Aerials In BASE

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The risks of a particular aerial in BASE (aside from the generic risks that relate to BASE jumping in general) are not defined by the difficulty of the aerial to be attempted, but upon the relationship of the aerial difficulty to the skill level of the participant.

In other words the more you train and prepare yourself, the less dangerous the act becomes.

The following are a collection of notes I have written over the last couple of years. Note that there may be inconsistencies and inaccuracies. This is a working document and there will be future additions and updates.
Special credit to Roland Simpson and Ron Piemonte (among many) for their expertise which contributed towards this document.

Contributions or suggested changes to this document are most welcome. Please email them to me at: DwainWeston@yahoo.com

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Disclaimer: No guarantee is given as to the accuracy of the information contained in this document. This document is not designed to encourage or condone performing aerials when BASE jumping. Attempting to perform aerials when BASE jumping significantly increases the risk or an already inherently dangerous activity. Participants assume full responsibilities for their actions and whatever outcomes arise as a result.

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Aerials In The Low Altitude BASE Environment

Aerials
- Doing an aerial is easy.
- Deploying in a stable body position after performing an aerial is difficult.

Aerials introduce to your BASE jump:
- Greater chance of loosing height awareness
- Significant chance of severe off-headings and line twists
- Increased chance of a partial or total canopy malfunction

BASE aerials vs. Freestyle Skydiving
- Doing an aerial in the first 3-4 seconds of a BASE jump is ENTIRELY different to the skydiving environment. The insufficient airflow upon which to fly dictates the use of a completely different technique for aerials.
- The closest comparison to low airspeed BASE aerials is platform diving NOT freestyle skydiving.
- Attempting to use certain freestyle skydiving techniques may actually hinder your BASE aerial attempt.

Planning the Aerial. The following elements need to be considered:
1. What delay am I planning to do?
2. What is the best gear configuration?
3. Can I maintain awareness and orientation during the aerial?
4. Can I guarantee that I will be able to deploy in a stable body position?
5. How do I launch the aerial?

BACKWARD Rotating Aerials
- Reverse Somersaults (Gainer) - Jump forward and rotate backwards
- Back Somersaults – Jump backward and rotate backwards

<u>Low airspeed deployment from Backward Rotating Aerials</u>
- Head down at p/c release
- 180 degrees of available rotation from p/c release to line stretch
- Danger of deploying p/c into shoes (hooks on shoes can be a major issue here)

Reverse Somersaults (Gainers)
- ½ a rotation required before commencing deployment
- More difficult to commence rotation – higher energy input required to launch
- Easy to stall out on your back
- Danger of hitting the back of your head
- The further you jump out the harder it is to rotate fast

Back Somersaults
- ½ rotation required before commencing deployment
- Very easy to induce too much rotational energy and over-amp
- Visualize doing a back dive – not a back somersault

FORWARD Rotating Aerials
- Front Somersaults - Jump forward and rotate forward
- Inward Somersaults – Jump backward and rotate forward

<u>Low airspeed deployment from Forward Rotating Aerials</u>
- Head high at p/c release.
- Only 90 degrees of available rotation from p/c release to line stretch.
- Danger of p/c going under arm.
- High chance of being head down on deployment.

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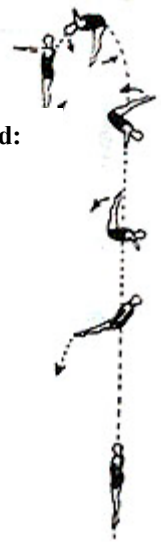
- Line stretch swings your body in the opposite direction to the rotation (opening shock on neck is more pronounced).

