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Summary of Phase II of Inlet Spray Testing for Rolls Royce Canada

**Prepared by: Craig R. Davison
Brian Galeote
Victor Mings**

April 29, 2011

LTR-GTL-2011-0034



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**Summary of Phase II of Inlet Spray Testing for Rolls
Royce Canada**

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Executive Summary

Testing was completed for Rolls Royce Canada to determine the effect of surface treatments on the inlet guide vanes on reducing the droplet sizes at the exit of the test rig. The test rig represented a 40° section of an inlet to a Rolls-Royce Trent 60 engine. The exit of the test section simulated the inlet to the first compressor stage and the droplet sizes were characterised at this point with a Malvern Spraytec laser diffraction instrument.

The following surface treatments were tested at two inlet guide vane positions, 20° and 0°:

1. Hydrophobic coating
2. Hydrophilic coating
3. High serrations on trailing edge
4. Medium serrations on trailing edge
5. Low serrations on trailing edge
6. Combination of high serration with hydrophobic coating
7. Combination of high serration with hydrophobic coating on blade but with coating removed from serrations

A test was also performed to assess the influence of the inlet strut on the droplet size. The inlet strut was found to shed large droplets but in a small spatial area. There was no clear overall reduction in droplet size for any of the surface treatments. Improvements were seen under some test conditions but were made worse under others. Analysis of the results also revealed that the location of the peak droplet sizes may be shifted by the surface treatments and an increase in geometric fidelity should be used in future tests to determine if changes are actual variations in droplet size or if the shed droplets have shifted spatially to a position that is not being measured.

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Nomenclature

Variables

| | |
|----|---|
| AH | Absolute humidity (kg water/kg dry air) |
| RH | Relative humidity |
| T | Temperature |
| V | Velocity |
| p | Pressure |

Greek

| | |
|--------|---------|
| ρ | Density |
|--------|---------|

Abbreviations

| | |
|------|---|
| CFM | Cubic feet per minute |
| Dv50 | Diameter at which 50% of the volume of water droplets have diameter below this value also called mean volume diameter (MVD) |
| Dv90 | Diameter at which 90% of the volume of water droplets have diameter below this value |
| GPH | US gallons per hour |
| IGV | Inlet guide vane |
| NRC | National Research Council Canada |
| PLC | Programmable logic controller |
| PRV | Pressure relief valve |
| PSI | Pounds per square inch |
| RRC | Rolls Royce Canada |
| TE | Trailing edge |
| VFD | Variable frequency drive |

1 Introduction

This report summarises the testing apparatus and procedure and presents the data obtained for Rolls Royce Canada (RRC) during the inlet spray rig testing at the National Research Council Canada (NRC) in Ottawa from June to December 2010. The majority of the testing involved characterising the water droplet size along radial lines of a $1/9^{\text{th}}$ sector engine inlet rig. This work continued the testing done in 2007 and reported in LTR-GTL-2007-0045 (Davison and Benner, 2008).

This report supports and clarifies the electronic data files and video images recorded during the testing. The work performed was originally defined by NRC proposal RP-GTL-2009-0013 (Davison, 2009). Details were subsequently modified through discussions with RRC representatives.

2 Experimental Apparatus

The experimental apparatus for the 1/9th sector rig was comprised of the following main components:

1. Water treatment and supply
2. Test section, transition ducting and air supply
3. Droplet sizing system.

2.1 Water Treatment and Supply

The water supply system was comprised of a deionisation system and 10 μ m filter followed by a Danfoss PAH 10 pump, controlled by a variable frequency drive (VFD), supplying 3 flow lanes and a drain line. A simplified schematic of the water system is given in figure 1. The water flow rate through the nozzles was determined from the difference between the inlet, and the combined drain and pressure relief valve (PRV) mass flows. The pump was controlled based on the delivery pressure of the water at the spray bars. The calibration sheets for the pressure transducers used can be found in Appendix A:

The Danfoss PAH 10 is a 9-piston positive displacement pump with a flow range of 8 to 22 L/min (125 to 350 GPH). To obtain lower flow rates the drain valve could be opened to bleed off the excess, but this was not required during this test series. The VFD and all remote control valves were operated from a programmable logic controller (PLC) located in the control room assembled in test cell number 3.

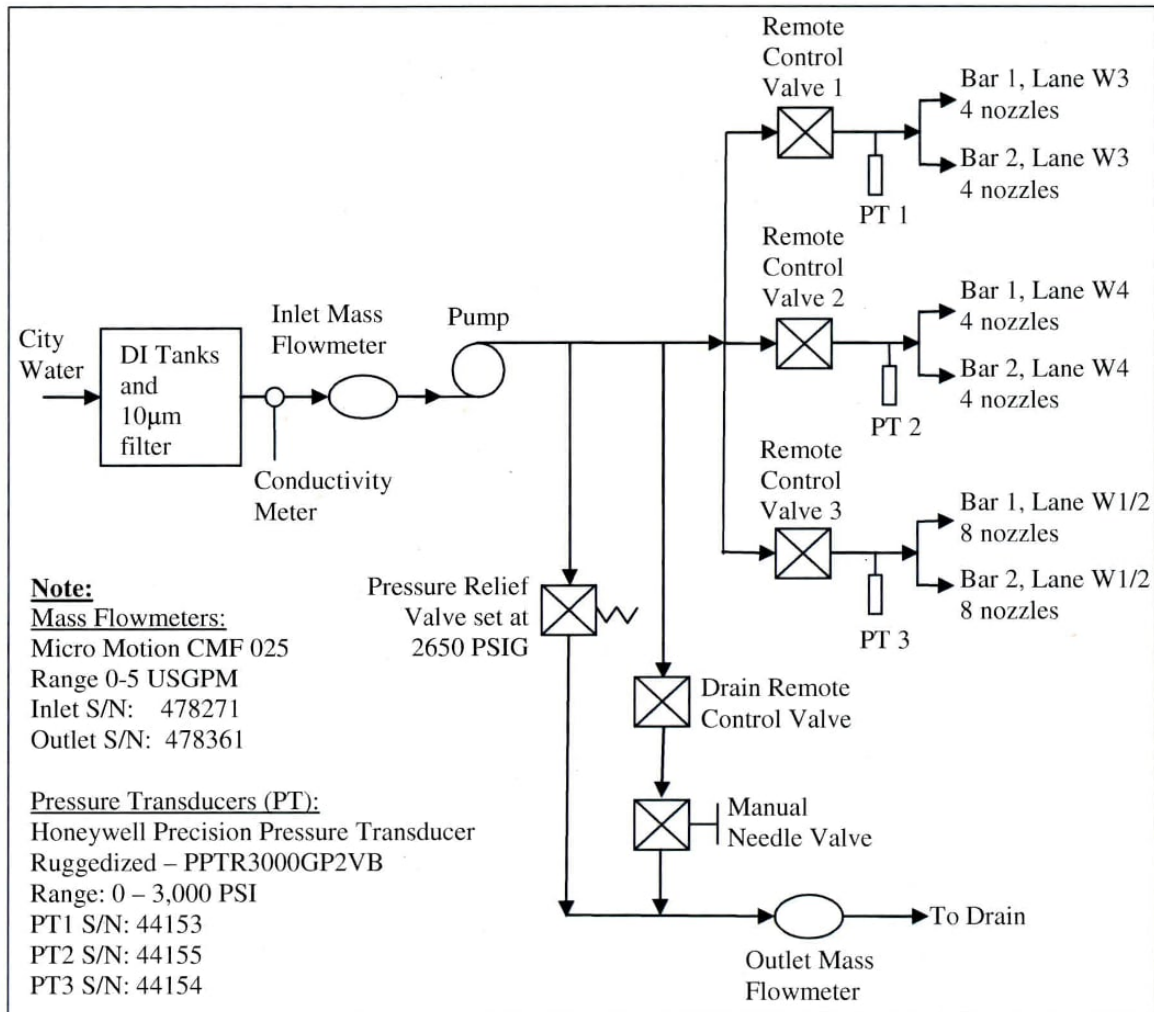


Figure 1: Water system schematic

2.2 Test section, transition ducting and air supply

The test section and transition ducts were supplied by RRC. Figure 2, taken from the RRC statement of work for phase 1 (Rafla, 2007), depicts the test section under investigation. It represents a 40° section of an inlet to a Rolls-Royce Trent 60 engine. The layout of the entire wind tunnel is shown in figure 3. The inlet transition ducting connected the circular cross section ducting, that fed from the free air in the test cell, to the test section inlet.

The test section exit was followed by the Malvern viewing section. This section of tunnel allowed optical access through the flow stream for the Malvern and maintained the same cross section as the test section exit. Optical access was provided by openings in the viewing section. This not only allowed the clearest optical path but also kept the viewing section clear of water running along the surface of the duct. Sliders on the duct allowed the openings to be moved to align with the line of sight of the Malvern. During early tests glass windows were used, but the water running over them interfered with the results.

Following the viewing section was a RRC supplied diffusing transition section and a final circular diffusing duct connecting to the blower. The blower exhausted into a diffusing section, including a 90° turn, followed by a final plywood extension duct to prevent water dripping onto the motor and shaft. NRC personnel installed the rig and ducting in test cell number 3 in building M-7, at the NRC Montreal Road campus in Ottawa.

The ducting was instrumented to measure inlet temperature, humidity and barometric pressure. Static pressure taps were installed on the straight section of the inlet duct to determine the air mass flow. In addition, a pitot-static pressure probe was installed at the inlet of the test section to check the velocity. Due to the very low velocity in the inlet duct this pitot-static probe provided a more accurate determination of the mass flow.

During Phase I of the testing the flow was induced by sonic nozzles downstream of the test section and the inlet ducting leading to the transition duct was longer with a larger inlet. The Malvern viewing section was also changed the optical and fluid flow properties relevant to the test remained very similar. and A comparison of the results from Phase I and II of testing indicate that these rig changes did not significantly affect them (Davison and Benner, 2008).

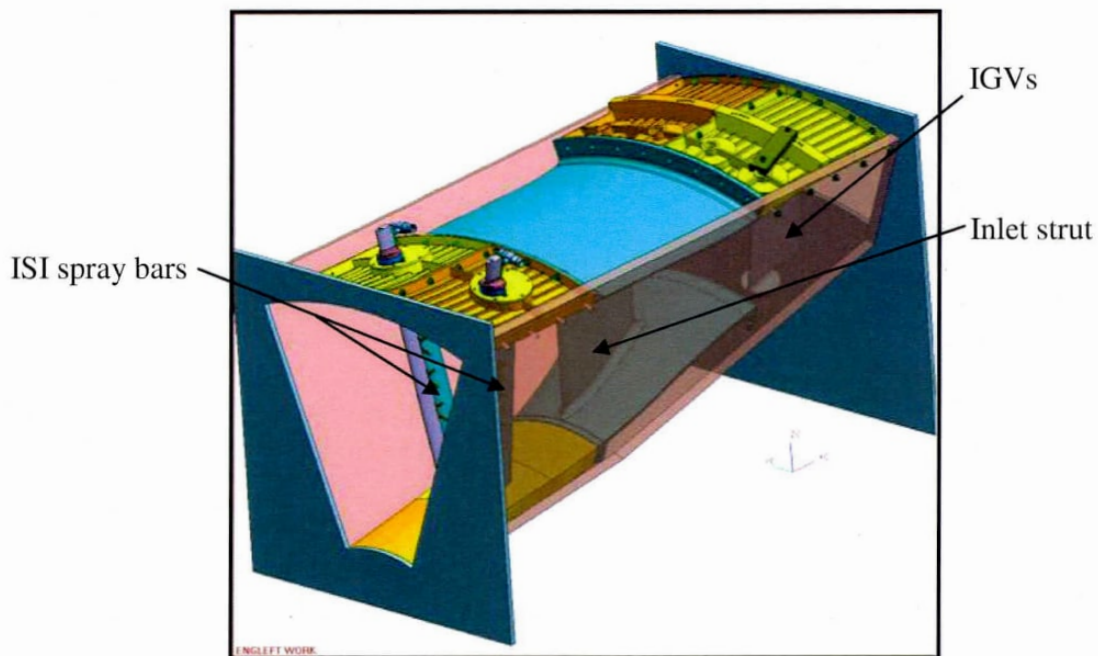
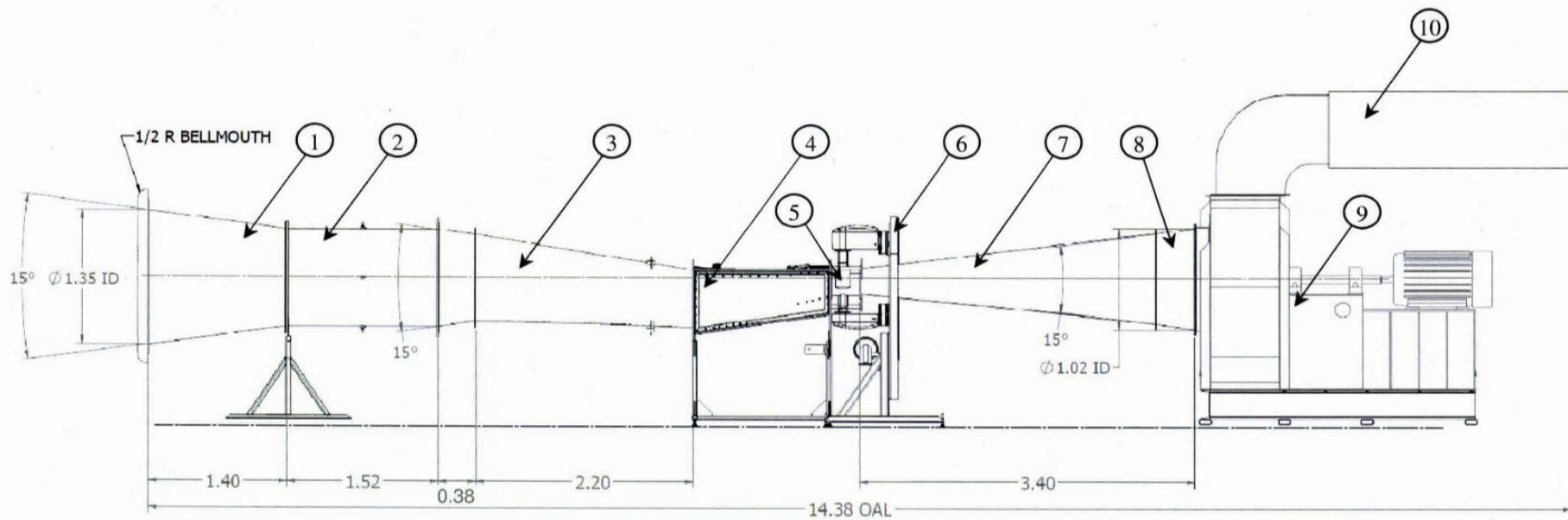


Figure 2: Rolls Royce Test Section (Rafla, 2007)



- 1 – Inlet reducing duct
- 2 – Straight section with static pressure taps
- 3 – Transition duct to test section
- 4 – Test section
- 5 – Exit duct allowing optical access to flow by Malvern
- 6 – Radial traversing mechanism for Malvern
- 7 – Diffusing transition duct
- 8 – Diffusing exit duct
- 9 – 200 HP blower and motor assembly
- 10 – Extension duct 2.4 m long

Figure 3: Layout of test rig – all dimensions in meters

The air flow through the test section was drawn by a New York Blower heavy duty, high efficiency, industrial fan, airfoil series 30AF, size 445, direct coupled to a 200 HP electric motor. The fan speed was controlled by a VFD linked to the PLC in the control room. The fan curve at 95% maximum speed is shown in figure 4. The required 17.2 kg/s (38 lb/s) corresponds to 32,000 CFM at that operating condition. The fan was operator controlled to maintain the required mass flow through the rig via the PLC in the control room.

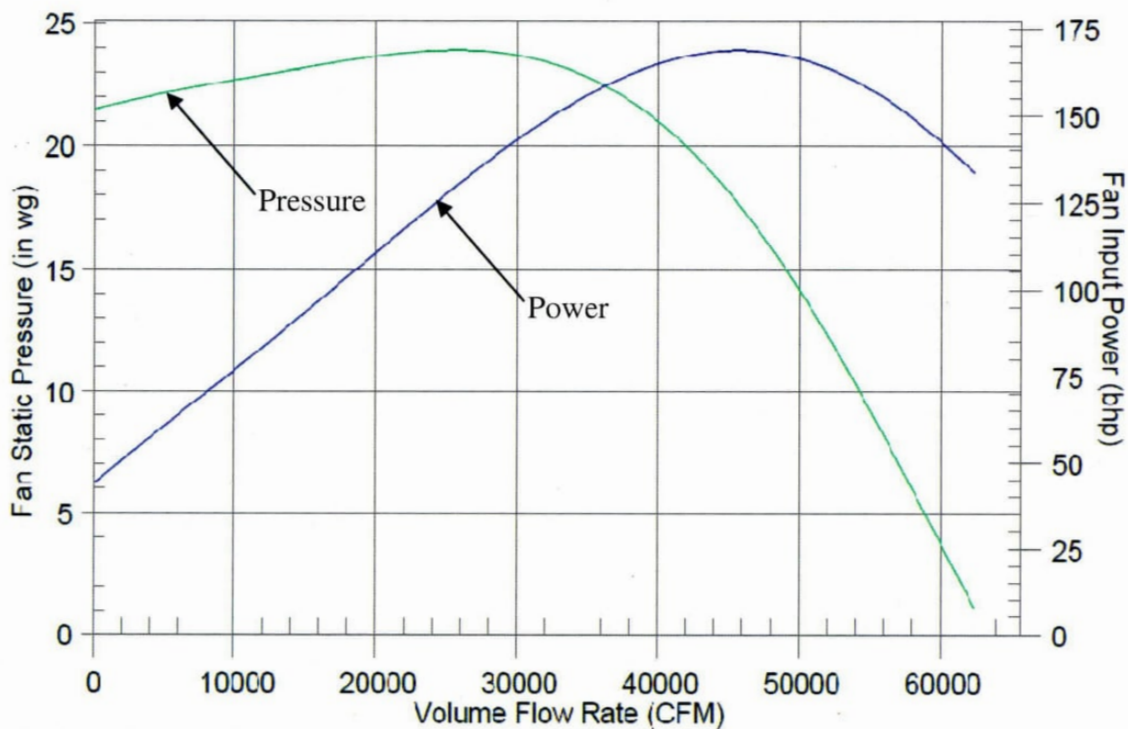


Figure 4: Fan curve at 95% maximum speed for AF-Thirty 445 blower

2.3 Droplet Sizing System

A circumferential traverse mechanism was developed for a Malvern instrument. The Malvern Spraytec laser diffraction instrument was used to assess the droplet sizes at the exit plane. The traverse mechanism included a gear system that allowed a hand crank wheel to rotate the mechanism. The traverse mechanism was capable of reaching both bounds of the exit plane, as can be seen in figure 5, which shows the traverse mechanism installed on the rig with the Malvern in place.

The Malvern requires a line of sight through the flow path. Initially a clear acrylic section was supplied by RRC to allow additional lines of sight for cameras to view the inlet guide vanes (IGV), and the Malvern line of sight was through glass lenses mounted in acrylic sliders that mounted over slots in the viewing section. Unfortunately the acrylic section was unable to handle the stress caused by the static pressure induced by

the 150 m/s air speed and was replaced by a dimensionally identical version manufactured from aluminum and assembled by M-7 staff. The glass lenses allowed water running along the inner surface of the test rig to run through the optical path and interfere with the Malvern measurements. The lenses were removed and the inflowing air diverted the surface water away from the line of sight. The Malvern viewing section is pictured in figure 6 without the acrylic sliders one of which is shown below in figure 7.

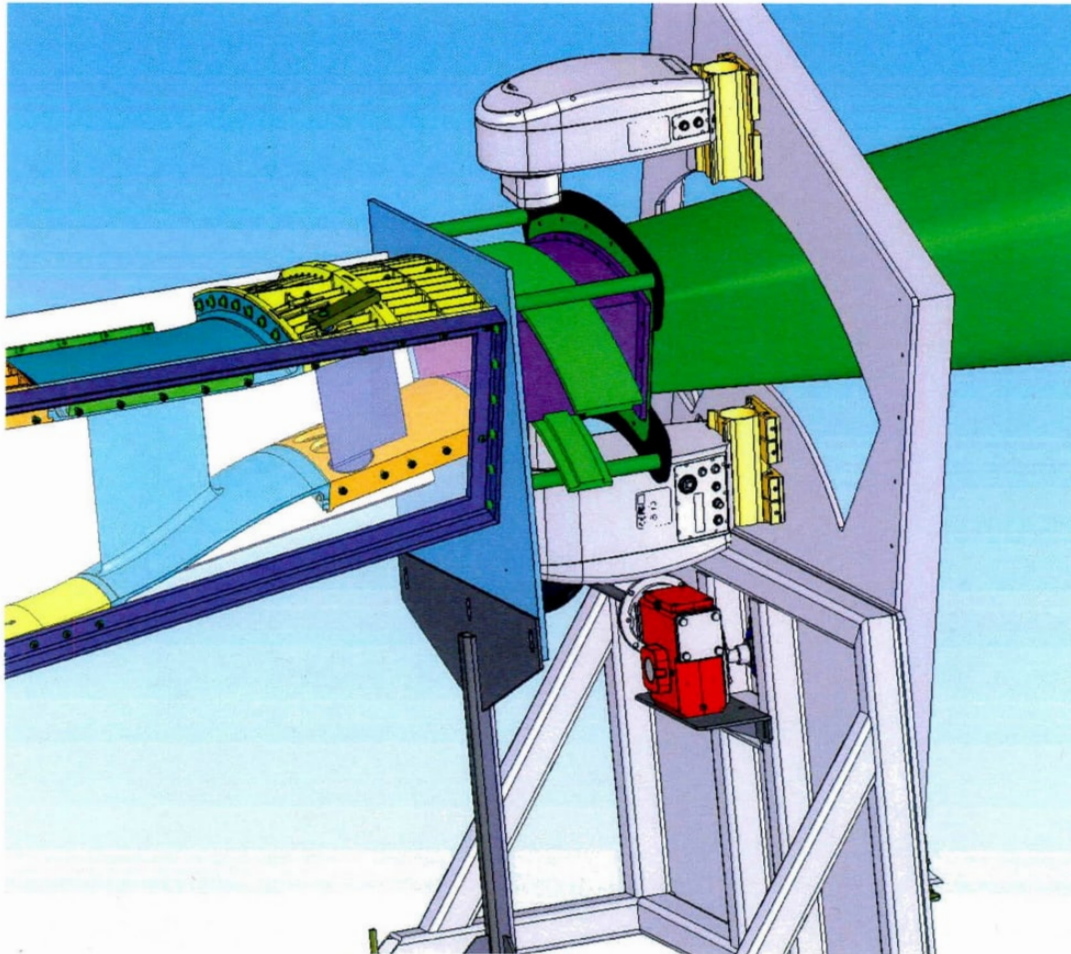


Figure 5: Circumferential traverse on test rig with Malvern installed

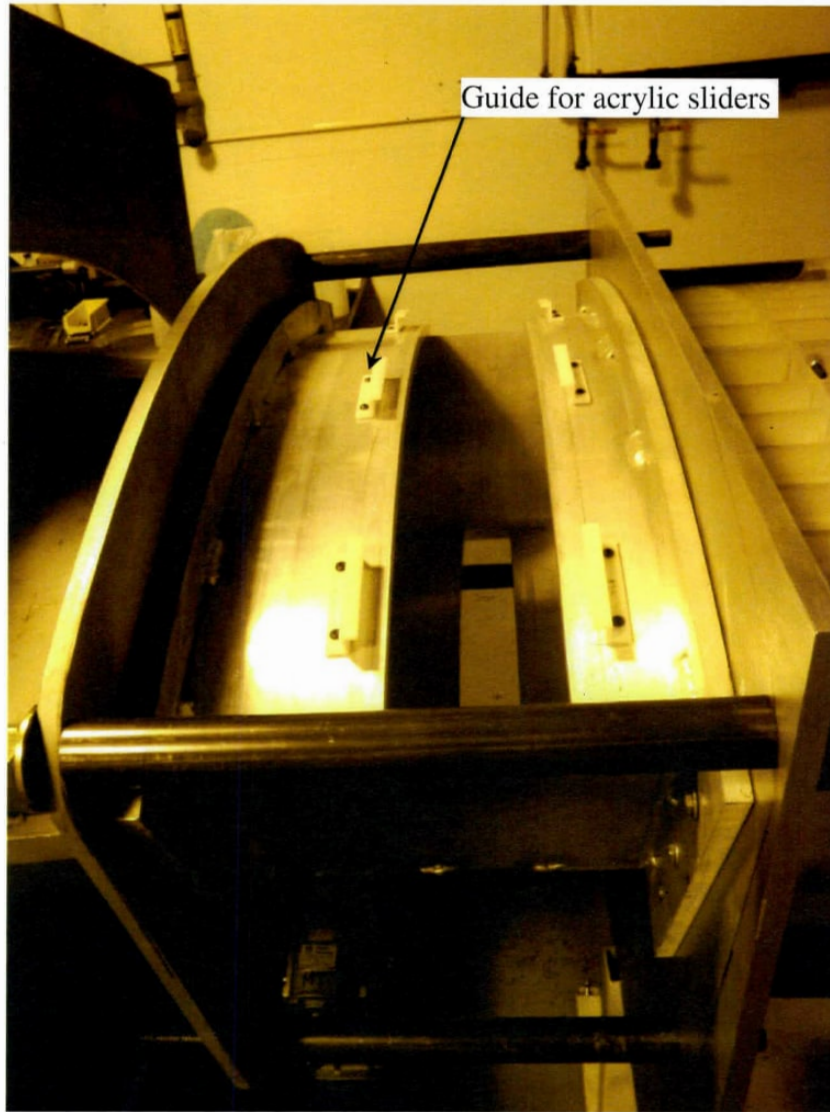


Figure 6: Malvern viewing section

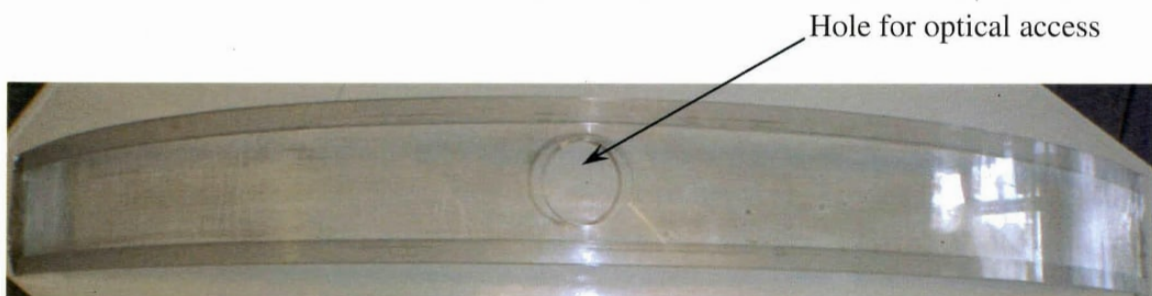


Figure 7: Acrylic slider for optical access

3 Rig Testing

Phase one of the test program revealed that droplet agglomeration on the IGVs created much larger droplets than were produced by the nozzles, which would enter the first stage of the compressor. The objective of the testing was to determine the effect of surface treatments of the IGVs in reducing the droplet size ingested by the compressor. The following parameters were examined during this test program:

1. IGV angles – two settings were tested 0° and 20°
2. Trailing edge (TE) serrations – none, low, medium and high
3. Surface coating – none, hydrophobic, hydrophilic and hydrophobic with TE serrations sand blasted

The IGVs had a very low angle of attack at the 20° setting and a significantly higher angle of attack at the 0° setting. This resulted in greater flow blockage and turning of the air flow at the 0° setting.

In addition, a test was performed with no IGVs installed to determine the effect of the inlet strut on droplet size, as agglomeration was also observed on the strut. Table 1 summarises the test cases run.

During the testing the inlet pressure, temperature and humidity levels were determined by the external ambient conditions as the test cell was open to the outdoors and the fan exhaust was approximately 1 m from the exit of the building. The momentum carried most of the water and, presumably, most of the air out of the test cell. If this was not the case the air temperature at the inlet would have risen due to heating by the 149 kW (200HP) blower and with the test cell door open this was not observed, but, as expected, was observed with the test cell door closed.

As the inlet air was not treated the temperature and humidity depended on the ambient conditions. On warm dry days there was potential for evaporation of the spray. Appendix E: presents the expected evaporation rates of droplets passing through the rig under different conditions.

Table 1: Test parameters

| Case | Number of Runs | IGV Setting | Serrations | Coating |
|------|----------------|-------------|------------|-------------------------------|
| 1 | 2 | 0 | None | None |
| 2 | 2 | 0 | None | Hydrophobic |
| 3 | 2 | 0 | None | Hydrophilic |
| 4 | 2 | 0 | Low | None |
| 5 | 2 | 0 | Medium | None |
| 6 | 2 | 0 | High | None |
| 7 | 2 | 0 | High | Hydrophobic |
| 8 | 1 | 0 | High | Hydrophobic – sand blasted TE |
| 9 | 2 | 20 | None | None |
| 10 | 2 | 20 | None | Hydrophobic |
| 11 | 2 | 20 | None | Hydrophilic |
| 12 | 2 | 20 | Low | None |
| 13 | 2 | 20 | Medium | None |
| 14 | 2 | 20 | High | None |
| 15 | 2 | 20 | High | Hydrophobic |
| 16 | 1 | 20 | High | Hydrophobic – sand blasted TE |

The Malvern line of sight was approximately 5° off in the radial direction. This was due to an offset in the Malvern laser relative to the receiving sensor of 2.5 cm (1 inch) and a 4.4 cm (1.75 inch) offset of the traversing rig. The Malvern offset was discovered near the mid-point of the program and was not adjusted to ensure consistency within the test program. This caused 2° of offset and was also, unknowingly, present during Phase I of the testing. The remaining offset was caused by a misplacement of the traversing rig and was not discovered until the testing was concluded.

The measurement positions and lines of sight are shown in figure 8 with the positions of the IGVs and the strut. In some cases additional measurements were taken between the positions shown. The line of sight for these positions would be parallel to the lines shown at the angular position given.

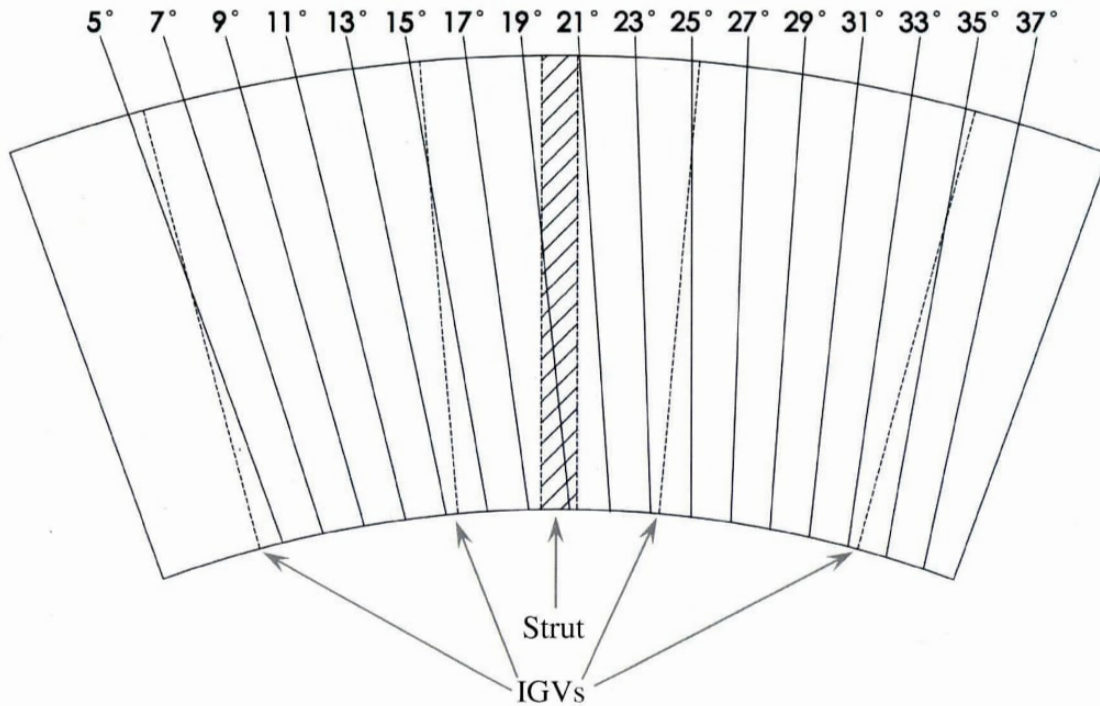


Figure 8: Location of Malvern lines of sight on rig looking in direction of flow

3.1 Procedure

3.1.1 Tunnel

The tunnel procedure was followed to obtain the correct air flow and water delivery pressure. The test procedure followed is given in Appendix B:. The start up procedure ensured that the data acquisition system was zeroed correctly and that the deionised water system was cleared and delivering water at the system specification. It also ensured that instrumentation and cameras were functioning and that the system was safe to operate.

When changing the IGV angle from 20° to 0°, the blower fan speed was increased to maintain the desired mass flow rate. Conversely, the fan power was decreased when performing the opposite IGV angle change.

The objective of the test procedure was to ensure steady flow at the correct flow conditions before data was recorded. The shut down procedure ensured that the system was cleared and left in a safe state.

3.1.2 Malvern

The Malvern procedure was followed to align the Malvern detector/receiver heads to the proper position during the test matrix. The test procedure followed is given in Appendix C:. The start up procedure ensured that the Malvern optics were zeroed correctly and that the background checks were repeatable.

The objective of the Malvern procedure was to ensure a consistent method to record reliable and repeatable data. The shut down procedure ensured that the system was turned off properly and left in a safe state.

3.2 Results

The results of the droplet sizing are presented in graphical form in this section. Appendix F: provides the size data in tabular form and the corresponding data from the test rig including temperatures, humidity air and water flow rates and pressures.

The results presented provide the average $Dv90$ and average $Dv50$. The average results are the average of all the tests performed for that case, usually two. Each test averaged the data over a 1 minute period. The $Dv50$ corresponds to the mean volume diameter (MVD) and is the particle diameter for which 50% of the particle volume is made up in smaller particles and 50% in larger. This is a common reference size for particle size distributions. The $Dv90$ corresponds to the particle diameter where 90% of the particle volume is made up in smaller particles and 10% in larger. This value captures the larger particles in the distribution that cause the most erosion.

3.2.1 Baseline

The baseline runs consisted of cases 1 and 9 and served as a comparison point for the other cases. These cases correspond to the conditions tested in phase I of this work and results are similar. Peaks are close in magnitude and location (Davison and Benner, 2008). The baseline and no IGV cases will be presented with droplet sizes. Subsequent cases will be presented as variations from the relevant IGV setting baseline case.

Figure 9 shows the baseline runs with a 20° IGV setting. Two runs were performed and both are shown. Significant differences between runs are seen at the peak centered on 19° and at positions greater than 33° . The measurements at greater than 33° are likely being influenced by the wall effects which are an artefact of the test conditions and are not present in the real engine. The peak at 19° is well away from the wall and could be due to the rapid change in diameter in this vicinity. A slight change in test conditions or position of the Malvern will cause the peak to shift relative to the line of sight and alter the result.

Figure 10 shows the two test cases with 0° IGV setting. The largest deviation is at the 19° location. Based on the shape of the curves it appears that the peak is not being measured and the difference is due to a slight shift in the peak relative to the measurement line. Again the results above 33° are questionable due to the wall effects. In subsequent sections the locations above 33° will not be shown, but the data is included in the appendix.

Figure 11 presents the average results for the 0° and 20° IGV settings and for the no IGV case. For no IGVs the Malvern was moved in 1° increments in the vicinity of the strut. This allowed the peak at 20° to be located. It appears that the peak for the 0° setting in this location has not been measured as the strut is likely still generating a peak, although possibly reduced, and a curve fit to the surrounding points would indicate a peak at 20° .

The elevation in diameter in the 15° to 23° range would appear to be influenced by both the strut and the IGV. The peak in 25° to 33° range, however, is due to the influence of the IGV.

The Dv50 results are shown in figure 12. The peaks are much less distinct than for the Dv90. This is as we would expect since the shedding from the structures in the flow produce a few very large drops influencing the tail of the distribution much more than the mean. As the larger droplets are of primary interest the remaining Dv50 data is presented in Appendix F: but not in the main body of this report.

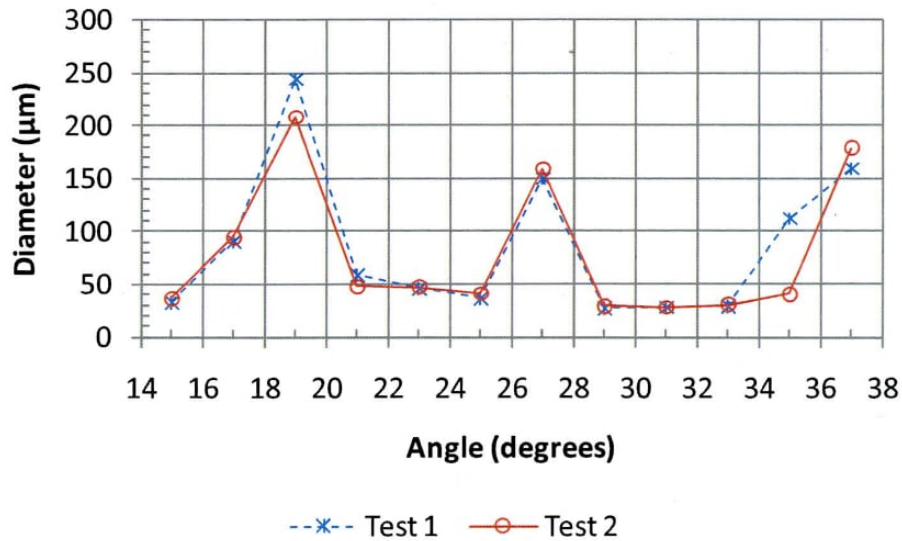


Figure 9: Dv90 baseline results for 20° IGV setting showing repeat runs

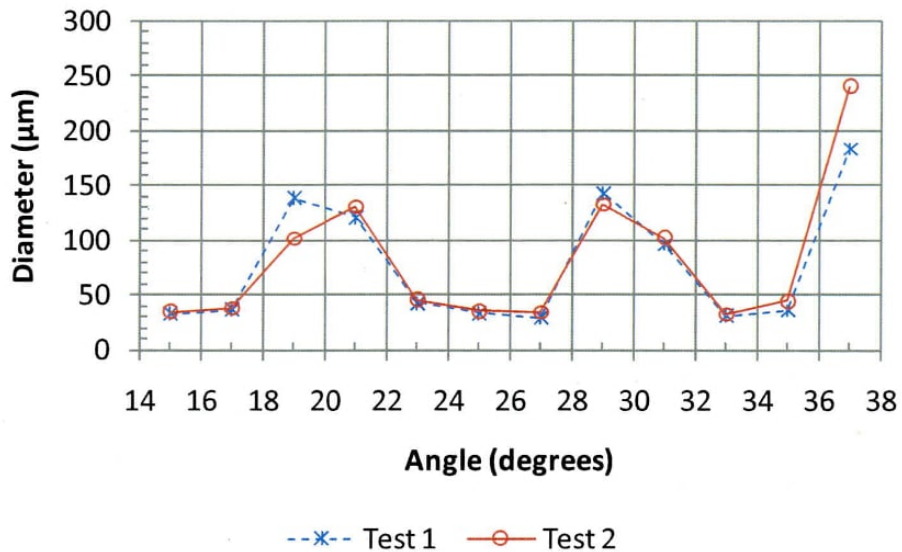


Figure 10: Dv90 baseline results for 0° IGV setting showing repeat runs

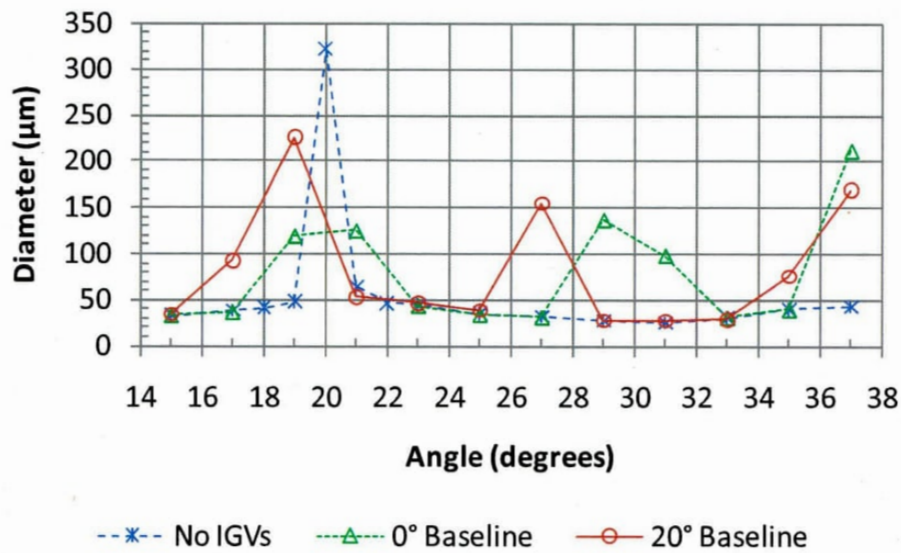


Figure 11: Comparison of average Dv90 results baseline tests and no IGV case

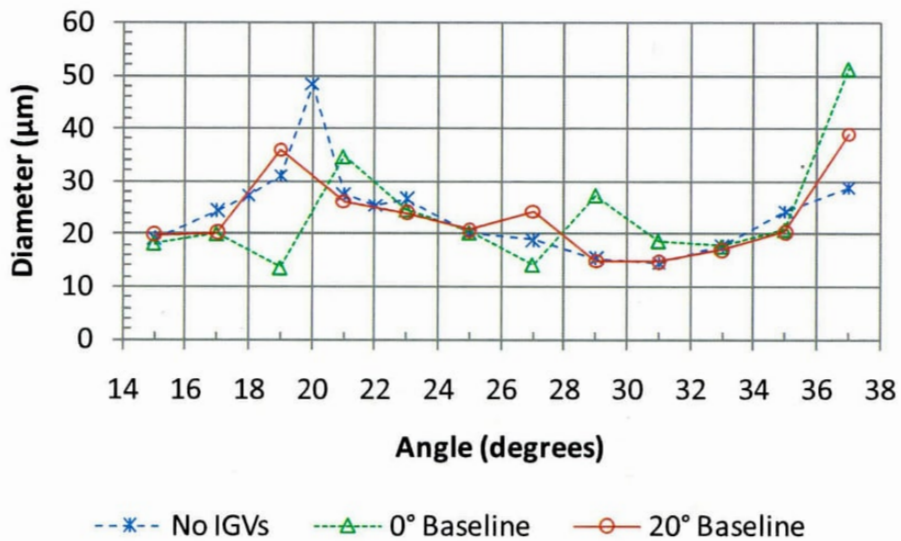


Figure 12: Comparison of average Dv50 results baseline tests and no IGV case

During the no IGV test the inlet strut was painted with poster paint. Poster paint is water based and easily washes off when exposed to water. This allows the location the water flows over to be identified. Figure 13 shows the strut looking from the inlet of the wind tunnel with the spray bars in operation. It is clear that most of the water does not impact on the strut but the port side appears to come closer to the strut. This is also apparent in the pictures of the paint removal after one minute of spray, shown in figure 14. The port side has more paint removed in the upper portion and also has more removed from the floor of the test section.

