

ISO 7870-2:2023-03 (E)

Control charts - Part 2: Shewhart control charts

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
3.1	General presence	1
3.2	Symbols	1
3.2.1	For the purposes of this document, the following symbols apply	1
4	Concepts of Shewhart control charts	3
4.1	Shewhart control chart	3
4.2	Control limits	3
4.3	Process in statistical control	3
4.4	Action limits	4
4.5	Warning limits	4
4.6	Type 1 error	4
4.7	Type 2 error	4
4.8	Process not in control	4
4.9	Phase 1 of statistical process control	5
4.10	Phase 2 of control charts	5
5	Types of control charts	5
5.1	Types of Shewhart control charts	5
5.2	Control charts where no pre-specified values of process parameters are given	5
5.3	Control charts with respect to given pre-specified values of process parameters	6
5.4	Types of variables and attribute control charts	6
5.4.1	Variables control charts	6
5.4.2	Attribute control charts	6
6	Variables control charts	7
6.1	Usefulness of variables control charts	7
6.2	Assumption of normality	7
6.3	Pair of control charts	8
6.4	Average, X chart and range, R chart or average, X chart and standard deviation, s chart	8
6.5	Control chart for individuals, X, and moving ranges, Rm	9
6.6	Control charts for medians, X	10
7	Control procedure and interpretation for variables control charts	11
7.1	Underlying principle	11
7.2	Collect preliminary data	11
7.3	Examine s (or R) chart	11
7.4	Homogenization for s (or R) chart	11
7.5	Homogenization for X chart	12
7.6	Ongoing monitoring of process	12
8	Unnatural pattern and tests for assignable causes of variation	12
8.1	Natural pattern	12
8.2	Unnatural patterns	13

8.2.1	General	13
8.2.2	Lack of control in the average chart only	13
8.2.3	Lack of control in the variation chart only	13
8.2.4	Lack of control in both average and variation charts	14
8.2.5	Depiction of unnatural patterns	14
9	Process control, process capability, and process improvement	15
9.1	Process control	15
9.2	Process capability and improvement	16
10	Attribute control charts	18
10.1	Attribute data	18
10.2	Distributions	18
10.3	Subgroup size	18
10.4	Control chart for fraction nonconforming (p chart)	19
11	Preliminary considerations before starting a control chart	19
11.1	Choice of critical to quality (CTQ) characteristics describing the process to control	19
11.2	Analysis of the process	19
11.3	Choice of rational subgroup	20
11.4	Frequency and size of subgroups	20
11.5	Preliminary data collection	21
11.6	Out of control action plan	21
12	Steps in the construction of control charts	21
12.1	Typical format of a standard control chart form	21
12.2	Determine data collection strategy	22
12.3	Data collection and computation	23
12.4	Plotting X chart and R chart	23
13	Caution with Shewhart control charts	24
13.1	General caution	24
13.2	Correlated data	26
13.3	Use of alternative rules to the three- rule	26
Annex A (informative) Illustrative examples		27
Annex B (informative) Practical notices on the pattern tests for assignable causes of variation		46
Bibliography		48