Technical Information

Universal Application Rate Chart for 35 cm Tip Spacing

TIP CAPACITY	LIQUID PRESSURE IN bar	CAPACITY ONE NOZZLE IN l/min	l/ha – 35 cm NOZZLE SPACING											
			4 km/h	6 km/h	8 km/h	10 km/h	12 km/h	14 km/h	16 km/h	18 km/h	20 km/h	25 km/h	30 km/h	35 km/h
01	1.0	0.23	98.6	65.7	49.3	39.4	32.9	28.2	24.6	21.9	19.7	15.8	13.1	11.3
	1.5	0.28	120	80.0	60.0	48.0	40.0	34.3	30.0	26.7	24.0	19.2	16.0	13.7
	2.0	0.32	137	91.4	68.6	54.9	45.7	39.2	34.3	30.5	27.4	21.9	18.3	15.7
	3.0	0.39	167	111	83.6	66.9	55.7	47.8	41.8	37.1	33.4	26.7	22.3	19.1
	4.0	0.45	193	129	96.4	77.1	64.3	55.1	48.2	42.9	38.6	30.9	25.7	22.0
	5.0	0.50	214	143	107	85.7	71.4	61.2	53.6	47.6	42.9	34.3	28.6	24.5
	6.0	0.55	236	157	118	94.3	78.6	67.3	58.9	52.4	47.1	37.7	31.4	26.9
	7.0	0.60	257	171	129	103	85.7	73.5	64.3	57.1	51.4	41.1	34.3	29.4
015	1.0	0.34	146	97.1	72.9	58.3	48.6	41.6	36.4	32.4	29.1	23.3	19.4	16.7
	1.5	0.42	180	120	90.0	72.0	60.0	51.4	45.0	40.0	36.0	28.8	24.0	20.6
	2.0	0.48	206	137	103	82.3	68.6	58.8	51.4	45.7	41.1	32.9	27.4	23.5
	3.0	0.59	253	169	126	101	84.3	72.2	63.2	56.2	50.6	40.5	33.7	28.9
	4.0	0.68	291	194	146	117	97.1	83.3	72.9	64.8	58.3	46.6	38.9	33.3
	5.0	0.76	326	217	163	130	109	93.1	81.4	72.4	65.1	52.1	43.4	37.2
	6.0	0.83	356	237	178	142	119	102	88.9	79.0	71.1	56.9	47.4	40.7
	7.0	0.90	386	257	193	154	129	110	96.4	85.7	77.1	61.7	51.4	44.1
02	1.0	0.46	197	131	98.6	78.9	65.7	56.3	49.3	43.8	39.4	31.5	26.3	22.5
	1.5	0.56	240	160	120	96.0	80.0	68.6	60.0	53.3	48.0	38.4	32.0	27.4
	2.0	0.65	279	186	139	111	92.9	79.6	69.6	61.9	55.7	44.6	37.1	31.8
	3.0	0.79	339	226	169	135	113	96.7	84.6	75.2	67.7	54.2	45.1	38.7
	4.0	0.91	390	260	195	156	130	111	97.5	86.7	78.0	62.4	52.0	44.6
	5.0	1.02	437	291	219	175	146	125	109	97.1	87.4	69.9	58.3	50.0
	6.0	1.12	480	320	240	192	160	137	120	107	96.0	76.8	64.0	54.9
	7.0	1.21	519	346	259	207	173	148	130	115	104	83.0	69.1	59.3
025	1.0	0.57	244	163	122	97.7	81.4	69.8	61.1	54.3	48.9	39.1	32.6	27.9
	1.5	0.70	300	200	150	120	100	85.7	75.0	66.7	60.0	48.0	40.0	34.3
	2.0	0.81	347	231	174	139	116	99.2	86.8	77.1	69.4	55.5	46.3	39.7
	3.0	0.99	424	283	212	170	141	121	106	94.3	84.9	67.9	56.6	48.5
	4.0	1.14	489	326	244	195	163	140	122	109	97.7	78.2	65.1	55.8
	5.0	1.28	549	366	274	219	183	157	137	122	110	87.8	73.1	62.7
	6.0	1.40	600	400	300	240	200	171	150	133	120	96.0	80.0	68.6
	7.0	1.51	647	431	324	259	216	185	162	144	129	104	86.3	74.0
03	1.0	0.68	291	194	146	117	97.1	83.3	72.9	64.8	58.3	46.6	38.9	33.3
	1.5	0.83	356	237	178	142	119	102	88.9	79.0	71.1	56.9	47.4	40.7
	2.0	0.96	411	274	206	165	137	118	103	91.4	82.3	65.8	54.9	47.0
	3.0	1.18	506	337	253	202	169	144	126	112	101	80.9	67.4	57.8
	4.0	1.36	583	389	291	233	194	167	146	130	117	93.3	77.7	66.6
	5.0	1.52	651	434	326	261	217	186	163	145	130	104	86.9	74.4
	6.0	1.67	716	477	358	286	239	204	179	159	143	115	95.4	81.8
	7.0	1.80	771	514	386	309	257	220	193	171	154	123	103	88.2
04	1.0	0.91	390	260	195	156	130	111	97.5	86.7	78.0	62.4	52.0	44.6
	1.5	1.12	480	320	240	192	160	137	120	107	96.0	76.8	64.0	54.9
	2.0	1.29	553	369	276	221	184	158	138	123	111	88.5	73.7	63.2
	3.0	1.58	677	451	339	271	226	193	169	150	135	108	90.3	77.4
	4.0	1.82	780	520	390	312	260	223	195	173	156	125	104	89.1
	5.0	2.04	874	583	437	350	291	250	219	194	175	140	117	99.9
	6.0	2.23	956	637	478	382	319	273	239	212	191	153	127	109
	7.0	2.41	1033	689	516	413	344	295	258	230	207	165	138	118
05	1.0	1.14	489	326	244	195	163	140	122	109	97.7	78.2	65.1	55.8
	1.5	1.39	596	397	298	238	199	170	149	132	119	95.3	79.4	68.1
	2.0	1.61	690	460	345	276	230	197	173	153	138	110	92.0	78.9
	3.0	1.97	844	563	422	338	281	241	211	188	169	135	113	96.5
	4.0	2.27	973	649	486	389	324	278	243	216	195	156	130	111
	5.0	2.54	1089	726	544	435	363	311	272	242	218	174	145	124
	6.0	2.79	1196	797	598	478	399	342	299	266	239	191	159	137
	7.0	3.01	1290	860	645	516	430	369	323	287	258	206	172	147
06	1.0	1.37	587	391	294	235	196	168	147	130	117	93.9	78.3	67.1
	1.5	1.68	720	480	360	288	240	206	180	160	144	115	96.0	82.3
	2.0	1.94	831	554	416	333	277	238	208	185	166	133	111	95.0
	3.0	2.37	1016	677	508	406	339	290	254	226	203	163	135	116
	4.0	2.74	1174	783	587	470	391	336	294	261	235	188	157	134
	5.0	3.06	1311	874	656	525	437	375	328	291	262	210	175	150
	6.0	3.35	1436	957	718	574	479	410	359	319	287	230	191	164
	7.0	3.62	1551	1034	776	621	517	443	388	345	310	248	207	177
08	1.0	1.82	780	520	390	312	260	223	195	173	156	125	104	89.1
	1.5	2.23	956	637	478	382	319	273	239	212	191	153	127	109
	2.0	2.58	1106	737	553	442	369	316	276	246	221	177	147	126
	3.0	3.16	1354	903	677	542	451	387	339	301	271	217	181	155
	4.0	3.65	1564	1043	782	626	521	447	391	348	313	250	209	179
	5.0	4.08	1749	1166	874	699	583	500	437	389	350	280	233	200
	6.0	4.47	1916	1277	958	766	639	547	479	426	383	307	255	219
	7.0	4.83	2070	1380	1035	828	690	591	518	460	414	331	276	237
10	1.0	2.28	977	651	489	391	326	279	244	217	195	156	130	112
	1.5	2.79	1196	797	598	478	399	342	299	266	239	191	159	137
	2.0	3.23	1384	923	692	554	461	396	346	308	277	221	185	158
	3.0	3.95	1693	1129	846	677	564	484	423	376	339	271	226	193
	4.0	4.56	1954	1303	977	782	651	558	489	434	391	313	261	223
	5.0	5.10	2186	1457	1093	874	729	624	546	486	437	350	291	250
	6.0	5.59	2396	1597	1198	958	799	684	599	532	479	383	319	274
	7.0	6.03	2584	1723	1292	1034	861	738	646	574	517	413	345	295
15	1.0	3.42	1466	977	733	586	489	419	366	326	293	235	195	168
	1.5	4.19	1796	1197	898	718	599	513	449	399	359	287	239	205
	2.0	4.83	2070	1380	1035	828	690	591	518	460	414	331	276	237
	3.0	5.92	2537	1691	1269	1015	846	725	634	564	507	406	338	290
	4.0	6.84	2931	1954	1466	1173	977	838	733	651	586	469	391	335
	5.0	7.64	3274	2183	1637	1310	1091	936	819	728	655	524	437	374
	6.0	8.37	3587	2391	1794	1435	1196	1025	897	797	717	574	478	410
	7.0	9.04	3874	2583	1937	1550	1291	1107	969	861	775	620	517	443
20	1.0	4.56	1954	1303	977	782	651	558	489	434	391	313	261	223
	1.5	5.58	2391	1594	1196	957	797	683	598	531	478	383	319	273
	2.0	6.44	2760	1840	1380	1104	920	789	690	613	552	442	368	315
	3.0	7.89	3381	2254	1691	1353	1127	966	845	751	676	541	451	386
	4.0	9.11	3904	2603	1952	1562	1301	1116	976	868	781	625	521	446
	5.0	10.19	4367	2911	2184	1747	1456	1248	1092	970	873	699	582	499
	6.0	11.16	4783	3189	2391	1913	1594	1367	1196	1063	957	765	638	547
	7.0	12.05	5164	3443	2582	2066	1721	1476	1291	1148	1033	826	689	590