The no IGV test was performed approximately two thirds of the way through the test matrix. At the conclusion of testing paint still remained on the strut and floor of the test section and is shown in figure 15. After this period of time exposed to the spray it could

be assumed that any area exposed to a significant quantity of water would have the paint removed. The port side still exhibits greater paint removal than the starboard side. The port side floor also shows more paint removal and a trail of removed paint leads from the trailing edge to the end of the end of the painted section slightly biased to the port side. Although the IGVs in the 0° setting pushes the flow to the port side the same bias was seen in the figure 14 after testing with no IGVs installed.

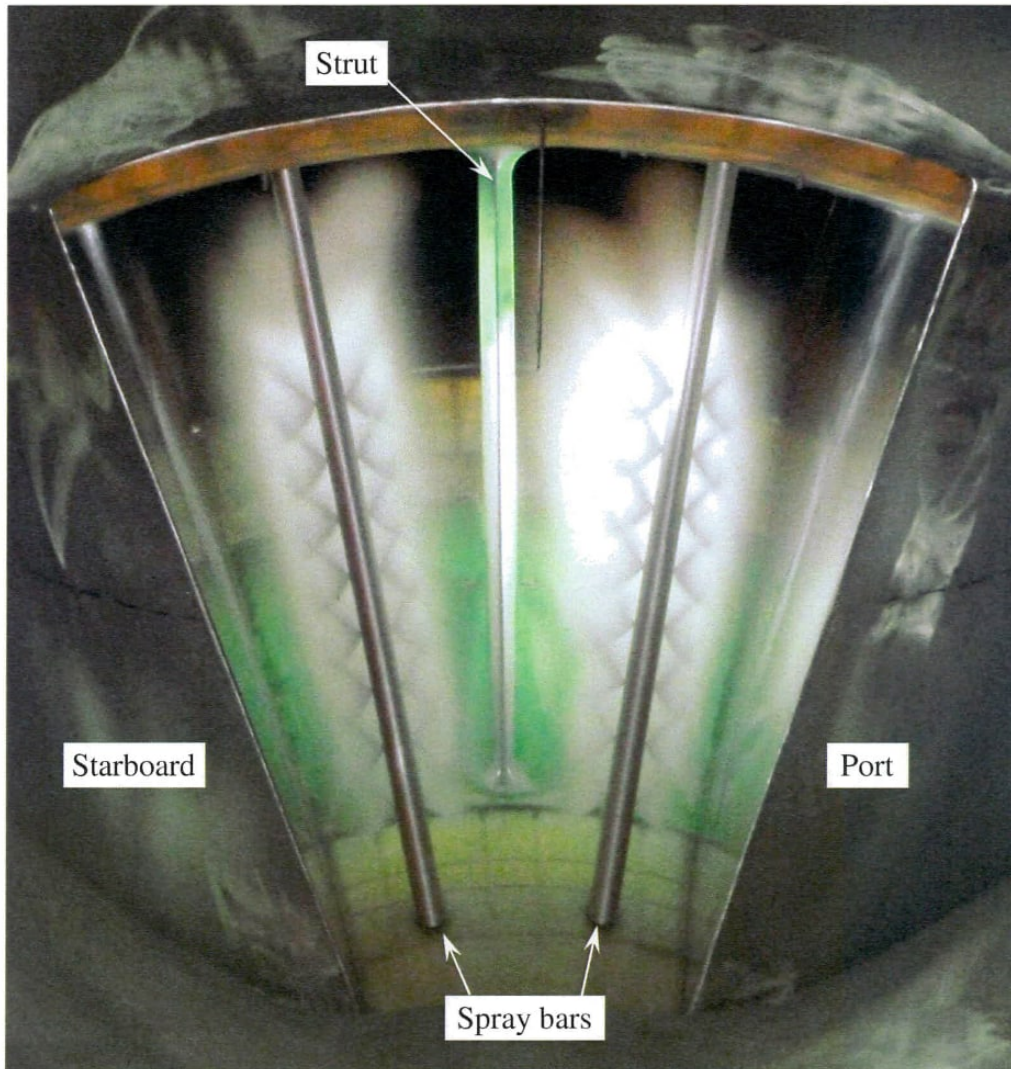


Figure 13: View of test section with spray on from upstream with no IGVs installed



Figure 14: Paint removal on strut after 1 minute of spray with no IGVs installed

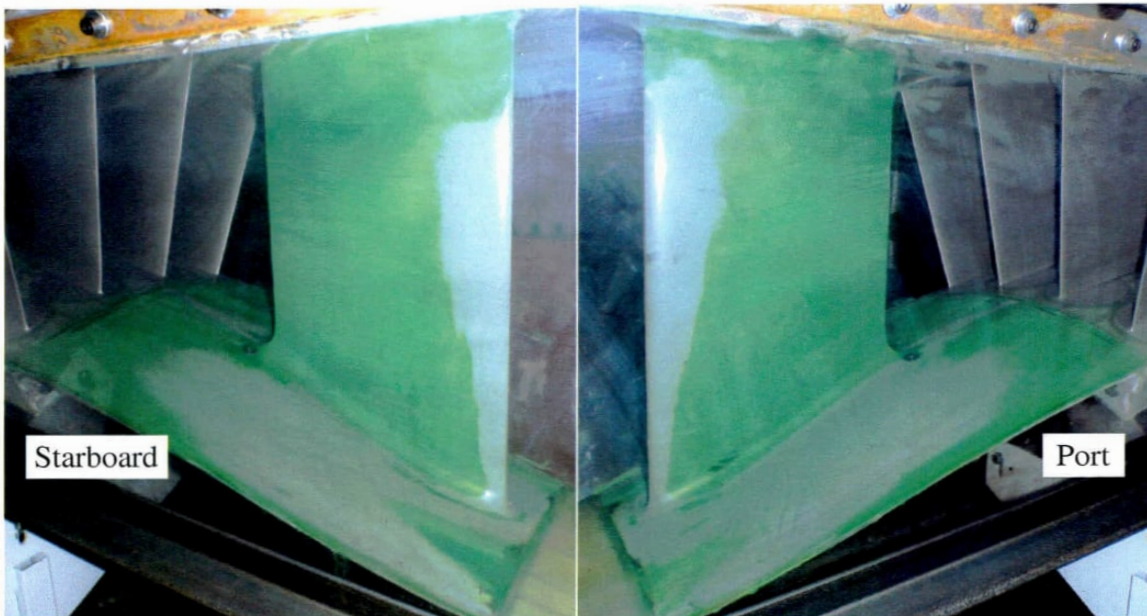


Figure 15: Paint removal on strut after completion of test matrix

3.2.2 Serrations

One strategy RRC wished to examine to reduce the size of the droplets shed from the IGVs was machining serrations into the trailing edge of the IGVs. Three serration sizes were supplied labelled high, medium and low. Figure 16 shows one example of the serrated trailing edge. Figure 17 presents the serrated results minus the baseline results for the 20° IGV setting. The low serration shows a reduced Dv_{90} between 16° and 23° but no difference above that. The high and medium cases match the low case except for two locations. At 19° they both show larger Dv_{90} results than the baseline case, although the high serration is a negligible difference. At 27° the high serration shows a large improvement and the medium shows a slight improvement. Overall the high serration is

the only one that shows an overall improvement. A more detailed sweep at 1°, or less, intervals is recommended to ensure that this is not just the result of peak shifting.

The results for the 0° setting are not as positive. Figure 18 presents the results for the 0° setting and the low serration shows little difference from the baseline but is overall worse. All serration types show similar results above the 22° position. The most significant change is at the 19° position where the high and medium serration IGVs show a significant increase in the Dv90. Overall it appears that all the serrations have a net negative effect of the results.

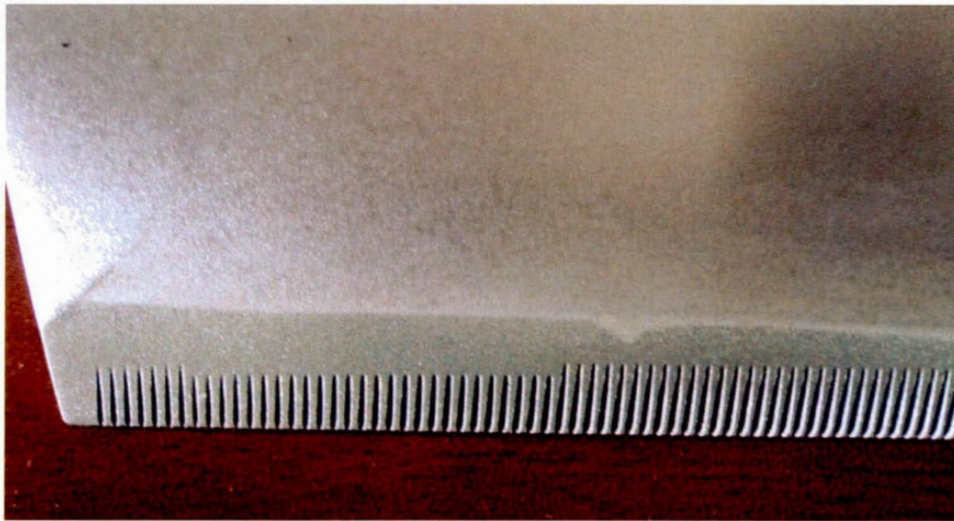


Figure 16: Serrated IGV trailing edge

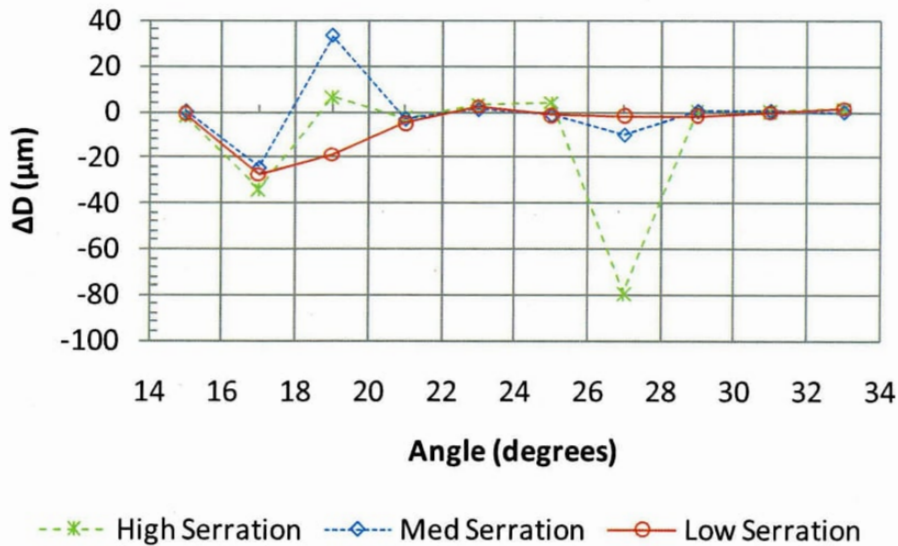


Figure 17: Average Dv90 results for serrations minus average baseline results with 20° IGV setting

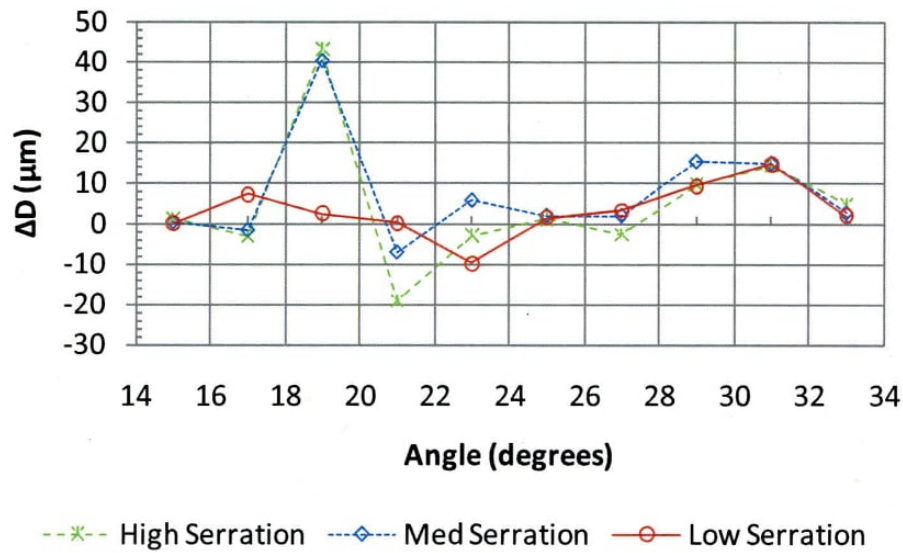


Figure 18: Average Dv90 results for serrations minus average baseline results with 0° IGV setting

3.2.3 Coatings

Hydrophilic and hydrophobic coatings were tested. The coated blades were supplied by RRC. Figure 19 compares the results for the coated blades to the baseline for the 20° IGV setting. Both coatings show an improvement at both peaks. The hydrophobic coating shows a more substantial improvement at the 17° setting but practically none at 27° where the hydrophilic shows a similar improvement to what it gave at 17°.

At the 0° IGV setting, shown in figure 20, the coatings almost consistently produce worse results. The only exception is at the 21° location. This pattern of a reduction in size next to an increase in size probably indicates that the peak is being shifted. Again sampling at higher geometric fidelity is required to determine the true nature of the change occurring.

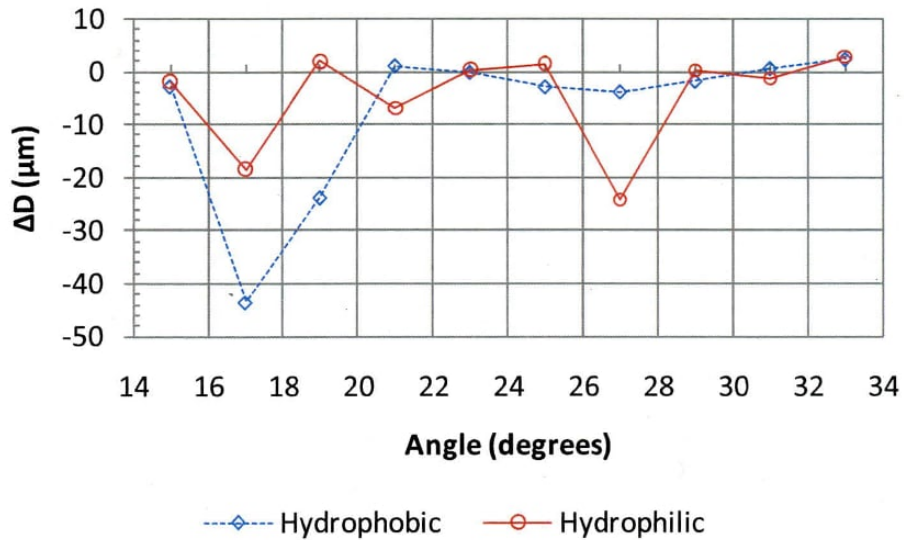


Figure 19: Average Dv90 results for coatings minus average baseline results with 20° IGV setting

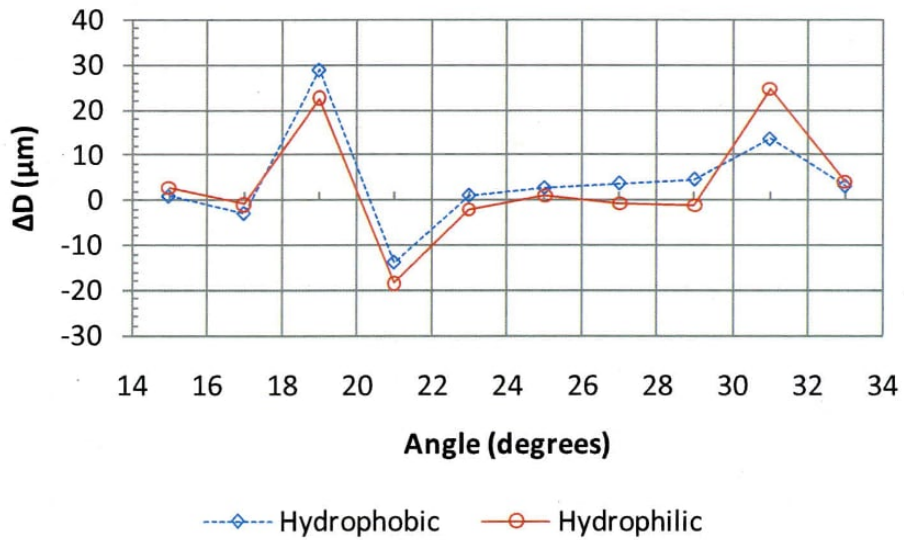


Figure 20: Average Dv90 results for coatings minus average baseline results with 0° IGV setting

3.2.4 Combined Surface Treatments

Based on the previous tests RRC decided to combine the high serration with the hydrophobic coating and subsequently removing the hydrophobic coating from the serrations. The hydrophobic coating was removed from the serrations by sandblasting performed by M-7 shop personnel. Figure 16 shows the results of this process. It should be noted that while all of the other cases had two tests performed the case with the sand blasted serrations only had one test.

With the 20° IGV setting no combination improved on the improvement obtained with the hydrophobic coating alone as seen in figure 21. The high serration case, as noted previously, showed a large improvement at 27° position, but all the other cases showed a negligible change. The combination of treatments appeared to have the effect of cancelling the benefits of the individual treatments.

At the 0° IGV setting the net result for all cases is a decrease in performance compared to the baseline case. No combination is clearly superior to the others. The trend at the 19° and 21° positions is interesting. The high serration vane has the largest Dv90 at 19° and the smallest at 21° while the high serration coated blade has the smallest Dv90 at 19° and the largest at 21°. The sand blasted vane falls in the middle in both positions. The only vane that did not follow the trend was the hydrophobic which shared the smallest drop size at 19° and was in the middle at 21°. Despite this deviation it is clear that some of the difference at least is attributable to a shifting position of the peak droplet size as the gains seen at one position are cancelled by the losses in the adjoining location.

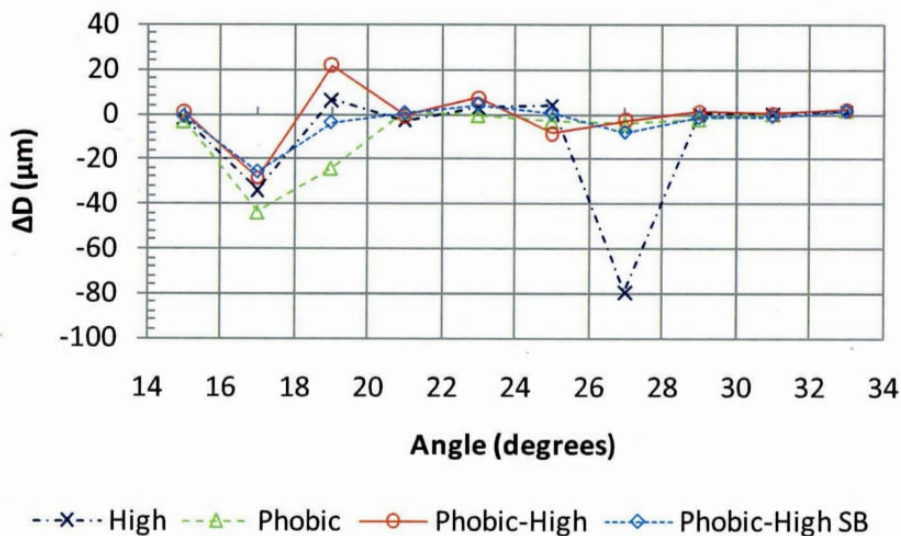


Figure 21: Average Dv90 results minus average baseline results with 20° IGV setting for the high serration (High), hydrophobic coating (Phobic), high serration with hydrophobic coating (Phobic-High) and high serration with hydrophobic coating on blade but removed from serrations (Phobic-High-SB)

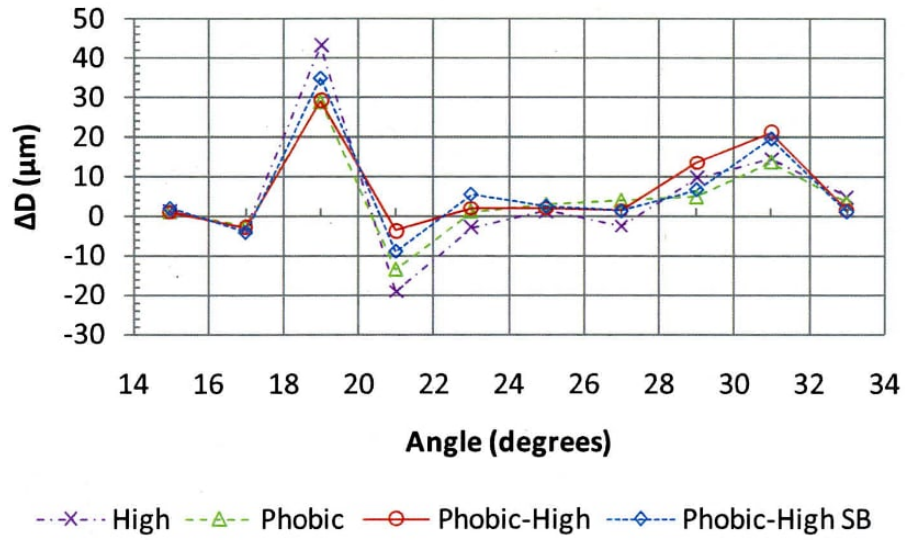


Figure 22: Average Dv90 results minus average baseline results with 0° IGV setting for the high serration (High), hydrophobic coating (Phobic), high serration with hydrophobic coating (Phobic-High) and high serration with hydrophobic coating on blade but removed

4 Summary and Recommendations

This report presents the test apparatus and data for the inlet spray testing performed for RRC during the months of September to December 2010. This test series verified that, in addition to the IGVs, the inlet strut was shedding large droplets and should be considered in any plan to reduce the maximum droplet size ingested by the compressor. Of the surface treatments considered none provided a clear advantage under all test conditions.

In some cases the geometric fidelity of 2° sample spacing was inadequate to determine if the droplet size had been reduced or if the location of the maximum droplet size had been shifted. For future tests it is recommended that the fidelity be increased to at least 1° spacing in the regions of shed droplets.

References

- Davison, C. R., "Phase II Spray Rig Testing in Support of Inlet Spray Inter-cooling Project", National Research Council Canada, RP-GTL-2009-0013, Ottawa, Ontario, Apr. 2009, 6p.
- Davison, C. R. and Benner, M., "Summary of Inlet Spray Testing for Rolls Royce Canada", National Research Council Canada, LTR-GTL-2007-0045, Ottawa, Apr. 2008.
- Davison, C. R.; MacLeod, J. D. and Ratvasky, T. P., "Naturally Aspirating Isokinetic Total Water Content Probe: Preliminary Test Results and Design Modifications", 2010, AIAA-2010-7530, 2nd AIAA Atmospheric and Space Environments Conference, 2-5 Aug., 2010, Toronto, ON, Canada, AIAA.
- Rafla, K., "Trent ISI Rig at the NRC: Statement of Work", Rolls Royce Canada, GTES 10660, Montreal, Quebec, July 2007.

Appendix A: Pressure Transducer Calibration Sheets

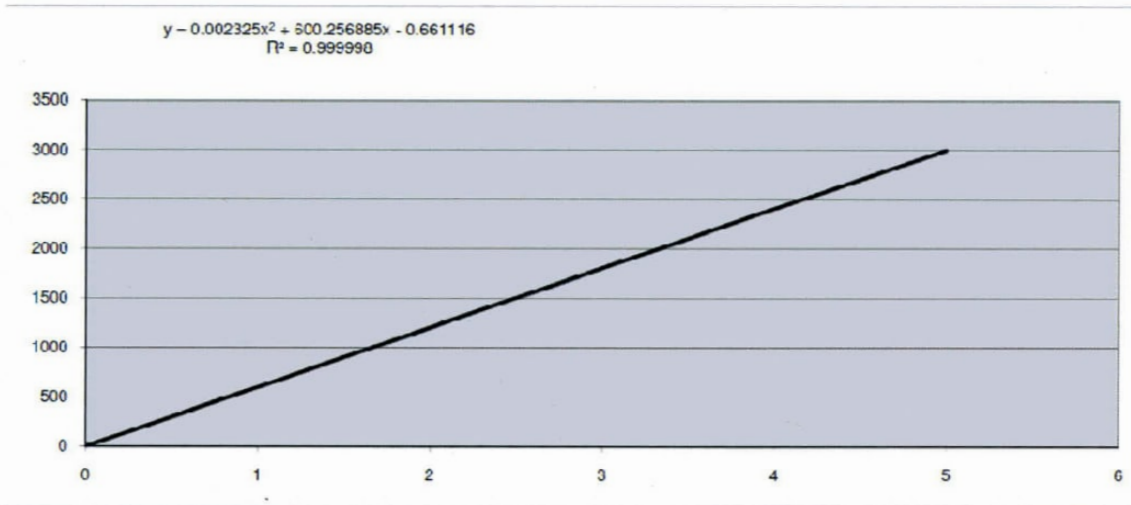


DAS ANALOG CALIBRATION

Project: RR PHASE 2
 Channel: P_L1/2
 Model (SN): Honeywell L3
 Range: 3000
 Eng. Unit: PSIG

| VOLTS | Expected PSIG | Calculated PSIG | %FS Error |
|----------|---------------|-----------------|-----------|
| 0.002136 | 0.000000 | 1.682792 | -0.056093 |
| 1.247340 | 750.000000 | 748.086276 | 0.063791 |
| 2.503500 | 1500.000000 | 1501.610071 | -0.053669 |
| 3.748000 | 2250.000000 | 2248.687214 | 0.043760 |
| 4.999000 | 3000.000000 | 3000.215801 | -0.007193 |

A = 0.176008
 B = 599.202734
 C = 0.402894
 R2 = 1.000000



| Calibration Standard: | Serial Number | Calibration due date | Performed by |
|-------------------------|---------------|----------------------|---------------------|
| Crystal Pump Calibrator | 2925-420807 | 20-Nov-10 | Cameron Instruments |

| Calibrated by: | Signature | Location | Date |
|----------------|-----------|-------------|-----------|
| J. Williams | | Test Cell 3 | 15-Jun-10 |

Figure 23: Lane 1/2 pressure transducer calibration

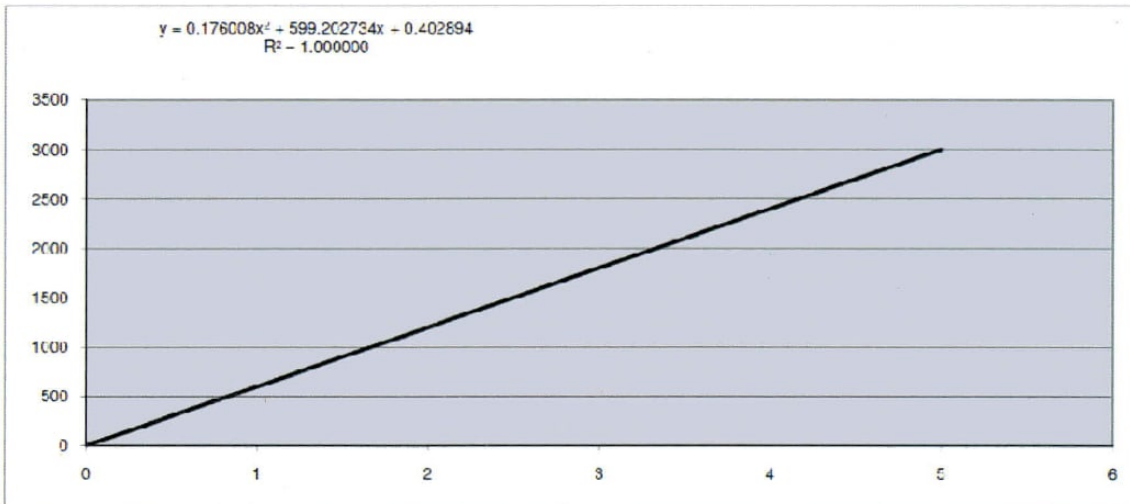


DAS ANALOG CALIBRATION

Project: RR PHASE 2
 Channel: P_L3
 Model (SN): Honeywell L3
 Range: 3000
 Eng. Unit: PSIG

| VOLTS | Expected PSIG | Calculated PSIG | %FS Error |
|----------|---------------|-----------------|-----------|
| 0.000001 | 0.000000 | 0.403493 | -0.013450 |
| 1.243943 | 750.000000 | 749.047502 | 0.031750 |
| 2.501549 | 1500.000000 | 1500.439308 | -0.014644 |
| 3.750797 | 2250.000000 | 2250.366876 | -0.012229 |
| 4.998213 | 3000.000000 | 2999.742844 | 0.008572 |

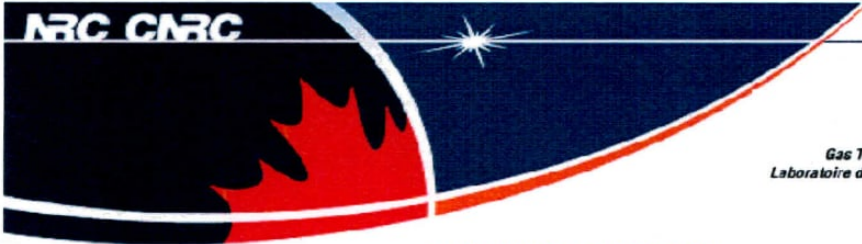
A = 0.176008
 B = 599.202734
 C = 0.402894
 R2 = 1.000000



| Calibration Standard: | Serial Number | Calibration due date | Performed by |
|-------------------------|---------------|----------------------|---------------------|
| Crystal Pump Calibrator | 2925-420807 | 20-Nov-10 | Cameron Instruments |

| Calibrated by: | Signature | Location | Date |
|----------------|-----------|-------------|-----------|
| J. Williams | | Test Cell 3 | 15-Jun-10 |

Figure 24: Lane 3 pressure transducer calibration

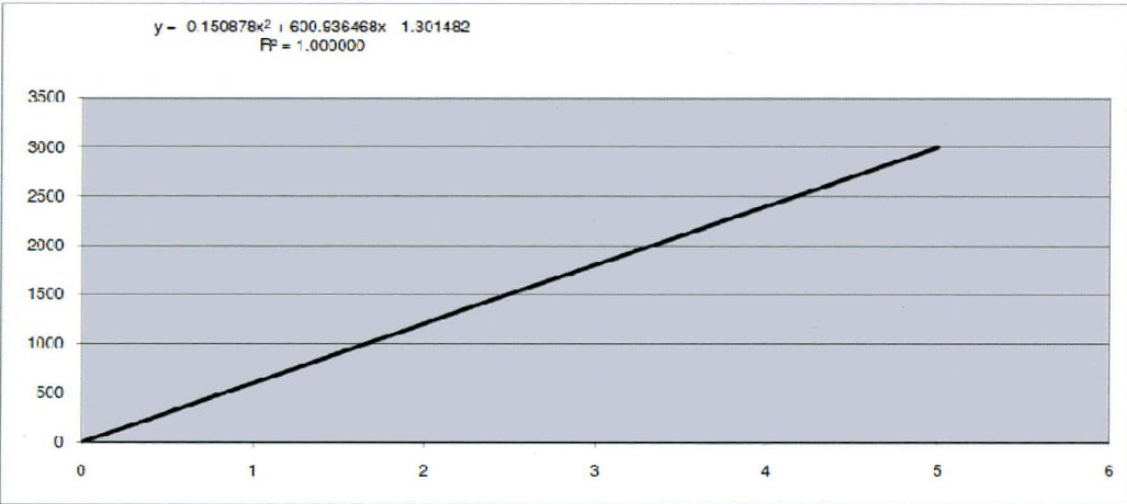


DAS ANALOG CALIBRATION

Project: RR Phase 2
 Channel: P L4
 Model (SN): Honeywell
 Range: 3000
 Eng. Unit: psig

| VOLTS | Expected psig | Calculated psig | %FS Error |
|----------|---------------|-----------------|-----------|
| 0.002419 | 0.000000 | 0.152182 | -0.005073 |
| 1.250270 | 750.000000 | 749.795507 | 0.006816 |
| 2.499342 | 1500.000000 | 1499.701781 | 0.009941 |
| 3.750856 | 2250.000000 | 2250.601984 | -0.020066 |
| 5.000233 | 3000.000000 | 2999.748575 | 0.009381 |

A = -0.150878
 B = 600.936468
 C = -1.301482
 R2 = 1.000000



| Calibration Standard: | Serial Number | Calibration due date | Performed by |
|-------------------------|---------------|----------------------|---------------------|
| Crystal Pump Calibrator | 2925-420807 | 20-Nov-10 | Cameron Instruments |

| Calibrated by: | Signature | Location | Date |
|----------------|----------------------|-------------|-----------|
| J. Williams | <i>John Williams</i> | Test Cell 3 | 15-Jun-10 |

Figure 25: Lane 4 pressure transducer calibration

Appendix B: Operating Procedure

The following procedure was version 1.2 which was followed during the test program it was last modified July 16, 2010.

Start Up Procedure

1. Ensure data acquisition system is on and running
2. Ensure control PLC is on and running
3. Open test cell overhead door
4. Place warning signs
5. Zero pressure brick
6. Visually check rig for problems in particular:
 - a. Inlet for material that could be ingested
 - b. Test section structural integrity
7. Turn city water to pump on
8. Activate Malvern
9. Ensure E-stop is not activated
10. Turn fan disconnect switch on
11. Turn pump disconnect switch on
12. Ensure compressed air is supplied to valves
13. Open drain valve, close spray bar supply valves
14. Activate pump and run for 5 minutes before switching to spray bars
15. Turn camera lights on
16. Ensure cameras are aimed and focused as desired
17. Take zero SS reading
18. Start blower bring to required speed and allow to reach steady state
19. Note in log that check list has been performed, start time and operators
20. Begin testing

Test Procedure

1. Looking downstream align traverse rig with left zero position and set inclinometer to zero
2. For each test point:
 - a. Set traverse rig at required angle
 - b. Ensure air flow conditions are as required (38lb/s) and water flow to bars is off (valves closed)
 - c. Zero Malvern
 - d. Open valves to spray bars, close drain valve and set pressure (2200 PSIG)
 - e. Allow to stabilise
 - f. Take Malvern reading and steady state point
 - g. Record in log Malvern file reference, steady state file number, traverse angle, pump set point and fan set point

Appendix C: Malvern Procedure

Running Malvern for RRC in Cell-3

1. Turn on computer.
2. Login under operator.
3. Remove blue covers off Malvern heads.
4. Turn on power to the Malvern unit. (Blue light should go on)
5. Double click on Spraytec icon located top left hand of desktop.
6. Login under operator.
7. Go to top menu "**Tools**", select "**Laser Control**" and click the "**ON**" button to allow the rig operator to position the Malvern.
8. When given confirmation that the Malvern is in position, select the "**OFF**" button to turn the laser off and close the "**Laser control**" window.
9. Go to the top menu "**Measure**" and select "**Start SOP**"
10. Select "**M-7 Cell-3 RR setep.ssop**"
11. Save **.smea** file for the current project.
12. A description can be but in the general comments in "**Edit Documentation**".
Make sure water is off and air flow is at set point before continuing to next step.
When ready, select "**OK**".
13. It will automatically go through background checks, should take approximately 1 to 3 minutes.
14. When start button goes green, it has finished the background. Let control operator know you are finished so he/she can turn water on and set test parameters.
15. When control operator signals the ok, press the "**Start**" button.
16. Allow significant time for an average, 2 to 5 minutes.
17. Press "**Stop**" when finished the test point.
18. A window will appear asking to repeat point, select "**NO**".
19. Start process over again from step 7.

Turning Malvern OFF

1. Exit the Malvern program.
2. Turn Malvern off, blue light will go off.
3. Put blue covers back on Malvern heads for protection.

Turn computer off.

Appendix D: Data File Structure

The raw data is presented in two forms:

1. Steady state
2. Transient

The file names are as follows:

Steady state – “TUNNELSSxxx.dat”

Transient – “TUNNELTRxxx.dat”

Where the xxx is replaced with a sequential number. The number is increased regardless of file type recorded so that transient file 10 would follow steady state file 9 and the subsequent steady state or transient file would be 11.

The first two rows of the data file contain the data description and units for the column. The steady state file then has four rows containing the mean, minimum, maximum and standard deviation for the time period recorded. The transient file contains the actual data measured at the specified frequency. Table 2 explains each of the relevant columns in the data file. Due to changes made during the test program the column number may vary but the column headings will be consistent.

Table 2: Data file fields

| Column | Description | Units | Notes |
|--------|-------------|-------|---|
| 1 | READ | ##### | The units row contains the date and time. Contains number of scans used in the average. |
| 2 | Looptime | ms | Length of time for each scan |
| 3 | ScanFreq | Hz | Frequency of scans |
| 4 | Scan | # | File number ie: xxx given in file names above |
| 5 | DTIME | sec | Time over which average was taken |
| 6 | IRIGDEC | hours | Not used |
| 7 | TINLET.AVG | DEGC | Average inlet temperature – measured at very low velocity so equivalent to total temperature |
| 8 | PS_IN.AVG | PSIA | Average static pressure from static taps in straight duct section (see figure 3), used to determine mass flow |
| 9 | TINLET.SP | N/A | TINLET.MAX - TINLET.MIN |
| 10 | PS_IN.SP | N/A | PS_IN.MAX - PS_IN.MIN |
| 11 | TINLET.MAX | N/A | Maximum of TINLET_000, TINLET_090, TINLET_180 and TINLET_270 |
| 12 | PS_IN.MAX | N/A | Maximum of PS_IN045, PS_IN135, PS_IN225 and PS_IN315 |
| 13 | TINLET.MIN | N/A | Minimum of TINLET_000, TINLET_090, TINLET_180 and TINLET_270 |
| 14 | PS_IN.MIN | N/A | Minimum of PS_IN045, PS_IN135, PS_IN225 and PS_IN315 |
| 15 | BARO | psia | Absolute pressure in test cell 3 |

| Column | Description | Units | Notes |
|--------|-------------|-------|--|
| 16 | AIRFLOW | lbm/s | Air flow from straight duct section (less accurate than MASS_FLW due to low speed) |
| 17 | PS_AVG_FIL | PSIA | PS_IN.AVG with exponential filter applied |
| 18 | MASS_FLW | lbm/s | Mass flow of air through tunnel from pitot-static probe |
| 19 | TS | K | Static temperature at center of test section inlet plane |
| 20 | PS_IN315 | PSIA | Static pressure. measured at 315° used for PS_IN.AVG |
| 21 | PS_IN225 | PSIA | Static pressure. measured at 225° used for PS_IN.AVG |
| 22 | PS_IN135 | PSIA | Static pressure. measured at 135°, used for PS_IN.AVG |
| 23 | PS_IN045 | PSIA | Static pressure. measured at 45° used for PS_IN.AVG |
| 24 | PT_TOTAL | PSIA | Total pressure at center of test section inlet plane (from pitot-static probe) |
| 25 | PS_STATIC | PSIA | Static pressure at center of test section inlet plane (from pitot-static probe) |
| 26 | PS_PUMP | PSIA | Static pressure near blower inlet – only used during commissioning phase |
| 27 | P_L3 | PSIG | Water pressure at lane W3 inlet |
| 28 | P_L4 | PSIG | Water pressure at lane W4 inlet |
| 29 | P_L1-2 | PSIG | Water pressure at lane W1/2 inlet |
| 30 | P_Pump | PSIG | Pressure at pump outlet |
| 31 | P_Water | PSIG | Pressure at pump inlet |
| 32 | WT.FLW | PPH | Water flow rate |
| 34 | RH | % | Relative humidity at tunnel inlet |
| 35 | TEMP | DEGC | Ambient temp at RH sensor |
| 36 | WATER_C | CM | Conductivity of treated water in microsiemens |
| 37 | TINLET_000 | DEGC | Temp. measured at 0° on tunnel inlet plane, used for TINLET.AVG |
| 38 | TINLET_090 | DEGC | Temp. measured at 90° on tunnel inlet plane, used for TINLET.AVG |
| 39 | TINLET_180 | DEGC | Temp. measured at 180° on tunnel inlet plane, used for TINLET.AVG |
| 40 | TINLET_270 | DEGC | Temp. measured at 270° on tunnel inlet plane, used for TINLET.AVG |

Appendix E: Evaporation Rates

The relative humidity at the rig inlet and outlet are calculated based on the static temperature and pressure at that location and the tunnel inlet absolute humidity. A value of 1 or greater indicates the potential for condensation. Any value of less than one indicates a potential for evaporation of the spray. The maximum possible evaporation can be calculated based on the capacity of the air to take on water vapour. This maximum is shown in Figure 26. While this is a theoretical maximum the very short dwell time, about 0.017 seconds, and the low disruption of the streamlines make it likely almost no evaporation would take place.

