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Virkelighetens krefter

Rigging og konfigurering av utstyr

«Rigging is a higher risk activity than most arborist activities. Therefore, relevant training and knowledge is required prior to carrying out rigging operations. We recommend that the user has attended and completed a relevant and recognized arborist's training program, e.g. ETT (Certified European Tree Technician), ETW (Certified European Tree Worker).....»

Teufelberger



«The individual components of the system interact in a way that has neither been fully investigated nor understood. Rigging exposes the climber, the equipment and the tree itself to high loads that are difficult to calculate.»

Teufelberger

Rigging i hverdagen

Interessefelt

- Krefter ved negativ rigging
- Tekstiler, knuter og styrketap
- Sikkerhetsfaktorer
- Vektor
- Krefter i speedlines



A person wearing a white protective suit, mask, and gloves is working on a rocky surface. They are holding a piece of equipment, possibly a camera or a sensor, and are looking at it. The background shows a rocky terrain with some equipment and cables scattered around.

Forsøk i felt

Negativ rigging

#letitrun



Forsøk

Furu (*Pinus sylvestris*), Sunnmøre, januar 2023

- Negativ rigging med lastcelle
- Heising med traverstau PET/
UHMPE
- Forsøk med speedline



Utstyr brukt til negativ rigging

Produktspesifikasjoner

Utstyr	WLL	MBL	Diameter
Straighpoint* lastcelle	60kN	300kN	
Marlow Raptor Øyeslynge	856kg	5990kg	16mm
Stein OMEGA -16 ringslynge		4900kg	16mm
FTC Katuali riggingtau	5,7kN	40kN	12mm
GRCS riggingbrems	2200 lbs (907kg)	Ukjent	

*Datatransmisjon 50 - 200hz

Knuter

Knuter

- Halvstikk + løpende pålestikk på kubben
- Børedrag (cow htich/ ku-knute) sikret med halvstikk til ankeret.



Navn	Lengde (cm)	Diameter bunn (cm)	Diameter topp (Cm)	Vekt (kg)	Kraft (kN)	Tid Oppbremsing (S)
Neg_rig_1- running	169	21	15	66	2,7	0,24
Neg_rig_2_ snatched	206	27	22	140	6,8	0,21
Neg_rig_3_ running	137	33	38	130	6	0,45
Neg_rig_4_ snatched	134	35	34	125	8,2	0,16
Neg_rig_5_ d_block	125	37	36	190	5,8	0,25

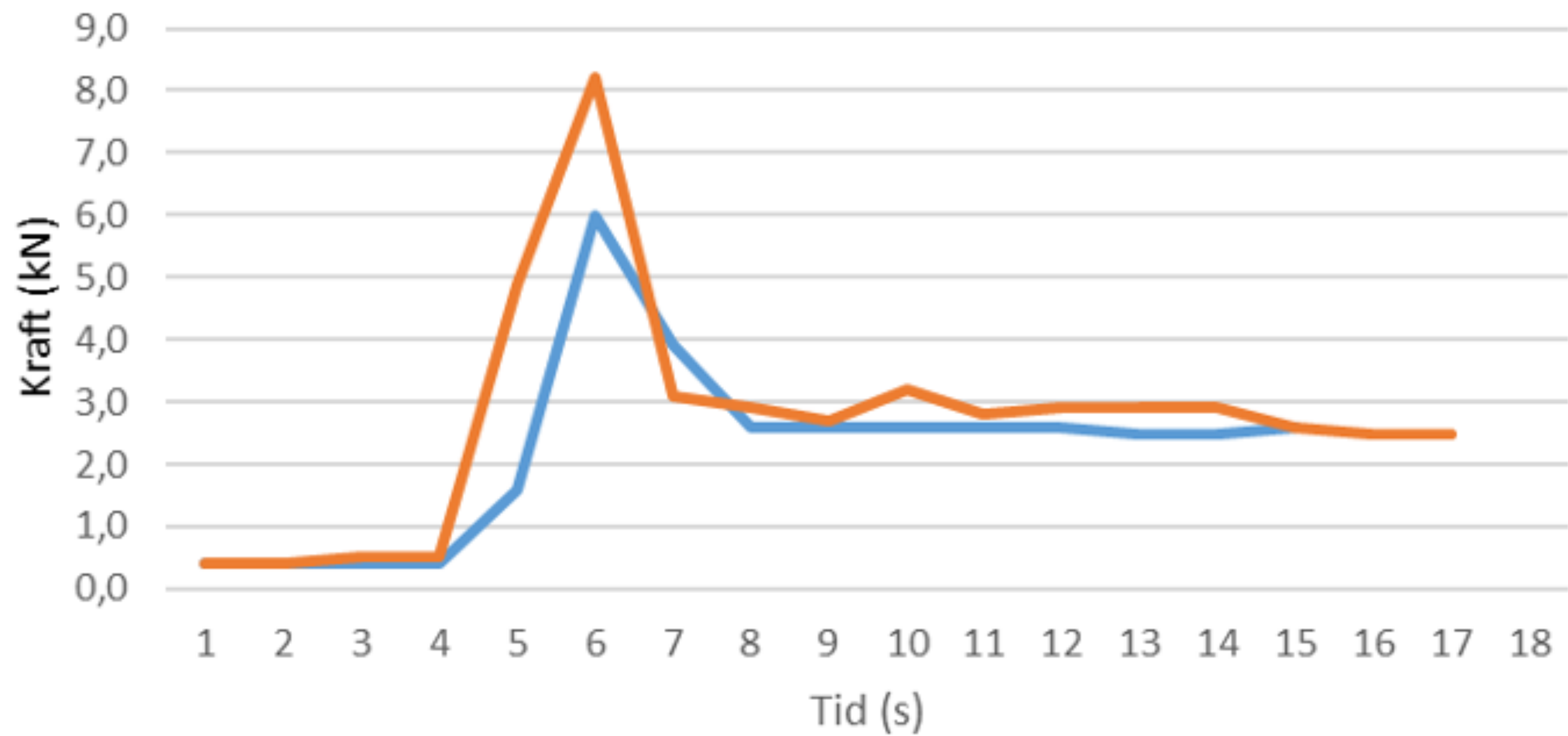
Maks: 6kN



Maks: 8,2kN



Maks belastning



Husk 8,5.....



Vekt

Hvordan anslå vekta?

- Volum x vekt/m³
- Tabeller
- Apper

Nå vet vi vekta... hva da?

Treslag	Ca. vekt pr kubikkmeter (kg)
Edelgran	850
Spisslønn	980
Platanlønn	840
Hestekastanje	880
Svartor	810
Hengebjørk	840
Agnbøk	950
Bøk	1003
Ask	800
Lerk	810
Gran	800
Sitkagran	600
Furu	820
Osp	690
Sommereik	1001
Kjempetuja	570
Parklind	670
Hemlokk	800
Alm	880

Tommelregler

Forsigtige estimer.....for life?

