GRAVITY LINK, A SECONDARY RETENTION

BY ALF K. FJELLDAL & ROBERT KOLSING

GRAVITY8

AGENDA

1. WHO WE ARE AND WHAT WE ARE DOING
2. THE PROBLEM WE SOLVE
3. THE PRODUCT

1. WHO WE ARE AND WHAT WE ARE DOING

Gravity8 is a Norwegian company established in 2017 by;
Alf Kristian Fjelldal and **Robert Kolsing**

The company specialize in dropped object solutions

Gravity8 has developed a dynamic link under the brand name **GravityLink**

The GravityLink is made to be a part of a safety barrier or as a secondary retention with the purpose of stopping a dropped object

2. THE PROBLEM WE SOLVE

The design of the GravityLink makes it possible to secure object heavier than 50 kg.

In other situations; objects are left without the secondary retention.

Because of:

1) The size of the wire rope.
2) No relevant anchor point strong enough to resist the force when the object is stopped.

3. THE SOLUTION

Gravity8 has developed the ultra-efficient GravityLink.

The construction replace the ordinary secondary retention.

It is designed to stop a falling object and absorb the major part of the dynamic force generated by the falling motion.

3. WHY USE THE GRAVITYLINK?

The GravityLink mounted on the anchor line can reduce up to 90% of the energy from a falling object.

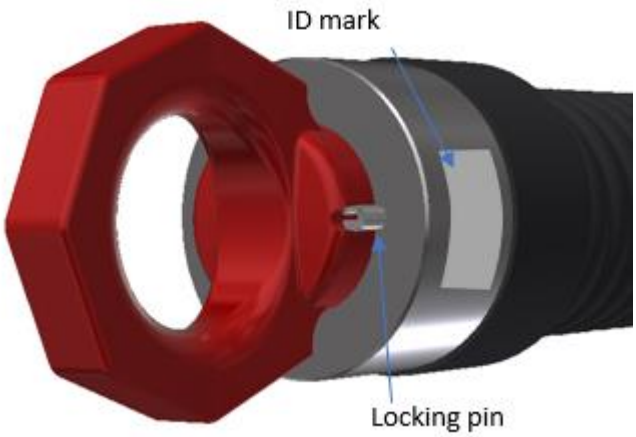
This will significantly mitigate the risk of a structural collapse from the energy generated by the sudden stop of the object.

The GravityLink is connected in-line as a secondary retention and will stay passive as long as the object is in place.

If a situation occurs, and the object falls, the GravityLink will be activated.

In the moment the anchor line is stretched out, the energy will be absorbed by the GravityLink.

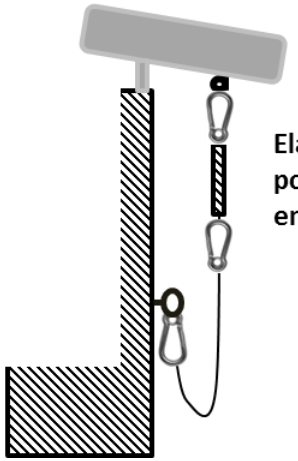
The GravityLink will be permanently deformed and must be replaced.



3. THE THEORY BEHIND THE GRAVITYLINK

STATIC POSITION

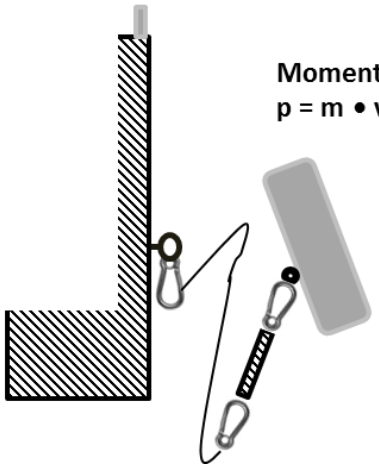
Potential energy
$PE = m \bullet g \bullet h$



