

NONEL[®]



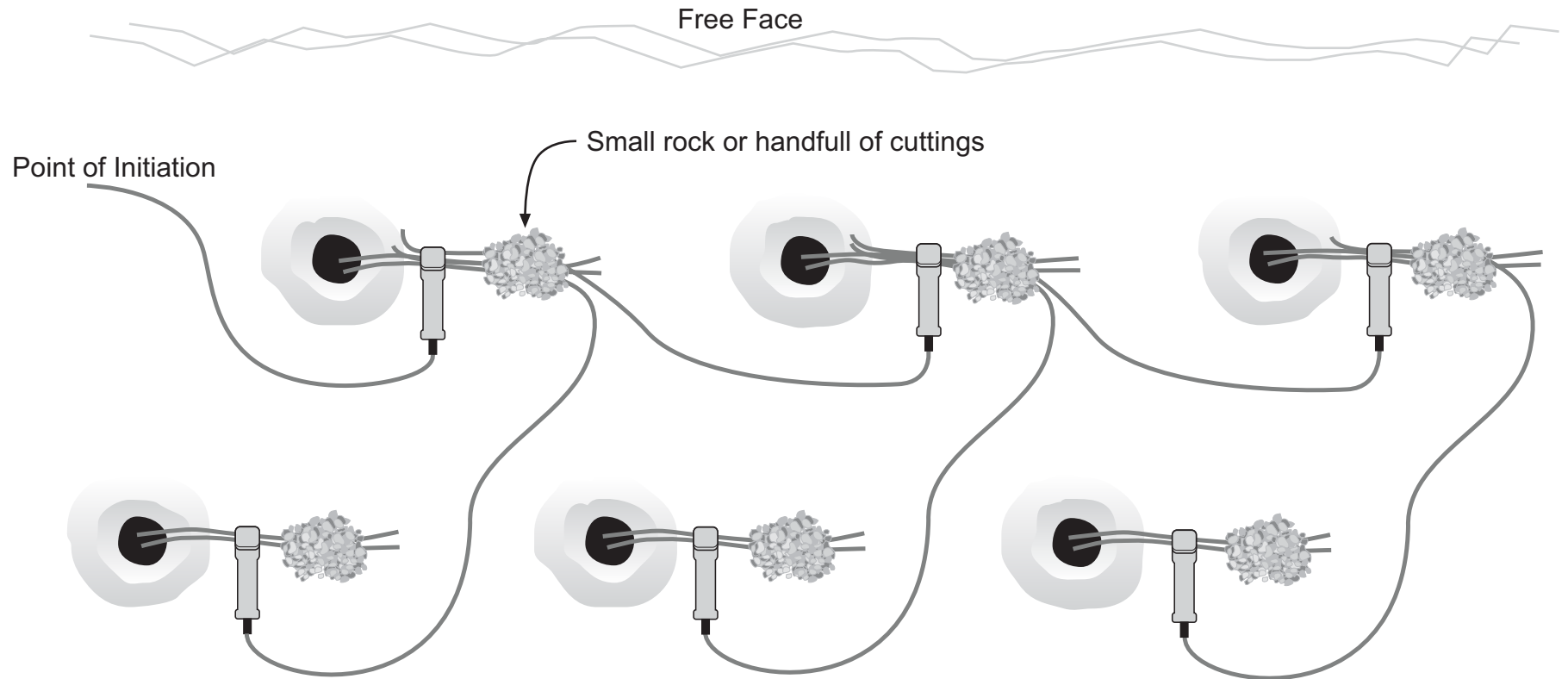
Shot Pattern Guide

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Revised 15 December 2006

DYNO[®]
Dyno Nobel

Groundbreaking Performance[™]

These diagrams illustrate the "best practice" for connecting surface delay units with downhole units and other surface delay units in the blast and are intended to help the blaster eliminate potential misinterpretations of diagrams on the following pages. **These timing sequence patterns are suggestions only.** This information and/or field situations cannot illustrate every application or variation of conditions under which Dyno Nobel products are used or which a blaster may experience.



EZTL® delay units must be correctly snapped into relevant shock tubes and be visually easy to check

Proper Hook-up for NONEL® EZTL® Surface Delay Detonators

A

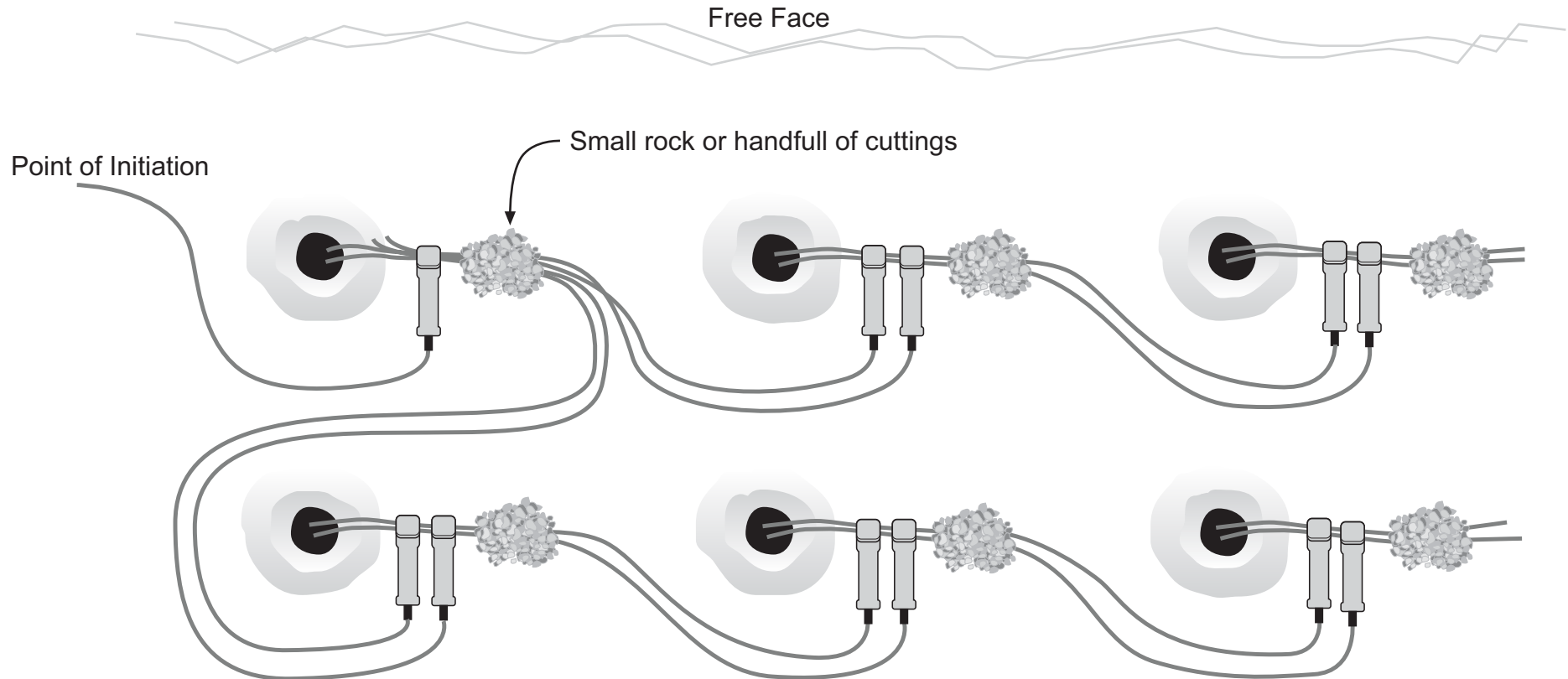


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The *NONEL® Shot Pattern Guide* is designed to assist the blaster with surface timing sequences. It is not designed to illustrate the connection of surface delay units to downhole units but rather is intended to offer surface timing sequence suggestions. Proper training, the correct use of *NONEL®* products and using the most appropriate shot pattern for the application greatly reduces the probability of shot failures. Common shot failure causes include shovel cuts or nicks during stemming, shrapnel from surface detonators, kinks or knots in shock tubing, cuts or nicks caused by stepping on or driving over shock tubing and improper shock tube connection in connection clips.

These diagrams illustrate the "best practices" for connection of surface delay units with down-the-hole units and other surface delay units in the blast. They are intended to help the blaster eliminate potential misinterpretations of the diagrams on the following pages. Timing patterns and proper hook-up procedures are two separate things. The enclosed timing sequence patterns are suggestions only. Not all information and/or field situations can be illustrated to cover every application or variation of conditions under which the products are used or a blaster may experience.



EZTL® and EZ DET® delay units must be correctly snapped into relevant shock tubes and be visually easy to check.

Proper Hook-up for NONEL® EZTL® and EZ DET® Surface Delay Detonators B

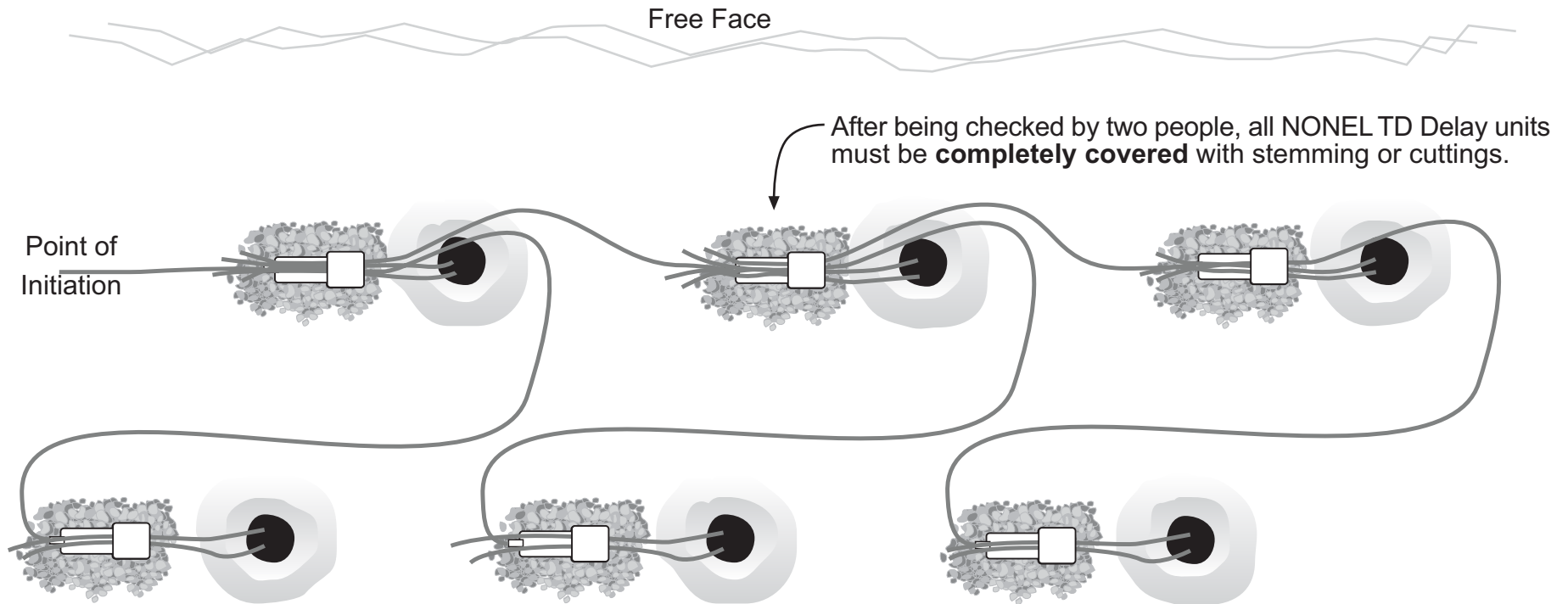
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Doubling the surface units in some timing sequences decreases surface shut downs. A shut down on any line leaving unfired blastholes can result in airblast, flyrock, poor fragmentation and/or unsafe mucking due to buried unshot primers in the muckpile. Doubling surface delay units reduces the probability of a shut down.

These diagrams illustrate the "best practices" for connection of surface delay units with down-the-hole units and other surface delay units in the blast. They are intended to help the blaster eliminate potential misinterpretations of the diagrams on the following pages. Timing patterns and proper hook-up procedures are two separate things. The enclosed timing sequence patterns are suggestions only. Not all information and/or field situations can be illustrated to cover every application or variation of conditions under which the products are used or a blaster may experience.



Proper Hook-up for NONEL[®] TD Surface Delay Detonators

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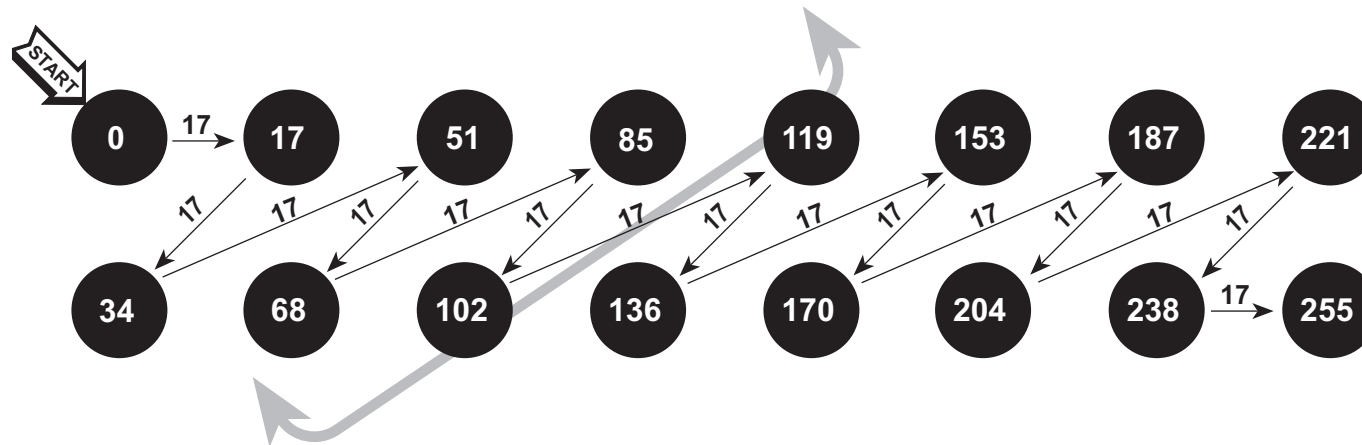
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When using NONEL[®] TD Delays, place all downline leads and outgoing NONEL TD Delay(s) tube leads in the bunch block parallel to the detonator with the detonator pointing in the direction of desired initiation. Make sure that the inside of the bunch block is free from dirt. Snap the door of the bunch block closed ensuring that tubes remain within the NONEL TD bunch block and in direct contact with the detonator. Make sure all shock tube leaves the bunch block in a straight line for at least 12 in. (0.3 m). Two people should double check all NONEL TD connections and cover the bunch blocks. One person should hold the bunch block with the tube leading away from the block in the opposite direction, while the other person covers it with stemming or cuttings. Both people should double check to ensure all NONEL TD connections are correct and all shock tube leads are enclosed in each bunch block. Cover all blocks with drill cuttings or similar material to hold them in position, prevent shrapnel from cutting off other shock tubes and control noise.

