

# LKAB Kiruna's new haulage level ABB mine hoist upgrade for production increase

Power and productivity  
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When LKAB increases the production from 26 to 33 million tonnes of crude ore per year, hoist capacity is of vital importance. The first measure taken was to upgrade the four sub-vertical level hoists from DC to AC-technology. The second is to install a fifth double skip hoist on this level in order to start operating the new production level at -1365 m. The present four hoists will continue with the -1045 production level until production on this level ceases.

**Why did LKAB select ABB hoist technology?**

- High operation availability
- Production friendly operating system
- Safe and precise interaction between brake hydraulics and motor drive control
- Good experience from previous installations

**Why did LKAB select the ABB AC drives?**

- Motor and drive operate at a power factor of 1.0
- Low voltage drop, so that more than one hoist can be started at the same time
- Smaller size transformers
- Low harmonics levels
- High efficiency

Hoist data	sub-vertical level -1045	sub-vertical level -1365
Number of hoists	4	5
Production	1560 tonnes/hour/hoist	1510 tonnes/hour/hoist
Hoisting distance	355 m	710 m
Speed	11 m/s	17 m/s
Pulley diameter	3.25 m	3.25 m
Number of ropes per hoist	6	6
Hoisting	Skip / skip	Skip / skip
Payload	30 tonnes	34 tonnes
Skip including rope attachment	36.5 tonnes	40 tonnes
Motor power	5,600 kW	5,600 kW
Motor voltage	3 x 3150 V	3 x 3150 V
Motor speed	64.7 rpm at 8.6 Hz	100 rpm at 13.3 Hz
Drive system	AC with Direct Torque Control	DTC
Upgrade schedule	May 2007 - Oct 2008	2012



# The ABB hoist system

**Frequency converter**



**Productive motor power gentle on the supply network**

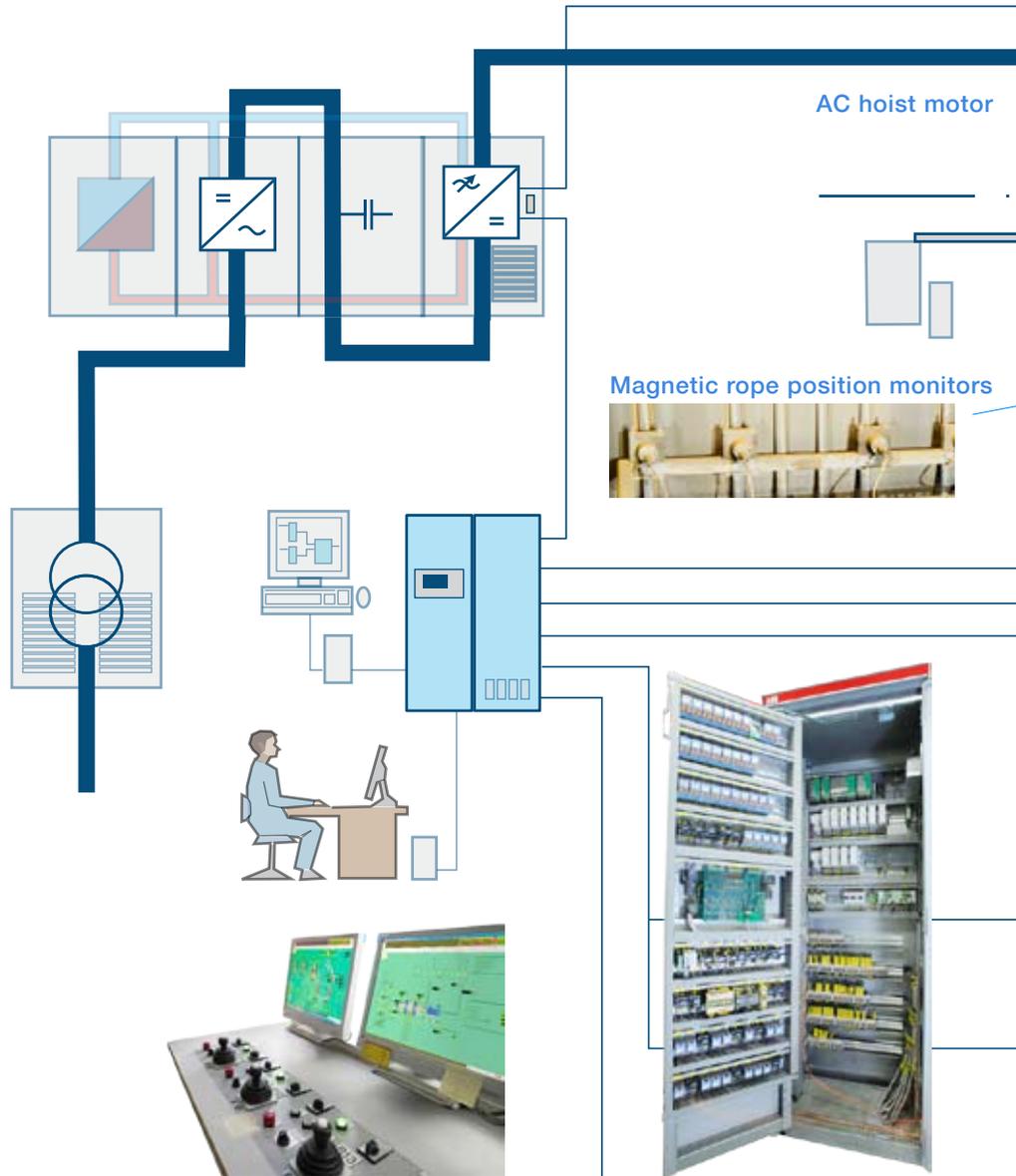
The frequency converter ACS 6000 with direct torque control and the synchronous hoist motor outperforms any other hoist drive solution.



