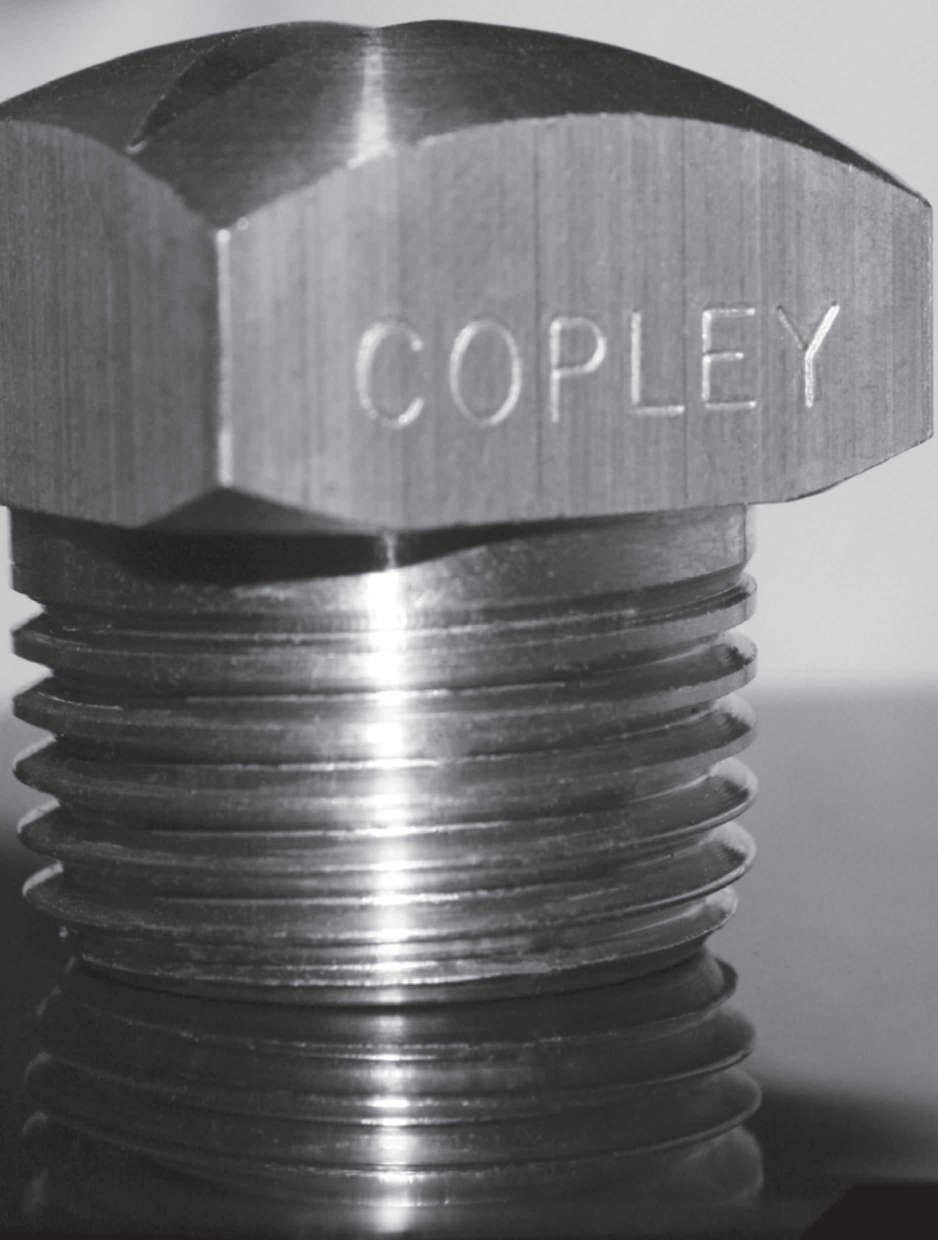


COPLEY'S SPRAYING NOZZLES

For more efficient spraying of bitumen and emulsion

COPLEY'S

COPLEY'S SPRAYING NOZZLES

This summary of relevant facts about the selection and use of Copley Spraying Nozzles should give our users a better understanding of their applications, selection and more efficient use.

COPLEY'S SPRAYING NOZZLES

USES

The nozzles are primarily designed to spray liquid tar, bitumen emulsion or water onto the road or footpath.

They are also used to spray water onto earth work for consolidating road foundations and to spray water onto concrete during the curing period.

STOCKS

A full range of orifice sizes are kept in stock for immediate delivery.

