

RVSS Appendix A & B Training 2024

# Rope and Cable Safe Working Standards

Appendix A for Steel Cables and Wire Ropes

**17 & 18 January 2024**



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

# Agenda

- *0900 - 1000* - Appendix A for Steel Cables and Wire Ropes  
Background, applicability, and terminology  
Factors of safety and equipment operating requirements
- *1000 - 1100* - Appendix A for Steel Cables and Wire Ropes continued...
  - Deck safety and extenuating circumstances
  - Testing and maintenance
  - Operator training and record keeping
  - Encouraged actions, but not expressly required



# Purpose of Appendix A

The major purposes of RVSS Appendix A are:

- 1.To establish safe and effective operating limits for vessels in the Academic Research 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.

# 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 (i.e. Cargo Cranes)
4. This standard assumes that the tension member is properly used for its intended purpose.



# Actions

Appendix A dictates actions that must occur before, during, and after a deployment takes place

These include:

administrative,  
operational, and  
maintenance actions

# Terminology

- 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?)

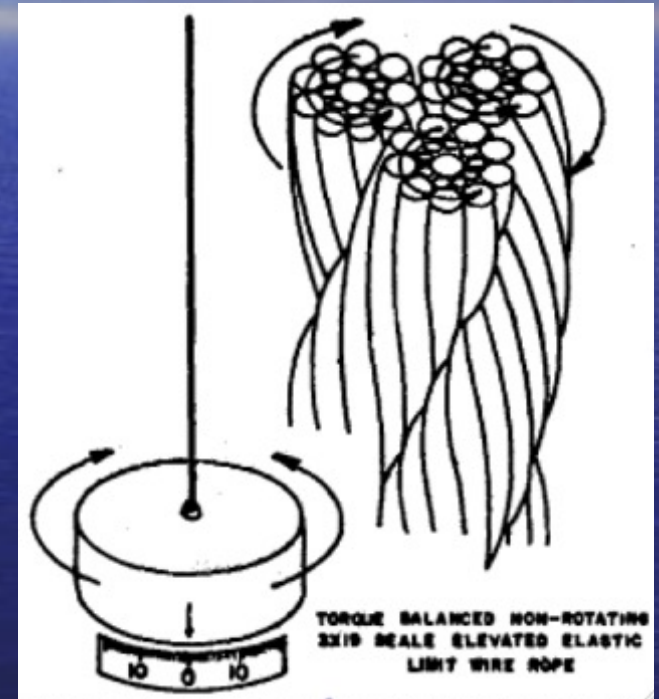
# The Limit for Rope or Cable Tension

- 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.



# Rope :

- A woven, flexible tension member with no internal conductors.
- It may be made from natural fibers, synthetic fibers, or metal.
- UNOLS 3x19 is Torque Balanced

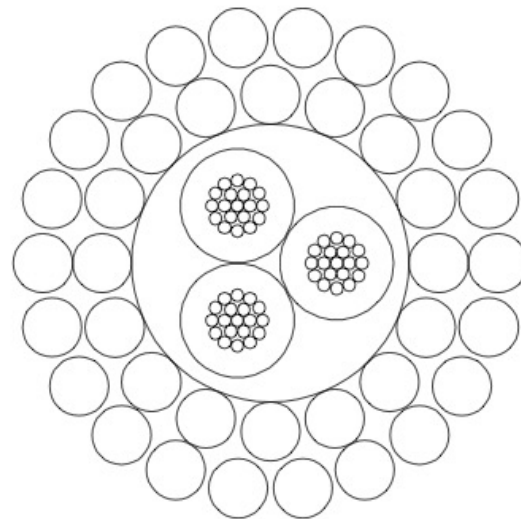


# Cable:

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

## **DATA LINE<sup>®</sup>**

Description	Inch	mm
<b><u>INSULATED CONDUCTOR (3)</u></b>		
Cdr: #19 AWG (19/0.008") Bare Cu	0.039	0.99
Ins: .016" wall Polypropylene	0.071	1.80
<b><u>ASSEMBLY</u></b>		
3 ins. cdrs. cabled	0.153	3.89
<b><u>BELT</u></b>		
0.015" wall HD Polyethylene	0.183	4.65
<b><u>ARMOR - 2 layers</u></b>		
16/0.0375" GEIPS	0.247	6.27
22/0.0375" GEIPS	0.322	8.18





# Load Terms: TBL

- 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: NBL

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



# Load Terms: ABL

- 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.

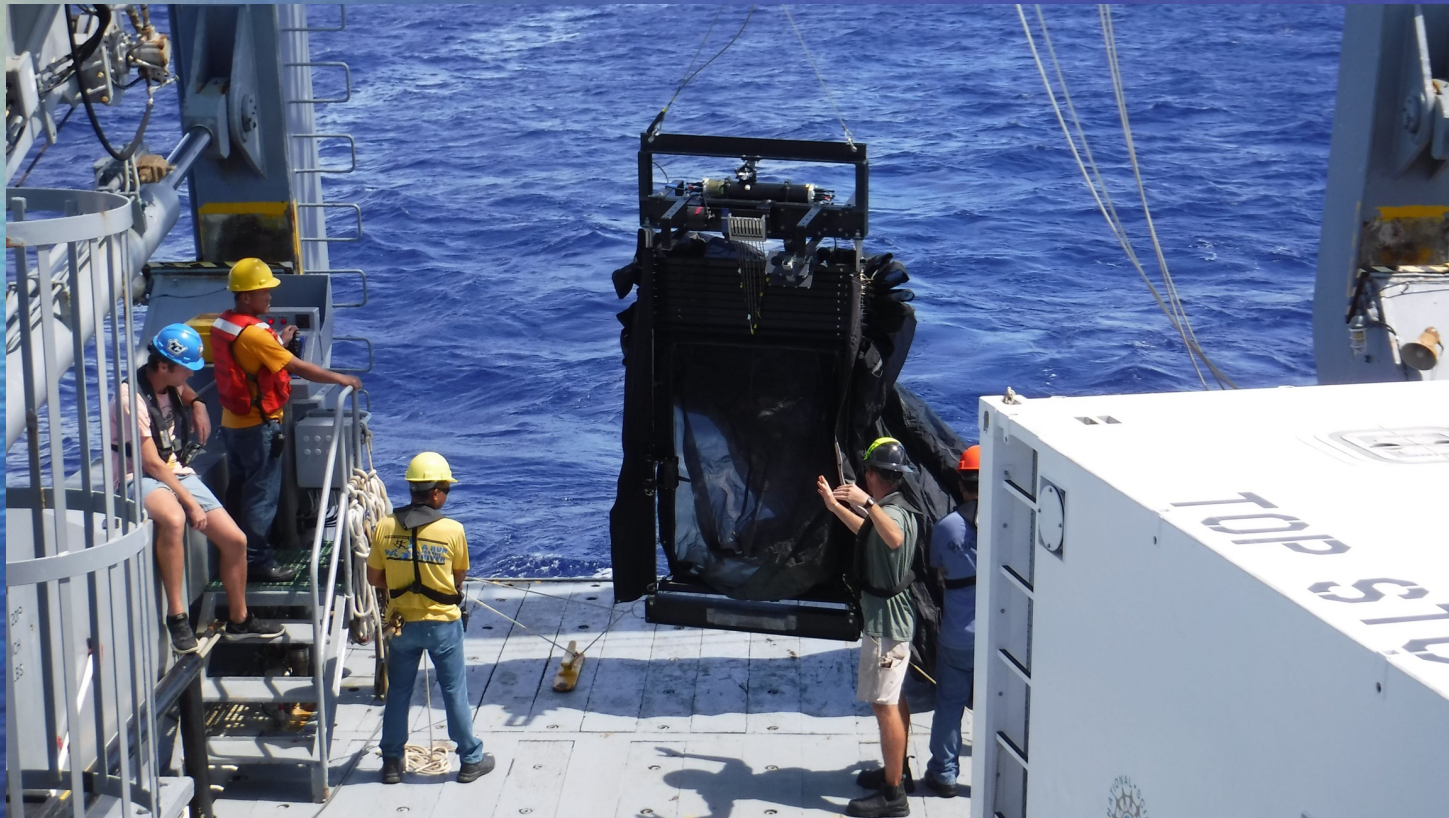
# Fixed Ends and Free to Rotate

- 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 fixed end.
- An example of a fixed end application is towing a MOCNESS.



# Fixed Ends and Free to Rotate

- MOCNESS: Multiple Opening/Closing Net and Environmental Sensing System





# Fixed Ends and Free to Rotate

## Also for Fixed Ends: Trawl Nets





# 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.

# Fixed Ends and Free to Rotate

- Free to Rotate: CTD package.





# Factor of Safety (FS)

- Factor of Safety is the ratio of the maximum stress that a structural part or other piece of material can withstand to the maximum stress estimated for it in the use for which it is designed.

# Factor of Safety (FS)

- Three FS levels are available for steel cable, and four for steel wire rope.
- Factor of Safety
  - 5 or greater Both Cable and Wire Rope
  - 5 to 2.5 Both Cable and Wire Rope
  - 2.5 to 2.0 Both Cable and Wire Rope
  - 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.

