

Safety standards as applied by Metso Minerals on mobile equipment

**Advantages, experiences and
future developments**

**4th Atlantic Alliance Conference
April 20th 2007**

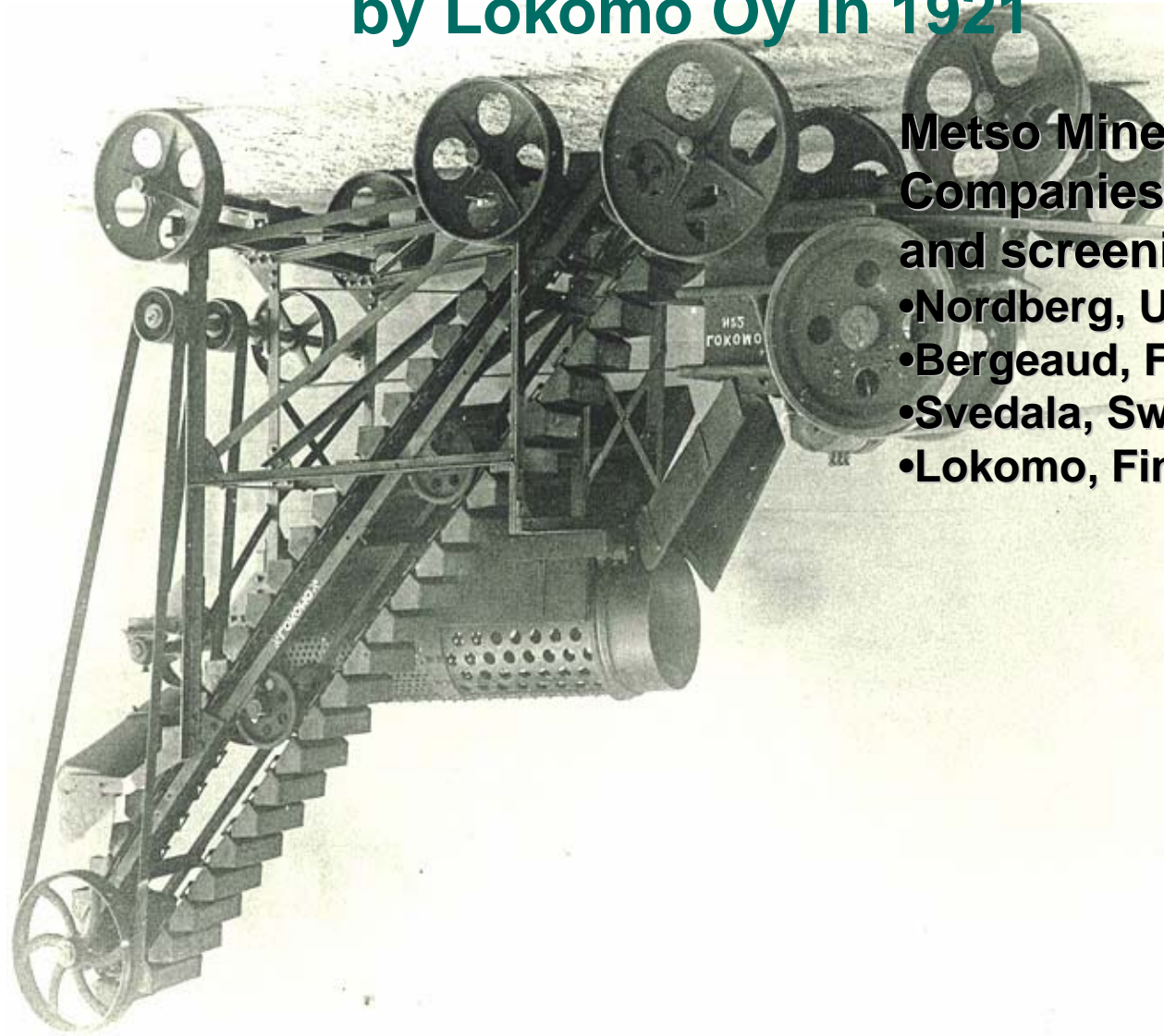


Safety standards as applied by Metso Minerals on mobile equipment

- Experience
- Standards and how we work
- Examples
- The future



The first crusher manufactured by Lokomo Oy in 1921



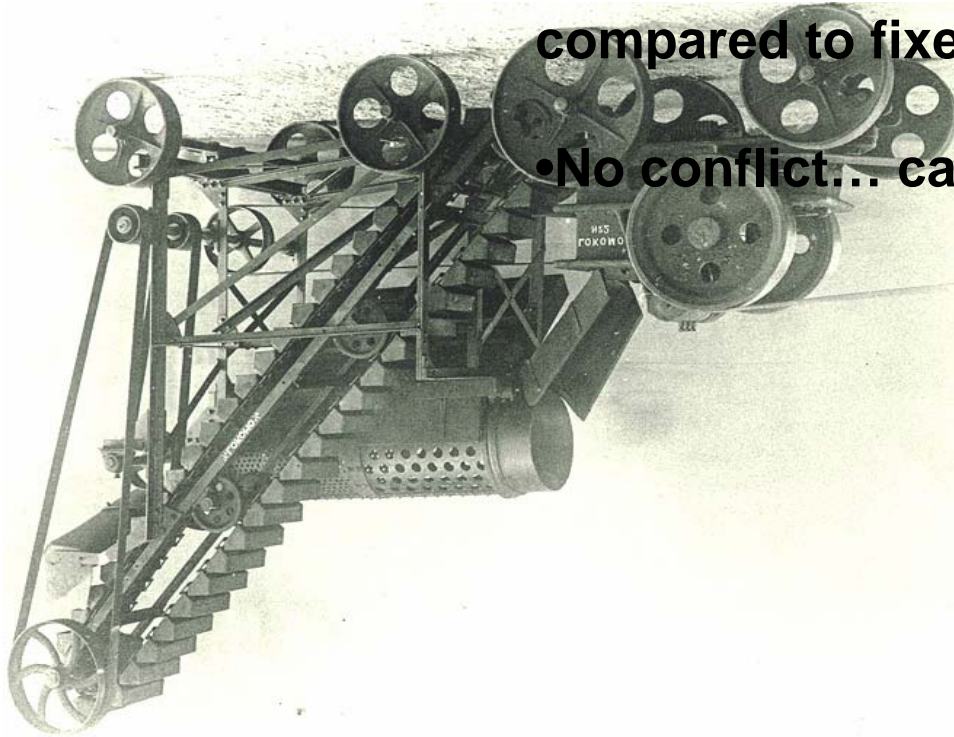
**Metso Minerals 'Cornerstone'
Companies for crushing
and screening equipment:**

