A=(B+C)/D

Technical Information

Universal Application Rate Chart for 15″ Tip Spacing

TIP CAPACITY	LIQUID PRESSURE IN PSI	CAPACITY 1 NOZZLE IN GPM	CAPACITY 1 NOZZLE IN OZ./MIN.	GALLONS PER ACRE – 15″ NOZZLE SPACING											
				4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	18 MPH	20 MPH	22 MPH
01	15	0.061	7.8	6.0	4.8	4.0	3.5	3.0	2.4	2.0	1.7	1.5	1.3	1.2	1.1
	20	0.071	9.1	7.0	5.6	4.7	4.0	3.5	2.8	2.3	2.0	1.8	1.6	1.4	1.3
	30	0.087	11	8.6	6.9	5.7	4.9	4.3	3.4	2.9	2.5	2.2	1.9	1.7	1.6
	40	0.10	13	9.9	7.9	6.6	5.7	5.0	4.0	3.3	2.8	2.5	2.2	2.0	1.8
	50	0.11	14	10.9	8.7	7.3	6.2	5.4	4.4	3.6	3.1	2.7	2.4	2.2	2.0
	60	0.12	15	11.9	9.5	7.9	6.8	5.9	4.8	4.0	3.4	3.0	2.6	2.4	2.2
	75	0.14	18	13.9	11.1	9.2	7.9	6.9	5.5	4.6	4.0	3.5	3.1	2.8	2.5
	90	0.15	19	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	3.3	3.0	2.7
015	15	0.092	12	9.1	7.3	6.1	5.2	4.6	3.6	3.0	2.6	2.3	2.0	1.8	1.7
	20	0.11	14	10.9	8.7	7.3	6.2	5.4	4.4	3.6	3.1	2.7	2.4	2.2	2.0
	30	0.13	17	12.9	10.3	8.6	7.4	6.4	5.1	4.3	3.7	3.2	2.9	2.6	2.3
	40	0.15	19	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	3.3	3.0	2.7
	50	0.17	22	16.8	13.5	11.2	9.6	8.4	6.7	5.6	4.8	4.2	3.7	3.4	3.1
	60	0.18	23	17.8	14.3	11.9	10.2	8.9	7.1	5.9	5.1	4.5	4.0	3.6	3.2
	75	0.21	27	21	16.6	13.9	11.9	10.4	8.3	6.9	5.9	5.2	4.6	4.2	3.8
	90	0.23	29	23	18.2	15.2	13.0	11.4	9.1	7.6	6.5	5.7	5.1	4.6	4.1
02	15	0.12	15	11.9	9.5	7.9	6.8	5.9	4.8	4.0	3.4	3.0	2.6	2.4	2.2
	20	0.14	18	13.9	11.1	9.2	7.9	6.9	5.5	4.6	4.0	3.5	3.1	2.8	2.5
	30	0.17	22	16.8	13.5	11.2	9.6	8.4	6.7	5.6	4.8	4.2	3.7	3.4	3.1
	40	0.20	26	19.8	15.8	13.2	11.3	9.9	7.9	6.6	5.7	5.0	4.4	4.0	3.6
	50	0.22	28	22	17.4	14.5	12.4	10.9	8.7	7.3	6.2	5.4	4.8	4.4	4.0
	60	0.24	31	24	19.0	15.8	13.6	11.9	9.5	7.9	6.8	5.9	5.3	4.8	4.3
	75	0.27	35	27	21	17.8	15.3	13.4	10.7	8.9	7.6	6.7	5.9	5.3	4.9
	90	0.30	38	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	6.6	5.9	5.4
025	15	0.15	19	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	3.3	3.0	2.7
	20	0.18	23	17.8	14.3	11.9	10.2	8.9	7.1	5.9	5.1	4.5	4.0	3.6	3.2
	30	0.22	28	22	17.4	14.5	12.4	10.9	8.7	7.3	6.2	5.4	4.8	4.4	4.0
	40	0.25	32	25	19.8	16.5	14.1	12.4	9.9	8.3	7.1	6.2	5.5	5.0	4.5
	50	0.28	36	28	22	18.5	15.8	13.9	11.1	9.2	7.9	6.9	6.2	5.5	5.0
	60	0.31	40	31	25	20	17.5	15.3	12.3	10.2	8.8	7.7	6.8	6.1	5.6
	75	0.34	44	34	27	22	19.2	16.8	13.5	11.2	9.6	8.4	7.5	6.7	6.1
	90	0.38	49	38	30	25	21	18.8	15.0	12.5	10.7	9.4	8.4	7.5	6.8
03	15	0.18	23	17.8	14.3	11.9	10.2	8.9	7.1	5.9	5.1	4.5	4.0	3.6	3.2
	20	0.21	27	21	16.6	13.9	11.9	10.4	8.3	6.9	5.9	5.2	4.6	4.2	3.8
	30	0.26	33	26	21	17.2	14.7	12.9	10.3	8.6	7.4	6.4	5.7	5.1	4.7
	40	0.30	38	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	6.6	5.9	5.4
	50	0.34	44	34	27	22	19.2	16.8	13.5	11.2	9.6	8.4	7.5	6.7	6.1
	60	0.37	47	37	29	24	21	18.3	14.7	12.2	10.5	9.2	8.1	7.3	6.7
	75	0.41	52	41	32	27	23	20	16.2	13.5	11.6	10.1	9.0	8.1	7.4
	90	0.45	58	45	36	30	25	22	17.8	14.9	12.7	11.1	9.9	8.9	8.1
04	15	0.24	31	24	19.0	15.8	13.6	11.9	9.5	7.9	6.8	5.9	5.3	4.8	4.3
	20	0.28	36	28	22	18.5	15.8	13.9	11.1	9.2	7.9	6.9	6.2	5.5	5.0
	30	0.35	45	35	28	23	19.8	17.3	13.9	11.6	9.9	8.7	7.7	6.9	6.3
	40	0.40	51	40	32	26	23	19.8	15.8	13.2	11.3	9.9	8.8	7.9	7.2
	50	0.45	58	45	36	30	25	22	17.8	14.9	12.7	11.1	9.9	8.9	8.1
	60	0.49	63	49	39	32	28	24	19.4	16.2	13.9	12.1	10.8	9.7	8.8
	75	0.55	70	54	44	36	31	27	22	18.2	15.6	13.6	12.1	10.9	9.9
	90	0.60	77	59	48	40	34	30	24	19.8	17.0	14.9	13.2	11.9	10.8
05	15	0.31	40	31	25	20	17.5	15.3	12.3	10.2	8.8	7.7	6.8	6.1	5.6
	20	0.35	45	35	28	23	19.8	17.3	13.9	11.6	9.9	8.7	7.7	6.9	6.3
	30	0.43	55	43	34	28	24	21	17.0	14.2	12.2	10.6	9.5	8.5	7.7
	40	0.50	64	50	40	33	28	25	19.8	16.5	14.1	12.4	11.0	9.9	9.0
	50	0.56	72	55	44	37	32	28	22	18.5	15.8	13.9	12.3	11.1	10.1
	60	0.61	78	60	48	40	35	30	24	20	17.3	15.1	13.4	12.1	11.0
	75	0.68	87	67	54	45	38	34	27	22	19.2	16.8	15.0	13.5	12.2
	90	0.75	96	74	59	50	42	37	30	25	21	18.6	16.5	14.9	13.5
06	15	0.37	47	37	29	24	21	18.3	14.7	12.2	10.5	9.2	8.1	7.3	6.7
	20	0.42	54	42	33	28	24	21	16.6	13.9	11.9	10.4	9.2	8.3	7.6
	30	0.52	67	51	41	34	29	26	21	17.2	14.7	12.9	11.4	10.3	9.4
	40	0.60	77	59	48	40	34	30	24	19.8	17.0	14.9	13.2	11.9	10.8
	50	0.67	86	66	53	44	38	33	27	22	19.0	16.6	14.7	13.3	12.1
	60	0.73	93	72	58	48	41	36	29	24	21	18.1	16.1	14.5	13.1
	75	0.82	105	81	65	54	46	41	32	27	23	20	18.0	16.2	14.8
	90	0.90	115	89	71	59	51	45	36	30	25	22	19.8	17.8	16.2
08	15	0.49	63	49	39	32	28	24	19.4	16.2	13.9	12.1	10.8	9.7	8.8
	20	0.57	73	56	45	38	32	28	23	18.8	16.1	14.1	12.5	11.3	10.3
	30	0.69	88	68	55	46	39	34	27	23	19.5	17.1	15.2	13.7	12.4
	40	0.80	102	79	63	53	45	40	32	26	23	19.8	17.6	15.8	14.4
	50	0.89	114	88	70	59	50	44	35	29	25	22	19.6	17.6	16.0
	60	0.98	125	97	78	65	55	49	39	32	28	24	22	19.4	17.6
	75	1.10	141	109	87	73	62	54	44	36	31	27	24	22	19.8
	90	1.20	154	119	95	79	68	59	48	40	34	30	26	24	22
10	15	0.61	78	60	48	40	35	30	24	20	17.3	15.1	13.4	12.1	11.0
	20	0.71	91	70	56	47	40	35	28	23	20	17.6	15.6	14.1	12.8
	30	0.87	111	86	69	57	49	43	34	29	25	22	19.1	17.2	15.7
	40	1.00	128	99	79	66	57	50	40	33	28	25	22	19.8	18.0
	50	1.12	143	111	89	74	63	55	44	37	32	28	25	22	20
	60	1.22	156	121	97	81	69	60	48	40	35	30	27	24	22
	75	1.37	175	136	109	90	78	68	54	45	39	34	30	27	25
	90	1.50	192	149	119	99	85	74	59	50	42	37	33	30	27
15	15	0.92	118	91	73	61	52	46	36	30	26	23	20	18.2	16.6
	20	1.06	136	105	84	70	60	52	42	35	30	26	23	21	19.1
	30	1.30	166	129	103	86	74	64	51	43	37	32	29	26	23
	40	1.50	192	149	119	99	85	74	59	50	42	37	33	30	27
	50	1.68	215	166	133	111	95	83	67	55	48	42	37	33	30
	60	1.84	236	182	146	121	104	91	73	61	52	46	40	36	33
	75	2.05	262	203	162	135	116	101	81	68	58	51	45	41	37
	90	2.25	288	223	178	149	127	111	89	74	64	56	50	45	41
20	15	1.22	156	121	97	81	69	60	48	40	35	30	27	24	22
	20	1.41	180	140	112	93	80	70	56	47	40	35	31	28	25
	30	1.73	221	171	137	114	98	86	69	57	49	43	38	34	31
	40	2.00	256	198	158	132	113	99	79	66	57	50	44	40	36
	50	2.24	287	222	177	148	127	111	89	74	63	55	49	44	40
	60	2.45	314	243	194	162	139	121	97	81	69	61	54	49	44
	75	2.74	351	271	217	181	155	136	109	90	78	68	60	54	49
	90	3.00	384	297	238	198	170	149	119	99	85	74	66	59	54

Note: Always double check your application rates. Tabulations are based on spraying water at 70°F (21°C).

