



November 11, 2010

State-of-the-Art Drive System Solutions for Crushing and Grinding

Drive Solutions

- Gearless Mill Drives (GMD)
- Ring-geared Mill Drives
 - Dual-Pinion Mill Drives
 - Single-Pinion Mill Drives
- High-Pressure Grinding Rolls (HPGR) Drives



Gearless Mill Drive Solutions

The Concept

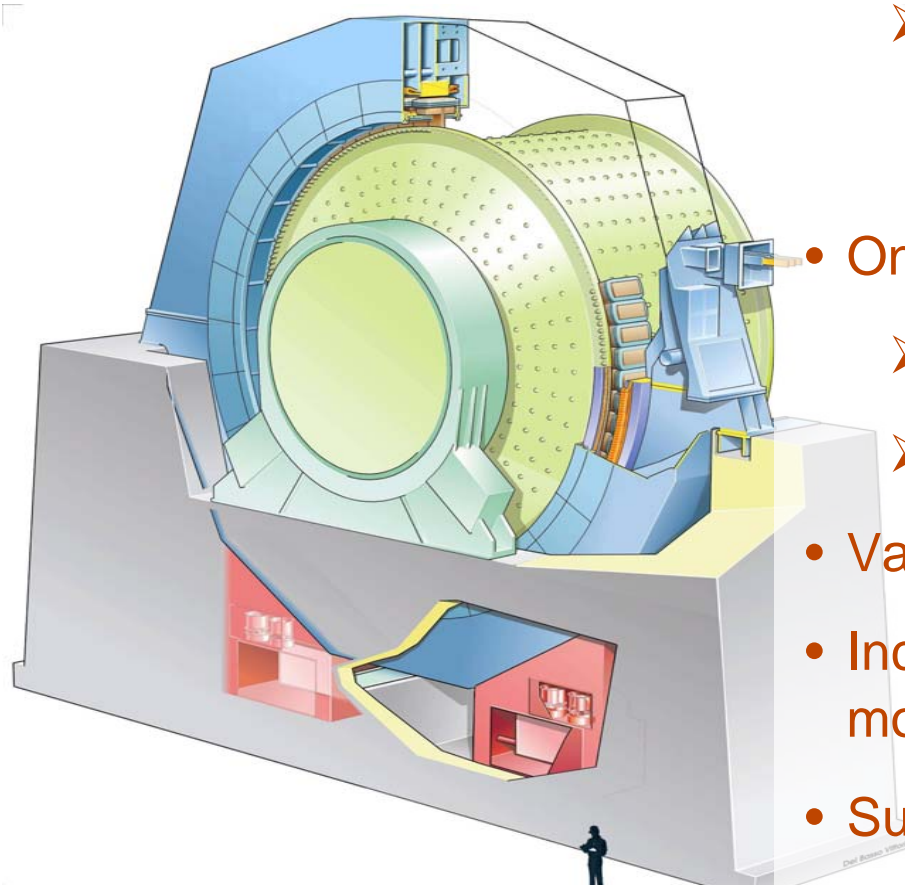


In a GMD, the poles are directly mounted on the **mill body** – making it the **rotor** of a **synchronous motor**.

The stator is wrapped around the mill body – which is why a GMD is also called “**Ring Motor**” or “**Wrap-around Motor**”



Gearless Mill Drive Solutions Advantages



- Eliminates the need for couplings, gearboxes, pinions and a ring gear
 - Therefore **MORE EFFICIENT** as **friction losses** typical for geared applications are **eliminated** !
- Only wearing parts are
 - Dust seal and
 - Slip rings for Excitation
- Variable Speed & Bi-Directional
- Inching and Creeping without additional motor
- Suitable for Mills up to **35 MW**
- Suitable for Mill Shells up to **44 feet Diameter**

Gearless Mill Drive Solutions

40 Years Experience

1st GMD over 20'

Newmont Mining Corp., NEVADA – USA

1994

Power : 11.2 MW / Mill Diameter : 20'



1st GMD over 30'

