



FAI Sporting Code

Section 6

*Fédération
Aéronautique
Internationale*

Regulations for the Conduct of International Aerobatic Events

Part 1 Powered Aircraft

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FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE

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¹ FAI Statutes, Chapter 1, para. 1.6

² FAI Sporting Code, General Section, Chapter 3, para 3.1.3.

³ FAI Statutes, Chapter 1, para 1.8.1

⁴ FAI Statutes, Chapter 2, para 2.1.1; 2.4.2; 2.5.2 and 2.7.2

⁵ FAI Bylaws, Chapter 1, para 1.2.1

⁶ FAI Statutes, Chapter 2, para 2.4.2.2.5,

⁷ FAI Bylaws, Chapter 1, para 1.2.3

⁸ FAI Statutes, Chapter 5, para 5.1.1; 5.5; and 5.6

⁹ FAI Sporting Code, General Section, Chapter 3, para 3.1.7

¹⁰ FAI Sporting Code, General Section, Chapter 1, paras 1.2. and 1.4

¹¹ FAI Statutes, Chapter 5, para 5.6.3

¹² FAI Bylaws, Chapter 1, para 1.2.2



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1. GENERAL RULES FOR WORLD AND CONTINENTAL AEROBATIC CHAMPIONSHIPS AND INTERNATIONAL AEROBATIC COMPETITIONS

1.1. Aims Of Aerobatic Championships And International Aerobatic Competitions

- 1.1.1.1. To establish the champions and the winners in the various programmes of both the men's and women's divisions as appropriate.
- 1.1.1.2. To establish the overall champions and the overall winners in both the men's and women's divisions as appropriate.
- 1.1.1.3. To establish the champion teams and team winners in both the men's and women's divisions as appropriate.
- 1.1.1.4. To promote the sporting skill of aerobatic pilots of FAI member aero clubs and arrange competitive contests between aerobatic pilots of FAI member aero clubs, and to allow aerobatic pilots the maximum opportunity to demonstrate within the scope of the general rules their ability in competition with others.
- 1.1.1.5. To promote and popularise aerobatics and to develop and foster friendly relations between aerobatic pilots of different countries.
- 1.1.1.6. In pursuance of these aims and in case of dispute over the interpretation and application of these rules, and any other regulations for the conduct of aerobatic championships and competitions, a competitor shall be entitled to the benefit of reasonable doubt.

1.2. General Regulations

1.2.1. Contest Categories

1.2.1.1. World Championships

- a) World Championships will be held every two years and should last not longer than 7 to 12 days from opening to closing ceremonies.
- b) A National Airports Control, or other legal entity, which has applied to be host and organiser will be entrusted with the organisation of World Championships pending approval by CIVA.
- c) The organisers will provide conditions for entry and participation for any national FAI member aero club on equal rights basis, and will carry out the World Championships on the basis of the decisions and rules of the FAI.
- d) Each NAC will be notified by the organiser, not later than 6 months before the beginning of the championships, of any general organisational conditions such as time, place, travel and visa formalities, entry forms, entry deadline, etc.
- e) CIVA shall decide at the meeting which precedes a World Championships which FAI language(s) shall be used as the working language(s) both orally and in writing for all purposes for the duration of the championships.

1.2.1.2. Continental Championships

- a) Continental Championships may be held in years when there are no World Championships and in principle should not last more than 7 days.
- b) The championships shall be open to all FAI members of one of the continents: FAI members of other continents may be invited to compete, but not for the title of Continental Champion.



- c) In other respects rule 1.2.1.1 applies.
- d) Except where otherwise stated in Sporting Code, the rules and regulations of World Championships should apply.

1.2.1.3. International Competitions

- a) Organisers will be a national FAI member aero club.
- b) International contests must be made known to the FAI for inclusion in the calendar of international events by October of the year preceding the contest.
- c) Any national FAI member aero club may be invited to participate in an international contest.
- d) It is recommended that programmes are arranged according to the rules and regulations of World Championships.
- e) Each participating national FAI member aero club will be notified by the organising aero club not later than 3 months before the beginning of the contest of any general organisational details and of details specifically relevant to the contest.

1.2.2. Aircraft Categories

World and Continental Championships are at present open to:

1.2.2.1. Piston-engined aircraft - Unlimited Class "U"

1.2.2.2. Piston-engined aircraft - Advanced Class "A"

A list of types of piston-engined aircraft excluded from Advanced (see Section 4.6.2) will be updated at each CIVA meeting.

1.2.2.3. Piston-engined aircraft – Yak52 Class “Y52”

1.2.2.4. In International Competitions, the organizers may stipulate that entry shall be restricted to a single aircraft type, for example Pitts S-2B or Yak 52. In such events, Sporting Code will apply in principle, but local variations, approved in advance by the Bureau of CIVA, may be made to take into account aircraft performance.

1.2.3. Number of Competitors

1.2.3.1. "U"

- a) World and Continental Aerobatic Championships will be held or recognised as such if there are in the men's class at least 15 competitors from at least 5 countries. The women's World and Continental Championships will be held if the men's championships take place and provided that there are at least 5 women competitors from at least 3 countries.
- b) Continental Championships may also be recognised as such if there are at least 15 men and women competitors from at least 5 countries competing in a single class.

1.2.3.2. "A" and “Y52”

- a) World and Continental Aerobatic Championships will be held or recognised as such if there are at least 15 competitors from at least 5 countries.

1.2.3.3. Events will be recognised as international competitions provided that there are at least 6 competitors from at least 3 countries participating.



1.2.4. Team Composition

1.2.4.1. World Championships

- a) "U"
 - i) National Airports Controls shall notify the organisers of a World Championships, not less than two months before it is due to start, of the number of competing pilots to be entered from their countries up to a maximum of ten (10). Of these pilots, no more than six (6) may be of the same gender. If the resulting total number exceeds eighty (80) competitors, the organisers shall have the right, without reference to CIVA, to reduce the maximum number of pilots per country to nine (9) or eight (8), and in this event shall at once notify NACs accordingly. NACs must also at this time indicate the number of pilots they wish to enter for Programme 4.
 - ii) Solo male or female entries are allowed and will be accepted from NACs unable to send the minimum number of 3 competitors required for the team competition in the men's and women's divisions.
 - iii) In the event that fewer than 3 teams comprised of 3 or more male or female pilots, the number of pilots required to constitute a team will be reduced to 2. The requirements of paragraph 1.2.3.1 still apply.
 - iv) No later than at registration, NACs shall advise the Organiser of the names of those pilots competing in Programmes Q to 3 who should also be considered for entry into Programme 4.
 - v) In addition to those pilots notified above, each NAC may nominate one additional pilot to compete in Programme 4 only. The deadlines for notification of entry and fee payment for this additional pilot, plus the amount of the entry fee, will be as for the others, but the pilot will not be required to arrive at the contest site until, at latest, the day before Programme 4 is scheduled to be flown. No training flights will be allowed for Programme 4 after the contest has started.
 - vi) After the normal entry closing date, the Organiser shall notify the names and countries of these additional pilots to the President of the International Jury. The qualification of these pilots to fly this Freestyle programme will be subject to review by the International Jury. If a pilot is rejected, notification will be sent to the relevant NAC at least two weeks before the start of the Championships.
- b) "A" and "Y52"
 - i) National Airports Controls shall notify the organisers of a World Championships, not less than two months before it is due to start, of the number of competing pilots to be entered from their NAC up to a maximum of eight (8). The organisers shall have the right, without reference to CIVA, to reduce this maximum number of pilots of each nation from 8 to 6 competitors. In this event the organisers shall at once notify NACs accordingly.
 - ii) Solo entries are allowed for NACs.
- c) The team of each NAC may include the following officials: 1 chief delegate, 1 team manager, 1 chief trainer, trainers, doctors, interpreters, mechanics etc.
- d) Every competitor must be a member of his or her NAC and must be in possession of a valid FAI sporting licence.
- e) Every official must be a member of his or her NAC.



- f) The admission of observers depends on the facilities available and is subject to agreement with the organising aero club.

1.2.4.2. Continental Championships and International Competitions

The composition of teams and the number of members of a team will be fixed by the organising aero club.

- a) "U"

For Continental Championships, the number of competitors of each NAC should be no more than ten (10), of which no more than six (6) may be of the same gender.

- b) "A" and "Y52"

For Continental Championships, the number of competitors of each NAC should be no more than eight (8).

- c) Every competitor must be a member of his or her NAC and must be in possession of a valid FAI sporting licence.
- d) Every official must be a member of his or her NAC.

1.2.4.3. Eligibility "A"

- a) Pilots who have flown in an Unlimited World or Continental Championship for powered aircraft, during the year of an Advanced contest or in the preceding two years, will only be eligible to fly in the Advanced contest if they gained less than 60% of the maximum possible marks across the sequences they flew in the last Unlimited contest.

1.2.4.4. Non-NAC Entries

- a) Organisers are also obliged to accept entries from FAI Applicants as described in paragraph 3.2.1 or Sporting Code, General Section.
- b) At their discretion, Organisers may accept further entries from pilots not representing their NAC. These entrants will be classified as "*Hors Concours (H/C)*". They will pay normal entry fees, subject to the normal entry deadlines for the contest, and be treated as other competitors. In the event of time constraints, however, they can expect to be shifted in the order of flight or deleted from the flight programmes altogether at the discretion of the International Jury. H/C pilots will appear in the final results but will not be ranked or eligible for any awards or medals.

1.2.5. Entries

- 1.2.5.1. The official entry forms must be completed correctly and submitted to the organising aero club not later than requested by the organisers.
- 1.2.5.2. Every national FAI aero club must be notified of the address of the organising aero club not later than 6 months for World and Continental Championships, or 3 months for international competitions, prior to the beginning of the event. (See 1.2.1.1, 1.2.1.2 or 1.2.1.3)

1.2.6. Aircraft Documentation

- 1.2.6.1. All competing aircraft must meet the performance characteristics required for the kind of flight they will be undertaking. A valid aerobatic certificate of airworthiness or equivalent document issued by the competent aviation authority of the participant's country must be produced to the organisers for every contest aircraft.
- 1.2.6.2. Aircraft will not be admitted to the contest unless the appropriate documentation has been submitted to the organisers.



1.2.7. Air Safety

- 1.2.7.1. All competitors must observe and adhere to the regulations currently in force in the organiser's country for air safety as well as the special regulations in force at the contest aerodrome. To facilitate this, the organiser must ensure that an English translation of applicable rules, issued by the Aviation or Customs Authorities of the host country, is available in advance in a bulletin or on the competition website.
- 1.2.7.2. Any violation of the safety regulations in force may at any time render the offender liable to exclusion from the contest. No responsibility will be undertaken by the organisers for any such violation by competitors or others.
- 1.2.7.3. To enable the pilot to watch over his or her own safety, an accelerometer must be installed in each competing aircraft.
- 1.2.7.4. The Chief Judge may, with the agreement of two-thirds of the Board of Judges, exclude a pilot who is not flying safely or could cause an unsafe situation. This would apply from takeoff to touchdown.
- 1.2.7.5. Any competitor required to interrupt a competition flight due to danger of collision with conflicting air traffic or a bird, should be treated in the same manner as if a mechanical defect (paragraph 4.2.7) had taken place. If the pilot is required to orbit to avoid any such hazard, the Chief Judge will allow additional time if required.

1.2.8. Insurance

- 1.2.8.1. The organisers will provide a promoter's liability insurance of an adequate sum against third party risks for the duration of the contest covering functional test flights, training and competition flights, in accordance with the legal requirements of the country in which the championships or competition is held.
- 1.2.8.2. All competitors must produce evidence of adequate third party insurance valid for the duration of the contest and valid in the organiser's country. The organisers should specify in local regulations the amount of insurance cover regarded as adequate.

1.2.9. Competitors and Aircraft

- 1.2.9.1. All flights carried out by competitors at World and Continental Championships and international competitions must be made solo; this applies to competition flights and training flights.
- 1.2.9.2. Replacements of competitors at Championships and international competitions will be left to the discretion of the International Jury, but no such replacement will in any case be permitted less than 12 hours before the commencement of the first competition flight.
- 1.2.9.3. A contest aircraft may on the recommendation of the technical commission, and with the permission of the International Jury, be replaced at any time by another contest aircraft.

1.3. Classification Of Aerobatic Contests

1.3.1. World Championships

At World Championships the following competition flights will be scheduled:

1.3.1.1. Programmes "U" and "A"

- a) Programme Q: The Known Compulsory Programme
 - Programme 1: The Free Programme
 - Programme 2: The 1st Unknown Compulsory Programme
 - Programme 3: The 2nd Unknown Compulsory Programme
 - Programme 4: The Final Freestyle Programme (Unlimited only)



- b) Programme Q will be a qualification and training flight. The final results of this programme will not count toward the Championships, unless due to bad weather etc. only Programme 1 has been completed. In these exceptional circumstances, the combined results of Programmes Q and 1 will be used rather than declare a non-contest. Any pilot scoring less than 60% of the total possible score will not continue in the competition unless the pilot is, in the judgement of the International Jury and Board of Judges, capable of safely flying the remaining programmes.
- c) For Programme 3, a mandatory cut of 25% of the competitors, without respect to gender, will be introduced on the basis of the final results after Programmes 1 and 2. If there is insufficient time to complete the championships due to weather problems or unforeseen circumstances, the International Jury is authorised to introduce an additional cut of the competitors, without respect to gender, up to a maximum of 50% of the combined standings after Programmes 1 and 2.
- d) The decision on the number of competitors who will fly the Final Freestyle Programme will be made by the International Jury in consultation with the organisers, but will be not less than 10 pilots nor more than 20. Priority in selection will be given to those additional pilots entered by NACs for this programme only, then to the pilots of other NACs and then to further pilots from all NACs in their order of ranking in the programmes so far completed.
- e) In Unlimited, Programme 4 shall have priority over Programme 3. Thus, if weather forecasts indicate that all programmes may not be completed before the end of the contest period, the organisers, in consultation with the International Jury, shall direct that Programme 4 be flown before Programme 3.

1.3.1.2. Programmes "Y52"

- a) The Known Programme: The Known Compulsory Programme
Programme 1: The Free Programme
Programme 2: The 1st Unknown Compulsory Programme
Programme 3: The 2nd Unknown Compulsory Programme
- b) The final results of all completed programmes will count toward the Championship.
- c) The qualification for succeeding programmes will be as follows:
Programme 1: All qualified competitors
Programme 2: All qualified competitor
Programme 3: A minimum of the 25 highest placed competitors after the Known Programme, Programmes 1 and 2, subject to Jury discretion.

1.3.1.3. Champions "U"

World Champions in the male and female classes will be:

- a) **World Champion in the Free Programme:**
The male competitor and female competitor who gain the highest number of points each in Programme 1.
- b) **World Champion in the Unknown Programmes:**
The male competitor and female competitor who gain the highest total number of combined points each in Programmes 2 and 3.
- c) **World Champion in the Final Freestyle Programme:**
The male competitor and female competitor who gain the highest number of points each in Programme 4.



- d) **Overall World Champion in the male and female classes:**
The male competitor and female competitor who gain the highest total number of points each in Programmes 1, 2 and 3.
- e) **Overall World Champion:**
The competitor who gains the highest total number of points in Programmes 1, 2 and 3, regardless of gender.
- f) **Men's World Champion Team:**
Will be that men's team with the highest total number of points in Programmes 1, 2 and 3 taking into account the three highest individual scores in that team.
- g) **Women's World Champion Team:**
Will be that women's team with the highest total number of points in Programmes 1, 2 and 3 (or relevant programmes consistent with rule 1.3.1.1.b), taking into account the three highest individual scores in that team (or two if rule 1.2.4.1.a)iii). is in force), provided that there are at least 3 female teams with at least 2 competitors each.
- h) **World Champion Team:**
In the event that fewer than 3 teams comprised of 2 or more female pilots compete, the Team awards will be given regardless of gender, i.e. taking into account the total number of points of the three highest individual scores of the mixed teams.
- i) Awards will be given in compliance with paragraph 4.5.

1.3.1.4. Champions "A"

Advanced World Champions will be:

- a) **Advanced World Champion in the Free Programme:**
The competitor who gains the highest number of points in Programme 1.
- b) **Advanced World Champion in the Compulsory Unknown Programme:**
The competitor who gains the highest total number of points in the 1st Unknown.
- c) **Advanced World Champion in the Free Unknown Programme:**
The competitor who gains the highest total number of points in the 2nd Unknown.
- d) **Overall Advanced World Champion:**
The competitor who gains the highest total number of points in Programmes 1, 2, and 3.
- e) **Advanced World Champion Team:**
Will be that team with the highest total number of points in Programmes 1, 2 and 3 taking into account the three highest individual scores in that team.

1.3.1.5. Champions "Y52"

Yak52 World Champions will be:

- a) **Yak52 World Champion in the Known Programme:**
The competitor who gains the highest number of points in the Known Programme.
- b) **Yak52 World Champion in the Free Programme:**
The competitor who gains the highest number of points in Programme 1.
- c) **Yak52 World Champion in Programme 2:**
The competitor who gains the highest total number of points in the 1st Unknown.
- d) **Yak52 World Champion in Programme 3:**
The competitor who gains the highest total number of points in the 2nd Unknown.



e) **Overall Yak52 World Champion:**

The competitor who gains the highest total number of points in the Known Programme plus Programmes 1, 2, and 3.

f) **Yak 52 World Champion Team:**

Will be that team with the highest total number of points in the Known Programme plus Programmes 1, 2 and 3 taking into account the three highest individual scores in that team.

1.3.1.6. Champions and Winners "U" and "A"

- a) In addition to establishing World Champions, second and third placings will also be established in the individual and team competitions, in accordance with paragraph 1.3.1.3, and these will be recognised by the award of medals and diplomas.
- b) The World Champion (in Unlimited male and female World Champions) will be the competitors who gain the highest total number of points each in Programmes 1, 2 and 3. Programme 4 will be a separate competition programme with its own gold, silver and bronze medals. In the event that Programmes 1, 2, and 3 are not completed, World Champions will be named in Programme 1 and 2 as well as Overall Champions and World Champion Teams. In the event that only Programme 1 is completed, the results for Programme Q will be used retrospectively to declare Overall World Champion, male and female overall World Champions in Unlimited, World Champions in the Known and Free Programmes and World Champion Teams.
- c) If the number of female competitors in Unlimited is less than 5, there will still be a final placing based on Programmes 1, 2 and 3 and independent of the final placings of the men. In this case there will be one female overall winner and second and third placings; but there will be no Overall Women's Champion.

1.3.1.7. Champions and Winners "Y52"

- a) In addition to establishing World Champions, second and third placings will also be established in accordance with paragraph 1.3.1.5, and these will be recognised by the award of medals and diplomas.
- b) In the event that the Known Programme and Programmes 1, 2 and 3 are not completed, the overall World Champion will be named on the basis of scores in the Known Programme, Programmes 1 and 2. In the event that only the Known Programme and Programme 1 are completed, these results will be used to declare an overall Y52 World Champion and Y52 World Champion Team.

1.3.2. Continental Championships and International Competitions

1.3.2.1. "U"

Rules 1.3.1.1, 1.3.1.3 and 1.3.1.6 should apply, except as indicated below.

- a) If there are insufficient men and women competitors to establish separate men's and women's divisions, then the championships may take place in one single division, provided that the number of competitors and NACs taking part are at least that required under rule 1.2.3.1.

1.3.2.2. "A"

Rules 1.3.1.1, 1.3.1.4 and 1.3.1.6 should be applied excluding any references to gender.

1.3.2.3. "Y52"

Rules 1.3.1.2, 1.3.1.5, and 1.3.1.7 should be applied.



1.4. Contest Bodies

1.4.1. The International Jury

1.4.1.1. The International Jury is the supreme arbitration body of international aerobatic events and shall be responsible for:

- a) Interpreting the general rules, the judging rules and the general regulations of the contests;
- b) Supervising the activities of the Chief Judge and the Board of Judges; during judging, members of the International Jury must not remain in the vicinity of the International Judges;
- c) Supervising the technical commission;
- d) Dealing with protests from competitors.

Overseeing the administration of the contest and ensuring that the organisers of international contests meet the requirements as stipulated in the checklist provided to the organisers for such events.

1.4.1.2. Appointment

- a) The International Jury at World and Continental Championships will be appointed by the FAI Aerobatics Commission (CIVA) and will consist of a chairman and at least 2 members with adequate reserves, who must be members of different NACs. The Chief Judge shall be an advisory member of the International Jury and the Contest Director shall be adviser to it. The President of CIVA or one of the Vice Presidents will be chairman of the International Jury and will supervise its activities. Detailed duties of the International Jury are contained in Section 3.
- b) At International Competitions the jury will be appointed and guided by the organisers. If possible, each participating aero club should be represented in the jury, and the chairman should be a member of CIVA.

1.4.1.3. At least three members of the International Jury must be available to hear appeals or protests submitted by competitors.

1.4.1.4. Any decision taken by the International Jury by majority vote is final.

1.4.1.5. When the International Jury is making a decision which concerns the team or a competitor of the same NAC as a member of the International Jury that member of the jury shall abstain from voting.

1.4.1.6. The International Jury may temporarily vary any rules approved by the International Aerobatics Commission (CIVA) during a contest under the following circumstances:

- a) There is an absolute majority within the International Jury, when conducting a vote to introduce a temporary variation to the regulations, and
- b) There is a two-thirds majority amongst the participating teams' Chief Delegates, when conducting a vote to introduce a temporary variation to the regulations.

1.4.1.7. In the event that the rules of the Sporting Code are not adhered to at a World Championship, or if the International Jury is not provided with sufficient information to perform their duties in accordance with the rules, the International Jury may stop the contest until matters are remedied.



- a) If remedial action is not taken, the International Jury has the power to declare that the requirements of a World Championship have not been fulfilled in accordance with the rules and that the event has only the status of a World Competition. If this latter action is taken, the International Jury shall prepare a full report for submission to the next meeting of CIVA at which their decision shall either be endorsed or reversed.

1.4.2. Board of Judges

- 1.4.2.1. Details concerning the employment of the Chief Judge and the composition of the Board of Judges and the appointment and disqualification of its members are laid down in the "Judging Rules for World and Continental Aerobatic Championships and International Aerobatic Competitions" (Section 2).

1.4.3. Contest Management

- 1.4.3.1. The Contest Director will be responsible for the regular and orderly performance of the contest. The Contest Director is responsible to the International Jury for the efficient administration of the contest.
- 1.4.3.2. The contest management will be composed of:
 - a) The Contest Director,
 - b) The Flight Director,
 - c) The Chief Judge,
 - d) The Chairman of the Technical Commission.

1.4.4. Technical Commission

- 1.4.4.1. The Technical Commission will be composed of 3 to 5 engineers or mechanics. CIVA compiles a list of capable engineers or mechanics nominated by the NACs; written evidence as to qualification, experience and technical knowledge must be submitted by the NACs. CIVA selects from the list of approved engineers and mechanics the members of the Technical Commission for World Championships; if possible, the selection of the members of the Technical Commission should be guided by the type of competing aircraft operated during the contest.
- 1.4.4.2. The representative of the organisers will be nominated as the Chairman of the Technical Commission.
- 1.4.4.3. The Technical Commission is responsible to the International Jury for the inspection of competing aircraft and of aircraft documentation; for certifying compliance with the airworthiness regulations of aircraft after inspection; for a qualified and objective inspection in case of defects of the technical equipment; and for finding the causes of defects which have occurred during the competition flights. The Technical Commission will advise and inform the International Jury on any points of technical importance.
- 1.4.4.4. The Technical Commission is also responsible for blocking radio sets to use only the official 'Safety Frequency'.

1.5. Protests

- 1.5.1.1. Protests will be accepted from individual competitors and teams only. They will be dealt with in compliance with the FAI General Section of the Sporting Code, Chapter 5. All protests must be submitted to the President of the International Jury in writing, either directly or through the Contest Director, with a deposit, not later than two hours after the occurrence,



decision or publication of results which causes the protest to be made. "Non-working" hours, as defined in local regulations for the specific championships or competitions will not be counted. Every protest must refer to the rule or rules to which it relates. The amount of the deposit shall be stated in the local regulations for the championships or competition. It should not exceed \$100.

- 1.5.1.2. The deposit will be returned if the protest is upheld. The International Jury may request the attendance of the protesting competitor if it considers this desirable. The decision of the International Jury is final.

1.6. Final Regulations

1.6.1. Interpretation

- 1.6.1.1. International aerobatic events will be carried out in compliance with Sporting Code and local regulations of the organisers.
- 1.6.1.2. Any differences arising during an event will be dealt with by reference to the above rules. For the interpretation of the text at championships, a standard version written in one of the official FAI languages (English, French, Russian, Spanish) shall be taken as the authority. CIVA will select one of the FAI languages as the basis for interpretation.

1.6.2. Competitors' Pledge

- 1.6.2.1. All competitors undertake, by signing the entry form, to comply with the General Section and Section 6 of the Sporting Code of the FAI and any local regulations made under rule 1.6.3.1 (below).

1.6.3. Supplementary Rules

- 1.6.3.1. The organisers will, within the scope of the Sporting Code and the approval by CIVA, prepare such local regulations or specialized details as are relevant and necessary for clarification of organisational problems and duly distribute them to all FAI NACs (see 1.2.1.1, 1.2.1.3 and 1.2.7.1).
- 1.6.3.2. The technical and organisational preparations of World or Continental Championships will be checked by CIVA regarding their compliance with the general rules before the beginning of the event.
 - a) The organisers shall publish in the agreed FAI language(s) and send to the NACs which have indicated a preliminary intention to participate, not less than 6 months prior to the World or Continental Championships:
 - i) the local regulations containing only local operating procedures and administrative details including details of the aerodrome at which the Championships will be held.
 - ii) An English translation of applicable rules, issued by the Aviation or Customs Authorities of the host country.



2. JUDGING RULES FOR WORLD AND CONTINENTAL AEROBATIC CHAMPIONSHIPS AND INTERNATIONAL AEROBATIC COMPETITIONS

2.1. Board of Judges

2.1.1.1. Judging during World and Continental Aerobatic Championships and international aerobatic competitions will be carried out by an International Board of Judges in compliance with the following rules.

2.1.2. Representation on the Board of Judges

2.1.2.1. At World and Continental Championships all participating NACs have, if they wish, the right to nominate an International Judge for the Board of Judges. Judges can also make individual application to the President of CIVA. These nominations and applications must be made by a deadline published by the President of CIVA in the year in which the Championships are held. Judges are subsequently selected in accordance with procedures established by CIVA. The selection process includes a ranking of Judges by the RI's in the CIVA Judges Performance Database (JPD) from past Championships and/or the evaluation of judges' experience for those who do not have a JPD history. Final selection will be ratified by the Bureau of CIVA.

2.1.2.2. For international competitions, International Judges will be invited by the organizers

2.1.3. Qualification of Judges.

2.1.3.1. All International Judges selected for the Championships or invited by the organisers of International Competitions must have been approved by the FAI Aerobatics Commission (CIVA) of FAI and listed in the FAI official document to that effect.

2.1.3.2. To be a current FAI judge at FAI aerobatic championships, an FAI International Judge must additionally fulfil the following currency requirements:

- a) In the year in which the championship is held or during the previous calendar year, the judge must have either judged at a national or international aerobatic championship at appropriate class or flown in that level competition as a pilot, or served as an official team trainer whose duties include critiquing appropriate level team members.
- b) Before the championship is held, the judge must also have satisfactorily completed a study course on the current rules and regulations. This study course will be composed and administered by CIVA. It can either be completed in advance of the championship or on the contest site. The study course will be available no later than six months prior to the beginning of the championship.
- c) In addition, prior to the championship, the Chief Judge shall conduct an oral interview with each prospective International Judge. This interview will determine the judge's basic competency and knowledge of the rules. This examination shall include but not be limited to: judging criteria, familiarity with the Aresti System (Condensed), and the ability to immediately interpret complex figures and sequences. The Chief Judge will also insure that the judge is in possession of current regulations with appropriate translation if necessary. The International Jury, in conjunction with the Chief Judge, shall have the authority to disqualify any International Judge from the championship if it determines that the judge is continuously biased or not competent. This decision will be final and cannot be protested or appealed.



- d) If the minimum number of judges cannot be achieved by applying clause (b) above, the next preference in choice of judges will go to the FAI judge(s) whose currency most nearly matches those requirements.

2.1.3.3. If any judge(s) are not available and cannot complete their functions and the minimum of 7 judges are not present, the International Jury will use its discretion in filling the available slot.

2.1.3.4. If a substitute International Judge is appointed under 2.1.3.3 above, he shall only take his place on the Board of Judges at the start of the subsequent programme, and the marks of the departed judge for the programme he did not complete will be deleted.

2.1.4. The Chief Judge

2.1.4.1. For World Championships the Chief Judge will be selected and appointed by CIVA; he/she may not be a citizen of the organiser's country (exceptions to this must be accepted by CIVA).

2.1.4.2. For Continental Championships, the Chief Judge must be approved by CIVA.

2.1.4.3. In any case, the Chief Judge must be an International Judge listed in the FAI official record and must have previous experience of serving as Chief Judge at a national or international aerobatic championship (or a major national competition) run under FAI rules.

2.1.5. Composition of the Board of Judges

2.1.5.1. At World and Continental Championships and international competitions the International Board of Judges will be composed of:

- a) The Chief Judge;
- b) A minimum of 7 International Judges and 7 assistants (except at Yak52 contests, where a minimum of 5 International Judges and 5 assistants may be used) for marking the quality of aerobatic manoeuvres and positioning if the electronic tracking instrument is not in operation. The maximum number of such judges shall be 10.
- c) Positioning judges for operating the electronic tracking instrument and for recording the violations of the prescribed performance zone, or 4 Line Judges for the conventional recording of infringements of the performance zone. Positioning or line judges, although recommended, are not mandatory for international competitions;
- d) The administrative secretary, supervised by the Contest Director, who will be in charge of the documentation of results and of the evaluation office.

2.1.5.2. All judges who wish to be represented on the Board of Judges will judge Programme Q and Programmes 1 to 4, provided that they have a qualified assistant as required in paragraph 7.5.1.1. Any judge who does not provide a qualified assistant will be excluded.

2.1.5.3. The International Jury may exclude a judge from the Board of Judges after the completion of any programme if that judge's Ranking Index deteriorates significantly from those established in previous programmes.

2.1.5.4. The positioning judges working at the electronic tracking instrument may be nominated by the organisers. The positioning judges, whether at championships or at international competitions, shall be supervised by members of the International Jury or their delegates. If an electronic tracking instrument is not operated, the work of the positioning judges and their supervision is organised on the same basis.

2.1.5.5. The administrative secretary of the Chief Judge will be nominated by the organisers.



2.1.6. Timekeepers and Evaluators

- 2.1.6.1. The Chief Judge and his assistant will record the timing of flights, ideally an evaluator checking paperwork will be appointed.

2.1.7. Position of Judges

- 2.1.7.1. The judges (under 2.1.5.1.b)) will be posted by the Chief Judge at positions appropriate for observing the competitors, the positions of the judges being at least 15 m apart. The distance of the positions of the judges from the end points of the x/y axes will be a minimum of 150 m and a maximum of 250 m.

2.1.8. Role of Judges

- 2.1.8.1. The International Judges appointed for marking the quality of the manoeuvres will mark the manoeuvres and infringements of the lower and upper height limits, interruptions and insertions in compliance with the judging rules (see 7.3.1.1).

2.1.9. Judges' Assistants

- 2.1.9.1. The assistant(s) has (have) the following tasks:
- a) Telling the judge prior to the performance the sequence of the figures, details of the various figures, and any other special features.
 - b) Recording the mark given by the judge for each figure and writing down into the marking sheet any remarks concerning the rating. Any amendment of record must be signed by the judge.
 - c) Giving general assistance.

2.1.10. Timing, Interruptions, Height Infringements and Wing-Dipping

- 2.1.10.1. Checking the duration of flight will be the duty of the timekeepers assigned to the Chief Judge.
- 2.1.10.2. Recording programme interruptions, and giving penalty points for such interruptions or for infringements of the lower and upper height limits, and the infringement of penalty point rule 5.2.1.3 of Sporting Code concerning wing dipping three times in Programme 4 for the Unlimited category, will be carried out under the responsibility and control of the Chief Judge. Further entries on the marking sheet concerning positioning will be made on the basis of the positioning sheets after evaluation in the evaluation office.

2.2. Boundary Judging

2.2.1. Electronic Tracking Instrument

- 2.2.1.1. If an electronic tracking instrument is operated, the position of the aircraft will be indicated by the instrument and recorded with indelible ink by one of the positioning judges (i.e. instrument observers) on the positioning sheet, which will immediately be signed by an International Judge appointed to this end by the International Jury. The evaluation will be made in the evaluation office using a special positioning table.

2.2.2. Line Judges

- 2.2.2.1. The use of Line Judges is mandatory at World Championships if an electronic tracking device is not operated. Line Judges may only be waived at World Championships under special circumstances and with prior approval by the Bureau of CIVA. When line judges are used, they shall be placed at each corner of the performance zone. Line judges should, if



possible, be international. If they are operated by the organiser, a permanent supervision must be provided by the International Jury.

2.2.2.2. Line judges will be supplied with radio transmitters to enable contact with the Chief Judge's workstation. Two frequencies will be used with one diagonal pair of line judges on each frequency. Performance zone infringements will be reported in real time and noted both by the line judges concerned and at the Chief Judge's station.