Technical Information

Universal Application Rate Chart for 20″ Tip Spacing

TIP CAPACITY	LIQUID PRESSURE IN PSI	CAPACITY 1 NOZZLE IN GPM	CAPACITY 1 NOZZLE IN OZ./MIN.	GALLONS PER ACRE – 20″ NOZZLE SPACING											
				4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	18 MPH	20 MPH	22 MPH
01	15	0.061	7.8	4.5	3.6	3.0	2.6	2.3	1.8	1.5	1.3	1.1	1.0	0.91	0.82
	20	0.071	9.1	5.3	4.2	3.5	3.0	2.6	2.1	1.8	1.5	1.3	1.2	1.1	0.96
	30	0.087	11	6.5	5.2	4.3	3.7	3.2	2.6	2.2	1.8	1.6	1.4	1.3	1.2
	40	0.10	13	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9	1.7	1.5	1.4
	50	0.11	14	8.2	6.5	5.4	4.7	4.1	3.3	2.7	2.3	2.0	1.8	1.6	1.5
	60	0.12	15	8.9	7.1	5.9	5.1	4.5	3.6	3.0	2.5	2.2	2.0	1.8	1.6
	75	0.14	18	10.4	8.3	6.9	5.9	5.2	4.2	3.5	3.0	2.6	2.3	2.1	1.9
	90	0.15	19	11.1	8.9	7.4	6.4	5.6	4.5	3.7	3.2	2.8	2.5	2.2	2.0
015	15	0.092	12	6.8	5.5	4.6	3.9	3.4	2.7	2.3	2.0	1.7	1.5	1.4	1.2
	20	0.11	14	8.2	6.5	5.4	4.7	4.1	3.3	2.7	2.3	2.0	1.8	1.6	1.5
	30	0.13	17	9.7	7.7	6.4	5.5	4.8	3.9	3.2	2.8	2.4	2.1	1.9	1.8
	40	0.15	19	11.1	8.9	7.4	6.4	5.6	4.5	3.7	3.2	2.8	2.5	2.2	2.0
	50	0.17	22	12.6	10.1	8.4	7.2	6.3	5.0	4.2	3.6	3.2	2.8	2.5	2.3
	60	0.18	23	13.4	10.7	8.9	7.6	6.7	5.3	4.5	3.8	3.3	3.0	2.7	2.4
	75	0.21	27	15.6	12.5	10.4	8.9	7.8	6.2	5.2	4.5	3.9	3.5	3.1	2.8
	90	0.23	29	17.1	13.7	11.4	9.8	8.5	6.8	5.7	4.9	4.3	3.8	3.4	3.1
02	15	0.12	15	8.9	7.1	5.9	5.1	4.5	3.6	3.0	2.5	2.2	2.0	1.8	1.6
	20	0.14	18	10.4	8.3	6.9	5.9	5.2	4.2	3.5	3.0	2.6	2.3	2.1	1.9
	30	0.17	22	12.6	10.1	8.4	7.2	6.3	5.0	4.2	3.6	3.2	2.8	2.5	2.3
	40	0.20	26	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	3.3	3.0	2.7
	50	0.22	28	16.3	13.1	10.9	9.3	8.2	6.5	5.4	4.7	4.1	3.6	3.3	3.0
	60	0.24	31	17.8	14.3	11.9	10.2	8.9	7.1	5.9	5.1	4.5	4.0	3.6	3.2
	75	0.27	35	20	16.0	13.4	11.5	10.0	8.0	6.7	5.7	5.0	4.5	4.0	3.6
	90	0.30	38	22	17.8	14.9	12.7	11.1	8.9	7.4	6.4	5.6	5.0	4.5	4.1
025	15	0.15	19	11.1	8.9	7.4	6.4	5.6	4.5	3.7	3.2	2.8	2.5	2.2	2.0
	20	0.18	23	13.4	10.7	8.9	7.6	6.7	5.3	4.5	3.8	3.3	3.0	2.7	2.4
	30	0.22	28	16.3	13.1	10.9	9.3	8.2	6.5	5.4	4.7	4.1	3.6	3.3	3.0
	40	0.25	32	18.6	14.9	12.4	10.6	9.3	7.4	6.2	5.3	4.6	4.1	3.7	3.4
	50	0.28	36	21	16.6	13.9	11.9	10.4	8.3	6.9	5.9	5.2	4.6	4.2	3.8
	60	0.31	40	23	18.4	15.3	13.2	11.5	9.2	7.7	6.6	5.8	5.1	4.6	4.2
	75	0.34	44	25	20	16.8	14.4	12.6	10.1	8.4	7.2	6.3	5.6	5.0	4.6
	90	0.38	49	28	23	18.8	16.1	14.1	11.3	9.4	8.1	7.1	6.3	5.6	5.1
03	15	0.18	23	13.4	10.7	8.9	7.6	6.7	5.3	4.5	3.8	3.3	3.0	2.7	2.4
	20	0.21	27	15.6	12.5	10.4	8.9	7.8	6.2	5.2	4.5	3.9	3.5	3.1	2.8
	30	0.26	33	19.3	15.4	12.9	11.0	9.7	7.7	6.4	5.5	4.8	4.3	3.9	3.5
	40	0.30	38	22	17.8	14.9	12.7	11.1	8.9	7.4	6.4	5.6	5.0	4.5	4.1
	50	0.34	44	25	20	16.8	14.4	12.6	10.1	8.4	7.2	6.3	5.6	5.0	4.6
	60	0.37	47	27	22	18.3	15.7	13.7	11.0	9.2	7.8	6.9	6.1	5.5	5.0
	75	0.41	52	30	24	20	17.4	15.2	12.2	10.1	8.7	7.6	6.8	6.1	5.5
	90	0.45	58	33	27	22	19.1	16.7	13.4	11.1	9.5	8.4	7.4	6.7	6.1
04	15	0.24	31	17.8	14.3	11.9	10.2	8.9	7.1	5.9	5.1	4.5	4.0	3.6	3.2
	20	0.28	36	21	16.6	13.9	11.9	10.4	8.3	6.9	5.9	5.2	4.6	4.2	3.8
	30	0.35	45	26	21	17.3	14.9	13.0	10.4	8.7	7.4	6.5	5.8	5.2	4.7
	40	0.40	51	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	6.6	5.9	5.4
	50	0.45	58	33	27	22	19.1	16.7	13.4	11.1	9.5	8.4	7.4	6.7	6.1
	60	0.49	63	36	29	24	21	18.2	14.6	12.1	10.4	9.1	8.1	7.3	6.6
	75	0.55	70	41	33	27	23	20	16.3	13.6	11.7	10.2	9.1	8.2	7.4
	90	0.60	77	45	36	30	25	22	17.8	14.9	12.7	11.1	9.9	8.9	8.1
05	15	0.31	40	23	18.4	15.3	13.2	11.5	9.2	7.7	6.6	5.8	5.1	4.6	4.2
	20	0.35	45	26	21	17.3	14.9	13.0	10.4	8.7	7.4	6.5	5.8	5.2	4.7
	30	0.43	55	32	26	21	18.2	16.0	12.8	10.6	9.1	8.0	7.1	6.4	5.8
	40	0.50	64	37	30	25	21	18.6	14.9	12.4	10.6	9.3	8.3	7.4	6.8
	50	0.56	72	42	33	28	24	21	16.6	13.9	11.9	10.4	9.2	8.3	7.6
	60	0.61	78	45	36	30	26	23	18.1	15.1	12.9	11.3	10.1	9.1	8.2
	75	0.68	87	50	40	34	29	25	20	16.8	14.4	12.6	11.2	10.1	9.2
	90	0.75	96	56	45	37	32	28	22	18.6	15.9	13.9	12.4	11.1	10.1
06	15	0.37	47	27	22	18.3	15.7	13.7	11.0	9.2	7.8	6.9	6.1	5.5	5.0
	20	0.42	54	31	25	21	17.8	15.6	12.5	10.4	8.9	7.8	6.9	6.2	5.7
	30	0.52	67	39	31	26	22	19.3	15.4	12.9	11.0	9.7	8.6	7.7	7.0
	40	0.60	77	45	36	30	25	22	17.8	14.9	12.7	11.1	9.9	8.9	8.1
	50	0.67	86	50	40	33	28	25	19.9	16.6	14.2	12.4	11.1	9.9	9.0
	60	0.73	93	54	43	36	31	27	22	18.1	15.5	13.6	12.0	10.8	9.9
	75	0.82	105	61	49	41	35	30	24	20	17.4	15.2	13.5	12.2	11.1
	90	0.90	115	67	53	45	38	33	27	22	19.1	16.7	14.9	13.4	12.2
08	15	0.49	63	36	29	24	21	18.2	14.6	12.1	10.4	9.1	8.1	7.3	6.6
	20	0.57	73	42	34	28	24	21	16.9	14.1	12.1	10.6	9.4	8.5	7.7
	30	0.69	88	51	41	34	29	26	20	17.1	14.6	12.8	11.4	10.2	9.3
	40	0.80	102	59	48	40	34	30	24	19.8	17.0	14.9	13.2	11.9	10.8
	50	0.89	114	66	53	44	38	33	26	22	18.9	16.5	14.7	13.2	12.0
	60	0.98	125	73	58	49	42	36	29	24	21	18.2	16.2	14.6	13.2
	75	1.10	141	82	65	54	47	41	33	27	23	20	18.2	16.3	14.9
	90	1.20	154	89	71	59	51	45	36	30	25	22	19.8	17.8	16.2
10	15	0.61	78	45	36	30	26	23	18.1	15.1	12.9	11.3	10.1	9.1	8.2
	20	0.71	91	53	42	35	30	26	21	17.6	15.1	13.2	11.7	10.5	9.6
	30	0.87	111	65	52	43	37	32	26	22	18.5	16.1	14.4	12.9	11.7
	40	1.00	128	74	59	50	42	37	30	25	21	18.6	16.5	14.9	13.5
	50	1.12	143	83	67	55	48	42	33	28	24	21	18.5	16.6	15.1
	60	1.22	156	91	72	60	52	45	36	30	26	23	20	18.1	16.5
	75	1.37	175	102	81	68	58	51	41	34	29	25	23	20	18.5
	90	1.50	192	111	89	74	64	56	45	37	32	28	25	22	20
15	15	0.92	118	68	55	46	39	34	27	23	19.5	17.1	15.2	13.7	12.4
	20	1.06	136	79	63	52	45	39	31	26	22	19.7	17.5	15.7	14.3
	30	1.30	166	97	77	64	55	48	39	32	28	24	21	19.3	17.6
	40	1.50	192	111	89	74	64	56	45	37	32	28	25	22	20
	50	1.68	215	125	100	83	71	62	50	42	36	31	28	25	23
	60	1.84	236	137	109	91	78	68	55	46	39	34	30	27	25
	75	2.05	262	152	122	101	87	76	61	51	43	38	34	30	28
	90	2.25	288	167	134	111	95	84	67	56	48	42	37	33	30
20	15	1.22	156	91	72	60	52	45	36	30	26	23	20	18.1	16.5
	20	1.41	180	105	84	70	60	52	42	35	30	26	23	21	19.0
	30	1.73	221	128	103	86	73	64	51	43	37	32	29	26	23
	40	2.00	256	149	119	99	85	74	59	50	42	37	33	30	27
	50	2.24	287	166	133	111	95	83	67	55	48	42	37	33	30
	60	2.45	314	182	146	121	104	91	73	61	52	45	40	36	33
	75	2.74	351	203	163	136	116	102	81	68	58	51	45	41	37
	90	3.00	384	223	178	149	127	111	89	74	64	56	50	45	41

Note: Always double check your application rates. Tabulations are based on spraying water at 70°F (21°C).

A=$\frac{B+C}{D}$

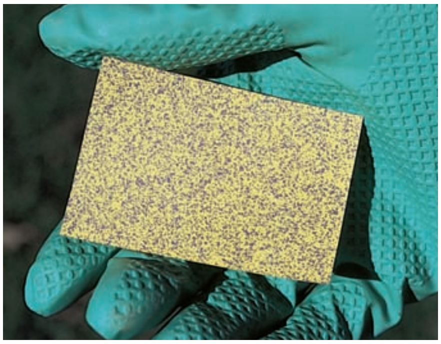
Technical Information

Universal Application Rate Chart for 30″ Tip Spacing

TIP CAPACITY	LIQUID PRESSURE IN PSI	CAPACITY 1 NOZZLE IN GPM	CAPACITY 1 NOZZLE IN OZ./MIN.	GALLONS PER ACRE – 30″ NOZZLE SPACING											
				4 MPH	5 MPH	6 MPH	7 MPH	8 MPH	10 MPH	12 MPH	14 MPH	16 MPH	18 MPH	20 MPH	22 MPH
01	15	0.061	7.8	3.0	2.4	2.0	1.7	1.5	1.2	1.0	0.86	0.75	0.67	0.60	0.55
	20	0.071	9.1	3.5	2.8	2.3	2.0	1.8	1.4	1.2	1.0	0.88	0.78	0.70	0.64
	30	0.087	11	4.3	3.4	2.9	2.5	2.2	1.7	1.4	1.2	1.1	0.96	0.86	0.78
	40	0.10	13	5.0	4.0	3.3	2.8	2.5	2.0	1.7	1.4	1.2	1.1	0.99	0.90
	50	0.11	14	5.4	4.4	3.6	3.1	2.7	2.2	1.8	1.6	1.4	1.2	1.1	0.99
	60	0.12	15	5.9	4.8	4.0	3.4	3.0	2.4	2.0	1.7	1.5	1.3	1.2	1.1
	75	0.14	18	6.9	5.5	4.6	4.0	3.5	2.8	2.3	2.0	1.7	1.5	1.4	1.3
	90	0.15	19	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9	1.7	1.5	1.4
015	15	0.092	12	4.6	3.6	3.0	2.6	2.3	1.8	1.5	1.3	1.1	1.0	0.91	0.83
	20	0.11	14	5.4	4.4	3.6	3.1	2.7	2.2	1.8	1.6	1.4	1.2	1.1	0.99
	30	0.13	17	6.4	5.1	4.3	3.7	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.2
	40	0.15	19	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9	1.7	1.5	1.4
	50	0.17	22	8.4	6.7	5.6	4.8	4.2	3.4	2.8	2.4	2.1	1.9	1.7	1.5
	60	0.18	23	8.9	7.1	5.9	5.1	4.5	3.6	3.0	2.5	2.2	2.0	1.8	1.6
	75	0.21	27	10.4	8.3	6.9	5.9	5.2	4.2	3.5	3.0	2.6	2.3	2.1	1.9
	90	0.23	29	11.4	9.1	7.6	6.5	5.7	4.6	3.8	3.3	2.8	2.5	2.3	2.1
02	15	0.12	15	5.9	4.8	4.0	3.4	3.0	2.4	2.0	1.7	1.5	1.3	1.2	1.1
	20	0.14	18	6.9	5.5	4.6	4.0	3.5	2.8	2.3	2.0	1.7	1.5	1.4	1.3
	30	0.17	22	8.4	6.7	5.6	4.8	4.2	3.4	2.8	2.4	2.1	1.9	1.7	1.5
	40	0.20	26	9.9	7.9	6.6	5.7	5.0	4.0	3.3	2.8	2.5	2.2	2.0	1.8
	50	0.22	28	10.9	8.7	7.3	6.2	5.4	4.4	3.6	3.1	2.7	2.4	2.2	2.0
	60	0.24	31	11.9	9.5	7.9	6.8	5.9	4.8	4.0	3.4	3.0	2.6	2.4	2.2
	75	0.27	35	13.4	10.7	8.9	7.6	6.7	5.3	4.5	3.8	3.3	3.0	2.7	2.4
	90	0.30	38	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	3.3	3.0	2.7
025	15	0.15	19	7.4	5.9	5.0	4.2	3.7	3.0	2.5	2.1	1.9	1.7	1.5	1.4
	20	0.18	23	8.9	7.1	5.9	5.1	4.5	3.6	3.0	2.5	2.2	2.0	1.8	1.6
	30	0.22	28	10.9	8.7	7.3	6.2	5.4	4.4	3.6	3.1	2.7	2.4	2.2	2.0
	40	0.25	32	12.4	9.9	8.3	7.1	6.2	5.0	4.1	3.5	3.1	2.8	2.5	2.3
	50	0.28	36	13.9	11.1	9.2	7.9	6.9	5.5	4.6	4.0	3.5	3.1	2.8	2.5
	60	0.31	40	15.3	12.3	10.2	8.8	7.7	6.1	5.1	4.4	3.8	3.4	3.1	2.8
	75	0.34	44	16.8	13.5	11.2	9.6	8.4	6.7	5.6	4.8	4.2	3.7	3.4	3.1
	90	0.38	49	18.8	15.0	12.5	10.7	9.4	7.5	6.3	5.4	4.7	4.2	3.8	3.4
03	15	0.18	23	8.9	7.1	5.9	5.1	4.5	3.6	3.0	2.5	2.2	2.0	1.8	1.6
	20	0.21	27	10.4	8.3	6.9	5.9	5.2	4.2	3.5	3.0	2.6	2.3	2.1	1.9
	30	0.26	33	12.9	10.3	8.6	7.4	6.4	5.1	4.3	3.7	3.2	2.9	2.6	2.3
	40	0.30	38	14.9	11.9	9.9	8.5	7.4	5.9	5.0	4.2	3.7	3.3	3.0	2.7
	50	0.34	44	16.8	13.5	11.2	9.6	8.4	6.7	5.6	4.8	4.2	3.7	3.4	3.1
	60	0.37	47	18.3	14.7	12.2	10.5	9.2	7.3	6.1	5.2	4.6	4.1	3.7	3.3
	75	0.41	52	20	16.2	13.5	11.6	10.1	8.1	6.8	5.8	5.1	4.5	4.1	3.7
	90	0.45	58	22	17.8	14.9	12.7	11.1	8.9	7.4	6.4	5.6	5.0	4.5	4.1
04	15	0.24	31	11.9	9.5	7.9	6.8	5.9	4.8	4.0	3.4	3.0	2.6	2.4	2.2
	20	0.28	36	13.9	11.1	9.2	7.9	6.9	5.5	4.6	4.0	3.5	3.1	2.8	2.5
	30	0.35	45	17.3	13.9	11.6	9.9	8.7	6.9	5.8	5.0	4.3	3.9	3.5	3.2
	40	0.40	51	19.8	15.8	13.2	11.3	9.9	7.9	6.6	5.7	5.0	4.4	4.0	3.6
	50	0.45	58	22	17.8	14.9	12.7	11.1	8.9	7.4	6.4	5.6	5.0	4.5	4.1
	60	0.49	63	24	19.4	16.2	13.9	12.1	9.7	8.1	6.9	6.1	5.4	4.9	4.4
	75	0.55	70	27	22	18.2	15.6	13.6	10.9	9.1	7.8	6.8	6.1	5.4	5.0
	90	0.60	77	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	6.6	5.9	5.4
05	15	0.31	40	15.3	12.3	10.2	8.8	7.7	6.1	5.1	4.4	3.8	3.4	3.1	2.8
	20	0.35	45	17.3	13.9	11.6	9.9	8.7	6.9	5.8	5.0	4.3	3.9	3.5	3.2
	30	0.43	55	21	17.0	14.2	12.2	10.6	8.5	7.1	6.1	5.3	4.7	4.3	3.9
	40	0.50	64	25	19.8	16.5	14.1	12.4	9.9	8.3	7.1	6.2	5.5	5.0	4.5
	50	0.56	72	28	22	18.5	15.8	13.9	11.1	9.2	7.9	6.9	6.2	5.5	5.0
	60	0.61	78	30	24	20	17.3	15.1	12.1	10.1	8.6	7.5	6.7	6.0	5.5
	75	0.68	87	34	27	22	19.2	16.8	13.5	11.2	9.6	8.4	7.5	6.7	6.1
	90	0.75	96	37	30	25	21	18.6	14.9	12.4	10.6	9.3	8.3	7.4	6.8
06	15	0.37	47	18.3	14.7	12.2	10.5	9.2	7.3	6.1	5.2	4.6	4.1	3.7	3.3
	20	0.42	54	21	16.6	13.9	11.9	10.4	8.3	6.9	5.9	5.2	4.6	4.2	3.8
	30	0.52	67	26	21	17.2	14.7	12.9	10.3	8.6	7.4	6.4	5.7	5.1	4.7
	40	0.60	77	30	24	19.8	17.0	14.9	11.9	9.9	8.5	7.4	6.6	5.9	5.4
	50	0.67	86	33	27	22	19.0	16.6	13.3	11.1	9.5	8.3	7.4	6.6	6.0
	60	0.73	93	36	29	24	21	18.1	14.5	12.0	10.3	9.0	8.0	7.2	6.6
	75	0.82	105	41	32	27	23	20	16.2	13.5	11.6	10.1	9.0	8.1	7.4
	90	0.90	115	45	36	30	25	22	17.8	14.9	12.7	11.1	9.9	8.9	8.1
08	15	0.49	63	24	19.4	16.2	13.9	12.1	9.7	8.1	6.9	6.1	5.4	4.9	4.4
	20	0.57	73	28	23	18.8	16.1	14.1	11.3	9.4	8.1	7.1	6.3	5.6	5.1
	30	0.69	88	34	27	23	19.5	17.1	13.7	11.4	9.8	8.5	7.6	6.8	6.2
	40	0.80	102	40	32	26	23	19.8	15.8	13.2	11.3	9.9	8.8	7.9	7.2
	50	0.89	114	44	35	29	25	22	17.6	14.7	12.6	11.0	9.8	8.8	8.0
	60	0.98	125	49	39	32	28	24	19.4	16.2	13.9	12.1	10.8	9.7	8.8
	75	1.10	141	54	44	36	31	27	22	18.2	15.6	13.6	12.1	10.9	9.9
	90	1.20	154	59	48	40	34	30	24	19.8	17.0	14.9	13.2	11.9	10.8
10	15	0.61	78	30	24	20	17.3	15.1	12.1	10.1	8.6	7.5	6.7	6.0	5.5
	20	0.71	91	35	28	23	20	17.6	14.1	11.7	10.0	8.8	7.8	7.0	6.4
	30	0.87	111	43	34	29	25	22	17.2	14.4	12.3	10.8	9.6	8.6	7.8
	40	1.00	128	50	40	33	28	25	19.8	16.5	14.1	12.4	11.0	9.9	9.0
	50	1.12	143	55	44	37	32	28	22	18.5	15.8	13.9	12.3	11.1	10.1
	60	1.22	156	60	48	40	35	30	24	20	17.3	15.1	13.4	12.1	11.0
	75	1.37	175	68	54	45	39	34	27	23	19.4	17.0	15.1	13.6	12.3
	90	1.50	192	74	59	50	42	37	30	25	21	18.6	16.5	14.9	13.5
15	15	0.92	118	46	36	30	26	23	18.2	15.2	13.0	11.4	10.1	9.1	8.3
	20	1.06	136	52	42	35	30	26	21	17.5	15.0	13.1	11.7	10.5	9.5
	30	1.30	166	64	51	43	37	32	26	21	18.4	16.1	14.3	12.9	11.7
	40	1.50	192	74	59	50	42	37	30	25	21	18.6	16.5	14.9	13.5
	50	1.68	215	83	67	55	48	42	33	28	24	21	18.5	16.6	15.1
	60	1.84	236	91	73	61	52	46	36	30	26	23	20	18.2	16.6
	75	2.05	262	101	81	68	58	51	41	34	29	25	23	20	18.5
	90	2.25	288	111	89	74	64	56	45	37	32	28	25	22	20
20	15	1.22	156	60	48	40	35	30	24	20	17.3	15.1	13.4	12.1	11.0
	20	1.41	180	70	56	47	40	35	28	23	19.9	17.4	15.5	14.0	12.7
	30	1.73	221	86	69	57	49	43	34	29	24	21	19.0	17.1	15.6
	40	2.00	256	99	79	66	57	50	40	33	28	25	22	19.8	18.0
	50	2.24	287	111	89	74	63	55	44	37	32	28	25	22	20
	60	2.45	314	121	97	81	69	61	49	40	35	30	27	24	22
	75	2.74	351	136	109	90	78	68	54	45	39	34	30	27	25
	90	3.00	384	149	119	99	85	74	59	50	42	37	33	30	27

Note: Always double check your application rates. Tabulations are based on spraying water at 70°F (21°C).

