## **FOR PWM SPRAYERS**

# **COMBO-JET® 110° Tip-Cap Performance Specifications for PWM Systems**

Please Note:  1. Flow and application rates shown are for water only, applied on 20" spacing.  2. For applications where a uniform pattern is required, recommended pressures are higher than in standard spray systems.  3. Cap color determined by flow rate, as per ISO standard.  4. In order to make this chart easier to use, not all available tip-cap sizes are shown. For specifications for 005, 0067, 20, 25, 30, 40, 50 & 60 size Tip-Caps, visit our website.							TI	R11 P SI	ERII	ES	TI	R11	ERI	ES	MR110-XX TIP SERIES Recommended Pressure:				TIP SERIES				SPRAY TIP PART #s	
5. Standard PWM systems have inherent flow capacity up to 1.5 US Gallons/Min								-70 PSI	ssuie.	Re		00 PSI	sure.	Recommended Pressure: 30-100 PSI				Recommended Pressure: 35-100 PSI						
Tip	Flow Sprayer Speed Range (Rounded)						VIV	ID (Dro	plet Si	ze in µ)	; %<14	11μ (Dr	ift %);	%< <b>20</b> 0	)μ (Drif	t %); %	<600µ	(Small Droplets)				Tip-Cap & Part No.		
Cap	Rate	PSI				e) @ 20"		110° E	R Serie	S	110° SR Series				110° MR Series				110° DR Series				Tip-Cap Part #	
No.	USGPM		5.0	7.5	10.0	12.5	15.0	VMD	<141	<200	<600	VMD	<141	<200	<600	VMD	<141	<200	<600	VMD	<141	<200	<600	Strainer Part #
	0.07	20	1.0-4.2	0.7-2.8	0.5-2.1	0.4-1.7	0.3-1.4	149	45%	84%	100%	-	-	-	-	-	-	-	-	-	-	-	-	ER110-01 40281-01
01	0.09	30	1.3-5.1	0.9-3.4	0.6-2.6	0.5-2.1	0.4-1.7	140	51%	87%	100%	-	-	-	-	-	-	-	-	-	-	-	-	
	0.10	40	1.5-5.9	1.0-4.0	0.7-3.0	0.6-2.4	0.5-2.0	133	56%	89%	100%	-	-	-	-	-	-	-	-	-	-	-	-	
	0.11	50	1.7-6.6	1.1-4.4	0.8-3.3	0.7-2.7	0.6-2.2	128	59%	91%	100%	-	-	-	-	-	-	-	-	-	-	-	-	
	0.12	60	1.8-7.3	1.2-4.8	0.9-3.6	0.7-2.9	0.6-2.4	124	62%	93%	100%	-	-	-	-	-	-	-	-	-	-	-	-	100 Mesh - Green
	0.13	70	2.0-7.8	1.3-5.2	1.0-3.9	0.8-3.1	0.7-2.6	121	65%	94%	100%	-	-	-	-	-	-	-	-	-	-	-	-	40251-00
	0.11	20	1.6-6.3	1.0-4.2	0.8-3.1	0.6-2.5	0.5-2.1	153	40%	77%	100%	-	-	-	-	-	-	-	-	-	-	-	-	ER110-015 40281-015
	0.13	30	1.9-7.7	1.3-5.1	1.0-3.8	0.8-3.1	0.6-2.6	145	47%	81%	100%	216	24%	45%	98%	323	11%	22%	94%	368	7%	15%	92%	SR110-015 40287-015
015	0.15	40	2.2-8.9	1.5-5.9	1.1-4.4	0.9-3.5	0.7-3.0	139	51%	83%	100%	200	28%	50%	98%	279	16%	30%	97%	329	10%	20%	94%	MR110-015 40291-015
10.0	0.17	50	2.5-10	1.7-6.6	1.2-5.0	1.0-4.0	0.8-3.3	135	55%	86%	100%	188	32%	55%	98%	248	20%	36%	98%	302	12%	24%	95%	DR110-015 40286-015
