ARESTI AEROCRIPTOGRAPHIC SYSTEM
Adopted by the FAI since 1961

World Artistic Flight

ARESTI AEROBATIC CATALOGUE (CONDENSED) 2012

SISTEMA AEROCRIPTOGRAFICO ARESTI

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ARESTI SYSTEM, S.L. **Versión 2012**

DEDICATORY

“Toda una vida dedicada a la aviación”

José Luis, papá:

La verdad y la razón sólo tienen un camino y el tiempo se encarga de colocar a cada cual en su sitio.

Con éste, tu trabajo, esperamos que desde donde tu encuentres, tu Obra te sirva de recompensa a tantas y tantas horas de fatigoso trabajo en solitario y no exento de disgustos.

Fue parte de tu vida y por ella hemos luchado.

Con todo nuestro cariño, tu mujer Leonor, tus hijos Felipe, Leonor, José Luis y Regina.

“An entire life dedicated to aviation”

José Luis, dad:

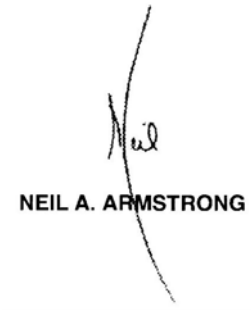
Truth and reason alone contain their destiny and history puts each in its place and context.

With this, your work, we hope that wherever you are, your Opus serves you as reward for so many weary hours of solitary toil, not without discomfort

It was part of your life and we have fought for it.

With all our affection, your wife Leonor and your children Felipe, Leonor, José Luis and Regina

To my fellow pilots: Aerobatic flight is the supreme test of discipline and precision for any aviator. To those of you who are willing to challenge yourselves with this most demanding aspect of flight, I send my very best wishes with the certainty that this volume by José Luis de Aresti will serve you well.



NEIL A. ARMSTRONG

There is nothing more beautiful than an aircraft executing aerobatic figures under the pilot's command. It is daring people who possess a great character for perfecting their mastery, who are competent in the technical field and capable of rationally manipulating present day technique who become passionately devoted to aerobatics.

I wish great success to all sports pilots and particularly to the women among them.

VALENTINA TERECHKOVA

To the pilots devoted to aviation, who with their ardour, enthusiasm and great dedication, contributed to the graphic representation, to the development and to the present day perfection of artistic flight in the entire world.

J. L. ARESTI

PREFACE

It is not common for a Spaniard to serve as a bridge, link and union between such unequal worlds as those which gyrate around the North American and Soviet orbits. To achieve that approximation, it is necessary to be in possession of a universal truth that does not raise an argument or reproach from either of those two ways of understanding society.

For this reason I celebrate the ecumenical value achieved by our international aeronautical figure, José Luis de Aresti, who has conciliated in that difficult and risky sport that is artistic flying, the technique, the audacity, the precision and that sportive truth which is friendship among all those who have felt the open and sincere calling of the sport.

During my term as National Sports Delegate and President of the Spanish Olympic Committee, I have had the good fortune to know José Luis de Aresti very well since on many occasions I have flown – with him as a friend – the plane which took us around Spanish geography on sports missions. This represented an invaluable collaboration and contribution to sports by this good friend.

It pleases me to believe in the success of this new edition of the “Aresti System” to which aeronautic sports owe so much.

JUAN ANTONIO SAMARANCH
President of the Internacional Olimpic Committee

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RECORD OF AMENDMENTS

Date	Amdt. No.	Revision details	Changed Pages
1987-1997	1-4	Revisions of original 1987 version	
January 1999	2nd Edition	Completely revised edition with deletion of Family 4, addition and modification of figures in Families 1, 8 and 9.	
January 2001	3rd Edition	Changes to Family 8 and some textual amendments.	12 to 14 29 & 30 39 to 48
November 2001	Version 2002-1	Changes to Family 1	17 to 22
November 2002	Version 2003-1	Deletion of cross-over spins	55 & 56
November 2004	Version 2005-1	Changes to paragraphs 23, 25 and 26	7 & 8
December 2005	Version 2006-1	Changes to Families 8.55 and 8.56	46
December 2006	Version 2007-1	Additional figures in Family 5	29
December 2007	Version 2008-1	Changes to coefficients for Family 2 Changes to Glider Tail Slides	12, 13, 23, 24
November 2008	Version 2009-1	Changes to representation of hesitation rolls	4 to 6, 9, 14
November 2009	Version 2010-1	Flick rolls from knife flight. New roll locations on 7.23 - 7.30.	8, 35, 36
Date	Version 2012	Major revision of Families 1-8.	vvvv

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Part I - DESCRIPTION OF THE CATALOGUE

THE FAMILIES

1. The condensed Aresti System consists of the following Families of figures:
   - 1.1. Family 1 – Lines and Angles
   - 1.2. Family 2 – Turns and Rolling Turns
   - 1.3. Family 3 – Combinations of Lines
   - 1.4. Family 4 – Not in Use
   - 1.5. Family 5 – Stall Turns (Hammerheads)
   - 1.6. Family 6 – Tailslides
   - 1.7. Family 7 – Loops & Eights
   - 1.8. Family 8 – Combinations of Lines, Angles and Loops
   - 1.9. Family 9 – Rolls and Spins

BASIC FIGURES AND COMPLEMENTARY ELEMENTS

2. Families 1 through 8 contain diagrams showing the aircraft's flightpath, each diagram being designated a 'Basic Figure'. Many such basic figures (e.g. 7.4.1.1, the Loop) can be flown, without modification, and be considered complete aerobatic figures. Others (e.g. 7.4.2.1, the Loop with a half-roll) cannot be flown without the addition of a complementary element.

7.4.1.1 Loop 7.4.2.1 Loop with half-roll

Figure 1

3. In basic figures, flight with a positive or zero angle of attack is shown with a solid line; flight with a negative angle of attack is shown with a dashed line. In this description, simple dotted lines are used when no specific angle of attack is shown. Flight lines may be vertical, horizontal or at 45° to the horizontal. No other angles are permitted. Each figure starts and ends in horizontal flight, depicted respectively by a small circle and a short cross-line. The cross-line is vertical for

figures ending on the main axis and horizontal for those ending on the secondary axis.

4. Family 9 contains symbols representing aircraft rotations of various sorts. These are designated 'Complementary Elements' and cannot be considered to be figures in isolation. A complementary element from Family 9 must always be superimposed on a basic figure from Families 1, 5, 6, 7 or 8. Then it may form a complete aerobatic figure.

5. Family 9 elements can be any one of the following: aileron roll without or with hesitations (a) & (b), rudder roll (flick or snap roll) (c) & (d) or spin (e) & (f). Flick Rolls and Spins may be Positive (c) & (e), or Negative (d) & (f). Symbols are conventionally used to differentiate these various types of rotation as follows:

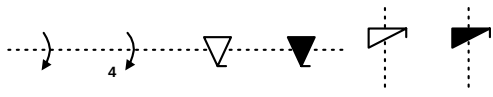

Figure 2a

6. When depicting aileron rolls, the arrows are drawn so as to be concave in the direction of flight. Flick rolls are depicted by an isosceles triangle, spins by a right-angled triangle. In flick rolls, the short tail at the apex of the symbol indicates the direction of flight. Spins always occur on vertical down lines entered from horizontal flight.

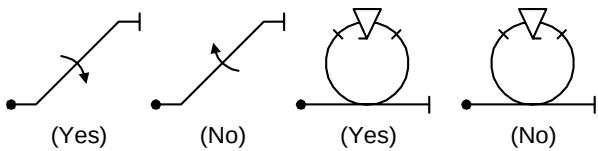

Figure 2b

REPRESENTATION OF COMPLEMENTARY ELEMENTS

7. In Families 1 to 8, complementary elements are conventionally shown by the inclusion of one of four possible symbols:

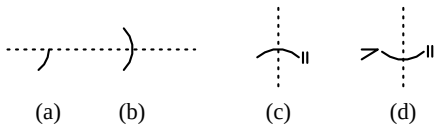

Figure 3

7.1. **The Compulsory Half-Roll Symbol (Fig 3a).** Where this occurs, on either a horizontal or 45° line, the aircraft must roll such as to finish 180° displaced from its original attitude for the figure geometry to be correct. This rotation may be accomplished by a simple 180° roll or by a combination producing the same net effect (Fig 4).

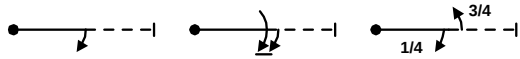

Figure 4

7.2. **The Optional Roll Symbol (Fig 3b).** Where this occurs, on either a horizontal or 45° line, the aircraft may roll a complete multiple of 360° e.g. single or double rolls (Fig 5).

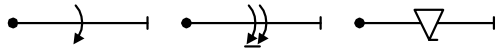

Figure 5

7.3. **The Vertical Optional Roll Symbol (Fig 3c).** Where an optional roll occurs on a vertical up or down line, the rotational element may result in a net change of attitude of a multiple of 90°. This can be achieved by a single complementary element or by a combination of such elements.

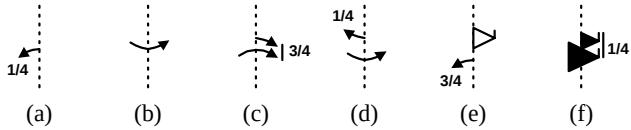

Figure 6

7.4. **The Optional Spin Symbol (Fig 3d).** Where a basic figure from Families 1 or 8 starts with a vertical down line, the first rotation of a complementary element may be by spinning from level flight rather than by pulling (or pushing) to the vertical down and rolling.

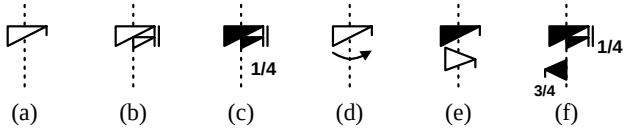

Figure 7

EXTENT OF ROTATIONS

8. Rotation is in multiples of 90° but may not be greater than 720°. Odd fractions of continuous rolls are shown as "¼", "¾" etc. The number and extent of hesitations are shown as "AxB", where A is the number of roll segments flown and B is the number that would occur in 360° of roll, except for 360° hesitation rolls which just have the "B" annotation.

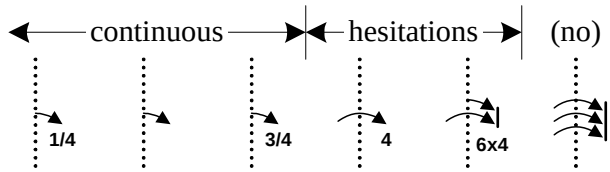

Figure 8

COLOUR CONVENTIONS

9. When drawings are printed in colour, negative lines, negative flick (snap) rolls and negative spins may be shown in red instead of black. Corresponding positive elements are invariably shown by black lines and white triangles.

'CORNER' CONVENTIONS

10. All basic figures except Family 1.1 depict a flightpath that has looping portions. When such a looping element has at least 180° of pitch, it is depicted in the diagrams as a curve. Some looping elements in some figures reverse direction without an intervening straight line. When it is less than 180°, the element is shown as a 'corner'. Despite being drawn for convenience in this manner, all such corners are to be interpreted as being flown in a continuous curve of constant and significant radius.

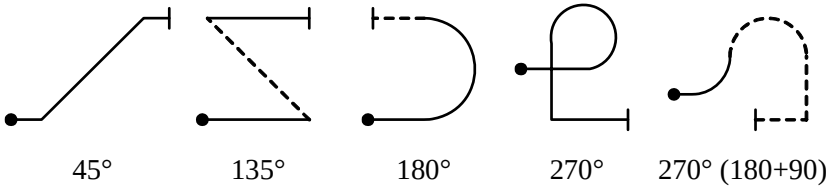

Figure 9

CATALOGUE NUMBERS AND DIFFICULTY COEFFICIENTS

11. All the manoeuvres are defined in accordance with a 4-number system. The first number indicates the Family to which the manoeuvre

belongs. The second figure shows sub-Family, the third the row, and the fourth the column, in which the figure is placed. The numbers are separated by dots. The sub-Family numbers are not sequential but indicate some additional characteristic of the manoeuvre. For example, Family 5 starts with sub-Family 5,2, the figures of which contain 2 lines: 1 up, 1 down; in sub-Family 5.3 each figure has 3 lines, and so on. In Family 9, Rolls and Spins, the sub-Family number distinguishes hesitation rolls, flick rolls and spins.

12. As a general rule for Families 1, 3, 5, 6, 7 and 8, figures in columns 1 and 2 ascend, those in column 1 starting in upright flight, column 2 inverted. Figures in columns 3 and 4 descend, column 3 starting in upright flight, column 4 inverted.

Figure 10

13. Each of the complementary rotation elements from family 9 is defined in accordance with a 4-number system. The first number is always a 9. The second number corresponds to the type of rotation, the third (row) to the direction of the underlying flightpath and the fourth (column) to the extent of rotation in multiples of 90°.

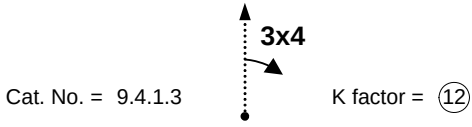

Figure 11

14. Difficulty coefficients (K factors) for basic figures are shown in circles beside the symbols. Those for Family 9 are shown in tabular form.

15. When a basic figure and one or more complementary elements are combined to form a complex figure, the total K-factor for the figure is the sum of the difficulty coefficients for the individual parts.

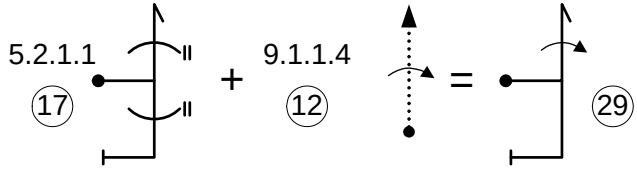

Figure 12

MULTIPLE, OPPOSITE AND UNLINKED ROTATIONS

16. Multiple continuous rotations are shown by the tips of the symbols being linked by a small line.

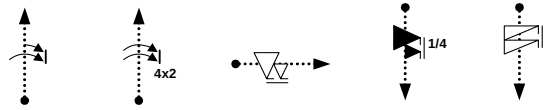

Figure 13

17. Figure 3 showed the various symbols used to show where rotation elements may be included. Paragraph 7 illustrated how these should be shown on drawings. Wherever a rotation sign appears,

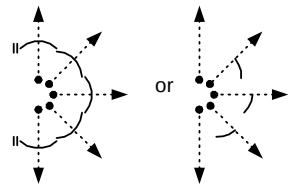

Figure 14

the rotational element may consist of a single item,

Figure 15

or a combination of two (not more) items.

Figure 16

18. By definition, there are three types of rotation (see also paragraph 5):

    18.1. Aileron Rolls (continuous or hesitation),

    18.2. Flick Rolls (positive or negative) and

    18.3. Spins (positive or negative)

19. Where two rotational elements of the same type are combined, the rotations must be in opposite roll directions, as shown by the position of the tip of the symbol.

