



*Fédération
Aéronautique
Internationale*

2023 FAI World Drone Racing Championship Sporting Rules

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***The modifications from the original version dated 1st February 2023
are marked with a double line in the right margin of the present document***

The rules for the 2023 World Drone Racing Championship (WDRC) are based on the F9U class rules.

Note: F9U class rules are part of the FAI Sporting Code - Section 4 Aeromodelling - Volume F9 Drone Sport.

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.

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 around one month before the WDRC. After publication, only minor changes of the design will be authorised when duly justified.

2. GENERAL SPECIFICATIONS FOR MODELS

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 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

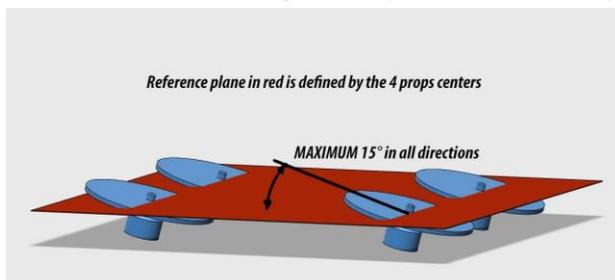
Only electric motors are allowed.

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

Only 2.4 GHz spread spectrum technology RC equipments may be used.

Any type of 2.4 GHz radio module may be installed on the RC equipment (BetaFPV 'ELRS Micro TX Module', Radiomaster 'Ranger 2.4 GHz ELRS Module', TBS 'Tracer Micro TX Starter', ImmersionRC 'Ghost JR Module', etc.).

Note: *Crossfire radio module 868 MHz/915 MHz, or other 900 MHz module will not be allowed unless a specific authorisation had been given by the organiser **prior to the event** to the competitor concerned.*

In any case, the radio module must be set to 100 mW maximum.

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 WDRC may be imposed to the concerned competitor by the contest director, with the consent of the FAI Jury.

2.5. Video system

Analog and digital video devices operated on 5.8 GHz band may be used for piloting.

Note: *It is expected to use the Raceband (band R) corresponding to the following frequencies: 5658 MHz - 5695 MHz - 5732 MHz - 5769 MHz - 5806 MHz - 5843 MHz - 5880 MHz - 5917 MHz.*

All analog and digital video transmitters must be set to 25 mW maximum output power emission.

The video output must be centered on the different Raceband frequencies with a 30 MHz maximum bandwidth.

In addition, the video transmitters will not be authorised to broadcast an additional signal due to the fact it may interference on the analog video receivers.

Any digital video device must be set to 25 Mbps maximum.

For an analog video camera, NTSC will be the only encoding admitted.

The video receiver system provided by the organiser will be compliant with analog and digital video transmitters.

A digital video recorder (DVR) will be provided by the organiser in order to permit to review races as necessary in case of doubt or complaint.

In case of non-authorized activation of a video transmitter, a penalty going up to disqualification from the WDRC may be imposed to the concerned competitor by the contest director, with the consent of the FAI Jury.

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 will be equipped with a LED light device including possibility to choose the colour so that each model in flight has a different colour.

The following specifications must be respected:

- A minimum of 32 RGB LED light bulbs or a minimum length of 280 mm of RGB LED strips with obfuscated light source (such a COB LED). In either scenario, the LED light should be uniformly distributed across all the arms of the model, allowing it to be clearly visible from any angle.
- Required colours: Red - Blue - Green - Pink - Purple - Yellow
- Possibility to easily change the colour before the race (switch, RGB controller, ...).

Note: *In order to improve the understanding of the races by the public and simplify organisation, the colours will be allocated according to the order of the pilots in the race.*

2.7. Identification mark

Each model shall carry 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 competition.

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

In case of an infringement to those rules, the competitor(s) concerned will be disqualified from the WDRC by the contest director with the consent of the FAI Jury.

Before the race, the competitor can change the model in the preparation area. Any technical problem after leaving the preparation area will be considered a race incident with no more possibility to change the model.

4. MODEL PROCESSING

A model processing will be done by the organiser in parallel with the official practice session.

Each competitor can register up to three models.

The organizer will mark each registered model with an easily visible, difficult to falsify identification such as a sticker.

If one of the models registered is lost or destroyed due to causes not applicable to the competitor concerned, the competitor shall have the right to present a replacement model for registration and processing up to one hour before the official starting time of the first qualifying round.