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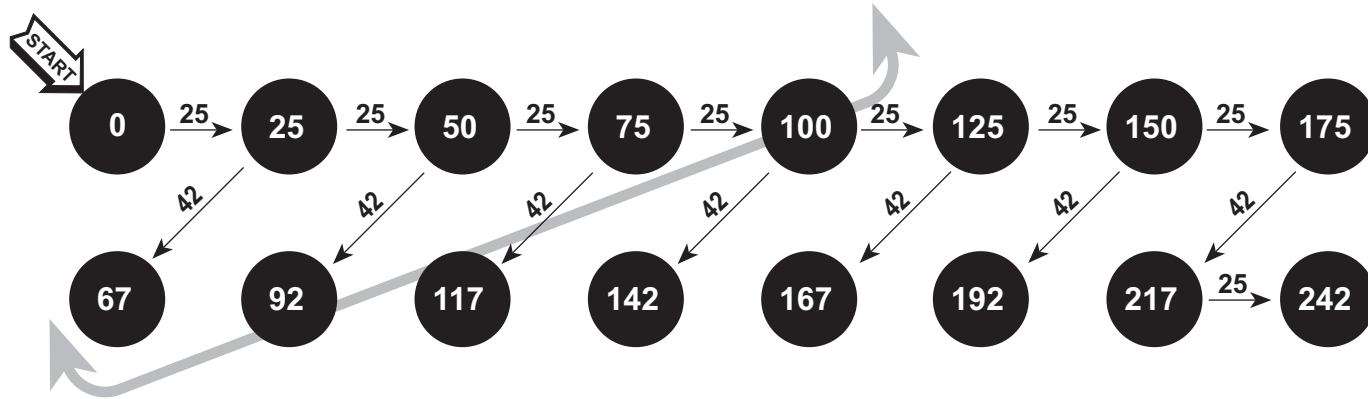
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	<p>APPLICATIONS</p> <p>Quarry or construction</p>	<p>SURFACE DELAYS</p> <p>17ms</p>	<p>NOTES</p>	
	<p>LIMITATIONS</p> <p>Infinite in length, 2 rows deep</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>		

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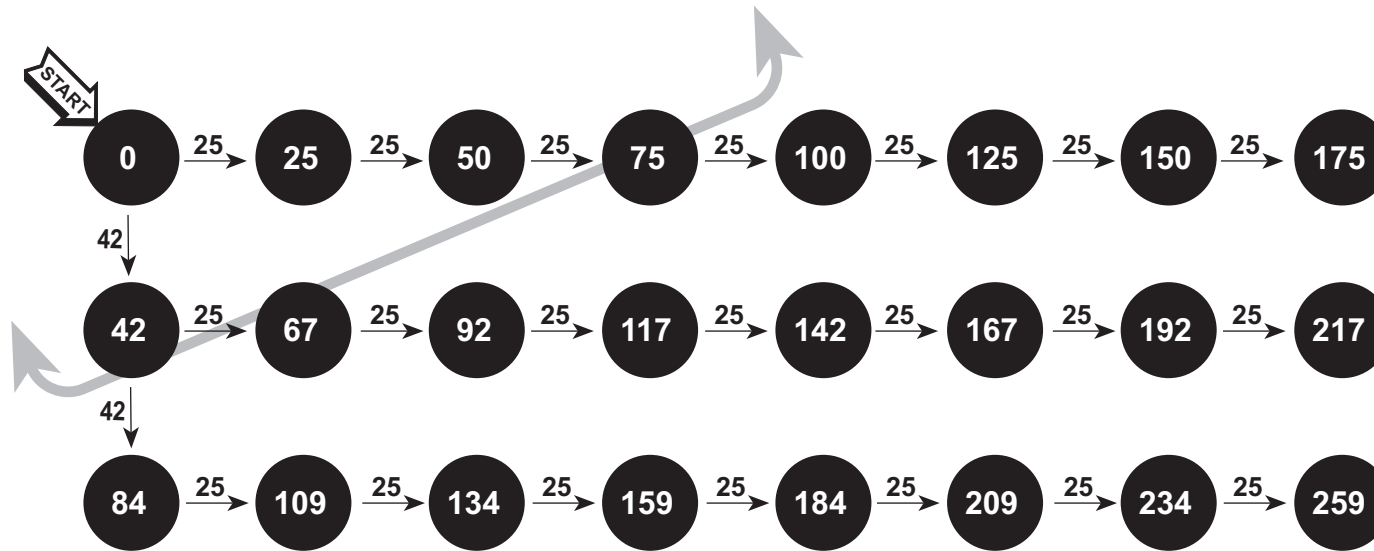
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	<p>APPLICATIONS</p>	<p>SURFACE DELAYS</p>		<p>NOTES</p>
	<p>Quarry, coal, construction or open pit</p>	<p>25ms and 42ms</p>		
	<p>LIMITATIONS</p>	<p>IN-HOLE DELAYS</p>		
<p>None</p>	<p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>			

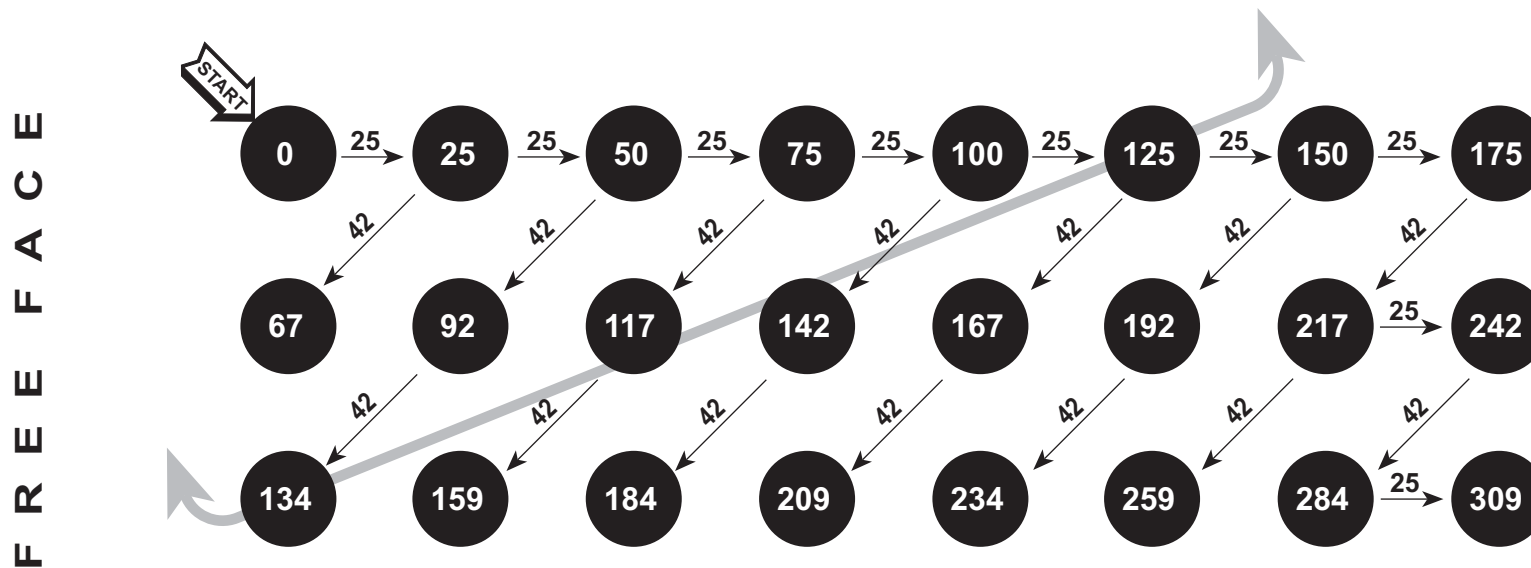
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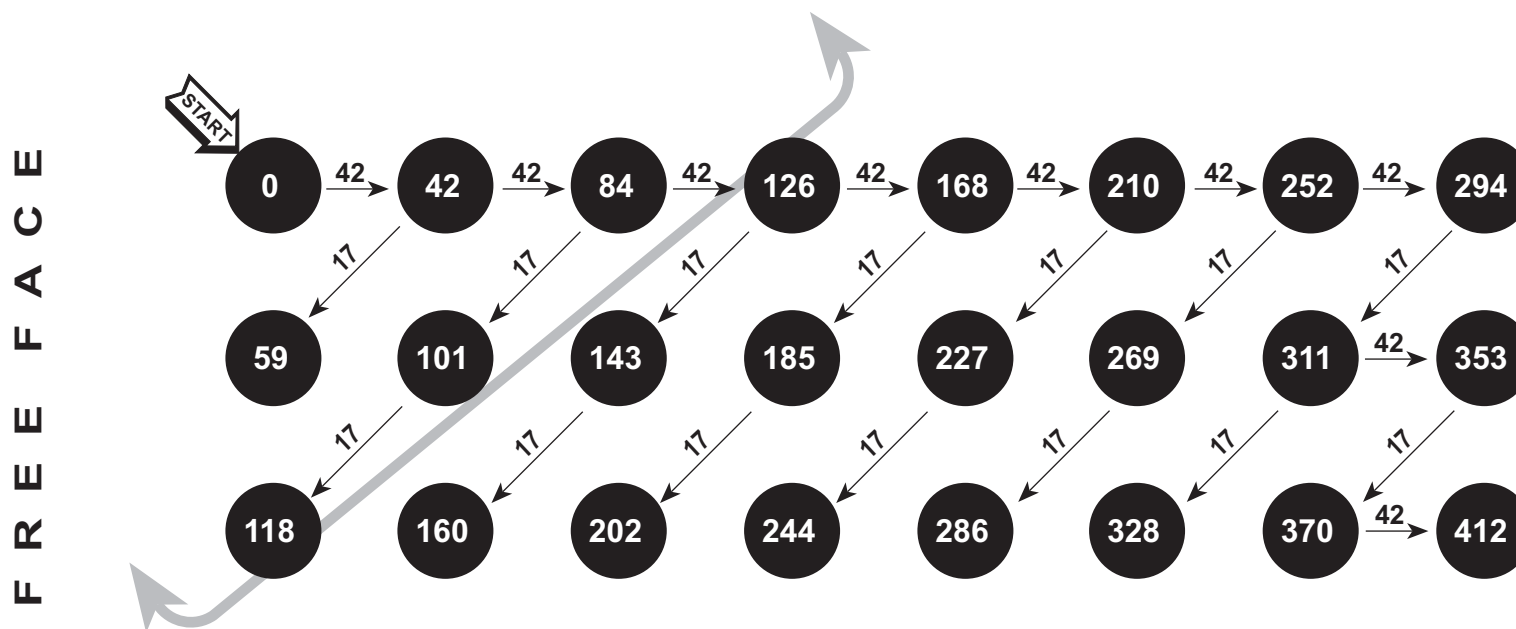
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	APPLICATIONS	SURFACE DELAYS	<p>NOTES</p> <p>Double surface units recommended with this timing sequence! Best results with 2 free faces.</p>		
	LIMITATIONS	IN-HOLE DELAYS			
	Quarry, coal or construction	25ms and 42ms	Infinite in length, 3 rows deep	Same delay period in each hole. Suggested in-hole delay: 500ms	

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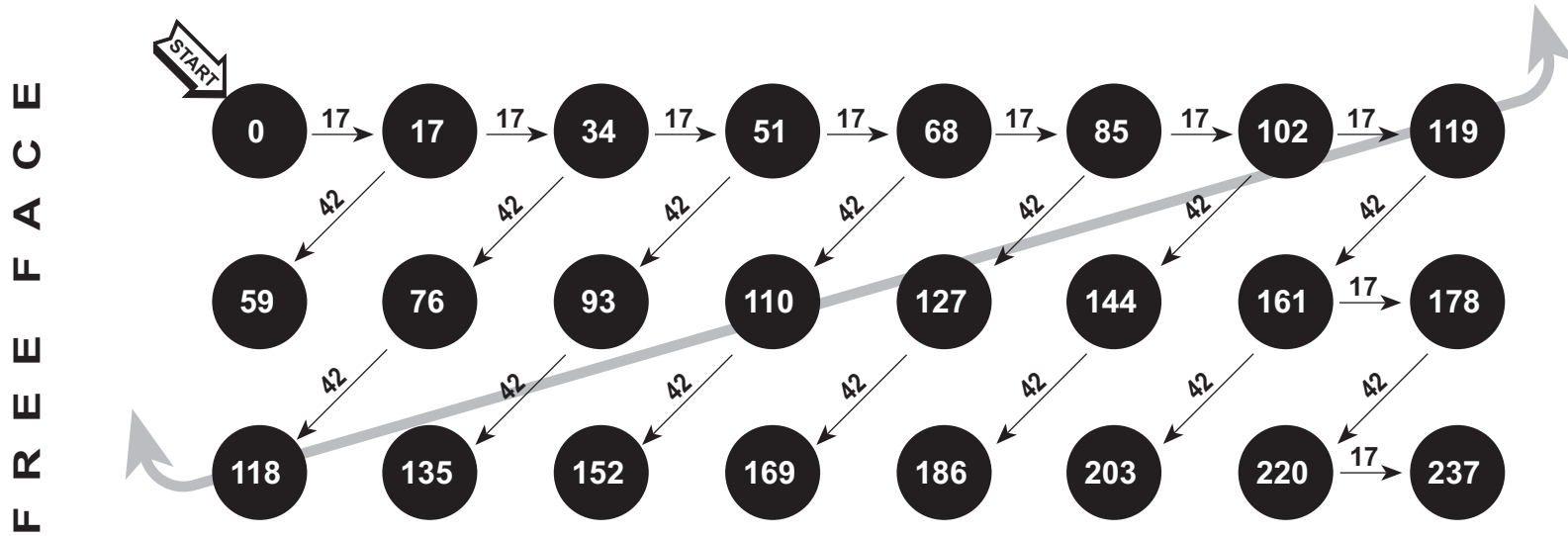
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	<p>APPLICATIONS</p>		<p>SURFACE DELAYS</p>		<p>NOTES</p>
	<p>Quarry, coal, construction or open pit</p>		<p>25ms and 42ms</p>		
	<p>LIMITATIONS</p>		<p>IN-HOLE DELAYS</p>		<p>Best results with 2 free faces.</p>
<p>Infinite in length, 2 or 3 rows deep</p>		<p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>			

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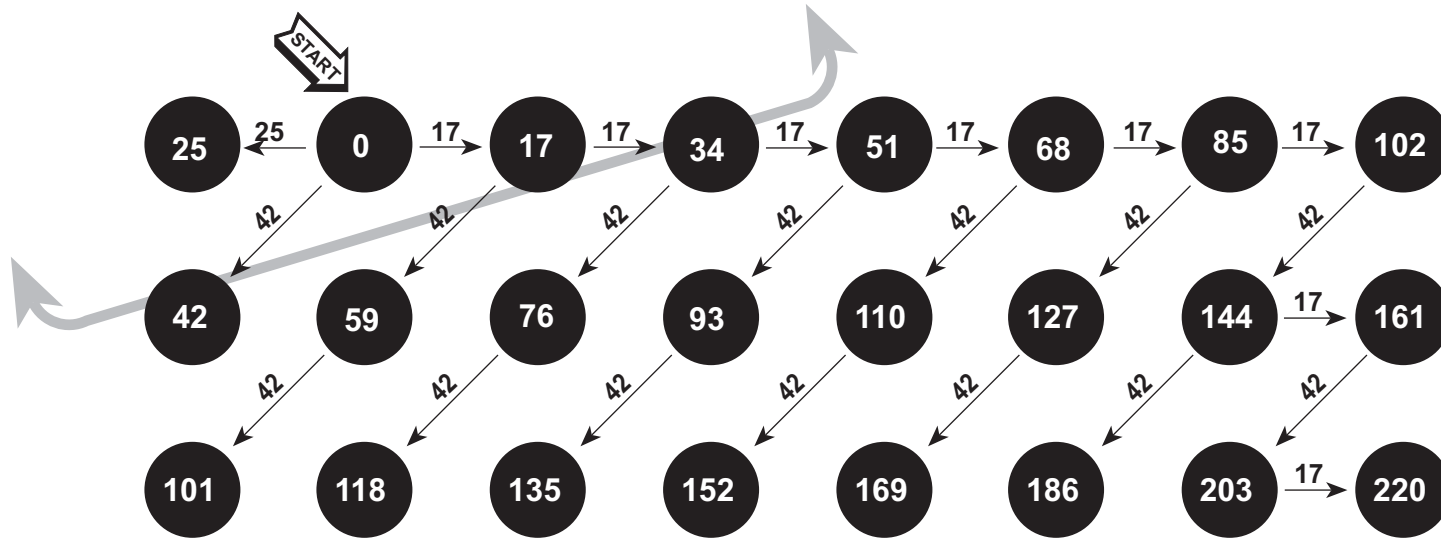
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	APPLICATIONS	SURFACE DELAYS	NOTES		
	Quarry, coal, construction or open pit	17ms and 42ms			
	LIMITATIONS	IN-HOLE DELAYS	Best results with 2 free faces.		
Infinite in depth, 5 rows deep	Same delay period in each hole. Suggested in-hole delay: 500ms				