Elastic potential energy

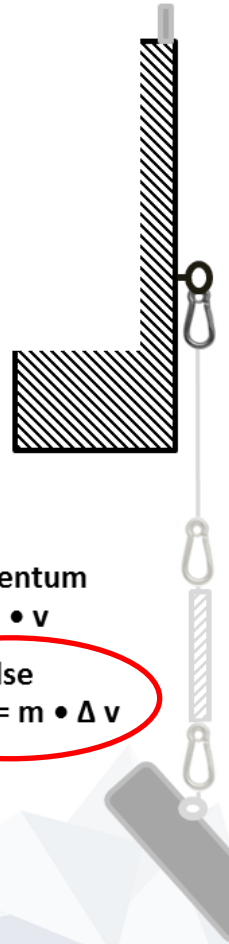
DROP

Kinetic energy
$KE = 0.5 \bullet m \bullet v^2$



Momentum
$p = m \bullet v$

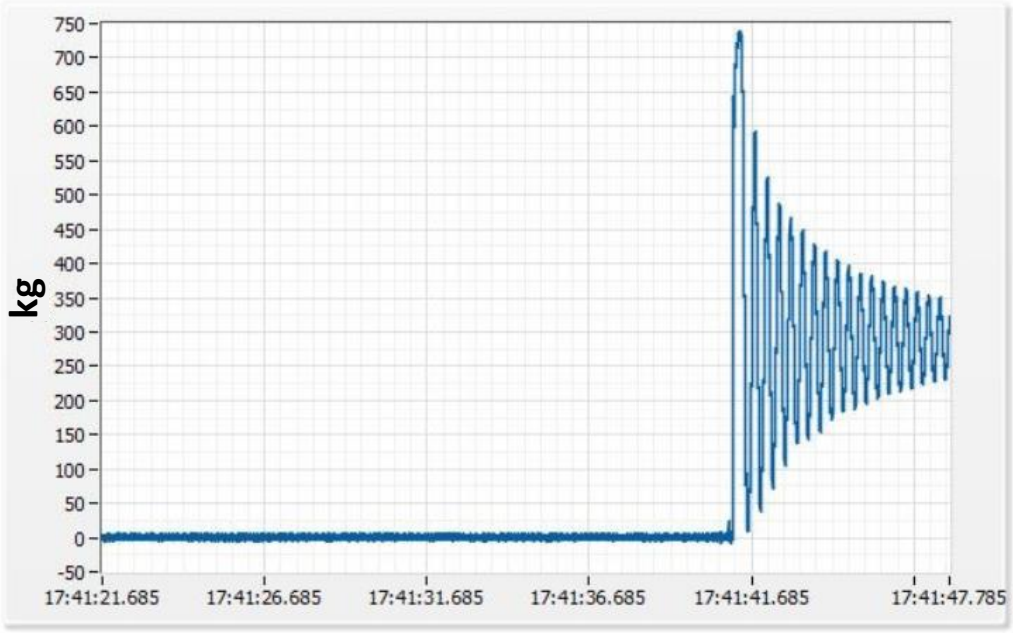
COLLISION

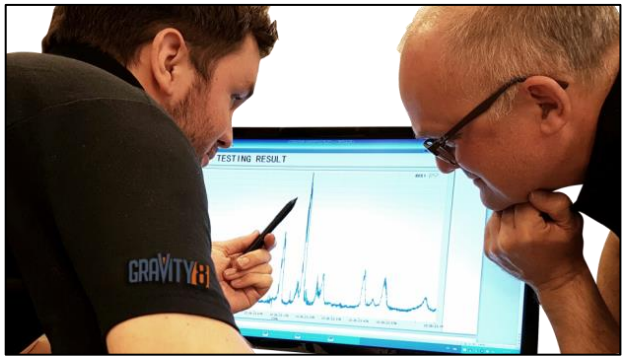


Momentum
$p = m \bullet v$

Impulse
$F \bullet t = m \bullet \Delta v$

3. TESTING AND CALIBRATION FACILITIES





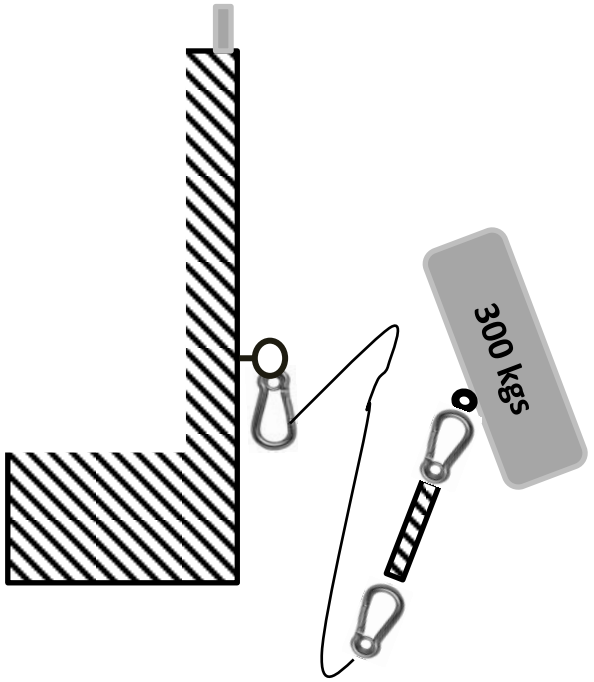
The drop testing and calibration take place in our own testing lab.

