## 4.3 CLASS F2C - TEAM RACING MODEL AIRCRAFT

### 4.3.1. Team Racing Event

A team racing event is a contest where all races start with three model aircraft (hereinafter called 'the model') except when, in exceptional cases, a race may begin with two or one model(s). The models are flown simultaneously in the same circuit, for a specified number of laps. The competitor's contest result is determined by a series of qualifying, semi-final, and final race times. The conduct of the contest is controlled by a Panel of Judges (hereinafter called 'the Judges'). The Judges may use video recording equipment, located in the Judge's Tower, to monitor the pilots and the pilot circle. At the discretion of the Judges this official recorded video can be used, after the race, as a judging aid.

Specific requirements include:

a) Team

i Each team consists of one pilot and one mechanic. No member of a team may be a member of another team.

ii The pilot's only function is to control the model and during the race, while his model's engine is running, he must remain in the centre circle.

iii The mechanic's only function is to fuel, adjust, and start the model's engine and during the race he must remain outside the flight circle. The engine must be started by flicking the propeller by hand.

iv During practice and races, the mechanic must wear a safety helmet, with a fastened chinstrap, strong enough to withstand the impact of a flying model. The pilot must have a safety strap connecting his wrist to the control handle.

b) Race

i Qualifying and semi-final races are of 100 laps duration and the final race is of 200 laps duration. Each model must land at least once during the race for refuelling.

ii Each team's race begins with a 'start' signal and finishes when the first condition of the five listed below is met:

a) All models have completed the required laps, or

b) the team is unable to continue racing, or

c) the team has been disqualified, or

d) when the judges declare "Stop racing – safety" or

e) the race maximum time limit has been reached.

iii The maximum time limit of a race is 6 minutes for qualifying and semi-final races, and 12 minutes for the final race.

iv Each team's result is registered for that race.

### 4.3.2. Team Racing Site

a) A team racing site consists of four concentric circles marked, in contrasting colour, on a flat, prepared surface of concrete, asphalt, terrazzo, etc as described in Annex 4F- the Control line organisers guide.

b) The flight circle is a 19.6 m radius solid line that defines the model's 'landing zone' (Centre Line of model inside the circle) and the model's 'pitting areas' (outside the circle). The circle is divided into six equally-spaced (60 degrees apart) sectors with each sector marked by two lines, one metre apart, on the outside of the flight circle to define the six 'pitting areas'.

c) The safety circle is a 19.1 m radius broken line that defines the point beyond which the pitman is not permitted to reach to retrieve a model.

d) The centre circle is a 3 m radius solid line: the pilots may not put a foot outside the line except during the start and at pit stops. The centre of this circle shall be marked with a reference contrasting colour spot of 0.3 m diameter.

e) The inner circle is a 2 m radius broken line (marked in a contrasting colour to the centre circle) that is a reference circle for the pilots.

f) Prior to the start of the contest, the Judges shall verify the dimensions of all the circle markings and announce to the competitors any variations from the requirements and their interpretations of the variations.

4.3.3. **Team Racing Model, Engine and Control System**

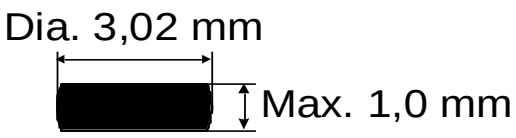
A team racing model is an aircraft with thrust provided by a piston engine, lift provided by fixed aerodynamic surface(s), and pitch control provided by movable aerodynamic surfaces (elevator).

4.3.3.1 The engine characteristics shall be:

a) A maximum swept volume of 2.5 $cm^3$.

b) Naturally aspirated via a single round venturi with a maximum inside diameter of 3 mm.

c) The venturi diameter shall be checked with a simple no-go plug gauge, per the following sketch




d) Any interconnecting chamber between the air intake and the induction port of the motor shall have a maximum volume of 1.25 $cm^3$. No intentional air leakage is allowed between the venturi and the crankcase and there shall be no supplementary air induction except for sub piston induction to a maximum height of 0.6 mm at the exhaust port. A single round supplementary fuel jet with a maximum diameter of 0.4 mm may be used between the venturi and the induction port of the engine.

e) The maximum exhaust outlet area is 60 $mm^2$ projected at the cylinder exhaust port or crankcase exhaust outlet whichever is smaller. If a silencer is used the exhaust outlet measurement is taken at the exhaust outlet end of the silencer. The piston face at the exhaust outlet shall not be visible from the exterior of the model when side or front exhaust engines are used.