	0.18	60	2.7-11	1.8-7.2	1.4-5.4	1.1-4.3	0.9-3.6	131	58%	87%	100%	178	34%	59%	98%	226	23%	41%	99%	282	14%	27%	96%	100 Mesh - Green
	0.20	70	2.9-12	2.0-7.8	1.5-5.9	1.2-4.7	1.0-3.9	128	61%	89%	100%	169	37%	62%	98%	209	25%	46%	99%	265	15%	30%	97%	40251-00
02	0.14	20	2.1-8.0	1.4-5.6	1.0-4.2	0.8-3.3	0.7-2.8	173	32%	62%	100%	-	-	-	-	-	-	-	-	-	-	-	-	ER110-02 40281-02
	0.17	30	2.6-10	1.7-6.8	1.3-5.1	1.0-4.1	0.9-3.4	160	39%	69%	100%	220	22%	43%	99%	317	11%	23%	95%	433	5%	10%	82%	SR110-02 40287-02
	0.20	40	2.9-12	2.0-7.9	1.5-5.9	1.2-4.7	1.0-3.9	151	45%	73%	100%	207	26%	48%	99%	281	15%	29%	97%	394	6%	13%	87%	MR110-02 40291-02
"-	0.22	50	3.3-13	2.2-8.8	1.6-6.6	1.3-5.3	1.1-4.4	144	49%	77%	100%	197	28%	52%	99%	256	18%	34%	97%	364	8%	16%	90%	DR110-02   40286-02
	0.24	60	3.6-14	2.4-10	1.8-7.2	1.4-5.8	1.2-4.8	138	52%	80%	100%	189	31%	55%	99%	237	21%	38%	98%	339	9%	19%	91%	50 Mesh - Red
	0.26	70	3.9-16	2.6-10	1.9-7.8	1.6-6.2	1.3-5.2	133	55%	82%	100%	182	32%	57%	99%	222	23%	42%	98%	318	10%	20%	93%	40250-00
025	0.17	20	2.6-10	1.7-7.0	1.3-5.2	1.0-4.1	0.9-3.5	194	28%	54%	100%	-	-	-	-	-	-	-	-	-	-	-	-	ER110-025 40281-025
	0.21	30	3.2-13	2.1-8.0	1.6-6.3	1.3-5.1	1.1-4.2	187	29%	56%	100%	237	19%	38%	98%	353	8%	17%	90%	437	5%	10%	79%	SR110-025 40287-025
	0.25	40	3.7-15	2.4-10	1.8-7.3	1.5-5.9	1.2-4.9	181	30%	57%	100%	223	22%	43%	98%	322	11%	22%	93%	401	6%	13%	86%	MR110-025 40291-025
	0.28	50	4.1-16	2.7-11	2.0-8.2	1.6-6.6	1.4-5.5	177	30%	59%	100%	213	25%	46%	98%	299	13%	25%	95%	373	8%	16%	89%	DR110-025 40286-025
	0.30	60	4.5-18	3.0-12	2.2-9.0	1.8-7.2	1.5-6.0	173	31%	60%	100%	204	27%	49%	98%	280	15%	28%	96%	350	9%	18%	91%	50 Mesh - Red
	0.33	70	4.8-19	3.2-13	2.4-10	1.9-7.8	1.6-6.5	170	31%	60%	100%	196	28%	51%	98%	263	16%	31%	96%	331	10%	20%	93%	40250-00
	0.21	20	3.1-12	2.1-8.0	1.5-6.0	1.2-4.9	1.0-4.1	199	26%	51%	99%	-	-	-	-	-	-	- 400/	-	- 404	-	- 70/	700/	ER110-03 40281-03
	0.26	30	3.8-15	2.5-10	1.9-8.0	1.5-6.1	1.3-5.1	185	31%	56%	99%	307	11%	23%	95%	399	6%	13%	86%	484	3%	7%	73%	SR110-03 40287-03
03	0.29	40	4.4-17	2.9-12	2.2-9.0	1.7-7.0	1.5-5.8	175	34%	59%	98%	282	14%	28%	96%	364	8%	17%	90%	447	5%	10%	79%	MR110-03 40291-03
	0.33	50	4.9-20	3.3-13	2.4-10	2.0-7.8	1.6-6.5	167	37%	62%	98%	263	17%	33%	97%	337	10%	20%	93%	419	6%	12%	83%	DR110-03   40286-03
