


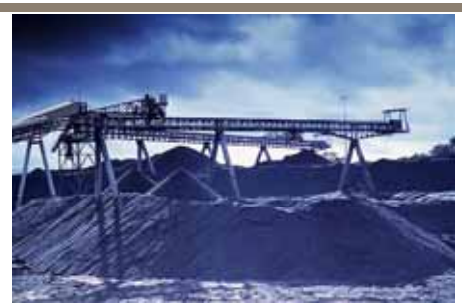

SWC
Dawid Brown
Catastrophic Failure

21 January 2010

Compiled by: P.J. Du Preez

Personal Background

- Rusty
- Junior Engineer at South Witbank Colliery
- Ndip Power Engineering
- In Final Stage of preparing to writing my GCC in November.

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I T

xstrata coal

PJ du Preez - Jun Engineer Xstrata

Tom de Lange - Mechanical Foreman Xstrata

Dirk Van Zyl - Chief Engineer David Brown

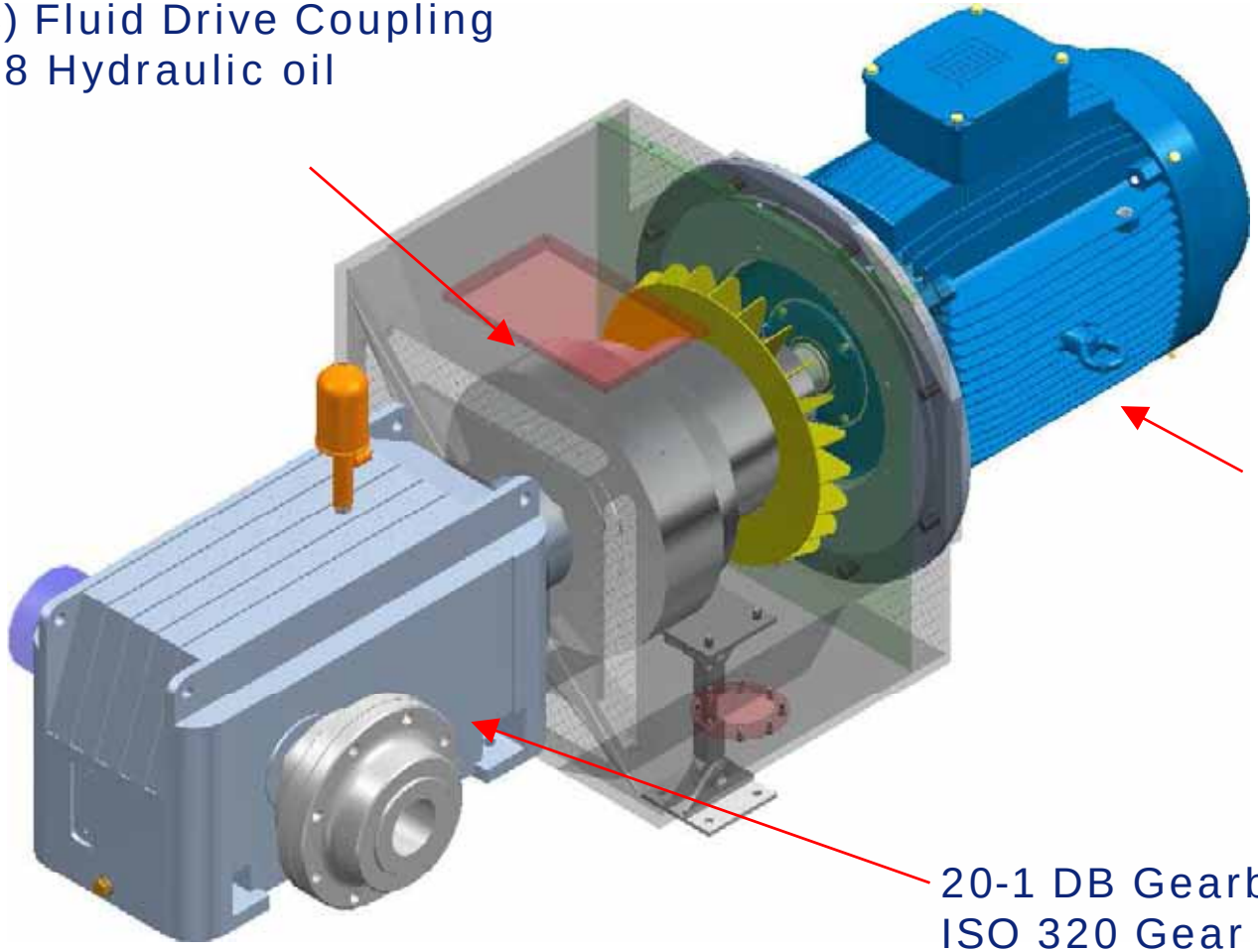
Darrel Elliot - Work Shop Manager

Louis Lombardt - Area Agent David Brown

Bret Buchan - Sales Engineer

Principles and Operation

Voith (7TSS) Fluid Drive Coupling
