

# Mooring Tails Inspection & Retirement Guidelines



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# 1. Introduction

This guideline is intended for use as part of Line Management Plan (LMP) according to OCIMF MEG4 in conjunction with Installation guideline and mooring rope use and care manual.

## 1.1 Factors affecting Mooring Tail Service Life

This document is a general guideline on tail retirement criteria for all vessel types. Below factors will affect expected lifetime of a mooring rope:

- Vessel type
- Mooring arrangement and its design
- Position of the tail
- Trading route
- Mooring frequency
- Ports
- Cargo
- Environment

All the above mentioned is important to have in mind when creating the vessels, mooring tail inspection routines, and intervals.

The retirement criteria in this document should support the Owner or Manager to create Mooring System Management Plan (MSMP).

This guideline is not intended to overrule or serve as a replacement for each individual vessel's operational practices or procedures or the experience of its crew, nor does it assume any responsibility of the manufacturer for the retirement of mooring ropes. For the avoidance of doubt, WSS shall not be liable for any losses incurred in connection with this guideline.

## 1.2 Factors that can prolong rope's lifespan

To assist in decision on the retirement of **tails**, we strongly recommend actively using Timm™ LMP software. The LMP-application is designed to reduce the administrative workload when recording, collecting, and evaluating the data needed to make informed decisions based on these retirement guidelines. By combing records of usage and inspection results with retirement guidelines, the LMP-application becomes an important tool to ensure the retirement guidelines are followed and gives all stakeholders a platform to view and assess the current status. Actively using the application ensures high quality data that can be used to improve the rope management and replenishment routines.

The following factors should also be considered in order to prolong the lifespan of mooring tails:

- Installation should be done by experienced crew, according to the manufacturer's instructions
- Ensure proper and regular maintenance of the mooring winches and fittings such as mooring bits, bollards, fair-leads, Panama chocks, rollers etc. to maintain smooth surface
- Crew should handle the ropes with care and follow the manufacturer's recommendations.
- Keep the ropes covered and out from the sunlight when not in use.
- Do not keep the tails stored in contact with chemicals.
- It is recommended to use the same type of mooring ropes/tails on all positions where ropes/tails are working in parallel
- Regular inspections by crew and third party

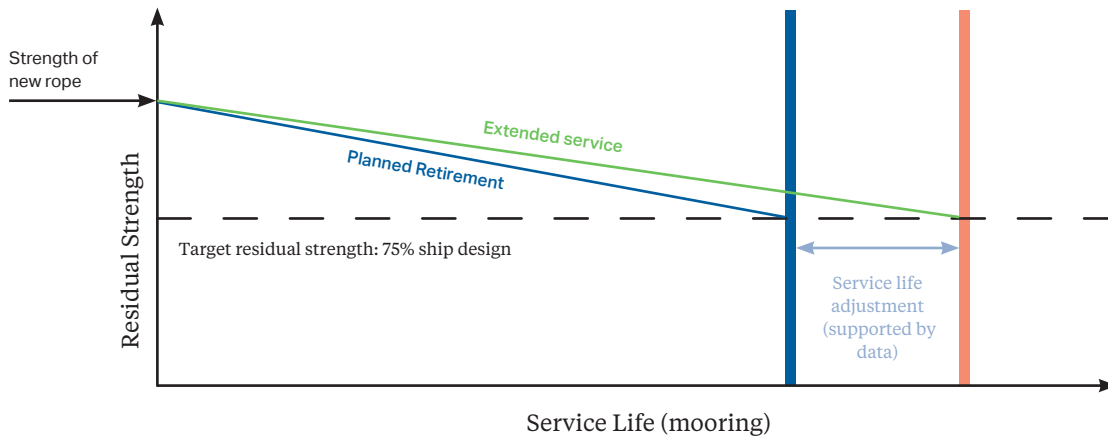
### 1.3 Load Limits

According to OCIMF MEG4, the typical operating range of the rope (incl. tail) is up to 22% of the Ship design MBL. The working load limit is 50% of the SDMBL for synthetic ropes/tails. Loads higher than this limit will cause damage on the ropes/tails, decrease its lifespan, and cause a risk of breakage by exceeding the residual strength.

