Fédération Aéronautique Internationale

2022 World Games
Drone Racing Sporting Rules

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The sporting rules are based on the F9U (RC Multi-Rotor Drone Racing) class rules as defined in the FAI Sporting Code - Section 4 Aeromodelling - Volume F9 Drone Sport.

Multi-rotor Drone Racing consists of several multi-rotor model aircraft flying together through a closed racing circuit.

Note: *A multi-rotor is a rotary wing radio-controlled model aircraft equipped with at least three power driven propeller devices.*

The generic term 'model' will be used in the present document.

Each model is operated by an FPV (First Person View) pilot who is considered as the competitor. The FPV pilot is equipped with a headset goggle that allows him(her) to pilot from the video picture of the onboard camera which is transmitted in real time on his(her) headset goggle.

The FPV pilot is assisted during the race by one and only one helper who stays next to him during the whole flight. The helper is mandatory. He may be another competitor.

The main task of the helper is to keep the model in visual line of sight. He must inform the FPV pilot of anything occurring that can affect his(her) piloting, especially about safety. If the helper requests the FPV pilot to land or to cut off the motors, he must do it immediately. In case of emergency, the helper is authorized to shut off the transmitter in order to trigger the fail-safe device.

1. RACING CIRCUIT

The racing circuit will be outdoor.

The design will be approved by FAI, and will be made public and published about two months before the event.

2. GENERAL SPECIFICATIONS FOR MODELS

A 1 % tolerance is applicable for inaccuracy of the measurement devices for size, weight and battery voltage.

The model must be equipped with a fail-safe device, the triggering of which stops the motors.

The following are strictly forbidden:

- Pre-programmed manoeuvring device.
- System for automatic positioning and/or path rectification in longitude, latitude or height.

Note: *Software recovery modes such as 'anti Turtle' or 'anti crash' and automatic system or which can be activated by the pilot in order to level back the model after a crash are permitted.*

2.1. Weight and size

The total weight of the model including all equipment necessary for flight (including batteries) shall not exceed 1 kg.

The axes of all motors must fit within a circle of 330 mm diameter.

2.2. Motorization

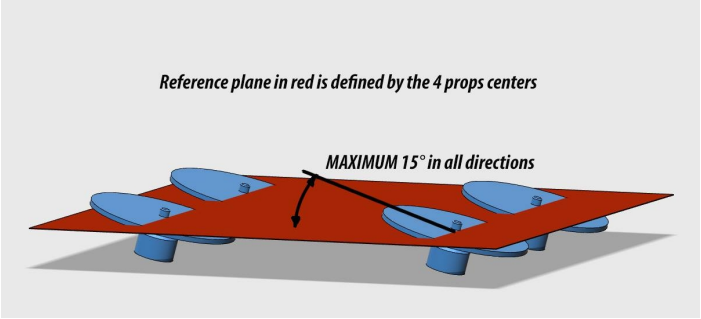
Only electric motors are allowed.

Battery pack up to 6 S is allowed. The voltage for each cell must not exceed 4.25 V. This means a maximum voltage of 17 V for a 4S battery pack, and 25.5 volts for a 6S battery pack.

The voltage measurement will be done before the flight.

The reference plane is defined with propellers centres. Each motor can be tilted up to 15° maximum angle in each direction.

On a tri-copter, the inclination of a motor in flight is only allowed with the yaw order.



2.3. Propellers

Maximum diameter: 6 inches (15.2 cm).

Full metal propellers are forbidden.

2.4. Radio control (RC) equipment

Any 2.4 GHz spread spectrum technology RC equipment may be used.

Use of a TBS Crossfire module (868 MHz / 915 MHz) or any other 900 MHz module on the RC equipment is subject to an authorization prior to the event. The output power of such modules must be settled to 100 mW maximum or a lower output that fulfils local regulations.

In order to limit risk of potential problems during the races with unwanted interference, the organizer may define restrictions for use of RC systems equipment outside the racing circuit.

In case of use of non-authorized RC equipment, penalty going up to disqualification from the event may be imposed to the concerned competitor by the event director, with the consent of the FAI Jury (see Volume CIAM General Rules paragraph C.19.1).

2.5. Video system

An analog video system provided by the organizer will be used for piloting and will be operated on 5.8 GHZ band.

The VTX must be set with a 25 mW maximum power emission.

In order to limit risk of potential problems during the races with unwanted emission, the organizer may define restrictions for use of video transmitters outside the racing circuit.

