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Association of Resource Companies, Ship Operators, Ports & Terminals

Mooring Winch Brake Testing and Ship Design MBL

Key Objectives

- **Based on Technical Papers to be Presented to the ARCSOPT Group. The papers aim to:**

✓ **Generate high level of confidence on Mooring Winch Brake settings and rendering values**

✓ **Correct setting of the vessels SDMBL**

✓ **A comparative study on Equipment standards on Dry Vessels**

The papers were written jointly by Anglo Eastern and Mer Solutions
With cooperation with BHP – Hay point Terminal

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Mooring Winch Brake Render Testing Guidelines

October 2022

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Mooring Winch Operations and Brake Testing Guidelines

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In Service Mooring Equipment Design and Analysis

October 2022

Paper 1: Brake Testing Guidance

- **Ability for a ship's mooring winch brakes to "Render" when the tension in the ship's mooring system reaches a pre-determined value is a crucial safety system**

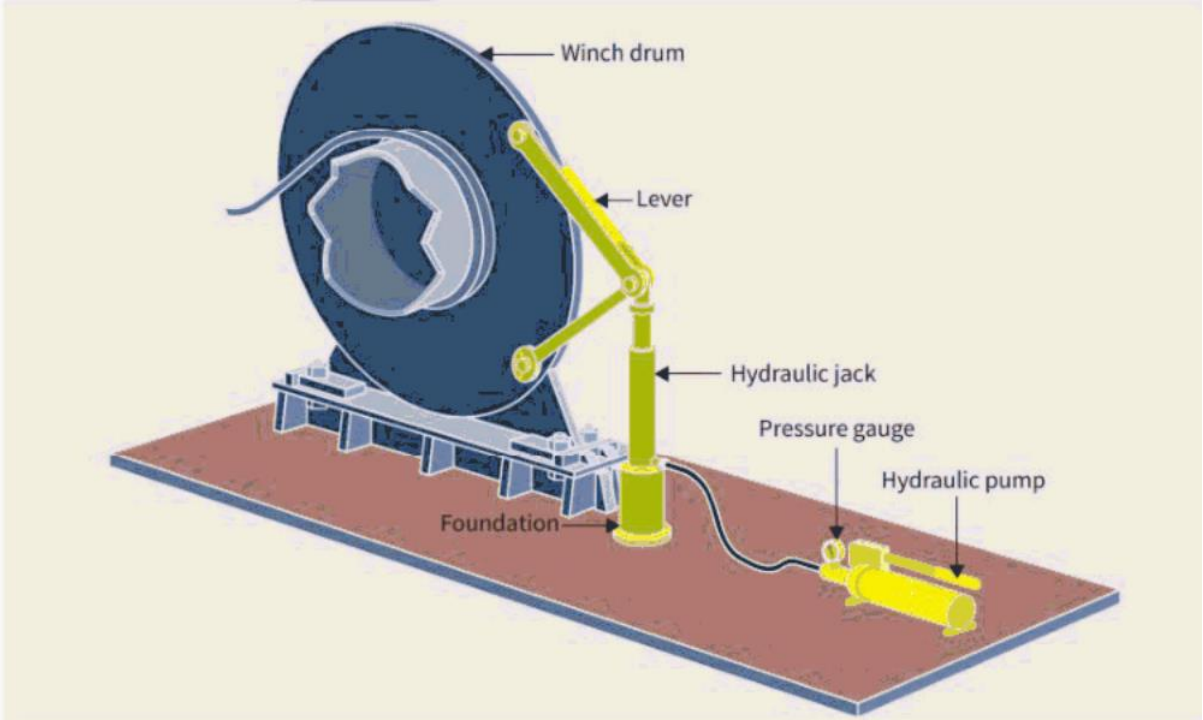
- **The paper analyses factors which can affect determination and setting of these values**

- **A Sample calculation is provided for split and conventional drums for reference**

Factors that may affect correct setting of brakes

- **ISO 3730 standards do not require winches on dry vessels to be designed for conducting a brake test**

- **When test arrangements are fabricated- guidance on test kits / distances of levers from drum / reaction forces from the deck plating are crucial factors to consider**



Factors that may affect calculations of rendering value

- **If an incorrect area of the jack is used in calculations, the jack pressure required is higher for the simulated load.**
- **This may result in lines being set to a higher rendering value than envisioned and affect the rendering at correct load**
- **The correct area to be used is of the flange receiving pressure from actuator**

Factors that may affect rendering at correct load

- **Line embedding in conventional drums**
- **Multiple layers on a split drum**
- **Importance of uniform lines on the same lead**
- **Maintenance of brakes and brake linings including floating connections**