During the competition, on request of the contest director or FAI Jury, any model may be checked by the organizer after the race to ensure it fits the specifications.

A competitor whose model wouldn't be compliant may be disqualified from the WDRC by the contest director, with the consent of the FAI Jury.

5. PRACTICE FLIGHTS

An official practice session will be organised in parallel with the model processing.

The practice session will be organised by groups with four pilots and an allocated flight time for each group of 3 minutes.

Each pilot can do as many circuit laps within the allowed flight time. Once the flight time is over, the pilots still in flight must go immediately to the landing area without finishing the current lap.

In case of a crash, and when the model cannot go on, the model must stay on the ground with motors cut off until the end of the practice session. The competitor cannot request another practice time except if the reason for the crash cannot be attributed to him.

Practice flights on the venue other than those authorised by the organiser are strictly forbidden under threat of being disqualified from the WDRC by the contest director, with the consent of the FAI Jury.

6. ORGANISATION OF THE COMPETITION

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

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

Each round for the qualification stage and the elimination stage is organized by groups (subdivision of the round corresponding to the number of pilots flying at the same time in the same race).

6.1. Timekeeping

Timekeeping will be done with an electronic timing system with appropriate redundancy in order to ensure complete and permanent reliability of the timekeeping.

Except for the qualifying stage, timekeeping is triggered at the start of the race.

For the qualifying stage, timekeeping is triggered for each model when the model passes the gate equipped with the timekeeping sensor(s). After taking off from the start area, the model must go directly to the gate equipped with the timekeeping sensor(s).

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, 'Pilots arm your quads' will be clearly announced.
- About three 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 there has been a technical problem with the start signal. Before the restart, the pilots will be given the opportunity to change the battery pack on their model.

If one or more pilots starts before the start signal (model not touching any point of its start area) the race will not be stopped, and the concerned pilots will be disqualified from the race.

6.3. Qualification stage

Each competitor will be entitled to participate to 3 (three) qualification rounds.

Considering the number of competitors registered, the qualification rounds will be organised, as much as possible, with 5 (five) competitors per group. Composition and flight order of the groups will be determined with a draw. The draw will be different for each qualifying round.

Each qualification round will be done with a maximum allocated flying time of 3 (three) minutes.

After the start, 3 (three) consecutive laps will be timed.

When the competitor has completed three laps or when the three minutes allocated time is over, he(he) must land the model.

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

Any race with less than the expected number of competitors, for example due to competitor(s) withdrawal, will be moved at the end of the qualifying round concerned in order to complete the race with competitor(s) that have been granted a reflight. If necessary, the last races 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 (three) competitors for the races concerned.

The result of each competitor for the qualification stage will be the average of the 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 5th 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 three times, competitors getting only two times to perform one valid circuit lap will be considered taking in account the average of their two times. If it is still not sufficient, competitors getting only 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

64 competitors will be selected from the qualification stage for the elimination stage.

All elimination rounds will be organised with 4 (four) pilots per group.

Races will be run on 3 (three) laps for all rounds of the elimination stage unless specified differently due to an exceptional circumstance.

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

6.5. Additional rounds sequence

All competitors not selected for the elimination stage (competitors placed over 64 in the qualification stage ranking) will be entitled to participate to 2 (two) additional rounds to determine their final placing from the 65th place to the end.

Considering the number of competitors expected for that sequence, the additional rounds will be organised, as much as possible, with 5 (five) competitors per group.

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

Each additional round will be done with a maximum allocated flying time of 3 (three) minutes.

After the start, 3 (three) consecutive laps will be timed.

When the competitor has completed three laps or when the three minutes allocated time is over, he/she must land the model.

Any race with less than the expected number of competitors, for example due to competitor(s) withdrawal, will be moved at the end of the additional round concerned. If necessary, the last races of the additional 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 (three) competitors for the races concerned.

The placing for the additional rounds sequence will be done taking in account for each competitor his/her best registered time to complete three consecutive laps.

The registered time to complete two consecutive laps will be considered for the placing of the competitors who did not succeed to complete three consecutive laps. For those who did not succeed to complete two consecutive laps, it will be considered the registered time for their first lap.

Competitors with three consecutive laps will be placed ahead of competitors with two consecutive laps, which in turn are ranked ahead of competitors with one lap only. Competitors which have not been in situation to complete one lap will be placed at the end.

In case of ties, the placing in the provisional ranking established at the end of the qualifying stage will be considered to split the tie for the concerned competitors.

