FIM RACING HOMOLOGATION PROGRAMME

New FRHPhe-02 Helmet phase 2

Mies, November 2022

FÉDÉRATION INTERNATIONALE DE MOTOCYCLISME

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Helmets - Eligible standards

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Standards of helmet eligible to apply for FRHPhe-02 Homologation procedure:

USA: DOT FMVSS 218 with SNELL M 2015 or M 2020R or M 2020D

JAPAN: JIS T 8133 2015 Type 2 Full face

EUROPE :

- ✓ ECE 22-05 type P (not valid for FRHPhe02, and after 31 December 2023 for sale)
- ✓ ECE 22-06 type P

FIM:

- ✓ FRHPhe-01 for Road Racing only until December 2025, for competition use
- ✓ FRHPhe-02 for **all disciplines** [1] as of January 2026, for competition use

[1] *(except for Trial, pedelec, SSV and Land Speed World Records (Streamliners only) riders)*

Definition - Glossary

FRHPhe: FIM Racing Homologation Programme for Helmets

PLA: Peak of the resultant Linear Acceleration

PRA: Peak of the resultant Rotational Acceleration

BrIC: Brain Injury Criterion

SFC: Skull Fracture Criterion

HIC: Head Injury Criterion

FRHPhe - Preamble

FIM RACING HOMOLOGATION PROGRAMME

In order to take account of a more complete and demanding evaluation of performance, and give specific and exclusive recognition to helmets that meet more demanding criteria, the FIM International Technical Commission have launched, the FIM Racing Homologation Programme for helmets (**FRHPhe-01 (Road Racing only**) & **FRHPhe-02 (all disciplines[1], Off-road included**), which features the latest state of art methods of testing.

Under these programmes, the FIM grant helmets a homologation certificate and labels, which will be a mandatory prerequisite to be entitled to access in several competitions.

To obtain such homologation, the helmet have to meet the high performance and quality standard set by the FIM, in addition to being approved according to selected international standards.

The helmet properties are evaluated through a test protocol which aims to trigger the development of helmets offering an optimal protection for riders. An optimal protection is understood as providing a minimised risk of skull fracture and of the multiple forms of brain damage, as well as a measured and controlled mechanical performance of the protective padding and the shell.

[1] Except for Trial, pedelec, SSV and Land Speed World Records[*] riders

[*] (Streamliners only)

FRHPhe-02 - Introduction

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The FIM test approach first assesses the helmet's response to very high and medium-low severity linear impacts, randomly in 9 to 13 out of 22 pre-established locations distributed all over the helmet surface. This aims at evenly assessing the level of protection against skull fracture and at featuring the mechanical properties of the protective padding (or liner).

Innovatively, the FIM test procedure is thereby a pioneer in the assessment of the helmet's response to medium severity oblique impacts, aiming at evaluating the level of protection against brain injuries generated by critical rotational accelerations. The oblique test constitutes the most novel and modern aspect of the methods of testing and reflects a very common scenario occurring in real world accidents, although never addressed in international standards so far.

Cheek pads must incorporate a quick release system, identified by a red strap.

In addition, a penetration test is included in the protocol and used to check the shell resistance to impacts against sharp objects.

With the first FIM standard that will be mandatory for Off-road helmets as from 01/01/2026, this standard will dramatically increase the level of safety for our riders.

Timeline for the helmets standards

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<table>
<tr><th colspan="6">TIMELINE FOR HELMET RIDERS</th></tr>
<tr><th></th><th>2022</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th></tr>
<tr><td rowspan="2">CCR</td><td colspan="3">FRHPhe-01 test possibilities</td><td></td><td rowspan="6">FRHPhe-02 compulsory</td></tr>
<tr><td colspan="4">FRHPhe-01 compulsory</td></tr>
<tr><td>OFF-ROAD</td><td colspan="4">UN ECE 22-05 & 22-06 (Only “P” type)
JIS T 8133:2015 (Type 2 Full face)
SNELL M 2015 or SNELL M 2020D or SNELL M 2020R</td></tr>
<tr><td>RALLYGP</td><td colspan="2">UN ECE 22-05 & 22-06 (Only “P” type)
JIS T 8133:2015 (Type 2 Full face)
SNELL M 2015 or M 2020D or M 2020R</td><td colspan="2">UN ECE 22-06 (Only “P” type)
JIS T 8133:2015 (Type 2 Full face)
SNELL M 2015 SNELL M 2020D or M 2020R</td></tr>
<tr><td>RALLY2, RALLY3, QUADS</td><td colspan="4">UN ECE 22-05 & 22-06 (Only “P” type)
JIS T 8133:2015 (Type 2 Full face)
SNELL M 2015 or SNELL M 2020D or SNELL M 2020R</td></tr>
<tr><td>ALL[1]</td><td></td><td>Draft
FRHPhe-02</td><td>FRHPhe-02 test start
(January 2023)</td><td>FRHPhe-02
Strongly recommended</td></tr>
</table>

