

### DECEMBER 14, 2019

**ROUND 4** FIA WORLD **ENDURANCE CHAMPIONSHIP** 



### 2012

Tréluyer/Fässler/Lotterer (Audi R18 e-tron quattro/Michelin)

### 2013

Davidson/Buemi/Sarrazin (Toyota TS030 Hybrid/Michelin)

### 2014

Wurz/Sarrazin/Conway (Toyota TS040 Hybrid/Michelin)



### 2015

**Dumas/Jani/Lieb** (Porsche 919 Hybrid/Michelin)

### **2016**

Di Grassi/Duval/Jarvis (Audi R18/Michelin)

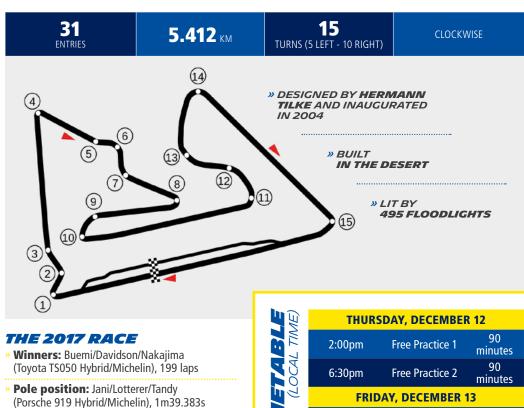
### 2017

Buemi/Davidson/Nakajima (Toyota TS050 Hybrid/Michelin)

### LAP RECORD:

Lucas di Grassi (Audi R18/Michelin) 1m38.828s (2016)

### THE CIRCUIT BAHRAIN INTERNATIONAL CIRCUIT (SAKHIR)



### THE 2017 RACE

- Winners: Buemi/Davidson/Nakajima (Toyota TS050 Hybrid/Michelin), 199 laps
- Pole position: Jani/Lotterer/Tandy (Porsche 919 Hybrid/Michelin), 1m39.383s
- Fastest race lap: André Lotterer (Porsche 919 Hybrid/Michelin), 1m42.862s
- Top speed: Roman Rusinov/Mathieu Vaxivière/ Thomas Laurent (Oreca07-Gibson), 289kph
- Michelin's 50th FIA WEC victory
- The Porsche 919 Hybrid/Michelin's final FIA **WEC** appearance
- Ferrari/Michelin one-two in LMGTE Pro



### **THURSDAY, DECEMBER 12** 2:00pm Free Practice 1

minutes 90 6:30pm Free Practice 2 minutes

90

### **FRIDAY, DECEMBER 13**

60 11:15am Free Practice 3 minutes LM GTE 20 4:40pm Qualifying minutes **LMP** 20 5:10pm Qualifying minutes

**SATURDAY, DECEMBER 14** 

Start. 3:00pm **8 Hours of Bahrain** 

Source : fiawec.com - Informations susceptibles de changer

### THE 2019 8 HOURS OF BAHRAIN

- » The FIA WEC is back in Bahrain for first time since 2017
- » The 2019/2020 FIA WEC's midpoint
- » The majority of the race takes place at night
- » The race is held during Bahrain's National Day festivities (December 16)







### **PIERRE ALVES**

**Endurance Programme Manager, Michelin Motorsport** 

"Sakhir is something of an atypical venue because of its layout which calls for frequent hard reacceleration, making traction performance very important, while big demands are made of the tyres longitudinally. The surface is even more abrasive than Shanghai, not only due to the asphalt but also because of the sand that gets blown onto the track. Grip levels are low but tend to pick up as the weekend progresses. The majority of the race takes place after sunset when the conditions can become humid."





### **ALLOCATION** 8 HOURS OF BAHRAIN





		8 HOU	RS OF BAHRAIN
	SLICKS Soft, Medium	INTERMEDIATE	WET
LM P1	31/71-18	31/71-18	31/71-18
	SLICKS Medium, Hard	INTERMEDIATE	WET
LM P2	FRONT: 30/68-18 REAR: 31/71-18	FRONT: 30/68-18 REAR: 31/71-18	FRONT: 30/68-18 REAR: 31/71-18
	SLICKS <u>Aston Martin:</u> Medium, Hard <u>Porsche and Ferrari</u> : Soft, Medium	INTERMEDIATE	WET
LM GTE PRO	FRONT: 30/68-18 REAR: 31/71-18	FRONT: 30/68-18 REAR: 31/71-18	FRONT: 30/68-18 REAR: 31/71-18
	SLICKS <u>Aston Martin and Porsche:</u> Medium, Hard <u>Ferrari:</u> Soft, Medium	INTERMEDIATE	WET
LM GTE AM	FRONT: 30/68-18 REAR: 31/71-18	FRONT: 30/68-18 REAR: 31/71-18	FRONT: 30/68-18 REAR: 31/71-18
EX : 31/71-18: width (cm) / exte	wing diagontos (ago) y intogios dia	mantau (in ab a a)	

