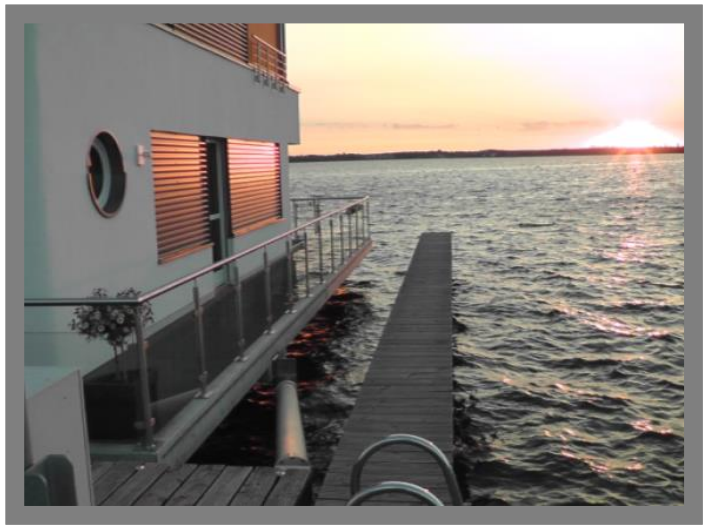
DualDocker®

Docking securely

FLOATING STRUCTURES

Mooring Solutions for Floating Structures



DualDocker is technology leader in mooring houseboats and floating homes

- **DualDocker** is a purely **mechanical mooring solution**; based on the principle of avoiding kinetic energy and the resulting braking forces.
- **Highly damped** and **without play**, regardless of water level.
- That's the reason for the **force reduction up to 90 % !**

- **DualDocker** offers highest level of **convenience and safety** in storms & waves.
  - **Jerk-free,** minimum level of motion
  - **Utmost safety** during a storm
  - **Maintenance free**
  - **Zero impact on underwater world**

Conventional Solutions

Stiff mooring booms

- No damping capacity
- High retention forces

Piles

- Visual Impact
- Limited damping capacity
- Jerking
- Noise

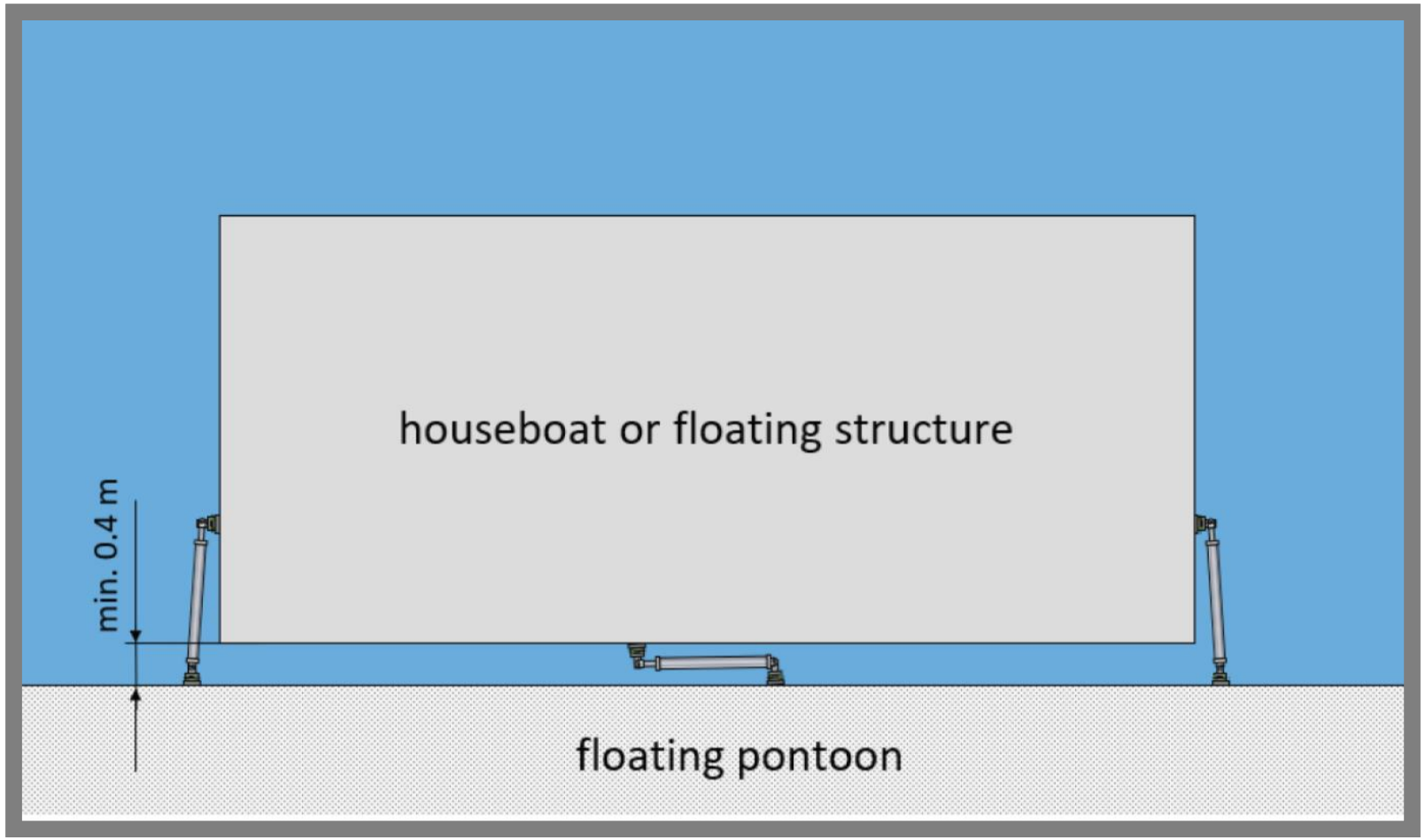
Stiff mooring booms

- No damping capacity
- Jerking & Movement

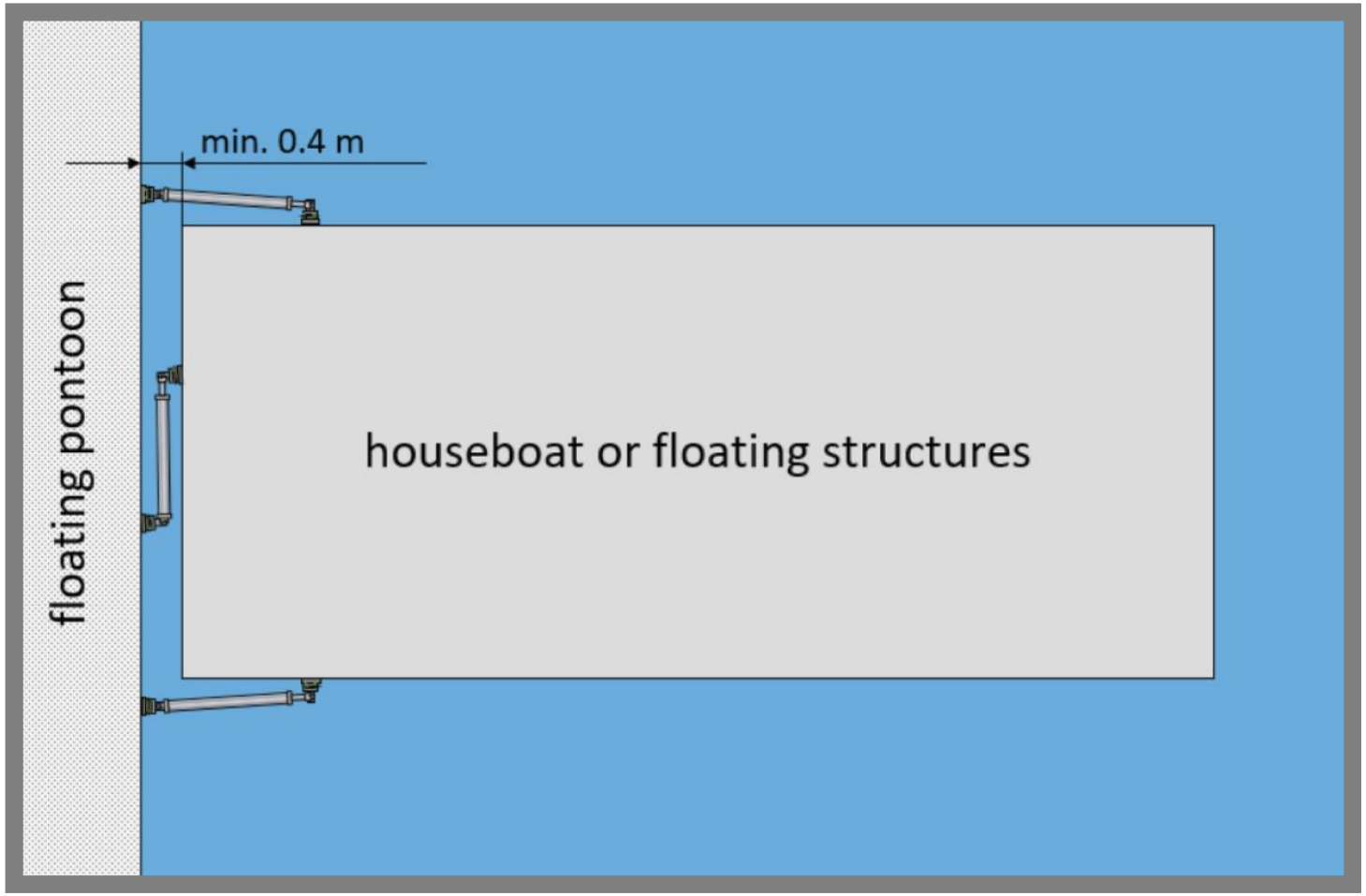
Disadvantages

- High retention forces
- Inconvenience
- Discomfort
- Damage
- Safe enough?