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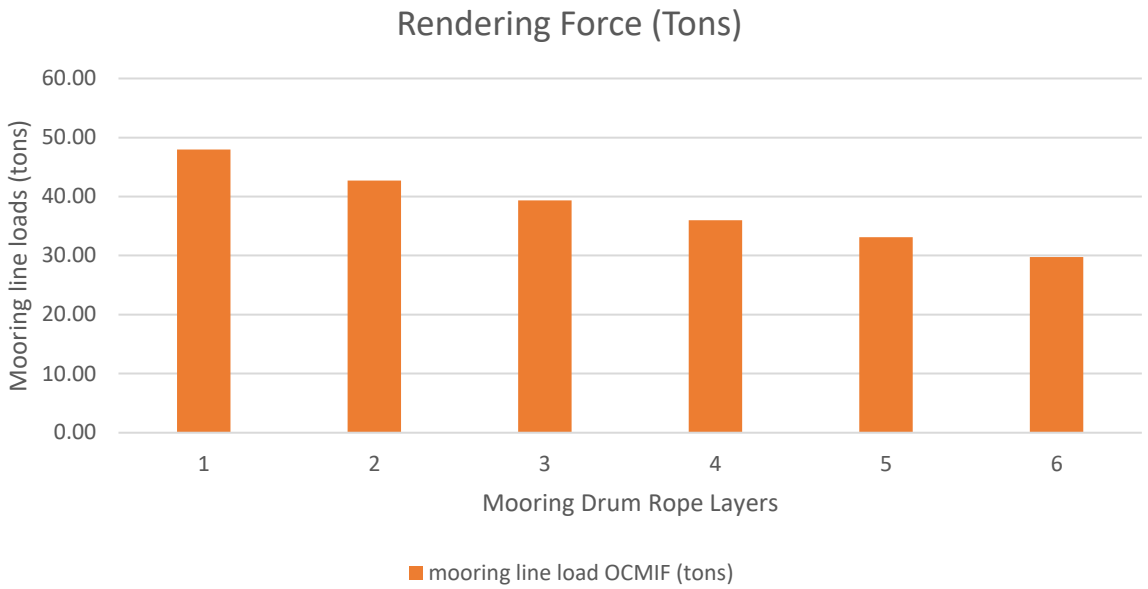
Paper 2: Ensuring Brakes are set correctly

- **A comparative study of EN number/OCIMF environmental criteria for determination of SdMBL (Ship Design MBL)**
- **Position of dry vessels in respect to the resistive forces offered by mooring arrangement of dry vessels VS Tankers**
- **Design line as per ISO 3730 standards and precautions when using EN number as a sole guidance for setting of the vessels SdMBL**
- **Factors to consider when choosing correct render forces**

The Effect of Layers on Rendering Forces



- **Reduction of rendering forces from the BRC at the first layer**
- **Effect of Increase in distance from the drum centre**

Winch brakes are designed to be set with one layer around the winch drum. Any further distance outward from the centre of the drum reduces the force necessary to render the winch brake. Securing the brake with a second layer will cause rendering at 11% less than declared brake capacity, and by 25% if the brake is set with a fourth layer.

The Effect of Layers on Rendering Forces

Drum diameter D in CM	Number of layers	Mooring lines diameter R (cm)	L=D/2+R	Actual Pull Force (Tons)	Percentage (%)
50.8	1	7.2	32.6	15.00	100%
50.8	2	14.4	39.8	12.29	82%
50.8	3	21.6	47	10.40	69%
50.8	4	28.8	54.2	9.02	60%
50.8	5	36	61.4	7.96	53%