- Nordberg, USA
- Bergeaud, France
- Svedala, Sweden
- Lokomo, Finland

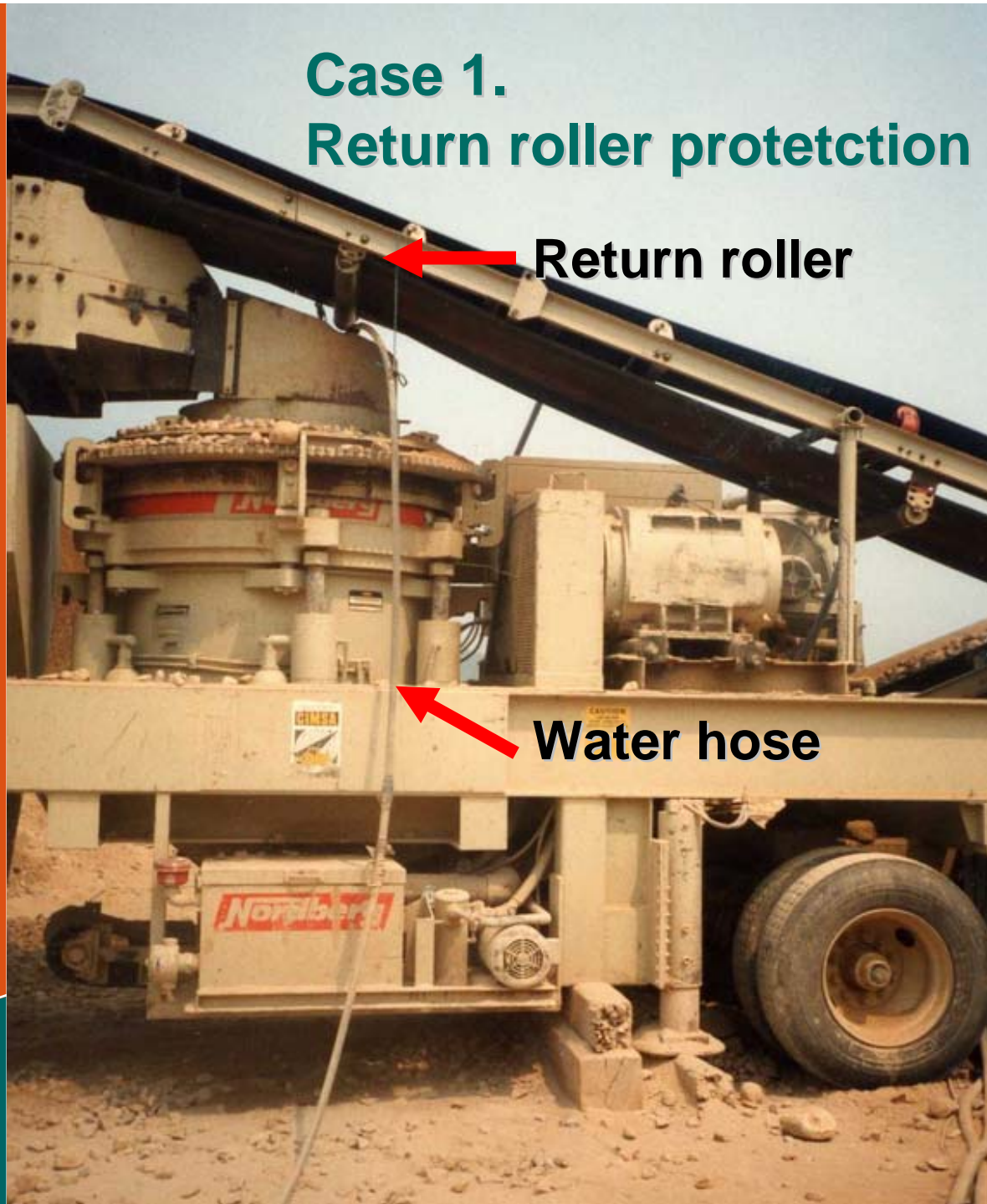


Mobile plants and safety... is there a conflict?

- Mobility and transportability require certain compactness
- Different solutions required when compared to fixed plants
- No conflict... call it a challenge!