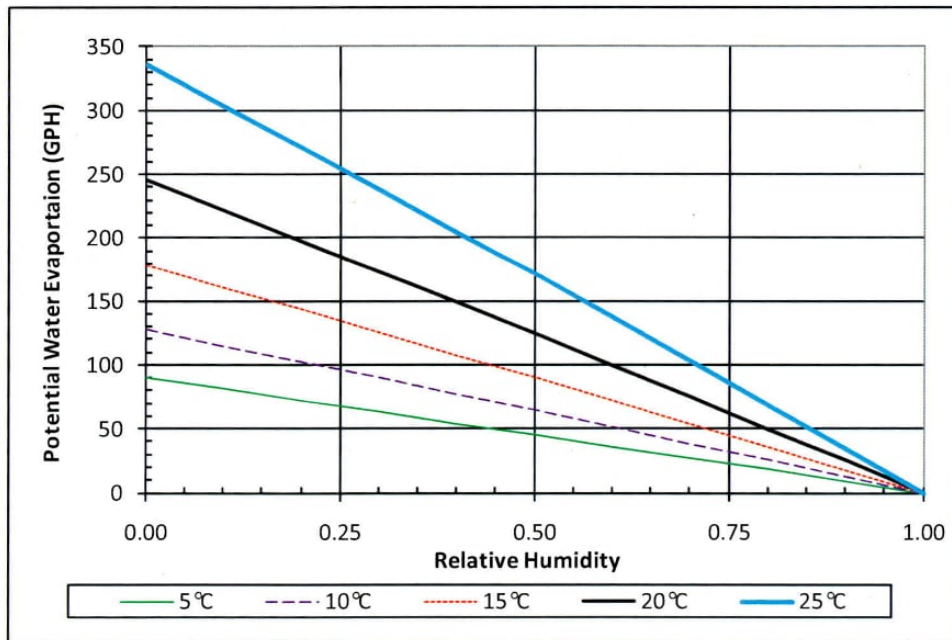


Figure 26: Potential for water evaporation into 17 kg/s air stream at 98 kPa

While figure 26 provides the maximum possible evaporation the short dwell time means this will not be achieved. The actual evaporation will be much less. An evaporation model, presented by Davison et al. (2010), was used to determine the evaporation in the rig. The model presented by Davison et al. assumed heat input to maintain the desired air temperature but for this simulation the air temperature was determined assuming no heat transfer to the system and the air cooling due to evaporation. With no IGVs the lowest $Dv50$ was about $14\mu\text{m}$ and the warmest inlet temperature was 25°C . The water was assumed to be injected perpendicular to the flow at 20m/s , but this velocity had a negligible effect on the results. Figure 27 shows the water evaporated for different drop sizes across a range in inlet humidities. As expected the larger droplets have less evaporation. For the worst case of 0% RH and each droplet size shrunk by approximately $1\mu\text{m}$ in diameter.

Figure 28 shows the effect of inlet temperature on the evaporation rate. It is nearly linear across the range of test conditions. To approximate the water evaporation rate for a given temperature and humidity find the evaporation rate from figure 27 for the droplet

diameter of interest and multiply it by the evaporation rate at the temperature of interest over the evaporation rate at 25°C, from figure 28. Applying curve fits to the data this procedure results in equation 1, with the temperature in Celsius. For a RH of 0.1 (10%) and a temperature of 7°C this technique yields 20.1GPH and the model yields 19.4GPH. The difference between them is less than the error in the model.

$$\dot{m} = (18.8RH^2 - 65.4RH + 46.7)(0.027T + 0.31) \quad (1)$$

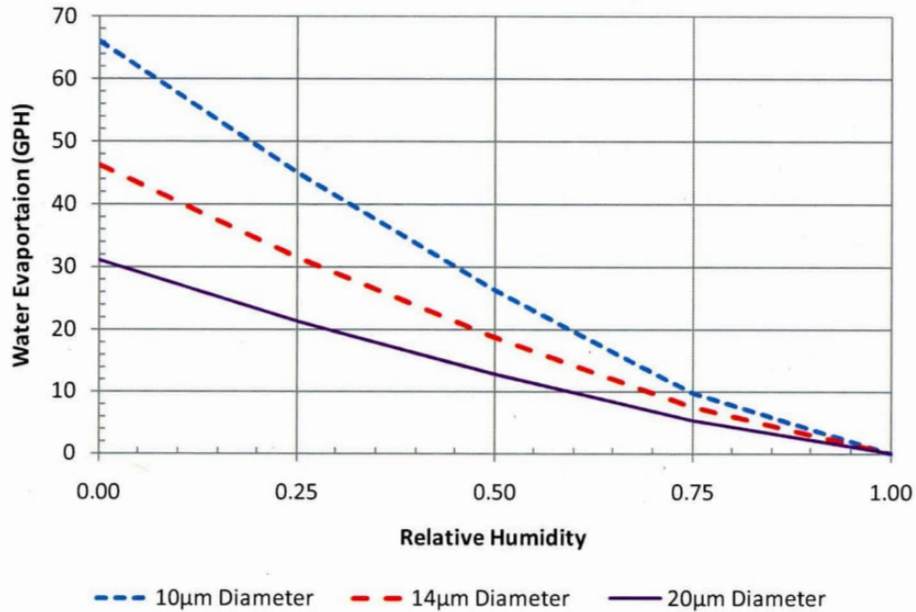


Figure 27: Droplet evaporation in test rig at 25°C

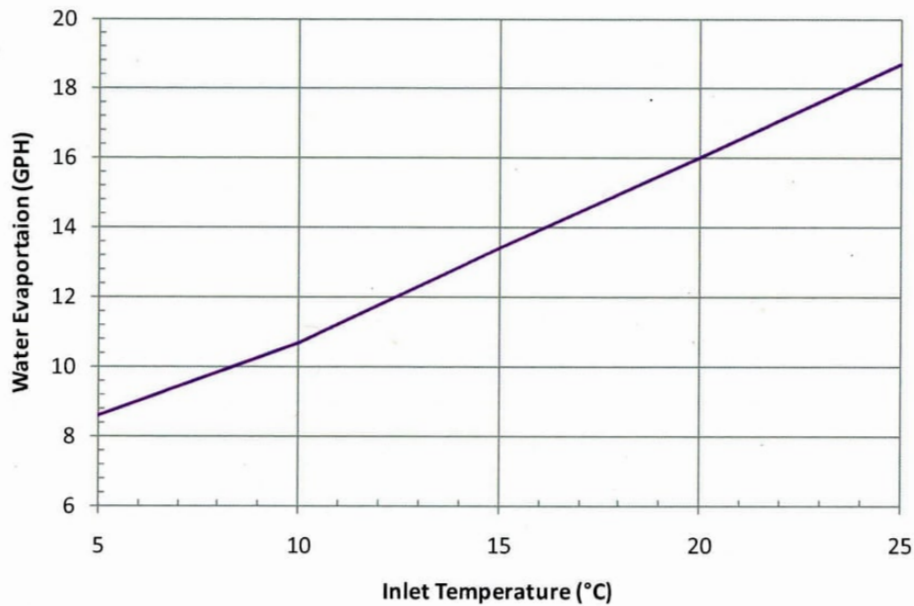


Figure 28: Variation of evaporation with inlet temperature at 50% relative humidity and 14µm diameter

Appendix F: Particle Size Data from Rig

F.a. Steady State Flow Data

Table 3 presents the air flow data from the rig during the Malvern measurements. The file number can be used to reference the Malvern measurement to which it corresponds. The steady state files can be found in the "Malvern" directory.

Table 3: Steady state air and water flow data corresponding to Malvern measurements