**Excitation transformer**

**Main transformer**

The motor drive transformer is normally smaller than that of a cyclo-converter or DC-converter solution.



**AC hoist motor**

**Magnetic rope position monitors**

**Operator control**

The operators are located in LKAB head office building. From there they have full control of the production.

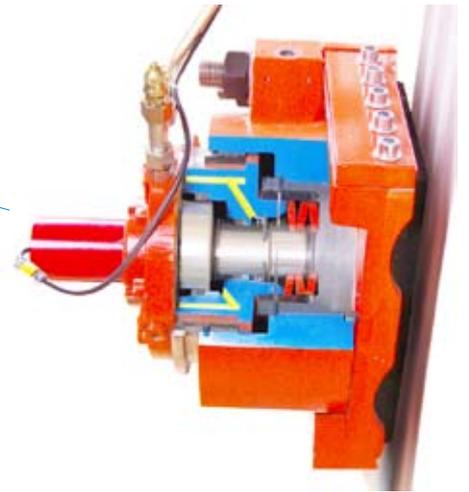
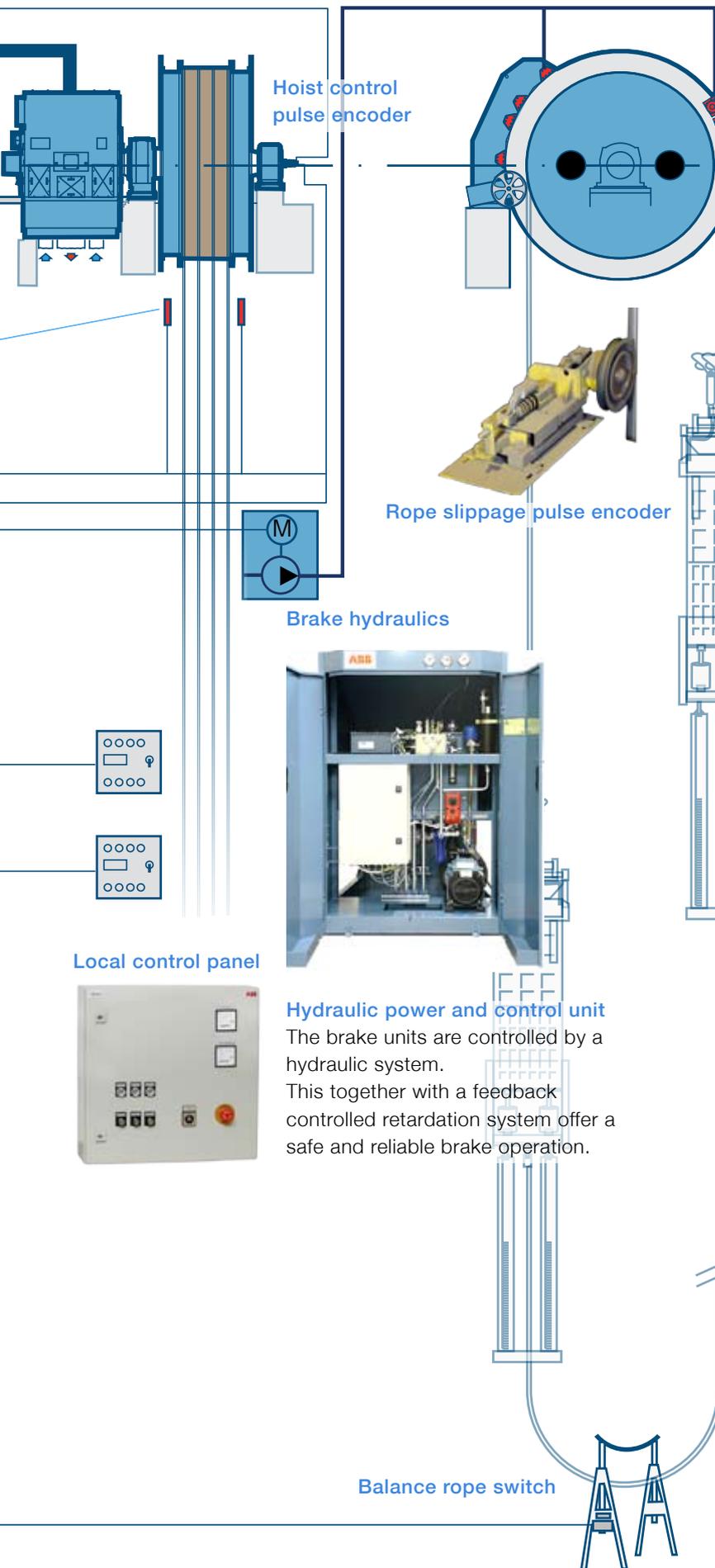
**Control system**

