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Standard Test Method for High Efficiency Sprinkler Nozzles

Deliverable #6: Final Report
(as stated in Exhibit B)

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Background

Anecdotally, high efficiency sprinkler (HES) nozzles have been known and promoted to reduce irrigation consumption. However, mechanisms are not fully known. Solomon et al. (2007) estimated 31% savings potential using high efficiency nozzles compared to traditional fixed spray head nozzles. However, this estimate was based on theoretical conservation based on higher application efficiency due to increased distribution uniformity. Bijoor (2019, 2021) documented 20% savings from a high efficiency nozzle rebate program in Santa Clara, CA. Dukes and Cardenas (2019) found 17% savings from a Florida utility rebate program pre/post and weather corrected analysis. In 2009, 17 residential and 6 commercial sites were retrofitted with HES nozzles with a goal of reducing peak demand in the morning hours (Petersen, 2013). Irrigation use was reduced 20% to 35% in three study years. A measurement and verification study of HES programs analyzed 117,552 residential and 8,287 commercial customers that had nozzle rebates with a total of 1.2 million nozzles installed. Savings analysis showed a reduction of 1.57 gpd/nozzle aggregate savings (Graham, 2016). For the average lawn with 30 nozzles the savings would be 17 kgal/yr. Baum-Haley, et al. (2012) measured water savings and cost effectiveness of HES nozzles and showed 11 kgal/yr savings across 82 single family homes. Commercial sites had 104 kgal/yr savings across 148 sites.

Sovocool et al. (2010) documented HES nozzles reducing application rates more than 50% and increasing distribution uniformity. In contrast to several rebate programs finding savings, Sovocool et al. (2013) analyzed pre/post intervention homes compared to non-intervention homes and found no water savings. The difference between the SNWA study reported by Sovocool et al. (2010, 2013) and other studies is that in the SNWA study full irrigation audits were performed and irrigation controllers were reprogrammed to match the new HES application rate. However, it is hypothesized that the typical spray head zone with traditional nozzles has excessive time programmed in the timeclock. Thus, replacing these nozzles with HES nozzles that have half the application rate results in an inherent irrigation reduction. In addition, the HES nozzles increase distribution uniformity and reduce runoff and wind drift. These factors resulted in savings according to the rebate studies discussed earlier.

Finally, manufacturers recommend use of pressure regulated SSBs with HES nozzles; however, benefit of pressure regulation is not fully known. This test procedure will quantify benefit of

pressure regulation, if any as well as providing insight as to different performance across brand and model differences since manufacturers often use different technologies in HES nozzles.

This sixth project deliverable is a final report of the four brands of sprinklers tested with HES nozzles tested with a half circle and a full circle nozzle pattern and each of those patterns at a 12 ft and 15 ft radius (Table 1). The selection of these patterns and radii encompass the most commonly used nozzles in the market. The HES nozzles were tested along with traditional (i.e. non-HES) nozzles in the two patterns and two radii for each brand. The nozzles were tested in the lab with equipment shown in the schematic in Fig. 1 and an overview of the test set up in Fig. 2.

Testing Methodology

Supply pressure was adjusted in increments to test nozzles beginning at recommended pressure (30-45 psi depending on nozzle) and in increments up to 85 psi and then in declining increments down to the starting pressure (Fig. 3). For example, if a sprinkler had a recommended pressure of 30 psi, tests were completed at 30, 45, 60, 75, 85, 75, 60, 45, and 30 psi. At each pressure test point the test sample was allowed to stabilize and readings of pressure and flowrate were collected every 30 seconds for a 4 minute test length (Figs. 4-5). Those individual readings were used to compute the mean, max, min and standard deviation. All tests were completed with a non-pressure regulated spray head body from the individual brand of sprinkler being tested. The four sprinkler brands tested were anonymously identified as A through D.

Results and Discussion

Tables 2-5 show the Brand A non-HES nozzle test flowrate across the increasing and decreasing supply pressures. Tables 6-9 show the Brand A HES nozzle test flowrate across the increasing and decreasing supply pressures. The abbreviations of 15F, 15H, 12F, 12H refer to 15 ft radius full circle and half circle and 12 ft radius full circle and half circle, respectively. Similarly, the three other brands test data are shown as follows:

| | | |
|--------------|---------|-----------------|
| Tables 10-13 | Brand B | non-HES nozzles |
| Tables 14-17 | Brand B | HES nozzles |
| Tables 18-21 | Brand C | non-HES nozzles |
| Tables 22-25 | Brand C | HES nozzles |
| Tables 26-29 | Brand D | non-HES nozzles |
| Tables 30-33 | Brand D | HES nozzles |

Testing of a type of nozzle in a particular brand generally had low manufacturing variation as evidenced by nearly zero standard deviation in flow rate across the replicated test samples.

The flowrate for the non-HES 15F nozzles ranged from 3.4 to 4.0 gpm at 30 psi. The 15H non-HES nozzles ranged from 1.7 to 2.0 gpm at the same pressure. In contrast, at the maximum tested pressure of 85 psi the flowrate ranged from 5.7 to 6.4 gpm for the 15F and 2.8 to 3.5

gpm for 15H nozzles. The flowrate from the recommended pressure of 30 psi to the maximum tested pressure of 85 psi increased by 62% and 70% for 15F and 15H respectively.

The 12 ft nozzles ranged from 2.1 to 2.6 gpm and 1.2 to 1.5 gpm for full (F) and half (H) circle nozzles, respectively. The flowrate ranged from 3.6 to 4.4 gpm for 12F non-HES nozzles and 1.9 to 2.4 gpm at peak tested pressure of 85 psi, a 70% and 60% increase from recommended to maximum tested pressure for 12F and 12H nozzles, respectively.

The HES nozzle radii do not translate directly to the 15 and 12 ft nozzles; however, it was attempted to match nozzles as close as possible even though radii for most HES nozzles was larger than the nominal 15 ft and 12 ft radii with non-HES nozzles.

The flowrate on the HES nozzles was less consistent than the non-HES nozzles across brand, likely due to differences in the nozzles design. Brands A and B had the highest flowrates of 2.1 to 2.2 gpm at 30 to 45 psi (recommended depending on nozzle) and 2.9 to 3.7 gpm at 85 psi. Brands C and D had flowrates of 1.1 to 1.5 gpm at 40 psi (recommended for both) and 1.7 to 2.1 gpm at maximum test pressure of 85 psi. Thus, the change in flowrate from recommended to maximum pressure was 53% and 46% increase in flowrate for brands A/B and C/D, respectively.

In summary, non-HES nozzles average flowrate at recommended pressure across the four brands tested here were as follows (gpm):

| Brand | non-HES | | | | HES | | | |
|-------|---------|-----|-----|-----|-----|-----|-----|-----|
| | 15F | 15H | 12F | 12H | 15F | 15H | 12F | 12H |
| A | 3.7 | 1.7 | 2.5 | 1.4 | 2.1 | 1.2 | 1.6 | 0.6 |
| B | 4.0 | 1.8 | 2.1 | 1.2 | 2.2 | 1.2 | 1.5 | 0.8 |
| C | 3.6 | 2.0 | 2.6 | 1.4 | 1.5 | 0.8 | 0.9 | 0.5 |
| D | 3.4 | 1.7 | 4.2 | 2.4 | 1.2 | 0.6 | 0.7 | 0.5 |

Across all combinations tested, HES nozzles had 55% lower flowrate at recommended pressure compared to non-HES nozzles. At maximum pressure tested (85 psi), HES nozzles had 52% lower flowrate.

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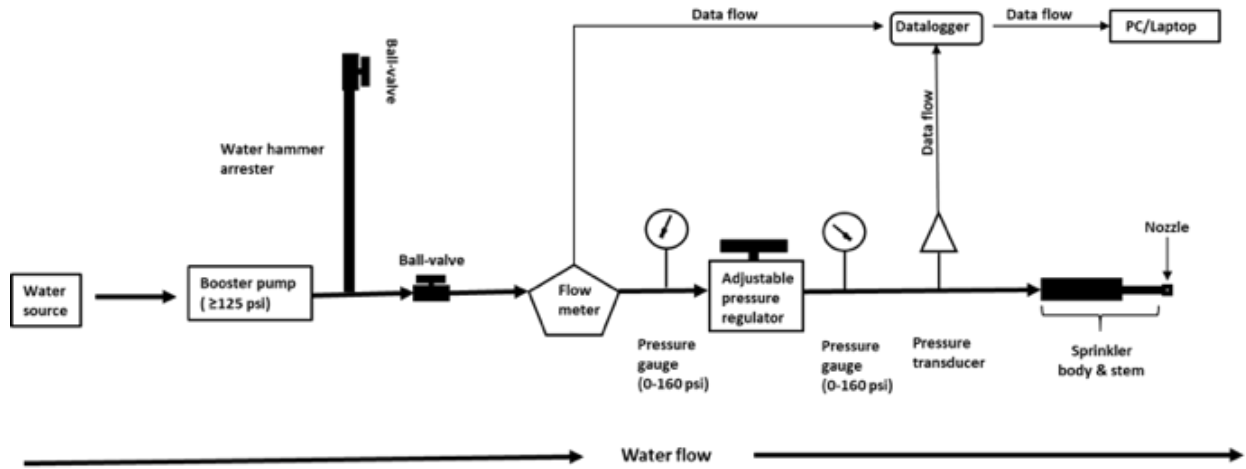


Figure 1. Schematic of laboratory test equipment.

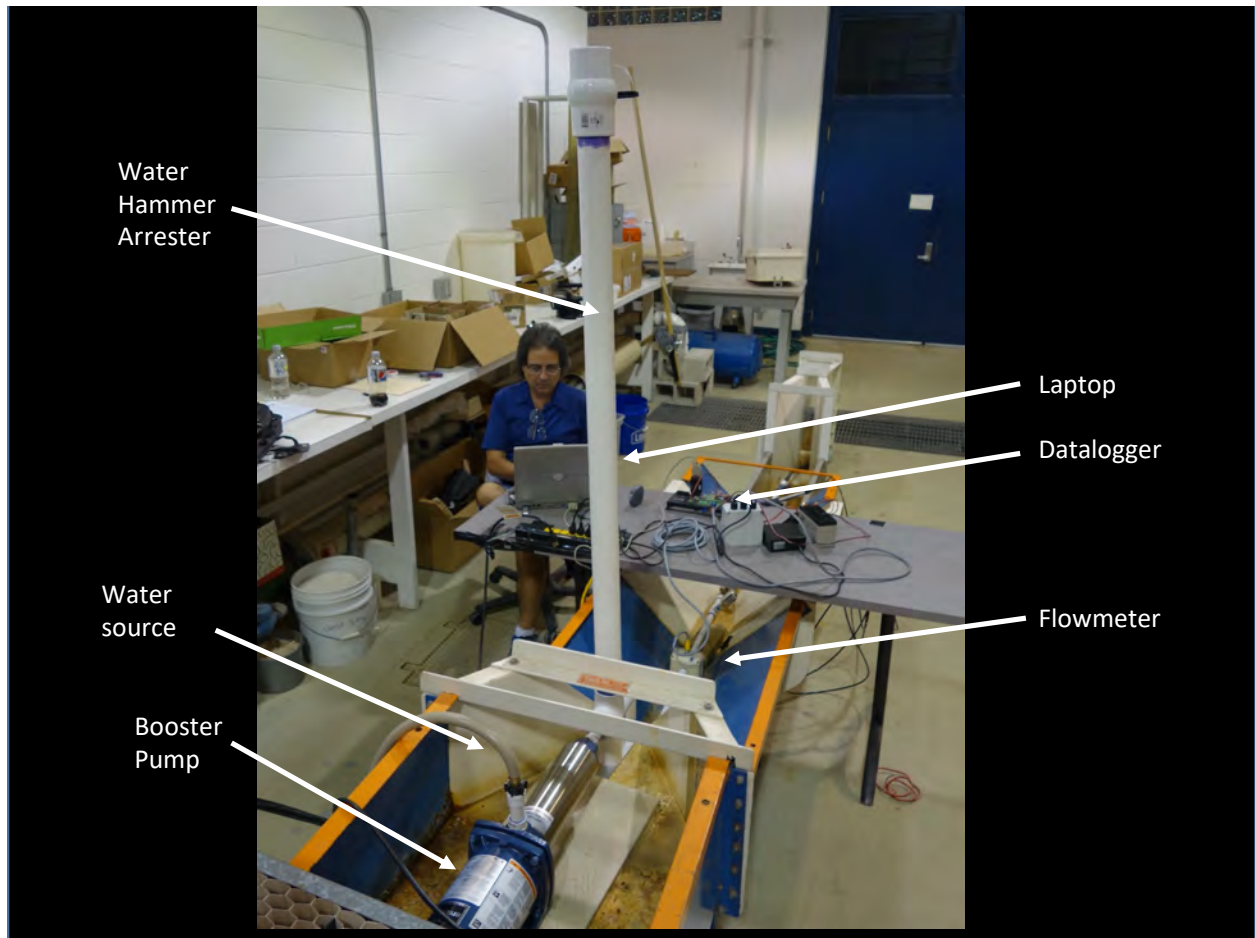


Figure 2. Overview of laboratory test equipment.

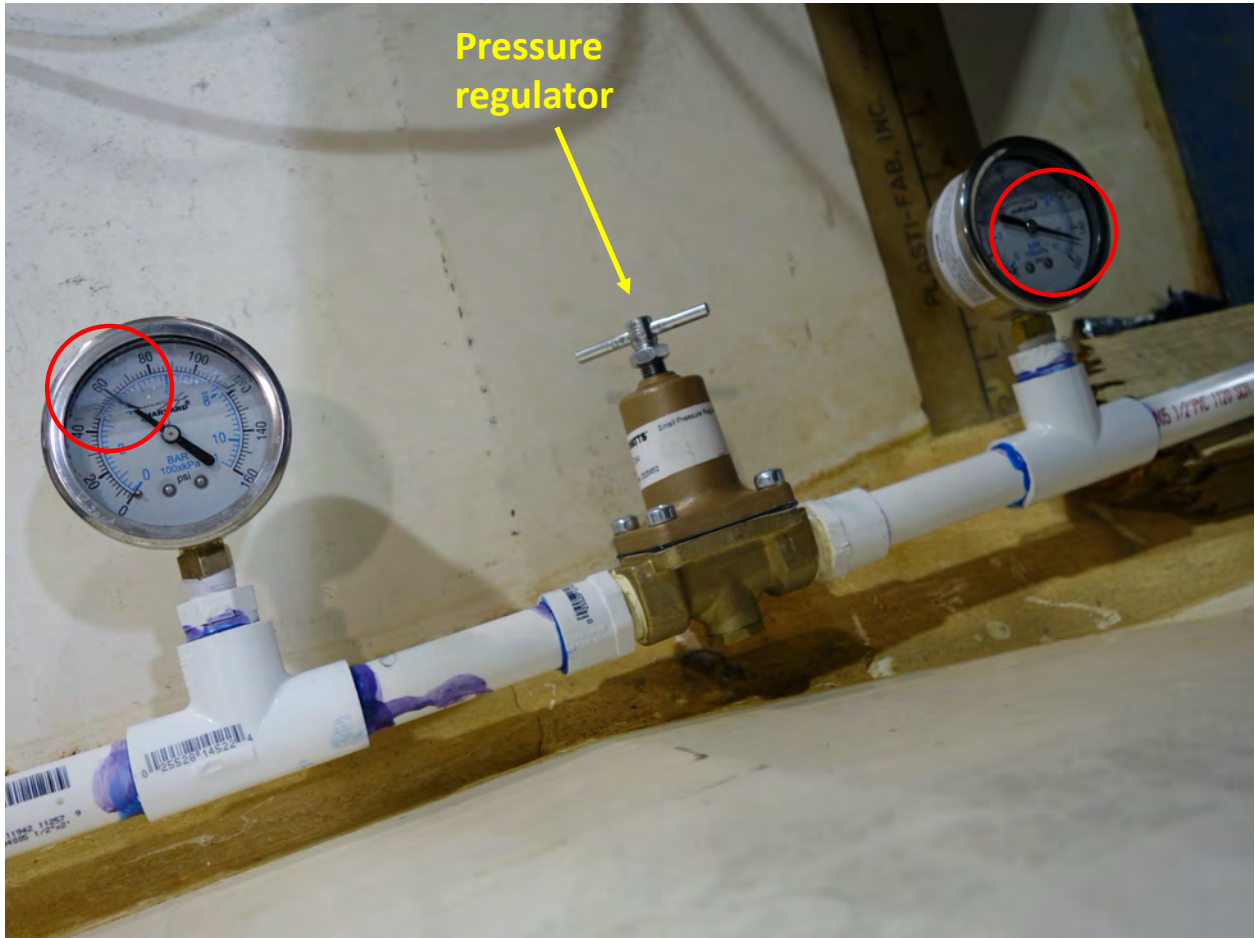


Figure 3. Pressure regulator, inlet and outlet gauge detail.

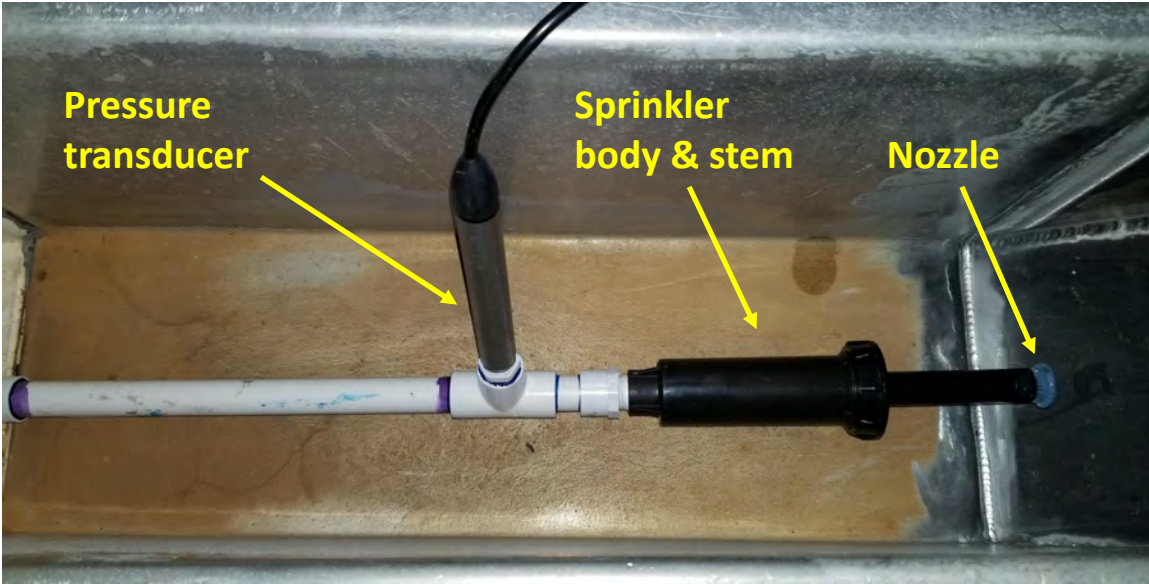


Figure 4. Detail of test sprinkler and nozzle with pressure transducer to log the inlet pressure.

