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HEADS UP

SNELL MEMORIAL FOUNDATION®

The Quarterly Newsletter of the Snell Memorial Foundation

This is the thirty-eighth of the Foundation's quarterly newsletters to the helmet manufacturing industry. The thirty-seventh was sent out in December. Comments and items for inclusion in subsequent issues are invited.

Manufacturers' Meeting

The Foundation hosted a Manufacturer's Meeting Friday, February 13, in Indianapolis just before the recent PowerSports Expo. The meeting was well attended. Among the topics discussed were tentative parameters for a children's motorsports helmet standard, the FIA Advance Helmet Specification and projections for the Snell 2005 motorsports helmets standards.

Draft M2005 & SA/K2005 Standards

Third drafts of the 2005 Snell M and SA/K standards are in preparation. The only differences between these and the second drafts are the test procedures for shell penetration. The revisions for these are discussed later in this newsletter.

These third drafts are expected to be the last step in the drafting process before final versions are released in May of this year. All interested individuals and groups are invited to comment but, in the interests of time, please do so as soon as possible. The second drafts are available for download and review on our website as is the "timeline" which describes the implementation of the 2005 standards as well as lists differences with the Snell standards currently in use.

In this issue...

Children's Motorsports Headgear

The symposium concerning children's needs and motorsports headgear hosted jointly by the Children's Hospital of Philadelphia and the Snell Memorial Foundation took place last April. A report, "Review of Pediatric Head and Neck Injury: Implications for Helmet Standards", is available for review. Copies are available from this office or may be downloaded from the Foundation's web site, www.smf.org.

Certified Products Lists

The Foundation posts lists of Snell certified products on its web site, *www.smf.org*. However, these lists are frequently incomplete or, in some cases,

outdated. Manufacturers are asked to check these lists frequently and to point out any errors and omissions. Since many people check these lists, missing or misspelled entries may represent lost sales while entries for discontinued items will create frustration and disappointment. Once we certify a helmet, we want everyone to know. Please help us out.

Shell Penetration Test

The shell penetration test in the first Snell standards could more reasonably have been called a shell deflection test. A four pound, pointed impactor was dropped through three feet onto a section of helmet that was supported on an upright hollow cylinder with an inner diameter of one and three quarter inches. If the shell deflected more than 3/8 of an inch into the hollow, the helmet was rejected.

The current shell penetration test drops a heavier impactor, 3 kg, from considerably higher, 3 meters but requires only that the penetrator not break through to make direct contact with a headform placed inside the helmet. Excepting only the 1985 Snell motorcycle helmet standard, this test has been in place in Snell motorsports standards since 1970 and also appears in the DOT motorcycle helmet standard, FMVSS 218, as well as a host of other national and international standards.

The third drafts of the 2005 Snell M and SA/K standards, due out shortly, are expected to include some revisions which will not change the test materially but which will more precisely define how the test is to be applied. For the first time in Snell standards, the penetration test sites will be limited to points on or within a specified test line as drawn on the helmet shell. Also, these sites will now be required to be no closer than 6 cm to the center of any previous impact or penetration test.

The description of the test headform will also be modified. Realistically, all that is required of the headform is that it conform to the inner surface of the helmet beneath the site of the penetration test, that it support the helmet with no discernible deflection throughout the shock delivered by the falling impactor, and that it accommodate some telltale to identify instances of direct contact with the impactor point. The modified headform description will facilitate building simpler, more efficient test hardware that will enable testing over all the legitimate sites throughout all the size ranges of helmets expected to be submitted for Snell testing.

Current test gear limits the Snell penetration test sites to the crown area of most helmets. Although no surprises are expected, there is, at least, a chance that some helmets that performed well in crown area penetrations tests may fail when tested near the test lines at the sides of the helmet. However, manufacturers of DOT qualified motorcycle helmets must deal with similar test requirements as specified in FMVSS 218 and manufacturers of helmets to be used in automotive racing may soon have to deal with an even more stringent test as specified in the FIA Advanced Helmet Test Specification.

This FIA Advanced Helmet Test Specification requires, among other things, that helmets withstand a 4 kg penetrator dropped through 3 meters and allow no direct contact between the penetrator and the supporting headform.

Headform Selection Procedures

The first and possibly most important operation in Snell helmet test procedures is helmet marking. The test technician examines the helmet, selects the most appropriate headform, positions the helmet on the headform and then marks the test lines that will guide the impact testing that will follow.

There's not much drama or excitement, helmets don't start crashing into anvils until later. Most visitors to the lab wait patiently through the marking demonstration for the destruction that follows. However, visiting test technicians scrutinize the operation carefully. A mistake in the helmet marking will not usually allow a bad helmet to pass but it may cause good helmets to fail.

Most Snell testing demands that the technician draw on his experience and imagination to perform the most punishing test on a helmet that the standard will allow. But helmet marking presumes, instead, that a knowledgeable consumer will be wearing a properly fitted unit positioned and adjusted to provide the best protection of which that helmet is capable. The technician must select the proper headform and then position the helmet first to provide the necessary visual field and then the most complete impact protection possible. In short, when testing, the technician must try to destroy the helmet but when marking, the technician must select the headform and position the helmet for the most favorable test outcome possible.

