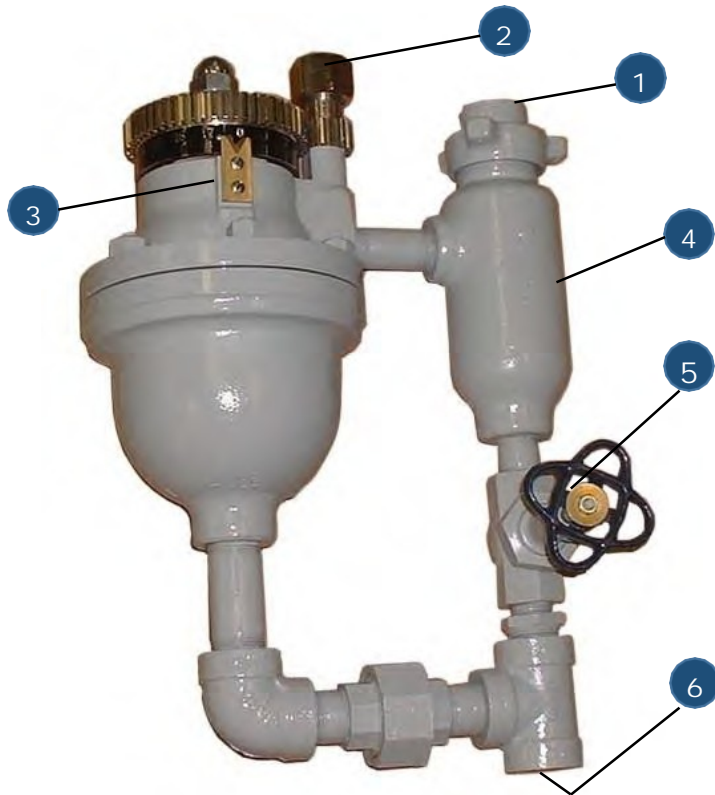


Continuous Boiler Blowdown Flow Control

Improves Boiler Efficiency and Water Quality



Two Models:

- OM250, for boilers up to 250 psi
- OM650, for boilers up to 650 psi

Features Include:

1. Inlet connection: 3/4" NPT
2. Adjustment pinion, removable for security
3. Index to locate orifice hole for required blowdown rate
4. Sediment chamber with stainless steel filter screen keeps large solids from clogging orifices
5. Drain valve to flush solids from the sediment chamber
6. Drain connection: 1" NPT for model OM250 and 1-1/4" for model OM650
7. Orifice Plate with 17 different hole sizes, see page 2 for details (not shown in photo on the left)

The Madden Orifice Meter gives the boiler operator precise repeatable control of the continuous blowdown flow rate. 17 different hole sizes are drilled in the stainless steel orifice plate. Each hole is precision drilled to a diameter that will produce the flow shown on the flow chart, (see pages 3 and 4). By selecting a larger hole the continuous blowdown flow is increased, or by selecting a smaller hole number on the index band the blowdown is reduced. Four different orifice plates (1A, 2A, 3A, and 4A) are available to provide a blowdown flow range suitable for the boiler operator to maintain the target boiler water quality level.

The boiler must have a continuous blowdown skimmer pipe installed inside the boiler drum, with the opening for the pipe within 6" of the normal water level in the boiler drum. The Madden Orifice Meter may be mounted near the boiler or near a continuous blowdown heat recovery system. The constant blowdown flow provided by the Madden Orifice Meter makes it an ideal device for use in conjunction with a blowdown heat recovery system, see the Madden heat recovery system brochure for details.

The Madden Orifice Meter has been in production for 60+ years. The units are generally used on industrial boilers from 200 HP up to over 100,000 PPH steam production, operating at pressures from 50 psi up to 650 psi. One unit is required for each boiler. The meter can be utilized as the sole flow control device or piped in parallel with a conductivity sensing blowdown control. The units are also used with non-fired boilers and reboilers used in refineries. The Madden Orifice Meter is guaranteed for up to 10 years against damage from cutting, wire drawing, or other distortion in the orifice plate.