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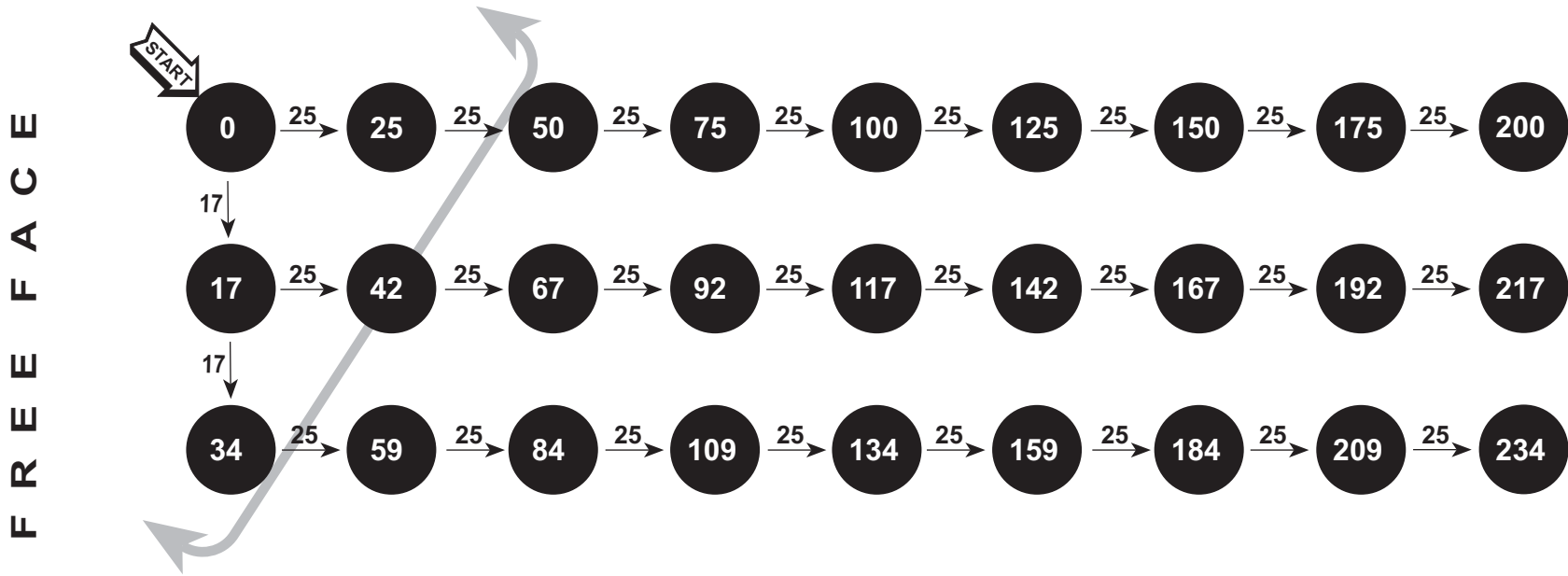
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	APPLICATIONS	SURFACE DELAYS		NOTES
	Quarry, coal, construction or open pit	17ms and 42ms		<p>Best results with 2 free faces.</p> <p>2 holes per 8ms delay if greater that 7 holes per row and 3 rows deep.</p>
	LIMITATIONS	IN-HOLE DELAYS		
Infinite in depth, 7 holes per row	Same delay period in each hole. Suggested in-hole delay: 500ms			

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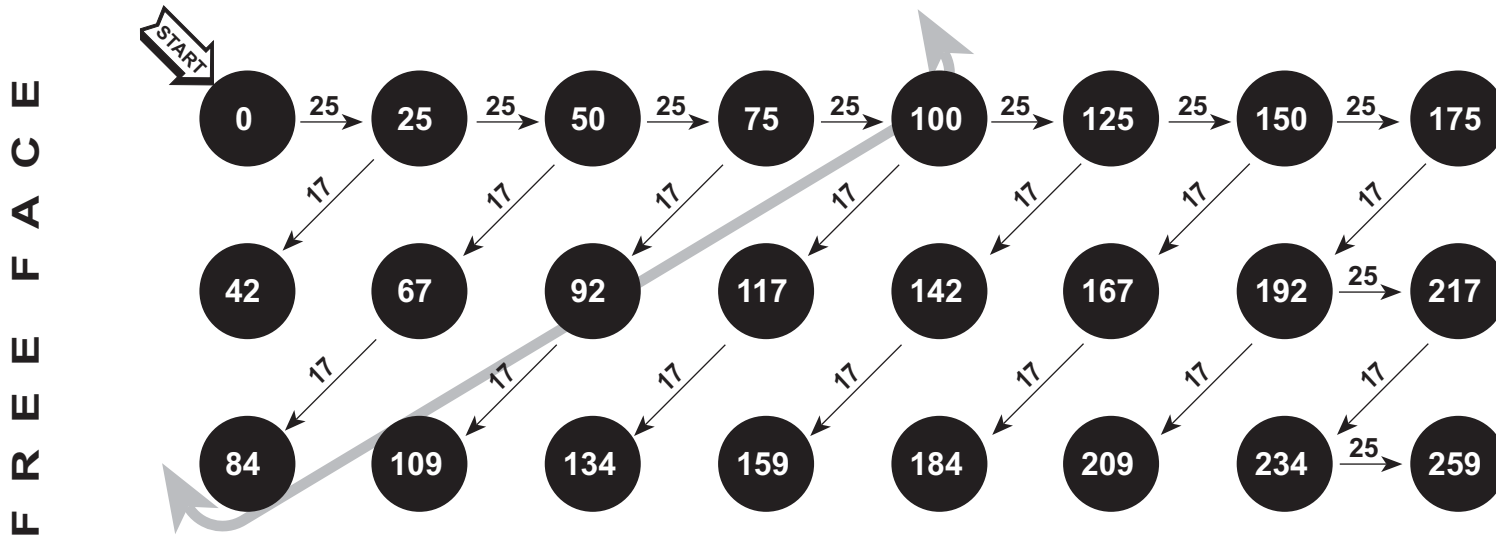
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	<p>APPLICATIONS</p> <p>Quarry, coal or construction</p>	<p>SURFACE DELAYS</p> <p>17ms, 25ms and 42ms</p>	<p>NOTES</p> <p>2 holes per 8ms delay if greater than 7 holes per row .</p>		
	<p>LIMITATIONS</p> <p>Infinite in depth, 7 holes per row</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>			

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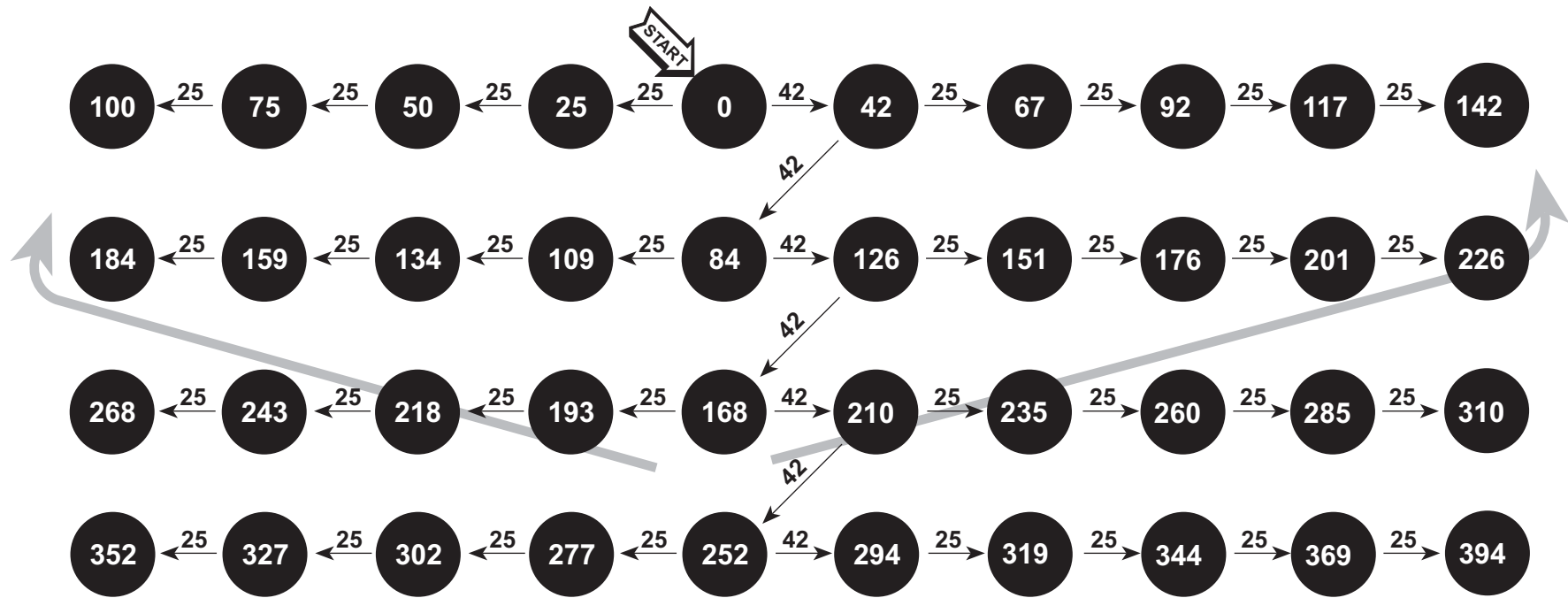
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	APPLICATIONS	SURFACE DELAYS		NOTES
	Construction or open pit	17ms and 25ms		Double surface units recommended with this timing sequence! Best results with 2 free faces.
	LIMITATIONS	IN-HOLE DELAYS		
Infinite in length, 3 rows deep	Same delay period in each hole. Suggested in-hole delay: 500ms			

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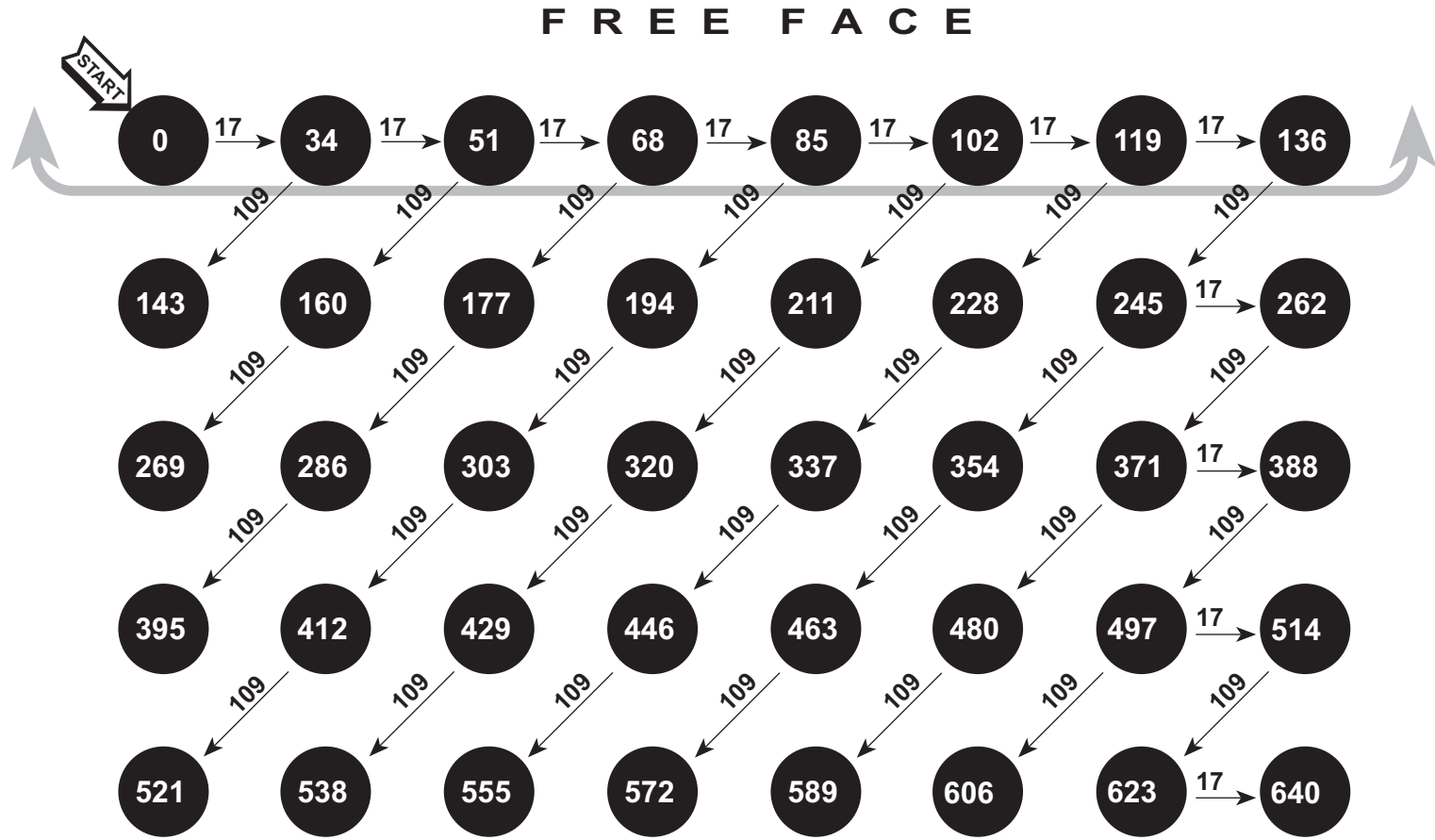


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	<p>APPLICATIONS</p> <p>Construction or open pit</p>	<p>SURFACE DELAYS</p> <p>17ms and 25ms</p>	<p>NOTES</p> <p>Best results with 2 free faces.</p>		
	<p>LIMITATIONS</p> <p>Infinite in length, 3 rows deep</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>			

