



# POLYURETHANE ELASTOMER COATING

We estimate that more than 50% of SPM Terminals now specify 100% Polyurethane Elastomer (PU) coating of their hawser assemblies.

Double Braid rope or ropes with an overbraided outer sheath (Gama 98®) are ideal for PU coating having a round, regular and relatively smooth surface. On these constructions it is possible to apply a uniform thickness of PU typically 2-3mm thick.

## Benefits

- **Polyurethane is an excellent abrasion resistor**

Hawsers are manufactured from multifilament yarns, usually Nylon, with a diameter smaller than the average human hair follicle. These yarns whilst immensely strong in tensile load are very easily cut, especially by motions at 90 degrees to the axis of the yarn (cross cutting). General abrasion comes from many forms at SPM Terminals, such as from handling on the quayside, rubbing up against the SPM or the hose string, from workboats etc.

- **Prevention of the ingress of foreign particles**

Sand or grit, picked up on the quayside, or carried by currents, especially near river estuaries, or even marine organisms such as barnacles or mussels growing on the rope will cause significant internal abrasion damage to a hawser under high tensile cyclic loading.

- **Maintenance of lubrication**

Nylon and polyester yarns when extruded have very fine film lubricant on their surface. Except for some very special Marine Finishes, most yarn lubricants are water soluble and will leech out of the rope over a period of time. PU coating will not prevent the lubricants from washing out eventually, but will prolong the time it takes to occur.

- **Reduction of water washing effect**

Water washing is the effect of water washing in and out of the rope structure damaging the fibres. Ropes which have suffered from water washing look like woollen sweaters with heavily matted yarns on the outer surface.

- **Reduction in flex fatigue**

Double braid ropes in a relaxed condition are very flexible. Thus whilst in the sea, even during very calm waters, there are usually small waves, so the rope bobs up and down over the waves continually moving and flexing. Every movement requires the yarns and strands to adjust their relative position and slide past their neighbour. Thus an SPM hawser left floating in the sea for 6 months without seeing a single tanker operation could easily have lost 30% of its original strength purely from flex fatigue and water washing. 100% PU coating significantly increases the axial stiffness of the rope, so waves tend to wash over the rope rather than it bobbing up and down with every small movement.



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- Note that partial PU coating (for example to protect an abrasion zone) is not recommended as this creates a flex node between the coated and uncoated sections where all flex movements are concentrated.
- Polyurethane elastomer is a two part mixture of the base Polyol and Isocyanate which is the catalyst. The ratio of the two elements to get a good quality PU has to be very precise. We have invested in the latest generation computer controlled dispensing machine which monitors the float rates many times per second continually adjusting the pump outputs to guarantee perfect product all the time.
- PU which is “off ratio” will either fail to cure and be permanently tacky or be too hard and brittle. The surface to which the PU is being applied must above all be dry. PU reacts violently with water during the application stage. If the PU is applied to a damp rope, the resultant PU will be like a sponge and have very poor tear strength. Oil will prevent any bond between the two surfaces.

**Physical Properties and Testing (PEL 029)**

	<b>SPECIFICATION</b>	<b>NORMATIVES</b>
<b>Type</b>	Polyether	
<b>Colour</b>	International Orange	
<b>Hardness</b>	80 Shore A minimum	BSS903 A57
<b>Tensile Strength</b>	10.5 MN/m <sup>2</sup>	BSS903 A2
<b>Elongation</b>	250% minimum	BSS903 A2
<b>Crescent Tear Strength</b>	33.6 kN/m	BSS903 A3

**Polyurethane Encapsulation of Thimbles**

It is common practice to PU encapsulate cast galvanised thimbles, to provide a barrier between the thimble wall and the rope. PU elastomer will extend 300% or more before tearing, whereas the rope will typically only extend 35% to break, thus PU does not inhibit rope performance. However great care has to be taken to ensure that localised extension does not occur which may create extensions of 300% over a small distance resulting in tears in the PU.

One area for particular care is the interface between the rope and thimble encapsulations. Suppliers who do not understand the behaviour of the products will demonstrate their lack of knowledge when the rope is put into service.

Typical failures show as the PU encapsulation breaks off at the thimble or tears occur at the junction between a PU coated rope and the thimble encapsulation.



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