Front Somersaults
- Full rotation required before commencing deployment
- Very easy to induce too much rotational energy and over-amp

Inward Somersaults
- Full rotation required before commencing deployment
- More difficult to commence rotation – high energy launch required
- Easy to stall out on your back
- Danger of hitting face but if you back away too far you won't spin

Inward:



BARREL ROLL Aerials
- Exiting on back and rolling over
- Full barrel Rolls

<u>Low airspeed deployment from Barrel rolls</u>
- Flat deployment
- High chance of shoulders not being level on deployment – square off shoulders to horizon
- Be prepared for off-heading or line twists

Exiting on Back and rolling over (Half Roll)
- Very typical for people to go severely head down on first few attempts
- Exit head high on back (almost in a standup)
- Roll over right side up so p/c is always clear for deployment during the roll

Full Barrel rolls
- Different to skydiving because you can't push off the air
- Gymnastics and diving twisting techniques are the best techniques to use.
- Recommended to gain stability in the air before commencing (don't twist directly off the platform otherwise twisting will be difficult to stop)

TWISTING SOMERSAULT Aerials
- Half Twisting somersaults
- Full/Multiple twisting somersaults

Low airspeed deployment from twisting somersaults
- Two rotational planes to deal with.
- Orientation issues become more critical:
    - Loss of Height awareness
    - Entanglement during deployment
    - Heading / line twists problems
- Large increase in complexity between half twisting somersaults and full/multiple twisting somersaults.
    - Attempt only with significant training outside of the BASE environment

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General order of difficulty for launching (easiest to hardest)

1. Front somersaults
2. Back somersaults
3. Reverse somersaults
4. Barrel Rolls
5. Inward somersaults
6. Half Twisting somersaults
7. Full or Multiple twisting somersaults

General order of difficulty for deployment (easiest to hardest)

1. Reverse somersaults
2. Back somersaults
3. Barrel Rolls
4. Inward somersaults
5. Front somersaults
6. Half Twisting somersaults
7. Full or Multiple twisting somersaults

In Summary:
The focus of a BASE aerial is NOT about performing the aerial.
The focus of a BASE aerial is about DEPLOYING in a stable fashion within the planned delay.

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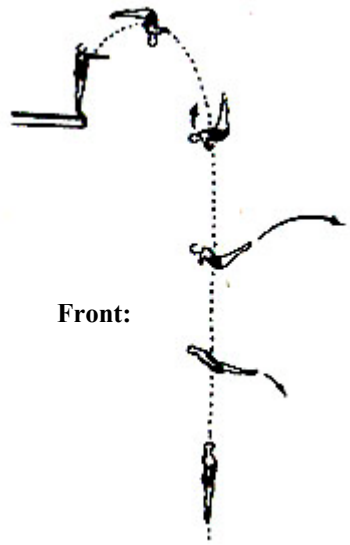
Aerial Exit Choices

A. Exit Type
One may somersault in two basic directions – forward or backwards
One may leave an exit point facing two basic directions – forward or backwards

2 * 2 = 4 Basic Exit Types:
- Jumping forward, somersaulting forward: Front somersault
- Jumping forward, somersaulting backwards: Reverse somersault (also known as a "Gainer")
- Jumping backwards, somersaulting forward: Inward somersault
- Jumping backwards, somersaulting backwards: Back somersault

B. Standing Position
The above exit types may be performed from two standing positions:
- Standing upright
- Arm-standing / Hand-standing

C. Body Position
The body may be held in three basic positions during a somersault:
- Tuck (Body bent at waist and knees)
- Pike (body bent at waist, legs straight)
- Straight / Layout (entire body straight)



Front:

D. Twisting Option
The jumper may also opt to twist or not twist during the rotation:
- Twisting somersault
- Non twisting somersault

E. Turn Option
The jumper may also opt to turn or not turn during the jump:
- Turning jump
- Non turning jump

A = 4 options
B = 2 options
C = 3 options
D = 2 options
E = 2 options

4*2*3*2*2 = 96 exit choices for an aerial. We may then additionally select the number of somersaults to be performed, the number for twists to be performed for each somersault and the degree's of turn. The total aerial options will then run to many hundreds.

