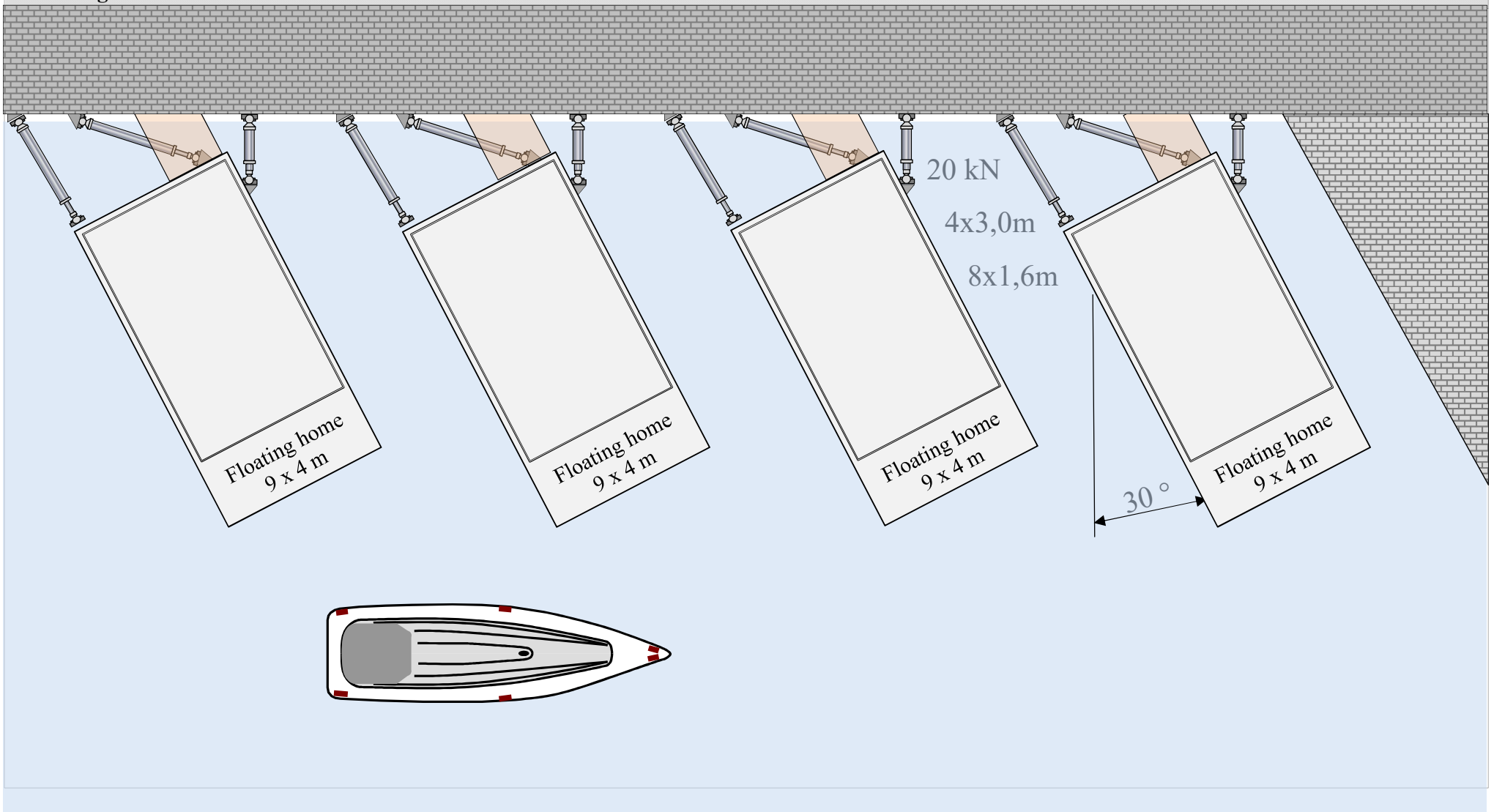
DualDocker Docking securely	**Offer**	**Ind.B**	MF, 18.04.2018
		419 1v1	