An electronic loadcell is sending signals directly to a software in the computer and enable detailed analyzes of the drop.

1. CASE EXAMPLE FOR GRAVITYLINK

WEIGHT OF OBJECT: 300 KG
DROP LENGTH: 1 METER

A rigid steel **wire rope** working as a secondary retention will be exposed to a force approx. 28.000 kg



If the GravityLink is mounted in-line as the secondary retention, the force will be reduced to approx. 850 kg

Conclusion:
A REDUCTION OF FORCE > 90%

3. WHAT CAN THE GRAVITYLINK SECURE?

In order to work efficient with objects from 10 and up to 500 kgs, the GravityLink is available in multiple sizes.

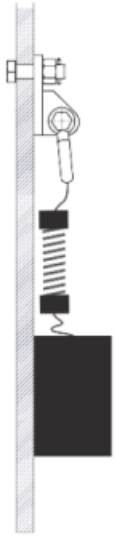
The product is designed to be mounted on an anchor line where the purpose of the anchor line is to work as the secondary retention in case of an object drop.

The secured objects might be;

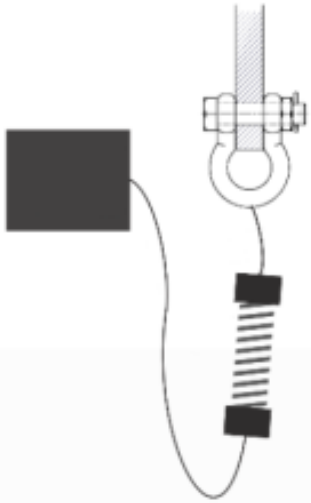
- floodlights,
- crane boom cameras,
- telecom antennas,
- derrick equipment
- machines and moving tools
- or any other object anchored to a structure