		Fitting		Mooring Line		Typical operational range		OCIMF (2018). Mooring equipment	
								& Ship Design MBL	
Increased loading on line leading to increased rate of damage and risk of loads exceeding residual strength	Max LDBF	105	LDBF = 100-105% ship design MBL						
	Ship design MBL	100	Ship design MBL						
		75	Residual Strength – Recommended retirement of mooring lines as according to OCIMF MEG4						
Working loads are within maximum expected values for anticipated environmental conditions	WLL (50-55%)	55 Wire	Working Load limit						
		50 Synthetics	Working Load limit						
Typical operational range		22							
		0	Recommended working load						

OCIMF MEG4 recommends retiring mooring ropes/tails, when the residual strength has reached 75% of the Ship Design MBL. Today this can only be determined by a destructive test.

For more individual retirement criteria we recommend performing a test of residual strength as mentioned by OCIMF MEG4. By performing a test and gradually building up historical data on different ropes and tails, the vessel will create the optimal solution. In addition to that, regular inspection with certain intervals should be performed and ropes and tails discarded if deemed necessary.



Service life adjustment according to OCIMF MEG4

## 2. Product Properties

	Timm™ Flex 8	Timm™ Master 8	Timm™ Master 12 SBA™
Construction	8-strand braided/plaited	8-strand braided/plaited	12-strand braided/plaited with SBA™ core
Fiber	Polyamid	Mixed Polyolefin/HT Polyester	Mixed Polyolefin/HT Polyester/SBA™core
Specific gravity	Approx. 1,14 (sinking)	Approx. 0,99 (floating)	Approx. 0,99 (floating)
Colours	White	White	White/Blue
UV resistance	Excellent	Excellent	Excellent
Abrasion resistance	Excellent	Very Good	Very Good
Water resistance	< 2% absorption	< 0,1% absorption	< 0,1% absorption
Heat resistance	215° (melting)	165-260° (melting)	165-260° (melting)
Elongation (new)	37-42% at break	16-18% at break	16-18% at break
Elongation (used)	23-27% at break	11-13% at break	11-13% at break
Tail designed lifetime	1000 mooring hours	2000 mooring hours	2000 mooring hours

Refer to Appendix A for more information on the elongation of mooring tails.

Designed lifetime is contingent on, but not limited to, the following factors:

- protected port
- deck equipment in excellent condition
- regular inspections
- not exceeding the WLL
- following the manuals for Installation, Use and care and Retirement

### 3. Tail condition evaluation

The chapters below provide basic guidance for assessing the different types of damage. Chapters are divided similarly as in Fiber Rope Inspection and Retirement Criteria CI 2004 -4 guideline and accompanied by our best practice and knowledge.

Knowledge of the causes and appearance of damage is essential for the proper evaluation of rope damage during inspection and important when deciding if the tail should be retired or kept in service.

#### 3.1 Colour Coding Definition




In the below sections we present main categories for damages on tails. Following color coding is used in conjunction with detailed explanation: The following factors should also be considered in order to prolong the lifespan of tails:

- Green – tail: in excellent condition
- Yellow – signs of damage in progression
- Red – tail exceeds the retirement criteria

#### 3.2 Cuts





Cuts in fibers and strands are usually a sign of contact between tail and any sharp edges. If one or more strands are cut, it is necessary to remove the affected area and re-splice new eye if possible. The level of damage is a function of the percentage of the tail cross-section that has been permanently lost.

**Timm™ Flex, Timm™ Master 8, Timm™ Master 12 SBA™**

Witnessed Condition	Code	Description/Recommendation
		Fibers intact, no visible cuts.
		Visible cut in fibers. Visible cuts in very few yarns is acceptable, however monitoring the tail is recommended. Inspect and find sharp edge in the path of the tail causing the cut and repair. Protect the rope.
		Cut yarns clearly visible on several yarns in the rope. Tail must be retired. Inspect and find sharp edge in the path of the rope causing the cut and repair the area. Protect the new rope.

