Full 2 2-Cycle Wing Edge Last Layer (22WELL)
By: **Christopher Mowla**

Notes:

- This is a collection of algorithms for all 58 2 2-cycle cases which can occur in the last layer.
  - **Mirror cases are coupled together.**

- For clarity, 5x5x5 permutation images were used to present the permutation cases.
- At least one algorithm is provided for each of the cases.
  - All algorithm's inverses solve/generate the same cases.

  - Every case has an algorithm which works on all size cubes.
    - Every algorithm in this document which is supercube safe (with the exception of 4x4x4 (only) algorithms for the first two cases) IS translatable to the nxnxn.

  - Every case has a pure (supercube safe) solution under it (marked as "//Safe").

  - Every algorithm has an ordered pair (block quarter turns, block half turns) signifying how long the algorithm is for direct translations to the nxnxn cube (should it be translatable to the nxnxn).
    - In other words, some of the algorithms are technically shorter for the 4x4x4 and/or 5x5x5 cubes.
    - Algorithms with lowest block half turns (also called btm) are listed first.

  - Most algorithms have an author attributed to them. Every algorithm listed could have been found independently by several authors, but the listed authors are the original (to the best of my knowledge).

- Not all algorithms work on every size cube.
  - If an algorithm has an "[4]" in the right-most column, **it only works on the 4x4x4 cube**.
  - If an algorithm has an "[E]" in the right-most column, it works on all *even* size cubes (with proportional layer translation).
  - **If an algorithm has neither of the above in the right-most column, it works on ALL size cubes and is linked to an online 5x5x5 cube animation. Otherwise it is linked to an online 4x4x4 cube animation.**
- A huge portion of the algorithms I created are just conjugates of l2 or r2.
  - In my opinion, these algorithms are even easier to understand than commutators which can solve the same case.
- **<u>This collection of algorithms is by no means complete</u>** in any way as far as the "best" algorithms that could exist (with further exploration), whether referring to having a low move count or being speed optimal.
  - There are probably many algorithms to be found by various methods, **including 2 gen <U,r> algorithms**.
- The attributed algorithm authors "André Boulouard et al." in full is:
  Werner Randelshofer,
  ## Walter Randelshofer,
  ### and André Boulouard.
- Last but not least, special thanks go to Walter Randelshofer for catching some errors.

Date: **January 11, 2012**   *(Last modified on February 23, 2018.)*   →See My **4-cycles** PDF as well!

Symmetric Cases
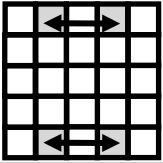
| Algorithm			Count	Author	Ref
F M' F' M' U2 F2 (M F')2 U2	SSE	SiGN	(14,11)	André Boulouard	[4]
L F' U L' S' L U' F L' U S U'//Safe	SSE	SiGN	(12,12)	André Boulouard	[4]
F U' R F' U M U' F R' U F' M'//Safe	SSE	SiGN	(12,12)	Walter Randelshofer	[4]
U' F R' U F' M F U' R F' U M'//Safe	SSE	SiGN	(12,12)	Per Kristen Fredlund	[4]
r U2 r2 F2 l D2 l D2 l2 F2 r U2//Safe	SSE	SiGN	(20,12)		
l' U2 l2 F2 r' D2 r' D2 r2 F2 l' U2//Safe	SSE	SiGN	(20,12)		
r U2 r2 F2 l D2 r' D2 r2 F2 l' U2//Safe	SSE	SiGN	(20,12)		
l' U2 l2 F2 r' D2 l D2 l2 F2 r U2//Safe	SSE	SiGN	(20,12)		
r B2 l2 D2 l D2 l B2 r2 U2 r U2//Safe	SSE	SiGN	(20,12)		
l' B2 r2 D2 r' D2 r' B2 l2 U2 l' U2//Safe	SSE	SiGN	(20,12)		
r B2 l2 D2 l D2 r' B2 l2 U2 l' U2//Safe	SSE	SiGN	(20,12)		
l' B2 r2 D2 r' D2 l B2 r2 U2 r U2//Safe	SSE	SiGN	(20,12)		
r' U2 r2 B2 l' D2 l' D2 l2 B2 r' U2//Safe	SSE	SiGN	(20,12)		
l U2 l2 B2 r D2 r D2 r2 B2 l U2//Safe	SSE	SiGN	(20,12)		
r' U2 r2 B2 l' D2 r D2 r2 B2 l U2//Safe	SSE	SiGN	(20,12)		
l U2 l2 B2 r D2 l' D2 l2 B2 r' U2//Safe	SSE	SiGN	(20,12)		
r' F2 l2 D2 l' D2 l' F2 r2 U2 r' U2//Safe	SSE	SiGN	(20,12)		
l F2 r2 D2 r D2 r F2 l2 U2 l U2//Safe	SSE	SiGN	(20,12)		
r' F2 l2 D2 l' D2 r F2 l2 U2 l U2//Safe	SSE	SiGN	(20,12)		
l F2 r2 D2 r D2 l' F2 r2 U2 r' U2//Safe	SSE	SiGN	(20,12)		
U2 r U2 r2 x U2 r U2 l U2 l' r' U2 r x'//Safe	SSE	SiGN	(20,13)		
F2 (r E' B2 E r l E' B2 E r2 l') F2//Safe	SSE	SiGN	(18,13)	André Boulouard	
F2 (r E F2 E' l r E F2 E' l' r2) F2//Safe	SSE	SiGN	(18,13)	Christopher Mowla	
L F' U L' b f' L U' F L' U b' f U'//Safe	SSE	SiGN	(14,14)	André Boulouard	
F U' R F' U l r' U' F R' U F' l' r//Safe	SSE	SiGN	(14,14)	Walter Randelshofer	
U' F R' U F' r' l F U' R F' U r l'//Safe	SSE	SiGN	(14,14)	Per Kristen Fredlund	
(l r') U' F R' U F' (l' r) F U' R F' U//Safe	SSE	SiGN	(14,14)		
r U2 l' r' U2 r U2 r' U2 l r U2 r' U2//Safe	SSE	SiGN	(20,14)	Kenneth Gustavsson	
F l' r F' l' r U2 F2 (l r' F')2 U2	SSE	SiGN	(18,15)	André Boulouard	
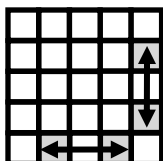
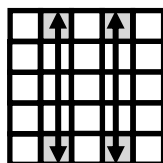| Algorithm					
R E R2 E2 R U' R' E2 R2 E' R' U//Safe	SSE	SiGN	(16,12)	Jessica Fridrich	[4]
F' R' E R F' U R' F E' F' R U' F2//Safe	SSE	SiGN	(14,13)	Walter Randelshofer	[4]
F' R' U F' (l' r) F U' R F' U (l r') U' F2//Safe	SSE	SiGN	(16,15)		
(R F') d M B2 M' u d M B2 M' u' d2 (F R')//Safe	SSE	SiGN	(18,15)	Per Kristen Fredlund	
x Rw U2 r2 U2 Rw' U R' U' Rw U2 r2 U2 Rw' U R U' x'//Safe	SSE	SiGN	(21,16)	Christopher Mowla	
z' U (l' r) U2 (l2 r2) U L' U' (l2 r2) U2 (l r') U' L z//Safe	SSE	SiGN	(22,16)	Jessica Fridrich	
r' D2 l2 D2 r F R' F' r' D2 l2 D2 r F R F'//Safe	SSE	SiGN	(22,16)	Per Kristen Fredlund	
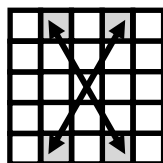
Algorithm					
r2 U2 r2 Uw2 r2 u2	SSE	SiGN	(12,6)	Chris Hardwick	[E]
(Uw2 Rw2 U2) r2 (U2 Rw2 Uw2)	SSE	SiGN	(14,7)	Stefan Pochmann	[E]
(Rw2 F2 U2) r2 (U2 F2 Rw2)	SSE	SiGN	(14,7)	Stefan Pochmann	
Rw2 (U2 r U2 S2)2 Rw2//Safe	SSE	SiGN	(18,10)	Walter Randelshofer	
(y Rw2 U2) Rw U2 Rw2 U2 Rw2 U2 Rw (U2 Rw2 y')	SSE	SiGN	(20,11)		[4]
(y Rw2 U2) Rw' U2 Rw2 U2 Rw2 U2 Rw' (U2 Rw2 y')	SSE	SiGN	(20,11)		[4]
(Rw2 U2) (E r2 E' r)2 (U2 Rw2)//Safe	SSE	SiGN	(15,12)	André Boulouard et al.	
(Rw2 U2) (E' r2 E r)2 (U2 Rw2)//Safe	SSE	SiGN	(15,12)	André Boulouard et al.	
(Rw2 U2) (E r2 E' r')2 (U2 Rw2)//Safe	SSE	SiGN	(15,12)	André Boulouard et al.	
(Rw2 U2) (E' r2 E r')2 (U2 Rw2)//Safe	SSE	SiGN	(15,12)	André Boulouard et al.	
r2 U2 B2 l r U2 (l' r) U2 r2 B2 U2//Safe	SSE	SiGN	(20,12)	Stefan Pochmann	
r2 U2 r U2 r2 U2 r2 U2 r U2 r2 U2//Safe	SSE	SiGN	(22,12)		
r' F U' R F' U l r U' F R' U F' l'//Safe	SSE	SiGN	(14,14)		
(Rw2 U2)(r E2)6 (U2 Rw2)//Safe	SSE	SiGN	(24,15)	Christopher Mowla	
(Rw2 U2)(r' E2)6 (U2 Rw2)//Safe	SSE	SiGN	(24,15)	Christopher Mowla	
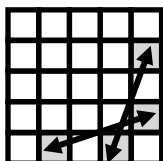
Algorithm					
(R2 D' x) r2 U2 r2 Uw2 r2 u2 (x' D R2)	SSE SiGN	(18,10)	Chris Hardwick	[E]
(R2 D' x Rw2 F2 U2) r2 (U2 F2 Rw2 x' D R2)	SSE SiGN	(20,11)	Stefan Pochmann	
(F2 U Rw2 U2 F2) r2 (F2 U2 Rw2 U' F2)	SSE SiGN	(20,11)	Stefan Pochmann	
(F U' F') r2 U2 r2 Uw2 r2 u2 (F U F')	SSE SiGN	(18,12)	Chris Hardwick	[E]
(F U' F' Rw2 F2 U2) r2 (U2 F2 Rw2 F U F')	SSE SiGN	(20,13)	Stefan Pochmann	
(y' R' F) l E F2 E' l' r' E F2 E' r (F' R y)//Safe	SSE SiGN	(16,14)	Christopher Mowla	
(y' R' F) l E' F2 E l' r' E' F2 E r (F' R y)//Safe	SSE SiGN	(16,14)	Christopher Mowla	
(R B') r' S' U2 S r l S' U2 S l' (B R')//Safe	SSE SiGN	(16,14)	Walter Randelshofer	
(R B') r' S U2 S' r l S U2 S' l' (B R')//Safe	SSE SiGN	(16,14)	Walter Randelshofer	
(Rw' U R U Lw' U2 Rw' U2) r2 (U2 Rw U2 Lw U' R' U' Rw)	SSE SiGN	(22,17)	Christopher Mowla	