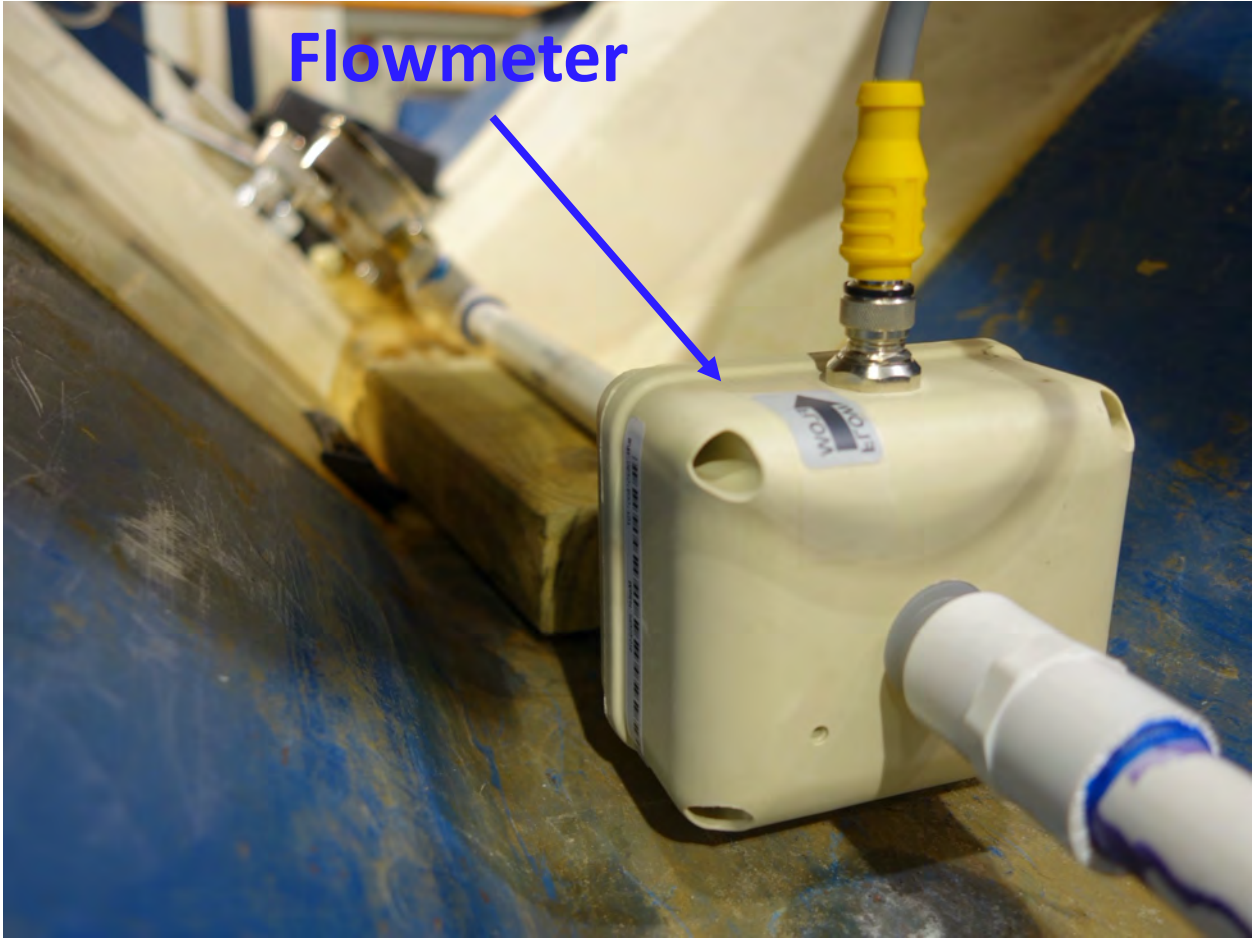


Figure 5. Flowmeter detail.

Table 1. Nozzles and sprinklers tested.

| Item | Brand | Test | Model | Radius (ft) & Pattern | |
|---------------|------------------|----------------|------------------|--------------------------|------|
| Nozzles | Hunter | HES Comparison | Pro-Spray Fixed | 12-H | |
| | | | | 12-F | |
| | | | | 15-H | |
| | | | | 15-F | |
| | | Testing model | MP Rotator | MP1000-180 | 12-H |
| | | | | MP1000-360 | 12-F |
| | | | | MP2000-180 | 15-H |
| | | | | MP2000-360 | 15-F |
| | | K-Rain | HES Comparison | FN | 12-H |
| | | | | | 12-F |
| | | | | | 15-H |
| | | | | | 15-F |
| Testing model | RN100-ADJ-90-270 | | 12-H | | |
| | | | 12-F | | |
| | | | RN200-ADJ-90-270 | 15-H | |
| | | | RN200-FIX360 | 15-F | |
| Rain Bird | HES Comparison | MPR | 12-H | | |
| | | | 12-F | | |
| | | | 15-H | | |
| | | | 15-F | | |
| | Testing model | R-VAN-14 | 12-H | | |
| | | | 12-F | | |
| | | | R-VAN-18 | 15-H | |
| | | | R-VAN-18-360 | 15-F | |

| | | | |
|--------------------|------------------|-------------------------|------|
| Toro | | | 12-H |
| | HES Comparison | 570 MPR | 12-F |
| | | | 15-H |
| | | | 15-F |
| | | O-12-H Precision Series | 12-H |
| | Testing model | O-12-F Precision Series | 12-F |
| | | O-15-H Precision Series | 15-H |
| | | O-15-F Precision Series | 15-F |
| Spray heads | Hunter | PROS-04 | |
| | K-Rain | Pro-S 78004 | |
| | Rain Bird | 1804 | |
| | Toro | 570Z-4P | |

Table 2. Brand A non-HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 29.9 | 30.1 | 29.4 | 0.27 | 3.64 | 3.78 | 3.43 | 0.12 |
| | | 45.2 | 45.2 | 45.1 | 0.02 | 4.45 | 4.53 | 4.34 | 0.07 |
| | | 60.0 | 60.2 | 59.9 | 0.09 | 5.10 | 5.30 | 4.91 | 0.13 |
| | | 75.0 | 75.3 | 74.9 | 0.12 | 5.82 | 6.03 | 5.57 | 0.13 |
| | | 85.3 | 85.6 | 84.4 | 0.38 | 6.08 | 6.43 | 5.85 | 0.19 |
| | | 75.0 | 75.2 | 74.5 | 0.22 | 5.68 | 5.90 | 5.49 | 0.14 |
| | | 59.9 | 60.1 | 59.3 | 0.25 | 5.13 | 5.39 | 4.89 | 0.16 |
| | | 45.0 | 45.4 | 44.8 | 0.19 | 4.42 | 4.55 | 4.27 | 0.08 |
| | | 30.0 | 30.0 | 29.9 | 0.05 | 3.61 | 3.80 | 3.44 | 0.13 |
| A | 2 | 29.9 | 30.1 | 29.5 | 0.18 | 3.69 | 3.86 | 3.52 | 0.10 |
| | | 45.1 | 45.2 | 45.1 | 0.04 | 4.56 | 4.66 | 4.40 | 0.09 |
| | | 60.0 | 60.1 | 59.9 | 0.04 | 5.21 | 5.38 | 5.04 | 0.13 |
| | | 75.0 | 75.2 | 74.8 | 0.14 | 5.87 | 6.17 | 5.62 | 0.20 |
| | | 85.1 | 85.3 | 85.0 | 0.10 | 6.21 | 6.50 | 6.06 | 0.14 |
| | | 75.0 | 75.5 | 74.5 | 0.31 | 5.89 | 6.07 | 5.60 | 0.16 |
| | | 59.9 | 60.3 | 59.5 | 0.34 | 5.27 | 5.34 | 5.19 | 0.05 |
| | | 44.9 | 45.2 | 44.7 | 0.16 | 4.57 | 4.70 | 4.49 | 0.07 |
| | | 30.1 | 30.4 | 29.9 | 0.14 | 3.74 | 3.92 | 3.51 | 0.11 |
| A | 3 | 30.0 | 30.2 | 29.9 | 0.12 | 3.75 | 3.89 | 3.59 | 0.10 |
| | | 45.2 | 45.2 | 45.1 | 0.03 | 4.59 | 4.73 | 4.32 | 0.13 |
| | | 60.0 | 60.1 | 60.0 | 0.03 | 5.32 | 5.51 | 5.11 | 0.13 |
| | | 74.9 | 75.1 | 74.5 | 0.20 | 5.96 | 6.13 | 5.76 | 0.11 |
| | | 85.2 | 85.3 | 85.1 | 0.10 | 6.32 | 6.58 | 6.15 | 0.12 |
| | | 75.0 | 75.3 | 74.9 | 0.16 | 5.90 | 6.16 | 5.60 | 0.19 |
| | | 59.9 | 60.1 | 59.8 | 0.09 | 5.35 | 5.52 | 5.14 | 0.11 |
| | | 45.1 | 45.2 | 44.9 | 0.12 | 4.67 | 4.83 | 4.49 | 0.12 |
| | | 30.2 | 30.4 | 30.1 | 0.09 | 3.79 | 4.00 | 3.53 | 0.16 |
| A | 4 | 30.0 | 30.1 | 30.0 | 0.03 | 3.80 | 3.96 | 3.61 | 0.11 |
| | | 45.5 | 45.9 | 45.4 | 0.17 | 4.60 | 4.74 | 4.41 | 0.13 |
| | | 60.0 | 60.1 | 60.0 | 0.05 | 5.31 | 5.48 | 5.15 | 0.10 |
| | | 74.9 | 75.4 | 74.4 | 0.32 | 5.99 | 6.22 | 5.59 | 0.18 |
| | | 85.3 | 85.6 | 85.0 | 0.19 | 6.38 | 6.59 | 6.18 | 0.13 |
| | | 74.9 | 75.1 | 74.7 | 0.12 | 5.84 | 6.22 | 5.68 | 0.18 |
| | | 59.6 | 59.9 | 59.5 | 0.14 | 5.28 | 5.43 | 5.07 | 0.13 |
| | | 44.9 | 45.0 | 44.7 | 0.09 | 4.58 | 4.68 | 4.46 | 0.08 |
| | | 30.2 | 30.3 | 30.1 | 0.07 | 3.79 | 4.04 | 3.54 | 0.15 |

Table 3. Brand A non-HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 29.9 | 30.1 | 29.5 | 0.20 | 1.60 | 1.67 | 1.52 | 0.05 |
| | | 45.1 | 45.1 | 45.0 | 0.06 | 1.99 | 2.08 | 1.85 | 0.07 |
| | | 60.0 | 60.0 | 59.9 | 0.03 | 2.28 | 2.38 | 2.10 | 0.09 |
| | | 74.8 | 75.1 | 74.7 | 0.15 | 2.55 | 2.64 | 2.41 | 0.07 |
| | | 85.0 | 85.1 | 84.8 | 0.09 | 2.72 | 2.96 | 2.46 | 0.15 |
| | | 75.0 | 75.1 | 74.9 | 0.08 | 2.57 | 2.63 | 2.49 | 0.05 |
| | | 60.0 | 60.3 | 59.7 | 0.16 | 2.27 | 2.47 | 2.10 | 0.11 |
| | | 44.8 | 45.0 | 44.7 | 0.10 | 2.02 | 2.11 | 1.90 | 0.07 |
| | | 29.9 | 30.3 | 29.8 | 0.17 | 1.63 | 1.67 | 1.57 | 0.04 |
| A | 2 | 30.0 | 30.1 | 29.8 | 0.12 | 1.68 | 1.77 | 1.59 | 0.06 |
| | | 45.1 | 45.1 | 45.0 | 0.04 | 1.95 | 2.01 | 1.91 | 0.03 |
| | | 60.4 | 60.4 | 60.2 | 0.05 | 2.39 | 2.54 | 2.24 | 0.10 |
| | | 75.0 | 75.0 | 74.9 | 0.04 | 2.63 | 2.87 | 2.49 | 0.11 |
| | | 85.0 | 85.0 | 84.9 | 0.05 | 2.89 | 3.03 | 2.72 | 0.11 |
| | | 75.0 | 75.1 | 74.9 | 0.09 | 2.66 | 2.81 | 2.54 | 0.08 |
| | | 60.0 | 60.1 | 59.9 | 0.06 | 2.38 | 2.45 | 2.32 | 0.05 |
| | | 44.9 | 45.0 | 44.7 | 0.11 | 2.06 | 2.16 | 1.98 | 0.06 |
| | | 30.1 | 30.2 | 30.0 | 0.06 | 1.75 | 1.92 | 1.63 | 0.11 |
| A | 3 | 30.0 | 30.0 | 29.9 | 0.04 | 1.61 | 1.69 | 1.53 | 0.05 |
| | | 45.0 | 45.1 | 45.0 | 0.04 | 2.06 | 2.13 | 1.99 | 0.06 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 2.33 | 2.45 | 2.24 | 0.07 |
| | | 74.9 | 75.1 | 74.7 | 0.12 | 2.61 | 2.70 | 2.54 | 0.06 |
| | | 85.0 | 85.1 | 84.9 | 0.07 | 2.67 | 2.74 | 2.57 | 0.05 |
| | | 74.9 | 75.1 | 74.8 | 0.08 | 2.59 | 2.76 | 2.38 | 0.11 |
| | | 60.0 | 60.1 | 59.7 | 0.13 | 2.32 | 2.39 | 2.21 | 0.05 |
| | | 44.9 | 45.2 | 44.6 | 0.22 | 2.01 | 2.12 | 1.94 | 0.06 |
| | | 30.0 | 30.3 | 29.9 | 0.12 | 1.67 | 1.77 | 1.55 | 0.07 |
| A | 4 | 30.0 | 30.2 | 30.0 | 0.06 | 1.76 | 1.81 | 1.69 | 0.04 |
| | | 45.1 | 45.2 | 45.0 | 0.06 | 2.15 | 2.26 | 2.08 | 0.06 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 2.43 | 2.52 | 2.27 | 0.08 |
| | | 75.0 | 75.0 | 75.0 | 0.02 | 2.72 | 2.85 | 2.56 | 0.10 |
| | | 85.0 | 85.1 | 84.9 | 0.08 | 2.79 | 2.88 | 2.68 | 0.08 |
| | | 75.0 | 75.1 | 75.0 | 0.05 | 2.75 | 2.89 | 2.64 | 0.09 |
| | | 59.9 | 60.1 | 59.8 | 0.07 | 2.40 | 2.48 | 2.32 | 0.05 |
| | | 44.9 | 45.0 | 44.9 | 0.05 | 2.11 | 2.15 | 2.07 | 0.03 |
| | | 30.0 | 30.1 | 29.9 | 0.05 | 1.74 | 1.88 | 1.67 | 0.07 |

Table 4. Brand A non-HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 30.0 | 30.1 | 29.9 | 0.05 | 2.44 | 2.53 | 2.28 | 0.07 |
| | | 45.0 | 45.2 | 45.0 | 0.06 | 2.95 | 3.08 | 2.86 | 0.07 |
| | | 59.9 | 59.9 | 59.8 | 0.03 | 3.40 | 3.48 | 3.34 | 0.04 |
| | | 75.0 | 75.2 | 74.9 | 0.12 | 3.80 | 3.89 | 3.69 | 0.07 |
| | | 85.0 | 85.1 | 84.9 | 0.06 | 4.04 | 4.18 | 3.95 | 0.07 |
| | | 75.0 | 75.1 | 74.7 | 0.13 | 3.87 | 4.05 | 3.75 | 0.11 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 3.48 | 3.58 | 3.35 | 0.07 |
| | | 45.1 | 45.2 | 45.0 | 0.06 | 2.95 | 3.13 | 2.72 | 0.12 |
| | | 29.9 | 30.0 | 29.8 | 0.06 | 2.42 | 2.54 | 2.33 | 0.07 |
| A | 2 | 30.1 | 30.2 | 30.1 | 0.04 | 2.41 | 2.52 | 2.31 | 0.08 |
| | | 45.1 | 45.1 | 45.0 | 0.03 | 3.03 | 3.10 | 2.88 | 0.08 |
| | | 60.1 | 60.1 | 60.1 | 0.03 | 3.48 | 3.54 | 3.40 | 0.05 |
| | | 74.9 | 75.0 | 74.9 | 0.04 | 3.87 | 3.99 | 3.80 | 0.07 |
| | | 84.9 | 85.2 | 84.6 | 0.23 | 4.10 | 4.20 | 3.95 | 0.09 |
| | | 75.1 | 75.3 | 75.1 | 0.06 | 3.86 | 4.03 | 3.76 | 0.09 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 3.44 | 3.53 | 3.35 | 0.06 |
| | | 45.0 | 45.0 | 44.9 | 0.02 | 3.01 | 3.11 | 2.91 | 0.08 |
| | | 30.0 | 30.2 | 29.9 | 0.10 | 2.44 | 2.55 | 2.36 | 0.06 |
| A | 3 | 30.0 | 30.2 | 29.9 | 0.12 | 2.43 | 2.51 | 2.32 | 0.06 |
| | | 45.2 | 45.2 | 45.1 | 0.01 | 3.01 | 3.17 | 2.91 | 0.08 |
| | | 60.1 | 60.1 | 60.0 | 0.04 | 3.42 | 3.52 | 3.32 | 0.08 |
| | | 75.1 | 75.4 | 75.0 | 0.14 | 3.86 | 3.97 | 3.73 | 0.09 |
| | | 85.2 | 85.3 | 85.0 | 0.11 | 4.09 | 4.19 | 4.03 | 0.05 |
| | | 74.9 | 75.0 | 74.8 | 0.05 | 3.83 | 3.90 | 3.71 | 0.07 |
| | | 60.0 | 60.1 | 59.9 | 0.07 | 3.44 | 3.53 | 3.33 | 0.09 |
| | | 44.9 | 45.1 | 44.8 | 0.09 | 2.99 | 3.03 | 2.95 | 0.03 |
| | | 29.9 | 30.0 | 29.9 | 0.05 | 2.47 | 2.66 | 2.41 | 0.08 |
| A | 4 | 29.9 | 30.2 | 29.6 | 0.19 | 2.53 | 2.58 | 2.47 | 0.04 |
| | | 44.6 | 45.1 | 41.4 | 1.29 | 3.10 | 3.18 | 3.04 | 0.05 |
| | | 60.1 | 60.3 | 60.0 | 0.13 | 3.53 | 3.61 | 3.49 | 0.04 |
| | | 75.0 | 75.2 | 74.9 | 0.08 | 3.94 | 4.03 | 3.88 | 0.05 |
| | | 84.8 | 84.9 | 84.7 | 0.09 | 4.18 | 4.26 | 4.13 | 0.05 |
| | | 74.9 | 75.1 | 74.7 | 0.11 | 3.80 | 3.91 | 3.73 | 0.07 |
| | | 60.0 | 60.2 | 60.0 | 0.07 | 3.55 | 3.60 | 3.46 | 0.05 |
| | | 44.9 | 45.0 | 44.9 | 0.07 | 3.08 | 3.16 | 2.97 | 0.05 |
| | | 30.0 | 30.0 | 29.9 | 0.06 | 2.54 | 2.64 | 2.48 | 0.05 |

