IMHC
International Materials Handling Conference

BELTCON 9
22-24 October 1997
Gallagher Estate, Midrand, RSA

Under the office of:
The SA Institute of Materials Handling
The SA Institution of Mechanical Engineering
Conveyor Manufacturers Association of SA Limited

TRIPPER DRIVING BY MEANS OF VISCOUS FRICTION TRANSMISSIONS IN SOUTH AFRICA

Author : A Exton
Presentation assisted by : A Scorgie

Nepean Mining South Africa (Pty) Ltd
PO Box 2272
2162 NORTH RIDING
RSA

Telephone : +2711 708 2854
Facsimile : +2711 708 2856

The S.A. Institution of Mechanical Engineering

C M A
Conveyor Manufacturers Association of SA Limited

SA Institute of Materials Handling

SYNOPSIS:

The conveying of shortwall RoM coal at Matla Colliery has gone through a transformation by utilising a single flight Tripper driven maingate conveyor with a conveying length of 3,300 meters and a capacity of 2,500 tph.

The purpose of this paper is to familiarise delegates with the practical and technical implications experienced in the design, installation, commissioning and operation of these conveyors by utilising viscous friction transmissions for ramping and Tripper driving.

The positioning of the tripper is discussed which is critical to the overall performance and ease of tripper removal during retreat mining operations. The paper further discusses the system as installed including the use of modular components such as the drive head, large capacity "live" belt storage unit, universal belt reeling & maintenance station, the peripheral equipment used as inputs to the PLC for the control of the conveyor and briefly the on line status monitoring of the conveyor.

The paper concludes that whilst the installation is more complex with the use of PLC's for the total control of the conveyor, including tension control, loop take up position monitoring etc., there are definite benefits in the employment of this technology.

INDEX

1.0 INTRODUCTION:

In order to meet the future long-term requirements for the Power Station, Matla Coal has embarked on increasing the use of the Longwall Mining method for coal extraction so as to best utilise the reserves. By utilising CM sections with the bord & pillar mining method, approximately 67 % reserve utilisation can be achieved. With the longwall mining method used at Matla presently the reserve utilisation is increased to approximately 98 %. As a result thereof the life of the power station is drastically increased. The 4 seam is currently using the largest longwall equipment in Africa. To achieve these benefits the conveying requirements created new challenges which were not previously encounted at the mine, namely the operation of Long Centre Distance Conveyors, (LCDC), in a rapid retreating underground application.

The purpose of this paper is to familiarise delegates with the design, installation, commissioning and operation of these (LCDC) conveyors when using viscous friction transmissions for ramping and Tripper driving.

2.0 ENQUIRY SPECIFICATIONS:

As a result of the requirements, the following basic design criteria was called for:

2.1 The conveyor is to be used in the Maingate for both development and shortwall extraction in a retreat mining operation.
2.2 It must have the capability to develop and retreat in a rapid manner so as to maximise the available cutting time.
2.3 The RoM design capacity is to be 2500 Tonnes per Hour.
2.4 The Loop Take Up, (LTU), is to store 300 meters of "live" belting and allow for face pushover while the belt is conveying coal.
2.5 A permanently installed powered reeler is to be employed for rapid insertion or extraction of belting.
2.6 The belting used is to be suitable for use in fiery mines. (Solid Woven PVC).
2.7 The installation is to be 3300 meters with a maximum lift of 20 meters.
2.8 The design must operate as a single flight belt conveyor over its entire length.
2.9 The use of standard components is to be maximised.
2.10 The belt width is to be 1350 and the belt speed should not exceed 4 m/sec.

SPECIFICATIONS OF CONVEYOR MATLA - 4 SEAM SHORTWALL

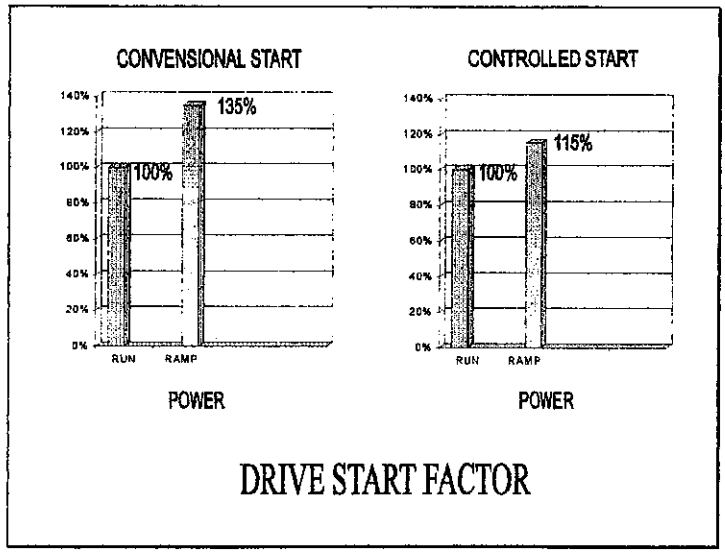
- MAINGATE CONVEYOR USED FOR DEVELOPMENT & EXTRACTION OF SHORTWALL COAL MINED IN RETREATE
- DEVELOPMENT & RETREAT OPERATION TO BE RAPID SO AS TO MAXIMISE CUTTING TIME
- RoM CAPACITY :- 2500 Tons per Hour
- LIVE BELT STORAGE CAPACITY :- 300 m CAPABLE OF INSERTING OR RETACTING IN ON ROLL
- PERMANENT POWERED BELT REELER FOR RAPID INSERTING OR RETRACTING OF 300 m ROLLS OF BELT
- BELTING SUITED TO FIERY MINES
- INSTALLATION SPECIFICATIONS :- LENGTH - 3300 m
  MAX LIFT - 20 m
- CONVEYOR OPERATES AS SINGLE BELT OVER ENTIRE LENGTH
- MAXIMUM USE OF STANDARD COMPONENTS
- BELT WIDTH - 1350 mm
- BELT SPEED - 4 m/sec (max)

3.0 REQUIRED CONTROL CRITERIA:

In order to ramp a conveyor of 3300 meters when using "stretchy" belting, the following fundamentals need must be addressed:

3.1. The control criteria to be employed in order to effectively ramp the above conveyor requires precise control within a closed loop system. This generally falls outside the capability of normal ramping devices currently used on the mine. Due to the length and the elastic stretch of the solid woven belt, a controlled linear ramp of sufficient time is required to maintain an acceptably low drive start factor that would not induce dynamics into the belt carcass.

