

## Introduction

Some helmets may include hardware for the attachment of tethers intended to limit the forward motion of the head. In frontal impacts, such tethers may bear much of the inertial load of the head and helmet potentially reducing the stresses to the wearer's cervical spine and the base of the skull. This addendum describes a particular hardware configuration intended for this purpose and sets requirements for its load bearing capabilities. Headgear meeting all the requirements set elsewhere for SA2010 and which also meet the requirements set forth in this addendum will be eligible for SAH2010 certification labels indicating FHR (frontal head restraint) capability.

Frontal head restraint requires additional equipment which may not be provided with the headgear. To get the maximum benefit, take care to select an appropriate frontal head restraint system and see that it is properly configured. Please contact the Foundation for a current list of those frontal head restraint systems deemed appropriate for use with helmets meeting this addendum.

## Requirements for Certification

If samples of the same model and size range are simultaneously being submitted for SA2010 certification and all are configured with tether attachment hardware, then a single additional sample configured for the largest appropriate head form is necessary. Otherwise, two complete samples equipped with tether attachment hardware and configured for the largest appropriate head form are required for FHR testing.

## Hardware Requirements

The necessary hardware shall be fixed in the shell and shall present M6 female threads accessible through holes in the shell for the attachment of helmet tether assemblies. Figures 1

and 2 show the two options for the shell fixed hardware. The limitations described below and in the figures are to assure that the hardware will function correctly with any of the intended FHR systems. The limitations assure that there will be at least four turns of thread securing the tether attachment within the shell fixed hardware. The limitations also assure a minimum footing area between the tether attachment and the exterior surface of the helmet shell. The limitations further assure a minimum intrusion of the hardware into the helmet interior. The limitations also require that the inner surface of the helmet's shock liner be no closer than 20 mm to the innermost surface of the shell fixed hardware.

#### Hardware Location

The helmet shall be placed upon the largest appropriate head form used in standard SA2010 certification testing, adjusted to the appropriate HPI for that head form and held in place with an applied force of 50 N. The position of the  $S_4$  plane shall be marked. The FHR hardware shall be fixed in the shell symmetrically on the right and left sides of the helmet. The shell holes for the attachment of the tether hardware shall be centered at points within 10 mm of the  $S_4$  plane and at least 70 mm behind the transverse (coronal) plane along the  $S_4$  plane. These centers shall be separated laterally from each other by at least 180 mm and by no more than 270 mm. The axes of the M6 threads shall be reasonably perpendicular to the shell.

#### Testing

At least one sample shall be inspected to determine compliance with the hardware requirements and locations. This sample shall then be tested in three different loading configurations. All testing shall be performed with the helmet at laboratory ambient temperature and humidity.

The test equipment shall consist of a full head form corresponding to the geometry of the largest appropriate of the six specified for SA2010 testing. This head form shall be fixed in the laboratory relative to a pair of mechanical actuators. Each of these actuators shall draw the end

of a length of flexible wire rope,  $\frac{1}{8}$ <sup>th</sup> inch minimum diameter, 7x7 stainless steel or comparable, along a line parallel  $\pm 5^\circ$  to the head form midsagittal plane and in a direction to the rear of the head form and downward at  $40^\circ \pm 5^\circ$  from the head form basic plane. When in operation, each actuator shall draw the rope at a rate of 100 mm/min  $\pm$  50 mm/min so long as the tension in the rope is less than that specified for the particular test and, should the particular test require both actuators, so long as the tension exerted does not exceed that of the other actuator by more than 0.2 kN.

#### Test 1

The first test shall be conducted using the rod end (rose joint) tether attachments as shown in figure 5. The attachments shall be threaded into the shell fixed hardware finger tight. The seating of the rod end attachment against the shell shall determine whether the orientation of the M6 thread axis is sufficiently perpendicular to the shell in the immediate area. The hardware shall not bind against the shell on one side so as to leave a noticeable gap on the other.

The helmet shall be placed upon the head form, positioned according to its specified HPI and then secured by its chin strap. The ends of the lengths of wire rope opposite the actuators shall be attached to the loading eyes of the rod end bearing and the equipment adjusted and locked so that there is no slack in the wire rope and the lengths are reasonably parallel and oriented, initially, along the vector specified above. The actuators will be started and the loading will continue until the helmet fails or the combined loading has equaled or exceeded the specified value of 7 kN for a cumulated period of 5 seconds; the load shall then be removed.