OZ Minerals Century Mine, Nth. Queensland – AUSTRALIA

1997

Power : 12 MW / Mill Diameter : 36'

1st GMD over 40'

Compañía Minera Doña Ines de Collahuasi, – CHILE

2003

Power : 21 MW / Mill Diameter : 40'



Gearless Mill Drive Solutions 40 Years Experience

Telfer, North-Western
Australia



Power : 15 MW / 36 ‘
2 x SAG Mills

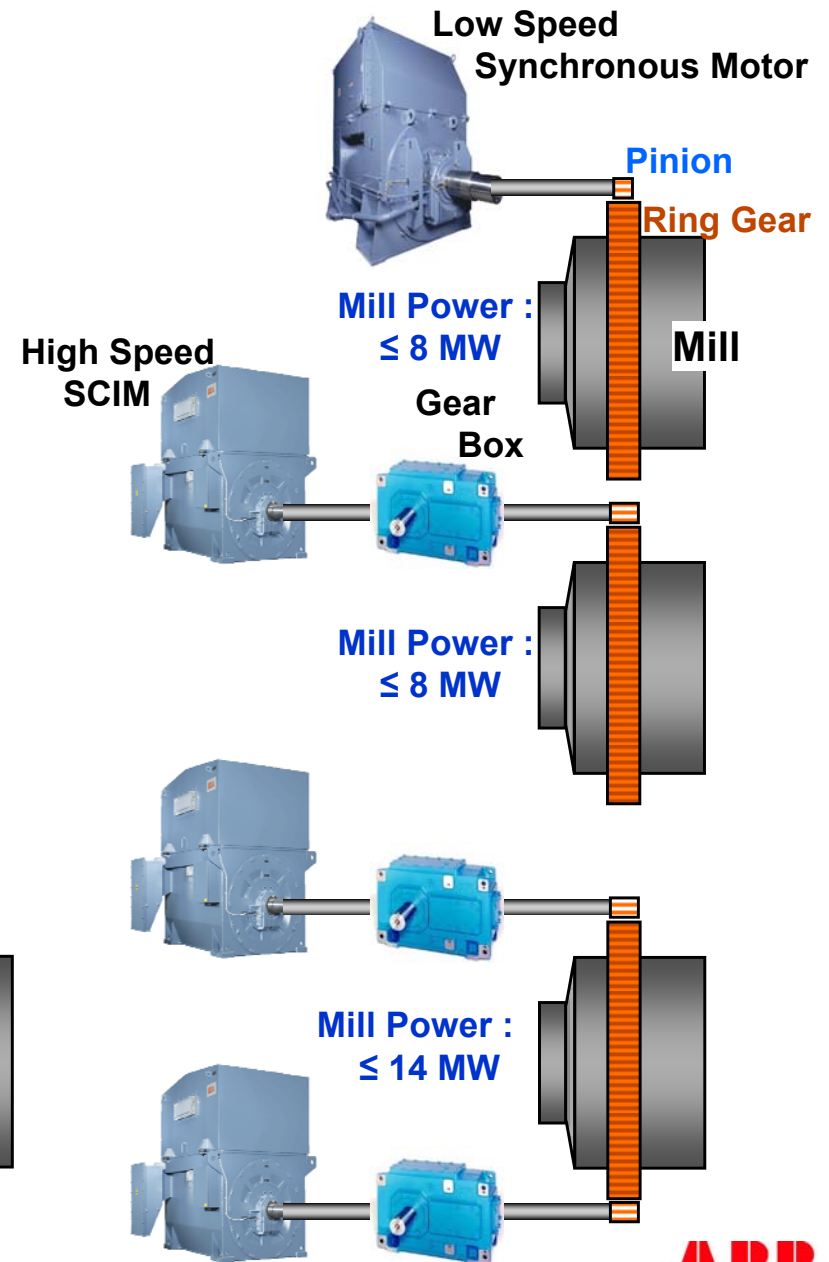
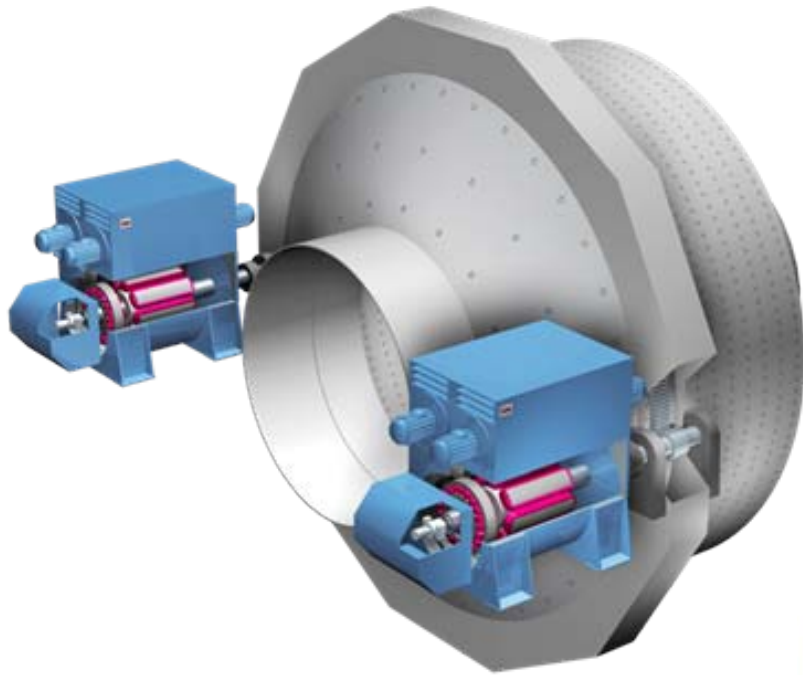
Gearless Mill Drive Solutions 40 Years Experience