3.2. Furthermore, in order to not exceed the maximum operating tensions for Solid Woven Belting it would require some form of intermediate drive. For the purpose of being able to rapidly retreat the conveyor to minimise downtime when the intermediate drive is removed, the choice was to install a modular Tripper drive which can be removed within one shift.

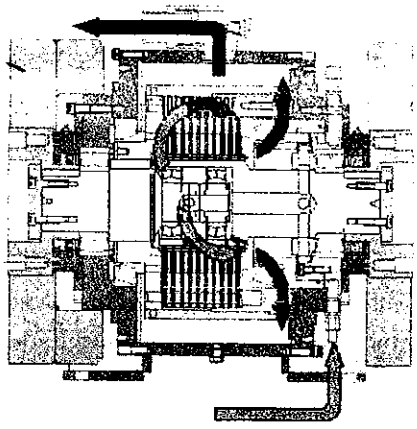


4.0 THE VISCOUS FRICTION TRANSMISSION:

The device is situated on the high-speed side of the drive module between a standard motor and a standard gearbox. (Viscous Friction Transmissions operating on the high speed side of the gearbox are generally smaller in size due to the lower torque requirement than those which are applied on the low speed side of the gearbox).

The viscous friction transmission is used to ramp the conveyor and to apply torque as and when required at the Tripper drive. The power packs are identical and interchangeable for both applications.

The device referred to above as used at Matla Coal is known as the "BOSS" Platinum Series transmission, which relates to "**B**elt **O**ptimised **S**oftstart & **S**lave" and is manufactured by Nepean Mining in Australia.



BOSS OIL PATH

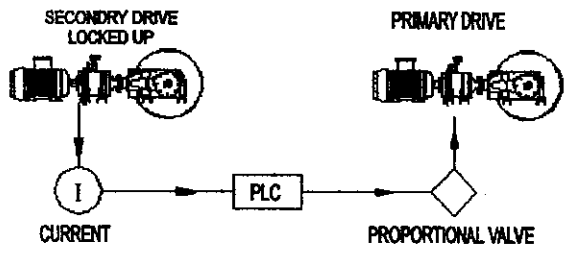
4.1 Principal of Operation:

The device is a multi plate modulated oil cooled transmission developed specifically to control output torque as required. This control is achieved by means of a PLC, which is programmed either to ramp or assist the conveyor in a controlled manner.

The transmission consists of a number of driving plates attached to the input shaft and the appropriate number of driven plates attached to the output shaft. The required torque is transmitted by either increasing or decreasing the pressure applied to the plates by the annular piston, which is in turn controlled by the PLC. In both cases the torque is applied in accordance with the code as programmed for the particular application.

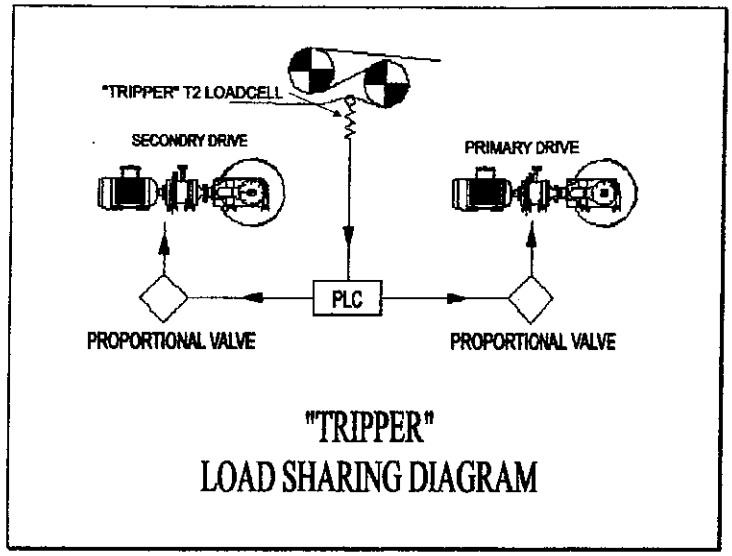
4.2 Load Sharing:

4.2.1 Outbye End: With the Platinum Series "BOSS" transmission load sharing is done at the outbye end by locking up the secondary drive thereby causing this drive to become the host. The primary drive then "Current Follows" the host through continual monitoring of the secondary drive current and modulates the primary transmission to follow this current by means of the PLC and the proportional valve.



OUTBYE DRIVE
"CURRENT FOLLOWING"
LOAD SHARING DIAGRAM

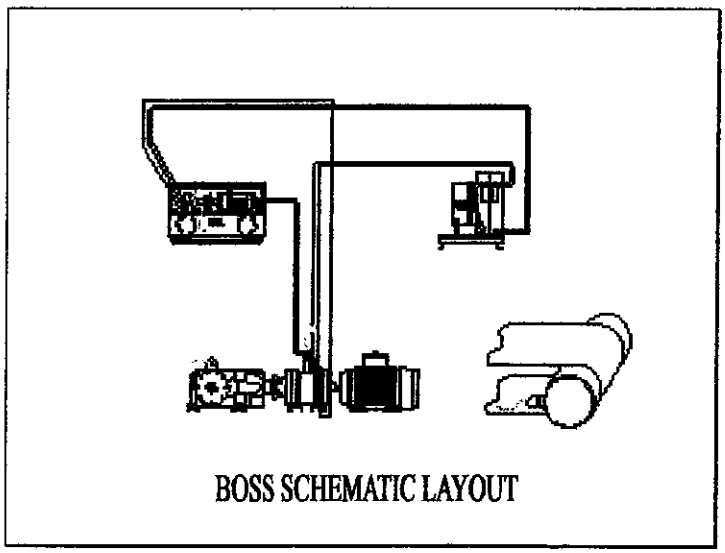
4.2.2 Tripper Drive: At the Tripper drive both transmissions are operating at a speed advantage of approximately 4 percent when compared to the outbye drive in order to outrun the host and thereby de tension the belt ahead of the Tripper. The load sharing is achieved by both transmissions striving to maintain the same "Target Tension".