4.3.3.2 The model characteristics shall be:

a) A minimum total projected surface area of 12 $dm^2$.

b) A maximum model weight of 500 g, including engine, shut-off/fuel tank and propeller but without fuel.

c) The minimum dimensions of the model fuselage at the top of the cockpit shall be:

height = 100 mm

width = 50 mm

cross-sectional area = 39 $cm^2$

Wing fillets shall not be included in the fuselage cross-sectional area.

If an exhaust silencer system is partly recessed into the fuselage, then the fuselage cross-section shall be measured with an imaginary outline of the cross-section as if there was no cut out for the exhaust silencer system.

d) The presence of a cockpit or cabin with a clear or painted windshield.

e) The minimum diameter of wheels shall be 25 mm.

The use of metal rimmed wheels is forbidden.

f) The maximum volume of fuel and oil permitted into a single tank is 7 $cm^3$.

g) The direction of model flight is anti-clockwise.

h) The Engine must be entirely enclosed within the fuselage except for the necessary openings to allow for engine air induction, compression, fuel rate adjustment, fuel filler and overflow tubes and cylinder cooling air intake and exhaust. The engine may be visible through these openings. Compression, fuel rate controls and fuel filler and overflow tubes and silencer (if fitted) may extend outside the fuselage.

i) The landing gear shall permit normal take-off and landing. It may be retractable during flight but must return to its extended position before landing.

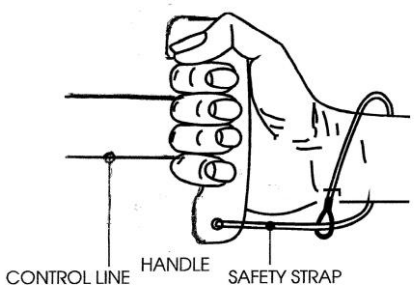
j) The fuel tank, tubing, and any associated filling/shut-off valves shall be accessible for accurate total volume measurement. A model will be disqualified if the organisers do not consider the system to be accessible or accurately measurable.

k) The model must be equipped with an effective pilot-actuated engine-stopping device.

l) The control system shall consist of two 0.35 mm diameter solid steel lines (minus tolerance of 0.011 mm allowed) or two 0.35 mm diameter stranded (minimum three equal diameter steel strands) lines (no minus tolerance allowed) connected to a pilot's control handle. The flying line length is 15.92 m (-0 mm/+25 mm tolerances allowed), measured from the centre of the control handle to the axis of the propeller.

m) A flexible 'line grouper' may be fixed to the wing at the point of exit of the flying line but may extend no more than 20 mm beyond the end of the wing. The control handle shall be constructed with the distance between the centre of the handle grip and the point of flying line flexibility no greater than 40 mm. Another 'line grouper' is permitted to link the lines together less than 300 mm from the centre of the control handle.

n) A safety strap connecting the competitor's wrist to the control handle must be provided by the Competitor and worn at all times while his model aircraft is flying. The strap should be as shown in the sketch ie. it should be attached to the wrist with a loop and sliding knot so that if the handle is released it will tighten itself securely around the wrist. The point of attachment at the handle is up to the discretion of the pilot.




HAND AND SAFETY STRAP FIGURE

4.3.3.3 The general model and engine requirements shall be:

a) The model aircraft must remain complete as defined in the whole of this paragraph 4.3.3 throughout the full race.

b) A team's models and engines shall not be used by other competitors in the same event.

c) Rule B.3.1.a) of Section 4B does not apply to class F2C

4.3.4. **Technical Checks**

All dimensional/visual characteristics (noted in paragraph 4.3.3 above) of each model, engine, and tank to be used in a contest shall be verified by the organisers with detail consideration noted below:

a) All fuel tanks shall have their capacities checked by an accurate visual examination of the volume of the fuel put into the tank and all connecting tubing and over-flow pipes. The check shall be made prior to the contest, after the final, and may be made after each race as determined by the organisers. The minimum reading accuracy of the checking system shall be 0.10 $cm^3$ and only two checks are permitted to prove compliance in the official processing period or at any subsequent checking.

