NOZZLE INFORMATION PACK

This pack has been developed to provide additional support to Assessors following the 2018/19 Pesticide Assessor Updates.

Assessor Name: ……

Assessor Number: ……

Nozzle Codes and Identification

Nozzles can be identified by a range of means, for example; visual shape, nozzle orifice shape, code and colour.

Common Name	Picture	Spray Pattern	BCPC Code	Example Manufacturer Code	Orifice Shape	Other Common Names
Flat Fan			F110/1.2/3	03F110	Elliptical	Fan
Evenspray Flat Fan			FE80/0.6/3	02E80	Oblong with rounded ends	Evenspray
Air Inclusion			N/A	GA110-035	Elliptical	Bubble jet
Deflector			D/1.2/1	AN1.2	Round	Anvil Floodjet Polijet
Full Cone				03FCX80	Round. Daylight visible through orifice	Solid Cone
Hollow Cone			HC/0.6/3	02HCX80	Round. No daylight visible through orifice	

BCPC - British Crop Protection Council

Spray Quality

Spray quality refers to the size of spray droplets produced by a nozzle at a specified pressure. The table below gives details and typical uses of differing spray qualities.

SPRAY QUALITY CLASSIFICATION	**FINE**
Typical droplet size	VMD 175 microns (0.175mm)
Drift risk	**High**
Penetration through foliage	Poor
Retention on foliage	Good
Typical uses	Foliar acting herbicides for grass weed control, contact fungicides and insecticides where the product label specifies good coverage.
SPRAY QUALITY CLASSIFICATION	**MEDIUM**
Typical droplet size	VMD 225 microns (0.225mm)
Drift risk	**Moderate**
Penetration through foliage	Good
Retention on foliage	Good
Typical uses	Most products and applications especially when no spray quality is specified on the label
SPRAY QUALITY CLASSIFICATION	**COARSE**
Typical droplet size	VMD 280 microns (0.280mm)
Drift risk	**Low**
Penetration through foliage	Good
Retention on foliage	Moderate to poor
Typical uses	Residual or soil applied pesticides or where drift risk must be minimised

The spray quality produced by a nozzle at a specified pressure can be identified on nozzle manufacturer's literature. An example is shown below, in this instance using differing colours to indicate differing spray quality. A key is at the bottom of the table.

	HYPRO TIP REF. (REC. FILTER MESH)	PRESS. BAR	FLOW L/MIN	LITRES/HECTARE AT KM/H 8KPH	10KPH	12KPH	16KPH	18KPH	BCPC NOZZLE CODE
Orange	01F110OR (100 #)	2.0	0.327	49	39	33	24	22	F110/0.40/3
		3.0	0.400	60	48	40	30	27	
		4.0	0.462	69	55	46	35	31	
Green	015F110RG (100 #)	2.0	0.490	73	59	49	37	33	F110/0.60/3
		3.0	0.600	90	72	60	45	40	
		4.0	0.693	104	83	69	52	46	
Yellow	02F110YE (100 #)	2.0	0.653	98	78	65	49	44	F110/0.80/3
		3.0	0.800	120	96	80	60	53	
		4.0	0.924	139	111	92	69	62	
Lilac	025F110VI (100 #)	2.0	0.816	122	98	82	61	54	F110/1.00/3
		3.0	1.000	150	120	100	75	67	
		4.0	1.155	173	139	115	87	77	
Blue	03F110UB (100 #)	2.0	0.980	147	118	98	73	65	F110/1.20/3
		3.0	1.200	180	144	120	90	80	
		4.0	1.386	208	166	139	104	92	
Red	04F110RE (50 #)	2.0	1.306	196	157	131	98	87	F110/1.60/3
		3.0	1.600	240	192	160	120	107	
		4.0	1.848	277	222	185	139	123	
Brown	05F110LB (50 #)	2.0	1.633	245	196	163	122	109	F110/2.00/3
		3.0	2.000	300	240	200	150	133	
		4.0	2.309	346	277	231	173	154	
Grey	06F110GY (50 #)	2.0	1.960	294	235	196	147	131	F110/2.40/3
		3.0	2.400	360	288	240	180	160	
		4.0	2.771	416	333	277	208	185	
White	08F110WH (50 #)	2.0	2.613	392	314	261	196	174	F110/3.20/3
		3.0	3.200	480	384	320	240	213	
		4.0	3.695	554	443	370	277	246	
Light Blue	10F110CB (30 #)	2.0	3.266	490	392	327	245	218	F110/4.00/3
		3.0	4.000	600	480	400	300	267	
		4.0	4.619	693	554	462	346	308	
Light Green	15F110LG (30 #)	2.0	4.899	735	588	490	367	327	F110/6.00/3
		3.0	6.000	900	720	600	450	400	
		4.0	6.928	1039	831	693	520	462	
Black	20F110BL (30 #)	2.0	6.532	980	784	653	490	435	F110/8.00/3
		3.0	8.000	1200	960	800	600	533	
		4.0	9.238	1386	1109	924	693	616	