Algorithm				
F2 l E F2 E' l' r' E F2 E' r F2//Safe	SSE SiGN	(16,12)	Christopher Mowla
F2 l E' F2 E l' r' E' F2 E r F2//Safe	SSE SiGN	(16,12)	Christopher Mowla
F2 l' S U2 S' r l S U2 S' r' F2//Safe	SSE SiGN	(16,12)	Walter Randelshofer
F2 l' S' U2 S r l S' U2 S r' F2//Safe	SSE SiGN	(16,12)	Walter Randelshofer
(y' R' F U' Rw2 U2 F2) r2 (F2 U2 Rw2 U F' R y)	SSE SiGN	(20,13)	Stefan Pochmann
(y R' U F' Rw2 F2 U2) r2 (U2 F2 Rw2 F U' R y')	SSE SiGN	(20,13)	Stefan Pochmann
r U2 l D2 l' U2 (l r') U2 r D2 r' U2 l'//Safe	SSE SiGN	(20,14)	Kenneth Gustavsson
(F r U' R U' Lw U2 Rw U2) r2 (U2 Rw' U2 Lw' U R' U r' F')	SSE SiGN	(24,19)	Christopher Mowla
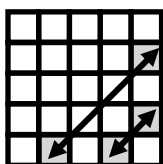
| Algorithm				
(R B) r2 U2 r2 Uw2 r2 u2 (B' R')	SSE SiGN	(16,10)	Chris Hardwick	[E]
(R x' U Rw2 U2 F2) r2 (F2 U2 Rw2 U' x R')	SSE SiGN	(20,11)	Stefan Pochmann
F' R d2 R' F U F' U2 R d2 R' U2 F U'//Safe	SSE SiGN	(16,14)	Per Kristen Fredlund
R' U2 B u2 B' U2 R U' R' B u2 B' R U//Safe	SSE SiGN	(16,14)	Walter Randelshofer
(R2 D) l' E F2 E' r l E F2 E' r' (D' R2)//Safe	SSE SiGN	(16,14)	Per Kristen Fredlund
R B U2 r2 U2 B2 l r U2 (l' r) U2 r2 B R'//Safe	SSE SiGN	(22,15)	Stefan Pochmann