Case 1. Return roller protection



Return roller

Water hose

**Chiapas,
Mexico - 1992**

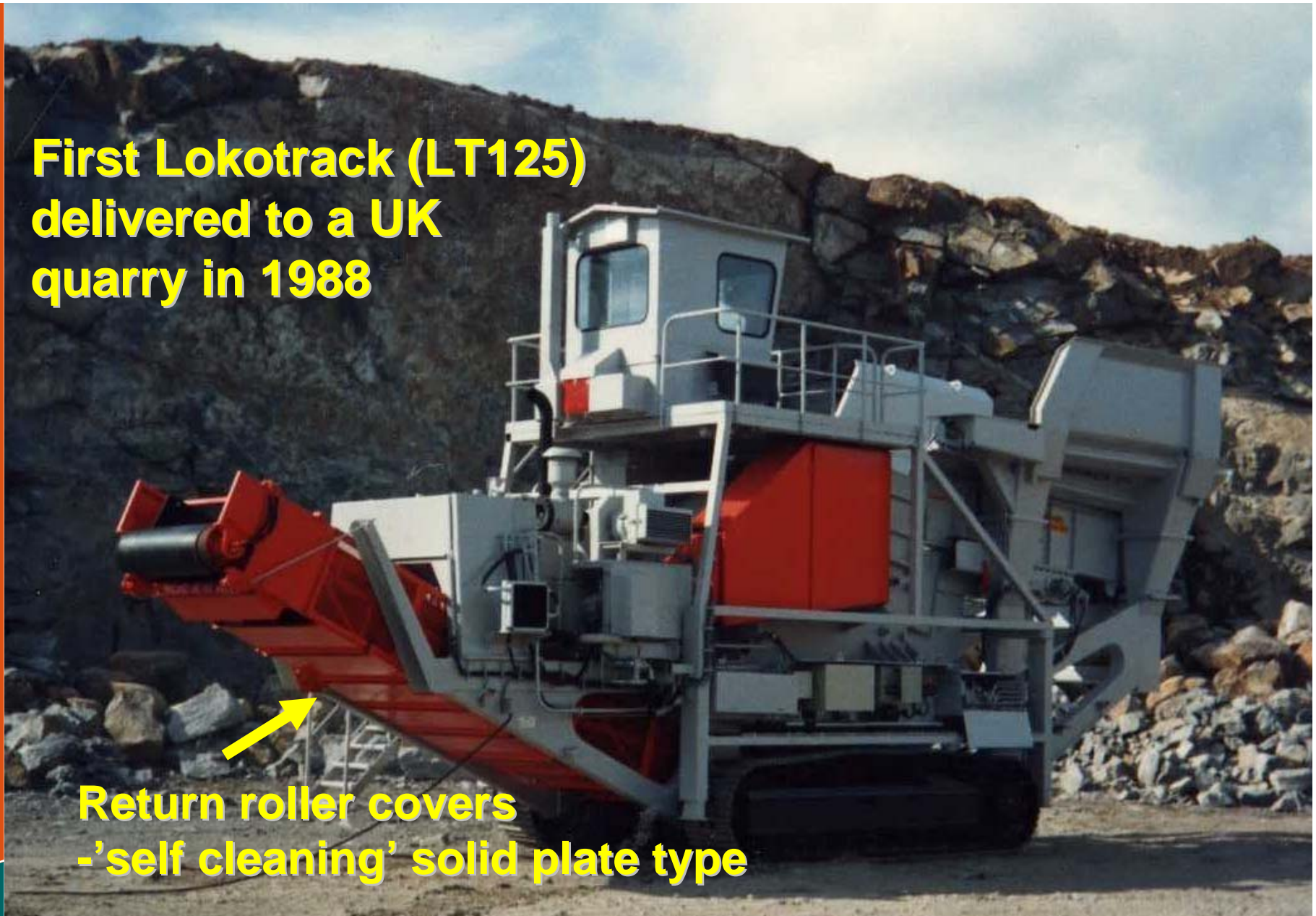
- **Locally built cone crusher plant**

5 minutes later...