b) The flying line length shall be measured before each race. A load sufficient to remove only the slack from the lines may be applied during the flying line length check.

c) Both flying lines shall be checked for diameter at three locations along the length of the lines, prior to each race, using an instrument which complies with the specification in paragraph 8.1 of the F2 Organiser's Guide.

d) The control system shall be checked for strength before each race by applying a tension load between the model and the control handle grip equal to a minimum of 30 times the weight of the model and a maximum of 140 N using an instrument with a maximum reading accuracy of 1.0 N. Before each race a separate test shall be made between the wrist strap and the control handle to the same standard.

e) Prior to each race the flying lines shall be checked to verify that there is no intentional twisting and/or linking of the two control lines from the point of exit of the model and a point 300 mm from the control handle.

f) The engine capacity and exhaust area shall be verified prior to the contest, after the final race, and may be checked after each race, as determined by the organisers.

g) If the engine has an integral head or extremely tight fitting piston/liner assembly, the team must provide tooling to allow the crankshaft stroke to be measured accurately. Measuring instruments shall comply with the specifications in paragraph 8.1 of the F2 Organiser's Guide

4.3.5. **Organisation of Races.**

a) The three teams in each round of qualifying and semi-final races shall be determined by a blind draw. Contest organisers shall, where necessary, determine the mechanism that ensures that there is only one team of any nation in the same qualifying or semi-final race. Races with fewer than three teams will be put at the end of the draw, in order to allow a 3-team race with teams that have been granted a re-flight in that round.

b) When a qualifying race does not contain three teams per rule 4.3.5.a), the judges shall ask for volunteers (from different nations in the case of ~~World Cup competitions or~~ World/Continental Championships) to allow the remaining race to start with three teams.

If there are sufficient or more, volunteers for a qualifying race, the Judges shall conduct a blind draw to start the race with three teams and shall conduct a separate draw for the segment choice order. The volunteer team(s) shall not be eligible to have a time registered or to be granted a re-flight from this race.

If there are insufficient volunteers, the competing team(s) will be allowed to start the race with fewer than three teams to complete their qualifying or semi-final race.

c) Before entering the circle, teams may run their engines under the contest organiser's supervision so as not to interfere with the starting procedure of a race. Mechanics shall not walk with a running engine.

d) In the event of unsuitable weather conditions (such as strong winds, unacceptable air temperature, rain, or snow) that would lead to unacceptable sporting results (paragraph B.15.1.d of the ABR Volume of the Sporting Code) the F2C Contest Director or the Judges may postpone races or prematurely end the contest.

4.3.6. **Race from Start to Finish.**

a) The teams enter the flying circle at the invitation of the Judges. One 'observer' or Team Manager may enter with each team to provide verbal assistance but shall not render any physical help to the mechanic during the race.

b) The teams select their pitting areas for qualifying and semi-final races in the order of the race draw. The chosen pitting areas are considered occupied until the race is finished and teams are not permitted to change their selected pitting segment after the start of the warm-up period.

For the final race, the selection of the pitting areas shall be according to the times achieved in the semi-finals races with the lowest time choosing first. In the case of a tie, the teams' second best semi-final results shall decide the order of choice.

c) The teams may not start their engines prior to the 90 seconds engine(s) warm-up period unless otherwise directed by the Circle Marshal.

d) The Circle Marshal signals (visually and orally) the start of the 90 seconds engine warm up period. A second signal (visual and oral) announces the end of the warming-up period and the Circle Marshall orders the mechanics to stop engines.

e) The next 30 seconds are allowed for final preparations and the Circle Marshal announces the final ten seconds and then orally counts down the last five seconds to the start. For the last three seconds of the countdown, and at the starting signal, the mechanics must be standing erect and the pilots must be crouching on the border of the centre circle (one foot outside the centre circle), with one hand touching the ground and with their control handles as close to the ground as defined by the Judges.

f) A "sharp" starting signal (visual and oral) must be given by the Circle Marshal to enable accurate timing.

g) The models must fly at a normal height, between two and three metres, except when overtaking, taking off or landing.

h) The correct piloting technique is to walk a circle at the centre of the 3 m centre circle with centre of this circle remaining at the extremity of the pilots' left shoulders except when allowing space for an overtaking pilot (Fig 4.3.6.i).