Using ISO 68 Hydraulic oil

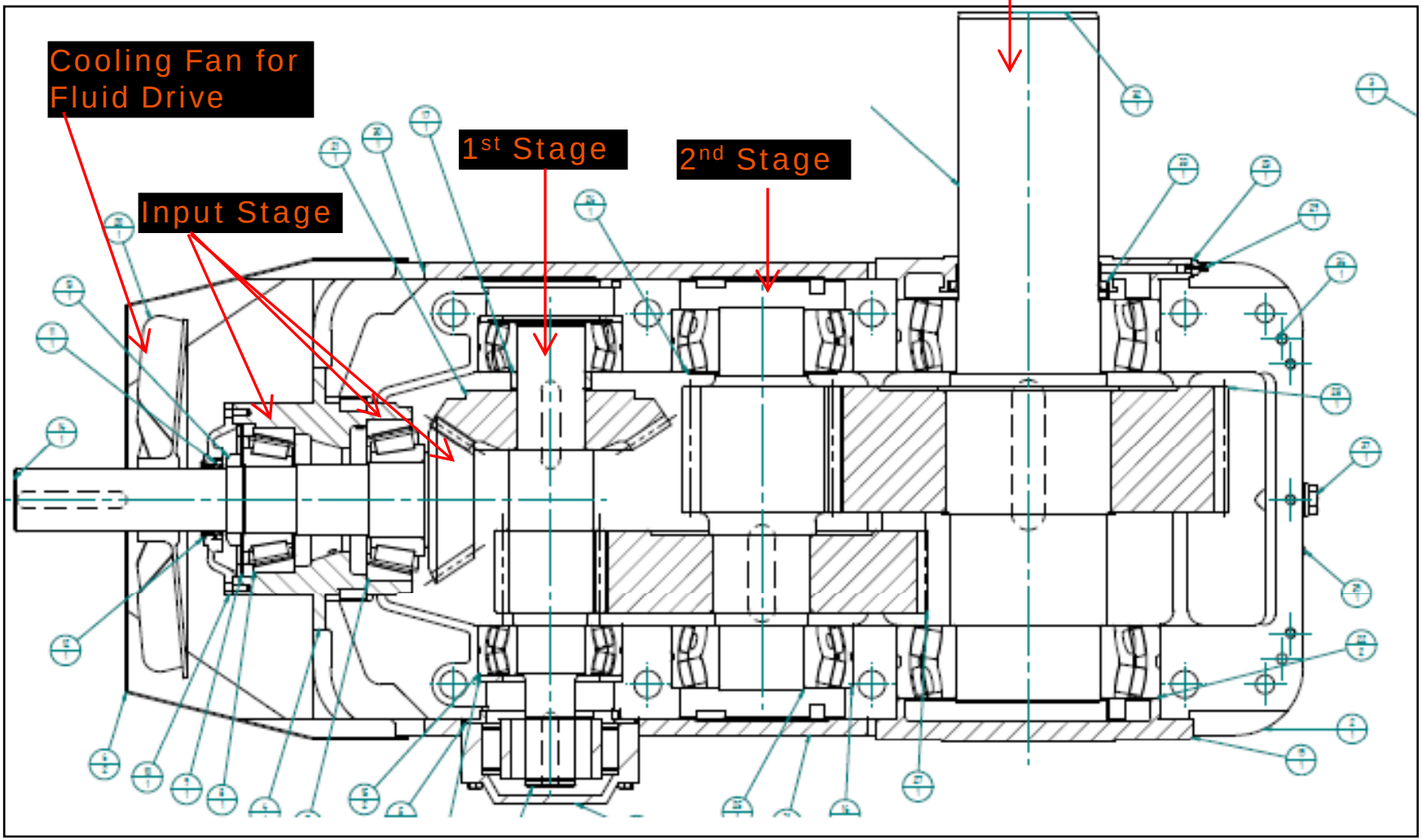


FLP WEG
110kW
Motor

700Nm
Torque

20-1 DB Gearbox
ISO 320 Gear oil

Detail Drawing

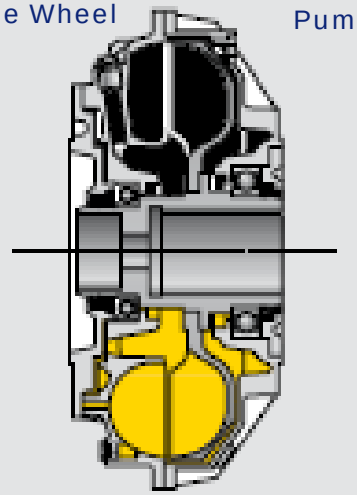


Gearbox Lubrication

- The gearbox lubrication mechanism:
  - The bottom part of the gearbox forms a sump.
  - The gears are submerged ¼ in the oil and through the motion of the gears splashes the oil inside the gearbox.
  - Then gravity does it part the oil runs along the side of the gearbox and are caught by oil channels and conveyed to the bearings.

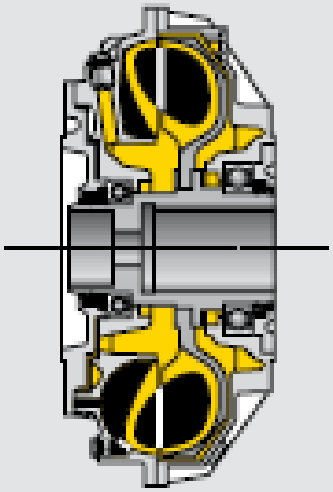
Fluid Drive

Standstill



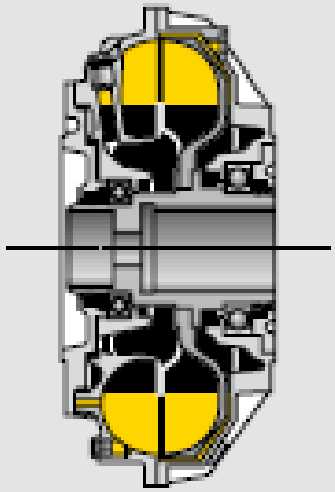
All the fluid in the coupling is at rest.

Start-up



With increasing speed, the operating fluid in the working circuit is accelerated via the pump wheel. The circulatory flow created in this way is supported by the turbine wheel and sets the latter in motion. The torque development is determined by the characteristic curve of the coupling, while the start-up characteristics are influenced by an appropriate arrangement of compensating chambers (delay chamber, annular chamber).

Nominal Operation



The low speed difference between pump and turbine wheel (the so called nominal slip) leads to the flow condition in the coupling becoming stationary. Only the torque required by the driven machine is transmitted.

