ANNEX 5F

CLASS F3N – RADIO CONTROLLED HELICOPTER FREESTYLE

5F.1 DEFINITION OF A RADIO CONTROLLED (R/C) HELICOPTER

An R/C helicopter is a heavier-than-air model aircraft that derives all of its lift and horizontal propulsion from a power driven rotor system(s) rotating about a nominally vertical axis (or axes). Fixed horizontal supporting surfaces up to 4 percent of the swept area of the lifting rotor(s) are permitted. A fixed or controllable horizontal stabiliser of up to 2% of the swept area of the lifting rotor(s) is permitted. Ground effect machines (hovercraft), convertiplanes or aircraft that hover by means of propeller slipstream(s) deflected downward are not considered to be helicopters.

5F.2 GENERAL CHARACTERISTICS

The swept area of the lifting rotor is not limited. The engine displacement is not limited. **The use of pre-programmed flight manoeuvres is forbidden.**

Limitations are:

a) WEIGHT: The weight of the model aircraft (with fuel or with batteries) must not exceed 6.**5** kg.

~~b) GYROS: The use of automatic stabilisation devices that utilise external references is forbidden. The use of pre-programmed flight manoeuvres is forbidden. The use of an electronic rate sensor is limited to rotation about the yaw axis. The use of a governor is permitted.~~

b) BATTERIES: Electric motors are limited to a maximum no load voltage of 51 volts for the propulsion circuit.

c) ROTOR BLADES: All-metal main or tail rotor blades are prohibited.

5F.3 CONTEST AREA LAYOUT

Refer to Figure 5F.A. The drawing shows a recommended layout, but the distances should be kept for safety reasons.

5F.4 NUMBER OF HELPERS

After leaving the start box, the pilot is allowed one helper. The helper may give information to the pilot during the flight.

5F.5 NUMBER OF MODELS

The number of models is not limited. One model may be used by several pilots.

5F.6 THE OFFICIAL FLIGHT

Before the flight the pilot has to be officially called. The model can be flown or be carried to the flying area. The flight begins in the compulsory schedule when the model leaves the start box; in freestyle with the announcement of the start. In the compulsory schedule the pilot is allowed to restart his engine once only after an autorotation.

5F.7 SCORING

The number of judges is at least three, max five. In the Freestyle Compulsory program each manoeuvre is given a score between 0 and 20 points by each judge. A manoeuvre not completed or not flown according to the description shall be scored zero (0) points. If a manoeuvre is scored zero points all judges must agree. In the Freestyle Unlimited Program the scoring is made after the flight according to the scoring criteria.

~~The estimation of the noise level is made by the majority of all judges. The flight time is measured by one judge or an official.~~ In the Freestyle Compulsory program only manoeuvres that are performed completely in the flight time of 8 minutes will receive a score. If the flight time for the Freestyle Unlimited **or Music** program is less than three or more than five minutes, there will be a downgrade of 5% for the flight.

The prohibited flying area is observed by the judges. If the safety line is crossed the flight will be scored zero points.

5F.8 CLASSIFICATION

After the completion of every round, all scores will be normalised by awarding 100~~,00%~~**0 points** to the highest scoring flight. The remaining scores are then normalised to a percentage in the ratio of actual score over the highest score of the round.

There shall be two rounds ~~each~~ for the compulsory **schedule** and **one round each for** freestyle ~~schedules.~~ **unlimited and music freestyle.** However, the lowest score of each competitor will be the throwaway score, the other scores are added and **then divided by** the **number of counting preliminary rounds. The** result is the ~~final~~ **preliminary** score. If only one round is possible then the classification will be based on that round.
After completion of the preliminary flights the top 10 are entitled to two fly-off flights, one for compulsory and one for music freestyle schedule. The normalised results of the preliminary rounds for the top 10 pilots plus the two fly-off scores provide three normalised scores with the best two to count for the final individual classification.

At national and open International Competitions the preliminary/fly-off system is not mandatory.

Ties will be broken by counting the throwaway score. If the tie still stands, a "sudden death" freestyle fly-off must take place until a decision is made.

5F.9 ORGANISATION

The flight order for the first compulsory round will be determined by a random draw. The flight order for rounds two (freestyle), three (compulsory) and four (**music** freestyle) will start after the first, second and third quarter of the initial order.

Preparation Time:

A competitor must be called at least 5 minutes before he is required to enter the start box. The model aircraft may be hovered only up to eye level in the start box.

After the preceding competitor has finished his flight, the competitor is given another minute (two minutes in Freestyle) to make last adjustments or checks, and then his flight time starts.

5F.10 FLIGHT PROGRAM

Freestyle Compulsory

Every pilot makes his choice of eight different manoeuvres from the list of manoeuvres (ref paragraph 5F.11). He may choose different manoeuvres for each round.

The list with the manoeuvres chosen for a round must be delivered to the Contest Director or an official before the beginning of the round.

The flight time in the compulsory rounds is eight minutes.

Freestyle Unlimited

Each competitor is given a flight timeframe of at least three, max five minutes. During this time there are no restrictions for the flight or the performed manoeuvres except the safety line. The play-back of music is not allowed.

Music Freestyle ~~(optional, only demo flights and not part of the competition):~~

The same criteria as in Freestyle, but the play-back of music during the flight is prescribed.