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Aerial Progression Order

A recommended progression (not a totally rigid order) for aerials with 3-4 sec or less delay would be:

1. Reverse somersault (gainer) in brief tuck, pike and layout position. Learn to execute it in a variety of delays (For example, be able to do it with both a 1.5 and a 3 second delay).
2. Double reverse. Attempt tuck/layout transition initially then try double pike.
3. Back somersault, single and double (DFO).
4. Front pike - p/c handheld initially. (Front should be slow if going stowed).
5. Triple reverse & back somersaults - tuck. Quads are possible in this timeframe if you can spin fast and maintain orientation and height awareness.
6. Optional: Work on 1,2 and 5 with running exits if you have access to an object that allows it.
7. Flying front – p/c stowed.
8. Double font (pike) - p/c stowed.
9. Optional: Add a handstand exit to all of the above (except for 6).
10. Inward somersaults - single and double
11. Front layout with ½ twist, back layout (DFO)
12. Back layout, ½ twist, front tuck
13. Double inward with ½ twist
14. Reverse pike, ½ twist, front tuck (DFO)
15. Front pike, layout with ½ twist, back pike (DFO)
16. Double front tuck, layout with ½ twist, back tuck (DFO)
17. Inward tuck, layout with ½ twist, back tuck.
18. Back layout with ½ twist, front layout with ½ twist, back tuck (DFO).
19. Front layout with full twist, front tuck.
20. Back layout with 1.5 twists, front tuck.
21. Front pike, front layout with full twist, front tuck.
22. Back pike, back layout with 1.5 twists, front tuck.
23. Front layout with double twist, front tuck.
24. Back layout with 2.5 twists, front pike.
25. Reverse layout with 1.5 twists, front layout with ½ twist, back tuck.
26. etc...

DFO *= Deploy Facing Object (A Span is highly recommended)*

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Dive Training for Aerial BASE

You should never attempt to enter the water flat when simulating an aerial BASE jump (for reasons other than pain avoidance). The best way to train is with the mindset that entering the water equates to the time of p/c release (or transitioning to a track for longer delays).

For backward rotating somersaults (backs and reverses), you need to straighten your body and throw the p/c when you are head down. Canopy extraction should then occur when you are horizontal and line stretch should occur when you are slightly head-high. This sequence of body position relative to stages of deployment results in an excellent chance for an on-heading and minimizes potential entanglement complications.

For forward rotations (fronts and inwards), you need to straighten your body and throw the p/c when you are in a standup position (be very careful not to toss the p/c too early or it can go under your arm). Canopy extraction should occur when you are 45 degrees head high and line stretch when you are level.

Deploying out of front rotations in low airspeed is much harder than back rotations because you can only rotate 90 degrees during the deployment, whereas with a back you can rotate up to 180 degrees during the deployment. Therefore on front rotations, timing on p/c release and rotation speed relative to deployment airspeed is much more critical. Try doing a front somersault stowed with a 1.5 sec delay and not being head down on line stretch – it's doable but the timing and execution has to be precise. However as you delay longer on front rotations deployment becomes exponentially easier as the rotation is slower and airflow becomes useful for stopping or slowing the rotation.

For using the springboard / platform for training in BASE, the following dives equate to the following basic aerials in BASE jumping:

<u>BASE Aerial = Springboard/Platform Dive</u>

Gainer = Reverse dive (dive entry)
Double Gainer = Reverse 1 and a half (dive entry)

Back = Back dive (dive entry)
Double Back = Back 1 and a half (dive entry)

Front = Front somersault (feet entry)
Double Front = Double front somersault (feet entry)

Inward = Inward Somersault (feet entry)
Double Inward = Double Inward Somersault (feet entry)

One word of caution: Self teaching aerials in the dive environment often results in bad technique. Bad technique can be used to successfully achieve many basic aerials in the BASE environment, however as soon as you try to advance to something more challenging you will find progression difficult if not impossible.
Un-learning bad technique often takes longer than learning the correct technique from scratch. It's almost more important to have a dive coach when learning the fundamentals than when trying to learn the advanced maneuvers.