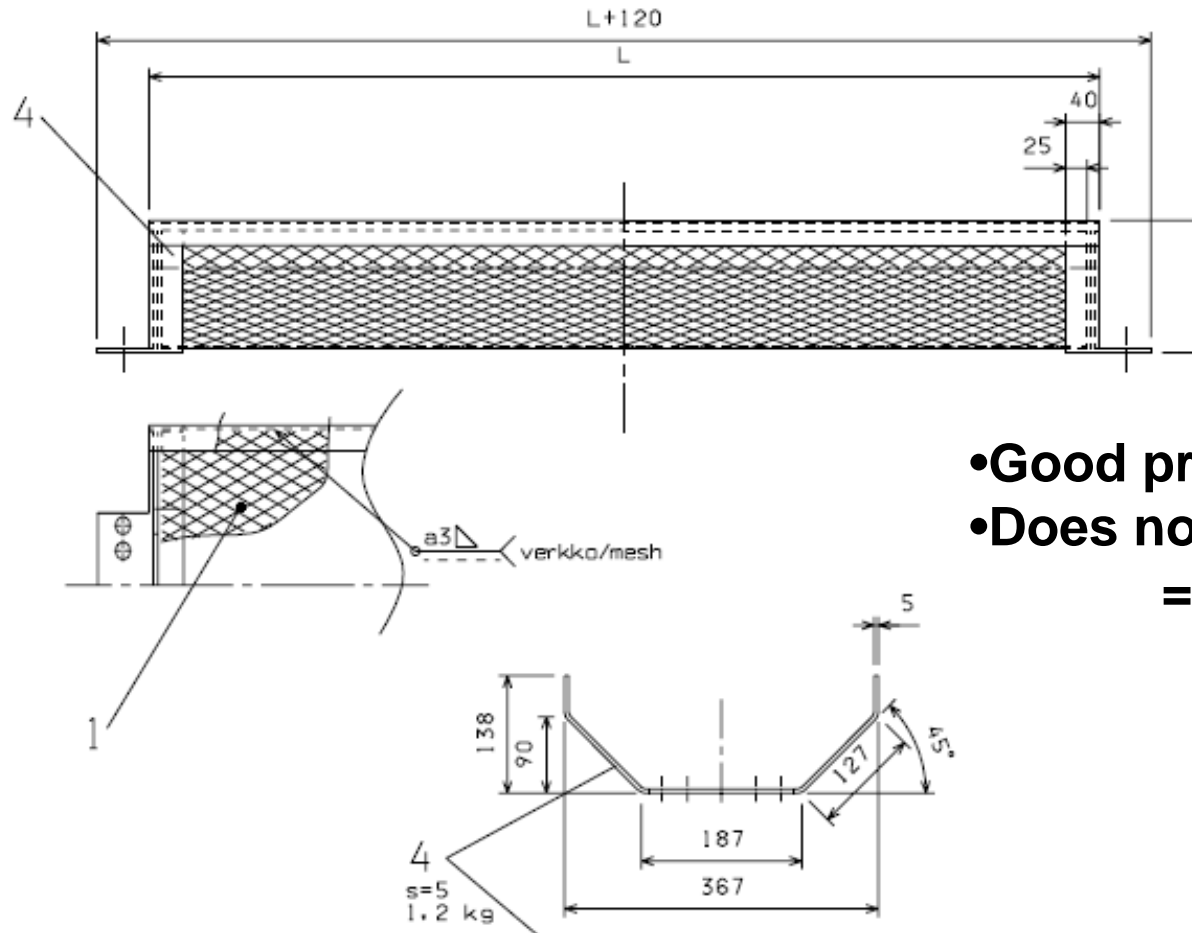
**First Lokotrack (LT125)
delivered to a UK
quarry in 1988**

**Return roller covers
- 'self cleaning' solid plate type**



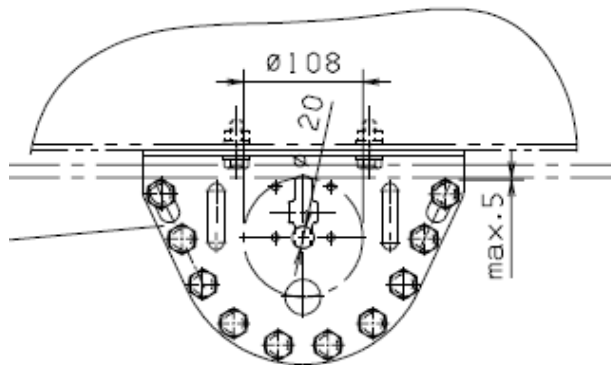
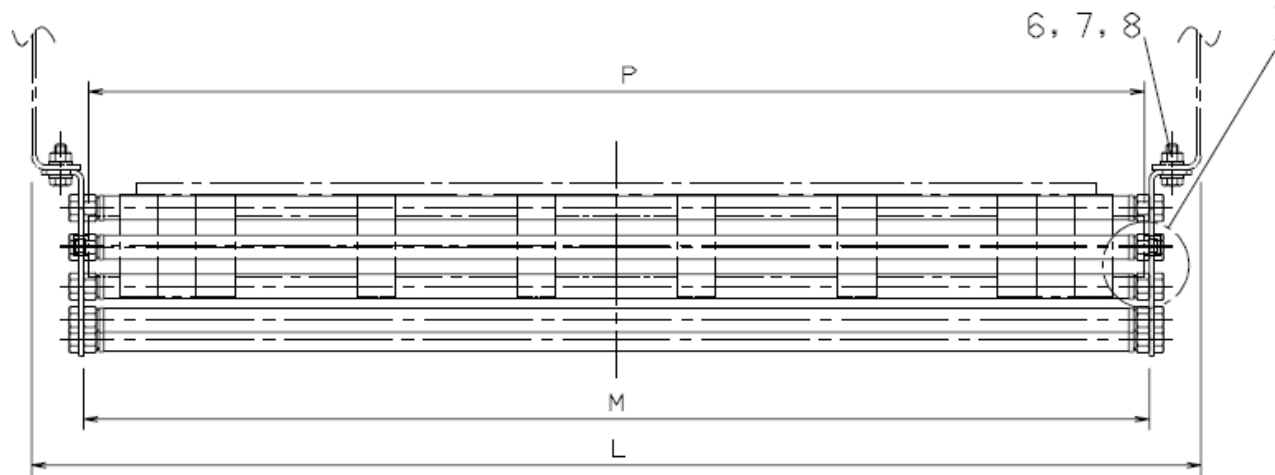
Return roller cover