[1] *(except for Trial, pedelec, SSV and Land Speed World Records (Streamliners only) riders)*

FRHPhe label for FIM homologated helmet

FIM label must be sewn only on the chin strap by the manufacturer during the production process.

FIM RACING HOMOLOGATED HELMET

CRASHED HELMET
Text

RIDER CLASS
Text

RIDER NAME
Text

SIZE
MS

SIZE (CM)
57-58

HELMET PHOTOS

TRADEMARK
AGV

MODEL COMMERCIAL NAME
PISTA GP R

HOMOLOGATED COMBINATION OF ACCESSORIES
Rear spoiler
Chin inlets
Front inlets
Rear outlets
Optional: Rain Screen

Restricted data

TRADEMARK
AGV

MODEL COMMERCIAL NAME
PISTA GP R Racing

HOMOLOGATED COMBINATION OF ACCESSORIES
Rear spoiler
Chin inlets
Front inlets
Rear outlets
Optional: Rain Screen

TRADENAME WEBPAGE
www.agv.com

REFERENCE INTERNATIONAL HOMOLOGATION
ECE

INTERNATIONAL HOMOLOGATION N.
22R-052797/P Extension 03, 04, 06, 07

FIM HOMOLOGATION MANUAL OF REFERENCE
FRHPhe-01 - 2018

VALID FOR FIM CIRCUIT RACING COMPETITIONS
FIM Grand Prix World Championship
FIM SBK World Championship
FIM Supersport World Championship
FIM Supersport 300 World Championship
FIM Sidecar World Championship
FIM MotoGP Rookies Cup
FIM JuniorGP World Championship
FIM MotoE World Cup
FIM Land Speed World Records
FIM Endurance World Championship
FIM Endurance World Cup

At the technical control, the technical steward will scan the QR code and has access on the list of pictures + homologated accessories of the helmet and in which FIM Championships/Cups the helmet can compete then the steward can fulfill and save all rider information in the software.

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FIM increase the level of safety for riders