Performance of the Schedules

The competitor may choose his position during the flight with the following constraints:

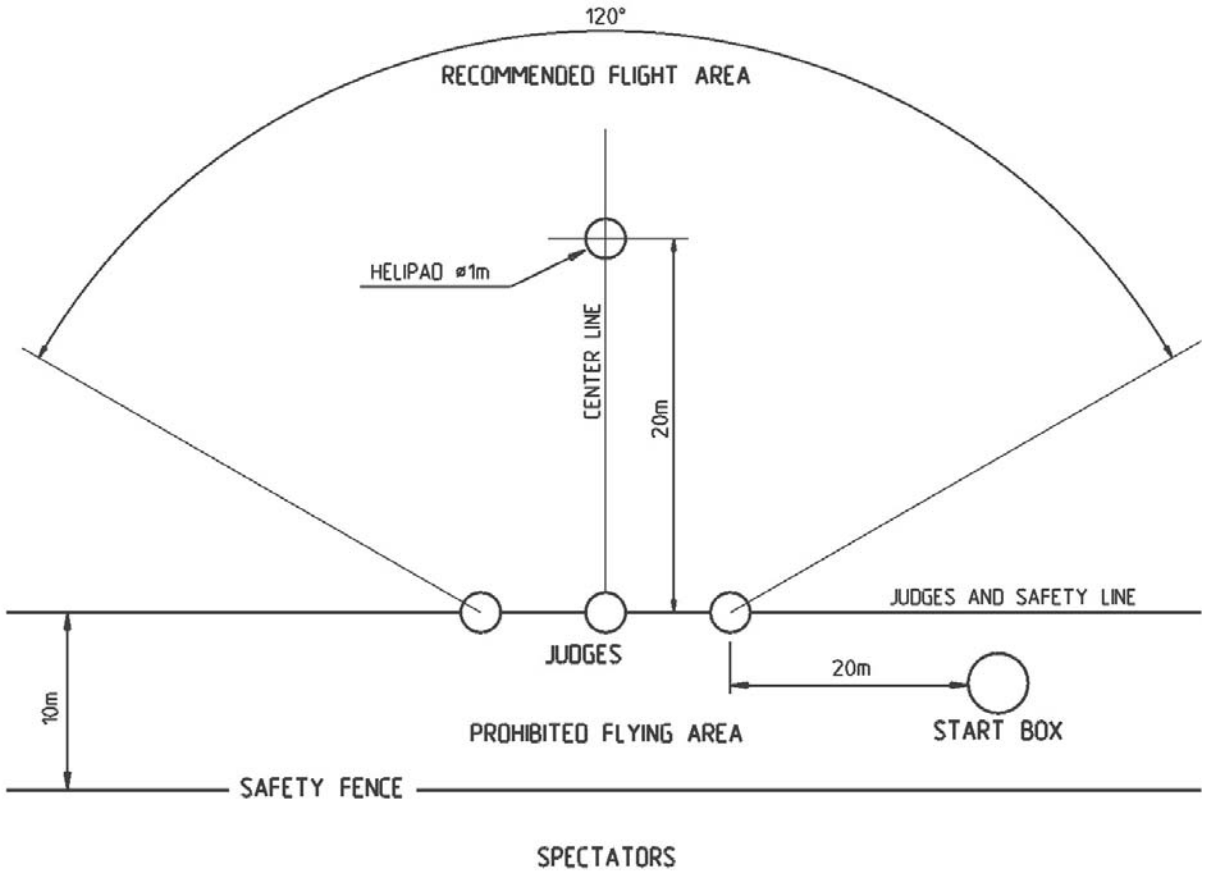
(a) The model must not fly between the pilot and judges.

(b) The model must keep a safety distance of at least twenty meters from the judges (i.e. helipad).

(c) The pilot must stand in front of the judges.

The non-observance of these constraints will be penalised by a zero score for the manoeuvre.

FIGURE 5F.A – F3N CONTEST AREA LAYOUT



5F.11 COMPULSORY MANOEUVRE DESCRIPTIONS

General:
The competitor or his caller must announce the name and start and finish of each manoeuvre. All aerobatic manoeuvres start and end with a straight and level flight of 10 meters minimum length parallel to the judges line. All manoeuvres from stationary flight start and end with a hovering of at least 1 second with the model parallel or vertical to the flight line.
All manoeuvres (considering also entry and exit) should be performed symmetrical to the centre line. For safety reasons, a minimum altitude of 5 meters on aerobatic and 2 meters on hovering manoeuvres should be kept.
If the engine is running during the autorotation there will be a downgrade of 4 points by each judge. If the engine is still running during the landing after an autorotation the score will be zero.
The drawings in Annex C shall illustrate the manoeuvres, in case of a dispute the following text takes precedence over the drawings. All manoeuvres can also be flown in opposite direction as shown in the drawings.

Number	Name	K-Factor

Description

1. Immelmann 3
Model executes a half roll immediately followed by a half inside loop to upright flight in opposite direction.

2. Inverted hovering 3
Model approaches slowly in inverted flight, stops in an altitude of 5-10 meters for at least 2 seconds and transitions to a slow inverted forward flight.

3. ~~**Double** **Inside loop** **3,5**~~
Model performs an inside loop ~~3,5~~
~~Model enters the first loop, immediately followed by the second loop. Loops are in same plane and location (superimposed).~~

4. Inverted pirouette 3,5
Model hovers in inverted flight and performs a slow (at least 4 seconds) 360°-pirouette, maintaining its lateral position.

