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)

Additional information (calculation formulae, results):

Kinetic energy:

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

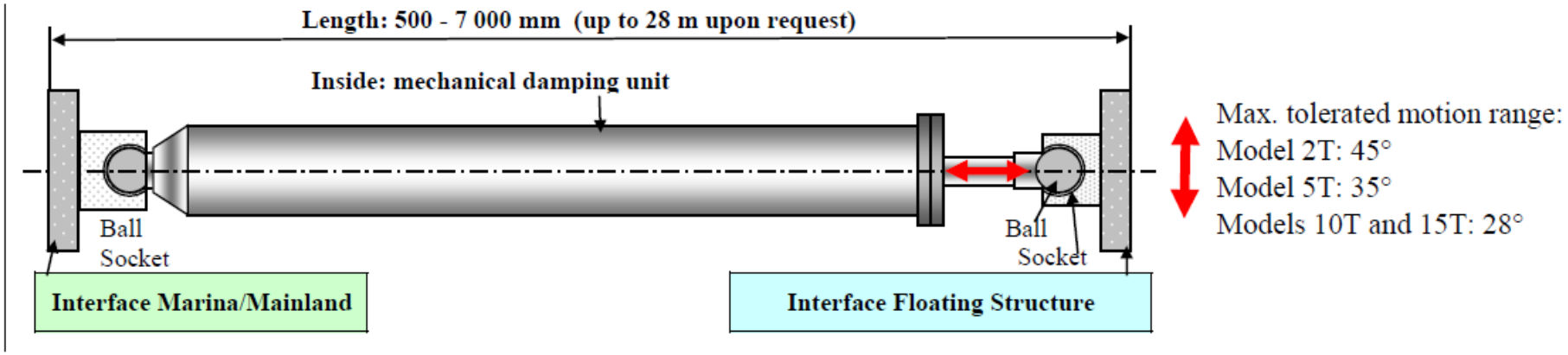
Braking force:

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

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



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 stain.

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

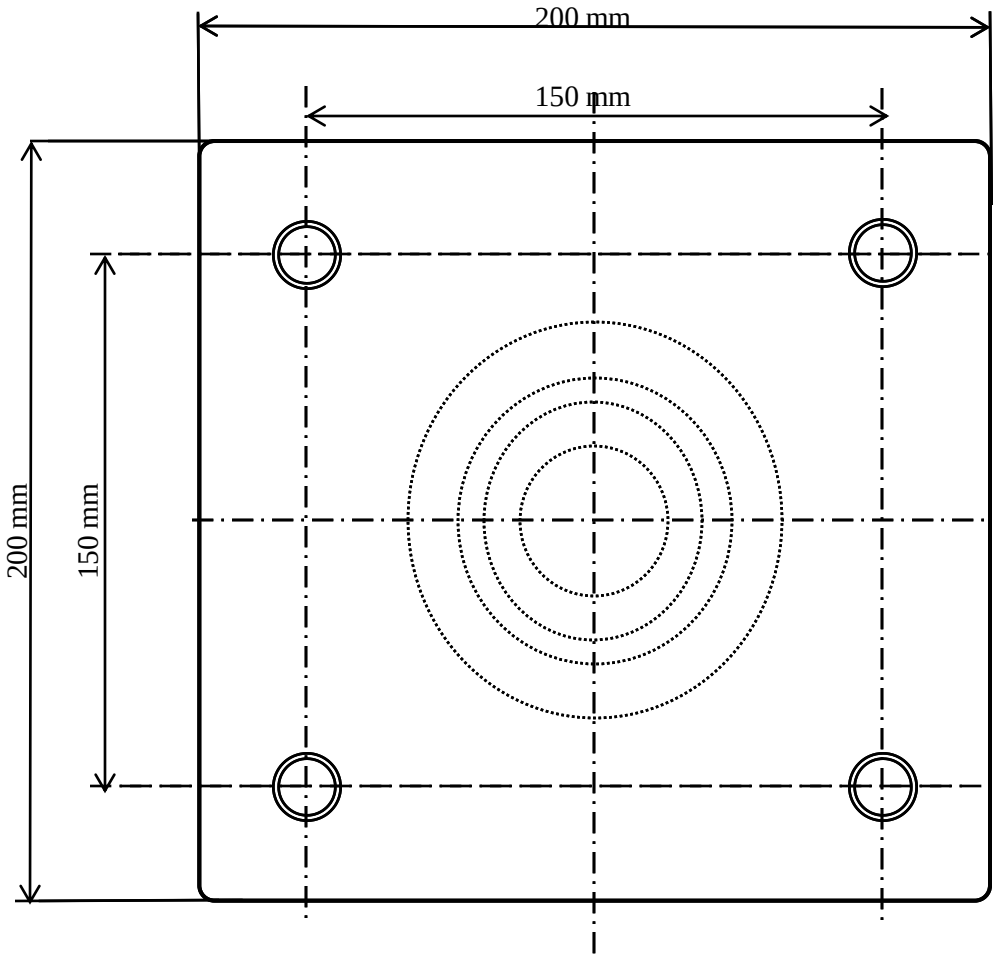
Environmental impact:

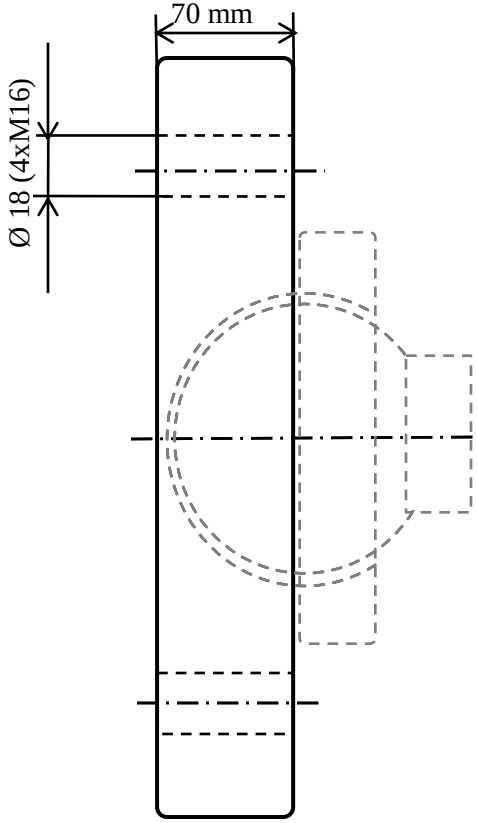
DualDocker systems are environmentally friendly. They operate quietly, self-sufficiently and without the use of oils or other lubricants

Additional valid documents:

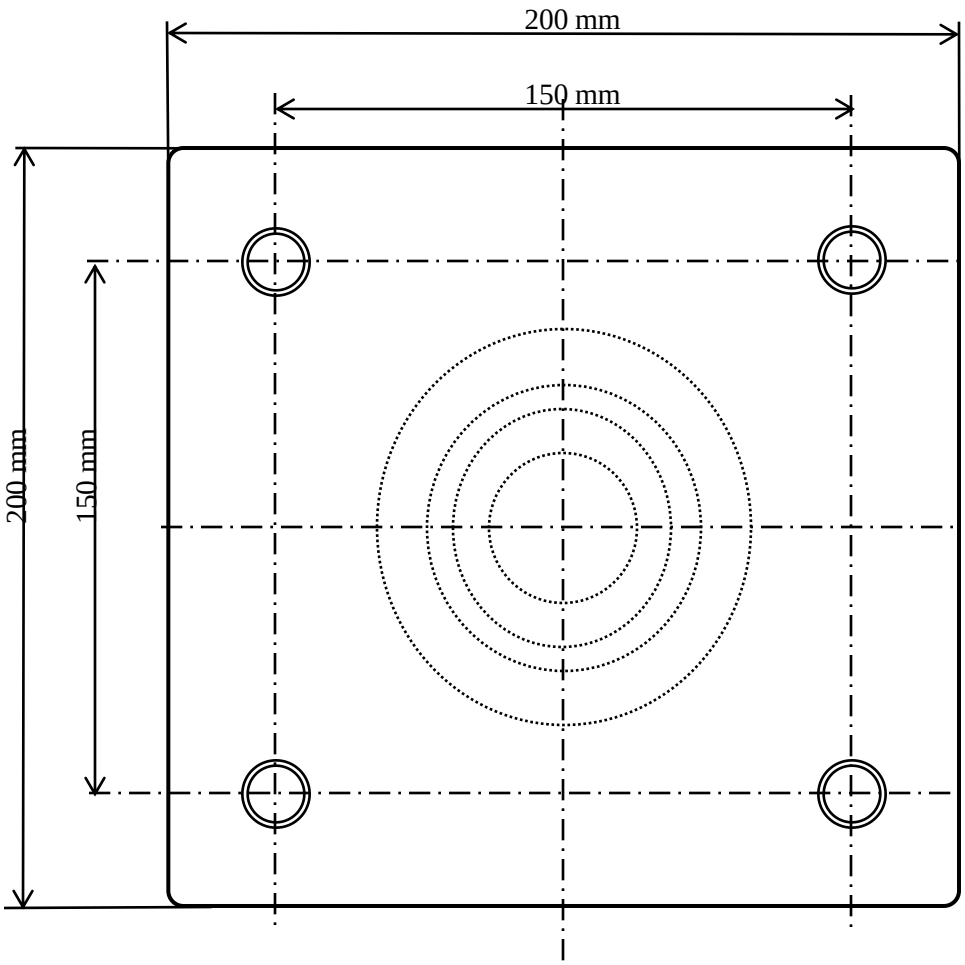
Technical and commercial offer, Installation Instructions, Operating Manual, Maintenance Instructions, Securing Instructions, CE Declaration of Conformity, General Terms and Conditions

Standard adapter (interface at both ends)

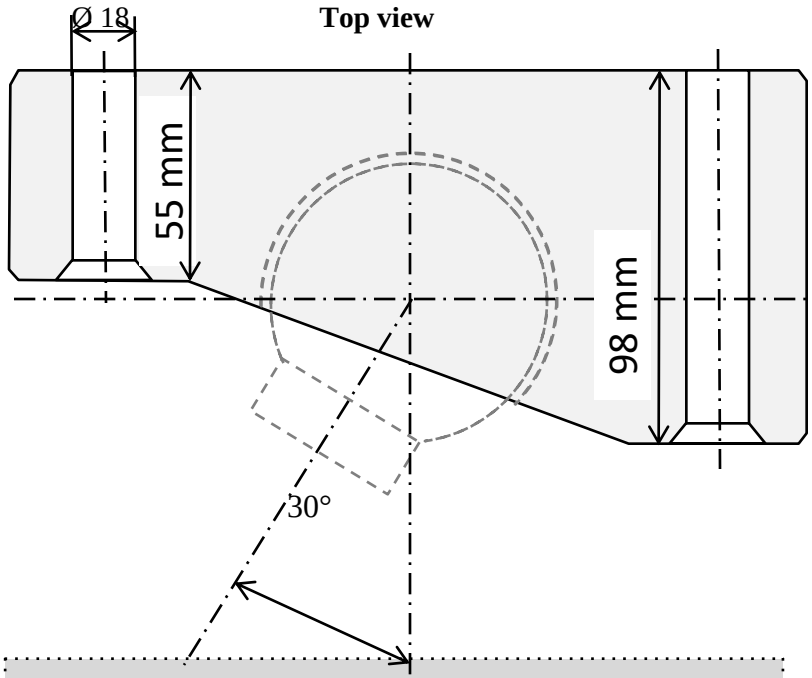




Forces transmitted via DualDocker adapter into the pier/quay/pontoon:		
	tolerated forces:	breaking forces:
Pull forces:	100 kN	200 kN
Push forces:	100 kN	200 kN
Side forces:	100 kN	200 kN