2.2.2.3. Only box outs reported on both frequencies (independent confirmation) and observed at the Chief Judge's workstation to be realistic will be taken into account on the Chief Judge's score sheet submitted to the scoring system. A record of each line judge's recorded infringements and those verified at the Chief Judge's workstation will be kept and will be made available to competitors.

2.3. Judging Administration

2.3.1. Collection of Marking Sheets

2.3.1.1. Immediately after a competitor has completed a competition flight and the judges have finished their marking, the marking sheets will be collected for perusal at the Chief Judge's workstation. Once any required actions are taken (conference, penalties added, indexes checked etc.) the marking sheets will be forwarded for entry into the scoring system. The individual judges themselves must sign off any changes to their marking sheets.

2.3.1.2. In Programme 4 ("U" only), Judges will keep all the marking sheets until all competitors have completed the programme. Should the completion of all flights in Programme 4 be interrupted, all Judges' marking sheets shall be collected and secured by the Chief Judge until flying resumes.

2.3.1.3. Once the marking sheets have left the Chief Judge's workstation, they come under the supervision and jurisdiction of the International Jury.

2.3.2. Publication of Results

2.3.2.1. The total results for each competitor in each of the competition flights shall be available to the competitors, in the agreed working language(s), prior to the start of the subsequent programme. The current results of each programme will be published on an information board to indicate the placings of the competitors. The final evaluation and placing will be found and announced after checking by the International Jury, not later than the following day.

2.3.3. Public Announcements

2.3.3.1. Prior to the take-off for and during the performance of a programme, details concerning the competitor concerned may be published by any means (radio commentary, etc.).

2.3.4. Protests, Decisions of International Jury, Confidentiality

2.3.4.1. All protests will be dealt with by the International Jury, in cooperation with the Chief Judge if his assistance is required and his duties permit. Decisions taken by the International Jury are final and must not be changed later. The judges are advised to keep activities of the Board of Judges and of the International Jury strictly confidential.

2.3.5. Procedure for the Mark of Zero

2.3.5.1. A mark of zero can be deserved for one of two reasons: The figure flown may have a single, gross error (e.g. a geometrical error of 90 degrees or more, or simply the wrong figure), or



the figure may be basically correct but contain a number of smaller errors that cause the grade to fall to zero by accumulation of downgrading points. The first such zero is called a 'Hard Zero' and is marked on a score sheet with the annotation "HZ". The second type of zero is a 'Soft Zero' and is marked on a score sheet by the annotation "0.0".

- 2.3.5.2. Detailed instruction for the handling of situations where the panel of judges is not unanimous in grades of zero are given in 7.2.

2.3.6. Reprimand and Disqualification of Judges

- 2.3.6.1. The reprimands and/or the disqualification of judges by the International Jury shall be administered in compliance with the appropriate Sporting Code.
- 2.3.6.2. In case of a disqualification of a judge, the marking which was the reason for the disqualification will not be counted for the programme in question. CIVA will decide upon the further use of the disqualified judge on the recommendation of the International Jury.
- 2.3.6.3. On the basis of judging data, which have to be available promptly, it is the duty of the International Jury to monitor the performance of the judges.



3. DUTIES OF THE INTERNATIONAL JURY

The activities of the International Jury will be organised systematically by the chairman of the International Jury from the opening of the contest. The chairman of the International Jury should allot duties to each of the members of the jury every day. The various duties include:

3.1.1. Meetings

- 3.1.1.1. Attending the meetings of the International Board of Judges (dealing with familiarisation, evaluation, checking the marking sheets).
- 3.1.1.2. If required, holding daily evaluation meetings (after the daily contest programme has been completed).
- 3.1.1.3. Final meeting of the International Jury. Evaluation of the activities of the International Jury and of the development of the contest and a preliminary assessment of the experience gained during the contest

3.1.2. Supervision

- 3.1.2.1. Direct supervision of the International Board of Judges, which is primarily conducted by the Chief Judge. This is to include preparation of the judging analysis for all judges.
- 3.1.2.2. Supervision of the line judges and/or supervising and checking the operation of the electronic positioning device.
- 3.1.2.3. Supervision of the activities of the scoring office.
- 3.1.2.4. Supervision of the activities of the Technical Commission.
- 3.1.2.5. Supervision of the activities of the meteorological centre.
- 3.1.2.6. Checking the publication of contest results; making visits to the pilots' camp to gather or give information.
- 3.1.2.7. Supervision of briefings and the drawing of secret lots.
- 3.1.2.8. Checking the availability and accuracy of medals and trophies at the beginning of the competition.

3.1.3. Mediation

- 3.1.3.1. Discussion of protests, if necessary in cooperation with the Chief Judge, the Flight Director, the Chairman of the Technical Commission, and the Contest Director. Taking down on record the proceedings in meetings or activities where decisions are sought (e.g. a note of comments, resolutions, etc.). The International Jury will publish the results of all protests and decisions. The meetings of the International Jury must not impede the progress of the contest.
- 3.1.3.2. Explanatory discussions with chief delegates and team managers to explain measures taken by the Jury; interpretation of the Sporting Code of the FAI and all regulations. This should be done after completion of the daily competition programme or before the beginning of competition flying (i.e. in any case without impeding the progress of the contest).
- 3.1.3.3. Control of the Unknown Compulsory Programmes in accordance with Sporting Code; including supervision, composition, and explanation, as appropriate.



3.1.4. Organiser's Responsibility.

- 3.1.4.1. The organisers of international aerobatic events must provide the necessary material and technical conditions and the required number of staff in order to enable the International Jury to carry out its functions.



4. THE ORGANISATION OF WORLD AND CONTINENTAL AEROBATIC CHAMPIONSHIPS AND INTERNATIONAL AEROBATIC COMPETITIONS

4.1. Administrative Arrangements

4.1.1. Entry Fees

4.1.1.1. World Championships:

- a) Every National Airports Control sending a team or solo pilot or officials to World Championships must pay an entry fee for each member of the official team, solo competitors and officials (except judges or warm-up pilots) to the organising Aero Club.
- b) Entry fees will be fixed by CIVA on agreement with the organisers.
- c) The organiser will notify NACs of the date of payment and of the receiving agency.
- d) Entry fees will be refunded if the World Aerobatic Championships do not take place.

4.1.1.2. Continental Championships and International Competitions:

- a) Every NAC sending participants and officials to the event will pay entry fees to the organizing Aero Club.
- b) Entry fees will be fixed by CIVA on agreement with the organisers.
- c) Entry fees will be refunded if the event does not take place.
- d) The decision on refunding the entry fees for other reasons is left to the organisers.
- e) No entry fees are required for judges.

4.1.2. Accommodation, Food, Medical Services

4.1.2.1. At World Championships, the organisers will provide adequate accommodation and food for the duration of the event to all members of official teams, solo competitors, officials and other assistants for whom entry fees have been paid, on the understanding that no extra charges will be imposed for these services. In addition, airfield charges will be covered for those persons for whom entry fees have been paid. It is recommended a reduced fee be offered by the organisers to entrants who desire to arrange their own accommodation and evening meals.

4.1.2.2. The organisers will be responsible for adequate medical services being available to all official participants.

4.1.3. Fuel and Oil

4.1.3.1. At World Championships, aircraft fuel and oil will be provided by the organisers for functional test flights and contest flights without imposing extra charge.

4.1.4. Technical Services

4.1.4.1. The organisers will provide technical assistance and hangarage for competing aircraft, if required.

4.1.5. Interpreters

4.1.5.1. Interpreters, working with the International Jury and the Board of Judges, will be provided by the organisers, if necessary.



4.1.6. Briefings

- 4.1.6.1. Prior to the start of a contest there will be a briefing by the organisers for Chief Delegates or Team Managers, members of the International Jury and Judges, on flight conditions, the contest programmes, and any other problems which might arise over the interpretation of the rules.
- 4.1.6.2. For familiarisation with and a standardised interpretation of the judging rules the Chief Judge will hold seminars with the Judges and Team Managers or other representatives of each team, and carry out at least one judging test for which a non-competing pilot shall be available. Throughout the duration of the contest the Chief Judge will hold routine evaluation meetings with the Judges.
- 4.1.6.3. Before the beginning of competition flying, on each competition day, a briefing will be held for competitors, officials, judges and the International Jury on organisational matters concerning the competition day, on meteorological conditions, etc. The briefing should last not longer than 30 minutes.

4.1.7. Sequence of Flights (Drawing of Lots)

- 4.1.7.1. The sequence of flights for Programmes Q and 4 ("U" only) of Championships and International Competitions will be determined by lot to be arranged by the Contest Director or his Assistant, in the presence of a representative of the International Jury. Each competitor will draw his or her own lot. In the event a competitor is not present to draw his or her own lot, a member of that competitor's team may do so.
- 4.1.7.2. In Programmes 1, 2, and 3, the competitors will be divided into three equal groups. If the number of competitors is not a complete multiple of three, the highest ranking group will be enlarged to include the excess pilots. The groups will be based on provisional accumulated overall results after the previous programmes. The results of Programme Q will only be used with respect to Programme 1. The order of flight in each group will be determined by drawing of lots as described in paragraph 4.1.7.1. The flight order of the groups will be the reverse of their rank. (The flights start with the group of the lowest scores). Notwithstanding this rule, if there is a shortage of time to complete the last remaining programme, flying can be reversed with the top ranking group flying first. The lower ranking groups would fly only if time so permits. The drawing of lots may be made by a CIVA-approved random programme, if one is available, under the supervision of the International Jury.
- 4.1.7.3. The sequence of flights may be altered by the International Jury if special circumstances require, e.g. when two closely-drawn pilots are to fly the same aircraft. In such a case, there must be a minimum of two flights or 15 minutes between engine shut-off and the next start-up on the same aeroplane. If this time period causes a gap in the continuity of flying, the Starter shall inform the Chief Judge accordingly. When re-ordering flights, the Jury must ensure that competitors remain within the same grouping when a random draw has taken place.
- 4.1.7.4. The organisers will ensure that the first two (Yak52, one only) flights of each competition day and each programme, will be by non-competing pilots. The Contest Director, with the concurrence of the Chief Judge, may delete the second warm up flight. Team reserve pilots will be utilized, to the extent they are available, by the organisers for this purpose in an equitable way. The intent of this regulation is to permit judges to see a wide variety of aircraft during the warm up flights.



4.2. Operating Regulations

4.2.1. Video/Audio Devices

- 4.2.1.1. Video cameras may be mounted in/on competition aircraft at the discretion of the pilot.
- 4.2.1.2. The use of technical devices to convey audible information to the pilot is not permitted during World and Continental Championships except for a radio set with a blocked "Safety Frequency". Radio sets are required and must be able to be tuned to the "Safety Frequency". Any other devices, which are not permitted, will either be removed from the competing aircraft or rendered inoperative and sealed by the Technical Commission. Receiving any kind of audible information from any unauthorised technical device will make the competitor liable to disqualification from the contest.
- 4.2.1.3. Failure of a competitor's radio after arrival at the contest site will not be grounds for disqualification. The contest organisers will arrange other means for the safe and orderly dispatch of these pilots.
- 4.2.1.4. Radios, set to the "Safety Frequency", are only for communication from the Chief Judge to the competing pilot for box control purposes and to serve urgent flight safety matters. Use of the Safety Frequency may be discontinued at the discretion of the International Jury if problems occur which compromise its security. In that case, radios will be rendered non-operational by the Technical Commission.
- 4.2.1.5. The "Safety Frequency" will be selected by the organisers and given to the competitor together with the competition papers. The "Safety Frequency" will be monitored during all competition flights, and possibly recorded on tape.
- 4.2.1.6. The organisers (the Technical Commission) will be responsible for technically adequate sealing of radios (without penetrating the interior) assuring that no frequency other than the "Safety Frequency" can be used.
- 4.2.1.7. Once airborne, and before entering the Performance Zone, a pilot may call the Chief Judge on the safety frequency, saying: "Number x, radio check". The Chief Judge must respond to this call if he hears it. If he/she hears no response, the pilot may elect to land as in the case of any other technical defect, in accordance with section 4.2.7.
- 4.2.1.8. The standard phraseology in the event that the time limit is exceeded will be the Chief Judge saying "Time, time, time" and no other. The standard phraseology in the event that a break is required for safety reasons will be the Chief Judge saying "Break, break, break" and no other.

4.2.2. Meteorological Conditions

- 4.2.2.1. Flights will be carried out between the hours of sunrise and sunset at the place of competition. These times may be extended by the International Jury, if required, to a maximum of 30 minutes either side of official sunrise and sunset, i.e. SR minus 30 minutes and SS plus 30 minutes. If the visibility deteriorates within the stated time limits the International Jury will decide upon the start and finish of the competition.
- 4.2.2.2. Minima
 - a) The minimum height of the cloud base must be 50 metres above the maximum height determined for each competition flight. For the Unlimited Final Freestyle Programme, the minimum height of the cloud base must be 800m.



- b) The minimum prevailing flight visibility, determined with reference to ground features from the midpoint of the contest area at the maximum height for the competition flight, must be 5 kilometres.
- c) The maximum permissible average wind speed at the surface is 12 m/sec. At 500 m the maximum permissible average headwind component is 12 m/sec. Maximum crosswind components, in relation to the main axis, are 6 m/sec at the surface and 8 m/sec at 500 m. Maximum tail wind component at the surface and 500 m is 3 m/sec.
- d) Competition flight will not take place in precipitation.
- e) In "A" and "Y52" the maximum permitted density altitude for sequences to be flown without interruption is 3,000 feet.

4.2.2.3. Weather Information

- a) The Contest Director must provide the competitors, the Chief Judge, the Board of Judges and the International Jury with half-hourly information on weather conditions and, at shorter intervals, on wind speed and direction at 500 m height if required due to meteorological developments.
- b) The wind speed and direction must be measured on the site of the competition, or in the immediate vicinity (less than 5 nautical miles). The wind speed and direction must be measured by a qualified weather station crew using the appropriate tools: radar or balloon ascent. Measurement of the wind speed and direction using an aircraft is not authorized.
- c) The weather bulletin with information on wind speed and direction will be published on a board at the flight line for competitors upon decision by the Contest Director. The bulletin must include the time of any change in wind speed and direction as well as the time of the bulletin's publication. The Team Managers are responsible for passing these data on to their teams. Under stable weather conditions adequately meeting the above conditions, half-hourly information is not required. The International Jury will decide upon the necessity of providing this information.

4.2.2.4. Adverse Weather

- a) If the meteorological conditions do not meet the requirements of 4.2.2.2, the Chief Judge after consultation with the International Jury will discontinue competition flights. Such decision may be taken:
 - i) if the information in the bulletin from the aerodrome weather service was obtained by balloon ascent.
 - ii) if there is information available from competitors who have just finished or discontinued a flight owing to weather conditions which, in the opinion of the pilot, were outside the prescribed limits.
 - iii) if the visibility is judged independently by members of the International Jury, the Chief Judge or the competitors to be below the minimum laid down.
- b) In such cases the members of the International Jury should immediately use an aircraft, to be made available for this specific purpose, and arrange for a weather reconnaissance flight in order to observe the horizontal visibility and cloud height.
- c) After an interruption for the wind exceeding the limit above, flying shall not be resumed until the wind speed has stabilized at or below the limits for 30 minutes.
- d) In circumstances where intermittent low cloud is passing through the Performance Zone, followed by clear patches of weather, the Contest Director in conjunction with



both the International Jury and the Chief Judge, may waive the time limit for the completion of the programme, thus allowing a competitor to orbit if so desired, until the Zone is clear.

- e) If the cloud is at least 800 m above aerodrome level, and if a majority of Chief Delegates agree, the International Jury may relax the visibility and wind limitations stated above in the interests of completing the first three competition programmes before the end of the contest period

4.2.2.5. If in his or her opinion the weather conditions do not comply with the competition rules, a competitor may discontinue his or her flight before starting the sequence or, during the programme, in level flight at the end of a figure i.e.:

- a) If during any programme the horizontal visibility deteriorates to less than 5 km.
- b) If the cloud height in the performance zone is lower than the height in the following table.

Category	Break if lower than:	No flying if lower than:
Unlimited	1050 m	800 m
Advanced	1150 m	800 m
Yak 52	1250 m	950 m

- c) If precipitation becomes apparent. In this case, members of the International Jury should immediately use their test aircraft in order to check the weather conditions in the performance area and to reach a decision on the possible repetition of the competition flight. This applies to Programmes Q, 1, 2 and 3.
- d) If the wind exceeds the limits specified in 4.2.2.2: if a competitor during a flight is not able to observe such changes and he or she completes the flight – i.e. if the competitor made his or her flight under conditions which were disadvantageous as compared with other competitors - this competitor is entitled to repeat the flight, except in Programmes 2 and 3.
- e) The marking for the repetition flight for a competitor will be continued from the figure immediately following the break.
- f) If a competitor discontinues his or her flight without sufficient reason, no repetition flight will be allowed.

4.2.2.6. Permitted Breaks

- a) The International Jury may allow flights to be made in two parts, during the performance of all Programmes other than the Final Freestyle, if the height of the cloud base is between the heights given in the table at paragraph 4.2.2.5.b). The competitor is then allowed to readjust height without penalty to commence the second part. An equivalent permitted break will be allowed in “A” and “Y52” if the density altitude exceeds that given in paragraph 4.2.2.2.e).
- b) The pilot may choose where to take this break without stating so in advance, and such break need not be marked on Forms B or C. However, second or subsequent breaks will be penalized in accordance with paragraph 5.2.5. When an interruption occurs along the y-axis, the competitor must resume his or her flight in the same direction of flight.
- c) If the cloud base subsequently rises to the higher figure in the table, pilots may no longer interrupt their flights without penalty; with due warning, i.e. at least 10 minutes in

advance, pilots will be advised by the Contest Director (or his staff), following advice to him from the International Jury, when they are to fly with/without interruption when the weather conditions have changed.

Note: even though an interruption may be allowed without penalty by the International Jury, there is no obligation for pilots to interrupt their flight.

4.2.3. Conduct of Competition Flights

- 4.2.3.1. Competition flights at Championships and International Competitions will be made separately in the sequence determined by the drawing of lots or by rank order, as appropriate. No competitor may commence a competition programme before completing the previous one.
- 4.2.3.2. The direction of flight for the start of the Compulsory Programmes shall be determined by the International Jury. The International Jury shall also determine the alignment of the main axis for the Free Programme (Programme 1), but the competitor may choose to start his or her first figure along either axis in either direction, provided he or she shows clearly on the drawings of his or her programme the direction to be chosen. No flight shall be required to take place less than 30 minutes after the direction of flight is determined or subsequently changed.
 - a) The decision with regard to the into-wind direction of flight shall take into account the predominant direction of the actual winds. Flying at the start of each day, and each flight programme, shall commence into the most direct prevailing wind.
- 4.2.3.3. There will be, if required, a 30 minute break after every two hours of competition flying for the Board of Judges to have a rest.
- 4.2.3.4. The organiser of World and Continental Championships must establish an efficient radio communication between the contest officials (Contest Director, Chief Judge, Flight Director, Chairman of the Technical Commission, and International Jury) and supervise the running of the contest and the contest rules.

4.2.4. Height Limitations

- 4.2.4.1. The following height limitations have been determined for all contest flights:

Category	Upper	Lower	Disqualification
Unlimited	1000 m	100 m	50 m
Advanced	1100 m	200 m	100 m
Yak 52	1200 m	200 m	100 m

- 4.2.4.2. If the organisers do not have any precision height measuring devices available, they will nominate a non-competing pilot who will daily carry out a flight at these heights around the performance zone and along the two axes of the performance zone.
- 4.2.4.3. Penalties
 - a) Disqualification (for the current programme) for infringements of the disqualification height limit (4.2.4.1), by which air safety is endangered, shall be decided by a two-thirds majority vote of the Board of Judges.
 - b) When a precision height measuring device is not available, a competitor will be penalized for an infringement of the lower height limit or the upper height limit in accordance with paragraph 5.2.2.1 if observed by a simple majority of the judges.



4.2.5. Performance Zone

- 4.2.5.1. The programme will be flown with reference to the longitudinal and lateral axes marked on the ground. The performance zone (see Section 4.7) will be a clearly and distinctly marked area of 1000 x 1000 metres whose central point will be the intersection of the axes. The zone must be located adjacent to a suitable emergency landing area.
- 4.2.5.2. The longitudinal (main) and the lateral (secondary) axes shall both be marked by 7 contrasting marking strips. Only one axis system must be visible at a time. The size of these markers must be at least 2 x 9 metres, with the longer side aligned with the direction of the axis. The ends of the axes and the four corners of the box must be clearly marked and also must be at least 2 X 9 metres in size. On the main axis and near the centre point two arrows will be placed, both pointing into the official wind as determined by the International Jury.
- 4.2.5.3. The colour of the marking strips must be in distinct contrast to the ground and other airfield markings, which latter should be removed if possible.
- 4.2.5.4. If the prescribed wind conditions in 4.2.2.2 are not fulfilled, the competition will be discontinued. The International Jury will determine any change of direction of the main axis as may be necessary, and arrange for a rapid shifting of the axes.
- 4.2.5.5. Marking of positioning will be carried out by the Board of Judges. Additionally, the recording of infringements of the performance zone may be carried out either with an electronic positioning instrument or by Line Judges in accordance with the judging rules. If an electronic instrument is in use and becomes inoperable, the International Jury must decide whether Line Judges are to record zone infringements. If Line Judges are to be used at World Championships, the organiser will prepare four corners of the performance zone for the use of four Line Judges to cover this eventuality (see 5.1.4.2 and 5.2.3.2.)

4.2.6. Duration of Flight and Signalling Start and Finish

4.2.6.1. Time Limits

- a) Programme Q will have a time limit of 10 minutes (12 minutes for Yak 52) maximum from "lift off" to exit from the box (wing dips at completion of flight). During the flight, the pilot will be permitted to fly practice figures prior to and after the actual performance of Programme Q. The end of the 10 minute time limit will be clearly announced by the Chief Judge to the pilot by means of radio. Each Programme Q figure performed after 10 minutes will not be marked by the judges. In the event that a pilot takes a permitted weather break, the stop watch will be stopped on the third wing dip at the start of the break and re-started on the third wing dip signalling the beginning of the second part of the broken sequence.
- b) Programmes 1-3 must be completed within 15 minutes. (Note: "Lift-off" will be defined as the point in time the competitor is visible to the Chief Judge/timers as "off the ground".)
- c) In Programme 4 ("U" only) there is a time window of between 3 minutes 30 seconds and four minutes in which to complete the programme, without penalty, after signalling the start of the sequence.
- d) The Chief Judge shall indicate by call or signal the time during which the Judges must watch and mark a programme.



- e) If for some reason a general recall is necessary, this will be indicated to competitors and Judges by a red pyrotechnic. A recall is, except in dangerous situations, allowed only up to the beginning of a programme.

4.2.6.2. Signalling

- a) A competitor must signal the start and finish of each programme, and any interruption, by distinctly dipping the wing three (3) times immediately one after the other by more than 45 degrees. For timing purposes the programme is deemed to start on the return of the wings to level after the third wing dip; and is deemed to finish on their return to level after the third of the final wing dips.
- b) The aircraft may start and/or finish the wing dips either inside or outside the aerobatic zone. They may be in normal or inverted flight or a horizontal, climbing or descending path. If the first figure in a programme begins in inverted flight, all wing dips must be performed in inverted flight. The competitor may change his flight attitude from normal to inverted only by a half roll prior to the first wing dip. The return of wings to 'level' therefore does not necessarily refer to the aircraft being 'in level flight'.
- c) A horizontal flight path is required at the start of the first figure. This horizontal may be started inside the aerobatic zone or, provided that it is clearly seen to continue inside, it may be started outside the zone.

4.2.7. Measures in Case of Mechanical Defects

4.2.7.1. Defects on the Ground

- a) In the event of a competing aircraft becoming unserviceable before the start of a flight, the International Jury may, on the recommendation of the Technical Commission, permit the competitor to use another aircraft or the same aircraft following the removal of the defect.
- b) In the event that a test flight is required and the competitor does not allow a non-competing pilot to fly his aircraft for test purposes, a special authorization will be given to the competitor to fly this test flight under the following conditions:
 - i) that the flight will consist of a maximum of three aerobatic figures;
 - ii) that these figures will be recommended by the Technical Commission and approved by the International Jury;
 - iii) if the competitor violates these conditions he will be disqualified

4.2.7.2. Defects in Flight

- a) When a competitor has a mechanical defect in flight and decides to land, he/she will be required to taxi (if able) to a designated secure area that is protected from spectators and other team members. This area will be off limits to everyone except the competitor, the Technical Commission and the International Jury. An engineer from the competitor's team will be permitted to enter the area with the concurrence of the Jury. The competitor will be required to remain in his aircraft until the arrival of a member of the International Jury who will release him and subsequently permit the aircraft to be worked on and inspected.
- b) In the event of a competitor breaking off his or her competition flight in case of technical damage which is beyond the pilot's control after take-off, he or she may be allowed to repeat the flight provided that evidence of the damage can be furnished to the Technical Commission within two hours after landing. For finding the damage only, the following persons will be permitted to work on the aircraft: the competitor and the mechanic



named by the competitor, plus members of the Technical Commission (except the one belonging to the pilot's Aero Club) and the International Jury. When the cause of the damage has been found, the damage will be repaired by the mechanic of the aircraft and other experts, as recommended by the Technical Commission.

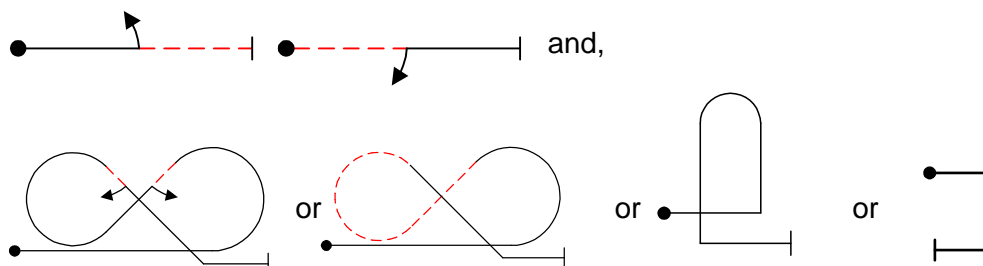
- 4.2.7.3. Any damage will be counted as such provided it is a break or deformation found on the aircraft or engine or their component parts without use of any special device except a magnifying glass.
- 4.2.7.4. The following defects will not be counted:
- a) incorrect adjustment;
 - b) technical trouble caused by dirt if attributed to negligence of the competitor or his/her team. Note: if it can be ascertained by the Technical Commission that contaminated fuel or oil was supplied by the organisers, the penalizing rule does not apply;
 - c) insufficient or missing safety devices causing a change of settings during the flight.
- 4.2.7.5. In cases (a) to (c) above (with the exception of the Note in (b)), the competitor will not be permitted to repeat his or her flight.
- 4.2.7.6. The International Jury must, not later than five hours from the landing of the competitor concerned, decide whether or not a repetition flight will be approved. In case of doubt on the basis of the statement by the Technical Commission, the International Jury shall decide in favour of the competitor.
- 4.2.7.7. In order to avoid any delay in the progress of the contest, the flight will be repeated at the first available opportunity closest to the original flight order even if this is prior to the decision of the International Jury.
- 4.2.7.8. The sequence of repetition flights is determined by the sequence of interruptions of competition flights.
- 4.2.7.9. A competitor making a repetition flight must re-fly the entire programme. Judging and scoring will be continued from the figure during which the technical problem occurred in the interrupted programme.

4.3. Programmes Of World And Continental Championships

4.3.1. Competition Flights

- 4.3.1.1. Each competitor will make up to five competition flights (Programmes Q, 1, 2, 3 and, in Unlimited, 4), depending on the cuts made in accordance with Rules 1.3.1.1 and 1.3.1.2. Programme 4 will be flown by the highest placed competitors in accordance with Rule 1.3.1.1.d)).

- 4.3.1.2. Before the wing-dipping at the start of each competition flight in Programmes 1, 2, 3, and 4 it is recommended that all pilots perform safety manoeuvres as follows. These figures are optional but, if flown, may only be flown once, in any order, and continuously on the same axis. They must be flown inside the performance zone:



- 4.3.1.3. Programme Q (Y52, The Known Programme) – The Known Compulsory Programme

- 4.3.1.4. The Known Compulsory Programme will be composed of nine (9) figures in normal and inverted flight performed consecutively and continuously, observing the prescribed sequence of the figures.

- 4.3.1.5. The programme must be such as to enable competitors to fly all figures safely in the aircraft available to them, provided that the aircraft meet the requirements of normal technical standards. The figures will be selected from the Aresti System (Condensed).

- 4.3.1.6. Programme Q of a World or Continental Championship will be selected and made known by CIVA at least six months prior to the beginning of that Championships.

- 4.3.1.7. Programme 1 - The Free Programme

- 4.3.1.8. The Free Programme may be composed of a specified maximum number of figures or combinations of figures. A combination will be taken as one figure. All figures must be taken from the Aresti System (Condensed) as currently amended by CIVA. The total difficulty coefficient of all figures and combinations of figures shall not exceed a certain amount. The limits in each case are given in the table below.

	Maximum Figures	Maximum Total K
Unlimited	9	420
Advanced	12	300
Yak 52	12	225

- 4.3.1.9. The start and finish of Programme 1 must be carried out in normal and inverted level flight. Competitors may begin and finish their programme at any height between the upper and lower limits given in Rule 4.2.4.1.

- 4.3.1.10. Any figure or combination of figures which is identified in the Aresti System (Condensed) as currently amended by CIVA may be selected to compose the Free Programme

- Any figure or combination of figures which is selected must bear the catalogue reference number(s) and the difficulty coefficient(s) (K) stated in the Aresti System (Condensed) as currently amended by CIVA. The numbers and coefficients in the Aresti System (Condensed) will be taken as definitive.
- A catalogue reference number may be used only once.



4.3.1.11. The method of constructing figures and calculating difficulty coefficients is as described in the Aresti System (Condensed).

4.3.1.12. Composition

- a) The character and composition of basic figures must not be changed when combining other figures with them.
- b) The direction of rotation of rolls is not prescribed.
However:
 - i) When rolls are in continuous rotation, the tips of the symbols are to be linked by a small line.
 - ii) In un-linked rolls performed in the same direction, no line links the symbols but the tips must be drawn pointing in the same direction.
 - iii) In opposite rolls the tips of the symbols must be drawn pointing in opposite directions.
- c) Un-linked rolls in the same direction must be of different types. The two types of rolls are defined as follows:
 - i) Aileron rolls (slow rolls and hesitation rolls)
 - ii) Flick rolls (positive and negative)

4.3.1.13. Versatility

In order to achieve versatility in the design of Programme 1, it is a mandatory requirement that competitors shall include the following. Programmes not including these figures will not be accepted:

Family	Yak 52	Advanced	Unlimited
1	Not Required	At least one figure	
2	At least 1 from 2.3 to 2.20		One from 2.5 to 2.15, or from 2.17 to 2.20
5	At least one figure		One to three figures
6	Not required		At least one figure
7	At least one figure		
8	At least one figure		At least one figure, but not more than 4 figures from 8.1 to 8.4
9.1 to 9.8	At least one from each sub-family		Not specified
9.9 & 9.10	At least two, not necessarily one from each sub-family		At least two from each sub-family
9.11 & 9.12	Only one figure from either		
Opposite Family 9.1 to 9.10 Rolls	At least one instance		



4.3.1.14. Sequence Submission

- a) Not later than 48 hours before the start of Programme 1, each competitor must submit a computer file for the programme, in an acceptable format, to the Contest Director for verification of compliance with the relevant Rules. The file must contain completed pages for the three Forms described below. Currently acceptable file formats are Microsoft Visio using Aresti software and Olan.
- b) Form 'A' will show all symbols, catalogue reference numbers and coefficients.
- c) Form 'B' will show the continuous sequence of the programme as it would be flown with the wind blowing from right to left, plus a table listing the Figure Numbers, their Catalogue Numbers and coefficients.
- d) Form 'C' will show the continuous sequence of the programme as it would be flown with the wind blowing from left to right.
- e) Forms 'B' and 'C' must carry the correct symbol for the wind direction.
- f) The forms will include the conventional symbols, catalogue numbers and coefficients only. No account will be taken of any other writing or notation.

4.3.1.15. Checking

- a) It shall be the duty of the Contest Officials to check the catalogue reference numbers on Form 'A' of each competitor with the symbols on Forms 'B' and 'C', taking the reference numbers in the Aresti System (Condensed) as the basic criteria for deciding compliance with the Rules of this section.
- b) The final responsibility for the correctness and compatibility of Forms 'A', 'B', and 'C' lies with the competitor. Any inaccuracies in the drawing of symbols or in the quoting of coefficients, or the discovery of any cases of repetition of figures, will be referred to the competitor's Team Manager so that the forms may be corrected and resubmitted.
- c) The Contest Officials referred to in this rule are those of the organiser.
- d) In order to avoid possible alteration and resubmission of forms during the contest, NACs may, if they wish, submit their computer files to the organisers for checking not more than one month before the beginning of the contest.