6.6. Final stage

Three finals will be planned: Overall Final - Junior final - Women final. Each final will be run with a single race on 3 (three) laps unless specified differently due to an exceptional circumstance.

In any final race, 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.

Overall final

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 to determine their final ranking from 1st to 4th place.

Junior final

A Junior final will be organised subject junior competitors from at least four nations participate to the WDRC.

The four best placed juniors in the overall individual classification are selected for this final to determine their final ranking from 1st to 4th for the junior individual classification.

Note: The Junior final will not be organised if more than 2 (two) juniors are selected for the overall final. In that situation, the juniors participating in the overall final will be placed in the junior classification considering their ranking in the overall final; the other junior(s) will be placed considering their ranking in the overall individual classification.

Women final

A Women final will be organised subject female competitors from at least four nations participate to the WDRC.

The four best placed women in the overall individual classification are selected for this final to determine their final ranking from 1st to 4th for the women individual classification.

Note: The Women final will not be organised if more than 2 (two) women are selected for the overall final. In that situation, the women participating in the overall final will be placed in the women classification considering their ranking in the overall final; the other women will be placed considering their ranking in the overall individual classification.

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 by the starter, and how to proceed.

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 a pilot does not fly on the expected way (does not cross an obstacle, misses a pylon or flag, does a circuit cut ...) the corresponding circuit lap will not be validated. The pilot may try to execute immediately and on a safe manner a manoeuvre to correct the mistake.

If the pilot corrects its mistake, the lap will be validated.

If during this manoeuvre the pilot has a collision with another model, the pilot will be disqualified for the race.

7.3. Disqualification from the race

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

- Start before the start signal (See 6.2).
- Collision with another model when executing a manoeuvre to correct a mistake (See 7.2).
- Circuit exit (crossing of the safety line).
- Celebratory manoeuvre, especially after the pilot finishes.
- Hazardous piloting or safety compromised.

The disqualification is decided by the race director or, where applicable, by the judge assigned to the concerned pilot.

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.

Pilot(s) disqualified will be placed for the race after the other pilots. In case more than one pilot is disqualified from the race, the pilots concerned will be placed taking into account the qualification stage ranking.

If a pilot disqualified from a race is considered not being sufficiently cooperative to land, the concerned pilot may be disqualified from the event by the event director with the consent of the Jury.

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 indicate that he/she stopped the race by putting off his/her headset google.

The pilot and the helper must then stay quiet in their position until the race is finished for all pilots.

7.5. Safety occurrence

A pilot can be requested to stop to fly 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 case of a serious safety issue, the race director may decide to stop the race and disqualify the pilot(s) eventually responsible of the safety issue. A restart of the race will be done for the pilots who had not been disqualified and were still in the air when the safety issue occurred.

8. REFLIGHTS

Possibility of an individual reflight will only be considered for the qualification stage.

Note: For a video issue, indisputable evidence must be available especially when the pilot concerned had not used the video available from the organiser' receiver.

The reflights will be organised at the end of the qualifying round concerned, or as part of any race that have fewer than the required number of competitors.

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

For the rest of the competition (elimination stage, additional rounds sequence, final stage), individual reflights will not be awarded. In that situation, video issue or collision with another model will be considered as race incidents with no reflight possibility.

9. FINAL CLASSIFICATION

9.1. Overall individual classification

The individual overall classification concerns all competitors (including juniors and women) and will be established as described in the following table.

| Place | |
|---------------|--|
| 1 | 1 st in final |
| 2 | 2 nd in final |
| 3 | 3 rd in final |
| 4 | 4 th in final |
| 5 | 3 rd in race 61 |
| 6 | 4 th in race 61 |
| 7 | 3 rd in race 59 |
| 8 | 4 th in race 59 |
| 9 to 12 | 3 rd and 4 th in races 57 and 58 with final placing according to provisional ranking after qualifying stage |
| 13 to 16 | 3 rd and 4 th in races 53 and 54 with final placing according to provisional ranking after qualifying stage |
| 17 to 24 | 3 rd and 4 th in races 49 to 52 with final placing according to provisional ranking after qualifying stage |
| 25 to 32 | 3 rd and 4 th in races 41 to 44 with final placing according to provisional ranking after qualifying stage |
| 33 to 48 | 3 rd and 4 th in races 33 to 40 with final placing according to provisional ranking after qualifying stage |
| 49 to 64 | 3 rd and 4 th in races 25 to 32 with final placing according to provisional ranking after qualifying stage |
| 65 and beyond | Placing resulting from the additional rounds sequence. In case of ties, provisional ranking after qualifying stage will be considered to split the tie for the concerned competitors. |

9.2. Junior individual classification

The junior individual classification will be done considering:

- placing in the junior final (or in the overall final) for the concerned juniors;
- ranking in the overall individual classification for the other juniors.

