

## **Arctic Cat Ctec800 Pipe Update... Jim Czekala**

Andy Klingdensmith brought his 700 mile stock 2018 ZR8000 to dyno test/ tune/ evaluate newly received pipes from Speedwerx and Speed Shop Inc (SSI) on the Ctec 800 engine.

The Speedwerx exhaust included a Y pipe. The SSI pipe was a stock pipe, modified by adding an internal stinger and lengthening of the center section—very similar to the then popular F7 Firecat “pipe mod” of the early 2000’s, and used with the stock Y pipe. SSI had sent an experimental stainless Y pipe for us to test (their new SuperFlow 902 engine dyno is not yet functional so they hired DTR to independently test both the Y and the pipe mod) that turned out to be slightly less powerful than the stock pipe, and that data is not included here. We would also include the Jaws pipe and Ypipe for comparison—one we tested on a different Ctec 800 earlier on this website.

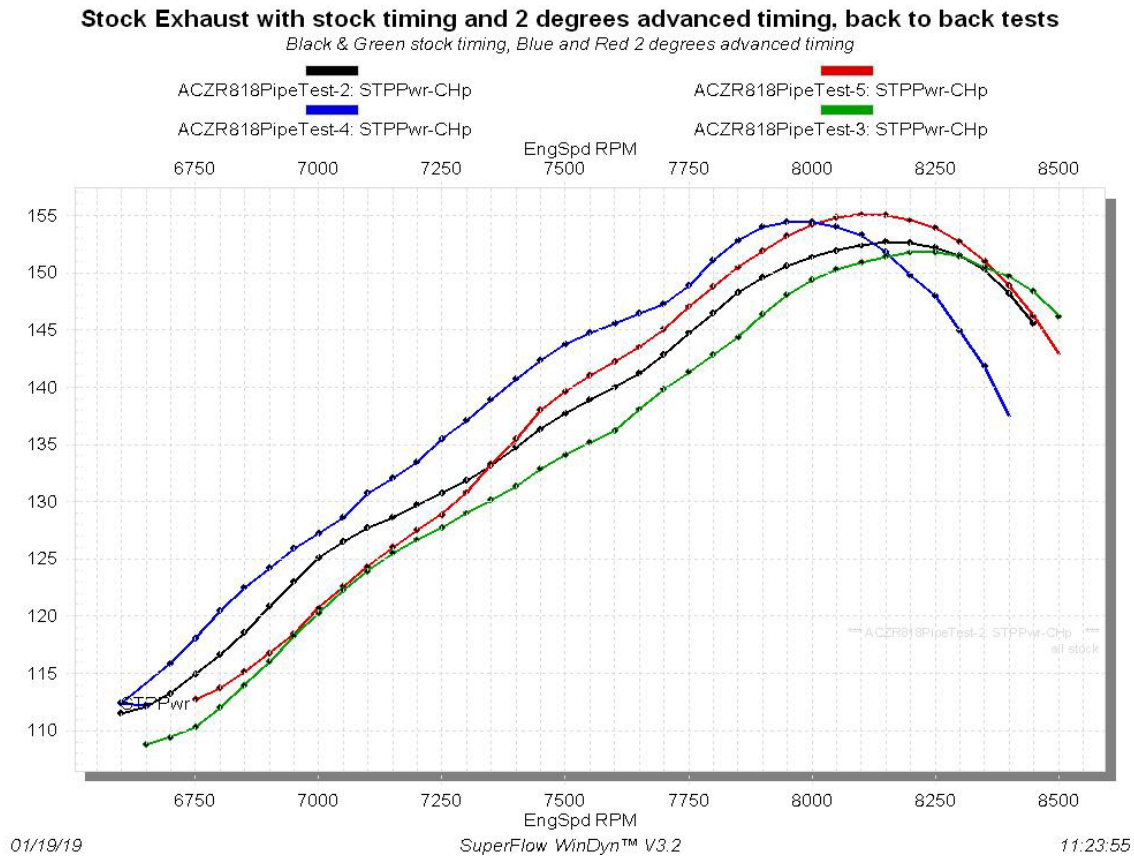
Note that while it makes substantially more HP than the stock pipe but less than the Speedwerx exhaust, the SSI pipe mod is about half the cost and when fitted with the stock heatshield is indiscernible from the stock pipe. And while the stock exhaust system benefited from advancing ignition timing with our 11-029 Dynojet PCV—especially when hot—the aftermarket pipes really needed the advanced timing to perform optimally. For this test session we advanced the timing a flat two degrees as though it was advanced by the installation of a \$20 offset timing key. But an offset key advances timing at all RPM and throttle positions as well as advancing fuel injector timing, which may not be optimal (feedback, please, from those DTR members who opt for the offset key).

