

**THE DEVELOPMENT OF A DESIGN PROTOCOL FOR  
PRODUCTION OF HIGH SPEED COINING DIES.**

by

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## **DISSERTATION SUMMARY**

### **THE DEVELOPMENT OF A DESIGN PROTOCOL FOR PRODUCTION OF HIGH SPEED COINING DIES.**

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In the production process of coining dies various obstacles are encountered. Due to the complexity of the process and the system, many of the underlying problems remain unidentified just to repeat themselves at a later stage.

The project was done to provide the client with a better understanding of the major factors that influence the development process. If the source of a problem can be identified and is understood a course of action can be determined that will prevent the problem from reoccurring.

The project focus was on the behaviour of the die and coin material during the deformation and heat treatment processes. The behaviour of the material was explained from a theoretical point of view and methods to control this behaviour were discussed.

A design protocol was established, which will enable the developer to achieve improved results during the development process. The main objective of the protocol is to improve consistency in the results that are obtained during the development process.

## ABSTRACT

**Title:** THE DEVELOPMENT OF A DESIGN PROTOCOL FOR PRODUCTION OF HIGH SPEED COINING DIES.

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The degree of success with which coining dies are manufactured greatly influences the total development time and therefore the total success of a project. In the production process of the coining dies, various obstacles are often encountered. These obstacles retard the project and adversely affect the profit margin of the company.

There are no scientific models in place by which these dies can be developed. Consequently the development and production process is done on a trial and error basis. Due to the complexity of the process and the system many of the underlying problems remain unidentified just to repeat themselves at a later stage.

The major factors determining the success of a project, from the perspective of the development department, is the total project time, the quality of the product (i.e. the dies and the final coins) and die life.

The purpose of the project was to analyse the development process in detail and to develop a design protocol, which will guide the developer during development. The design protocol will suggest a procedure to follow when developing dies. The design protocol will assist the die developer in locating the source of certain problems systematically.

The project was done to provide the client with a better understanding of the major factors that influence the development process. If the source of a problem can be identified and is

understood the proper action could be determined and employed to prevent the problem from reoccurring. This project will serve as the basis for further development efforts in this field.

During the course of the study emphasis was put on the development and production of the high speed coining dies. The major factors that influence the development process were identified and development tests were done to establish the influence of each of these factors. The development process was broken down into components and each component was evaluated separately.

The test focus was on the behaviour of the die and coin material during the deformation and heat treatment processes. For each test a significant amount of test data was collected. The results of the tests were analysed and evaluated. The behaviour of the material was explained from a theoretical point of view and methods to control this behaviour were discussed. The test results were generalized to apply to all development projects.

The source of many of the problems that are encountered during the development and production process were identified and quantified with the test results. On the basis of these results the design protocol was established. Many of the problems encountered are process control related. Solutions to improve the process control are discussed in the report.

The design protocol will enable the developer to achieve improved results during the development process. The design protocol can also be used as a tool to establish the cause and recourse for certain development and production problems. The main objective of the protocol is to improve consistency in the results that are obtained during the development process.

The design protocol will enable the developer to implement a faster and more efficient development process, while avoiding problem areas, thereby reducing the total project time and increasing product quality and profit margins.

## ACKNOWLEDGEMENTS

I would like to thank God for giving me the strength and ability.

**“I would rather walk with God in the dark than go alone in the light.”**

Mary Gardiner Brainard

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## LIST OF SYMBOLS AND ABBREVIATIONS

$HR_b$	Rockwell B Hardness
$HR_c$	Rockwell C Hardness
$\sigma_y$	Yield Strength
$\varepsilon$	Strain
$H_v$	Vickers Hardness



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## PROLOGUE

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A successful development effort and a short project time are crucial if the S.A Mint is to succeed in the competitive international industry of coin manufacturing. Scientific knowledge in the process will be an asset to the company and will guide the company in deciding where further development efforts are necessary.

The degree of success with which coining dies are made, greatly influences the total development time and therefore the total success of a project. In the production process of the coining dies various obstacles are often encountered. These obstacles retard the project and adversely affect the profit margin of the company.

There are no scientific models in place by which these dies can be developed. Consequently the development and production process is done on a trial and error basis. Due to the complexity of the process and the system, many of the underlying problems remain unidentified just to repeat themselves at a later stage.

A detailed functional analysis was done on the entire development and production process. This was necessary to identify the problem areas, to get an overall picture of the process, and to determine all the factors that play a role in each process. The inter-relationship of

the different activities was also established. A report was compiled and delivered to the Mint. The report indicated certain problem areas, which need to receive attention. The functional analysis report will not be included in this report.