#### Test 2

The rod end tether attachments shall be removed. The helmet shall be repositioned on the head form and the chin strap adjusted as necessary. Then a single lifting eye as shown in figure 6 shall be threaded into that element of the shell fixed hardware selected by the test

technician. The apposite wire rope shall be attached to the lifting eye and the equipment adjusted and locked so that there is no slack in the wire rope and the initial orientation of the loading is the same as that defined above. The actuator will be started and the loading will continue until the helmet fails or the loading has equaled or exceeded the specified value of 3.5 kN for a cumulated period of 5 seconds; the load shall then be removed.

### Test 3

The lifting eye shall be removed. The helmet shall be repositioned on the head form and the chin strap adjusted as necessary. The rod end tether attachments shall then be threaded back into the shell fixed hardware. The wire ropes reattached and the equipment adjusted and locked so that there is no slack in the wire rope and the lengths are reasonably parallel and, initially, oriented along the vectors specified earlier. The actuators will be started and the loading will continue until the helmet fails or the combined loading has equaled or exceeded the specified value of 14 kN for a cumulated period of 5 seconds; the load shall then be removed.

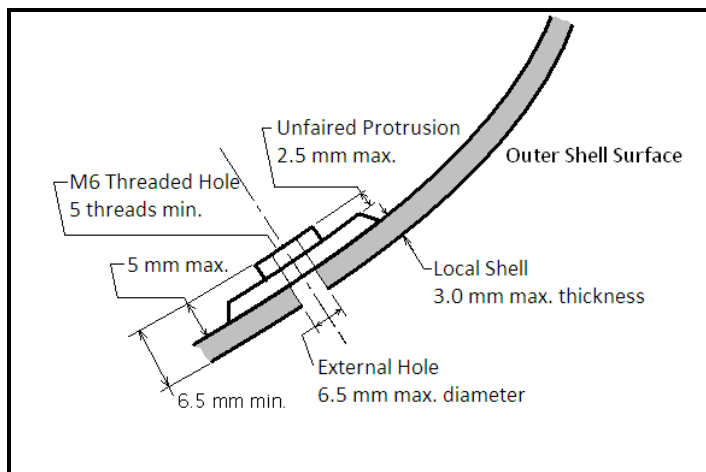
### Evaluation of Results

In Test 1, if the rod end hardware is found to bind against the helmet shell on one side and leave a noticeable gap on the other, the helmet shall be rejected. At the completion of Tests 1 and 2, the helmet must retain its structural integrity. Otherwise, the helmet shall be rejected. For all three tests, the helmet bear a load equal to or exceeding the specified load for the specified cumulated period. Otherwise the helmet shall be rejected. Finally, if at the beginning of Tests 2 or 3, if the technician cannot easily remove the tether hardware from the previous test and thread the hardware for the next test into the shell fixed hardware, the helmet shall be rejected.

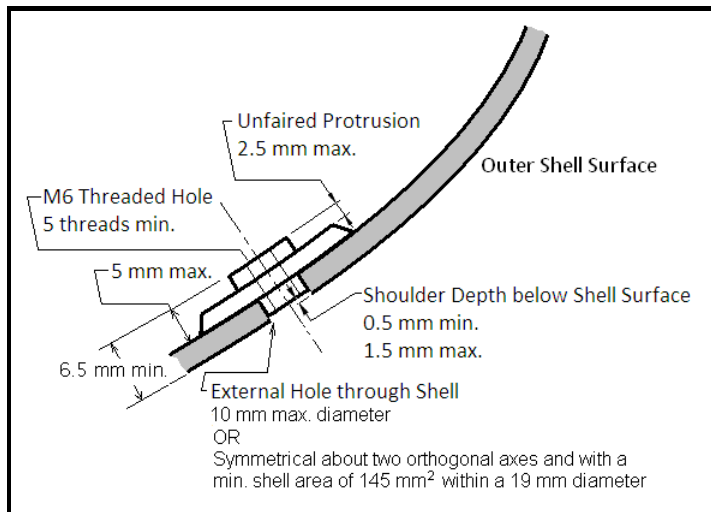
| Test | Set Up                                     | Peak Load Required | Causes for Failure  |
|------|--|--------------------|---|
| #1   | Rod End Bearings<br>Two Tethers            | 7.0 kN             | Attachment misalignment<br>Structure won't manage load<br>Loss of Integrity |
| #2   | Lifting Eye Either side<br>One tether only | 3.5 kN             | Misalignment etc.<br>Structure won't manage load<br>Loss of Integrity       |
| #3   | Rod End Bearings<br>Two Tethers            | 14.0 kN            | Misalignment etc.<br>Structure won't manage load                            |