Box type, made out of mesh



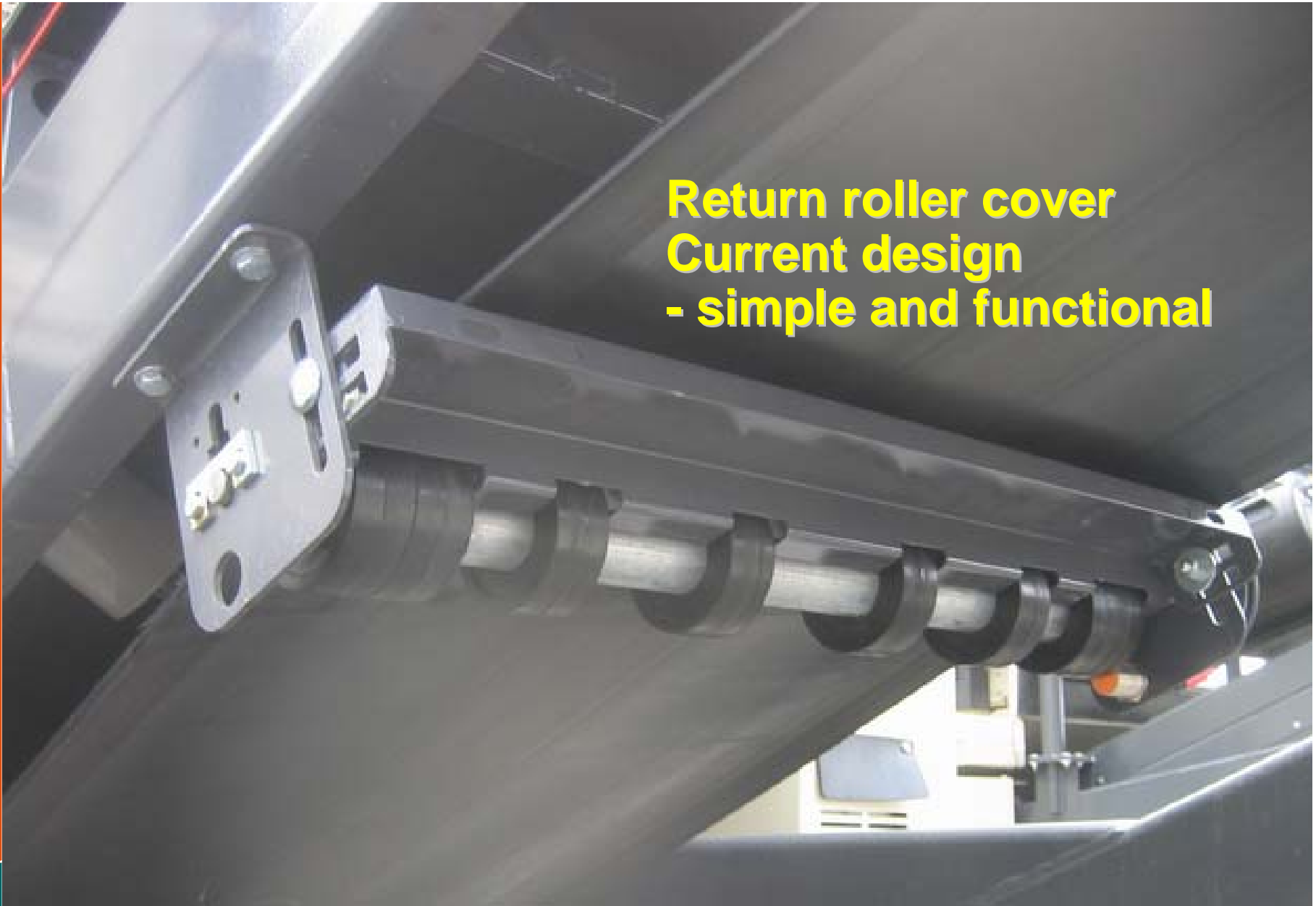
- Good protection
- Does not stay clean
=> gets removed

Return roller cover Model 'Gatling'