"TRIPPER"
LOAD SHARING DIAGRAM

4.3 The Hydraulic Power Pack:

A dual power pack used for cooling & flushing purposes combined with a pressure source to supply oil in order to modulate the annular piston of the "BOSS" transmission is required.
During ramping the circulating oil is heated and this heat energy needs to be dissipated by means of an external hydraulic cooler which is thermostatically controlled by the PLC. The cooling & flushing oil is continuously filtered.



BOSS SCHEMATIC LAYOUT

4.4 The PLC for the Control of the Conveyor:

The PLC used at Matla Coal Ltd is the Allen Bradley 5/04. This PLC is commonly used to control conveyors in similar applications in Australia.

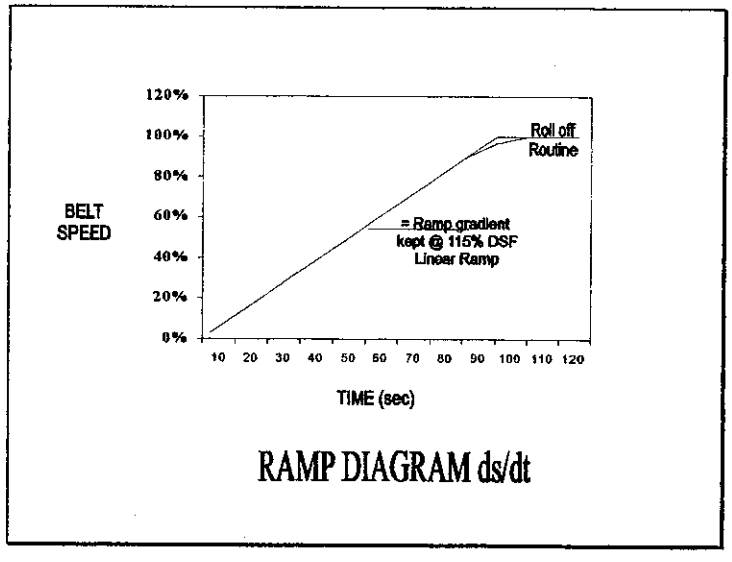
Nepean Mining in Australia has developed the control philosophy for the "BOSS" transmission over many years in conjunction with a control company with extensive conveyor experience. This control technology has also been applied to viscous friction drive devices, which operate on the low speed side of the power module via a dedicated gearbox.

The required torque is controlled by the PLC through a proportional control valve. This valve is instructed by the PLC via a driver card to apply or reduce the pressure to the annular piston. The PLC is continuously analysing the state of the conveyor in accordance with the PLC Code as written.

The PLC control system incorporates an Allen Bradley 550 Panelview indicating various screens as required for on site monitoring, commissioning, fault-finding etc.

4.5 The Ramp:

Various acceleration profiles can be programmed into the PLC in order to obtain an acceptable result. The Ramp profile chosen for Matla Coal is a ds/dt combination that follows a linear profile. As the ramp nears completion a programmed "Roll Out" routine allows for a smooth transition to full speed. This ramp allows for torque to be gradually introduced into the belt carcass at an acceptably low rate keeping the drive start factor sufficiently low, (<115% linear), at all times as not to create any tension waves.

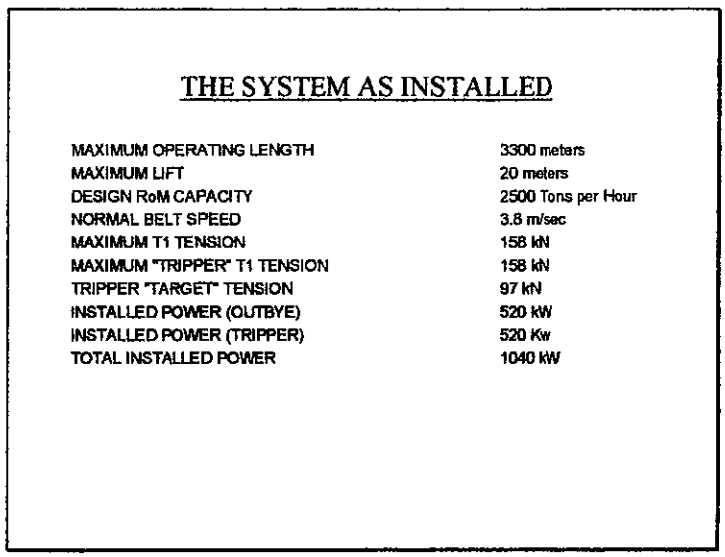


RAMP DIAGRAM ds/dt

5.0 THE SYSTEM AS INSTALLED:

After designing the conveyor to suit the application the final drive specification was as follows:

Maximum operating length	3300	meters
Maximum lift	20	meters
Design capacity	2500	tonnes per hour
Nominal Belt Speed	3.8	meters per sec.
Maximum T1 Tension	158	kN
Maximum "Tripper" T1 Tension	158	kN
Tripper "Target" Tension	97	kN
Installed power (Outbye)	520	kW
Installed power (Tripper)	520	kW
Total Installed Power	1040	kW