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | p (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) |
| High Serration 0 Degrees - September 15, 2010 | | | | | | | | | | | | | | | | | | | |
| 148 | - | 100.7 | 17 | 0.48 | 0.0059 | | 87.1 | 0 | 0.00 | 0.0 | 17 | 100.7 | 0.48 | 1.20 | 0.0 | 17 | 100.7 | 0.48 | 1.20 |
| 149 | - | 100.4 | 17 | 0.58 | 0.0070 | 17.3 | 198.0 | 2202 | 4.22 | 65.9 | 15 | 98.0 | 0.65 | 1.18 | 136.6 | 8 | 89.8 | 0.96 | 1.11 |
| 150 | 15 | 100.5 | 17 | 0.56 | 0.0067 | 17.1 | 197.9 | 2200 | 4.22 | 65.1 | 15 | 98.1 | 0.62 | 1.18 | 134.7 | 8 | 90.1 | 0.90 | 1.11 |
| 151 | 17 | 100.5 | 17 | 0.57 | 0.0069 | 17.3 | 197.9 | 2201 | 4.22 | 66.1 | 15 | 98.1 | 0.63 | 1.18 | 137.0 | 8 | 89.8 | 0.93 | 1.11 |
| 152 | 19 | 100.5 | 17 | 0.57 | 0.0071 | 17.2 | 198.0 | 2200 | 4.22 | 65.9 | 15 | 98.1 | 0.64 | 1.18 | 136.6 | 8 | 89.9 | 0.94 | 1.11 |
| 153 | 21 | 100.5 | 17 | 0.58 | 0.0069 | 17.3 | 197.9 | 2200 | 4.22 | 65.9 | 15 | 98.1 | 0.65 | 1.18 | 136.7 | 7 | 89.9 | 0.95 | 1.11 |
| 154 | 23 | 100.5 | 17 | 0.56 | 0.0067 | 17.2 | 197.9 | 2200 | 4.22 | 65.5 | 14 | 98.1 | 0.63 | 1.18 | 135.6 | 7 | 90.0 | 0.92 | 1.11 |
| 155 | 25 | 100.5 | 17 | 0.57 | 0.0069 | 17.0 | 198.0 | 2201 | 4.22 | 64.8 | 15 | 98.1 | 0.64 | 1.18 | 134.0 | 8 | 90.3 | 0.92 | 1.11 |
| 156 | 27 | 100.5 | 17 | 0.57 | 0.0069 | 17.3 | 198.0 | 2200 | 4.22 | 66.1 | 15 | 98.1 | 0.64 | 1.18 | 137.2 | 8 | 89.8 | 0.94 | 1.11 |
| 157 | 29 | 100.5 | 17 | 0.58 | 0.0071 | 17.3 | 198.0 | 2200 | 4.22 | 66.2 | 15 | 98.1 | 0.65 | 1.18 | 137.3 | 8 | 89.8 | 0.96 | 1.11 |
| 158 | 31 | 100.5 | 17 | 0.58 | 0.0071 | 17.5 | 198.0 | 2200 | 4.22 | 66.9 | 15 | 98.0 | 0.65 | 1.18 | 139.0 | 8 | 89.5 | 0.97 | 1.11 |
| 159 | 33 | 100.5 | 17 | 0.56 | 0.0069 | 17.4 | 198.0 | 2201 | 4.22 | 66.6 | 15 | 98.0 | 0.63 | 1.18 | 138.3 | 8 | 89.6 | 0.93 | 1.11 |
| 160 | 35 | 100.5 | 17 | 0.59 | 0.0071 | 17.1 | 197.9 | 2200 | 4.22 | 65.3 | 15 | 98.1 | 0.66 | 1.18 | 135.3 | 8 | 90.1 | 0.96 | 1.11 |
| 161 | 37 | 100.5 | 17 | 0.59 | 0.0071 | 17.1 | 197.9 | 2200 | 4.22 | 65.1 | 15 | 98.2 | 0.66 | 1.18 | 134.7 | 8 | 90.2 | 0.95 | 1.11 |
| 162 | - | 100.7 | 18 | 0.50 | 0.0063 | | 1.9 | 0 | 0.00 | 0.0 | 18 | 100.7 | 0.50 | 1.20 | 0.0 | 18 | 100.7 | 0.50 | 1.20 |
| High Serration 20 Degrees - September 16, 2010 | | | | | | | | | | | | | | | | | | | |
| 163 | - | 100.3 | 17 | 0.52 | 0.0062 | | 86.6 | 0 | 0.00 | 0.0 | 17 | 100.3 | 0.52 | 1.20 | 0.0 | 17 | 100.3 | 0.52 | 1.20 |
| 164 | 15 | 100.1 | 16 | 0.68 | 0.0079 | 16.9 | 182.9 | 1828 | 4.28 | 64.6 | 14 | 97.8 | 0.76 | 1.18 | 133.5 | 7 | 89.9 | 1.10 | 1.11 |
| 165 | 17 | 100.1 | 17 | 0.66 | 0.0080 | 17.3 | 200.7 | 2199 | 4.28 | 66.4 | 15 | 97.6 | 0.74 | 1.18 | 137.8 | 7 | 89.3 | 1.10 | 1.10 |
| 166 | 19 | 100.1 | 16 | 0.66 | 0.0077 | 16.9 | 200.8 | 2201 | 4.28 | 64.4 | 14 | 97.8 | 0.74 | 1.18 | 133.0 | 7 | 90.1 | 1.07 | 1.11 |
| 167 | 21 | 100.1 | 16 | 0.69 | 0.0080 | 17.1 | 200.6 | 2198 | 4.28 | 65.3 | 14 | 97.8 | 0.77 | 1.18 | 135.0 | 7 | 89.8 | 1.12 | 1.11 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 168 | 23 | 100.1 | 16 | 0.67 | 0.0079 | 17.1 | 200.8 | 2201 | 4.28 | 65.3 | 14 | 97.7 | 0.75 | 1.18 | 135.0 | 7 | 89.7 | 1.09 | 1.11 |
| 169 | 25 | 100.0 | 16 | 0.67 | 0.0078 | 17.2 | 200.9 | 2201 | 4.28 | 65.8 | 14 | 97.7 | 0.75 | 1.18 | 136.3 | 7 | 89.5 | 1.09 | 1.11 |
| 170 | 27 | 100.0 | 16 | 0.69 | 0.0078 | 17.2 | 200.9 | 2201 | 4.28 | 65.7 | 14 | 97.6 | 0.78 | 1.18 | 136.1 | 7 | 89.5 | 1.14 | 1.11 |
| 172 | 29 | 100.0 | 16 | 0.78 | 0.0088 | 17.1 | 200.9 | 2203 | 4.28 | 65.2 | 14 | 97.7 | 0.87 | 1.18 | 134.8 | 7 | 89.7 | 1.27 | 1.11 |
| 173 | 31 | 100.0 | 16 | 0.77 | 0.0089 | 17.0 | 201.0 | 2203 | 4.28 | 65.1 | 14 | 97.7 | 0.86 | 1.18 | 134.5 | 7 | 89.7 | 1.26 | 1.11 |
| 175 | 33 | 100.0 | 15 | 0.82 | 0.0088 | 16.9 | 200.9 | 2201 | 4.28 | 64.4 | 13 | 97.7 | 0.91 | 1.18 | 132.8 | 6 | 89.9 | 1.31 | 1.12 |
| 176 | 35 | 100.0 | 16 | 0.84 | 0.0093 | 16.8 | 201.0 | 2203 | 4.28 | 64.2 | 13 | 97.7 | 0.93 | 1.18 | 132.5 | 7 | 90.0 | 1.34 | 1.12 |
| 177 | 37 | 100.0 | 15 | 0.81 | 0.0089 | 16.8 | 201.1 | 2203 | 4.28 | 64.2 | 13 | 97.7 | 0.90 | 1.18 | 132.5 | 7 | 90.0 | 1.30 | 1.12 |
| 178 | - | 100.2 | 15 | 0.75 | 0.0080 | 0.3 | 0.2 | 0 | 0.00 | 1.3 | 15 | 100.2 | 0.75 | 1.21 | 2.5 | 15 | 100.2 | 0.75 | 1.21 |
| Baseline 20 Degrees - September 17, 2010 | | | | | | | | | | | | | | | | | | | |
| 179 | - | 100.7 | 17 | 0.50 | 0.0059 | 0.3 | 86.7 | 0 | 0.00 | 1.0 | 17 | 100.7 | 0.50 | 1.21 | 1.9 | 17 | 100.7 | 0.50 | 1.21 |
| 180 | 15 | 100.5 | 16 | 0.62 | 0.0071 | 16.8 | 200.8 | 2202 | 4.28 | 63.9 | 14 | 98.2 | 0.69 | 1.19 | 131.8 | 7 | 90.6 | 0.99 | 1.12 |
| 181 | 17 | 100.5 | 16 | 0.60 | 0.0069 | 17.0 | 201.0 | 2204 | 4.28 | 64.6 | 14 | 98.2 | 0.67 | 1.19 | 133.6 | 7 | 90.3 | 0.96 | 1.12 |
| 182 | 19 | 100.5 | 16 | 0.62 | 0.0069 | 16.9 | 200.9 | 2204 | 4.28 | 64.3 | 14 | 98.2 | 0.69 | 1.19 | 132.7 | 7 | 90.4 | 0.99 | 1.12 |
| 183 | 19 | 100.6 | 17 | 0.56 | 0.0066 | 16.6 | 200.9 | 2203 | 4.28 | 63.2 | 15 | 98.3 | 0.62 | 1.19 | 130.3 | 8 | 90.9 | 0.87 | 1.12 |
| 185 | 15 | 100.5 | 17 | 0.56 | 0.0066 | 17.2 | 200.9 | 2203 | 4.28 | 65.5 | 15 | 98.2 | 0.62 | 1.18 | 135.7 | 8 | 90.1 | 0.91 | 1.11 |
| 186 | - | 100.7 | 17 | 0.49 | 0.0059 | 0.2 | 0.1 | 0 | 0.00 | 0.8 | 17 | 100.7 | 0.49 | 1.21 | 1.6 | 17 | 100.7 | 0.49 | 1.21 |
| 187 | - | 100.7 | 18 | 0.40 | 0.0053 | | 86.9 | 0 | 0.00 | 0.0 | 18 | 100.7 | 0.40 | 1.20 | 0.0 | 18 | 100.7 | 0.40 | 1.20 |
| 188 | 19 | 100.5 | 19 | 0.44 | 0.0058 | 17.2 | 200.6 | 2202 | 4.28 | 66.1 | 16 | 98.1 | 0.49 | 1.18 | 137.0 | 9 | 89.9 | 0.72 | 1.11 |
| 189 | 21 | 100.5 | 19 | 0.42 | 0.0057 | 17.4 | 200.7 | 2204 | 4.28 | 66.9 | 16 | 98.0 | 0.48 | 1.18 | 138.9 | 9 | 89.6 | 0.70 | 1.10 |
| 190 | 23 | 100.5 | 19 | 0.43 | 0.0059 | 17.3 | 200.7 | 2204 | 4.27 | 66.6 | 17 | 98.1 | 0.48 | 1.17 | 138.2 | 10 | 89.7 | 0.71 | 1.10 |
| 191 | 25 | 100.5 | 18 | 0.43 | 0.0056 | 17.4 | 200.7 | 2204 | 4.28 | 66.8 | 16 | 98.1 | 0.48 | 1.18 | 138.7 | 9 | 89.6 | 0.71 | 1.10 |
| 192 | 27 | 100.5 | 19 | 0.41 | 0.0056 | 17.3 | 200.8 | 2205 | 4.28 | 66.5 | 16 | 98.1 | 0.46 | 1.18 | 137.9 | 9 | 89.8 | 0.68 | 1.10 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 193 | 29 | 100.5 | 18 | 0.41 | 0.0054 | 17.2 | 200.8 | 2204 | 4.28 | 65.8 | 16 | 98.1 | 0.46 | 1.18 | 136.2 | 9 | 90.0 | 0.67 | 1.11 |
| 196 | 31 | 100.5 | 18 | 0.44 | 0.0058 | 17.5 | 200.7 | 2203 | 4.28 | 67.1 | 16 | 98.0 | 0.50 | 1.18 | 139.3 | 9 | 89.5 | 0.74 | 1.10 |
| 197 | 33 | 100.5 | 18 | 0.43 | 0.0057 | 17.5 | 200.7 | 2204 | 4.28 | 67.2 | 16 | 98.0 | 0.48 | 1.18 | 139.7 | 9 | 89.5 | 0.72 | 1.10 |
| 198 | 35 | 100.5 | 19 | 0.42 | 0.0057 | 17.3 | 200.8 | 2204 | 4.28 | 66.3 | 16 | 98.1 | 0.48 | 1.18 | 137.6 | 9 | 89.8 | 0.70 | 1.10 |
| 199 | 37 | 100.5 | 19 | 0.45 | 0.0061 | 17.1 | 200.7 | 2204 | 4.28 | 65.7 | 17 | 98.1 | 0.50 | 1.18 | 136.1 | 10 | 90.0 | 0.73 | 1.10 |
| Baseline 0 Degrees - September 17, 2010 | | | | | | | | | | | | | | | | | | | |
| 200 | 15 | 100.5 | 19 | 0.42 | 0.0059 | 16.9 | 200.8 | 2205 | 4.28 | 65.1 | 17 | 98.2 | 0.47 | 1.17 | 134.7 | 10 | 90.2 | 0.67 | 1.10 |
| 201 | 17 | 100.5 | 19 | 0.43 | 0.0061 | 17.0 | 200.7 | 2204 | 4.28 | 65.4 | 17 | 98.1 | 0.48 | 1.17 | 135.2 | 10 | 90.2 | 0.69 | 1.10 |
| 202 | 19 | 100.5 | 19 | 0.44 | 0.0061 | 17.5 | 200.8 | 2204 | 4.28 | 67.2 | 17 | 98.0 | 0.49 | 1.17 | 139.6 | 10 | 89.5 | 0.73 | 1.10 |
| 203 | 21 | 100.5 | 20 | 0.45 | 0.0065 | 17.5 | 200.7 | 2204 | 4.28 | 67.3 | 17 | 98.0 | 0.51 | 1.17 | 140.0 | 10 | 89.5 | 0.75 | 1.10 |
| 204 | 23 | 100.5 | 20 | 0.41 | 0.0058 | 17.4 | 200.8 | 2205 | 4.28 | 66.8 | 17 | 98.0 | 0.46 | 1.17 | 138.7 | 10 | 89.7 | 0.67 | 1.10 |
| 205 | 25 | 100.5 | 20 | 0.42 | 0.0061 | 17.4 | 200.7 | 2204 | 4.27 | 66.9 | 18 | 98.0 | 0.47 | 1.17 | 138.8 | 10 | 89.6 | 0.69 | 1.10 |
| 206 | 27 | 100.5 | 20 | 0.42 | 0.0062 | 17.2 | 200.8 | 2204 | 4.28 | 66.4 | 18 | 98.0 | 0.47 | 1.17 | 137.8 | 11 | 89.8 | 0.68 | 1.10 |
| 207 | 29 | 100.5 | 20 | 0.40 | 0.0060 | 17.5 | 200.8 | 2201 | 4.28 | 67.6 | 18 | 98.0 | 0.45 | 1.17 | 140.6 | 11 | 89.4 | 0.67 | 1.09 |
| 208 | 31 | 100.5 | 20 | 0.44 | 0.0062 | 17.6 | 200.7 | 2203 | 4.28 | 67.8 | 17 | 97.9 | 0.49 | 1.17 | 141.2 | 10 | 89.3 | 0.73 | 1.10 |
| 209 | 35 | 100.5 | 19 | 0.43 | 0.0060 | 17.3 | 200.7 | 2204 | 4.28 | 66.7 | 17 | 98.0 | 0.48 | 1.17 | 138.5 | 10 | 89.7 | 0.70 | 1.10 |
| 210 | 37 | 100.5 | 20 | 0.45 | 0.0063 | 16.5 | 200.7 | 2204 | 4.28 | 63.3 | 18 | 98.3 | 0.49 | 1.17 | 130.4 | 11 | 90.9 | 0.69 | 1.11 |
| 211 | - | 100.7 | 20 | 0.43 | 0.0062 | | 1.2 | 0 | 0.00 | 0.0 | 20 | 100.7 | 0.43 | 1.19 | 0.0 | 20 | 100.7 | 0.43 | 1.19 |
| Low Serration 20 Degrees - September 21, 2010 | | | | | | | | | | | | | | | | | | | |
| 212 | - | 100.3 | 20 | 0.49 | 0.0071 | 0.3 | 86.5 | 0 | 0.00 | 1.0 | 20 | 100.3 | 0.49 | 1.19 | 1.9 | 20 | 100.3 | 0.49 | 1.19 |
| 213 | 15 | 100.0 | 18 | 0.69 | 0.0091 | 17.5 | 200.3 | 2200 | 4.27 | 67.3 | 16 | 97.6 | 0.78 | 1.17 | 139.8 | 9 | 89.1 | 1.16 | 1.10 |
| 214 | 17 | 100.0 | 17 | 0.72 | 0.0087 | 17.7 | 200.4 | 2202 | 4.27 | 67.9 | 15 | 97.5 | 0.81 | 1.17 | 141.2 | 7 | 88.8 | 1.22 | 1.10 |
| 215 | 19 | 100.0 | 17 | 0.68 | 0.0083 | 17.3 | 200.5 | 2203 | 4.27 | 66.5 | 15 | 97.5 | 0.77 | 1.17 | 138.1 | 7 | 89.2 | 1.13 | 1.10 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 216 | 21 | 99.9 | 17 | 0.71 | 0.0089 | 16.9 | 200.6 | 2205 | 4.27 | 65.1 | 15 | 97.6 | 0.79 | 1.17 | 134.5 | 8 | 89.7 | 1.15 | 1.10 |
| 217 | 23 | 99.9 | 17 | 0.66 | 0.0082 | 17.6 | 200.5 | 2202 | 4.27 | 67.7 | 15 | 97.4 | 0.75 | 1.17 | 140.8 | 7 | 88.8 | 1.12 | 1.10 |
| 218 | 25 | 99.9 | 18 | 0.64 | 0.0082 | 17.1 | 200.6 | 2203 | 4.27 | 65.8 | 16 | 97.5 | 0.72 | 1.17 | 136.3 | 8 | 89.4 | 1.05 | 1.10 |
| 219 | 27 | 99.9 | 18 | 0.65 | 0.0083 | 17.1 | 200.6 | 2203 | 4.27 | 65.7 | 15 | 97.5 | 0.73 | 1.17 | 136.0 | 8 | 89.5 | 1.06 | 1.10 |
| 220 | 29 | 99.8 | 18 | 0.60 | 0.0076 | 17.3 | 200.6 | 2203 | 4.27 | 66.7 | 15 | 97.4 | 0.68 | 1.17 | 138.4 | 8 | 89.1 | 1.00 | 1.10 |
| 221 | 31 | 99.8 | 18 | 0.58 | 0.0076 | 17.8 | 200.7 | 2204 | 4.27 | 68.7 | 16 | 97.3 | 0.65 | 1.17 | 143.4 | 8 | 88.3 | 1.00 | 1.09 |
| 222 | 33 | 99.8 | 18 | 0.59 | 0.0077 | 17.2 | 200.6 | 2204 | 4.27 | 66.4 | 16 | 97.4 | 0.66 | 1.17 | 137.7 | 9 | 89.2 | 0.97 | 1.10 |
| 223 | 35 | 99.8 | 18 | 0.59 | 0.0079 | 17.2 | 200.6 | 2203 | 4.27 | 66.3 | 16 | 97.4 | 0.66 | 1.17 | 137.6 | 9 | 89.2 | 0.96 | 1.10 |
| 224 | 37 | 99.8 | 19 | 0.57 | 0.0078 | 16.9 | 200.6 | 2203 | 4.27 | 65.5 | 17 | 97.4 | 0.64 | 1.17 | 135.7 | 10 | 89.5 | 0.92 | 1.10 |
| 225 | - | 99.9 | 21 | 0.50 | 0.0076 | 0.3 | 0.1 | 0 | 0.00 | 1.2 | 21 | 99.9 | 0.50 | 1.18 | 2.4 | 21 | 99.9 | 0.50 | 1.18 |
| Low Serration 0 Degrees - September 22, 2010 | | | | | | | | | | | | | | | | | | | |
| 227 | - | 100.0 | 22 | 0.71 | 0.0121 | | 86.5 | -1 | 0.00 | 0.0 | 22 | 100.0 | 0.71 | 1.17 | 0.0 | 22 | 100.0 | 0.71 | 1.17 |
| 228 | 15 | 99.8 | 22 | 0.79 | 0.0131 | 16.5 | 200.2 | 2200 | 4.27 | 64.7 | 20 | 97.5 | 0.87 | 1.15 | 133.3 | 13 | 89.9 | 1.23 | 1.09 |
| 230 | 17 | 99.8 | 22 | 0.75 | 0.0128 | 16.7 | 201.0 | 2211 | 4.28 | 65.6 | 20 | 97.5 | 0.83 | 1.15 | 135.5 | 13 | 89.6 | 1.19 | 1.08 |
| 231 | 19 | 99.8 | 22 | 0.74 | 0.0125 | 17.0 | 200.6 | 2204 | 4.27 | 66.7 | 20 | 97.4 | 0.82 | 1.15 | 138.2 | 13 | 89.2 | 1.20 | 1.08 |
| 232 | 21 | 99.8 | 22 | 0.77 | 0.0130 | 16.9 | 200.3 | 2201 | 4.27 | 66.2 | 20 | 97.4 | 0.86 | 1.15 | 136.8 | 13 | 89.4 | 1.24 | 1.08 |
| 233 | 23 | 99.8 | 22 | 0.71 | 0.0122 | 17.0 | 200.6 | 2204 | 4.27 | 66.6 | 20 | 97.4 | 0.79 | 1.15 | 137.9 | 13 | 89.3 | 1.14 | 1.08 |
| 234 | 25 | 99.8 | 22 | 0.71 | 0.0122 | 17.1 | 200.6 | 2204 | 4.27 | 67.2 | 20 | 97.4 | 0.80 | 1.15 | 139.4 | 13 | 89.1 | 1.16 | 1.08 |
| 235 | 27 | 99.8 | 22 | 0.70 | 0.0119 | 17.2 | 200.6 | 2205 | 4.27 | 67.5 | 20 | 97.4 | 0.78 | 1.15 | 140.0 | 13 | 89.0 | 1.14 | 1.08 |
| 236 | 29 | 99.8 | 22 | 0.71 | 0.0122 | 17.3 | 200.7 | 2206 | 4.27 | 67.9 | 20 | 97.3 | 0.80 | 1.15 | 141.0 | 13 | 88.8 | 1.18 | 1.08 |
| 237 | 31 | 99.8 | 22 | 0.68 | 0.0117 | 17.2 | 200.4 | 2202 | 4.27 | 67.6 | 20 | 97.4 | 0.76 | 1.15 | 140.3 | 13 | 88.9 | 1.12 | 1.08 |
| 238 | 33 | 99.8 | 22 | 0.69 | 0.0117 | 17.5 | 200.6 | 2205 | 4.27 | 68.8 | 20 | 97.3 | 0.77 | 1.15 | 143.3 | 12 | 88.5 | 1.16 | 1.07 |
| 239 | 35 | 99.8 | 22 | 0.68 | 0.0116 | 17.3 | 200.6 | 2205 | 4.27 | 68.0 | 20 | 97.3 | 0.76 | 1.15 | 141.3 | 12 | 88.8 | 1.12 | 1.08 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 240 | 37 | 99.9 | 22 | 0.67 | 0.0115 | 15.7 | 200.6 | 2205 | 4.27 | 61.6 | 21 | 97.8 | 0.73 | 1.15 | 126.3 | 15 | 91.0 | 0.99 | 1.09 |
| 241 | - | 100.0 | 22 | 0.67 | 0.0113 | 0.3 | 0.1 | -1 | 0.00 | 1.2 | 22 | 100.0 | 0.67 | 1.17 | 2.2 | 22 | 100.0 | 0.67 | 1.17 |
| Hydrophobic 20 Degrees - September 22, 2010 | | | | | | | | | | | | | | | | | | | |
| 242 | - | 100.0 | 22 | 0.45 | 0.0074 | 5.6 | 86.6 | -1 | 0.00 | 21.3 | 21 | 99.8 | 0.46 | 1.17 | 41.7 | 21 | 99.0 | 0.47 | 1.17 |
| 243 | 15 | 99.8 | 22 | 0.49 | 0.0083 | 17.5 | 200.3 | 2200 | 4.27 | 68.4 | 20 | 97.3 | 0.55 | 1.15 | 142.4 | 12 | 88.6 | 0.82 | 1.08 |
| 244 | 17 | 99.8 | 22 | 0.53 | 0.0086 | 17.5 | 200.2 | 2199 | 4.27 | 68.4 | 19 | 97.3 | 0.59 | 1.15 | 142.4 | 12 | 88.6 | 0.88 | 1.08 |
| 245 | 19 | 99.9 | 22 | 0.49 | 0.0082 | 17.6 | 200.5 | 2204 | 4.27 | 68.8 | 20 | 97.3 | 0.55 | 1.15 | 143.4 | 12 | 88.5 | 0.83 | 1.08 |
| 246 | 21 | 99.9 | 22 | 0.51 | 0.0084 | 17.4 | 200.3 | 2201 | 4.27 | 67.9 | 19 | 97.4 | 0.58 | 1.15 | 141.3 | 12 | 88.8 | 0.85 | 1.08 |
| 247 | 23 | 99.9 | 22 | 0.53 | 0.0086 | 16.8 | 200.5 | 2204 | 4.27 | 65.5 | 19 | 97.6 | 0.59 | 1.16 | 135.5 | 12 | 89.7 | 0.85 | 1.09 |
| 248 | 25 | 99.9 | 21 | 0.52 | 0.0082 | 17.3 | 200.1 | 2199 | 4.27 | 67.4 | 19 | 97.4 | 0.58 | 1.16 | 140.0 | 12 | 89.0 | 0.85 | 1.08 |
| 249 | 27 | 99.9 | 22 | 0.50 | 0.0081 | 17.2 | 200.4 | 2202 | 4.27 | 67.1 | 19 | 97.5 | 0.56 | 1.16 | 139.4 | 12 | 89.1 | 0.81 | 1.08 |
| 250 | 29 | 99.9 | 21 | 0.50 | 0.0081 | 17.4 | 200.5 | 2203 | 4.27 | 67.7 | 19 | 97.4 | 0.57 | 1.16 | 140.8 | 12 | 88.9 | 0.84 | 1.08 |
| 251 | 31 | 99.9 | 21 | 0.50 | 0.0080 | 17.3 | 200.4 | 2201 | 4.27 | 67.4 | 19 | 97.4 | 0.57 | 1.16 | 140.0 | 11 | 89.0 | 0.83 | 1.08 |
| 252 | 33 | 99.9 | 21 | 0.50 | 0.0080 | 17.6 | 200.5 | 2202 | 4.27 | 68.8 | 19 | 97.3 | 0.56 | 1.16 | 143.4 | 11 | 88.5 | 0.84 | 1.08 |
| 253 | 35 | 99.9 | 21 | 0.53 | 0.0084 | 17.5 | 200.4 | 2203 | 4.27 | 68.1 | 19 | 97.4 | 0.60 | 1.16 | 141.7 | 11 | 88.8 | 0.89 | 1.08 |
| 254 | 37 | 99.9 | 21 | 0.51 | 0.0082 | 16.9 | 200.4 | 2202 | 4.27 | 65.8 | 19 | 97.6 | 0.57 | 1.16 | 136.2 | 12 | 89.6 | 0.83 | 1.09 |
| 255 | - | 100.1 | 22 | 0.48 | 0.0080 | 0.2 | 0.0 | -1 | 0.00 | 0.6 | 22 | 100.1 | 0.48 | 1.18 | 1.1 | 22 | 100.1 | 0.48 | 1.18 |
| Hydrophobic 0 Degrees - September 23, 2010 | | | | | | | | | | | | | | | | | | | |
| 259 | - | 101.2 | 19 | 0.37 | 0.0050 | 0.3 | 86.6 | 0 | 0.00 | 1.0 | 19 | 101.2 | 0.37 | 1.20 | 2.0 | 19 | 101.2 | 0.37 | 1.20 |
| 260 | 15 | 101.0 | 18 | 0.55 | 0.0069 | 17.4 | 200.3 | 2200 | 4.27 | 66.3 | 15 | 98.5 | 0.62 | 1.18 | 137.6 | 8 | 90.2 | 0.91 | 1.11 |
| 261 | 17 | 101.0 | 18 | 0.51 | 0.0065 | 17.4 | 200.4 | 2200 | 4.27 | 66.3 | 16 | 98.5 | 0.57 | 1.18 | 137.6 | 9 | 90.2 | 0.84 | 1.11 |
| 262 | 19 | 101.0 | 18 | 0.51 | 0.0065 | 17.4 | 200.4 | 2200 | 4.27 | 66.3 | 16 | 98.5 | 0.57 | 1.18 | 137.6 | 8 | 90.2 | 0.85 | 1.11 |
| 263 | 21 | 101.0 | 18 | 0.50 | 0.0062 | 17.4 | 200.7 | 2204 | 4.28 | 66.2 | 15 | 98.5 | 0.56 | 1.19 | 137.3 | 8 | 90.2 | 0.82 | 1.11 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|--------------|--------------|-----------|------|--------|-----------------------|------------------------|-------------------------------|-------------------|------------|-----------|------------|------|---------------------------|------------|-----------|------------|------|---------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 264 | 23 | 101.0 | 17 | 0.50 | 0.0062 | 17.7 | 200.7 | 2203 | 4.28 | 67.2 | 15 | 98.5 | 0.56 | 1.18 | 139.7 | 8 | 89.9 | 0.83 | 1.11 |
| 265 | 25 | 101.0 | 17 | 0.50 | 0.0060 | 17.4 | 200.7 | 2203 | 4.28 | 66.1 | 15 | 98.6 | 0.56 | 1.19 | 137.0 | 8 | 90.3 | 0.83 | 1.12 |
| 267 | 27 | 100.9 | 17 | 0.51 | 0.0061 | 17.5 | 200.5 | 2200 | 4.27 | 66.2 | 15 | 98.5 | 0.57 | 1.19 | 137.4 | 8 | 90.2 | 0.84 | 1.11 |
| 268 | 29 | 100.9 | 17 | 0.50 | 0.0060 | 17.3 | 200.8 | 2205 | 4.28 | 65.6 | 15 | 98.6 | 0.56 | 1.19 | 135.8 | 8 | 90.4 | 0.82 | 1.12 |
| 269 | 31 | 100.9 | 17 | 0.52 | 0.0063 | 17.4 | 200.8 | 2204 | 4.28 | 65.9 | 15 | 98.5 | 0.59 | 1.19 | 136.6 | 8 | 90.3 | 0.86 | 1.12 |
| 270 | 33 | 100.9 | 17 | 0.52 | 0.0062 | 17.3 | 200.8 | 2204 | 4.28 | 65.5 | 15 | 98.5 | 0.58 | 1.19 | 135.7 | 8 | 90.4 | 0.85 | 1.12 |
| 271 | 35 | 100.9 | 17 | 0.48 | 0.0057 | 17.3 | 200.9 | 2205 | 4.28 | 65.5 | 14 | 98.5 | 0.54 | 1.19 | 135.6 | 7 | 90.4 | 0.79 | 1.12 |
| 272 | 37 | 100.9 | 17 | 0.50 | 0.0060 | 16.5 | 200.9 | 2205 | 4.28 | 62.5 | 15 | 98.8 | 0.55 | 1.19 | 128.7 | 9 | 91.4 | 0.77 | 1.13 |
| 273 | - | 101.1 | 17 | 0.49 | 0.0059 | 0.3 | 0.1 | 0 | 0.00 | 1.0 | 17 | 101.1 | 0.49 | 1.21 | 1.9 | 17 | 101.1 | 0.49 | 1.21 |
| Hydrophilic 20 Degrees - September 27, 2010 | | | | | | | | | | | | | | | | | | | |
| 274 | - | 100.8 | 18 | 0.58 | 0.0074 | 0.2 | 86.5 | -1 | 0.00 | 0.8 | 18 | 100.8 | 0.58 | 1.20 | 1.6 | 18 | 100.8 | 0.58 | 1.20 |
| 278 | 15 | 100.6 | 17 | 0.85 | 0.0103 | 17.1 | 200.1 | 2198 | 4.27 | 65.3 | 15 | 98.2 | 0.95 | 1.18 | 134.9 | 8 | 90.2 | 1.38 | 1.11 |
| 279 | 17 | 100.5 | 17 | 0.82 | 0.0101 | 17.3 | 200.1 | 2199 | 4.27 | 66.2 | 15 | 98.1 | 0.92 | 1.18 | 137.1 | 8 | 89.9 | 1.36 | 1.11 |
| 280 | 19 | 100.5 | 17 | 0.83 | 0.0101 | 17.4 | 200.7 | 2206 | 4.27 | 66.5 | 15 | 98.1 | 0.93 | 1.18 | 137.9 | 8 | 89.7 | 1.38 | 1.11 |
| 282 | 21 | 100.5 | 16 | 0.84 | 0.0098 | 17.5 | 200.5 | 2203 | 4.27 | 66.8 | 14 | 98.0 | 0.95 | 1.18 | 138.6 | 7 | 89.6 | 1.41 | 1.11 |
| 283 | 23 | 100.5 | 17 | 0.80 | 0.0096 | 17.4 | 200.9 | 2207 | 4.28 | 66.4 | 15 | 98.1 | 0.89 | 1.18 | 137.6 | 7 | 89.8 | 1.32 | 1.11 |
| 285 | 25 | 100.5 | 16 | 0.85 | 0.0098 | 17.0 | 200.5 | 2203 | 4.27 | 64.7 | 14 | 98.2 | 0.94 | 1.18 | 133.6 | 7 | 90.3 | 1.36 | 1.12 |
| 286 | 27 | 100.5 | 16 | 0.82 | 0.0094 | 17.2 | 200.6 | 2203 | 4.27 | 65.5 | 14 | 98.1 | 0.92 | 1.18 | 135.3 | 7 | 90.1 | 1.34 | 1.12 |
| 287 | 29 | 100.5 | 16 | 0.81 | 0.0092 | 17.2 | 200.5 | 2201 | 4.27 | 65.5 | 14 | 98.1 | 0.90 | 1.18 | 135.4 | 7 | 90.0 | 1.32 | 1.12 |
| 288 | 31 | 99.0 | 16 | 0.83 | 0.0096 | 17.2 | 200.5 | 2202 | 4.27 | 66.3 | 14 | 96.6 | 0.94 | 1.17 | 137.4 | 7 | 88.4 | 1.38 | 1.10 |
| 289 | 33 | 100.5 | 16 | 0.81 | 0.0092 | 17.0 | 200.2 | 2196 | 4.27 | 64.5 | 14 | 98.2 | 0.90 | 1.19 | 133.2 | 7 | 90.3 | 1.30 | 1.12 |
| 290 | 35 | 100.4 | 16 | 0.83 | 0.0095 | 17.2 | 200.2 | 2196 | 4.27 | 65.5 | 14 | 98.1 | 0.93 | 1.18 | 135.4 | 7 | 90.0 | 1.36 | 1.11 |
| 291 | 37 | 100.4 | 16 | 0.81 | 0.0095 | 16.7 | 200.2 | 2196 | 4.27 | 63.8 | 14 | 98.2 | 0.90 | 1.18 | 131.4 | 8 | 90.6 | 1.28 | 1.12 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|--------------|--------------|-----------|------|--------|-----------------------|------------------------|-------------------------------|-------------------|------------|-----------|------------|------|--------------------------------|------------|-----------|------------|------|--------------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 292 | - | 100.6 | 16 | 0.74 | 0.0085 | 0.3 | 1.7 | 0 | 0.00 | 1.1 | 16 | 100.6 | 0.74 | 1.20 | 2.2 | 16 | 100.6 | 0.74 | 1.20 |
| Hydrophilic 0 Degrees - September 27, 2010 | | | | | | | | | | | | | | | | | | | |
| 293 | - | 100.5 | 17 | 0.66 | 0.0082 | 0.1 | 86.5 | 0 | 0.00 | 0.5 | 17 | 100.5 | 0.66 | 1.20 | 0.9 | 17 | 100.5 | 0.66 | 1.20 |
| 294 | 15 | 100.2 | 18 | 0.78 | 0.0101 | 17.0 | 200.3 | 2199 | 4.27 | 65.3 | 16 | 97.9 | 0.87 | 1.17 | 134.9 | 9 | 90.0 | 1.26 | 1.11 |
| 295 | 17 | 100.2 | 18 | 0.82 | 0.0105 | 17.1 | 200.3 | 2198 | 4.27 | 65.7 | 16 | 97.8 | 0.92 | 1.17 | 135.9 | 9 | 89.8 | 1.34 | 1.11 |
| 296 | 19 | 100.2 | 18 | 0.79 | 0.0101 | 17.2 | 200.3 | 2199 | 4.27 | 66.2 | 15 | 97.8 | 0.89 | 1.17 | 137.2 | 8 | 89.6 | 1.31 | 1.10 |
| 297 | 21 | 100.2 | 18 | 0.76 | 0.0098 | 17.4 | 200.2 | 2196 | 4.27 | 66.8 | 16 | 97.7 | 0.85 | 1.17 | 138.6 | 8 | 89.4 | 1.26 | 1.10 |
| 298 | 23 | 100.2 | 17 | 0.80 | 0.0099 | 17.8 | 200.1 | 2195 | 4.27 | 68.3 | 15 | 97.6 | 0.91 | 1.17 | 142.2 | 7 | 88.8 | 1.38 | 1.10 |
| 299 | 25 | 100.2 | 17 | 0.84 | 0.0105 | 17.4 | 200.3 | 2200 | 4.27 | 67.0 | 15 | 97.7 | 0.95 | 1.17 | 138.8 | 8 | 89.3 | 1.41 | 1.10 |
| 300 | 27 | 100.1 | 17 | 0.80 | 0.0100 | 17.3 | 200.6 | 2203 | 4.27 | 66.5 | 15 | 97.7 | 0.90 | 1.17 | 137.8 | 8 | 89.4 | 1.33 | 1.10 |
| 301 | 31 | 100.1 | 17 | 0.80 | 0.0101 | 17.5 | 200.6 | 2203 | 4.27 | 67.4 | 15 | 97.7 | 0.90 | 1.17 | 139.9 | 8 | 89.1 | 1.35 | 1.10 |
| 302 | 29 | 100.1 | 18 | 0.82 | 0.0104 | 17.6 | 200.5 | 2202 | 4.27 | 67.6 | 15 | 97.6 | 0.92 | 1.17 | 140.5 | 8 | 89.0 | 1.38 | 1.10 |
| 303 | 33 | 100.2 | 17 | 0.82 | 0.0103 | 17.3 | 200.7 | 2204 | 4.27 | 66.5 | 15 | 97.7 | 0.91 | 1.17 | 137.8 | 8 | 89.4 | 1.35 | 1.10 |
| 304 | 35 | 100.1 | 17 | 0.85 | 0.0106 | 16.9 | 199.0 | 2178 | 4.26 | 64.7 | 15 | 97.9 | 0.95 | 1.17 | 133.4 | 8 | 90.1 | 1.37 | 1.11 |
| 305 | 37 | 100.1 | 17 | 0.84 | 0.0105 | 16.0 | 200.2 | 2197 | 4.27 | 61.4 | 16 | 98.1 | 0.92 | 1.18 | 125.7 | 10 | 91.2 | 1.27 | 1.12 |
| 306 | - | 100.3 | 17 | 0.78 | 0.0096 | 0.1 | -59.8 | 0 | 0.00 | 0.5 | 17 | 100.3 | 0.78 | 1.20 | 1.1 | 17 | 100.3 | 0.78 | 1.20 |
| Baseline 20 Degrees -September 29, 2010 | | | | | | | | | | | | | | | | | | | |
| 307 | - | 99.9 | 19 | 0.53 | 0.0074 | 0.3 | 86.6 | 0 | 0.00 | 1.1 | 19 | 99.9 | 0.53 | 1.18 | 2.2 | 19 | 99.9 | 0.53 | 1.18 |
| 308 | 15 | 99.7 | 18 | 0.70 | 0.0092 | 17.0 | 200.4 | 2201 | 4.27 | 65.6 | 16 | 97.3 | 0.79 | 1.17 | 135.8 | 9 | 89.3 | 1.14 | 1.10 |
| 309 | 17 | 99.7 | 18 | 0.67 | 0.0088 | 17.2 | 200.6 | 2204 | 4.27 | 66.5 | 16 | 97.3 | 0.76 | 1.17 | 137.8 | 9 | 89.0 | 1.11 | 1.10 |
| 310 | 19 | 99.7 | 18 | 0.69 | 0.0089 | 17.5 | 200.3 | 2199 | 4.27 | 67.6 | 16 | 97.2 | 0.77 | 1.17 | 140.4 | 8 | 88.6 | 1.16 | 1.09 |
| 311 | 21 | 99.7 | 18 | 0.71 | 0.0092 | 17.1 | 201.0 | 2198 | 4.29 | 66.2 | 16 | 97.3 | 0.79 | 1.17 | 137.1 | 9 | 89.1 | 1.16 | 1.10 |
| 312 | 23 | 99.7 | 18 | 0.69 | 0.0088 | 16.8 | 201.4 | 2202 | 4.29 | 64.8 | 16 | 97.4 | 0.77 | 1.17 | 133.9 | 9 | 89.6 | 1.10 | 1.10 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 314 | 25 | 99.7 | 18 | 0.70 | 0.0090 | 17.0 | 201.1 | 2199 | 4.29 | 65.8 | 16 | 97.3 | 0.79 | 1.17 | 136.2 | 9 | 89.2 | 1.15 | 1.10 |
| 315 | 27 | 99.7 | 17 | 0.69 | 0.0087 | 17.2 | 201.4 | 2203 | 4.29 | 66.3 | 15 | 97.3 | 0.77 | 1.17 | 137.5 | 8 | 89.0 | 1.14 | 1.10 |
| 317 | 27 | 99.7 | 17 | 0.73 | 0.0090 | 16.9 | 201.3 | 2202 | 4.29 | 65.1 | 15 | 97.4 | 0.82 | 1.17 | 134.5 | 8 | 89.5 | 1.19 | 1.10 |
| 318 | 29 | 99.7 | 17 | 0.71 | 0.0088 | 17.1 | 201.1 | 2199 | 4.29 | 66.0 | 15 | 97.3 | 0.80 | 1.17 | 136.6 | 8 | 89.2 | 1.17 | 1.10 |
| 319 | 31 | 97.2 | 17 | 0.69 | 0.0088 | 16.9 | 201.3 | 2201 | 4.29 | 66.7 | 15 | 94.8 | 0.77 | 1.14 | 138.5 | 8 | 86.7 | 1.15 | 1.07 |
| 320 | 33 | 99.7 | 17 | 0.68 | 0.0083 | 17.3 | 201.3 | 2201 | 4.29 | 66.6 | 15 | 97.3 | 0.77 | 1.17 | 138.2 | 7 | 88.9 | 1.14 | 1.10 |
| 321 | 35 | 99.7 | 18 | 0.69 | 0.0088 | 17.3 | 184.9 | 1857 | 4.29 | 66.7 | 15 | 97.3 | 0.78 | 1.17 | 138.5 | 8 | 88.9 | 1.15 | 1.10 |
| 322 | 37 | 99.7 | 18 | 0.68 | 0.0087 | 16.9 | 201.0 | 2197 | 4.29 | 65.1 | 15 | 97.4 | 0.76 | 1.17 | 134.7 | 9 | 89.5 | 1.10 | 1.10 |
| 323 | - | 100.0 | 17 | 0.66 | 0.0082 | 0.2 | 0.1 | 0 | 0.00 | 0.6 | 17 | 99.9 | 0.66 | 1.19 | 1.2 | 17 | 99.9 | 0.66 | 1.19 |
| Baseline 0 Degrees - September 30, 2010 | | | | | | | | | | | | | | | | | | | |
| 324 | - | 99.8 | 19 | 0.66 | 0.0094 | | 86.4 | -1 | 0.00 | 0.0 | 19 | 99.8 | 0.66 | 1.18 | 0.0 | 19 | 99.8 | 0.66 | 1.18 |
| 325 | 15 | 99.6 | 18 | 0.85 | 0.0114 | 16.9 | 200.9 | 2198 | 4.28 | 65.4 | 16 | 97.3 | 0.95 | 1.16 | 135.0 | 9 | 89.4 | 1.37 | 1.10 |
| 326 | 17 | 99.6 | 19 | 0.85 | 0.0119 | 17.1 | 200.7 | 2196 | 4.28 | 66.6 | 17 | 97.2 | 0.95 | 1.16 | 137.8 | 10 | 89.0 | 1.40 | 1.09 |
| 327 | 19 | 99.6 | 19 | 0.84 | 0.0118 | 17.2 | 200.8 | 2198 | 4.28 | 67.0 | 17 | 97.1 | 0.95 | 1.16 | 138.7 | 9 | 88.8 | 1.40 | 1.09 |
| 328 | 21 | 99.5 | 18 | 0.90 | 0.0120 | 17.4 | 201.1 | 2202 | 4.29 | 67.5 | 16 | 97.1 | 1.01 | 1.16 | 139.9 | 9 | 88.6 | 1.51 | 1.09 |
| 329 | - | 99.7 | 18 | 0.81 | 0.0105 | 0.4 | 1.9 | 0 | 0.00 | 1.3 | 18 | 99.7 | 0.81 | 1.19 | 2.6 | 18 | 99.7 | 0.81 | 1.19 |
| 330 | - | 99.7 | 18 | 0.75 | 0.0100 | | 86.7 | 0 | 0.00 | 0.0 | 18 | 99.7 | 0.75 | 1.18 | 0.0 | 18 | 99.7 | 0.75 | 1.18 |
| 331 | 23 | 99.4 | 18 | 0.84 | 0.0113 | 17.5 | 201.1 | 2201 | 4.29 | 68.2 | 16 | 96.9 | 0.95 | 1.16 | 141.8 | 8 | 88.2 | 1.43 | 1.09 |
| 332 | 25 | 99.4 | 18 | 0.86 | 0.0115 | 17.5 | 201.2 | 2201 | 4.29 | 68.1 | 16 | 96.9 | 0.97 | 1.16 | 141.5 | 8 | 88.3 | 1.46 | 1.09 |
| 333 | 27 | 99.4 | 18 | 0.89 | 0.0116 | 17.3 | 200.9 | 2198 | 4.29 | 67.0 | 16 | 97.0 | 1.00 | 1.16 | 138.7 | 8 | 88.7 | 1.48 | 1.09 |
| 334 | 29 | 99.4 | 18 | 0.89 | 0.0119 | 17.3 | 201.0 | 2199 | 4.29 | 67.3 | 16 | 97.0 | 1.00 | 1.16 | 139.5 | 9 | 88.6 | 1.48 | 1.09 |
| 335 | 31 | 99.4 | 18 | 0.89 | 0.0118 | 17.3 | 201.3 | 2203 | 4.29 | 67.3 | 16 | 96.9 | 1.00 | 1.16 | 139.6 | 9 | 88.5 | 1.48 | 1.09 |
| 337 | 33 | 99.4 | 18 | 0.93 | 0.0123 | 17.6 | 201.1 | 2199 | 4.29 | 68.5 | 16 | 96.9 | 1.05 | 1.16 | 142.3 | 8 | 88.1 | 1.59 | 1.09 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 338 | 35 | 99.4 | 18 | 0.89 | 0.0119 | 17.5 | 201.3 | 2201 | 4.29 | 68.0 | 16 | 96.9 | 1.00 | 1.16 | 141.2 | 8 | 88.3 | 1.51 | 1.09 |
| 339 | 37 | 99.4 | 18 | 0.87 | 0.0114 | 15.7 | 201.4 | 2203 | 4.29 | 60.9 | 16 | 97.4 | 0.96 | 1.16 | 124.7 | 10 | 90.6 | 1.31 | 1.11 |
| 340 | - | 99.5 | 18 | 0.84 | 0.0109 | | 0.1 | 0 | 0.00 | 0.0 | 18 | 99.5 | 0.84 | 1.18 | 0.0 | 18 | 99.5 | 0.84 | 1.18 |
| High Serration 20 Degrees - October 1, 2010 | | | | | | | | | | | | | | | | | | | |
| 341 | - | 99.8 | 19 | 0.55 | 0.0075 | | 89.1 | -1 | 0.00 | 0.0 | 19 | 99.8 | 0.55 | 1.19 | 0.0 | 19 | 99.8 | 0.55 | 1.19 |
| 342 | 15 | 99.6 | 18 | 0.71 | 0.0093 | 17.2 | 200.8 | 2196 | 4.28 | 66.5 | 16 | 97.2 | 0.80 | 1.16 | 137.9 | 9 | 88.9 | 1.17 | 1.09 |
| 343 | 17 | 99.6 | 18 | 0.69 | 0.0090 | 17.2 | 201.2 | 2202 | 4.29 | 66.5 | 16 | 97.2 | 0.77 | 1.17 | 137.9 | 8 | 88.9 | 1.14 | 1.09 |
| 344 | 19 | 99.6 | 18 | 0.64 | 0.0084 | 17.6 | 201.8 | 2210 | 4.29 | 68.0 | 16 | 97.0 | 0.72 | 1.16 | 141.6 | 8 | 88.4 | 1.08 | 1.09 |
| 345 | 21 | 99.6 | 18 | 0.64 | 0.0082 | 17.4 | 201.3 | 2202 | 4.29 | 67.4 | 15 | 97.1 | 0.72 | 1.17 | 140.1 | 8 | 88.6 | 1.08 | 1.09 |
| 346 | 23 | 99.5 | 18 | 0.64 | 0.0083 | 17.5 | 201.2 | 2201 | 4.29 | 67.7 | 16 | 97.0 | 0.72 | 1.16 | 140.9 | 8 | 88.4 | 1.07 | 1.09 |
| 347 | 25 | 99.6 | 18 | 0.66 | 0.0087 | 17.5 | 201.2 | 2202 | 4.29 | 67.9 | 16 | 97.0 | 0.75 | 1.16 | 141.3 | 8 | 88.4 | 1.12 | 1.09 |
| 348 | 27 | 99.5 | 17 | 0.65 | 0.0082 | 16.9 | 201.4 | 2205 | 4.29 | 65.4 | 15 | 97.2 | 0.73 | 1.17 | 135.2 | 8 | 89.3 | 1.06 | 1.10 |
| 349 | 29 | 99.6 | 17 | 0.63 | 0.0079 | 16.8 | 201.5 | 2205 | 4.29 | 65.0 | 15 | 97.3 | 0.70 | 1.17 | 134.3 | 9 | 89.4 | 1.01 | 1.10 |
| 350 | 31 | 99.5 | 17 | 0.63 | 0.0079 | 17.3 | 201.3 | 2202 | 4.29 | 66.7 | 15 | 97.1 | 0.70 | 1.17 | 138.4 | 8 | 88.8 | 1.04 | 1.10 |
| 352 | 33 | 99.5 | 17 | 0.66 | 0.0081 | 17.1 | 201.5 | 2205 | 4.29 | 65.9 | 15 | 97.2 | 0.74 | 1.17 | 136.6 | 8 | 89.1 | 1.08 | 1.10 |
| 353 | 35 | 99.6 | 18 | 0.63 | 0.0081 | 16.7 | 201.6 | 2207 | 4.29 | 64.6 | 16 | 97.3 | 0.70 | 1.17 | 133.6 | 9 | 89.5 | 1.01 | 1.10 |
| 354 | 37 | 99.6 | 18 | 0.62 | 0.0079 | 17.1 | 201.3 | 2203 | 4.29 | 66.1 | 15 | 97.2 | 0.70 | 1.17 | 137.1 | 8 | 89.0 | 1.02 | 1.10 |
| 355 | - | 99.8 | 18 | 0.59 | 0.0074 | 0.5 | 0.1 | 0 | 0.00 | 1.8 | 18 | 99.8 | 0.59 | 1.19 | 3.6 | 18 | 99.8 | 0.59 | 1.19 |
| High Serration 0 Degrees - October 1, 2010 | | | | | | | | | | | | | | | | | | | |
| 356 | - | 99.8 | 18 | 0.51 | 0.0067 | | 86.8 | -1 | 0.00 | 0.0 | 18 | 99.8 | 0.51 | 1.19 | 0.0 | 18 | 99.8 | 0.51 | 1.19 |
| 357 | 15 | 99.6 | 19 | 0.56 | 0.0077 | 17.0 | 201.1 | 2202 | 4.29 | 65.8 | 17 | 97.2 | 0.62 | 1.16 | 136.3 | 10 | 89.2 | 0.90 | 1.09 |
| 358 | 17 | 99.6 | 18 | 0.55 | 0.0074 | 17.4 | 201.1 | 2201 | 4.29 | 67.2 | 16 | 97.1 | 0.62 | 1.16 | 139.7 | 9 | 88.7 | 0.92 | 1.09 |
| 359 | 19 | 99.6 | 19 | 0.55 | 0.0077 | 17.3 | 200.9 | 2198 | 4.28 | 67.2 | 17 | 97.1 | 0.62 | 1.16 | 139.7 | 9 | 88.7 | 0.91 | 1.09 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 360 | 21 | 99.6 | 18 | 0.53 | 0.0071 | 17.2 | 200.8 | 2199 | 4.28 | 66.4 | 16 | 97.2 | 0.60 | 1.17 | 137.7 | 9 | 89.0 | 0.88 | 1.09 |
| 361 | 23 | 99.6 | 19 | 0.51 | 0.0070 | 17.7 | 201.1 | 2202 | 4.29 | 68.9 | 17 | 97.0 | 0.57 | 1.16 | 143.7 | 9 | 88.1 | 0.87 | 1.08 |
| 362 | 25 | 99.6 | 18 | 0.51 | 0.0068 | 17.5 | 201.1 | 2202 | 4.29 | 67.9 | 16 | 97.1 | 0.58 | 1.16 | 141.3 | 8 | 88.4 | 0.87 | 1.09 |
| 363 | 27 | 99.6 | 18 | 0.52 | 0.0067 | 17.5 | 201.1 | 2202 | 4.28 | 67.8 | 16 | 97.1 | 0.58 | 1.17 | 141.0 | 8 | 88.5 | 0.87 | 1.09 |
| 364 | 29 | 99.6 | 19 | 0.50 | 0.0068 | 17.3 | 201.2 | 2203 | 4.29 | 67.0 | 16 | 97.2 | 0.57 | 1.16 | 139.1 | 9 | 88.8 | 0.84 | 1.09 |
| 365 | 31 | 99.6 | 18 | 0.52 | 0.0068 | 17.3 | 201.2 | 2204 | 4.28 | 66.7 | 16 | 97.2 | 0.58 | 1.17 | 138.4 | 9 | 88.9 | 0.86 | 1.09 |
| 366 | 33 | 99.6 | 18 | 0.51 | 0.0066 | 17.7 | 201.2 | 2203 | 4.29 | 68.6 | 16 | 97.1 | 0.57 | 1.17 | 143.1 | 8 | 88.2 | 0.87 | 1.09 |
| 367 | 35 | 99.6 | 18 | 0.54 | 0.0069 | 17.6 | 201.1 | 2202 | 4.29 | 68.1 | 15 | 97.1 | 0.61 | 1.17 | 141.9 | 8 | 88.4 | 0.92 | 1.09 |
| 368 | 37 | 99.7 | 18 | 0.55 | 0.0070 | 16.0 | 201.1 | 2203 | 4.28 | 61.4 | 16 | 97.6 | 0.60 | 1.17 | 126.1 | 10 | 90.7 | 0.83 | 1.11 |
| 369 | - | 99.9 | 18 | 0.52 | 0.0068 | | 0.1 | 0 | 0.00 | 0.0 | 18 | 99.9 | 0.52 | 1.19 | 0.0 | 18 | 99.9 | 0.52 | 1.19 |
| Hydrophobic 0 Degrees - October 4, 2010 | | | | | | | | | | | | | | | | | | | |
| 370 | - | 101.7 | 13 | 0.47 | 0.0044 | 0.2 | 86.9 | 0 | 0.00 | 0.9 | 13 | 101.7 | 0.47 | 1.23 | 1.8 | 13 | 101.7 | 0.47 | 1.23 |
| 371 | 15 | 101.5 | 14 | 0.63 | 0.0062 | 17.6 | 200.9 | 2195 | 4.29 | 65.7 | 12 | 99.0 | 0.71 | 1.21 | 136.3 | 5 | 90.7 | 1.05 | 1.13 |
| 372 | 17 | 101.5 | 13 | 0.66 | 0.0062 | 17.4 | 201.3 | 2199 | 4.29 | 64.6 | 11 | 99.2 | 0.74 | 1.21 | 133.7 | 4 | 91.1 | 1.08 | 1.14 |
| 373 | 19 | 101.5 | 13 | 0.66 | 0.0063 | 17.3 | 201.3 | 2204 | 4.29 | 64.5 | 11 | 99.1 | 0.74 | 1.21 | 133.5 | 5 | 91.1 | 1.08 | 1.14 |
| 374 | 21 | 101.5 | 13 | 0.64 | 0.0060 | 17.5 | 200.9 | 2203 | 4.28 | 65.4 | 11 | 99.1 | 0.71 | 1.21 | 135.4 | 4 | 90.8 | 1.05 | 1.14 |
| 375 | 23 | 101.5 | 13 | 0.64 | 0.0058 | 17.4 | 201.1 | 2197 | 4.29 | 64.6 | 11 | 99.1 | 0.71 | 1.21 | 133.5 | 4 | 91.1 | 1.04 | 1.14 |
| 376 | 25 | 101.5 | 13 | 0.62 | 0.0056 | 17.4 | 201.6 | 2205 | 4.29 | 64.6 | 11 | 99.1 | 0.69 | 1.21 | 133.6 | 4 | 91.1 | 1.02 | 1.14 |
| 377 | 27 | 101.5 | 13 | 0.61 | 0.0056 | 17.3 | 201.6 | 2204 | 4.29 | 64.3 | 11 | 99.2 | 0.68 | 1.21 | 133.1 | 4 | 91.2 | 0.99 | 1.14 |
| 378 | 29 | 101.5 | 12 | 0.63 | 0.0056 | 17.6 | 201.7 | 2205 | 4.30 | 65.2 | 10 | 99.1 | 0.71 | 1.21 | 135.0 | 3 | 90.9 | 1.05 | 1.14 |
| 379 | 31 | 101.5 | 12 | 0.60 | 0.0054 | 17.4 | 201.8 | 2207 | 4.29 | 64.8 | 10 | 99.1 | 0.67 | 1.21 | 134.1 | 4 | 91.0 | 0.99 | 1.14 |
| 380 | 33 | 101.5 | 13 | 0.60 | 0.0055 | 17.4 | 201.6 | 2202 | 4.30 | 64.9 | 11 | 99.1 | 0.67 | 1.21 | 134.4 | 4 | 91.0 | 0.98 | 1.14 |
| 381 | 35 | 101.5 | 13 | 0.60 | 0.0054 | 17.2 | 201.3 | 2199 | 4.29 | 64.0 | 11 | 99.2 | 0.67 | 1.21 | 132.3 | 4 | 91.3 | 0.97 | 1.14 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 382 | 37 | 101.5 | 13 | 0.59 | 0.0055 | 16.5 | 201.3 | 2200 | 4.29 | 61.5 | 11 | 99.4 | 0.65 | 1.21 | 126.3 | 5 | 92.2 | 0.91 | 1.15 |
| 383 | - | 101.7 | 13 | 0.53 | 0.0049 | 0.4 | 1.7 | 0 | 0.00 | 1.4 | 13 | 101.7 | 0.53 | 1.23 | 2.7 | 13 | 101.7 | 0.53 | 1.23 |
| Hydrophobic 20 Degrees - October 7, 2010 | | | | | | | | | | | | | | | | | | | |
| 388 | - | 99.0 | 20 | 0.41 | 0.0061 | | 86.6 | 0 | 0.00 | 0.0 | 20 | 99.0 | 0.41 | 1.17 | 0.0 | 20 | 99.0 | 0.41 | 1.17 |
| 389 | 15 | 98.7 | 19 | 0.43 | 0.0059 | 16.9 | 200.1 | 2197 | 4.27 | 65.7 | 16 | 96.4 | 0.48 | 1.16 | 136.2 | 9 | 88.4 | 0.70 | 1.09 |
| 390 | 17 | 98.8 | 19 | 0.44 | 0.0062 | 16.8 | 200.2 | 2199 | 4.27 | 65.8 | 17 | 96.4 | 0.50 | 1.15 | 136.3 | 10 | 88.4 | 0.72 | 1.08 |
| 391 | 19 | 98.7 | 19 | 0.42 | 0.0060 | 16.4 | 200.6 | 2202 | 4.27 | 64.1 | 17 | 96.5 | 0.47 | 1.15 | 132.4 | 10 | 89.0 | 0.67 | 1.09 |
| 392 | 21 | 98.7 | 19 | 0.42 | 0.0057 | 17.4 | 200.6 | 2203 | 4.27 | 67.9 | 16 | 96.2 | 0.47 | 1.15 | 141.2 | 9 | 87.7 | 0.70 | 1.08 |
| 393 | 23 | 98.7 | 19 | 0.41 | 0.0056 | 17.7 | 200.6 | 2203 | 4.27 | 69.2 | 16 | 96.1 | 0.46 | 1.15 | 144.6 | 8 | 87.1 | 0.71 | 1.08 |
| 394 | 25 | 98.7 | 18 | 0.41 | 0.0056 | 17.6 | 200.7 | 2204 | 4.28 | 68.5 | 16 | 96.2 | 0.47 | 1.15 | 142.9 | 8 | 87.4 | 0.71 | 1.08 |
| 395 | 27 | 98.7 | 18 | 0.42 | 0.0056 | 17.2 | 200.7 | 2203 | 4.27 | 67.0 | 16 | 96.3 | 0.47 | 1.16 | 139.3 | 9 | 87.9 | 0.70 | 1.08 |
| 396 | 29 | 98.7 | 19 | 0.40 | 0.0056 | 16.9 | 200.7 | 2204 | 4.28 | 66.0 | 17 | 96.4 | 0.45 | 1.15 | 136.8 | 10 | 88.3 | 0.65 | 1.08 |
| 397 | 31 | 98.7 | 18 | 0.38 | 0.0052 | 17.0 | 200.6 | 2202 | 4.28 | 66.4 | 16 | 96.3 | 0.43 | 1.16 | 137.7 | 9 | 88.2 | 0.63 | 1.09 |
| 398 | 33 | 98.7 | 19 | 0.38 | 0.0053 | 17.8 | 200.8 | 2203 | 4.28 | 69.4 | 16 | 96.1 | 0.43 | 1.15 | 145.1 | 8 | 87.1 | 0.67 | 1.07 |
| 399 | 35 | 98.8 | 19 | 0.39 | 0.0053 | 16.9 | 200.8 | 2204 | 4.28 | 65.8 | 16 | 96.4 | 0.44 | 1.16 | 136.2 | 9 | 88.4 | 0.64 | 1.09 |
| 400 | 37 | 98.8 | 18 | 0.40 | 0.0053 | 17.2 | 200.8 | 2205 | 4.28 | 67.1 | 16 | 96.3 | 0.45 | 1.16 | 139.5 | 8 | 88.0 | 0.67 | 1.08 |
| 401 | - | 99.0 | 18 | 0.43 | 0.0055 | 0.2 | 1.2 | 0 | 0.00 | 0.8 | 18 | 99.0 | 0.43 | 1.18 | 1.6 | 18 | 99.0 | 0.43 | 1.18 |
| Hydrophilic 20 Degrees - October 8, 2010 | | | | | | | | | | | | | | | | | | | |
| 402 | 15 | 99.3 | 17 | 0.55 | 0.0067 | 16.8 | 200.7 | 2200 | 4.28 | 64.7 | 15 | 97.0 | 0.61 | 1.17 | 133.8 | 8 | 89.3 | 0.89 | 1.10 |
| 403 | 17 | 99.3 | 17 | 0.55 | 0.0068 | 16.8 | 200.5 | 2198 | 4.28 | 64.9 | 15 | 97.0 | 0.61 | 1.17 | 134.2 | 8 | 89.2 | 0.88 | 1.10 |
| 404 | 19 | 99.3 | 17 | 0.56 | 0.0070 | 17.1 | 200.6 | 2199 | 4.28 | 66.0 | 15 | 96.9 | 0.63 | 1.17 | 136.9 | 8 | 88.8 | 0.93 | 1.10 |
| 405 | 21 | 99.3 | 16 | 0.55 | 0.0064 | 17.1 | 200.7 | 2203 | 4.28 | 65.9 | 14 | 96.9 | 0.61 | 1.17 | 136.7 | 7 | 88.8 | 0.90 | 1.10 |
| 406 | 23 | 99.3 | 17 | 0.55 | 0.0068 | 17.2 | 200.9 | 2205 | 4.28 | 66.3 | 15 | 96.9 | 0.62 | 1.17 | 137.6 | 8 | 88.7 | 0.92 | 1.10 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 407 | 25 | 99.3 | 17 | 0.56 | 0.0068 | 17.7 | 201.0 | 2205 | 4.28 | 68.4 | 14 | 96.7 | 0.64 | 1.17 | 142.7 | 7 | 87.9 | 0.97 | 1.09 |
| 408 | 27 | 99.3 | 17 | 0.56 | 0.0069 | 17.3 | 200.7 | 2203 | 4.28 | 67.0 | 15 | 96.8 | 0.63 | 1.17 | 139.1 | 8 | 88.4 | 0.94 | 1.09 |
| 409 | 29 | 99.3 | 17 | 0.55 | 0.0067 | 17.8 | 200.8 | 2202 | 4.28 | 68.6 | 14 | 96.7 | 0.62 | 1.17 | 143.2 | 7 | 87.8 | 0.95 | 1.09 |
| 410 | 31 | 99.3 | 17 | 0.54 | 0.0066 | 17.1 | 200.8 | 2203 | 4.28 | 66.1 | 15 | 96.9 | 0.60 | 1.17 | 137.1 | 8 | 88.7 | 0.89 | 1.10 |
| 411 | - | 99.5 | 18 | 0.51 | 0.0066 | 0.3 | 1.6 | 0 | 0.00 | 1.2 | 18 | 99.5 | 0.51 | 1.19 | 2.3 | 18 | 99.5 | 0.51 | 1.19 |
| 412 | - | 99.4 | 19 | 0.45 | 0.0063 | | 0.1 | -1 | 0.00 | 0.0 | 19 | 99.4 | 0.45 | 1.18 | 0.0 | 19 | 99.4 | 0.45 | 1.18 |
| 413 | 33 | 99.2 | 20 | 0.45 | 0.0066 | 16.9 | 200.6 | 2200 | 4.28 | 66.0 | 18 | 96.9 | 0.50 | 1.16 | 136.7 | 11 | 88.8 | 0.73 | 1.09 |
| 414 | 35 | 99.2 | 20 | 0.44 | 0.0065 | 16.9 | 200.6 | 2202 | 4.28 | 65.9 | 18 | 96.9 | 0.50 | 1.16 | 136.5 | 11 | 88.9 | 0.72 | 1.09 |
| 416 | 37 | 99.2 | 20 | 0.45 | 0.0066 | 17.1 | 200.6 | 2201 | 4.28 | 66.8 | 18 | 96.8 | 0.51 | 1.16 | 138.7 | 10 | 88.5 | 0.75 | 1.08 |
| Hydrophilic 0 Degrees - October 8, 2010 | | | | | | | | | | | | | | | | | | | |
| 417 | - | 99.2 | 19 | 0.49 | 0.0070 | 16.6 | 200.5 | 2202 | 4.27 | 64.6 | 17 | 97.0 | 0.55 | 1.16 | 133.5 | 11 | 89.3 | 0.78 | 1.09 |
| 418 | 15 | 99.2 | 20 | 0.47 | 0.0068 | 16.8 | 200.7 | 2204 | 4.27 | 65.7 | 17 | 96.9 | 0.53 | 1.16 | 135.9 | 10 | 88.9 | 0.76 | 1.09 |
| 419 | 19 | 99.2 | 20 | 0.47 | 0.0068 | 17.1 | 200.8 | 2206 | 4.28 | 66.6 | 17 | 96.8 | 0.53 | 1.16 | 138.1 | 10 | 88.6 | 0.77 | 1.08 |
| 420 | 21 | 99.2 | 20 | 0.49 | 0.0071 | 17.4 | 200.8 | 2206 | 4.28 | 67.9 | 17 | 96.7 | 0.55 | 1.15 | 141.2 | 10 | 88.1 | 0.82 | 1.08 |
| 421 | 23 | 99.2 | 19 | 0.47 | 0.0067 | 17.3 | 200.9 | 2207 | 4.28 | 67.6 | 17 | 96.7 | 0.53 | 1.16 | 140.5 | 10 | 88.2 | 0.79 | 1.08 |
| 422 | 25 | 99.2 | 19 | 0.48 | 0.0068 | 17.2 | 200.6 | 2203 | 4.27 | 67.2 | 17 | 96.7 | 0.54 | 1.16 | 139.7 | 10 | 88.3 | 0.80 | 1.08 |
| 423 | 27 | 99.2 | 20 | 0.50 | 0.0072 | 17.2 | 200.8 | 2202 | 4.28 | 67.3 | 17 | 96.7 | 0.56 | 1.15 | 139.9 | 10 | 88.3 | 0.83 | 1.08 |
| 424 | 29 | 99.2 | 20 | 0.49 | 0.0070 | 17.6 | 200.7 | 2204 | 4.28 | 68.6 | 17 | 96.6 | 0.55 | 1.15 | 143.1 | 9 | 87.8 | 0.83 | 1.08 |
| 425 | 31 | 99.2 | 20 | 0.48 | 0.0070 | 17.4 | 200.8 | 2204 | 4.28 | 67.9 | 17 | 96.7 | 0.54 | 1.15 | 141.4 | 10 | 88.1 | 0.81 | 1.08 |
| 426 | 33 | 99.2 | 20 | 0.49 | 0.0071 | 17.4 | 200.8 | 2202 | 4.28 | 68.0 | 17 | 96.7 | 0.56 | 1.15 | 141.5 | 10 | 88.1 | 0.83 | 1.08 |
| 427 | 35 | 99.2 | 20 | 0.50 | 0.0072 | 17.3 | 200.7 | 2201 | 4.28 | 67.7 | 17 | 96.7 | 0.56 | 1.15 | 140.8 | 10 | 88.2 | 0.83 | 1.08 |
| 428 | 37 | 99.2 | 20 | 0.49 | 0.0071 | 15.8 | 200.8 | 2204 | 4.28 | 61.7 | 18 | 97.1 | 0.54 | 1.16 | 126.6 | 12 | 90.2 | 0.75 | 1.10 |
| 429 | - | 99.4 | 19 | 0.52 | 0.0072 | | 0.1 | 0 | 0.00 | 0.0 | 19 | 99.4 | 0.52 | 1.18 | 0.0 | 19 | 99.4 | 0.52 | 1.18 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|--------------|--------------|-----------|------|--------|-----------------------|------------------------|-------------------------------|-------------------|------------|-----------|------------|------|--------------------------------|------------|-----------|------------|------|--------------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| Low Serration 20 Degrees - October 12, 2010 | | | | | | | | | | | | | | | | | | | |
| 430 | - | 100.1 | 15 | 0.34 | 0.0037 | | 86.5 | 0 | 0.00 | 0.0 | 15 | 100.1 | 0.34 | 1.21 | 0.0 | 15 | 100.1 | 0.34 | 1.21 |
| 431 | 15 | 99.9 | 15 | 0.53 | 0.0055 | 17.4 | 200.7 | 2198 | 4.28 | 66.1 | 12 | 97.5 | 0.59 | 1.19 | 137.1 | 5 | 89.2 | 0.88 | 1.11 |
| 432 | 17 | 99.9 | 14 | 0.61 | 0.0062 | 17.3 | 200.8 | 2201 | 4.28 | 65.9 | 12 | 97.5 | 0.69 | 1.19 | 136.6 | 5 | 89.3 | 1.02 | 1.11 |
| 433 | 19 | 99.9 | 15 | 0.54 | 0.0057 | 17.6 | 200.7 | 2200 | 4.28 | 67.2 | 12 | 97.4 | 0.61 | 1.18 | 139.8 | 5 | 88.8 | 0.92 | 1.11 |
| 434 | 21 | 99.9 | 14 | 0.54 | 0.0054 | 16.9 | 200.9 | 2203 | 4.28 | 64.2 | 12 | 97.6 | 0.61 | 1.19 | 132.6 | 5 | 89.9 | 0.88 | 1.12 |
| 435 | - | 100.1 | 14 | 0.46 | 0.0046 | 0.4 | 0.2 | 0 | 0.00 | 1.3 | 14 | 100.1 | 0.46 | 1.21 | 2.6 | 14 | 100.1 | 0.46 | 1.21 |
| 436 | - | 100.1 | 14 | 0.42 | 0.0043 | | 0.1 | 0 | 0.00 | 0.0 | 14 | 100.1 | 0.42 | 1.21 | 0.0 | 14 | 100.1 | 0.42 | 1.21 |
| 437 | 23 | 99.9 | 14 | 0.49 | 0.0050 | 17.1 | 201.0 | 2203 | 4.28 | 64.9 | 12 | 97.6 | 0.55 | 1.19 | 134.2 | 5 | 89.6 | 0.80 | 1.12 |
| 438 | 25 | 99.9 | 14 | 0.53 | 0.0055 | 16.9 | 200.7 | 2199 | 4.28 | 64.2 | 12 | 97.6 | 0.59 | 1.19 | 132.6 | 6 | 89.9 | 0.86 | 1.12 |
| 439 | 27 | 99.9 | 14 | 0.50 | 0.0051 | 17.3 | 201.0 | 2202 | 4.28 | 65.8 | 12 | 97.5 | 0.57 | 1.19 | 136.6 | 5 | 89.2 | 0.84 | 1.11 |
| 440 | 29 | 99.9 | 15 | 0.50 | 0.0054 | 17.2 | 200.8 | 2200 | 4.28 | 65.7 | 13 | 97.5 | 0.57 | 1.18 | 136.2 | 6 | 89.3 | 0.83 | 1.11 |
| 441 | 31 | 99.9 | 15 | 0.51 | 0.0053 | 17.3 | 201.0 | 2202 | 4.28 | 65.8 | 13 | 97.5 | 0.57 | 1.18 | 136.5 | 5 | 89.3 | 0.84 | 1.11 |
| 442 | 33 | 99.9 | 15 | 0.50 | 0.0054 | 17.5 | 200.7 | 2200 | 4.28 | 66.8 | 13 | 97.4 | 0.57 | 1.18 | 138.9 | 5 | 88.9 | 0.85 | 1.11 |
| 443 | 35 | 99.9 | 15 | 0.49 | 0.0053 | 17.1 | 200.7 | 2200 | 4.28 | 65.0 | 13 | 97.5 | 0.55 | 1.18 | 134.5 | 6 | 89.6 | 0.80 | 1.11 |
| 444 | 37 | 99.9 | 15 | 0.49 | 0.0051 | 17.1 | 200.9 | 2202 | 4.28 | 65.0 | 13 | 97.5 | 0.55 | 1.19 | 134.5 | 6 | 89.6 | 0.80 | 1.12 |
| Low Serration 0 Degrees - October 12, 2010 | | | | | | | | | | | | | | | | | | | |
| 445 | 15 | 99.9 | 16 | 0.46 | 0.0052 | 17.3 | 201.0 | 2203 | 4.28 | 65.9 | 14 | 97.5 | 0.52 | 1.18 | 136.6 | 6 | 89.3 | 0.77 | 1.11 |
| 446 | 17 | 99.9 | 16 | 0.46 | 0.0051 | 17.4 | 201.0 | 2205 | 4.28 | 66.6 | 13 | 97.4 | 0.51 | 1.18 | 138.3 | 6 | 89.0 | 0.77 | 1.11 |
| 447 | 19 | 99.8 | 16 | 0.48 | 0.0054 | 17.5 | 200.8 | 2202 | 4.28 | 66.8 | 13 | 97.4 | 0.54 | 1.18 | 138.8 | 6 | 88.9 | 0.81 | 1.11 |
| 449 | 21 | 99.9 | 16 | 0.48 | 0.0054 | 17.7 | 200.8 | 2203 | 4.28 | 67.8 | 13 | 97.3 | 0.55 | 1.18 | 141.1 | 6 | 88.6 | 0.83 | 1.10 |
| 450 | 33 | 99.9 | 16 | 0.47 | 0.0053 | 17.7 | 200.8 | 2203 | 4.28 | 67.7 | 14 | 97.3 | 0.53 | 1.18 | 141.0 | 6 | 88.6 | 0.80 | 1.10 |
| 451 | 25 | 99.9 | 16 | 0.47 | 0.0052 | 17.5 | 200.7 | 2202 | 4.28 | 66.7 | 13 | 97.4 | 0.52 | 1.18 | 138.5 | 6 | 89.0 | 0.78 | 1.11 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 452 | 27 | 99.9 | 16 | 0.44 | 0.0051 | 17.3 | 200.8 | 2203 | 4.28 | 66.1 | 14 | 97.5 | 0.50 | 1.18 | 137.0 | 7 | 89.2 | 0.74 | 1.11 |
| 453 | 29 | 99.9 | 16 | 0.44 | 0.0049 | 17.6 | 200.8 | 2203 | 4.28 | 67.1 | 13 | 97.4 | 0.50 | 1.18 | 139.5 | 6 | 88.8 | 0.75 | 1.11 |
| 454 | 31 | 99.9 | 16 | 0.45 | 0.0052 | 17.5 | 200.8 | 2203 | 4.28 | 66.8 | 14 | 97.4 | 0.51 | 1.18 | 138.9 | 7 | 89.0 | 0.76 | 1.10 |
| 455 | 33 | 99.9 | 16 | 0.44 | 0.0050 | 17.5 | 200.8 | 2204 | 4.28 | 66.7 | 14 | 97.4 | 0.50 | 1.18 | 138.6 | 6 | 89.0 | 0.74 | 1.11 |
| 456 | 35 | 99.9 | 16 | 0.45 | 0.0053 | 17.3 | 200.8 | 2204 | 4.28 | 66.3 | 14 | 97.5 | 0.51 | 1.18 | 137.7 | 7 | 89.2 | 0.75 | 1.11 |
| 457 | 37 | 99.9 | 16 | 0.46 | 0.0052 | 16.1 | 200.9 | 2204 | 4.28 | 61.2 | 14 | 97.9 | 0.51 | 1.18 | 125.5 | 8 | 90.9 | 0.70 | 1.12 |
| 458 | - | 100.1 | 16 | 0.43 | 0.0048 | | 0.1 | 0 | 0.00 | 0.0 | 16 | 100.1 | 0.43 | 1.20 | 0.0 | 16 | 100.1 | 0.43 | 1.20 |
| Medium Serration 20 Degrees - October 13, 2010 | | | | | | | | | | | | | | | | | | | |
| 459 | - | 100.5 | 19 | 0.29 | 0.0040 | | 86.6 | 0 | 0.00 | 0.0 | 19 | 100.5 | 0.29 | 1.19 | 0.0 | 19 | 100.5 | 0.29 | 1.19 |
| 460 | - | 100.4 | 18 | 0.35 | 0.0044 | | 86.7 | 0 | 0.00 | 0.0 | 18 | 100.4 | 0.35 | 1.20 | 0.0 | 18 | 100.4 | 0.35 | 1.20 |
| 461 | 15 | 100.2 | 18 | 0.39 | 0.0049 | 17.1 | 200.4 | 2201 | 4.27 | 65.5 | 15 | 97.8 | 0.44 | 1.18 | 135.6 | 8 | 89.8 | 0.64 | 1.11 |
| 462 | 17 | 100.2 | 18 | 0.43 | 0.0055 | 17.3 | 200.2 | 2202 | 4.27 | 66.2 | 16 | 97.8 | 0.48 | 1.17 | 137.3 | 9 | 89.5 | 0.70 | 1.10 |
| 463 | 19 | 100.2 | 18 | 0.39 | 0.0051 | 17.2 | 200.3 | 2202 | 4.27 | 66.0 | 16 | 97.8 | 0.44 | 1.17 | 136.7 | 9 | 89.6 | 0.64 | 1.10 |
| 464 | 21 | 100.1 | 18 | 0.41 | 0.0051 | 18.1 | 200.4 | 2203 | 4.27 | 69.4 | 15 | 97.5 | 0.46 | 1.17 | 145.0 | 7 | 88.3 | 0.71 | 1.09 |
| 465 | 23 | 100.2 | 18 | 0.39 | 0.0050 | 17.3 | 200.5 | 2203 | 4.27 | 66.2 | 16 | 97.7 | 0.44 | 1.18 | 137.4 | 8 | 89.5 | 0.65 | 1.10 |
| 466 | 25 | 100.2 | 18 | 0.39 | 0.0052 | 17.2 | 200.5 | 2205 | 4.27 | 66.2 | 16 | 97.7 | 0.44 | 1.17 | 137.3 | 9 | 89.5 | 0.65 | 1.10 |
| 467 | 27 | 100.1 | 17 | 0.38 | 0.0048 | 17.2 | 200.4 | 2203 | 4.27 | 65.8 | 15 | 97.8 | 0.43 | 1.18 | 136.4 | 8 | 89.6 | 0.63 | 1.11 |
| 468 | 29 | 100.1 | 18 | 0.38 | 0.0050 | 17.2 | 200.3 | 2201 | 4.27 | 65.9 | 16 | 97.8 | 0.43 | 1.17 | 136.5 | 9 | 89.6 | 0.63 | 1.10 |
| 469 | 31 | 100.1 | 18 | 0.38 | 0.0049 | 17.4 | 200.3 | 2201 | 4.27 | 66.9 | 15 | 97.7 | 0.43 | 1.18 | 139.0 | 8 | 89.2 | 0.64 | 1.10 |
| 470 | 33 | 100.1 | 18 | 0.37 | 0.0049 | 17.3 | 200.5 | 2203 | 4.27 | 66.3 | 16 | 97.7 | 0.42 | 1.17 | 137.4 | 9 | 89.5 | 0.61 | 1.10 |
| 471 | 35 | 100.1 | 18 | 0.39 | 0.0050 | 17.1 | 200.4 | 2203 | 4.27 | 65.7 | 16 | 97.8 | 0.43 | 1.18 | 136.1 | 9 | 89.7 | 0.63 | 1.10 |
| 472 | 37 | 100.1 | 18 | 0.39 | 0.0050 | 17.1 | 200.4 | 2204 | 4.27 | 65.6 | 16 | 97.8 | 0.44 | 1.18 | 136.0 | 9 | 89.7 | 0.64 | 1.11 |
| 473 | - | 100.3 | 18 | 0.37 | 0.0048 | 0.2 | 0.1 | 0 | 0.00 | 0.6 | 18 | 100.3 | 0.37 | 1.20 | 1.2 | 18 | 100.3 | 0.37 | 1.20 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | p (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) |
| Medium Serration 0 Degrees - October 14, 2010 | | | | | | | | | | | | | | | | | | | |
| 474 | - | 99.8 | 18 | 0.49 | 0.0062 | | 86.4 | 0 | 0.00 | 0.0 | 18 | 99.8 | 0.49 | 1.19 | 0.0 | 18 | 99.8 | 0.49 | 1.19 |
| 475 | 15 | 99.6 | 17 | 0.65 | 0.0080 | 17.1 | 200.5 | 2200 | 4.28 | 65.7 | 15 | 97.2 | 0.73 | 1.17 | 136.1 | 8 | 89.2 | 1.06 | 1.10 |
| 476 | 17 | 99.6 | 17 | 0.65 | 0.0081 | 17.3 | 200.3 | 2200 | 4.27 | 66.7 | 15 | 97.1 | 0.73 | 1.17 | 138.5 | 8 | 88.8 | 1.08 | 1.10 |
| 477 | 19 | 99.5 | 17 | 0.65 | 0.0080 | 17.4 | 200.4 | 2200 | 4.27 | 67.1 | 15 | 97.1 | 0.73 | 1.17 | 139.3 | 8 | 88.6 | 1.08 | 1.10 |
| 478 | 21 | 99.5 | 17 | 0.64 | 0.0078 | 17.5 | 200.6 | 2204 | 4.27 | 67.7 | 15 | 97.0 | 0.72 | 1.17 | 140.8 | 7 | 88.4 | 1.09 | 1.09 |
| 479 | 23 | 99.5 | 17 | 0.69 | 0.0082 | 17.5 | 200.5 | 2203 | 4.27 | 67.2 | 14 | 97.0 | 0.78 | 1.17 | 139.7 | 7 | 88.5 | 1.16 | 1.10 |
| 480 | 25 | 99.5 | 16 | 0.67 | 0.0078 | 17.5 | 200.7 | 2204 | 4.28 | 67.4 | 14 | 97.0 | 0.75 | 1.17 | 140.2 | 6 | 88.4 | 1.13 | 1.10 |
| 481 | 29 | 99.5 | 16 | 0.63 | 0.0072 | 17.3 | 200.7 | 2203 | 4.27 | 66.3 | 14 | 97.1 | 0.71 | 1.17 | 137.6 | 7 | 88.8 | 1.05 | 1.10 |
| 482 | 31 | 99.5 | 16 | 0.63 | 0.0074 | 17.3 | 200.7 | 2203 | 4.28 | 66.7 | 14 | 97.1 | 0.71 | 1.17 | 138.6 | 7 | 88.7 | 1.05 | 1.10 |
| 483 | 33 | 99.5 | 16 | 0.62 | 0.0073 | 17.5 | 200.6 | 2203 | 4.27 | 67.5 | 14 | 97.0 | 0.70 | 1.17 | 140.5 | 7 | 88.4 | 1.05 | 1.10 |
| 484 | 35 | 99.5 | 17 | 0.61 | 0.0073 | 17.5 | 200.8 | 2204 | 4.28 | 67.4 | 14 | 97.0 | 0.69 | 1.17 | 140.3 | 7 | 88.4 | 1.03 | 1.09 |
| 485 | 37 | 99.5 | 16 | 0.62 | 0.0073 | 16.1 | 200.8 | 2205 | 4.28 | 62.0 | 15 | 97.4 | 0.69 | 1.17 | 127.4 | 8 | 90.3 | 0.95 | 1.11 |
| 486 | - | 99.7 | 16 | 0.56 | 0.0064 | 0.4 | 0.1 | 0 | 0.00 | 1.4 | 16 | 99.7 | 0.56 | 1.20 | 2.7 | 16 | 99.7 | 0.56 | 1.20 |
| No IGV Baseline - October 26, 2010 | | | | | | | | | | | | | | | | | | | |
| 488 | - | 99.5 | 18 | 0.61 | 0.0079 | | 0.0 | 0 | 0.00 | 0.0 | 18 | 99.5 | 0.61 | 1.19 | 0.0 | 18 | 99.5 | 0.61 | 1.19 |
| 489 | 15 | 99.3 | 17 | 0.78 | 0.0098 | 17.3 | 200.1 | 2203 | 4.26 | 66.9 | 15 | 96.9 | 0.87 | 1.16 | 138.7 | 8 | 88.5 | 1.30 | 1.09 |
| 490 | 17 | 99.3 | 17 | 0.76 | 0.0094 | 17.1 | 199.9 | 2198 | 4.26 | 66.0 | 15 | 96.9 | 0.85 | 1.17 | 136.6 | 8 | 88.8 | 1.24 | 1.10 |
| 491 | 18 | 99.3 | 17 | 0.77 | 0.0092 | 17.0 | 200.0 | 2200 | 4.26 | 65.8 | 15 | 97.0 | 0.86 | 1.17 | 136.2 | 7 | 88.9 | 1.26 | 1.10 |
| 492 | 19 | 99.3 | 17 | 0.77 | 0.0095 | 16.8 | 200.2 | 2205 | 4.26 | 65.0 | 15 | 97.0 | 0.86 | 1.17 | 134.3 | 8 | 89.2 | 1.24 | 1.10 |
| 493 | 20 | 99.3 | 17 | 0.76 | 0.0095 | 17.0 | 200.0 | 2201 | 4.26 | 65.6 | 15 | 97.0 | 0.85 | 1.17 | 135.8 | 8 | 89.0 | 1.24 | 1.10 |
| 494 | 21 | 99.3 | 17 | 0.76 | 0.0095 | 17.0 | 200.2 | 2203 | 4.26 | 65.9 | 15 | 97.0 | 0.85 | 1.17 | 136.4 | 8 | 88.9 | 1.24 | 1.10 |
| 495 | 22 | 99.3 | 17 | 0.77 | 0.0095 | 17.0 | 200.0 | 2202 | 4.26 | 65.7 | 15 | 97.0 | 0.86 | 1.17 | 135.9 | 8 | 89.0 | 1.26 | 1.10 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 496 | 23 | 99.3 | 17 | 0.80 | 0.0097 | 16.9 | 199.8 | 2199 | 4.26 | 65.4 | 15 | 97.0 | 0.89 | 1.17 | 135.3 | 8 | 89.0 | 1.30 | 1.10 |
| 497 | 25 | 99.3 | 17 | 0.77 | 0.0096 | 17.0 | 200.0 | 2201 | 4.26 | 65.8 | 15 | 96.9 | 0.86 | 1.16 | 136.3 | 8 | 88.9 | 1.26 | 1.10 |
| 498 | 27 | 99.3 | 17 | 0.77 | 0.0095 | 16.9 | 200.0 | 2201 | 4.26 | 65.6 | 15 | 96.9 | 0.86 | 1.17 | 135.6 | 8 | 88.9 | 1.25 | 1.10 |
| 499 | 29 | 99.2 | 18 | 0.76 | 0.0100 | 17.0 | 200.1 | 2204 | 4.26 | 66.2 | 16 | 96.9 | 0.86 | 1.16 | 137.0 | 9 | 88.8 | 1.25 | 1.09 |
| 500 | 31 | 99.2 | 17 | 0.76 | 0.0097 | 17.0 | 199.8 | 2199 | 4.26 | 65.7 | 15 | 96.9 | 0.85 | 1.16 | 136.0 | 8 | 88.9 | 1.24 | 1.09 |
| 501 | 33 | 99.2 | 18 | 0.75 | 0.0096 | 17.0 | 200.0 | 2201 | 4.26 | 65.9 | 15 | 96.9 | 0.84 | 1.16 | 136.4 | 8 | 88.8 | 1.23 | 1.09 |
| 502 | 35 | 99.2 | 18 | 0.74 | 0.0096 | 16.9 | 200.1 | 2203 | 4.26 | 65.6 | 16 | 96.9 | 0.83 | 1.16 | 135.8 | 9 | 88.9 | 1.20 | 1.09 |
| 503 | 37 | 99.2 | 17 | 0.74 | 0.0093 | 16.8 | 199.9 | 2200 | 4.26 | 65.1 | 15 | 96.9 | 0.83 | 1.17 | 134.4 | 8 | 89.1 | 1.20 | 1.10 |
| 504 | - | 99.4 | 17 | 0.70 | 0.0086 | | 0.2 | 0 | 0.00 | 0.0 | 17 | 99.4 | 0.70 | 1.19 | 0.0 | 17 | 99.4 | 0.70 | 1.19 |
| High Serration Hydrophobic 20 Degrees - October 27, 2010 | | | | | | | | | | | | | | | | | | | |
| 505 | - | 99.5 | 20 | 0.37 | 0.0054 | | 0.1 | -1 | 0.00 | 0.0 | 20 | 99.5 | 0.37 | 1.18 | 0.0 | 20 | 99.5 | 0.37 | 1.18 |
| 506 | 15 | 99.2 | 20 | 0.41 | 0.0059 | 17.2 | 199.9 | 2203 | 4.26 | 67.1 | 17 | 96.8 | 0.46 | 1.16 | 139.5 | 10 | 88.4 | 0.68 | 1.08 |
| 507 | 17 | 99.2 | 20 | 0.41 | 0.0059 | 17.4 | 198.9 | 2185 | 4.26 | 67.9 | 17 | 96.7 | 0.46 | 1.16 | 141.4 | 10 | 88.1 | 0.69 | 1.08 |
| 508 | 18 | 99.2 | 20 | 0.38 | 0.0056 | 17.8 | 199.8 | 2202 | 4.26 | 69.6 | 18 | 96.6 | 0.43 | 1.15 | 145.5 | 10 | 87.5 | 0.66 | 1.07 |
| 509 | 19 | 99.2 | 20 | 0.40 | 0.0059 | 17.1 | 199.7 | 2203 | 4.25 | 66.9 | 18 | 96.8 | 0.45 | 1.16 | 138.9 | 10 | 88.5 | 0.66 | 1.08 |
| 510 | 20 | 99.2 | 20 | 0.40 | 0.0060 | 16.9 | 199.7 | 2203 | 4.25 | 66.1 | 18 | 96.9 | 0.45 | 1.15 | 137.0 | 11 | 88.8 | 0.65 | 1.09 |
| 511 | 21 | 99.2 | 21 | 0.38 | 0.0058 | 17.2 | 199.9 | 2206 | 4.26 | 67.4 | 18 | 96.8 | 0.42 | 1.15 | 140.0 | 11 | 88.4 | 0.63 | 1.08 |
| 512 | 22 | 99.2 | 20 | 0.40 | 0.0061 | 17.4 | 200.0 | 2206 | 4.26 | 68.0 | 18 | 96.7 | 0.45 | 1.15 | 141.6 | 11 | 88.1 | 0.67 | 1.08 |
| 513 | 23 | 99.2 | 21 | 0.40 | 0.0061 | 17.2 | 200.0 | 2206 | 4.26 | 67.4 | 18 | 96.7 | 0.44 | 1.15 | 140.2 | 11 | 88.3 | 0.66 | 1.08 |
| 514 | 25 | 99.2 | 21 | 0.38 | 0.0059 | 17.5 | 200.0 | 2206 | 4.26 | 68.5 | 18 | 96.6 | 0.43 | 1.15 | 142.7 | 10 | 87.9 | 0.65 | 1.08 |
| 515 | 27 | 99.2 | 21 | 0.41 | 0.0063 | 17.2 | 199.9 | 2204 | 4.26 | 67.5 | 18 | 96.7 | 0.46 | 1.15 | 140.3 | 11 | 88.3 | 0.69 | 1.08 |
| 516 | 29 | 99.2 | 21 | 0.37 | 0.0058 | 17.3 | 199.9 | 2206 | 4.26 | 67.8 | 18 | 96.7 | 0.42 | 1.15 | 141.0 | 11 | 88.2 | 0.63 | 1.08 |
| 517 | 31 | 99.2 | 21 | 0.40 | 0.0062 | 17.2 | 199.5 | 2200 | 4.25 | 67.3 | 18 | 96.7 | 0.45 | 1.15 | 139.9 | 11 | 88.3 | 0.67 | 1.08 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) |
| 518 | 33 | 99.2 | 21 | 0.40 | 0.0061 | 16.9 | 199.6 | 2200 | 4.26 | 66.3 | 19 | 96.8 | 0.44 | 1.15 | 137.5 | 11 | 88.7 | 0.64 | 1.08 |
| 519 | 35 | 99.2 | 21 | 0.40 | 0.0061 | 17.0 | 199.8 | 2205 | 4.26 | 66.4 | 18 | 96.8 | 0.44 | 1.15 | 137.7 | 11 | 88.6 | 0.65 | 1.08 |
| 521 | 37 | 99.1 | 21 | 0.41 | 0.0062 | 17.1 | 199.6 | 2201 | 4.25 | 66.8 | 18 | 96.7 | 0.46 | 1.15 | 138.5 | 11 | 88.5 | 0.67 | 1.08 |
| 522 | - | 99.3 | 21 | 0.38 | 0.0059 | | 0.0 | -1 | 0.00 | 0.0 | 21 | 99.3 | 0.38 | 1.17 | 0.0 | 21 | 99.3 | 0.38 | 1.17 |
| 540 | 19 | 100.1 | 13 | 0.42 | 0.0038 | 17.0 | 200.9 | 2198 | 4.29 | 64.1 | 11 | 97.8 | 0.47 | 1.20 | 132.5 | 4 | 89.9 | 0.68 | 1.13 |
| 541 | 19.5 | 100.1 | 12 | 0.42 | 0.0037 | 17.1 | 200.9 | 2200 | 4.28 | 64.3 | 10 | 97.8 | 0.47 | 1.20 | 132.9 | 4 | 89.9 | 0.68 | 1.13 |
| 542 | 20 | 100.1 | 12 | 0.44 | 0.0038 | 17.1 | 201.0 | 2200 | 4.28 | 64.1 | 10 | 97.8 | 0.49 | 1.20 | 132.5 | 3 | 89.9 | 0.71 | 1.13 |
| High Serration Hydrophobic 0 Degrees -October 29, 2010 | | | | | | | | | | | | | | | | | | | |
| 524 | - | 100.3 | 16 | 0.26 | 0.0028 | | 86.7 | 0 | 0.00 | 0.0 | 16 | 100.3 | 0.26 | 1.21 | 0.0 | 16 | 100.3 | 0.26 | 1.21 |
| 525 | 15 | 100.1 | 14 | 0.43 | 0.0043 | 17.2 | 199.8 | 2200 | 4.26 | 65.1 | 12 | 97.7 | 0.48 | 1.19 | 134.8 | 5 | 89.7 | 0.70 | 1.12 |
| 526 | 17 | 100.1 | 14 | 0.42 | 0.0042 | 17.4 | 200.0 | 2200 | 4.26 | 65.7 | 12 | 97.6 | 0.47 | 1.19 | 136.3 | 5 | 89.4 | 0.69 | 1.12 |
| 527 | 18 | 100.0 | 13 | 0.39 | 0.0038 | 17.7 | 200.2 | 2202 | 4.27 | 67.1 | 11 | 97.5 | 0.44 | 1.19 | 139.7 | 4 | 88.8 | 0.67 | 1.12 |
| 528 | 19 | 100.0 | 14 | 0.42 | 0.0042 | 17.5 | 200.2 | 2202 | 4.27 | 66.3 | 12 | 97.5 | 0.47 | 1.19 | 137.8 | 4 | 89.1 | 0.71 | 1.12 |
| 529 | 20 | 100.0 | 14 | 0.38 | 0.0037 | 17.6 | 200.5 | 2203 | 4.27 | 66.7 | 11 | 97.5 | 0.43 | 1.19 | 138.8 | 4 | 89.0 | 0.64 | 1.12 |
| 530 | 21 | 100.0 | 13 | 0.42 | 0.0039 | 17.5 | 200.2 | 2200 | 4.27 | 66.0 | 11 | 97.6 | 0.47 | 1.19 | 136.9 | 4 | 89.2 | 0.70 | 1.12 |
| 531 | 22 | 100.0 | 13 | 0.39 | 0.0037 | 17.5 | 200.4 | 2202 | 4.27 | 66.0 | 11 | 97.6 | 0.44 | 1.19 | 137.1 | 4 | 89.2 | 0.65 | 1.12 |
| 532 | 23 | 100.0 | 14 | 0.39 | 0.0038 | 17.4 | 200.2 | 2200 | 4.27 | 66.0 | 11 | 97.6 | 0.44 | 1.19 | 137.0 | 4 | 89.3 | 0.66 | 1.12 |
| 533 | 25 | 100.0 | 13 | 0.39 | 0.0037 | 17.4 | 200.3 | 2203 | 4.27 | 65.7 | 11 | 97.6 | 0.44 | 1.19 | 136.3 | 4 | 89.3 | 0.65 | 1.12 |
| 534 | 27 | 100.0 | 13 | 0.40 | 0.0038 | 17.5 | 200.3 | 2202 | 4.27 | 66.1 | 11 | 97.6 | 0.45 | 1.19 | 137.3 | 4 | 89.2 | 0.67 | 1.12 |
| 535 | 29 | 100.0 | 13 | 0.40 | 0.0039 | 17.3 | 200.4 | 2202 | 4.27 | 65.3 | 11 | 97.6 | 0.45 | 1.19 | 135.4 | 4 | 89.5 | 0.66 | 1.12 |
| 536 | 31 | 100.0 | 13 | 0.39 | 0.0037 | 17.4 | 202.0 | 2198 | 4.31 | 65.6 | 11 | 97.6 | 0.44 | 1.19 | 136.1 | 4 | 89.4 | 0.66 | 1.12 |
| 537 | 33 | 100.0 | 12 | 0.43 | 0.0038 | 17.3 | 201.2 | 2200 | 4.29 | 65.0 | 10 | 97.7 | 0.48 | 1.20 | 134.7 | 3 | 89.6 | 0.71 | 1.13 |
| 538 | 35 | 100.0 | 12 | 0.44 | 0.0039 | 17.6 | 201.2 | 2202 | 4.29 | 66.1 | 10 | 97.6 | 0.50 | 1.20 | 137.3 | 3 | 89.2 | 0.75 | 1.12 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|-----------------------------|------------|--------|---------|------|-----------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 539 | 37 | 100.1 | 12 | 0.43 | 0.0037 | 16.3 | 201.0 | 2200 | 4.28 | 61.3 | 10 | 97.9 | 0.48 | 1.20 | 125.9 | 4 | 90.9 | 0.67 | 1.14 |
| 543 | - | 100.3 | 13 | 0.38 | 0.0035 | | 0.2 | 0 | 0.00 | 0.0 | 13 | 100.3 | 0.38 | 1.22 | 0.0 | 13 | 100.3 | 0.38 | 1.22 |
| High Serration Hydrophobic 20 Degrees - November 1, 2010 | | | | | | | | | | | | | | | | | | | |
| 545 | - | 101.7 | 14 | 0.32 | 0.0031 | | 86.5 | 0 | 0.00 | 0.0 | 14 | 101.7 | 0.32 | 1.23 | 0.0 | 14 | 101.7 | 0.32 | 1.23 |
| 547 | 15 | 101.5 | 14 | 0.51 | 0.0051 | 17.3 | 201.1 | 2200 | 4.29 | 64.7 | 12 | 99.1 | 0.56 | 1.21 | 133.9 | 6 | 91.1 | 0.82 | 1.14 |
| 548 | 17 | 101.5 | 13 | 0.51 | 0.0048 | 17.2 | 201.5 | 2205 | 4.29 | 63.9 | 11 | 99.2 | 0.57 | 1.21 | 131.9 | 5 | 91.3 | 0.82 | 1.14 |
| 549 | 18 | 101.5 | 14 | 0.53 | 0.0052 | 17.0 | 201.0 | 2202 | 4.28 | 63.5 | 12 | 99.2 | 0.60 | 1.21 | 131.1 | 5 | 91.5 | 0.85 | 1.14 |
| 550 | 19 | 101.5 | 14 | 0.51 | 0.0050 | 17.0 | 201.0 | 2202 | 4.28 | 63.6 | 12 | 99.2 | 0.56 | 1.21 | 131.2 | 5 | 91.4 | 0.81 | 1.14 |
| 551 | 20 | 101.5 | 13 | 0.51 | 0.0048 | 17.4 | 201.1 | 2204 | 4.28 | 65.0 | 11 | 99.1 | 0.57 | 1.21 | 134.6 | 4 | 90.9 | 0.83 | 1.14 |
| 552 | 21 | 101.5 | 12 | 0.55 | 0.0048 | 17.0 | 201.0 | 2203 | 4.28 | 63.1 | 10 | 99.2 | 0.61 | 1.22 | 130.1 | 4 | 91.5 | 0.88 | 1.15 |
| 553 | 22 | 101.4 | 13 | 0.53 | 0.0050 | 17.3 | 201.0 | 2202 | 4.28 | 64.6 | 11 | 99.1 | 0.59 | 1.21 | 133.7 | 4 | 91.0 | 0.87 | 1.14 |
| 554 | 23 | 101.5 | 13 | 0.54 | 0.0048 | 17.2 | 201.0 | 2202 | 4.28 | 63.8 | 11 | 99.1 | 0.60 | 1.21 | 131.7 | 4 | 91.3 | 0.86 | 1.14 |
| 555 | 25 | 101.4 | 13 | 0.53 | 0.0048 | 17.2 | 201.0 | 2204 | 4.28 | 64.1 | 11 | 99.1 | 0.59 | 1.21 | 132.5 | 4 | 91.2 | 0.86 | 1.14 |
| 556 | 27 | 101.4 | 13 | 0.51 | 0.0048 | 17.3 | 200.9 | 2202 | 4.28 | 64.5 | 11 | 99.1 | 0.58 | 1.21 | 133.4 | 4 | 91.1 | 0.84 | 1.14 |
| 557 | 29 | 101.5 | 12 | 0.50 | 0.0043 | 17.3 | 201.0 | 2198 | 4.29 | 63.9 | 10 | 99.1 | 0.56 | 1.22 | 132.1 | 3 | 91.2 | 0.81 | 1.15 |
| 558 | 31 | 101.5 | 13 | 0.51 | 0.0046 | 17.3 | 201.0 | 2203 | 4.28 | 64.4 | 11 | 99.1 | 0.57 | 1.21 | 133.3 | 4 | 91.1 | 0.83 | 1.14 |
| 559 | 33 | 101.5 | 12 | 0.52 | 0.0046 | 17.3 | 200.9 | 2201 | 4.28 | 64.1 | 10 | 99.1 | 0.58 | 1.21 | 132.4 | 4 | 91.2 | 0.84 | 1.14 |
| 560 | 35 | 101.5 | 13 | 0.50 | 0.0045 | 17.1 | 200.9 | 2200 | 4.28 | 63.5 | 11 | 99.2 | 0.56 | 1.21 | 131.1 | 4 | 91.4 | 0.81 | 1.15 |
| 561 | 37 | 101.5 | 13 | 0.51 | 0.0046 | 17.0 | 201.0 | 2201 | 4.28 | 63.0 | 11 | 99.2 | 0.57 | 1.21 | 129.9 | 4 | 91.6 | 0.82 | 1.15 |
| 562 | - | 101.7 | 13 | 0.45 | 0.0041 | 0.1 | 0.2 | 0 | 0.00 | 0.4 | 13 | 101.7 | 0.45 | 1.24 | 0.8 | 13 | 101.7 | 0.45 | 1.24 |
| High Serration Hydrophobic 0 Degrees - November 5, 2010 | | | | | | | | | | | | | | | | | | | |
| 564 | - | 98.6 | 16 | 0.32 | 0.0037 | | 0.0 | -1 | 0.00 | 0.0 | 16 | 98.6 | 0.32 | 1.18 | 0.0 | 16 | 98.6 | 0.32 | 1.18 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|-----------|--------------|--------|------|--------|-----------------|------------------|-------------------------|----------------|-----------|--------|---------|------|------------------------|------------|--------|---------|------|------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 565 | 15 | 98.4 | 14 | 0.66 | 0.0069 | 16.8 | 200.7 | 2197 | 4.28 | 64.8 | 12 | 96.1 | 0.74 | 1.17 | 134.1 | 5 | 88.3 | 1.08 | 1.10 |
| 566 | 17 | 98.4 | 14 | 0.69 | 0.0069 | 17.2 | 200.8 | 2201 | 4.28 | 66.4 | 11 | 95.9 | 0.78 | 1.17 | 137.9 | 4 | 87.7 | 1.16 | 1.10 |
| 567 | 18 | 98.4 | 14 | 0.69 | 0.0069 | 17.3 | 200.8 | 2202 | 4.28 | 66.8 | 11 | 95.9 | 0.78 | 1.17 | 138.8 | 4 | 87.5 | 1.17 | 1.10 |
| 568 | 19 | 98.3 | 13 | 0.70 | 0.0069 | 17.4 | 200.8 | 2202 | 4.28 | 67.0 | 11 | 95.9 | 0.79 | 1.17 | 139.2 | 4 | 87.4 | 1.20 | 1.10 |
| 569 | 20 | 98.3 | 13 | 0.68 | 0.0065 | 17.3 | 200.9 | 2201 | 4.28 | 66.7 | 11 | 95.9 | 0.77 | 1.17 | 138.6 | 3 | 87.5 | 1.16 | 1.10 |
| 570 | 21 | 98.3 | 12 | 0.74 | 0.0068 | 17.5 | 200.8 | 2201 | 4.28 | 67.4 | 10 | 95.8 | 0.83 | 1.17 | 140.2 | 3 | 87.2 | 1.27 | 1.10 |
| 571 | 22 | 98.3 | 13 | 0.67 | 0.0062 | 17.8 | 200.9 | 2202 | 4.28 | 68.3 | 10 | 95.8 | 0.76 | 1.17 | 142.5 | 2 | 86.9 | 1.18 | 1.09 |
| 572 | 23 | 98.4 | 12 | 0.71 | 0.0065 | 17.4 | 200.9 | 2200 | 4.28 | 66.7 | 10 | 95.9 | 0.80 | 1.18 | 138.7 | 3 | 87.5 | 1.22 | 1.10 |
| 573 | 25 | 98.4 | 12 | 0.64 | 0.0059 | 17.4 | 201.2 | 2204 | 4.29 | 66.9 | 10 | 95.9 | 0.73 | 1.18 | 139.1 | 3 | 87.4 | 1.10 | 1.10 |
| 574 | 27 | 98.4 | 12 | 0.67 | 0.0061 | 17.2 | 201.2 | 2203 | 4.29 | 66.0 | 10 | 96.0 | 0.76 | 1.18 | 137.0 | 3 | 87.8 | 1.13 | 1.10 |
| 575 | 29 | 98.4 | 12 | 0.73 | 0.0066 | 17.3 | 201.1 | 2200 | 4.29 | 66.3 | 10 | 96.0 | 0.82 | 1.18 | 137.6 | 3 | 87.7 | 1.23 | 1.10 |
| 576 | 31 | 98.4 | 12 | 0.73 | 0.0064 | 17.2 | 201.1 | 2201 | 4.29 | 65.9 | 10 | 96.0 | 0.82 | 1.18 | 136.7 | 3 | 87.8 | 1.22 | 1.11 |
| 577 | 33 | 98.4 | 12 | 0.72 | 0.0063 | 17.0 | 201.4 | 2202 | 4.29 | 65.0 | 10 | 96.1 | 0.80 | 1.18 | 134.6 | 3 | 88.1 | 1.19 | 1.11 |
| 578 | 35 | 98.4 | 11 | 0.72 | 0.0062 | 17.3 | 201.2 | 2202 | 4.29 | 66.2 | 9 | 96.0 | 0.81 | 1.18 | 137.5 | 2 | 87.7 | 1.23 | 1.11 |
| 579 | 37 | 98.5 | 11 | 0.68 | 0.0058 | 16.1 | 201.2 | 2203 | 4.29 | 61.1 | 9 | 96.4 | 0.76 | 1.18 | 125.5 | 3 | 89.5 | 1.06 | 1.12 |
| 580 | - | 98.7 | 12 | 0.61 | 0.0053 | | 0.3 | 0 | 0.00 | 0.0 | 12 | 98.7 | 0.61 | 1.20 | 0.0 | 12 | 98.7 | 0.61 | 1.20 |
| Medium Serration 20 Degrees - November 8, 2010 | | | | | | | | | | | | | | | | | | | |
| 581 | - | 100.1 | 15 | 0.23 | 0.0025 | | 86.6 | 0 | 0.00 | 0.0 | 15 | 100.1 | 0.23 | 1.21 | 0.0 | 15 | 100.1 | 0.23 | 1.21 |
| 582 | 15 | 99.9 | 15 | 0.43 | 0.0047 | 17.6 | 201.2 | 2201 | 4.29 | 67.0 | 13 | 97.4 | 0.48 | 1.18 | 139.3 | 6 | 88.9 | 0.72 | 1.11 |
| 583 | 17 | 99.9 | 15 | 0.43 | 0.0046 | 17.1 | 201.1 | 2203 | 4.29 | 65.3 | 13 | 97.5 | 0.48 | 1.18 | 135.3 | 6 | 89.5 | 0.70 | 1.11 |
| 584 | 19 | 99.9 | 12 | 0.46 | 0.0041 | 16.9 | 200.7 | 2198 | 4.28 | 63.5 | 10 | 97.6 | 0.51 | 1.20 | 131.1 | 4 | 90.0 | 0.73 | 1.13 |
| 585 | 21 | 99.9 | 14 | 0.42 | 0.0042 | 17.1 | 200.8 | 2199 | 4.28 | 64.6 | 12 | 97.5 | 0.47 | 1.19 | 133.7 | 5 | 89.6 | 0.69 | 1.12 |
| 586 | 23 | 99.9 | 13 | 0.42 | 0.0039 | 16.8 | 201.0 | 2202 | 4.28 | 63.4 | 11 | 97.6 | 0.46 | 1.19 | 130.7 | 4 | 90.0 | 0.67 | 1.13 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|--|--------------|--------------|-----------|------|--------|-----------------------|------------------------|-------------------------------|-------------------|------------|-----------|------------|------|---------------------------|------------|-----------|------------|------|---------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 587 | 25 | 99.9 | 14 | 0.45 | 0.0045 | 17.1 | 201.1 | 2201 | 4.29 | 64.9 | 12 | 97.5 | 0.50 | 1.19 | 134.2 | 5 | 89.6 | 0.73 | 1.12 |
| 588 | 27 | 99.9 | 14 | 0.41 | 0.0042 | 17.3 | 201.2 | 2204 | 4.29 | 65.6 | 12 | 97.5 | 0.46 | 1.19 | 136.0 | 5 | 89.3 | 0.68 | 1.12 |
| 589 | 29 | 99.9 | 15 | 0.43 | 0.0044 | 17.2 | 200.9 | 2200 | 4.28 | 65.4 | 12 | 97.5 | 0.48 | 1.19 | 135.5 | 5 | 89.4 | 0.71 | 1.11 |
| 590 | 31 | 99.9 | 14 | 0.41 | 0.0041 | 17.4 | 201.1 | 2202 | 4.28 | 65.9 | 12 | 97.5 | 0.46 | 1.19 | 136.7 | 5 | 89.2 | 0.68 | 1.12 |
| 591 | 33 | 99.9 | 14 | 0.42 | 0.0043 | 17.3 | 201.1 | 2203 | 4.28 | 65.7 | 12 | 97.5 | 0.47 | 1.19 | 136.2 | 5 | 89.3 | 0.70 | 1.11 |
| 592 | 35 | 99.9 | 14 | 0.45 | 0.0046 | 17.2 | 200.8 | 2198 | 4.28 | 65.4 | 12 | 97.5 | 0.50 | 1.19 | 135.4 | 5 | 89.4 | 0.74 | 1.12 |
| 593 | 37 | 99.9 | 14 | 0.42 | 0.0042 | 17.0 | 200.7 | 2199 | 4.28 | 64.2 | 12 | 97.6 | 0.47 | 1.19 | 132.7 | 5 | 89.8 | 0.68 | 1.12 |
| 594 | - | 100.1 | 13 | 0.39 | 0.0038 | | 2.8 | 0 | 0.00 | 0.0 | 13 | 100.1 | 0.39 | 1.21 | 0.0 | 13 | 100.1 | 0.39 | 1.21 |
| Medium Serration 0 Degrees - November 9, 2010 | | | | | | | | | | | | | | | | | | | |
| 595 | - | 100.7 | 17 | 0.29 | 0.0034 | | 86.3 | 0 | 0.00 | 0.0 | 17 | 100.7 | 0.29 | 1.21 | 0.0 | 17 | 100.7 | 0.29 | 1.21 |
| 596 | 15 | 100.6 | 17 | 0.42 | 0.0050 | 17.3 | 200.7 | 2202 | 4.28 | 65.9 | 15 | 98.2 | 0.47 | 1.18 | 136.7 | 8 | 89.9 | 0.69 | 1.11 |
| 597 | 17 | 100.6 | 16 | 0.45 | 0.0051 | 17.5 | 200.7 | 2203 | 4.28 | 66.5 | 14 | 98.1 | 0.50 | 1.19 | 138.1 | 7 | 89.7 | 0.74 | 1.11 |
| 598 | 19 | 100.6 | 16 | 0.47 | 0.0052 | 17.4 | 200.3 | 2197 | 4.27 | 66.2 | 14 | 98.1 | 0.52 | 1.19 | 137.3 | 6 | 89.8 | 0.77 | 1.12 |
| 599 | 21 | 100.6 | 16 | 0.45 | 0.0050 | 17.3 | 200.6 | 2204 | 4.27 | 65.7 | 14 | 98.2 | 0.50 | 1.19 | 136.3 | 7 | 90.0 | 0.73 | 1.12 |
| 600 | 23 | 100.6 | 15 | 0.45 | 0.0048 | 17.3 | 200.8 | 2202 | 4.28 | 65.5 | 13 | 98.2 | 0.51 | 1.19 | 135.8 | 6 | 90.0 | 0.74 | 1.12 |
| 601 | 25 | 100.5 | 15 | 0.44 | 0.0047 | 17.6 | 200.3 | 2205 | 4.27 | 66.6 | 13 | 98.1 | 0.50 | 1.19 | 138.3 | 6 | 89.6 | 0.75 | 1.12 |
| 602 | 27 | 100.5 | 15 | 0.44 | 0.0047 | 17.2 | 200.2 | 2204 | 4.26 | 65.2 | 13 | 98.2 | 0.50 | 1.19 | 134.9 | 6 | 90.1 | 0.73 | 1.12 |
| 603 | 29 | 100.5 | 16 | 0.43 | 0.0047 | 17.1 | 200.1 | 2203 | 4.26 | 64.7 | 13 | 98.2 | 0.48 | 1.19 | 133.8 | 7 | 90.3 | 0.70 | 1.12 |
| 604 | 31 | 100.5 | 15 | 0.43 | 0.0047 | 17.3 | 199.8 | 2199 | 4.26 | 65.5 | 13 | 98.1 | 0.48 | 1.19 | 135.8 | 6 | 90.0 | 0.71 | 1.12 |
| 605 | 33 | 100.5 | 15 | 0.45 | 0.0048 | 17.4 | 200.1 | 2205 | 4.26 | 65.8 | 13 | 98.1 | 0.50 | 1.19 | 136.5 | 6 | 89.9 | 0.74 | 1.12 |
| 606 | 35 | 100.5 | 16 | 0.43 | 0.0047 | 17.1 | 200.0 | 2201 | 4.26 | 64.9 | 14 | 98.2 | 0.48 | 1.19 | 134.3 | 7 | 90.2 | 0.70 | 1.12 |
| 607 | 37 | 100.6 | 15 | 0.43 | 0.0047 | 16.3 | 200.2 | 2204 | 4.26 | 61.5 | 14 | 98.4 | 0.48 | 1.19 | 126.4 | 7 | 91.4 | 0.67 | 1.13 |
| 608 | - | 100.8 | 16 | 0.30 | 0.0033 | | 1.8 | 0 | 0.00 | 0.0 | 16 | 100.8 | 0.30 | 1.21 | 0.0 | 16 | 100.8 | 0.30 | 1.21 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|---|--------------|--------------|-----------|------|--------|-----------------------|------------------------|-------------------------------|-------------------|------------|-----------|------------|------|--------------------------------|------------|-----------|------------|------|--------------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | p (kPa) | RH | ρ (kg/m ³) |
| High Serration Hydrophobic Sandblasted Tips 0 Degrees - November 10, 2010 | | | | | | | | | | | | | | | | | | | |
| 611 | - | 101.7 | 12 | 0.38 | 0.0032 | | 0.2 | 0 | 0.00 | 0.0 | 12 | 101.7 | 0.38 | 1.24 | 0.0 | 12 | 101.7 | 0.38 | 1.24 |
| 612 | 15 | 101.5 | 13 | 0.47 | 0.0045 | 17.6 | 200.5 | 2197 | 4.28 | 65.4 | 11 | 99.0 | 0.53 | 1.21 | 135.6 | 4 | 90.8 | 0.78 | 1.14 |
| 613 | 17 | 101.5 | 13 | 0.49 | 0.0044 | 17.6 | 200.4 | 2203 | 4.27 | 65.6 | 10 | 99.0 | 0.55 | 1.21 | 135.9 | 3 | 90.7 | 0.81 | 1.14 |
| 614 | 19 | 101.5 | 13 | 0.45 | 0.0042 | 17.5 | 200.4 | 2202 | 4.27 | 65.0 | 11 | 99.1 | 0.51 | 1.21 | 134.7 | 4 | 90.9 | 0.75 | 1.14 |
| 615 | 21 | 101.5 | 13 | 0.45 | 0.0043 | 17.6 | 200.1 | 2198 | 4.27 | 65.4 | 11 | 99.0 | 0.51 | 1.21 | 135.5 | 4 | 90.8 | 0.75 | 1.14 |
| 616 | 23 | 101.4 | 13 | 0.48 | 0.0044 | 17.7 | 201.2 | 2202 | 4.29 | 65.7 | 11 | 99.0 | 0.54 | 1.21 | 136.4 | 4 | 90.6 | 0.80 | 1.14 |
| 617 | 25 | 101.4 | 13 | 0.45 | 0.0041 | 17.3 | 197.8 | 2199 | 4.22 | 64.3 | 11 | 99.1 | 0.50 | 1.21 | 132.8 | 4 | 91.1 | 0.72 | 1.14 |
| 618 | 27 | 101.4 | 13 | 0.43 | 0.0038 | 17.4 | 198.0 | 2203 | 4.22 | 64.7 | 11 | 99.1 | 0.48 | 1.21 | 133.9 | 4 | 91.0 | 0.70 | 1.14 |
| 619 | 29 | 101.4 | 13 | 0.43 | 0.0041 | 17.4 | 197.9 | 2202 | 4.22 | 64.7 | 11 | 99.1 | 0.48 | 1.21 | 133.9 | 5 | 91.0 | 0.70 | 1.14 |
| 620 | 31 | 101.4 | 13 | 0.45 | 0.0042 | 17.3 | 197.9 | 2203 | 4.22 | 64.4 | 11 | 99.1 | 0.50 | 1.21 | 133.2 | 4 | 91.1 | 0.73 | 1.14 |
| 621 | - | 101.6 | 12 | 0.38 | 0.0033 | | 3.7 | 0 | 0.00 | 0.0 | 12 | 101.6 | 0.38 | 1.24 | 0.0 | 12 | 101.6 | 0.38 | 1.24 |
| 622 | - | 101.5 | 13 | 0.33 | 0.0031 | | 4.0 | 0 | 0.00 | 0.0 | 13 | 101.5 | 0.33 | 1.23 | 0.0 | 13 | 101.5 | 0.33 | 1.23 |
| 623 | 33 | 101.3 | 14 | 0.37 | 0.0037 | 17.4 | 197.7 | 2200 | 4.21 | 65.1 | 12 | 98.9 | 0.42 | 1.21 | 134.8 | 5 | 90.8 | 0.61 | 1.13 |
| 624 | 35 | 101.3 | 15 | 0.40 | 0.0042 | 17.3 | 197.8 | 2202 | 4.21 | 65.1 | 13 | 98.9 | 0.44 | 1.20 | 134.7 | 6 | 90.8 | 0.65 | 1.13 |
| 625 | 37 | 101.3 | 15 | 0.38 | 0.0039 | 16.4 | 197.9 | 2202 | 4.22 | 61.3 | 13 | 99.2 | 0.42 | 1.21 | 125.8 | 7 | 92.1 | 0.59 | 1.14 |
| High Serration Hydrophobic Sandblasted Tips 20 Degrees - November 10, 2010 | | | | | | | | | | | | | | | | | | | |
| 626 | 15 | 101.3 | 15 | 0.39 | 0.0041 | 17.6 | 197.7 | 2201 | 4.21 | 66.2 | 13 | 98.9 | 0.44 | 1.20 | 137.4 | 6 | 90.4 | 0.65 | 1.13 |
| 627 | 17 | 101.3 | 15 | 0.37 | 0.0041 | 17.1 | 197.4 | 2200 | 4.21 | 64.3 | 13 | 99.0 | 0.42 | 1.20 | 132.9 | 7 | 91.1 | 0.60 | 1.13 |
| 628 | 19 | 101.4 | 16 | 0.43 | 0.0048 | 17.1 | 198.2 | 2197 | 4.23 | 64.2 | 14 | 99.0 | 0.48 | 1.20 | 132.7 | 7 | 91.2 | 0.70 | 1.13 |
| 629 | 21 | 101.4 | 15 | 0.39 | 0.0042 | 17.1 | 197.6 | 2202 | 4.21 | 64.2 | 13 | 99.1 | 0.44 | 1.20 | 132.7 | 6 | 91.2 | 0.63 | 1.13 |
| 630 | 23 | 101.4 | 16 | 0.40 | 0.0044 | 17.2 | 197.7 | 2205 | 4.21 | 64.5 | 14 | 99.0 | 0.45 | 1.20 | 133.4 | 7 | 91.1 | 0.64 | 1.13 |
| 631 | 25 | 101.4 | 15 | 0.43 | 0.0046 | 17.3 | 197.5 | 2204 | 4.21 | 65.1 | 13 | 99.0 | 0.48 | 1.20 | 134.8 | 6 | 90.9 | 0.70 | 1.13 |