Symmetric Cases
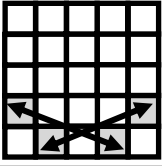
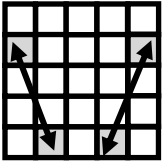|			
(r2 B2 U l2 U') l2 (U l2 U' B2 r2)	SSE SiGN	(18,11)	Christopher Mowla
(l2 B2 U' r2 U) r2 (U' r2 U B2 l2)	SSE SiGN	(18,11)	Christopher Mowla
(r2 F2) (D' y') r' E' r2 E r' E' r2 U (F2 r2)//Safe	SSE SiGN	(19,13)	Per Kristen Fredlund
f U' R' d' R U R' d F R f' R' F' R//Safe	SSE SiGN	(14,14)	Walter Randelshofer
r' L F' L' D' f' D L F L' D' f D r//Safe	SSE SiGN	(14,14)	André Boulouard et al.
r' U' r U' r U r2 U r U' r U' r' U2	SSE SiGN	(16,14)	Kenneth Gustavsson
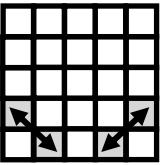
|			
(r2 U2 F M' U) r2 (U' M F' U2 r2)	SSE SiGN	(16,11)	Christopher Mowla
(l2 U2 F' M' U') l2 (U M F U2 l2)	SSE SiGN	(16,11)	Christopher Mowla
L' F u2 F' L U L' F u2 F' L U'//Safe	SSE SiGN	(14,12)	Thom Barlow
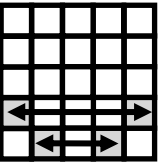
|				
(y' r2 U' Bw2 r E B2) r2 (B2 E' r' Bw2 U r2 y)	SSE SiGN	(20,13)	Christopher Mowla	
(y' r2 U' Bw2 r E' B2) r2 (B2 E r' Bw2 U r2 y)	SSE SiGN	(20,13)	Christopher Mowla	
(y l2 U' Bw2 r E F2) r2 (F2 E' r' Bw2 U l2 y')	SSE SiGN	(20,13)	Christopher Mowla	
(y l2 U' Bw2 r E' F2) r2 (F2 E r' Bw2 U l2 y')	SSE SiGN	(20,13)	Christopher Mowla	
r2 R B R' f2 R F R' f' R F' B' R' f' r2//Safe	SSE SiGN	(18,15)	Walter Randelshofer	
(x' r2 U x' U R F L2 U) l2 (U' L2 F' R' U' x U' r2 x)	SSE SiGN	(20,15)	Christopher Mowla	
(x' l2 U' x' U' L' F' R2 U') r2 (U R2 F L U x U l2 x)	SSE SiGN	(20,15)	Christopher Mowla	
F2 R2 Bw2 F' U' F2 U L F U L2 U' L Bw2 R2	SSE SiGN	(21,15)	Tom Rokicki	[4]
(r L2 y') r D2 r' l' U' l r D2 r' l' U l (y L2 r')//Safe	SSE SiGN	(20,16)	Thom Barlow	
Rw F2 r2 F L F' U R' U' r2 U R U' F L' F Rw'//Safe	SSE SiGN	(20,17)	Christopher Mowla	
Rw' U2 r2 U R U' Rw U' R' U r2 U' R U Rw' U R' U Rw	SSE SiGN	(22,19)	Christopher Mowla	

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| Algorithm			Metric	Author
(r2 B2 U' l2 U) l2 (U' l2 U B2 r2)	SSE	SiGN	(18,11)	Christopher Mowla
l2 F2 (D' y') l' E' l2 E l' E' l2 U F2 l2//Safe	SSE	SiGN	(19,13)	Per Kristen Fredlund
l D' b D L F' L' D' b' D L F L' l'//Safe	SSE	SiGN	(14,14)	André Boulouard et al.
r' U r U r U' r2 U' r U r U r' U2	SSE	SiGN	(16,14)	Kenneth Gustavsson
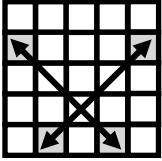
Algorithm			Metric	Author
(r2 U2 F' M' U') r2 (U M F U2 r2)	SSE	SiGN	(16,11)	Christopher Mowla
L' F d2 F' L U L' F d2 F' L U'//Safe	SSE	SiGN	(14,12)	Thom Barlow
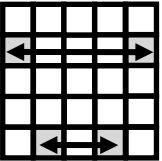
Algorithm			Metric	Author
(y' Rw2 U Bw2 r E B2) r2 (B2 E' r' Bw2 U' Rw2 y)	SSE	SiGN	(20,13)	Christopher Mowla
(y' Rw2 U Bw2 r E' B2) r2 (B2 E r' Bw2 U' Rw2 y)	SSE	SiGN	(20,13)	Christopher Mowla
(y l2 U Bw2 r E F2) r2 (F2 E' r' Bw2 U' l2 y')	SSE	SiGN	(20,13)	Christopher Mowla
(y l2 U Bw2 r E' F2) r2 (F2 E r' Bw2 U' l2 y')	SSE	SiGN	(20,13)	Christopher Mowla
(x r2 U F L U R2 F) l2 (F' R2 U' L' F' U' r2 x')	SSE	SiGN	(20,15)	Christopher Mowla
(L l) F L' F D' b D F' L' F' L' D' b' D l'//Safe	SSE	SiGN	(16,16)	Walter Randelshofer
(l L2 y') r D2 r' l' U' l r D2 r' l' U l (y L2 l')//Safe	SSE	SiGN	(20,16)	Thom Barlow
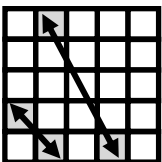
| Algorithm			Metric	Author
(Rw2 F2 U2 x' U' R U) r2 (U' R' U x U2 F2 Rw2)	SSE	SiGN	(20,13)	Christopher Mowla
B' (R' U' R F' u2 F R' U R F' u2 F) B//Safe	SSE	SiGN	(16,14)	Walter Randelshofer
(Rw2 y') L2 U' r' (E y) r2 D L2 D' r2 (y' E') r U (y Rw2)//Safe	SSE	SiGN	(20,14)	André Boulouard et al.
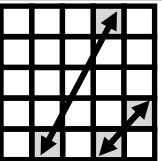
| Algorithm			Metric	Author
(Lw2 F2 U2 x' U L' U') l2 (U L U' x U2 F2 Lw2)	SSE	SiGN	(20,13)	Christopher Mowla
B (F u2 F' L U L' F u2 F' L U' L') B'//Safe	SSE	SiGN	(16,14)	Walter Randelshofer
(Lw2 y) R2 U l (E' y') l2 D' R2 D l2 (y E) l' U' (y' Lw2)//Safe	SSE	SiGN	(20,14)	André Boulouard et al.