Besides adding torque and HP, advancing the timing reduces the EGT/ heat energy entering the tuned pipe, perhaps extending the time at WOT before backpressure becomes excessive causing HP to be diminished. On this day, we would run two back to back tests of each pipe—a total of 24+ seconds total at WOT. The exception was with stock timing, neither the Speedwerx nor the Jaws exhaust performed well at the first 12 seconds so we stopped there. And we neglected to test the SSI pipe mod with stock timing, so it’s only shown back to back with the advanced timing.

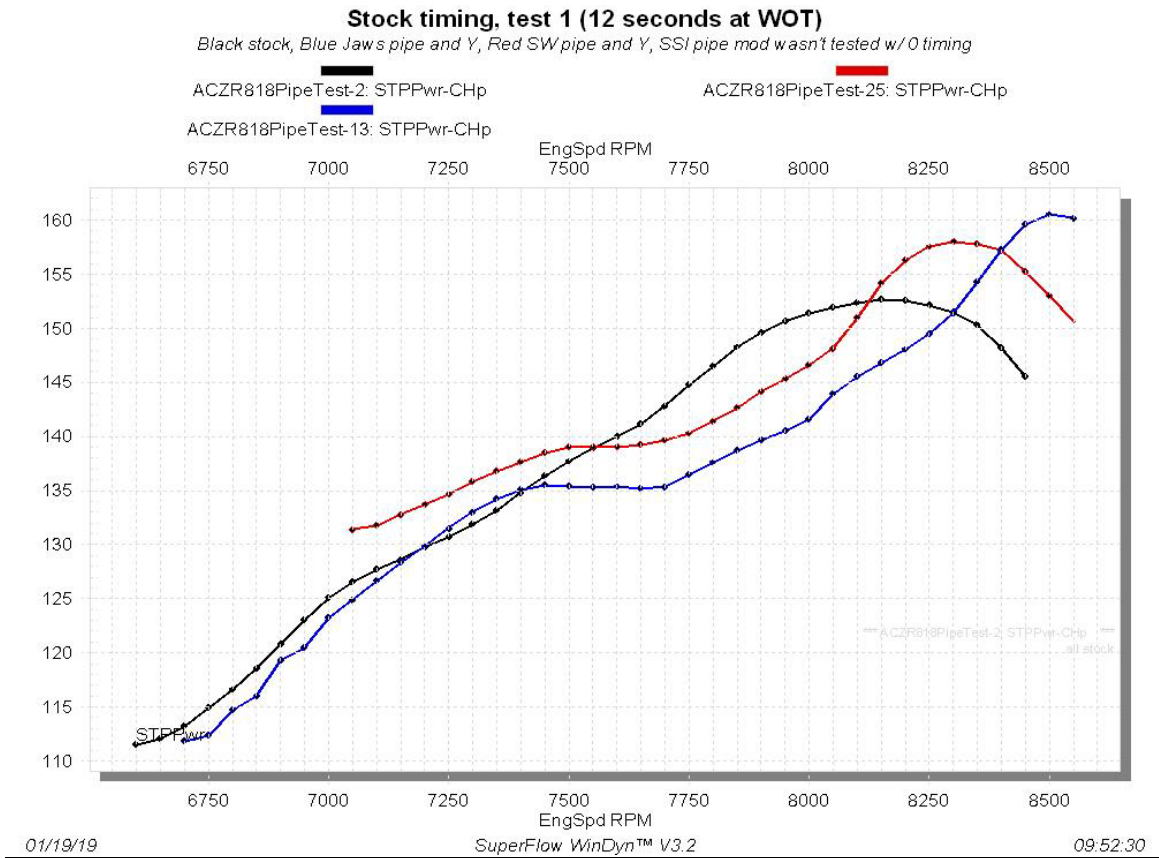
All testing was done with 92.1 R+M/2 octane 4% ethanol fuel and with the stock muffler fitted.

Next, we plan to do further testing with a SLP exhaust and also with that excellent Precision EFI ECU reflash. I should note here that while we had Andy's broken in stocker on the dyno we tried unsuccessfully to match the Precision EFI reflash's torque and HP by adding fuel flow and increasing timing. The best we could do was with stock fuel flow and the two degrees of timing—154.4 HP or nearly *six HP less HP than the optimized Precision EFI reflash!* How can that be? Injector timing? It will be interesting to test a 160 HP reflashed ECU with higher output exhausts.

