



Mining haulage for the 21st century







MINING HAULAGE FOR THE 21st CENTURY

The first significant change in rigid haul truck design for 50 years

ETF's innovative breakthrough hauling system was developed specifically to overcome the limitations of operating existing trucks.

- Haul train configuration (multiple unit functionality)
- Increased utilization
- Increased technical availability
- Lowest cost per ton
- Assured total life cycle costing
- Eco-design with substantial environmental benefits
- Safest trucks in the industry
- Major tyre issues resolved

All-Wheel-Drive and All-Wheel-Steering- just two of many unexploited economic and operational benefits:

In order to solve loss of production suffered by conventional haul trucks during heavy rain or snow, ETF designed an all new innovative truck incorporating all-wheel-drive, all-wheel-steer configuration, combined with advanced Anti Lock Braking and Traction Control.

Due to the sheer scale of this increased traction, ETF trucks can climb grades better as well as maintain full stability downhill loaded even during full 'all wheel retarding' on any surface and under any climatic conditions. As a result, mine operators will see increased machine utilization induced production in the order of 8 % without increased capital expenditure.

Active independent hydro-pneumatic suspension

As a result of antiquated design the majority of current large haul trucks suffer from very stiff and limited suspension travel resulting in extreme torsional stresses as well as heavy, unmanaged and poorly directed impact forces into the main frame. ETF developed a special hydro-pneumatic suspension system that automatically compensates for the vehicles changing body attitude, equalizing loading between individual axle-lines.

This compensation feature increases stability while negotiating a curve, resulting in higher secure permissible speeds and shorter overall trip times. The extremely long wheel travel (950 mm) protects the main frame.



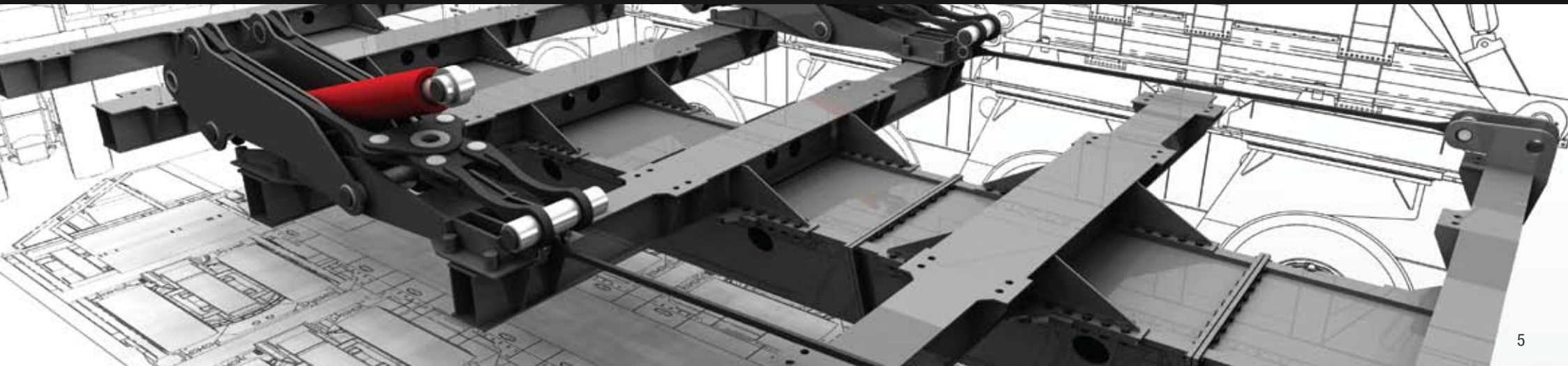
Oscillating axles

Axle construction is also totally unique, rather than solid drive axles mounted across the entire width of the truck severely limiting space, ETF did away with the centre part altogether leaving two completely independent axle assemblies.

This radically different approach allows each axle to not only independently steer the vehicle, but each also oscillates right and left preventing the 100% overloading of the tyres experienced when conventional two axle trucks encounter extreme undulating surfaces while loading and dumping. This combination of long wheel travel and axle oscillation provides supreme road contact and optimum tyre-load spread under all operating environments.