Differences between BASE aerials and diving technique include when you are jumping, for example, a 300ft vertical wall. You HAVE to launch out far for survival reasons. This is counter to the techniques in diving - especially for reverse somersaults and inwards (as launching out counteracts the rotation). If you are planning to do these aerials from low vertical walls then you HAVE to learn how to jump out far and do (for example) a reverse 1.5 from the 5 meter platform. Jumping out from the platform will make any dive coach cringe (as it is counteractive to the somersault and considered bad form in diving), but BASE aerials are not the same as diving and therefore different factors (such as the object strike potential) dictate that different techniques are sometimes used.

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Advanced Issues in BASE Aerials

Deploying out of a twisting somersault and getting an on-heading is very difficult (but not impossible). I've found deploying out of ½ twists to be OK (but I'm still prone to 90 degrees off-headings – I believe this is not because I'm uneven on line stretch, but because I'm not yet square when the canopy lifts out of the pack tray and the canopy drags more on one lower corner which turns it). However full/multiple twists are even more difficult to deploy directly out off.
I've found that by performing a non-twisting somersault after a twisting somersault just prior to deployment works really well. In other words I will add a single back or front rotation onto the end of a twisting somersault to help orientation and to be totally square for deployment.

If you do want to deploy directly out of a twisting somersault then get the twist(s) done early as possible in the somersault to have the highest chance of being square for deployment.

Also another problem with deploying out of a twister is as follows. To stop a twist you need to square off by opening up at the arms, however the action of reaching back for the p/c counteracts the squaring off action. You need to square off to stop the twist and then reach back. The time frame to do this is often very tight (if p/c release timing is late and you will over-rotate). If you rush the squaring off action and reach for the p/c too early you won't stop the twist and deployment will be ugly.
Also you have much more momentum to square off with due to the weight of the rig (and it's leverage behind your back). The squaring off action requires more force to stop the twist than in diving due to the rig.
This problem also transcends to starting the twist. A 1.5 twist in the BASE environment requires more energy to get going than a 2.5 twist in the diving environment due to the equipment and clothing. The weight and leverage of the rig is out from your body. Twisting throws the 16 pound rig in a circular path around your body which requires a great deal of energy to commence.
Also the rig is really limiting in the normal body movements (esp. the main lift webbing). Try putting a rig on and doing a round-off (handspring half twist) on the floor and you will feel the restriction.

In summary you can not believe that just because you can do a certain action in the diving environment it will work just as well in the BASE environment due to the restrictions of the harness and weight of the rig.

Blind entries
Spotting blind or blind entry (such as on a reverse 1.5 in diving) isn't as much of problem in BASE as it is in diving. One of the things that makes BASE aerials so much

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BASE Aerials in Competition

Possible rule set for 4 seconds of working time

Aerial BASE jumping is rapidly gaining popularity in the BASE community. It represents a unique sub-branch in true "Sport BASE jumping", as it requires substantial training to become proficient at higher levels.

Many of the techniques used in aerial BASE jumping emulate platform diving. The sport of platform diving has well-established rules and techniques for judging and is an Olympic event. Aerial BASE jumping can adapt some of these techniques to prevent "re-inventing the wheel" and to help establish credibility as a sport.

It is important to have a defined structure in place as the skill sets and number of aerial BASE jumpers in the community rapidly increases over the next few years. In other words event organizers should adopt a PRO-ACTIVE approach in regards to the future of aerial BASE jumping rather a REACTIVE approach as the sport advances and changes.

The proposed scoring system is designed to encourage jumpers to perform an aerial that is well within their skill set, rather than to be ambitious and poorly perform a more advanced aerial. This will help reduce the chance of incidents.

The Freefall Control Rounds will judge the competitors ability, control and grace in freefall.

Jumpers must be in a stable position to commence tracking or deploy at the 4 second mark.

Jumpers must nominate their competition jump before the round begins. This gives time for the judges to work out the degree of difficulty to be applied to each jump. Each proposed jump must be approved by the judges for safety reasons. If a jump is considered questionable in regards to safety the judges may interview the jumper to determine their previous experience level with the proposed maneuver.

Jumpers cannot repeat the same jump (with the exception of non-rotational jumps) in any of the Freefall Control rounds. If it wasn't for this rule, jumpers would be at an advantage to just repeat their best jump in all Freefall Control rounds. Diversity of ability is something that is rewarded in an aerial competition.

