

Guidance Note for Spray Tanker Operator

FOREWORD

Safety and quality are two of the major objectives of the Road Surface Treatments Association and this Guidance Note is designed to help achieve these goals however it is no substitute for a thorough risk assessment which will be specific to site and operational circumstances.

The Guidance Note is intended to cover on-site operations and is not intended to cover annual maintenance or workshop overhaul.

This booklet represents a Code of Practice which, when followed, will help eliminate accidents and provide for the efficient operation of bulk sprayers and a consistent high quality spray pattern.

As the sprayer is the key item of surface dressing plant, it is vital that operators are fully trained, and that they follow this Code and the instructions issued by individual sprayer manufacturers.

The Association wishes to promote excellent workmanship, carried out competently and safely for all those engaged in, on and around the surface dressing site.

THINK QUALITY - THINK SAFETY

Robert Gillespie – RSTA Chairman

ROAD SURFACE TREATMENTS ASSOCIATION

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SECTION A - OPERATORS' GUIDE TO SURFACE DRESSING SPRAYERS

1. INTRODUCTION

Good surface dressing depends to a very great extent on applying the binder evenly at the proper rate. Variations in thickness of the binder film can happen in two ways:

- (a) Incorrect distribution across the road caused by:
 - (i) Change in spray temperature and/or pressure.
 - (ii) Faults in the spray bar and/or hood.
 - (iii) Spray bar height.
 - (iv) Poor jointing

- (b) Variations in distribution along the road caused by:
 - (i) Change in pressure, pump output and/or temperature.
 - (ii) Varying road speed.

Good surface dressing therefore depends on keeping a spray bar in good working order and keeping variations in pressure, temperature and road speed under control.

2. TANKER LABELLING

Tankers must comply with the recommendations of the Chemical Industries Association (CIA) voluntary code for tanker labeling for low hazard products.

In the past information on the type of substance was carried by the driver or vehicle crew in the form of a Transport Emergency Card (commonly referred to as a Tremcard). This also contained the United Nations (UN) identification number of the substance. As of June 2009 these cards are no longer required, having being replaced by "Instructions in Writing".

"Instructions in Writing" is a four page document written in the language of the driver and crew, and in no other language. "Instructions in Writing" is divided into three sections:

- Section 1 provides guidance to the driver and crew on what to do in the event of an incident
- Section 2 contains a list of hazard warning symbols and additional guidance on what to do if the load carried corresponds to one of these
- Section 3 outlines the protective equipment that should be carried in the vehicle

3. TESTING AND CALIBRATION

The machines should comply with the requirements of BS 1707 "Hot Binder Distributors for Road Surface Dressing" and be tested and certified at least annually by a UKAS accredited agency.

The output from the spray bar is measured in litres per minute at spraying temperature and a driver's chart, is made out accordingly. A typical driver's chart for KI-70 emulsion is shown below and is an example, but it is important to remember that a SEPARATE CHART should be available for each type of binder used.

DRIVER'S CHART

ROAD SPEED/RATE OF SPREAD

COMPANY..... A. N. OTHER			
VEHICLE No. ... AB10 CDE FLEET No..... SD10			
SPRAYBAR A SUPPLIER			
Conditions of Test		Rate of Speed Litres/m	Road Speed MPH
Binder.....	K1-70 EMULSION	2.2	1.56
		2.1	1.76
Viscosity.....	30 SECS @ 85°C	2.0	1.95
		1.9	2.15
Spray Temperature.....	80 - 85°C	1.8	2.34
		1.7	2.53
Spray Height.....	450 MM	1.6	2.73
		1.5	2.92
Pressure.....	24 PSI	1.4	3.32
		1.3	3.51
Litres/min ... OVER TOTAL WIDTH	368.8	1.1	3.70
		1.0	3.90
Spray Width VARIABLE TESTED AT	3658mm	1.0	3.90
	Left Hand Side	Right Hand Side	
Butt Joints	OK	OK	
Lap Joints	OK	NOT SUITABLE	
Overlap for full spray: 75mm		For Part Spray: 300mm	
Date: 01/01/2011 Signed: <i>A N Other</i>			

4. TEMPERATURE

The binder is heated to the temperatures listed in Table 1, which enables it to be sprayed through the jets.