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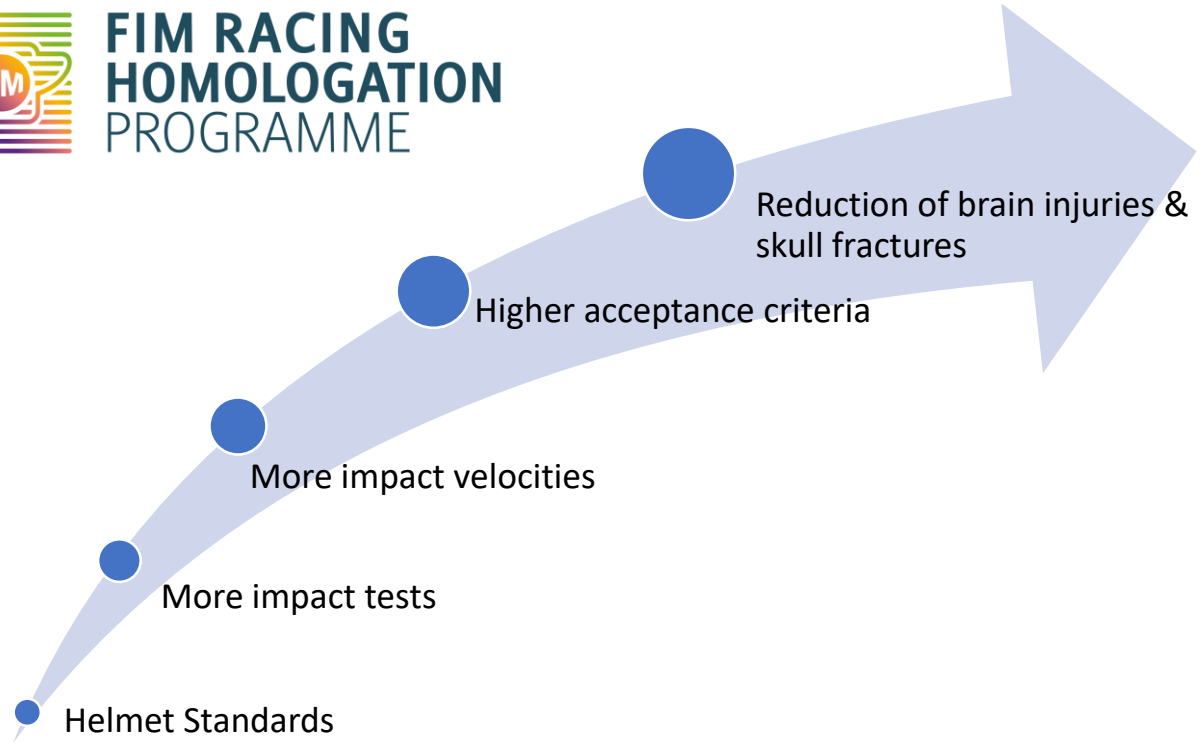
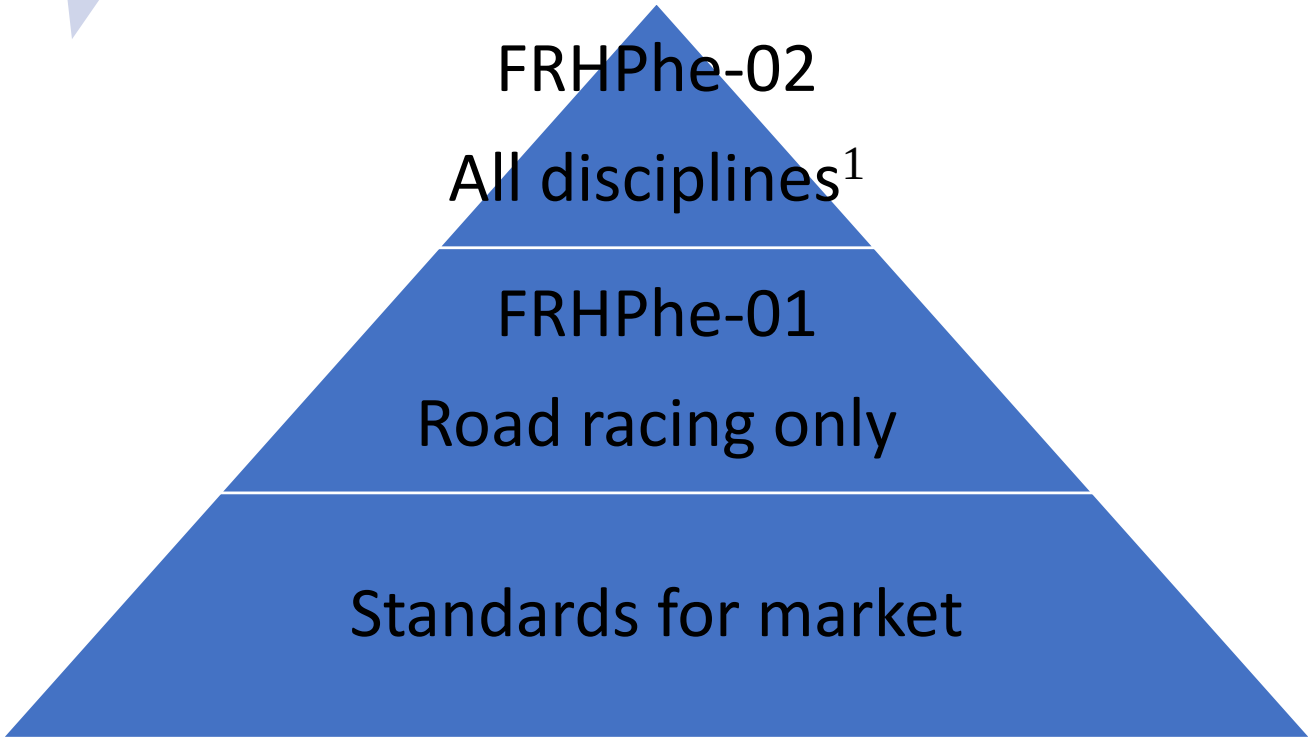


