DSI UNDERGROUND
A SANDVIK COMPANY

KINLOC® Indie

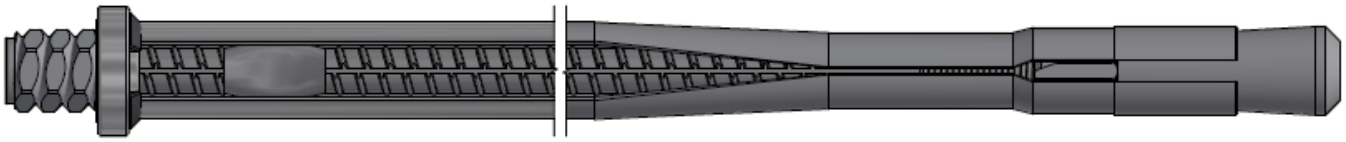
Mechanically Point Anchored Friction Bolt

Product Overview

The KINLOC® Indie is the premium development arising from the growing KINLOC® product range and represents the most advanced features currently available in this class of product in the market. The product has been specifically designed to both provide point load capacity but equally in the event of dynamic ground movement the product has the ability to sustain impacts above 40 [kJ].

The KINLOC® Indie is highly intentional in its design outcomes – being derived from a rigorous analysis of mechanical performance and geotechnical application. Radial expansion of the KINLOC® Indie head maximises surface area engagement within the bore hole offering best practice in load transfer capacity.

The predominant feature that elevates the performance of the KINLOC® Indie is the independent anchoring head, which is external to and mechanically isolated from the influence of the friction bolt body under geotechnical load.



Product Specifications

Physical Properties				
	Minimum		Typical	
Yield Strength	300 [MPa]	120 [kN]	400 [MPa]	150 [kN]
Tensile Strength	600 [MPa]	220 [kN]	680 [MPa]	250 [kN]
Elongation (after fracture)	14%		20%	
Shear Strength (Calculated)	226 [kN]		254 [kN]	
Dynamic Capacity			35 [kJ]	
Dynamic Displacement			150 [mm]	
Mass Per Metre	5.94 [kg]			
Friction Bolt Diameter	Ø47 [mm]			
Hole Diameter Range	Ø44 [mm] min. / 45.5 [mm] max.			
Cross Sectional Area	370 [mm^2]			
Installation Torque	330 [Nm] Nominal			
Maximum Anchor Point	50 [mm]			

Recommended maximum expansion of anchor point to effectively secure the anchor has been tested at 50mm. Theoretical expansion may exceed this.

Product Features

- Premium point anchored Friction Bolt – high capacity performance – to 250 [kN].
- Point anchoring is completely independent of the friction bolt body, providing stable anchoring during ground movement and shock loads.
- Percussive installation, then rotation to pretension. Resin is not required.
- Point anchoring head assembly has been proven to be beyond the capacity of the bar.
- Dynamic capacity has been measured above 40 [kJ] with stable test outcomes and displacements up to 175 [mm] – refer to Dynamic Performance Chart below. Factors of safety need to be applied.
- Galvanised coating systems are available providing specialised corrosion protection for all bolt elements.
- The KINLOC® meshing plate can be used to secure mesh after bolt installation with the same installation spanner.
- The KINLOC® Indie Bolt comes with an Event Capture System (ECS). In the event of bolt overload, the fractured segment is retained in the collar.

Design

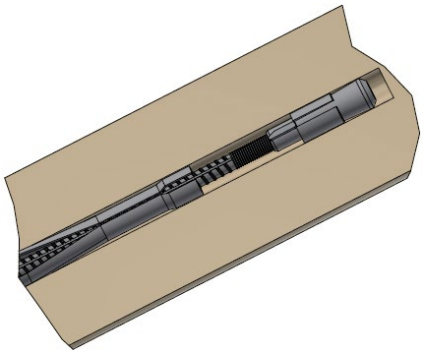
Toe – End Design Logic

The expansion ring is initially activated by bar rotation, locking into the bore hole wall.

The expansion ring is made from an alternate load bearing material. Its radial loading pattern and increased contact area around the circumference of the bore hole significantly increases point anchoring capabilities.

As ground movement occurs, the solid bar is retained by the expansion head and takes up load while the friction bolt body provides additional support to the system.

The friction bolt tube material is known to abrasively wear and slip in the bore-hole under higher loads. The KINLOC® Indie expansion head avoids this concern – its expansion ring is independent of the friction bolt material.



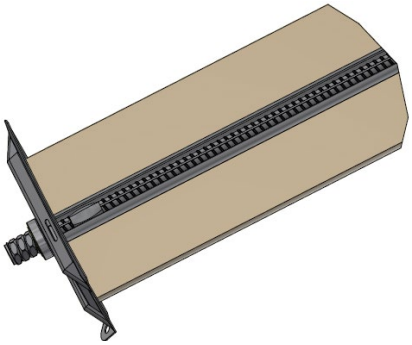
Collar – End Design Logic

At the collar end of the installation, ground movement also has implications for the functional performance of the bolt.

For the KINLOC® Indie, the friction bolt tube is not constrained by point anchoring, it is free to travel with ground movement – as such, the friction bolt displaces within the borehole.