St. Ives, Australia

Power : 13.5 MW / 36 ‘
1 x SAG Mill



Ring-geared Mill Drive Solutions



The Mill Application Controller

- Take care of the Starting Phase
- Provide Frozen Charge Protection



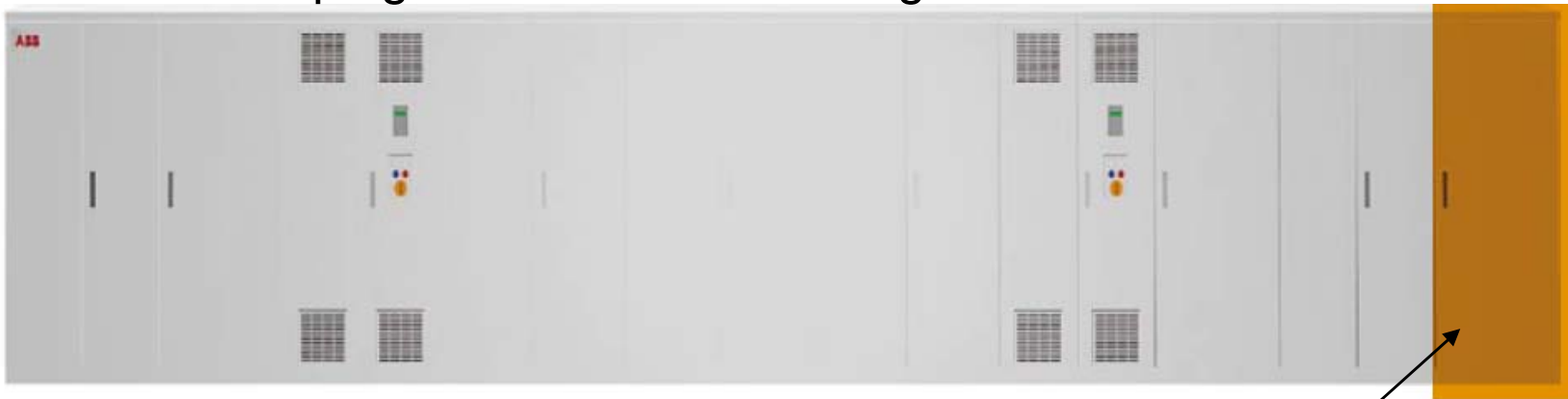
- Options:

- Inching

Controlled Roll Back

- Creeping

Frozen Charge Remover



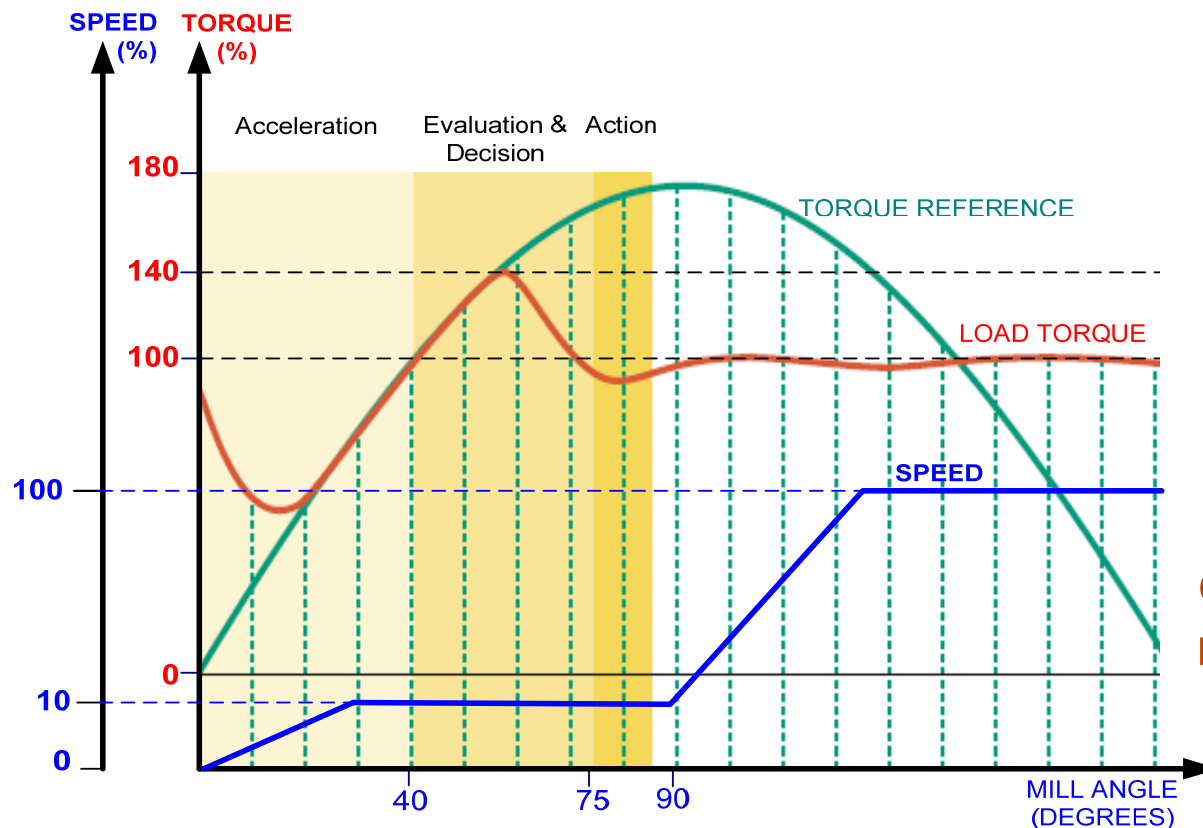
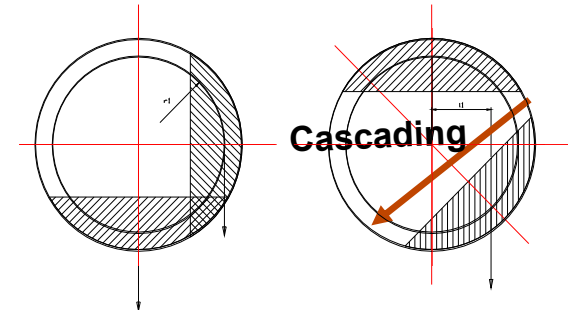
Mill Application Controller Cabinet

Special Features

Frozen charge protection

Under normal conditions, the charge in a Mill starts to cascade as soon as a certain Mill Angle is reached.