MANUFACTURE

During manufacture the shape and size of the orifice is held to a very fine tolerance.

This enables damaged nozzles to be replaced on a bar without disturbing the overall uniformity of distribution of liquid.

TYPES OF NOZZLES

There are two distinct types of nozzles:-

1. INTERMEDIATE or STANDARD NOZZLES the general features of which are shown in Fig. B.
2. END NOZZLES shown in Fig. C. These end nozzles are only used on the two outer ends of a spray bar.
3. EAN18W END NOZZLE WITH PIN can be used to provide a sharper edge to the discharge from the end nozzle.

The nozzles are made with various sizes of orifice to give different rates of discharge.

FIG. B

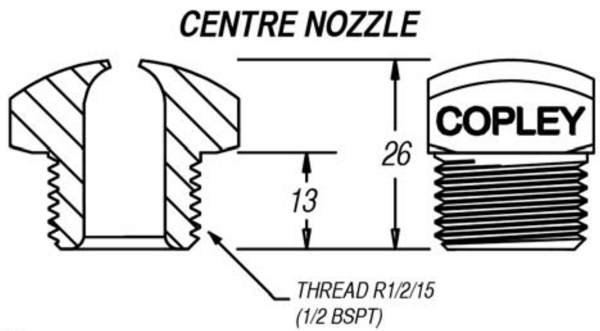
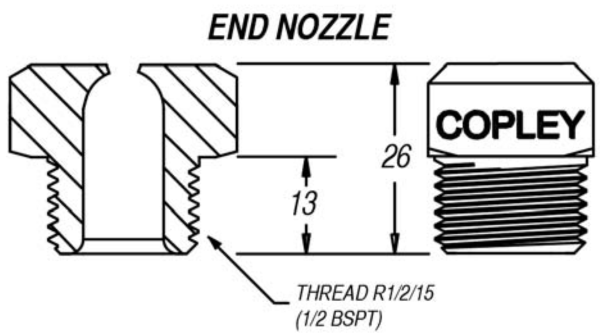


FIG. C



NOTE: DIM. ARE APPROX.

The reason for the various sizes of orifice is explained in a later paragraph.

All the nozzles are made from 7/8 inch (22.2 mm) square brass and have a ½ inch (12.7 mm) British Standard Pipe Thread (tapered) for assembly on to a spray bar.

FIG. 3. DISCHARGE FROM STANDARD NOZZLE

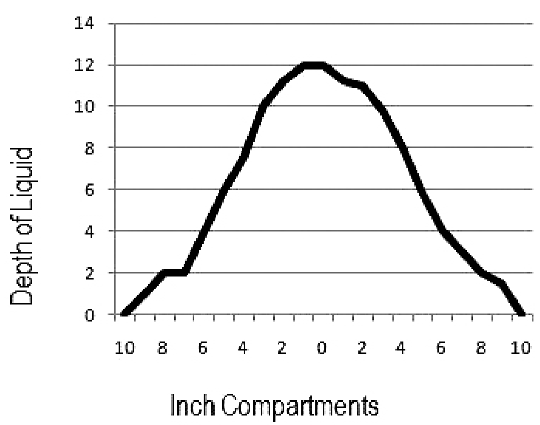
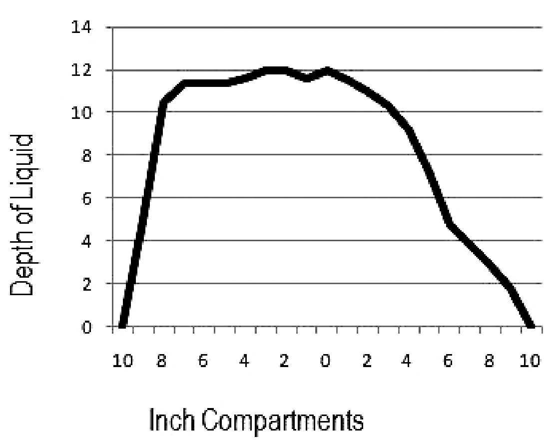


FIG. 4. DISCHARGE FROM END NOZZLE



NOZZLE DESIGN

The nozzles are designed to give the maximum uniformity of distribution of the sprayed liquid across the width of the sprayed surface, when they are used in sets which are screwed into a hollow spray bar. They are also most suitable for hand spraying when one of more of the intermediate nozzles are attached to the end of a hand bar. When in operation the nozzles deliver the liquid in a fan-shaped stream. A single nozzle does not deliver an even amount of liquid across the width of this fan.