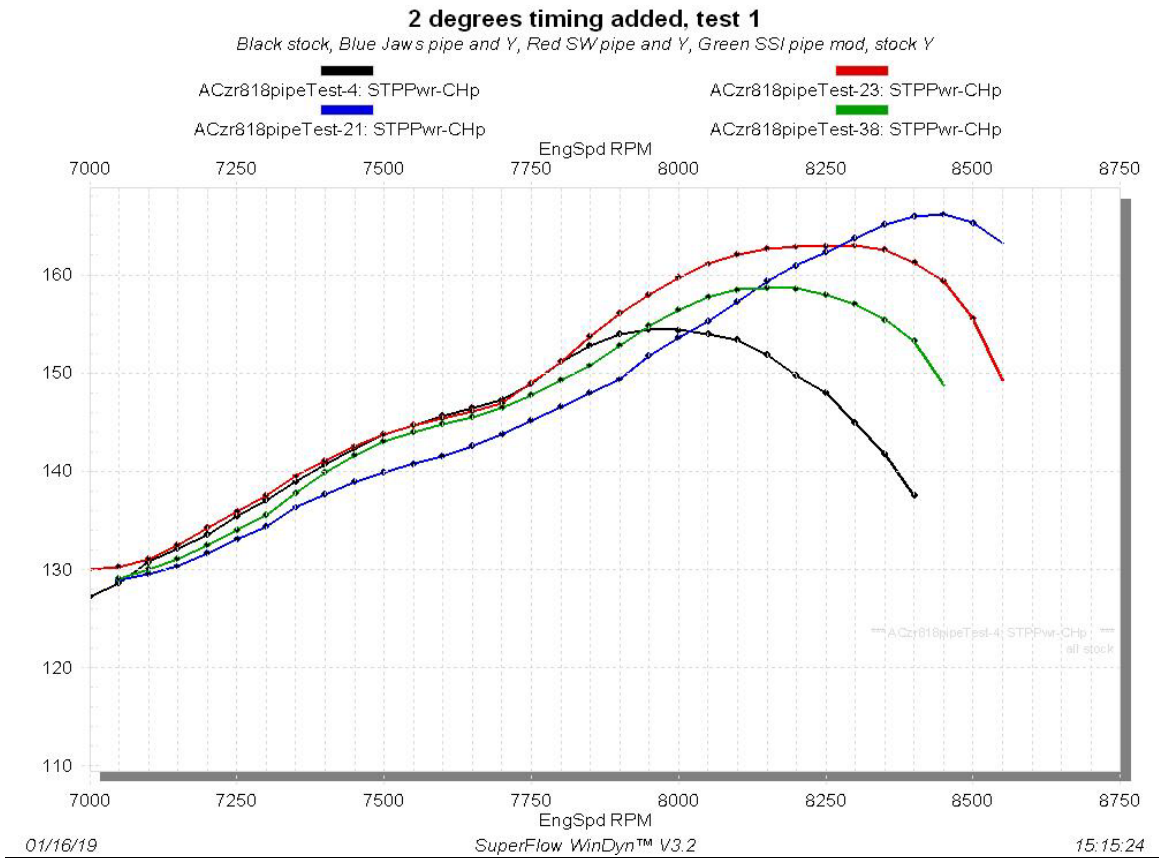
Here is the stock exhaust system, tested back to back with both stock and two degrees advanced timing. Note that with the cooler EGT resulting from the advanced timing, the stock exhaust needed more time at WOT to be optimized, hence the higher HP on the second back to back test.