MADDEN ORIFICE METER

Tough components at the heart of the Madden Orifice Meter

- The index slot in the steel selector disc exposes the desired orifice on the orifice plate for service. The selector disc rotates when the adjustment key is turned from one index number to another. The disc has a Stellite surface hardening coating and is lapped to the same finish and flatness as the mating orifice plate to insure a leak free seal.
- Type 420 stainless steel material is used to make the orifice plate. The plate is drilled with 17 holes of increasing size. See the flow charts on pages 3 and 4 for the actual hole sizes and the blowdown rate for each hole at various boiler pressures. The orifice plate is heat treated to 500 brinnell hardness and lapped to a mirror finish with a tolerance of three light bands (.00003"). The lapped finish prevents high pressure water from leaking through any orifice but the one selected.



Selector Disc



Orifice Plate

| Part No. | Boiler Max Psi | Orifice Plate Size | Shipping wt. (lbs) | Dimensions (W x D x H) |
|----------|----------------|--------------------|--------------------|------------------------|
| OM2501A | 250 | 1A | 64 | 11.5" x 9" x 19" |
| OM2502A | 250 | 2A | 64 | 11.5" x 9" x 19" |
| OM2503A | 250 | 3A | 64 | 11.5" x 9" x 19" |
| OM2504A | 250 | 4A | 64 | 11.5" x 9" x 19" |
| OM6501A | 650 | 1A | 80 | 14" x 12.5" x 20" |
| OM6502A | 650 | 2A | 80 | 14" x 12.5" x 20" |
| OM6503A | 650 | 3A | 80 | 14" x 12.5" x 20" |
| OM6504A | 650 | 4A | 80 | 14" x 12.5" x 20" |

Specification:

1. General: The contractor shall furnish and install a flow control for continuous boiler blowdown, model no. (OM250 or OM650) as manufactured by Madden Manufacturing, Inc., Elkhart, IN. This equipment will have a maximum design working pressure of (250 or 650) p.s.i.g. The meter will be capable of precise flow control of continuous boiler blowdown using the straight edge orifice principle at a boiler operating pressure of ___ p.s.i.g., with a blowdown flow range from ___ PPH to ___ PPH.
2. The flow control shall consist of: A multiple orifice meter with an attached filter and sediment chamber designed to trap scale and suspended solids that could clog the small orifice holes. The stainless steel filter screen mesh will be smaller than the smallest hole in the orifice plate. The flow control will have a hardened stainless steel plate with not less than seventeen (17) graduated orifices, spaced and indexed so only one of the orifices will be opened to flow at a time. The orifices will be graduated in size to provide a range in rate of flow to cover the minimum and maximum continuous blowdown requirements of the boiler. The orifice plates shall be machined, heat treated, and along with the mating selector disc be ground and lapped to a flatness of three light bands to prevent leakage and wire drawing damage. The unit will have a gear driven indexing mechanism with a removable key to prevent tampering. A drain valve will be provided to flush the filter and sediment chamber.
3. A flowchart will be provided showing the blowdown flow in pounds per hour at the boiler operating pressure for each orifice setting. A manual for installation, operation and maintenance will be provided.
4. One orifice meter unit is required for each boiler.

Madden Engineered Products, LLC.: Continuous Boiler Blowdown Orifice Meter Flow Chart