EX.: 31/71-18: width (cm) / exterior diameter (cm) x interior diameter (inches)



### ALLOCATION (MICHELIN PILOT SPORT ENDURANCE SLICKS) PER CAR – 8 HOURS OF BAHRAIN

	Free Practice	Qualifying + Race
LM P1	12 tyres	Qualifying + Race: 26 tyres
LM P2	12 tyres	Qualifying + Race: 26 tyres
LM GTE PRO	12 tyres	Qualifying + Race: 26 tyres
LM GTE AM	16 tyres	Qualifying + Race: 34 tyres







### BAHRAIN TRIVIA

- » Bahrain is a Persian Gulf archipelago made up of 33 islands
- » The main island is connected to Saudi Arabia by the King Fahd Causeway
- » Bahrain's capital Manama is situated in the north of the country
- » Bahrain is the world's fourth most densely-populated country: 2,641 people/sq. km
- » Sakhir International Circuit was built in a desert (92% of the country is
- » Sakhir Palace is a huge palace near Zallaq built in 1901



### BAHRAIN AND MOTORSPORT

- » Michelin won the F1 grands prix at Sakhir in 2005 and 2006 with Fernando Alonso
- » A 'rookie' test will be held in Bahrain the day after the race
- » In 2004, Bahrain became the first Gulf State to host a Formula 1 grand prix
- » Sakhir also hosts karting endurance races and dragster events



















