



MINING TRUCK

ETF developed a new and innovative Mining truck range which combines the features of Large Haul Trucks and Articulated Dump Trucks. Because of the All-Wheel-Drive/all-Wheel-Steering capability, ETF trucks can operate in both Off-Highway and Off-Road conditions. Production delays due to slippery road conditions during heavy rain or snow are events consigned to the past.









MT-88



Payload
88 US tons (80 MT)

MT-135



Payload
135 US tons (125 MT)

MT-170



Payload
170 US tons (155 MT)

MT-240



Payload
240 US tons (218 MT)

Features:

- All-Wheel-Drive
- All-Wheel-Steering
- Multiple engines
- Automatic lifting axles during empty haul
- Major components change in 15 minutes (Engines, tyres, axles 60 minutes)
- 95 % technical availability
- Higher usage
- Safer by design
- Environmentally friendly

Click [here](#) for details

ETF MINING TRUCK RANGE:

Model	Payload		Power		Drive
	ST	MT	HP	kW	Configuration
MT-88	88	80	1287	960	8x8x8
MT-135	135	125	1287	960	12x12x12
MT-170	170	155	2574	1920	16x16x16
MT-240	240	218	2574	1920	20x16x20

ST: Short ton (US)

MT: Metric ton



INNOVATIVE MINING HAUL TRAIN

ETF developed a new and innovative Haul Train configuration for mining. ETF Haul Trains are the answer to the demand for even larger payloads than even current Ultra-Class Trucks offer. The innovative design results in the lowest cost per ton in the industry.

Payloads from 463 to 873 US tons.

Huge operator cost savings

Tyre savings of more than 45 %

In-pit loading and hauling even in very

wet and slippery conditions





by one operator) (Simultaneous or individual tipping of each vehicle in the train



Haul Trains 4-axle line

3x HT-152 One operator!



Payload 463 US tons (420 metric tons)

Haul Trains 5-axle line

3x HT-218 One operator!



Payload 655 US tons (596 metric tons)

4x HT-218 One operator!



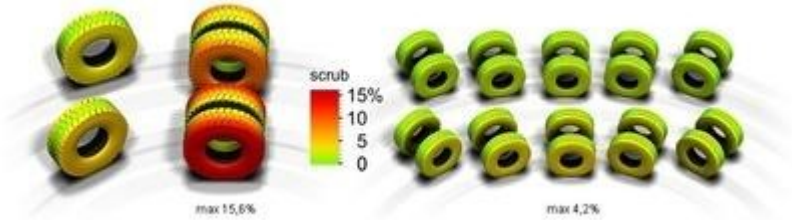
Payload 873 US tons (794 metric tons)

ETF Haul Trains can be used on the same roads where current Large Haul Trucks are operating with existing haul road profiles and bend radius.

- Two-way side-tippers standard (Left and right tipping).
- No haulage distance limitations as with current Large Haul Trucks.

Tyre problems solved:

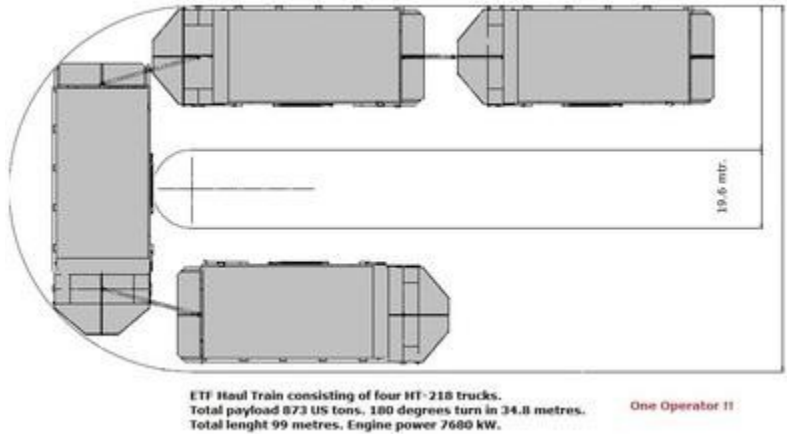
One of the biggest limitations of current haul trucks are the tyres more importantly maintaining their condition. All ETF truck and train combinations are equipped with a Central Tyre Inflation System which keeps the tyre pressure correct at all times and in all operating conditions. If for example very soft surface conditions might require a lower inflation pressure then this can be set for all the tyres, then later if conditions change the standard pressure can quickly be re-set.



In case of a flat tyre, the operator receives a message on his cab display and the affected axle is automatically lifted to prevent total-loss of the tyre or structural damage to the suspension. While a conventional two axle 6 tyre truck would have to suspend production dump its load and then be towed to the workshop, the ETF truck can maintain full operation with one axle line lifted. During empty hauling 40% of the tyres are automatically lifted to reduce tyre costs. The tyre size used 24.00R35 is also easier to obtain and far less expensive than the large 63in sizes required by Ultra Class Trucks.

Compared with Ultra-class Trucks the tyre costs are more than 45 % lower!