| File | Angle (°) | Tunnel Inlet | | | | Air Flow (kg/s) | Water Flow (GPH) | Spray Nozzles | | Rig Inlet | | | | | Rig Outlet | | | | |
|------|--------------|--------------|-----------|------|--------|-----------------------|------------------------|-------------------------------|-------------------|------------|-----------|------------|------|--------------------------------|------------|-----------|------------|------|--------------------------------|
| | | P (kPa) | T (°C) | RH | AH | | | Average Pressure (PSIG) | Average Flow # | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) | V (m/s) | T (°C) | P (kPa) | RH | ρ (kg/m ³) |
| 632 | 27 | 101.4 | 15 | 0.40 | 0.0042 | 17.1 | 197.2 | 2196 | 4.21 | 64.2 | 13 | 99.1 | 0.44 | 1.20 | 132.6 | 6 | 91.2 | 0.64 | 1.13 |
| 633 | 29 | 101.4 | 15 | 0.39 | 0.0042 | 17.2 | 197.4 | 2199 | 4.21 | 64.5 | 13 | 99.1 | 0.44 | 1.20 | 133.3 | 6 | 91.1 | 0.64 | 1.13 |
| 634 | 31 | 101.4 | 15 | 0.41 | 0.0044 | 17.3 | 197.4 | 2202 | 4.21 | 64.9 | 13 | 99.0 | 0.46 | 1.20 | 134.2 | 6 | 91.0 | 0.67 | 1.13 |
| 635 | 33 | 101.4 | 15 | 0.41 | 0.0044 | 17.3 | 197.5 | 2203 | 4.21 | 64.9 | 13 | 99.1 | 0.45 | 1.20 | 134.2 | 6 | 91.0 | 0.66 | 1.13 |
| 636 | 35 | 101.4 | 14 | 0.40 | 0.0040 | 17.5 | 197.6 | 2203 | 4.21 | 65.4 | 12 | 99.0 | 0.45 | 1.21 | 135.5 | 5 | 90.7 | 0.66 | 1.13 |
| 637 | 37 | 101.4 | 13 | 0.40 | 0.0038 | 17.2 | 197.5 | 2204 | 4.21 | 64.2 | 11 | 99.1 | 0.45 | 1.21 | 132.8 | 5 | 91.1 | 0.65 | 1.14 |
| 638 | - | 101.6 | 14 | 0.35 | 0.0035 | | 1.8 | 0 | 0.00 | 0.0 | 14 | 101.6 | 0.35 | 1.23 | 0.0 | 14 | 101.6 | 0.35 | 1.23 |

