JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS Z 8101-3 : 1999

(ISO/FDIS 3534-3 : 1999)

Statistics—Vocabulary and symbols—Part 3 : Design of experiments

JIS Z 8101-3 : 1999 has been revised under date of January 20, 2006. The revised items are included in Amendment 1.

ICS 01.040.03; 03.120.30

Descriptors : vocabulary, marks, symbols, experimental design

Reference number : **JIS Z 8101-3 : 1999 (E)**

24 S

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. By this establishment **JIS Z 8101** : 1981 was withdrawn and replaced with this Standard.

This Standard has been prepared based on **ISO/FDIS 3534-3** issued in 1999.

JIS Z 8101 : 1999 consists of the following parts, under the general title *Statistics—Vocabulary and symbols*:

— Part 1 : *Probability and general statistical terms*
— Part 2 : *Statistical quality control terms*
— Part 3 : *Design of experiments*

Date of Establishment: 1999-05-20

Date of Public Notice in Official Gazette: 1999-05-20

Investigated by: Japanese Industrial Standards Committee
Divisional Council on Basic Items

JIS Z 8101-3:1999, First English edition published in 2000-08

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

Printed in Japan

Contents

JAPANESE INDUSTRIAL STANDARD

JIS Z 8101-3 : 1999
(ISO/FDIS 3534-3 : 1999)

Statistics—Vocabulary and symbols— Part 3 : Design of experiments

Introduction This Japanese Industrial Standard has been prepared based on **ISO/ FDIS 3534-3** *Statistics—Vocabulary and symbols—Part 3 : Design of experiments* issued in 1999 as the FDIS edition without changing the technical contents.

The portions underlined with dots in this Standard are not stated in the original International Standard.

Design of experiments is essentially a strategy of planning experiments so that valid and relevant conclusions may be reached efficiently and economically. The selection of the specific experimental plan should depend on the type of question to be addressed, the degree of generality to be attached to the conclusions, and the resources available (experimental material, personnel, time). A properly designed and executed experiment will frequently lead to relatively simple statistical analysis and interpretation of the results.

In recent years, the application of experimental design has flourished, notably due to the recognition that designed experiments are essential for improving the quality of goods and services. Although statistical quality control, management resolve, inspection, and other quality tools also serve this function, experimental design represents the methodology of choice in complex, variable and interactive settings. Historically, design of experiments has evolved and thrived in the agricultural area. Medicine has also enjoyed a long standing history of careful experimental design. Currently, industrial settings are witnessing the considerable benefits of the methodology—due to ease of initiating efforts (user-friendly software packages), improved training, influential advocates, and accumulating successes with experimental design.

Factorial experiments (see **2.1**) provide a methodology for studying the interrelationships among multiple factors of interest to the experimenter. These types of experiments can be far more efficient and effective than intuitive one-factor-at-a-time experiments. Factorial experiments are particularly well-suited for determining that a factor behaves differently (as reflected in the experimental response) at different levels of other factors. Frequently, the "breakthrough" in quality comes from the synergism revealed in a study of "interactions" (see **1.17**). If the number of factors under consideration is large, then factorial experiments could exceed resources. However, fractional factorial designs (see **2.1.1**) offer a possible compromise. Actually, if the initial goal is to identify factors warranting further investigation, then screening designs (see **2.2**) can be useful.

In planning an experiment, it is necessary to limit biases introduced by the experimental conditions or assignment of treatments to experimental units. Topics such as "randomization" (see **1.29**) and "blocking" (see **1.28**) deal with minimizing the effects of nuisance or extraneous elements. Specific blocking strategies include randomized block designs (see **2.3.1**), Latin-square designs (see **2.3.2**) and variants, and balanced incomplete block designs (see **2.3.4.1**).

Viewing design of experiments as an evolutionary process with continuous improvement as a goal, response surface designs (see **2.4**) play a pivotal role. By considering multiple levels of key factors, response surface methods neatly accommodate curvilinear effects in the vicinity of optimum points.