Table 5. Brand A non-HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 29.9 | 30.0 | 29.9 | 0.05 | 1.39 | 1.56 | 1.29 | 0.08 |
| | | 44.5 | 45.0 | 44.1 | 0.30 | 1.65 | 1.75 | 1.58 | 0.07 |
| | | 60.0 | 60.0 | 59.9 | 0.05 | 1.96 | 2.07 | 1.87 | 0.09 |
| | | 75.2 | 75.2 | 75.1 | 0.03 | 2.20 | 2.42 | 2.05 | 0.13 |
| | | 84.9 | 85.0 | 84.9 | 0.05 | 2.41 | 2.57 | 2.28 | 0.11 |
| | | 74.8 | 75.0 | 74.7 | 0.10 | 2.21 | 2.41 | 2.08 | 0.10 |
| | | 60.0 | 60.2 | 59.8 | 0.10 | 2.00 | 2.16 | 1.86 | 0.09 |
| | | 45.0 | 45.2 | 44.9 | 0.11 | 1.70 | 1.78 | 1.59 | 0.06 |
| | | 30.0 | 30.1 | 29.9 | 0.06 | 1.38 | 1.51 | 1.26 | 0.08 |
| A | 2 | 30.0 | 30.1 | 29.9 | 0.10 | 1.33 | 1.42 | 1.22 | 0.06 |
| | | 45.0 | 45.0 | 45.0 | 0.01 | 1.57 | 1.66 | 1.41 | 0.08 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 1.83 | 1.88 | 1.77 | 0.05 |
| | | 74.9 | 75.1 | 74.7 | 0.13 | 2.01 | 2.15 | 1.93 | 0.07 |
| | | 85.0 | 85.1 | 85.0 | 0.05 | 2.18 | 2.32 | 1.94 | 0.12 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 2.04 | 2.14 | 1.93 | 0.07 |
| | | 59.9 | 60.1 | 59.3 | 0.25 | 1.80 | 1.94 | 1.68 | 0.09 |
| | | 45.0 | 45.0 | 44.9 | 0.04 | 1.56 | 1.63 | 1.48 | 0.05 |
| | | 30.0 | 30.0 | 30.0 | 0.02 | 1.30 | 1.50 | 1.17 | 0.10 |
| A | 3 | 30.0 | 30.4 | 29.6 | 0.25 | 1.38 | 1.40 | 1.34 | 0.02 |
| | | 45.1 | 45.2 | 45.0 | 0.09 | 1.67 | 1.71 | 1.63 | 0.03 |
| | | 60.0 | 60.3 | 60.0 | 0.09 | 1.93 | 2.03 | 1.85 | 0.07 |
| | | 75.1 | 75.2 | 74.9 | 0.08 | 2.18 | 2.27 | 2.08 | 0.07 |
| | | 84.9 | 85.1 | 84.7 | 0.11 | 2.28 | 2.34 | 2.21 | 0.05 |
| | | 74.9 | 75.1 | 74.8 | 0.09 | 2.13 | 2.23 | 2.01 | 0.07 |
| | | 60.0 | 60.2 | 59.9 | 0.07 | 1.94 | 2.00 | 1.90 | 0.03 |
| | | 44.7 | 44.9 | 44.6 | 0.12 | 1.65 | 1.72 | 1.56 | 0.05 |
| | | 29.9 | 30.0 | 29.8 | 0.07 | 1.36 | 1.41 | 1.30 | 0.04 |
| A | 4 | 29.9 | 30.1 | 29.7 | 0.15 | 1.34 | 1.44 | 1.27 | 0.05 |
| | | 45.0 | 45.1 | 45.0 | 0.04 | 1.65 | 1.70 | 1.58 | 0.04 |
| | | 59.7 | 59.9 | 59.7 | 0.06 | 1.92 | 1.97 | 1.86 | 0.04 |
| | | 75.0 | 75.1 | 75.0 | 0.05 | 2.13 | 2.19 | 2.04 | 0.06 |
| | | 85.0 | 85.1 | 84.9 | 0.05 | 2.30 | 2.40 | 2.18 | 0.08 |
| | | 74.9 | 75.1 | 74.8 | 0.11 | 2.09 | 2.17 | 2.01 | 0.06 |
| | | 59.9 | 60.0 | 59.7 | 0.10 | 1.92 | 2.00 | 1.77 | 0.08 |
| | | 45.0 | 45.0 | 44.9 | 0.05 | 1.67 | 1.76 | 1.61 | 0.06 |
| | | 29.9 | 30.0 | 29.9 | 0.04 | 1.36 | 1.46 | 1.18 | 0.11 |

Table 6. Brand A HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 45.0 | 45.3 | 44.8 | 0.17 | 2.04 | 2.20 | 1.86 | 0.11 |
| | | 60.0 | 60.2 | 60.0 | 0.06 | 2.42 | 2.61 | 2.23 | 0.11 |
| | | 75.0 | 75.0 | 74.8 | 0.06 | 2.75 | 2.90 | 2.62 | 0.09 |
| | | 85.0 | 85.1 | 85.0 | 0.04 | 2.93 | 3.10 | 2.78 | 0.10 |
| | | 75.0 | 75.1 | 74.9 | 0.08 | 2.74 | 2.80 | 2.67 | 0.04 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 2.48 | 2.60 | 2.35 | 0.08 |
| | | 45.2 | 45.3 | 45.2 | 0.06 | 2.12 | 2.25 | 2.03 | 0.08 |
| A | 2 | 45.1 | 45.3 | 44.8 | 0.12 | 2.06 | 2.11 | 1.99 | 0.04 |
| | | 59.9 | 60.0 | 59.9 | 0.05 | 2.38 | 2.44 | 2.24 | 0.06 |
| | | 75.0 | 75.1 | 75.0 | 0.05 | 2.76 | 2.86 | 2.64 | 0.08 |
| | | 85.0 | 85.2 | 84.8 | 0.13 | 2.84 | 2.98 | 2.68 | 0.11 |
| | | 75.0 | 75.1 | 75.0 | 0.04 | 2.77 | 2.89 | 2.63 | 0.09 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 2.40 | 2.58 | 2.27 | 0.10 |
| | | 45.0 | 45.1 | 44.9 | 0.07 | 2.09 | 2.17 | 1.96 | 0.08 |
| A | 3 | 45.0 | 45.1 | 44.9 | 0.04 | 2.07 | 2.16 | 2.02 | 0.05 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 2.45 | 2.57 | 2.35 | 0.08 |
| | | 75.1 | 75.1 | 75.0 | 0.05 | 2.73 | 2.85 | 2.63 | 0.08 |
| | | 85.0 | 85.1 | 84.9 | 0.05 | 2.88 | 3.10 | 2.77 | 0.11 |
| | | 75.0 | 75.4 | 74.9 | 0.16 | 2.77 | 2.88 | 2.70 | 0.07 |
| | | 59.9 | 60.1 | 59.9 | 0.06 | 2.46 | 2.56 | 2.35 | 0.08 |
| | | 44.9 | 45.0 | 44.9 | 0.06 | 2.10 | 2.18 | 2.05 | 0.05 |
| A | 4 | 45.0 | 45.1 | 44.9 | 0.06 | 2.07 | 2.17 | 1.98 | 0.06 |
| | | 60.0 | 60.1 | 59.9 | 0.04 | 2.43 | 2.52 | 2.30 | 0.06 |
| | | 75.1 | 75.3 | 75.0 | 0.09 | 2.70 | 2.91 | 2.57 | 0.12 |
| | | 85.1 | 85.3 | 85.0 | 0.09 | 2.93 | 3.13 | 2.75 | 0.13 |
| | | 75.0 | 75.0 | 74.9 | 0.05 | 2.71 | 2.83 | 2.65 | 0.06 |
| | | 59.9 | 60.2 | 59.8 | 0.16 | 2.42 | 2.54 | 2.36 | 0.06 |
| | | 44.9 | 45.3 | 44.8 | 0.13 | 2.11 | 2.17 | 2.01 | 0.06 |

Table 7. Brand A HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 45.0 | 45.1 | 44.9 | 0.08 | 1.12 | 1.18 | 1.06 | 0.04 |
| | | 60.0 | 60.0 | 59.9 | 0.04 | 1.31 | 1.43 | 1.13 | 0.10 |
| | | 75.0 | 75.1 | 74.9 | 0.05 | 1.41 | 1.59 | 1.26 | 0.11 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 1.55 | 1.64 | 1.36 | 0.10 |
| | | 75.0 | 75.1 | 75.0 | 0.05 | 1.49 | 1.55 | 1.42 | 0.05 |
| | | 60.0 | 60.2 | 59.9 | 0.08 | 1.30 | 1.38 | 1.23 | 0.05 |
| | | 45.0 | 45.2 | 44.9 | 0.10 | 1.11 | 1.20 | 1.05 | 0.06 |
| A | 2 | 45.0 | 45.1 | 45.0 | 0.05 | 1.18 | 1.24 | 1.10 | 0.04 |
| | | 59.9 | 60.2 | 59.6 | 0.21 | 1.35 | 1.41 | 1.31 | 0.03 |
| | | 74.9 | 75.2 | 74.7 | 0.20 | 1.48 | 1.62 | 1.32 | 0.09 |
| | | 85.0 | 85.1 | 84.9 | 0.05 | 1.66 | 1.76 | 1.59 | 0.06 |
| | | 75.0 | 75.2 | 74.9 | 0.10 | 1.55 | 1.67 | 1.43 | 0.08 |
| | | 60.0 | 60.3 | 59.6 | 0.21 | 1.31 | 1.45 | 1.19 | 0.09 |
| | | 45.0 | 45.2 | 44.9 | 0.08 | 1.15 | 1.21 | 1.09 | 0.04 |
| A | 3 | 45.0 | 45.0 | 44.9 | 0.05 | 1.20 | 1.32 | 1.11 | 0.06 |
| | | 60.0 | 60.1 | 59.9 | 0.04 | 1.38 | 1.45 | 1.32 | 0.05 |
| | | 75.0 | 75.1 | 75.0 | 0.03 | 1.55 | 1.68 | 1.45 | 0.07 |
| | | 85.0 | 85.1 | 85.0 | 0.04 | 1.62 | 1.72 | 1.45 | 0.10 |
| | | 75.0 | 75.0 | 74.9 | 0.04 | 1.48 | 1.55 | 1.39 | 0.05 |
| | | 60.1 | 60.1 | 59.9 | 0.08 | 1.36 | 1.42 | 1.26 | 0.05 |
| | | 45.0 | 45.1 | 44.9 | 0.07 | 1.06 | 1.12 | 1.02 | 0.04 |
| A | 4 | 44.9 | 45.0 | 44.9 | 0.03 | 1.07 | 1.14 | 0.96 | 0.06 |
| | | 60.1 | 60.2 | 60.0 | 0.07 | 1.28 | 1.32 | 1.23 | 0.04 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 1.44 | 1.54 | 1.36 | 0.07 |
| | | 85.1 | 85.1 | 85.0 | 0.04 | 1.48 | 1.55 | 1.34 | 0.07 |
| | | 75.1 | 75.2 | 75.0 | 0.08 | 1.45 | 1.55 | 1.39 | 0.05 |
| | | 60.1 | 60.1 | 60.0 | 0.04 | 1.28 | 1.39 | 1.18 | 0.07 |
| | | 45.0 | 45.1 | 45.0 | 0.05 | 1.03 | 1.09 | 0.97 | 0.04 |

Table 8. Brand A HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 45.0 | 45.1 | 45.0 | 0.04 | 1.62 | 1.69 | 1.53 | 0.05 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 1.92 | 1.97 | 1.86 | 0.04 |
| | | 75.0 | 75.1 | 74.9 | 0.05 | 2.15 | 2.23 | 2.05 | 0.06 |
| | | 85.0 | 85.2 | 84.9 | 0.08 | 2.30 | 2.38 | 2.19 | 0.07 |
| | | 75.0 | 75.1 | 74.9 | 0.06 | 2.14 | 2.32 | 2.01 | 0.09 |
| | | 60.0 | 60.0 | 59.9 | 0.04 | 1.92 | 2.08 | 1.86 | 0.07 |
| | | 44.9 | 45.0 | 44.8 | 0.07 | 1.63 | 1.67 | 1.51 | 0.06 |
| A | 2 | 45.1 | 45.3 | 44.8 | 0.15 | 1.59 | 1.67 | 1.51 | 0.06 |
| | | 60.0 | 60.0 | 59.8 | 0.07 | 1.82 | 1.88 | 1.73 | 0.04 |
| | | 75.0 | 75.1 | 74.8 | 0.09 | 2.06 | 2.15 | 1.98 | 0.05 |
| | | 85.0 | 85.2 | 84.9 | 0.09 | 2.20 | 2.32 | 2.14 | 0.06 |
| | | 74.9 | 75.1 | 74.8 | 0.11 | 2.08 | 2.14 | 2.02 | 0.04 |
| | | 59.9 | 60.1 | 59.8 | 0.09 | 1.85 | 1.89 | 1.77 | 0.04 |
| | | 45.1 | 45.1 | 45.0 | 0.05 | 1.58 | 1.62 | 1.53 | 0.03 |
| A | 3 | 45.0 | 45.2 | 44.7 | 0.17 | 1.58 | 1.63 | 1.52 | 0.04 |
| | | 60.0 | 60.0 | 59.9 | 0.05 | 1.81 | 1.92 | 1.74 | 0.07 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 2.07 | 2.24 | 1.88 | 0.11 |
| | | 85.0 | 85.1 | 84.9 | 0.07 | 2.22 | 2.32 | 2.13 | 0.07 |
| | | 74.9 | 75.0 | 74.7 | 0.12 | 2.00 | 2.06 | 1.96 | 0.04 |
| | | 59.8 | 59.9 | 59.6 | 0.12 | 1.80 | 1.89 | 1.70 | 0.07 |
| | | 45.1 | 45.1 | 45.0 | 0.05 | 1.55 | 1.62 | 1.50 | 0.04 |
| A | 4 | 45.0 | 45.1 | 44.9 | 0.07 | 1.66 | 1.72 | 1.54 | 0.06 |
| | | 60.1 | 60.3 | 59.9 | 0.14 | 1.89 | 1.95 | 1.82 | 0.04 |
| | | 75.1 | 75.2 | 75.0 | 0.09 | 2.14 | 2.21 | 2.03 | 0.05 |
| | | 85.0 | 85.1 | 84.8 | 0.10 | 2.28 | 2.38 | 2.19 | 0.05 |
| | | 75.1 | 75.2 | 74.9 | 0.09 | 2.12 | 2.21 | 2.05 | 0.06 |
| | | 60.0 | 60.2 | 59.9 | 0.10 | 1.93 | 2.05 | 1.88 | 0.06 |
| | | 44.9 | 45.0 | 44.9 | 0.05 | 1.65 | 1.75 | 1.59 | 0.05 |

Table 9. Brand A HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| A | 1 | 45.0 | 45.3 | 44.9 | 0.12 | 0.55 | 0.61 | 0.49 | 0.04 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 0.67 | 0.76 | 0.58 | 0.06 |
| | | 75.1 | 75.2 | 75.0 | 0.07 | 0.73 | 0.77 | 0.67 | 0.03 |
| | | 85.1 | 85.2 | 84.9 | 0.10 | 0.77 | 0.82 | 0.73 | 0.03 |
| | | 75.1 | 75.2 | 75.1 | 0.03 | 0.75 | 0.80 | 0.71 | 0.03 |
| | | 60.0 | 60.1 | 59.9 | 0.06 | 0.64 | 0.67 | 0.60 | 0.02 |
| | | 45.1 | 45.2 | 45.1 | 0.04 | 0.58 | 0.60 | 0.54 | 0.02 |
| A | 2 | 44.9 | 45.0 | 44.8 | 0.07 | 0.55 | 0.60 | 0.51 | 0.03 |
| | | 60.0 | 60.1 | 59.9 | 0.07 | 0.63 | 0.68 | 0.52 | 0.05 |
| | | 75.0 | 75.2 | 74.8 | 0.12 | 0.71 | 0.81 | 0.66 | 0.06 |
| | | 85.0 | 85.1 | 84.9 | 0.06 | 0.73 | 0.77 | 0.71 | 0.02 |
| | | 75.0 | 75.1 | 74.9 | 0.04 | 0.72 | 0.76 | 0.68 | 0.03 |
| | | 60.0 | 60.1 | 59.9 | 0.06 | 0.62 | 0.68 | 0.59 | 0.03 |
| | | 45.0 | 45.0 | 44.9 | 0.05 | 0.54 | 0.57 | 0.51 | 0.02 |
| A | 3 | 44.9 | 45.3 | 44.5 | 0.29 | 0.55 | 0.60 | 0.52 | 0.03 |
| | | 60.1 | 60.2 | 59.7 | 0.18 | 0.64 | 0.73 | 0.59 | 0.04 |
| | | 75.0 | 75.2 | 74.8 | 0.11 | 0.75 | 0.81 | 0.70 | 0.05 |
| | | 84.8 | 85.1 | 84.6 | 0.19 | 0.81 | 0.91 | 0.67 | 0.08 |
| | | 75.3 | 75.5 | 75.2 | 0.11 | 0.75 | 0.91 | 0.62 | 0.10 |
| | | 60.1 | 60.4 | 60.0 | 0.15 | 0.60 | 0.69 | 0.47 | 0.07 |
| | | 45.0 | 45.1 | 44.7 | 0.14 | 0.52 | 0.69 | 0.43 | 0.08 |
| A | 4 | 45.0 | 45.2 | 44.9 | 0.09 | 0.60 | 0.66 | 0.56 | 0.04 |
| | | 60.0 | 60.2 | 59.9 | 0.08 | 0.72 | 0.76 | 0.69 | 0.02 |
| | | 75.0 | 75.0 | 74.9 | 0.05 | 0.77 | 0.80 | 0.74 | 0.02 |
| | | 85.0 | 85.1 | 85.0 | 0.05 | 0.83 | 0.87 | 0.78 | 0.04 |
| | | 75.1 | 75.2 | 74.9 | 0.10 | 0.79 | 0.82 | 0.78 | 0.02 |
| | | 60.0 | 60.1 | 59.9 | 0.11 | 0.73 | 0.82 | 0.65 | 0.06 |
| | | 45.0 | 45.1 | 45.0 | 0.03 | 0.63 | 0.65 | 0.61 | 0.01 |