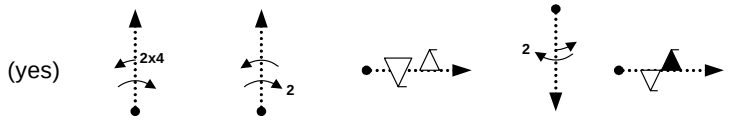

Figure 17

If the rotational elements are of differing types, they may be opposite,

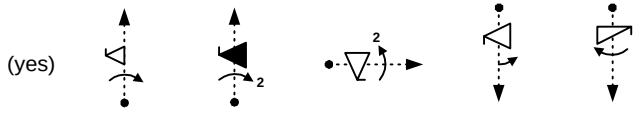

Figure 18

or in the same direction but unlinked.

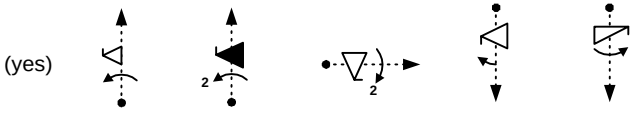

Figure 19

20. Unlinked rolls of the same type and the same direction are not allowed.

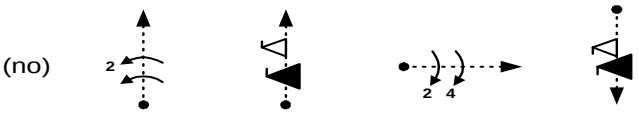

Figure 20

21. When unlinked or opposite rolls are flown, there must be a brief but perceptible pause between them, as in a hesitation roll.

22. The Catalogue numbers and K-factors are all taken into account in describing and evaluating the figure.

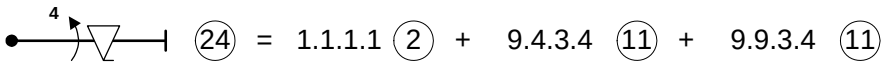

Figure 21

POSITIVE AND NEGATIVE FLICK ROLLS

23. A positive flick roll is easier to perform when placed on a line where the aircraft already has a positive angle of attack (solid line). Similarly, a negative flick roll is easier to perform when entered from a negative (dashed) line. Therefore, for each type of flick, in any particular direction of flight, there are two K-factors. When a flick occurs immediately at the end of a looping segment, it carries the loading of the looping line.

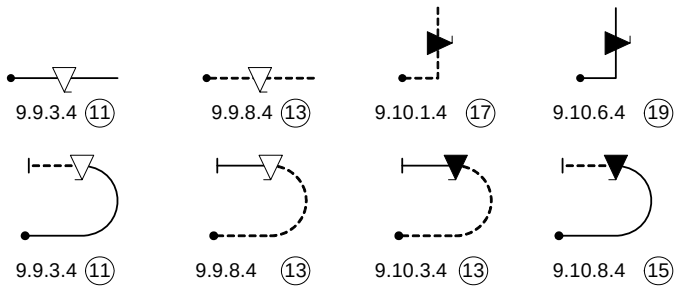

Figure 22

24. In the case of some vertical lines, however, such as after a fractional or complete aileron roll or a spin, stall turn or tailslide, the angle of attack is deemed to be zero. In these cases, the flick roll is accorded the lower of the two possible K-factors.

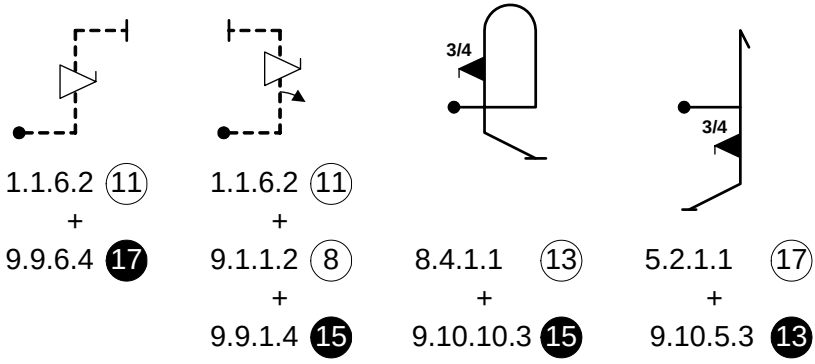

Figure 23

25. In the case of flick rolls initiated from knife-flight, the K-factor accorded to the manoeuvre shall be determined by whether the flick is initiated using top rudder or bottom rudder. When top rudder is used, the lower coefficient shall apply, while the higher coefficient shall apply to flicks initiated with bottom rudder.

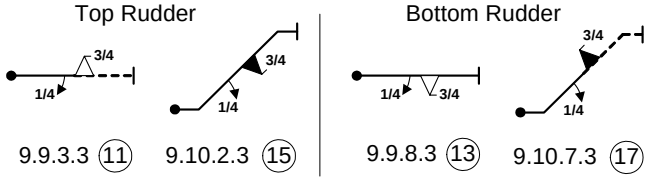

Figure 24

POSITIVE AND NEGATIVE SPINS

26. A positive (stick back) spin is always started from an upright attitude, a negative (stick forward) spin from an inverted attitude.

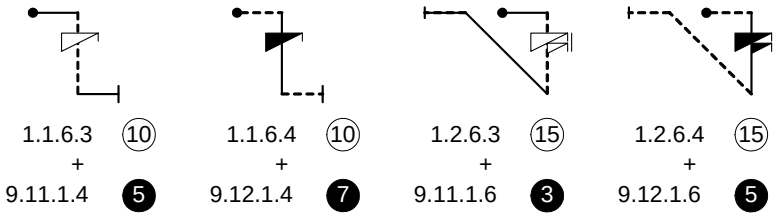

Figure 25

27. When combined with another rotation in an opposite or unlinked combination, the spin must be the first of the two elements.

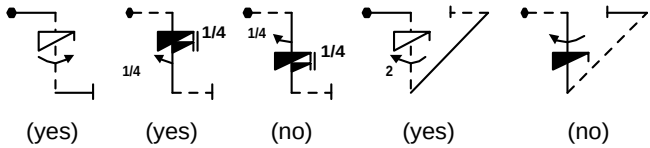

Figure 26

SAMPLE SEQUENCE CONSTRUCTION

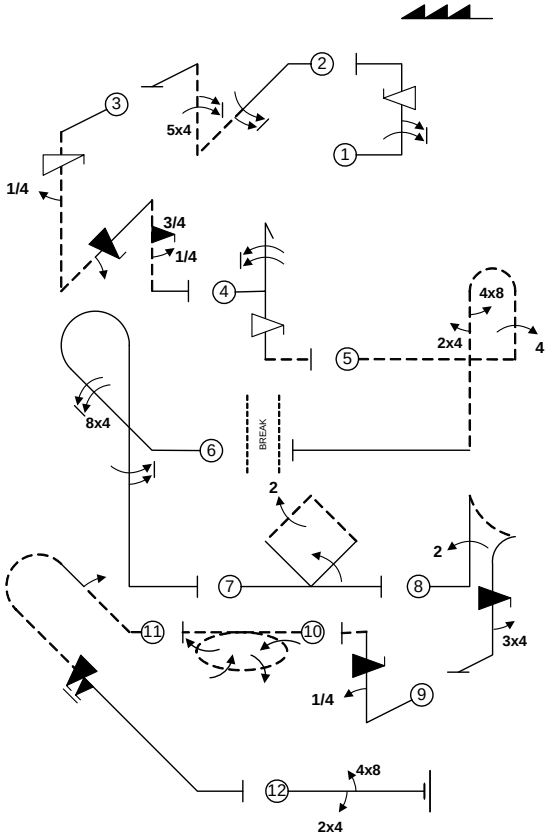

Fig 1	1.6.1 9.1.1.6 9.9.1.4	10 15 15	40
Fig 2	1.14.3 9.1.4.6 9.4.1.5	15 10 18	43
Fig 3	1.39.3 9.11.1.4 9.1.5.1 9.1.2.2 9.10.7.4 9.10.5.3 9.1.5.1	25 5 2 6 17 13 2	70
Fig 4	5.1.3 9.1.1.8 9.9.5.4	18 18 11	47
Fig 5	8.2.2 9.4.1.4 9.8.5.2 9.4.5.2	17 15 7 5	44
Fig 6	8.57.1 9.4.2.8 9.1.5.6	12 22 10	44
Fig 7	7.9.1 9.1.2.4 9.2.4.4	15 10 9	34
Fig 8	6.2.1 9.2.1.4 9.10.5.4 9.4.5.3	15 13 13 8	49
Fig 9	1.7.1 9.1.1.1 9.10.1.4	9 6 17	32
Fig 10	2.15.4	25	25
Fig 11	8.16.2 9.1.2.2 9.10.4.6	16 6 16	38
Fig 12	1.1.1 9.4.3.2 9.8.3.2	2 5 7	14
Total K = 480			

Figure 27

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Part II - METHOD OF EVALUATION

Note: Each basic figure and rotational element in the catalogue is accorded a difficulty coefficient or K-factor. For the basic shapes in Families 1 through 8, the manoeuvre is broken down into its different flight segments and each is given a points value. Rotational elements are given a K-factor according to their flight direction and extent. The processes are consistent and are described below.

BASE VALUES FOR DIFFERENT FLIGHT ATTITUDES

1. Straight lines:

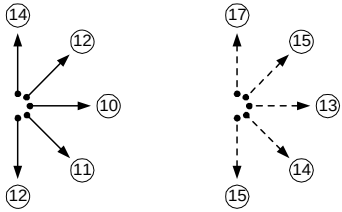

Figure 1

2. Loop arcs:

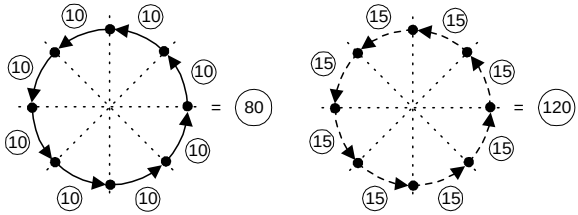

Figure 2

COEFFICIENT CALCULATIONS

LINES

3. All the positive and/or negative straight lines which have in the middle the sign of an optional 360° roll, are calculated as a single line:

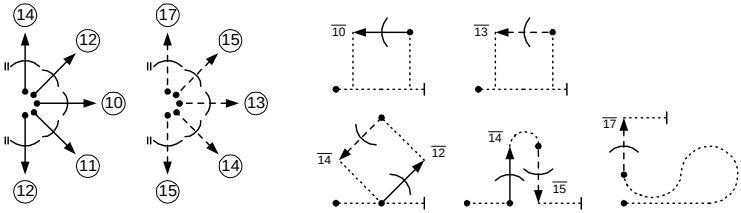

Figure 3

4. All the figures of Family 1 are excepted from this rule, as these lines have been multiplied by two.

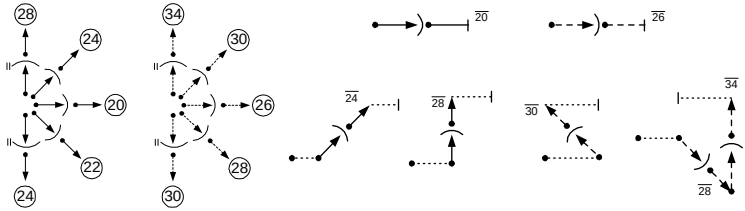

Figure 4

5. Where the attitude of the aircraft changes it is obviously two lines:

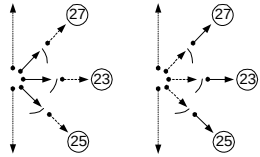

Figure 5

6. In the final calculations, all numbers are divided by 10 and rounded to the nearest whole number.

FAMILY 2

7. TURNS. An upright turn is 10 points for 90 degrees. Inverted is 13 points.

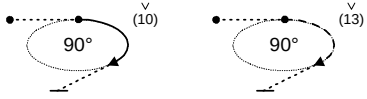

Figure 6

8. ROLLING TURNS. The method for rolling turns is as follows. The sum of points is divided by 10 and rounded to the nearest whole number.

   8.1. An element for the entry and exit lines as in paragraph 3.

   8.2. An element for each 90° arc of turn:

      8.2.1. with rolling inwards 40 points (gliders 50)

      8.2.2. with rolling outwards 50 points (gliders 70)

   8.3. An element for the first roll, based on the underlying arc:

Points	90°	120°	180°	360°
Power (Glider)	80 (120)	106 (150)	160 (240)	280 (420)

   8.4. In Family 2.1.2 only, the half roll is evaluated as a full roll.

8.5. Any second or subsequent rolls count 50% as in paragraph 12.

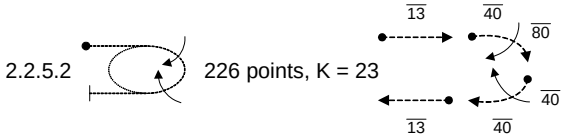

Figure 7

8.6. When alternate rolls occur, each reversal of direction is 20 points (50 in gliders).

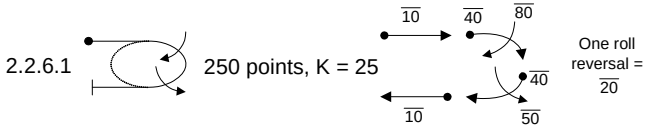

Figure 8

FAMILY 5

9. A base value of 84 points is applied to a normal entry stall turn and a value of 115 to an inverted entry stall turn.

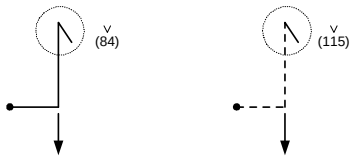

Figure 9

FAMILY 6

10. The turn around in a tailslide (either way) is 64 points.

    Note: For Gliders the turn-around in a tail slide is the same as for the equivalent stall turn.

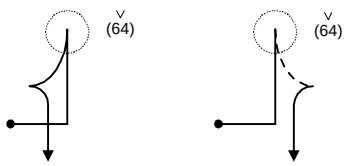

Figure 10

FAMILY 7

11. No line is counted in the vertical “S”:

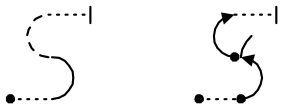

Figure 11

FAMILY 9

12. The points given for rotations are full K-factors and are not divided by 10. Two rolls linked, on any line, are given 50% more than a full roll:

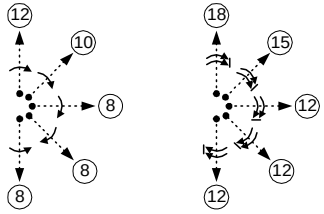

Figure 12

13. For hesitation rolls, one point is added for every stop:

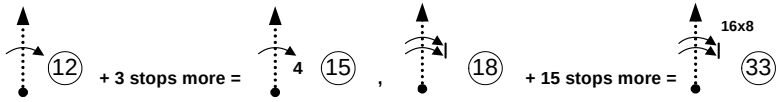

Figure 13

14. For opposite rolls the full value of each roll is taken, for example:

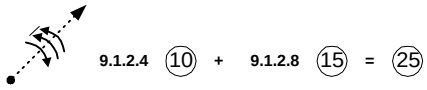

Figure 14

15. For spins, the difficulty is independent of the extent of the rotation, except for 1¼ and 1 turns, where the final flightpath is much less vertical. One point is added for each 90° less than 1½ turns.