Orifice Plate Number 1-A *Flow in lbs. of Water Per Hour*

Model OM250-1A

Model OM650-1A

| Pressure - PSIG | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
|----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Orifice #1 – Dia - .040" | 75 | 94 | 106 | 118 | 130 | 139 | 149 | 159 | 167 | 183 | 198 | 212 | 225 | 236 | 248 | 259 | 270 |
| Orifice #2 – Dia - .0468" | 103 | 130 | 146 | 162 | 179 | 191 | 205 | 218 | 230 | 251 | 272 | 291 | 308 | 324 | 342 | 356 | 368 |
| Orifice #3 – Dia - .0555" | 143 | 181 | 204 | 224 | 250 | 267 | 286 | 304 | 321 | 351 | 380 | 407 | 432 | 454 | 473 | 496 | 515 |
| Orifice #4 – Dia - .0625" | 183 | 232 | 260 | 288 | 318 | 340 | 366 | 389 | 409 | 448 | 484 | 519 | 549 | 578 | 608 | 633 | 656 |
| Orifice #5 – Dia - .070" | 228 | 289 | 326 | 361 | 398 | 426 | 457 | 486 | 512 | 560 | 606 | 649 | 687 | 725 | 760 | 797 | 830 |
| Orifice #6 – Dia - .0785" | 287 | 364 | 409 | 454 | 501 | 535 | 576 | 610 | 645 | 704 | 763 | 816 | 865 | 911 | 956 | 995 | 1030 |
| Orifice #7 – Dia - .086" | 344 | 438 | 490 | 545 | 600 | 642 | 690 | 733 | 772 | 845 | 916 | 978 | 1038 | 1091 | 1148 | 1194 | 1248 |
| Orifice #8 – Dia - .0935" | 406 | 520 | 579 | 642 | 710 | 758 | 815 | 866 | 914 | 998 | 1080 | 1155 | 1223 | 1290 | 1356 | 1411 | 1465 |
| Orifice #9 – Dia - .0995" | 462 | 589 | 657 | 730 | 806 | 861 | 926 | 985 | 1039 | 1132 | 1229 | 1312 | 1390 | 1465 | 1540 | 1605 | 1667 |
| Orifice #10 – Dia - .1065" | 530 | 676 | 755 | 837 | 925 | 987 | 1061 | 1129 | 1186 | 1300 | 1409 | 1507 | 1595 | 1680 | 1762 | 1840 | 1920 |
| Orifice #11 – Dia - .113" | 595 | 756 | 847 | 941 | 1039 | 1110 | 1192 | 1269 | 1338 | 1460 | 1581 | 1691 | 1791 | 1889 | 1985 | 2066 | 2145 |
| Orifice #12 – Dia - .120" | 670 | 854 | 955 | 1060 | 1170 | 1250 | 1345 | 1430 | 1503 | 1643 | 1785 | 1903 | 2015 | 2128 | 2232 | 2325 | 2420 |
| Orifice #13 – Dia - .1285" | 771 | 977 | 1097 | 1218 | 1345 | 1437 | 1545 | 1640 | 1730 | 1890 | 2048 | 2190 | 2320 | 2443 | 2570 | 2676 | 2780 |
| Orifice #14 – Dia - .136" | 864 | 1089 | 1230 | 1364 | 1508 | 1610 | 1730 | 1838 | 1936 | 2119 | 2295 | 2455 | 2600 | 2740 | 2872 | 2990 | 3105 |
| Orifice #15 – Dia - .144" | 966 | 1229 | 1378 | 1529 | 1689 | 1800 | 1936 | 2060 | 2170 | 2372 | 2570 | 2742 | 2908 | 3055 | 3218 | 3355 | 3490 |
| Orifice #16 – Dia - .152" | 1079 | 1370 | 1532 | 1702 | 1880 | 2008 | 2160 | 2295 | 2420 | 2640 | 2862 | 3060 | 3243 | 3420 | 3590 | 3741 | 3890 |
| Orifice #17 – Dia - .161" | 1210 | 1538 | 1722 | 1911 | 2115 | 2256 | 2425 | 2580 | 2720 | 2970 | 3220 | 3440 | 3648 | 3840 | 4040 | 4205 | 4365 |