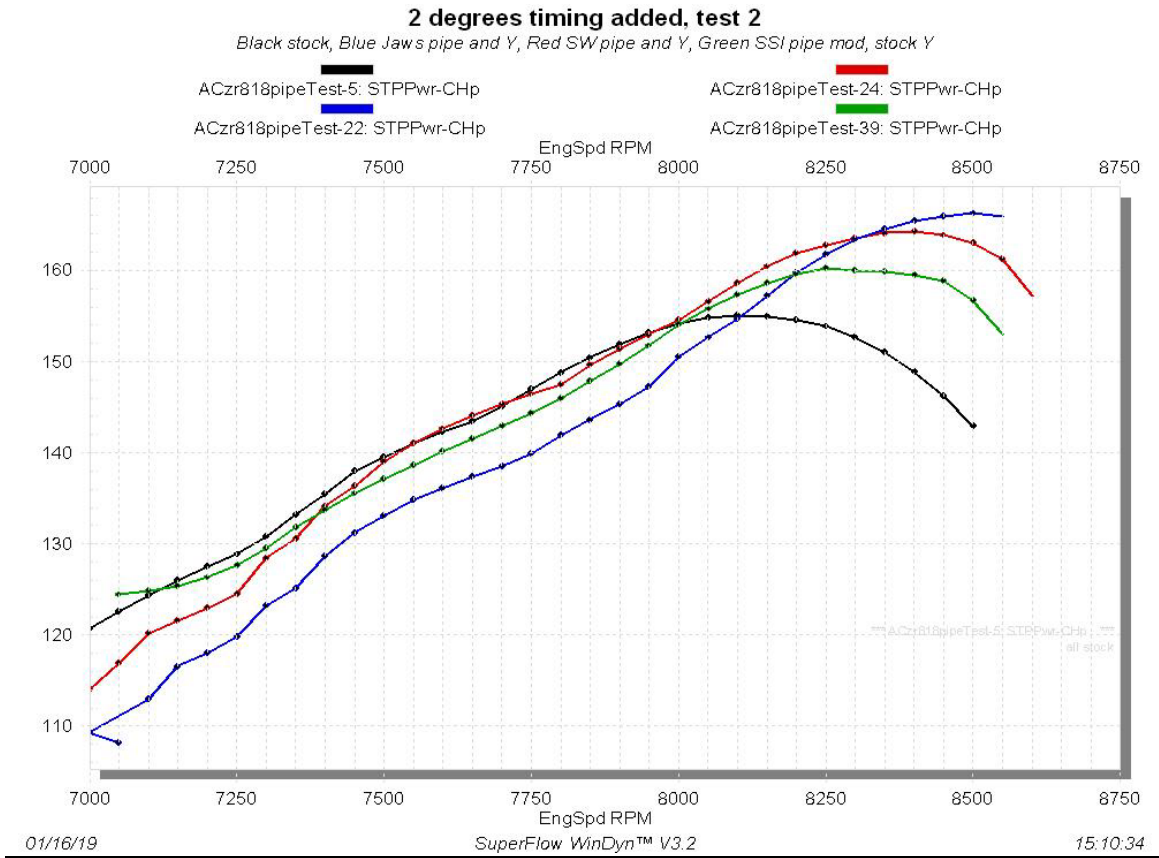
This is our first test group—the stock, Speedwerx and Jaws exhausts, all tested with stock timing, one 12 second WOT dyno test. Note the sag in midrange HP of the aftermarket exhausts due to the very conservative midrange ignition timing of the Ctec 800 ECU. Note that we neglected to test the SSI pipe mod with stock timing.



Next, leaving fuel flow stock, we used the Dynojet 11-029 to advance timing two degrees at 100% throttle only and retested the Jaws and Speedwerx and for the first time tested the SSI pipe mod with the stock Y pipe. Note how the aftermarket exhausts' HP curves benefited greatly from having the proper ignition timing. Stock fuel was adequate for all of the exhaust systems.



Finally, here is test two of each exhaust system's back to back tests where max HP was created with each exhaust.



### Stock exhaust second test with 2 degrees advanced timing

| EngSpd<br>RPM | STPPwr<br>CHp | STPTrq<br>Clb-ft | BSFA<br>lb/hph | FuelA<br>lbs/hr | LamAF1<br>Ratio | Baro_P<br>InHga | LM1Air<br>SCFM | STPCor<br>Factor |
|---------------|---------------|------------------|----------------|-----------------|-----------------|-----------------|----------------|------------------|
| 6650          | 112.2         | 88.6             | 0.695          | 73.9            | 14.14           | 28.79           | 236.9          | 1.037            |
| 6600          | 112.4         | 89.4             | 0.696          | 74.8            | 14.06           | 28.79           | 237.7          | 1.037            |
| 6700          | 115.9         | 90.8             | 0.693          | 75.5            | 13.98           | 28.79           | 239.2          | 1.037            |
| 6750          | 118.1         | 91.9             | 0.691          | 76.4            | 13.89           | 28.79           | 240.1          | 1.037            |
| 6800          | 120.5         | 93.0             | 0.690          | 77.5            | 13.80           | 28.79           | 241.5          | 1.037            |
| 6850          | 122.5         | 93.9             | 0.688          | 78.8            | 13.69           | 28.79           | 243.5          | 1.037            |
| 6900          | 124.2         | 94.5             | 0.686          | 80.0            | 13.59           | 28.79           | 245.5          | 1.037            |
| 6950          | 125.9         | 95.1             | 0.684          | 81.1            | 13.46           | 28.79           | 247.4          | 1.037            |
| 7000          | 127.2         | 95.4             | 0.679          | 81.4            | 13.40           | 28.79           | 248.3          | 1.037            |
| 7050          | 128.6         | 95.8             | 0.677          | 81.9            | 13.40           | 28.79           | 248.3          | 1.036            |
| 7100          | 130.7         | 96.7             | 0.677          | 82.6            | 13.44           | 28.79           | 249.7          | 1.037            |
| 7150          | 132.1         | 97.0             | 0.674          | 82.9            | 13.48           | 28.79           | 252.5          | 1.037            |
| 7200          | 133.5         | 97.4             | 0.671          | 83.2            | 13.51           | 28.79           | 254.2          | 1.037            |