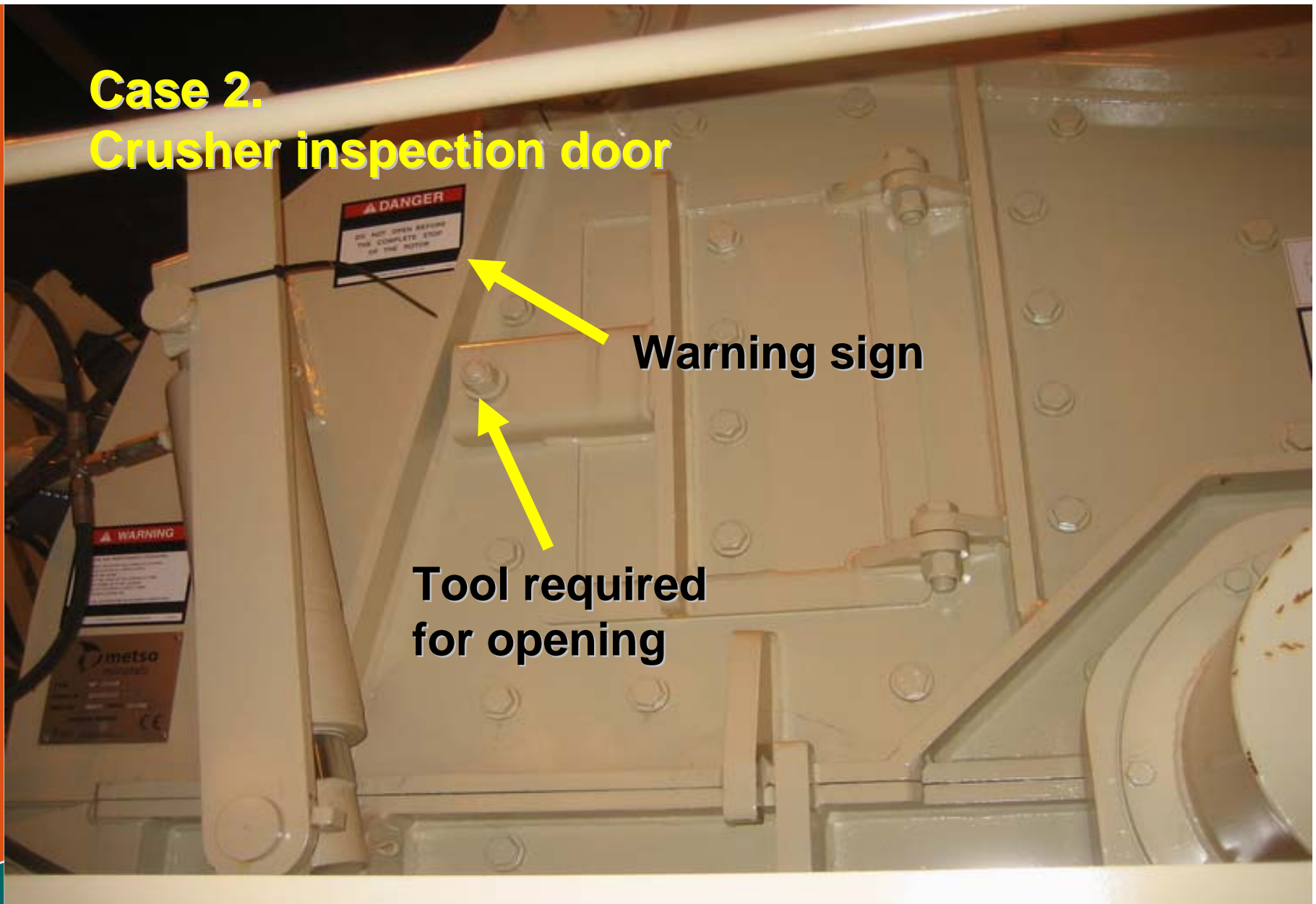


- Good protection
- Keeps clean
- Difficult to assemble
=> will not be re-assembled after some maintenance

**Return roller cover
Current design
- simple and functional**



Case 2. Crusher inspection door



Case 2. Crusher inspection door

Requirement :

- limit switch to stop the plant when the door is opened



The lesson is:

- The safety equipment
 - must provide full protection
 - must fulfill the standards**AND**
 - must be practical and reliable
 - must not prevent the machine to be used for it's actual purpose
 - must not prevent maintenance

**Device which has been removed or by-passed is more dangerous than one which was not there originally
=> "illusion of safety"**



Machinery safety, regulation hierarchy

**Machinery directive
98/37/EC**

Safety of machinery.
Basic concepts, general principles for design
EN-ISO 12100-1 and 2
(EN 292-1 and 2)

Principles for risk assessment
EN 1050

Harmonised standards
(C-standards)
E.g.:
EN 474 Earth moving machinery
EN 1889-1 Mobile machinery working underground - Rubber tyred vehicles
prEN 1009-1...4 Mechanical processing of minerals

Directives on Safety and health of workers at work
89/391/ETC
89/655/ETC

Exposure directives
2003/10/EC Noise
2002/44/EC Vibration

National health and safety regulations

2000/14/EC Noise emission in the environment by equipment for use outdoors

97/68/EC Engine exhaust emission directive

89/336/ETC EMC-directive (Electromagnetic compatibility)

97/23/EC Pressure equipment directive

SAFE MACHINERY



Machine type specific standards under work

Also for mobile crushers and screens

CEN Technical Committee (TC) 151 has proposed the following standards:

- **prEN 1009-1:** Feeding, crushing, milling, sizing and sorting machines for mechanical processing of minerals and similar solid materials - Safety - Part 1: Common requirements for single machines and processing plant
- **prEN 1009-2:** Feeding, crushing, milling, sizing and sorting machines for mechanical processing of minerals and similar solid materials - Safety - Part 2: Feeding machinery
- **prEN 1009-3:** Feeding, crushing, milling, sizing and sorting machines for mechanical processing of minerals and similar solid materials - Safety - Part 3: Crushing and milling machinery
- **prEN 1009-4:** Feeding, crushing, milling, sizing and sorting machines for mechanical processing of minerals and similar solid materials - Safety - Part 4: Sorting and sizing machines
 - to be decided soon..

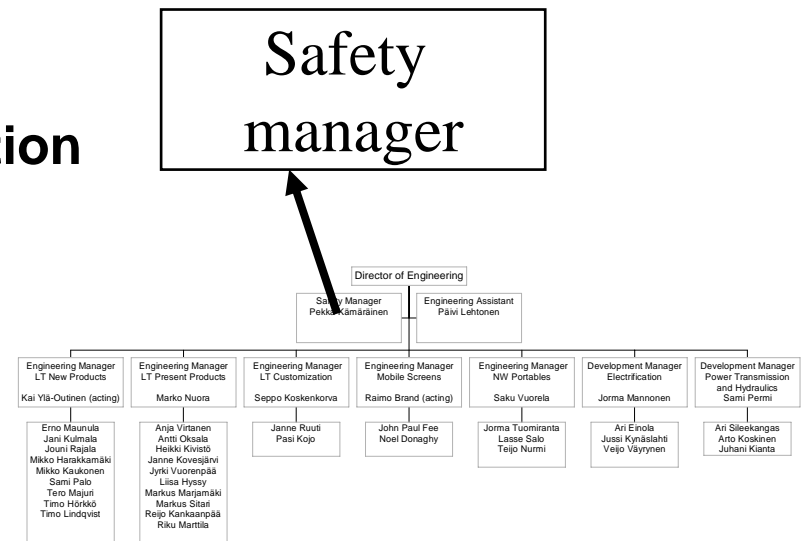
ISO Technical committee 195 has proposed the following standards :

- **ISO/CD 21873.2:** Building construction machinery and equipment - Mobile crushers - Terminology and commercial specifications
- **ISO/WD 21873-2:** Building construction machinery and equipment - Mobile crushers - Part 2: Safety requirements
 - 1st draft ready spring 2006

MM Mobile equipment engineering

Safety manager's key responsibilities:

- Training of engineering personnel
- Participating product development projects
 - risk analysis
 - risk assessments
- Follow and participate standardization



All engineering changes always are subject to a safety review:

- Does this change have effect on safety?

