

HousAll Design Validation and Environmental Testing

The HousAll Shelter System was and is still being put through exhaustive testing to confirm and improve upon the integrity of the design, the materials used and its ability to withstand the environment, these tests included; water/rain, wind, snow load, heat, cold and ultra-violet radiation.

Materials:

In regard to materials, the HousAll Shelter System is composed of rust resistant steel and polypropylene in the form of panels and injection moulded piece parts. The properties of steel and polypropylene are well know and documented in the industry and so, no direct testing of their properties were deemed necessary. Industry Reports as to their properties are available upon request. The appropriateness of these materials were tested by HousAll in an indirect fashion, in other words, how they interacted with the design of the Shelter System.



Environmental testing and material selection is and was an integral part of the design phase, there was no purpose in carrying on with development if the chosen design and/or material was going to leak, fall down, or fail in some other manner. Several design concepts and features were discarded along the way and, in fact, it took seven (7) attempts in our laboratory with resulting design changes before the HousAll passed its water tests. Now, it simply does not leak, period.

Water/Rain:

HousAll built a rain making machine that pushed water through a one (1) inch pipe, at sixty (60) pounds per square inch and then through a large 'shower like' sprinkler head over each four (4) foot section of the HousAll unit. This poured water onto the unit at a rate equal to XX gallons or, XXX litres per minute. The HousAll



unit was then placed, with its floor system installed, over the main drain of the lab such that the water collected under, and all around, the unit to a depth of approximately one (1) inch; this was to test the integrity of the floor system and its ability to keep flowing water out of the unit in the case of poor exterior drainage. The optional floor system has been designed to keep as much as three (3) inches of flowing water from gaining ingress into the unit.



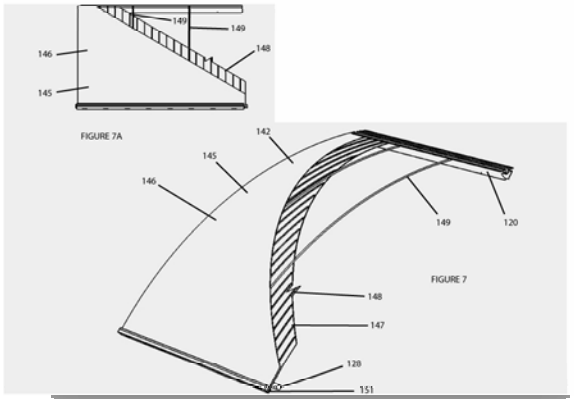
Given our changing weather patterns, the HousAll Shelter System was also tested and passed for 'monsoon like' rain while under an accumulated snow load of two hundred and forty (240) kilograms, or, six hundred (600) pounds of snow on a family sized unit. In fact, a family sized HousAll Shelter System will support in excess of one thousand six hundred (1,600) pounds of weight on the roof without

fear of collapse, or, seven hundred and twenty (720) kilograms.

The HousAll's windows, vents and doors were tested individually and in an isolated fashion; this was done to impose higher water flow rates as these were the most likely areas of concern for ingress. All of these tests were passed before the design was finalized. The HousAll's windows are made of Lexan, the miracle plastic used to make bullet proof glass, swat helmets and shields, etc., so they are extremely difficult to break.



Heat and Cold:



Material specifications for Polypropylene indicated that it would perform well for our application in the heat and the cold, but, given the extreme environments that exist where the HousAll was intended for use, that is anywhere in this world where it might be needed, a decision was made to develop a method for reinforcing the material; this is one of HousAll's leading Utility Patent Applications under the Patent Co-Operation Treaty.

The HousAll has been tested in the lab for temperatures in excess of sixty (60) degrees centigrade and outside to minus thirty-five degrees centigrade (forty-seven (47) with the wind-chill factor) and all with great success and plenty of tolerance remaining.



Snow Load:

The HousAll Shelter System has been designed to take over one hundred and fifty (150)



pounds, or, sixty eight (68) kilograms of weight per panel section without fear of collapse. That means over sixteen hundred (1,600) pounds, or, seven hundred and twenty (720) kilograms of weight for a typical family sized unit. However, the HousAll has also been designed so that this will only ever be put to the test under the most unusual of

extreme circumstances, this is because the roof has also been designed to both avoid build up and to shed accumulated snow when it does occur.

The roof design suppresses accumulation on the windward side of the structure and the pitch of the roof means that significant build up on the leeward side of the structure is also held to a minimum and eventually falls off under its own weight as is evidenced in these pictures.



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Even though the HousAll offers a standard insulation value of approximately R4, far surpassing



anything offered by tents, it leaks enough heat that when lived in full time snow load will not be a concern because it soon falls or melts off. The optional winter kit offers a boosted insulation value of approximately R10, or, insulation approximately equivalent to 1950/60s North American Home and the snow will still melt off in time.

Wind:

The HousAll's unique design means that it can withstand wind gusts approaching 120 kilometres per hour. While Canada and the field test location is not regularly subjected to near hurricane conditions we are known to get some violent wind, rain and hail storms. The HousAll field test unit has survived three major storms since it was first installed outside, storms that tore the roofs off neighbouring barns and houses, uprooted huge trees and destroyed or, toppled other temporary structures. The only pictures we have to show are uneventful as the unit remains in good order.

Ultra Violet/Sun:

There are three different versions of the HousAll Shelter System, a low end version that has no UV treatment at all, this is the version currently undergoing field testing by HousAll Systems, and it will last as long as two (2) to three (3) years before the plastics need replacement. HousAll's field test unit is in its third year and is still showing no significant signs of wear (yellowing), but, this is due to the low UV found where the unit is installed, approximately at the forty-fifth (45th) parallel. The mid-range version has a three percent (3%) UV Retardant added and will last as long as five (5) to seven (7) years before the plastics need replacing and the high end version will last in excess of ten (10) years plus before the plastics will need to be replaced.

Matra Plast Hi-Core® XLC – Ongoing U.V. Testing: At April 21, 2003

Plastics are very subject to attack by heat and Ultra-Violet light in the frequencies from 250-385 nanometers. Without protection, plastics will experience loss of strength and impact resistance, discoloration or yellowing and crazing or loss of gloss.

In order to quickly evaluate a long-life UV protection system, Matra Plast is using a testing procedure that can best be described as “aggressive to plastics”. Using a single-port focused light source, a beam from a Xenon Arc lamp, filtered to pass only the specified UV frequencies, is aimed at the test specimen.

The UV exposure rate is calibrated to expose the sample to pure, plastic-degrading UV light at a rate equal to the average annual UV exposure in Albuquerque, New Mexico, *every 6 days*.

In the second of a series of comparative tests, we chose control samples of generic long-life, transparent glazing products, 8mm UV protected PC and Acrylic twin-wall sheet, to help us understand the comparative results.

These three samples – 8mm Hi-Core® XLC and 8mm UV protected PC and Acrylic twin-wall were all exposed together, to the total amount of UV radiation that they would have received in New Mexico over the course of 12 years. This test will continue to “equivalent to 18-years”.

The photograph below shows the three products at “12-years results”.



The laboratory report indicates that for the Hi-Core® XLC there is virtually no difference between the “equivalent to 12-years” exposed sheet and the non-exposed sheet.

This result is confirmed and supported by a continuing testing program at Atlas-DSET weathering laboratories in Phoenix, Arizona.

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