FIM RACING HOMOLOGATED HELMET



[1] Except for Trial, pedelec, SSV and Land Speed World Records* riders
* (Streamliners only)

Comparison FRHPhe-01 & FRHPhe-02 / UN ECE 22- 05 & 22-06

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STANDARDS	FIM HOMOLOGATED HELMET FRHPhe-02		FIM HOMOLOGATED HELMET FRHPhe-01		UN ECE 22-06		UN ECE 22-05	
Specific test	**Impact points**	**Impact severity**	**Impact points**	**Impact severity**	**Impact points** * At the discretion of laboratory	**Impact severity**	**Impact points**	**Impact severity**
Prerequisite FRHPhe - Helmet shall be certified compliant with at least one of the following standards:	**UN ECE 22-06 (Only "P" type) JIS T 8133:2015 (Type 2 Full face) SNELL M 2015 or M 2020D or M 2020R**		**UN ECE 22-05 or 22-06 (Only "P" type) JIS T 8133:2015 (Type 2 Full face) SNELL M 2015 or M 2020D or M 2020R**					
Lower face cover test	S impact point	6 m/s	S impact point N°1	6 m/s	S impact point	6 m/s	S impact point	5,5 m/s
			S impact point N°2	5 m/s				
Impact tests against flat anvil	4 among 17	8.2 m/s	B, X, P, R + 3 among 12	8.2 m/s	B, X, P, R + *at least 3 among 12	7,5 m/s	B, X, P, R	7,5 m/s
			B, X, P, R	5 m/s	B, X, P, R	8.2 m/s		
					*B, X, P, R	6 m/s		
Impact tests against kerbstone anvil	-	-	-	-	B, X, P, R + *at least 3 among 12	7,5 m/s	B, X, P, R	7,5 m/s
	-	-	-	-	*B, X, P, R	6 m/s		
Impact tests against hemispherical anvil	4 among 17	7.5 m/s	-	-	-	-	-	-
Impact tests against oblique anvil	Rear (180°), Front (0°) and Lateral-left (270°)	8 m/s	Front Lateral-right (45°), Rear (180°), Lateral-left (270°), Front (0°) and Rear Lateral-right(135°)	8 m/s	Front Lateral-right (45°), Rear (180°), Lateral-left (270°), Front (0°) and Rear Lateral-right(135°)	8 m/s	-	-
	Lateral-right (90°)	5 m/s	-	-	-	-	-	-
Quick removal cheek pads test	✓	✓	-	-	-	-	-	-
Penetration test	At least 2 points	3 kg stricker 2 m height	At least 2 points	3 kg stricker 2 m height	-	-	-	-

FRHPhe-02 Impact velocity

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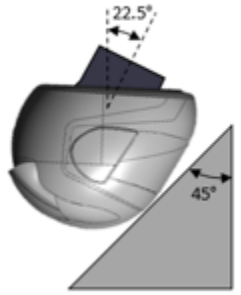
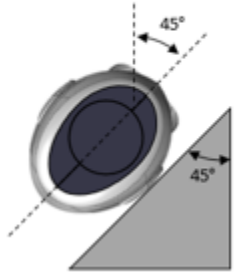
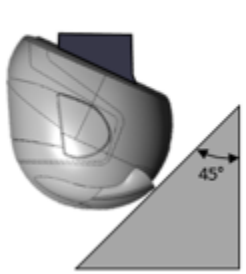
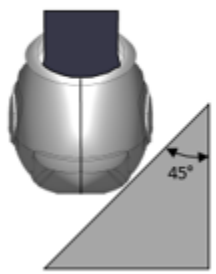
Oblique Anvil - Impact velocity:

- 8.00 (+0.15, -0.00) m/s for Front (0°), Rear (180°) and Lateral-Left (270°)
- 5.00 (+0.15, -0.00) for Lateral-Right (90°)