4.3.1.16. Should a competitor disagree with a decision of the Contest Officials concerning his or her Programme 1, a complaint may be put to the International Jury before flying commences in Programme 1. The approved programmes of all competitors will be published before the end of Programme Q, in sufficient time for complaints and protests to be made. Once the flying of Programme 1 has started, no complaints of any kind will be accepted by the International Jury on any aspect of the composition of a competitor's programme.

4.3.1.17. The organisers will be responsible for reproducing a sufficient number of copies of competitors' programmes to meet the requirements of the contest. One set of copies of Programme 1 (Form B only) to be provided to each Team (and to each Judge, see 7.5.1.2) prior to the start of this programme.

4.3.1.18. The organisers will be responsible for ensuring that the names of the competitors will not appear on Forms A, B, and C that are given to the judges.

4.3.1.19. Notwithstanding paragraph 4.3.1.15.b), the judges shall only take into account what is actually shown on the relevant Form B or Form C, depending on the prevailing wind direction. The figures drawn on this Form, their orientation with reference to wind and box



axes, shall be definitive. Corrections may be made to Forms B & C, via the Contest Organisation, and presented to the Chief Judge at any time prior to the flight commencing.

4.3.2. Programmes 2 & 3 - The Unknown Programmes

- 4.3.2.1. For the Unknown Compulsory Programmes, figures will be chosen from Section 9. A maximum of 10 figures may be submitted. A representative of every NAC which has a pilot (or pilots) competing may submit one figure, unless there are more than 10 NACs participating. In this case, the procedure to determine which NACs will submit figures will be as in paragraph 4.3.2.2. Repetition of any manoeuvre with the same catalogue number is not allowed within any one programme. Repetition of a complete figure from Programme 2 is not allowed in Programme 3. The intent of this regulation is that in Programme 3, the sequence will be different from that in Programme 2, composed with the new figures submitted by Aero Clubs for Programme 3.

Category	Programme	Minimum K	Maximum K
Yak 52	2	15	25
	3	15	30
Advanced	2	15	35
	3	15	40
Unlimited	2	22	No limit
	3	22	No limit

- 4.3.2.2. If there are pilots competing from more than 10 NACs, 10 such Clubs will be selected to nominate figures for each Unknown Compulsory Programme. This procedure will be applied separately for Programmes 2 and 3. For "A" and "Y52" those Clubs that have at least 3 pilots regardless of gender or, in Unlimited, those with either a male or a female team of three pilots, shall have the first priority to be selected for this group. Clubs with less than three pilots of either gender shall have the lower priority. The International Jury, guided by this system of priorities, shall draw lots as necessary to determine which Clubs shall choose figures and in which order. Priority to be in the group does not imply priority in the order of selecting figures.
- 4.3.2.3. If there are pilots from fewer than 10 NACs participating, their representatives will still select only one figure each. The remaining figures will be selected by the International Jury. These figures must be of the average difficulty of the figures submitted by the NACs and cover Families not represented by them. Repetition of Catalogue numbers is not allowed throughout the nominated figures.
- 4.3.2.4. Sequences for Programme 2 or 3 are to be composed using the 10 figures submitted by the Aero Clubs and additional figures from Section 9, solely to aid in composition. These additional linking figures must be simple, but may contain repetitions despite rule 4.3.2.1.

- a) In the nomination of figures there will be a limit on the number of figures selected from the following:

Family	Yak 52	Advanced	Unlimited
1.6 – 1.11			Max. of two from columns 3 and 4
1.14, 1.15	Max. of one only from columns 3 and 4		
7.23 to 7.30	Max. of one figure only		
8.1 to 8.4 8.15 to 8.18 8.31 to 8.34			A maximum of two from columns 3 and 4
9.9	Min. two, max. 4		A maximum of four*
9.10	None		A maximum of four*
			* Total of Families 9.9 and 9.10 not to exceed six, at least one of which must be vertically climbing
9.11 & 9.12	A maximum of one figure		

- b) There will not be more than 1 flick roll (Family 9.9 or 9.10) per figure.

- c) Sequences will consist of no more than 14 figures.

4.3.2.5. The contest organiser shall provide copies of the list of figures to all competing NACs, and each club may submit a sequence for each Programme, composed of these figures, to the International Jury. Additionally, the contest organiser will determine the deadline for submitting proposed sequences.

4.3.2.6. Programme 2, The Compulsory Unknown

- The International Jury will select one of the submitted sequences for use and will insure all figures are as drawn by the NACs submitting them, e.g. entry/exit directions are as drawn.
- The International Jury may alter the selected sequence, if necessary for safety reasons.
- Programme 2, after being approved by the Chief Delegates or their representatives, will be announced to competitors by the International Jury not less than 18 hours before the time at which each programme is to be flown.

4.3.2.7. Programme 3, The Free Unknown

- The International Jury will publish all the sequences proposed by the NACs. At least one linking figure, up to a maximum of four, must be included in each sequence. The K-factors for the linking figure(s) shall be modified so that they share equally an aggregate of 24K.
- All these proposed sequences must be checked by the International Jury and if necessary corrected at least 24 hours before the start of the programme.
- At least 18 hours before the commencement of Programme 3, each competitor will notify the Organiser which of the alternative proposals he/she will fly.
- At least 1 hour before the start of Programme 3, the Organiser shall provide each NAC with a list of the Free Unknowns chosen by each competing pilot.



- 4.3.2.8. Training for the Unknown Programmes is not permitted. Competitors violating this regulation will be disqualified.
- 4.3.2.9. The lists of figures for Unknown Programmes (Rule 4.3.2.1.) shall be re-approved at each meeting of CIVA which immediately precedes a World Championship. If, within 2 hours of publication, the sequence of figures for a programme chosen by the International Jury (Rule 4.3.2.6.a.) is shown by a team's representative or solo competitor to be dangerous, then the International Jury shall redesign the sequence without changing the figures selected under Rule 4.3.2.1.

4.3.3. Programme 4 - The Final Freestyle Programme (Unlimited only)

- 4.3.3.1. Programme 4 will be the last programme flown in the competition. The selection of figures or figure combinations for this programme need not be made with reference to the Aresti System (Condensed); there will be no limitation on the number of figures and the total difficulty coefficient.
- 4.3.3.2. The start and finish of Programme 4 may be in normal or inverted flight on a horizontal, ascending or descending path, which must not deviate from the horizontal by more than 45 degrees. Competitors may begin or finish their programme at any height between 100 and 1000 metres above aerodrome level.
- 4.3.3.3. There will be no submission of forms containing the sequence of figures to the Contest Director.
- 4.3.3.4. Smoke may be used at the option of each individual pilot.

4.3.4. Time Between Programmes

- 4.3.4.1. The organisers must allow sufficient time between programmes such that no competitor shall be required to fly less than six hours after landing from his/her previous flight

4.4. Programmes at International Competitions

4.4.1. Programmes

Programme Q	(Y52, The Known Programme) Known Compulsory Programme
Programme 1:	The Free Programme
Programme 2:	The Compulsory Unknown Programme
Programme 3:	The Free Unknown Programme
Programme 4:	The Final Freestyle Programme (Unlimited only)

- 4.4.1.1. It is recommended that the selection of the figures and the composition of Programmes Q, 1, 2, and 3 follow the rules as applied to World Championships. At least three programmes (e.g. Known, Free, and Unknown Programmes) are normally required, but see paragraph 1.3.1.1.b) and 1.3.1.2.b).
- 4.4.1.2. The decision on the number of competitors who will have to fly the Unlimited Final Freestyle Programme will be left to the organisers, but should be handled similarly to the Rules for World Championships.

4.4.2. Winners and Placings

- 4.4.2.1. The winners and the second and third placings in the overall Class and Team competitions will be established.
- 4.4.2.2. The winners and the second and third placings will be honoured appropriately by the organisers.



4.5. Awards

4.5.1. Unlimited Contests

4.5.1.1. World Championships

- a) The Men's and Women's World Champions respectively will be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded an FAI Silver and Bronze Medal respectively and Diplomas of the FAI.
- b) The Overall World Aerobatic Champion of the men or women will be awarded the Jose L. Aresti Cup.
- c) The Women's World Champion will be awarded the Royal Aero Club Trophy donated by the United Kingdom.
- d) The World Champions, second, and third placings in the various programmes (Q, Free, Unknown 1, Unknown 2 and Final Freestyle) will be awarded Gold, Silver and Bronze Medals by CIVA and Diplomas by the FAI.
- e) The World Champion in the Unknown Programme (combined results from Programmes 2 and 3) will be awarded the Eric Müller Trophy donated by Switzerland.
- f) The World Champion in the Four Minute Freestyle Programme will be awarded the Manfred Strössenreuther Trophy donated by the Federal Republic of Germany.
- g) The Men's and Women's World Team Champions (or the World Team Champions if rule 1.3.1.3.h). is in force), comprising the three highest-scoring pilots and the Team Manager, will each be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded FAI Silver and Bronze Medals respectively and Diplomas of the FAI.
- h) The Men's World Team Champions (or the World Team Champions if rule 1.3.1.3.h). is in force) will be awarded the Petr N. Nesterov Cup donated by the USSR.
- i) The Women's World Team Champions will be awarded the FAI Challenge Cup donated by the USSR.
- j) The top placing Team (Men's, Women's or Mixed) from the southern hemisphere will be awarded the Southern Cross Trophy donated by South Africa.
- k) The organisers are recommended to give awards at World and Continental Championships to the Chief Judge, the Panel of Judges, the Chief of the Scoring Office and all the specialists in the computing room.

4.5.1.2. Continental Championships and International Competitions

- a) The Men's and Women's Continental Champions, respectively, will be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded an FAI Silver and Bronze Medal, respectively, and Diplomas of FAI.
- b) The Continental Champions, second, and third placings in the various programmes (Q, Free, Unknown 1, Unknown 2 and Final Freestyle) will be awarded Gold, Silver and Bronze Medals by CIVA and Diplomas by the FAI.
- c) The Men's and Women's (or Mixed if rule 1.3.1.3.h). is in force) Continental Team Champions, comprising the three highest-scoring pilots and the Team Manager, will each be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded FAI Silver and Bronze medals respectively and Diplomas of the FAI.



- d) The Overall European Champion will be awarded the Manfred Strössenreuther Trophy donated by the Federal Republic of Germany.
- e) The male European Team Champions will be awarded the Darius and Girenus Trophy.

4.5.1.3. World Air Games

- a) Medals and Diplomas awarded at the World Air Games will be identical to World Championships (see 4.5.1.1)

4.5.2. Advanced Events

4.5.2.1. World Championships

- a) The World Advanced Aerobatic Champion will be awarded the Gold Medal and Diploma of the FAI, as well as the Peter Celliers Trophy. The second and third placings will be awarded an FAI Silver and Bronze Medal respectively and Diplomas of the FAI.
- b) The World Advanced Champions, second and third placings in the various programmes (Q, Free, Unknown 1, Unknown 2) will be awarded Gold, Silver and Bronze Medals by CIVA and Diplomas by the FAI.
- c) The World Advanced Team Champions, comprising the three highest-scoring pilots and the Team Manager, will be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded FAI Silver and Bronze Medals respectively and Diplomas of the FAI.
- d) The organisers are recommended to give awards at World and Continental Championships to the Chief Judge, the Panel of Judges, the Chief of the Scoring Office and all the specialists in the computing room.

4.5.2.2. Continental Championships and International Competitions

- a) The Continental Advanced Champion will be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded an FAI Silver and Bronze Medal, respectively, and Diplomas of FAI.
- b) The Continental Advanced Champions, second, and third placings in the various programmes (Q, Free, Unknown 1, Unknown 2) will be awarded Gold, Silver and Bronze Medals by CIVA and Diplomas by the FAI.
- c) Continental Advanced Team Champions, comprising the three highest-scoring pilots and the Team Manager, will each be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded FAI Silver and Bronze medals respectively and Diplomas of the FAI.

4.5.3. Yak 52 Events

4.5.3.1. World Championships

- a) The Yak 52 World Aerobatic Champion will be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded an FAI Silver and Bronze Medal respectively and Diplomas of the FAI.
- b) The Yak 52 World Aerobatic Champion in the Free Programme and in each of the Unknown Programmes will be awarded Gold Medals by CIVA and Diplomas by the FAI. The second and third placings will be awarded Silver and Bronze Medals by CIVA and Diplomas by the FAI.
- c) The Yak 52 World Team Champions, comprising the three highest-scoring pilots and the Team Manager, will be awarded the Gold Team Medal and Diploma of the FAI. The



second and third placings will be awarded FAI Silver and Bronze Team Medals respectively and Diplomas of the FAI.

- d) The organisers are recommended to give awards at World and Continental Championships to the Chief Judge, the Panel of Judges, the Chief of the Scoring Office and all the specialists in the computing room.

4.5.3.2. Continental Championships and International Competitions

- a) Continental Champions will be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded an FAI Silver and Bronze Medal, respectively, and Diplomas of the FAI.
- b) The Continental Champions, second and third placings in the various programmes will be awarded Medals by CIVA and Diplomas by the FAI.
- c) Continental Team Champions, comprising the three highest-scoring pilots and the Team Manager, will each be awarded the Gold Medal and Diploma of the FAI. The second and third placings will be awarded FAI Silver and Bronze medals respectively and Diplomas of the FAI.

4.6. Aircraft Restrictions

4.6.1. Yak 52 Contests

- 4.6.1.1. Aircraft must pass a technical inspection of the wing attachment units. Only those aircraft with the reinforced wing and a G-limit of +7/-5 are allowed. They must be equipped with checked and sealed accelerometers. Any pilot exceeding the +7/-5 g-limit will be excluded from the competition.

4.6.2. Advanced Contests

- 4.6.2.1. All aircraft of 260 hp or more are excluded, unless included in the list below.

4.6.2.2. Approved aircraft.

- a) All biplanes with standard engine.
- b) All two-seat aircraft with standard engine.
- c) With standard Lycoming engines:
 - i) Zlin 50L, Zlin 50LA, Zlin 50LS, and Zlin 50LX
 - ii) CAP-231 (unmodified)
 - iii) CAP-21DS (I-SIVM)
- d) With standard M-14P engine (unmodified)
 - i) Yak 55, 55M
 - ii) Technoavia SP-55
 - iii) SP-91/95, I-3

4.6.2.3. A "standard" engine is defined as:

- a) A Lycoming engine not exceeding 300hp
- b) A Vedenyev M-14P engine not exceeding 360hp

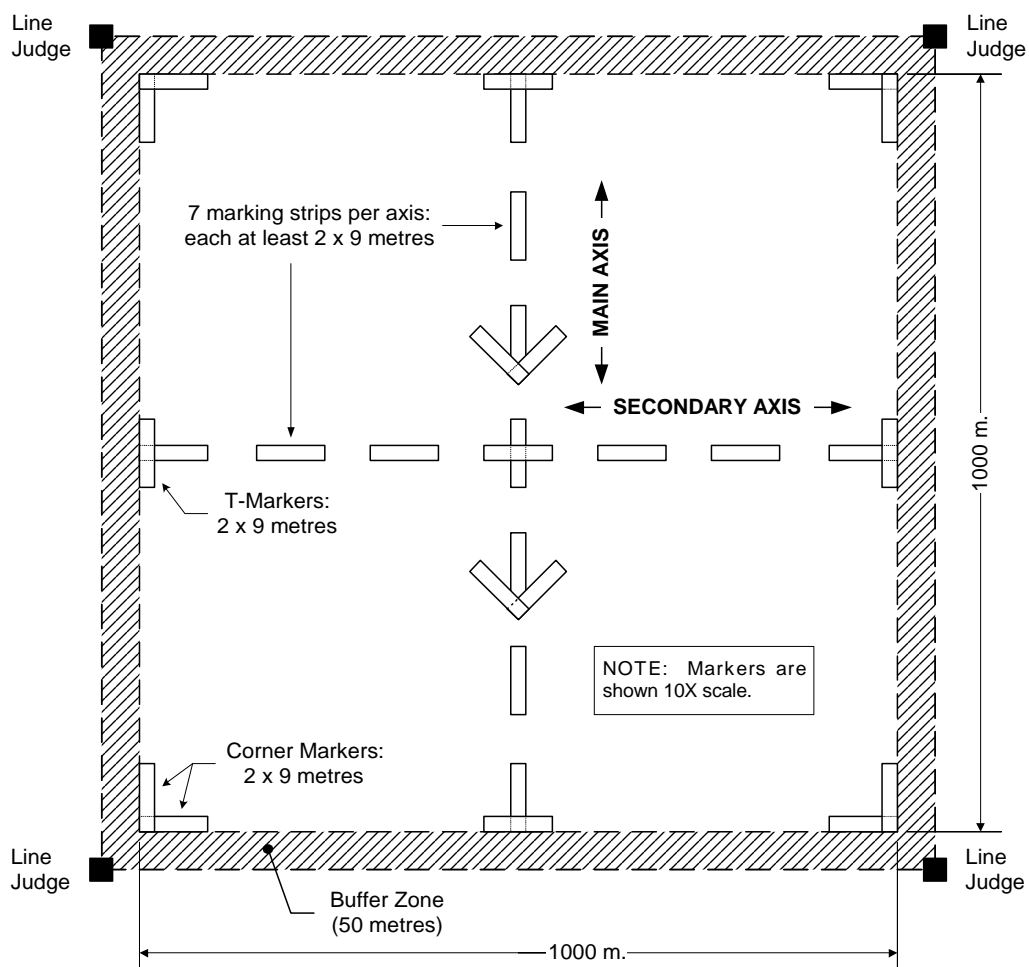
- 4.6.2.4. In the case of experimental or homebuilt aircraft, except Ultimate 10-300S, or modified series production aircraft with 6-cylinder Lycoming engines, the pilot must produce a current

bench test certificate from a reputable engine builder/rebuilder confirming the maximum rated horsepower. The Jury may require aircraft with supercharged engines to be ground run at take-off power to confirm maximum achievable manifold pressure.

- 4.6.2.5. Initial approval for a new type aircraft, not included in one of the approved categories, to compete in Advanced competitions may be sought by the CIVA Delegate of the country concerned and granted by CIVA at its plenary meeting.
- 4.6.2.6. The organizers or the President of the International Jury may recommend to CIVA the exclusion of aircraft types, should they deem it necessary.

4.7. The Aerobatic Performance Zone

- 4.7.1.1. The performance zone (box) must be clearly marked as shown in the accompanying diagram. The markers must be visible from any height within the performance zone.
- 4.7.1.2. Marking must be complete prior to the start of Programme Q. Aerial pictures of the box, taken along both axes, must be distributed to the International Jury and competing Teams to determine the correctness of the box geometry and to facilitate familiarization with the physical references.





5. REGULATIONS FOR THE EVALUATION OF COMPETITION FLIGHTS

5.1. Evaluation Of The Performance

5.1.1. Judges

- 5.1.1.1. Each programme of World and Continental Championships will be marked by the Judges using a standardised system: see Section 6 and also 5.2 and 5.3 below. The same rules should apply to International Competitions.
- 5.1.1.2. The marks given by a Judge to a pilot of his/her own country shall be included.
- 5.1.1.3. Where the majority decision of the Panel of Judges is required, in a case of disagreement about the penalisation of the flight of a competitor, the Chief Judge shall have a casting vote in the event of a tie.

5.1.2. Marks for Figures

- 5.1.2.1. The Judges will independently assess the quality of each figure and its components as performed in the sequences for Programmes Q, 1, 2 and 3, marking with numbers from 0 to 10, in intervals of 0.5; for Programme 4 the assessment will be in accordance with 5.1.5.1. A Hard Zero (HZ) mark will be awarded if the figure is incorrect or missing, in accordance with Section 5.3.
- 5.1.2.2. The scores will be calculated by multiplying the coefficient (K) for each figure by the mark given to each.
- 5.1.2.3. When marking the quality of the performance of individual figures, the Judges have to consider the following general principles:
 - a) the geometry of the figures (including shape, radii, angles, plane of flight, direction of flight), which must be in compliance with the prescribed characteristics;
 - b) the precision of the performance, for which there are Marking Criteria set out in Section 6;
 - c) the distinctly recognizable start and finish of each figure with a horizontal line;
 - d) For Programmes Q, 1, 2 and 3 note also that the figure flown must be in accordance with the pre-stated figure in the original sequence;
 - e) that in judging a figure which comprises a combination of manoeuvres, the marking criteria of its various components continue to apply, but the combined manoeuvres are to be taken as a unit;
 - f) that the length of lines and the size of radii caused by the flying characteristics of an aircraft are not to be taken into account in the marking;
 - g) that inverted figures are judged by the same criteria as upright figures.
- 5.1.2.4. Once horizontal flight path is established at the end of a figure in a sequence, the beginning of the next figure is considered to have occurred. This rule is not to be interpreted to mean that a competitor will incur penalty points for performance zone infringements (see 5.2.3) if the next figure is actually performed inside the 50 m boundary of the performance zone.
- 5.1.2.5. If a judge misses seeing a figure, or any part of a figure such that a grade cannot be given with full confidence, the Judge will give a mark of "Average" or "A" to that figure.



5.1.3. Calculation of Scores

The calculation of scores for a competitor's programme will be as follows:

- 5.1.3.1. The marks given by a Judge are processed according to Sporting Code, Section 8, with the final scores being determined for a programme as a whole. The CIVA-approved software programme must be used and obtained from the President of CIVA.
- 5.1.3.2. It shall be a duty of the organiser to arrange for the publication of the competition results in accordance with Rule 5.1.3.1. The marking sheets must be made available to the competitors, Chief Delegates, Team Managers, and Contest Officials for information and/or checking before the start of the subsequent programme.
- 5.1.3.3. A copy of the files generated by the CIVA-approved Computer Scoring System must be available to any official or Team Manager upon request. The media used for that copy will be supplied by the requester and has to be compatible with the computer being used by the contest organisers. A complete copy of all the files must be sent to the President of CIVA after the contest is finished.

5.1.4. Marking of Positioning

- 5.1.4.1. If an electronic, radar or radio-controlled tracking instrument is operated, the observance of the performance zone and of the positions of the individual figures are recorded.
- 5.1.4.2. For conventional marking of positioning, the positioning mark will be given by the Board of Judges. At the discretion of the organiser, infringements of the performance zone may be recorded by Line Judges.
- 5.1.4.3. The competitors should try to perform their programmes within the confines of the performance zone and in symmetry about the secondary axis. Depending on the aircraft's height and on the nature of the figure being flown, there is also an optimum range from the judges for the placement of each figure. At this range, the geometrical errors in the figure, and the precise nature of the figure, are both clear and easy to assess.
- 5.1.4.4. When Line Judges are not used, it is particularly important for each judge to consider the precise placement of each figure against the ideal and also in relation to the limits of the performance zone. The highest marks will be given if the central point of a competition flight is above the secondary axis, and if each figure is optimally placed inside the performance zone. A more full explanation of the principles of the judging of positioning is given in Section 6.9.
- 5.1.4.5. The K factor accorded to positioning marks will depend on whether infringements of the performance zone are being recorded and, if so, whether by Line Judges or an electronic instrument

a) Unlimited

Flight Programme	No Infringements Recorded	Infringements Recorded	
		Electronic Instrument	Line Judges
Programme Q, 2 & 3	K = 60	K = 20	K = 10
Programme 1	K = 60	K = 30	K = 20



b) Advanced & Yak52

Flight Programme	No Infringements Recorded	Infringements Recorded	
		Electronic Instrument	Line Judges
Programme Q, 1, 2 and 3	K = 40	K = 20	K = 10

5.1.5. Marking of Programme 4 (Criteria)

- 5.1.5.1. Programme 4 (Unlimited Final Freestyle Programme) will be marked under 3 headings as in the table below. Each of these shall contain sub-headings as detailed in Section 6.10.

Criteria	K-factor
Technical Merit	160
Artistic Impression	160
Positioning	80
Total	400

5.1.6. Official Video Recording

- 5.1.6.1. An official video recording from the Judges' position must be made of every individual competition flight in a World or Continental Aerobatic Championship. The official recording must be available to the International Jury to assist their decision on any protests regarding the evaluation of a competition flight. The recording shall not be available to competitors or Team Officials at a World or Continental Aerobatic Championship, except in conjunction with the International Jury's decisions on protests and with their agreement. After the completion of the championships, the recording may be released by the organisers for use in training.
- 5.1.6.2. The official recording shall also be available to the Chief Judge and the Board of Judges to assist their discussions on matters of fact.
- 5.1.6.3. Organisers must provide quality equipment with qualified operators to insure useful information is provided to the judges and International Jury for their decisions.

5.2. Penalty Points Deductible From Total (Averaged) Scores

5.2.1. Time Limits for the Programmes

- 5.2.1.1. Figures of Programmes Q, 1, 2, and 3 finished beyond the prescribed time for climbing and flying the programme (see Rule 4.2.6.1) will not be marked by the Judges. The end of the time allowed will be signalled by the Chief Judge.
- 5.2.1.2. Any deviation, shorter or longer, from the time allowed for Programme 4 will incur 10 penalty points for each second or fractional part of a second of deviation.
- 5.2.1.3. Failure of a competitor to observe precisely Rule 4.2.6.2 in Programme 4 (signalling start and finish) will result in a penalty of 150 points. To check and decide on this is the responsibility of the Chief Judge assisted by the timekeepers.

5.2.2. Infringement of Height Limits

5.2.2.1. Unlimited

- a) For every obvious and visually recognised infringement of the lower height limit during the performance of Programmes Q, 1, 2, 3 and 4, the competitor will be given 250 penalty points; an additional 250 penalty points will be given for each figure flown completely below the lower height limit; for an infringement of the upper height limit 50 penalty points are given. A competitor flying lower than 50 metres will be disqualified (from the current programme) for causing a dangerous situation.



5.2.2.2. Advanced and Yak 52

- a) For every obvious and visually recognised infringement of the lower height limit during the performance of any programmes, the competitor will be given 200 penalty points; an additional 200 penalty points will be given for each figure flown completely below the lower height limit. For an infringement of the upper height limit, 30 penalty points will be given. A competitor flying lower than 100 metres ("A") or 150 metres ("Y52") will be disqualified (from the current programme) for causing a dangerous situation.

5.2.2.3. If a precision height measuring device is not available, infringements of the lower height limits will be estimated by the Judges and will be penalised only if a simple majority has recognised the violation and duly recorded this on their marking sheets. In case the required simple majority could not rise from a vote within the Board of Judges, the Chief Judge shall have a casting vote. An infringement of the lower 50 m level must be agreed by at least a two-thirds majority of the Judges, whether the precision height measuring device is available or not.

5.2.3. Infringements of the Performance Zone

5.2.3.1. An infringement is considered to have occurred if the fuselage of the aircraft is seen by the Line Judges to have crossed the line being observed, even if this occurs more than once in a single figure.

5.2.3.2. The performance zone for all programmes will be 1000 metres each for the main (x) and the cross-wind (y) axes. For Programmes Q, 1, 2 and 3, infringements may be recorded by a technical device or by four Line Judges. When performance zone infringements are not recorded (see 2.2.2.1), the highest K factors will be used for positioning marks (see 5.1.4.5). The decision to adopt this option will be published not later than the second contest bulletin.

5.2.3.3. For each infringement of the performance zone in Programmes Q, 1, 2 and 3 by more than 50 metres in the direction of the x-axis and/or the y-axis a pilot will be given penalty points in accordance with the table below; this applies to the operation of either the conventional or the technical method (i.e. either visual observation or tracking).

5.2.3.4. If the conventional method is used, each infringement beyond 50 metres outside the performance zone will be penalised. Thereafter, for every figure started beyond 50 metres outside the performance zone, further penalty points will be given, again in accordance with the table below.

Zone Infringement	Unlimited	Advanced or Yak 52
Penalty point tariff	30	20

5.2.4. Flight Regulations and Dangerous Flying

5.2.4.1. Competitors found guilty of violating flight regulations and/or causing a dangerous situation will, on the recommendation of the International Jury, be disqualified by the Contest Director. The Chief Judge may, with the agreement of two-thirds of the Board of Judges, exclude a pilot who is not flying safely or could cause an unsafe situation. This would apply from takeoff to touchdown (see Rule 1.2.7.4)

5.2.4.2. A penalty of 250 points (200 points in "A" and "Y52") will be awarded to a pilot who, without reasonable cause, is not ready when their slot time arrives.



5.2.5. Interruption of a Programme or Addition of Figures

- 5.2.5.1. A competitor will be given penalty points, in accordance with the appropriate tariff, if he or she interrupts his or her programme:
- a) by dipping the wing three (3) times immediate one after the other;
 - b) in order to make a change of attitude or direction between two figures (more than 90°);
 - c) in order to lose or regain height;
- 5.2.5.2. Following a programme interruption, the competitor must restart his or her programme with the figure
- a) immediately preceding the point of interruption;
 - b) in which the interruption occurred;
 - c) immediately following the point of interruption
- In no case shall a figure that has already received a score (even if zero) prior to a programme interruption as in 5.2.5.1 be rescored.
- 5.2.5.3. Should the competitor restart his or her programme at any point other than provided for in 5.2.5.2, the competitor will be given additional penalty points in accordance with the appropriate tariff.
- 5.2.5.4. The addition of a figure to a sequence will also result in penalty points, but all subsequent figures correctly flown will be marked. For example, if the additional figure flown is a repeat of the previous figure, the score for the original figure must be retained, even if zero. Under no circumstances should a competitor be allowed to gain an advantage due to this additional figure.

Interruption or Addition	Unlimited	Advanced	Yak 52
Penalty point tariff	150	100	50

5.2.6. Violations of Safety Manoeuvres

- 5.2.6.1. A penalty of 30 points (all categories) will be given for each and every figure flown outside the box or other than the prescribed manoeuvres set out in Rule 4.3.1.2.

5.3. Penalties And Devaluations Applicable To Figures In Programmes Q, 1, 2, And 3

It is assumed by a Judge that a contestant is going to fly a perfect figure, therefore he/she starts with the grade of 10 and proceeds to downgrade this mark (a) by fixed values as prescribed herein, and (b) by further values in conformity with the Judging Criteria in Section 6.

5.3.1. Downgrades

- 5.3.1.1. The absence of a distinct horizontal start or finish to a figure will reduce the mark by 1 point in each case for each figure affected.
- 5.3.1.2. At the completion of a figure, each deviation from the correct direction of flight path will attract a reduction of 0.5 points per 2.5° of deviation, 1 point per 5° of deviation.
- 5.3.1.3. As there is no "free" space between figures (5.1.2.4) any reduction applied in accordance with 5.3.1.2 must also apply as an error at the start of the subsequent figure.



- 5.3.1.4. All deviations from the correct geometry (plane of flight, direction of flight, angle of bank), and for deviations from the proper flight path or the proper attitude (as appropriate), the mark will be reduced by 1 point per 5° deviation.
- 5.3.1.5. Over-rotating a roll and rolling the wings back again must be penalised by 1 point per 5° of over-rotation, even if the correct geometry is resumed afterwards, and no matter how quickly the correction is made. The same provisions apply when, at the end of a loop or part-loop, the aircraft's nose is pitched beyond the desired line and then brought back again.
- 5.3.1.6. If within a figure two or more lines have to be of the same length, the basis for judging is the first line flown. Any observed variation must be penalised by reducing the marks in accordance with paragraphs 6.7.1.6 and 6.7.1.7.
- 5.3.1.7. Slow rolls flown in combination with a turn (family 2.3 – 2.20) or loop (family 7.5 – 7.6) must be smoothly continuous: i.e. there must not be any change in the rate of roll from beginning to end.
- 5.3.1.8. Marking criteria for combinations of rolls with turns and loops will include the even integration of the rolls within the figure.
- 5.3.1.9. Specific downgrades are noted in paragraph 6.8.3

5.3.2. Soft Zero

- 5.3.2.1. A valid mark of 0.0 (a “Soft Zero”) will be given to a figure if the deductions reflecting the imperfection of the execution of the figure lead to a value lower than the score of 0.5.
- 5.3.2.2. Additionally, a mark of soft zero will be given if the Judge considers that the figure is incorrectly flown in respect of a criterion that is a matter of subjective perception, rather than clearly demonstrable fact. For example, if the Judge considers that a flick roll or spin never started proper auto-rotation, or that a tail slide did not move backwards by the required amount.

5.3.3. Hard Zero

- 5.3.3.1. A grade of “Hard Zero” (HZ) should be given if the Judge considers that the figure is incorrectly flown in respect of a geometrical error, as listed below, that is clearly verifiable as a matter of fact. A grade of “HZ” will be given to a figure if:
 - a) any figure is flown which does not conform to the drawing held by the judges for marking purposes (Form ‘B’ or ‘C’). Note - when a figure is added to a sequence Rule 5.2.5.2 applies.
 - b) the remaining segment of the turn or loop (Rule 5.3.1.8) reaches 90°;
 - c) any deviation from the prescribed direction (Rules 5.3.1.2 and 5.3.1.3) reaches 90°;
 - d) any other single deviation in geometry/flight path/attitude/rotation (Rule 5.3.1) reaches 90°;
 - e) the pre-stated figure or any part of it is omitted;
 - f) any figure is started behind the Judges.
 - g) any part of the figure was not visible as it was flown in or behind cloud. If the figure was visible to a majority of judges, then the average of their grades may be given by the unsighted judges.

However, if figures subsequent to the hard zero mark are correct and are flown in the correct direction, they shall be marked in the normal way.

