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ANNEX 5C

F3M R/C LARGE AEROBATIC AIRCRAFT OFFICIAL FLYING AND JUDGING GUIDE

5C.1. Purpose:

The purpose of this R/C Large Aerobatic Aircraft Flying and Judging Guide is to provide an accurate description of each type of figure used in competition and to provide a reference for use in developing a uniformly high standard of judging in all CIAM sanctioned contests. Study of this guide by the competitor will help him or her learn exactly what is expected, while study by the judges will help them decide precisely how well the competitor meets these expectations.

Flying and judging are very similar in nature. This is why contestant judging is generally promoted. Nevertheless, there are some key differences between judges and pilots, mostly related to Mental Attitude and Technical Knowledge. Reference to any gender in this document shall include both male and female.

5C.2. Mental attitude: Mental attitude by itself can be divided into four (4) sub-categories:

5C.21. Bias: Bias can either be conscious or unconscious. The conscious bias is fortunately rare, and would be for instance when a judge deliberately awards a score lower or higher than the competitor deserves. The word for that action is cheating and it shall not be tolerated. Conscious bias can also occur because a friendship or regional relationship with the competitor. Most problems with bias are of the unconscious or unintentional type since they are more prevalent. A good example would be the 'halo' or recognition for a champion or well-known flyer who might unintentionally be awarded extra points based on recognition alone. This can work against an unknown flyer having a great day. This type of bias can also work against the champion flyer, just because the judge unconsciously might want to see a new face in the winner's circle. Another example might be bias towards a certain type of airplane like mono versus biplane, or bias towards a style of flying.

For instance, a pilot cuts crisp corners on square manoeuvre versus a flyer with a more graceful style. Sometimes we even see an equipment bias where a judge may unknowingly try to support a previous personal opinion regarding a certain brand of radio, certain type of engine, or size of aircraft. These unconscious biases are easily understood as we all have personal preferences. Nevertheless, the judge must try hard to base his or her score solely on the quality of the flight, and nothing more.

5C.22. Self-confidence: The self-confidence factor is based on knowledge instead of arrogance or ego. A judge with self-confidence can score a pilot fairly, whether he is a World Champion or not. A judge with self-confidence will not be uncomfortable in giving a wide range of scores in a single sequence. Scores as low as 2 or 4, or as high as 9 or 10 will not be uncommon.

5C.23. Sense of independence: A judge doesn't operate in a glass cage but shares the flight line with another judge and scribes. The judge cannot allow himself or herself to be influenced by more dominant or experienced personalities sitting nearby. Judging is an independent exercise and caution should be exercised not to influence or be influenced by others on the flight line. If scribes are used, scores should be communicated using a low tone voice so that the other judge and the pilot cannot hear and be influenced by it.

5C.23. Adherence to the rules: Adherence to the rules is probably the most significant of all the elements required to make a good judge. A good judge has developed a sense of fair playing and knows that a good contest is one in which everyone plays by the same rules. Anyone sitting in a judging chair must adhere to the rules existing at that time or disqualify him or herself.

5C.3. Technical knowledge:

Technical knowledge employs the use of an organised system of downgrading as well as the need to be consistent and accurate. The downgrading or deficit grading system assumes that the contestant is going to fly a perfect figure that starts with a 10, and then downgrades it based on the mistakes observed as they occur, rather than falling into the trap of scoring on overall impression. It should be assumed by a judge that a contestant is going to fly a well-formed figure, so he should start with the grade of 10. As he watches the figure, he then begins to find fault with what he sees and starts downgrading as it progresses. This system is preferable to waiting until the figure is finished, and tries to assign a grade on overall impression. The latter can be erratic and inconsistent, and also confines grading into a too narrow range. However, as a final check, the score should be consistent with the figure's overall quality.

Every judge should strive for a high degree of consistency and accuracy. The most important aspect of consistent judging is for each judge to establish his or her standard and then maintain that standard throughout the contest.

5C.4. FAI ARESTI System (condensed)

The F3M Large R/C aerobatic power aircraft aerobatics sequences are based on a catalogue of figures adopted by the FAI (Fédération Aéronautique Internationale), from the “ARESTI Aerobatic Catalogue (Condensed)” for full scale aerobatics. The catalogue consists of the following nine (9) families of figures:

- Family 1 – Lines and Angles
- Family 2 – Turns and Rolling Turns
- Family 3 – Combinations of Lines
- Family 4 – (Not in Use)
- Family 5 – Stall Turns (Hammerheads)
- Family 6 – Tail Slides
- Family 7 – Loops and Eights
- Family 8 – Combinations of lines, Angles, and Loops
- Family 9 – Rolls and Spins

It is beyond the scope of this Flying and Judging Guide to explain in detail the structure of the ARESTI catalogue, and how to read the ARESTI drawing language used. A good judge (as well as a pilot) must become very familiar with the above and should be able to quickly understand the figure simply by looking at the ARESTI drawing. The complete catalogue of figures is available directly from the ARESTI Web site at (<http://www.arestisystem.com>). Judges and pilots are strongly encouraged to download this document for personal reference.

5C.41. Rules: R/C large aerobatic aircraft class F3M has several rules that differ from either Full Scale Aerobatics (CIVA) or class F3A. Because the judging pool used in F3M contests sometimes comes from both or either of those two groups, it is useful to go through the major differences:

Rules	CIVA Powered Aircraft	F3M / AMA RC SCALE AEROBATICS	F3A
Downgrade one (1) point for each deviation of:	5 degrees	10 degrees (1/2 point for 5°)	15 degrees (1 point for 15°)
Judging criteria:	Aircraft attitude and Flight path	Flight path	Flight path

5C.42. Definitions:

There are some words and phrases which are used consistently throughout the text in a very precise sense, and it is as well to define at the start the sense in which each is used:

Figure: Each individual component of a sequence, which may comprise one or more manoeuvres in combination; it starts and ends with a horizontal line.

Manoeuvre: Any one of the basic aerobatic movements, which may be combined to make a figure (e.g. an avalanche is one figure consisting of two manoeuvres – loop and flick roll)

Mark/Point/Score: Marks are assigned (from 0 to 10) by judges, and may be devalued by various point values. The score is calculated by multiplying the judges' marks by the coefficients (K factors) and adding the products.

5C.5. Flight Path, Aircraft Attitude, and Wind Correction:

R/C large aerobatic aircraft class F3M requires all figures within the sequence to be wind corrected.

Judges should evaluate any figure focusing primarily on the aircraft flight path, but at the same time, also downgrade for any variation of the aircraft attitude that is not directly related to maintaining a correct flight path.

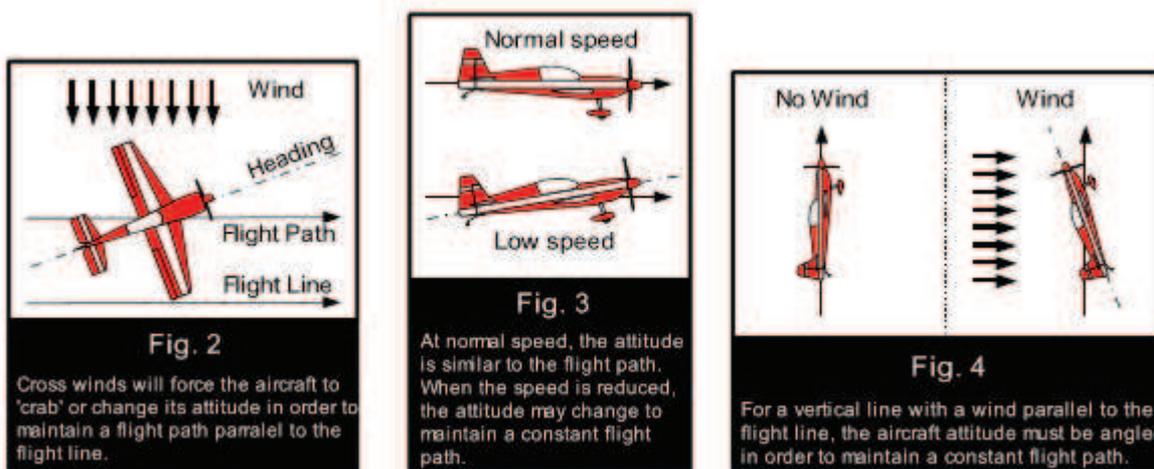
5C.51. Flight path. Think of the aircraft condensed into a single dot and watch the path this dot takes through the sky. This is the flight path, or track, or the aircraft's centre of gravity. Judging the flight path consists of comparing the observed path with fixed references such as the horizon, or the X and Y-axis of the aerobatic airspace.

5C.52. Attitude. The aircraft attitude is defined as the position of the aircraft in the sky, and is characterised by the variations it has on the yaw, pitch, and roll axis. In a “no-wind” and normal speed condition, the aircraft’s attitude (its heading) will generally point in the same direction as the flight path. In case of a cross wind, the aircraft attitude must vary (on the yaw axis) in order to maintain a constant and straight flight path, as required by the Large R/C aerobatic power model aircraft rules (Fig. 2).

Also, a reduction in speed will force the aircraft to change its pitch in order to maintain the correct flight path (Fig. 3).

Depending the type of aircraft (low wing, high wing, etc.), the flight attitude might be different from one to another to maintain the correct flight path. Judges should disregard this difference in attitude and only concentrate on the flight path described by the aircraft.

5C.53. Wind correction. When judging a manoeuvre, understanding what constitutes wind correction, and what is not, is one of the toughest challenges. The general rule is that judges should ignore any aircraft change of attitude required to maintain a correct flight path. At the same time, the usual 0.5 point deduction per 5 degrees of deviation shall be applied to anything that is not related with wind correcting. For instance, when the wind is blowing parallel to the flight path, the pilot flying a vertical line might use its elevator to change the aircraft’s attitude in order to maintain a straight vertical flight path (Fig. 4).

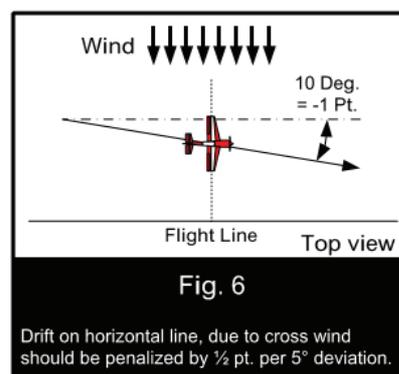
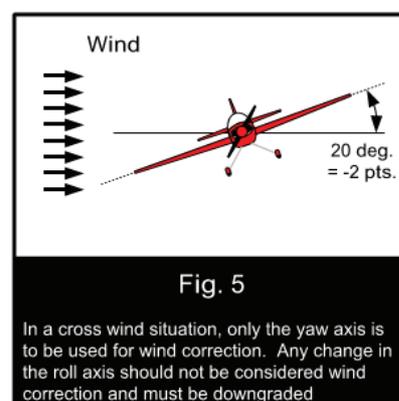


This change of attitude should not be downgraded. On the other hand, any bank angle of the wing in the roll axis should be downgraded using the standard rule of 0.5 point deduction per 5 degrees (Fig. 5). The judges should only downgrade for induced pilot corrections and disregard any sudden attitude changes due to wind bumps. Always give the competitor the benefit of the doubt when not sure.

The only manoeuvres that are not to be wind corrected are the ones involving a stalled condition, such as a Stall Turn (otherwise known as “Hammerhead”), Tail Slide, spin and snap roll(s) (otherwise known as a “flick roll”). During the period of time that the aircraft is in a stalled, or near stalled condition, any wind drift should be disregarded by the judges and not downgraded.