i) The walking circle should be as small as possible, so that the controlling handle moves forward in the direction of the model. and

i) the pilot's handle is positioned in the centre line of the pilot's body. The handle is allowed to move vertically on this line as long as it does not move more than 30 cm out from the chest of the pilot nor be pulled back over the pilots head in an attempt to shorten the radius of the model's path. (An exception is allowed for 3 laps when taking off, landing or overtaking), and

ii) the lines are perpendicular to the pilot's shoulders. When the pilot is positioned correctly the lines form a tangent to the pilots' walking circle (Fig 4.3.6.i)., and

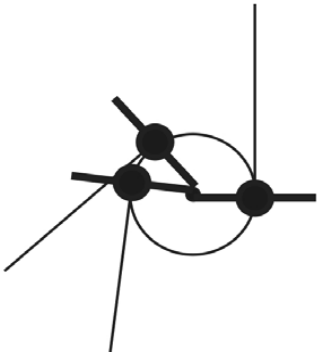


Fig 4.3.6.i

iii) the pilot must stand in an upright position. He must not lean backwards in an attempt to shorten the radius of the model's path or block an overtaking pilot, and

iv) the pilot's non flying arm should remain by his side or slightly forward. He should not hold or obstruct another pilot.

j) Overtaking must be carried out by over flying, with the model's altitude at a maximum height of 6 metres. The pilot being overtaken must not carry out any manoeuvre to impede the overtaking competitor or his model and must leave space for the overtaking pilot when the overtaking is finished.

k) The model is allowed to fly a maximum of two consecutive laps without the motor running.

l) Landings must take place with the centre line of the model inside the flight circle. A landing model has right-of-way priority over stationary or 'taking off' models.

m) The model must land, with its motor stopped, before the mechanic is allowed to catch it.

n) After the mechanic has caught the model, he must go to the nearest free pitting area from the point at which the model was stopped.

o) Prior to the start of the race and during pit stops, the pilot must be crouching at the edge of the centre circle with one hand on the ground, only one foot outside the centre circle and his handle and lines as close to the ground as defined by the judges. When the mechanic releases the model the pilot must proceed toward the centre of the circle and merge with the other pilot still flying. At all other times the pilots must remain inside the centre circle.

p) During the re-fuelling and re-starting of the motor, the mechanic must keep the model in contact with the ground by at least one point and with the model's centre line outside the flight circle. If engine adjustments are necessary the model is permitted to be off the ground by a maximum of 250 mm.

q) When a team has finished the race, is disqualified, or when it cannot otherwise continue, the pilot must sit down or crouch outside the centre circle as long as the other competitors are still engaged in the race, unless the Circle Marshal allows him to leave the circle earlier.

r) When a team cannot finish the race and its model is in a position where it may obstruct other teams, the pilot must immediately clear the model to a safe location.

s) The race is finished as defined in paragraph 4.3.1.b) above.

4.3.7. **Definitions of Official Flight and Re-flight**

Any team in any race, that is not granted a re-flight, records an official flight.

Re-flights may be granted as follows:

a) In a qualifying or semi-final race when any team which suffers a significant time penalty through an act of obstruction or collision, for which that team was not responsible.

b) In a qualifying or semi-final race when only a single team is able to continue and before any team has completed 50 laps.

c) In a final race when one, or more teams, is unable to continue because of an obstruction or collision and before any team has completed 100 laps The final shall be stopped and all teams that have not been disqualified as a result of the obstruction or collision or prior to the stoppage.

d) When any team has its protest against disqualification upheld.

e) When any team retires from a drawn race prior to the start of the warm-up period.

A team that has been granted a re-flight is allowed to participate in another race.

4.3.8. **Warnings, Disqualifications and Penalties**

Warnings and disqualifications are given at the discretion of the Judges when infringements to the normal race procedure occur that involve safety, disadvantage, or advantage. Each warning or disqualification shall be notified both visually and orally to the team concerned.

4.3.8.1 A team may be warned if:

a) Either member of a team carries out a potentially dangerous action.

b) Either member of a team interrupts or obstructs another team.

c) Either member of a team carries out any action that unfairly improves their race time.