Asymmetric Cases (with diagonal)
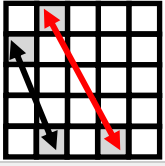
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(Rw2 U' F2 U') r2 (U F2 U Rw2)	SSE SiGN	(14,9)	Christopher Mowla
(Rw2 F2 L' U L U) r2 (U' L' U' L F2 Rw2)	SSE SiGN	(18,13)	Christopher Mowla
B L' B' U2 l' D' l U2 l' D B L B' l//Safe	SSE SiGN	(16,14)	Walter Randelshofer
B2 r2 D F' L F D' r2 D F' L' F D' B2//Safe	SSE SiGN	(18,14)	André Boulouard et al.
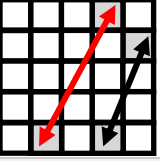
|			
(Lw2 U F2 U) l2 (U' F2 U' Lw2)	SSE SiGN	(14,9)	Christopher Mowla
(Lw2 F2 R U' R' U') l2 (U R U R' F2 Lw2)	SSE SiGN	(18,13)	Christopher Mowla
r B' R B D r' U2 r D' r' U2 B' R' B//Safe	SSE SiGN	(16,14)	Walter Randelshofer
B2 l2 D' F R' F' D l2 D' F R F' D B2//Safe	SSE SiGN	(18,14)	André Boulouard et al.
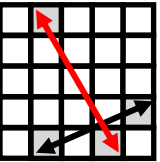
|			
(r2 U F2 U) r2 (U' F2 U' r2)	SSE SiGN	(14,9)	Christopher Mowla
(Lw2 F2 R' U R U) l2 (U' R' U' R F2 Lw2)	SSE SiGN	(18,13)	Christopher Mowla
B' R B U2 l' D l U2 l' D' B' R' B l//Safe	SSE SiGN	(16,14)	Walter Randelshofer
B2 r2 D' F R' F' D r2 D' F R F' D B2//Safe	SSE SiGN	(18,14)	André Boulouard et al.
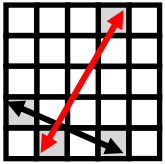
|			
(l2 U' F2 U') l2 (U F2 U l2)	SSE SiGN	(14,9)	Christopher Mowla
(Rw2 F2 L U' L' U') r2 (U L U L' F2 Rw2)	SSE SiGN	(18,13)	Christopher Mowla
r B L' B' D' r' U2 r D r' U2 B L B'//Safe	SSE SiGN	(16,14)	Walter Randelshofer
B2 l2 D F' L F D' l2 D F' L' F D' B2//Safe	SSE SiGN	(18,14)	André Boulouard et al.
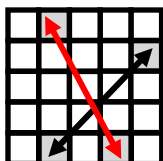
Algorithm				Author	
(x Rw2 U' R U' F2) l2 (F2 U R' U Rw2 x')	SSE	SiGN	(16,11)	Christopher Mowla	
B (F d2 F' L U L' F d2 F' L U' L') B'//Safe	SSE	SiGN	(16,14)	Walter Randelshofer	
r2 B2 (D y) r2 E b' U' B2 U b E' r2 (y' D') r2//Safe	SSE	SiGN	(20,14)	André Boulouard et al.	
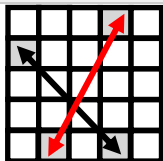
Algorithm				Author	
(x Lw2 U L' U F2) r2 (F2 U' L U' Lw2 x')	SSE	SiGN	(16,11)	Christopher Mowla	
B' (R' U' R F' d2 F R' U R F' d2 F) B//Safe	SSE	SiGN	(16,14)	Walter Randelshofer	
l2 B2 (D' y') l2 E' b U B2 U' b' E l2 (y D) l2//Safe	SSE	SiGN	(20,14)	André Boulouard et al.	
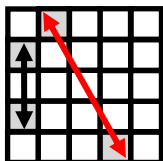
| Algorithm				Author	
y r' U l' r' D2 l r U' r' l' D2 l r2 y'//Safe	SSE	SiGN	(16,13)	Thom Barlow	
y' l' U' l' r' U2 l r U r' l' U2 l2 r y	SSE	SiGN	(16,13)	Thom Barlow	[4]
F' (B' b') u2 F B U' F' B' u2 F B U b//Safe	SSE	SiGN	(16,14)	Walter Randelshofer	
(x' l' U L' U' Lw' U2 F2) l2 (F2 U2 Lw U L U' l x)	SSE	SiGN	(20,15)	Christopher Mowla	
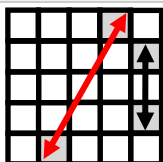
| Algorithm				Author	
y' l U' l r D2 l' r' U l r D2 l2 r' y//Safe	SSE	SiGN	(16,13)	Thom Barlow	
y r U l r U2 l' r' U' l r U2 l' r2 y'	SSE	SiGN	(16,13)	Thom Barlow	[4]
F (B b) u2 F' B' U F B u2 F' B' U' b'//Safe	SSE	SiGN	(16,14)	Walter Randelshofer	
(x' r U' R U Rw U2 F2) r2 (F2 U2 Rw' U' R' U r' x)	SSE	SiGN	(20,15)	Christopher Mowla	

Asymmetric Cases (with opposite)
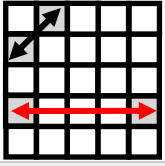

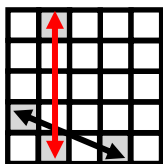|			
(L F r2 U F2 U) r2 (U' F2 U' r2 F' L')	SSE SiGN	(18,13)	Christopher Mowla
Bw2 U' r U B R' B' U' r' U B R B' Bw2//Safe	SSE SiGN	(15,14)	André Boulouard et al.
R B' R' f U2 R u' R' U2 R u B R' f'//Safe	SSE SiGN	(16,14)	Walter Randelshofer
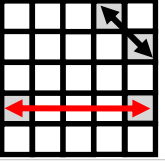
|			
(R' F' l2 U' F2 U') l2 (U F2 U l2 F R)	SSE SiGN	(18,13)	Christopher Mowla
Bw2 U l' U' B' L B U l U' B' L' B Bw2//Safe	SSE SiGN	(15,14)	André Boulouard et al.
L' B L f' U2 L' u L U2 L' u' B' L f//Safe	SSE SiGN	(16,14)	Walter Randelshofer
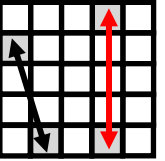
|			
(B Rw2 U' F2 L U') r2 (U L' F2 U Rw2 B')	SSE SiGN	(18,13)	Christopher Mowla
(B Rw2 U' L F2 U') r2 (U F2 L' U Rw2 B')	SSE SiGN	(18,13)	Christopher Mowla
Rw L B u' B' L' U L B u B' L' U' Rw'//Safe	SSE SiGN	(14,14)	André Boulouard et al.
(F2 U' l' r' U' F2 U') r2 (U F2 U r l U F2)	SSE SiGN	(20,15)	Christopher Mowla
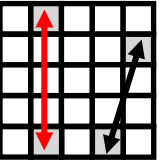
|			
(B' Lw2 U F2 R' U) l2 (U' R F2 U' Lw2 B)	SSE SiGN	(18,13)	Christopher Mowla
(B' Lw2 U R' F2 U) l2 (U' F2 R U' Lw2 B)	SSE SiGN	(18,13)	Christopher Mowla
Lw' R' B' u B R U' R' B' u' B R U Lw//Safe	SSE SiGN	(14,14)	André Boulouard et al.
(F2 U l r U F2 U) l2 (U' F2 U' r' l' U' F2)	SSE SiGN	(20,15)	Christopher Mowla

