

Preface

The main mechanical ventilator for underground coal mines is one of the most expensive items governing the productivity, safety and profitability of a mine. It requires the most tactical and strategic planning as it affects the capital and revenue expenditure of the mine for its whole life. To select a main mechanical ventilator, optimally ensuring lowest overall cost for the whole life of a mine needs elaborate, scientific and techno-commercial considerations. The ventilation requirement of any underground mine is not a static quantity, but rather it changes dynamically. In a modern mechanized coal mine, the ranges of ventilation requirements are wide and selection of main mechanical ventilators is a complex techno-economic decision. Many times, the selection of the operating point is carried out manually at the intersection point of the mine characteristics curve and fan characteristics curve, which is qualitative, cumbersome and prone to error. Moreover, the operating point is also dynamic in nature and should be selected quantitatively considering dynamic changes in both mine characteristics curve and fan characteristics curve. This book aims to provide a user friendly, reliable, quantitative and software driven solution for selecting the main mechanical ventilator for underground coal mines.

I had three goals in writing this book.

Structured Approach: I planned to elaborate on the methodology of selection of main mechanical ventilators covering technical and economic considerations. As this is a very complex decision, I tried to explain the precautions to be taken during technical considerations so that a fan is selected optimally. Every mine operator desires to reduce the ventilation cost and I tried to cover all possible technical variants in respect of centrifugal as well as axial flow ventilators used in underground coal mines.

Computer Program: I tried to provide the algorithm for selection of main mechanical ventilators so that practicing mining engineers, regulators, researchers and mine operators can develop their own code in their preferred high level language using the discussed algorithm. The developed program considers the environmental requirements, regulatory conditions and the occupational health related issues of the underground coal mine so that the working conditions of an underground environment may be maintained as productive, healthy and safe at all times.

Case Study: The case study also provides a platform to demonstrate the discussed technology and methodology. I tried to cover an Indian case study where the equivalent resistance of the mine was computed using ventilation network analysis software. The same network was used for selection of main mechanical ventilators out of nine variants of mechanical ventilator. The graphical output table showing technical and cost parameters for case study mines has been discussed in details.

This book offers a framework for selecting the most techno-economic fan for any mining condition judiciously, accurately, reliably, quickly and effectively by suggesting the suitable mechanical ventilator, which can deliver the required quantity of air at the lowest cost. Chapter 1 summarizes all design considerations, technical complexities in selecting the main ventilator and key factors responsible for selection of main mechanical ventilators to suit a given mining condition. It provides a holistic review of the needs and difficulties in fan selection. Chapter 2 emphasizes the various methods used for carrying out a ventilation network analysis. Chapter 3 addresses the method of fan selection incorporating all technical considerations and economic considerations. Chapter 4 discusses all possible ways to reduce the ventilation cost as well as a number of technical variants for achieving significant energy savings. Chapter 5 contains the computer code developed in 'C' language for selecting the techno-economic ventilator to suit a particular mining condition. The data handling, operation, source compiling and limitation of the program are also discussed. Chapter 6 demonstrates the use of computer programs by covering an Indian case study. The particulars of all data files, program outputs and discussions on results are analyzed in this chapter.

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<http://www.springer.com/978-3-319-56858-4>

Selection of Main Mechanical Ventilators for
Underground Coal Mines

A Case Study

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2017, XI, 88 p. 21 illus. in color., Softcover

ISBN: 978-3-319-56858-4