UNCLASSIFIED

AD NUMBER

AD127124

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited. Document partially illegible.

FROM:

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; DEC 1956. Other requests shall be referred to Army Quartermaster Research and Development Center, Environmental Protection Research Divsion, Natick, MA. Document partially illegible.

AUTHORITY

usanl ltr 7 jul 1970

THIS PAGE IS UNCLASSIFIED

UNCLASSIFIED

AD 127124

Armed Services Technical Information Agency

Reproduced by

DOCUMENT SERVICE CENTER

KNOTT BUILDING, DAYTON, 2, OHIO

This document is the property of the United States Government. It is furnished for the duration of the contract and shall be returned when no longer required, or upon recall by ASTIA to the following address: Armed Services Technical Information Agency, Document Service Center, Knott Building, Dayton 2, Ohio.

NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

UNCLASSIFIED

HEADQUARTERS

QUARTERMASTER RESEARCH & DEVELOPMENT COMMAND

TECHNICAL REPORT

EP-41

QUARTERMASTER HUMAN ENGINEERING HANDBOOK SERIES:

II. DIMENSIONS OF THE UPPER LIMIT OF GLOVED HAND SIZE

QUARTERMASTER RESEARCH & DEVELOPMENT CENTER

ENVIRONMENTAL PROTECTION RESEARCH DIVISION

DECEMBER 1956

NATICK, MASSACHUSETTS

HEADQUARTERS QUARTERMASTER RESEARCH & DEVELOPMENT COMMAND
OFFICE OF THE COMMANDING GENERAL
NATICK, MASSACHUSETTS

11 December 1956

Major General Kester L. Hastings
The Quartermaster General
Department of the Army
Washington 25, D. C.

Dear General Hastings:

This report is the second in the series of human engineering handbooks describing the body size of soldiers wearing Quartermaster clothing and equipment. It presents data on the dimensions of the hand when wearing the various items of cold weather handwear. Such data are essential for determining the sizing and space allowances required in hand-operated equipment to accommodate the gloved hand and are immediately useful to the designers of both equipment and handwear.

The need for human engineering data of this type was expressed by representatives of the other Technical Services at the 1955 Army Human Engineering Conference. The Quartermaster Corps agreed to furnish the data on the body size dimensions of the Quartermaster-equipped soldier to the other Technical Services for use in the design of man-operated equipment. Further reports dealing with other aspects of the dimensions of the Quartermaster-equipped soldier are in preparation.

Sincerely yours,

C. G. CALLOWAY
Brigadier General, USA
Commanding

1 Incl
EP-41

HEADQUARTERS QUARTERMASTER RESEARCH & DEVELOPMENT COMMAND
Quartermaster Research & Development Center, U S Army
Natick, Massachusetts

ENVIRONMENTAL PROTECTION RESEARCH DIVISION

Technical Report
EP-41

QUARTERMASTER HUMAN ENGINEERING HANDBOOK SERIES:

II. DIMENSIONS OF THE UPPER LIMIT OF GLOVED HAND SIZE

John L. Kobrick, Ph. D.
Research Psychologist

PSYCHOLOGY BRANCH

Project Reference:
7-83-01-004

December 1956

Foreword

Protection of the hand from cold or traumatic injury presents a complex problem. Every conceivable method for protecting the hand to some degree interferes with the ability to do things with the hand. Hand dexterity, sensitivity and functional capabilities are all limited by handwear. To the designer of hand-operated equipment, handwear presents the further problem of designing the equipment to accommodate the gloved hand. Knobs, levers, switches, triggers, etc. must be properly sized and spaced to permit satisfactory operation by the man wearing cold weather handwear.

This report presents data on the size and shape of the hand covered by various cold weather handwear ensembles. These data are provided for the guidance of equipment designers who are responsible for the design of hand-operated equipment.

AUSTIN HENSCHEL, Ph.D.
Chief
Environmental Protection Research Division

Approved:

JAMES C. BRADFORD, Colonel, QMC
Commanding Officer
QM R and D Center Operations

A. STUART HUNTER, Ph.D.
Scientific Director
QM Research and Development Command

CONTENTS

			Page
Abstract			xiv
1. Introduction			1
2. Procedure			1
3. Data and Method of Use			3
Anti-contact glove			
	Figure	View	
The hand extended flat	1	A	5
	2	B	5
	3	C	6
	4	D	6
	5	E	7
The hand closed as a fist	6	A	7
	7	B	8
	8	C	8
	9	D	9
	10	E	9
¼" handle diameter	11	A	10
	12	B	10
	13	C	11
	14	D	11
	15	E	12
½" handle diameter	16	A	12
	17	B	13
	18	C	13
	19	D	14
	20	E	14
3/4" handle diameter	21	A	15
	22	B	15
	23	C	16
	24	D	16
	25	E	17
1" handle diameter	26	A	17
	27	B	18
	28	C	18
	29	D	19
	30	E	19

CONTENTS

Anti-contact glove (cont'd)	Figure	View	Page
1¼" handle diameter	31	A	20
	32	B	20
	33	C	21
	34	D	21
	35	E	22
1½" handle diameter	36	A	22
	37	B	23
	38	C	23
	39	D	24
	40	E	24
1 3/4" handle diameter	41	A	25
	42	B	25
	43	C	26
	44	D	26
	45	E	27
2" handle diameter	46	A	27
	47	B	28
	48	C	28
	49	D	29
	50	E	29
¼" knob diameter	51	A	30
	52	B	30
	53	C	31
	54	D	31
	55	E	32
½" knob diameter	56	A	32
	57	B	33
	58	C	33
	59	D	34
	60	E	34
3/4" knob diameter	61	A	35
	62	B	35
	63	C	36
	64	D	36
	65	E	37
1" knob diameter	66	A	37
	67	B	38
	68	C	38
	69	D	39
	70	E	39

CONTENTS

Anti-contact glove (cont'd)	Figure	View	Page
1¼" knob diameter	71	A	40
	72	B	40
	73	C	41
	74	D	41
	75	E	42
1½" knob diameter	76	A	42
	77	B	43
	78	C	43
	79	D	44
	80	E	44
1 3/4" knob diameter	81	A	45
	82	B	45
	83	C	46
	84	D	46
	85	E	47
2" knob diameter	86	A	47
	87	B	48
	88	C	48
	89	D	49
	90	E	49
Wet-cold fingered glove			
The hand extended flat	91	A	50
	92	B	50
	93	C	51
	94	D	51
	95	E	52
The hand closed as a fist	96	A	52
	97	B	53
	98	C	53
	99	D	54
	100	E	54
¼" handle diameter	101	A	55
	102	B	55
	103	C	56
	104	D	56
	105	E	57
½" handle diameter	106	A	57
	107	B	58
	108	C	58
	109	D	59
	110	E	59

CONTENTS

Wet-cold fingered glove (cont'd)	Figure	View	Page
	111	A	60
	112	B	60
3/4" handle diameter	113	C	61
	114	D	61
	115	E	62
	116	A	62
	117	B	63
1" handle diameter	118	C	63
	119	D	64
	120	E	64
	121	A	65
	122	B	65
1¼" handle diameter	123	C	66
	124	D	66
	125	E	67
	126	A	67
	127	B	68
1½" handle diameter	128	C	68
	129	D	69
	130	E	69
	131	A	70
	132	B	70
1 3/4" handle diameter	133	C	71
	134	D	71
	135	E	72
	136	A	72
	137	B	73
2" handle diameter	138	C	73
	139	D	74
	140	E	74
	141	A	75
	142	B	75
¼" knob diameter	143	C	76
	144	D	76
	145	E	77
	146	A	77
	147	B	78
½" knob diameter	148	C	78
	149	D	79
	150	E	79

CONTENTS

Wet-cold fingered glove (cont'd)	Figure	View	Page
3/4" knob diameter	151	A	80
	152	B	80
	153	C	81
	154	D	81
	155	E	82
1" knob diameter	156	A	82
	157	B	83
	158	C	83
	159	D	84
	160	E	84
1¼" knob diameter	161	A	85
	162	B	85
	163	C	86
	164	D	86
	165	E	87
1½" knob diameter	166	A	87
	167	B	88
	168	C	88
	169	D	89
	170	E	89
1 3/4" knob diameter	171	A	90
	172	B	90
	173	C	91
	174	D	91
	175	E	92
2" knob diameter	176	A	92
	177	B	93
	178	C	93
	179	D	94
	180	E	94
Wet-cold mitten			
The hand extended flat	181	A	95
	182	B	95
	183	C	96
	184	D	96
	185	E	97

CONTENTS

Wet-cold mitten (cont'd)	Figure	View	Page
	186	A	97
	187	B	98
The hand closed as a fist	188	C	98
	189	D	99
	190	E	99
	191	A	100
	192	B	100
¼" handle diameter	193	C	101
	194	D	101
	195	E	102
	196	A	102
	197	B	103
½" handle diameter	198	C	103
	199	D	104
	200	E	104
	201	A	105
	202	B	105
3/4" handle diameter	203	C	106
	204	D	106
	205	E	107
	206	A	107
	207	B	108
1" handle diameter	208	C	108
	209	D	109
	210	E	109
	211	A	110
	212	B	110
1¼" handle diameter	213	C	111
	214	D	111
	215	E	112
	216	A	112
	217	B	113
1½" handle diameter	218	C	113
	219	D	114
	220	E	114
	221	A	115
	222	B	115
1 3/4" handle diameter	223	C	116
	224	D	116
	225	E	117

CONTENTS

Wet-cold mitten (cont'd)

	Figure	View	Page
2" handle diameter	226	A	117
	227	B	118
	228	C	118
	229	D	119
	230	E	119
¼" knob diameter	231	A	120
	232	B	120
	233	C	121
	234	D	121
	235	E	122
½" knob diameter	236	A	122
	237	B	123
	238	C	123
	239	D	124
	240	E	124
3/4" knob diameter	241	A	125
	242	B	125
	243	C	126
	244	D	126
	245	E	127
1" knob diameter	246	A	127
	247	B	128
	248	C	128
	249	D	129
	250	E	129
1¼" knob diameter	251	A	130
	252	B	130
	253	C	131
	254	D	131
	255	E	132
1½" knob diameter	256	A	132
	257	B	133
	258	C	133
	259	D	134
	260	E	134
1 3/4" knob diameter	261	A	135
	262	B	135
	263	C	136
	264	D	136
	265	E	137

CONTENTS

Wet-cold mitten (cont'd)	Figure	View	Page
	266	A	137
	267	B	138
2" knob diameter	268	C	138
	269	D	139
	270	E	139
Arctic mitten			
	271	A	140
	272	B	140
The hand extended flat	273	C	141
	274	D	141
	275	E	142
	276	A	142
	277	B	143
The hand closed as a fist	278	C	143
	279	D	144
	280	E	144
	281	A	145
	282	B	145
¼" handle diameter	283	C	146
	284	D	146
	285	E	147
	286	A	147
	287	B	148
½" handle diameter	288	C	148
	289	D	149
	290	E	149
	291	A	150
	292	B	150
3/4" handle diameter	293	C	151
	294	D	151
	295	E	152
	296	A	152
	297	B	153
1" handle diameter	298	C	153
	299	D	154
	300	E	154

CONTENTS

Arctic mitten (cont'd)	Figure	View	Page
1¼" handle diameter	301	A	155
	302	B	155
	303	C	156
	304	D	156
	305	E	157
1½" handle diameter	306	A	157
	307	B	158
	308	C	158
	309	D	159
	310	E	159
1 3/4" handle diameter	311	A	160
	312	B	160
	313	C	161
	314	D	161
	315	E	162
2" handle diameter	316	A	162
	317	B	163
	318	C	163
	319	D	164
	320	E	164
¼" knob diameter	321	A	165
	322	B	165
	323	C	166
	324	D	166
	325	E	167
½" knob diameter	326	A	167
	327	B	168
	328	C	168
	329	D	169
	330	E	169
3/4" knob diameter	331	A	170
	332	B	170
	333	C	171
	334	D	171
	335	E	172
1" knob diameter	336	A	172
	337	B	173
	338	C	173
	339	D	174
	340	E	174

CONTENTS

Arctic mitten (cont'd)	Figure	View	Page
1¼" knob diameter	341	A	175
	342	B	175
	343	C	176
	344	D	176
	345	E	177
1½" knob diameter	346	A	177
	347	B	178
	348	C	178
	349	D	179
	350	E	179
1 3/4" knob diameter	351	A	180
	352	B	180
	353	C	181
	354	D	181
	355	E	182
2" knob diameter	356	A	182
	357	B	183
	358	C	183
	359	D	184
	360	E	184

4. Summary 185

5. Acknowledgement 185

6. References 185

Distribution List

Abstract

This report presents human engineering information on the hand size of the soldier wearing various ensembles of Quartermaster protective handwear. It is intended for use as a handbook by engineers for establishing size and space allowances in the design and sizing of hand-operated equipment. The criterion employed is the bare hand size that is equal to or bigger than the hand size of 95% of the Army personnel, i.e., the 95th percentile of the Army hand size distribution. The information is presented in pictorial form with index scales, so that dimensions can be measured on the pictures and referred to the index scale to establish actual size.

QM HUMAN ENGINEERING HANDBOOK SERIES: II. DIMENSIONS OF THE UPPER LIMIT OF GLOVED HAND SIZE

1. Introduction

One of the problems facing designers of hand-operated equipment is the determination of sizing and spacing allowances to accommodate the hands of Army equipment operators. Although statistics on bare hand size of military personnel are available, sizing and spacing allowances based upon bare hand size alone are inadequate where equipment is intended for operation in the cold. In these cases, the operator's protective handwear produces an appreciable increase in hand size, and larger allowances must be made.

This report, the second in a series of Quartermaster human engineering handbook reports (2), is intended to aid engineers and equipment designers in establishing adequate sizing and spacing allowances to accommodate operators wearing QM protective handwear. Spatial dimensions of the four standard QM handwear ensembles for environmental protection are presented for the 95th percentile of Army hand sizes. Equipment designed to these criteria can be expected to accommodate all soldiers except the largest five percent when wearing standard Army handwear.*

2. Procedure

A subject was selected whose major hand dimensions equalled or exceeded those of the 95th percentile of the US Air Force size distribution for the hand (1).** The principal hand dimensions considered were hand length, palm length, hand breadth at thumb, hand breadth at metacarpale and fist circumference. The upper size limit in handwear was achieved by dressing the subject in size "Large" items.

---

*A similar report describing the fifth percentile of Army hand sizes will also be published.

**Air Force rather than Army values were used because size differences between personnel of the two services are slight, and Air Force anthropometry included several hand dimensions not treated by Newman and White (3) for the Army population.

The components of the handwear ensembles used are the following:

Anti-contact glove

Glove, cloth, anti-contact, leather palm, seal brown, Shade No. 105, Mil. G 10902A, Federal Stock No. 8415-227-1222

Wet-cold mitten

Mitten, inserts, wool and nylon knit, 3-finger, OD, Federal Stock No. 8440-160-1376

Mitten, shells, leather, 3-finger, M-1951, Federal Stock No. 8440-199-5408

Wet-cold fingered glove

Glove, insert, wool, knitted, OD, Federal Stock No. 8415-160-0815

Glove, shell, leather, M-1949, Federal Stock No. 8415-160-0887

Arctic mitten

Mitten, inserts, wool and nylon knit, 3-finger, OD, Federal Stock No. 8440-160-1376

Mitten Set, Arctic, cotton, oxford gauntlet, OD Type I, Federal Stock No. 8415-268-7690*

The data were obtained by use of a photographic technique, details of which were described in a previous report (2). The photographs were taken approximately nine feet from the subject, using a Leica 35-millimeter camera equipped with a reflex focusing hood and a lens with a focal length of 135 millimeters. An aperture setting of f. 13.0 and an exposure time of 1/50 second was used. The subject's hand was photographed in various views wearing each of the four standard QM protective handwear ensembles in the following poses:

1. the hand extended flat

2. the hand closed as a fist

*Size "Small" was used here since this is the only size in which this item is issued to the Army at the present time. All other handwear items in this study were size "Large".

3. the hand gripping handles of the following diameters: ¼", ½", 3/4", 1", 1¼", 1½", 1 3/4" and 2"

4. the fingers gripping knobs of the following diameters: ¼", ½", 3/4", 1", 1¼", 1½", 1 3/4" and 2"

3. Data and Method of Use

The data are presented in Figures 1 through 360. Each figure contains a scale graduated in inches and centimeters, and is intended to be the index of actual size for any handwear dimension shown in the photograph. In order to obtain a desired handwear dimension, it is only necessary to bridge the pictured dimension with a pair of dividers, transfer the dividers to the appropriate scale units shown in that figure, and read off the actual size.

However, one precaution should be observed. Since the depth effect in a photograph is produced by a progressive size reduction inward from the foreground, an increasing, though slight, error will be introduced as measurements are taken successively farther outside a hypothetical plane extending vertically above the scale. However, it is felt that almost any desired dimension can be obtained with a degree of accuracy sufficient for most purposes.

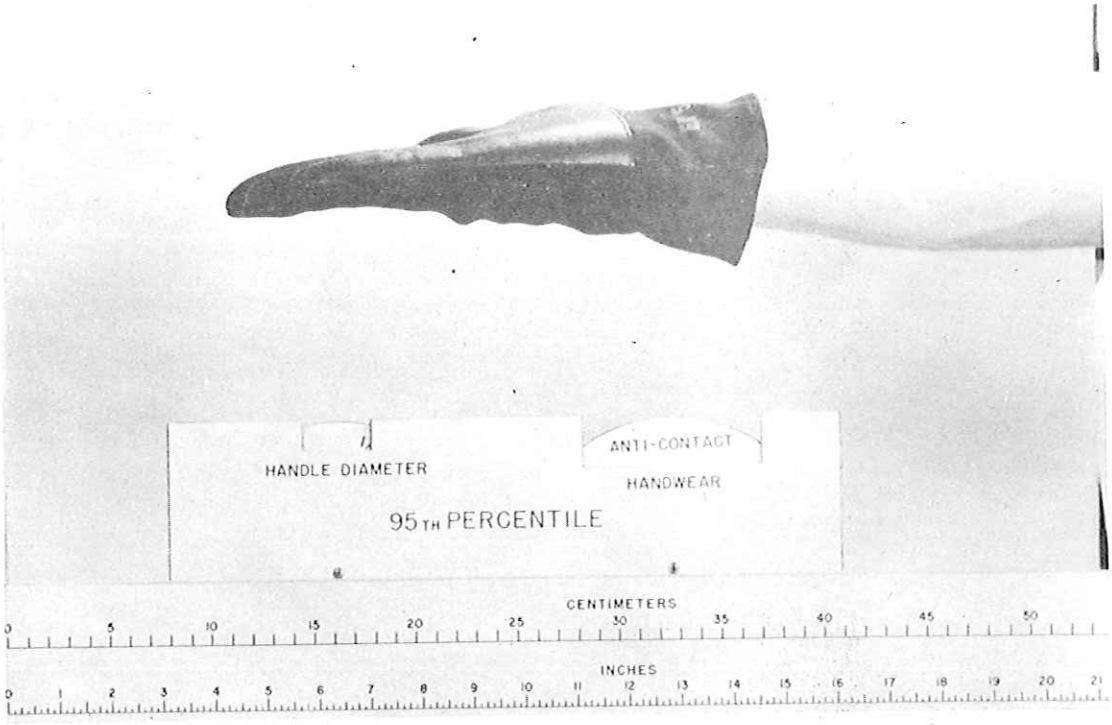

Figure 1. The hand extended flat (View A)

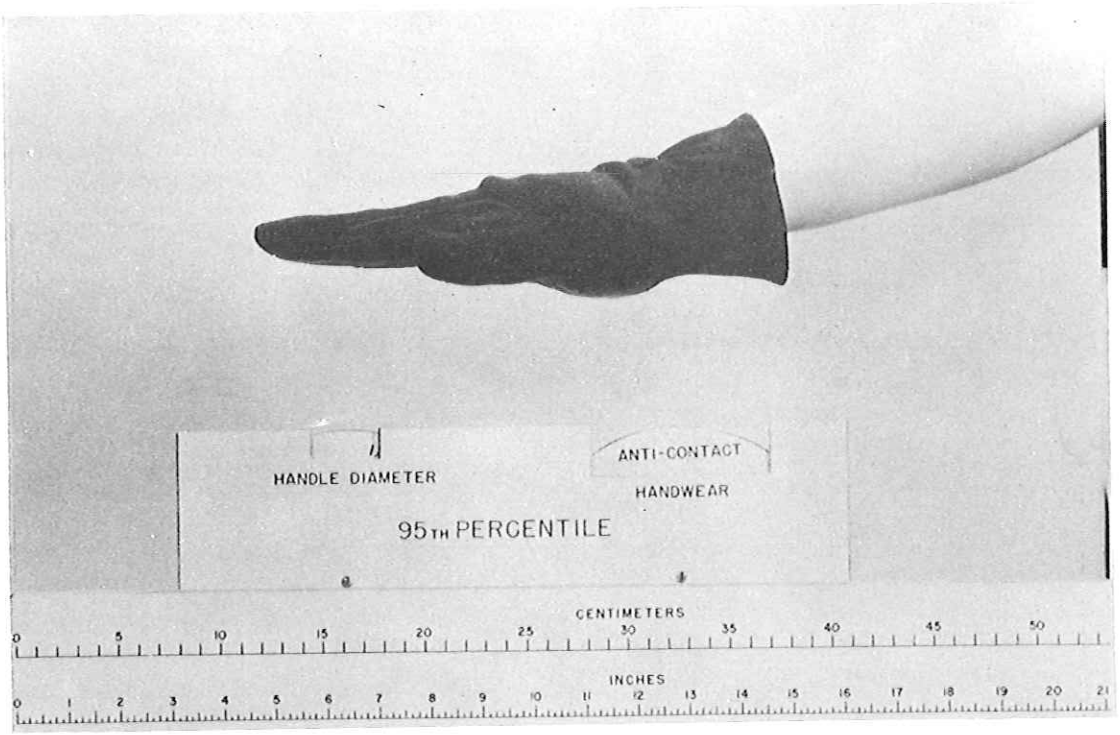

Figure 2. The hand extended flat (View B)

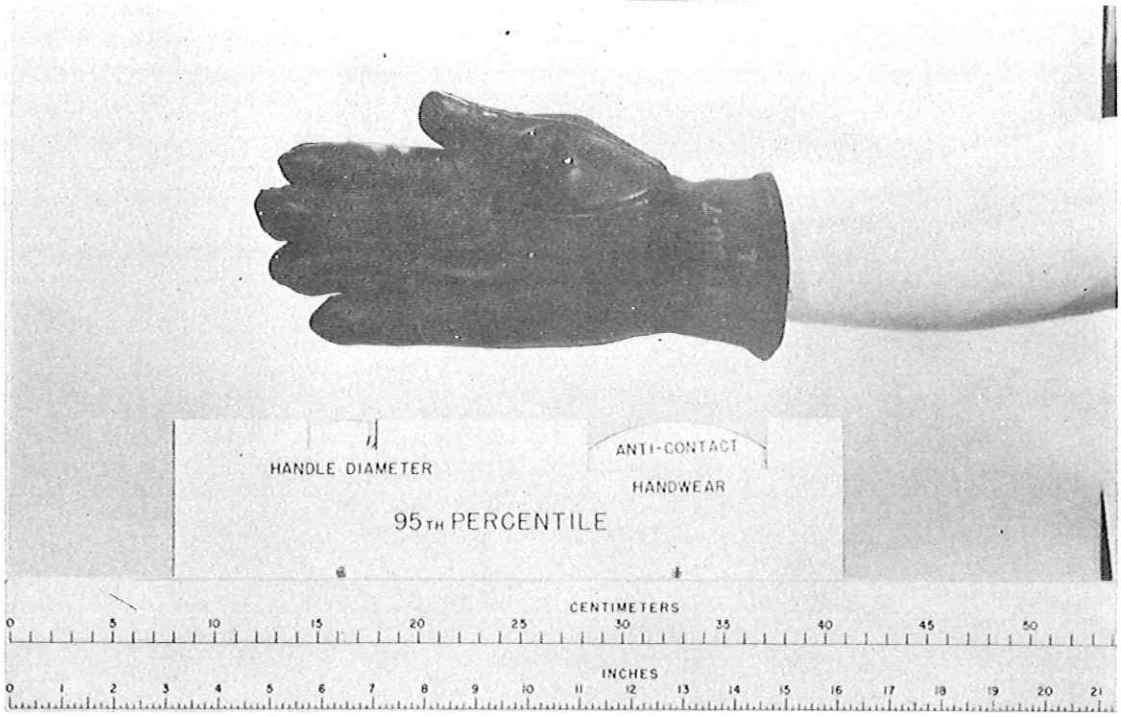

Figure 3. The hand extended flat (View C)

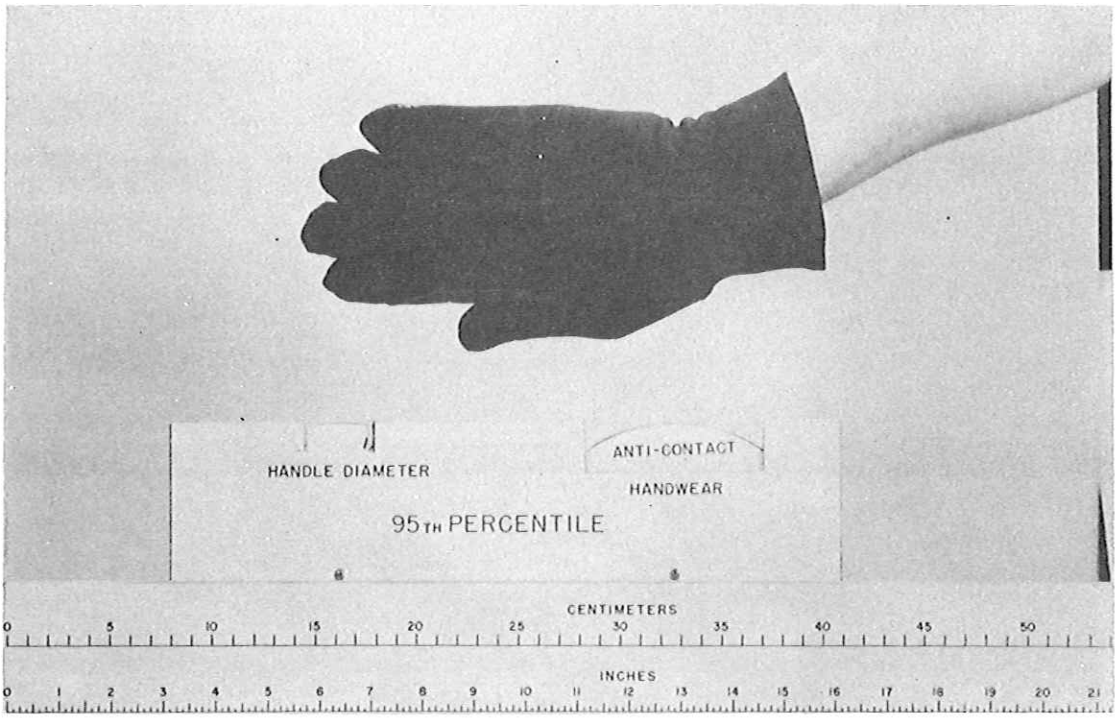

Figure 4. The hand extended flat (View D)

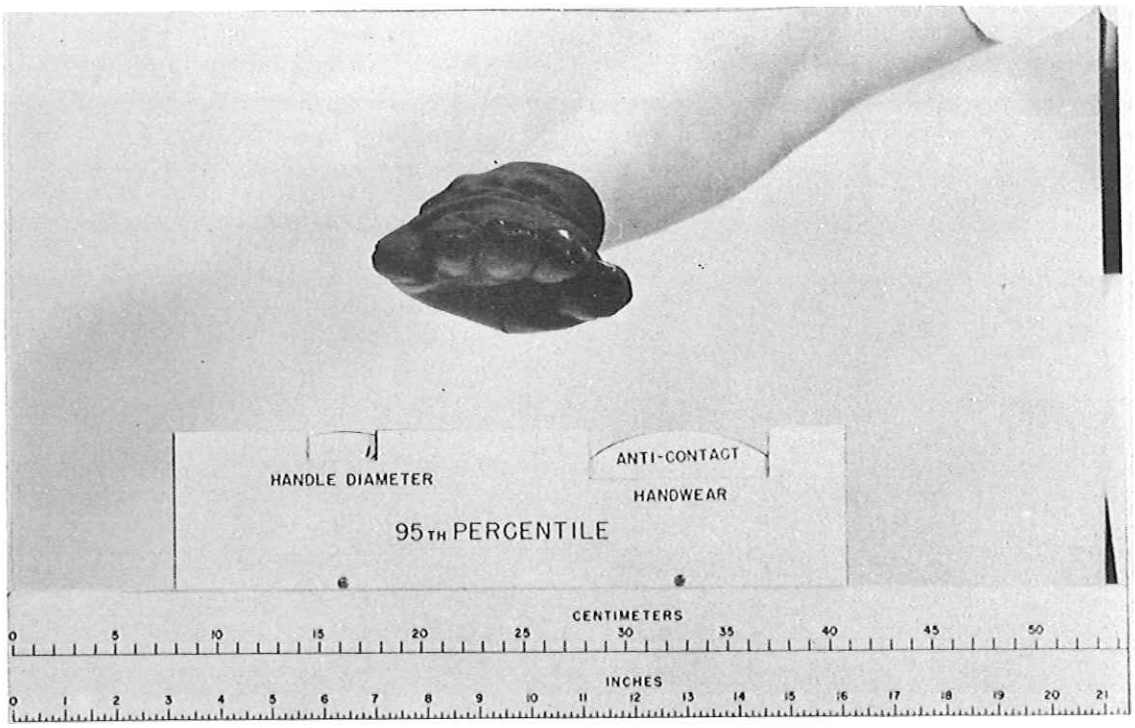

Figure 5. The hand extended flat (View E)

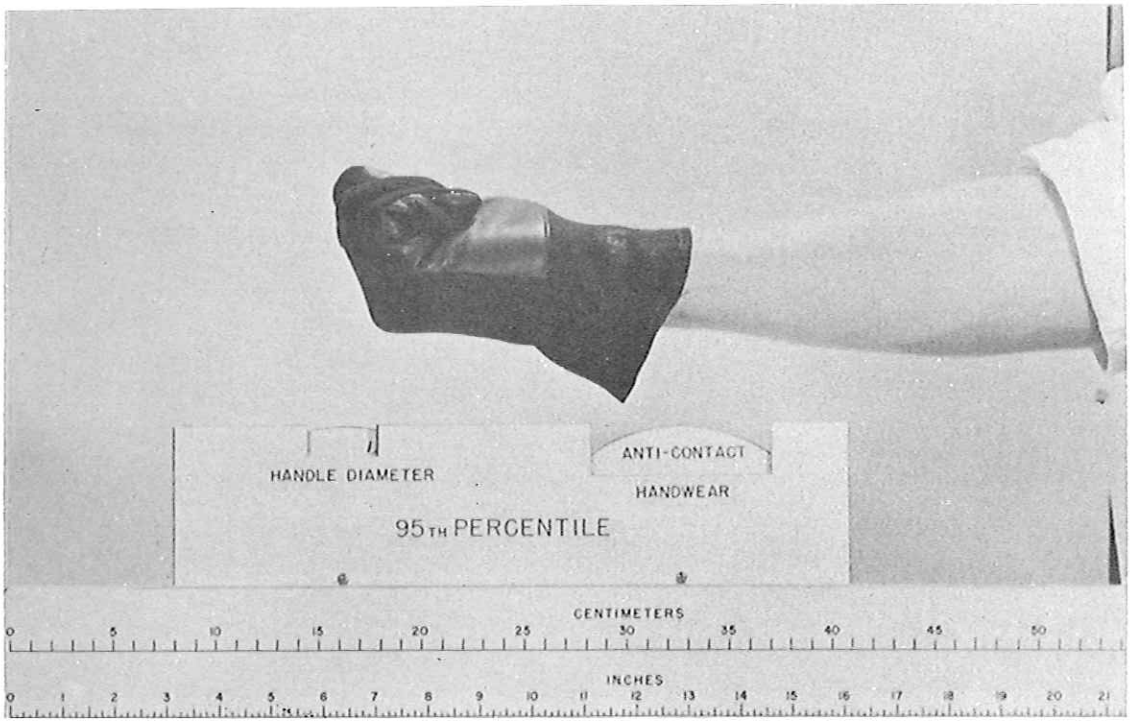

Figure 6. The hand closed as a fist (View A)

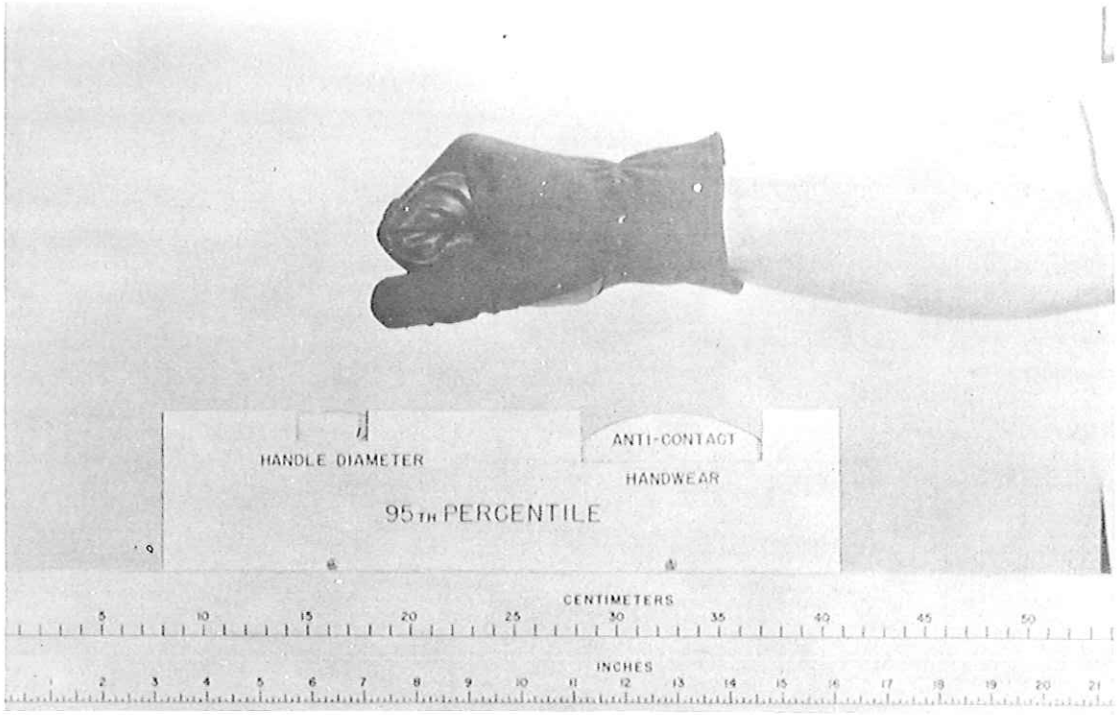

Figure 7. The hand closed as a fist (View B)

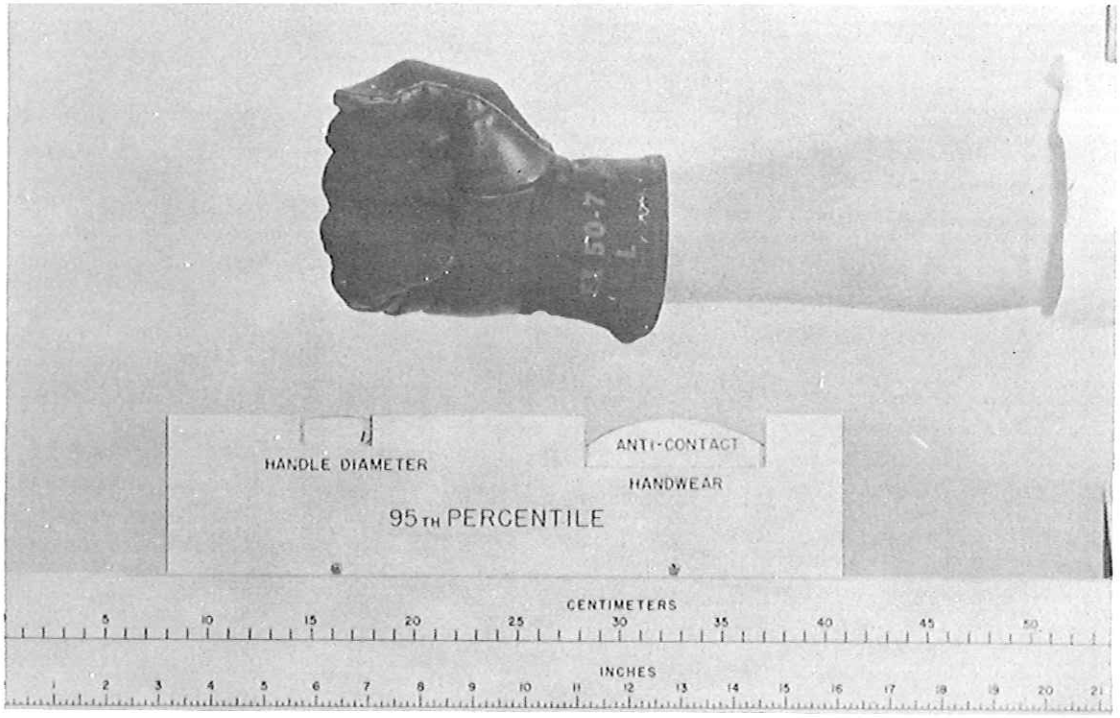

Figure 8. The hand closed as a fist (View C)

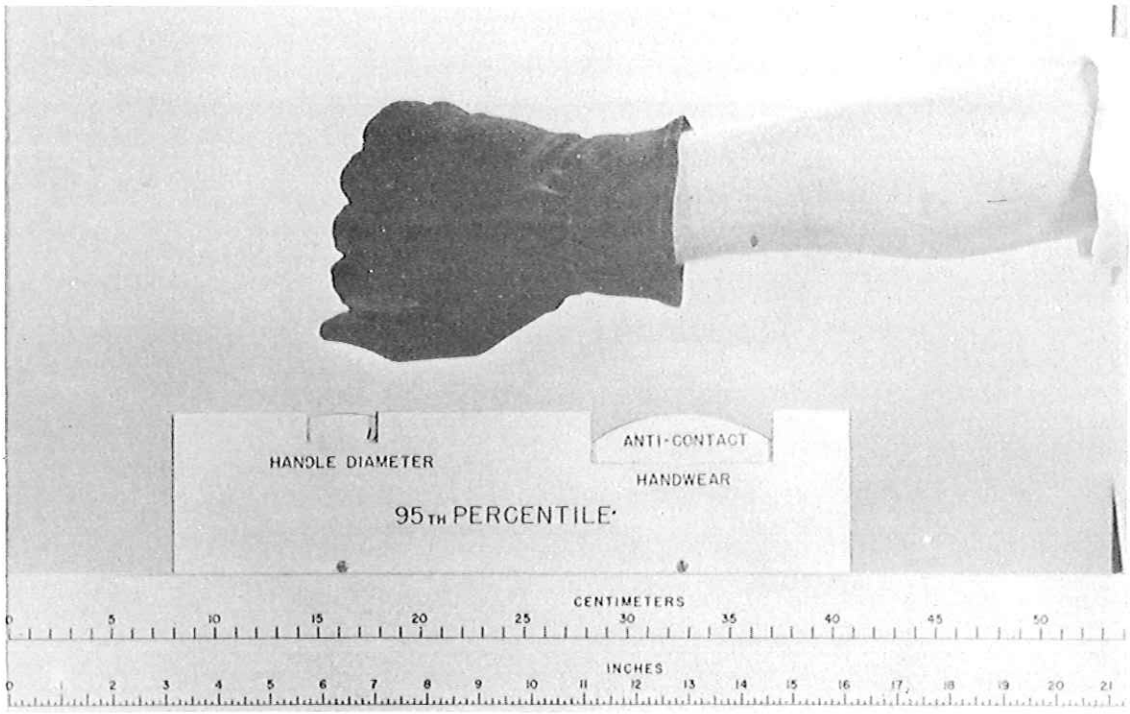

Figure 9. The hand closed as a fist (View D)

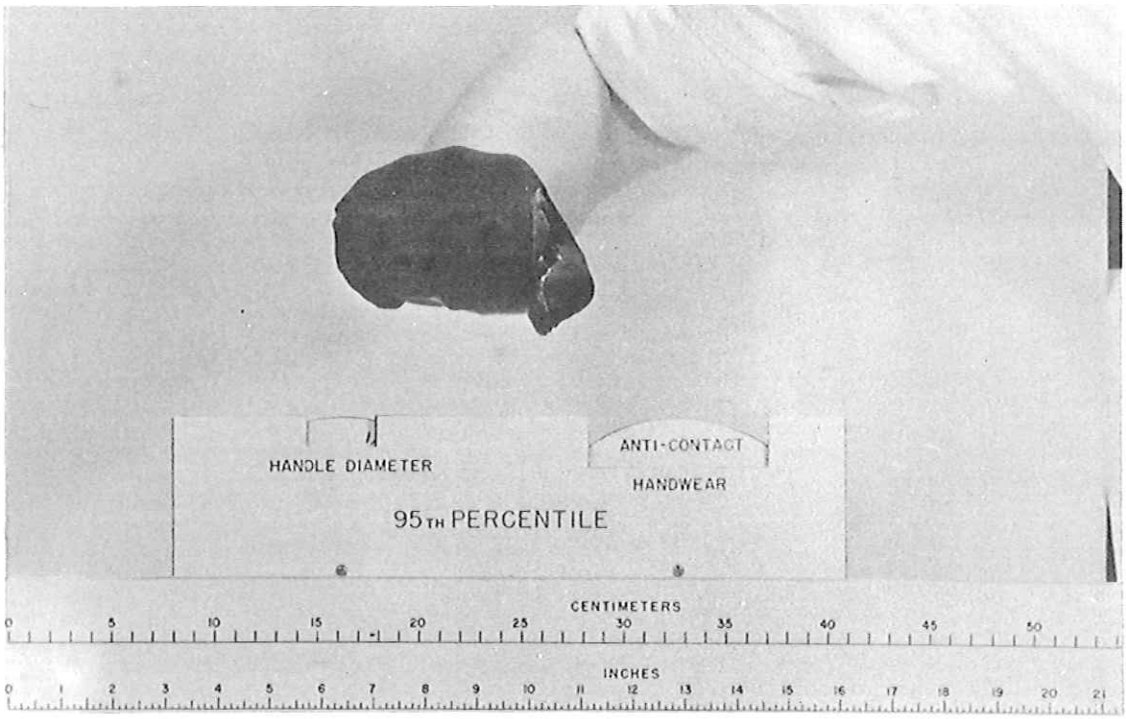

Figure 10. The hand closed as a fist (View E)

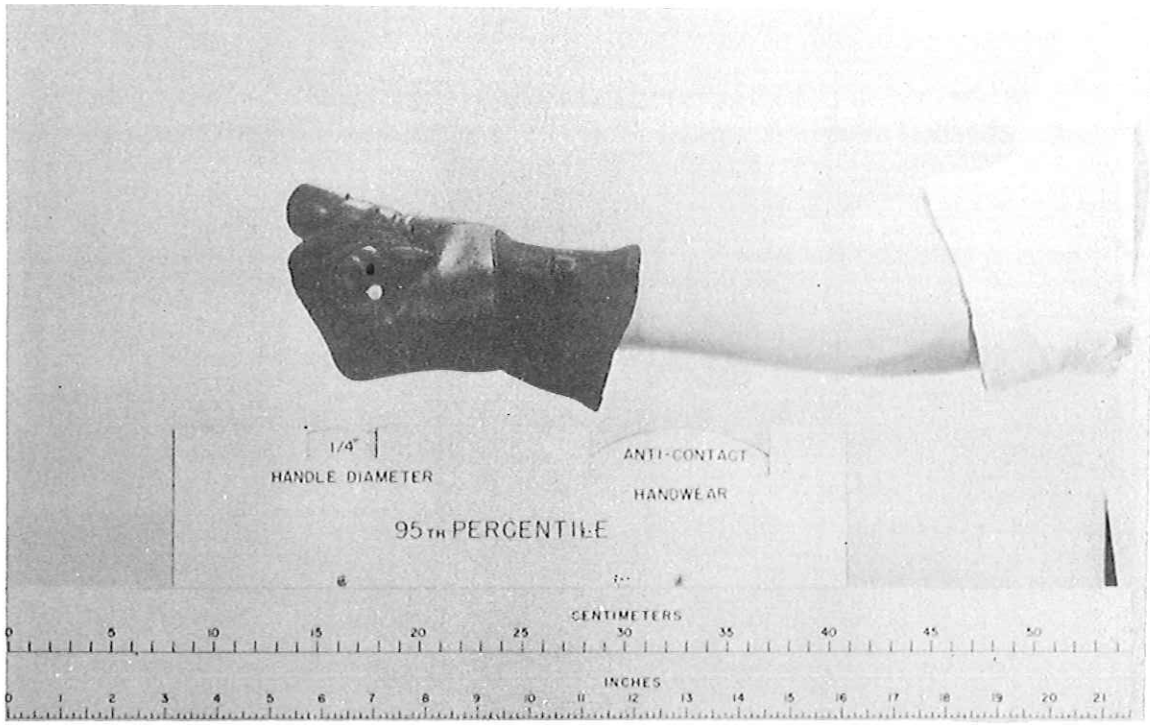

Figure 11. ¼" handle diameter (View A)

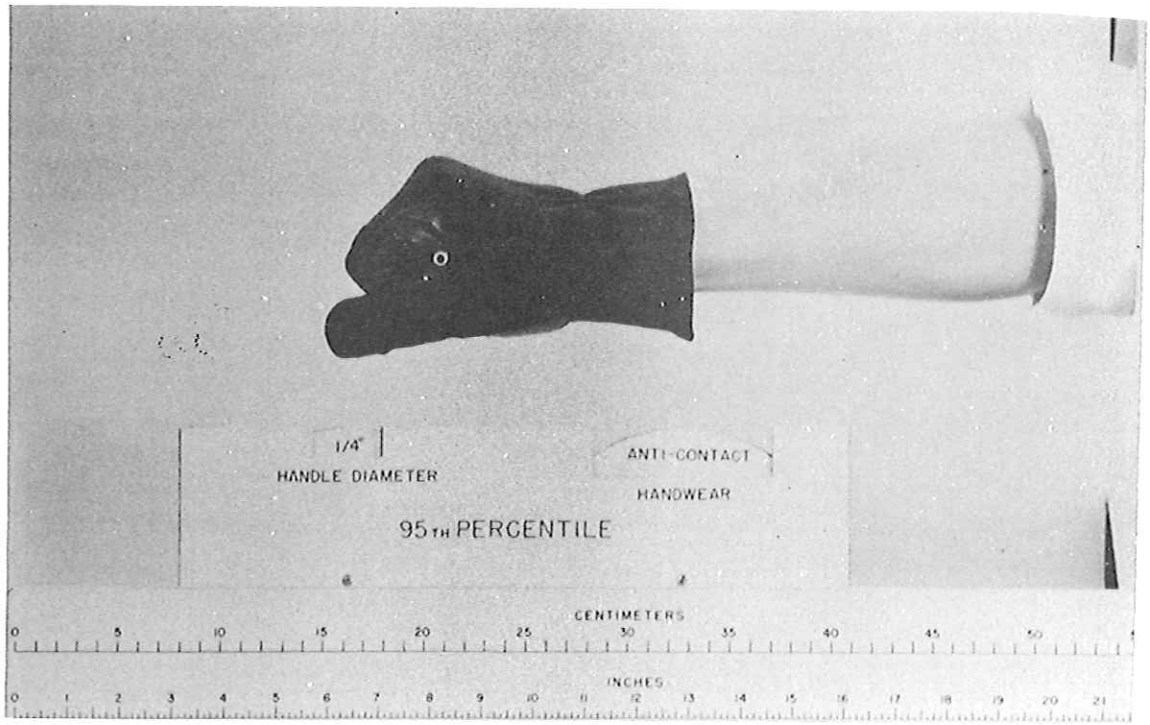

Figure 12. ¼" handle diameter (View B)

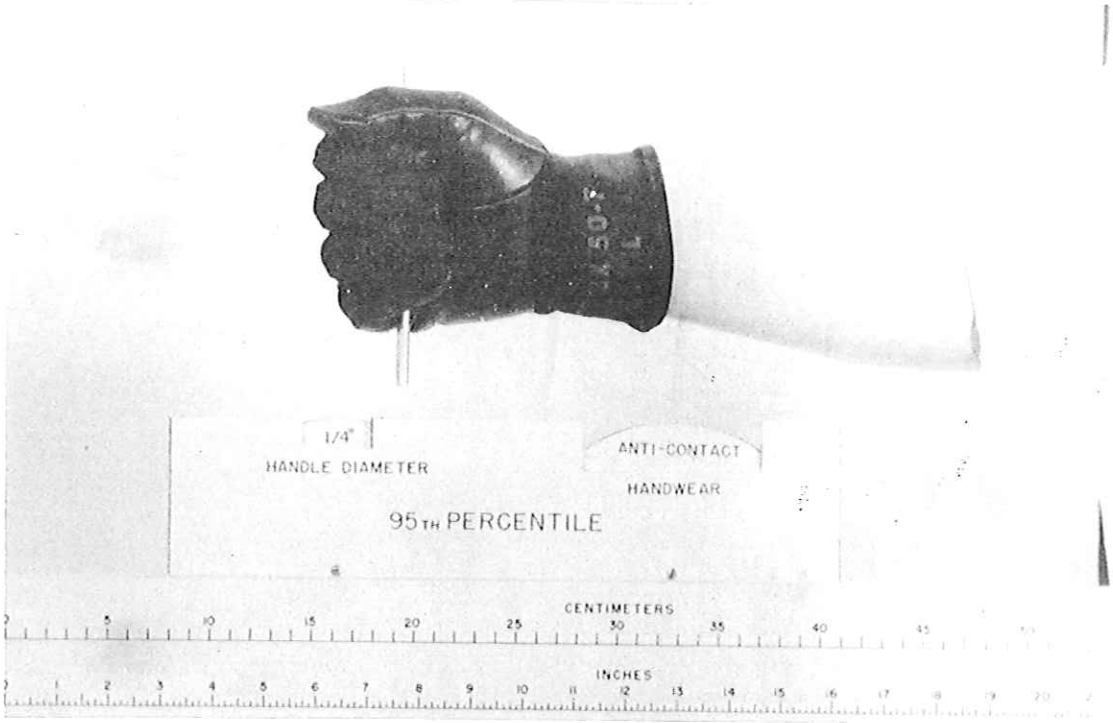

Figure 13. $\frac{1}{4}$" handle diameter (View C)

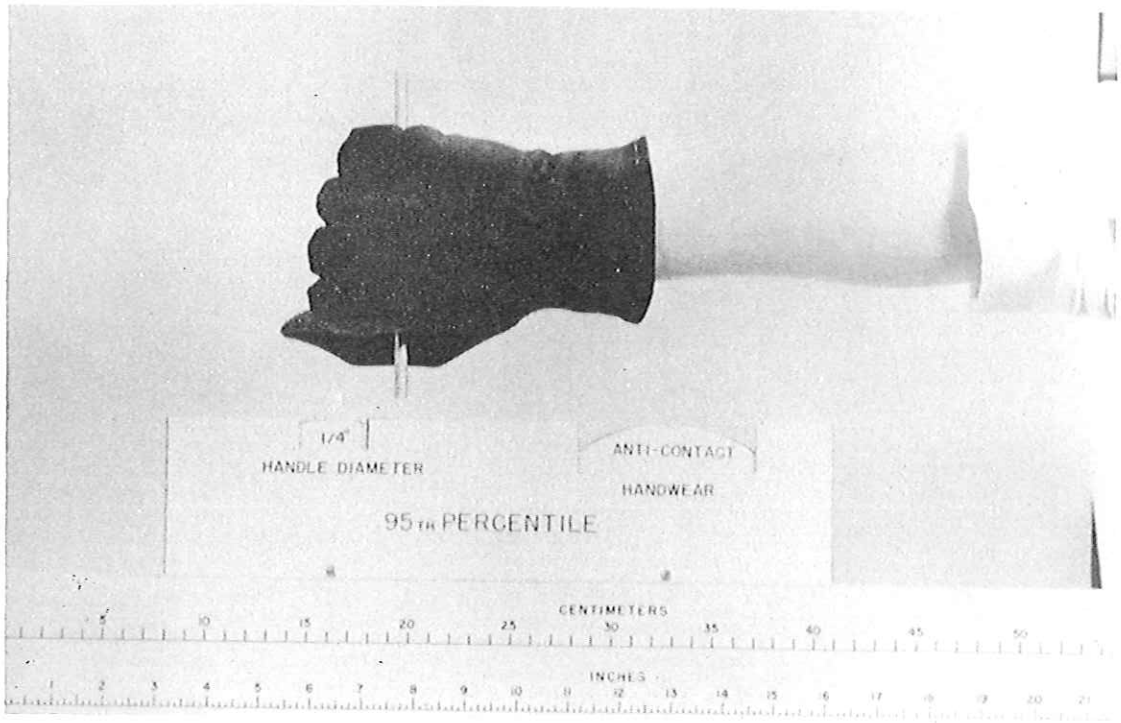

Figure 14. $\frac{1}{4}$" handle diameter (View D)

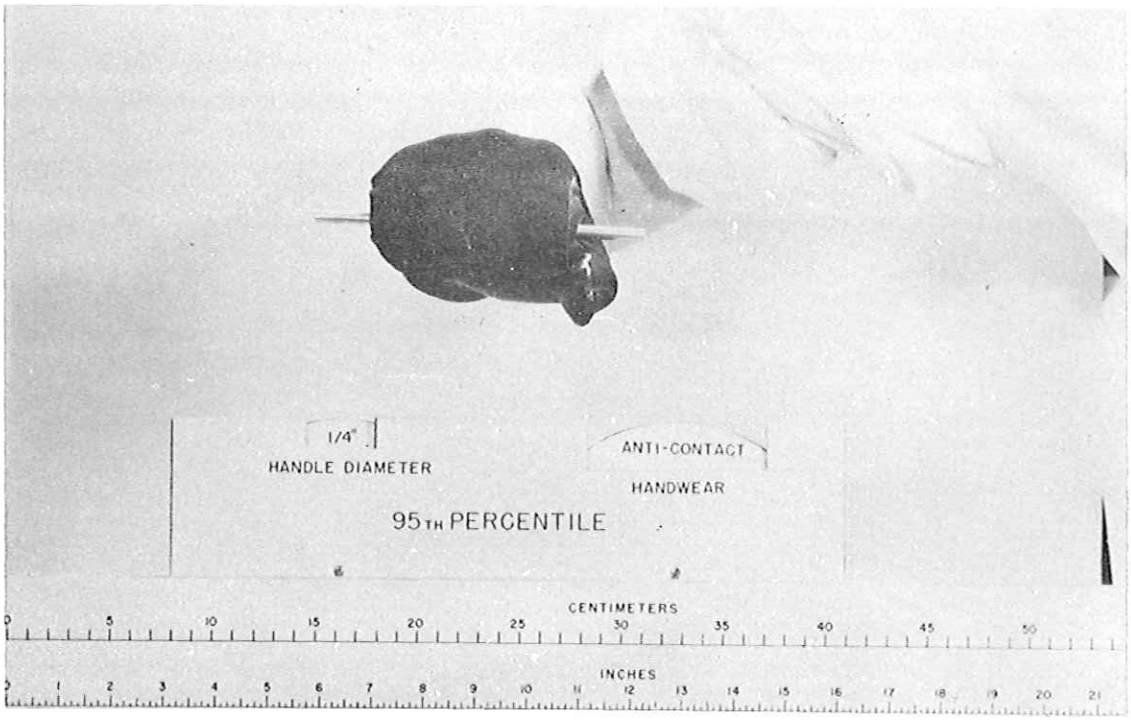

Figure 15. $\frac{1}{4}$" handle diameter (View E)

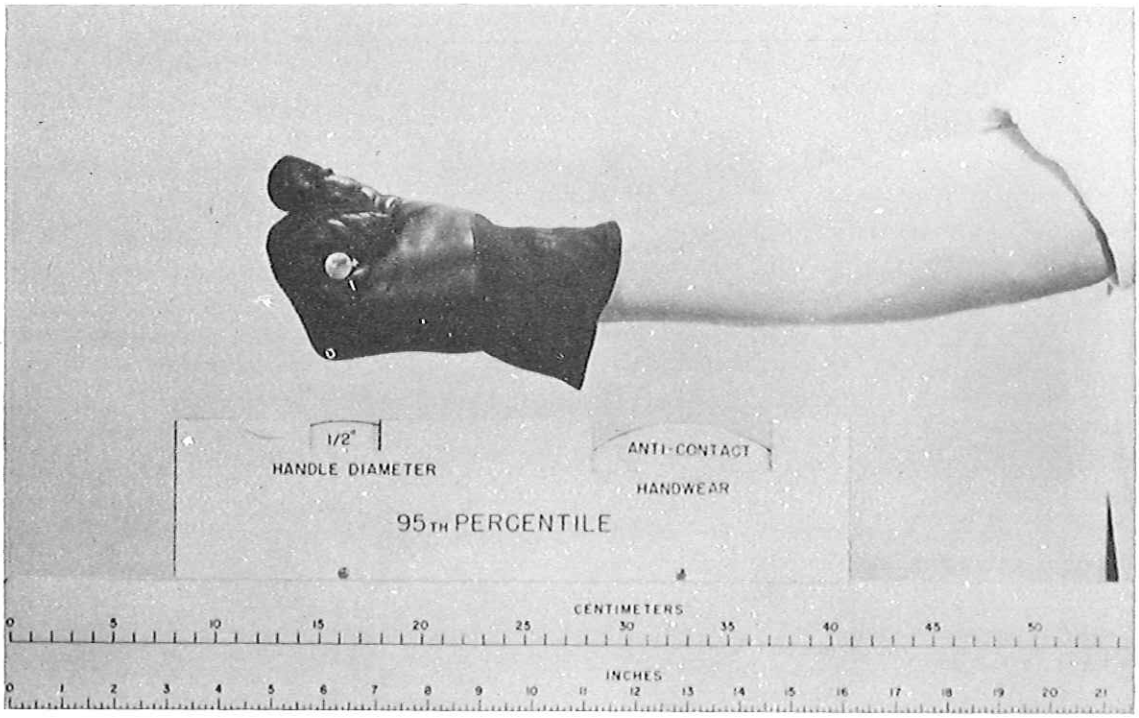

Figure 16. $\frac{1}{2}$" handle diameter (View A)

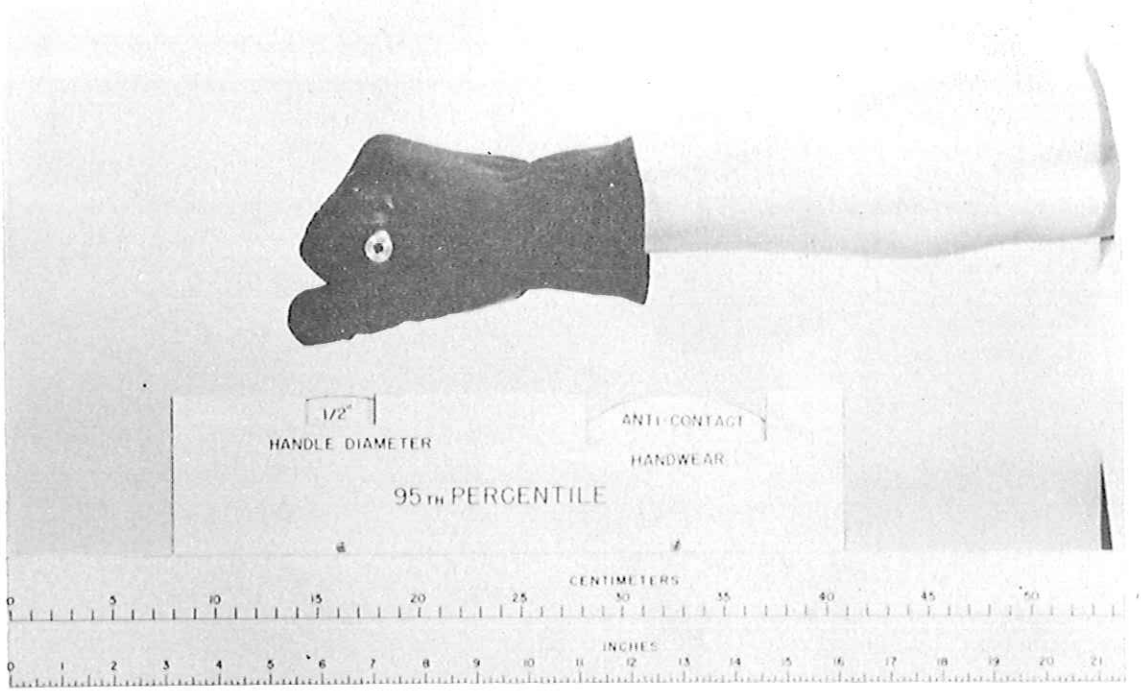

Figure 17. ½" handle diameter (View B)

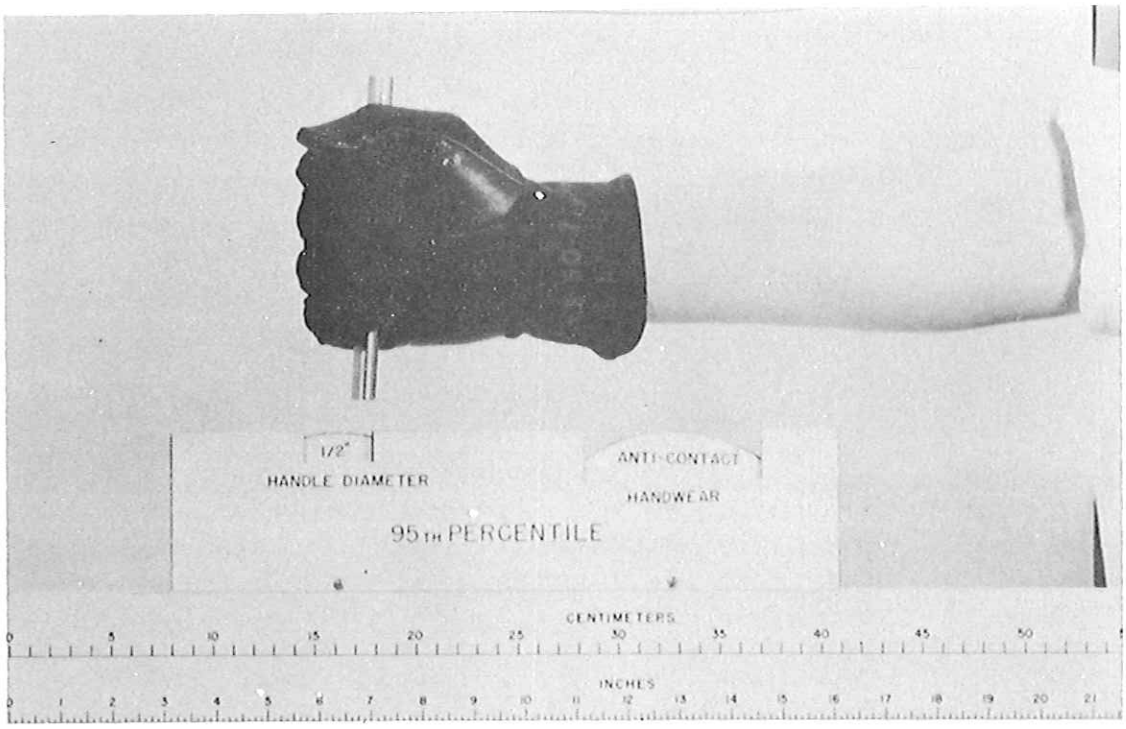

Figure 18. ½" handle diameter (View C)

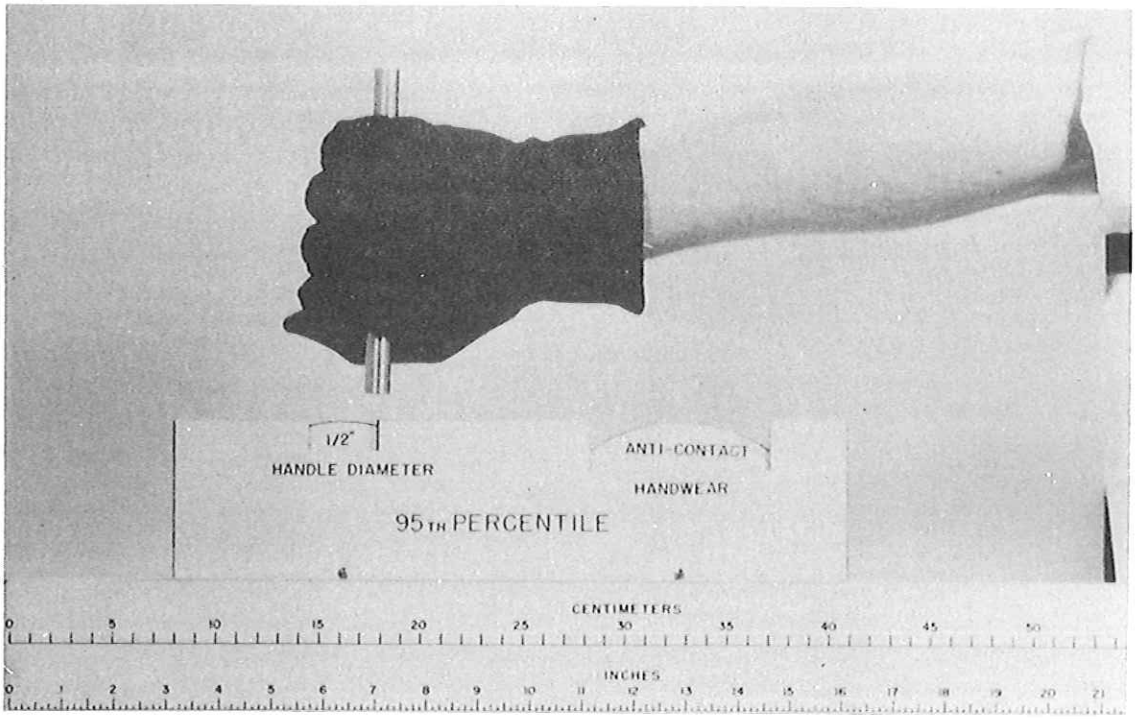

Figure 19. ½" handle diameter (View D)

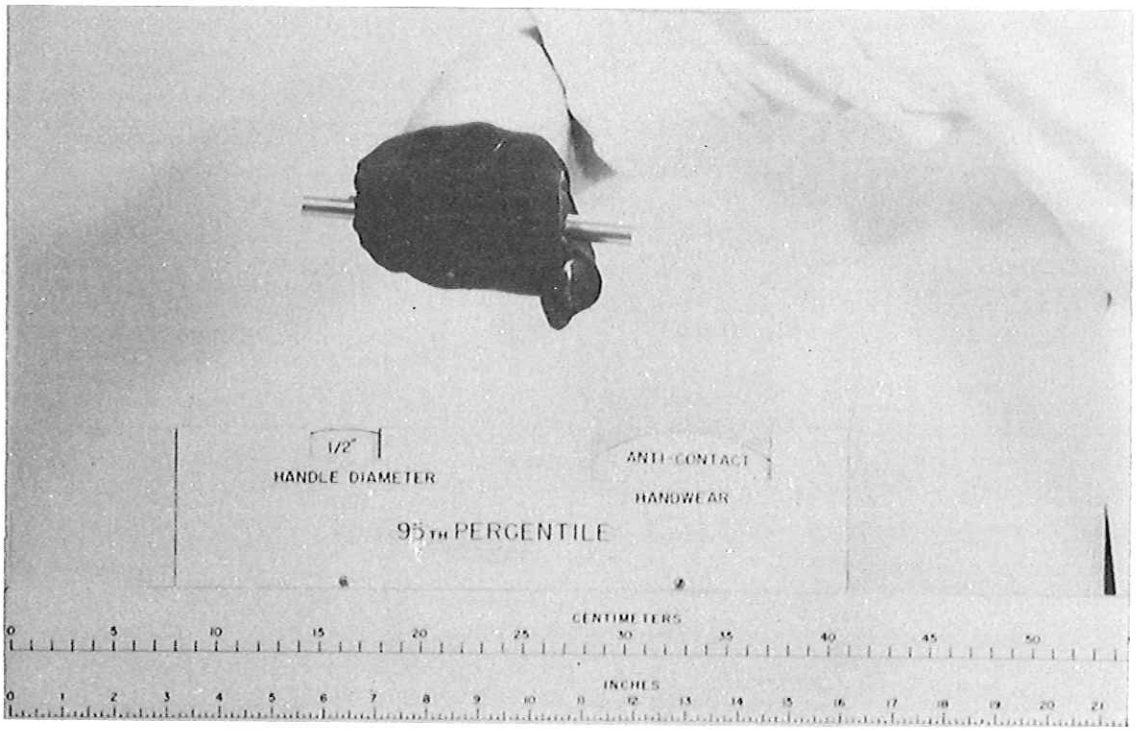

Figure 20. ½" handle diameter (View E)

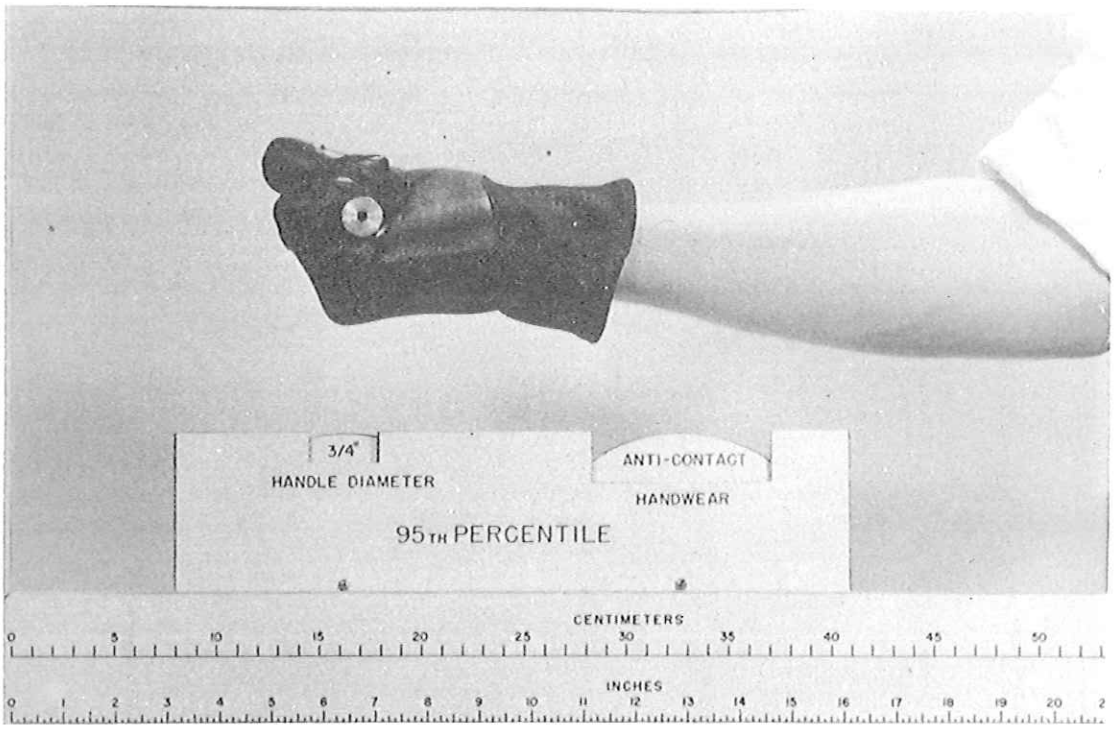

Figure 21. 3/4" handle diameter (View A)

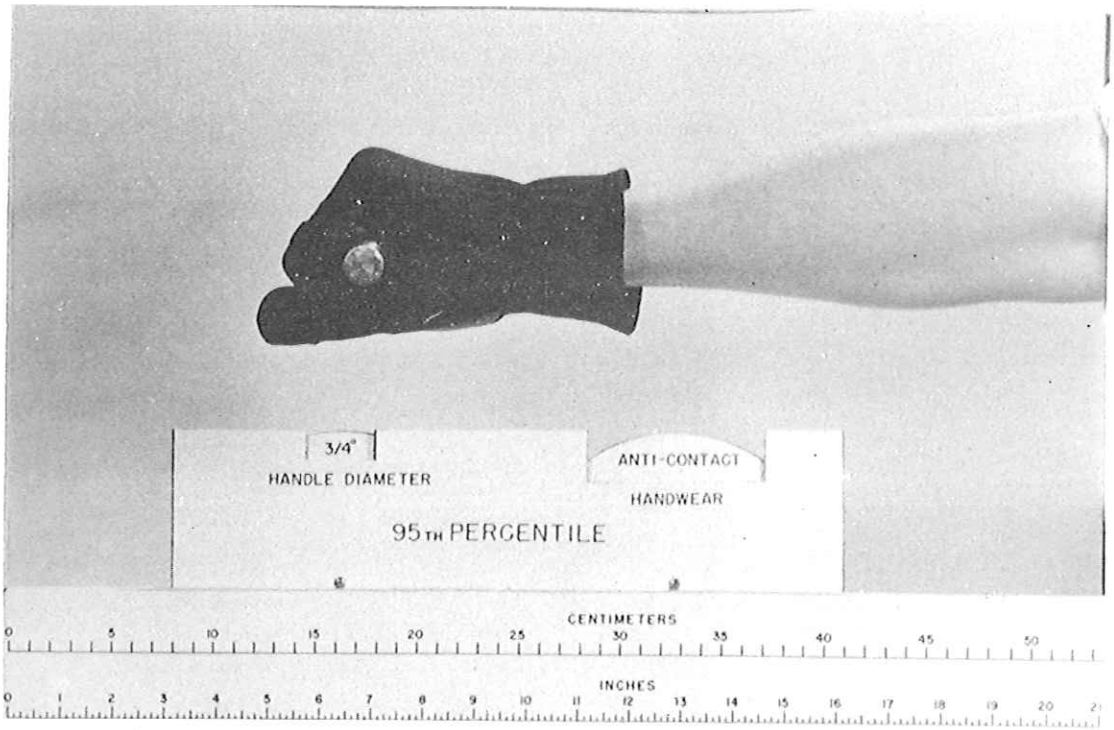

Figure 22. 3/4" handle diameter (View B)

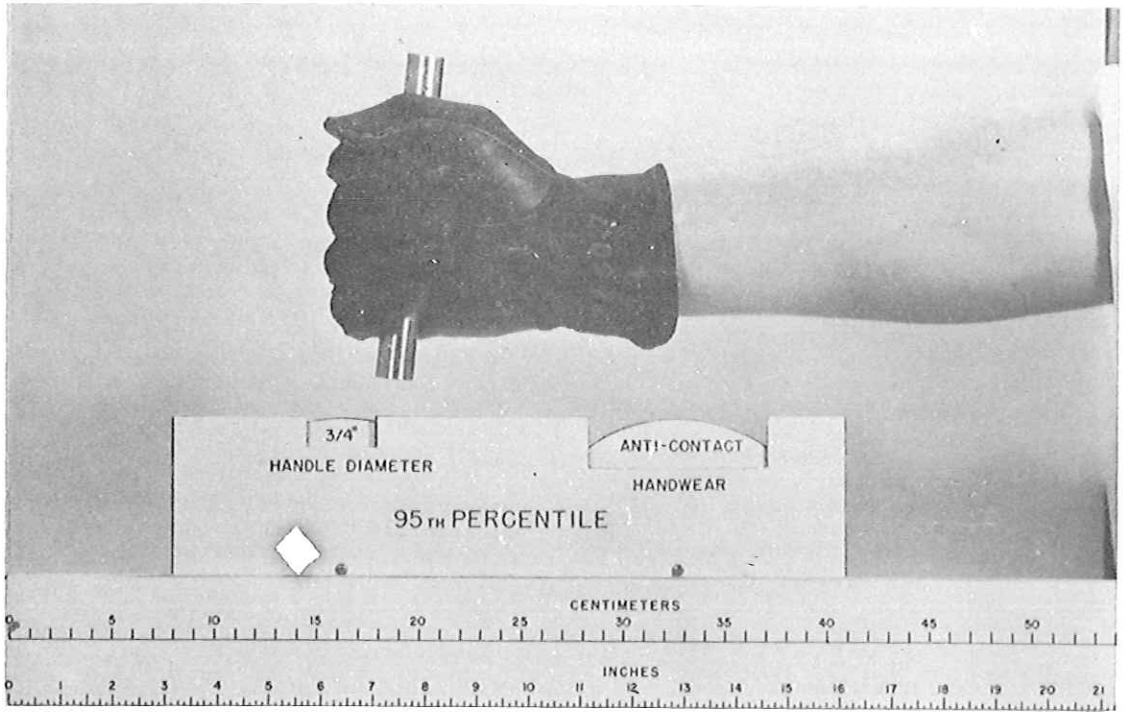

Figure 23. 3/4" handle diameter (View C)

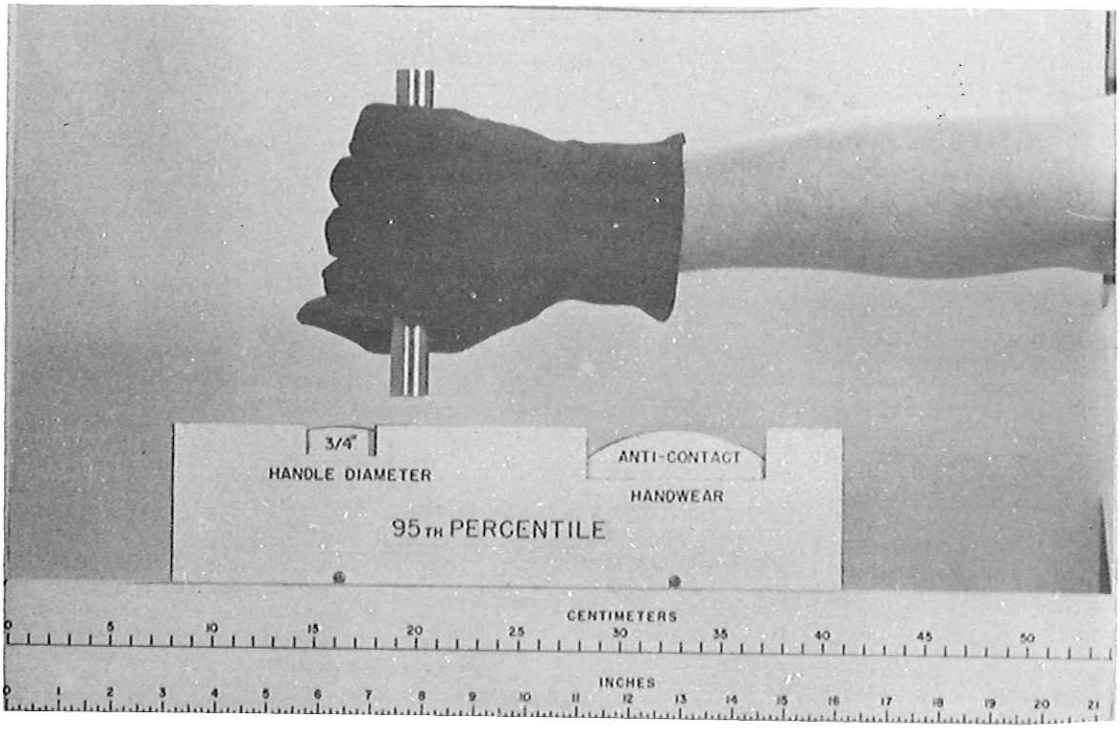

Figure 24. 3/4" handle diameter (View D)

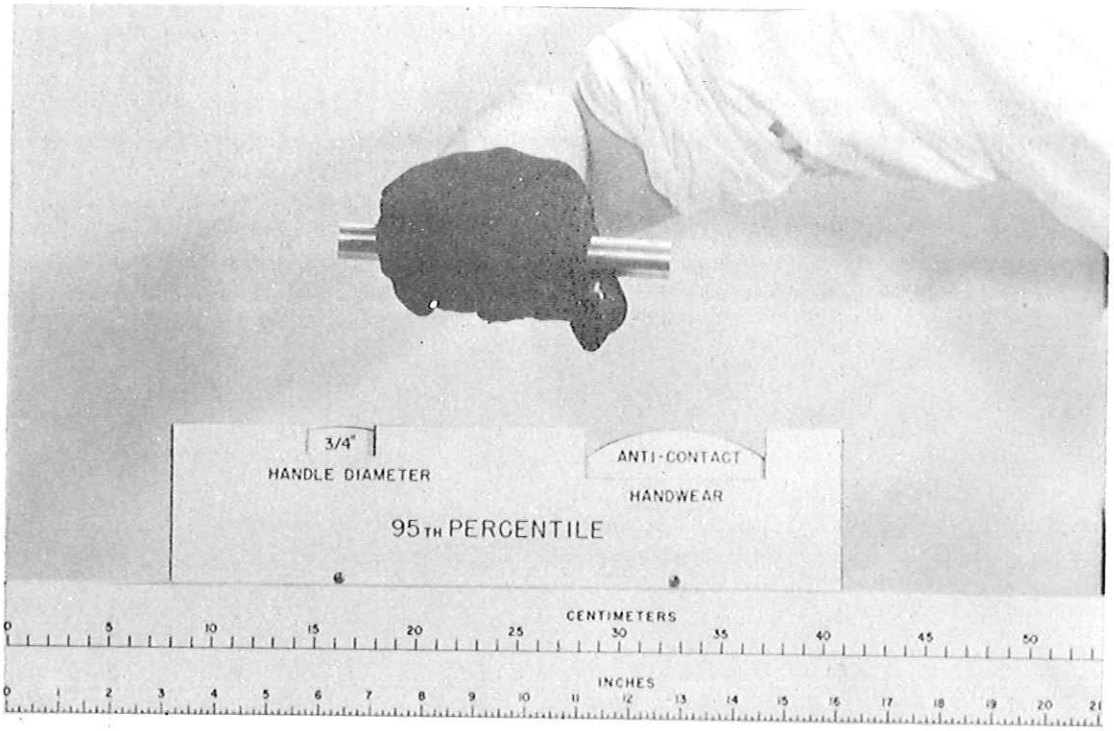

Figure 25. 3/4" handle diameter (View E)

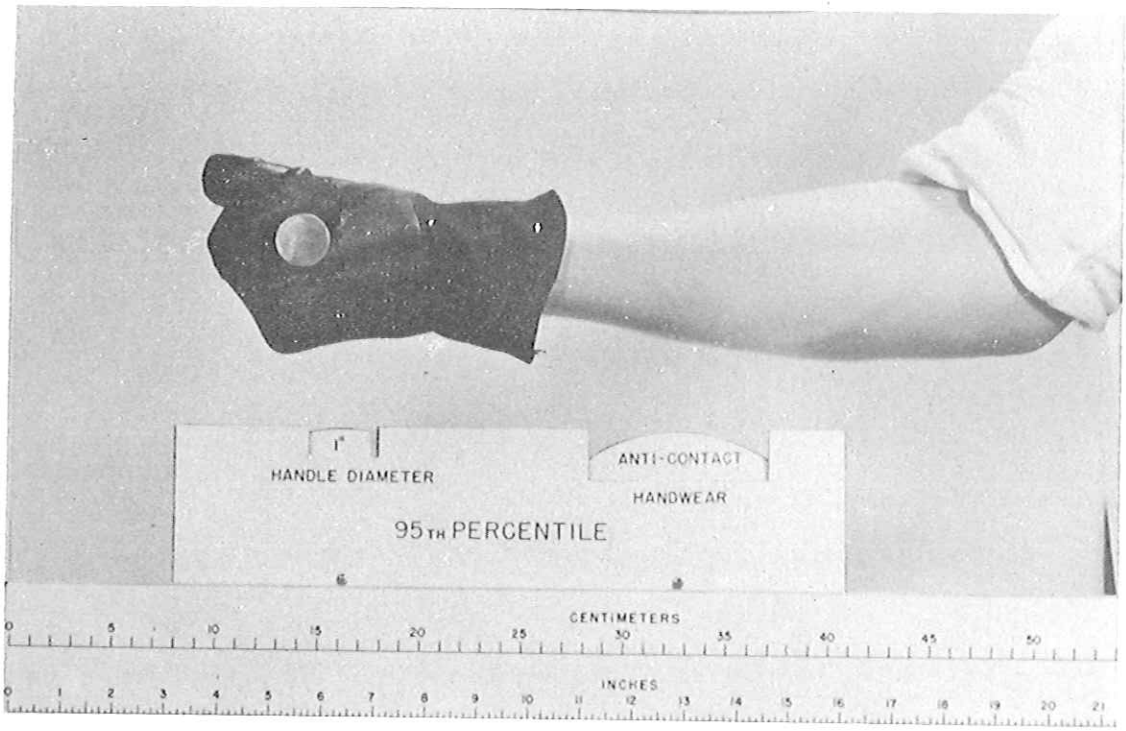

Figure 26. 1" handle diameter (View A)

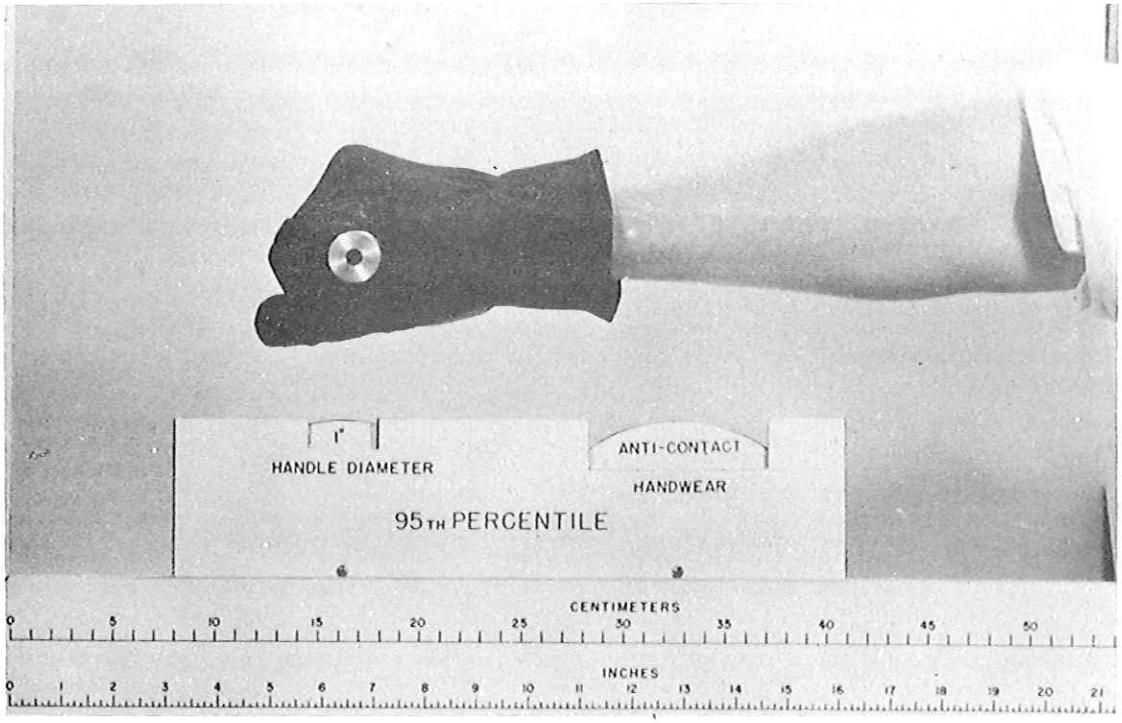

Figure 27. 1" handle diameter (View B)