In case of non-authorized activation of a video transmitter, a penalty going up to disqualification from the contest may be imposed to the concerned competitor by the contest director, with the consent of the FAI Jury (see Volume CIAM General Rules paragraph C.19.1).

All official flights will be recorded on a digital video recorder (DVR) in order to permit to review races as necessary in case of doubt or complaint.

2.6. LED light device

In order to provide for the public the best view of the models during the races and to facilitate the task of the judges, each model must be equipped with a LED light device including possibility to choose the colour so that each model in flight has a different colour.

The goal is that every model must be viewable from every direction and angle.

LED light device requirements:

- 40 LED's minimum (4 on bottom and 4 on top on each of the 4 arms of the model + 8 on the sides of the body).
- RGB controller to program the assigned colour before each race.
- Mandatory colours: Blue - Green - Orange - Pink - Purple - Red - Yellow

Competitors must strictly respect the requirements and take care the device allows to change easily the colour just before the race.

Note: *In order to simplify organisation and improve the understanding of the races by the public, the colour, such as the video frequency, will be assigned for each race according to the draw order in the group.*

2.7. Identification mark

Each model shall carry in a clearly visible the 3 (three) letters national identification mark followed by the FAI Sporting Licence ID number.

The letters and numbers must be at least 6 mm high and appear at least once on each model.

3. NUMBER OF MODELS

Each competitor may use a maximum of 3 (three models) for the entire contest.

A model can be used by only one competitor during the contest.

In case of an infringement to that rule, the concerned competitors will be disqualified from the contest by the contest director, with the consent of the FAI Jury (see Volume CIAM General Rules paragraph C.19.1).

The competitor can change the model:

- before the start of the race as long as the competitor hasn't left the preparation area,

- or between two rounds of the qualification stage and elimination stage.

4. MODEL PROCESSING

A model processing will be done by the organiser.

Each competitor can register up to three models.

For points which will be checked at the model processing, see the Processing Form in Annex 1. This form may be subject to changes.

The organiser will mark each registered model with a visible and difficult to falsify marking.

When, after the model processing a model is lost or damaged, the competitor shall have the right to present a further model for checking up to one hour before the beginning of the first qualifying round.

A random spot-check may be done following any official race to check the most important characteristics of a model.

A competitor whose model wouldn't be compliant may be disqualified from the contest by the contest director, with the consent of the FAI Jury (see Volume CIAM General Rules paragraph C.19.1).

5. PRACTICE FLIGHTS

An official practice session will be organised before the beginning of the qualifying rounds.

The official practice will be run according to the draw of the first qualifying round.

Practice flights on the venue other than those authorised by the organiser are strictly forbidden under threat of being disqualified from the contest.

6. CONTEST ORGANISATION

The contest will be organized on the basis of three stages:

- Qualification stage (to qualify for the elimination stage).
- Elimination stage (to qualify for the final stage by successive elimination rounds).
- Final stage.

Each round for the qualification and elimination stages will be organized with 4 (four) pilots per group (subdivision of the round corresponding to the number of pilots normally flying at the same time in the same race).

6.1. Timekeeping

Every race will be timed with an electronic timing system provided by the organiser. The organiser will supply for free to each competitor the eventual chips to install on the models.

For the qualifying stage, timekeeping will be triggered for each model when the model will pass the timekeeping sensor. Each pilot must go directly after the start where the timekeeping sensor is positioned without possibility to do flight recognition of the track.

For the elimination and final stages, timekeeping will be triggered at the start of the race.

6.2. Procedure for the start of the race

The start of the race will be done as follows:

- After the models have been placed on the start area, the starter will request the pilots if they are ready to start.
- When the starter considers that the pilots are ready, the starter will announce clearly 'Arm your quads'.
- About 3 seconds after this announcement and taking care of an equivalent time for all races, there will be a brief and intelligible sound signal for the start of the race; no countdown (3, 2, 1) will be done before the start signal.

The starter must immediately stop the race and do a new start when he considers that:

- the start procedure has not been done properly;
- or a pilot has jumped the start and a decision is justified to disqualify him(her).

Before the restart, the pilots will be given the opportunity to change the battery pack on their model.

6.3. Qualification stage

Each competitor will be entitled to participate to 4 (four) qualification rounds.

Composition and flight order of the groups will be determined with a blind draw. The draw will be different for each qualifying round.

Each qualification round will be done with a maximum allocated flying time of 4 (for) minutes.

After the start, 3 (three) consecutive laps will be timed. After the 3 laps are finished, the pilot must land the model.