- Kroneseksjoner: 4 -7 x seksjon
- Stammeseksjoner: 8 - **11** x seksjon

Tenk: Værst tenkelig utfall!

Peak Loads 14

14.4 Estimating Peak Loads

14.4.1 The more information and understanding that can be applied to the peak load estimate, the more accurate it will be and the safer the operation.

14.4.2 Estimating the PL begins with an accurate estimate of the weight of the section which is to be removed. This is covered in section 12.

14.4.3 The most significant factor affecting the PL will be the rigging technique used, and more specifically the position of the rigging point in relation to the cut section. The two most common set-ups for consideration are referred to in this guide as rigging point above (RPA) and rigging point below (RPB).

- Rigging point above is where the rigged section is below the rigging point. Generally, this means that the rigging rope can be pre-tensioned, immediately reducing any potential peak loads.
- Rigging point below is where the rigged section is above the rigging point, which results in an element of free-fall (albeit brief) prior to the section being arrested by the rigging rope. This free-fall causes a significant increase in the potential PL which can be many times greater than the PL experienced in RPA.

14.4.4 The calculation illustrated below can be used to estimate a worst-case scenario when considering the potential peak load for rigging point above or rigging point below. The key difference between them is the anchor force (AF), which is a much greater value when estimating rigging point below.

- Rigging point above: anchor force = $\times 2$
- Rigging point below: anchor force = $\times 11$

Weight (Mass)
This is the weight of the piece based on its length and diameter and derived from the log weight chart for green hornbeam (see 12.2.3).
This **does not** account for species.

Safety Factor
A conventional safety factor which increases the log weight value by 30% to allow for potential misjudgements when working out log weight.

NB: Be aware that this **does not** fully account for an underestimation of diameter!

$(70\text{kg} \times 1.27) \times 1.3 \times 11 = 1271.27\text{kg} (13\text{kN})$

Species-Specific Correction Factor
This is the value for the actual species of the tree being worked upon (see 12.2.4).

Anchor Force
The amount by which you will multiply the 'true' log weight based on whether the rigging point is above or below the load.

Peak Load
This is the load experienced at the anchor point, based on the assumption of a worst-case scenario.

14.4.4 Equation for calculating worst-case scenario peak load. This example is a rigging point below set-up.

Technical Guide 3 – Rigging and Dismantling | Peak Loads 99



Tekstiler

Redusere energimengden og sikre lang levetid(!!!)