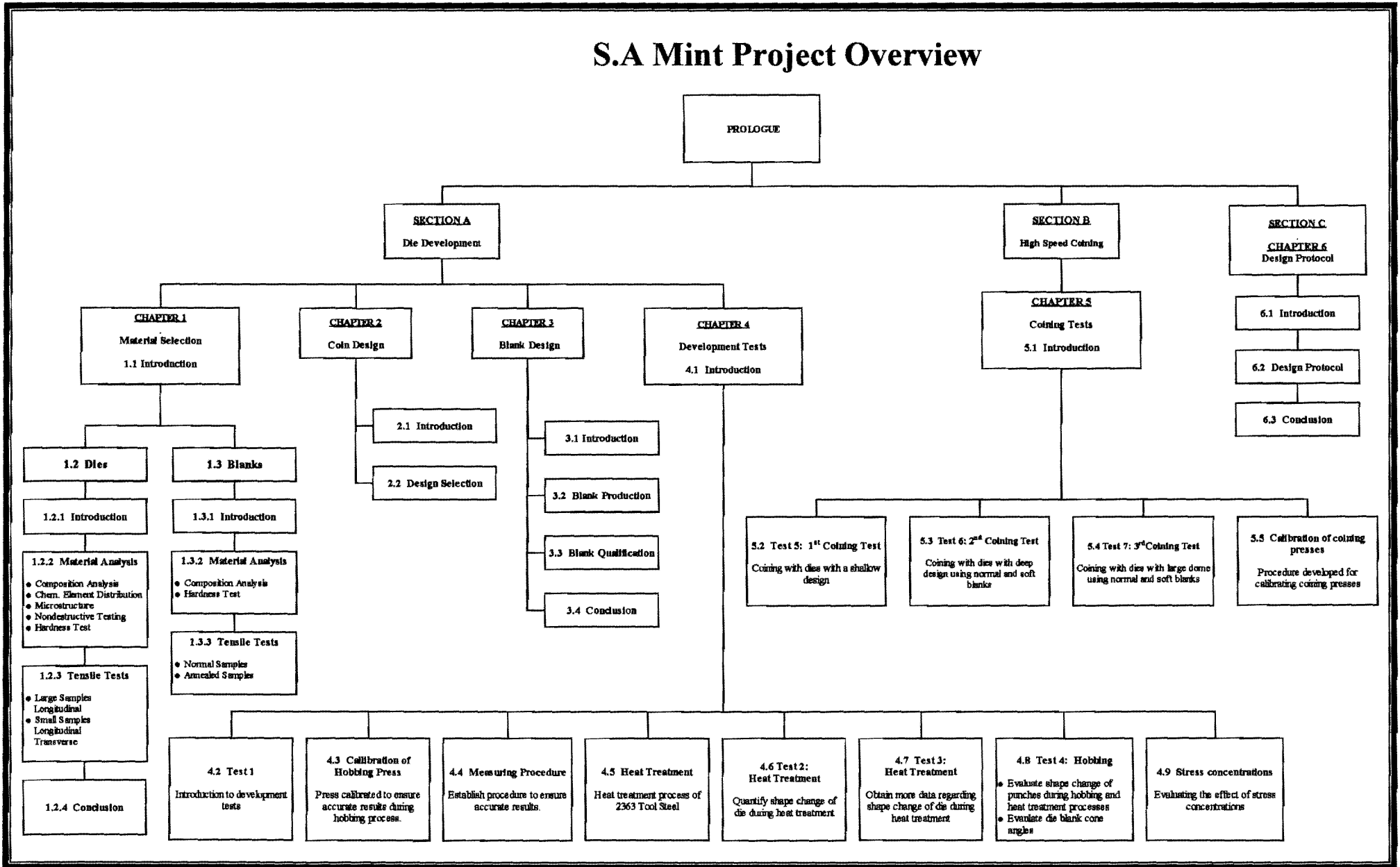
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The project was done to provide the client with a better understanding of the major factors that influence the development process. If the source of a problem can be identified and is understood the course of action can be determined that will prevent the problem from reoccurring. This project will serve as the basis for further development efforts in this field. The test focus was on the behaviour of the die and coin material during deformation and heat treatment processes.

In Chapter 1 the material that was used for the project will be analysed. Chapter 2 and 3 will deal with the design of the coin and the production of the blanks. All the development tests that were done on the production of the master punch are discussed in Chapter 4. Chapter 5 contains the results of the coining tests and the design protocol that was developed is discussed in Chapter 6.

A project overview is included in Figure 1 to show what was done during the project and to show how the structure of the report was compiled.

# S.A Mint Project Overview



**FIGURE 1**

**Project Overview**