Note: According to the Volume CIAM General Rules paragraph C.15.6.1 b), the title of Junior World Champion will be awarded only if junior competitors from at least four different nations participate.

9.3. Women individual classification

The women individual classification will be done considering:

- placing in the women final (or in the overall final) for the concerned women;
- ranking in the overall individual placing for the other women.

Note: According to the Volume CIAM General Rules paragraph C.15.6.1 c), the title of Women World Champion will be awarded only if female competitors from at least four nations participate.

9.4. National team classification

The national team classification will be established by adding together the numerical final placing of the three best placed members of each national team considering the overall individual classification **without taking in account the individual competitors**.

Teams will be ranked from the lowest numerical places to the highest, with complete three competitors' teams ahead of two competitor teams, which in turn are ranked ahead of one competitor teams.

In the case of a tie, the best individual placing decides to split the tie for the concerned national teams.

10. FAI Jury and judges

10.1. FAI Jury

The FAI Jury will be appointed according to the Volume CIAM General Rules paragraphs C.7.1 and C.7.2. The three members of the FAI Jury shall be of different nationalities.

10.2. Judges

In each race, each pilot will be scored by a judge. The judge will have a video device allowing to follow the flight of his(her) assigned pilot, sharing the same picture as the pilot.

The judge will monitor that the pilot follows the circuit and crosses every gate and obstacle correctly. He(she) will notify the competitor or the helper the infractions or other relevant information noted during the race. The notifications other than a disqualification will be addressed when the race is finished.

Note: In case of disqualification, the number of circuit laps completed at the moment of the disqualification will be communicated by the judge to the concerned pilot and recorded.

A supervisor judge will be also appointed.