- 5.3.3.2. During a repetition flight (paragraphs 4.2.2.5.e) or 4.2.7.9) the figures before the break must all be flown correctly. If a competitor omits or flies such a figure incorrectly, so as to gain an unfair advantage, the grade awarded for that figure during the first flight will be reduced to a "HZ".
- 5.3.3.3. When difficulties occur in interpreting the correct application of the "HZ" mark, the Chief Judge may call for a discussion on the spot by the International Judges. The official video may be used in these discussions to help determine matters of fact, but not of perception. Such discussions shall not interfere with the subsequent flights. Form A shall be retained until the final decision is made at the next possible break.

5.3.4. Mix of Zeros

- 5.3.4.1. The Fair Play System computer software programme will handle a mix of Hard Zeros, Soft Zeros or "A" grades in accordance with paragraph 5.3.4.4. In order for this to function correctly, the Chief Judge, if necessary after a conference as described in paragraph 5.3.3.3, must fill the Confirmed Hard Zero (CHZ) field on the judging sheets if a Hard Zero was in fact flown. If review shows the figure to have been correct, the "CHZ" box must be left open.
- 5.3.4.2. If during this process the Chief Judge establishes that there is a mix of Hard and Soft Zeros for the same error, i.e. it is only the extent of the error above 45 degrees that cannot be established, and these combined Zeros are in the majority for this error, the Chief Judge shall instruct those judges with the Soft Zeros to change their score sheets to Hard Zeros and sign the sheets accordingly. The Chief Judge will then fill the CHZ field. Consequently, no judge will in this instance have a point added to his Hard Zero Anomaly count (8.8.4.2).
- 5.3.4.3. Where there is a mixture of Hard and Soft Zeros for a figure started behind the Judges (rule 5.3.3.1.f) the Chief Judge shall determine by a simple majority (with the Chief Judge casting a vote as required) if a Hard Zero is applicable. Those judges in a minority, having given a score, shall then bring this score to Hard Zero and sign their sheets accordingly. Judges shall be instructed to grade figures regardless of whether they believe the figure was started behind them. These scores will then be used if the figure is deemed to have been flown in front of the Judges, when the Chief Judge calls for a vote on this issue.
- 5.3.4.4. When a mix of hard and soft zeroes, non-zero marks and/or "A" grades exists, the following resolution will take place in the computer scoring programme:
- "A" grades will first be set to "Missing".
 - If the "CHZ" box has been filled, then all other grades will be changed to "HZ".
 - If the "CHZ" box is open then "HZ" grades will be set to "Missing".

After normalisation, the "Missing" grades will be replaced with Fitted Values determined by the computer.

6. CRITERIA FOR JUDGING AEROBATIC FIGURES

6.1. Preface

- 6.1.1.1. The following is an expansion and clarification of the general principles for grading aerobatic figures stated in Regulation 5.1.2. The final grade awarded to a figure has many facets, but the first and most important component in any grade is the geometry of the figure as compared to the true horizon and Aerobatic Box axes. Geometry is derived from two distinctly different entities: flight path and attitude.

6.2. 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:

6.2.1. Angle of attack

- 6.2.1.1. The angle at which the wings of an aeroplane meet the relative airflow.

6.2.2. Angle of incidence

- 6.2.2.1. The angle at which the wing is attached to the aeroplane.

6.2.3. Figure

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

6.2.4. Manoeuvre

- 6.2.4.1. 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).

6.2.5. Score/Mark/Point

- 6.2.5.1. **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.

6.3. Flight Path And Attitude

6.3.1. Flight Path

- 6.3.1.1. Think of the airplane condensed into a single dot and watch the path this dot takes through the sky. This is the flight path, or track, of 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 axes of the Aerobatic Box. (Figure 1)

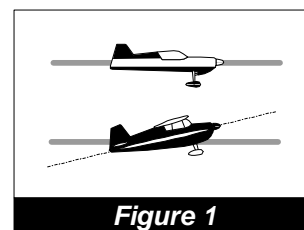


Figure 1

6.3.2. Vertical Attitude

- 6.3.2.1. Judging vertical lines is based on the attitude of the aircraft and not its flight path. When an aircraft's flight path, in a zero wind condition, is exactly 90 degrees to the horizon, the wings are being held at the correct angle to produce no lift. The aircraft's attitude while in this condition (zero lift) defines the proper judging criterion for vertical attitude. This is called the zero-lift axis.
- a) When this zero-lift axis is vertical, the longitudinal axis of some aircraft

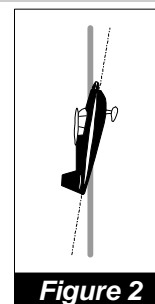
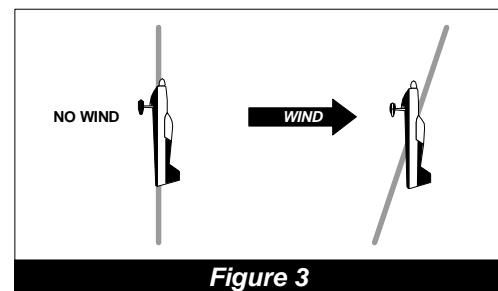


Figure 2

may not appear to be vertical. (Figure2) The Judge must determine the proper vertical attitude for each aircraft type according to its zero-lift axis. The best opportunity to make this determination is to observe practice flights and note the different aircrafts' vertical attitudes, both up and down.

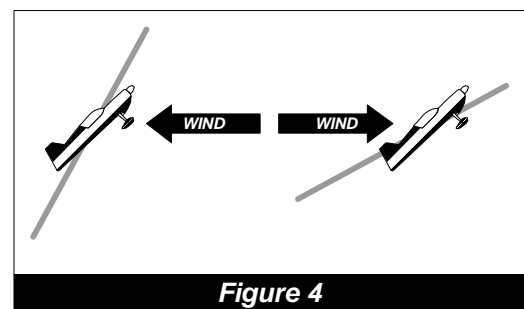
- b) An aid for judging the perfect vertical (zero-lift) attitude is to observe vertical rolls. During a truly vertical roll, the aircraft's wings will constantly be parallel to the horizon, something which is especially noticeable after 90 degrees of roll.
- c) Be aware that aircraft types whose zero-lift axis does not pass through the tail will make a spiral with the tail during a perfect vertical roll. From the Judges' perspective, this spiral will look as if the tail is shifting off-axis from the zero-lift axis flight path.

- 6.3.2.2. When there is a wind of any kind, the observed flight path will be offset from perpendicular to the horizon by some degree. This wind effect must be completely ignored by the Judge, who must only evaluate the accuracy of the vertical attitude. (Figure 3)



6.3.3. The 45 Degree Attitude

- 6.3.3.1. This is the vertical attitude plus or minus 45 degrees. In view of the difficulty in judging 45 degree lines accurately, scoring deductions should be applied with care. When flown into the wind, a perfect 45 degree line will appear to be steep while the opposite is true when flown downwind. (Figure 4) As with the vertical attitude, this wind effect must be completely ignored by the Judge who must only evaluate the accuracy of the 45 degree attitude. The prescribed deduction is one (1) point per five (5) degrees of deviation from the correct geometry (0.5 points per 2.5 degrees).



6.4. Grading

- 6.4.1.1. All transitions from one plane of flight to another should have a reasonable and constant radius. The size of that radius is not a grading criteria and higher grades are not to be given to "square, high-G" corners.
- 6.4.1.2. It should be assumed that a competitor is going to fly a perfect figure, so a Judge starts with a grade of 10. As the figure is performed, the Judge then begins to find faults (if any) with what he or she sees, and starts downgrading as the figure progresses. This system of grading is required by the rules as opposed to waiting until the figure is finished and assigning a grade based on overall impression. The latter causes the judging to be erratic and inconsistent.

6.5. Summary

- 6.5.1.1. Remember, it is the Judge's job to find fault: be a nit-picker. 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 with which you can find little or no fault. Take care not to grade on an overall impression of a flight. Be ready to award a low grade for a poor figure even if you have been grading other figures flown by that competitor with 8's and 9's.

- 6.5.1.2. On the other hand, when you see a competitor barely getting through the figures and you have been giving 4's and 5's, don't be afraid to award a 9 for the almost perfect 90 degree turn that you just saw.
- 6.5.1.3. Finally, and most importantly, only grade what you see. If you can't see anything wrong with a figure, don't deduct any points, even if you think there must be something wrong. Always give the competitor the benefit of the doubt.

6.6. Wind Correction

- 6.6.1.1. There are two kinds of wind correction: correction for figure geometry (shape) and correction for Aerobatic Box positioning.
- 6.6.1.2. The competitor is required to make the shape of all loops and part-loops within a figure perfectly round as seen by the judge on the ground. Wind correction is required for loops and part-loops within figures so that the aircraft's flight path describes a constant radius circle or part circle. Remember, the Judge grades for the roundness of the flight path. Any deviation from perfect roundness must result in a reduction of the score for that figure.

- 6.6.1.3. The competitor is also required to keep the aircraft within the Aerobatic Box. This becomes more of a problem when a wind is blowing at an angle to the X axis. (Figure 5) The primary method of dealing with cross-box drift is to include a "wind corrector" figure in the sequence. A wind corrector is a figure which places the aircraft onto the Y axis. Because the Y axis is non-directional, the competitor can turn onto the Y axis in the direction which will allow an upwind position change before flying a subsequent figure which returns the aircraft to the X axis.

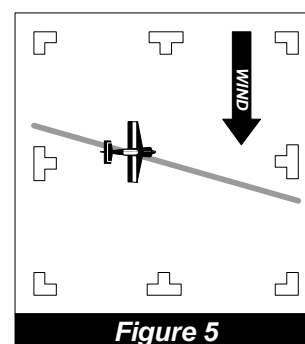


Figure 5

- 6.6.1.4. A well designed Free Program will always include at least one, and preferably more, wind corrector figures. Not every Known Compulsory or Unknown Program contains sufficient (or any) wind corrector figures, however, in this case, it is up to the competitor to keep the aircraft within the Aerobatic Box without benefit of a specific Y axis figure to accomplish it.

- 6.6.1.5. A common approach is to crab into the wind as done in navigational flight. (see Figure 6) Crabbing means that the aircraft's heading is at an angle to the competition axis (X or Y). The downside to this approach is that if this heading angle can be detected by the Judge, a deduction of one (1) point per five (5) degrees will be given.

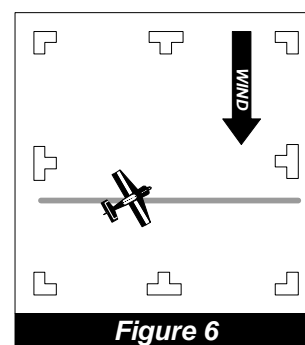
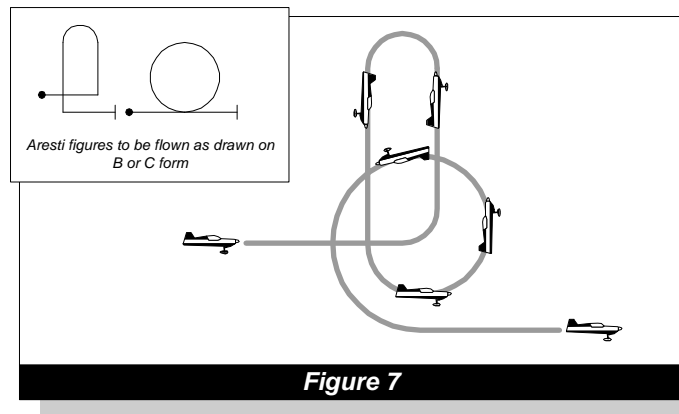


Figure 6

- 6.6.1.6. It is possible for the competitor to correct for wind in such a manner that the attitude remains absolutely true to the correct geometry of the figure but the flight path has a sideways component. It goes beyond the scope of this document to

provide a tutorial on how this may be accomplished, but what is clear is that if any yaw (heading) deviation or bank angle is visible to the Judge, the score must be reduced at the rate of one (1) point for every five (5) degrees of deviation detected.

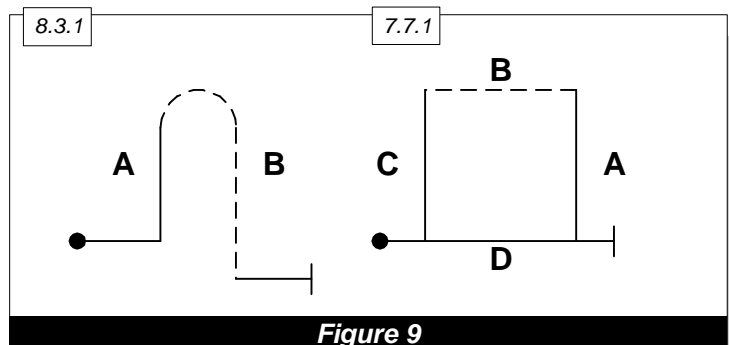
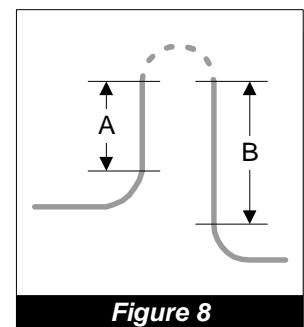
- 6.6.1.7. Please note, however: even if it is plainly evident that the aircraft has moved laterally within the Aerobatic Box, if the method of that movement cannot be detected by the Judge, no deduction for such correction must be made.



6.7. The Two Basic Components Of Aerobatic Construction: Lines And Loops

6.7.1. Lines

- 6.7.1.1. All lines are judged in relation to the true horizon and the Aerobatic Box's axes. Horizontal lines are judged on flight path, not attitude. Different aircraft at different airspeeds will employ different attitudes to maintain a horizontal flight path. (Figure 1) While maintaining a horizontal flight path, the aircraft's heading must remain parallel to the X or Y axis. The deduction for deviation in either axis is one (1) point per five (5) degrees from the correct geometry.
- 6.7.1.2. 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-recognizable 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 by one (1) point. (Figure 7)
- 6.7.1.3. All lines that occur inside a figure have a beginning and an end which define their length. They are preceded and followed by part-loops. (Figure 8)
- 6.7.1.4. With the exception of Family 3 figures and some figures in Family 7, the criterion for the length of lines within a figure states that they do not have to be of equal length. Therefore, it is imperative that the judges become familiar with the specific criterion for the length of lines for each figure. For example, the length of the lines in a "Humpty-bump" do not need to be equal, but all four lines in a "Square loop" must be of equal length. (Figure 9)



- 6.7.1.5. Whenever any kind of roll is placed on an interior line (except when any type of roll follows a spin), the lengths of the two

parts of the line before and after the roll must be equal. 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 by 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.

6.7.1.6. 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: (Figures 10 & 11)

- a visible variation - 1 point deduction;
- if the lengths vary by 1:2 - 2 point deduction
- and so forth up to a 3 point deduction.
- No line before or after roll, 4 point deduction.

6.7.1.7. The basis for judging line length is the first line flown. The absence of one of these lines before OR after a roll has to be penalised by 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 45 degree up-line with a full roll on the line. However, the airplane 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.

6.7.1.8. All 90 degree and 45 degree lines are preceded by the execution of a part-loop. Since we have in this part-loop a significant angle-of-attack, the aircraft's attitude in the part-loop will differ from its flight path. Therefore, when the aircraft's attitude reaches the desired line after transitioning from the part-loop, this difference between attitude and flight path will be carried on and will be the same as the angle-of-attack. For this reason, the only criterion for judging in that moment of reaching the desired line is to be the attitude of the aircraft and not it's flight path. It would then be very illogical suddenly to change the criterion of judgement from the visible and straight line of attitude to the unrecognizable and curved line of flight path. Therefore, the judging of 90 degree and 45 degree lines can only be based on attitude, not flight path.

6.7.2. Loops and Part Loops

6.7.2.1. 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.

- A loop must have, by definition, a constant radius. It starts and ends in a well-defined line which, for a complete loop, will be horizontal. For a part-loop, however, such lines may be in any other plane of flight and will be defined by the aircraft's attitude. 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

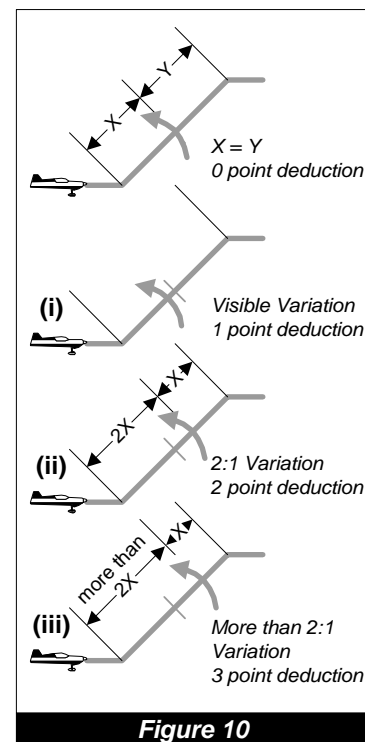


Figure 10

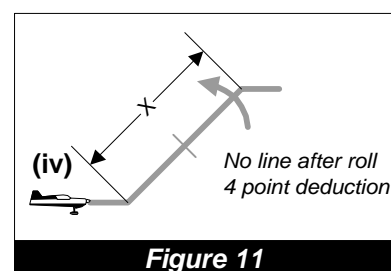


Figure 11

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 two part-loops are separated by a line between.

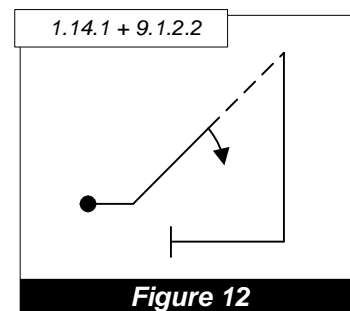


Figure 12

- b) The part-loops of any one figure should all have the same radius, except in Family 1 figures and where indicated in Family 8.1 thru 8.28 and 8.49 thru 8.56. For example, a figure starts on a horizontal line, with a quarter loop next, followed by a vertical line and then another quarter loop. 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. However, the top radius must not be a "corner" or very sharp angle. It must have a smooth, distinct and constant radius.

6.8. Aresti System (Condensed) Families

6.8.1. Family 1 - Lines and Angles

- 6.8.1.1. Family 1.1 to 1.11 has been fully covered in the preceding section. Note that the figures in Family 1.12 to 1.39 are NOT performed as drawn in the Catalogue. (Figure 12)
- 6.8.1.2. In each of these figures there are three (four in 1.28 - 1.39) looping components: a one-eighth loop, a three-eighths loop and a quarter loop. Rolls may be performed on the 45 degree line and/or the 90 degree line, with the part-lines before and after the roll being of equal length. The initial horizontal line and the line at the end of the figure may be flown at different altitudes.
- 6.8.1.3. Figure 13 shows Family 1.12 to 1.19 as flown. Radii a, b, and c may all be different and entrance altitude "A" can be different from exit altitude "B".

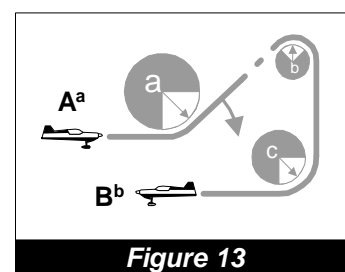


Figure 13

6.8.2. Family 2.1 – 2.2 Turns

- 6.8.2.1. Competition turns (Figure 14) are not to be confused with standard coordinated turns. In aerobatic competition, a turn is divided into three parts:
- establishing the bank using a roll on heading;
 - the turn itself; and
 - a roll back to straight and level flight on heading.
- 6.8.2.2. 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.
- 6.8.2.3. Once the roll is completed and the angle of bank is established, the competitor 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 is

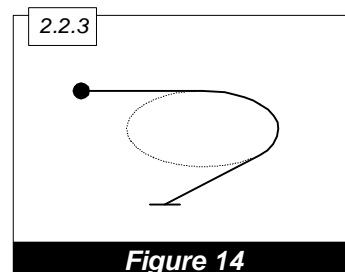


Figure 14

NOT wind corrected. Therefore, in wind, a 360 degree turn will not appear as a perfect circle.

6.8.2.4. 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.

6.8.2.5. Downgrades:

- a) The angle of bank established by the initial rolling manoeuvre must be at least 60 degrees. Anything less is a one (1) point deduction for every five (5) degrees.
- b) The angle of bank, once established, must remain constant. Any deviation is a one (1) point deduction for every five (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 either one (1) point for every five (5) degrees of change or 1 point for every 100 feet.
- 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 Judge 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 one (1) point deduction for every five (5) degrees of deviation.

6.8.3. Family 2.3 - 2.20 - Rolling Turns

6.8.3.1. The rolling turn (Figure 15) is a figure that combines a turn of a prescribed amount with a roll or rolls integrated throughout the turn.

6.8.3.2. These rolls may be in the same direction as the turn and are called "rolls in" or "rolls to the inside". They can be rolls in the opposite direction of the turn and are called "rolls out" or "rolls to the outside". Or there can be rolls alternating in and out.

6.8.3.3. 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 directions.

6.8.3.4. To help visualize the execution of this figure and facilitate a way for the Judge 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 2.10.1). First, on the prescribed entry heading, the pilot executes a turn and simultaneously initiates a roll in the same direction as the turn. The judge 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 one (1) point for five (5) degrees rule but will judge changes in the rate of roll, changes in rate of turn and changes in altitude (see downgrades below). At the end of the figure the aircraft must be wings level and on the prescribed heading.

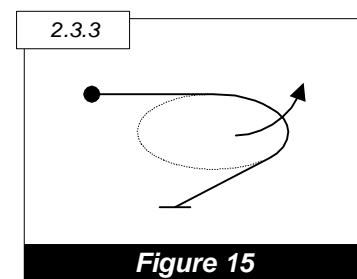


Figure 15

6.8.3.5. 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.

6.8.3.6. Downgrades:

- a) Performing more or fewer rolls than the catalogue description calls for results in the figure being zeroed.
- b) All rolls in a rolling turn are slow rolls. If a flick roll is performed, the figure is zeroed.
- c) Each stoppage of the rate of roll is a deduction of no more than two (2) points.
- d) Each variation in the rate of roll is no more than a one (1) point deduction.
- e) Each stoppage in the rate of turn is a deduction of no more than two (2) points.
- f) Each variation in the rate of turn is no more than a one (1) point deduction.
- g) Variations in altitude are deducted using either one (1) point for every five (5) degrees or 100 feet of altitude.
- h) One (1) point for every five (5) degrees that the aircraft is not in level flight when reversing roll direction.
- i) One (1) point for every five (5) degrees of roll remaining when the aircraft has reached its exit heading.
- j) One (1) point for every five (5) degrees of turn remaining when the aircraft has completed its last roll.

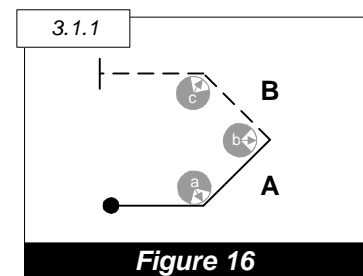


Figure 16

6.8.4. Family 3 - Combinations of Lines

6.8.4.1. The transition from level flight to 45 degree lines should be at a constant and reasonable 1/8 looping radius. All lines within the figure should be equal in length. The 45 degree transitions in Family 3.1 should have a constant and reasonable radius and not (as drawn) a sharp corner. (Figure 16)

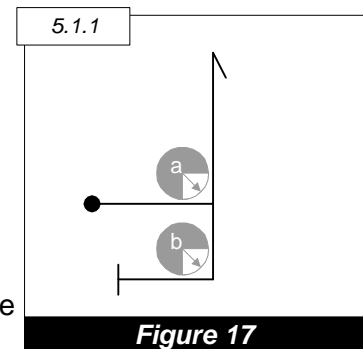


Figure 17

6.8.5. Family 5 - Stall Turns

6.8.5.1. In its most basic form (Figure 17), the stall turn begins when the aircraft leaves horizontal flight and flies a quarter loop to establish a vertical climb. At the top of the vertical line, the aircraft pivots and establishes a vertical descent, with the figure ending as the aircraft is returned to horizontal flight.

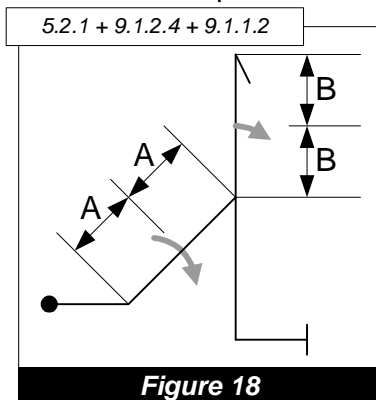


Figure 18

6.8.5.2. The judging criteria are:

- a) All radii must be equal.
- b) Vertical and 45° attitudes must comply with Section 6.3. Any deviation will result in a deduction of one (1) point per (5) degrees of error.
- c) Any rolls must be centred on their underlying lines (Figure 18). For deductions see 6.7.1.6.
- d) The lines may all be of different lengths.

- e) During the vertical climb or vertical descent, the wings must remain parallel to the horizon. There will be a one (1) point deduction per five (5) degrees of deviation of the vertical (yaw) axis from horizontal. This deviation is often referred to as "dragging a wing".

- f) As the aircraft nears the point where it would stop climbing, it must pivot in a plane parallel to vertical. Ideally, the aircraft pivots around its centre of gravity. To avoid a deduction, the aircraft must pivot around an axis point which cannot not be farther away from its centre of gravity than its wingtips (1/2 wingspan, Pivot Point Range from A to B, Figure 19). The downgrade for this deviation

(often referred to as "flying over the top") is one (1) point per half wingspan that the point of rotation exceeds the maximum allowed (Pivot Point B, Figure 19).

- g) The rate at which the aircraft pivots around its vertical axis is not a judging criterion.
- h) The wings must remain in the vertical geometric plane throughout the turnaround, and the aircraft's attitude before and after the turnaround must be absolutely vertical, with no pitch or roll. If there is movement around the roll axis, often referred to as "torqueing" (Figure 20), there is a deduction of one (1) point for each five (5) degrees off axis.

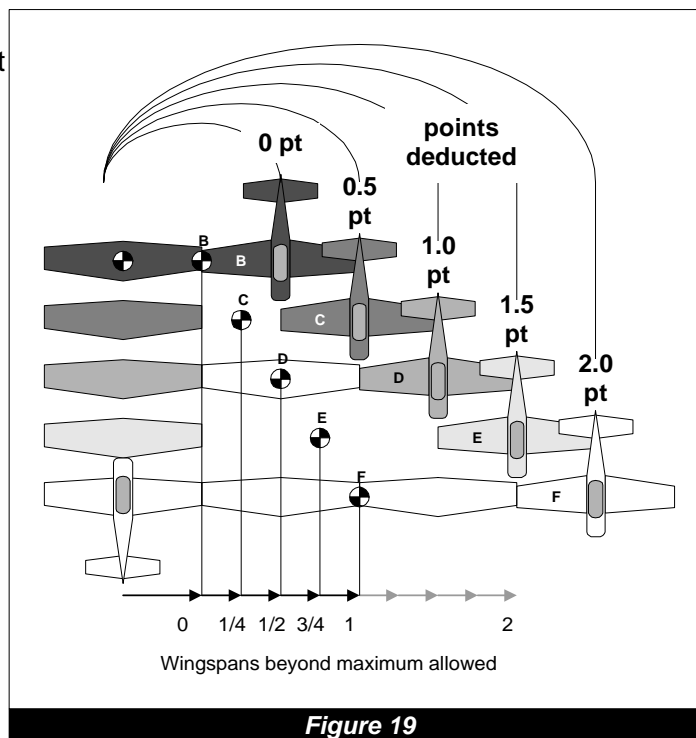


Figure 19

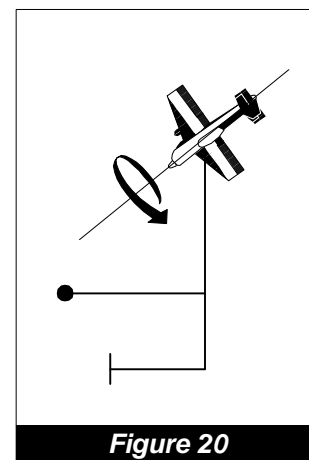


Figure 20

6.8.6. Family 6 - Tailslides

- 6.8.6.1. All the criteria of the Hammerhead apply to this figure except, of course, for the manoeuvre at the top of the vertical climb. At the point when the aircraft stops, it must slide backwards by at least a half fuselage length. If there is no slide of at least this length, the grade is soft zero (0.0). The aircraft must slide in the vertical plane and not with the nose inclined towards the horizon. A slide of this type must be downgraded by the formula of one (1) point for every five (5) degrees of inclination.

6.8.6.2. 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" 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.

6.8.6.3. There are two types of tailslides: wheels-down (also called "canopy-up") and wheels up (also called "canopy-down"). The wheels-down tailslide is depicted in the Aresti diagram with a curved solid line at the top of the tailslide symbol. (Figure 21) The wheels-up tailslide is depicted in the Aresti diagram with a curved dashed line at the top of the tailslide symbol. (Figure 22)

6.8.6.4. This figure must be watched carefully, as the aircraft can fall the wrong way, which is graded a Hard Zero (HZ), with the correct direction of flight and the proper aircraft attitude still maintained. Wings should stay level with the horizon throughout and not drop during the slide or the fall through. Watch for the aircraft torquing off the correct plane of flight, which must be downgraded. Also watch for "cheating" on the vertical line up in the direction of the slide just prior to sliding (Figure 23). Any "cheating" on the up-line will most likely carry over into the backwards slide as well. Because the slide backwards must also be perfectly vertical, a second deduction would be taken if this deviation from vertical is visible. The entry quarter loop and the exit quarter loop must both have the same radii. 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.

6.8.6.5. When rolls are combined with Family 6 figures, there must be an equal length of line before and after the roll(s). In the vertical down line, the aircraft must attain a vertical attitude and establish a down line before starting the roll(s).

6.8.6.6. In summary, the aircraft should make a smooth and steady transition up to vertical flight, the wings should stay level in relation to the horizon, and the aircraft should come to a complete stop in this attitude. After sliding backward at least one half fuselage length, 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 before transitioning into horizontal flight with a quarter loop of radius equal to the entry quarter loop.

6.8.7. Family 7 - Loops, Vertical S's, and Figure 8's

6.8.7.1. The size of a loop is not a grading criteria. 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.

6.8.8. Family 7.1 - 7.4 - Half-Loops With Rolls

6.8.8.1. 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 loops discussion below).

6.8.8.2. When a half-loop is preceded by a roll or rolls, the half-loop follows immediately after the rolls 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

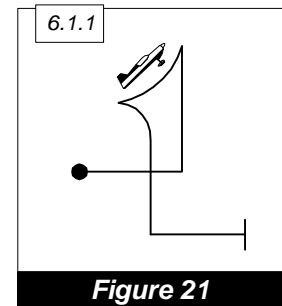


Figure 21

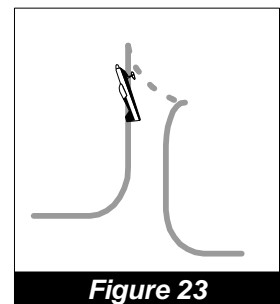


Figure 23

completed, the Judge must downgrade the figure one (1) point for every five (5) degrees of half-loop flown on which the roll was performed.

- 6.8.8.3. 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 two points depending on the length of the line drawn. Should the roll begin before the half-loop is completed, the Judge must downgrade the figure one (1) point for every five (5) degrees of half-loop on which the roll was performed. (Figure 24)

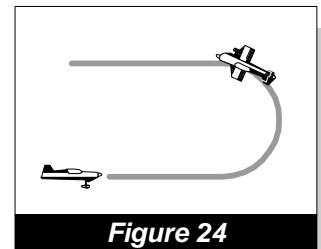


Figure 24

6.8.9. Family 7.5 - 7.6 - Full Loops

- 6.8.9.1. All full loops must appear perfectly round to the Judge. This means that they must be wind corrected to have a constant radius. This wind correction is only with regards to the roundness of the loop and not for the effect of any crosswind on the figure. Therefore, no deduction is given if the finish point is displaced relative to the start point in a direction perpendicular to the plane of the loop. Full loops must also begin and end at the same altitude or they will be downgraded. (Figure 25)
- 6.8.9.2. Loops must be flown with no visible crabbing and wings must be level at all times. The one (1) point for every five (5) degrees rule holds for both these cases.
- 6.8.9.3. If there is a roll or rolls at the apex of the loop, it must be centred in the loop and flown on the arc of the loop itself. 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 one (1) point for every five (5) degrees of the arc that it is off centred.
- 6.8.9.4. To better quantify deductions for irregularity of the radius of looping figures, the Judge divides the loop into quadrants. Any variation in the radius from one quadrant to the next can be downgraded a fixed number of points depending on the magnitude of the variation. The goal of each Judge is to develop a reproducible method to judge all loops with the same criteria.
- 6.8.9.5. 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. (Figure 26) Less common are loops with a horizontal diameter greater than the vertical. This is called an egg-shaped or pumpkin-shaped loop. (Figure 27) Another common error is in varying the radius of the final quadrant performing an "e" shaped loop. (Figure 28)
- 6.8.9.6. Whatever method is used, standard downgrades should be applied for each of these errors. Additional downgrades should be applied based on the magnitude of variation.