### **ENTRY LIST 8 HOURS OF BAHRAIN**

### LM P1

**REBELLION RACING • REBELLION R13 - GIBSON** SENNA/MENEZES/NATO



**TEAM LNT • GINETTA G60 - AER** N°5 ROBERTSON/HANLEY/KING



**TEAM LNT • GINETTA G60-AFR** SIMPSON/DYSON/SMITH



TOYOTA GAZOO RACING • TOYOTA TS050 - HYBRID



N°7 **CONWAY/KOBAYASHI/LOPEZ** 



TOYOTA GAZOO RACING • TOYOTA TS050 - HYBRID **BUEMI/NAKAJIMA/HARTLEY** 



### LM GTE AM

AF CORSE • FERRARI 488 GTE EVO N°54 FLOHR/CASTELLACCI/FISICHELLA



**TEAM PROJECT 1 • PORSCHE 911 RSR** N°56



PERFETTI/HEINEMEIER-HANSON/CAIROLI

**TEAM PROJECT 1 • PORSCHE 911 RSR KEATING/TEN VOORDE/BLEEKEMOLEN** 



**RED RIVER SPORT • FERRARI 488 GTE EVO** N°62

**GRIMES/MOWLEN/HOLLINGS** 



MR RACING • FERRARI 488 GTF N°70

N°57

N°98

ISHIKAWA/BERETTA/COZZOLINO



**DEMPSEY-PROTON RACING • PORSCHE 911 RSR** N°77 RIED/CAMPBELL/PERA



AF CORSE • FERRARI 488 GTE EVO N°83



PERRODO/COLLARD/NIELSEN



**GULF RACING • PORSCHE 911 RSR** N°86





**DEMPSEY-PROTON RACING • PORSCHE 911 RSR** N°88 PREINING/TBA/TBA



**TF SPORT** • ASTON MARTIN VANTAGE N°90



YOLUC/EASTWOOD/ADAM

**ASTON MARTIN RACING •** ASTON MARTIN VANTAGE DALLA LANA/TURNER/GUNN



### LM P2

**UNITED AUTOSPORTS • ORECA07 - GIBSON** N°22 HANSON/ALBUQUERQUE/DI RESTA



G-DRIVE RACING • AURUS01 - GIBSON RUSINOV/VAN UITERT/VERGNE N°26



**RACING TEAM NEDERLAND • ORECA 07 - GIBSON** N°29 **VAN EERD/VAN DER GARDE/DE VRIES** 



**HIGH CLASS RACING • ORECA07 - GIBSON** N°33

PATTERSON/YAMASHITA/FJORDBACH **SIGNATECH ALPINE ELF •** ALPINE A470 - GIBSON



N°36 LAURENT/NEGRAO/RAGUES

JACKIE CHAN DC RACING • ORECA07 - GIBSON N°37 **TUNG/AUBRY/STEVENS** 

JOTA • ORECA 07 - GIBSON

N°38

N°42

**GONZALEZ/DA COSTA/DAVIDSON** 

LACORTE/BELICCHI/SERNAGIOTTO



LAPIERRE/BORGA/COIGNY **CETILAR RACING • DALLARAP217 - GIBSON** 

**COOL RACING •** ORECA 07 - GIBSON



### LM GTE PRO

AF CORSE • FERRARI 488 GTE EVO N°51 **CALADO/PIER GUIDI** 



AF CORSE • FERRARI 488 GTE EVO N°71





PORSCHE GT TEAM • PORSCHE 911 RSR-19 N°91 **BRUNI/LIETZ** 



PORSCHE GT TEAM • PORSCHE 911 RSR-19 N°92

**CHRISTENSEN/ESTRE** 



**ASTON MARTIN RACING •** ASTON MARTIN VANTAGE AMR N°95 **SORENSEN/THIIM** 





**ASTON MARTIN RACING •** ASTON MARTIN VANTAGE AMR N°97 LYNN/MARTIN









## **STANDINGS**

LM	P1 CHAMPIONSHIP	ı	30/08-1/09	6/10	10/11	14/12	1/02			13-14/07	тот.
1st	TOYOTA GAZOO RACING	MICHELIN	26	26	18	1-7/12	1/02	20/03	23/04	13 14/07	70
2 <sup>nd</sup>	REBELLION RACING	MICHELIN	2	15	26						43
3 <sup>rd</sup>	TEAM LNT	MICHELIN	15	2	12						29
LM	IP DRIVERS		30/08-1/09	6/10		14/12		20/03	25/04	13-14/07	тот.
1 <sup>st</sup>	BRENDON HARTLEY	MICHELIN	18	26	18						62
1 <sup>st</sup>	KAZUKI NAKAJIMA	MICHELIN	18	26	18						62
1st	SÉBASTIEN BUEMI	MICHELIN	26	18	18						62
2 <sup>nd</sup>	JOSE MARIA LOPEZ	MICHELIN	26	18	15						59
2 <sup>nd</sup>	KAMUI KOBAYASHI	MICHELIN	26	18	15						59
2 <sup>nd</sup>	MIKE CONWAY	MICHELIN	26	18	15						59
3 <sup>rd</sup>	BRUNO SENNA	MICHELIN	2	15	26						43
3 <sup>rd</sup>	GUSTAVO MENEZES	MICHELIN	2	15	26						43
3 <sup>rd</sup>	NORMAN NATO	MICHELIN	2	15	26						43

LM	P2 CHAMPIONSHIP		30/08-1/09					тот.
1 <sup>st</sup>	RACING TEAM NEDERLAND	MICHELIN	16	25	10			51
2 <sup>nd</sup>	JACKIE CHAN DC RACING		12	19	18			49
3 <sup>rd</sup>	SIGNATECH ALPINE ELF	MICHELIN	18	8	12			38

LM	IP2 DRIVERS	30/08-1/09					13-14/07	тот.
1st	FRITS VAN EERD	16	25	10				51
1st	GIEDO VAN DER GARDE	16	25	10				51
2 <sup>nd</sup>	GABRIEL AUBRY	12	19	18				49
2 <sup>nd</sup>	HO-PIN TUNG	12	19	18				49
2 <sup>nd</sup>	WILL STEVENS	12	19	18				49
3 <sup>rd</sup>	ANDRÉ NEGRÃO	18	8	12				38
3 <sup>rd</sup>	PIERRE RAGUES	18	8	12				38
3 <sup>rd</sup>	THOMAS LAURENT	18	8	12				38