F.b. Particle Size Results

F.b.a. Summary Data

The following table presents the Dv50 and Dv90 values for all runs with their corresponding Steady State file number.

Table 4: Summary data for Malvern measurements on test rig

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| High Serration 0 Degrees - September 15, 2010 | | | |
| 150 | 15 | 20.71 | 34.49 |
| 151 | 17 | 19.24 | 33.76 |
| 152 | 19 | 86.9* | 475.8* |
| 153 | 21 | 27.74 | 63.39 |
| 154 | 23 | 23.05 | 40.67 |
| 155 | 25 | 20.83 | 35.39 |
| 156 | 27 | 13.45 | 26.75 |
| 157 | 29 | 23.56 | 149.9 |
| 158 | 31 | 18.94 | 106.5 |
| 159 | 33 | 19.69 | 35.46 |
| 160 | 35 | 20.5 | 44.29 |
| 161 | 37 | 54.91 | 287.8 |
| High Serration 20 Degrees - September 16, 2010 | | | |
| 164 | 15 | 17.77 | 32.59 |
| 165 | 17 | 26.72 | 40.85 |
| 166 | 19 | 44.62* | 381.3* |
| 167 | 21 | 35.29* | 369.6* |
| 168 | 23 | 25.23 | 50.1 |
| 169 | 25 | 18.67 | 44.9 |
| 170 | 27 | 18.32 | 34.35 |
| 172 | 29 | 15.62 | 27.41 |
| 173 | 31 | 14.32 | 27.62 |
| 175 | 33 | 17.81 | 30.05 |
| 176 | 35 | 28.72 | 259 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|--|-----------|-----------|-----------|
| 177 | 37 | 32.7 | 120 |
| Baseline 20 Degrees - September 17, 2010 | | | |
| 185 | 15 | 19.63 | 32.54 |
| Not available | 17 | 21.69 | 90.89 |
| 188 | 19 | 37.37 | 243.6 |
| 189 | 21 | 26.64 | 58.59 |
| 190 | 23 | 24.1 | 45.59 |
| 191 | 25 | 19.67 | 36.12 |
| 192 | 27 | 22.48 | 149.6 |
| 193 | 29 | 14.19 | 26.72 |
| 196 | 31 | 14.45 | 27.7 |
| 197 | 33 | 16.88 | 28.35 |
| 198 | 35 | 20.96 | 112.1 |
| 199 | 37 | 36.15 | 159.2 |
| Baseline 0 Degrees - September 17, 2010 | | | |
| 200 | 15 | 18.02 | 32.5 |
| 201 | 17 | 20.18 | 36.23 |
| 202 | 19 | 13.82 | 138.1 |
| 203 | 21 | 35.19 | 120.8 |
| 204 | 23 | 25.1 | 42.51 |
| 205 | 25 | 20.04 | 33.39 |
| 206 | 27 | 13.27 | 28.98 |
| 207 | 29 | 29.35 | 142.4 |
| 208 | 31 | 17.85 | 95.82 |
| Not available | 33 | 17.54 | 30.77 |
| 209 | 35 | 20.52 | 35.6 |
| 210 | 37 | 35.56 | 183.4 |
| Low Serration 20 Degrees - September 21, 2010 | | | |
| 213 | 15 | 17.82 | 31.99 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| 214 | 17 | 20.86 | 71.34 |
| 215 | 19 | 36.25 | 235.5 |
| 216 | 21 | 25.06 | 46.27 |
| 217 | 23 | 25.04 | 46.78 |
| 218 | 25 | 20.94 | 36.15 |
| 219 | 27 | 23.6 | 154.9 |
| 220 | 29 | 14.37 | 25.9 |
| 221 | 31 | 14.3 | 25.65 |
| 222 | 33 | 17.66 | 30.81 |
| 223 | 35 | 20.05 | 117.3 |
| 224 | 37 | 31.37 | 146.8 |
| Low Serration 0 Degrees - September 22, 2010 | | | |
| 228 | 15 | 18.86 | 32.8 |
| 230 | 17 | 20.46 | 51.1 |
| 231 | 19 | 14.17 | 112.8 |
| 232 | 21 | 32.7 | 112.8 |
| 233 | 23 | 24.67 | 20.01 |
| 234 | 25 | 20.48 | 34.17 |
| 235 | 27 | 15.72 | 40.27 |
| 236 | 29 | 37.49 | 143.7 |
| 237 | 31 | 18.49 | 107.8 |
| 238 | 33 | 18.52 | 34.25 |
| 239 | 35 | 20.91 | 36.75 |
| 240 | 37 | 72.6 | 248.8 |
| Hydrophobic 20 Degrees - September 22, 2010 | | | |
| 243 | 15 | 17.98 | 31.33 |
| 244 | 17 | 17.01 | 52.17 |
| 245 | 19 | 30.71 | 193.5 |
| 246 | 21 | 28.61 | 48.95 |
| 247 | 23 | 24.79 | 45.76 |
| 248 | 25 | 19.89 | 35.58 |
| 249 | 27 | 17.76 | 146.5 |
| 250 | 29 | 13.69 | 24.4 |
| 251 | 31 | 14.85 | 29.52 |
| 252 | 33 | 17.19 | 30.23 |
| 253 | 35 | 19.19 | 115.3 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|--|-----------|-----------|-----------|
| 254 | 37 | 31.87 | 138.9 |
| Hydrophobic 0 Degrees - September 23, 2010 | | | |
| 260 | 15 | 19.82 | 33.81 |
| 261 | 17 | 19.97 | 34.5 |
| 262 | 19 | 13.91 | 150.4 |
| 263 | 21 | 30.53 | 110.7 |
| 264 | 23 | 25.15 | 45.71 |
| 265 | 25 | 21.37 | 35.76 |
| 267 | 27 | 15.72 | 35.6 |
| 268 | 29 | 26.22 | 138.8 |
| 269 | 31 | 20.15 | 105.1 |
| 270 | 33 | 18.53 | 33.85 |
| 271 | 35 | 21.12 | 44.02 |
| 272 | 37 | 66.04 | 347.5 |
| Hydrophilic 20 Degrees - September 27, 2010 | | | |
| 278 | 15 | 19.46 | 32.48 |
| 279 | 17 | 19.75 | 88.92 |
| 280 | 19 | 36.12 | 242.7 |
| 282 | 21 | 25.79 | 47.34 |
| 283 | 23 | 25.13 | 45.97 |
| 285 | 25 | 21.26 | 39.14 |
| 286 | 27 | 21.42 | 154.6 |
| 287 | 29 | 16.15 | 31.23 |
| 288 | 31 | 14.42 | 28.3 |
| 289 | 33 | 17.3 | 34.19 |
| 290 | 35 | 20.48 | 135 |
| 291 | 37 | 39.8 | 167.9 |
| Hydrophilic 0 Degrees - September 27, 2010 | | | |
| 294 | 15 | 20.1 | 35.75 |
| 295 | 17 | 19.49 | 33.95 |
| 296 | 19 | 14.6 | 119 |
| 297 | 21 | 32.85 | 101.9 |
| 298 | 23 | 24.36 | 41.63 |
| 299 | 25 | 19.94 | 35.24 |
| 300 | 27 | 12.95 | 32.24 |
| 301 | 31 | 25.55 | 132 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|--|-----------|-----------|-----------|
| 302 | 29 | 23.98 | 133.1 |
| 303 | 33 | 19.63 | 37.08 |
| 304 | 35 | 20.71 | 39 |
| 305 | 37 | 73.9 | 250 |
| Baseline 20 Degrees -September 29, 2010 | | | |
| 308 | 15 | 20.03 | 36.45 |
| 309 | 17 | 18.83 | 94.52 |
| 310 | 19 | 34.47 | 207.6 |
| 311 | 21 | 25.59 | 47.51 |
| 312 | 23 | 24.02 | 46.9 |
| 314 | 25 | 21.96 | 40.62 |
| 315 | 27 | 26.09 | 159.2 |
| 318 | 29 | 15.61 | 28.49 |
| 319 | 31 | 15.04 | 27.21 |
| 320 | 33 | 17.21 | 29.61 |
| 321 | 35 | 19.75 | 39.79 |
| 322 | 37 | 41.64 | 178.5 |
| Baseline 0 Degrees - September 30, 2010 | | | |
| 325 | 15 | 18.56 | 34.2 |
| 326 | 17 | 20 | 37.55 |
| 327 | 19 | 13.5 | 101.5 |
| 328 | 21 | 34.08 | 130.2 |
| 331 | 23 | 24.19 | 45.24 |
| 332 | 25 | 20.65 | 35.16 |
| 333 | 27 | 15.35 | 34.15 |
| 334 | 29 | 25.48 | 132.2 |
| 335 | 31 | 19.66 | 101.8 |
| 337 | 33 | 17.99 | 32.21 |
| 338 | 35 | 21.29 | 44.09 |
| 339 | 37 | 66.75 | 240.4 |
| High Serration 20 Degrees - October 1, 2010 | | | |
| 342 | 15 | 18.74 | 32.01 |
| 343 | 17 | 20.5 | 76.8 |
| 344 | 19 | 36.75 | 232 |
| 345 | 21 | 25.91 | 50.25 |
| 346 | 23 | 24.75 | 47.79 |
| 347 | 25 | 21.72 | 39.79 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| 348 | 27 | 23.95 | 115.3 |
| 349 | 29 | 14.95 | 28 |
| 350 | 31 | 14.83 | 27.67 |
| 352 | 33 | 17.95 | 30.45 |
| 353 | 35 | 22.56 | 179.2 |
| 354 | 37 | 39.91 | 184.3 |
| High Serration 0 Degrees - October 1, 2010 | | | |
| 357 | 15 | 20.23 | 34.72 |
| 358 | 17 | 19.65 | 33.67 |
| 359 | 19 | 17.58 | 162.9 |
| 360 | 21 | 37 | 149.3 |
| 361 | 23 | 25.13 | 41.18 |
| 362 | 25 | 21.31 | 35.71 |
| 363 | 27 | 15.66 | 31.05 |
| 364 | 29 | 32.47 | 143.8 |
| 365 | 31 | 19.64 | 119.9 |
| 366 | 33 | 19.42 | 36.85 |
| 367 | 35 | 22.16 | 56.44 |
| 368 | 37 | 91.16 | 324.2 |
| Hydrophobic 0 Degrees - October 4, 2010 | | | |
| 371 | 15 | 19.87 | 34.72 |
| 372 | 17 | 19.47 | 33.52 |
| 373 | 19 | 12.66 | 146.9 |
| 374 | 21 | 30.69 | 112.8 |
| 375 | 23 | 25.03 | 44.17 |
| 376 | 25 | 21.23 | 38.29 |
| 377 | 27 | 16.35 | 35.12 |
| 378 | 29 | 28.71 | 145.1 |
| 379 | 31 | 22.04 | 119.7 |
| 380 | 33 | 18.53 | 35.42 |
| 381 | 35 | 22.27 | 42.42 |
| 382 | 37 | 55.4 | 248.5 |
| Hydrophobic 20 Degrees - October 7, 2010 | | | |
| 389 | 15 | 18.91 | 31.9 |
| 390 | 17 | 17.27 | 46.21 |
| 391 | 19 | 34.08 | 210.1 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|--|-----------|-----------|-----------|
| 392 | 21 | 29.22 | 59.27 |
| 393 | 23 | 25.57 | 46.36 |
| 394 | 25 | 20.57 | 35.35 |
| 395 | 27 | 23.45 | 154.6 |
| 396 | 29 | 14.6 | 27.13 |
| 397 | 31 | 14.39 | 26.51 |
| 398 | 33 | 17.86 | 32.42 |
| 399 | 35 | 20.01 | 129.2 |
| 400 | 37 | 31.49 | 163.4 |
| Hydrophilic 20 Degrees - October 8, 2010 | | | |
| 402 | 15 | 18.81 | 32.58 |
| 403 | 17 | 25.84 | 59.46 |
| 404 | 19 | 33.75 | 212.3 |
| 405 | 21 | 25.07 | 44.89 |
| 406 | 23 | 25.35 | 47.14 |
| 407 | 25 | 19.44 | 40.63 |
| 408 | 27 | 20.97 | 105.7 |
| 409 | 29 | 13.6 | 24.29 |
| 410 | 31 | 13.97 | 24.05 |
| 413 | 33 | 17.07 | 29.53 |
| 414 | 35 | 30.93 | 211.5 |
| 416 | 37 | 29.59 | 43.48 |
| Hydrophilic 0 Degrees - October 8, 2010 | | | |
| 417 | 15 | 19.48 | 36.46 |
| 418 | 17 | 19.52 | 37.98 |
| 419 | 19 | 15.84 | 165.9 |
| 420 | 21 | 34.81 | 112 |
| 421 | 23 | 25.78 | 41.77 |
| 422 | 25 | 21.15 | 35.26 |
| 423 | 27 | 14.43 | 29.38 |
| 424 | 29 | 30.92 | 140.1 |
| 425 | 31 | 19.86 | 113.9 |
| 426 | 33 | 18.62 | 33.98 |
| 427 | 35 | 20.92 | 38.66 |
| 428 | 37 | 66.2 | 262.1 |
| Low Serration 20 Degrees - October 12, 2010 | | | |
| 431 | 15 | 19.02 | 34.9 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| 432 | 17 | 18.69 | 58.63 |
| 433 | 19 | 31.97 | 178.3 |
| 434 | 21 | 27.39 | 49.8 |
| 437 | 23 | 26.26 | 50.26 |
| 438 | 25 | 21.36 | 37.63 |
| 439 | 27 | 22.33 | 150 |
| 440 | 29 | 14.06 | 25.64 |
| 441 | 31 | 15.27 | 28.22 |
| 442 | 33 | 16.44 | 29.66 |
| 443 | 35 | 22.98 | 196.4 |
| 444 | 37 | 40.04 | 185.4 |
| Low Serration 0 Degrees - October 12, 2010 | | | |
| 445 | 15 | 19.45 | 34.02 |
| 446 | 17 | 20.02 | 37.06 |
| 447 | 19 | 15.27 | 132 |
| 449 | 21 | 38.08 | 138.7 |
| 450 | 33 | 27.05 | 48.13 |
| 451 | 25 | 21.2 | 37.43 |
| 452 | 27 | 14.77 | 29.68 |
| 453 | 29 | 29.32 | 149.2 |
| 454 | 31 | 20.95 | 119.1 |
| 455 | 33 | 18.06 | 32.76 |
| 456 | 35 | 21.66 | 47.29 |
| 457 | 37 | 42.26 | 226.2 |
| Medium Serration 20 Degrees - October 13, 2010 | | | |
| 461 | 15 | 20.23 | 35.09 |
| 462 | 17 | 16.98 | 46.33 |
| 463 | 19 | 34.09 | 213.9 |
| 464 | 21 | 27.74 | 50.55 |
| 465 | 23 | 26.29 | 49.41 |
| 466 | 25 | 21.56 | 36.21 |
| 467 | 27 | 22.24 | 140.3 |
| 468 | 29 | 14.61 | 25.95 |
| 469 | 31 | 14.95 | 28.03 |
| 470 | 33 | 16.7 | 28.7 |
| 471 | 35 | 20.35 | 44.19 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| 472 | 37 | 40.46 | 208 |
| Medium Serration 0 Degrees - October 14, 2010 | | | |
| 475 | 15 | 19.83 | 34.99 |
| 476 | 17 | 19.68 | 36.22 |
| 477 | 19 | 15.53 | 179.1 |
| 478 | 21 | 31.92 | 114.1 |
| 479 | 23 | 26.05 | 48.49 |
| 480 | 25 | 20.8 | 36.2 |
| Not available | 27 | 15.52 | 34.03 |
| 481 | 29 | 41.71 | 149.8 |
| 482 | 31 | 20.68 | 113.6 |
| 483 | 33 | 19.88 | 34.49 |
| 484 | 35 | 22.1 | 43.82 |
| 485 | 37 | 87.25 | 274.5 |
| No IGV Baseline - October 26, 2010 | | | |
| 489 | 15 | 19.12 | 32.97 |
| 490 | 17 | 24.41 | 38.68 |
| 491 | 18 | 27.26 | 41.5 |
| 492 | 19 | 31.04 | 48.3 |
| 493 | 20 | 48.33 | 322.4 |
| 494 | 21 | 27.57 | 64.34 |
| 495 | 22 | 25.44 | 46.34 |
| 496 | 23 | 26.62 | 44.63 |
| 497 | 25 | 20.09 | 34.82 |
| 498 | 27 | 18.9 | 32.2 |
| 499 | 29 | 15.44 | 27.37 |
| 500 | 31 | 14.54 | 25.09 |
| 501 | 33 | 17.82 | 30.85 |
| 502 | 35 | 24.33 | 39.85 |
| 503 | 37 | 28.81 | 42.78 |
| High Serration Hydrophobic 20 Degrees - October 27, 2010 | | | |
| 506 | 15 | 19.78 | 36.99 |
| 507 | 17 | 20.5 | 64.84 |
| 508 | 18 | 30.64 | 78.2 |
| 509 | 19 | 37.68 | 255.3 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| 510 | 20 | 31.61 | 175 |
| 511 | 21 | 28.51 | 48.18 |
| 512 | 22 | 27.15 | 46.48 |
| 513 | 23 | 27.51 | 53.01 |
| 514 | 25 | 21.01 | 21.01 |
| 515 | 27 | 23.32 | 148.4 |
| 516 | 29 | 14.58 | 28.39 |
| 517 | 31 | 13.99 | 25.5 |
| 518 | 33 | 18.32 | 32 |
| 519 | 35 | 19.53 | 41.42 |
| 521 | 37 | 33.77 | 174.5 |
| High Serration Hydrophobic 0 Degrees - October 29, 2010 | | | |
| 525 | 15 | 18.84 | 35.26 |
| 526 | 17 | 19.96 | 35.5 |
| 527 | 18 | 17 | 33.19 |
| 528 | 19 | 15.63 | 130.8 |
| 529 | 20 | 39.25 | 213.8 |
| 530 | 21 | 33.38 | 113.8 |
| 531 | 22 | 28.62 | 65.29 |
| 532 | 23 | 25.66 | 45.38 |
| 533 | 25 | 21.61 | 36.36 |
| 534 | 27 | 16.03 | 34.41 |
| 535 | 29 | 31.63 | 150.5 |
| 536 | 31 | 20.93 | 123.7 |
| 537 | 33 | 19.26 | 33.42 |
| 538 | 35 | 22.54 | 44.99 |
| 539 | 37 | 72 | 249.6 |
| High Serration Hydrophobic 20 Degrees - November 1, 2010 | | | |
| 547 | 15 | 19.38 | 33.69 |
| 548 | 17 | 18.08 | 63.94 |
| 549 | 18 | 30.33 | 110.5 |
| 550 | 19 | 34.11 | 239.3 |
| 551 | 20 | 30.01 | 173.1 |
| 552 | 21 | 27.75 | 56.68 |
| 553 | 22 | 25.92 | 44.54 |
| 554 | 23 | 26.15 | 53.93 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|--|-----------|-----------|-----------|
| 555 | 25 | 21.25 | 38.74 |
| 556 | 27 | 22.79 | 154.7 |
| 557 | 29 | 16.12 | 29.06 |
| 558 | 31 | 16.05 | 29.97 |
| 559 | 33 | 16.99 | 30 |
| 560 | 35 | 21.56 | 123.1 |
| 561 | 37 | 45.14 | 209 |
| High Serration Hydrophobic 0 Degrees - November 5, 2010 | | | |
| 565 | 15 | 19.12 | 33.27 |
| 566 | 17 | 18.97 | 32.17 |
| 567 | 18 | 16.17 | 31.94 |
| 568 | 19 | 16.09 | 166.9 |
| 569 | 20 | 32.47 | 195.4 |
| 570 | 21 | 34.01 | 129.5 |
| 571 | 22 | 27.5 | 58.19 |
| 572 | 23 | 25.02 | 46.02 |
| 573 | 25 | 20.82 | 36.05 |
| 574 | 27 | 15.61 | 31.56 |
| 575 | 29 | 36.09 | 150.9 |
| 576 | 31 | 20.56 | 116.1 |
| 577 | 33 | 18.03 | 32.18 |
| 578 | 35 | 21.91 | 45.04 |
| 579 | 37 | 99.93 | 321.2 |
| Medium Serration 20 Degrees - November 8, 2010 | | | |
| 582 | 15 | 19.37 | 34.32 |
| 583 | 17 | 18.82 | 90.11 |
| 584 | 19 | 40.58 | 304 |
| 585 | 21 | 26.52 | 49.17 |
| 586 | 23 | 25.07 | 45.13 |
| 587 | 25 | 21.32 | 37.44 |
| 588 | 27 | 21.47 | 148.4 |
| 589 | 29 | 15.97 | 29.91 |
| 590 | 31 | 14.97 | 27.56 |
| 591 | 33 | 16.68 | 29.15 |
| 592 | 35 | 22.3 | 131.8 |
| 593 | 37 | 42.79 | 209 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|---|-----------|-----------|-----------|
| Medium Serration 0 Degrees - November 9, 2010 | | | |
| 596 | 15 | 17.82 | 32.23 |
| 597 | 17 | 19.56 | 34.14 |
| 598 | 19 | 16.72 | 141.3 |
| 599 | 21 | 33.54 | 122.6 |
| 600 | 23 | 25.49 | 50.75 |
| 601 | 25 | 21.86 | 36.44 |
| 602 | 27 | 15.1 | 33.18 |
| 603 | 29 | 38.16 | 155.5 |
| 604 | 31 | 19.51 | 113.8 |
| 605 | 33 | 19.41 | 33.83 |
| 606 | 35 | 22.03 | 41.51 |
| 607 | 37 | 87.75 | 281.2 |
| High Serration Hydrophobic Sandblasted Tips 0 Degrees - November 10, 2010 | | | |
| 612 | 15 | 19.86 | 35.18 |
| 613 | 17 | 19.33 | 32.69 |
| 614 | 19 | 15.53 | 154.6 |
| 615 | 21 | 28.84 | 116.5 |
| 616 | 23 | 25.17 | 49.28 |
| 617 | 25 | 21.65 | 36.64 |
| 618 | 27 | 15.53 | 32.75 |
| 619 | 29 | 22.5 | 143.9 |
| 620 | 31 | 19.49 | 118.3 |
| 623 | 33 | 18.23 | 32.48 |
| 624 | 35 | 22.75 | 48.63 |
| 625 | 37 | 74.55 | 266.9 |
| High Serration Hydrophobic Sandblasted Tips 20 Degrees - November 10, 2010 | | | |
| 626 | 15 | 19.82 | 33.34 |
| 627 | 17 | 17.94 | 66.76 |
| 628 | 19 | 34.86 | 221.8 |
| 629 | 21 | 27.29 | 53.46 |
| 630 | 23 | 26.94 | 50.56 |
| 631 | 25 | 22.7 | 38.49 |
| 632 | 27 | 18.73 | 146.3 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|-----------|-----------|-----------|-----------|
| 633 | 29 | 14.6 | 26.03 |
| 634 | 31 | 15.06 | 26.48 |
| 635 | 33 | 18.27 | 30.26 |

| SS File # | Angle (°) | Dv50 (µm) | Dv90 (µm) |
|-----------|-----------|-----------|-----------|
| 636 | 35 | 18.82 | 40.11 |
| 637 | 37 | 32.55 | 167 |

*Values in shaded areas were excluded from analysis as they were found to be unreasonably high, most likely due to large water droplets running across the top and/or bottom glass lenses (see Section 2.3). After the effect of the lenses was noticed, they were removed.

F.b.b. ***Dv90 Plots***

This section presents Dv90 plots of the individual tests for each blade treatment. These plots provide all the measurement points including the positions greater than 33° which are affected by the wall. To present the region of interest in more detail, if the near wall values were much higher than the results in the main flow the scale was truncated and a note added to the plot giving the value, see for example figure 36.