Wind correction should be used throughout the aerobatic airspace. Any drift observed on any line (horizontal, 45 degrees or vertical) should be downgraded using the 0.5 point deduction per 5 degrees rule (Fig. 6).

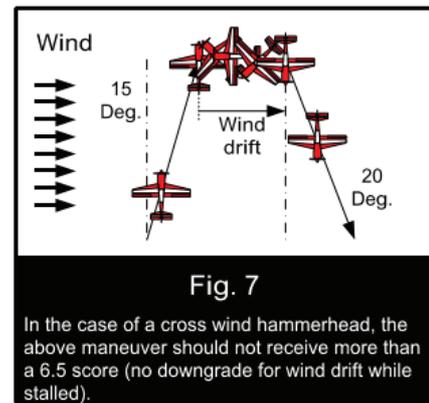
For instance, in the case of a Stall Turn performed with a severe crosswind, the vertical line will start directly after the ¼ loop. This is the first point of reference to be used for the upline. The flight path on the way up is 15 degrees off compared to the perfect vertical up line; the downgrade should then be 1.5 points. When the aircraft starts its Stall Turn, it is in a stalled condition and no downgrade should be applied for wind drift during that time. Once the rotation is complete, a new reference point should be established for the perfect vertical downline.



If the flight path on the downline is 20 degrees off, the downgrade should then be 2 points (Fig. 7).

The competitor is required to make the shape of all manoeuvres perfect regardless of the wind conditions. Loops and partial loops must be round, vertical lines must be perpendicular to the horizon and horizontal line parallel to the X or Y-axis. For 45-degree lines, judges must make an allowance for the aircraft's position relative to their own.

A true 45 degree line flown at the end of the aerobatic airspace will appear steeper when flown towards the end of the airspace and shallower when flown towards the centre. Judging is of the true line flown and judges should not downgrade the manoeuvre for visual deformation due to the angle it is observed. Always give the competitor the benefit of the doubt when not sure.



5C.54. Grading of Figures: The judges will independently assess the quality of each figure and its components as performed in the sequences, grading with numbers from ten (10) to zero (0) in increments of one-half (0.5) point. A grade of ten (10) represents a perfect figure in which the judge saw no deviations from prescribed criteria.

Remember, it is the judge's job to find fault: be a nitpicker. On the other hand, give a grade of 10 if you see a perfect figure—but if you are really being critical, you won't see too many. Don't get in a rut. Guard against confining your grades in too narrow a range. If you watch carefully and grade consistently, you will find yourself giving an occasional 2, 3, or 4 on some sloppy figures that are not quite bad enough for a zero. You will also be giving an occasional 9 or 10 for the superlative figure which you can find little or no fault.

As a judge, you are expected to grade only against one standard, and that is perfection. The performance of the aircraft, the difficulty in performing a figure (on the basis of your personal experience or perception), the weather condition or the pilot's name and reputation should not be considered in formulating your grade.

5C.6. Grading Principles

5C.6.1. General principles.

When grading the quality of the performance of individual figures, judges should consider the following general principles:

- a: The geometry of the figures (including the shape, radii, angles, flight path, direction of flight, heading and bank angle) must comply with the prescribed criteria.
- b: The precision of the performance compared to the criteria as explained later in this guide.
- c: The smoothness of the performance
- d: The distinctly recognisable start and finish of each figure with a horizontal line.
- e: The figure must be the one depicted on the flimsy (Form B or C) appropriate to the direction of the flight chosen by the pilot to perform and flown in its proper order within the sequence. For figures with a Y-axis component, it is the pilot's discretion, in addition to fly inbound or out bound, as to which direction to fly the turn, left or right. For Family 9, Rotational Elements it is the pilot's discretion to which direction to perform the roll or first roll, if it is unlinked roll combination. In all cases, the figure flown must have the entry and exit direction as depicted on the flimsy appropriate to the direction of flight chosen by the pilot to perform (Form B or C) in the X-axis.
- f: The grading criteria of each component will apply in a combination figure so that one overall grade for the figure will result.
- g: The length of the lines and the size of the radii caused by the flying characteristics of an aircraft are not to be taken into account in the grading.
- h: Negative figures are graded by the same criteria as positive figures.

i: Speed of aircraft is not a criterion. A reduction of grade will be applied for each deviation from the prescribed criteria for the figure. The grade will be reduced by 0.5 points for each 5 degrees of deviation.

5C.6.2: Beginning and ending of a figure. The first figure of a sequence begins at the moment the aircraft departs from its wings-level, horizontal flight path.

A figure is complete at the moment the aircraft returns to a wings-level, horizontal flight path of one fuselage plane length. The only exception to this are the exit lines in the “ARESTI Aerobatic Catalogue (Condensed)”, Families 7.4.3 and 7.4.4 (Square Loops) and 7.4.6 (Octagon Loops). Once a horizontal flight path of one fuselage plane length is established at the end of a figure, the beginning of the next figure is deemed to have occurred (Fig. 8). If an aircraft does not return to wings-level, horizontal flight before commencing the next figure, the one (1) point per figure deduction will be applied. Ref. Rule 5C.7. If the competitor corrects any errors in exit flight path, bank angle, or heading before initiating the subsequent figure, only the first figure shall be downgraded. Failure to correct such errors shall result in a downgrade to both figures.

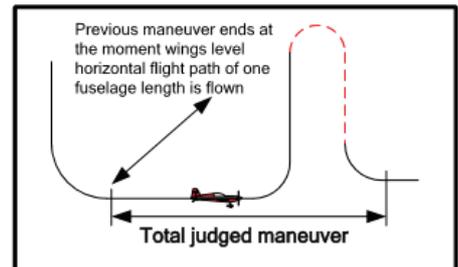


Fig. 8

The horizontal line prior to the maneuver to be judged is also part of this maneuver, and therefore subject to the same downgrades as any other lines.

5C.6.3: Zero. A zero will be given for:

a: Omitting a figure in the program. In this case, only the omitted figure will be zeroed. For instance, if the pilot omits the centre figure and flies straight to do the next figure, only the centre figure will receive a zero and the next figure will be scored normally.

b: Flying a figure that deviates from the ARESTI drawing held by the judges for scoring purposes. For instance, if the pilot flies a Humpty Bump instead of a Stall Turn, the figure will be marked zero (0).

c: Adding a figure to a program will zero the next following correct figure except when it is necessary to perform a Corrective Manoeuvre (c.1) due to the previous figure not being completed as per the program. A zero will be given to the figure immediately following any other added figure, even if the following figure is performed correctly.

c.1: A Corrective Manoeuvre can only be a turn of 270 degrees or less, and /or a roll of 180 degrees or less. In this case, a break penalty will be assessed against the competitor's raw score prior to normalizing.

For instance:

1: If the exit of a figure is done upright instead of inverted (the pilot forgot to perform a ½ roll on the downline), and corrects this by doing ½ roll after the exit, on the horizontal line, the original figure will be marked zero (0) because the ½ roll was omitted on the downline, however the following figure will be scored because this ½ roll was added only to correct the attitude of the aircraft for the beginning of that next figure. (Fig. 9). A break penalty will be applied, see **Rule 5C.6.3.c.1**.

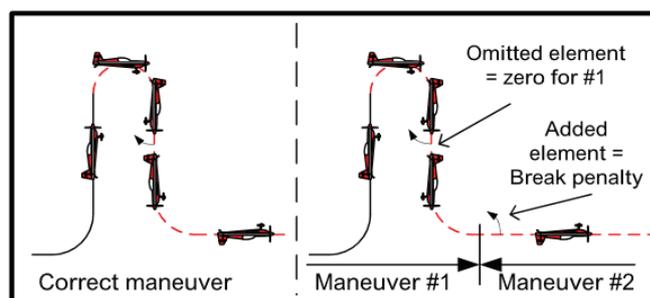


Fig. 9

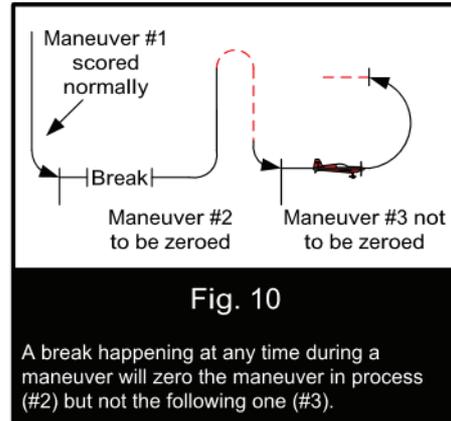
If part of the maneuver is either omitted or added, all of maneuver #1 must be zeroed. The half roll performed after the end of maneuver #1 will cause a break penalty. Maneuver #2 will be judged.

2: If the pilot exits the figure in the wrong direction on the X-axis (pull instead of push at the bottom of a figure), then adds a 180 degree turn and a 180 degree roll to correct the mistake and comes back to the correct flight direction he/she will be assessed a break penalty, see **Rule 5C.6.3.c.1**.

The original figure will be marked zero (0) because the exit ¼ loop was not performed per the ARESTI, and the following figure will be scored from wings level after the completion of the 180-degree turn.

Note: Corrective actions that exceed 270 degrees of turn or 180 degrees of roll constitute a Break in Sequence.

d: Break in the sequence. A break in the sequence is characterised by a total departure from the sequence to be flown. For instance, a pilot that becomes disoriented; aborts the figure and circles around a couple of times before resuming the sequence again. Another example might be a pilot that aborts a figure thinking that the aircraft has equipment problems, makes a couple of fly-bys in order to confirm that everything is operating normal, and then decides to resume the sequence. A deadstick, or a landing during the sequence shall not be considered as a break and all remaining figures that were not flown will be marked zero (0).



When a Break in Sequence occurs, the figure in progress (at the time of the break) should be marked zero (0) and a break penalty will be assessed against the competitor's raw score prior to normalizing. Situations may occur where a pilot performs an incorrect manoeuvre, resulting in a zero, exits that figure improperly, and then performs a break in sequence. In this instance, the pilot receives a zero for the first failed figure, and a zero for the next figure in which the Break in Sequence occurred.

Resumption of scored flight: The pilot or the caller should visually indicate to the judges his intention to resume the sequence. He should then first establish a wing-level horizontal line, call the restart of the sequence to get the judges' attention, perform the last flown figure that is to be marked zero (0), and continue the sequence from there on. Normal judging will resume after the completion of the marked zero (0) figure.

A break in the sequence related to safety, weather, for collision avoidance, or by request from the judges or the Contest Director will not be penalised.

e: Flying a figure in the wrong direction on the X-axis. The Y-axis is non-directional.

f: Any cumulative deviation in excess of 90 degrees in the roll, pitch or yaw axes that are not related to wind corrections.

g: Any figure or figures started and flown completely or partially on the pilot side of the deadline. The aircraft must clearly penetrate the deadline to receive a zero.

Judges should score each figure independently and not communicate with each other while judging of the sequence. Once the sequence is complete, the judges may, but are not required to, confer and review any figure receiving a zero, but need not agree on the score.

