



# SHELL ECO-MARATHON 2020 OFFICIAL RULES

Shell  
Eco-marathon





**ARTICLE 29: SAFETY BELTS**

- a) The Driver’s seat must be fitted with an effective safety harness with at least five mounting points to maintain the Driver securely in his/her seat.
- b) The safety harness must able to withstand a **700 N load**.  
The safety harness and its fitting will be evaluated during technical inspection. For Prototype vehicles, this will be done by raising the vehicle with the Driver on board using the safety harness buckle as the lifting point.
- c) The Urban Concept vehicle safety harness must be specifically manufactured for motorsport use (e.g. certified or compliant with FIA standards).

**ARTICLE 30: VEHICLE ACCESS**

- a) It is imperative for Drivers, fully harnessed, to be able to vacate their vehicles at any time without assistance in less than 10 seconds.
- b) Prototype vehicles must be equipped with a sufficiently large opening for the cockpit. The driving position must be designed so that emergency services can easily extract the Driver from his/her vehicle, if necessary.
- c) **The opening release mechanism of the driver compartment must be easily and intuitively operable from both inside and outside the vehicle. The method of opening from the outside must be clearly marked by a red arrow and must not require any tools.**
- d) It is forbidden to use adhesive tape to close the Driver’s opening from the outside.

**ARTICLE 31: HORN**

- a) **Each vehicle must be equipped with an electrically powered horn typically used in current automobiles. Bike or cycling horns are no longer permitted.**
- b) The horn must be mounted at the front of the vehicle without obstruction.
- c) When the vehicle is in normal operating condition, it must emit a sound greater than 85 dBA when measured 4 meters horizontally from the vehicle. The horn must produce a continuous **single tone** sound when activated (chirping or siren like tones are not permitted).
- d) **The horn must be powered by the accessory or propulsion battery. However, the power consumed by the horn will not be measured by the Joulemeter (see Article 56:d)iv).**

**ARTICLE 32: ON-BOARD FIRE EXTINGUISHER**

- a) Each vehicle must be fitted with a fire extinguisher (ABC or BC type).

**ARTICLE 33: DRIVER POSITION**

For safety reasons, the head-first driving position is prohibited.

**ARTICLE 34: CLUTCH AND TRANSMISSION**

- a) Only UrbanConcept ICE vehicles are required to have ‘idling capabilities. This means the vehicle must be able to remain stationary while the engine is running.
- b) Guards for transmission chains and/or belts are mandatory.

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**ARTICLE 36: ENVIRONMENTAL RESPECT**

- a) All vehicles are expected to comply with reasonable environmental conditions including smoke, odour, and sound level emitted.

**2 – URBANCONCEPT GROUP**

**ARTICLE 44: DEFINITION**

Under the name “UrbanConcept”, Shell offers an opportunity to design and build energy efficient vehicles that are closer in appearance to today’s production type passenger cars. One particular feature of this group is that vehicles competing in this group will require “stop and go” driving.

**ARTICLE 45: DIMENSIONS**

- a) The total vehicle height must be between 1000 mm and 1300 mm.
- b) The total vehicle width, excluding rear view mirrors, must be between 1200 mm and 1300 mm.
- c) The total vehicle length must be between 2200 mm and 3500 mm.
- d) The track width must be at least 1000 mm for the front axle and 800 mm for the rear axle, measured between the midpoints where the tyres touch the ground.
- e) The wheelbase must be at least 1200 mm.
- f) The Driver’s compartment must have a minimum height of 880 mm and a minimum width of 700 mm at the Driver’s shoulders.
- g) The ground clearance must be at least 100 mm with the driver in the vehicle.
- h) The maximum vehicle weight (excluding the Driver) is 225 kg.

**ARTICLE 46: VEHICLE BODY**

- a) Teams are requested to submit technical drawings, photographs or animations of their entire vehicle design to the Organisers for approval at their earliest opportunity.
- b) The body must cover all mechanical parts whether the vehicle is viewed from the front, the rear, the sides or from above. In addition, the wheels and suspension must be fully covered by the body when seen from above and up to the axle centre line when seen from front or rear. The covering for the wheels and suspension must be a rigid integral part of the vehicle body.
- c) It is prohibited to use any commercially available vehicle body parts.
- d) Access to the vehicle by the Driver must be as easy and practical as typically found in common production type passenger cars. All UrbanConcept vehicles must have a side-door design. The door opening must have a minimum dimension of 500 x 800 mm. This means a rectangular template of this dimension must be able to pass through the door opening.