Front (0°)	Lateral right (90°)	Rear (180°)	Lateral left (270°)
			

Different impact sequence for full-face helmets nas off-road helmets:

- Full-face helmets: Rear (180°), Front (0°), Lateral-Left (270°), Lateral-Right (90°)
- Off-road helmets: Front (0°), Rear (180°), Lateral-Left (270°), Lateral-Right (90°)

Hemispherical Anvil (radius: 48 mm):

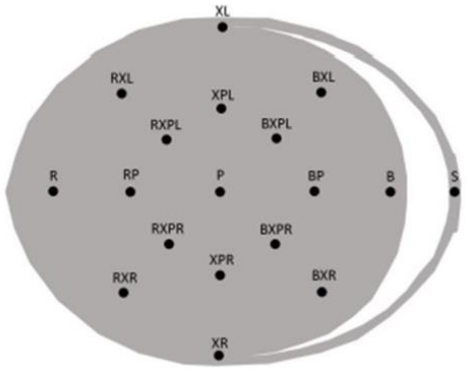
Impact velocity: 7.5 m/s

Impact points: 4 impact points selected among the 17 defined points (excluding S impact point)

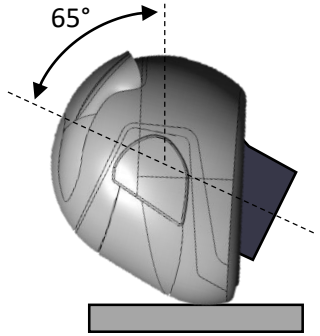
Flat Anvil

Impact velocity: 8.2m/s

Impact points: **4 impact points** selected among the 17 defined points (excluding S impact point).



In FRHPhe-02 **the S impact point** is tested at 6 m/s on Sample #1 before the impacts against flat anvil at 8.2 m/s.



Acceptance criteria for FRHPhe-02

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A Helmet Model and Size is granted homologation (with the declared accessories if any) if it complies with all the criteria in accordance with the acceptance criteria summarized below.

Sample	Specific test	Impact point	Impact severity	Acceptance criteria FRHPhe-02			
				PLA (g)	SFC(g)	BrIC	PRA (rad/s^2)
#1	Lower face cover test	S impact point	6 m/s	≤ 275	-	-	-
	Impact tests against flat anvil	4 among 17	8.2 m/s	≤ 275	≤ 212	≤ 0.78	≤ 10000
#2	Impact tests against hemispherical anvil	4 among 17	7.5 m/s	≤ 275	≤ 212	≤ 0.78	≤ 10000
#3	Impact tests against oblique anvil	Rear, Front and Lateral-left	8 m/s	≤ 170	≤ 140	≤ 0.78	≤ 10000
		Lateral-right	5 m/s	≤ 170	≤ 140	≤ 0.78	≤ 10000
	Quick removal cheek pads test	-	-	Cheek pads shall be easily removed			
#4	Penetration test	At least 2 points	3 kg striker 2 m height	No contact between striker tip and the spherical support surface			

Table 4: Acceptance criteria for FRHPhe-02

Helmet's shield/visor of full-face helmets shall remain closed during the lower face cover test.

Helmet's shield/visor of full-face helmets shall remain closed during the first oblique impact.

The helmet shall not exhibit any breakage or deformation dangerous to the rider. For example, shield/visor and shell significant fractures or any part of the helmet detached that can injure the rider. The inside of the helmet shall not exhibit any sharp edges that represent a risk of laceration or puncture to the rider. The retention system fixings shall not be released.

Notwithstanding the above, to be granted the homologation, the helmet shall not exhibit (after any of all the prescribed tests) any breakage or deformation that is deemed dangerous by the FIM.

PLA & PRA

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PLA: Peak Linear Acceleration is the maximum resultant linear acceleration value recorded during a crash test at the centre of gravity of the headform. It is expressed in [g] (standard gravity acceleration).

PRA: Peak Rotational Acceleration is the maximum resultant rotational acceleration value recorded during a crash test at the centre of gravity of the headform. It is expressed in [rad/s^2].

