



Waterproof Characteristics of 3M™ VHB™ Tapes

Technical Bulletin

July 2023

Ingress Protection Background

The IP code, International Protection Marking, IEC standard 60529 classifies and rates the degree of protection provided against the intrusion of solid particles (such as dust) and liquids (water) by electrical enclosures. The rating is generically a 2-digit code, the first referring to solid particle protection and the second to liquid or water protection. Where there is no protection or where it isn't of interest, the digit is replaced with the letter X.

The electronics industry uses pressure sensitive adhesive (PSA) tapes to seal their devices and certify them to particular ratings: IP68 is typical. This would refer to dust tight (6 rating for solid particle) and suitable for immersion up to 2 meters for 30 minutes (7 rating for liquid). It is important to note that this is a device level test or characterization and not something tested on the PSA tape itself. A device manufacturer will test and rate their device, in addition to simulated devices being made to test the integrity of the PSA tape.

More recently, IPX8 has been designated by many manufacturers. There are some concerns with this rating. The first is the same with other rating questions – that this is a device level characteristic, not a tape characteristic. The second issue is that IPX8 is not specifically defined. The description for the 8 rating is *“suitable for continuous immersion in water under conditions which are specified by the manufacturer.”* Typically, the device is immersed beyond 1 meter with a depth and time duration specified by the manufacturer, albeit more stringent than the 7 rating.

Answering the question whether a PSA tape is capable of meeting IPX8 would require knowledge of how the device maker defines this. Any claims regarding meeting IPX8 will have to include a description of how IPX8 is defined (for example depth, duration, and geometry).

For this test development and characterization, IPX8 is considered equivalent to 14 lbs/in² (psi) pressure (about 10 meters depth) for 30 minutes with a 2 mm line width of a 3M™ VHB Tape or a ~4 mm width of 3M™ VHB™ Extrudable Tape in a circular pattern at a thickness of 1.0 – 1.5 mm. These are double-sided PSA tapes. This testing was extended to 43 psi (about 30 meters depth) for samples that passed the 10 meter simulated depth. A metal substrate was bonded with the PSA tapes to a clear plastic (acrylic) or glass substrate to allow for water ingress inspection.

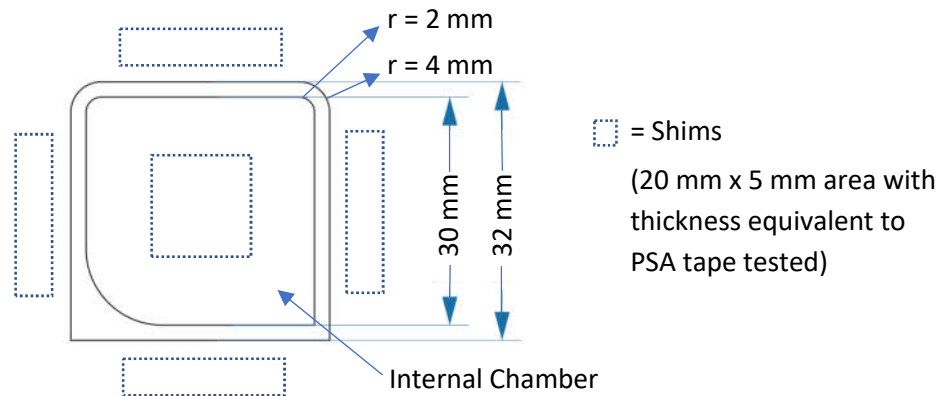
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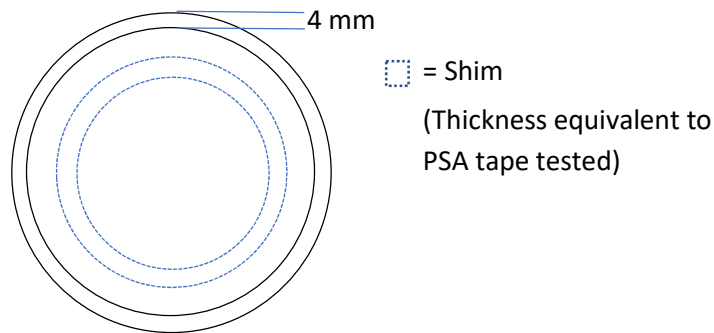
Immersion	1	2	3	4	5
Simulated depth (chamber pressure)	1 m (4.3 psi)	10 m (14.2 psi)	30 m (42.7 psi)	10 m w/shims (14.2 psi)	30 m w/shims (42.7 psi)
Pressurized duration in min	30	30	30	30	30

Test Device

The test configuration for 3M™ VHB™ Tapes 86415, 5907 and 5980 is shown below in the consistent black line. Shims are shown in the dashed lines.



The test configuration for the 3M™ VHB™ Extrudable Tape is shown below in the black consistent lines while the shim is shown in the dashed line.



Due to the viscoelastic nature of PSA tapes, the applied pressure across the edge of simulated devices would be decreased due to the compression of the PSA tape. To account for this, it is necessary that samples are tested to the same pressures, with and without shims (at the same thickness as the PSA tape used), to maintain or compress the bond line, respectively. The simulated devices will be considered as passing the test when no visible liquid has entered the internal chamber of the device.

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Results

Simulated Depth (Chamber Pressure)	Pressurized Duration in Minutes	3M™ VHB™ Tape 86415	3M™ VHB™ Tape 5907	3M™ VHB™ Tape 5980	3M™ VHB™ Extrudable Tape – Round Bead	3M™ VHB™ Extrudable Tape – Ribbon Bead
3 m (4.3 psi)	30	Pass	Pass	Pass	Pass	Pass
10 m (14.2 psi)	30	Pass	Pass	Pass	Pass	Pass
30 m (42.7 psi)	30	Pass	Pass	Pass	Pass	Pass
10 m w/shims (14.2 psi)	30	Pass	Pass	Pass	Pass	Pass
30 m w/shims (42.7 psi)	30	Pass	Pass	Pass	Pass	Pass

Conclusions

The PSA tape samples evaluated were representatives of common 3M™ VHB™ Thin Foam Tapes for electronics applications (3M™ VHB™ Tape 86415, 3M™ VHB™ Tape 5907 and 3M™ VHB™ Tape 5980) as well as 3M™ VHB™ Extrudable Tape. These tapes have passed the testing described in this report. These results are not to be used as a certification of device waterproofness, only to show that if used properly, 3M™ VHB™ Tapes will provide a watertight seal.

Technical Information

The technical information and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed. It has been prepared from testing that was performed using standard test methods, and tested equipment that is calibrated in compliance to ISO9001 and operated by trained professionals in controlled environments. The data should be considered representative or typical only and should not be used for specification purposes. 3M reserves the right to make changes to the design, construction and technical data of products without prior warning.

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ISO 9001

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001 standards.



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