Project information:	
Reference number:	**419 1v1** Ind.C
Customer:	Floatbase, Netherlands
Customer reference:	Email Marc van Ommen dated 30 August 2017, updated information dated 16.04.2018
Location:	Milford Waterfront, Wales, UK
Project description:	Mooring solution for 4 floating homes

Conditions at location - max. tolerated figures:	
Max. area exposed to wind:	20 m²
Max. wind speed:	35 m/s
Max. current:	1,0 m/s
Max. area exposed to current:	5 m²
Breakwater:	Yes
Maximum wave hight:	0,5 m
Max. water level difference:	n.a. / floating pontoon
Technical Director's remarks:	Best solution: DualDocker in 'Tri-Docker -Set up'. Highly damped and zero play regardless of water level. Retention forces are drastically reduced by up to 90% for calm, secure and comfortable mooring. Fixed distance to the pontoon and the total lack of jerking guarantees utmost residents' convenience.
Max. tolerated impact = basis for calculation of kinetic engergy:	
Max. weight:	5 tons
Max. speed:	0,05 m/s
Remarks:	**These are the maximum tolerated figures !**

Rendering :


20 kN
4x3,0m
8x1,6m
Floating home
9 x 4 m
Floating home
9 x 4 m
Floating home
9 x 4 m
Floating home
9 x 4 m
30 °

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Description of DualDocker components:

	UNIT		PULL / Unit			PUSH / Unit			TOTAL	
Technical Data:	Quan-tity	Length [m]	tolerated force [kN]	damping way [mm]	**E** kin. [kJ]	tolerated force [kN]	damping way [mm]	**E** kin. [kJ]	Quan-tity	Remarks:
DualDocker Arm	4	3,0	20	150	1,50	20	150	1,50	4 Arms	DualDocker 2 T. - 3,0 m
DualDocker Arm	8	1,6	20	150	1,50	20	150	1,50	8 Arms	DualDocker 2 T. - 1,6 m

Material:

- Saltwater resistant aluminium alloy, anodised
- Bolts in stainless steel 4VA
- All moving units in maintenance-free synthetic guiding units

Surface treatment:

- **'Anodised 25µm', inside & outside (Standard)**

  Tubes are anodised 25µm outside and inside. Very high corrosion protection for long life expectancy.

  Recommended for freshwater and saltwater conditions; if DualDocker arms are not usually flooded or submerged.