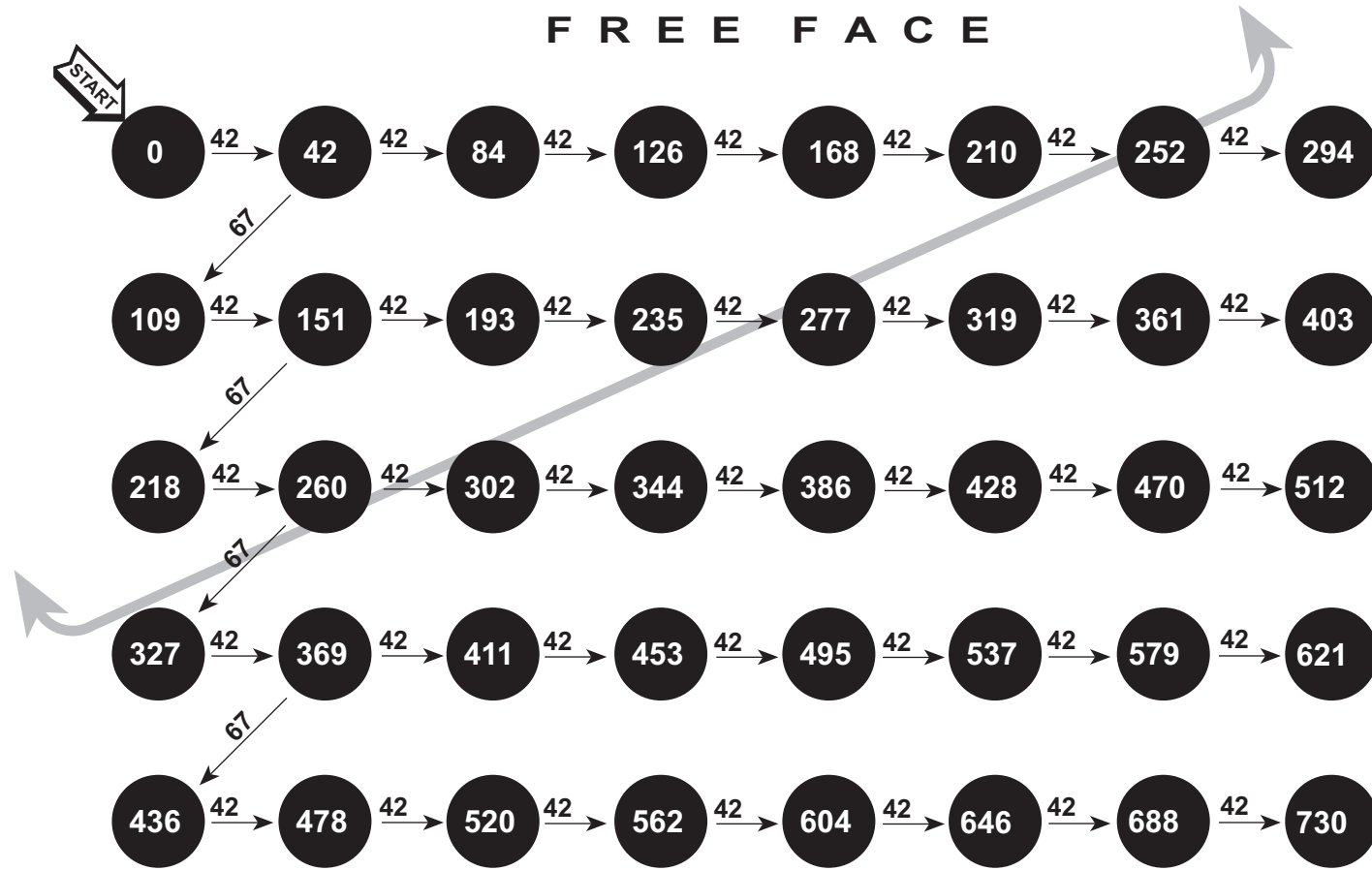
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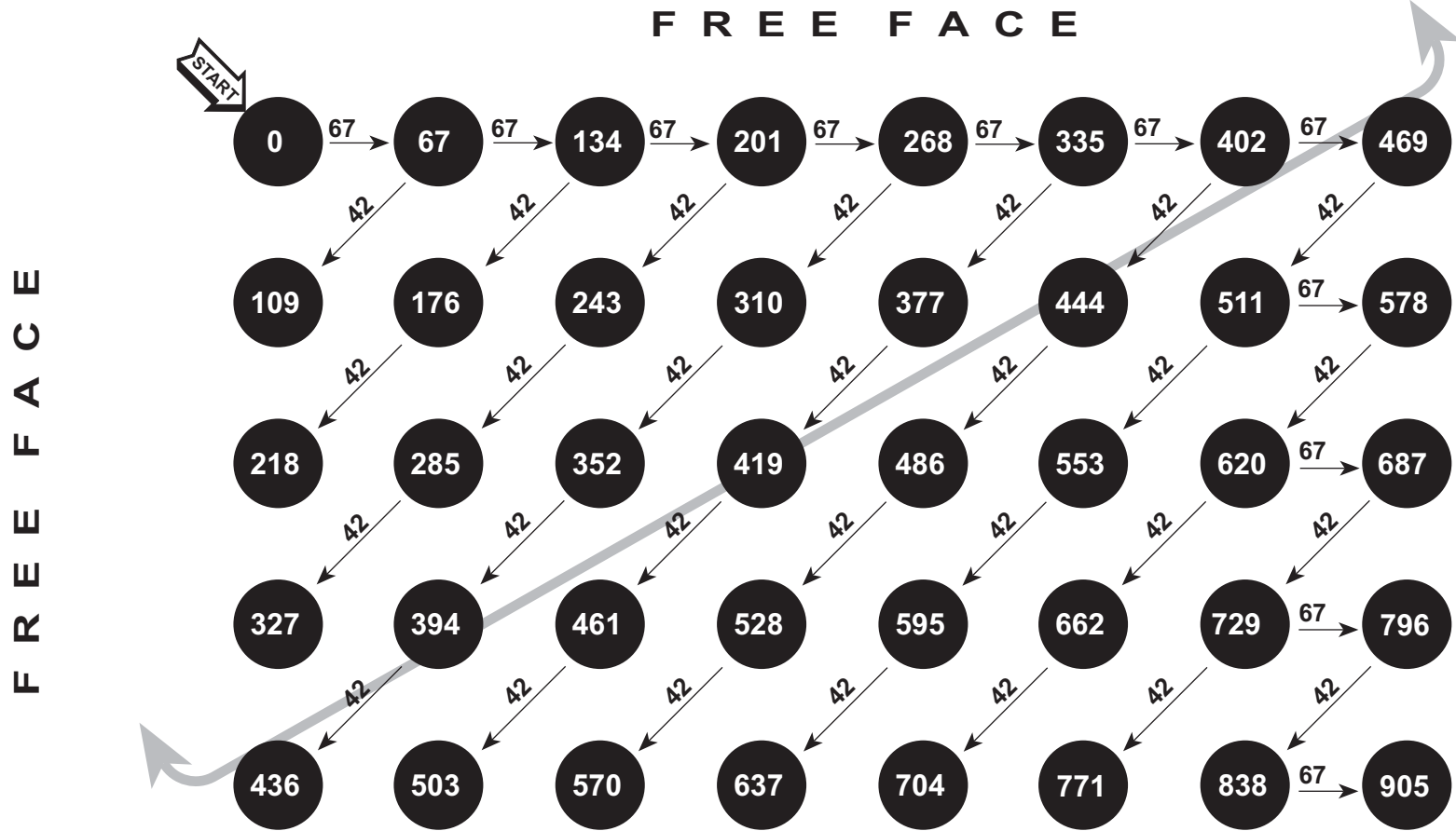
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	APPLICATIONS	SURFACE DELAYS	NOTES		
	Quarry, construction or open pit	25ms and 42ms			
	LIMITATIONS	IN-HOLE DELAYS	<p>Double surface units recommended with this timing sequence!</p> <p>Must have no more than 5 holes on opening side to ensure 1 hole per 8ms delay.</p>		
10 holes in length and infinite in depth or 2 rows deep and infinite in length	Same delay period in each hole. Suggested in-hole delay: 500ms				



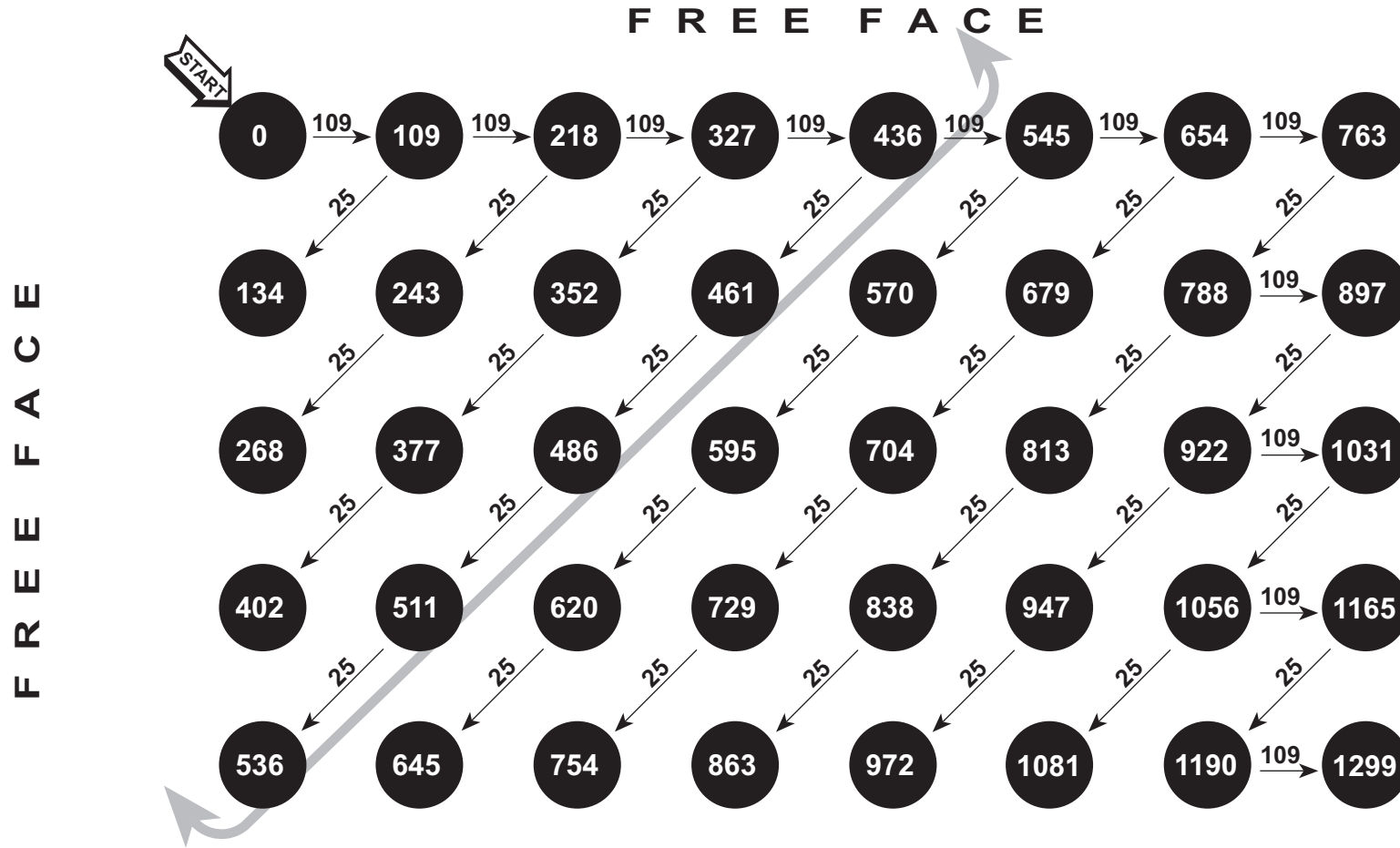
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APPLICATIONS	LIMITATIONS	SURFACE DELAYS	NOTES	
Quarry, cast blasting or open pit	2 holes per delay	17ms and 109ms	Use this design only where burdens are sufficient for the amount of suggested delay between rows.	
		IN-HOLE DELAYS		
		Same delay period in each hole. Suggested in-hole delay: 500ms		



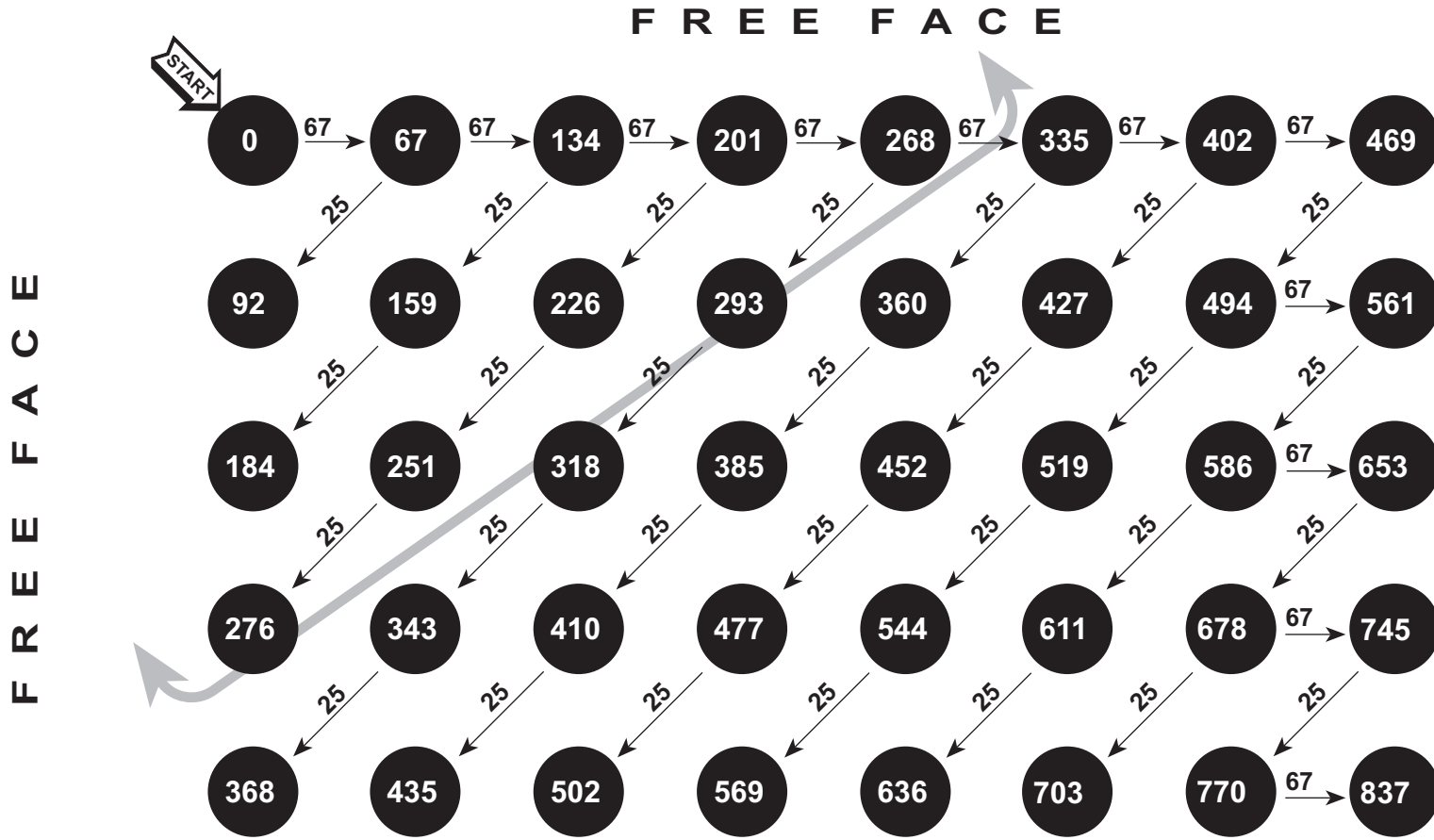
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	<p>APPLICATIONS</p>	<p>SURFACE DELAYS</p>		<p>NOTES</p>	
	<p>All</p>	<p>42ms and 67ms</p>		<p>Double surface units recommended with this timing sequence!</p>	
	<p>LIMITATIONS</p>	<p>IN-HOLE DELAYS</p>			
<p>Infinite in length, 10 rows deep</p>	<p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>				