Three steps for Marking:

1. Initial Score out of ten
2. Subtract Deductions
3. Multiply by Degree of Difficulty

Initial Score

Points or half points shall be awarded from 0 to 10 according to the opinion of the judges and the following table:

- Completely failed	0 points
- Unsatisfactory	½ to 2 points
- Deficient	2 ½ to 4 ½ points
- Satisfactory	5 to 6 points
- Good	6 ½ to 8 points
- Very Good	8 ½ to 9 points
- Excellent	9 to 10 points

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When scoring an aerial a judge must not be influenced by any factor other than the technique and execution of the aerial. The aerial is to be considered without regard to the difficulty of the maneuver, the track or the deployment of the canopy.

During the passage through the air the body can be carried straight (A), with pike (B), with tuck (C) or combination (D).

A. In the straight position the body shall not be bent, either at the knees or at the hips, the feet shall be together and the toes pointed. The position of the arms is optional.

B. In the pike position the body shall be bent at the hips, but the legs must be kept straight at the knees, the feet shall be together and the toes pointed. The position of the arms is optional.

C. In the tuck position the body shall be compact, bent at the knees and hips with the knees and feet together, hands on the lower legs and the toes pointed.

D. Combination. The body position is optional but should be aesthetically pleasing in order to score well The jumper may transition between straight, pike and tuck position during the aerial. (For example the first rotation is done in a tuck position and the second is done in a layout position).

E. Flying. In all flying dives a straight position shall be clearly shown for at least one quarter of a somersault (90°) and that position shall be assumed from the take off. When the straight position is not shown for at least one quarter of a somersault (90°) the maximum award shall be 4 1/2 points.

F. Box. In the box position the body is arched at the waist and chest and the legs are bent. The position of the arms is optional.

Deductions:

- Aerial other that the one announced (eg. Attempts a double reverse but looses orientation and does a triple by mistake). Up to 10 points at the judge's discretion (declared a failed aerial). This forces the jumper to plan an aerial rather than "throw something out there and see what happens".

- When a jumper clearly makes another position than that announced (eg. Performs a rotation in a pike position when they announced a straight position). Up to 4 points at the judge's discretion. This is required because, for example, a rotation in a straight position has a higher degree of difficulty than a rotation with a pike. The jumper can elect the Combination position (D) to avoid this penalty.

- The jumper deviates from being in a stable position for commencing tracking at the 4 second mark or performs a poor track or deploys dangerously close to the object. Up to 10 points deducted at the judge's discretion dependent on the perceived level of safety violation.

Degree of Difficulty (DD)

The Degree of Difficulty formula for 4 seconds of working time will be applied to each nominated jump.

Examples:

1. Jumper exits flat and stable in a straight position. Demonstrations absolute perfect form during the freefall. Is transitioning to track cleanly at the 4 second mark.

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Mark out of 10: 10
Deductions: 0
Degree of difficulty: 1.2
Final score: 12

2. Jumper performs a Reverse somersault (gainer) in layout position. Body position is ugly during the rotation. Over-rotates and is head high at the 4 second mark making track slow to get moving but still achieves safe clearance from the building for deployment.

Mark out of 10: 5
Deductions: 2
Degree of difficulty: 1.6
Final score (5-2)*1.6 = 4.8

3. Jumper nominates a Double Reverse somersault in pike position. Jump is well performed but legs bent during second rotation – closer to a tuck rather than the pike position.

