

THE CMA HANDBOOK

Dave Pitcher

Fenner Conveyor Belting (SA) (Pty) Ltd

INTRODUCTION

In 2003, the CMA board agreed to the creation of a handbook for the design of belt conveyors. A committee was set up with representatives of CMA member companies. During the early meetings of the committee, the structure and content of the handbook was formalised. This paper describes the elements that have defined the handbook. The final layout of the handbook and the objectives for writing the book are discussed.

The shelves of many bookstores are filled with 'How To' books. Yet, look at a list of famous authors, and not many of these write 'How To' books. So perhaps Oscar Wilde was correct when stating that 'Nothing that is worth knowing can be taught'. [1] This of course begs the question, 'Why publish a reference "How To" book about belt conveyors?'

PURPOSE

The motivation for the book is that the design engineer is seldom given the formal knowledge needed to bridge the gap from theory to practice. So the book has, as its main objective, the statement of the first principles and how these can be used for well-engineered belt conveyors.

A secondary function of the manual will be to act as a common method of good belt conveyor design for local conditions. In recent times the CMA has given some formal education to some 180 or more learners interested in the subject of belt conveyors. The notes that are provided for the CMA diploma course in design and operation of belt conveyors are extremely useful and comprehensive. In fact, these have been considered sufficient to become the recognised CMA handbook. However, the CMA diploma course notes state the methods of calculating every parameter without backing up the method with the underlying first principles. So it is feared that continuing with these notes will continue to foster arguments about the different methods of calculating the base parameters of a belt conveyor system. Indeed, when the question of dynamics needs to be considered, it is practically impossible to extend the methods for the purpose. A belt conveyor is a system of components put together for the specific purpose of transporting goods automatically by means of an endless strap. Many such systems exist. The handbook was to deal exclusively with troughed belt conveyors handling bulk solids.

TIMELINE

Originally it was envisaged that the handbook would be completed by 2006. At the outset, the complexity of gathering all the necessary information, agreeing on the depth of detail and presenting the information in an easily understandable format was not realised. It took four years to gather the information to be included. Then the task of assigning chapters to individuals on the handbook committee led to many revisions of the content. It was agreed that a technical editor should be appointed to ensure that a common technical approach was used in each chapter in spite of having being written and edited by many different people. Another stumbling block has been graphic content that accurately and professionally illustrates the many concepts. Bearing in mind that the targeted reader has probably never seen a troughed belt conveyor for bulk handling, this aspect is considered to be of prime importance.

Deliberations on the format of the handbook are still on going. This aspect is still to be finalised. The traditional bound handbook has the advantage of relative ease of copyright control but the serious disadvantage of the high cost. An electronic file has considerable cost savings, particularly when extensive use of colour is to be used. The disadvantage of the latter is that by allowing that the document can be printed will compromise income. The local industry has very low regard for copyright.

PREVIEW OF CONTENT

It is intended that the handbook will be completed by August 2012. Each chapter will have introductory paragraphs of a common form explaining the purpose and content.

Overview

- Flow diagram
- Conveyor components
- Typical conveyor layouts

Conveyor capacity

- Capacity definitions
- Elements
- Equations for first calculations of capacity
- Material characteristics
- Carrying capacities

Fundamental design

- Derivation of equations
- Application of equations
- Basic power calculations - running
- Basic power calculations - dynamics
- Objectives of drives, ramping technology, inertia
- Belt lift
- Drive calculations

Pulley selection

- Shaft diameter calculations
- Shell diameter calculations
- Lagging
- Bearing centres
- Crowned pulleys
- Locking elements
- High and low tension pulleys

Curves and transitions

- Starting and stopping
- Vertical curves
- Horizontal curves
- Belt turnovers
- Transitions
- Transition distances – calculation equations

Idlers

- Shaft diameter calculations
- Bearing selection calculations
- Roll diameter calculations
- Troughing angles and idler roll configuration
- Spacing
- Special considerations in vertical and horizontal curves
- Types of idler
- Selection criteria and use of calculation equations