|      |       |       |       |      |       |       |       |       |
|------|-------|-------|-------|------|-------|-------|-------|-------|
| 7250 | 135.4 | 98.1  | 0.668 | 83.5 | 13.53 | 28.79 | 255.6 | 1.037 |
| 7300 | 137.0 | 98.6  | 0.664 | 83.8 | 13.55 | 28.79 | 257.0 | 1.037 |
| 7350 | 138.9 | 99.2  | 0.660 | 84.3 | 13.56 | 28.79 | 258.4 | 1.036 |
| 7400 | 140.7 | 99.9  | 0.656 | 84.7 | 13.57 | 28.79 | 260.1 | 1.036 |
| 7450 | 142.3 | 100.3 | 0.652 | 85.1 | 13.55 | 28.79 | 261.6 | 1.036 |
| 7500 | 143.7 | 100.6 | 0.649 | 85.4 | 13.53 | 28.79 | 262.4 | 1.036 |
| 7550 | 144.7 | 100.7 | 0.646 | 85.8 | 13.52 | 28.79 | 263.0 | 1.037 |
| 7600 | 145.6 | 100.6 | 0.645 | 86.4 | 13.49 | 28.79 | 263.8 | 1.037 |
| 7650 | 146.5 | 100.5 | 0.643 | 87.1 | 13.45 | 28.79 | 265.1 | 1.037 |
| 7700 | 147.2 | 100.4 | 0.638 | 87.6 | 13.41 | 28.79 | 266.4 | 1.037 |
| 7750 | 148.9 | 100.9 | 0.637 | 88.4 | 13.38 | 28.79 | 267.2 | 1.037 |
| 7800 | 151.1 | 101.7 | 0.637 | 89.5 | 13.32 | 28.79 | 269.0 | 1.036 |
| 7850 | 152.8 | 102.2 | 0.636 | 90.2 | 13.26 | 28.79 | 271.1 | 1.036 |
| 7900 | 154.0 | 102.4 | 0.636 | 90.9 | 13.20 | 28.79 | 272.1 | 1.036 |
| 7950 | 154.4 | 102.0 | 0.630 | 90.3 | 12.99 | 28.79 | 272.9 | 1.036 |
| 8000 | 154.4 | 101.3 | 0.632 | 90.9 | 12.90 | 28.79 | 272.4 | 1.036 |
| 8050 | 154.0 | 100.5 | 0.636 | 91.7 | 12.81 | 28.79 | 272.1 | 1.037 |
| 8100 | 153.3 | 99.4  | 0.638 | 91.3 | 12.63 | 28.79 | 273.1 | 1.037 |
| 8150 | 151.8 | 97.8  | 0.631 | 91.1 | 12.36 | 28.79 | 273.4 | 1.037 |
| 8200 | 149.8 | 95.9  | 0.630 | 90.8 | 12.54 | 28.79 | 272.4 | 1.037 |
| 8250 | 148.0 | 94.2  | 0.630 | 90.5 | 12.66 | 28.79 | 271.7 | 1.037 |
| 8300 | 144.9 | 91.7  | 0.632 | 90.1 | 12.70 | 28.79 | 271.3 | 1.037 |
| 8350 | 141.8 | 89.2  | 0.639 | 89.6 | 12.74 | 28.79 | 271.0 | 1.037 |
| 8400 | 137.5 | 86.0  | 0.649 | 89.4 | 12.77 | 28.79 | 270.5 | 1.037 |

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### Speedwerx exhaust second test with 2 degrees advanced timing