Orifice Plate Number 2-A *Flow in lbs. of Water Per Hour*

Model OM250-2A

Model OM650-2A

| Pressure - PSIG | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
|----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Orifice #1 – Dia - .0785" | 287 | 364 | 409 | 454 | 501 | 535 | 576 | 610 | 645 | 704 | 763 | 816 | 865 | 911 | 956 | 995 | 1030 |
| Orifice #2 – Dia - .086" | 344 | 438 | 490 | 545 | 600 | 642 | 690 | 733 | 772 | 845 | 916 | 978 | 1038 | 1091 | 1148 | 1194 | 1248 |
| Orifice #3 – Dia - .0935" | 406 | 520 | 579 | 642 | 710 | 758 | 815 | 866 | 914 | 998 | 1080 | 1155 | 1223 | 1290 | 1356 | 1411 | 1465 |
| Orifice #4 – Dia - .0995" | 462 | 589 | 657 | 730 | 806 | 861 | 926 | 985 | 1039 | 1132 | 1229 | 1312 | 1390 | 1465 | 1540 | 1605 | 1667 |
| Orifice #5 – Dia - .1065" | 530 | 676 | 755 | 837 | 925 | 987 | 1061 | 1129 | 1186 | 1300 | 1409 | 1507 | 1595 | 1680 | 1762 | 1840 | 1920 |
| Orifice #6 – Dia - .113" | 595 | 756 | 847 | 941 | 1039 | 1110 | 1192 | 1269 | 1338 | 1460 | 1581 | 1691 | 1791 | 1889 | 1985 | 2066 | 2145 |
| Orifice #7 – Dia - .120" | 670 | 854 | 955 | 1060 | 1170 | 1250 | 1345 | 1430 | 1503 | 1643 | 1785 | 1903 | 2015 | 2128 | 2232 | 2325 | 2420 |
| Orifice #8 – Dia - .1285" | 771 | 977 | 1097 | 1218 | 1345 | 1437 | 1545 | 1640 | 1730 | 1890 | 2048 | 2190 | 2320 | 2443 | 2570 | 2676 | 2780 |
| Orifice #9 – Dia - .136" | 864 | 1089 | 1230 | 1364 | 1508 | 1610 | 1730 | 1838 | 1936 | 2119 | 2295 | 2455 | 2600 | 2740 | 2872 | 2990 | 3105 |
| Orifice #10 – Dia - .144" | 966 | 1229 | 1378 | 1529 | 1689 | 1800 | 1936 | 2060 | 2170 | 2372 | 2570 | 2742 | 2908 | 3055 | 3218 | 3355 | 3490 |
| Orifice #11 – Dia - .152" | 1079 | 1370 | 1532 | 1702 | 1880 | 2008 | 2160 | 2295 | 2420 | 2640 | 2862 | 3060 | 3243 | 3420 | 3590 | 3741 | 3890 |
| Orifice #12 – Dia - .161" | 1210 | 1538 | 1722 | 1911 | 2115 | 2256 | 2425 | 2580 | 2720 | 2970 | 3220 | 3440 | 3648 | 3840 | 4040 | 4205 | 4365 |
| Orifice #13 – Dia - .1718" | 1378 | 1747 | 1960 | 2175 | 2400 | 2563 | 2760 | 2930 | 3090 | 3370 | 3660 | 3910 | 4149 | 4365 | 4590 | 4780 | 4960 |
| Orifice #14 – Dia - .182" | 1548 | 1958 | 2200 | 2444 | 2700 | 2880 | 3100 | 3295 | 3470 | 3794 | 4110 | 4385 | 4655 | 4900 | 5150 | 5361 | 5560 |
| Orifice #15 – Dia - .1935" | 1749 | 2215 | 2490 | 2761 | 3050 | 3260 | 3510 | 3720 | 3923 | 4290 | 4650 | 4960 | 5260 | 5550 | 5820 | 6060 | 6290 |
| Orifice #16 – Dia - .2055" | 1970 | 2490 | 2800 | 3110 | 3430 | 3665 | 3942 | 4190 | 4420 | 4830 | 5230 | 5595 | 5925 | 6245 | 6550 | 6835 | 7110 |
| Orifice #17 – Dia - .2187" | 2238 | 2835 | 3180 | 3530 | 3900 | 4160 | 4480 | 4760 | 5020 | 5485 | 5950 | 6360 | 6740 | 7090 | 7450 | 7760 | 8060 |