Calibration/Adjustment Accessories



Water and Oil Sensitive Paper

These specially coated papers are used for evaluating spray distributions, swath widths, droplet densities and penetration of spray. Water sensitive paper is yellow and is stained blue by exposure to aqueous spray droplets. White oil sensitive paper turns black in areas exposed to oil droplets. For more information on water sensitive paper see Data Sheet 20301; for more information on oil sensitive paper see Data Sheet 20302.

Water and oil sensitive paper sold by TeeJet Technologies is manufactured by Syngenta Crop Protection AG.

WATER SENSITIVE PAPER		
PART NUMBER	PAPER SIZE	QUANTITY/PACKAGE
20301-1N	3″ x 1″	50 cards
20301-2N	3″ x 2″	50 cards
20301-3N	20″ x 1″	25 strips

OIL SENSITIVE PAPER		
PART NUMBER	PAPER SIZE	QUANTITY/PACKAGE
20302-1	3″ x 2″	50 cards

How to order:
Specify part number.
Example: 20301-1N
Water Sensitive Paper

TeeJet Tip Cleaning Brush

How to order:
Specify part number.
Example: CP20016-NY

TeeJet Calibration Container

The TeeJet Calibration Container features a 68 oz. (2.0 L) capacity and a raised dual scale in both U.S. and metric graduations. The container is molded of polypropylene for excellent chemical resistance and durability.

How to order:
Example: CP24034A-PP
(Calibration Container only)

Technical Information

Useful Formulas

$$\text{GPM (Per Nozzle)} = \frac{\text{GPA} \times \text{MPH} \times \text{W}}{5{,}940}$$

$$\text{GPM (Per Nozzle)} = \frac{\text{GAL/1000FT}^2 \times \text{MPH} \times \text{W}}{136}$$

$$\text{GPA} = \frac{5{,}940 \times \text{GPM (Per Nozzle)}}{\text{MPH} \times \text{W}}$$

$$\text{GAL/1000FT}^2 = \frac{136 \times \text{GPM (Per Nozzle)}}{\text{MPH} \times \text{W}}$$

GPM – Gallons Per Minute

GPA – Gallons Per Acre

GAL/1000FT^2 – Gallons Per 1000 Square Feet

MPH – Miles Per Hour

W – Nozzle spacing (in inches) for broadcast spraying
– Spray width (in inches) for single nozzle, band spraying or boomless spraying
– Row spacing (in inches) divided by the number of nozzles per row for directed spraying

Useful Formulas for Roadway Applications

$$\text{GPLM} = \frac{60 \times \text{GPM}}{\text{MPH}} \qquad \text{GPM} = \frac{\text{GPLM} \times \text{MPH}}{60}$$

GPLM = Gallons Per Lane Mile

Note: GPLM is not a normal volume per unit area measurement. It is a volume per distance measurement. Increases or decreases in lane width (swath width) are not accommodated by these formulas.

Measuring Travel Speed

Measure a test course in the area to be sprayed or in an area with similar surface conditions. Minimum lengths of 100 and 200 feet are recommended for measuring speeds up to 5 and 10 MPH, respectively. Determine the time required to travel the test course. To help ensure accuracy, conduct the speed check with a partially loaded (about half full) sprayer and select the engine throttle setting and gear that will be used when spraying. Repeat the above process and average the times that were measured. Use the following equation or the table at right to determine ground speed.

$$\text{Speed (MPH)} = \frac{\text{Distance (FT)} \times 60}{\text{Time (seconds)} \times 88}$$

Speeds

SPEED IN MPH	TIME REQUIRED IN SECONDS TO TRAVEL A DISTANCE OF:		
	100 Feet	200 Feet	300 Feet
1.0	68	136	205
1.5	45	91	136
2.0	34	68	102
2.5	27	55	82
3.0	23	45	68
3.5	19	39	58
4.0	17	34	51
4.5	15	30	45
5.0	14	27	41
5.5	—	25	37
6.0	—	23	34
6.5	—	21	31
7.0	—	19	29
7.5	—	18	27
8.0	—	17	26
8.5	—	16	24
9.0	—	15	23

Nozzle Spacing

If the nozzle spacing on your boom is different than those tabulated, multiply the tabulated GPA coverages by one of the following factors.

20″	
OTHER SPACING (INCHES)	CONVERSION FACTOR
8	2.5
10	2
12	1.67
14	1.43
16	1.25
18	1.11
22	.91
24	.83
30	.66

30″	
OTHER SPACING (INCHES)	CONVERSION FACTOR
26	1.15
28	1.07
32	.94
34	.88
36	.83
38	.79
40	.75
42	.71
44	.68

40″	
OTHER SPACING (INCHES)	CONVERSION FACTOR
28	1.43
30	1.33
32	1.25
34	1.18
36	1.11
38	1.05
42	.95
44	.91
48	.83

Miscellaneous Conversion Factors

One Acre = 43,560 Square Feet
= 43.56 1000FT^2 Blocks
= 0.405 Hectare

One Hectare = 2.471 Acres

One Gallon Per Acre
= 2.9 Fluid Ounces per 1000FT^2
= 9.35 Liters Per Hectare

One Gallon Per 1000FT^2 = 43.56 GPA

One Mile = 5,280 Feet
= 1,610 Meters
= 1.61 Kilometers

One Gallon = 128 Fluid Ounces
= 8 Pints
= 4 Quarts
= 3.79 Liters
= 0.83 Imperial Gallon

One Pound Per Square Inch
= 0.069 bar
= 6.896 Kilopascals

One Mile Per Hour = 1.609 Kilometers Per Hour

Suggested Minimum Spray Heights

The nozzle height suggestions in the table below are based on the minimum overlap required to obtain uniform distribution. However, in many cases, typical height adjustments are based on a 1 to 1 nozzle spacing to height ratio. For example, 110° flat spray tips spaced 20 inches apart are commonly set 20 inches above the target.

		(Inches)		
	Spray angle	20″	30″	40″
TP, TJ	65°	22–24″	33–35″	NR*
TP, XR, TX, DG, TJ, AI, XRC	80°	17–19″	26–28″	NR*
TP, XR, DG, TT, TTI, TJ, DGTJ, AI, AIXR, AIC, XRC, TTJ, AITTJ	110°	16–18″	20–22″	NR*
FullJet®	120°	10–18″**	14–18″**	14–18″**
FloodJet® TK, TF, K, QCK, QCTF, 1/4TTJ	120°	14–16″***	15–17″***	18–20″***

* Not recommended.

** Nozzle height based on 30° to 45° angle of orientation.

*** Wide angle spray tip height is influenced by nozzle orientation. The critical factor is to achieve a double spray pattern overlap.

Technical Information

Spraying Liquids with a Density Other Than Water

Since all the tabulations in this catalog are based on spraying water, which weighs 8.34 lbs. per USA gallon, conversion factors must be used when spraying liquids that are heavier or lighter than water. To determine the proper size nozzle for the liquid to be sprayed, first multiply the desired GPM or GPA of liquid by the water rate conversion factor. Then use the new converted GPM or GPA rate to select the proper size nozzle.

Example:

Desired application rate is 20 GPA of 28%N. Determine the correct nozzle size as follows:

GPA (liquid other than water) x Conversion Factor
= GPA (from table in catalog)

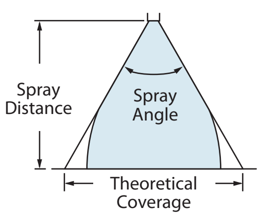
20 GPA (28%) x 1.13
= 22.6 GPA (water)

The applicator should choose a nozzle size that will supply 22.6 GPA of water at the desired pressure.

WEIGHT OF SOLUTION	SPECIFIC GRAVITY	CONVERSION FACTOR
7.0 lbs./gal.	.84	.92
8.0 lbs./gal.	.96	.98
8.34 lbs./gal.	1.00 – WATER	1.00
9.0 lbs./gal.	1.08	1.04
10.0 lbs./gal.	1.20	1.10
10.65 lbs./gal.	1.28 – 28% nitrogen	1.13
11.0 lbs./gal.	1.32	1.15
12.0 lbs./gal.	1.44	1.20
14.0 lbs./gal.	1.68	1.30

Spray Coverage Information

This table lists the theoretical coverage of spray patterns as calculated from the included spray angle of the spray and the distance from the nozzle orifice. These values are based on the assumption that the spray angle remains the same throughout the entire spray distance. In actual practice, the tabulated spray angle does not hold for long spray distances.

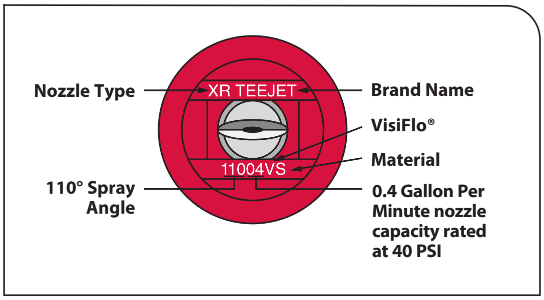


INCLUDED SPRAY ANGLE	THEORETICAL COVERAGE AT VARIOUS SPRAY HEIGHTS (IN INCHES)							
	8″	10″	12″	15″	18″	24″	30″	36″
15°	2.1	2.6	3.2	3.9	4.7	6.3	7.9	9.5
20°	2.8	3.5	4.2	5.3	6.4	8.5	10.6	12.7
25°	3.5	4.4	5.3	6.6	8.0	10.6	13.3	15.9
30°	4.3	5.4	6.4	8.1	9.7	12.8	16.1	19.3
35°	5.0	6.3	7.6	9.5	11.3	15.5	18.9	22.7
40°	5.8	7.3	8.7	10.9	13.1	17.5	21.8	26.2
45°	6.6	8.3	9.9	12.4	14.9	19.9	24.8	29.8
50°	7.5	9.3	11.2	14.0	16.8	22.4	28.0	33.6
55°	8.3	10.3	12.5	15.6	18.7	25.0	31.2	37.5
60°	9.2	11.5	13.8	17.3	20.6	27.7	34.6	41.6
65°	10.2	12.7	15.3	19.2	22.9	30.5	38.2	45.8
73°	11.8	14.8	17.8	22.0	27.0	36.0	44.0	53.0
80°	13.4	16.8	20.2	25.2	30.3	40.3	50.4	60.4
85°	14.7	18.3	22.0	27.5	33.0	44.0	55.4	66.4
90°	16.0	20.0	24.0	30.0	36.0	48.0	60.0	72.0
95°	17.5	21.8	26.2	32.8	40.3	52.4	65.5	78.6
100°	19.1	23.8	28.6	35.8	43.0	57.2	71.6	85.9
110°	22.8	28.5	34.3	42.8	51.4	68.5	85.6	103
120°	27.7	34.6	41.6	52.0	62.4	83.2	104	
130°	34.3	42.9	51.5	64.4	77.3	103		
140°	43.8	54.8	65.7	82.2	98.6			
150°	59.6	74.5	89.5					

Nozzle Nomenclature

There are many types of nozzles available, with each providing different flow rates, spray angles, droplet sizes and patterns. Some of these spray tip characteristics are indicated by the tip number.

Remember, when replacing tips, be sure to purchase the same tip number, thereby ensuring your sprayer remains properly calibrated.



Information About Spray Pressure

Flow Rate

Nozzle flow rate varies with spraying pressure. In general, the relationship between GPM and pressure is as follows:

$$\frac{GPM_1}{GPM_2} = \frac{\sqrt{PSI_1}}{\sqrt{PSI_2}}$$

This equation is explained by the illustration to the right. Simply stated, in order to double the flow through a nozzle, the pressure must be increased four times.

Higher pressure not only increases the flow rate through a nozzle, but it also influences the droplet size and the rate of orifice wear. As pressure is increased, the droplet size decreases and the rate of orifice wear increases.

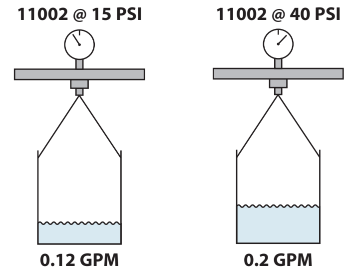
The values given in the tabulation sections of this catalog indicate the most commonly used pressure ranges for the associated spray tips. When information on the performance of spray tips outside of the pressure range given in this catalog is required, contact TeeJet Technologies or your local rep.

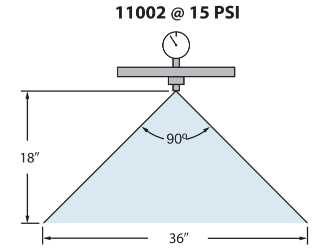
Spray Angle and Coverage

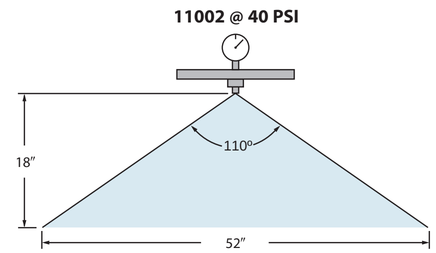
Depending on the nozzle type and size, the operating pressure can have a significant effect on spray angle and quality of spray distribution. As shown here for an 11002 flat spray tip, lowering the pressure results in a smaller spray angle and a significant reduction in spray coverage.

Tabulations for spray tips in this catalog are based on spraying water. Generally, liquids more viscous than water produce relatively smaller spray angles, while liquids with surface tensions lower than water will produce wider spray angles. In situations where the uniformity of spray distribution is important, be careful to operate your spray tips within the proper pressure range.

Note: Suggested minimum spray heights for broadcast spraying are based upon nozzles spraying water at the rated spray angle.







