iNOVEX INDUSTRIES, INC.

Technical Service Bulletin – 053014

To: All Dealers, Distributors, and Customers
From: Harry Farkhan, Executive Vice President
Subject: Tube Tire Sealant Testing and Performance

By their nature, tire sealants can never be 100% effective in sealing all punctures. This holds especially true for tube tire applications. There are several variables that can impact our tube sealants' efficiency (thickness of tubes, speed of operation, puncturing object size, location of injury, ambient temperature, tire's starting pressure, etc.). Having said that, Inovex has been able to achieve an industry leading 90%+ sealing efficiency with our NEW improved Ride-On Motoscooter and Bike-On tube tire sealants. Achieving 90%+ sealing efficiency from objects smaller than 3mm in diameter that penetrate the coverage area of a tire is no small feat. The industry average is well below 50% and many tire sealants can't seal tube punctures at all. However, as good as our products are, tubes can tear and we cannot seal tears.

There are several things to consider when evaluating tire sealants in tubes. We have outlined some critical items that you need to be aware of to ensure optimum results.

1. In our testing we have noticed that thin tubes (less than 1mm thick) have a tendency to tear easily when punctured with nails that are significantly larger in diameter than the thickness of tube they are penetrating. For example a nail that is 3mm in diameter is 333% larger than a .9mm tube's thickness. The odds of a tear occurring when such a large (in comparison to tube's thickness) object penetrates the tube increases the more times a tube is tested that way. In our testing we can seal more than ten (10) 3mm nail punctures as long as the tube does not tear. Unfortunately, the tube can tear on the first, fifth, tenth, or fifteenth puncture. There is no way to predict when or why one puncture will tear a tube while multiple other identical ones do not. Regardless, if a tube ends up tearing, it will result in the termination of the test. Please note that 3mm is the maximum diameter of a nail or smooth round object that can penetrate the tire and while maintaining a 90%+ chance of sealing. Larger diameter objects or screws of any size will increase the chance of a tube tearing significantly. DO NOT perform test with screws as the threads on a screw will catch on the tire rubber and tube as it is being pushed through. This will cause a ragged, irregular and larger puncture than the actual diameter of the screw. If using a screw, limit the size to no more than 2mm.

2. In real world applications, the Ride-On tube sealants will be installed in tubes for some time (maybe a couple of weeks or longer) before they are punctured. Ride-On performs better the longer it is in a tire. We consider Ride-On's tube tire sealants preventive sealants – they are supposed to be installed in tires before a puncture occurs. The longer the product is in a tire, the more it will remove and

iNOVEX INDUSTRIES, INC.
45681 Oakbrook Court • Unit 102 • Sterling • Virginia 20166 • USA
Phone: 703-421-9778 • Fax: 703-421-1967 • e-mail: info@ride-on.com • http://www.ride-on.com
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absorb the non-stick powder that is installed in tubes during the manufacturing process to prevent the tubes from sticking to themselves. This will allow the Ride-On to better coat the inside of a tube thus maximizing its chance of sealing.

When possible, we recommend that Ride-On be installed in tubes that will be tested as far in advance as possible. Allowing the product to run in a tire for even a few kilometers a day for 2-3 days can make a difference. This will give you results that are more in line with what can be expected in the real world. Remember to run a test tire for at least 3-5 km before the making first puncture to insure the product has evenly distributed and that the tire, tube, and sealant have warmed up.

3. **PULL NAIL OR PUNCTURING OBJECT OUT SLOWLY**! In tube tires, Ride-On has to seal both the tube and the tire. Pulling the nail out slowly allows the Ride-On sealant to flow out of the tube and through the hole in the tire to seal both the tube and the tire. Also, if the head (back end) of a puncturing object is missing, treat it as if it may be a screw to minimize the potential further damage to the tire as you remove it. Slowly pull the object out by unscrewing it in a counter-clockwise direction. Pulling a screw out will end up tearing a tube and doing more damage to the tire. Always remove a screw by unscrewing it.