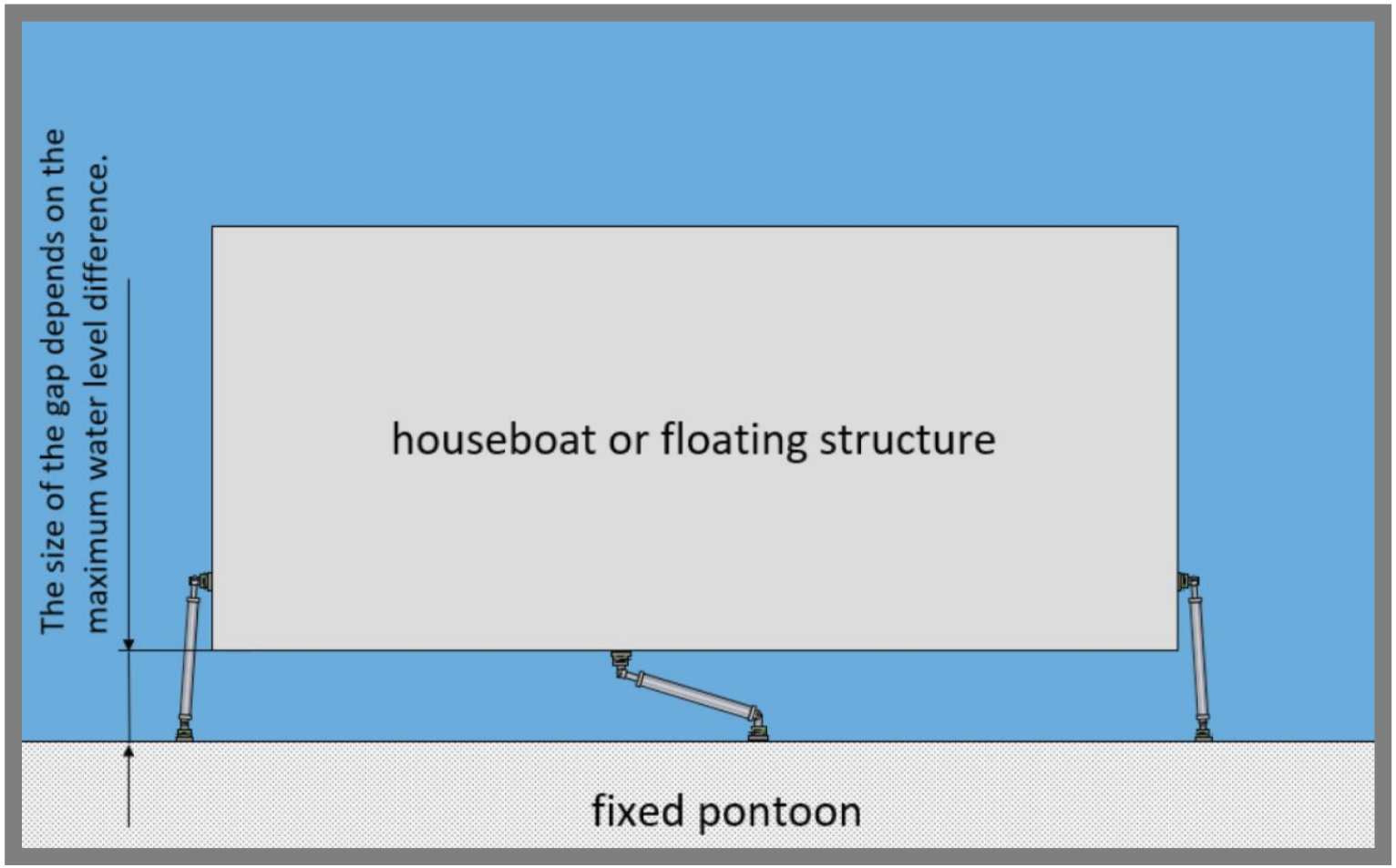
TriDocker on Floating Pontoon



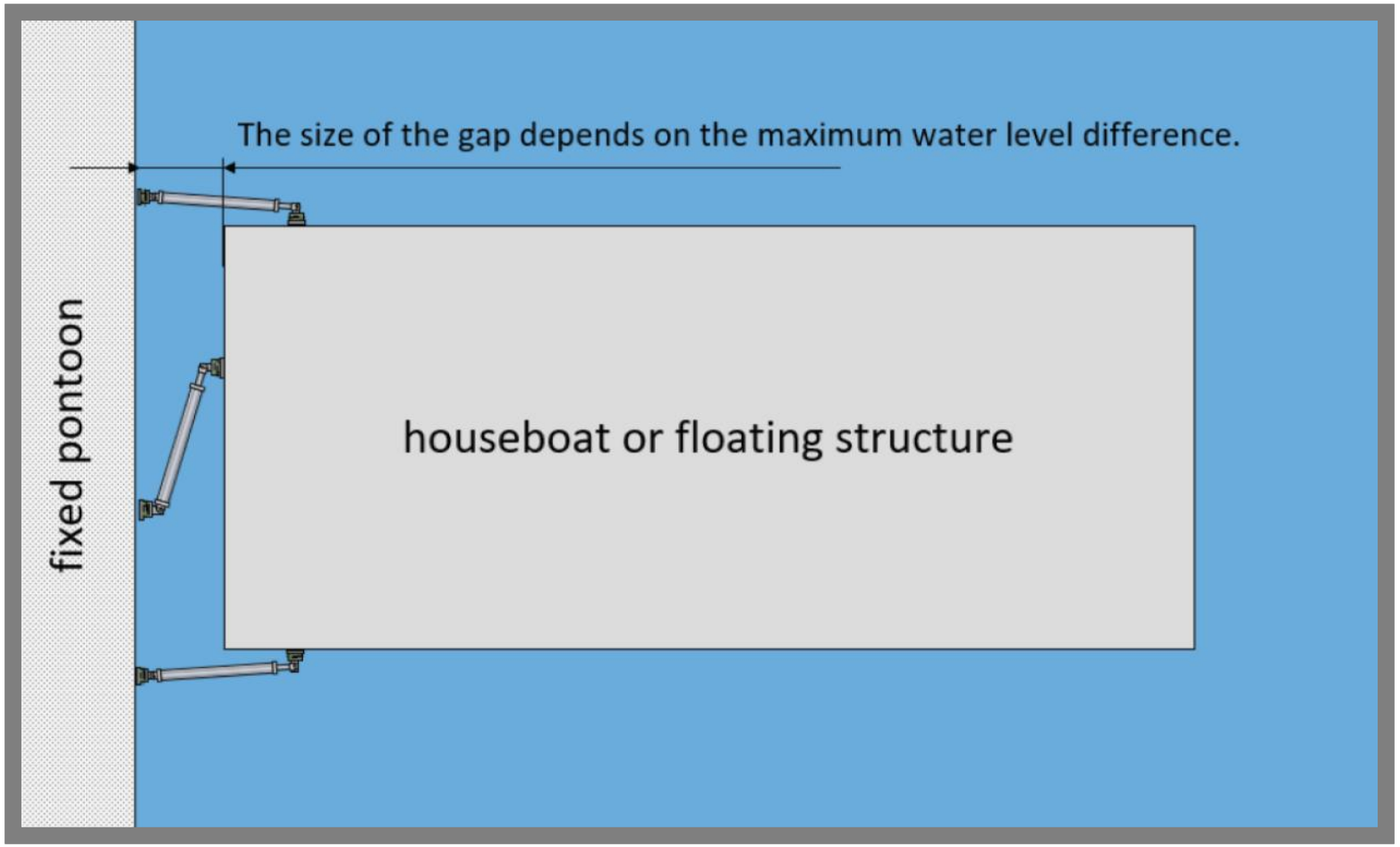
TriDocker on Floating Pontoon



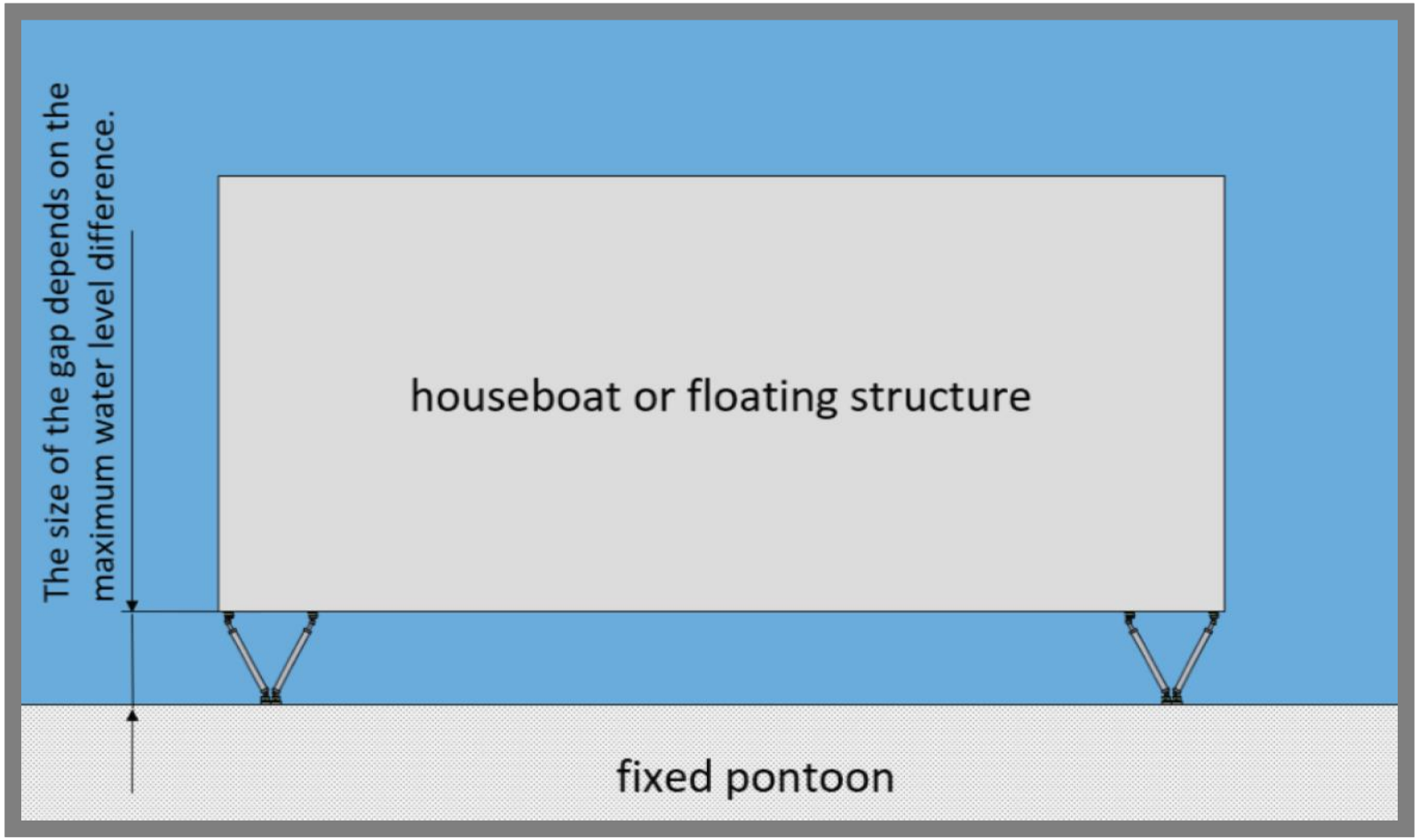
TriDocker on Fixed Pontoon



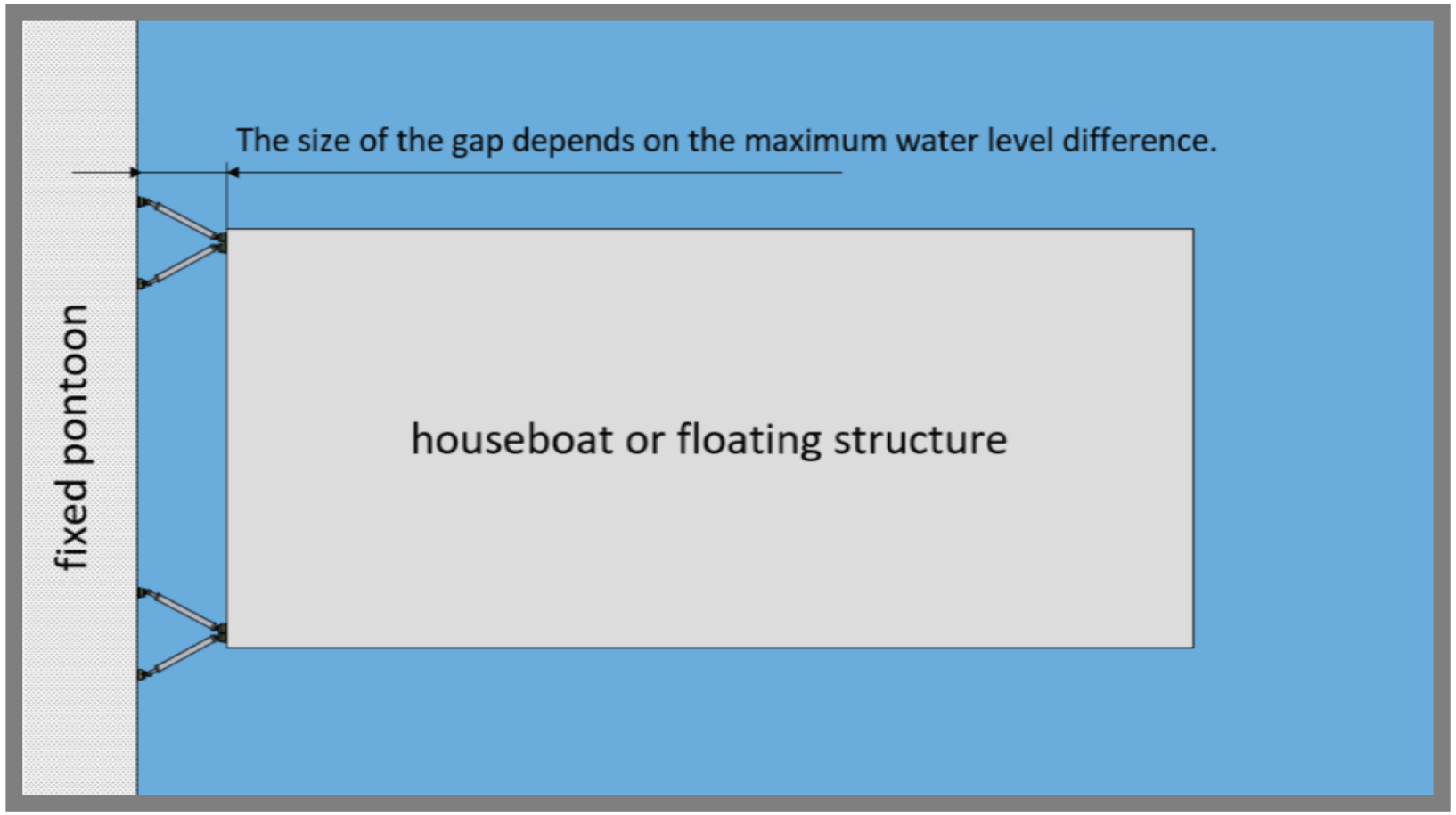
TriDocker on Fixed Pontoon



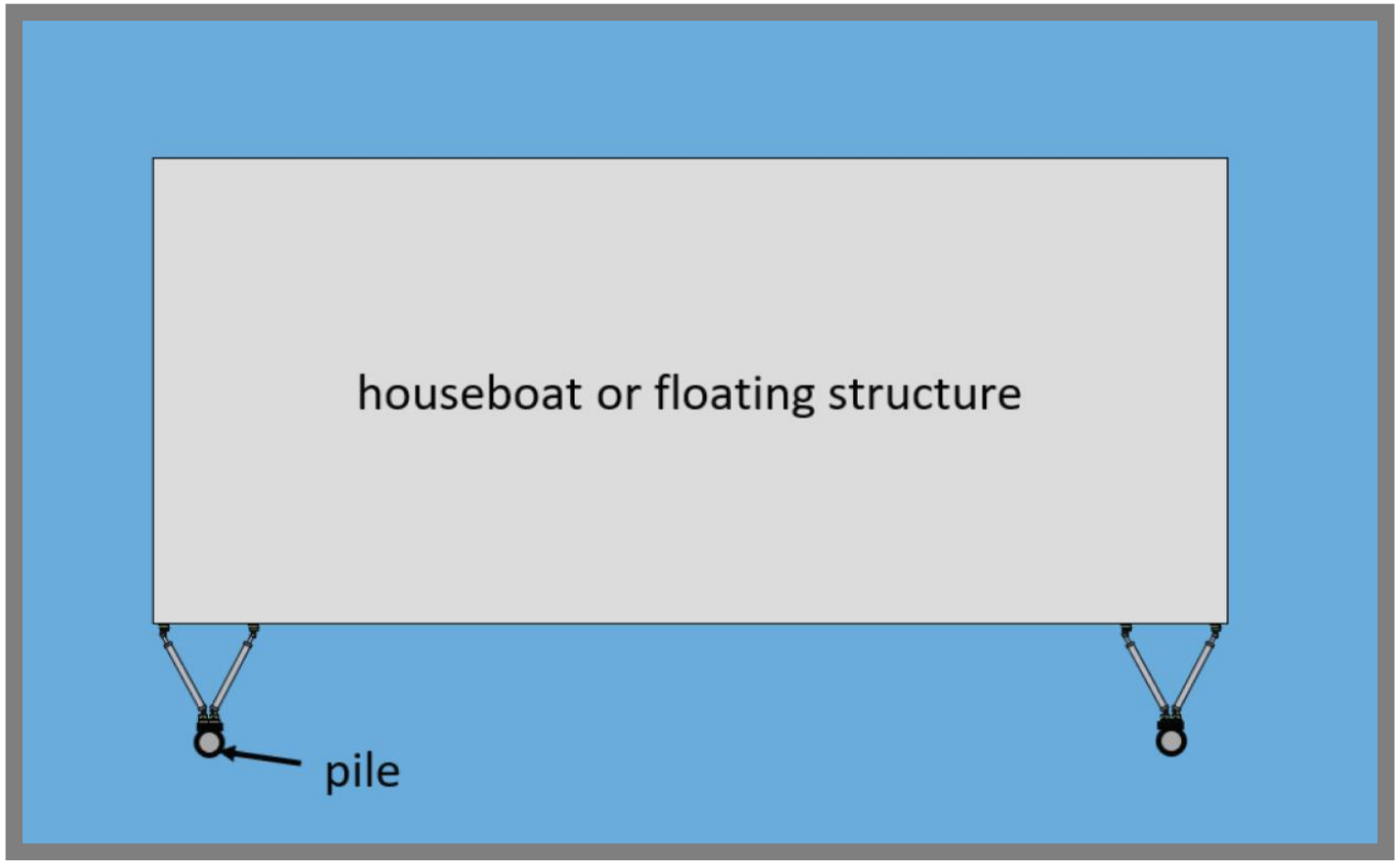
V-Setup on Fixed Pontoon



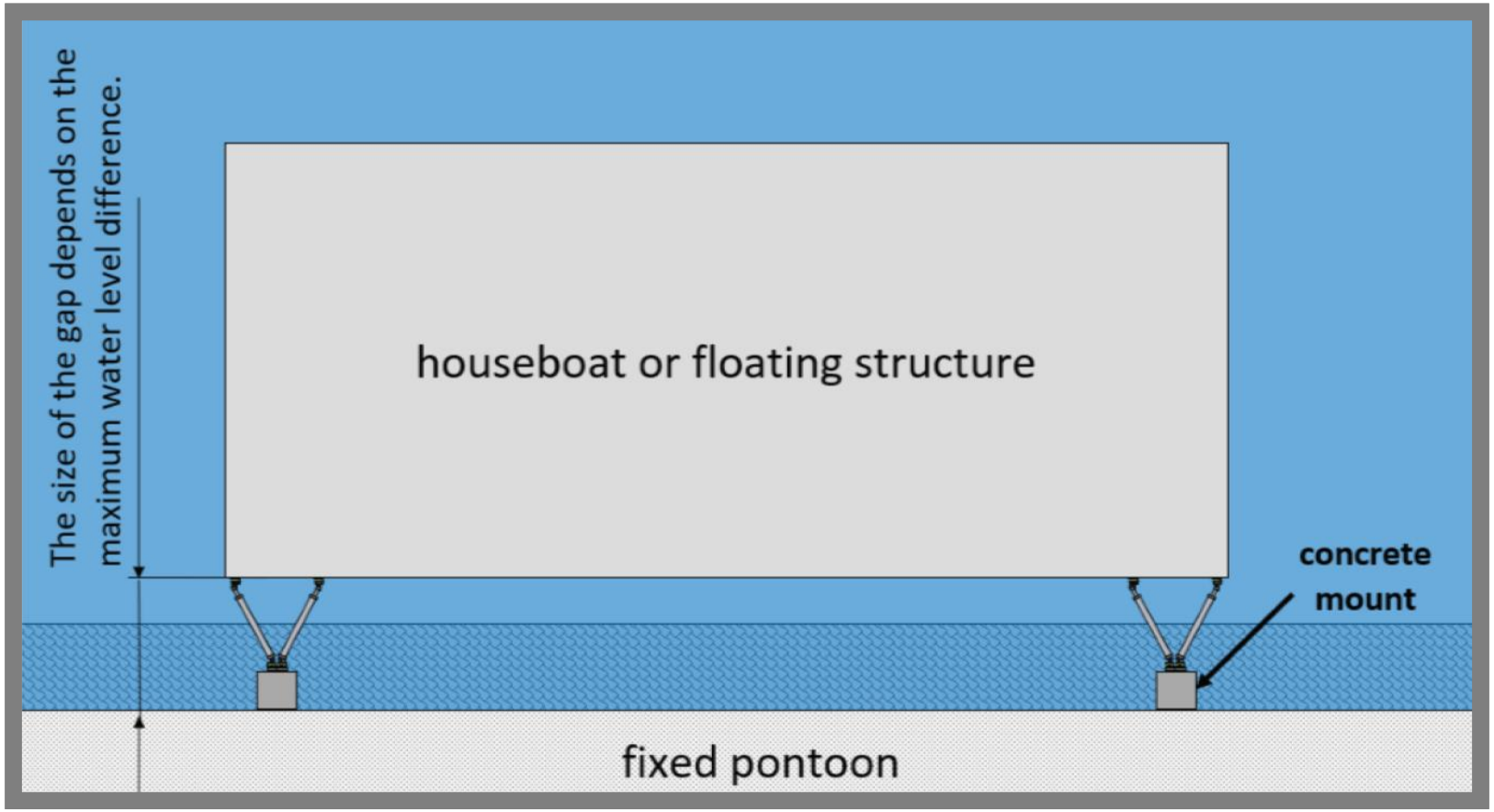
V-Setup on Fixed Pontoon



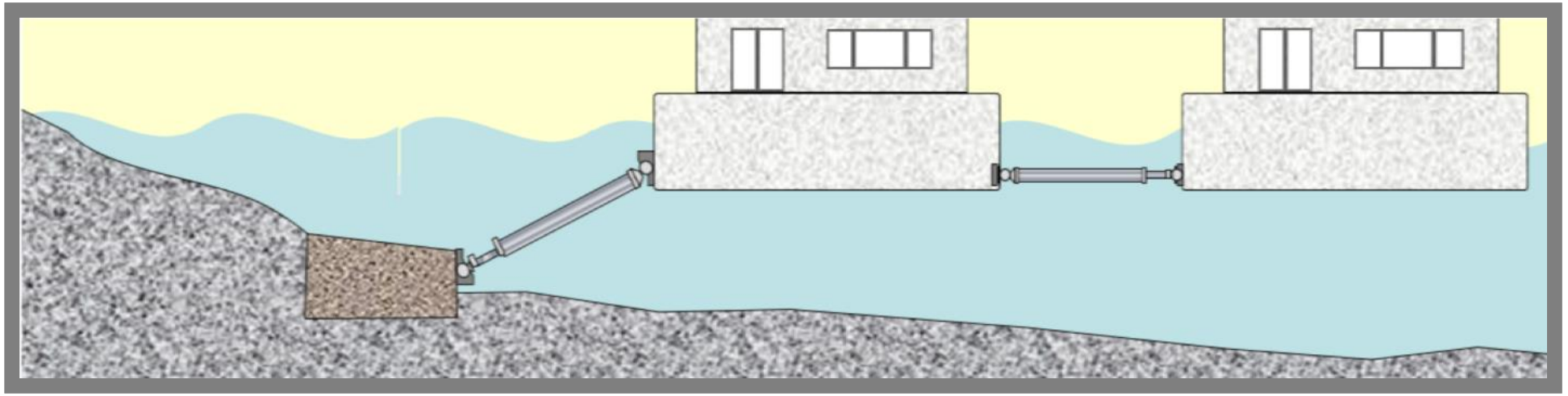
V-Setup on piles



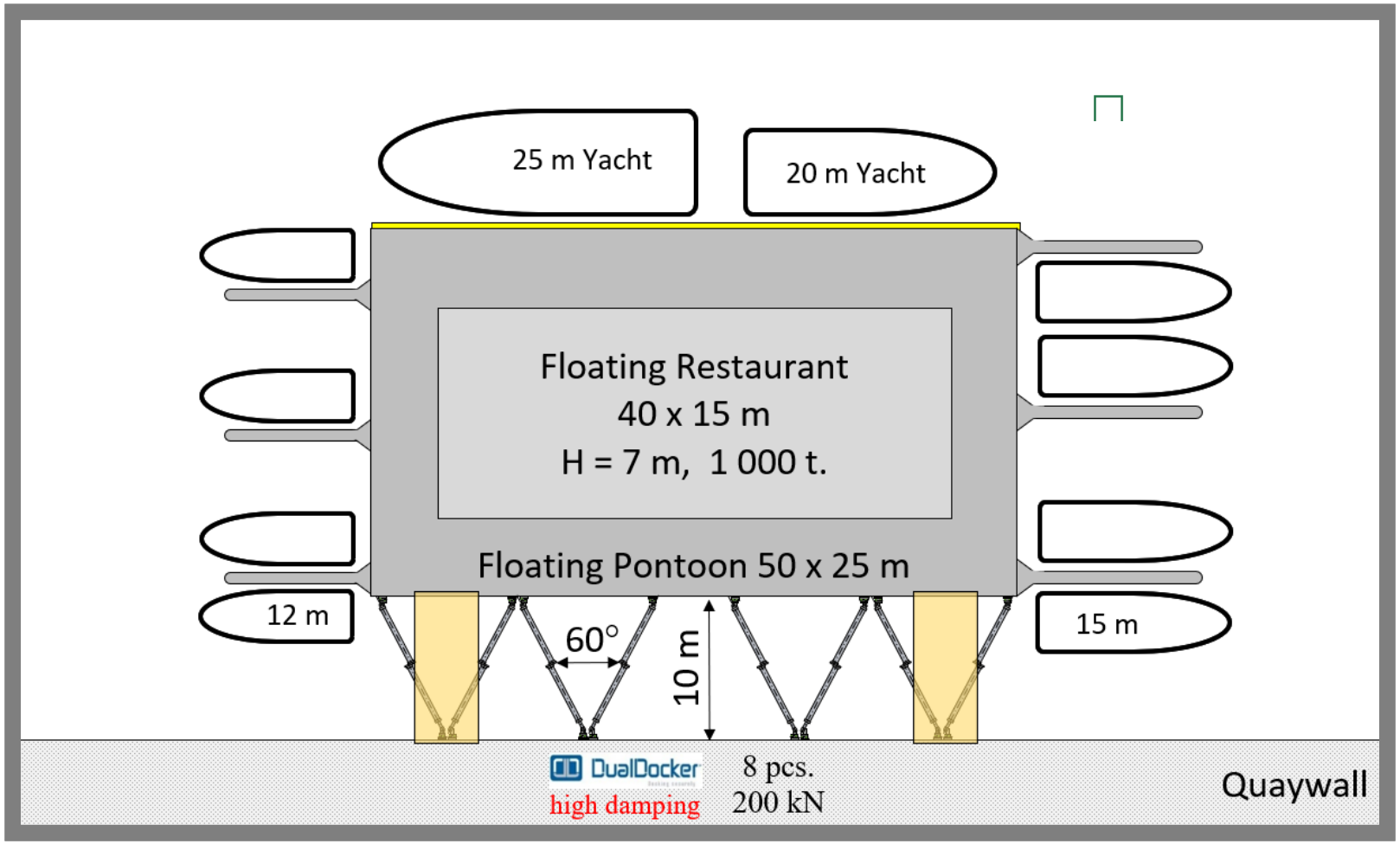
V-Setup on concrete mounts



Under water installation

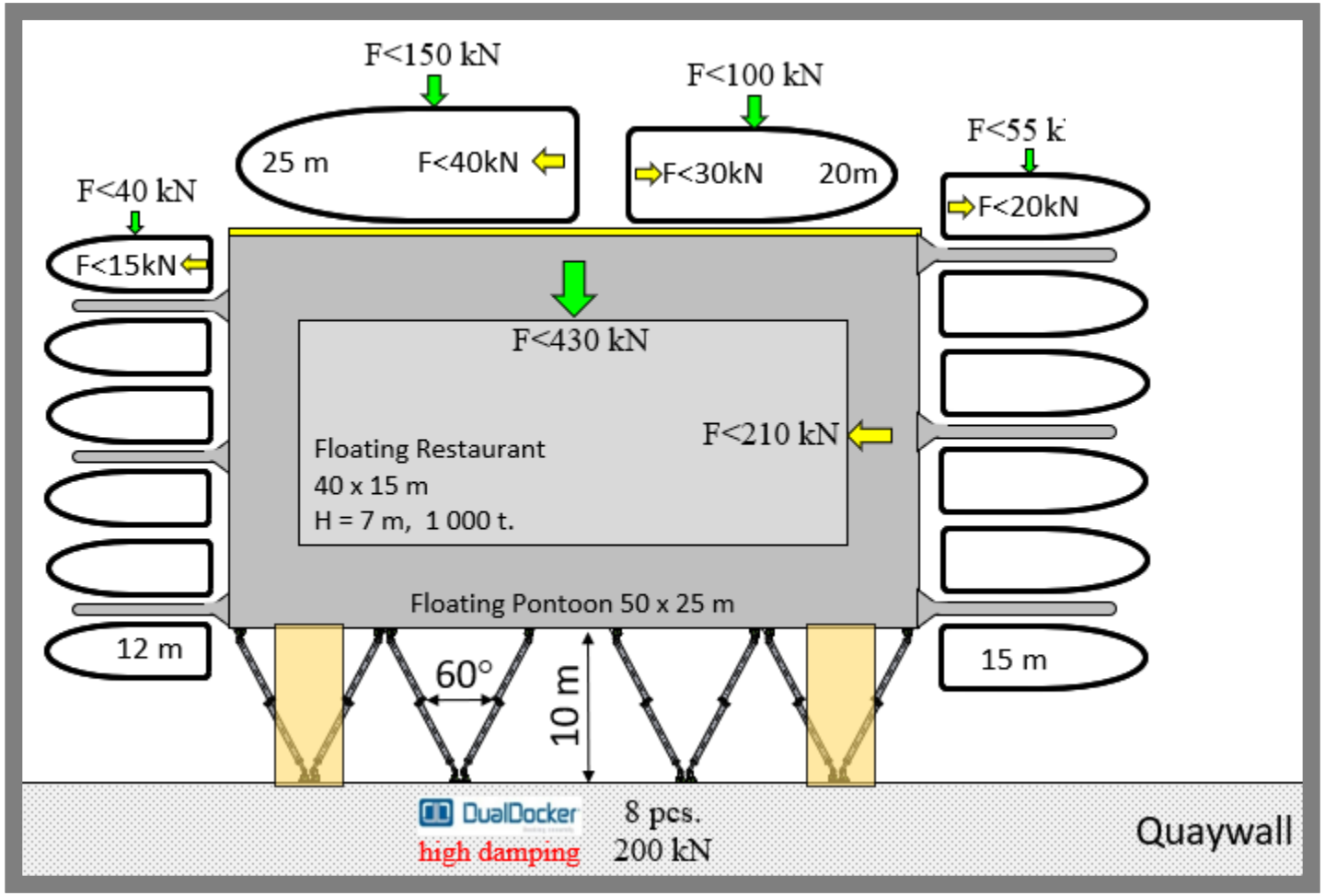


Restaurant



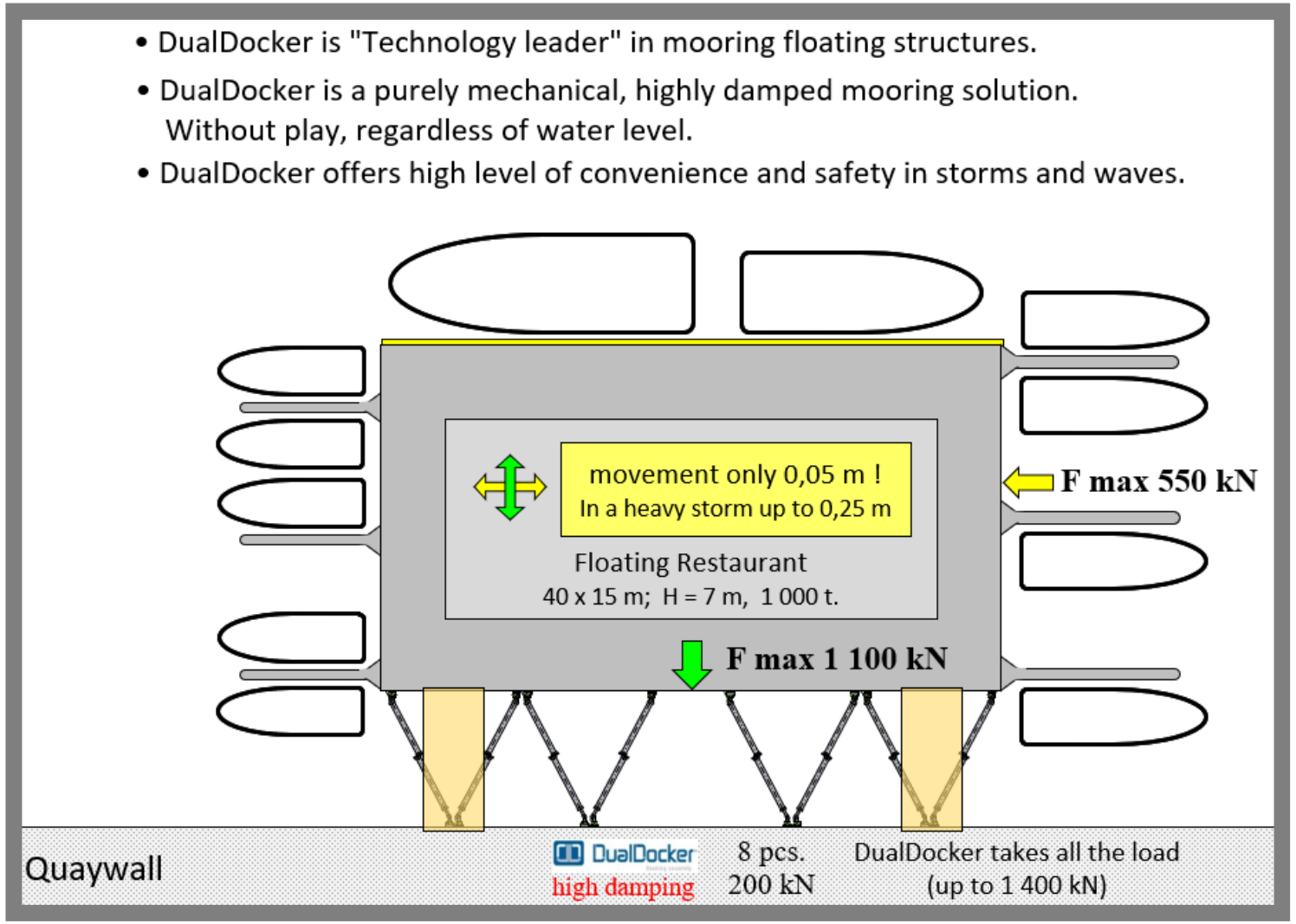
Waterlevel Difference 2,0 m • Max. Windspeed 40 m/s • Max. Current 1,0 m/s • Max. Wave 0,7 m

Restaurant


F<150 kN
F<100 kN
F<55 k
25 m
F<40kN
F<30kN
20m
F<20kN
F<40 kN
F<15kN
F<430 kN
F<210 kN
Floating Restaurant
40 x 15 m
H = 7 m, 1 000 t.
Floating Pontoon 50 x 25 m