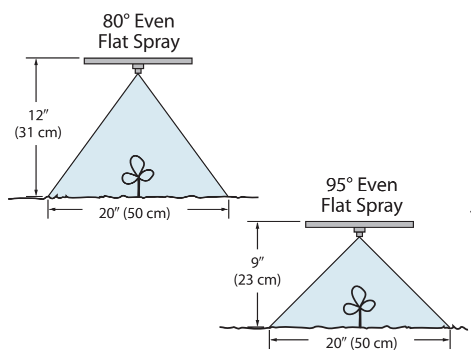
Pressure Drop Through Various Hose Sizes

FLOW IN GPM	PRESSURE DROP IN PSI (10′ [3 m] LENGTH WITHOUT COUPLINGS)				
	¼″ I.D.	3/8″ I.D.	½″ I.D.	¾″ I.D.	1″ I.D.
0.5	1.4	.2			
1.0		.7			
1.5		1.4	.4		
2.0		2.4	.6		
2.5		3.4	.9		
3.0			1.2		
4.0			2.0		
5.0			2.9	.4	
6.0			4.0	.6	
8.0				.9	.3
10.0				1.4	.4

Helpful Reminders for Band Spraying

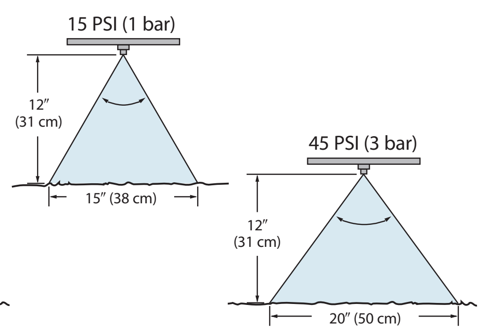
Wider angle spray tips allow the spray height to be lowered to minimize drift.

Example:



The spray angle of the nozzle and the resulting band width are directly influenced by the spraying pressure.

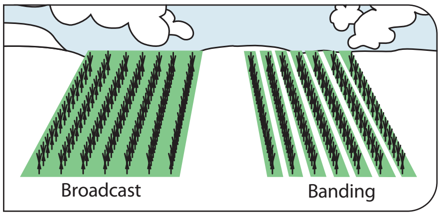
Example: 8002E Even Flat Spray



Use care when calculating:
Field Acres/Hectares vs. Treated Acres/Hectares

Field Acres/Hectares = Total Acres/Hectares of Planted Cropland

Treated Acres/Hectares = Field Acres/Hectares X $\frac{\text{Band Width}}{\text{Row Spacing}}$



Pressure Drop Through Sprayer Components

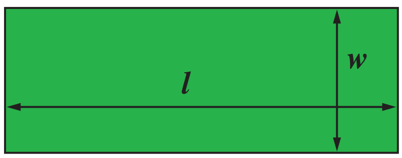
COMPONENT NUMBER	TYPICAL PRESSURE DROP (PSI) AT VARIOUS FLOW RATES (GPM)																					
	0.5 GPM	1.0 GPM	2.0 GPM	3.0 GPM	4.0 GPM	5.0 GPM	6.0 GPM	7.0 GPM	8.0 GPM	9.0 GPM	10 GPM	15 GPM	18 GPM	24 GPM	32 GPM	48 GPM	64 GPM	75 GPM	100 GPM	125 GPM	150 GPM	200 GPM
AA2 GunJet		0.2	0.9	2.0	3.4	5.3	7.3	10.0	13.0	16.0												
AA18 GunJet		0.6	2.2	5.0	8.3	13.0	18.4	25.0	33.0	40.0												
AA30L GunJet		0.6	2.2	5.0	9.0	14.0	20.2	27.5														
AA43 GunJet				0.4	0.6	1.0	1.5	2.0	2.6	3.3	4.1	9.2	13.2									
AA143 GunJet				0.3	0.6	0.9	1.3	1.7	2.2	2.8	3.5	7.9	11.3									
AA6B Valve				0.3	0.6	0.9	1.3	1.7	2.2	2.8	3.5	7.8	11.3	20.0								
AA17 Valve			0.2	0.5	0.8	1.3	1.8	2.5	3.2	4.1	5.0	11.3	16.2	28.8								
AA144A/144P Valve			0.2	0.5	0.8	1.3	1.8	2.5	3.2	4.1	5.0	11.3	16.2	28.8								
AA144A-1-3/AA144P-1-3 Valve			0.3	0.7	1.3	2.0	2.8	3.8	5.0	6.3	7.8	17.6	25.3									
AA145H Valve				0.2	0.4	0.6	0.8	1.1	1.4	1.8	2.2	5.0	7.2	12.8	22.8							
344 2-way Valve								0.2	0.3	0.4	0.5	1.1	1.6	2.8	5.0	11.3	20.0	27.5				
344 3-way Valve						0.2	0.3	0.4	0.6	0.7	0.9	2.0	2.8	5.0	8.9	20.0	35.6					
346 2-way Valve												0.1	0.2	0.3	0.5	1.2	2.0	2.8	5.0	7.8	11.3	20.0
346 3-way Valve												0.3	0.4	0.7	1.3	2.8	5.0	6.9	12.2	19.1	27.5	
356 Valve												0.1	0.2	0.3	0.5	1.2	2.0	2.8	5.0	7.8	11.3	20.0
430 2-way* Manifold			0.1	0.3	0.6	0.9	1.3	1.8	2.3	3.0	3.7	8.2	11.8	21.0								
430 3-way* Manifold			0.1	0.3	0.6	0.9	1.3	1.8	2.3	3.0	3.7	8.2	11.8	21.0								
430 FB* Manifold			0.2	0.5	0.9	1.5	2.1	2.9	3.8	4.8	5.9	13.3	19.1									
440* Manifold						0.2	0.3	0.4	0.5	0.6	0.7	1.7	2.4	4.3	7.6	17.0	30.3					
450* Manifold						0.1	0.2	0.2	0.3	0.4	0.5	1.1	1.6	2.8	5.0	11.3	20.0	27.5				
450 FB* Manifold						0.1	0.2	0.2	0.3	0.4	0.5	1.1	1.6	2.8	5.0	11.3	20.0	27.5				
460 2-way* Manifold						0.2	0.3	0.4	0.5	0.6	0.8	1.8	2.6	4.6	8.2	18.4	32.8					
460 3-way* Manifold						0.2	0.3	0.4	0.5	0.6	0.8	1.8	2.6	4.6	8.2	18.4	32.8					
460 FB* Manifold						0.2	0.3	0.4	0.6	0.7	0.9	2.0	2.8	5.0	8.9	20.0	35.6					
490* Manifold												0.1	0.2	0.3	0.5	1.2	2.0	2.8	5.0	7.8	11.3	20.0
540* Manifold						0.2	0.2	0.3	0.4	0.6	0.7	1.5	2.2	4.0	7.0	15.8	28.1					
QJ300 Nozzle Body	0.1	0.4	1.6	3.7	6.5	10.2	14.7	20.0														
QJ360C Nozzle Body	0.2	1.0	4.0	8.9	15.8	24.7																
QJ360E Nozzle Body	0.6	2.2	8.9	20.0	35.6																	
QJ360F Nozzle Body	0.1	0.4	1.7	3.9	6.9	10.8	15.6	21.2	27.7	35.0												
QJ380 Nozzle Body	0.1	0.6	2.2	5.0	8.9	13.9	20.0	27.2	35.6													
QJ380F Nozzle Body	0.1	0.2	1.0	2.2	4.0	6.2	8.9	12.1	15.8	20.0	24.7											
24230A/24216A Nozzle Body	0.5	2.0	7.8	17.6	31.3																	
QJ17560A Nozzle Body	0.2	1.0	4.0	8.9	15.8	24.7																
AA122-1/2 Line Strainer				0.3	0.6	0.9	1.3	1.7	2.2	2.8	3.5	7.8	11.3	20.0								
AA122-3/4 Line Strainer				0.2	0.3	0.5	0.7	1.0	1.3	1.6	2.0	4.4	6.3	11.3	20.0							
AA122-QC Line Strainer				0.1	0.2	0.4	0.6	0.8	1.0	1.3	1.5	3.5	5.0	8.9	15.8	35.6						
AA126-3 Line Strainer						0.2	0.3	0.5	0.6	0.8	0.9	2.1	3.1	5.4	9.7	21.8						
AA126-4/F50/M50 Line Strainer								0.2	0.3	0.3	0.4	0.9	1.3	2.4	4.2	9.4	16.7	23.0				
AA126-5 Line Strainer												0.3	0.5	0.8	1.5	3.3	5.9	8.1	14.4	22.4		
AA126-6/F75 Line Strainer												0.2	0.3	0.5	0.9	1.9	3.5	4.7	8.4	13.2	19.0	

*Manifold pressure drop data based on a single valve. Quantity of valves, inlet fitting size and inlet feed setup may affect pressure drop rating. Please contact your local TeeJet sale representative for additional information.

Area Measurement

It is essential to know the amount of area that you intend to cover when applying a pesticide or fertilizer. Turf areas such as home lawns and golf course greens, tees and fairways should be measured in square feet or acres, depending upon the units needed.

Rectangular Areas



Area = Length (***l***) x Width (***w***)

Example:

What is the area of a lawn that is 300 feet long and 150 feet wide?

Area = 300 feet x 150 feet
= 45,000 square feet

By using the following equation, it is possible to determine the area in acres.

$$\text{Area in acres} = \frac{\text{Area in square feet}}{\text{43,560 sq. ft. per acre}}$$

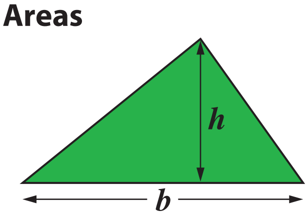
(There are 43,560 square feet in an acre.)

Example:

$$\text{Area in acres} = \frac{\text{45,000 sq. ft.}}{\text{43,560 sq. ft. per acre}}$$

$$= \text{1.03 acres}$$

Triangular Areas



$$\text{Area} = \frac{\text{Base } (b) \text{ x Height } (h)}{2}$$

Example:

The base of a corner lot is 250 feet while the height is 50 feet. What is the area of the lot?

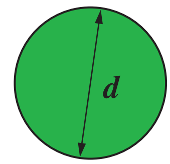
$$\text{Area} = \frac{\text{250 feet x 50 feet}}{2}$$

$$= \text{6,250 square feet}$$

$$\text{Area in acres} = \frac{\text{6,250 square feet}}{\text{43,560 sq. ft. per acre}}$$

$$= \text{0.14 acre}$$

Circular Areas



$$\text{Area} = \frac{\pi \text{ x Diameter}^2 (d)}{4}$$

$$\pi = 3.14159$$

Example:

What is the area of a green that has a diameter of 45 feet?

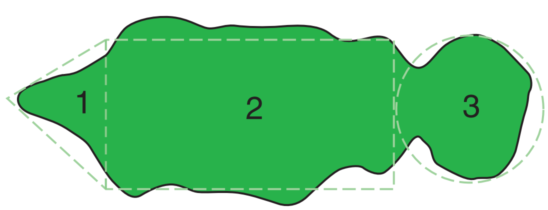
$$\text{Area} = \frac{\pi \text{ x (45 feet)}^2}{4} = \frac{\text{3.14 x 2025}}{4}$$

$$= \text{1,590 square feet}$$

$$\text{Area in acres} = \frac{\text{1,590 square feet}}{\text{43,560 sq. ft. per acre}}$$

$$= \text{0.04 acre}$$

Irregular Areas



Any irregularly shaped turf area can usually be reduced to one or more geometric figures. The area of each figure is calculated and the areas are then added together to obtain the total area.

Example:

What is the total area of the Par-3 hole illustrated above?

The area can be broken into a triangle (area 1), a rectangle (area 2) and a circle (area 3). Then use the previously mentioned equations for determining areas to find the total area.

$$\text{Area 1} = \frac{\text{25 feet x 30 feet}}{2} = \text{375 square feet}$$

$$\text{Area 2} = \text{25 feet x 475 feet} = \text{11,875 square feet}$$

$$\text{Area 3} = \frac{\text{3.14 x (45 feet)}^2}{4} = \text{1,590 square feet}$$

$$\text{Total Area} = \text{375 + 11,875 + 1,590} = \text{13,840 square feet}$$

$$= \frac{\text{13,840 square feet}}{\text{43,560 sq. ft. per acre}} = \text{0.32 acre}$$

Sprayer Calibration

Broadcast Application

Sprayer calibration **(1) readies your sprayer for operation** and **(2) diagnoses tip wear**. This will give you optimum performance of your TeeJet® tips.

Equipment Needed:

- TeeJet Calibration Container
- Calculator
- TeeJet Cleaning Brush
- One new TeeJet Spray Tip matched to the nozzles on your sprayer
- Stopwatch or wristwatch with second hand

STEP NUMBER 1

Check Your Tractor/Sprayer Speed!

Knowing your real sprayer speed is an essential part of accurate spraying. Speedometer readings and some electronic measurement devices can be inaccurate because of wheel slippage. Check the time required to move over a 100- or 200-foot strip on your field. Fence posts can serve as permanent markers. The starting post should be far enough away to permit your tractor/sprayer to reach desired spraying speed. Hold that speed as you travel between the "start" and "end" markers. Most accurate measurement will be obtained with the spray tank half full. Refer to the table on page 140 to calculate your real speed. When the correct throttle and gear settings are identified, mark your tachometer or speedometer to help you control this **vital** part of accurate chemical application.

STEP NUMBER 2

$A = \frac{B+C}{D}$ The Inputs

Before spraying, record the following:	**EXAMPLE**
Nozzle type on your sprayer (All nozzles must be identical)	TT11004 Flat Spray Tip
Recommended application volume (From manufacturer's label)	20 GPA
Measured sprayer speed	6 MPH
Nozzle spacing	20 Inches

STEP NUMBER 3

Calculating Required Nozzle Output

Determine GPM nozzle output from formula.

FORMULA: $GPM = \frac{GPA \times MPH \times W}{5{,}940 \text{ (constant)}}$

EXAMPLE: $GPM = \frac{20 \times 6 \times 20}{5{,}940} = \frac{2{,}400}{5{,}940}$

ANSWER: 0.404 GPM

STEP NUMBER 4

Setting the Correct Pressure

Turn on your sprayer and check for leaks or blockage. Inspect and clean, if necessary, all tips and strainers with TeeJet brush. Replace one tip and strainer **with an identical new tip and strainer** on sprayer boom.

Check appropriate tip selection table and determine the pressure required to deliver the nozzle output calculated from the formula in Step 3 for your new tip. Since all of the tabulations are based on spraying water, conversion factors must be used when spraying solutions that are heavier or lighter than water (see page 141).

Example: (Using above inputs) refer to TeeJet table on page 7 for TT11004 flat spray tip. The table shows that this nozzle delivers 0.40 GPM at 40 PSI.

Turn on your sprayer and adjust pressure. **Collect and measure the volume of the spray from the new tip for one minute in the collection jar.** Fine tune the pressure until you collect .40 GPM.

You have now adjusted your sprayer to the proper pressure. It will properly deliver the application rate specified by the chemical manufacturer at your measured sprayer speed.

STEP NUMBER 5

Checking Your System

Problem Diagnosis: Now, check the flow rate of a few tips on each boom section. If the flow rate of any tip is 10 percent greater or less than that of the newly installed spray tip, recheck the output of that tip. If only one tip is faulty, replace with new tip and strainer and your system is ready for spraying. However, if a second tip is defective, **replace all tips on the entire boom**. This may sound unrealistic, but two worn tips on a boom are ample indication of tip wear problems. Replacing only a couple of worn tips invites potentially serious application problems.

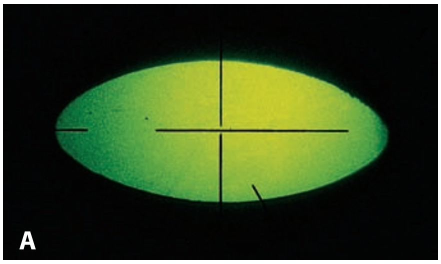
Banding and Directed Applications

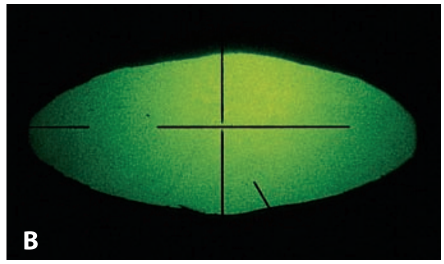
The only difference between the above procedure and calibrating for banding or directed applications is the input value used for "W" in the formula in Step 3.

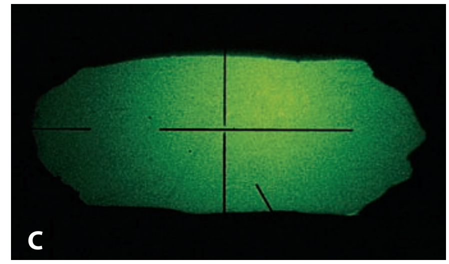
For single nozzle banding or boomless applications:
W = Sprayed band width or swath width (in inches).

For multiple nozzle directed applications:
W = Row spacing (in inches) divided by the number of nozzles per row.