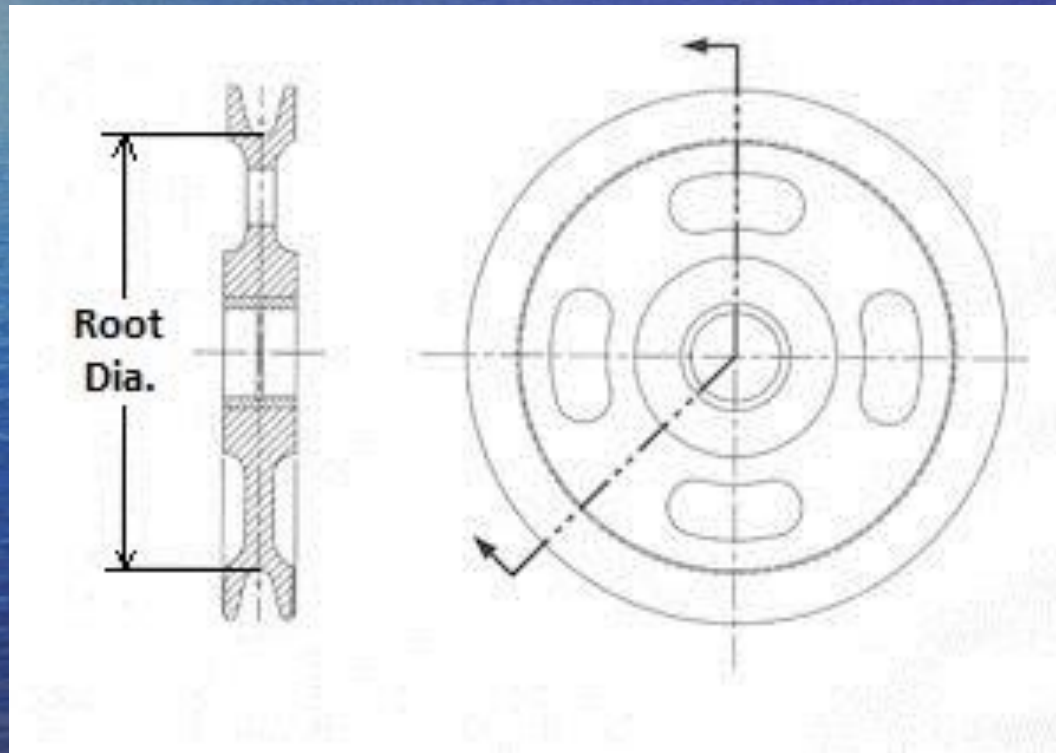
# Equipment Requirements for Factor of Safety Selection

- Sheaves
- Rollers
- Tension Monitoring
- Alarms



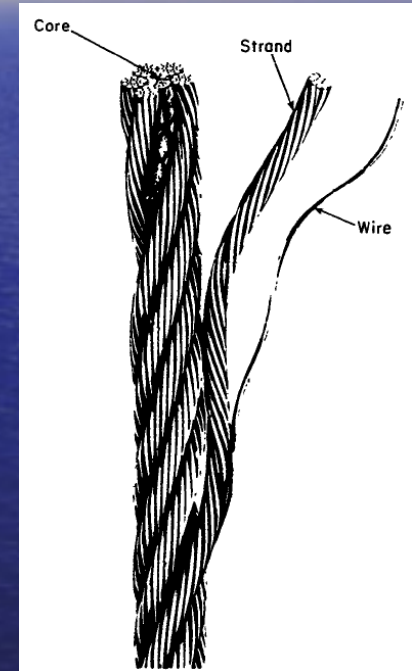
# Equipment Requirements for FS Selection: Sheaves

- Minimum Sheave Diameter:  $D$  or Root Dia.



# Equipment Requirements for FS Selection: Sheaves

- Minimum Sheave Diameter: D
  - For  $FS > 5.0$ :
    - As large as practical
  - For  $FS < 5.0$ :
    - D at least  $40 \cdot d$
    - and
    - D at least  $400 \cdot d_1$
    - d is tension member diameter
    - $d_1$  for wire rope is largest of the outer wires
    - $d_1$  for cables largest of the armor wires





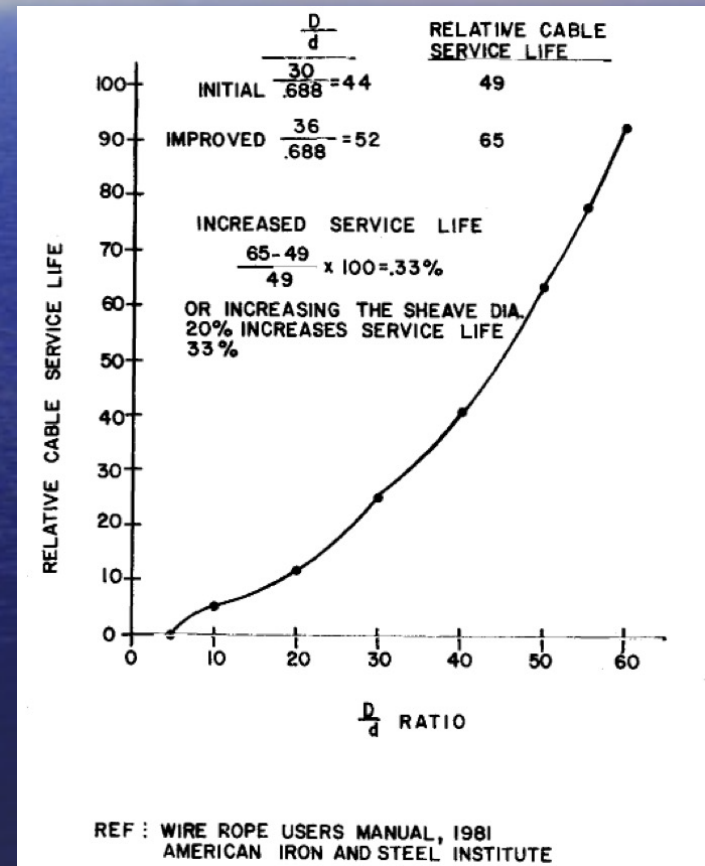
# Equipment Requirements for FS Selection: Sheaves

- Importance of Sheave Diameter:  
Service Life  
Strength Efficiency

# Equipment Requirements for FS Selection: Sheaves

## Service Life: Example

- Increasing Dia. 20%
- Increases Service Life SL 33%

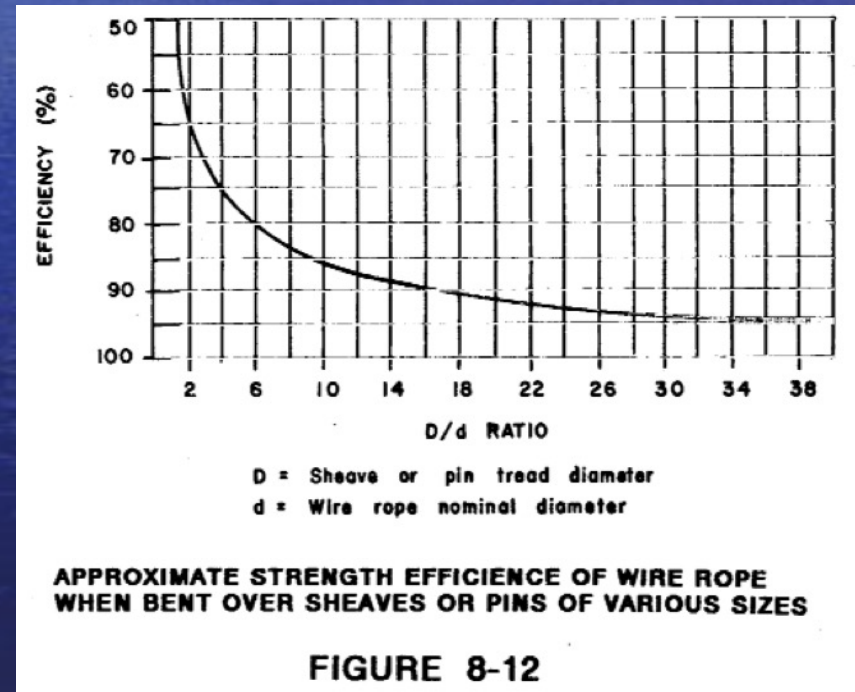




# Equipment Requirements for FS Selection: Sheaves

## Strength Efficiency:

- Increasing Dia.
- Increases breaking strength



# Equipment Requirements for FS Selection: Sheaves

## SHEAVE DIAMETER (D) DETERMINATION

d	d <sub>1</sub>	400d <sub>1</sub> [in]	40d [in]	Larger of 400 d <sub>1</sub> or 40 d [in]
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Wire Ropes:

1/4"	.031"	12.4	10	12
3/8"	.044	17.6	15	18
1/2"	.058"	23.2	20	23
9/16"	.066"	26.4	22.5	26

Cables:

.322"	.0375"	15.0	12.9	15
.680"	.060"	24	27	27
.681"	.050"	20	27	27

d<sub>1</sub> for **wire rope** is the largest diameter of the outer wire

d<sub>1</sub> for **cable** is the largest diameter of the armor wire

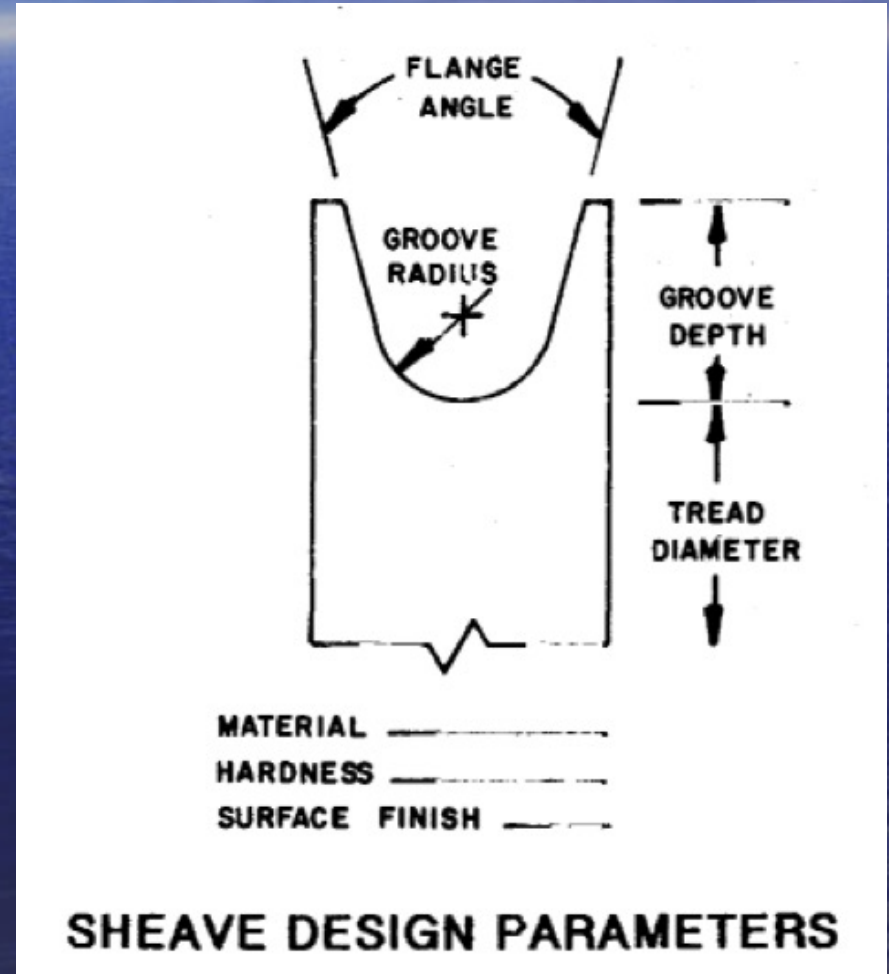


# Equipment Requirements for FS Selection: Sheaves

- Note related to 0.681" cable  
Manufacturer Recommends 48" for  
0.681" cable 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

Grooves in sheaves should be slightly larger than the rope or cable:

In order to avoid pinching and binding

To permit the tension member to adjust itself to the radius of curvature.

# Equipment Requirements for FS Selection: Sheaves

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



# Equipment Requirements for FS Selection: Sheaves

Groove Radius  
gets smaller  
with use:



# Equipment Requirements for FS Selection: Sheaves

Groove Radius gets smaller with use:

Caution when installing new tension members.

Caution when end for ending tension members

Caution when planning for deep casts



# Equipment Requirements for FS Selection: Sheaves

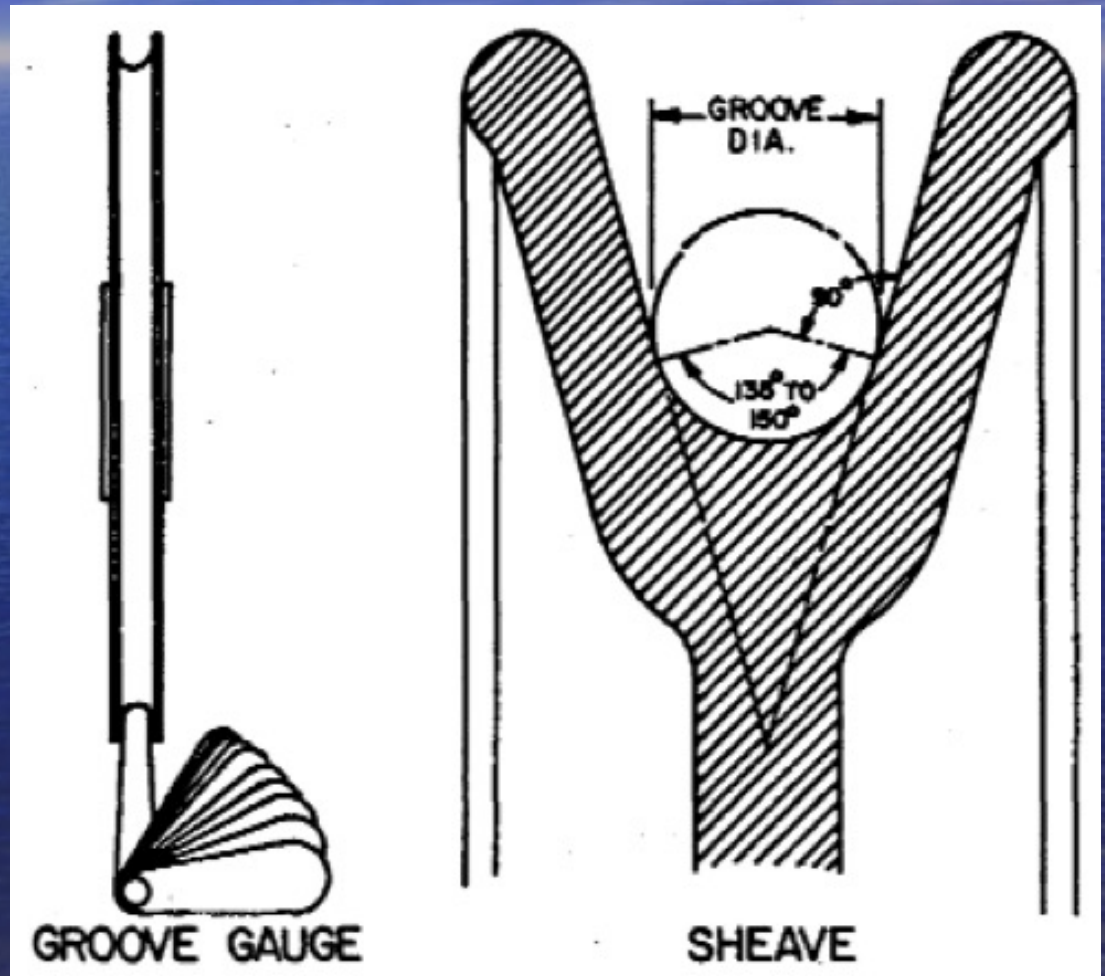
## SHEAVE GROOVE RADII

Grooving Code	A			B		C
Factor of Safety	1.5 ≤ F.S. < 2.5			2.5 ≤ F.S. < 5.0		F.S. > 5.0
	New or re-machined Grooves					
	Worn Minimum Radius [in] (d/2*1.025) <sup>†</sup> unless otherwise noted	Minimum Radius [in] (d/2*1.05) <sup>†</sup> unless otherwise noted	Maximum Radius [in] (d/2*1.1) <sup>††</sup>	Worn Minimum Radius [in] (d/2*1.025) <sup>†</sup> unless otherwise noted	Maximum Radius [in] (d/2 x 1.5)*	No Grooving Criteria
Wire Diameter and Type						
1/4" 3x19	.129 (d/2*1.03)*	.133 (d/2*1.06)*	0.138	.129 (d/2x1.03) <sup>†</sup>	0.188	
3/8" 3x19	0.192	0.197	0.206	0.192	0.281	
1/2" 3x19	0.256	0.263	0.275	0.256	0.375	
9/16" 3x19	0.288	0.295	0.309	0.288	0.422	
Factor of Safety	2.0 ≤ F.S. < 2.5					
.322" EM	0.165	0.169	0.177	0.165	0.242	
.680" CX	0.349	0.357	0.374	0.349	.510	
.681" PO	0.349	0.357	0.374	0.349	.510	

Ref: UNOLS Wire Database

# 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

Note: Drill bits are an alternative

# Equipment Requirements for FS Selection: Sheaves

Prior to June 2023 it required changing sheaves or getting a waiver to operate 9/16" wire rope at  $FS < 2.5$  on a sheave grooved for 0.680/0.681" cable.

i.e. Sheave max groove radius for 9/16" wire rope (0.309") for  $FS < 2.5$  is smaller than the Sheave min groove radius for 0.680/0.681" cable (0.349")



# Equipment Requirements for FS Selection: Sheaves

Turning Block with Changeable Grooves:



# Equipment Requirements for FS Selection: Sheaves

RVSS June 2023 Change:

Provides conditions where 9/16" wire rope may be operated with a FS as low as 1.5 in grooves up to 0.748" (the max diameter of the 0.680/0.681" cable per the UNOLS groove gauge).