Enhanced steering



All ETF trucks have All-Wheel-Steering then turning radius. In single lane use just 9.8 m (sufficient for a Haul Train with HT-218 truck each) For a 180 degrees turn only 34.8 meter

Higher Technical Availability

One way ETF obtains an extremely high technical availability percentage is by exchanging components instead of repairing it on the vehicle. This means that the Haul Train can continue operating and the repairs of the components can then be completed in the workshop. Tyres and Power Modules can be changed in 15 minutes; ETF can keep stock levels of spare parts very low while always ensuring the right component is available.



Higher Utilization

Downtime for checking tyre pressures, topping up of lubricants and c completed automatically during operation. Absolutely no loss of prod trucks would be parked until conditions improved the fully integrated maintains full time operation of the fleet.

Safer

Collision accidents will be considerably reduced because there are few

Haul Trains are equipped as standard with:

- ABS brakes and Traction Control on all wheels resulting in su kniving;
- Optical Safety System;
- Sleep Deterrent System;
- Collision Warning System;
- Camera's on both sides and rear;
- Enhanced lighting;
- Enhanced Ergonomics and HVAC system.

This is all done to reduce fatigue and make the driving of the Large H

Click [here](#) fore more details.

ETF Haul Trains: the lowest cost per ton in the industry!



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body

ETF MT-240 Truck with coal



ETF MT-240 Truck with rock body



Front view oscillating

axles



Side view suspension travel (950 mm)



