

Table of Contents

1.	Objectives	1
2.	Principles of milling	3
	2.1 Overview of the milling process	3
	2.2 Introduction to milling theory	6
	2.2.1 Particle breakage	6
	2.2.2 Energy requirements	8
3.	Intake of malt and adjuncts to silo	11
	3.1 A typical intake system	11
	3.2 Operation and maintenance	15
4.	Handling of malt and adjuncts from storage to milling	19
5.	Milling of malt and cereals	33
	5.1 Introduction	33
	5.2 Types of mill	34
	5.2.1 Roller-mill	34
	5.2.2 Hammer-mill	34
	5.2.3 Disc-mill	34
	5.3 Design of dry roller-mills	36
	5.3.1 Description in general	36
	5.3.2 Types of roller-mill	38
	5.4 Dry milling with conditioning	51
	5.4.1 Introduction	51
	5.4.2 Principle	51
	5.4.3 Applications.....	53
	5.5. Wet milling	54
	5.5.1 Hot water conditioning	54
	5.5.2 Steep conditioning roller-mills	55
	5.6. Hammer-mills	58
	5.7 Sampling adjustment and maintenance	60
	5.7.1 Control of grist	60
	5.7.2 Control of roller gap	61
	5.7.3 Routine maintenance checks	62
	5.8 Transfer	64
	5.8.1 Gravity methods	64

6.	Performance evaluation	65
	6.1 Introduction	65
	6.2 Grist properties	66
	6.3 Milling systems	68
	6.4 Grist size distribution	71
	6.5 Wort separation systems	73
	6.5.1 Mash tun	73
	6.5.2 Lauter tun.....	73
	6.5.3 Mash filter	74
	6.6 Monitoring milling performance	76
7.	Hazards	79
	7.1 Health hazards in general	79
	7.2 Control of hazardous substances	81
	7.3 Noise	82
	7.4 Pests	83
	7.5 Dust Explosions	84
	7.5.1 Introduction	84
	7.5.2 Conditions for an explosion to occur	84
	7.5.3 Types of explosion	85
	7.5.4 Precautions.....	85
	7.5.5 Methods for sizing relief vents	89
8.	Research and Development	93
	8.1 Introduction	93
	8.2 Optimisation of the milling process	94
	8.2.1 Reduction in grist oxidation	94
	8.2.2 Grist fractionation	95
	8.2.3 Other items	96
	8.3 Priorities	97
9.	General references	99
 Appendix		
	Cereal Adjuncts	101