

# **Equipment Calibration for Waterborne road marking paints based on FASTRACK™ emulsion from Rohm and Haas**

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New Zealand Road Markers Federation 2005 Conference  
17-19 August 2005 Christchurch New Zealand**

## **Introduction**

Waterborne paint for use as pavement markings revolve around three key criteria. The paint, the glass beads and the application of both. The correct application of glass beads is critical to delivering both long term durability and sustained retroreflectivity, however the large scope of bead type, method of application and equipment type places it outside the scope of this paper. The writer would direct those interested in glass bead application equipment and maintenance to the Potters Asia Pacific publication “Part3- Bead Guns and Applications Systems” for a comprehensive review.

The paint component and the relevant application is greatly influenced by the presence of a major component, FASTRACK™ acrylic emulsion from Rohm and Haas Company. This acrylic emulsion helps bind the other ingredients together and imparts three key properties

- Fast dry speeds under adverse conditions of low temperature, high humidity and low wind speeds
- Adhesion to glass beads and oily surfaces
- High resistance to wash out

Specifying the right amount of paint is dictated by the road surface and the specified glass bead size. Achieving the right amount of paint is dependent on the using the right equipment, calibrated correctly and operated by experienced contractors.

While specifying the correct amount of paint is a topic for another day, hitting the target application rates is critical and equipment specific. All paint application systems have some clear similarities. Perhaps the clearest way to envisage this system is to view the “paint circuit”. Each component of the circuit has a role to play and we will address each on in turn. However prior to looking at those components of the paint circuit what about the characteristics of the paint itself.

## **The Paint**

Waterborne paints are typically based on 550g/L FASTRACK emulsion from Rohm and Haas Company. This product has a pH of 10 and is buffered with Ammonia. No surprise then to find the paint made from this emulsion is also high pH and smells of ammonia. This high pH means the paint is alkaline and therefore reacts with many common metals. We discuss replacement of these metals with stainless steel later in this paper.

As the ammonia evaporates, the paint skins rapidly, so exposure to air should be limited. The paint is also high solids (60%) and much of this is achieved through addition of extenders which deliver durability but also adds body or weight to every litre of paint. Think about how best to handle when the SG is 1.7kg/L. The paint uses water to carry this high level of solid material so expect paint to be caught in filters under 150um.

The balance of the paint formulation (other than the solid material) is water. Therefore temperature, humidity and wind speed all play vital roles in how quickly the paint will completely dry.

Due to the rapid dry chemistry built into these paints through the use of FASTRACK emulsion, the only realistic method to apply these paints is by spray. The clean edges, minimal overspray and reduced noise offered by airless spray has seen virtually exclusive adoption of this technique for line marking.

### **Paint Handling Tips**

- When handling paint, minimise the time that it is left exposed to the air.
- Any air leaks in the system should be fixed immediately.
- Regularly top-up paint tanks when possible, especially at the end of the day's work.
- Mist a thin layer of water or ammoniated water on top of the paint if extended storage is necessary.
- Clean the nozzles of your guns immediately you stop spraying, even if just for a few minutes.
- Oil or petroleum jelly can be placed on the spray tip during stoppages to prevent nozzles from clogging.
- An alternative to cleaning the nozzles during a work break is to wrap them in a cloth soaked in ammoniated water.
- Do not run the tanks dry, as an empty tank allows air to enter the system. If this happens more than once, the system may need to be dismantled and completely cleaned.
- Heat exchangers, tanks and lines should be left full of paint while standing overnight, or anytime the road marking truck is stationary for several hours.
- Always turn the water supply to the heat exchanger off prior to shut down to allow the paint to cool down.
- Water based road marking paint is formulated 'ready for use'. Adding water to thin the paint will increase dry time as there will be more water to evaporate, and is generally not recommended.
- Heat exchangers, tanks and lines should be left full of paint while standing overnight, or anytime the road marking truck is stationary for several hours.
- Always turn the water supply to the heat exchanger off prior to shut down to allow the paint to cool down.
- Water based road marking paint is formulated 'ready for use'. Adding water to thin the paint will increase dry time as there will be more water to evaporate, and is generally not recommended.
- Never add solvents used in solvent-based paint to a water based paint as it will solidify.

- If paint supplied in drums arrives with skins formed on top, remove the skins before using the paint to avoid blocking filters. Alternatively, return severely skinned paint unused to your paint supplier.
- If possible, thoroughly mix paint supplied in drums or larger containers to obtain uniform composition, before pouring it into the tank or pumping through the filter.
- Always check for skins in the tanks before starting up each day.
- When left standing overnight, tanks must be closed and, if it is an airless spray system, the pump pressure turned off.
- Heat the paint between the pump and the gun only as it is being used.
- Do not heat the paint to greater than 40°C in the heat exchanger.
- Do not return heated paint to the paint tank.

### **Paint Cleanup**

Paint spills are best handled by using an absorbent material such as sand or saw dust rather than trying to clean up by water. Using water tends to make the affected spill area larger and runs the risk of introducing diluted paint into waterways. An alternative approach, particularly if it is thick, is to leave it and allow the paint to dry. It can then be pried off the substrate and disposed safely as solid waste. Routine shutdowns should involve discharge of paint into an appropriate waste container and then returned to the depot for treatment. Digging a hole next to the road and discharging paint is not acceptable and should never be considered.

## **Paint Equipment Generalities**

### **Paint supply**

Most paints are available in 20L or 200L drums. However use of 500L/1000L Intermediate Bulk Containers (IBC's) are much better suited to large scale use. Environmentally they are better as they use a disposal inner bladder. They also reduce waste per container. More importantly the rapid run up in world steel prices will impact on drum package cost. A likely repercussion of this will be less drums or possibly a big move to plastic drums.