The graph, Fig 3, of the delivery from an intermediate nozzle shows the heaviest delivery at the centre of the fan and a tapering off towards each edge.

The graph, Fig 4, of the delivery from an end nozzle shows the heaviest delivery at one outer edge and a tapering off to the other edge.

These special design features in conjunction with correct spacing on the spray bar and correct height above the surface ensure a double overlap of the fan spray and maximum uniformity of distribution of the liquid over the full width of the sprayed surface.

COPLEY'S SPRAYING NOZZLES

UNIFORMITY OF DISTRIBUTION

The degree of uniformity of distribution achieved is shown by the graph Fig. 7 (Page 8). The actual discharge from a spraying machine was held in a tank having 1 inch (25.4 mm) compartments. The depth of liquid in each compartment is shown on the graph.

This conclusively shows the advantages of using COPLEY SPRAYING NOZZLES to obtain the best results with a minimum application of spraying material.

While the nozzles control the transverse distribution, the longitudinal distribution is controlled by the even forward speed of the vehicle. To assist in maintaining this correct forward speed a calibrated tachometer is attached to the driven vehicle.

ASSEMBLY OF NOZZLES ON THE SPRAY BAR

The maximum uniformity of distribution can only be achieved when the nozzles are assembled on the spray bar at (a) correct spacing, (b) correct alignment of fan, (c) correct height above the pavement, (d) correct volume of liquid per minute for each nozzle.

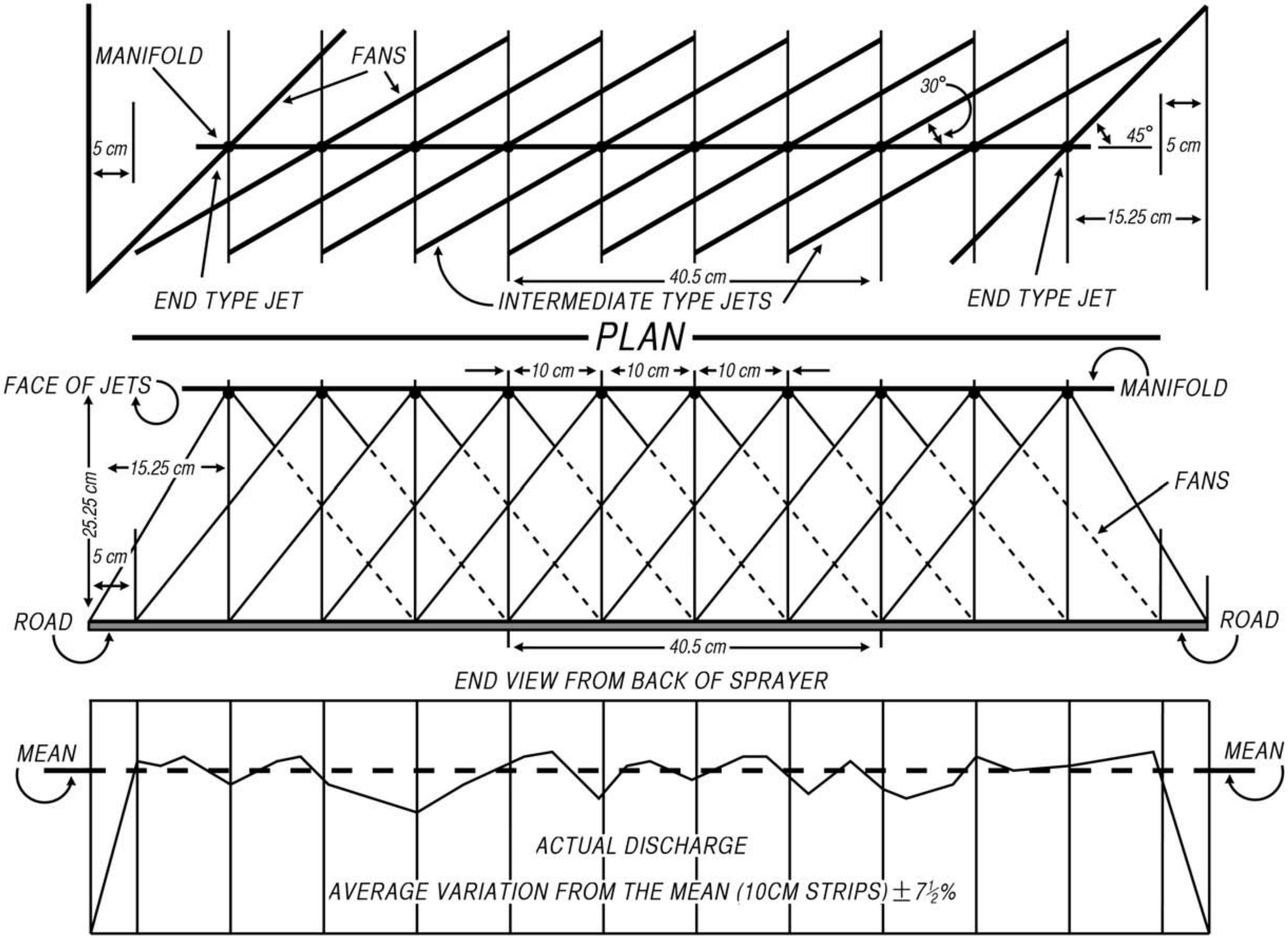
The sketch Fig. 5 (Page 8) shows the correct spacing and alignment of fan. The 4 inch (101.6 mm) centres should not be altered. When heavier or lighter applications are required, nozzles with a larger or smaller orifice should be used.