Styrketap i forhold til MBL i frilengde

- 50 %



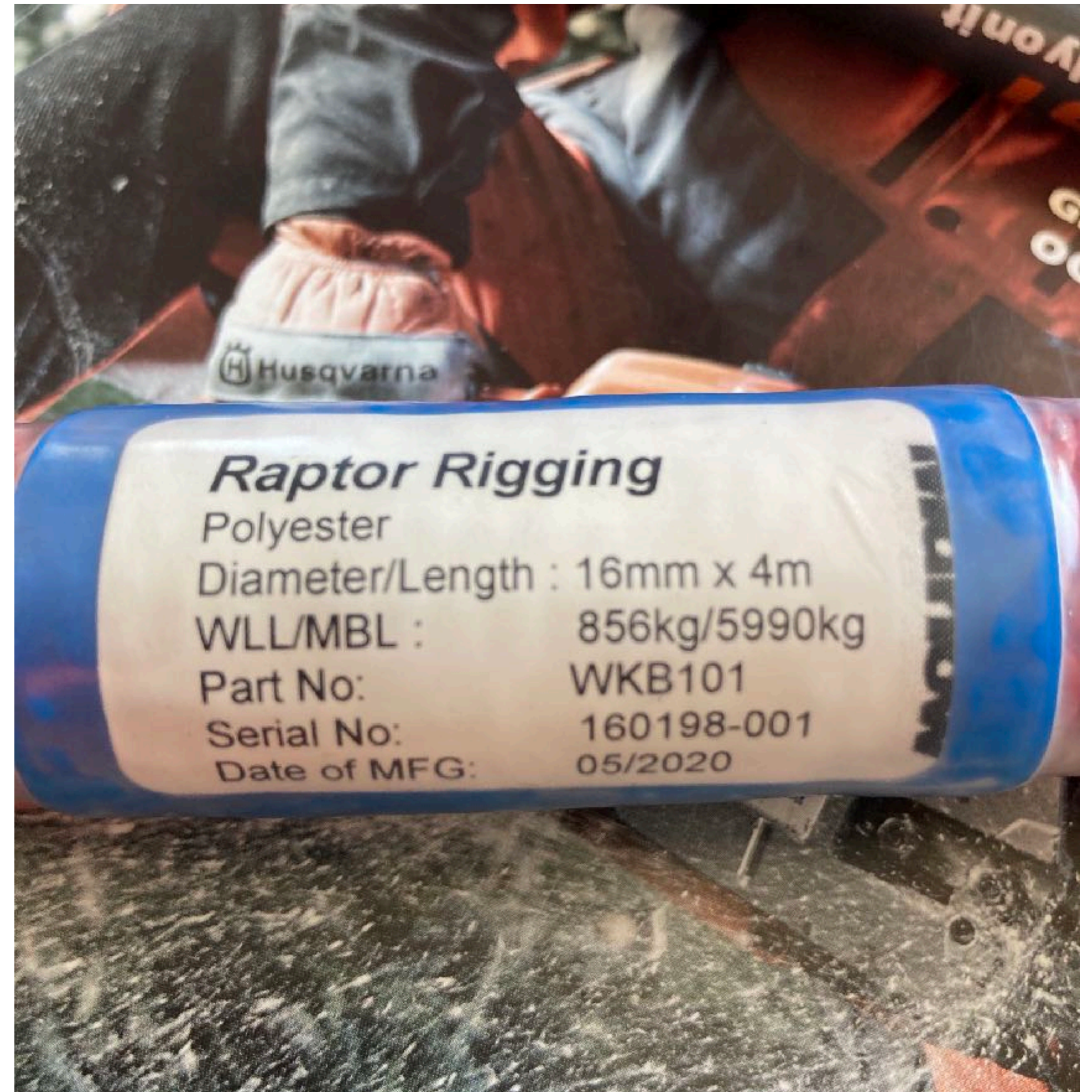
+110 %



Sikkerhetsfaktor tekstiler

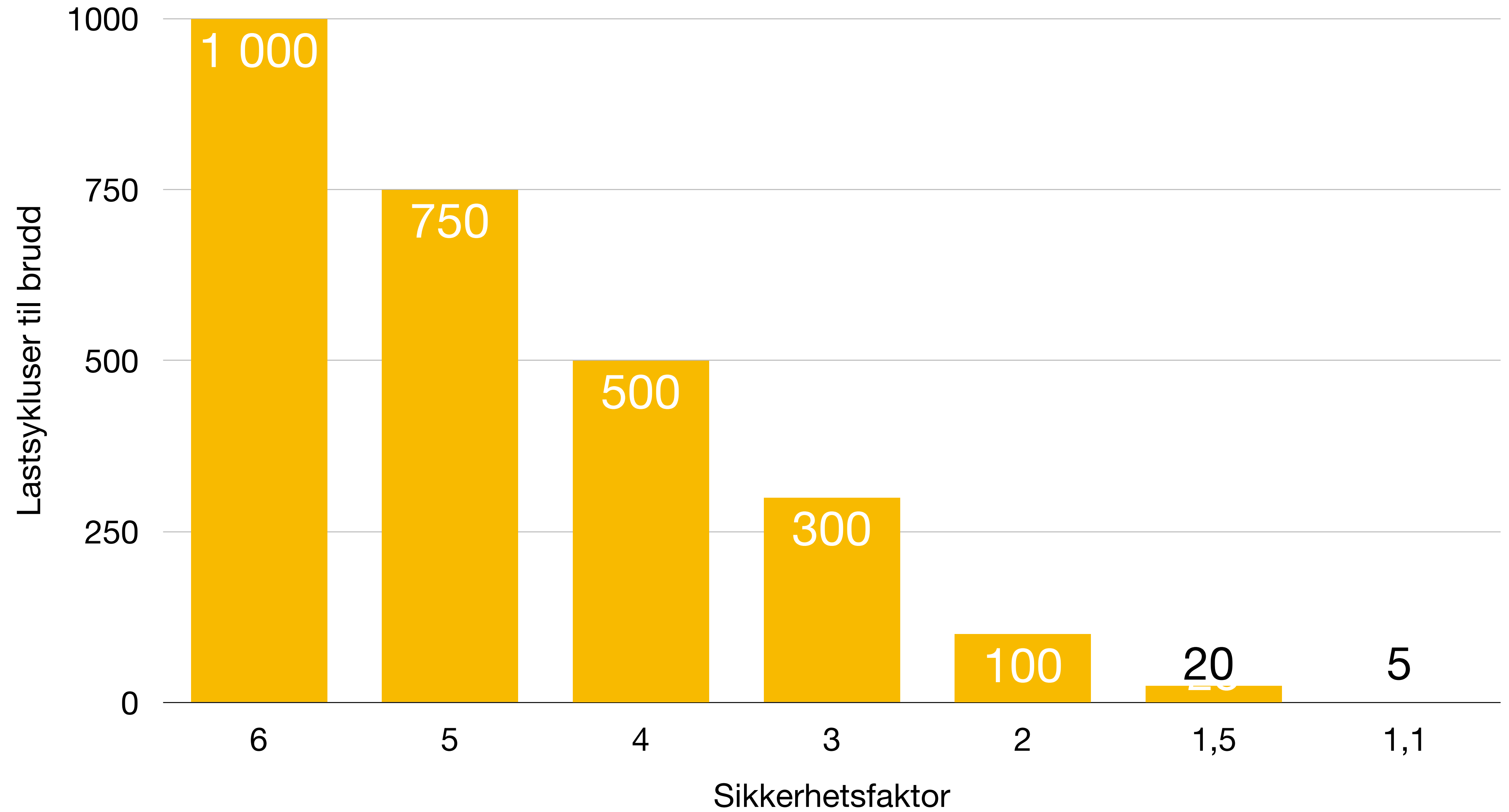
- WLL: Arbeidslast
- MBL: Bruddstyrke
- SF: Sikkerhetsfaktor
- $SF = MBL / WLL$

- $5990 / 856 = 7^*$



*Hvor kommer dette fra?

Safety by design!



LET IT RUN!!!!!!!