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 50 cm Tip Spacing

TIP CAPACITY	LIQUID PRESSURE IN bar	CAPACITY 1 NOZZLE IN l/min	l/ha – 50 cm NOZZLE SPACING											
			4 km/h	6 km/h	8 km/h	10 km/h	12 km/h	14 km/h	16 km/h	18 km/h	20 km/h	25 km/h	30 km/h	35 km/h
01	1.0	0.23	69.0	46.0	34.5	27.6	23.0	19.7	17.3	15.3	13.8	11.0	9.2	7.9
	1.5	0.28	84.0	56.0	42.0	33.6	28.0	24.0	21.0	18.7	16.8	13.4	11.2	9.6
	2.0	0.32	96.0	64.0	48.0	38.4	32.0	27.4	24.0	21.3	19.2	15.4	12.8	11.0
	3.0	0.39	117	78.0	58.5	46.8	39.0	33.4	29.3	26.0	23.4	18.7	15.6	13.4
	4.0	0.45	135	90.0	67.5	54.0	45.0	38.6	33.8	30.0	27.0	21.6	18.0	15.4
	5.0	0.50	150	100	75.0	60.0	50.0	42.9	37.5	33.3	30.0	24.0	20.0	17.1
	6.0	0.55	165	110	82.5	66.0	55.0	47.1	41.3	36.7	33.0	26.4	22.0	18.9
	7.0	0.60	180	120	90.0	72.0	60.0	51.4	45.0	40.0	36.0	28.8	24.0	20.6
015	1.0	0.34	102	68.0	51.0	40.8	34.0	29.1	25.5	22.7	20.4	16.3	13.6	11.7
	1.5	0.42	126	84.0	63.0	50.4	42.0	36.0	31.5	28.0	25.2	20.2	16.8	14.4
	2.0	0.48	144	96.0	72.0	57.6	48.0	41.1	36.0	32.0	28.8	23.0	19.2	16.5
	3.0	0.59	177	118	88.5	70.8	59.0	50.6	44.3	39.3	35.4	28.3	23.6	20.2
	4.0	0.68	204	136	102	81.6	68.0	58.3	51.0	45.3	40.8	32.6	27.2	23.3
	5.0	0.76	228	152	114	91.2	76.0	65.1	57.0	50.7	45.6	36.5	30.4	26.1
	6.0	0.83	249	166	125	99.6	83.0	71.1	62.3	55.3	49.8	39.8	33.2	28.5
	7.0	0.90	270	180	135	108	90.0	77.1	67.5	60.0	54.0	43.2	36.0	30.9
02	1.0	0.46	138	92.0	69.0	55.2	46.0	39.4	34.5	30.7	27.6	22.1	18.4	15.8
	1.5	0.56	168	112	84.0	67.2	56.0	48.0	42.0	37.3	33.6	26.9	22.4	19.2
	2.0	0.65	195	130	97.5	78.0	65.0	55.7	48.8	43.3	39.0	31.2	26.0	22.3
	3.0	0.79	237	158	119	94.8	79.0	67.7	59.3	52.7	47.4	37.9	31.6	27.1
	4.0	0.91	273	182	137	109	91.0	78.0	68.3	60.7	54.6	43.7	36.4	31.2
	5.0	1.02	306	204	153	122	102	87.4	76.5	68.0	61.2	49.0	40.8	35.0
	6.0	1.12	336	224	168	134	112	96.0	84.0	74.7	67.2	53.8	44.8	38.4
	7.0	1.21	363	242	182	145	121	104	90.8	80.7	72.6	58.1	48.4	41.5
025	1.0	0.57	171	114	85.5	68.4	57.0	48.9	42.8	38.0	34.2	27.4	22.8	19.5
	1.5	0.70	210	140	105	84.0	70.0	60.0	52.5	46.7	42.0	33.6	28.0	24.0
	2.0	0.81	243	162	122	97.2	81.0	69.4	60.8	54.0	48.6	38.9	32.4	27.8
	3.0	0.99	297	198	149	119	99.0	84.9	74.3	66.0	59.4	47.5	39.6	33.9
	4.0	1.14	342	228	171	137	114	97.7	85.5	76.0	68.4	54.7	45.6	39.1
	5.0	1.28	384	256	192	154	128	110	96.0	85.3	76.8	61.4	51.2	43.9
	6.0	1.40	420	280	210	168	140	120	105	93.3	84.0	67.2	56.0	48.0
	7.0	1.51	453	302	227	181	151	129	113	101	90.6	72.5	60.4	51.8
03	1.0	0.68	204	136	102	81.6	68.0	58.3	51.0	45.3	40.8	32.6	27.2	23.3
	1.5	0.83	249	166	125	99.6	83.0	71.1	62.3	55.3	49.8	39.8	33.2	28.5
	2.0	0.96	288	192	144	115	96.0	82.3	72.0	64.0	57.6	46.1	38.4	32.9
	3.0	1.18	354	236	177	142	118	101	88.5	78.7	70.8	56.6	47.2	40.5
	4.0	1.36	408	272	204	163	136	117	102	90.7	81.6	65.3	54.4	46.6
	5.0	1.52	456	304	228	182	152	130	114	101	91.2	73.0	60.8	52.1
	6.0	1.67	501	334	251	200	167	143	125	111	100	80.2	66.8	57.3
	7.0	1.80	540	360	270	216	180	154	135	120	108	86.4	72.0	61.7
04	1.0	0.91	273	182	137	109	91.0	78.0	68.3	60.7	54.6	43.7	36.4	31.2
	1.5	1.12	336	224	168	134	112	96.0	84.0	74.7	67.2	53.8	44.8	38.4
	2.0	1.29	387	258	194	155	129	111	96.8	86.0	77.4	61.9	51.6	44.2
	3.0	1.58	474	316	237	190	158	135	119	105	94.8	75.8	63.2	54.2
	4.0	1.82	546	364	273	218	182	156	137	121	109	87.4	72.8	62.4
	5.0	2.04	612	408	306	245	204	175	153	136	122	97.9	81.6	69.9
	6.0	2.23	669	446	335	268	223	191	167	149	134	107	89.2	76.5
	7.0	2.41	723	482	362	289	241	207	181	161	145	116	96.4	82.6
05	1.0	1.14	342	228	171	137	114	97.7	85.5	76.0	68.4	54.7	45.6	39.1
	1.5	1.39	417	278	209	167	139	119	104	92.7	83.4	66.7	55.6	47.7
	2.0	1.61	483	322	242	193	161	138	121	107	96.6	77.3	64.4	55.2
	3.0	1.97	591	394	296	236	197	169	148	131	118	94.6	78.8	67.5
	4.0	2.27	681	454	341	272	227	195	170	151	136	109	90.8	77.8
	5.0	2.54	762	508	381	305	254	218	191	169	152	122	102	87.1
	6.0	2.79	837	558	419	335	279	239	209	186	167	134	112	95.7
	7.0	3.01	903	602	452	361	301	258	226	201	181	144	120	103
06	1.0	1.37	411	274	206	164	137	117	103	91.3	82.2	65.8	54.8	47.0
	1.5	1.68	504	336	252	202	168	144	126	112	101	80.6	67.2	57.6
	2.0	1.94	582	388	291	233	194	166	146	129	116	93.1	77.6	66.5
	3.0	2.37	711	474	356	284	237	203	178	158	142	114	94.8	81.3
	4.0	2.74	822	548	411	329	274	235	206	183	164	132	110	93.9
	5.0	3.06	918	612	459	367	306	262	230	204	184	147	122	105
	6.0	3.35	1005	670	503	402	335	287	251	223	201	161	134	115
	7.0	3.62	1086	724	543	434	362	310	272	241	217	174	145	124
08	1.0	1.82	546	364	273	218	182	156	137	121	109	87.4	72.8	62.4
	1.5	2.23	669	446	335	268	223	191	167	149	134	107	89.2	76.5
	2.0	2.58	774	516	387	310	258	221	194	172	155	124	103	88.5
	3.0	3.16	948	632	474	379	316	271	237	211	190	152	126	108
	4.0	3.65	1095	730	548	438	365	313	274	243	219	175	146	125
	5.0	4.08	1224	816	612	490	408	350	306	272	245	196	163	140
	6.0	4.47	1341	894	671	536	447	383	335	298	268	215	179	153
	7.0	4.83	1449	966	725	580	483	414	362	322	290	232	193	166
10	1.0	2.28	684	456	342	274	228	195	171	152	137	109	91.2	78.2
	1.5	2.79	837	558	419	335	279	239	209	186	167	134	112	95.7
	2.0	3.23	969	646	485	388	323	277	242	215	194	155	129	111
	3.0	3.95	1185	790	593	474	395	339	296	263	237	190	158	135
	4.0	4.56	1368	912	684	547	456	391	342	304	274	219	182	156
	5.0	5.10	1530	1020	765	612	510	437	383	340	306	245	204	175
	6.0	5.59	1677	1118	839	671	559	479	419	373	335	268	224	192
	7.0	6.03	1809	1206	905	724	603	517	452	402	362	289	241	207
15	1.0	3.42	1026	684	513	410	342	293	257	228	205	164	137	117
	1.5	4.19	1257	838	629	503	419	359	314	279	251	201	168	144
	2.0	4.83	1449	966	725	580	483	414	362	322	290	232	193	166
	3.0	5.92	1776	1184	888	710	592	507	444	395	355	284	237	203
	4.0	6.84	2052	1368	1026	821	684	586	513	456	410	328	274	235
	5.0	7.64	2292	1528	1146	917	764	655	573	509	458	367	306	262
	6.0	8.37	2511	1674	1256	1004	837	717	628	558	502	402	335	287
	7.0	9.04	2712	1808	1356	1085	904	775	678	603	542	434	362	310
20	1.0	4.56	1368	912	684	547	456	391	342	304	274	219	182	156
	1.5	5.58	1674	1116	837	670	558	478	419	372	335	268	223	191
	2.0	6.44	1932	1288	966	773	644	552	483	429	386	309	258	221
	3.0	7.89	2367	1578	1184	947	789	676	592	526	473	379	316	271
	4.0	9.11	2733	1822	1367	1093	911	781	683	607	547	437	364	312
	5.0	10.19	3057	2038	1529	1223	1019	873	764	679	611	489	408	349
	6.0	11.16	3348	2232	1674	1339	1116	957	837	744	670	536	446	383
	7.0	12.05	3615	2410	1808	1446	1205	1033	904	803	723	578	482	413