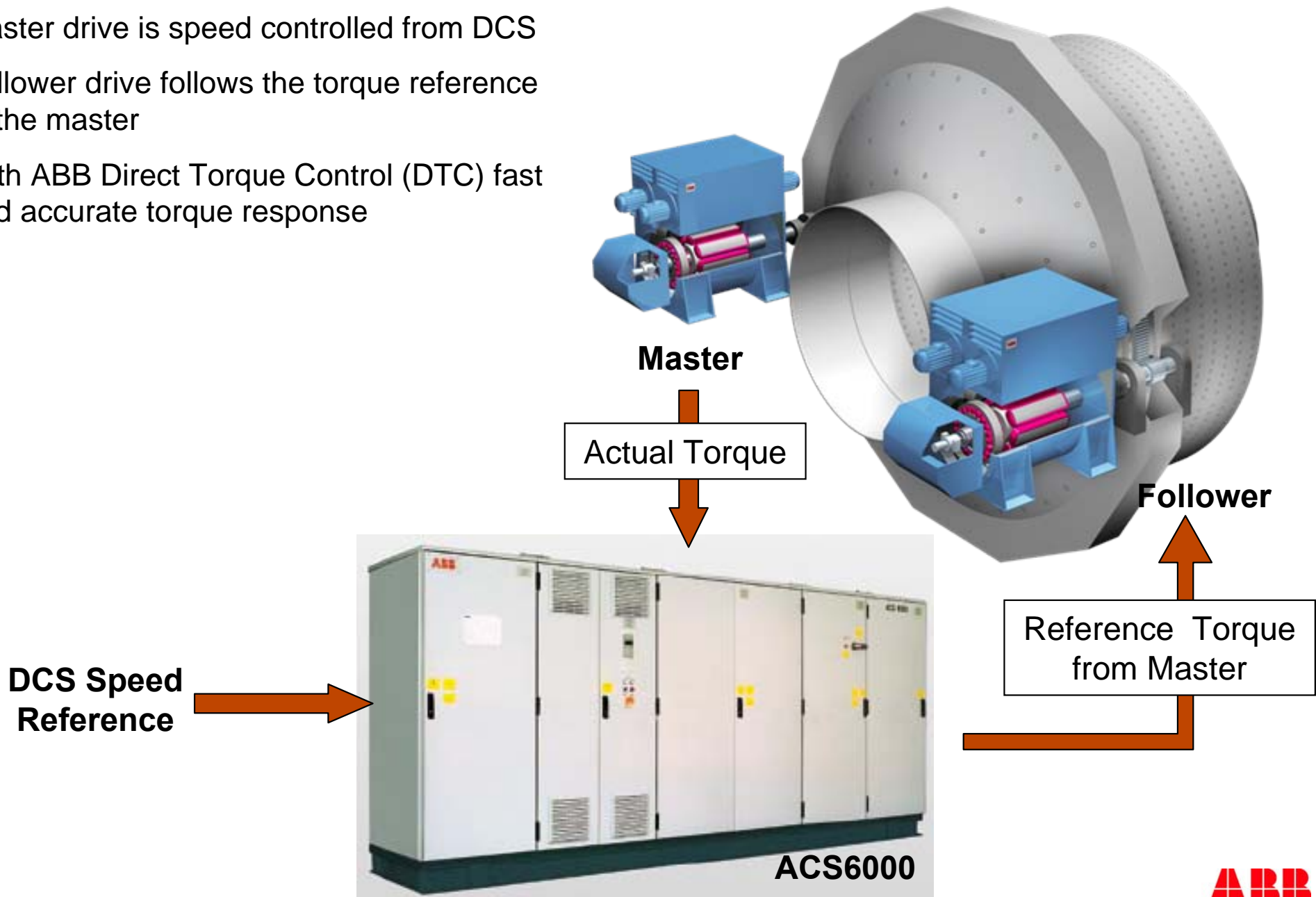
In rare cases, for instance after long suspended mill operation, the charge can settle in a large lump and stick to the mill body.