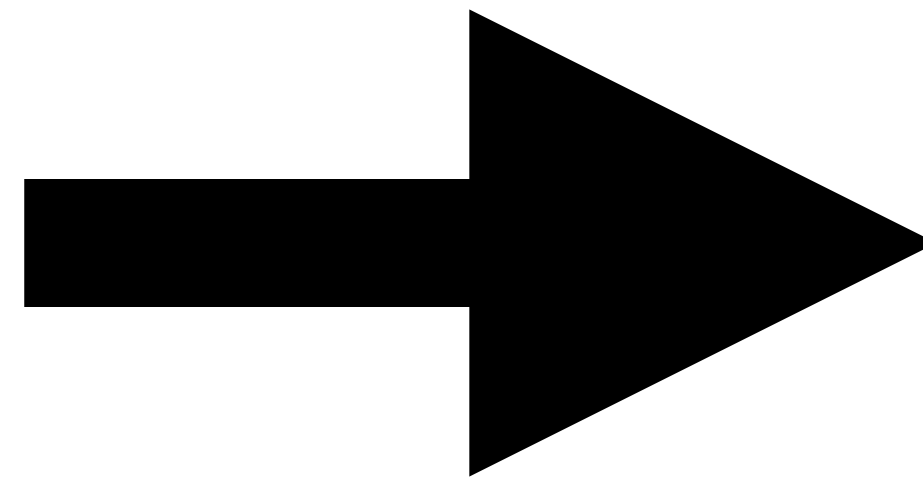
Kortere fall

Mindre seksjoner

Mer strekk i tauet

Mer tau i systemet

Bruk vektor