The internal bar carries load independently of the friction bolt tube, while the ECS (Event Capture System) is retained and secured within the friction bolt. This permits full independent movement and yield of the bar while ensuring the functionality of the ESC system.

The fully integrated KINLOC® Indie product design permits high capacity point anchoring, ECS functionality as well as delivering the required dynamic performance – a combination of axial force and elongation.



Validation

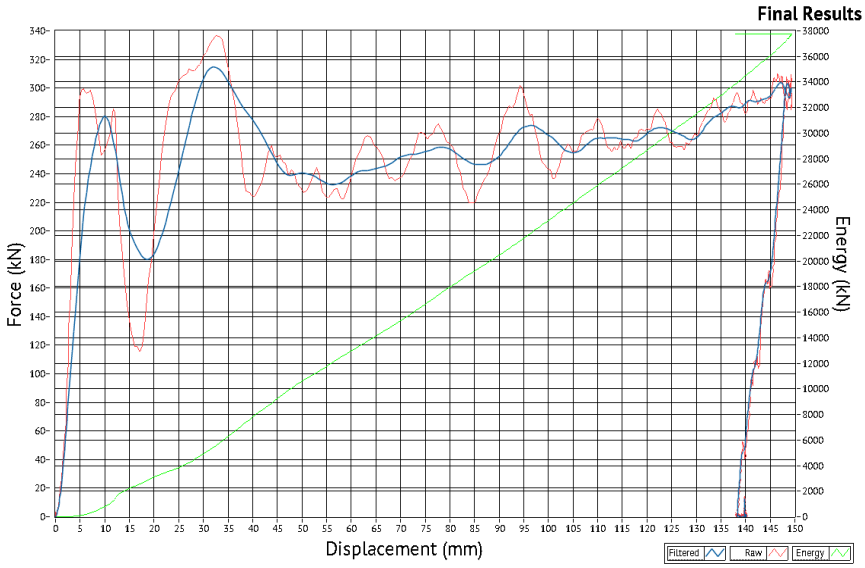
- The KINLOC® Indie provides dynamic performance through elongation of the bar material. The product design permits the solid bar to anchor and elongate unencumbered by the friction bolt.
- The bar type selected is based on the balance of peak load and elongation properties.
- The internal free length for the bar material within a standard bolt is 2,250 [mm] – this length is the basis for performance testing.

Dynamic Testing

Dynamic drop testing has been conducted on the KINLOC® Indie, using the momentum transfer method.

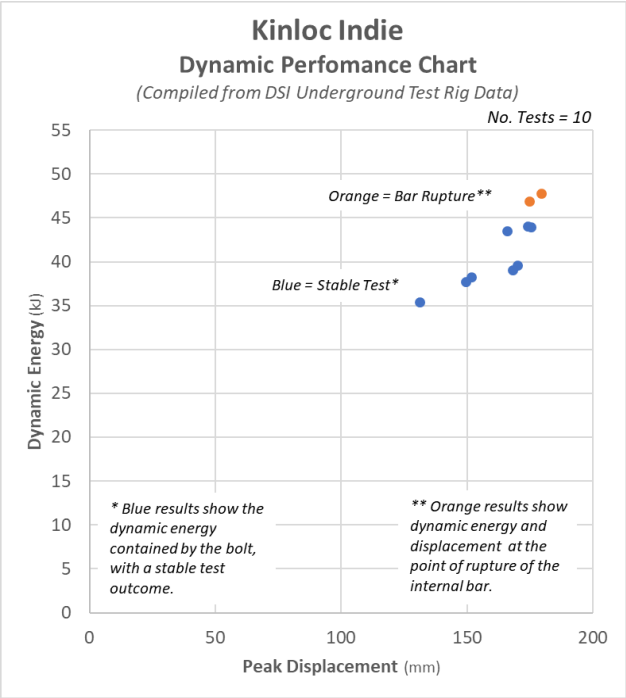
The test format used a 2.4 [m] bolt, installed into a pre-drilled test pipe being split at its mid-point, representing a fault line or discontinuity at 1.2 [m] into the rockmass.

Typical Dynamic Test Curve



- Measured Energy Output: 37.8 [kJ]
- Peak Displacement: 149 [mm]
- Peak Force: 314.6 [kN]
- Post-test analysis indicates minimal movement of the anchoring head at this level of energy containment. The dynamic energy is therefore generated by elongation of the bar material.

Dynamic Performance Chart



- The above Dynamic Performance Chart shows the relationship between energy and displacement for the Kinloc Indie across 10 dynamic tests.

Underground Testing

The KINLOC® Indie has been rigorously tested through numerous underground installation trials and subsequent load transfer testing.

Underground pull tests have proven that point anchoring of the KINLOC® Indie is capable to 25 tonnes – highlighting the extreme performance of the point anchoring expansion head.

Laboratory tests have also confirmed the unique locking action of the expansion head mechanism and load bearing capability.

Product Accessories

- Spanner
- Dragonfly Plate
- Dome Plate
- Pull Ring
- 16T Pull Tester
- Hanger Nut

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