5. Backward circle 3,5
Model enters the manoeuvre backwards in upright flight and executes a horizontal circle aligned to the ~~center~~**centre** line.

6. Double Immelmann 4
Model executes a half inside loop immediately followed by a half roll to upright flight. After a straight flight of about 20 meters model performs a half outside loop, again immediately followed by a half roll to upright flight.

7. 2-point roll 4
Model enters in upright flight, then performs a half roll followed by a recognizable straight segment in inverted flight and another half roll back to upright flight.

8. ~~Flip forward 4,5~~
~~Model hovers and enters one continuous pushed (forward) flip back to upright hovering position.~~
~~9.~~ Double roll backwards 4,5
Model enters in upright backward flight and executes two consecutive axial rolls.

~~10~~**9**. 4-point roll 4,5
Model enters in upright forward flight and then performs 4 quarter rolls, separated each by a recognizable straight segment of the same duration.

~~11. Horizontal eight backwards 5~~
10. Backward horizontal eight 5
Model enters in upright backward flight parallel to the judges' line, executes a 90°-turn to a straight flight above the ~~center~~ **centre** line and then performs a horizontal eight, consisting of two 360° circles.

~~12. Double outside~~

11. **Outside** loop (with half rolls) 5

Model executes a half roll to inverted flight, followed by a recognisable straight segment and then enters an outside loop (upward). ~~immediately followed by the second loop. Loops are in same plane and location (superimposed~~ After the ~~second~~ loop, model flies another recognizable straight segment, followed by a half roll to upright flight.

~~13~~**12**. Inverted horizontal eight 5

Model enters in inverted forward flight parallel to the judges' line, executes a 90°-turn to a straight flight above the ~~center~~ **centre** line and then performs a horizontal eight, consisting of two 360° circles.

~~14.~~**13.** Backward knife edge pirouette 5,5

Model enters in upright backward flight, transitions to a slight ascent (max 15°) and executes a quarter roll. After a recognizable straight segment model performs a 360°-pirouette, followed by another straight segment and a quarter roll in opposite direction to the first to upright backward flight.

~~15~~**14**. 4 **pushed** half flips ~~forward~~ 5,5

Model hovers in upright position, then executes four half pushed flips (forward) separated each by a hovering of about 2 seconds. Model maintains its position during the manoeuvre.

~~16~~**15**. Loop sidewards 5,5

Model enters in upright sideward flight and performs an inside loop with the longitudinal axis always vertical to the flight path.

~~17~~**16**. Tic-toc (Metronome) 6

Model hovers or moves slowly and is brought to vertical position (Nose up). It maintains its position by rotating alternately about the lateral axis for about 45° in each direction. Both 45°-positions have to be reached at least three times. The tail rotor stays almost in the same position during the manoeuvre.

~~18. Inverted autorotation 6~~

~~Model enters in an altitude of at least 30 meters in inverted flight. The engine must be off and the model descends in the inverted autorotative state for about 5 seconds. Then it is brought to upright position, either by a half roll or a flip and descends to a smooth landing on the helipad.~~

~~19~~**17**. 0°-turn with half roll 6

Model enters in upright backward flight and performs a quarter inside loop to a vertical climb and a stop. During the following dive model executes a half roll and a quarter outside loop to inverted forward flight.

~~20~~**18**. Backward loop 6,5

Model enters in upright backward flight and performs an inside loop with the tail always pointing in flight direction.

~~21. Inverted nose-in circle 6,5~~

~~Model hovers and moves laterally slowly and performs a horizontal circle with the nose of the model always pointing to the center of the circle and exits in the same manner as it started.~~

~~22~~**19**. 360°-turn with roll ~~7~~ **6,5**

Model enters in upright forward flight and executes a quarter (inside) loop to a vertical climb. Just before the stall, model executes a 360°-pirouette to a vertical (backward) dive, followed by another quarter (inside) loop to upright flight and an axial backward roll.

~~23. Inverted backward horizontal eight 7~~

~~Model enters in inverted backward flight parallel to the judges line, executes a 90°-turn to a straight flight above the center line and then performs a horizontal eight, consisting of two 360° circles with the tail always pointing in flight direction.~~

~~24. Rolling circle 7,5~~

~~Model executes a horizontal circle while it performs consecutive axial rolls. Model speed, rolling rate and the radius of the circle should be constant.~~

~~25.~~**20**. Backward 4-point roll ~~7.5~~**6,5**

Model enters in upright backward flight and then performs 4 quarter rolls, separated each by a recognizable straight segment of the same duration. The tail of the model always points in the flight direction.

~~26~~ **21.** **Inverted autorotation** **6,5**

Model enters in an altitude of at least 30 meters in inverted flight. The engine must be off and the model descends in the inverted autorotative state for about 5 seconds. Then it is brought to upright position, either by a half roll or a flip and descends to a smooth landing on the helipad.

22. Inverted backwards horizontal eight 7
Model enters in inverted backward flight parallel to the judges line, executes a 90°-turn to a straight flight above the center line and then performs a horizontal eight, consisting of two 360° circles with the tail always pointing in flight direction.

23. Rolling circle 7,5
Model executes a horizontal circle while it performs consecutive axial rolls. Model speed, rolling rate and the radius of the circle should be constant.

24. 4 rainbows with half rolls 7,5
Model performs a rainbow (a semicircle with the lateral axis always vertical to the flight path) to a recognisable stop, then a stationary half roll to another stop. Then it enters another rainbow to a stop on the position of the start of the manoeuvre, followed by another half roll and continues like that, until four rainbows and four half rolls are completed.