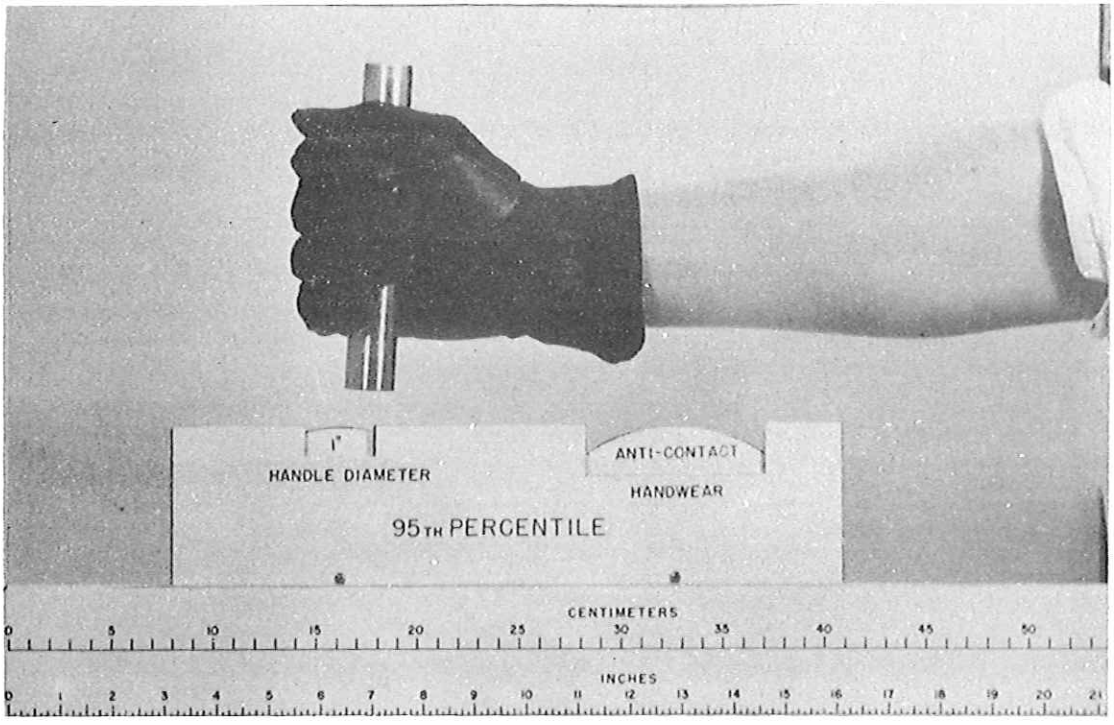

Figure 28. 1" handle diameter (View C)

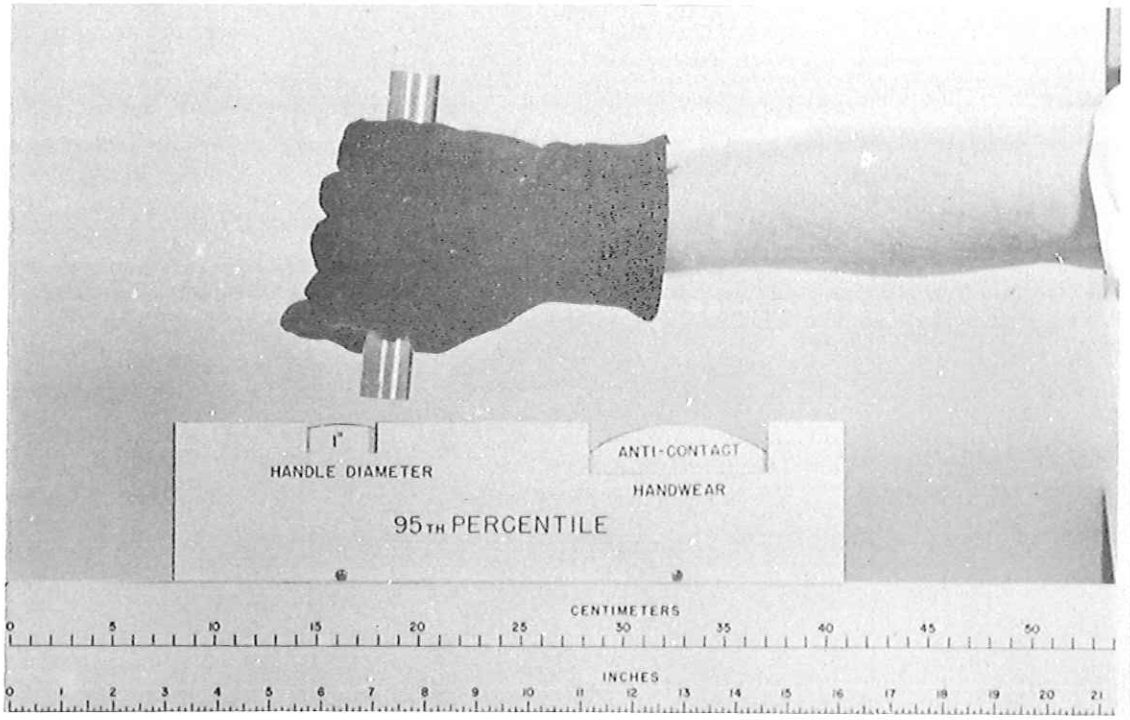

Figure 29. 1" handle diameter (View D)

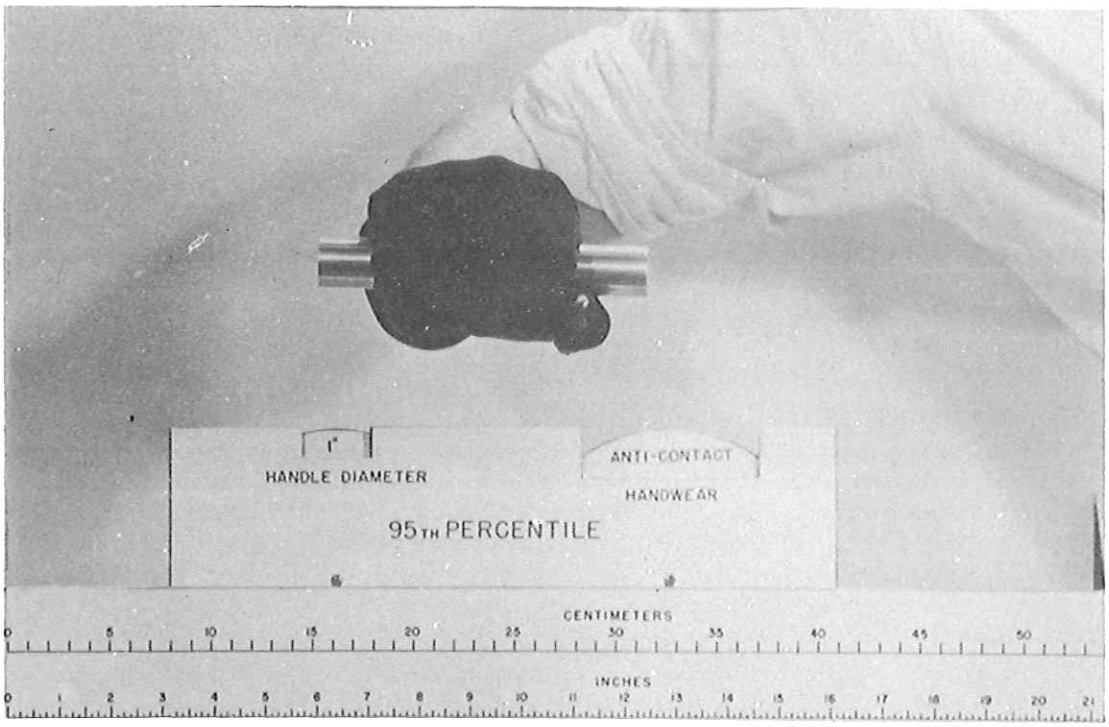

Figure 30. 1" handle diameter (View E)

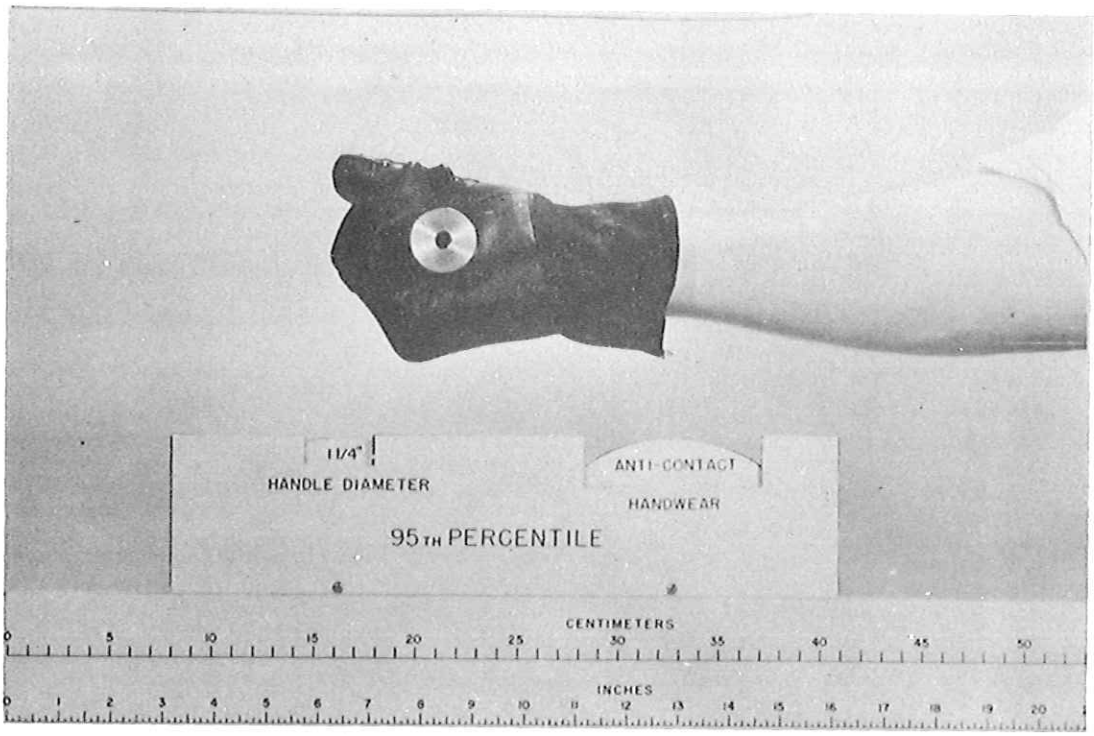

Figure 31. $1\frac{1}{4}$" handle diameter (View A)

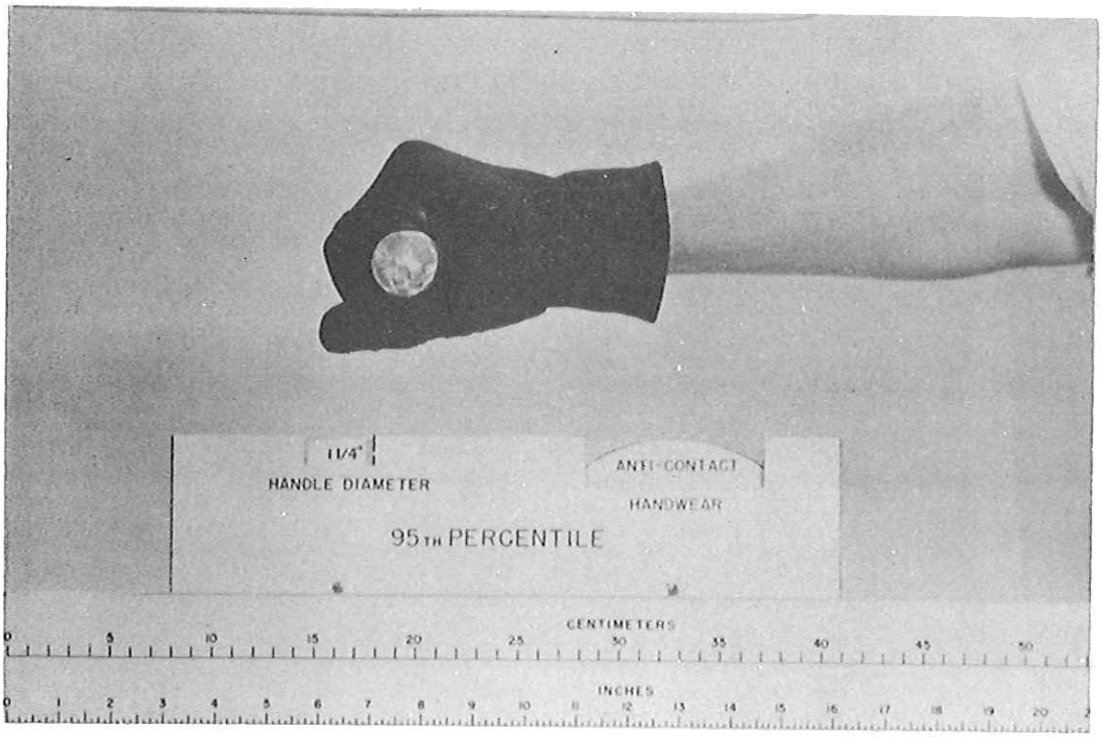

Figure 32. $1\frac{1}{4}$" handle diameter (View B)

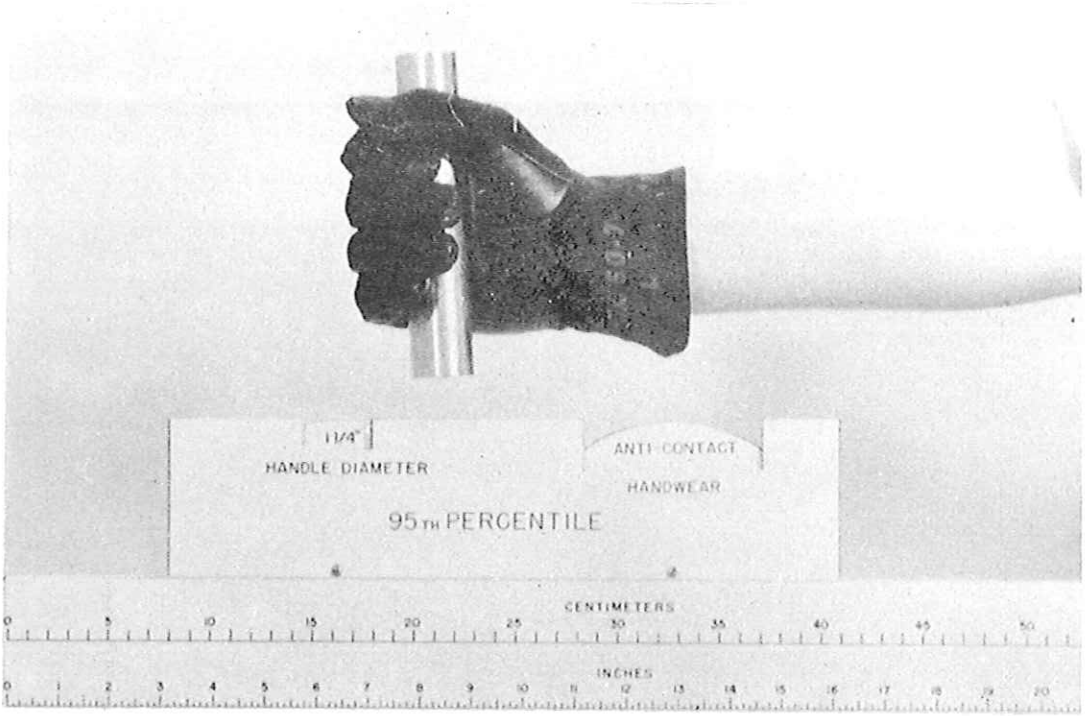

Figure 33. $1\frac{1}{4}$" handle diameter (View C)

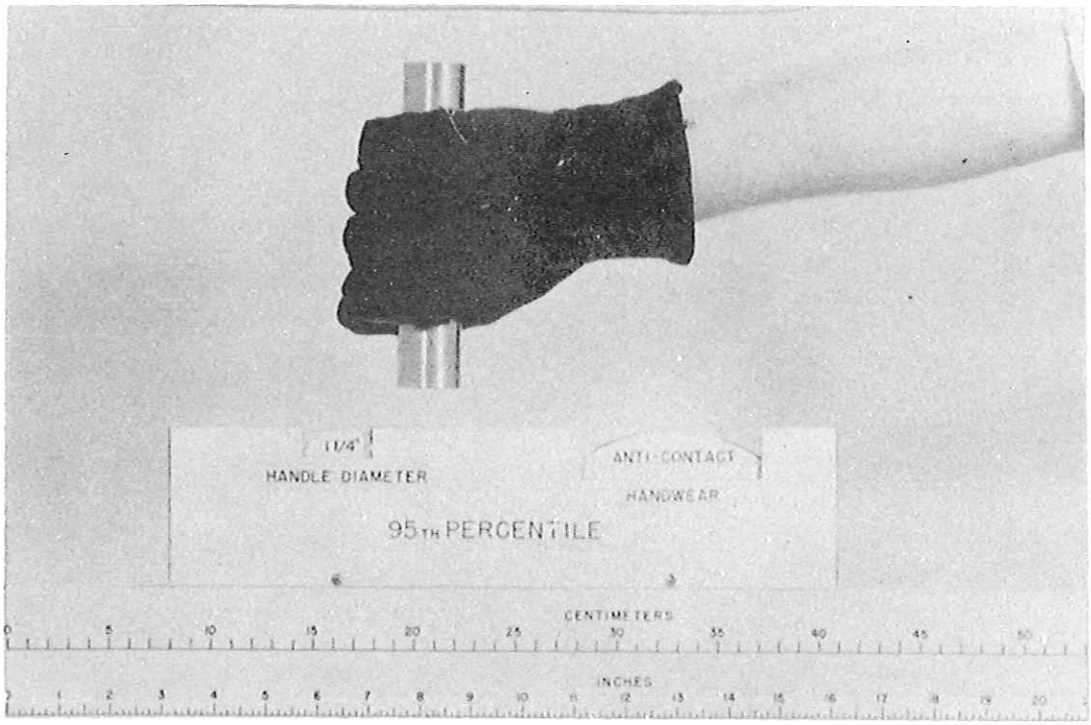

Figure 34. $1\frac{1}{4}$" handle diameter (View D)

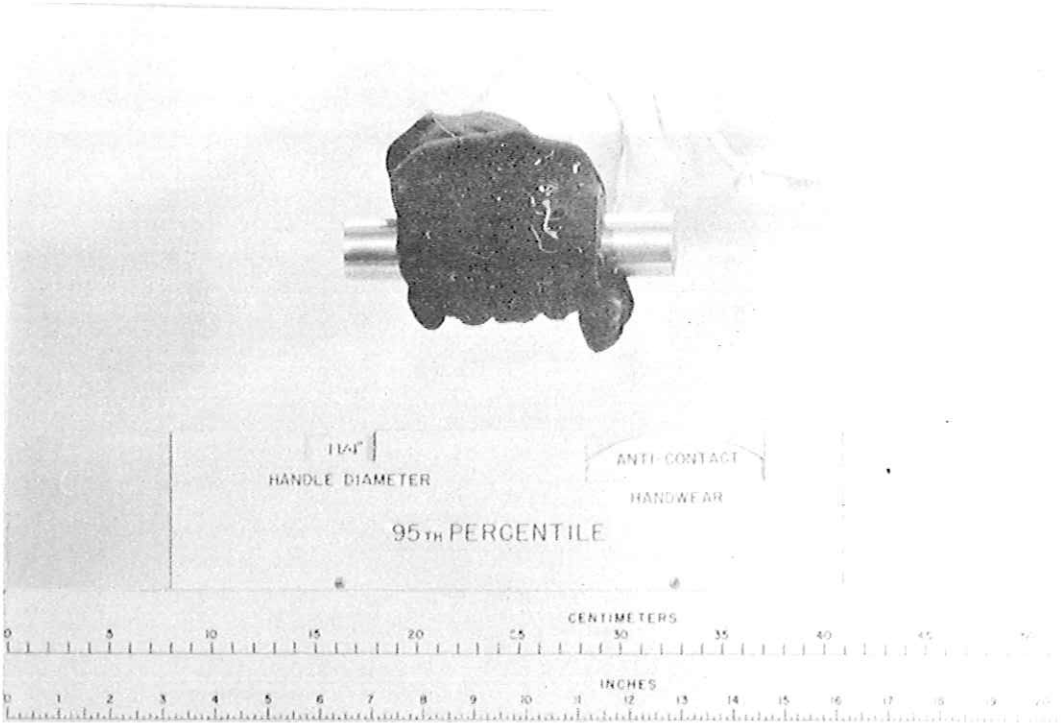

Figure 35. $1\frac{1}{4}$" handle diameter (View E)

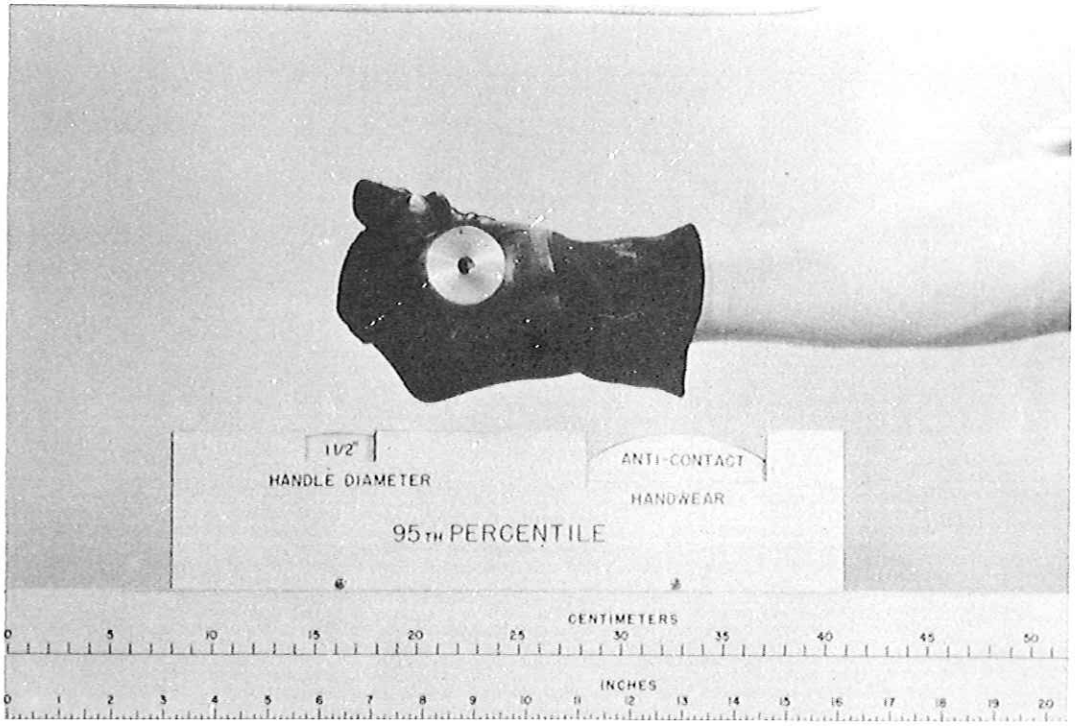

Figure 36. $1\frac{1}{2}$" handle diameter (View A)

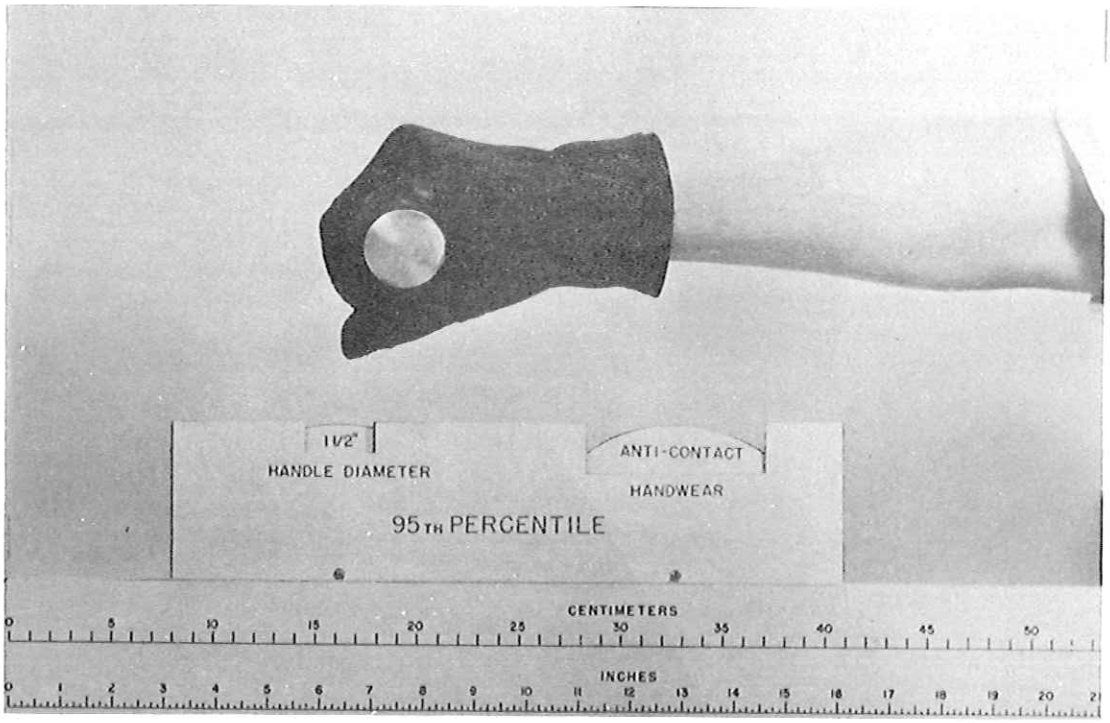

Figure 37. $1\frac{1}{2}$" handle diameter (View B)

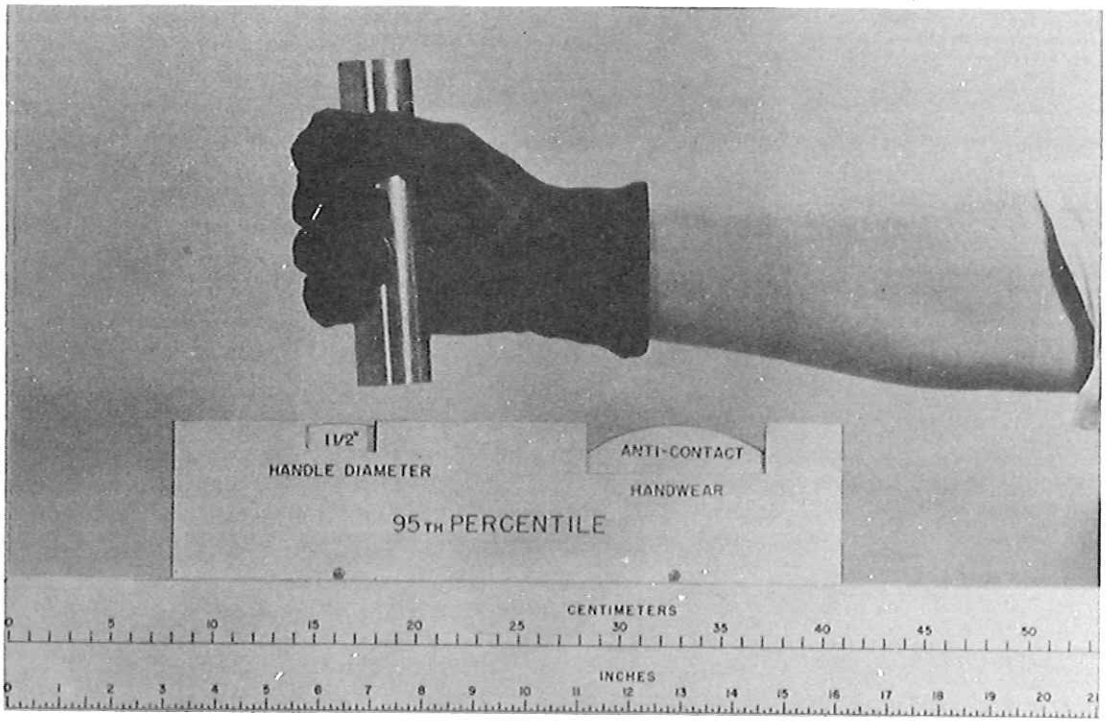

Figure 38. $1\frac{1}{2}$" handle diameter (View C)

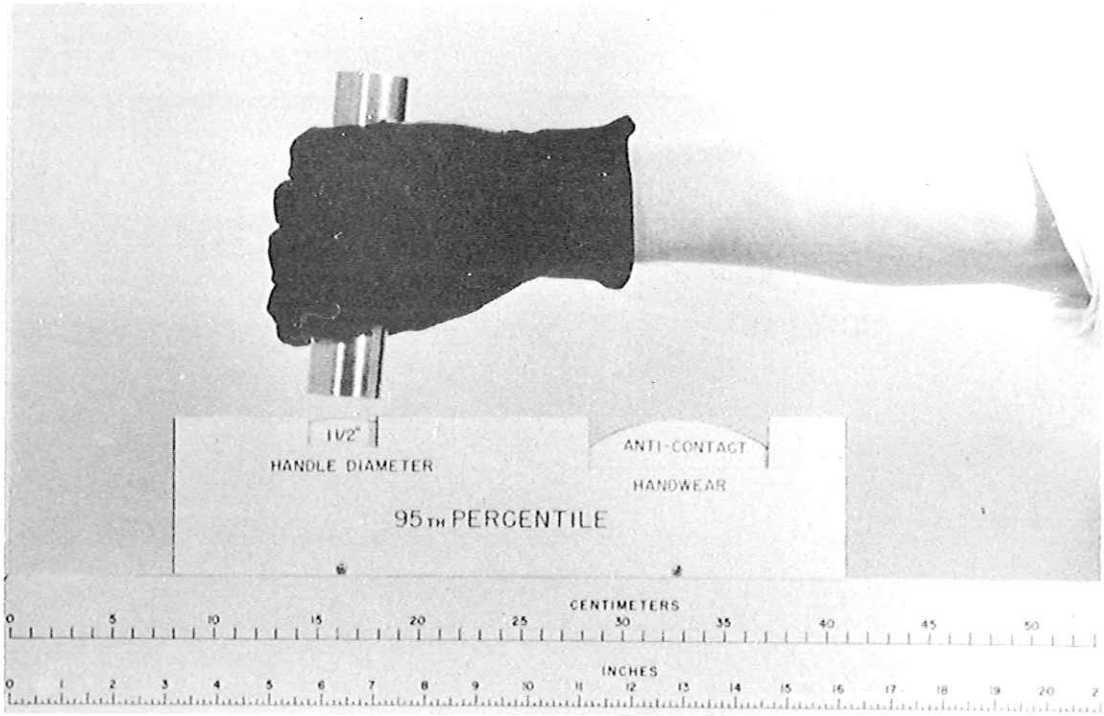

Figure 39. 1½" handle diameter (View D)

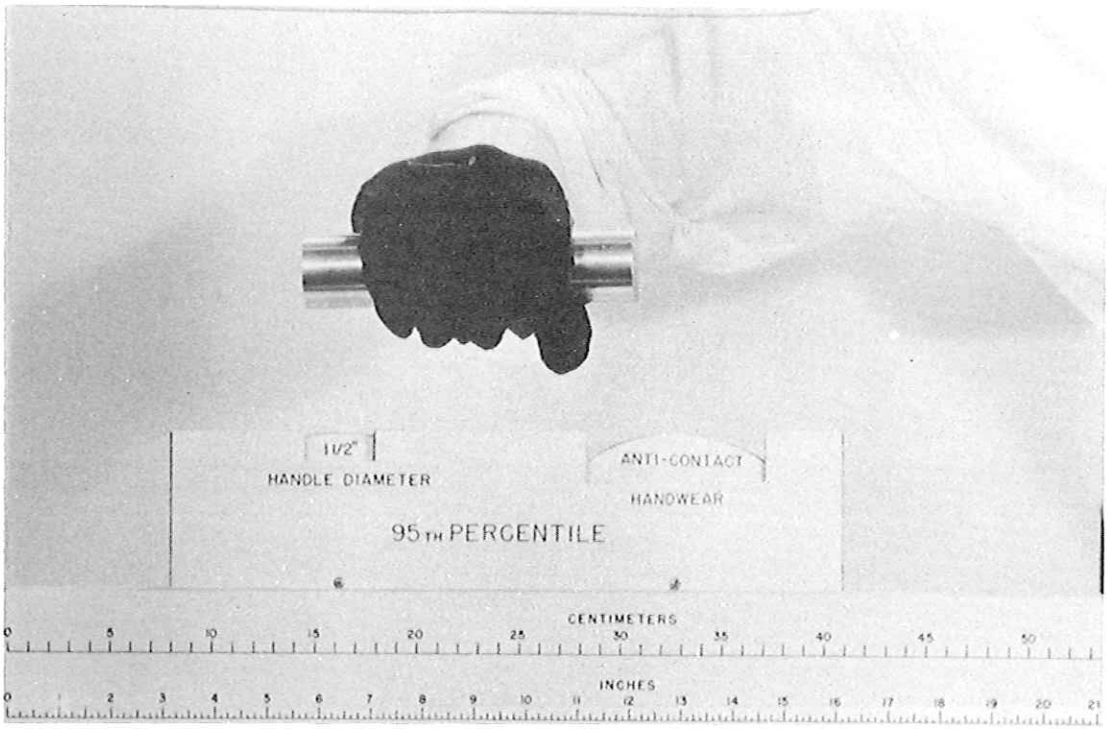

Figure 40. 1½" handle diameter (View E)

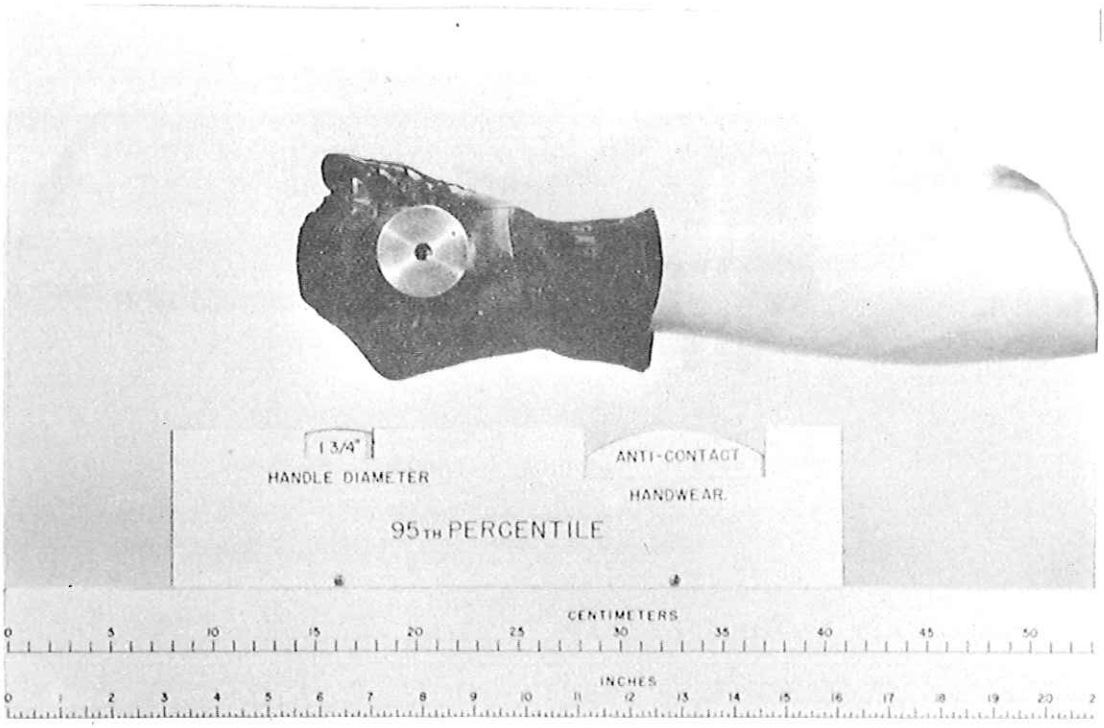

Figure 41. 1 3/4" handle diameter (View A)

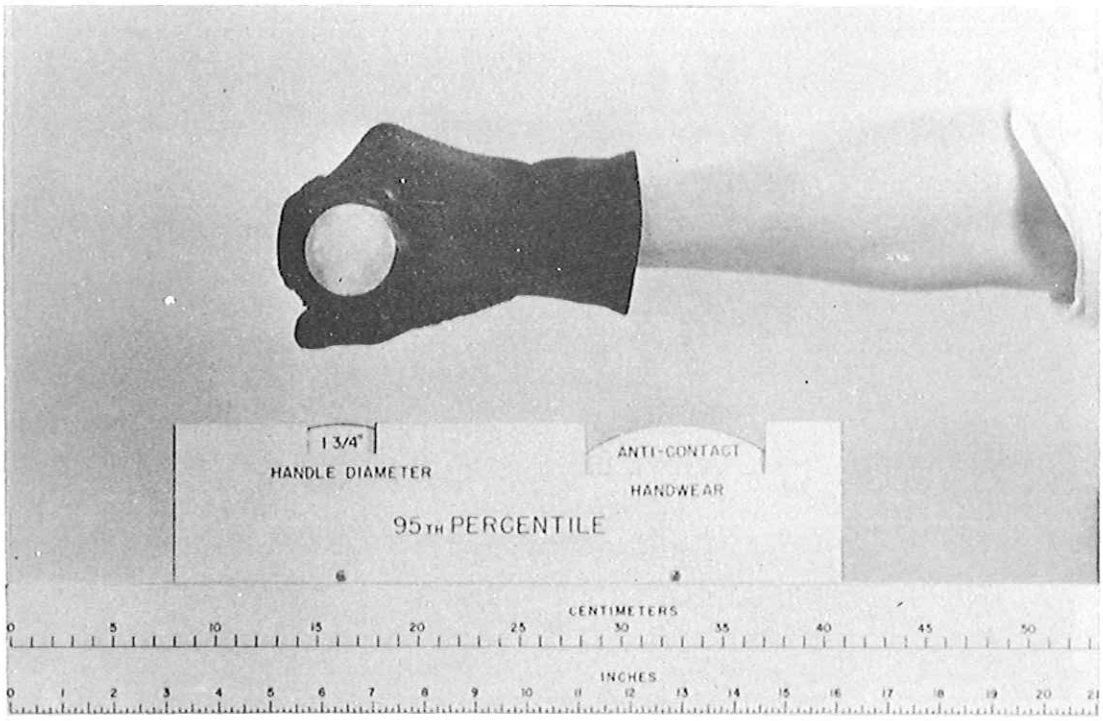

Figure 42. 1 3/4" handle diameter (View B)

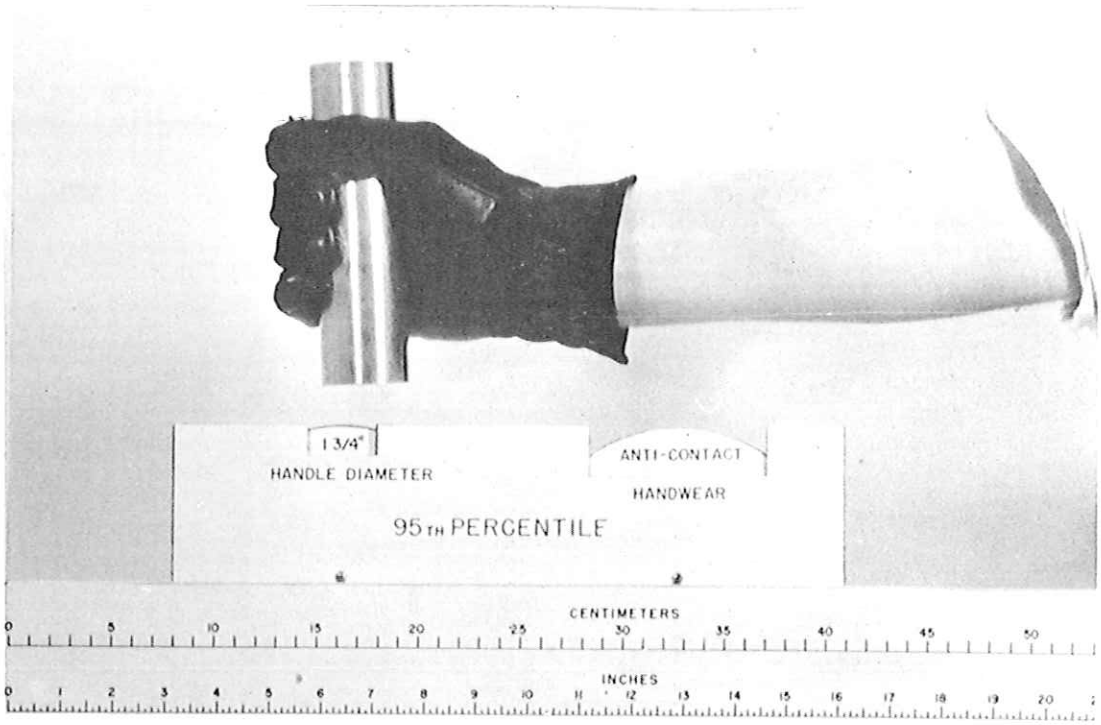

Figure 43. 1 3/4" handle diameter (View C)

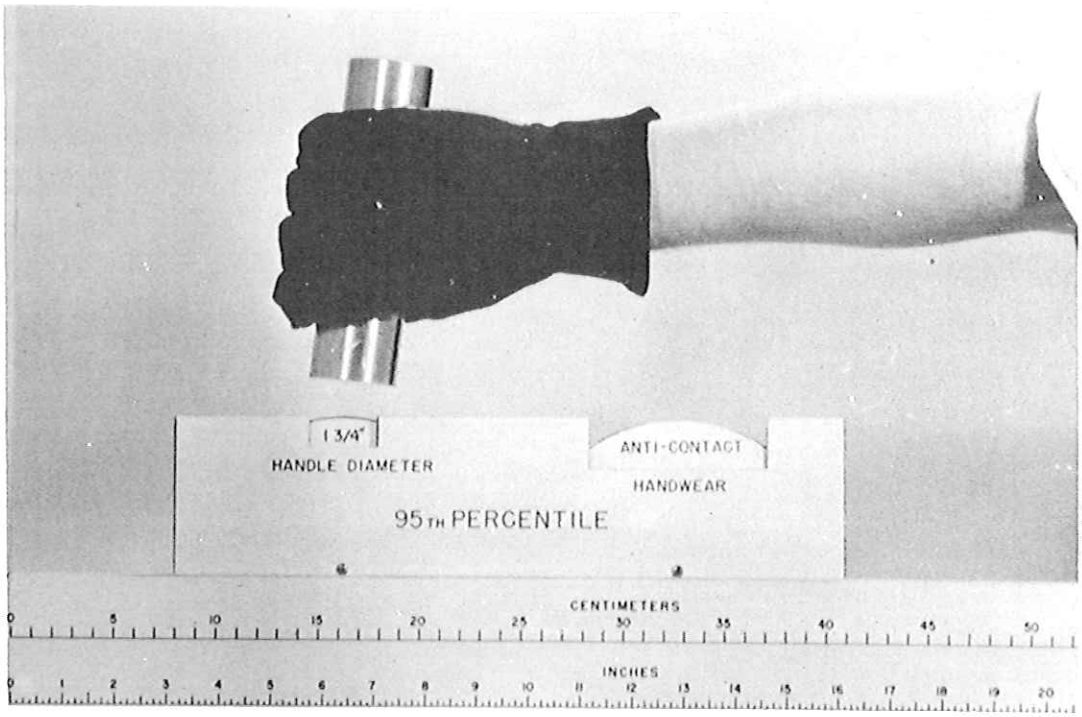

Figure 44. 1 3/4" handle diameter (View D)

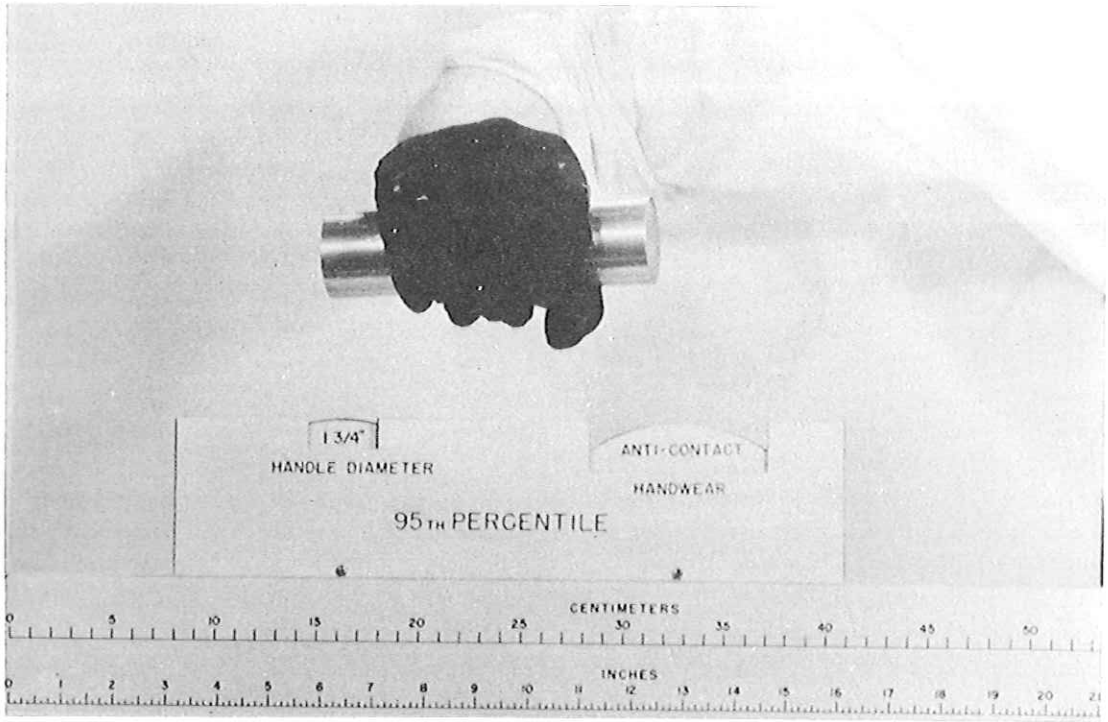

Figure 45. 1 3/4" handle diameter (View E)

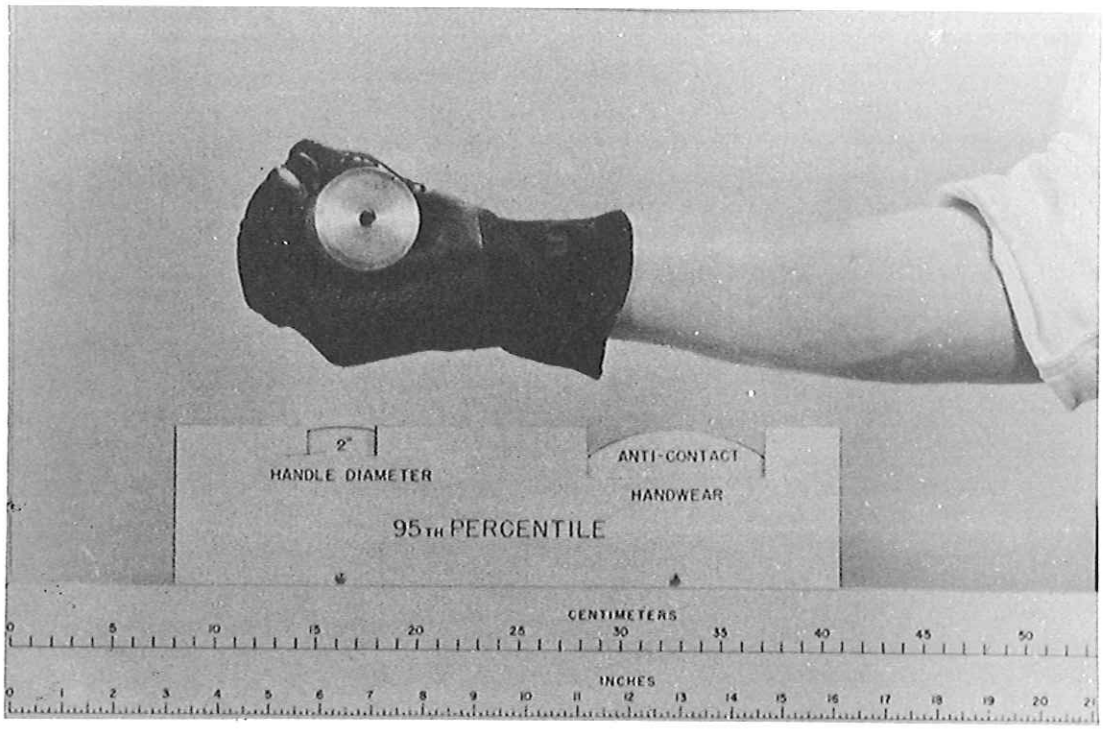

Figure 46. 2" handle diameter (View A)

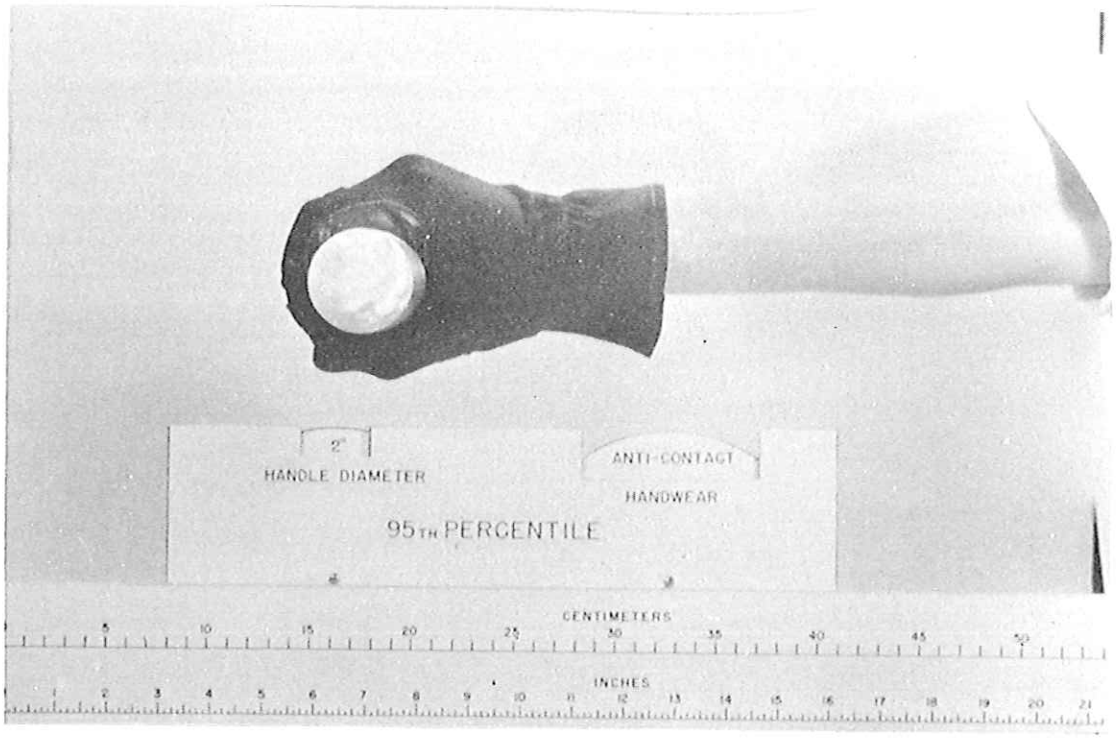

Figure 47. 2" handle diameter (View B)

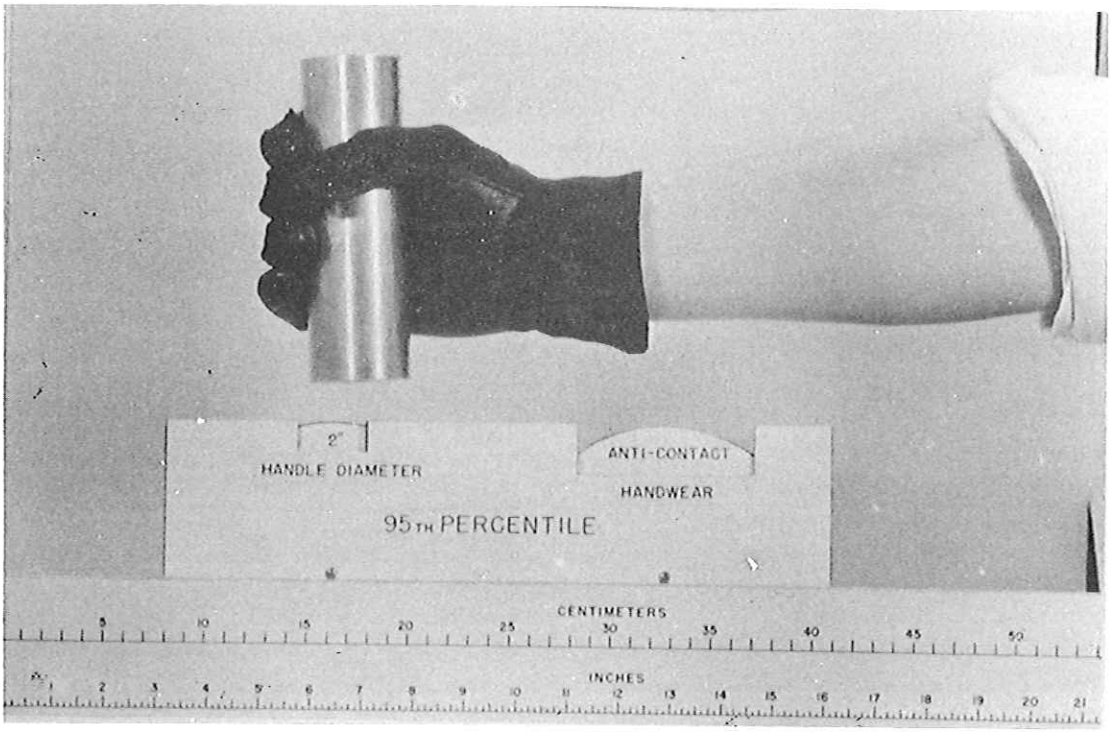

Figure 48. 2" handle diameter (View C)

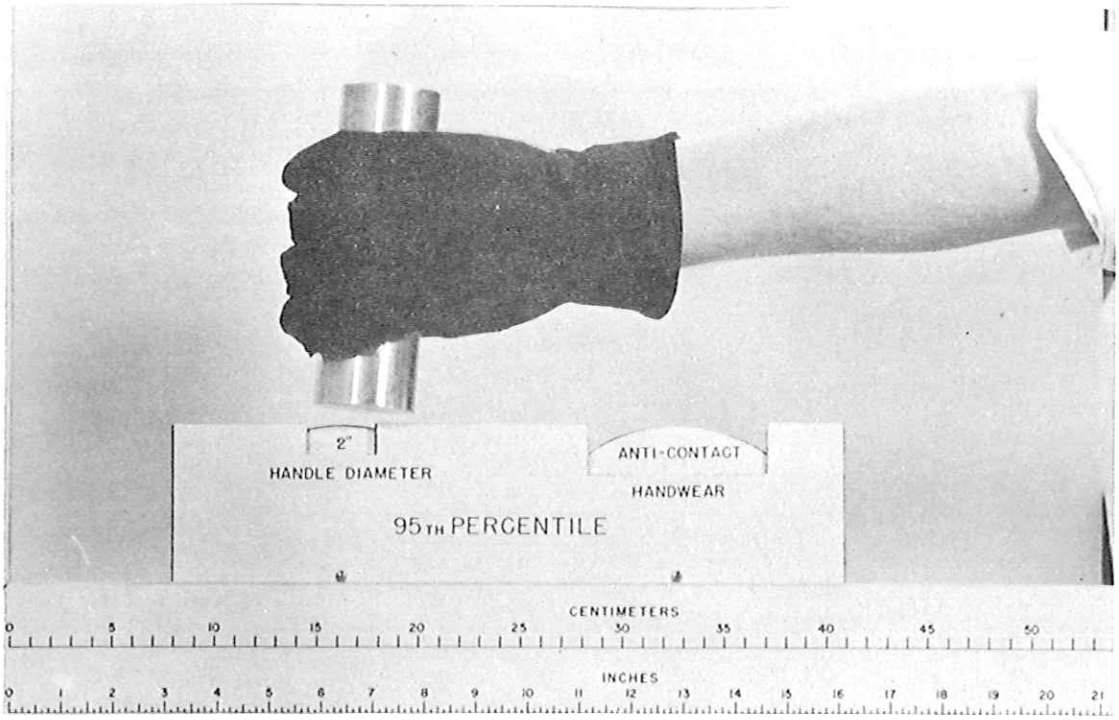

Figure 49. 2" handle diameter (View D)

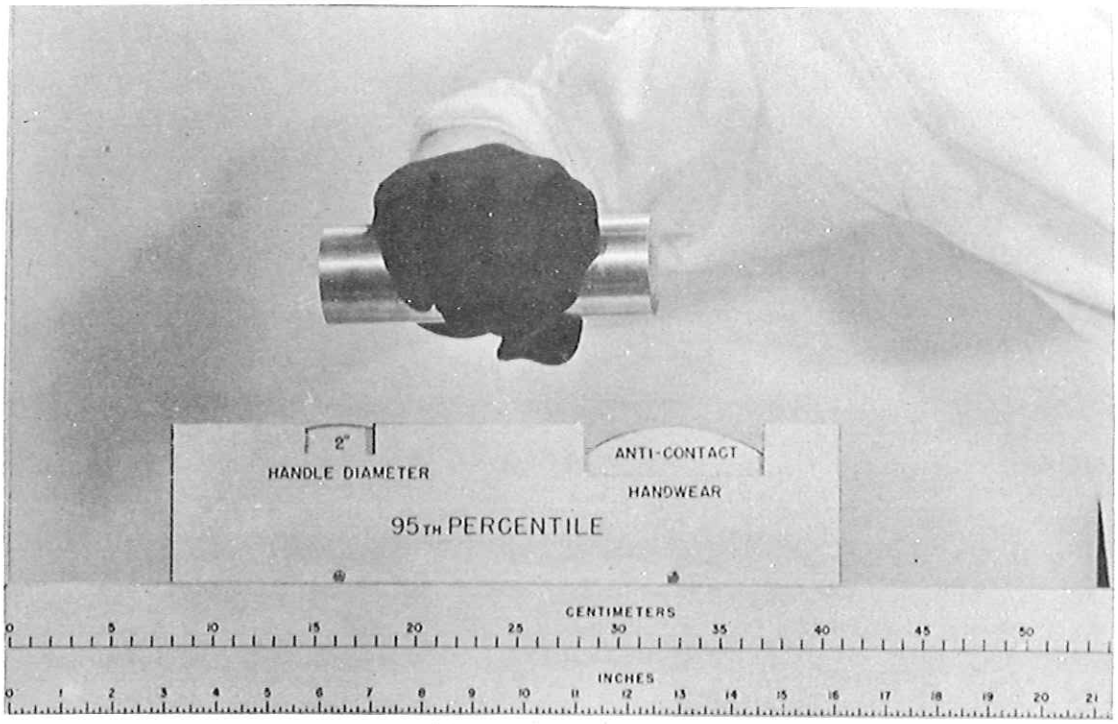

Figure 50. 2" handle diameter (View E)

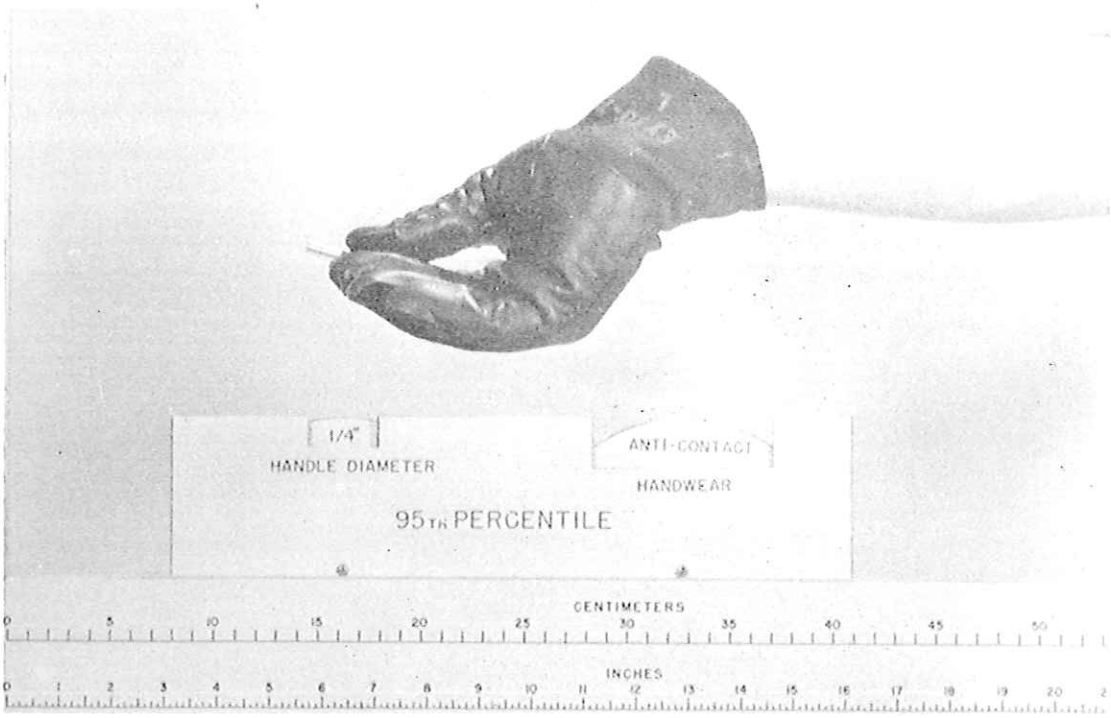

Figure 51. $\frac{1}{4}$" knob diameter (View A)

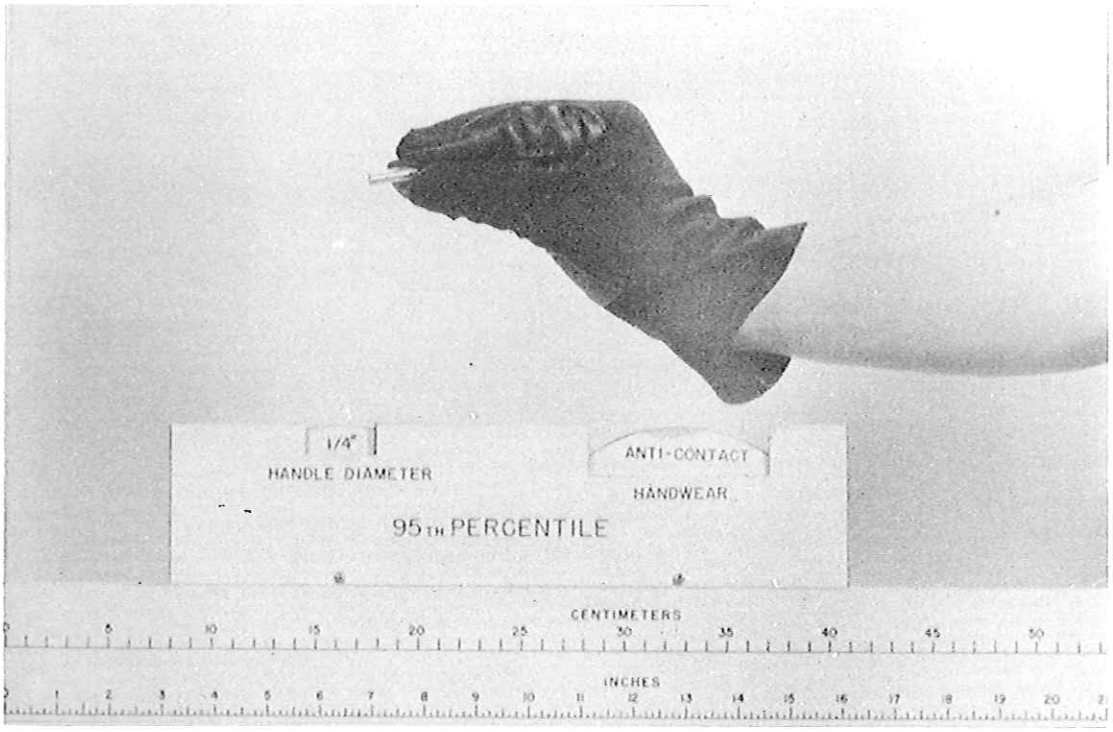

Figure 52. $\frac{1}{4}$" knob diameter (View B)

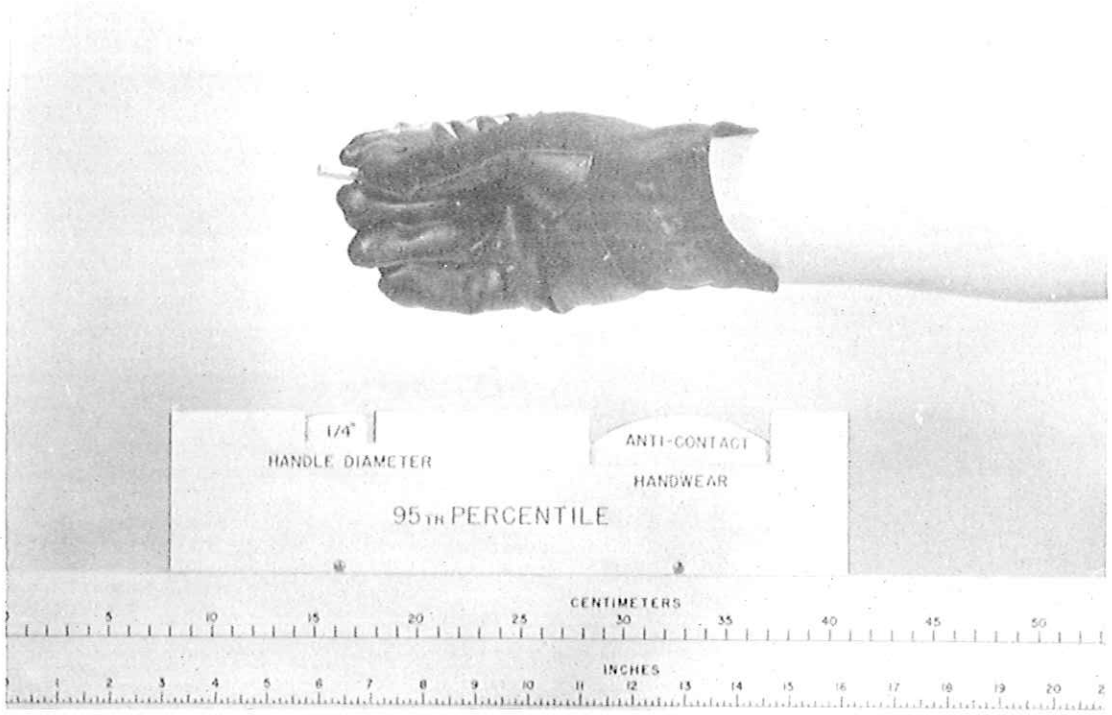

Figure 53. $\frac{1}{4}$" knob diameter (View C)

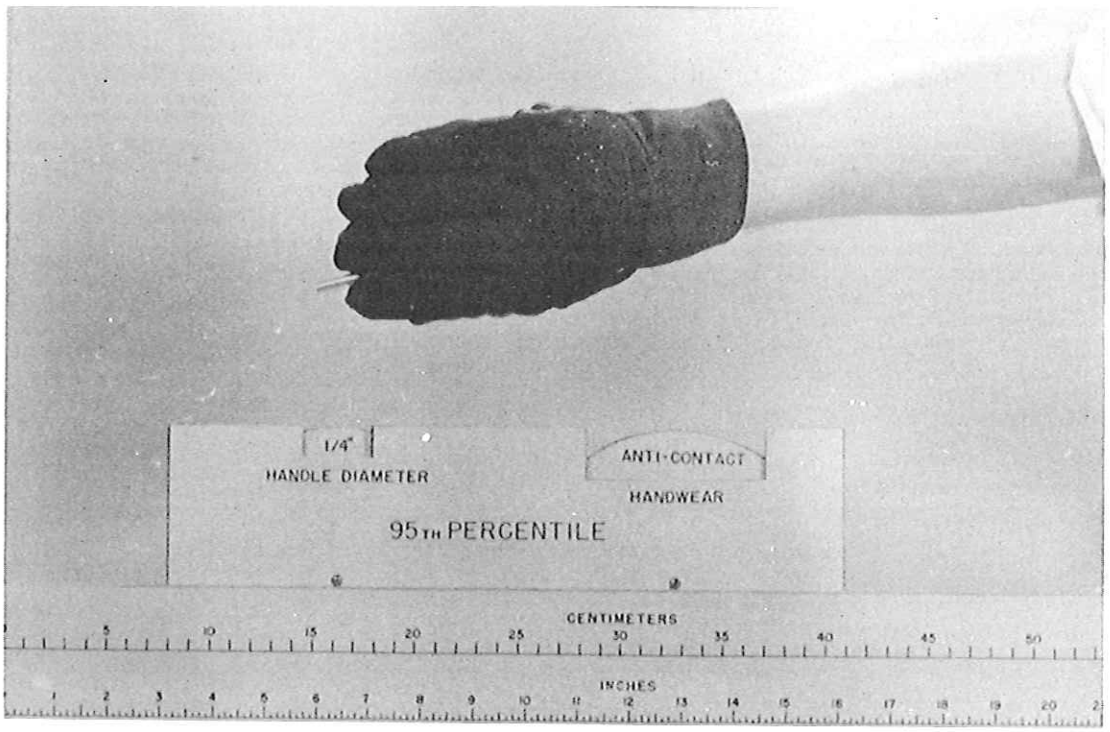

Figure 54. $\frac{1}{4}$" knob diameter (View D)

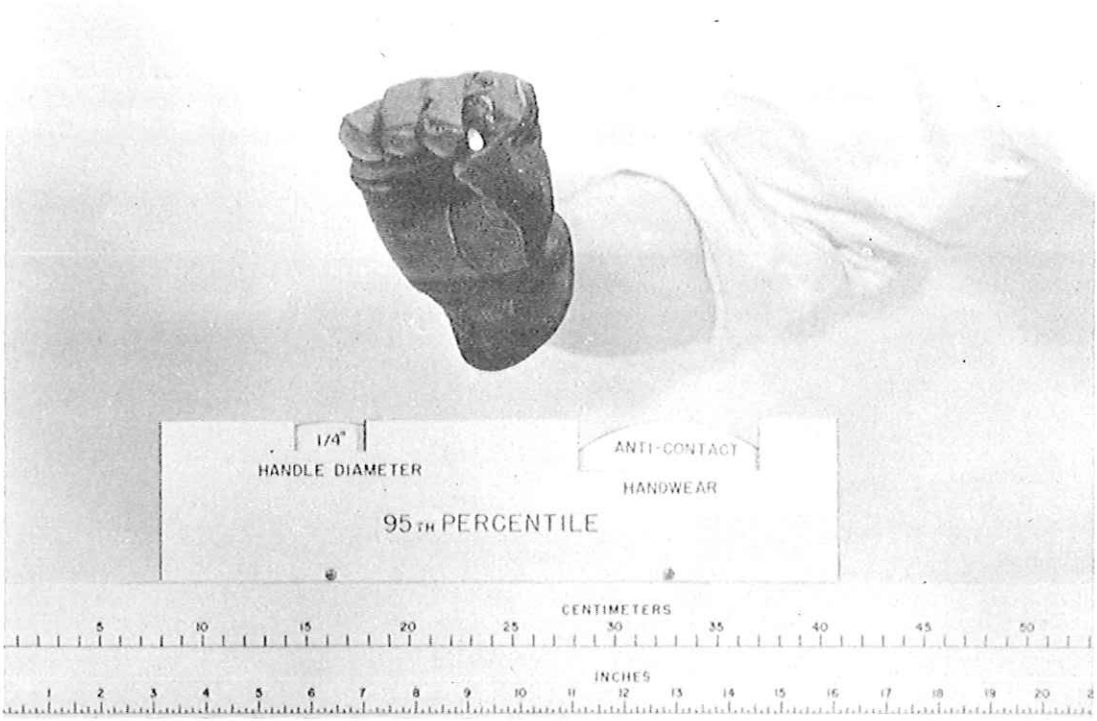

Figure 55. $\frac{1}{4}$" knob diameter (View E)

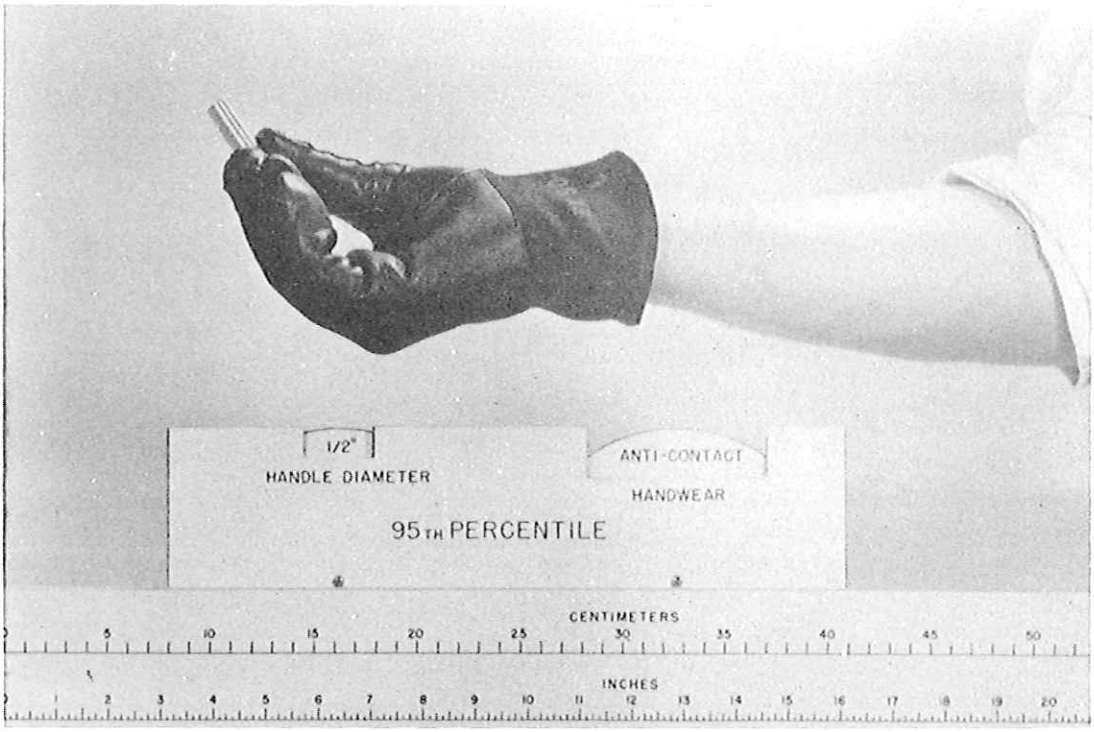

Figure 56. $\frac{1}{2}$" knob diameter (View A)

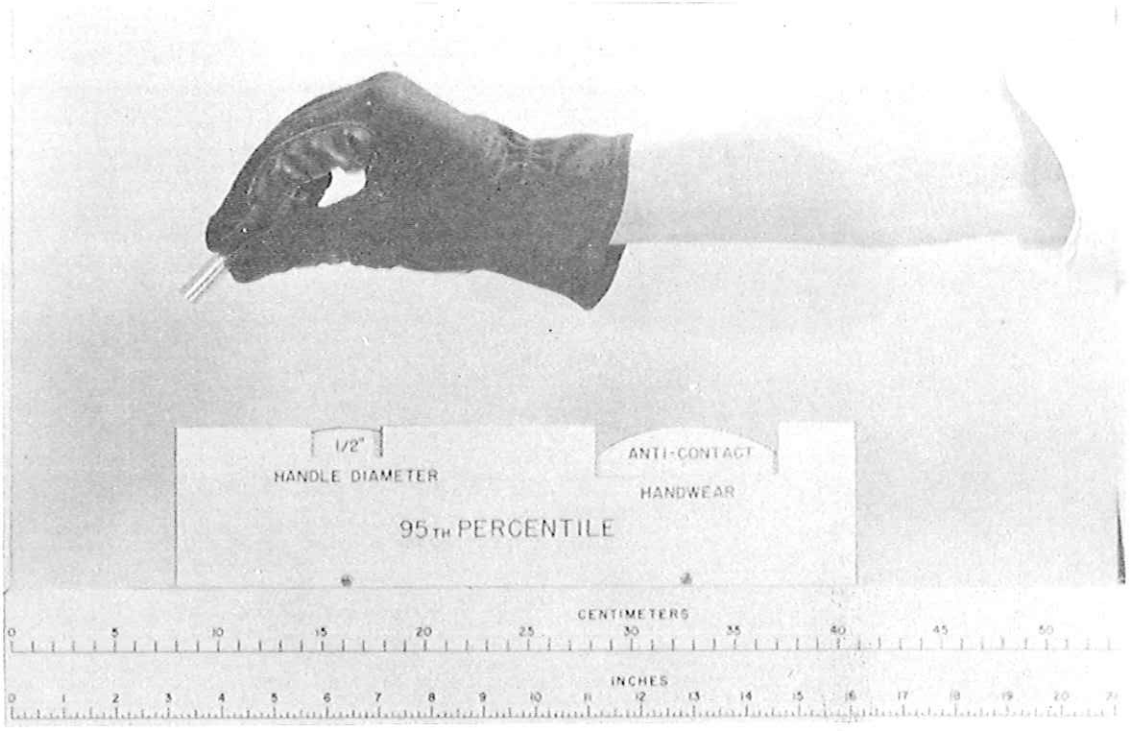

Figure 57. ½" knob diameter (View B)

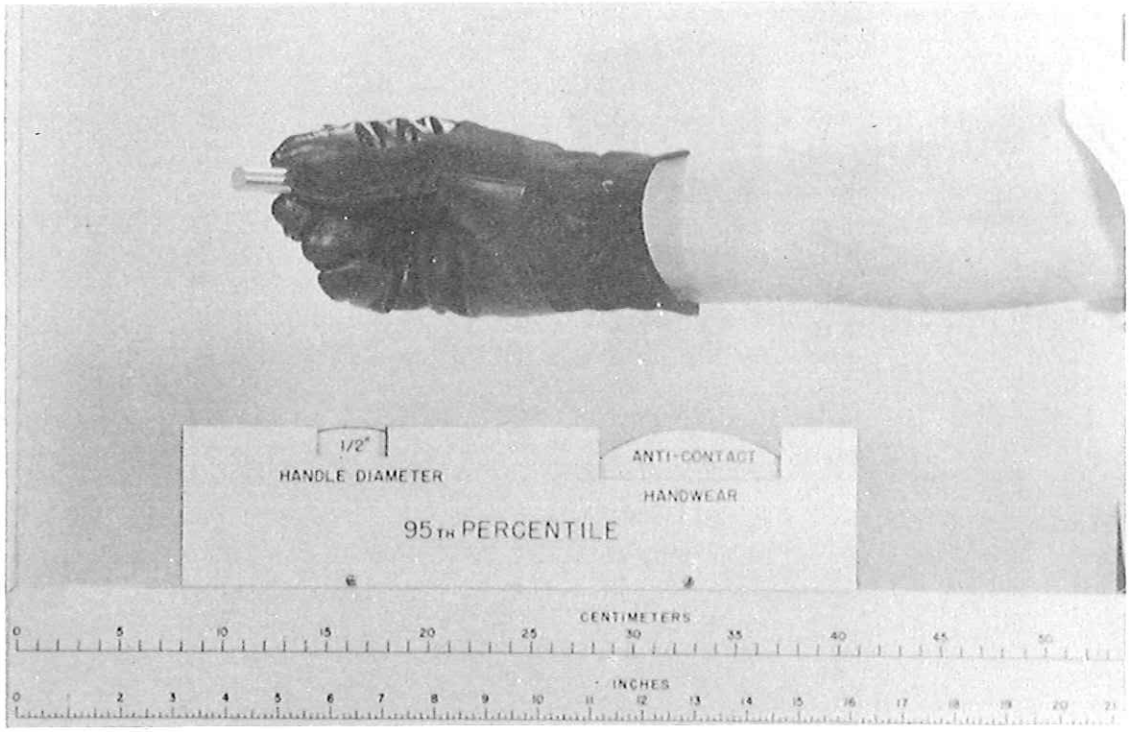

Figure 58. ½" knob diameter (View C)

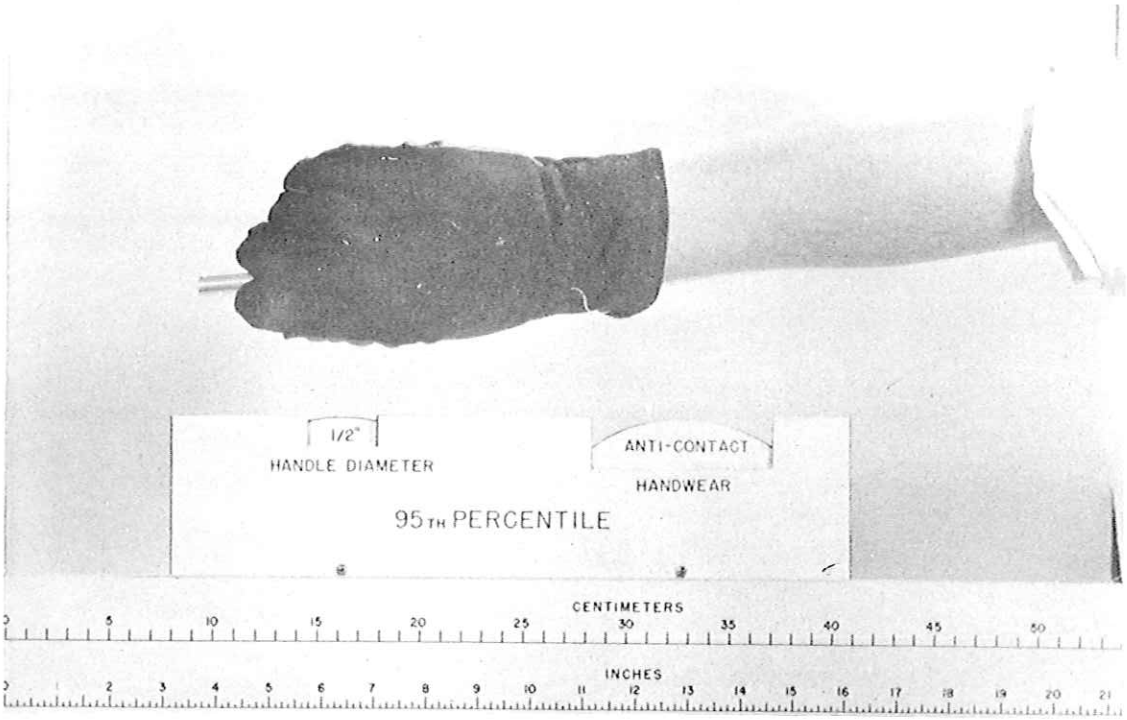

Figure 59. ½" knob diameter (View D)

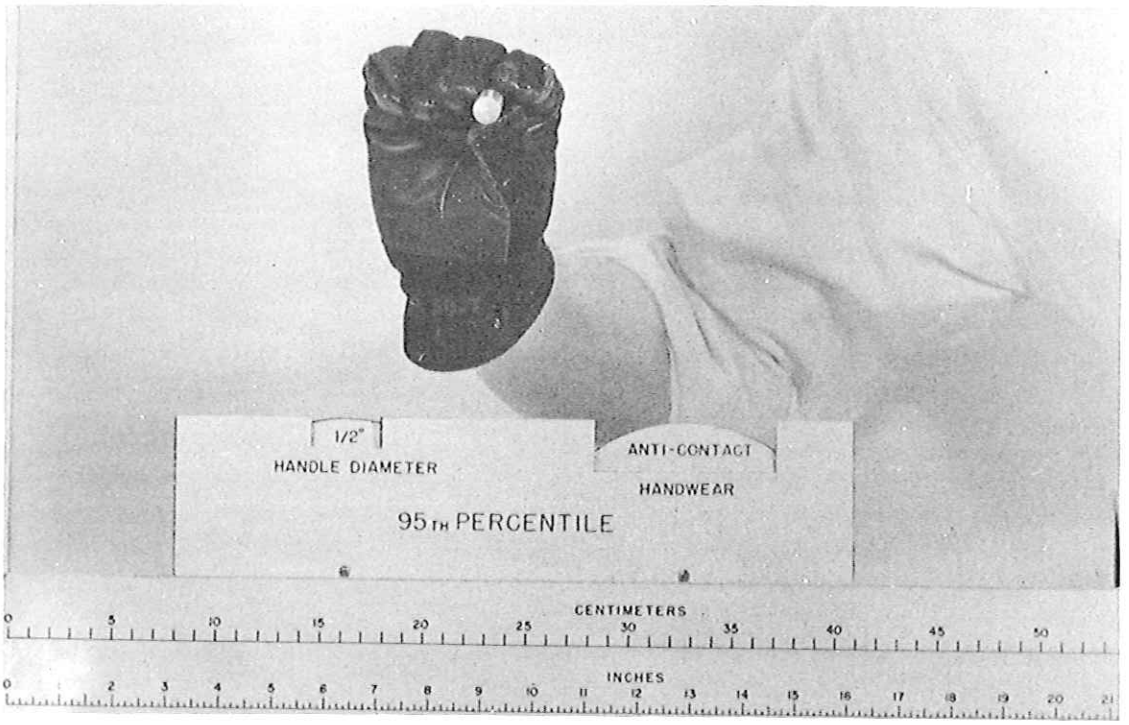

Figure 60. ½" knob diameter (View E)