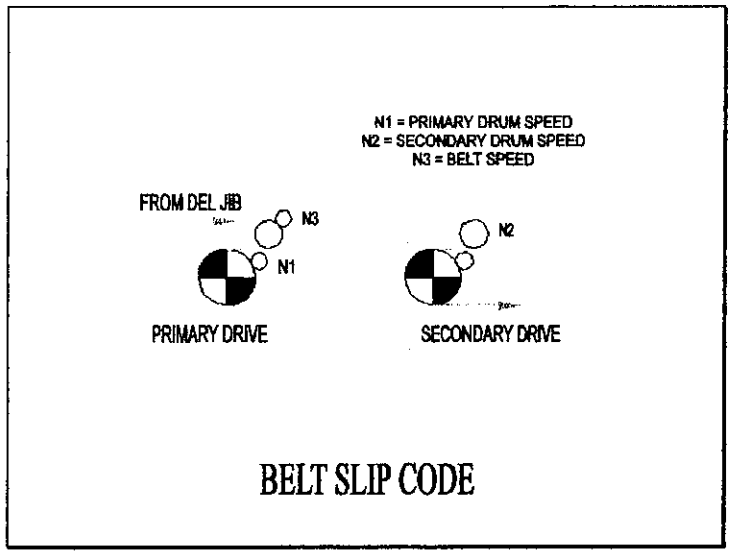


5.1 Selected Belt Class:

The recommended belting as calculated for the 3300 meter conveyor at Matla Coal is SABS Class 1250. The belting installed is Fennerplast PVC Solid Woven FRAS with standard 1,6 mm top and bottom covers. From the tension calculations this belt will operate within a Factor of Safety of 10:1 in the running condition. In Australia belt manufacturers have accepted to operate at a Factor of Safety of 8:1 provided the conveyor is accelerated in controlled manner with a sufficiently low drive start factor.

Belt Splicing: Vulcanised finger splicing was recommended for use in the Gate conveyors based on previous experiences at South Bulga Coal, NSW, Australia. Mechanical splicing however appears to be more popular & convenient to the South African Mining industry. It was recommended that if mechanical splicing is used, then a clip management program should be implemented. This would ensure that clips are changed at regular intervals prior to damage taking place at the clip to belt interface. Matla Coal opted for the use of clip joints, which have to date been successful.

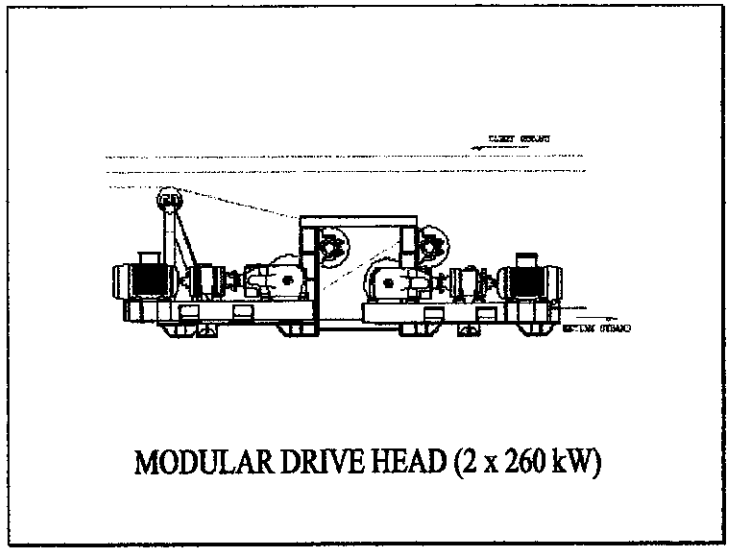
Belt Slip Code: The system as installed continually monitors all the drive pulley speeds and belt speed independently at the outbye and at the Tripper drive. The belt slip code protection system is capable of accurately detecting slip from 5 to 100 percent belt speed during ramping and normal running. Conventional belt slip protection by means of belt speed switches has been found to be inadequate when applying long ramps to conveyors.



5.2 Delivery Jib & Modular Drivehead:

Delivery Jib: The delivery jib as supplied is floor mounted with a beltline height of 3100 mm. One primary and two secondary scrapers and a dribble chute were fitted to discharge fines onto the receiving belt.

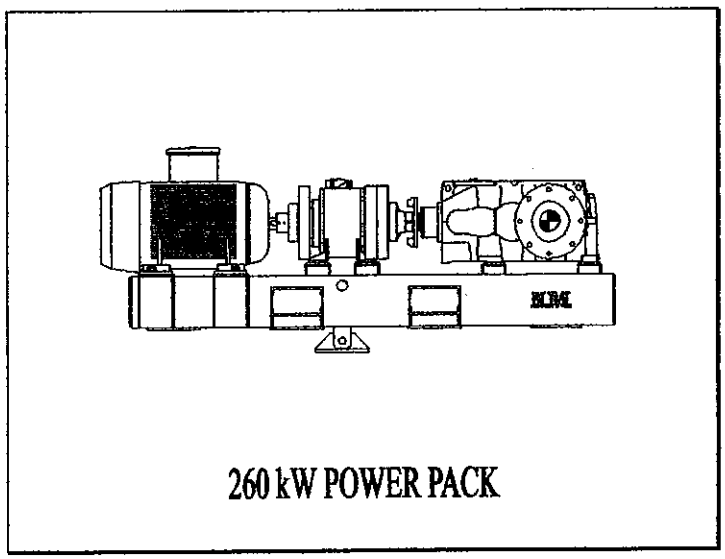
Drive Head: The cleanside / cleanside drive head is of the modular "L" Frame type with machined vertical beams. This drivehead allows for all drive configurations to be set up with minor modifications to the "L" frames.



5.3 Power Modules and Affiliated Equipment.

The 4 X 260 kW power modules consist of the following components:

- 260 kW 4 pole, 1000 volt, Flameproof motor.
- "BOSS 300" multiple wet disc, pressure modulated, viscous friction transmission for ramping or tripper driving.
- Right Angle Horizontal Conveyor Drive gearbox with a nominal ratio of 20:1.
- Baseplate / Torque Arm for the effective mounting of all the above mentioned components & the Low speed coupling.
- A 5.5 kW hydraulic power pack which circulates 130 litres of cooling oil per minute for the "BOSS" Transmission. This power pack also supplies low volume medium pressure oil for the actuation of the annular piston in the "BOSS" Transmission.
- A galvanised Flameproof Oil / Air Heat Exchanger autonomously mounted within 6 meters of the power pack capable of dissipating 100 kW of heat energy. Filters are fitted to the outlet end of the Cooler allowing for 100 percent continuous filtration.



