AS 3940—1990

Australian Standard®

Quality control — Guide to the use of control chart methods including Cusum techniques

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Australian Organization for Quality Control
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Federal Chamber of Automotive Industries
Federation of Automotive Products Manufacturers
Institute of Quality Assurance
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PREFACE

This Standard has been prepared by the Standards Australia Committee on Statistical Quality Procedures, at the request of the Quality and Reliability Standards Board.

The need for an Australian Standard to cover process control standards, such as Shewhart control charts and Cusum charts, had been referred to Standards Australia by the Australian Organization for Quality, which was aware that the current Standards used by local industry (i.e., either U.K. or U.S.A. Standards) differed in matters of both definition and emphasis.

This Standard is based on BS 5700, *Guide to process control using quality control chart methods and Cusum techniques*. It provides information to assist the user to clarify the choice between the complementary Standards AS 3941, AS 3942 and AS 3943.

These Standards are 'free standing', in that any one can be implemented without reference to this Standard, or to the other Standards. This Standard gives sufficient information to clarify the choice between those Standards for any particular application. It gives the underlying reasons for the rules used in making this choice and gives some insight into the complicating factors in a particular process which need specific attention.

In order to provide a logical sequence in this Standard, it has been necessary occasionally to duplicate or paraphrase material that is contained within AS 3941, AS 3942 and AS 3943. This is considered preferable to repeated cross-referencing between those Standards and this Standard.

Acknowledgement is made to the British Standards Institution and to the authors of papers in the statistical journals, whose work has been drawn upon.

CONTENTS

FOREWORD

The idea of controlling a process through the medium of a control chart is usually ascribed to Dr Walter A Shewhart's pioneering work at the Western Electric Co. (U.S.A.) in the 1920s. Shewhart was the first to note the distinction between variability resulting from common (non-assignable) causes, and that from special (assignable) causes. He developed a simple but powerful tool to dynamically separate the two – the control chart. Since then control charts have evolved in many different ways, and have been used successfully in a wide variety of process control situations.

Control charts of the Shewhart variety can be likened to a continuous (and visual) test of a statistical hypothesis about that process. In general the hypothesis is that the process continues in control, until the control chart indicates that the hypothesis is no longer acceptable. This is the primary function of the charts, but experience has also shown that control charts effectively direct attention towards special causes of variability when they appear, and that they readily highlight the extent of common cause variability that require management action for its reduction.

The various control charting methods described are designed to indicate any lack of control in a process resulting from some change or deterioration, thus allowing an early decision to be made about re-setting or correcting the process. It has to be recognized, however, that in many cases the major impact and benefits of control charting do not arise only from the statistical interpretation of the plotted points, but more because someone is seen to be taking an interest in the process or product, and is extracting information that is being recorded and used. If this is viewed in contrast to the usual situation of either no monitoring at all, or of inspection on a batch basis (be it 100% or sampling) at some stage removed from the process, it is clear that the motivational effects of simply instituting any form of sampling and recording close to the process should not be underestimated.

In any enterprise the responsibility for quality rests with every member of the organization. Whilst setting up, plotting and analysis of control charts should be operator/supervisor activities, they should be used by all levels in the organization.

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE. This Standard provides guidance on the selection and application of quality control chart methods for process control and is complementary to AS 3941, AS 3942 and AS 3943 (which provide detailed operational procedures based on the use of either Shewhart control charts or cumulative sum (Cusum) techniques). It is designed for use by quality practitioners and other persons concerned with making decisions on charting technique.

The Standard explains how control charts work, the types of risk involved, the reasoning behind the decision rules, and how the average run length gives a measure of their effectiveness. Other aspects covered are frequency of sampling, sample sizes, and methods for identifying types of variation. The Standard also provides an itemized procedure for the determination of process capability, which is an essential prerequisite to the achievement of process/quality control.

The systematic approach given in this Standard has the principal objective of assisting development within industry of a sound appreciation of the relative merits of the many and various control methods currently available.

As such, this Standard provides a basic reference for both industrial training and technical educational purposes irrespective of whether the charts are produced manually or by computer.

1.2 REFERENCED DOCUMENTS. The following documents below are referred to in this Standard:

AS
1057 Quality assurance and quality control — Glossary of terms

3941 Quality control — Guide to number non-conforming charts

3942 Quality control — Variable charts guide

3943 Quality control — Guide to data analysis and quality control using Cusum techniques

1.3 DEFINITIONS. For the purpose of this Standard, the definitions given in AS 1057 apply. However, in line with ISO policy of using the term ‘nonconformity’ to denote departure from specification, as opposed to the term ‘defect’ which (in ISO usage) now denotes an inability to satisfy normal usage requirements, this Standard avoids using the terms ‘defect’ and ‘defective’.

For the purposes of this Standard the term ‘nonconformity’ for any one departure from specification, and the term ‘nonconforming item’ for any item containing one or more ‘nonconformities’, apply.

1.4 NOTATION. For the purpose of this Standard the symbols used in AS 1057 apply.