Spray Tip Wear







Tips Don't Last Forever!

There is sufficient evidence that spray tips may be the most neglected component in today's farming. Even in countries with obligatory sprayer testing, spray tips are the most significant failure. On the other hand, they are among the most critical of items in proper application of valuable agricultural chemicals.

For example, a 10 percent over-application of chemical on a twice-sprayed 1,000-acre farm could represent a loss of $2,000–$10,000 based on today's chemical investments of $10.00–$50.00 per acre. This does not take into account potential crop damage.

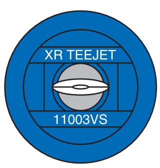
An Inside Look at Nozzle Orifice Wear and Damage

While wear may not be detected when visually inspecting a nozzle, it can be seen when viewed through an optical comparator. The edges of the worn nozzle (B) appear more rounded than the edges of the new nozzle (A). Damage to nozzle (C) was caused by improper cleaning. The spraying results from these tips can be seen in the illustrations below.

Determining Tip Wear

The best way to determine if a spray tip is excessively worn is to compare the flow rate from the used tip to the flow rate of a new tip of the same size and type. Charts in this catalog indicate the flow rates for new nozzles. Check the flow of each tip by using an accurate graduated collection container, a timing device and an accurate pressure gauge mounted at the nozzle tip. Compare the flow rate of the old tip to that of the new one. Spray tips are considered excessively worn and should be replaced when their flow exceeds the flow of a new tip by 10%. Reference page 145 for more information.

Spray Tip Care is the First Step to Successful Application

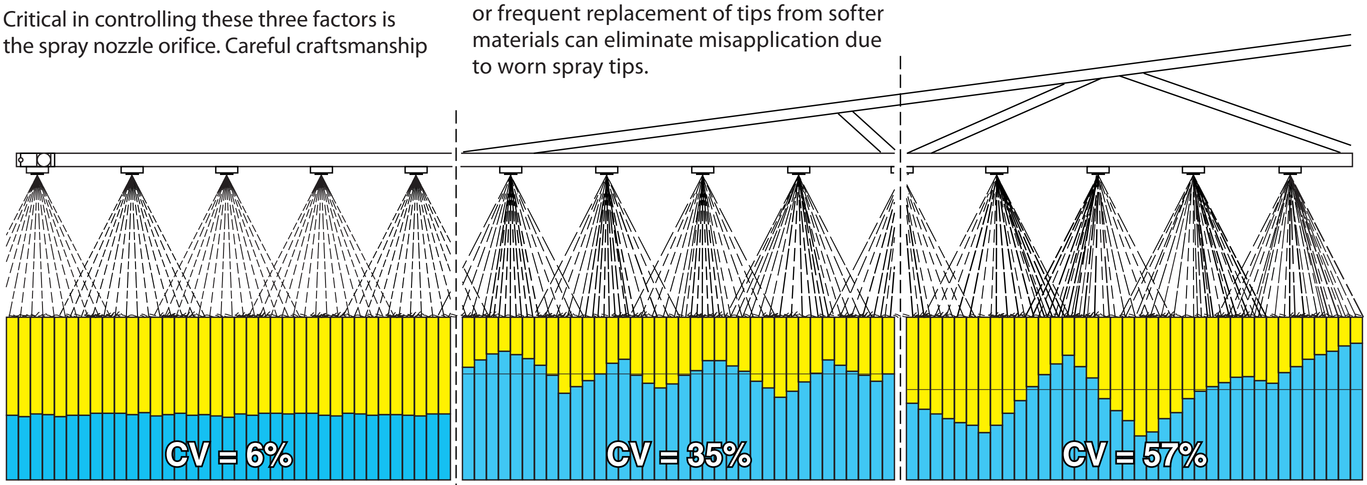


The successful performance of a crop chemical is highly dependent on its proper application as recommended by the chemical manufacturer. Proper selection and operation of spray nozzles are very important steps in accurate chemical application. The volume of spray passing through each nozzle plus the droplet size and spray distribution on the target can influence pest control.

Critical in controlling these three factors is the spray nozzle orifice. Careful craftsmanship goes into the precision manufacturing of each nozzle orifice. European standards, for example the JKI, require very small flow tolerances of new nozzles (+/-5%) of nominal flow. Many TeeJet nozzle types and sizes are already JKI-approved, which confirms the high quality standard designed into TeeJet nozzles. To maintain the quality in practical spraying as long as possible, the operator's job is the proper maintenance of those spray tips.

The illustration below compares the spraying results obtained from well-maintained vs. poorly-maintained spray tips. Poor spray distribution can be prevented. Selection of longer wearing tip materials or frequent replacement of tips from softer materials can eliminate misapplication due to worn spray tips.

Careful cleaning of a clogged spray tip can mean the difference between a clean field and one with weed streaks. Flat spray tips have finely crafted thin edges around the orifice to control the spray. Even the slightest damage from improper cleaning can cause both an increased flow rate and poor spray distribution. Be sure to use adequate strainers in your spray system to minimize clogging. If a tip does clog, only use a soft bristled brush or toothpick to clean it—never use a metal object. Use extreme care with soft tip materials such as plastic. Experience has shown that even a wooden toothpick can distort the orifice.



NEW SPRAY TIPS
Produce a uniform distribution when properly overlapped.

WORN SPRAY TIPS
Have a higher output with more spray concentrated under each tip.

DAMAGED SPRAY TIPS
Have a very erratic output – overapplying and underapplying.

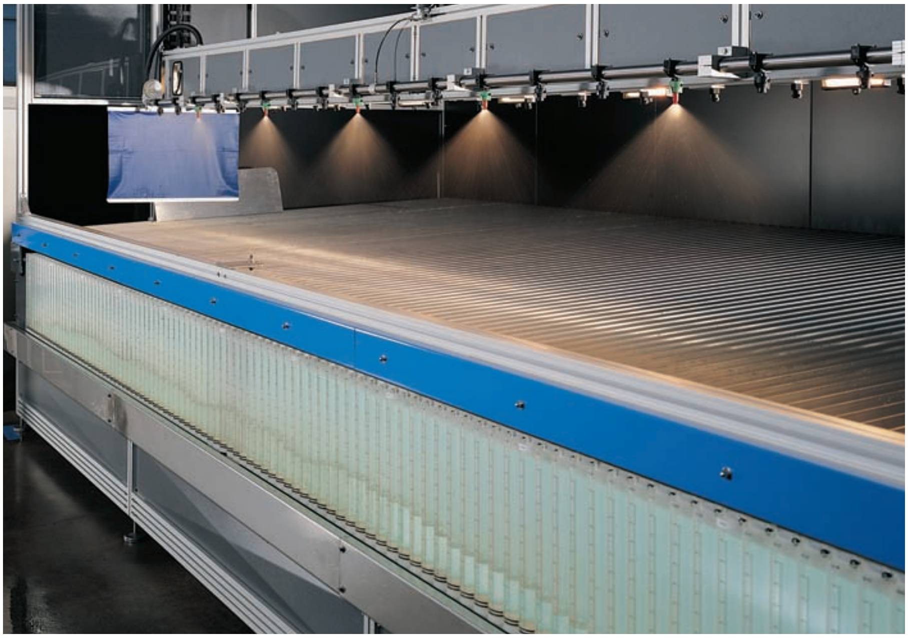
Spray Distribution Quality

One of the most overlooked factors that can dramatically influence the effectiveness of a given crop production chemical is spray distribution. The uniformity of the spray distribution across the boom or within the spray swath is an essential component to achieving maximum chemical effectiveness with minimal cost and minimal non-target contamination. This is more than critical if carrier and chemical rates are applied at the recommended minimum rate. There are many other factors influencing a crop production chemical's effectiveness, such as weather, application timing, active ingredient rates, pest infestation, etc. However, an operator must become aware of spray distribution quality if maximum efficiency is expected.

Measurement Techniques

Spray distribution can be measured in different ways. TeeJet Technologies and some sprayer manufacturers, as well as other research and testing stations, have patternators (spray tables) that collect the spray from nozzles on a standardized or real boom. These patternators have a number of channels aligned perpendicular to the nozzle spray. The channels carry the spray liquid into vessels for measuring and analysis (see photo with TeeJet patternator). Under controlled conditions, very accurate distribution measurements can be made for nozzle evaluation and development. Distribution measurements can also take place on an actual farm sprayer. For static measurements along the sprayer boom, a patternator equal or very similar to the one described earlier is placed under the boom in a stationary position or as a small patternator unit scanning the whole boom up to a width of 50 m. Any system of patternator measures electronically the quantity of water in each channel and calculates the values. A distribution quality test gives the applicator important information about the state of the nozzles on the boom. When much more detailed information about spray quality and coverage is required, a dynamic system—spraying a tracer (dye)—can be used. The same is true if the distribution within the swath on a boom has to be measured. Currently, only a few test units worldwide have the ability to perform a stationary test. These tests usually involve shaking or moving the spray boom to simulate actual field and application conditions.

Most of the distribution measuring devices result in data points representing the sprayer's boom swath uniformity. These data points can be very revealing just through visual observation. However, for comparison reasons, a statistical method is widely accepted. This method is Coefficient of Variation (Cv). The Cv compiles all the patternator data points and summarizes them into a simple percentage, indicating the amount of variation within a given distribution. For extremely uniform distributions under accurate conditions, the Cv can be ≤ 7%. In some European countries, nozzles must conform to very strict Cv specifications, while other countries may require the sprayer's distribution to be tested for uniformity every one or two years. These types of stipulations emphasize the great importance of distribution quality and its effect on crop production effectiveness.



Factors Affecting Distribution

There are a number of factors contributing to the distribution quality of a spray boom or resulting Cv percentage. During a static measurement, the following factors can significantly affect the distribution.

- Nozzles
  - type
  - pressure
  - spacing
  - spray angle
  - offset angle
  - spray pattern quality
  - flow rate
  - overlap
- Boom Height
- Worn Nozzles
- Pressure Losses
- Plugged Filters
- Plugged Nozzles
- Plumbing Factors Influencing Liquid Turbulence at Nozzle

Additionally, in the field during the spraying application or during a dynamic distribution test, the following can influence the distribution quality:

- Boom Stability
  - vertical movement (pitch)
  - horizontal movement (yaw)
- Environmental Conditions
  - wind velocity
  - wind direction
- Pressure Losses (sprayer plumbing)
- Sprayer Speed and Resulting Turbulence

The effect of distribution uniformity on the efficiency of a crop production chemical can vary under different circumstances. The crop production chemical itself can have dramatic influence over its efficiency. Always consult the manufacturer's chemical label or recommendation before spraying.

Droplet Size and Drift Information

A nozzle's spray pattern is made up of numerous spray droplets of varying sizes. Droplet size refers to the diameter of an individual spray droplet.

Since most nozzles have a wide distribution of droplet sizes (otherwise known as droplet spectrum), it is useful to summarize this with statistical analysis. Most advanced drop size measuring devices are automated, using computers and high-speed illumination sources such as lasers to analyze thousands of droplets in a few seconds. Through statistics, this large volume of data can be reduced to a single number that is representative of the drop sizes contained in the spray pattern and can then be classified into droplet size classes. These classes (extremely fine, very fine, fine, medium, coarse, very coarse, extremely coarse and ultra coarse) can then be used to compare one nozzle to another. Care must be taken when comparing one nozzle's drop size to another, as the specific testing procedure and instrument can bias the comparison.

Droplet sizes are usually measured in microns (micrometers). One micron equals 0.001 mm. The micron is a useful unit of measurement because it is small enough that whole numbers can be used in drop size measurement.

The majority of agricultural nozzles can be classified as producing either fine, medium, coarse or very coarse droplets. A nozzle with a coarse or very coarse droplet is usually selected to minimize off-target spray drift, while a nozzle with a fine droplet is required to obtain maximum surface coverage of the target plant.

To show comparisons between nozzle types, spray angle, pressure and flow rate, refer to the droplet size classes shown in the tables on pages 152–155.

Another droplet size measurement that is useful for determining a nozzle's drift potential is the percentage of driftable fines. Since the smaller droplets have a greater tendency to move off-target, it makes sense to determine what the percentage of small droplets is for a particular nozzle in order to minimize it when drift is a concern. Droplets below 150 microns are considered potential drift contributors. The table below shows several nozzles and their percentage of driftable fines.

TeeJet Technologies uses the most advanced measuring instrumentation (PDPA and Oxford lasers) to characterize sprays, obtaining droplet size and other important information. For the latest accurate information about nozzles and their droplet size, please contact your nearest TeeJet representative.

Driftable Droplets*

NOZZLE TYPE (0.50 GPM FLOW)	APPROXIMATE PERCENT OF SPRAY VOLUME LESS THAN 150 MICRONS	
	15 PSI	40 PSI
XR – Extended Range TeeJet (110º)	19%	30%
TT – Turbo TeeJet (110º)	4%	13%
TTJ60 – Turbo TwinJet (110º)	3%	10%
TF – Turbo FloodJet	2%	7%
AIXR – Air Induction XR (110º)	2%	7%
AITTJ60 – Air Induction Turbo TwinJet (110º)	1%	6%
AI – Air Induction TeeJet (110º)	N/A	5%
TTI – Turbo TeeJet Induction (110º)	<1%	2%

*Data obtained from Oxford VisiSizer system spraying water at 70ºF (21ºC) under laboratory conditions.

Assessment of Nozzle Drift Control in Europe

Several European countries now consider it important to assess nozzles for spray drift control as this enables general cooperation between agriculture, nature conservation and environmental protection. Although spray pattern distribution testing has been carried out for several decades (see page 147), preliminary assessment criteria for drift control during chemical applications were first defined in the 1980's and 1990's. A minimum value was determined for the small droplet ratio ($D_{v0.1}$) of nozzles. The development of the XR TeeJet® nozzles, together with the first generation of drift control nozzles (DG TeeJet®), achieved significant advances in crop protection technology. However, these proved insufficient as environmental regulations on chemical application became more and more restrictive. Stricter requirements for buffer strips to protect surface water and sensitive areas around fields in particular have led to the development of a program that assesses nozzle drift control as well as to innovative nozzles producing larger droplet sizes. While nozzle development is described on pages 150 and 151, priority here is given to describing drift control evaluation programs.

Drift control assessment systems in Europe

Countries such as the UK, the Netherlands and Germany do not use standardized systems for measuring reduction in drift. However, one aspect shared by all systems is they all use a reference system based on the 03 nozzle specified in the BCPC droplet size classification scheme at 43.5 PSI (3 bar) pressure and at a spray height of 19.7" (50 cm) above the target surface. Drift from this nozzle is defined as 100%. The drift control levels from other nozzle types at the same pressure are compared with this reference nozzle. For example, a nozzle categorized as 50% produces at least 50% less drift than the reference nozzle. The countries mentioned above have compiled corresponding percentage drift control categories, which vary from one another in some areas and are valid only at a national level.

While in Germany drift control categories of 50% / 75% / 90% / 99% apply, they are categorized as 50% / 75% / 90% / 95% in the Netherlands and as 25% / 50% / 75% in the UK. Furthermore, the same nozzle type and size operated at the same pressure may be categorized as 50% in country A and 75% in country B. This is due to different methods of measurement and calculation. The future may lead to international standardization emerging over the next few years as a result of approaching EU harmonization. At present, TeeJet Technologies is obliged to test new developments and have them assessed in each of these countries to verify the effectiveness of the technical advances so farmers can use our products without fearing conflict with the government.

The system in Germany

In Germany, the Julius Kühn Institute-Federal Research Institute for Cultivated Plants (JKI), is responsible for testing nozzles for agricultural use. Drift measurements are taken in the field under the most standardized conditions possible for temperature, wind direction, wind velocity and forward speed. This method is mandatory for testing air-assisted sprayers and their affect on nozzles used on permanent crops such as orchards and vineyards. Thanks to field measurements recorded over many years and their high correlation with temperature-controlled wind tunnel measurements, drift measurements on agricultural nozzles can now also be conducted at the JKI wind tunnel in absolutely standardized conditions. In all cases, tracer methods are used to quantify droplets of a high detection limit on artificial collectors and feed the data into a "DIX model" (drift potential index). This gives DIX values expressed as categories in the percentage drift reduction classes.

The system in the UK

The UK currently uses only one assessment system for agricultural nozzles. The Pesticide Safety Directorate (PSD) evaluates data recorded in the wind tunnel, but in contrast to the JKI, it records the droplets landed on horizontal collectors. The climatic conditions are standardized as well. The test nozzle is compared with the BCPC reference nozzle and awarded a corresponding star rating where one star equates to drift levels up to 75%, two stars up to 50% and three stars up to 25% of those of the reference system.