## **STANDINGS**

GT	E CHAMPIONSHIP		30/08-1/09					13-14/07	тот.
1st	PORSCHE	MICHELIN	43	27	44				114
2 <sup>nd</sup>	ASTON MARTIN	MICHELIN	25	40	27				92
3 <sup>rd</sup>	FERRARI	MICHELIN	21	22	12				55
						1			
GT	E DRIVERS		30/08-1/09	6/10		14/12		13-14/07	тот.
<b>G</b> 77	E DRIVERS  KEVIN ESTRE	MICHELIN							тот. 62
		MICHELIN	30/08-1/09	6/10	10/11				
1 <sup>st</sup>	KEVIN ESTRE		30/08-1/09 18	6/10 18	10/11 26				62
1 <sup>st</sup> 1 <sup>er</sup>	KEVIN ESTRE MICHAEL CHRISTENSEN	MICHELIN	30/08-1/09 18 18	6/10 18 18	10/11 26 26				62 62
1 <sup>st</sup> 1 <sup>er</sup> 2 <sup>nd</sup>	KEVIN ESTRE MICHAEL CHRISTENSEN GIANMARIA BRUNI	MICHBLIN	30/08-1/09 18 18 25	6/10 18 18 9	10/11 26 26 18				62 62 52

GT	E AM CHAMDIONSHID	I	**	•	*)		<b>(</b>				тот.
			30/08-1/09	6/10	10/11	14/12	1/02	20/03	25/04	13-14/07	
1st	TF SPORT	MICHELIN	7	26	25						58
2 <sup>nd</sup>	AF CORSE	MICHELIN	25	18	12						55
3 <sup>rd</sup>	TEAM PROJECT 1	MICHELIN	1	15	18						34

GT	E AM DRIVERS		**	•	*3		<b>(</b>				тот.
			30/08-1/09	6/10	10/11	14/12	1/02	20/03	25/04	13-14/07	
1st	CHARLES EASTWOOD	MICHELIN	7	26	25						58
1st	JONATHAN ADAM	MICHELIN	7	26	25						58
1st	SALIH YOLUC	MICHELIN	7	26	25						58
2 <sup>nd</sup>	EMMANUEL COLLARD	MICHELIN	25	18	12						55
2 <sup>nd</sup>	FRANÇOIS PERRODO	MICHELIN	25	18	12						55
2 <sup>nd</sup>	NICKLAS NIELSEN	MICHELIN	25	18	12						55
3 <sup>rd</sup>	BEN KEATING	MICHELIN	1	15	18						34
3 <sup>rd</sup>	JEROEN BLEEKEMOLEN	MICHELIN	1	15	18						34





### MICHELIN FIA WEC RANGE 2019/2020 SEASON

	2019/2			
25/17	SLICK Soft - Medium - Hard	HYBRID	SILL WET RA	FULL WET
LM P1	31/71-18	31/71-18	31/71-18	31/71-18
ar 1	SLICK Soft - Medium - Hard	INTERM	EDIATES	WET
LM P2	Front: 30/68-18 Rear: 31/71-18		80/68-18 81/71-18	Front: 30/68-18 Rear: 31/71-18
172	SLICK Soft - Medium - Hard		MEDIATE	FULL WET
LM GTE PRO	Front: 30/68-18		80/68-18	Front: 30/68-18
	Rear: 31/71-18	rear: 3	1/71-18	Rear: 31/71-18
LM GTE AM	Front: 30/68-18 Rear: 31/71-18		80/68-18 1/71-18	Front: 30/68-18 Rear: 31/71-18
	108/			

# EXTRACTS FROM THE FIA WEC SPORTING REGULATIONS

Two drivers from each crew must at least set one timed lap in qualifying. The reference for the starting grid (except Le Mans) is calculated on the average of the two fastest lap times (one per driver). If at least two crews set an identical average time, priority is given to the one who set it first.

For the LMP2 category, one of the two timed laps used for the establishment of the grid must be completed by a Silver or Bronze driver.

For the LMGTE Am category, one of the two timed laps used for the establishment of the grid must be completed by a Bronze driver.

Races start after a formation lap.

To be classified, a car must cross the finish line and must have covered at least 70% of the distance covered by the car classified in first place in the overall classification.

## POINTS-SCORING SYSTEM 4-HOUR RACES

1st - 38 points

2<sup>nd</sup> - 27 points

3<sup>rd</sup> - 23 points

4th - 18 points

5<sup>th</sup> - 15 points

6<sup>th</sup> - 12 points

7<sup>th</sup> - 9 points 8<sup>th</sup> - 6 points

9<sup>th</sup> - 3 points

10<sup>th</sup> - 2 point

+10<sup>th</sup> - 1 point

Pole position: +1 point Drivers and Manufacturers For all the above classifications, an additional point will be awarded, at each Competition, to the "pole position" team in each category (best time achieved by the car in each category during qualifying with the exception of additional cars), as well as to all the drivers making up the crew of the car concerned.