Unique Monorail frame

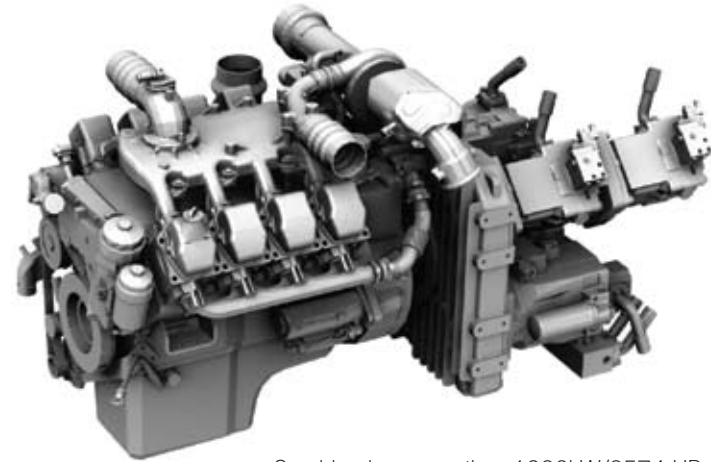
The main frame of an existing large haul truck is often the component which determines the entire lifetime of the vehicle. Huge forces are transferred into the frame due to road impacts and dump body shocks during loading. ETF developed an innovative solution: the Monorail frame. Instead of a frame running on top of the axles as on competitive vehicles, the ETF design places the frame between the axles lowering the centre of gravity. Existing vehicles have four points on which the total load is transferred to the wheels. ETF's monorail and axle system has ten points. In this way the forces to the frame are better equalised. This monorail construction, in combination with long wheel travel reduces frame fatigue.



ETF APPLIED TECHNICAL INNOVATIONS

Multiple engines = Power on demand

Haulage can account for 40 -50% of the surface mine operating expenses, most expensive being fuel and tyres. Existing large haul trucks are powered by one large displacement diesel engine which is only ever fully utilised during the loaded cycle. On empty returns large engines are not efficient, in fact wastes fuel. That's why ETF choose to power the truck using four individual engines to provide full power, when operating on empty hauls only two engines are all that is normally required. This also provides another unique ETF feature; a redundancy package to backup systems like steering and braking power. If one engine should develop a problem, it will 'automatically' shut down with no involvement needed by the operator, the truck maintains fully operational, until a workshop diagnosis is arranged.



Combined power rating: 1920kW/2574 HP







HAUL TRAIN CONFIGURATION

Multiple linked trucks; One driver

Unique to ETF, each truck irrespective of capacity can operate together with others of the same capacity as a 'Haul Train'. Two, three, four or more individual trucks can easily be linked together using a steel arm carrying an enclosed armoured data cable within its structure. Information data from the first operator controlled truck is transmitted via the link arm to the following trucks guiding and controlling all important operating functions like engine power, steering direction and brakes, just as if each unit had separate operators following each other.

The real operational advantage soon becomes very obvious, for every train there is just one operator, so as unit numbers increase payload capacity goes 'up' while operator costs come 'down'.

If for any reason the mine plan should change requiring more or fewer units in the train each truck unit can be de-coupled, allowing each truck to operate independently. This unique configuration provides a mine wishing to change operating capacity the opportunity of simply altering the number of trucks in the train.



Haul trains feature 'three way dumping' capability, each truck can dump individually sideward's or together at the same time at the dump area and crusher.





ETF **DESIGNED FOR FAST MAINTENANCE & REPAIR**

ETF's unique ground up rethink design incorporates interchangeable engine power packs and drive axles to reduce down time. Both these major components can be quickly exchanged; any repairs required can then be completed in the workshop while the truck concerned is back in full production. After repairs and before the component is stored for the next exchange, each is fully power tested to ensure operating performance. Fast wheel / tyre changes, both outer and inner are also part of the unique technical design repair and maintenance package.







EFFICIENT TYRE MANAGEMENT

Efficient tyre utilization and cost saving

Twenty 24.00 R35 tyres mounted on five axle lines support the vehicle's GVW. During empty haulage one axle line, two wheel groups are lifted automatically, saving fuel and tyres. The MT-240 mining truck is equipped with a Central Tyre Inflation System. This keeps the exact tyre pressure under real-time conditions. In case of a flat tyre the offending axle is immediately and automatically lifted preventing total-loss of the tyre and possible damage to the suspension. When conventional two axle trucks turn into a curve; the rear dual tyres act very much like two, very wide tyres with both inner and outer edges fighting to follow different circumferences or pathways on the road surface. This result is called scrubbing/abrasion of the tyre surfaces

as the inner is forced to turn at a different speed than the outer on the same side. Irrespective of whether the trucks is mechanically controlled by a differential or by angle sensors for electric drive, in real mine site conditions all rear tyres are affected by the same rapid, uneven tyre wear. Overall this inherent design fault increases core temperature and risk of failure while contributing to as much as 47 % increased tyre wear. In direct comparison all 20 wheels of the ETF truck are independently controlled, irrespective of direction or steering angle, each following a geometrically correct pathway across the road surface.