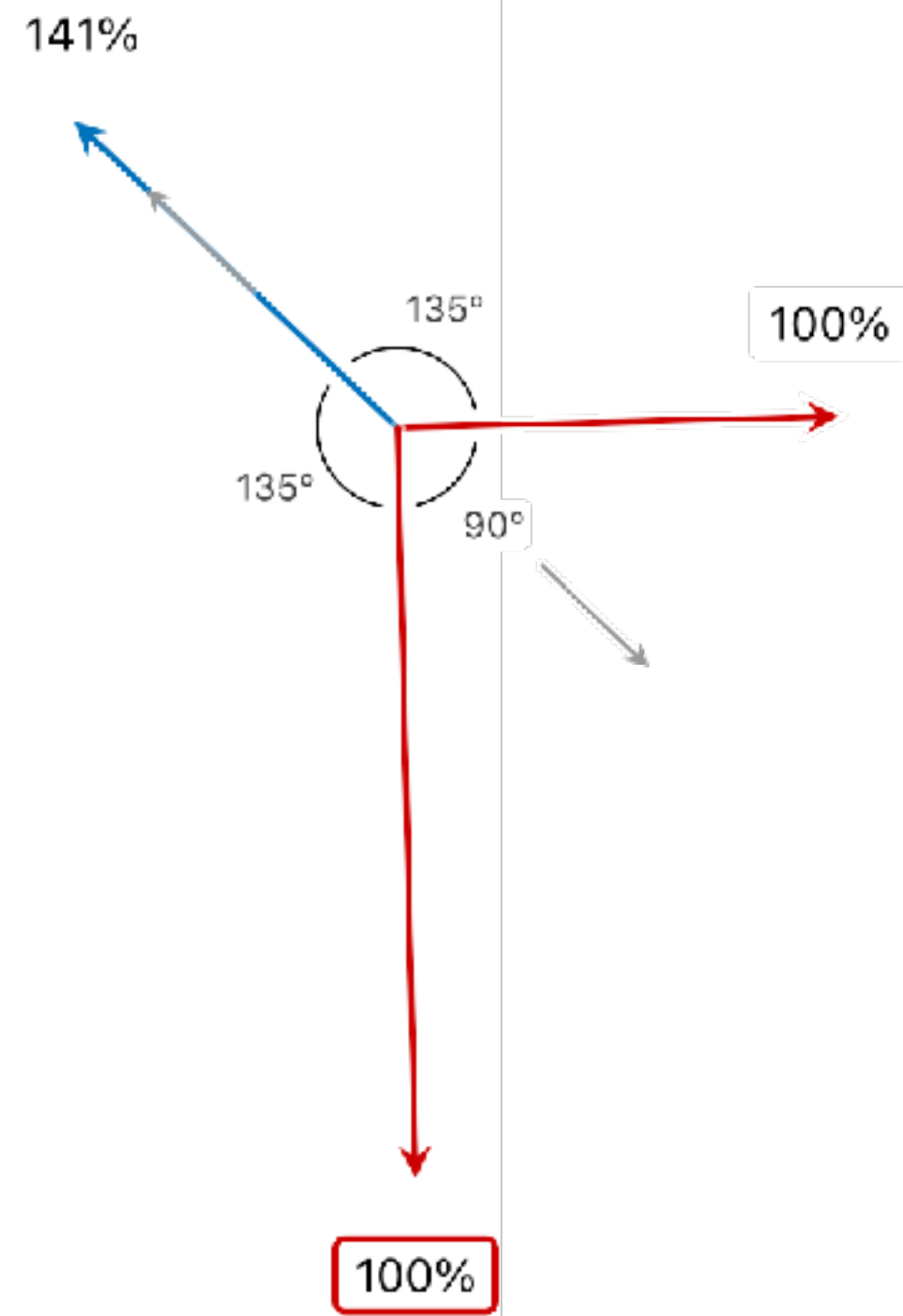
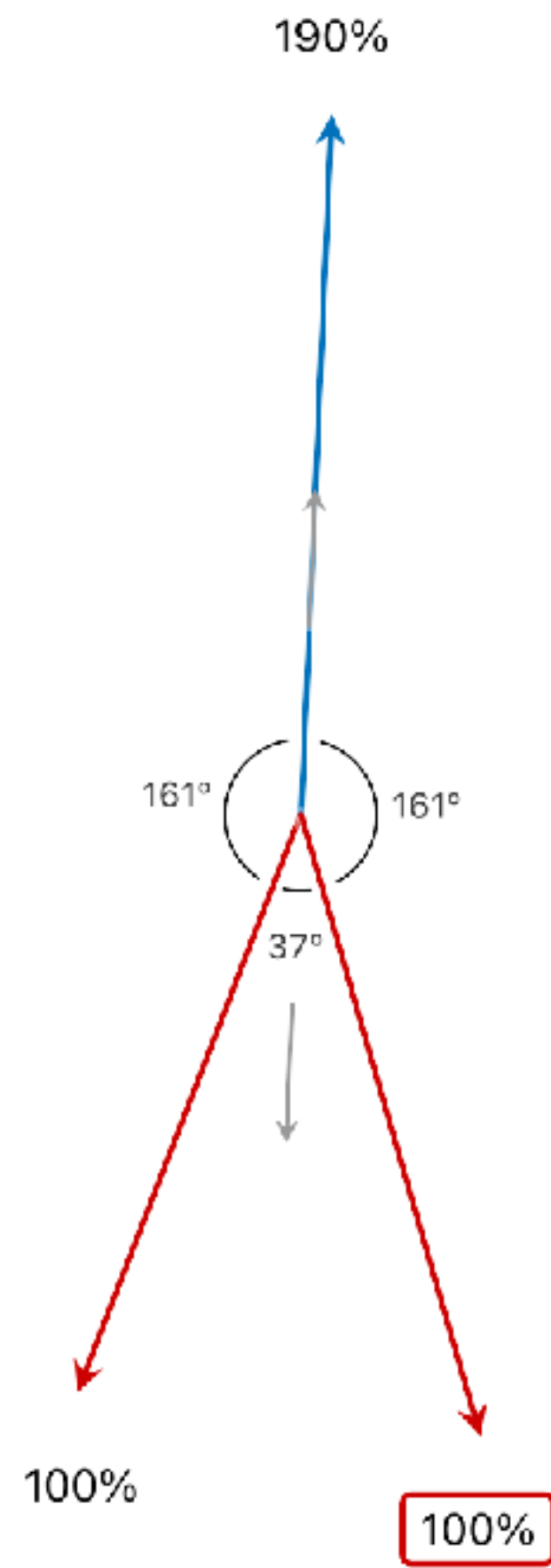
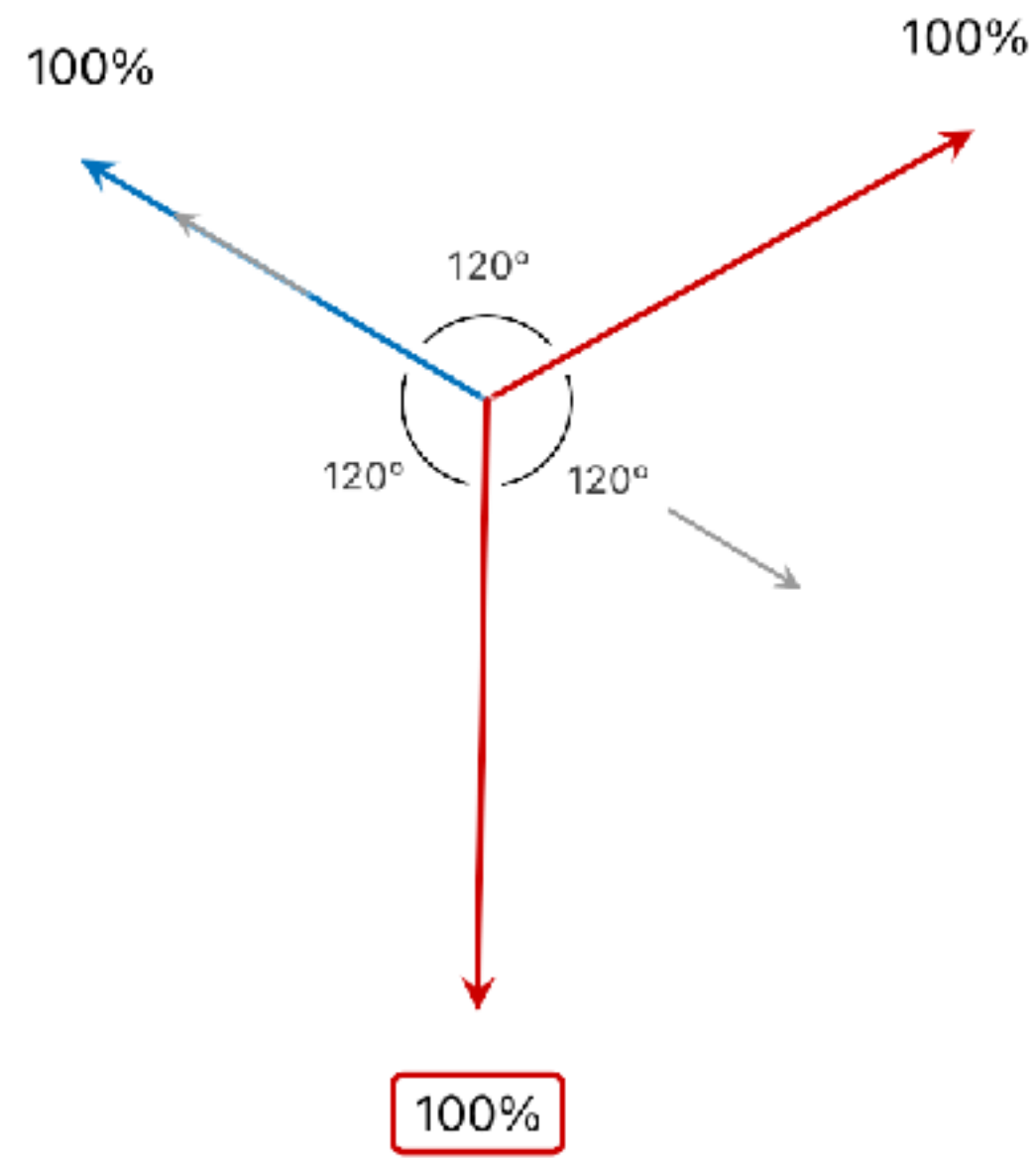
**MINDRE BELASTNING
MER SIKKERHET**