Reflights will be flown at the end of the concerned round.

Races with less than 4 pilots, for example in case of withdrawal of a pilot, will be put at the end of the draw of the round, in order to allow a complete pilots race with pilot(s) that have been granted a reflight in the round.

If necessary, the last groups of each qualifying round may be rearranged by the supervisor judge (under supervision of a FAI Jury member) in order to achieve as much as possible a minimum of 3 pilots per group.

The result of each competitor for the qualification stage will be the average of the 3 (three) best times recorded to perform one valid circuit lap taking in account all the qualifying rounds. Those best times may be done in the same qualifying round or in different ones.

A provisional ranking will be established at the end of the qualifying stage, taking in account the result obtained by each competitor. In case of a tie for the last place(s) for selection to the elimination stage, the 4th best time recorded to perform one valid circuit lap result will be considered to split the tie, and then if necessary the 5^{rh} one, and so on. In case the times are not sufficient, a tie-break flight will be organized between the competitors still concerned by the tie.

When the number of competitors required for the elimination stage is not reached with the competitors getting 3 (three) times, competitors getting only 2 (two) times to perform one valid circuit lap will be considered taking in account the average of their 2 times. If it is still not sufficient, competitors getting only 1 (one) time to perform one valid circuit lap will be considered.

When the number of competitors required for the elimination stage is still finally not reached, an additional qualifying flight will be organized for the competitors who have not been able to set a time at that stage. This will be repeated until the appropriate number of competitors for the elimination stage is reached.

In any case, the competitors who need an additional qualifying flight to achieve a time to be selected for the elimination stage will be placed after those who are already selected, and then those who need a second additional flight, and so on.

6.4. Elimination stage

All 32 competitors will be selected for the elimination stage.

All races of the elimination stage will be run on a defined number of laps taking in account the performance achieved during the qualification stage. Except under exceptional circumstances, the number of laps will be identical for all rounds of the elimination stage.

The placing for each race is determined taking in account the time achieved when the number of laps is completed.

Those who will not finish their flight will be ranked considering the distance completed (number of laps and part of the last lap completed), disqualified competitors being placed at the end.

The two best placed will be directly selected for the next round. In case of a tie for the second place, the placing in the provisional ranking established at the end of the qualifying stage will be considered to define who is selected for the next round.

Double elimination

Instead of direct elimination of the competitors placed third and fourth in each race of any elimination round, the double elimination sequence will be applied.

This sequence allows competitors eliminated in elimination rounds to continue to fly still getting possibility to access the final.

Competitors placed third and fourth in any race of the double elimination sequence are definitively eliminated.

Organisation of the races

For the first elimination round, the composition of the groups for the races is defined considering the provisional ranking established at the end of the qualifying stage.

The organisation of the rounds up to the final and the composition of the races for the first elimination round are detailed in Annex 2.

6.5. Final stage

The two best placed in the last elimination round (one race) and the two best placed in the last round of the double elimination sequence (one race) are selected for the final stage to determine their final ranking from 1st to 4th place.

With double elimination sequence is applied, the two competitors coming from the double elimination bracket have one loss each whereas the two other competitors are qualified for the final stage without any loss.

In order to avoid a competitor with one loss placing ahead of a competitor without any loss, the final stage will be organized as necessary with successive final races instead a single final race.

In each successive final race, pilots placed in first and second places are directly selected for the next final race. Pilots placed third and fourth (or the pilot placed third when the race concerns only 3 pilots) get one loss.

As soon as a competitor gets two losses, he is then definitively eliminated and so does not fly in the next final race. In that situation, the winner (and also possibly the second placed pilot) got one loss maximum, all other pilots being eliminated with two losses.

When two pilots are eliminated in the same final race, the final placing of those two pilots will be determined considering their place in the considered race.

6.6. Final classification

The final classification of the 32 competitors will be established as described in the following table.

Place	Scenario B with double elimination sequence applied
1	1st placed in final stage
2	2nd placed in final stage
3	3rd placed in final stage
4	4th placed in final stage
5	3rd in race 29
6	4th in race 29
7	3rd in race 27
8	4th in race 27
9 to 12	3rd and 4th in races 25 and 26 with final placing according to provisional ranking after qualifying stage
13 to 16	3rd and 4th in races 21 and 22 with final placing according to provisional ranking after qualifying stage
17 to 24	3rd and 4th in races 17 to 20 with final placing according to provisional ranking after qualifying stage
25 to 32	3rd and 4th in races13 to 16 with final placing according to provisional ranking after qualifying stage

7. FLIGHT OCCURRENCES

7.1. Obstacle damaged or destroyed during the race

When an obstacle is accidentally damaged or destroyed during a race, the pilots will be informed as soon as possible of the incident and how to proceed.