ARRANGEMENT OF "COPLEY" TYPE JETS IN A MANIFOLD (SPRAY BAR) FITTED TO A BITUMEN SPRAYER

FIG. 5

FIG. 6

FIG. 7



GRAPH OF TYPICAL TRANSVERSE DISTRIBUTION

COPLEY'S SPRAYING NOZZLES

ASSEMBLY OF NOZZLES ON THE SPRAY BAR

The angle of the slot in each type of nozzle is such that the square face of the nozzle, should be parallel with the spray bar to give the correct alignment of each fan.

The sketch, Fig. 6 (Page 8) shows the correct height above the pavement and the reason for the use of the end nozzles. Any variation from the 10 inch (254.0mm) height will alter the amount of overlap of each fan.

The use of the end nozzles counteracts the reduced number of overlaps at the ends of the bar and gives an even distribution to about 1 inch (25.4mm) of each edge of the sprayed surface.

OPERATION

The liquid to be sprayed must be forced through the spray bar and the nozzles at a suitable pressure. This is done by means of a power driven pump, mounted between the tank and the spray bar.

For cold emulsions, water and the like, this may be done by means of pressurised tank.

NOTE: The pressure in the spray bar must be sufficient to give the designed rate of discharge of liquid per minute for each nozzle.

VARIATION OF DISCHARGE RATE

A slight variation of discharge rate per nozzle, above or below the designed rate, can be used with fairly satisfactory results. However, for the maximum uniformity over the sprayed surface it is better to keep as close as possible to the designed rate of discharge of the nozzles.

ORIFICE SIZES

The purpose of having a range of orifice sizes is to facilitate the spraying of heavy or light applications of liquid to the surface without the necessity of having the spraying vehicle travelling at too slow or too high a speed. Also to avoid the necessity of getting too far away from the designed rate of discharge of each nozzle.

RANGE OF SIZES AND DISCHARGE RATES

Nozzle number	Orifice Width	Discharge Rate
• B8	.175" (4.44 mm)	8 Gals. (36.36lt) Per min.
• B6	.150" (3.81 mm)	6 (27.27lt) " " "
• AN18	.133" (3.37 mm)	4 (18.18lt) " " "
• A3	.115" (2.92 mm)	3 (13.63lt) " " "
• S2	.091" (2.31 mm)	2 (9.09lt) " " "
• S1	.061" (1.56 mm)	1 (4.54lt) " " "

For each size of intermediate nozzle, there is a corresponding END NOZZLE marked thus.

EB6, EAN18, EAN18W, EA3, ES2, ES1.

The discharge rate of the end nozzles in approximately double that of the corresponding intermediate nozzles.

PRESSURES REQUIRED IN THE SPRAY BAR

To give the designed rate of discharge, the pressure required at the nozzle orifice is approximately 12 lbs. per square inch (82.73 kilopascals).

This pressure may vary up or down to achieve a specific discharge rate per nozzle. The pressure at the nozzle orifice must never be less than 10 lbs. per square inch (68.94 kilopascals). If it drops below this pressure, the fan and distribution of each nozzle will not be correct.

When materials of different viscosity are being sprayed, it will be necessary to alter the pressure to achieve the same discharge rate, consequently a new calibration would be required.

As there is a considerable drop in pressure between the pump outlet and the nozzle orifice due to bends, restrictions and friction in the supply line, a considerably higher pressure is required at the pump outlet to maintain the correct pressure in the spray bar.