(l2 U' F L' F U') l2 (U F' L F' U l2)	SSE SiGN	(16,13)	Christopher Mowla
l' U L B d B' L' U' L B d' B' L' l//Safe	SSE SiGN	(14,14)	André Boulouard et al.
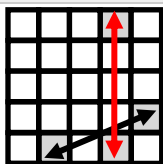
|			
(r2 U F' R F' U) r2 (U' F R' F U' r2)	SSE SiGN	(16,13)	Christopher Mowla
r U' R' B' d' B R U R' B' d B R r'//Safe	SSE SiGN	(14,14)	André Boulouard et al.
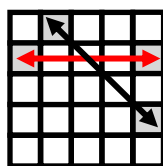
|			
(R' F' Rw2 U' F2 U') r2 (U F2 U Rw2 F R)	SSE SiGN	(18,13)	Christopher Mowla
L' B L b U2 L' d' L U2 L' d B' L b'//Safe	SSE SiGN	(16,14)	Walter Randelshofer
b2 B' R B D l D' B' R' B D l' D' b2//Safe	SSE SiGN	(16,14)	André Boulouard et al.
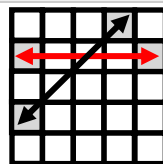
|			
(L F Lw2 U F2 U) l2 (U' F2 U' Lw2 F' L')	SSE SiGN	(18,13)	Christopher Mowla
R B' R' b' U2 R d R' U2 R d' B R' b//Safe	SSE SiGN	(16,14)	Walter Randelshofer
b2 B L' B' D' r' D B L B' D' r D b2//Safe	SSE SiGN	(16,14)	André Boulouard et al.

Asymmetric Cases (with "edge flip")
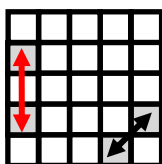
|				
(Uw2 Fw D2 R' B' L) u2 (L' B R D2 Fw' Uw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Dw2 Bw D2 L' F' R) u2 (R' F L D2 Bw' Dw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Uw2 Bw R2 U' B' D) l2 (D' B U R2 Bw' Uw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Dw2 Fw L2 U' F' D) r2 (D' F U L2 Fw' Dw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Dw2 f D F2 U' F2) r2 (F2 U F2 D' f' Dw2)	SSE SiGN	(20,13)	Ed Trice	[E]
b (D' r2 E' f' U B2 U' f E r2 D L2) b'//Safe	SSE SiGN	(16,14)	Walter Randelshofer	
Bw L2 U' r' (E y) r2 D L2 D' r2 (y' E') r U Bw'//Safe	SSE SiGN	(18,14)	André Boulouard et al.	
F2 U' l' r' U F' L U' F l r F' U L' F'//Safe	SSE SiGN	(16,15)	Christopher Mowla	
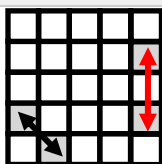
|				
(Uw2 Fw' D2 L B R') u2 (R B' L' D2 Fw Uw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Dw2 Bw' D2 R F L') u2 (L F' R' D2 Bw Dw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Uw2 Bw' L2 U B D') r2 (D B' U' L2 Bw Uw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Dw2 Fw' R2 U F D') l2 (D F' U' R2 Fw Dw2)	SSE SiGN	(18,13)	Tom Rokicki	[E]
(Dw2 f' D' F2 U F2) l2 (F2 U' F2 D f Dw2)	SSE SiGN	(20,13)	Ed Trice	[E]
b' (U l E' b2 D' F2 D b2 E l' U' R2) b//Safe	SSE SiGN	(16,14)	Walter Randelshofer	
Bw' R2 U l (E' y') l2 D' R2 D l2 (y E) l' U' Bw//Safe	SSE SiGN	(18,14)	André Boulouard et al.	
F2 U l r U' F R' U F' l' r' F U' R F//Safe	SSE SiGN	(16,15)	Christopher Mowla	
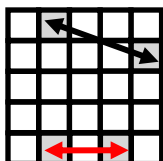
Algorithm			Metrics	Author	
(r2 b U r D l') b2 (l D' r' U' b' r2)	SSE	SiGN	(16,13)	Ed Trice	[4]
(Dw2 r' U' B2 D' r') f2 (r D B2 U r Dw2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(Dw2 b' U' b' l' D2) f2 (D2 l b U b Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Dw2 b' U' b' l D2) f2 (D2 l' b U b Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Rw2 U L B' Rw Bw2) u2 (Bw2 Rw' B L' U' Rw2)	SSE	SiGN	(18,13)	Tom Rokicki	[E]
r' (U b E' r' D' L2 D r E b' U' F2) r//Safe	SSE	SiGN	(16,14)	Walter Randelshofer	
(r2 U' B2 U' x U L U') r2 (U L' U' x' U B2 U r2)	SSE	SiGN	(20,15)	Christopher Mowla	
y r' F' L U' F l r F' U L' F U' l' r' U r y'//Safe	SSE	SiGN	(16,16)	Christopher Mowla	
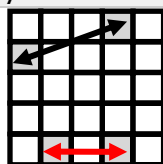
| Algorithm			Metrics	Author	
(l2 b' U' l' D' r) b2 (r' D l U b l2)	SSE	SiGN	(16,13)	Ed Trice	[4]
(Dw2 l U B2 D l) f2 (l' D' B2 U' l' Dw2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(Dw2 b U b r D2) f2 (D2 r' b' U' b' Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Dw2 b U b r' D2) f2 (D2 r b' U' b' Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Lw2 U' R' B Lw' Bw2) u2 (Bw2 Lw B' R U Lw2)	SSE	SiGN	(18,13)	Tom Rokicki	[E]
l (D' b E' r' U L2 U' r E b' D F2) l'//Safe	SSE	SiGN	(16,14)	Walter Randelshofer	
(l2 U B2 U x U' R' U) l2 (U' R U x' U' B2 U' l2)	SSE	SiGN	(20,15)	Christopher Mowla	
y' l F R' U F' l' r' F U' R F' U l r U' l' y//Safe	SSE	SiGN	(16,16)	Christopher Mowla	
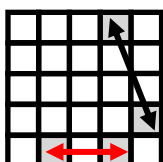
Algorithm			Metrics	Author	
(Dw2 l U' B2 D' l) b2 (l' D B2 U l' Dw2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(Uw2 Lw B' Rw2 u2 B) l2 (B' u2 Rw2 B Lw' Uw2)	SSE	SiGN	(18,13)	Tom Rokicki	[4]
(Dw2 f U' f r D2) b2 (D2 r' f' U f' Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Dw2 f U' f r' D2) b2 (D2 r f' U f' Dw2)	SSE	SiGN	(20,13)	Ed Trice	[E]
(Lw y') R2 D r (E y) r' U' R2 U r (y' E') r' D' (y Lw')//Safe	SSE	SiGN	(16,14)	André Boulouard et al.	
(Lw2 U' B2 U' F L F') l2 (F L' F' U B2 U Lw2)	SSE	SiGN	(20,15)	Christopher Mowla	
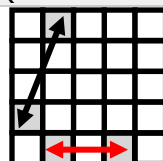
| Algorithm			Metrics	Author	
(Dw2 r' U B2 D r') b2 (r D' B2 U' r Dw2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(Dw2 f' U f' l' D2) b2 (D2 l f U' f Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Dw2 f' U f' l D2) b2 (D2 l' f U' f Dw2)	SSE	SiGN	(18,13)	Ed Trice	[E]
(Uw2 Rw' B Lw2 u2 B') r2 (B u2 Lw2 B' Rw Uw2)	SSE	SiGN	(20,13)	Tom Rokicki	[4]
(Rw' y) L2 D' l' (E' y') l U L2 U' l' (y E) l D (y' Rw)//Safe	SSE	SiGN	(16,14)	André Boulouard et al.	
(Rw2 U B2 U F' R' F) r2 (F' R F U' B2 U' Rw2)	SSE	SiGN	(20,15)	Christopher Mowla	
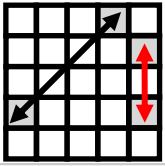
|				
(l2 f' L2 U R2 U') b2 (U R2 U' L2 f l2)	SSE SiGN	(20,13)	Ed Trice	[4]
(l2 f' L2 D B2 U') l2 (U B2 D' L2 f l2)	SSE SiGN	(20,13)	Ed Trice	[4]
(l2 f' U R2 U' L2) b2 (L2 U R2 U' f l2)	SSE SiGN	(20,13)	Ed Trice	[4]
(l2 f' U R2 D' B2) r2 (B2 D R2 U' f l2)	SSE SiGN	(20,13)	Ed Trice	[4]
(l2 f' U' b2 D' B2) r2 (B2 D b2 U f l2)	SSE SiGN	(20,13)	Ed Trice	[4]
(Dw2 f' D B2 U' B2) r2 (B2 U B2 D' f Dw2)	SSE SiGN	(20,13)	Ed Trice &Tom Rokicki	[E]
b' R2 D' r2 (y' E') r U R2 U' r' (E y) r2 D b//Safe	SSE SiGN	(18,14)	André Boulouard et al.	
b' (U' r E b2 D B2 D' b2 E' r' U R2) b//Safe	SSE SiGN	(18,14)	Walter Randelshofer	
r2 U l r U' F R' U F' l' r' F U' R F' r2//Safe	SSE SiGN	(18,16)	Christopher Mowla	
(B2 l' B M U' Lw' B2 D2) r2 (D2 B2 Lw U M' B' l B2)	SSE SiGN	(24,17)	Christopher Mowla	
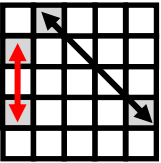
|				
(r2 f R2 U' L2 U) b2 (U' L2 U R2 f' r2)	SSE SiGN	(20,13)	Ed Trice	[4]
(r2 f R2 D' B2 U) r2 (U' B2 D R2 f' r2)	SSE SiGN	(20,13)	Ed Trice	[4]
(r2 f U' L2 U R2) b2 (R2 U' L2 U f' r2)	SSE SiGN	(20,13)	Ed Trice	[4]
(r2 f U' L2 D B2) l2 (B2 D' L2 U f' r2)	SSE SiGN	(20,13)	Ed Trice	[4]
(r2 f U b2 D B2) l2 (B2 D' b2 U' f' r2)	SSE SiGN	(20,13)	Ed Trice	[4]
(Dw2 f D' B2 U B2) l2 (B2 U' B2 D f' Dw2)	SSE SiGN	(20,13)	Ed Trice &Tom Rokicki	[E]
b L2 D l2 (y E) l' U' L2 U l (E' y') l2 D' b'//Safe	SSE SiGN	(18,14)	André Boulouard et al.	
b (D l2 E f' U' F2 U f E' l2 D' L2) b'//Safe	SSE SiGN	(18,14)	Walter Randelshofer	
l2 U' l' r' U F' L U' F l r F' U L' F l2//Safe	SSE SiGN	(18,16)	Christopher Mowla	
(B2 r B' M U Rw B2 D2) l2 (D2 B2 Rw' U' M' B r' B2)	SSE SiGN	(24,17)	Christopher Mowla	