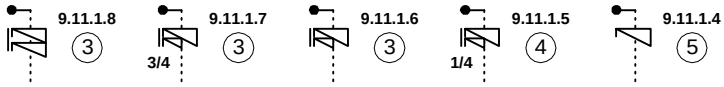

Figure 15

TOTAL COEFFICIENT OF EACH BASIC FIGURE

16. Except for Family 9, all the values are divided by 10 and then rounded to the nearest single figure:

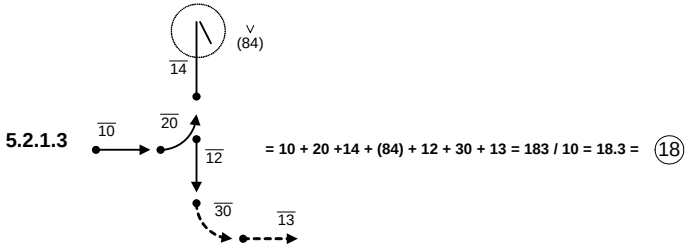

Figure 16

Part III – LIST OF FIGURES

CONTENTS

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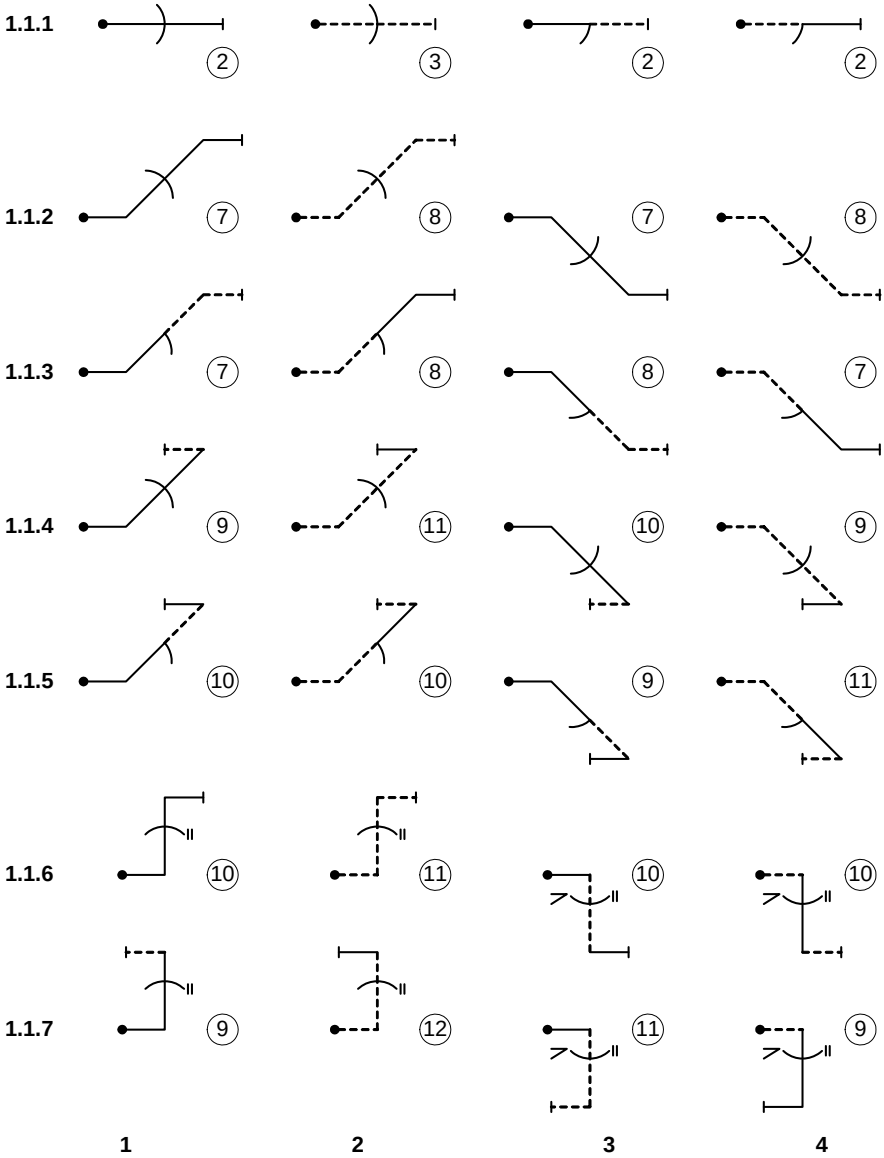
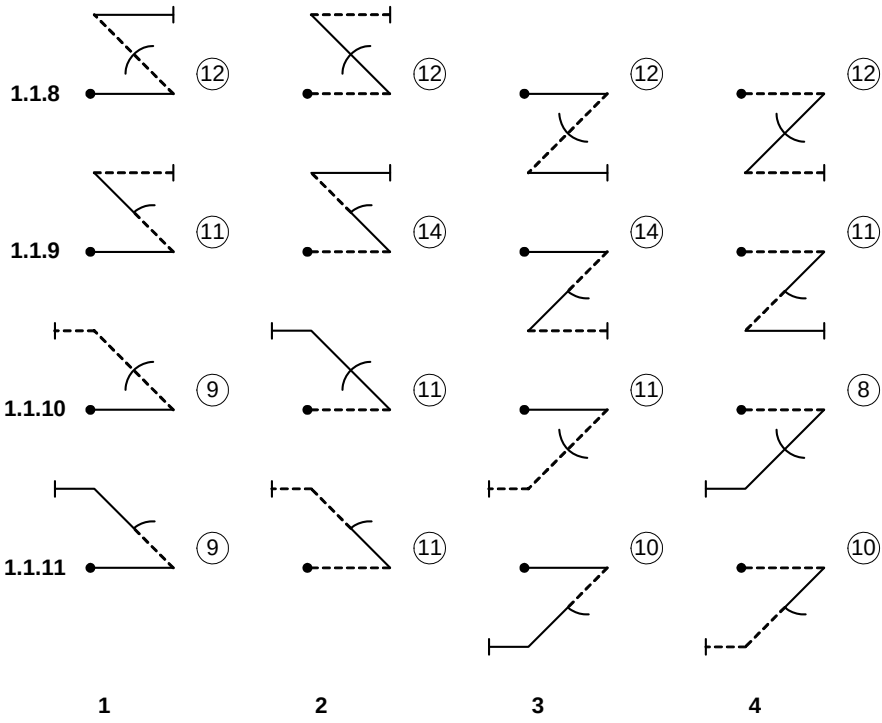
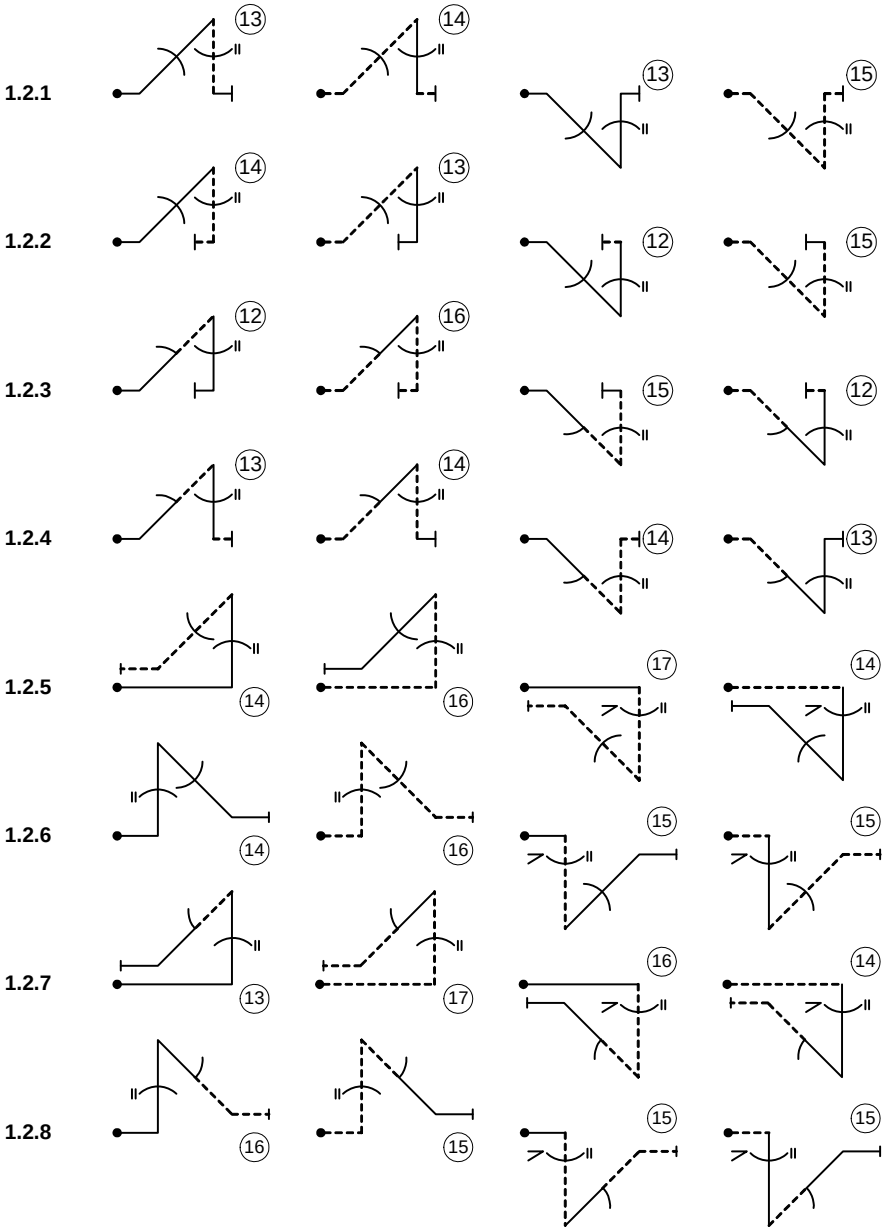
Family 1.1. Single Lines



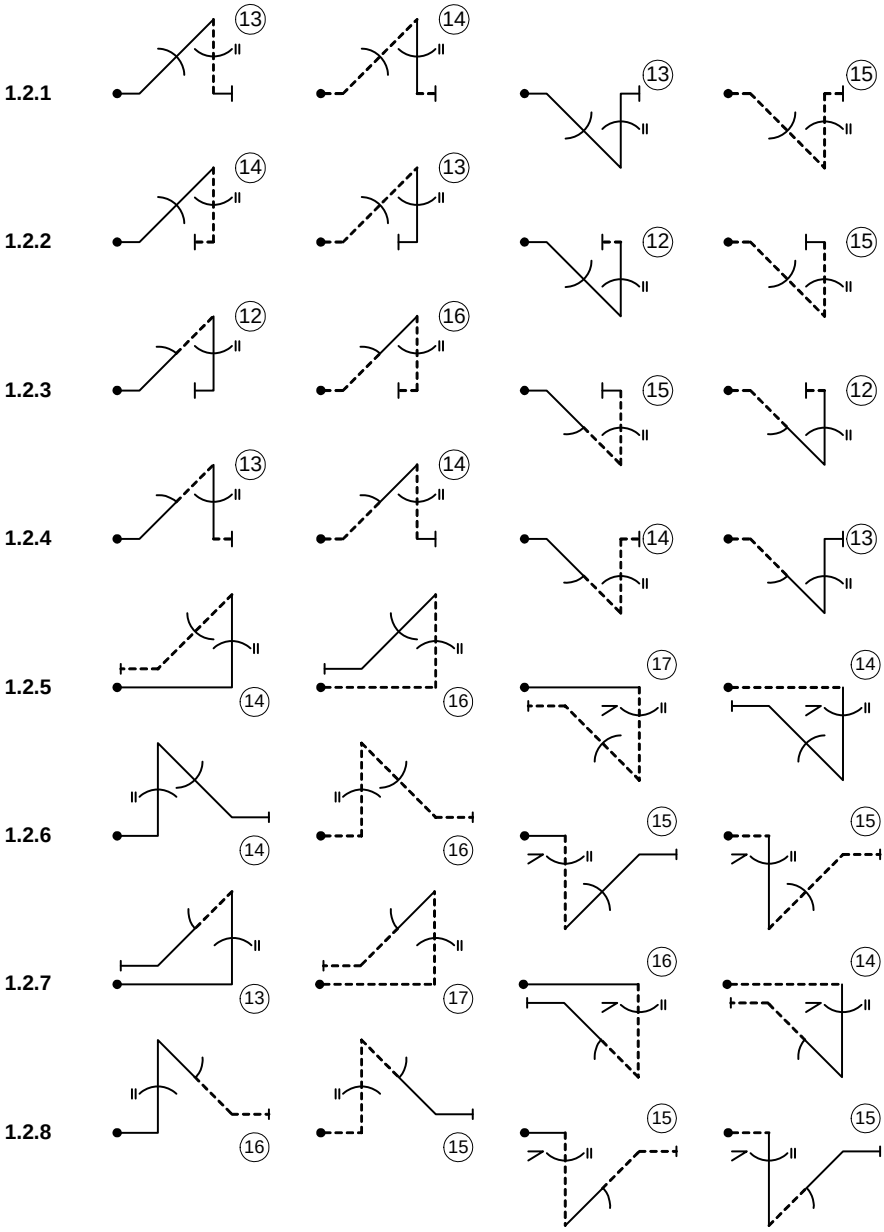
Family 1.1 (cont.)