	0.36	60 70	5.4-21 5.8-23	3.6-14	2.7-11	2.1-8.6	1.8-7.1	160 155	39% 41%	65% 67%	97%	247	19%	36% 39%	97%	315 297	11%	22%	94%	396 376	6% 7%	13% 15%	86%	50 Mesh - Red 40250-00
-	0.39	20	4.1-16	2.7-11	2.0-8.1	1.6-6.5	1.4-5.4	243	18%	35%	97%	234	20 /0	39/0	37 /0	231	1370	2070	33 /0	370	1 /0	13/0	00 /0	ER110-04 40281-04
	0.27	30	5.0-20	3.3-13	2.5-10	2.0-8.0	1.7-6.6	228	21%	41%	97%	319	10%	21%	93%	425	4%	10%	83%	519	3%	6%	67%	SR110-04 40287-04
	0.34	40	5.8-23	3.8-15	2.9-12	2.3-9.2	1.9-7.7	217	24%	44%	97%	294	13%	26%	95%	386	6%	14%	88%	478	4%	9%	74%	MR110-04 40291-04
04	0.43	50	6.4-26	4.3-17	3.2-13	2.6-10.3	2.1-8.6	209	26%	47%	96%	275	15%	30%	96%	355	8%	17%	91%	447	5%	10%	79%	DR110-04 40286-04
	0.43	60	7.0-28	4.7-19	3.5-14	2.8-11.3	2.3-9.4	202	27%	50%	96%	259	17%	33%	96%	330	9%	19%	93%	421	6%	12%	82%	50 Mesh - Red
	0.51	70	7.6-30	5.1-20	3.8-15	3-12.2	2.5-10.1	196	29%	52%	96%	245	18%	35%	97%	309	10%	21%	95%	400	6%	13%	84%	40250-00
	0.34	20	5.0-20	3.3-13	2.5-10	2.0-8.0	1.7-6.7	253	17%	34%	95%	-	-	-	-	- 505	-		-		-	-	-	ER110-05 40281-05
	0.41	30	6.1-24			2.4-9.8		231		40%		367	7%	16%	90%	501	3%	7%	69%	539	2%	5%	61%	SR110-05 40287-05
	0.48	40	7.1-28	4.7-19		2.8-11.3		217	25%	44%	95%	334	10%	21%	93%	459	4%	9%	76%	513	3%	6%		MR110-05 40291-05
05	0.53	50	7.9-32	5.3-21	4.0-16			207	27%	47%	95%	308	12%	24%	94%	427	5%	12%	80%	492	3%	7%	70%	DR110-05 40286-05
	0.58	60	8.7-35	5.8-23	4.3-17	3.5-13.8		198	29%	50%	95%	287	14%	27%	95%	400	6%	13%	83%	475	3%	8%	73%	50 Mesh - Red
	0.63	70	9.3-37	6.2-25	4.7-19		3.1-12.5	192	31%	52%	95%	269	15%	30%	96%	378	7%	15%	85%	460	4%	8%	75%	40250-00
	0.40	20	5.9-24	3.9-16	2.9-12	2.4-9.4		289	13%	26%	94%	-	-	-	-		-	-	-	-	-	-	-	ER110-06 40281-06
	0.48	30	7.2-29	4.8-19	3.6-14	2.9-12		268	16%	32%	94%	438	5%	10%	81%	524	3%	6%	64%	583	2%	4%	54%	SR110-06 40287-06
06	0.56	40	8.3-33	5.5-22	4.2-17	3.3-13		253	19%	36%	94%	393	7%	15%	87%	490	3%	8%	71%	547	2%	5%	61%	MR110-06 40291-06
	0.63	50	9.3-37	6.2-25	4.6-19	3.7-15	3.1-12	242	21%	39%	95%	358	9%	19%	90%	465	4%	9%	76%	519	3%	6%	65%	DR110-06 40286-06
	0.69	60	10-41	6.8-27	5.1-20	4.1-16	3.4-14	233	23%	41%	95%	330	11%	22%	92%	443	5%	10%	79%	496	3%	7%	69%	50 Mesh - Red
	0.74	70	11-44	7.3-29	5.5-22	4.4-18	3.7-15	225	24%	43%	95%	306	12%	24%	93%	426	5%	11%	81%	476	3%	7%	71%	40250-00
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Extremely Fine <60