BrIC

The Brain Injury Criterion (BrIC) is a measure used to determine the risk of inducing traumatic brain injury arising from a sudden head rotation and is calculated so:

$$BrIC = \sqrt{\left(\frac{\omega_x}{\omega_{xC}}\right)^2 + \left(\frac{\omega_y}{\omega_{yC}}\right)^2 + \left(\frac{\omega_z}{\omega_{zC}}\right)^2}$$

Where:

ω_x, ω_y and ω_z are maximum angular rates on X-, Y-, and Z-axis respectively

ω_{xC}, ω_{yC} and ω_{zC} are the critical angular velocities in their respective directions:

- ω_{xC} = 66.25 [rad/s]
- ω_{yC} = 56.45 [rad/s]

ω_{zC} = 42.87 [rad/s]

SFC

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Skull Fracture Criterion is a measure used to determine the risk of skull fracture. SFC is defined as the averaged linear acceleration over the HIC time interval:

$$SFC = \frac{\Delta V_{HIC}}{\Delta T_{HIC}}$$

Where ΔT_{HIC} is the time interval and ΔV_{HIC} is the change in velocity over the time interval.

HIC

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The head injury criterion (HIC) is a measure of the likelihood of head injury arising from an impact for linear accelerations. The HIC is derived from the measurements of an accelerometer mounted at the centre of mass of a crash test dummy's head placed inside the helmet to be tested.

It is defined as:

$$HIC = \max_{t_1,t_2} \left\{ (t_2 - t_1) * \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a(t)dt \right]^{2.5} \right\}$$

where t1 and t2 are the initial and final times (in seconds) chosen to maximise HIC, and acceleration a is measured in *g*'s (standard gravity acceleration). The time duration, t2 – t1, is limited to a maximum value of 36 [ms], usually 15 [ms].

Why is HIC replaced by SFC, BrIC and PRA in FRHPhe-02?

FRHPhe-01 impact test against flat anvil does not limit the rotational motion of the headform during the impact and PLA is used as skull fracture criteria (Rigby et al., 2011) while HIC is used as a generic head injury criterion (Versace, 1971).

FRHPhe-02 impact test against flat anvil (and also against hemispherical anvil) limits the rotational motion of the headform during the impact.

The FRHPhe-02 approach for the acceptance criteria is based on head injury type, which leads to the substitution of the HIC which is a non-specific head injury criterion by the SFC, BrIC and PRA in order to use PLA and SFC as skull fracture criteria (Chan et al., 2007; Rigby et al., 2011), BrIC as diffuse axonal injury criterion (Takhounts et al., 2013) and PRA as acute subdural hematoma criterion (Depreitere et al., 2006).

Why is HIC not used as skull fracture criterion while PLA and SFC are?

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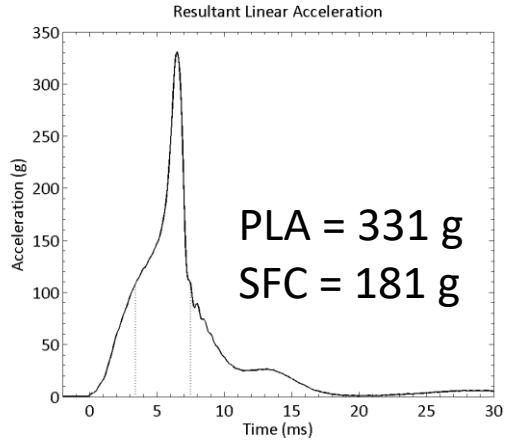
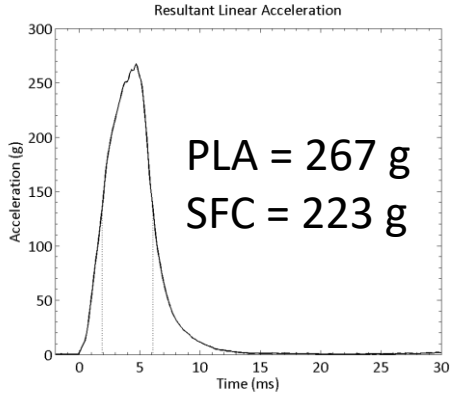
One of the main functions of the helmet shell is to distribute the impact load over a greater area of the underlying liner and therefore, areas of local high pressure only occurs when the protective padding has been bottomed out.