BCPC CODING FINE MEDIUM COARSE

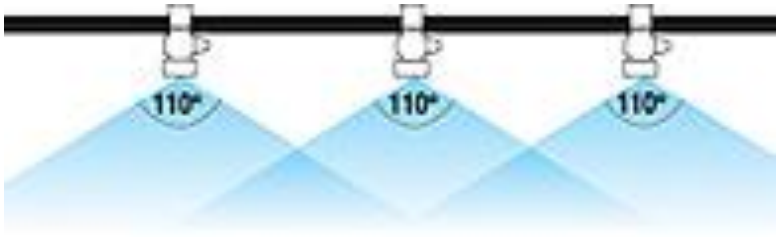
Calculating Nozzle Outputs

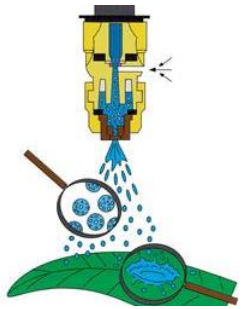
Calculating boom sprayer nozzle output at the rated pressure (3bar) can be carried out using the 'rule of 4'. This is done by placing a decimal point within the nozzle code number (e.g. a red 04 nozzle = 0.4) and then multiplying this figure by 4.

Examples as follows:

- Lilac Nozzle (025 code): 0.25 x 4 = 1 litre/min at 3 bar
- Red Nozzle (04 code): 0.4 x 4 = 1.6 litres/min at 3 bar
- Grey nozzle (06 code): 0.6 x 4 = 2.4 litres/min at 3 bar

Nozzle Information and Uses

Nozzle Type:	Spray Pattern:	Information and Uses:
Flat Fan 		A versatile nozzle suitable for the overall application of herbicides, fungicides, insecticides and growth regulators. Differing spray qualities suitable for a wide range of targets can be achieved, by selecting a suitable nozzle and/or adjusting pressure. Most often producing a 110° or 80° angle spray with an elliptical spray pattern. 110° nozzles are designed to be used at 50cm spacing and at a minimum of 50cm above the target. 80° nozzles are designed to be used at 50cm spacing and at a minimum of 75cm above the target. When used at the correct height above target, a double overlap of spray is achieved. This will allow for small amounts of boom roll and target/ground height variation, but still provide coverage of the target. 
Evenspray Flat Fan 		A nozzle designed for ‘band spraying’. This could be a narrow width with a hand held applicator, or on a machine mounted applicator for spraying in between rows of crop with multiple nozzles on a boom. Differing angles of spray are found, 80° being more common. The spray pattern is even from edge to edge.

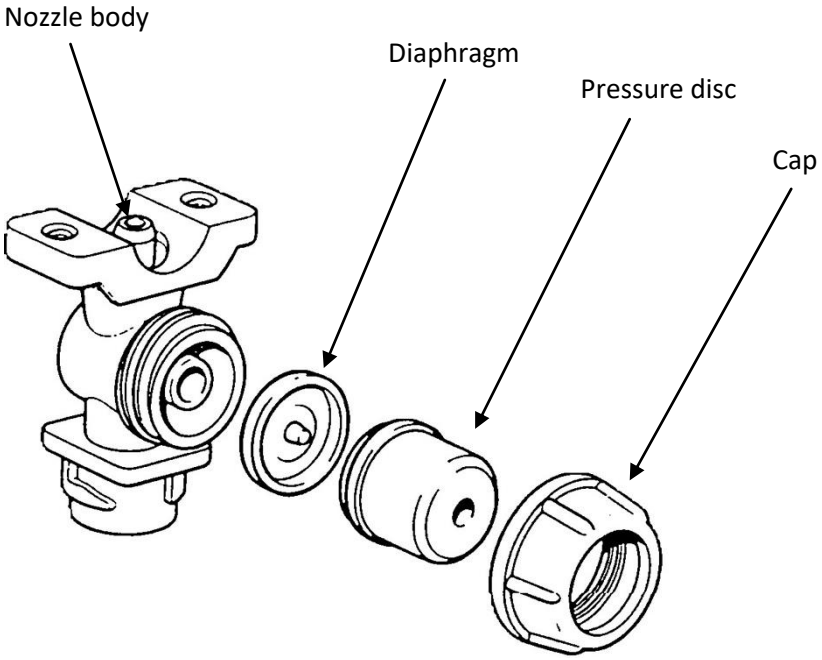
Nozzle Type:	Spray Pattern:	Information and Uses:
Air Inclusion 		These nozzles include air within the spray droplet. This has the effect of increasing the droplet size travelling through the air. On hitting the target the droplet 'splatters' creating finer droplets that adhere to the target. The spray pattern is similar to a Flat Fan nozzle, requiring an overlap to give even distribution along a boom. Air inclusion nozzles are frequently used to minimise drift potential and permit reduced buffer zones with certain products. There will usually be a specified pressure range that must be adhered to for this purpose. Air inclusion nozzles can often be identified because of an air hole or holes on the side of the nozzle body, as indicated by the arrow on the diagram below. 
Deflector 		These nozzles are typically used with handheld applicators as a single nozzle. Occasionally fitted to a multiple nozzle boom, on walk over sprayers and ATV mounted applicators. The nozzle is prone to damage due to poor handling, usually being dragged on the floor. Blockage is unusual due to the large round orifice. Spray pattern is fairly even from one side to the other, though some lighter areas of cover are not uncommon. With herbicides this is generally not a problem.