Table 10. Brand B non-HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.1 | 30.2 | 30.1 | 0.05 | 3.97 | 4.20 | 3.78 | 0.15 |
| | | 45.2 | 45.3 | 45.1 | 0.05 | 4.81 | 5.03 | 4.63 | 0.12 |
| | | 60.0 | 60.2 | 59.9 | 0.08 | 5.57 | 5.74 | 5.48 | 0.10 |
| | | 75.1 | 75.2 | 74.9 | 0.11 | 6.15 | 6.46 | 5.84 | 0.20 |
| | | 81.1 | 81.3 | 80.9 | 0.15 | 6.36 | 6.80 | 5.68 | 0.36 |
| | | 75.0 | 75.4 | 74.6 | 0.31 | 6.11 | 6.50 | 5.84 | 0.24 |
| | | 60.0 | 60.1 | 59.8 | 0.09 | 5.53 | 5.68 | 5.43 | 0.09 |
| | | 45.0 | 45.1 | 44.9 | 0.09 | 4.87 | 5.08 | 4.50 | 0.18 |
| | | 29.9 | 30.1 | 29.9 | 0.09 | 3.97 | 4.27 | 3.72 | 0.20 |
| B | 2 | 30.0 | 30.1 | 30.0 | 0.02 | 3.97 | 4.54 | 3.61 | 0.29 |
| | | 45.1 | 45.3 | 45.0 | 0.09 | 4.83 | 5.01 | 4.69 | 0.12 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 5.60 | 5.70 | 5.50 | 0.07 |
| | | 75.0 | 75.3 | 74.6 | 0.20 | 6.29 | 6.66 | 5.87 | 0.25 |
| | | 80.1 | 80.3 | 79.7 | 0.17 | 6.45 | 6.69 | 6.23 | 0.15 |
| | | 75.1 | 75.3 | 74.9 | 0.13 | 6.33 | 6.64 | 6.12 | 0.19 |
| | | 60.0 | 60.2 | 59.9 | 0.10 | 5.59 | 5.89 | 5.40 | 0.16 |
| | | 45.0 | 45.2 | 44.9 | 0.10 | 4.84 | 5.13 | 4.71 | 0.14 |
| | | 30.0 | 30.1 | 29.8 | 0.12 | 3.88 | 4.01 | 3.63 | 0.12 |
| B | 3 | 30.1 | 30.2 | 30.0 | 0.10 | 4.00 | 4.17 | 3.88 | 0.11 |
| | | 45.1 | 45.2 | 45.0 | 0.05 | 4.88 | 4.98 | 4.77 | 0.07 |
| | | 60.1 | 60.2 | 60.0 | 0.09 | 5.57 | 5.79 | 5.37 | 0.15 |
| | | 75.0 | 75.6 | 74.4 | 0.35 | 6.31 | 6.51 | 6.18 | 0.10 |
| | | 81.9 | 82.3 | 81.5 | 0.26 | 6.47 | 6.69 | 6.18 | 0.21 |
| | | 75.1 | 75.3 | 74.9 | 0.14 | 6.32 | 6.56 | 6.09 | 0.16 |
| | | 59.9 | 60.3 | 59.0 | 0.39 | 5.50 | 6.06 | 4.87 | 0.40 |
| | | 45.0 | 45.1 | 45.0 | 0.07 | 4.84 | 4.90 | 4.75 | 0.05 |
| | | 30.0 | 30.0 | 30.0 | 0.02 | 3.97 | 4.06 | 3.82 | 0.08 |
| B | 4 | 30.1 | 30.2 | 29.9 | 0.10 | 3.96 | 4.07 | 3.86 | 0.07 |
| | | 45.1 | 45.3 | 44.9 | 0.11 | 4.84 | 4.88 | 4.72 | 0.05 |
| | | 60.0 | 60.5 | 59.8 | 0.18 | 5.59 | 5.78 | 5.43 | 0.11 |
| | | 75.0 | 75.2 | 74.9 | 0.14 | 6.25 | 6.57 | 6.04 | 0.18 |
| | | 81.4 | 81.9 | 80.8 | 0.43 | 6.51 | 7.16 | 6.11 | 0.32 |
| | | 75.1 | 75.5 | 74.8 | 0.26 | 6.29 | 6.74 | 6.06 | 0.21 |
| | | 60.1 | 60.2 | 60.0 | 0.08 | 5.61 | 5.87 | 5.48 | 0.12 |
| | | 44.9 | 45.2 | 44.8 | 0.15 | 4.81 | 4.94 | 4.70 | 0.08 |
| | | 30.0 | 30.1 | 29.9 | 0.04 | 3.89 | 3.93 | 3.84 | 0.03 |

Table 11. Brand B non-HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.0 | 30.1 | 29.9 | 0.06 | 1.79 | 1.88 | 1.66 | 0.07 |
| | | 45.2 | 45.3 | 45.0 | 0.09 | 2.18 | 2.32 | 2.07 | 0.10 |
| | | 60.2 | 60.3 | 60.1 | 0.08 | 2.54 | 2.66 | 2.42 | 0.09 |
| | | 75.2 | 75.3 | 74.9 | 0.12 | 2.81 | 3.06 | 2.62 | 0.14 |
| | | 85.1 | 85.2 | 85.0 | 0.06 | 2.99 | 3.10 | 2.83 | 0.10 |
| | | 75.1 | 75.2 | 75.0 | 0.07 | 2.86 | 2.96 | 2.71 | 0.09 |
| | | 65.0 | 65.0 | 64.9 | 0.04 | 2.58 | 2.67 | 2.40 | 0.09 |
| | | 45.0 | 45.1 | 45.0 | 0.04 | 2.18 | 2.39 | 2.02 | 0.11 |
| | | 30.0 | 30.1 | 29.9 | 0.04 | 1.79 | 1.95 | 1.65 | 0.11 |
| B | 2 | 30.0 | 30.0 | 30.0 | 0.02 | 1.77 | 1.87 | 1.63 | 0.09 |
| | | 45.1 | 45.1 | 45.0 | 0.02 | 2.17 | 2.31 | 2.08 | 0.08 |
| | | 60.1 | 60.2 | 60.1 | 0.05 | 2.54 | 2.63 | 2.37 | 0.09 |
| | | 75.1 | 75.2 | 75.0 | 0.05 | 2.82 | 2.96 | 2.58 | 0.13 |
| | | 85.2 | 85.3 | 85.1 | 0.05 | 3.03 | 3.23 | 2.83 | 0.12 |
| | | 75.0 | 75.2 | 74.8 | 0.12 | 2.86 | 3.10 | 2.78 | 0.11 |
| | | 59.9 | 60.0 | 59.8 | 0.07 | 2.51 | 2.64 | 2.40 | 0.07 |
| | | 44.9 | 45.0 | 44.9 | 0.06 | 2.19 | 2.37 | 2.11 | 0.10 |
| | | 30.0 | 30.0 | 29.9 | 0.04 | 1.78 | 1.97 | 1.63 | 0.12 |
| B | 3 | 30.1 | 30.1 | 30.1 | 0.03 | 1.83 | 1.92 | 1.73 | 0.07 |
| | | 45.1 | 45.2 | 45.1 | 0.02 | 2.32 | 2.45 | 2.17 | 0.09 |
| | | 60.3 | 60.4 | 59.9 | 0.16 | 2.59 | 2.70 | 2.38 | 0.11 |
| | | 75.0 | 75.2 | 74.9 | 0.08 | 2.86 | 2.99 | 2.79 | 0.07 |
| | | 85.1 | 85.2 | 85.0 | 0.11 | 3.09 | 3.28 | 2.93 | 0.10 |
| | | 75.0 | 75.1 | 74.9 | 0.05 | 2.89 | 3.04 | 2.73 | 0.11 |
| | | 60.0 | 60.1 | 60.0 | 0.03 | 2.60 | 2.77 | 2.42 | 0.11 |
| | | 45.0 | 45.2 | 44.9 | 0.10 | 2.28 | 2.46 | 2.07 | 0.12 |
| | | 29.9 | 30.0 | 29.9 | 0.06 | 1.83 | 1.97 | 1.61 | 0.13 |
| B | 4 | 30.0 | 30.1 | 30.0 | 0.03 | 1.73 | 1.81 | 1.60 | 0.07 |
| | | 45.1 | 45.2 | 45.1 | 0.04 | 2.10 | 2.25 | 1.97 | 0.09 |
| | | 60.1 | 60.2 | 60.1 | 0.02 | 2.42 | 2.51 | 2.17 | 0.11 |
| | | 75.1 | 75.3 | 74.9 | 0.15 | 2.65 | 2.89 | 2.41 | 0.15 |
| | | 85.2 | 85.3 | 85.1 | 0.07 | 2.99 | 3.12 | 2.81 | 0.09 |
| | | 75.0 | 75.1 | 74.9 | 0.05 | 2.66 | 2.85 | 2.45 | 0.16 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 2.47 | 2.58 | 2.39 | 0.06 |
| | | 45.0 | 45.1 | 44.9 | 0.10 | 2.12 | 2.22 | 2.04 | 0.06 |
| | | 30.0 | 30.1 | 29.9 | 0.07 | 1.70 | 1.82 | 1.60 | 0.08 |

Table 12. Brand B non-HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.0 | 30.1 | 29.7 | 0.13 | 2.16 | 2.33 | 2.01 | 0.11 |
| | | 45.1 | 45.2 | 45.1 | 0.04 | 2.66 | 2.79 | 2.53 | 0.09 |
| | | 60.1 | 60.3 | 60.1 | 0.08 | 3.07 | 3.17 | 3.00 | 0.05 |
| | | 75.1 | 75.2 | 75.0 | 0.08 | 3.47 | 3.61 | 3.28 | 0.11 |
| | | 85.2 | 85.3 | 85.0 | 0.11 | 3.65 | 3.80 | 3.43 | 0.12 |
| | | 75.0 | 75.1 | 74.9 | 0.05 | 3.39 | 3.55 | 3.20 | 0.12 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 3.06 | 3.18 | 2.82 | 0.12 |
| | | 45.0 | 45.1 | 44.9 | 0.04 | 2.68 | 2.78 | 2.62 | 0.05 |
| | | 30.0 | 30.1 | 30.0 | 0.03 | 2.19 | 2.37 | 2.07 | 0.10 |
| B | 2 | 29.9 | 30.0 | 29.9 | 0.03 | 2.17 | 2.23 | 2.08 | 0.05 |
| | | 45.1 | 45.2 | 45.1 | 0.05 | 2.57 | 2.69 | 2.49 | 0.07 |
| | | 60.2 | 60.3 | 60.1 | 0.08 | 2.95 | 3.07 | 2.86 | 0.07 |
| | | 75.1 | 75.3 | 75.0 | 0.09 | 3.36 | 3.56 | 3.22 | 0.10 |
| | | 85.1 | 85.3 | 84.9 | 0.14 | 3.54 | 3.64 | 3.43 | 0.09 |
| | | 75.0 | 75.1 | 74.9 | 0.10 | 3.30 | 3.38 | 3.20 | 0.06 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 2.98 | 3.06 | 2.86 | 0.08 |
| | | 45.0 | 45.1 | 44.9 | 0.06 | 2.56 | 2.67 | 2.50 | 0.06 |
| | | 30.0 | 30.0 | 29.9 | 0.05 | 2.10 | 2.18 | 2.01 | 0.06 |
| B | 3 | 29.8 | 30.1 | 29.4 | 0.27 | 2.12 | 2.19 | 2.03 | 0.06 |
| | | 45.1 | 45.2 | 45.0 | 0.08 | 2.61 | 2.71 | 2.43 | 0.08 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 2.96 | 3.15 | 2.80 | 0.11 |
| | | 75.1 | 75.2 | 75.0 | 0.05 | 3.33 | 3.49 | 3.10 | 0.12 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 3.55 | 3.78 | 3.26 | 0.18 |
| | | 75.1 | 75.2 | 75.1 | 0.04 | 3.32 | 3.41 | 3.15 | 0.09 |
| | | 59.9 | 60.0 | 59.9 | 0.03 | 3.00 | 3.28 | 2.87 | 0.13 |
| | | 45.0 | 45.0 | 45.0 | 0.03 | 2.66 | 2.84 | 2.51 | 0.11 |
| | | 30.0 | 30.1 | 29.9 | 0.07 | 2.19 | 2.33 | 2.09 | 0.09 |
| B | 4 | 30.0 | 30.1 | 29.9 | 0.05 | 2.12 | 2.28 | 2.05 | 0.07 |
| | | 45.1 | 45.2 | 45.0 | 0.08 | 2.53 | 2.62 | 2.48 | 0.05 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 2.95 | 3.08 | 2.88 | 0.07 |
| | | 75.1 | 75.2 | 74.9 | 0.09 | 3.35 | 3.43 | 3.29 | 0.06 |
| | | 85.1 | 85.2 | 85.1 | 0.05 | 3.52 | 3.78 | 3.35 | 0.14 |
| | | 74.9 | 75.1 | 74.8 | 0.08 | 3.37 | 3.48 | 3.10 | 0.13 |
| | | 59.9 | 60.0 | 59.9 | 0.04 | 2.95 | 3.16 | 2.81 | 0.12 |
| | | 45.0 | 45.1 | 44.9 | 0.05 | 2.63 | 2.74 | 2.58 | 0.05 |
| | | 30.1 | 30.2 | 30.1 | 0.05 | 2.04 | 2.20 | 1.84 | 0.13 |

Table 13. Brand B non-HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.0 | 30.2 | 29.8 | 0.12 | 1.16 | 1.26 | 1.09 | 0.06 |
| | | 45.1 | 45.2 | 44.9 | 0.07 | 1.45 | 1.50 | 1.38 | 0.04 |
| | | 60.0 | 60.1 | 59.9 | 0.04 | 1.61 | 1.67 | 1.53 | 0.05 |
| | | 74.9 | 75.0 | 74.9 | 0.06 | 1.83 | 1.97 | 1.68 | 0.09 |
| | | 85.0 | 85.1 | 84.9 | 0.08 | 1.96 | 2.15 | 1.83 | 0.12 |
| | | 75.0 | 75.0 | 74.9 | 0.04 | 1.91 | 2.08 | 1.79 | 0.10 |
| | | 59.9 | 60.1 | 59.8 | 0.10 | 1.69 | 1.76 | 1.57 | 0.07 |
| | | 45.0 | 45.1 | 44.9 | 0.04 | 1.42 | 1.57 | 1.36 | 0.06 |
| | | 30.0 | 30.4 | 29.6 | 0.27 | 1.19 | 1.21 | 1.16 | 0.02 |
| B | 2 | 30.1 | 30.2 | 29.9 | 0.07 | 1.17 | 1.23 | 1.09 | 0.04 |
| | | 45.0 | 45.0 | 44.9 | 0.02 | 1.44 | 1.49 | 1.40 | 0.03 |
| | | 60.1 | 60.1 | 60.0 | 0.04 | 1.61 | 1.73 | 1.44 | 0.09 |
| | | 75.0 | 75.1 | 74.9 | 0.06 | 1.82 | 1.96 | 1.76 | 0.06 |
| | | 84.9 | 85.0 | 84.8 | 0.07 | 1.93 | 2.10 | 1.75 | 0.11 |
| | | 75.0 | 75.1 | 75.0 | 0.04 | 1.83 | 2.01 | 1.66 | 0.12 |
| | | 59.9 | 60.1 | 59.6 | 0.17 | 1.61 | 1.70 | 1.44 | 0.09 |
| | | 44.9 | 45.1 | 44.8 | 0.10 | 1.41 | 1.59 | 1.24 | 0.10 |
| | | 29.9 | 30.0 | 29.8 | 0.10 | 1.16 | 1.29 | 1.07 | 0.09 |
| B | 3 | 30.1 | 30.4 | 29.4 | 0.34 | 1.18 | 1.22 | 1.14 | 0.03 |
| | | 44.8 | 44.9 | 44.7 | 0.08 | 1.41 | 1.56 | 1.23 | 0.09 |
| | | 60.0 | 60.2 | 59.9 | 0.12 | 1.70 | 1.80 | 1.58 | 0.08 |
| | | 75.1 | 75.3 | 75.0 | 0.09 | 1.80 | 2.02 | 1.59 | 0.15 |
| | | 85.2 | 85.3 | 84.9 | 0.12 | 1.97 | 2.18 | 1.66 | 0.18 |
| | | 75.0 | 75.1 | 75.0 | 0.03 | 1.89 | 2.14 | 1.71 | 0.14 |
| | | 60.1 | 60.1 | 60.0 | 0.05 | 1.61 | 1.75 | 1.42 | 0.13 |
| | | 45.0 | 45.1 | 44.9 | 0.04 | 1.37 | 1.51 | 1.23 | 0.11 |
| | | 30.0 | 30.1 | 30.0 | 0.03 | 1.18 | 1.38 | 0.99 | 0.14 |
| B | 4 | 31.9 | 45.2 | 30.0 | 5.35 | 1.20 | 1.38 | 1.02 | 0.11 |
| | | 47.0 | 60.4 | 45.1 | 5.42 | 1.48 | 1.75 | 1.30 | 0.15 |
| | | 61.9 | 75.1 | 60.0 | 5.32 | 1.66 | 1.91 | 1.54 | 0.14 |
| | | 76.4 | 85.3 | 75.0 | 3.61 | 1.98 | 2.07 | 1.89 | 0.07 |
| | | 83.8 | 85.1 | 75.0 | 3.58 | 1.93 | 2.12 | 1.79 | 0.10 |
| | | 73.2 | 75.1 | 60.2 | 5.27 | 1.79 | 1.96 | 1.44 | 0.17 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 1.70 | 1.80 | 1.54 | 0.09 |
| | | 45.0 | 45.0 | 45.0 | 0.02 | 1.41 | 1.50 | 1.21 | 0.09 |
| | | 30.0 | 30.0 | 30.0 | 0.03 | 1.16 | 1.32 | 1.02 | 0.10 |

Table 14. Brand B HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.0 | 30.0 | 30.0 | 0.02 | 2.21 | 2.31 | 2.14 | 0.06 |
| | | 45.1 | 45.1 | 45.1 | 0.02 | 2.73 | 2.80 | 2.68 | 0.04 |
| | | 60.1 | 60.2 | 60.0 | 0.08 | 3.13 | 3.26 | 3.01 | 0.08 |
| | | 74.9 | 75.0 | 74.9 | 0.03 | 3.51 | 3.58 | 3.42 | 0.06 |
| | | 85.1 | 85.2 | 85.0 | 0.07 | 3.74 | 3.78 | 3.66 | 0.04 |
| | | 74.9 | 75.0 | 74.9 | 0.04 | 3.49 | 3.62 | 3.40 | 0.10 |
| | | 59.9 | 60.1 | 59.7 | 0.14 | 3.14 | 3.22 | 3.00 | 0.07 |
| | | 45.0 | 45.0 | 44.9 | 0.03 | 2.67 | 2.77 | 2.56 | 0.06 |
| | | 30.0 | 30.1 | 29.9 | 0.05 | 2.17 | 2.29 | 2.03 | 0.08 |
| B | 2 | 30.0 | 30.1 | 29.9 | 0.06 | 2.19 | 2.32 | 1.98 | 0.12 |
| | | 45.1 | 45.2 | 45.0 | 0.06 | 2.73 | 2.81 | 2.62 | 0.07 |
| | | 60.1 | 60.1 | 60.1 | 0.03 | 3.19 | 3.32 | 3.07 | 0.09 |
| | | 75.3 | 75.4 | 75.1 | 0.12 | 3.54 | 3.64 | 3.48 | 0.05 |
| | | 85.1 | 85.2 | 85.1 | 0.04 | 3.78 | 3.85 | 3.72 | 0.05 |
| | | 74.9 | 75.1 | 74.8 | 0.09 | 3.47 | 3.52 | 3.44 | 0.03 |
| | | 60.0 | 60.2 | 59.8 | 0.14 | 3.18 | 3.23 | 3.13 | 0.03 |
| | | 44.9 | 45.0 | 44.8 | 0.07 | 2.73 | 2.84 | 2.59 | 0.09 |
| | | 30.0 | 30.1 | 29.9 | 0.08 | 2.21 | 2.32 | 2.13 | 0.07 |
| B | 3 | 30.0 | 30.1 | 30.0 | 0.03 | 2.17 | 2.26 | 2.11 | 0.06 |
| | | 45.1 | 45.1 | 45.0 | 0.05 | 2.71 | 2.78 | 2.66 | 0.04 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 3.15 | 3.19 | 3.07 | 0.04 |
| | | 75.0 | 75.1 | 75.0 | 0.07 | 3.51 | 3.61 | 3.41 | 0.07 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 3.74 | 3.80 | 3.68 | 0.04 |
| | | 74.9 | 75.1 | 74.8 | 0.12 | 3.51 | 3.55 | 3.45 | 0.04 |
| | | 60.0 | 60.0 | 59.9 | 0.05 | 3.12 | 3.20 | 3.05 | 0.04 |
| | | 45.0 | 45.0 | 44.9 | 0.04 | 2.70 | 2.78 | 2.63 | 0.06 |
| | | 30.0 | 30.1 | 30.0 | 0.04 | 2.18 | 2.27 | 2.08 | 0.07 |
| B | 4 | 30.1 | 30.2 | 29.9 | 0.09 | 2.22 | 2.33 | 2.11 | 0.08 |
| | | 45.1 | 45.2 | 44.9 | 0.11 | 2.72 | 2.81 | 2.62 | 0.07 |
| | | 60.0 | 60.1 | 59.9 | 0.07 | 3.14 | 3.18 | 3.07 | 0.04 |
| | | 75.1 | 75.1 | 74.9 | 0.07 | 3.52 | 3.62 | 3.45 | 0.05 |
| | | 85.0 | 85.2 | 84.9 | 0.10 | 3.70 | 3.76 | 3.61 | 0.05 |
| | | 75.0 | 75.1 | 74.8 | 0.07 | 3.52 | 3.58 | 3.44 | 0.05 |
| | | 60.0 | 60.1 | 59.9 | 0.06 | 3.10 | 3.23 | 2.97 | 0.08 |
| | | 45.0 | 45.1 | 45.0 | 0.03 | 2.73 | 2.90 | 2.65 | 0.08 |
| | | 30.0 | 30.0 | 29.9 | 0.03 | 2.24 | 2.37 | 2.18 | 0.07 |