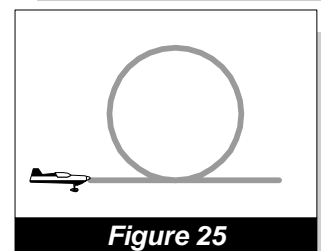


Figure 25

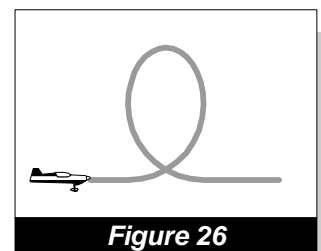


Figure 26

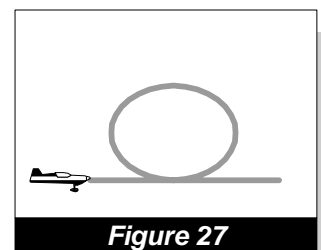


Figure 27

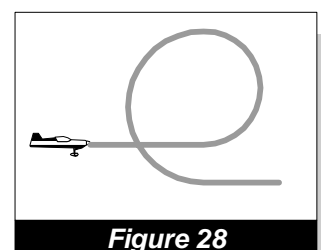


Figure 28

6.8.10. Family 7.7 - 7.10 - Square, Diamond and Octagonal Loops

- 6.8.10.1. Square, Diamond and Octagon loops are flown as hesitation loops with lines of equal length and partial loops with equal radii. All horizontal lines are judged on flight path and vertical

and diagonal lines are judged based on aircraft attitude. As such, except in a windless condition, the judge should never expect to see these figures closed. They will always be driven by the wind. 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.

6.8.10.2. In Figure 29:

- Radii $a = b = c = d$
- Line Length $A = B = C = D$
- Figure is not complete until $D = A$

6.8.10.3. Where rolls are flown on the Square or Diamond loops, they must be centred on the line.

6.8.10.4. 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. A frequently seen error in hesitation loops is for the aircraft to overshoot the partial loop and then have to bring the nose back to correct the attitude. This must be downgraded by one (1) point for every five (5) degrees.

6.8.11. Family 7.11 - 7.12 - Vertical S's

6.8.11.1. These figures are accomplished with two joined half-loops flown in opposite directions. (Figure 30) 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 roll between the half-loops. When a roll is performed between the half-loops, there is no line before or after the roll. However, the roll is flown on a horizontal line which begins as soon as the first half-loop is finished. As soon as the roll is finished, the next half-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.

6.8.12. Family 7.13 - 7.18 - Vertical 8's

6.8.12.1. These figures are performed by flying two loops, one above the other. Sub-family 7.13-7.16 is composed of two loops, both above or both below the entry altitude. Sub-family 7.17 - 7.18 is composed of one loop above and one loop below the entry altitude. In either case the entry and exit altitudes must be the same.

6.8.12.2. These figures may be combined with various types of half rolls. When a roll is performed between the loops, there is no line before or after the roll. However the roll is flown on a horizontal line which begins as soon as the first loop is finished. As soon as the roll is finished, the next loop must begin immediately. Adding a line at either of these points is at least a two (2) points 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 roll between the loops, they must be directly above one another. (Figure 31)

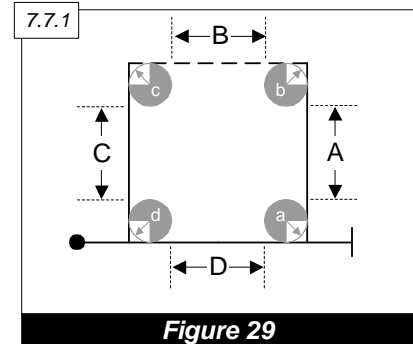


Figure 29

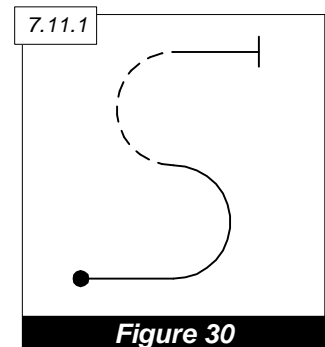


Figure 30

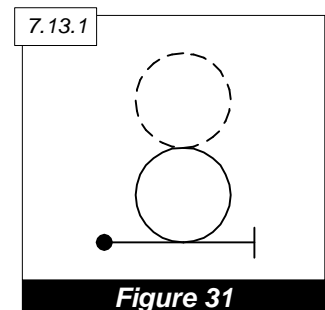


Figure 31

6.8.13. Family 7.19 - 7.22 - Partial 8's

6.8.13.1. Sometimes referred to as "Goldfish", the entry and exit radii in these figures must be identical. However, the $\frac{3}{4}$ loop can be of a different but constant radius. The entry and exit lines are judged with reference to the 45 degree attitude, not 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 loop. That is, the entry and exit altitudes need not correspond to the altitude limits of the loop. (Figure 32)

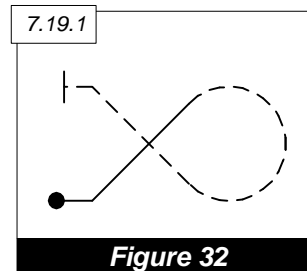


Figure 32

6.8.14. Family 7.23 - 7.30 - Horizontal 8's

6.8.14.1. Both loops must be the same size and the lines between the loops flown at exactly 45 degrees attitude. This means that only if there is no wind will they intersect at the exact midpoint of the 8. If there are rolls of any variety, they will only occur on the 45 degree lines and be positioned so that the lines before and after the roll are of equal length. For deductions see 6.7.1.6.

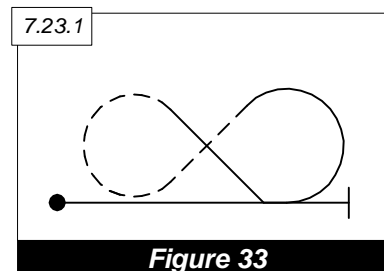


Figure 33

6.8.14.2. The start and finish of the figure and the bottoms (or tops if the figure is reversed) of the two loops must be at the same altitude. However, if there are multiple rolls flown on the last 45 degree line, that line may project above or below the looping portions and exit at a different altitude than the entry altitude of the figure.

6.8.14.3. The radius of the part-loop between 45 degree and horizontal need not equal the radii of the loops of the Horizontal 8 itself. A common fault is to fly these part-loops as drawn in the catalogue symbol, which means with a corner. This must be downgraded. (Figure 33)

6.8.15. Family 7.31 - 7.38 - Combination 8's

6.8.15.1. Besides possessing the unique characteristic of containing three 45 degree lines on which rolls may potentially be placed, these sub-families should be judged as 7.23 to 7.30 but with the addition of an extra 45° line.

6.8.15.2. Radii of the entry/exit 1/8th loops must be equal and the radii of the two 3/4 loops must be equal. However, the radii of the entry/exit 1/8th loops need not equal the radii of the internal $\frac{3}{4}$ loops. The two $\frac{3}{4}$ loops must have the same diameter and occur at the same altitude. Any rolls placed on any 45° line must be centred. The horizontal entry/exit lines must coincide with the top and bottom of the loops, except when the first or last 45° lines contain multiple linked, unlinked or opposite rolls, when they may be extended (not shortened) above or below the extreme of the $\frac{3}{4}$ looping segments. Shortening of a line, as in Figure 34, should be penalised by up to 2 points.

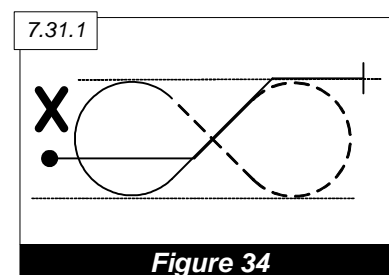


Figure 34

6.8.16. Family 8 - Combinations of Lines, Loops and Rolls

6.8.16.1. Although some of the figures in this Family appear to be exotic, there are no new judging criteria for these figures. These figures are combinations of horizontal, vertical and 45 degree lines as well as partial loops of varying degrees. The judging criteria for these lines and loops are unchanged. What is left to discuss are the judging criteria for the combinations of these lines and loops.

6.8.17. Family 8.1 - 8.28 - Humpty Bumps

6.8.17.1. These figures, whether vertical or performed with 45 degree lines, are judged as combination of lines and loops. For all these figures, the radii of the first and last partial loop must be equal. However, the half loop in the middle of the figure can be of a different radius. (Figures 35 and 36) These half loops 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.

6.8.17.2. 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.

6.8.18. Family 8.29 - 8.48, 8.51 - 8.54, Reverse Half Cubans, Half Cubans etc

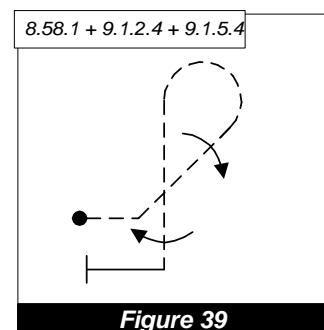
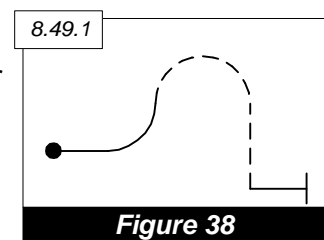
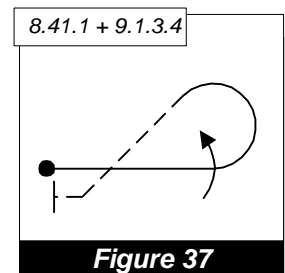
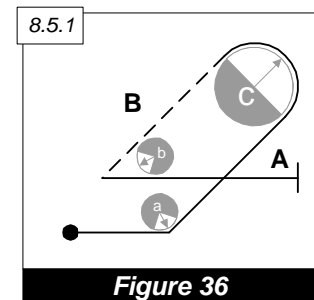
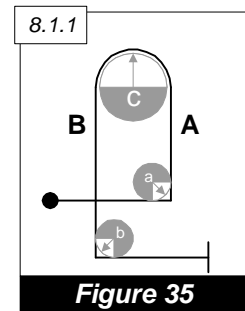
6.8.18.1. In these figures, all partial loops must have the same radii. The rolls on vertical and 45 degree lines must be centred. Horizontal rolls immediately preceding or following looping segments have the same criteria as in Families 7.1 to 7.4. Angles drawn in the pictograms, such as in Figure 37, are to be flown as partial loops.

6.8.19. Family 8.49, 8.50, 8.55 & 8.56 - Multiple Looping Combinations

6.8.19.1. When $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ loops join each other in these sub-families, their radii must be equal and there is no line between the loops. (Figure 38) A line drawn would be a minimum two (2) point deduction depending on the length of the line. The only exception is the $\frac{1}{4}$ loop that returns the aircraft to horizontal flight, which should have a reasonable radius, but need not match the other looping radii.

6.8.20. Family 8.57 - 8.72 - Teardrops

6.8.20.1. In these figures, all partial loops must have the same radii. The rolls on vertical and 45 degree lines must be centred. Angles are to be flown as partial loops. In the case of this figure, a $\frac{1}{8}$ outside loop is flown followed by an inverted 45 degree line up with an optional 360 degree roll. Then an outside $\frac{5}{8}$ loop is flown and a vertical line down on which there may be another 360 degree roll. Finally a quarter loop is flown, bringing the aircraft back to upright horizontal flight. (Figure 39)



6.8.21. Family 9 - Rolls and Spins

6.8.21.1. Rolls may be performed on horizontal, 45 degree or 90 degree lines; on complete loops; between part-loops; between part-loops and lines; and following spin elements.

6.8.21.2. They may be 1/4, 1/2, 3/4 or a full 360 degrees in their rotation, up to two consecutive full rolls. Additionally, slow rolls may be flown in combination with turns as prescribed in Family 2 (Rolling Turns).

6.8.21.3. 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.

6.8.21.4. 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. (Figure 40)
- b) Unlinked rolls must be of different types, the two types being defined as follows:
 - i) Aileron rolls (slow rolls and hesitation rolls)
 - ii) Flick rolls (positive and negative)
- c) With unlinked 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). They must have a brief but perceptible pause between them and they are to be flown in the same direction of rotation. (Figure 41)
- d) 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 opposite direction to the first. Opposite rolls, including those in rolling turns, should be flown as one continuous manoeuvre - the brief check between opposite rotations should be minimal. (Figure 42) If the two rolls are of the same type, they must be flown in opposite directions if they are not linked.
- e) Either aileron or flick rolls may follow spin elements (Family 9.11 or 9.12). When a spin and a roll are combined on the same vertical down line they will always be unlinked; may be flown in either the same or opposite direction, as shown by the position of the tips of the symbols on the Form B or C; and the combination may not exceed two rotational elements. (For example, it would be illegal to combine two opposite direction aileron rolls with a spin element.)

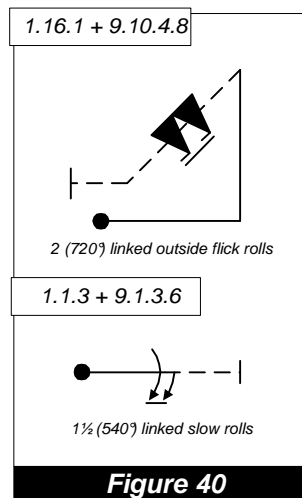


Figure 40

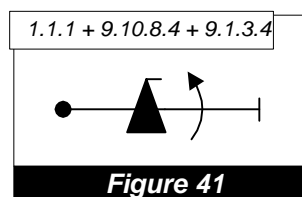


Figure 41

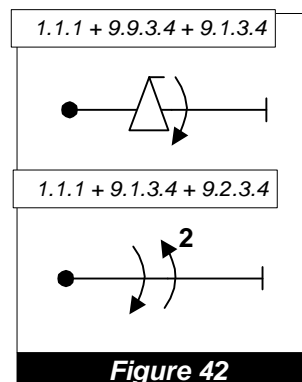


Figure 42

6.8.22. Family 9.1 - Slow Rolls

6.8.22.1. The penalty for varying the rate of roll is one (1) point per variation. Any stoppage in the slow roll that could result in its being considered a hesitation roll, would hard zero (HZ) the figure.

6.8.22.2. 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 penalized accordingly.

6.8.22.3. The wings 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". A deduction of 0.5 point to one (1) point is given depending on the severity of the "bump".

6.8.23. Family 9.2 - 9.8 - Hesitation Rolls

6.8.23.1. For hesitation rolls, the second digit in the catalogue number indicates the number of points: Family 9.2 is 2-point rolls; Family 9.4 is 4-point rolls; and Family 9.8 is 8-point rolls.

6.8.23.2. These rolls are judged on the same criteria as the slow 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 hesitations must be constant throughout with the aircraft projecting the pre-stated plane and direction of flight.

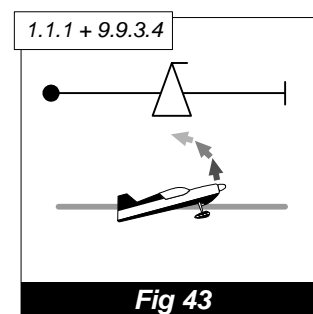
6.8.23.3. The pauses will be of identical duration and the degree of rotation correct between each pause: 180 degrees, 90 degrees, or 45 degrees. Each pause of a hesitation roll must be clearly recognizable in every case, but it is especially important that in poor visibility or at high altitude, the competitor pauses long enough to make them recognizable to the Judges. If a pause is not recognizable to a judge, the figure is graded a Hard Zero (HZ).

6.8.24. Family 9.9 - Positive Flick Rolls

6.8.24.1. Flick rolls represent one of the greatest challenges to judges. This is primarily due to two factors: (1) the "flicking" characteristics of different types of aircraft are unique; and (2), flick rolls are a high energy manoeuvre that occur very quickly. Flicks happen so fast, in fact, that it is virtually impossible for a judge to determine the exact order in which events occur, especially at the beginning of the flick. There are no criteria, therefore, for seeing nose and wing movement initiated at the same time as with the other autorotation family, Spins.

6.8.24.2. The judge must see two things to determine that a flick roll has occurred. The nose must depart the flight path and autorotation must be initiated. If the judge does not observe both events, the figure must be given a soft zero (0.0).

6.8.24.3. For a positive flick roll, the nose must move away clearly and unambiguously from the wheels (Figure 43). This puts the aircraft's wings near the critical angle-of-attack. If the nose moves in the wrong direction, a hard zero (HZ) is given. Either shortly after the nose moves, or simultaneously with the nose movement, the aircraft must be seen to yaw around its vertical axis, thus initiating a stall of one wing and subsequent autorotation. If any movement about the longitudinal (roll) axis is observed before the autorotation starts, the figure is downgraded one (1) point per five (5) degrees of roll.



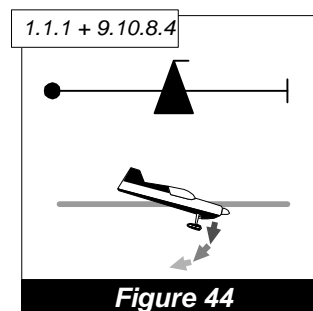
6.8.24.4. Throughout the flick roll, the main axis of the flick roll's rotation must be in the correct plane and direction of flight. However, the type of motion (angle-of-attack and angular velocity) displayed around the main axis of autorotation differs between aircraft types (much as each type of aircraft has different spin characteristics). If the character of the flick roll changes during the figure, the figure is downgraded. (see Family 9.1) A changing rate of rotation or the nose moving more onto the flight path (like a slow roll) is the most often observed change in character. But for all aircraft types, the criteria for stopping the flick roll is the

same: the attitude before starting the flick roll and in the instant of stopping it must be identical and must correspond to the geometry of the basic figure on which the flick roll is performed.

- 6.8.24.5. Flick rolls must be observed very carefully to ensure that the competitor is not "aileroning" the aircraft around its longitudinal axis. Aerobatic aircraft with very high rates of roll can occasionally fool a judge in the execution of flick rolls. The movement of the aircraft's nose departing the flight path prior to autorotation is a good clue to the proper execution of a flick roll. As always, the competitor is given the benefit of the doubt, but if a judge is certain that a proper flick roll has not been executed, a soft zero (0.0) is given. Another common error is for the aircraft to autorotate, but to not stay in autorotation until the end of the figure. In this case, a deduction of one (1) point for each five (5) degrees of rotation remaining when the autorotation stops must be made. If autorotation ends with more than 45 degrees of rotation remaining, even if the roll is completed with aileron, the flick roll is awarded a soft zero.

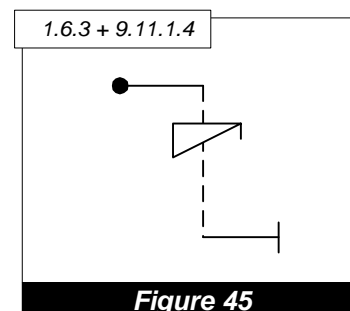
6.8.25. Family 9.10 - Negative Flick Rolls

- 6.8.25.1. For negative flick rolls, all criteria stated for positive flick rolls apply except, of course, that the aircraft is in a negative rather than positive angle-of-attack during autorotation. Therefore, in a negative flick roll the nose of the aircraft will move toward the wheels as it departs the line of the aircraft's flight path (Figure 44). This direction of motion must be observed very carefully, since it is the defining characteristic that differentiates a negative flick roll from a positive flick roll. As with positive flick rolls, if the nose does not move in the correct direction, it is not a negative flick roll and the figure must be given a hard zero (HZ).



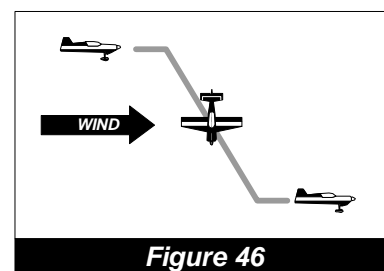
6.8.26. Family 9.11 and 9.12 - Spins

- 6.8.26.1. All spins begin and end with horizontal flight. In order to spin, the aircraft must be completely stalled in horizontal, level flight from a clearly visible horizontal line before the stall. When the aircraft stalls, the centre of gravity will drop from wings-level horizontal flight. It should be noted that an aircraft has forward inertia as the aircraft decelerates through stall speed.



- 6.8.26.2. This appearance is more pronounced when the figure is performed downwind, and is enhanced when performed into the wind. This change in appearance is not a grading criteria. (Figure 46)

- 6.8.26.3. When the aircraft stalls, the nose will fall and at the same time the wing tip will drop in the direction of the spin. Failure to achieve this should be considered a "forced entry" and downgraded one (1) point per five (5) degrees of deviation.



- 6.8.26.4. After completion of the prescribed number of turns, the aircraft must stop rotating precisely on the pre-stated heading, then a 90 degree down, wings-level attitude must be seen. Grading criteria for the basic figure being flown then resumes. If a roll 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 criteria to centre either a spin element alone or a spin-roll combination on the vertical down line. Be alert for early stopping of the stalled autorotation followed by "aileroning" to the pre-stated heading. In this case, a deduction of one (1) point for every five (5) degrees of "aileroning" must be applied. For example, in a one-turn spin the autorotation is observed to stop after 345 degrees of rotation and the ailerons are used to complete the rotation. The highest score this spin could receive is a 7.0.

6.8.26.5. 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 spin quite flat in conventional spins. Speed of rotation is also not a judging criterion.

6.8.26.6. If the aircraft never stalls, it is apparent that it cannot spin, and a soft zero (0.0) must be given. You will see "simulated" spins where barrel rolls or flick rolls are offered as spin entries. In both cases, the flight path will not be downward. In all of these cases, the figure will be zeroed.

6.8.26.7. In all spins the grading criteria are:

- a) A clean breaking stall in horizontal flight.
- b) Fully-stalled autorotation.
- c) Stopping on pre-stated heading.
- d) Vertical down, wings-level attitude after stopping on heading.
- e) A constant, reasonable quarter-loop radius back the horizontal flight.

6.9. Positioning

6.9.1.1. Positioning is scored in one of two ways: mechanically, by means of a tracking device; or by the individual judges.

6.9.1.2. Positioning refers to the placement of the figures in relation to the boundaries of the performance zone. Additionally, positioning relates to the placement of each figure at its optimum range from the judges, taking into account the height of the aircraft and the nature of the individual figure being flown. Lastly, positioning also refers to the symmetrical placement of the sequence, as a whole, to the left and right of the judges' position.

6.9.2. Performance Zone Boundaries

6.9.2.1. When Line Judges are used at a contest, infringements of the performance zone will be directly penalised and judges need pay less attention to such infringements when considering a grade for positioning. When Line Judges are not used, however, a much higher K factor is applied to the positioning score and judges must make additional reductions to the grades given when a pilot flies figures in a position that is clearly outside the confines of the performance zone.

6.9.2.2. In this latter case, the K factor is specifically chosen so that one less mark for the positioning grade equates to two figures being flown outside the performance zone. Thus, if a judge considers in these circumstances that four figures have been flown outside the zone, a deduction of 2 marks should be made from the positioning grade, in addition to any deductions made under the terms of the following paragraphs.



6.9.3. Optimal Placement of Figures

- 6.9.3.1. Even though figures are flown within the performance zone, judges must still consider their positioning in relation to an optimum position where clarity of execution and geometry are at their greatest. This optimum position will vary depending on the aircraft's height and the nature of the figure.
- 6.9.3.2. Consistently accurate flying is best assessed when the elevation of the judge's sight line from the horizontal is reasonably constant. This means that when an aircraft is at the greatest height, it should be also at its furthest distance away from the judging position along the secondary axis. Consequently, when an aircraft is low, then it should be closer to the judges to give the same viewing perspective.
- 6.9.3.3. In even the best positioned sequence, however, some variations in the judges sight line elevation are inevitable. These different viewing angles also affect the optimum position for figures of different kinds. For example, looping shapes and 45-degree climbing or descending lines are much easier to judge accurately if the sight angle in relation to the horizon is small. Conversely, such figures are difficult to assess if flown high up and close to the front of the performance zone.
- 6.9.3.4. Further, such fine points as the accuracy of hesitations in an 8-point roll are much easier to judge when the figure is close to the judges and fairly low, rather than over a kilometre away at the rear of the performance zone – let alone outside it.
- 6.9.3.5. Consideration of all the parameters in the few short paragraphs of this section will enable a judge to make a clear decision about any figure that is clearly flown in other than its optimum position. Judging of the particular figure will be difficult, and such bad presentation should be reflected in the positioning grade for the sequence. It would be appropriate to deduct between 0.5 and 1 mark for any such misplaced figure, depending on the severity of the difficulty incurred.

6.9.4. Sequence Symmetry

- 6.9.4.1. The previous sections have considered figures placed outside the performance zone and figures flown too close to, or too far away from, the judging position. The last consideration in assessing the positioning grade for the sequence is its symmetry about the secondary axis. Particularly in conditions of a strong headwind, or perhaps a slight but legal tailwind, some pilots might have difficulty in placing the sequence symmetrically about the secondary axis.
- 6.9.4.2. In a sequence of 12 figures, for example, 6 figures flown upwind and 6 downwind of the centre would present an ideal flight. A less even balance, perhaps 4 and 8, would represent a lower level of skill and would attract a further deduction of one mark from the positioning grade. Further imbalance than this, 3 to 9, or 2 to 10, should progressively attract greater downgrading of the positioning grade.

6.9.5. Summary

- 6.9.5.1. The judge's final decision on a grade for positioning is not a simple one. It must take in to account deductions for asymmetry of the sequence, non-optimal placement of individual figures and, in the case where Line Judges are not used, figures clearly flown outside the performance zone. Whilst a particularly well designed and positioned sequence might still merit a grade of 8.5 or so, a badly flown sequence could well deserve a very low grade from 0 to perhaps 2 or 3.



- 6.9.5.2. This extra burden placed on the judging panel deserves as much consideration as the grading of individual figures if the differences between good and bad flights are to be fairly assessed.

6.10. The Final Freestyle Programme (Unlimited Only)

- 6.10.1.1. The Final Freestyle Programme will be judged under three main headings. A grade of up to 10 marks, in increments of 0.5 will be given under each of the ten sub-headings.

6.10.2. Technical Merit (160K)

The Technical Merit of a flight shall be assessed by its fulfilment of the following objectives.

6.10.2.1. Use of Many Different Areas of the Flight Envelope – 40K

The pilot is expected to make full use of many different areas of the flight envelope of the aircraft. This means flying at the full range of air speeds and accelerations permitted. The time available should be divided between high speed, high G manoeuvres and slower flight periods. Both positive and negative parts of the envelope should be used, in reference to both speed and G. The flight should include the demonstration of controlled flight beyond the stall boundary by use of auto-rotation or other high-alpha manoeuvres. The judge will deduct points if any of these areas are noticeably under-utilised.

6.10.2.2. Exploitation of Aerodynamic Controls and Gyroscopic Forces – 40K

The pilot is expected to show movement of the aircraft about all axes using both conventional aerodynamic controls and also using propeller-generated gyroscopic forces. Higher marks will be given to pilots able to make use of all these effects through a wide range of aircraft attitudes and flight paths. Repeated use of any such forces in the same or similar attitudes should attract lower scores.

6.10.2.3. The Clarity of the Execution of Individual Manoeuvre Elements – 40K

It should be clear to the judges that the manoeuvres flown were, in fact, intended and fully under the pilot's control. Higher marks will be given under this heading when individual manoeuvre elements are started and finished on obviously precise headings and in well-defined attitudes. When, for example, gyroscopic manoeuvres are allowed to decay into imprecise, poorly defined auto-rotation, judges should consider deducting marks for poor execution. Marks should also be deducted if it appears that the pilot has relinquished control of the aircraft for short periods.

6.10.2.4. The Combination of Manoeuvre Elements in a Wide Variety of Figures Flown on Different Axes and Flight paths – 40K

Many different figures should be completed in the time available. These should include manoeuvre elements of many different kinds and should use many different flight paths and axes. Lower marks should be given to a pilot who used only one or two principal axes of flight. However, the use of additional axes must be clear and precise, not giving the appearance of being used by chance. Marks should also be deducted if any particular manoeuvre element is over-used or continues for an excessive period of time. For example, higher marks would be given in the event of a two-turn flat spin followed by something else, than to a multi-turn spin that simply took up more time.

6.10.3. Artistic Impression (160K)

6.10.3.1. The Pleasing and Continuous Flow of Figures – 40K

In a precisely flown sequence, the completion of a figure will be well described when movement about an axis ceases and a particular attitude is briefly held. The start of the next figure or manoeuvre should then begin without any prolonged period of inactivity caused by



the need to reposition the aircraft or re-orientate the pilot. Marks will be deducted for any obvious period of level flight, or inactivity, required between figures.

6.10.3.2. Contrasting Periods of Dynamic and Graceful Manoeuvres – 40K

In a musical symphony, the listener's mood may be changed by contrasting fast and slow movements. Similarly, in a Freestyle sequence, the audience should be treated to a flight that causes different reactions. While some manoeuvres involve very high speeds, sudden attitude changes and rapid rotations, others involve slower speeds or more gentle transitions. Higher marks will be given to a pilot who finds time in his programme for showing such differences of mood and pace. Marks should be deducted in this category for a flight that shows no such distinctions.

6.10.3.3. Presenting Individual Figures in Their Best Orientation – 40K

Figures can give different impressions when seen from different viewpoints. For example, a climbing inverted flat spin (*eventail*) looks most impressive when the top surface of the aircraft can be seen. A loop flown in a plane inclined at 45 degrees to the vertical is best appreciated when it is flown on the Y-axis. Marks should therefore be deducted if the judge is not shown a figure in its best orientation.

6.10.3.4. Placing Individual Figures in Their Optimum Position – 40K

Each figure has an optimum position from which it should be viewed. For example, a loop flown overhead does not give the same pleasing geometry as one flown further distant. Similarly, a figure flown near the upper height limit will cause discomfort when flown at the near edge of the performance zone; a low-level horizontal figure is better seen from close than far away. Higher marks will therefore be given when individual figures are optimally placed, while judges should deduct marks when it appears that a figure is not well positioned.

6.10.4. Positioning (80K)

6.10.4.1. Symmetry – 40K

Highest marks will be given when the sequence as a whole is balanced evenly to the left and right of the judges' direct line of vision towards the centre of the performance zone. Marks should be deducted if, by design or by the influence of the wind, a pilot's programme is noticeably biased to left or right. The greater the degree of asymmetry, the greater should be the deduction.

6.10.4.2. The Performance Zone – 40K

Even though a flight might be symmetrical, it may also be spread too far to either side, so that some manoeuvre elements are flown outside the performance zone. Figures may also be flown on the direct line of vision but very distant. Any part of the flight that is flown so far away that it appears to be outside the zone should be penalized at a rate of 0.5 of a mark for each apparent excursion.



7. CODE OF PRACTICE FOR THE CHIEF JUDGE AND BOARD OF JUDGES AT WORLD AND CONTINENTAL AEROBATIC CHAMPIONSHIPS

7.1. Chief Judge

- 7.1.1.1. The Chief Judge's primary concern should be the accurate and fair judging of the competition flights, including the monitoring of flights for Hard Zero marks and penalties. He should place his expertise at the disposal of the Board of Judges, and coordinate and guide their work.
- 7.1.1.2. The Chief Judge oversees administrative matters (correctness of paperwork, recording of penalties, etc.) but should be provided with a small group of special assistants who will perform at least the following tasks under his supervision:
 - a) calling the manoeuvres and recording the notes of the Chief Judge, to whatever extent he requires;
 - b) processing and expediting the flow of paperwork;
 - c) receiving and recording the calls of the Line Judges;
 - d) handling all other radio communications. One of his assistants should assist in monitoring the zero marks and penalties awarded by the Judges after each flight.
- 7.1.1.3. It is essential that the Chief Judge follows each flight, with emphasis on recording hard zeroes, interruptions, insertions and height penalties. Such infringements and comments should be recorded, as an *aide-memoire*, on a score sheet which should be retained for reference prior to the judges' scoresheets being submitted to the workstation. The official recording of penalties will be on the appropriate section of the score sheet reserved for the use of the Chief Judge and entered prior to submission to the scoring system.
- 7.1.1.4. The Chief Judge must hold seminars with the Judges, at least one of which will be with Team Managers or other team representatives present (CIVA 4.1.6.1). He should give guidance to the Judges as to the current Judging Criteria and rules for judging, on which he should conduct 'question and answer' sessions with the aid of the President of the Judging Sub-Committee.
- 7.1.1.5. The Chief Judge will hold other routine evaluation meetings with the Judges during the contest (CIVA 4.1.6.2), and before it begins he must hold practice sessions on the judging line during the contestants' training flights (see 6 below). He should ensure that the Code of Practice is understood and operates smoothly, and establish a good working relationship between teams of Judges and Assistants, Timekeepers, and other helpers.
- 7.1.1.6. The Chief Judge is responsible for ensuring that there is enough time between flights for the judging to be unhurried: he should control (by radio) the flow from one contestant to the next.
- 7.1.1.7. At the end of each flight, the Chief Judge should ascertain whether any of the Judges has recorded a Hard Zero (HZ) mark, height penalty, interruption penalty or insertion penalty. This will be done by perusal of the score sheets collected from the judges, prior to entry into the scoring system.
- 7.1.1.8. In the event of a difference of opinion between the Judges concerning a Hard Zero (HZ) mark, insertion penalty or interruption penalty, the Chief Judge may, at his own discretion, either call a judging conference as soon as possible or follow CIVA Regulation 5.3.4.1 at his workstation without further reference to the judges. From Programme 2 onwards (with

flights in reverse order) a judging conference will always be held to resolve differences, removing the discretion of the Chief Judge to waive such a conference. The official video shall be available to assist in such discussion when it concerns a matter of fact, for example the direction of a rolling turn or the omission of a figure or manoeuvre.