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

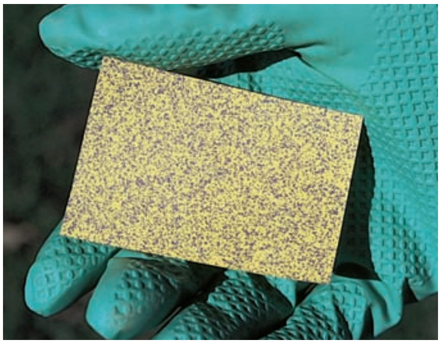
Technical Information

Universal Application Rate Chart for 75 cm Tip Spacing

TIP CAPACITY	LIQUID PRESSURE IN bar	CAPACITY 1 NOZZLE IN l/min	l/ha – 75 cm NOZZLE SPACING											
			4 km/h	6 km/h	8 km/h	10 km/h	12 km/h	14 km/h	16 km/h	18 km/h	20 km/h	25 km/h	30 km/h	35 km/h
01	1.0	0.23	46.0	30.7	23.0	18.4	15.3	13.1	11.5	10.2	9.2	7.4	6.1	5.3
	1.5	0.28	56.0	37.3	28.0	22.4	18.7	16.0	14.0	12.4	11.2	9.0	7.5	6.4
	2.0	0.32	64.0	42.7	32.0	25.6	21.3	18.3	16.0	14.2	12.8	10.2	8.5	7.3
	3.0	0.39	78.0	52.0	39.0	31.2	26.0	22.3	19.5	17.3	15.6	12.5	10.4	8.9
	4.0	0.45	90.0	60.0	45.0	36.0	30.0	25.7	22.5	20.0	18.0	14.4	12.0	10.3
	5.0	0.50	100	66.7	50.0	40.0	33.3	28.6	25.0	22.2	20.0	16.0	13.3	11.4
	6.0	0.55	110	73.3	55.0	44.0	36.7	31.4	27.5	24.4	22.0	17.6	14.7	12.6
	7.0	0.60	120	80.0	60.0	48.0	40.0	34.3	30.0	26.7	24.0	19.2	16.0	13.7
015	1.0	0.34	68.0	45.3	34.0	27.2	22.7	19.4	17.0	15.1	13.6	10.9	9.1	7.8
	1.5	0.42	84.0	56.0	42.0	33.6	28.0	24.0	21.0	18.7	16.8	13.4	11.2	9.6
	2.0	0.48	96.0	64.0	48.0	38.4	32.0	27.4	24.0	21.3	19.2	15.4	12.8	11.0
	3.0	0.59	118	78.7	59.0	47.2	39.3	33.7	29.5	26.2	23.6	18.9	15.7	13.5
	4.0	0.68	136	90.7	68.0	54.4	45.3	38.9	34.0	30.2	27.2	21.8	18.1	15.5
	5.0	0.76	152	101	76.0	60.8	50.7	43.4	38.0	33.8	30.4	24.3	20.3	17.4
	6.0	0.83	166	111	83.0	66.4	55.3	47.4	41.5	36.9	33.2	26.6	22.1	19.0
	7.0	0.90	180	120	90.0	72.0	60.0	51.4	45.0	40.0	36.0	28.8	24.0	20.6
02	1.0	0.46	92.0	61.3	46.0	36.8	30.7	26.3	23.0	20.4	18.4	14.7	12.3	10.5
	1.5	0.56	112	74.7	56.0	44.8	37.3	32.0	28.0	24.9	22.4	17.9	14.9	12.8
	2.0	0.65	130	86.7	65.0	52.0	43.3	37.1	32.5	28.9	26.0	20.8	17.3	14.9
	3.0	0.79	158	105	79.0	63.2	52.7	45.1	39.5	35.1	31.6	25.3	21.1	18.1
	4.0	0.91	182	121	91.0	72.8	60.7	52.0	45.5	40.4	36.4	29.1	24.3	20.8
	5.0	1.02	204	136	102	81.6	68.0	58.3	51.0	45.3	40.8	32.6	27.2	23.3
	6.0	1.12	224	149	112	89.6	74.7	64.0	56.0	49.8	44.8	35.8	29.9	25.6
	7.0	1.21	242	161	121	96.8	80.7	69.1	60.5	53.8	48.4	38.7	32.3	27.7
025	1.0	0.57	114	76.0	57.0	45.6	38.0	32.6	28.5	25.3	22.8	18.2	15.2	13.0
	1.5	0.70	140	93.3	70.0	56.0	46.7	40.0	35.0	31.1	28.0	22.4	18.7	16.0
	2.0	0.81	162	108	81.0	64.8	54.0	46.3	40.5	36.0	32.4	25.9	21.6	18.5
	3.0	0.99	198	132	99.0	79.2	66.0	56.6	49.5	44.0	39.6	31.7	26.4	22.6
	4.0	1.14	228	152	114	91.2	76.0	65.1	57.0	50.7	45.6	36.5	30.4	26.1
	5.0	1.28	256	171	128	102	85.3	73.1	64.0	56.9	51.2	41.0	34.1	29.3
	6.0	1.40	280	187	140	112	93.3	80.0	70.0	62.2	56.0	44.8	37.3	32.0
	7.0	1.51	302	201	151	121	101	86.3	75.5	67.1	60.4	48.3	40.3	34.5
03	1.0	0.68	136	90.7	68.0	54.4	45.3	38.9	34.0	30.2	27.2	21.8	18.1	15.5
	1.5	0.83	166	111	83.0	66.4	55.3	47.4	41.5	36.9	33.2	26.6	22.1	19.0
	2.0	0.96	192	128	96.0	76.8	64.0	54.9	48.0	42.7	38.4	30.7	25.6	21.9
	3.0	1.18	236	157	118	94.4	78.7	67.4	59.0	52.4	47.2	37.8	31.5	27.0
	4.0	1.36	272	181	136	109	90.7	77.7	68.0	60.4	54.4	43.5	36.3	31.1
	5.0	1.52	304	203	152	122	101	86.9	76.0	67.6	60.8	48.6	40.5	34.7
	6.0	1.67	334	223	167	134	111	95.4	83.5	74.2	66.8	53.4	44.5	38.2
	7.0	1.80	360	240	180	144	120	103	90.0	80.0	72.0	57.6	48.0	41.1
04	1.0	0.91	182	121	91.0	72.8	60.7	52.0	45.5	40.4	36.4	29.1	24.3	20.8
	1.5	1.12	224	149	112	89.6	74.7	64.0	56.0	49.8	44.8	35.8	29.9	25.6
	2.0	1.29	258	172	129	103	86.0	73.7	64.5	57.3	51.6	41.3	34.4	29.5
	3.0	1.58	316	211	158	126	105	90.3	79.0	70.2	63.2	50.6	42.1	36.1
	4.0	1.82	364	243	182	146	121	104	91.0	80.9	72.8	58.2	48.5	41.6
	5.0	2.04	408	272	204	163	136	117	102	90.7	81.6	65.3	54.4	46.6
	6.0	2.23	446	297	223	178	149	127	112	99.1	89.2	71.4	59.5	51.0
	7.0	2.41	482	321	241	193	161	138	121	107	96.4	77.1	64.3	55.1
05	1.0	1.14	228	152	114	91.2	76.0	65.1	57.0	50.7	45.6	36.5	30.4	26.1
	1.5	1.39	278	185	139	111	92.7	79.4	69.5	61.8	55.6	44.5	37.1	31.8
	2.0	1.61	322	215	161	129	107	92.0	80.5	71.6	64.4	51.5	42.9	36.8
	3.0	1.97	394	263	197	158	131	113	98.5	87.6	78.8	63.0	52.5	45.0
	4.0	2.27	454	303	227	182	151	130	114	101	90.8	72.6	60.5	51.9
	5.0	2.54	508	339	254	203	169	145	127	113	102	81.3	67.7	58.1
	6.0	2.79	558	372	279	223	186	159	140	124	112	89.3	74.4	63.8
	7.0	3.01	602	401	301	241	201	172	151	134	120	96.3	80.3	68.8
06	1.0	1.37	274	183	137	110	91.3	78.3	68.5	60.9	54.8	43.8	36.5	31.3
	1.5	1.68	336	224	168	134	112	96.0	84.0	74.7	67.2	53.8	44.8	38.4
	2.0	1.94	388	259	194	155	129	111	97.0	86.2	77.6	62.1	51.7	44.3
	3.0	2.37	474	316	237	190	158	135	119	105	94.8	75.8	63.2	54.2
	4.0	2.74	548	365	274	219	183	157	137	122	110	87.7	73.1	62.6
	5.0	3.06	612	408	306	245	204	175	153	136	122	97.9	81.6	69.9
	6.0	3.35	670	447	335	268	223	191	168	149	134	107	89.3	76.6
	7.0	3.62	724	483	362	290	241	207	181	161	145	116	96.5	82.7
08	1.0	1.82	364	243	182	146	121	104	91.0	80.9	72.8	58.2	48.5	41.6
	1.5	2.23	446	297	223	178	149	127	112	99.1	89.2	71.4	59.5	51.0
	2.0	2.58	516	344	258	206	172	147	129	115	103	82.6	68.8	59.0
	3.0	3.16	632	421	316	253	211	181	158	140	126	101	84.3	72.2
	4.0	3.65	730	487	365	292	243	209	183	162	146	117	97.3	83.4
	5.0	4.08	816	544	408	326	272	233	204	181	163	131	109	93.3
	6.0	4.47	894	596	447	358	298	255	224	199	179	143	119	102
	7.0	4.83	966	644	483	386	322	276	242	215	193	155	129	110
10	1.0	2.28	456	304	228	182	152	130	114	101	91.2	73.0	60.8	52.1
	1.5	2.79	558	372	279	223	186	159	140	124	112	89.3	74.4	63.8
	2.0	3.23	646	431	323	258	215	185	162	144	129	103	86.1	73.8
	3.0	3.95	790	527	395	316	263	226	198	176	158	126	105	90.3
	4.0	4.56	912	608	456	365	304	261	228	203	182	146	122	104
	5.0	5.10	1020	680	510	408	340	291	255	227	204	163	136	117
	6.0	5.59	1118	745	559	447	373	319	280	248	224	179	149	128
	7.0	6.03	1206	804	603	482	402	345	302	268	241	193	161	138
15	1.0	3.42	684	456	342	274	228	195	171	152	137	109	91.2	78.2
	1.5	4.19	838	559	419	335	279	239	210	186	168	134	112	95.8
	2.0	4.83	966	644	483	386	322	276	242	215	193	155	129	110
	3.0	5.92	1184	789	592	474	395	338	296	263	237	189	158	135
	4.0	6.84	1368	912	684	547	456	391	342	304	274	219	182	156
	5.0	7.64	1528	1019	764	611	509	437	382	340	306	244	204	175
	6.0	8.37	1674	1116	837	670	558	478	419	372	335	268	223	191
	7.0	9.04	1808	1205	904	723	603	517	452	402	362	289	241	207
20	1.0	4.56	912	608	456	365	304	261	228	203	182	146	122	104
	1.5	5.58	1116	744	558	446	372	319	279	248	223	179	149	128
	2.0	6.44	1288	859	644	515	429	368	322	286	258	206	172	147
	3.0	7.89	1578	1052	789	631	526	451	395	351	316	252	210	180
	4.0	9.11	1822	1215	911	729	607	521	456	405	364	292	243	208
	5.0	10.19	2038	1359	1019	815	679	582	510	453	408	326	272	233
	6.0	11.16	2232	1488	1116	893	744	638	558	496	446	357	298	255
	7.0	12.05	2410	1607	1205	964	803	689	603	536	482	386	321	275

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	76 mm x 26 mm	50 cards
20301-2N	76 mm x 52 mm	50 cards
20301-3N	500 mm x 26 mm	25 strips

OIL SENSITIVE PAPER		
PART NUMBER	PAPER SIZE	QUANTITY/PACKAGE
20302-1	76 mm x 52 mm	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

$$\text{l/min (Per Nozzle)} = \frac{\text{l/ha} \times \text{km/h} \times W}{60{,}000}$$

$$\text{l/ha} = \frac{60{,}000 \times \text{l/min (Per Nozzle)}}{\text{km/h} \times W}$$

l/min – Liters Per Minute

L/ha – Liters Per Hectare

km/h – Kilometers Per Hour

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

Useful Formulas for Roadway Applications

$$\text{l/km} = \frac{60 \times \text{l/min}}{\text{km/hr}} \qquad \text{l/min} = \frac{\text{l/lkm} \times \text{km/hr}}{60}$$

l/lkm = Liters Per Lane Kilometer

Note: l/km 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 30 and 60 meters are recommended for measuring speeds up to 8 and 14 km/h, respectively. Determine the time required to travel the test course. To help ensure accuracy, conduct the speed check with a partially loaded 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.

$$\text{Speed (km/h)} = \frac{\text{Distance (m)} \times 3.6}{\text{Time (seconds)}}$$

Speeds

Speed in km/h	Time Required in SECONDS to Travel a Distance of:			
	30 m	60 m	90 m	120 m
5	22	43	65	86
6	18	36	54	72
7	15	31	46	62
8	14	27	41	54
9	—	24	36	48
10	—	22	32	43
11	—	20	29	39
12	—	18	27	36
13	—	17	25	33
14	—	15	23	31
16	—	14	20	27
18	—	—	18	24
20	—	—	16	22
25	—	—	13	17
30	—	—	—	14
35	—	—	—	12
40	—	—	—	11

Nozzle Spacing

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

50 cm	
Other Spacing (cm)	Conversion Factor
20	2.5
25	2
30	1.67
35	1.43
40	1.25
45	1.11
60	.83
70	.71
75	.66

75 cm	
Other Spacing (cm)	Conversion Factor
40	1.88
45	1.67
50	1.5
60	1.25
70	1.07
80	.94
90	.83
110	.68
120	.63

100 cm	
Other Spacing (cm)	Conversion Factor
70	1.43
75	1.33
80	1.25
85	1.18
90	1.11
95	1.05
105	.95
110	.91
120	.83

Miscellaneous Conversion Factors

One Hectare = 10,000 Square Meters
2.471 Acres

One Acre = 0.405 Hectare

One Liter Per Hectare = 0.1069 Gallon Per Acre

One Kilometer = 1,000 Meters
= 3,300 Feet = 0.621 Mile

One Liter = 0.26 Gallon
= 0.22 Imperial Gallon

One Bar = 100 Kilopascals
= 14.5 Pounds Per Square Inch

One Kilometer Per Hour = 0.62 Mile 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 50 cm apart are commonly set 50 cm above the target.