25. Funnel 7,5
Model enters in inverted forward flight and performs a quarter pirouette. Model then performs ~~four~~ **three** superimposed circles in lateral inverted flight with the rotor disk tilt at least 45 degree from a horizontal plane. The diameter of the circles should be at least 10 meters.

26. Snake 8
Model enters in upright backward flight and then describes a sinuous line by alternately performing upright and inverted circle segments of equal diameter and length. There should be at least four complete circle segments and the length of the manoeuvre should be at least 50 meters.

~~28.~~**27.** Inverted pirouetting circle 8
Model enters in inverted flight and executes a horizontal circle while performing consecutive pirouettes. Model speed, pirouetting rate and the radius of the circle should be constant.

~~29~~**28**. Triple pirouetting flip 8
Model hovers or moves slowly and then starts pirouetting. At the same time or after one pirouette the model starts to flip three times while it continues to perform pirouettes. There should be at least one pirouette during each 360° flip (2 pirouettes are shown in the drawing). Both rotations should have a constant rate and the model maintains its position during the manoeuvre.

~~30~~**29**. Pirouetting loop 8,5
Model enters in upright flight and starts performing pirouettes. Then it executes an inside loop while constantly rotating about the yaw axis. During the loop there have to be at least 2, max 6 pirouettes. The pirouettes should be distributed equal on the loop.

~~31~~**30**. Cuban eight backwards 8,5
Model enters in upright backward flight and executes a 5/8 inside loop to a 45°-descent. It performs a half roll, followed by a ¾ inside loop and another half roll in 45°.descent. Model then finishes the first partial loop to upright backward flight. The tail of the model always points in the flight direction.

~~32~~**31**. Backward rolling circle 8,5
Model enters in backward flight and executes a horizontal circle while it performs consecutive axial rolls. Model speed, rolling rate and the radius of the circle should be constant and the tail of the model always points in the flight direction.

32. 4 X 270°-Turns 9
Model enters in upright backward flight and performs a quarter loop to vertical flight. On the top the model performs a 270 degree turn to a vertical descend sidewards, followed by a half inverted loop sidewards to vertical flight and another 270 degree turn in the same direction as the first. Model continues until 4 turns (all in the same direction) are completed and exits in upright backward flight.

33. Double 4-point ~~tic~~**Tic**-toc (Metronome) 9
Model hovers or moves slowly and is brought to vertical position (Nose up). It maintains its position by rotating

alternately about the lateral axis for about 45° in each direction. Both 45°-positions have to be reached one time (i.e. one tic-toc) and then the model performs a quarter pirouette. It performs another complete tic-toc in this position, then again performs another quarter pirouette and so on, until it performed two complete pirouettes while executing tic-tocs.

34. ~~Circle with flips~~ **Rolling rotation** 9

~~The model executes a horizontal circle while it rotates about its lateral axis and stops shortly in each vertical position. The manoeuvre can be described as a series of 0°-turns, connected by half loops on a circular path. The radii of the loops should be equal and all stops should reach the same altitude. Also the circle should be round and not polygonal.~~

Model hovers and then performs at least six stationary rolls while its lateral axis rotates about 360 degree (viewed from above)

35. Diamond (Bavarian rhomb) 9

Model enters in upright forward flight and over the center line it performs a 45° pushed flip and enters a 45° climb of at least 20 meters length. After a pushed 90° flip it climbs for another 20 meters under 45° back to the center line where it performs another quarter pushed flip. It descends under 45° to another quarter pushed flip and a final descend back to the center line and then exits the manoeuvre in upright flight. During the 45° ascends/descends the longitudinal axis of the model should be almost perpendicular to the flight path.

36. Pirouetting funnel 9,5

Model enters in inverted flight and then starts pirouetting whereas it performs ~~two~~ **three** superimposed circles in lateral inverted flight with the rotor disk tilt at least 45 degree from a horizontal plane. The diameter of the circles should be at least 10 meters and there should be at least three pirouettes during each circle.

37. ~~Autorotation~~**Funnel with** ~~with pirouetting flip~~ **half rolls** 9,5

Model enters ~~at an altitude of at least 30 meters in upright~~ **in inverted forward** flight ~~The engine must be off~~ and ~~the model descends in the autorotative state. During the descend, the model~~ performs ~~one pirouetting flip with at least two pirouettes and then descends to a smooth landing on the helipad~~ **a quarter pirouette. Model then performs three superimposed circles in lateral inverted flight with the rotor disk tilt at least 45 degree from a horizontal plane. After each half funnel except the last the model performs a half roll. After three funnels (and five half rolls) the model exits in upright forward flight. The diameter of the circles should be at least 10 meters**.

38. Square of rainbows 10

Model hovers and enters the manoeuvre with a rainbow, i.e. a not stationary flip that follows a semi-circular flight path of at least 10 meters diameter. On top of the rainbow the model performs a half flip about the axis, that is vertical at this point (e.g. on a pulled rainbow the model performs a flip about the longitudinal axis (like a half roll); on a rainbow flown sidewards it performs a half (pushed or pulled) flip).

Model then hovers and enters another rainbow, alternately about the longitudinal and the lateral axis, until it reaches the starting position after the fourth rainbow. The four hovering positions between the rainbows are situated on the edges of a square of 10 meters.