Line diameter = 72mm

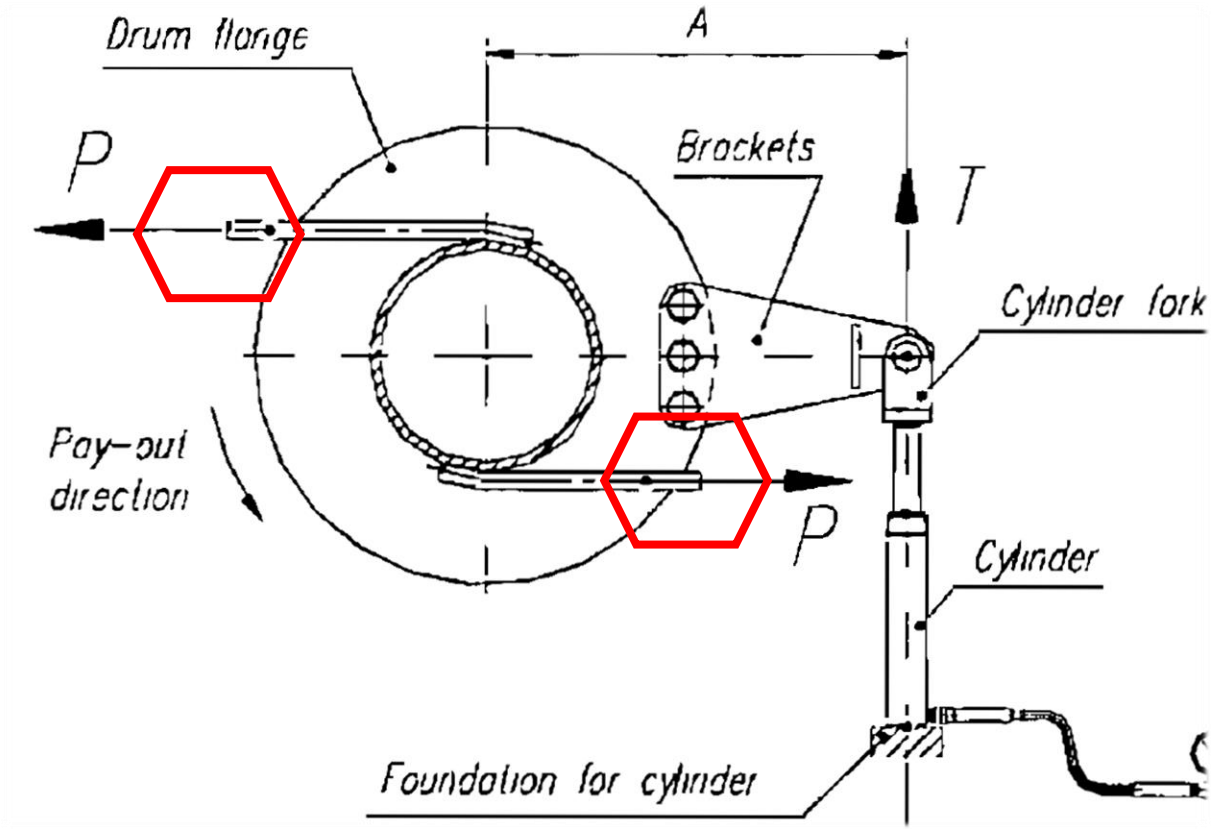
Drum diameter D in CM	Number of layers	Mooring lines diameter R (cm)	L=D/2+R	Actual Pull Force (Tons)	Percentage (%)
50.8	1	3.4	28.8	15.00	100%
50.8	2	6.8	32.2	13.42	89%
50.8	3	10.2	35.6	12.13	81%
50.8	4	13.6	39	11.08	74%
50.8	5	17	42.4	10.19	68%

Line diameter = 34mm

- **While OCIMF Values may look standard – they are not and reduction in forces is variable**
- **The diameter of the mooring line has a large influence on reduction of force required for rendering of brakes.**
- **A lower diameter line is always beneficial , however at no time the design line of the winch must be exceeded**

The Correct Location on Layer

- The correct distance of the layer on mooring line to be taken is 0.5 times the diameter of the lines
- While this is usually correct for the first layer, errors are often noted on 2nd and 3rd layers where the correct value is 1.5 and 2.5-times rope diameter
- A higher than necessary lever sets the brake at higher values when calculated for 2nd and 3rd layer



The Brake Screw Pitch and Marking

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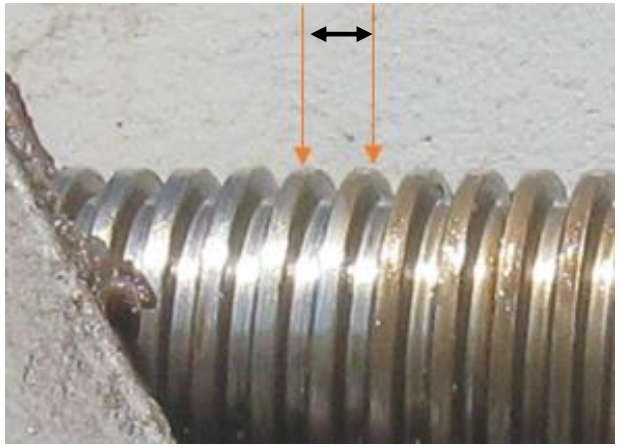
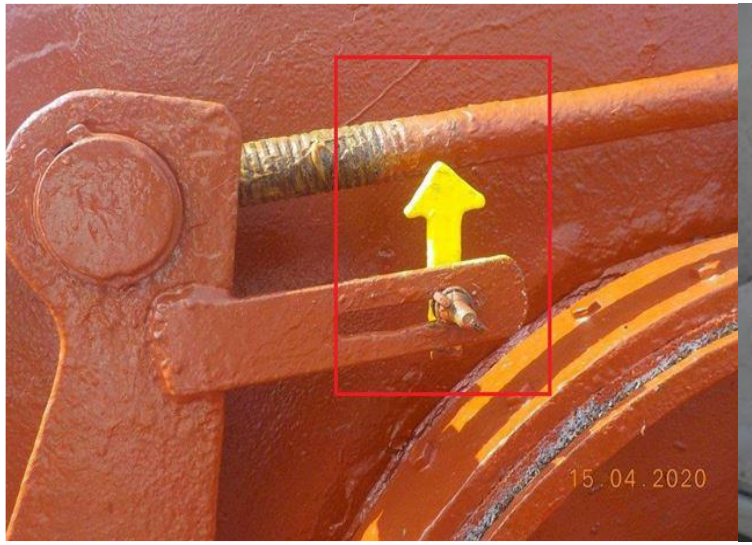
- **A brake tightening crew with a large pitch requires exact markings. A single turn on the brake causes a large travel and tightening**
- **During tests it is noticed that even half a turn more can result in incorrect setting**
- **A sharp and robust marking is hence necessary**