The system in the Netherlands

Although the Dutch have used an assessment system for agricultural nozzles for several years (Lozingenbesluit Open Teelten Veehouderij/ Water Pollution Act, Sustainable Crop Protection), they are about to introduce a system for nozzles used in orchard spraying. Agrotechnology & Food Innovations B.V. (WageningenUR) is in charge of the measurements. A Phase Doppler Particle Analyzer (PDPA laser) is used to investigate the droplets and droplet speed from a nozzle offering the following characteristics: $D_{v0.1}$, VMD, $D_{v0.9}$ and volume fraction <100µm. The data collected is then fed into the IDEFICS model. The calculation also factors in a reference crop and stage, a buffer strip in the field, forward speed and defined weather conditions to arrive at a percentage nozzle classification for the particular spray pressure under examination. Approval bodies such as CTB (75% / 90% / 95%) and RIZA (50%) publish the classifications.

Benefits and options for users

The use of drift control nozzles brings significant benefits to users in the countries listed, as well as others around the world. Depending on the location of the fields relative to environmentally sensitive areas such as surface water and field boundaries, applicators can reduce the width of buffer strips, as stipulated by the relevant restrictions in association with the approval of the chemical (e.g. 20 meter no-spray buffer strips). Consequently, it is possible to apply chemicals subject to restrictions in field margins near surface water etc., provided that the user complies with the national application regulations. If the directions of use for a particular product require a 75% reduction of drift, allowing for carrier volume and travel speed, it will be necessary to use a nozzle with a 75% drift control classification and operate it at the spray pressure specified. As a general rule, forward speed can be optimized so that the same nozzle can be used near the field boundaries as well as within the middle of the applied field area. With this, the carrier volume remains constant in different situations. Since it is possible to define minimum buffer strip widths for all applications at a national level as well, these must always be considered on a case by case basis.

In general, for successful crop protection, it is necessary to select nozzles of a high percentage classification (75% or higher) only in those situations where statutory buffer strip requirements apply. Otherwise, we suggest using nozzles at a spray pressure achieving a 50% drift control or using non-classified nozzles.

For further information about the low-drift categories of TeeJet nozzles, contact your TeeJet representative or go to www.teejet.com.

Drift Causes and Control

Figure 1. This is not what crop protection should look like!

When applying crop protection chemicals, spray drift is a term used for those droplets containing the active ingredients that are not deposited on the target area. The droplets most prone to spray drift are usually small in size, less than 150 micron in diameter and easily moved off the target area by wind or other climatic conditions. Drift can cause crop protection chemicals to be deposited in undesirable areas with serious consequences, such as:

- Damage to sensitive adjoining crops.
- Surface water contamination.
- Health risks for animals and people.
- Possible contamination to the target area and adjacent areas or possible over-application within the target area.

Causes of Spray Drift

A number of variables contribute to spray drift; these are predominantly due to the spray equipment system and meteorological factors.

■ Droplet Size

Within the spray equipment system, drop size is the most influential factor related to drift.

When a liquid solution is sprayed under pressure it is atomized into droplets of varying sizes: **The smaller the nozzle size and the greater the spray pressure, the smaller the droplets and therefore the greater the proportion of driftable droplets.**

■ Spray Height

As the distance between the nozzle and the target area increases, the greater impact wind velocity can have on drift. The influence of wind can increase the proportion of smaller drops being carried off target and considered drift.

Do not spray at greater heights than those recommended by the spray tip manufacturer, while taking care not to spray below the minimum recommended heights.

■ Operating Speed

Increased operating speeds can cause the spray to be diverted back into upward wind currents and vortexes behind the sprayer, which trap small droplets and can contribute to drift.

Apply crop protection chemicals according to good, professional practices at maximum operating speeds of 4 to 6 mph (with air induction type nozzles—up to 6 mph). As wind velocities increase, reduce operating speed.*

* Liquid fertilizer applications using the TeeJet® tips with very coarse droplets can be performed at higher operating speeds.

■ Wind Velocity

Among the meteorological factors affecting drift, wind velocity has the greatest impact. Increased wind speeds cause increased spray drift. It is common knowledge that in most parts of the world the wind velocity is variable throughout the day (see Figure 2). Therefore, it is important for spraying to take place during the relatively calm hours of the day. The early morning and early evening are usually the most calm. **Refer to chemical label for velocity recommendations.** When spraying with traditional techniques the following rules-of-thumb apply:

In low wind velocity situations, spraying can be performed at recommended nozzle pressures.

As wind velocities increase up to 17 mph, spray pressure should be reduced and nozzle size increased to obtain larger droplets that are less prone to drift. Wind measurements should be taken throughout the spraying operation with a wind meter or anemometer. As the risk of spray drift increases, selecting designed to more coarse droplets that are less prone to drift is extremely important. Some such TeeJet nozzles that fit into this category are: DG TeeJet®, Turbo TeeJet®, AI TeeJet, Turbo TeeJet Induction, and AIXR TeeJet.

When wind velocities exceed 11 MPH (5 m/s), spraying operation should not be performed.

■ Air Temperature and Humidity

In ambient temperatures over 77°F/25°C with low relative humidity, small droplets are especially prone to drift due to the effects of evaporation.

High temperature during the spraying application may necessitate system changes, such as nozzles that produce a coarser droplet or suspending spraying.

■ Crop Protection Chemicals and Carrier Volumes

Before applying crop protection chemicals, the applicator should read and follow all instructions provided by the manufacturer. Since extremely low carrier volume usually necessitates the use of small nozzle sizes, the drift potential is increased. As high a carrier volume as practical is recommended.

Application Regulations for Spray Drift Control

In several European countries, regulatory authorities have issued application regulations in the use of crop protection chemicals to protect the environment. In order to protect the surface waters and the field buffer areas (examples are: hedges and grassy areas of a certain width) distance requirements must be kept because of spray drift. Inside the European Union (EU) there is a directive for the harmonization of crop protection chemicals in regards to environmental protection. In this respect the procedures that have been implemented in Germany, England and the Netherlands will be established in other EU countries in the coming years.

To reach the objectives for environmental protection, spray drift reducing measures have been integrated as a central instrument in the practice of risk evaluation. For example, buffer zones may be reduced in width if certain spraying techniques or equipment is used that have been approved and certified by certain regulatory agencies. Many of the TeeJet nozzles designed for reducing spray drift have been approved and certified in several EU countries. The certification of those registrars fits into a drift reduction category, such as 90%, 75%, or 50% (90/75/50) control of drift (see page 149). This rating is related to the comparison of the BCPC reference nozzle capacity of 03 at 3 bar.

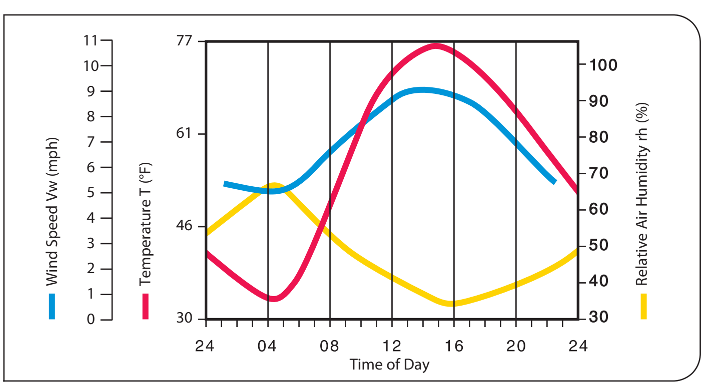


Figure 2. Development of wind velocity, air temperature and relative air humidity (example). From: Malberg

Nozzles for Spray Drift Control

Drift potential can be minimized even when it is necessary to use small nozzle capacities by selecting nozzle types that produce larger Volume Median Diameter (VMD) droplets and a lower percentage of small droplets. Figure 4 is an example showing VMD's produced by nozzles of identical flow rates (size 11003) which produce coarser droplets than an XR TeeJet and then larger droplets in sequence; TT/TTJ60, AIXR, AITTJ60, AI and TTI. TTI nozzles produce the coarsest droplet size spectrum of this group. When operating at a pressure of 50 PSI (3 bar) and 5 MPH (7 km/h) ground speed, the application rate is 20 GPA (200 l/ha). At the same time, the observation is that the VMD increases significantly from the XR to the TTI. This shows that it is possible to cover the entire droplet size spectrum from very fine to extremely coarse droplets by using different types of nozzles. While susceptibility to drift decreases when droplets become larger, the number of droplets available may lead to less uniform coverage. To compensate for this drawback and for the chemical to be effective, it is necessary to apply the optimum pressure range specified for a particular type of nozzle. If applicators comply with the parameters set by the manufacturers, they will always cover 10–15% of the target surface on average, which is not least attributed to the fact that less drift translates into more effective coverage. Figure 4 shows the VMD curves by nozzle type indicating the optimum pressure ranges for the individual nozzles which should be selected with respect to both effective drift control and effect of the chemical. When the focus is on drift control, TT, TTJ60 and AIXR are operated at pressures of less than 29.5 PSI (2 bar). Yet, where maximum effect is critical, the nozzles are operated at pressures between 29.5 PSI (2 bar) and 52 PSI (3.5 bar) or even higher in specific conditions. These pressure ranges do not apply to AI and TTI, which operate at less than 43.5 PSI (3 bar) when drift control is critical and always at 58 PSI (4 bar) and 101.5 PSI (7 bar) and even 116 PSI (8 bar) when the emphasis is on chemical affect. Therefore, for applicators to select the correct nozzle size it is necessary to consider the spray pressure at which a chemical is most effective. With this, they simply have to reduce pressure and ground speed to comply with statutory buffer strip requirements. It is down to the conditions prevailing at the individual farm (location of the field, number of water bodies, type of chemical applied, etc.) whether they should choose a TeeJet nozzle that reduces drift by 50%, 75% or 90%. On principle, applicators should use 75% or 90% drift control nozzles (extremely coarse droplets) only when spraying near field boundaries and 50% or less TeeJet nozzles in all other areas of the field.

While the classic XR TeeJet orifice provides two functions; metering the volume flow rate and distributing and creating the droplets, all other nozzle types discussed above use a pre-orifice for metering while distribution and droplet creation takes place at the exit orifice (Fig. 3). Both functions and devices relate to each other with respect to geometry and spacing and interact with respect to the droplet size produced. The TT, TTJ60, AITTJ60 and TTI nozzles force the liquid to change direction after it has passed the pre-orifice, forcing it into a horizontal chamber and to change direction again into the nearly vertical passage in the orifice itself. The AI, AITTJ60, AIXR and TTI air induction nozzles operate on the Venturi principle, where the pre-orifice generates a higher-velocity stream, aspirating air through the side holes. This specific air/liquid mix creates more coarse droplets that are filled with air, depending on the chemical used.

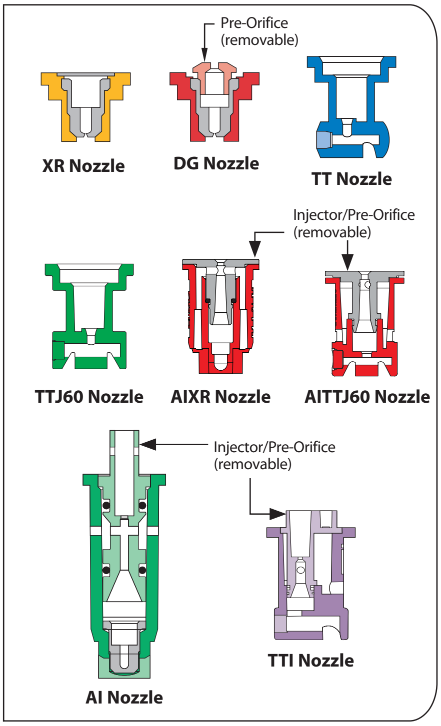


Figure 3: XR, DG, TT, AIXR, AI, AITTJ60, TTJ60 and TTI nozzles (sectional drawings).

Summary

Successful drift management centers on sound knowledge about drift contributing factors and the use of drift control, TeeJet nozzles. To strike a sound balance between successful chemical application and environmental protection, applicators should use approved broadcast TeeJet nozzles that are classified as drift control and operate these within the pressure ranges that ensure chemical effectiveness; i.e. set nozzles to 50% drift control or less. The following list shows all the relevant factors that need to be considered, optimized or applied to achieve effective drift control:

- **Low-Drift TeeJet nozzles**
- **Spraying pressure and droplet size**
- **Application rate and nozzle size**
- **Spraying height**
- **Forward speed**
- **Wind velocity**
- **Ambient temperature and relative humidity**
- **Buffer strips (or apply options that allow reducing the width of buffer strips)**
- **Compliance with manufacturer instructions**

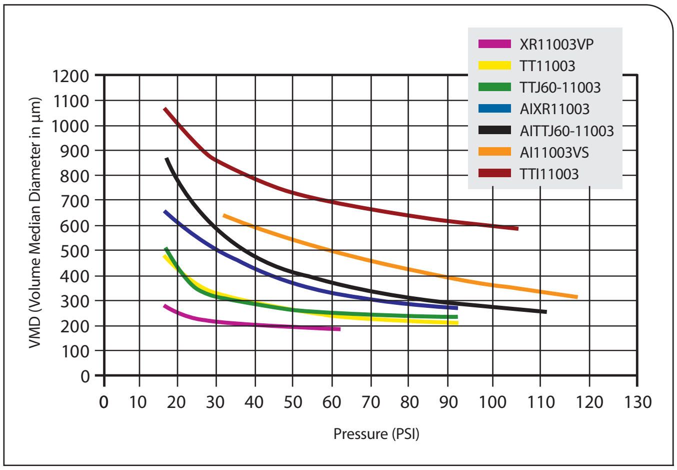


Figure 4. Volumetric droplet diameters of XR, TT, TTJ60, AIXR, AI, AITTJ60 and TTI nozzles relative to pressure

Measurement conditions:

– Continuous Oxford Laser measurement across the full width of the flat spray

– Water temperature 70 °F

Drop Size Classification

Nozzle selection is often based upon droplet size. The droplet size from a nozzle becomes very important when the efficacy of a particular plant protection chemical is dependent on coverage, or the prevention of spray leaving the target area is a priority.

The majority of the nozzles used in agriculture can be classified as producing droplets in the range of fine to ultra coarse droplets. Nozzles that produce droplets in the finer to middle portion of the range are usually recommended for post-emergence contact applications, which require excellent coverage on the intended target area. This may include herbicides, insecticides and fungicides. Nozzles producing droplets from the middle to coarser end of the range, while offering less thorough surface coverage, provide significantly improved drift control. These nozzles are commonly used for systemic and pre-emergence surface applied herbicides.

An important point to remember when choosing a spray nozzle that produces a droplet size in one of the eight categories is that one nozzle can produce different droplet size classifications at different pressures. A nozzle might produce medium droplets at low pressures, while producing fine droplets as pressure is increased.

Droplet size classes are shown in the following tables to assist in choosing an appropriate spray tip.

Category	Symbol	Color Code
Extremely Fine	XF	
Very Fine	VF	
Fine	F	
Medium	M	
Coarse	C	
Very Coarse	VC	
Extremely Coarse	XC	
Ultra Coarse	UC	

Droplet size classifications are based on BCPC specifications and in accordance with ASABE Standard S572.1 at the date of printing. Classifications are subject to change.

