WHITEPAPER

CABLE AND ACCESSORIES

MINING INDUSTRY

2023 | PT JJ-LAPP CABLE INDONESIA

JJ-LAPP

ABOUT JJ-LAPP

JJ-LAPP was founded as a joint venture between Jebsen & Jessen Group and LAPP Holding Asia Pte Ltd, a subsidiary of LAPP Group in Germany, to become the leading cable and connectivity solutions provider in ASEAN. We bring value to our customers by localising German innovation, manufacturing our high-quality products in Indonesia, and complementing this with a suite of products sourced from world-renowned brands. This enables us to provide a wide range of solutions that maximises return on investment for our customers.

Serving across ASEAN, our team is committed to building trust-based partnerships with our customers and helping them achieve the business success they desire. We are proud to have served the Building Automation, Industrial Automation, Renewable Energy, Original Equipment Manufacturer, Transportation, and Automotive sectors with cable and connectivity solutions since 1980.

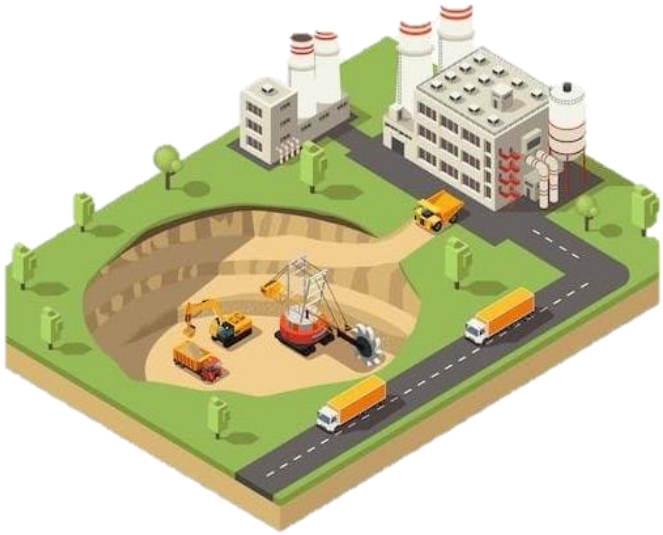
www.jj-lapp.com

OVERVIEW

Minerals are one of the oldest types of energy on earth. ASEAN is one of the largest markets in the world for the supply of mineral raw materials and ASEAN Member States are among the top global suppliers of major mineral and metal products. Trade in minerals accounted for $250 billion or close to 9% of ASEAN's total trade in 2018. 21% of the trade in minerals are internal ASEAN trade. Mining sector expected to further strengthen focus on sustainable resource development including on capacity building towards the use of green mining technologies and enhancing value added in minerals.

Mining has relied on diesel-powered machinery, which tends to be hot and noisy, while generating particulate emissions. Electric-powered mining equipment is cleaner, cooler and quieter than traditional diesel-powered machinery. But crucially it has the potential to save costs too.

TYPE OF MINING METHODS



Surface Mining 1 General Process

There are two methods of mineral extraction based on the depth of the soil, namely surface mining and underground mining. Surface mining is the process of extracting coal from a soil layer close to the surface. On the other hand, underground mining is the process of extracting coal from layers buried deep beneath the ground. However, in each mining process, essential equipment will be needed that can support the mining process. These essential tools are not only used during the mining process but also during the process of transporting mineral sediments that have been successfully extracted from the land to the mineral processing plants. In this whitepaper, we will discuss more deeply the types of mining methods and processes, as well as the types of cables that are suitable for use in any essential equipment that will support mining work.

Surface mining has several mining methods, namely Strip mining, Open-Pit Mining, Contour Mining, Auger Mining, and Mountaintop Removal. Broadly speaking, these five mining methods have almost the same process, namely land clearing of things on the surface of the soil (Land Clearing), excavation of the surface of the soil (Top Soil Removal), then the last process is drilling,

and or blasting of mineral sediment layers for exploitation (mining). What distinguishes the five processes of the mining method from surface mining is the pattern of excavation based on the location of the minerals. There are 5 important tools in the surface mining coal extraction method, namely:

1. Stacker/Reclaimer/Dragline: this tool functions to dig and move excavated material to be placed in the stockpile.

Surface Mining 2 Dredging

2. Drill Rig: this tool works for the process of drilling coal or hard mineral sediments.

3. Conveyor Belt: this tool functions for the process of moving soil, broken rock concrete, gravel, and sand. The material transfer capacity using this conveyor belt is very high because the material is moved continuously at relatively high speeds due to relatively long distances. (Hauling Process)

Surface Mining 3 Excavator Bucket Wheel

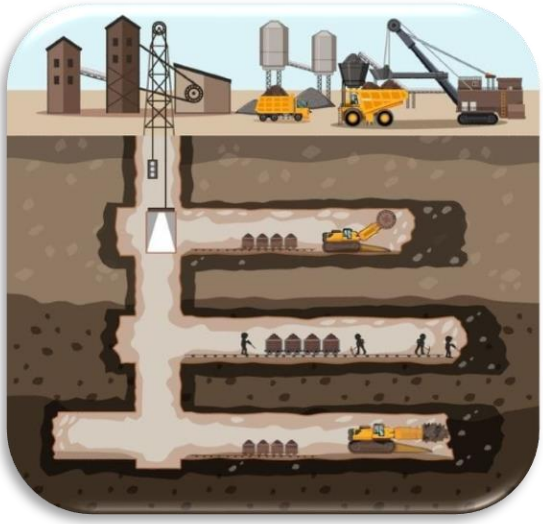
4. Excavator Bucket Wheel: this tool functions as a continuous digging machine on a large scale. This tool is very productive and effective in mining

exploitation because this tool is designed to include a conveyor belt for the transportation of excavated minerals.

Surface Mining 4 Reeling Cable

5. Trailing and Reeling Cable: Trailing and reeling cables are electric power cables for mobile equipment, such as large excavators, draglines, stackers, and reclaimers. This cable can move without having to cut off the electrical power used. This cable is designed to always move on a dragline, or bucket wheel excavator.

Underground Mining has two mining methods, namely the Long Wall method and the Room and Pillar method (stoping). The Long Wall method is an underground mining method by installing a mechanical cutting tool between the conveyor and the hydraulic support for the overburdened roof. This cutting tool works automatically in the mineral extraction process. This long-wall mining method can produce more than 70% of the extraction yield, but the impact of this method can cause surface subsidence. The Long Wall method of underground mining extraction is usually used to extract coal that is far below the soil layer. Room and Pillar is the oldest method used for gold, nickel, and copper mining processes. While the Room and Pille method is a mining method in which there is 40% of the mineral pillars serve as a support for overburden. This method can usually be used when the mineral is flat.



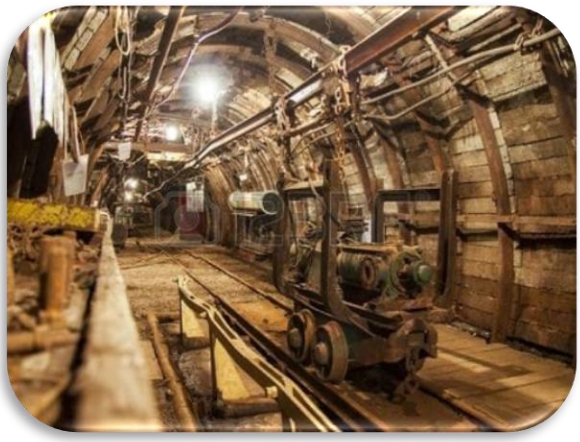
Underground Mining 1 General Process

The underground mining extraction method has 3 methods to access the ore namely Decline (Ramp), Shafts, Adits. Decline/Ramp is a spiral tunnel which circles either the flank of the deposit or circles around the deposit. The decline begins with a box cut, which is the portal to the surface. Shafts are vertical excavations sunk adjacent to an ore body. Shaft haulage is more economical than truck haulage at depth. Adits are horizontal excavations into the side of a hill or mountain. Adits are used for horizontal or near-horizontal ore bodies where there is no need for a ramp or shaft.

There are several essential tools used in the underground mining extraction method:

1. Pneumatic Drill: Type of percussive equipment that runs on compressed air could also be classified as a large mechanical drill. These pneumatic drills are typically used to drill small diameter holes in hard rock in mining

2. Tunnelling Jumbo: A versatile modular electro-hydraulic excavation machines that can be used for both fast face drilling and mechanized longhole drilling and bolting.