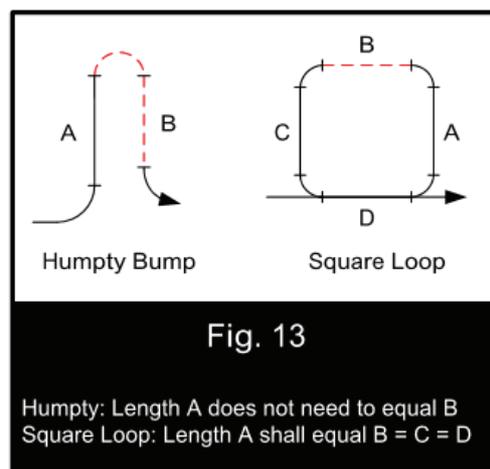
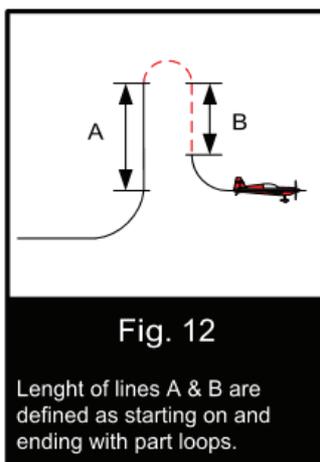
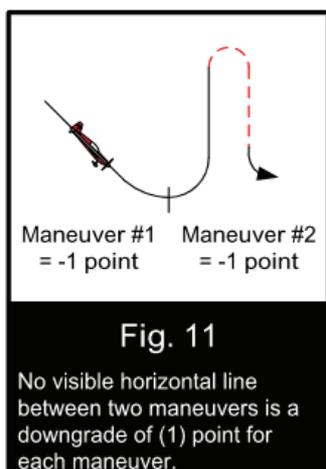
If a judge, for some reason outside the control of the competitor, is not able to follow the model aircraft through the entire figure, the judge will give a mark of "Average" or "AV" to that figure. In this case, the judge's mark for that particular figure will be the average of the numerical marks given by the other judges. If all the judges give a "AV" mark to a figure, then the pilot is allowed to re flight this figure. This reflight should occur on the first flight after the judges' break or last in the round, in front of the same set of judges. The result of the reflight will be final.

5C.7. Basic Components of Aerobatics:

5C.7.1: Lines

All lines are judged in relation to the true horizon and the axes of the Aerobic Airspace. Horizontal and Vertical lines are judged primarily on flight path (Ref Rule 5C.5.3 for wind correction criteria).

All figures begin and end on definite horizontal lines, and both must be present in order to earn a good grade. A competitor who rushes from one figure to another, without showing this horizontal and well-recognisable line will be downgraded by one (1) point for each missing line in each figure affected.



Therefore, leaving out the line between two figures will downgrade the preceding figure by one (1) point and the following figure also by one (1) point. (Fig. 11).

All lines that occur inside a figure have a beginning and an end that define their length. They are preceded and followed by part-loops.

With the exception of Family 3 figures (Three, Four & Eight Corners) and some figures in Family 7 (Loops and Eights), the criterion for the length of lines within a figure states that they do not have to be of equal length (Fig. 12). For example, the length of the lines in a Single Humpty-bump does not need to be equal, but all four lines in a Square Loop must be of equal length (Fig. 13).

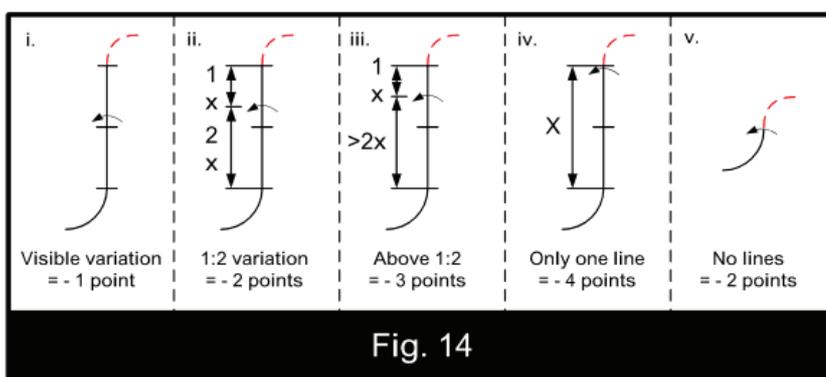
Whenever any kind of roll is placed on an interior line, the lengths of the two parts of the line before and after the roll must be equal. Exceptions are when any type of roll follows a spin element. Judges should take care to judge the symmetry of the length of lines in a figure using only the length of the lines and not be elapsed time taken to fly each segment. This difference in length versus elapsed time is most noticeable in figures where rolls are placed on up-lines. As the aircraft loses airspeed, the time it takes to fly a line after the roll will be greater than the time required to fly the line of the same length before the roll.

If within a figure two or more lines must be of the same length, an observed variation is penalised by reducing the grade in the following manner (Fig. 14):

- i- A visible variation = 1 point deduction
- ii- If the lengths vary by 1:2 = 2 point deduction
- iii- And so forth up to a 3 point deduction
- iv- No line before or after roll, 4 point deduction.
- v- No line at all before and after roll = 2 point deduction.

The basis for judging line length is the first line flown. The absence of one of these lines either before OR after a roll has to be penalised by one (1) additional point. IF there are no lines before AND after the roll, the total penalty is two (2) points only.

Example: The competitor is to fly a vertical up-line with a full roll on the line. However, the aircraft is returned to level flight immediately after the roll. The deduction is 4 points: 3 points are deducted because the lines are of vastly different length and another 1 point is deducted because of the absence of one of the lines.



5C.7.2: Loops and part-loops

The loop is a figure from Family 7, but part-loops are integral to every other family so it is necessary to discuss the loop before going on to the other families.

5C.7.2.1: General criteria

A loop must have, by definition, a constant radius. It starts and ends in a well-defined line that, for a complete loop, will be horizontal. For a part-loop however, such lines may be in any other plane of flight. As the speed changes during execution of a loop or part-loop, the angular velocity around the aircraft's lateral axis also has to change in order to keep the radius constant. When the speed decreases, for example, to half its initial rate, the angular velocity, to keep the same radius, will be reduced by half—this is a fact of physics. Thus, the angular velocity can be an aid for the judge to gauge the radius— especially when the angular velocity in the higher part-loop is seen to be faster, as this is a clear indication that the radius is smaller. This aid becomes more important when a line separates two part-loops. Refer to section 5C.8.7 for specific criteria for judging loops and part loops.

5C.7.2.2: Matching Radii. Certain figures require that the part-loop portion of the figure have the same radius. When identical radii are required depends on the figure in question. This is defined by how a particular figure is depicted (drawn) in the ARESTI Aerobatic Catalogue.

5C.7.2.2a Round Corners For any figure having more than one internal part-loop depicted in the catalogue as an actual round, or looping line, element, all such part-loops must have the same radius – with an exception for all of Family 8.8 (Double Humpty Bumps). For those figures, the radius of the second half-loop is not required to match the radius of the first one.

7.2.2b Corner Angles For any figure having more than one internal part-loop depicted in the catalogue with a hard, or corner, angle, no such part-loop is required to match the radius of any other part-loop depicted in the same figure – with the exception of figures which must maintain a set geometric proportion, i.e.,

- a) All of Family 3 (Combination of Lines)
- b) Family 7.4.3.x to 7.4.6.x (Hesitation Loops)

For example, the quarter-loop at the top of the vertical line (Family 1 figure) need not have the same size radius as the quarter-loop at the bottom (Fig. 15). However, the top radius must not be “corner” or very sharp angle (Fig. 16). It must have a smooth, distinct, and constant radius.

5C.8. FAI “ARESTI Aerobatic Catalogue (Condensed)” Families:**5C.8.1: Family 1: Lines and Angles.**

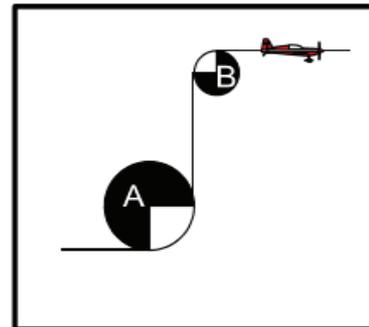
Family 1.1.1 to 1.1.11 has been fully covered in the preceding section. Note that the figures in Family 1.2.1 to 1.2.16 are NOT performed as drawn in the “ARESTI Aerobatic Catalogue (Condensed)”. In each of these figures there are three looping components: a one-eight loop, a three-eight loop and a quarter loop. Rolls may be performed on the 45-degree line and/or the 90-degree line, with the part line being of equal length. The initial horizontal line and the line at the end of the figure may be flown at different altitudes (Fig. 17).

5C.8.2: Family 2: Turns and Rolling Turns.

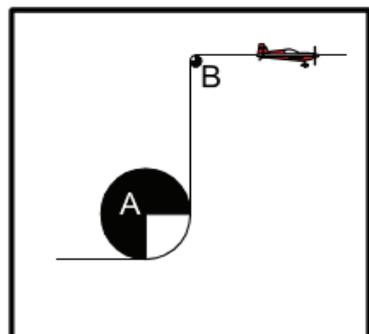
5C.8.2.1: Turns. In aerobatic competition, a turn is divided into three parts:

- 1: Establishing the bank using a roll on heading.
- 2: The turn itself.
- 3: A roll back to straight and level flight on heading.

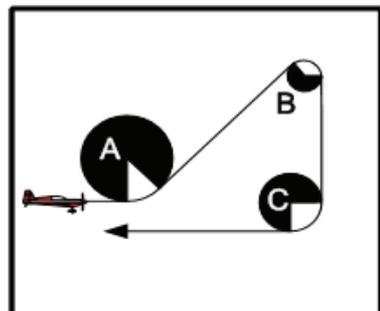
Let's look at the turn during each of these three parts. First, the roll to establish the bank. This must be a roll of between 60 and 90 degrees; it must be performed on the entry heading; and the aircraft must maintain a constant horizontal line. Once the roll is completed and the angle of bank is established, the competitor

**Fig. 15**

A & B radii do not need to match

**Fig. 16**

Sharp angles, or 'corners' must be downgraded.

**Fig. 17**

Family 1.2.1 - 1.2.16 as flown radii A, B and C may all be different. Start and exit altitude may also differ.

immediately performs the turn. The turn must maintain the established angle of bank throughout. The aircraft must also maintain horizontal flight. The rate of turn is constant throughout and the figure must be wind corrected so that, for instance, a 360-degree turn will be a perfect circle. It should be noted that the wind correction cannot be performed by visibly changing the bank angle.

As soon as the aircraft is on the exit heading, the competitor performs another roll at a rate equal to the entry roll. Again, the aircraft must maintain a constant horizontal line.

Downgrades:

a: The angle of bank established by the initial rolling manoeuvre must be at least 60 degrees and not greater than 90 degrees. Any less or more is a 0.5 point deduction for every 5 degrees.

b: The angle of bank, once established, must remain constant. Any deviation is a 0.5 point deduction for every 5 degrees of deviation.

c: The rate of roll must be the same for the entry and exit rolls of this figure. Any deviation is a one (1) point deduction.

d: The aircraft must maintain a constant altitude throughout the figure. Any variation would be 0.5 point deduction for every 5 degrees of change.

e: The rate of turn must remain constant. Any change would be not more than a one (1) point deduction for each change. Note that the rate of turn may appear to change in a strong wind, when it really isn't changing. The judges must always keep the wind in mind and give the pilot the benefit of the doubt if there is any question.

f: The aircraft must begin and end on the prescribed heading. Any deviation is a 0.5 point deduction for every 5 degrees of deviation.

5C.8.2.2: Rolling Turns

The rolling turn is a figure that combines a turn of a prescribed amount with a roll or rolls integrated throughout the turn. The rolls integrated into the turn may be in the same direction as the turn and are called "rolls to the inside" or may be in the opposite direction of the turn and are then called "rolls to the outside" (Fig. 18). There can also be rolls alternating in and out. The direction of these rolls, to the inside or to the outside, must be flown exactly as depicted in the ARESTI. When we say that the rolls are integrated, we are saying that in addition to there being constant rate of turn throughout the figure, there is also a constant rate of roll throughout. Naturally, the one exception to this constant roll rate is the pause when reversing roll direction. In addition, the entire manoeuvre is to be flown at a constant altitude.

