

# Contents

<b>Introduction</b> .....	1
<b>1 – Quality and processes in tissue</b> .....	3
1.1 – The quest to define quality .....	4
1.2 – How is tissue paper made? .....	7
<b>2 – Working in quality today – ISO 9000 Vision 2000</b> .....	11
2.1 – The main differences introduced by the new edition of the standard .....	12
2.2 – The innovations of ISO 9001:2000 .....	13
2.2.1 Customer satisfaction .....	13
2.2.2 Communication with customers .....	13
2.2.3 Internal communication .....	13
2.2.4 Staff competence and awareness .....	13
2.2.5 Measuring the processes .....	14
2.2.6 Data analysis .....	14
2.2.7 Continuous improvement .....	14
2.2.8 A leaner standard .....	15
2.2.9 Integrated systems .....	15
2.3 – The quality management principles of the new standard .....	15
2.3.1 Customer-oriented organization .....	15
2.3.2 Leadership .....	16
2.3.3 Personnel engagement .....	17
2.3.4 A process approach .....	17
2.3.5 A systemic approach to management .....	17
2.3.6 Continuous improvement .....	18
2.3.7 Fact-based decisions .....	18
2.3.8 Mutually beneficial relationships with suppliers .....	19
<b>3 – Tissue Paper Quality</b> .....	21
3.1 – Dimensional characteristics .....	22
3.2 – Grammage .....	23
3.2.1 Standard UNI EN ISO 12625-6:2005 .....	25

## Contents

---

3.3 – Thickness and apparent bulk density . . . . .	26
3.3.1 Standard UNI EN ISO 12625-3:2005 . . . . .	28
3.4 – Strength . . . . .	30
3.4.1 How to obtain paper strength . . . . .	30
3.4.2 Measuring strength . . . . .	38
3.4.3 Standard UNI EN ISO 12625-4:2005 (part 4). . . . .	41
3.5 – Wet strength . . . . .	41
3.5.1 Wet resistance test . . . . .	42
3.5.2 Standard UNI EN ISO 12625-5:2005 (part 5). . . . .	44
3.5.3 Bottle test (pulpability test) . . . . .	44
3.5.4 Quick assessment test. . . . .	44
3.6 – Total, relative and capillary water absorption . . . . .	47
3.6.1 Directing absorption values on the semi-finished product or on the finished product . . . . .	51
3.6.2 Reasons for the increase in three-ply tissue papers . . . . .	53
3.6.3 Standard UNI EN ISO 9073-6:2004 . . . . .	58
3.6.4 Standard UNI EN ISO 12625-8:2011 . . . . .	59
3.6.5 Standard UNI ISO 8787:2006 . . . . .	59
3.6.6 The “radial wiking” test. . . . .	60
3.7 – The degree of brightness . . . . .	
3.7.1 Standard UNI ISO 2470-1:2010 . . . . .	65
3.7.2 Standard UNI ISO 2470-2:2010 . . . . .	66
3.8 Optical bleachers or brighteners . . . . .	66
3.8.1 The Wood’s lamp examination. . . . .	66
3.9 – Moisture content in the paper . . . . .	67
3.9.1 The importance of the moisture value . . . . .	67
3.9.2 The measurement method . . . . .	68
3.9.3 Standard UNI EN ISO 287: 2009. . . . .	70
3.10 Determination of ash content . . . . .	71
3.10.1 A simple method for determining ash . . . . .	72
3.10.2 Standard UNI 6445: 1986. . . . .	73
3.10.3 Standard UNI ISO 1762: 2005 . . . . .	74
3.11 – Softness – Qualitative and quantitative analysis of the product . . . . .	74
3.11.1 Standard UNI EN ISO 12625-1: 2011. . . . .	76
3.12 – Standard references and test methods . . . . .	81
3.12.1 What is a test method . . . . .	82
3.13 – Measurements: statistical parameters . . . . .	82
3.13.1 Repeatability, comparability and reproducibility . . . . .	83
3.14 – Components of uncertainty . . . . .	84
3.14.1 How it is expressed and how it is measured . . . . .	85
<b>4 – The raw material . . . . .</b>	<b>89</b>
4.1 – A few words on cellulose. . . . .	89
4.1.1 Obtaining chemical, chemi-thermomechanical, and mechanical cellulose pulp . . . . .	90
4.1.2 Chemical pulps: kraft process or sulfate process . . . . .	92
4.1.3 Chemical and semichemical pulps: the sulfite process . . . . .	93