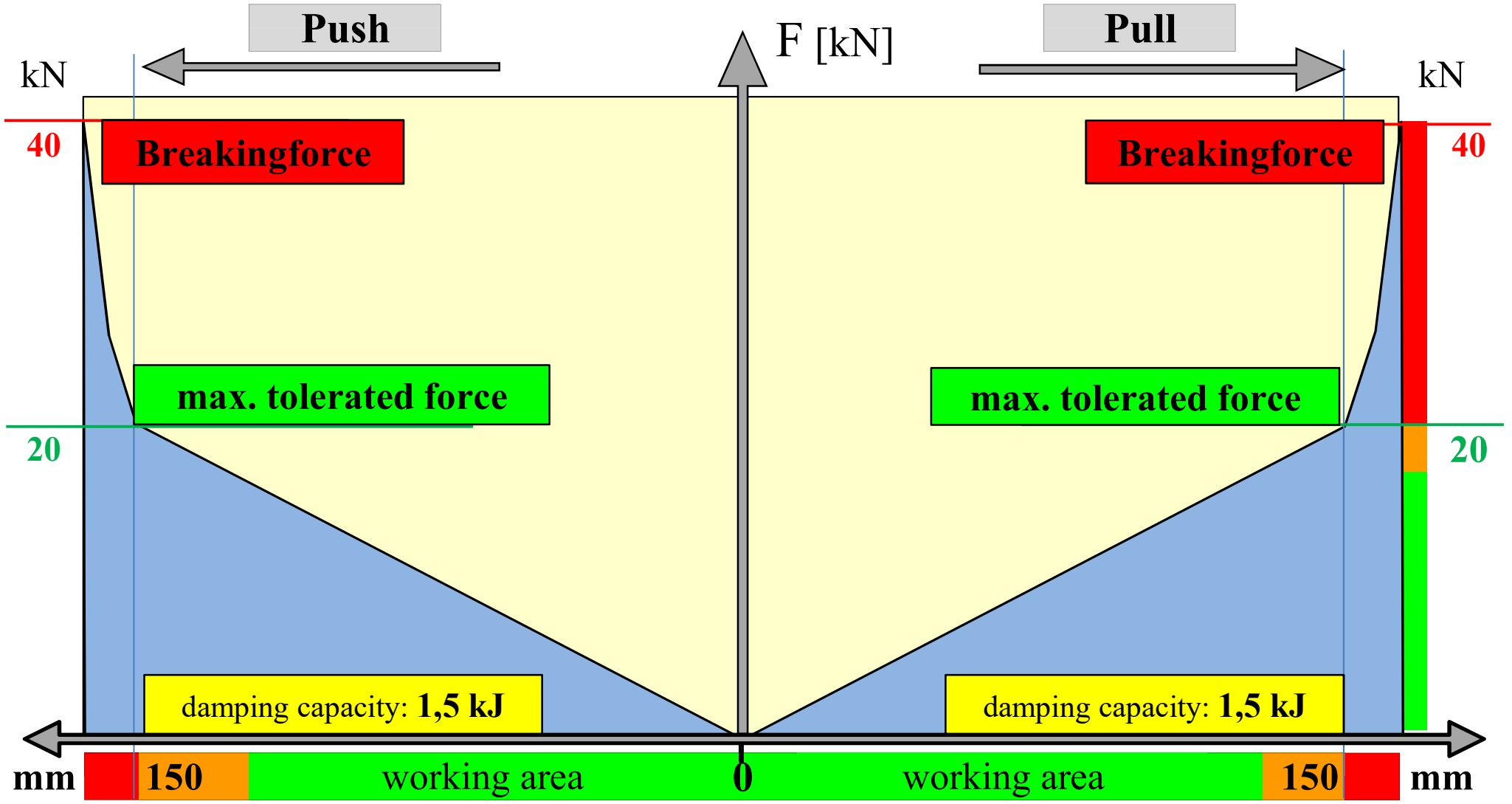
Damping:

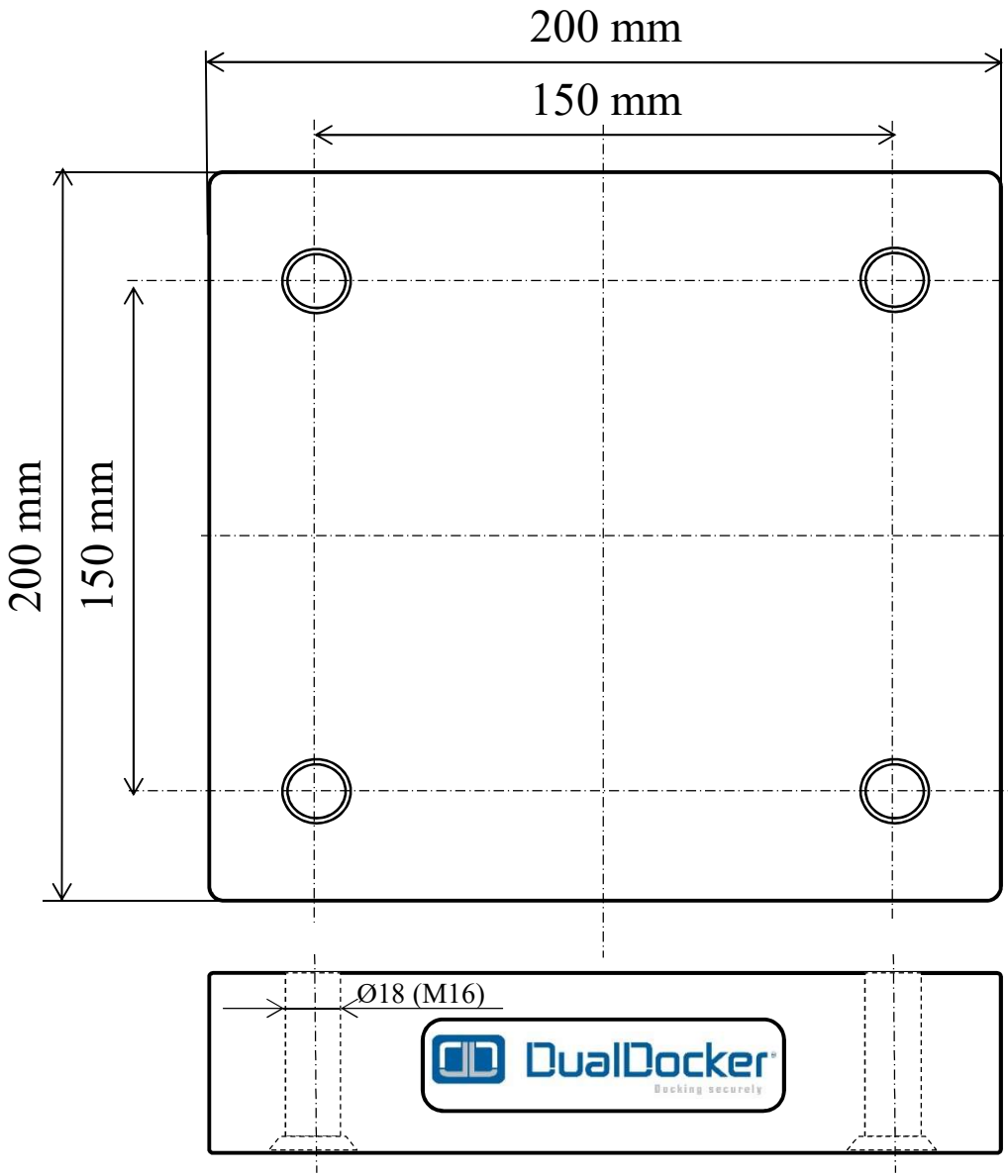
- **'Standard'** damping capacity

Securing package:

- **No securing lines** (Standard)

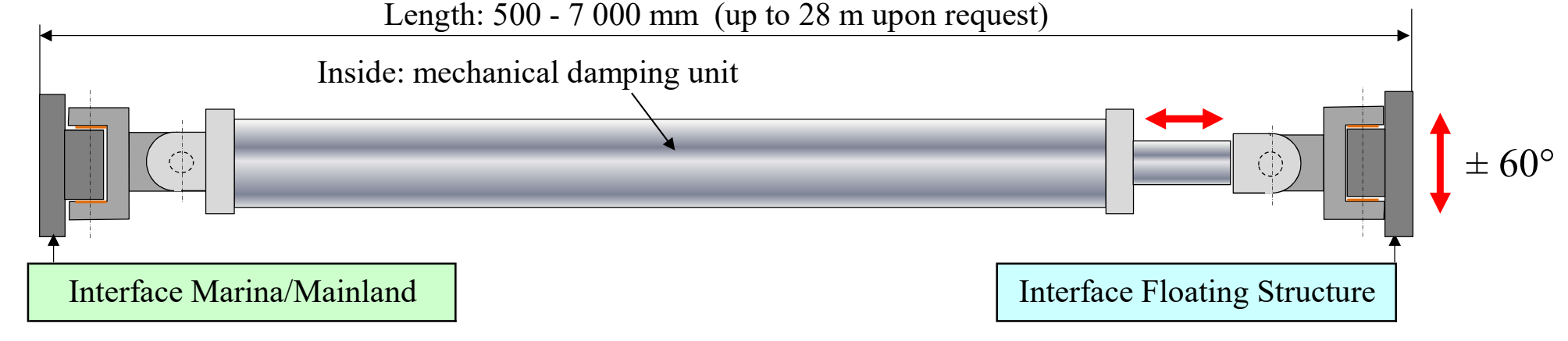
Pull & push: Load displacement diagram (force-distance)





