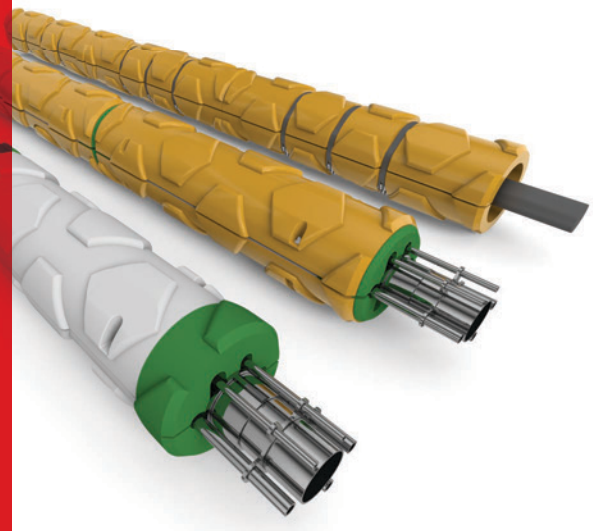
# Low drag vibration suppression buoyancy

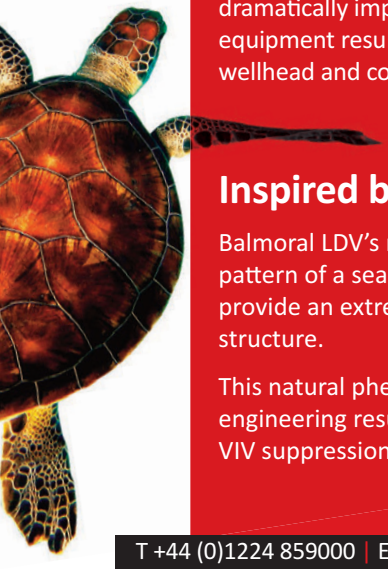
**Balmoral LDV buoyancy is a result of Balmoral's continuous innovation drive to provide clients with industry-leading technology to help reduce offshore operational costs.**

**DuraFloat LDV (patent pending) integrates vortex induced vibration suppression and drag reduction into drill riser buoyancy modules to increase rig efficiency without compromising on safety or structural integrity. The system minimises vessel down time, leading to significant cost savings.**

Balmoral LDV provides optimum uplift while offering >75% VIV suppression which dramatically improves riser motion and drag in subsea environments compared to traditional drill riser buoyancy. The revolutionary design eliminates the need for ancillary suppression equipment.

It is recognised that reduced riser motion due to VIV suppression dramatically improves the fatigue performance of subsea equipment resulting in further cost savings by extending the life of wellhead and conductor/casing equipment.





## Inspired by nature

Balmoral LDV's revolutionary profile was inspired by the carapace pattern of a sea turtle which has been sculpted over millennia to provide an extremely efficient and low drag hydrodynamic structure.

This natural phenomenon was industrialised using biomimetic engineering resulting in a man-made structure capable of offering VIV suppression and low drag performance.

T +44 (0)1224 859000 | E surety@balmoral.co.uk | www.balmoraloffshore.com

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## LDV analysis, validation and testing

Extensive CFD and fluent modelling of the design was carried out, indicating up to 75% efficiency in VIV suppression and diminished drag by up to 33%.

Half scale tank testing was carried out at SINTEF Ocean that confirmed strong operating performance. Testing of the modules was the largest project the renowned test centre had ever undertaken; the parameters are detailed below:

- Test sample OD 0.611m. with an L/D ratio of 13
- Reynolds number ($6\times10^5 – 3\times10^6$) with varying surface roughness ratios ($1\times10^{-6} – 1\times10^{-4}$)

Tests included:

- Fixed cylinder tests
- Free oscillation tests
- Forced motion test
- Flow visualisation trials

## Applications

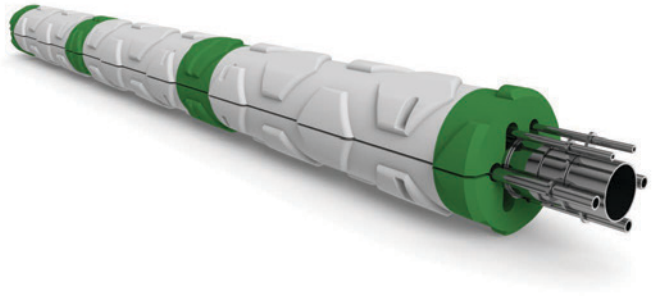
- Marine drilling risers
- Jumpers
- Long pipeline spans
- Production risers
- Umbilicals
- Flowlines
- Power cables
- Geometry can be utilised for traditional VIV strakes

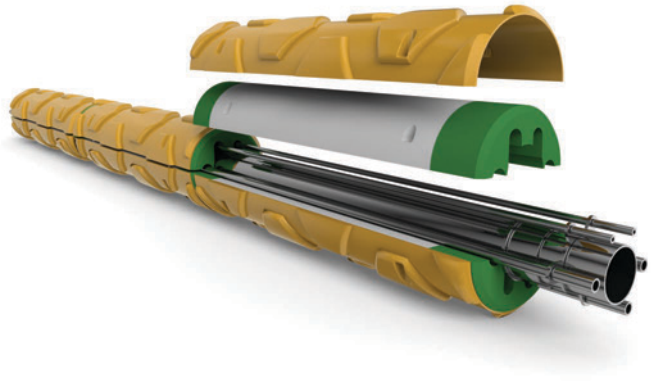
## Benefits

- Significantly reduces VIV and drag when compared to conventional buoyancy
- Improved operational windows by allowing drilling in heavier seas
- Reduced drag and loads during deployment/recovery, riser disconnect and hang off
- Significant reduction in VIV fatigue damage
- Negligible loss of buoyancy
- Eliminates assembly/recovery times
- Easily stacked vertically and horizontally
- Can be used with existing riser handling and storage equipment

## DuraFloat LDV

- Drilling riser buoyancy foam
- Modules are produced using proven manufacturing techniques
- Minimal buoyancy loss
- Operational to 4500msw





## DuraGuard LDV

- Retrofit option for existing drill riser buoyancy modules
- Significant cost savings via re-use of existing buoyancy
- Alternative to VIV strakes
- Improved handling and stacking
- Improved roller deployment

## DuraFloat LDV with integral clamp

- Alternative to VIV straked production riser buoyancy
- Utilises patented integral installation methods

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