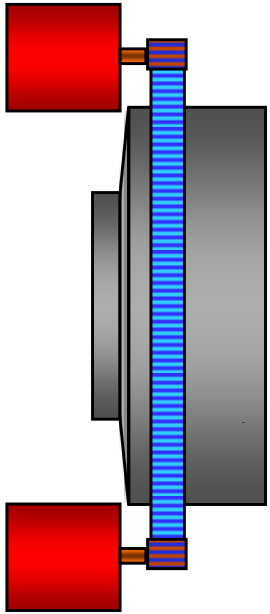
Frozen charge protection is a system that prevents “lumps of ore” to be lifted and then dropped, causing damage to the mill shell as well as the bearings.

Active Load Sharing

- Master drive is speed controlled from DCS
- Follower drive follows the torque reference of the master
- With ABB Direct Torque Control (DTC) fast and accurate torque response

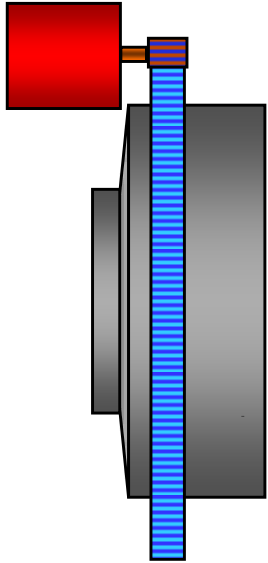


Drive Inherent Electrical and Process Features



- Allows mill speed adjustment to optimize the process
- Network friendly due to smooth starting (no starting current stress)
- Low starting currents because the current is proportional to the power
- Power Factor 0.95 with diode bridge and 1 with four quadrant drive (active front end) under ALL conditions
- Ride Through Function available
- Primary Transformer Voltage up to 36kV

Drive Inherent Mechanical Features



- Reduced mechanical stresses on the ring gear of the mill:
 - Very smooth start
 - Smooth torque over entire range (no ripples)
 - Fast DTC controls limits backlash impact
- Frozen charge protection
- Variable speed operation reduces liner wear
- Speed adjustments possible depending on mill load
- No need of air clutch, for mechanical protection shear pins only
- Bi-directional
- No gearbox with low speed synchronous machine