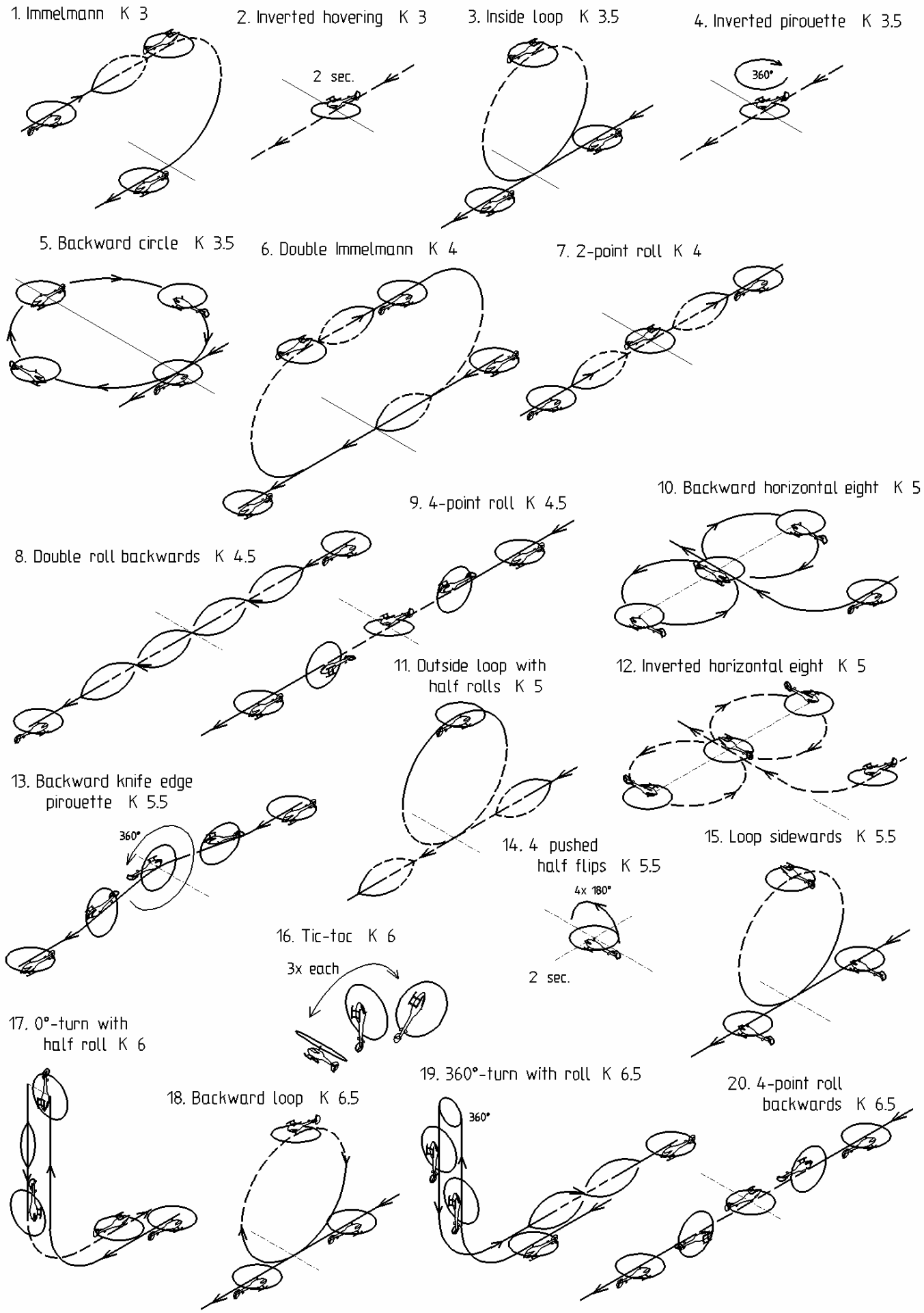
39. Pirouetting tic-toc (Metronome) 10

Model hovers or moves slowly and is brought to vertical position (Nose up). It maintains its position by rotating alternately about the lateral or the longitudinal axis for about 45° in each direction while it performs pirouettes of a constant rate. Both 45°-positions have to be reached at least three times (i.e. three tic-tocs) and also there has to be at least one complete pirouette.

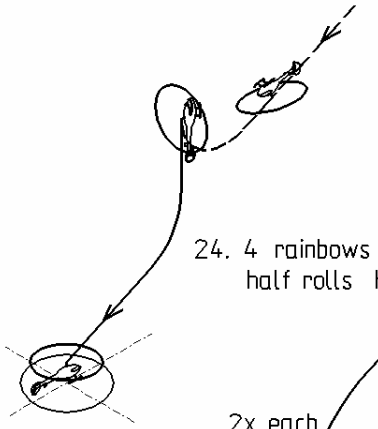
40. Pirouetting globe 10

Model enters in upright flight and then performs four pirouetting loops. During each loop, the flight path is changed in a way, that the next loop is rotated about 45° (seen from above) until a complete globe has been described. The model exits the manoeuvre at the same altitude but in opposite direction to the beginning. During each loop, the model must perform at least two pirouettes.

