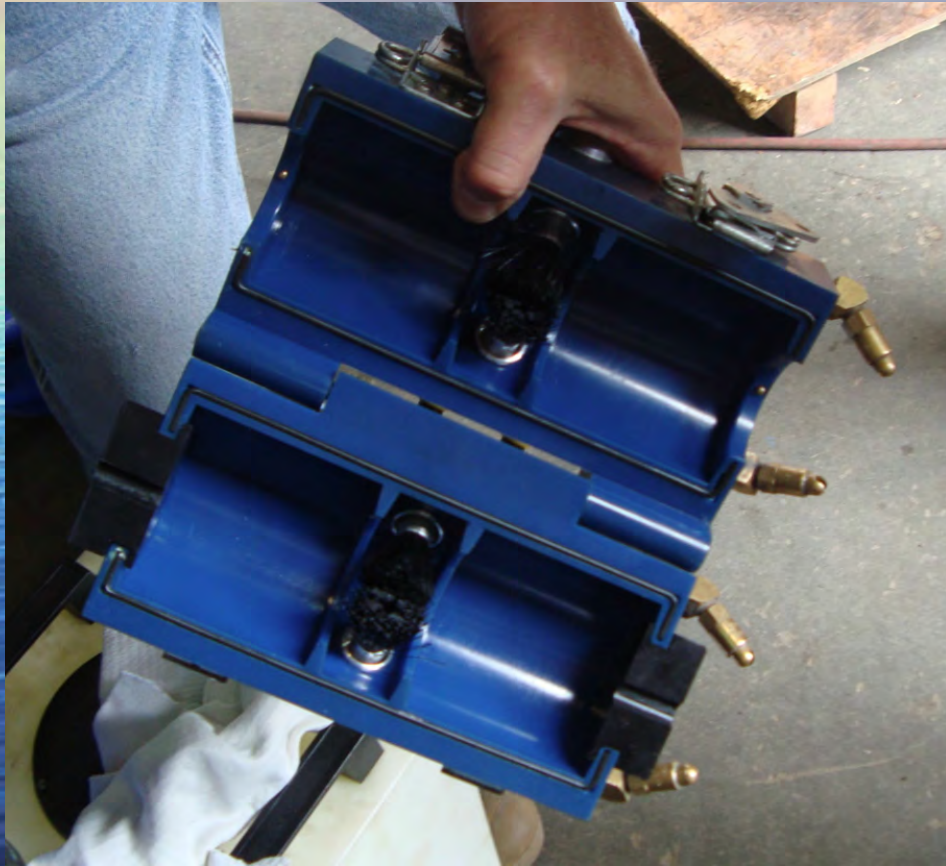
Retirement of Steel Tension Members, or cutback:

- Physical Damage including:
 - Kinks
 - Bird caging
 - Abrasion
 - Broken wires
 - Excessing corrosion

Encouraged Action, but not expressly required

- Lubricate tension member <12 months (A. 5.8)
- Referenced to the UNOLS Wire Maintenance Policy (Latest Jan 2015)
- Use Environmentally acceptable lubricants
- Extends tension member life several times

Encouraged Action, but not Lubricator Shell & Pump



Encouraged Action, but not expressly required

- Fresh Water Wash (A.5.9)
- End of every cruise and <month
- Referenced to the UNOLS Wire Maintenance Policy (Latest Jan 2015)
- Systems that automatically wash on haul back highly encouraged.

Encouraged Action, but not expressly required: FW Wash

- Automatic on Haul Back



Encouraged Action, but not expressly required: FW Wash

- Manual Remote Turn On and Off



Encouraged Action, but not expressly required:

- **Heave Compensation (A.7.2)**
- Motion-compensation may be used to reduce the dynamic loads below the permissible limit and/or to reduce the chances of a “zero load” condition.
- May not be used as a load limiting device

Encouraged Action, but not expressly required:

- **Load Limiting Devices (A.7.1)**
- **Weak Links:**
 - **Set to break the payload free to save the tension member , avoid overboating system damage, limit dangers to the vessel.**

Encouraged Action, but not expressly required:

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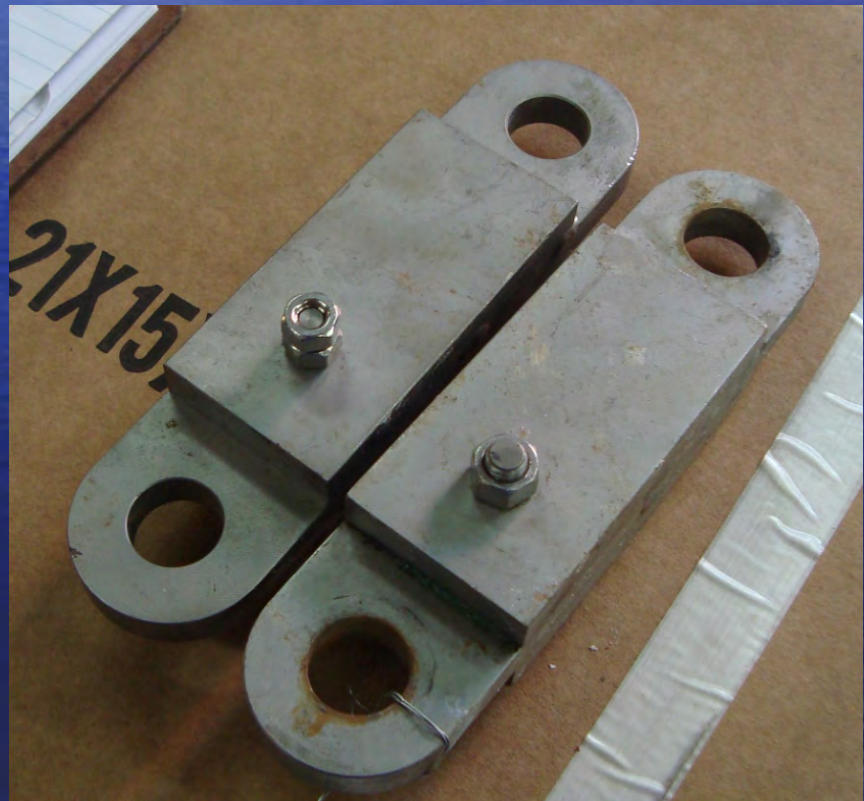
Encouraged Action, but not expressly required:

- **Load Limiting Devices (A.7.1)**
- **Weak Links: RVIB Palmer**



Encouraged Action, but not expressly required:

- **More Weak Links:**



Encouraged Action, but not expressly required:

- **Render:** The capability of the winch to automatically pay out at a pre-set maximum tension in order to prevent the tension member from exceeding the pre-set tension.

Where the weak link itself might be entangled or buried, then Auto-Render shall be the preferred method of strain relief.

RVSS Appendix A Compliance:

Appendix A Assist Summary for Each Wire or Cable

Appendix A Assist Summary for Each Wire or Cable (updated 8_25_2015 JMS/wec)						
Note: This is not all inclusive. See Appendix A RVSS Edition 10 for requirements.						
Requirement or Attribute	Select Applicable Column FS				FS=	Comments
	FS of 5.0 or higher	FS from 2.5 to 4.99	FS from 2.0 to 2.49	FS from 1.5 to 1.99		
Post Cable/Wire SWL in clear view of the winch operator (RVSS 8.6)	Applies	Applies	Applies	Applies	Y/N	
General						
Determine Cable/Wire Safe Working Load (SWL) as: Assigned Breaking Load / Factor of Safety	Applies	Applies	Applies	Applies	Y/N	
Lubricate tension member <12 months (A.5.8)					Y/N	
Fresh Water Wash (lesser of: end of cruise or < 1 month) (A.5.9)					Y/N	
Develop Extenuating Circumstance Procedure (A.8.4)	Applies	Applies	Applies	Applies	Y/N	
Tension Monitoring						
Have ability to keep load < SWL: May be calculated w/"g" factor at least 0.75 or from Tensionometer	Applies				Y/N	
Have ability to keep load < SWL: Actual from monitoring system		Applies	Applies	Applies	Y/N	
Tensionometer display at operator's station with 3 Hz refresh rate		Applies			Y/N	
Tensionometer display at operator's station with 10 Hz refresh rate			Applies	Applies	Y/N	
Tension continuously monitored using a tension trending graph			Applies	Applies	Y/N	
Tensionometer logging at 3 Hz		Applies			Y/N	
Tensionometer logging at 20 Hz			Applies	Applies	Y/N	
Tensionometer Recalibration at least every 6 mo.		Applies	Applies	Applies	Y/N	
Tension measuring system maintained with 4% accuracy		Applies			Y/N	
Tension measuring system maintained with 3% accuracy			Applies	Applies	Y/N	
Alarms						
Audible and visual tension alarms w/data logging Alarm at < ABL/2.8		Applies			Y/N	
Audible and visual tension alarms w/data logging Alarm at < ABL/2.2			Applies		Y/N	
Audible and visual tension alarms w/data logging Alarm at < ABL/1.7				Applies	Y/N	
Alarm conditions automatically logged		Applies	Applies	Applies	Y/N	
Sheaves and Fairlead Rollers						
Sheaves & Rollers: As large as practical	Applies				Y/N	
Sheaves & Rollers: D/d ratio meet 40:1 or 400d1 whichever is greater		Applies	Applies	Applies	Y/N	
Sheaves: Groves as close to d as possible and no more than 1.5d		Applies			Y/N	
Sheaves: Groves per Ref A 1.1 (Groove size relative to nominal diameter of wire rope: 3/16" to 1/4" 3% to 6%; over 1/4" 2.5% to 5%)			Applies	Applies	Y/N	
Deck Safety						
Good safety practices	Applies				Y/N	
Establish danger zones / safety zones		Applies	Applies	Applies	Y/N	
Warning notices posted		Applies	Applies	Applies	Y/N	
Physical or visual barriers			Applies	Applies	Y/N	
Doors and accesses secured			Applies	Applies	Y/N	
Testing						
Tension testing up to SWL load every 2 years. Break testing not req'd at FS=5.0	Applies				Y/N	
Break Testing every 2 yrs		Applies			Y/N	
Break Testing every yr if 10% decrease in ABL or cutback		Applies			Y/N	
Break Testing every yrs			Applies	Applies	Y/N	
Break Testing every 6 mo. if 10% decrease in ABL or cutback			Applies	Applies	Y/N	
Logbooks: UNOLS wire identifier: Cable Inventory/History and Running Use						
Logs stay with the wires transfer with the wire	Applies	Applies	Applies	Applies	Y/N	
Log of Tension Testing to SWL	Applies				Y/N	
Log of wire Break Testing		Applies	Applies	Applies	Y/N	
Log Cutbacks	Applies	Applies	Applies	Applies	Y/N	
Log Spooling Operations	Applies	Applies	Applies	Applies	Y/N	
Log of Lubrication	Applies	Applies	Applies	Applies	Y/N	
Wire Train Description	Applies	Applies	Applies	Applies	Y/N	
Maximum load and payout for each cast by calculation or monitoring.	Applies	Applies	Applies	Applies	Y/N	
Winch Operator						
Operator deemed competent in writing by master and owner	Applies				Y/N	
Operator "Certified Competent" in writing by master and owner renewed annually		Applies	Applies	Applies	Y/N	
Master verify qualifications and designate approved operators.		Applies	Applies	Applies	Y/N	
Training record for formal operator training program for winch, handling apparatus, and monitoring system.		Applies	Applies	Applies	Y/N	

Suggestions: Please contact Ted@JMSnet.com



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Waivers:

In the event that despite best efforts, compliance with a standard is not possible, a waiver may be granted. For example in attempting to comply with the size of winch rollers and sheaves as prescribed in Appendix A, physical structural limitations prevented the modifications of the sheaves/rollers in order to meet Appendix A.

Waivers:

Waiver granted to Endeavor for rollers due to levelwind close to winch control booth.



Procedures for Waivers:

The UNOLS ship operator shall send a written request to the UNOLS Safety Committee Chair explaining the situation and the request for a ruling on a proposed operation. The Chair would then seek subject matter expert advice and conduct a review by a board of (3) Safety Committee members. The Chair will then provide a written response back to the operator with a copy to the agencies funding that program.