### Standards Enforcement

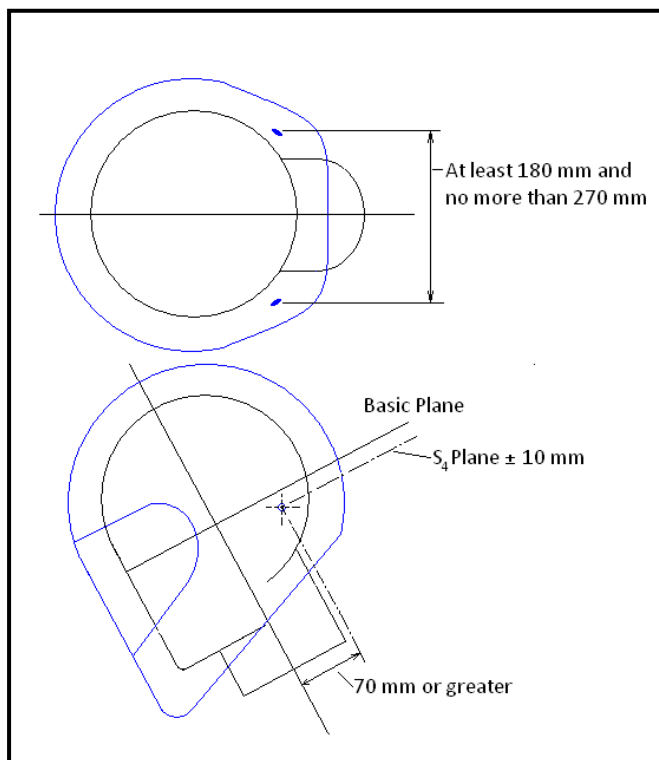
Units acquired for enforcement testing may be equipped with factory installed tether attachment hardware. At the discretion of the test technician, instead of resorting to the rod end and lifting eye hardware, the test loads may be applied directly through the factory installed hardware through reasonably appropriate hardware links.