Underground Mining 2 Load Haul Dump

3. Robotic Scalers: Removing loose and potentially dangerous rock material from rock surfaces. Scaling plays an essential role in the underground cyclical tunnel excavation process.

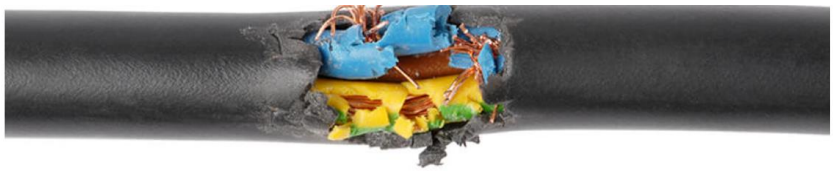
4. Conveyor Belt (Load Haul Dump/LHD process): Used to transport material which is too bulky or heavy to be carried long distances, its importance can often be overlooked on mine sites.

5. Skips/Cages (LHD Process): Bringing mine materials to the surface of a mine shaft. It designs for both vertical and incline shaft.

From the description of the process described above, it can be understood that the mining process using surface and underground extraction methods has almost the same ambiance, such as a dusty, harsh environment, and several chemical reactions can corrode equipment. Therefore, the selection of cables for essential equipment in the mining process is a necessary and important thing to do. Purposed that the mining process gets time and cost efficiencies that go hand in hand.

MINING CABLE ISSUES

One common problem in mining cable applications is cable damage due to the harsh and abrasive environments in which they are used. This can be caused by a number of factors, including exposure to chemicals, extreme temperatures, moisture, and physical impact or abrasion.



To solve this problem, it is important to use high-quality cables that are specifically designed for mining applications. These cables should be insulated and jacketed with materials that are resistant to chemicals, moisture, and abrasion. Additionally, the cables should be properly installed and maintained to ensure they are not subjected to unnecessary stress or strain.

MINING CABLE TYPE

Mining cable has a unique construction that allows it to be somewhat flexible while carrying all three conductors, a ground and a ground check wire all under one jacket. In mining cables, the ground check conductor is used to provide a low resistance path to ground, which helps to protect the equipment and personnel from electrical hazards. The ground check

conductor is typically a bare copper conductor that runs parallel to the power conductors in the cable.

Mining cables are typically designed to withstand the harsh conditions found in mining environments, such as high humidity, corrosive chemicals, and mechanical wear and tear. They are often used to power heavy equipment such as drills, pumps, and conveyors. Some common types of mining cables include:

1. Portable Power Cables: These cables are used to provide temporary power to equipment in mining and construction sites. They are designed to be flexible and durable, and are often used in applications where frequent movement is required.

2. Type W Mining Cable: This is a heavy-duty cable that is designed for use in underground mining operations. It is typically used to power high-voltage equipment and is capable of withstanding high temperatures and mechanical stress.

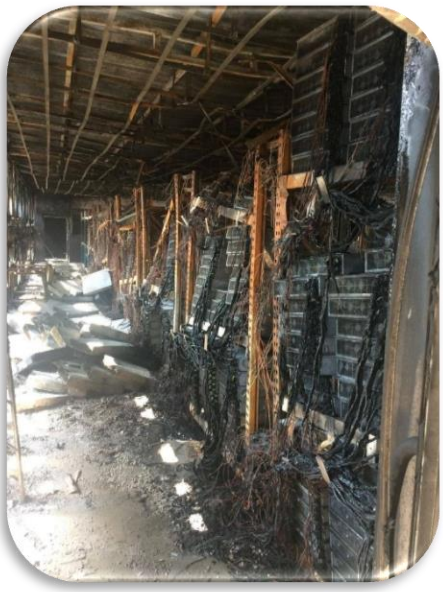
3. Type G Mining Cable: This cable is similar to Type W, but it is designed for use in surface mining operations. It is also used to power high-voltage equipment, but it is more flexible than Type W and is better suited for applications where frequent movement is required.

4. Type G-GC: G-GC is typically used to power equipment in mining tunnels. The G-GC stands for ground with a ground check, and like the name implies it contains grounding wires and something that is unique to mining cable, a

ground check wire. The ground check wire sends a signal that let's the operator know the ground wire is in tact.