Table 15. Brand B HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 29.8 | 30.0 | 29.7 | 0.14 | 1.17 | 1.18 | 1.14 | 0.02 |
| | | 45.0 | 45.1 | 45.0 | 0.02 | 1.44 | 1.49 | 1.38 | 0.04 |
| | | 60.1 | 60.1 | 60.0 | 0.03 | 1.68 | 1.71 | 1.64 | 0.02 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 1.87 | 1.92 | 1.82 | 0.03 |
| | | 85.1 | 85.2 | 85.0 | 0.07 | 1.98 | 2.03 | 1.93 | 0.03 |
| | | 75.0 | 75.0 | 74.9 | 0.02 | 1.83 | 1.85 | 1.81 | 0.01 |
| | | 60.0 | 60.0 | 59.9 | 0.04 | 1.67 | 1.69 | 1.66 | 0.01 |
| | | 45.0 | 45.4 | 44.8 | 0.15 | 1.44 | 1.50 | 1.36 | 0.04 |
| B | 2 | 29.8 | 30.0 | 29.7 | 0.11 | 1.15 | 1.24 | 1.09 | 0.05 |
| | | 30.0 | 30.2 | 29.5 | 0.24 | 1.16 | 1.19 | 1.14 | 0.02 |
| | | 45.1 | 45.2 | 45.0 | 0.07 | 1.42 | 1.48 | 1.38 | 0.03 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 1.65 | 1.71 | 1.62 | 0.03 |
| | | 75.1 | 75.2 | 74.9 | 0.09 | 1.85 | 1.89 | 1.83 | 0.02 |
| | | 85.1 | 85.1 | 84.9 | 0.08 | 1.95 | 2.03 | 1.89 | 0.05 |
| | | 74.9 | 75.0 | 74.9 | 0.05 | 1.83 | 1.88 | 1.80 | 0.03 |
| | | 59.9 | 60.0 | 59.8 | 0.05 | 1.63 | 1.67 | 1.59 | 0.02 |
| B | 3 | 45.0 | 45.1 | 44.9 | 0.07 | 1.44 | 1.48 | 1.42 | 0.02 |
| | | 30.0 | 30.0 | 29.9 | 0.05 | 1.16 | 1.22 | 1.10 | 0.04 |
| | | 30.1 | 30.1 | 30.0 | 0.03 | 1.18 | 1.23 | 1.11 | 0.04 |
| | | 45.0 | 45.1 | 45.0 | 0.03 | 1.43 | 1.47 | 1.41 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 1.65 | 1.69 | 1.62 | 0.03 |
| | | 75.1 | 75.3 | 74.9 | 0.12 | 1.87 | 1.91 | 1.84 | 0.03 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 1.99 | 2.03 | 1.94 | 0.03 |
| | | 75.0 | 75.0 | 74.9 | 0.05 | 1.88 | 1.90 | 1.85 | 0.02 |
| B | 4 | 59.9 | 60.0 | 59.8 | 0.09 | 1.67 | 1.72 | 1.65 | 0.02 |
| | | 45.0 | 45.0 | 44.9 | 0.02 | 1.44 | 1.52 | 1.40 | 0.04 |
| | | 30.0 | 30.0 | 29.9 | 0.05 | 1.16 | 1.21 | 1.08 | 0.04 |
| | | 30.0 | 30.1 | 30.0 | 0.05 | 1.15 | 1.24 | 1.08 | 0.06 |
| | | 45.0 | 45.1 | 44.9 | 0.05 | 1.43 | 1.47 | 1.39 | 0.03 |
| | | 60.0 | 60.1 | 60.0 | 0.05 | 1.64 | 1.70 | 1.60 | 0.04 |
| | | 75.0 | 75.1 | 75.0 | 0.04 | 1.85 | 1.89 | 1.82 | 0.03 |
| | | 85.1 | 85.2 | 84.9 | 0.11 | 1.99 | 2.07 | 1.91 | 0.05 |
| B | 4 | 74.9 | 75.0 | 74.9 | 0.04 | 1.85 | 1.90 | 1.79 | 0.03 |
| | | 60.0 | 60.0 | 59.9 | 0.05 | 1.65 | 1.73 | 1.61 | 0.04 |
| | | 44.9 | 45.0 | 44.9 | 0.04 | 1.45 | 1.51 | 1.41 | 0.04 |
| | | 30.0 | 30.2 | 29.9 | 0.11 | 1.15 | 1.17 | 1.10 | 0.03 |

Table 16. Brand B HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.2 | 30.5 | 30.0 | 0.15 | 1.45 | 1.50 | 1.37 | 0.04 |
| | | 45.0 | 45.3 | 44.9 | 0.13 | 1.72 | 1.83 | 1.65 | 0.06 |
| | | 60.1 | 60.2 | 60.0 | 0.07 | 2.01 | 2.11 | 1.88 | 0.08 |
| | | 75.1 | 75.2 | 75.0 | 0.04 | 2.25 | 2.33 | 2.19 | 0.05 |
| | | 85.1 | 85.2 | 85.0 | 0.06 | 2.40 | 2.43 | 2.33 | 0.03 |
| | | 74.9 | 75.0 | 74.8 | 0.05 | 2.26 | 2.37 | 2.18 | 0.06 |
| | | 59.9 | 60.0 | 59.9 | 0.04 | 1.99 | 2.07 | 1.90 | 0.07 |
| | | 45.0 | 45.0 | 45.0 | 0.03 | 1.74 | 1.84 | 1.64 | 0.07 |
| B | 2 | 30.0 | 30.1 | 29.9 | 0.05 | 1.42 | 1.47 | 1.36 | 0.04 |
| | | 30.1 | 30.1 | 30.0 | 0.06 | 1.45 | 1.49 | 1.38 | 0.04 |
| | | 45.0 | 45.2 | 44.9 | 0.09 | 1.71 | 1.80 | 1.66 | 0.04 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 2.04 | 2.11 | 1.95 | 0.05 |
| | | 75.0 | 75.2 | 75.0 | 0.09 | 2.26 | 2.32 | 2.20 | 0.05 |
| | | 85.1 | 85.2 | 84.8 | 0.14 | 2.40 | 2.45 | 2.33 | 0.04 |
| | | 75.0 | 75.1 | 74.9 | 0.05 | 2.26 | 2.36 | 2.06 | 0.10 |
| | | 60.0 | 60.1 | 59.9 | 0.08 | 2.05 | 2.12 | 1.93 | 0.06 |
| B | 3 | 45.0 | 45.0 | 45.0 | 0.03 | 1.73 | 1.80 | 1.61 | 0.07 |
| | | 30.0 | 30.1 | 29.9 | 0.05 | 1.44 | 1.52 | 1.36 | 0.06 |
| | | 30.1 | 30.1 | 30.0 | 0.03 | 1.42 | 1.48 | 1.37 | 0.04 |
| | | 45.1 | 45.3 | 44.9 | 0.13 | 1.75 | 1.80 | 1.70 | 0.03 |
| | | 60.1 | 60.1 | 60.1 | 0.03 | 2.01 | 2.07 | 1.93 | 0.05 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 2.23 | 2.28 | 2.19 | 0.03 |
| | | 85.1 | 85.2 | 85.0 | 0.05 | 2.40 | 2.44 | 2.37 | 0.02 |
| | | 75.0 | 75.0 | 74.9 | 0.03 | 2.24 | 2.30 | 2.21 | 0.03 |
| B | 4 | 59.9 | 60.1 | 59.8 | 0.07 | 1.98 | 2.06 | 1.87 | 0.06 |
| | | 45.0 | 45.1 | 44.8 | 0.08 | 1.76 | 1.82 | 1.68 | 0.04 |
| | | 29.9 | 30.0 | 29.9 | 0.02 | 1.40 | 1.53 | 1.33 | 0.06 |
| | | 30.0 | 30.0 | 30.0 | 0.01 | 1.42 | 1.48 | 1.37 | 0.04 |
| | | 45.1 | 45.2 | 45.0 | 0.06 | 1.75 | 1.77 | 1.72 | 0.02 |
| | | 60.0 | 60.1 | 60.0 | 0.06 | 2.05 | 2.12 | 2.01 | 0.03 |
| | | 75.1 | 75.2 | 75.0 | 0.05 | 2.29 | 2.35 | 2.22 | 0.05 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 2.44 | 2.49 | 2.36 | 0.04 |
| B | 4 | 74.9 | 75.0 | 74.9 | 0.07 | 2.23 | 2.27 | 2.16 | 0.04 |
| | | 59.9 | 60.0 | 59.9 | 0.02 | 2.02 | 2.11 | 1.96 | 0.05 |
| | | 44.9 | 45.0 | 44.8 | 0.09 | 1.72 | 1.78 | 1.68 | 0.03 |
| | | 30.0 | 30.1 | 29.9 | 0.05 | 1.44 | 1.49 | 1.35 | 0.05 |

Table 17. Brand B HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| B | 1 | 30.2 | 30.4 | 30.0 | 0.15 | 0.75 | 0.78 | 0.73 | 0.02 |
| | | 44.9 | 45.4 | 44.6 | 0.26 | 0.86 | 0.91 | 0.81 | 0.03 |
| | | 60.0 | 60.1 | 59.8 | 0.09 | 0.99 | 1.07 | 0.93 | 0.04 |
| | | 75.1 | 75.1 | 75.1 | 0.01 | 1.16 | 1.23 | 1.11 | 0.04 |
| | | 85.1 | 85.2 | 85.0 | 0.05 | 1.24 | 1.33 | 1.16 | 0.06 |
| | | 75.0 | 75.1 | 75.0 | 0.02 | 1.15 | 1.19 | 1.07 | 0.04 |
| | | 60.0 | 60.1 | 60.0 | 0.03 | 1.03 | 1.11 | 0.94 | 0.05 |
| | | 44.9 | 45.0 | 44.8 | 0.06 | 0.87 | 0.91 | 0.81 | 0.03 |
| B | 2 | 30.1 | 30.1 | 30.1 | 0.02 | 0.76 | 0.87 | 0.63 | 0.08 |
| | | 29.9 | 30.0 | 29.9 | 0.04 | 0.74 | 0.89 | 0.65 | 0.07 |
| | | 45.0 | 45.2 | 44.9 | 0.07 | 0.85 | 0.91 | 0.79 | 0.04 |
| | | 59.9 | 60.1 | 59.8 | 0.11 | 1.06 | 1.28 | 0.96 | 0.11 |
| | | 74.9 | 75.0 | 74.9 | 0.06 | 1.13 | 1.20 | 1.07 | 0.05 |
| | | 84.8 | 85.0 | 84.7 | 0.11 | 1.20 | 1.28 | 1.10 | 0.05 |
| | | 75.0 | 75.1 | 74.9 | 0.06 | 1.15 | 1.25 | 1.06 | 0.07 |
| | | 60.0 | 60.2 | 60.0 | 0.08 | 1.01 | 1.06 | 0.92 | 0.04 |
| B | 3 | 45.1 | 45.2 | 45.0 | 0.08 | 0.91 | 0.96 | 0.85 | 0.04 |
| | | 29.9 | 30.1 | 29.9 | 0.10 | 0.74 | 0.81 | 0.69 | 0.04 |
| | | 30.0 | 30.1 | 30.0 | 0.04 | 0.73 | 0.76 | 0.68 | 0.02 |
| | | 45.0 | 45.2 | 45.0 | 0.06 | 0.90 | 0.92 | 0.87 | 0.02 |
| | | 60.1 | 60.3 | 60.0 | 0.11 | 1.03 | 1.08 | 0.99 | 0.03 |
| | | 75.1 | 75.5 | 75.0 | 0.20 | 1.15 | 1.18 | 1.11 | 0.02 |
| | | 85.0 | 85.1 | 84.9 | 0.05 | 1.23 | 1.27 | 1.18 | 0.03 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 1.15 | 1.19 | 1.13 | 0.02 |
| B | 4 | 60.0 | 60.1 | 59.9 | 0.09 | 1.04 | 1.07 | 1.01 | 0.02 |
| | | 45.0 | 45.1 | 44.9 | 0.05 | 0.90 | 0.94 | 0.84 | 0.03 |
| | | 30.1 | 30.2 | 29.9 | 0.09 | 0.74 | 0.78 | 0.71 | 0.02 |
| | | 30.1 | 30.1 | 30.1 | 0.02 | 0.72 | 0.75 | 0.67 | 0.03 |
| | | 45.1 | 45.2 | 44.9 | 0.11 | 0.90 | 0.96 | 0.86 | 0.04 |
| | | 60.1 | 60.2 | 59.9 | 0.08 | 1.06 | 1.09 | 1.04 | 0.02 |
| | | 75.0 | 75.1 | 75.0 | 0.07 | 1.16 | 1.19 | 1.12 | 0.02 |
| | | 85.0 | 85.1 | 84.8 | 0.14 | 1.25 | 1.31 | 1.20 | 0.04 |
| B | 4 | 75.0 | 75.1 | 74.8 | 0.07 | 1.16 | 1.22 | 1.14 | 0.03 |
| | | 60.0 | 60.1 | 59.7 | 0.15 | 1.03 | 1.10 | 0.98 | 0.03 |
| | | 44.9 | 45.0 | 44.9 | 0.05 | 0.88 | 0.90 | 0.85 | 0.02 |
| | | 30.1 | 30.2 | 29.9 | 0.08 | 0.72 | 0.75 | 0.70 | 0.02 |

Table 18. Brand C non-HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 30.0 | 30.1 | 29.9 | 0.07 | 3.65 | 3.74 | 3.57 | 0.05 |
| | | 45.0 | 45.1 | 45.0 | 0.03 | 4.46 | 4.58 | 4.38 | 0.07 |
| | | 60.0 | 60.2 | 59.9 | 0.09 | 5.17 | 5.26 | 5.06 | 0.07 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 5.73 | 5.83 | 5.61 | 0.07 |
| | | 85.1 | 85.2 | 84.8 | 0.15 | 6.07 | 6.15 | 6.02 | 0.06 |
| | | 75.0 | 75.2 | 74.8 | 0.14 | 5.76 | 5.92 | 5.59 | 0.12 |
| | | 60.0 | 60.3 | 59.9 | 0.14 | 5.11 | 5.21 | 5.04 | 0.05 |
| | | 44.9 | 45.0 | 44.9 | 0.04 | 4.46 | 4.53 | 4.41 | 0.04 |
| | | 29.9 | 30.0 | 29.9 | 0.05 | 3.64 | 3.75 | 3.60 | 0.05 |
| C | 2 | 30.0 | 30.2 | 29.9 | 0.11 | 3.64 | 3.74 | 3.59 | 0.05 |
| | | 45.1 | 45.2 | 45.0 | 0.08 | 4.48 | 4.54 | 4.42 | 0.04 |
| | | 60.0 | 60.1 | 59.9 | 0.09 | 5.13 | 5.24 | 5.01 | 0.08 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 5.67 | 5.84 | 5.45 | 0.12 |
| | | 85.1 | 85.2 | 84.9 | 0.10 | 6.16 | 6.39 | 5.97 | 0.16 |
| | | 74.9 | 75.2 | 74.9 | 0.10 | 5.74 | 5.84 | 5.67 | 0.06 |
| | | 59.9 | 60.3 | 59.7 | 0.18 | 5.09 | 5.24 | 5.00 | 0.07 |
| | | 44.9 | 45.0 | 44.8 | 0.07 | 4.43 | 4.56 | 4.21 | 0.11 |
| | | 30.0 | 30.1 | 29.9 | 0.08 | 3.67 | 3.71 | 3.58 | 0.05 |
| C | 3 | 30.1 | 30.2 | 30.1 | 0.04 | 3.64 | 3.70 | 3.58 | 0.04 |
| | | 45.1 | 45.3 | 44.9 | 0.14 | 4.41 | 4.52 | 4.34 | 0.07 |
| | | 60.1 | 60.2 | 60.0 | 0.10 | 5.10 | 5.19 | 4.94 | 0.08 |
| | | 74.9 | 75.0 | 74.7 | 0.10 | 5.66 | 5.84 | 5.53 | 0.11 |
| | | 84.9 | 85.1 | 84.8 | 0.12 | 6.07 | 6.40 | 5.85 | 0.17 |
| | | 74.9 | 75.2 | 74.7 | 0.15 | 5.68 | 5.83 | 5.51 | 0.11 |
| | | 59.8 | 60.0 | 59.8 | 0.06 | 5.09 | 5.15 | 5.00 | 0.05 |
| | | 45.1 | 45.3 | 44.9 | 0.12 | 4.44 | 4.56 | 4.37 | 0.06 |
| | | 30.0 | 30.0 | 29.9 | 0.05 | 3.60 | 3.67 | 3.55 | 0.04 |
| C | 4 | 30.0 | 30.2 | 29.8 | 0.11 | 3.62 | 3.74 | 3.54 | 0.06 |
| | | 45.1 | 45.2 | 45.0 | 0.06 | 4.45 | 4.54 | 4.37 | 0.06 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 5.11 | 5.24 | 4.99 | 0.08 |
| | | 74.9 | 75.2 | 74.7 | 0.14 | 5.72 | 5.88 | 5.62 | 0.09 |
| | | 85.1 | 85.3 | 84.9 | 0.14 | 6.12 | 6.17 | 6.01 | 0.06 |
| | | 75.0 | 75.4 | 74.3 | 0.35 | 5.73 | 6.02 | 5.59 | 0.14 |
| | | 59.9 | 60.1 | 59.7 | 0.13 | 5.18 | 5.24 | 5.05 | 0.06 |
| | | 45.1 | 45.2 | 44.9 | 0.08 | 4.46 | 4.51 | 4.40 | 0.04 |
| | | 30.0 | 30.1 | 29.9 | 0.07 | 3.63 | 3.67 | 3.56 | 0.03 |