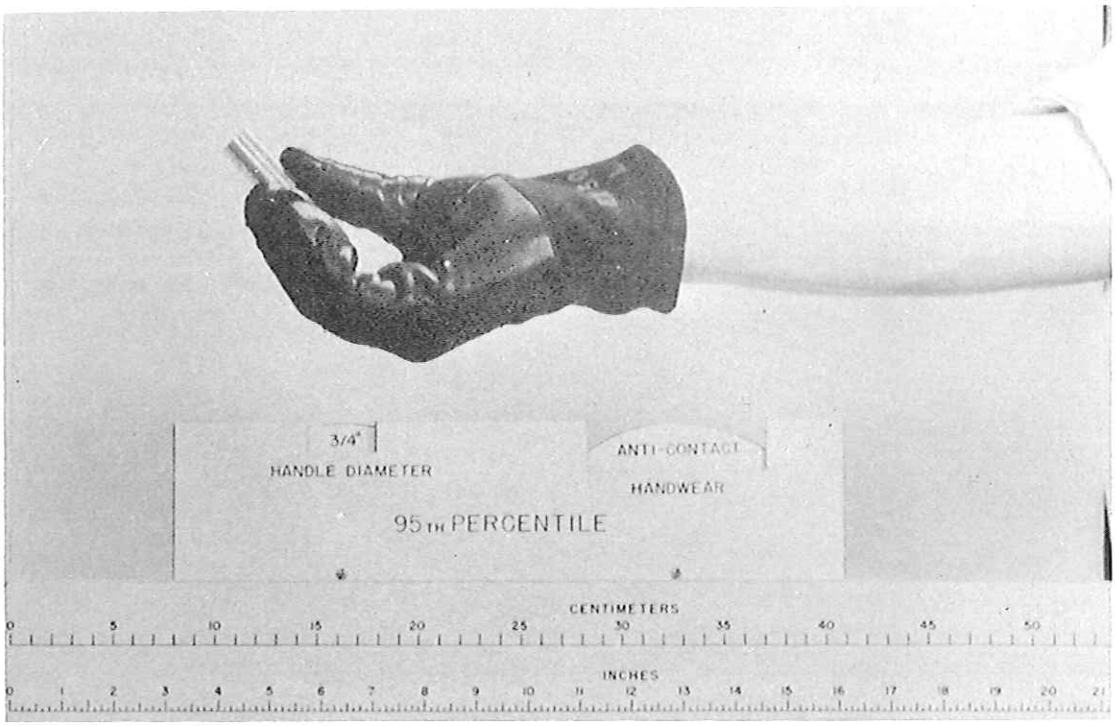

Figure 61. 3/4" knob diameter (View A)

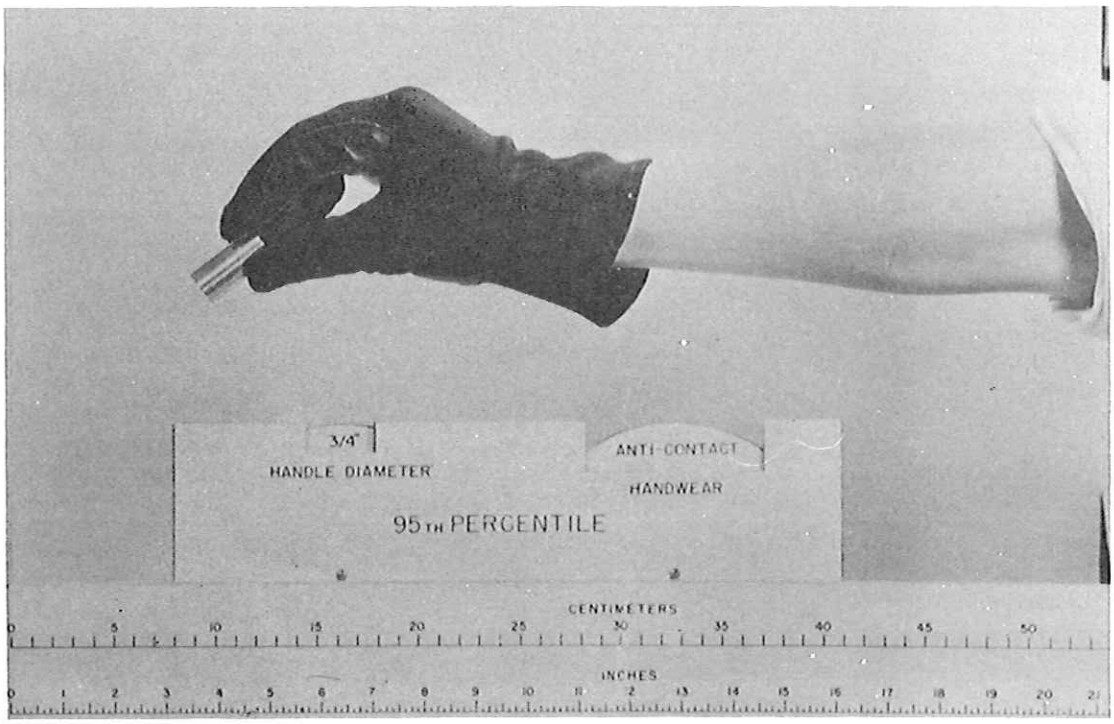

Figure 62. 3/4" knob diameter (View B)

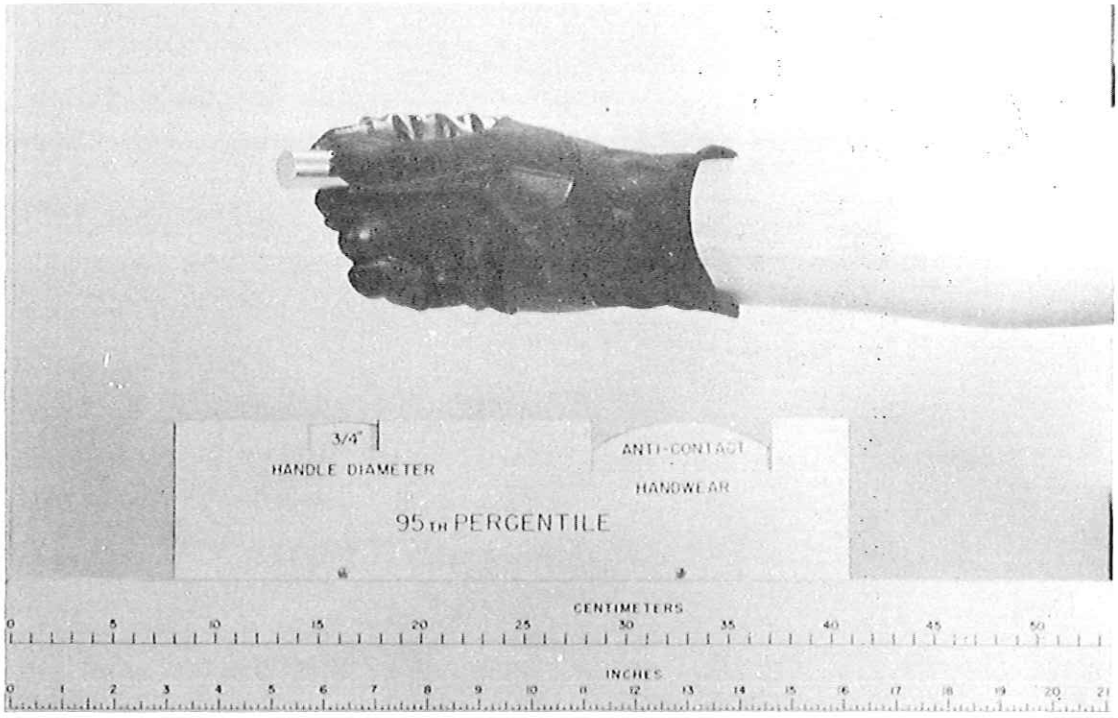

Figure 63. 3/4" knob diameter (View C)

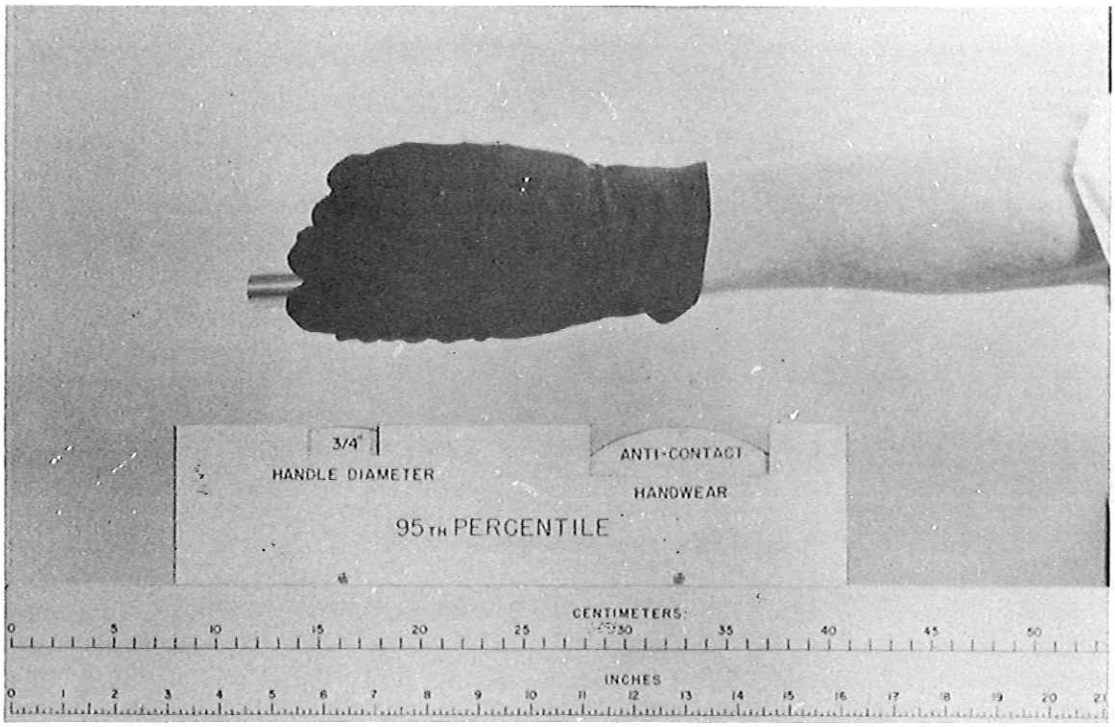

Figure 64. 3/4" knob diameter (View D)

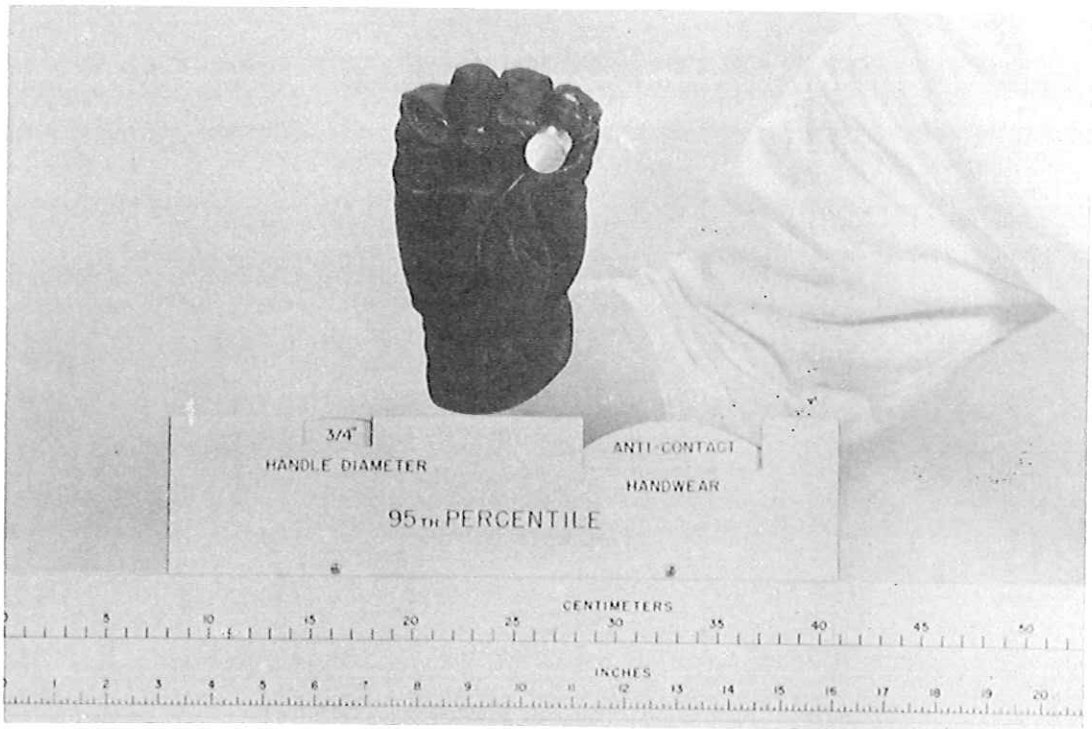

Figure 65. 3/4" knob diameter (View E)

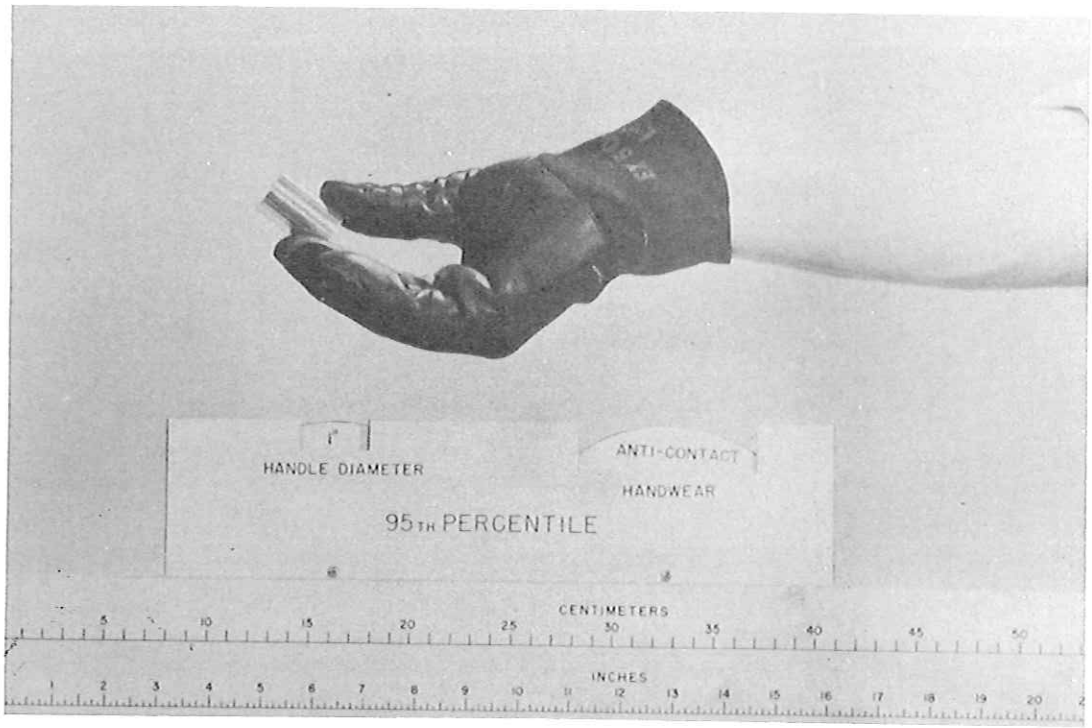

Figure 66. 1" knob diameter (View A)

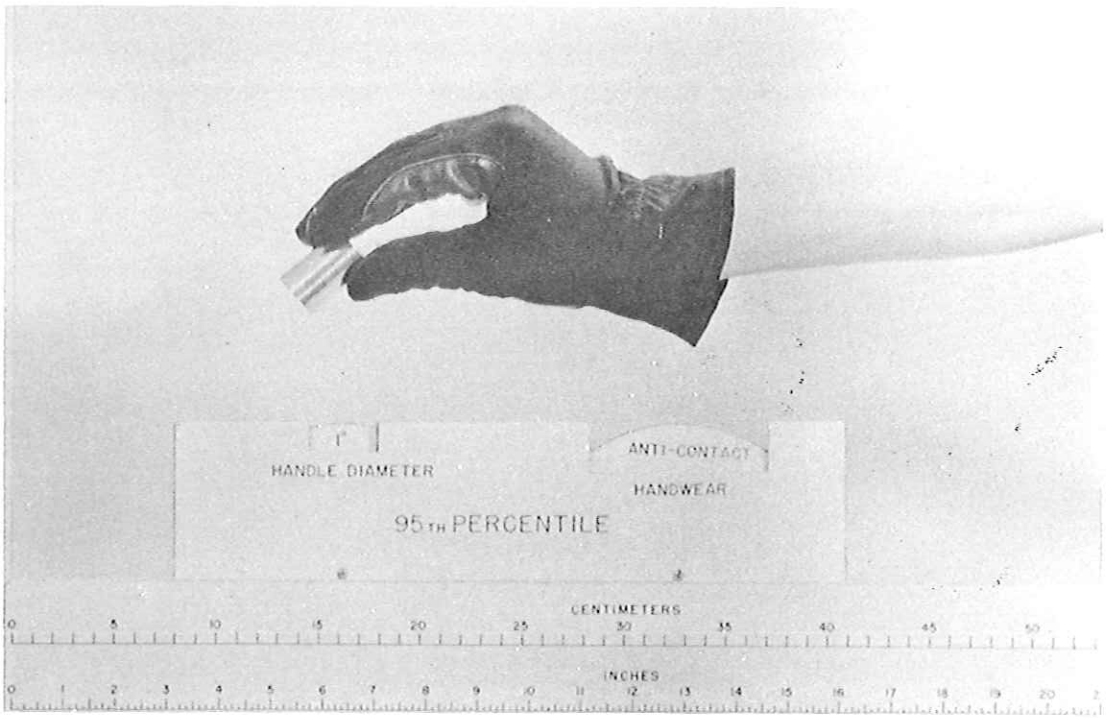

Figure 67. 1" knob diameter (View B)

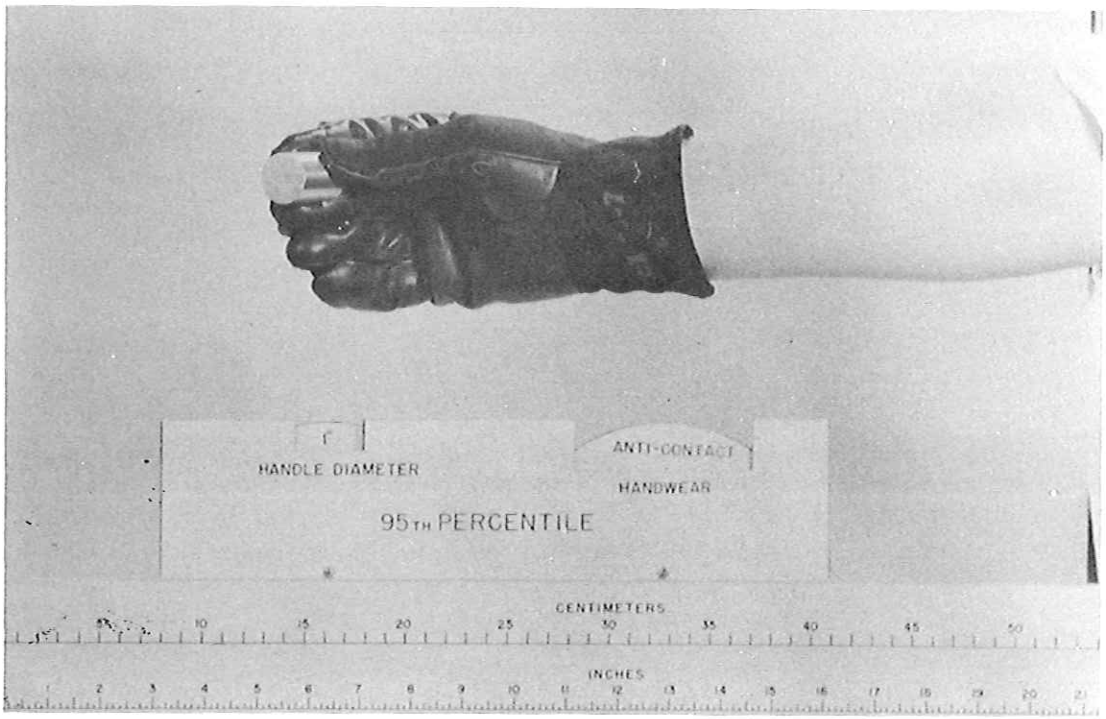

Figure 68. 1" knob diameter (View C)

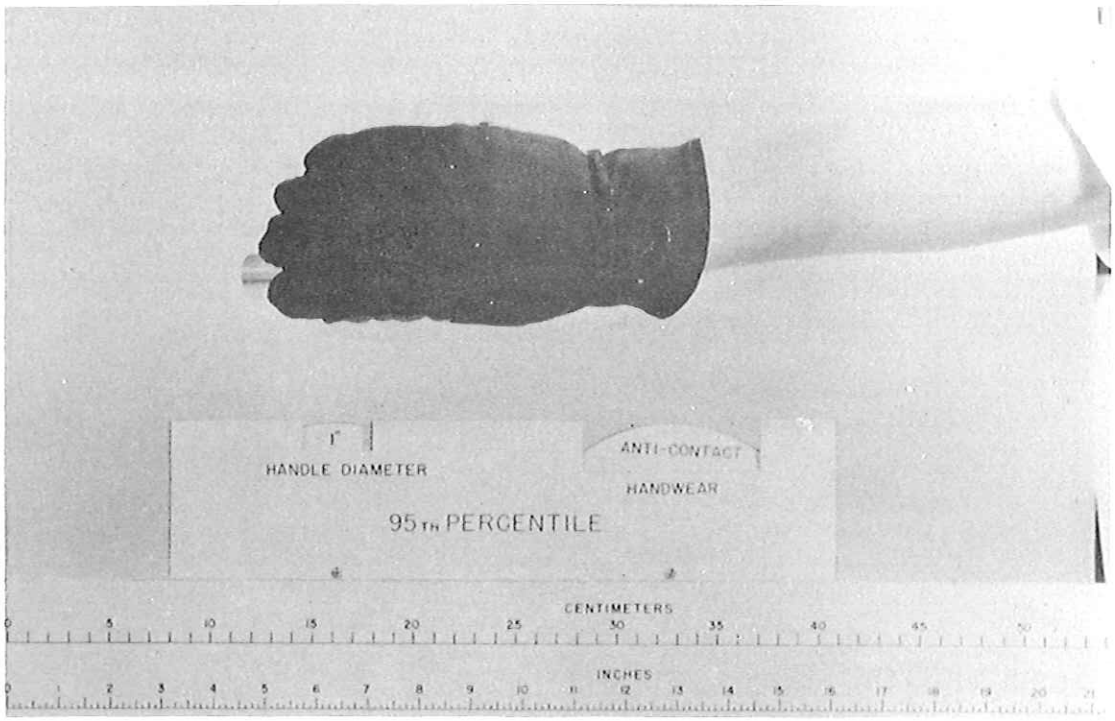

Figure 69. 1" knob diameter (View D)

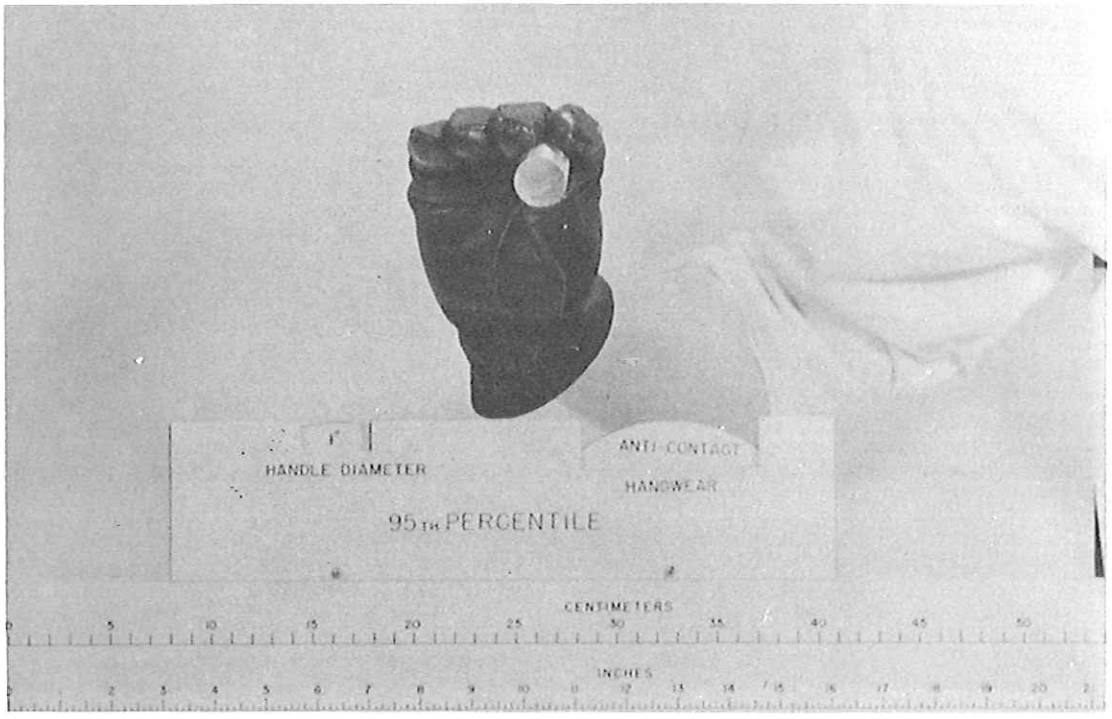

Figure 70. 1" knob diameter (View E)

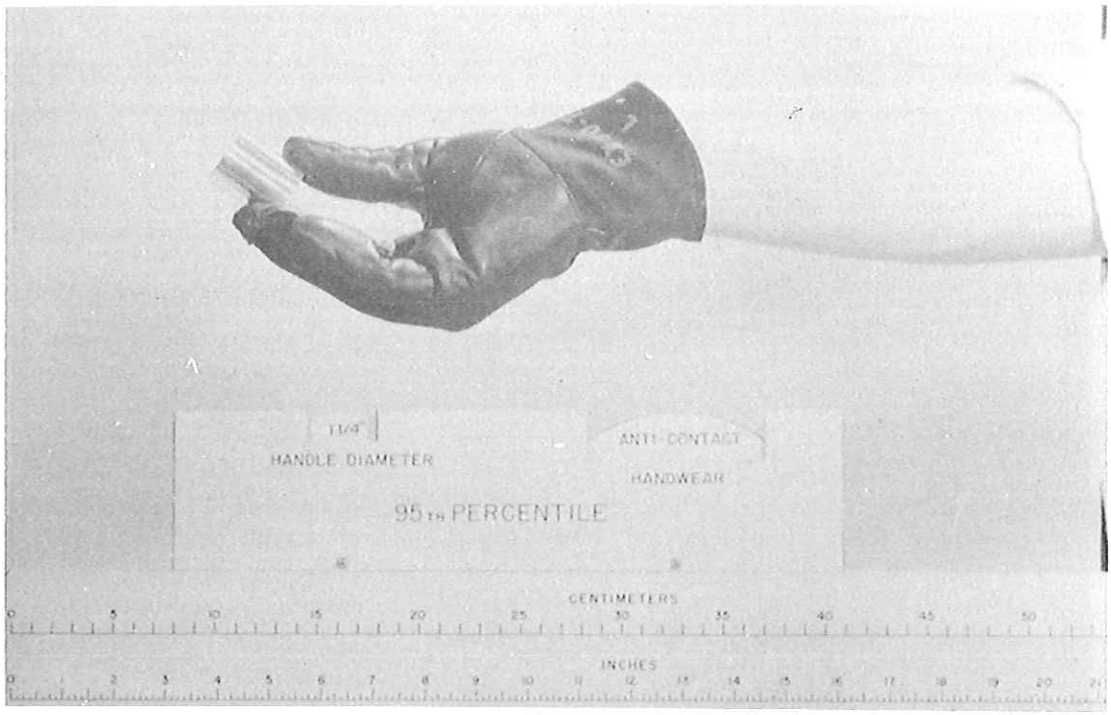

Figure 71. $1\frac{1}{4}$" knob diameter (View A)

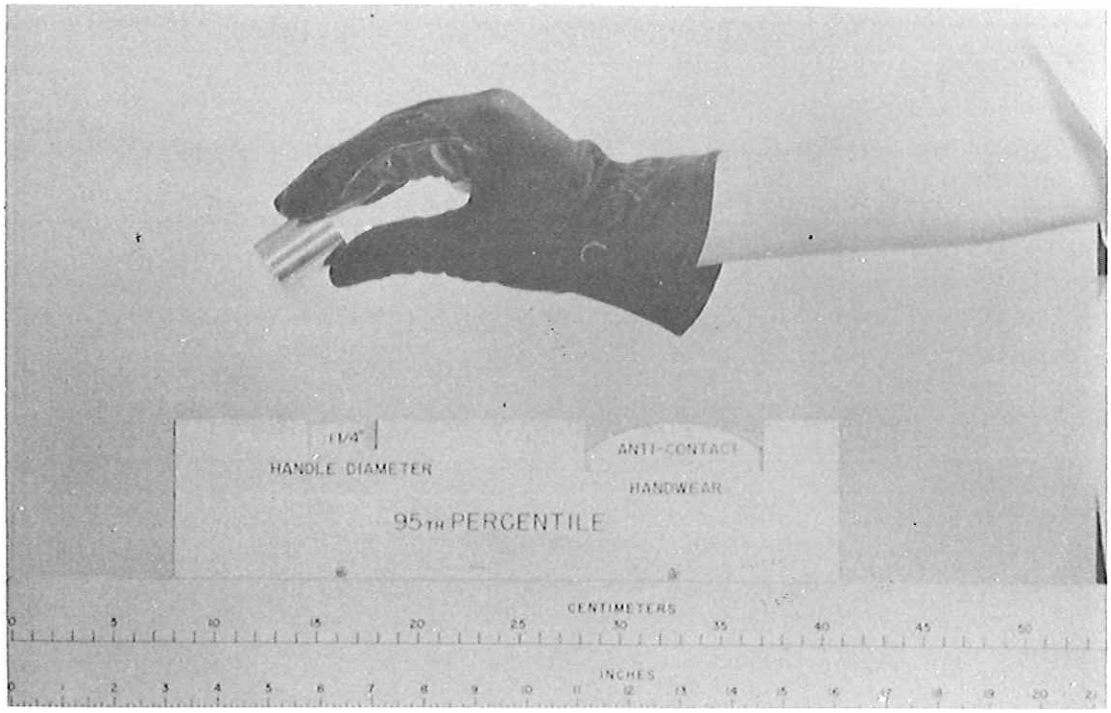

Figure 72. $1\frac{1}{4}$" knob diameter (View B)

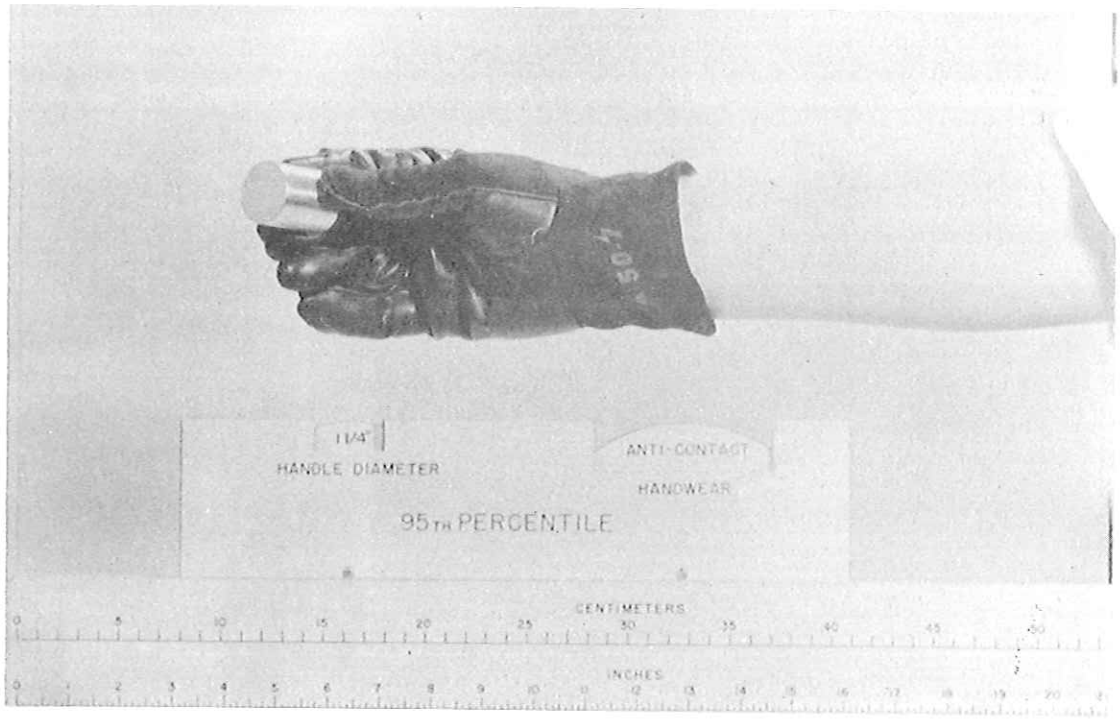

Figure 73. $1\frac{1}{4}$" knob diameter (View C)

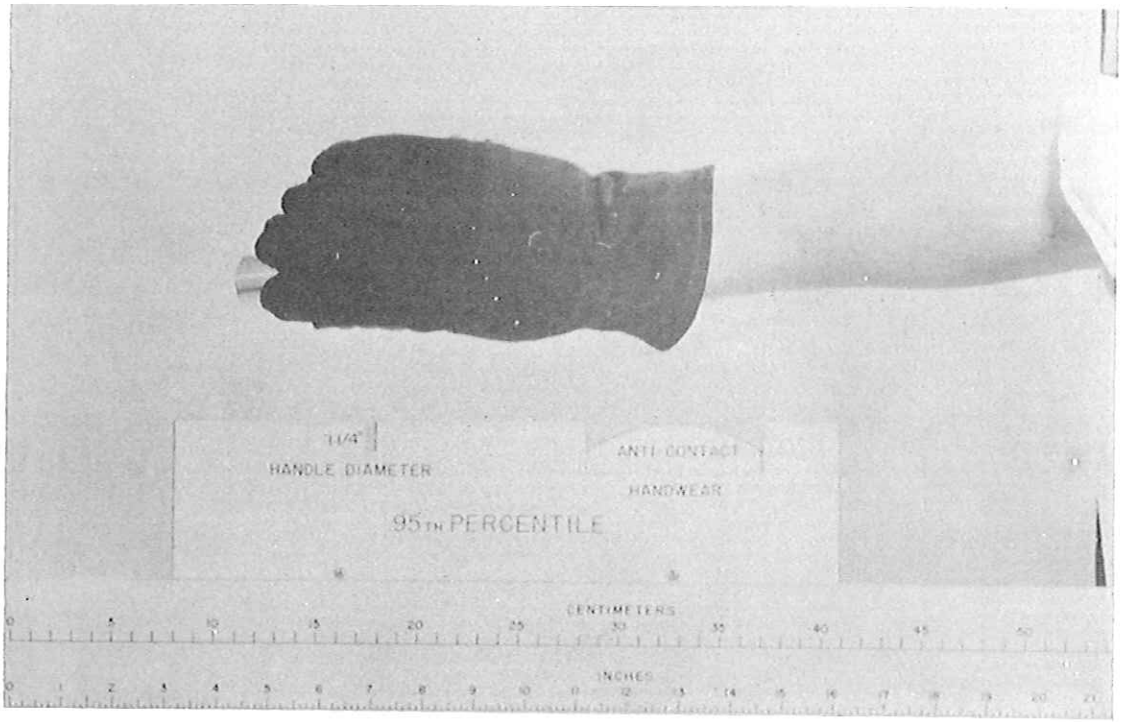

Figure 74. $1\frac{1}{4}$" knob diameter (View D)

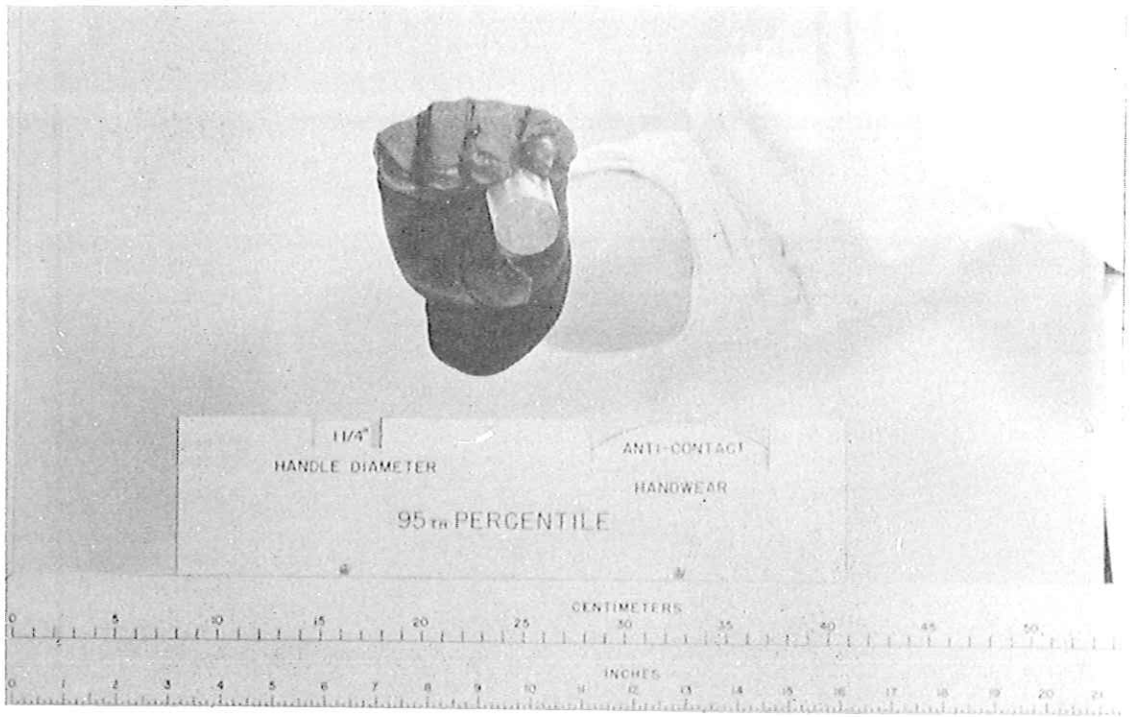

Figure 75. 1¼" knob diameter (View E)

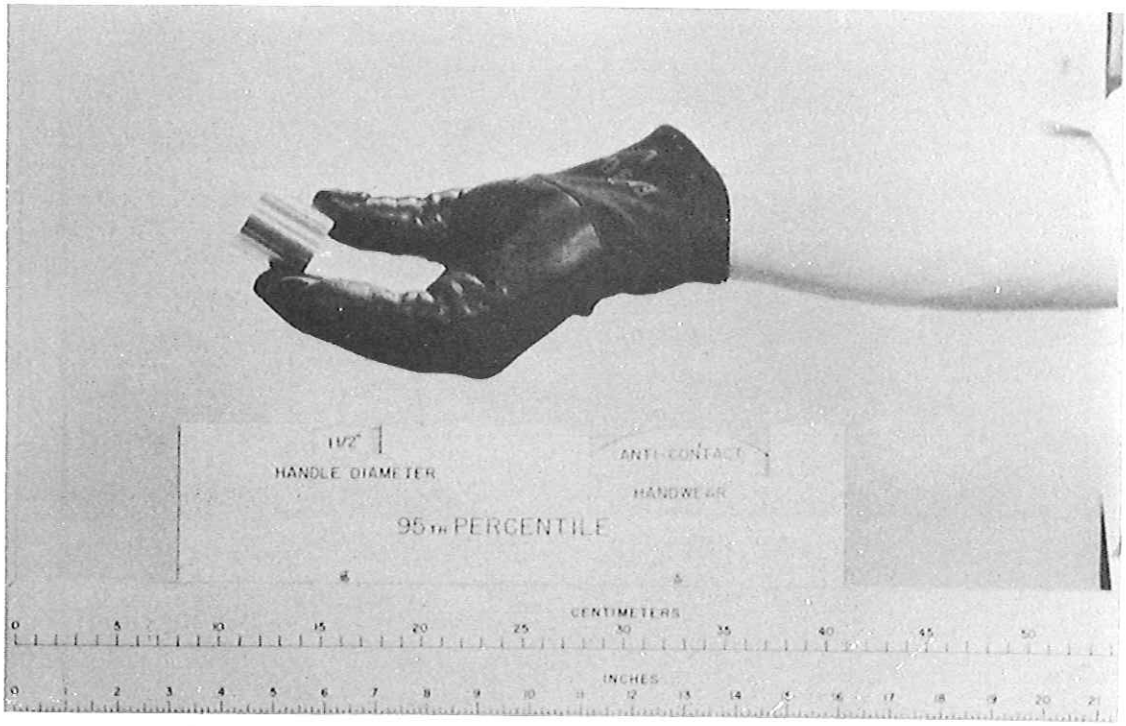

Figure 76. 1½" knob diameter (View A)

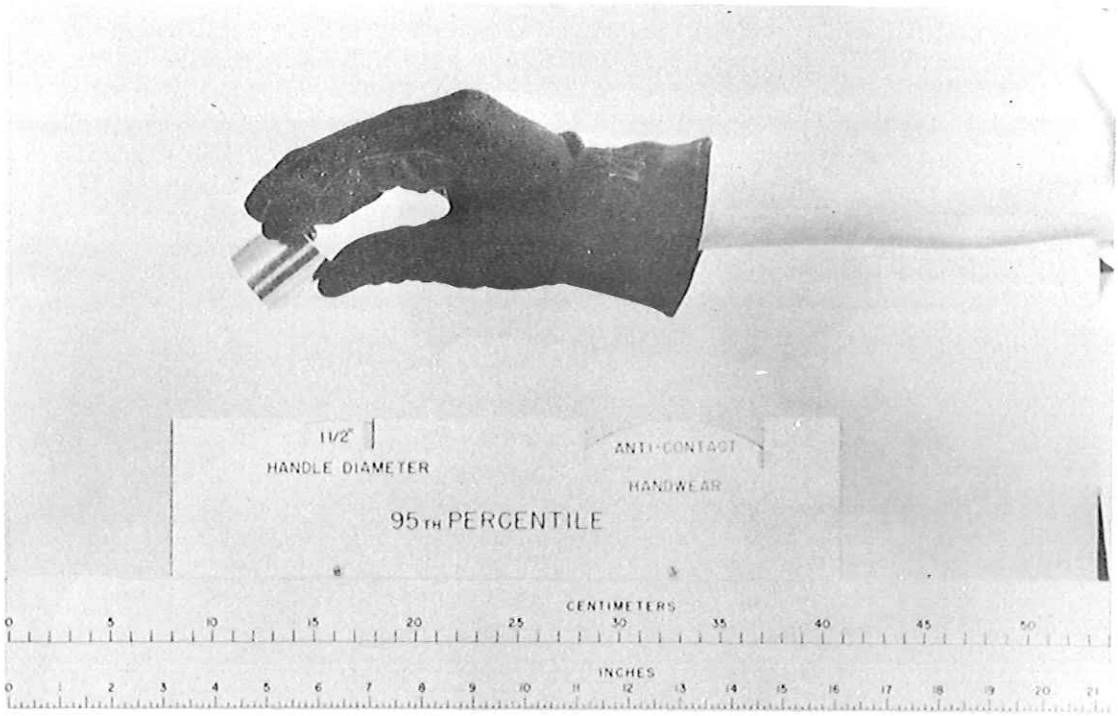

Figure 77. 1½" knob diameter (View B)

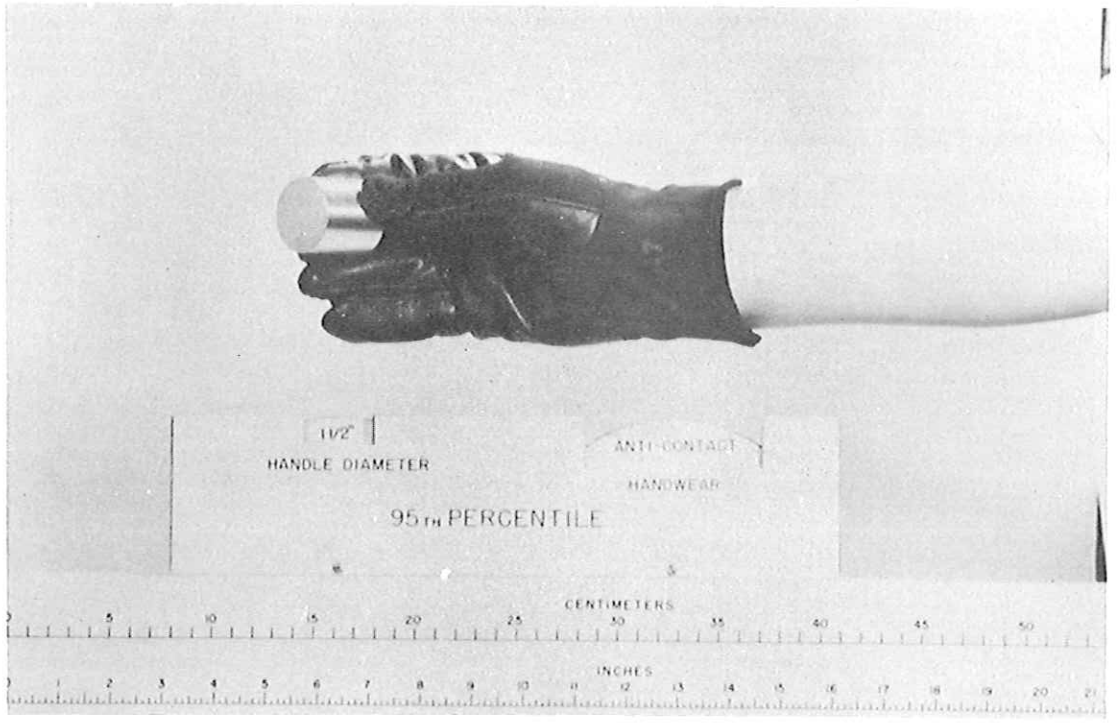

Figure 78. 1½" knob diameter (View C)

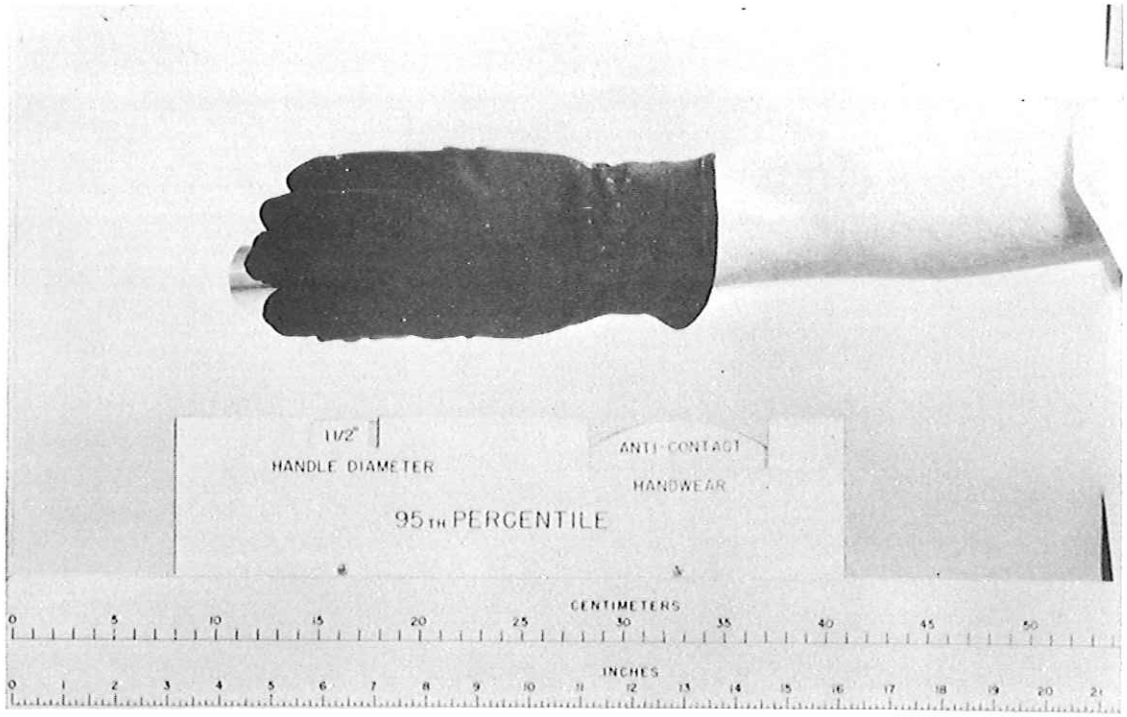

Figure 79. 1½" knob diameter (View D)

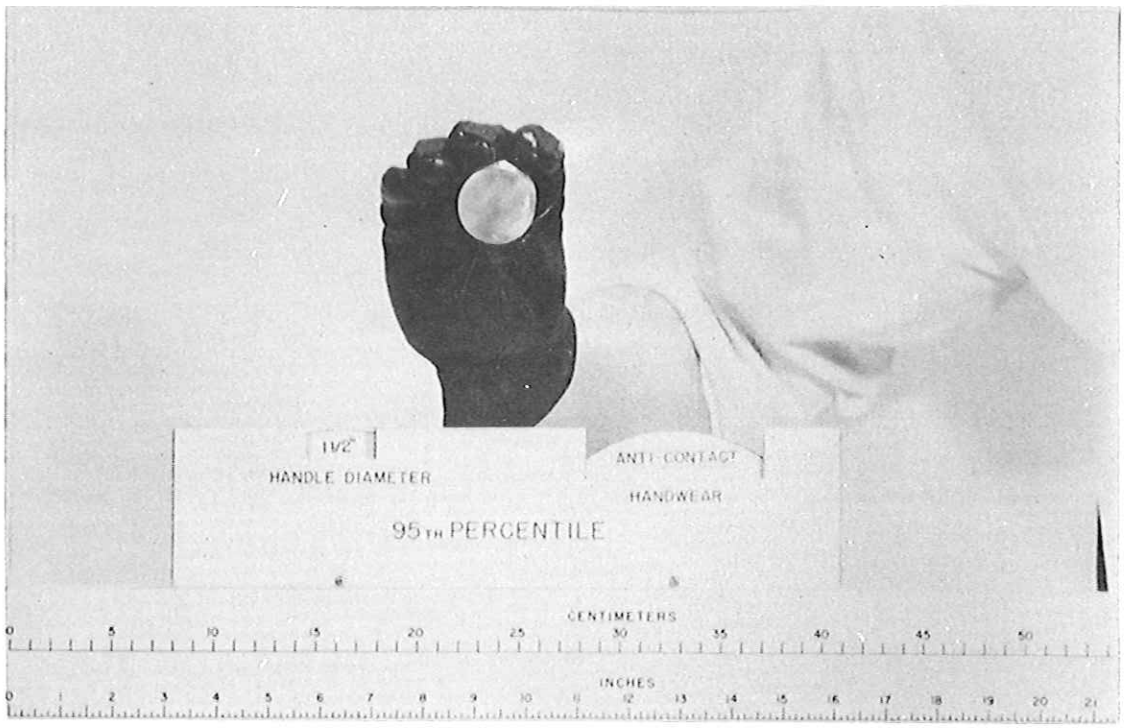

Figure 80. 1½" knob diameter (View E)

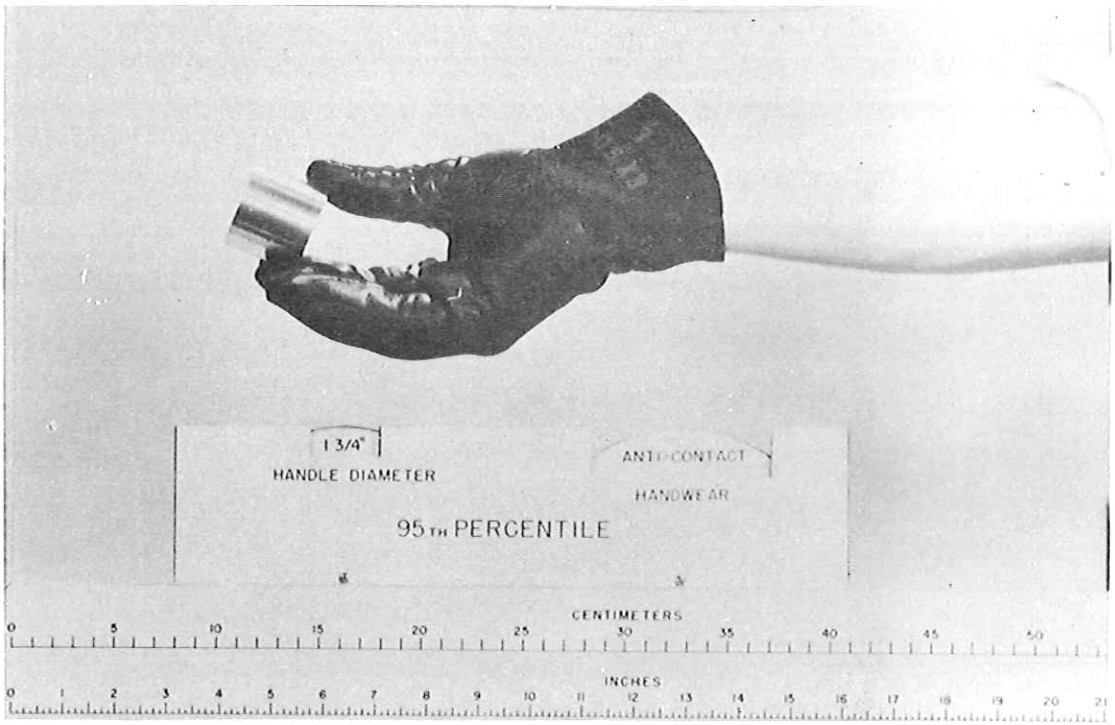

Figure 81. 1 3/4" knob diameter (View A)

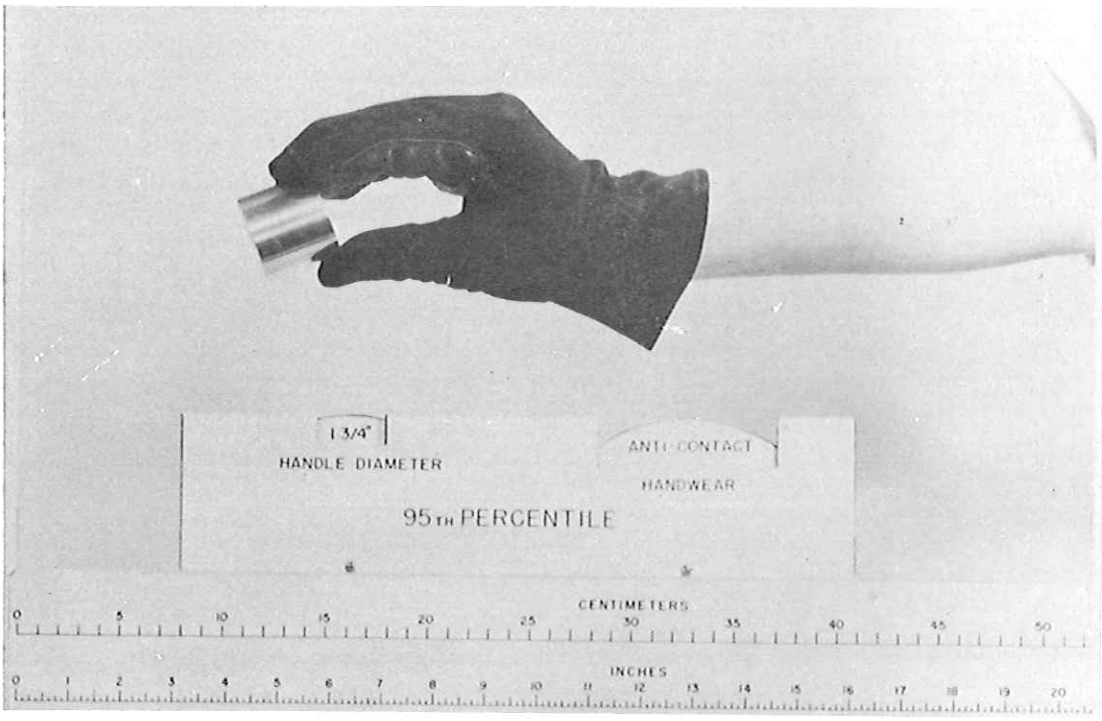

Figure 82. 1 3/4" knob diameter (View B)

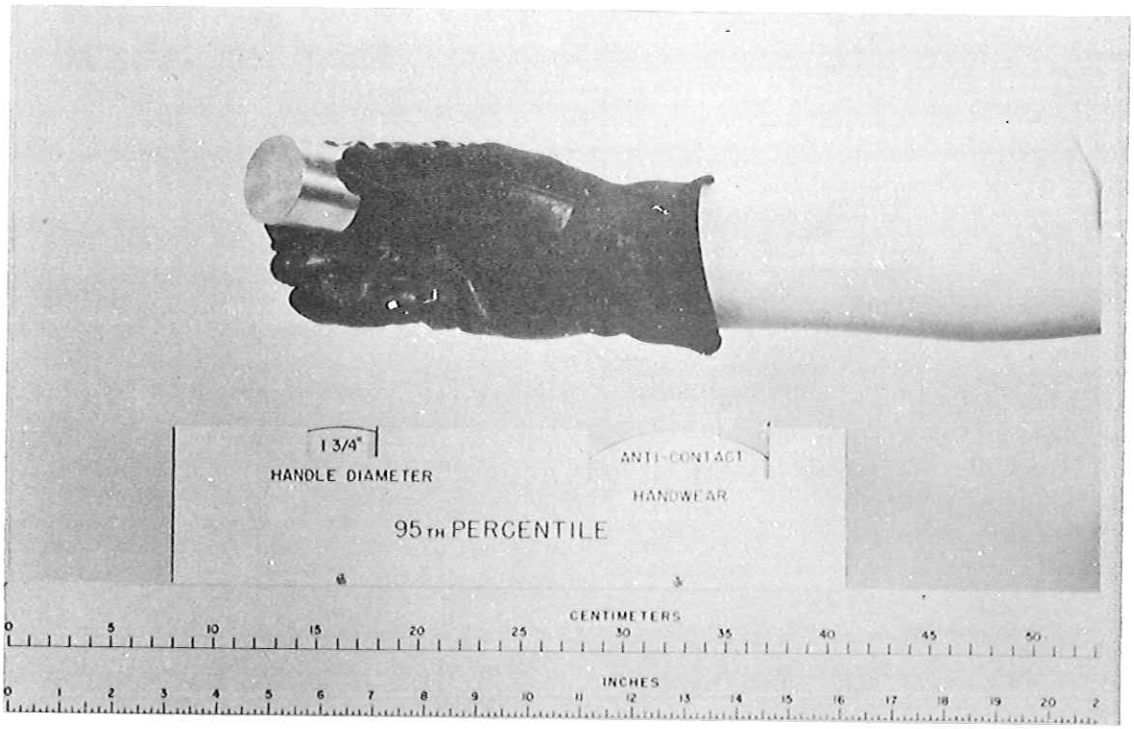

Figure 83. 1 3/4" knob diameter (View C)

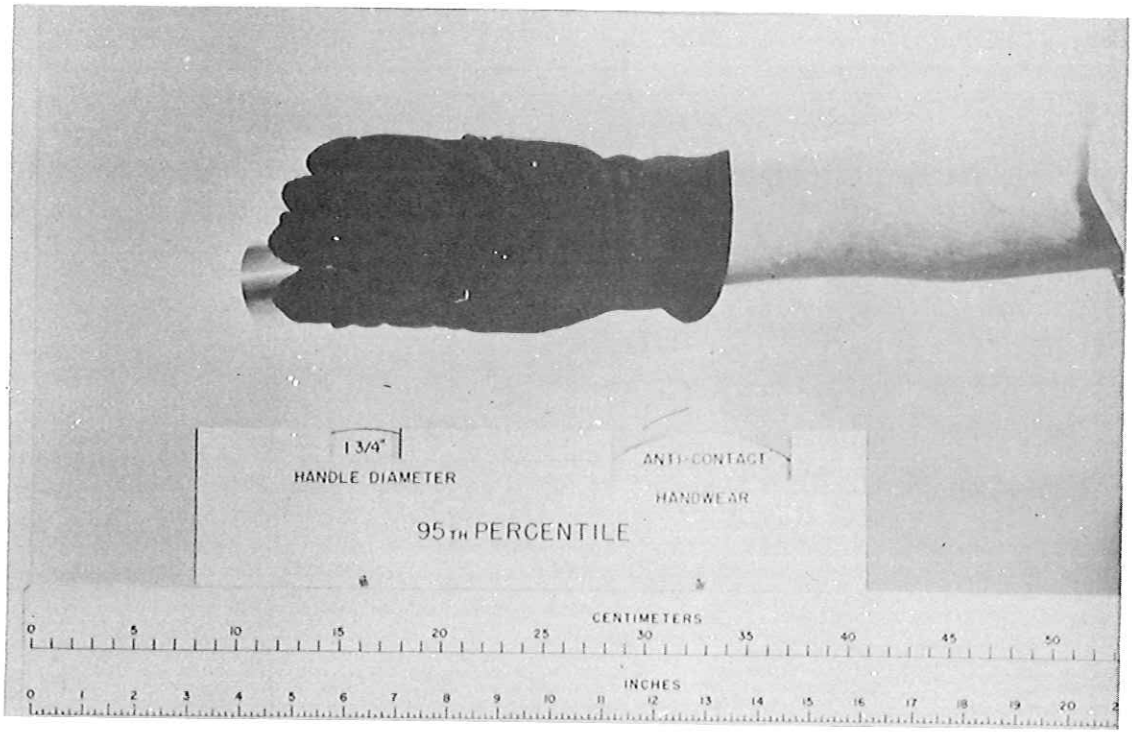

Figure 84. 1 3/4" knob diameter (View D)

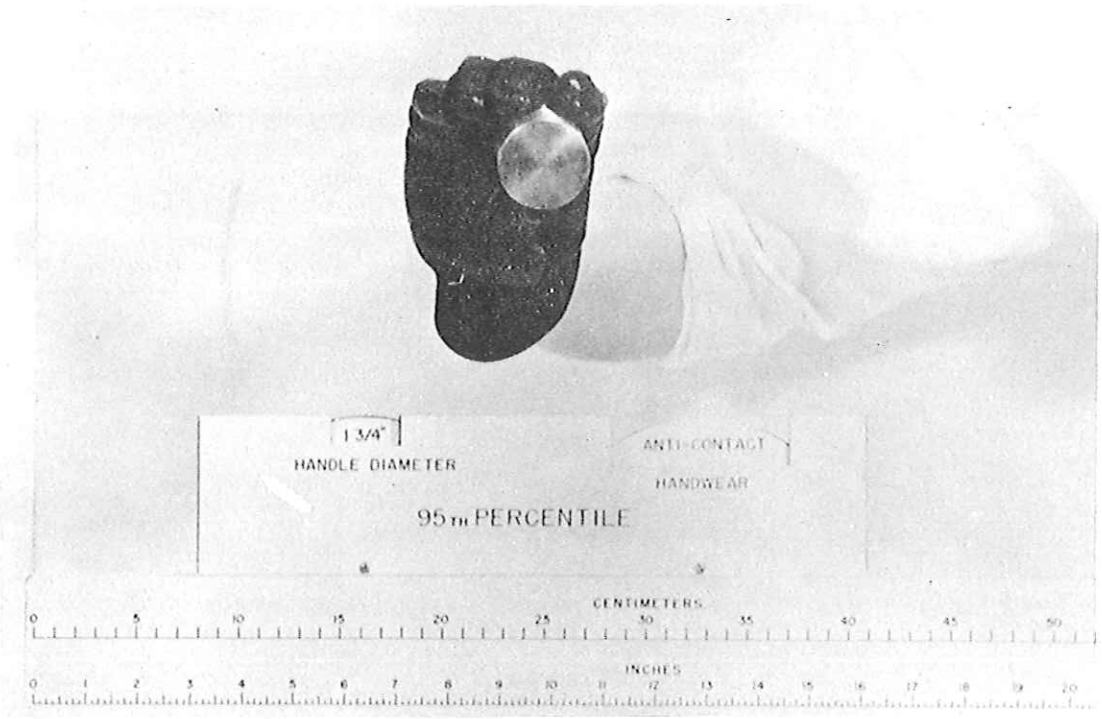

Figure 85. 1 3/4" knob diameter (View E)

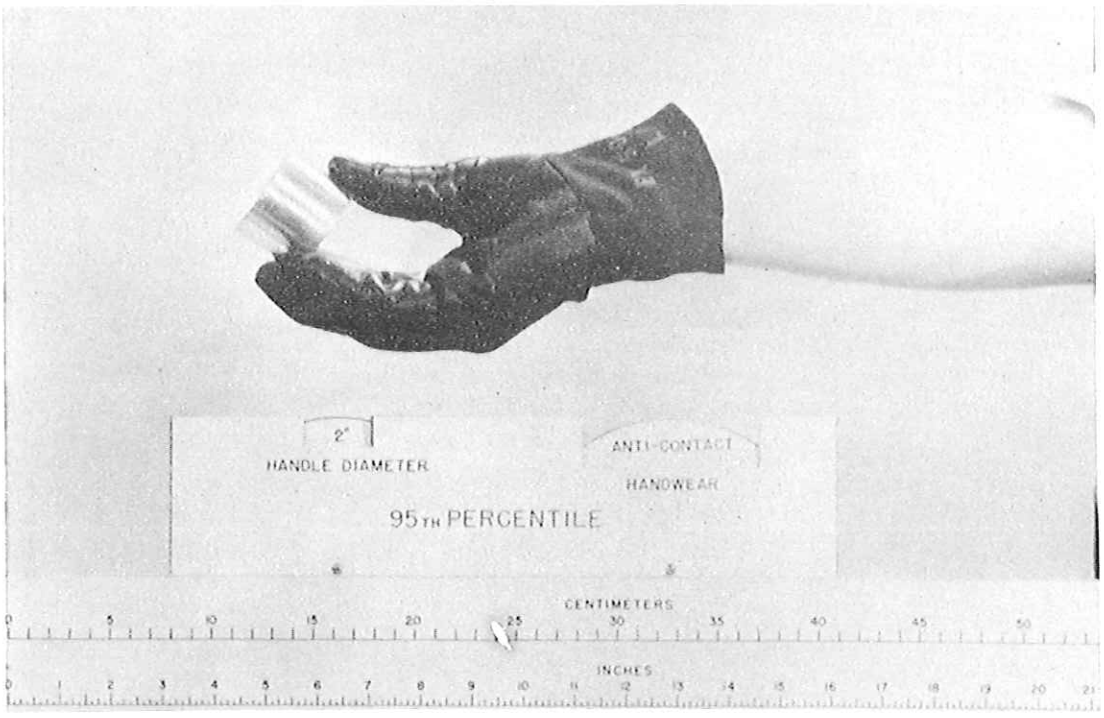

Figure 86. 2" knob diameter (View A)

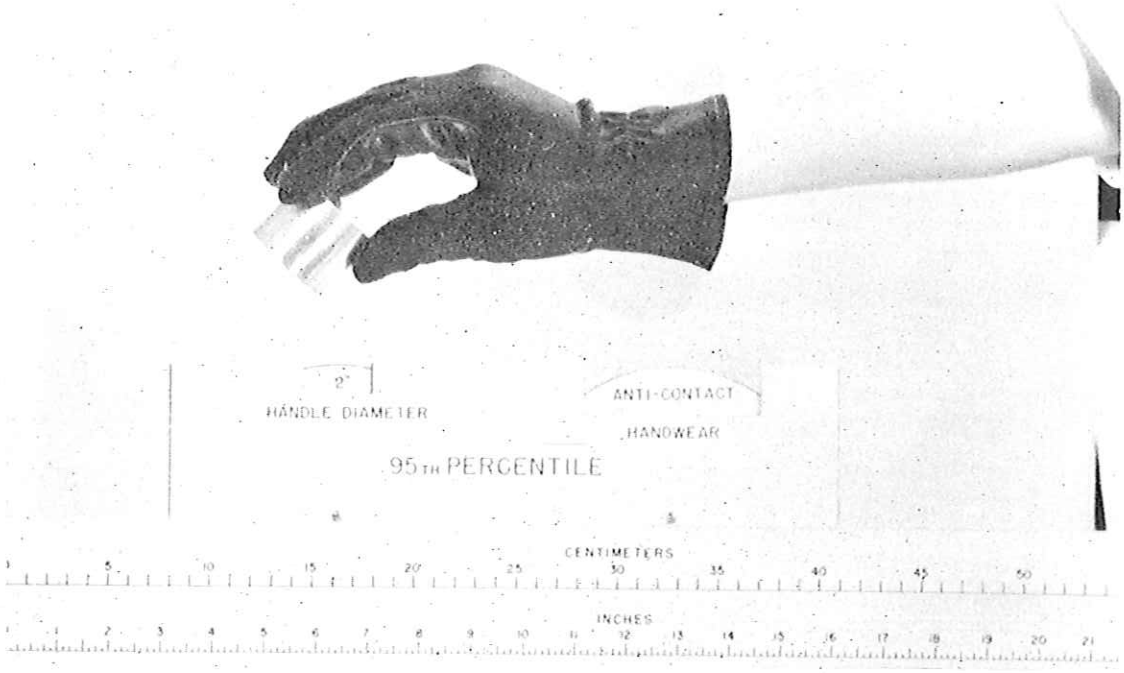

Figure 87. 2" knob diameter (View B)

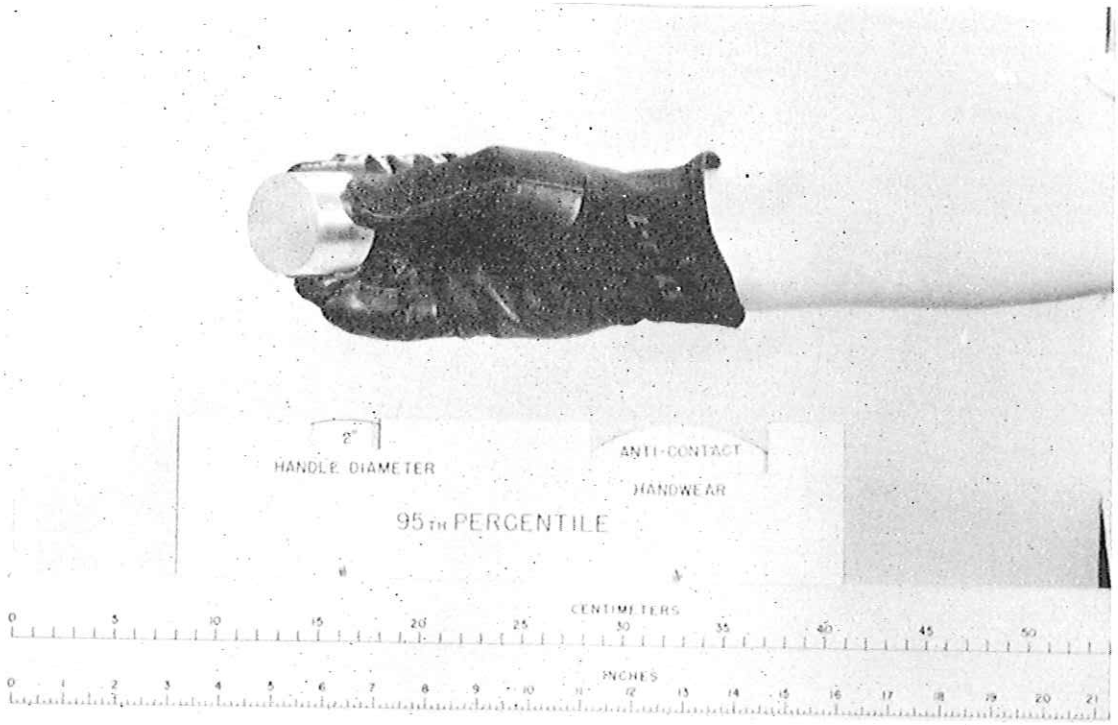

Figure 88. 2" knob diameter (View C)

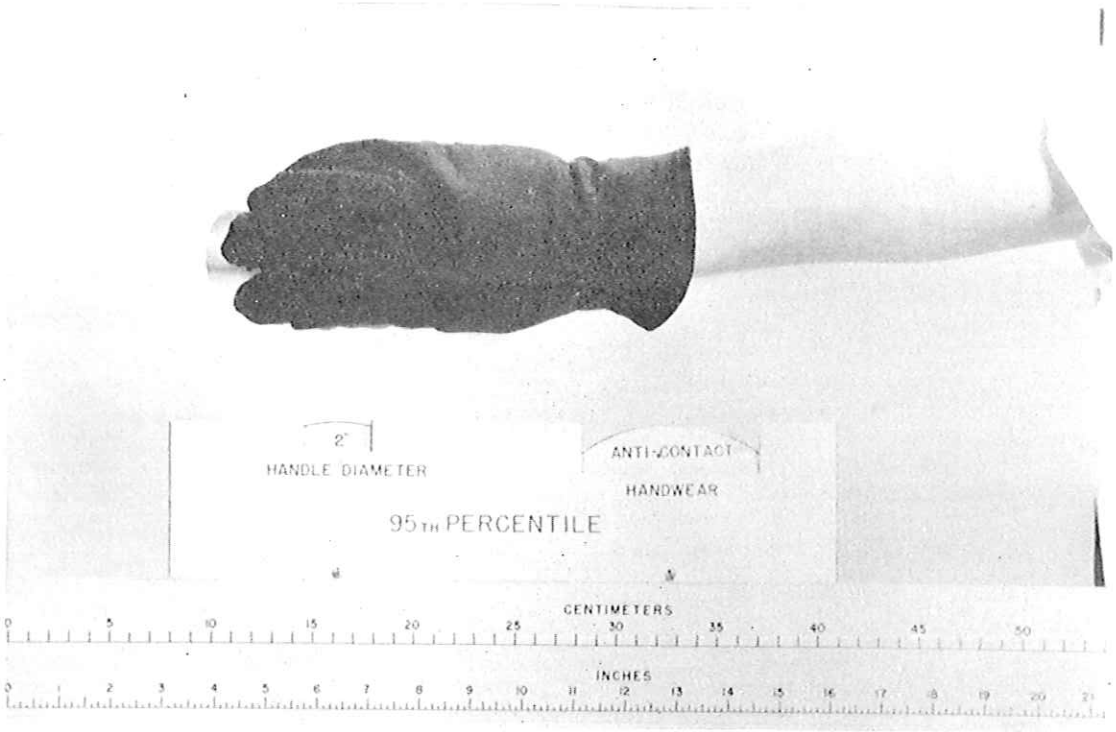

Figure 89. 2" knob diameter (View D)

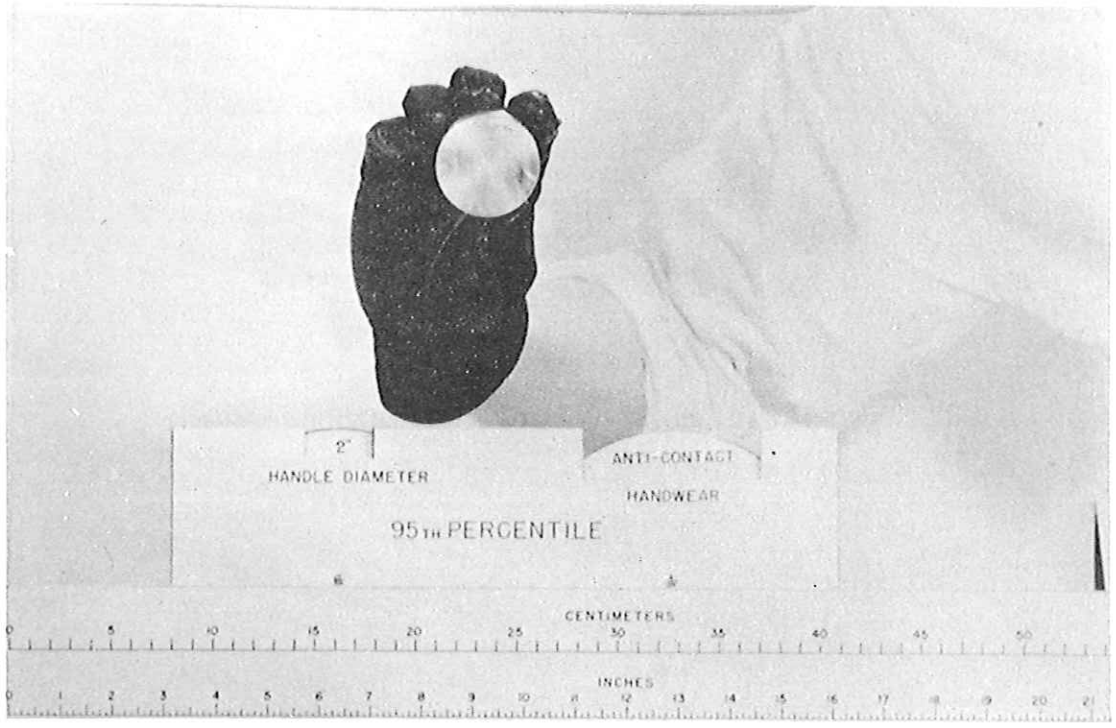

Figure 90. 2" knob diameter (View E)

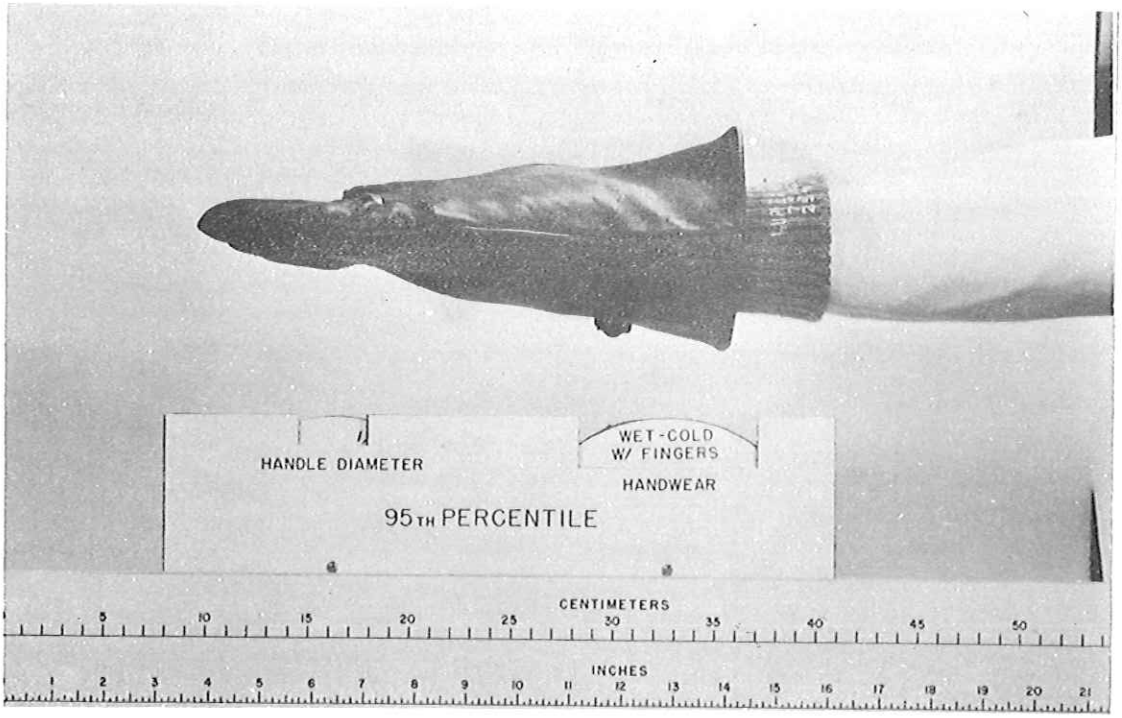

Figure 91. The hand extended flat (View A)

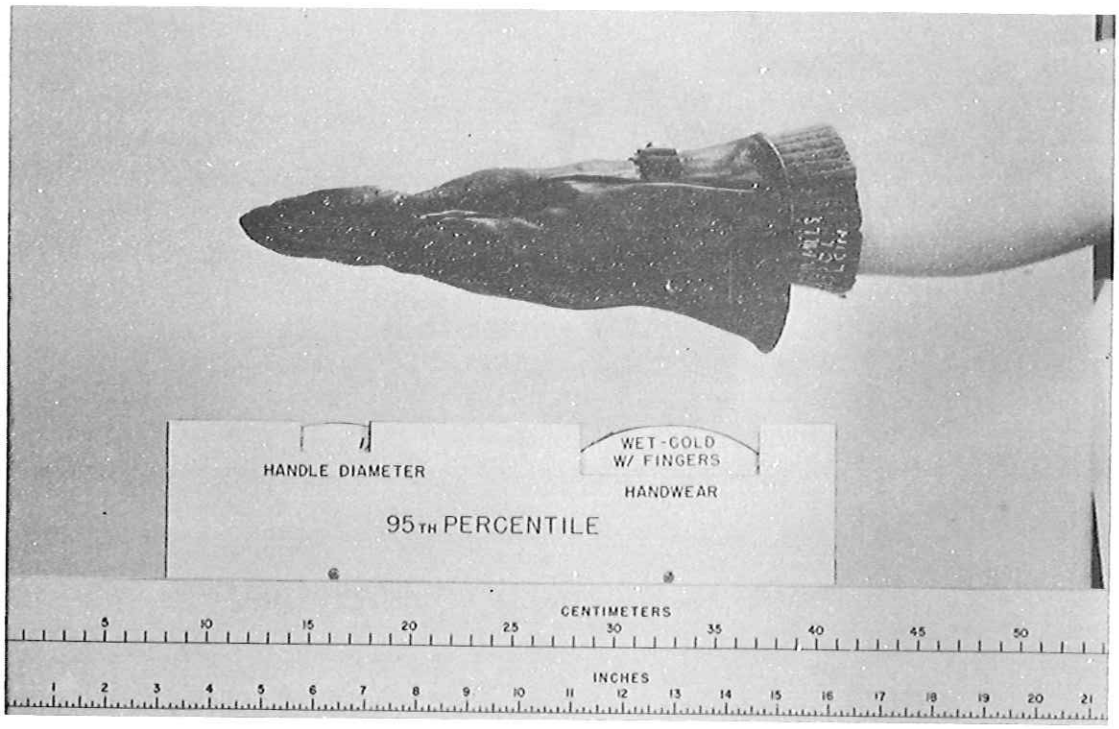

Figure 92. The hand extended flat (View B)

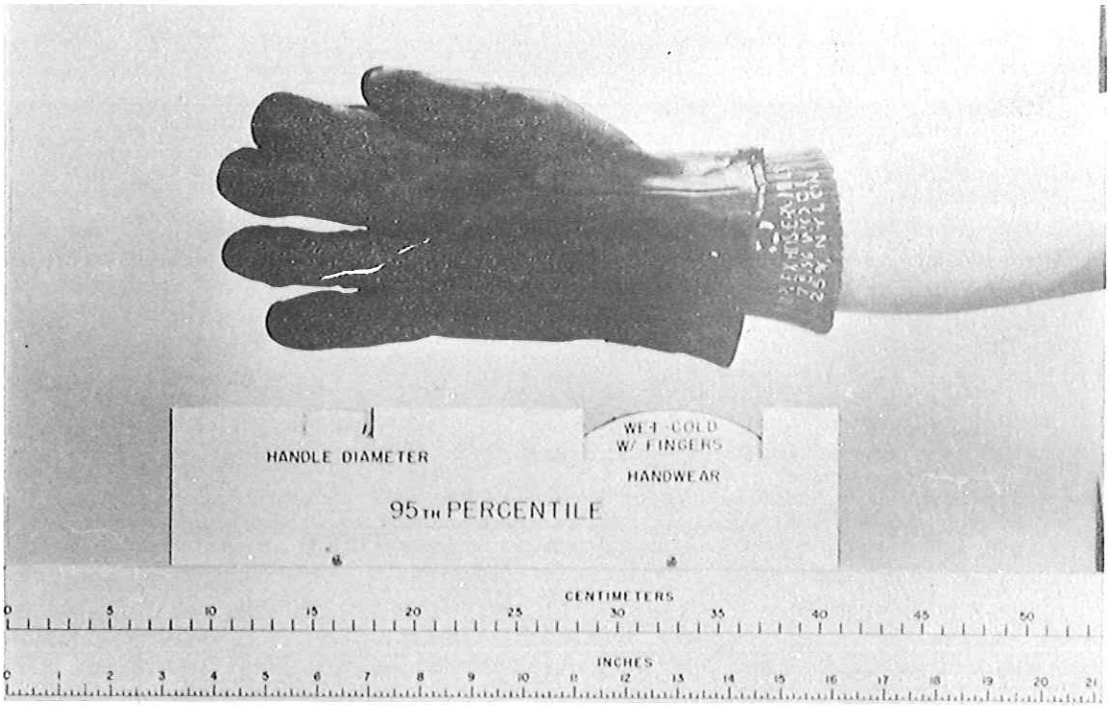

Figure 93. The hand extended flat (View C)

