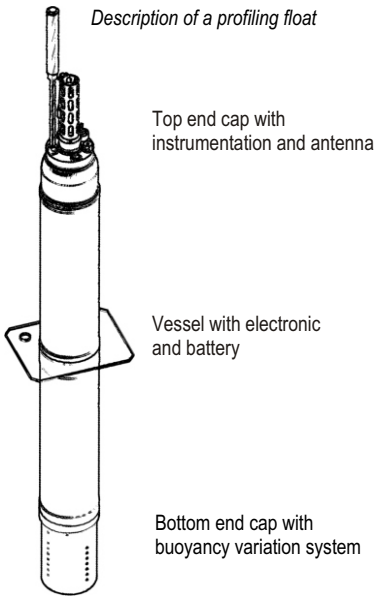
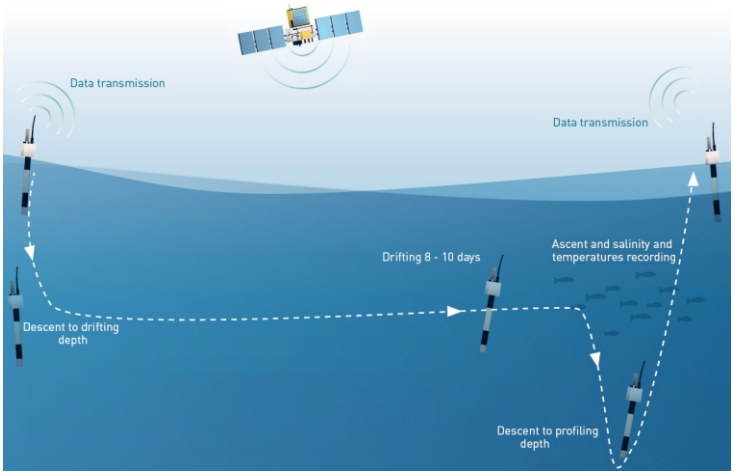
Filament wound housings for profiling floats



Description of a profiling float

What is a profiling float ?

Profiling floats are autonomous instruments for operational oceanography used in Argo International project. At the moment, more than 3.500 profiling floats are deployed in all oceans.
They collect profiles of pressure, temperature, and salinity data in the seawater column, which are transmit by satellite. Then they adjust their buoyancy to sink again and repeat their mission until the lack of energy.



Typical profiling float cycle

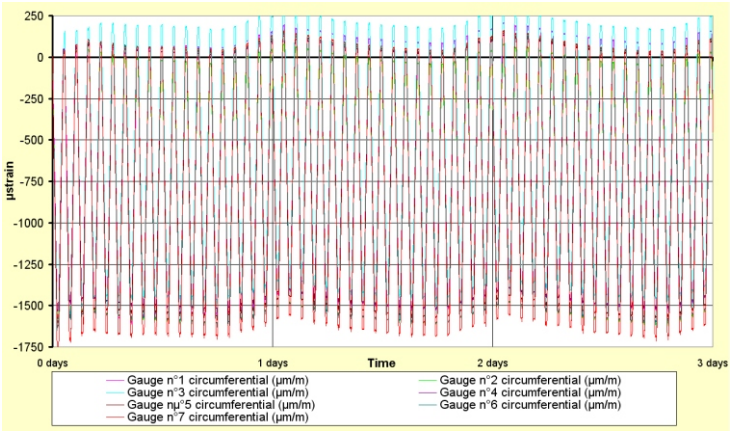
Design constraints

- Operating depth: 2000 m for Argo floats, down to 4000 m for new generations
- Temperature between 2°C to 50°C
- Lifespan: up to 5 years in sea conditions
- Between 150 to 250 cycles from surface to max depth
- Weight and volume allowing neutral buoyancy of the profiling floats
- Compressibility in accordance with seawater compressibility

Cycling tests performed at IFREMER on filament wound housings

The aim is to represent the life cycle of profiling floats that is a succession of compression buckling and steady state.
2 types of filament wound housings have been tested:
- Glass-epoxy housings, internal diameter 110 mm, thickness 11 mm (Arvor profiling float)
- Carbon-epoxy housing, internal diameter 120 mm, thickness 13 mm (Arvor 350 profiling float)

The first one undergone 250 cycles at 210 bar, the second one 150 cycles at 360 bar.



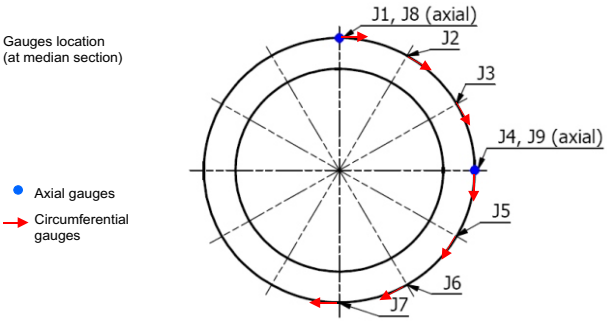
3 days of cycling test (54 cycles) from 0 to 360 bar on carbon-epoxy housing, circumferential gauges

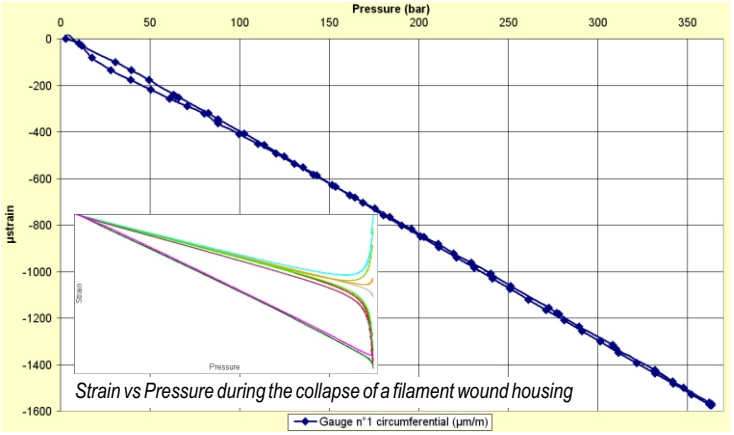
Conclusion

- No residual strain
- The variations are due to temperature variations between night and day
- Both housings withstand the cycles of compression buckling and steady state witch are representative of their life cycle

Advantages of filament wound housings

- Prices: using filament wound housings in replacement of aluminium housings leads to reduce costs
- Simplicity: avoid the need of anodising and the use of syntactic foam
- Availability: Filament winding allow order by unit





Strain vs Pressure during the collapse of a filament wound housing

1 cycle from 0 to 360 bar on carbon-epoxy housing, gauge n°1 (axial)

What we still need to know?

- What are the consequences of cycling on fatigue strength?
- How to estimate the residual strength due to manufacturing process?
- What are the consequences of water uptake?

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