**From 2019 onwards all UrbanConcept cars will be required to have a door on each side of the driver compartment meeting the requirements above.**

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**ARTICLE 50: LIGHTING**

The vehicle must have a functional external lighting system, including: a) Two front headlights

- b) Two front turn indicators
- c) Two rear turn indicators
- d) Two red brake lights in the rear
- e) Two red rear running lights
- f) The centre of each headlight unit must be located at an equal distance and at least 300 mm from the centre-line of the vehicle.
- g) The mandatory red indicator light for the self-starter operation must be separate from any of the above (see Article 64:c).
- h) **A Hazard light function must be included in the vehicle system.**

**ARTICLE 51: BRAKING**

- a) The vehicle must be equipped with a four-disc hydraulic brake system, with a single brake pedal, which has a minimum surface area of 2500 mm<sup>2</sup>. The brake pedal must operate the master cylinders either directly or through a rigid mechanical link. Wires/cables are not allowed. **Commercially available brake systems (discs and calipers) with a minimum disc thickness of 3 mm are mandatory. Manufacturer's documentation is required to demonstrate authenticity. Bicycle brakes are not allowed.**
- b) The brakes must operate independently on the front and rear axles or in an X pattern (i.e. right front wheel with left rear wheel, and left front wheel with right rear wheel).
- c) **A single master cylinder may be used provided it has a dual circuit. A maximum of two master cylinders is allowed.**
- d) The effectiveness of the brake system will be tested during vehicle inspection. The vehicle must remain immobile with the Driver inside when it is placed on a 20 percent incline with the main brake in place. Moreover, a dynamic inspection may be performed on the vehicle-handling course.
- e) A parking brake function is required to keep the car stationary during technical inspections and fuel measurements. It must provide a brake force of at least 50 N.
- f) Wet weather capability is mandatory (see Article 52:a)).

**ARTICLE 52: WET WEATHER RUNNING**

- a) During weather conditions of light rain/drizzle, the UrbanConcept vehicles (only) may be required to drive on the track during competition with approval from the Race Director. Therefore, all UrbanConcept vehicles must be adequate for running under such conditions.
- b) The vehicle must be equipped with an effective electric windscreen wiper arm assembly typically found in a production car.
- c) The operation of the wiper assembly must be activated by an independent switch easily accessible to the driver.
- d) The wiper operation must provide the driver a clear view.

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- e) The vehicle must be adequately ventilated to prevent driver’s compartment from fogging.
- f) It is required that the vehicle’s electrical system be suitable for wet weather conditions to prevent malfunction.
- g) The effectiveness of the vehicle to run in wet conditions will be evaluated during the initial inspection phase.
- h) Tyres must have a minimum tread of 1.6 mm (see Article 49:).
- i) The vehicle’s brake effectiveness may be re-inspected before and/or after any run.

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**3. ENERGY SOURCES**

**3A – GENERAL**

**ARTICLE 53: ENERGY TYPES**

Vehicles may only use any one of the following energies: a) Internal Combustion\*:

Electric Mobility\*\*\*:

- i. Hydrogen. ii. Battery Electric.

**ARTICLE 56: JOULEMETERS**

- a) **Joulemeters will be installed on all UrbanConcept, prototype battery electric, and selected Prototype ICE and hydrogen vehicles.**
- b) **The Organisers will provide a joulemeter to selected teams at the event.**
- c) **Joulemeters must be installed inside the engine compartment. Joulemeters mounted outside the vehicle are forbidden.**

**ARTICLE 57: VEHICLE ELECTRICAL SYSTEMS**

- a) For safety reasons, the maximum voltage on board of any vehicle at any point must not exceed 48 Volts nominal and 60 Volts max (This includes on-board batteries, external batteries, supercapacitors, fuel cell stack, etc.).
- b) For all vehicles, only one on-board battery is allowed.
- c) Accessory battery
  - i. The accessory battery provides all allowed electrical needs such as safety devices (windscreen wipers, lights, hydrogen sensors, hydrogen relays and hydrogen shutdown valve), ignition, fuel
  - ii.

**3B – ELECTRIC PROPULSION**

**ARTICLE 65: FUEL CELL POWERED VEHICLES**

- a) Fuel system

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<p>i. Participants must provide a description and a <b>process flow diagram</b> of the fuel supply system. ii. The fuel system must be easily accessible for inspection and measurements.</p>		
<p>iii. The fuel cell must run by itself. The electricity needed for temperature regulation, fan, compressor, electronic management system for the fuel cell and the electric motor must be supplied by the fuel cell and not by the accessory battery.</p>		
<p>iv. The hydrogen system must be designed as follows:  <div style="margin-left: 40px;"> <p>H<sub>2</sub> cylinder → Pressure regulator directly attached to the cylinder → Emergency shutdown valve directly attached to the outlet of the pressure regulator → Flow meter → Fuel Cell</p> </div> </p>		
<p>c) Ventilation  <p>The vehicle body must allow for ventilation at the highest point of the fuel cell compartment, providing an orifice with a minimum opening of 500 mm<sup>2</sup>. Another 500 mm<sup>2</sup> opening must be provided at the highest point of the driver compartment.</p> </p>		
<p>d) Hydrogen detector  <p>i. A hydrogen sensor must be installed in the fuel cell compartment, near the main ventilation orifice mentioned above.</p> </p>		
<p>e) Emergency shutdown valve and relay</p>		
<p><b>4. ON-VEHICLE TELEMETRY EQUIPMENT</b></p>		
<p><b>ARTICLE 80: GENERAL</b></p>		
<p>a) For <b>2018</b>, all UrbanConcept, <b>and selected Prototype teams must install the</b> telemetry system provided by the Organiser for the duration of the event. This system is composed of an onboard computer, external antenna, <b>a dedicated battery system, internal connector box and cables</b>, and one or more energy measurement <b>sensors</b>, dependent on the vehicle's energy type.</p>		
<p><b>ARTICLE 81: ONBOARD COMPUTER</b></p>		
<p>a) <b>Mounting location and instructions will be made available to the teams from the Shell Ecomarathon's participant website.</b></p>		
<p>b) The onboard computer will be powered by <b>a dedicated battery system provided by the Organisers. The dedicated battery system must remain isolated from the vehicle electrical system.</b></p>		
<p><b>ARTICLE 82: EXTERNAL ANTENNA</b></p>		
<p>Each onboard computer is accompanied with an antenna pod. This pod must be mounted on the outside of vehicles that has an unobstructed view of the sky. The mounting of this antenna requires a 32 mm diameter hole in the body of the vehicle.</p>		