1. Swirling Jets

Temperature affects the performance of swirling spray jets in two ways:

- (a) The spray from each jet will not swirl properly if the binder is either too hot or too cold.
- (b) The rate of discharge decreases as the temperature rises and increases as the temperature falls. The variation is about 2.5 % per 5°C. (about 5 litres per minute for a standard 2.3 m spray bar).

2. Slot Jets

When using slot jets, the effect of temperature change is the reverse of those given in 1 (b) above, i.e. the rate of discharge increases with higher temperature.

Table 1
Recommended Spraying Temperatures for Binders
*(Swirling Jet Pattern Spray bars)

Bitumen emulsions	
Class (BS434 Part 1)	Spraying Temp °C
K1-70	85 ± -5
All other classes	See Note 2

Note 1

Proprietary binders should be sprayed at the manufacturer's recommended temperatures.

Note 2*

The spraying temperatures of binders through slot jets will not be as above, but should comply with the details on the driver's chart for the binder in use.

5. PRESSURE

Change in pressure affects the performance of spray jets. The output is proportional to the square root of absolute pressure.

Pressure **MUST** be kept constant at the figure shown on the driver's chart.

6. ROAD SPEED

It is the driver's responsibility to drive steadily at the correct speed and on the correct line. Any variation in speed will alter the rate of spread - this is one of the most common causes of surface dressing failure.

Machines are fitted with low-speed speedometers to enable the driver to maintain the speed given on the driver's chart. In some machines, spray bar output is automatically adjusted to the vehicle speed.

7. TRANSVERSE DISTRIBUTION

The transverse distribution achieved on test will be maintained throughout the season if the following points are watched:

- (a) Temperature
 - (b) Pressure
 - (c) Spray Height.
 - (d) Jets and jet operating linkage are in good order.
 - (e) Slot jets are correctly aligned.
 - (f) Jets are clear (not blocked or partly blocked).
Carry out jet test (paragraph 20) daily.
 - (g) The baffles and spray curtains are undamaged and correctly positioned.
 - (h) Filters are maintained in good condition and checked at least every day or if the pressure starts to drop.
- } As on the driver's chart.

8. SPRAY BAR HEIGHT

The driver's chart gives the height from road surface to the jet at which the bar was tested and which gives the best results. Any change in height will alter the transverse distribution.

At the correct height, the hood curtains should just clear the road surface, the height of the spray bar being adjusted as the load is sprayed. This keeps the distribution even and lessens the nuisance of binder fumes. Note: Slot jet spray bars may not have curtains, but maintaining the bars at the correct height is essential.

9. BAFFLES AND SPRAY CURTAINS FOR SWIRLING JETS

The correct distribution at the edge of the spray is obtained by the position and shape of the end curtains and the 'V' baffles inside the hood. If the curtains and baffles are damaged or moved out of their correct positions, the spray distribution will be altered, which may cause loss of chippings at joints.

10. CLEANING OF PUMPS AND SPRAY BARS

Use gas oil as the solvent for K1- 70 and other proprietary polymer modified emulsion binders. Care needs to be exercised if flushing material enters the tank. (See also Section 23). Under no circumstances should the spray bar be cleaned by spraying any solvent through the nozzles as this will cause the solvent to vaporize thereby creating a potentially explosive atmosphere, which can be ignited by concurrent generation of static electricity. Cleaning solvent must be discharged through the discharge pipe provided and returned to the depot in a suitable container for disposal.

PREPARATION FOR SPRAYING

11. FILTERS

Examine pump suction and delivery filters for blockage. A spare set of filters must be carried and changed when necessary, cleaning the replaced filters with a wire brush and the solvent recommended in paragraph 10. Alternatively the used filters can be cleaned by burning out and brushing but this must be subject to the development of a written safe procedure and in any event must be done on safe hard surface at least 10 metres from any other plant or potentially vulnerable structure.

Check that the filters are undamaged and fitting snugly in the pipe. Never neglect filters, as a choked filter will reduce the flow of binder to the spray bar and a filter in bad shape may allow dirt to pass which may block the spray jets.

12. JETS AND BLOCKAGES

Swirling spray jets usually have more than one inlet port. It is important to remember that the binder will continue to swirl with all but one of the inlet ports blocked: a complete stoppage is due either to all inlet ports being blocked or a piece of carbon or other dirt entering the swirl chamber and lodging in the outlet. Three-stage filtering should be used as follows:

- (1) Charging hole – 4.76mm (3/16in) mesh holes;
- (2) Pump suction from tank – 3.18mm (1/8in) mesh holes
- (3) Pump delivery top spray bar – 2.38 mm (3/32in) mesh holes

13. HEATING BINDERS

Never heat unless the binder level in the tanker is above the safe level marked on the dip-stick or volume capacity gauge, specific to each tanker. The level should also be shown on the outside of the tanker.

