

**WINCHES & WINDERS (PTY) LIMITED t/a
TECH EDGE / FULTONS WINCHES**

**REVOLUTIONARY
NEW MINE SAFETY DEVELOPMENT**

**FULTONS 1400 SINGLE DRUM MOBILE MINE
RESCUE WINDER**

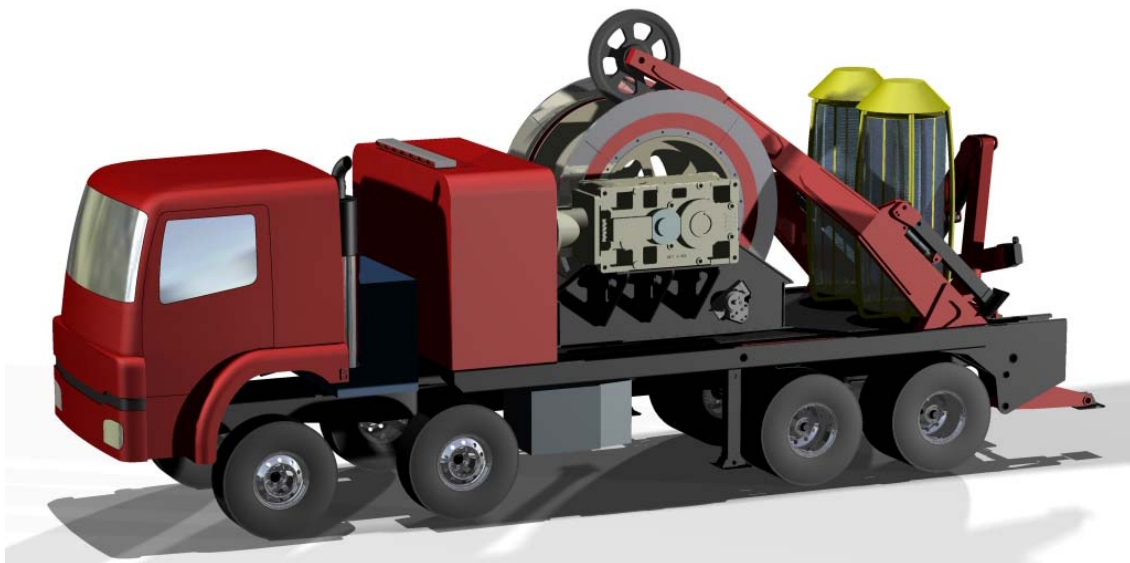
Winches & Winders (Pty) Ltd has been manufacturing winders for use in the South African mining industry for over 70 years and has installed over 6000 small, medium and large machines including single, double and four drum winders.

We are registered under the ISO 9001:2008 Quality System after audit by British Standards Institute and SGS South Africa.

As a result of market requirements, Winches & Winders (Pty) Ltd has developed a Single Drum Truck Mounted Mobile Mine Rescue Winder with capability to rescue 8 people at a time from 3000m depth. The truck is 8 x 4 wheel drive, capable of off-road and rough terrain travel.

Our design is protected under South African Design No. F2011/231 – 233.

The winder is based on our tried and tested Fultons 1400 Single Drum Winder with Double Disc Brakes, connected to a standard Fultons gearbox, hydraulically driven, powered through the Power Take Off of the truck. It is self-contained with on-board back-up power for winder and braking system.



Fultons 1400 Single Drum Mobile Mine Rescue Winder

1. Winder Design

The Fultons winder drum, gearbox, braking system, and base are all designed to the highest standards and exceed all requirements set by SA Mining Legislation.

The project utilises the latest state of the art winder technology, including CAD and Finite Element Analysis. The Fultons reputation for long life and high reliability is maintained from job inception to final commissioning and hand-over.

Our design addresses all specific requirements stipulated by the Manager : Mine Safety, SA Department of Minerals and Energy.

2. Truck Specification

Mercedes Benz Axor 3535K-51, 8 x 4, extra chassis length with deployment arms for sheave wheel. Larger fuel tank, capacity 1 350ℓ, equal to 48 hours working / driving time.

6 Cylinder engine, total displacement 11,967cm³, 260kW power output at 1900RPM, coupled to manual transmission with low range and crawler gear. This allows economical operation, high climbing performance under high loads and easier vehicle handling.

The engine is fitted with a split shaft PTO rated at 210kW to drive main hydraulic pump, as well as a standard gearbox PTO rated at 45kW to drive other hydraulic systems such as rear crane and sheave wheel mechanism

The high-strength chassis frame is E 500 TM high strength steel. The chassis components are cold-formed for enhanced strength, ensuring high loading capacity.

Hydraulic outriggers are fitted to ensure stability of the unit when in winder operation.

3. Sheave Wheel Deployment Mechanism

1. Hydraulically operated deployment structure to support sheave wheel.
2. Reinforced sub-frame to support load and moments of deployment arms.
3. Hydraulically operated rear support arms on sub-frame to balance sheave wheel deployment.
4. Hydraulically operated rear support legs on deployment arms with manual final positioning.
5. Mechanical locks for travelling mode and maximum deployment angle.
6. Electronic safe device for maximum deployment angle.