End



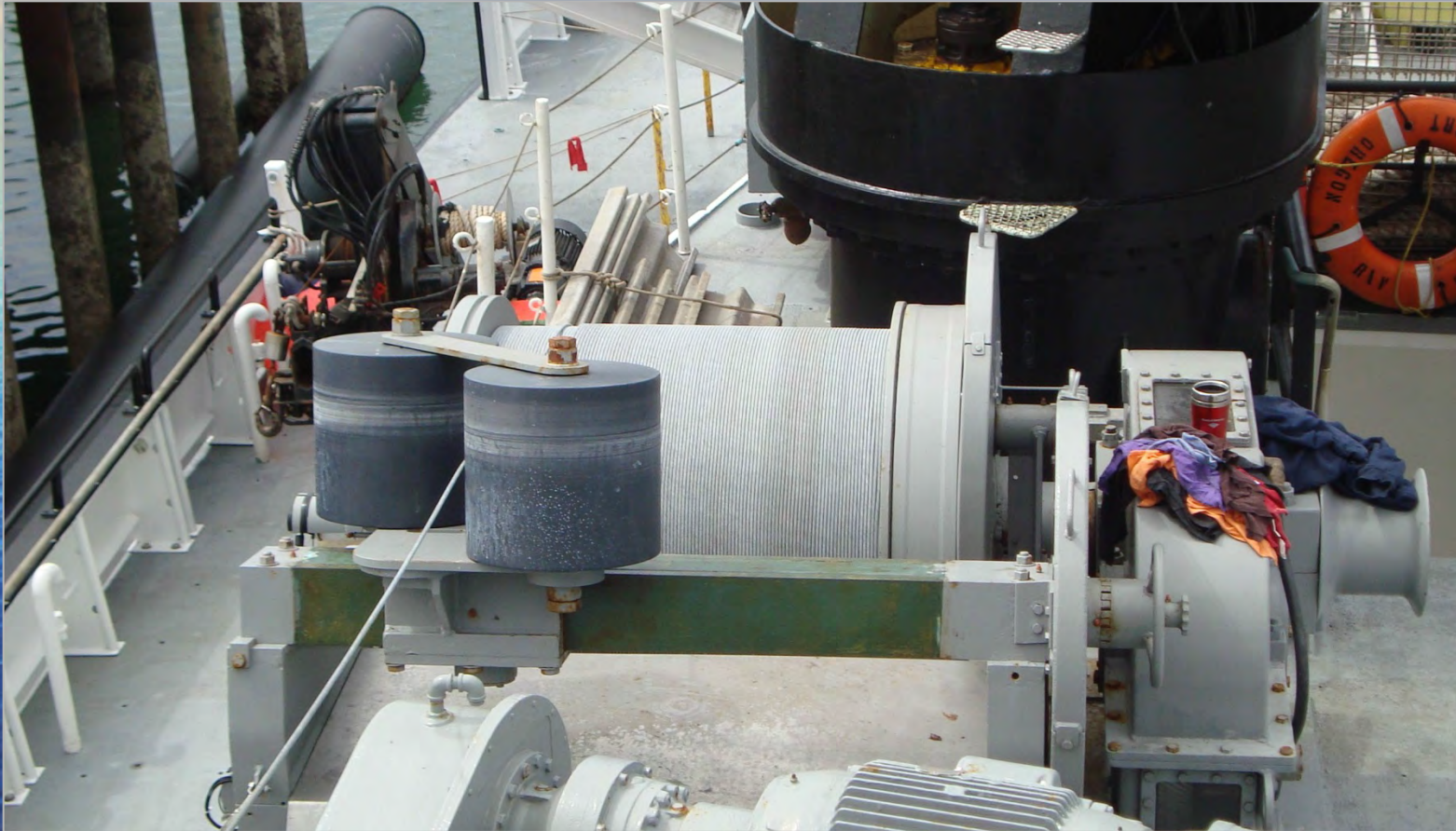
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While Logging Maximum Load and Payout for Each Cast

- Consider also recording amount of tension member deployed where the maximum load occurs.
- Consider referencing this as a distance from the drum end.

Common Findings: Sheave and Fairlead Roller Diameter

Large rollers installed on RV OCEANUS



Common Findings: SWT Documentation

WLL or SWL identified on a block is not the same as Safe Working Tension (SWT). These blocks don't indicate if the WLL is for the tension member or for the shackle/block.



Best Practice: Sheaves

Clear indication of SWL expressed in terms of tension.
This predates Safe Working Tension terminology



Best Practices: Sheave Wrap Angle



RV SAVANNAH: Instrument blocks that measure the wrap angle in order to measure the tension in the cable.

Appendix B System Level Assist Sheets

Appendix B Assist Sheet for Overboard Handling Systems (updated 11_1_15 JMS/wec)
 This assist sheet is to access progress toward compliance with RVSS Appendix B by the compliance date of 7/15/2016 per RVSS Edition 10 dated July 2015