260 kW POWER PACK

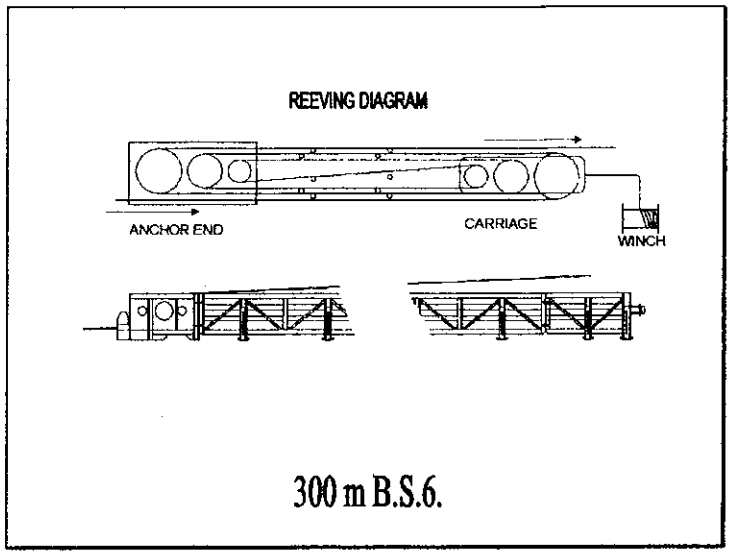
5.4 300 meter 6 lap Belt Storage unit:

The 6 Lap Belt Storage Unit supplied is of the compression beam type.

Railbays were jig manufactured for ease of assembly underground. The railbays are fitted with tapered locating pins at the head end for alignment purposes. Guide rollers fitted with roller bearings are used in the carriage frame to reduce frictional losses. All railbays are fitted with adjustable legs for ease of levelling. The BS-6 is fully guarded.

Tracking of the dead shaft LTU pulleys within the anchor frame and the carriage was allowed for. The belt separation assemblies are automatically placed at their predetermined positions by means of a cantenary system. The take up sheaves are fitted with double cylindrical roller bearings to reduce friction allowing for greater take up sensitivity.

The overall length of the 300-meter "live" belt storage system is 72 meters.



5.5 Belt Reeler & Maintenance Station:

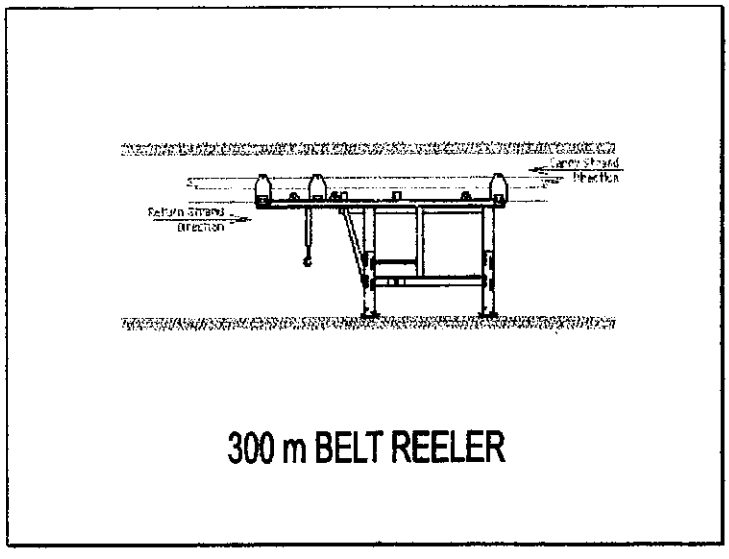
The Belt winder and maintenance station attaches to the belt storage unit.

A 300-meter roll of belting can be inserted under the structure from the side or end by use of an LHD. This point is situated in a crosscut to facilitate easier access.

One hydraulic belt clamp is situated at the Anchor End and the other two clamps are situated at the reeling station with one being a powered moving clamp.

Two lift cylinders are fitted to raise or lower the full or empty reel of belting with one horizontal cylinder used to locate the reel correctly into the winding spindle.

The belt winding, ejecting, clamping and travelling functions are all done by means of a 15 kW flameproof hydraulic power pack.

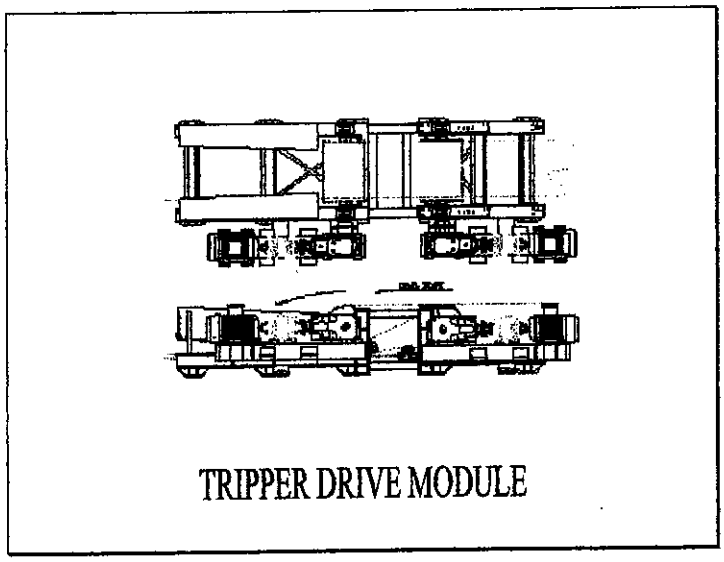


5.6 The Tripper Drive:

The Tripper drive module is manufactured in the same way as the outbye drive and consists of L - Frames with machined vertical beams.

Operating Philosophy: The Tripper drive is operated by constantly sensing the "Tripper T2 Target" tension just outbye of the Tripper by means of a load cell input to the PLC. If the belt is empty and the tension is lower than the programmed "Target" tension, then no drive is applied at the "BOSS" transmission. The state of the transmission is in "spring bias" and awaiting tension to increase to the required pre set value. Up until this point the belt is pulled through the Tripper by the Outbye drive. As the loading increases and the tension reaches the pre set "Target" tension, then only is torque applied at the required level to maintain that pre set "Target" tension.