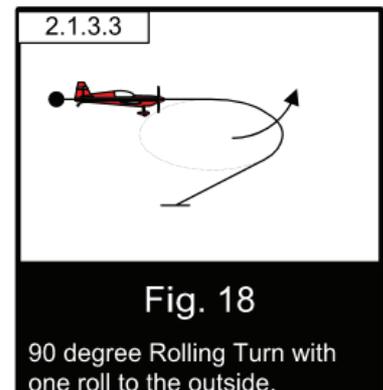
To help visualise the execution of this figure and facilitate a way for the judges to determine a constant roll rate, let's look at an aircraft performing a 360 degree rolling turn with 4 rolls to the inside from upright (Family 2.4.7.1). First, on the prescribed entry heading, the pilot executes a turn and simultaneously initiates a roll in the same direction as the turn. The judges will expect the aircraft to be inverted at 45, 135, 225 and 315 degrees and to be upright at 90, 180, 270 and 360 degrees. At these interim headings, the judge will NOT downgrade using the 0.5 point for 5 degree rule but will judge changes in the rate of roll, changes in the rate of turn and changes in altitude. At the end of the 4 rolls, the aircraft must have terminated its 360 degree turn and finish at the same point where it started, wings level and on the prescribed heading.

When a rolling turn is performed with rolls alternating directions, the aircraft must change direction of roll at a wings level attitude. The position of the aircraft in the turn is still only used as an aid to determine if the pilot is varying the rate of roll or turn.

Downgrades:

a: Performing more or fewer rolls than the ARESTI description calls for, or rolling in a direction different than depicted on the ARESTI results in the figure being zeroed.

b: All rolls in a rolling turn are standard rolls. If a snap roll is performed, the figure will be marked zero (0).



c: Each stoppage of the rate of roll is a deduction of one (1) point.

d: Each variation in the rate of roll is a one (1) point deduction.

e: Each variation in the rate of turn is a one (1) point deduction.

f: Variations in altitude are deducted using 0.5 points per every 5 degrees difference.

g: 0.5 points per every 5 degrees that the aircraft is not in level flight when reversing roll direction.

h: 0.5 points for every 5 degrees of roll remaining when the aircraft has reached its heading.

i: 0.5 points for every 5 degrees of turn remaining when the aircraft has completed its last roll.

5C.8.3. Family 3: Combinations of Lines.

For all the figures in Family 3, (Three Corners, Four Corners, and Eight Corners) the transition from level flight to a 45 degree line should be at a constant and reasonable one eighth (1/8) looping radius. All lines within the figure should be equal in length. All part loops within the figure should be of identical radii. The 45-degree transitions in Family 3 should have a constant radius and not a sharp corner (Fig. 19). The basis for judging line length is the first line flown. Refer to rule 5C.7.1 for downgrades.

The radius of all part loops in the figure are measured against the first part loop flown in the manoeuvre. Thereafter, each part loop flown within the manoeuvre that has a different radius than the first part loop flown receives a one (1) point deduction.

Each part loop flown in the manoeuvre must have a constant radius. Each variation of radius within a part loop receives a one (1) point deduction.

5C.8.4: Family 4: Not in use.

5C.8.5: Family 5.2-5.4: Stall Turns.

Stall Turns, also referred to as “Hammerheads”, are some of the most graceful figures in the “ARESTI Aerobatic Catalogue (Condensed).” In its most basic form, the figure begins when the aircraft leaves horizontal flight and flies a one-quarter loop to establish a vertical climb or flies a one-eighth loop to establish a 45 degree up line. If the entry is a one-eighth loop to a 45 degree line then, having presented that line, the aircraft will fly another one-eighth loop and establish a vertical up line. At the top of the vertical line, the aircraft stops, pivots and establishes a vertical descent. The vertical line may terminate in a one-quarter loop which will return the aircraft to horizontal flight and end the figure. Or, after the vertical descent from the peak, the aircraft may fly a one-eighth loop to a 45 degree down line. Having presented this line, the aircraft will fly another one-eighth loop to return to horizontal flight thus ending the figure.

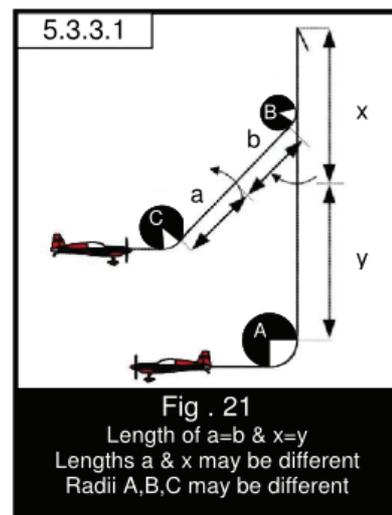
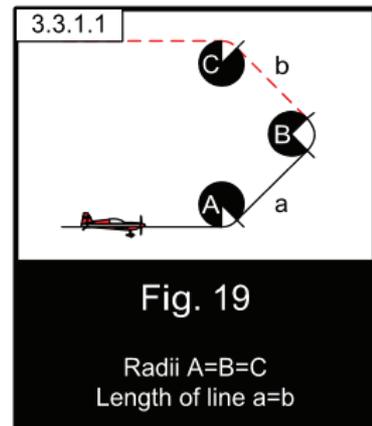
The judging criteria are:

a: The up and down lines, vertical or 45 degree, must be wind corrected so that they are flown as a straight line at the correct angle to the horizon.

b: On the up and down lines, any roll deviation, or deviation of the track of the aircraft in pitch or yaw will result in a deduction of 0.5 points per 5 degrees of deviation.

c: Any added roll element(s) on the vertical or 45 degree lines must be positioned so that the line segments before and after the roll elements are of equal length (Fig 21).

d: The length of the up and down lines, vertical or 45 degree need not be equal. Therefore, the altitude of the horizontal lines at the entry and exit of the hammerhead may be different and no downgrade applies for this difference.



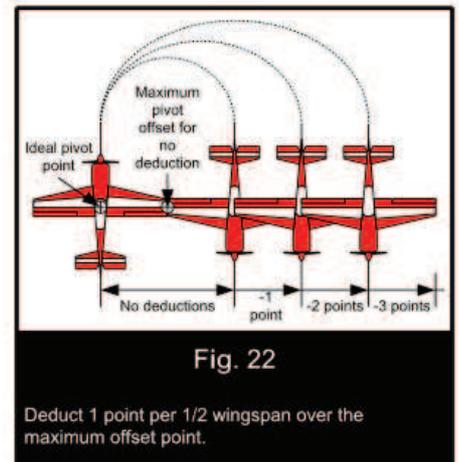
e: As the aircraft nears the point where it stops climbing, it must pivot in a plane parallel to vertical. Any alignment deviation from parallel to the vertical should be downgraded 0.5 points for each 5 degrees of deviation.

f: When the aircraft pivots at the top of the vertical line in a stalled or near stalled condition, no deduction should be applied for wind drift during that particular time.

g: In the case of strong cross winds, the aircraft will most probably be “crabbing” to wind correct the up and down lines. The pivot at the top of the line might therefore be less or more than 180 degrees and no downgrade should be applied to it.

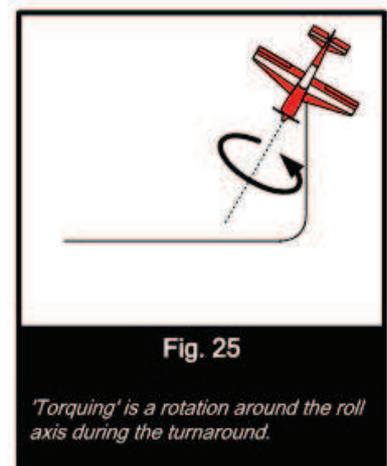
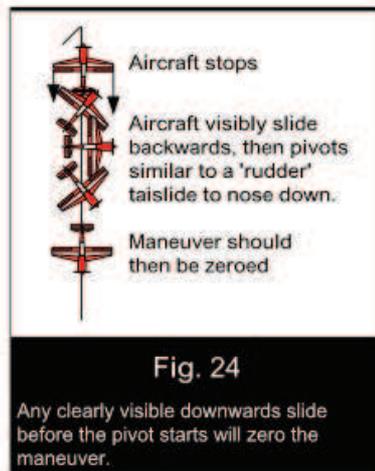
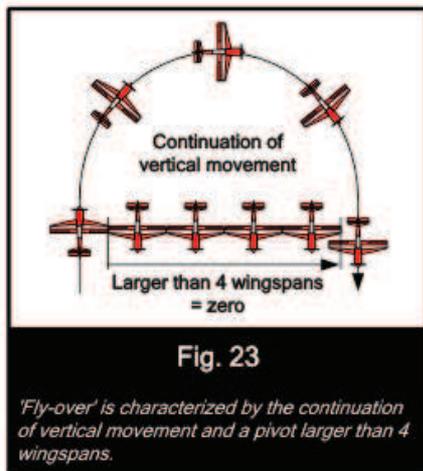
h: Any pendulum movement observed after the pivot is subject to downgrade at 0.5 points per 5 degrees of movement off the vertical. This downgrade is applied for each movement either side of the vertical.

When rotating at the top of the manoeuvre, ideally, the aircraft pivots around its centre of gravity. To avoid a deduction, the aircraft must pivot around an axis point, which cannot be farther away from its centre of gravity on the vertical up line than its wingtip (½ wingspan). The downgrade for this deviation is one (1) point per half wingspan that the point of rotation exceeds the maximum allowed (Fig 22).



Judges must be careful to deduct only for true extended turnaround, and not for any apparent deviation caused by wind drift during the pivot. One way to recognize a “fly-over” from a wind drift will be that the “fly-over” is generally characterised by the continuation of vertical movement and a pivot larger than 4 wingspans. A “fly-over” Stall Turn should be marked zero (0) (Fig 23).

The manoeuvre should also be marked zero (0) if any distinctive backward sliding movement is observed before the start of the pivot, even if the rotation is correctly performed after the slide (Fig. 24). The rate at which the aircraft pivots around its vertical axis is not a judging criterion.



During the pivot, the wings must remain in the vertical geometric plane as dictated by the ARESTI. This alignment must be maintained throughout the pivot, and the aircraft’s attitude at the beginning and the ending of the pivot must be absolutely vertical. During the pivot there must be no deviation in pitch or roll. Any pitch and roll deviation observed during the pivot should be downgraded at 0.5 points for each 5 degrees of deviation. Such movement around the roll axis during the pivot is often referred to as “torquing” (Fig 25).

5C.8.6: Family 6.2: Two Line Tail Slides.

All the criteria of the Stall Turn apply to this figure except, of course, for the manoeuvre at the top of the vertical climb. At the point when the aircraft stops climbing, it must slide backwards a visible amount in the vertical plane. The key here is “visible” and “vertical plane.” If the aircraft pivots directly on the top, without any clearly visible slide, the manoeuvre should then be marked zero (0). Following the slide backwards, the aircraft must then tip over and fall through to a diving position. Often the nose will swing back or “pendulum” in pitch past the vertical after falling through.

The figure is not to be downgraded for this, nor downgraded if it does not happen. It is a function of the length of the slide and the type of aircraft, and is not to be considered in grading the figure.

There are two types of Tail Slides: wheels-down and wheels-up. The wheels-down Tail Slide is depicted in the ARESTI diagram with a curved solid line at the top of the Tail Slide symbol (Fig. 26). The wheels-up Tail Slide is depicted in the ARESTI diagram with a curved dashed line at the top of the Tail Slide symbol (Fig. 27).

This figure must be watched carefully, as the aircraft can fall the wrong way (which is graded a zero) with the correct direction of flight and the proper aircraft attitude still maintained.