Note: *The organizer will define the person (event director, starter,,...) in charge to decide how to proceed and to clearly inform the pilots.*

In the case where it concerns an obstacle to be crossed (air gate, tunnel,,...), the decision may be to continue to cross the obstacle, or to give permission to bypass it, or to stop the race. When bypassing of the concerned obstacle is authorized, pilots must do their best not to take advantage of the situation.

In case it concerns an obstacle to be avoided, the race will continue except if it is decided differently considering for example that safety is impacted. When race continues, pilots must do their best to follow the track and not to take advantage of the situation.

7.2. Faults and penalties

In the case an obstacle that needs to be crossed is not effectively crossed, the pilot may try to execute a manoeuvre to cross the obstacle again. If during this manoeuvre the pilot has a collision with another model, the pilot will be disqualified for the race. If the pilot does not cross an obstacle to be crossed, the corresponding circuit lap will not be validated by his(her) assigned judge.

In the case of a circuit cut (for example during a turn), the pilot may execute as soon as possible a manoeuvre to come back into the circuit where he left it. If his(her) assigned judge considers that the pilot has not made the manoeuvre with sufficient urgency, the judge can decide that the corresponding circuit lap is not validated. If during this manoeuvre the pilot has a collision with another model, the pilot will be disqualified for the race.

In both cases, the pilot whose model has been collided into may be granted a reflight if he(she) is considered no longer able to continue his(her) flight in a competitive way. In that situation, the pilot must stop his(her) flight as soon as possible after the collision and say it clearly. The reflight will be granted subject to the corresponding judge confirming that the collision has clearly penalised the pilot. If the pilot decides to continue to fly, a reflight may not be considered.

7.3. Disqualification from the race

A pilot may also be disqualified from a race in the following scenarios:

- a start before the start signal if it is considered that this early start gives a clear advantage to the concerned pilot;
- a circuit exit (crossing of the safety line);
- a celebratory manoeuvre, especially after the pilot finishes.

The disqualification is decided at the discretion of the judge assigned to the concerned pilot.

The judge can also pronounce a disqualification if the judge considers that:

- the pilot flies so high that the performance of the pilot on the track cannot be judged;
- the piloting is hazardous or if safety is compromised.

When a pilot is disqualified, he must land as soon as he has been informed. In any case, the result of the pilot for the race will not be validated. If the pilot is considered not being sufficiently cooperative to land, the concerned pilot may be disqualified from the event by the FAI Jury on request of the assigned judge.

7.4. Crash

When a model crashes, the concerned pilot can resume if the model is in a situation to do so.

When the model cannot go on, it must stay on the ground with motors cut off until the end of the race. The pilot must clearly say that he has stopped flying.

7.5. Safety occurrence

The pilot can be requested to stop the flight if it is considered the model no longer meets acceptable safety standards. It could be for example the case when a model is damaged after a collision or after a crash, or when the battery is dangling.

In such a situation, a reflight for the concerned pilot may not be considered.

8. REFLIGHTS

8.1. Causes for reflight

Incidents during races such as a collision with an obstacle or a collision between models cannot justify a reflight, except in the specific situation defined in sub-paragraph 7.2.

When a pilot gets a video problem that he(she) considers will prevent him(her) from continuing the flight, he(she) must immediately say it clearly. A reflight will only be considered if the pilot has used the video from the organizer's receiver and if the problem is confirmed by the judge.

In addition, a reflight may be considered when:

- Either the model cannot start or the flight cannot be made in normal conditions because of an unexpected cause beyond the pilot’s control.
- For a reason of safety, either the model cannot be prepared or the flight cannot be made in the allotted time limit or when either is disrupted by an external interference.

- For a reason independent from the pilot's will, the pilot has been forced to land by request of an official. Failures of the model, motorization or radio cannot be considered as reasons independent from the pilot's will.
- The chair of the pilot clearly affects his(her) flight; if the helper of the pilot is the cause of the problem then a reflight cannot be granted.

Noise in the environment of the pilots (noise in the public, noise from other competitors, …) cannot justify a reflight.

For any pilot being granted a reflight, the original flight for which the pilot has been granted the reflight is then definitively cancelled.