# Asymmetric Cases (without a **diagonal**, an **opposite**, and an **"edge flip"**)
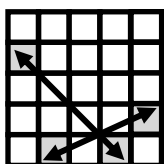
(L' B' r2 U F2 U) r2 (U' F2 U' r2 B L)	SSE SiGN	(18,13)	Christopher Mowla
r2 U b l D l' b' U' b l D' l' b' r2//Safe	SSE SiGN	(16,14)	André Boulouard et al.
(L' l') F d2 F' L U2 L' F d2 F' L U2 l//Safe	SSE SiGN	(18,14)	Walter Randelshofer
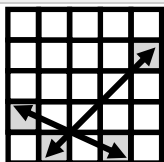
|			
(R B l2 U' F2 U') l2 (U F2 U l2 B' R')	SSE SiGN	(18,13)	Christopher Mowla
l2 U' b' r' D' r b U b' r' D r b l2//Safe	SSE SiGN	(16,14)	André Boulouard et al.
(R r) F' d2 F R' U2 R F' d2 F R' U2 r'//Safe	SSE SiGN	(18,14)	Walter Randelshofer
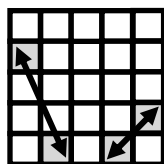
|			
(R B r2 U' F2 U') r2 (U F2 U r2 B' R')	SSE SiGN	(18,13)	Christopher Mowla
r2 U' l f D' f' l' U l f D f' l' r2//Safe	SSE SiGN	(16,14)	André Boulouard et al.
r2 (f l D' l' f' U' f l D l' f' U) r2//Safe	SSE SiGN	(16,14)	Walter Randelshofer
r2 (U' l f D' f' l' U l f D f' l') r2//Safe	SSE SiGN	(16,14)	Walter Randelshofer
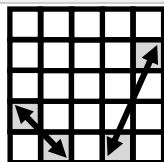
(L' B' l2 U F2 U) l2 (U' F2 U' l2 B L)	SSE SiGN	(18,13)	Christopher Mowla
l2 U r' f' D f r U' r' f' D' f r l2//Safe	SSE SiGN	(16,14)	André Boulouard et al.
l2 (f' r' D r f U f' r' D' r f U') l2//Safe	SSE SiGN	(16,14)	Walter Randelshofer
l2 (U r' f' D f r U' r' f' D' f r) l2//Safe	SSE SiGN	(16,14)	Walter Randelshofer