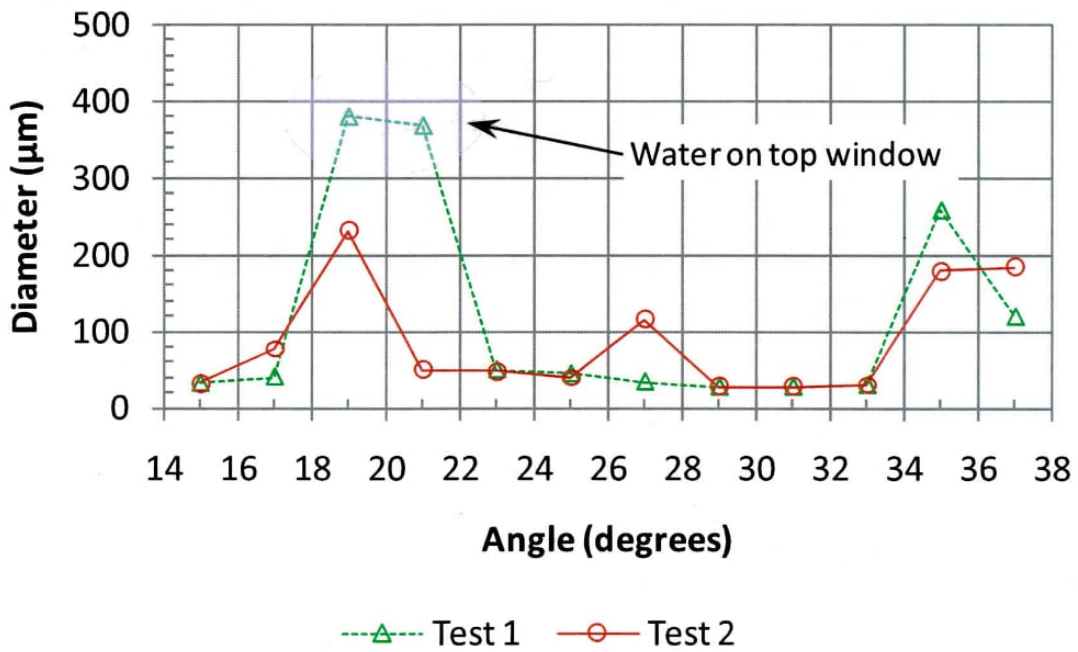


Figure 29: Dv90 results for high serration IGV at 20° setting

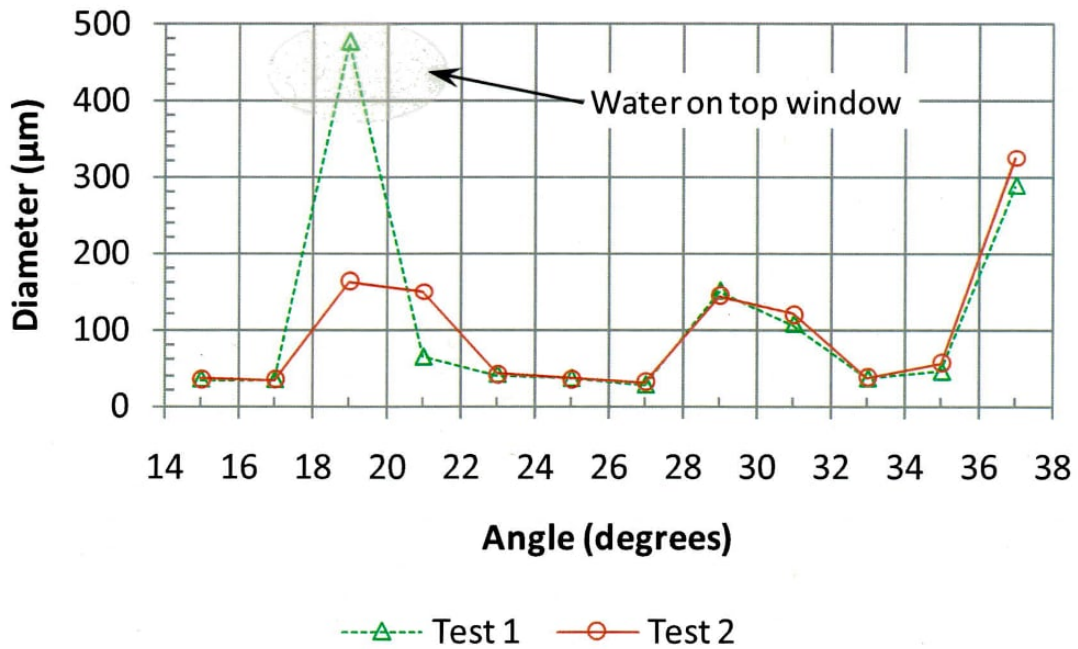


Figure 30: Dv90 results for high serration IGV at 0° setting

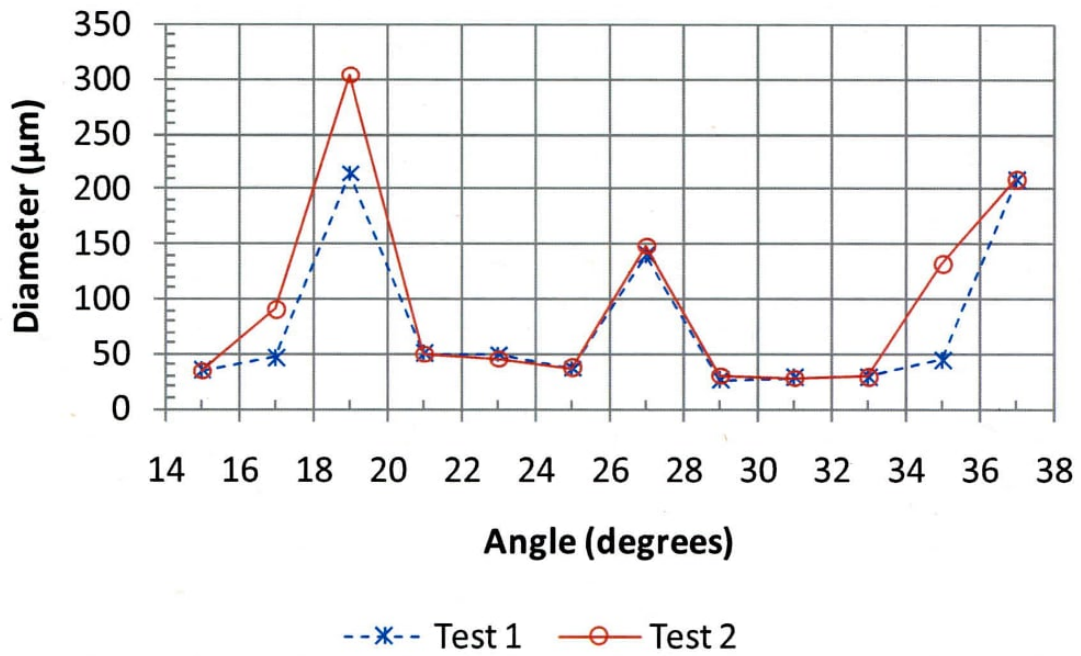


Figure 31: Dv90 results for medium serration IGV at 20° setting

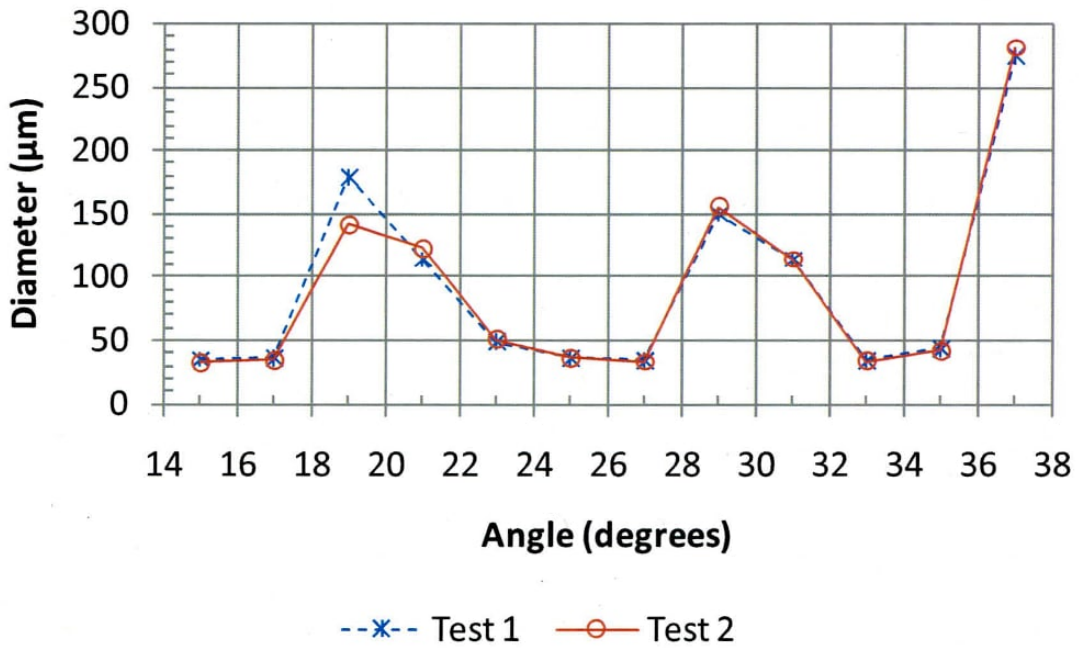


Figure 32: Dv90 results for medium serration IGV at 0° setting

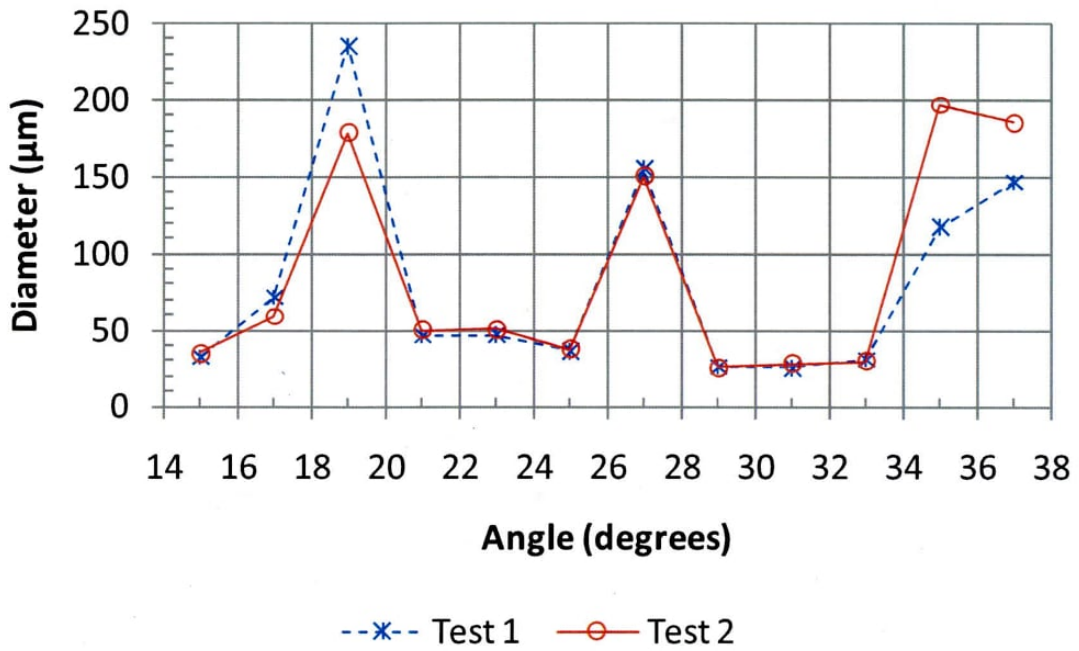


Figure 33: Dv90 results for low serration IGV at 20° setting

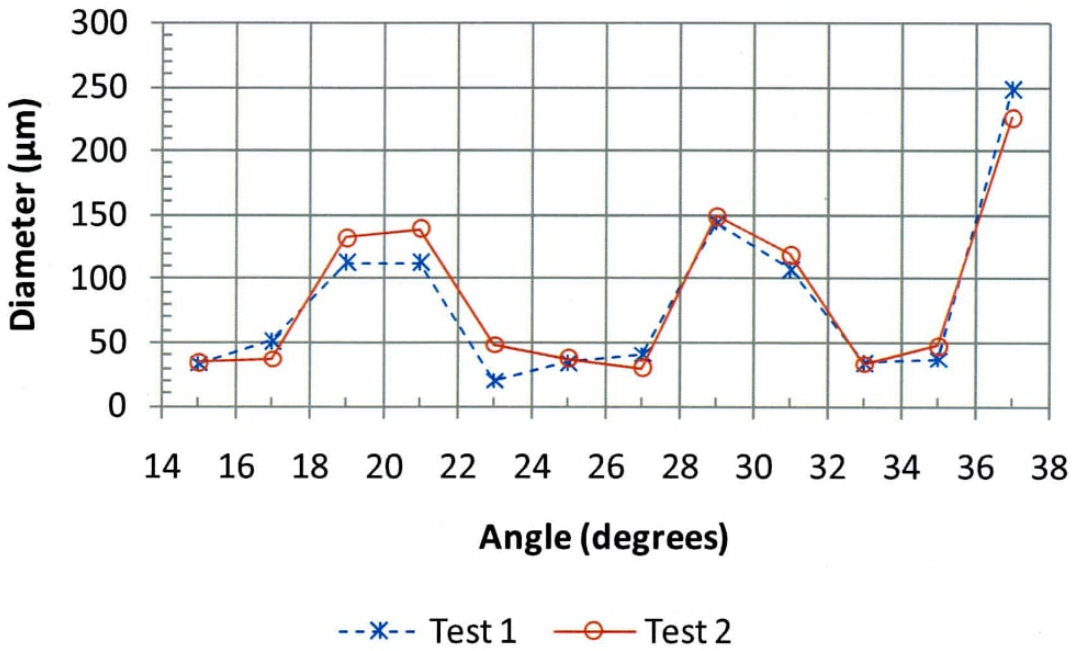


Figure 34: Dv90 results for low serration IGV at 0° setting

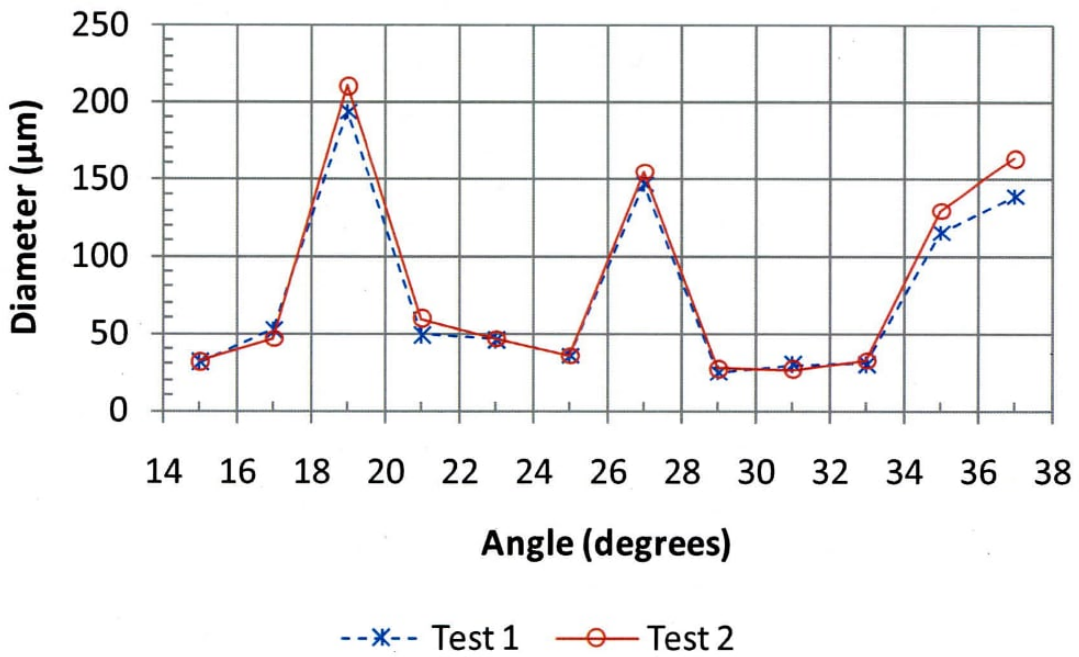


Figure 35: Dv90 results for hydrophobic coated IGv at 20° setting

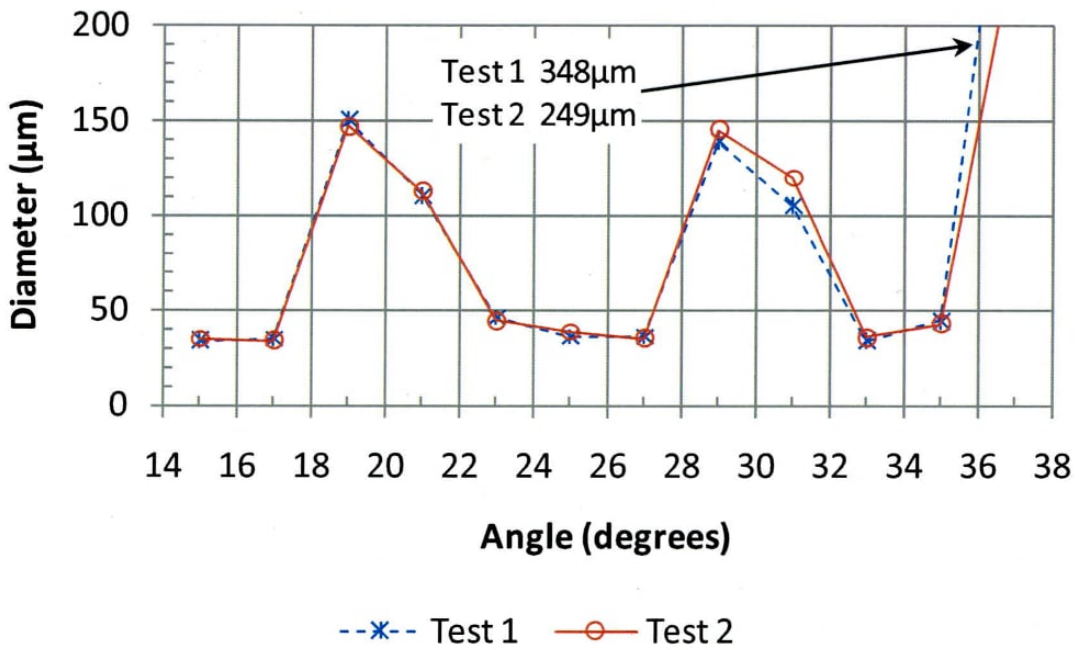


Figure 36: Dv90 results for hydrophobic coated IGv at 0° setting

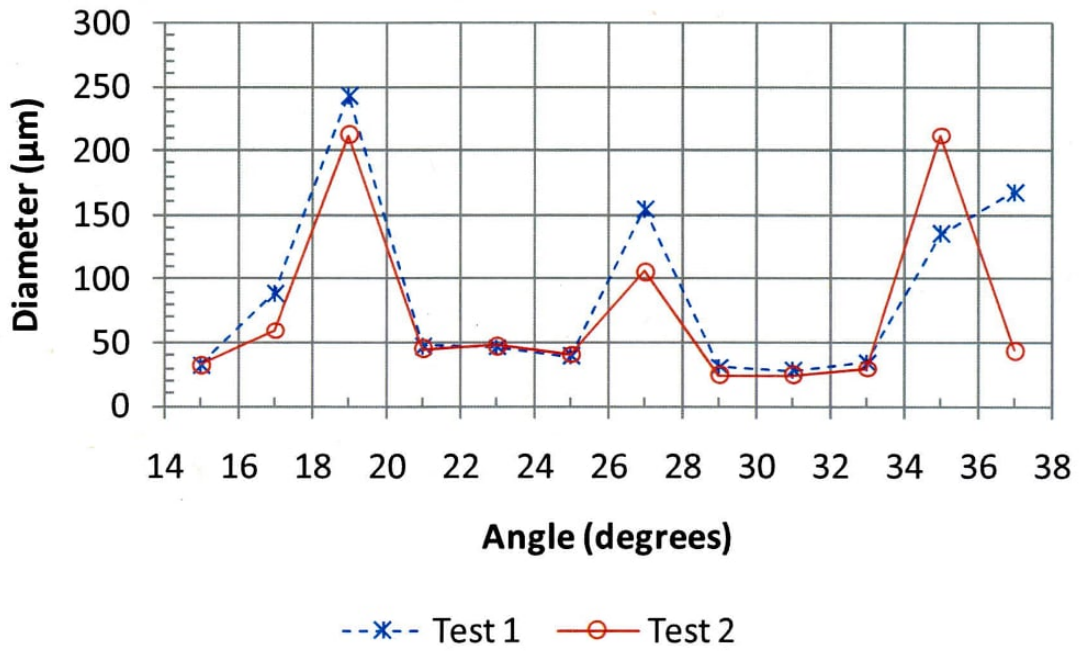


Figure 37: Dv90 results for hydrophilic coated IGV at 20° setting

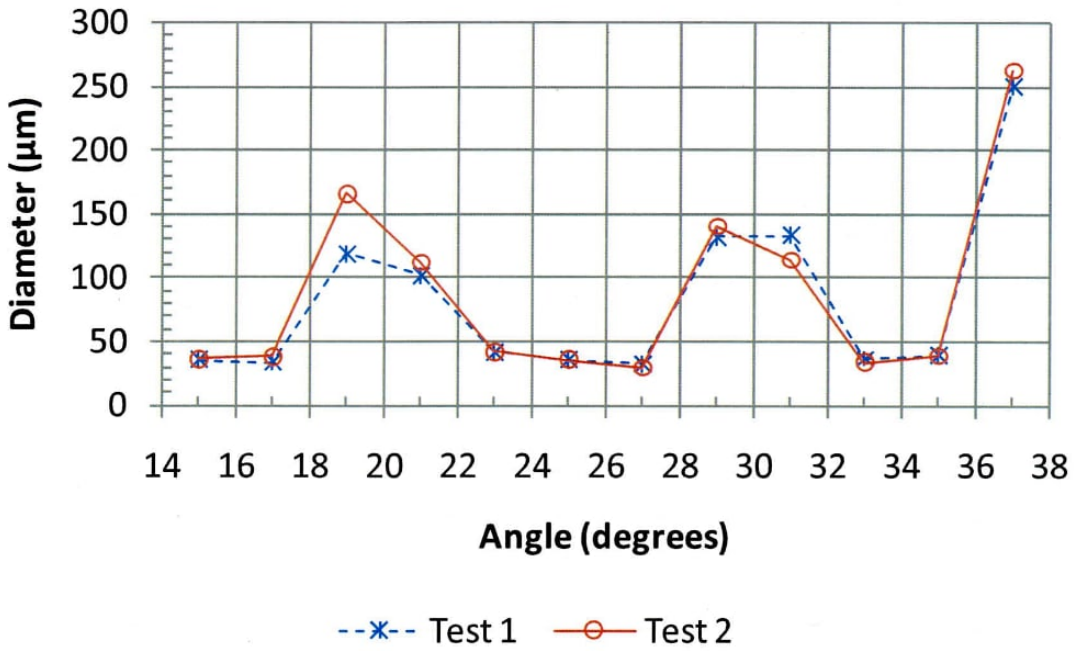


Figure 38: Dv90 results for hydrophilic coated IGV at 0° setting

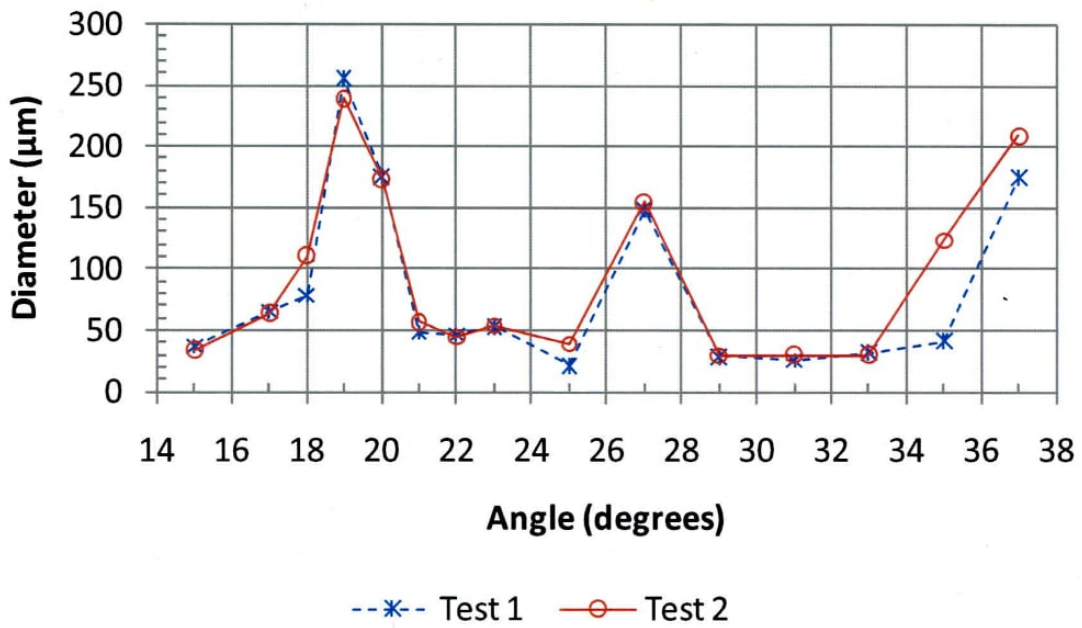


Figure 39: Dv90 results for hydrophobic coated with high serration IGV at 20° setting

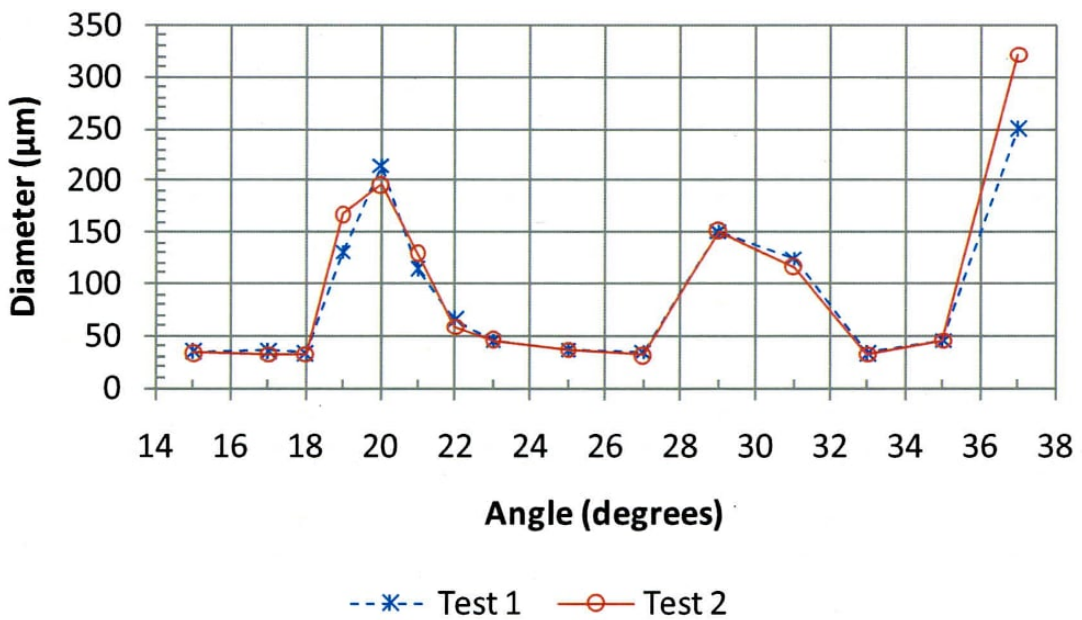


Figure 40: Dv90 results for hydrophobic coated with high serration IGV at 0° setting

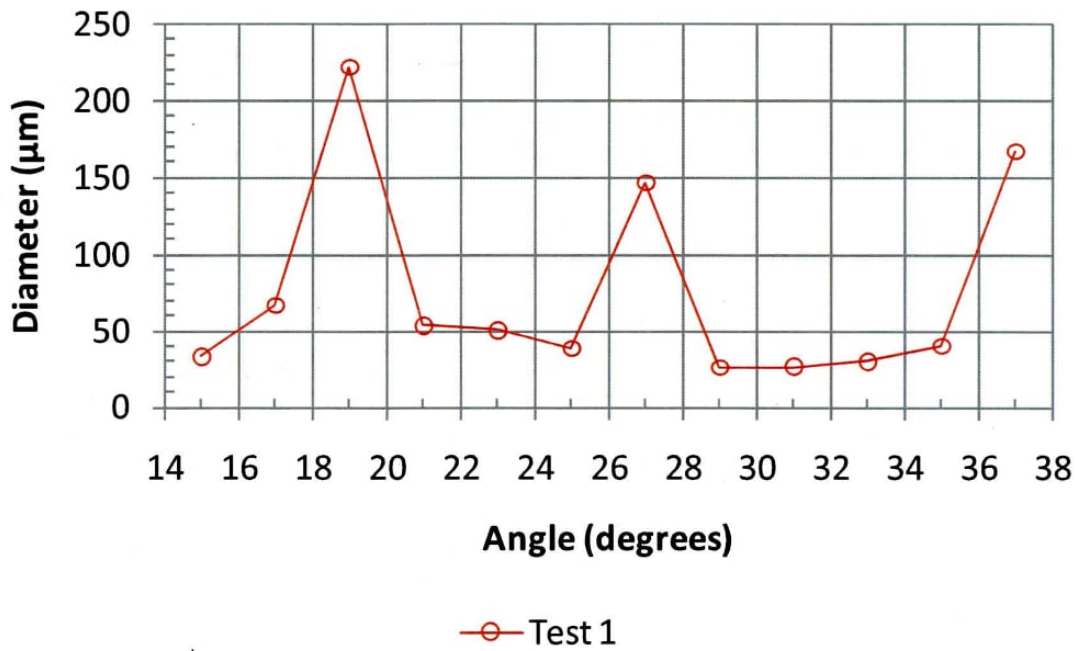


Figure 41: Dv90 results for hydrophobic coated with sand blasted high serration IGV at 20° setting

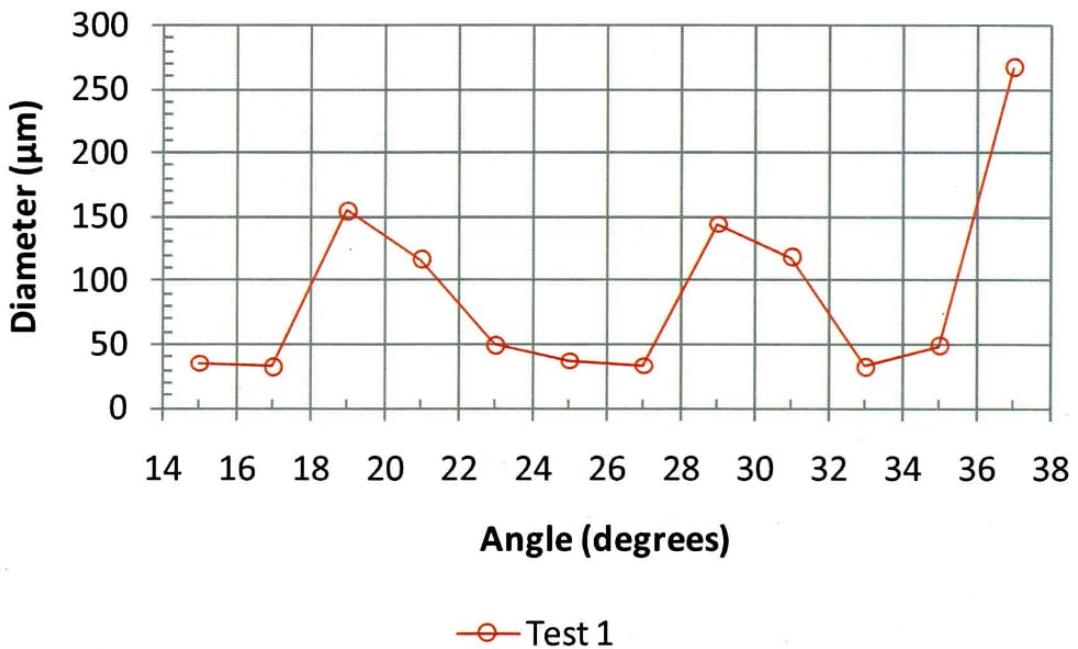


Figure 42: Dv90 results for hydrophobic coated with sand blasted high serration IGV at 0° setting

F.b.c. **Dv50 Plots**

This section presents Dv50 plots of the individual tests for each blade treatment. These plots provide all the measurement points including the positions greater than 33° which are affected by the wall. To present the region of interest in more detail, if the near wall values were much higher than the results in the main flow the scale was truncated and a note added to the plot giving the value, see for example figure 44.