The nature of a Tripper drive in rapid retreat mining applications only makes provision for the Tripper to remain in operation for a given period. When ready to be removed, the belt is cut and the Tripper is taken out of service. In order to restart the conveyor, the status at the outbye panelview has to be changed to that of "Tripper out of Service".

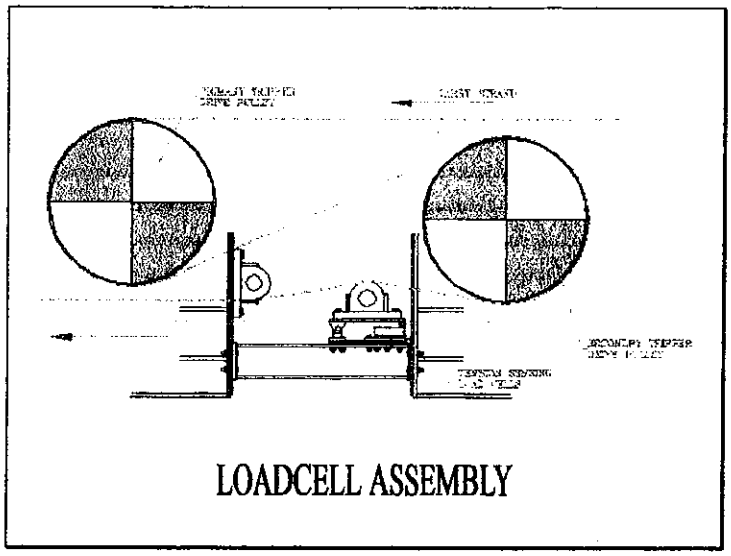


TRIPPER DRIVE MODULE

Sequence of Operation:

1. Receive command for the conveyor to start.
2. Start up the winch and tension the system to the required starting tension.
3. Sequentially start the auxiliary and main drive motors under no load
4. Similarly start the tripper drive motors.
5. Apply torque to the Outbye drive via the "BOSS" transmission and jog the belt prior to ramping in order to separate the elastic stretch from the acceleration.
6. Commence the ramp in accordance with the code as written to full speed.
7. When the belt reaches full speed, reduce the tension to the programmed run tension.

NOTE: The "Tripper" will only apply torque when the pre-set Tripper T2 "TARGET" tension has been reached and will from then on maintain this "TARGET" tension.



LOADCELL ASSEMBLY

5.7 The live tensioning system:

The winch supplied uses an Eddy Current coupling to generate a constant tension at a variable speed. This design allows for a smooth take up system that will not induce any transients into the belt carcass. The winch is controlled from the outbye PLC and includes the following features:

Broken belt Detection: The speed of the winch drum is continually monitored and should a belt break, the rate of change in winch drum speed will shut down the conveyor and the Panelview will indicate a broken belt.

Carriage Position Indication: The winch drum is fitted with a drum encoder, which indicates the drum direction and carriage position on the Panelview.

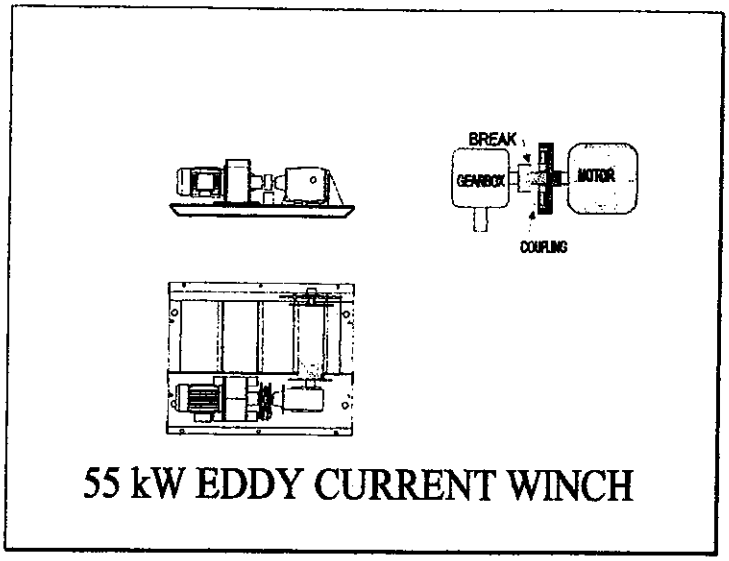
Roping: When installing or removing a rope, the winch speed is set and positively controlled by the pre set low tension.

Winch Lock Out Feature: If the winch does not see carriage movement for 150 seconds, then the winch will shut down and apply the brake. Only when a pre determined change in tension is sensed, will the winch restart.

The operational parameters of the winch are as follows:

Maximum Single Line Tension	55	kN
Maximum Single Line Speed	0,6	m/sec
Slip Rate	160	percent
"Live" Capacity	350	meters.

A T2 load cell is fitted to provide an input tension signal to the PLC.



5.8 Flameproof Electrical Panels:

The panels supplied were manufactured under sub contract to suit the application and are flameproof. The construction of the panels are "Mine Duty" & skid mounted.

Vacuum Contactors and electronic overloads were used. The incoming protection of the panel is as specified by Ingwe Coal and all periphery equipment is protected by means of IS barriers.

5.8.1 The PLC:

The PLC as previously described is housed within the electrical control panels.

5.9 Peripheral Equipment:

The peripheral equipment was specifically developed for belt conveyors, which are to be operated by means of PLC's requiring loop powered 4-20 mA outputs. The inputs to the PLC are as follows:

5.9.1 Speedsens: The "Speedsens" is used to supply feedback to the PLC with respect to accurate speed measurement on all drive drums and belt speed.

5.9.2 Tempsens: The "Tempsens" is for temperature measurement feedback from the "BOSS" coupling as the oil exits the coupling.

5.9.3 Current Sensor: The "Current Sensor" supplies motor current feedback to the PLC in the form of a 4 - 20 mA signal.

5.9.4 Loadcells & IS Converters: The loadcell at the Outbye drive & the Tripper are fitted with IS 4-20 mA converters supplying tension input to the PLC.