3. INSTALLATION OF THE GRAVITYLINK

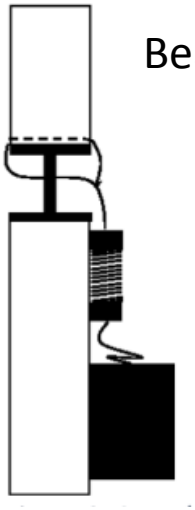
Wall mounting



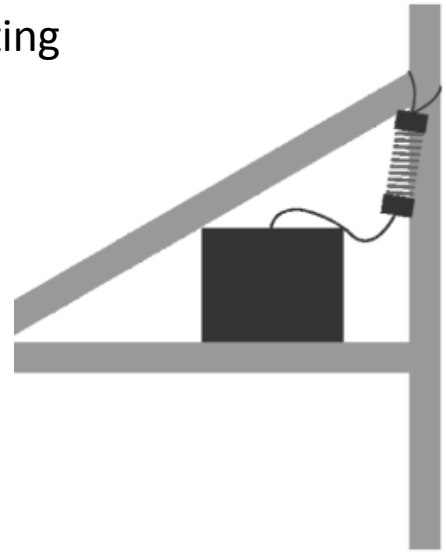
Edge mounting



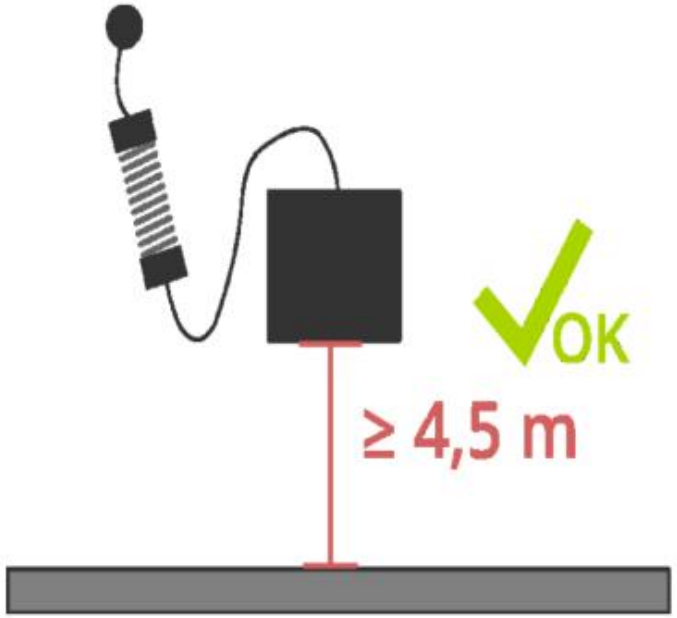
Beam Structure mounting



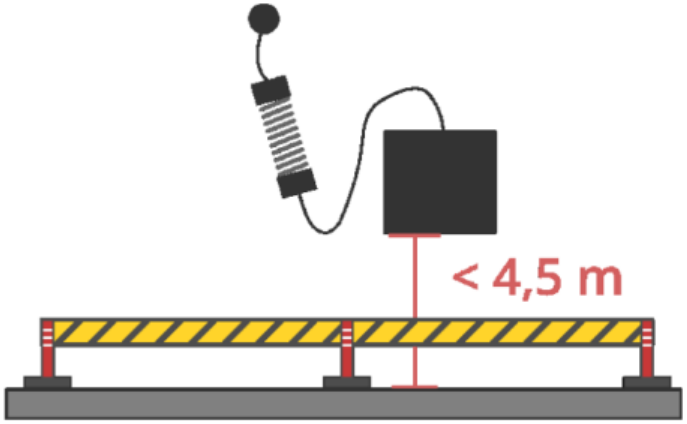
Lattice Structure mounting



3. SAFETY UNDERNEATH THE GRAVITYLINK



- In spaces where personnel is present, the ground clearance of secured object shall be min. 4.5 meter and without restrictions.



- If ground clearance of secured object is less than 4.5 meter, then area underneath should be closed or stricted to personell, in accordance with NS-EN 355.

3. DELIVERY LEVELS

1. The hardware product only; a complete GravityLink, ready to be attached to the object as an secondary retention enabling skilled personnel on site to safely mount the item on place.

2. The product as described above. In addition we can offer engineering work included stress and material calculation.

3. A complete delivery including the GravityLink, engineering work and on site assembling to the actual objects by our personnel.

A RISK or HAZID analyze is not included in a GravityLink delivery and must come in addition to the installation of the product.

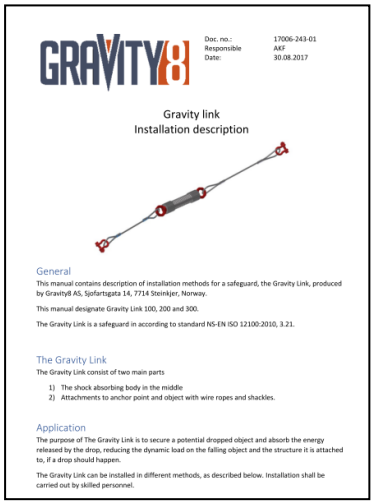
3. DOCUMENTATION AND CERTIFICATE

DECLARATION OF CONFORMITY
In according to Machinery Directive 2006/42/EC

Business name and full address of the manufacturer. (1)	Gravity 8 AS Sjofartsgata 14 7714 Steinkjer e-post: robert@gravity8.no Web.: www.gravity8.no
Authorised person to compile the technical file. (2)	Only the manufacturer can provide technical documentation.
Description and identification of the machinery, and commercial name. (3)	Gravity Link 100 (See TEK17006-100-01) Gravity Link 200 (See TEK17006-200-01) Gravity Link 300 (See TEK17006-300-01) Gravity Link shall be installed and used in according to 17006-243-01 installation and user manual.
Declaring that the machinery fulfils all the relevant provisions of this. (4)	We herby declare that Gravity8's product Gravity Link fulfill all relevant demands in the Machinery Directive 2006/42/EC
Harmonised standards used. (7)	NS-EN ISO 12100:2010
Reference to other technical standards and specifications used. (8)	NS-EN 355 Energy absorbers. NS-EN 364 Test methods. NS-EN 1990 Basis of structural design. NORSOK R-002 og R-003.
The place and date of the declaration. (9)	Steinkjer, 30. August 2017
The identity and signature of the person empowered to draw up the declaration on behalf of the manufacturer or his authorised representative. (10)	Alf Kristian Fjellvåg Technical responsible Gravity8 AS

The numbers in brackets refer to the points in Appendix II 1 A of the Regulation.