# Equipment Requirements for FS Selection: Rollers

- Generally Limited to FS of 5.0



# Equipment Requirements for FS Selection: Rollers

- Rollers have same diameter requirements as sheaves if under load
- 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





# Equipment Requirements for FS Selection: Rollers

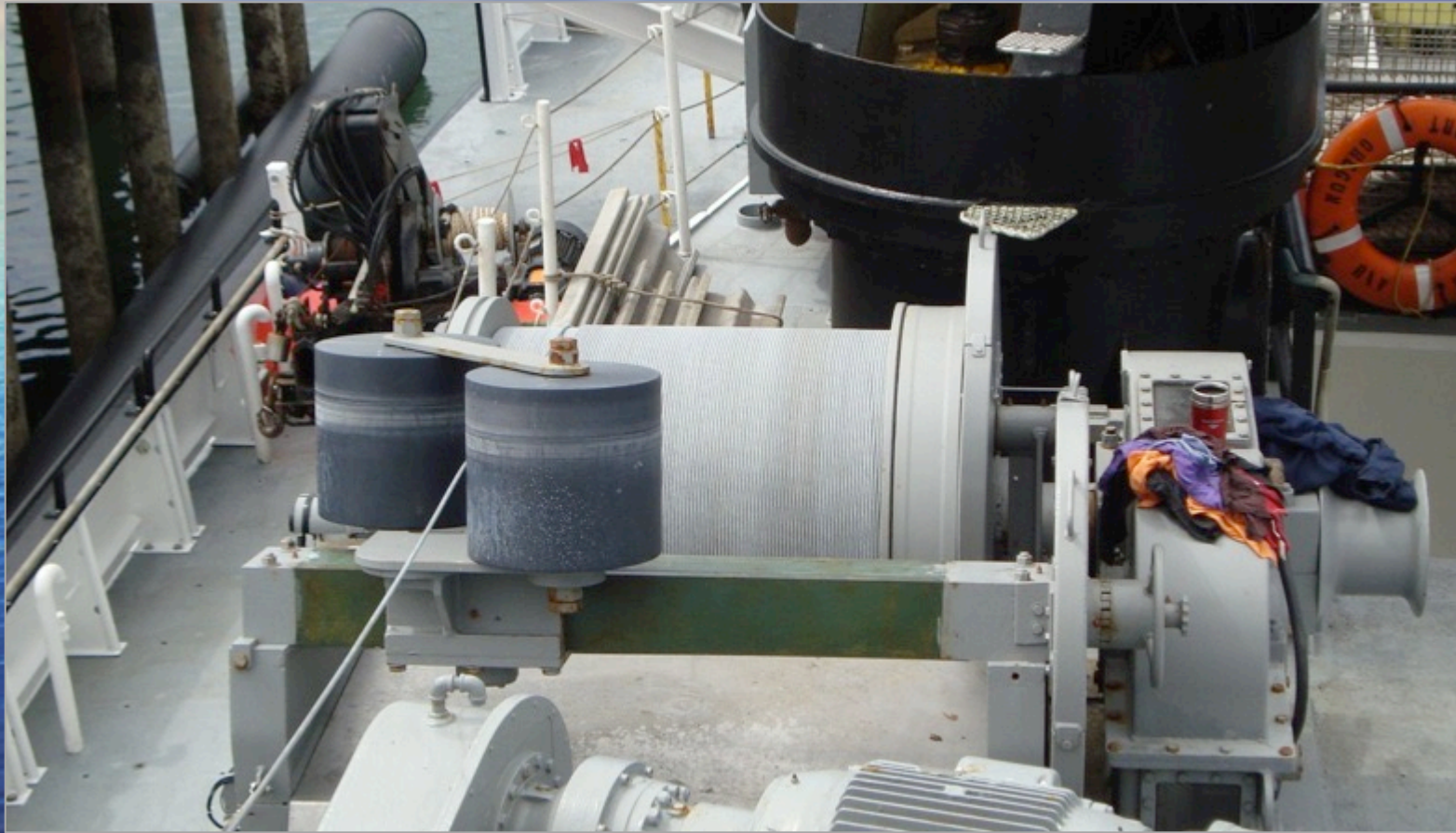
- Sense rollers, capture rollers, & guides do not need to meet the Diameter requirements.
- The cable does not bend around them while under load.





# Common Findings: Sheave and Fairlead Roller Diameter

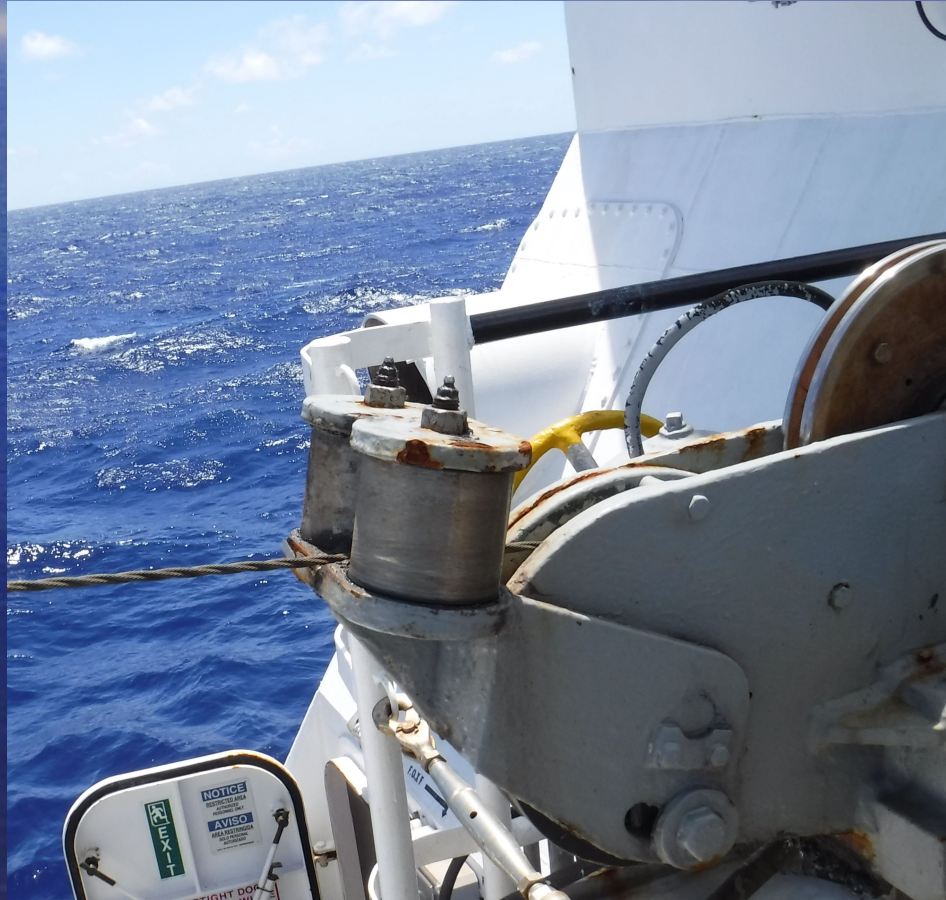
Large rollers installed on RV OCEANUS





# Equipment Requirements for FS Selection: Rollers

The tension member should not contact other surfaces:





# Equipment Requirements for FS Selection: Rollers

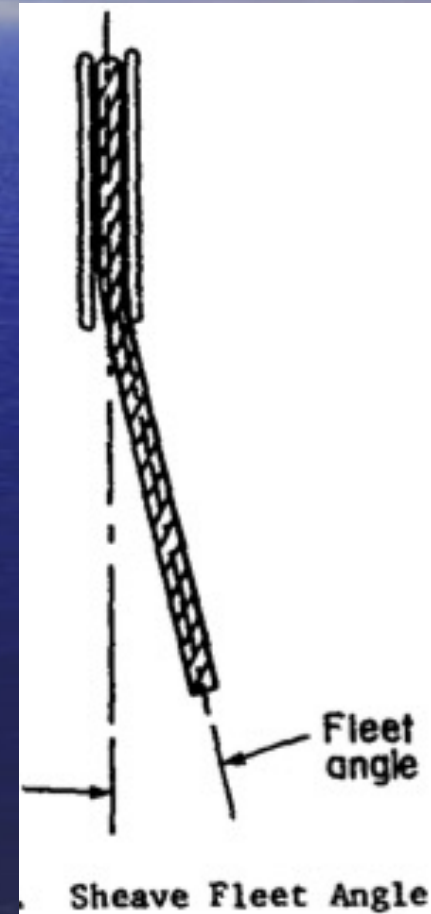
The tension member should not contact other surfaces:



# Associated Sheave Info: Not an Appendix Requirement

Sheave Fleet Angle  
typically less than  $1\frac{1}{2}$   
degrees.

Must have the correct  
flange (or throat)  
angle.





# Associated Sheave Info: Not an Appendix Requirement

Sheave Fleet Angle should be less than  $1\frac{1}{2}$  degrees, if the sheave is designed for a fleet angle.





# Associated Sheave Info: Not an Appendix Requirement

Sheave Fleet Angle  
typically less than 1 1/2  
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 tension member, 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),

dynamic loads (the effects due to accelerations from heave), and

transient loads (pull out forces) .