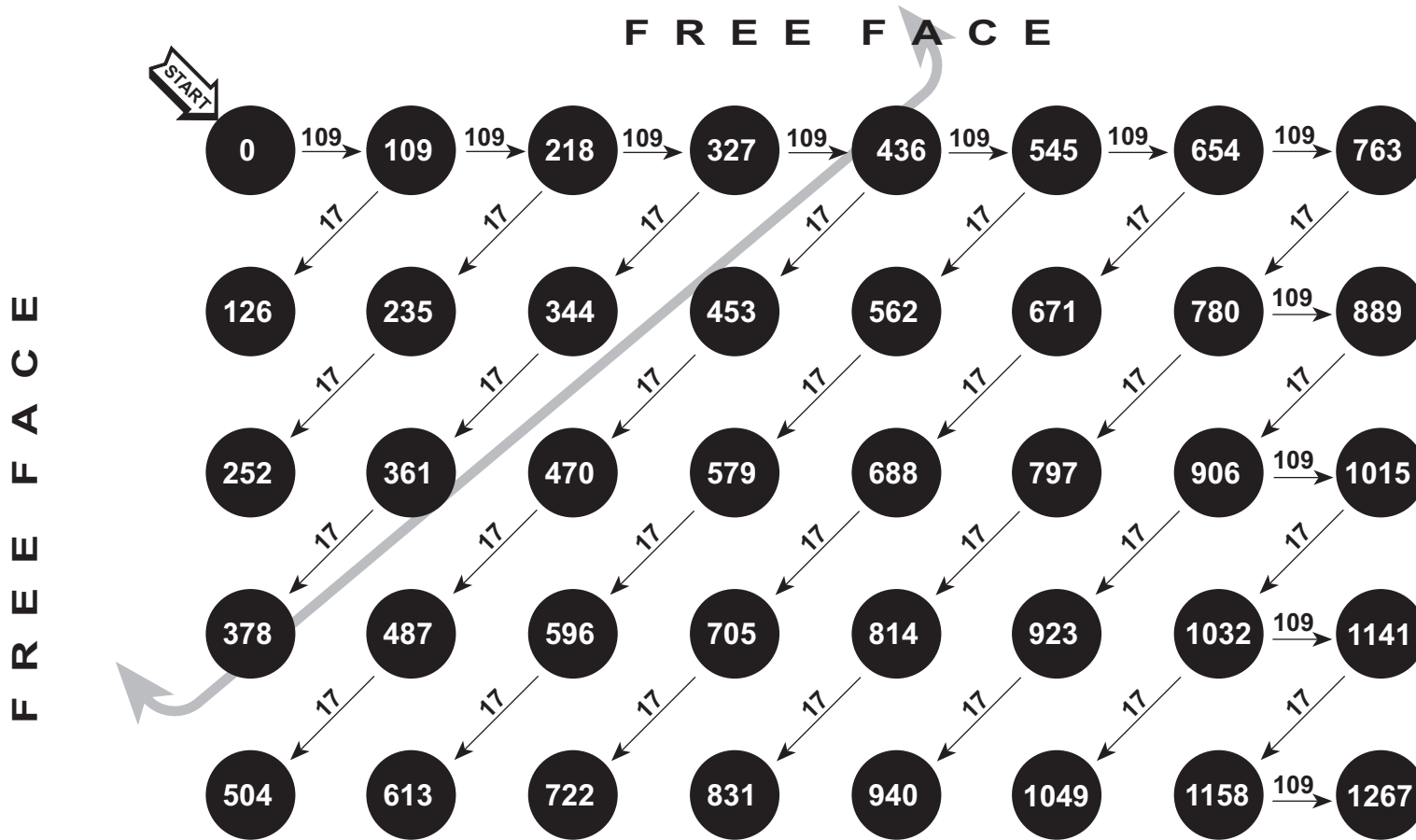
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	APPLICATIONS	SURFACE DELAYS		NOTES
	Open pit	42ms and 67ms		Use where limited movement is desired.
	LIMITATIONS	IN-HOLE DELAYS		
None	Same delay period in each hole. Suggested in-hole delay: 500ms			



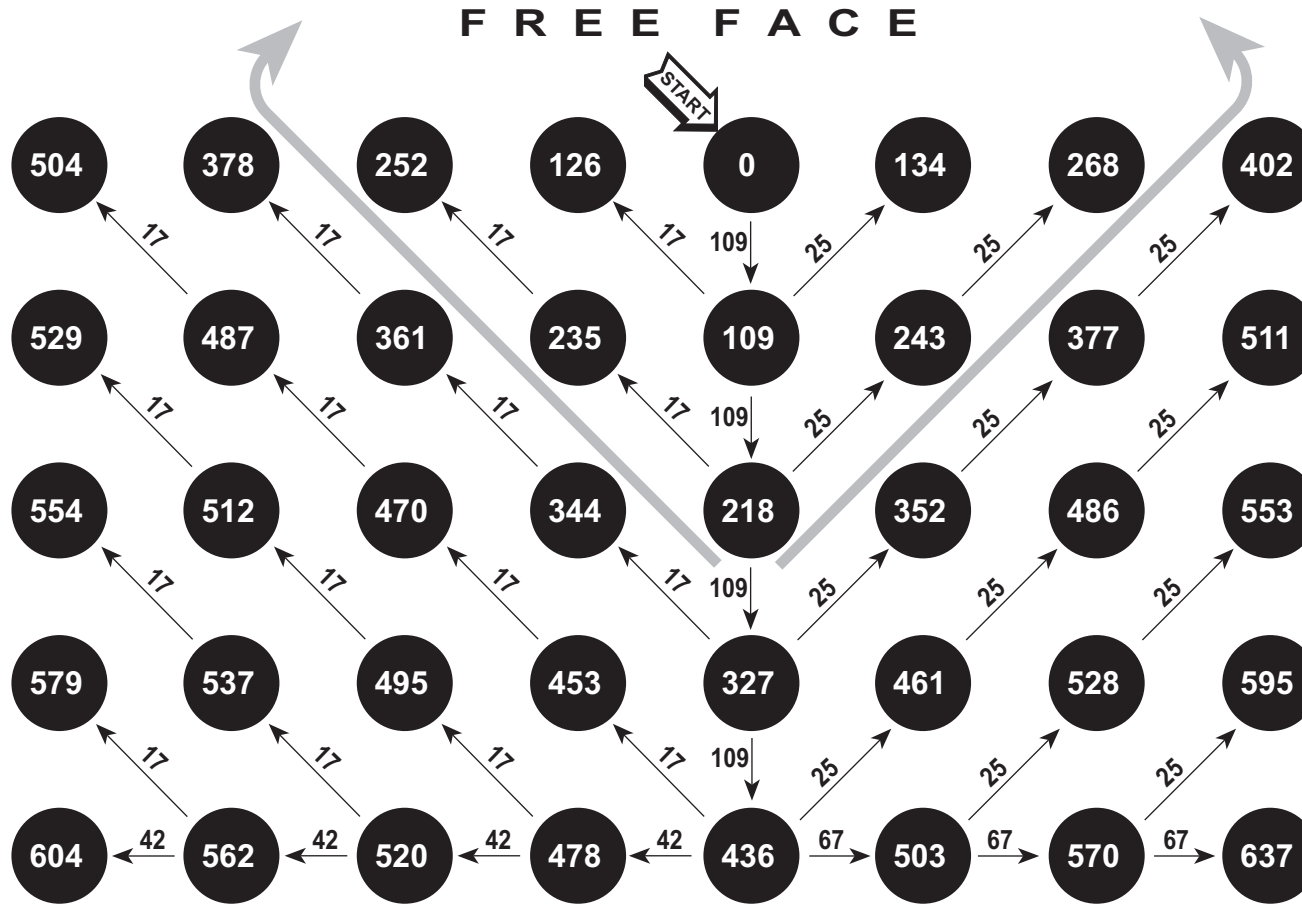
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	<p>APPLICATIONS</p>	<p>SURFACE DELAYS</p>		<p>NOTES</p>
	<p>Coal or open pit</p>	<p>25ms and 109ms</p>		<p>Use where limited movement is desired.</p>
	<p>LIMITATIONS</p>	<p>IN-HOLE DELAYS</p>		
<p>Infinite in length, 10 rows deep</p>	<p>Same delay period in each hole. Suggested in-hole delay: 500ms or higher</p>			



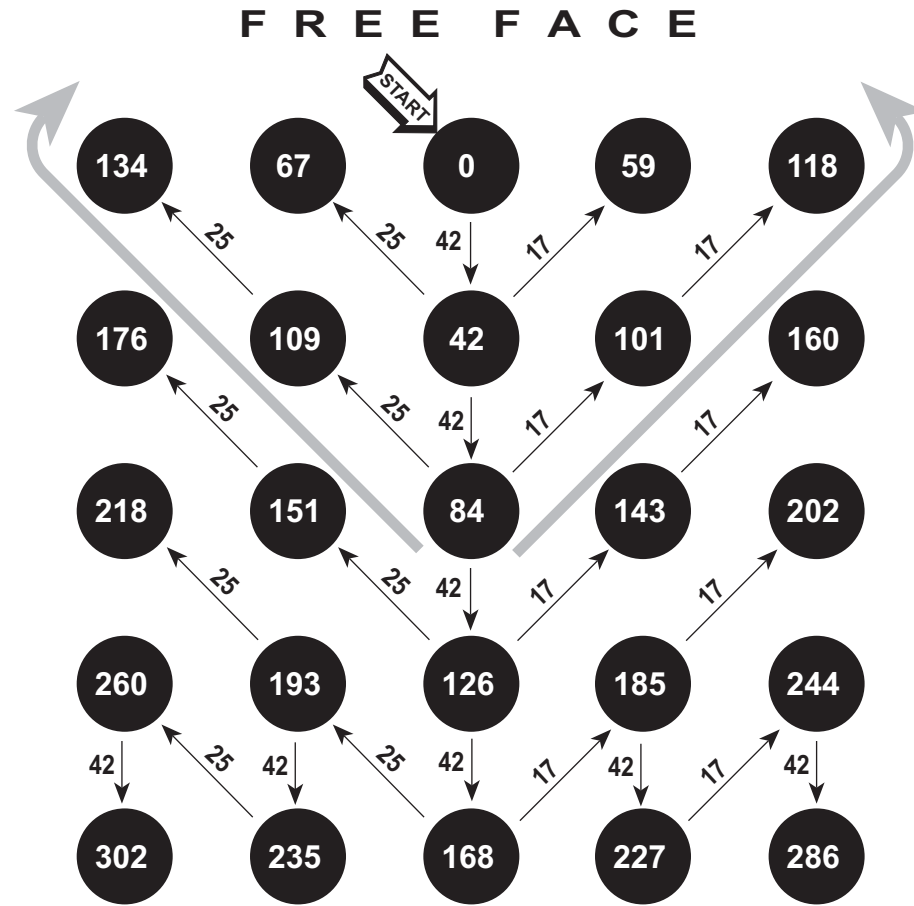
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	<p>APPLICATIONS</p> <p>Quarry, coal or open pit</p>				<p>SURFACE DELAYS</p> <p>25ms and 67ms</p>				<p>NOTES</p> <p>Use where limited movement is desired.</p>	
	<p>LIMITATIONS</p> <p>Infinite in length, 10 rows deep</p>				<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>					



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	<p>APPLICATIONS</p> <p>Open pit</p>		<p>SURFACE DELAYS</p> <p>17ms and 109ms</p>		<p>NOTES</p> <p>Use where limited movement is desired.</p>		
	<p>LIMITATIONS</p> <p>Infinite in length, 6 rows deep</p>		<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms or higher</p>				

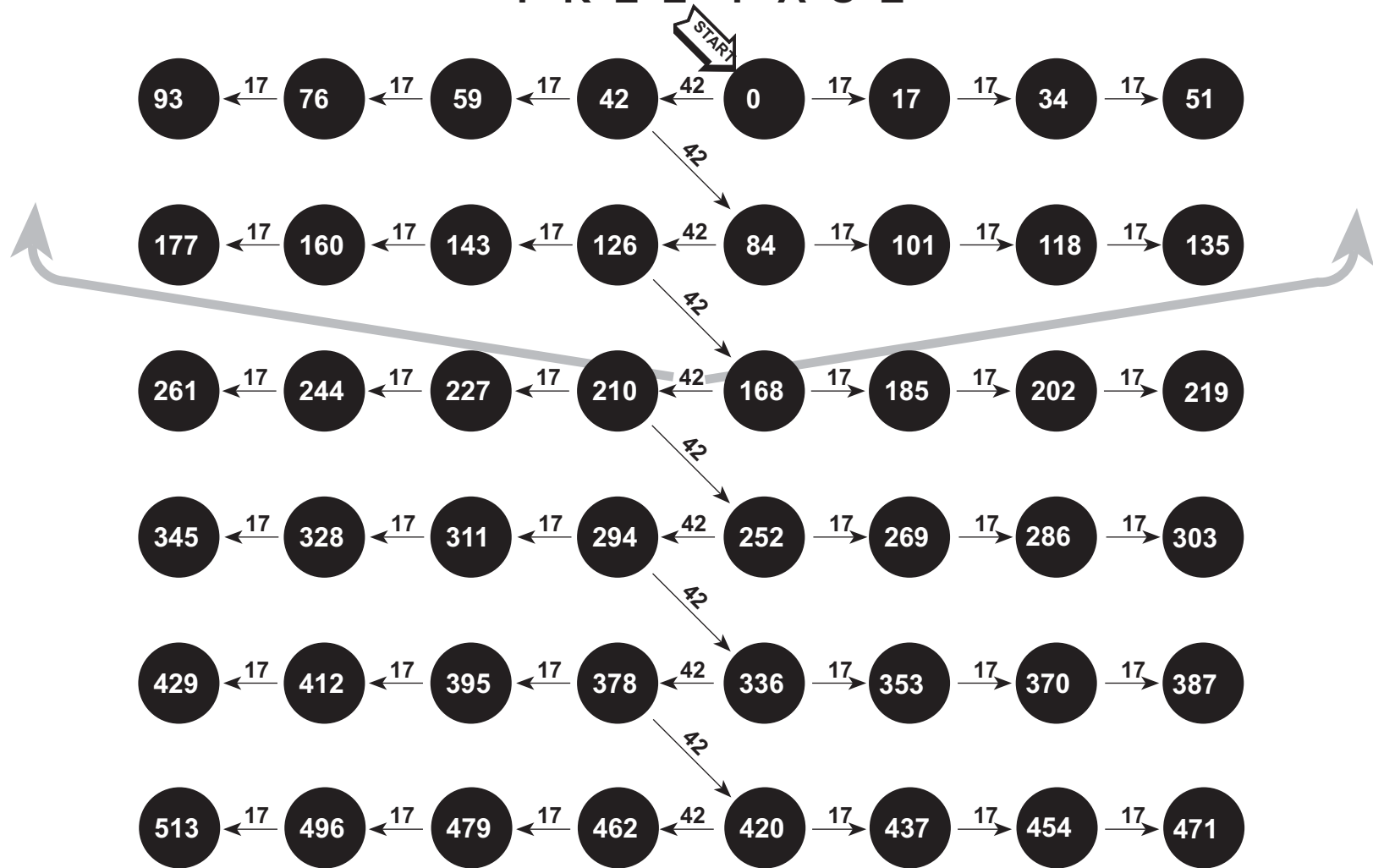


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	<p>APPLICATIONS</p> <p>Coal</p>		<p>SURFACE DELAYS</p> <p>17ms, 25ms, 42ms, 67ms and 109ms</p>	
	<p>LIMITATIONS</p> <p>2 holes per 8ms delay</p>		<p>IN-HOLE</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>	
			<p>NOTES</p> <p>This delay pattern has the potential of cutting off unfired blastholes.</p> <p>Use where limited movement is desired.</p>	