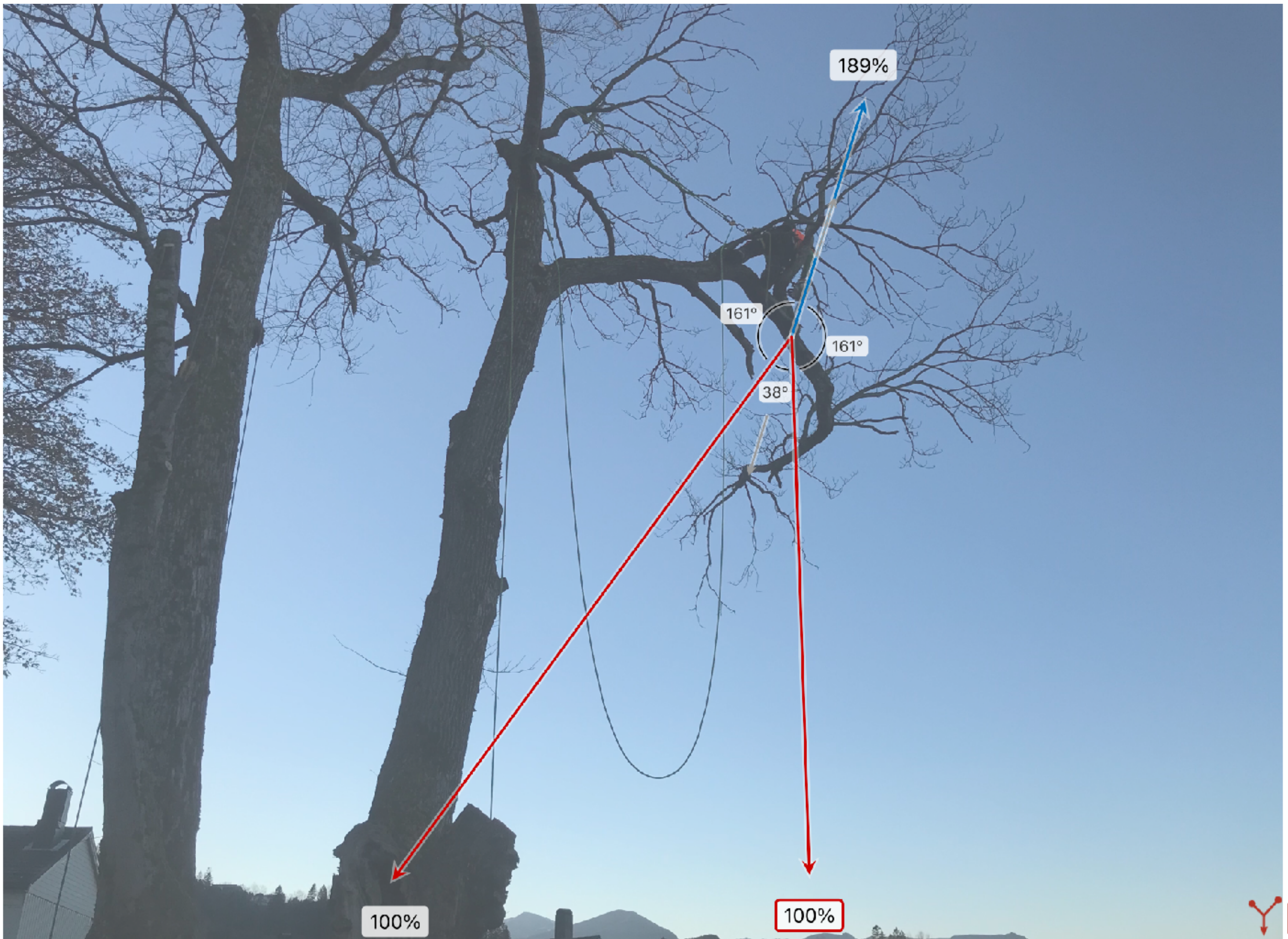


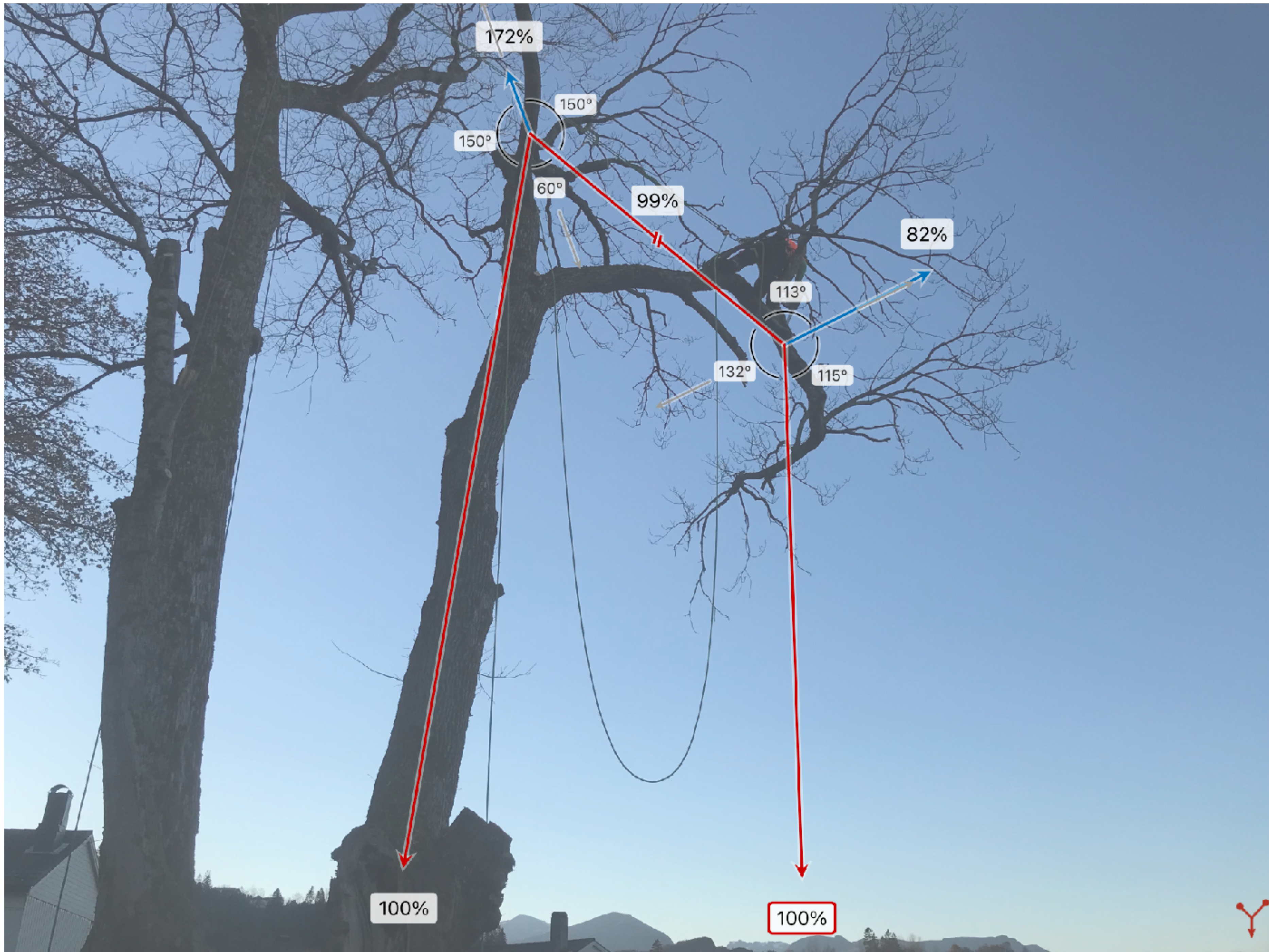
Vektor

«I matematikk, fysikk, teknikk er vektor en størrelse som er bestemt av både måltall og retning; eksempler er hastighet, akselerasjon og kraft.»