# Equipment Requirements: EMT for FS of 5.0 if no monitoring

Examples in  
the appendix  
including for  
a bottom  
grab





# Equipment Requirements: EMT for FS@5.0 if no monitoring

<b><i>A grab is planned on 500m of 0.25" 3x19 wire rope using a FS of 5.0.</i></b>		
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	
<b>Static Total</b>		<b>342</b>
<b>Quasi-Static Load (drag)</b>		<b>35</b>
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	
<b>Dynamic Load (multiply Mass Total by 0.75 for g=1.75)</b>		<b>310</b>
<b>Transient Load Pull Out Load</b>	100	<b>100</b>
<b>Estimated Maximum Tension Pounds-force</b>		<b>787</b>
<b><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></b>		

# Equipment Requirements: Tension Monitoring

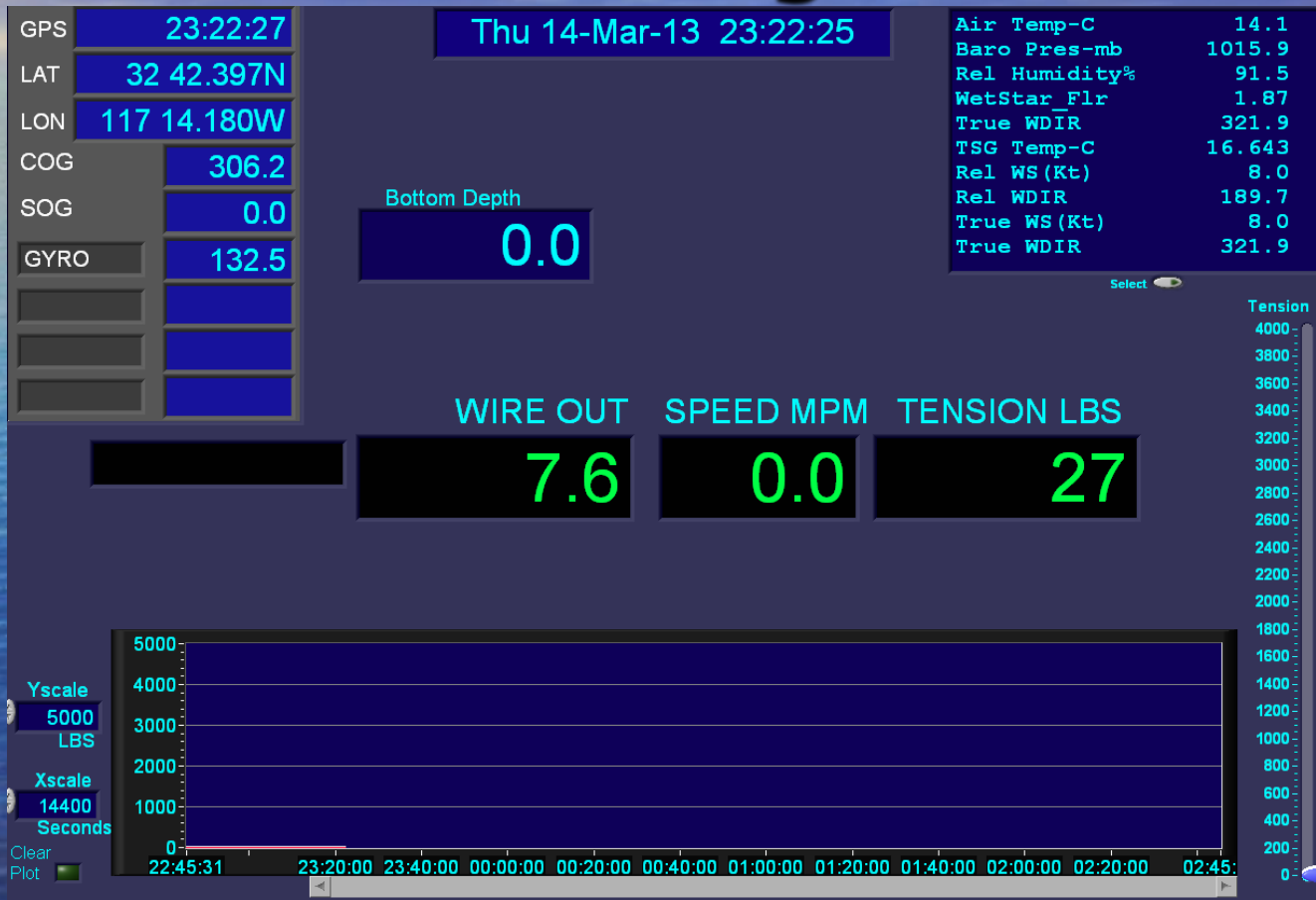
FS less than 5 to 2.5:

Tension must be monitored at the winch operator's station with a display refresh rate of at least 3 Hz.

The system must also be capable of logging tension data at a minimum frequency of 3 Hz .



# Equipment Requirements: Tension Monitoring



# Equipment Requirements: Tension Monitoring

Required at  
Operator's  
Station and  
Good Practice  
to display to  
working deck





# Equipment Requirements: Tension Monitoring

FS less than 2.5 to 1.5:

Tension must be monitored at the winch operator's station with a display refresh rate of at least 10 Hz .

The system must also be capable of logging tension data at a minimum frequency of 20 Hz .

Tension must be continuously monitored using a “tension trending” graph.

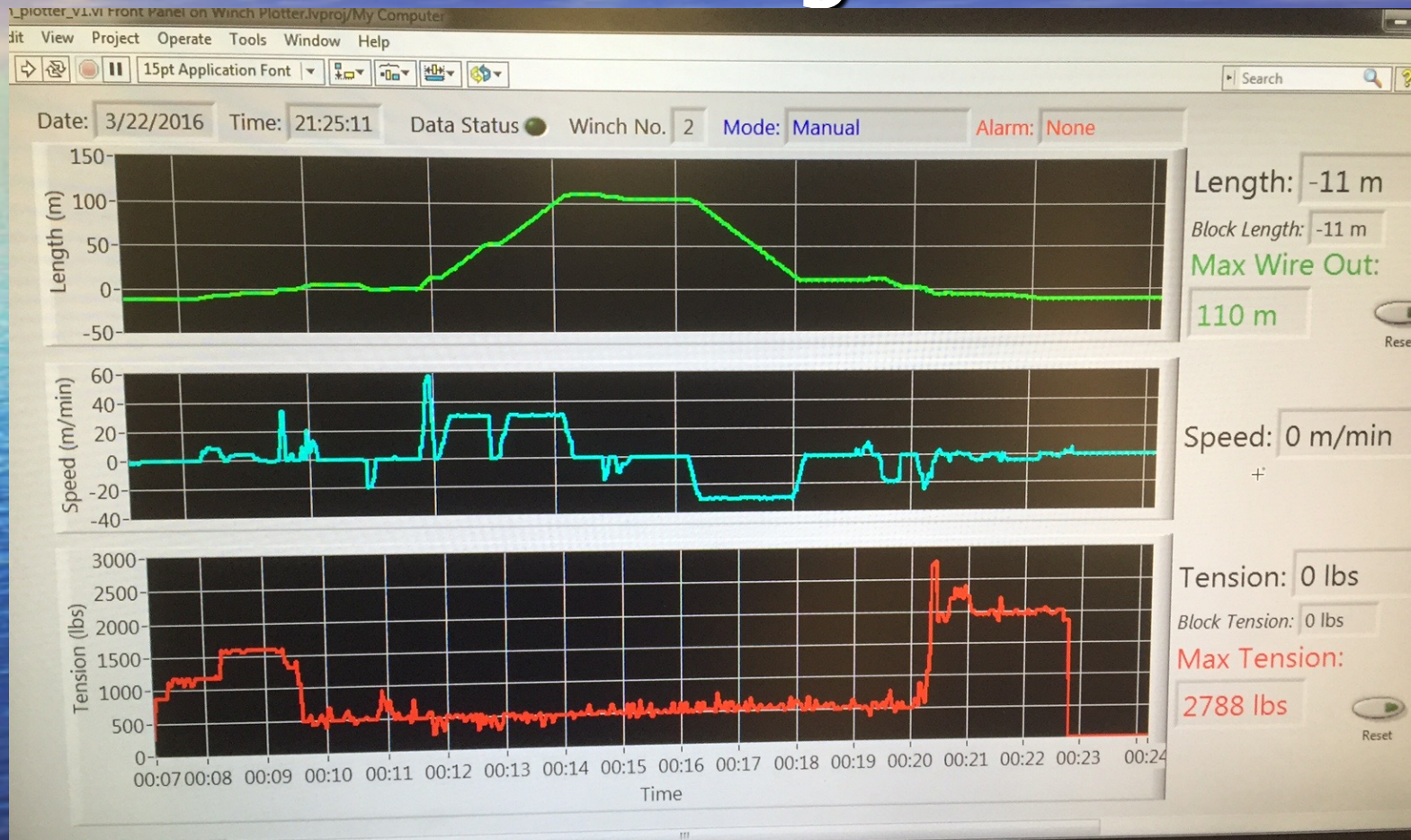
# Equipment Requirements: Tension Monitoring and Alarms

## Trending Graph





# Equipment Requirements: Tension Monitoring and Alarms





# Equipment Requirements: Tension Monitoring

## Calibrations

All FS less than 5

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



# Equipment Requirements: Tension Monitoring

Maintained within an Accuracy  
FS less than 5 to 2.5:

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

FS less than 2.5 to 1.5:

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

Consider: Is the monitoring system staying within tolerance limits?

# Equipment Requirements: Tension Alarms

FS less than 5 to 2.5:

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

FS less than 2.5 to 2.0:

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

FS less than 2.0 to 1.5:

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

Also: Alarm conditions must automatically be included in the logged data.