### **6.5 TYRES**

### **6.5.1 Definitions and general conditions**

Each tyre must be identified by RFID and barcode. All references must be declared to the Technical Delegate at least 48 hours before the start of the Competition. This list of designated tyres will be notified to the Stewards at the beginning of the Competition.

All tyres must be identifiable at any time (including when tyres are fitted on the car) via direct measurement by the RFID detection system put in place by the FIA. This includes automatic and manual detection. When tyres are fitted on the car, RFID must be on the outer side of the tyre.

Only in case of malfunction of the RFID system, manual measurement will be handled via barcode identification.

The use of undeclared tyres is prohibited in all Competitions of the Championship.

To allow automatic detection, each car must be equipped with RFID stickers according to Appendix 6. These stickers must be in place at all times during the Competition.

## 6.5.2 Dry-weather tyres: Declaration of specifications for the season

Tyre manufacturers may declare to the FIA/ACO a maximum of 3 tyre specifications per season, which will be frozen for the duration of the season. 2 of them must be declared at least 48 hours before the first Competition of the season.

Specifications break down as follows:

- LMP1 H, LMGTE Pro, LMGTE Am: 3 specifications per car model
- LMP1 NH, LMP2: 3 specifications for all models of cars entered in the category.

### 6.5.3 Dry-weather tyres: Declaration of specifications for the Competition

At the latest 48 hours before the beginning of any given Competition, tyre manufacturers must declare to the Technical Delegate 2 (or 3 if applicable) of the tyre specifications described in Article 6.5.2) to be used by Competitors during the Competition, to the exclusion of any other.

Tyre specifications are limited to 2 for Competitions comprising a race of 12 hours or less and to 3 for Competitions comprising a race of more than 12 hours.

### 6.5.5 Dry-weather tyres: collection and reintroduction (LMP1 H, LMP1 NH and LMGTE Pro only)

### **Collection:**

At the latest the day before the beginning of the first Competition, the Technical Delegate will segregate tyres per specification and per car model which will have to be reintroduced in all the following Competitions of the Championship.

Segregation will proceed as follows:

For the first 2 specifications declared before the first Competition of the season:

- Segregation of 1 set\* of tyres per specification per car model and per Competition comprising a race of 6 hours (or less)
- Segregation of 2 sets\* of tyres per specification per car model and per Competition comprising a race of 6 hours or greater but less than 24 hours.
- Segregation of 3 sets\* of tyres per specification per car model and per Competition comprising a race of 24 hours.
  - \* A set of tyres is a set of 4 tyres made up of 2 front tyres and 2 rear tyres.





If the third specification is declared at the same time as the first two, it will be part of the segregation process described above. After segregation, the Technical Delegate will communicate to the tyre manufacturer the full list of segregated tyres for the full season.

If the third specification is declared after the first Competition, the same segregation process will be applied taking into account the number of Competitions remaining in the season.

After segregation, the Technical Delegate will communicate to the tyre manufacturer an update of the list of segregated tyres.

Tyres to be reintroduced must not be part of the references declared by tyre manufacturers to the Technical Delegates before each Competition.

#### **Reintroduction:**

From the second race Competition, at the latest 24 hours before the start of the race, the Technical Delegate will transmit to the Competitors and tyre manufacturers the list of tyres for re-allocation, mentioning the number of the car on which each tyre is to be used. This list will be notified to the Stewards.

Each Competitor is responsible for the reintroduction of tyres, and must do so in compliance with these regulations.

Each tyre must be reintroduced on the first use of new tyres of the specification concerned during the race.

### 6.5.6 Wet-weather tyres: declaration of specifications for the season

Tyre manufactures must declare wetweather tyre specifications as listed below. Any specification will be frozen for the season and must be declared to the Technical Delegate at the latest 48 hours before the first Competition of the season. A drawing of the declared specifications must be sent with the declaration (digital format and on 1:1 scale tracing paper).