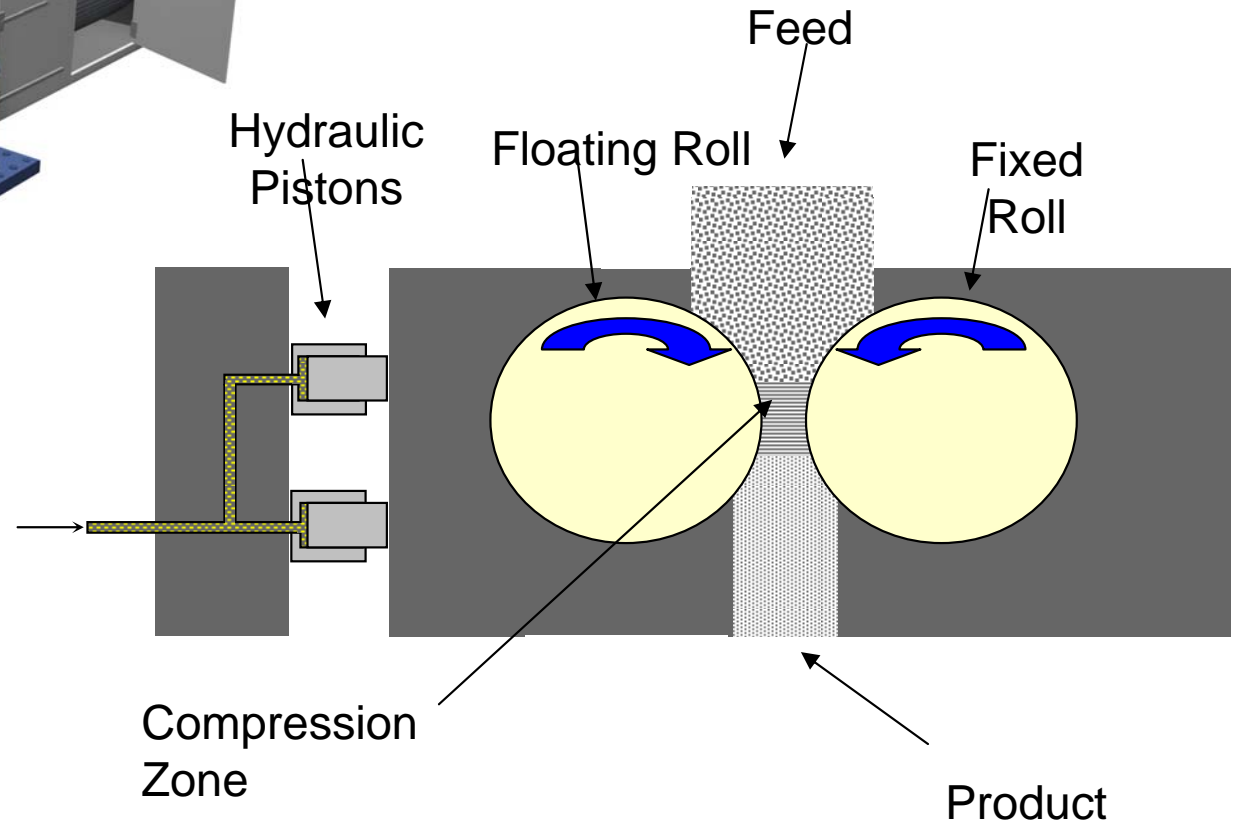
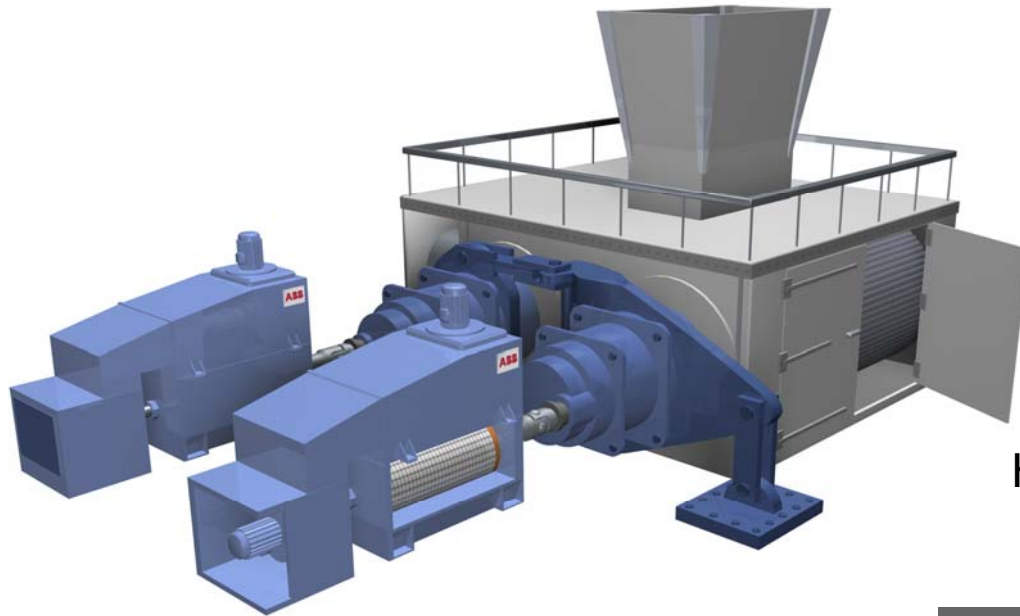
Mill Drive Solutions 40 years experience