	(cm)			
		50 cm	75 cm	100 cm
TP, TJ	65°	75	100	NR*
TP, XR, TX, DG, TJ, AI, XRC	80°	60	80	NR*
TP, XR, DG, TT, TTI, TJ, DGTJ, AI, AIXR, AIC, XRC, TTJ, AITTJ	110°	40	60	NR*
FullJet®	120°	40**	60**	75**
FloodJet® TK, TF, K, QCK, QCTF, 1/4TTJ	120°	40***	60***	75***

* 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 1 kilogram per liter, 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 l/min or l/ha of the spray liquid by the water rate conversion factor. Then use the new converted l/min or l/ha rate to select the proper size nozzle.

Example:

Desired application rate is 100 l/ha of a liquid that has a density of 1.28 kg/L. Determine the correct nozzle size as follows:

l/ha (liquid other than water) x Conversion Factor
= l/ha (from table in catalog)

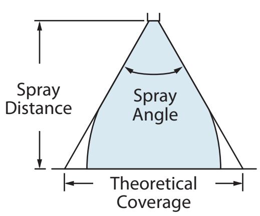
100 l/ha (1.28 kg/L solution) x 1.13
= 113 l/ha (water)

The applicator should choose a nozzle size that will supply 113 l/ha of water at the desired pressure.

DENSITY – kg/L	CONVERSION FACTOR
0.84	0.92
0.96	0.98
1.00 – WATER	1.00
1.08	1.04
1.20	1.10
1.28 – 28% nitrogen	1.13
1.32	1.15
1.44	1.20
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.

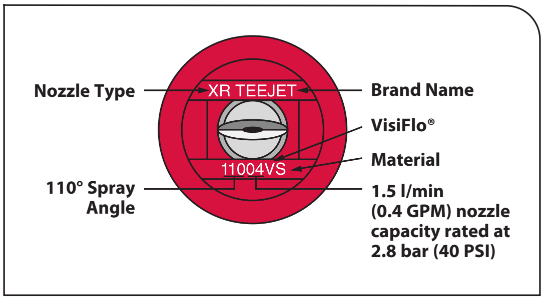


INCLUDED SPRAY ANGLE	THEORETICAL COVERAGE AT VARIOUS SPRAY HEIGHTS (IN cm)							
	20 cm	30 cm	40 cm	50 cm	60 cm	70 cm	80 cm	90 cm
15°	5.3	7.9	10.5	13.2	15.8	18.4	21.1	23.7
20°	7.1	10.6	14.1	17.6	21.2	24.7	28.2	31.7
25°	8.9	13.3	17.7	22.2	26.6	31.0	35.5	39.9
30°	10.7	16.1	21.4	26.8	32.2	37.5	42.9	48.2
35°	12.6	18.9	25.2	31.5	37.8	44.1	50.5	56.8
40°	14.6	21.8	29.1	36.4	43.7	51.0	58.2	65.5
45°	16.6	24.9	33.1	41.4	49.7	58.0	66.3	74.6
50°	18.7	28.0	37.3	46.6	56.0	65.3	74.6	83.9
55°	20.8	31.2	41.7	52.1	62.5	72.9	83.3	93.7
60°	23.1	34.6	46.2	57.7	69.3	80.8	92.4	104
65°	25.5	38.2	51.0	63.7	76.5	89.2	102	115
73°	29.6	44.4	59.2	74.0	88.8	104	118	133
80°	33.6	50.4	67.1	83.9	101	118	134	151
85°	36.7	55.0	73.3	91.6	110	128	147	165
90°	40.0	60.0	80.0	100	120	140	160	180
95°	43.7	65.5	87.3	109	131	153	175	196
100°	47.7	71.5	95.3	119	143	167	191	215
110°	57.1	85.7	114	143	171	200	229	257
120°	69.3	104	139	173	208	243		
130°	85.8	129	172	215	257			
140°	110	165	220	275				
150°	149	224	299					

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 l/min and pressure is as follows:

$$\frac{l/min_1}{l/min_2} = \frac{\sqrt{bar_1}}{\sqrt{bar_2}}$$

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.

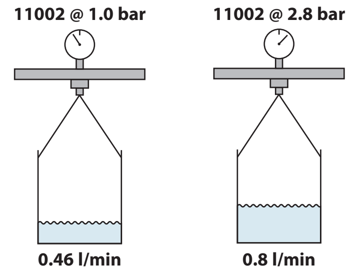
The values given in the tabulation sections of this catalog indicate the most commonly used pressure ranges for the associated spray tips. When information on the performance of spray tips outside of the pressure range given in this catalog is required, contact TeeJet Technologies or your local rep.

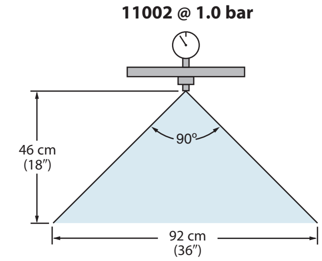
Spray Angle and Coverage

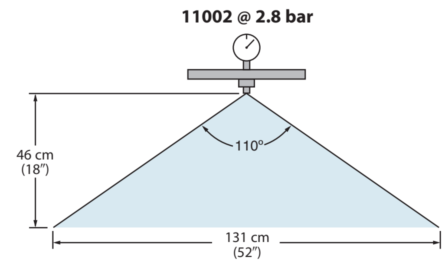
Depending on the nozzle type and size, the operating pressure can have a significant effect on spray angle and quality of spray distribution. As shown here for an 11002 flat spray tip, lowering the pressure results in a smaller spray angle and a significant reduction in spray coverage.

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.







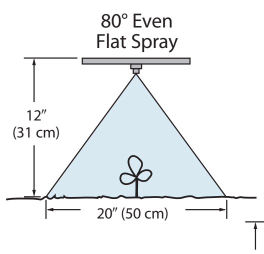
Pressure Drop Through Various Hose Sizes

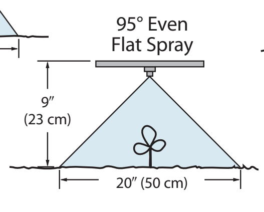
FLOW IN l/min	PRESSURE DROP IN 3 m (10′) LENGTH WITHOUT COUPLINGS									
	6.4 mm		9.5 mm		12.7 mm		19.0 mm		25.4 mm	
	bar	Kpa	bar	Kpa	bar	Kpa	bar	Kpa	bar	Kpa
1.9	0.1	9.6		1.4						
3.8				4.8						
5.8			0.1	9.6		2.8				
7.7			0.2	16.5		4.1				
9.6			0.2	23.4	0.1	6.2				
11.5					0.1	8.3				
15.4					0.1	13.8				
19.2					0.2	20.0		2.8		
23.1					0.3	27.6		4.1		
30.8							0.1	6.2		2.1
38.5							0.1	9.6		2.8

Helpful Reminders for Band Spraying

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

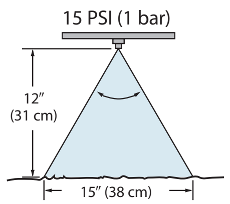
Example:

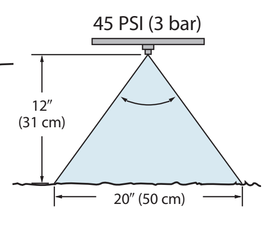




The spray angle of the nozzle and the resulting band width are directly influenced by the spraying pressure.