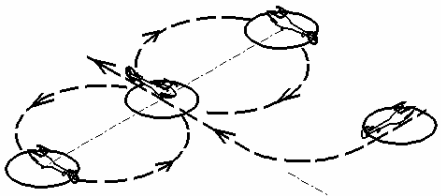
5F.12 F3N COMPULSORY MANOEUVRE DRAWINGS



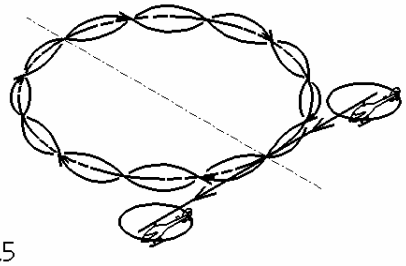
21. Inverted autorotation K 6.5



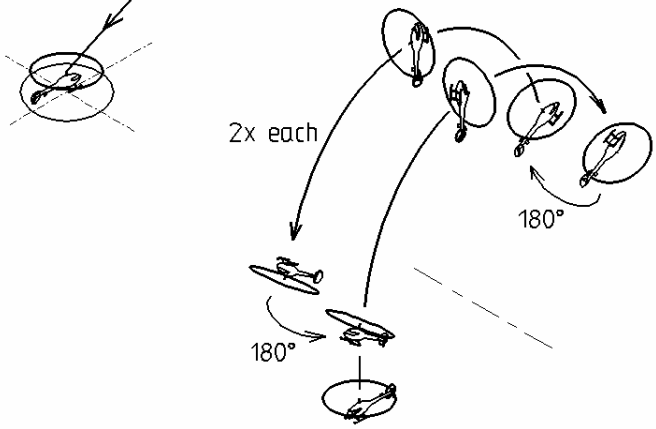
22. Inverted backwards horizontal eight K 7