Page 1 System Level

Overboard Handling System Operator's Manual (see note 2)	Reference	Y or N or NA	Comment
For each Overboard Handling System (OHS) Configuration	B.12		
System Title/Description		Y / N / NA	
OHS MCD	B.5	Y / N / NA	
List of component MCDs	B.5.2.7	Y / N / NA	
Version of each component MCD	B.5.2.7	Y / N / NA	
DLT and/or SWT	B.5.2.7	Y / N / NA	
Reference to each component booklet	B.12	Y / N / NA	
Identify the deployment type(s)	B.5.2.7	Y / N / NA	
Diagram the applicable range of geometries	B.5.2.7	Y / N / NA	
Description of the OHS Layout including:			
Location of each major component	B.12	Y / N / NA	
Orientation of each major component	B.12	Y / N / NA	
Geometry of the tension member	B.12	Y / N / NA	
Overall dimension of each major component	B.12	Y / N / NA	
Weight of major portable components	B.12	Y / N / NA	
OHS Test Procedures and Records:	B.6		
Twice in 5 yrs. not to exceed 3 yrs. for fixed OHS	B.6.3	Y / N / NA	
Within 3 yrs. for OHS containing portable components	B.6.3	Y / N / NA	
OHS Loaded to 125% OHS SWT	B.6.3	Y / N / NA	
Written Test Procedure including geometries	B.6.7	Y / N / NA	
Specify tension member	B.6.7	Y / N / NA	
Specify safety precautions	B.6.7	Y / N / NA	
Test records for each component if tested singly	B.6.8	Y / N / NA	
Test date, test method, names of testers	B.6.8	Y / N / NA	
Records aboard vessel and operator's office	B.6.8	Y / N / NA	
Procedural Safety Requirements	B.7	Y / N / NA	
For new OHS:	B.7.1.1		
Procedures for rigging and un-rigging	B.7.1.1	Y / N / NA	
Procedure for launch and retrieving payload	B.7.1.1	Y / N / NA	
Test plans	B.7.1.1	Y / N / NA	
Training program	B.7.1.1	Y / N / NA	
For existing OHS:	B.7.1.2		
Procedures for rigging and un-rigging	B.7.1.2	Y / N / NA	
Procedure for launch and retrieving payload	B.7.1.2	Y / N / NA	

General Safety:	B.7.2		
Guards and rail enclosures	B.7.2	Y / N / NA	
Emergency stops at equipment	B.7.2	Y / N / NA	
Emergency stops at all operator's stations	B.7.2	Y / N / NA	
Beacon lights when operating	B.7.2	Y / N / NA	
Physical barrier systems to exclude personnel from tension member paths and snap back	B.7.2	Y / N / NA	
Operator Training Procedures and Records	B.8	Y / N / NA	
Formal training program for each operating station	B.8	Y / N / NA	
Annual demonstration of competency	B.8	Y / N / NA	
Records of initial training and competency checks	B.8	Y / N / NA	
Notes:			
1. When using weak links the link should break less than the lowest component SWT (other than the tension member).	B.10.3 B.4.5.3		
2. A OHS Operators Manual is not required when an OHS is formed by combining portable and fixed equipment. This does not appear to waive the requirements of sections B.3 through B.11.	B.12		
3. The Overboard Handling Data Document (OHDD) is completed by the science party for each cruise (B.3). Consider keeping these with the Operators Manuals.	B.3		
4. The tension member tested breaking load (TBL) almost always exceeds the nominal breaking load (NBL) and assigned breaking load (ABL) and thus the TBL should be considered when determining use of a weak link.			
5. In all cases except the exemptions for uninspected vessels listed in sections B.4.5 the tension member should break before the overboard handling system fails.			
6. The prior version of this appendix required OHS emergency procedures be addressed. Although a requirement in appendix A has been added for tension member extenuating circumstances, consideration should be given to plan OHS emergency procedures.			
7. Consider if the tension member or weak link in an OHS should fail before the vessel has stability difficulty if a payload bottom hang occurs.			

Suggestions: Please contact Ted@JMSnet.com

Appendix B Component Assist Sheets

Appendix B Assist Sheet for Overboard Handling Systems (updated 11_1_2015 JMS/wec)
 This assist sheet is to access progress toward compliance with RVSS Appendix B by the
 compliance date of 7/15/2016 per RVSS Edition 10 dated July 2015

Page 2 Component & Sub-System Level

For each Overboard Handling System (OHS) Component in the
 OHS System Configuration:

Reference

Component MCD Booklet including:	B.11	Y / N / NA
Component Maximum Capability Document (MCD) including:	B.5	Y / N / NA
Safe Working Tension (SWT) specified	B.5.2	Y / N / NA
Reaction Forces on adjacent structures	B.5.2	Y / N / NA
Design Line Tension (DLT) specified if new	B.5.2	Y / N / NA
Reaction Forces on Bolts if bolted	B.5.2	Y / N / NA
Diagram of bolt arrangement if bolted	B.5.2	Y / N / NA
Required bolt strength / grade if bolted	B.5.2	Y / N / NA
Design standard used for determining MCD	B.5.2	Y / N / NA
Calculations used to evaluate MCD if feasible	B.5.2	Y / N / NA
If MCD determined by testing in lieu of calculation:		
SWT<test load/1.5	B.6.11	Y / N / NA
Associated MCD shows range of geometries	B.6.11	Y / N / NA
For Standard Deck Hardware referencing Mfg.'s Data:		
Manufacturer's data sheets showing FS>1.5	B.5.2.1	Y / N / NA
Manufacturer's data sheets showing SWT	B.5.2.1	Y / N / NA
For Tension Members:		
Manufacturer's data sheets showing NBL	B.5.2.2	Y / N / NA
Current ABL	B.5.2.2	Y / N / NA
	RVSS Appendix A	Y / N / NA
	B.5.2.2	Y / N / NA
SWT for each applicable FS range	RVSS Appendix A	Y / N / NA
For Custom Components:		
DLT and/or SWT for each deployment type	B.5.2.3	Y / N / NA
	B.2	Y / N / NA
Diagram of range of tension member geometries	B.5.2.3	Y / N / NA
For each Deck Socket used as a OHS component:		
DLT and/or SWT for each component rigging configuration	B.5.2.4	Y / N / NA
Diagram of range of geometries	B.5.2.4	Y / N / NA
For Winches:		
Maximum Line Pull	B.5.2.5	Y / N / NA
For Tension Mitigation Devices and Systems:		
For Render & Render Recover	Y / N / NA	
	Y / N / NA	
Description of Capabilities meeting B.10.2	B.5.2.6	Y / N / NA
	B.10.2	Y / N / NA
For Weak Links:		
	Y / N / NA	
Calibration and Test documents	B.5.2.6	Y / N / NA
	B.10.3	Y / N / NA

Test to fail < lowest OHS component SWT	B.5.2.6		Y / N / NA
	B.10.3		
If used where DLT<NBL exception (B.4.5.3) then Design Details and failure load	B.5.2.6		
	B.10.3		Y / N / NA
Dimensions in all configurations	B.11		Y / N / NA
Test Procedures and Records	B.6		Y / N / NA
Calibrated instrument or certified test weight	B.6.1		Y / N / NA
For Deck Sockets and Foundations if part of OHS			Y / N / NA
Test records including description, test date, tensions, test method, and names	B.6.2.2		Y / N / NA
	B.6.8		Y / N / NA
For Other Components:			Y / N / NA
Tested to 125% SWT	B.6.2.4		Y / N / NA
Frequency:			Y / N / NA
Auxiliary padeyes every 3 years	B.6.2.5		Y / N / NA
Deck Sockets every 3 years	B.6.2.5		Y / N / NA
All other components Twice every 5 yrs. not to exceed 3 years	B.6.2.5		Y / N / NA
Portable Systems 3 years in specific configuration	B.6.4		Y / N / NA
Loaded to 125% OHS SWT	B.6.3		Y / N / NA
Written Test Procedure including geometries	B.6.7		Y / N / NA
Specify tension member	B.6.7		Y / N / NA
Specify safety precautions	B.6.7		Y / N / NA
Test records for each component if tested singly	B.6.8		Y / N / NA
Test date, test method, names of testers	B.6.8		Y / N / NA
Records aboard vessel and operator's office	B.6.8		Y / N / NA
Procedural Safety Requirements	B.7		Y / N / NA
For new component:	B.7.1.1		Y / N / NA
Procedures for rigging and un-rigging	B.7.1.1		Y / N / NA
Procedure for launch and retrieving payload	B.7.1.1		Y / N / NA
Test plans	B.7.1.1		Y / N / NA
Training program	B.7.1.1		Y / N / NA
For existing component:	B.7.1.2		
Procedures for rigging and un-rigging	B.7.1.2		Y / N / NA
Procedure for launch and retrieving payload	B.7.1.2		Y / N / NA
General Safety:	B.7.2		Y / N / NA
Guards and rail enclosures	B.7.2		Y / N / NA
Emergency stops at equipment	B.7.2		Y / N / NA
Emergency stops at all operator's stations	B.7.2		Y / N / NA
Beacon lights when operating	B.7.2		Y / N / NA
Physical barrier systems to exclude personnel from tension member paths and snap back	B.7.2		Y / N / NA
Operator Training and Records	B.8		Y / N / NA
Component operators/users receive training	B.8		Y / N / NA
Prove operational and safety competency	B.8		Y / N / NA
Preventative Maintenance Procedures and Frequency	B.11		Y / N / NA
If a Portable Component:			Y / N / NA
Weight	B.11		Y / N / NA
Ship Service and Interface Requirements	B.11		Y / N / NA