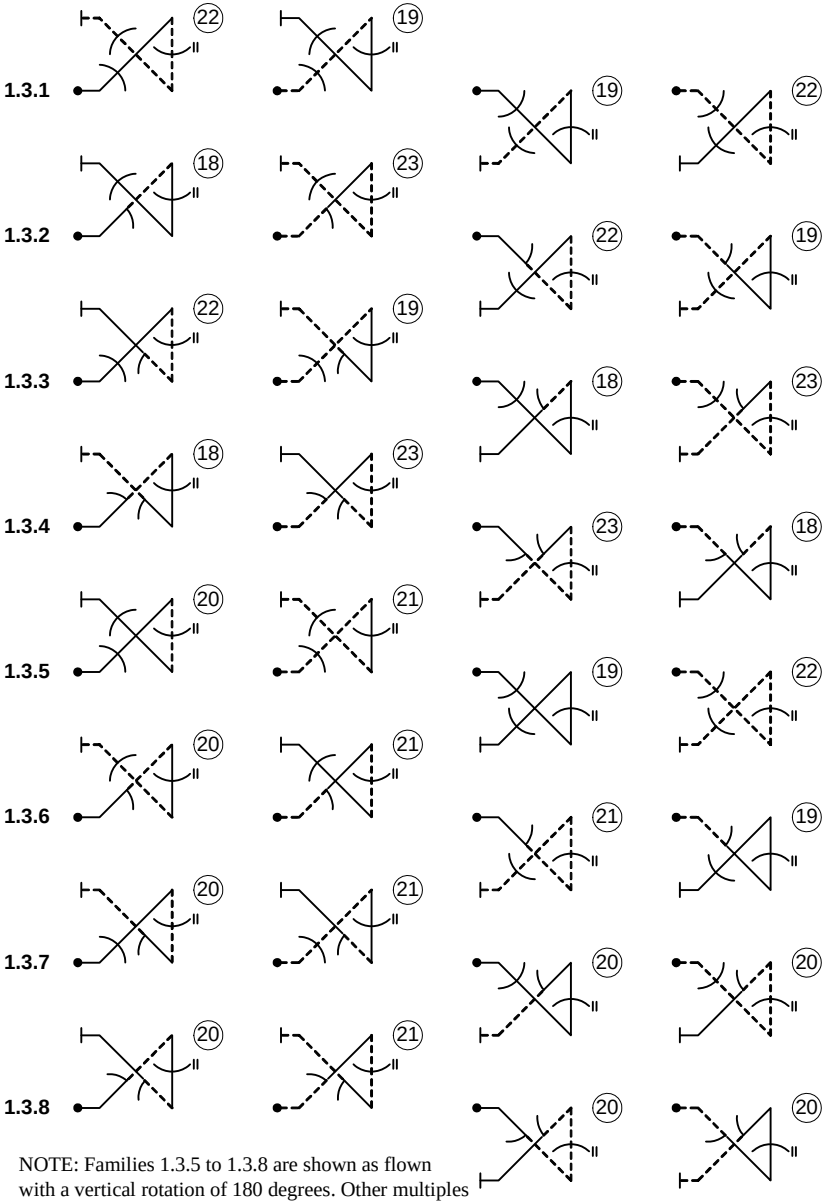
Family 1.2. Two Lines



Family 1.2 (cont.)

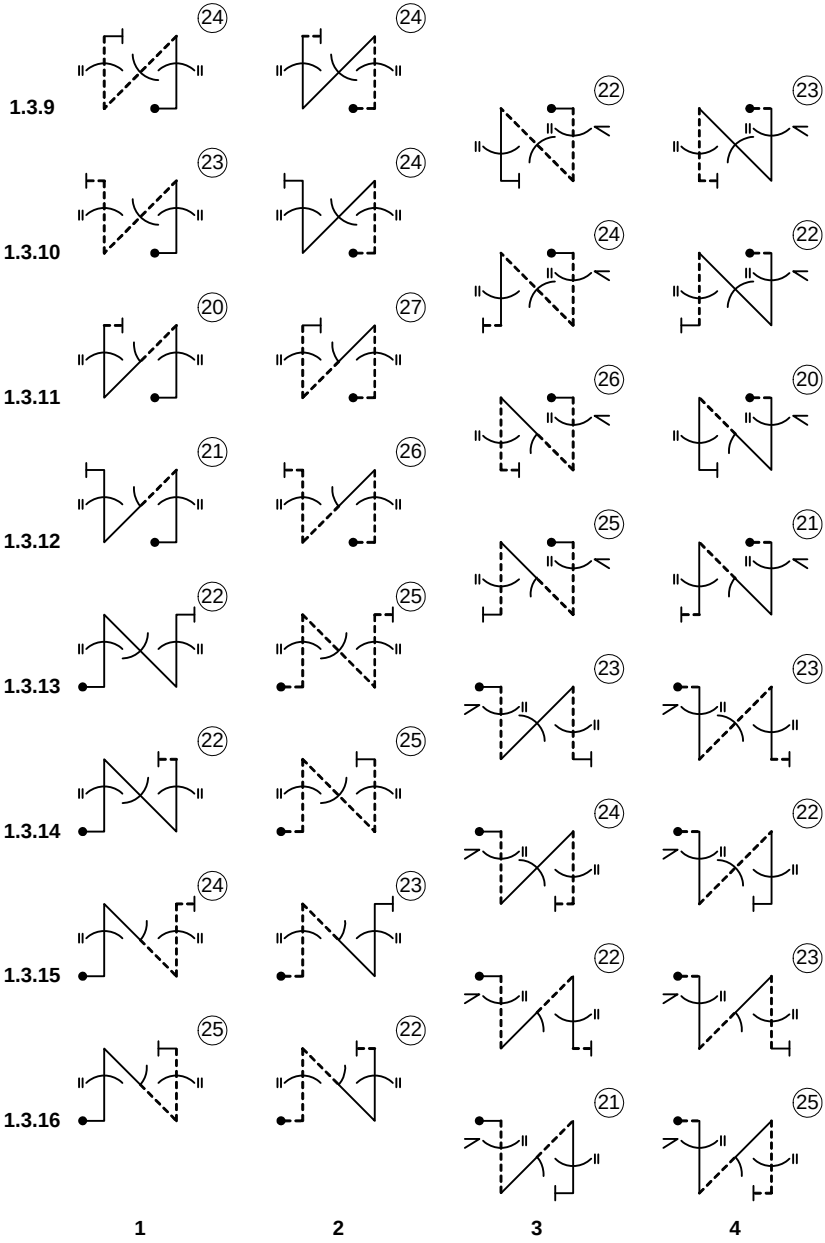


Family 1.3. Three Lines



NOTE: Families 1.3.5 to 1.3.8 are shown as flown with a vertical rotation of 180 degrees. Other multiples of 90 degrees of vertical rotation are permitted.

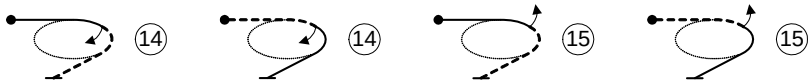
Family 1.3 (cont.)



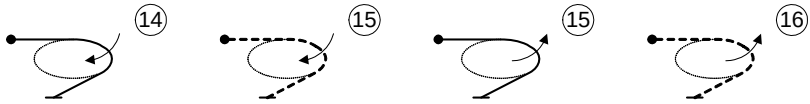
Family 2.1. 90° Turns

2.1.1

2.1.2



2.1.3

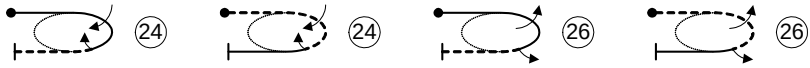


Family 2.2. 180° Turns

2.2.1

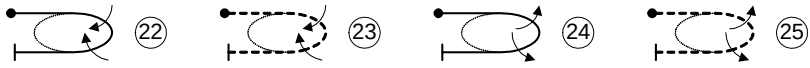
2.2.2

2.2.3

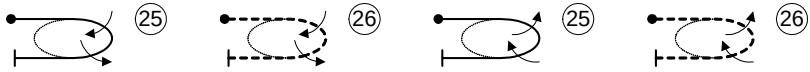


2.2.4

2.2.5

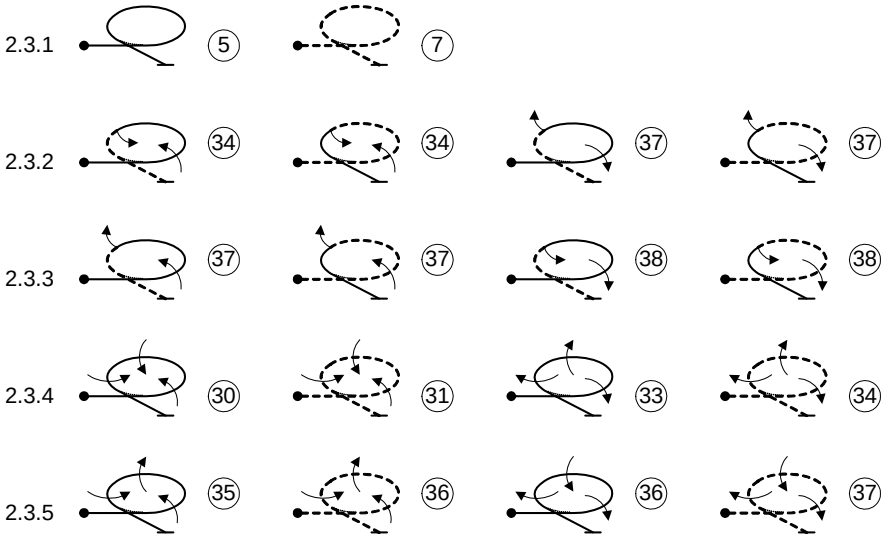


2.2.6

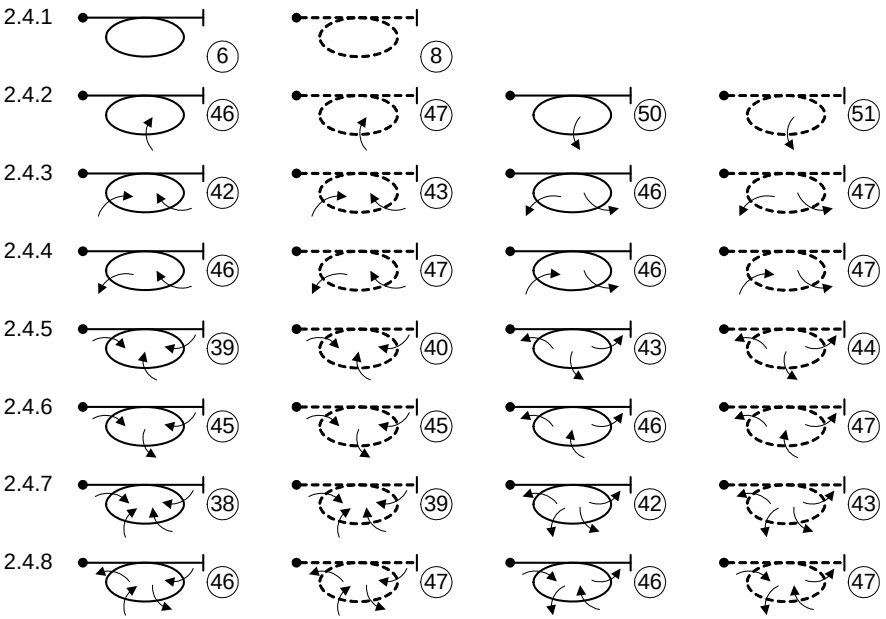


1 2 3 4

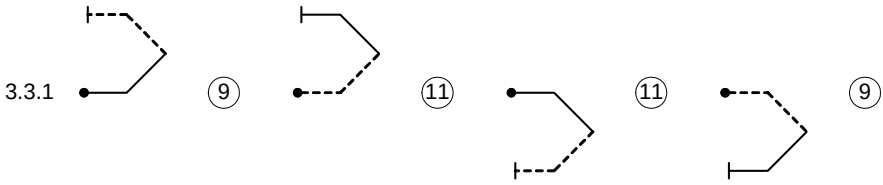
Family 2.3. 270° Turns



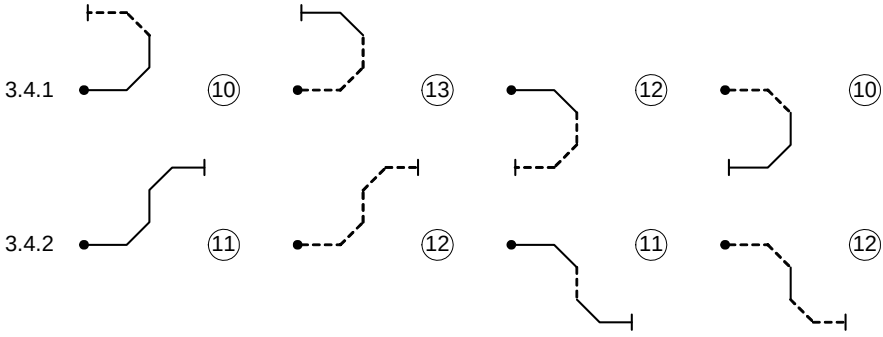
Family 2.4. 360° Turns



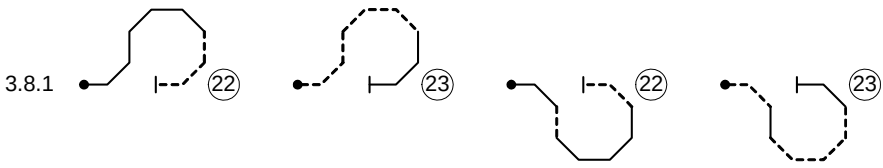
Family 3.3 Three Corners



Family 3.4. Four Corners



Family 3.8 Eight Corners



1 2 3 4

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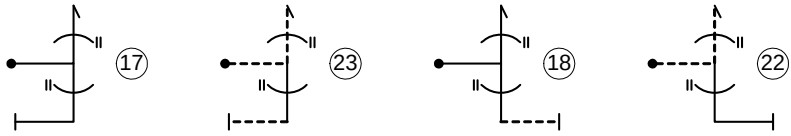
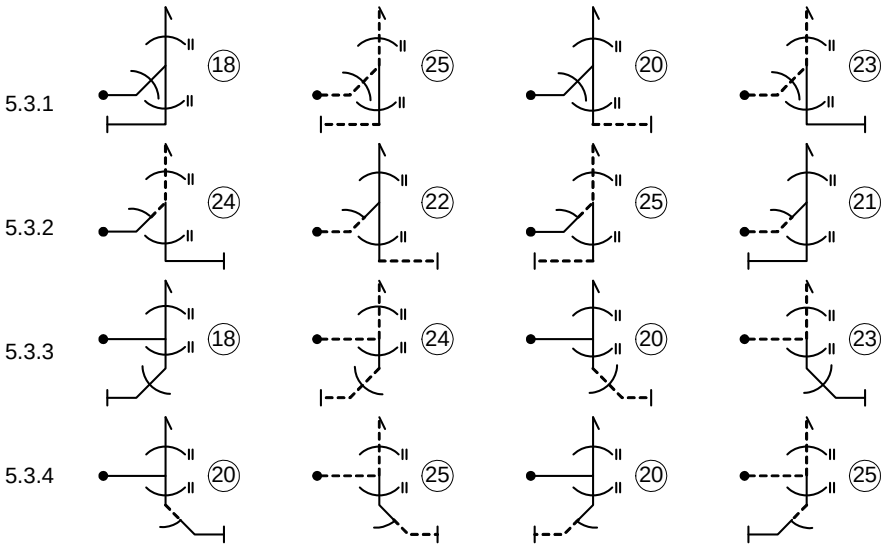
Family 5.2. Two Line Stall Turns