View oscillation and suspension travel

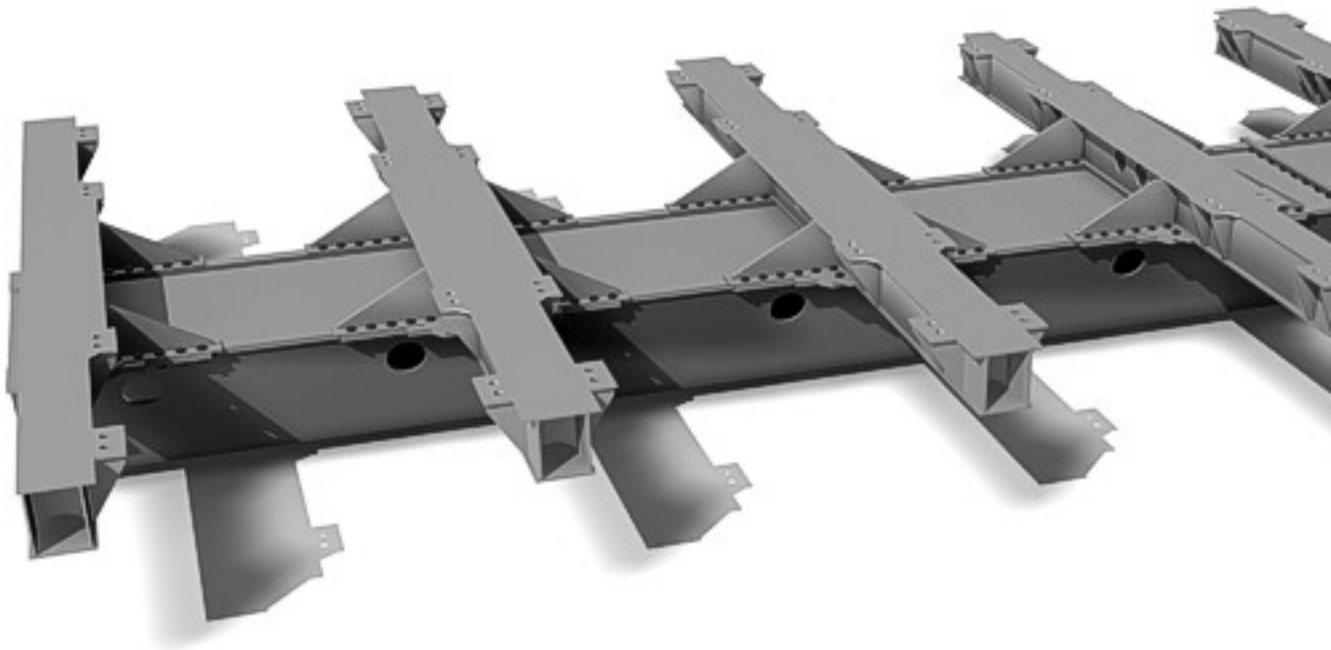


haulage

Two axle-lines lifted during empty

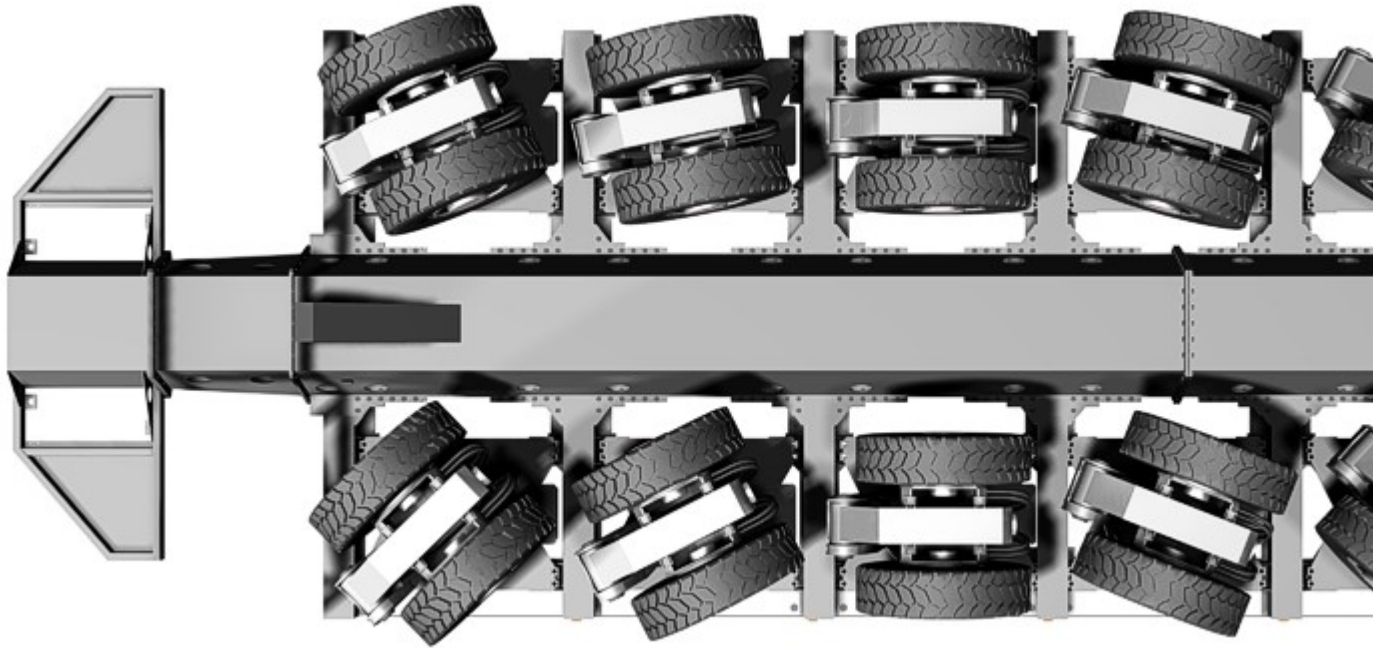


Axle automatically lifted in case of flat tyre



Monorail

frame





All-Wheel- Steering and All-Wheel -Drive



body tipping

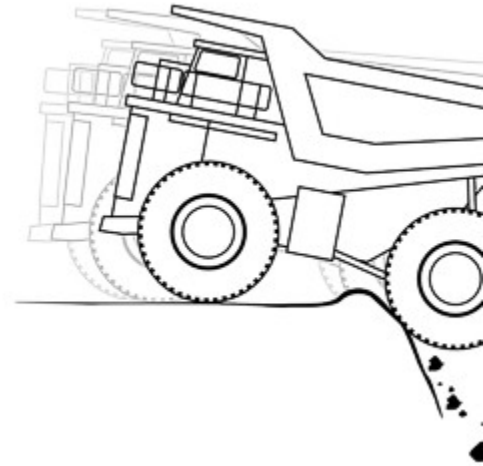
Coal



Rock body tipping

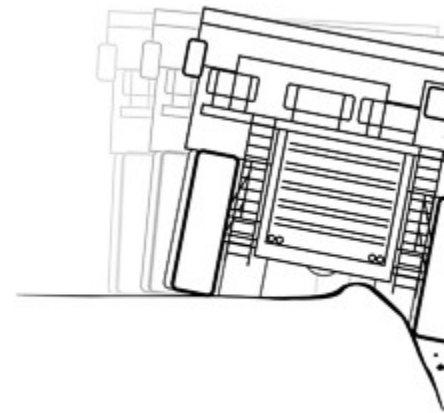


3-way tipper for Haul Train use



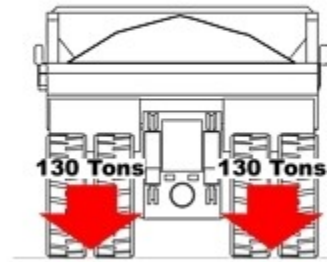
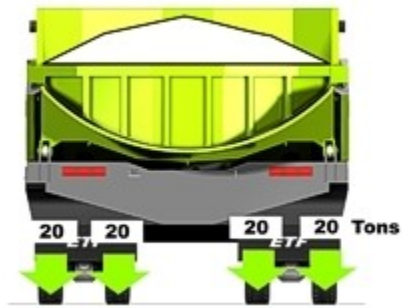
error

Fall down prevention caused by driver



trucks correction still possible !!

Driving over the road shoulder with ERF



The effects of better spread ground pressure (ETF versus current Large Haul Trucks)