Properties of ISO 68 Oil

- Very high performance anti-wear hydraulic oil.
- Extremely good filterability.
- Excellent hydraulic stability.
- Good demulsibility.
- Superior thermal stability (no sludge forming under high temperatures).
- Good anti foaming and air release properties.

Properties of ISO 320

- Good Seal compatibility.
- Excellent EP and Anti-wear Properties.
- Very good resistance to oil oxidisation and degradation.
- Good protection to rust and corrosion of copper alloys.
- Good anti foaming and emulsion formation.

History

- In February the specific power pack was send to David Brown for repairs on the gearbox internals.
- It was returned to site before the 15th of March
- On the 15th of March 2009 the specific repaired David Brown power pack was installed on section 3A belt to form part of the drive.

Sequence of events

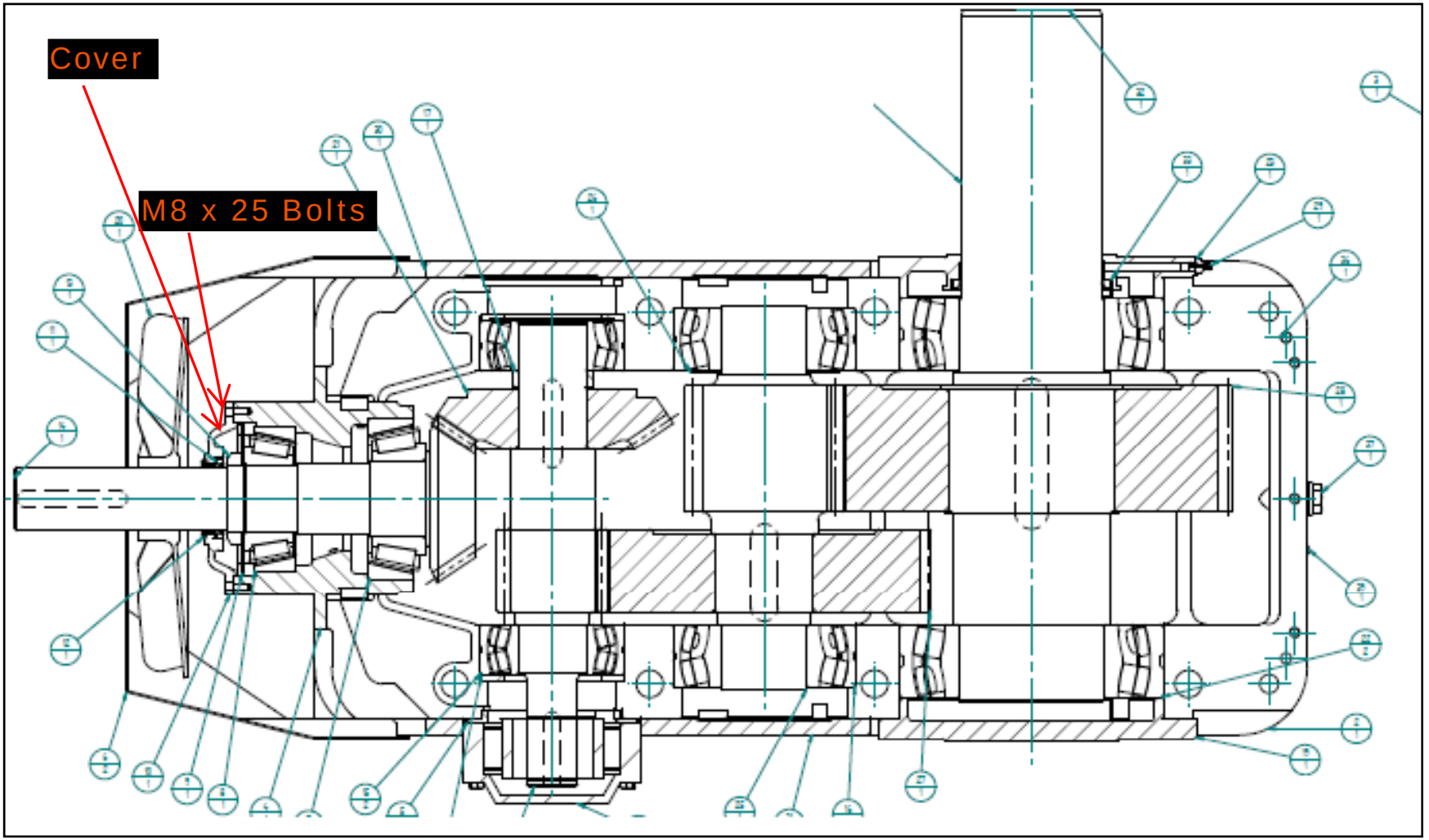
- Time of incident
  - 23:00 on the 15/10/09
  - Control room phoned at 23:30 all relevant people and notify them that the sect 3 was on stop.