A typical example from a test shows that for a 20 foot (6 metre) spray bar to provide a 12lbs per square inch (82.73 kilopascals) pressure at the nozzle, the pump outlet pressure is required to be approximately 40lbs per square inch (275.79 kilopascals).

COPLEY'S SPRAYING NOZZLES

FACTORS GOVERNING EFFICIENCY

To reduce the load on the pump it is important to have a minimum of restrictions in the pipe fittings between the pump and the nozzles. Adequate pump size is essential. A large enough pipe from tank to the pump and similarly, from the pump to the spray bar, is a vital factor.

CONTROL OF DISCHARGE RATE

Since a pressure gauge is the only means of controlling the discharge rate of the nozzles during spraying it is imperative that the pressure gauge be of a satisfactory design. It should have the largest possible dial with a pressure range only sufficient to cover the operating pressures.

It should be possible for the operator to maintain pressure to within ¼ lb. per square inch (1.72 kilopascals). A greater degree of control will be maintained if the pressure gauge is taken from the pipe line between the control valves and the spray bar.

The tube from the pipe line to the pressure gauge should be heavily lagged and should rise continuously to the gauge without the use of elbows. This will prevent coagulated material blocking the tube to the gauge.

ALTERNATE METHOD OF CONTROLLING THE DISCHARGE RATE

The control of the discharge rate can also be achieved by controlling the revolutions per minute made by the pump.

This is done by means of a suitable revolution counter mounted on the pump shaft or on the pump motor with a suitable governor to control the revolutions per minute of the pump motor and thus the pump itself. The pump used must be a positive supply geared pump.

This method of controlling the discharge rate is used mainly on spraying machines that have a fully recirculating spray bar and pumping system. With this system a shut-off cock is mounted between each nozzle and the spray bar, the cut-on and cut-off being done by a master control lever which operates each tap simultaneously.

When this method of controlling the discharge rate is used it is still advantageous to have a pressure gauge mounted on the spray bar as a secondary check, for both calibrating the sprayer and during the actual spraying operations.

FOR CALIBRATION the speed of the motor is adjusted until the pump is supplying sufficient liquid to give the correct discharge rate per nozzle. When this is achieved the pressure in the spray bar will also be found to be correct.

The governor is then adjusted to maintain the correct revolutions per minute of the pump and at the same time, a reading of the pressure in the spray bar is noted for use as a secondary check.

NOTE: The operator must keep a constant check on the revolutions per minute counter to ensure that the correct pump revolutions per minute are maintained during all spraying operations. With this system it is necessary to check for wear in the pump which will be noticed by a drop in pressure at the spray bar.

COPLEY'S SPRAYING NOZZLES

SELECTION OF NOZZLE SIZE

For the general spraying of roads the "AN18" orifice is the most commonly used. For hand spraying of footpaths etc., the "S2" orifice size is probably the most satisfactory.

The several items that influence the size of the nozzle selected are:-

1. Average rate of application of liquid to the surface in gallons per square yard (litres per square metre).
2. Average forward speed of the vehicle desired.
3. Width of the spray bar.
4. Capacity of pump to supply.

After selecting the nearest orifice size having regard to the factors stated, it is now necessary to calibrate the spraying machine under operating conditions to obtain the correct figures of pressure in the supply line that will give the required discharge rate per nozzle.

This must be done for each width of spray bar used and for each type of material to be sprayed when the viscosity of the materials are not the same.

When taps are used between the spray bar and the nozzle, the area of the passage through the tap should be larger than the bore size of the nozzle used.

This ensures a correct flow of liquid through the nozzle bore and a correct distribution of liquid over the width of fan from each nozzle.

