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# Trouble-free Mill Start (TMS) Frozen Charge Detection for WRIMs

## SIMINE Conventional Mill Drives

The newly developed system „Trouble-free Mill Start“ (TMS) provides Wound Rotor Induction Motor (WRIM) driven horizontal mills with a reliable detection of a frozen charge.

### **Avoid production losses through effective detection of a frozen charge**

Well known and equally feared by mill operators is the phenomenon known as frozen charge: After only 20 minutes of inactivity in the mill, the material within the mill can significantly solidify.

When performing maintenance at mills, downtime can last for several hours or even several days. During this period, the mill charge (or material) can solidify to what is called a frozen charge. In the case of a frozen charge, the material in the mill does not cascade or tumble at the normal 35 ° to 50 ° mill angle. The charge continues to stick to the inner wall of the mill as a solid mass, and eventually falls off from the side of the mill chamber.

The sudden impact of this falling frozen charge mass can cause substantial damage to the interior of the mill and to the mill bearing due to its concentrated weight.

### **Limit or eliminate unexpected costly repair**

The necessary repairs following a frozen charge can cause significant unplanned downtime, in worst cases can last up to several months. Since mill production can generate thousands of dollars per hour, in extreme cases a production loss of several million dollars could arise.

To detect a frozen charge in time and to be able to switch off the mill prior to any damaging activity, Siemens developed Frozen Charge Detection Systems for all its Integrated Drive Trains (IDS). These systems provide the necessary protection for the operation of horizontal mills driven by WRIMs.

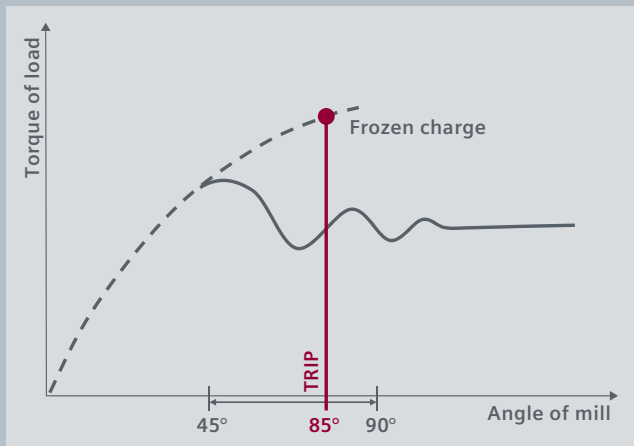


Fig. 1 – Load angle in normal operation and with frozen charge

### Frozen Charge Detection for all drive systems

Regardless of whether it is gearless mill drives or conventional mill drives, Siemens offers, since decades, different Frozen Chart Detection Systems to recognize the frozen charge problem.

Siemens developed and patented its Frozen Charge Protection System back in 1986, the first application of this technology was put into operation in 1988 with a gearless drive installed in Chuquicamata mine located in Chile.

Recently, a Frozen Charge Detection system for horizontal mills driven by WRI Motors called Trouble-free Mill Start (TMS), has also been developed and is now available for the mining market.

### What is TMS system?

The TMS system monitors the torque of the motor vs. angular position of the mill. It switches off the drive before the load angle reaches a dangerous zone of 85° or more degrees.

*“It sounds simple – because we kept the solution simple.”*

For example, no speed encoder is required since the rotor current is used as the basis for the torque measurement, from what the drive torque is calculated. With the information from two current transducers and the known ratio of the drive train, the angle of rotation of the mill can be accurately determined and safely controlled. TMS is a standard product, spare parts and services are easily available.

For each mill application, the current transducer is customer-specific selected and supplied. The turn-off angle of the mill, as well as the speed ratio of the mill, are being set during commissioning. This can be done by Siemens engineers or by the customer himself.

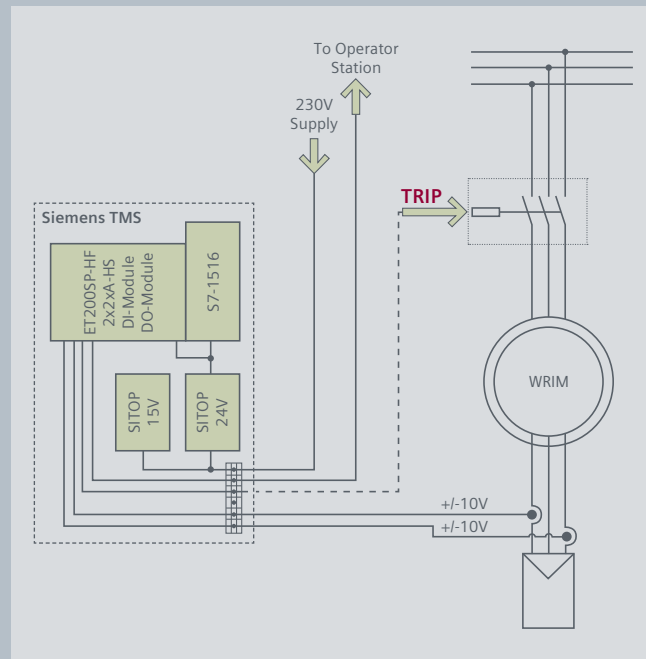


Fig. 2 – Integration of the TMS system in the WRIM drive train

### Retrofitted without downtime

The TMS system, once set up, is highly accurate and reliable, featuring a robust design and easy implementation:

- No speed encoder is required for monitoring the rotation angle, only two current transducers are needed.
- TMS can operate virtually on any WRIM-driven horizontal mills, applicable to both fixed-speed mills as well as variable-speed mills with Slip Energy Recovery Drive (SER).
- It can also be implemented as a retrofit solution without mill downtime.