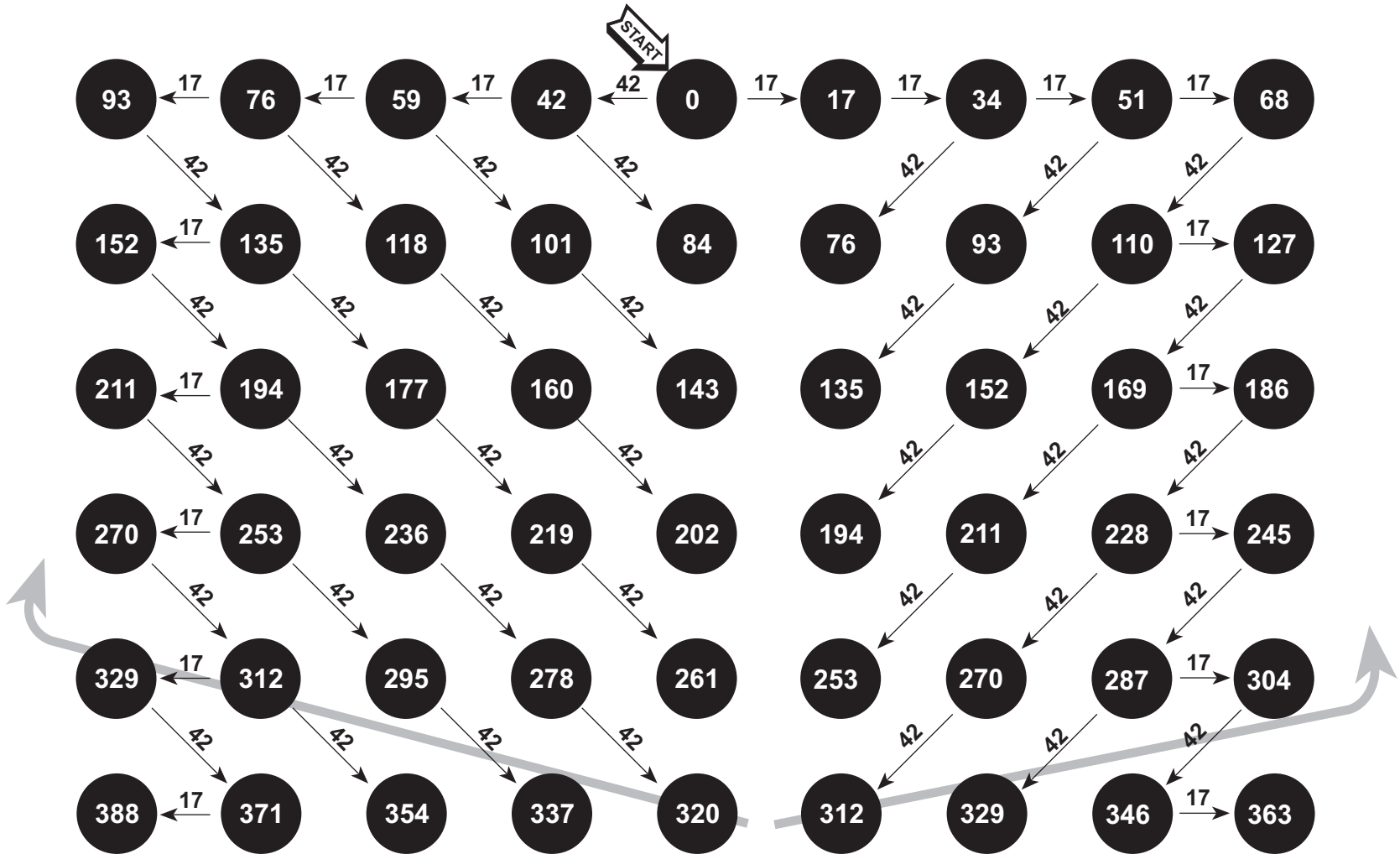
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	<p>1</p>	<p>18</p>		
	<p>APPLICATIONS</p>	<p>SURFACE DELAYS</p>	<p>NOTES</p>	
	<p>Coal</p>	<p>17ms, 25ms and 42ms</p>	<p>This delay pattern has the potential of cutting off unfired blastholes.</p>	
<p>LIMITATIONS</p>	<p>IN-HOLE DELAYS</p>	<p>Use where limited movement is desired.</p>		
<p>Infinite in depth, 5 holes long</p>	<p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>			

FREEFACE



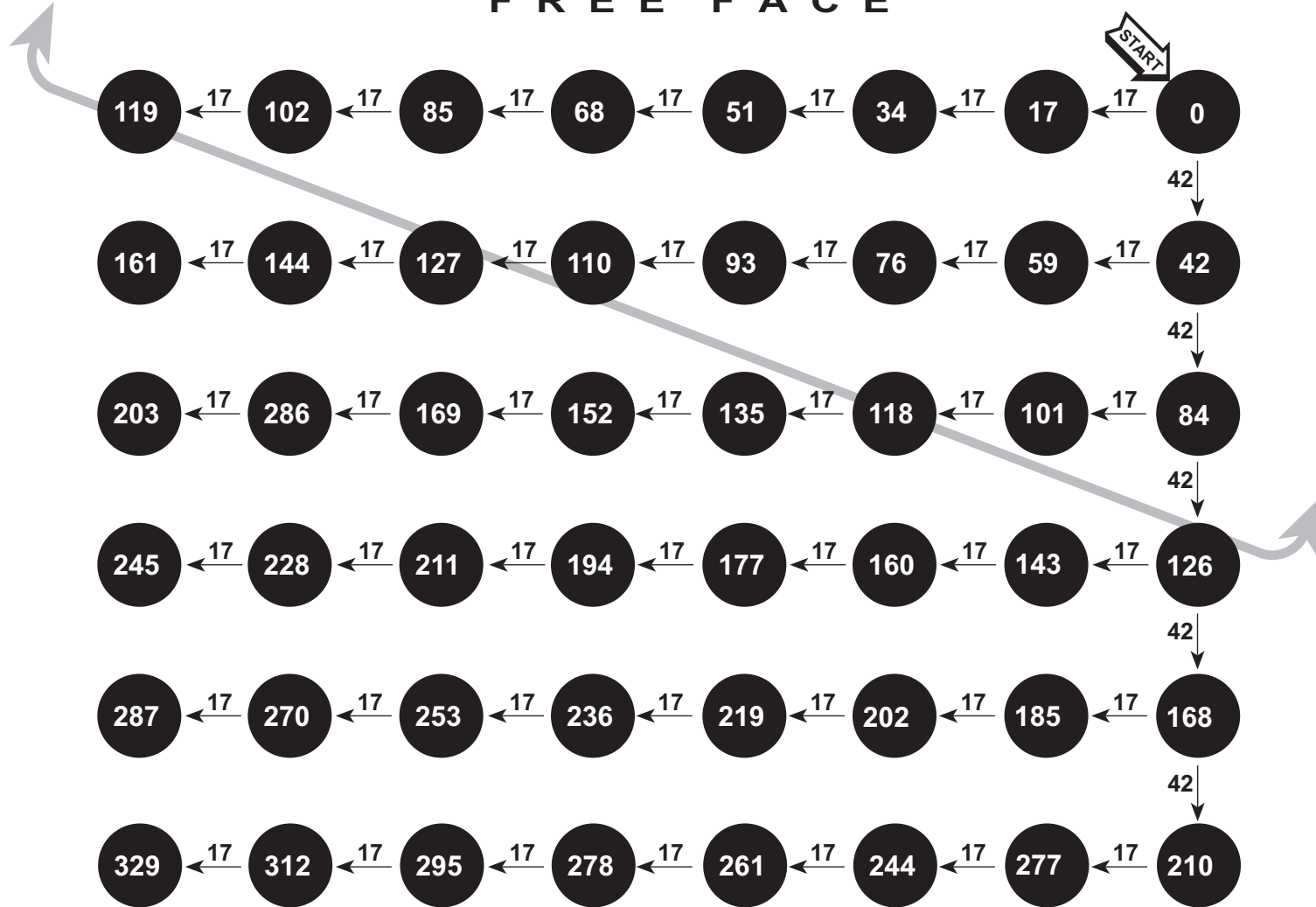
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	<p>APPLICATIONS</p>	<p>SURFACE DELAYS</p>	<p>NOTES</p> <p>Double surface units recommended with this timing sequence!</p>		
	<p>Quarry, construction or open pit</p>	<p>17ms and 42ms</p>			
	<p>LIMITATIONS</p>	<p>IN-HOLE DELAYS</p>			
<p>No more than four 17ms in a row</p>	<p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>				

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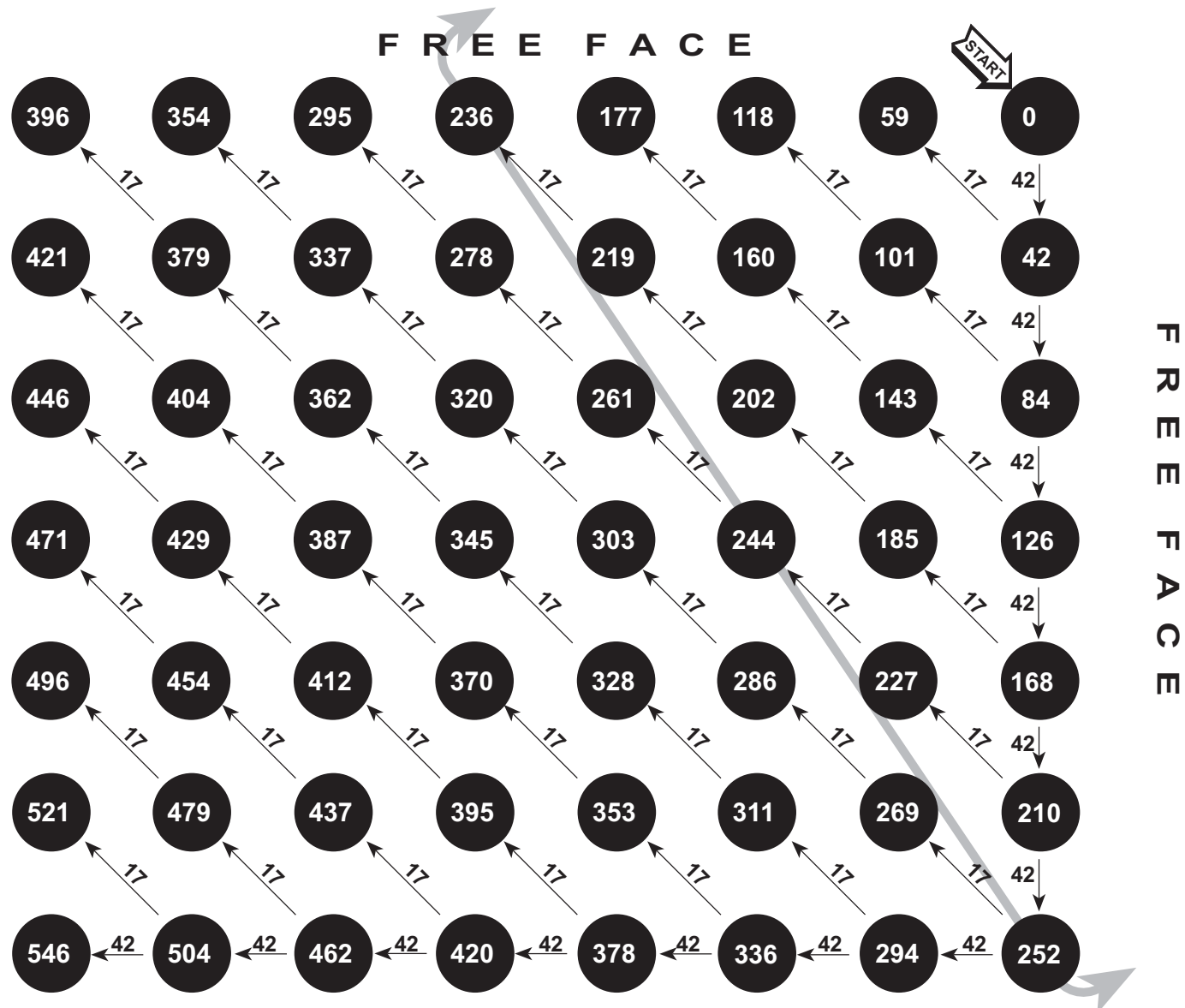


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	<p>APPLICATIONS</p> <p>Quarry, open pit or coal</p>	<p>SURFACE DELAYS</p> <p>17ms and 42ms</p>	<p>NOTES</p>		
	<p>LIMITATIONS</p> <p>2 holes per 8ms delay</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>			

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	<p>APPLICATIONS</p>	<p>SURFACE DELAYS</p>	<p>NOTES</p> <p>Double surface units recommended with this timing sequence!</p>		
	<p>Quarry, construction, coal or open pit</p>	<p>17ms and 42ms</p>			
	<p>LIMITATIONS</p>	<p>IN-HOLE DELAYS</p>			
<p>2 holes per 8ms delay after 2 rows</p>	<p>Same delay period in each hole. Suggested in-hole delay: 500ms</p>				



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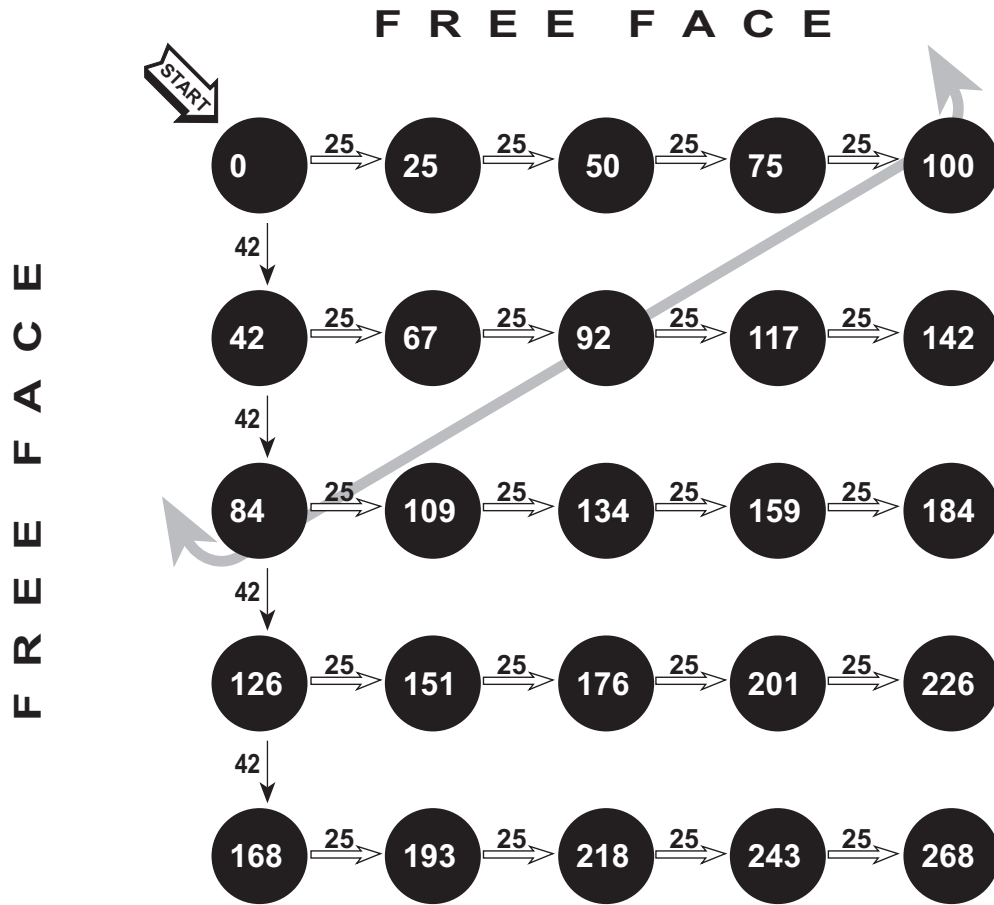
000	Sequential Time	00	NONEL® EZTL® Delay Time (ms)	Movement Direction	1 22
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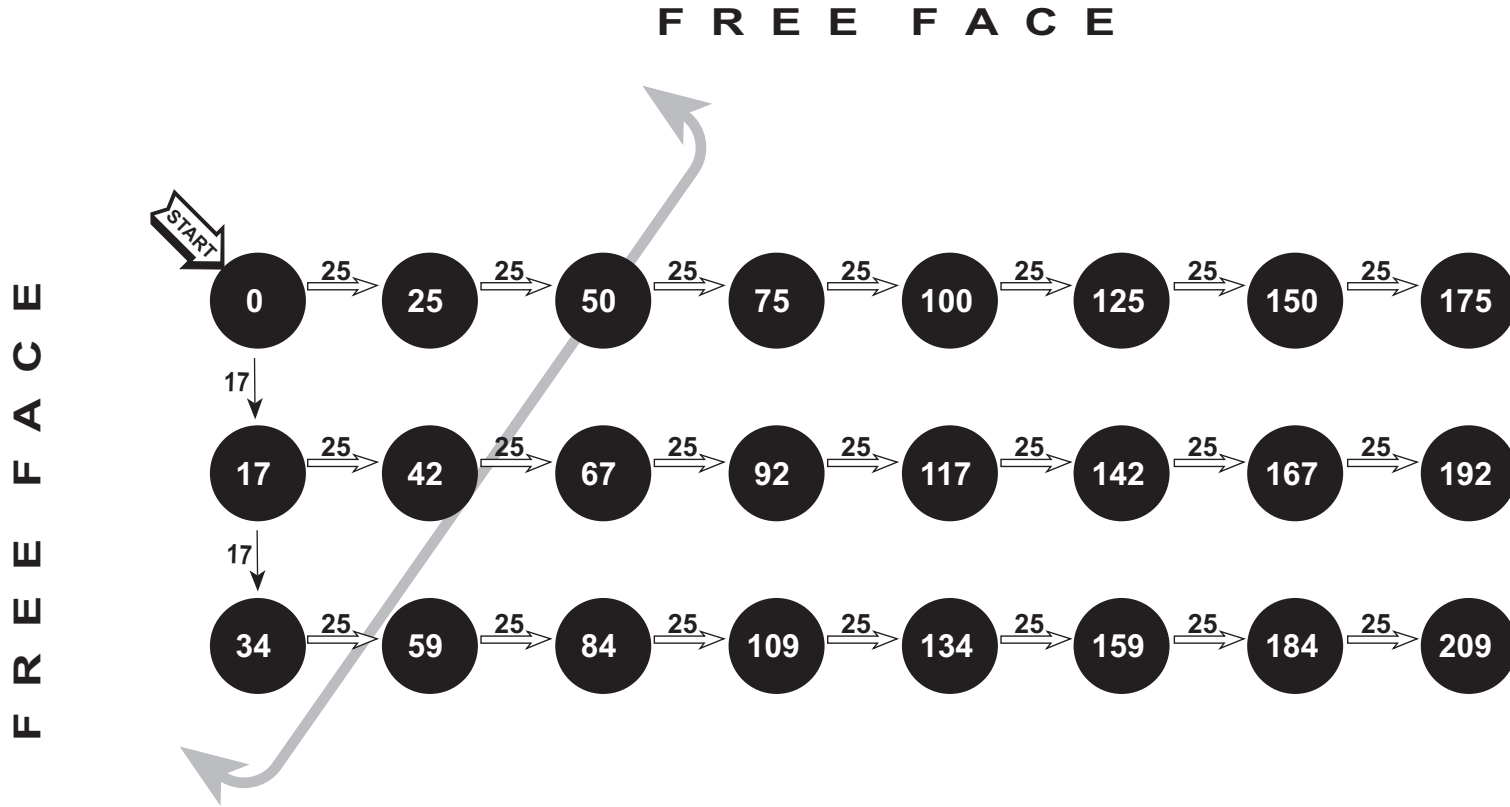
APPLICATIONS
Quarry, construction, coal or open pit
LIMITATIONS
Infinite in length, 5 rows deep