4. Our tube sealants use a combination of fibers/particles and latex to seal tube tires. The fibers/particles do 95%+ of the sealing and the latex does the rest. To maintain an air-tight seal, it is important for the latex to cure. Sometimes a small amount of air will continue to escape from the puncture for up to one to three days. As the latex cures, the puncture will seal completely and no further air loss will be observed. It is normal for a tire to lose up to 0.3 bar or more during this time.

5. In order to be able to seal the tube and the tire, the tube must be properly inflated. Ride-On will seal most efficiently when the tire and tube are inflated to the specified pressure for a given vehicle. When a tube is pressurized adequately, it presses against the inside surface of the tire with greater force. This reduces tire sealant leakage from the tube into the tire (tire cavity) when it is punctured. Also, maintaining a tight contact between the tube and tire surface optimizes the ability for the tube tire sealant to flow from inside the tube through the puncture in the tire.

6. Because of item 5 (above) we highly recommend that when you are demonstrating our sealant in tube tires, you perform ONE puncture at a time. DO NOT DRIVE OVER NAIL BOARDS THAT HAVE MULTIPLE NAILS ON THEM. The ability of Ride-On to seal subsequent punctures drops as the air pressure

inside a tire is reduced and the tube no longer presses against the inner liner of the tire with sufficient force.

7. Make sure that each previous puncture is sealed and that the tire is re-aired before you re-puncture the tire.

8. Every time the tube tire gets punctured, a small amount of Ride-On sealant will seep into the space between the tube and the tire (tire cavity). Larger objects that penetrate the tire can cause more sealant seepage. This small amount of tire sealant leaking between the tire and the tube is normal and it helps reduce air leakage from around the tube to the path of least resistance which is the space around the valve stem. As the product cures between the tire and the tube, the seal becomes more effective. The curing of this layer of sealant can take 1-3 days depending on the temperature.

   Please note that this sealant (when uncured) can also act as a lubricant and allow the tube to move inside the tire from side to side. This movement can dislodge a plug and cause the tube to leak more (especially around the valve stem area). Under normal conditions when a tire is punctured and sufficient time passes between a subsequent puncture, the cured product will allow the sealing efficiency to remain at 90%+ levels. However, if multiple punctures are being performed in a short period of time, the amount of uncured liquid around the tire will increase significantly and cause the tube to float and move around over a layer of the sealant. This will allow the tube to move significantly more than in real world conditions (customers scooters) potentially causing the plugs to dislodge and the tire to lose more pressure. Under real world conditions this would not happen as product between the tube and tire would have cured in 1-3 days.

9. For best results when performing multiple punctures use smaller diameter perforating objects (2.3 mm and less) and avoid making punctures any closer than 8 cm from each other. **Also when testing, if possible avoid puncturing the valves stem area (refer to item 10 below).** Although Ride-On will seal punctures that are closer to each other or near the valve stem, you want to minimize the chance of failure by avoiding making these punctures.

10. The valve stem of the tube is an area where the thickness of the tube almost doubles because of the vulcanizing of the actual valve stem to the tube as part of the manufacturing process. This thicker portion of the tube prevents the tube from fully expanding (like the rest of the tube) to press against the tire casing firmly. This allows air to escape from around the tube and out of the space around the valve stem (path of least resistance) instead of through the puncture hole which is sealed by the sealant. You observe that when you puncture a tire

somewhere else and the product appears to seal it (no air escapes from the hole), the tire continues to lose pressure. If you check around the valve stem, you will notice that the air is escaping from there. Furthermore, the valve stem area is where the tube seams are joined (see pictures below) causing another weak spot. The efficiency of sealing tubes in this area is reduced and puncturing this area during demonstrations is not advisable.

11. If there is a slow leak after a puncture, you must re-inflate the tire and continue to ride the scooter/e-bike some more. Most slow leaks will seal eventually once the latex has had a chance to cure. If a slow leak does not stop leaking, there could be a tear in the tube. Small tears (4-6 mm) will appear as slow leaks that never stop leaking air.

Placing an O-ring around the valve stem (between the tube and the rim) will help seal the path of least resistance as explained in item 10 above – the space around the valve stem (opening in the wheel through which the valve stem sticks out) – and optimize the performance in tube tires. Inovex is currently working on developing an o-ring optimized for this very purpose.

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