| EngSpd | STPPwr | STPTrq | BSFA   | FuelA  | LamAF1 | Air_1c | LM1Air | STPCor |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| RPM    | CHp    | Clb-ft | lb/hph | lbs/hr | Ratio  | CFM    | SCFM   | Factor |
| 7000   | 114.0  | 85.5   | 0.698  | 76.2   | 12.90  | 193.0  | 218.4  | 1.037  |
| 7050   | 116.9  | 87.1   | 0.691  | 77.4   | 12.85  | 199.0  | 220.9  | 1.037  |
| 7100   | 120.2  | 88.9   | 0.706  | 81.4   | 13.01  | 211.3  | 235.1  | 1.037  |
| 7150   | 121.6  | 89.3   | 0.700  | 81.6   | 13.01  | 212.4  | 235.7  | 1.037  |
| 7200   | 122.9  | 89.7   | 0.695  | 81.9   | 13.01  | 213.9  | 236.6  | 1.037  |
| 7250   | 124.5  | 90.2   | 0.693  | 82.7   | 13.01  | 217.4  | 238.9  | 1.037  |
| 7300   | 128.5  | 92.4   | 0.682  | 84.1   | 12.99  | 223.9  | 242.5  | 1.037  |
| 7350   | 130.5  | 93.3   | 0.674  | 84.4   | 12.99  | 225.8  | 243.3  | 1.037  |
| 7400   | 134.1  | 95.2   | 0.660  | 85.0   | 13.08  | 231.1  | 246.7  | 1.037  |
| 7450   | 136.3  | 96.1   | 0.649  | 84.8   | 13.17  | 233.6  | 248.0  | 1.037  |
| 7500   | 139.0  | 97.3   | 0.634  | 84.5   | 13.33  | 237.3  | 250.0  | 1.037  |
| 7550   | 141.0  | 98.1   | 0.626  | 84.7   | 13.41  | 239.8  | 252.1  | 1.037  |
| 7600   | 142.6  | 98.6   | 0.619  | 84.7   | 13.46  | 242.2  | 253.0  | 1.037  |
| 7650   | 144.1  | 98.9   | 0.615  | 85.0   | 13.44  | 245.3  | 253.7  | 1.037  |
| 7700   | 145.3  | 99.1   | 0.615  | 85.7   | 13.40  | 247.2  | 254.9  | 1.037  |
| 7750   | 146.4  | 99.2   | 0.613  | 86.1   | 13.37  | 248.8  | 255.6  | 1.037  |
| 7800   | 147.5  | 99.3   | 0.613  | 86.7   | 13.32  | 250.5  | 256.4  | 1.037  |
| 7850   | 149.7  | 100.1  | 0.612  | 87.9   | 13.09  | 254.2  | 255.5  | 1.037  |

|      |       |       |       |      |       |       |       |       |
|------|-------|-------|-------|------|-------|-------|-------|-------|
| 7900 | 151.4 | 100.7 | 0.608 | 88.3 | 13.03 | 255.3 | 255.6 | 1.037 |
| 7950 | 153.0 | 101.1 | 0.607 | 89.0 | 13.00 | 256.5 | 256.8 | 1.037 |
| 8000 | 154.6 | 101.5 | 0.604 | 89.6 | 12.97 | 258.1 | 257.8 | 1.037 |
| 8050 | 156.6 | 102.2 | 0.601 | 90.2 | 12.88 | 259.7 | 257.9 | 1.037 |
| 8100 | 158.6 | 102.9 | 0.595 | 90.5 | 12.81 | 260.7 | 257.3 | 1.037 |
| 8150 | 160.4 | 103.4 | 0.588 | 90.5 | 12.77 | 261.7 | 256.6 | 1.037 |
| 8200 | 161.8 | 103.7 | 0.583 | 90.5 | 12.76 | 262.5 | 256.3 | 1.037 |
| 8250 | 162.8 | 103.7 | 0.579 | 90.4 | 12.78 | 263.5 | 256.5 | 1.037 |
| 8300 | 163.5 | 103.5 | 0.576 | 90.4 | 12.84 | 264.4 | 257.6 | 1.037 |
| 8350 | 164.1 | 103.2 | 0.575 | 90.4 | 12.88 | 265.2 | 258.7 | 1.037 |
| 8400 | 164.3 | 102.7 | 0.574 | 90.4 | 12.94 | 265.8 | 259.7 | 1.037 |
| 8450 | 163.9 | 101.8 | 0.575 | 90.4 | 13.02 | 266.4 | 261.1 | 1.037 |
| 8500 | 163.0 | 100.7 | 0.576 | 90.1 | 13.07 | 266.8 | 261.4 | 1.037 |
| 8550 | 161.3 | 99.1  | 0.583 | 90.1 | 13.11 | 266.8 | 262.3 | 1.037 |
| 8600 | 157.3 | 96.0  | 0.603 | 90.9 | 13.13 | 266.3 | 265.2 | 1.037 |