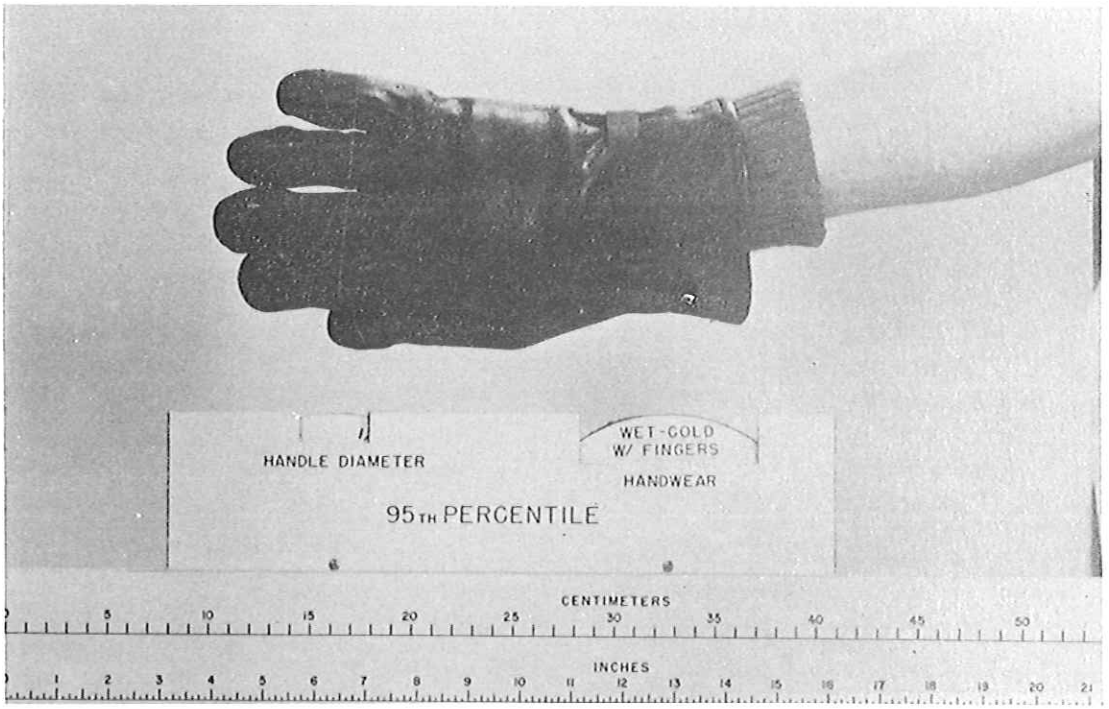

Figure 94. The hand extended flat (View D)

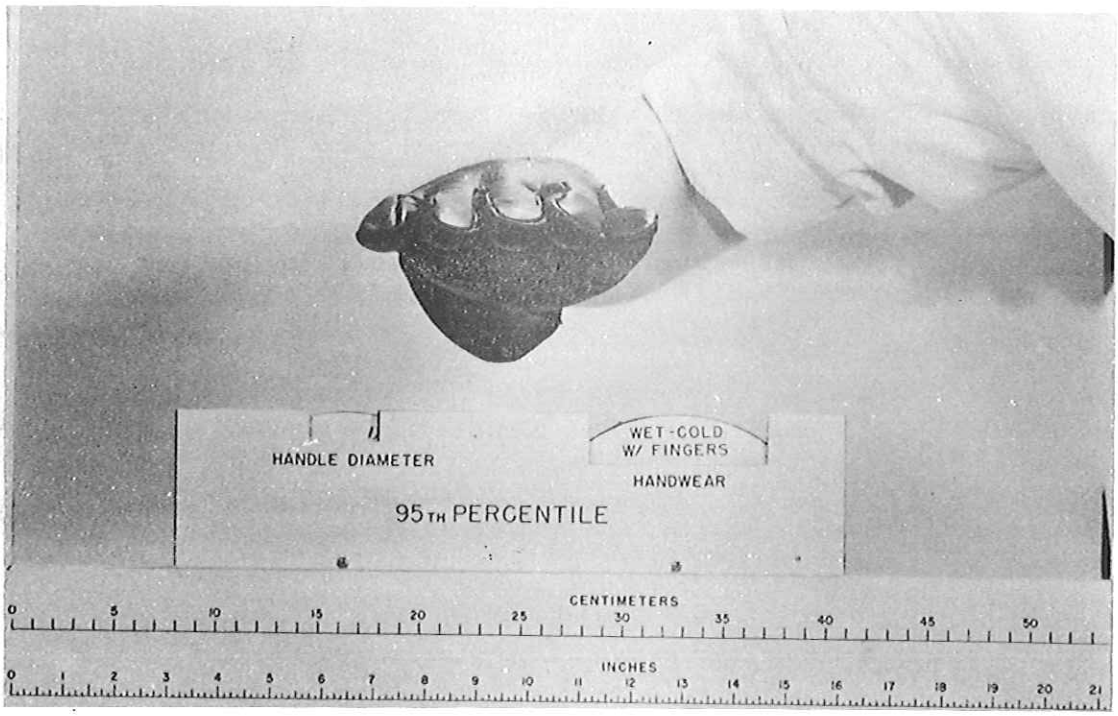

Figure 95. The hand extended flat (View E)

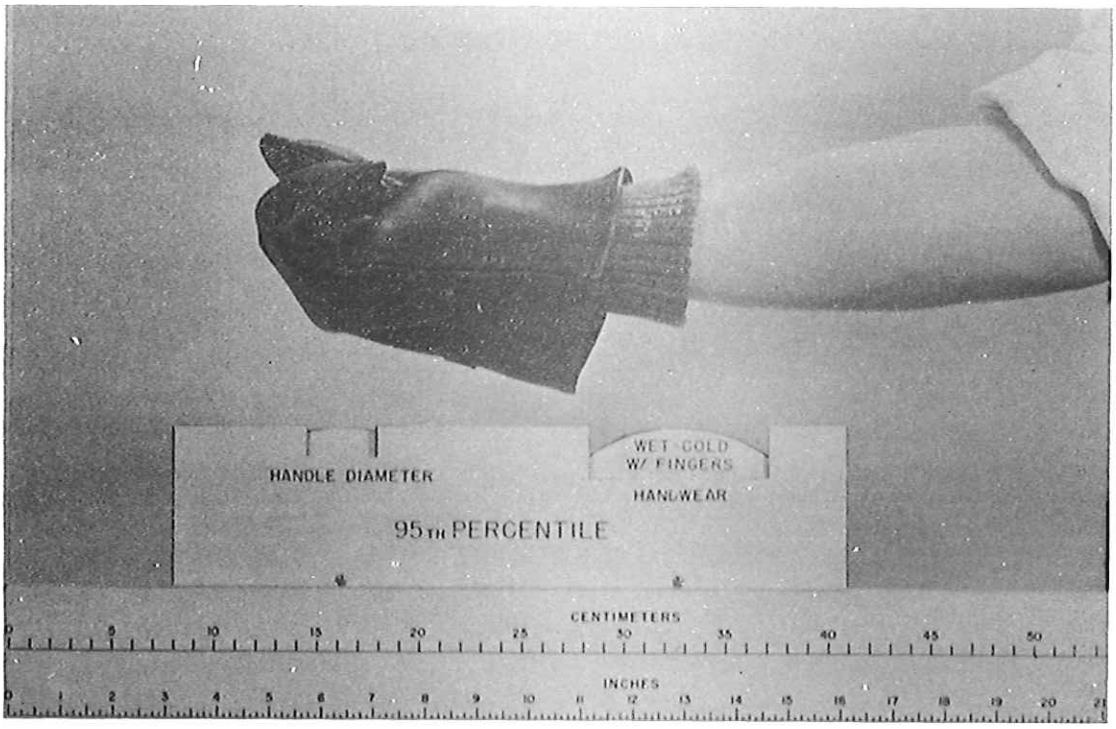

Figure 96. The hand closed as a fist (View A)

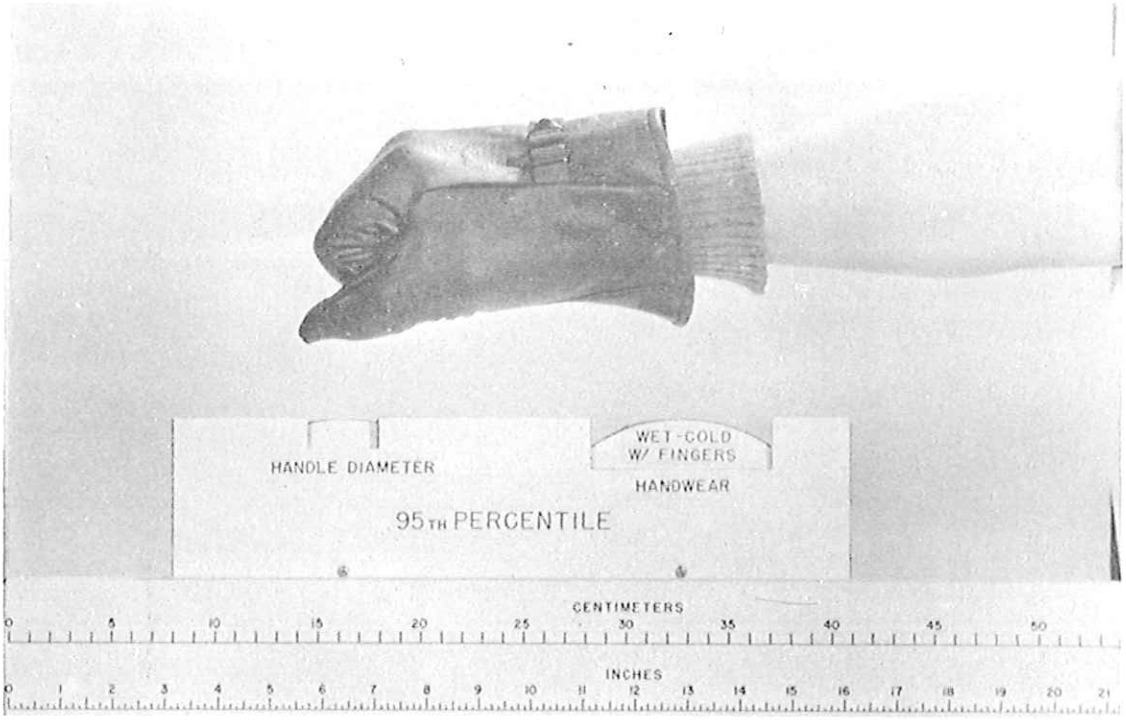

Figure 97. The hand closed as a fist (View B)

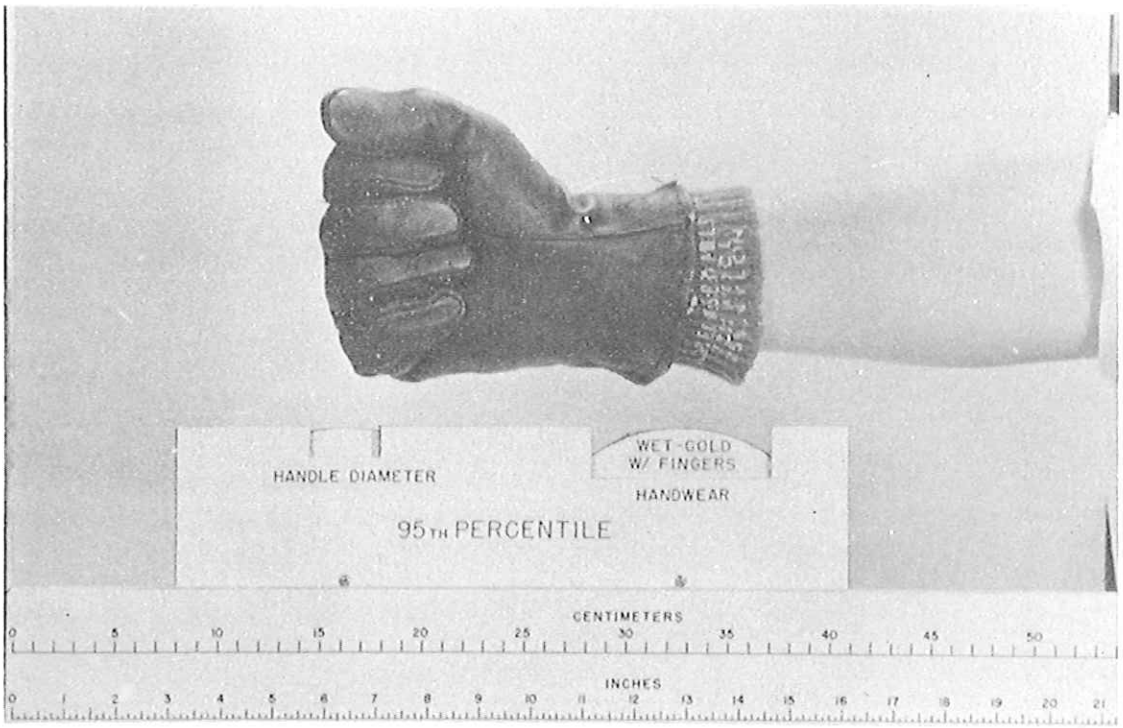

Figure 98. The hand closed as a fist (View C)

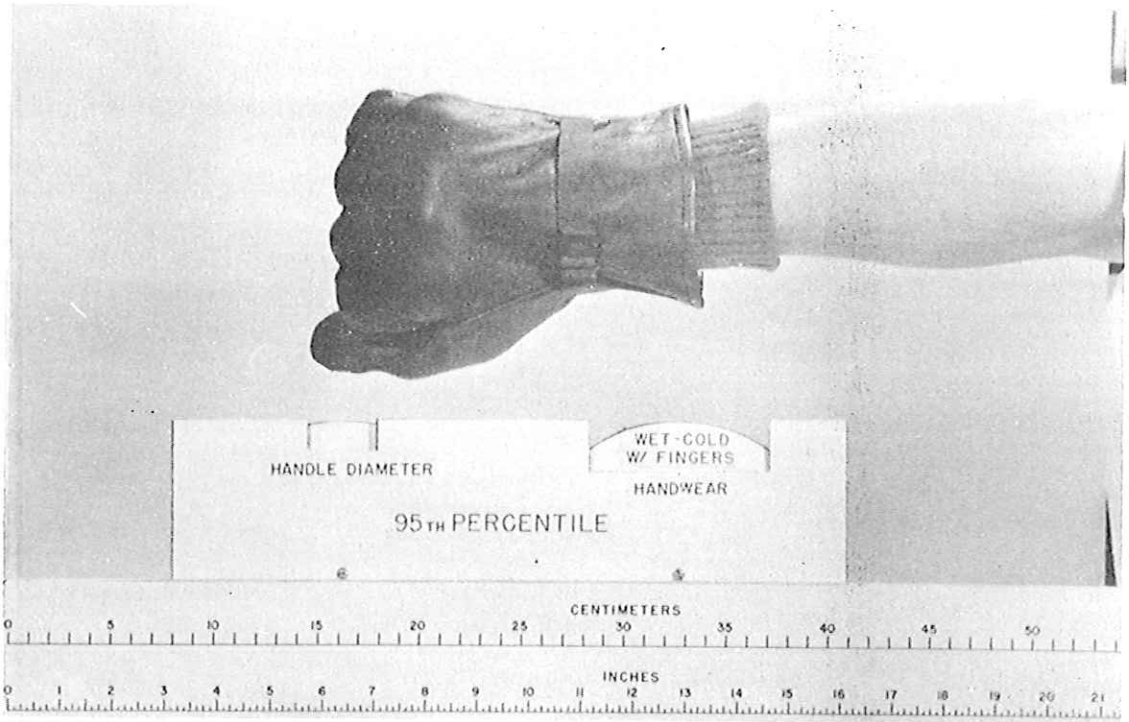

Figure 99. The hand closed as a fist (View D)

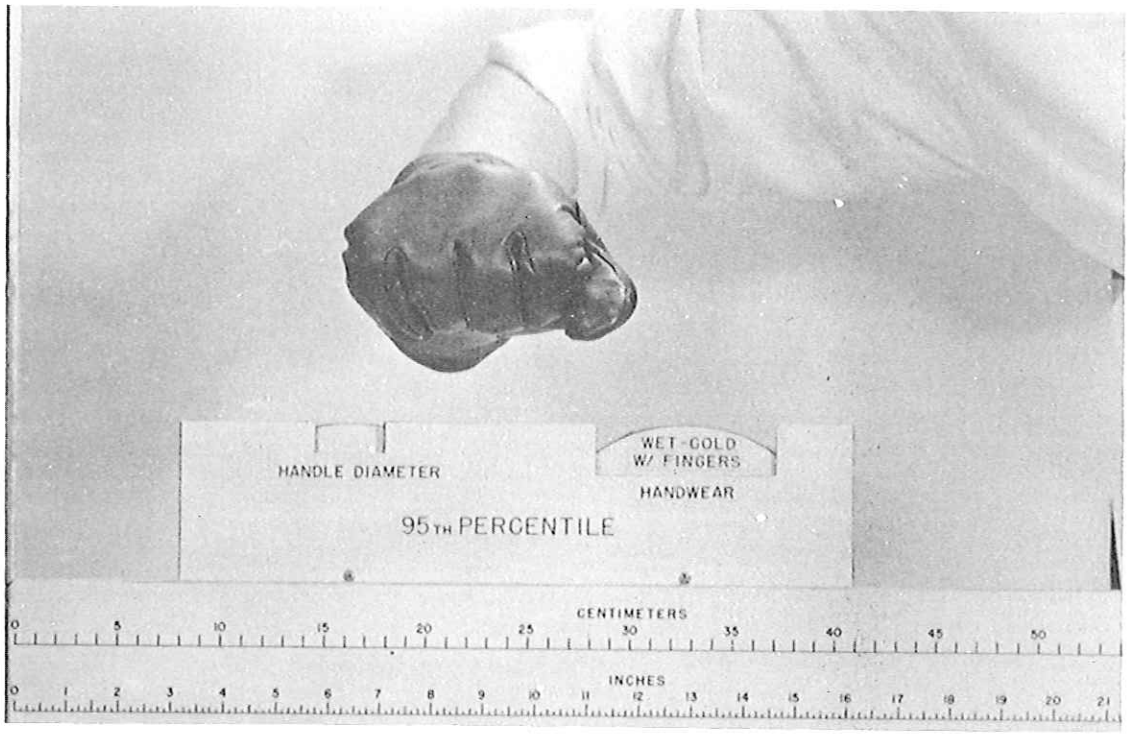

Figure 100. The hand closed as a fist (View E)

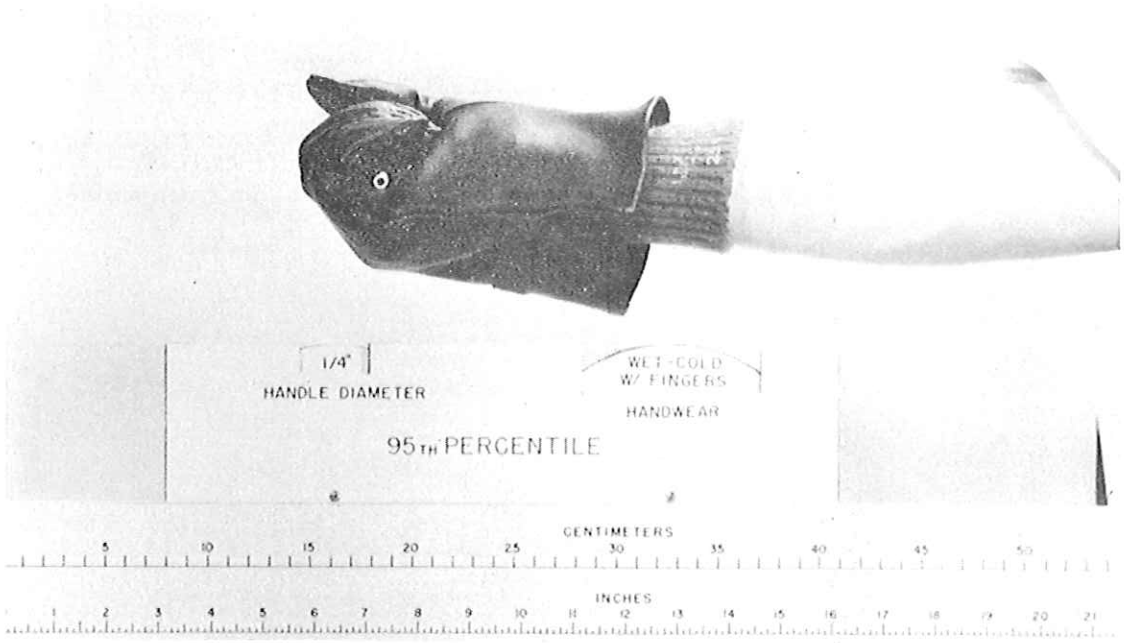

Figure 101. $\frac{1}{4}$" handle diameter (View A)

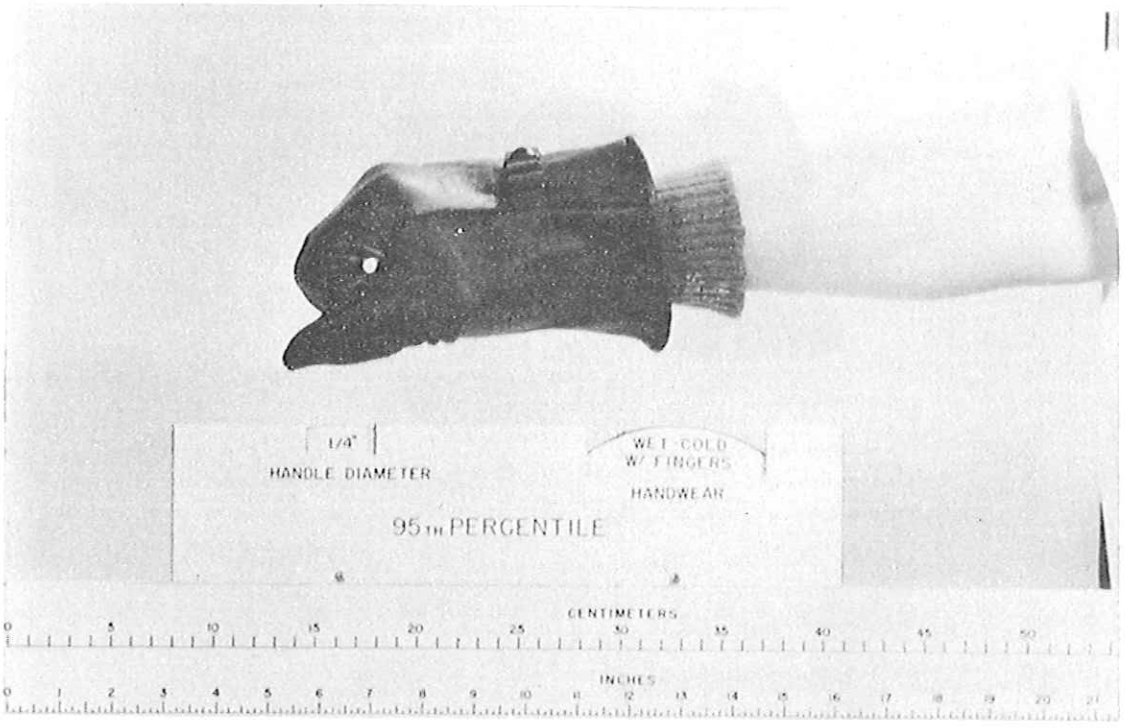

Figure 102. $\frac{1}{4}$" handle diameter (View B)

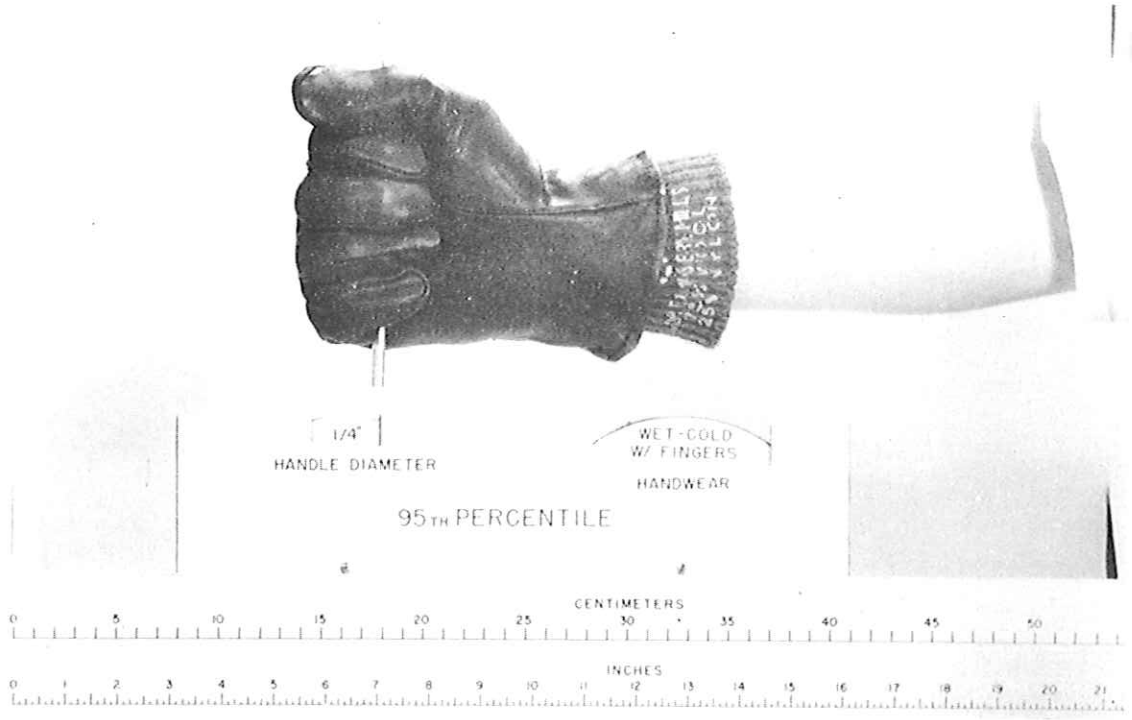

Figure 103. $\frac{1}{4}$" handle diameter (View C)

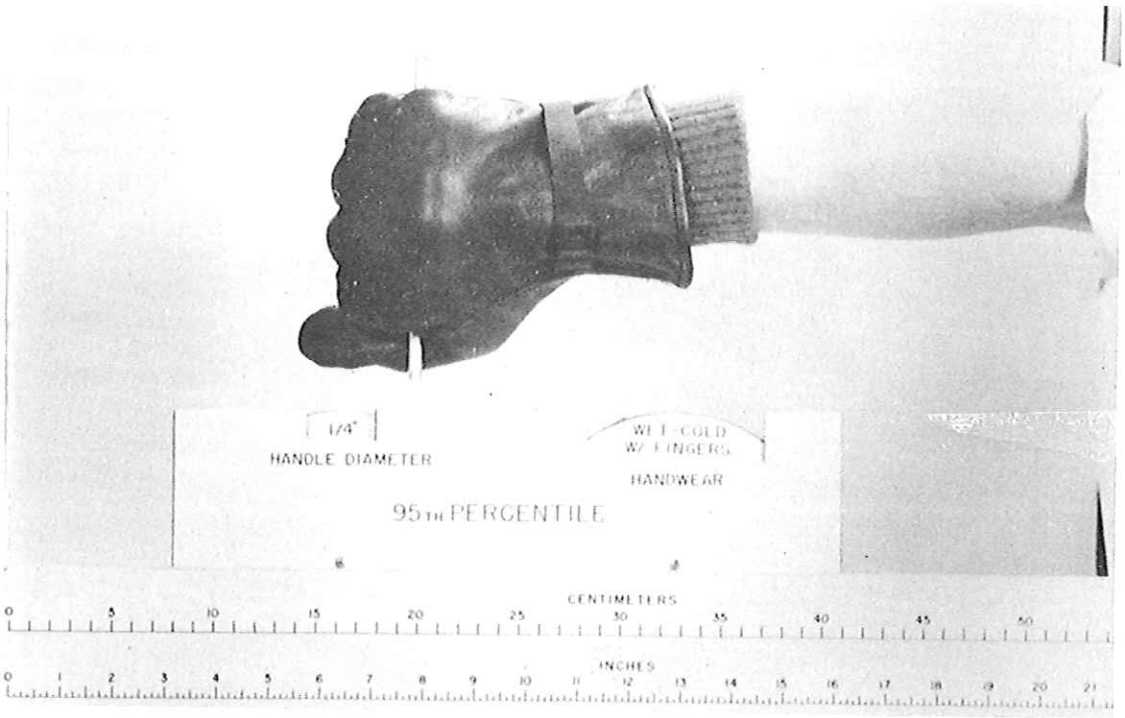

Figure 104. $\frac{1}{4}$" handle diameter (View D)

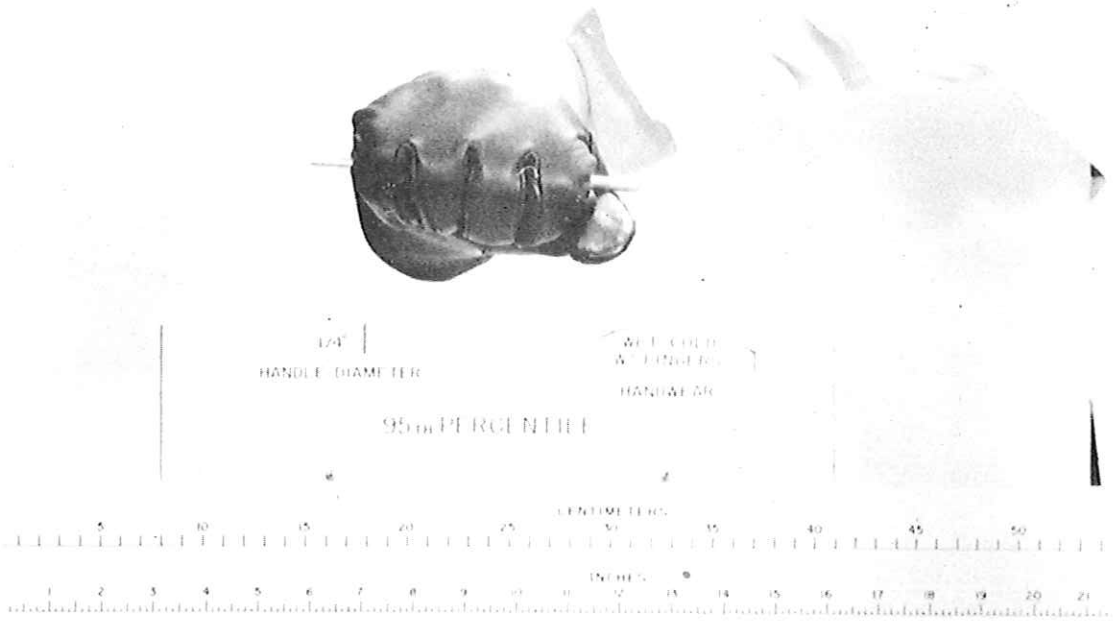

Figure 105. $\frac{1}{4}$" handle diameter (View E)

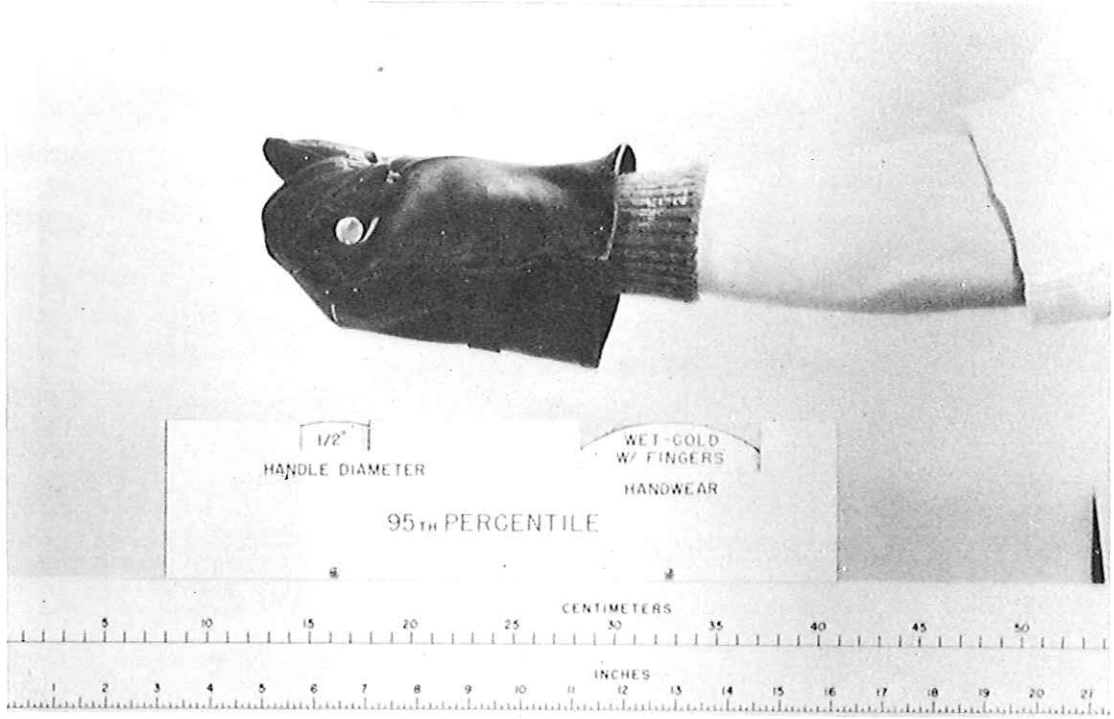

Figure 106. $\frac{1}{2}$" handle diameter (View A)

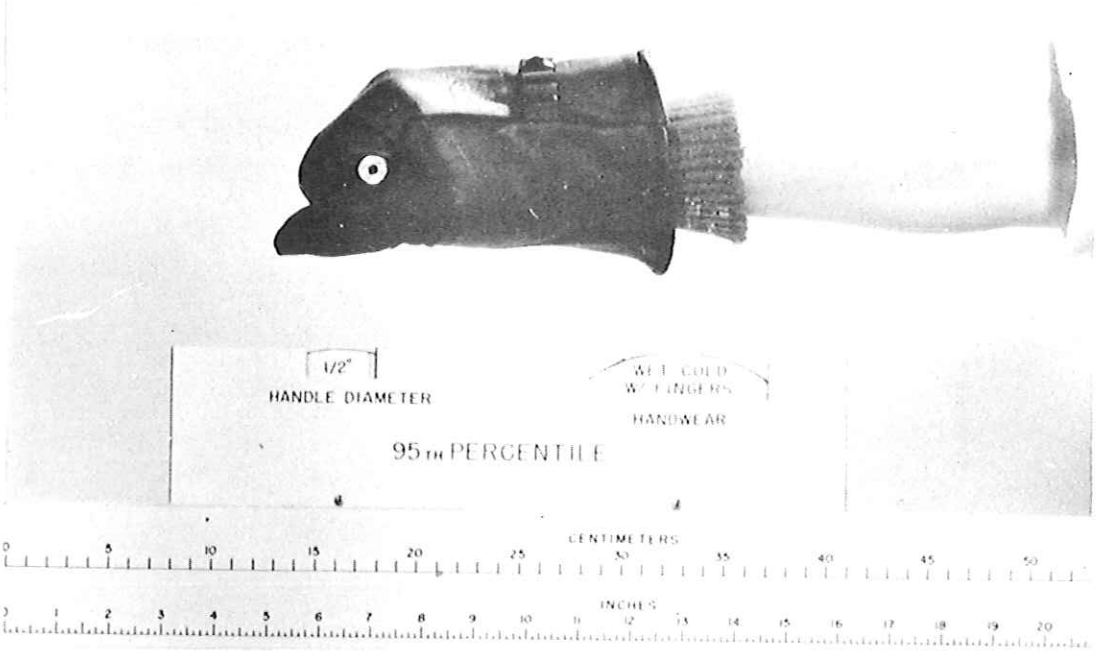

Figure 107. ½" handle diameter (View B)

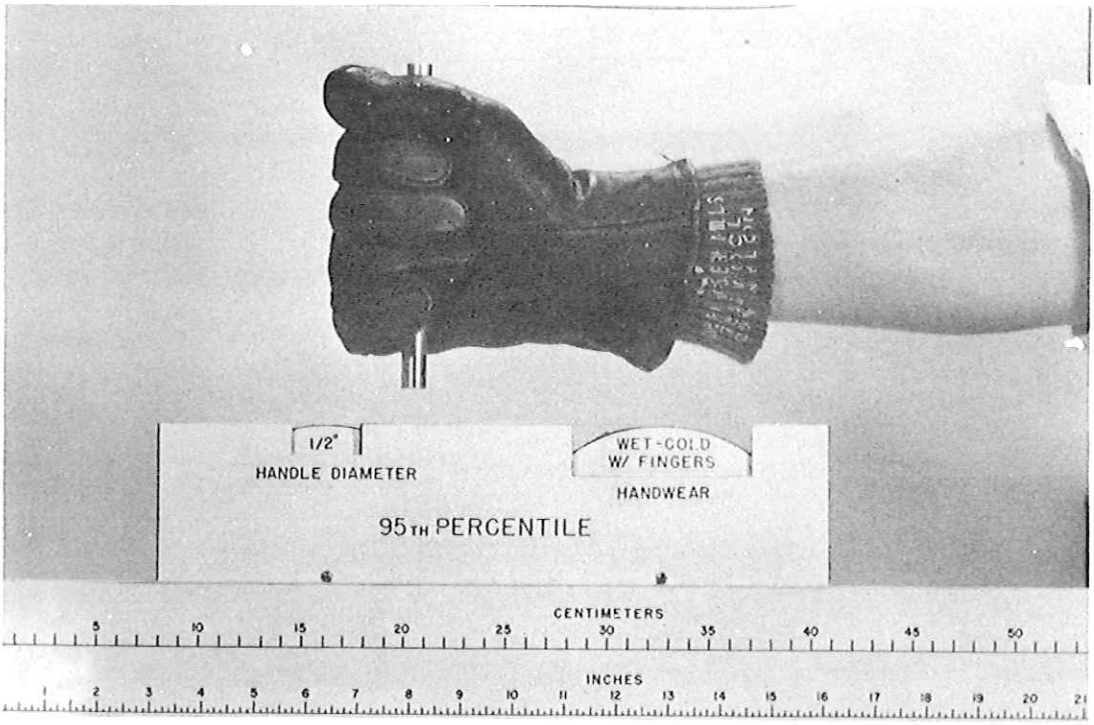

Figure 108. ½" handle diameter (View C)

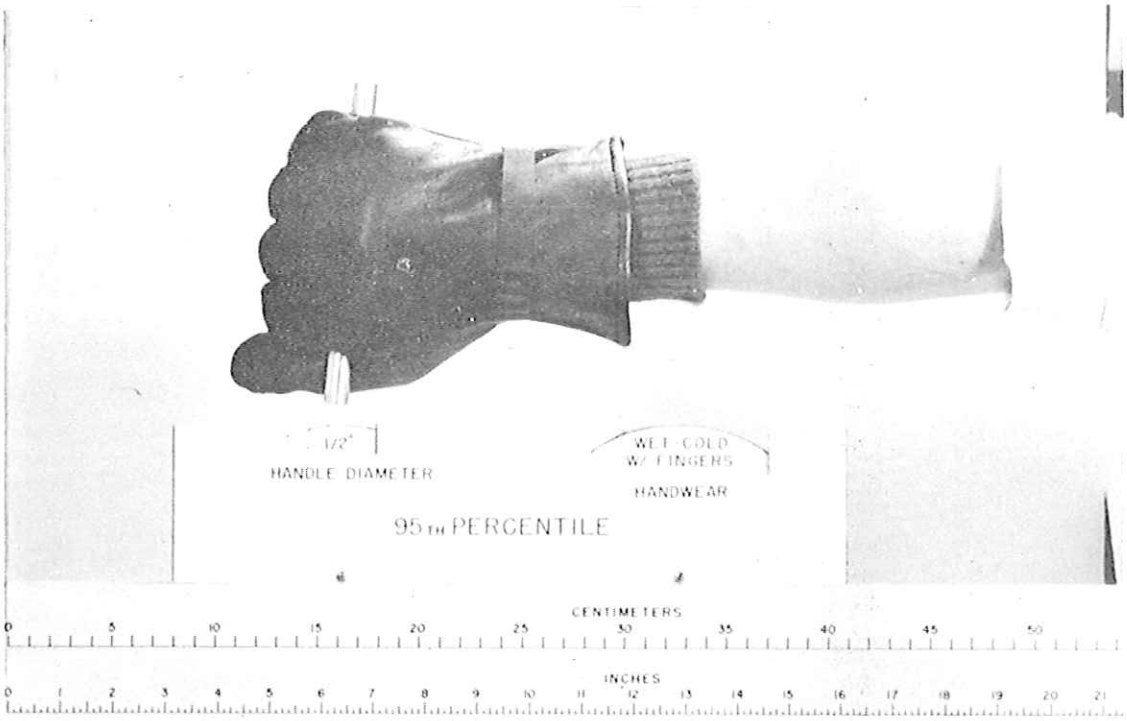

Figure 109. ½" handle diameter (View D)

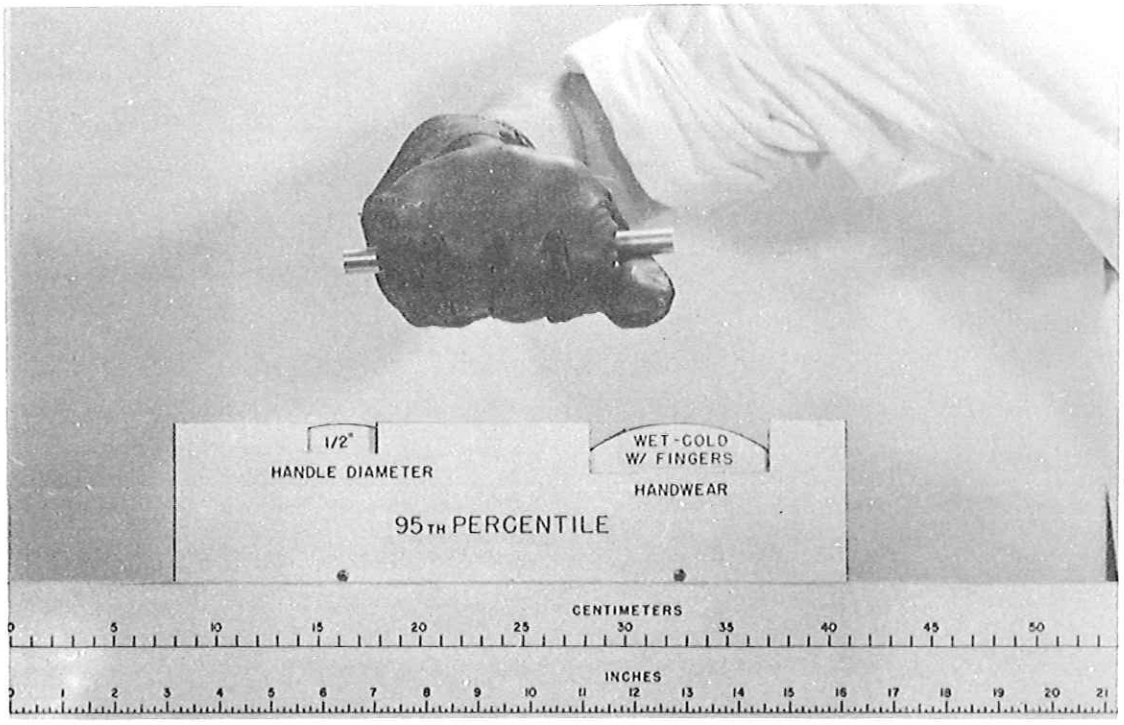

Figure 110. ½" handle diameter (View E)

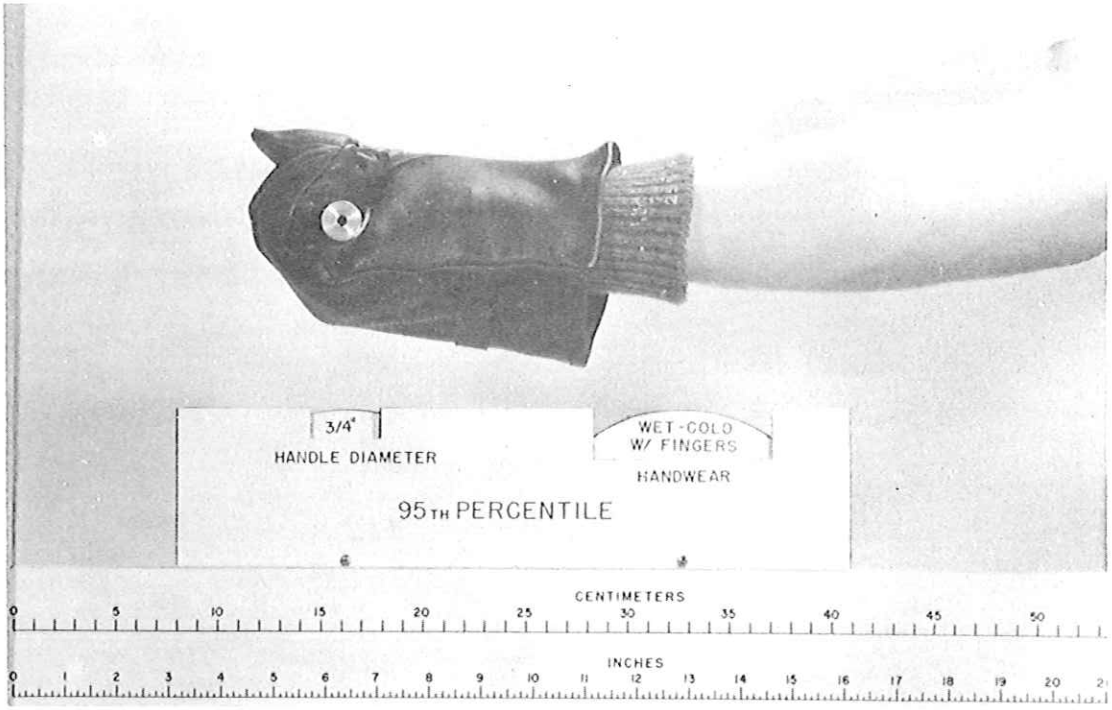

Figure 111. 3/4" handle diameter (View A)

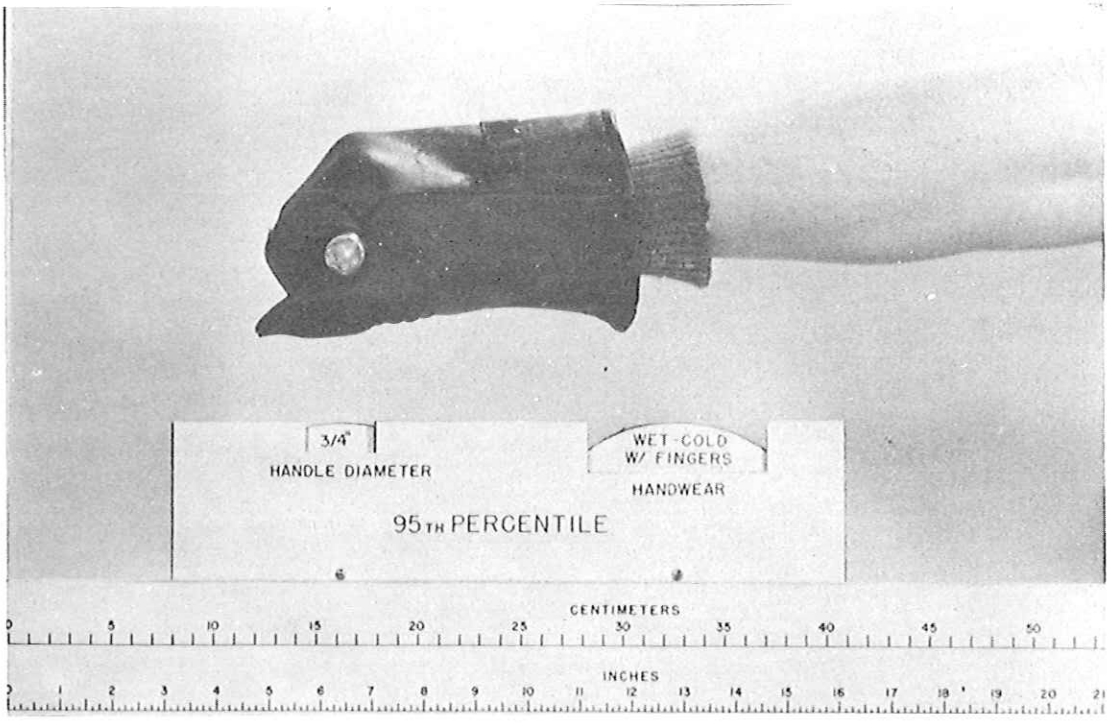

Figure 112. 3/4" handle diameter (View B)

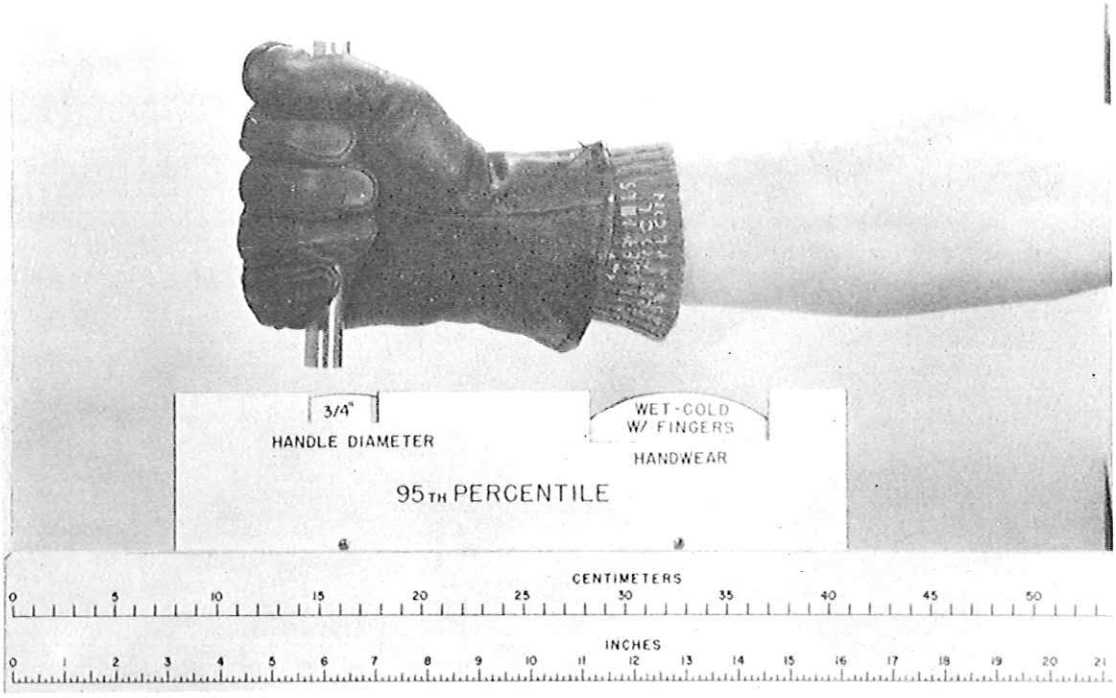

Figure 113. 3/4" handle diameter (View C)

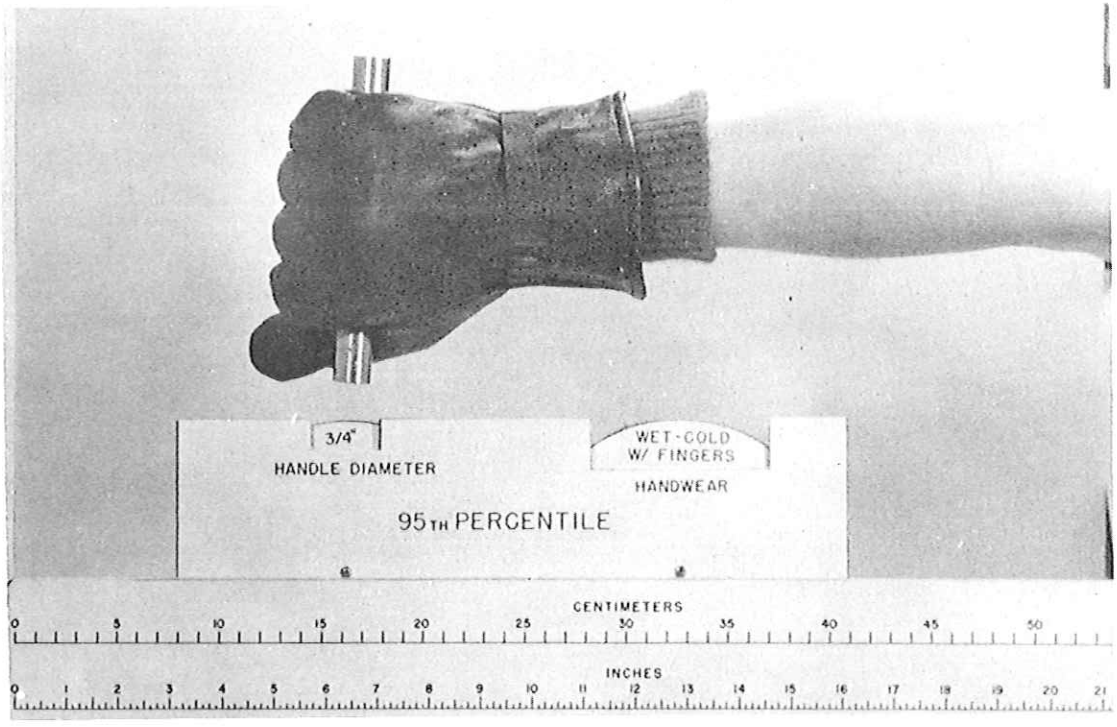

Figure 114. 3/4" handle diameter (View D)

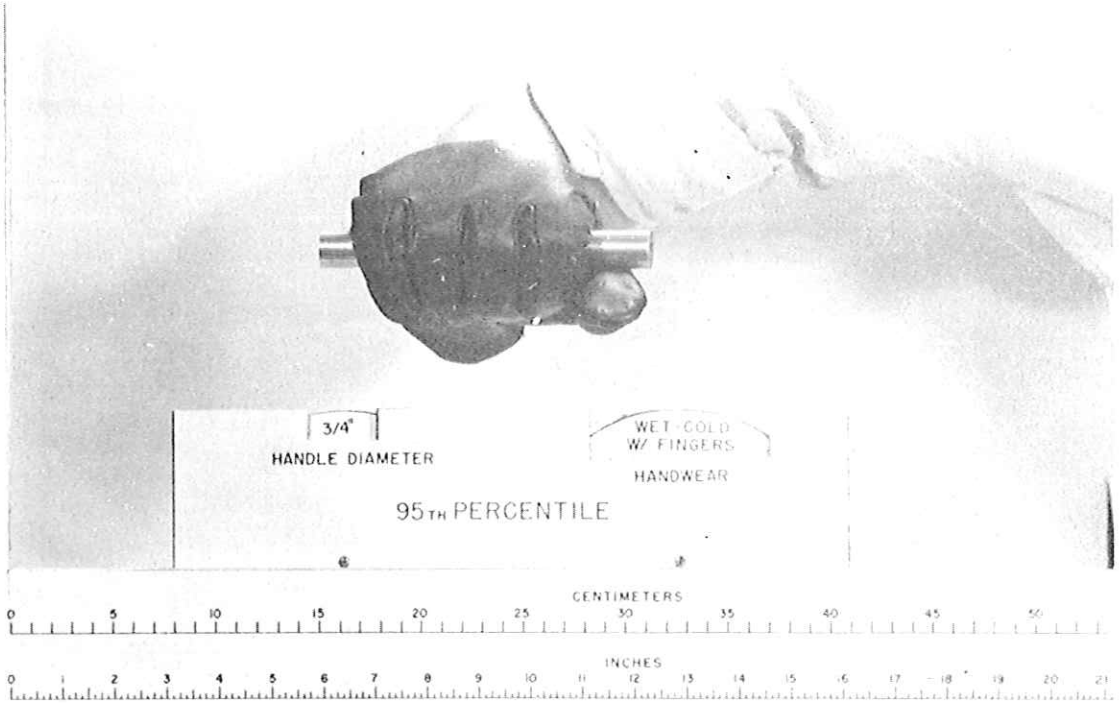

Figure 115. 3/4" handle diameter (View E)

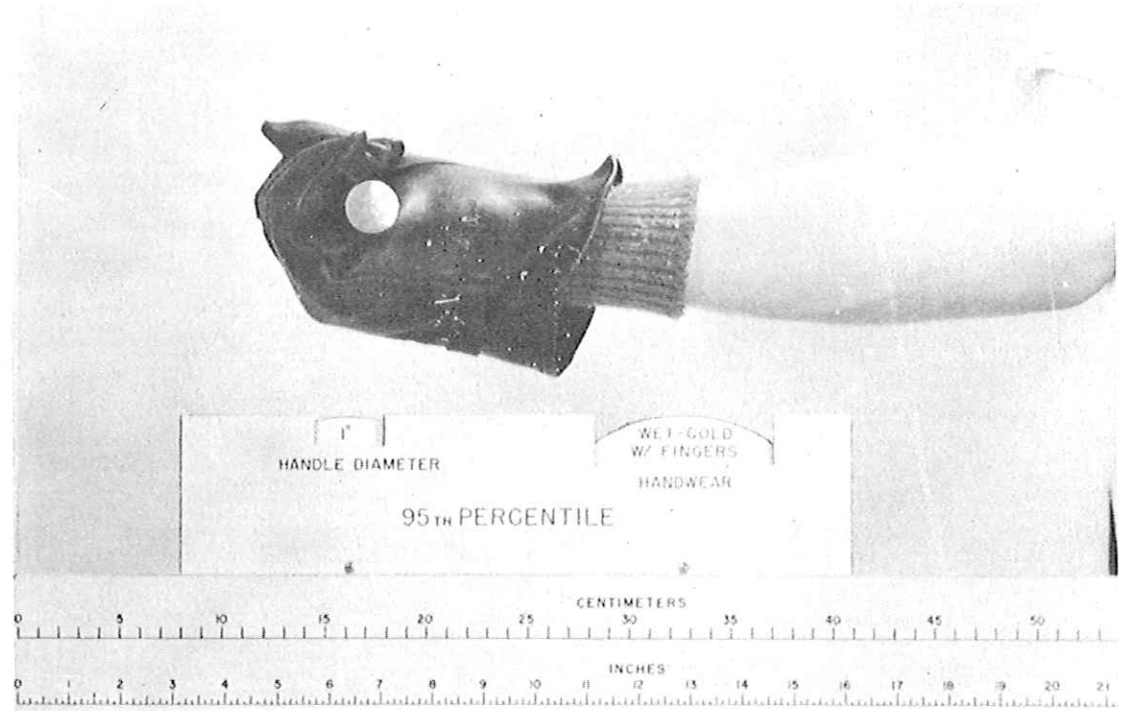

Figure 116. 1" handle diameter (View A)

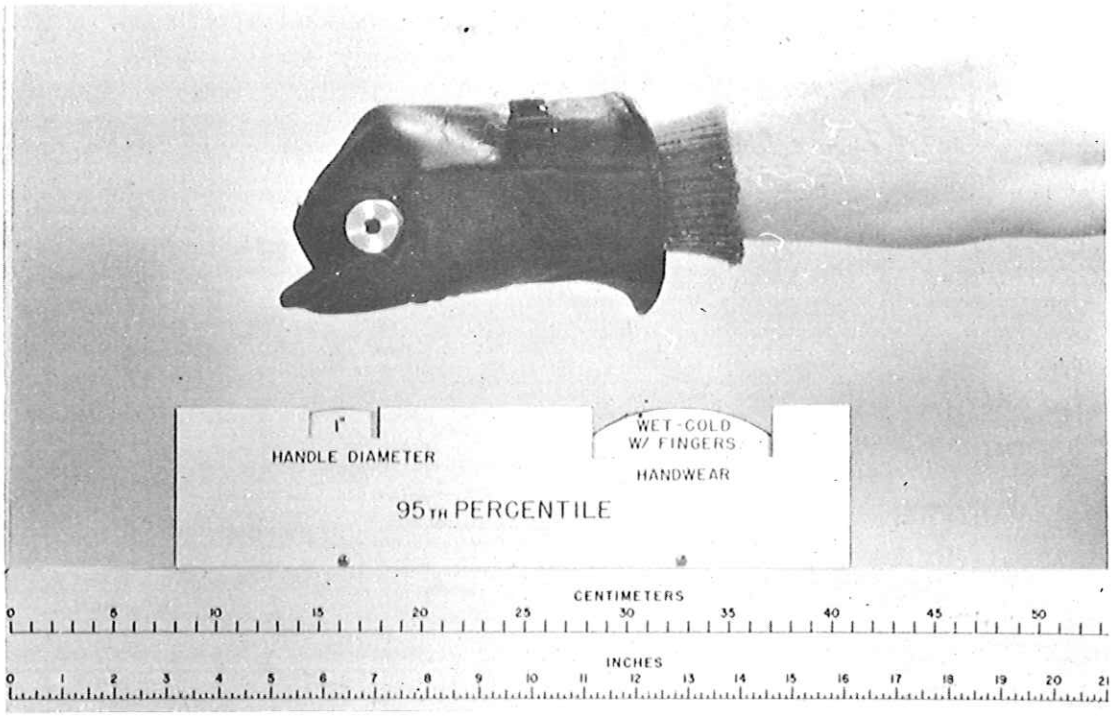

Figure 117. 1" handle diameter (View B)

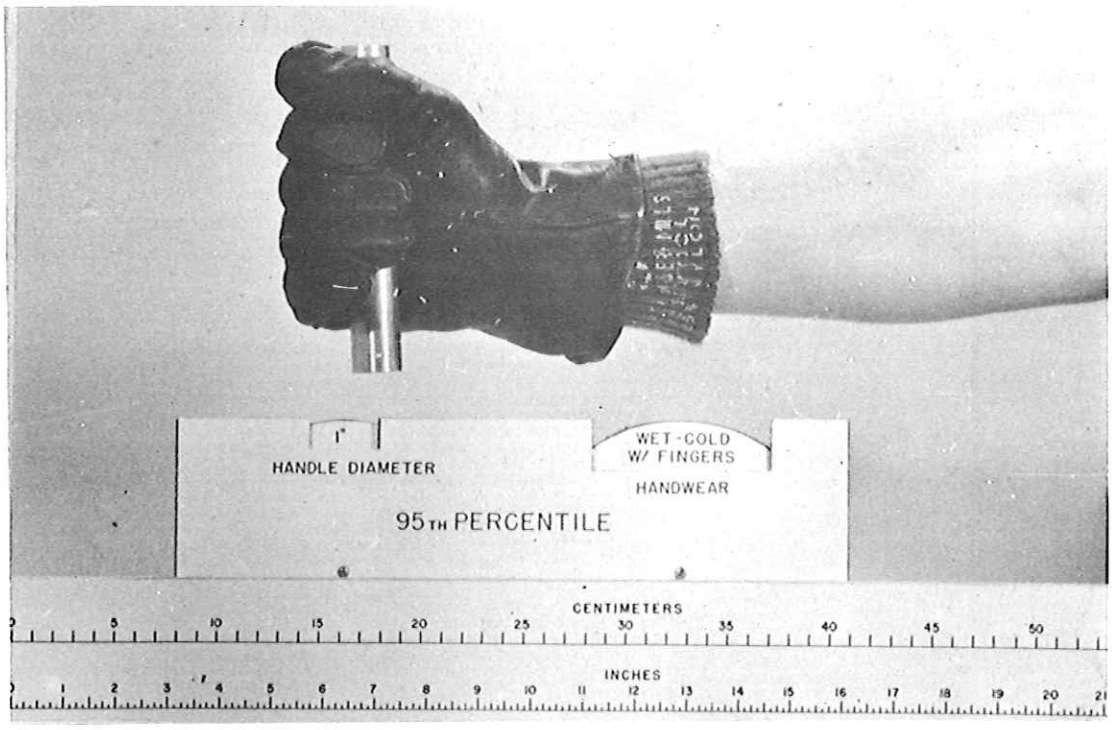

Figure 118. 1" handle diameter (View C)

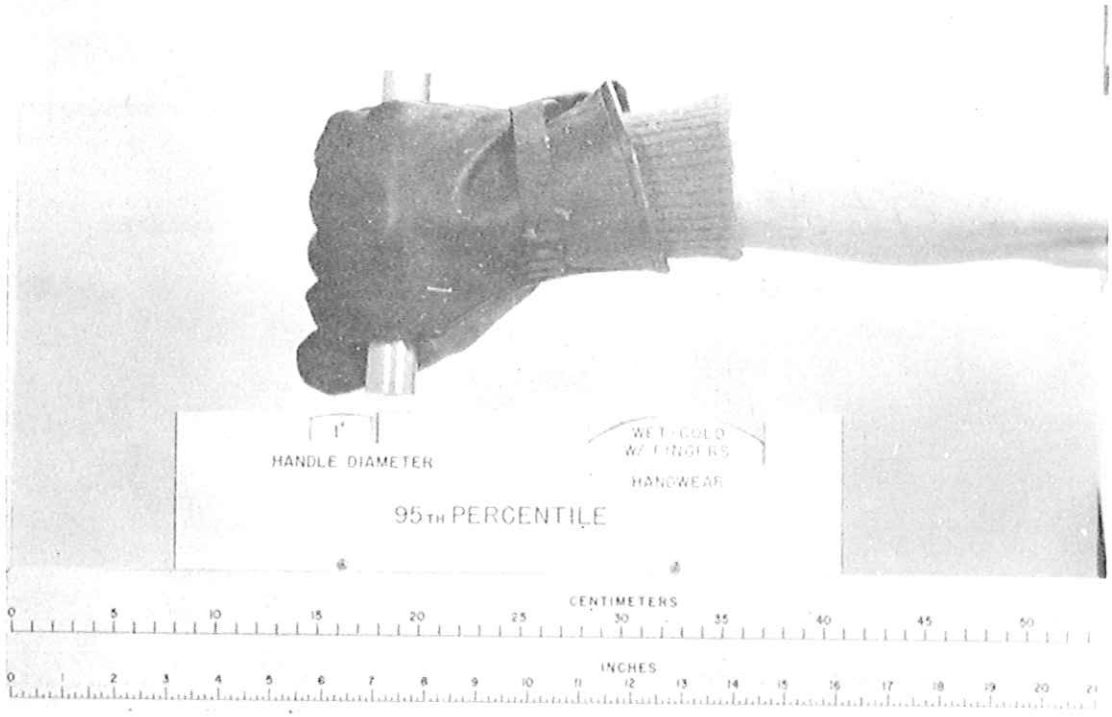

Figure 119. 1" handle diameter (View D)

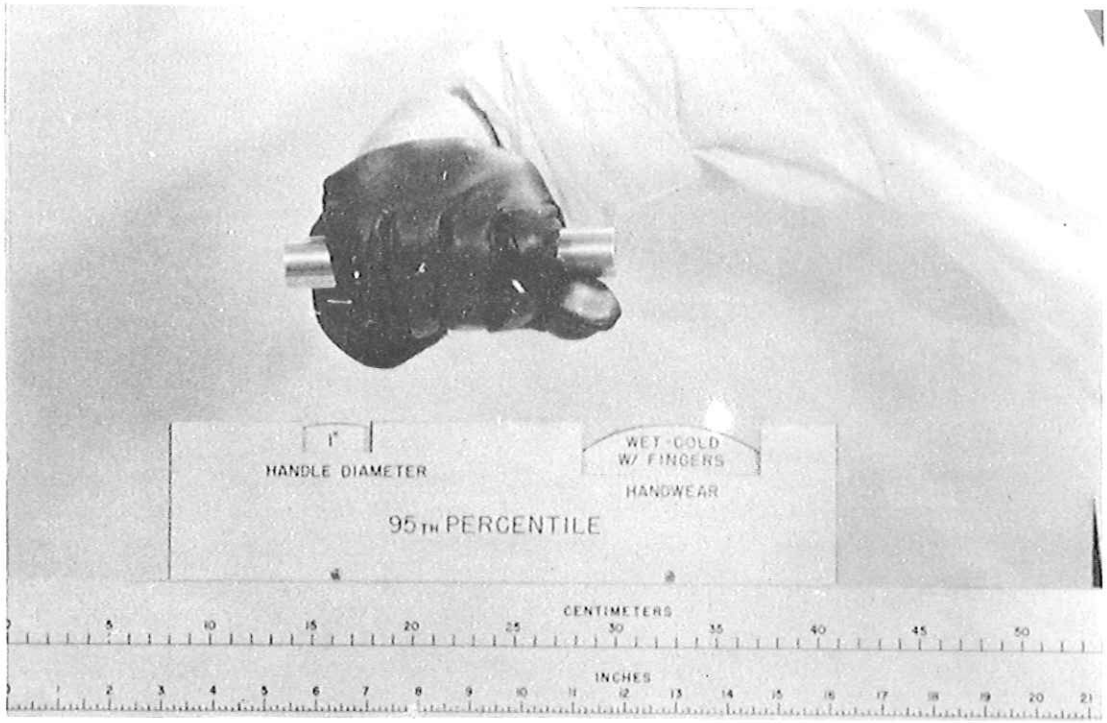

Figure 120. 1" handle diameter (View E)

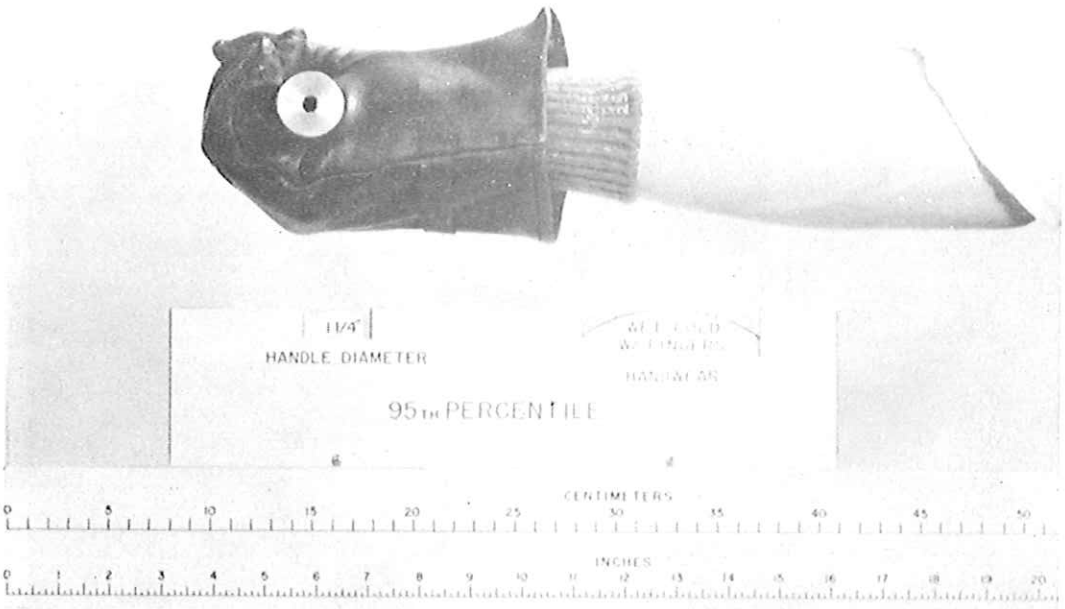

Figure 121. $1\frac{1}{4}$" handle diameter (View A)

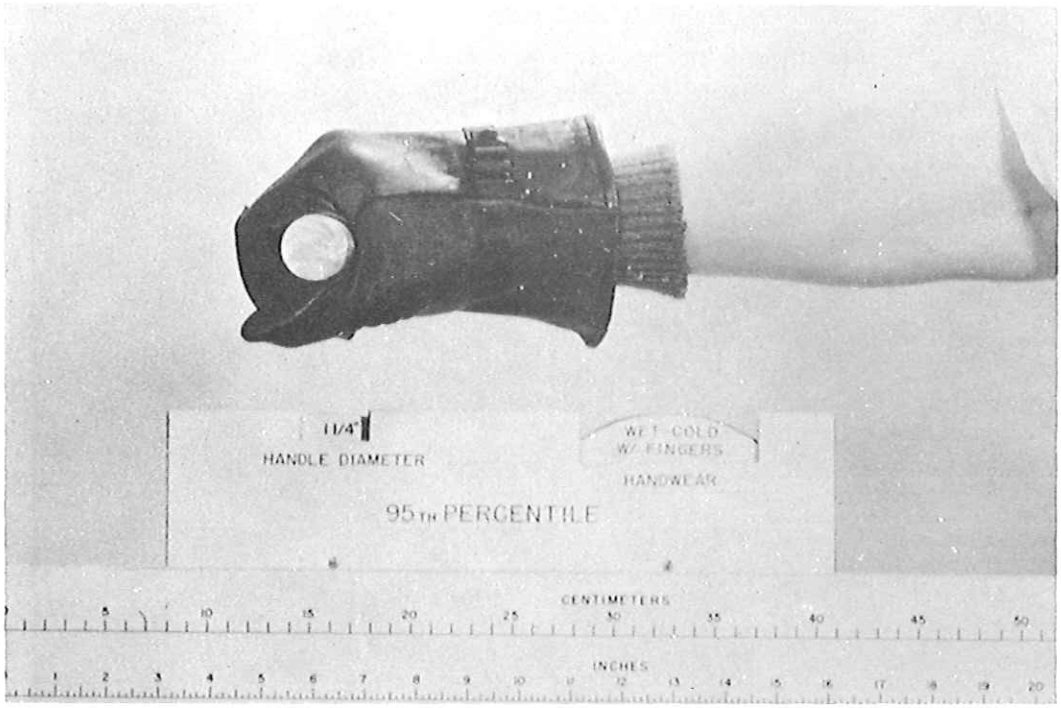

Figure 122. $1\frac{1}{4}$" handle diameter (View B)

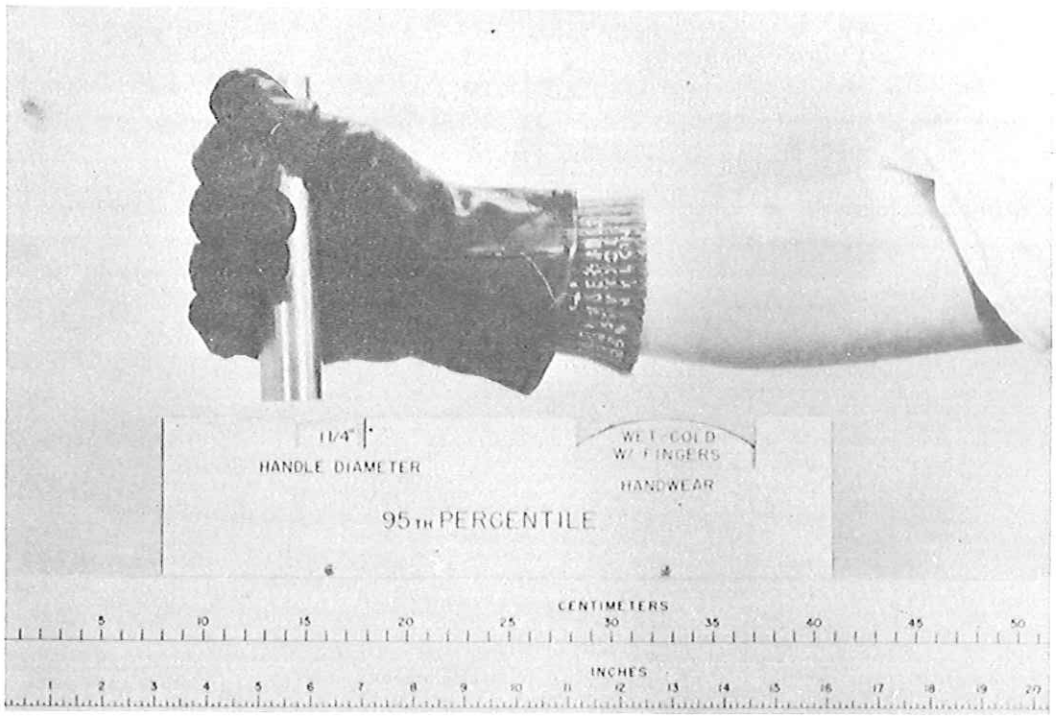

Figure 123. $1\frac{1}{4}$" handle diameter (View C)

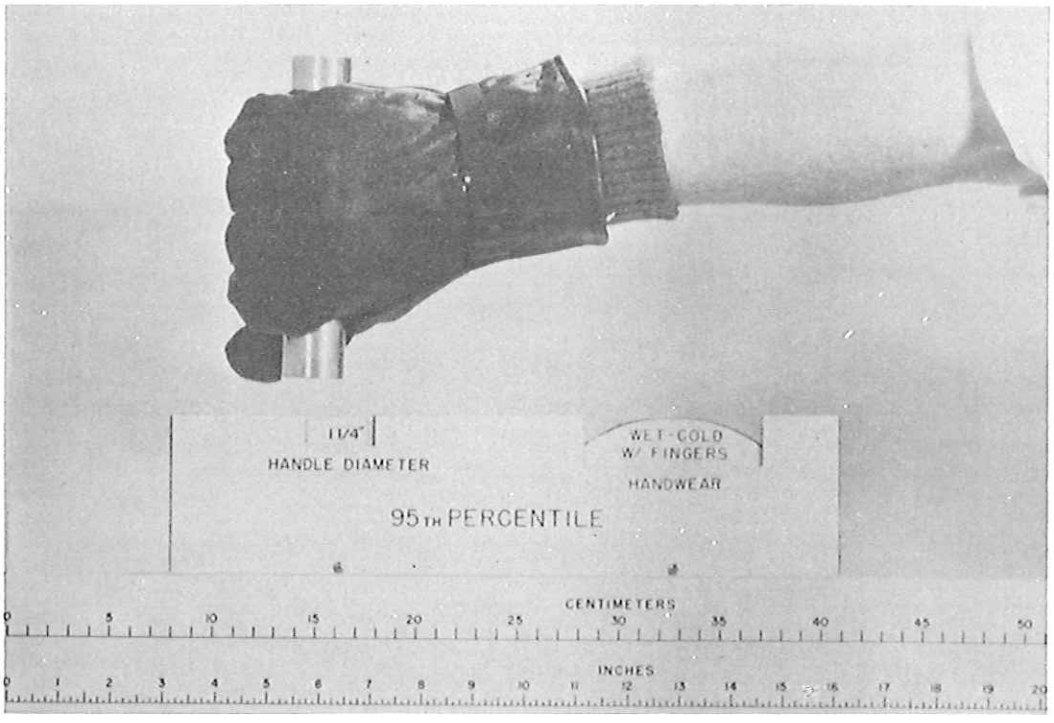

Figure 124. $1\frac{1}{4}$" handle diameter (View D)

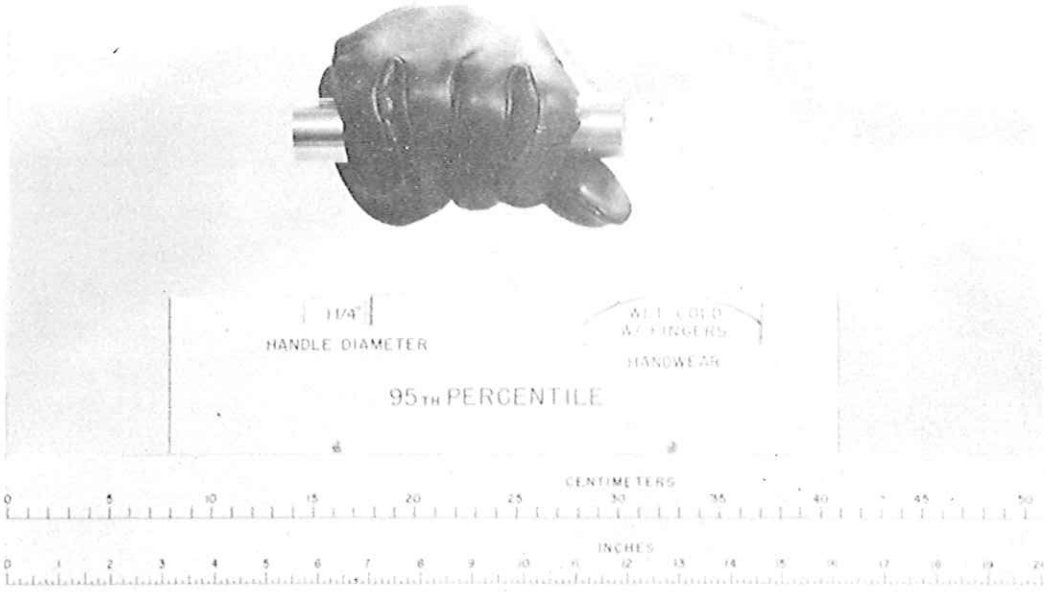

Figure 125. $1\frac{1}{4}$" handle diameter (View E)

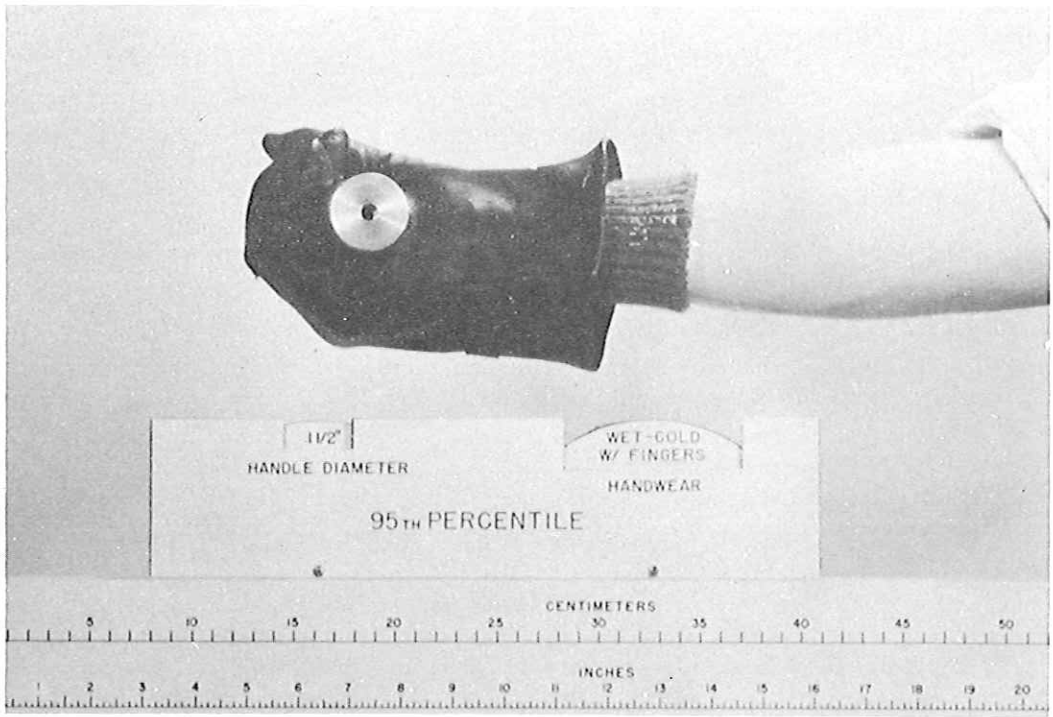

Figure 126. $1\frac{1}{2}$" handle diameter (View A)

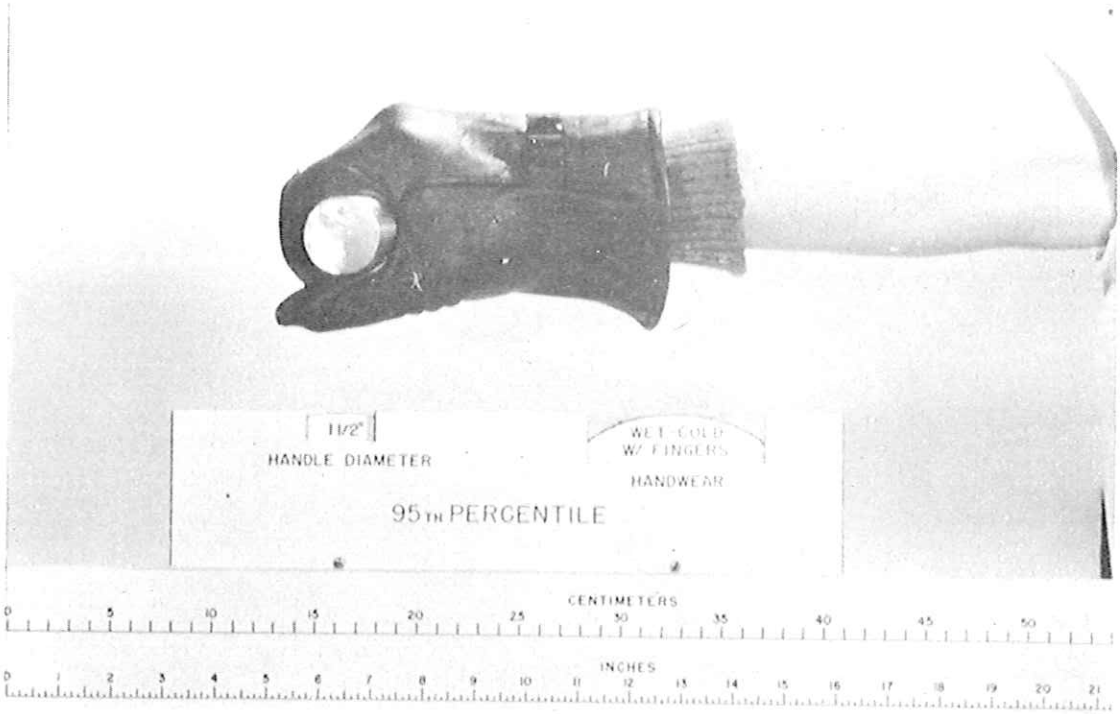

Figure 127. 1½" handle diameter (View B)