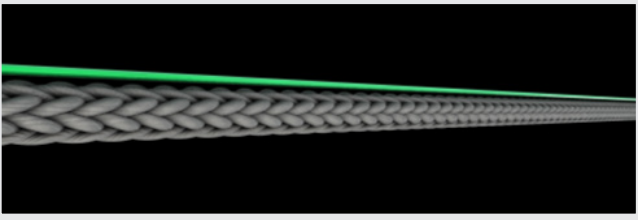
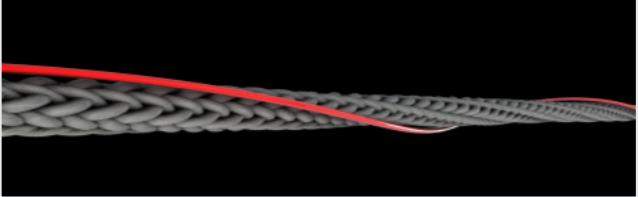
### 3.3 Pulled Strands and Yarns

If yarns or strands get stuck on equipment or obstacles, these yarns or strands can be pulled out. Pulled yarns or strand can easily be put back into the tail.

Witnessed Condition	Code	Description/Recommendation
		Minor damage. Hide the fibers inside the rope. Inspect and find the obstacle causing the pulled yarns and remove or repair.
		Pulled yarns can be repaired by working the yarns into the tail or cutting off close to the rope surface. Inspect and find the obstacle causing the pulled yarns and remove or repair.
		Pulled strand can be repaired by working the strand into the rope by locating the damage on the length of the tail and by pulling and settling the strand. Inspect and find the obstacle causing the pulled strand and remove or repair.
		Pulled strand caused major constructional damage on tail's length. Tails must be retired. Inspect and find the obstacle causing the pulled strand and remove or repair.

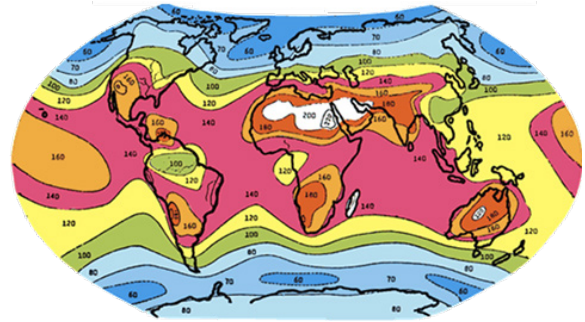
### 3.4 Twist

Tails should display little or no twist. If there are twists in the tail, be aware that one twist per meter will decrease the strength of the tail by approximately 6%.





Witnessed Condition	Code	Description/Recommendation
		No twist. Perfect conditions.
		Visible twist. Risk of decreasing the tail's strength. Untwist the rope in opposite direction at first possible occasion.

### 3.5 UV Degradation

Ultra-violet (UV) radiation from direct sunlight will cause brittle, weak outer yarns on the tail and start destruction process in inner yarns. UV degradation is difficult to inspect visually, however brittleness and discoloration may be observed in some cases. For a definitive assessment, strength testing of a few surface fibers or in some cases the entire tail is required. In some cases, the filaments can be crushed by hand due to brittleness. Some improperly stored tails could seem to be in good condition, but UV damage will be easily visible under tension.



Generalized Isolines of Global Radiation (Kcal./cm<sup>2</sup>/year) expressed in Kilo-Langley per year By H.E. Landsberg



Witnessed Condition	Code	Description/Recommendation
		UV degradations visible by crushed fibers. Tail must be retired.
		UV degradations visible by crushed fibers. Tail must be retired.
		Yarns easily crushed or damaged by hand. Tail must be retired.
		UV degradation on tail after tension is applied. Damaged fibers easily visible. The signs of UV degradation are not always visible before tension is applied. Attention must be paid to ropes that have been exposed to sunlight over an extensive period of time. Tail must be retired.