AI TeeJet® (AI)

	PSI										
	30	35	40	45	50	55	60	70	80	90	100
AI80015	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AI8002	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AI80025	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC
AI8003	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC
AI81004	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AI8005	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC
AI8006	UC	UC	UC	UC	UC	XC	XC	XC	XC	XC	XC
AI110015	UC	XC	XC	XC	XC	XC	VC	VC	VC	C	C
AI11002	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C
AI110025	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AI11003	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AI11004	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AI11005	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC
AI11006	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC
AI11008	UC	UC	UC	UC	XC	XC	XC	XC	VC	VC	VC

AI TeeJet® (AI E)

	PSI							
	30	40	50	60	70	80	90	100
AI95015E	UC	XC	XC	VC	VC	VC	C	C
AI9502E	UC	XC	XC	VC	VC	VC	VC	C
AI95025E	UC	XC	XC	VC	VC	VC	VC	C
AI9503E	UC	XC	XC	VC	VC	VC	VC	C
AI9504E	UC	XC	XC	VC	VC	VC	VC	C
AI9505E	UC	XC	XC	VC	VC	VC	VC	VC
AI9506E	UC	UC	XC	XC	XC	VC	VC	VC
AI9508E	UC	UC	XC	XC	XC	VC	VC	VC

AI3070 TeeJet® (AI3070)

	PSI							
	20	30	40	50	60	70	80	90
AI3070-015	VC	C	C	M	M	M	M	F
AI3070-02	XC	VC	C	C	C	M	M	M
AI3070-025	XC	VC	C	C	C	C	C	M
AI3070-03	XC	XC	VC	C	C	C	C	C
AI3070-04	UC	XC	VC	VC	VC	C	C	C
AI3070-05	UC	XC	VC	VC	VC	C	C	C

AIC TeeJet® (AIC)

	PSI										
	30	35	40	45	50	55	60	70	80	90	100
AIC110015	UC	XC	XC	XC	XC	XC	VC	VC	VC	C	C
AIC11002	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C
AIC110025	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AIC11003	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AIC11004	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AIC11005	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC
AIC11006	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC
AIC11008	UC	UC	UC	UC	XC	XC	XC	XC	VC	VC	VC
AIC11010	UC	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC
AIC11015	UC	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC

AIUB TeeJet® (AIUB)

	PSI							
	30	40	50	60	70	80	90	100
AIUB8502	UC	XC	XC	VC	VC	VC	VC	C
AIUB85025	UC	XC	XC	XC	VC	VC	VC	C
AIUB8503	UC	XC	XC	XC	VC	VC	VC	C
AIUB8504	UC	XC	XC	XC	VC	VC	VC	C

Air Induction Turbo TwinJet® (AITTJ60)

	PSI										
	20	25	30	35	40	50	60	70	80	90	100
AITTJ60-11002	XC	XC	VC	VC	VC	C	C	C	C	C	M
AITTJ60-110025	XC	XC	VC	VC	VC	C	C	C	C	C	M
AITTJ60-11003	UC	XC	XC	XC	VC	VC	C	C	C	C	C
AITTJ60-11004	UC	XC	XC	XC	VC	VC	C	C	C	C	C
AITTJ60-11005	UC	XC	XC	XC	XC	VC	VC	C	C	C	C
AITTJ60-11006	UC	XC	XC	XC	XC	VC	VC	C	C	C	C
AITTJ60-11008	UC	UC	UC	UC	XC	XC	VC	VC	VC	C	C
AITTJ60-11010	UC	UC	UC	UC	UC	XC	XC	XC	XC	VC	VC
AITTJ60-11015	UC	UC	UC	UC	UC	XC	XC	XC	VC	VC	VC

AIXR TeeJet® (AIXR)

	PSI										
	15	20	25	30	35	40	50	60	70	75	90
AIXR110015	XC	XC	VC	C	C	C	C	M	M	M	M
AIXR11002	XC	XC	XC	VC	VC	C	C	C	C	M	M
AIXR110025	XC	XC	XC	XC	VC	VC	C	C	C	C	C
AIXR11003	XC	XC	XC	XC	VC	VC	C	C	C	C	C
AIXR11004	UC	XC	XC	XC	XC	XC	VC	VC	C	C	C
AIXR11005	UC	XC	XC	XC	XC	XC	VC	VC	C	C	C
AIXR11006	UC	XC	XC	XC	XC	XC	VC	VC	VC	C	C

AITX ConeJet® (AITXA & AITXB)

	PSI							
	60	80	100	120	140	160	180	200
AITXA8001 AITXB8001	XC	VC	VC	C	C	C	C	C
AITXA80015 AITXB80015	XC	XC	VC	C	C	C	C	C
AITXA8002 AITXB8002	XC	XC	XC	VC	VC	VC	VC	C
AITXA80025 AITXB80025	UC	XC	XC	XC	XC	XC	VC	VC
AITXA8003 AITXB8003	UC	XC	XC	XC	XC	VC	VC	VC
AITXA8004 AITXB8004	UC	UC	XC	XC	XC	XC	XC	VC

DG TwinJet® (DGTJ60)

	PSI				
	30	35	40	50	60
DGTJ60-110015	F	F	F	F	F
DGTJ60-11002	M	M	M	F	F
DGTJ60-11003	M	M	M	F	F
DGTJ60-11004	C	C	C	C	M
DGTJ60-11006	C	C	C	C	C
DGTJ60-11008	C	C	C	C	C

DG TeeJet® (DG E)

	PSI				
	30	35	40	50	60
DG95015E	M	M	M	F	F
DG9502E	M	M	M	M	M
DG9503E	C	M	M	M	M
DG9504E	C	C	C	M	M
DG9505E	C	C	C	M	M

DG TeeJet (DG)

	PSI				
	30	35	40	50	60
DG80015	M	M	M	M	F
DG8002	M	M	M	M	M
DG8003	C	M	M	M	M
DG8004	C	C	C	M	M
DG8005	C	C	C	M	M
DG110015	M	M	F	F	F
DG11002	M	M	M	M	M
DG11003	C	M	M	M	M
DG11004	C	C	M	M	M
DG11005	C	C	C	M	M

Turbo FloodJet® (TF)

	PSI				
	10	20	30	40	50
TF-2	UC	XC	XC	VC	VC
TF-2.5	UC	UC	XC	XC	VC
TF-3	UC	UC	XC	XC	VC
TF-4	UC	UC	XC	XC	XC
TF-5	UC	UC	UC	XC	XC
TF-7.5	UC	UC	UC	XC	XC
TF-10	UC	UC	UC	XC	XC

TeeJet® (TP)

	PSI				
	30	35	40	50	60
TP8001	F	F	F	F	F
TP80015	F	F	F	F	F
TP8002	F	F	F	F	F
TP8003	F	F	F	F	F
TP8004	M	M	M	F	F
TP8005	M	M	M	M	F
TP8006	M	M	M	M	M
TP8008	C	C	M	M	M
TP11001	F	F	F	F	VF
TP110015	F	F	F	F	F
TP11002	F	F	F	F	F
TP11003	F	F	F	F	F
TP11004	M	M	M	F	F
TP11005	M	M	M	F	F
TP11006	M	M	M	M	F
TP11008	C	M	M	M	M

Turbo TeeJet® (TT)

	PSI										
	15	20	25	30	35	40	50	60	70	80	90
TT11001	C	C	M	M	M	M	M	F	F	F	F
TT110015	VC	C	C	M	M	M	M	F	F	F	F
TT11002	VC	VC	C	C	M	M	M	M	F	F	F
TT110025	VC	VC	C	C	M	M	M	M	F	F	F
TT11003	VC	VC	C	C	C	C	M	M	M	M	F
TT11004	XC	VC	VC	C	C	C	M	M	M	M	M
TT11005	XC	VC	VC	VC	VC	C	C	M	M	M	M
TT11006	XC	VC	VC	VC	VC	VC	C	C	C	M	M
TT11008	XC	VC	VC	VC	VC	C	C	C	C	M	M

Drop Size Classification

Turbo TeeJet® Induction (TTI)

	PSI											
	15	20	25	30	35	40	50	60	70	80	90	100
TTI110015	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC	XC
TTI11002	UC	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC
TTI110025	UC	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC
TTI11003	UC	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC
TTI11004	UC	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC
TTI11005	UC	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC
TTI11006	UC	UC	UC	UC	UC	UC	UC	UC	XC	XC	XC	XC

TurfJet (TTJ)

	PSI						
	25	30	40	50	60	70	75
1/4TTJ02	UC	UC	UC	XC	XC	XC	XC
1/4TTJ04	UC	UC	UC	UC	UC	UC	UC
1/4TTJ05	UC	UC	UC	UC	UC	UC	UC
1/4TTJ06	UC	UC	UC	UC	UC	UC	UC
1/4TTJ08	UC	UC	UC	UC	UC	UC	UC
1/4TTJ10	UC	UC	UC	UC	UC	UC	UC
1/4TTJ15	UC	UC	UC	UC	UC	UC	UC

TwinJet® (TJ60 E)

	PSI			
	30	40	50	60
TJ60-8002E	F	F	F	F
TJ60-8003E	F	F	F	F
TJ60-8004E	M	F	F	F
TJ60-8006E	M	M	M	M

TX ConeJet® (TXA & TXB)

	PSI							
	30	40	50	60	70	80	90	100
TXA800050 TXB800050	F	VF	VF	VF	VF	VF	VF	VF
TXA800067 TXB800067	F	VF	VF	VF	VF	VF	VF	VF
TXA8001 TXB8001	F	F	VF	VF	VF	VF	VF	VF
TXA80015 TXB80015	F	F	F	F	F	VF	VF	VF
TXA8002 TXB8002	F	F	F	F	VF	VF	VF	VF
TXA8003 TXB8003	F	F	F	F	F	F	VF	VF
TXA8004 TXB8004	F	F	F	F	F	F	VF	VF

Turbo TwinJet® (TTJ60)

	PSI									
	20	25	30	35	40	50	60	70	80	90
TTJ60-11002	C	C	C	C	C	M	M	M	M	M
TTJ60-110025	VC	C	C	C	C	C	C	M	M	M
TTJ60-11003	VC	C	C	C	C	C	C	C	M	M
TTJ60-11004	VC	C	C	C	C	C	C	C	C	M
TTJ60-11005	VC	C	C	C	C	C	C	C	C	C
TTJ60-11006	XC	VC	VC	C	C	C	C	C	C	C

TwinJet® (TJ60)

	PSI				
	30	35	40	50	60
TJ60-6501	F	VF	VF	VF	VF
TJ60-650134	F	F	F	VF	VF
TJ60-6502	F	F	F	F	F
TJ60-6503	M	F	F	F	F
TJ60-6504	M	M	M	M	F
TJ60-6506	M	M	M	M	M
TJ60-6508	C	C	C	M	M
TJ60-8001	VF	VF	VF	VF	VF
TJ60-8002	F	F	F	F	F
TJ60-8003	F	F	F	F	F
TJ60-8004	M	M	F	F	F
TJ60-8005	M	M	M	F	F
TJ60-8006	M	M	M	M	M
TJ60-8008	C	M	M	M	M
TJ60-8010	C	C	C	M	M
TJ60-11002	F	VF	VF	VF	VF
TJ60-11003	F	F	F	F	F
TJ60-11004	F	F	F	F	F
TJ60-11005	M	M	M	F	F
TJ60-11006	M	M	M	F	F
TJ60-11008	M	M	M	M	M
TJ60-11010	M	M	M	M	M

TX ConeJet® (TX)

	PSI							
	30	40	50	60	70	80	90	100
TX-1	VF	VF	VF	VF	VF	VF	VF	VF
TX-2	VF	VF	VF	VF	VF	VF	VF	VF
TX-3	F	VF	VF	VF	VF	VF	VF	VF
TX-4	F	VF	VF	VF	VF	VF	VF	VF
TX-6	F	F	VF	VF	VF	VF	VF	VF
TX-8	F	F	VF	VF	VF	VF	VF	VF
TX-10	F	F	F	F	VF	VF	VF	VF
TX-12	F	F	F	F	VF	VF	VF	VF
TX-18	F	F	F	F	F	F	VF	VF
TX-26	F	F	F	F	F	F	VF	VF

TXR ConeJet® (TXR)

	PSI							
	30	40	50	60	70	80	90	100
TXR800053	VF	VF	VF	VF	VF	VF	VF	VF
TXR800071	F	VF	VF	VF	VF	VF	VF	VF
TXR8001	F	F	VF	VF	VF	VF	VF	VF
TXR80013	F	F	VF	VF	VF	VF	VF	VF
TXR80015	F	F	F	F	F	VF	VF	VF
TXR80017	F	F	F	F	VF	VF	VF	VF
TXR8002	F	F	F	F	VF	VF	VF	VF
TXR80028	F	F	F	F	F	VF	VF	VF
TXR8003	F	F	F	F	F	F	VF	VF
TXR80036	F	F	F	F	F	F	VF	VF
TXR8004	F	F	F	F	F	F	VF	VF
TXR80049	F	F	F	F	F	F	F	F

XR TeeJet® (XR)

	PSI						
	15	20	25	30	40	50	60
XR8001	F	F	F	F	F	F	F
XR80015	M	F	F	F	F	F	F
XR8002	M	M	F	F	F	F	F
XR80025	M	M	F	F	F	F	F
XR8003	M	M	M	F	F	F	F
XR80035	M	M	M	M	M	F	F
XR8004	C	M	M	M	M	F	F
XR8005	C	C	M	M	M	M	F
XR8006	C	C	C	M	M	M	M
XR8008	VC	VC	C	C	M	M	M
XR8010	XC	VC	VC	C	C	C	C
XR8015	XC	XC	VC	VC	VC	C	C
XR11001	F	F	F	F	F	F	VF
XR110015	F	F	F	F	F	F	F
XR11002	M	F	F	F	F	F	F
XR110025	M	M	F	F	F	F	F
XR11003	M	M	M	F	F	F	F
XR11004	M	M	M	M	M	F	F
XR11005	M	M	M	M	M	F	F
XR11006	C	M	M	M	M	M	F
XR11008	C	C	C	C	M	M	M
XR11010	VC	C	C	C	M	M	M
XR11015	VC	VC	VC	VC	C	C	C

TK FloodJet® (TK-VP)

	PSI				
	10	20	30	40	50
TK-VP1	C	M	F	F	F
TK-VP1.5	C	M	F	F	F
TK-VP2	C	M	F	F	F
TK-VP2.5	C	M	F	F	F
TK-VP3	C	M	F	F	F
TK-VP4	C	M	M	F	F
TK-VP5	C	M	M	F	F
TK-VP7.5	VC	C	C	C	M
TK-VP10	XC	VC	C	C	M

XP BoomJet® (XP)

	PSI				
	20	30	40	50	60
1/4XP10R 1/4XP10L	UC	UC	UC	UC	UC
1/4XP20R 1/4XP20L	UC	UC	UC	UC	UC
1/4XP25R 1/4XP25L	UC	UC	UC	UC	UC
1/4XP40R 1/4XP40L	UC	UC	UC	UC	UC
1/4XP80R 1/4XP80L	UC	UC	UC	UC	UC

XRC TeeJet (XRC)

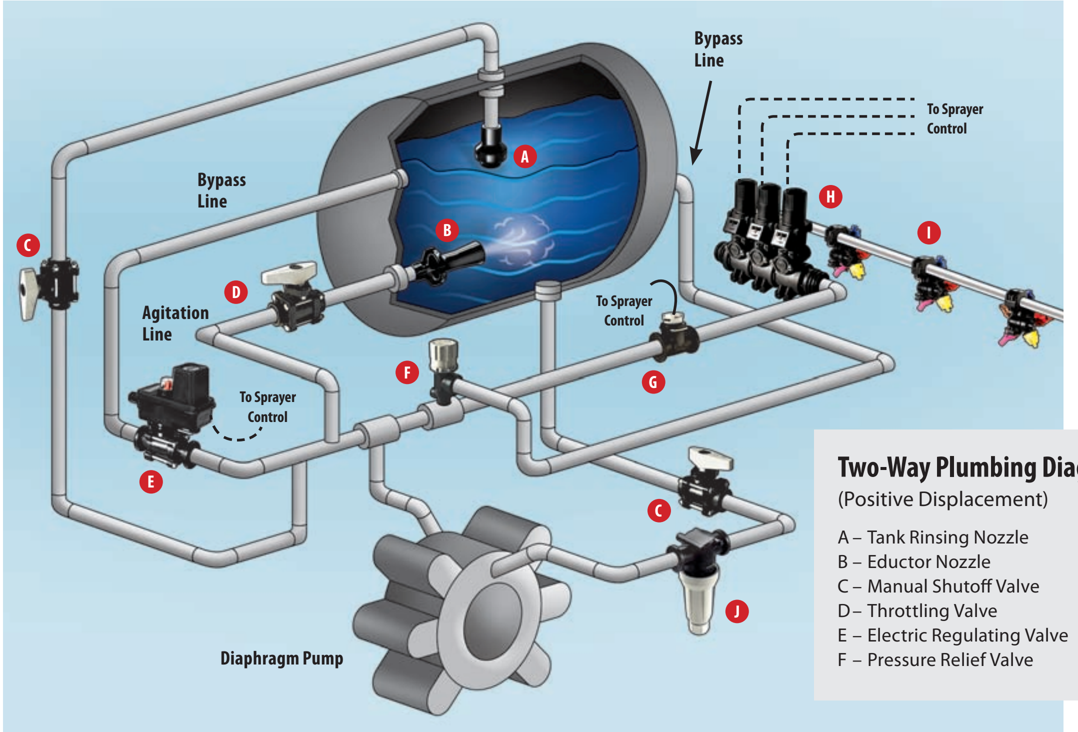
	PSI						
	15	20	25	30	40	50	60
XRC80015	M	F	F	F	F	F	F
XRC8002	M	M	F	F	F	F	F
XRC8003	M	M	M	F	F	F	F
XRC8004	C	M	M	M	M	F	F
XRC8005	C	C	M	M	M	M	F
XRC8006	C	C	C	M	M	M	M
XRC8008	VC	VC	C	C	M	M	M
XRC11002	M	F	F	F	F	F	F
XRC110025	M	M	F	F	F	F	F
XRC11003	M	M	M	F	F	F	F
XRC11004	M	M	M	M	M	F	F
XRC11005	M	M	M	M	M	F	F
XRC11006	C	M	M	M	M	M	F
XRC11008	C	C	C	C	M	M	M
XRC11010	VC	C	C	C	M	M	M
XRC11015	VC	VC	VC	VC	C	C	C
XRC11020	XC	XC	XC	VC	VC	VC	VC

Plumbing Diagrams

The following diagrams have been developed to serve as a guideline for plumbing agricultural sprayers. Similar manual valves may be substituted for electric valves. However, the sequence in which these valves occur should remain the same. Note that one of the most common causes of premature valve failure is improper installation.