11. INTERRUPTION OF THE COMPETITION

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

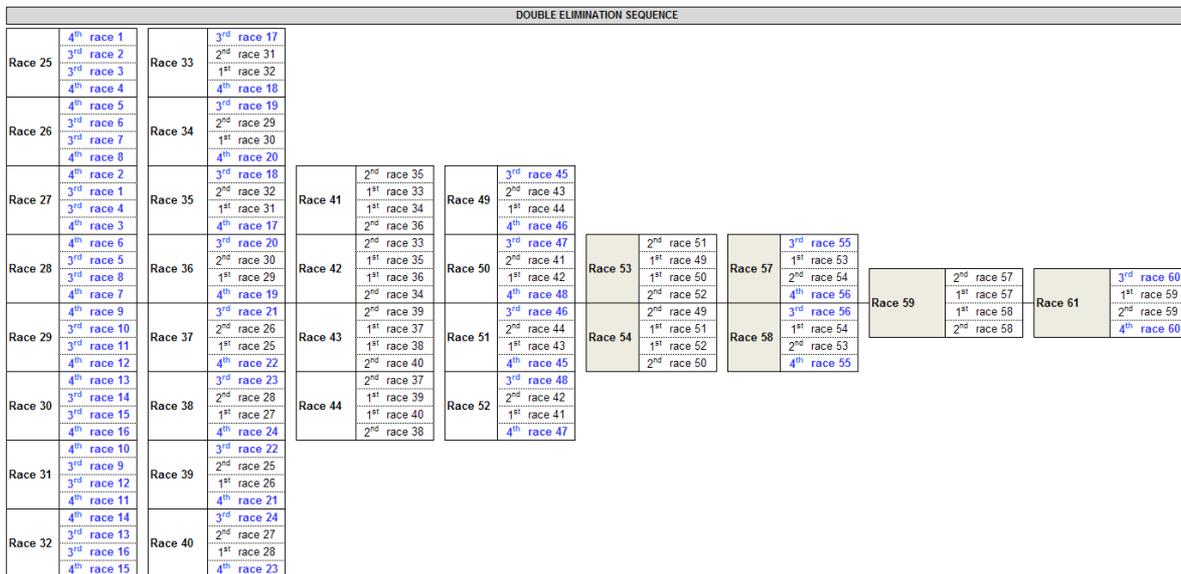
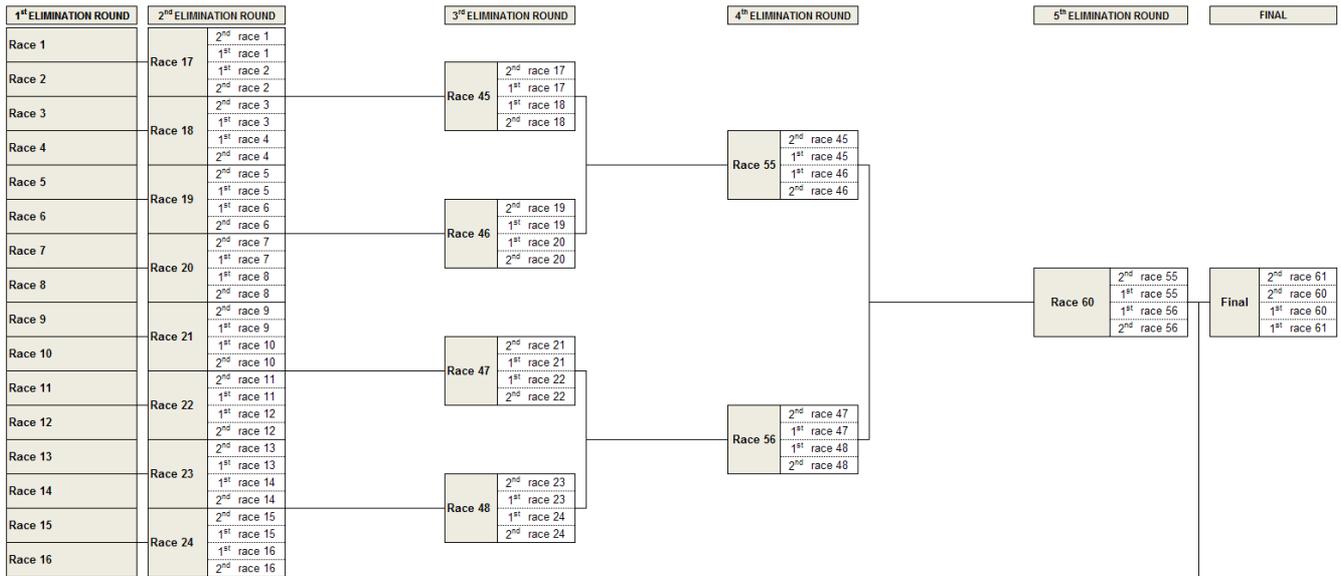
- Wind continuously stronger than 9 m/s measured at 2 m above the ground near the preparation area for at least one (1) minute.
- Due to atmospheric conditions (rain, stormy condition,...) in which it would be dangerous to continue to fly.
- Other exceptional circumstances such as for example incident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

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

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

- ANNEX - Organisation of the elimination stage

1- Organisation



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

| | | | | |
|---------|-----------|-----------|-----------|-----------|
| Race 1 | Placed 1 | Placed 17 | Placed 33 | Placed 49 |
| Race 2 | Placed 16 | Placed 32 | Placed 48 | Placed 64 |
| Race 3 | Placed 8 | Placed 24 | Placed 40 | Placed 56 |
| Race 4 | Placed 14 | Placed 30 | Placed 46 | Placed 62 |
| Race 5 | Placed 4 | Placed 20 | Placed 36 | Placed 52 |
| Race 6 | Placed 12 | Placed 28 | Placed 44 | Placed 60 |
| Race 7 | Placed 6 | Placed 22 | Placed 38 | Placed 54 |
| Race 8 | Placed 10 | Placed 26 | Placed 42 | Placed 58 |
| Race 9 | Placed 9 | Placed 25 | Placed 41 | Placed 57 |
| Race 10 | Placed 5 | Placed 21 | Placed 37 | Placed 53 |
| Race 11 | Placed 11 | Placed 27 | Placed 43 | Placed 59 |
| Race 12 | Placed 3 | Placed 19 | Placed 35 | Placed 51 |
| Race 13 | Placed 13 | Placed 29 | Placed 45 | Placed 61 |
| Race 14 | Placed 7 | Placed 23 | Placed 39 | Placed 55 |
| Race 15 | Placed 15 | Placed 31 | Placed 47 | Placed 63 |
| Race 16 | Placed 2 | Placed 18 | Placed 34 | Placed 50 |