### 3.6 Chemical Degradation




Synthetic fibers generally have good resistance towards chemical attack and heat exposure under normal circumstances but may be weakened in certain situations. In many cases visual inspection may reveal discoloration and brittleness of the fibers. Melting, bonding of fibers, hard spots or stickiness may be observed, yet these indications are not always present. Any exposure to chemicals shall be logged and the inspector should research the exposure history of the tail.

Nylon tails can be seriously degraded by long-term contamination with rust when wet. This can be detected by a reddish or brown coloration.

#### Timm Master

Witnessed Condition	Code	Description/Recommendation
		Tail log shows that there has been significant exposure to chemicals. Tail must be retired.
		Tail discoloration, brittle fibers, fusion, bonding of fibers, hardness. Chemical exposure suspected. Tail must be retired.





#### Timm Flex

Witnessed Condition	Code	Description/Recommendation
		Tail log shows that there has been significant exposure to chemicals. Tail must be retired.
		Tail discoloration, brittle fibers, fusion, bonding of fibers, hardness. Chemical exposure suspected. Tail must be retired.
		Nylon tail has been used or stored when wet in contact with oil. Tail must be tested or retired.



### 3.7 Dirt and Particles

Contamination with dirt and particles can cause internal fiber abrasion in ropes.

Witnessed Condition	Code	Description/Recommendation
		<p>Tail and deck/floor dirty. Recommended to inspect regularly for internal and external abrasion.</p>
		<p>Tail discoloration, brittle fibers, fusion, bonding of fibers, hardness. Chemical exposure suspected. Tail must be retired.</p>

### 3.8 Excessive Loading/Shock Load

Overloading or shock loading a tail above the working load limit might cause significant loss of strength and/or durability, but the damage may not be detectable by visual or tactile inspection. The best method to determine whether excessive tension or shock loading has occurred is the usage history of the tail, but it can be difficult to define. The inspector must take a conservative approach when reviewing the usage history of the tail. Shock loading may cause internal melting of the fibers in the tail. All incidents with shock loads or excessive load must be registered in the tail log/LMP.

### 3.9 Wet Conditions, Excessive Humidity, and Temperature

This section is applicable to Timm Flex 8/12 tails.

The strength and elongation of polyamide / Nylon tails decreases in wet conditions. Therefore, polyamide / Nylon tails used frequently in wet conditions will degrade faster and will likely need to be retired earlier.

Polyamide / Nylon tails stored in environment with high humidity and high temperature over long periods of time can lose elongation and strength, even if they haven't been used. Tails that have been damaged by humidity will usually not exhibit any change in visual aspect but will become hard. Tails that are significantly harder to the touch and are likely damaged by humidity should be retired.

## 4. Conclusion/Evaluation

All mooring ropes, tails and accessories shall be regularly evaluated by responsible deck officer. The frequency shall be defined based on vessel type, trading route, port conditions etc. If any special incident occur, such as sudden swell, passing vessel or other unforeseen situations, immediate visual inspection and evaluation shall be performed and logged accordingly.

To conclude on the ropes condition, below points shall be checked:

- Evaluate the rope's/tail's log in LMP or similar for the rope's/tail's history and mooring hours evaluation
- If any of the witnessed conditions above have been evaluated with color code red, the rope shall be retired or turned end-to-end in case this is possible
- In case of yellow color code evaluations, pay special attention to these points during the next inspection
- If more than one yellow observation on the same rope/tail has been recorded, the total degradation must be evaluated. It is recommended to use the same type of ropes on all positions where ropes are working in parallel
- In case of some doubt contact producer for consultation or further evaluation (record of rope/tail history will be necessary)

Residual strength of the rope/tail can only be determined by destructive test. Please contact producer for further information. Re-splicing of a new eye must be performed according to the manufacturer's manual by competent personnel.