Declaration of Conformity



Doc. no.: 17006-243-01
Responsible AKF
Date: 30.08.2017

Gravity link
Installation description

General

This manual contains description of installation methods for a safeguard, the Gravity Link, produced by Gravity8 AS, Sjofartsgata 14, 7714 Steinkjer, Norway.

This manual designate Gravity Link 100, 200 and 300.

The Gravity Link is a safeguard in according to standard NS-EN ISO 12100:2010, 3.21.

The Gravity Link

The Gravity Link consist of two main parts

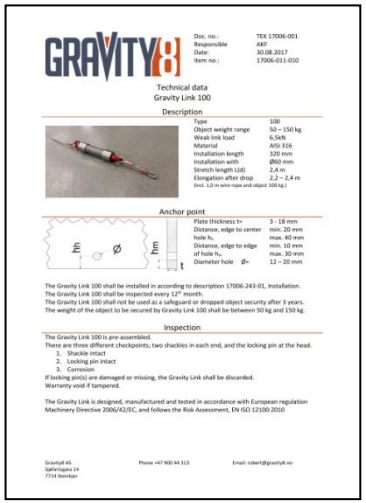
1) The shock absorbing body in the middle
2) Attachments to anchor point and object with wire ropes and shackles.

Application

The purpose of The Gravity Link is to secure a potential dropped object and absorb the energy released by the drop, reducing the dynamic load on the falling object and the structure it is attached to, if a drop should happen.

The Gravity Link can be installed in different methods, as described below. Installation shall be carried out by skilled personnel.

Installation Description



Doc. no.: TEK 17006-001
Responsible AKF
Date: 30.08.2017
Item no.: 17006-011-010

Technical data
Gravity Link 100

Description

Type	100
Object weight range:	50 – 150 kg
Weak link load	6,5kN
Material	AISI 316
Installation length	320 mm
Installation with	Ø60 mm
Stretch length (Ld)	2,4 m
Elongation after drop (incl. 1,0 m wire rope and object 100 kg.)	2,2 – 2,4 m

Anchor point

Plate thickness t=	3 - 18 mm
Distance, edge to center hole h_c	min. 20 mm max. 40 mm
Distance, edge to edge of hole h_e	min. 10 mm max. 30 mm
Diameter hole Ø=	12 – 20 mm

The Gravity Link 100 shall be installed in according to description 17006-243-01, Installation.
The Gravity Link 100 shall be inspected every 12th month.
The Gravity Link 100 shall not be used as a safeguard or dropped object security after 3 years.
The weight of the object to be secured by Gravity Link 100 shall be between 50 kg and 150 kg.

Inspection

The Gravity Link 100 is pre-assembled.
There are three different checkpoints; two shackles in each end, and the locking pin at the head.
1. Shackle intact
2. Locking pin intact
3. Corrosion

If locking pin(s) are damaged or missing, the Gravity Link shall be discarded.
Warranty void if tampered.

The Gravity Link is designed, manufactured and tested in accordance with European regulation Machinery Directive 2006/42/EC, and follows the Risk Assessment, EN ISO 12100:2010

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Technical Data

FCB
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Sjofartsgata 14
7714 Steinkjer

P.O. number:
17006

FCB Doc. Number:
17006-290-01

Customer Doc. Number:

Description of Project/Notification:
Test and approval of Gravity Link

Rev.	date	Reason for issue	Made by	Checked by	Appr. by
00	2017-06-15	Client acceptance	AKF		

Project: 17006
Client: Gravity8
Subject: Gravity Link

Rev. no.: 00
Doc. no.: 17006-290-01
Page: 1 of 10

Report Dynamic Link Testing

3. SUMMARY

The GravityLink is a Patent Pending product that is engineered and produced in Norway.

GravityLink is an active safety barrier that will stay inactive until the object falls from its static position.

A GravityLink mounted on the anchor line can reduce up to 90% of the energy from a falling object.

[redacted]

[redacted]

Comparison 40kg

Drop 300kg

THANK YOU FOR YOUR ATTENTION !