Example: 8002E Even Flat Spray



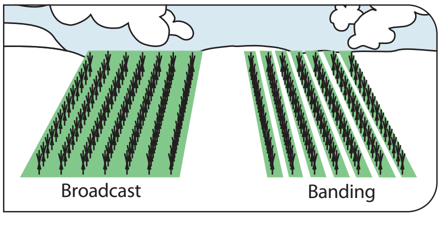


Use care when calculating:
Field Acres/Hectares vs. Treated Acres/Hectares

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

Treated Acres/Hectares =

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



Pressure Drop Through Sprayer Components

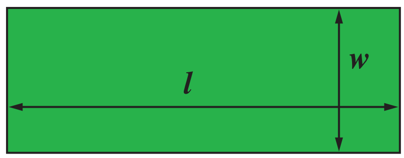
COMPONENT NUMBER	TYPICAL PRESSURE DROP (bar) AT VARIOUS FLOW RATES (l/min)																				
	2.0 l/min	3.0 l/min	4.0 l/min	5.0 l/min	7.5 l/min	10.0 l/min	15.0 l/min	20.0 l/min	25.0 l/min	30.0 l/min	40.0 l/min	50.0 l/min	75.0 l/min	100 l/min	150 l/min	200 l/min	250 l/min	300 l/min	375 l/min	450 l/min	550 l/min	750 l/min
AA2 GunJet			0.02	0.03	0.06	0.11	0.26	0.45	0.71	1.02	1.82	2.84										
AA18 GunJet		0.02	0.04	0.07	0.16	0.28	0.62	1.10	1.72	2.48	4.42											
AA30L GunJet		0.03	0.05	0.07	0.17	0.30	0.67	1.19	1.86	2.67	4.75											
AA43 GunJet						0.02	0.05	0.08	0.13	0.18	0.32	0.51	1.14	2.02	4.55							
AA143 GunJet						0.02	0.04	0.07	0.10	0.15	0.27	0.42	0.94	1.68	3.78							
AA6B Valve						0.02	0.03	0.06	0.10	0.14	0.25	0.38	0.87	1.54	3.46							
AA17 Valve						0.02	0.03	0.06	0.10	0.14	0.25	0.38	0.87	1.54	3.46							
AA144A/144P Valve						0.02	0.03	0.06	0.10	0.14	0.25	0.38	0.87	1.54	3.46							
AA144A-1-3/AA144P-1-3 Valve					0.02	0.04	0.09	0.15	0.24	0.34	0.60	0.94	2.13	3.78								
AA145H Valve							0.02	0.04	0.07	0.09	0.17	0.26	0.59	1.05	2.35	4.19						
344 2-way Valve										0.02	0.04	0.06	0.13	0.23	0.52	0.93	1.45	2.09	3.27			
344 3-way Valve								0.02	0.03	0.04	0.07	0.10	0.23	0.41	0.92	1.64	2.57	3.70				
346 2-way Valve														0.02	0.05	0.09	0.15	0.21	0.33	0.48	0.72	1.33
346 3-way Valve													0.03	0.06	0.13	0.23	0.36	0.52	0.82	1.18	1.76	3.27
356 Valve														0.02	0.05	0.09	0.15	0.21	0.33	0.48	0.72	1.33
430 2-way* Manifold						0.02	0.04	0.07	0.11	0.16	0.28	0.44	0.99	1.76	3.95							
430 3-way* Manifold						0.02	0.04	0.07	0.11	0.16	0.28	0.44	0.99	1.76	3.95							
430 FB* Manifold					0.02	0.03	0.06	0.11	0.17	0.25	0.44	0.69	1.56	2.78								
440* Manifold									0.02	0.03	0.06	0.09	0.20	0.35	0.80	1.42	2.21	3.19				
450* Manifold										0.02	0.04	0.06	0.13	0.23	0.52	0.93	1.45	2.09	3.27			
450 FB* Manifold										0.02	0.04	0.06	0.13	0.23	0.52	0.93	1.45	2.09	3.27			
460 2-way* Manifold								0.02	0.02	0.03	0.06	0.09	0.21	0.38	0.85	1.51	2.35	3.39				
460 3-way* Manifold								0.02	0.02	0.03	0.06	0.09	0.21	0.38	0.85	1.51	2.35	3.39				
460 FB* Manifold								0.02	0.03	0.04	0.07	0.10	0.23	0.41	0.92	1.64	2.57	3.70				
490* Manifold														0.02	0.05	0.09	0.15	0.21	0.33	0.48	0.72	1.33
540* Manifold									0.02	0.03	0.05	0.08	0.18	0.33	0.74	1.31	2.04	2.94				
QJ300 Nozzle Body		0.02	0.03	0.05	0.11	0.20	0.44	0.78	1.22	1.76	3.12											
QJ360C Nozzle Body	0.02	0.04	0.08	0.12	0.26	0.47	1.06	1.88	2.94													
QJ360E Nozzle Body	0.04	0.09	0.17	0.26	0.59	1.05	2.35															
QJ360F Nozzle Body		0.02	0.03	0.05	0.11	0.20	0.46	0.82	1.28	1.84	3.27											
QJ380 Nozzle Body		0.02	0.04	0.07	0.15	0.26	0.59	1.05	1.64	2.35	4.19											
QJ380F Nozzle Body			0.02	0.03	0.07	0.12	0.26	0.47	0.74	1.06	1.88	2.94										
24230A/24216A Nozzle Body	0.04	0.08	0.15	0.23	0.51	0.91	2.06	3.65														
QJ17560A Nozzle Body	0.02	0.04	0.08	0.12	0.26	0.47	1.06	1.88	2.94													
AA122-1/2 Line Strainer						0.02	0.04	0.07	0.10	0.15	0.27	0.42	0.94	1.68	3.78							
AA122-3/4 Line Strainer							0.02	0.04	0.06	0.09	0.15	0.24	0.53	0.94	2.13	3.78						
AA122-QC Line Strainer							0.02	0.03	0.05	0.07	0.12	0.18	0.41	0.74	1.65	2.94						
AA126-3 Line Strainer								0.02	0.03	0.04	0.07	0.11	0.25	0.45	1.01	1.80	2.81	4.04				
AA126-4/F50/M50 Line Strainer										0.02	0.03	0.05	0.11	0.20	0.44	0.78	1.22	1.76	2.74	3.95		
AA126-5 Line Strainer												0.02	0.04	0.07	0.15	0.27	0.43	0.62	0.96	1.38	2.07	3.85
AA126-6/F75 Line Strainer													0.02	0.04	0.09	0.16	0.25	0.36	0.56	0.81	1.21	2.26

*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 150 meters long by 75 meters wide?

$$\begin{aligned}\text{Area} &= 150 \text{ meters} \times 75 \text{ meters}\\ &= 11{,}250 \text{ square meters}\end{aligned}$$

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

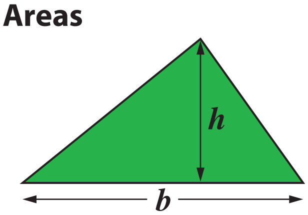
$$\text{Area in hectares} = \frac{\text{Area in square meters}}{10{,}000 \text{ square meters per hectare}}$$

(There are 10,000 square meters in a hectare.)

Example:

$$\text{Area in hectares} = \frac{11{,}250 \text{ square meters}}{10{,}000 \text{ square meters per hectare}} = 1.125 \text{ hectares}$$

Triangular Areas



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

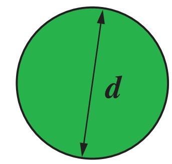
Example:

The base of a corner lot is 120 meters while the height is 50 meters. What is the area of the lot?

$$\text{Area} = \frac{120 \text{ meters} \times 50 \text{ meters}}{2} = 3{,}000 \text{ square meters}$$

$$\text{Area in hectares} = \frac{3{,}000 \text{ square meters}}{10{,}000 \text{ square meters per hectare}} = 0.30 \text{ hectare}$$

Circular Areas



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

$$\pi = 3.14159$$

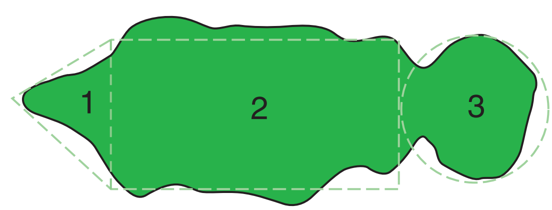
Example:

What is the area of a green that has a diameter of 15 meters?

$$\text{Area} = \frac{\pi \times (15 \text{ meters})^2}{4} = \frac{3.14 \times 225}{4} = 177 \text{ square meters}$$

$$\text{Area in hectares} = \frac{177 \text{ square meters}}{10{,}000 \text{ square meters per hectare}} = 0.018 \text{ hectare}$$

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.

$$\text{Area 1} = \frac{15 \text{ meters} \times 20 \text{ meters}}{2} = 150 \text{ square meters}$$

$$\text{Area 2} = 15 \text{ meters} \times 150 \text{ meters} = 2{,}250 \text{ square meters}$$

$$\text{Area 3} = \frac{3.14 \times (20)^2}{4} = 314 \text{ square meters}$$

$$\text{Total Area} = 150 + 2{,}250 + 314 = 2{,}714 \text{ square meters}$$

$$= \frac{2{,}714 \text{ square meters}}{10{,}000 \text{ square meters per hectare}} = 0.27 \text{ hectare}$$

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 30- or 60-meter 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

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)	190 l/ha
Measured sprayer speed	10 km/h
Nozzle spacing	50 cm

STEP NUMBER 3

Calculating Required Nozzle Output

Determine l/min nozzle output from formula.

FORMULA: $\text{l/min} = \dfrac{\text{l/ha} \times \text{km/h} \times \text{W}}{60{,}000}$

EXAMPLE: $\text{l/min} = \dfrac{190 \times 10 \times 50}{60{,}000}$

ANSWER: 1.58 l/min

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 1.58 l/min at 3 bar.

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 1.58 l/min.

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.

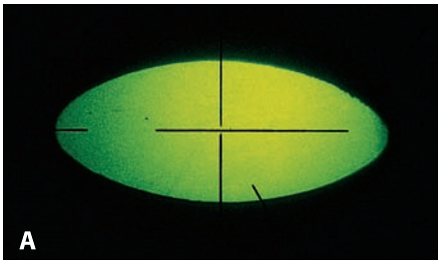
Banding and Directed Applications

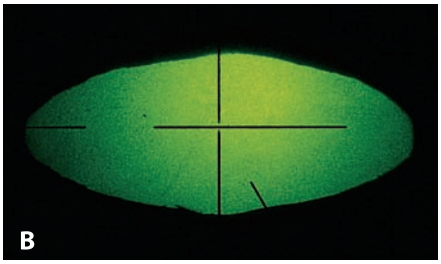
The only difference between the above procedure and calibrating for banding or directed applications is the input value used for “W” in the formula in Step 3.

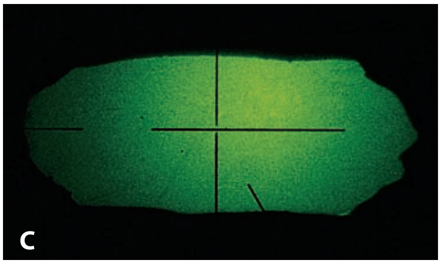
For single nozzle banding or boomless applications:
W = Sprayed band width or swath width (in cm).

For multiple nozzle directed applications:
W = Row spacing (in cm) 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 200-hectare farm could represent a loss of U.S. $1,000–$5,000 based on today's chemical investments of $25.00–$125.00 per hectare. This does not take into account potential crop damage.

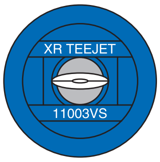
An Inside Look at Nozzle Orifice Wear and Damage

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

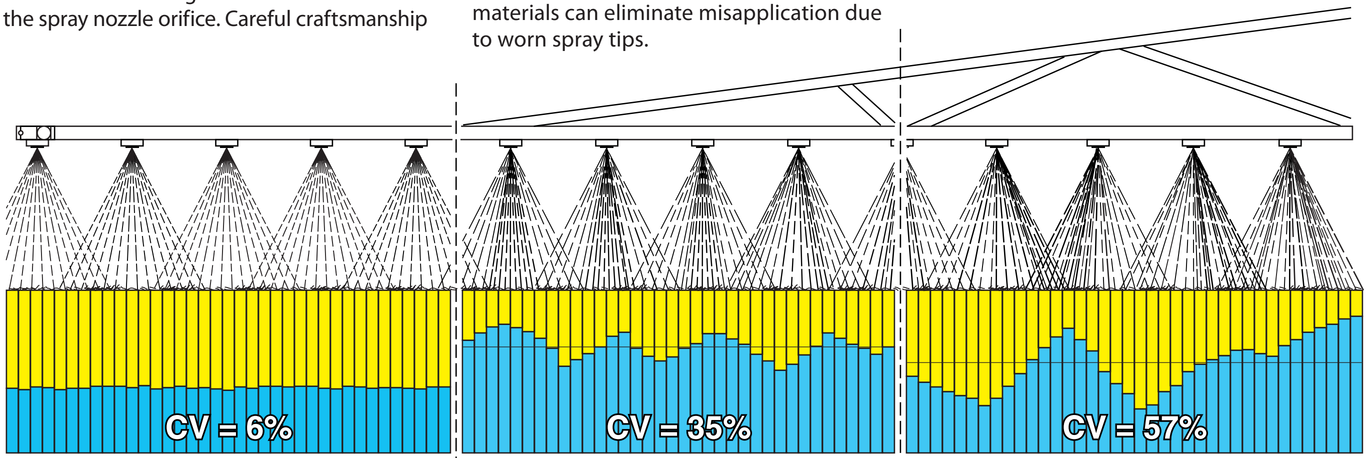


The successful performance of a crop chemical is highly dependent on its proper application as recommended by the chemical manufacturer. Proper selection and operation of spray nozzles are very important steps in accurate chemical application. The volume of spray passing through each nozzle plus the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