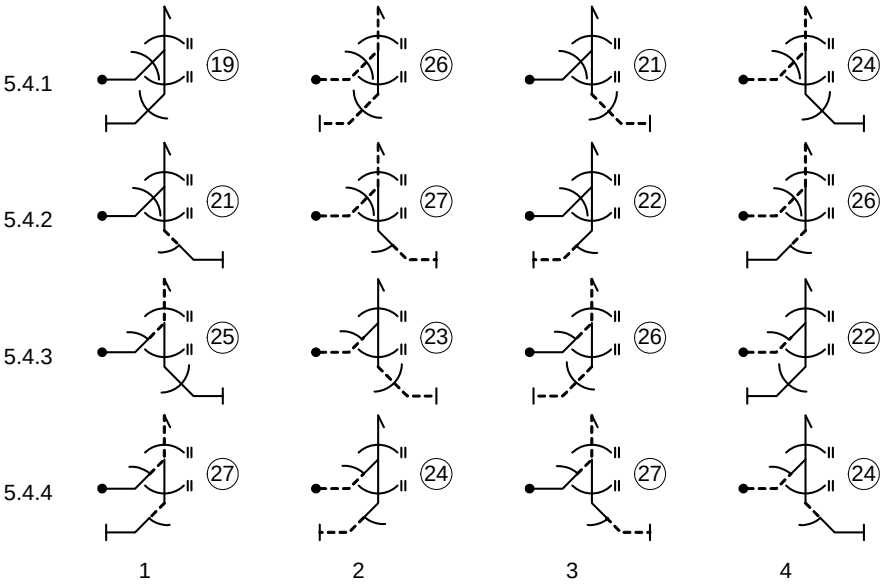
5.2.1



Family 5.3. Three Line Stall Turns

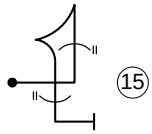


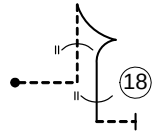
Family 5.4. Four Line Stall Turns

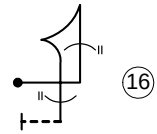


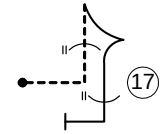
Family 6.2. Two Line Tail Slides

6.2.1

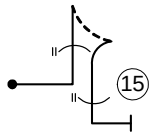


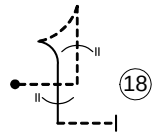


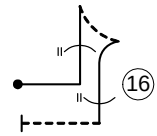


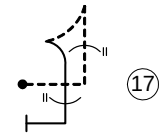


6.2.2



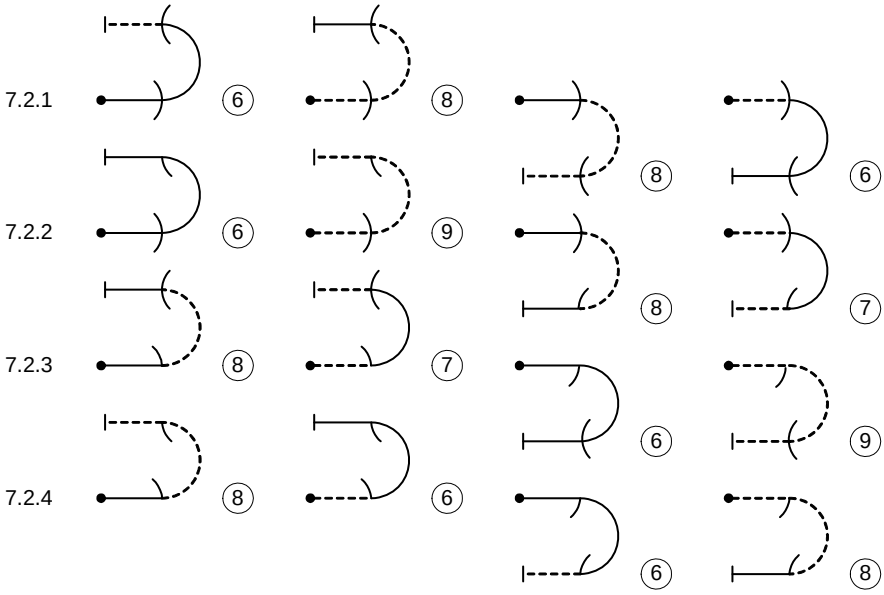




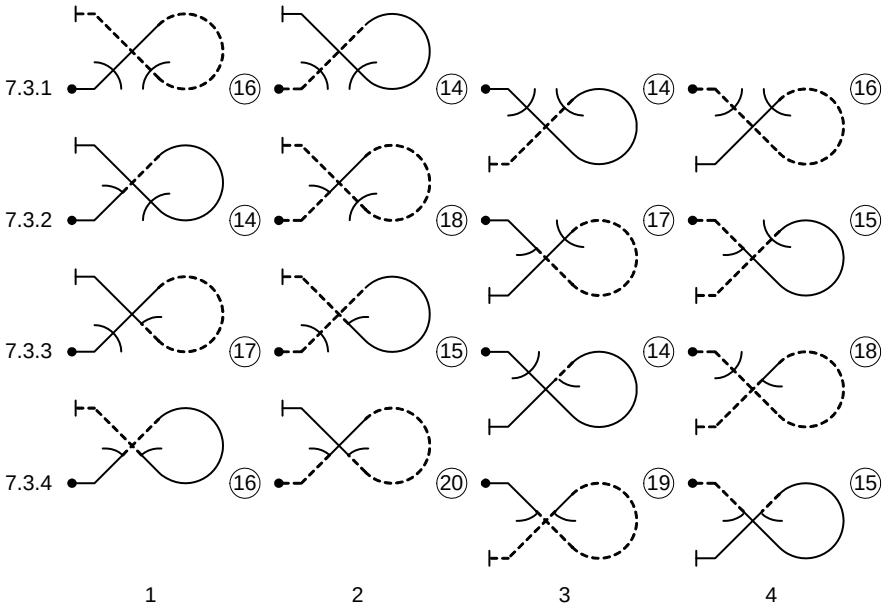


1 2 3 4

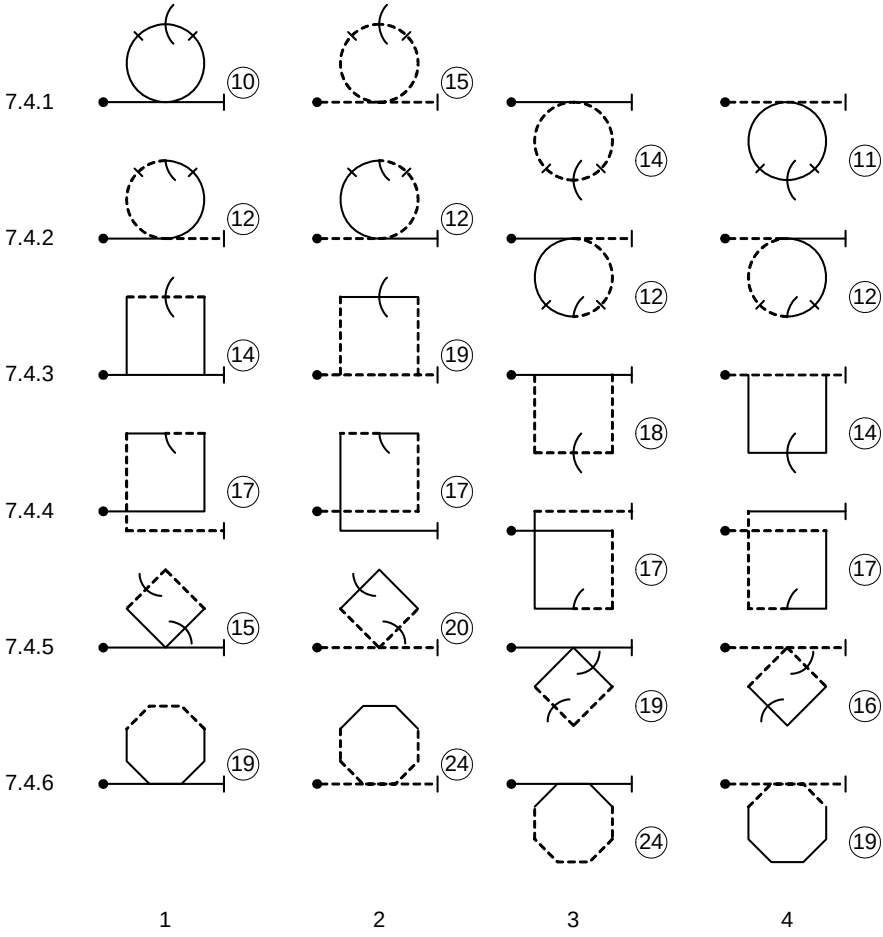
Family 7.2. Half Loops