In case of shock load breakage, the whole length under tension has been affected. The tail must be retired and replaced.

If you are in doubt of the ability of the product performing its required application, it should be taken out of the operation and replaced.

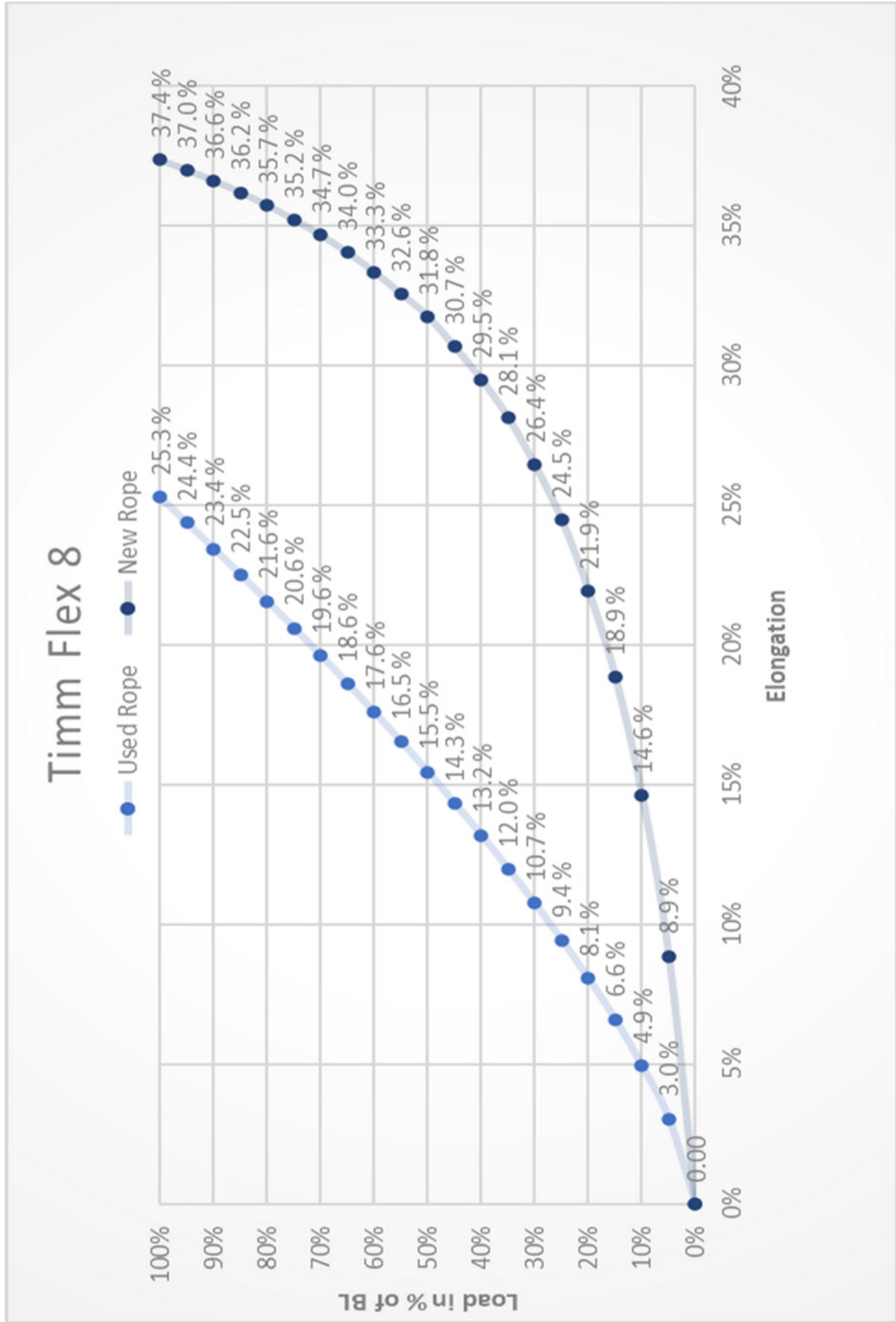
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