The tanker should be located on level ground with the hand-brake fully applied. When the burners are lit, circulate the binder through the tank but not through the spray bar as this will waste heat and should be postponed until only a few minutes before spraying commences.

Tankers **MUST** be continually attended while heating is in progress; care should be exercised as smoking or naked flame could ignite the flammable vapour. After heating has been completed, spraying should not commence until there has been time for the heater tubes to cool to a safe temperature.

Overheating of binders is very dangerous because it creates a high fire/explosion risk of the boiling over of emulsion. It can also cause damage to heating tubes through coking.

Do not use burners when loading or unloading regardless of what binder is being used. Sufficient time must be given between heating and loading to allow the burners to cool to a safe working temperature.

14. SAFETY

BE SAFE:

Refer to the Safety Code in Part 2 of this booklet.

15. SPRAY BAR OPERATING LINKAGE

When spraying the jets are opened and a stop-valve on the end of the spray bar, adjacent to the return pipe to the tank, is closed. Faulty action of the operating linkage can result in the stop-valve not closing so that pressure is lost and a weak spray results.

16. PRESSURE CONTROL

When circulating, check pressure control, that is the pressure gauges, relief valve and spray bar stop-valve, by seeing that the 'circulating' pressure is normal (usually between 5 and 8 psi).

Never operate the sprayer at pressure in excess of those recommended. When jet cutting, a relief valve should enable the correct pressure to be maintained.

Some sprayers control pressure by use of a hydraulic proportional spool valve via a pressure sensor. In these systems no manual relief valve is fitted.

17. VARIATION IN WORKING PRESSURE

At the start of each spray run, check that the working pressure has been reached. A variation from the working pressure may be due to an inaccurate pressure gauge.

Each spray bar is fitted with two pressure gauges. If the readings differ by more than 2 psi, then the faulty gauge must be found by checking with a spare gauge, and replaced.

(a) LOSS OF PRESSURE

- (i) Automatic stop-valve on spray bar not fully closed, due to faulty linkage movement.
- (ii) Filters choked with dirt restricting flow of binder to spray bar.
- (iii) Relief valve jammed in 'open' position.
- (iv) Air leak on suction side of pump.

(b) EXCESS OF PRESSURE

Excess pressure may be caused by relief valve jamming in 'closed' position.

18. SPEEDOMETER WITH FIFTH WHEEL

If fitted, the fifth wheel must be kept clean. If a layer of binder and stone builds up on the wheel, its diameter may well increase by 25 mm (a 12.5 mm layer all round). If the wheel is 250 mm in diameter a coating of this thickness will mean that a tenth more ground is covered for each revolution. This would reduce the rate of spread from say 1.1 to 1.0 1/m².

19. AIR VENT

Make sure that the air vent is clear at all times, otherwise when spraying, the spray pressure will drop and a vacuum can form which may collapse the tank, or when loading, the tank may burst.

20. JET TEST FOR SWIRLING JETS

Jet tests should be carried out every day using the following procedure where swirling jets are in use:

- (a) Disengage all jet - operating handles from the bus-bar.
- (b) Engage the end jet on either side into the bus-bar.
- (c) Move the master lever to the 'spray' position, hold for one second and shut off smartly.
- (d) Disengage the end jets from the bus-bar.
- (e) Move vehicle forward by one metre.

Repeat this drill using successive pairs of jets toward the centre of the bar, If each jet develops a full and symmetrical spray, the picture on the road will be a 'V' of rings of binder (depending upon temperature and pressure). Any jet not developing such a ring (other than the end jets) must be examined and put right. The spray from the end jet is deflected by the baffle and will not form a full ring.

The test should be carried out on a clean, level surface; the road to be surface dressed is ideal.

The rings of binder will not seriously harm the subsequent dressing and, if they do show up eventually, the pattern can be looked upon as a hallmark of good spraying.

Slot jets also need to be checked for correct operation by visual inspection of the shape of the fan of binder from each jet. Poorly shaped fans indicate likely blockage and the jets should be cleaned and re-tested.

