CONTENTS

Foreword ........................................ iii
Standards Committee Roster ......................... v

1 Introduction ........................................ 1
1.1 References ........................................... 1
1.2 Classification .......................................... 1
1.3 Federal Government Use ............................. 1

2 Basic Principles ..................................... 1
2.1 Accuracy in Gaging .................................. 1
2.2 Limitations of Gaging ............................... 1
2.3 Determining Size of Gages ......................... 10
2.4 Standard Temperature ............................... 10

3 General Practice ...................................... 10
3.1 General Design ........................................ 10
3.2 Types of Gages ......................................... 10
3.3 Interpretation of Tolerances ....................... 10
3.4 Direction of Tolerances on Gages ................ 10
3.5 Standard Thread Gage Tolerances ................ 11
3.6 Tolerance on Lead .................................... 11
3.7 Tolerances on Half-Angle ........................... 11
3.8 Check of Effect of Lead and Flank Angle Variations on Product Thread .......................... 11
3.9 Calibration Requirements and Standards ........ 11

4 Types of Gages for Product Internal Thread .......... 11
4.1 GO Working Thread Plug Gages ................... 11
4.2 NOT GO (HI) Thread Plug Gages .................. 13
4.3 Thread Snap Gages — GO Segments or Rolls .... 14
4.4 Thread Snap Gages — NOT GO (HI) Segments or Rolls ............................... 20
4.5 Thread Snap Gages — Minimum Material: Pitch Diameter Cone and Vee ......................... 20
4.6 Thread Snap Gages — Minimum Material: Thread Groove Diameter Type ............................ 23
4.7 Thread-Setting Solid Ring Gages ................... 24
4.8 Plain Plug, Snap, and Indicating Gages to Check Minor Diameter of Internal Thread ........ 24
4.9 Snap and Indicating Gages to Check Major Diameter of Internal Thread ....................... 28
4.10 Functional Indicating Thread Gages for Internal Thread ........................................ 28
4.11 Minimum-Material Indicating Thread Gages for Internal Thread ............................... 33
4.12 Indicating Runout Thread Gage for Internal Thread ........................................ 33
4.13 Differential Gaging .................................... 37
4.14 Pitch Micrometers ...................................................... 39
4.15 Thread-Measuring Balls .................................................. 39
4.16 Optical Comparator and Toolmaker's Microscope .................. 39
4.17 Profile Tracing Instrument ............................................. 40
4.18 Surface Roughness Equipment ........................................... 40
4.19 Roundness Equipment .................................................... 40
4.20 Miscellaneous Gages and Gaging Equipment ................................ 40

5 Types of Gages for Product External Thread .......................... 40
5.1 GO Working Thread Ring Gages .......................................... 40
5.2 NOT GO (LO) Thread Ring Gages ........................................ 128
5.3 Thread Snap Gages — GO Segments or Rolls ................................ 129
5.4 Thread Snap Gages — NOT GO (LO) Segments or Rolls ................ 131
5.5 Thread Snap Gages — Cone and Vee ..................................... 133
5.6 Thread Snap Gages — Minimum Material: Thread Groove Diameter Type 133
5.7 Plain Ring and Snap Gages to Check Major Diameter of Product External Threads ................................................................. 133
5.8 Snap Gages for Minor Diameter of Product External Threads ........ 135
5.9 Functional Indicating Thread Gages for External Thread ................ 135
5.10 Minimum-Material Indicating Thread Gages for External Thread ... 139
5.11 Indicating Runout Gage for External Threads ......................... 139
5.12 Differential Gaging .......................................................... 139
5.13 W Tolerance Runout Gage for External Threads ....................... 143
5.14 Plain Check Plug Gages for Thread Ring Gages ...................... 148
5.15 Indicating Plain Diameter Gages — Major Diameter of Product External Threads ................................................................. 148
5.16 Indicating Gages to Check Minor Diameter of External Thread .... 148
5.17 Thread Micrometers .......................................................... 159
5.18 Thread-Measuring Wires ................................................... 159
5.19 Optical Comparator and Toolmaker's Microscope .................... 159
5.20 Profile Tracing Instrument .................................................. 160
5.21 Electromechanical Lead Tester ............................................ 160
5.22 Helical Path Attachment Used With GO Type Thread Indicating Gage 160
5.23 Helical Path Analyzer ........................................................ 160
5.24 Surface Roughness Equipment ............................................ 161
5.25 Roundness Equipment ..................................................... 161
5.26 Miscellaneous Gages and Gaging Equipment .......................... 161