ETF Haul Train during tipping



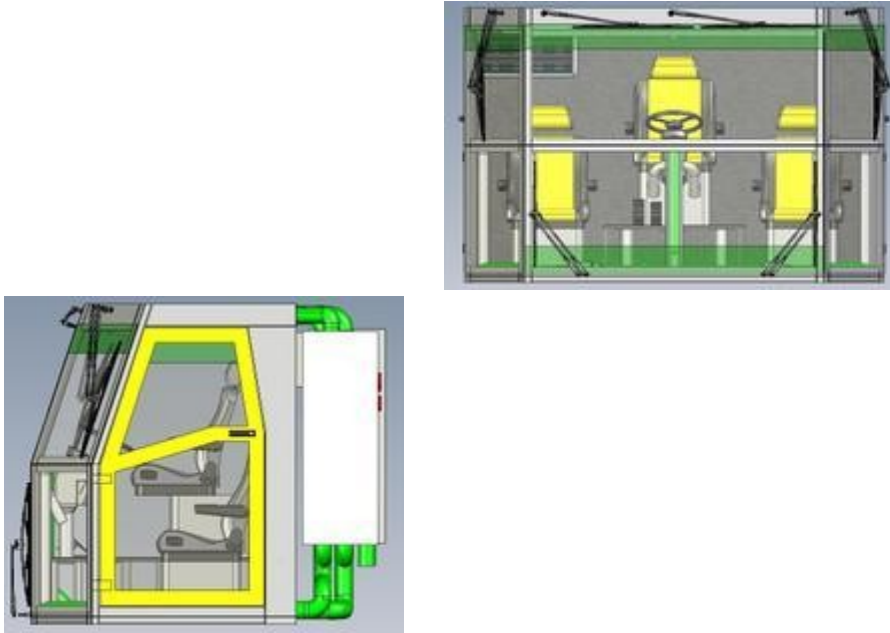
AN EXCEPTIONAL CABIN

To reduce operator's fatigue, ETF put considerable effort into making the operator's job easier. No more gear shifting, most of the functions of existing vehicle operation are automated. The result is a simple operation, just a steering wheel, a throttle and the brake/retard pedal have to be operated. This enables the operator to concentrate on driving only. Technical problems due to operator errors belonging to the past.

The cabin is the workplace of the operator. We understand the importance of a safe and comfortable cabin therefore we designed a very large cabin. The cabin is equipped with a modern climate control system. The cabin is pressurized to keep dust and fumes out.

To keep food and drinks cool, the cabin is also equipped with a small fridge.

The cabin has three suspended seats including main operator, an instructor and a trainee. All seats are equipped with safety belts and an in-seat ventilation system is supplied as standard in order to assure a good working environment even in tropical conditions. The latest sciences of ergonomics are applied throughout the cab interior.



EFFICIENT TYRE UTILIZATION AND COST SAVING:

Five axle lines with a total of twenty tyres transfer the vehicle weight onto the road. The axles are oscillating 10 degrees left and right which always compensate the load between the tyres. ETF suspension spring rate is softer than the average tyre, this minimize tyre deflection and prevents heat buildup. During empty hauls eight tyres are lifted in order to save costs. All the wheels are steering which is also a benefit for tyre wear. ETF trucks are equipped with a Central Tyre Inflation System. This CTIS keeps the exact tyre pressure under real-time conditions. In case of a flat tyre the axle is automatically lifted to prevent a total loss of the flat tyre.

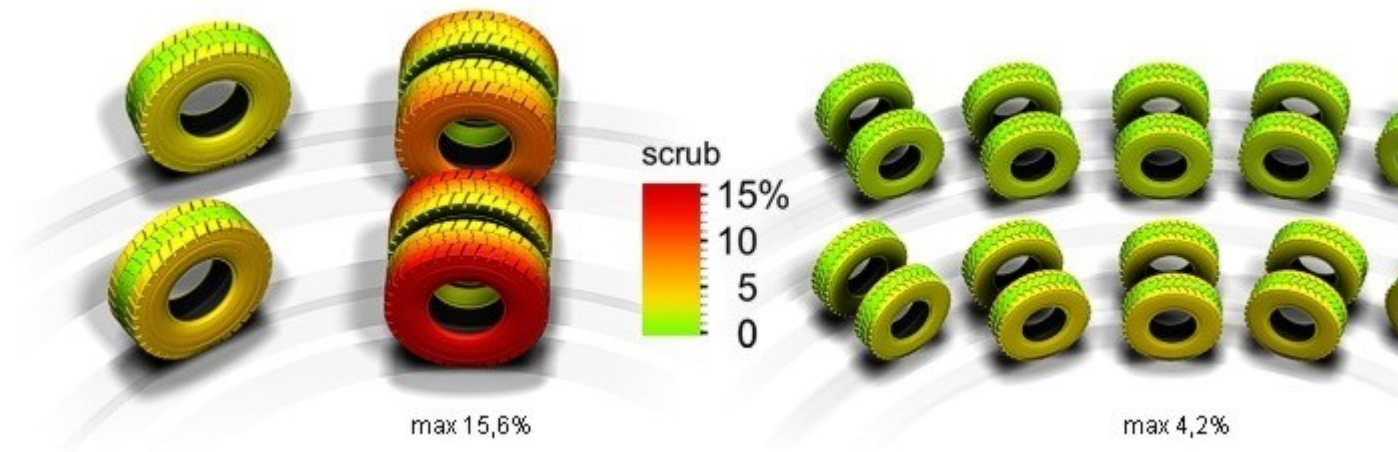
Wheel alignment and tyre scrubbing, how has ETF solved these issues?

In any on-road vehicle, be it a humble family saloon up to large class 8 road truck/trailer combination, it's universally recognized that accurate alignment is essential to extended tire life, road handling, ease of operation, as well as achieving optimum fuel economy. When discussing mining trucks wheel alignment is hardly ever mentioned, while the cost of tyres often tops the list of haulage expenditure. Misalignment of front and rear axles due to road damage and or suspension/steering component wear has a dramatic impact on operating outlay with the majority of costs attributed directly to high priced mining tyres. Studies have proven that 80% of haul trucks operating today have some axle misalignment.