5.9.5 Communication between Outbye Drive and Tripper drive:

The Tripper drive is operated by constantly sensing the "Tripper T2" tension just outbye of the tripper by means of a load cell. For this reason there is no data highway linking the Outbye Drive PLC and the Tripper Drive PLC. There is however a 1,5 sq.mm. 4-core cable between the two drives used as a "handshake" to ensure that the Tripper Drive is ready for the outbye drive to commence a ramp.

6.0 INSTALLATION CRITERIA:

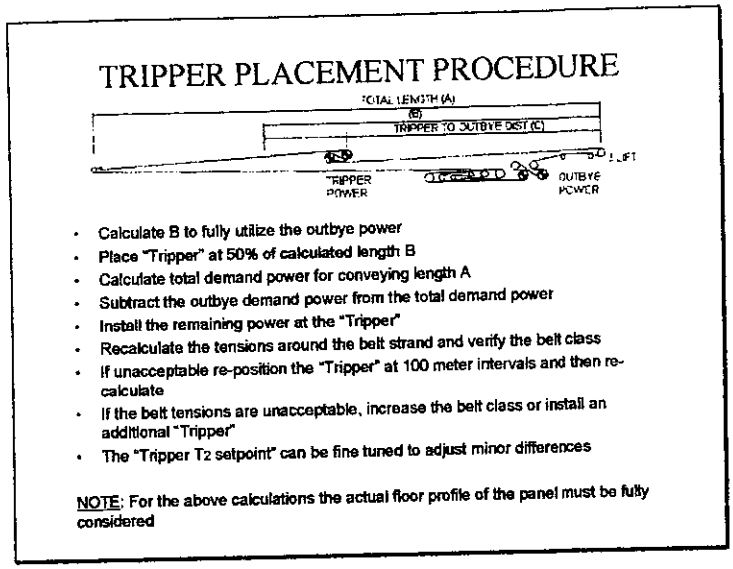
Due to the overall length of the machine, emphasis was placed on alignment from the roadway centre line as well as from the grade lines. For ease of operation of the equipment the following should be noted:

1. The Delivery Jib has sufficient height to allow for a smooth transition of material to the receiving belt by means of a correctly designed chute.
2. The drivehead and power packs are to be situated in an area with sufficient space to facilitate ease of handling of heavy equipment.
3. Sufficient space must be allowed for the winch to be situated within an area next to the belt storage unit that will not allow the fleet angle of the winch rope to exceed 1,5 degrees per side.
4. The powered reeler is to be situated in a split in order to comfortably access this area with the 300-meter coil of belting for either insertion or removal.
5. In lower seams the mined roof height in the drive area is to be of sufficient length to allow for graded structure behind the reeler.

6.1 Positioning the Tripper:

In order to achieve the best results for tripper driving, the following should be applied to the positioning the tripper.

1. Calculate the length of the conveyor from the outbye end for the given profile and data to fully utilise the installed power at the outbye end.
2. From previous calculations and experience the tension "control window" lies between 50 & 65 % of this calculated length and the tripper should be placed at the 50 % position.
3. Take the total power required to drive the conveyor and subtract the demand power at the outbye drive from this value. Install the remaining power at the Tripper.
4. Recalculate the tensions around the belt strand and verify if the tensions are within the recommendations as set by the belting manufacturer.
5. Should the tensions require an improved distribution the Tripper should be re-positioned at increments of 100 meters at a time and the tensions then calculated once more. (This procedure needs to be followed due to the profile of the conveyor following the floor profile as determined by that particular panel).
6. Should the running tensions as distributed be too high, then either the belt class needs to be upgraded or an additional tripper should be installed.
7. In the case of a retreating conveyor no power is to be applied at the Tripper if the tail end is closer than 300 meters from the Tripper. This practice could instigate pulling belting out of the LTU due to the speed advantage given to the Tripper over the Outbye drive.
8. Notwithstanding the above, it should be noted that the Tripper T2 "Target" tension setpoint is adjustable from 40 kN to 120 kN and thereby power & tension drawn and generated by the Tripper, can be accurately adjusted during final commissioning.



6.2 Removal of the Tripper:

The Tripper, when applied to a conveyor with a retreating tail end, should be removed at any time convenient to the mining operation provided that the power as applied at the outbye is capable of driving the belt comfortably but must be removed before the tail end to Tripper distance reaches 300 meters. This creates a fairly large window for timing the Tripper removal.

7.0 Commissioning:

PLC controlled conveyors with Tripper drives require the commissioning to be completed in accordance with a given procedure and the following should be noted:

All the periphery equipment which form inputs to the PLC such as the belt speed, drive pulley speed, winch haul speed sensors, temperature sensors, motor current converters, strain gauge transmitters, proximity switches etc. are to be calibrated and scaled or adjusted accordingly.

The initial commissioning of the conveyor without load requires a combined effort from the conveyor supplier and the end user. At Matla Coal the development was completed some months prior to the gate conveyor being installed and the idlers had not been rotated for approximately 10 weeks. The entire partly untracked conveyor had to be ramped up manually from the outbye end absorbing considerable power due to the increased idler frictions. After running for a few hours the frictions were reduced to an acceptable level to commence automatic ramping and proper empty commissioning.

Loaded commissioning, particularly at the Tripper, is difficult. In order to commission the conveyor correctly the belt needs to be fully loaded across its entire length for a period of time long enough to fine tune all parameters. As conveying capacities need to be over specified by the mine, full design loaded commissioning is rarely achieved.

8.0 MONITORING:

8.1 Status Monitoring at the PLC:

The PLC Code as written controls the conveyor with all the required functions to achieve optimum results. It is however required to supply some form of status monitoring at the electrical panel in order to observe motor current, temperature, belt speed etc. Should the conveyor however be stopped by the PLC due to a field fault, then this needs to be communicated at the panel.

For these reasons it is necessary to supply an indication system to inform operating staff of what the cause of failure is and to be able to reset the fault after rectification thereof. The "Panelview" has a full diagnostic system and faultfinding guide programmed for ease of maintenance and will flag up the problem each time it occurs. It will not allow the conveyor to be restarted until the problem has been rectified and the PLC has been reset.