Table 19. Brand C non-HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 30.1 | 30.2 | 30.0 | 0.07 | 2.03 | 2.10 | 1.94 | 0.06 |
| | | 45.2 | 45.2 | 45.1 | 0.03 | 2.50 | 2.59 | 2.39 | 0.07 |
| | | 60.1 | 60.3 | 60.0 | 0.09 | 2.86 | 2.94 | 2.82 | 0.05 |
| | | 75.1 | 75.2 | 74.9 | 0.13 | 3.20 | 3.23 | 3.17 | 0.02 |
| | | 85.1 | 85.3 | 85.0 | 0.11 | 3.43 | 3.52 | 3.35 | 0.06 |
| | | 74.9 | 75.0 | 74.8 | 0.07 | 3.23 | 3.29 | 3.18 | 0.04 |
| | | 59.9 | 60.1 | 59.8 | 0.11 | 2.85 | 2.91 | 2.79 | 0.04 |
| | | 45.0 | 45.1 | 44.9 | 0.08 | 2.47 | 2.52 | 2.38 | 0.05 |
| | | 30.0 | 30.0 | 29.8 | 0.09 | 2.02 | 2.08 | 1.86 | 0.07 |
| C | 2 | 30.1 | 30.2 | 29.9 | 0.08 | 2.02 | 2.06 | 1.95 | 0.03 |
| | | 45.1 | 45.3 | 45.0 | 0.11 | 2.47 | 2.54 | 2.41 | 0.04 |
| | | 60.1 | 60.2 | 59.9 | 0.11 | 2.89 | 2.95 | 2.80 | 0.05 |
| | | 75.1 | 75.2 | 75.0 | 0.07 | 3.22 | 3.24 | 3.20 | 0.02 |
| | | 85.1 | 85.2 | 85.0 | 0.09 | 3.43 | 3.47 | 3.37 | 0.04 |
| | | 74.9 | 75.3 | 74.7 | 0.17 | 3.23 | 3.35 | 3.12 | 0.08 |
| | | 60.0 | 60.1 | 59.9 | 0.06 | 2.89 | 2.97 | 2.74 | 0.08 |
| | | 45.0 | 45.1 | 44.9 | 0.09 | 2.49 | 2.59 | 2.33 | 0.08 |
| | | 30.0 | 30.1 | 30.0 | 0.05 | 2.01 | 2.05 | 1.94 | 0.03 |
| C | 3 | 30.1 | 30.2 | 30.0 | 0.08 | 2.04 | 2.18 | 1.95 | 0.09 |
| | | 45.2 | 45.4 | 45.1 | 0.10 | 2.57 | 2.68 | 2.45 | 0.08 |
| | | 60.1 | 60.2 | 60.0 | 0.07 | 2.93 | 3.02 | 2.82 | 0.07 |
| | | 75.1 | 75.3 | 75.0 | 0.09 | 3.24 | 3.34 | 3.10 | 0.08 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 3.52 | 3.63 | 3.45 | 0.05 |
| | | 75.0 | 75.2 | 74.8 | 0.13 | 3.27 | 3.40 | 3.14 | 0.08 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 2.93 | 3.05 | 2.86 | 0.06 |
| | | 44.9 | 45.1 | 44.9 | 0.08 | 2.52 | 2.60 | 2.37 | 0.09 |
| | | 29.9 | 30.0 | 29.9 | 0.03 | 2.06 | 2.15 | 1.94 | 0.07 |
| C | 4 | 30.0 | 30.1 | 30.0 | 0.06 | 1.99 | 2.08 | 1.93 | 0.05 |
| | | 45.1 | 45.2 | 45.1 | 0.04 | 2.44 | 2.48 | 2.33 | 0.05 |
| | | 60.1 | 60.2 | 59.9 | 0.08 | 2.85 | 2.91 | 2.80 | 0.05 |
| | | 75.1 | 75.2 | 75.0 | 0.06 | 3.20 | 3.34 | 3.06 | 0.10 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 3.43 | 3.54 | 3.35 | 0.06 |
| | | 75.0 | 75.1 | 74.7 | 0.12 | 3.18 | 3.31 | 3.06 | 0.09 |
| | | 59.9 | 60.0 | 59.8 | 0.08 | 2.84 | 2.97 | 2.79 | 0.06 |
| | | 44.9 | 45.1 | 44.9 | 0.09 | 2.44 | 2.54 | 2.39 | 0.05 |
| | | 30.0 | 30.0 | 30.0 | 0.03 | 2.03 | 2.07 | 1.99 | 0.03 |

Table 20. Brand C non-HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 30.1 | 30.1 | 30.0 | 0.02 | 2.72 | 2.78 | 2.58 | 0.07 |
| | | 45.1 | 45.2 | 45.0 | 0.10 | 3.31 | 3.33 | 3.28 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 3.81 | 3.88 | 3.73 | 0.05 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 4.29 | 4.43 | 4.12 | 0.09 |
| | | 84.9 | 85.0 | 84.8 | 0.07 | 4.54 | 4.67 | 4.38 | 0.10 |
| | | 75.0 | 75.1 | 75.0 | 0.04 | 4.27 | 4.34 | 4.23 | 0.04 |
| | | 59.9 | 60.1 | 59.8 | 0.10 | 3.84 | 3.94 | 3.78 | 0.05 |
| | | 45.0 | 45.1 | 44.9 | 0.08 | 3.32 | 3.35 | 3.26 | 0.03 |
| | | 29.9 | 30.0 | 29.8 | 0.07 | 2.72 | 2.77 | 2.65 | 0.04 |
| C | 2 | 30.0 | 30.1 | 30.0 | 0.03 | 2.58 | 2.69 | 2.42 | 0.09 |
| | | 45.0 | 45.1 | 45.0 | 0.02 | 3.13 | 3.24 | 3.04 | 0.07 |
| | | 60.1 | 60.1 | 60.0 | 0.04 | 3.57 | 3.66 | 3.48 | 0.06 |
| | | 75.1 | 75.2 | 75.0 | 0.07 | 3.98 | 4.05 | 3.94 | 0.04 |
| | | 85.0 | 85.3 | 84.8 | 0.19 | 4.18 | 4.27 | 4.03 | 0.08 |
| | | 75.0 | 75.1 | 74.9 | 0.08 | 3.92 | 4.05 | 3.79 | 0.09 |
| | | 59.9 | 60.0 | 59.9 | 0.02 | 3.56 | 3.65 | 3.48 | 0.06 |
| | | 45.0 | 45.1 | 44.9 | 0.07 | 3.01 | 3.07 | 2.95 | 0.05 |
| | | 30.0 | 30.0 | 29.9 | 0.04 | 2.51 | 2.58 | 2.42 | 0.05 |
| C | 3 | 30.0 | 30.1 | 30.0 | 0.02 | 2.55 | 2.64 | 2.43 | 0.07 |
| | | 45.1 | 45.1 | 45.0 | 0.03 | 3.22 | 3.30 | 3.12 | 0.06 |
| | | 60.1 | 60.2 | 59.9 | 0.10 | 3.63 | 3.73 | 3.52 | 0.06 |
| | | 75.0 | 75.1 | 75.0 | 0.03 | 4.10 | 4.21 | 4.04 | 0.06 |
| | | 85.0 | 85.1 | 84.8 | 0.10 | 4.27 | 4.36 | 4.17 | 0.06 |
| | | 75.1 | 75.2 | 75.0 | 0.04 | 4.06 | 4.13 | 4.00 | 0.04 |
| | | 59.9 | 60.0 | 59.9 | 0.05 | 3.63 | 3.69 | 3.55 | 0.04 |
| | | 45.0 | 45.1 | 44.8 | 0.08 | 3.15 | 3.30 | 3.06 | 0.07 |
| | | 30.0 | 30.1 | 29.9 | 0.08 | 2.57 | 2.70 | 2.43 | 0.08 |
| C | 4 | 30.0 | 30.1 | 29.9 | 0.05 | 2.59 | 2.64 | 2.48 | 0.05 |
| | | 45.0 | 45.2 | 44.8 | 0.13 | 3.19 | 3.24 | 3.13 | 0.04 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 3.71 | 3.78 | 3.67 | 0.04 |
| | | 74.9 | 75.1 | 74.9 | 0.07 | 4.15 | 4.22 | 4.06 | 0.05 |
| | | 85.1 | 85.3 | 85.0 | 0.11 | 4.43 | 4.52 | 4.36 | 0.06 |
| | | 75.0 | 75.2 | 74.9 | 0.08 | 4.12 | 4.24 | 3.99 | 0.09 |
| | | 59.9 | 60.1 | 59.9 | 0.09 | 3.71 | 3.80 | 3.67 | 0.04 |
| | | 44.9 | 45.0 | 44.8 | 0.05 | 3.16 | 3.28 | 3.08 | 0.07 |
| | | 30.0 | 30.0 | 29.9 | 0.04 | 2.60 | 2.82 | 2.34 | 0.17 |

Table 21. Brand C non-HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 30.0 | 30.4 | 29.7 | 0.23 | 1.39 | 1.43 | 1.36 | 0.03 |
| | | 45.0 | 45.1 | 45.0 | 0.05 | 1.68 | 1.70 | 1.63 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.07 | 1.97 | 2.02 | 1.88 | 0.05 |
| | | 75.1 | 75.2 | 75.0 | 0.09 | 2.22 | 2.27 | 2.17 | 0.04 |
| | | 85.0 | 85.1 | 84.8 | 0.09 | 2.36 | 2.41 | 2.27 | 0.04 |
| | | 75.0 | 75.1 | 74.9 | 0.06 | 2.19 | 2.24 | 2.16 | 0.03 |
| | | 59.9 | 60.0 | 59.8 | 0.06 | 1.98 | 2.03 | 1.92 | 0.04 |
| | | 44.9 | 45.0 | 44.9 | 0.03 | 1.69 | 1.76 | 1.63 | 0.04 |
| | | 30.0 | 30.1 | 29.9 | 0.07 | 1.39 | 1.43 | 1.30 | 0.05 |
| C | 2 | 30.1 | 30.2 | 30.1 | 0.04 | 1.27 | 1.34 | 1.23 | 0.03 |
| | | 45.0 | 45.1 | 45.0 | 0.04 | 1.59 | 1.63 | 1.56 | 0.03 |
| | | 60.2 | 60.2 | 60.1 | 0.04 | 1.85 | 1.90 | 1.81 | 0.03 |
| | | 75.1 | 75.1 | 75.0 | 0.02 | 2.03 | 2.10 | 1.99 | 0.04 |
| | | 85.0 | 85.0 | 85.0 | 0.00 | 2.19 | 2.25 | 2.12 | 0.04 |
| | | 75.0 | 75.1 | 75.0 | 0.04 | 2.04 | 2.09 | 2.00 | 0.03 |
| | | 59.9 | 60.1 | 59.8 | 0.08 | 1.83 | 1.92 | 1.80 | 0.04 |
| | | 45.0 | 45.1 | 44.9 | 0.08 | 1.59 | 1.61 | 1.54 | 0.02 |
| | | 30.0 | 30.1 | 29.9 | 0.06 | 1.27 | 1.32 | 1.17 | 0.05 |
| C | 3 | 30.1 | 30.2 | 30.0 | 0.07 | 1.41 | 1.47 | 1.34 | 0.05 |
| | | 45.1 | 45.1 | 45.0 | 0.03 | 1.71 | 1.75 | 1.67 | 0.03 |
| | | 60.1 | 60.2 | 60.0 | 0.05 | 1.99 | 2.08 | 1.94 | 0.05 |
| | | 75.1 | 75.2 | 75.0 | 0.07 | 2.27 | 2.32 | 2.22 | 0.03 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 2.36 | 2.39 | 2.31 | 0.03 |
| | | 74.9 | 75.0 | 74.8 | 0.06 | 2.21 | 2.29 | 2.13 | 0.06 |
| | | 59.8 | 59.9 | 59.7 | 0.09 | 1.99 | 2.02 | 1.96 | 0.02 |
| | | 45.0 | 45.0 | 44.9 | 0.04 | 1.72 | 1.75 | 1.70 | 0.02 |
| | | 30.0 | 30.1 | 29.9 | 0.07 | 1.41 | 1.55 | 1.34 | 0.06 |
| C | 4 | 29.9 | 30.0 | 29.8 | 0.05 | 1.31 | 1.38 | 1.26 | 0.05 |
| | | 45.1 | 45.2 | 45.0 | 0.05 | 1.63 | 1.66 | 1.60 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.09 | 1.90 | 1.93 | 1.86 | 0.02 |
| | | 75.1 | 75.2 | 75.1 | 0.05 | 2.15 | 2.20 | 2.12 | 0.03 |
| | | 85.2 | 85.3 | 85.0 | 0.11 | 2.31 | 2.37 | 2.27 | 0.03 |
| | | 75.0 | 75.1 | 74.8 | 0.12 | 2.12 | 2.19 | 2.09 | 0.03 |
| | | 59.9 | 60.0 | 59.7 | 0.10 | 1.91 | 1.96 | 1.88 | 0.02 |
| | | 44.9 | 45.1 | 44.9 | 0.09 | 1.65 | 1.68 | 1.61 | 0.03 |
| | | 30.0 | 30.1 | 29.9 | 0.10 | 1.34 | 1.44 | 1.28 | 0.05 |

Table 22. Brand C HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 40.1 | 40.2 | 40.0 | 0.09 | 1.51 | 1.53 | 1.48 | 0.02 |
| | | 55.1 | 55.2 | 55.0 | 0.05 | 1.78 | 1.82 | 1.70 | 0.04 |
| | | 70.1 | 70.2 | 69.8 | 0.16 | 1.99 | 2.01 | 1.97 | 0.01 |
| | | 85.1 | 85.2 | 85.0 | 0.09 | 2.20 | 2.29 | 2.15 | 0.04 |
| | | 69.7 | 69.9 | 69.3 | 0.23 | 1.99 | 2.06 | 1.94 | 0.04 |
| | | 54.8 | 54.9 | 54.7 | 0.10 | 1.77 | 1.80 | 1.73 | 0.03 |
| | | 39.9 | 40.0 | 39.9 | 0.03 | 1.51 | 1.58 | 1.46 | 0.04 |
| C | 2 | 40.1 | 40.2 | 40.0 | 0.06 | 1.52 | 1.56 | 1.49 | 0.03 |
| | | 55.1 | 55.2 | 55.0 | 0.04 | 1.77 | 1.79 | 1.74 | 0.02 |
| | | 75.1 | 75.2 | 75.0 | 0.06 | 2.05 | 2.12 | 2.01 | 0.05 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 2.18 | 2.25 | 2.13 | 0.04 |
| | | 69.9 | 70.0 | 69.9 | 0.05 | 2.01 | 2.05 | 1.94 | 0.03 |
| | | 54.9 | 55.0 | 54.8 | 0.05 | 1.75 | 1.77 | 1.73 | 0.01 |
| | | 39.9 | 40.2 | 39.8 | 0.15 | 1.49 | 1.51 | 1.48 | 0.01 |
| C | 3 | 39.9 | 39.9 | 39.9 | 0.02 | 1.45 | 1.50 | 1.43 | 0.02 |
| | | 55.1 | 55.1 | 55.0 | 0.03 | 1.69 | 1.71 | 1.66 | 0.01 |
| | | 70.1 | 70.2 | 70.1 | 0.03 | 1.90 | 1.96 | 1.84 | 0.03 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 2.12 | 2.16 | 2.07 | 0.03 |
| | | 69.9 | 70.1 | 69.8 | 0.08 | 1.89 | 1.93 | 1.81 | 0.04 |
| | | 54.9 | 55.0 | 54.9 | 0.04 | 1.69 | 1.72 | 1.67 | 0.02 |
| | | 39.9 | 40.1 | 39.7 | 0.13 | 1.45 | 1.51 | 1.42 | 0.03 |
| C | 4 | 39.9 | 40.1 | 39.9 | 0.09 | 1.44 | 1.48 | 1.41 | 0.03 |
| | | 55.1 | 55.1 | 55.0 | 0.04 | 1.69 | 1.72 | 1.67 | 0.02 |
| | | 70.1 | 70.2 | 70.1 | 0.04 | 1.91 | 1.99 | 1.84 | 0.05 |
| | | 85.2 | 85.2 | 85.0 | 0.08 | 2.10 | 2.15 | 2.02 | 0.04 |
| | | 70.1 | 70.2 | 70.0 | 0.07 | 1.93 | 1.99 | 1.87 | 0.04 |
| | | 55.0 | 55.1 | 54.9 | 0.06 | 1.69 | 1.74 | 1.64 | 0.04 |
| | | 40.1 | 41.1 | 40.0 | 0.37 | 1.46 | 1.48 | 1.37 | 0.04 |

Table 23. Brand C HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 40.0 | 40.1 | 39.8 | 0.11 | 0.75 | 0.77 | 0.73 | 0.01 |
| | | 55.0 | 55.2 | 55.0 | 0.06 | 0.89 | 0.93 | 0.87 | 0.02 |
| | | 70.2 | 70.3 | 69.9 | 0.13 | 1.01 | 1.01 | 0.99 | 0.01 |
| | | 85.1 | 85.2 | 85.1 | 0.04 | 1.11 | 1.12 | 1.10 | 0.01 |
| | | 74.9 | 75.0 | 74.9 | 0.05 | 1.04 | 1.06 | 1.03 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.05 | 0.88 | 0.90 | 0.87 | 0.01 |
| | | 39.9 | 40.0 | 39.8 | 0.08 | 0.75 | 0.76 | 0.73 | 0.01 |
| C | 2 | 40.1 | 40.3 | 39.9 | 0.14 | 0.77 | 0.83 | 0.72 | 0.03 |
| | | 55.2 | 55.3 | 55.1 | 0.07 | 0.90 | 0.95 | 0.84 | 0.04 |
| | | 70.1 | 70.2 | 70.1 | 0.03 | 1.01 | 1.02 | 0.98 | 0.01 |
| | | 85.1 | 85.2 | 85.1 | 0.05 | 1.11 | 1.14 | 1.09 | 0.02 |
| | | 70.1 | 70.3 | 69.9 | 0.14 | 1.01 | 1.02 | 0.99 | 0.01 |
| | | 54.9 | 55.2 | 54.8 | 0.12 | 0.89 | 0.93 | 0.86 | 0.02 |
| | | 40.0 | 40.0 | 39.9 | 0.05 | 0.74 | 0.78 | 0.72 | 0.02 |
| C | 3 | 40.0 | 40.0 | 39.9 | 0.03 | 0.76 | 0.82 | 0.70 | 0.04 |
| | | 55.0 | 55.2 | 54.9 | 0.09 | 0.87 | 0.89 | 0.85 | 0.02 |
| | | 70.0 | 70.0 | 70.0 | 0.01 | 0.99 | 1.02 | 0.96 | 0.02 |
| | | 85.1 | 85.2 | 85.1 | 0.04 | 1.10 | 1.12 | 1.10 | 0.01 |
| | | 69.9 | 70.0 | 69.8 | 0.07 | 0.98 | 1.01 | 0.94 | 0.02 |
| | | 55.0 | 55.1 | 54.9 | 0.06 | 0.88 | 0.91 | 0.86 | 0.02 |
| | | 40.0 | 40.2 | 39.8 | 0.15 | 0.75 | 0.78 | 0.72 | 0.02 |
| C | 4 | 40.0 | 40.0 | 40.0 | 0.02 | 0.80 | 0.83 | 0.76 | 0.02 |
| | | 55.1 | 55.2 | 55.0 | 0.05 | 0.95 | 0.99 | 0.91 | 0.03 |
| | | 70.1 | 70.2 | 70.0 | 0.07 | 1.05 | 1.08 | 1.02 | 0.02 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 1.16 | 1.20 | 1.12 | 0.03 |
| | | 69.9 | 70.0 | 69.9 | 0.04 | 1.04 | 1.07 | 1.02 | 0.02 |
| | | 55.0 | 55.1 | 54.8 | 0.09 | 0.92 | 0.99 | 0.88 | 0.03 |
| | | 39.9 | 40.1 | 39.8 | 0.10 | 0.79 | 0.82 | 0.75 | 0.02 |