CALIBRATING THE SPRAYING MACHINE

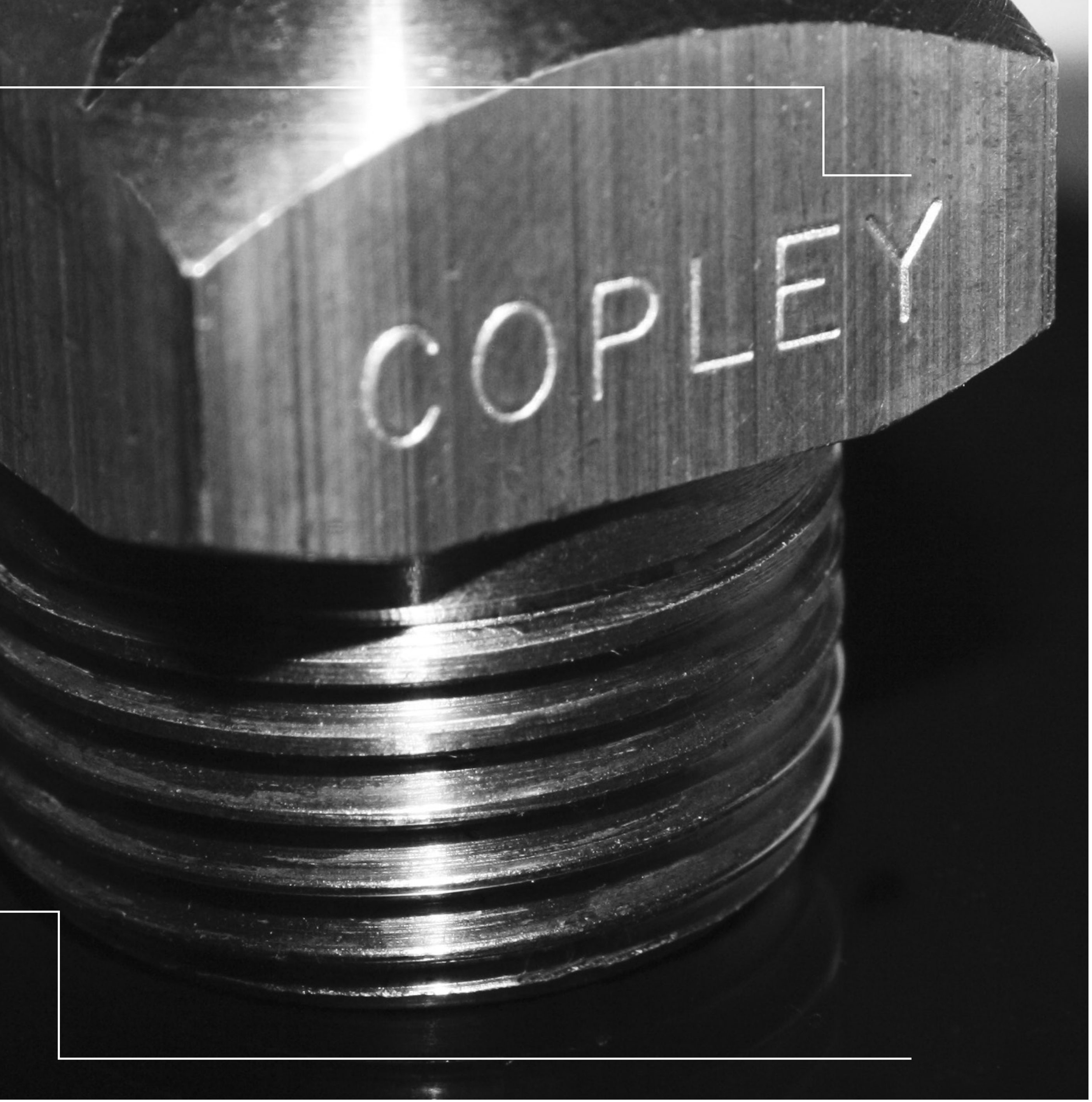
The spraying machine is set up over a test pit and filled with test oil of similar viscosity as that of the liquid to be sprayed.

The machine is turned on for a suitable period of time, measured with a stop watch, at the same time noting the pressure at one or more points on the delivery line.

If the discharge rate is too low or too high, the revolutions per minute of the pump is raised or lowered, or the bypass valve adjusted until the desired output per nozzle is achieved.

The pressure is now recorded and this pressure must be maintained for all subsequent spraying operations to ensure the correct rate of application of the material being sprayed on to the road surface.

These tests must be made for each width of spray bar to be used and also for each type of liquid of different viscosities to be sprayed. Similar tests for calibrating apply when the spraying is done by tank pressure instead of a pump.



COPLEY'S SPRAYING NOZZLES

PERIODIC TESTS

It is advantageous to have regular tests of spraying machines, particularly after any servicing or alteration is made to the spraying machine equipment.

APPLICATION IN GALLONS PER SQUARE YARD
(LITRES PER SQUARE METRE)

Having calibrated the spraying machine for each width of spray bar, the speed of the vehicle is calculated to give an application of any fraction of a gallon per square yard (litres per square metre) as required.

CONCLUSION

We hope that this summary of facts about the use of COPLEY SPRAYING NOZZLES will give our users a better understanding of the application, selection and more efficient use of these nozzles.

We are pleased at any time to give further information that may help to overcome your individual spraying problems.

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