The judging criteria are:

a: All lines and arcs flown in the figure are to be wind corrected and correctly aligned within the airspace as described in sections 5C.5.3, 5C.7.1 and 5C.7.2. Observed alignment deviations receive a deduction of 0.5 points for each 5 degrees of deviation.

b: Absence of any visible backward slide in the vertical plane zero's the entire figure.

c: On all up and down lines, the roll attitude must be perpendicular to the plane of the main axis of flight, either the X or Y axis. This includes the duration of the fall through. Watch for the aircraft torqueing off the correct plane of flight. Any deviation in roll should be downgraded at 0.5 points per five (5) degrees of deviation.

d: As with the Stall Turn, the aircraft will be in a stalled or near-stalled condition at the top of the vertical line and no deduction for wind drift should be applied during that particular time.

e: The altitude of the entry and exit horizontal lines need not be the same and the figure must not be downgraded if they are different.

f: When rolls are combined with Family 6 figures, the line segments before and after the roll(s) must be of equal length. Refer to rule 5C.7.1 for downgrades.

g: After performing the Tail Slide at the peak of the manoeuvre, the aircraft must establish a visible vertical down line. If this line is omitted, a downgrade of one (1) point is to be applied.

In summary, the aircraft should make a smooth and steady transition up to vertical flight, and the aircraft should come to a complete stop in this attitude. After sliding backward a visible amount, it should fall through in the appropriate direction without dropping a wing or the nose moving off axis, and recover on the same plane as that of entry. After completion of this, it should again project the 90-degree down line (wind corrected if required) before transitioning into horizontal flight.

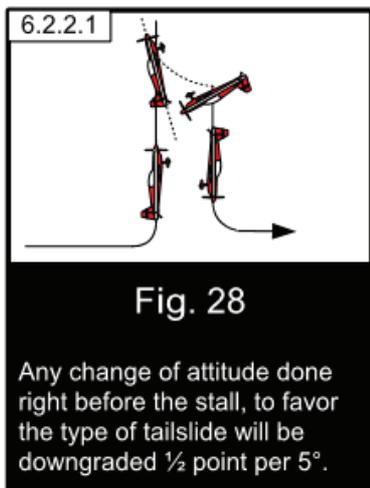
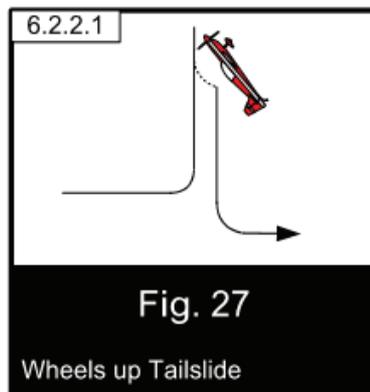
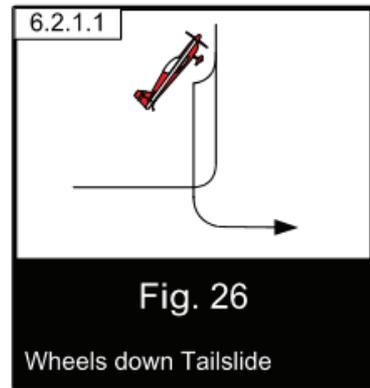
5C.8.7: Family 7: Loops and Eights.

5C.8.7.1: General Principles:

Family seven figures are covered in the following sections in groups, sections 5C. 8.7.2 to 5C.8.7.8. Each section provides the manoeuvre description and the overall judging criteria for the group. Each section also provides, for the most part, the downgrades to be applied for deviations. However, some downgrades in some of the sections are not completely specified and, as such, are described here:

a. The size of a loop or part loop is not a grading criterion. It will vary according to the flight characteristics of the aircraft. A large loop is not graded any higher or lower than a small loop, but any variation to the radius will downgrade these figures.

b. All radii are to be constant. Each visible variation in the radii in a loop or part loop is to be downgraded by one (1) point.



c. Where radii of part loops within these figures are required to be the same and they are not, a downgrade of one (1) point is to be applied for each mismatch. The standard is the first part loop flown within the figure.

d. Where complete loops or part loops within these figures are required to be the same size and they are not, a downgrade of one (1) point per mismatch is to be applied.

e. Roll elements that are to be done on a line must be centred and are to define two equal length line segments, one either side of the roll element. Refer to rule 5C.7.1 for downgrades.

f. Where a roll element is to be done entering or exiting a part loop there is to be no line shown between the part loop and the roll element. The downgrade for showing a line in these situations is a minimum of two points.

g. Where a roll element is to be done on a line between two vertical half loops, or between two full loops that form a vertical eight, and the line is absent, a downgrade of two (2) points is to be applied. There are to be no lines before or after the roll element and, if present, each such added line should result in a two (2) point deduction.

5C.8.7.2: Family 7.2: Half Loops

The half-loops in this sub-family must be of a constant radius and wind-corrected to appear as a perfect half circle (see full loop discussion below). When a half-loop is preceded by a roll or rolls, the half-loop follows immediately after the roll(s) without any visible line. Drawing a line requires a downgrade of at least two (2) points depending on the length of the line drawn. Should the half-loop begin before the roll is completed, the judge must downgrade the figure 0.5 points for every 5 degrees of half-loop flown on which the roll was performed.

The half-loop followed by a roll is also flown with no line between the half-loop and roll. Again, drawing a line requires a downgrade of at least 2 points depending on the length of the line drawn (Fig. 29). Should the roll begin before the half-loop is completed, the judges must downgrade the figure 0.5 points for every 5 degrees of half-loop on which the roll was performed (Fig. 30). Great care should be taken here to differentiate between aircraft airfoils and the slow speed at the top of the half loop + roll manoeuvre. The aircraft will appear to begin the roll before reaching horizontal flight due to its high pitch attitude. As the aircraft accelerates, it will then establish a cruise pitch attitude.

5C.8.7.3: Family 7.3: Three-Quarter Loops

Sometimes referred to as “Goldfish” (Fig 31), the lines are judged with reference to the 45 degree flight path. Any rolls on the 45 degree lines must be centred on that line. It is not required that the lengths of the 45 degree lines bear any strict relation to the diameter of the three-quarter (3/4) loop. That is, the entry and exit altitudes do not need to correspond to the altitude limits of the loop.

5C.8.7.4: Family 7.4: Whole Loops

5C.8.7.4.a: Round Loops (7.4.1 – 7.4.2)

All whole round loops must appear perfectly round to the judge (Fig 33). If required, they must be wind corrected to have a constant radius. This wind correction is not only with regards to the roundness of the loop but also for the effect of any crosswind on the figure. Therefore, a standard deduction of 0.5 points per five (5) degrees should be applied if the finish point is displaced in a direction perpendicular to the plane of the loop (Fig. 34). In a heavy crosswind situation, a loop might be flown with visible crabbing and no deduction should be applied in this case.

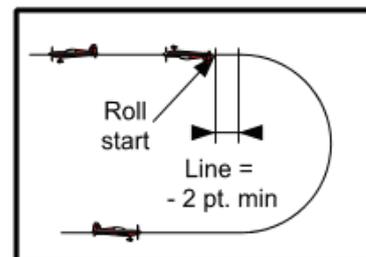


Fig. 29

Drawing a line after the 1/2 loop is a minimum downgrade of 2 points.

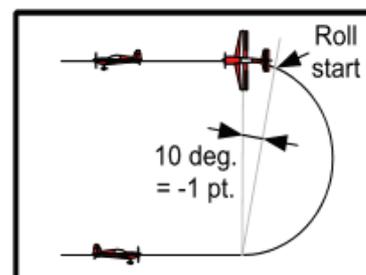


Fig. 30

Aircraft starting the roll ten degrees early before reaching horizontal flight = - 1 point

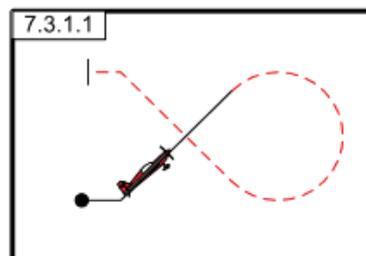


Fig. 31

Three-Quarter Loops or "Goldfish"

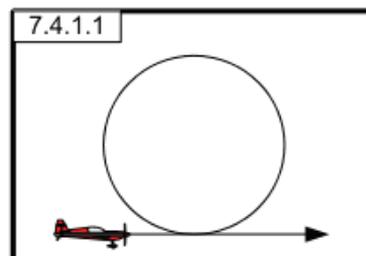
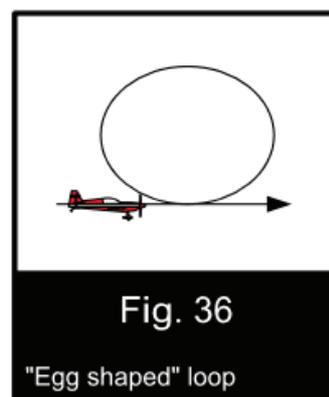
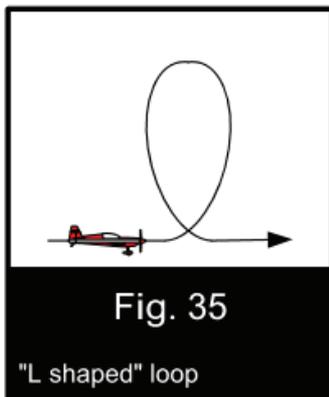
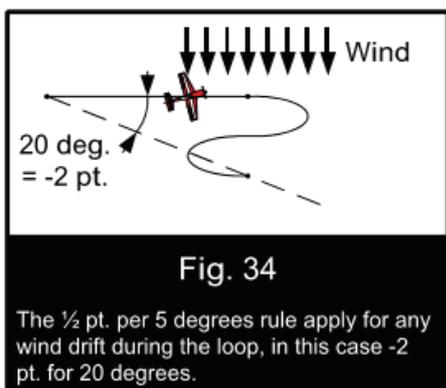


Fig. 33

Full loops must appear perfectly round to the judges.

To better quantify deductions for loops, the judges should watch for these irregularities: perpendicular displacement, change of radius, aircraft roll and flat spots (aircraft without a flight path radius) within the loop.



Deductions are as follows:

- a. As stated in first paragraph, 0.5 points per five degrees for perpendicular displacement.
- b. A variation in the radius will be a one point deduction per occurrence.
- c. Aircraft displaying any roll other than during a roll element on the loop, 0.5 point per five degrees of roll.
- d. Flight path without any radius (straight line or "flat spot"), one point per occurrence.

In judging loops, a common error is for the vertical diameter of the loop to be larger than the horizontal diameter. This is often called an "L" shaped loop (Fig. 35). Less common are loops with a horizontal diameter greater than the vertical. This is called an egg-shaped loop (Fig. 36).

Another common error is in varying the radius of the final quadrant performing an "e" shaped loop (Fig. 37). The downgrades listed above should be applied for each of these errors.

If there is a rolling element (roll, point rolls or snap roll) at the apex of the loop, it must be centred in the loop and flown on the arc of the loop itself (Fig. 38). Flying the roll on a line at the apex of the loop is at least a two (2) point downgrade. If the roll is not centred, it must be downgraded 0.5 points for every five degrees that it is off centre.