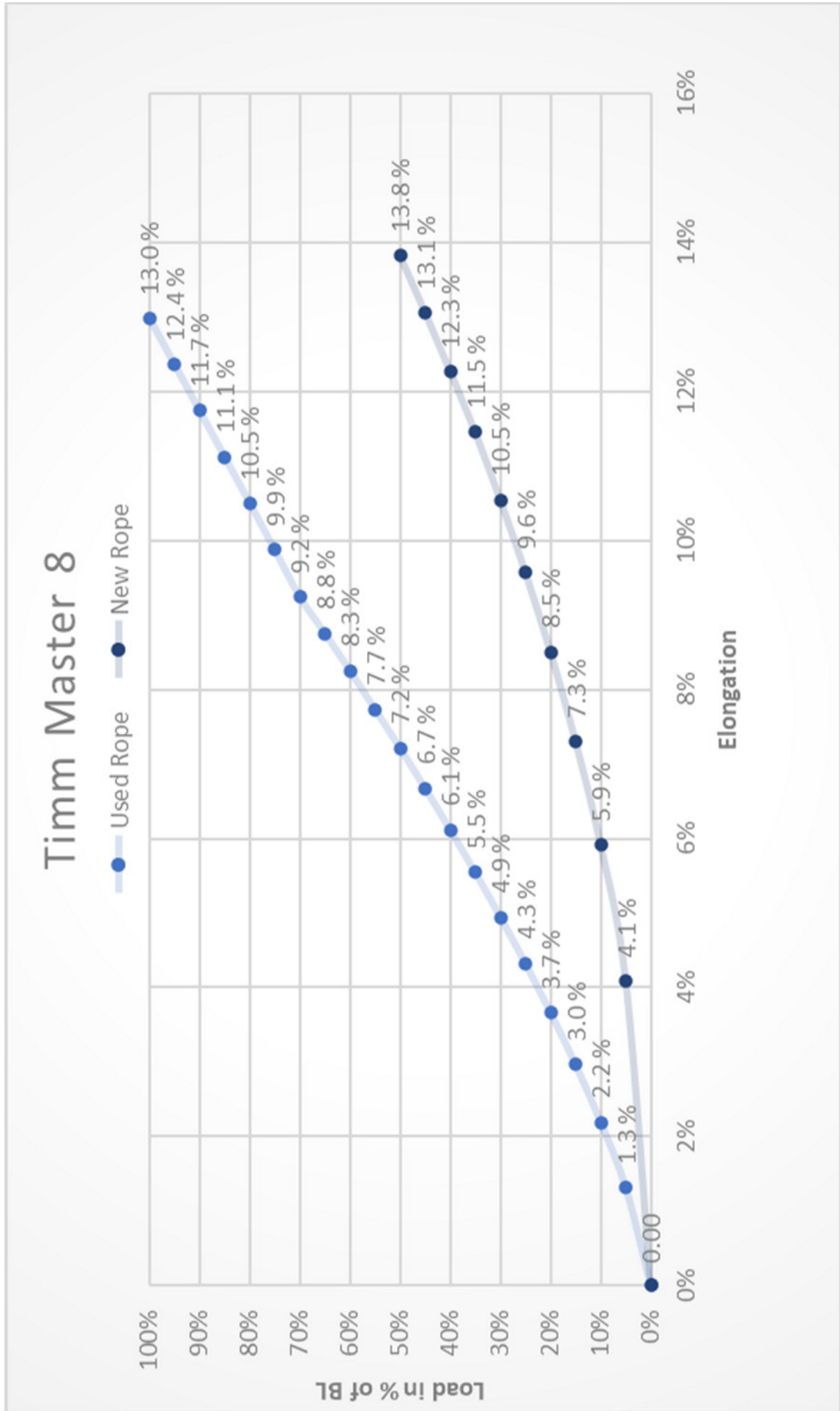
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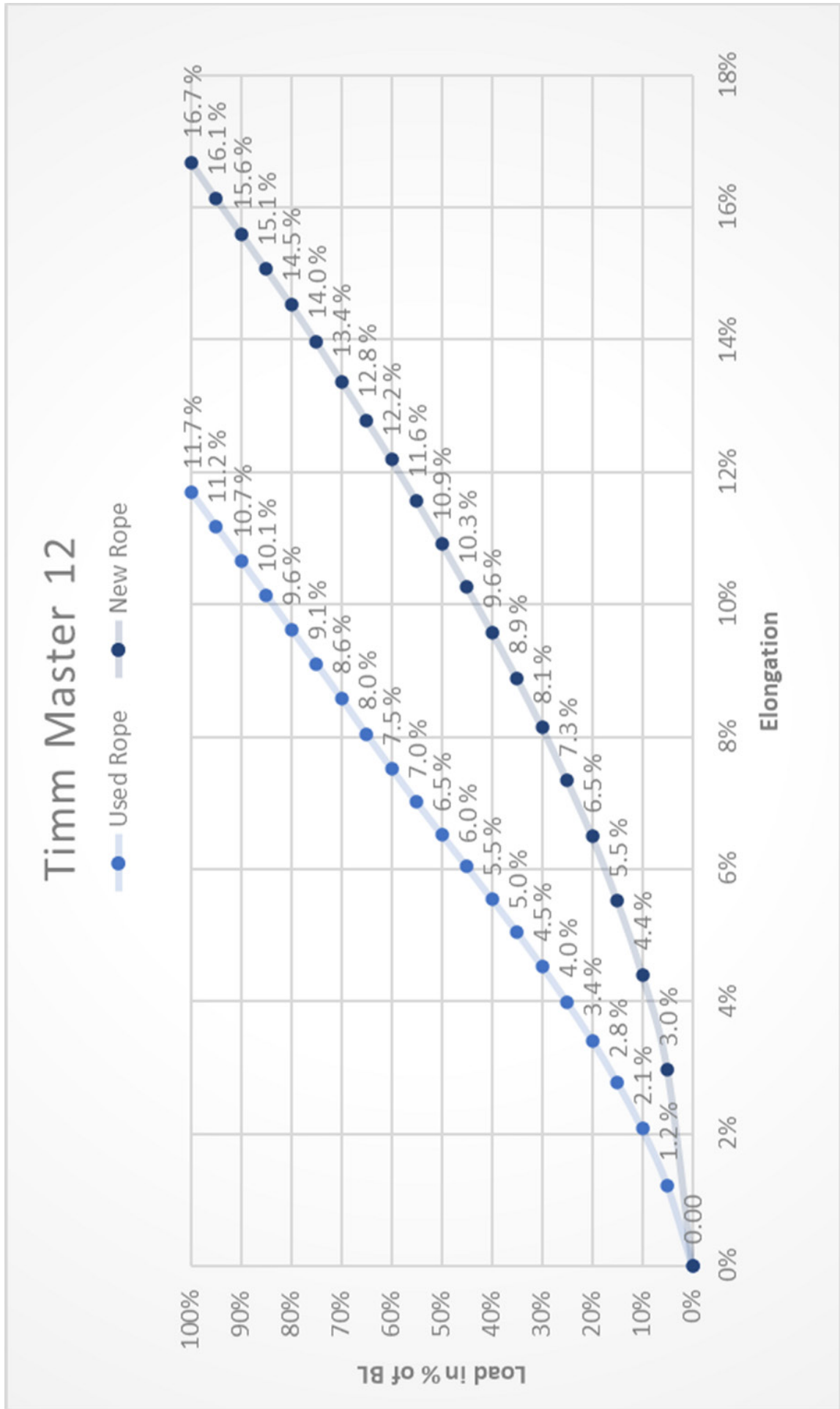
# Appendix A – Elongation Graphs