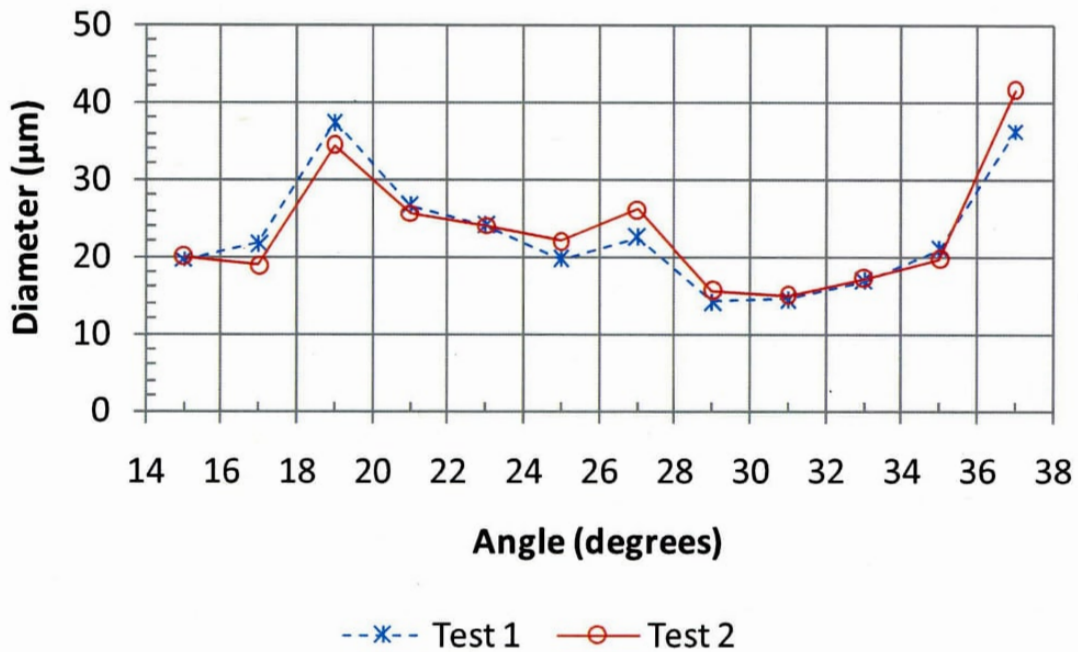


Figure 43: Dv50 results for baseline IGV at 20° setting

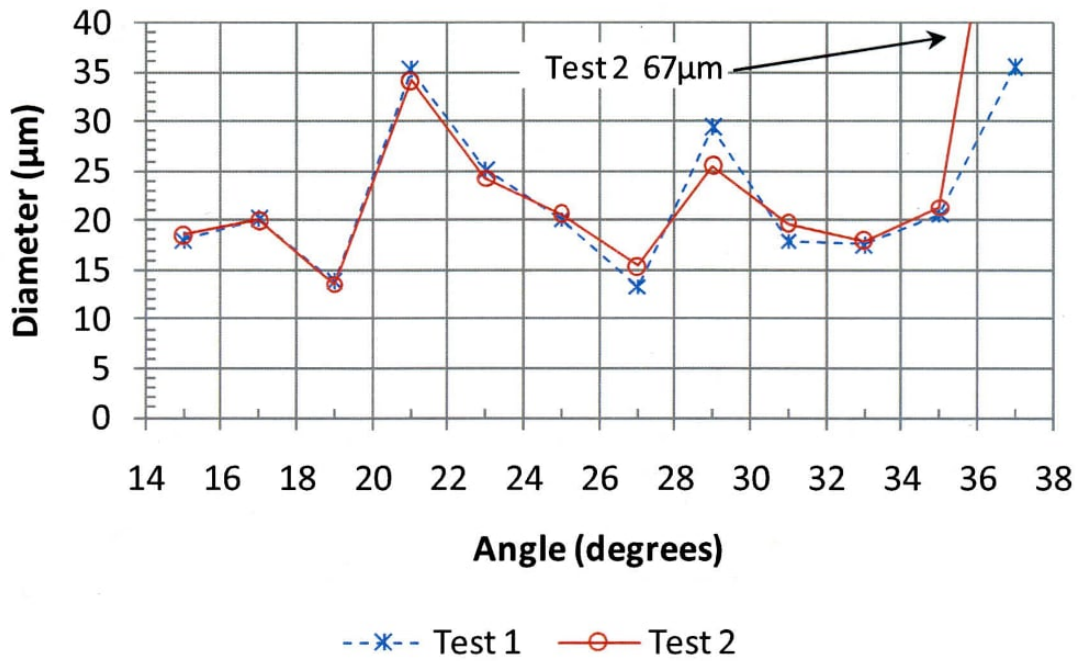


Figure 44: Dv50 results for baseline IGV at 0° setting

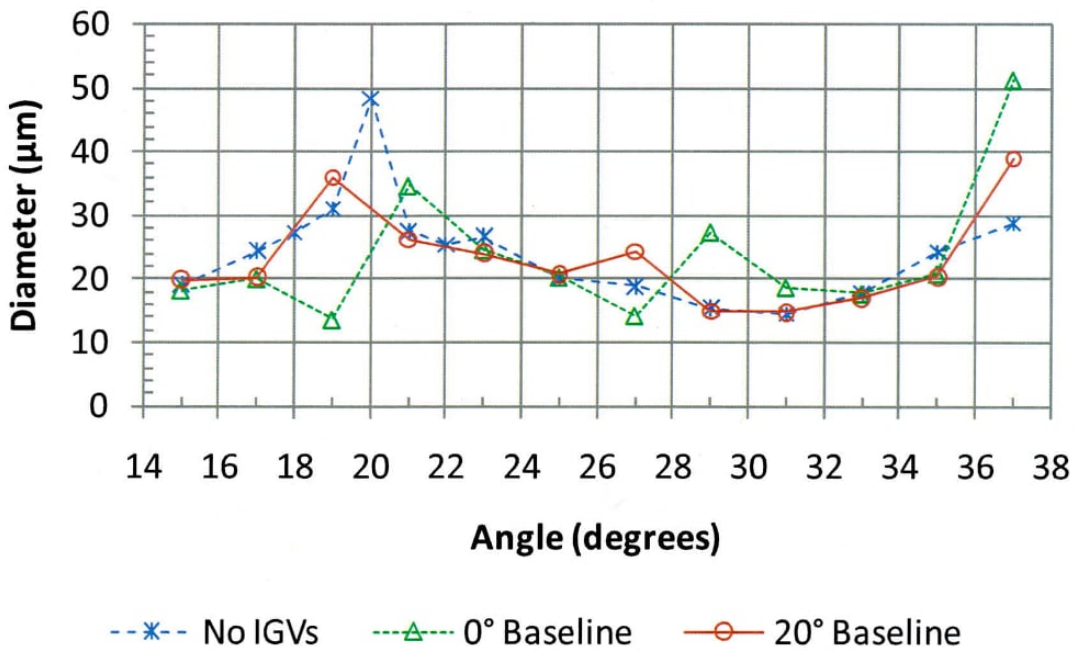


Figure 45: Comparison of average Dv50 results baseline tests and no IGV case

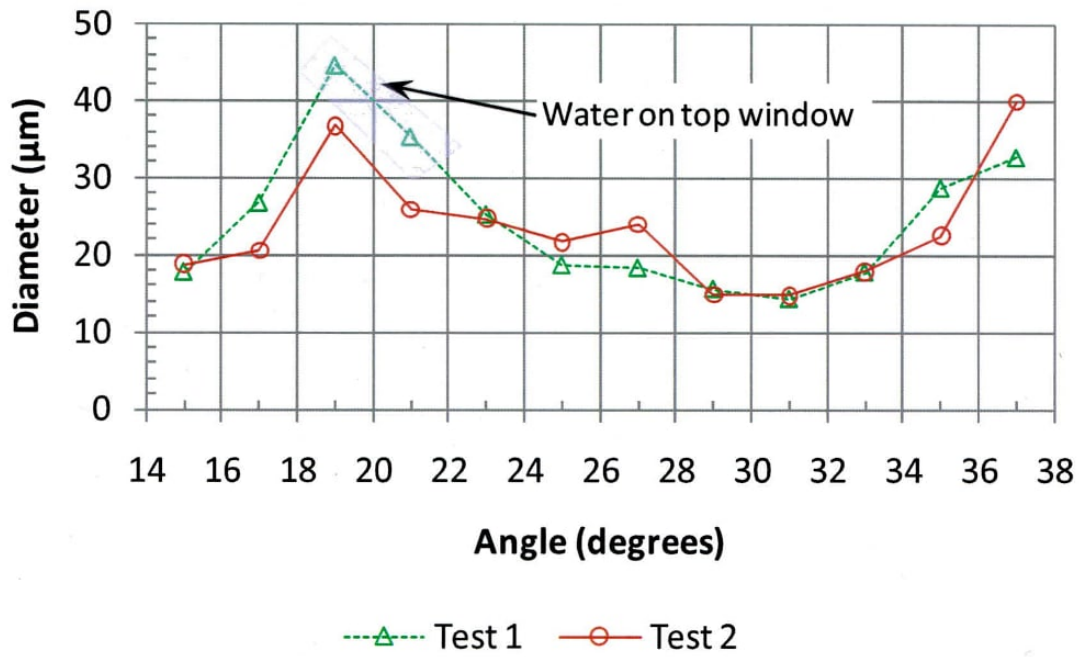


Figure 46: Dv50 results for high serration IGV at 20° setting

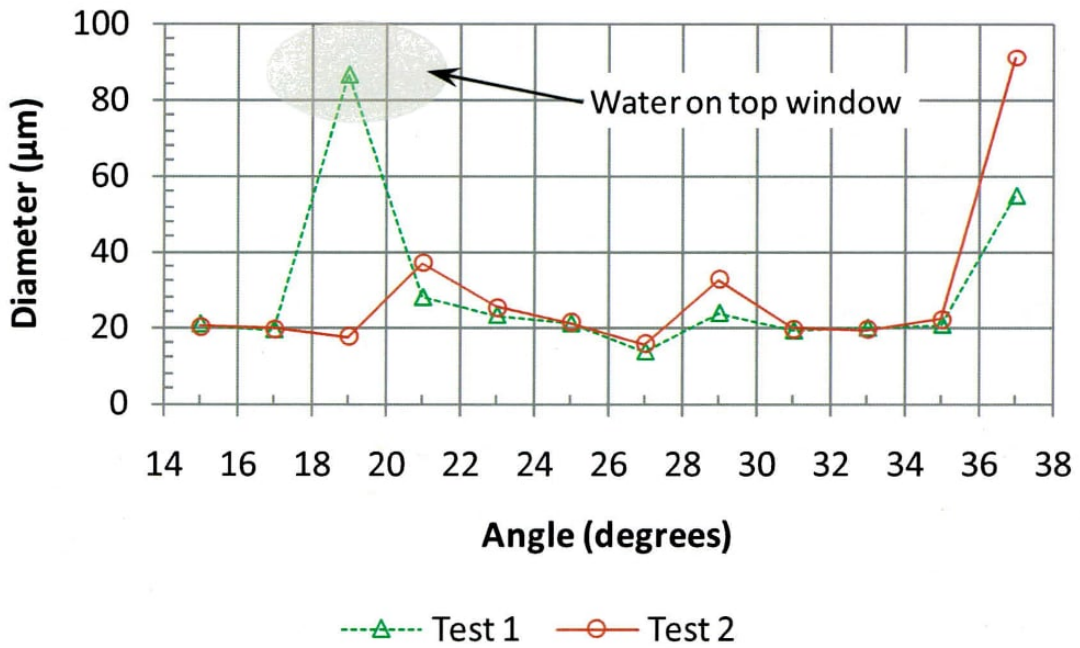


Figure 47: Dv50 results for high serration IGV at 0° setting

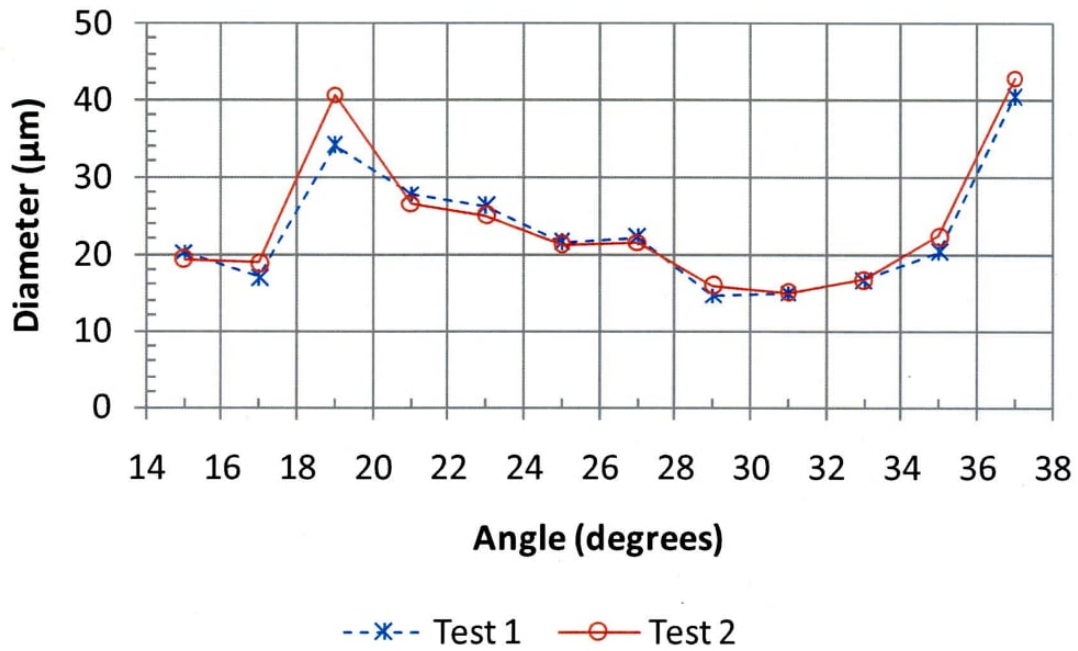


Figure 48: Dv50 results for medium serration IGV at 20° setting

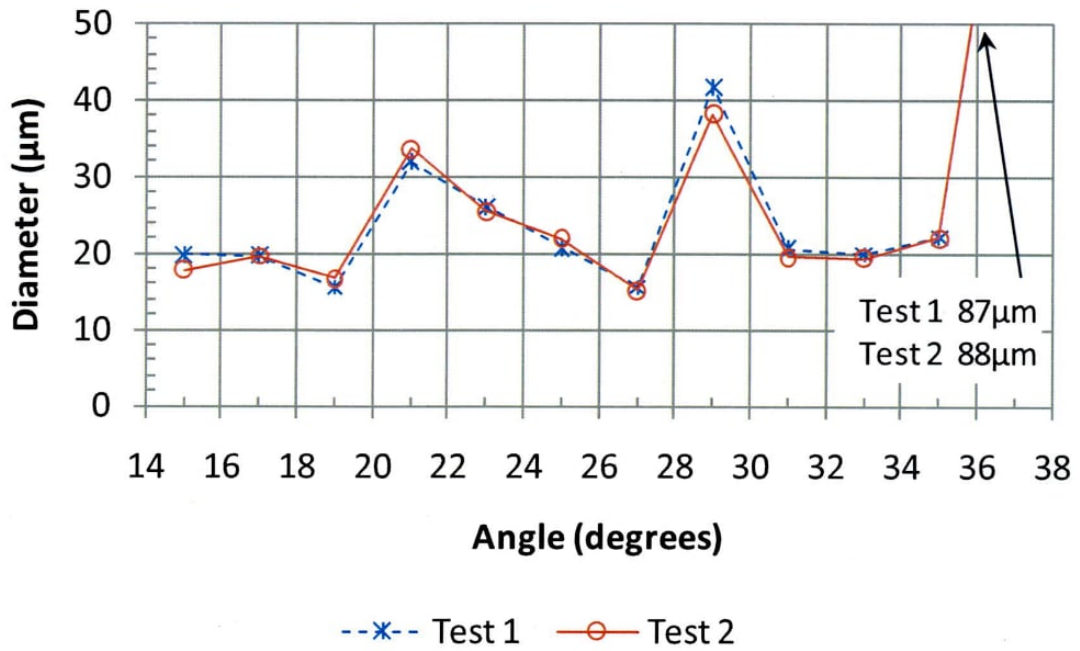


Figure 49: Dv50 results for medium serration IGV at 0° setting

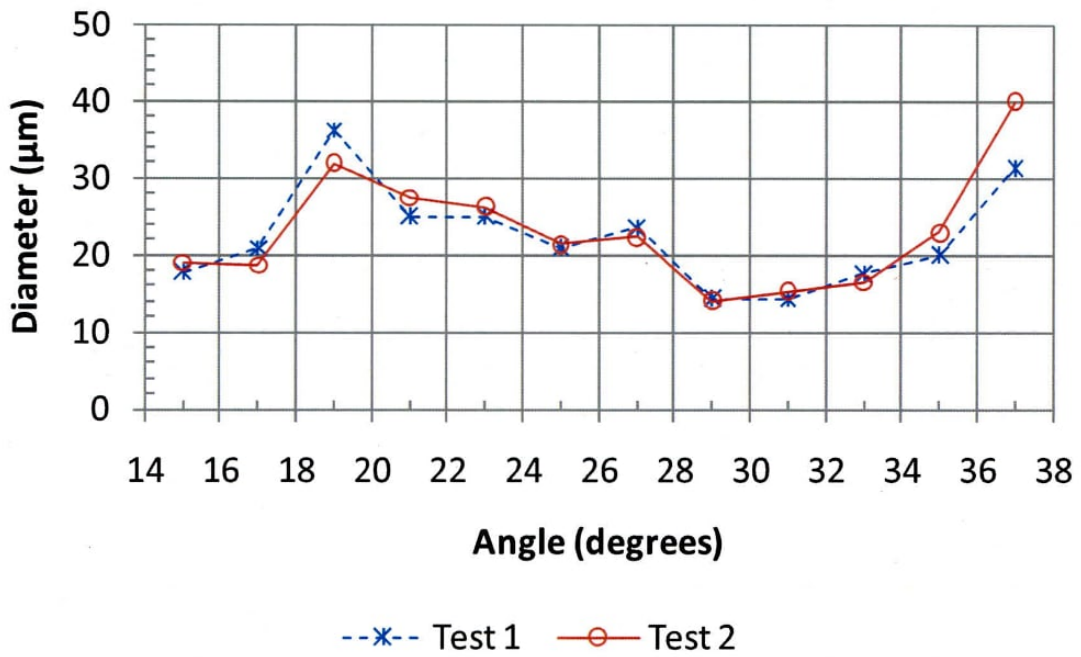


Figure 50: Dv50 results for low serration IGV at 20° setting

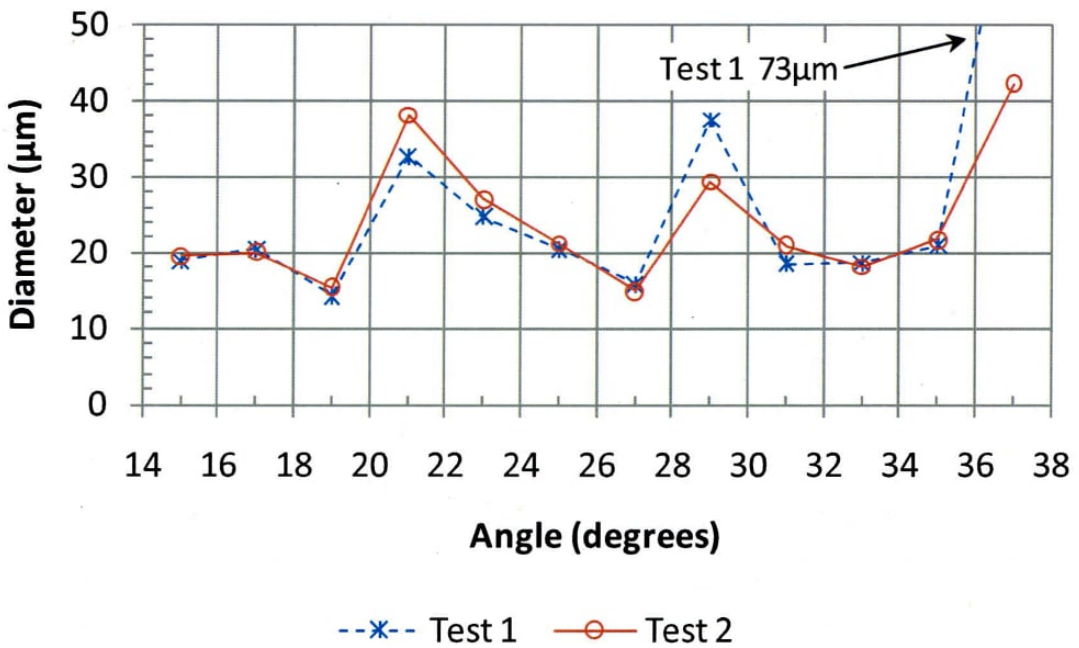


Figure 51: Dv50 results for low serration IGV at 0° setting

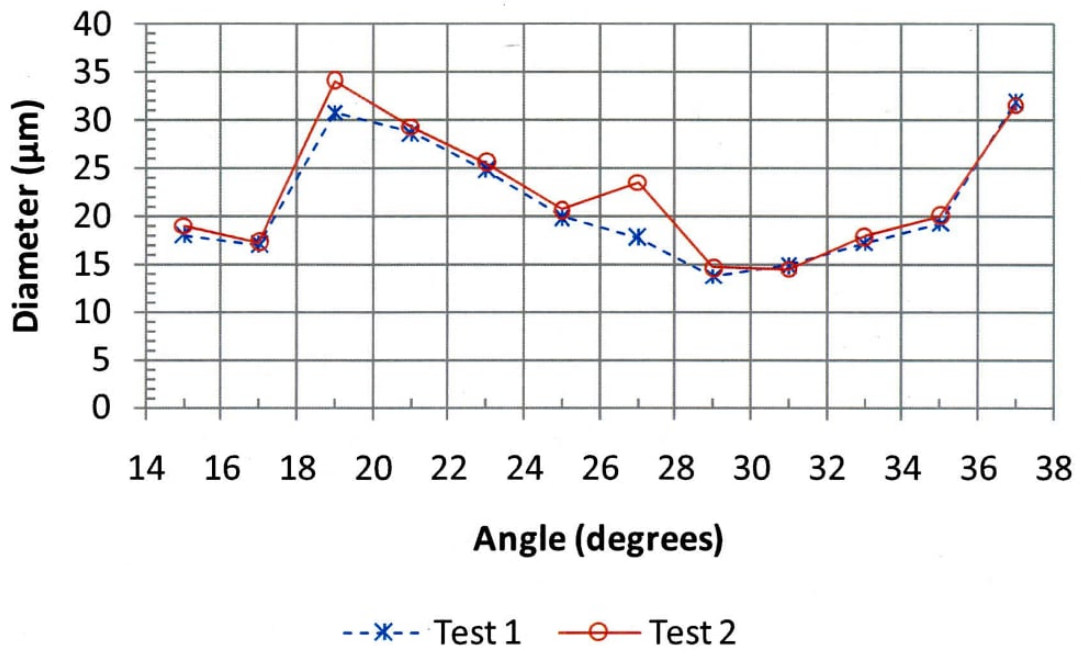


Figure 52: Dv50 results for hydrophobic coated IGV at 20° setting

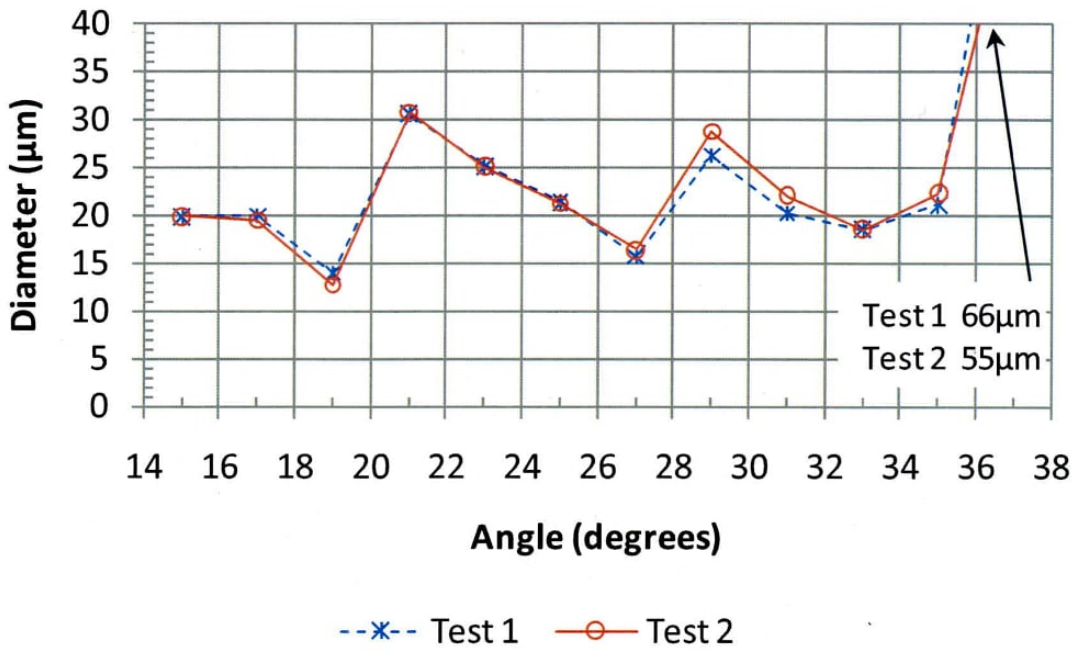


Figure 53: Dv50 results for hydrophobic coated IGV at 0° setting

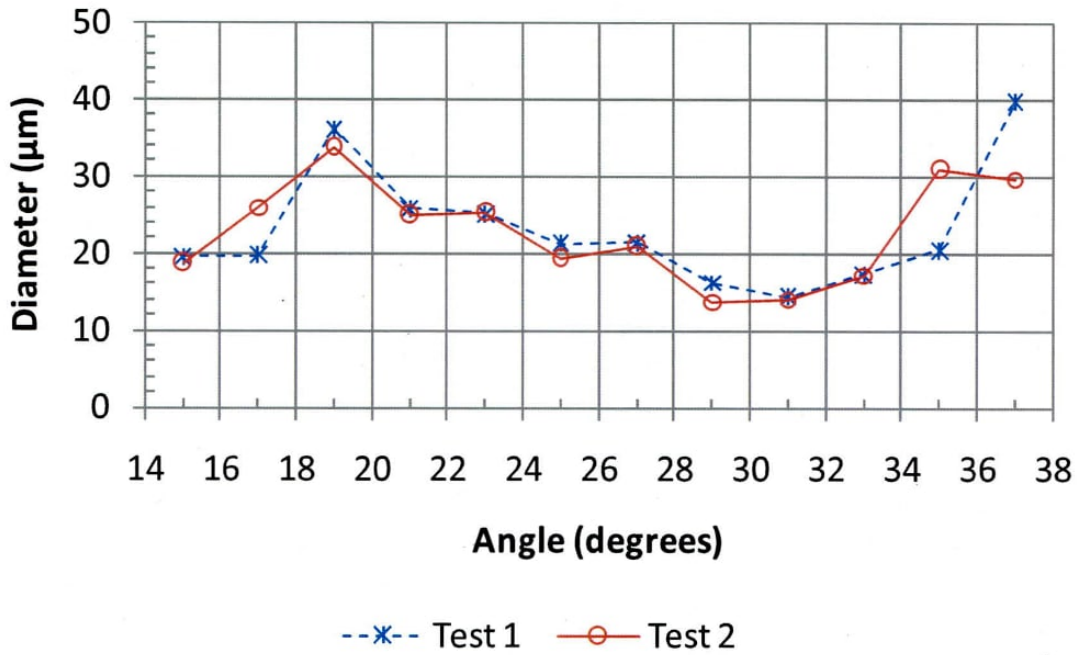


Figure 54: Dv50 results for hydrophilic coated IGV at 20° setting

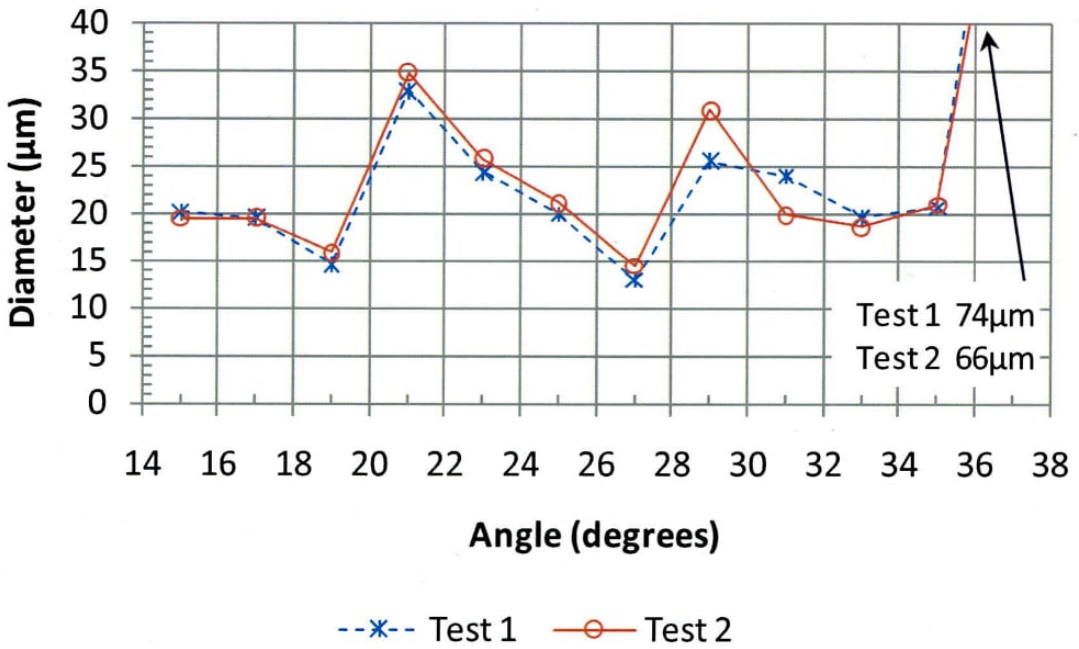


Figure 55: Dv50 results for hydrophilic coated IGV at 0° setting

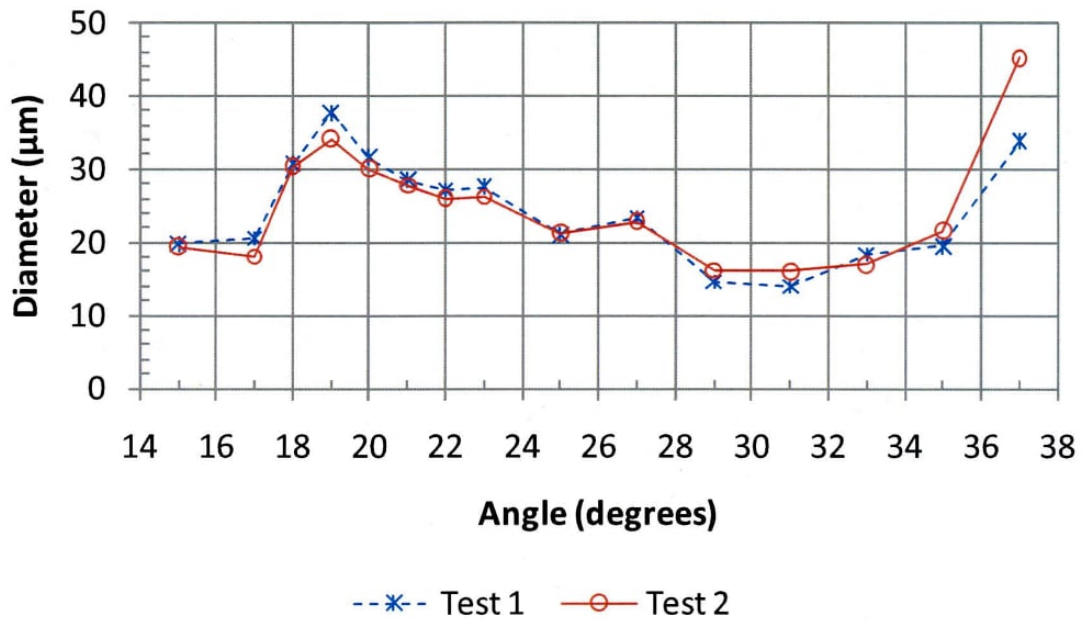


Figure 56: Dv50 results for hydrophobic coated with high serration IGv at 20° setting

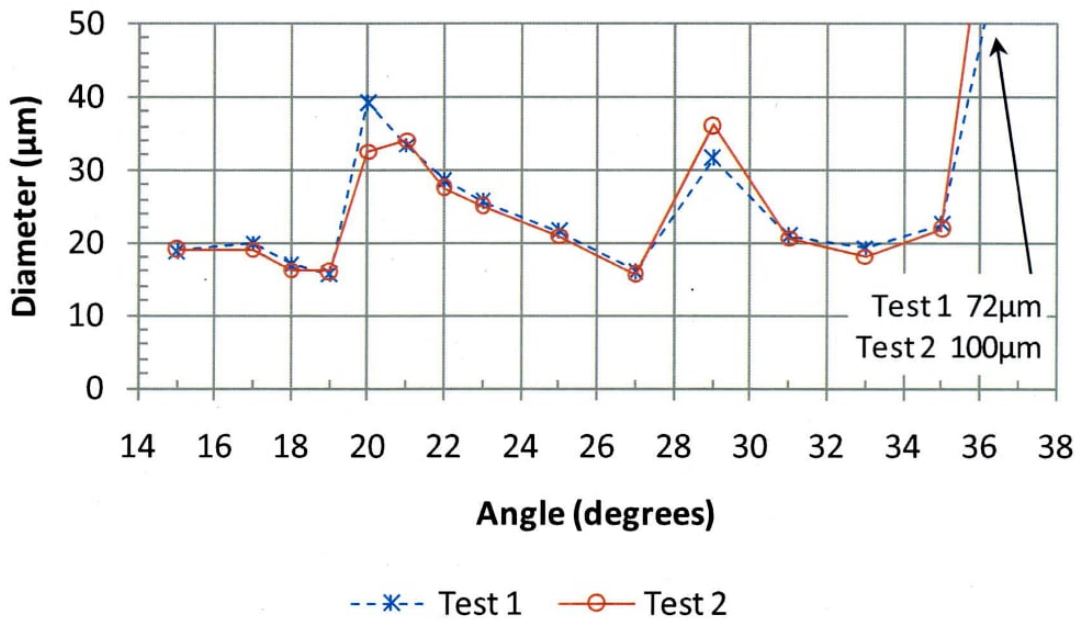


Figure 57: Dv50 results for hydrophobic coated with high serration IGv at 0° setting

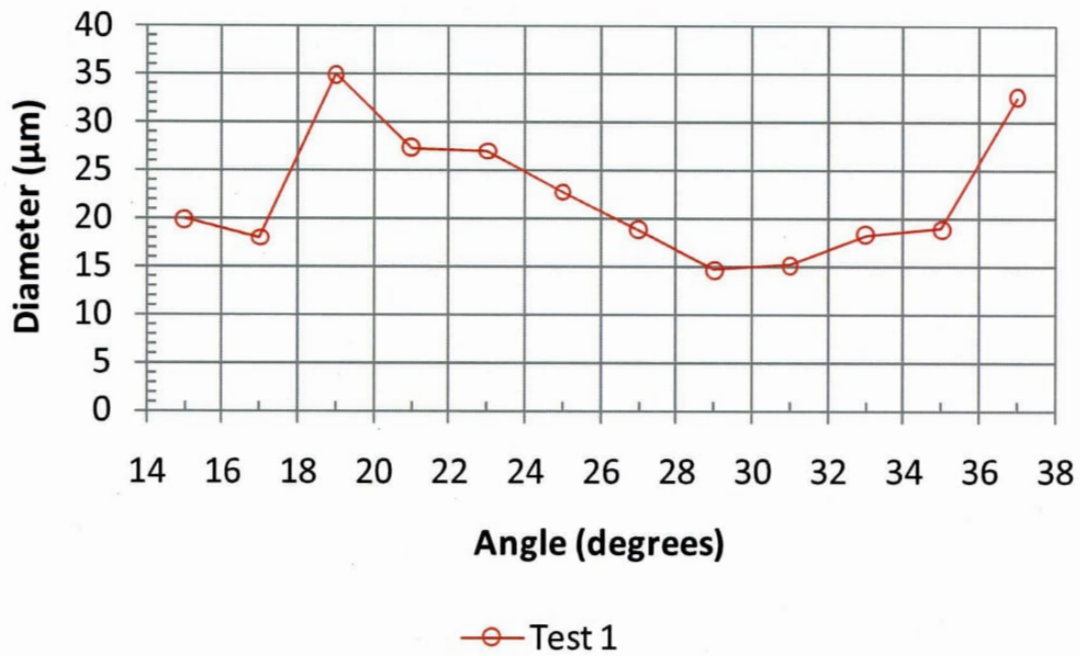


Figure 58: Dv50 results for hydrophobic coated with sand blasted high serration IGV at 20° setting

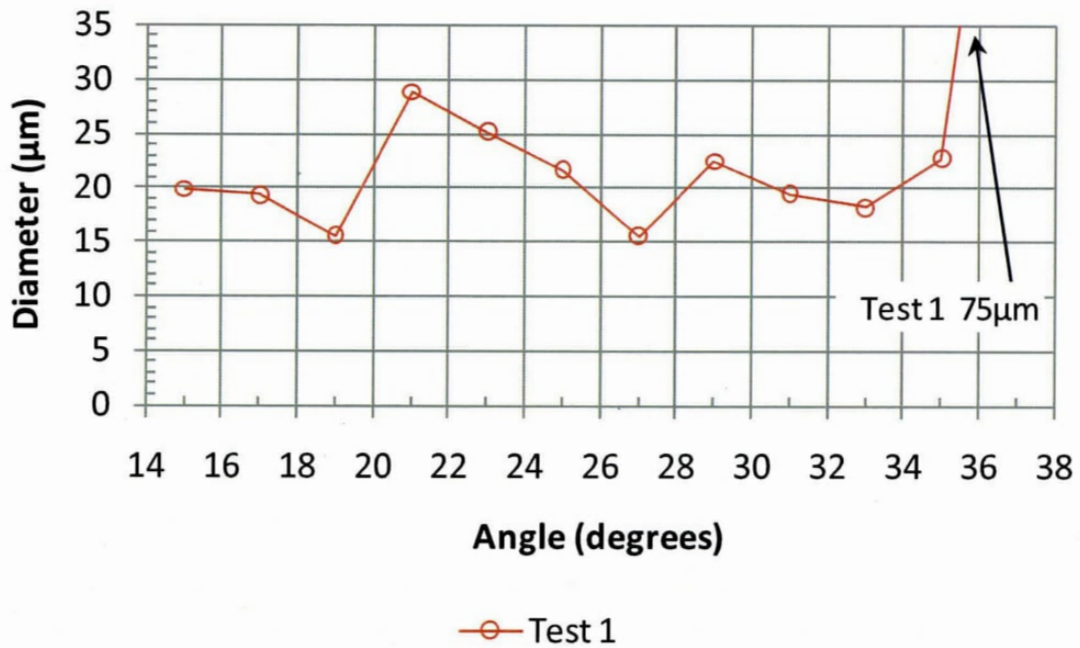


Figure 59: Dv50 results for hydrophobic coated with sand blasted high serration IGV at 0° setting

F.b.d. **Deviations from Baseline Results for Surface Treatments**

This section provides plots of the difference between the average Dv50 baseline results and the average Dv50 results for the cases with the surface treatments.

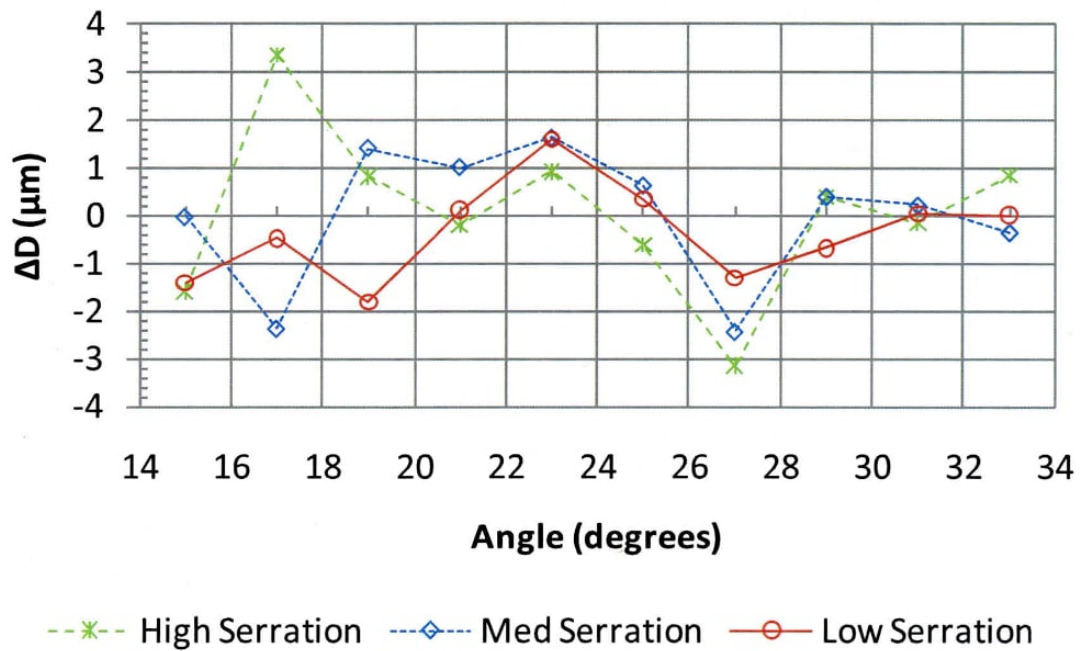


Figure 60: Average Dv50 results for serrations minus average baseline results with 20° IGV setting

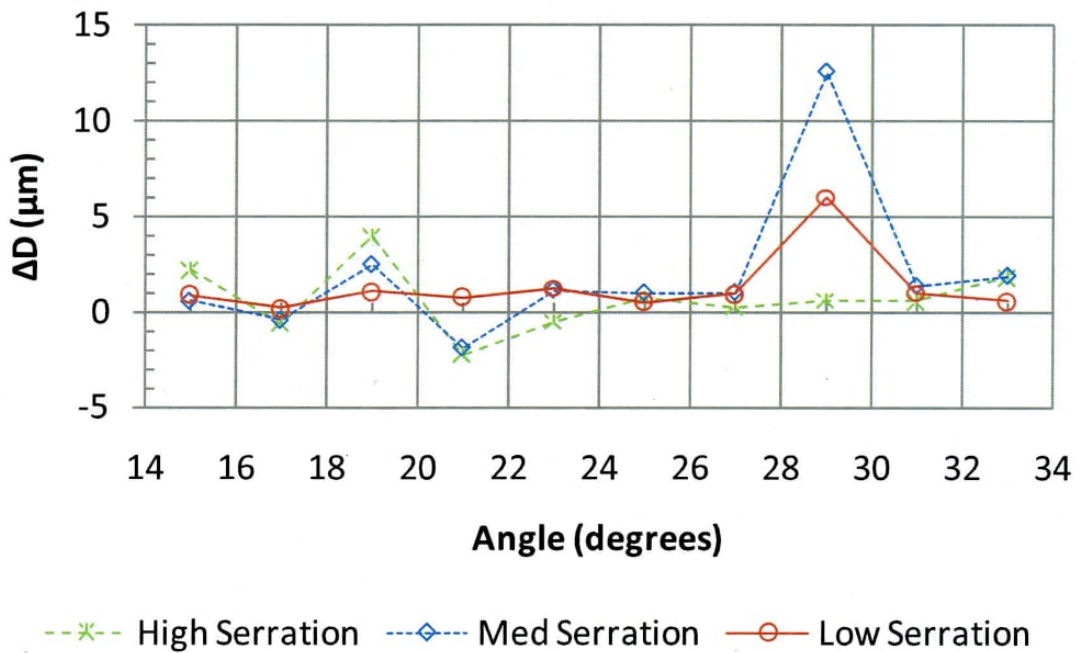


Figure 61: Average Dv50 results for serrations minus average baseline results with 0° IGV setting

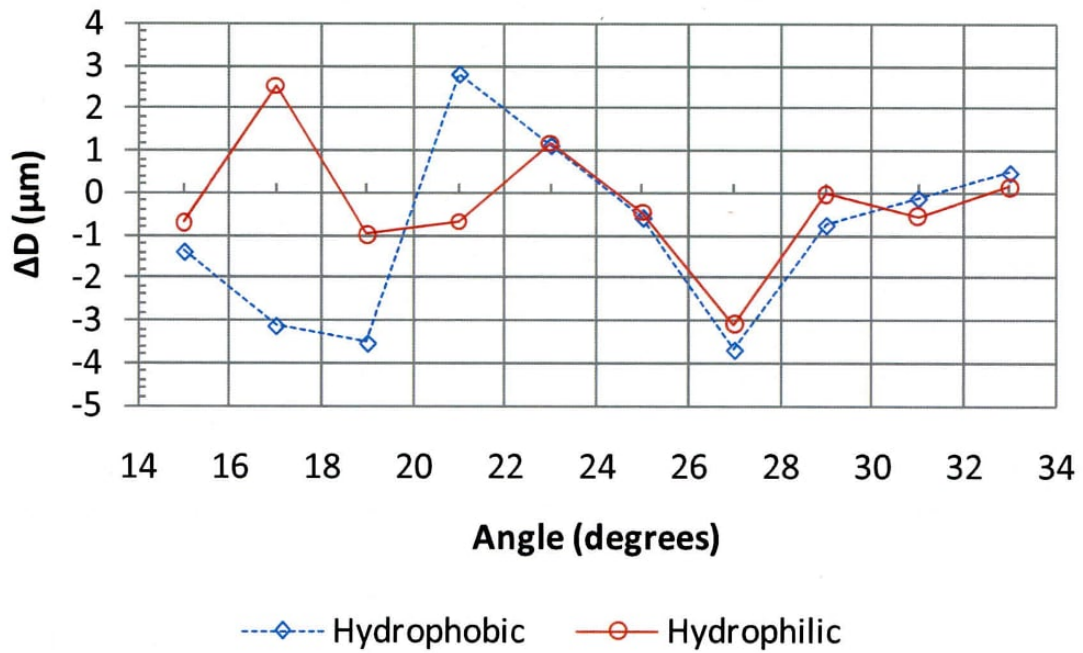


Figure 62: Average Dv50 results for coatings minus average baseline results with 20° IGV setting

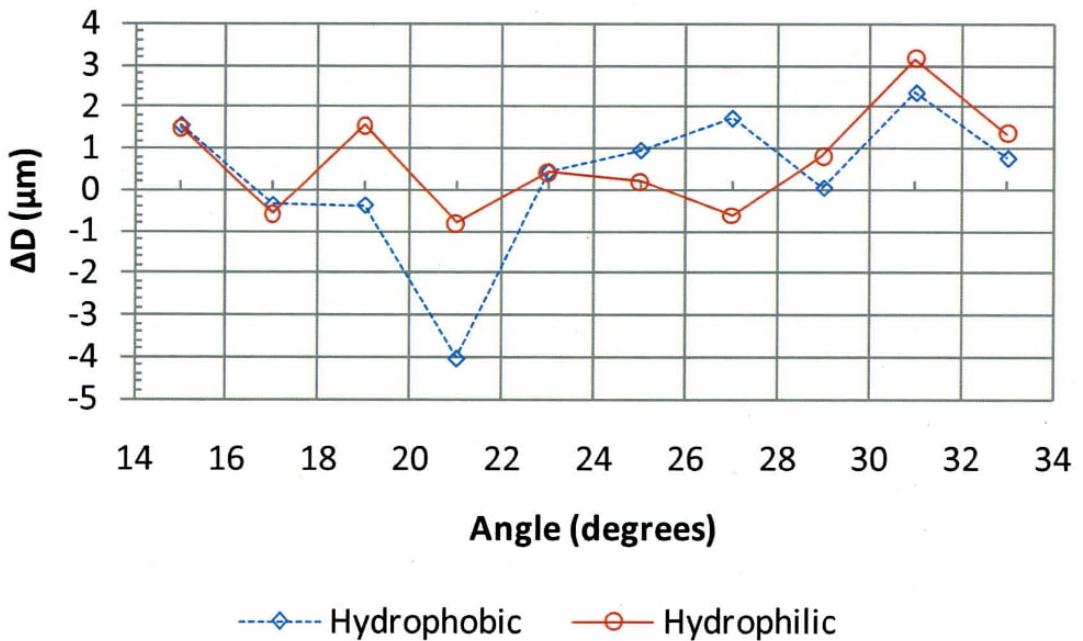


Figure 63: Average Dv50 results for coatings minus average baseline results with 0° IGV setting

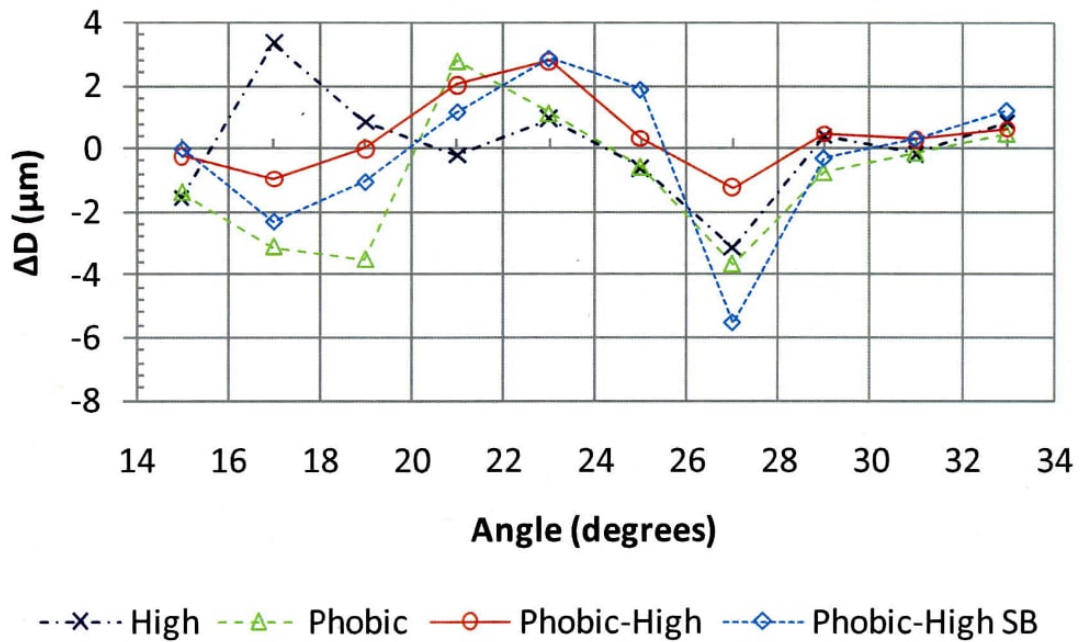


Figure 64: Average Dv50 results minus average baseline results with 20° IGV setting for the high serration (High), hydrophobic coating (Phobic), high serration with hydrophobic coating (Phobic-High) and high serration with hydrophobic coating on blade but removed from serrations (Phobic-High-SB)

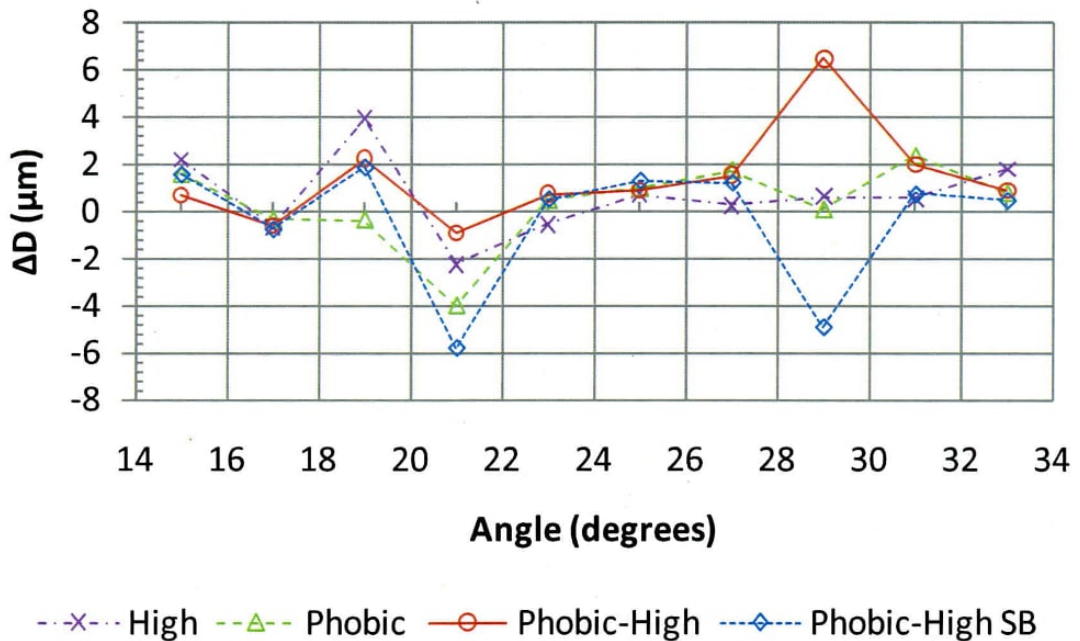


Figure 65: Average Dv50 results minus average baseline results with 0° IGV setting for the high serration (High), hydrophobic coating (Phobic), high serration with hydrophobic coating (Phobic-High) and high serration with hydrophobic coating on blade but removed