12 m
60°
10 m
15 m
DualDocker
high damping
8 pcs.
200 kN
Quaywall

Restaurant

- DualDocker is "Technology leader" in mooring floating structures.
- DualDocker is a purely mechanical, highly damped mooring solution.
  Without play, regardless of water level.
- DualDocker offers high level of convenience and safety in storms and waves.



Calculation of dynamic forces (kinetic energy):

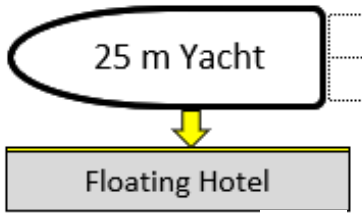
Input	mass [N]	981	[kN]	100,00	[tons]
Input	max. arriving speed [m/s]	0,10	[m/s]	0,36	[km/h]
Result	kin. energy	4,91	kJ		

Calculation of braking force:

Input	braking distance [m]	0,20	[m]		
Result	max. braking force [N]	49	[kN]	5,00	[tons]

"damped" with DualDocker

Calculation: dynamic forces during docking manoeuvre



Yacht mass : **100,0** [tons]

max. speed: **0,10** [m/s]

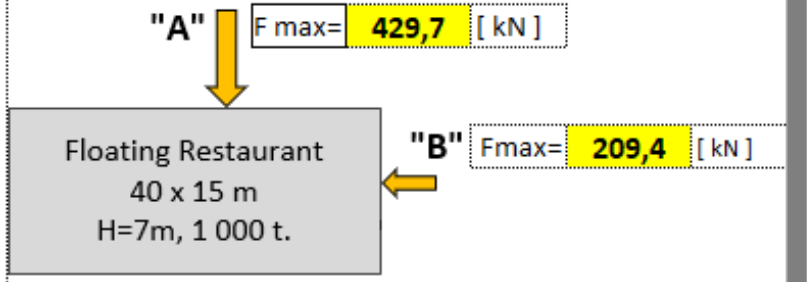
Calculation of dynamic forces (kinetic energy):

Input	mass [N]	9 810	[kN]	1 000,00	[tons]
