

# VINEYARD WIND

September 20, 2023

Re: Big Bubble Curtain Performance Improvement Procedures Updated

Dear All,

Upon review of the Sound Field Verification (SFV) interim report results, JASCO advised that improvements to the performance of both Big Bubble Curtains (BBC) is necessary to achieve the modeled acoustic thresholds. As such, Vineyard Wind 1, LLC (VW), with the support of ThayerMahan (TM), has conducted an analysis and has determined the following procedures are required to optimize BBC noise abatement during monopile (MP) pilings. Until further notice, I hereby on behalf of Vineyard Wind instruct the following additions to the DEME and ThayerMahan procedures:

1. BBC Order of Operations:
  - a) TM drills all BBC hose-holes.
  - b) DEME gives TM a heading for the Orion at the next MP installation site.
  - c) TM chooses an appropriate, safe heading for the BBC vessel at the MP installation site.
  - d) TM deploys BBC hose.
  - e) TM connects the BBC vessel to the hose.
  - f) TM performs a hose flush and then a full-pressure (FP) test by blowing a BBC.
  - g) VW/TM review FP test pictures and videos to determine if the BBC has a gap or weak area. If a gap or weak area is present, then TM retrieves, redrills, redeploys, and retests the BBC hose (if time before installation allows).
  - h) TM disconnects the BBC vessel from the hose.
  - i) BBC vessel withdraws 500m away from the MP installation site to allow the Orion to move into position.
  - j) Orion moves into position for the MP installation.
  - k) BBC vessel returns to its pre-arranged heading and reconnects to the BBC hose.
  - l) TM ramps the BBC hose up to minimum pressure and awaits the 1-hour notice for the piling.
  - m) Upon receiving the 1-hour notice, TM ramps the BBC up to full pressure (BBC is now ready).
  - n) DEME/Orion performs the MP installation.
  - o) TM disconnects the BBC vessel from the hose and the BBC vessel moves 500m out from the installation site to allow the Orion to exit the installation position.
  - p) Later, after DEME moves the Orion to the next installation site, the BBC vessel returns and TM retrieves the BBC hose.
  - q) Repeat steps a through p.
2. Prior to any future BBC hose deployment, provide VW for approval a sketch with planned BBC/2BBC vessel locations, BBC location, and Orion location/orientation. Optimize the vessel positions to ensure that the weaker areas far from the hose inlets on one BBC is covered by a stronger area of the other BBC.

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# VINEYARD WIND

3. Hydrotechnik Lubeck engineers, widely considered to be the most-experienced BBC engineers in the world, have recommended to VW and TM that the BBC hoses be retrieved after no more than one week on the seafloor and all hose bubble-holes be manually drilled with a power drill to ensure maximum BBC performance. The drilling process clears the hose-holes of sedimentation so the bubbles may emanate without impedence. The re-drilling operation is completed prior to the redeployment of the BBC. Although VW and TM make every effort to minimize the amount of time a BBC hose lays on the seafloor to less than a week whenever possible, a week is a realistically-achievable limit due to the time required for installations, weather standby, equipment maintenance, and port calls. The date that a BBC hose was last drilled is recorded on the BBC performance report.
4. After hose deployment and during daylight, perform a full-pressure hose test as soon as possible after each BBC hose deployment but prior to the arrival of the Orion. Document the start and stop times of the full-pressure hose test and provide photographs of the bubble curtains during the full-pressure test that demonstrate the performance (full bubble ring with no gaps and no weak areas). Provide a BBC Pressure Test Report to Vineyard Wind demonstrating the performance of the BBC. If the pressure test demonstrates weak areas or gaps in the BBC, report to VW immediately to discuss possible re-deployment. Provide BBC Pressure Test Report to VW for approval ASAP and prior to Orion arriving at the position.
5. Before and during piling do visual inspections to assess BBC performance and coverage and take photos and videos from vessel deck/bridge (bridge footage is the best vantage point, but get footage from the deck too). All videos and photographs must include a time stamp and explanation regarding the contents with GPS coordinates whenever possible. These videos and photos should be included in the BBC Performance Report. Make sure that all photographs obtained from the vessel are taken from the same vantage point (whenever possible), document this location along with the BBC vessel heading in relation to the other vessels, and include this information in the BBC Performance Report.
6. Limit the number of disconnects and reconnects of the BBC hose from/to the BBC vessels as much as technically feasible. Ideally, hose-disconnection should each only be done once to allow the Orion to move into position and twice only during emergency situations, such as times where the safety of BBC equipment or the vessel is at stake. Each time a reconnection occurs, perform a hose flush. Document any disconnection and reconnection that occur and any additional full-pressure tests that are performed prior to the start of pile driving operations on the BBC Performance Report. While connected, run enough compressors to generate a sufficient minimum pressure in the hose to prevent sediment from entering the hose-holes.

# VINEYARD WIND

7. Observe and report to VW: weather, visibility and sea state requirements for BBC hose deployment, connection, operation, and recovery as denoted in the table below.

	Units	Deploying	Connecting	Operating	Recovering
<b>Net Time</b>	Hr				
<b>Weather Window</b>	Hr				
<b>Limiting Wind (Average)</b>	m/s				
<b>Limiting Significant Wave Height (Hs)</b>	m				
<b>Visibility</b>	m				
<b>Limiting Current (All Directions)</b>	m/s				

8. Document the tide and other metocean conditions in the BBC Performance Report.
9. For BBC Performance Reports, please include any important observations regarding performance (before, during, & after installation), such as any hose weaker areas, as well as all maintenance procedures performed (pressure tests, hose maintenance, etc.) both before & after installation, and the length of time the BBC was on the seafloor.

Vineyard Wind 1, LLC reserves the right to modify these procedures as new operational information may become available. Thank you in advance for your cooperation.

Sincerely,

*Soren Sorensen*

Soren Sorensen  
Foundation Package Manager/The Engineer  
Vineyard Wind 1, LLC