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### Jaws exhaust second test with 2 degrees advanced timing

| EngSpd | STPPwr | STPTRq | BSFA   | FuelA  | LamAF1 | Air_1c | LM1Air | STPCor |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| RPM    | CHp    | Clb-ft | lb/hph | lbs/hr | Ratio  | CFM    | SCFM   | Factor |
| 7050   | 108.2  | 80.6   | 0.739  | 76.7   | 12.51  | 186.8  | 213.1  | 1.037  |
| 7000   | 109.3  | 82.0   | 0.739  | 77.4   | 12.40  | 191.1  | 213.3  | 1.037  |
| 7100   | 113.0  | 83.6   | 0.753  | 81.6   | 12.51  | 202.6  | 226.6  | 1.037  |
| 7150   | 116.6  | 85.6   | 0.742  | 82.9   | 12.55  | 207.6  | 231.2  | 1.037  |
| 7200   | 118.0  | 86.1   | 0.735  | 83.2   | 12.55  | 209.1  | 232.0  | 1.037  |
| 7250   | 119.8  | 86.8   | 0.730  | 83.8   | 12.56  | 212.9  | 233.8  | 1.037  |
| 7300   | 123.2  | 88.6   | 0.718  | 84.8   | 12.68  | 219.5  | 238.9  | 1.037  |
| 7350   | 125.1  | 89.4   | 0.709  | 85.1   | 12.73  | 221.5  | 240.7  | 1.037  |
| 7400   | 128.7  | 91.3   | 0.689  | 85.0   | 12.85  | 227.0  | 242.7  | 1.037  |
| 7450   | 131.2  | 92.5   | 0.674  | 84.9   | 12.97  | 230.1  | 244.6  | 1.037  |
| 7500   | 133.1  | 93.2   | 0.666  | 85.0   | 13.07  | 232.7  | 246.8  | 1.037  |
| 7550   | 134.8  | 93.8   | 0.659  | 85.2   | 13.14  | 236.1  | 248.7  | 1.037  |
| 7600   | 136.2  | 94.1   | 0.655  | 85.5   | 13.16  | 238.6  | 250.0  | 1.037  |
| 7650   | 137.4  | 94.3   | 0.653  | 86.0   | 13.15  | 240.8  | 251.4  | 1.037  |
| 7700   | 138.5  | 94.4   | 0.652  | 86.6   | 13.12  | 243.5  | 252.3  | 1.037  |
| 7750   | 139.9  | 94.8   | 0.650  | 87.2   | 13.05  | 246.1  | 252.8  | 1.037  |
| 7800   | 141.9  | 95.5   | 0.647  | 88.0   | 12.96  | 248.7  | 253.5  | 1.037  |
| 7850   | 143.6  | 96.1   | 0.645  | 88.8   | 12.91  | 250.4  | 254.8  | 1.037  |
| 7900   | 145.4  | 96.7   | 0.643  | 89.7   | 12.86  | 252.1  | 256.2  | 1.037  |
| 7950   | 147.2  | 97.3   | 0.640  | 90.3   | 12.78  | 254.1  | 256.5  | 1.037  |
| 8000   | 150.5  | 98.8   | 0.628  | 90.6   | 12.65  | 256.8  | 254.9  | 1.037  |
| 8050   | 152.6  | 99.6   | 0.621  | 90.8   | 12.62  | 258.0  | 254.8  | 1.037  |
| 8100   | 154.6  | 100.3  | 0.615  | 91.1   | 12.60  | 259.2  | 255.2  | 1.037  |
| 8150   | 157.2  | 101.3  | 0.609  | 91.7   | 12.60  | 261.2  | 256.9  | 1.037  |
| 8200   | 159.8  | 102.3  | 0.601  | 92.1   | 12.62  | 262.5  | 258.4  | 1.037  |
| 8250   | 161.7  | 103.0  | 0.594  | 92.0   | 12.64  | 263.6  | 258.6  | 1.037  |
| 8300   | 163.4  | 103.4  | 0.585  | 91.6   | 12.70  | 264.7  | 258.6  | 1.037  |

|      |       |       |       |      |       |       |       |       |
|------|-------|-------|-------|------|-------|-------|-------|-------|
| 8350 | 164.6 | 103.5 | 0.578 | 91.2 | 12.77 | 265.5 | 258.8 | 1.037 |
| 8400 | 165.4 | 103.4 | 0.571 | 90.6 | 12.87 | 266.4 | 259.1 | 1.037 |
| 8450 | 165.9 | 103.1 | 0.567 | 90.1 | 12.98 | 267.3 | 259.9 | 1.037 |
| 8500 | 166.3 | 102.7 | 0.565 | 90.0 | 13.07 | 268.1 | 261.5 | 1.037 |
| 8550 | 166.0 | 102.0 | 0.566 | 90.0 | 13.17 | 269.0 | 263.5 | 1.037 |