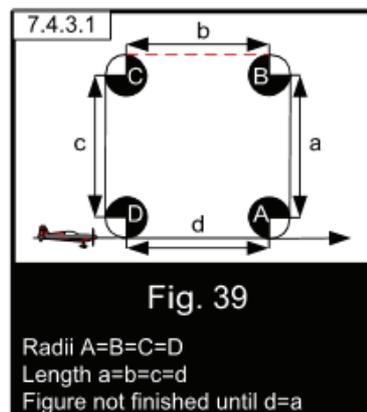
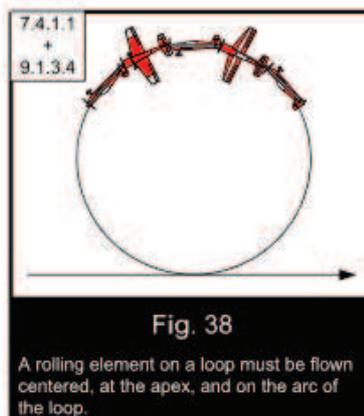
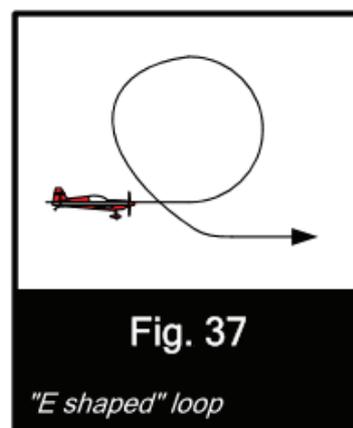
5C.8.7.4.b: Family 7.4.3- 7.4.6: Square, Diamond and Octagon Loops

Square and Octagon loops are flown as hesitation loops with lines of equal length and partial loops with equal radii (Fig. 39). Square and Octagon loops are not considered complete until the last horizontal line is drawn equal to the length of the first line of the figure.

All horizontal, vertical, and 45-degree lines are judged on flight path and should therefore be wind corrected. As such, the judge should always expect to see these figures closed, the same way as a round loop.

Where rolls are flown on the Square or Diamond loops, they must be centred on the line. Aids for judging all hesitation loops are that a good performance will contain changes of angular velocity in all the partial loops, and variations of time taken to draw the length of each interior line, which also varies according to the aircraft's speed. The rhythm of all these partial loops is a help for judging.

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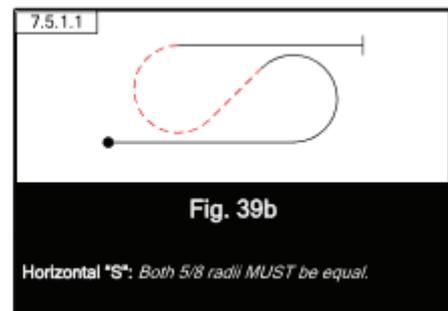
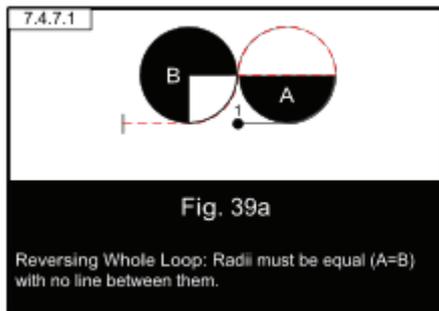


5C.8.7.4c: Family 7.4.7-7.4.14 Reversing Whole Loops

Reversing Whole Loops shall be judged using the same criteria for Whole Loops. No line is to be flown between the 1/4 and 3/4 loop segments, and the radii of all loop segments must be equal (Fig 39a). Drawing a line between the loop segments requires a downgrade of at least two (2) points depending on the length of the line drawn. Rolls placed either before or after the Reversing Whole Loop shall be flown with no line segment between the roll and the loop. Drawing a line requires a downgrade of at least two (2) points depending on the length of the line drawn. Any rolling element flown at the apex (top of loop) or bottom of the loop shall be judged in accordance with the rules for Whole Loops found in paragraph 8.7.4.a.

5C.8.7.5a. Family 7.5.1-7.5.8: Horizontal “S”s

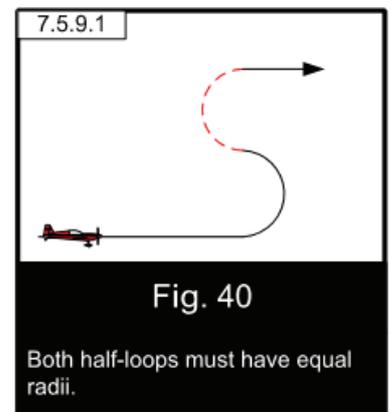
Horizontal “S”s may be described as two Half Cubans joined together, sharing a common 45 degree line. In these figures, both 5/8ths loops must have the same radii (Fig 39b). When the looping portion of the figure is immediately preceded by (on entry) or followed by (on exit) a roll or rolls, there must be no visible line between the roll and loop elements. Drawing a line requires a downgrade of at least two (2) points depending on the length of the line drawn. This criterion is not meant to imply that one element (roll or loop) must start before the preceding element is completely finished. A brief hesitation between elements (similar to opposite rolls) should not be downgraded.



Any rolls that are placed on the 45-degree line (between the two 5/8ths looping portions) must be centred on the line, and do not follow or precede the looping portions as described above.

5C.8.7.5b. Family 7.5.9-7.5.10: Vertical “S”s

These figures are accomplished with two joined half-loops flown in opposite directions (Fig. 40). Look for both half-loops to be the same size and perfectly round. The half-loops should be a continuous looping figure when there is no half roll between the half-loops. When a half roll is performed between the half loops (full roll(s) are not authorized), there is no line before or after the half roll. However, the half roll is flown on a horizontal line which begins as soon as the first half-loop is finished. As soon as the half roll is finished, the next half-loop must begin immediately (Fig. 41). Adding a line at either of these points is at least a two (2) point deduction, depending on the length of the line.



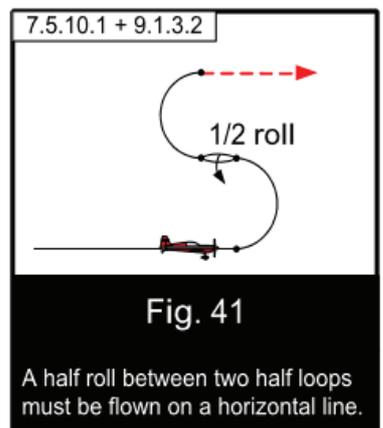
5C.8.7.6: Not in Use

5C.8.7.7: Not in Use

5C.8.7.8a: Family 7.8.1 - 7.8.8: Horizontal Eights

Also referred to as “Cuban Eights,” the 5/8ths and 3/4 loops must have the same radii; lines between the loops flown at exactly 45 degrees (Fig. 42). Wind correction shall be applied throughout the figure so that the 45-degree lines intersect at the exact mid-point of the Horizontal Eight. If there are roll elements on the 45 degree line(s), they will be positioned so that the lines before and after the roll are of equal length.

When the 5/8ths loop portion is preceded or followed by a roll element, there must be no visible line between the roll element and the 5/8ths loop. Inserting a line between the roll element and 5/8ths loop portion requires a minimum downgrade of 2 points.



The start and finish of the figure and the bottoms (or tops if reversed) of the 5/8ths and 3/4 loops must be at the same altitude.

The radius of the 1/8 loop between the 45 degree line and horizontal flight need not equal the radii of the 5/8ths and 3/4 loops of the Horizontal 8.

5C.8.7.8b: Family 7.8.9 - 7.8.16: Horizontal Super "8"s

Besides possessing the unique characteristic of containing three 45-degree lines on which rolls may potentially be placed, this family can be thought of as two linked Three-Quarter Loops (Family 7.3).

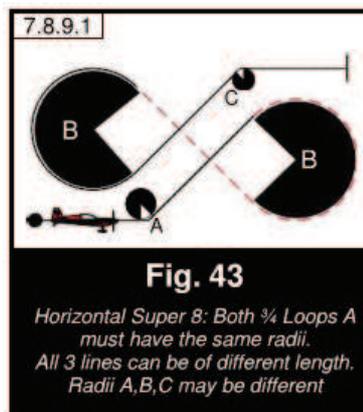
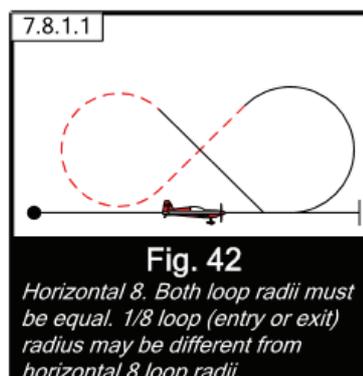
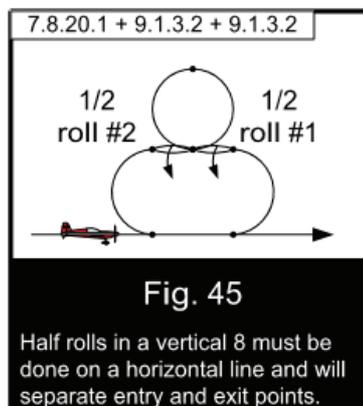
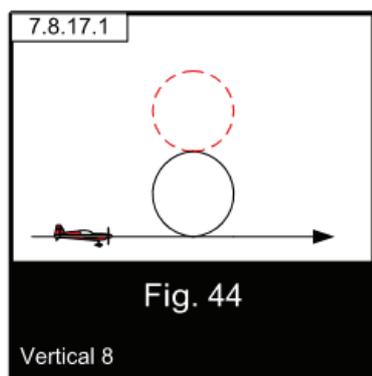
The radii of the two 3/4 loops must be identical to each other. Each of the 45-degree lines may be of different lengths, but any rolls placed on them must be centred. The two 3/4 loops need not occur at the same altitude, nor is there any relationship between the horizontal entry/exit altitude and the altitude limits of the two 3/4 loops (Fig. 43).

5C.8.7.8c: Family 7.8.17 – 7.8.22: Vertical "8"s

These figures are performed by flying two loops, one above the other (Fig. 44).

Sub-family 7.8.17-7.8.20 is composed of two loops, both above or both below the entry altitude. Sub-family 7.8.21 - 7.8.22 is composed of one loop above and one loop below the entry altitude. In case, the entry and exit altitude must be the same.

These figures may be combined with various types of half rolls. When a half roll is performed between the loops, there is no line before or after the half roll. However, the half roll is flown on a horizontal line that begins as soon as the first loop is finished. As soon as the half roll is finished, the next loop must begin immediately. Adding a line at either of these points is at least a two (2) point deduction depending on the length of the line. These figures are to be graded using the same criteria as full loops. Additionally, both loops must be of the same size. Unless there is a half roll between the loops, they must be directly above one another. Here as well, the beginning and the end point of the manoeuvre will not be in the same vertical plane if a half roll is flown between the loops (Fig. 45). This should not be a reason for downgrade.



5C.8.8: Family 8: Combination of Lines, Loops, and Rolls

5C.8.8.1 – General Principles:

Family 8 figures are covered in the following sections. Each section provides the manoeuvre description and the overall judging criteria for the group. Each section also provides, for the most part, the downgrades to be applied for deviations. However, some downgrades in some of the sections are not completely specified and, as such, are described here.

a. The size of a loop or part loop is not a grading criterion. It will vary according to the flight characteristics of the aircraft. A large loop is not graded any higher or lower than a small loop, but any variation to the radius will downgrade these figures.

b. All radii are to be constant. Each visible variation in the radii in a loop or part loop is to be downgraded by one (1) point.

c. Where radii of part loops within these figures are required to be the same and they are not, a downgrade of one (1) point should be applied for each mismatch. The standard is the first part loop flown within the figure.