Table 24. Brand C HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 39.9 | 40.0 | 39.8 | 0.06 | 0.88 | 0.94 | 0.81 | 0.05 |
| | | 55.0 | 55.2 | 54.8 | 0.11 | 1.04 | 1.08 | 0.99 | 0.03 |
| | | 70.0 | 70.1 | 70.0 | 0.05 | 1.18 | 1.20 | 1.16 | 0.01 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 1.32 | 1.34 | 1.29 | 0.02 |
| | | 69.9 | 70.0 | 69.9 | 0.03 | 1.16 | 1.18 | 1.14 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.07 | 1.04 | 1.10 | 1.01 | 0.03 |
| | | 40.0 | 40.1 | 39.9 | 0.08 | 0.89 | 1.00 | 0.82 | 0.06 |
| C | 2 | 40.0 | 40.1 | 39.9 | 0.04 | 0.86 | 0.94 | 0.83 | 0.04 |
| | | 55.3 | 55.4 | 55.0 | 0.15 | 1.03 | 1.07 | 0.99 | 0.03 |
| | | 70.3 | 70.3 | 70.1 | 0.06 | 1.16 | 1.21 | 1.13 | 0.03 |
| | | 85.3 | 85.4 | 85.1 | 0.13 | 1.29 | 1.33 | 1.26 | 0.02 |
| | | 69.9 | 70.0 | 69.9 | 0.04 | 1.15 | 1.19 | 1.13 | 0.02 |
| | | 54.9 | 55.0 | 54.9 | 0.05 | 1.01 | 1.06 | 0.98 | 0.02 |
| | | 39.8 | 39.9 | 39.8 | 0.06 | 0.88 | 0.92 | 0.83 | 0.03 |
| C | 3 | 40.0 | 40.1 | 39.9 | 0.04 | 0.87 | 0.90 | 0.85 | 0.02 |
| | | 55.0 | 55.1 | 55.0 | 0.02 | 1.04 | 1.08 | 1.01 | 0.02 |
| | | 70.2 | 70.2 | 70.1 | 0.05 | 1.15 | 1.18 | 1.11 | 0.02 |
| | | 85.1 | 85.1 | 85.1 | 0.00 | 1.28 | 1.36 | 1.18 | 0.06 |
| | | 70.1 | 70.1 | 70.0 | 0.04 | 1.16 | 1.20 | 1.13 | 0.02 |
| | | 55.0 | 55.0 | 55.0 | 0.01 | 1.02 | 1.04 | 0.98 | 0.02 |
| | | 40.0 | 40.0 | 39.9 | 0.02 | 0.87 | 0.91 | 0.83 | 0.02 |
| C | 4 | 40.1 | 40.2 | 40.0 | 0.05 | 0.90 | 0.98 | 0.86 | 0.04 |
| | | 55.0 | 55.1 | 55.0 | 0.02 | 1.06 | 1.13 | 1.02 | 0.03 |
| | | 70.1 | 70.1 | 70.1 | 0.02 | 1.20 | 1.23 | 1.19 | 0.01 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 1.32 | 1.39 | 1.26 | 0.04 |
| | | 69.9 | 70.0 | 69.9 | 0.04 | 1.17 | 1.20 | 1.15 | 0.02 |
| | | 54.9 | 55.0 | 54.9 | 0.01 | 1.04 | 1.11 | 1.00 | 0.03 |
| | | 40.0 | 40.1 | 39.8 | 0.10 | 0.89 | 0.91 | 0.86 | 0.02 |

Table 25. Brand C HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| C | 1 | 39.9 | 40.1 | 39.9 | 0.06 | 0.44 | 0.47 | 0.41 | 0.02 |
| | | 55.0 | 55.1 | 55.0 | 0.03 | 0.52 | 0.56 | 0.49 | 0.02 |
| | | 70.0 | 70.2 | 69.9 | 0.08 | 0.58 | 0.61 | 0.55 | 0.02 |
| | | 85.0 | 85.2 | 84.9 | 0.09 | 0.63 | 0.65 | 0.61 | 0.01 |
| | | 69.9 | 70.0 | 69.8 | 0.08 | 0.61 | 0.74 | 0.54 | 0.06 |
| | | 55.0 | 55.2 | 54.9 | 0.09 | 0.52 | 0.57 | 0.45 | 0.04 |
| | | 40.0 | 40.2 | 39.9 | 0.10 | 0.46 | 0.55 | 0.35 | 0.07 |
| C | 2 | 40.0 | 40.2 | 39.9 | 0.11 | 0.46 | 0.50 | 0.44 | 0.02 |
| | | 55.0 | 55.1 | 54.9 | 0.05 | 0.55 | 0.59 | 0.52 | 0.02 |
| | | 70.0 | 70.1 | 69.9 | 0.07 | 0.58 | 0.64 | 0.55 | 0.03 |
| | | 85.0 | 85.2 | 84.8 | 0.13 | 0.64 | 0.65 | 0.61 | 0.02 |
| | | 70.0 | 70.1 | 70.0 | 0.02 | 0.61 | 0.63 | 0.57 | 0.02 |
| | | 55.0 | 55.0 | 54.9 | 0.03 | 0.55 | 0.57 | 0.53 | 0.02 |
| | | 40.0 | 40.1 | 39.7 | 0.17 | 0.47 | 0.49 | 0.44 | 0.02 |
| C | 3 | 40.0 | 40.1 | 39.8 | 0.10 | 0.45 | 0.48 | 0.44 | 0.02 |
| | | 55.1 | 55.1 | 55.0 | 0.05 | 0.51 | 0.53 | 0.48 | 0.02 |
| | | 70.2 | 70.5 | 70.0 | 0.17 | 0.56 | 0.61 | 0.48 | 0.04 |
| | | 85.1 | 85.2 | 84.9 | 0.12 | 0.61 | 0.65 | 0.57 | 0.02 |
| | | 70.0 | 70.1 | 69.9 | 0.07 | 0.60 | 0.64 | 0.56 | 0.02 |
| | | 54.9 | 55.1 | 54.8 | 0.12 | 0.52 | 0.55 | 0.49 | 0.02 |
| | | 40.0 | 40.1 | 39.9 | 0.06 | 0.44 | 0.47 | 0.41 | 0.03 |
| C | 4 | 40.0 | 40.2 | 39.9 | 0.11 | 0.47 | 0.49 | 0.44 | 0.02 |
| | | 55.1 | 55.2 | 55.0 | 0.06 | 0.55 | 0.61 | 0.51 | 0.03 |
| | | 70.0 | 70.1 | 69.8 | 0.08 | 0.61 | 0.66 | 0.57 | 0.03 |
| | | 85.0 | 85.1 | 84.7 | 0.14 | 0.64 | 0.68 | 0.61 | 0.03 |
| | | 70.1 | 70.2 | 69.8 | 0.13 | 0.60 | 0.62 | 0.57 | 0.02 |
| | | 55.0 | 55.1 | 54.8 | 0.09 | 0.53 | 0.54 | 0.51 | 0.01 |
| | | 39.9 | 40.0 | 39.7 | 0.14 | 0.46 | 0.48 | 0.44 | 0.02 |

Table 26. Brand D non-HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 30.0 | 30.1 | 29.9 | 0.06 | 3.41 | 3.45 | 3.38 | 0.02 |
| | | 45.2 | 45.3 | 45.0 | 0.13 | 4.18 | 4.22 | 4.10 | 0.03 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 4.80 | 4.84 | 4.75 | 0.03 |
| | | 75.0 | 75.1 | 74.9 | 0.10 | 5.37 | 5.41 | 5.34 | 0.03 |
| | | 84.9 | 85.1 | 84.7 | 0.16 | 5.69 | 5.75 | 5.63 | 0.04 |
| | | 75.0 | 75.2 | 74.8 | 0.13 | 5.33 | 5.37 | 5.30 | 0.02 |
| | | 60.1 | 60.1 | 60.0 | 0.04 | 4.78 | 4.85 | 4.75 | 0.04 |
| | | 45.0 | 45.0 | 44.9 | 0.05 | 4.14 | 4.18 | 4.11 | 0.02 |
| | | 29.9 | 30.0 | 29.7 | 0.10 | 3.38 | 3.43 | 3.33 | 0.04 |
| D | 2 | 29.9 | 30.0 | 29.8 | 0.07 | 3.40 | 3.45 | 3.36 | 0.03 |
| | | 45.0 | 45.1 | 44.9 | 0.06 | 4.14 | 4.18 | 4.12 | 0.02 |
| | | 60.1 | 60.1 | 59.9 | 0.07 | 4.79 | 4.82 | 4.77 | 0.01 |
| | | 75.0 | 75.2 | 74.8 | 0.11 | 5.36 | 5.42 | 5.34 | 0.03 |
| | | 85.0 | 85.2 | 84.8 | 0.14 | 5.71 | 5.77 | 5.66 | 0.04 |
| | | 75.0 | 75.2 | 74.7 | 0.17 | 5.38 | 5.41 | 5.35 | 0.03 |
| | | 60.0 | 60.2 | 59.9 | 0.12 | 4.81 | 4.86 | 4.77 | 0.03 |
| | | 44.9 | 45.2 | 44.7 | 0.16 | 4.15 | 4.20 | 4.13 | 0.02 |
| | | 30.0 | 30.1 | 29.9 | 0.06 | 3.40 | 3.42 | 3.36 | 0.02 |
| D | 3 | 30.0 | 30.1 | 29.9 | 0.06 | 3.32 | 3.35 | 3.30 | 0.02 |
| | | 45.0 | 45.1 | 45.0 | 0.03 | 4.06 | 4.08 | 4.05 | 0.01 |
| | | 60.1 | 60.2 | 60.0 | 0.07 | 4.68 | 4.70 | 4.65 | 0.02 |
| | | 74.9 | 75.1 | 74.7 | 0.14 | 5.21 | 5.23 | 5.19 | 0.02 |
| | | 85.0 | 85.1 | 84.7 | 0.12 | 5.55 | 5.60 | 5.51 | 0.03 |
| | | 74.9 | 75.2 | 74.7 | 0.14 | 5.21 | 5.24 | 5.18 | 0.02 |
| | | 60.0 | 60.1 | 59.8 | 0.09 | 4.66 | 4.71 | 4.58 | 0.04 |
| | | 45.0 | 45.1 | 44.9 | 0.07 | 4.05 | 4.12 | 3.91 | 0.06 |
| | | 30.0 | 30.0 | 29.9 | 0.04 | 3.33 | 3.37 | 3.28 | 0.03 |
| D | 4 | 30.1 | 30.2 | 30.0 | 0.05 | 3.42 | 3.45 | 3.40 | 0.02 |
| | | 45.0 | 45.1 | 44.9 | 0.05 | 4.17 | 4.21 | 4.14 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 4.81 | 4.85 | 4.77 | 0.03 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 5.36 | 5.38 | 5.32 | 0.02 |
| | | 85.0 | 85.2 | 84.8 | 0.15 | 5.73 | 5.79 | 5.69 | 0.03 |
| | | 75.0 | 75.1 | 74.9 | 0.08 | 5.35 | 5.41 | 5.31 | 0.03 |
| | | 60.0 | 60.1 | 59.9 | 0.08 | 4.80 | 4.84 | 4.76 | 0.02 |
| | | 45.0 | 45.0 | 44.9 | 0.05 | 4.15 | 4.21 | 4.12 | 0.03 |
| | | 29.9 | 30.0 | 29.9 | 0.04 | 3.41 | 3.43 | 3.37 | 0.02 |

Table 27. Brand D non-HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 29.9 | 30.1 | 29.8 | 0.11 | 1.67 | 1.72 | 1.65 | 0.02 |
| | | 45.0 | 45.0 | 44.9 | 0.03 | 2.06 | 2.10 | 2.00 | 0.03 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 2.36 | 2.39 | 2.32 | 0.02 |
| | | 75.0 | 75.1 | 75.0 | 0.02 | 2.66 | 2.67 | 2.64 | 0.01 |
| | | 85.0 | 85.1 | 84.9 | 0.07 | 2.83 | 2.86 | 2.80 | 0.02 |
| | | 75.1 | 75.1 | 75.0 | 0.02 | 2.65 | 2.67 | 2.61 | 0.02 |
| | | 60.0 | 60.0 | 59.9 | 0.05 | 2.39 | 2.43 | 2.36 | 0.03 |
| | | 45.0 | 45.0 | 44.9 | 0.05 | 2.04 | 2.14 | 1.97 | 0.05 |
| | | 29.9 | 30.1 | 29.8 | 0.12 | 1.67 | 1.70 | 1.65 | 0.02 |
| D | 2 | 30.0 | 30.2 | 29.9 | 0.10 | 1.56 | 1.59 | 1.55 | 0.01 |
| | | 45.1 | 45.1 | 45.0 | 0.04 | 1.91 | 1.94 | 1.89 | 0.02 |
| | | 60.0 | 60.2 | 60.0 | 0.06 | 2.22 | 2.29 | 2.11 | 0.06 |
| | | 75.1 | 75.1 | 75.0 | 0.05 | 2.46 | 2.48 | 2.42 | 0.03 |
| | | 85.0 | 85.1 | 85.0 | 0.05 | 2.64 | 2.67 | 2.60 | 0.02 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 2.47 | 2.49 | 2.45 | 0.01 |
| | | 60.0 | 60.2 | 59.8 | 0.17 | 2.19 | 2.22 | 2.13 | 0.03 |
| | | 45.0 | 45.0 | 44.9 | 0.05 | 1.90 | 1.93 | 1.87 | 0.03 |
| | | 29.9 | 30.0 | 29.9 | 0.05 | 1.56 | 1.58 | 1.54 | 0.01 |
| D | 3 | 30.1 | 30.2 | 30.1 | 0.05 | 1.68 | 1.70 | 1.66 | 0.02 |
| | | 45.0 | 45.1 | 45.0 | 0.06 | 2.04 | 2.07 | 2.02 | 0.02 |
| | | 60.1 | 60.1 | 60.0 | 0.03 | 2.36 | 2.41 | 2.30 | 0.04 |
| | | 75.1 | 75.2 | 75.0 | 0.08 | 2.65 | 2.68 | 2.62 | 0.02 |
| | | 85.0 | 85.2 | 84.9 | 0.09 | 2.82 | 2.84 | 2.80 | 0.01 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 2.65 | 2.68 | 2.62 | 0.02 |
| | | 59.9 | 60.0 | 59.9 | 0.06 | 2.36 | 2.39 | 2.34 | 0.02 |
| | | 44.9 | 45.0 | 44.9 | 0.05 | 2.04 | 2.06 | 2.03 | 0.01 |
| | | 30.0 | 30.0 | 29.9 | 0.05 | 1.67 | 1.70 | 1.66 | 0.02 |
| D | 4 | 30.0 | 30.1 | 29.9 | 0.09 | 1.79 | 1.81 | 1.76 | 0.02 |
| | | 45.1 | 45.1 | 45.0 | 0.02 | 2.20 | 2.23 | 2.18 | 0.02 |
| | | 60.0 | 60.1 | 60.0 | 0.04 | 2.53 | 2.58 | 2.48 | 0.03 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 2.85 | 2.88 | 2.82 | 0.02 |
| | | 85.0 | 85.1 | 84.9 | 0.08 | 3.02 | 3.05 | 2.98 | 0.03 |
| | | 75.0 | 75.0 | 74.9 | 0.03 | 2.84 | 2.86 | 2.81 | 0.01 |
| | | 60.0 | 60.0 | 59.9 | 0.04 | 2.53 | 2.55 | 2.53 | 0.01 |
| | | 44.9 | 45.2 | 44.8 | 0.13 | 2.19 | 2.22 | 2.17 | 0.02 |
| | | 29.9 | 30.0 | 29.9 | 0.03 | 1.78 | 1.80 | 1.77 | 0.01 |

Table 28. Brand D non-HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 30.1 | 30.3 | 29.9 | 0.13 | 2.47 | 2.49 | 2.44 | 0.02 |
| | | 45.0 | 45.0 | 45.0 | 0.02 | 3.02 | 3.04 | 2.99 | 0.02 |
| | | 60.0 | 60.0 | 59.9 | 0.05 | 3.50 | 3.51 | 3.48 | 0.01 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 3.91 | 3.94 | 3.88 | 0.02 |
| | | 85.1 | 85.4 | 84.9 | 0.16 | 4.17 | 4.21 | 4.14 | 0.02 |
| | | 75.0 | 75.1 | 74.9 | 0.08 | 3.93 | 4.00 | 3.89 | 0.03 |
| | | 59.9 | 60.0 | 59.9 | 0.03 | 3.50 | 3.55 | 3.47 | 0.02 |
| | | 45.0 | 45.1 | 44.9 | 0.05 | 3.04 | 3.06 | 3.01 | 0.02 |
| | | 30.0 | 30.2 | 29.9 | 0.08 | 2.47 | 2.55 | 2.35 | 0.06 |
| D | 2 | 30.0 | 30.1 | 30.0 | 0.04 | 2.58 | 2.60 | 2.53 | 0.02 |
| | | 45.1 | 45.2 | 45.0 | 0.05 | 3.17 | 3.20 | 3.13 | 0.02 |
| | | 60.1 | 60.1 | 60.0 | 0.03 | 3.64 | 3.67 | 3.61 | 0.02 |
| | | 75.1 | 75.2 | 75.0 | 0.10 | 4.11 | 4.16 | 4.07 | 0.04 |
| | | 85.0 | 85.1 | 84.9 | 0.07 | 4.34 | 4.38 | 4.27 | 0.04 |
| | | 74.9 | 75.2 | 74.8 | 0.15 | 4.09 | 4.14 | 4.06 | 0.03 |
| | | 59.9 | 60.1 | 59.7 | 0.14 | 3.67 | 3.71 | 3.64 | 0.03 |
| | | 44.9 | 45.1 | 44.8 | 0.12 | 3.17 | 3.21 | 3.13 | 0.03 |
| | | 30.0 | 30.1 | 29.9 | 0.05 | 2.58 | 2.62 | 2.54 | 0.03 |
| D | 3 | 30.0 | 30.1 | 30.0 | 0.02 | 2.58 | 2.62 | 2.54 | 0.03 |
| | | 45.0 | 45.1 | 45.0 | 0.05 | 3.17 | 3.20 | 3.13 | 0.02 |
| | | 60.1 | 60.2 | 59.9 | 0.08 | 3.64 | 3.68 | 3.60 | 0.02 |
| | | 75.1 | 75.2 | 75.0 | 0.08 | 4.06 | 4.10 | 4.01 | 0.03 |
| | | 84.9 | 85.0 | 84.7 | 0.10 | 4.31 | 4.35 | 4.28 | 0.02 |
| | | 75.1 | 75.2 | 75.0 | 0.07 | 4.08 | 4.11 | 4.05 | 0.02 |
| | | 59.9 | 60.0 | 59.8 | 0.08 | 3.65 | 3.69 | 3.62 | 0.02 |
| | | 44.9 | 45.2 | 44.8 | 0.12 | 3.18 | 3.23 | 3.16 | 0.02 |
| | | 30.0 | 30.1 | 29.8 | 0.08 | 2.58 | 2.63 | 2.56 | 0.03 |
| D | 4 | 30.0 | 30.0 | 30.0 | 0.02 | 2.45 | 2.52 | 2.37 | 0.06 |
| | | 45.0 | 45.1 | 44.9 | 0.07 | 2.99 | 3.03 | 2.96 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 3.46 | 3.48 | 3.44 | 0.02 |
| | | 75.1 | 75.1 | 75.0 | 0.04 | 3.87 | 3.89 | 3.84 | 0.02 |
| | | 84.9 | 85.2 | 84.8 | 0.16 | 4.09 | 4.12 | 4.02 | 0.04 |
| | | 75.1 | 75.2 | 74.9 | 0.11 | 3.87 | 3.90 | 3.86 | 0.02 |
| | | 59.9 | 60.0 | 59.9 | 0.03 | 3.45 | 3.48 | 3.42 | 0.02 |
| | | 45.0 | 45.0 | 44.8 | 0.06 | 3.00 | 3.04 | 2.94 | 0.03 |
| | | 30.0 | 30.1 | 29.9 | 0.06 | 2.44 | 2.47 | 2.41 | 0.02 |