5. Type SHD-GC Mining Cable: This is a special type of mining cable that includes a ground check conductor. It is used to provide a low-resistance path to ground and is often used in applications where electrical safety is a concern. SHD-GC also known as shovel or dragline cable, is used for continuous mining electric shovels, conveyors, loaders and other mobile mining equipment. SHD-GC cable construction is similar to G-GC construction with a few differences. SHD-GC construction contains a separator tape around each conductor that allows for more flexibility, and an extra layer of insulation underneath the outer jacket.

CABLE MINING APPLICATION



The mining exploitation process has an extremely harsh environment. This is due to the type of material and the conditions in which the material is found under the ground and rocks. Most of the mining products taken are in the form of solid objects which can trigger dust and scratches and can even damage the cables supporting the exploration equipment. Therefore, a flexible, dust-resistant, anti-abrasion and scratch-resistant

cable material is needed. In this case, the material that is very suitable for mining is cable material made of special rubber and PUR. A very harsh environment in the mining process occurs in every process of mining exploration. Especially in the hauling process of mining products. In this process, the newly obtained mining products will be transferred to the stockpile which requires high flexibility on each piece of equipment. So it is necessary to choose the right cable and have a high life to support its essential functions.

Surface mining requires ever-increasing performance of machines and methods. The larger and larger, movable machines in use nowadays require medium voltage flexible reeling and trailing cables for power supply suitable for operation under the most extreme conditions. Specialized energy and data transmission systems in such large machines need specially designed

Surface Mining

Trailing and Reeling	Dredging/ Submersible Pump	Power / Semi Fix Installation	Fix Installation for Conveyor	Signalling and Control Cable
NSGAFÖU 1,8/3 kV, **Flexible single-conductor rubber cable with 1.8/3 kV rated voltage** SHD-GC, **Flexible MV 2-25 KV cable for energy supply of heavy mobile equipment such as drag lines,shovels, dredges, drills, under extreme mechanical stresses and abrasion during trailing operation in opencast mine**	H07RN-F, enhanced version **Halogen-free; Long-run submersion; Bending/Loop Torsion (WTG): -40°C to +90°C; UV/Ozone resistant**	NSSHÖU, **Mechanically robust rubber cable for mining and surface mining** (N)TSCGEWÖU, **Flexible cable for fixed energy distribution lines in mines and alongside material handling equipment**	NSSHÖU, **Mechanically robust rubber cable for mining and surface mining**	ÖLFLEX® 440 P - **PUR control cable for indoor and outdoor use - cold flexible, abrasion resistant, flame retardant and halogen-free with VDE certification** ÖLFLEX® CLASSIC 400 P- **PUR control cable for oil-, notch- and abrasion resistant application in industrial machinery, appliances, intrumentation, control and automation**
+TÖU	H07RN8-F, **Submersible pump cable; Formerly: "ÖLFLEX® AQUA RN8"**	(N)TMCGEWÖU, **Medium voltage rubber sheathed flexible cable, single-core, normally used for shor t-length connections of transformers and switchgears, as well as power cables on mining equipment and alongside conveyor belts**	**(N)TSCGECEWÖU, Flexible MV cable for fixed energy distribution lines in mines and alongside material handling equipment**	ÖLFLEX® 540 CP- **screened, VDE certified outdoor use an constructions sites with yellow jacket colour - cold flexible, abrasion resistant, halogen-free.**
(N)TSCGECEWOU, **Flexible MV cable for energy supply of heavy mobile equipment such as drag lines, shovels, dredges, drills, under extreme mechanical stresses and abrasion during trailing operation in opencast mine**	(N)TSCGEWÖU, **Heavy duty flexible medium voltage power cable designed for permanent immersion in fresh or salt water where mechanical stress is likely**		SHD-GC, **Medium Voltage Flexible cable for fixed energy distribution lines in mines and alongside material handling equipment**	

and optimized cables adapted to such individual demands. Focus type of cable that suitable for Surface mining are Flame retardant, Oil-resistant, High notch resistance, Abrasion-resistant and High mechanical stress. Some of cable type needs long-time water submersion capabilities.

Underground mining is characterized by a strong focus on critical electrical and mechanical safety aspects in addition to performance features. The cable designs should include all necessary power and control elements to fully match requirements, as well as control and signaling elements to notify any malfunctioning in order to minimize downtimes of machines and keeping the highest levels of safety.