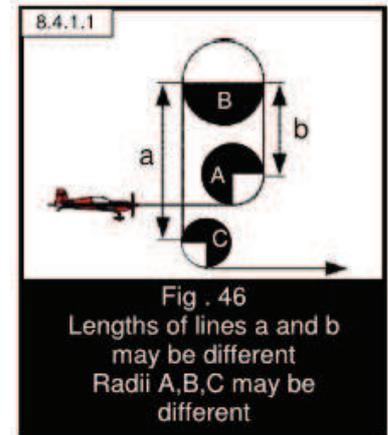
d. Roll elements that are to be done on lines must be centred and are to define two equal length line segments either side of the roll element. Refer to rule 5C.7.1 for downgrades.

e. Where a roll element is to be done entering or exiting a part loop there is to be no line shown between the part loop and the roll element. The downgrade for showing a line in these situations is a minimum of two points. This criterion is not meant to imply that one element (roll or loop) must start before the preceding element is completely finished. A brief hesitation between elements (similar to opposite rolls) should not be downgraded.

5C.Sections 8.8.1 to 8.8.3: Not in Use.

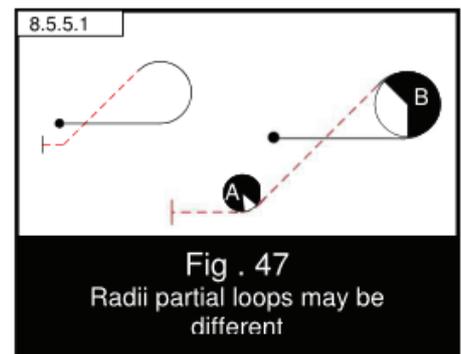
5C.8.8.4.1: Family 8.4.1 - 8.4.28: Humpty Bumps and Diagonal Humpty Bumps.

These figures, whether vertical or performed with 45-degree lines, are judged as combination of lines and loops. Half loop must still have a constant radius from the time they depart the vertical or 45-degree line. This requires a change in angular velocity during the half loop. The lines in these figures may be of different lengths, and therefore the entry and exit altitudes of these figures can be different. Rolls on any of these lines must be centred (Fig.46).



5C.8.8.5: Family 8.5.1-8.5.24: Half Cubans and Vertical 5/8ths Loops.

In these figures, when the looping portion of the figure is immediately preceded or followed by a roll or rolls, there must be no visible line between the roll and loop elements. The rolls on vertical and 45-degree lines must be centred, except for roll(s) following a spin. Angles drawn in the “ARESTI Aerobatic Catalogue (Condensed)” (Fig. 47), are to be flown as partial loops. No such part-loop is required to match the radius of any other part loop depicted in the same figure.



5C.8.8.6: Family 8.6: “P” Loops and Reversing “P” Loops

When 1/4, 1/2 or 3/4 loops join each other in these sub-families, the radii must be equal and there is no line between the loops. Inserting a line between joined loop segments requires a minimum two (2) point deduction depending on the length of the line (Fig. 49).

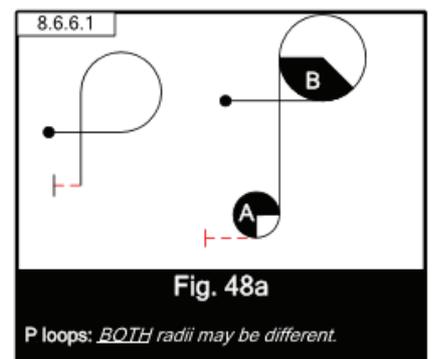
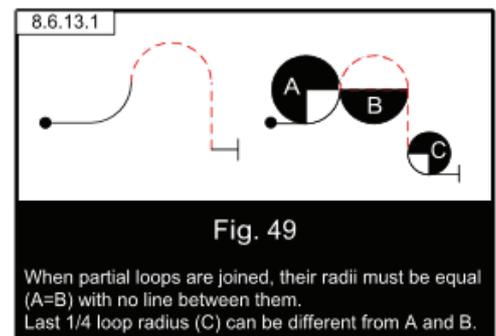
Roll elements on the vertical line must be centred.

Roll elements at the apex of the loop must be centred in the loop and flown on the arc of the loop. Flying the roll on a line at the apex of the loop is at least a two (2) point downgrade. If the roll is not centred, it must be downgraded 0.5 points for every five degrees that it is off centre.

When a loop portion is preceded or followed by a roll element, there must be no visible line between the roll element and the loop portion. Inserting a line between the roll element and loop portion requires a minimum downgrade of 2 points.

The 1/4 loop to or from horizontal flight should have a reasonable radius, but need not match the other looping radii (fig.48a).

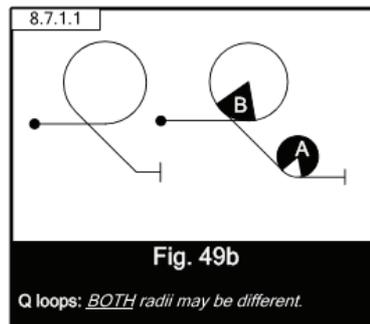
cont/...



5C.8.8.7: Family 8.7: 7/8ths loops

Sometimes called “Q Loops”, these figures consist of a 7/8ths loop with either a 45 degree entry or exit line. The 1/8th loop to or from the 45 degree line should have a reasonable radius, but need not match the radius of the 7/8ths loop. (fig.49b)

Roll elements on the 45 degree line must be centred. Roll elements at the apex of the 7/8ths loop must be centred on the loop and flown in the arc of the loop. Flying the roll on a line at the apex of the loop is at least a two (2) point downgrade. If the roll is not centred, it must be downgraded 0.5 points for every five degrees that it is off centre.



When the 7/8ths loop is preceded or followed by a roll element, there must be no visible line between the roll element and the loop. Inserting a line between the roll element and 7/8ths loop requires a minimum downgrade of 2 points.

Note: for certain types of “Q” Loops in this family, rolls are not allowed at the apex of the 7/8th loop (for example, figures 8.7.x.3 and 8.7.x.4).

5C.8.8.8: Family 8.8: Double Humpty Bumps

These figures are generally judged using the same criteria as Single Humpty Bumps (see section 5C.8.8.4.1). The two half-loops are not required to match each other, nor are they required to match the entry/exit loop radii. As with Single Humpty Bumps, the entry and exit altitudes need not be equal (Fig.49a).

5C.8.8.9: Not in Use

5C.8.8.10: Family 8.10: Reversing 1 ¼ Loops

The ¾ and ½ loops in these sub-families must be the same size and are flown as continuous segments with no line between the loops. Inserting a line between joined loop segments requires a minimum two (2) point deduction depending on the length of the line.

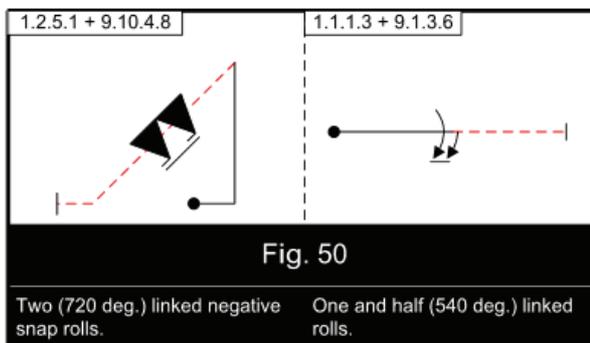
Roll elements on the vertical line must be centred.

When the ¾ loop is preceded by a roll element, there must be no visible line between the roll element and the loop portion. Inserting a line between the roll element and loop portion requires a minimum downgrade of 2 points.

The final ¼ loop to horizontal flight should have a reasonable radius, but need not match the other looping radii.

5C.8.9: Family 9: Rotational Elements

Rolls (9.1 - 9.10) may be performed on horizontal, 45-degree or 90-degree lines, on complete loops, between part-loops, between part-loops and line, and following spin elements. They may be ¼, ½, ¾, or a full 360 degrees in their rotation, up to two consecutive full rolls. Additionally, rolls may be flown in combination with turns as prescribed in Family 2 (Rolling Turns). In all cases, the same criteria apply: The rate of roll must be constant throughout the roll(s). The aircraft should continue to project, during the rolling portion, the prescribed plane and direction of flight.



Multiple rolls may be linked, unlinked or opposite:

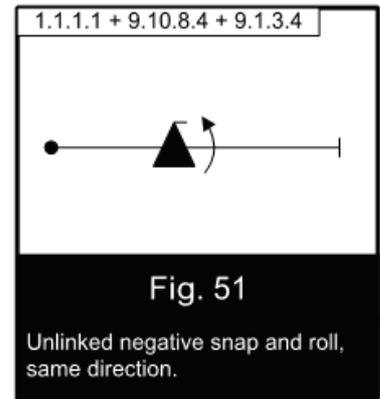
a: When rolls are in continuous rotation, the tips of the symbols are linked by a small line. When flying linked rolls, there is no pause between them (Fig. 50). Should there be one; the figure should then be marked zero (0).

b: Unlinked rolls must be of different types, the two types being defined as follows:

Type I: Aileron rolls (rolls and point rolls)

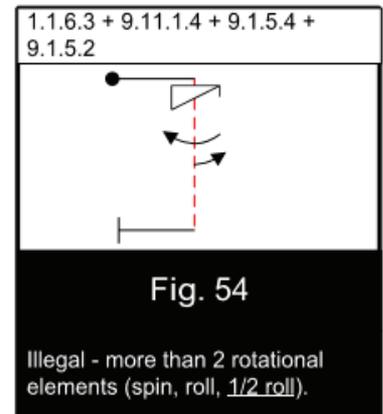
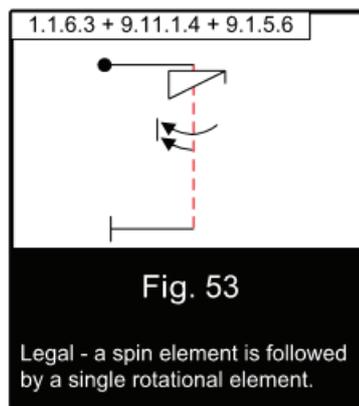
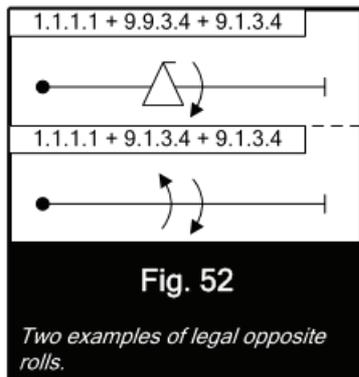
Type II: Snap rolls (positive and negative) – also referred to as “Flick Rolls”.

No line links the symbols, though their tips are drawn pointing in the same direction (i.e. on the same side of the line). Unlinked rolling elements must show a brief but perceptible pause between the elements that comprise the rolling combination. Absence of a perceptible pause between elements of the combination shall be downgraded by 1 point. This downgrade applies if the direction of rotation is required to be the same or opposite. (Fig. 51)



c: Opposite rolls may be either of the same or different type. In opposite rolls, the tips of the symbols are drawn on opposite sides of the line, indicating they are to be flown in opposite directions of rotation. The pilot may elect to fly the first roll in either direction, but the second roll must be the opposite direction to the first. Opposite rolls, including those in rolling turns should be flown as one continuous manoeuvre - the brief pause between opposite rotations should be minimal (Fig. 52). If the two rolls are of the same type, they must be flown in opposite direction if they are not linked.

d: Either aileron rolls or snap rolls may follow spin elements (Family 9.11 or 9.12). A spin and a roll combined on the same vertical downline will always be unlinked. They may be flown either in the same or opposite direction, as shown by the position of the tips of the symbols on the ARESTI diagram. The spin will always be the first element with a maximum of two (2) turns. It can be followed by a second rotational element like a roll or a snap roll also limited to a maximum of two (2) turns (Fig. 53). Adding a third rotational element will make the manoeuvre illegal, i.e. a one turn spin combined with one opposite roll and one opposite half roll (Fig. 54).