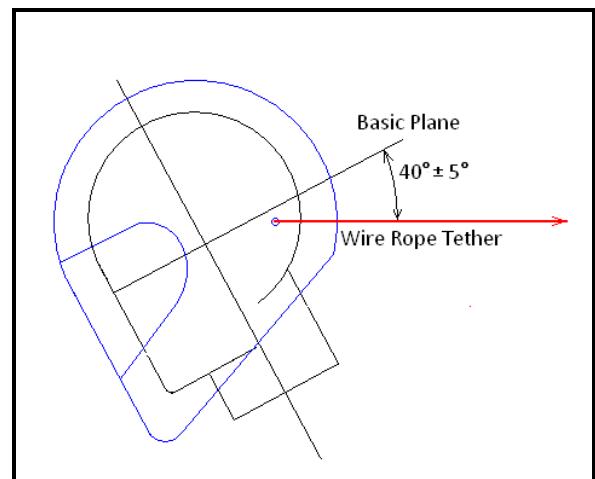
**Figure 1 Option #1**



**Figure 2 Option #2**



**Figure 3 Location of FHR Hardware**



**Figure 4 Initial Orientation of Tether Loadings**

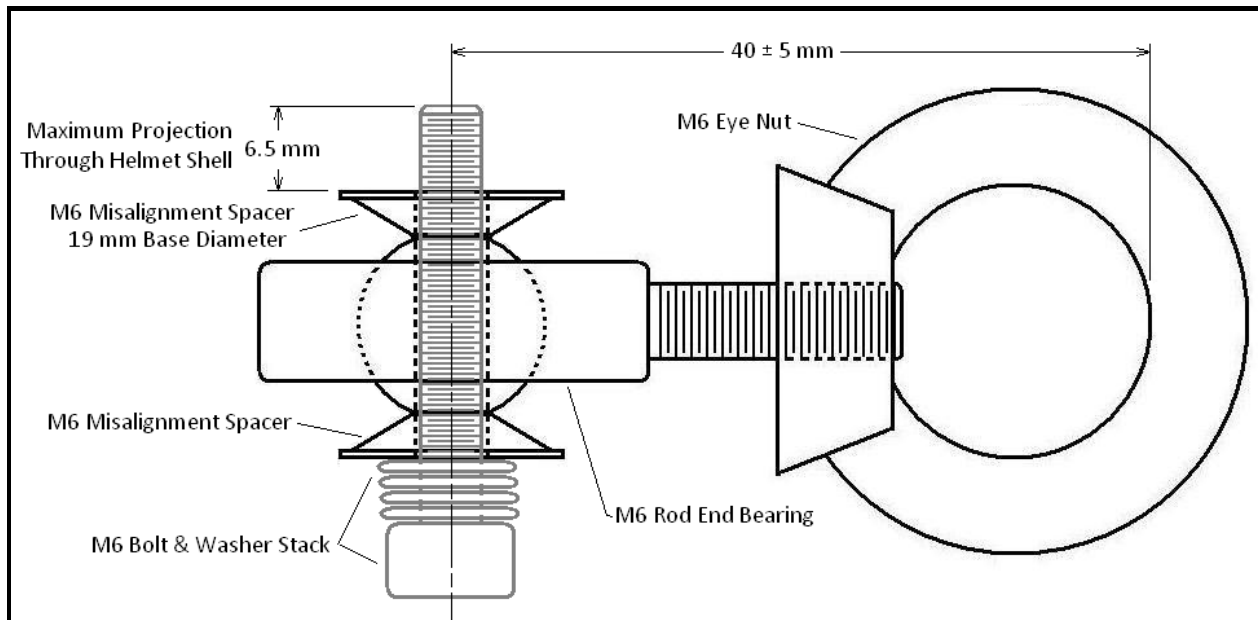


Figure 5 Rod End Attachment

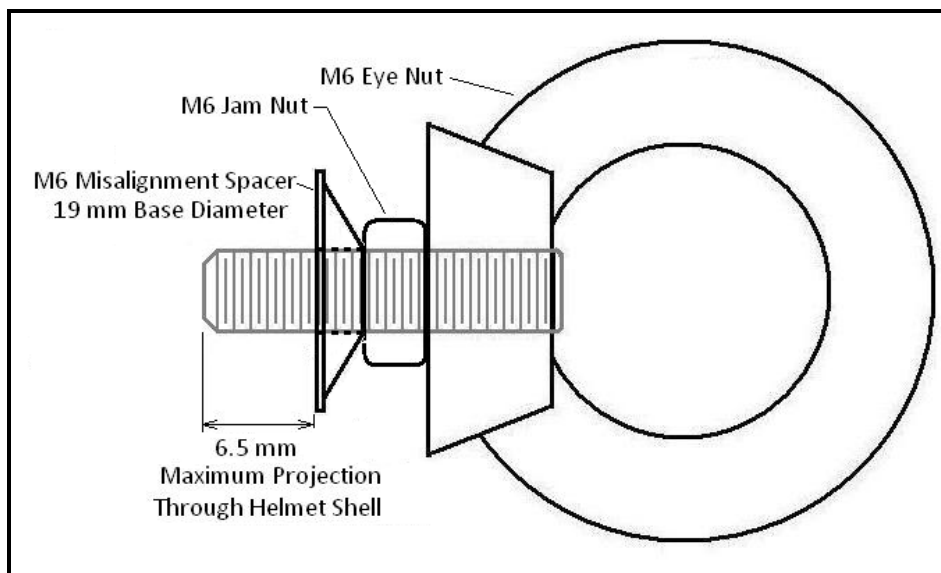


Figure 6 Lifting Eye Attachment