Input	speed [m/s]	0,03	[m/s]	0,11	[km/h]
Result	kin. energy	4,41	kJ		

Calculation of braking force:

Input	braking distance [m]	0,20	[m]		
Result	max. braking force [N]	44	[kN]	4,50	[tons]

Calculation: mooring ... s in "wind & waves"



Calculation of static forces: Wind & current direction "A"

Wind pressure: F wind = 0,5 x air density x speed ^{2} x surface area exposed to wind x CD-value

Input	air density	1,25	[kg/m^3]		
Input	speed	40	[m/s]	144,00	[km/h]
Input	surface area	330	[m^2]		
Input	CD value	1,1			
Result	wind pressure	363,0	[kN]	37,00	[tons]

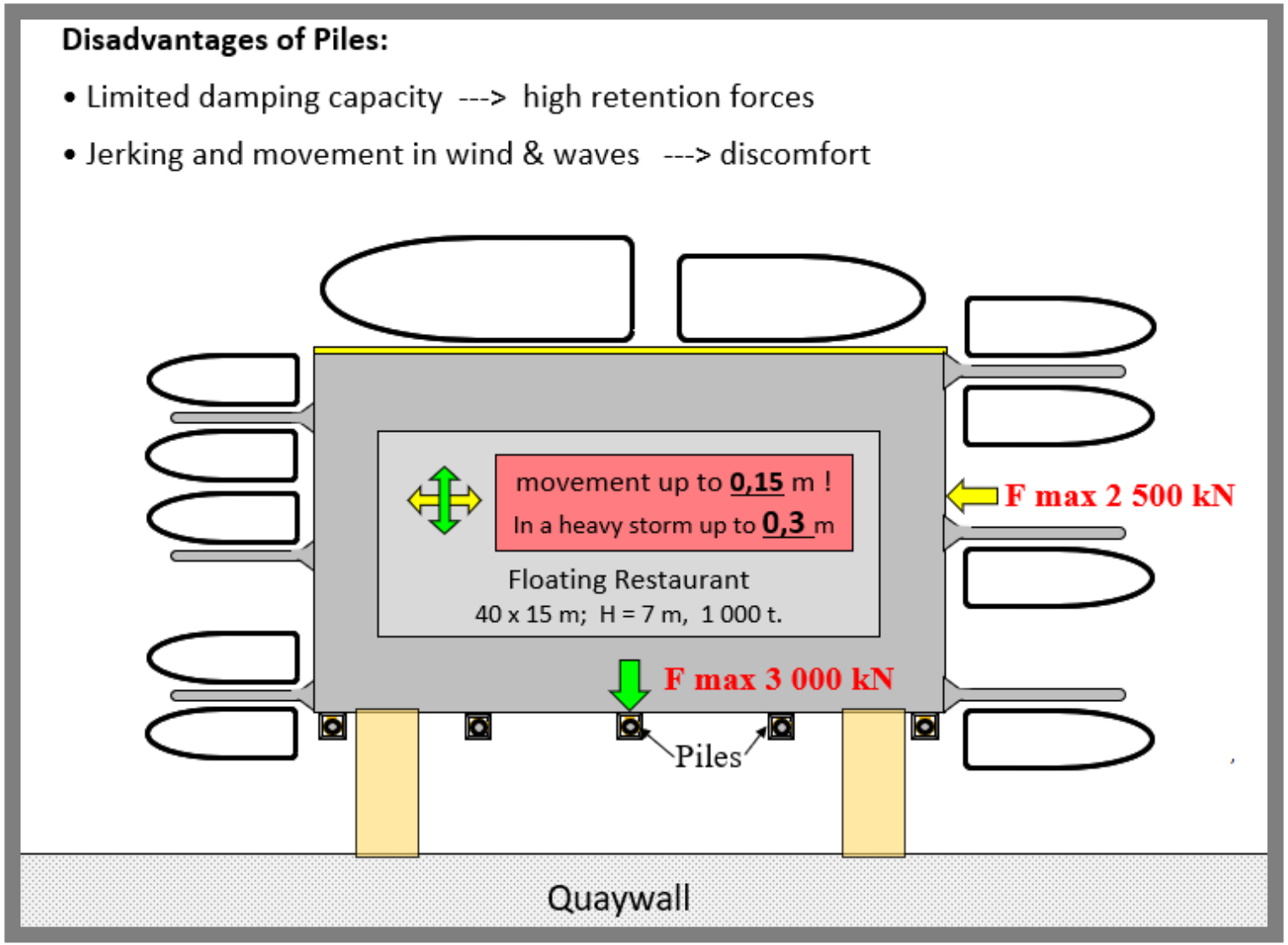
Current Pressure: F water = 0,5 x water density x speed ^{2} x surface area exposed to current x CD value

Input	water density	1026	[kg/m^3]		
Input	speed	1	[m/s]	3,60	[km/h]
Input	surface area	40	[m^2]		
Input	CD value	1,1			
Result	pressure (current)	22,6	[kN]	2,30	[tons]
Result	wind + current + braking f.	**429,7**	[kN]	43,8	[tons]