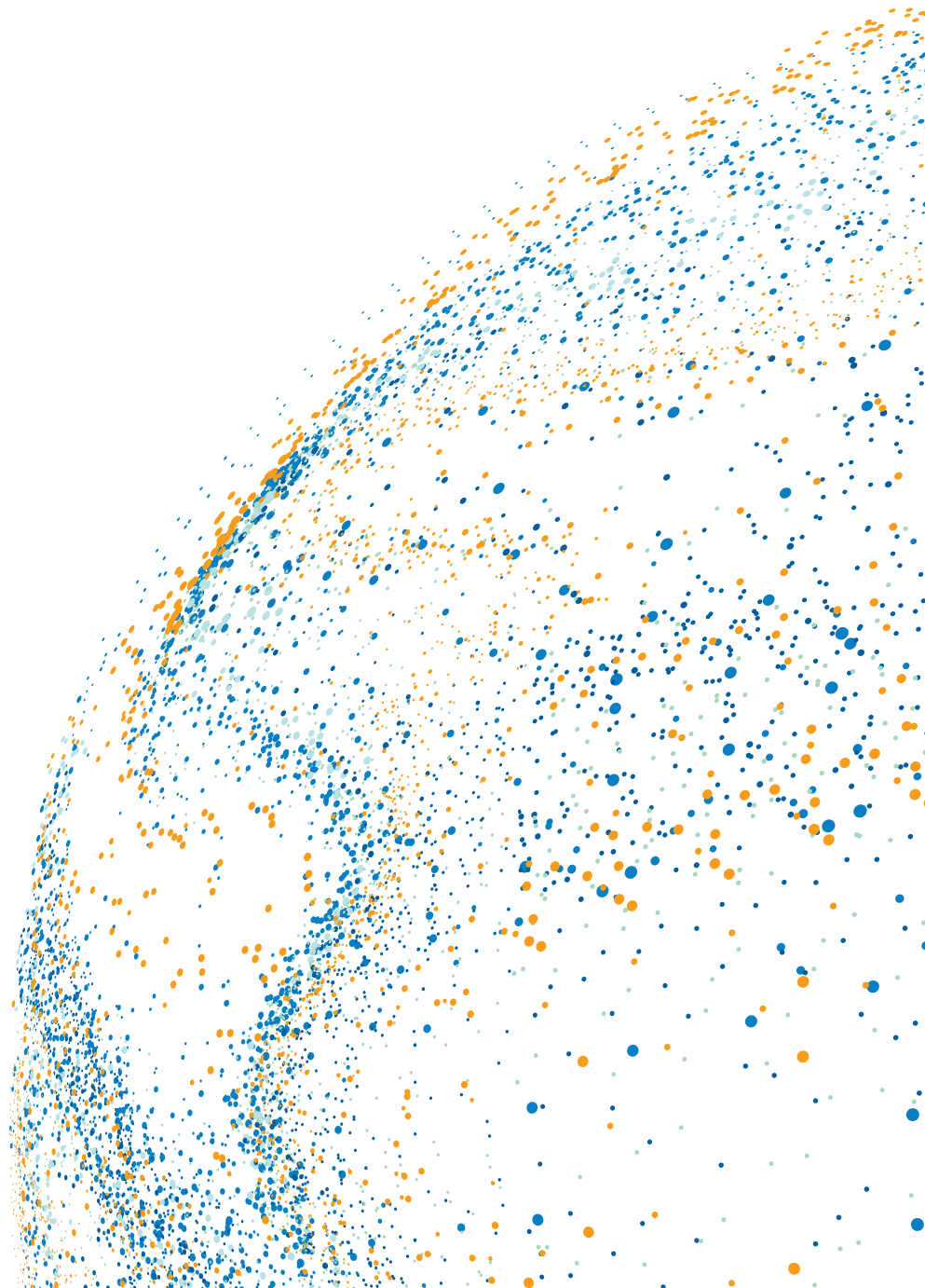


## Appendix A – Elongation Graphs



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