Machine directive 98/3/EY

Pos 1.2 Control system - Start from one place only



Machine directive 98/3/EY

Pos 1.2 Control system - Safety stops

Emergency switch



Conveyor stop wires

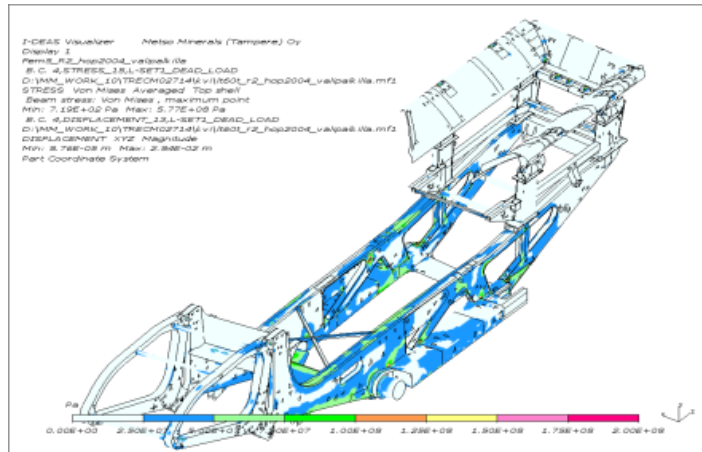


Machine directive 98/3/EY

Pos 1.3 Mechanical safety hazard - Structural or component failure

Structural strength - FEM analysis

High quality components



- High technical reliability provides:**
- decreased safety risk due to failure
 - decreased safety risk when making repair
- ...and more up-time**

Machine directive 98/3/EY

Pos 1.3 Mechanical safety hazard - Falling objects

Jaw crusher cavity safety gate & Warning signs



Machine directive 98/3/EY

Pos 1.3 Mechanical safety hazard - Moving parts

Hydraulic folding and locking of feed hopper walls

=> No need for manual work => HAZARD ELIMINATED



Machine directive 98/3/EY

Pos 1.3 Mechanical safety hazard - Moving parts

Flywheel and belt cover

- Opening requires a tool (as required in Pos.4)



Machine directive 98/3/EY
Pos 1.5 Other safety hazard - High temperature
Exhaust pipe cover



Machine directive 98/3/EY

Pos 1.5 Other safety hazard - Fire

Engine compartment fire extinguisher - Option



Machine directive 98/3/EY

Pos 1.5 Other safety hazard - Noise

Noise insulated engine cover and muffler

Feed hopper rubber lining



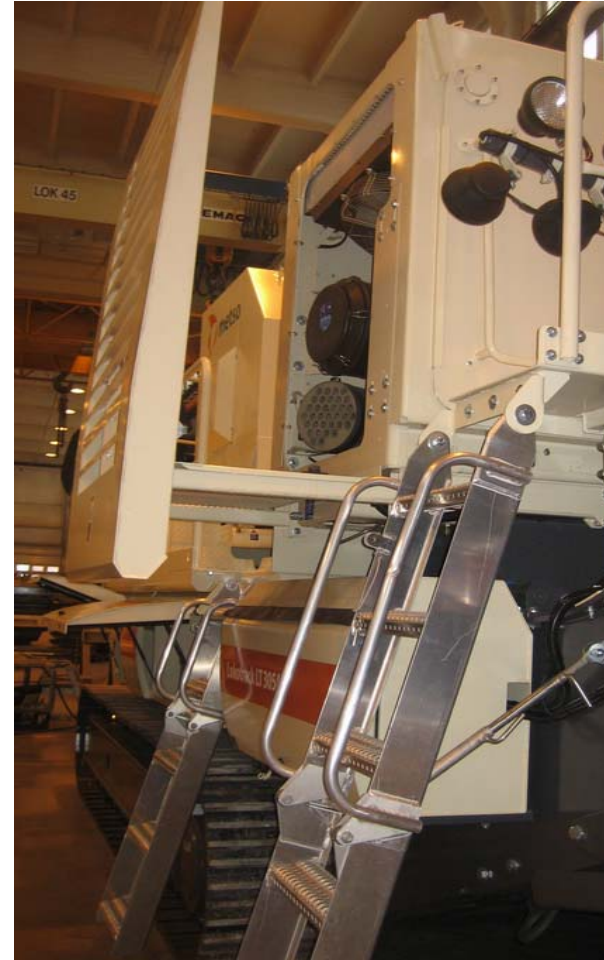
Machine directive 98/3/EY
Pos 1.5 Other safety hazard - Dust
Dust encapsulation
High pressure water suppression system