The digging of tunnels for mines or dams is done with very large tunneling machines, called TBM - Tunnel Boring Machines that require special reeling cables. Such cables must fulfil the highest levels of safety and feed the

UNDERGROUND				
Fixed Installation for Conveyor	**Chain/ Scaler/Shearer**	**Trailing and Reeling**	**Control and Signaling**	**Tunelling and Festoon**
 NSSHÖU, **Mechanically robust rubber cable for mining and surface mining**	 G-GC, **Flexible cable for fixed energy distribution lines in mines and alongside material handling equipment. Halogen free polyurethane sheathed version with tape reflective.**	 ÖLFLEX® CRANE NSHTÖU - **Reelable cables for low and medium mechanical stress.**	 UNITRONIC® FD CP (TP) plus A, **Shielded, High-Performance PUR outer sheath, tear and notch-resistant, resistant to mineral oils and abrasion when used in power chains**	 (N)3GHSSYCY, **Flexible cable for energy supply of MV equipment, in tunnelling and underground mining applications**
 (N)3GHSSYCY, **Flexible cable for energy supply of MV equipment, in tunnelling and underground mining applications**	 (N)SSHCÖU O/J, **Heavy duty, flame retardant, abrasion, notch, tear, oils and fats resistant flexible cable for aggressive environments.**	ÖLFLEX® CRANE PUR - **Reelable polyurethane cables for low, medium and high mechanical stress.** ÖLFLEX® CRANE VS (N)SHTÖU - **Reelable cables for medium to high mechanical stress**	 ÖLFLEX® 440 CP **- Screened, abrasion- and oil-resistant all-weather control cable with TPE insulation and PUR sheath - VDE certified**	 FG7H1OAM1, **Flexible cable for energy supply of MV equipment, in tunnelling and underground mining applications, LSZH Low smoke zero halogen sheathed version**
 FG7H1OAM1, **Flexible cable for energy supply of MV equipment, in tunnelling and underground mining applications, LSZH Low smoke zero halogen sheathed version**		 (N)TSKCGEWÖU, **Flexible reeling cable with integrated fibre optics wires for high and extreme mechanical stresses, e.g. torsional stress, deflection into different planes and high reeling speed**	ETHERLINE® PN CAT.6A P FC, **Ethernet cable Category 6A, Class EA for fixed installation with FC inner sheath PUR outer sheath is highly resistant to mineral oils and abrasion**	

heavy machines with power, further compressed air and water needs to be pumped to enable the tunnel construction. Focus type of cable that suitable for Underground mining are EMC-compliant, Flame retardant, Oil-resistant, Torsional Stress, High stress of abrasion resistance, mechanical-resistance, and Notch-resistant. Also it needs Halogen Free for additional safety since underground mining operational are deep bellow the soil.

CONCLUSION

One common problem in mining cable applications is cable damage due to the harsh and abrasive environments in which they are used. This can be caused by a number of factors, including exposure to chemicals, extreme temperatures, moisture, and physical impact or abrasion. We need some important characteristics to support all the processing of mining, such as:

1. High Mechanical Stress: LAPP cables are designed to withstand extreme conditions in terms of increased tensile loads, resistance to torsional stresses, minimum bending radius at any ambient temperature range and stress conditions and response to high travel speeds and acceleration.

2. Chemical & Abrasion Resistance: LAPP cables designed to withstand the most severe situations and guarantee resistance to extreme conditions (such as highspeed, oil and fuel, mud, moisture, and acids and basis), as well as to harsh environments (extreme low/high temperature, UV irradiation and ozone).

3. Longer Lifetime: LAPP cables has several special cables that designed to specific customer needs with an extended lifetime in comparison with standard and traditional Mining.

Additionally, the cables should be properly installed and maintained to ensure they are not subjected to unnecessary stress or strain. Another solution to this problem is to use cable protection systems, such as cable trays, conduits, and cable covers, to shield the cables from physical damage and exposure to the elements. These protection systems can help extend the lifespan of the cables and reduce the need for frequent replacements. Regular inspections and maintenance of the cables and cable protection systems can also help identify any potential issues before they become major problems. This can include checking for signs of wear and tear, corrosion, and other types of damage, as well as ensuring that the cables are properly grounded and connected.