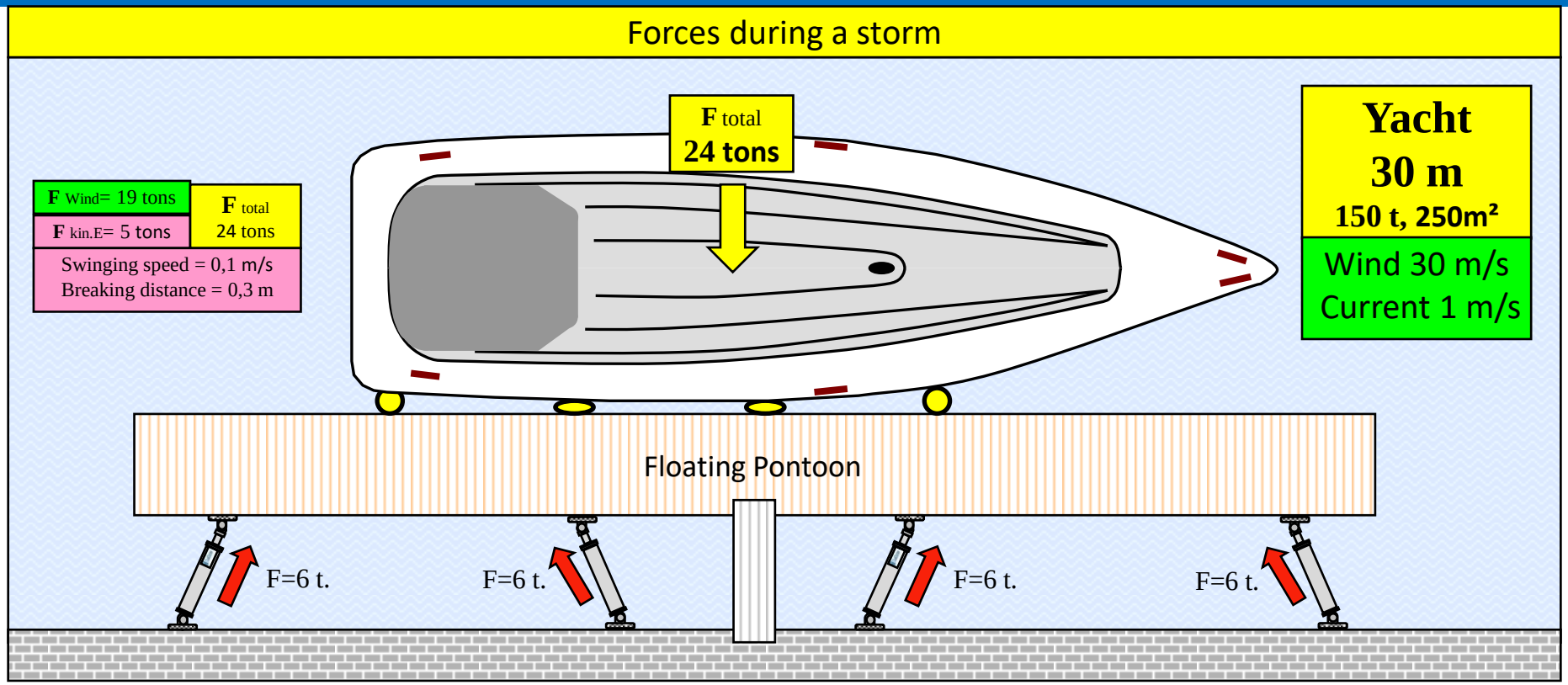
Standard adapter (interface at both ends)



Forces transmitted via DualDocker adapter into the pier/quay/pontoon:

	tolerated forces:	breaking forces:
Pull forces:	150 kN	300 kN
Push forces:	150 kN	300 kN
Side forces:	150 kN	300 kN

Forces during a storm



Forces during docking manoeuvre / collision speed

Example: Yacht 100 foot, 150 t, 4 Pcs. DualDocker 10 tons, Damping way 300 mm

Yacht speed [m/s]	Kin. energy [kJ]	F total [da kN=ton]	F [da kN=ton]	Way [mm]
0,1 m/s	7,5 kJ	16 da kN	4,0 da kN	70 mm
0,2 m/s	30,0 kJ	30 da kN	7,5 da kN	180 mm
0,3 m/s (0,6 kn)	67,5 kJ	40 da kN	10,0 da kN	300 mm

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