4.1.4 Mechanical and chemi-thermomechanical pulp (CTMP) . . . . .	94
4.1.5 Fiber bleaching processes . . . . .	94
4.1.6 The extent of AOX . . . . .	96
4.2 – Quality and characteristics of cellulose fibers . . . . .	96
4.3 – Tests on cellulose pulp . . . . .	97
4.3.1 Tests on cellulose pulp as is . . . . .	98
4.3.2 Test on cellulose pulp transformed into sheets using the sheet former	111
<b>5 – Cellulose classification . . . . .</b>	<b>117</b>
5.1 – Abbreviations of the main types of cellulose . . . . .	120
5.2 – Parameters adopted for assessment . . . . .	122
5.2.1 Physical parameters of greater or lesser importance . . . . .	124
5.2.2 Practical assessment in production of a cellulose classification based on theoretical parameters . . . . .	132
<b>6 – Study and preparation of pulps . . . . .</b>	<b>137</b>
6.1 – Example of high quality papers (code A) . . . . .	139
6.2 – Example of medium quality papers (code B) . . . . .	146
6.3 – Example of low quality papers (code C) . . . . .	156
<b>7 – The quality control and product development laboratory . . . . .</b>	<b>161</b>
7.1 – Conditioning and controlled atmosphere . . . . .	161
7.1.1 Standard UNI EN 20187: 1994 . . . . .	162
7.1.2 Measurement of relative humidity and temperature . . . . .	163
7.1.3 Sample management flow and analysis procedures . . . . .	166
7.1.4 Example of a test certificate on tissue paper . . . . .	168
7.1.5 General notes on sample preparation . . . . .	172
7.1.6 Dimensional analyses . . . . .	173
7.1.7 Preparation of the test pieces for the strength and absorption tests, and counting the number of sheets in the event of tests on rolls . . . . .	175
7.1.8 Detection of the presence of optical bleachers . . . . .	189
7.1.9 Detection of the paper’s moisture content . . . . .	190
7.1.10 Determination of ash . . . . .	192
<b>8 – Process control . . . . .</b>	<b>195</b>
8.1 – What is the master document – Control document . . . . .	196
8.2 – Raw materials (cellulose) . . . . .	198
8.2.1 Sample control document . . . . .	200
8.2.2 Example procedures . . . . .	201
8.3 – Pulp preparation . . . . .	206
8.3.1 Master document for the production of semi-finished products (Semi-finished product master document – Pulp master document) . . . . .	206
8.3.2 Example of procedure for managing a master document for pulps . . . . .	209
8.3.3 Pulp mix preparation control document . . . . .	212
8.4 – The pope reel and the rewinder . . . . .	213
8.4.1 Example of a control document . . . . .	213

## Contents

---

8.4.2 Quality control procedure for tissue paper at paper machine outfeed and rewinder outfeed . . . . .	216
8.4.3 Simple example of instruction for performing visual checks on the paper in production . . . . .	218
8.4.4 Example of instruction for taking samples of the reel to be tested . . .	219
8.4.5 Examples of instructions for performing tests for production controls	219
8.4.6 Special cases: papers intended for the British market . . . . .	220
8.5 – Production checklist . . . . .	224
8.5.1 Sample questions . . . . .	225
8.6 – Tracing and tracking semi-finished products . . . . .	226
8.6.1 Example of a tracing and tracking procedure . . . . .	226
8.7 – Process control in converting . . . . .	229
8.7.1 Example of a product’s master document . . . . .	230
8.7.2 Examples of procedures and operating instructions at the rewinder . .	235
8.7.3 Operating instructions for the corewinder . . . . .	238
8.7.4 Possible instructions in the case of cut products (napkins and handkerchiefs) . . . . .	239
8.7.5 Roll cutting phase in converting . . . . .	240
8.7.6 Roll packaging phase in converting . . . . .	241
8.7.7 Weights collection. . . . .	242
8.7.8 Test on the efficiency of the opening of tissue packets. . . . .	244
8.7.9 Determination of the sheer strength of the reseal tape. . . . .	244
8.7.10 Determination of the fatigue strength (residual) of the reseal tape. . .	245
8.7.11 Determination of the strength of the pre-cut portion . . . . .	246
8.7.12 Palletizing Area . . . . .	247
8.7.13 Traceability and tracking of finished product in converting. . . . .	248
8.8 – Finished product . . . . .	248
8.8.1 Sample procedure for identification and traceability . . . . .	249
8.8.2 Non-compliance management . . . . .	250
<b>9 – Food contact and migration tests . . . . .</b>	<b>257</b>
9.1 – Annex IV, Section I – Basic rules for testing migration in food simulants . .	258
9.1.1 Basic rules for the verification of global and specific migration . . . . .	258
9.1.2 Food simulants . . . . .	258
9.1.3 Internal migration test . . . . .	262
<b>Conclusion . . . . .</b>	<b>265</b>
<b>Bibliography . . . . .</b>	<b>267</b>
<b>Index of the standards quoted . . . . .</b>	<b>269</b>
<b>List of the general standards on paper and board and cellulose pulp . . . . .</b>	<b>271</b>
<b>Glossary . . . . .</b>	<b>279</b>