Paper 3: Mooring equipment Design and Analysis : Setting Vessels SdMBL

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- **This paper is a study of in-service equipment on bulk carriers and its analysis**
- **The study was conduced by using the pre arrival information of about 90 vessels which performed operations at Hay Point**
- **The primary objectives were to study identified SdMBL and its implication on the Brake rendering values**

Results of Analysis

Ship	DWT	Age	No of Powered Drums	Split Drum	Type of line	LDBF Line	SWL Fittings	BHC winch	SWL winch	Declared SDMBL	SDMBL Suggested	BRP Set by ship	Correct BRP Required
Ship 3	80K	8	10	N	pp	70	50	40	50	60	50	32	30
Ship 7	81K	6	12	N	PP+PES	76	62	48	60	47	62	28.2	37.2
Ship 14	81K	7	12	N	PP+PES	68	62	48	60	68.3	62	43.05	37.2
Ship 31	95K	9	16	N	nylon	90	63	48	60	47.7	63	35	37.8
Ship 37	179K	11	16	N	nylon	94	72	57.2	71.5	57	72	44.7	43.2
Ship 40	180K	5	16	N	PP+PES	98	73	60.1	75.1	79.94	73	47.96	43.8

- **51% of the vessels: SWL of winch = SWL of Fittings. SdMBL should be common SWL but was incorrect in some cases**

Results of Analysis

	DWT	Age	No of Powered Drums	Split Drum	SWL Fittings	BHC winch	SWL winch	Declared SDMBL	SDMBL Suggested	BRP set by Ship	BRP as per Suggested SDMBL	BRP at first layer
Ship 8	81K	0.1	10	N	62	43.8	54.75	68.3	62	35.1	37.2	43.5
Ship 16	81K	9	12	N	64	45	56.25	60	64	36	38.4	45.0

Ship	DWT	Age	No of Powered Drums	Split Drum	SWL Fittings	BHC winch	SWL winch	Declared SDMBL	SDMBL Suggested	BRP set by Ship	BRP as per Suggested SDMBL
Ship 21	82K	0.4	12	N	90	48	60	55	60	60	36
Ship 24	82K	1	12	N	90	52.8	66	83	66	48	39.6

Ship	DWT	Age	No of Powered Drums	Split Drum	SWL Fittings	BHC winch	SWL winch	Declared SDMBL	SDMBL Suggested	BRP set by Ship	Desired BRP	Effective BRP at 3rd Layer
Ship 15	81K	12	12	N	64	36	45	64	60	30	35-39ts	30
Ship 45	182K	10	16	N	73	48	60	73	73	37	45-49ts	39

- **31% of the vessels: SWL of winch was lower or substantially lower than the = SWL of Fittings. SdMBL in such cases must be carefully evaluated.**
- **In some cases it was necessary to approach the winch manufacturer to improve the holding capacity of the winch or consider split drums**

Results of Analysis

Ship	DWT	Age	No of Powered Drums	Split Drum	Type of line	LDBF Line	SWL Fittings	BHC winch	SWL winch	Declared SDMBL
Ship 10	81K	0.4	10	Y	PP+PES	105	64	60	75	75
Ship 11	81K	9	12	N	PP+PES	81.6	69	60	75	63

- On some vessels SWL of winch was higher than the = SWL of Fittings. In such case the Winch Hauling Load comes into play.
- The Hauling Load can pull the line more than its working load limit during mooring affecting the line lifecycle.
- It was recommended to approach the makers to reduce the hauling load.

Next Steps ?

- **Release papers to the wider group within ARCSOPT for initial deliberations within the group for common acceptable solutions**
- **Acceptable solutions intend to develop confidence between operators and terminals on values of SDMBL and setting of brakes**
- **Upon reaching common understanding, release the papers to industry and adoption of practices**

Thankyou!

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