7.1.1.9. In case of a vote among the Judges on the question of penalization, all judges shall vote irrespective of nationality.

7.1.1.10. After the warm-up flight(s) in Programme 4, the Chief Judge will hold a mandatory meeting of all judges. The marks of the judges will be compared to establish a judging standard for the programme.

7.2. Hard Zeros

7.2.1.1. The awarding of Confirmed Hard Zero marks is determined by the Chief Judge, if necessary after a judging conference. When a Judge's vote is over-ruled, upward correction of a Hard Zero will be to a Fitted Value determined by the scoring software. When awarding a Hard Zero, judges are to write down the nature of the error and are not to give a 'reserve' mark.

7.2.1.2. The procedure for handling Hard Zeros and penalties on the judging line can be broken down as follows:

7.2.2. Hard Zeros Given By The Majority Of Judges.

The score sheets go to the scanner unchanged, the Chief Judge having checked the Confirmed Hard Zero (CHZ) box on the score sheet, unless a conference to confirm the facts is demanded by any judge(s). The computer system changes the minority scores to HZ and determines the judges' HZI points for Section 8.8.4.

7.2.3. Hard Zeros Given By 50% Or Less Of The Judges.

The Chief Judge first determines by means of conferencing whether the Hard Zero is correct or not. If correct, the Chief Judge will check the "CHZ" box on the score sheet; if not he will leave it blank. The judges must not change their score sheets as a result of the discussion. The score sheets will then go to the scanner and the computer system will then change the incorrect grades and determine judges' HZI points for Section 8.8.4.

7.2.4. Hard Zeros – Fact not Perception.

The Chief Judge will examine the reasons given by the scoring judges for the award of a Hard Zero. If the scoring judge has made a mistake and quoted a reason which is actually a matter of perception (e.g. "No Flick"), the Chief Judge will instruct that the scoring judge change his grade to Soft Zero.

7.2.5. Hard Zeroes – On matters referred to or determined by the International Jury

The Chief Judge may on occasions, where there is a mixture of of scores and Hard Zeroes for a figure, not be able to determine the validity of the Hard Zero score(s), due to uncertainty in the Regulations (e.g. paperwork errors). In such instances the Chief Judge shall tick the CHZ box and then refer the matter to the International Jury for clarification and a decision.

7.2.5.1. Where the International Jury determines the Hard Zero grade is correct, those judges who had given numerical grades will have their grades changed to Hard Zero by the President of the International Jury, without prejudice to their Ranking Index.

7.2.5.2. Where the International Jury determine the Hard Zero grade is incorrect, the Hard Zero confirmation will be reversed and those judges who have given Hard Zeros will have their grades changed to an average by the President of the International Jury, without prejudice to their Ranking Index.



7.3. Height, Interruption and Insertion Penalties.

- 7.3.1.1. Each judge must record such infringements on their score sheet. Where there are no such infringements the words "No Penalties" or "NP" should be entered in the remarks box, thus giving a positive indication in either instance. The Chief Judge or his assistant will then enter the appropriate penalty based on the majority result. In the case of a 50/50 split the Chief Judge may call a conference or cast his vote as appropriate.
- 7.3.1.2. Unless the precision height measuring device is in use, the awarding of penalties for infringements of upper and lower height limitations is decided by majority vote of the judges. In the case the required simple majority could not rise from a vote within the Board of Judges, the Chief Judge shall have the casting vote. A two-thirds majority is always required for the penalty of disqualification (CIVA 4.2.4.3, 5.2.2.3)
- 7.3.1.3. The Chief Judge must record when a competitor has exceeded the time limit for a programme (CIVA 4.2.6.1). This should not be brought to the judges' attention whilst the flight is in progress, but immediately after the flight has ended and the scores brought to zero as appropriate (CIVA 5.2.1.1). He should also confirm which figures should receive a Hard Zero because they were started behind the judges (CIVA 5.3.3.1.f). This should also be dealt with immediately after the flight and the scores brought to zero as appropriate.
- 7.3.1.4. The Chief Judge, assisted by the timekeepers, has the responsibility for the awarding of penalties for improper wing-rocking (CIVA 5.2.1.3).

7.4. Judges' Performance Evaluation

- 7.4.1.1. Judges evaluation by flight programme will be conducted by the International Jury using the software programme approved by CIVA (see Section 8.8). The Chief Judge will receive a complete analysis of all Judges from the International Jury after each programme is completed.
- 7.4.1.2. Their own individual judging analysis will be given to each judge, during a discussion with the Chief Judge, between programmes.
- 7.4.1.3. The complete judging analysis of the whole contest will be made available to NACs after the competition has been completed.

7.5. The Judges

- 7.5.1.1. It is required that all Judges use an experienced Judge's Assistant together with a writer who may be supplied on request by the organizers (subject to availability). Judges who do not provide qualified Assistants will be excluded.
- 7.5.1.2. All Judges should study copies of all contestants' Free Programmes, provided by the organisers, before flying of the programme is started.
- 7.5.1.3. A Judge may only reconsider his marks so long as his score sheet is still in his possession or if asked to do so at the request of the Chief Judge. Once entered into the scoring system, the scoring sheet comes under the jurisdiction of the International Jury. The judge himself must sign off any changes on the score sheet.
- 7.5.1.4. The preliminary flights by non-competing pilots (CIVA 4.1.7.4) will be marked exactly as if they were competitors; bearing in mind that the purpose of these flights is so that the first competing pilot who follows them shall not be penalized by receiving an unduly low 'anchor' mark.



- 7.5.1.5. It is strongly recommended that the Judges record remarks on the score sheets.
- 7.5.1.6. Judges shall not keep or make reference to a flight order sheet, or communicate to third parties by means of cell phone, radio, etc whilst on the judging line or during breaks/lunches. Failure to adhere to this instruction may lead to expulsion from the judging line.

8. STATISTICAL METHOD FOR PROCESSING SCORES

8.1. The CIVA Fair Play System - Purpose

- 8.1.1.1. Calculation of grades and scores for an aerobatic competition Programme using a mathematical process to give equal importance to all judges, while replacing anomalous grades with statistically fitted values.

8.2. Overview

The rating of a pilot performance for a given flight is an amount of points arising from two separate sources:

- 8.2.1.1. An evaluation of the quality of flown figures and of a flight's positioning with a grade given by judges observing the flight, on a scale ranging from 0 to 10 in increments of 0.5. These grades are multiplied by difficulty coefficients for each figure and added to derive a score for the programme for each pilot.
- 8.2.1.2. Penalties arising from height or time infringements and/or interruptions of the program sequence and other disciplinary actions.
- 8.2.1.3. The scores from 8.2.1.1 are subject to random and systematic errors due to the inevitable lack of exactness of judging. The purpose of the Fair Play system is to reduce the effect of those errors to a minimum. The penalties from 8.2.1.2 are not subject to the same errors and are simply subtracted from the scores results 8.2.1.1 after they have been calculated as described below.

8.3. Pre-Processing

8.3.1. Dealing with Hard Zeros and Missed Figures

- 8.3.1.1. Prior to the scoring data being entered into the computer, the Chief Judge must ascertain the validity of Hard Zero grades. If a figure is determined to have been a Confirmed Hard Zero, this must be designated by the Chief Judge. The grades given to that figure by the grading judges must not be altered prior to being input into the computer.
- 8.3.1.2. For a figure determined not to be a Confirmed Hard Zero, any "HZ" grade given by a grading judge must remain unaltered prior to data entry into the scoring computer.
- 8.3.1.3. Figures that have been missed by a grading judge must be marked "A". These missing grades will be replaced automatically by the Fair Play system.

8.3.2. Identifying Figure Grades for Analysis

- 8.3.2.1. Prior to the start of the Programme, the data input to the scoring computer will include the number of pilots, the number of figures (including positioning and, for gliders, harmony) each pilot will fly, the K-factors of each figure and the number of judges for the programme.
- 8.3.2.2. Each figure will be given a full identifying number in the format **kkkffpp** where:
- a) *kkk* is the K-factor, with leading zeroes if necessary, e.g. "037" if K-factor =37
 - b) *ff* is the figure number, with leading zeroes if necessary, and
 - c) *pp* is the pilot number, with leading zeroes if necessary.
- 8.3.2.3. Note that the number *pp* allocated to a pilot must remain the same throughout a contest and should not be confused with the flight order number any pilot may be allocated for a particular programme.

8.3.3. Grouping Figure Grades for Analysis

8.3.3.1. Statistical manipulation must only be carried out on sets of data of reasonable size. Furthermore, such analysis is best conducted on sets of data that share similar source characteristics. To meet these requirements, the grading data from a programme must be combined into appropriate groups.

8.3.3.2. For the purpose of the Fair Play analysis, data will be arranged in groups in the following generalised format:

K-factor	Figure #	Pilot #	Judge 1	Judge 2	...	...	Judge j
Kkk ₁	ff	pp	Grade _{1,1}				
Kkk ₂	ff	pp					
Kkk ₃	ff	pp					
...					
...					
kkk _n	ff	pp					Grade _{n,j}

8.3.3.3. In such a data set, the arrangement of rows will be by ascending value of the full figure Identification Number *kkkffpp*. In compulsory programmes, Known and Unknown, all pilots fly the same figures and the number of rows per data group will normally be the same as the number of pilots. This means that each data group in a compulsory sequence will correspond to a figure of that sequence flown by all pilots, in the form:

K-factor	Figure #	Pilot #	Judge 1	Judge 2	...	...	Judge j
kkk	Figure 1	Pilot 1	Grade _{1,1}				
kkk	Figure 1	Pilot 2					
kkk	Figure 1	Pilot 3					
...					
...					
kkk	Figure 1	Pilot p					Grade _{p,j}

8.3.3.4. Exceptionally, if the number of pilots is less than 11 (see 1.2.3.3), the target number of rows for each group (NrmGrp) will be as follows:

Number of Pilots	2	3	4	5	6	7	8	9	10
Group Size	12	12	12	15	12	14	16	18	20

8.3.3.5. In Free Programmes, where pilots fly different figures and/or numbers of figures, additional information is required so that the figures included in each data group are reasonably similar in type and complexity. Therefore each figure in a Free Programme (including Positioning and Harmony grades) will additionally be allocated to a Super-Family. Super-Families are defined as follows.



Super-Family Numbers (FF)	Unlimited Power	Adv & Y52 Power	Gliders
Harmony			00
Positioning	01	01	01
Aresti family 2	02	02	02
Figures containing spins	Spins ignored	03	03
Figures without spins but with flicks	Flicks ignored	04	04
Aresti family 5	05	05	05
Aresti family 6	06	06	06
Aresti families 1, 7 and 8	07	07	07

Notes: In Unlimited Power, Spins and Flicks are ignored and the Super-Family depends only on the Aresti Family of the underlying figure. If either Super-Family 05 or 06 contains less figures than the minimum of 11 data points, these two Super-Families will be combined.

8.3.3.6. Hence a Full Free Figure Identification Number will be of the form FFkkkffpp.

8.3.3.7. Free Programmes.

- a) In the Positioning and Harmony Super-Families, the group size will equal the number of pilots, i.e. each will contain the complete Super-Family. If the number of pilots (N_p) whose flights have been judged is < 11 , however, (see 1.2.3.3) then these Super-Families will be combined into a group containing them both.
- b) In other Super-Families, comprising aerobatic figures, the data groups will be formed from within each Super-Family, unless N_p is less than 11. The target number of rows for each group (N_{rmGrp}) will be the number of pilots whose flights have been judged, while the minimum group size ($MinGrp$) will remain 11 rows. When $N_p < 11$, then N_{rmGrp} will be as tabulated in 8.3.3.4, and a group may contain figures from more than one Super-Family. When a Super-Family contains more figures than the number of pilots, it may thus be split into two or more groups.
 - i) The boundary between adjacent groups within a single Super-Family will be made preferably at the change of K-factor nearest the target size within the range 'target row to target plus minimum rows', or if this is not successful nearest the target size but between the target row and the minimum group size. If no change of K-factor is available the group boundary will be set at the target row.
 - ii) For example, suppose that a Free Programme has 40 pilots and that Super-Family 07 contains 250 figures. This data will be divided into a number of groups, each of which will contain approximately 40 rows. The final group will contain at least 11 rows.

8.3.3.8. No analysis should be started until all groups contain at least 5 rows of numerical data. Results calculated by FPS are liable to change until all data have been entered. Once the data have been compiled into groups, the analysis will proceed as follows.

8.3.4. Confirmation of Hard Zero

8.3.4.1. The first stage of processing is to set to "HZ" all numerical grades given to a figure subsequently deemed to be a Confirmed Hard Zero by the Chief Judge. Any grade thus reduced to "HZ" must result in an increment to the particular judge's record for determining the HZ anomaly count of the Judging Performance Analysis.

8.3.4.2. Once Confirmed Hard Zeros have been implemented, each pilot's score sheet should be printed and made available for inspection along with the judges grading sheets.

8.3.5. Treatment of Other "HZ" or of "A" Grades

8.3.5.1. If a figure is not deemed to be a Confirmed Hard Zero, any "HZ" or "A" grades given for that figure must be treated as missing data points. Such grades will therefore be excluded from the calculation of means or standard deviations until such time as they are replaced later in the process. For each "HZ" grade that is not confirmed, an increment will be made to the judge's HZ anomaly count.

8.3.6. Treatment of Soft Zero Grades

8.3.6.1. Soft Zero grades are not subject to the same confirmation process as Hard Zeros. They are generally treated as valid numerical grades in the same way as non-zero grades. However, Soft Zero grades should not influence the normalisation of non-zero grades that is described below.

8.4. Definitions

8.4.1. The Basic Data Values

8.4.1.1. Define the Raw Grades, for a given sequence, as:
 $S(ff, pp, j)$

This is the Grade awarded by Judge j to Pilot pp flying Figure ff .

8.4.1.2. These Grades are then divided into semi-homogeneous Groups as defined above, and are now defined as:
 $R_g(fp, j)$

This is the Grade awarded by Judge j to (Pilot p flying Figure f) in Group g , and is represented physically by a rectangular array of numbers where fp is the row index and j is the column index.

8.4.1.3. There should also be a count indicator of values 0 and 1 to indicate 0 for any SZ, HZ or A values. These are designated: $N_g(fp, j)$

8.4.1.4. Counts

a) Pilot Count = No. Judges who score this pilot/figure combination

$$C_g(fp, *) = \sum_j \{N_g(fp, j)\} \quad (1)$$

b) Judge Count = No. Pilot/figures scored by this judge

$$C_g(*, j) = \sum_{fp} \{N_g(fp, j)\} \quad (2)$$

c) Overall Count = Total number of Scores

$$C_g(*, *) = \sum_{fp, j} \{N_g(fp, j)\} \quad (3)$$

8.4.1.5. Mean Values

a) Pilot Mean

$$mR_g(fp, *) = \sum_j \{R_g(fp, j)\} / C_g(fp, *) \quad (4)$$

b) Judge Mean

$$mR_g(*, j) = \sum_{fp} \{R_g(fp, j)\} / C_g(*, j) \quad (5)$$

c) Overall Mean

$$mR_g(*, *) = \sum_{fp, j} \{R_g(fp, j)\} / C_g(*, *) \quad (6)$$

8.4.1.6. Standard Deviations

- a) Judge Standard Deviation

$$sdR_g(*, j) = \sqrt{[\sum_{fp} \{R_g(fp, j)\}^2 - C_g(*, j) \cdot \{mR_g(*, j)\}^2] / [C_g(*, j) - 1]} \quad (7)$$

- b) Average Judge Standard Deviation

$$sdR_g(*,) = \sum_j \{sdR_g(*, j)\} / J \quad (8)$$

8.5. Group Processes

8.5.1. Normalisation of a Data Group

- a) The first stage of the analysis is to Normalise the non-zero grades in the data group to give each judge's column of grades the same standard deviation. This will give equal importance to each judge's opinion. In the normalisation formula:
- b) Norm1_g(fp,j) is the Normalised grade to replace the Raw grade
sdR_g(* ,j) is the standard deviation for a judge's Raw grades in this group
sdR_g(* , *) is the standard deviation for all the Raw grades in this group from all judges and,

$$Norm1_g(fp,j) = mR_g(*, *) + [R_g(fp,j) - mR_g(*, j)] \cdot sdR_g(*,) / sdR_g(*, j) \quad (9)$$

- 8.5.1.2. If the result of formula (7) or (8) is zero, then formula (9) cannot be applied and the grades for this judge, or this group, should be set to the overall mean for this group. If the result of formula (9) is less than zero, then it should be set at zero.

- 8.5.1.3. Soft Zero (0.0) grades are excluded from this normalisation process because, for each judge, these form part of a second mode of distribution of raw grades. After the non-zero grades are normalised, the Soft Zero grades are set to 0.0 so that they are included in the process of determining Fitted Values and figure anomalies. Hence:

$$\text{If } R_g(fp,j) = 0.0, \text{ Then } Norm1_g(fp,j) = 0.0 \quad (9a)$$

8.5.2. Derivation of Fitted Values

- 8.5.2.1. Within the data group, a Fitted Value for a figure grade for a pilot is the grade that you would expect a particular judge to give a particular pilot/figure combination, based on an analysis of all the judges' grades for all the pilot/figure combinations in the group, including numerical zeroes (SZ) but excluding factual zeroes (HZ). In the Fitted Value formula:

- a) FV1_g(fp,j) is the Fitted Value derived from Norm1_g(fp,j)
mNorm1_g(* ,j) is the mean of the Normalised numerical grades in the group for that judge
mNorm1_g(fp, *) is the mean of the Normalised numerical grades in the group for that pilot/figure
mNorm1_g(* , *) is the mean of all the Normalised numerical grades for that group for all judges and,

$$FV1_g(fp,j) = mNorm1_g(*, j) + mNorm1_g(fp, *) - mNorm1_g(*, *) \quad (10)$$

8.5.3. Assessment of Anomalous Grades

The normalised grades in each group must be tested for anomalies caused by judging error or partiality.

8.5.3.1. The Uncertainty of Any Individual Data Point

- a) A data point (grade) will be considered anomalous if its uncertainty exceeds a given threshold value. This uncertainty is derived by a two-way analysis of variance and starts with the calculation of the Residual for each data point. In the Residual formula:
- b) $Res1_g(fp,j)$ is the Residual value for each data point in the group after the first normalisation, and,

$$Res1_g(fp,j) = Norm1_g(fp,j) - FV1_g(fp,j) \quad (11)$$

- c) $RSS1_g$ is the Residual Sum of Squares for the data group after normalisation and,

$$RSS1_g = \sum_{fp,j} \{Res1_g(fp,j)\}^2 \quad (12)$$

8.5.3.2. The Degrees of Freedom of the data group is determined by:

- a) D_g is the value of the Degrees of Freedom of the data group
 FP_g is the number of pilot/figure rows in the group
 J_g is the number of judges in the programme (columns in the data group)
 Nm_g is the number of missing values (HZ or A) in the group, and

$$D_g = \{[FP_g - 1] * [J_g - 1]\} - Nm_g \quad (13)$$

8.5.3.3. The Residual Standard Deviation of the data group, $RSD1_g$, is determined by:

$$RSD1_g = \sqrt{RSS1_g / D_g} \quad (14)$$

8.5.3.4. Finally, the uncertainty of each individual data point, $U1_g(fp,j)$ is calculated:

$$U1_g(fp,j) = ABS[Res1_g(fp,j)] / RSD1_g \quad (15)$$

8.5.4. Treatment of Anomalous Grades

- 8.5.4.1. If the uncertainty of an individual grade, $U1_g(fp,j)$, exceeds 2.24 it has an uncertainty of approximately 97.5%. This degree of anomaly, or more, is to be expected in the case of a small number of soft zeroes for a figure which generally attracts a majority of high grades. Similarly, such an anomaly might occur if a single judge missed a large pilot error that led all other judges to award a very low grade. Anomalies such as this should be treated as though they were missing values. This treatment will give the benefit of the doubt to the pilot in situations where it is possible that a very significant judging error has been made.
- 8.5.4.2. The raw grade for any data point showing such an anomaly should be set to "Missing" in the original Raw Data $Rg(fp, j)$ – call it $R2g(fp, j)$. The judge concerned should have an increment made to Low or High Score anomaly count in the Judging Performance Analysis, as appropriate, for each grade replaced.
- 8.5.4.3. When making judgements based on the perception of the quality of flick rolls or spins, the panel of judges might produce a series of grades in which the distribution is bi-modal rather than Gaussian. For example, a set of grades might possibly include a number of soft zeroes and a number of high grades. In extremely rare cases, this difference of opinion may be so great that the majority of raw grades might be considered anomalous by this analysis. In this situation it is not fair to assume that the remaining grades are truly representative of the pilot's performance of the figure concerned.
- 8.5.4.4. Therefore, if the number of missing values that would be carried forward to the second normalisation exceeds 60% of the number of judges, all grades for this figure by this pilot should be replaced by the FV1 value derived at Formula 10.

8.5.5. Second Normalisation of the Group

8.5.5.1. If anomalies have been removed from the raw grades, the data set will have more missing values. It would therefore be necessary to normalise the data group for a second time. Again, Soft Zero (0.0) grades must be excluded from the Normalisation and these grades must remain 0.0. Using only the remaining non-zero grades new values must be determined for $mNorm_g(*,j)$, $mN_g(fp, *)$, $mN_g(*, *)$ and thus $FV_g(fp,j)$.

a) Hence,

$$Norm2_g(fp,j) = mR2_g(*,*) + [R2_g(fp,j) - mR2_g(*,j)] * sdR2_g(*,*) / sdR2_g(*,j) \quad (16)$$

b) and,

$$FV2_g(fp,j) = mNorm2_g(*,j) + mNorm2_g(fp,*) - mNorm2_g(*,*) \quad (17)$$

8.5.5.2. These new fitted values will have been determined free from the influence of any anomalous grades and are thus robust and give the benefit of any doubt to the pilot in the case of minority soft zeroes for an otherwise highly-graded figure.

8.5.6. Replacement of Missing Grades

8.5.6.1. These $FV2_g(fp,j)$ values are then used to replace the HZ, A and 'Missing' anomalous grades carried forward from the preceding analysis.

8.5.6.2. The judge concerned should have an increment made to his Low Score or High Score anomaly count in the Judging Performance Analysis, as appropriate, for each anomalous grade replaced, as well as to the HZ anomaly count for any HZ replaced.

8.5.6.3. After these replacements, the second normalised grades will be the final processed grades for each data group.

8.5.7. Assembly of Processed Grades by Pilot

8.5.7.1. After processing in the separate data groups, the final processed grades must be combined into a single matrix and this table sorted by ascending value of the Pilot identification number and then the figure number. These grades are then multiplied by the respective K-factor for each figure and totalled to give:

a) $SR(p,f,j)$ an overall score for each pilot on each figure from each judge

8.5.7.2. These can then give

a) $SR(p,f,*)$ an overall score for each pilot for each figure over all judges, where:

$$SR(p,f,*) = \sum_j SR(p,f,j) \quad (18)$$

b) $SR(p,*,j)$ an overall score for each pilot for each judge over all figures, where:

$$SR(p,*,j) = \sum_f SR(p,f,j) \quad (19)$$

c) $SR(p,*,*)$ an overall score for each pilot, where:

$$SR(p,*,*) = \sum_{f,j} SR(p,f,j) \quad (20)$$

8.5.7.3. These data should be printed and passed to each pilot at the earliest possible stage, so that the changes made during the processing stage can be understood.

8.6. Sequence Processes

8.6.1. Normalisation of Sequence Scores

8.6.1.1. It is now necessary to repeat the normalisation process at the sequence stage, once again to ensure that the opinion of each judge is given the same importance.

8.6.1.2. The sequence score data, $SR(p,j)$, can be set out in a matrix form as shown here.

Pilot #	Judge 1	Judge 2	Judge 3	...	...	...	Judge j
Pilot 1	$SR(1,1)$	$SR(1,2)$	...	...	...	...	...
Pilot 2	$SR(2,1)$	...	...	...	...	...	...
Pilot 3	...	...	...	...	...	...	...
...
...
Pilot p	...	...	...	...	...	...	$SR(p,j)$

8.6.1.3. From this table:

- a) $mSR(*,j)$ is the mean of all the scores given by Judge j.
 $sdSR(*,j)$ is the standard deviation of all the scores given by Judge j.
 $sdSR(*,*)$ is the average standard deviation of all the scores given to all the pilots by all the judges, and

$$\text{NormS}(p,j) = mSR(*,j) + [SR(p,j) - mSR(*,j)] * sdSR(*,*) / sdSR(*,j) \quad (21)$$

8.6.2. Derivation of Sequence Fitted Values

8.6.2.1. Next sequence fitted values are derived from the normalised scores to enable calculation of standardised residuals at the sequence level. In this derivation:

- a) $mNormS(*,j)$ is the mean of all the normalised scores given by Judge j.
 $mNormS(p,*)$ is the mean of all the normalised scores given to Pilot p.
 $mNormS(*,*)$ is the mean of all normalised scores given by all judges to all pilots, and

$$FVS(p,j) = mNormS(*,j) + mNormS(p,*) - mNormS(*,*) \quad (22)$$

8.6.3. Assessment of Sequence Anomalies

8.6.3.1. Despite the replacement of anomalous figures at the earlier stage of the process, it might be possible for slight, consistent favouritism or subconscious bias to influence unduly a Judge's overall score for a pilot. Such a score might be high or low and should be replaced if its degree of uncertainty reaches approximately 90%.

8.6.3.2. Therefore the analysis must next derive the residuals for the sequence scores:

$$ResS(p,j) = NormS(p,j) - FVS(p,j), \text{ and} \quad (23)$$

$$RSS_s = \sum_{p,j} \{ResS(p,j)\}^2 \quad (24)$$

8.6.3.3. The number of degrees of freedom for the sequence data set is calculated where:

- a) D_s is the value of the Degrees of Freedom of the sequence data
- P_s is the number of Pilots in the sequence
- J_s is the number of judges in the sequence
- Nm_s is the number of missing values (confirmed HZ for all figures by a pilot), and

$$D_s = \{[P_s - 1] * [J_s - 1]\} - Nm_s \quad (25)$$

8.6.3.4. The Residual Standard Deviation for the sequence is given by:

$$RSD_s = \sqrt{RSS_s / D_s} \quad (26)$$

8.6.3.5. The uncertainty of each sequence score is given by:

$$US_s(p,j) = ABS[ResS(p,j)] / RSD_s \quad (27)$$

8.6.3.6. If this uncertainty figure exceeds 1.65 (90%) it must be replaced by the fitted value FVS(p,j).

8.6.4. Interim Final Sequence Score

8.6.4.1. The processed sequence score for each pilot will be the sum of the normalised sequence scores over judges, after replacement of anomalous values of NormS(p,j) by fitted values FVS(p,j).

$$PS(p) = \sum_j \{NormS(p,j) \text{ or } FVS(p,j)\} / N_j \quad (28)$$

8.6.4.2. Penalties awarded for whatever reason are subtracted from this processed score to give each pilot's final overall score for the sequence.

$$FS(p) = PS(p) - Pen(p) \quad (29)$$

8.6.5. Second FPS Iteration and Final Sequence Score

8.6.5.1. When flights are of a very low standard, it is unlikely that the judges will show the same consistency of grading as when flights are of a high standard. Therefore, such low standard flights can have undue influence over the way in which the FPS system treats other scores.

8.6.5.2. To prevent such undue influence, the following procedure will be followed if the total number of competing pilots exceeds 30:

- a) Determine the values of PS(p) as a percentage of the maximum possible score for the sequence.
- b) If this value is less than 60% for a known sequence (Programmes Q, 1 and 4), or less than 50% for an unknown sequence, temporarily remove these flights raw data from the whole data set and re-apply the FPS process in its entirety. This will generate more reliable results for the retained pilots.
- c) Publish the final ranked order, based on FS(p) from the first FPS iteration for the excluded, low-scoring pilots, and based on FS(p) from the second FPS iteration for the retained, higher scoring pilots.

8.7. Process Summary

8.7.1. The process carries out the following analytical steps:

- 8.7.1.1. Sets confirmed Hard Zeros to HZ for all judges
- 8.7.1.2. Treats unconfirmed HZ and A grades as "Missing" at this stage.
- 8.7.1.3. Arranges figure grades into data groups for further analysis.



8.7.1.4. Within each data group:

- a) Normalises the grades to give equal importance to each judge.
- b) Derives fitted values for each judge for each figure.
- c) Determines if any normalised grades are more than 95% uncertain and disregards them by setting them to "Missing".
- d) Derives revised normalised grades and fitted values taking account of the new missing data.
- e) Replaces all the missing grades with revised fitted values.

8.7.1.5. At the sequence level:

- a) Normalises the scores to give equal importance to each judge.
- b) Derives fitted values for each judge for each pilot.
- c) Determines if any scores are more than 90% uncertain and replaces them with fitted values.

8.7.1.6. In the Second Iteration:

- a) Repeats the FPS process excluding certain low-scoring flights.
- b) Recombines all results into a final ranking order.

8.8. Judging Performance Analysis

The Fair Play System generates judging analysis data from the raw and FPS-processed scores. A Ranking Index is derived and judging errors totalled in a number of different categories. This data is gathered by the FPS and made available to the International Jury after each sequence and may, at the Jury's discretion, be passed on the Chief Delegates of each national team at the completion of each Programme, or at the end of the contest.

8.8.1. Ranking Index (RI)

- 8.8.1.1. The Ranking Index measures how closely an individual judge's pilot ranking for a programme conforms to the overall ranking based on all judges' assessments. It is derived by comparing the ranking each judge would have provided for each pilot if no other judges were present (*Jrank*) with the overall ranking calculated from the combined judging panel after all anomalies have been resolved and prior to any penalties being included (*Prank*). In the event that *Jrank* and *Prank* differ, this difference is weighted by an amount proportional to the differences in the underlying sequence scores that lead to this difference. A ranking error is penalised more heavily when it involves a larger difference in scores than when only minor differences in scores are the cause.
- 8.8.1.2. To derive the "raw" Judge rankings (*Jrank*), all HZ and SZ grades are set to numerical zero (0.0) and any "A" grade is assumed missing. This array of data is then normalised, and Fitted Values determined using normal FPS techniques. "A" grades only are replaced with FV and then a pilot total score is calculated by multiplying each normalised figure mark by the relevant K Factor.
- 8.8.1.3. After the full FPS process is complete, a full panel score (Pscore) and ranking (Prank) is determined for each pilot prior to the application of any penalties.
- 8.8.1.4. To derive the "Raw" Judge scores (*Jscore*), a final normalisation is conducted to rescale each judge's all-pilot average "raw" scores and all-pilot average standard deviation of "raw"

scores (as calculated in 8.8.1.2) to be the same as the all-pilot average and standard deviation of the full panel score (calculated in 8.8.1.3).

- 8.8.1.5. An index is now derived from these data for each judge. This takes account of differences in ranks and differences in total scores. Thus:

$$RI = \left\{ \sum_1^{Np} \frac{abs(Jrank - Prank) * abs(Jscore - Pscore)}{Jscore} \right\} * \frac{40}{Np}$$

- 8.8.1.6. Typically, a judge's Ranking Index will be in the range 1 to 50, lower numbers indicating that a judge's individual rankings are closer to the overall panel rankings. When there has been a second FPS iteration in accordance with rule 8.6.5, the RI is calculated using only data from the second iteration, i.e. pilots excluded from the second iteration are also excluded from the RI calculation.

8.8.2. Low and High Scoring Anomalies

- 8.8.2.1. A Low or High Scoring Anomaly is determined to have occurred each time a judge grades a figure significantly lower or higher than the consensus view of the judges.
- 8.8.2.2. For each figure, examine the normalised scores. If a judge's score for the figure has been determined 'Low' or 'High' at the approved confidence level, then add one to that judge's aggregate of errors under the appropriate heading.

8.8.3. Discrimination

- 8.8.3.1. Judges show differing degrees of "Discrimination" in that they score over wider or narrower ranges of raw grades. The FPS will keep track of these raw grades for subsequent publication and analysis in the form of histograms and banded totals.

8.8.4. Hard Zero Anomalies

- 8.8.4.1. The occurrence of Hard Zeros is determined by majority voting or by video conference. The scoring system determines the application of the Index from the "CHZ" box on the score sheets.
- 8.8.4.2. In the event that an individual judge fails to identify a confirmed Hard Zero, then add one to that judge's aggregate of errors under this heading. Similarly, if a judge gives a grade of HZ when no such error occurred, add one to the aggregate of errors under this heading.

8.8.5. Sequence Score Anomalies

- 8.8.5.1. A Sequence Anomaly occurs whenever a judge grades a whole sequence significantly higher or lower than the consensus view of the judges.
- 8.8.5.2. For each pilot, examine the normalised sequence scores. If a judge's score for the sequence has been determined 'High' or 'Low' at the approved confidence level, then add one to that judge's aggregate of errors under this heading.

9. LIST OF FIGURES FOR PROGRAMMES 2 AND 3

This section illustrates those figures that may be nominated for the compilation of unknown programmes at each type of contest.

