



Date of Preparation or Revision: August 2014

A REPORT ON THE EFFECT OF MOISTURE EXPOSURE ON MECHANICAL PROPERTIES OF PULTRUDED COMPOSITES

TO WHOM IT MAY CONCERN:

In a recent study performed at BRP comparing the effectiveness of sealers on machined edges of pultruded parts, a set of non-sealed coupons were also immersed in water at 110°F over a period of 1 year and tested for tensile and flexural property degradation at 7 intervals. At every interval a set of 6 samples per test, machined as per respective test method prior to immersion, were taken out of water bath, patted dry and tested as soon as possible. The conclusions of the test data are as given:

Conclusions

- 1. The loss or gain of strength due to sealing the machined edges of coupon is statistically insignificant, proving that sealing the cut or drilled edges doesn't have any positive effect on performance of pultruded parts.**
2. Comparing the control sample (unsealed at ambient on day 0) with the sample immersed in water at 110°F for a period of 1 year, there is about 19% reduction in tensile strength and 23% reduction in flexural strength.
3. It was observed that the rate of reduction of strength is higher in first 90 days of testing and appeared to flatten from 90 to 364 days.
4. No significant change in both tensile and flexural moduli were observed.
- 5. It has to be noted that the tested values after 1 year exposure to hot water are still greater than that of BRP published minimum required properties.**

TEST DATA

The test data regarding sealed (using pigmented Hetrolac[®]) and non-sealed samples as follows:

| Properties of Non-Sealed Control Sample on Day 0 | | | | |
|--|---------------------|---------------------------------------|----------------------|--|
| | Tensile Stress, psi | Tensile Modulus x 10 ⁶ psi | Flexural Stress, psi | Flexural Modulus x 10 ⁶ psi |
| Average | 55117 | 3.852 | 66000 | 2.653 |
| Std. Dev. | 1665 | 0.1344 | 3178 | 0.1532 |

| Tensile Stress % as per ASTM D 638 | | | | | | | | | |
|------------------------------------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Days | 7 | 14 | 28 | 63 | 91 | 181 | 273 | 364 |
| Sealed Samples | Average | 48600 | 49133 | 46617 | 44923 | 44827 | 45967 | 46633 | 45483 |
| | Std. Dev. | 272 | 1573 | 2592 | 1982 | 2054 | 900 | 880 | 2166 |
| Non-Sealed Samples | Average | 49650 | 47450 | 46450 | 47101 | 43799 | 44950 | 44350 | 45183 |
| | Std. Dev. | 1086 | 1993 | 1936 | 1855 | 1277 | 1427 | 2577 | 2726 |

| Tensile Modulus, x10 ⁶ psi as per ASTM D 638 | | | | | | | | | |
|---|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Days | 7 | 14 | 28 | 63 | 91 | 181 | 273 | 364 |
| Sealed Samples | Average | 3.805 | 3.835 | 3.708 | 3.805 | 3.663 | 3.672 | 3.932 | 3.938 |
| | Std. Dev. | 0.225 | 0.192 | 0.105 | 0.164 | 0.168 | 0.120 | 0.366 | 0.160 |
| Non-Sealed Samples | Average | 3.858 | 3.787 | 3.92 | 3.863 | 3.757 | 3.778 | 3.72 | 3.735 |
| | Std. Dev. | 0.137 | 0.194 | 0.102 | 0.126 | 0.159 | 0.116 | 0.488 | 0.142 |

| Flexural Stress, psi as per ASTM D 790 | | | | | | | | | |
|--|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Days | 7 | 14 | 28 | 63 | 91 | 181 | 273 | 364 |
| Sealed Samples | Average | 57717 | 59950 | 56933 | 52567 | 52933 | 52733 | 52933 | 50500 |
| | Std. Dev. | 2626 | 1559 | 2763 | 3407 | 3755 | 1294 | 4110 | 2122 |
| Non-Sealed Samples | Average | 57683 | 55783 | 57033 | 55100 | 53550 | 53833 | 54867 | 51000 |
| | Std. Dev. | 3058 | 2231 | 3016 | 1470 | 3378 | 2334 | 2171 | 3470 |

| Flexural Modulus, x10 ⁶ psi as per ASTM D 790 | | | | | | | | | |
|--|-----------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Days | 7 | 14 | 28 | 63 | 91 | 181 | 273 | 364 |
| Sealed Samples | Average | 2.668 | 2.698 | 2.72 | 2.537 | 2.615 | 2.547 | 2.64 | 2.565 |
| | Std. Dev. | 0.105 | 0.138 | 0.135 | 0.117 | 0.105 | 0.121 | 0.115 | 0.104 |
| Non-Sealed Samples | Average | 2.617 | 2.558 | 2.585 | 2.615 | 2.65 | 2.642 | 2.637 | 2.638 |
| | Std. Dev. | 0.103 | 0.114 | 0.068 | 0.096 | 0.118 | 0.096 | 0.104 | 0.044 |

If you have any further questions regarding this matter, please feel free to contact the company.