# Pulse Width Modulation (PWM) Spray Tip Charts§ for Spraying *XtendiMax® 2 Herbicide With VaporGrip® Technology*[1]

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**THE FOLLOW INFORMATION IS PERMITTED FOR USE IN CANADA ONLY, where chemical label requirements are approved. Ths following information is based on the Xtendimax® 2 with Vaporgrip® technology, dated May 3, 2021 from the Bayer.com website. Always ensure the current label requirements are followed.**

XTENDIMAX® 2 With VaporGrip® Technology

FOR USE IN ONLY In approved provinces

**IMPORTANT DISCLAIMER - PWM Nozzle Pressure:** The below tip charts are based on **commonly used** Pulse Width Modulation ("PWM") spray systems, and the inherent pressure drops that occur through the solenoid associated with them. ENSURE your PWM system follows the same gauge and tip pressure relationships. ALWAYS confirm pressure at spray tip corresponds with label requirements PRIOR to spraying any chemical. Proper maintenance and observation of system performance to maintain accurate pressures is recommended. Nozzle charts are based on spraying WATER at controlled temperature.

**LEGEND:**

**GAUGE PRESSURE**
*Boom Pressure (PSI)*
Gauge pressure is the boom pressure required to obtain the required tip pressure (PSI). Gauge pressure figures (due to solenoids) are for standard Capstan and Raven PWM solenoids. Check with PWM system supplier to confirm gauge/tip pressure relationship.

**TIP PRESSURE**
*Pressure (PSI) at the Tip*
All required label rates and operating criteria are based on required tip pressure, not to be confused with gauge pressure. Tip pressure creates the spray pattern and droplet quality required for spray application.

**DUTY CYCLE (%)**
*Effective ON time of PWM*
Since PWM systems hold pressure constant, the flow at the tip is adjusted by the length of time the solenoids stay open (the duty cycle). Ideal operating duty cycle range is 50-100%. At 100% duty cycle, solenoid is fully open and not pulsing.
[2] **To calculate duty cycle for a specific speed, divide traveled speed by speed at 100% duty cycle. i.e. UR110-08 @ 15 GPA and 50 PSI @ tip: 13.3MPH / 17.7MPH = 71% Duty Cycle**

## EXAMPLE APPLICATIONS FOR MAX DRIFT REDUCTION

| 10 US GPA | 15 US GPA | 20 US GPA |
|---|---|---|
|  |  |  |
| *UR110-06 @ 12.5mph 60 PSI @ Boom 75% duty cycle* | *UR110-08 @ 12.5mph 63 PSI @ Boom 71% duty cycle[2]* | *UR110-10 @ 12.5mph 55 PSI @ Boom 75% duty cycle* |

## LOWEST DRIFT NOZZLE - *COMBO-JET®* UR Series
## VERY LOW DRIFT NOZZLE - *COMBO-JET®* DR Series
## GOOD COVERAGE & LOW DRIFT REDUCTION NOZZLE - *COMBO-JET®* MR Series

**DESIGNED FOR ALL PWM SYSTEMS**
e.g. Case AimCommand FLEX, Capstan Pinpoint, John Deere ExactApply, Intellispray, Hawkeye, etc.