Due to the rigid design of head surrogates used in helmet testing standards, when the protective padding bottoms out a high acceleration peak of verv short duration is observed.





Therefore, a combination of PLA and SFC assessment criteria may be appropriate for skull fracture prevention in helmet testing standards because PLA will restrict high magnitude acceleration curves of short duration while SFC will restrict long duration acceleration curves.

FIM RACING HOMOLOGATED HELMET

FRHPhe-01

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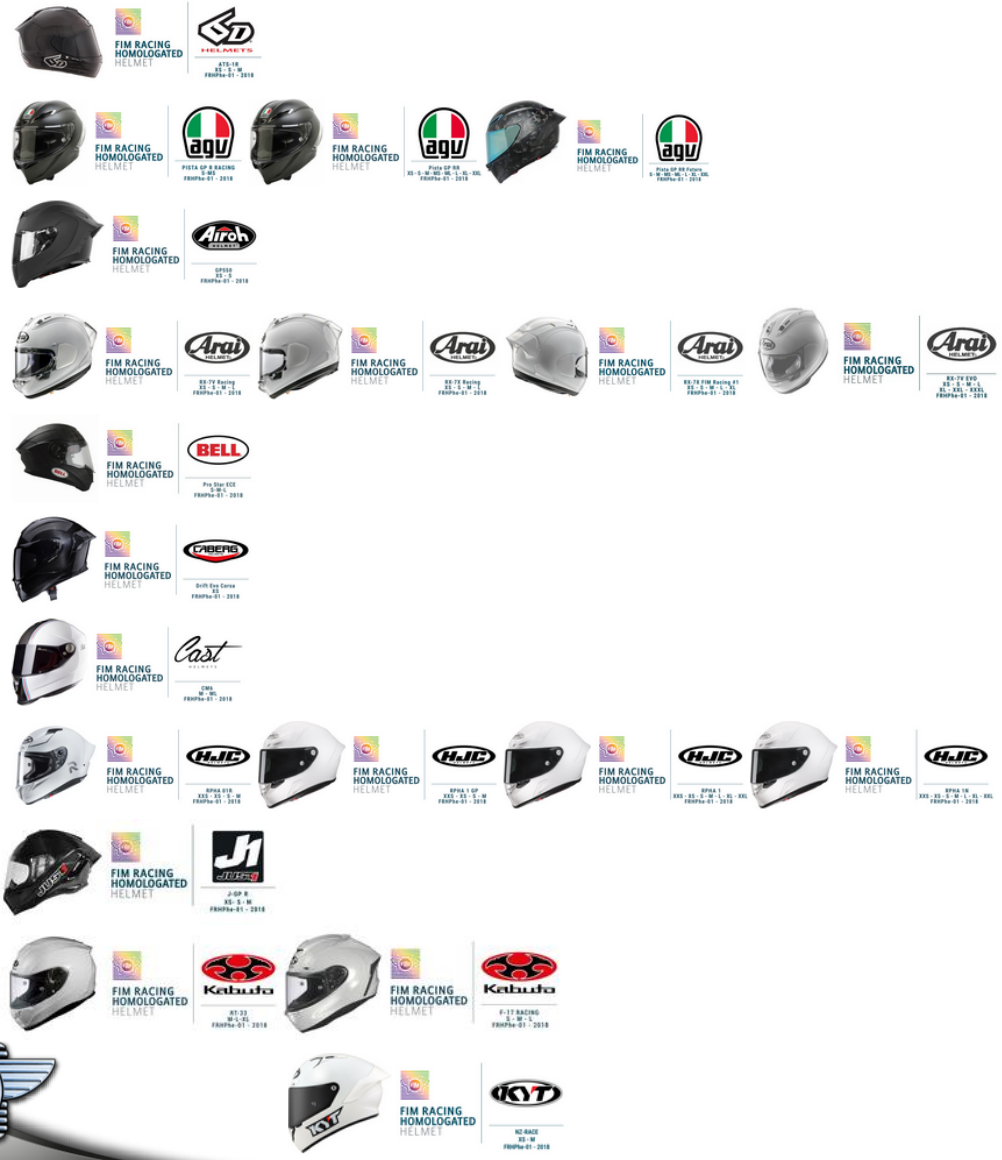

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THANK YOU