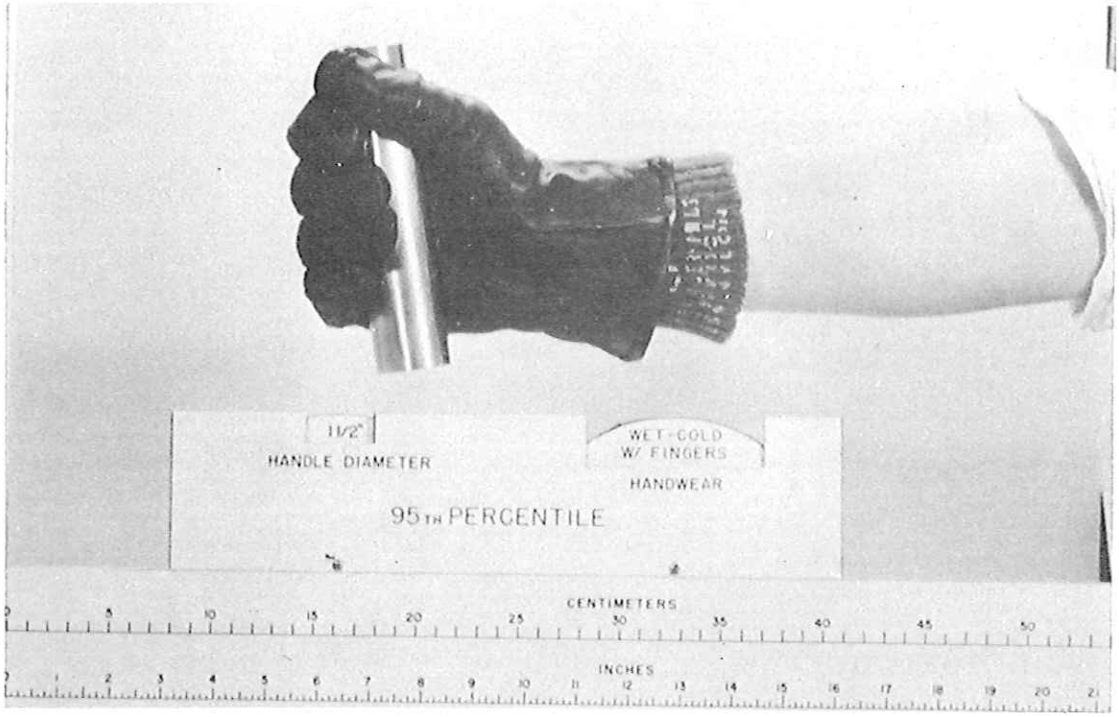

Figure 128. 1½" handle diameter (View C)

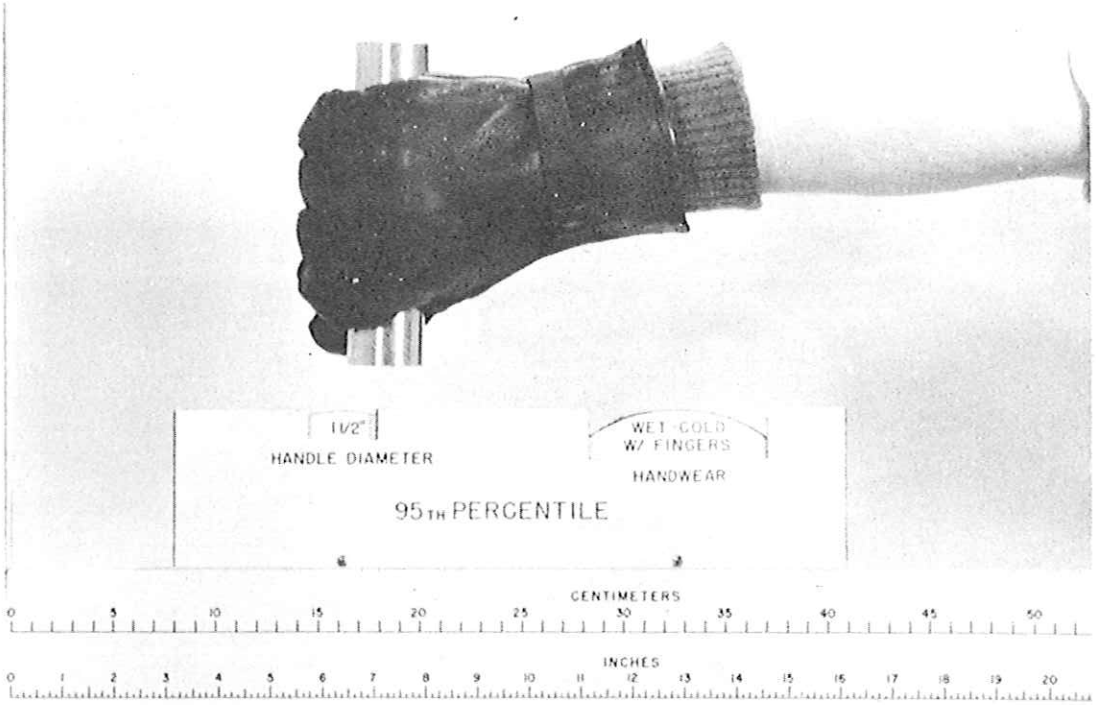

Figure 129. 1½" handle diameter (View D)

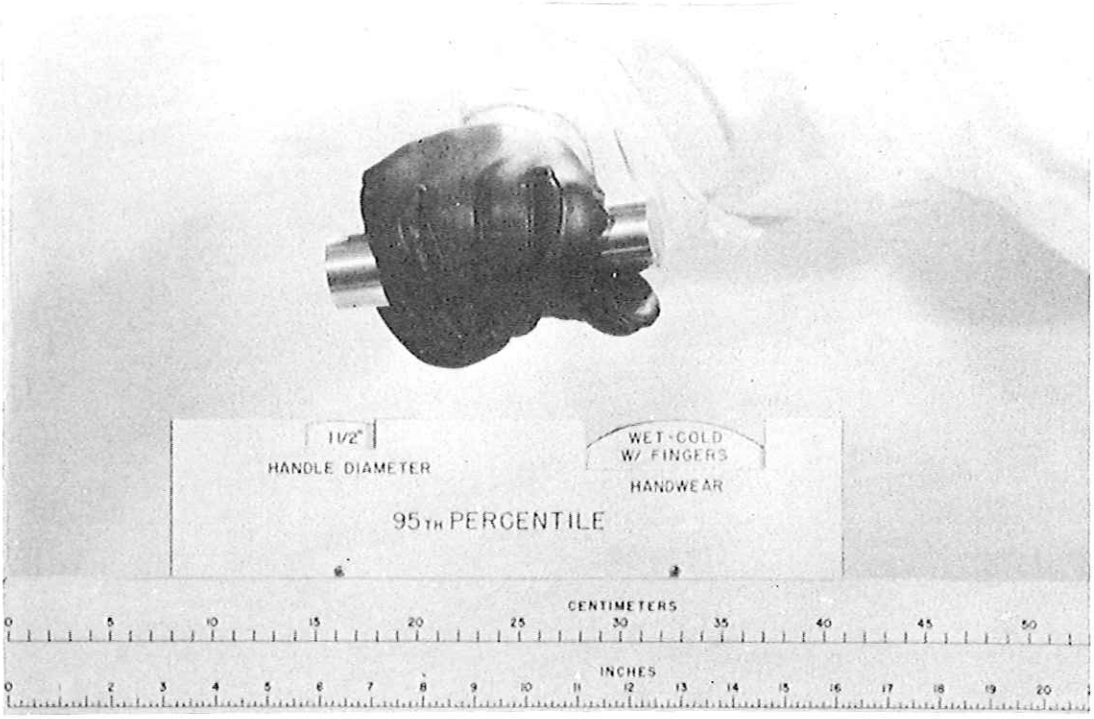

Figure 130. 1½" handle diameter (View E)

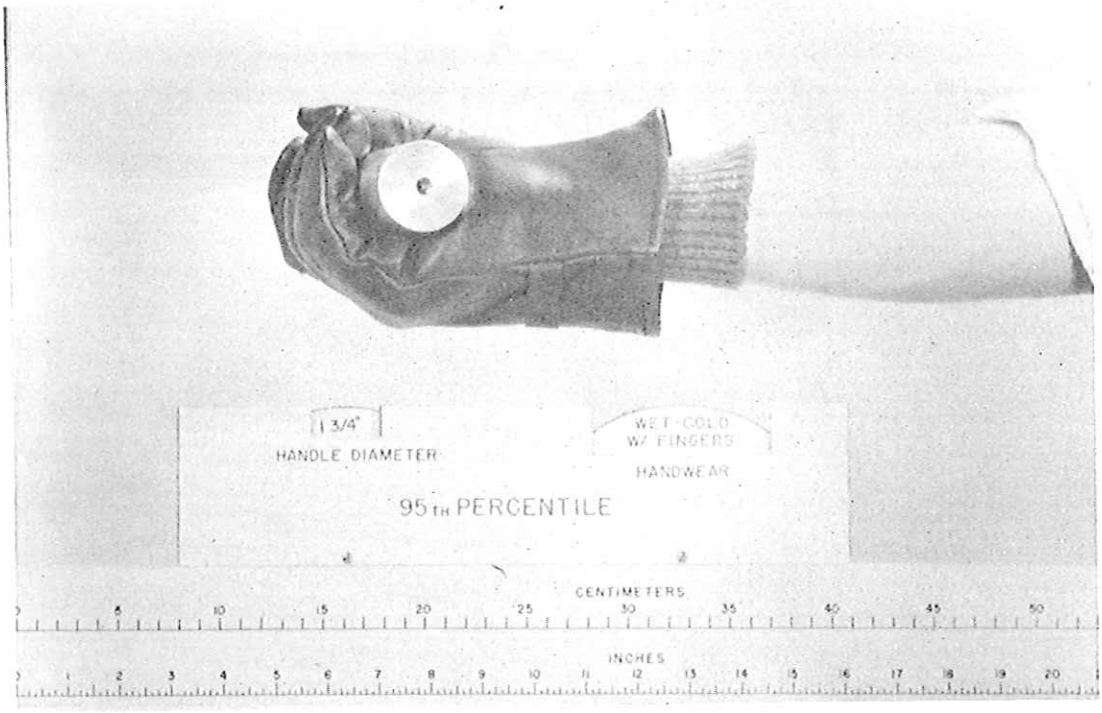

Figure 131. 1 3/4" handle diameter (View A)

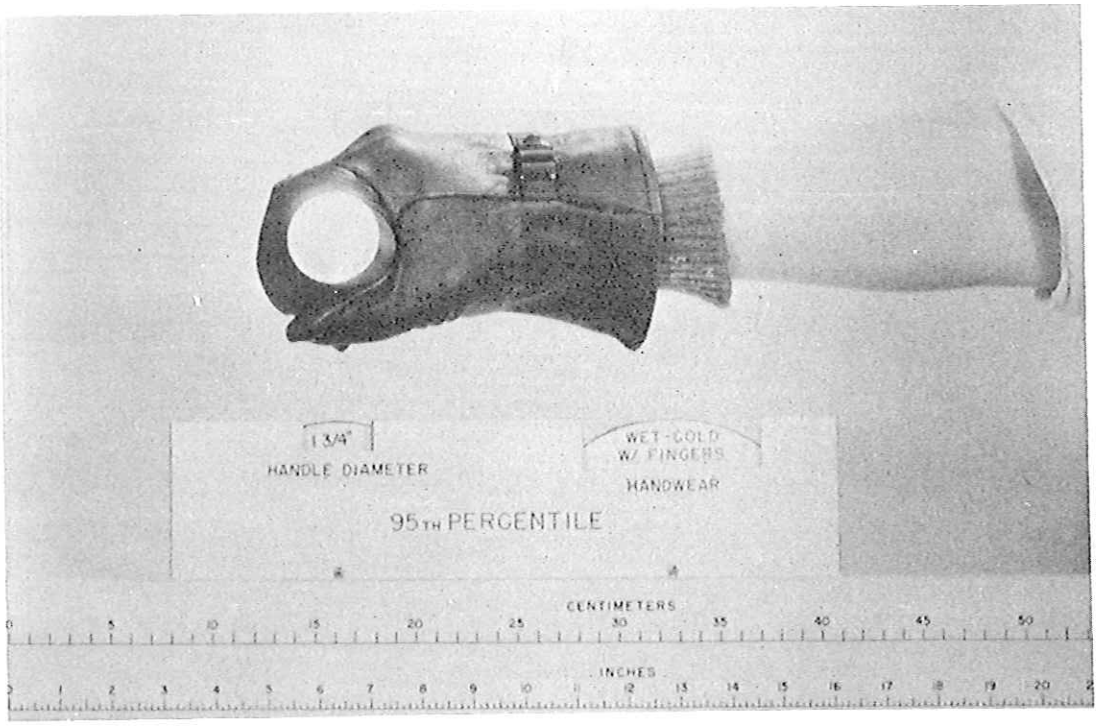

Figure 132. 1 3/4" handle diameter (View B)

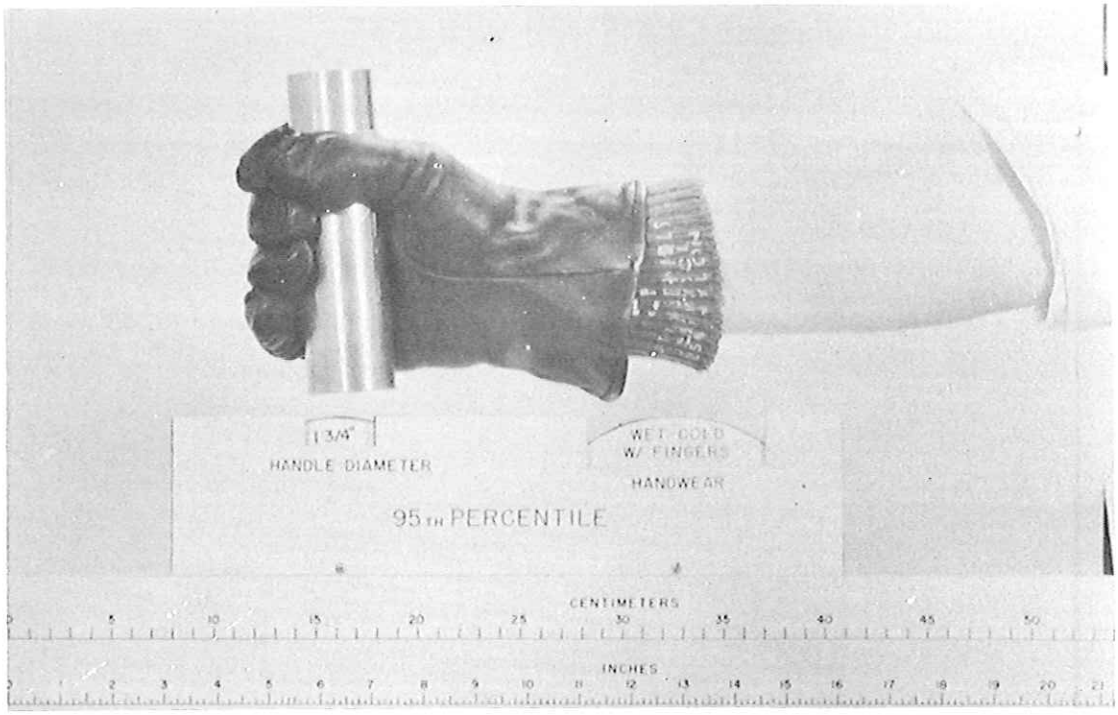

Figure 133. 1 3/4" handle diameter (View C)

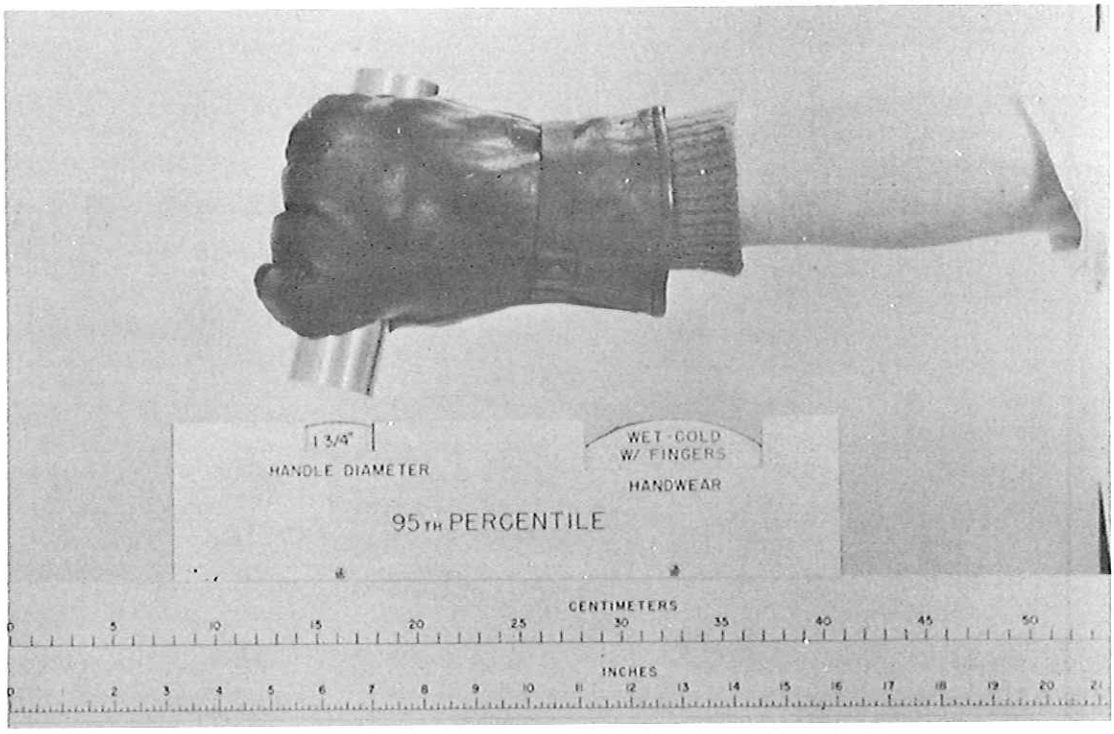

Figure 134. 1 3/4" handle diameter (View D)

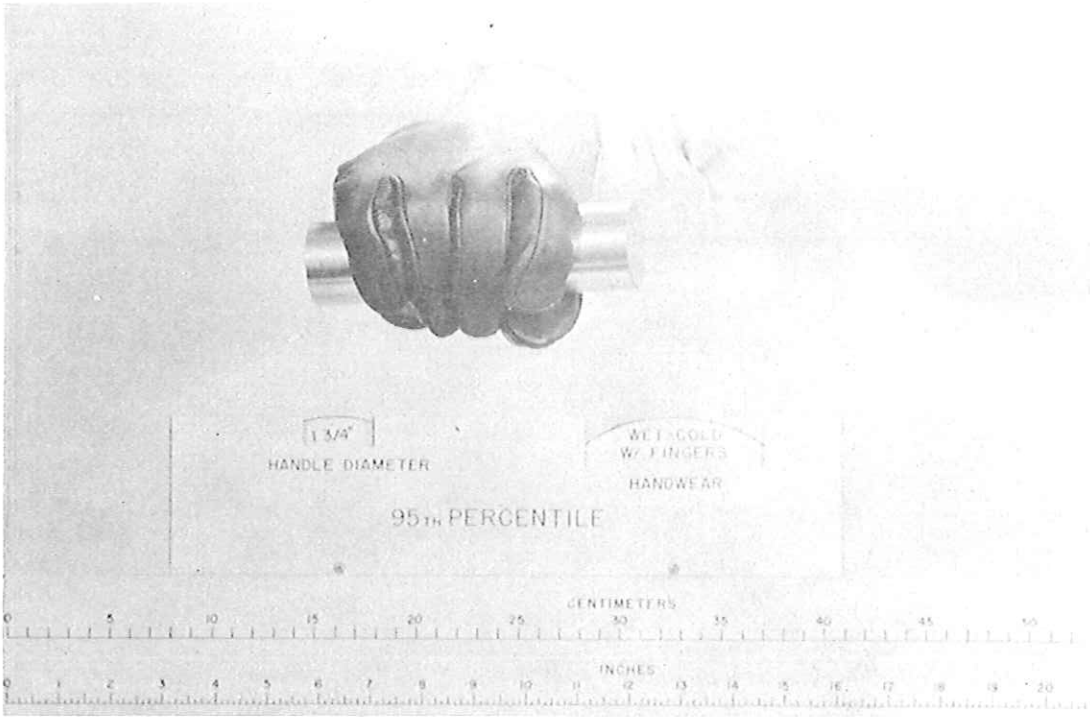

Figure 135. 1 3/4" handle diameter (View E)

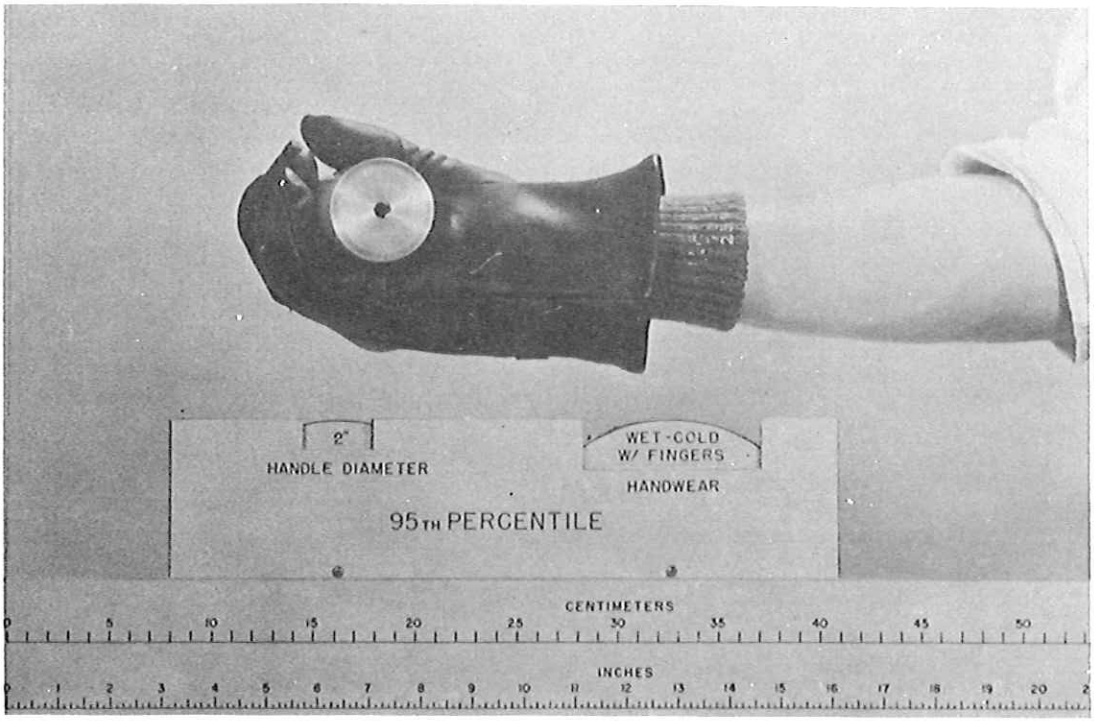

Figure 136. 2" handle diameter (View A)

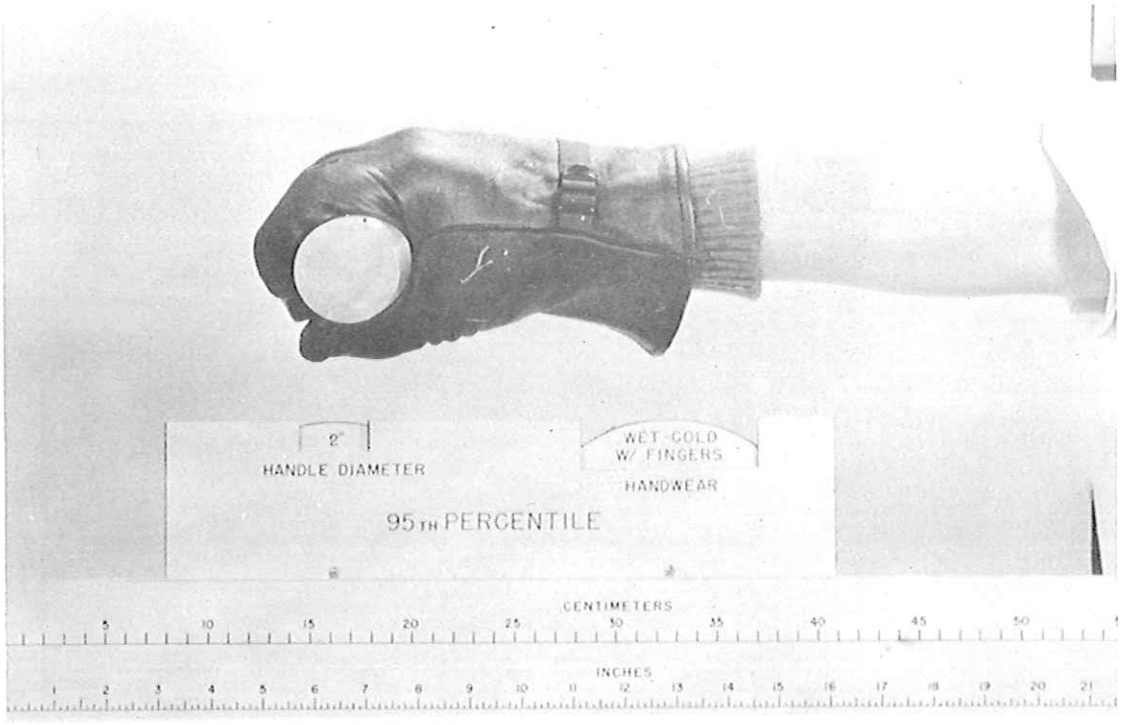

Figure 137. 2" handle diameter (View B)

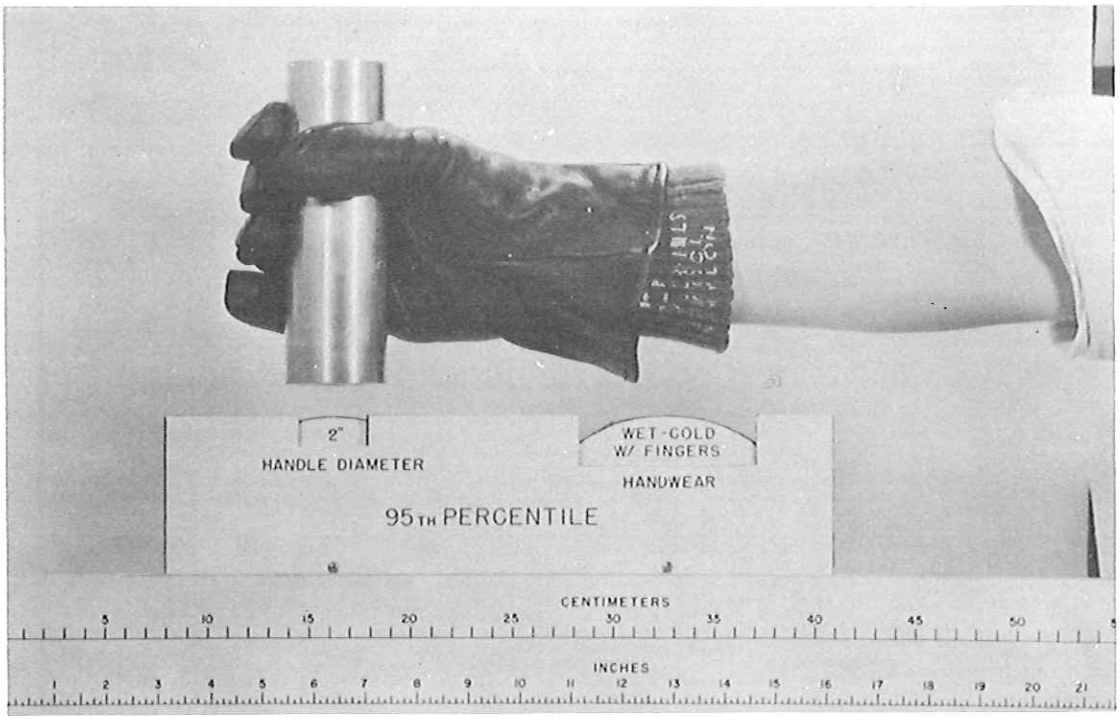

Figure 138. 2" handle diameter (View C)

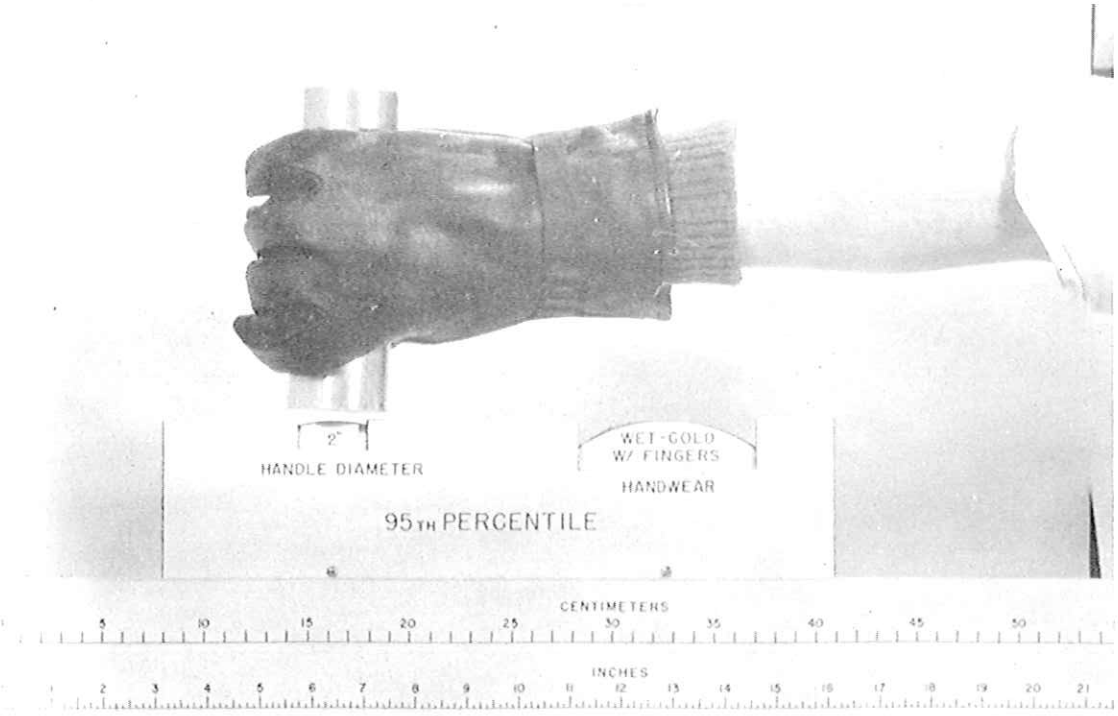

Figure 139. 2" handle diameter (View D)

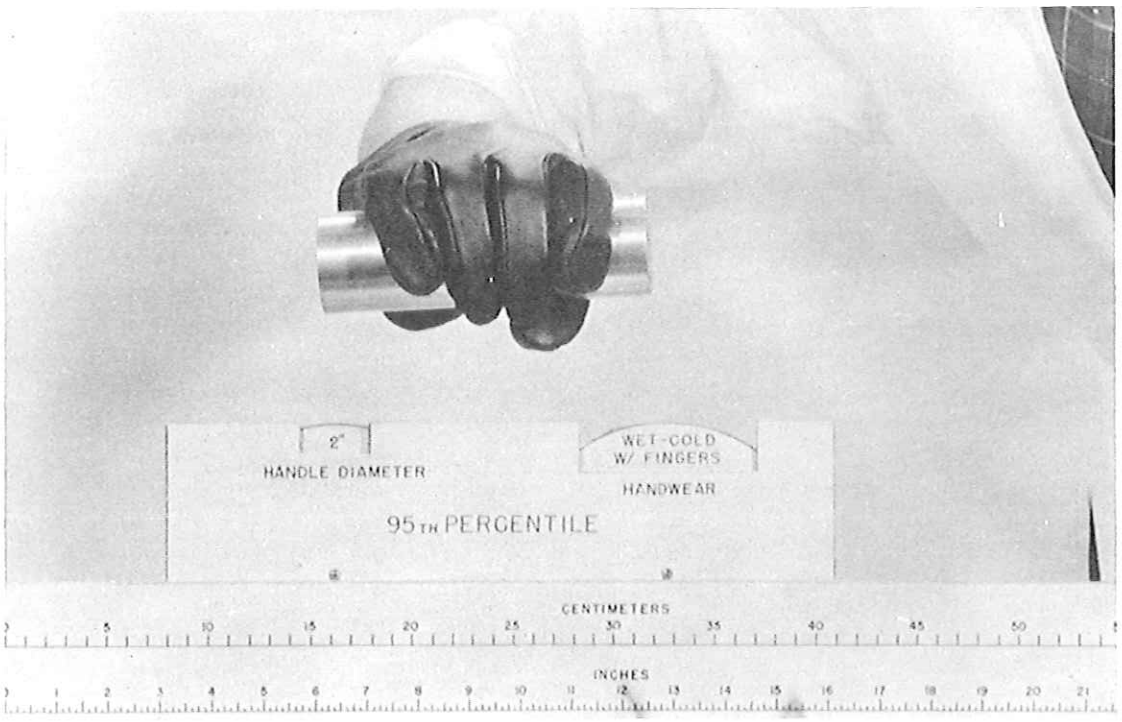

Figure 140. 2" handle diameter (View E)

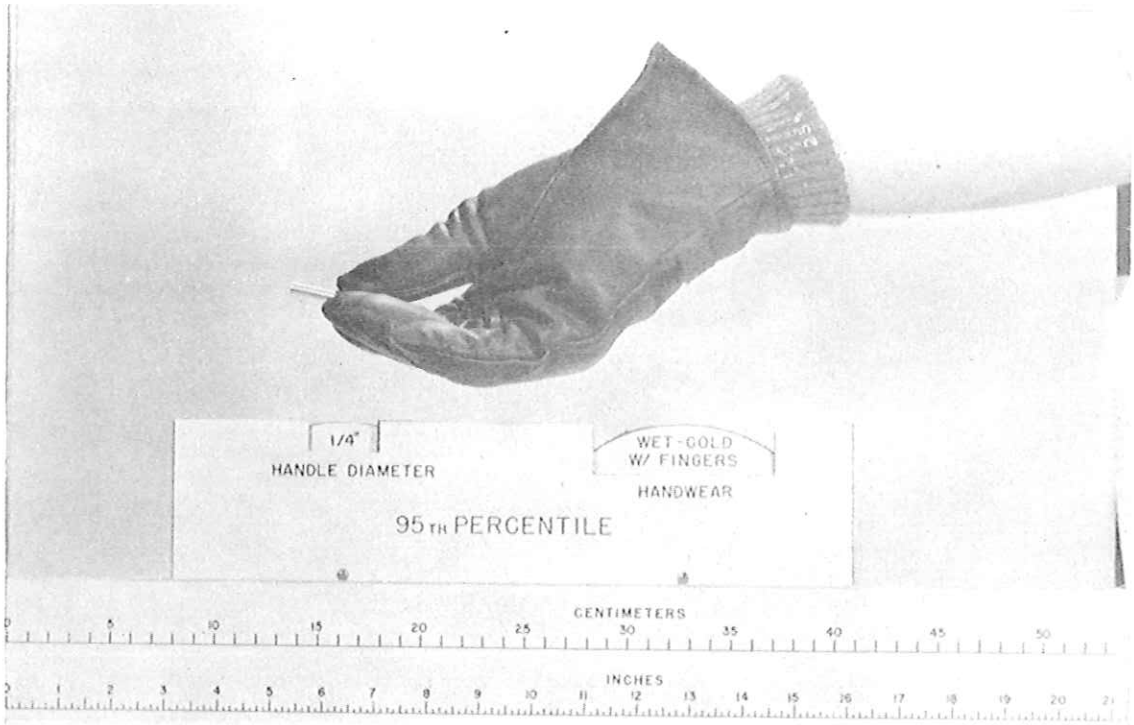

Figure 141. $\frac{1}{4}$" knob diameter (View A)

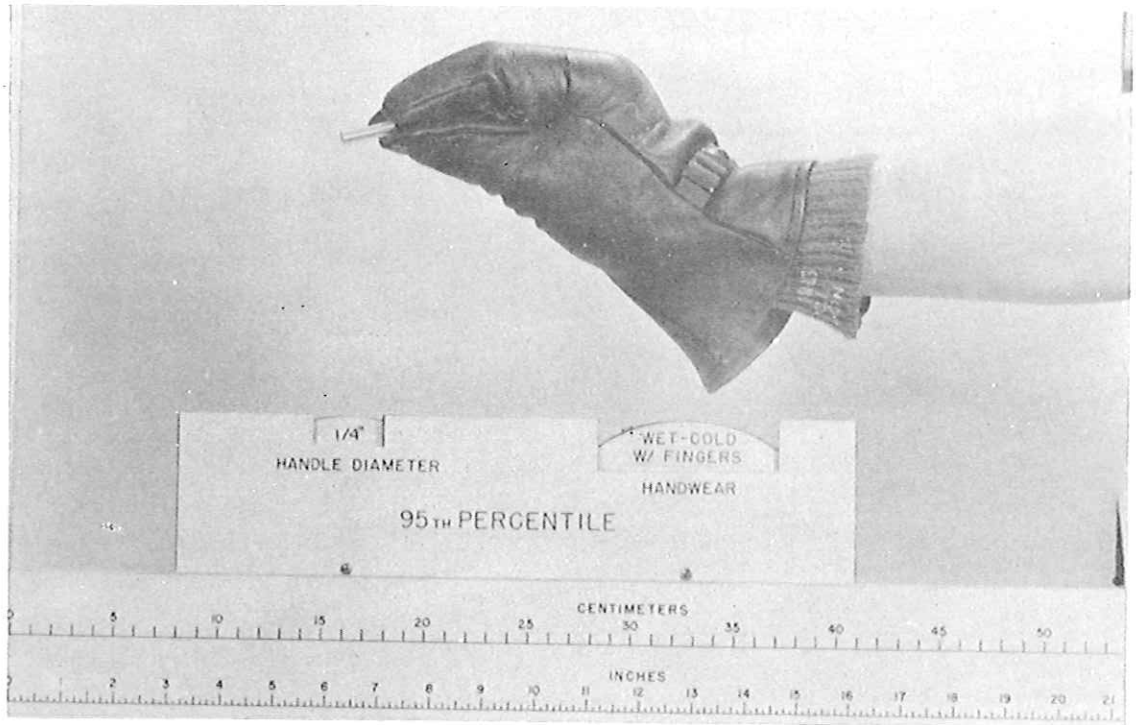

Figure 142. $\frac{1}{4}$" knob diameter (View B)

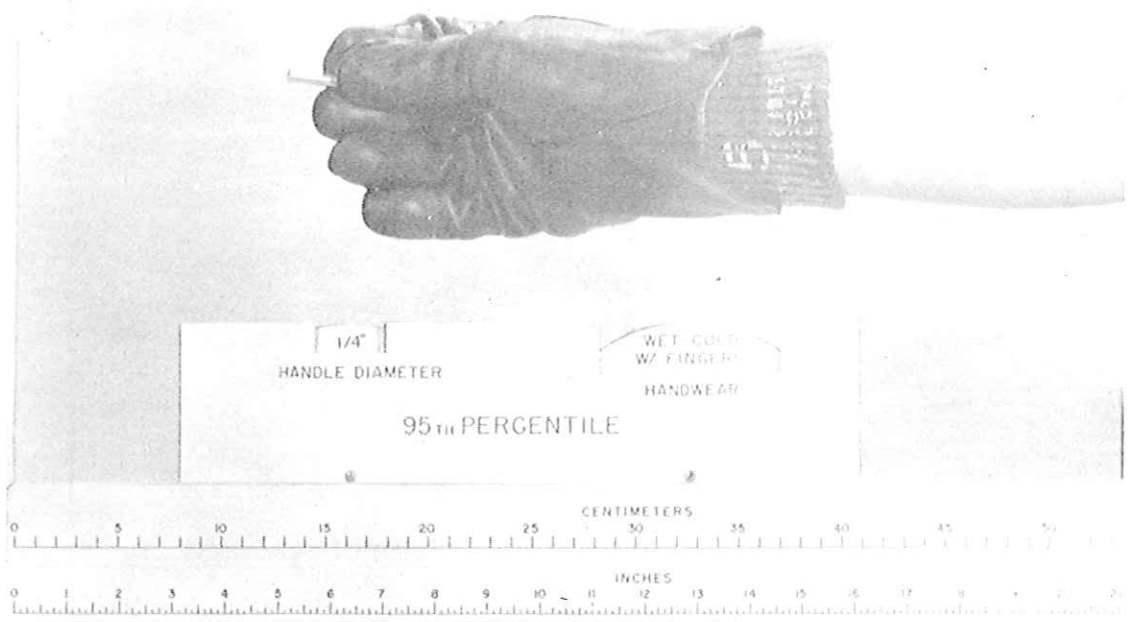

Figure 143. $\frac{1}{4}$" knob diameter (View C)

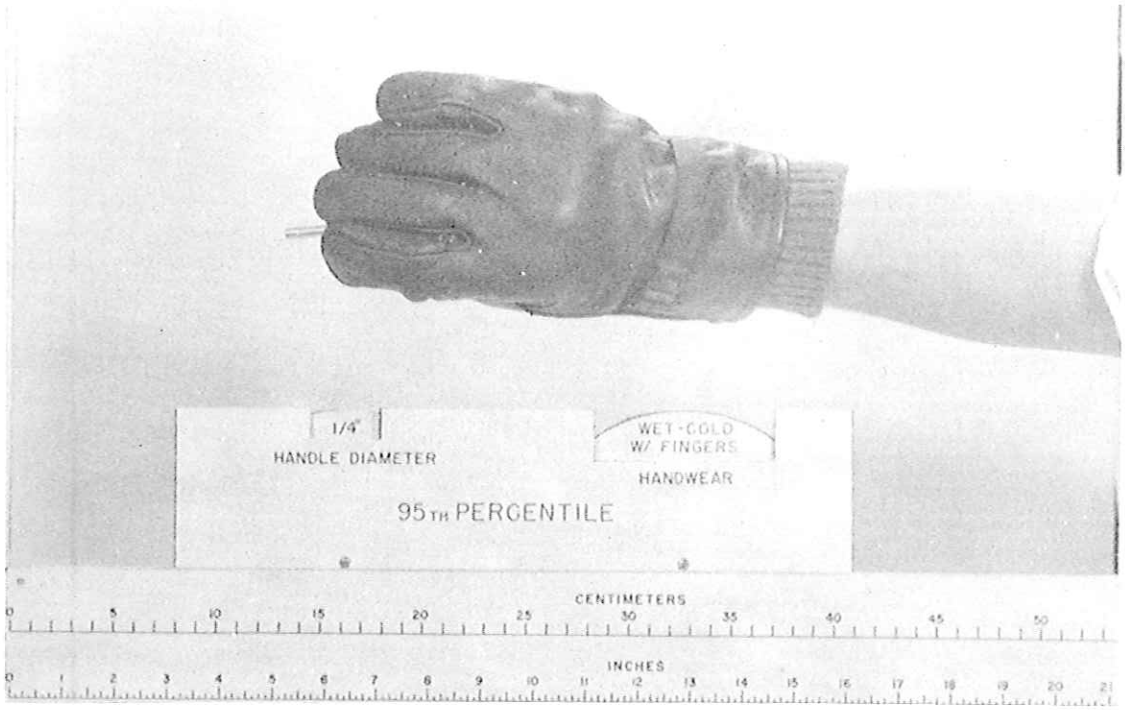

Figure 144. $\frac{1}{4}$" knob diameter (View D)

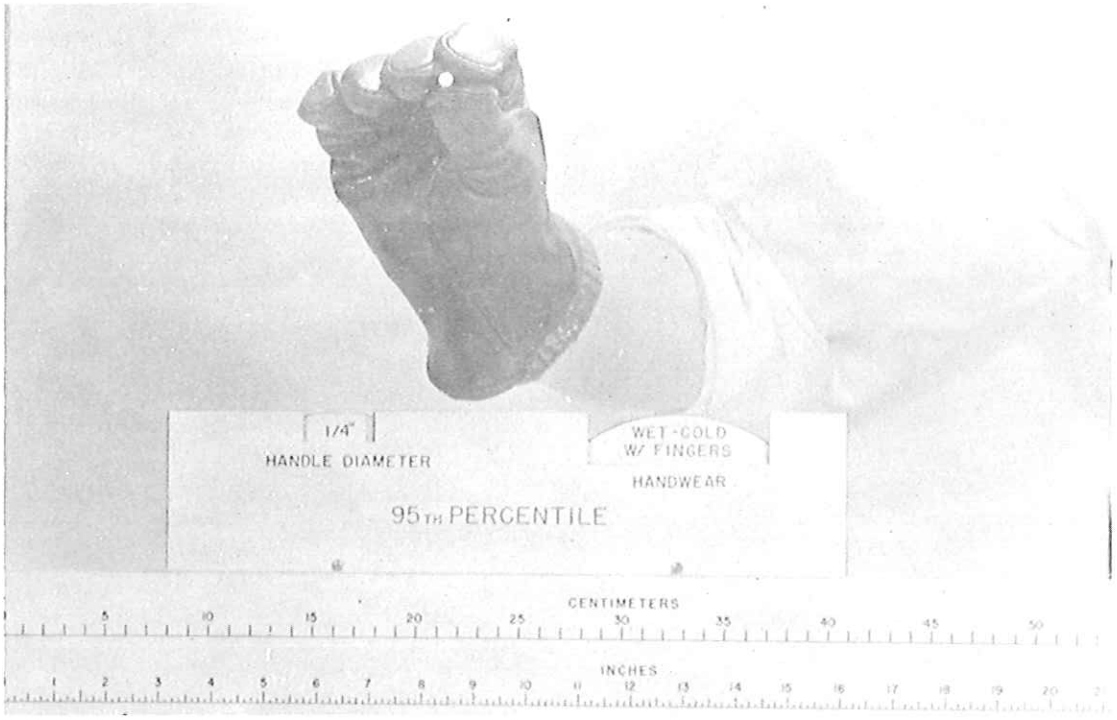

Figure 145. $\frac{1}{4}$" knob diameter (View E)

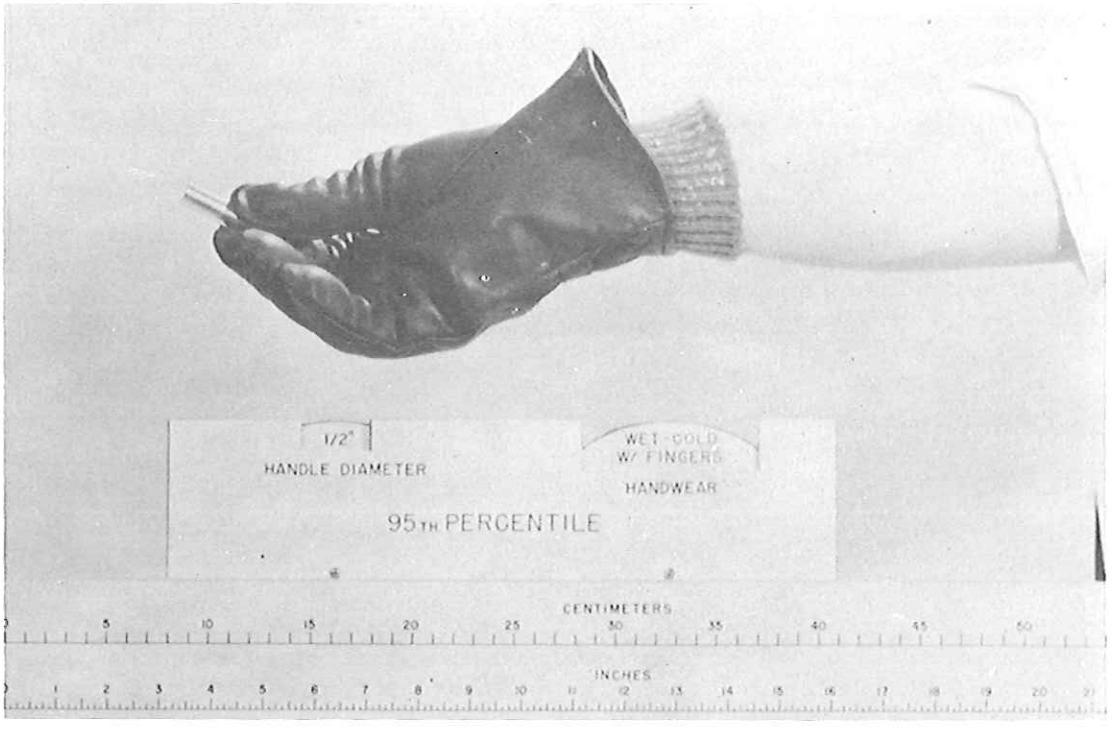

Figure 146. $\frac{1}{2}$" knob diameter (View A)

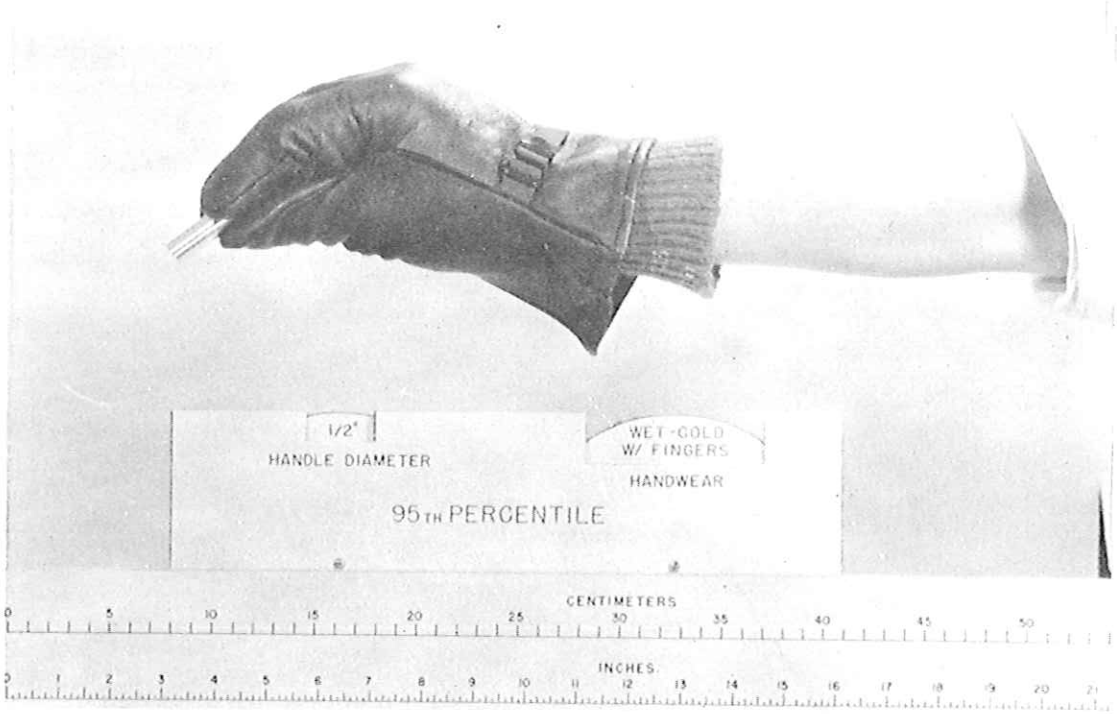

Figure 147. ½" knob diameter (View B)

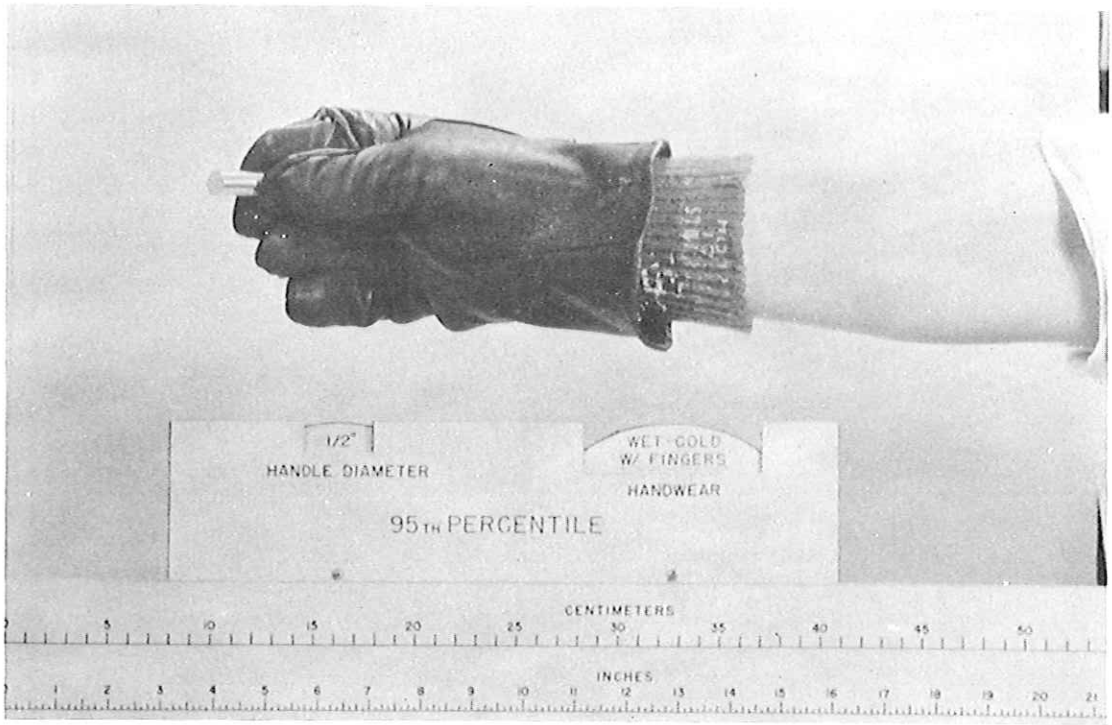

Figure 148. ½" knob diameter (View C)

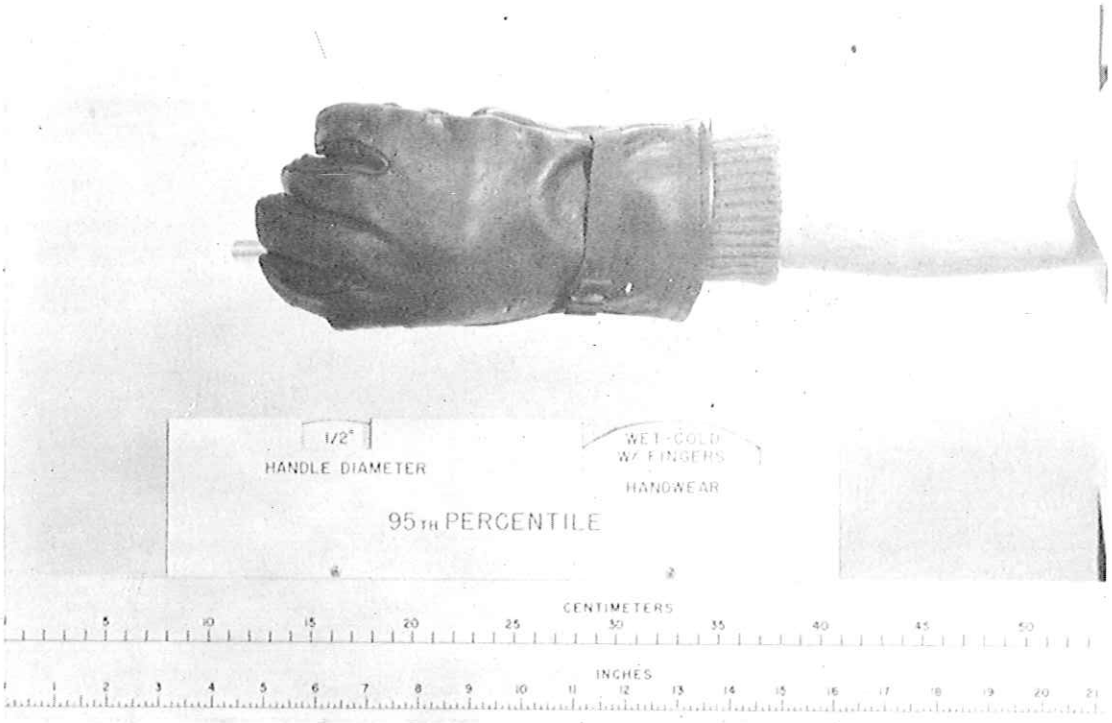

Figure 149. ½" knob diameter (View D)

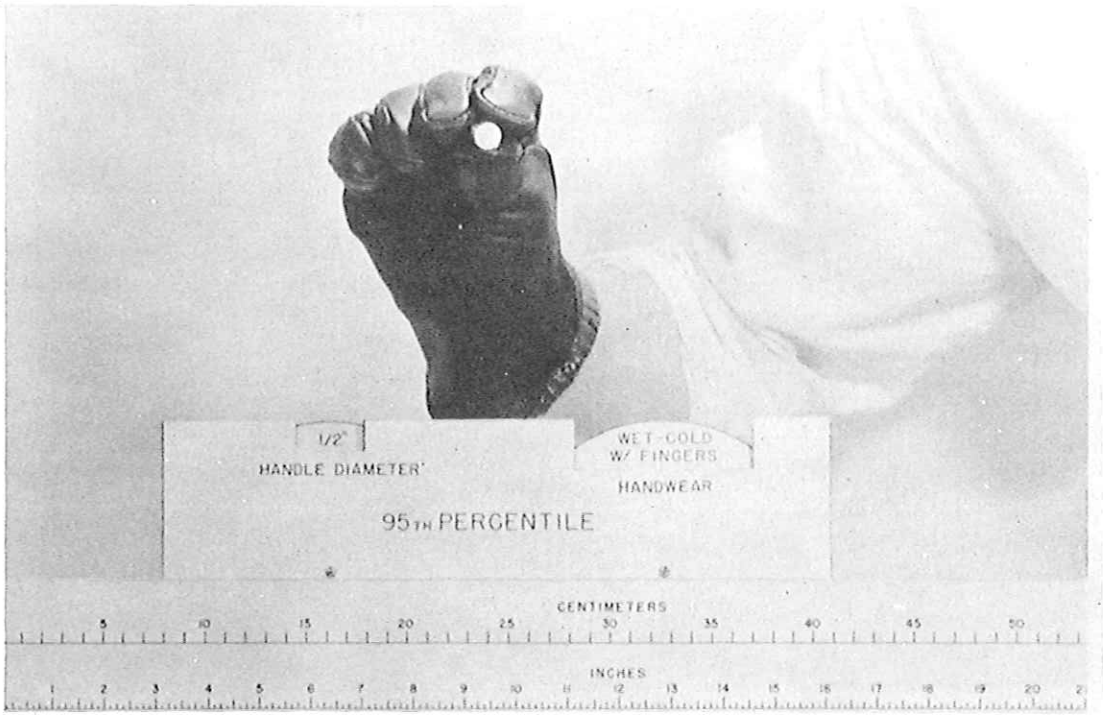

Figure 150. ½" knob diameter (View E)

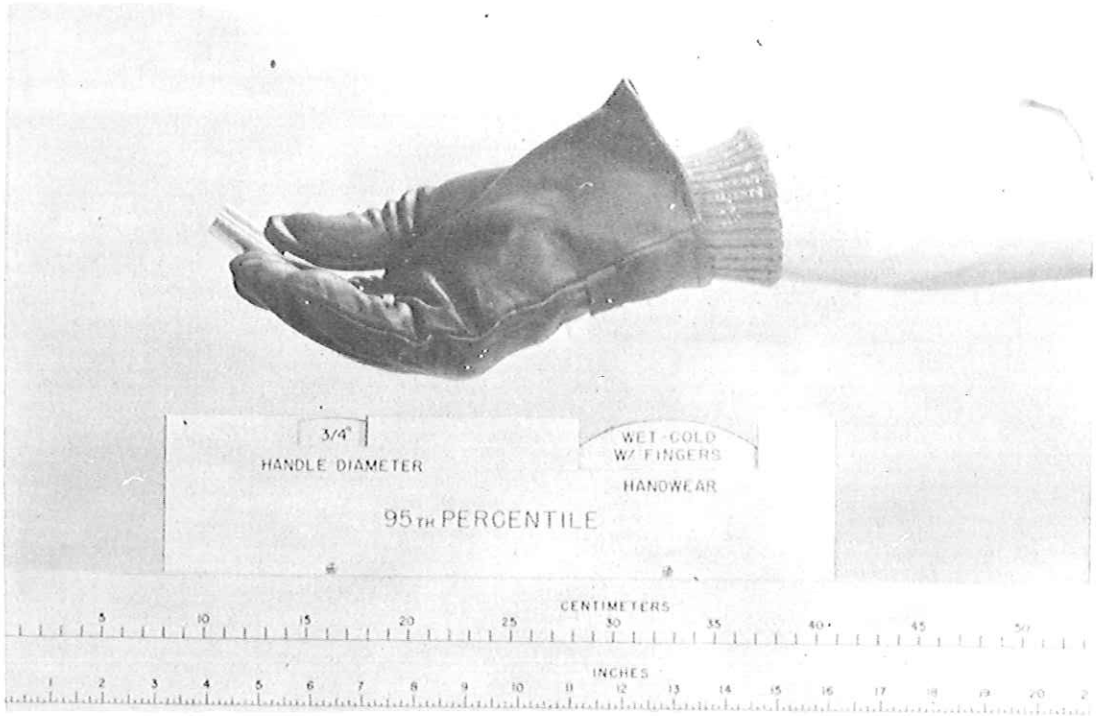

Figure 151. 3/4" knob diameter (View A)

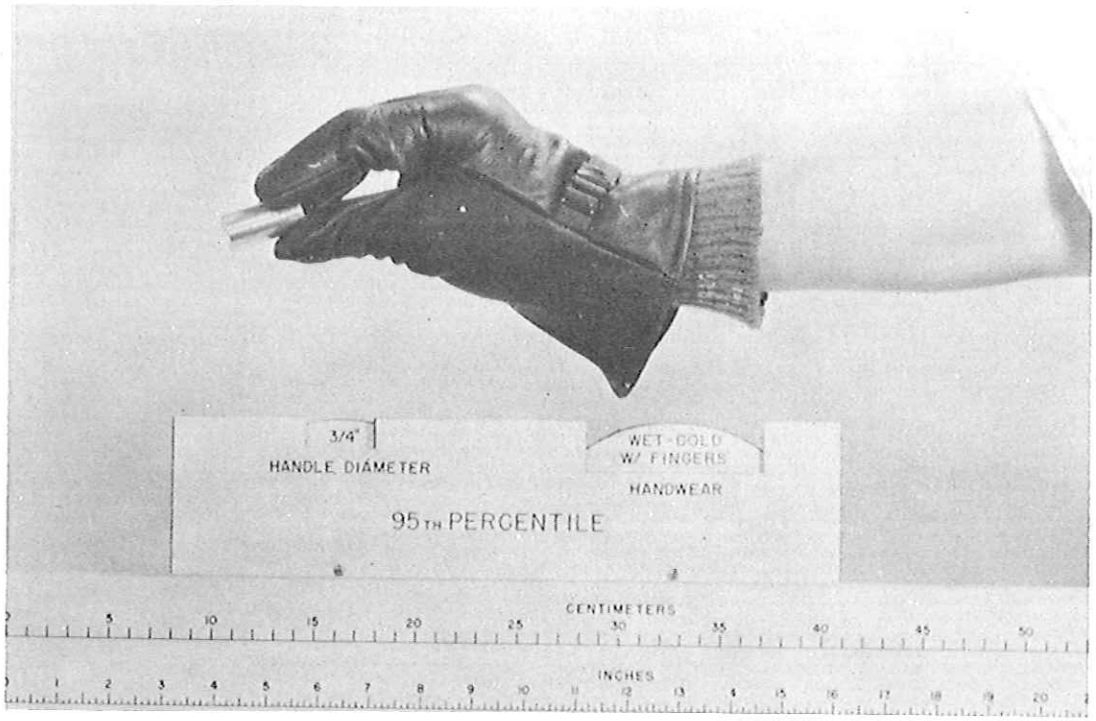

Figure 152. 3/4" knob diameter (View B)

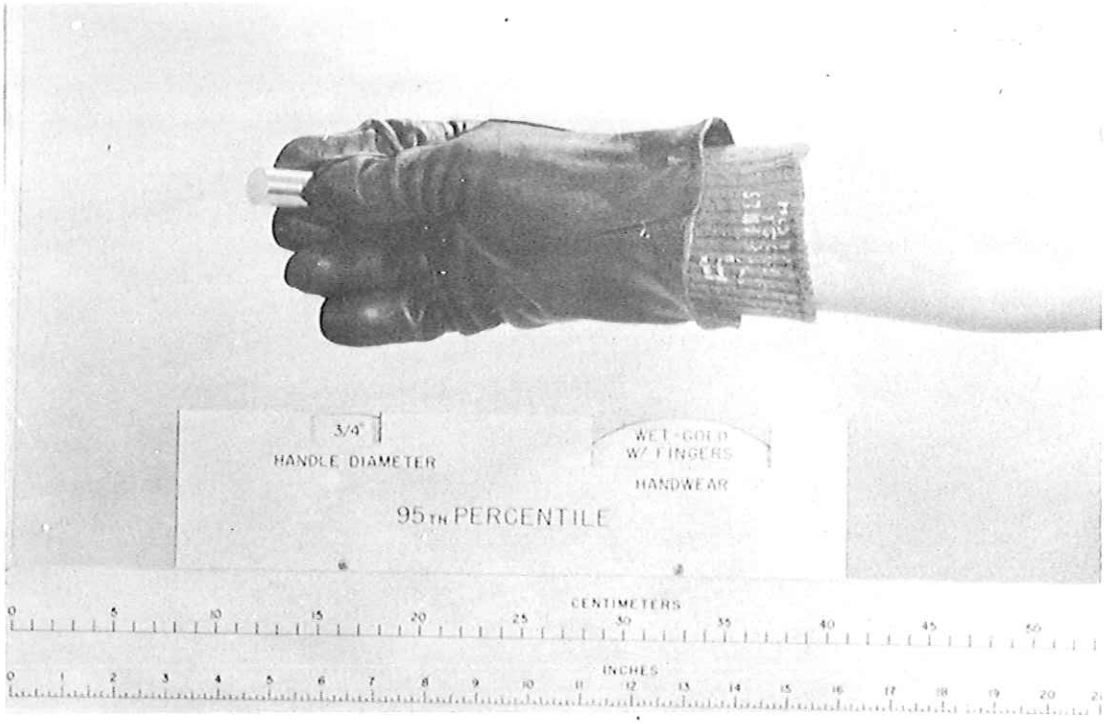

Figure 153. 3/4" knob diameter (View C)

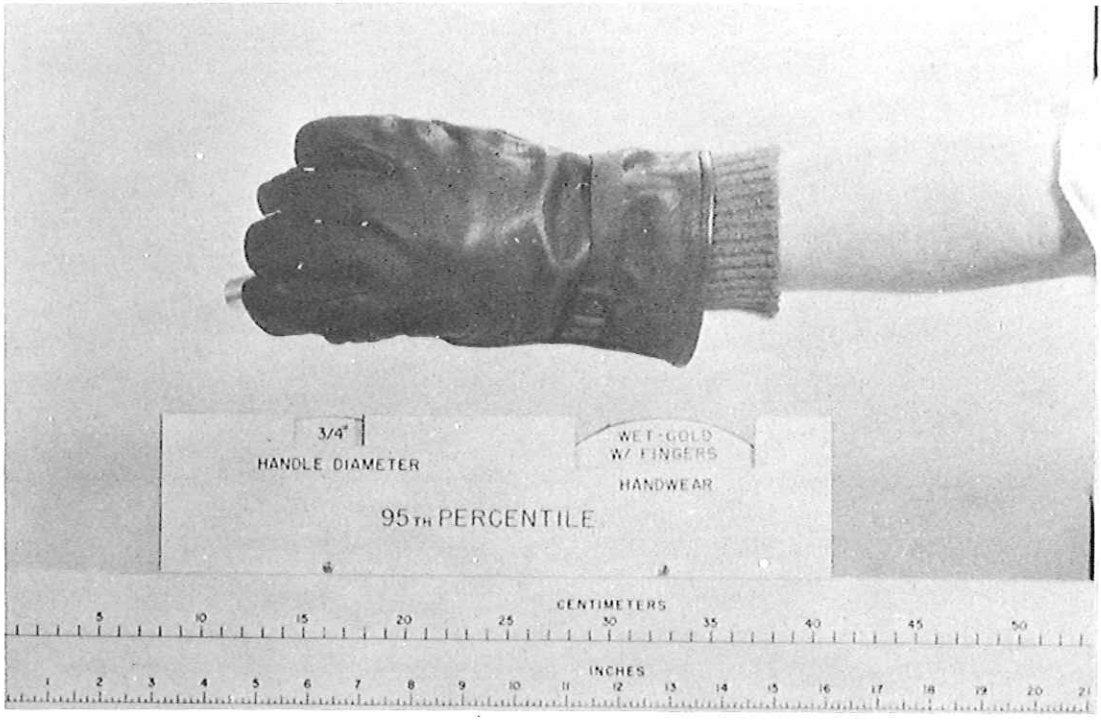

Figure 154. 3/4" knob diameter (View D)

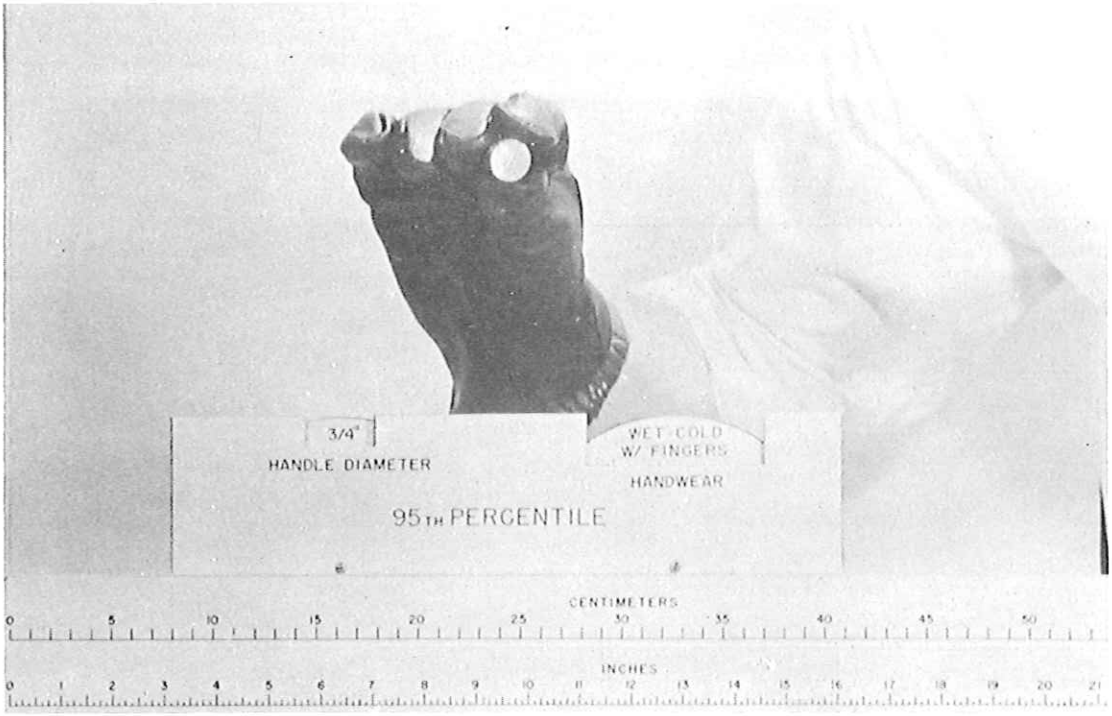

Figure 155. 3/4" knob diameter (View E)

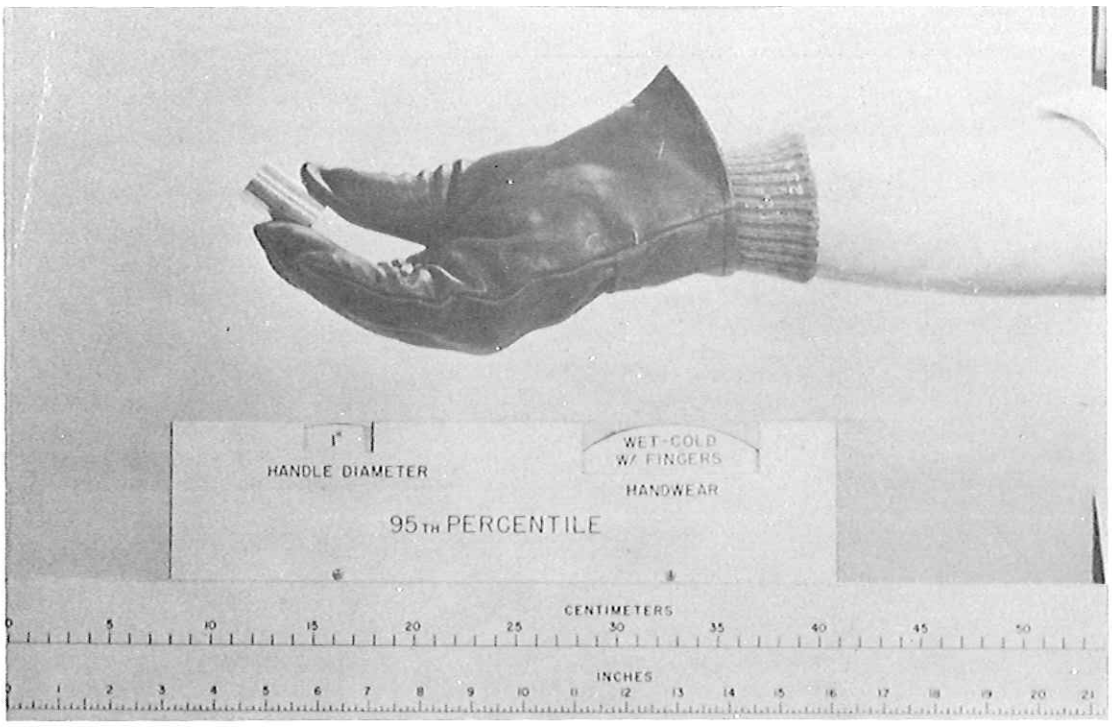

Figure 156. 1" knob diameter (View A)

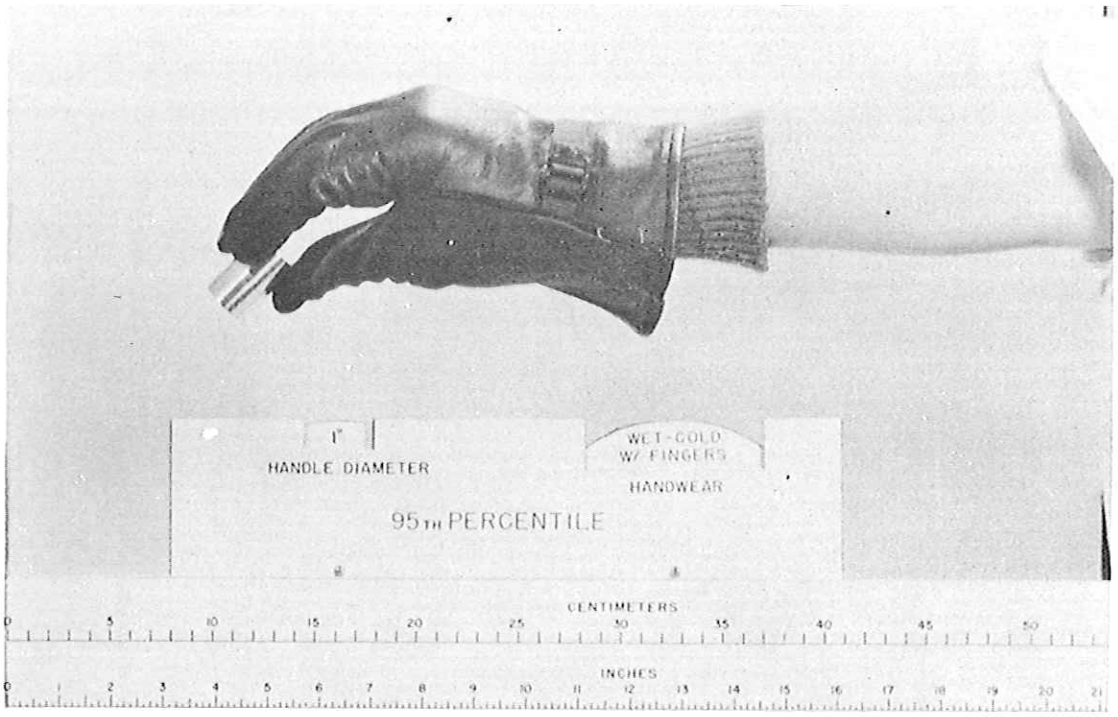

Figure 157. 1" knob diameter (View B)

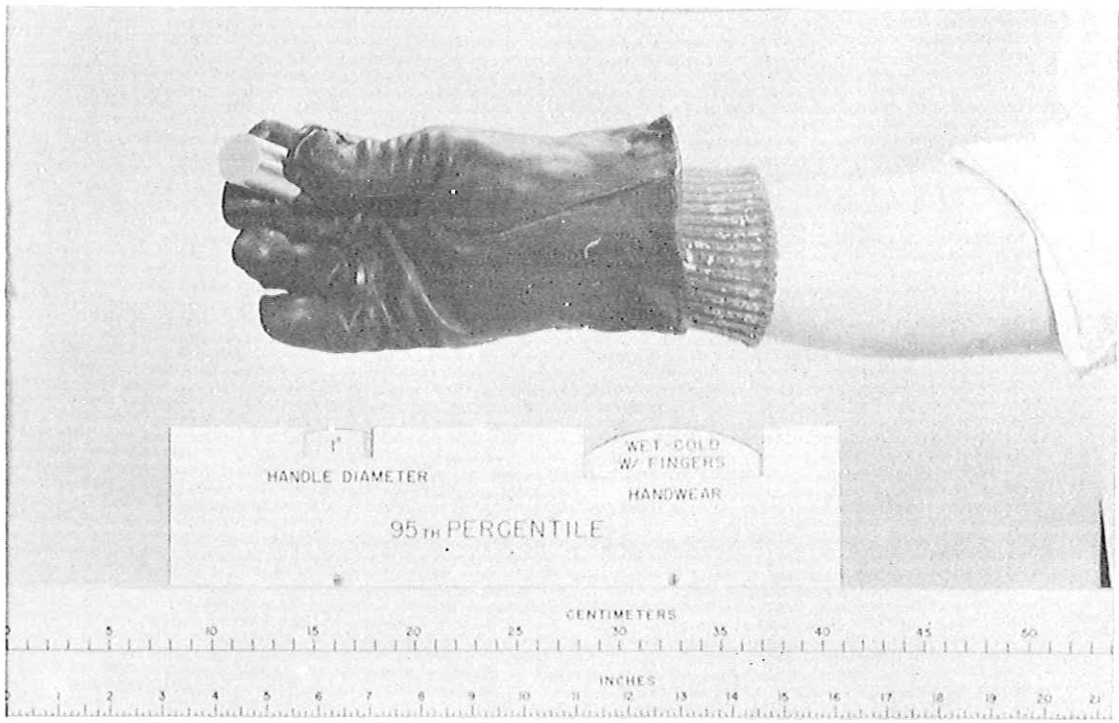

Figure 158. 1" knob diameter (View C)

Figure 159. 1" knob diameter (View D)

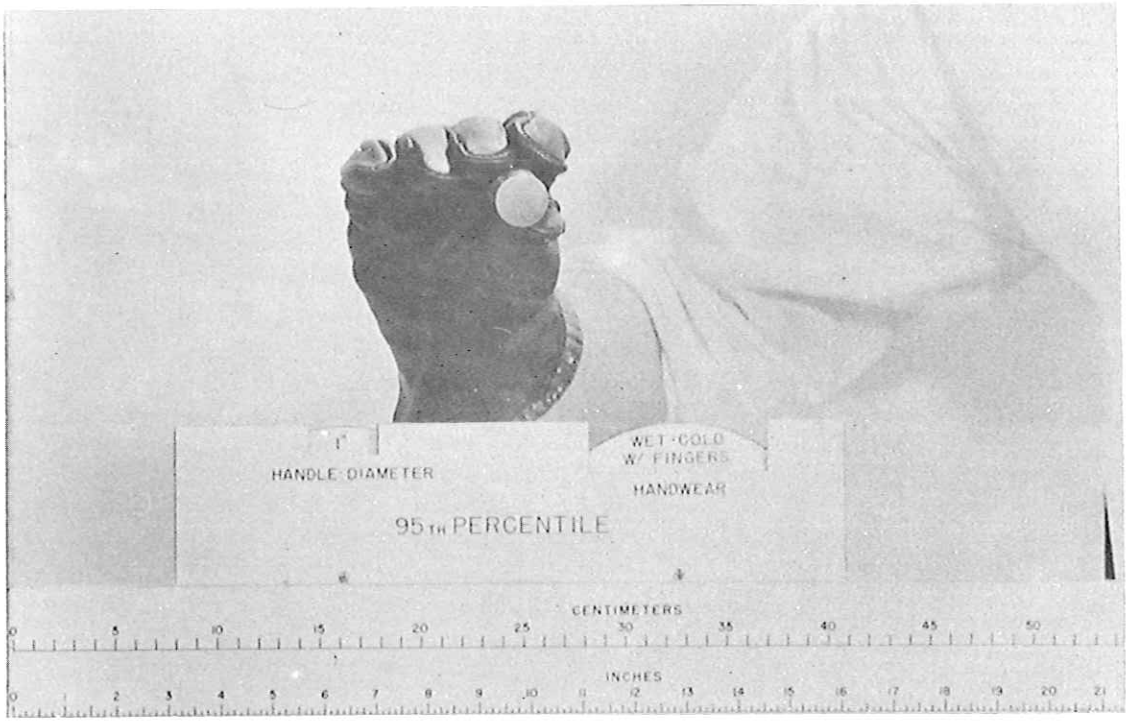

Figure 160. 1" knob diameter (View E)

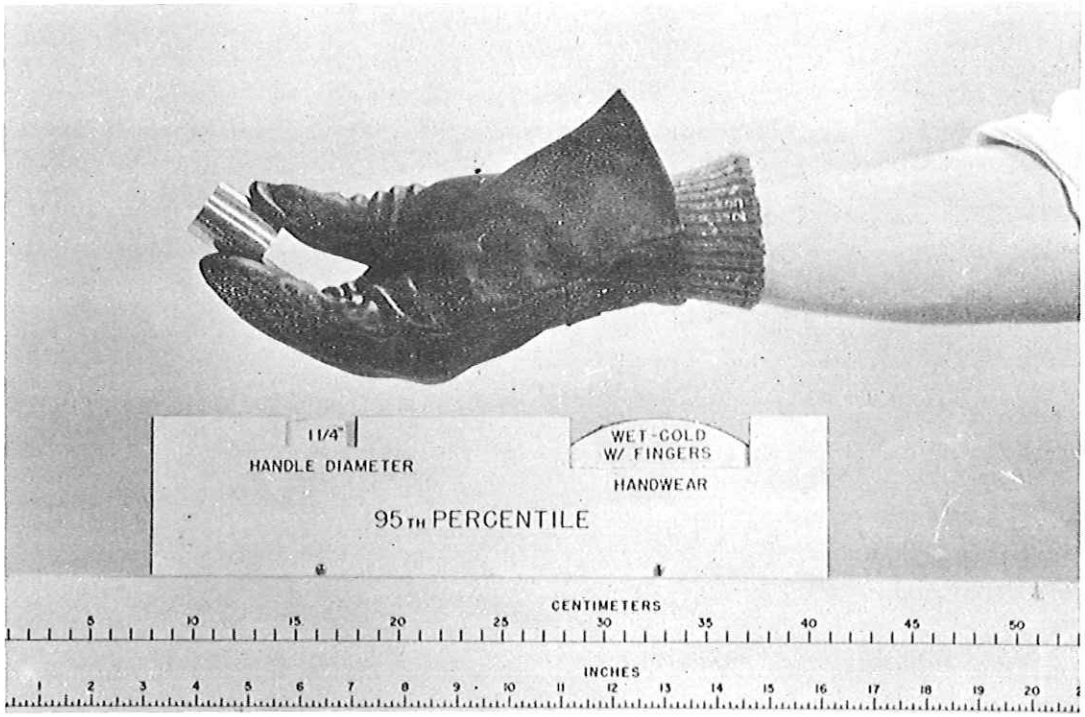

Figure 161. 1¼" knob diameter (View A)

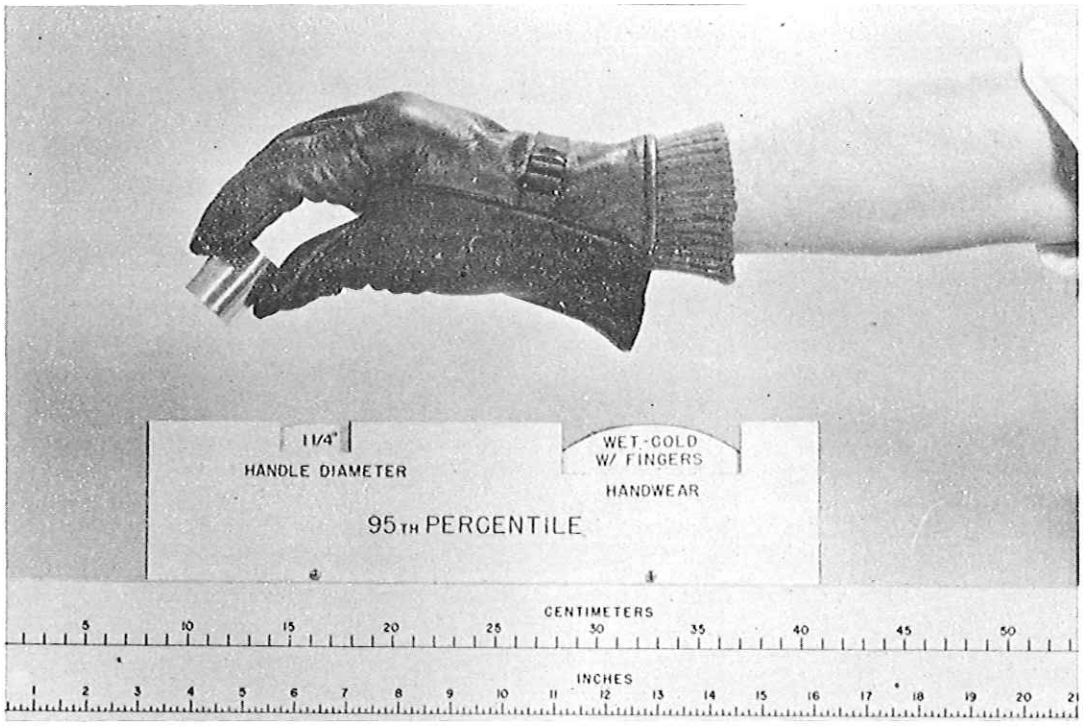

Figure 162. 1¼" knob diameter (View B)