DURING SPRAYING

21. PRESSURE AND TEMPERATURE

At the start of every run, the pressure gauge reading should be checked to see that the working pressure is maintained.

The temperature of the binder should be checked at least once every half - hour.

22. JOINTS

When jointing, see that the overlap conforms with the instructions on the driver's chart.

AFTER SPRAYING

23. SCAVENGING THE SPRAYING SYSTEM

Binders are bad conductors of heat; small quantities of binder left in the tank will hinder your start. Always try to finish with an empty tank.

When work is finished for the day or the machine is standing for a prolonged period, empty the circulation system and flush the pump with the solvent recommended in paragraph 10. If this is carefully done, pumps and pipe blockages will be avoided. **NEVER DISCHARGE THIS SOLVENT THROUGH THE NOZZLES – SEE 10 ABOVE.**

It is important to know the position and use of all valves on the pipe system. To scavenge the system, close the valve on the suction from the tank and open the valve on suction from air. Air can then be pumped through the whole system and up into the tank until the spray bar and pipe from spray bar to tank are cleared of binder.

Introduce solvents (see paragraph 10) into the pump and spray bar. Before recommencing work, this must be removed from the bar drain pipe into a suitable labelled container for correct disposal or re-use.

24. CLEANLINESS

Cleanliness is of great importance and tankers should be cleaned every day as some fouling is inevitable and, if allowed to build up, becomes difficult to remove and will impair the operations.

SECTION B - OPERATORS' SAFETY GUIDE

1. INTRODUCTION

These notes are produced to ensure your safety and the safety of the general public and should be read in conjunction with any company safety policy/procedure.

Employees are reminded that they have a duty under the Health and Safety at Work Act to take reasonable care for their own safety and the safety of others who may be affected by their acts or omissions.

Read these notes carefully and be sure they are fully understood in order to prevent accidents and ensure that you know what action to take in the event of an accident.

2. BULK SPRAYERS

General

The effect of a tanker catching fire is very serious and can result in death or injury to you, your fellow operatives and members of the public. It is vital that every precaution for accident prevention is taken. The sprayer must be operated strictly in accordance with the risk assessment provided by your supervisor.

Precautions for all Binders

- (a) You must know which binder is being used.
- (b) Keep your sprayer clean and ensure that there are no leaks from pipes unions or flanges.
- (c) Before heating binder, ensure that the sprayer is on level ground and that there is sufficient binder in the tank to completely cover the heater tubes. (See paragraph 13 in Section A).
- (d) Ensure that all valves are in their correct position.
- (e) Do not overheat the binder. The maximum temperature for normal viscosities of the binder should be:

Hot emulsion (K1-70)	85° C
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- (f) When using higher or lower viscosity materials or proprietary materials, follow the manufacturer's recommendations. See also the table in paragraph 4 of Section A.

- (g) All burners, louvres and dampers must be off or closed before spraying commences and sufficient time given to allow the burner flues to cool to a safe working temperature.
- (h) Be sure that all fire extinguishers on the sprayer are charged and in proper working order. These must be placed externally on the machine in an easily accessible position and locks, if any, must be removed before work commences.
Remove fire extinguishers once a week from the container and shake up the powder to avoid compaction.
- (i) Your vehicle must carry the approved Low Hazard Warning Panels, one at the rear and one on each side (see Paragraph 3).
- (j) Ensure that your bell or buzzer warning system between driver and spray bar operator is understood and working.
- (k) Ensure that all ancillary machinery with moving parts is adequately guarded.
- (l) Ensure that tank, bar thermometers and pressure gauges are in good working order and have been checked against a master gauge.
- (m) Be aware that spraying can generate static electricity and spray bars should be earthed before cleaning with a low flash point solvent.

3. HAZARD WARNING PANELS

EMERGENCY ACTION CODE (1)	HAZARD WARNING SIGN (DIAMOND) (3)	
SUBSTANCE , IDENTIFICATION NUMBER (2)		
SPECIALIST ADVICE- TELEPHONE NUMBER WHERE SPECIALIST ADVICE CAN BE OBTAINED AT ALL TIMES WHEN THE SUBSTANCE IS BEING CONVEYED (4)		NAME OF MANUFACTURER, OWNER OF THE SUBSTANCE OR HOUSE SYMBOL (5)

Notes

1. EMERGENCY ACTION CODE

This consists of a number and a letter. For bitumen-based binders the number is '2', which tells the emergency services to use water fog or a fine spray. In the event of spillage, the product should be contained.