| Nozzle Size & Angle | Flow Rate USGPM | Boom PSI | Tip psi | Application Rate in US Gallons / Acre on 20" Nozzle Spacing @ Sprayer Speed in mph @ 50-100% Duty Cycle | | | Spray Class; VMD (Droplet Size in µ); %<141µ (Drift %); %<600µ (Small Droplets) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | MR110° Series HIGHER COVERAGE | | | | DR110° Series HIGH DRIFT CONTROL | | | | UR110° Series BEST DRIFT CONTROL | |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-025 | | #40291-025 | | DR110-025 | | #40286-025 | | UR110-025 | #40292-025 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| 110 -025 Nozzles | 0.23 | **35** | 34 | 3.5-6.9 | 2.3-4.6 | 1.7-3.4 | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | UC | 568 |
| | 0.25 | **40** | 39 | 3.7-7.3 | 2.5-4.9 | 1.9-3.7 | | | | | | | | | UC | 546 |
| | 0.26 | **45** | 44 | 3.9-7.8 | 2.6-5.2 | 2-3.9 | | | | | | | | | UC | 526 |
| | 0.28 | **50** | 49 | 4.1-8.2 | 2.8-5.5 | 2.1-4.1 | | | | | | | | | UC | 509 |
| | 0.30 | **60** | 58 | 4.5-9 | 3-6 | 2.3-4.5 | | | | | | | | | XC | 478 |
| | 0.31 | **65** | 63 | 4.7-9.3 | 3.1-6.2 | 2.4-4.7 | | | | | | | | | XC | 465 |
| | 0.33 | **70** | 68 | 4.9-9.7 | 3.3-6.5 | 2.4-4.8 | | | | | | | | | XC | 453 |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-03 | | #40291-03 | | DR110-03 | | #40286-03 | | UR110-03 | #40292-03 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| 110 -03 Nozzles | 0.28 | **35** | 34 | 4.1-8.2 | 2.8-5.5 | 2.1-4.1 | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | UC | 618 |
| | 0.29 | **40** | 39 | 4.4-8.7 | 2.9-5.8 | 2.2-4.4 | | | | | | | | | UC | 596 |
| | 0.31 | **45** | 43 | 4.7-9.3 | 3.1-6.2 | 2.3-4.6 | | | | | | | | | UC | 576 |
| | 0.33 | **50** | 48 | 4.9-9.8 | 3.3-6.5 | 2.5-4.9 | | | | | | | | | UC | 558 |
| | 0.36 | **60** | 58 | 5.4-11 | 3.6-7.1 | 2.7-5.4 | | | | | | | | | UC | 527 |
| | 0.38 | **65** | 63 | 5.6-11 | 3.7-7.4 | 2.8-5.6 | | | | | | | | | UC | 514 |
| | 0.39 | **70** | 68 | 5.8-12 | 3.9-7.7 | 2.9-5.8 | | | | | | | | | UC | 501 |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-04 | | #40291-04 | | DR110-04 | | #40286-04 | | UR110-04 | #40292-04 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| 110 -04 Nozzles | 0.36 | **35** | 33 | 5.4-11 | 3.6-7.2 | 2.7-5.4 | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | UC | 631 |
| | 0.39 | **40** | 37 | 5.8-12 | 3.9-7.7 | 2.9-5.8 | | | | | | | | | UC | 611 |
| | 0.41 | **45** | 42 | 6.1-12 | 4.1-8.1 | 3.1-6.1 | | | | | | | | | UC | 593 |
| | 0.43 | **50** | 47 | 6.5-13 | 4.3-8.6 | 3.2-6.4 | | | | | | | | | UC | 577 |
| | 0.47 | **60** | 56 | 7.1-14 | 4.7-9.4 | 3.5-7 | | | | | | | | | UC | 549 |
| | 0.49 | **65** | 61 | 7.4-15 | 4.9-9.8 | 3.7-7.3 | | | | | | | | | UC | 537 |
| | 0.51 | **70** | 66 | 7.6-15 | 5.1-10 | 3.8-7.6 | | | | | | | | | UC | 526 |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-05 | | #40291-05 | | DR110-05 | | #40286-05 | | UR110-05 | #40292-05 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| 110 -05 Nozzles | 0.45 | **35** | 32 | 6.6-13 | 4.4-8.8 | 3.3-6.6 | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | XC | 525 | 2% | 64% | UC | 652 |
| | 0.48 | **40** | 36 | 7.1-14 | 4.7-9.4 | 3.6-7.1 | | | | | XC | 513 | 3% | 66% | UC | 634 |
| | 0.50 | **45** | 41 | 7.5-15 | 5-10 | 3.8-7.5 | | | | | XC | 502 | 3% | 68% | UC | 618 |
| | 0.53 | **50** | 45 | 7.9-16 | 5.3-11 | 4-7.9 | | | | | XC | 492 | 3% | 70% | UC | 604 |
| | 0.58 | **60** | 54 | 8.7-17 | 5.8-12 | 4.4-8.7 | | | | | XC | 475 | 3% | 73% | UC | 582 |
| | 0.61 | **65** | 59 | 9-18 | 6-12 | 4.5-9 | | | | | XC | 467 | 3% | 74% | UC | 572 |
| | 0.63 | **70** | 63 | 9.4-19 | 6.3-13 | 4.7-9.3 | | | | | XC | 460 | 4% | 75% | UC | 563 |

**WIND SPEED & INVERSION MATTERS**
As wind & boom height increase, observed spray drift will increase substantially.
At approximately 12mph wind, driftable fines will DOUBLE! - based on water (not active ingred.)