Generally, in any moving vehicle both driven and steered axles need to roll in parallel with the chassis centre line, with adjustments provided by threaded links between axle lines. Scrubbing, the term for this acceleration of tyre, is caused by this misalignment and can also be attributed to the rear axles. But other than the problem of 'torque steer' experienced when a powered axle is forced out of this parallel alignment because of the failure of components that support it, or the very nature of its design, there is normally little or no rear axle adjustment available.



Tyre behaviour comparison between a conventional 240 ton large haul truck a ETF MT-240 truck. Straight forward drive generates no scrubbing.



In curves the dual tyres of conventional trucks are scrubbing on the total surface. Compared with the total surface on the road on six 40.00R57 and the twenty 24.00 R35 tyres of ETF trucks the difference in scrubbing is 62%. This generates heat and results in excessive tyre wear.



Difference in tyre size for conventional 240 ton large haul trucks and ETF's 240 ton mining truck.

With the mining industry demanding greater productivity and the resulting push for larger and larger payloads, manufacturers responded in the most cost effective way by simply 'up-scaling' smaller capacity versions of the same design, with no apparent consideration to addressing some fundamental operational issues associated with this misguided

philosophy. One associated problem with enlarging capacity is the increasing width of the truck and the increasing length of the rear axle causing the distance between the dual rear wheels to expand. While modern conventional front steering systems incorporating two independent wheels/tyres across the axle line, were designed to take full account of the 'Ackerman principal' whereby in a left turn the inside tyre turns at a greater angle than the outer. Rear axles are always supported in parallel with the frame, so with this conventional approach driving in a straight line there's no real issue. However, things change rapidly for the worse when negotiating a bend. While each front wheel happily follows the differing path, at the rear it's a very different story promoted by the distances measured between each dual wheel set and the affect this has on tyre scrubbing and ultimately vehicle stability. For example, during a powered right hand turn as the inside right rear wheel enters the bend it's forced to travel at the same 'faster' speed as the adjacent dual wheel.

The very same can be said of the outside dual wheel set, the outside wheel travels a greater distance than its adjacent wheel forcing it to turn faster, when simple geometry advocates that each individual tyre should in fact travel a different distance and therefore differing speed compared with the others on the same axle line. (Fig.2) The result felt by the operator would be vibration as each wheel shuffles for wheel speed causing some road surface damage. And even with the differential on a mechanical and torque control on modern electric drive trucks, both still induce understeer as the drive wheels tend to push the truck forward rather than around the curve causing unnecessary tyre scrub to both front and rear tyres.



When discussing a rigid truck that possesses both, all wheel drive and all wheel steer, clearly attributes describing the ultimate mining machine; attempting to maintain all those wheels and their respective steering angles during every second of every operating day would be mechanically challenging to set up and almost impossible to maintain. So, how could this ever be achieved today?