**Symmetric Cases (with All "Oriented" Wings)**
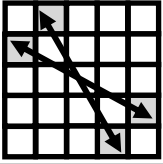
|				
(Rw2 U' R2 F2 U') r2 (U F2 R2 U Rw2)	SSE SiGN	(18,11)	Christopher Mowla	
(Rw2 U' F2 R2 U') r2 (U R2 F2 U Rw2)	SSE SiGN	(18,11)	Christopher Mowla	
(R' Rw2 U' F2 R' U') r2 (U R F2 U Rw2 R)	SSE SiGN	(18,13)	Christopher Mowla	
(L' r2 U F2 L U) r2 (U' L' F2 U' r2 L)	SSE SiGN	(18,13)	Christopher Mowla	
x' Rw2 u2 R' L' U L R u2 R' L' U' L R Rw2 x//Safe	SSE SiGN	(18,14)	André Boulouard et al.	
(R2 r2) b2 R' L' B R L b2 R' L' B' (L R') r2//Safe	SSE SiGN	(18,14)	Walter Randelshofer	
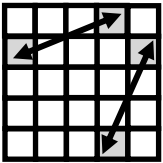
|				
(y r2 U') (E r2 E' r)2 (U r2 y')//Safe	SSE SiGN	(15,11)	André Boulouard et al.	
(Uw2 r2 U l2 U') l2 (U l2 U' r2 Uw2)	SSE SiGN	(18,11)	Christopher Mowla	[E]
r' F' R' U F r' F' U' R F U r U' r//Safe	SSE SiGN	(14,14)	André Boulouard et al.	
r2 D' R2 D U r' U' D' R2 U D r U' r2//Safe	SSE SiGN	(18,14)	Christopher Mowla	
B L F' L' (B b) l B' L B l' (F B') L' (B' b')//Safe	SSE SiGN	(15,15)	Walter Randelshofer	
r2 U' (r2 U2)2 r' (U2 r2)2 U2 r' U' r2//Safe	SSE SiGN	(26,15)	Christopher Mowla	
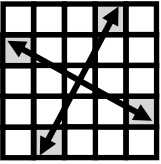
(Rw2 B2 Rw2' U)2	SSE SiGN	(14,8)	Thom Barlow	[4]
Fw2 R2 Fw2 U' Bw2 L2 Bw2 U'	SSE SiGN	(14,8)	Tom Rokicki	[4]
l r U2 l' r' U r l U2 r' l' U'	SSE SiGN	(14,12)	Thom Barlow	
U' L R u2 R' L' U L R u2 R' L'//Safe	SSE SiGN	(14,12)	Per Kristen Fredlund	
l r D2 l' r' U r l D2 r' l' U'//Safe	SSE SiGN	(14,12)	Thom Barlow	
R' L' d2 R L U R' L' d2 R L U'//Safe	SSE SiGN	(14,12)	Walter Randelshofer	
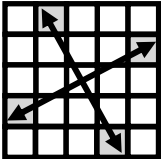
|					
(Lw2 B2 Lw2 U')2	SSE SiGN	(14,8)	Thom Barlow	[4]
Fw2 L2 Fw2 U Bw2 R2 Bw2 U	SSE SiGN	(14,8)	Tom Rokicki	[4]
l' r' U2 l r U' r' l' U2 r l U	SSE SiGN	(14,12)	Thom Barlow	
U L' R' u2 R L U' L' R' u2 R L//Safe	SSE SiGN	(14,12)	Per Kristen Fredlund	
l' r' D2 l r U' r' l' D2 r l U//Safe	SSE SiGN	(14,12)	Thom Barlow	
R L d2 R' L' U' R L d2 R' L' U//Safe	SSE SiGN	(14,12)	Walter Randelshofer	
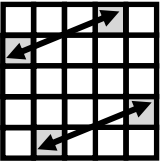
|				
y' L U' R u2 R' U M x U' L u2 L' U R' y//Safe	SSE SiGN	(15,13)	André Boulouard et al.
M2 U' l' r' E F2 E' l r E F2 (D y) M2//Safe	SSE SiGN	(15,13)	Christopher Mowla
F' U' B' d2 B U (F B') U' F' d2 F U B//Safe	SSE SiGN	(15,13)	Walter Randelshofer
R F L u L' F' U' F L u' L' F' U R'//Safe	SSE SiGN	(14,14)	André Boulouard et al.
Bw2 U l2 D L2 D' l2 (D U') l2 U L2 U' l2 D' Bw2//Safe	SSE SiGN	(23,15)	Christopher Mowla
l U' r D2 r' U l' U2 l U' r D2 r' U l' U2//Safe	SSE SiGN	(20,16)	Thom Barlow
(y x U2 l2 U F' L U R2 F') r2 (F R2 U' L' F U' l2 U2 x' y')	SSE SiGN	(24,17)	Christopher Mowla
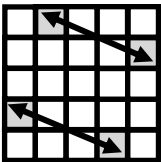
|				
y R' U L' u2 L U' M x U R' u2 R U' L y'//Safe	SSE SiGN	(15,13)	André Boulouard et al.
M2 U l r E' F2 E l' r' E' F2 (D' y') M2//Safe	SSE SiGN	(15,13)	Christopher Mowla
F U B d2 B' U' (F' B) U F d2 F' U' B'//Safe	SSE SiGN	(15,13)	Walter Randelshofer
L' F' R' u' R F U F' R' u R F U' L//Safe	SSE SiGN	(14,14)	André Boulouard et al.
Bw2 U' r2 D' R2 D r2 (D' U) r2 U' R2 U r2 D Bw2//Safe	SSE SiGN	(23,15)	Christopher Mowla
r' U l' D2 l U' r U2 r' U l' D2 l U' r U2//Safe	SSE SiGN	(20,16)	Thom Barlow
(y' x U2 r2 U' F R' U' L2 F) l2 (F' L2 U R F' U r2 U2 x' y)	SSE SiGN	(24,17)	Christopher Mowla