DO NOT SPRAY IN INVERSION CONDITIONS
Ensure not to spray during/before sunrise or two hours before sunset, or during inversion conditions.

**IMPORTANT: Required Pre-orifices**
Each nozzle include snap-in pre-orifices that MUST be used for proper spray operation.
These pre-orifices are **NOT** interchangeable between sizes/series of spray nozzle.

**UR Dual Pre-orifices Series**
The **UR series** tip-cap includes two snap-in orifices. One is short and snaps directly into the cap, the other is longer and snaps into the short orifice. NEVER operate UR series spray tips without BOTH orifices properly snapped in.


**UR SERIES Two Pre-orifices snapped into each other, and snap into the cap**

*For some sizes of UR series tip-cap, orifice color(s) will not match the cap.

- Patented -

Shown application information is based on water @ 26.5°C in a controlled environment and should not be considered actual. Information is provided for comparison to other Combo-Jet® spray tips, for educational purposes only. Repeat testing results can vary.

[1] TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, BAYER AND WILGER MAKE NO RECOMMENDATION OR WARRANTY HEREIN REGARDING THE USE OF ANY PRODUCT THAT MAY APPEAR ON THIS PAGE, REGARDLESS OF WHETHER SUCH PRODUCT IS USED ALONE OR WITH A COMBINATION OF XTENDIMAX® 2 WITH VAPORGRIP® TECHNOLOGY OR ANY WILGER PRODUCTS. BUYER AND ALL USERS ARE SOLELY RESPONSIBLE FOR ANY LACK OF PERFORMANCE, LOSS, OR DAMAGE IN CONNECTION WITH THE USE OR HANDLING OF ANY SUCH PRODUCT ALONE OR WITH XTENDIMAX™ WITH VAPORGRIP™ TECHNOLOGY. REFER TO CHEMICAL LABEL, SUPPLEMENTARY LABEL AND LOCAL LEGISLATION FOR ANY ADDITIONAL RESTRICTIONS OR REQUIREMENTS ON CHEMICAL APPLICATIONS.

# Pulse Width Modulation (PWM) Spray Tip Charts§ for Spraying *XtendiMax® 2 Herbicide With VaporGrip® Technology*[1]

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**IMPORTANT DISCLAIMER - PWM Nozzle Pressure:** The below tip charts are based on **commonly used** Pulse Width Modulation ("PWM") spray systems, and the inherent pressure drops that occur through the solenoid associated with them. ENSURE your PWM system follows the same gauge and tip pressure relationships. ALWAYS confirm pressure at spray tip corresponds with label requirements PRIOR to spraying any chemical. Proper maintenance and observation of system performance to maintain accurate pressures is recommended. Nozzle charts are based on spraying WATER at controlled temperature.

**LEGEND:**

**GAUGE PRESSURE**
*Boom Pressure (PSI)*
Gauge pressure is the boom pressure required to obtain the required tip pressure (PSI). Gauge pressure figures (due to solenoids) are for standard Capstan and Raven PWM solenoids. Check with PWM system supplier to confirm gauge/tip pressure relationship.

**TIP PRESSURE**
*Pressure (PSI) at the Tip*
All required label rates and operating criteria are based on required tip pressure, not to be confused with gauge pressure. Tip pressure creates the spray pattern and droplet quality required for spray application.

