



Preface vii

CHAPTER : ► IN

Dimensions not to scale 19

Dimensions not complete 19

1.1	Standard abbreviations 2	1.10	Dimensioning common features 20
1.2	Drawing instruments 4		Diameters 20
	Basic instruments 4		Radii 20
	Pencils 4		Small spaces 20
	Scale rule 4		Spherical surfaces 20
	Eraser and erasing shield 4		Squares 20
	Set squares 5		Holes 22
	Drawing set 5		Positioning holes 22
	French curves and flexible curve 5		Countersinks 23
	Protractor 6		Counterbores 23
	Circle and ellipse templates 6		Spotfaces 23
	Technical pen set 6		Chamfers 23
	Lettering guides 6		Keyways-square and rectangular 24
1.3	Letters and numerals 8		Keyways-Woodruff 27
	Character form and height 8		Tapers 27
	Spacing 8	1.11	Screw threads 28
	Character usage 8		General representation 28
1.4	Types of line 8		Threads on assembly and special
1.5	Line thicknesses 10		threads 28
1.6	Scales 10		Dimensioning full and runout
	Use of scales 11		threads 29
	Indication of scales 11		Dimensioning metric threads in
1.7	Sizes of drawing paper 11		holes 29
	Preferred sheet series 11	1.12	The Australian metric thread
	Non-preferred sheet series 11		profile 30
	Rolls 11	1.13	The ISO metric thread 30
1.8	Layouts of drawing sheets 11		Graphical comparison of metric
	Sheet frames (borderlines) 11		thread series 31
	Title block 11		Tapping size and clearance holes for
	Material or parts list 13		ISO metric threads 31
	Revisions table 14	1.14	Sectioning—symbols and methods 33
	Zoning 15		General symbol 33
1.9	<u> </u>		Hatching lines 33
	Dimensioning symbols 15		Adjacent parts 33
	Dimension and projection lines 15		Dimensions 33
	Linear dimensions 17		Large areas 34
	Angular dimensions 17		Sectional view and cutting plane 34
	Methods of dimensioning 18		Hatching thin areas 34
	Staggered dimensions 18		Exceptions to the general rule 34
	Functional dimensions 18		Interposed and revolved sections 35
	Overall dimensions 19		Removed sections 35
	Auxiliary dimensions 19		Part or local sections 35

Aligned sections 35

Displacement of holes in section 36

1.15	Drawing sectional views 36		Application of tolerances to
	The full sectional view 36		dimensions 63
	The offset sectional view 36		Methods of dimensioning to avoid
	The half sectional view 36		accumulation of tolerances 65
	Rules to remember when	1.20	Assembly of components 66
	sectioning 37		Introduction 66
1.16	Welding drafting 38		Types of assemblies 66
	Welding standards 38		Components assembled externally 66
	The basic symbol 38		Components assembled internally 66
	The standard welding symbol 38	1.21	Problems (limits and fits) 68
	Welding terminology 38		Geometry tolerancing 69
	Application of the standard welding		Introduction 69
	symbol 39		Types of geometry tolerances 70
	Welding procedures 41		Terms used in geometry
	Joint preparation 41		tolerancing 70
1.17	Surface texture 41	1.23	Methods of displaying geometry
.,.,	Indication on drawings 41	1.20	tolerances 72
	Surface texture terminology 41		Tolerance frame method 72
	Surface roughness measurement—		Datum feature 73
	R_a 45	1 24	Basic concepts of geometry
	The standard symbol 45	1.2,	tolerancing 73
	Surface roughness (R_a)	1 25	Interpretation of geometry
	applications 45	1120	tolerancing 73
	Application of surface texture symbol		Flatness 73
	to drawings 45		Straightness 73
	Roughness grade numbers 46		Perpendicularity 73
	Direction of surface pattern or lay 49		Position 81
1 18	Representation of common		Position (concentricity) 81
	features 49		Position (symmetry) 81
1 19	Fits and tolerances 53		Cylindricity 81
,	Introduction 53		Profiles 82
	Shaft 53		Angularity 82
	Hole 53		Parallelism 82
	Nominal size 53		Circularity 82
	Basic size 53	•	Runout 83
	Limits of size 53	1 26	Analysis of geometry tolerance on a
	Deviation 53	1,20	drawing 83
	Tolerance 53	1 27	Using geometry tolerances on a
	Fit 54	X /	drawing 83
	Allowance 55		Interpretation of limits of size for the
	Grades of tolerance 55		control of form 83
	Bilateral limits 60	1.28	Problems (geometry tolerancing) 85
	Unilateral limits 60		CAD corner 87
	Fundamental deviation of		Reference list for geometry
	tolerance 60	2,00	tolerancing 89
	The hole-basis system 60		Standard publications 89
	The shaft-basis system 00		Books 89
	Designation of a fit 62		
	U		

CHAPTER 2 ► GEOMETRICAL CONSTRUCTIONS

- Drawing instrument exercises 92
- Geometrical constructions used in 2.2 engineering drawing 94 Application of the involute curve 104 The cylindrical helix 104
- Cams 107 2.3 Types of cam 107 Applications 107 Displacement diagram 107
- Conic sections 113