9.1. Colour Coding

9.1.1. Yak 52

- 9.1.1.1. Yak 52 figures are shown throughout in blue and are marked with a blue Y symbol. Textual comments relating to Yak 52 figures are also in blue.

9.1.2. Advanced

- 9.1.2.1. In Advanced contests, all the Yak 52 figures may be flown (unless otherwise noted in the text), plus those shown in red and marked with a red A symbol. Textual comments relating to Advanced figures are also in red.

9.1.3. Unlimited

- 9.1.3.1. In Unlimited contests, all the Yak 52 and Advanced figures may be flown, plus those shown in black. Unlimited figures are not marked with a symbol. Textual comments relating to Unlimited figures are also in black.

9.2. Roll, Flick and Spin Combination

9.2.1. Yak 52 and Advanced

- 9.2.1.1. Unlinked and opposite rolls are permitted only on straight horizontal lines.
9.2.1.2. No roll element, neither aileron nor flick roll, may be added after a spin.

9.2.2. Unlimited

- 9.2.2.1. Unlinked and opposite rolls permitted only on straight horizontal lines except that:
a) On vertical lines, opposite aileron rolls may be added as long as neither the total extent of rotation nor the number of stops exceed the limits shown in the table below.

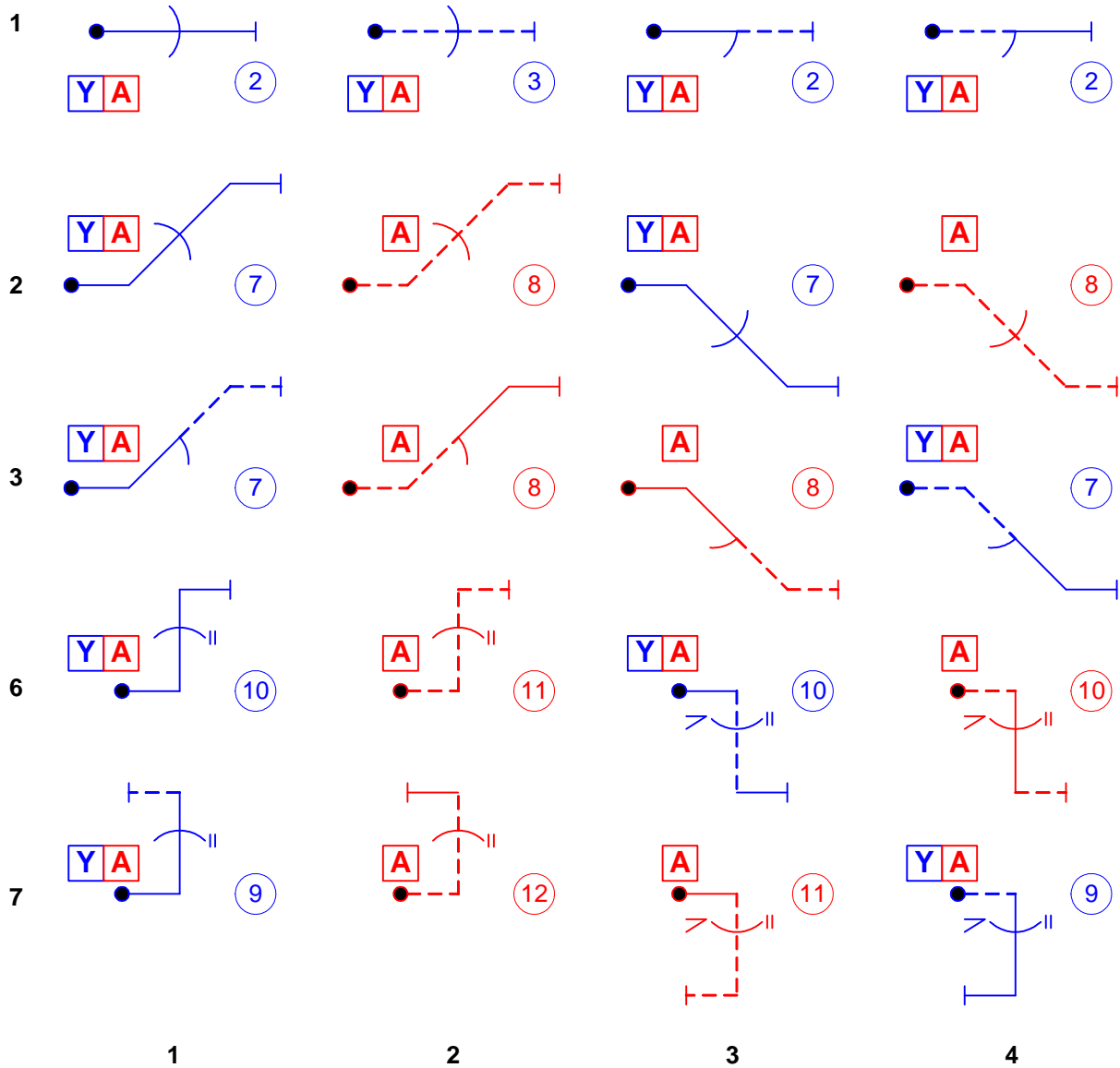
Line Direction	Total Rotation	Stops
Vertical Up	450°	4
9.2.2.2. Vertical Down	9.2.2.3. 360°	9.2.2.4. 3

- 9.2.2.5. An aileron or flick roll element may be added after a spin.

9.2.3. All Categories

- 9.2.3.1. Any of the figures illustrated with a 360° optional roll sign may be performed without that roll

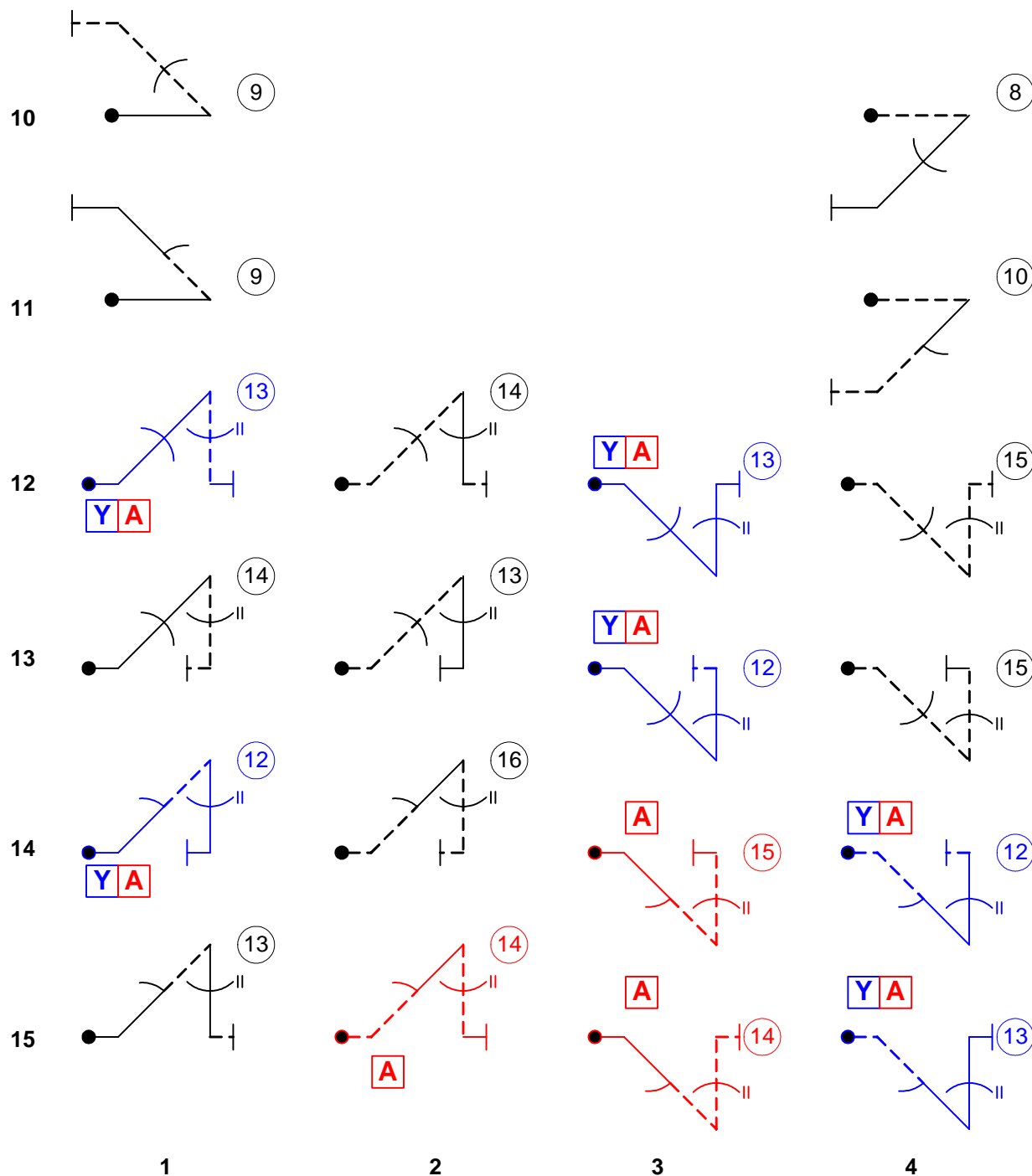
9.3. Family 1.1 To 1.7



9.3.1.1. Yak 52: Figures 1.6.x and 1.7.x: No rolls; 1.6.3: Spin only.

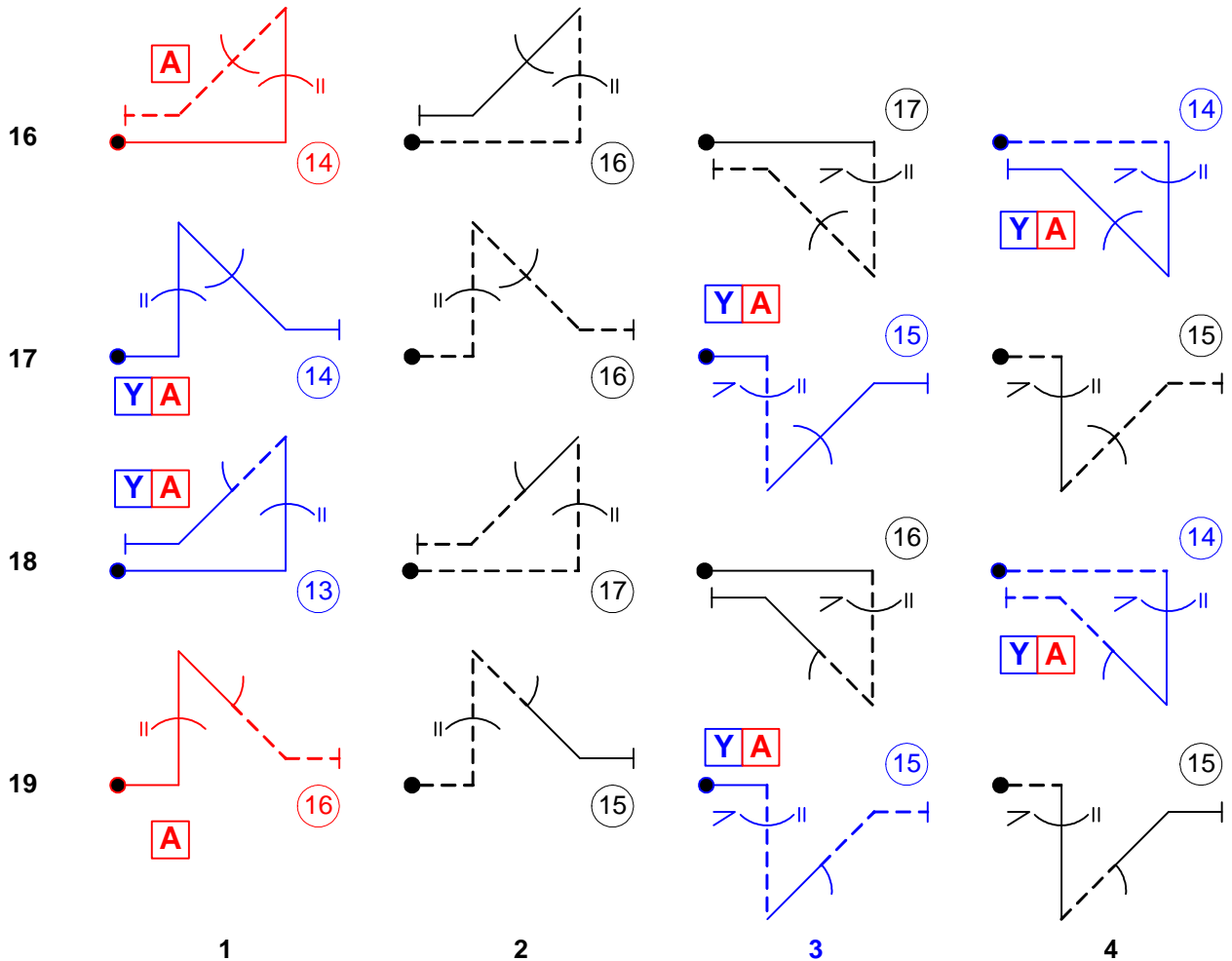
9.3.1.2. Unlimited: Family 1.1 used for linking figures only.

9.4. Family 1.10 To 1.15



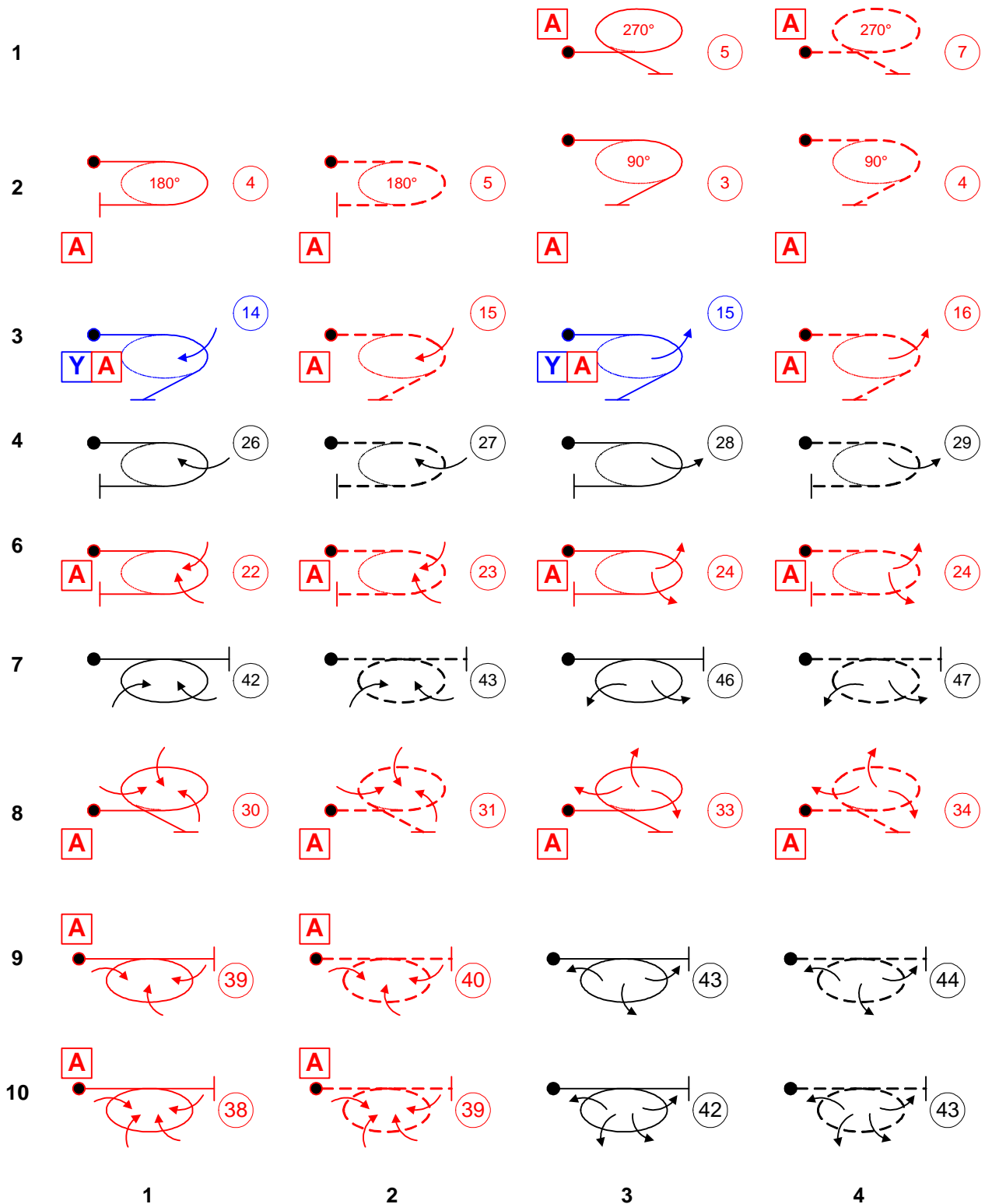
9.4.1.1. Yak 52: Figures 1.12.x to 1.15.x: No vertical roll elements.

9.5. Family 1.16 To 1.19



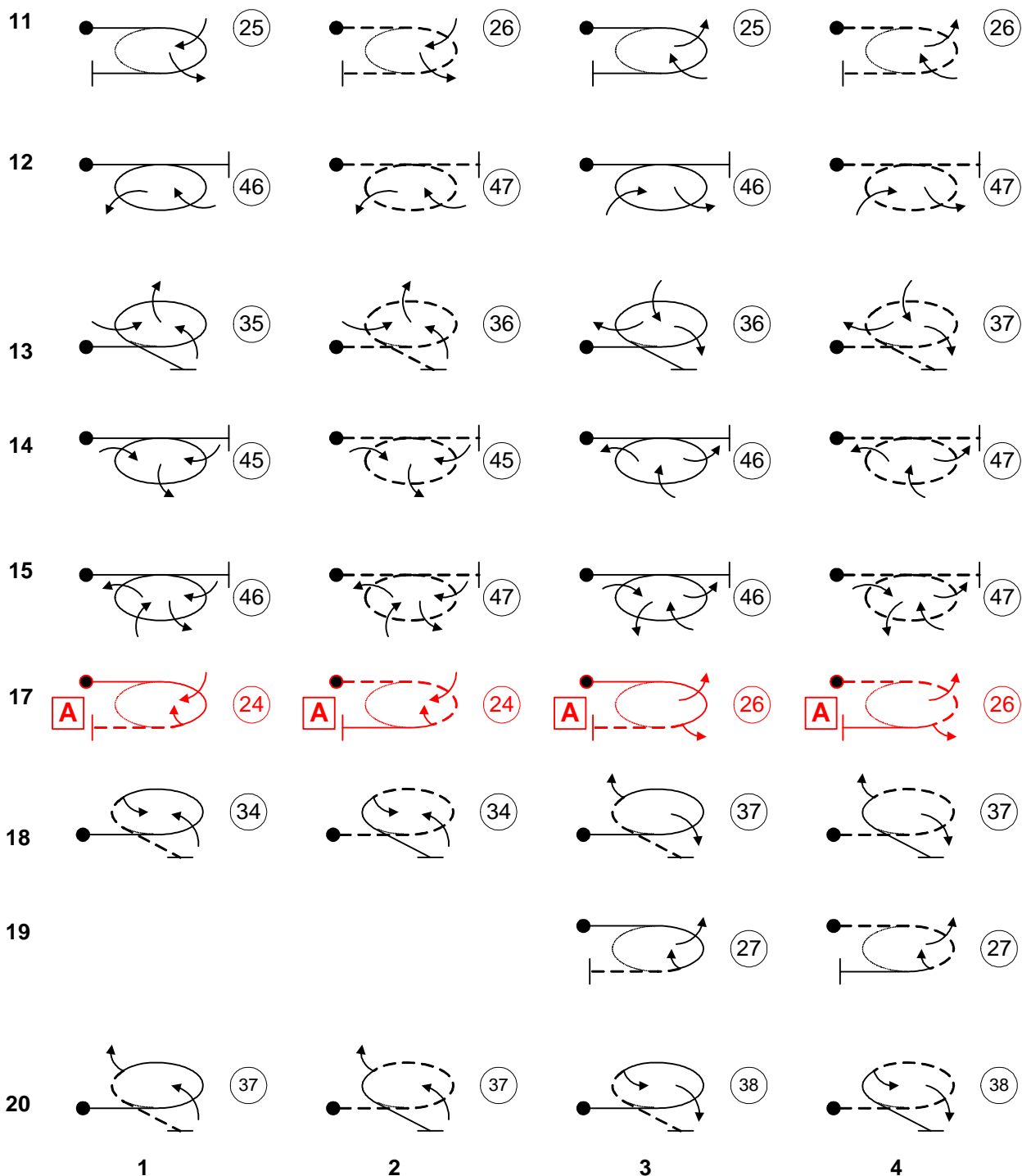
9.5.1.1. Yak 52: Columns 3 and 4: No vertical rolling elements. Column 3: Spin only

9.6. Family 2.1 To 2.8

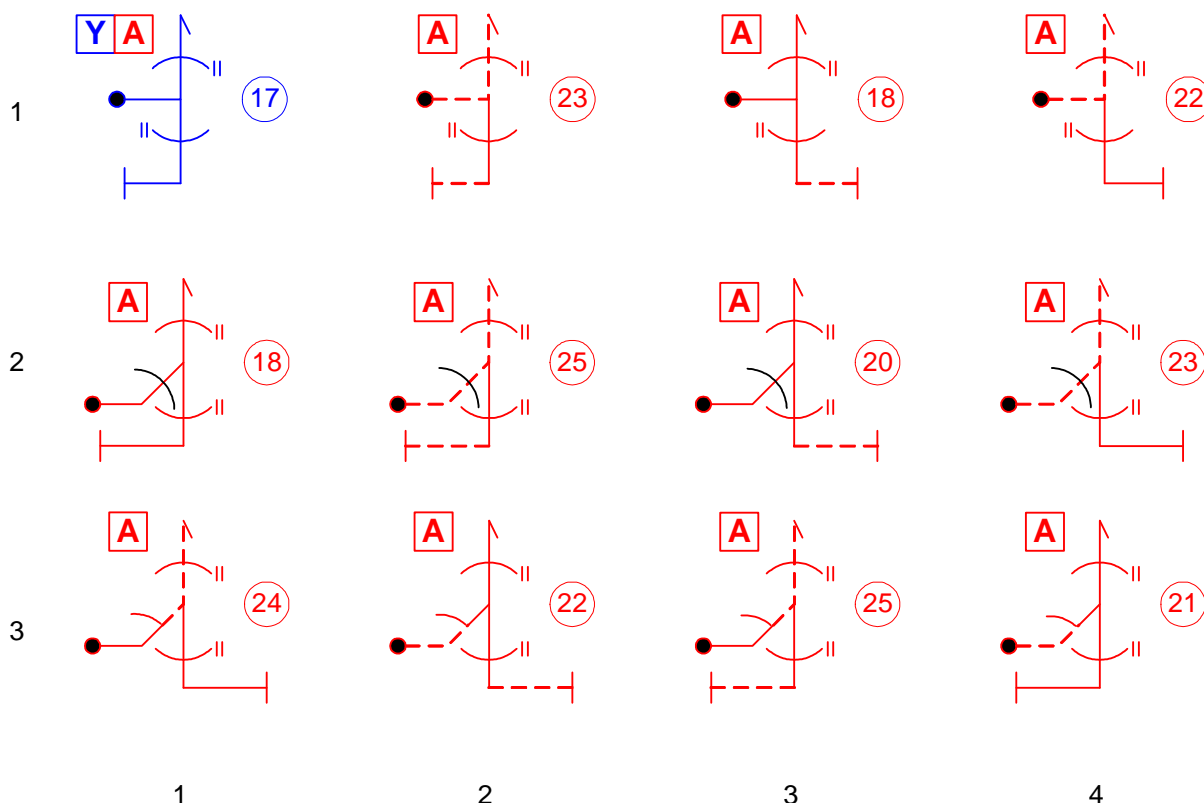


9.6.1.1. Figures in Rows 1 and 2 are not permitted in the Unlimited category.

9.7. Family 2.9 To 2.20



9.8. Family 5.1 Stall Turns

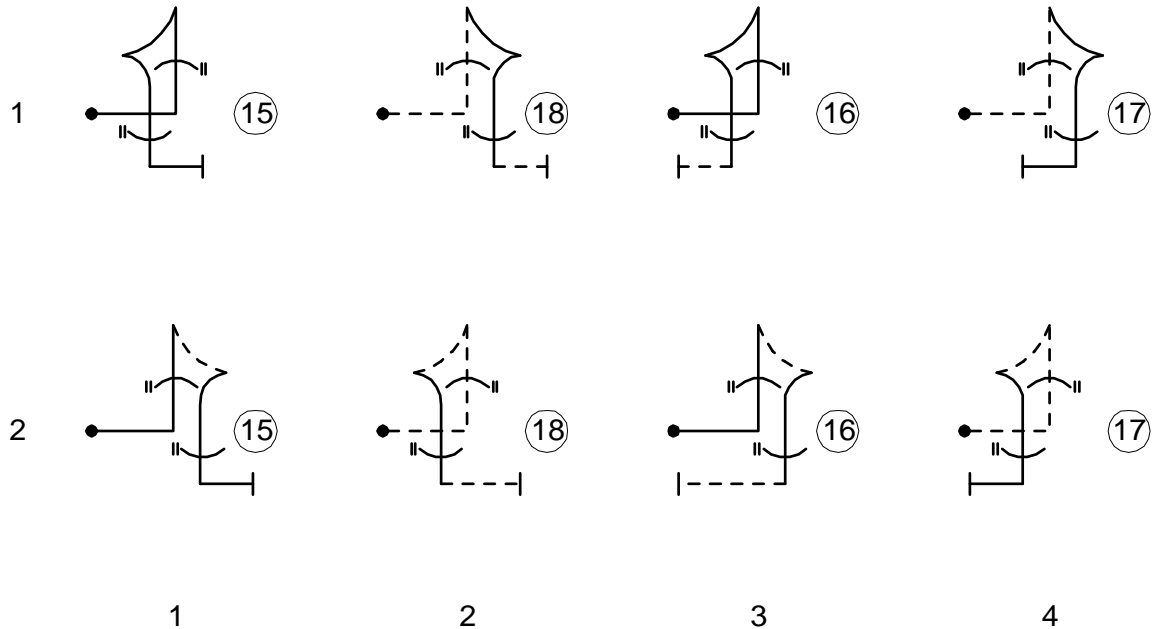


9.8.1.1. All categories: Flick Rolls are not permitted on ascending vertical or 45-degree lines except in Family 5.1.

9.8.1.2. Advanced: Maximum of 9.4.2.2 allowed on 45-degree lines. Maximum of 9.1.1.1 allowed on ascending vertical lines in Families 5.2 and 5.3.

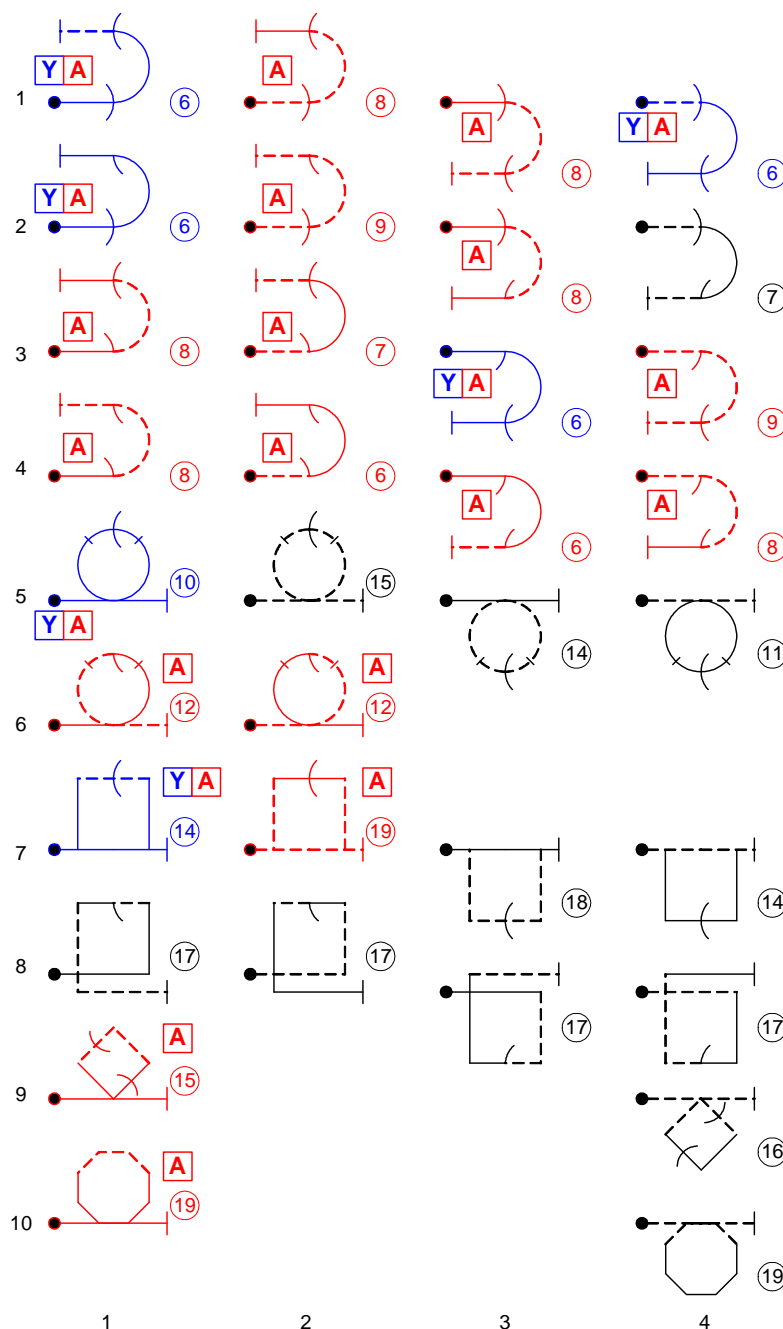
9.8.1.3. Unlimited: Combinations of climbing aileron roll elements (45-degrees plus vertical) in Families 5.2 and 5.3 must not exceed the maxima specified in 9.2.2.1.a).

9.9. Family 6.1 To 6.2 Tail Slides



9.9.1.1. No flick rolls will be allowed on upward vertical lines.

9.10. Family 7.1 To 7.10



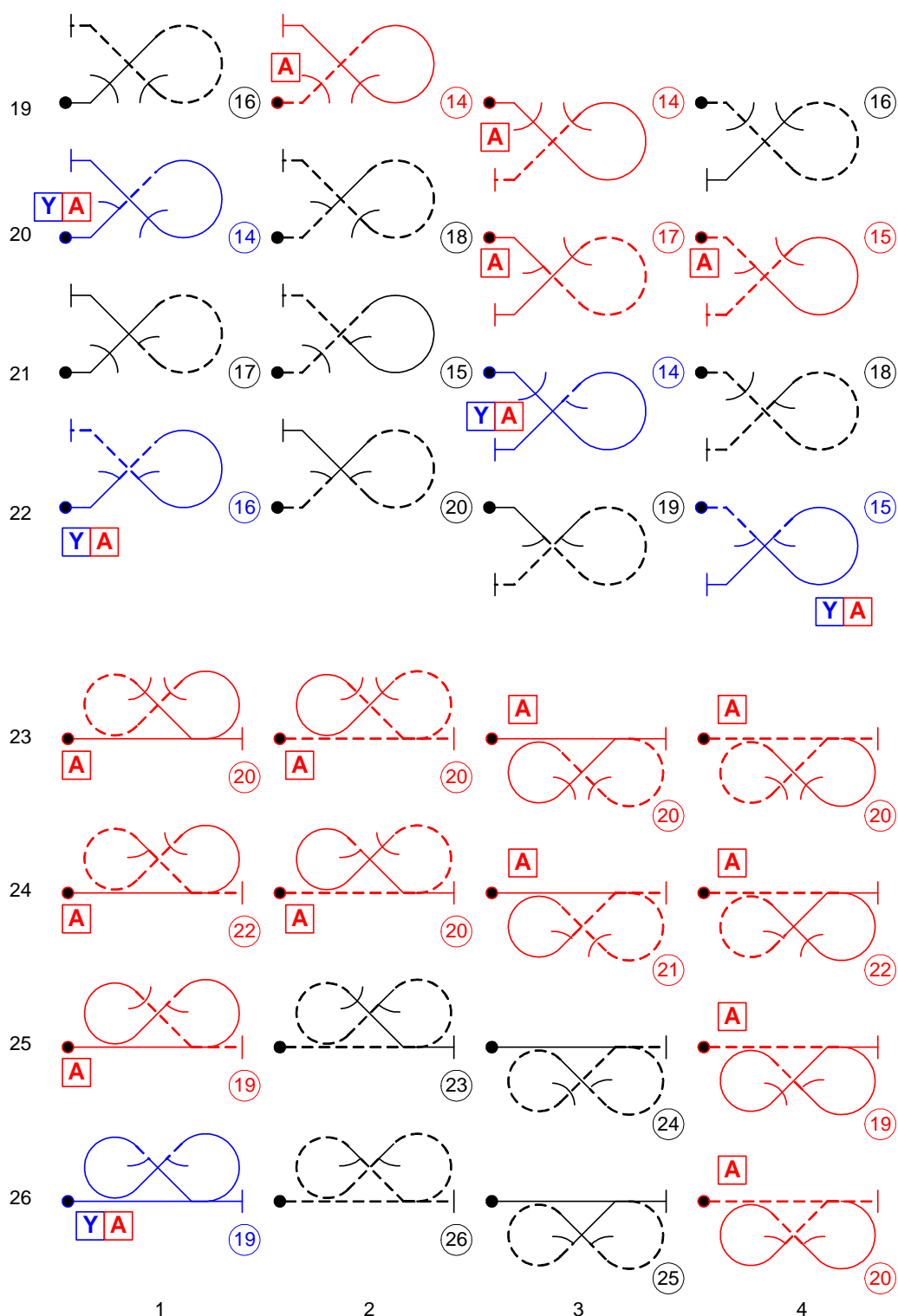
9.10.1.1.All Categories. Flick rolls are not permitted on the horizontal entry lines of figures in columns 1 and 2, nor on the horizontal exit lines of figures in columns 3 and 4, of 7.1 to 7.4.