Standard end piece (interface at both ends)

Forces transmitted via DualDocker adapter into the pier/quay/pontoon:		
	tolerated forces:	breaking forces:
Pull forces:	20 kN	40 kN
Push forces:	20 kN	40 kN
Side forces:	20 kN	40 kN



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

Material overview:

Type of material	Specification	DualDocker warranty	Expected lifetime	Wear & tear	Material fatigue
Aluminium alloy	6060 / T66 & 6082 / T6	2 years	10 years + (*)	low risk	very low risk
Damping elements	Polyurethane	2 years	15 years + (*)	very low risk	low risk
Slide guides	synthetic material	2 years	10 years + (**)	low risk	very low risk
Bolts etc	stainless steel 1.4571	2 years	15 years + (*)	very low risk	very low risk

Remarks (*): Depending on local conditions. Requirement: No surface damages; regular maintenance
Remarks (**): Slide guides are subject to 'wear and tear': Life time depends on local conditions and level of strain.

Additional INFO:
Aluminium anodised is state-of-the-art and is being used sucessfully in many technical fields
Polyurethane is being used (and has been over many decades) successfully in the marina industry
Slide guides are ordered from certified suppliers (they have been proven successful under harsh conditions in trucks, ships etc)
Bolts and other connecting parts are secured (Loctite or snap ring)
Joints are -for safety reasons-not welded, but bolted or glued and riveted

Risk parts:

- Construction and dimensioning will not allow any risk parts
- DualDocker systems are maintenance free (see also instructions for visual checks)
- Material and all parts are purchased from certified suppliers (QM ISO 9001). Documented inspection and test records
- All DualDocker arms undergo a documented final inspection

Environmental impact:

DualDocker systems are environmentally friendly. They operate quietly, self-sufficiently and without the use of oils or other lubricants

Additional valid documents:

Technical and commercial offer, Installation Instructions, Operating Manual, Maintenance Instructions, Securing Instructions, CE Declaration of Conformity, General Terms and Conditions

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Calculation of dynamic forces (kinetic energy):							
Input	mass [N]	50 000	[N]	50,0	[kN]	5,10	[tons]
Input	speed [m/s]	0,05	[m/s]	0,18	[km/h]		
Result	kin. energy	0,06	kJ				

Calculation of braking force:							
Input	braking distance [m]	0,15	[m]				
Result	Ø braking force [N]	417	[N]	0,4	[kN]	0,04	[tons]
Result	max. braking force [N]	833	[N]	0,8	[kN]	0,08	[tons]

Calcultation of static forces:							
Wind pressure: F wind = 0,5 x air density (1,25) x speed ² (30m/s) x surface area exposed to wind (70m²) x CD-value (1,1)							
Input	air density	1,25	[kg/m³]				
Input	speed	35	[m/s]	126,00	[km/h]		
Input	surface area	22	[m²]				
Input	CD value	1,1					
Result	wind pressure	18 528	[N]	18,5	[kN]	1,89	[tons]
Pressure caused by current: F water = 0,5 x water density (1026) x speed ² (1,5 m/s) x surface area exposed to current (10 m²) x CD value (1,1)							
Input	water density	1026	[kg/m³]				
Input	speed	1	[m/s]	3,60	[km/h]		
Input	surface area	9	[m²]				
Input	CD value	1,1					
Result	pressure caused by curre	5 079	[N]	5,1	[kN]	0,52	[tons]
Result	total pressure (wind & cur	23 607	[N]	23,6	[kN]	2,41	[tons]
Result	wind&current+braking f.	24 440	[N]	24,4	[kN]	2,49	[tons]