

## Cooling system de-airing test

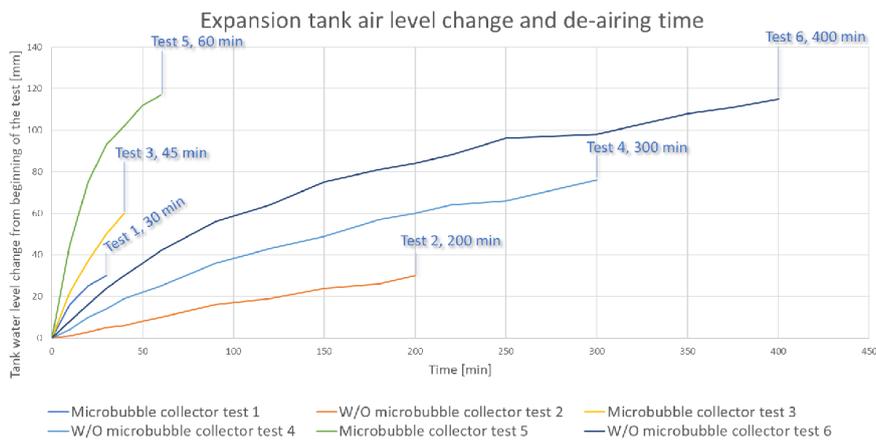


### Background

- Coolant must be de-aired properly to maximize the cooling power and to prevent static pressure deviation and air leakages.
- De-airing tests performed compared cooling systems with microbubble collectors, cooling system without microbubble collector and cooling systems with bladder tank.
- Tests were carried out by studying the coolant level change and coolant color/texture changes. Coolant level couldn't be monitored from bladder tank so pressure change was monitored instead when testing the bladder tank.

### Test results: Adwatec solution with and without microbubble collectors

- The difference between the de-airing times with microbubble collectors and without microbubble collectors was roughly 1:7.
- When Microbubble collector de-aired the cooling circuit in 1 hour it took approximately 7 hours for system without the microbubble collector.



- Comparable tests: Test 1 and 2; Test 3 and 4; Test 5 and 6.

Test number	Air volume in coolant [%]
Test 1	1,4
Test 2	1,4
Test 3	2,9
Test 4	2,9
Test 5	4,5
Test 6	4,5
Test 7	4,5

### Test results: Adwatec solution with microbubble collectors vs. bladder tank

- It took the bladder tank (test 7) approximately 12 hours to de-air the cooling circuit that had 2 liters (1bar(g) pressure) air mixed to coolant flow. Same amount of air was de-aired from same cooling circuit in 60 minutes by using microbubble collector. It was even slower to de-air the cooling system with a bladder tank than with normal tank without microbubble collector.
- Tests showed no considerable difference between de-airing times when the cooling circuit volume was increased. De-airing time increase could be seen when more air was mixed to the coolant flow.

### Applicability of test results to real life

- In tests the ratio between cooling times didn't vary with coolant volume or air concentration increase. This means that it is possible to compare the de-airing time ratios despite the cooling circuit volume or air concentration changes. For example, if it takes 2 hours to de-air the pipeline with Adwatec cooling system using microbubble collector then it is going to take approximately 24 hours to de-air the cooling system with bladder tank.