# Equipment Requirements: Deck Safety:

FS 5 or Greater:

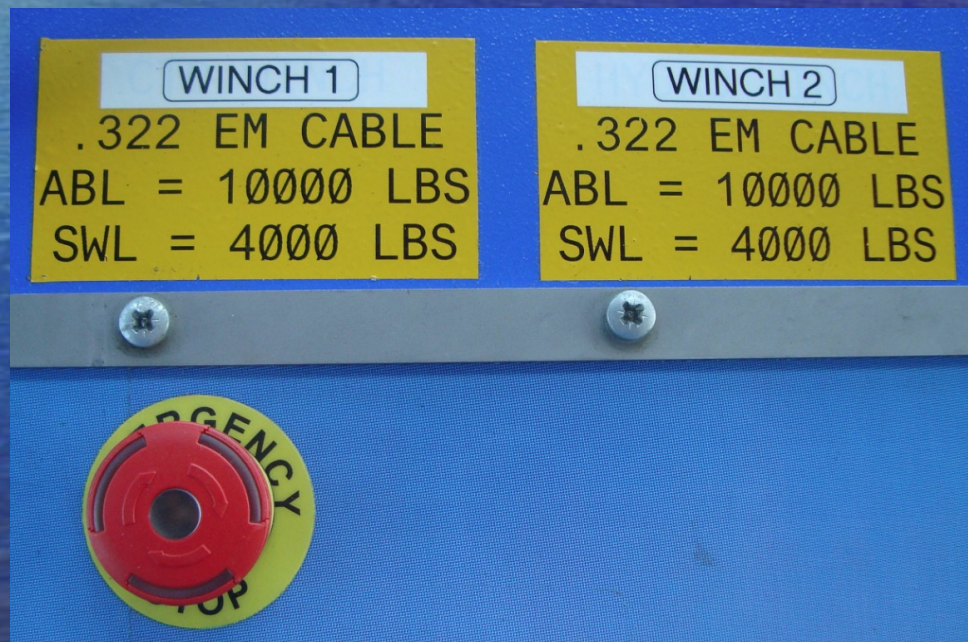
Personnel on deck should follow good safety practices when working in the vicinity of tension members during use



# Equipment Requirements: Deck Safety:

Good safety practice:

SWTs & E-stops at Operators Station





# Equipment Requirements: Deck Safety:

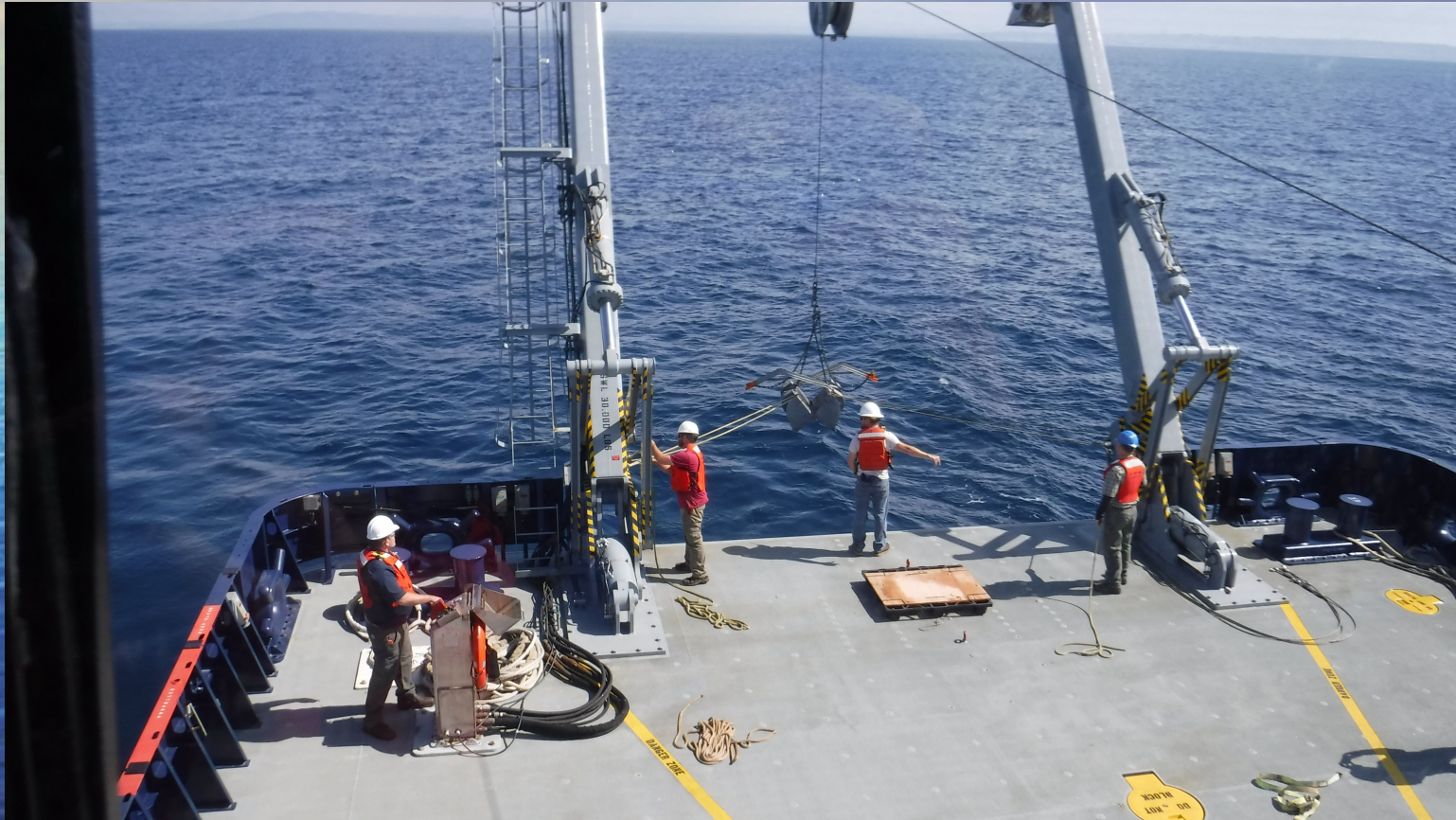
FS less than 5:

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: Safety Zone





# Equipment Requirements: Deck Safety: Safety Zone





# Equipment Requirements: Deck Safety: Safety Zone





# Equipment Requirements: Deck Safety: Safety Zone





# Equipment Requirements: Deck Safety:

FS 1.5 to 2.5:

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





# Equipment Requirements: Deck Safety:

FS 1.5 to 2.5:

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





# Equipment Requirements: Deck Safety:

FS 1.5 to 2.5:  
Physical and/or  
visual barriers  
should be  
erected as  
needed.

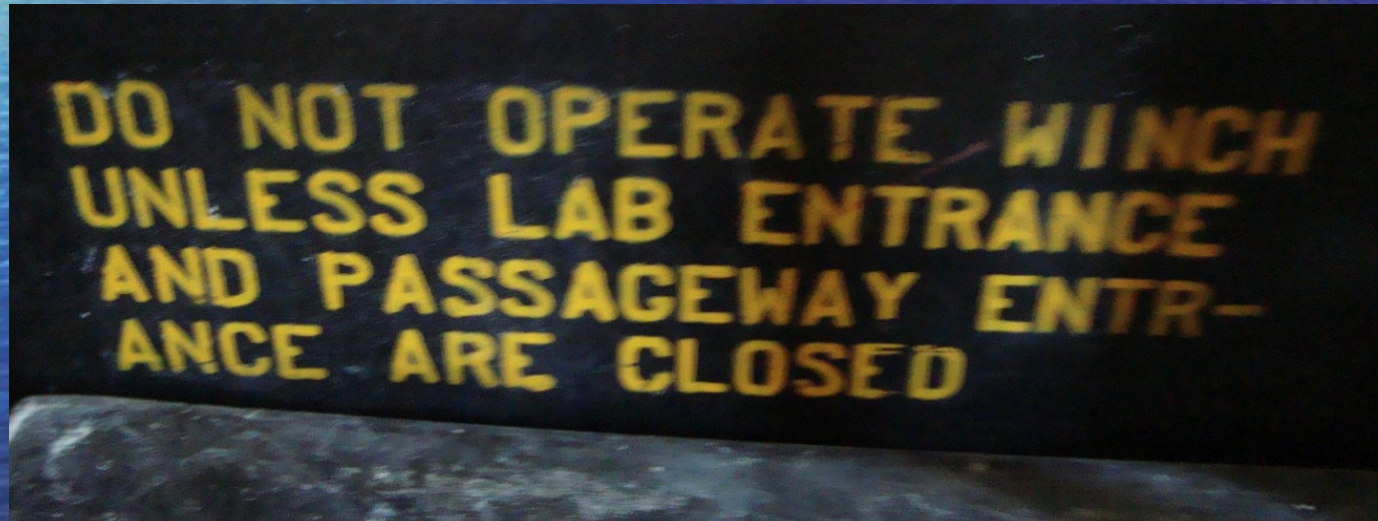




# Equipment Requirements: Deck Safety:

FS 1.5 to 2.5: Additionally

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



# 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:
- Plans in the ARF include:
  - Degrading Weather and Sea State
  - Tension member in propeller
  - Payload package stuck to the bottom
  - Winch failure
  - Loss of ship's power
  - Loss of payload package

# 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. \_\_\_\_\_



# Testing and Maintenance:

- FS 5 or greater:
- Note: break testing is now required.

# Testing and Maintenance:

- FS 2.5 and above
- 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 1.5 to 2.5
- Samples shall be sent for testing every year.
- 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:

- All FS:
- 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 UNOLS Wire Pool



# 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

- All FS
- 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” is 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.

# Logbooks & Record Keeping

- Logs stay with the tension members upon transfer



# Logbooks & Record Keeping

- Wire Break Testing
- Cutbacks
- Spooling Operations
- Lubrication
- Wire Train Description
- Maximum payout for each cast.
- Maximum load for each cast by calculation or monitoring.

# Logbooks: Running Use Log

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



# Logbooks: Running Use Log

A standardized format is being considered. It will maintain a max tension point referenced to the drum end and that won't change with cutbacks.