Mark out of 10: 7
Deductions: 2.5 (nominated body position)
Degree of difficulty: 2.0
Final score (7-2.5) * 1.9 = 8.55

Judging Scoresheet Example:

Jumper	**Score /10**	Deductions				Degree of difficulty	TOTAL (Score – Deductions) * DD
		Nominated Aerial not completed	Nominated Body position not performed	Safety Violation	**Total Ded.**		
#42	8		1	1	2	2.2	**13.2**
#43	5				0	1.8	**9.0**
#44	10				0	1.0	**10.0**
#45	9			2	2	2.0	**14.0**
#46	7				0	2.4	**16.8**
#47	6	5			5	2.8	**2.8**
#48	4		1	10	10	1.6	**0**

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Degree of Difficulty Tables

4 SECONDS WORKING TIME

FORMULA AND COMPONENTS
Note: Degree of Difficulty is Calculated by Adding A + B + C + D + E

A, **B** and **C** address rotations in all three dimensions.
D addresses the body position(s) held during the rotations.
E addresses the difficulty of stabilizing out of the aerial at the 4 second mark.

A: SOMERSAULTS
Difficulty of performing rotations
Note: Number of somersaults is from exit position to line stretch. Half rotations are only performed from an armstand exit.

Number of somersaults	0	½	1	1 ½	2	2 ½	3	3 ½	4	4 ½	5	5 ½	6
4 seconds	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.2

B: TWISTS
Difficulty of performing twists.

	1/2 twist 0 - 1 somersault, or 0 – 180 deg turn	1/2 twist > 1 somersault, or > 180 deg turn	1	1 ½	2	2 ½	3	3 ½	4	4 ½	5
4 seconds	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2

C: TURN
Difficulty of performing flat turns

Degree of turn	0	90	180	270	360	450	540	630	720	810	900	990	1080
4 seconds	0	0.4	0.7	1.1	1.3	1.5	1.7	2.1	2.3	2.4	2.6	2.8	3.0

D: FLIGHT POSITION.
Difficulty of performing rotations or turns in various body positions.
Note: Non somersaulting floater exits (side and full) will be scored as Fwd (as the body rotates 90 forward to the flat position).
Key: Fwd = Forward Somersault. Back = Backward Somersault. Rev = Reverse Somersault.
Inw = Inward Somersault. Arm = Armstand exit

4 seconds	0 – 1 SOMERSAULT or 0 – 180 deg turn					1½ - 3 SOMERSAULTS or 270 – 540 deg turn					3½ – 4 ½ SOMERSAULTS or 630 – 810 deg turn					5 – 6 SOMERSAULTS or 900 – 1080 deg turn				
	Fwd	Back	Rev	Inw	Arm	Fwd	Back	Rev	Inw	Arm	Fwd	Back	Rev	Inw	Arm	Fwd	Back	Rev	Inw	Arm
C – Tuck	0	0	0	0	0	0	0	0	0.1	0	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.2
B – Pike	0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.5	0.4
A – Straight	0.2	0.2	0.3	0.4	0.3	0.3	0.3	0.4	0.5	0.4	0.4	0.4	0.5	0.6	0.4	0.5	0.5	0.6	0.7	0.5
D – Com	0	0	0	0.1	0	0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.2	0.2	0.4	0.2
E – Fly	0.1	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.4	0.3	0.3	0.3	0.3	0.5	0.4	0.4	0.4	0.4	0.6	0.5
F – Box	0	0	0	0.1	0	0	0.1	0.1	0.2	0	0.1	0.1	0.1	0.3	0.1	0.2	0.2	0.2	0.4	0.2

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E: ROTATION DIRECTION ON AERIAL COMPLETION
Difficulty of stabilizing out of rotation and commencing tracking or deploying at the 4 second mark.
Note: The largest value of 1, 2 or 3 will be applied to the formula.

1. **Somersault Direction on Final Rotation**

Number of Somersaults	½	1.0	1 ½	2.0	2 ½	3.0	3 ½	4.0	4 ½	5.0	5 ½	6.0
Forward Rotation (4 seconds)	0	0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3
Backward Rotation (4 seconds)	0	0	0	0	0	0.1	0.1	0.1	0.2	0.2	0.2	0.2

OR

2. **Amount of Turn**

Degree of turn	90	180	270	360	450	540	630	720	810	900	990	1080
4 seconds	0	0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3

OR

3. **Twisting on Final Rotation or Turn**

Total number of twists	½	1.0	1 ½	2.0	2 ½	3.0	3 ½	4.0	4 ½	5.0
4 seconds	0	0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3

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