The ellipse 115 The parabola 118

- 2.5 Problems 121 Cycloids, involute, spirals, curves 121 Helixes 121 Cams 122 Conic sections 123
- 2.6 Problems (construction of geometrical shapes and templates) 1243
- 2.7 CAD corner 130

ORTHOGONAL PROJECTION CHAPTER 3 ▶

- 3.1 Orthogonal projection 132 Introduction 132 Principles of projection 132
- 3.2 Third-angle projection 132 Designation of third-angle views 132 Number of views 134 Projection of orthogonal views 134
- 3.3 First-angle projection 135
- 3.4 Relationship between first-angle and third-angle views 137
- 3.5 Production of a mechanical drawing 137

- 1. Drawing of borderline and location of views 137
- 2. Light construction of views 138
- 3. Lining in of views 138
- 4. Dimensioning and insertion of subtitles and notes 138
- 5. Drawing of title block, parts list and revisions table 140
- 3.6 Problems 142
- CAD corner 165 3.7

DESCRIPTIVE GEOMETRY: AUXILIARY VIEWS CHAPTER 4 ▶

- Descriptive geometry 168 True length and inclination of lines 170 Methods of determining true length 172 True length—worked examples 173
- 4.2 Auxiliary orthogonal views 174 Introduction 174
- 4.3 Primary auxiliary views 175 Types of primary auxiliary views 175 Partial auxiliary views 175
- Orientation of auxiliary views 177 Secondary auxiliary views 178 Procedure 178 Use of a secondary auxiliary view to construct normal views 181
- 4.5 General rules 181
- 4.6 Problems 183 True length 194
- 4.7 CAD corner 196

PICTORIAL DRAWING: ISOMETRIC AND OBLIQUE PARALLEL CHAPTER 5 ▶ **PROJECTION**

- 5.1 Introduction 198
- 5.2 Axonometric projection 198
- 5.3 Isometric projection 198 Isometric scale 198 Isometric drawing 199 Selection of isometric axes 199 Isometric circles—ordinate method 199 Isometric circles-four-centre method 200 Isometric curves 201 Isometric angles and non-isometric
- lines 201 5.4 Making an isometric drawing 202

Representation of details common to pictorial drawings 203 Fillets and rounds 203 Threads 203

Sectioning 203

Dimensioning 203

- 5.6 Oblique parallel projection 204 Length of depth lines 204 Circles on the oblique face 205 Angles on oblique drawings 205 Selection of the receding axis 205
- Problems 207 5.7
- 5.8 CAD corner 214

CHAPTER 6 ▶ WORKING DRAWINGS: DETAIL AND ASSEMBLY DRAWING

- 6.1 Detail drawings 216
- 6.2 Assembly drawings 216
- 6.3 Working drawings 218

- 6.4 Problems (working drawings) 218
- 6.5 CAD corner 245

CHAPTER 7 > DRAWING ANALYSIS

- 7.1 Sample analysis 248
- 7.2 Problems 250

7.3 CAD corner 257

CHAPTER 8 ▶ INTERSECTIONS AND DEVELOPMENT OF SURFACES

8.1 Development of prisms 260
Rectangular right prism 260
Truncated right prism 260
Rectangular prism pipe elbow 260
Hexagonal right prism 261
Truncated hexagonal right prism 261
Truncated oblique hexagonal
prism 261

Other prismatic shapes 261

- 8.2 Line of intersection—cylinders and cones 262
 - 1. Element method 262
 - 2. Cutting plane method 262
 - 3. Common sphere method 263
- 8.3 Development of cylinders 264
 Right cylinder 264
 Truncated right cylinder 264
 Oblique cylinder 265
 Elbows 266
- 8.4 Development of T pieces 266
 Oblique T piece—equal diameter cylinders 266
 Offset oblique T piece—unequal diameter cylinders 267
 Oblique cylindrical connecting pipe 269
- 8.5 Development of pyramids 269 Right pyramid 269 Oblique pyramid 272
- 8.6 Development of cones 273 Right cone 273

Right cone truncated parallel to the base 274

Right cone truncated at an angle to the base 274

Right cone-vertical cylinder intersection 274

Truncated right cone-right cylinder intersection 276

Right cone-right cylinder oblique intersection 277

Oblique cone 278

Oblique cone-oblique cylinder intersection 279

8.7 Development of breeches or Y pieces 280

Breeches piece—equal angle, equal diameters; unequal angle, equal diameters 280

Breeches piece—cylinder and two cones, equal angle 281

8.8 Development of transition pieces 281 Square-to-rectangle transition piece 281

Round-to-round transition piece 282 Square-to-round transition piece 283 Oblique hood 284 Offset rectangle-to-rectangle transition piece 285

8.9 Problems (development) 287

8.10 CAD corner 295

APPENDIX | > STRUCTURAL STEEL SECTIONS 297

Gauge lines for structural steel (AISC) 307

APPENDIX 2 > REINFORCED CONCRETE 311

Index 317