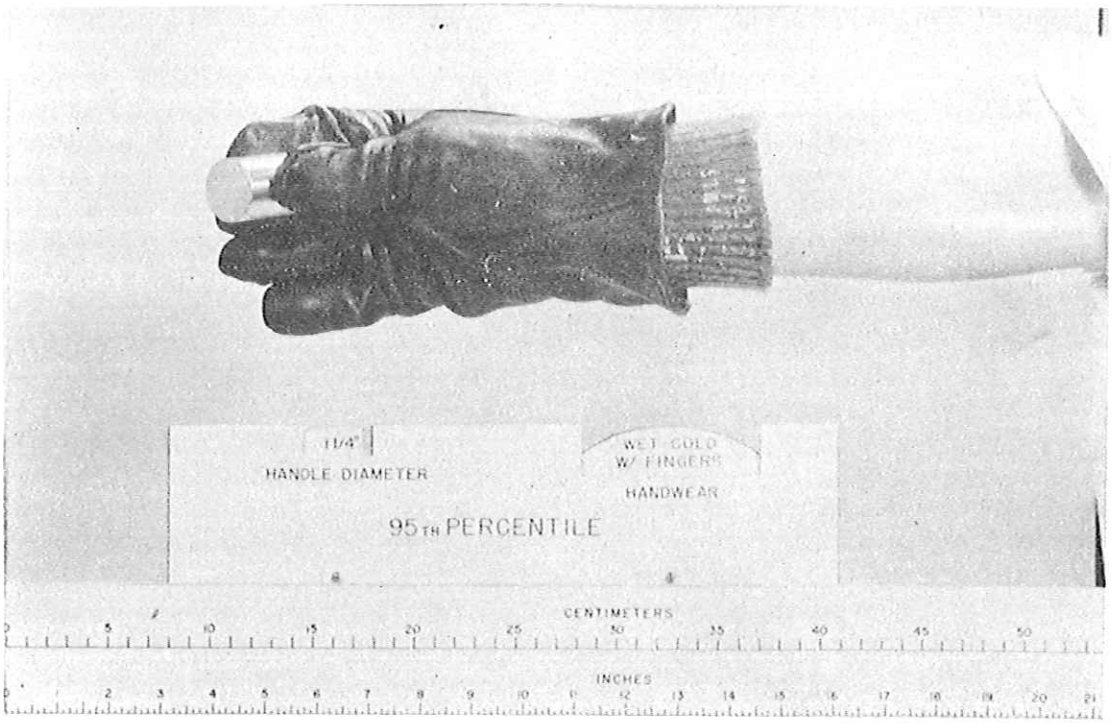

Figure 163. 1¼" knob diameter (View C)

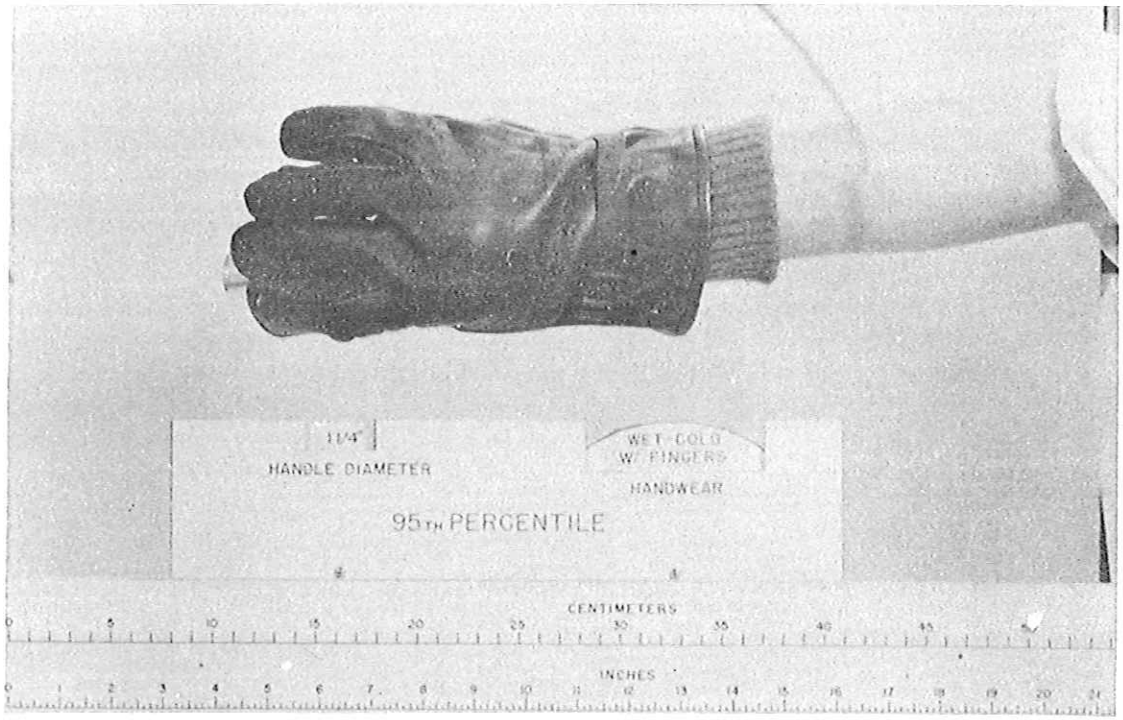

Figure 164. 1¼" knob diameter (View D)

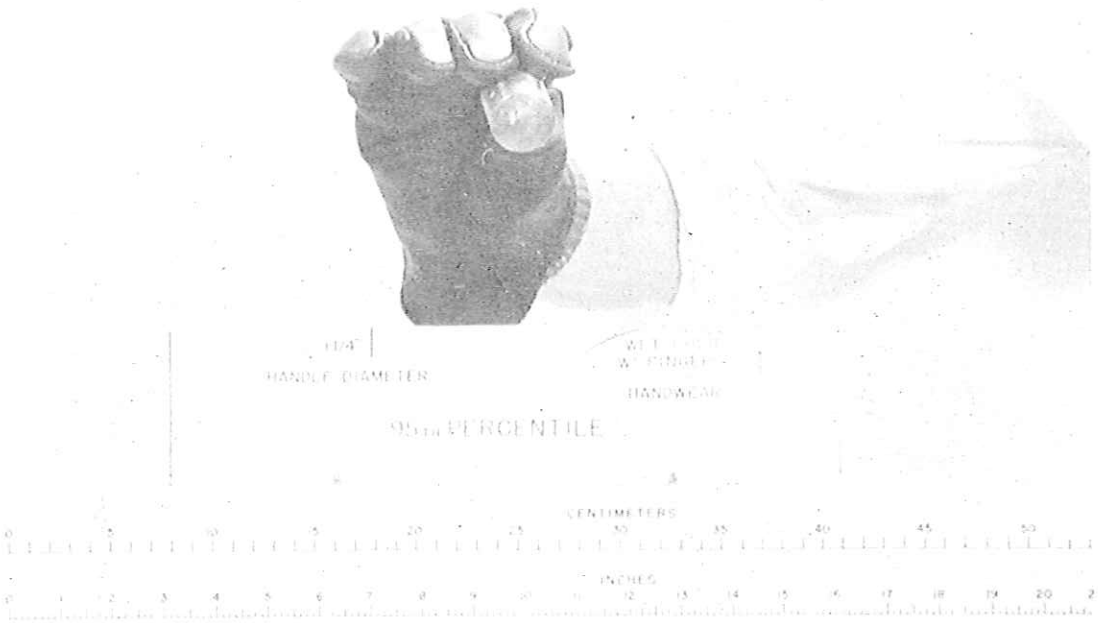

Figure 165. $1\frac{1}{4}$" knob diameter (View E)

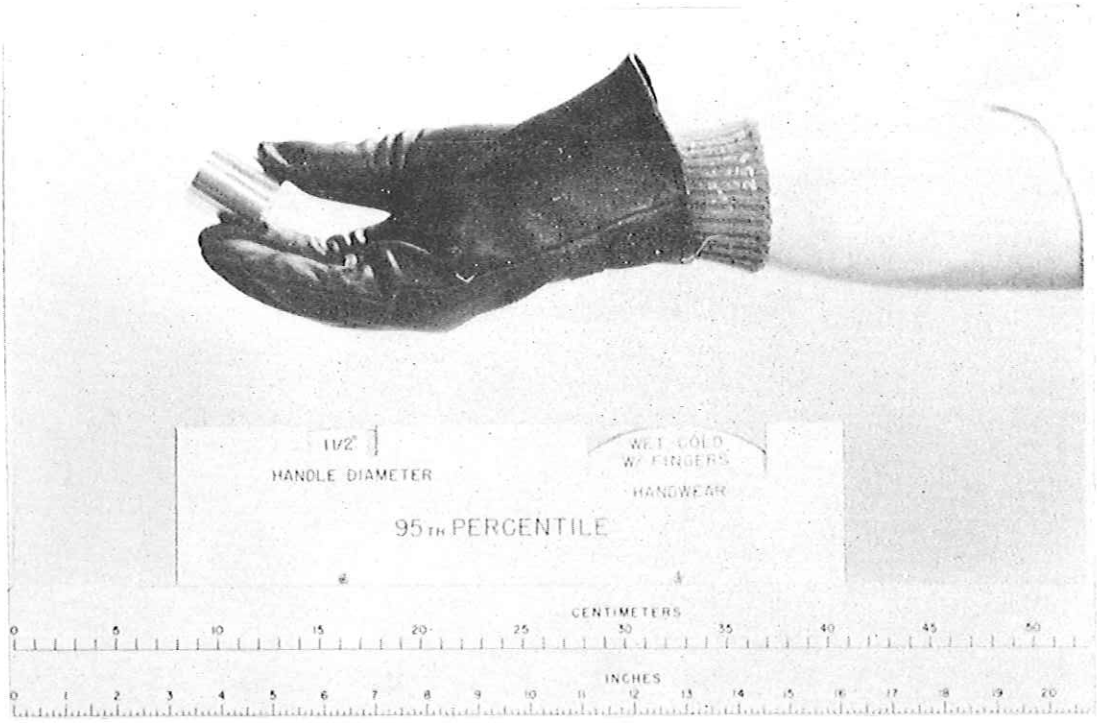

Figure 166. $1\frac{1}{2}$" knob diameter (View A)

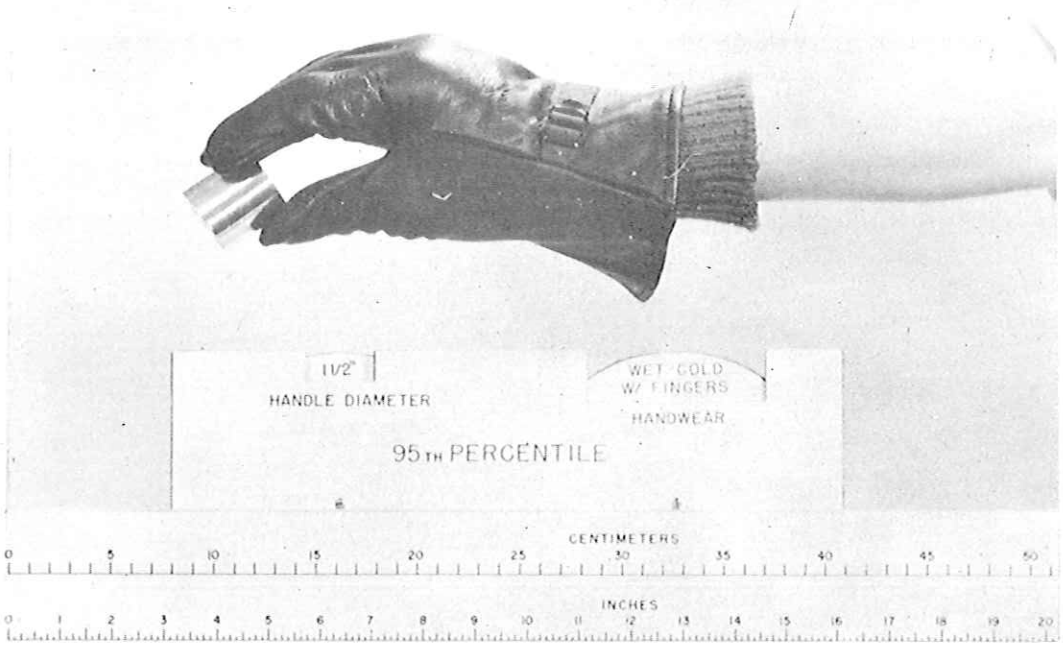

Figure 167. 1½" knob diameter (View B)

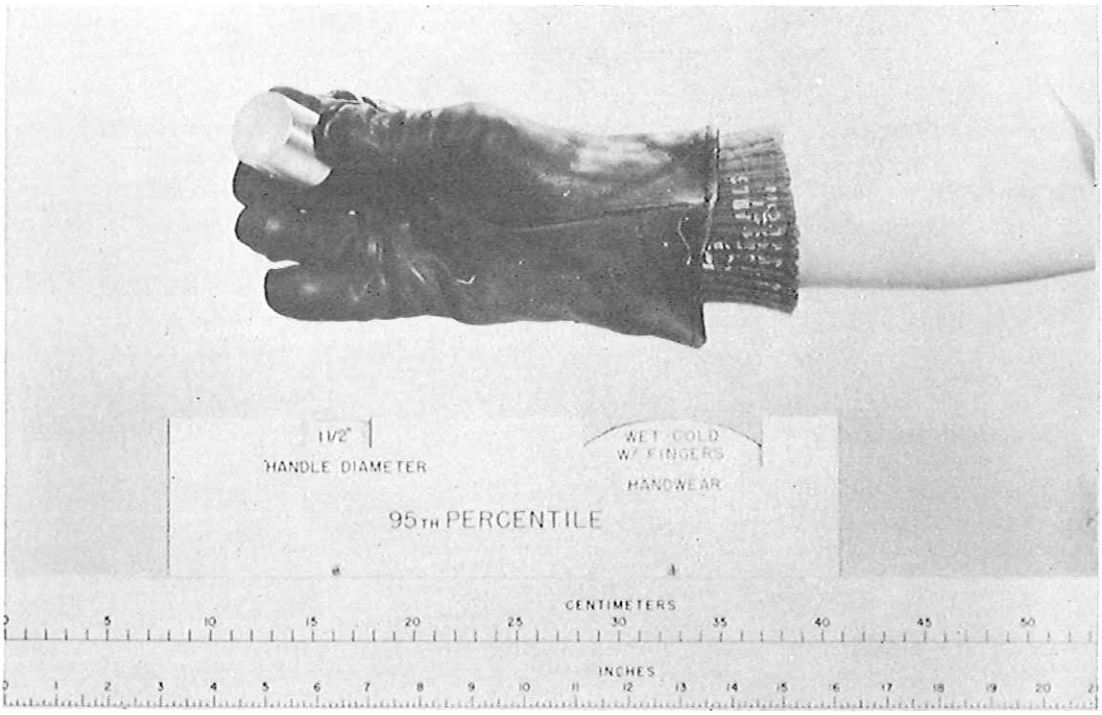

Figure 168. 1½" knob diameter (View C)

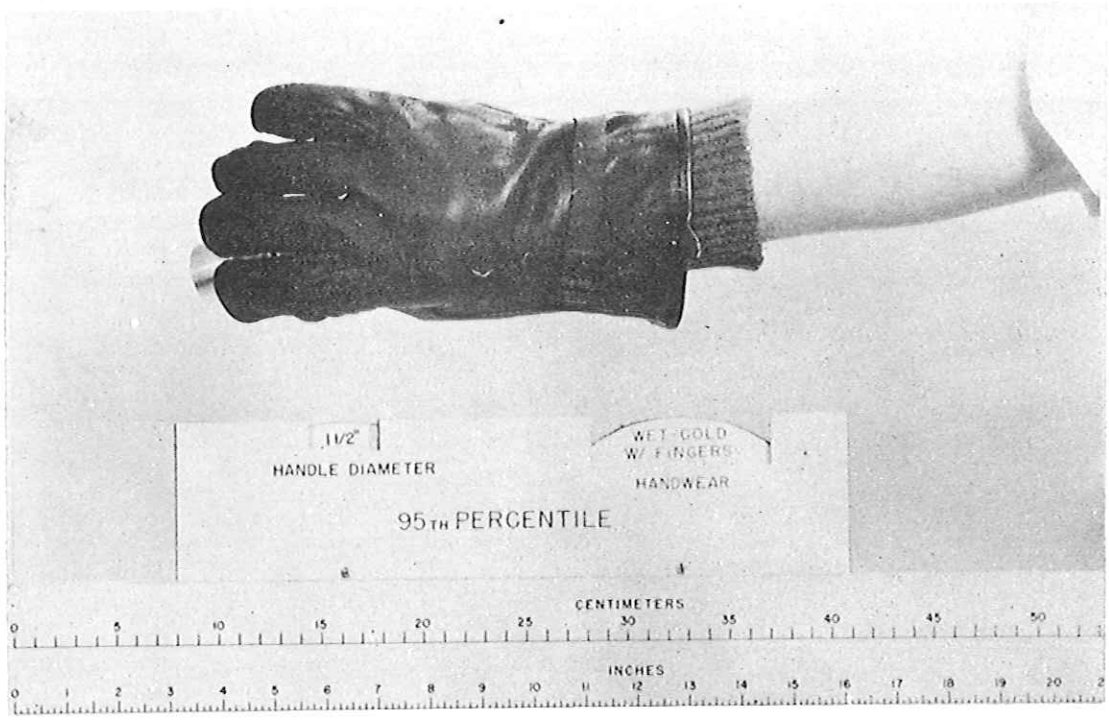

Figure 169. 1½" knob diameter (View D)

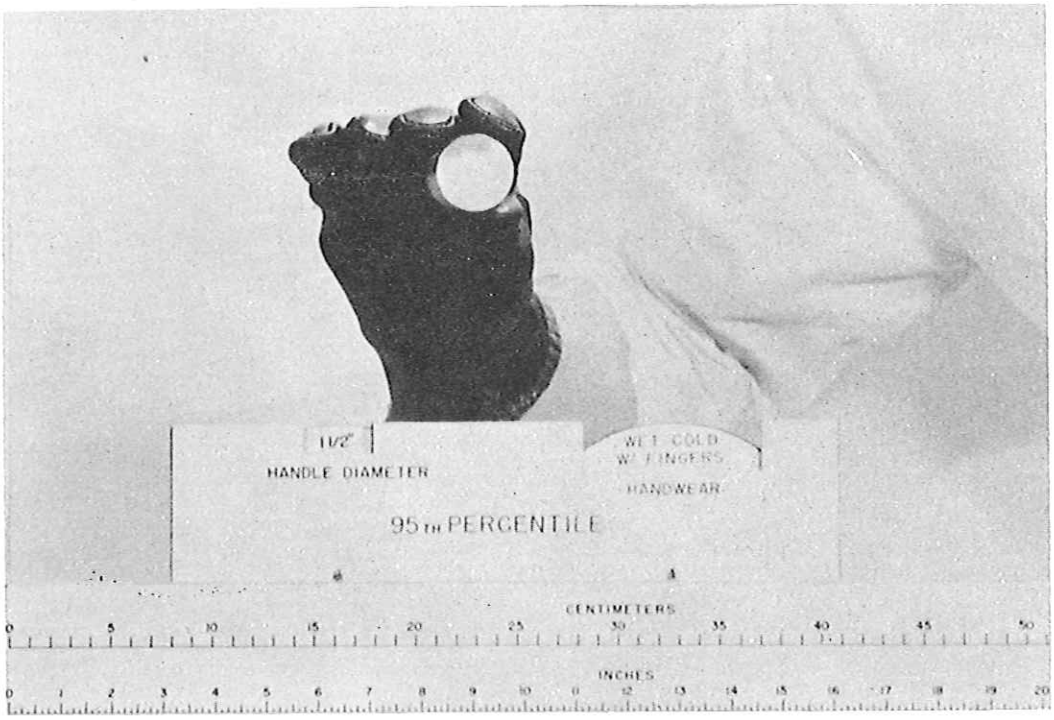

Figure 170. 1½" knob diameter (View E)

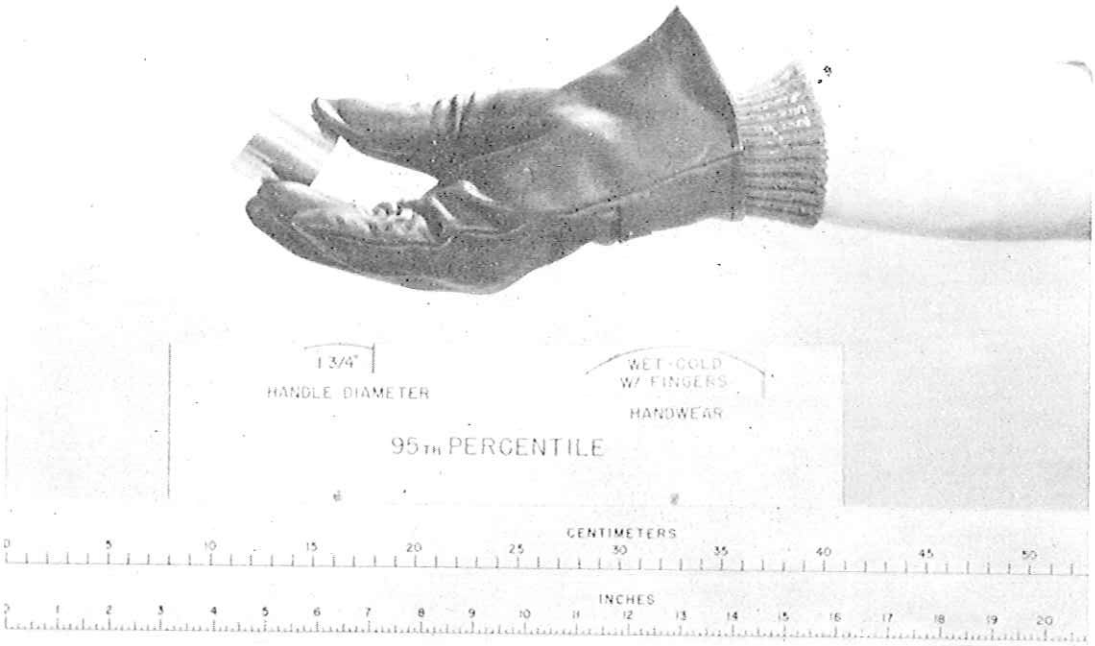

Figure 171. 1 3/4" knob diameter (View A)

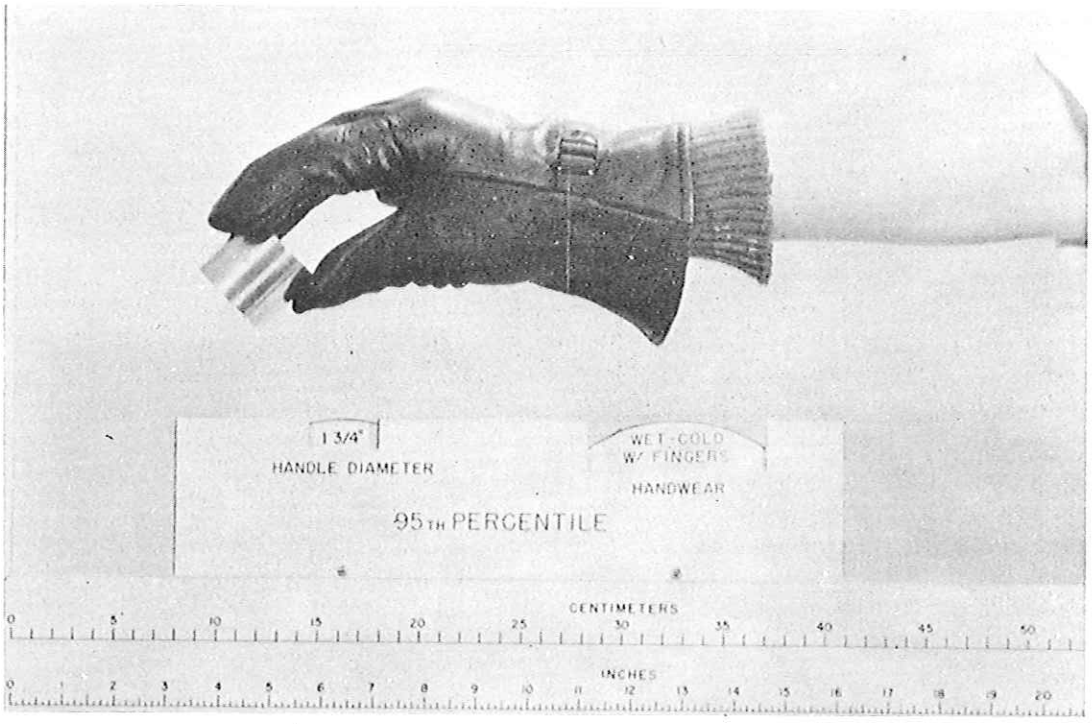

Figure 172. 1 3/4" knob diameter (View B)

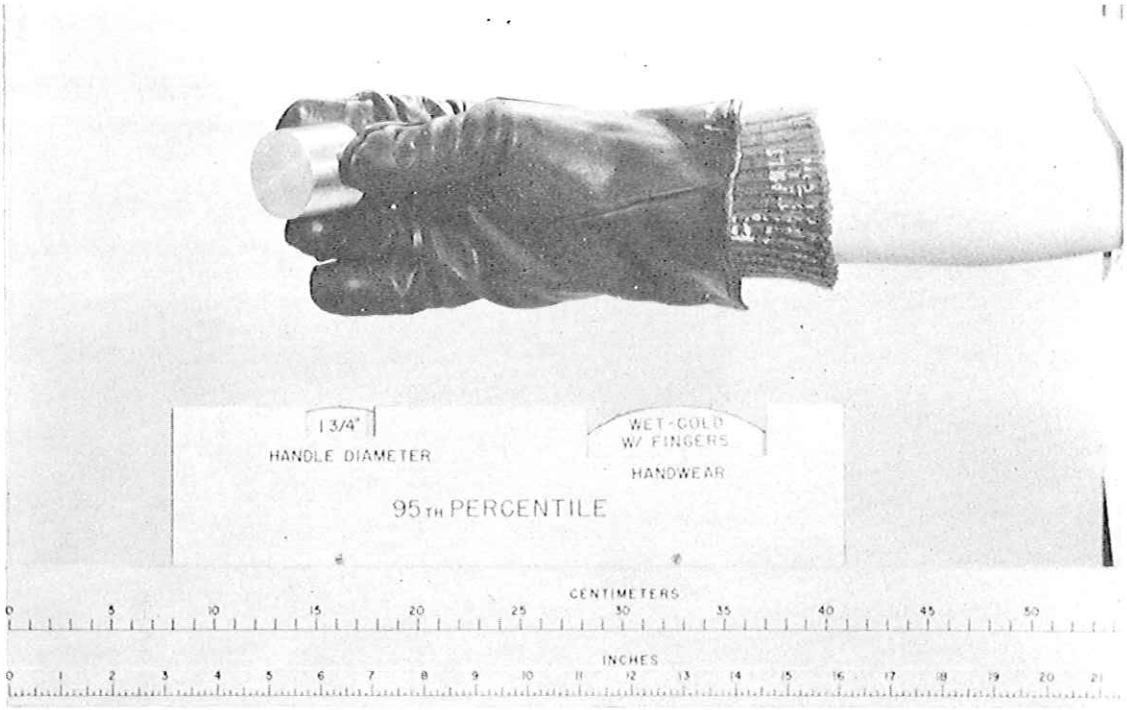

Figure 173. 1 3/4" knob diameter (View C)

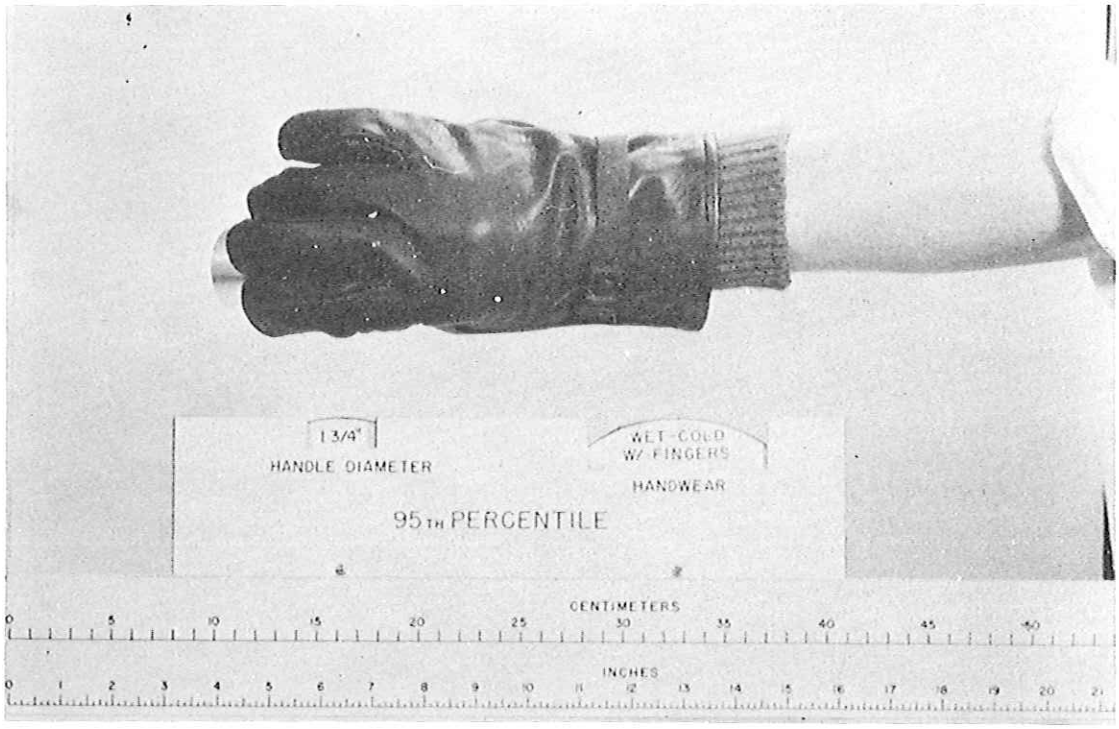

Figure 174. 1 3/4" knob diameter (View D)

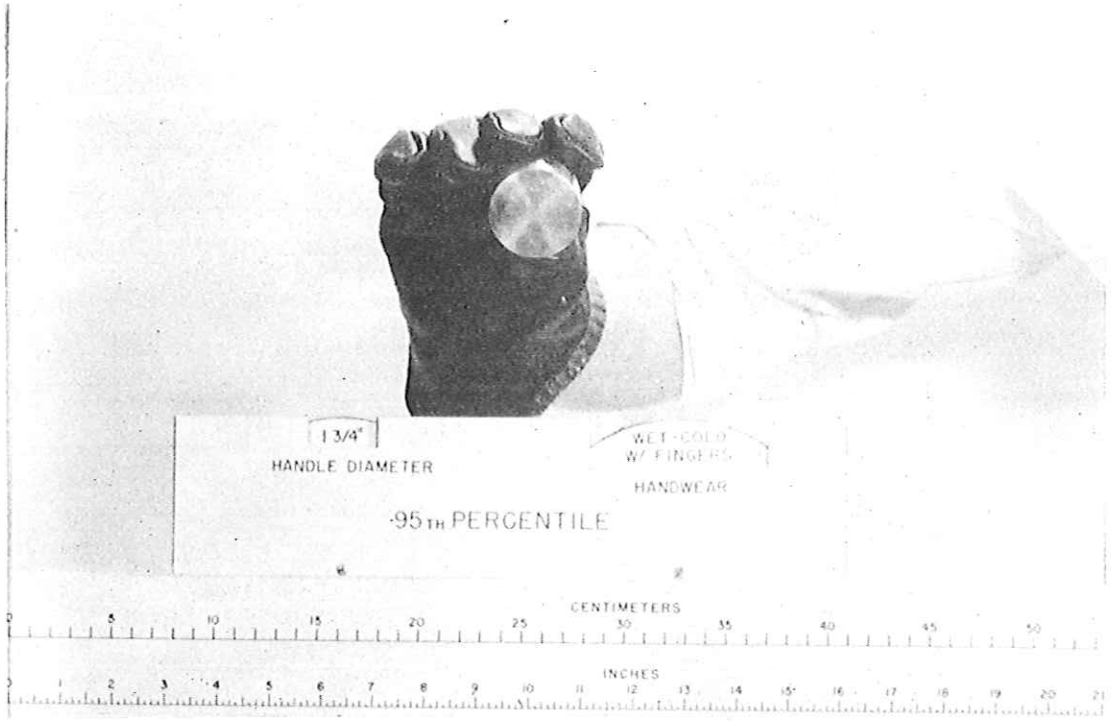

Figure 175. 1 3/4" knob diameter (View E)

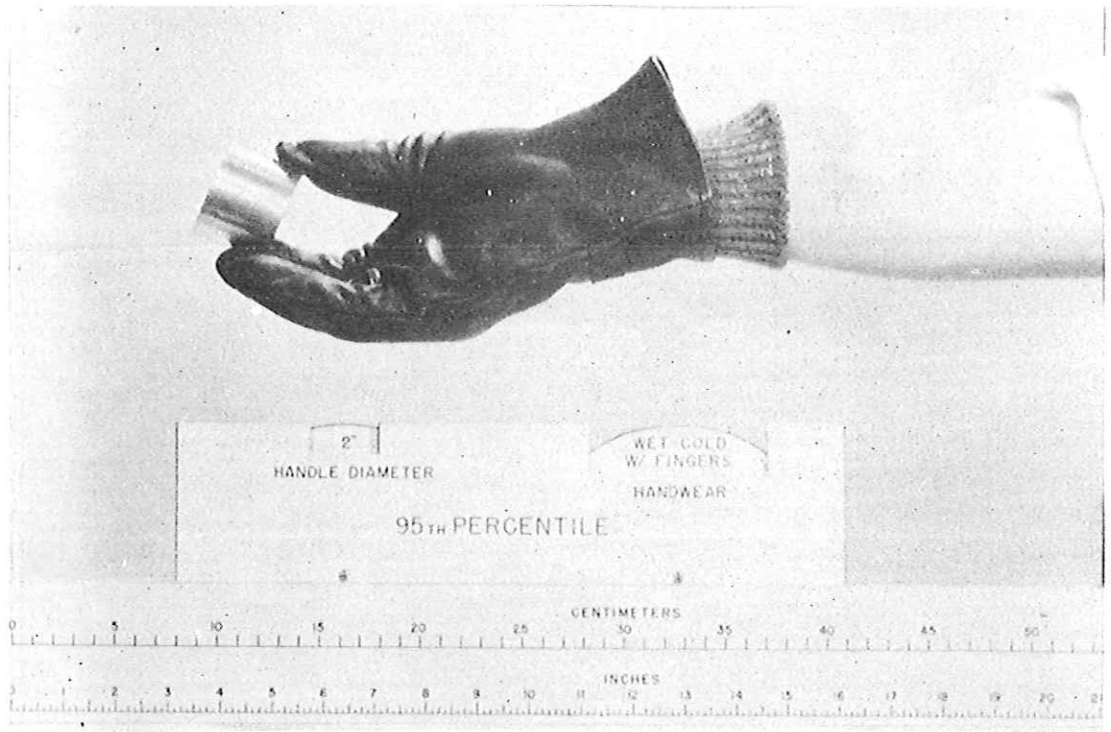

Figure 176. 2" knob diameter (View A)

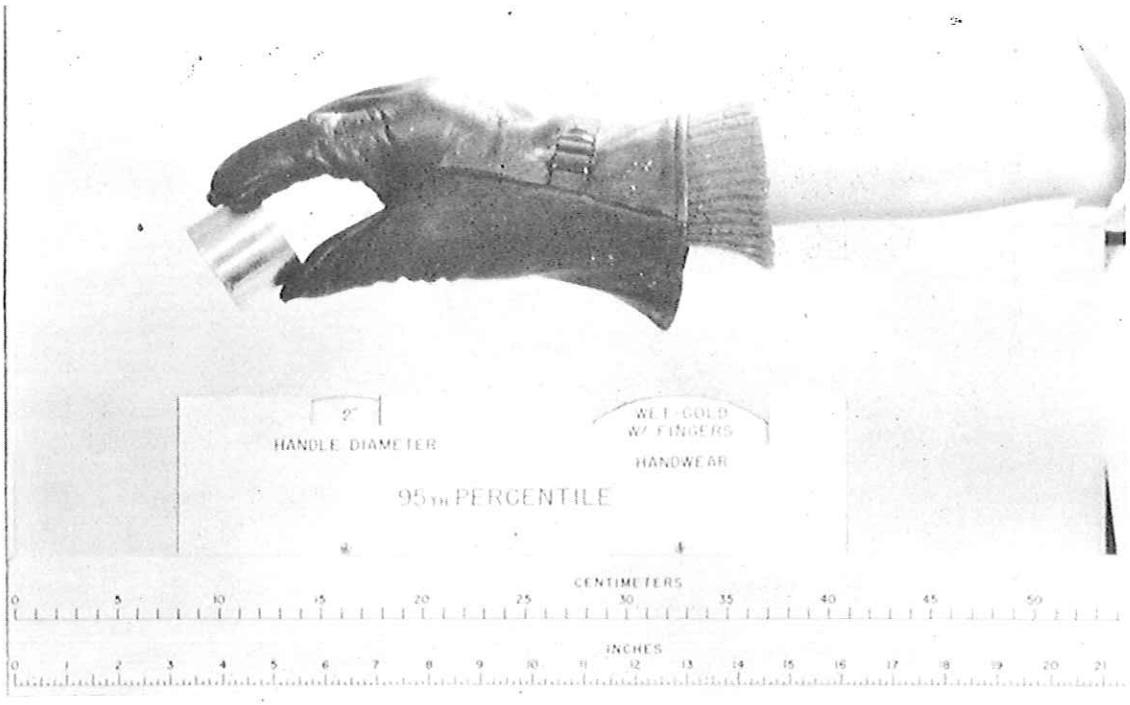

Figure 177. 2" knob diameter (View B)

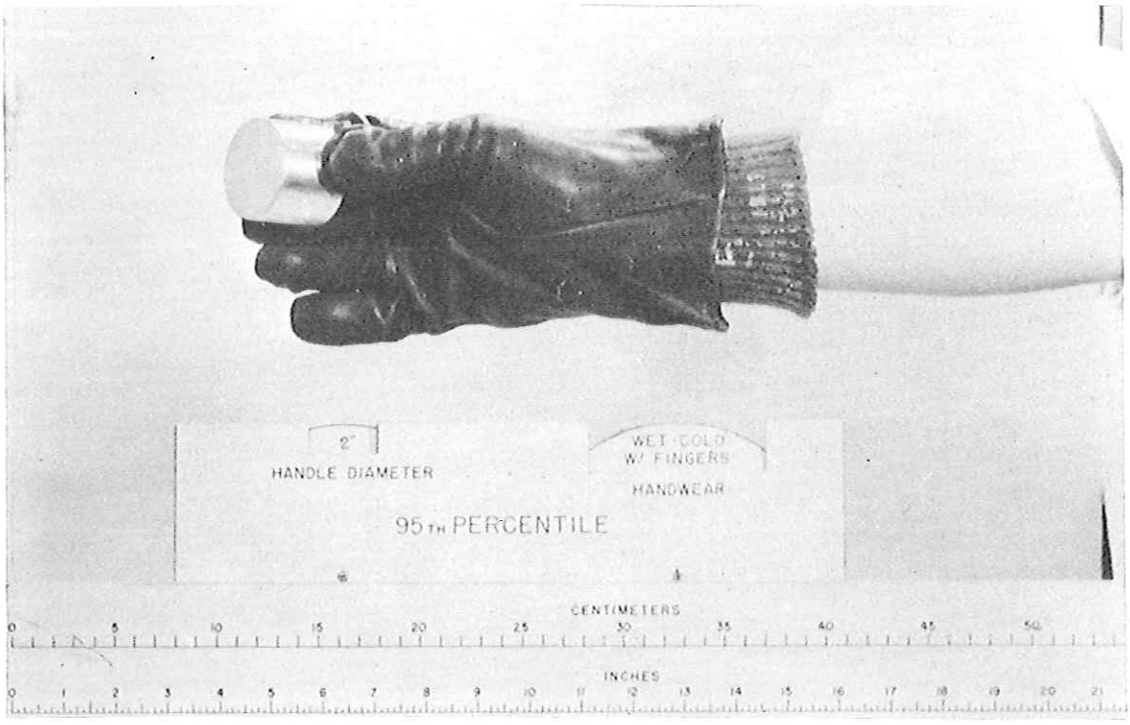

Figure 178. 2" knob diameter (View C)

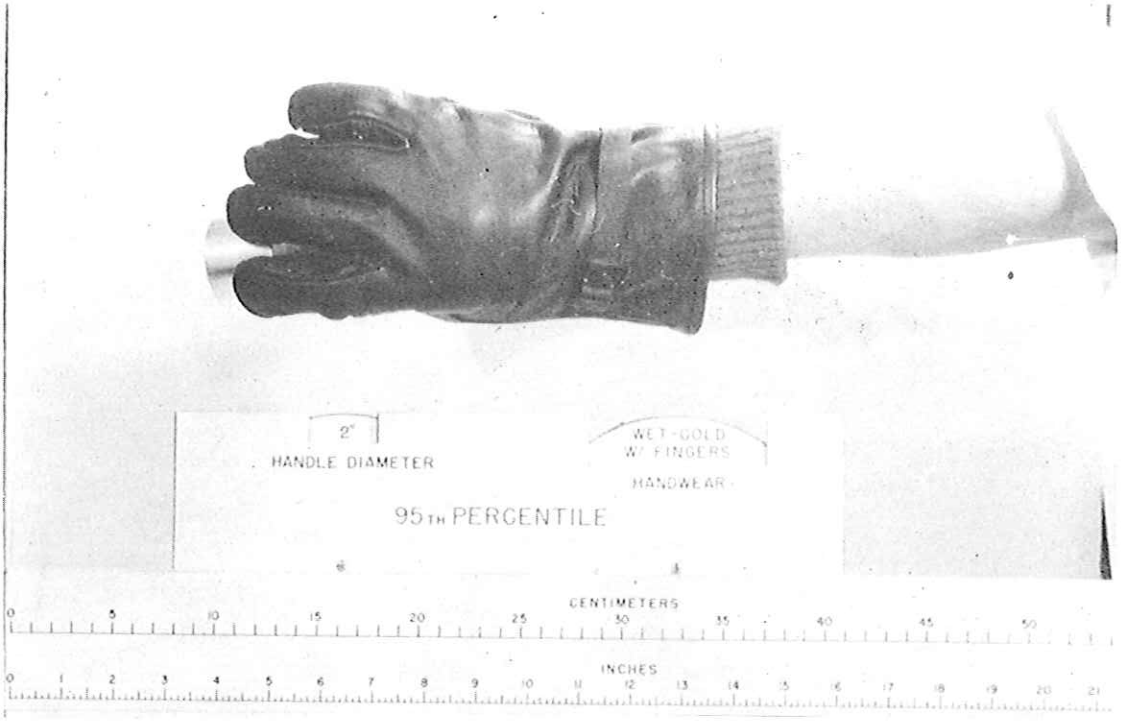

Figure 179. 2" knob diameter (View D)

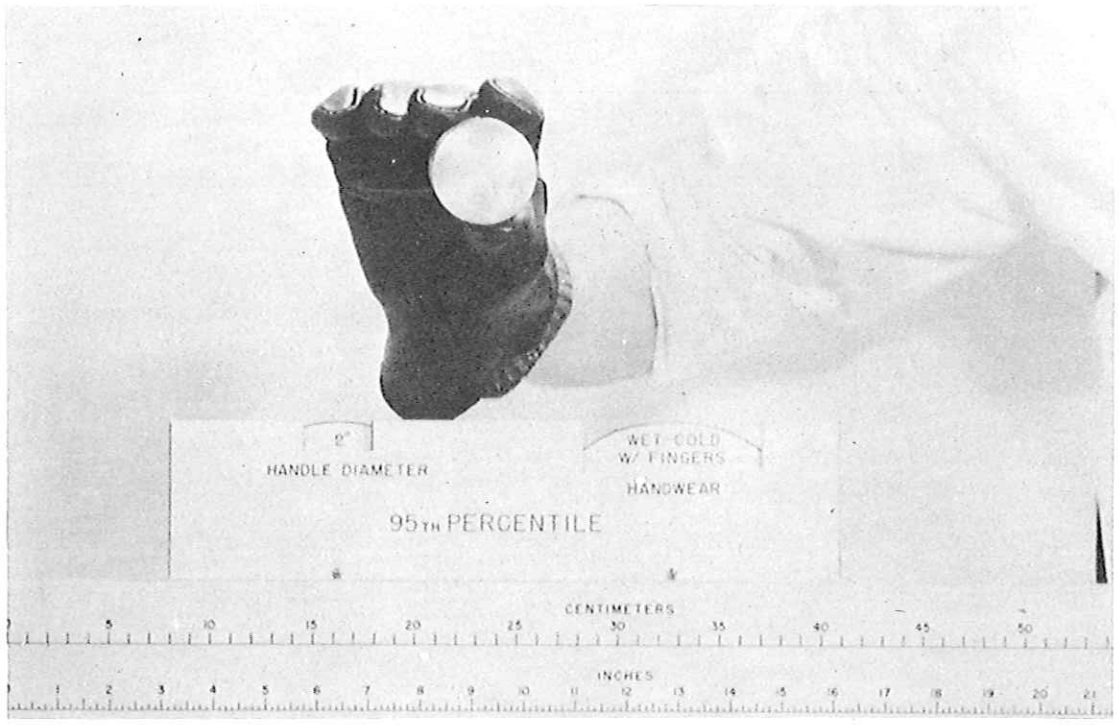

Figure 180. 2" knob diameter (View E)

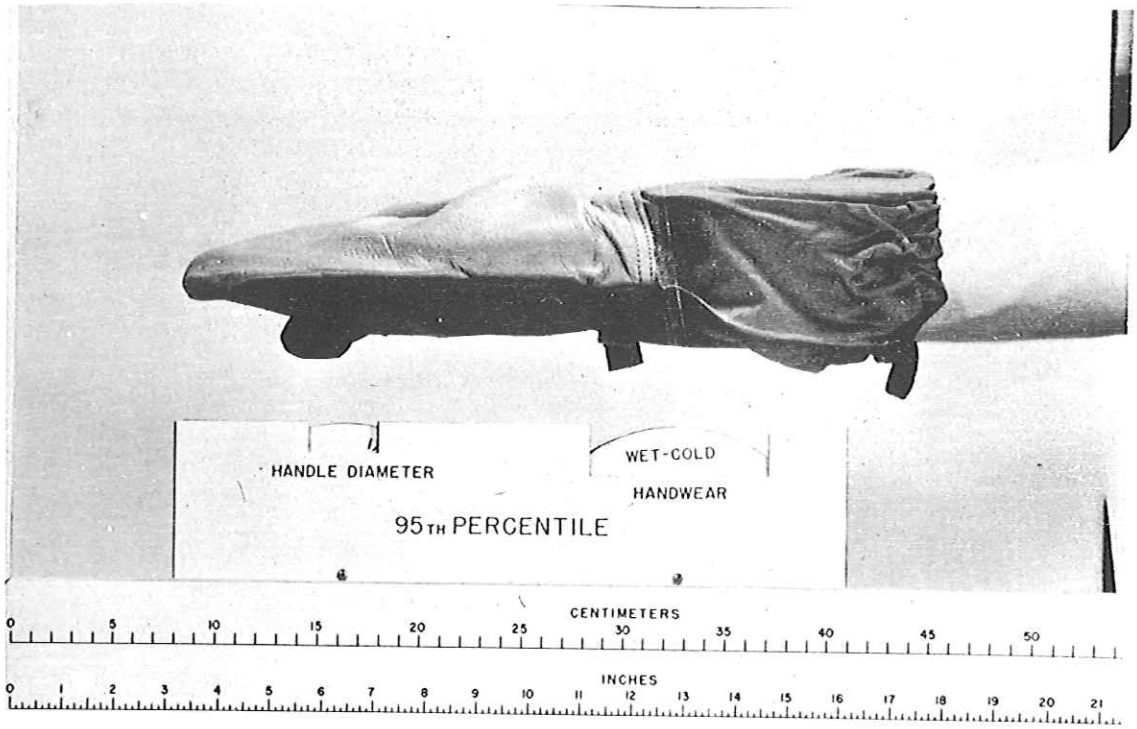

Figure 181. The hand extended flat (View A)

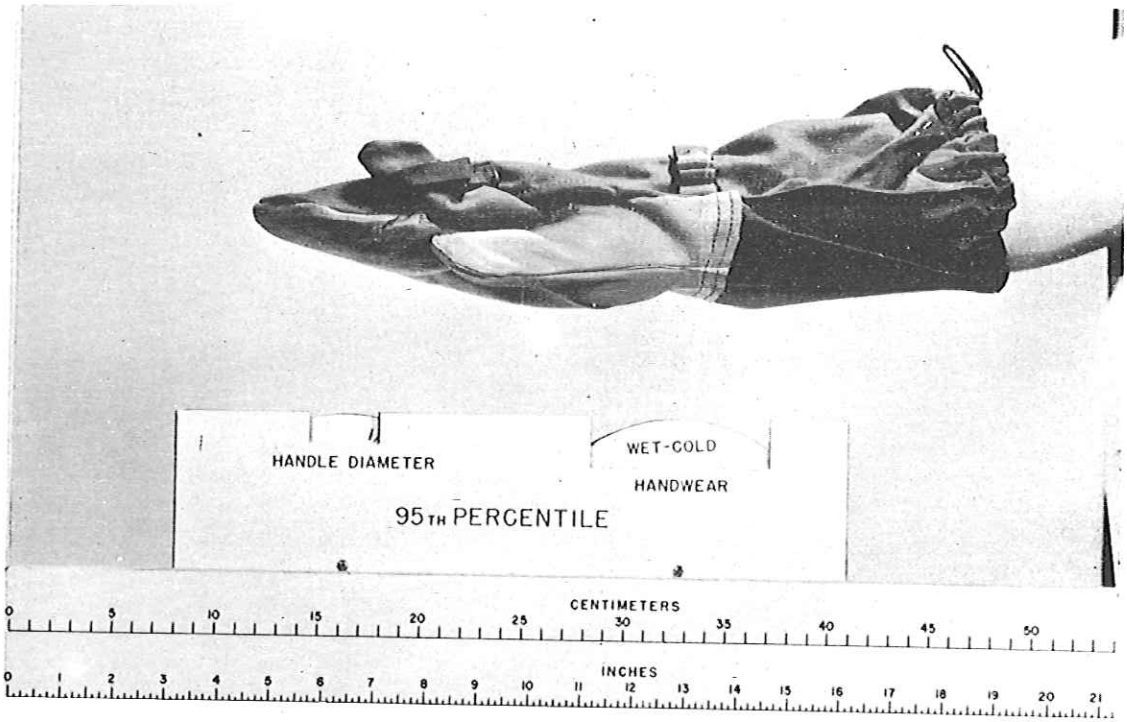

Figure 182. The hand extended flat (View B)

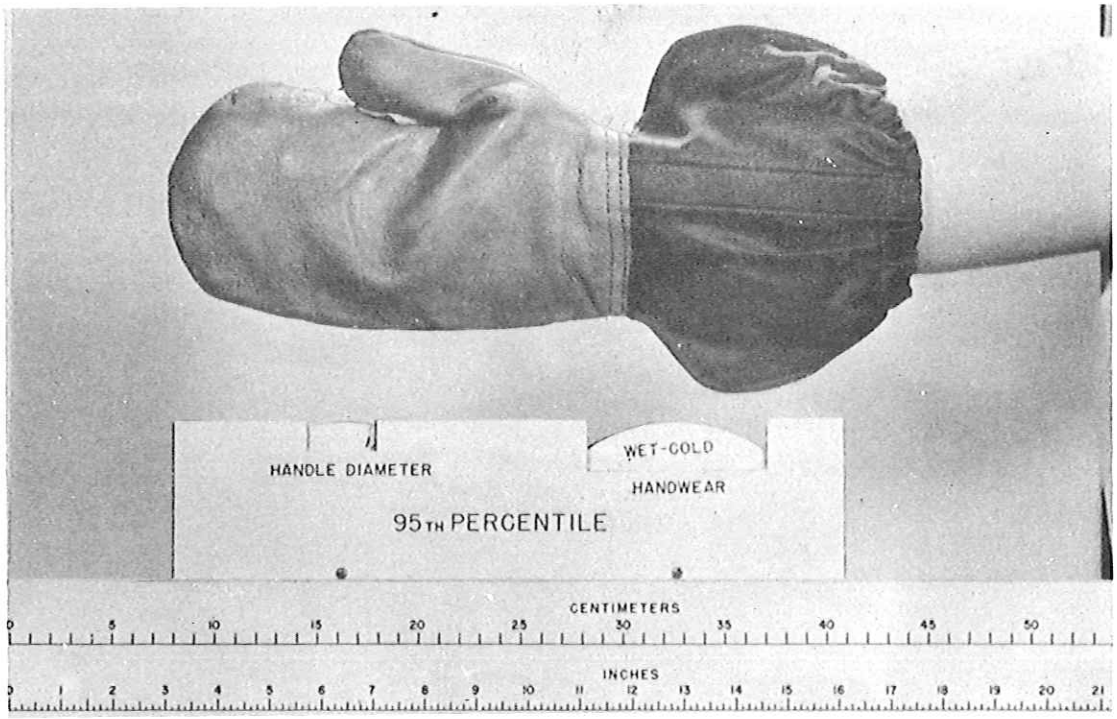

Figure 183. The hand extended flat (View C)

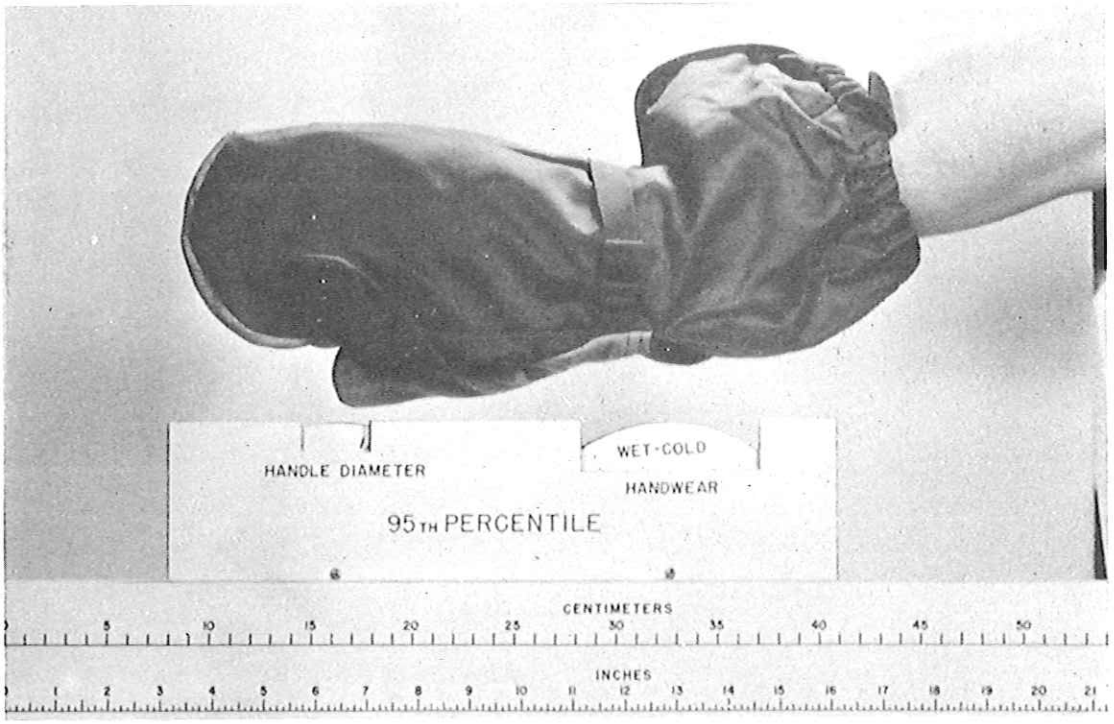

Figure 184. The hand extended flat (View D)

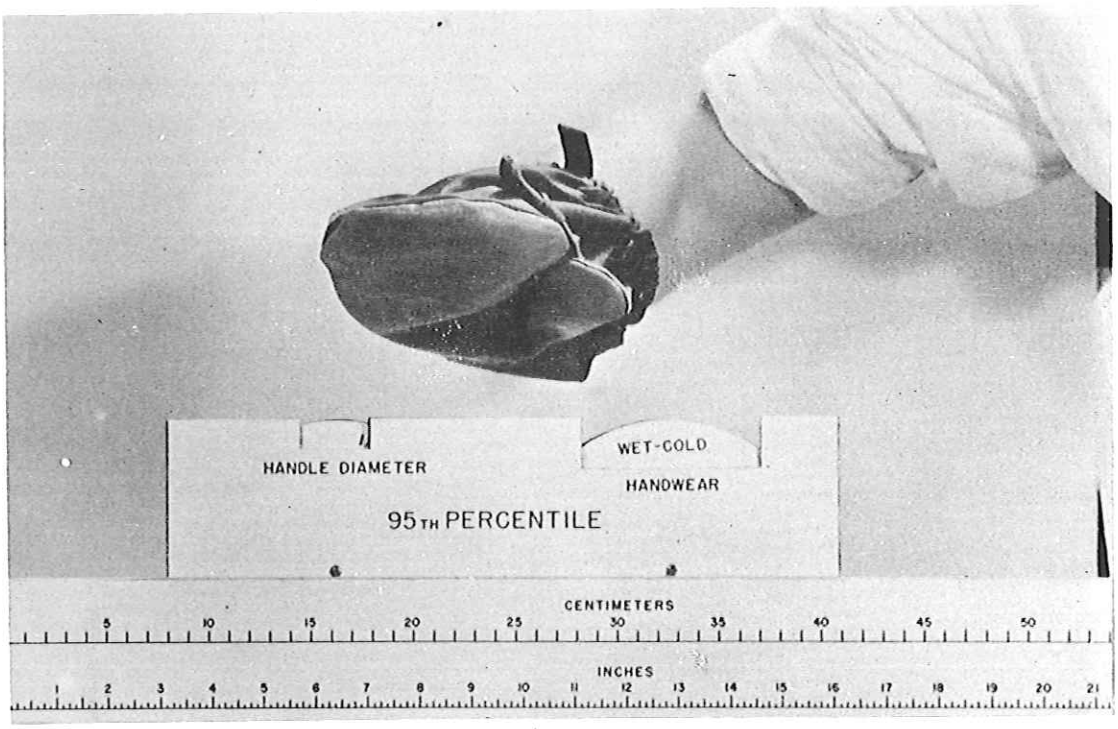

Figure 185. The hand extended flat (View E)

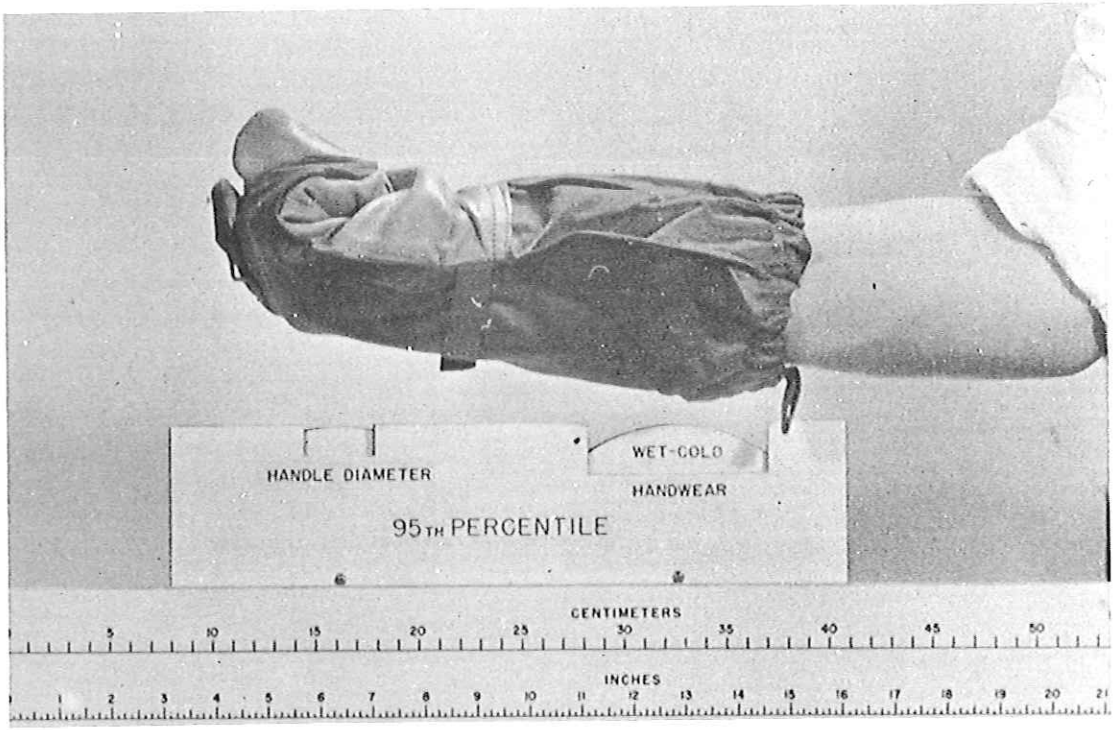

Figure 186. The hand closed as a fist (View A)

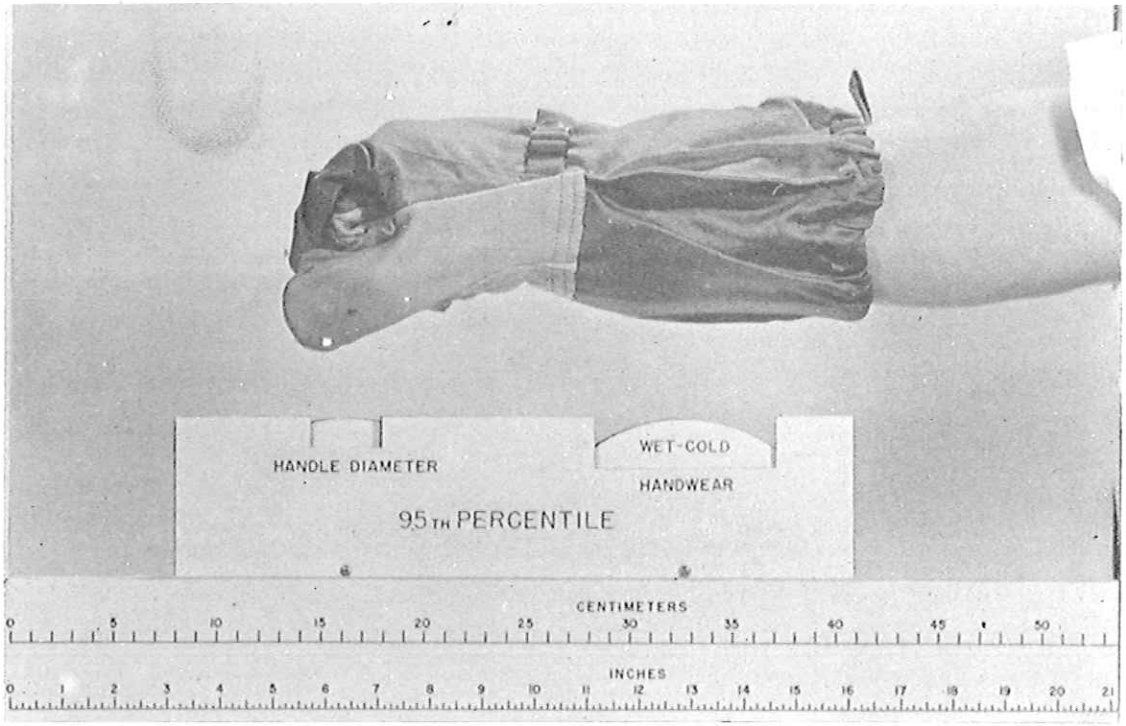

Figure 187. The hand closed as a fist (View B)

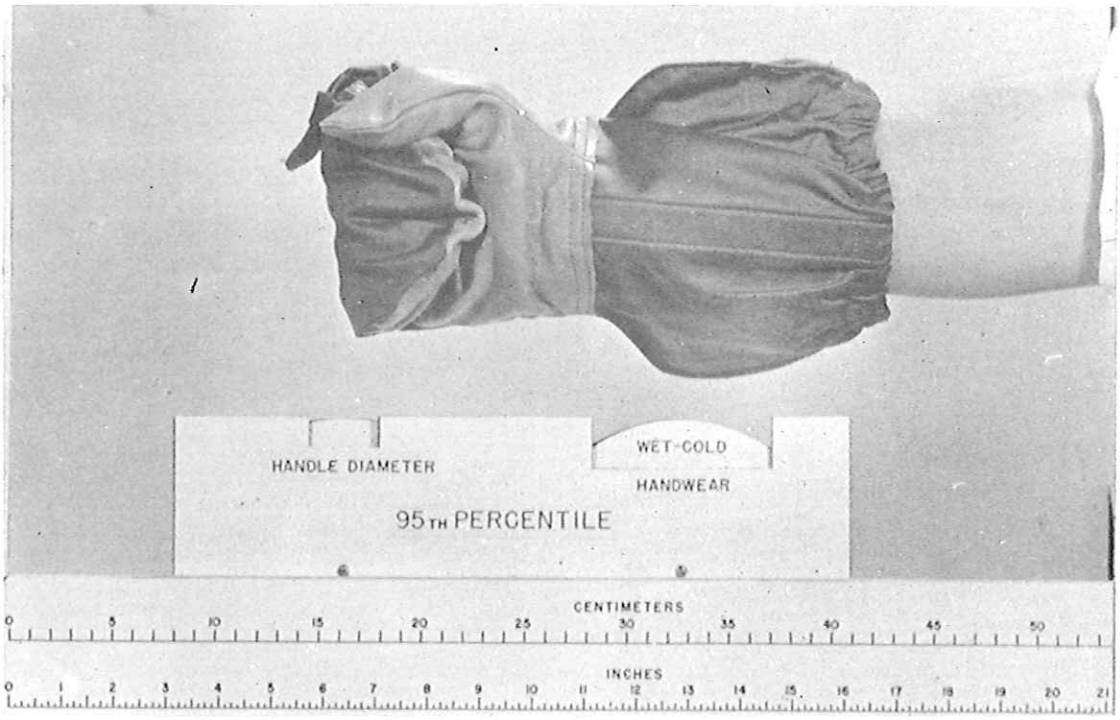

Figure 188. The hand closed as a fist (View C)

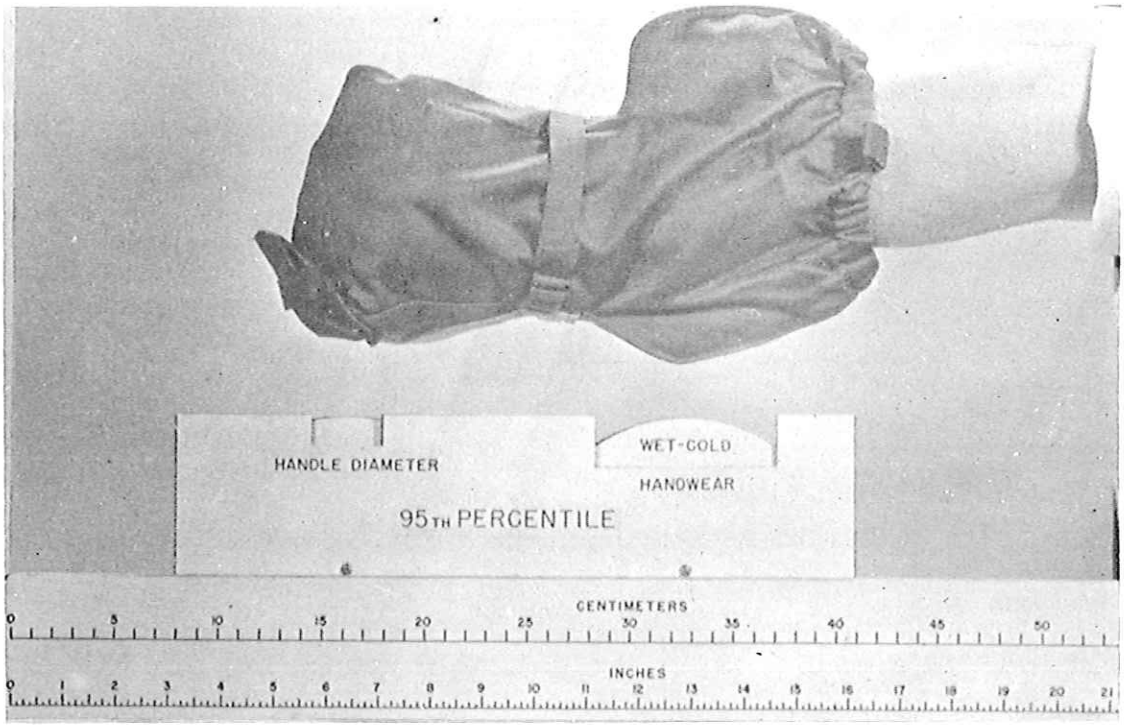

Figure 189. The hand closed as a fist (View D)

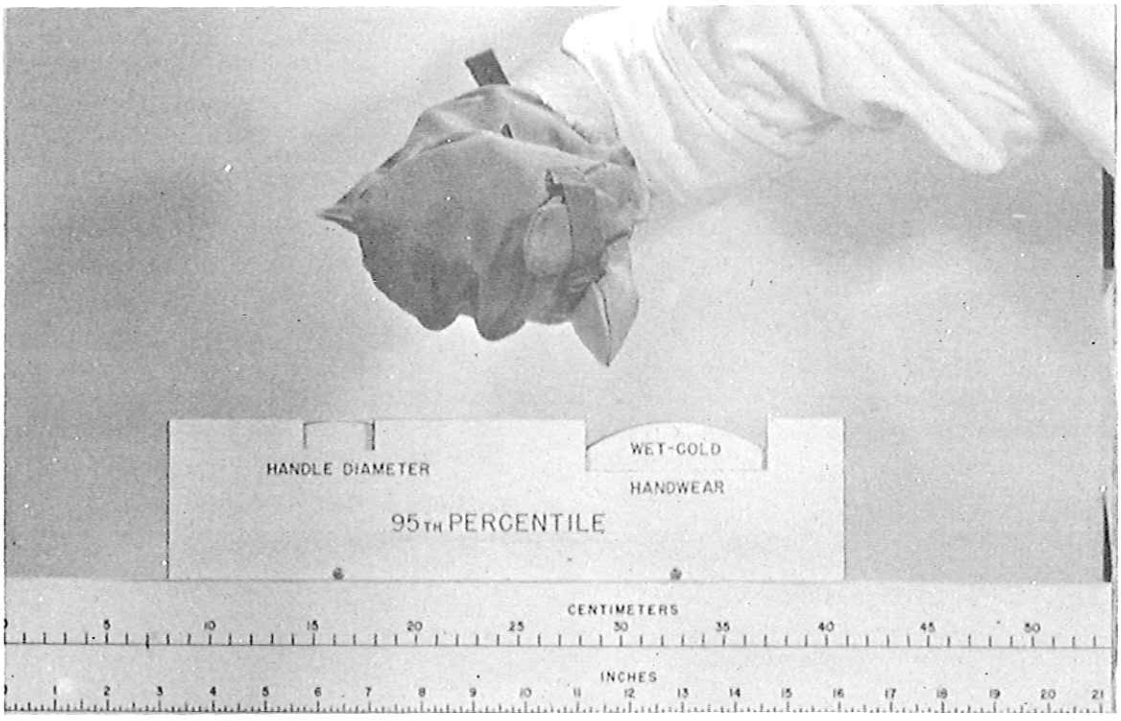

Figure 190. The hand closed as a fist (View E)

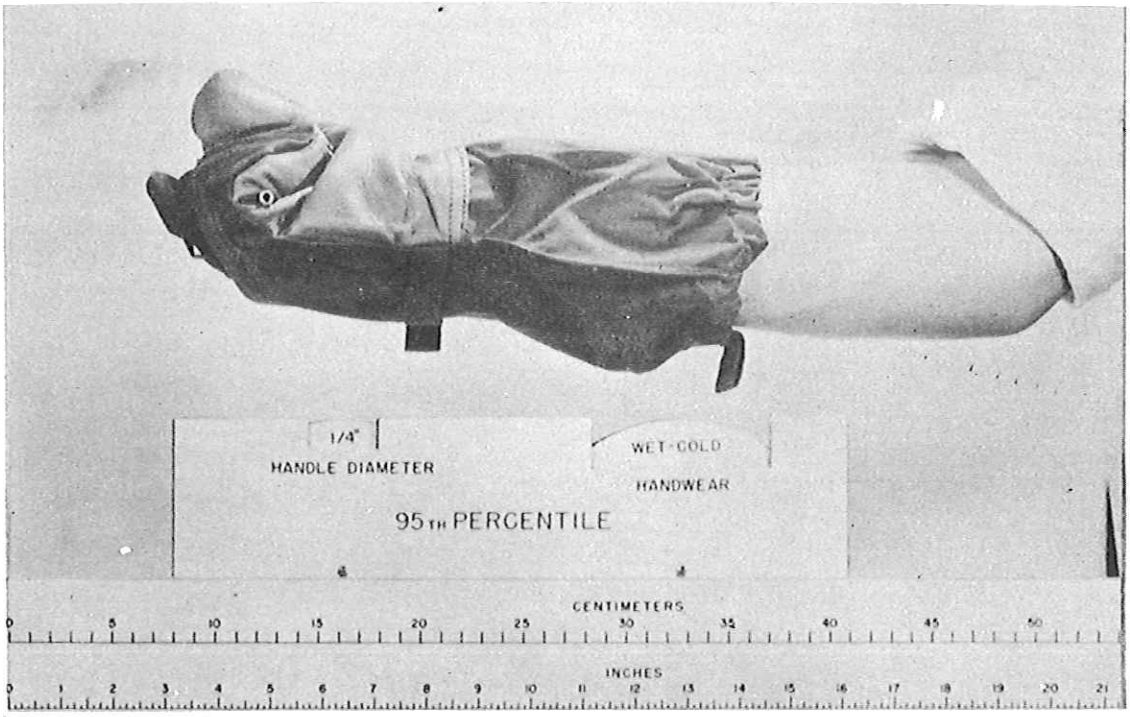

Figure 191. $\frac{1}{4}$" handle diameter (View A)

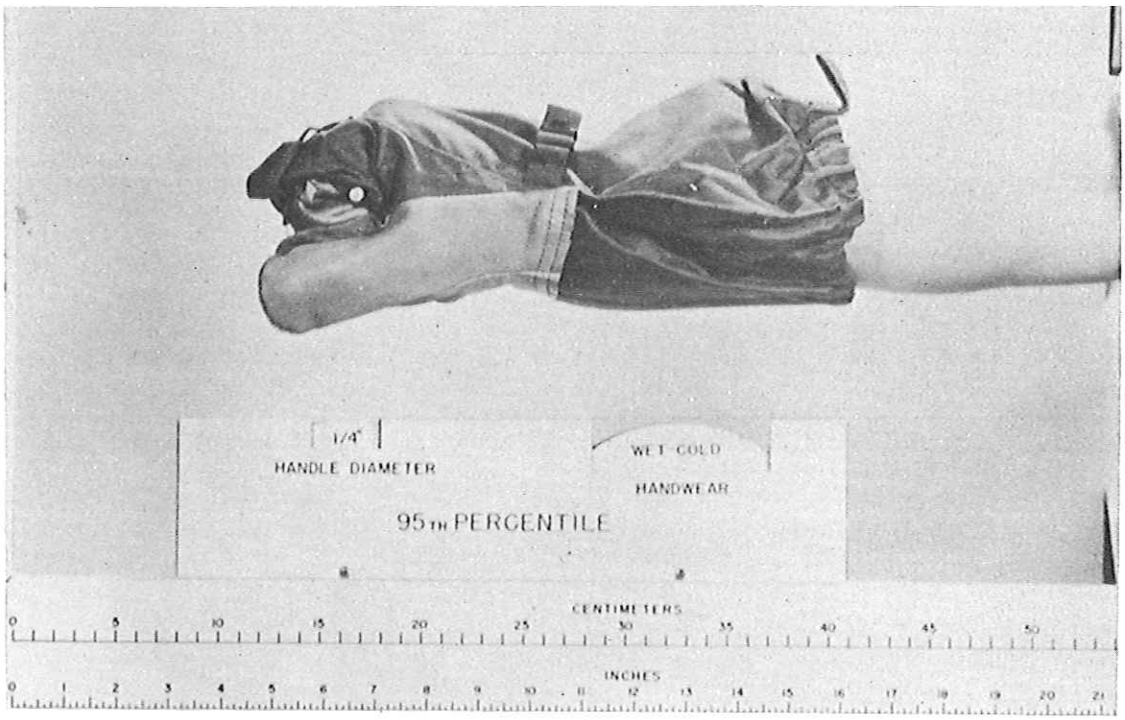

Figure 192. $\frac{1}{4}$" handle diameter (View B)

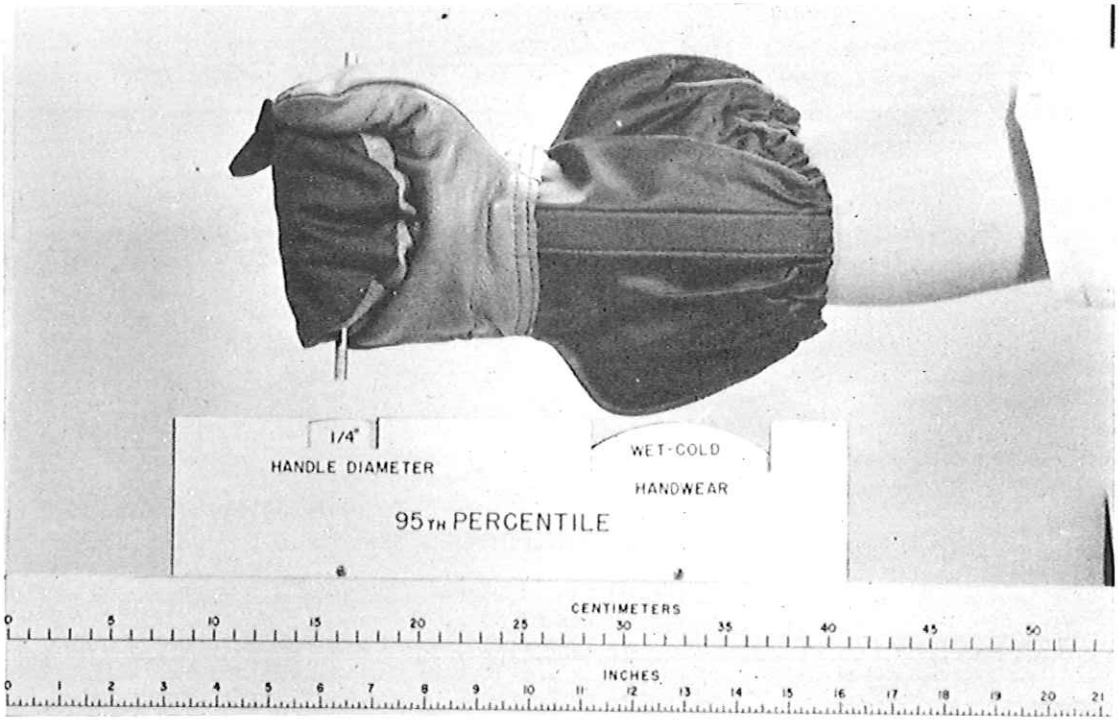

Figure 193. $\frac{1}{4}$" handle diameter (View C)

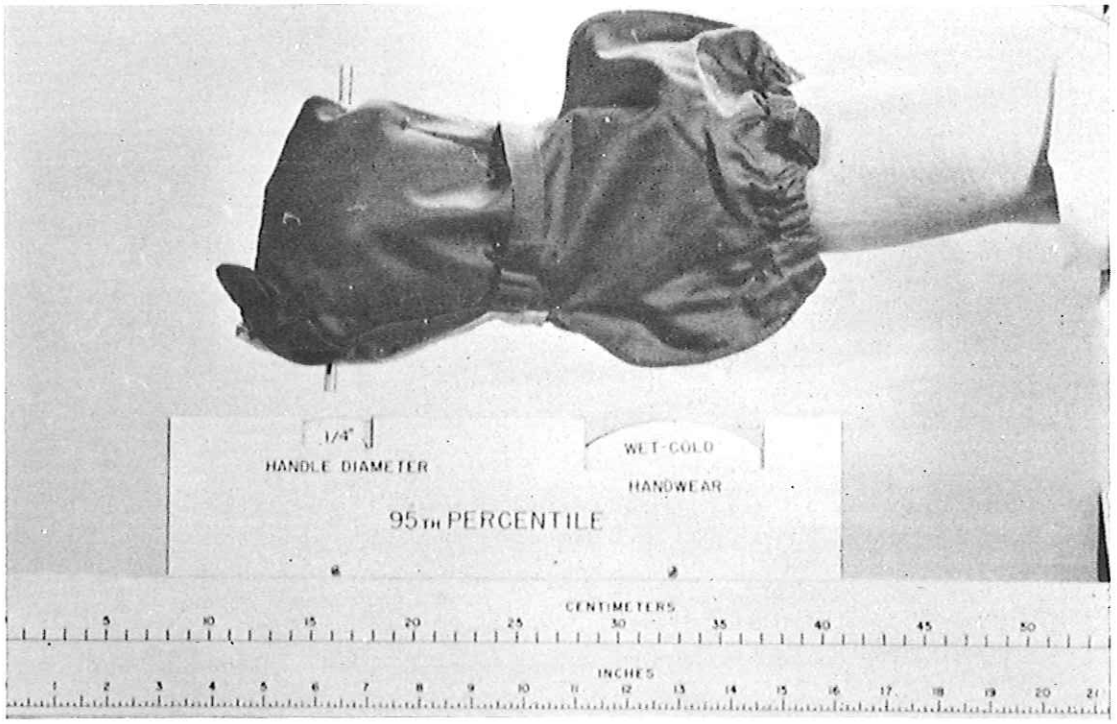

Figure 194. $\frac{1}{4}$" handle diameter (View D)

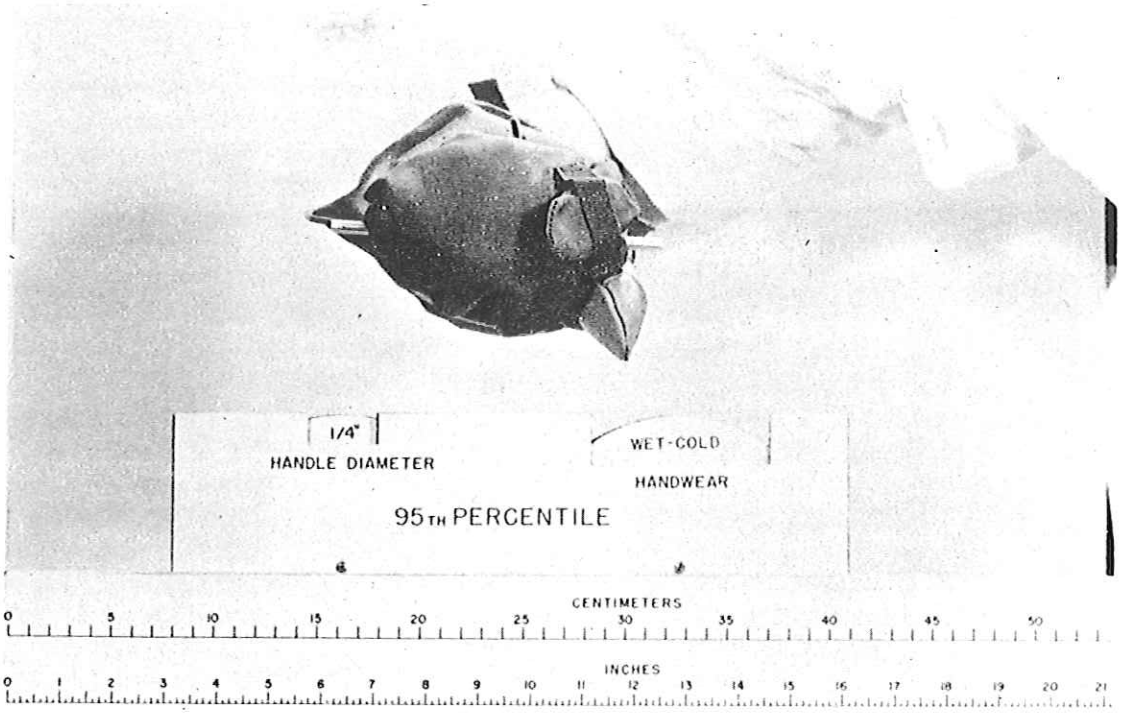

Figure 195. $\frac{1}{4}$" handle diameter (View E)

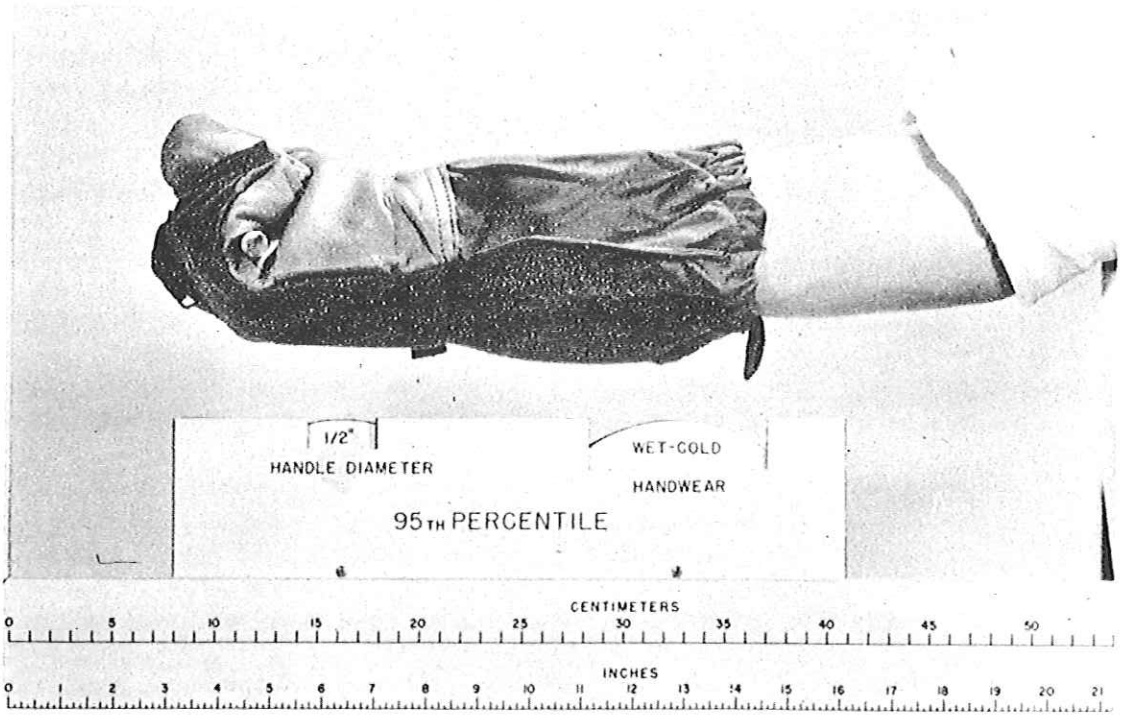

Figure 196. $\frac{1}{2}$" handle diameter (View A)