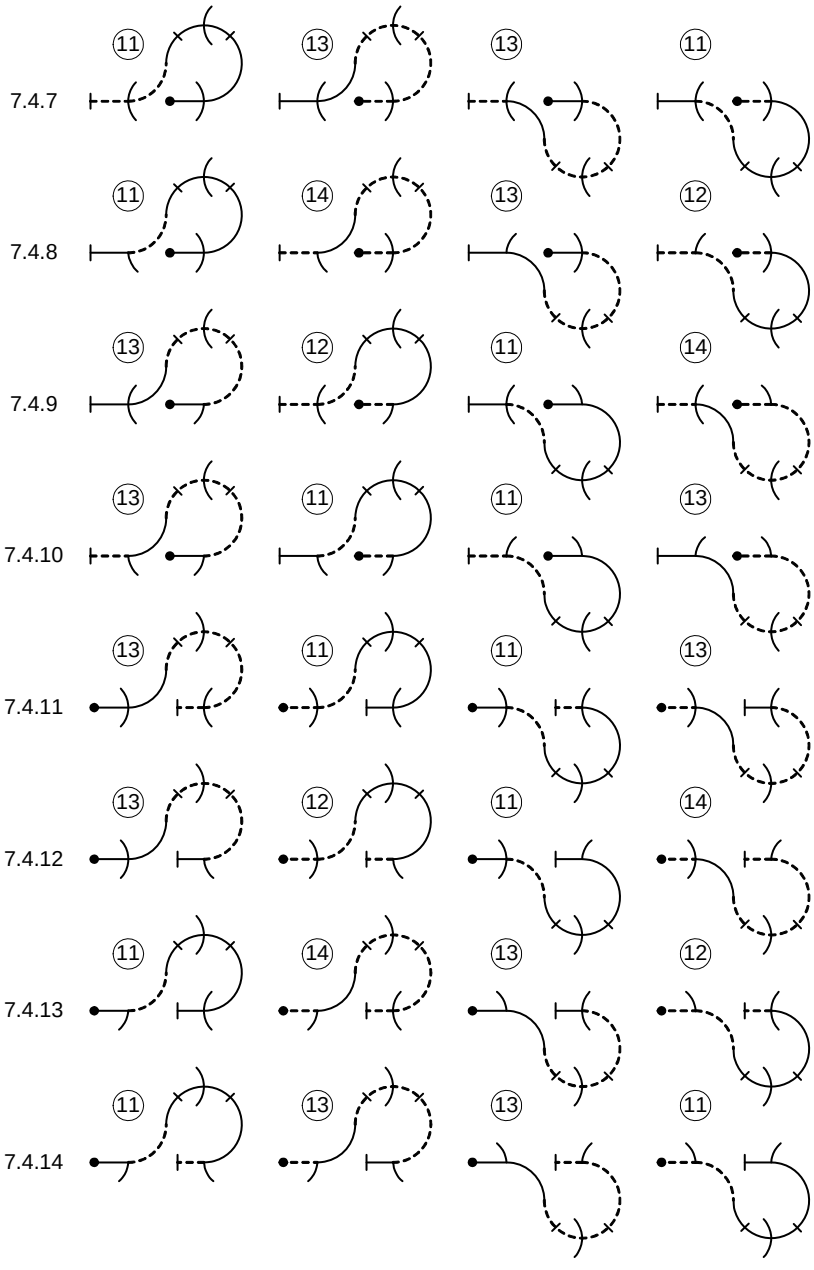
Family 7.3. Three-Quarter Loops



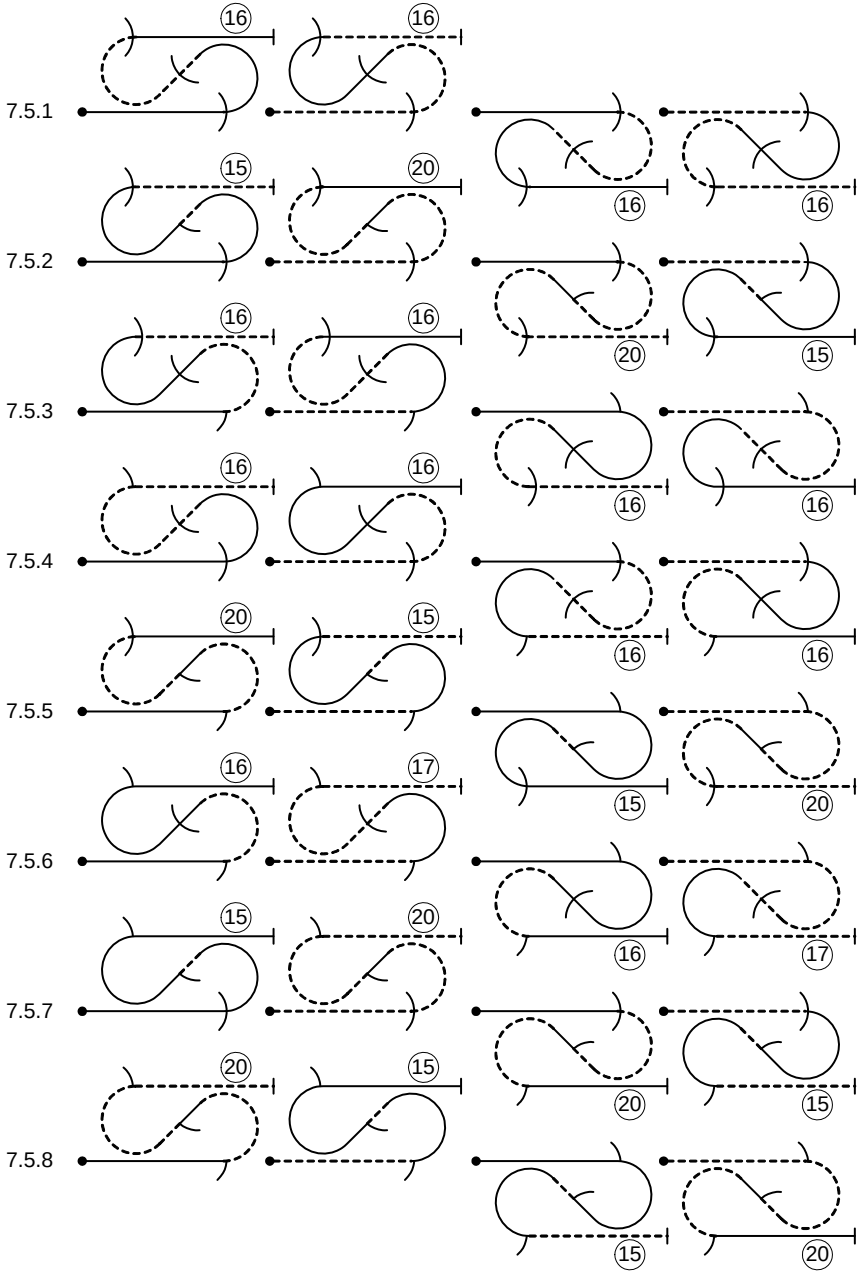
Family 7.4. Whole Loops



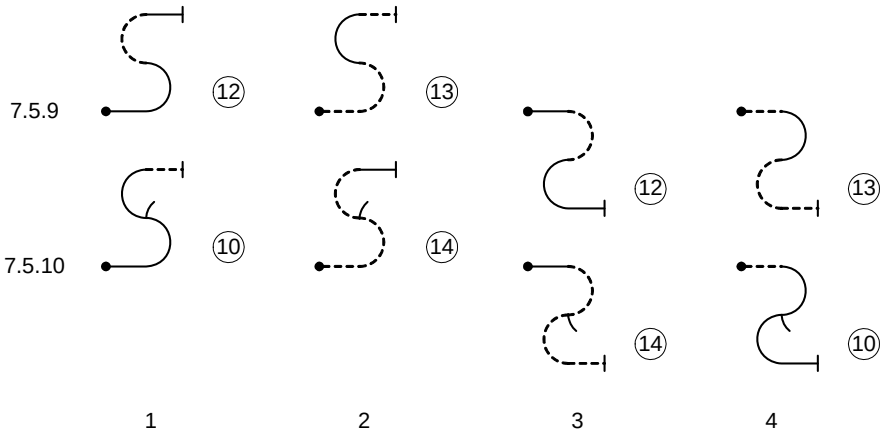
7.4. (cont.) Reversing Whole Loops



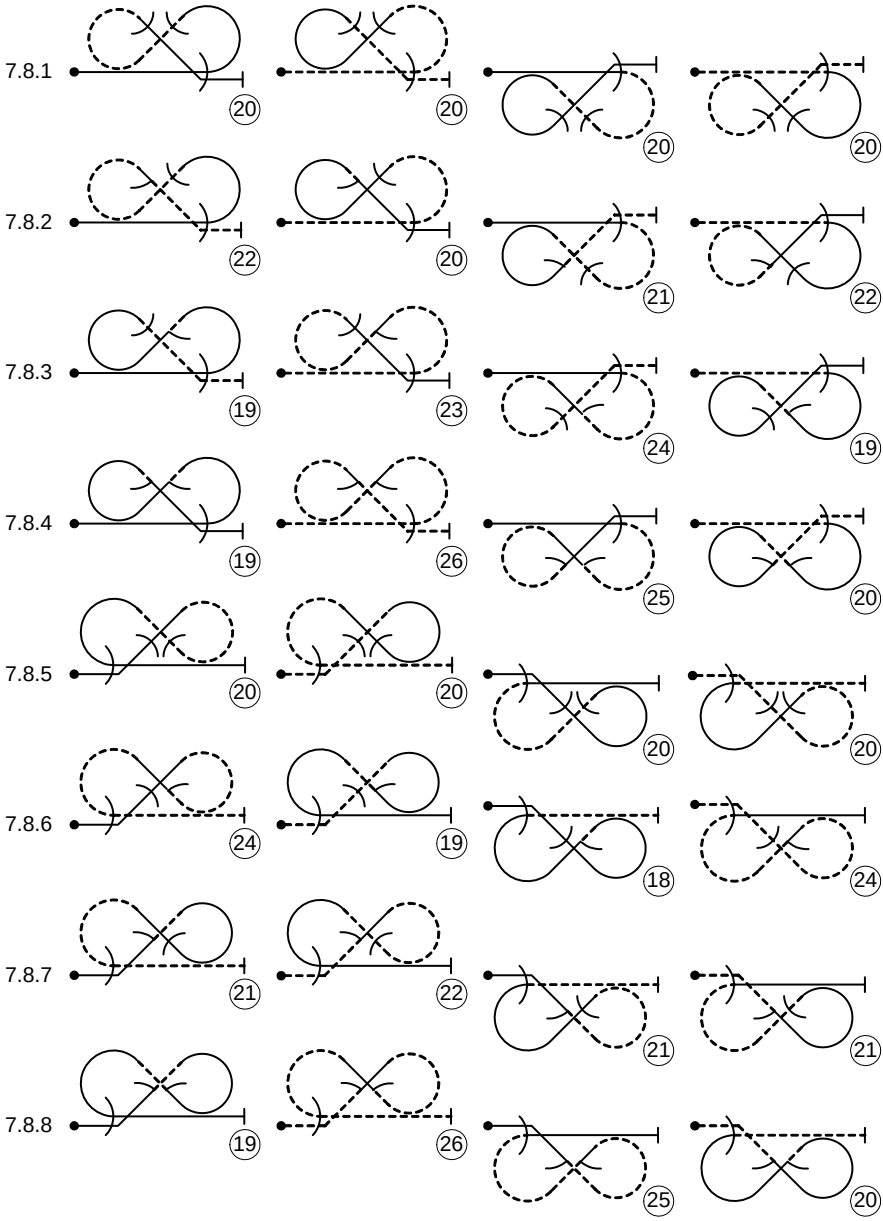
Family 7.5. Horizontal "S"s



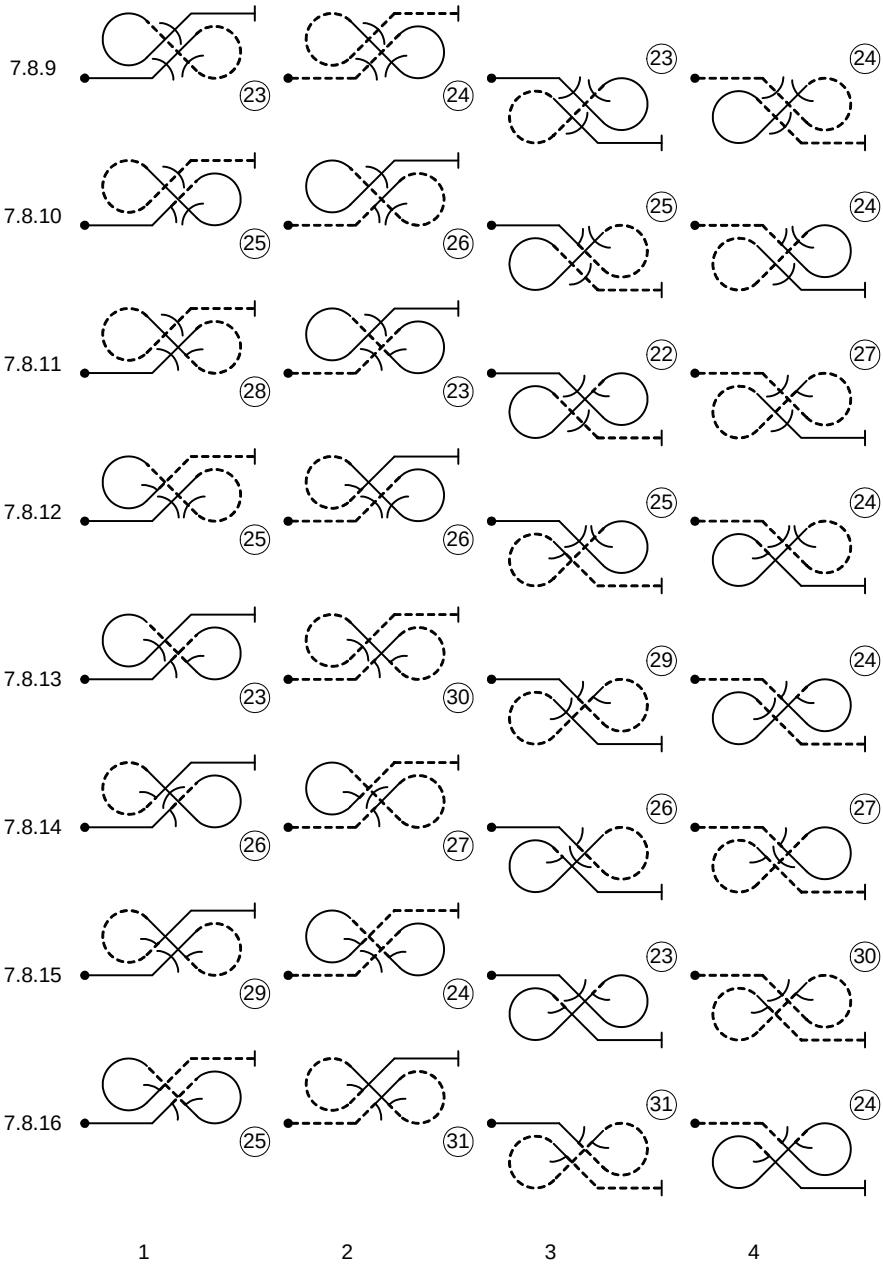
Family 7.5. (cont.) Vertical "S"s



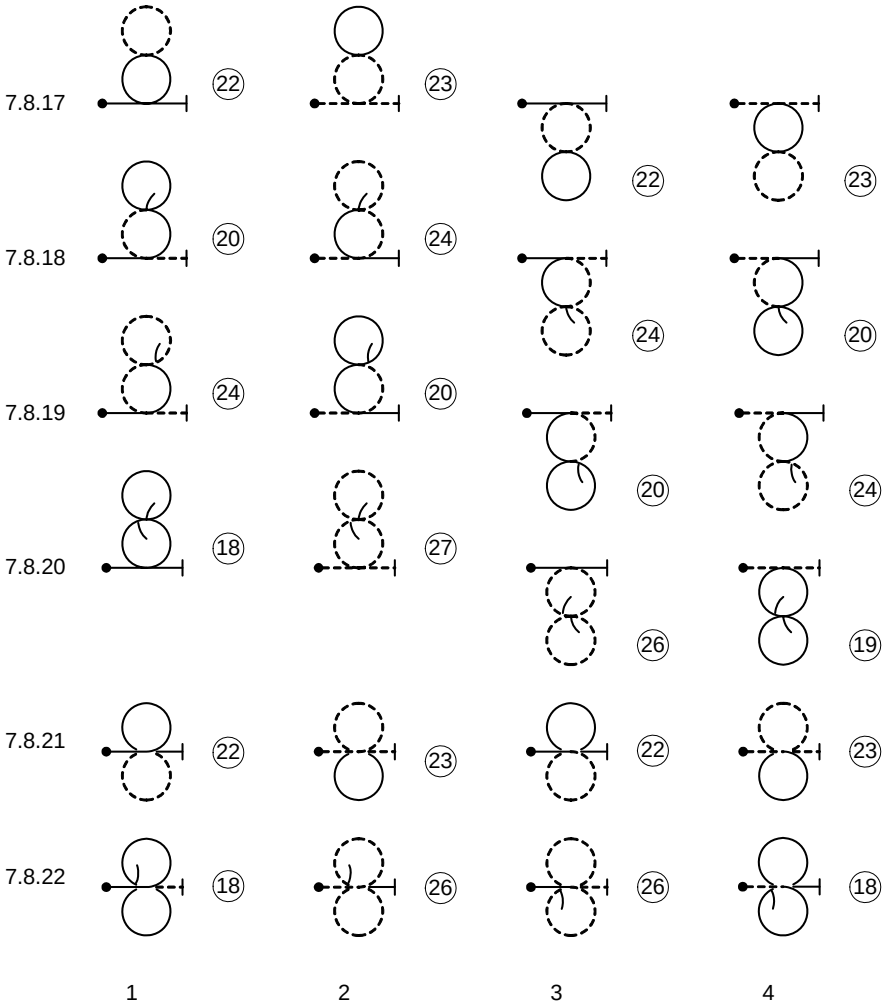
Family 7.8. Horizontal "8"s



Family 7.8. (cont.) Horizontal Super "8"s



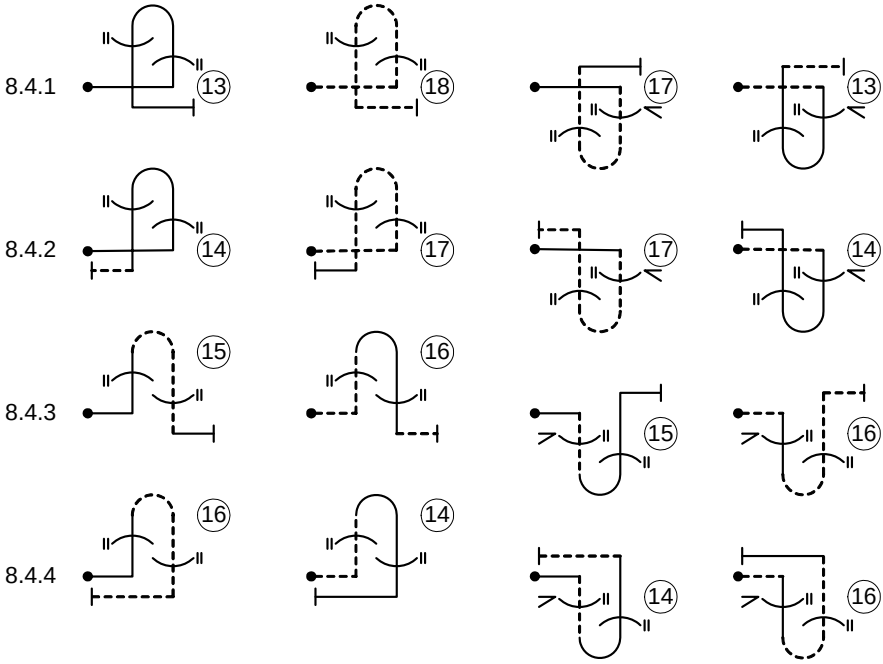
Family 7.8. (cont.) Vertical "8"s



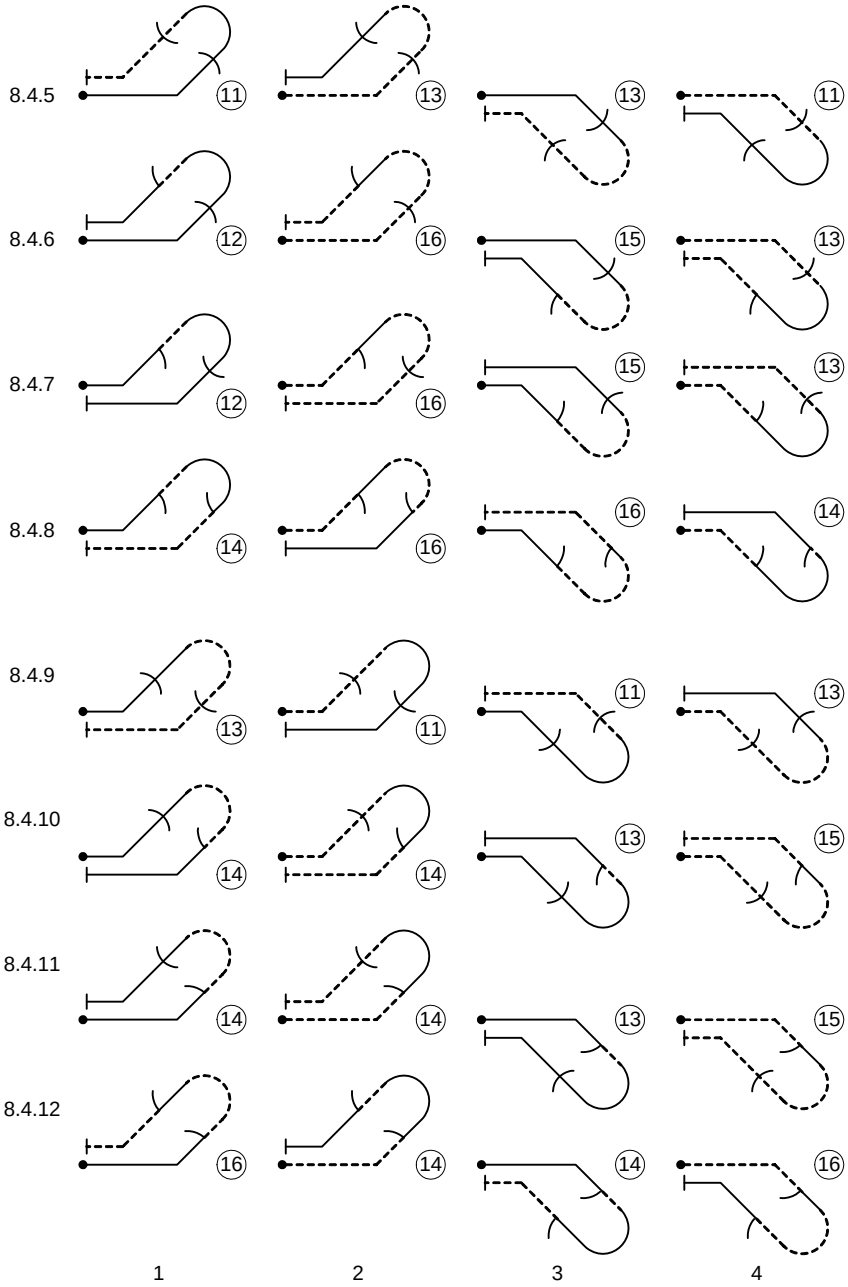
NOTE: At the sign ⌒ , only half-rolls permitted.