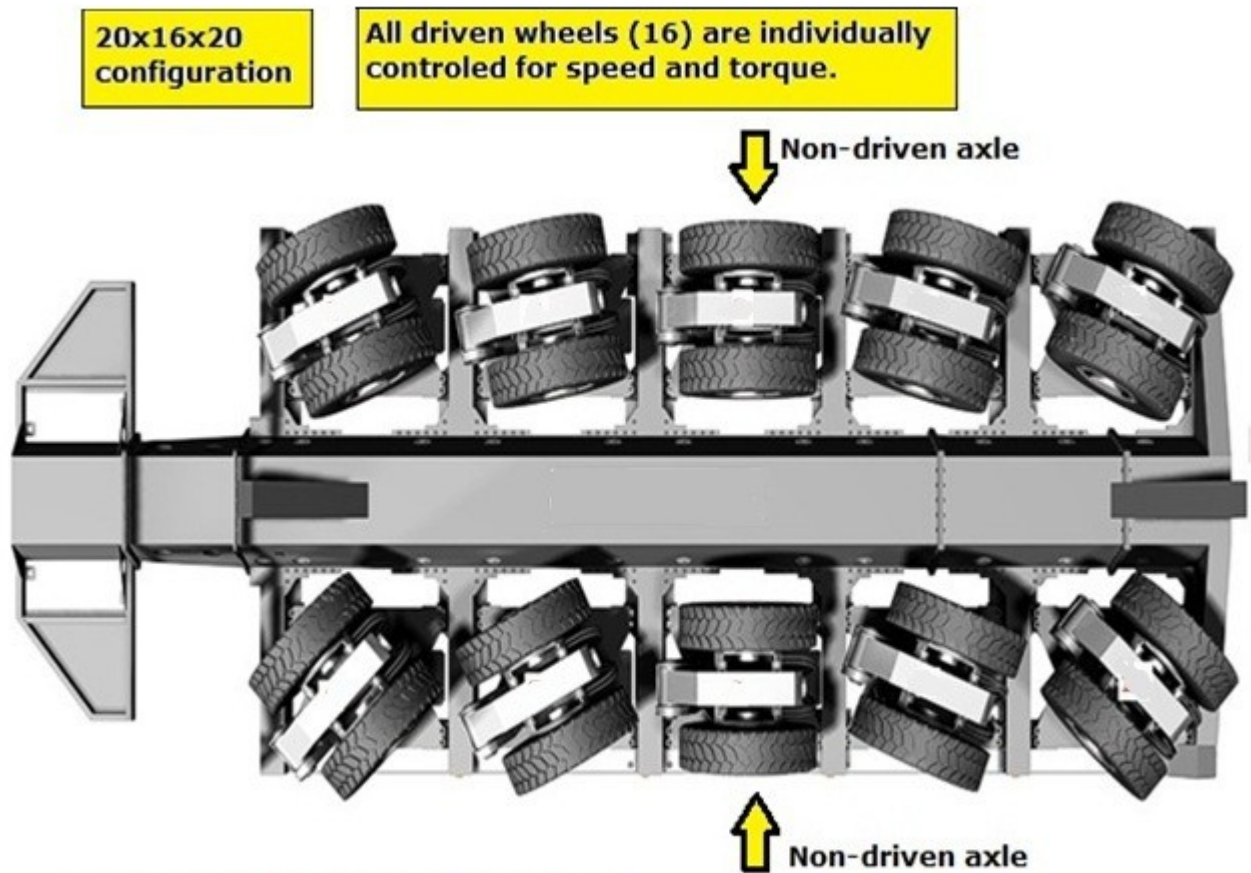


Fig. 1 ETF MT-240 wheel arrangement
Each wheel group follows the correct path irrespective of conditions

Well, considering the largest ETF truck (Fig 1) has 10 wheel groups, 8 of which supports two independently powered wheels.

Let's just say that ETF has achieved the almost impossible by incorporating fast microprocessors, some leading edge hydraulics, advanced angle sensors and innovative controlling software. Each wheel angle is controlled independently of all others, that's 20 independent geometrically correct circles traced in the ground offering the very best in handling with a turning circle to rival a rigid trucks half its length while at the same time almost totally eliminating tyre scrub. But it goes further than that, powered and steered front wheels reduces the tendency to understeer so powering and steering all axles provides the ultimate steering and driving capability of any mine truck on the market today. (Fig. 3)

Automatic wheel alignment

The steering control system automatically adjusts all wheel-alignment angles on-the-fly. On a conventional two axle vehicle the technical term used by the automotive industry is 'four wheel alignment' so when describing the ETF this must now be changed to 'ten wheel alignment' simply because as mentioned there are 10 independent dual tyre wheel groups that need to be correctly aligned for perfect straight line tracking. Compared with current vehicles the ETF trucks steering and oscillating axles, soft long travel suspension, lifting axles on empty hauls and the Central Tyre Inflation System equate to **tyre costs savings in excess of 45 %**.



during empty haulage

Last axle line lifted





detected

Automatic axle lifting after tyre problem is

Tyre change within 15 minutes!

ETF developed a fast tyre-change system. A wheel can be exchanged within 15 minutes. Technical availability will be higher because of this exceptional short tyre change.





change efficient a flat tyre

Two wheel handlers are being used to



tyre is mounted

Damaged tyre is removed and the new



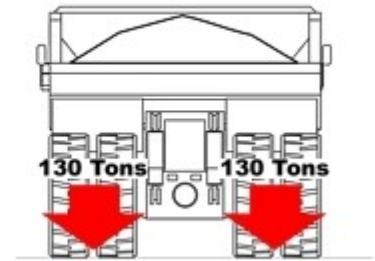
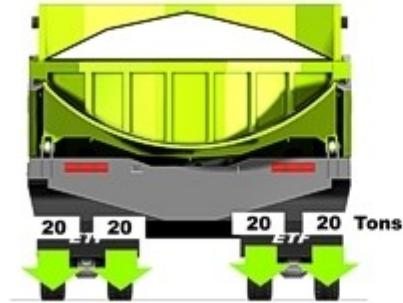


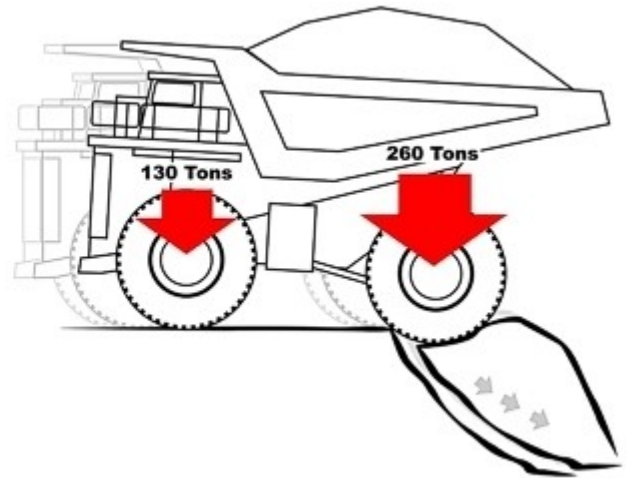
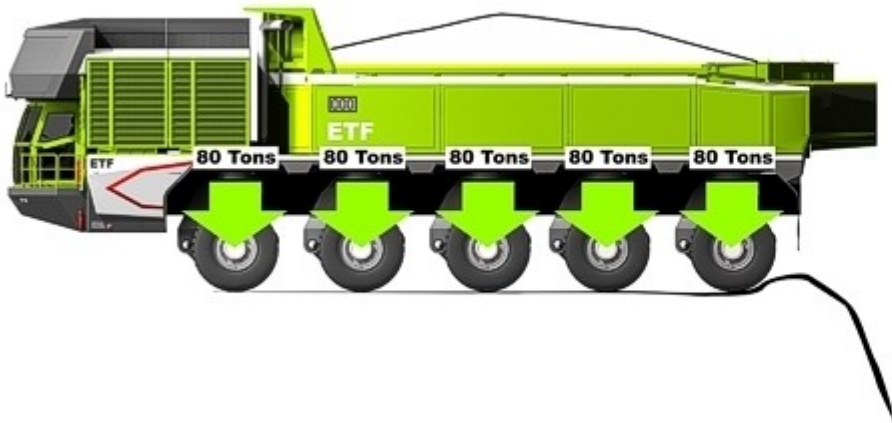