VMD

Volume Median Diameter Size of the median droplet in microns (µ) for a sprayed volume. Half of the volume is made up of droplets smaller than the VMD; half is made up of droplets larger.

Very Fine 60-105µ

% <141μ

% Driftable Fines

Percentage of volume which is likely to drift. 141μ is now replacing 200μ as the

new standard for driftable fines.

Fine 106-235μ

Droplet Categories as per **ASABE \$572.1** Classification (2009-current) Medium 236-340µ

Coarse 341-403µ % **<200**μ

% Driftable Fines

Percentage of volume which is likely to drift. 200µ is shown for reference.

 $141\mu$  is used as the new standard for

driftable fines.

Very Coarse 404-502µ

**Extremely Coarse** 503-665µ

#### % <600μ

% Useful Droplets Percentage of volume which is made up of 'useful' droplets. As the distribution of useful droplets lowers, coverage is reduced.

Ultra Coarse >665µ

### **Strainer Mesh & Tips**

Recommended Strainer mesh Mesh of strainer determined by the size of a tip. For larger tips (08+), strainers are not required. For PWM systems, typically 80 mesh inline strainers are used as well.

### FOR PWM SPRAYERS

## **COMBO-JET® 110° Tip-Cap Performance Specifications for PWM Systems**

1. Flow and application rates shown are for water only, applied on 20" spacing 2. For applications where a uniform pattern is required, recommended

- pressures are higher than in standard spray systems.

  3. Cap color determined by flow rate, as per ISO standard.

  4. In order to make this chart easier to use, not all available tip-cap sizes are shown. For specifications for 005, 0067, 20, 25, 30, 40, 50 & 60 size Tip-Caps,

**ER110-XX SR110-XX TIP SERIES** 

**TIP SERIES** 

**MR110-XX** TIP SERIES

**DR110-XX TIP SERIES**  **SPRAY TIP** PART #s

ndard PWM systems have inherent flow canacity un to 1.5 USG/Min

Recommended pressure varies with

Recommended pressure varies with

Recommended pressure varies with

5.	5. Standard PWM systems have innerent flow capacity up to 1.5 USG/Min							each size of tip each size of tip									each si	ze of tip		each size of tip					
Tip	Flow		Sprayer Speed Range (Rounded)						VMD (Droplet Siz				ze in μ); %<141μ (Drift %);				%<200µ (Drift %); %<600µ				(Small Droplets)				& Part No.
Cap	Rate	PSI	@ Application Rate (US Gallons/Acre) @ 20"					110° ER Series				110° SR Series				110° MR Series				110° DR Series				Tip-Cap	Part #
No.	USGPM		5.0	7.5	10.0	12.5	15.0	VMD	<141	<200	<600	VMD	<141	<200	<600	VMD	<141	<200	<600	VMD	<141	<200	<600	Strainer	not req'd
	0.62	30	9.1-37	6.1-24	4.6-18	3.7-15	3.0-12	312	15%	28%	92%	489	4%	11%	59%	570	3%	7%	45%	651	3%	4%	35%	ER110-08	40281-08
	0.71	40	11-42	7-28	5.3-21	4.2-17	3.5-14	286	18%	32%	93%	445	6%	13%	68%	522	4%	9%	54%	606	3%	5%	42%	SR110-08	40287-08
08	0.79	50	12-47	7.9-31	5.9-24	4.7-19	3.9-16	266	20%	36%	95%	410	7%	15%	74%	486	5%	10%	61%	571	4%	6%	47%	MR110-08	40291-08
	0.87	60	13-52	8.6-34	6.5-26	5.2-21	4.3-17	249	21%	38%	95%	382	8%	16%	78%	455	6%	11%	65%	543	4%	7%	50%	DR110-08	40286-08
	0.94	70	14-56	9.3-37	7.0-28	5.6-22	4.7-19	235	23%	41%	96%	359	9%	17%	80%	430	6%	12%	69%	519	4%	8%	53%		
	0.73	30	11-43	7.2-29	5.4-22	4.3-17	3.6-14	357	11%	25%	88%	527	4%	9%	50%	579	3%	6%	43%	716	2%	3%	26%	ER110-10	40281-10
	0.84	40	13-50	8.3-33	6.2-25	5.0-20	4.2-17	330	13%	28%	90%	480	6%	11%	60%	533	4%	7%	51%	679	2%	4%	31%	SR110-10	40287-10
10	0.94	50	14-56	9.3-37	7.0-28	5.6-22	4.7-19	310	16%	31%	91%	444	7%	13%	67%	497	5%	8%	57%	651	3%	5%	35%	MR110-10	40291-10
	1.03	60	15-61	10-41	7.6-31	6.1-24	5.1-20	293	17%	33%	92%	414	8%	14%	72%	468	5%	10%	61%	628	3%	5%	38%	DR110-10	40286-10
	1.11	70	17-66	11-44	8.3-33	6.6-26	5.5-22	278	19%	35%	93%	389	8%	15%	75%	444	6%	10%	64%	608	4%	6%	40%		
	0.84	30	13-50	8.3-33	6.3-25	5.0-20	4.2-17	430	8%	16%	68%	554	3%	5%	44%	699	3%	3%	24%	670	2%	5%	31%	ER110-125	40281-125
	0.97	40	14-58	9.6-39	7.2-29	5.8-23	4.8-19	403	9%	17%	73%	506	4%	8%	55%	652	3%	4%	33%	635	3%	6%	36%	SR110-125	40287-125
125	1.09	50	16-65	11-43	8.1-32	6.5-26	5.4-22	383	10%	18%	77%	469	5%	10%	62%	616	4%	6%	40%	617	3%	7%	39%	MR110-125	40291-128
	1.19	60	18-71	12-47	8.8-35	7.1-28	5.9-24	366	11%	19%	79%	439	6%	12%	67%	587	4%	7%	44%	605	4%	7%	40%	DR110-125	40286-125
	1.29	70	19-76	13-51	9.6-38	7.6-31	6.4-25	351	12%	20%	81%	413	6%	13%	71%	562	5%	7%	48%	596	4%	7%	41%		
	0.93	30	14-55	9.2-37	6.9-28	5.5-22	4.6-18	463	7%	14%	58%	636	3%	4%	27%	686	4%	5%	27%	740	3%	2%	23%	ER110-15	40281-15
	1.08	40	16-64	11-43	8.0-32	6.4-26	5.3-21	434	9%	16%	65%	594	4%	6%	38%	652	4%	6%	33%	705	3%	3%	31%	SR110-15	40287-15
15	1.20	50	18-72	12-48	8.9-36	7.2-29	6.0-24	413	10%	17%	69%	561	4%	7%	46%	626	4%	6%	38%	678	3%	4%	36%	MR110-15	40291-15
	1.32	60	20-78	13-52	9.8-39	7.8-31	6.5-26	395	11%	18%	72%	534	5%	8%	52%	604	4%	7%	41%	655	3%	5%	40%	DR110-15	40286-15
	1.43	70	21-85	14-56	11-42	8.5-34	7.1-28	380	11%	19%	74%	511	5%	9%	56%	586	4%	7%	44%	637	4%	5%	43%		