ETF HELPS PROTECT THE ENVIRONMENT

To all mining companies care for the environment is an ever important issue one that requires special attention. ETF trucks are contributing considerably to protecting the environment and the ground op approach to truck design has incorporated many systems and components that work towards minimizing negative environmental impact.

Advantages and savings made using ETF trucks:

- Considerable reduction in engine emissions
- Savings in raw materials
- Reduction of waste handling
- Reduction of logistics
- Recyclability

All ETF trucks are standard equipped with engines certified to Off Highway EU Stage IIIA / EPA Tier 3 emission regulations. Optional Tier 4i engines.



Optimized Passive- and Active Safety

Maintaining safety is the single most important issue at any mine site. Modern management realises that maximum efforts have to be made to further improve safety in all areas of operation. ETF trucks are equipped with an extensive list of both active and passive safety features unique to the industry: Sleep Deterrent System, Collision Warning System, ABS & Traction control, Electronic Stability Control, Optical Safety System, superb all round Visibility aided by four Cameras, enhanced vehicle lighting, and even a factory fitted Fire Suppression System. The list goes on, but all are there for a purpose to ensure optimal driver's safety and comfort for reduced fatigue; features don't only protect lives but play their part at reducing downtime and cost.

Best in Class

To reduce driver fatigue, one of the main causes of accidents, ETF put considerable effort into making the operator's environment 'Best in Class'.

From the ergonomically designed visibility cabin, three air seats with ventilation and heating, to the layout of the driver controls, everything is designed to provide 'Best in Class'. This enables operators to concentrate on what they do best 'driving' - technical problems associated with operator errors are now issues of the past

CONTAINER DELIVERY

Delivered in containers and assembled at your site

ETF trucks are delivered in standard ISO containers and assembled at your site. This will avoid the problems associated with the transportation of conventional Large Haul Trucks, such as road width and bridge carrying capacities.

Assembling time for each truck is approx. 1,5 weeks per unit.:





MINING TRUCK AUTOMATION

Mining automation

Full autonomous haulage is being evaluated with some success, offering a combination of efficient operation with reduced operator involvement. Nevertheless, this material management solution is still better suited to specific global applications either separated from the main mine or where there is more land area than most mines have at their deposal. However, there is an alternative, interim step available to all and one that can be quickly incorporated into any existing mine without extensive and expensive infrastructure investment.

Semi Autonomous systems have been developed by ETF to provide greater support to the operator and reduce operating costs to the mine. For a Haul Train operation, 'Automatic Stepped Distance Control' (ASDC) is incorporated.

ASDC functions when an ETF haul train is required to be loaded by a shovel. The shovel operator will swing the first pass, the second and third until fully loaded, but before the shovel returns for the next pass the truck operator selects the distance control function and the truck automatically moves forward aligning the second truck in the correct position for the next shovel pass and so on until the second and any linked trucks are fully loaded.

This feature is included to further improve machine productivity through reduced spotting time, as well as improving operator safety because reversing a truck can be difficult even for the most experienced operator especially when lighting conditions deteriorate or very late at night/early mornings, periods of particularly high operator fatigue.

FUTURE MINING

The Future of Surface Mining according to ETF

Product Driven: Customers will demand specialized tailored products that meet 'all' their individual requirements.

Flexible: Mines will employ operational techniques and methodology that are focussed towards increasing production without investing in increased truck capacity and associated loading equipment endeavouring to stabilize or significantly lower operating costs.

Responsive: Equipment manufacturers need to be capable of operating in a market where quick response to customer's requests for changes to equipment specifications, must be implemented without incessant delays and corporate red tape inherent in the machine industry.

Technical innovation is and will continue to be the driving force behind developments in large mobile mining equipment. ETF has for the very first time re-defined the vision and concept of the mining truck, developing proprietary features that provide distinct, quantifiable advantages over the competition in terms of overall vehicle efficiency. Today the ETF approach is simple, always design and develop new products from the ground up using a combination of sophisticated materials and advanced technology, while never waiting for issues to arise but continually searching out a problem and then solving it, whatever it takes.

ETF has always undergone a process of continuous product improvement so what is today defined by ETF as the new age of truck design may be outdated by the next ETF innovation introduction, in what is expected to be one of the fastest truck development programs in the history of mining equipment.



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