Positive Displacement Pump

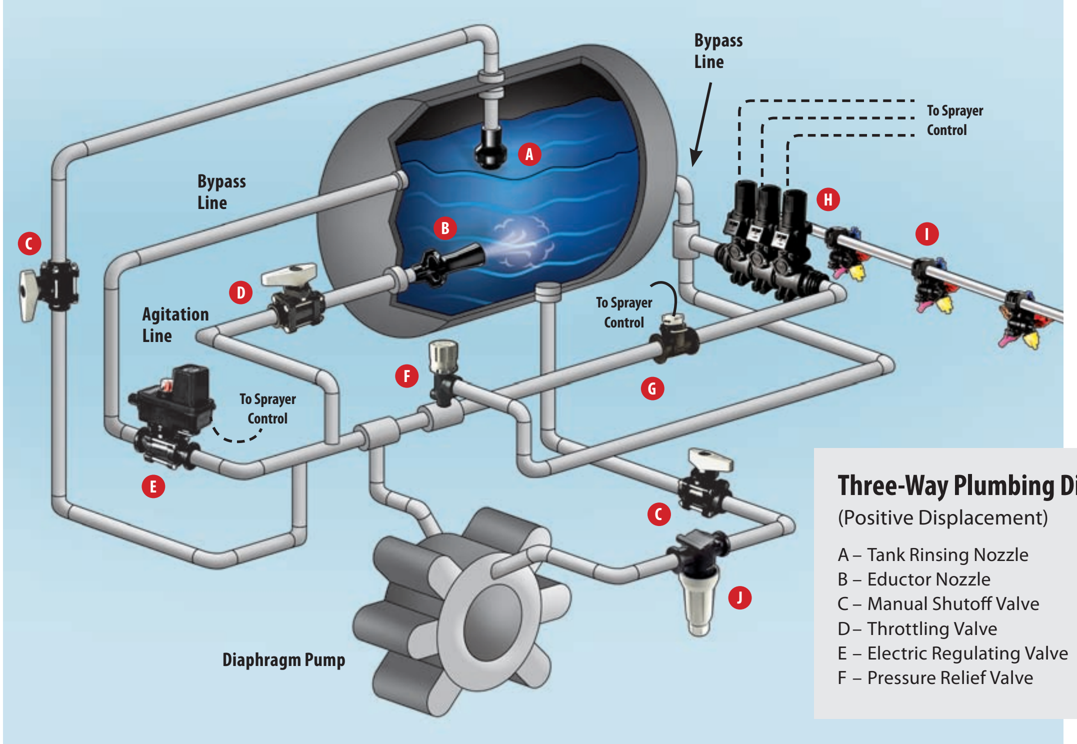
Piston, roller and diaphragm pumps are all types of positive displacement pumps. This means that pump output is proportional to speed and virtually independent of pressure. A key component in a positive displacement system is the pressure relief valve. Proper placement and sizing of the pressure relief valve is essential for safe and accurate operation of a positive displacement pump.



Two-Way Plumbing Diagram

(Positive Displacement)

A – Tank Rinsing Nozzle
B – Eductor Nozzle
C – Manual Shutoff Valve
D – Throttling Valve
E – Electric Regulating Valve
F – Pressure Relief Valve
G – Flowmeter
H – 2-Way Boom Control Manifold
I – Nozzle Bodies & Spray Tips
J – Line Strainer



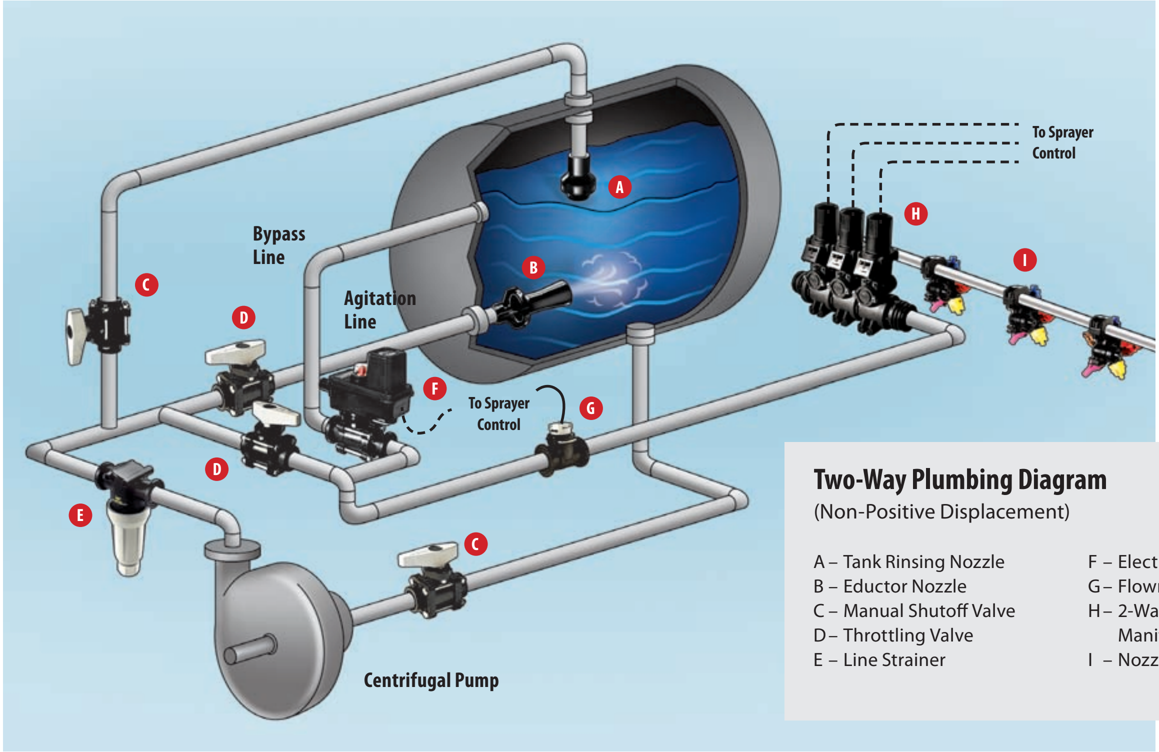
Three-Way Plumbing Diagram

(Positive Displacement)

A – Tank Rinsing Nozzle
B – Eductor Nozzle
C – Manual Shutoff Valve
D – Throttling Valve
E – Electric Regulating Valve
F – Pressure Relief Valve
G – Flowmeter
H – 3-Way Boom Control Manifold
I – Nozzle Bodies & Spray Tips
J – Line Strainer

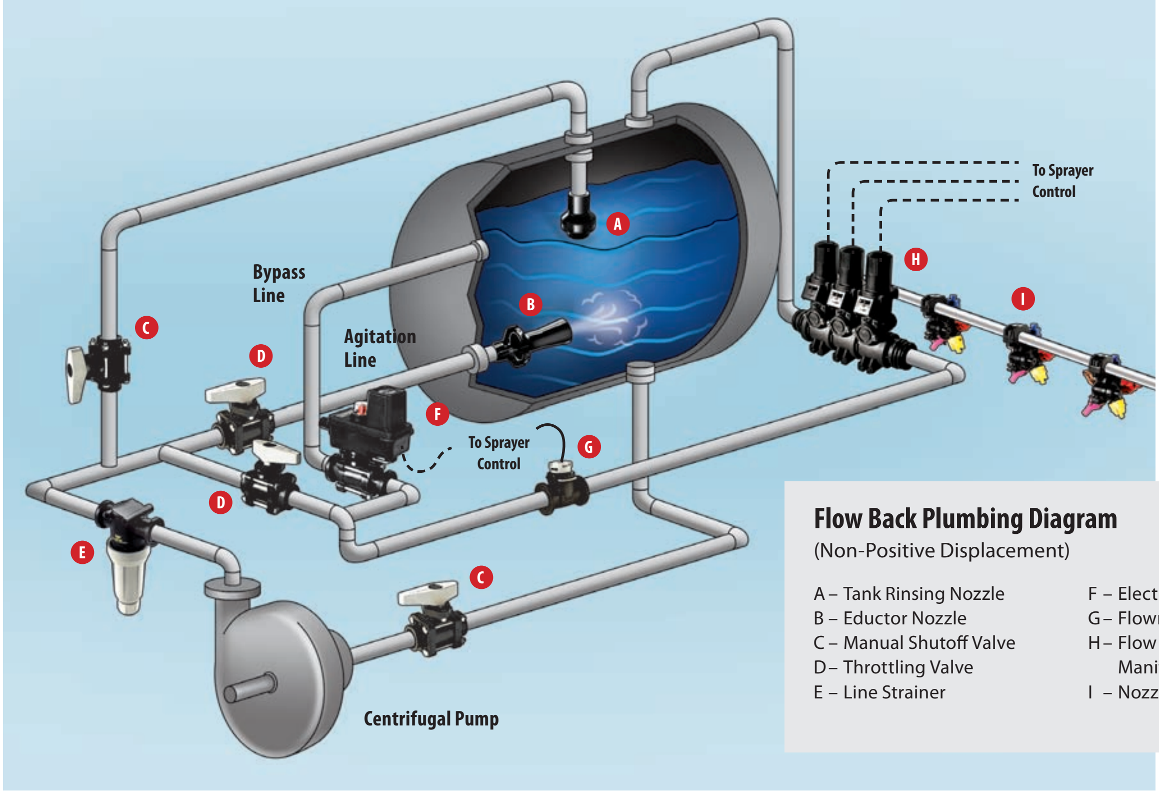
Non-Positive Displacement Pump

The centrifugal pump is the most common non-positive displacement pump. The output from this type of pump is influenced by pressure. This pump is ideal for delivering large volumes of liquid at low pressures. A key component of the centrifugal pump is the throttling valve. A manual throttling valve on the main output line is essential for the accurate operation of the centrifugal pump.



Two-Way Plumbing Diagram
(Non-Positive Displacement)

A – Tank Rinsing Nozzle
B – Eductor Nozzle
C – Manual Shutoff Valve
D – Throttling Valve
E – Line Strainer
F – Electric Regulating Valve
G – Flowmeter
H – 2-Way Boom Control Manifold
I – Nozzle Bodies & Spray Tips



Flow Back Plumbing Diagram
(Non-Positive Displacement)

A – Tank Rinsing Nozzle
B – Eductor Nozzle
C – Manual Shutoff Valve
D – Throttling Valve
E – Line Strainer
F – Electric Regulating Valve
G – Flowmeter
H – Flow Back Boom Control Manifold
I – Nozzle Bodies & Spray Tips

Notes

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Seller shall have no obligation to ensure that any goods purchased from Seller meet any special Buyer quality assurance specifications and/or other special Buyer requirements unless such specifications and/or other requirements are specifically set forth in Buyer's purchase order and expressly accepted by Seller. In the event that any such goods supplied by Seller in connection therewith, are applied to an end use without the appropriate specification and/or other requirement therefore having been set forth in Buyer's purchase order and expressly accepted by Seller, Buyer shall indemnify and hold Seller harmless against any and all damages or claims for damages made by any person for any injury, fatal or nonfatal, to any person or for any damage to the property of any person incident to or arising out of such application.

(8) CLAIMS

Claims respecting the condition of goods, compliance with specifications or any other matter affecting goods shipped to Buyer must be made promptly and, unless otherwise agreed to in writing by Seller, in no event later than one (1) year after receipt of the goods buy Buyer. In no event shall any goods be returned, reworked or scrapped by Buyer without the express written authorization of Seller.

(9) DEFAULT IN PAYMENT

If Buyer fails to make payments on any contract between Buyer and Seller in accordance with Seller's terms, Seller, in addition to any other remedies available to it, may at its option, (i) defer further shipments until such payments are made and satisfactory credit arrangements are reestablished or (ii) cancel the unshipped balance of any order.

(10) TECHNICAL ASSISTANCE

Unless otherwise expressly stated by Seller, (a) any technical advice provided by Seller with respect to the use of goods furnished to Buyer shall be without charge; (b) Buyer shall have sole responsibility for selection and specification of the goods appropriate for the end use of such goods.

(11) SAFETY PRECAUTIONS

Buyer shall require its employees to use all safety devices, and proper safe operation procedures as set forth in manuals and instruction sheets furnished by Seller. Buyer shall not remove or modify any such device or warning sign. It is the Buyer's responsibility to provide all means that may be necessary to effectively protect all employees from serious bodily injury which otherwise may result from the method of particular use, operation, set up or service of the goods. The operator's or machine manual, ANSI safety standards, OSHA regulations and other sources should be consulted. If Buyer fails to comply with provisions of this paragraph or the applicable standards and regulations aforementioned, and a person is injured as a result thereof, Buyer agrees to indemnity and save Seller harmless from any liability or obligation incurred by Seller.

(12) CANCELLATION

Orders for goods specifically manufactured for Buyer cannot be canceled or modified by Buyer, and releases cannot be held up by Buyer, after such goods are in process except with the express written consent of Seller and subject to conditions then to be agreed upon which shall include, without limitation, protection of Seller against all loss.

(13) PATENTS

The Seller shall not be liable for any costs or damages incurred by the Buyer as a result of any suit or proceeding brought against Buyer so far as based on claims (a) that use of any product, or any part thereof furnished hereunder, in combination with products not supplied by the Seller or (b) that a manufacturing or other process utilizing any product, or any part thereof furnished hereunder, constitute knowing and willful infringement of patents or trademarks arising from compliance with Buyer's designs or specifications or instructions.

(14) COMPLETE AGREEMENT

THIS CONTRACT SETS FORTH THE ENTIRE AGREEMENT AND UNDERSTANDING OF THE PARTIES RELATING TO THE SUBJECT MATTER HEREOF, AND SUPERSEDES ALL PRIOR AGREEMENTS, DISCUSSIONS AND UNDERSTANDINGS BETWEEN THEM WHETHER ORAL OR WRITTEN, RELATING TO THE SUBJECT MATTER HEREOF.

(15) GOVERNING LAW

All orders are accepted by Seller at its mailing address in Wheaton, Illinois, and shall be governed by and interpreted in accordance with the laws of the State of Illinois. The United Nations Convention on Contacts for the International Sale of Goods of April 11, 1980 shall be excluded.

(16) FORCE MAJEURE

Neither party shall be in default of its obligations to the other party for any period of Force Majeure. "Force Majeure" shall mean any delay or failure of a party to perform its obligations to the other party due to causes beyond its control and without its fault or negligence. This shall include, without limitation, Acts of God, strike, civil commotion, acts of government, and any other comparable, non-foreseeable, and a serious event.

(17) CONFIDENTIAL INFORMATION

Buyer shall maintain Confidential Information in confidence using the same care as used for its own Confidential Information. Buyer shall not disclose or divulge any Confidential Information received by it from Seller in connection with any products or services supplied by Seller to Buyer or to a third party without prior written consent of Seller, and Buyer may not use any Confidential Information for any purpose other than for the manufacture, sale and maintenance of Buyer's products. For the purposes hereof, "Confidential Information" includes any and all information and data, including, but not limited to, any business, commercial, intellectual property, technical information and data disclosed by Seller to Buyer in connection with the sale of Seller's products to Buyer, or relating to Seller's business relationship or the definition, development, marketing, selling, manufacture or distribution of Seller's products, whether disclosed orally, in writing or electronically, and irrespective of the medium in which such information or data is embedded, whether in tangible form or contained in an intangible storage medium. Confidential Information shall include any copies or abstracts made thereof, as well as any product, apparatus, modules, samples, prototypes or parts thereof.