8.2. Organization of the reflights

Reflights for individuals are permitted for the qualifying stage and, as such, reflights may be organised separately or as part of any races that have fewer than the required number of pilots.

The same applies for the additional rounds optional sequence if done according to the modalities defined for this sequence in sub-paragraph **Erreur ! Source du renvoi introuvable.**.

Elimination and final stages

It is not possible to organize an individual reflight for elimination stage because the placing in the race determines the selection for the next round so the race must be restarted when a reflight is granted.

The same applies for the final stage.

It is desirable to stop the race as soon as possible once an incident occurs that may justify a reflight. The restart will only concern the pilot who has been granted a reflight and the pilots who were still in the air when the stop of the race has been announced.

Note: *The organizer will define the person (event director, starter, ...) in charge to decide the stop of the race and to inform clearly the pilots.*

In the case where the race has not been stopped and that subsequently a reflight is granted, a new race will be organized. This new race will include only the pilot who has been granted a reflight and the pilots who have finished the original race (or placed first or second at the end of the original race for those who don't finish it). Instead of participating in the new race, a pilot may choose to keep the time he got in the original race; in that situation, his(her) placing will be considered by comparing his(her) time in the original race against the new times of the pilots who participate in the new race.

9. OFFICIALS

9.1. FAI Jury

The three members of the FAI Jury will be of different nationalities.

The FAI Jury members will be selected by FAI.

9.2. Supervisor and pilots' Judges

In each race, each pilot will be scored by a judge standing behind him(her).

The judge will be equipped with a video screen connected on a video output of his(her) pilot receiver allowing him(her) to follow the flight of his assigned competitor sharing all the time the same video picture.

The judge will monitor that the pilot follows the circuit and crosses every gate and obstacle correctly.

The judge will inform the pilot when he(she) is disqualified or must stop the flight considering the model no longer meets acceptable safety standards. He(She) may optionally notify the competitor at the moment of any infringement or if a lap is not validated but is not required to do so.

The judge must be satisfied that any undertaking by the pilot to re-attempt a missed gate, obstacle or circuit cut is conducted in compliance with the rules and that any competitive advantage has been forfeit.

At the end of the flight, the pilot will be informed if the flight is considered to be valid or if a disqualification has been pronounced; in the case of disqualification, the number of circuit laps done at the moment of the disqualification will be communicated to the concerned pilot and recorded.

A supervisor judge will be appointed.

The supervisor and pilots' judges will be selected by CIAM.

9.3. Other officials

The other officials necessary to run the event (Competition director, starter, persons in charge of the checking of the models before each race, person to review the video recording in case of a complaint, etc.) will be appointed by the organiser.

10. INTERRUPTION OF THE CONTEST

The event should be interrupted or the start delayed by the event director in the following circumstances:

- Wind continuously stronger than 9 m/s measured at 2 m above the ground near the preparation area for at least one (1) minute.
- Due to atmospheric conditions (rain, stormy condition, …) in which it would be dangerous to continue to fly.
- Other exceptional circumstances such as for example incident affecting safety or requiring access for emergency services.

When an interruption occurs during an official flight, this flight is cancelled.

If the event cannot go on, the final ranking will be the last available provisional ranking.

- ANNEX 1 - Processing form

Competitor's FAMILY and First name: .....

Country: ..... . **FAI Sporting Licence ID number:** .....

Radio control equipment:

Reference of the RC equipment: .....

2,4 GHz ☐ Other frequency (precise the frequency): .....

If appropriate, reference of the 868 MHz and/or 915 MHz module: .....

Reference of the headset goggle: .....

Number of models processed (3 maximum)**:** .....

Weight (1 kg maximum including batteries and all on-board devices)

Model A:..... ***Model B:*** ..... ***Model C:*** .....

Batteries references (25.5 V max for 6S):

Model A:.....

Model B: .....

Model C: .....

	Model A	***Model B***	***Model C***
Identification mark (minimum 6 mm high)	☐	☐	☐
Size (distance between axes less than 330 mm)	☐	☐	☐
Prop size (not more than 6”)	☐	☐	☐
Test of the fail-safe device	☐	☐	☐

Reference of the VTX used on the model:

Model A:.....

Model B: .....

Model C: .....