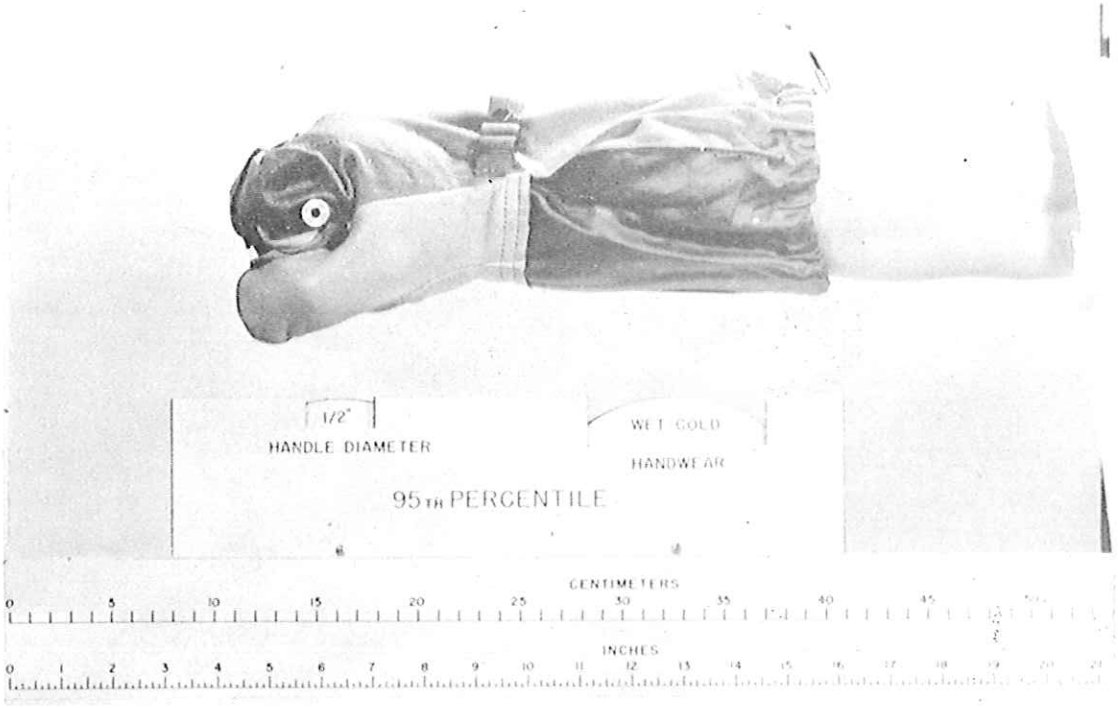

Figure 197. ½" handle diameter (View B)

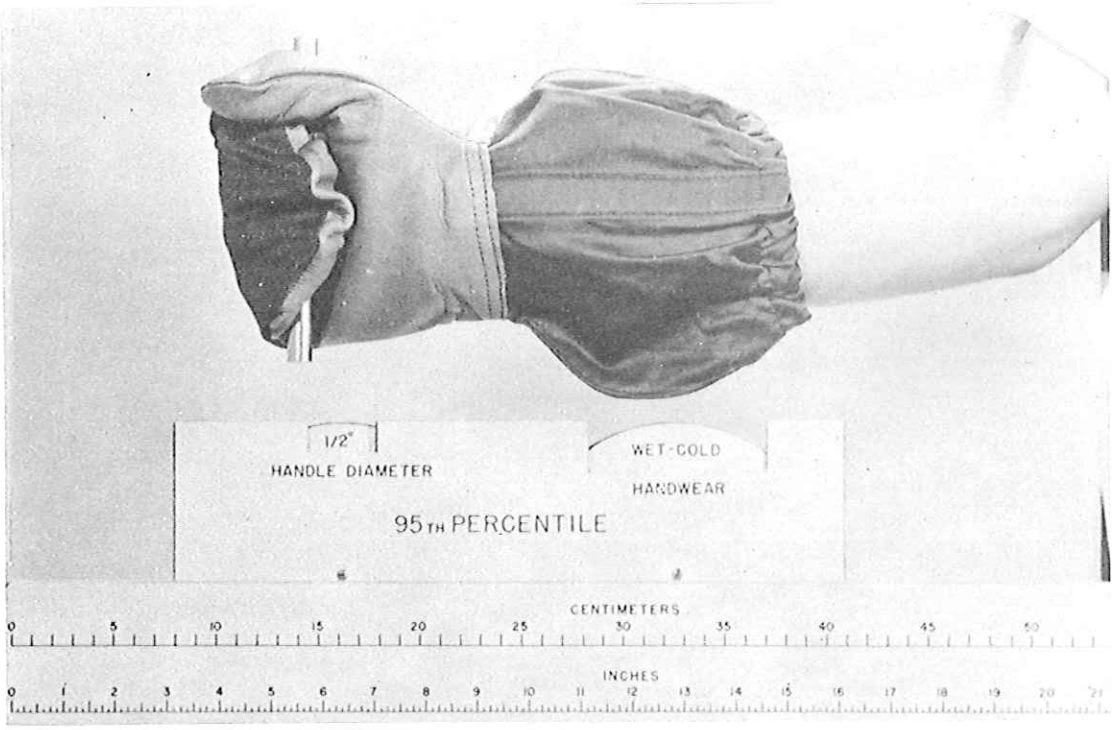

Figure 198. ½" handle diameter (View C)

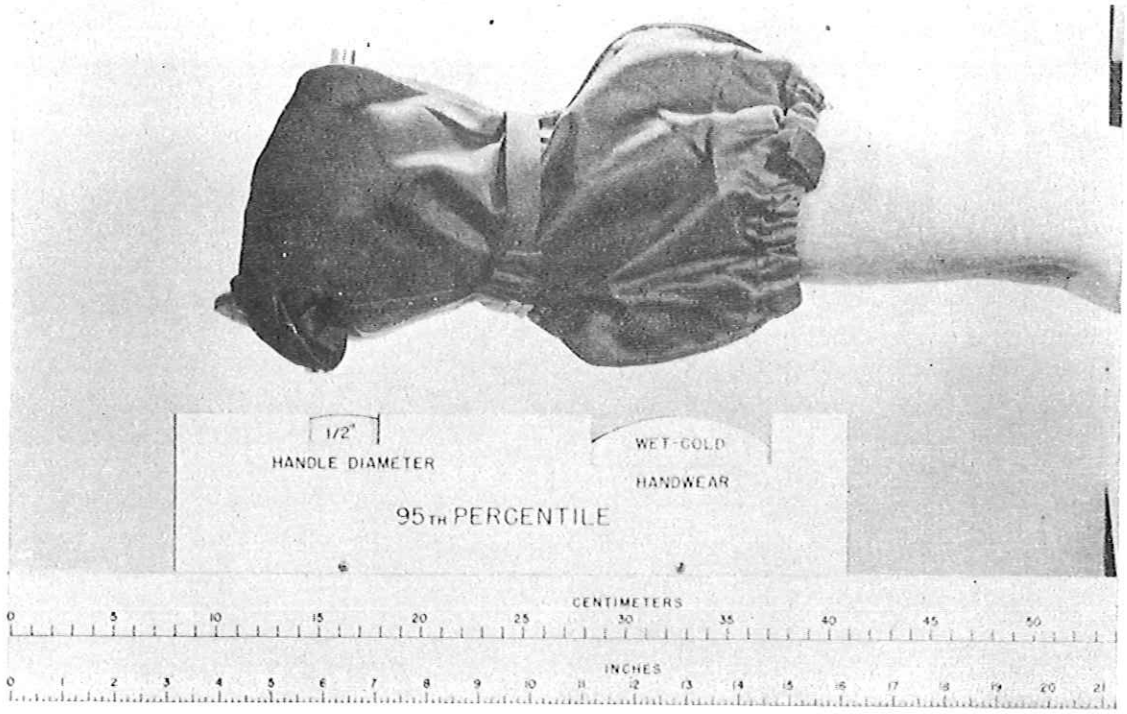

Figure 199. ½" handle diameter (View D)

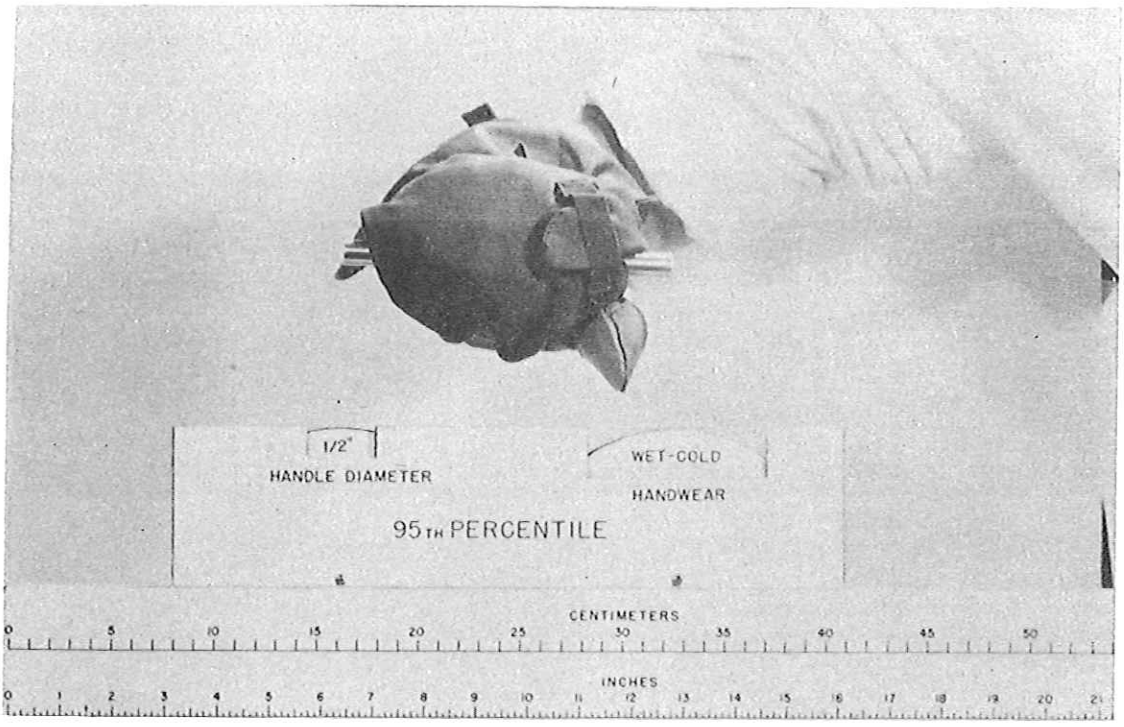

Figure 200. ½" handle diameter (View E)

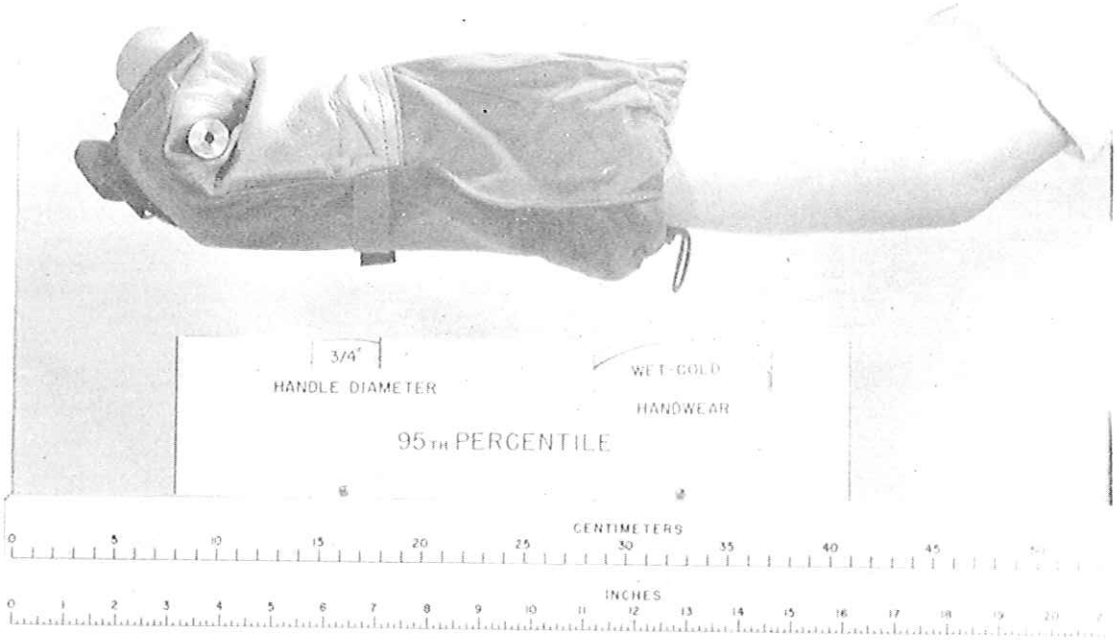

Figure 201. 3/4" handle diameter (View A)

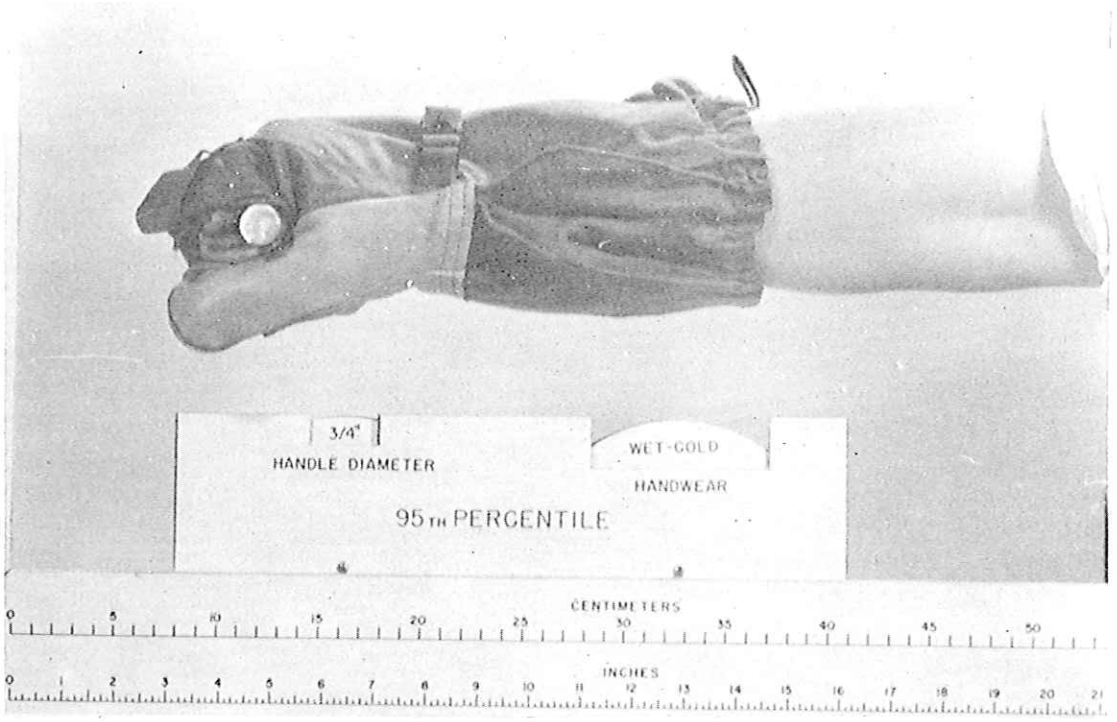

Figure 202. 3/4" handle diameter (View B)

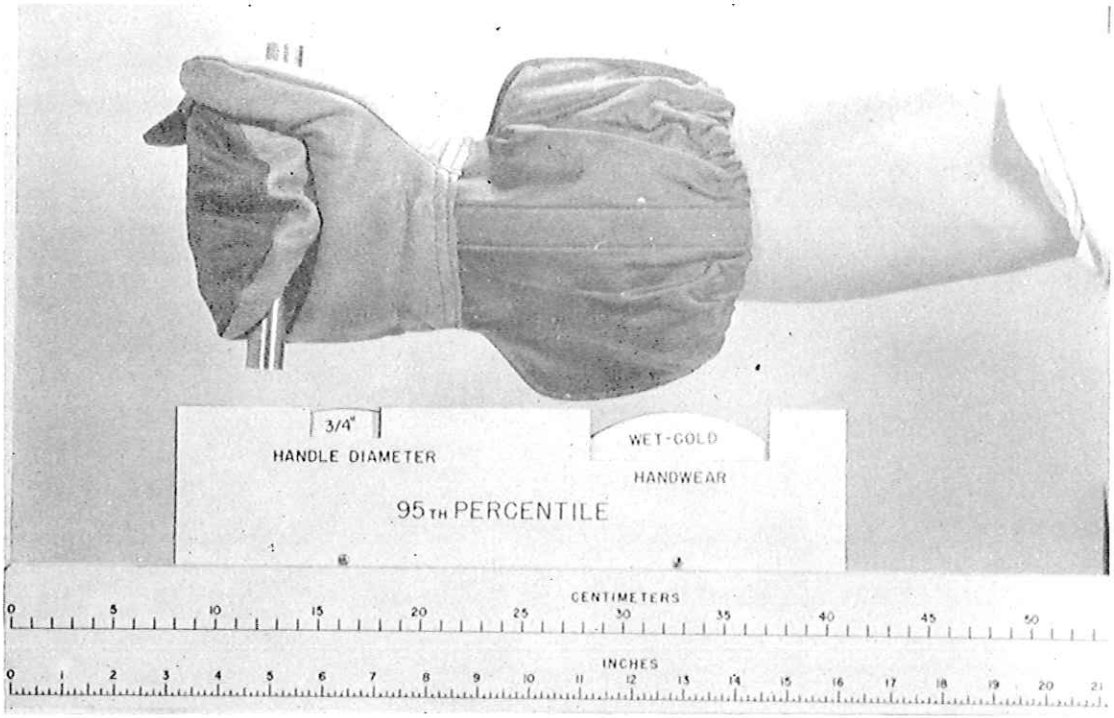

Figure 203. 3/4" handle diameter (View C)

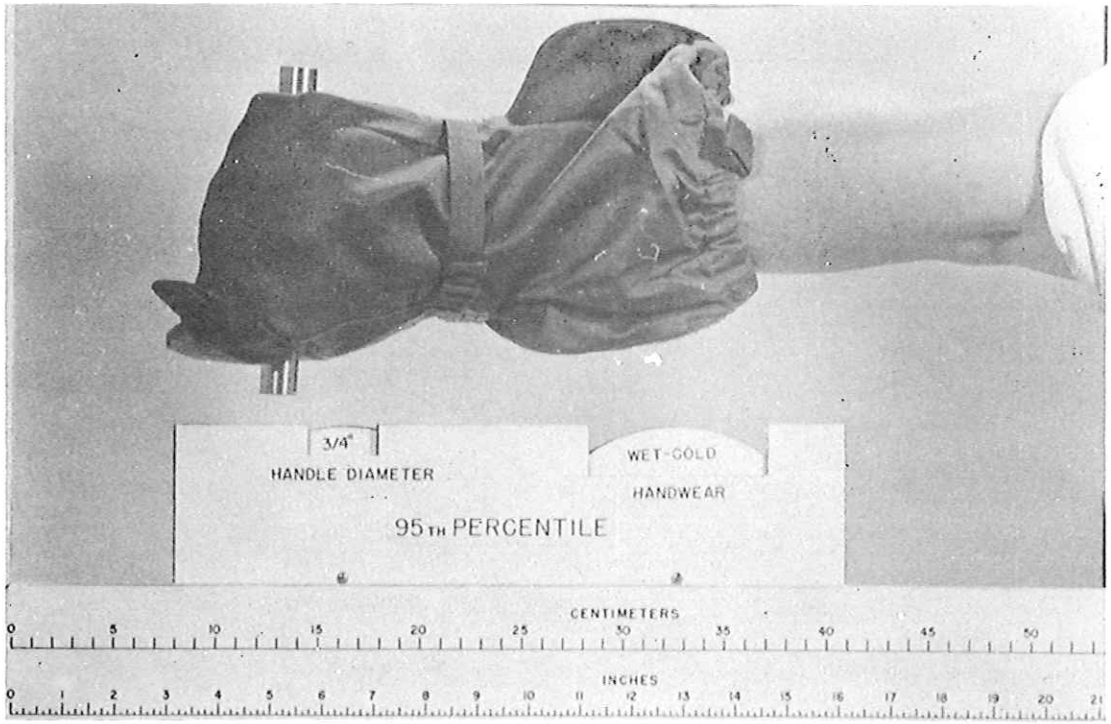

Figure 204. 3/4" handle diameter (View D)

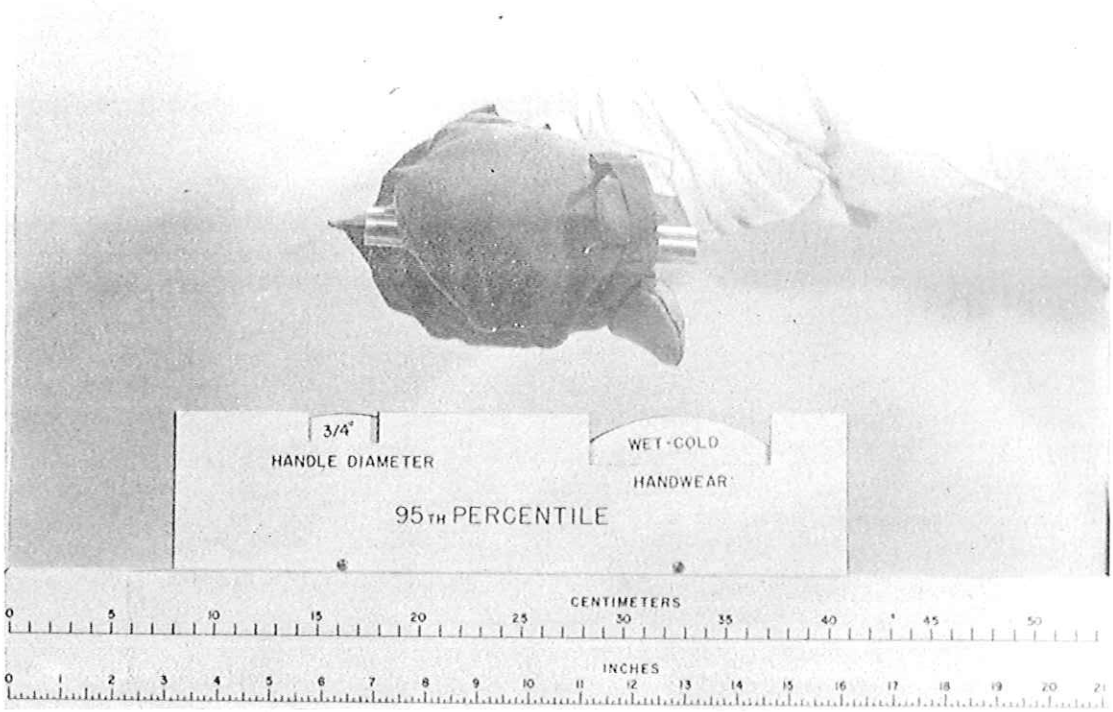

Figure 205. 3/4" handle diameter (View E)

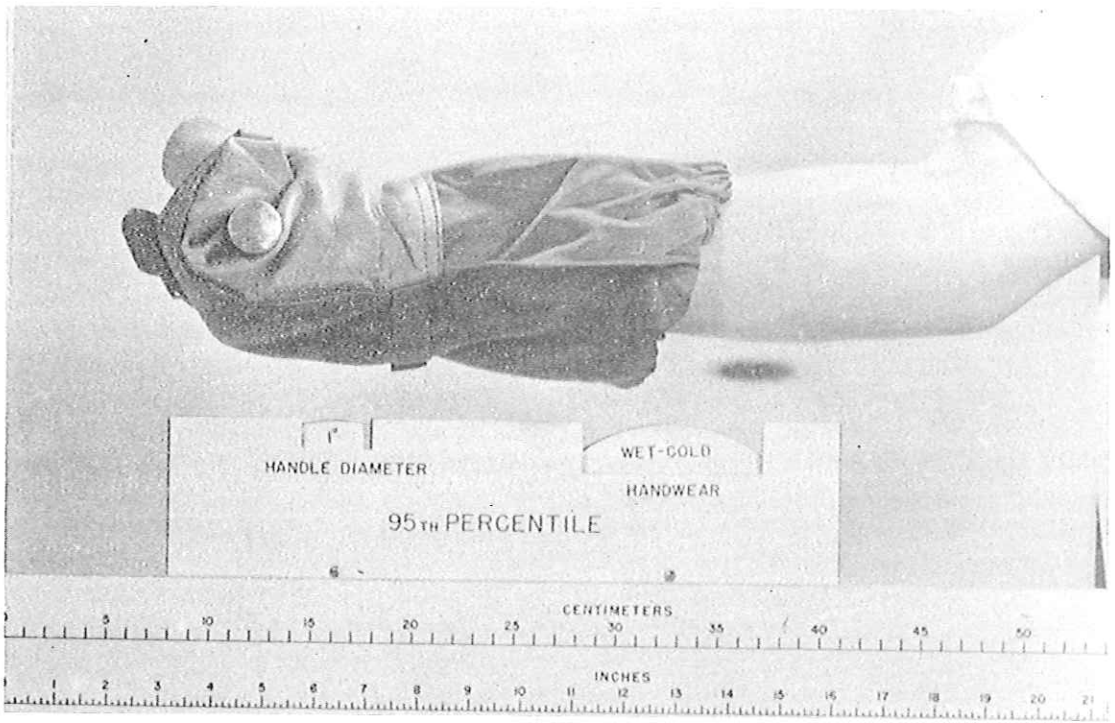

Figure 206. 1" handle diameter (View A)

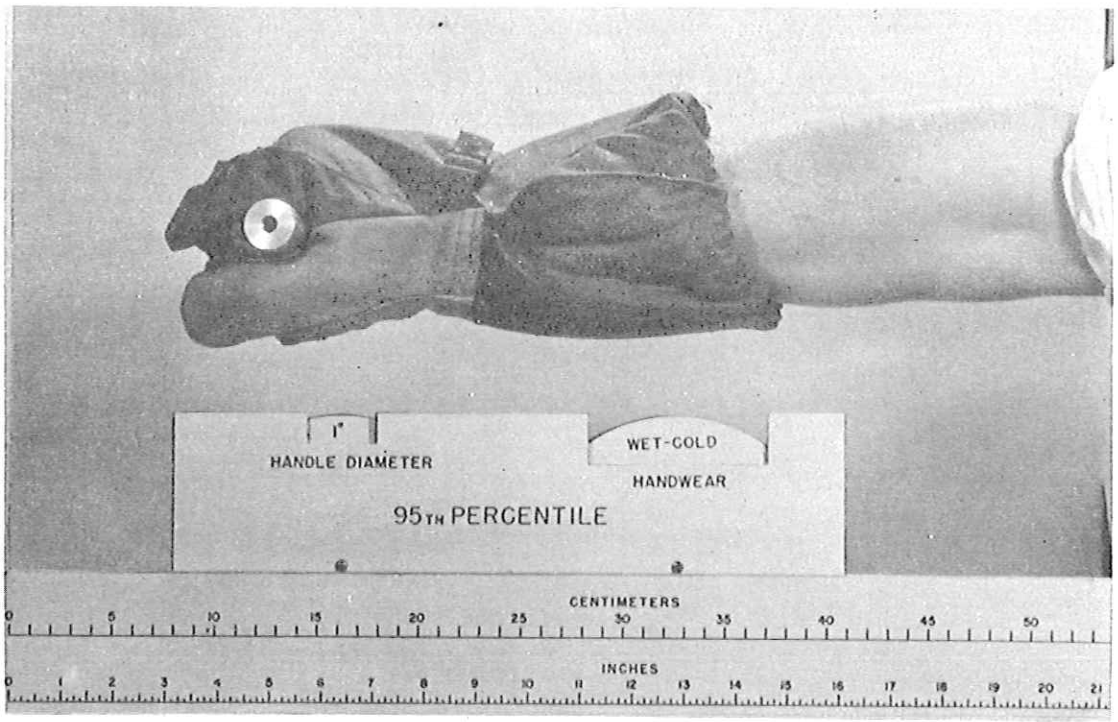

Figure 207. 1" handle diameter (View B)

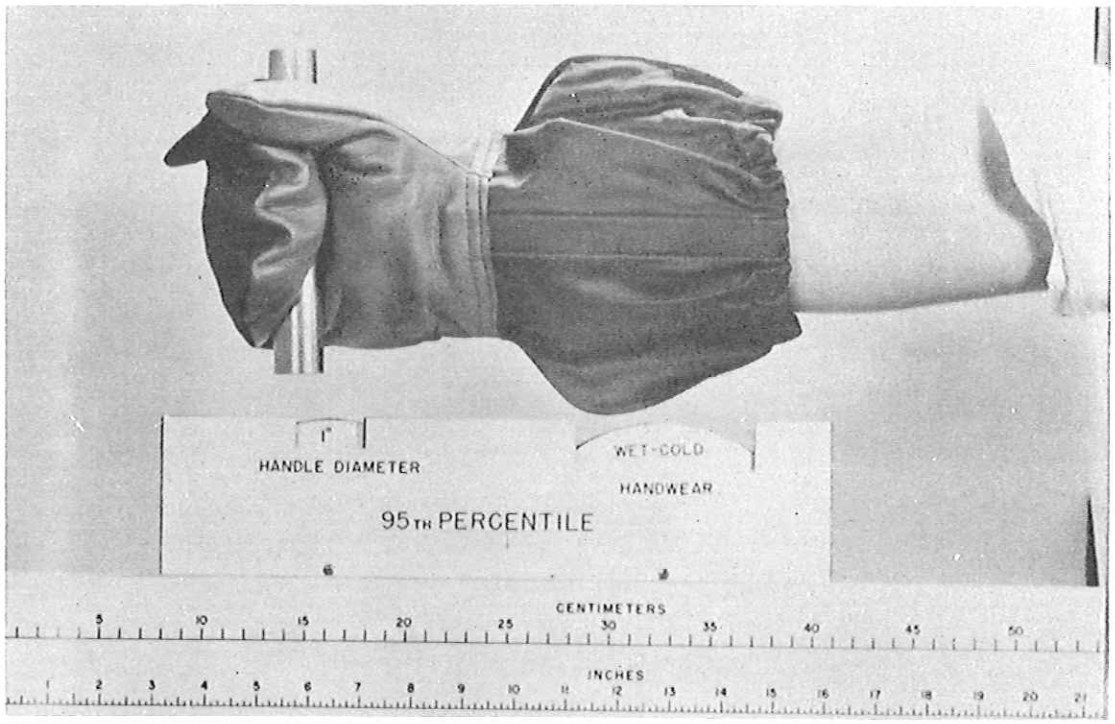

Figure 208. 1" handle diameter (View C)

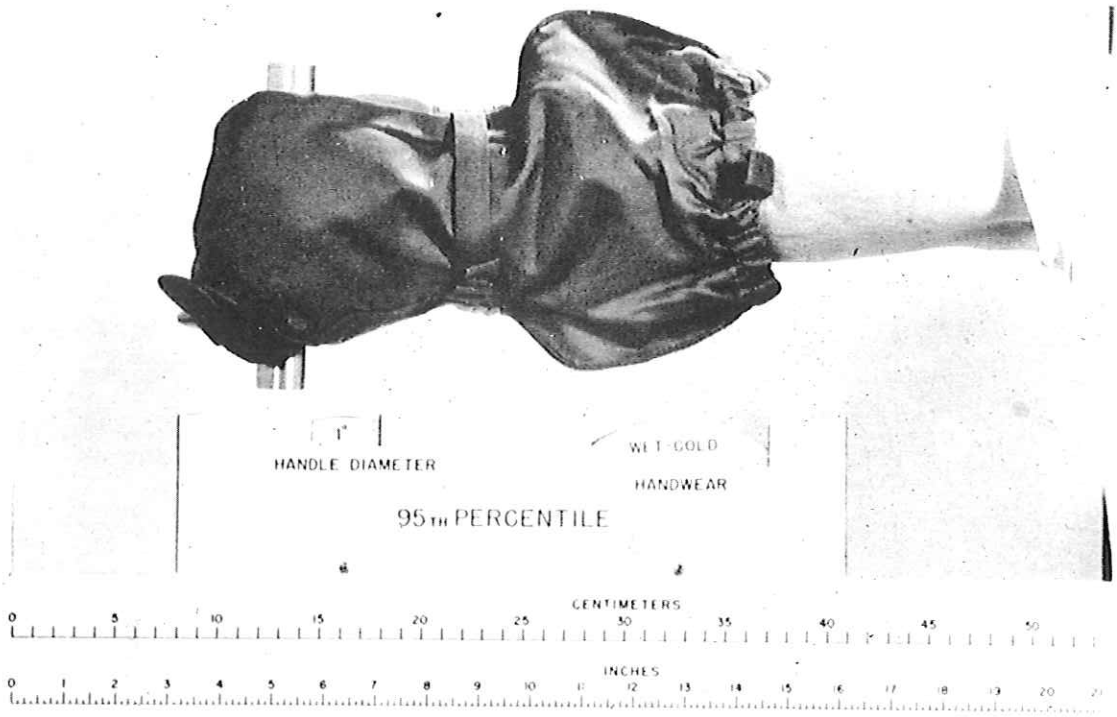

Figure 209. 1" handle diameter (View D)

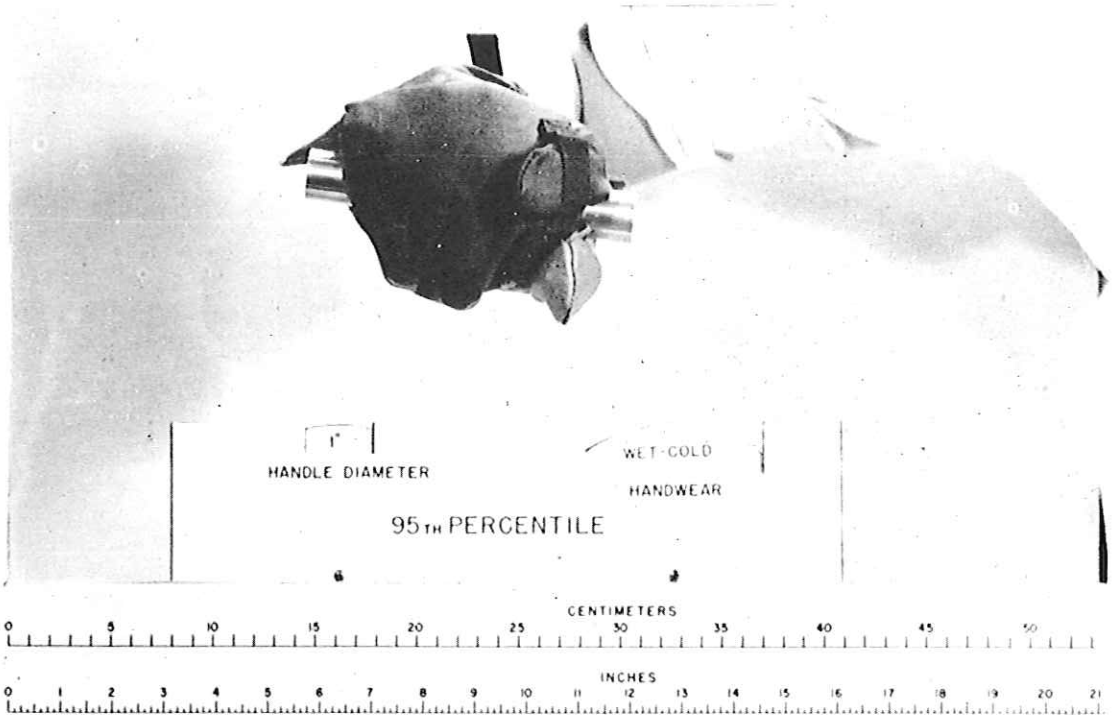

Figure 210. 1" handle diameter (View E)

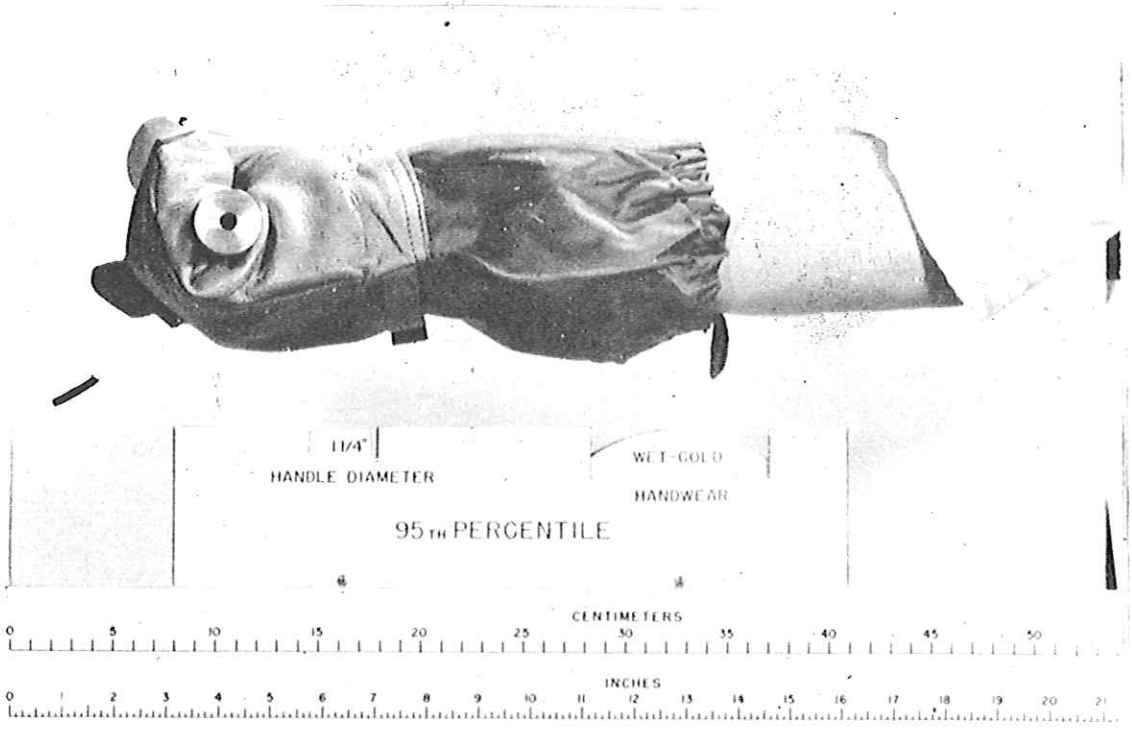

Figure 211. $1\frac{1}{4}$" handle diameter (View A)

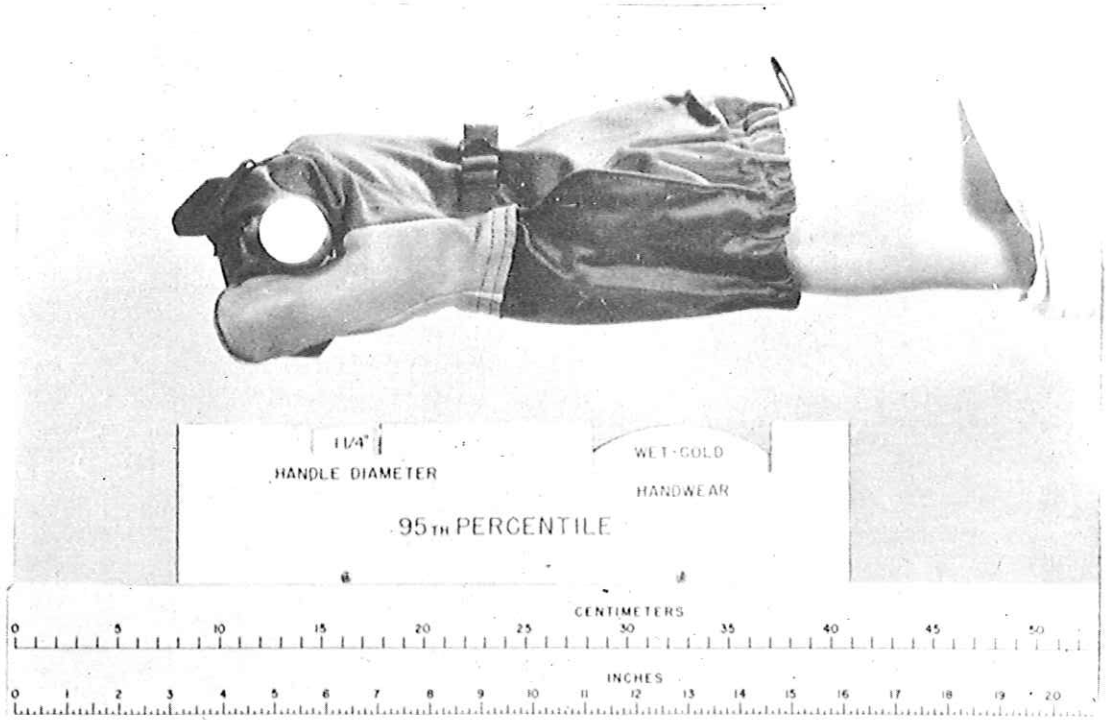

Figure 212. $1\frac{1}{4}$" handle diameter (View B)

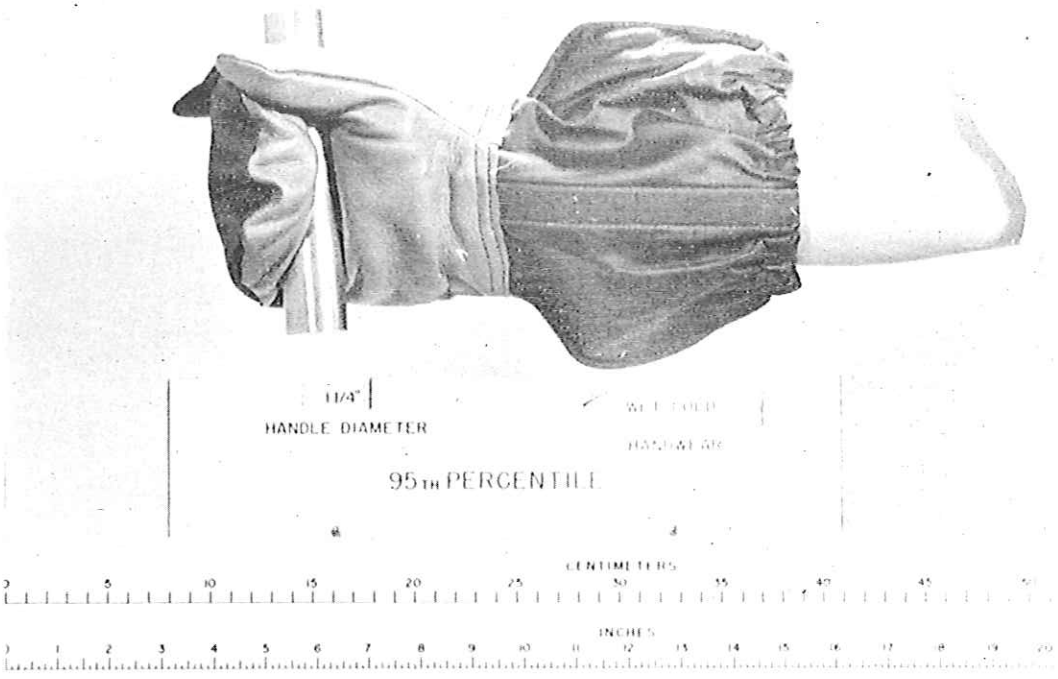

Figure 213. $1\frac{1}{4}$" handle diameter (View C)

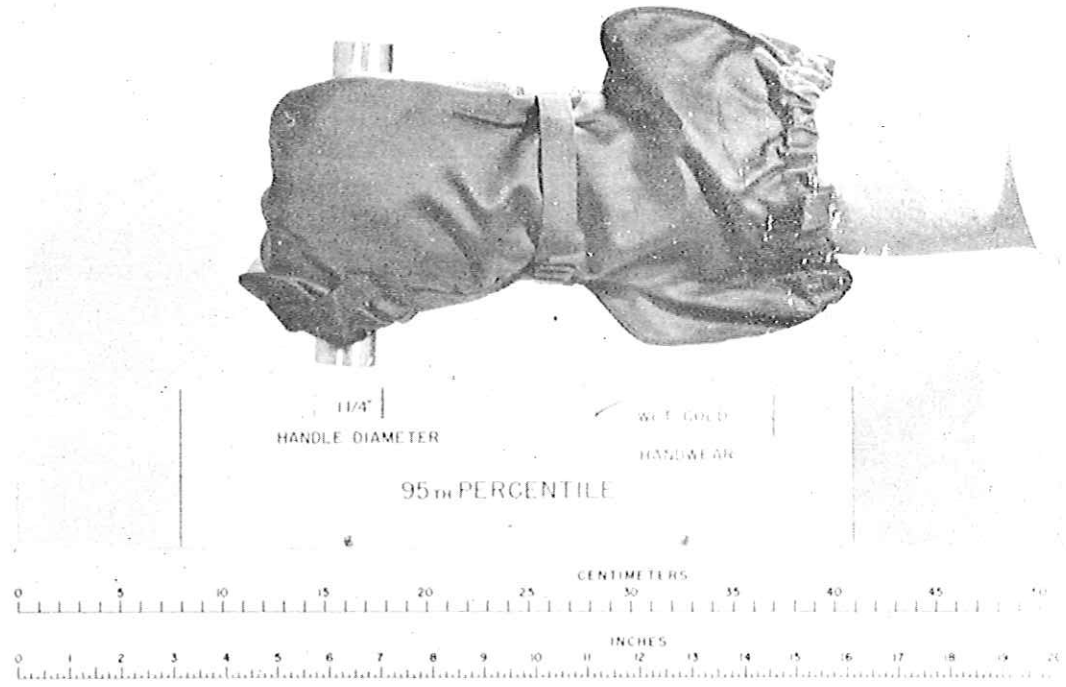

Figure 214. $1\frac{1}{4}$" handle diameter (View D)

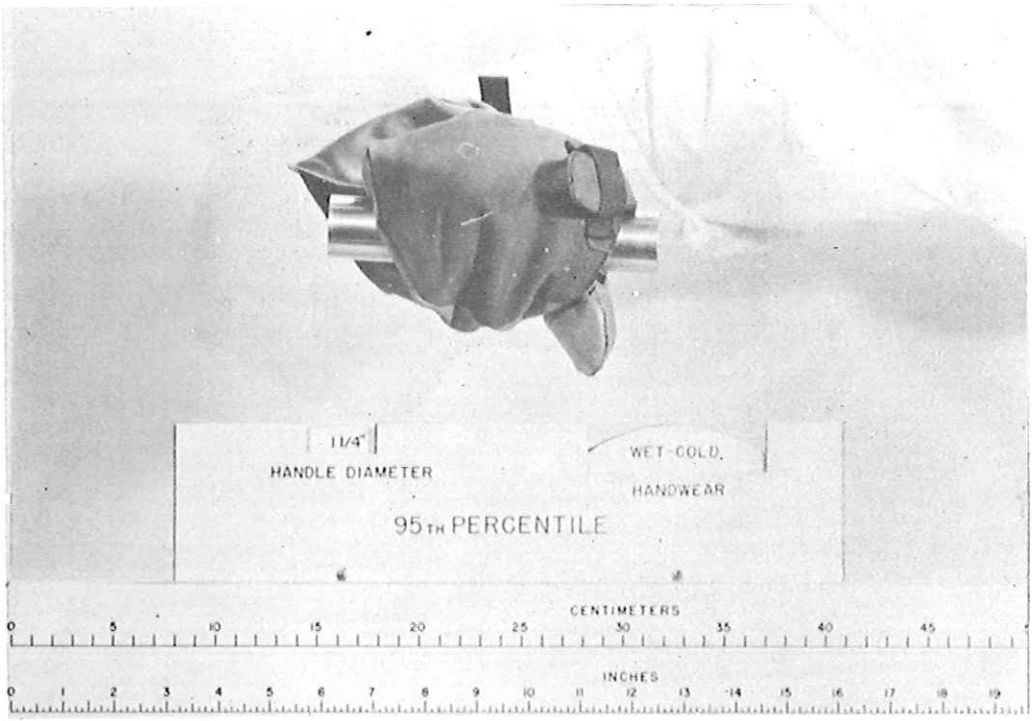

Figure 215. 1¼" handle diameter (View E)

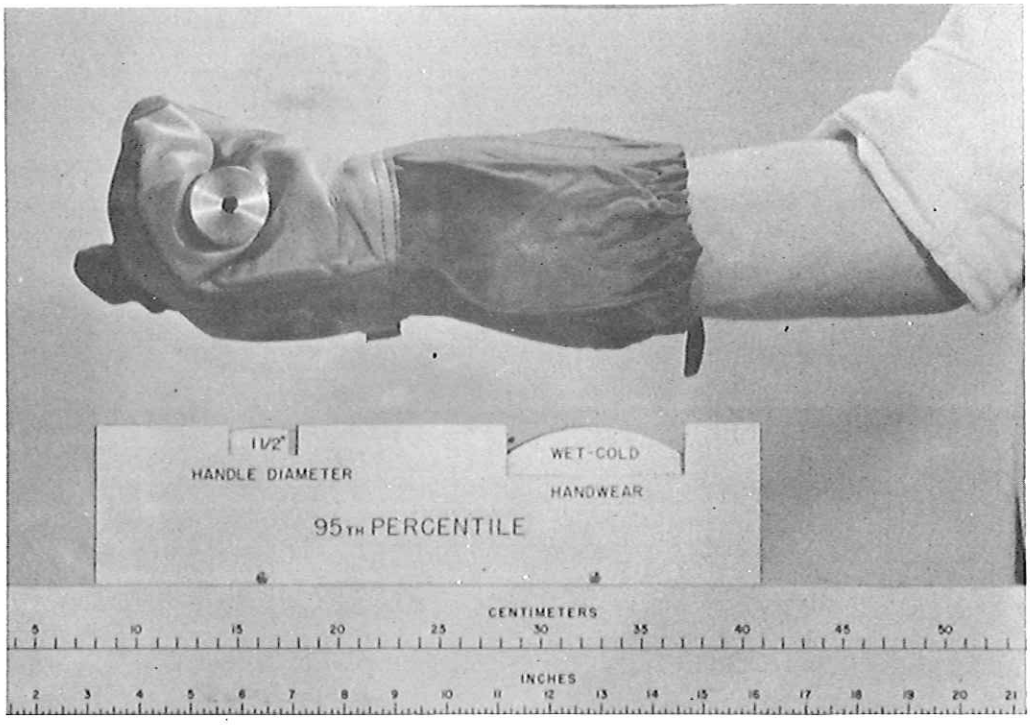

Figure 216. 1½" handle diameter (View A)

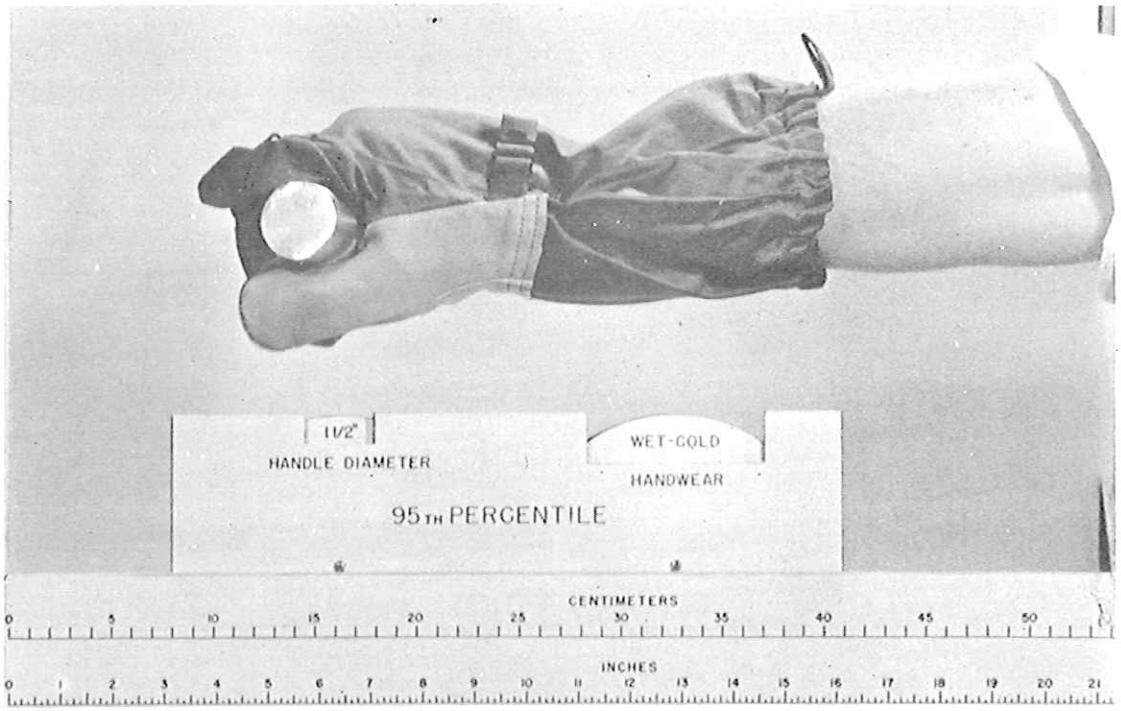

Figure 217. $1\frac{1}{2}$" handle diameter (View B)

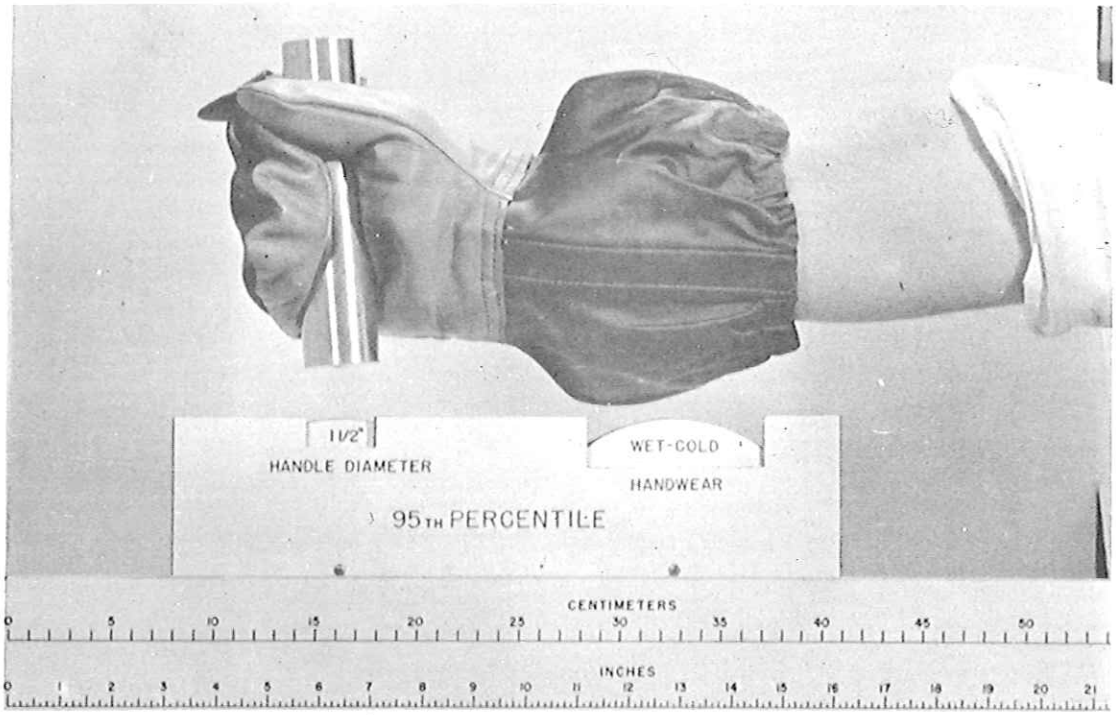

Figure 218. $1\frac{1}{2}$" handle diameter (View C)

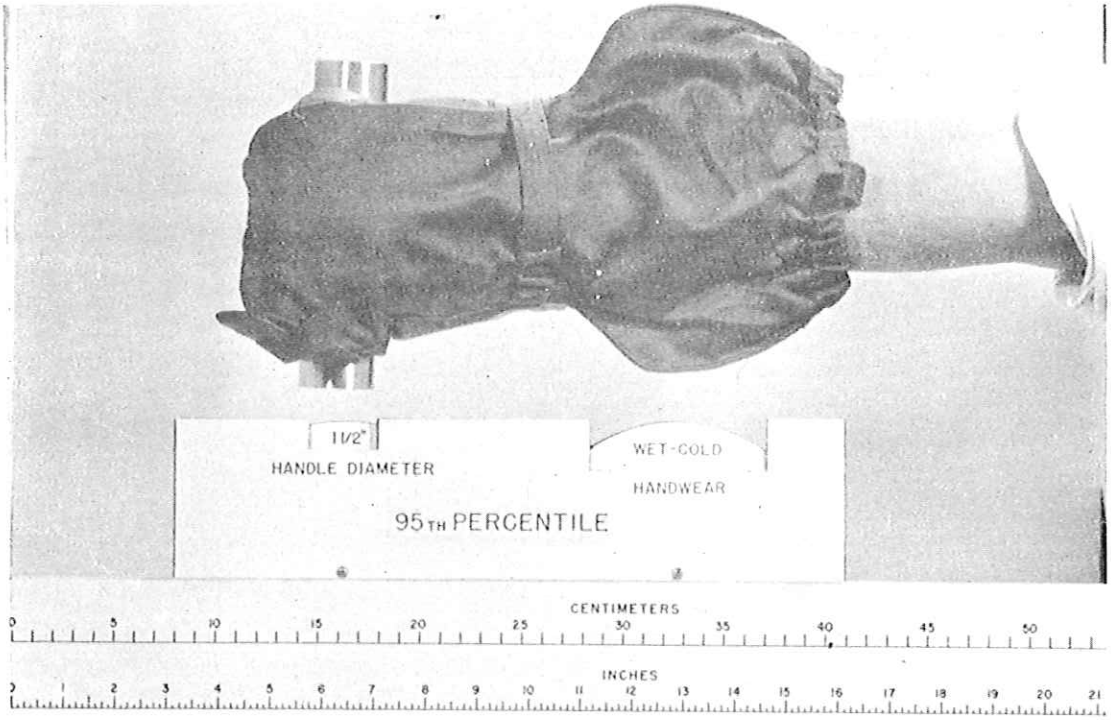

Figure 219. $1\frac{1}{2}$" handle diameter (View D)

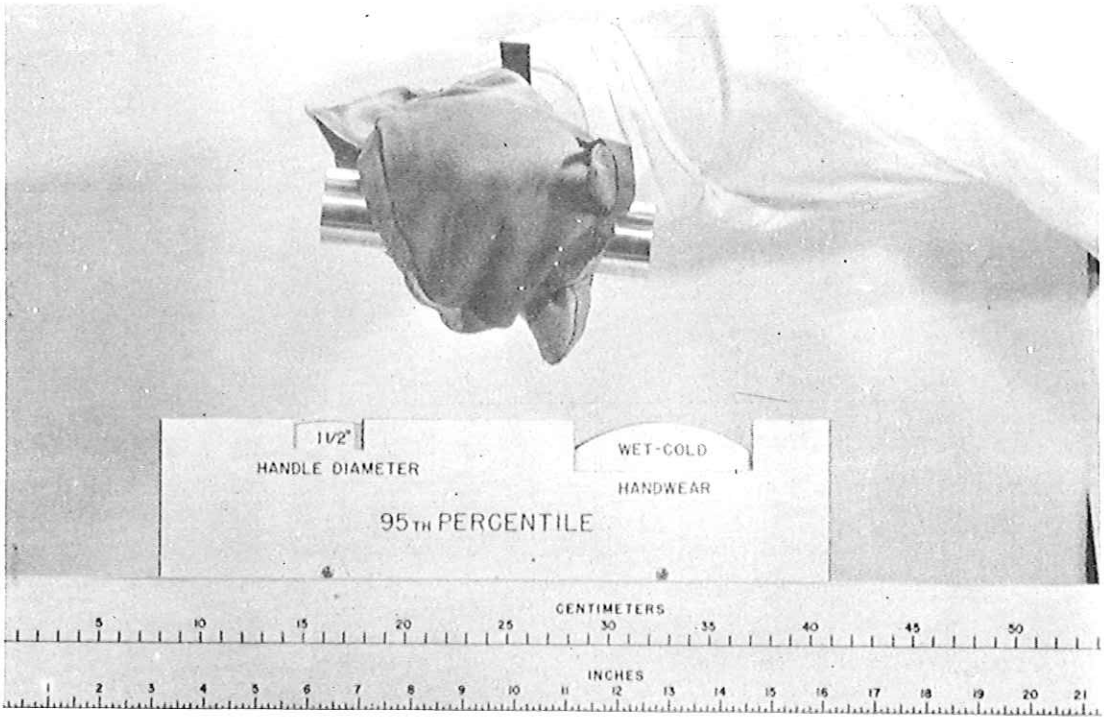

Figure 220. $1\frac{1}{2}$" handle diameter (View E)

Figure 221. 1 3/4" handle diameter (View A)

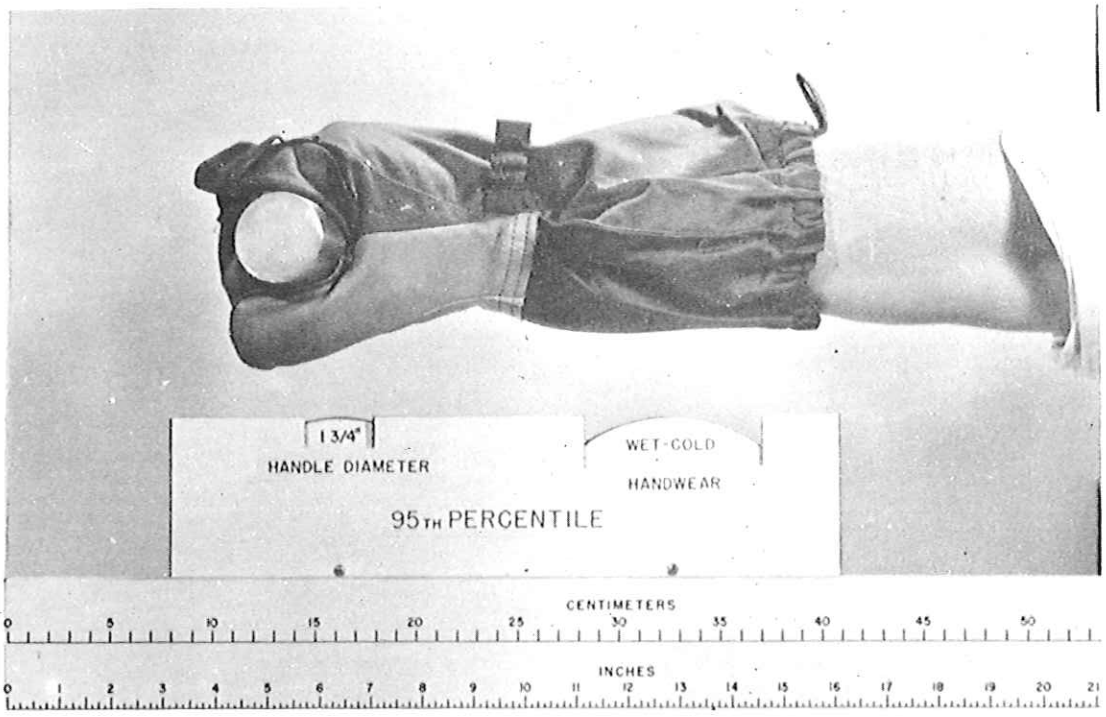

Figure 222. 1 3/4" handle diameter (View B)

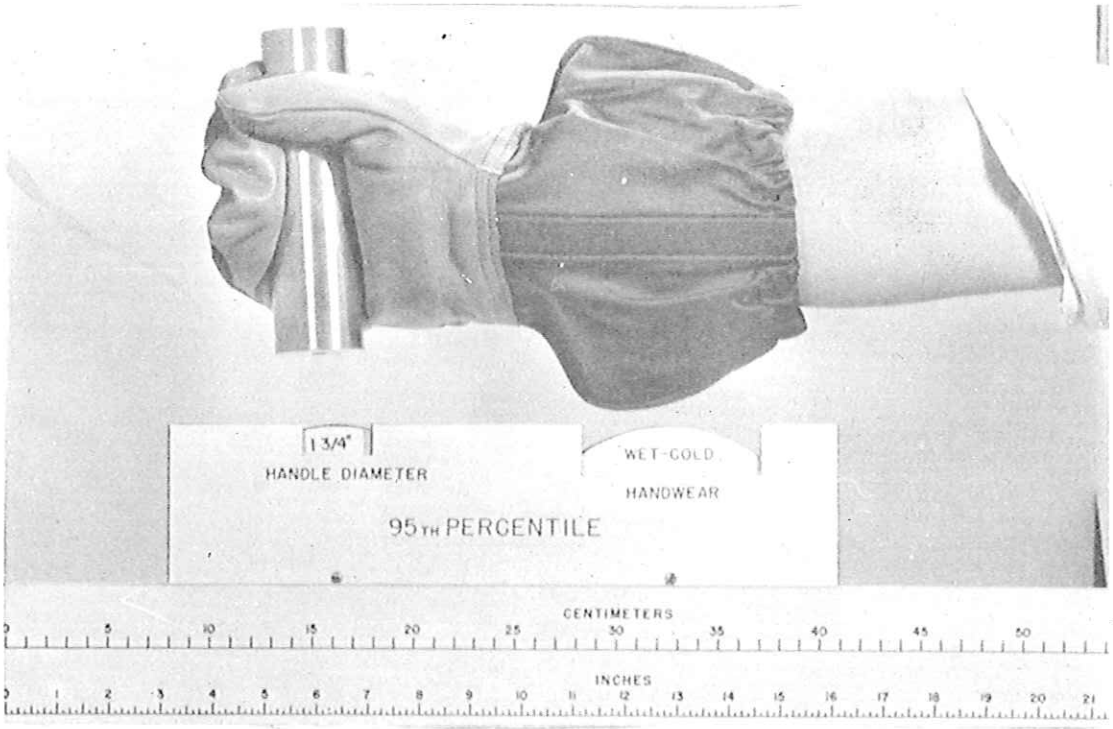

Figure 223. 1 3/4" handle diameter (View C)

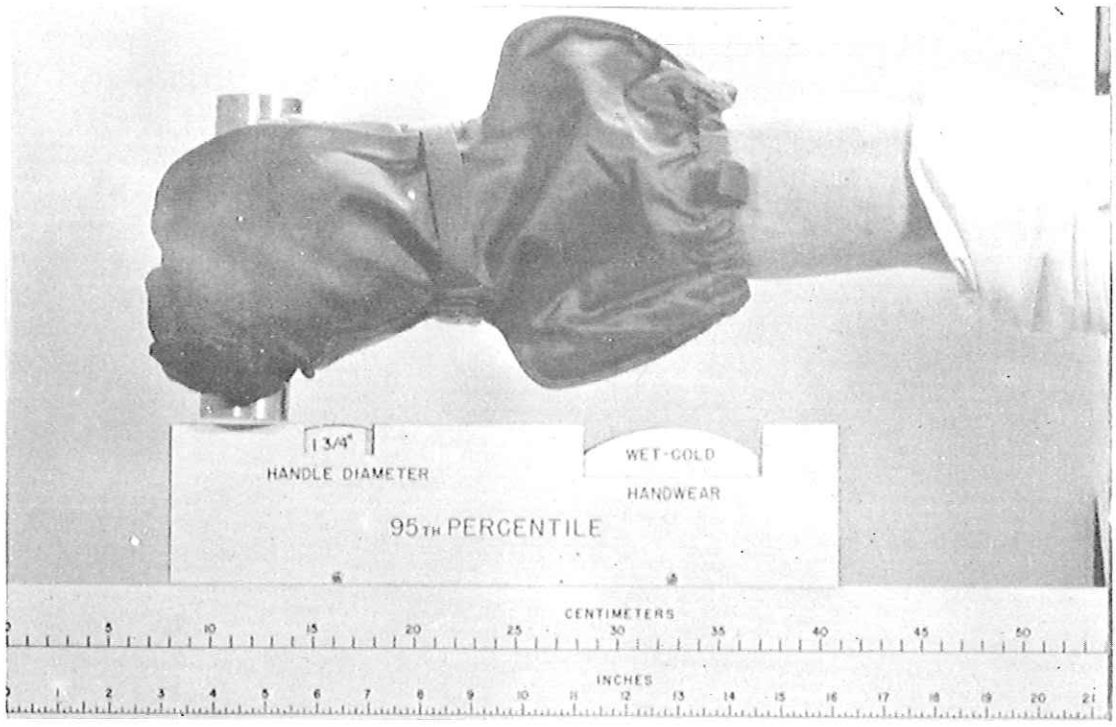

Figure 224. 1 3/4" handle diameter (View D)

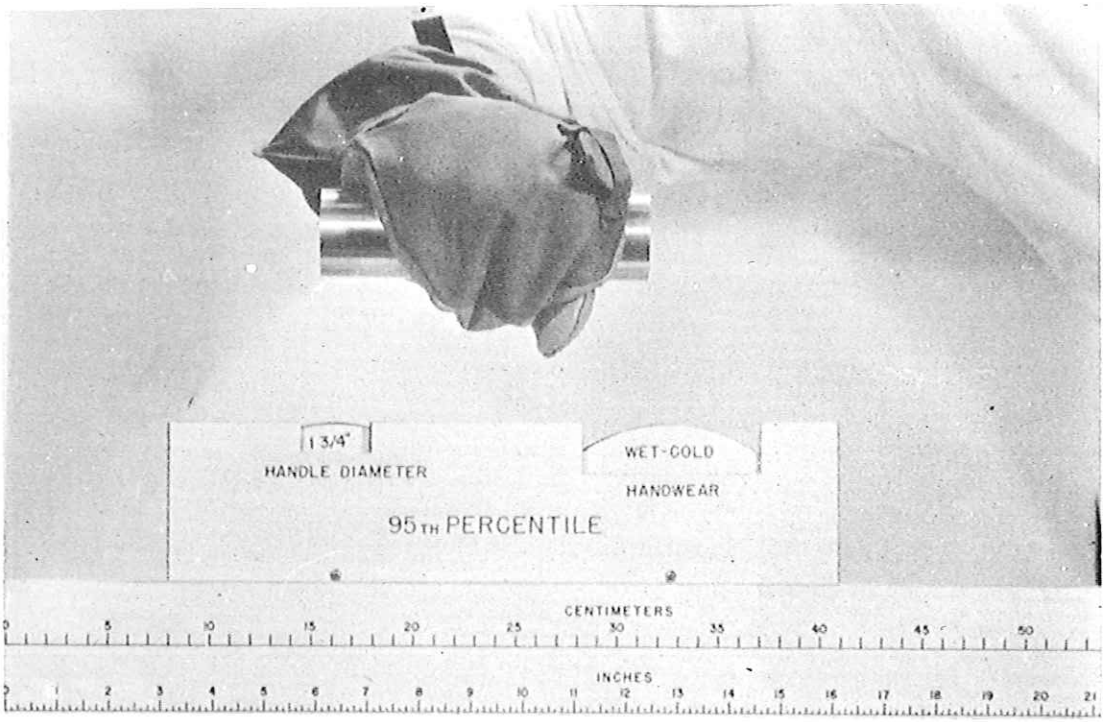

Figure 225. 1 3/4" handle diameter (View E)

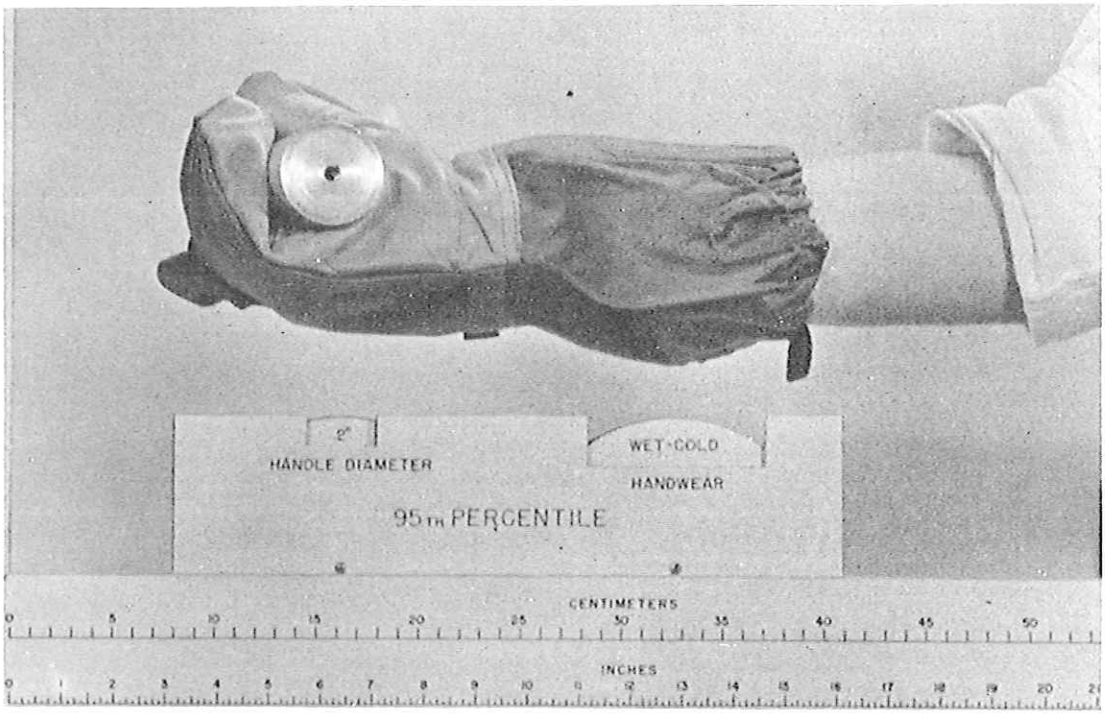

Figure 226. 2" handle diameter (View A)

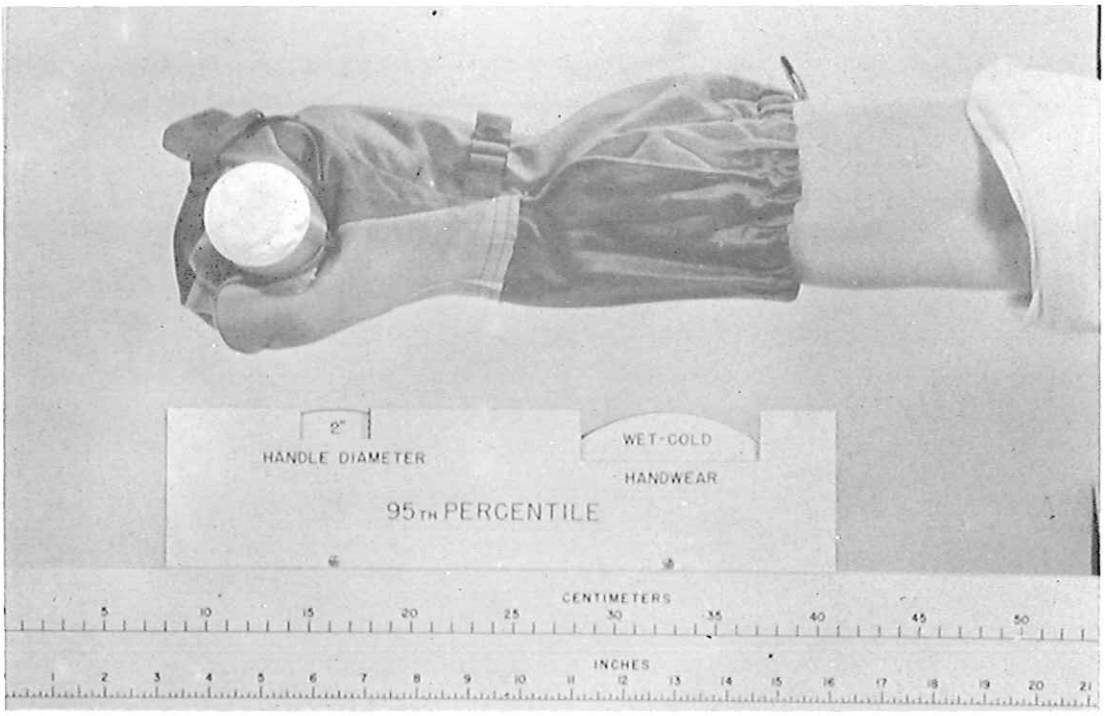

Figure 227. 2" handle diameter (View B)

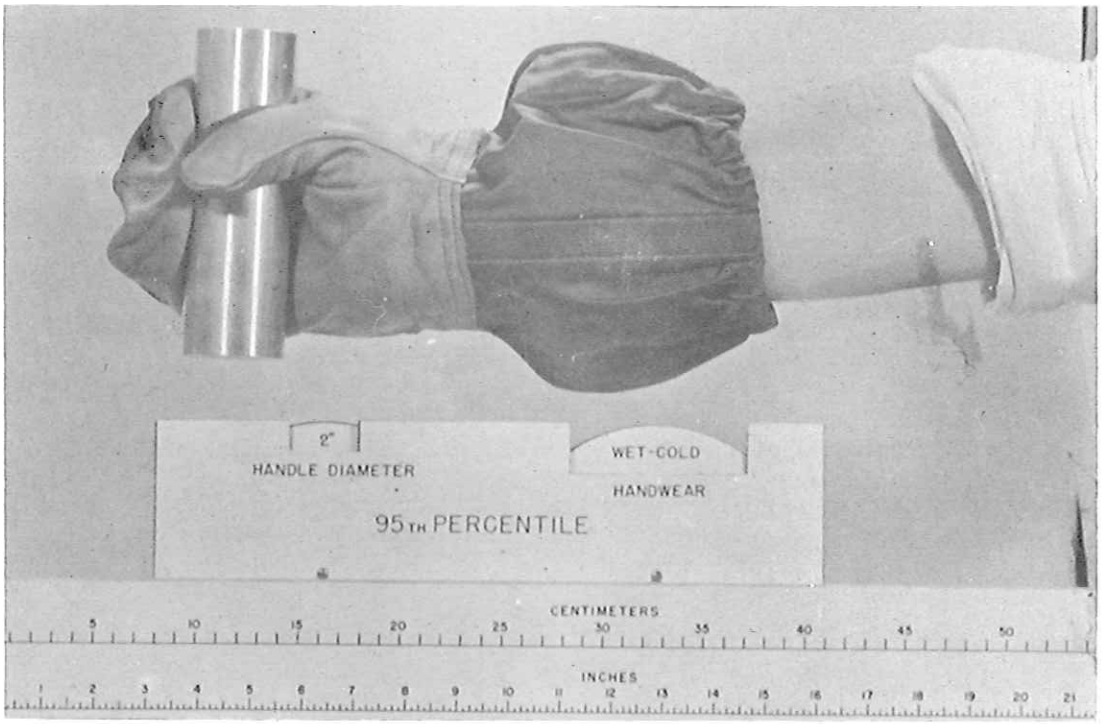

Figure 228. 2" handle diameter (View C)

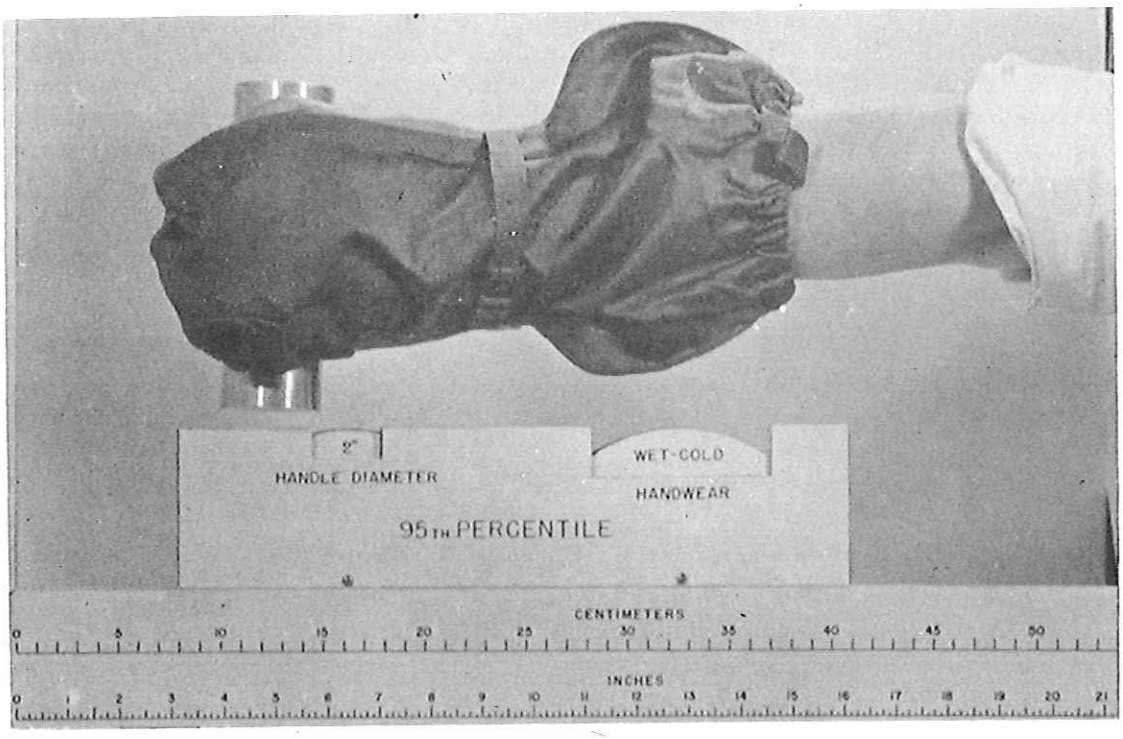

Figure 229. 2" handle diameter (View D)

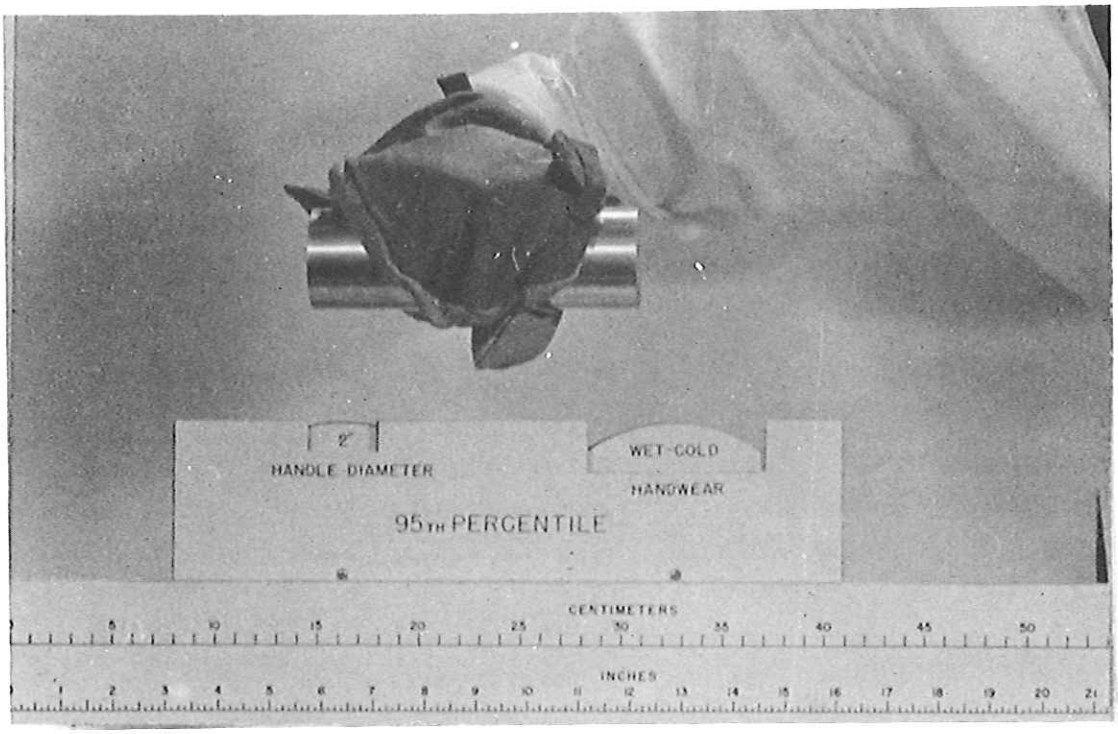

Figure 230. 2" handle diameter (View E)

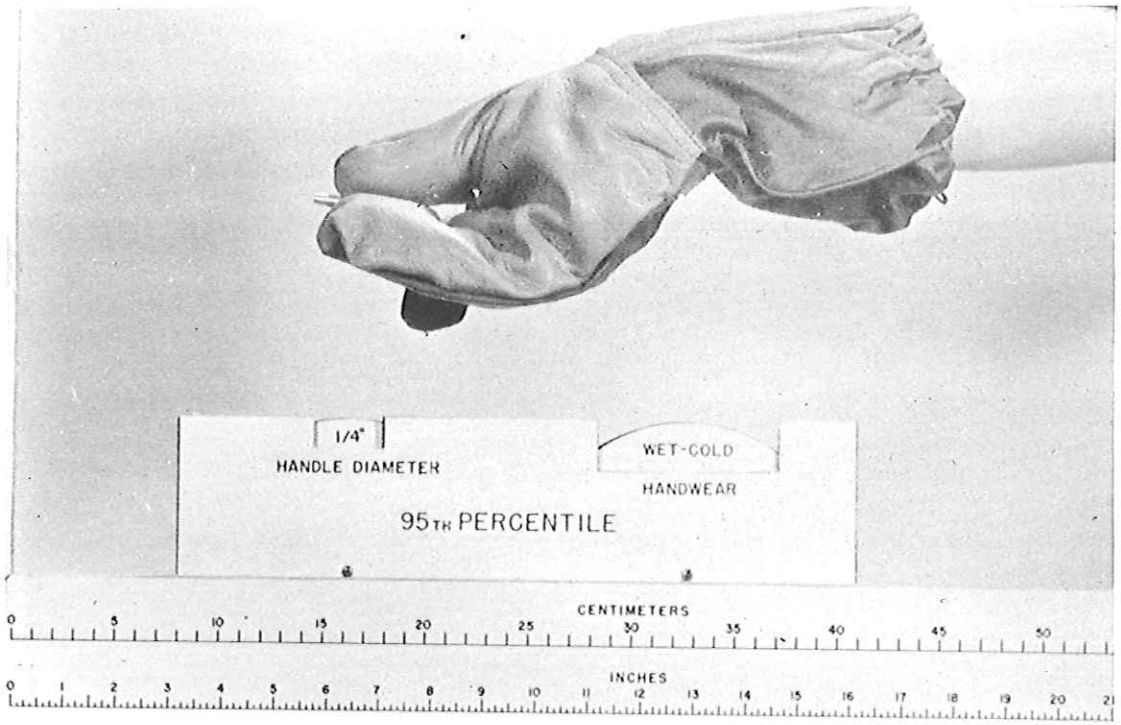

Figure 231. $\frac{1}{4}$" knob diameter (View A)