Inventory of Spares	B.11		Y / N / NA
			Y / N / NA
Other requirements not required in component booklet			Y / N / NA
Structural Design Criteria:	B.4		Y / N / NA
Design Line Tension (DLT) < Ultimate Design Tension divided by 1.5	B.4.5		Y / N / NA
Safe Working Tension (SWT) < DLT	B.4.4		Y / N / NA
Labeling:	B.9		Y / N / NA
All components labeled	B.9.1		Y / N / NA
Include SWT	B.9.1		Y / N / NA
Most recent test date	B.9.1		Y / N / NA
SWT diagram/geometries	B.9.1		Y / N / NA
Reference to MCD or other docs.	B.9.1		Y / N / NA
For Standard Deck Hardware	B.9.2		Y / N / NA
Color coded	B.9.2		Y / N / NA
Conspicuously marked referencing test cycle	B.9.2		Y / N / NA
For Deck Sockets:	B.9.3		Y / N / NA
Marked referencing specific use	B.9.3		Y / N / NA
Exceptions and Exemptions:			
Special cases for uninspected vessels:	B.4.5		Y / N / NA
Deployments is the water column	B.4.5.1		Y / N / NA
Render and Render Recover	B.4.5.2		Y / N / NA
Weak Links	B.4.5.3		Y / N / NA
Underpowered Vessel	B.4.5.4		Y / N / NA
USCG special case with granted permission	B.4.5.5		Y / N / NA
Deck Bolts don't need MCD	B.5.1		
	B.6.2.1		Y / N / NA
Testing exemptions:			
OHS test can satisfy general purpose component testing (to 125% OHS SWT) for specified configurations	B.6.2.1		Y / N / NA
Auxiliary padeye require testing if part of OHS. If not part of an OHS then this appendix does not require auxiliary padeye testing.	B.6.2.1		Y / N / NA
Deck Sockets require testing if part of OHS. If not part of an OHS then this appendix does not require Deck Socket testing.	B.6.2.1		Y / N / NA
	B.6.2.2		Y / N / NA
Deck bolts do not need testing if made to a specification and marked with grade. Deck bolts is not tested require periodic inspection.	B.6.2.1		Y / N / NA
Alternative Testing Methods	B.6.6.1		Y / N / NA
	B.6.6.2		
Laboratory and Piecewise Testing	B.6.6.3		Y / N / NA