The control system works together with the motor drive. It includes control of feeders, conveyors and measuring pockets at loading level as well as push button control at service levels.

## Hoist motor drive

The muscle of the mine hoist is a synchronous machine, getting its power from a medium voltage frequency converter, ACS 6000.

The Direct Torque Control (DTC) gives full control in all possible situations and speeds. The ACS 6000 is a four quadrant converter and thanks to the high switching frequency of the IGCT it delivers high quality sinusoidal current to the supply network during slowdown.



**Brake unit**

The mine hoist is equipped with 14 disc brake units, 7 on each side of the pulley. Each hydraulic brake unit has two calliper halves where the brake pads are secured. The brake pads clamp onto the brake disc by the force from strong cup springs and they are operated by means of the hydraulic system.

**Rope attachment**

In order to equalize the variations in rope tension, the skip is attached to the ropes via cylinders that equalize tension by means of a hydraulic system.



**Deceleration and braking**

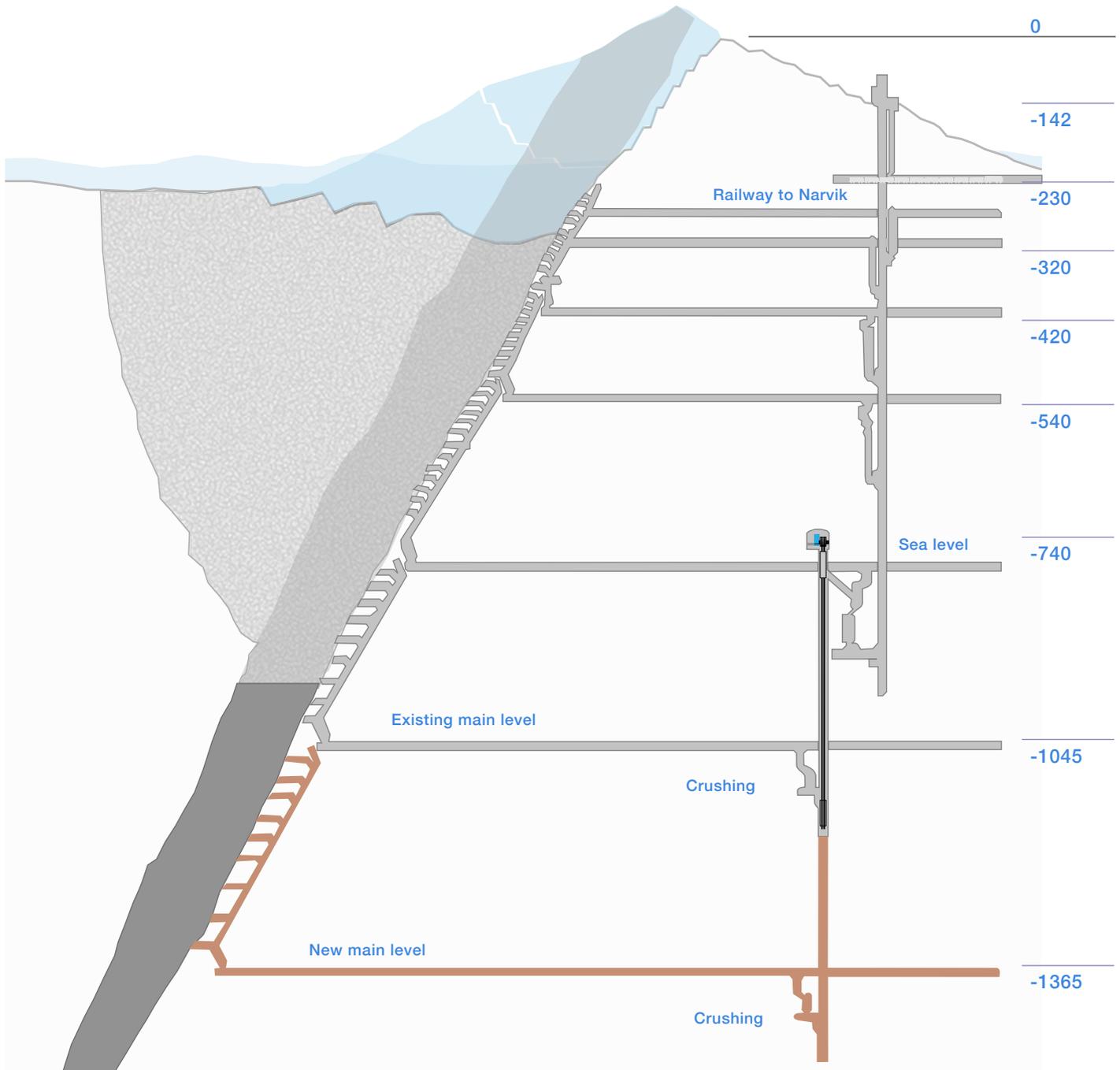
During normal stop the motor drive system controls the deceleration until the hoist stops. The hydraulic disc brake system is normally used for parking.

To ensure the same smooth retardation during an abnormal situation the disc brake system is designed to operate with a controlled braking force independently of external power supply. This will ensure the same retardation levels during all operating situations regardless of the direction of travel, speed, load and other factors. This greatly improves the safety performance of the mine hoist while reducing the mechanical stresses in the equipment.