Figures
1 Maximum-Material GO Functional Limit ...................................... 12
2 Partial End Threads and Chip Grooves ................................... 14
3 NOT GO (HI) Functional Diameter Limit ................................ 16
4 Thread Snap Gages — Maximum-Material GO Functional Limit .......... 19
5 Thread Snap Gages — NOT GO (HI) Functional Diameter Limit .... 21
6 Thread Snap Gages — Minimum-Material Pitch Diameter Limit — Cone and Vee 22
7 Thread Snap Gages — Minimum-Material Thread Groove Diameter Limit 23
8 Thread Form of Solid Thread-Setting Ring Gages ......................... 26
9 Minor Diameter Limit — Cylindrical Plug Gages .......................... 27
10 Indicating Plain Diameter Gages — Max.-Min. Minor Diameter Limit and Size ................................................................. 29
11 Snap and Indicating Diameter Gages — Max.-Min. Major Diameter Limit and Size ................................................................. 30
13 Calibration Requirements and Standards for X Tolerance Thread Gages,
Indicating Gages, Plain Gages, and Measuring Equipment for Internal
Product Threads .......................................................... 155
14 Calibration Requirements for Thread- and Plain-Setting Gages .................. 159

Appendices
A Calibration and Inspection of Limit Gages, Snap Gages, Indicating Gages,
and Measuring Instruments
A1 General ................................................................. 163
A2 Thread Plug Gage Calibration ........................................ 163
A3 Thread Ring Gage Inspection ......................................... 164
A4 Plain Plug Gage Calibration .......................................... 167
A5 Plain Ring Gage Calibration .......................................... 168
A6 Plain Snap Gages ..................................................... 168
A7 Rolls With Zero Lead Thread Form Used on Snap and Indicating
Gages .......................................................................... 168
A8 Inspecting Peripheral Contacting Segments Used on External
Product Thread .......................................................... 168
A9 Inspection of Thread Contact Segments Used on
Internal Product Thread .............................................. 170
A10 Check for Magnification Discrepancies Due to Indicating
System Linkage .......................................................... 170
A11 Calibration of Dial and Electronic Indicators ...................... 170
A12 Assessment of Surface Quality ...................................... 171

B Metrology of 60 deg. Screw Threads ...................................... 173
B1 Wire Method of Measurement of Pitch Diameter (Thread Groove
Diameter) ................................................................. 173
B2 Size of Wires ........................................................... 173
B3 Methods of Measuring Wires Considering the Effect of Deformation .......... 173
B4 Methods of Measurement Using Wires ................................. 176
B5 Standard Specification for Wires and Standard Practice in Measurement
of Wires of 60 deg. Threads ............................................ 176
B6 General Formula for Measurement of Pitch Diameter ..................... 177
B7 Simplified Formula for Pitch Diameter .................................. 177
B8 Setting Measuring Instruments With Variable Measuring Force .............. 178
B9 Thread Balls ............................................................ 178
B10 Internal Pitch Diameter Measurement .................................. 179

Figure
B1 A Three-Wire Method of Measuring Pitch (Thread Groove)
Diameter of Thread Plug Gages .......................................... 174

Tables
A1 Minimum Magnification ............................................... 164
A2 60 deg. Included Thread Angle ..................................... 165
A3 Lengths of AGD Taperlock and Trilock Thread Plug Gage Blanks
Selected From ANSI B47.1 .............................................. 166
A4 Lengths of AGD Thread Ring Gage Blanks and Total Thread Lengths
of Standard Truncated-Setting Plug Gage Blanks Selected from ANSI
B47.1 ........................................................................ 169
B1 Thread-Measuring Wires for 60 deg. Screw Threads ...................... 175
B2 Measuring Force for Over-Wire Measurements of External Pitch Diameter
and Wire Calibration, and Cylindrical Diameter for Wire Calibration .......... 176
B3 Measuring Force Over Balls for Internal Pitch Diameter
Measurement and Ball Calibration ....................................... 179