For emulsion binders, the letter is 'X', which indicates also that full body protective clothing with breathing apparatus should be used, but that there is no danger of violent reaction or explosion.

2. SUBSTANCE IDENTIFICATION NUMBER

Emulsions binders do not have a number, but the words BITUMEN WATER EMULSION should appear.

3. GENERAL

- (a) All panels for bitumen emulsions have a white background.
- (b) The above descriptions and information only apply to standard surface dressing binders.
- (c) If products are carried in packages and containers on tankers or support vehicles and are designated to be dangerous for conveyance, additional procedures are required which include signing, additional information, etc.

4. IN THE EVENT OF FIRE

- (a) Shut off supply of binder to the jets and if possible close the main valve and stop the pump.
- (b) Clear the area.
- (c) Assess the risk/ situation. Attack the fire with fire extinguishers and send a member of the gang to phone the fire and other emergency services.
- (d) If safe to do so, recover the TREM card / Instructions in Writing from the cab to hand to the emergency services when they arrive.
- (e) Initiate traffic control.

5. BURST PIPES

Most bursts and leaks occur in pipes between pump and spray bar delivering binder under pressure, the most common cause being high pressure developing due to blockages in the spray line and/or spray bar. Before starting work on any day, examine all flexible pipes and couplings and report defects immediately.

6. DELIVERY OF MATERIALS

First satisfy yourself that the material which has been delivered is the binder which was ordered. Then satisfy yourself, by dipping the tanker, that you have sufficient capacity to accept the delivery. Use only the correct unions and pipework, wear protective clothing, do not stand in line with the flange couplings when transfer is taking place.

Discharge by flexible hose direct into the top manhole in the tanker is highly dangerous and must not be allowed. An air vent to prevent any build-up of pressure must be maintained. Keep non-essential people away from the area.

7. PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

All members of surface dressing gangs should be supplied with suitable and adequate clothing and equipment to protect themselves whilst at work.

For general gang members, safety footwear, along with distinctive colour trousers or overalls plus high visibility jackets or waistcoats to BS EN 471, dependent on road type, and gloves where necessary.

The sprayer driver and spray bar operator will need all the above but due to the additional risk, it will need to be supplemented.

The sprayer operatives must use overalls (cotton or other natural fibre) without any loose belts etc., but the trouser legs must be capable of going over the boots. Gloves must be the right type for the various tasks – heat resistant/impervious to solvents - and protect the hand from the product running down inside the glove.

When transferring products, the operators should protect head and face as well as general precautions by means of helmet, visor and neck guard.

Consideration must be given to the risk of head injury from falling objects or passing equipment/vehicle and a decision as to whether hard hats will be worn should be made.

8. PERSONAL HYGIENE AND CARE

This is of great importance. All traces of binder should be washed from the skin after work and regular baths or showers taken.

Use a suitable hand cleaner.

Use olive oil or other vegetable oil as a solvent for removing binder on the skin.

Do not use diesel oil or other solvents to clean your hands.

Ensure that all clothing is regularly changed and properly cleaned before re-use.

Using overalls impregnated with solvents or bitumen is a potential fire hazard.

The surface dressing operation is normally carried out during the times of year when the weather is driest and hottest. Consideration must be given to:

- (a) Having adequate supply of drinking water on the vehicles.
- (b) Allowing operatives to take reasonable breaks and to see that these are taken in the shade.
- (c) Keeping any exposed skin protected from the harmful effects of the sun by shading, covering or sun block.

9. FIRST AID

The most significant hazard, to which personnel handling binders are exposed, is heat burn. If a burn occurs from contact with hot bitumen emulsion binder, the affected part should be cooled immediately by plunging into cold running water for at least 15 minutes. If running water is not available, any water source should be used.

NO ATTEMPT SHOULD BE MADE to pull off adhering binder from the skin.

If hot bitumen should be splashed in the eye, cool as rapidly as possible in cold water for at least 15 minutes.

All cases - medical assistance must be obtained without delay.

10. FIRST AID BOX

Make sure you know where the first aid box is kept and that it is adequately stocked. A container of fresh, clean water should be available for washing eyes and/or a proprietary eye wash.

11. ACCIDENT REPORTING

All accidents must be entered in your company's Accident Report Book and should also be reported without delay in accordance with your company's procedures and legal requirements.