### **Materials of Construction**

All fittings should be 304 Stainless or higher to prevent reaction of the paint with bronze, brass, aluminium or galvanising. Equally well hoses should be made from materials compatible with waterborne paint. Contact your supplier such as Graco Inc. The sizing of hoses is also important. Waterborne paint is high solids and is typically applied at wet film thicknesses in excess of 400micron. Therefore hoses should be 18mm diameter to allow adequate paint flow rates particularly at higher application speeds

## **The Paint Circuit Components**

### **Paint Filters**

Paint companies generally filter at around 200-250um. Any particles in the paint smaller than 200um will pass through a tip larger than 10 thou. To the best of the writers knowledge the smallest tip routinely used in airless spray would be on a pedestrian unit and that is usually 15 thou or 375 um. Therefore using small filters of both aperture and capacity on road marking equipment is a recipe for down time. Some good ideas on filter choice are

- Filters should be on the suction side of the pump
- Filters should be about 10% smaller than the intended tip size
- Filters are designed to remove larger skins or flakes that have formed during storage
- Filter bags made from nylon or synthetic should be cleaned/changed regularly
- Typical bag dimensions are 100mm diameter and 150-300mm long. A stainless steel housing capable of holding the bag is required. The housing should allow paint to enter at the top and discharge at the bottom. Most commercially available filter housings will be pressure rated but this is not required if the filter is on the suction side.

### **Paint Pumps**

The pump is a key component and dictates the application speed upper limit. A big pump say 25-40L pm, allows for higher applications speeds but only if the tip size on the guns is big enough to allow the flow. Some extra flow can be achieved by pushing up the operating pressure. A small pump with a big tip is bit like a low pressure garden hose. Some useful ideas on pump choice are

- Always use low shear pumps such as diaphragm or piston pumps
- Hydraulic pumps such as Graco's Viscount series are very common
- Pump sizes should match intended outputs. Large tip sizes eg 60-80thou combined high striping speeds eg 15-20kph may require 25-40L pm pump capacity.
- Line widths and intended paint thickness will also dictate pump capacity
- Line patterns and colours influence the number of pumps required.

### **Accumulators**

Paint pulsing is a common cause of line "pinching". It may occur at each stroke of the pump and is more common with higher viscosity paints. It can be overcome by fitting a 1 litre nitrogen charged accumulator between the pump and the spray guns. Specialised equipment manufacturers eg Graco, use hoses made from flexible material than help absorb the pulse and can work as an accumulator.

### **Heat Exchangers**

Heating water based road marking paint before spraying is optional. It is sometimes done in areas where cold weather conditions are common. A paint circuit heat exchanger uses water from the host vehicle's cooling system to transfer heat to the paint.

Benefits include control of paint viscosity to provide consistent flow and atomisation, fan width and pump load. Heating will not accelerate the drying of water based paint under high humidity. Equally well it will not affect dry through times of paint.

### **Airless Spray application and Tip selection**

Most common branded spray equipment can be used to apply water based road marking paints as long as all metal surfaces coming into contact with the paint are made of stainless steel.

Airless spray is more commonly used compared to conventional air assisted spray as it applies a greater volume of paint, has a faster application rate and produces a sharper line edge. However, conventional air spray equipment is less costly and generally more forgiving. A recommended starting point airless spray set-up for longitudinal line marking is a tungsten carbide tip with 25 degree setting and aperture size of around 1575 microns (0.062”).

Experienced operators will balance the pump capacity/operating pressure and tip size versus desired speed of application, line width and target wet film thickness. A larger tip will allow more paint to flow but needs a more pump capacity to keep paint up to it. If you want to produce a 150mm edge line at 500um WFT at application rates of 15kph, or worse still double or no overtaking lines you need to increase the tip sizes. Don't be scared to use 90thou if you have the pump capacity

### **Back Pressure Regulators**

A paint line, returning from the spray gun feeding paint back to the paint filter, is necessary for most efficient operation and maintenance. It can be controlled by a simple hand operated ball-valve or an automatic back pressure regulator.(BPR)

BPR's provide even delivery to the spray guns. This removes line ballooning common when painting continuous and broken lines simultaneously.

### **Calibration and Measurement**

The paint circuit, correctly installed will only meet the customers specification if its operated within its capability. Equally well if operated outside these design parameters the customer will not get what they paid for. The role of calibration and measurement is critical to delivering happy customers. It is also important that if you are a contractor, hitting the spec first time without the embarrassment and cost of a recall is critical. Achieving the right correct wet film thickness and maintaining this over a days work requires calibration and measurement.

Two methods can be used.

Method 1- An wet application to a test plate at the target application speed. It is then either weighed and WFT calculated or WFT directly measured via a wet film comb or wheel

Method 2- A much easier method as it uses a stationary vehicle. The spray gun is activated and the paint collected in a plastic bag. The bag is weighed and a simple conversion table will establish the WFT at various target vehicle speeds.

## **Glass Beads**

Waterborne pavement marking systems all require the use of glass beads. These beads play a critical role by

- Imparting retroreflectivity to water based painted pavement markings.
- Providing significant improvements to the durability and wear characteristics of the marking
- Assisting skid resistance of the marking
- Availability in a range of sizes and applications
- Providing wet night visibility and improved safety for drivers at an average 1mm diameter.

Full details for handling, application and maintenance of glass beads application equipment available through Potters Industries.

## **Summary**

The paint quality, the equipment used to apply the paint, the choice of the correct glass type and the delivering of these at the required rates by experienced operators all contribute to the right outcome. Happy customers and return work