Sheave Wheel Pre-Deployment



Sheave Wheel in Deployment



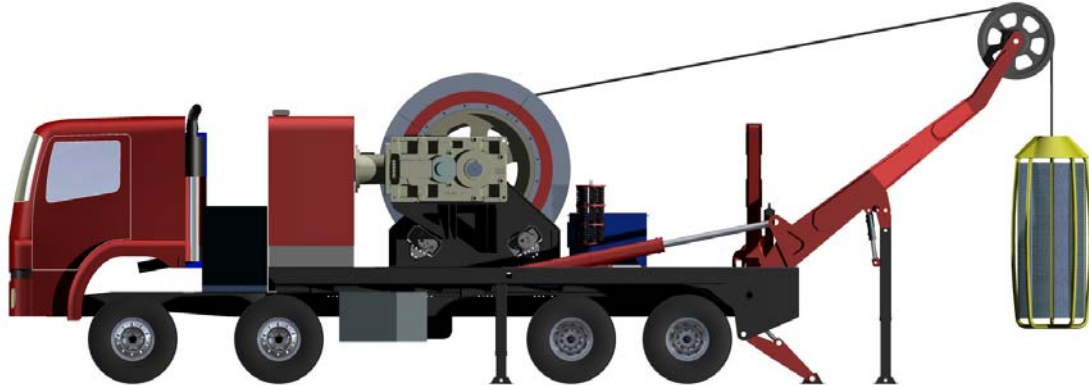
Sheave Wheel Deployed, Support Legs Locked,
Winder Ready for Operation

3.1. Overturning moment due to rope pull

The moment on the truck at rope break of 262kW, taken about the end of the bed, is 630kNm.

The moment due to the mass of the truck and load is 697kNm.

The safety factor on overturning before rope break is 2,66.



4. Truck Sub-Frame

A customised sub-frame is fabricated from 300WA steel, based on final winder design, sheave wheel deployment mechanism, auxiliary power unit, drivers cabin and rear crane.

A stress and strength Finite Element Analysis is conducted using our Autodesk Finite Element Analysis System, to confirm final overall design.

5. Outriggers

Standard outriggers are fitted to bear the forces resulting from rope pull.

The outriggers serve to stabilize the truck during operation and also serve as anchor points for grouted foundation bolts if used.

6. Winder Base Frame

The winder base frame is fabricated from 300WA steel and bolted to the sub-frame. A stress and strength Finite Element Analysis is conducted using our Autodesk Finite Element Analysis System.

7. Gearbox

A Fultons 1200 gearbox is selected based on the torque due to the maximum rope pull. The gearbox has a torque rating of 73,5kNm, resulting in torque safety factor of 1,596.

8. Power Take Off

The truck PTO is of sufficient power and specification to accommodate the winder, braking system and crane. Using maximum load, changes in altitude and losses in the power train, a PTO output of 140kW is required. This is available on the specified truck, power taken from an engine driven split PTO.

9. Hydraulic Winder Drive System

The hydraulic piston pump set is a tandem unit, close coupled to the PTO. The main pump is pressure and flow compensated, which drives the hydraulic motor. The auxiliary pump powers the braking system. An oil cooler will be fitted, suitably sized to prevent overheating of the oil.

Oil from the main pump flows via a pressure filter to a proportional throttle valve, and from there via a directional control valve to the motor. A counterbalance valve prevents overrun. The hydraulic motor is close coupled to the winder gearbox.

Motor control is via the electric panel. Signals from the joystick are fed to an amplifier card, which controls the proportional valve. This regulates the motor speed. The directional control valve controls the forward / reverse movement.

In an emergency, there is a manually operated directional control valve. This will have a fixed flow, set by the flow control valve.

10. Hydraulic Braking System

The auxiliary brake pump is pressure compensated, with a reservoir, and provided with a level gauge, filler breather and 10-micron return filter combination.

Mounted on the reservoir is a compact manifold block, with pressure quick drop, fast braking and adjustable slow braking. Fixed orifice controls are also provided and two safety trip valves employed for additional safety.

A driver's lever linked to a proportional control valve is situated in the driver's pedestal, to select "off", "on" and "float" control of the brakes. This is provided with a switch to de-energise all emergency valves when placed in the "brakes on" position. Our standard manifold block is designed for easy setting of braking times, simple maintenance and fault finding. Fast and slow braking together with quick drop are incorporated in the hydraulic circuits.

The operation of the main brakes is linked to the winch safety circuit which when activated, dumps the hydraulic pressure and automatically applies the brakes.

11. Main Braking System

The main braking system consists of two main disc brake paths which will each accommodate 2 Svendborg fail safe hydraulic disc brake units. The brakes will be designed to hold twice the full load at the bottom of the shaft, rope load included, and can be tested independently.

Please note that the double main brakes represent a significant safety feature.

12. Safety Circuit

The safety circuit complies with all requirements of the Mines Inspectorate for man and material winders, which will consist of overwind, underwind, three turn warning, overspeed protection, key switch and emergency stop. All electrical circuits will be 24volt supplied by the truck's electrical systems.

13. Communication

An E-cam communication system is supplied to enable communication between conveyance and winder operator.

14. Truck Crane

The truck is equipped with a crane at the rear, complete with hydraulic yoke and basket. A hydraulic power pack driven from the truck PTO powers the crane.

The crane will be used to load and offload the rescue cage and support equipment.

15. Backup Power Supply

A diesel engine of sufficient power coupled to a hydraulic pump drives the winder and braking system in the event of truck engine failure.

This emergency system enables brake release and hoisting at limited speed.

16. Lighting

Lighting powered by the truck is supplied around the truck and towards the headgear via 12/24volt LED lights, and spotlights.

17. Rescue Cage

The rescue cage will consist of two detachable decks, manufactured from aluminum as far as possible. Each deck has four seats, with option of converting two seats to accommodate a spine trauma stretcher. Each person in the cage has a safety harness hooked to the cage centre component.

18. Enquires

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