- Findings
  - At 22:45 it was reported by the fitter on shift that the gearbox was running at higher temperature than normal. No oil leaks observed on the ground.
  - Whilst conducting another inspection the fitter noticed that the belt was on stop.
  - On investigation the cause of the stoppage it was identified that the gearbox failed. Oil was observed on the ground at the drive.
  - Time lapse between identifying high temperature and failure was 15 min.
- The following were discovered
  - The Motor was sheared off, the fluid drive coupling housing was also sheared off and the fluid drive coupling were hanging skew from the gearbox.
- Complete power pack was replaced
- Failure again on start up due to phase loose inside motor.
- Replace power pack again.
- Production of coal.

MTTF

- History of Gearbox
  - It was 7 Months (4704 Hrs) in service.
  - Gearbox was assembled at DB.
  - According to DB assembly QC list there was a certain length of bolt (M8 x 25) to be used to secure the input pinion Bearing oil cove of the gearbox. This was not done. A different length of bolt (M8 x 16) was used.
  - The bearing is a thrust bearing. The thrust causes a dynamic condition. In order to prevent the cover from vibrating loose 25mm bolts should be used.
  - Good Engineering practice is to use lock tight on the bolts.

Detail Drawing



MTTR

- MTTR
  - It took 6 hours to replace the old gearbox with a new one.
  - The new gearbox failed on start-up due to one phase in the motor failed and burned off.
  - This resulted into a additional 2 hours downtime.
  - Total down time for production was 8 hours.

Facts established at David Brown investigation

- Gearbox was send for repairs.
- QC not up to standard.
- QC component document was a Paper exercise.
- Didn’t use correct components (human Factor).
- Power Pack returned to SWC.
- Power pack installed.
- Inspection done by fitter on shift.
- Due to vibration and thrust and situation caused by human error bolts vibrated loose and input pinion bearing cover came loose causing oil starvation (12min) and gearbox failure with in 3min of oil drainage.
- Exchange Power Pack.
- Failure again due to human error (motor single phase).
- Replace Power pack.
- Commissioning - Production

Cost of Failure

- Capital Cost
  - R360 000
- Production loss
  - 250T/H x 8 = 2000 Ton's
- Production Cost
  - 250T/H x 8 x R460 = R920 000
- Total loss
  - 920 000 + 360 000 = R1.28 M

Photos Before investigation

Photos during investigation

Preventative measures

- SWC
  - Maintenance Regularly.
  - Inspection on all the input pinion cover bolts.
  - Oil Samples.
  - Vibration and Thermal monitoring.

- DB
  - New service centre dedicated to repairs. Costing R12M.
  - Proper QC assurance.
  - More focused management of QC list and components.

Conclusion

- As a result of poor Quality Control and human error from both sides the Operation suffered a production loss of 2000 tons.
- Financial lost R1.28 M.

Thank You