Store Norske Leksikon





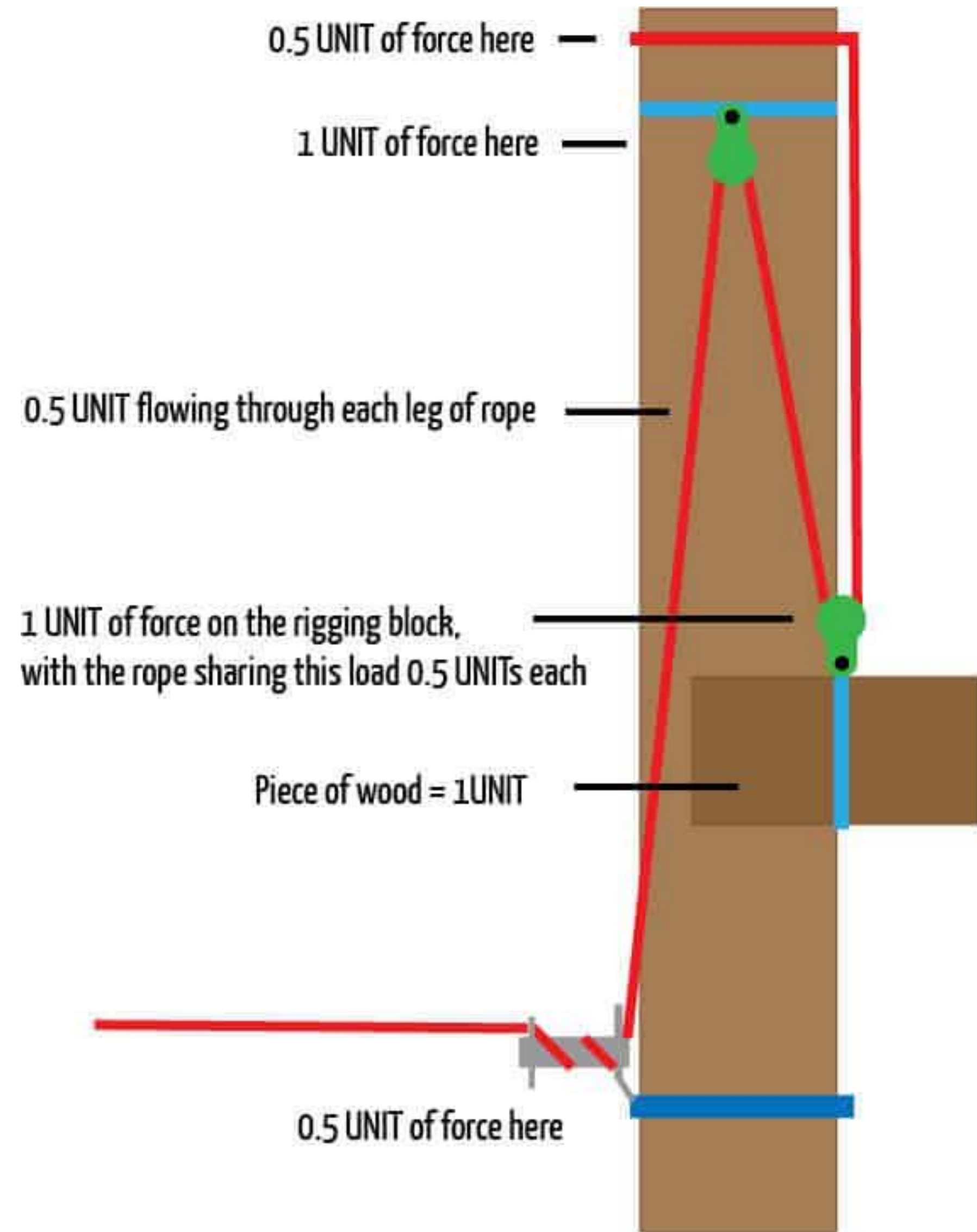
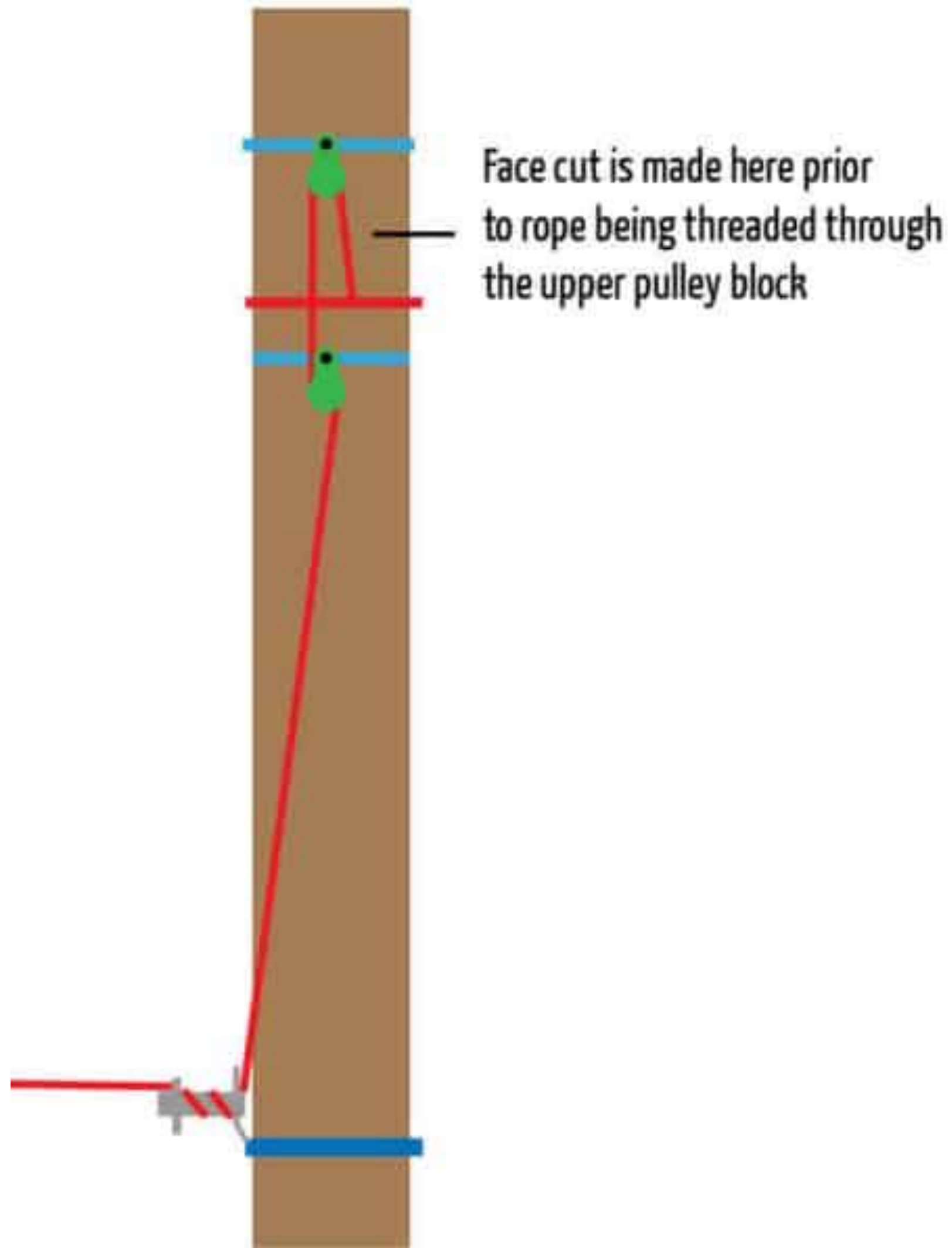


A person wearing a white protective suit, mask, and gloves is working with ropes and a pulley system. The person is holding a rope that is attached to a pulley. The background is a textured, light-colored surface. The text "Double Block Rigging" is overlaid on the bottom left of the image.

Double Block Rigging

Vektor som venn

Double block rigging System setup



**Maks:
5,8kN**



Navn	Vekt kg	Maks kN	kN/kg
Neg_rig_4_snatched	125	8,2	0,656
Neg_rig_5_d_block	190	5,8	0,305

53,5% reduksjon i belastning.....
det fungerer!



Vektor ved bruk av speedline

YouTube style

Vektor er ikke vår venn her!