- LMP1 H: 1 intermediate and 2 wet specifications per car model
- LMP1 NH: 1 intermediate and 2 wet specifications for all models of cars entered in the category
- LMP2: 1 intermediate and 1 wet specification for all models of cars entered in the category
- LMGTE Pro / LMGTE Am: 1 intermediate and 1 wet specification per car model

### 6.5.7 Wet-weather tyres: declaration of specifications for the Competitions

The number of wet-weather tyre specifications usable during a Competition is not limited, subject to the provisions of Article 6.5.6

#### 6.5.8 Wet-weather tyres: allocation

Unless specifically authorised in the present Regulations, wet-weather tyres may be used only after the track has been declared wet by the Clerk of the Course / Race Director.

The number of wet-weather tyres usable during a Competition is not limited

### 6.5.9 Tyres used to join the starting grid

Tyres used for going from the pits to the starting grid before the race may be either wet-weather or dry weather tyres and will not be counted in the allocation of tyres.

### 6.5.10 Change of tyre manufacturer during the season

A change of tyre manufacturer is not allowed during the season for the LMGTE Pro and LMGTE Am categories. It is allowed only once for the LMP1 H, LMP1 NH and LMP2 categories.

### 6.5.11 Specific sessions

During a Competition, if a specific test session (e.g. Safari circuit) is organised by the Promoter of the Competition, conditions regarding tyre limitation and declaration will not be applied.

### 6.5.12 Grooving and regrooving

Grooving tyres is strictly prohibited. The regrooving of the tyres is not allowed in LMP2 and LMGTE Am. The regrooving of tyres is allowed in LMP1 H, LMP1 NH and LMGTE Pro.

### **6.5.13 Exchange of commercial** tyres (for the LMP2 category only)

Each tyre manufacturer may be given used tyres, used during a Competition, of the other manufacturers in their category. This applies to both dry-weather and wet-weather tyre specifications.

Tyre exchange is to be done with the support and confirmation of the Technical Delegate.

### Exchange of new tyres (applicable for dry-weather and wet-weather tvres):

Any tyre specification declared for the Championship must be exchanged at the first Competition during which it is introduced.

This process may be repeated only once per season, at the 24 Hours of Le Mans.

### Exchange of used tyres (applicable for drv-weather and wet-weather tyres):

A full set of tyres, used during the race, may be exchanged between tyre manufacturers.

This process may be repeated at every race in the Championship (upon request from a tyre manufacturer during the Competition). The exchange is to be notified within 1 hour after the end of the race.

### 6.5.14 Applicable Penalties

Penalty for breaching the tyre rule: 3-minute Stop & Go per infringement.

### **PIT STOP** REGULATIONS

### 12.5 Safety and obligations during wheel/tyre changes

### 12.5.1 Where wheel/tyre changes are authorised

Wheel/tyre changes are authorised only:

- On the starting grid up to the "3 minutes" board
- In the working area in front of the car's pit, on the conditions defined by Article 12.3
- As an exception, the tyres may be changed inside the garage if and only if the car has been pushed there for the purpose of carrying out mechanical operations on it. This dispensation of the established principle will be interpreted restrictively
- On the track during the suspension of a race according to Article 14.3.

### 12.5.2 Obligations of the mechanics

For a wheel change, mechanics must:

- bring a maximum of two pneumatic wheel guns into the working area,
- without external assistance, take the new wheels, fit them on the car and put the replaced ones between the garage and the 2.5 m line or inside the garage,
- carry at all times the detached wheels when they are outside the garage. However, in order to facilitate the wheel changes, it is possible to lay them flat on the ground near the car just during the change of the wheel concerned,
- · not throw the wheels or drop them,

• disconnect the air jacks and take the equipment back behind the 2.5 m line.

At no moment beyond the 2.5 m line may wheel(s), wheel gun(s), bodywork or any other equipment be left unattended by one of the four mechanics

The area situated between the painted line in front of the pit shutter and the 2.5 m painted line may be used for tyres and the tools necessary for these operations. No assistance may be given by a person standing in that area.

For any wheel that the mechanics lose control of, or for any other infringement of the present article: penalty at the Stewards' discretion.

### 12.5.3 Restrictions concerning equipment

It is prohibited to have any equipment:

- For speeding up the removal of the wheels. Only two wheel guns or two pneumatic torque wrenches are authorised per car in the working area at any given time. A maximum of 2 different pneumatic wheel guns can be used during a wheel change to change the tyres.
- For warming the tyres and/or keeping them at constant temperature in the working area, in the garage and on the starting grid. (see Article 12.1.2) Penalty in case of infringement: at the Stewards' discretion.
- Which is operated using an external power source (electrical, pneumatic, etc.), with the exception of the two wheel guns and the air-jack coupling.