Symmetric Cases (with All "Unoriented" Wings)
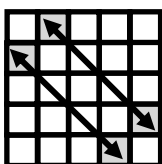
Algorithm				
L' F d2 F' L U2 L' F d2 F' L U2//Safe	SSE	SiGN	(16,12)	Thom Barlow
(M2 U) r' U2 r D2 r' U2 l' r U2 l D2 l' U2 l (U' M2)//Safe	SSE	SiGN	(26,18)	Kenneth Gustavsson
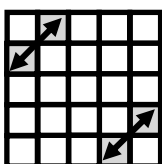
Algorithm				
F' R u2 R' F U2 F' R u2 R' F U2//Safe	SSE	SiGN	(18,12)	Thom Barlow
(y l) r (D' y') F2 E' l r E F2 E' l' r' U r' (l' y')//Safe	SSE	SiGN	(17,15)	Christopher Mowla
Bw2 U' r D' R2 D r' D' U r U' R2 U r' D Bw2//Safe	SSE	SiGN	(20,16)	Christopher Mowla
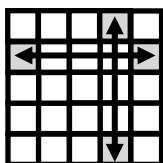
| Algorithm				
r' F' M' U r' U' R U r2 U' L' U x'//Safe	SSE	SiGN	(13,12)	André Boulouard et al. &Ed Trice
r B' M U r U' L U r2 U' R' U x//Safe	SSE	SiGN	(13,12)	Ed Trice
L F' L' b2 L B L' b' L (F B') L' b'//Safe	SSE	SiGN	(13,12)	Walter Randelshofer
(x R2) r' U' L R U r' U' R' U r2 U' L' U (R2 x')//Safe	SSE	SiGN	(18,15)	André Boulouard et al.
M B b L F' L' F B2 b2 R' F' R B b M' U//Safe	SSE	SiGN	(18,16)	Tom Rokicki
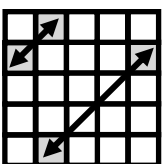
| Algorithm				
y r D' R2 D r (E y) r' U' R2 U r (E' y') r2 y'//Safe	SSE	SiGN	(16,13)	André Boulouard et al.
(r2 F2 U2 B M U') r2 (U M' B' U2 F2 r2)	SSE	SiGN	(20,13)	Christopher Mowla

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# Asymmetric Cases (2 "oriented" wings AND 2 "unoriented" wings)
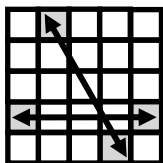
| Algorithm				Author	
(F L f2 D' B r2) d2 (r2 B' D f2 L' F')	SSE	SiGN	(18,13)	Ed Trice	[4]
(R2 f' D Fw' F' u2) l2 (u2 F Fw D' f R2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(R2 f' D Fw' F' d2) l2 (d2 F Fw D' f R2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(R2 f' D Bw' B' u2) r2 (u2 B Bw D' f R2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(R2 f' D Bw' B' d2) r2 (d2 B Bw D' f R2)	SSE	SiGN	(18,13)	Ed Trice	[4]
R2 y l' D2 l r U r' l' D2 l r U' r' y' R2//Safe	SSE	SiGN	(18,14)	Thom Barlow	
R2 y l' D2 l r U' r' l' D2 l r U r' y' R2//Safe	SSE	SiGN	(18,14)	Per Kristen Fredlund	
(R U' B) (Fw2 L2 Fw2 U)2 (B' U R')	SSE	SiGN	(20,14)	Tom Rokicki	[4]
(R U' B) Fw2 L2 Fw2 U Bw2 R2 Bw2 U (B' U R')	SSE	SiGN	(20,14)	Tom Rokicki	[4]
l' f' L' F' B' L f' L' F L f2 L' B (L l)//Safe	SSE	SiGN	(16,15)	Walter Randelshofer	
(r2 U F2 U x' U' R U) r2 (U' R' U x U' F2 U' r2)	SSE	SiGN	(20,15)	Christopher Mowla	
(y r' U2 M' r) U r' U2 r' U2 r U2 r U (r' M U2 r y')	SSE	SiGN	(22,17)	Christopher Mowla	
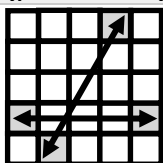
| Algorithm				Author	
(F' R' f2 D B' l2) d2 (l2 B D' f2 R F)	SSE	SiGN	(18,13)	Ed Trice	[4]
(L2 f D' Fw F u2) r2 (u2 F' Fw' D f' L2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(L2 f D' Fw F d2) r2 (d2 F' Fw' D f' L2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(L2 f D' Bw B u2) l2 (u2 B' Bw' D f' L2)	SSE	SiGN	(18,13)	Ed Trice	[4]
(L2 f D' Bw B d2) l2 (d2 B' Bw' D f' L2)	SSE	SiGN	(18,13)	Ed Trice	[4]
L2 y' r D2 l' r' U' r l D2 l' r' U l y L2//Safe	SSE	SiGN	(18,14)	Thom Barlow	
L2 y' r D2 l' r' U r l D2 l' r' U' l y L2//Safe	SSE	SiGN	(18,14)	Per Kristen Fredlund	
(L' U B') (Fw2 R2 Fw2 U')2 (B U' L)	SSE	SiGN	(20,14)	Tom Rokicki	[4]
(L' U B') Fw2 R2 Fw2 U' Bw2 L2 Bw2 U' (B U' L)	SSE	SiGN	(20,14)	Tom Rokicki	[4]
r f R F B R' f R F' R' f2 R B' (R' r')//Safe	SSE	SiGN	(16,15)	Walter Randelshofer	
(l2 U' F2 U' x' U L' U') l2 (U L U' x U F2 U l2)	SSE	SiGN	(20,15)	Christopher Mowla	
(y' l U2 M' l') U' l U2 l U2 l' U2 l' U' (l M U2 l' y)	SSE	SiGN	(22,17)	Christopher Mowla	
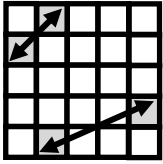
z' S R' d R F U' F' R' d' R F U B'//Safe	SSE SiGN	(13,13)	André Boulouard et al.	
(F L Fw2 D' B r2) d2 (r2 B' D Fw2 L' F')	SSE SiGN	(18,13)	Ed Trice	[4]
(r2 U F2 U x' U R U') r2 (U R' U' x U' F2 U' r2)	SSE SiGN	(20,15)	Christopher Mowla	
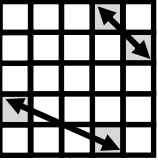
z S' L d' L' F' U F L d L' F' U' B//Safe	SSE SiGN	(13,13)	André Boulouard et al.	
(F' R' Fw2 D B' l2) d2 (l2 B D' Fw2 R F)	SSE SiGN	(18,13)	Ed Trice	[4]
(l2 U' F2 U' x' U' L' U) l2 (U' L U x U F2 U l2)	SSE SiGN	(20,15)	Christopher Mowla	
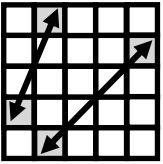
F U' B' L' u' L B U B' L' u L S z'//Safe	SSE SiGN	(13,13)	André Boulouard et al.
l' U R' B' u B R U' R' B' u' B R l//Safe	SSE SiGN	(14,14)	André Boulouard et al.
(r2 U B2 U x U L U') r2 (U L' U' x' U' B2 U' r2)	SSE SiGN	(20,15)	Christopher Mowla
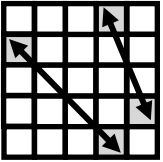
F' U B R u R' B' U' B R u' R' S' z//Safe	SSE SiGN	(13,13)	André Boulouard et al.
r U' L B u' B' L' U L B u B' L' r'//Safe	SSE SiGN	(14,14)	André Boulouard et al.
(l2 U' B2 U' x U' R' U) l2 (U' R U x' U B2 U l2)	SSE SiGN	(20,15)	Christopher Mowla