SURFACE DELAYS
17ms and 42ms
IN-HOLE DELAYS
Same delay period in each hole. Suggested in-hole delay: 500ms

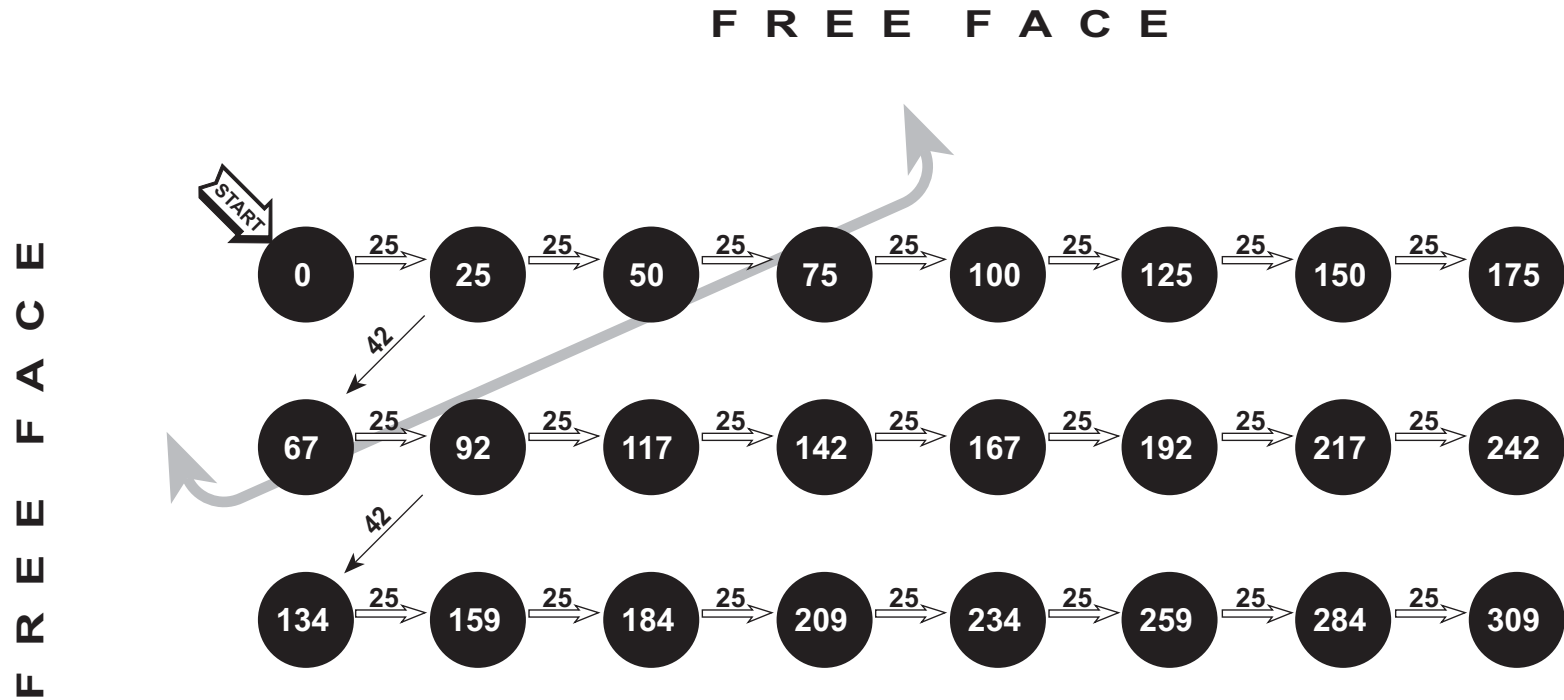
NOTES
This delay pattern has the potential of cutting off unfired blastholes. Use where limited movement is desired.



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	APPLICATIONS	SURFACE DELAYS		NOTES	
	Quarry, construction, coal or open pit	42ms		Double surface units recommended with this timing sequence!	
	LIMITATIONS	IN-HOLE DELAYS			
Infinite in depth, 5 holes wide	25ms surface, 500ms in-hole				

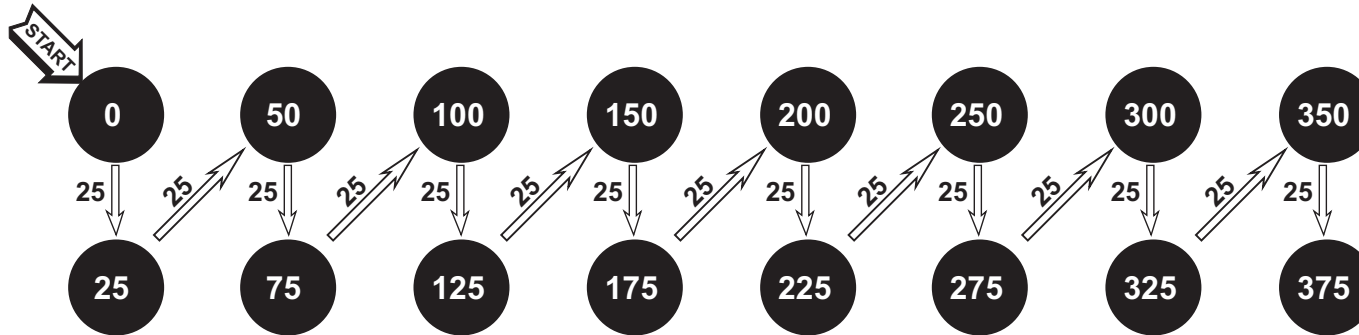


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	APPLICATIONS	SURFACE DELAYS		NOTES	
	Construction or open pit	17ms		Double surface units recommended with this timing sequence!	
	LIMITATIONS	IN-HOLE DELAYS			
Infinite in depth, 3 holes deep	25ms surface, 500ms in-hole				



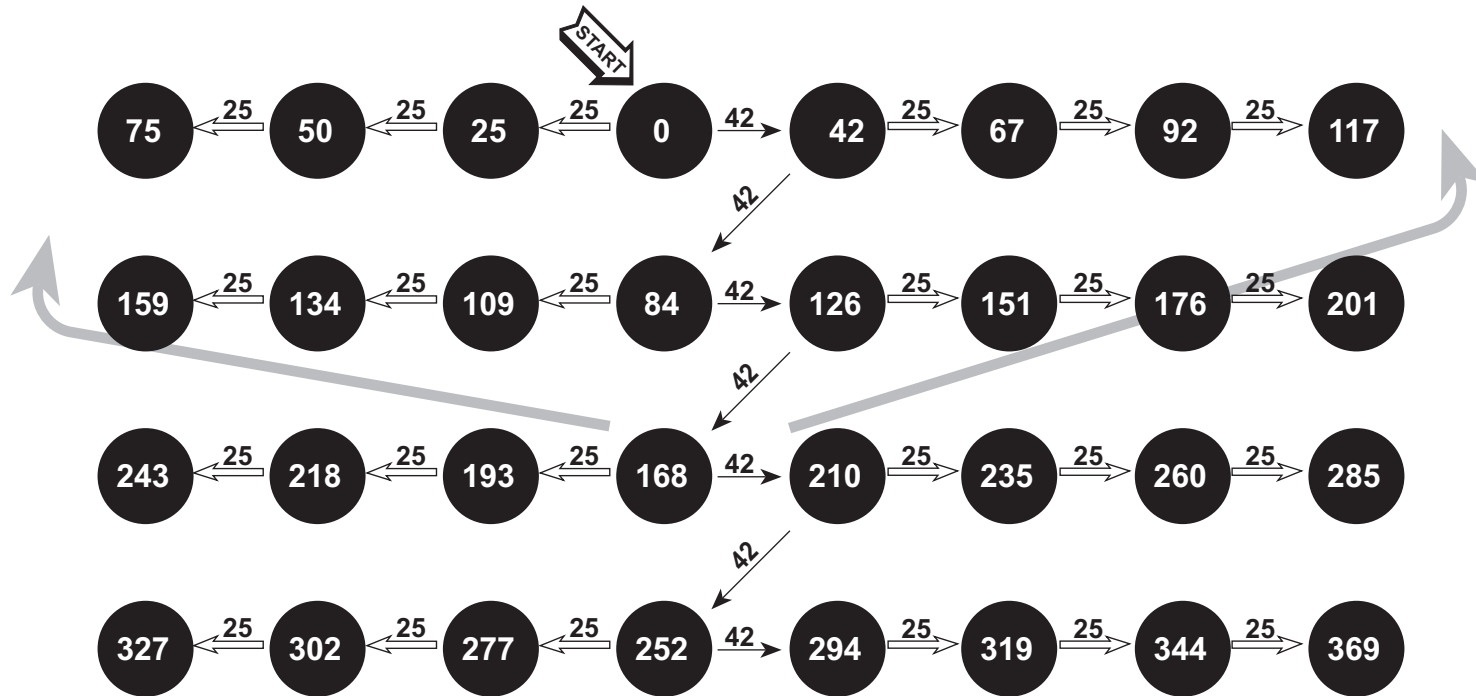
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	APPLICATIONS	SURFACE DELAYS		NOTES	
	Quarry or construction	42ms		<p>Double surface units recommended with this timing sequence!</p>	
	LIMITATIONS	IN-HOLE DELAYS			
Infinite in length, 3 rows deep	25ms surface, 500ms in-hole				

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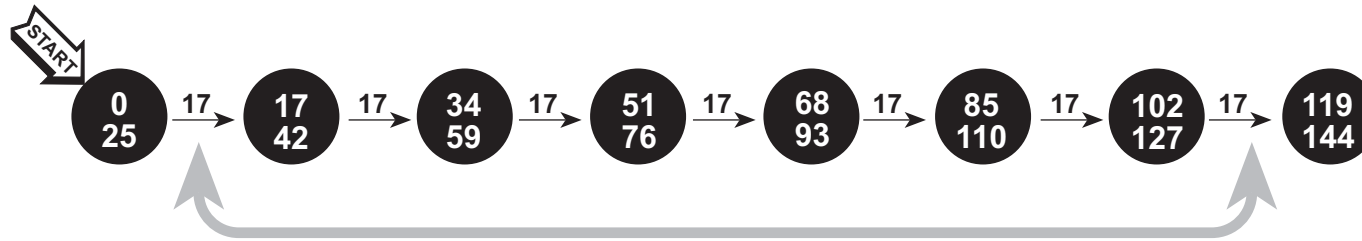
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	<p>APPLICATIONS</p> <p>Construction (ditch or trench)</p>	<p>SURFACE DELAYS</p> <p>None</p>	<p>NOTES</p>		
	<p>LIMITATIONS</p> <p>Infinite in length, 2 rows deep</p>	<p>IN-HOLE DELAYS</p> <p>25ms surface, 500ms in-hole</p>			

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	APPLICATIONS	SURFACE DELAYS		NOTES	
	Quarry or construction	42ms		Double surface units recommended with this timing sequence!	
	LIMITATIONS	IN-HOLE DELAYS			
Infinite in depth, 8 holes per row	25ms surface, 500ms in-hole				

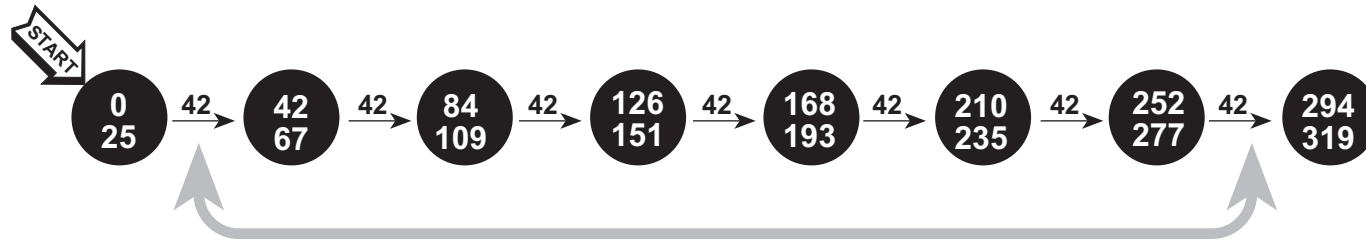
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	APPLICATIONS	SURFACE	NOTES		
	Quarry, 2 decks per hole	17ms	25ms between decks. Use the same delay in the same deck in all holes.		
	LIMITATIONS	IN-HOLE	Same delay period in each hole. Suggested in-hole delay: 475ms and 500ms		
	Infinite in length, 1 row deep, 2 decks				