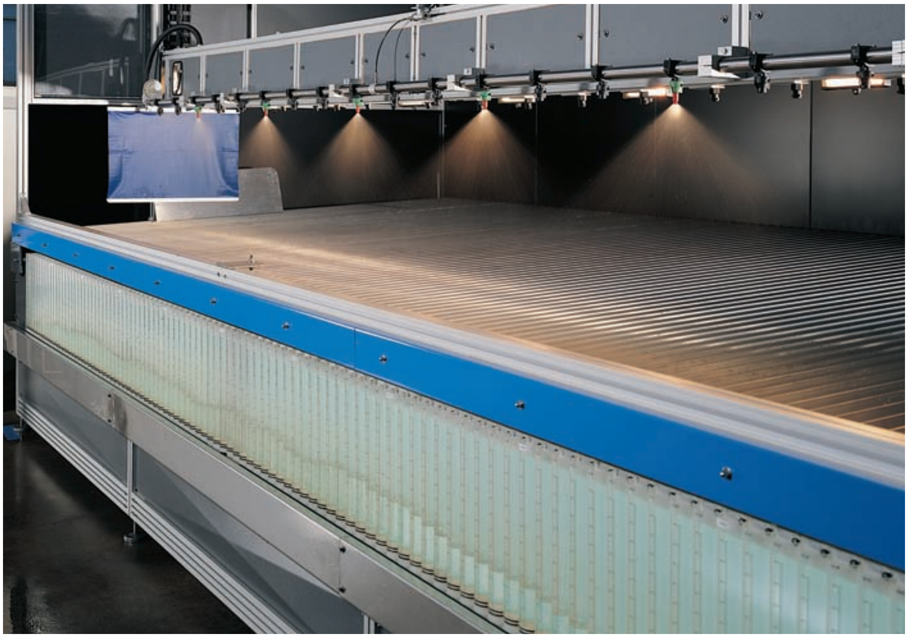
Spray Distribution Quality

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 (1.16 l/min FLOW)	APPROXIMATE PERCENT OF SPRAY VOLUME LESS THAN 150 MICRONS	
	1.5 bar	3 bar
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. (Optimum spray height 75 cm for 80° spray tips, 50 cm for 110° spray tips.)

■ Operating Speed

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

Apply crop protection chemicals according to good, professional practices at maximum operating speeds of 6 to 8 km/h (with air induction type nozzles—up to 10 km/h). 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 3 m/s, 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 5 m/s (11 MPH), spraying operation should not be performed.

■ Air Temperature and Humidity

In ambient temperatures over 25°C/77°F 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 regard 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 are 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.

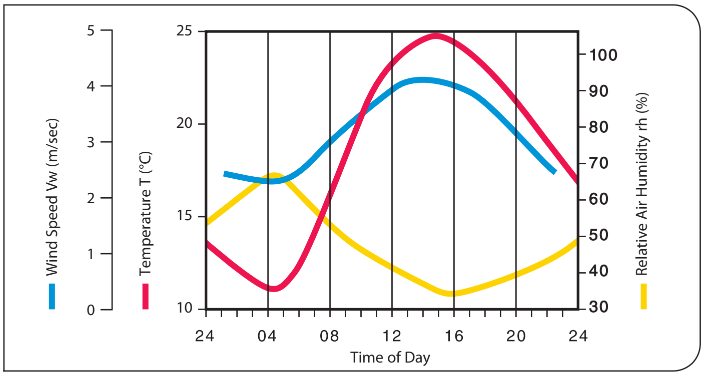


Figure 2. Development of wind velocity, air temperature and relative air humidity (example). From: Malberg

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 3 bar (50 PSI) and 7 km/h (5 MPH) ground speed, the application rate is 200 l/ha (20 MPH). 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 2 bar (29.5 PSI). Yet, where maximum effect is critical, the nozzles are operated at pressures between 2 bar (29.5 PSI) and 3.5 bar (52 PSI) or even higher in specific conditions. These pressure ranges do not apply to AI and TTI, which operate at less than 3 bar (43.5 PSI) when drift control is critical and always at 4 bar (58 PSI) and 7 bar (101.5 PSI) and even 8 bar (116 PSI) 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 (global patent). 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.

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**

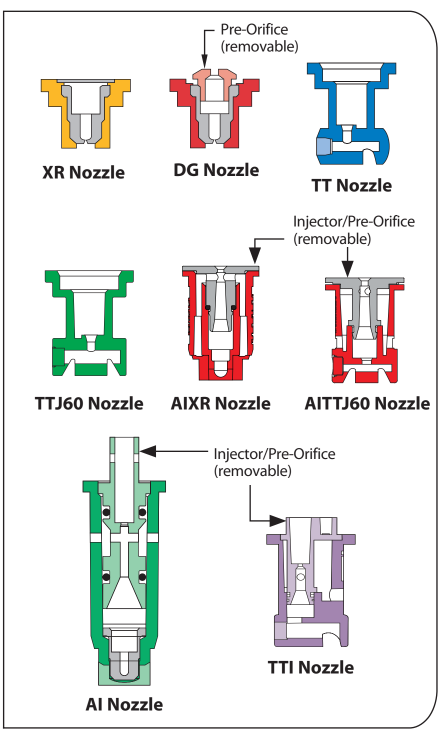


Figure 3: XR, DG, TT, AIXR, AI, AITTJ60, TTJ60 and TTI nozzles (sectional drawings).

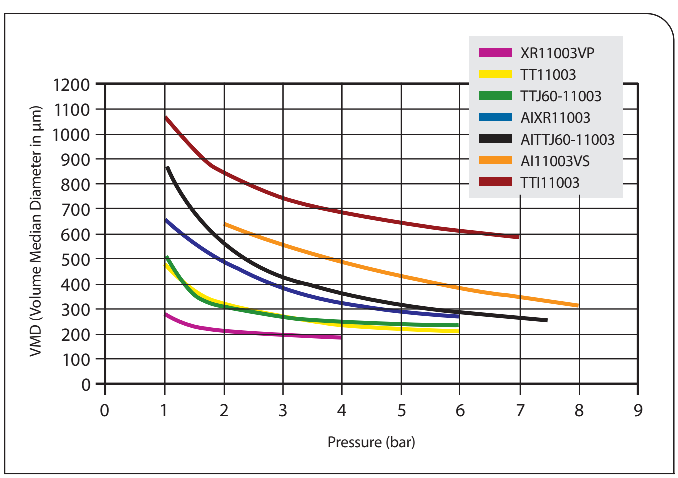


Figure 4. Volumetric droplet diameters of XR, TT, TTJ60, AIXR, AI, AITTJ60 and TTI nozzles relative to pressure

Measurement conditions:

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

– Water temperature 21 °C

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)

	bar											
	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	8.0
AI80015	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AI8002	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AI80025	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	VC	C
AI8003	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	VC	VC
AI81004	UC	UC	XC	XC	XC	XC	VC	VC	VC	C	C	C
AI8005	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	C
AI8006	UC	UC	UC	UC	XC	XC	XC	XC	XC	XC	XC	VC
AI110015	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C	C
AI11002	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C	C
AI110025	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AI11003	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AI11004	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AI11005	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AI11006	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	C
AI11008	UC	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C

AI TeeJet® (AI E)

	bar						
	2.0	3.0	4.0	5.0	6.0	7.0	8.0
AI95015E	UC	XC	XC	VC	VC	C	C
AI9502E	UC	XC	XC	VC	VC	C	C
AI95025E	UC	XC	XC	VC	VC	C	C
AI9503E	UC	XC	XC	VC	VC	C	C
AI9504E	UC	XC	XC	VC	VC	C	C
AI9505E	UC	XC	XC	VC	VC	C	C
AI9506E	UC	XC	XC	XC	VC	VC	C
AI9508E	UC	UC	XC	XC	VC	VC	C

AI3070 TeeJet® (AI3070)

	bar					
	1.5	2.0	3.0	4.0	5.0	6.0
AI3070-015	VC	C	C	M	M	M
AI3070-02	XC	VC	C	C	M	M
AI3070-025	XC	VC	C	C	C	M
AI3070-03	XC	XC	C	C	C	C
AI3070-04	UC	XC	VC	VC	C	C
AI3070-05	UC	XC	VC	VC	C	C

AIC TeeJet® (AIC)

	bar											
	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	8.0
AIC110015	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C	C
AIC11002	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C	C
AIC110025	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AIC11003	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AIC11004	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AIC11005	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C	C
AIC11006	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	VC	C
AIC11008	UC	UC	UC	XC	XC	XC	XC	VC	VC	VC	VC	C
AIC11010	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C
AIC11015	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC	VC	C

AIUB TeeJet® (AIUB)

	bar						
	2.0	3.0	4.0	5.0	6.0	7.0	8.0
AIUB8502	UC	XC	XC	VC	VC	C	C
AIUB85025	UC	XC	XC	VC	VC	C	C
AIUB8503	UC	XC	XC	VC	VC	C	C
AIUB8504	UC	XC	XC	VC	VC	C	C

Air Induction Turbo TwinJet® (AITTJ60)

	bar										
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	7.0
AITTJ60-11002	XC	VC	VC	VC	C	C	C	C	C	C	M
AITTJ60-110025	XC	VC	VC	VC	C	C	C	C	C	C	M
AITTJ60-11003	UC	XC	XC	VC	VC	VC	C	C	C	C	C
AITTJ60-11004	UC	XC	XC	VC	VC	VC	C	C	C	C	C
AITTJ60-11005	UC	XC	XC	XC	VC	VC	VC	C	C	C	C
AITTJ60-11006	UC	XC	XC	XC	VC	VC	VC	C	C	C	C
AITTJ60-11008	UC	UC	UC	XC	XC	XC	VC	VC	VC	VC	C
AITTJ60-11010	UC	UC	UC	UC	XC	XC	XC	XC	XC	VC	VC
AITTJ60-11015	UC	UC	UC	UC	XC	XC	XC	XC	VC	VC	VC

AIXR TeeJet® (AIXR)

	bar										
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
AIXR110015	XC	VC	VC	C	C	C	C	M	M	M	M
AIXR11002	XC	XC	VC	VC	C	C	C	C	C	M	M
AIXR110025	XC	XC	XC	VC	VC	C	C	C	C	C	C
AIXR11003	XC	XC	XC	VC	VC	C	C	C	C	C	C
AIXR11004	UC	XC	XC	XC	VC	VC	VC	C	C	C	C
AIXR11005	UC	XC	XC	XC	XC	VC	VC	VC	C	C	C
AIXR11006	UC	XC	XC	XC	XC	VC	VC	VC	C	C	C