5C.8.9.1: Family 9.1: Rolls

The penalty for varying the rate of roll is one (1) point per variation. Any stoppage in the roll that could result its being considered a point roll would grade the figure zero (0).

The finish of the roll must be as crisp and precise as possible. Coming to a slow finish in fact represents a change in the rate of roll and should be penalised accordingly.

The wing must stop precisely after the desired degree of rotation and not go past the stop point and then return. This is referred to as “bumping the point” and a deduction of 0.5 points per 5 degrees shall be given in this case.

5C.8.9.2: Family 9.2 - 9.8: Point Rolls. Point Rolls

These rolls are judged on the same criteria as the standard roll, only the aircraft stops rotation during the roll for a pre-stated number of times, i.e. 2, 4, or 8. The rate of the roll and the rhythm of the points must be constant throughout with the aircraft projecting the pre-stated plane and direction of flight.

The pauses will be of identical duration and the degree of rotation between each pause shall be 180 degrees, 90 degrees, or 45 degrees, as depicted by the Aresti diagram. Each visible variation in the duration of the pause segments is downgraded by one (1) point. Errors in degrees of rotation (under / over rotating the points) are downgraded at a half (.5) point per five (5) degrees.

The roll rate of the rolling segments must be constant with each roll segment matching that of the preceding segment. Any visible deviation in roll rate from one segment to the next, or within a segment, is to be downgraded by one (1) point per occurrence.

The duration of the rolling segments as compared to the pause segments need not be equal. Each pause of a point roll must be clearly recognisable in every case. If a pause is not recognisable or is omitted, the figure is graded a zero (0).

5C.8.9.3: Family 9.9: Snap Rolls (“Flick Rolls”)

Snap rolls may be positive (pitch to the canopy) or negative (pitch to the wheels). Other than this difference, all judging criteria are the same for either type of snap.

Snap rolls are difficult to judge due to the speed of the snaps and the variation in the manner in which different aircraft perform snaps. However, two things must be present in order that a judge can decide that a snap roll has occurred. They are:

- The nose must pitch in the correct direction as indicated by the ARESTI figure (Fig. 55 & 56).
- Autorotation must be initiated.

Given the high energy nature of the snap, it is very difficult to tell if these two items are occurring simultaneously or sequentially. Therefore, there is no requirement that these two movements start simultaneously. They may occur simultaneously or sequentially in the order presented.

The requirements and downgrades that apply to snap roll elements are:

a. The snap must be done in the correct direction, positive or negative. If done in the wrong direction the manoeuvre is to be zeroed. Judges must watch very carefully for this as, due to the speed of the snap, it is very possible to miss an incorrect direction of the pitch.

b. There must be departure in the pitch axis in the required direction of the snap. Without some displacement in pitch there can be no high speed stall and therefore, there can be no snap. Aerobatic aircraft with very high rates of roll can occasionally fool a judge and present an aileron roll in place of a true snap. The movement of the aircraft’s nose in pitch departing the flight path is a necessary clue to the proper execution of snap rolls. As always, the competitor is given the benefit of the doubt, but if a judge is certain that a proper snap roll has not been executed, a zero (0) is to be given.

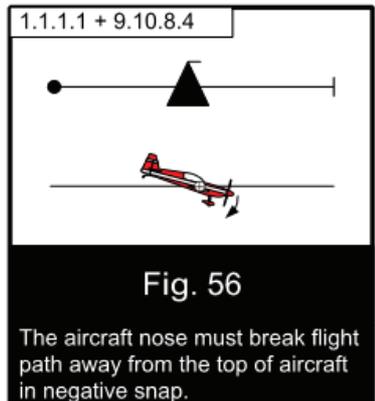
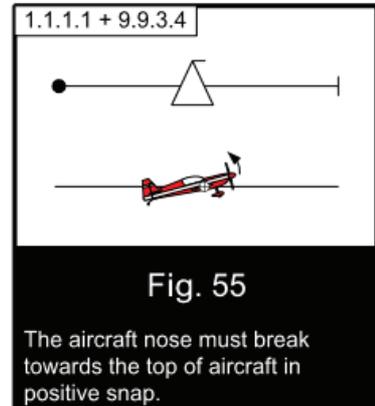
c. Autorotation must be initiated either simultaneously with the pitch departure, or immediately subsequent to it. No downgrade is to be applied if these two motions occur sequentially in the order just stated. Autorotation is difficult to discern but a definite clue is that there will be a yaw component to the rotation. Lacking any visible yaw, the aircraft will be rotating only on its roll axis and not presenting a true snap. As always, the competitor is given the benefit of the doubt, but if a judge is certain that autorotation is not present and therefore that a proper snap roll has not been executed, a zero (0) is to be given.

d. Any rotation / roll observed prior to the required pitch movement is to be downgraded 0.5 points for each 5 degrees of such rotation.

e. In the event that the start of autorotation is delayed somewhat after the required pitch movement has been shown, it is possible that the aircraft will draw a visible line between the pitch and the start of autorotation. If this occurs, the manoeuvre should be graded zero (0).

f. Autorotation, once initiated, must be maintained to the prescribed finish point of the snap roll. Coming out of autorotation early and aileroning to the end of the snap is a common error. In this case, a downgrade of 0.5 points for each 5 degrees is to be applied for the amount of rotation remaining at the point the autorotation ends, i.e., for however much the pilot ailerons to the finish. If the autorotation ends with more than 90 degrees of rotation remaining, even if the roll is completed with aileron, the snap roll is to be graded zero (0).

g. Alignment during the snap will vary from the prescribed line of flight due to the yaw displacement that is characteristic of a proper snap. This variation may be very small. However, immediately on completion of

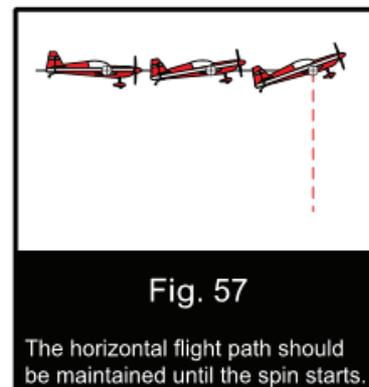


autorotation, the aircraft must be realigned with the prescribed line of flight. This will put the aircraft on a parallel but offset line or arc from that being flown prior to entry to the snap. If the aircraft exit from the snap is a line or arc that is identical to the entry line this is a clue that a proper snap was not executed. Again, the offset of the snap exit line or arc from snap entry line or arc may be very small but should be there. No penalty is to be applied for the offset or the realignment of the aircraft immediately after autorotation is completed. Lacking that realignment the extension of the snap exit line will be misaligned and that should be downgraded at 0.5 for each 5 degrees of misalignment from the prescribed line of flight in pitch, roll and yaw. "Line of flight" as just used here includes arcs.

5C.8.9.5: Family 9.11 - 9.12: Spins

Spins may be positive (entered from upright flight) or negative (entered from inverted flight). Other than this difference all judging criteria are the same for either type of spin.

Spin elements may be included in a number of Family 1 and Family 8 figures (where so indicated by the optional spin symbol in the ARESTI catalogue). All spins begin from horizontal flight with a defined entry line. This entry line to the spin is to be judged and downgraded as required in the same manner as any other wind corrected horizontal line. The only exception to judging the entry line is if the spin entry line is also the entry to the sequence. In this instance, the entry line is not judged and judging begins at the spin stall break. It should be noted that the flight path of the spin entry line should remain constant and not be influenced by the change of pitch attitude required to achieve the stall (Fig. 57), i.e., judge the track.

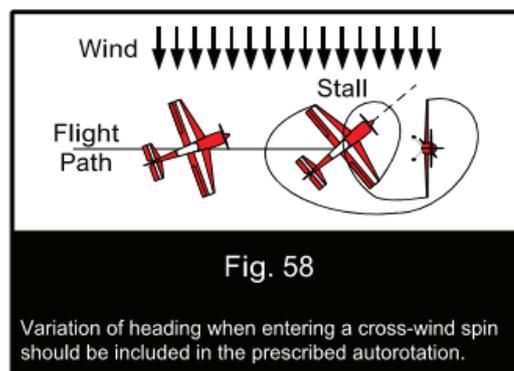


When the aircraft stalls, the nose will fall and at the same time a wing tip will drop in the direction of the spin initiating autorotation. The fall of the nose and the drop of the wing are to occur simultaneously. Failure to achieve this is to be considered a "late entry" and is to be downgraded. After completion of the prescribed number of turns, the aircraft must stop rotating precisely on the prescribed heading and then a wind corrected vertical down line must be shown. If a roll element follows a spin, there should be a brief, but perceptible pause (similar to unlinked rolls) between the spin and the roll. Because there is no vertical line before the spin, there is no criterion to centre a roll element that follows the spin on the vertical down line. No account is to be taken of the pitch attitude of the aircraft during autorotation, as some aircraft spin in a nearly vertical pitch attitude while others may spin in a somewhat flat attitude. Given these varying attitudes some aircraft may require a visible downward movement in order to set the aircraft into position to fly the required vertical downline after completion of autorotation. No downgrade is to be applied for this downward nose movement. Also, the speed of autorotation is not a judging criterion.

The requirements and downgrades that apply to spin elements are:

a. The entry line to the spin is a wind corrected line and any deviation in pitch, roll or yaw is to be downgraded at 0.5 points per each 5 degrees of misalignment. However, be sure to judge the track and not the attitude.

b. At the point of stall, the wings are to be level and any deviation in roll will be downgraded at 0.5 degrees for each 5 degrees of deviation. However, at this point in the spin element, when the aircraft is stalled or near stalled, no penalty should be applied for deviation in yaw due to wind. Also, due to wind the yaw attitude of the aircraft relative to the prescribed degree of rotation may result in actually rotating more or less than prescribed (Fig. 58). No penalty is to be applied for this variation provided it results from the effect of wind on the spin entry.



c. There must be a stall in order to have a proper spin. As always, the competitor is given the benefit of the doubt, but if a judge is certain that no stall occurred, a zero (0) is to be given.

d. The stall and the wing drop that indicates the start of auto rotation are to occur simultaneously. If they do not occur simultaneously, a downgrade of 0.5 points for each 5 degrees of movement that occurs in one movement before the other movement is shown, e.g., if the nose drops 20 degrees before the wing drop is shown a 2 point penalty is applied.

e. Starting the spin rotation in the wrong direction of rotation with a subsequent correction that forces the aircraft into the proper direction of rotation is to be penalised. Rotation movement in the incorrect direction is to be downgraded at .5 point for each 5 degrees of incorrect rotation.

f. The rotation in a spin must be autorotation which can be difficult to discern. A clue to making the judgment on "autorotation or not" is that autorotation will have a visible yaw component to the rotation. Absent this yaw component, it is probable that the aircraft is in some kind of an aileron roll. If a judge is certain that no autorotation occurred, a zero (0) is to be given.

g. The spin element must complete precisely at the degree of rotation called for by the ARESTI and not be short or beyond the prescribed end point of the rotation. Any deviation is to be downgraded 0.5 points per 5 degrees that the aircraft completes the spin short or long of the prescribed stopping point. Note that autorotation must carry to completion. It is common to see a pilot come out of autorotation early and aileron to the finish of the spin. If this occurs a penalty of 0.5 points per 5 degrees is to be applied for the amount of "aileroning" used to complete the required rotation.

h. Upon completion of the prescribed degree of rotation a vertical down line is to be shown. Omission of this line is to be downgraded one (1) point. Note that roll or snap elements may be called for on this down line after a spin. If they are called for, no centring requirement applies to the placement of these elements on this down line.