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**SSI stock pipe mod, stock Y, second test with 2 degrees advanced timing**

| EngSpd | STPPwr | STPTrq | BSFA   | FuelA  | LamAF1 | Air_1c | LM1Air | STPCor |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| RPM    | CHp    | Clb-ft | lb/hph | lbs/hr | Ratio  | CFM    | SCFM   | Factor |
| 7050   | 124.4  | 92.7   | 0.696  | 82.2   | 13.30  | 219.3  | 246.1  | 1.046  |
| 7100   | 124.9  | 92.4   | 0.695  | 82.5   | 13.31  | 221.4  | 247.2  | 1.046  |
| 7150   | 125.4  | 92.1   | 0.694  | 82.6   | 13.39  | 224.5  | 249.0  | 1.046  |
| 7200   | 126.3  | 92.1   | 0.692  | 83.0   | 13.45  | 226.5  | 251.3  | 1.046  |
| 7250   | 127.6  | 92.4   | 0.689  | 83.5   | 13.50  | 228.8  | 253.8  | 1.046  |
| 7300   | 129.5  | 93.2   | 0.683  | 84.0   | 13.52  | 231.4  | 255.7  | 1.046  |
| 7350   | 131.8  | 94.2   | 0.673  | 84.3   | 13.52  | 233.7  | 256.4  | 1.046  |
| 7400   | 133.7  | 94.9   | 0.664  | 84.3   | 13.51  | 235.3  | 256.3  | 1.046  |
| 7450   | 135.5  | 95.6   | 0.653  | 84.1   | 13.48  | 237.4  | 255.1  | 1.046  |
| 7500   | 137.1  | 96.0   | 0.645  | 84.0   | 13.45  | 239.0  | 254.3  | 1.046  |
| 7550   | 138.7  | 96.5   | 0.638  | 84.0   | 13.42  | 240.7  | 253.8  | 1.046  |
| 7600   | 140.1  | 96.8   | 0.632  | 84.1   | 13.38  | 242.7  | 253.1  | 1.046  |
| 7650   | 141.6  | 97.2   | 0.627  | 84.3   | 13.33  | 244.5  | 252.9  | 1.046  |
| 7700   | 142.9  | 97.5   | 0.624  | 84.8   | 13.27  | 246.2  | 253.2  | 1.046  |
| 7750   | 144.3  | 97.8   | 0.624  | 85.5   | 13.21  | 248.0  | 254.3  | 1.046  |
| 7800   | 145.9  | 98.3   | 0.624  | 86.4   | 13.13  | 250.2  | 255.4  | 1.046  |
| 7850   | 147.9  | 98.9   | 0.620  | 87.1   | 13.05  | 252.1  | 255.9  | 1.046  |
| 7900   | 149.8  | 99.6   | 0.617  | 87.7   | 12.99  | 253.9  | 256.4  | 1.046  |
| 7950   | 151.7  | 100.2  | 0.614  | 88.5   | 12.92  | 255.6  | 257.1  | 1.046  |
| 8000   | 154.1  | 101.1  | 0.612  | 89.6   | 12.83  | 257.5  | 258.7  | 1.046  |
| 8050   | 155.8  | 101.6  | 0.609  | 90.1   | 12.79  | 258.6  | 259.3  | 1.046  |
| 8100   | 157.3  | 102.0  | 0.604  | 90.2   | 12.76  | 259.9  | 258.9  | 1.046  |
| 8150   | 158.6  | 102.2  | 0.600  | 90.3   | 12.72  | 261.1  | 258.5  | 1.046  |
| 8200   | 159.6  | 102.3  | 0.597  | 90.5   | 12.70  | 261.7  | 258.7  | 1.046  |
| 8250   | 160.3  | 102.0  | 0.595  | 90.5   | 12.70  | 262.1  | 258.5  | 1.046  |
| 8300   | 160.0  | 101.3  | 0.591  | 89.8   | 12.77  | 262.8  | 258.1  | 1.046  |
| 8350   | 159.9  | 100.6  | 0.588  | 89.3   | 12.86  | 263.5  | 258.3  | 1.046  |
| 8400   | 159.5  | 99.7   | 0.588  | 89.0   | 12.94  | 264.0  | 259.2  | 1.046  |
| 8450   | 158.8  | 98.7   | 0.592  | 89.3   | 13.00  | 264.0  | 261.1  | 1.046  |
| 8500   | 156.7  | 96.8   | 0.603  | 89.6   | 13.06  | 263.7  | 263.4  | 1.046  |
| 8550   | 153.0  | 94.0   | 0.623  | 90.5   | 13.08  | 263.3  | 266.2  | 1.046  |

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