**Wheel change in 15 minutes; no competitor
can offer this feature!!**

Superb load-spread over all tyres

With ETF's axle configuration all the tyres bear the same load. This reduces the heat build-up in the tyre and also has an important impact on the construction of the roads.





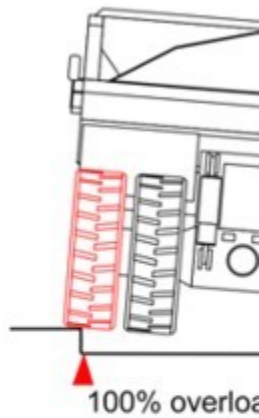
goes a little bit too far!!

No more landslides when the operator

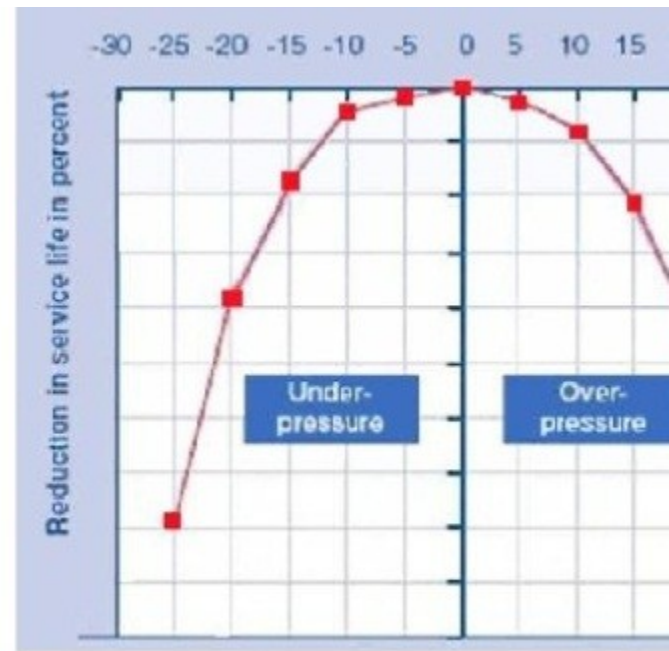
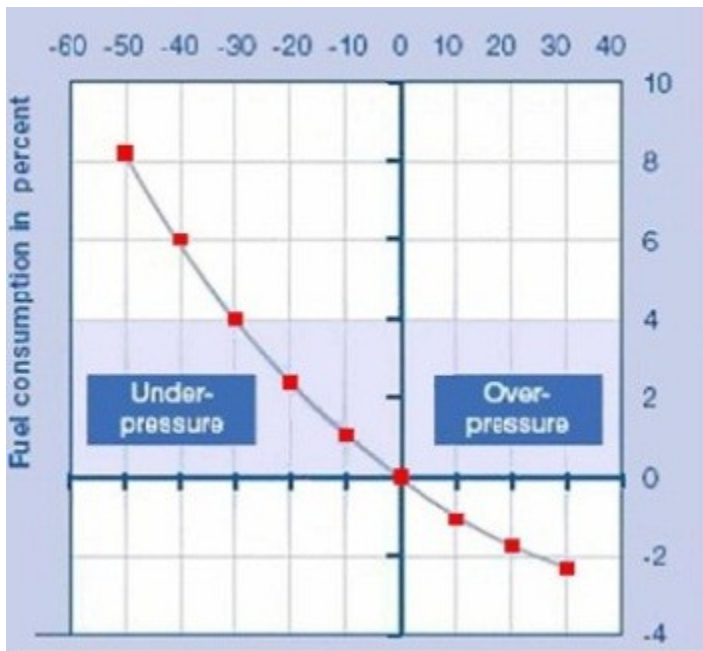
Single versus Dual tyres



Oscillating versus Rigid axles



**The economic importance of the correct
tyre pressure:**



Increased fuel
consumption

Increased fuel

Reduction in service life

Source: WABCO / MICHELIN

SMART POWER

In most mining operations trucks only half of the total working hours are used to haul material. During the other half the truck is empty. Large diesel engines are not efficient under partly loaded conditions.

ETF developed a creative way to overcome this inefficiency. Instead of using one large engine, ETF incorporates four smaller capacity engines. One engine is in use during empty hauling, two or three engines are in use during loaded hauling and the fourth engine comes into operation when full power is required while hauling on grade. The engines start in rotation 1-2-3-4 and quickly achieving the required RPM by electronically synchronizing with the others that are running. The Electric Control System is governing everything the moment of start and stop of all the individual engines. The whole operation is fully automatic and cannot be influenced by the operator.