**Hydraulic power and control unit**  
The brake units are controlled by a hydraulic system. This together with a feedback controlled retardation system offer a safe and reliable brake operation.



# The LKAB Kiruna Mine



## LKAB mining company

LKAB is a Swedish state owned company that operates two major mines in the north of Sweden. The iron ore is refined to pellets and fines.

Yearly production is about 25 million tonnes. LKAB plans to increase production to 30 million tonnes of pellets and fines.

## LKAB Kiruna mine

The LKAB Kiruna mine produces 26 Mtonnes of crude ore per year (33 Mtonnes/year with the new haulage level at -1365m). By means of 2-stage hoisting with 12 production hoists (5 + 7) the ore is brought to the surface. The production is fully automatic from train loading pockets to unloading pocket in the head frame.

## New main level Kiruna

The present main level in Kiruna, at 1,045 meters, is the sixth level since underground mining began in 1957.

When the -1,045 m level was built it was estimated that it would support mining until the year 2015, or perhaps several years beyond. But today, the situation is different. A higher production rate necessitates a more rapid rate of vertical mining than expected. Now, production demands are increasing, thanks to high delivery volumes.

Decision was taken for the next main level located on -1365 m. Based on current production plans, a new vertical system ought to be operational by the year 2013.

## Exploration of the orebody

LKAB is surveying the ore body in preparation for the next main level. There is a good knowledge of the ore body down to a depth of about -1,500 m. Data confirms that the ore body widens towards the north. At depth, the ore is large, high-grade and contains very little phosphorus. It appears to be twice as wide as at the present mining levels, up to 150-180 meters.

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