Calculation of static forces: Wind & current direction "B

air density	1,25	[kg/m^3]			
speed	40	[m/s]	144,00	[km/h]	
surface area	140	[m^2]			
CD value	1,1				
wind pressure	154,0	[kN]	15,70	[tons]	
water density	1026	[kg/m^3]			
speed	1	[m/s]	3,60	[km/h]	
surface area	20	[m^2]			
CD value	1,1				
pressure (current)	11,3	[kN]	1,15	[tons]	
wind + current + braking f.	**209,4**	[kN]	21,3	[tons]	

Restaurant - Piles



Calculation of dynamic forces (kinetic energy):

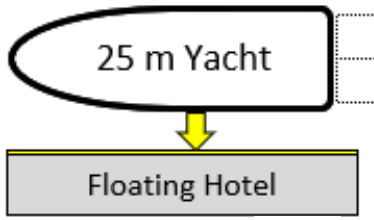
Input	mass [N]	981	[kN]	100,00	[tons]
Input	max. arriving speed [m/s]	0,10	[m/s]	0,36	[km/h]
Result	kin. energy	4,91	kJ		

Calculation of braking force:

Input	braking distance [m]	0,05	[m]		
Result	max. braking force [N]	196	[kN]	20,00	[tons]

"undamped" connection with "Piles"

Calculation: dynamic forces during docking manoeuvre



Yacht mass :	100,0	[tons]
max. speed:	0,10	[m/s]

Calculation of dynamic forces (kinetic energy):

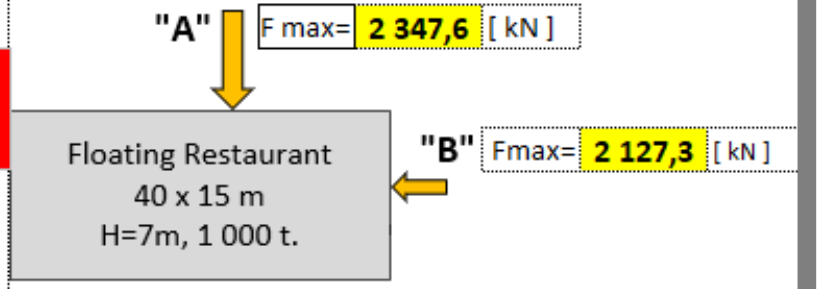
Input	mass [N]	9 810	[kN]	1 000,00	[tons]
Input	speed [m/s]	0,10	[m/s]	0,36	[km/h]
Result	kin. energy	49,05	kJ		

Calculation of braking force:

Input	braking distance [m]	0,05	[m]		
Result	max. braking force [N]	1 962	[kN]	200,00	[tons]

"undamped" connection with "Piles"

Calculation: mooring forces in "wind & waves"



Calculation of static forces: Wind & current direction "A"

Wind pressure: F wind = 0,5 x air density x speed ² x surface area exposed to wind x CD-value

Input	air density	1,25	[kg/m³]		
Input	speed	40	[m/s]	144,00	[km/h]
Input	surface area	330	[m²]		
Input	CD value	1,1			
Result	wind pressure	363,0	[kN]	37,00	[tons]

Current Pressure: F water = 0,5 x water density x speed ² x surface area exposed to current x CD value

Input	water density	1026	[kg/m³]		
Input	speed	1	[m/s]	3,60	[km/h]
Input	surface area	40	[m²]		
Input	CD value	1,1			
Result	pressure (current)	22,6	[kN]	2,30	[tons]
Result	wind + current + braking f.	**2 347,6**	[kN]	239,3	[tons]

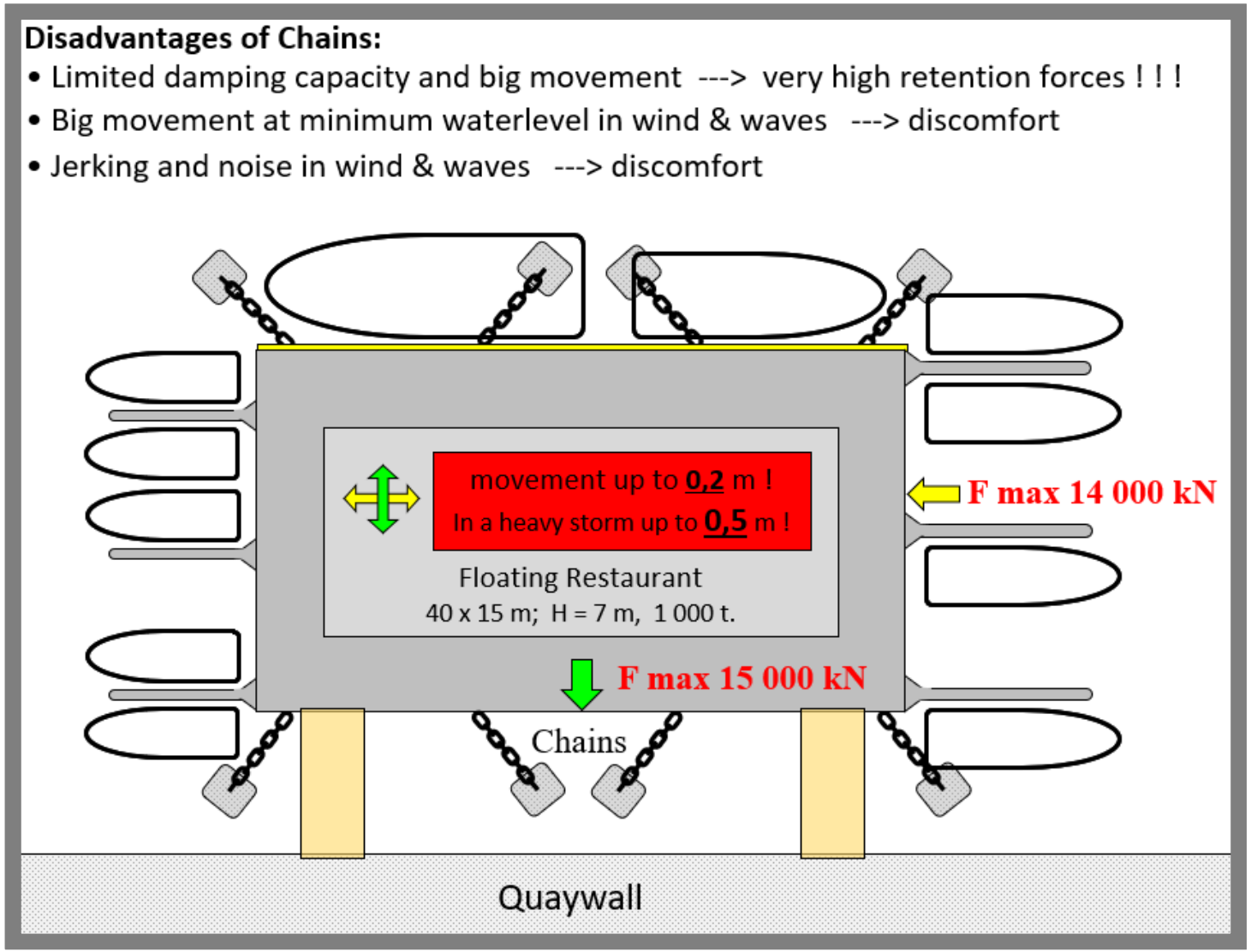
Calculation of static forces: Wind & current direction "B"

air density	1,25	[kg/m³]			
speed	40	[m/s]	144,00	[km/h]	
surface area	140	[m²]			
CD value	1,1				
wind pressure	154,0	[kN]	15,70	[tons]	
water density	1026	[kg/m³]			
speed	1	[m/s]	3,60	[km/h]	
surface area	20	[m²]			
CD value	1,1				
pressure (current)	11,3	[kN]	1,15	[tons]	
wind + current + braking f.	**2 127,3**	[kN]	216,8	[tons]	

Restaurant – Chains

Disadvantages of Chains:

- Limited damping capacity and big movement ---> very high retention forces ! ! !
- Big movement at minimum waterlevel in wind & waves ---> discomfort
- Jerking and noise in wind & waves ---> discomfort



Calculation of dynamic forces (kinetic energy):

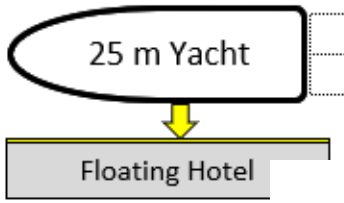
Input	mass [N]	981	[kN]	100,00	[tons]
Input	max. arriving speed [m/s]	0,10	[m/s]	0,36	[km/h]
Result	kin. energy	4,91	kJ		

"undamped" connection with **"Chains"**

Calculation of braking force:

Input	braking distance [m]	0,03	[m]		
Result	max. braking force [N]	327	[kN]	33,33	[tons]

Calculation: dynamic forces during docking manoeuvre



Yacht mass : **100,0** [tons]
max. speed: **0,10** [m/s]

Calculation of dynamic forces (kinetic energy):

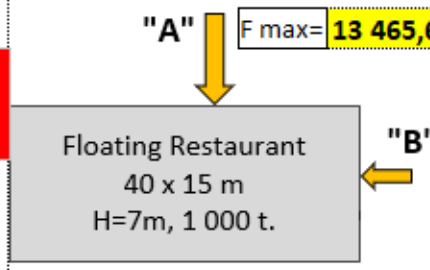
Input	mass [N]	9 810	[kN]	1 000,00	[tons]
Input	speed [m/s]	0,20	[m/s]	0,72	[km/h]
Result	kin. energy	196,20	kJ		

"undamped" connection with **"Chains"**

Calculation of braking force:

Input	braking distance [m]	0,03	[m]		
Result	max. braking force [N]	13 080	[kN]	1 333,33	[tons]

Calculation: mooring forces in "wind & waves"



Calculation of static forces: Wind & current direction "A"

Wind pressure: F wind = 0,5 x air density x speed ² x surface area exposed to wind x CD-value

Input	air density	1,25	[kg/m³]		
Input	speed	40	[m/s]	144,00	[km/h]
Input	surface area	330	[m²]		
Input	CD value	1,1			
Result	wind pressure	363,0	[kN]	37,00	[tons]

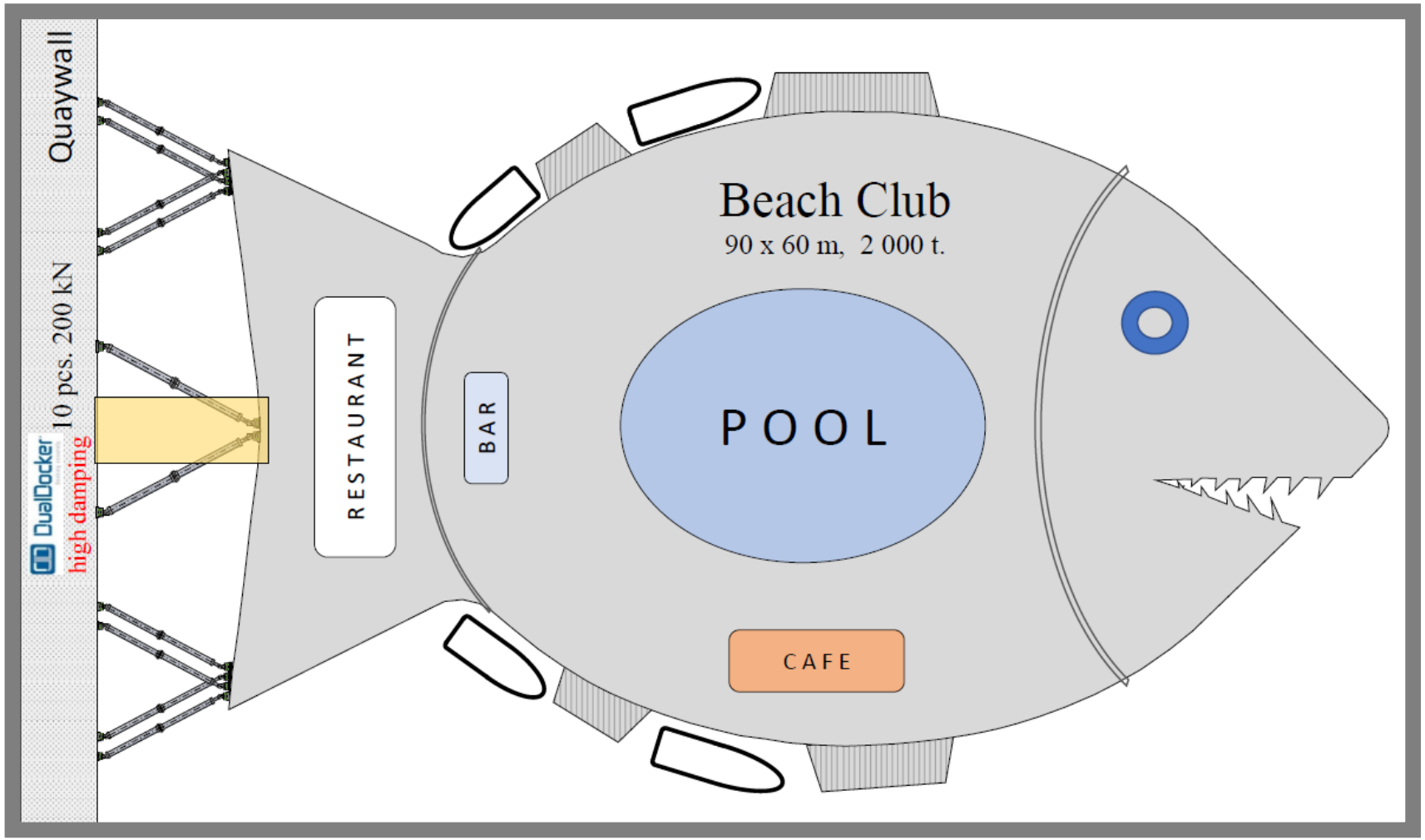
Current Pressure: F water = 0,5 x water density x speed ² x surface area exposed to current x CD value