Drives and related equipment

- Drive related equipment
- Selection of motor size

Drive technology

- Outline
- Drive sequencing
- Starting and stopping - derivation of equations
- Starting and stopping - application of equations
- Starting and stopping - effects, retarding forces and power requirements
- Ramping technology
- Holdback selection
- Flywheels and capstan brakes
- Brakes
- Description of drives
- Starting characteristics
- Fluid couplings

Belting

- Belting general
- Belt covers
- Elongation
- Load support
- Troughability
- Flexibility
- Impact
- Tension
- Splicing

Transfer technology

- Chute design
- Belt cleaning
- Dust suppression
- Spillage control
- Trajectory
- Skirts

Conveyor structure

- Run of conveyor structure
- Gantries and trestles
- Doghouse sheeting
- Vertical and horizontal curve considerations

Dynamics

- Effects
- Methods of control

Maintenance and safety

Electrical and instrumentation

- Electrical and controls

Take-ups

- Belt tensioning
- Position of take-up and effect on tension

Other

- Symbols and units
- Glossary
- Acronyms by chapter
- Table of References
- Acknowledgements and Index

NEXT STEPS

All the content requires technical editing for correctness. A list of graphics must be generated and then, working to the list, a professional graphic artist assigned to the work of creating these. Once all of this is collated and brought into the base document it will be compiled into a document with the agreed consistent appearance.

CONCLUSION

The handbook will serve to fill a gap in the education of engineers faced with the task of designing belt conveyors for bulk materials handling. It will never compete with the CEMA manual but it is hoped that it will provide a local perspective to the design of belt conveyors. It is intended that the manual will provide a thorough understanding of the fundamental concepts. If the desired objectives are met, the handbook will become the standard introduction to the design of belt conveyors for the southern African market.

ACKNOWLEDGEMENTS

The following is a list of people who have contributed in various ways in the compilation of the handbook:

Ronnie Bawden	Cecil Buys	Simon Curry	Peter Ellis
Alan Exton	Adi Frittella	Hans Kotze	Paul Nel
Wilton Monnery	Rudi Pieterse	Max Schenck	Graham Shortt
Chris Townsend	Jane Theron	Hans Voshol	

REFERENCES

1. A few maxims for the instruction of the over-educated, Oscar Wilde, Wikiquotes; http://en.wikiquote.org/wiki/Oscar_Wilde

ABOUT THE AUTHOR

DAVE PITCHER

Dave Pitcher has worked in the materials handling industry since 1974, focusing predominantly throughout his career on belt conveyor systems and conveyor belting in particular. He started as a sales representative for Gandy Belting division of SA Canvas in Durban where it was necessary to select the belt and then deliver and install it on the conveyor system. From 1975 through to 1992 he was employed by BTR Sarmcol, involved in development of new products for manufacture in South Africa and in the introduction of synthetic textile reinforced multi-ply conveyor belting through to steel cord reinforced conveyor belting. He spent a few years in the design of belt conveyor systems for original equipment company Group Five Goodwin, and then joined Dunlop Belting Products as technical services manager in 1998. In August 2008 he accepted the position of technology manager at Fenner Conveyor Belting, part of the worldwide Fenner Dunlop organisation. He has a Diploma in Datametrics from UNISA and a Diploma in Design, Operation and Maintenance of Belt Conveyors from CMA, both obtained with distinction. He is a director of the Conveyor Manufacturers Association and a fellow of the SA Institute of Materials Handling, and has been a committee member of SABS standards organisation for drawing up of conveyor belting standards since 1979. He has written and presented papers at the International Materials Handling Conference, 'Beltcon' on design of chutes, predicting the life of conveyor belting and joining conveyor belts. He serves on the organising committee of IMHC.

Dave Pitcher

Fenner Conveyor Belting (SA) (Pty) Ltd
21 Diesel Road
Isando 1600
Tel: +27 11 974 1902
Fax: +27 11 974 1900
Email: Dave.Pitcher@fenner.com