Tension Member Identifier e.g NSF-XX-CXXX

Winch Manuf. and model: e.g.Hawboldt SPRE-2640

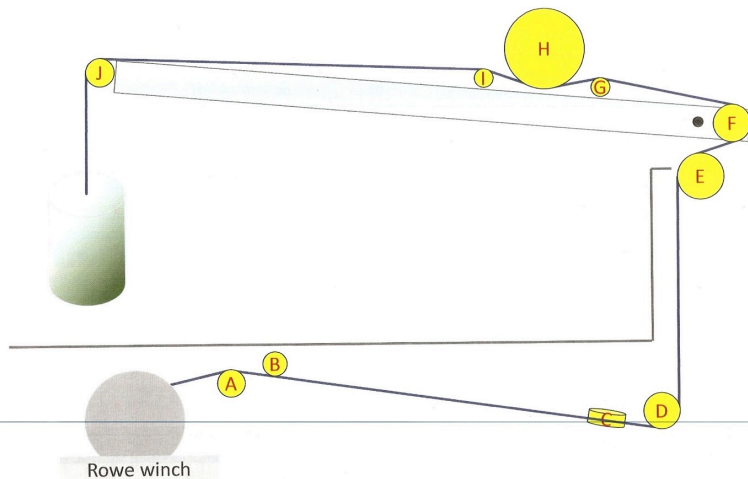
Sheave Train Description:

Number of Deployments Since Last Break Test

Cruise No.	Date	Cast #	Max Tension	Wire Out at Max Tension	Wire In at Max Tension	Max Wire Out	Notes

# Logbooks

- Sample Wire Train Description



CAB 0.322" wire diagram

CAB 0.322" wire diagram

sheave	function & angle change	D (cm)	D (in)	D/d	grooving
A	level wind, 20-30°	10.50	4.14	12.84	slightly wide groove
B	tension switch, 0° (small force)	9.23	3.63	11.29	slightly wide groove
C	turning, 20-30°	14.01	5.51	17.12	wide groove
D	turning, 90°	14.01	5.51	17.12	wide groove
E	turning, 45-100°	17.67	6.96	21.60	
F	turning, 135°	14.32	5.64	17.51	
G	tension guide, 30°	7.16	2.82	8.76	
H	metering, 60°	30.88	12.16	37.75	
I	tension guide, 30°	7.16	2.82	8.76	
J	Berger Engineering fairlead, 90°* (ovbd)	10.98	4.32	13.43	



# Minimum Log Requirements for TBL Testing Include:

Tension Member Identifier

Winch manufacturer and model

Record of all spooling operations, cutbacks, and re-terminations.

Wire train description

Number of sheaves between winch and water

Sheave dimensions including “D” root diameter and “w” groove width

Number and/or duration of deployments since last break test

Maximum tension during each deployment

Wire out at time of maximum tension

Maximum wire out for each deployment

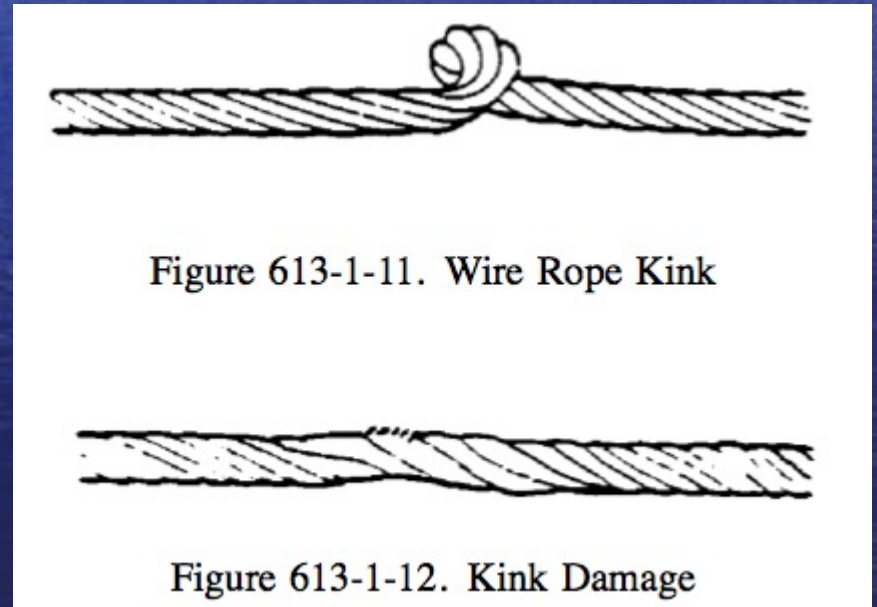
# Retirement of Steel Tension Members:

- 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
  - Excessive corrosion



# Encouraged Action, but not expressly required

Lubricate tension member <12 months

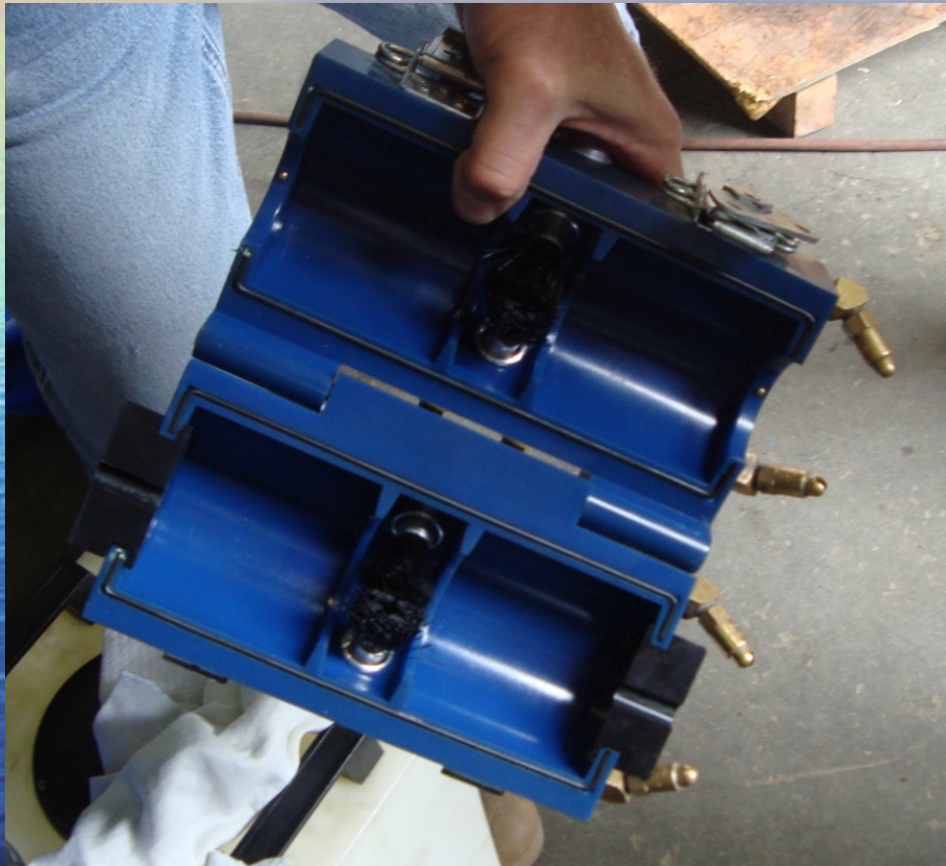
Referenced to the UNOLS Wire Maintenance Policy

Use Environmentally acceptable lubricants

Extends tension member life



# Encouraged Action, Lubricator Shell & Pump



# Encouraged Action, but not expressly required

## Fresh Water Wash

End of every cruise and <month

Referenced to the UNOLS Wire

## Maintenance Policy

Systems that automatically washes on haul back are highly encouraged.



# Encouraged Action, but not expressly required: FW Wash





# 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

Heave 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



# Another Option to reduce peak and zero loading, but not required:

Spring Damper  
RV Pelican



# Encouraged Action, but not expressly required:

## Load Limiting Devices

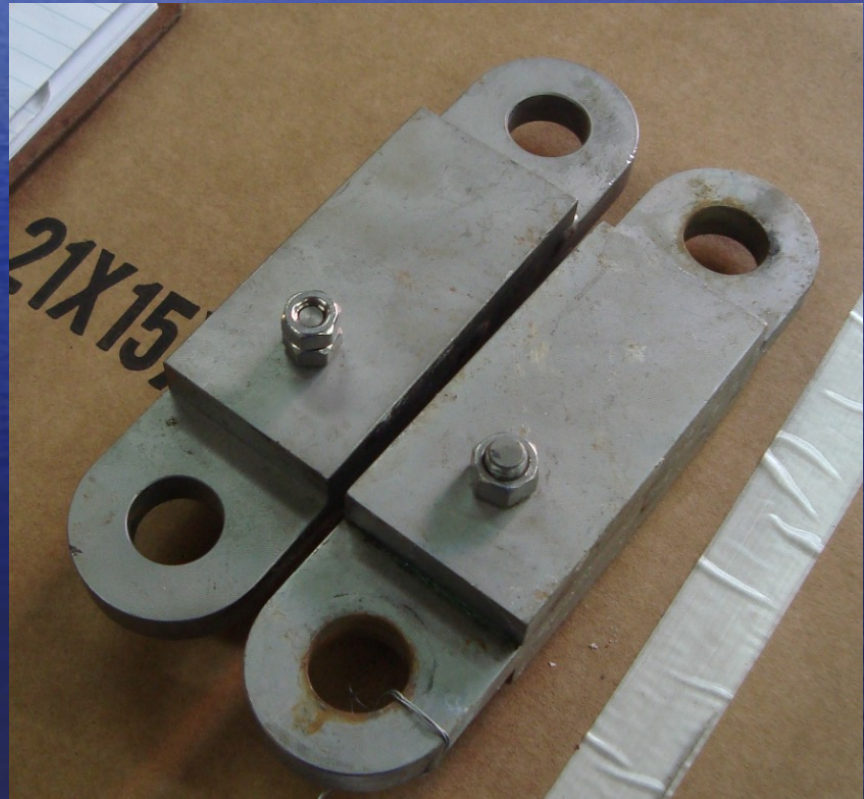
### Weak Links:

- Set to break the payload free to save the tension member , avoid overboarding system damage, limit dangers to the vessel.