LED light unit (if applicable)	☐	☐	☐
Organiser marking of the model	☐	☐	☐

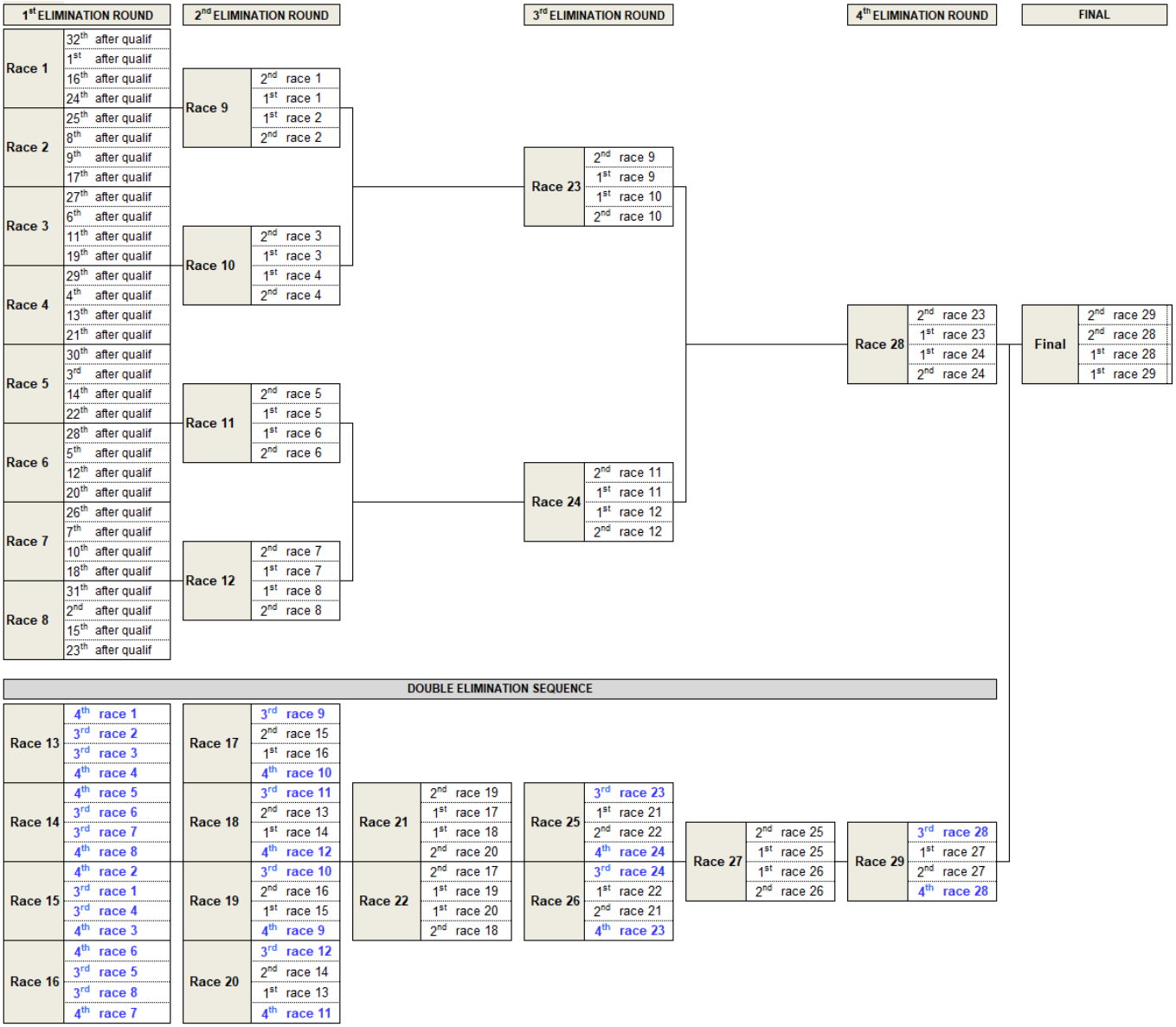
Name of the controller: .....

Signature of the controller:

.....

- ANNEX 2 - Organisation of the elimination stage

1- Organisation



2- Composition of the races for the 1st elimination round

Race 1	Placed 1	Placed 16	Placed 24	Placed 32
Race 2	Placed 8	Placed 9	Placed 17	Placed 25
Race 3	Placed 6	Placed 11	Placed 19	Placed 27
Race 4	Placed 4	Placed 13	Placed 21	Placed 29
Race 5	Placed 3	Placed 14	Placed 22	Placed 30
Race 6	Placed 5	Placed 12	Placed 20	Placed 28
Race 7	Placed 7	Placed 10	Placed 18	Placed 26
Race 8	Placed 2	Placed 15	Placed 23	Placed 31