**DUTY CYCLE (%)**
*Effective ON time of PWM*
Since PWM systems hold pressure constant, the flow at the tip is adjusted by the length of time the solenoids stay open (the duty cycle). Ideal operating duty cycle range is 50-100%. At 100% duty cycle, solenoid is fully open and not pulsing.
[2]**To calculate duty cycle for a specific speed, divide traveled speed by speed at 100% duty cycle. i.e. UR110-08 @ 15 GPA and 50 PSI @ tip: 13.3MPH / 17.7MPH = 71% Duty Cycle**

**EXAMPLE APPLICATIONS FOR MAX DRIFT REDUCTION**

| 10 US GPA | 15 US GPA | 20 US GPA |
|---|---|---|
|   |   |   |
| *UR110-06 @ 12.5mph 60 PSI @ Boom 75% duty cycle* | *UR110-08 @ 12.5mph 63 PSI @ Boom 71% duty cycle[2]* | *UR110-10 @ 12.5mph 55 PSI @ Boom 75% duty cycle* |

## LOWEST DRIFT NOZZLE - *COMBO-JET®* UR Series
## VERY LOW DRIFT NOZZLE - *COMBO-JET®* DR Series
## GOOD COVERAGE & LOW DRIFT REDUCTION NOZZLE - *COMBO-JET®* MR Series

**DESIGNED FOR ALL PWM SYSTEMS**
e.g. Case AimCommand FLEX, Capstan Pinpoint, John Deere ExactApply, Intellispray, Hawkeye, etc.

| Nozzle Size & Angle | Flow Rate USGPM | Boom PSI | Tip psi | Application Rate in US Gallons / Acre on 20" Nozzle Spacing @ Sprayer Speed in mph @ 50-100% Duty Cycle | | | Spray Class; VMD (Droplet Size in µ); %<141µ (Drift %); %<600µ (Small Droplets) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | MR110° Series HIGHER COVERAGE | | | | DR110° Series HIGH DRIFT CONTROL | | | | UR110° Series BEST DRIFT CONTROL | |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-06 | | #40291-06 | | DR110-06 | | #40286-06 | | UR110-06 | #40292-06 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| 110 -06 Nozzles | 0.56 | **40** | 35 | 8.3-17 | 5.6-11 | 4.2-8.3 | Nozzle Spray Characteristics too fine at most pressures to follow chemical label requirements. | | | | XC | 547 | 2% | 61% | UC | 653 |
| | 0.59 | **45** | 39 | 8.8-18 | 5.9-12 | 4.4-8.8 | | | | | XC | 532 | 2% | 63% | UC | 636 |
| | 0.63 | **50** | 43 | 9.3-19 | 6.2-12 | 4.7-9.3 | | | | | XC | 519 | 3% | 65% | UC | 622 |
| | 0.69 | **60** | 52 | 10-20 | 6.8-14 | 5.1-10 | | | | | XC | 496 | 3% | 69% | UC | 597 |
| | 0.71 | **65** | 57 | 11-21 | 7.1-14 | 5.3-11 | | | | | XC | 486 | 3% | 70% | UC | 587 |
| | 0.74 | **70** | 61 | 11-22 | 7.4-15 | 5.5-11 | | | | | XC | 476 | 3% | 71% | UC | 578 |
| | 0.79 | **80** | 70 | 12-24 | 7.9-16 | 5.9-12 | | | | | XC | 460 | 3% | 73% | UC | 561 |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-08 | | #40291-08 | | DR110-08 | | #40286-08 | | UR110-08 | #40292-08 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| Nozzles 110 -08 Nozzles | 0.71 | **40** | 32 | 11-21 | 7.1-14 | 5.3-11 | UC | 522 | 4% | 54% | UC | 606 | 3% | 42% | | |
| | 0.75 | **45** | 36 | 11-22 | 7.5-15 | 5.6-11 | UC | 503 | 5% | 58% | UC | 588 | 3% | 44% | UC | 672 |
| | 0.79 | **50** | 39 | 12-24 | 7.9-16 | 5.9-12 | UC | 486 | 5% | 61% | UC | 571 | 4% | 47% | UC | 654 |
| | 0.87 | **60** | 47 | 13-26 | 8.6-17 | 6.5-13 | XC | 455 | 6% | 65% | UC | 543 | 4% | 50% | UC | 623 |
| | 0.91 | **65** | 51 | 13-27 | 9-18 | 6.8-14 | XC | 442 | 6% | 67% | UC | 530 | 4% | 52% | UC | 610 |
| | 0.94 | **70** | 55 | 14-28 | 9.3-19 | 7-14 | XC | 430 | 6% | 69% | UC | 519 | 4% | 53% | UC | 598 |
| | 1.01 | **80** | 63 | 15-30 | 10-20 | 7.5-15 | XC | 408 | 7% | 71% | UC | 498 | 4% | 56% | UC | 578 |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 10gpa | 15gpa | 20gpa | MR110-10 | | #40291-10 | | DR110-10 | | #40286-10 | | UR110-10 | #40292-10 |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | Class | VMD |
| 110 -10 Nozzles | 0.89 | **45** | 32 | 13-27 | 8.8-18 | 6.6-13 | UC | 514 | 4% | 54% | UC | 604 | 5% | 58% | | |
| | 0.94 | **50** | 35 | 14-28 | 9.3-19 | 7-14 | UC | 497 | 5% | 57% | UC | 595 | 5% | 56% | UC | 680 |
| | 1.03 | **60** | 42 | 15-31 | 10-20 | 7.7-15 | XC | 468 | 5% | 61% | UC | 580 | 5% | 54% | UC | 648 |
| | 1.07 | **65** | 46 | 16-32 | 11-21 | 8-16 | XC | 456 | 5% | 62% | UC | 573 | 5% | 53% | UC | 634 |
| | 1.11 | **70** | 49 | 17-33 | 11-22 | 8.3-17 | XC | 444 | 6% | 64% | UC | 566 | 5% | 51% | UC | 621 |
| | 1.19 | **80** | 56 | 18-35 | 12-24 | 8.8-18 | XC | 423 | 6% | 66% | UC | 555 | 6% | 49% | UC | 599 |
| | Flow us gpm | Boom psi | Tip psi | Sprayer Speed (on 20" spacing) @ 15gpa | 18gpa | 20gpa | MR110-125 | | #40291-125 | | DR110-125 | | #40286-125 | | | |
| | | | | | | | Class | VMD | <141 | <600 | Class | VMD | <141 | <600 | | |
| 110 -125 Nozzles | 1.09 | **50** | 30 | 11-22 | 9-18 | 8.1-16 | UC | 633 | 4% | 37% | | | | | | |
| | 1.19 | **60** | 36 | 12-24 | 9.9-20 | 8.9-18 | UC | 616 | 4% | 40% | UC | 646 | 3% | 35% | | |
| | 1.24 | **65** | 39 | 12-25 | 10-21 | 9.2-18 | UC | 587 | 4% | 44% | UC | 626 | 4% | 37% | | |
| | 1.29 | **70** | 42 | 13-26 | 11-21 | 9.6-19 | UC | 574 | 4% | 46% | UC | 618 | 4% | 39% | | |
| | 1.38 | **80** | 48 | 14-27 | 11-23 | 10-20 | UC | 562 | 5% | 48% | UC | 609 | 4% | 40% | | |