Nozzle Type:	Spray Pattern:	Information and Uses:
Full Cone 		Suggested use for this nozzle is for spot treating with herbicides. Another useful application for the nozzle is for spraying around trees or obstacles, it allows the operator to maintain an even band around the tree/obstacle without the need to move or alter nozzle angle. The spray pattern is circular.
Hollow Cone 		The hollow cone nozzle is designed to give good coverage of fine spray quality droplets for overall treatment. Some have a ceramic tip, these are more resistant to wear and may be used at pressures up to 25 bar, typically on broadcast sprayers. The spray pattern is circular, but hollow. Easily distinguished from a full cone as you are not able to see light through the nozzle orifice. This is because an insert in the nozzle body diverts spray away from the centre of the spray pattern, and therefore blocks light passage also. The picture below shows an insert and the blue arrows show the two openings that spray liquid has to pass through. This creates the swirl required for the circular pattern. 

Nozzle assemblies

Nozzle assemblies on machine mounted applicators typically incorporate a diaphragm check valve (DCV) to prevent spray liquid dribbling from the nozzle when the sprayer is switched off. They are sometimes seen on walk over applicators also.

The diagram below shows an example with a spring powered pressure disc that forces the diaphragm against the nozzle body when spray pressure drops below approximately 0.8bar, this pressure will vary from manufacturer and with age.



Increasingly, pneumatic versions are seen on applicators.

On broadcast applicators (PA3, 02651) the nozzle assembly and DCV will be heavier duty, typically brass and the cap will need to be tightened with a spanner, not by hand.

On some DCV units there is the ability to shut off the individual nozzle, typically seen on ATV applicators where there is no section control.

On the left hand example above the horizontally mounted orange threaded cap is used to prevent the diaphragm from opening when the applicator is turned on. Note the threaded nozzle cap.

The right hand example uses a 'butterfly' type cap which you align the arrow on the cap to either on or off. On this version, a bayonet nozzle cap would be used.

Nozzle caps on DCV units are usually bayonet fitments. These generally align the nozzle at a slight offset from the boom pipe to which they attach. This prevents overlapping spray patterns from hitting one another and the spray quality being compromised. Where a threaded nozzle cap is used, the alignment will need to be manually set by the operator.

On hand held applicators, nozzle caps are nearly always threaded, though occasionally a bayonet cap is seen, typically taken from a machine mounted applicator, but without the DCV.

Pressure Management (Handheld Applicators)

Pressure management on handheld applicators is achieved either by adjusting a spring controlled valve on the sprayer, maintaining a consistent pumping rate, or by the use of a Spray Management Valve (SMV).

Spray management valves have been manufactured over the years to allow a constant flow of liquid at 1, 2 and 3 bar pressure. 1 bar being the most common and typically provided with piston pump handheld applicators.

This version allows 1 bar pressure through to the nozzle, to depressurise the applicator, the SMV must be removed and pressure released by squeezing the trigger.

SMV's are sometimes called constant flow valves or simply pressure regulators.

Versions are available which can be turned on or off and also be set at two different pressures.

Other spray nozzles and technology

Nozzle Type:	Information and Uses:
Extended range, boomless nozzle 	These are available to allow over 4m application from a single nozzle. Typically used where a conventional boom would be impractical.
Angled nozzles and nozzle caps  	Designed to hit front and back of the target by alternating the nozzles forward and backwards along the boom.
Twin caps  	These are available as an empty unit which you then fit your own nozzles, or with pre fitted nozzles. Twin caps allow for increased water volumes while maintaining the required spray quality, fore and aft coverage