Amandelbult,
South Africa

Power : 5.2 MW AG mill

HPGR System Application & Functionalities



Major advantages – Process Performance

- The roller press requires a twin drive application for its grinding rolls that need to full fill the following process demands:
 - Speed Control – Speed control on modern roller presses allows higher level of versatility in regards on material properties and increase overall performance.
 - Control Performance – ABB’s drive control (speed-torque) allows to respond instantly on the requirements of an inhomogeneous material and in addition, it can create between the two rolls a slight slip that optimize the crushing capabilities.
 - Load Sharing – The drive has built-in mechanical oscillation suppression to dampen any possible swinging in “Master-Follower” configuration. In addition, the stochastic nature of DTC prevents the mechanical system from oscillating in a predetermined controlled frequency, avoiding resonance.
 - Reliability – Since the variable speed drive system incorporates proven standard components, it is extremely reliable

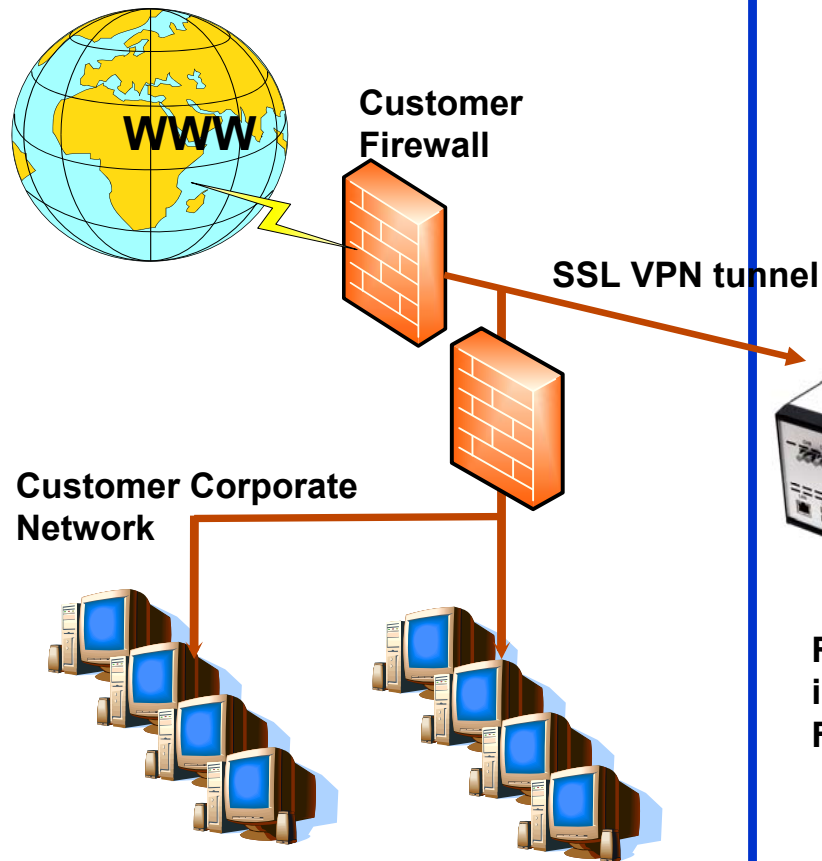
Mill drive solutions 40 years experience



Boddington,
Australia

Power : 2 x 2800 kW HPGR
4 Systems

Remote Diagnostics / Condition Monitoring



Example: Remote GMD Service

- Scope
 - Remote support for troubleshooting 24/7
 - Remote periodic maintenance
 - Preventive technical visits
 - Emergency technical visits
 - Technical assistance for major plant shutdowns
 - Training
- Benefits
 - Long term and integral support for these critical assets
 - Fast response guaranteed
 - 24/7 support available
 - Travel time reductions of specialists for remote support
 - Yearly agreed rates
 - Access to global ABB network expertise



Remote diagnostic room at ABB offices in Santiago-Chile

Power and productivity
for a better world™