# Encouraged Action, but not expressly required:

- **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.



# Appendix A Assist Sheet for Each Wire or Cable

Vessel \_\_\_\_\_ Date \_\_\_\_\_ Tension Mbr \_\_\_\_\_ Winch \_\_\_\_\_ Length \_\_\_\_\_ NSF Reel # \_\_\_\_\_

Appendix A Assist Summary for Each Wire, Cable or Synthetic Tension Member		Updated 1_9_2024 JMS/wec				
Note: This is not all inclusive. See Appendix A RVSS Edition 11 for requirements and operational insights.		Select Applicable Column FS				
Requirement or Attribute For	FS of 5.0 or higher	FS from 2.5 to 2.0	FS from 2.0 to 1.5	FS from 1.5 to 1.0	Compliant	Comments
<b>Steel Tension Members</b>						
Post Cable/Wire SWT in clear view of the winch operator	Applies	Applies	Applies	Applies	Y/N	
<b>General</b>						
Determine Cable/Wire Safe Working Load (SWT) as: Assigned Breaking Load / Factor of Safety (A.8.1)	Applies	Applies	Applies	Applies	Y/N	
Lubricate tension member <12 months (A.5.8)					Y/N	
Fresh Water Wash (lessor 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	
<b>Tension Monitoring</b>						
Have ability to keep load < SWT: (A.8.1)	Applies	Applies	Applies	Applies	Y/N	
May be calculated w/"g" factor at least 0.75 or from Tensionometer	Applies	Applies	Applies	Applies	Y/N	
Have ability to keep load < SWT: Actual from monitoring system	Applies	Applies	Applies	Applies	Y/N	
Tensionometer display at operator's station with 3 Hz refresh rate	Applies	Applies	Applies	Applies	Y/N	
Tensionometer display at operator's station with 10 Hz refresh rate	Applies	Applies	Applies	Applies	Y/N	
Tension continuously monitored using a tension trending graph	Applies	Applies	Applies	Applies	Y/N	
Tensionometer logging at 3 Hz	Applies	Applies	Applies	Applies	Y/N	
Tensionometer logging at 20 Hz	Applies	Applies	Applies	Applies	Y/N	
Tensionometer Recalibration at least every 6 mo.	Applies	Applies	Applies	Applies	Y/N	
Tension measuring system maintained with 4% accuracy	Applies	Applies	Applies	Applies	Y/N	
Tension measuring system maintained with 3% accuracy	Applies	Applies	Applies	Applies	Y/N	
<b>Alarms</b>						
Audible and visual tension alarms w/data logging	Applies	Applies	Applies	Applies	Y/N	
Audible and visual tension alarms w/data logging	Applies	Applies	Applies	Applies	Y/N	
Audible and visual tension alarms w/data logging	Applies	Applies	Applies	Applies	Y/N	
Alarm conditions automatically logged	Applies	Applies	Applies	Applies	Y/N	
<b>Sheaves and Fairlead Rollers</b>						
Sheaves & Rollers: As large as practical (A.8.1)	Applies	Applies	Applies	Applies	Y/N	
Sheaves & Rollers: D/d ratio meet 40:1 or 40d/1 whichever is	Applies	Applies	Applies	Applies	Y/N	
Sheaves: Grooves as close to d as practical and no more than 1.5d	Applies	Applies	Applies	Applies	Y/N	
Sheaves: Grooves 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	Applies	Applies	Y/N	
Note: Allowance from June 2023 update that 9/16 in. dia. 3X19 wire rope may be used on sheaves with a groove dia. between .576 in. and .748 in. provided the sheave tread diameter is 27 in. or more.						
<b>Deck Safety</b>						
Good safety practices (A.8.1)	Applies	Applies	Applies	Applies	Y/N	
Establish danger zones / safety zones	Applies	Applies	Applies	Applies	Y/N	
Warning notices posted	Applies	Applies	Applies	Applies	Y/N	
Physical or visual barriers	Applies	Applies	Applies	Applies	Y/N	
Doors and accesses secured	Applies	Applies	Applies	Applies	Y/N	

Vessel \_\_\_\_\_ Date \_\_\_\_\_ Tension Mbr \_\_\_\_\_ Winch \_\_\_\_\_ Length \_\_\_\_\_ NSF Reel # \_\_\_\_\_

Requirement or Attribute For	FS of 5.0 or higher	Compliant	Comments
<b>Testing</b>			
Break Testing every 2 yrs (A.8.1)	Applies	Applies	Y/N
Break Testing every yr if 10% decrease in ABL or cutback (A.8.1)	Applies	Applies	Y/N
Break Testing every yr	Applies	Applies	Y/N
Break Testing every 6 mo. if 10% decrease in ABL or cutback	Applies	Applies	Y/N
<b>Logbooks: UNOLS wire identifier: Cable Inventory/History and Running Use</b>			
Logs stay with the wires transfer with the wire	Applies	Applies	Y/N
Log of wire Break Testing	Applies	Applies	Y/N
Log Cutbacks	Applies	Applies	Y/N
Log Spooling Operations	Applies	Applies	Y/N
Log of Lubrication	Applies	Applies	Y/N
Wire Train Description	Applies	Applies	Y/N
Maximum payout for each cast.	Applies	Applies	Y/N
Maximum load for each cast by calculation or monitoring.	Applies	Applies	Y/N
<b>Winch Operator</b>			
Operator deemed competent in writing by master and owner	Applies	Applies	Y/N
Operator "Certified Competent" in writing by master and owner renewed annually.	Applies	Applies	Y/N
Master verify qualifications and designate approved operators.	Applies	Applies	Y/N
Training record for formal operator training program for winch, handling apparatus, and monitoring system.	Applies	Applies	Y/N
Suggestions: Please contact Ted@beechillbison.com			

Requirement or Attribute For	FS of 5.0 or higher	Compliant	Comments
<b>Synthetic Tension Members</b>			
<b>General</b>			
Communication established with Wire Pool for the synthetic tension member use.	Applies	Y/N	
A Synthetic Tension Member operated to a nominal FS = 5.0 on	Applies	Y/N	
Designate SWT	Applies	Y/N	
Post SWT in clear view of the winch operator	Applies	Y/N	
Develop Extenuating Circumstance Procedure (Required for steel tension members, not specific to synthetics)	Y/N		
<b>Tension Monitoring</b>			
Have ability to keep load < SWT:	Applies	Y/N	
Tension monitored at with a display refresh rate of 10 Hz.	Applies	Y/N	
Tension continuously monitored using tension trending graph.	Applies	Y/N	
Logging tension data at at refresh of 20 Hz (every 50 ms).	Applies	Y/N	
Tension measuring system calibrated at least every 6 months.	Applies	Y/N	
Tension measuring system maintained with an accuracy of	Applies	Y/N	
<b>Alarms</b>			
The handling system fitted with both audible and visual tension alarms that sound and illuminate prior to FS of 5.6	Applies	Y/N	
<b>Sheaves and Fairlead Rollers</b>			
Sheaves & Rollers: D/d ratio meet 40:1	Applies	Y/N	

Vessel \_\_\_\_\_ Date \_\_\_\_\_ Tension Mbr \_\_\_\_\_ Winch \_\_\_\_\_ Length \_\_\_\_\_ NSF Reel # \_\_\_\_\_

Requirement or Attribute For	FS of 5.0 or higher	Compliant	Comments
<b>Deck Safety</b>			
"Danger Zones" identified around tension members under	Applies	Y/N	
All personnel excluded from Danger Zones (to the extent possible) such that a sudden failure cannot result in injury	Applies	Y/N	
Warning notices displayed at points of access.	Applies	Y/N	
Physical and/or visual barriers.	Applies	Y/N	
Doors and accesses to the overboarding area secured	Applies	Y/N	
<b>Testing</b>			
Tension member samples sent for testing prior to use.	Applies	Y/N	
Tension member samples sent for testing after use.	Applies	Y/N	
<b>Logbooks: UNOLS Tension Member Identifier: Winch and system manufacturer: Cable Inventory/History and Running Use</b>			
Record of all spooling operations	Applies	Y/N	
Record of all cut backs, including those due to re-terminating.	Applies	Y/N	
Number and/or duration of deployments since last break test.	Applies	Y/N	
Maximum tension of each deployment and line out at time of maximum tension.	Applies	Y/N	
Maximum payout of each deployment.	Applies	Y/N	
Description of the sheave train.	Applies	Y/N	
Winch and system manufacturer.	Applies	Y/N	
The log transferable with the tension member.	Applies	Y/N	
Highly recommended* that the NSF Wire Pool Data Base be used to meet above requirements.	*	Y/N	
<b>Winch Operator</b>			
Certification by the Winch Owner that all Winch Operators are	Applies	Y/N	
Written documentation in place showing that each operator has been through and successfully passed a formal owner/operator developed training program on the	Applies	Y/N	
(a) winch, (b) handling apparatus, and (c) monitoring system.	Applies	Y/N	
Master verification that operators are qualified.	Applies	Y/N	
Master verification that operators are designated.	Applies	Y/N	
Operator certifications renewed annually by Master.	Applies	Y/N	
Operator qualifications refreshed and documented if there are configuration changes to controls or to the hardware.	Applies	Y/N	
Suggestions: Please contact Ted@beechillbison.com			

# 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.



# Questions?

- Ted Colburn