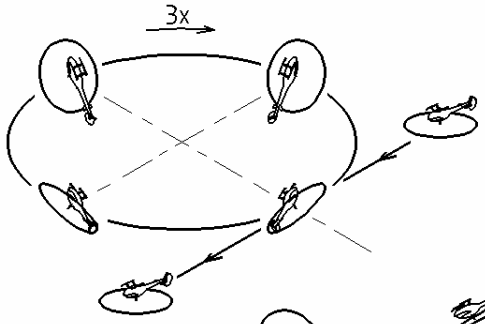
23. Rolling circle K 7.5



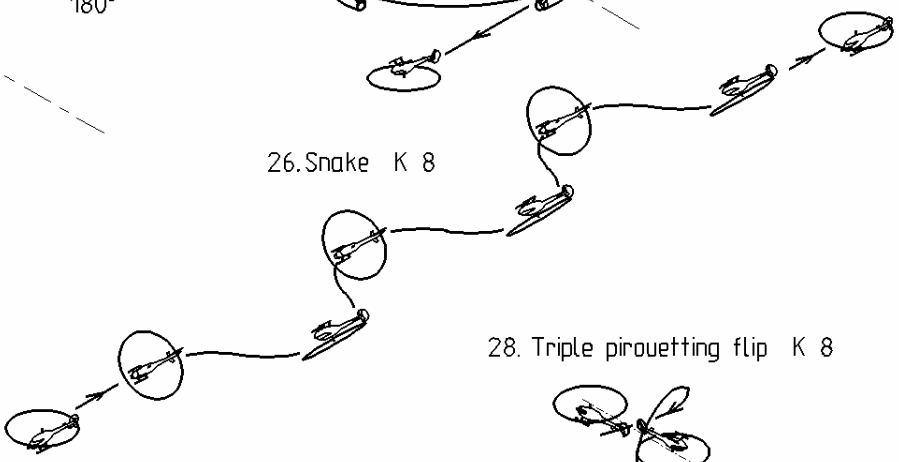
24. 4 rainbows with half rolls K 7.5



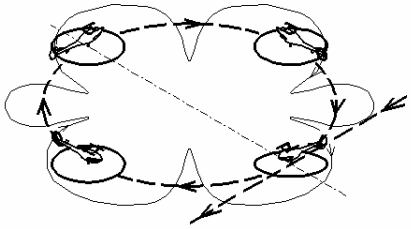
25. Funnel K 7.5



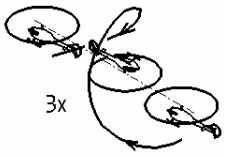
26. Snake K 8



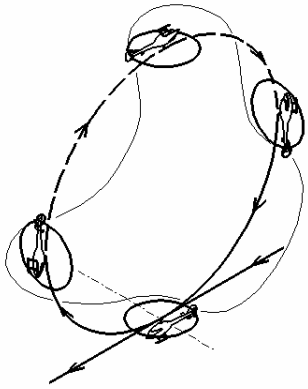
27. Inverted pirouetting circle K 8



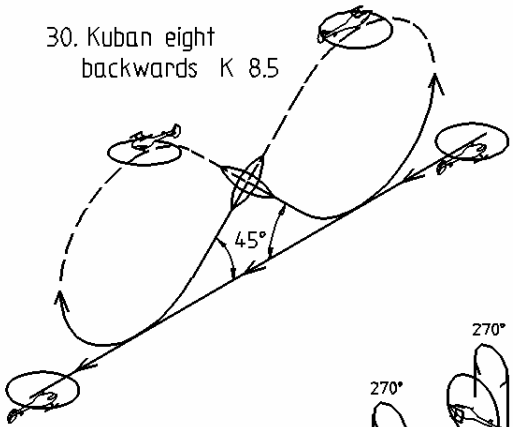
28. Triple pirouetting flip K 8



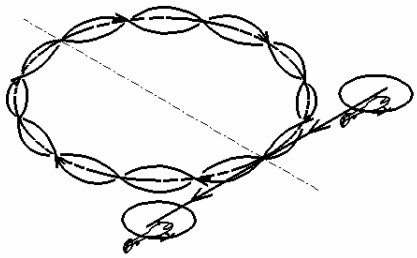
29. Pirouetting loop K 8.5



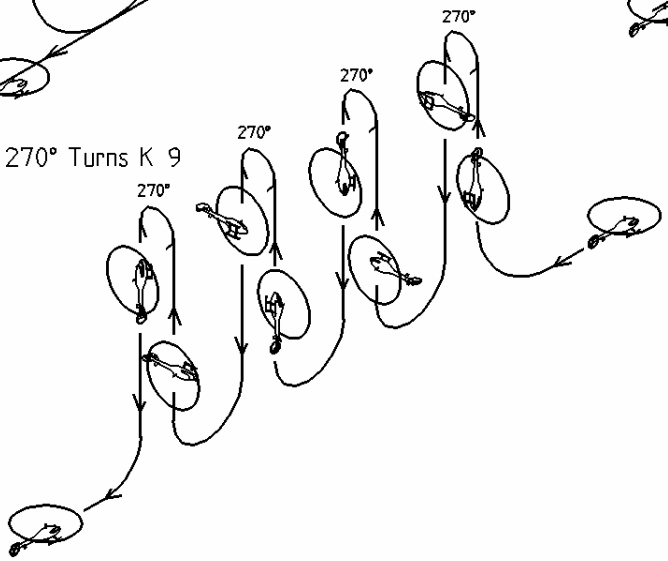
30. Kuban eight backwards K 8.5



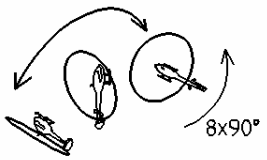
31. Backwards rolling circle K 8.5



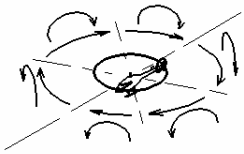
32. 4 270° Turns K 9



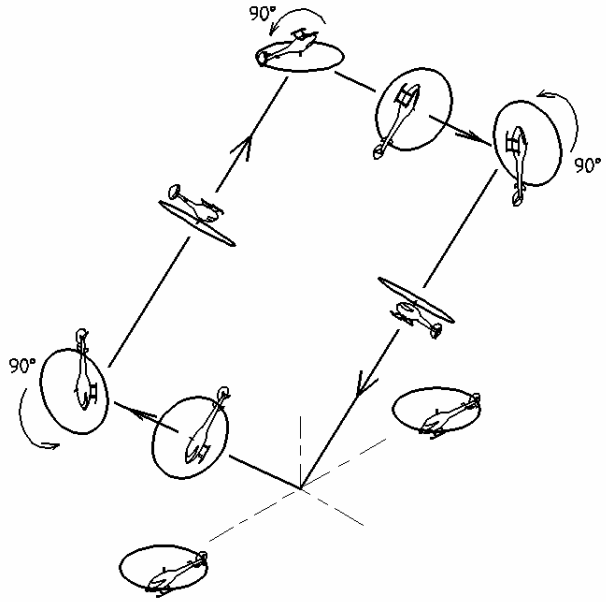
33. Double 4-point tic-toc K 9



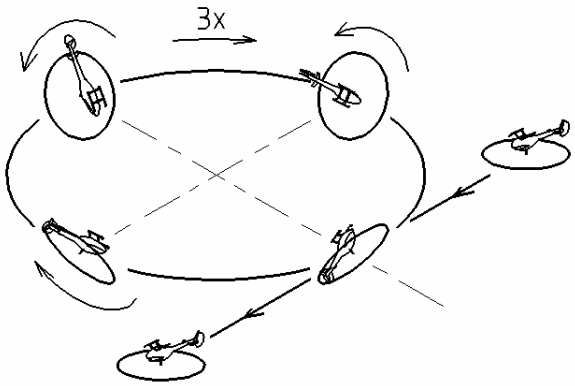
34. Rolling rotation K 9



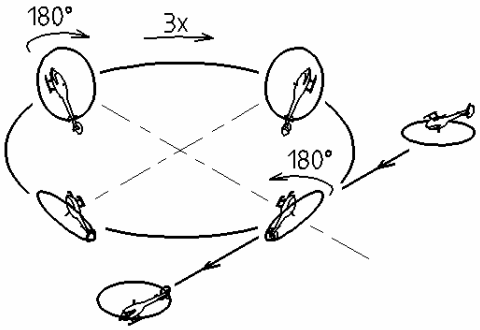
35. Diamond (Bavarian rhomb) K 9



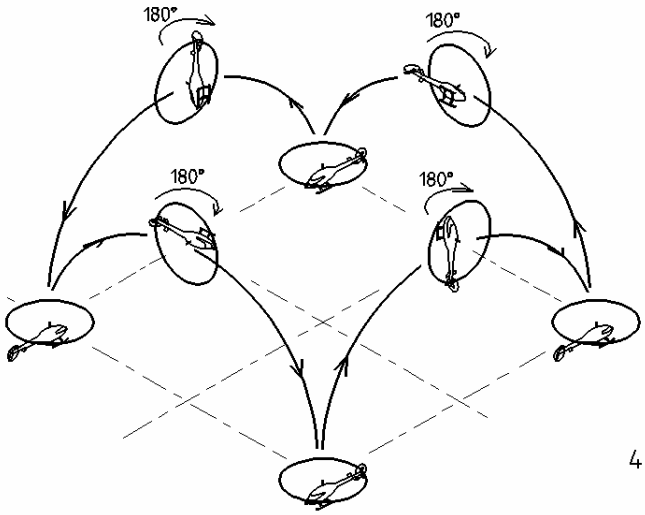
36. Pirouetting funnel K 9.5



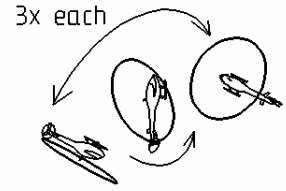
37. Funnel with half rolls K 9.5



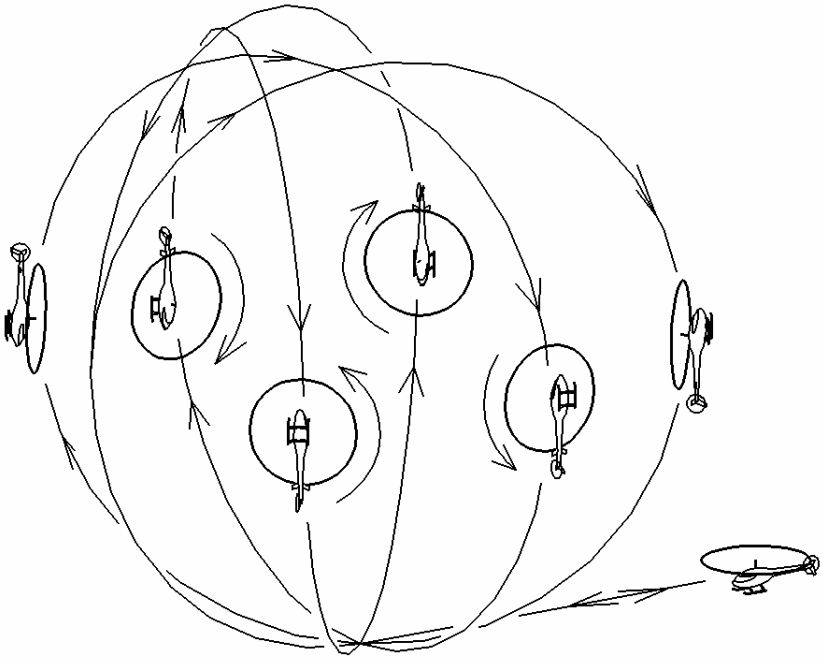
38. Square of rainbows K 10



39. Pirouetting tic-toc K 10



40. Pirouetting globe K 10



5F 13. EVALUATION OF THE LEVEL OF DIFFICULTY FOR FREESTYLE SCHEDULE

The following spreadsheet gives reference values for the estimation of the level of difficulty for both schedules, unlimited and music freestyle.

Score	Manoeuvres (examples)
6	Immelmann, short inverted passages, loop, loop with full pirouette on top, roll, turn, 540° turn, pirouettes, autorotation
11	½ Cuban eight, travelling pirouettes, long inverted passages, straight backwards flight, outside loop, vertical rolls, nose-in circle, flips
17	Inverted Immelmann, inverted hovering on eyelevel, circle backwards, loop with half pirouette on top, loop backwards, flip sidewards, Cuban eight, flips with hovering stops