DG TwinJet® (DGTJ60)

	bar				
	2.0	2.5	3.0	3.5	4.0
DGTJ60-110015	F	F	F	F	F
DGTJ60-11002	M	M	F	F	F
DGTJ60-11003	M	M	M	F	F
DGTJ60-11004	C	C	C	C	C
DGTJ60-11006	C	C	C	C	C
DGTJ60-11008	C	C	C	C	C

DG TeeJet (DG)

	bar				
	2.0	2.5	3.0	3.5	4.0
DG80015	M	M	M	M	F
DG8002	C	M	M	M	M
DG8003	C	M	M	M	M
DG8004	C	C	M	M	M
DG8005	C	C	C	M	M
DG110015	M	F	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

TeeJet® (TP)

	bar				
	2.0	2.5	3.0	3.5	4.0
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	M	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	F	F	F
TP11005	M	M	M	F	F
TP11006	M	M	M	M	F
TP11008	C	M	M	M	M

AITX ConeJet® (AITXA & AITXB)

	bar							
	4.0	5.0	6.0	7.0	8.0	9.0	10.0	12.0
AITXA8001 AITXB8001	XC	XC	VC	VC	C	C	C	C
AITXA80015 AITXB80015	XC	XC	VC	VC	VC	C	C	C
AITXA8002 AITXB8002	XC	XC	XC	XC	XC	VC	VC	VC
AITXA80025 AITXB80025	UC	UC	XC	XC	XC	XC	XC	XC
AITXA8003 AITXB8003	UC	UC	XC	XC	XC	XC	XC	VC
AITXA8004 AITXB8004	UC	UC	UC	XC	XC	XC	XC	XC

DG TeeJet® (DG E)

	bar				
	2.0	2.5	3.0	3.5	4.0
DG95015E	M	M	F	F	F
DG9502E	M	M	M	M	M
DG9503E	C	M	M	M	M
DG9504E	C	C	M	M	M
DG9505E	C	C	C	M	M

Turbo FloodJet® (TF)

	bar				
	1.0	1.5	2.0	2.5	3.0
TF-2	UC	XC	XC	XC	VC
TF-2.5	UC	UC	XC	XC	XC
TF-3	UC	UC	XC	XC	XC
TF-4	UC	UC	UC	XC	XC
TF-5	UC	UC	UC	UC	XC
TF-7.5	UC	UC	UC	UC	XC
TF-10	UC	UC	UC	UC	XC

Turbo TeeJet® (TT)

	bar										
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
TT11001	C	C	M	M	M	M	F	F	F	F	F
TT110015	VC	C	M	M	M	M	F	F	F	F	F
TT11002	VC	C	C	M	M	M	M	M	F	F	F
TT110025	VC	C	C	M	M	M	M	F	F	F	F
TT11003	VC	VC	C	C	M	M	M	M	M	M	M
TT11004	XC	VC	C	C	C	M	M	M	M	M	M
TT11005	XC	VC	VC	C	C	C	C	M	M	M	M
TT11006	XC	VC	VC	VC	VC	C	C	C	C	M	M
TT11008	XC	VC	VC	VC	C	C	C	C	M	M	M

Drop Size Classification

Turbo TeeJet® Induction (TTI)

	bar											
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	7.0
TTI110015	UC	UC	UC	UC	UC	UC	XC	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)

	bar						
	1.5	2.0	3.0	3.5	4.0	4.5	5.0
1/4TTJ02	UC	UC	XC	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)

	bar			
	2.0	2.5	3.0	4.0
TJ60-8002E	F	F	F	F
TJ60-8003E	F	F	F	F
TJ60-8004E	M	M	F	F
TJ60-8006E	M	M	M	M

TX ConeJet® (TXA & TXB)

	bar							
	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
TXA800050 TXB800050	VF	VF	VF	VF	VF	VF	VF	VF
TXA800067 TXB800067	VF	VF	VF	VF	VF	VF	VF	VF
TXA8001 TXB8001	F	VF	VF	VF	VF	VF	VF	VF
TXA80015 TXB80015	F	F	F	VF	VF	VF	VF	VF
TXA8002 TXB8002	F	F	VF	VF	VF	VF	VF	VF
TXA8003 TXB8003	F	F	F	F	VF	VF	VF	VF
TXA8004 TXB8004	F	F	F	F	VF	VF	VF	VF

Turbo TwinJet® (TTJ60)

	bar									
	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
TTJ60-11002	C	C	C	C	M	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	C	C	C	C	C	C	C	C

TwinJet® (TJ60)

	bar				
	2.0	2.5	3.0	3.5	4.0
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	M	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	F	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)

	bar							
	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
TX-1	VF	VF	VF	VF	VF	VF	VF	VF
TX-2	VF	VF	VF	VF	VF	VF	VF	VF
TX-3	VF	VF	VF	VF	VF	VF	VF	VF
TX-4	VF	VF	VF	VF	VF	VF	VF	VF
TX-6	F	VF	VF	VF	VF	VF	VF	VF
TX-8	F	VF	VF	VF	VF	VF	VF	VF
TX-10	F	F	VF	VF	VF	VF	VF	VF
TX-12	F	F	VF	VF	VF	VF	VF	VF
TX-18	F	F	F	F	VF	VF	VF	VF
TX-26	F	F	F	F	F	VF	VF	VF

TXR ConeJet® (TXR)

	bar							
	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
TXR800053	VF	VF	VF	VF	VF	VF	VF	VF
TXR800071	VF	VF	VF	VF	VF	VF	VF	VF
TXR8001	F	VF	VF	VF	VF	VF	VF	VF
TXR80013	F	VF	VF	VF	VF	VF	VF	VF
TXR80015	F	F	F	VF	VF	VF	VF	VF
TXR80017	F	F	VF	VF	VF	VF	VF	VF
TXR8002	F	F	VF	VF	VF	VF	VF	VF
TXR80028	F	F	VF	VF	VF	VF	VF	VF
TXR8003	F	F	F	F	VF	VF	VF	VF
TXR80036	F	F	F	F	VF	VF	VF	VF
TXR8004	F	F	F	F	VF	VF	VF	VF
TXR80049	F	F	F	F	F	F	F	F

XR TeeJet® (XR)

	bar						
	1.0	1.5	2.0	2.5	3.0	3.5	4.0
XR8001	F	F	F	F	F	F	F
XR80015	M	F	F	F	F	F	F
XR8002	M	F	F	F	F	F	F
XR80025	M	M	F	F	F	F	F
XR8003	M	M	F	F	F	F	F
XR80035	M	M	M	M	F	F	F
XR8004	C	M	M	M	M	F	F
XR8005	C	C	M	M	M	M	F
XR8006	C	C	M	M	M	M	M
XR8008	VC	VC	C	M	M	M	M
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	F	F	F	F	F	F
XR11003	M	M	F	F	F	F	F
XR11004	M	M	M	M	F	F	F
XR11005	M	M	M	M	M	F	F
XR11006	C	M	M	M	M	M	F
XR11008	C	C	C	M	M	M	M
XR11010	VC	C	C	C	M	M	M
XR11015	VC	VC	VC	C	C	C	C

TK FloodJet® (TK-VP)

	bar				
	1.0	1.5	2.0	2.5	3.0
TK-VP1	M	F	F	F	F
TK-VP1.5	M	F	F	F	F
TK-VP2	M	F	F	F	F
TK-VP2.5	M	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	C
TK-VP10	VC	C	C	C	C

XP BoomJet® (XP)

	bar				
	1.5	2.0	3.0	3.5	4.0
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)

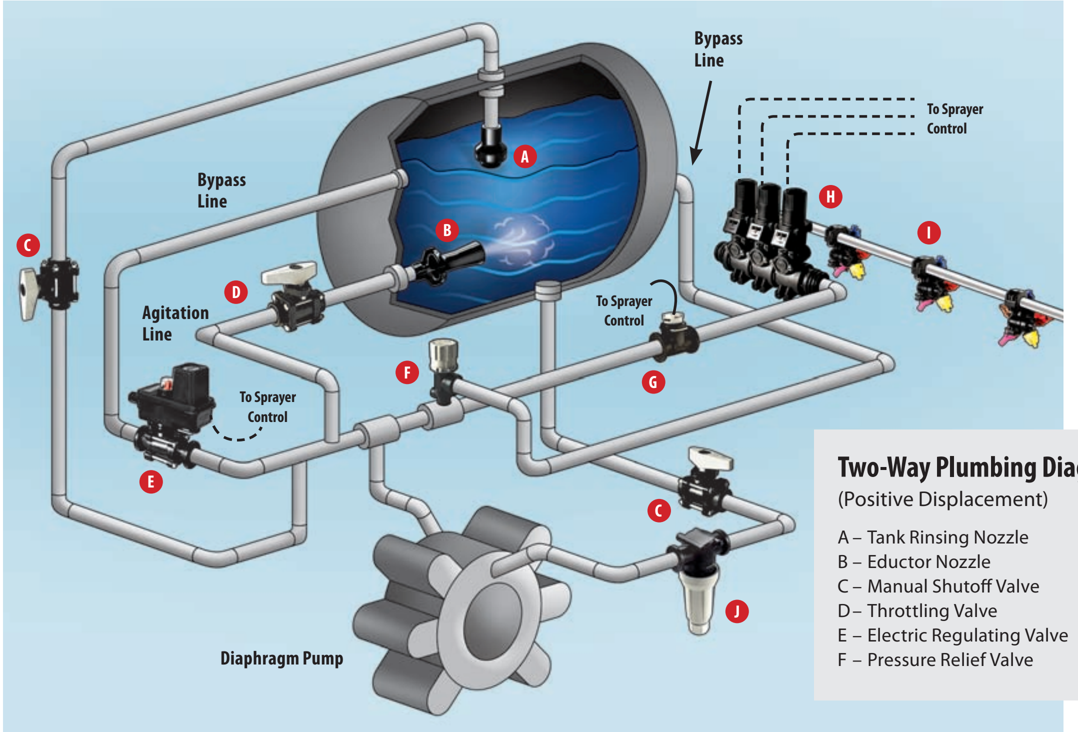
	bar						
	1.0	1.5	2.0	2.5	3.0	3.5	4.0
XRC80015	M	F	F	F	F	F	F
XRC8002	M	F	F	F	F	F	F
XRC8003	M	M	F	F	F	F	F
XRC8004	C	M	M	M	M	F	F
XRC8005	C	C	M	M	M	M	F
XRC8006	C	C	M	M	M	M	M
XRC8008	VC	VC	C	M	M	M	M
XRC11002	M	F	F	F	F	F	F
XRC110025	M	F	F	F	F	F	F
XRC11003	M	M	F	F	F	F	F
XRC11004	M	M	M	M	F	F	F
XRC11005	M	M	M	M	M	F	F
XRC11006	C	M	M	M	M	M	F
XRC11008	C	C	C	M	M	M	M
XRC11010	VC	C	C	C	M	M	M
XRC11015	VC	VC	VC	C	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