Input	water density	1026	[kg/m³]		
Input	speed	1	[m/s]	3,60	[km/h]
Input	surface area	40	[m²]		
Input	CD value	1,1			
Result	pressure (current)	22,6	[kN]	2,30	[tons]
Result	wind + current + braking f.	**13 465,6**	[kN]	1 372,6	[tons]

Calculation of static forces: Wind & current direction "B

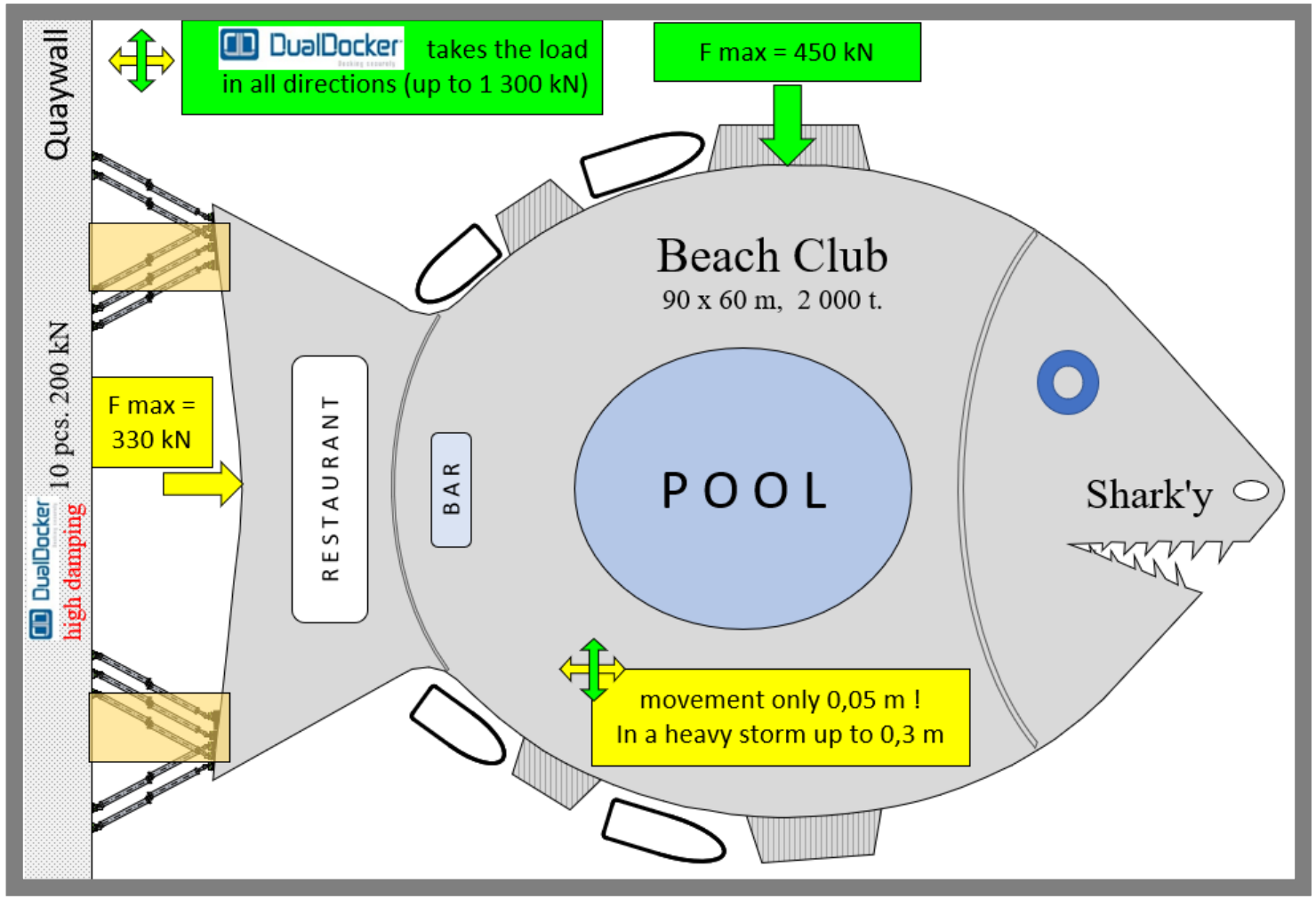
air density	1,25	[kg/m³]			
speed	40	[m/s]	144,00	[km/h]	
surface area	140	[m²]			
CD value	1,1				
wind pressure	154,0	[kN]	15,70	[tons]	
water density	1026	[kg/m³]			
speed	1	[m/s]	3,60	[km/h]	
surface area	20	[m²]			
CD value	1,1				
pressure (current)	11,3	[kN]	1,15	[tons]	
wind + current + braking f.	**13 245,3**	[kN]	1 350,2	[tons]	

Beach Club

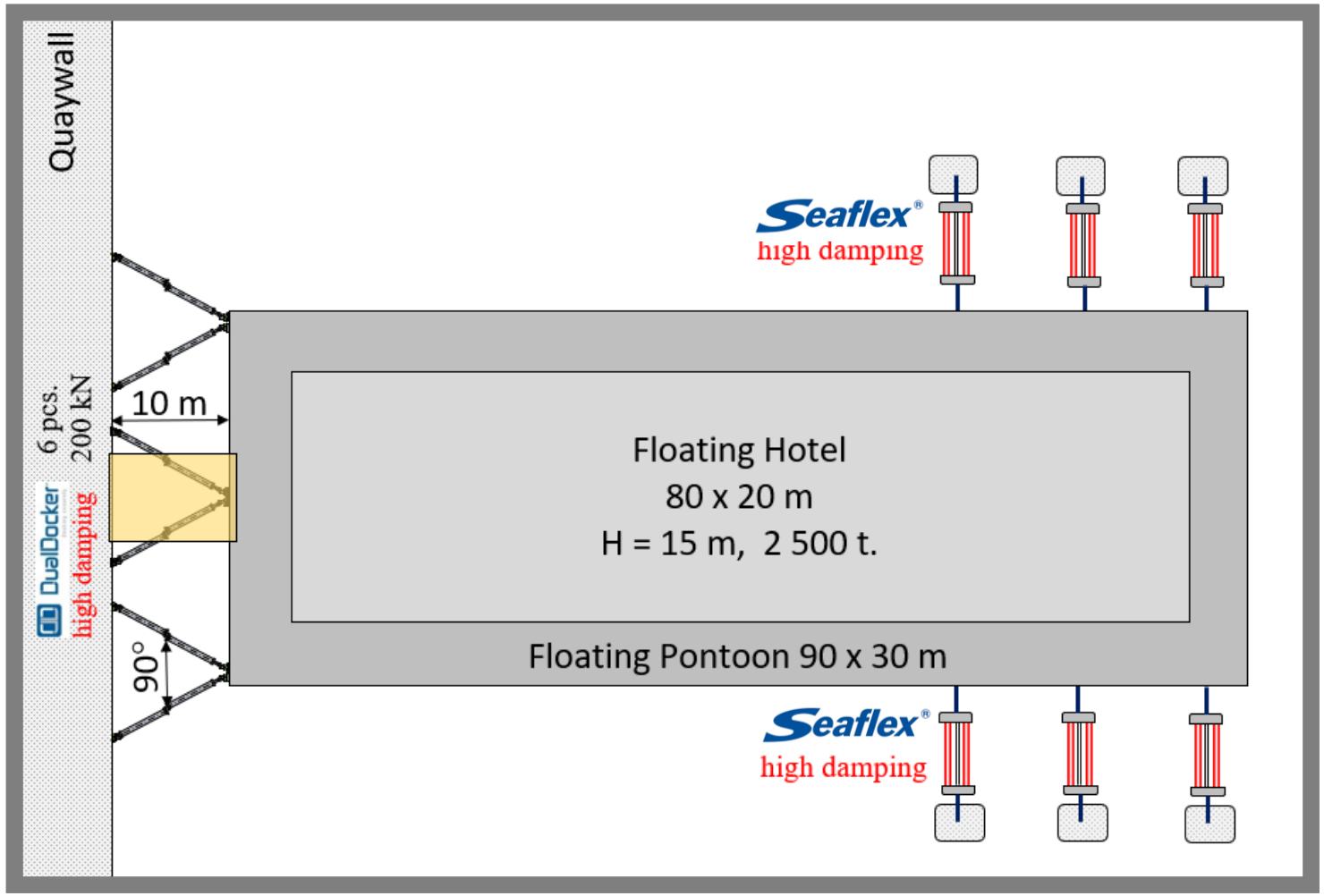


Waterlevel Difference 2,0 m • Max. Windspeed 40 m/s • Max. Current 1,0 m/s • Max. Wave 0,7 m

Beach Club

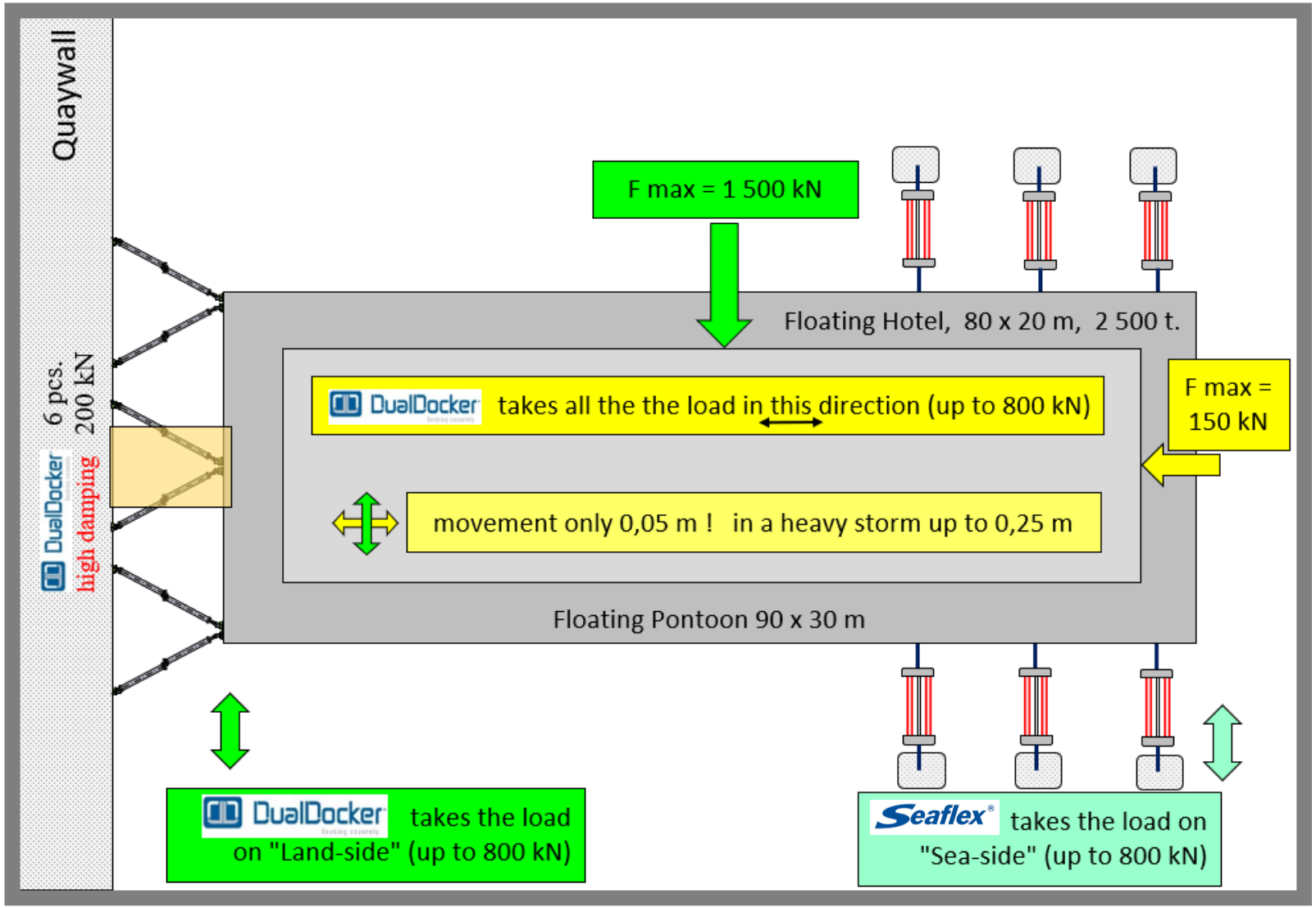

Quaywall
10 pcs. 200 kN
DualDocker high damping
DualDocker takes the load in all directions (up to 1 300 kN)
F max = 450 kN
F max = 330 kN
Beach Club
90 x 60 m, 2 000 t.
RESTAURANT
BAR
POOL
Shark'y
movement only 0,05 m !
In a heavy storm up to 0,3 m