**ARTICLE 83: HYDROGEN FLOW METER**

- a) All UrbanConcept Hydrogen vehicles must be fitted with the hydrogen flowmeter. The onboard computer will be connected to the flowmeter via a 1 meter cable.
- b) The hydrogen flowmeter is a Vogtlin Red-y smart series Hi performance GSM-B9TA-BN00 specially calibrated for Shell Eco-marathon.

**ARTICLE 84: LIQUID FLOWMETER**

- a) All Urban Concept Internal Combustion Engine vehicles must be fitted with the liquid flowmeter. The onboard computer will be connected to the liquid flowmeter via a 1 meter cable.
- b) The liquid flowmeter is a Max Machinery Model P001 specially modified for the Shell Eco-marathon. The liquid flowmeter kit, must be installed by the teams prior to Technical Inspection.

**ARTICLE 85: JOULEMETERS**

- a) Joulemeters will be used to measure the vehicle electrical energy and will be installed in all UrbanConcept vehicles, see Article 56:. In Urban Concept vehicles, the onboard computer will be connected to the Joulemeter via a 1 meter cable.

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**5. AWARDS AND PRIZES**

**5A – ON-TRACK AWARDS**

**ARTICLE 100: ON-TRACK AWARD OVERVIEW AND PRIZES**

All on-track prizes and trophies below are awarded twice, once for Prototype and once for UrbanConcept vehicles, in the three energy categories of Internal Combustion, Hydrogen Fuel Cell, and Battery Electric.

SHELL ECO-MARATHON ON-TRACK AWARD	ASIA AMERICAS	EUROPE	COMMENT
Internal Combustion Winner	US\$ 3,000	€2,500	Prize Money, Trophy, on-stage Winners Ceremony
Battery Electric Winner	US\$ 3,000	€2,500	Prize Money, Trophy, on-stage Winners Ceremony
Hydrogen Fuel Cell Winner	US\$ 3,000	€2,500	Prize Money, Trophy, on-stage Winners Ceremony
Hydrogen Fuel Cell Runner-up	US\$ 2,000	€1,700	Prize Money only

**5B – OFF-TRACK AWARDS**

**ARTICLE 101: OFF-TRACK AWARD OVERVIEW AND PRIZES**

All off-track prizes and trophies below are awarded once. Winners will receive the respective prize money, as well as a trophy on-stage during the Awards Ceremony.

SHELL ECO-MARATHON OFF-TRACK AWARD	ASIA AMERICAS	EUROPE
Communications Award	US\$3,000	€2,500
Vehicle Design Award Prototype	US\$3,000	€2,500
Vehicle Design Award UrbanConcept	US\$3,000	€2,500
Technical Innovation Award	US\$3,000	€2,500
Safety Award	US\$3,000	€2,500
Perseverance & Spirit of the Event Award	US\$3,000	€2,500

**APPENDIX 1: IDENTIFICATION OF VEHICLES**

**URBANCONCEPT**

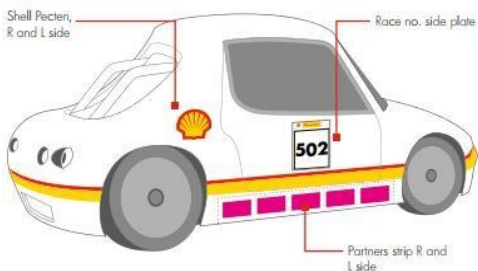
**FRONT View**

Note: On the front of the vehicle, the Pecten may be above the race no.



**SIDE View**

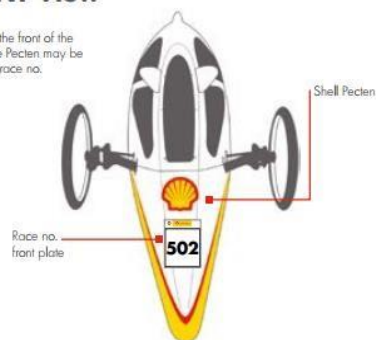
Shell Pecten, R and L side



**PROTOTYPE**

**FRONT View**

Note: On the front of the vehicle, the Pecten may be above the race no.



**SIDE View**

Shell Pecten, R and L sides