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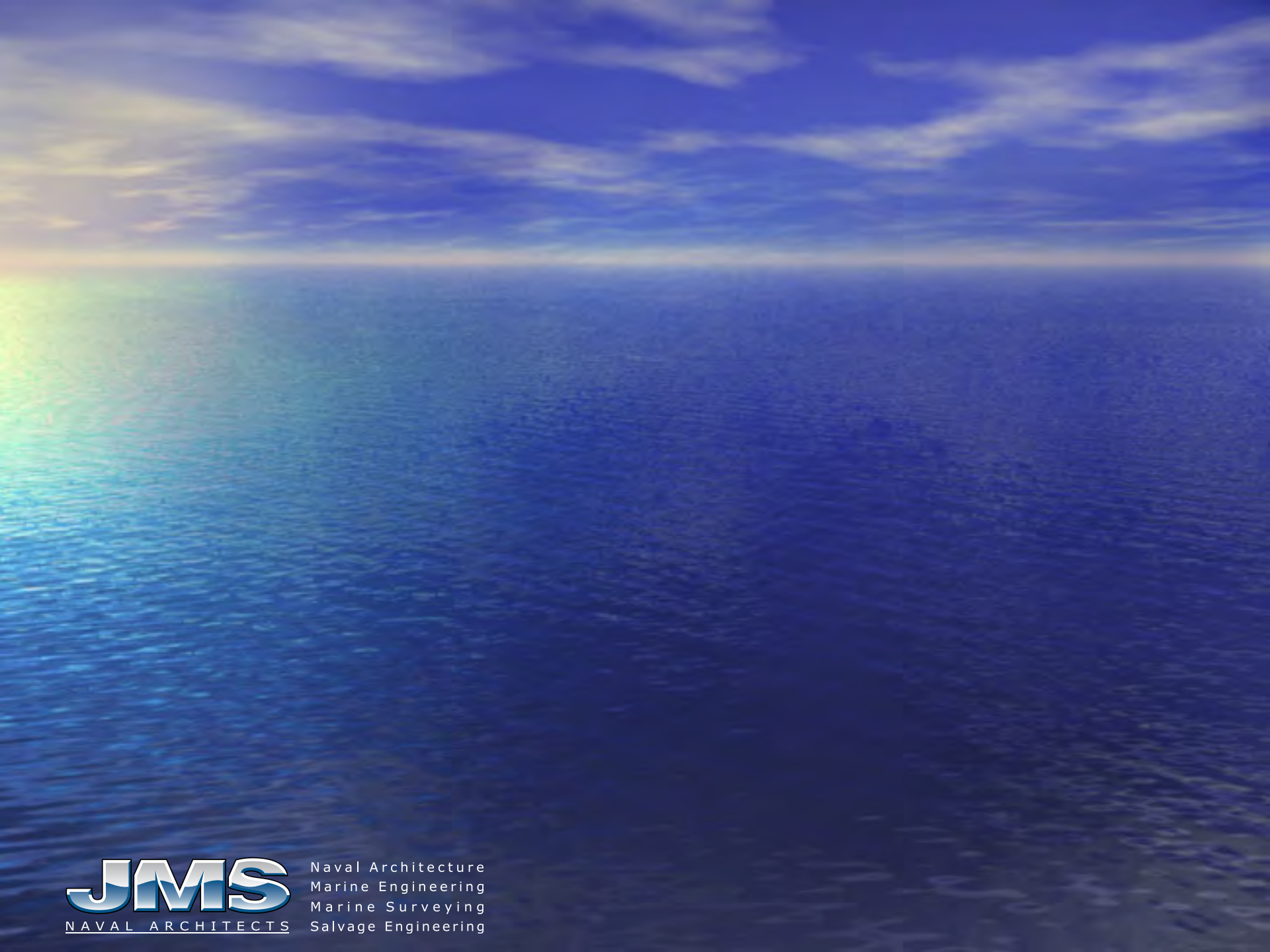
Independent Two-block safety devices are important



Questions?



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- **Cable:**
- A woven, flexible tension member with internal conductors or other means of transmitting data such as glass fiber.

- "D" :
- The root diameter of the sheave.

- “d” :
- The outside diameter of the cable or rope.

- “d1” :
- For cable the largest diameter wire in the armor wires. For wire rope the largest of the outer wires.

- **Dynamic Loads :**
- Loads induced due to vessel motion (heave, roll, pitch, etc.)

- **Elastic Limit :**
- The elastic limit or yield point of a material is the stress at which a material begins to deform plastically.
- Prior to the yield point the material will deform elastically and will return to its original shape when the applied stress is removed

- **Fixed Ends (FE) :**
- Both ends of the tension member being fixed without the ability to swivel.
- Most wire rope and cable NBL values are based on FE.
- An example of a fixed end application is towing a MOCNESS.

- **Free to Rotate :**
- The end of the tension member is free to rotate either because a swivel is at the end of the tension member or the package at the end of the tension member can rotate freely. Free to rotate applications typically have a NBL below the fixed end NBL. An example of a free to rotate application is a lowered CTD package.

- “g” :
- The vertical acceleration due to gravity. For normal static loading (no dynamic effect), “g” is equal to 1.0.
- Under ABS standards, normally 1.75 or 2.0 for vertical accelerations. “g” is applied to the mass of the package and tension member, not the weight.

- **Induced Rotation :**
- Induced rotation occurs when external forces cause torque to be applied to the tension member.
- Induced rotation should never be allowed to occur on a tension member that has not been specifically designed for this purpose.

- **Render-and-Recover :**
- A winch's combined ability to auto render, then haul the tension member back when the tension drops to an amount below the pre-set tension.
- Generally recovery haul back is limited to the point of the initial rendering.

- **Rope :**
- A woven, flexible tension member with no internal conductors.
- It may be made from natural fibers, synthetic fibers, or metal.

- **Tension Member :**
- Generic name used to describe a rope or cable in service for over the side work.

- **Transient Loads :**
- Loads induced which are temporary by nature, including the weight of entrained mud, weight of entrained water, pull out loads, drag due to package characteristics and/or winch speed, etc.