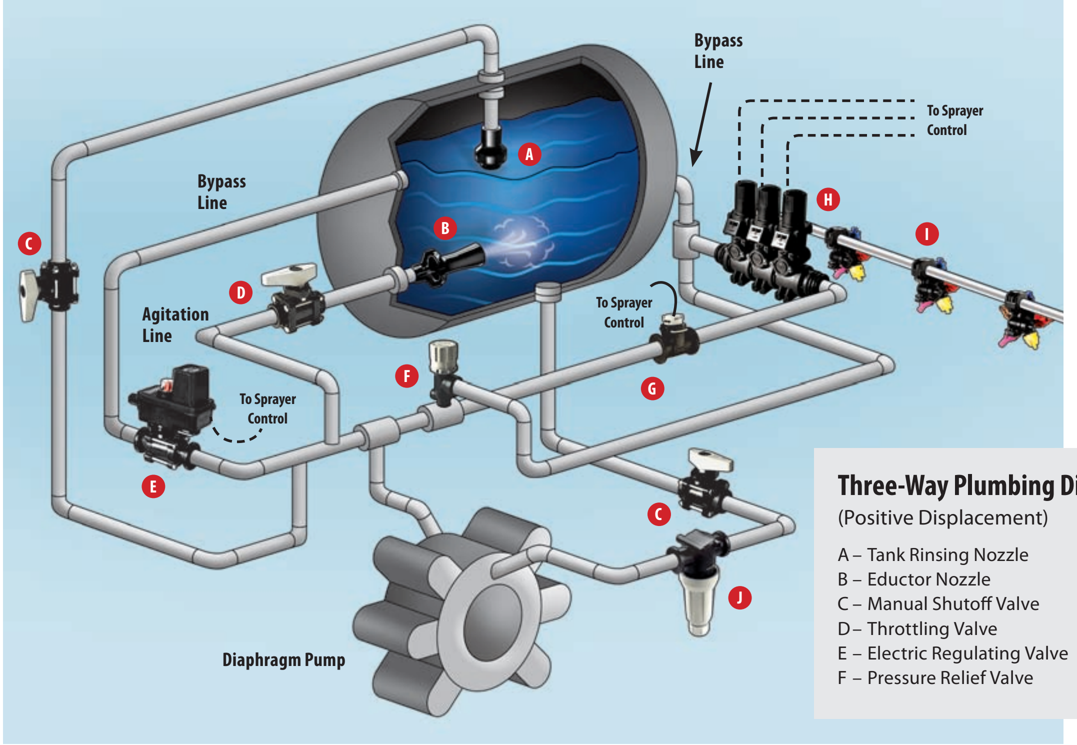
Piston, roller and diaphragm pumps are all types of positive displacement pumps. This means that pump output is proportional to speed and virtually independent of pressure. A key component in a positive displacement system is the pressure relief valve. Proper placement and sizing of the pressure relief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



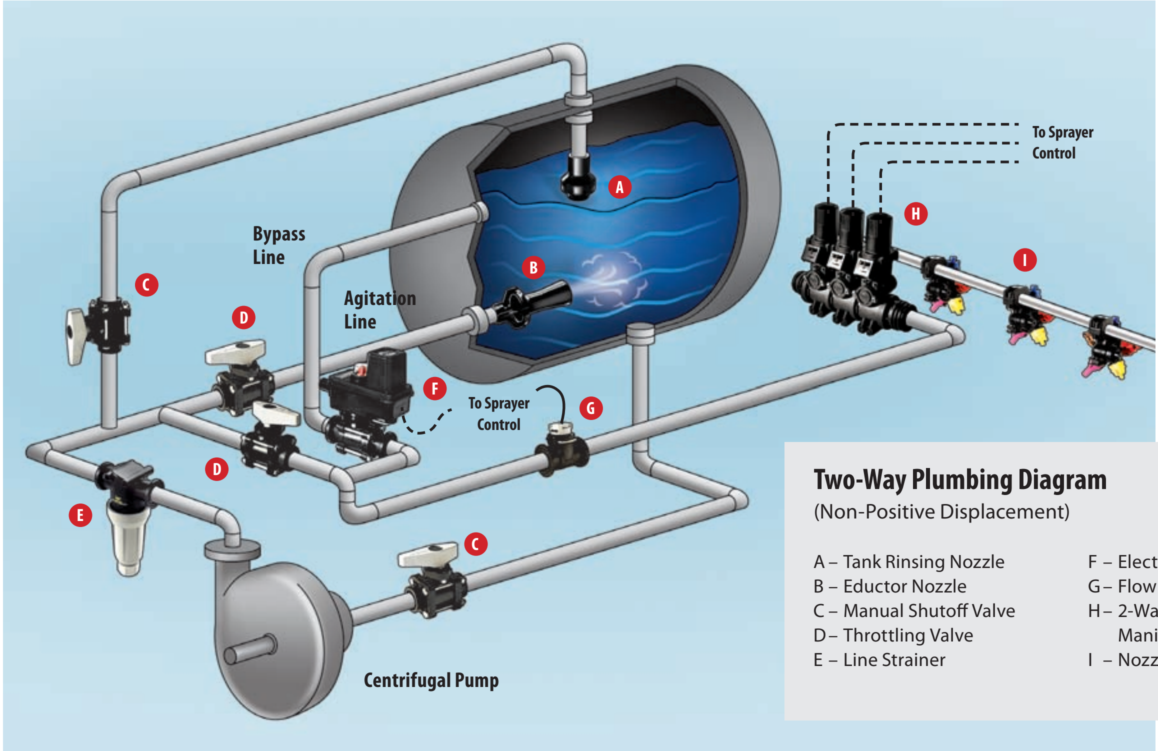
Three-Way Plumbing Diagram

(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

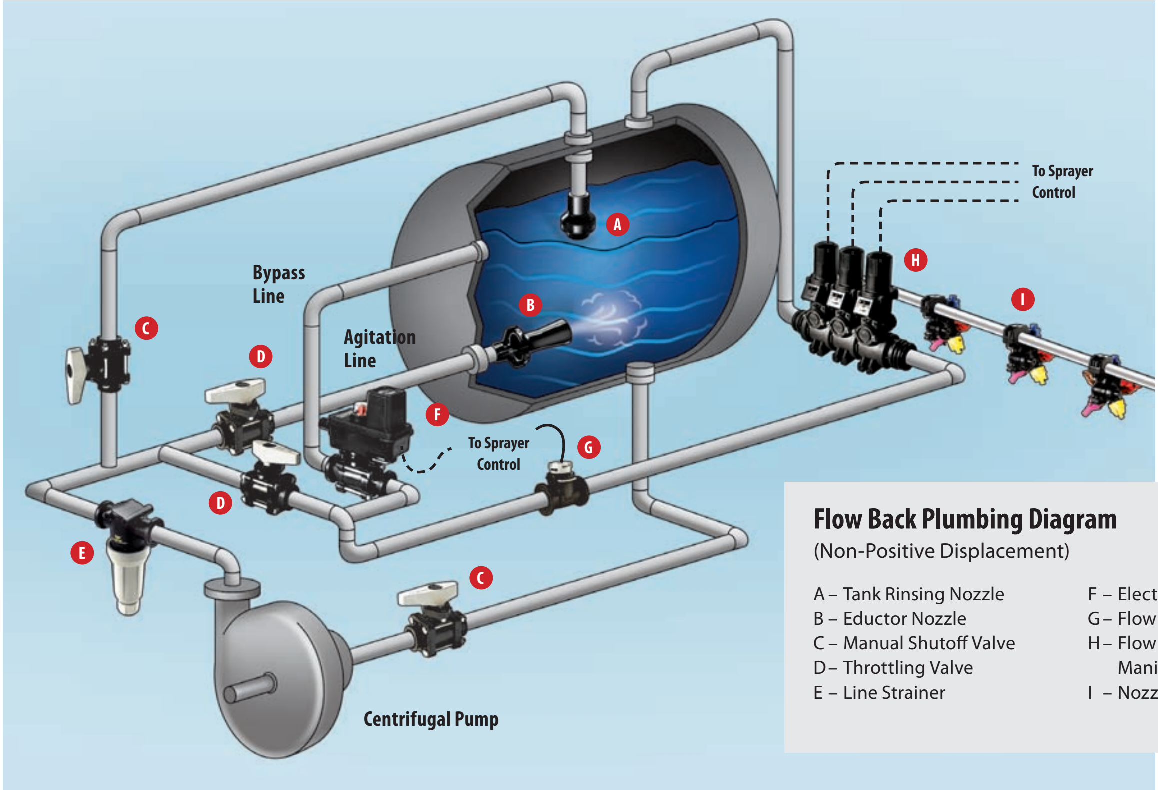
The centrifugal pump is the most common non-positive displacement pump. The output from this type of pump is influenced by pressure. This pump is ideal for delivering large volumes of liquid at low pressures. A key component of the centrifugal pump is the throttling valve. A manual throttling valve on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

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A small percentage of the items shown in this catalog may not be produced under an ISO registered system. For further information contact your sales representative.

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Seller's acceptance of any order is expressly subject to Buyer's assent to each and all of the terms and conditions set forth below and Buyer's assent to these terms and conditions shall be conclusively presumed from Buyer's receipt of this document without prompt written objection thereto or from Buyer's acceptance of all or any part of goods ordered. No addition to or modification of said terms and conditions shall be binding upon Seller unless specifically agreed to by Seller in writing. If Buyer's purchase order or other correspondence contains terms or conditions contrary to or in addition to the terms and conditions set forth below, acceptance of any order by Seller shall not be construed as assent to such contrary or additional terms and conditions or constitute a waiver by Seller of any of the terms and conditions.

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Unless otherwise specified: (a) all prices, quotations, shipments and deliveries by Seller are (i) EXW (Incoterms® 2010) if shipped to the Buyer within the United States, and (2) in all other circumstances DAP Buyer's location (Incoterms® 2010); (b) all base prices together with related extras and deductions, are subject to Seller's price in effect at the time of shipment; and (c) notwithstanding the use of the shipping term DAP and without any effect on the point at which the risk of loss shifts from Seller to Buyer, all transportation, import costs and other related charges are for the account of Buyer, including all increases or decreases in such charges prior to shipment. Payment of said price shall be due at the remittance address shown on the Seller's invoice upon receipt of Seller's invoice unless otherwise specified. Interest will be charged at a rate of 1 to 1½% per month on all balances outstanding more than 30 days after the date of the invoice. Price includes Seller's standard packaging. Special packaging requirements shall be quoted at an additional price.

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Buyer's remedies under this warranty shall be limited to the replacement, repair, or refund of the purchase price for any defective product at the Seller's option. Products claimed to be defective and for which repair or replacement is desired shall be, if requested by the Seller, returned transportation prepaid to Seller's plant for inspection. Results of ordinary wear and tear, improper operation, or maintenance or use of corrosive or abrasive materials shall not be considered a defect in material or workmanship. Any component part manufactured by another is not covered by Seller's warranty, but only by such warranty as its manufacturer gives. Because of the difficulty of asserting and measuring damages hereunder, it is agreed that, except for claims for bodily injury, Seller's liability to the Buyer or any third party, for any losses or damages, whether direct or otherwise, arising out of the purchase of product from Seller by Buyer shall not exceed the total amount billed and billable to the Buyer for the product hereunder. IN NO EVENT WILL SELLER BE LIABLE FOR ANY LOSS OF PROFITS OR OTHER SPECIAL OR CONSEQUENTIAL DAMAGES, EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

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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.

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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.

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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.