

## **2-Part Adhesive Bonding: Kevlar Fiber to Vehicle Body Armor**

**BACKGROUND** – U.S. military convoys and patrols are easy offensive targets. In 2004, a military commander in Iraq issued an urgent request for Armored Security Vehicles (ASV) for better personnel defense since the ASVs oblique armor redirects explosives away. ASVs are better armored than personnel vehicles and more maneuverable than tanks. In 2005, the Army ordered 724 ASVs from Textron. In 2006, the order grew to 1,200 ASVs and assemblies increased up to 48 ASVs per month.



Textron's M1117 Armored Security Vehicle

**APPLICATION** – To protect ASV personnel and contents, the body armor is lined with a thick layer of Kevlar® fiber (® of E.I. du Pont de Nemours and Co.). Approximately 30 different Kevlar shapes are pre-cut and assembled on a table. A specific shot size is selected from the Sealant Equipment & Engineering control panel and the See-Flo® 7 Meter Mix Dispense System dispenses a precise volume of 2-component mixed material into a container. Flame retardant and curing accelerant is added and mixed into the adhesive. The adhesive is applied to the Kevlar. The ASV is rotated on its axis for operator access and the adhesive-coated Kevlar fiber is applied directly to the body. C-clamps, vise-grips and column-jacks are put in place for 2-hours to maintain the Kevlar's position during the adhesive curing cycle.

**ADHESIVE MATERIAL** – Textron uses SIKA Biresin brand elastomeric urethane casting resin in 5 gallon pails with viscosities of 7,000 cps for Part A and 250 cps for Part B. The mix ratio is 1.5:1 by volume and has a 15 to 20 minute work life, ideal for the dispenser and process.

**THE METER MIX DISPENSE SYSTEM** – The See-Flo 7 is a continuous-flow, adjustable-ratio meter system with precision shot volume controls. Textron's system is cart-mounted. Material is placed in 10 gallon pressure tanks, agitated and de-gassed. The tanks are pressurized with nitrogen and materials feed the See-Flo 7's positive displacement piston metering cylinders.

**OPERATION** – The operator selects one of the 15 pre-set shot sizes throughout the day ranging from 360 cc to 3600 cc and initiates the meter-mix dispense cycle. The Program-A-Shot™ controls incorporate a linear-transducer to precisely measure the selected volume of mixed material. The See-Flo 7 meters the material on-ratio to the 2200-245 No-Drip™ Mix-Dispense Valve with disposable static mixer and delivers the urethane material at 22 cc's per second. A ratio-check is performed regularly to verify the 1.5:1 material ratio accuracy.

# See-Flo<sup>®</sup> 7 Meter Mix Dispense System



Kevlar Fabric is shown adhesive-bonded in position onto two door panel interiors



See-Flo 7 Meter Assembly with 2200-545 Mix Dispense Valve and Disposable Mixer



Linear Transducer Assembly



2200-545 Mix Dispense Valve and Disposable Mixer



Master Control Panel Operator Interface

Form No. AP-Textron SF7



Manufacturers of Precision Dispense Systems & Valves

45677 Helm Street • P.O. Box 701460  
Plymouth, MI 48170 • USA  
Phone: (734) 459-8600 Fax: (734) 459-8686  
Website: [www.SealantEquipment.com](http://www.SealantEquipment.com)  
Email: [Sales@SealantEquipment.com](mailto:Sales@SealantEquipment.com)