Orifice Plate Number 3-A Flow in lbs. of Water Per Hour

Model OM250-3A

Model OM650-3A

| Pressure - PSIG | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
|----------------------------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Orifice #1 – Dia - .113" | 595 | 756 | 847 | 941 | 1039 | 1110 | 1192 | 1269 | 1338 | 1460 | 1581 | 1691 | 1791 | 1889 | 1985 | 2066 | 2145 |
| Orifice #2 – Dia - .120" | 670 | 854 | 955 | 1060 | 1170 | 1250 | 1345 | 1430 | 1503 | 1643 | 1785 | 1903 | 2015 | 2128 | 2232 | 2325 | 2420 |
| Orifice #3 – Dia - .1285" | 771 | 977 | 1097 | 1218 | 1345 | 1437 | 1545 | 1640 | 1730 | 1890 | 2048 | 2190 | 2320 | 2443 | 2570 | 2676 | 2780 |
| Orifice #4 – Dia - .136" | 864 | 1089 | 1230 | 1364 | 1508 | 1610 | 1730 | 1838 | 1936 | 2119 | 2295 | 2455 | 2600 | 2740 | 2872 | 2990 | 3105 |
| Orifice #5 – Dia - .144" | 966 | 1229 | 1378 | 1529 | 1689 | 1800 | 1936 | 2060 | 2170 | 2372 | 2570 | 2742 | 2908 | 3055 | 3218 | 3355 | 3490 |
| Orifice #6 – Dia - .152" | 1079 | 1370 | 1532 | 1702 | 1880 | 2008 | 2160 | 2295 | 2420 | 2640 | 2862 | 3060 | 3243 | 3420 | 3590 | 3741 | 3890 |
| Orifice #7 – Dia - .161" | 1210 | 1538 | 1722 | 1911 | 2115 | 2256 | 2425 | 2580 | 2720 | 2970 | 3220 | 3440 | 3648 | 3840 | 4040 | 4205 | 4365 |
| Orifice #8 – Dia - .1718" | 1378 | 1747 | 1960 | 2175 | 2400 | 2563 | 2760 | 2930 | 3090 | 3370 | 3660 | 3910 | 4149 | 4365 | 4590 | 4780 | 4960 |
| Orifice #9 – Dia - .182" | 1548 | 1958 | 2200 | 2444 | 2700 | 2880 | 3100 | 3295 | 3470 | 3794 | 4110 | 4385 | 4655 | 4900 | 5150 | 5361 | 5560 |
| Orifice #10 – Dia - .1935" | 1749 | 2215 | 2490 | 2761 | 3050 | 3260 | 3510 | 3720 | 3923 | 4290 | 4650 | 4960 | 5260 | 5550 | 5820 | 6060 | 6290 |
| Orifice #11 – Dia - .2055" | 1970 | 2490 | 2800 | 3110 | 3430 | 3665 | 3942 | 4190 | 4420 | 4830 | 5230 | 5595 | 5925 | 6245 | 6550 | 6835 | 7110 |
| Orifice #12 – Dia - .2187" | 2238 | 2835 | 3180 | 3530 | 3900 | 4160 | 4480 | 4760 | 5020 | 5485 | 5950 | 6360 | 6740 | 7090 | 7450 | 7760 | 8060 |
| Orifice #13 – Dia - .234" | 2543 | 3215 | 3620 | 4020 | 4440 | 4740 | 5100 | 5420 | 5710 | 6240 | 6765 | 7230 | 7660 | 8060 | 8480 | 8840 | 9190 |
| Orifice #14 – Dia - .246" | 2825 | 3580 | 4025 | 4460 | 4942 | 5260 | 5660 | 6020 | 6345 | 6940 | 7518 | 8040 | 8510 | 8960 | 9415 | 9830 | 10230 |
| Orifice #15 – Dia - .261" | 3180 | 4025 | 4515 | 5015 | 5530 | 5905 | 6355 | 6760 | 7119 | 7775 | 8445 | 9010 | 9555 | 10060 | 10560 | 11105 | 11585 |
| Orifice #16 – Dia - .277" | 3579 | 4528 | 5090 | 5650 | 6240 | 6660 | 7160 | 7620 | 8020 | 8770 | 9510 | 10180 | 10770 | 11320 | 11900 | 12400 | 12890 |
| Orifice #17 – Dia - .295" | 4060 | 5130 | 5760 | 6405 | 7085 | 7555 | 8125 | 8635 | 9100 | 9940 | 10790 | 11510 | 12205 | 12850 | 13500 | 14070 | 14620 |