22	Horizontal eight backwards, loop sidewards, backwards roll, vertical backwards roll, turn with hesitations and/or changes of turning direction, rolling stall turn, autorotation with 180 degree turn, death spiral, autorotation backwards
28	½ Cuban eight backwards, straight inverted backwards flight, stationary inverted nose-in hovering, pirouetting circle, 4-point roll, inverted nose-in circle
34	Inverted circle backwards, outside loop backwards, ½ Cuban eight inverted, turn backwards, knife edge pirouette, inverted speed circle
39	inverted pirouette, ½ Cuban eight sidewards, travelling inverted pirouettes, inverted horizontal eight backwards, inverted backwards turn, 4-point roll backwards, rolling circle
45	Loop with flips, nose-in flips sidewards, sideward flight with flips, inverted pirouetting circle, stationary tic-toc, funnel, inverted autorotation
49	½ backward Cuban eight inverted, Cuban eight backwards, inverted loop sidewards, pirouetting flips
53	Combination of loops with changing direction and/or orientation, inverted funnel, snake, inverted autorotation backwards, inverted speed circle backwards
57	Pirouetting loop, 4-point tic-toc, rolling horizontal eight, rolling circle backwards, circle with flips, Cuban eight sidewards, pirouetting autorotation
60	Inverted funnel eight, pirouetting outside loop, rolling circle with reversal, rolling horizontal eight backwards, autorotation with inverted pirouettes
64	Inverted Cuban eight sidewards, rolling loop, circle or loop with pirouetting flips, tic-toc circle, rolling autorotation
68	Pirouetting tic-toc, rolling loop backwards, circle or eight with flips in varying directions, pirouetting funnel, inverted Cuban eight backwards
72	Rolling snake, tic-toc with rolls or flips, 4- or more point tic-toc, inverted pirouetting funnel, pirouetting globe, autorotation with pirouetting flips
76	BigBen, inverted pirouetting globe, pirouetting snake, pirouetting flip with reversal
80	Pirouetting manoeuvres with reversal (loop, globe, funnel, snake tic-toc), autorotation with pirouetting flips and rolls