Typical examples of warning infringements are:

a) When a pilot interferes with or obstructs another pilot either by his conduct in the circle, or by a manoeuvre of his model preventing another model aircraft from flying or landing normally.

b) When a pilot, instead of walking around the centre, stands in the same place or walks backwards or continuously keeps the centre spot of the circle between him and his model.

c) When the pilot's flying style does not conform to 4.3.6.i).

d) When a pilot applies physical effort to increase the speed of his model during the official flight.

e) When the height levels of -flight prescribed by the rules are exceeded.

f) When during the start of the race or during the pit stops, the pilot does not have one hand on the ground, or the control handle and the lines are not as close to the ground as defined by the judges.

g) When the pilot does not leave space in the centre circle for an overtaking pilot when the overtaking is finished.

h) When a mechanic:

- services the model with its centre line inside the flight circle;
- does not keep the model in contact with the ground by at least one point during normal servicing;
- lifts the model higher than 250 mm above the ground during adjustment

i) When the mechanic is not standing erect at the start signal.

A penalty of 5 seconds shall be added to the race time of a team starting the engine before the start signal.

4.3.8.2 A team may be disqualified if:

a) Either member of a team carries out a dangerous action.

b) Either member of a team causes a collision or obstruction that ends another team's race.

c) The Team Manager or observer carries out any physical action that materially affects the race result.

d) For any other flagrant breach of the rules.

Other typical examples of disqualification infringements are:

d) When the pilot puts a foot outside the centre circle before the mechanic has taken hold of the landing model.

e) When the model lands outside of the flight circle. (Landing is defined as the first point of contact between the wheel and the ground)

f) When the centre line of the model is outside the flight circle before the mechanic has caught the model.

g) When the mechanic steps inside the flight circle line or reaches inside the safety circle line.

h) When the mechanic retrieves his model by any device.

i) When overtaking is carried out by passing under the slower model provided the slower model flying height complies with rule 4.3.6.g.

j) When the pilot performs an extreme manoeuvre to overtake another model.

k) When jettisoning occurs or the model and other equipment is not in the condition as stated in 4.3.3. throughout the race.

l) When the model flies more than two laps with the motor stopped.

m) When the model is recovered with the motor running or prior to touch down with the motor stopped.

n) When after its model has been processed, the competing team uses parts or elements not checked and registered to that team during the processing. If the team has modifies its model by changing the characteristics or specifications imposed by the rules this may lead to the application of penalties as stated in the General Section of the Sporting Code.

o) When the mechanic does not act according to 4.3.6.n.

p) When the team accumulates three warnings during a qualifying or semi-final race or four warnings in a final.

In the final race a penalty of 5 seconds shall be added to the race time of a team that has been given a third warning.

Note: When a team that has been disqualified and is instructed to land its model, the pilot must land the model within 10 laps. If the team continues to fly on and further interferes with the remaining teams the judges can recommend that the team be disqualified from the whole contest.

4.3.9. **Team Qualification**

a) The team race competition shall have either three rounds of qualifying races, two rounds of semi-final races, and a final race or four rounds of qualifying races and a final race. Each competing team must take part in at least one qualifying race to progress to either the semi-finals or final race.

b) The number of teams advancing to the semi-final races will depend upon the total number of teams entered in the competition, based on best single result.

| Number of entered teams | Number of semi-finalists |
|---|---|
| 2 to 8 | 0 |
| 9 to 11 | 6 |
| 12 to 39 | 9 |
| 40 or more | 12 |

When semi-final races cannot be started with three teams, the numbers will be made up by advancing teams with the next best qualifying race times. Teams advanced to the semi-finals shall not be granted a re-flight but any registered flight times shall be eligible for classification.

c) In the case of a tie amongst the teams advancing to the semi-final races, or the final race (when no semi-final races are run) the next best qualifying race times for the teams will be taken into account, and so on, until the tie is broken. If after this, there is still a tie between some teams, new qualifying race(s) will be organised between these teams until the correct number of teams advance.

d) The teams who register the three best semi-final race times shall advance to the final race. When no semi-final races are run, the teams who register the three best qualifying race times shall advance to the final race. When fewer than three teams are either willing or able to take their place in the final, the number shall be made up by advancing the next best results from the semi-finals or qualifying flights as appropriate (this rule shall not apply where a final race is re-started with less than the three original teams).

e) A specific junior final will be flown if three or more junior teams have recorded a time in the qualifying races. The result of this junior final will be taken into account only for the specific junior classification, and will not change the general placing.