Table 29. Brand D non-HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 30.0 | 30.1 | 30.0 | 0.03 | 1.42 | 1.43 | 1.40 | 0.01 |
| | | 45.0 | 45.2 | 44.8 | 0.10 | 1.75 | 1.76 | 1.73 | 0.01 |
| | | 60.0 | 60.0 | 59.9 | 0.06 | 2.01 | 2.02 | 2.00 | 0.01 |
| | | 75.1 | 75.2 | 75.0 | 0.04 | 2.24 | 2.27 | 2.22 | 0.02 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 2.38 | 2.40 | 2.35 | 0.01 |
| | | 74.9 | 75.0 | 74.9 | 0.04 | 2.24 | 2.27 | 2.21 | 0.02 |
| | | 59.8 | 60.0 | 59.6 | 0.15 | 2.00 | 2.04 | 1.93 | 0.04 |
| | | 44.9 | 45.0 | 44.9 | 0.04 | 1.75 | 1.77 | 1.71 | 0.02 |
| | | 29.9 | 30.0 | 29.9 | 0.03 | 1.41 | 1.42 | 1.39 | 0.01 |
| D | 2 | 30.2 | 30.3 | 30.0 | 0.09 | 1.39 | 1.40 | 1.38 | 0.01 |
| | | 45.0 | 45.1 | 44.9 | 0.07 | 1.71 | 1.73 | 1.69 | 0.01 |
| | | 60.1 | 60.2 | 60.0 | 0.08 | 1.97 | 1.99 | 1.95 | 0.01 |
| | | 75.0 | 75.1 | 74.9 | 0.07 | 2.20 | 2.22 | 2.18 | 0.01 |
| | | 85.2 | 85.4 | 84.9 | 0.18 | 2.34 | 2.37 | 2.31 | 0.02 |
| | | 75.0 | 75.0 | 74.8 | 0.06 | 2.19 | 2.20 | 2.18 | 0.01 |
| | | 60.0 | 60.0 | 59.9 | 0.04 | 1.97 | 1.99 | 1.96 | 0.01 |
| | | 44.9 | 45.0 | 44.9 | 0.03 | 1.71 | 1.73 | 1.68 | 0.02 |
| | | 29.9 | 30.0 | 29.9 | 0.02 | 1.38 | 1.39 | 1.37 | 0.01 |
| D | 3 | 30.0 | 30.1 | 29.9 | 0.06 | 1.38 | 1.40 | 1.37 | 0.01 |
| | | 45.1 | 45.1 | 45.0 | 0.02 | 1.69 | 1.74 | 1.62 | 0.04 |
| | | 60.0 | 60.1 | 60.0 | 0.03 | 1.96 | 1.98 | 1.94 | 0.01 |
| | | 75.1 | 75.1 | 75.1 | 0.03 | 2.21 | 2.22 | 2.20 | 0.01 |
| | | 85.1 | 85.2 | 85.0 | 0.08 | 2.35 | 2.37 | 2.33 | 0.02 |
| | | 74.9 | 75.1 | 74.8 | 0.08 | 2.21 | 2.24 | 2.18 | 0.02 |
| | | 60.0 | 60.1 | 59.9 | 0.05 | 1.97 | 2.03 | 1.94 | 0.03 |
| | | 44.9 | 45.1 | 44.7 | 0.14 | 1.70 | 1.75 | 1.67 | 0.03 |
| | | 30.0 | 30.0 | 29.9 | 0.03 | 1.39 | 1.41 | 1.37 | 0.02 |
| D | 4 | 30.0 | 30.1 | 30.0 | 0.02 | 1.43 | 1.45 | 1.40 | 0.01 |
| | | 45.0 | 45.1 | 45.0 | 0.04 | 1.73 | 1.76 | 1.70 | 0.02 |
| | | 60.1 | 60.2 | 60.0 | 0.06 | 2.04 | 2.12 | 2.00 | 0.04 |
| | | 75.2 | 75.3 | 75.1 | 0.08 | 2.29 | 2.32 | 2.27 | 0.02 |
| | | 85.1 | 85.2 | 85.0 | 0.05 | 2.43 | 2.45 | 2.39 | 0.02 |
| | | 74.9 | 75.0 | 74.9 | 0.03 | 2.28 | 2.31 | 2.27 | 0.01 |
| | | 60.0 | 60.1 | 59.9 | 0.06 | 2.03 | 2.06 | 1.98 | 0.03 |
| | | 45.0 | 45.2 | 44.8 | 0.12 | 1.76 | 1.81 | 1.71 | 0.04 |
| | | 29.9 | 30.0 | 29.9 | 0.05 | 1.44 | 1.45 | 1.41 | 0.01 |

Table 30. Brand D HES 15F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 40.1 | 40.2 | 40.0 | 0.05 | 0.95 | 0.96 | 0.95 | 0.00 |
| | | 55.1 | 55.1 | 55.0 | 0.05 | 1.20 | 1.32 | 1.18 | 0.05 |
| | | 70.1 | 70.2 | 70.0 | 0.09 | 1.39 | 1.44 | 1.34 | 0.03 |
| | | 85.1 | 85.3 | 85.0 | 0.10 | 1.57 | 1.59 | 1.55 | 0.01 |
| | | 70.0 | 70.1 | 70.0 | 0.04 | 1.40 | 1.41 | 1.39 | 0.01 |
| | | 55.0 | 55.0 | 54.9 | 0.04 | 1.22 | 1.23 | 1.21 | 0.01 |
| | | 40.0 | 40.0 | 39.9 | 0.03 | 1.02 | 1.03 | 1.02 | 0.01 |
| D | 2 | 40.1 | 40.1 | 39.9 | 0.07 | 1.00 | 1.01 | 0.97 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.08 | 1.22 | 1.24 | 1.20 | 0.01 |
| | | 70.1 | 70.1 | 70.0 | 0.06 | 1.41 | 1.43 | 1.39 | 0.01 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 1.61 | 1.63 | 1.60 | 0.01 |
| | | 70.1 | 70.2 | 70.0 | 0.05 | 1.43 | 1.45 | 1.42 | 0.01 |
| | | 55.1 | 55.2 | 55.0 | 0.07 | 1.24 | 1.27 | 1.23 | 0.01 |
| | | 40.0 | 40.0 | 39.9 | 0.03 | 1.04 | 1.05 | 1.03 | 0.01 |
| D | 3 | 40.0 | 40.1 | 39.9 | 0.05 | 1.05 | 1.06 | 1.05 | 0.01 |
| | | 55.0 | 55.1 | 55.0 | 0.05 | 1.25 | 1.27 | 1.22 | 0.01 |
| | | 70.0 | 70.1 | 69.9 | 0.05 | 1.47 | 1.49 | 1.42 | 0.03 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 1.65 | 1.67 | 1.64 | 0.01 |
| | | 70.0 | 70.1 | 69.8 | 0.11 | 1.49 | 1.51 | 1.46 | 0.02 |
| | | 55.0 | 55.2 | 54.9 | 0.09 | 1.31 | 1.34 | 1.30 | 0.01 |
| | | 40.0 | 40.0 | 40.0 | 0.02 | 1.10 | 1.11 | 1.10 | 0.00 |
| D | 4 | 40.0 | 40.1 | 39.9 | 0.07 | 1.46 | 1.48 | 1.45 | 0.01 |
| | | 55.0 | 55.1 | 55.0 | 0.04 | 1.73 | 1.75 | 1.71 | 0.01 |
| | | 70.0 | 70.1 | 70.0 | 0.06 | 1.94 | 1.96 | 1.93 | 0.01 |
| | | 85.1 | 85.2 | 84.9 | 0.11 | 2.14 | 2.16 | 2.13 | 0.01 |
| | | 70.0 | 70.2 | 69.9 | 0.10 | 1.94 | 1.98 | 1.88 | 0.03 |
| | | 55.0 | 55.1 | 54.9 | 0.07 | 1.72 | 1.74 | 1.71 | 0.01 |
| | | 39.9 | 40.0 | 39.9 | 0.05 | 1.47 | 1.49 | 1.44 | 0.01 |

Table 31. Brand D HES 15H nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 40.0 | 40.1 | 39.9 | 0.06 | 0.58 | 0.58 | 0.57 | 0.00 |
| | | 55.1 | 55.2 | 54.9 | 0.08 | 0.68 | 0.70 | 0.67 | 0.01 |
| | | 70.1 | 70.2 | 70.0 | 0.05 | 0.77 | 0.78 | 0.76 | 0.01 |
| | | 85.0 | 85.1 | 84.8 | 0.12 | 0.81 | 0.83 | 0.79 | 0.02 |
| | | 70.0 | 70.1 | 69.8 | 0.10 | 0.77 | 0.79 | 0.76 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.07 | 0.68 | 0.70 | 0.66 | 0.01 |
| | | 39.9 | 40.1 | 39.8 | 0.10 | 0.58 | 0.58 | 0.57 | 0.01 |
| D | 2 | 40.0 | 40.2 | 39.7 | 0.16 | 0.62 | 0.64 | 0.62 | 0.01 |
| | | 55.1 | 55.2 | 55.0 | 0.08 | 0.74 | 0.79 | 0.73 | 0.02 |
| | | 70.1 | 70.2 | 70.0 | 0.04 | 0.83 | 0.85 | 0.82 | 0.01 |
| | | 85.0 | 85.1 | 84.9 | 0.08 | 0.88 | 0.89 | 0.87 | 0.01 |
| | | 70.0 | 70.1 | 69.9 | 0.09 | 0.84 | 0.92 | 0.81 | 0.04 |
| | | 55.0 | 55.1 | 55.0 | 0.03 | 0.73 | 0.73 | 0.72 | 0.00 |
| | | 40.0 | 40.1 | 39.9 | 0.06 | 0.62 | 0.66 | 0.61 | 0.02 |
| D | 3 | 40.1 | 40.4 | 39.9 | 0.15 | 0.62 | 0.62 | 0.61 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.10 | 0.73 | 0.74 | 0.71 | 0.01 |
| | | 70.0 | 70.3 | 69.8 | 0.16 | 0.81 | 0.82 | 0.78 | 0.01 |
| | | 85.0 | 85.1 | 84.9 | 0.07 | 0.87 | 0.89 | 0.85 | 0.01 |
| | | 70.0 | 70.3 | 69.9 | 0.16 | 0.81 | 0.81 | 0.80 | 0.01 |
| | | 55.0 | 55.2 | 54.8 | 0.11 | 0.72 | 0.73 | 0.70 | 0.01 |
| | | 39.9 | 40.1 | 39.8 | 0.09 | 0.62 | 0.62 | 0.61 | 0.01 |
| D | 4 | 40.1 | 40.2 | 40.0 | 0.07 | 0.57 | 0.58 | 0.54 | 0.01 |
| | | 55.1 | 55.3 | 54.8 | 0.16 | 0.67 | 0.70 | 0.67 | 0.01 |
| | | 69.9 | 70.1 | 69.9 | 0.07 | 0.75 | 0.77 | 0.74 | 0.01 |
| | | 85.0 | 85.1 | 84.9 | 0.06 | 0.80 | 0.82 | 0.78 | 0.01 |
| | | 70.1 | 70.1 | 70.0 | 0.04 | 0.75 | 0.78 | 0.73 | 0.02 |
| | | 54.9 | 55.1 | 54.9 | 0.07 | 0.67 | 0.70 | 0.64 | 0.02 |
| | | 40.0 | 40.1 | 39.9 | 0.05 | 0.57 | 0.58 | 0.56 | 0.01 |

Table 32. Brand D HES 12F nozzle test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 40.1 | 40.3 | 40.0 | 0.08 | 0.59 | 0.61 | 0.58 | 0.01 |
| | | 55.0 | 55.0 | 54.9 | 0.05 | 0.69 | 0.70 | 0.68 | 0.01 |
| | | 70.0 | 70.1 | 69.7 | 0.13 | 0.76 | 0.77 | 0.75 | 0.01 |
| | | 84.9 | 85.1 | 84.8 | 0.09 | 0.80 | 0.85 | 0.77 | 0.02 |
| | | 70.0 | 70.2 | 70.0 | 0.07 | 0.73 | 0.74 | 0.71 | 0.01 |
| | | 55.1 | 55.2 | 55.0 | 0.07 | 0.63 | 0.64 | 0.62 | 0.01 |
| | | 40.0 | 40.4 | 39.5 | 0.25 | 0.54 | 0.55 | 0.53 | 0.01 |
| D | 2 | 40.0 | 40.3 | 39.9 | 0.12 | 0.72 | 0.73 | 0.70 | 0.01 |
| | | 55.0 | 55.2 | 54.9 | 0.11 | 0.83 | 0.84 | 0.83 | 0.00 |
| | | 69.9 | 70.3 | 69.6 | 0.25 | 0.94 | 0.96 | 0.93 | 0.01 |
| | | 85.0 | 85.4 | 84.6 | 0.23 | 1.03 | 1.04 | 1.02 | 0.01 |
| | | 70.0 | 70.1 | 69.8 | 0.10 | 0.93 | 0.94 | 0.92 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.08 | 0.82 | 0.83 | 0.82 | 0.01 |
| | | 40.1 | 40.2 | 40.0 | 0.05 | 0.70 | 0.71 | 0.70 | 0.01 |
| D | 3 | 40.0 | 40.1 | 39.9 | 0.07 | 0.65 | 0.66 | 0.64 | 0.01 |
| | | 55.1 | 55.2 | 55.0 | 0.06 | 0.76 | 0.78 | 0.75 | 0.01 |
| | | 70.0 | 70.1 | 70.0 | 0.04 | 0.86 | 0.88 | 0.85 | 0.01 |
| | | 85.1 | 85.3 | 84.9 | 0.12 | 0.92 | 0.94 | 0.87 | 0.02 |
| | | 70.1 | 70.1 | 70.0 | 0.06 | 0.83 | 0.85 | 0.82 | 0.01 |
| | | 55.0 | 55.2 | 55.0 | 0.09 | 0.73 | 0.74 | 0.72 | 0.01 |
| | | 40.0 | 40.1 | 39.9 | 0.07 | 0.62 | 0.63 | 0.61 | 0.01 |
| D | 4 | 40.1 | 40.2 | 40.0 | 0.06 | 0.72 | 0.73 | 0.71 | 0.01 |
| | | 55.0 | 55.2 | 54.9 | 0.07 | 0.83 | 0.84 | 0.83 | 0.01 |
| | | 70.1 | 70.1 | 70.1 | 0.01 | 0.94 | 0.94 | 0.94 | 0.00 |
| | | 85.0 | 85.1 | 84.9 | 0.07 | 0.98 | 0.99 | 0.97 | 0.01 |
| | | 70.0 | 70.1 | 69.9 | 0.05 | 0.88 | 0.90 | 0.87 | 0.01 |
| | | 55.1 | 55.2 | 55.0 | 0.07 | 0.79 | 0.79 | 0.78 | 0.01 |
| | | 40.0 | 40.3 | 39.7 | 0.21 | 0.67 | 0.68 | 0.66 | 0.01 |

Table 33. Brand D HES 12H test results.

| Brand | Replicate | Inlet Pressure (psi) | | | | Flow Rate (gpm) | | | |
|-------|-----------|----------------------|------|------|---------|-----------------|------|------|---------|
| | | Avg | Max | Min | Std Dev | Avg | Max | Min | Std Dev |
| D | 1 | 40.1 | 40.3 | 40.0 | 0.08 | 0.50 | 0.52 | 0.48 | 0.01 |
| | | 55.1 | 55.2 | 54.9 | 0.10 | 0.62 | 0.64 | 0.61 | 0.01 |
| | | 70.0 | 70.1 | 69.9 | 0.07 | 0.73 | 0.74 | 0.69 | 0.02 |
| | | 85.1 | 85.2 | 84.9 | 0.09 | 0.76 | 0.78 | 0.75 | 0.01 |
| | | 70.1 | 70.2 | 69.9 | 0.11 | 0.73 | 0.74 | 0.69 | 0.02 |
| | | 55.0 | 55.1 | 55.0 | 0.03 | 0.63 | 0.66 | 0.61 | 0.02 |
| | | 40.0 | 40.1 | 40.0 | 0.01 | 0.50 | 0.51 | 0.49 | 0.01 |
| D | 2 | 40.0 | 40.1 | 39.9 | 0.08 | 0.53 | 0.54 | 0.52 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.06 | 0.63 | 0.66 | 0.61 | 0.02 |
| | | 70.1 | 70.2 | 70.0 | 0.06 | 0.70 | 0.72 | 0.69 | 0.01 |
| | | 85.0 | 85.2 | 85.0 | 0.07 | 0.75 | 0.77 | 0.74 | 0.01 |
| | | 70.1 | 70.3 | 69.9 | 0.14 | 0.71 | 0.72 | 0.68 | 0.01 |
| | | 55.1 | 55.2 | 54.8 | 0.13 | 0.62 | 0.62 | 0.61 | 0.00 |
| | | 40.1 | 40.4 | 40.0 | 0.15 | 0.53 | 0.55 | 0.51 | 0.01 |
| D | 3 | 39.9 | 40.0 | 39.8 | 0.05 | 0.50 | 0.52 | 0.48 | 0.01 |
| | | 55.0 | 55.3 | 54.8 | 0.17 | 0.58 | 0.59 | 0.57 | 0.01 |
| | | 69.9 | 70.1 | 69.7 | 0.15 | 0.65 | 0.66 | 0.65 | 0.00 |
| | | 85.1 | 85.2 | 85.0 | 0.07 | 0.73 | 0.75 | 0.72 | 0.01 |
| | | 70.0 | 70.0 | 69.9 | 0.03 | 0.66 | 0.67 | 0.65 | 0.01 |
| | | 54.9 | 55.0 | 54.8 | 0.09 | 0.58 | 0.59 | 0.55 | 0.02 |
| | | 40.0 | 40.3 | 39.8 | 0.19 | 0.49 | 0.50 | 0.48 | 0.01 |
| D | 4 | 40.0 | 40.2 | 39.7 | 0.16 | 0.57 | 0.59 | 0.56 | 0.01 |
| | | 55.0 | 55.1 | 54.9 | 0.07 | 0.66 | 0.68 | 0.65 | 0.01 |
| | | 70.0 | 70.3 | 69.9 | 0.15 | 0.73 | 0.74 | 0.69 | 0.02 |
| | | 85.1 | 85.1 | 85.0 | 0.05 | 0.80 | 0.80 | 0.79 | 0.00 |
| | | 70.0 | 70.1 | 69.8 | 0.12 | 0.73 | 0.74 | 0.72 | 0.01 |
| | | 55.1 | 55.2 | 55.0 | 0.08 | 0.65 | 0.66 | 0.64 | 0.00 |
| | | 39.9 | 40.0 | 39.9 | 0.05 | 0.55 | 0.56 | 0.54 | 0.01 |