<sup>\*</sup>Droplet categories: The above chart is based on the ASABE Standard 572.1. Refer to chemical label to verify which ASABE S572.1 categories should be followed.

Extremely Fine <60

#### **Recommended Pressure**

Pressure Range for Tips For PWM systems, the pressure loss through system components is accounted for in these charts. Specified pressure in chart is boom pressure. Additional solenoid wear may occur for pressures above 60PSI

Very Fine

Fine 106-235µ 60-105u

**ASABE Droplet Categories** 

Color Classifications

The colors associated with the VMD is

based on an ASABE standard for droplet

size categorization. See categories and

colors above. Refer to wilger.net for older

ASABE standard S572.

#### Medium 236-340u

Coarse 341-403u

**Duty Cycles** 

Effective run time of PWM

Since PWM systems hold pressure

constant, they adjust rates by the length

of time the solenoids stay open (the duty

cycle). Duty cycle is calculated by dividing

your current speed into the max speed

for that tip, Ideal operating duty cycles

are 40-100%.

Droplet Categories as per **ASABE S572.1** Classification (2009-current) Very Coarse 404-502u

### 503-665u **Pre-orifice Length & Color**

**Extremely Coarse** 

Differences in tip pre-orifices Pre-orifice color and length vary for some tips, SR-series pre-orifices will vary in color from the color of the cap. MR & DR pre-orifices will be the same color as the cap. Pre-orifices for high volume tips use a longer pre-orifice.

Ultra Coarse >665µ

#### **Using Tip Wizard**

Same search, different results PWM systems use plumbing components that cause more in pressure loss when compared to standard spray systems. Tip Wizard accounts for those pressure drops, and also provides crucial duty cycle information as well

# Multi-tip spraying with Pulse Width Modulation Technology

Pulse Width Modulation (PWM) provides the ability to hold tip pressure constant; therefore, holding the droplet size constant as well.

This holds true with multi-tip spraying as well.

As a standard, PWM systems use one solenoid per nozzle body. For best utilization of PWM technology, a dual tip adapter [left] is used.

Spraying with two seperate outlets [right] is possible, but the outlet not controlled by a solenoid will be controlled by the auto-rate controller.

To use Tip Wizard to help select a multi-tip setup, simply split the total flow rate into two (or more) parts and ensure the tips selected can operate within the same duty cycle range and pressures.



Example Rate: 10 US Gallons/Acre; Speed: 15 MPH; Nozzle Spacing: 20"; Target Droplet Size: 400 microns (Systemic Herbicide)

If the total application is 10GPA, the effective rates per tip must add up to 10GPA. For simplicity, split the flow in equal parts; for example, two tips applying 5GPA. While consulting the tip charts, a suitable choice might be the MR110-04 at ~35PSI, with effective volume of 5GPA per tip. The droplet size is right around 400microns, and max travel speed (15MPH) is at a ~70% duty cycle.