Floating Hotel

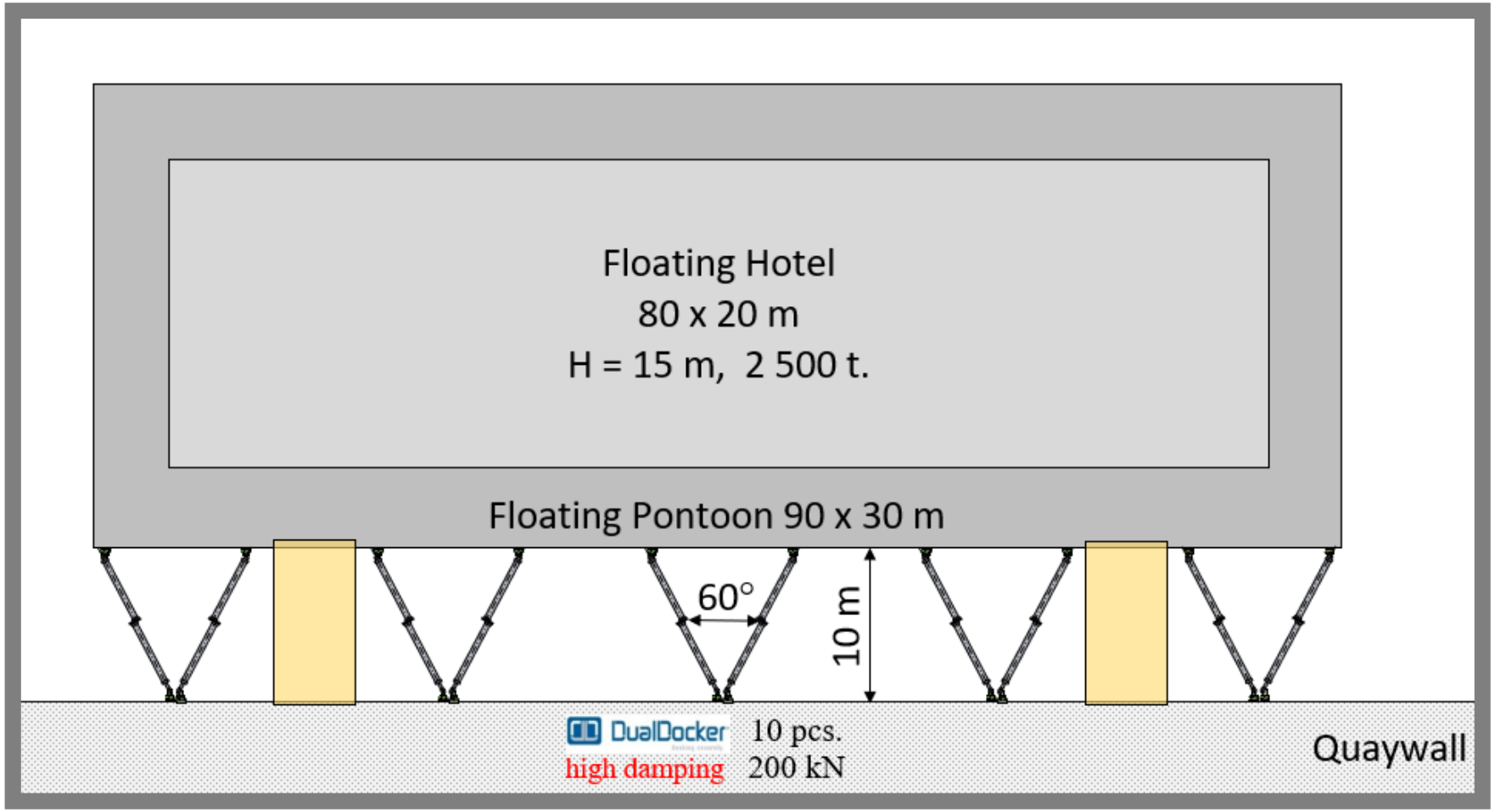


Waterlevel Difference 2,0 m • Max. Windspeed 40 m/s • Max. Current 1,0 m/s • Max. Wave 0,7 m

Floating Hotel

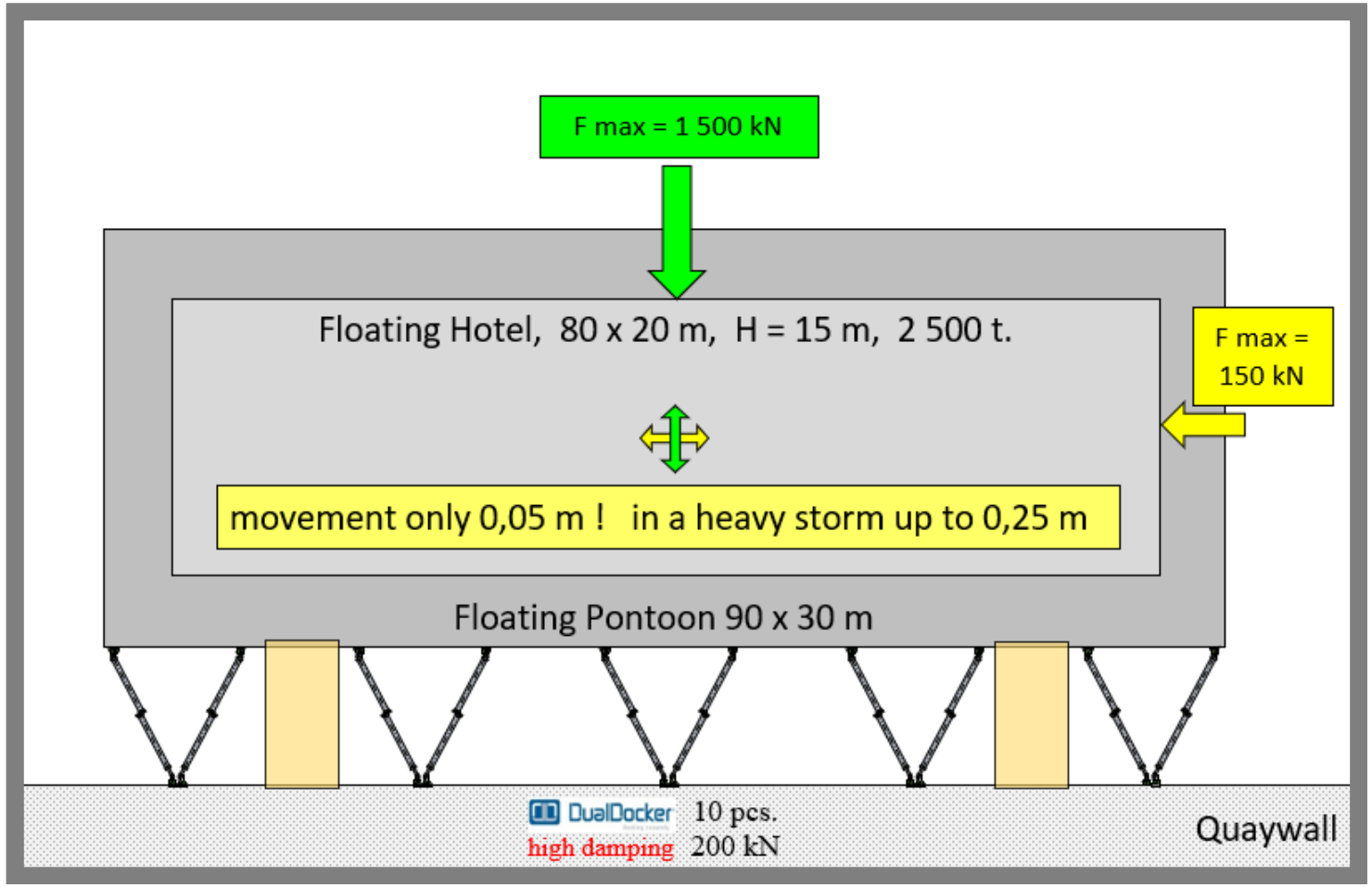


Floating Hotel



Waterlevel Difference 2,0 m • Max. Windspeed 40 m/s • Max. Current 1,0 m/s • Max. Wave 0,7 m