Machine directive 98/3/EY

Pos 1.6 Maintenance - accessibility to service points

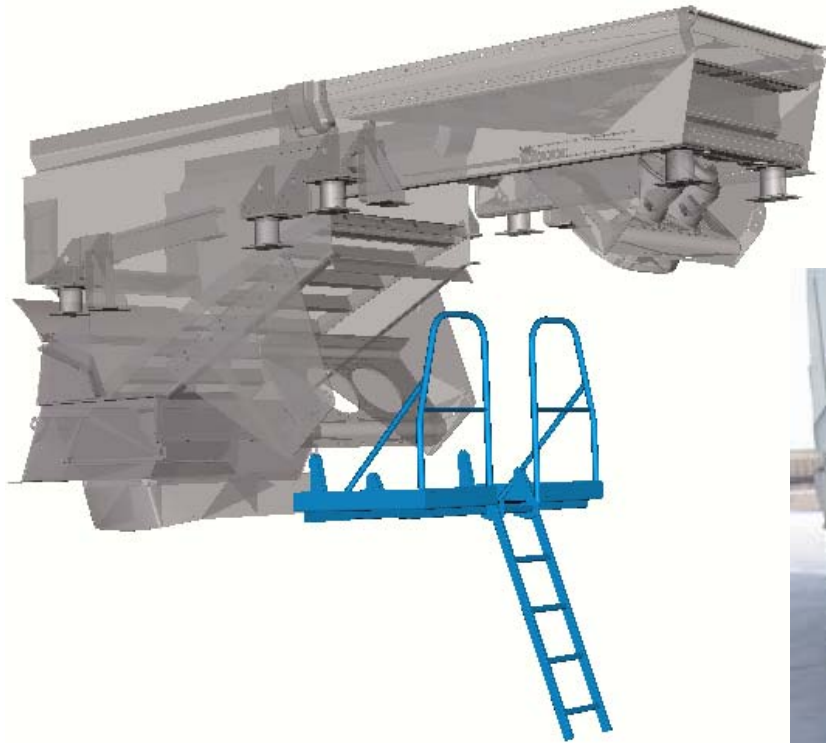
Stairs and platforms - Engine unit



Machine directive 98/3/EY

Pos 1.6 Maintenance - accessibility to service points

Stairs and platforms - Vibrating scalper



Machine directive 98/3/EY

Pos 1.6 Maintenance - accessibility to service points

Drainage points - Engine unit

Grease nipples - Belt conveyoyr



Machine directive 98/3/EY

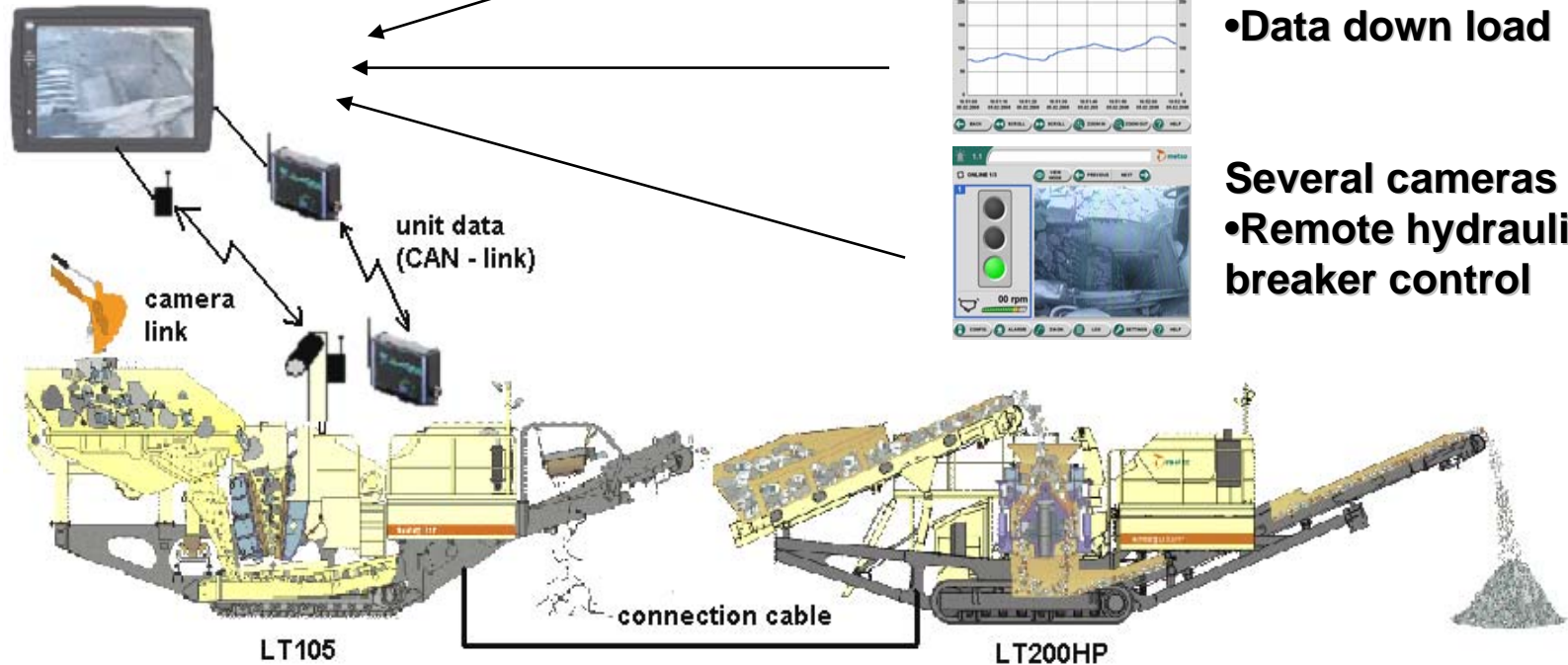
Pos 1.6 Maintenance - Safety lockout



Future developments

1. Improved dust and noise control systems
2. Improved remote control systems

Wireless display in the excavator cabin



- Control and monitoring of 1-5 machines

- Data down load

- Several cameras
- Remote hydraulic breaker control

THANK YOU!
...and safe crushing!