4.3.10. **Team Classification.**

a) Following a successful post-final race technical check in accordance with paragraph 4.3.4.a) and g), the teams that participated in the final race shall be placed at the head of the classification, using their final race times. In the case of a tie in the final race, the tie break will be determined by descending order of best semi-final, second best semi-final, and best qualifying race and so on until the tie is broken. If more than one team is disqualified in the final race, those teams shall be classified in order based on number of legal laps completed.

Note: The judges' decision to disqualify must be communicated to the lap counters to record the number of "legal" laps.

b) Teams that participated in the semi-final races, but did not advance to the final race, shall be classified next in order of their single best semi-final race times.

c) Teams that did not advance to the semi-final races shall then be classified in order of their single best qualifying race times.

d) Teams that completed no qualifying race shall then be classified in order based on numbers of laps completed.

e) A disqualified team shall always be classified after any team that has retired without a disqualification.

4.3.11**. National Team Classification.**

National team classification is established by adding the numerical classification position of each individual team. The national team with the lowest total is ranked first, etc with complete 3-team national teams ahead of 2-team national teams, etc. In case of a national team tie, the best individual team placing shall be used as a tie break. The defending champion's classification position shall not count toward a national team's classification unless he is part of the 3-team national team.

4.3.12. **Timekeepers**

a) Three timekeepers shall be assigned to each team in each race. They shall be positioned outside the flight circle, near the pitting area of the model which they are assigned to time. They are responsible for counting the laps of the model during the race and timing the race. They shall be equipped with mechanical lap counters and electronic stopwatches registering at least 1/100th second, with a minimum timing limit of 15 minutes. The stopwatches may be replaced or complemented by a computerised timing system of equal or better accuracy.

b) The time for the flight shall be calculated as defined below:

i) If all three watches record a time, a maximum tolerance of 0.18 seconds is allowed between the middle watch time and each of the two other watch times (lower and higher ones). If all recorded times are within the defined tolerance, the time for the flight shall be the average of the three watch times.

ii) If one stopwatch differs from the closer of the other two by more than 0.18 seconds, then the average time shall be calculated from the other two watch times.

iii) If both the lower and upper recorded times exceed the tolerance, the team shall be given the choice between having a re-flight or accepting the middle time as the time for the flight. Once the team has made its choice, the decision is irreversible.

iv) If only two watches record a time and they are within the 0.18 second tolerance, the time for the flight shall be the average of the two watch times.

v) If only two watches have a time and they are not within the 0.18 second tolerance, the team shall be notified. The team may accept the higher of the two watch times or be granted a re-flight. Once the team has made its choice, the decision is irreversible.

vi) If only one watch has a time, the team shall be notified. The team may accept the single time or be granted a re-flight. Once the team has made its choice, the decision is irreversible.

vii) If all watches fail, there will be no recorded time, the team shall be notified and granted a re-flight.

viii) The time retained will be made up to the next upper 1/10th second.

ix) All problems about timing must be reported to the F2C Chief Judge without delay.

4.3.13. **F2C Panel of Judges**

a) The contest organisers shall appoint three Judges, from the list of CIAM-approved judges proposed by the National Air Sport Controls. Each Judge shall have had proven proficiency and recent experience in international competition and judging at that contest's standard. The Judges shall have a working understanding of a common language. At World and Continental Championships, and other limited entry international competitions, the Judges shall be of different nationalities. In open international competitions, the Judges shall be of at least two nationalities and two of them shall be approved by CIAM.

a) The Judges are responsible for observing the conduct of each team during each race.

b) Notice of warnings and disqualification are given by loudspeaker announcement and coloured lights:

Green light - First warning (first offence)

Amber light - Second warning (renewal of the first offence or a new offence)

Red light - Third warning (renewal of previous offences or a new offence) and disqualification (in qualifying and semi-final races).

For the final only, a team shall be disqualified after a fourth offence, (renewal of previous offences or a new offence) by the judges verbally announcing "(Team Colour) - fourth offence. Disqualified".

In addition, a second set of lights, corresponding to the team colours, shall be provided. Upon the announcement of the fourth warning in a final race, the appropriate light for the disqualified team shall be displayed.

Note: The Team Race Judges' Guide is at Annex 4C.

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