Family 8.4. Humpty Bumps

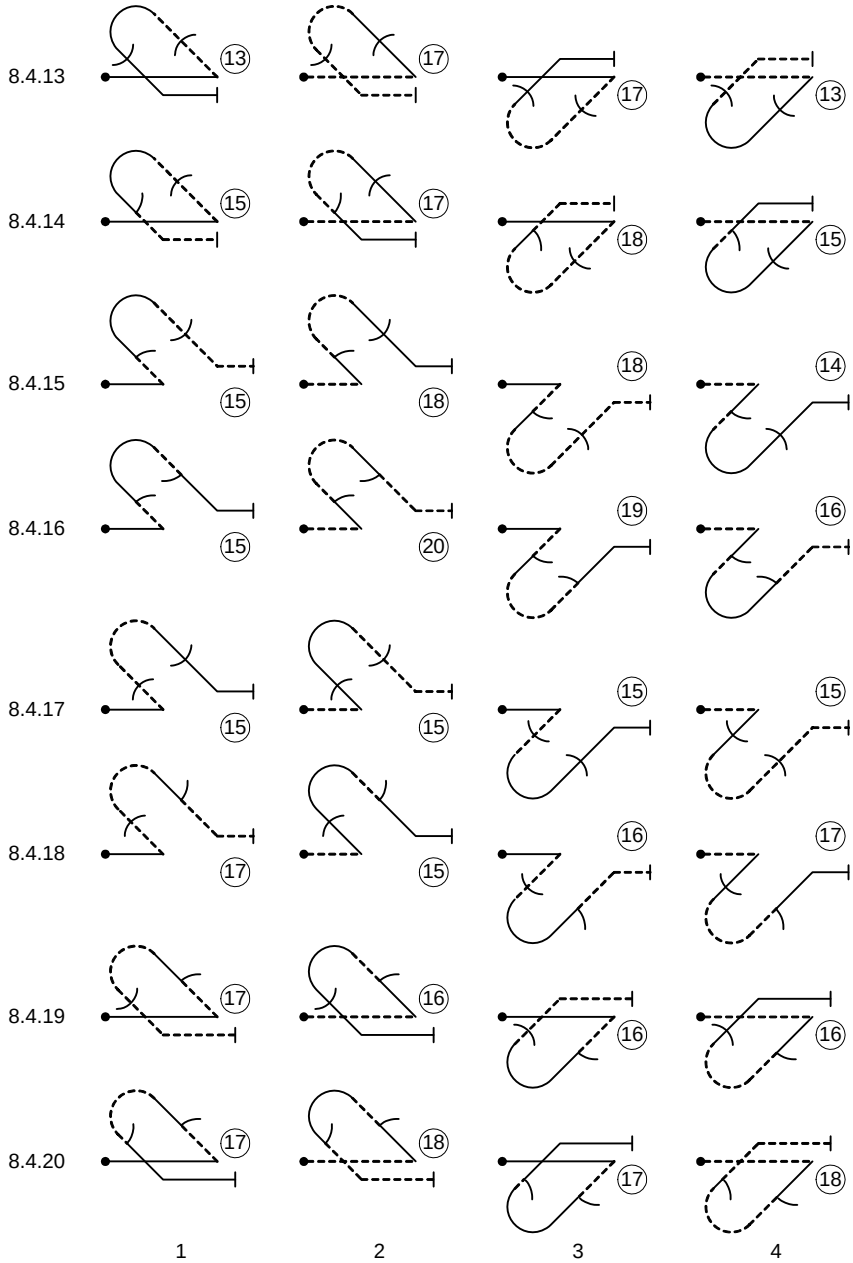
(4/8ths looping segment)



Family 8.4. (cont.) Diagonal Humpty Bumps

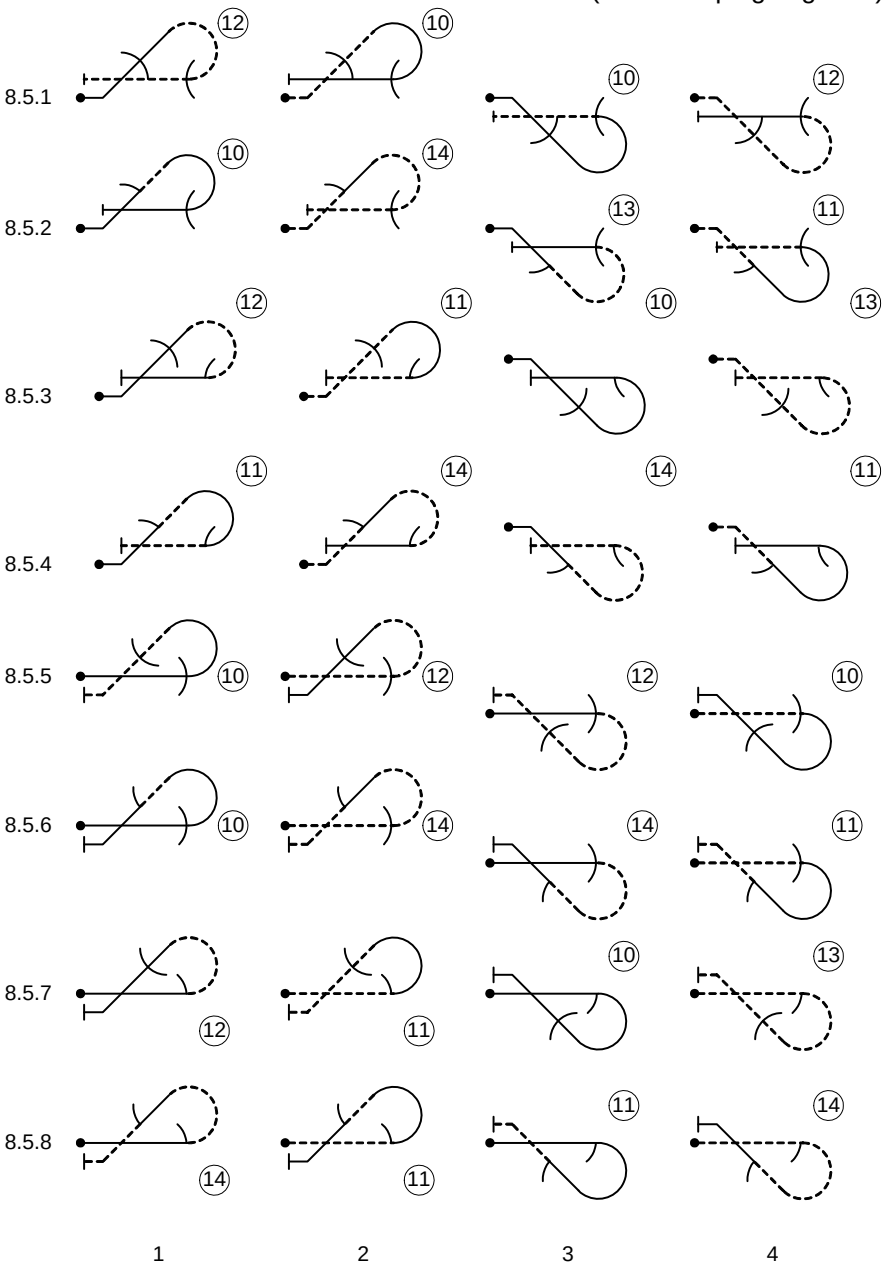


Family 8.4. Diagonal Humpty Bumps (cont.)

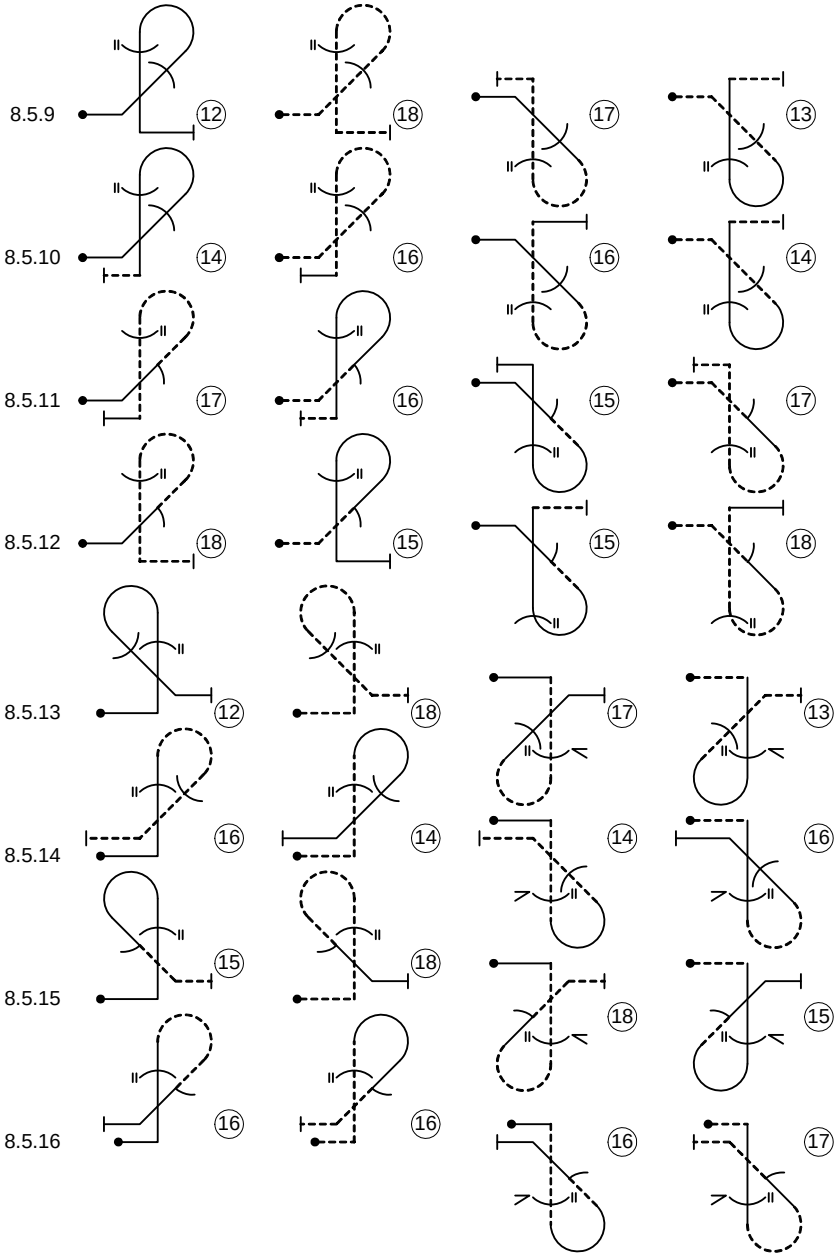


Family 8.5. Half Cubans

(5/8ths looping segment)