9.10.1.2.Yak 52. No roll on 7.7.1.

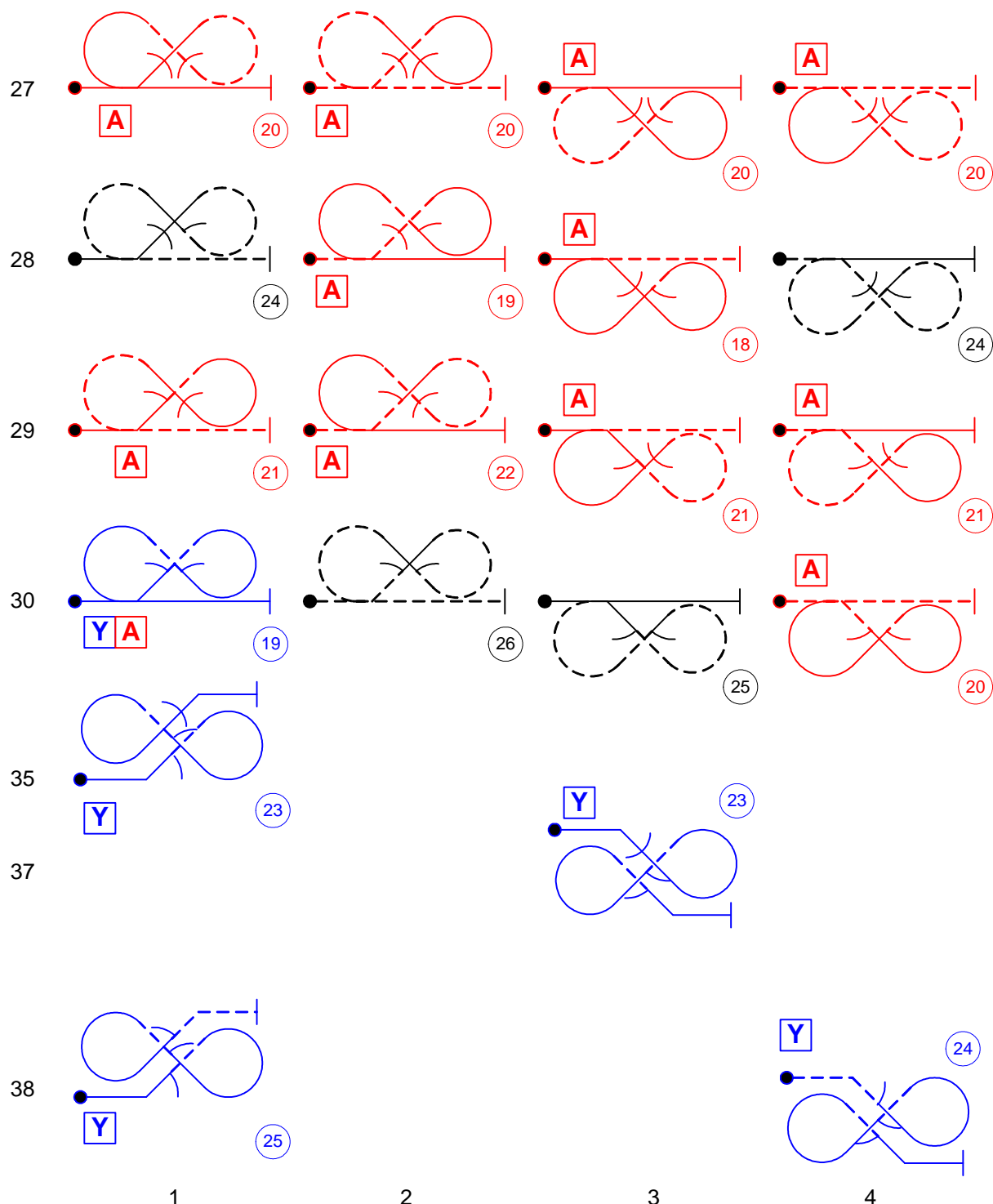
9.10.1.3.Advanced. Opposite or unlinked rolls are not permitted on 7.7.1 or 7.7.2. No rolls are permitted on 7.9.1.

9.10.1.4.Unlimited. Flick rolls are not permitted in figures in columns 3 and 4 of 7.5 to 7.8, nor on the lower lines of any figure in 7.9. Eight-point rolls (9.8.3.4) are not permitted on 7.5.3 or 7.5.4.

9.11. Family 7.19 To 7.26

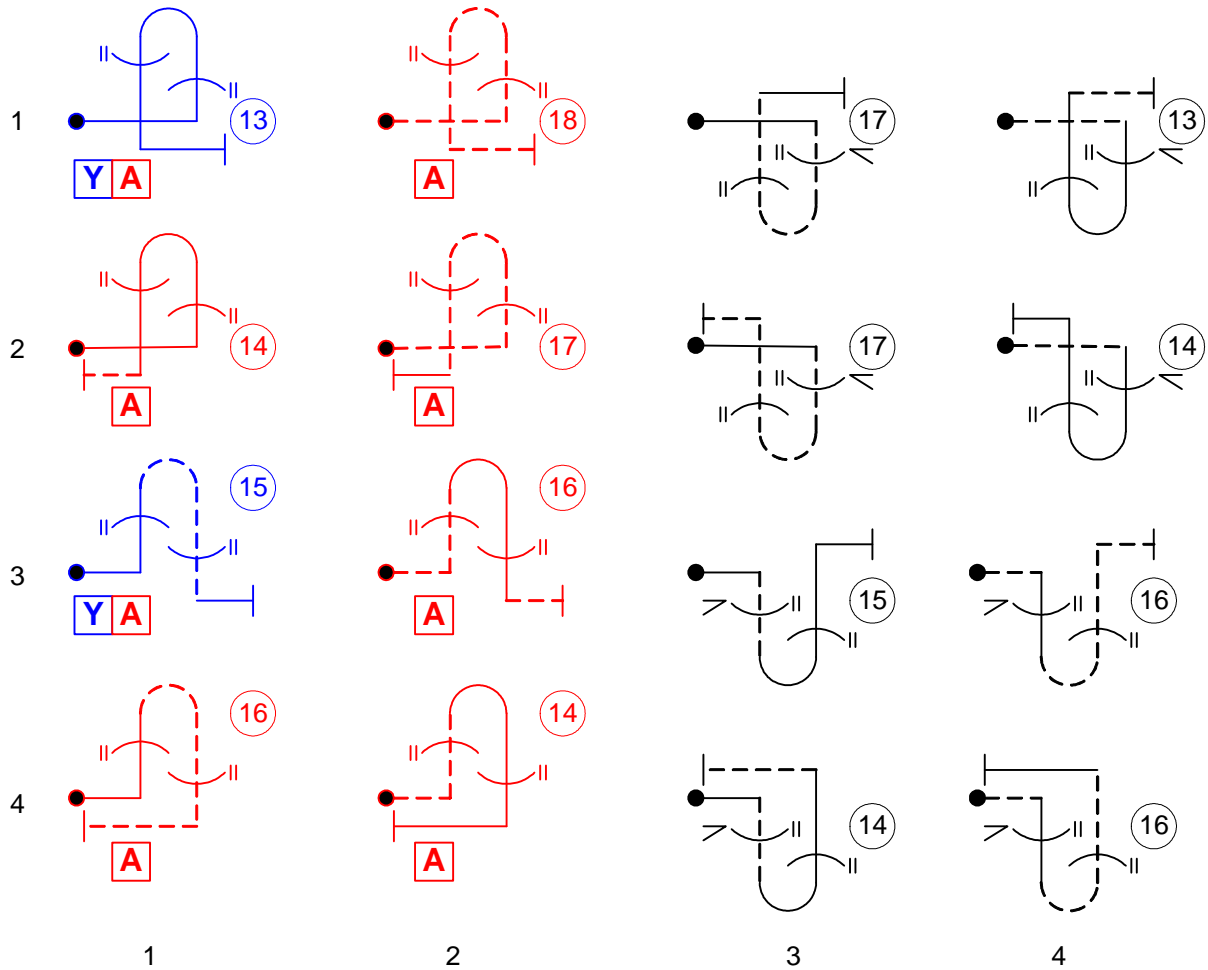


9.12. Family 7.27 To 7.38

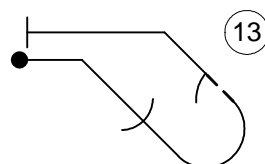
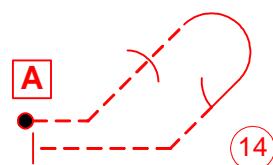
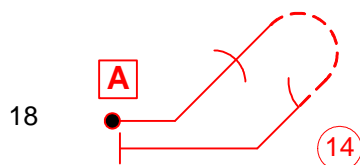
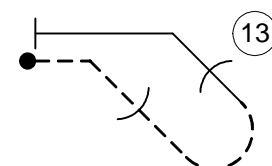
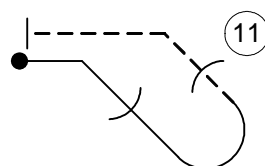
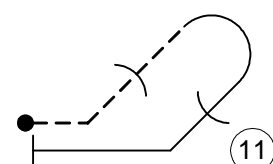
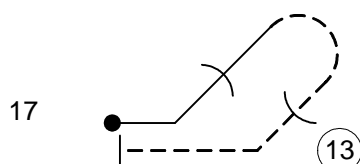
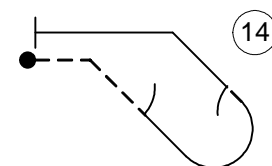
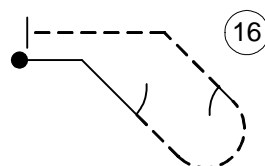
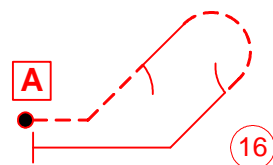
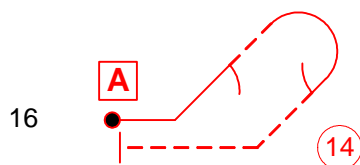
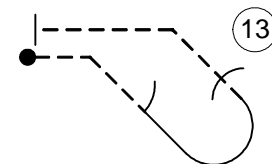
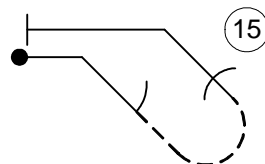
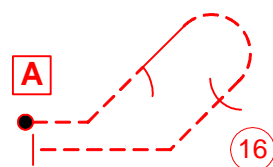
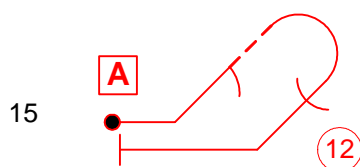
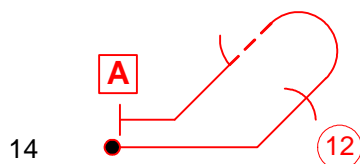
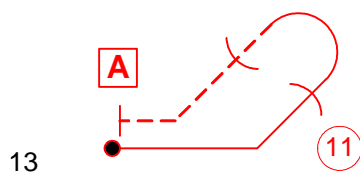


9.12.1.1. **Advanced** and Unlimited: Nothing from 7.35 to 7.38

9.13. Family 8.1 To 8.4



9.14. Family 8.13 To 8.18



1

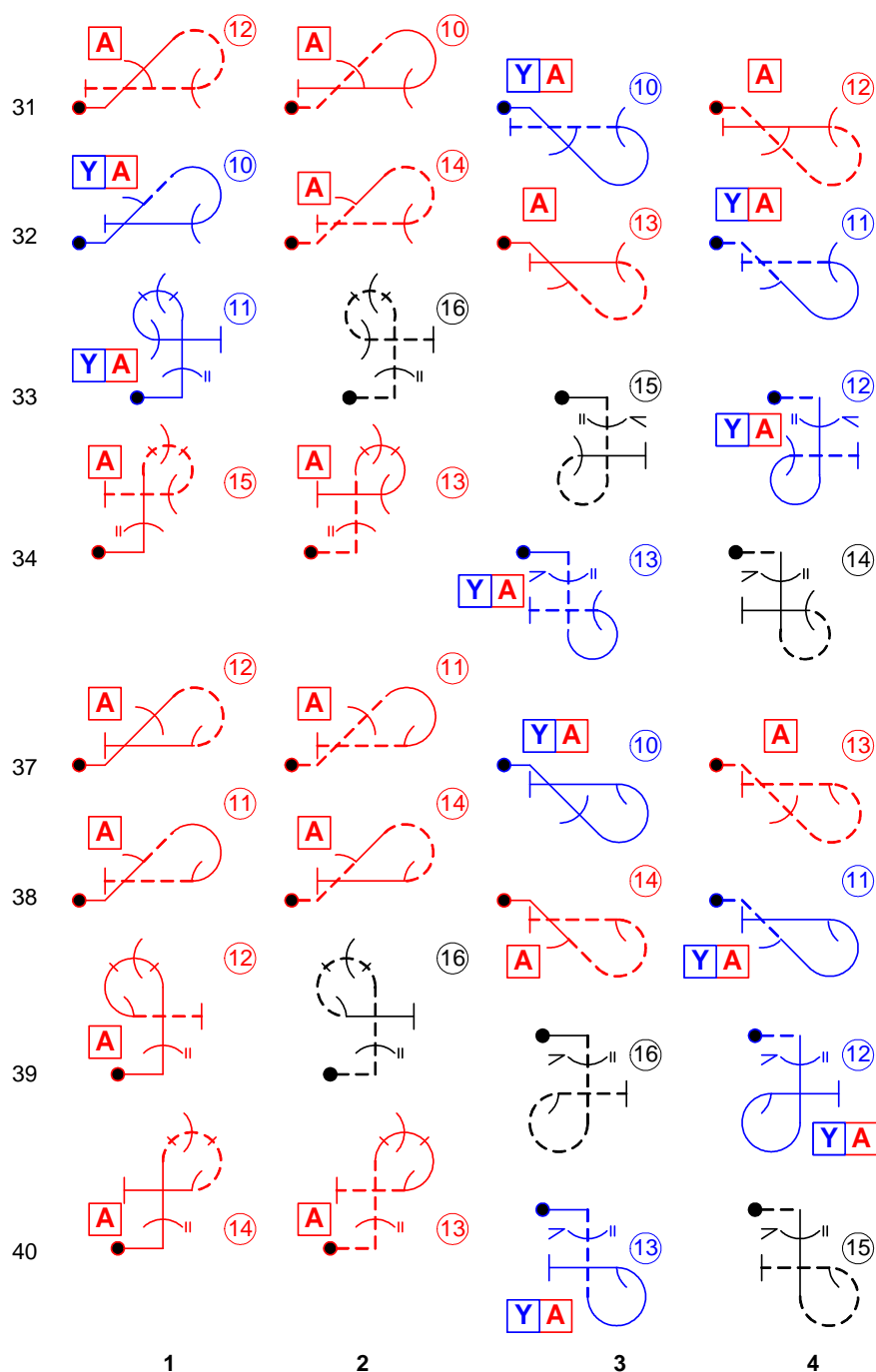
2

3

4

9.14.1.1.Advanced: No flick roll permitted on 8.13.1 or 8.14.1

9.15. Family 8.31 To 8.40



9.15.1.1. Yak 52: No vertical rolls; spin only on 8.34.3 and 8.40.3

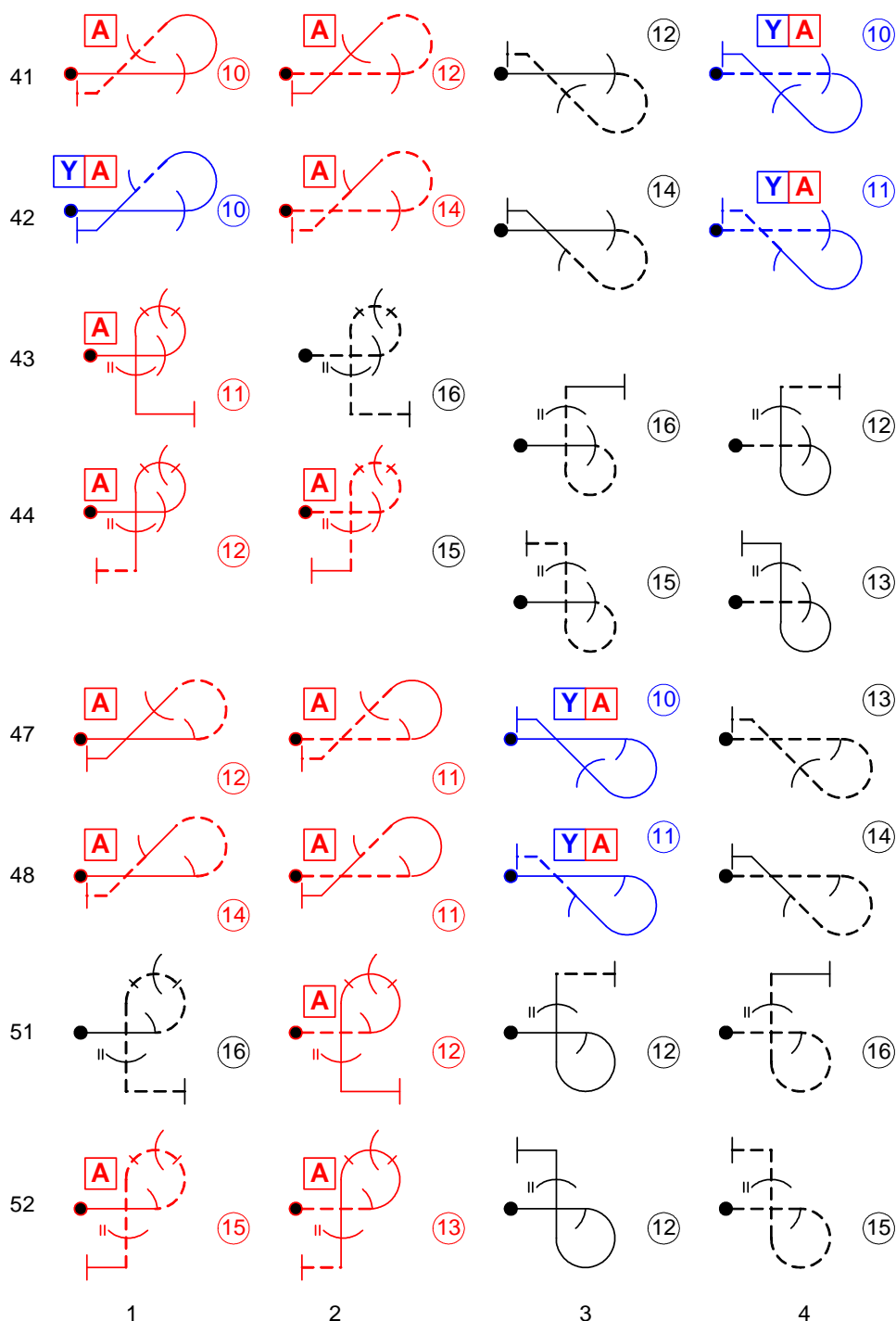
9.15.1.2. Yak 52 and Advanced: No rolls in tops of $\frac{3}{4}$ looping segments

9.15.1.3. Advanced: Not more than $\frac{1}{2}$ vertical roll up on column 1; no vertical roll up on column 2.

9.15.1.4. All Categories: No flick rolls on horizontal exit lines of any figure from columns 1 or 2.

9.15.1.5. Unlimited: Flick rolls are not permitted on the top of figures in columns 1 and 2 of figures 8.33, 8.34, 8.39 or 8.40 when preceded by a vertical roll exceeding 3 stops or more than 360 degrees of rotation.

9.16. Family 8.41 To 8.52

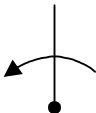



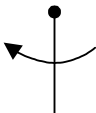


9.16.1.1.Advanced: No flick rolls on vertical down lines of 8.43, 8.44, 8.51 and 8.52 after a roll or hesitation roll in the loop.

9.16.1.2.All Categories: Flick rolls are not permitted on the horizontal entry lines of figures in columns 1 and 2.

9.16.1.3.Unlimited: No flick rolls on vertical down lines of 8.43, 8.44, 8.51 and 8.52 after a hesitation roll in the loop.

9.17. Family 9.1, Continuous Rolls

		$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
1		6	8	10	12	14			
		Y A	Y A	Y A					
2			6		10		12		
			Y A		Y A		Y A		
3		2	4	6	8	9	10	11	12
		A Y A		A Y A			Y A		A
4			4		8		10		
			Y A		Y A				
5		2	4	6	8				
		Y A	Y A	A					
		1	2	3	4	5	6	7	8

9.17.1.1. Advanced

- a) No level fly-off after 9.1.1.3.
- b) No negative recovery after 9.1.5.3.
- c) Not 9.1.2.6.

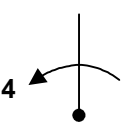
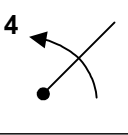
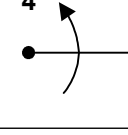
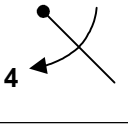
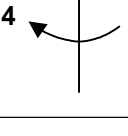


9.18. Family 9.2, Two-Point Rolls

					1		1½		2
1					13				
2					11				
					Y	A			
3					9		12		15
					Y	A	Y	A	A
4					9				
					A				
5					9				
		1	2	3	4	5	6	7	8

9.18.1.1.Unlimited: Not 9.2.3.8.

9.19. Family 9.4, Four-Point Rolls

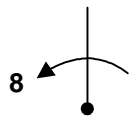
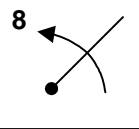
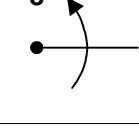
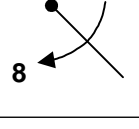
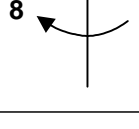
			$\frac{1}{2}$	$\frac{3}{4}$	1		$1\frac{1}{2}$		2
1			9 Y A	12	15				
2			7 Y A		13 Y A				
3			5 Y A	8 A Y A	11 Y A				
4			5 Y A		11				
5			5 Y A	8					
		1	2	3	4	5	6	7	8

9.19.1.1. Advanced

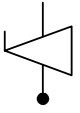

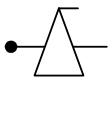

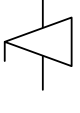
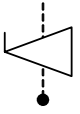

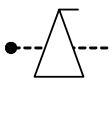

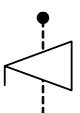
- a) No level fly-off after 9.4.1.2
- b) No inverted recovery after 9.4.5.2.



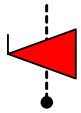

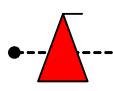


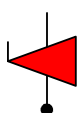

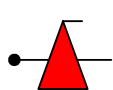


9.20. Family 9.8, Eight-Point Rolls

		$\frac{1}{4}$	$\frac{1}{2}$		1		$1\frac{1}{2}$		2
1		7 Y A	11						
2			9 Y A						
3			7 Y A		15 Y A				
4			7						
5		3 Y A	7						
		1	2	3	4	5	6	7	8






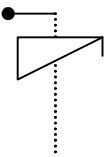
9.21. Family 9.9, Positive Flick Rolls

			$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
1			15	15	15				
2			13 Y A		13 Y A				
3			11 Y A		11 Y A		14 Y A		
4			11 A		11 A		14		
5			11 A	11 A	11				
6			17	17	17				
7			15		15				
8			13		13				
9			13		13				
10			13 A	13	13				
		1	2	3	4	5	6	7	8






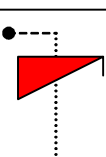
9.22. Family 9.10, Negative Flick Rolls

			$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
1			17	17	17				
2			15		15				
3			13		13		16		
4			13		13				
5			13	13	13				
6			19	19	19				
7			17		17				
8			15		15				
9			15		15				
10			15	15	15				
		1	2	3	4	5	6	7	8

9.23. Family 9.11, Upright Spins

							
			1	1¼	1½	1¾	2
1		Upright Entry Line		5	4	3	
				Y A	Y A	Y A	
			4	5	6	7	8

9.24. Family 9.12, Inverted Spins

							
			1	1¼	1½	1¾	2
1		Inverted Entry Line		7	6	5	
				A	A	A	
			4	5	6	7	8

10.2. Advanced Q Programme

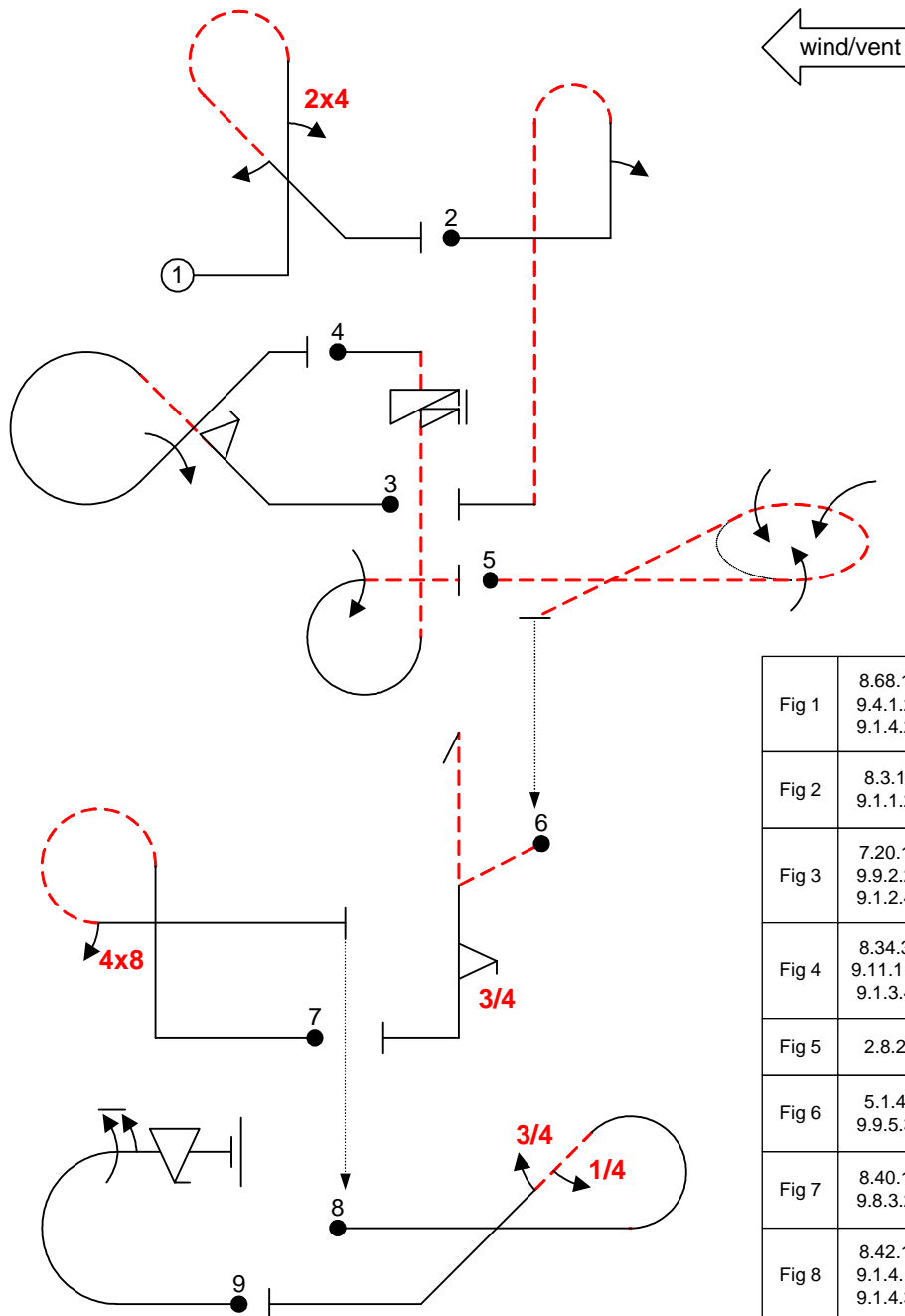


Fig 1	8.68.1 9.4.1.2 9.1.4.2	16 9 4	29
Fig 2	8.3.1 9.1.1.2	15 8	23
Fig 3	7.20.1 9.9.2.2 9.1.2.4	14 13 10	37
Fig 4	8.34.3 9.11.1.6 9.1.3.4	13 3 8	24
Fig 5	2.8.2	31	31
Fig 6	5.1.4 9.9.5.3	22 11	33
Fig 7	8.40.1 9.8.3.2	14 7	21
Fig 8	8.42.1 9.1.4.1 9.1.4.3	10 2 6	18
Fig 9	7.2.1 9.1.3.6 9.9.3.4	6 10 11	27
Total K = 243			

10.3. Yak 52 Known Programme

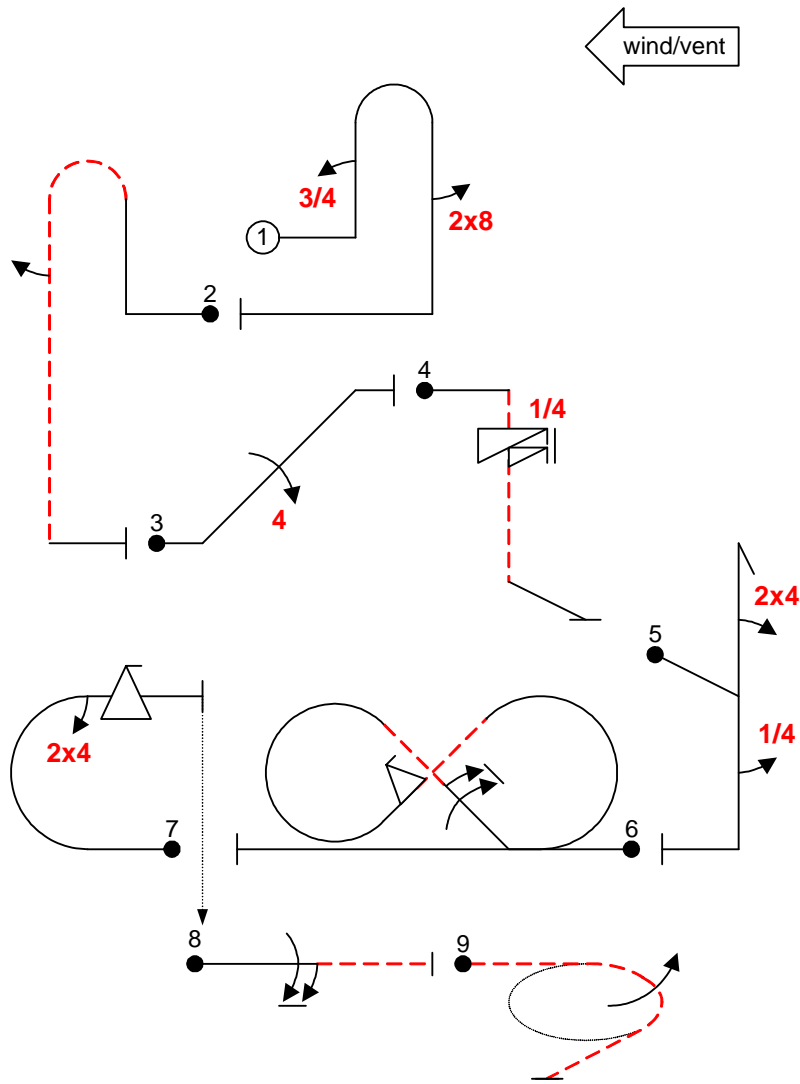


Fig 1	8.1.1 9.1.1.3 9.8.5.1	13 10 3	26
Fig 2	8.3.1 9.1.5.2	15 4	19
Fig 3	1.2.1 9.4.2.4	7 13	20
Fig 4	1.6.3 9.11.1.5	10 4	14
Fig 5	5.1.1 9.4.1.2 9.1.5.1	17 9 2	28
Fig 6	7.30.1 9.1.2.6 9.9.2.2	19 12 13	44
Fig 7	7.2.1 9.4.3.2 9.9.3.4	6 5 11	22
Fig 8	1.1.3 9.1.3.6	2 10	12
Fig 9	2.3.4	16	16
Total K = 201			



11. RECORD OF AMENDMENTS

Version Number	Date Issued
2006-1	1 February 2006
2007-1	21 January 2007
2008-1	20 February 2008
2009-1	1 January 2009