**#40204-00 Adapter for Non-Wilger Nozzle Bodies**
Use the quick-turn #40204-00 adapter for use of Combo-Jet nozzles on any non-Wilger nozzle body outlet.

**#40204-00 Adapts body to *COMBO-JET®***

**ASABE S572.1 Spray Classification**
Spray quality is categorized based on Dv0.1 and VMD droplet sizes.
Objective testing data (by 3rd party), from spray spectrum recording equipment (without wind tunnel use), has been used to classify spray quality for this chart. Extra data (e.g. VMD, etc.) can vary between testing equipment and method, and is provided as an educational resource only.
Tips sized up to 110-06 verified on Phase Doppler Particle Analyzer (PDPA); tips sized over 110-06 verified on Malvern.

- Fine (F)
- Medium (M)
- Coarse (C)
- Very Coarse (VC)
- Extremely Coarse (XC)
- Ultra Coarse (UC)

Not allowed by Xtendimax 2 with vaporgrip technology chemical label.

**VMD** *(Volume Median Diameter)*
The median droplet (in µ) for a sprayed volume. Half of the volume is made of droplets smaller, with half made up of droplets larger.

**% <141µ** *(% Driftable Fines)*
Percentage of volume which is likely to drift. As wind & boom height increase, observed spray drift will increase substantially.

**% <600µ** *(% of Small Droplets)*
% of volume which is made up of 'small' droplets, useful for coverage. As % of useful droplets lowers, overall coverage is reduced.

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