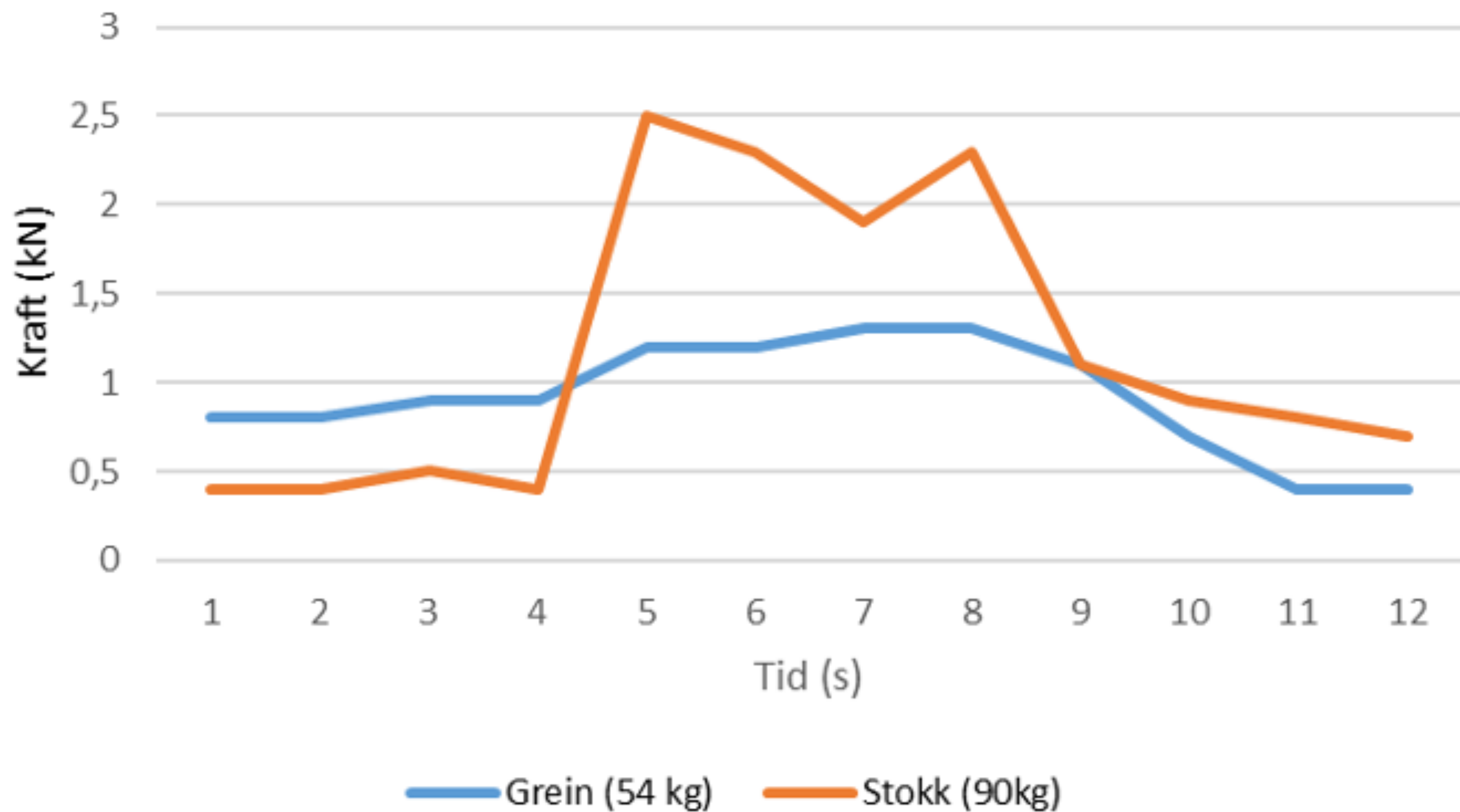




I vitenskapens navn...



Sammenligning speedline



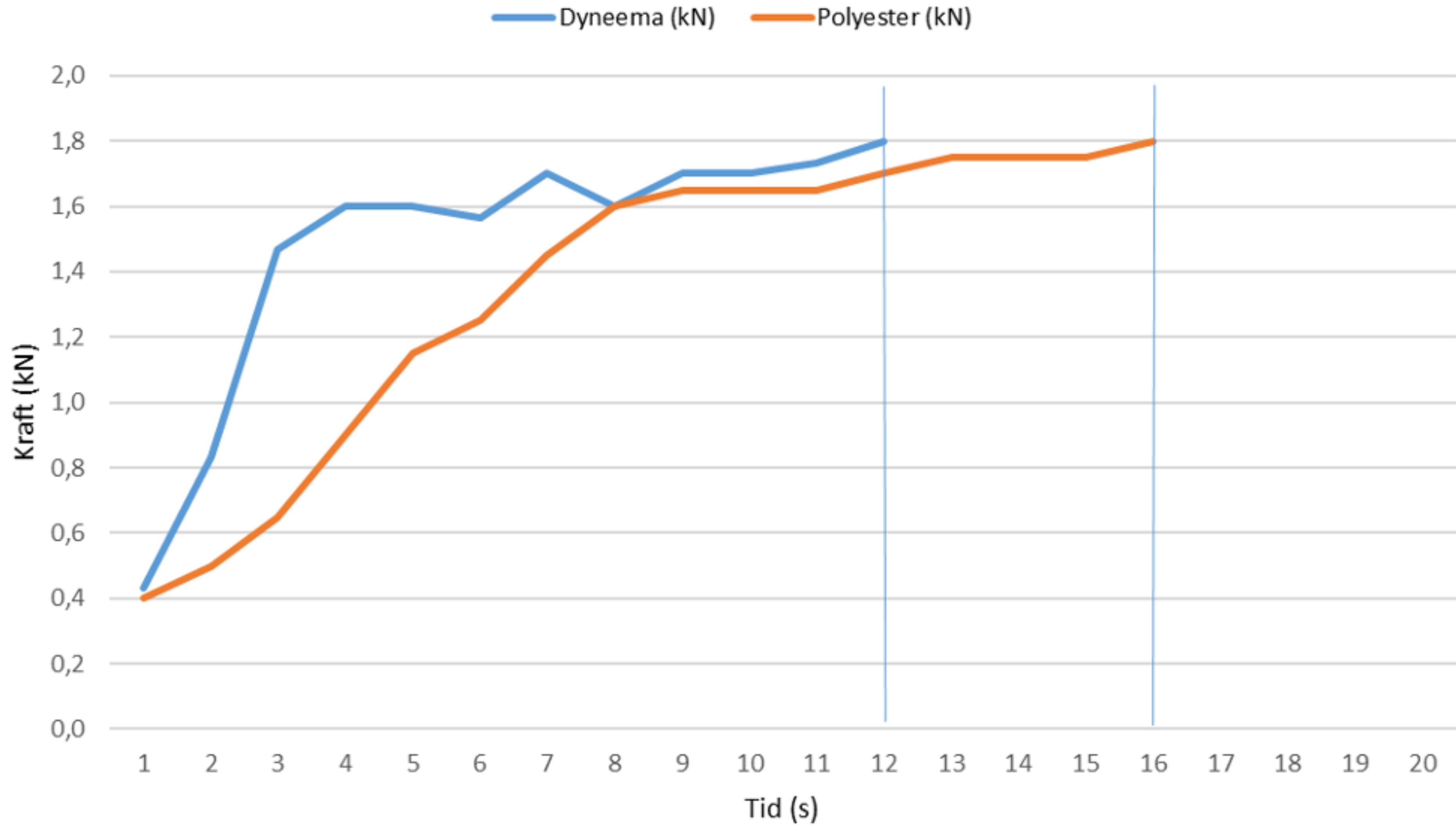


Bruk av tau med høy e-modul

Heisforsøk med UHMPE og PES



Egenskaper - traverstau







Videre lesning

- Rigging and Dismantling, Technical Guide 3, Arboricultural Association
ISBN 978-0-900978-72-2
- HSE RR 668: Evaluation of Current Rigging Practices, A Detter, C Cowell, L McKeown, P Howard, HSE Books
- The Art and Science of Practical Rigging, Peter S Donzelli, Sharon J Lilly.
ISBN 1-887956-28-8
- Rigrite App
- www.climbingarborist.com