Orifice Plate Number 4-A Flow in lbs. of Water Per Hour

Model OM250-4A

Model OM650-4A

| Pressure - PSIG | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 |
|----------------------------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Orifice #1 – Dia - .152" | 1079 | 1370 | 1532 | 1702 | 1880 | 2008 | 2160 | 2295 | 2420 | 2640 | 2862 | 3060 | 3243 | 3420 | 3590 | 3741 | 3890 |
| Orifice #2 – Dia - .161" | 1210 | 1538 | 1722 | 1911 | 2115 | 2256 | 2425 | 2580 | 2720 | 2970 | 3220 | 3440 | 3648 | 3840 | 4040 | 4205 | 4365 |
| Orifice #3 – Dia - .1718" | 1378 | 1747 | 1960 | 2175 | 2400 | 2563 | 2760 | 2930 | 3090 | 3370 | 3660 | 3910 | 4149 | 4365 | 4590 | 4780 | 4960 |
| Orifice #4 – Dia - .182" | 1548 | 1958 | 2200 | 2444 | 2700 | 2880 | 3100 | 3295 | 3470 | 3794 | 4110 | 4385 | 4655 | 4900 | 5150 | 5361 | 5560 |
| Orifice #5 – Dia - .1935" | 1749 | 2215 | 2490 | 2761 | 3050 | 3260 | 3510 | 3720 | 3923 | 4290 | 4650 | 4960 | 5260 | 5550 | 5820 | 6060 | 6290 |
| Orifice #6 – Dia - .2055" | 1970 | 2490 | 2800 | 3110 | 3430 | 3665 | 3942 | 4190 | 4420 | 4830 | 5230 | 5595 | 5925 | 6245 | 6550 | 6835 | 7110 |
| Orifice #7 – Dia - .2187" | 2238 | 2835 | 3180 | 3530 | 3900 | 4160 | 4480 | 4760 | 5020 | 5485 | 5950 | 6360 | 6740 | 7090 | 7450 | 7760 | 8060 |
| Orifice #8 – Dia - .234" | 2543 | 3215 | 3620 | 4020 | 4440 | 4740 | 5100 | 5420 | 5710 | 6240 | 6765 | 7230 | 7660 | 8060 | 8480 | 8840 | 9190 |
| Orifice #9 – Dia - .246" | 2825 | 3580 | 4025 | 4460 | 4942 | 5260 | 5660 | 6020 | 6345 | 6940 | 7518 | 8040 | 8510 | 8960 | 9415 | 9830 | 10230 |
| Orifice #10 – Dia - .261" | 3180 | 4025 | 4515 | 5015 | 5530 | 5905 | 6355 | 6760 | 7119 | 7775 | 8445 | 9010 | 9555 | 10060 | 10560 | 11105 | 11585 |
| Orifice #11 – Dia - .277" | 3579 | 4528 | 5090 | 5650 | 6240 | 6660 | 7160 | 7620 | 8020 | 8770 | 9510 | 10180 | 10770 | 11320 | 11900 | 12400 | 12890 |
| Orifice #12 – Dia - .295" | 4060 | 5130 | 5760 | 6405 | 7085 | 7555 | 8125 | 8635 | 9100 | 9940 | 10790 | 11510 | 12205 | 12850 | 13500 | 14070 | 14620 |
| Orifice #13 – Dia - .3125" | 4560 | 5775 | 6500 | 7210 | 7960 | 8530 | 9150 | 9730 | 10240 | 11200 | 12150 | 12980 | 13750 | 14490 | 15200 | 15850 | 16470 |
| Orifice #14 – Dia - .3281" | 5030 | 6350 | 7150 | 7940 | 8760 | 9355 | 10070 | 10700 | 11280 | 12305 | 13340 | 14270 | 15105 | 15910 | 16710 | 17410 | 18060 |
| Orifice #15 – Dia - .3437" | 5499 | 6945 | 7820 | 8690 | 9590 | 10240 | 11010 | 11710 | 12315 | 13490 | 14600 | 15600 | 16560 | 17410 | 18300 | 19100 | 19860 |
| Orifice #16 – Dia - .358" | 5985 | 7570 | 8500 | 9450 | 10420 | 11120 | 11995 | 12720 | 13410 | 14685 | 15900 | 17000 | 18010 | 18980 | 19915 | 20755 | 21550 |
| Orifice #17 – Dia - .375" | 6550 | 8295 | 9320 | 10350 | 11410 | 12200 | 13110 | 13950 | 14700 | 16050 | 17400 | 18600 | 19705 | 20760 | 21800 | 22720 | 23590 |