Snell standards allow any of five different headforms ranging from the smallest, the ISO A headform with a 50 cm (19 ¾ inch) circumference to the largest, the ISO O headform with a circumference of 62 cm (24 ½ inch). However, unlike most hats, helmets are rigid structures so getting a good fit is quite a bit more complicated than matching circumferences. The helmet must match the shape of the wearer's head. If it pinches anywhere, it will not fit properly and no one could reasonably be expected to wear it. Unfortunately, headforms rarely complain. Technicians can reliably tell when a helmet fits loosely but degrees of pinching that might draw howls of protest from the most tolerant individual will often seem a good, snug fit on one of our headforms.

Unfortunately, pinching also causes helmets to sit unnaturally high on the headform which, in turn, will cause the test lines to be marked unfairly low on the helmet surface, sometimes as much as twenty millimeters low. Since Snell standards already require helmet manufacturers to build in all the protection a wearer could reasonably carry on his head, the extra twenty millimeters of coverage a poorly chosen headform might tack on is almost sure to cause a failure.

Since the difference between a good, snug fit and unacceptable pinching is almost imperceptible, the Snell lab has developed an objective procedure for headform selection. Whenever there is any cause for uncertainty, the technician will place the helmet on the smaller of two headforms, square it up and position it to obtain a reasonable visual field. He will then mark the position of the test line at the front and rear centerlines of the helmet.

The technician will then place the helmet on the larger headform, square it up and adjust it so that the mark at the front centerline is at the level of the testline for this particular headform. He will then mark the position of the testline for this headform at the rear centerline and measure the distance to the rear centerline mark made previously. If this distance is greater than a certain value, the indication is that the helmet is not appropriate for the larger headform and should be marked and tested on the smaller. Otherwise, the larger of the two headforms is the most appropriate.

Smaller Headform	Larger Headform	Expected shift	if gap less than this value, use the larger headform
A	E	14.8 mm	17 mm
E	J	13.6 mm	16 mm
J	M	10.6 mm	13 mm
M	O	5.5 mm	8 mm

The figures in the table are based on the geometries of the five ISO headforms currently in use. Since larger sized helmets are expected to provide more coverage, a certain amount of distance between the two rear centerline marks is expected. If the measured distance is appreciably less than the value in the third column of the table, it is likely that a mistake has been made and the operation should be repeated. However, if the distance equals or exceeds the amount in the fourth column, the indication is that the helmet is too small for the larger headform and that there is a gap between the crown of the headform and the helmet interior.

Single Impact Testing

FIA has promulgated a set of requirements for headgear for use in their Formula 1 events. The FIA 8860-2004 Advanced Helmet Test Specification which will go into effect this July, is currently supplementary to Snell SA2000. Effectively, a helmet must already be Snell SA2000 capable in order to be considered a candidate for 8860-2004. However, the question remains, how much more demanding are the FIA tests over and above Snell SA2000.

There are a number of tests in FIA 8860 that might give an SA2000 helmet trouble: the shell penetration test as discussed earlier in this issue, the shell hardness test which seems set to select for carbon fiber shells, the dynamic crush test and, of course, the tether loading tests for the HANS system which is now a requirement for Formula 1. However, one of the most critical and certainly the most interesting is the FIA 8860 impact testing.

FIA calls out impact test procedures almost precisely identical to SA2000 except, instead of two impacts at a particular site, FIA demands a single but much more severe impact. The Snell double impacts are thought to have come about because there was limited ceiling space in the first Snell laboratories. The testers could not get all the impact severity they wanted from their test gear in one hit so they went for seconds. The dual impact regimen continued because it seemed serviceable and because most laboratory ceilings were not much higher than the minimum necessary for the first Snell impact. However, no one seems to know just how much single impact capability is implied in meeting Snell dual impact test requirements.

The Foundation proposes to find out. We hope to test a range of current SA2000 and M2000 headgear in order to determine the most severe single impact they might be able to withstand at particular test sites. The immediate question is whether current Snell configurations can be made to meet FIA single impact requirements. However, the most important question is whether single impact testing would lead to better standards and more protective helmets.

The dual impact regimen is time tested and the helmets that have evolved along with Snell standards are a proven benefit to competition racing and street motorcycling as well. Single impact must undergo a lot of careful scrutiny both in its effectiveness assessing current headgear as well as its implications for future development.

With this in mind, the Foundation requests that interested manufacturers provide samples for an extensive investigation. We're looking for sets of four or more identical samples to be tested on the ISO J headform.

Interested manufacturers should please contact this office to discuss providing samples. However, we need to keep these samples well separate from our ongoing certification and RST testing. So please call first so that we can anticipate your samples and deal with them correctly. We will provide detailed test reports at no charge to each manufacturer. We also expect to produce a report discussing the overall testing and findings. This report will likely include tables and graphs based on test results but which will be presented in such a way as to conceal the identities of the specific models tested and each manufacturers proprietary information.

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