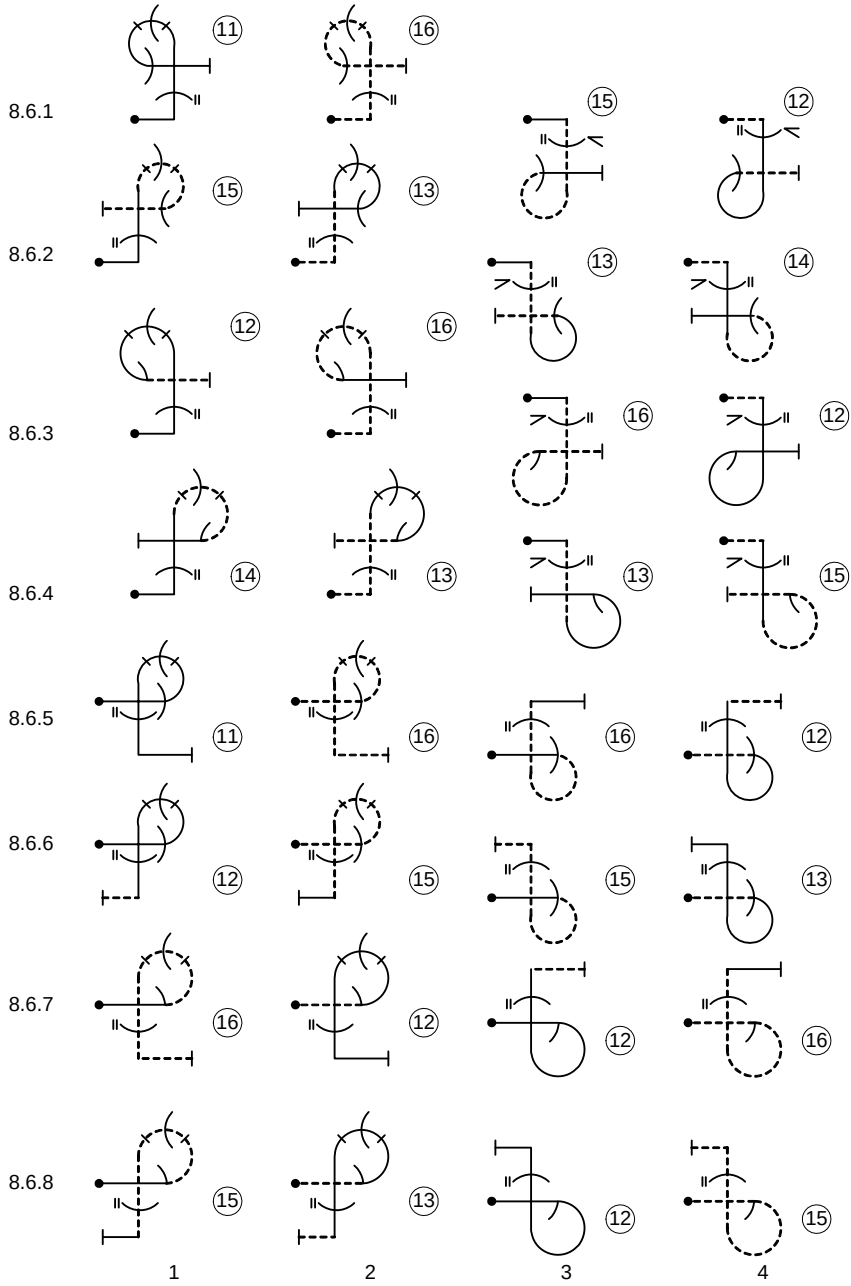


Family 8.5. (cont.) Vertical 5/8ths Loops

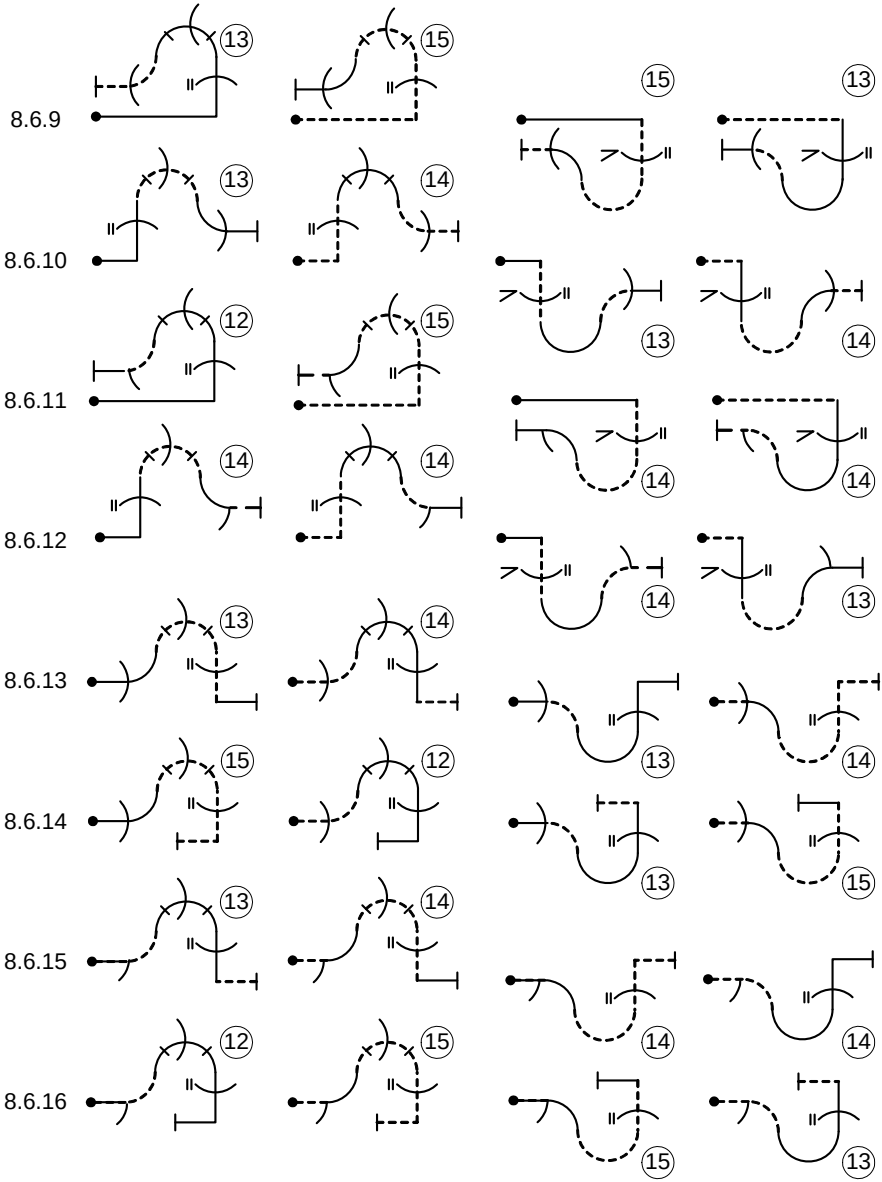


Family 8.6. "P" Loops

(6/8ths looping segment)



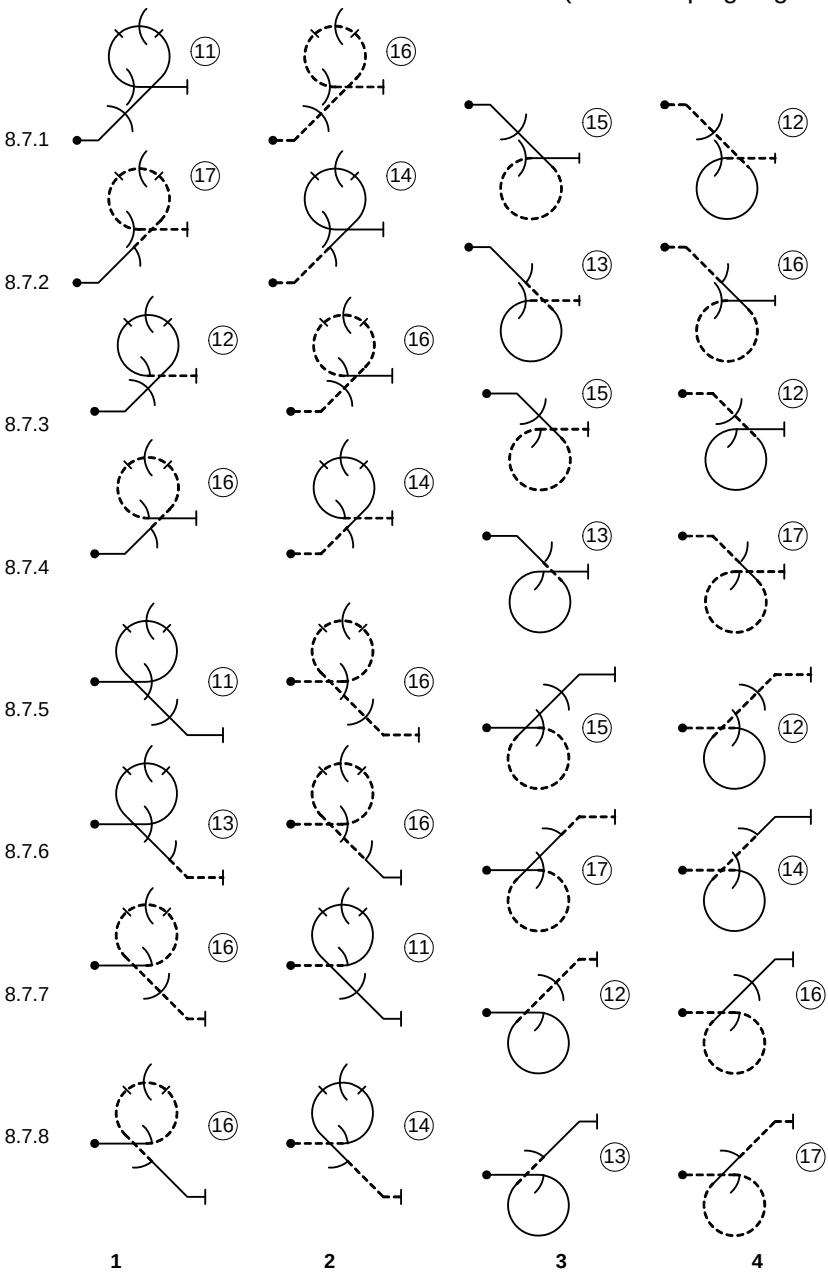
Family 8.6. (cont.) Reversing "P" Loops



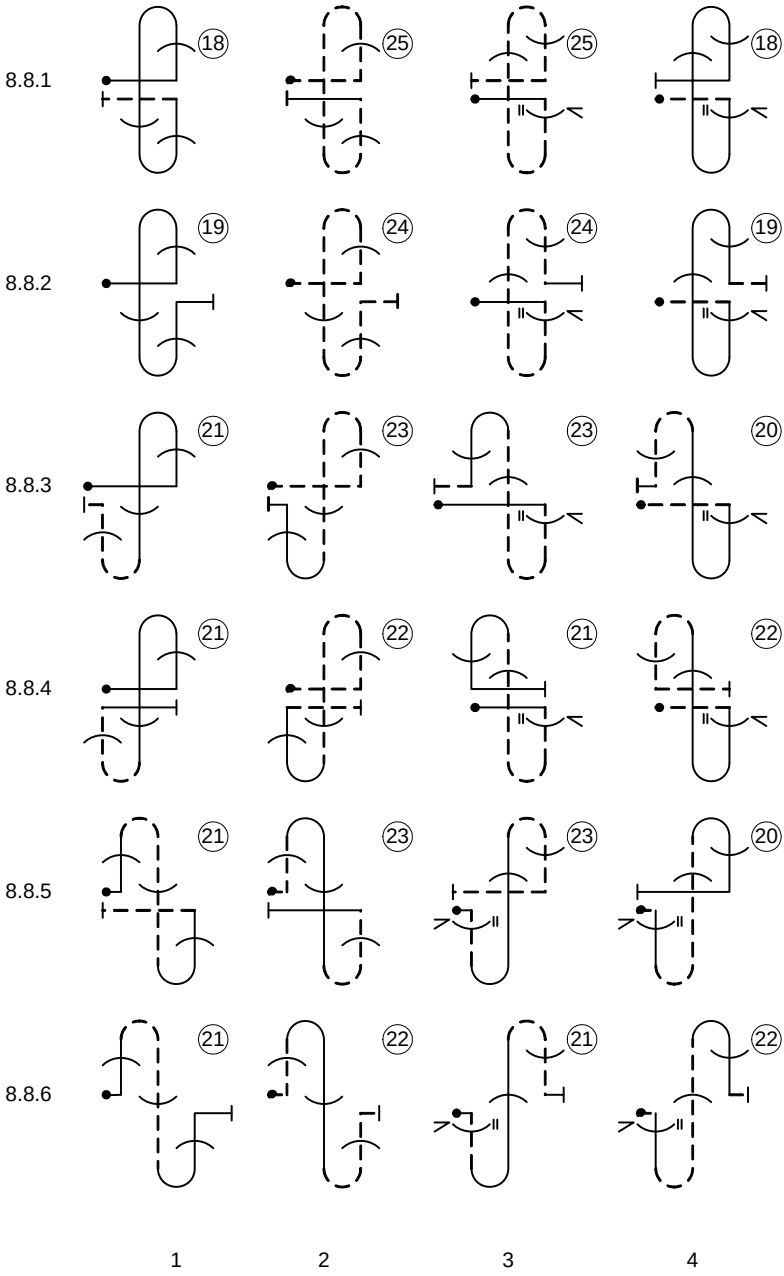
1 2 3 4

Family 8.7. "Q" Loops

(7/8ths looping segment)

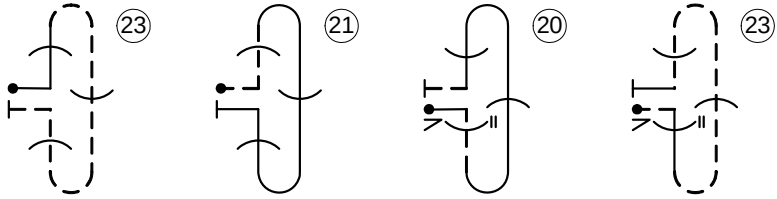


Family 8.8. Double Humpty Bumps

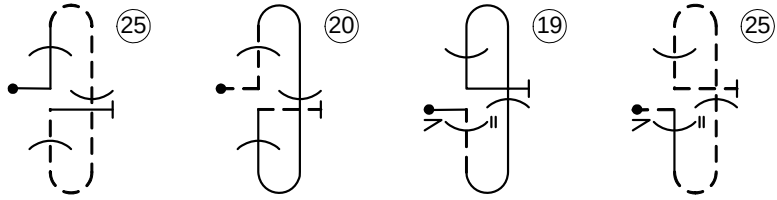


Family 8.8. Double Humpty Bumps (cont.)

8.8.7



8.8.8

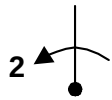
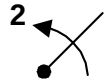
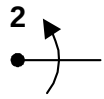
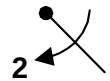
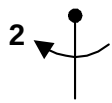


1 2 3 4

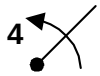
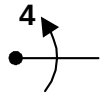
Family 9.1 (Aileron Rolls)

9.1		**¼**	**½**	**¾**	**1**	**1¼**	**1½**	**1¾**	**2**
1		6	8	10	12	14	15	17	18
2		4	6	8	10	11	12	14	15
3		2	4	6	8	9	10	11	12
4		2	4	6	8	9	10	11	12
5		2	4	6	8	9	10	11	12
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

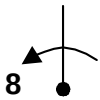
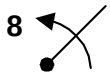
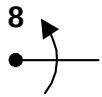
Family 9.2 (2-Point Aileron Rolls)

9.2					**1**		**1½**		**2**
1					13		17		21
2					11		14		18
3					9		12		15
4					9		12		15
5					9		12		15
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Family 9.4 (4-Point Aileron Rolls)

9.4			½	¾	**1**	1¼	1½	1¾	**2**
1			9	12	15	18	20	23	25
2			7	10	13	15	17	20	22
3			5	8	11	13	15	17	19
4			5	8	11	13	15	17	19
5			5	8	11	13	15	17	19
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Family 9.8 (8-Point Aileron Rolls)

9.8		¼	½	¾	**1**	**1¼**	**1½**	**1¾**	**2**
1		7	11	15	19	23	26	30	33
2		5	9	13	17	20	23	27	30
3		3	7	11	15	18	21	24	27
4		3	7	11	15	18	21	24	27
5		3	7	11	15	18	21	24	27
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

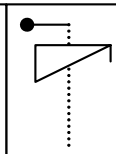
Family 9.9 (Positive Flick Rolls)

9.9			½	¾	1	1¼	1½	1¾	2
1			15	15	15	17	19	21	23
2			13	13	13	15	16	18	20
3			11	11	11	13	14	16	17
4			11	11	11	13	14	16	17
5			11	11	11	13	14	16	17
6			17	17	17	20	22	24	26
7			15	15	15	17	19	21	23
8			13	13	13	15	16	18	20
9			13	13	13	15	16	18	20
10			13	13	13	15	16	18	20
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

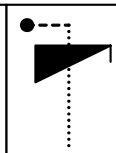
Family 9.10 (Negative Flick Rolls)

9.10			½	¾	1	1¼	1½	1¾	2
1			17	17	17	20	22	24	26
2			15	15	15	17	19	21	23
3			13	13	13	15	16	18	20
4			13	13	13	15	16	18	20
5			13	13	13	15	16	18	20
6			19	19	19	22	24	27	29
7			17	17	17	19	21	24	26
8			15	15	15	17	19	21	23
9			15	15	15	17	19	21	23
10			15	15	15	17	19	21	23
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Family 9.11 (Positive Spins)

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

Family 9.12 (Negative Spins)

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