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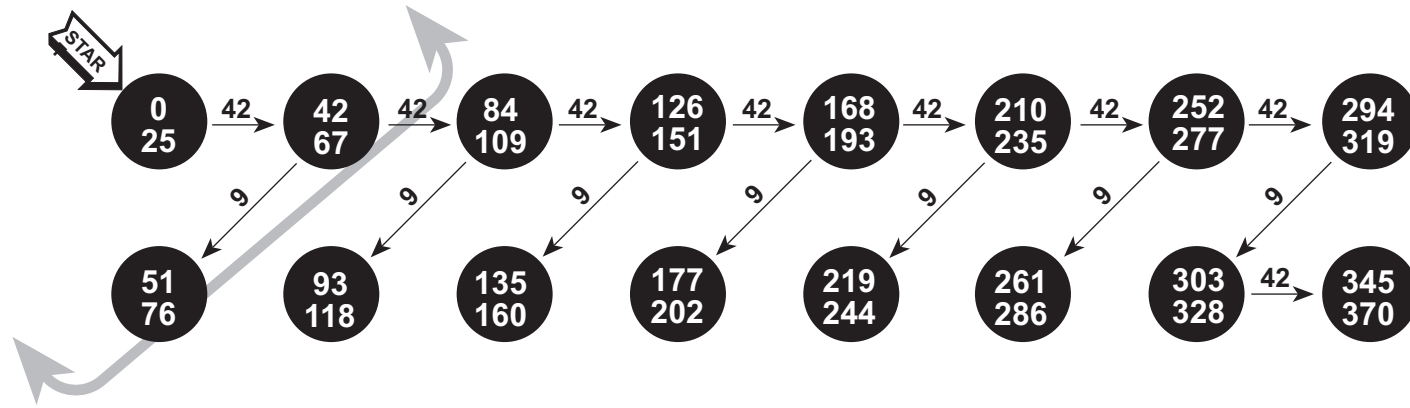
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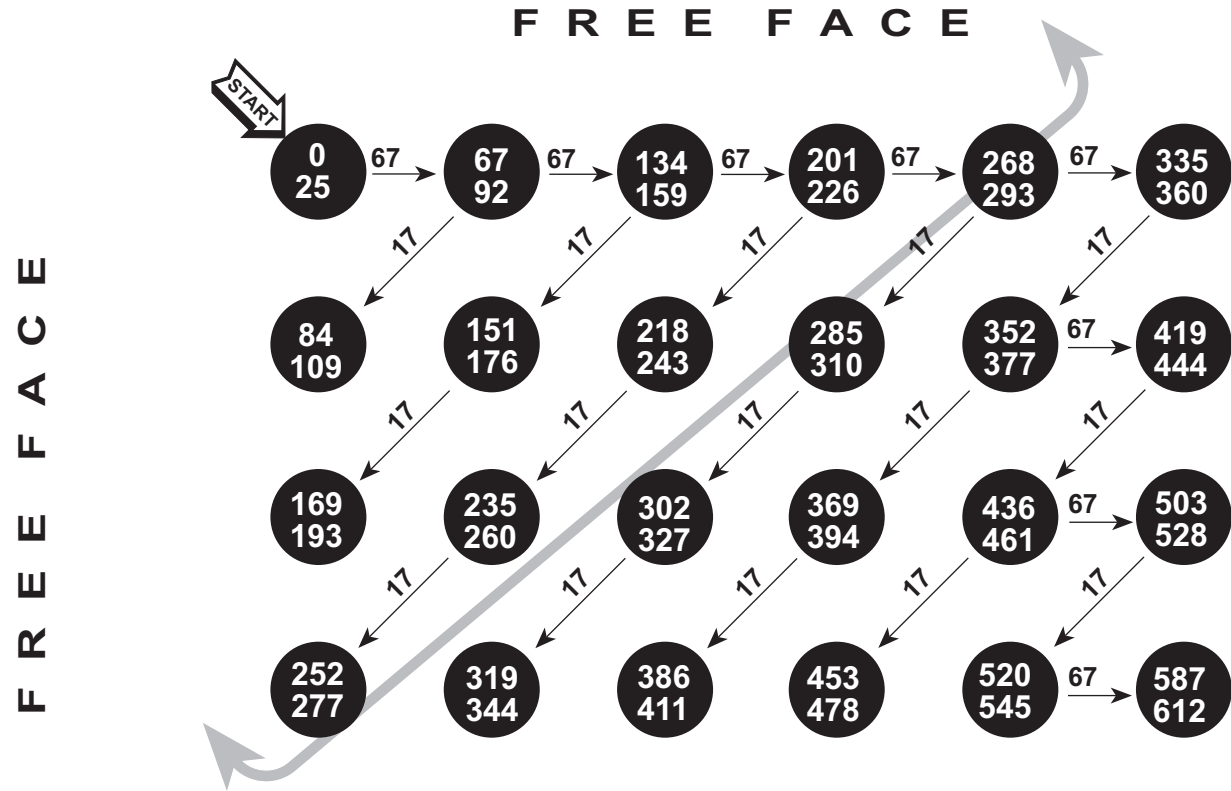
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	<p>APPLICATIONS</p> <p>Quarry, 2 decks per hole</p>	<p>SURFACE DELAYS</p> <p>42ms</p>	<p>NOTES</p> <p>25ms between decks. Use the same delay in the same deck in all holes.</p>		
	<p>LIMITATIONS</p> <p>Infinite in length, 1 row deep, 2 decks</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 475ms and 500ms</p>			
	<p>2</p>				

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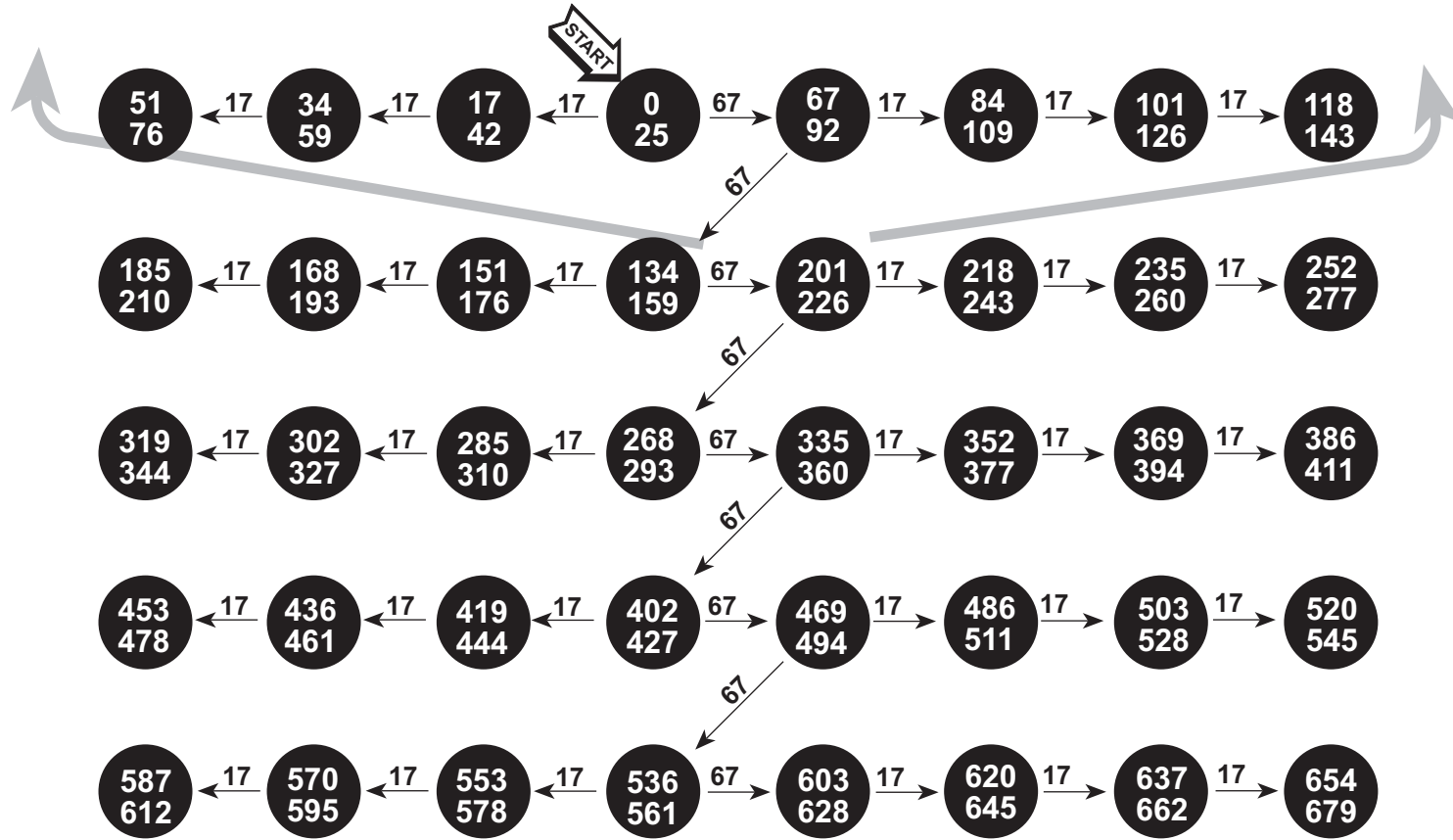


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	<p>APPLICATIONS</p> <p>Quarry, 2 decks per hole</p>	<p>SURFACE DELAYS</p> <p>9ms and 42ms</p>	<p>NOTES</p> <p>This pattern is designed for a square pattern fired in a true echelon. Use the same delay in the same deck in all holes.</p>		
	<p>LIMITATIONS</p> <p>Infinite in length, 2 rows deep, 2 decks</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 475ms and 500ms</p>			
	<p>3</p>				

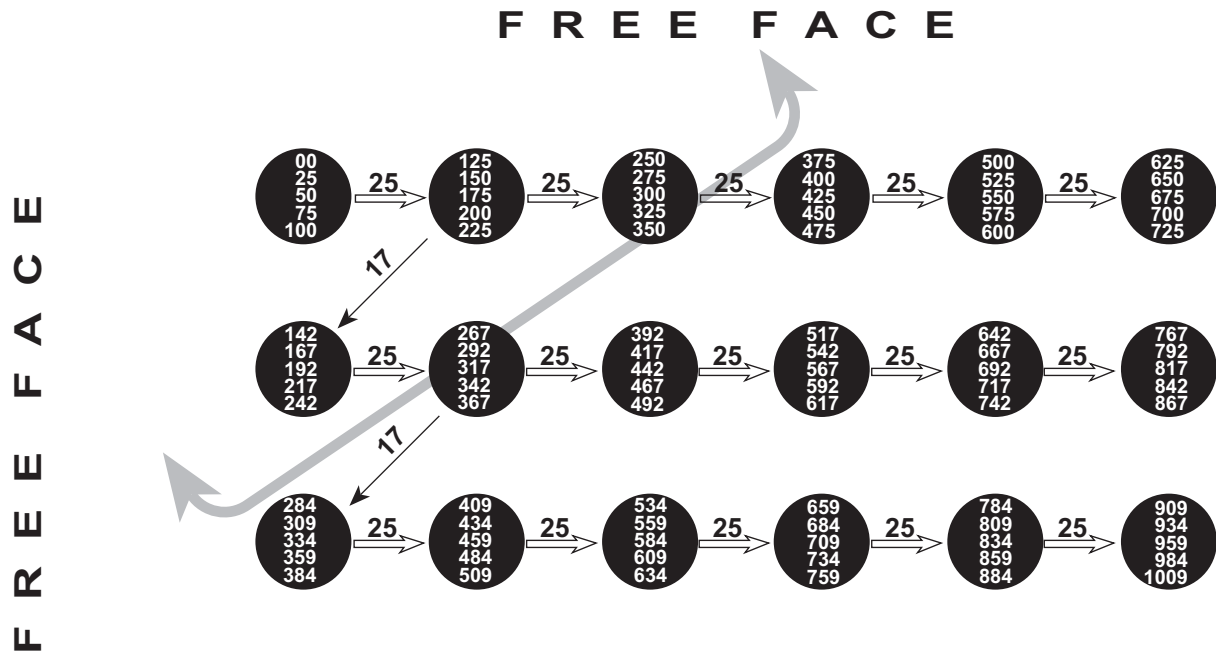


<p>DYNO[®] Dyno Nobel</p> <p>2650 Decker Lake Blvd, Suite 300 Salt Lake City, Utah USA 84119 Telephone: (800) 732-7534 www.dynonobel.com</p> <p><small>DYNO NOBEL INC. and its subsidiaries disclaim any warranties with respect to their products and the information presented herein, the safety or suitability thereof, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR ANY OTHER WARRANTY. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of their products. Under no circumstances shall DYNO NOBEL INC. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.</small></p>	<p>000 Sequential Time</p>	<p>00 NONEL[®] EZTL[®] Delay Time (ms)</p>	<p>Movement Direction</p>	<p>2 DECKS 4</p>
	<p>APPLICATIONS</p> <p>All, 2 decks per hole</p>	<p>SURFACE DELAYS</p> <p>17ms and 67ms</p>	<p>NOTES</p> <p>Use the same delay in the same deck in all holes.</p>	
	<p>LIMITATIONS</p> <p>Infinite in length, 4 rows deep maximum (1,2,3,4 rows)</p>	<p>IN-HOLE DELAYS</p> <p>Same delay period in each hole. Suggested in-hole delay: 475ms to 500ms</p>		

FREE FACE

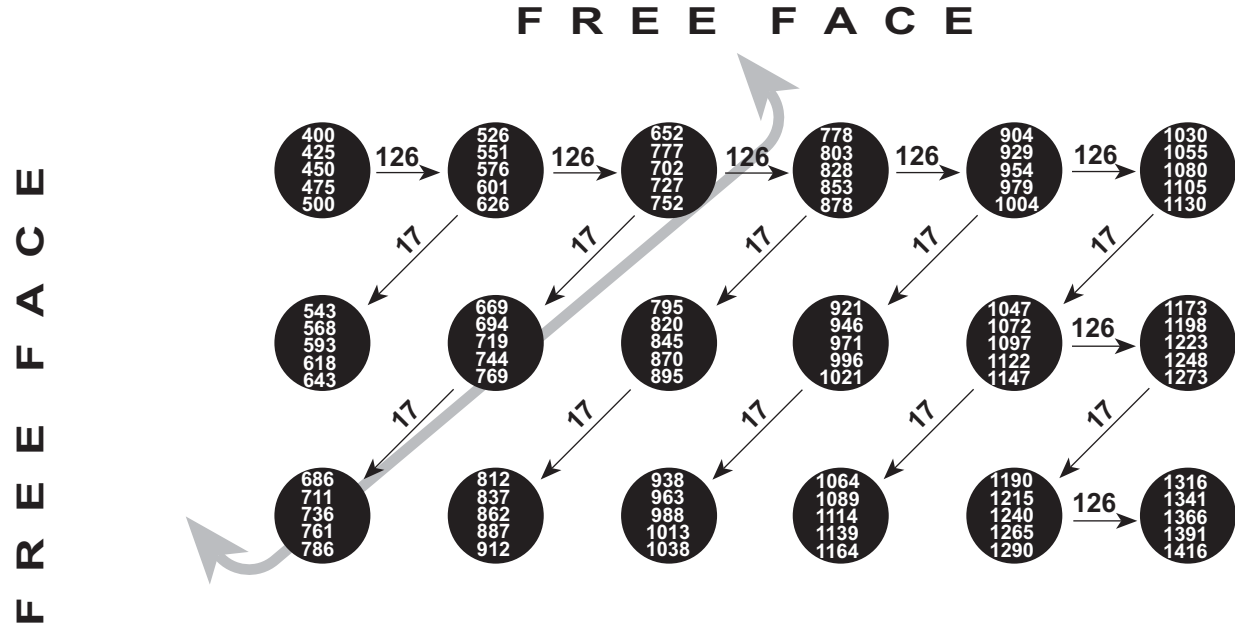


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	APPLICATIONS	SURFACE DELAYS	<p>NOTES Double surface units recommended with this timing sequence! Use the same delay in the same deck in all holes.</p>		
	Quarry or construction, 2 decks per hole	17ms and 67ms			
	LIMITATIONS	IN-HOLE DELAYS	<p>Same delay period in each hole. Suggested in-hole delay: 475ms and 500ms</p>		
8 holes long, infinite in depth, 2 decks	Same delay period in each hole. Suggested in-hole delay: 475ms and 500ms				



Using NONEL® EZ DET® in the hole for all decks

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	<p>APPLICATIONS</p> <p>Quarry, construction, mining or open pit</p>		<p>SURFACE DELAYS</p> <p>17ms EZTL delays, 25ms EZ DET delays</p>		<p>NOTES</p> <p>Double surface units recommended with this timing sequence!</p> <p>Connect EZ DETS to one another in order of desired sequence. Connect the last EZ DET of each borehole to the first EZ DET in the next borehole to continue initiation.</p>
	<p>LIMITATIONS</p> <p>Multiple deck charges fire together</p>		<p>IN-HOLE DELAYS</p> <p>Suggest EZ DET 25/500</p>		



Using NONEL[®] MS in the hole for all decks

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	<p>APPLICATIONS</p> <p>Quarry, construction or coal</p>	<p>SURFACE DELAYS</p> <p>Use either 17ms or 42ms EZTL delays. For 126ms, combine 109ms and 17ms EZTL delays.</p>	<p>NOTES</p> <p>The 17ms delay can be changed to 42ms with no adverse effects.</p>		
	<p>LIMITATIONS</p> <p>Infinite in length, 3 rows deep maximum , 2 decks or more</p>	<p>IN-HOLE DELAYS</p> <p>Recommend 400, 425, 450, 475, 500 ms per deck for up to 5 decks; only if EZ DETS are not available</p>	<p>Use the same delay in the same deck in all holes. 25ms between decks</p>		