8.2 Monitoring in the Surface Control Room & Beyond:

In modern mining operations it is necessary to have first hand information when working with high production faces. With the PLC operating the gate conveyor, all the functions applicable to the conveyor are easily monitored in the control room and beyond. Additional information can be brought to the PLC for monitoring purposes such as bearing temperatures, vibration monitoring of gearboxes etc. Some Australian collieries using the Longwall mining method monitor a few thousand points ranging from pressure transducers on support legs to all facets that require monitoring in the face.

This data is then easily communicated to the surface control room by means of an acceptable protocol and is then available through the local network on the mine.

Managers and engineers can access this data in various forms and customised reports are easily generated. Trending of previous operations for failure analysis can then be easily achieved. Face production is on line when a weightometer is fitted to the gate conveyor.
For the on line monitoring and technical analysis of the conveyor, this information is accessible via a modem to the OEM who can then log in to the system and advise the client accordingly. Fault finding via this mode is also possible.

A statement true to good results should not be forgotten, *"If you cannot measure it, you cannot manage it".*

At present monitoring is not practised beyond the underground conveyor area, but Matla Coal Ltd. have indicated that this will be the way forward in the future and investigations are under way to implement full monitoring.

"IF YOU CAN'T MEASURE IT, YOU CAN'T MANAGE IT!!"

9.0 TRAINING:

9.1 Long Centre Distance Conveying - Change of Mindset.

Current technology is making long centre distance-conveying possible to the mining industry for use in gate, section and trunk conveying applications.

One of the more difficult aspects of introducing new technology is to overcome pre conceived ideas as set in the minds of management and operating staff alike. It is normally perceived that the "old way" is still acceptable in the "modern world". Standardisation by the client is considered beneficial but is often dangerous as it could close the door to new technology. A change of mindset is required by all and sundry in order to understand that the new technology will give improved productivity, which will result in improved financial benefit to the mine.

9.2 Electrical & PLC Training:

It is imperative that the managers, engineers, foreman and electricians responsible for operating the equipment are made familiar through training applicable to the electrical panel and the periphery equipment. To many operators at Matla Coal this is the first time that PLC controlled equipment is placed in their care.

The logic of a PLC is often not understood and specialist training in PLC logic is required. This is normally done by the suppliers of the PLC on their premises in the form of an introductory course followed up by an advanced course should the delegate show sufficient interest. When once the personnel are trained and familiar with the PLC, it is only then realised how effective and simple these devices are. The client needs to purchase a notebook computer for future downloading, uploading and modification to the original code as written when an acceptable level of confidence has been reached.

Continual training has to be done until the staff is totally familiar with the equipment. At Matla the training of personnel commenced prior to the equipment going underground and remains ongoing.

9.3 Mechanical Training:

The mechanical training is not much different from conventional conveyors with the exception of a hydraulic power pack being available to operate the reeler. With reference to the ramping of the conveyor, the additional hydraulics and coolers do not pose any major change. This training normally takes place in the form of "on the job" training.

9.4 Operational Training:

With rapid advancing and retreating conveyors the operational training is important in order to allow a 300-meter coil of belting to be removed within an acceptable time. The loop must not be allowed to become over full permitting the conveyor to be stopped by the "loop full" limit setting. The removal of belting needs to be planned in advance so as to minimise downtime. Personnel are normally trained for these disciplines on site. Belt clips need to be observed regularly in accordance with the mines maintenance program.

10.0 Conclusion:

Four Long Centre Distance Conveyors as described above are now employed in both the development and the retreat mining applications on the 5 Seam Longwall and the 4 Seam Shortwall at Malta's Number 2 mine. The results of utilising LCDC at Matla Coal Ltd. have increased the conveyor availability from 86 % at best to 95 % (1). Production tonnage's have to date continually been exceeded when measured against the budgeted tonnage's.

References:

(1) Hattingh C.P.& Exton A.T, Long Centre Distance Conveyors (L.C.D.C) In an Underground Retreating Shortwall Mining Application ; International Conference on Efficient Ore Handling in Mining & Processing , Holiday Inn Johannesburg International Airport , 28-30 July 1997 .

Terminology Applicable to Paper:

Inbye	Tail end portion of conveyor
Outbye	Head end portion of conveyor
Jog	Creep speed- (Normally 10% of running speed)
LCDC	Long centre distance conveyor
LHD	Load Haul Dump Vehicle
Loop	Belt storage and take–up area
LTU	Loop take-up
Maingate	The main access roadway to the longwall panel
Tailgate	The opposite roadway to the longwall panel
RoM	Run of mine material
Roping	Applying or removing rope from the winch drum
Spring Bias	Where annular piston force equals spring separation force
Target Tension	Programmed "Tripper T2 tension"
Tripper	Intermediate Drive Module

ACKNOWLEDGEMENTS & APPRECIATION.

MATLA COAL LTD.	Mr. C P Hattingh
NEPEAN MINING – AUSTRALIA	Mr. Peter Gilbert.
JASDIP PTY LTD - AUSTRALIA	Mr. Paul Owen.
NEPEAN MINING South Africa	Mr. Hannes Fourie.
	Mr. Anthony Scorgie.

BELTCON 9 CONFERENCE

22 - 24 October 1997

GALLAGHER ESTATE - MIDRAND - South Africa

Speaker Biography – Alan Exton

The author of this paper has been involved in the mining industry since 1970 when he commenced his training West Rand Consolidated Mines Ltd as an apprenticed Fitter & Turner. After 7 years he joined the private sector in the mining division of Dowson & Dobson Ltd. as a design engineer. He was involved in the design field of both coal & hard rock mining equipment for various companies until 1987 when he was appointed as Manager: Sales & Service with Klockner Becorit Corporation SA (Pty) Ltd.

From 1990 to 1995 he worked on various underground belt-conveying projects. In July 1995 Nepean Mining South Africa (Pty) Ltd. was formed with Alan as Managing Director.

Relevant Affiliations:

1.0 Member of the South African Institution of Mechanical Engineers.

2.0 Professional Member of South African Institute of Materials Handling.

3.0 Current Chairman of the Conveyor Manufacturers Association.