Power costs savings of up to 25 % can be realized



Power packs are equipped with an unique quick coupling system enabling fast swap in case of maintenance and repair



packs within 15 minutes!!

Complete exchange of individual power

—



by:

ETF Trucks powered

480 kW Tier III & Tier IV interim

MTU / MERCEDES-BENZ OM-502

SCR catalytic converter.

with ultra low emissions incorporating

NEW INNOVATIVE VISION FOR LARGE MINE HAULAGE

In surface mines all over the world the haulage of overburden and minerals hasn't changed much in decades. Current Large Haul Trucks have severe limits when it comes to traction and operating distances.

Nature has creating many problems for these vehicles, torrential rain in the tropics together with ultra low temperatures, snow and ice in far North, both accounting for at least eight percent loss of production simply because current Large Haul Trucks can't operate safely and effectively under these conditions.

Additionally other important equipment like loading shovels and secondary equipment like loaders and dozers as well as the main Processing plant are also down due to the very fact that the primary haulage system isn't operating.

In order to overcome this production loss and to obtain additional cost savings ETF developed a new and innovative vision to the future of large haulage:

ETF's truck haulage concept

This concept manages four important technical issues:

- 1. 95 % technical availability**
- 2. 12 % Higher utilization**
- 3. Smart power & reduced tyre usage**
- 4. Less accidents**

1. 95 % technical availability

In order to obtain a higher technical availability the Repair & Maintenance times must be reduced. ETF reached this goal firstly in order to make a repair friendly design of its vehicles. In other words, the truck is designed with the eyes of the mechanic who ultimately will at some point have to repair it.

Secondly, components which take time are engineered in such a way that they can be exchanged in fifteen minutes! This means that the repairs can be carried out in the workshop without the pressure from the operation management and the truck can return quickly into full productive operation.

Finally, the ETF adapted F-1 pit-stop system. All the ETF trucks are equipped with a wireless information system. As soon as the operator gets a message on the cab display that a technical problem has occurred, the wireless system transmits the same message to the workshop. The technician will then have time to prepare the necessary (exchange) parts and associated equipment necessary to effectively carry out the repair.

2. 12 % Higher utilization

The most significant item to increase machine utilization is that all ETF trucks are equipped as standard with a unique All-Wheel-Drive propulsion system. Full production can continue in the rain or snow which generates an average of eight percent increased production. Depending on the mine size this can accumulate to increased revenues of millions of dollars per year.

Another important item is the elimination of checks during shift change. (Tyre pressure, oil, water, cleaning of mirrors, lights etc.)

ETF reached this by:

- Central Tyre Inflation System which, in real time, measures and adjusts the tyre pressure.
- Automatic oil level check and refill system
- Cameras instead of conventional mirrors
- Even equipping all the main lighting and cameras with a washing facility

Normally the shift change time would take say twenty minutes, with a 3-shift mine operation this could save an hour in twenty-four, which equates into another 4 % increase in productivity!

3. Smart power & tyre usage

In most applications Large Haul Trucks are operated for 50% of their operating time empty so you don't need the engines to work at maximum power. Therefore ETF uses a multiple engine configuration. During empty haul only one or two engines are providing power, during a loaded condition on very neutral inclines three engines will power up and only when hauling on grade will all four engines be required. By just incorporating this power management system saves approx 25 % in total power costs, fuel, component wear and machine repair costs.

For the same reasons there is no need for all the tyres to be in contact with the road during empty hauls. Two axle lines are automatically lifted when the vehicle is empty, this saves approx tyre costs and increases the time before overhaul of the axles and associated components. The Central Tyre Inflation System also enables automatic lifting of an axle in case of a flat tyre. This saves the total-loss of tyres in case the operator reacts too late.

Each engine and tyre can be exchanged within 15 minutes each. A full wheel group of two wheels takes 60 minutes.

4. Less accidents

Accidents are a great concern for the mine management. Loss of life and equipment are often occurring. ETF truly believes that this can be at least seriously reduced or even totally prevented with the right equipment. It all starts with the performance of the operator. Neither cost nor effort should be saved in order to give him or her right tools to carry out the job. At the first place the working environment, the cabin, must be designed in such a way that fatigue is prevented. ETF reaches this goal by standard:

1. Providing a superb comfortable cabin with:

- a. Enhanced ergonomics to reduce back pain
- b. Unique HVAC system which really cools and heats under severe conditions
- c. Ventilated and heated seats

2. Providing best in class all round vision with:

- a. Full cabin glazing with wipers and washers on all sides
- b. Cameras for side and rear view
- c. Enhanced front lighting (Xenon) with washers controlled by steering input for optimal operator vision lighting
up curves.

3. Providing state-of-the-art safety systems:

- a. ABS and Traction control
- b. Electronic stability control
- c. Optic Security System
- d. Sleep Deterrent System
- e. Collision Warning System

4. Providing optimal training facilities with:

- a. Trainer's seat with a separate (demountable) steering wheel with brake controls which can
if necessary override the operator.
- b. Trainee's seat

All these technical measures will result in reduced fatigue, optimal operator performance and less accidents.

ETF's haulage concept generates:

95 % technical availability

12 % increased productivity

47 % savings of tyre costs

25 % savings of power costs

Fewer accidents