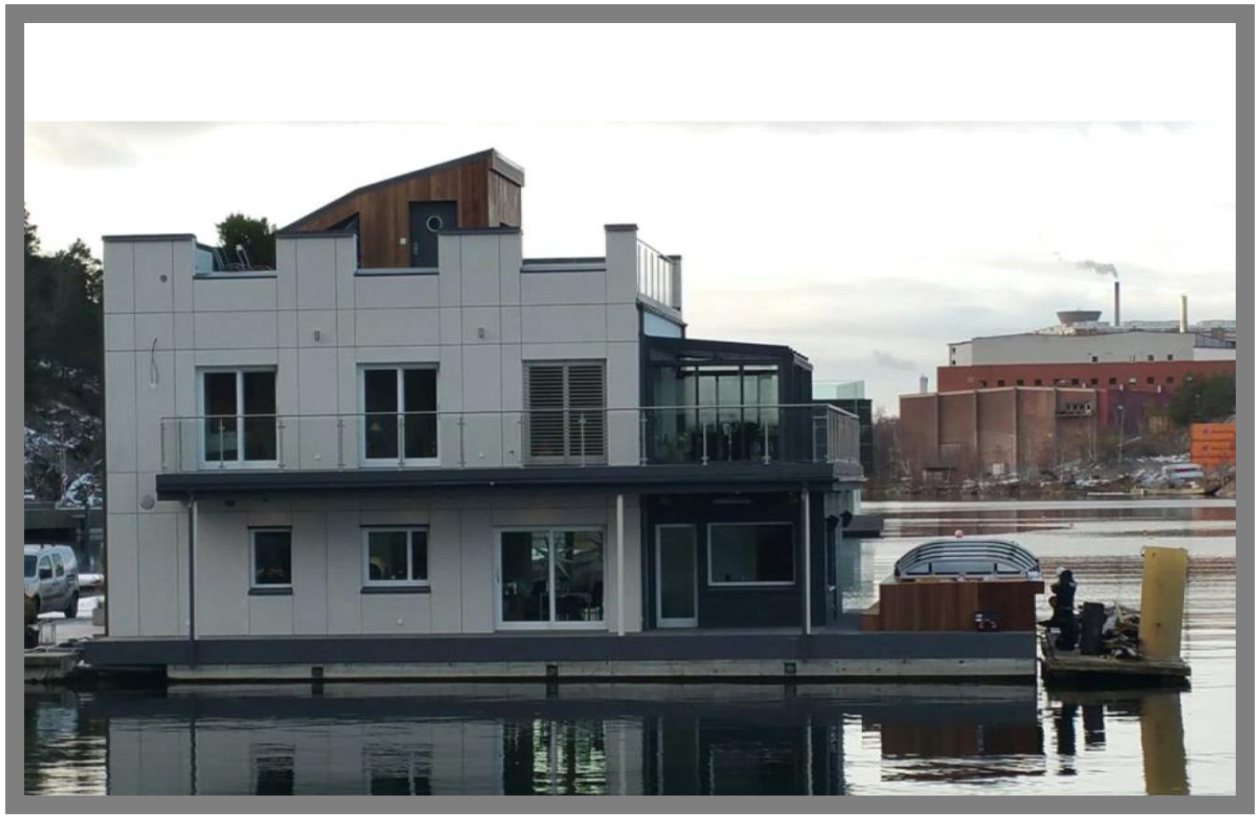
Floating Hotel



Kröslin, Germany

Max. Windspeed 40 m/s • 2 DualDocker arms

Stockholm, Sweden



Max. Windspeed 35 m/s • Max. weight 210 tons • 3 DualDocker arms

Stockholm, Sweden

Max. Windspeed 35 m/s • Max. weight 300 tons • 3 DualDocker arms

Bitterfeld, Germany

5 km fetch • No breakwater! • 150 t & 15 t houses • 2 DualDocker arms per house

Bitterfeld, Germany

5 km fetch • No breakwater! • weight: 150 t • 2 DualDocker arms

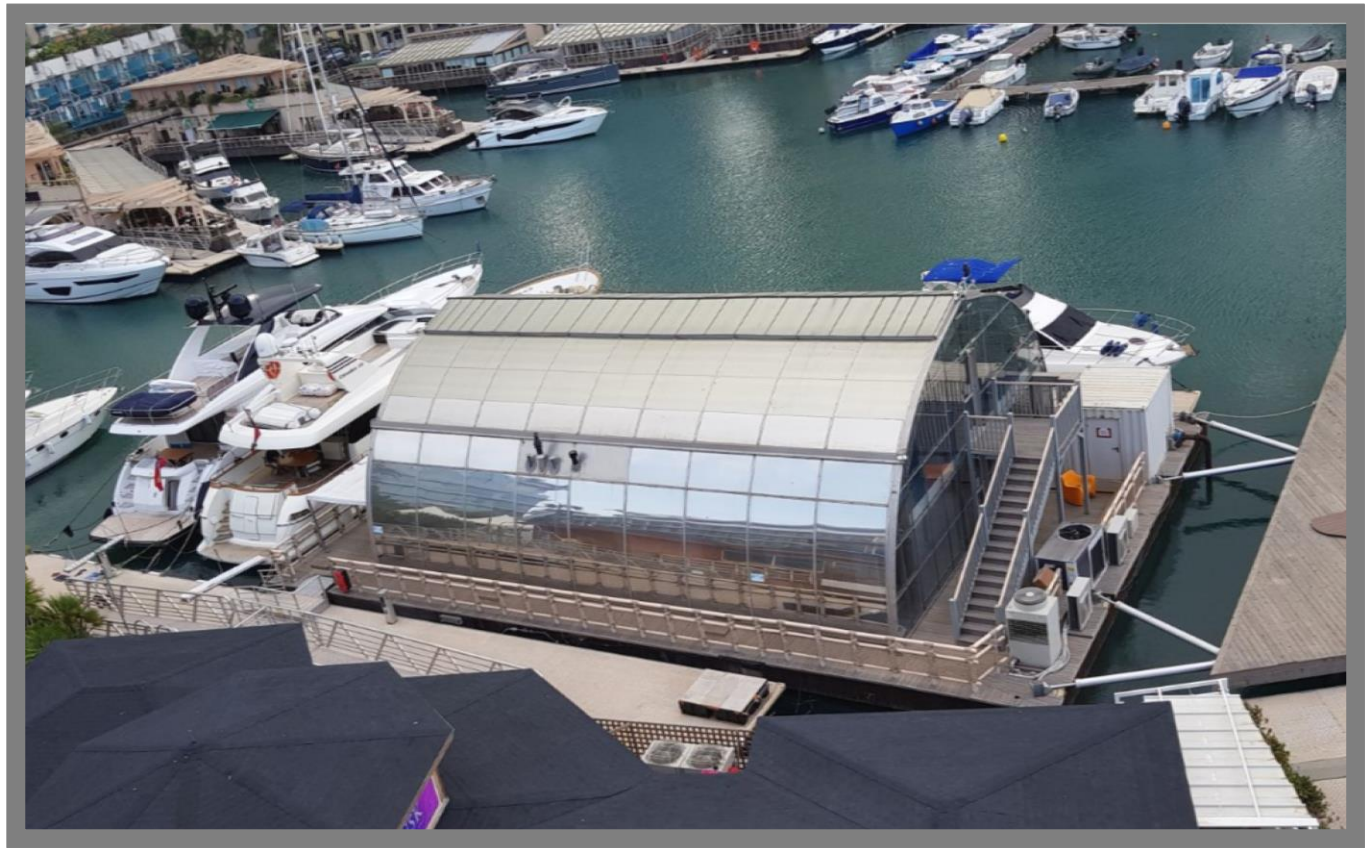
Bitterfeld, Germany

5 km fetch • No breakwater! • weight: 15 t • 2 DualDocker arms

Mücheln, Germany

7 km fetch • No breakwater! • weight: 15 t • 3 DualDocker arms

Strait of Gibraltar

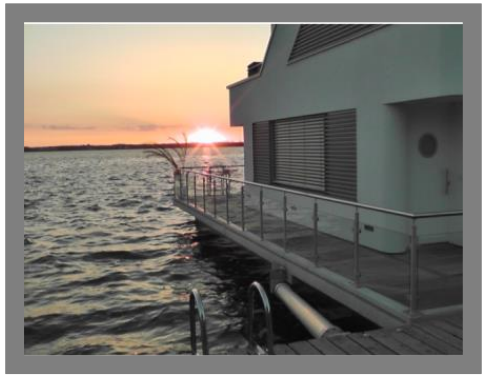


Max. wind speed 35 m/s • Rough conditions & High swell • weight: 350 t • 4 DualDocker arms

Benny, proud house owner: *"When my wife and I decided for this new floating lifestyle,* ***we didn't want to compromise on convenience or comfort****.*

So the mooring system ***DualDocker*** *was our* ***first choice*** *and we are* ***very happy*** *with it.*
We have had some storms recently and we were amazed how stable our new home lies in the water.
The total ***lack of jerking*** *(which I have experienced a lot in other, conventionally moored floating houses)* ***contributes a great deal to our high standard of living and comfort*** *here.*
The fixed distance to the pontoon ensuring ***one safe step on board*** *is a huge advantage, too."*
Benny's wife states, after the first winter*: "The safe mooring system has played a huge role so that I feel very comfortable in our house. I am very happy we moved on the water."*

"We strongly recommend the DualDocker to everyone who is planning on living in a floating house."
A number of Benny's neighbours have already decided for the DualDocker.



Ulf Sybel from 'Floating House, Germany' says: *"Residents want to enjoy their on-water holidays in peace and quiet without the excessive jerking motions or disturbing noises we were encountering with piles.*
DualDocker ensures that the customers are more than satisfied.
We are truly impressed !
We swear by the DualDocker and ***use it as the prime mooring solution for floating houses.***

Guest's statement, August 2013: *" [....] We are currently enjoying our holiday in the 'Floating 44' in Laboe and we would like to point out that we really feel extraordinarily comfortable.*
The Dual Docker arms are working impressively. ***The house lies amazingly stable. The feel-good-factor is extremely high.****"*

TV channel RTL West, Germany, May 2014*: "While other houseboats are known to move a lot, these ones in Xanten/Rhine are completely stable in all conditions, thanks to the innovative suspension units (DualDocker)."*

House owners' statement, May 2014*: "[…] Being on our floating house means pure relaxation."*

Marina Manager's comments:

*"**Traditional mooring solutions**, such as chains, piles or rigid distance holders showed to have **considerable disadvantages**.*

*We were concerned about the high, undamped force impact and the station's stability at changing water levels. [...] **So our risk assessment lead us to decide for the DualDocker system** [....]*

*We have got a **perfectly working filling station** for 2 vessles now and are very **happy** with the solution."*

Damping is crucial!

- **Damping reduces force impact** and **grants ‚safety'**!
- **Damping protects** human **lifes!**
- **Damping avoids** economical **damage!**

DualDocker reduces retention force!

WHY?

Energy created by **wind & waves, flotsam or collisions must be absorbed.**

Degradation of energy follows a simply physical principle **(force x distance)**

High damping (DualDocker): Long damping travel, low forces (like a crash barrier)

Minimal damping (chains, piles): **short distance, high forces** (like a concrete wall)

Kinetic energy:

$$E_{kin} = m\ v^2 / 2$$

Braking force:

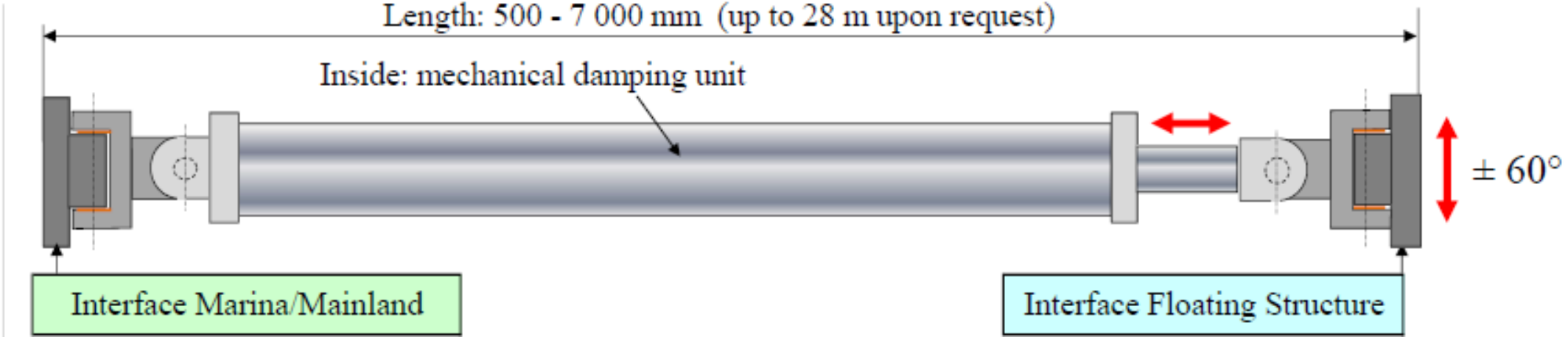
$$F = 2(E_{kin} / \text{distance})$$

Ekin…Kinetic energy [Joule]
m … mass [N]; 1 kg = 9.81 N
V … speed [m/s]
F … braking force [N]; 1 kg=.,81 N
Distance… braking distance [m]

Weight: **10 t**		
v [m/s]	Damp. Travel [m]	Retention force [kg]
0.1 m/s	0.5 m	0,2 t
	0.3 m	0,3 t
	0.1 m	1,0 t
0.3 m/s	0.5 m	1,8 t
	0.3 m	3,0 t
	0.1 m	9,0 t
0.5 m/s	0.5 m	5,0 t
	0.3 m	8,3 t
	0.1 m	25,0 t

Weight: **500 t**		
v [m/s]	Damp. Travel [m]	Retention force [kg]
0.1 m/s	0.5 m	10 t
	0.3 m	17 t
	0.1 m	50 t
0.3 m/s	0.5 m	90 t
	0.3 m	150 t
	0.1 m	450 t
0.5 m/s	0.5 m	250 t
	0.3 m	417 t
	0.1 m	1 250 t

Product Description



Product Description

DualDocker Technology:

- Docking system with high damping capacity, without play, regardless of water level
- High damping capacity
- Full instant damping capacity without time delay
- Fully mechanical, no energy source needed (no hydraulics, no oil, no gas, no pneumatics !)

Convenience & safety:

DualDocker offers high level of convenience and safety

- Minimum level of motion
- Utmost safety during a storm

Construction guidelines:

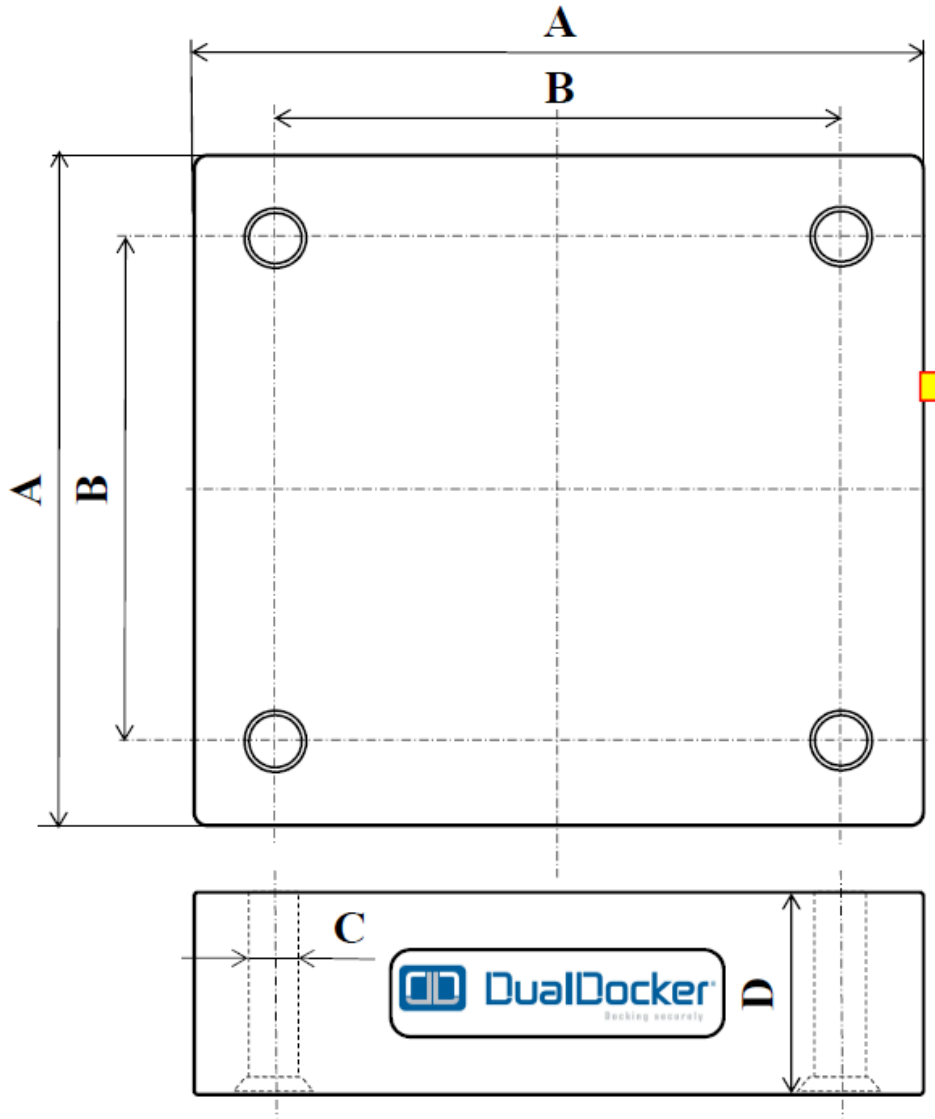
- Operational reliability: the construction is simple, safe and sound.
- Maintenance free & durable (choice of material , dimensioning in elastic range,surface)

Choice of material: Durability and resistance regarding salt water and UV impact

Dimensioning: Max. tolerated force impact + min. 100 % 'reserve' must lie within the **elastic** range
That means handling of max. tolerated force/stress is guaranteed over a long period of time without problems

Surface: We have had excellent experince with saltwater resistent (hard) anodised aluminium alloy
The surface is hard-wearing, saltwater and UV resistent and looks good

Connection Dimensions



Dimensions in "mm"					
Model	**A**	**B**	**C**		**D**
10 kN	**200**	**150**	**Ø 18**	M16	**30**
20 kN	**200**	**150**	**Ø 18**	M16	**30**
50 kN	**200**	**150**	**Ø 18**	M16	**30**
100 kN	**200**	**150**	**Ø 22**	M20	**30**
150 kN	**260**	**200**	**Ø 26**	M24	**30**
200 kN	**320**	**260**	**Ø 26**	M24	**35**

Forces transmitted via DualDocker adapter into the pier/quay/pontoon:		
	tolerated forces:	**breaking** forces:
Pull forces :	50 kN	100 kN
Push forces :	50 kN	100 kN
Side forces :	50 kN	100 kN

Protecting our precious environment
Respecting fauna & flora
Complying with strict regulations

Innovative Mooring Solutions & Berthing Stabilisers

Damped, Secure & Eco-Friendly

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