

TRIBOLOGY HANDBOOK

Editor

M. J. NEALE

B.Sc.(Eng.), D.I.C., Wh.Sch., C.Eng., F.I.Mech.E.

LONDON
BUTTERWORTHS



CONTENTS

A. COMPONENT SELECTION, DESIGN AND PERFORMANCE

Bearings

A1 Selection of bearing type	A12 Oscillatory journal bearings
A2 Selection of journal bearings	A13 Spherical bearings and universal couplings
A3 Selection of thrust bearings	A14 Instrument pivots
A4 Dry rubbing bearings	A15 Plain thrust bearings
A5 Steady load, pressure-fed journal bearings	A16 Profiled pad thrust bearings
A6 Ring and disc-fed journal bearings	A17 Tilting pad thrust bearings
A7 Grease, wick and drip-fed journal bearings	A18 Selection of rolling bearings
A8 Porous metal bearings	A19 Rolling bearing installation
A9 Hydrostatic bearings	A20 Plain bearing form and installation
A10 Gas bearings	A21 Radial stiffness of bearings
A11 Crankshaft bearings	A22 Bearing vibration

Cams, gears and roller chains

A23 Cams and tappets, performance and materials	A25 Metal gears, hardness, finish and lubricant
A24 Gears, selection of type and materials	A26 Roller chain drives, performance and materials

Reciprocating components

A27 Wire ropes and control cables	A31 Piston rings
A28 Slides, selection and design	A32 Cylinders and liners materials and finish
A29 Valves, selection and materials	
A30 Piston design	

Seals

A33 Selection of seals	A37 Soft piston seals
A34 Mechanical seals	A38 Mechanical piston rod packings
A35 Lip seals	A39 Labyrinths and throttling bushes
A36 Packed glands	A40 Oil flinger rings and drain grooves

Wear-resistant components

A41 Wear-resistant parts, material selection	A42 Hard surface coatings, selection and application
--	--

Metal forming and cutting tools

A43 Sheet forming and forging tools	A44 Wiredrawing dies
	A45 Metal cutting tools

High friction components

A46 Selection of belt drives	A51 Brakes: design data
A47 Belt drives, design, materials, performance	A52 Damping devices
A48 Selection of friction clutches	A53 Wheels, rails, tyres, performance and life
A49 Friction clutches, design and materials	A54 Capstans and drums performance and design
A50 Brakes: performance and selection	A55 Selection of industrial flooring materials

B. LUBRICATION

Lubricants

B1 Selection of lubricant type	B4 Greases
B2 Mineral oils	B5 Solid lubricants and coatings
B3 Synthetic oils	B6 Other liquids

Lubrication of components

B7 Plain bearing lubrication	B11 Coupling lubrication
B8 Rolling bearing lubrication	B12 Wire rope lubrication
B9 Gear and roller chain lubrication	B13 Lubrication in metal-working and cutting
B10 Slide lubrication	

Lubrication systems

B14 Selection of lubrication systems	B23 Selection of warning and protection devices
B15 Total loss grease systems	B24 Selection of heaters and coolers
B16 Total loss oil systems	B25 A guide to piping design
B17 Dip, splash systems	B26 Lubricant change periods and tests
B18 Mist systems	B27 Biological deterioration of lubricants
B19 Circulation systems	B28 Lubricant hazards; fire, explosion and health
B20 Design of storage tanks	B29 Commissioning lubrication systems
B21 Selection of pumps	B30 Running-in procedures
B22 Selection of filters and centrifuges	

C. PROPERTIES OF MATERIALS FOR TRIBOLOGICAL COMPONENTS AND SURFACES

Materials

C1 Plain bearing materials	C4 Rolling bearing materials
C2 Bearing surface coatings and treatments	C5 Gear materials
C3 Wear-resistant materials and surfaces	C6 Flexure and knife edge materials
	C7 Friction materials
	C8 Frictional properties of materials

D. ENVIRONMENTAL FACTORS

Environmental data for design

D1 World ambient climatic data	D3 Human limits of noise and vibration
D2 Industrial plant environmental data	

Machine design data for particular environments

D4 High pressure and vacuum	D7 Chemical effects
D5 High and low temperatures	D8 Vibration and shock
D6 Dirt and dust	D9 Storage

E. FAILURES AND REPAIR

Failure of common components

E1 Failure patterns	E5 Failures of friction surfaces
E2 Plain bearing failures	E6 Seal failures
E3 Rolling bearing failures	E7 Fretting problems
E4 Gear failures	

Operating and failure limits of components and machines

E8 Failure detection methods	E10 Failure limits of operating temperatures
E9 Failure limits of noise and vibration	E11 Allowable wear limits

Repair and maintenance methods

E12 Repair of plain bearings	E14 Repair of friction surfaces
E13 Repair of worn surfaces	E15 Lubrication maintenance planning

F. BASIC INFORMATION

Basic tribology

F1	Nature of surfaces and contact	F4	Viscosity and rheology
F2	Surface topography	F5	Methods of fluid film formation
F3	Friction mechanisms, effect of lubricants	F6	Mechanisms of wear

General design information

F7	Heat dissipation from bearing assemblies	F9	Shape tolerances of typical components
F8	Shaft deflections and slopes	F10	Relevant standards ISO and BSS
		F11	SI units and conversion factors