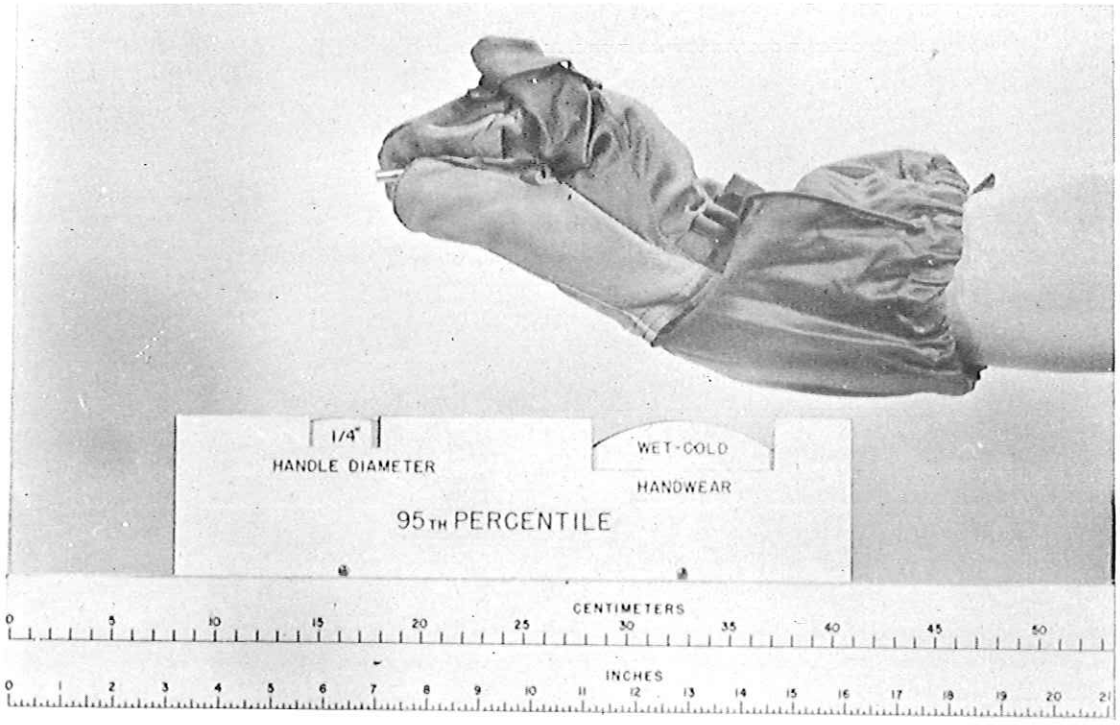

Figure 232. $\frac{1}{4}$" knob diameter (View B)

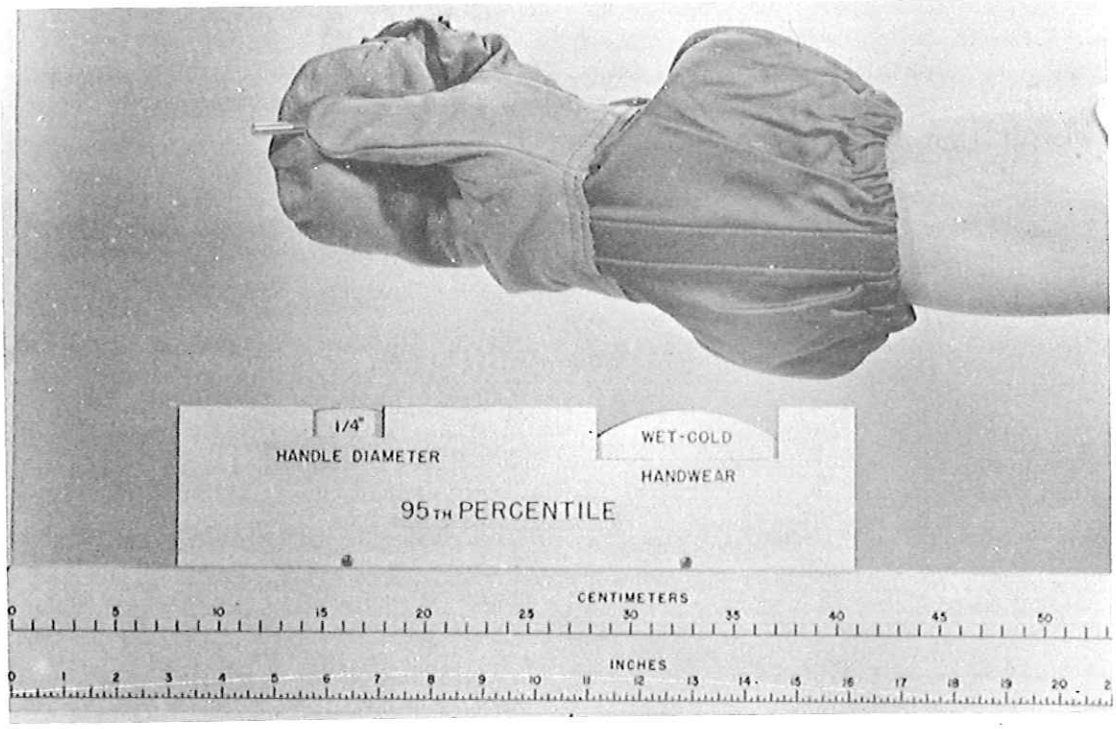

Figure 233. $\frac{1}{4}$" knob diameter (View C)

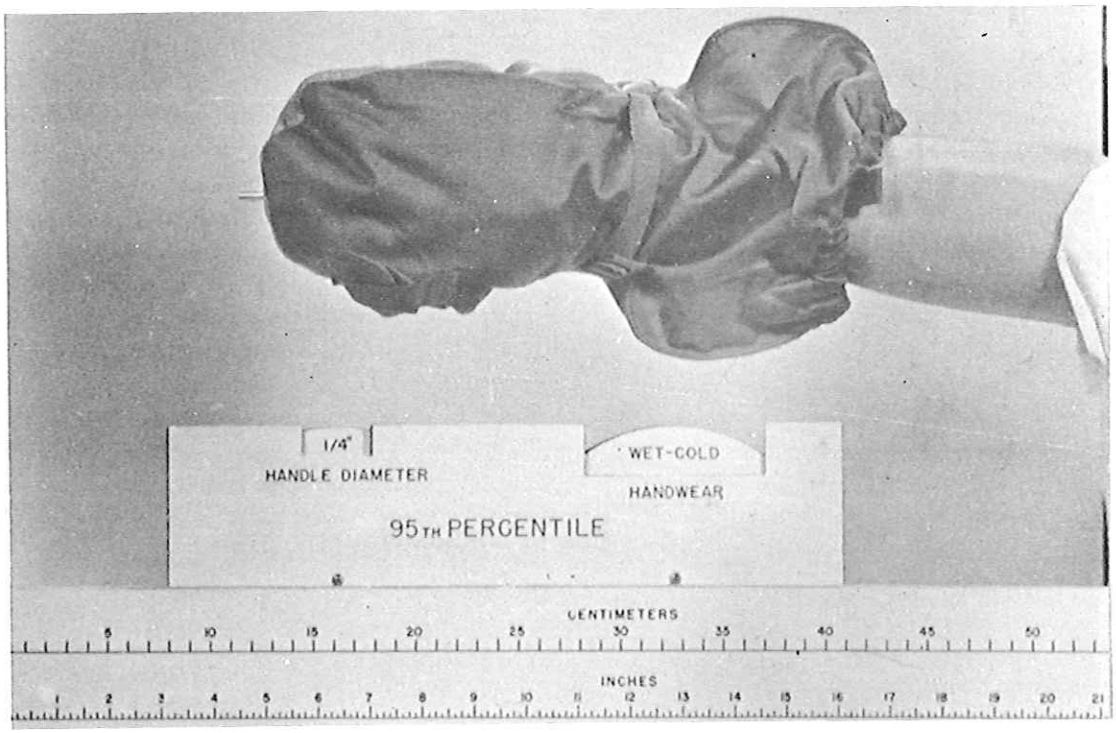

Figure 234. $\frac{1}{4}$" knob diameter (View D)

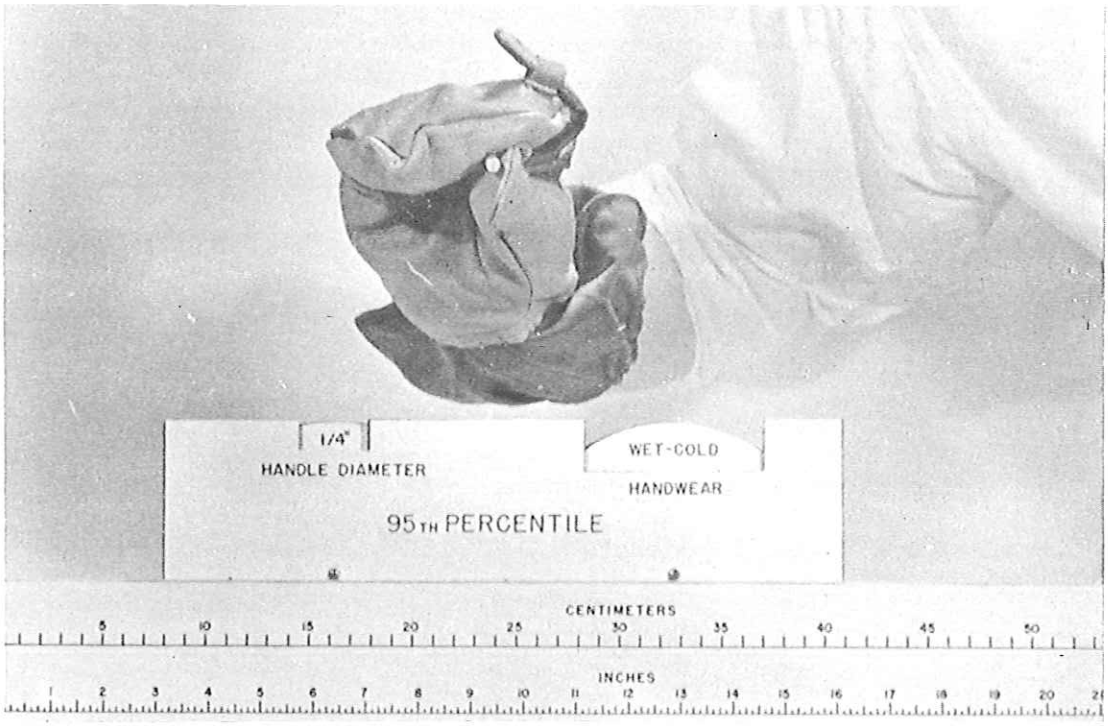

Figure 235. $\frac{1}{4}$" knob diameter (View E)

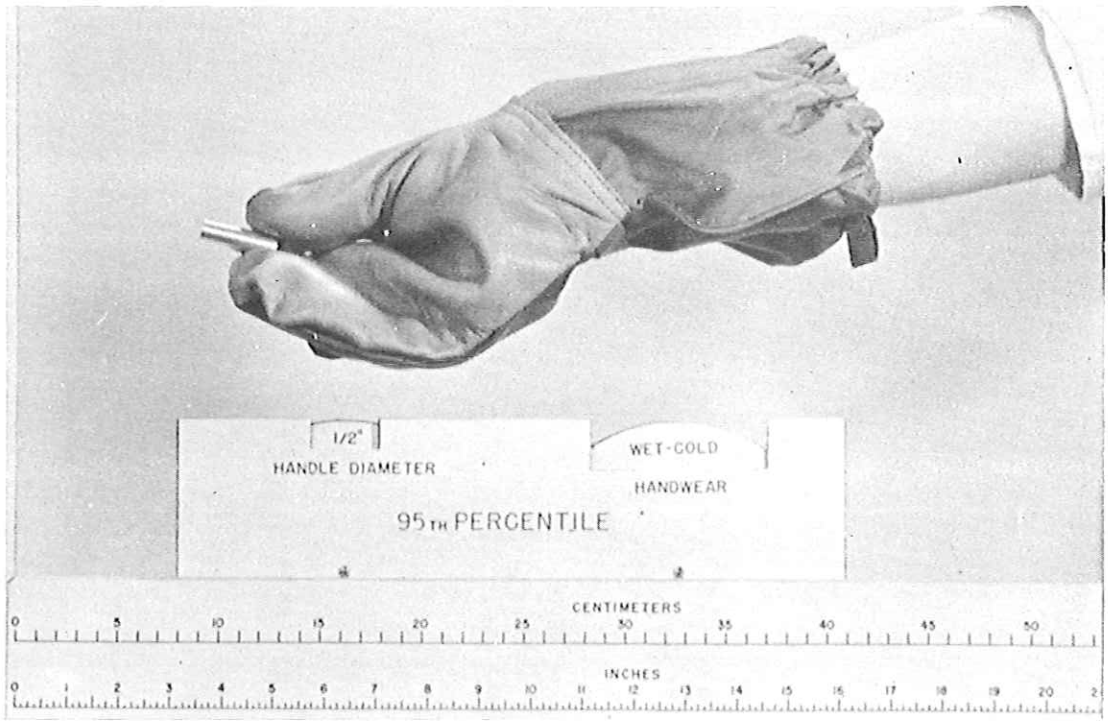

Figure 236. $\frac{1}{2}$" knob diameter (View A)

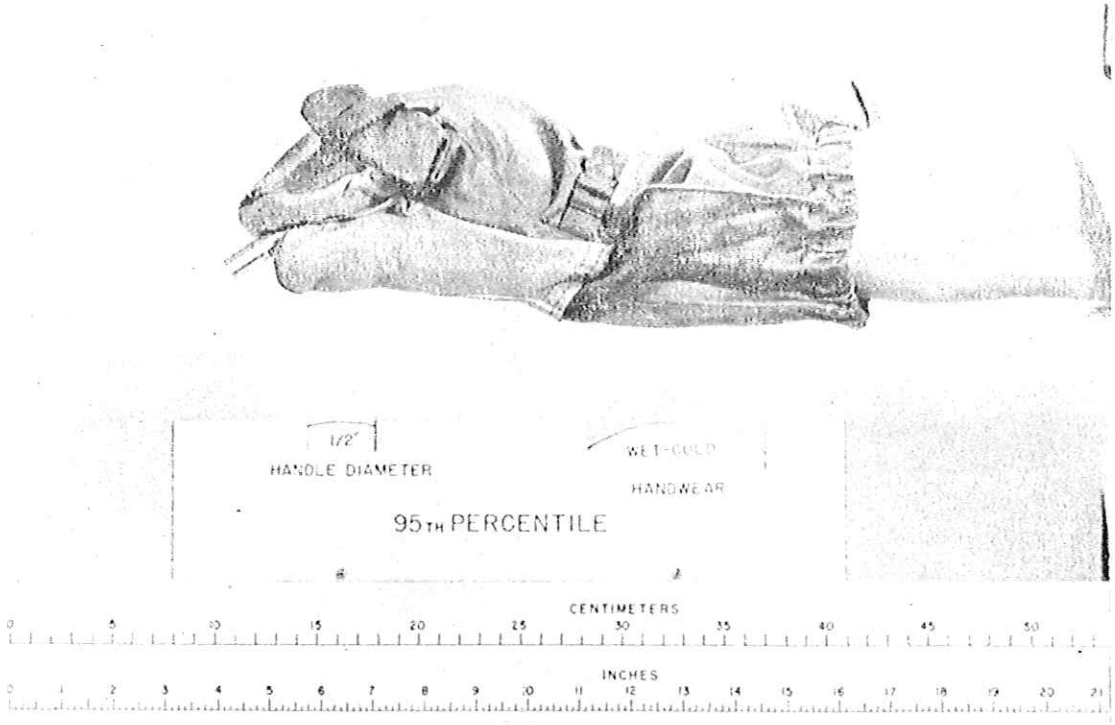

Figure 237. ½" knob diameter (View B)

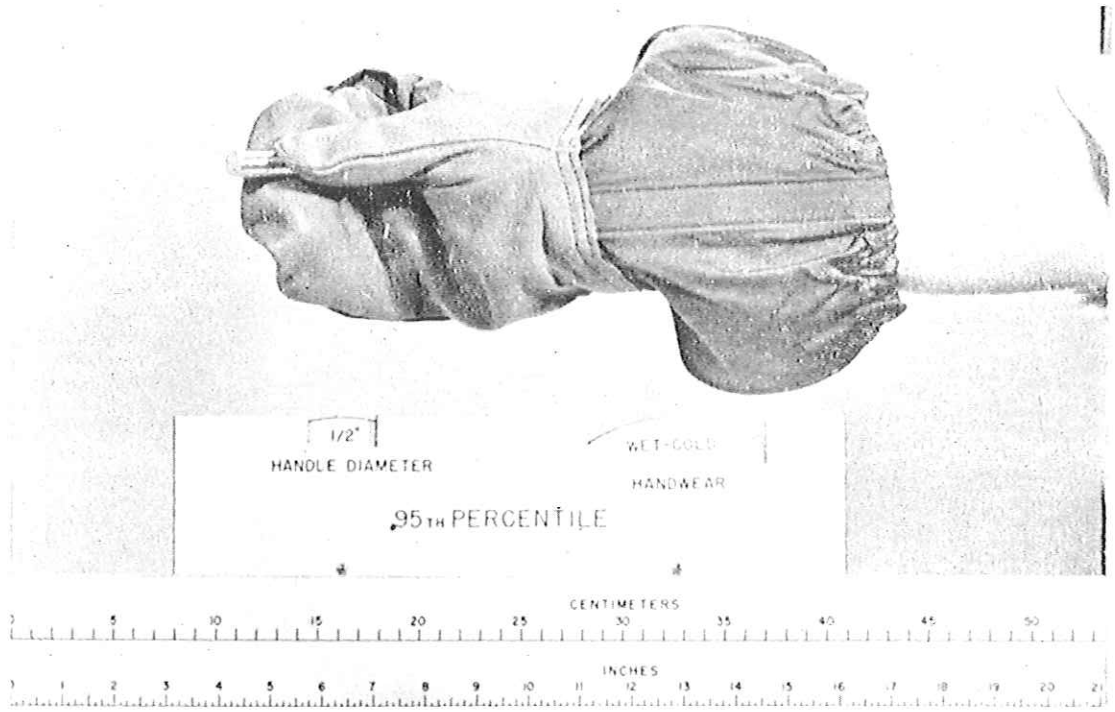

Figure 238. ½" knob diameter (View C)

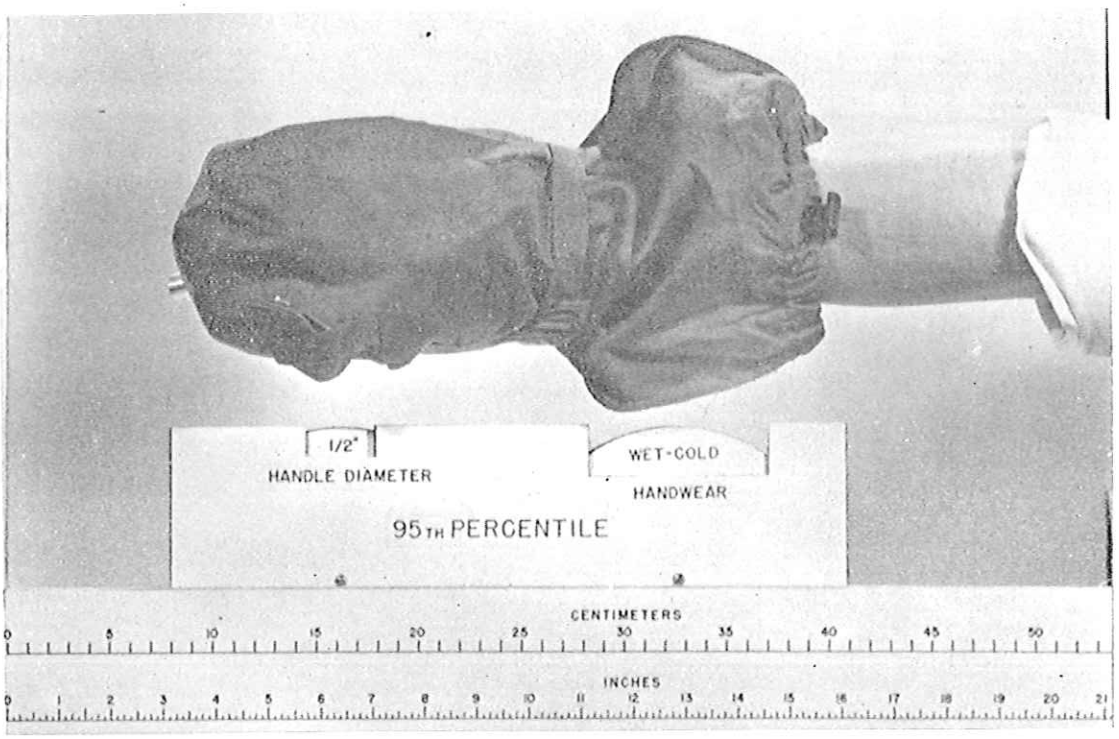

Figure 239. ½" knob diameter (View D)

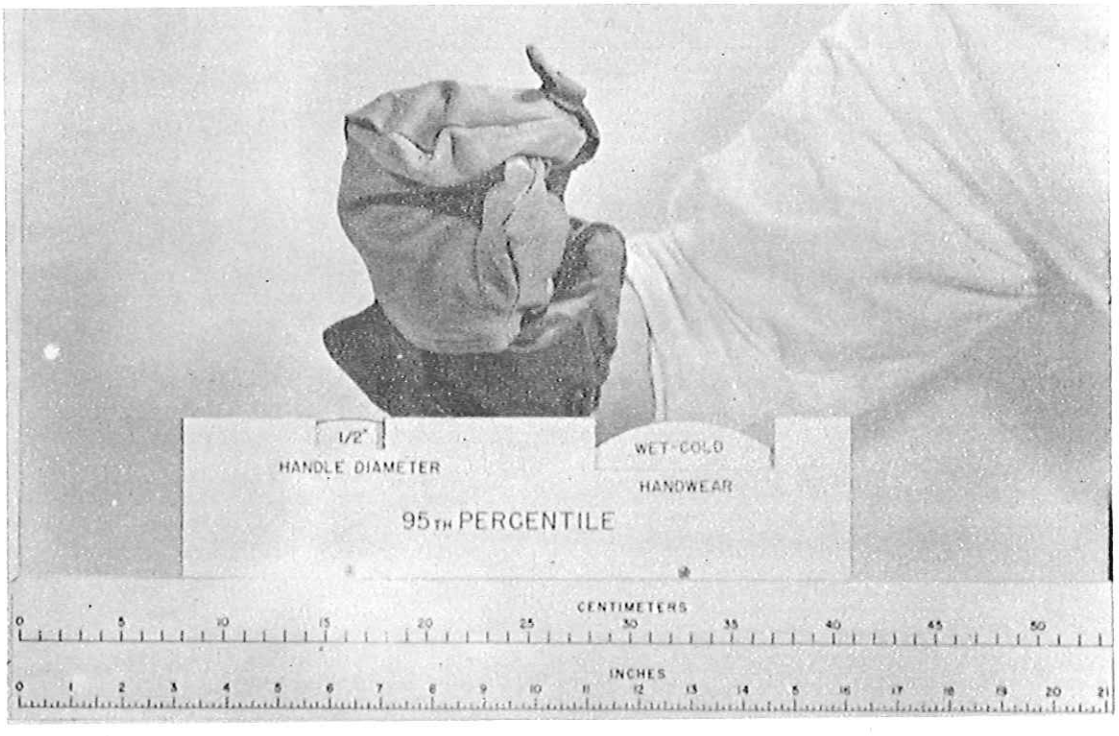

Figure 240. ½" knob diameter (View E)

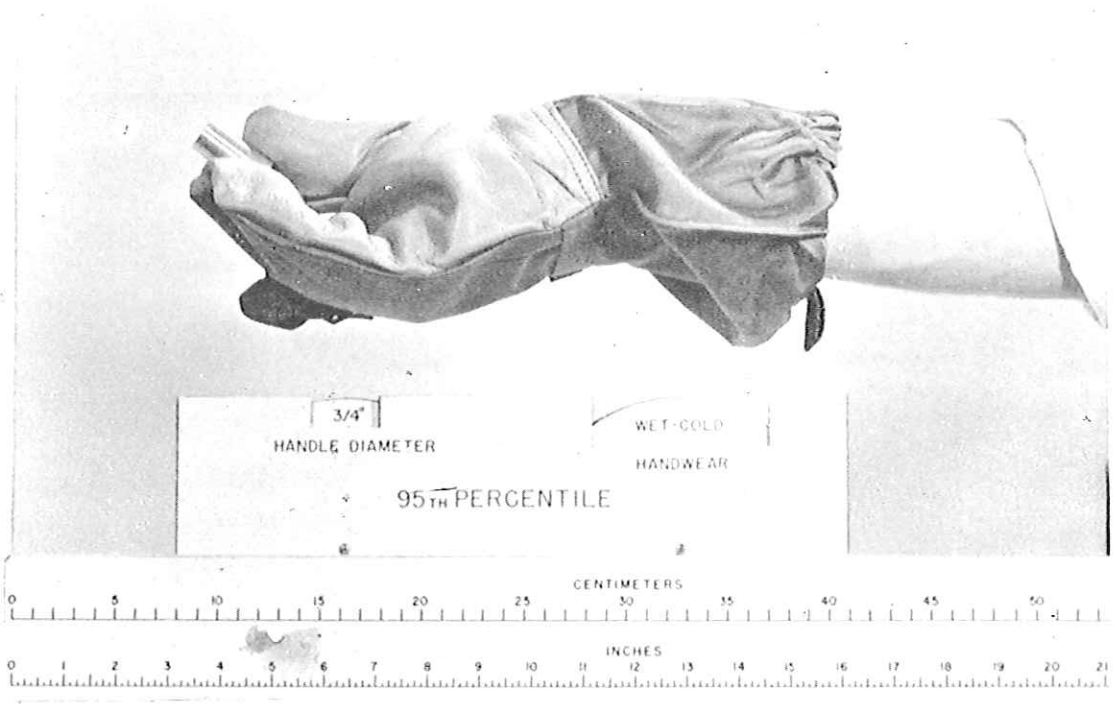

Figure 241. 3/4" knob diameter (View A)

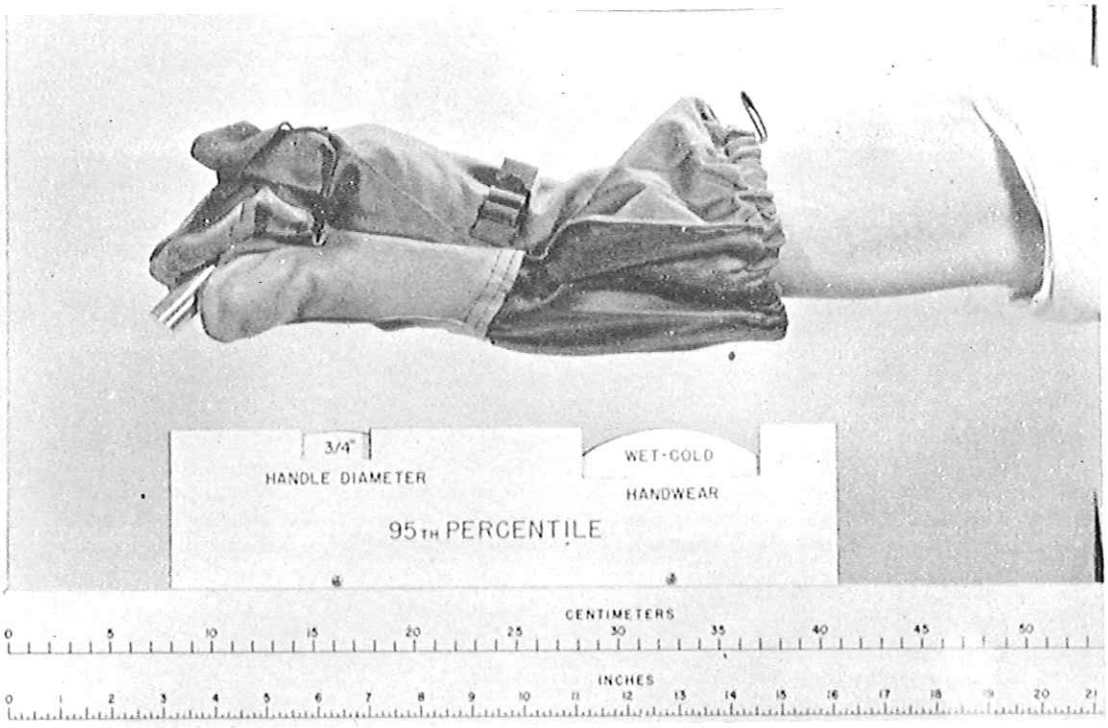

Figure 242. 3/4" knob diameter (View B)

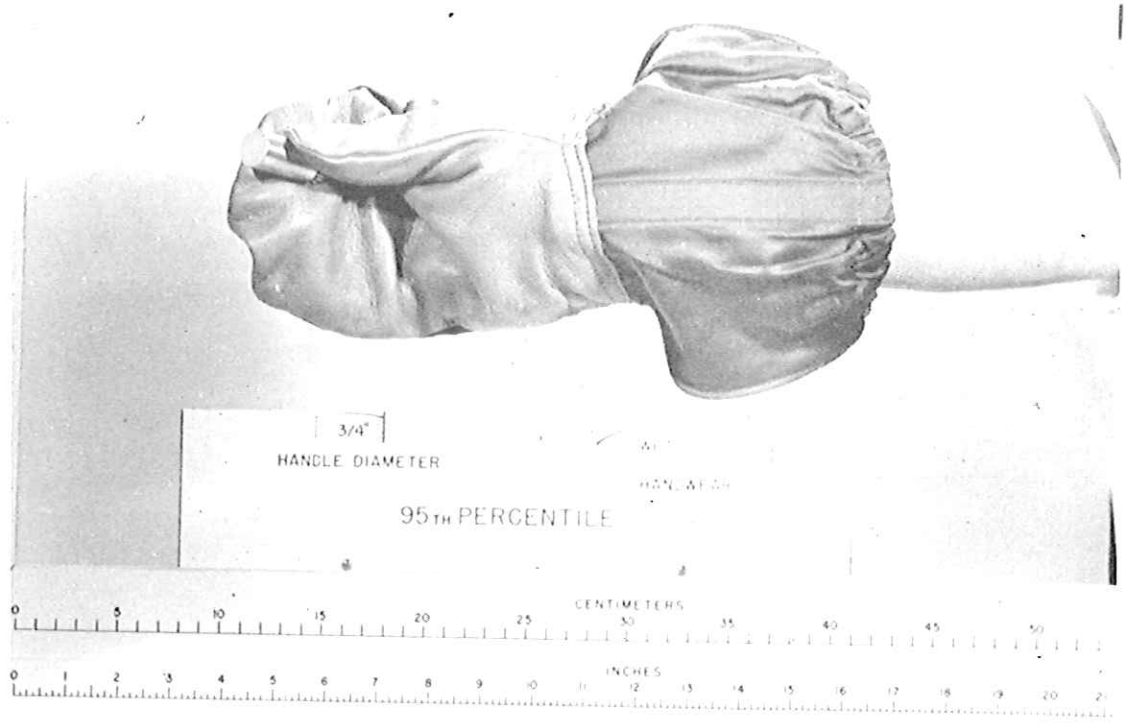

Figure 243. 3/4" knob diameter (View C)

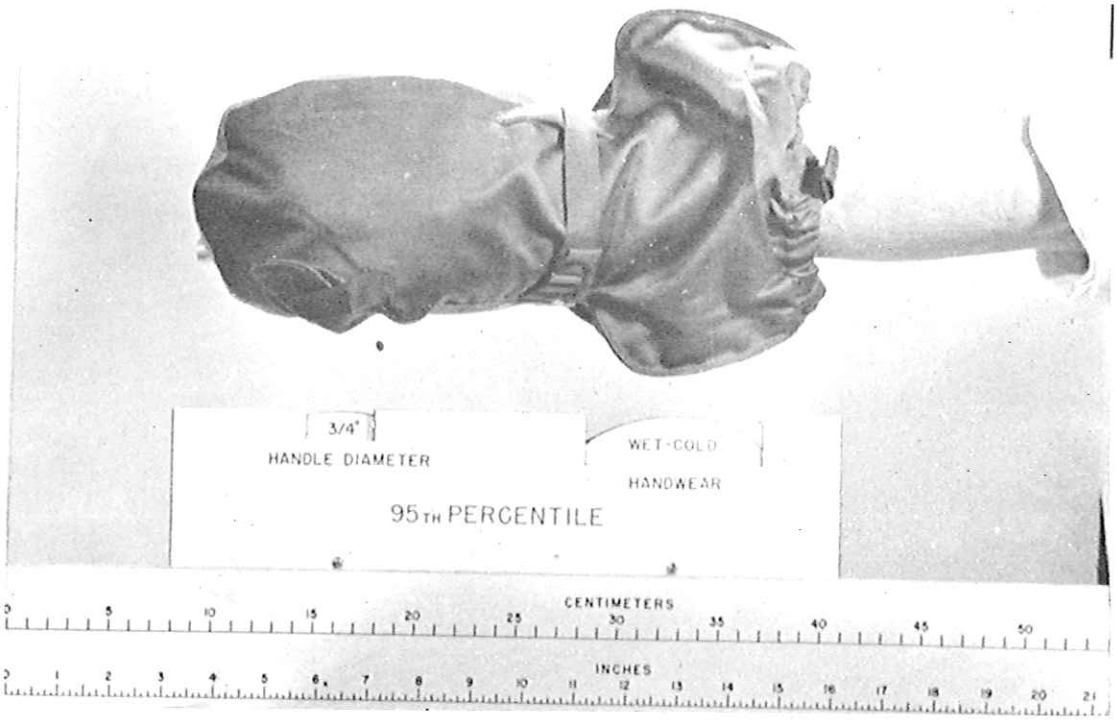

Figure 244. 3/4" knob diameter (View D)

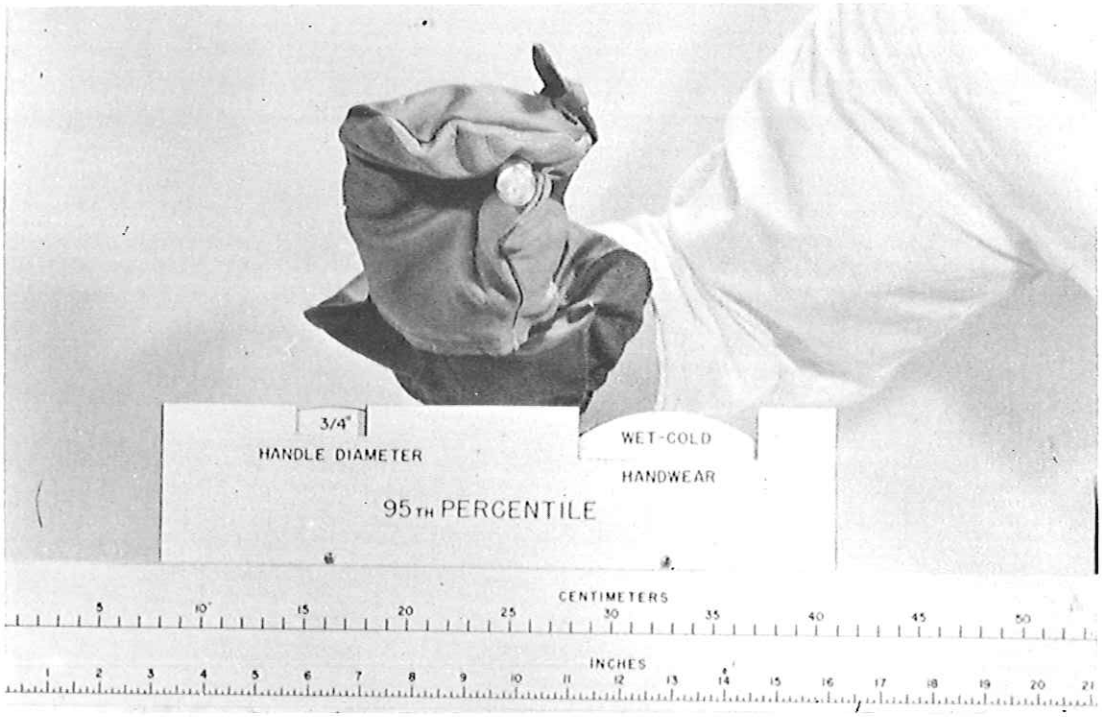

Figure 245. 3/4" knob diameter (View E)

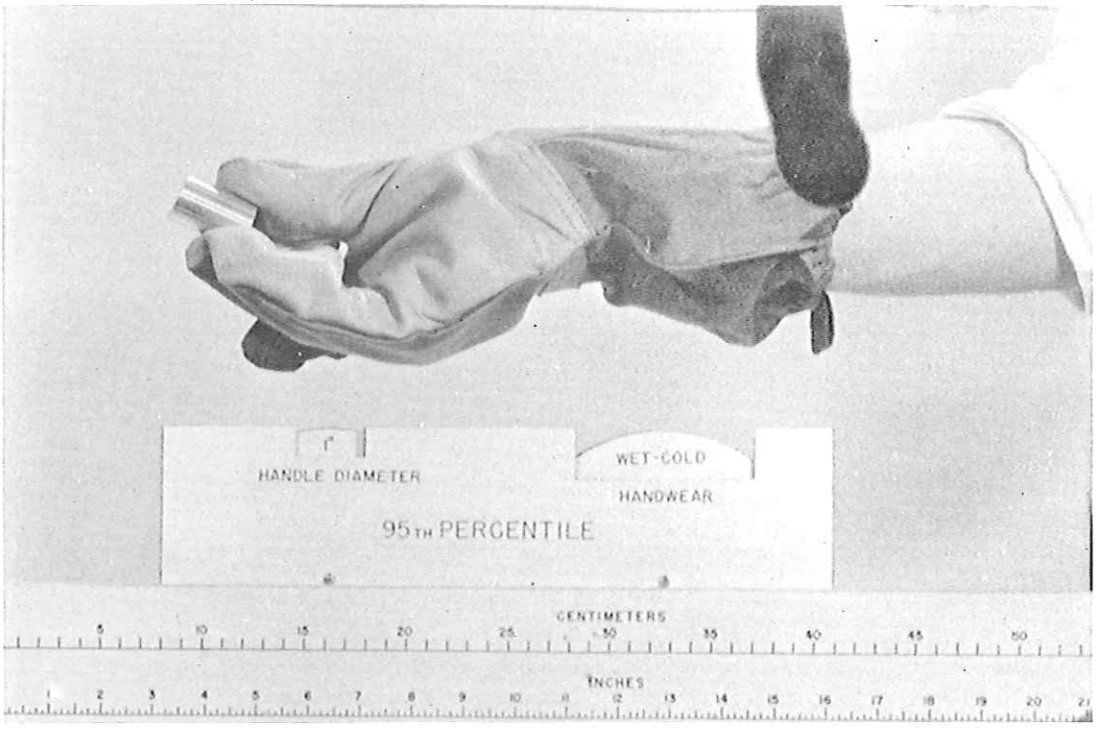

Figure 246. 1" knob diameter (View A)

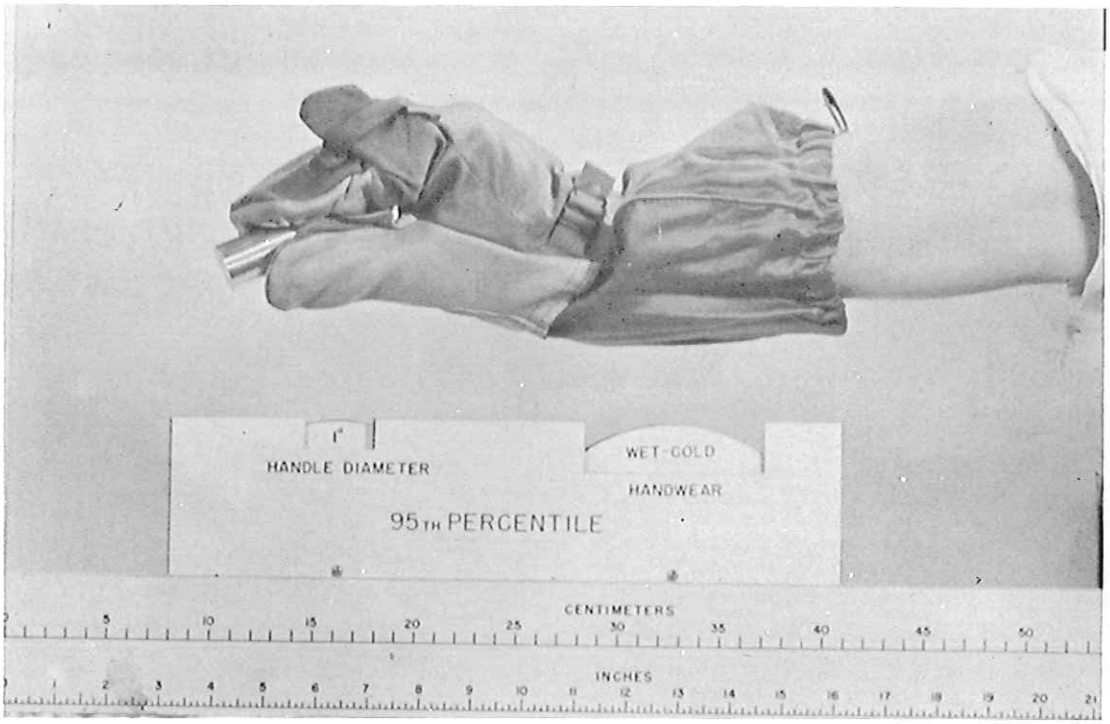

Figure 247. 1" knob diameter (View B)

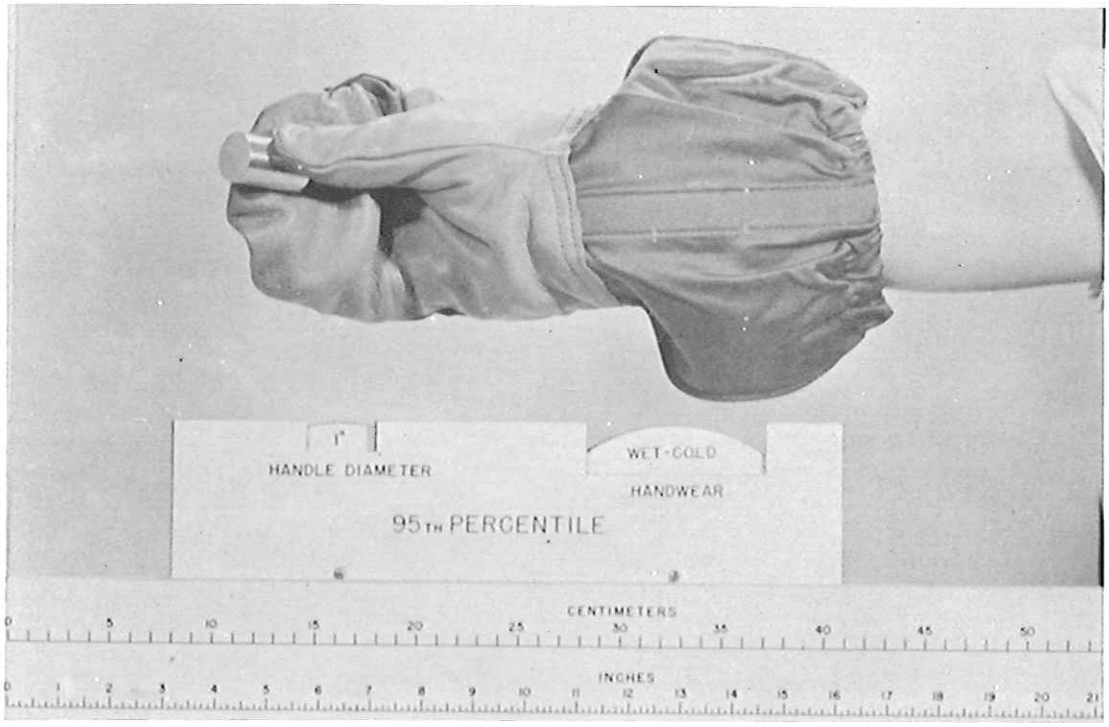

Figure 248. 1" knob diameter (View C)

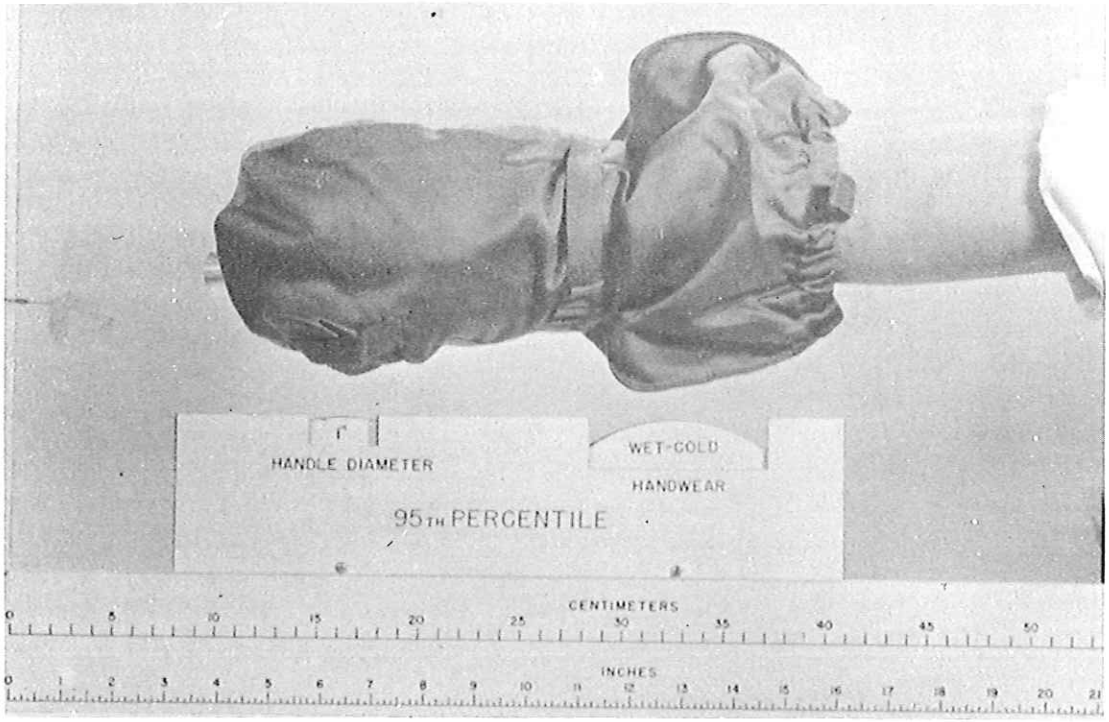

Figure 249. 1" knob diameter (View D)

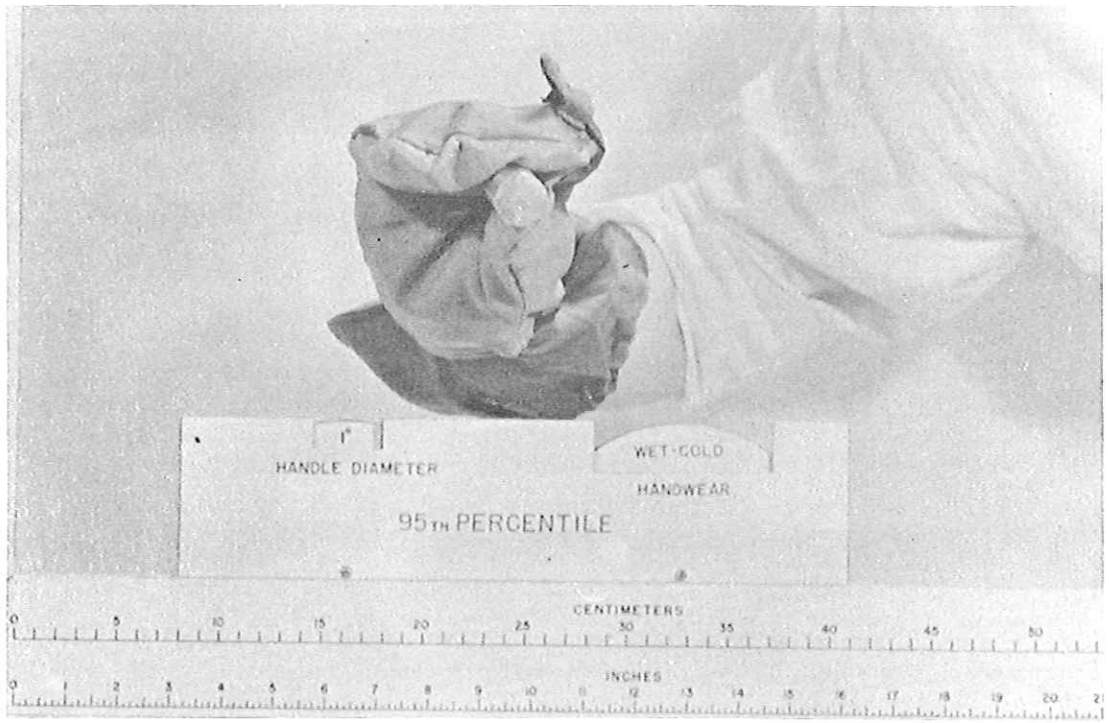

Figure 250. 1" knob diameter (View E)

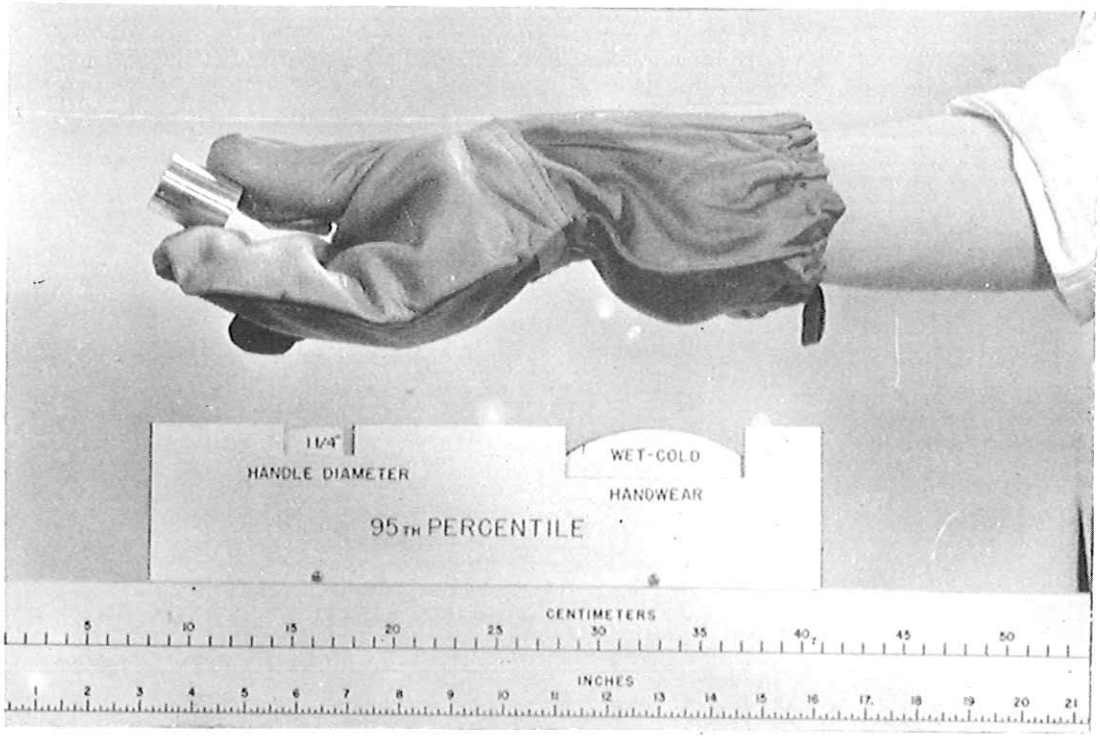

Figure 251. $1\frac{1}{4}$" knob diameter (View A)

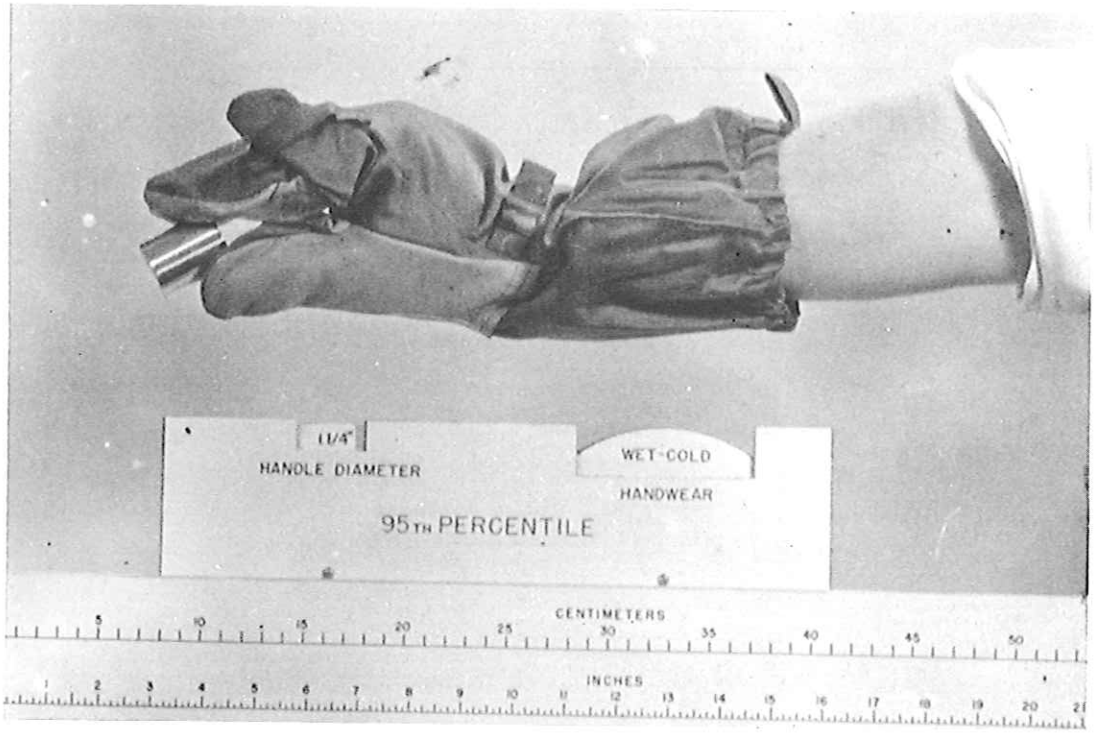

Figure 252. $1\frac{1}{4}$" knob diameter (View B)

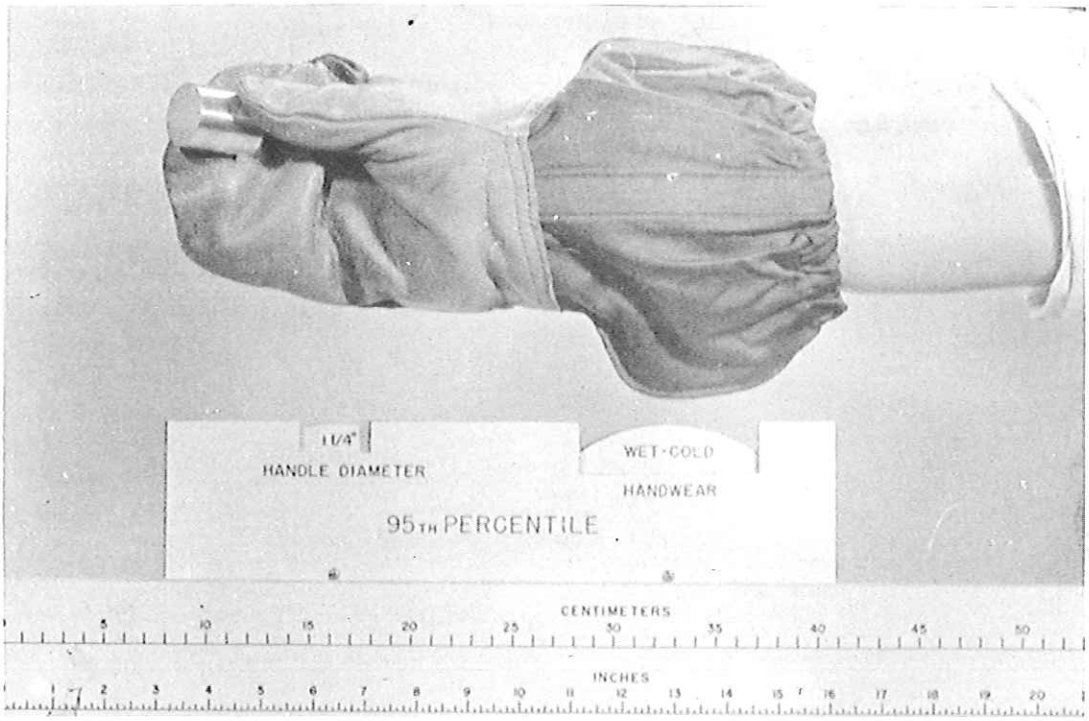

Figure 253. 1¼" knob diameter (View C)

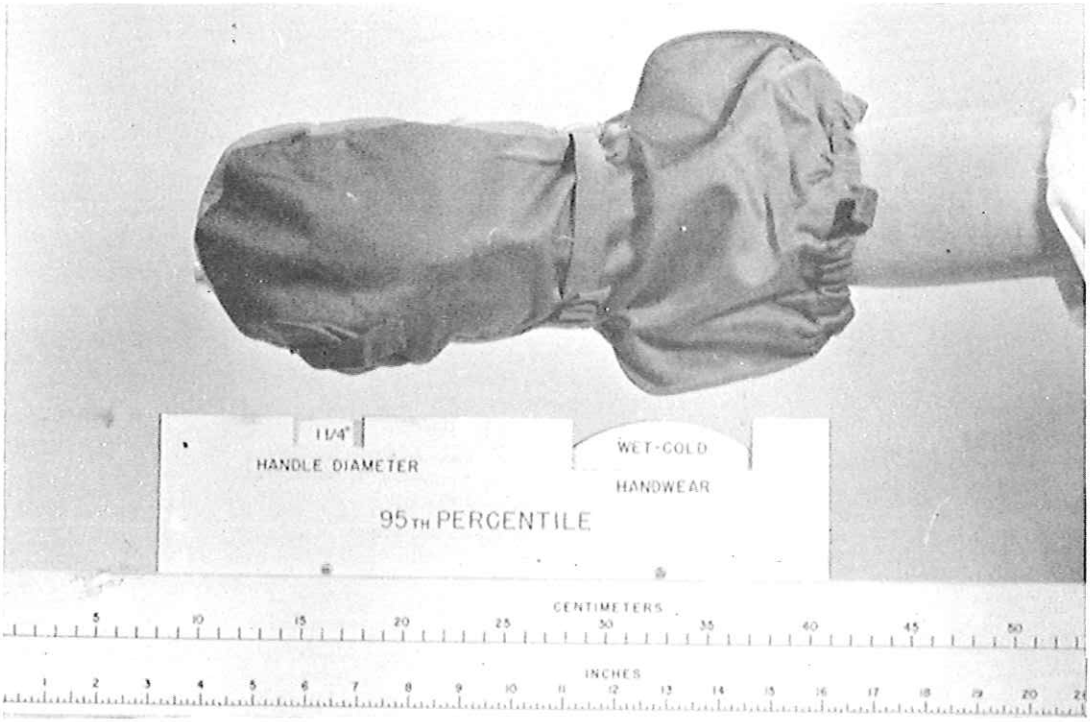

Figure 254. 1¼" knob diameter (View D)

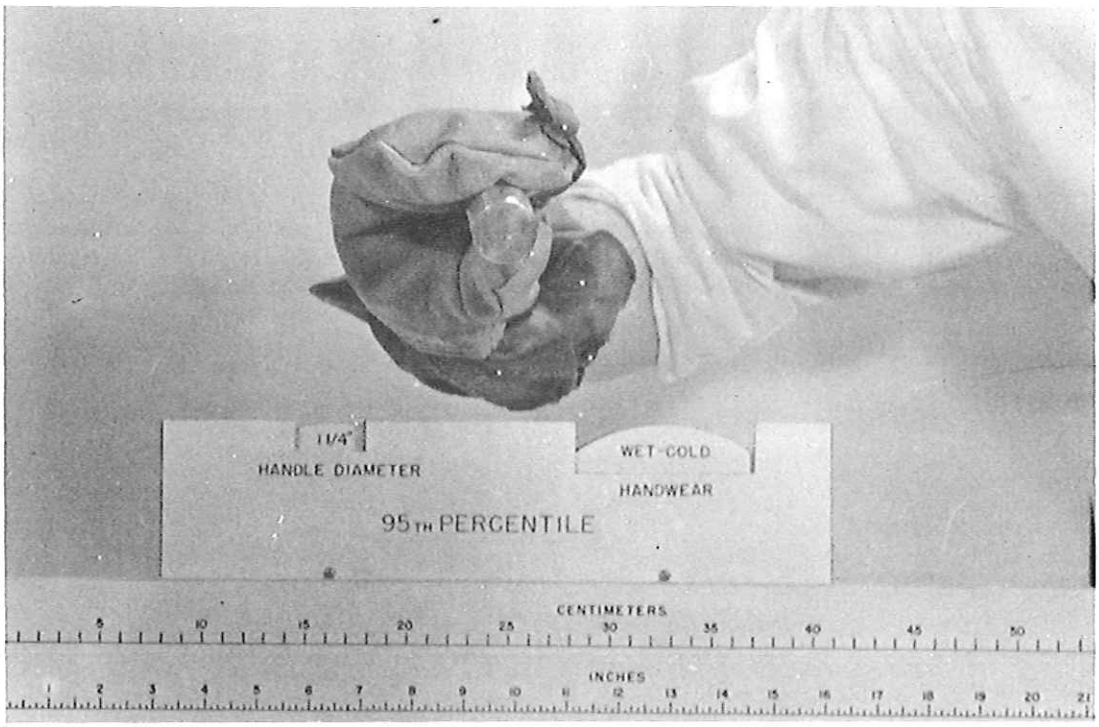

Figure 255. $1\frac{1}{4}$" knob diameter (View E)

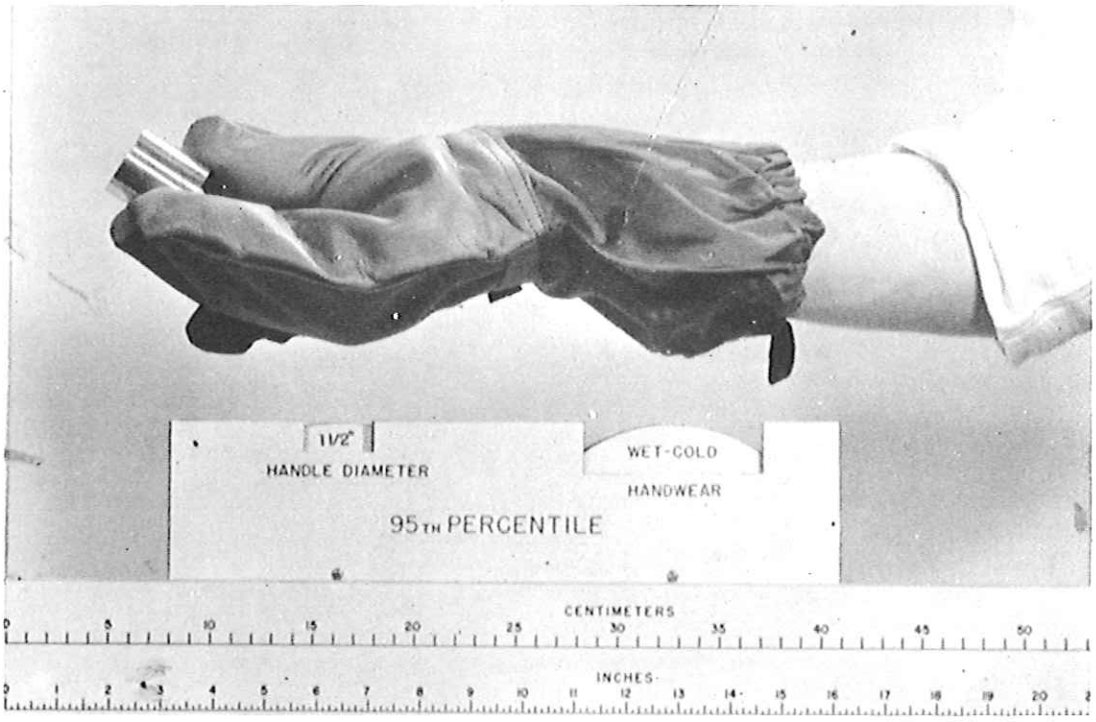

Figure 256. $1\frac{1}{2}$" knob diameter (View A)

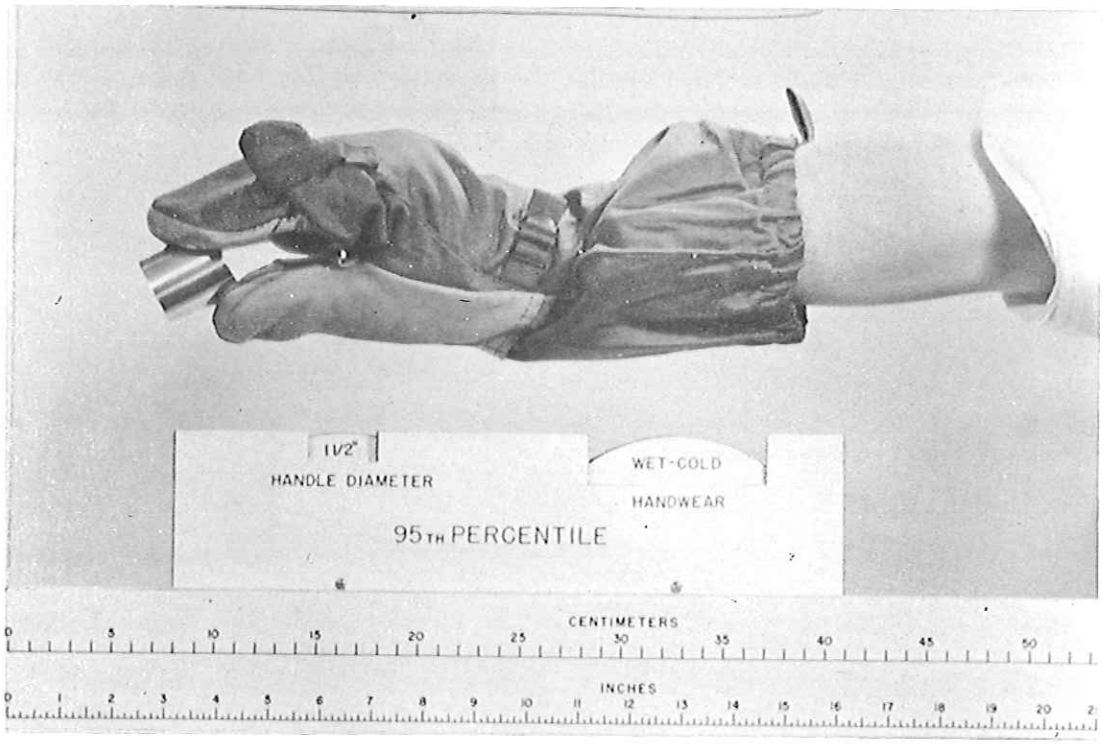

Figure 257. 1½" knob diameter (View B)

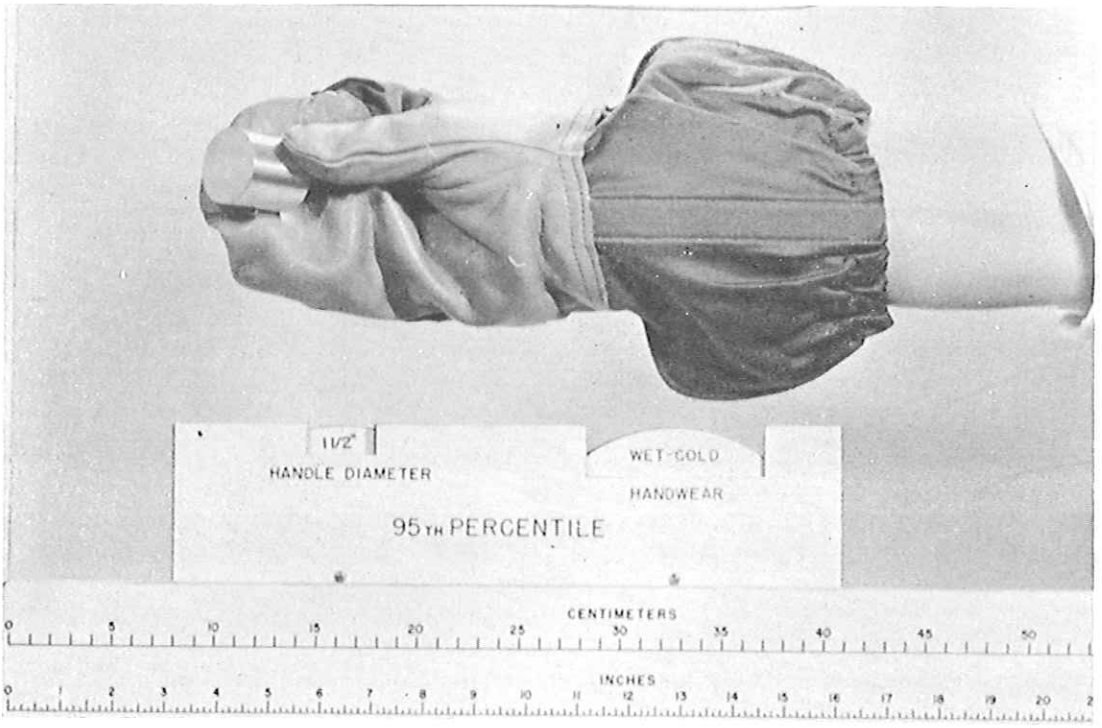

Figure 258. 1½" knob diameter (View C)

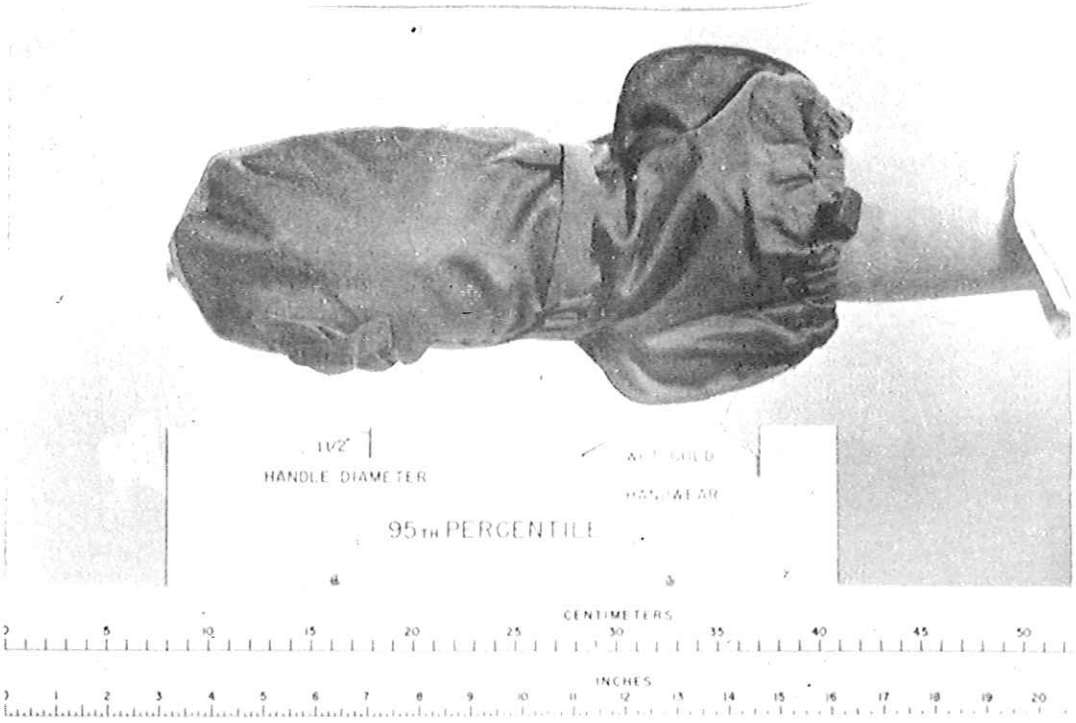

Figure 259. 1½" knob diameter (View D)

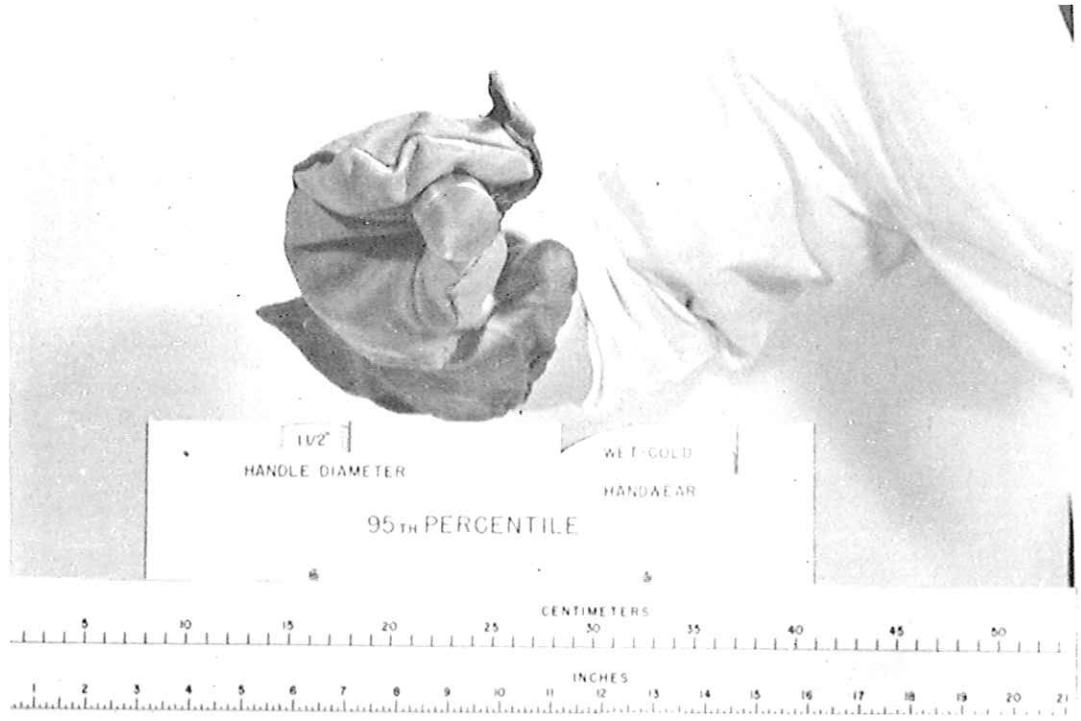

Figure 260. 1½" knob diameter (View E)

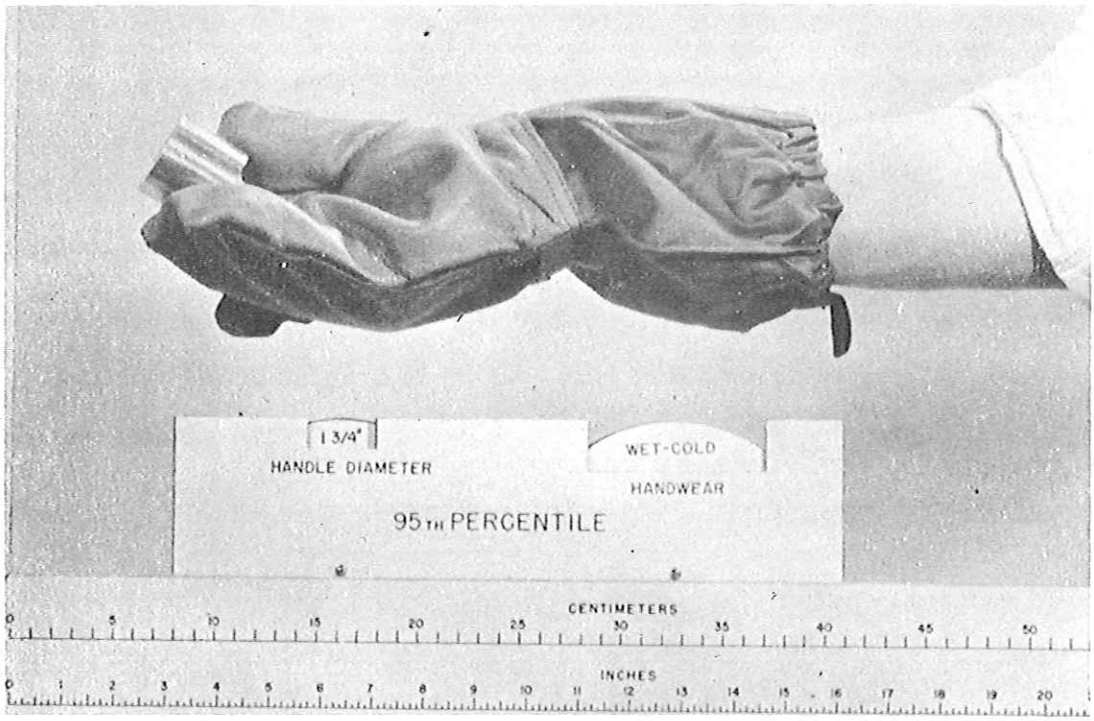

Figure 261. 1 3/4" knob diameter (View A)

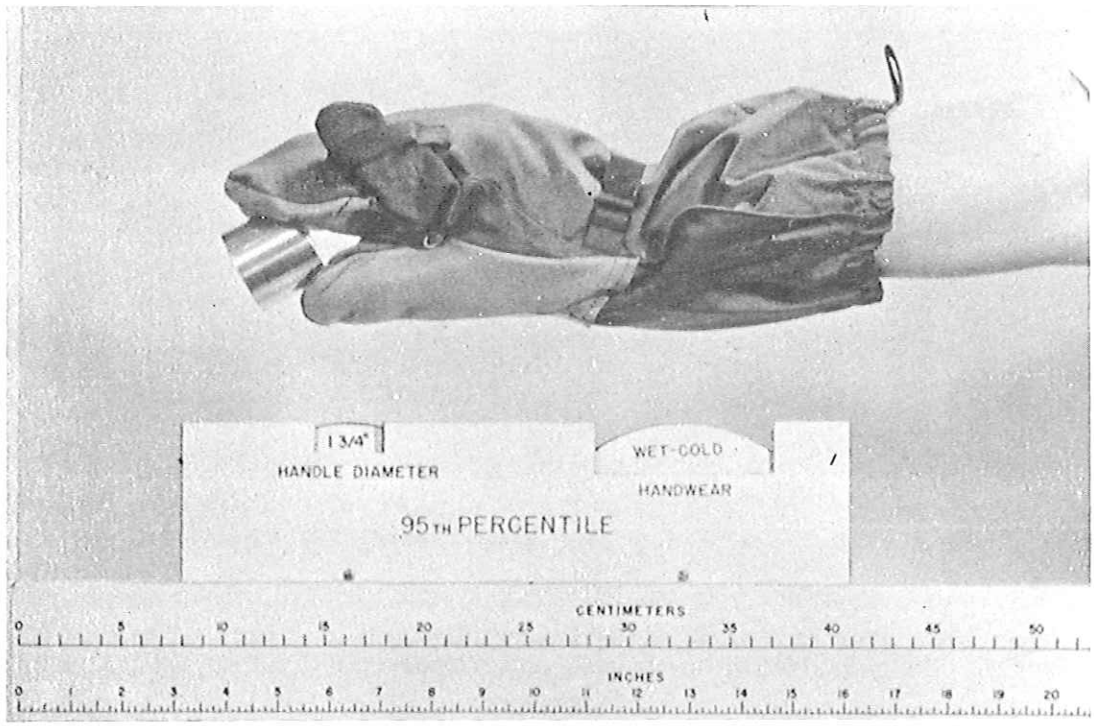

Figure 262. 1 3/4" knob diameter (View B)

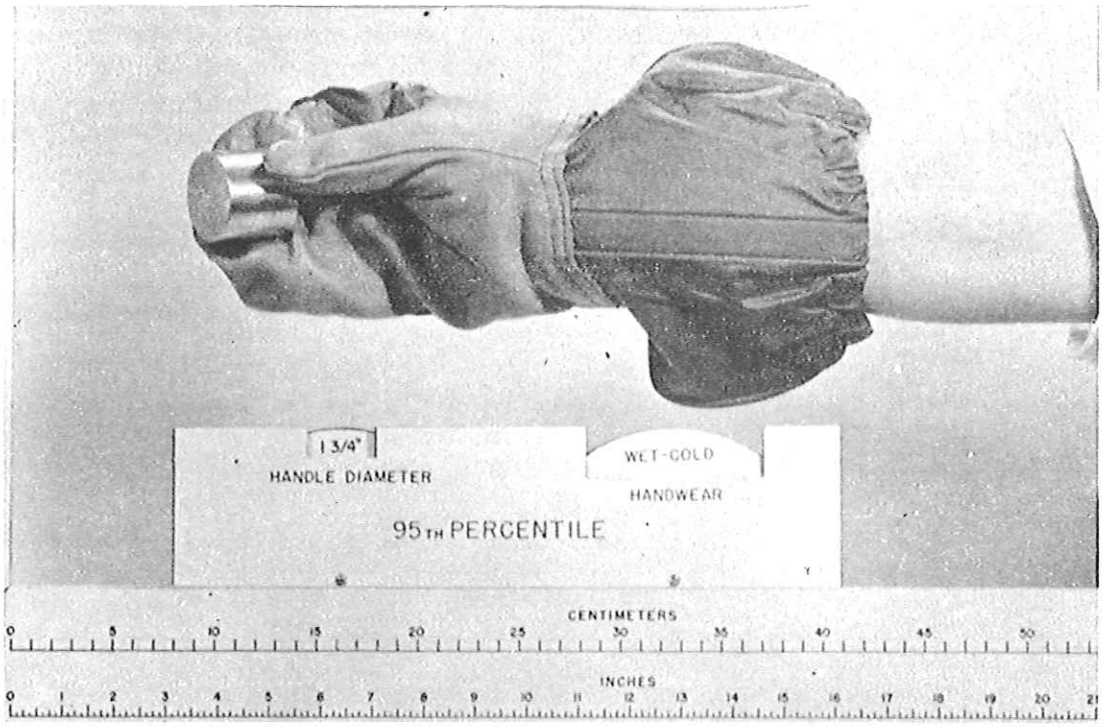

Figure 263. 1 3/4" knob diameter (View C)

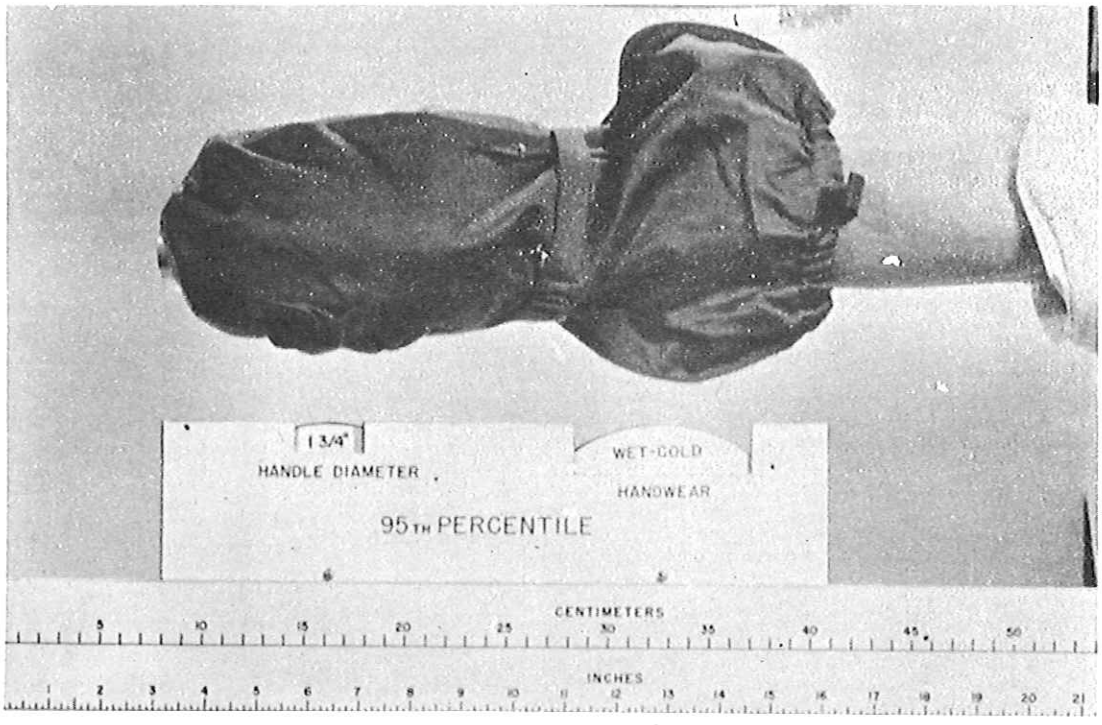

Figure 264. 1 3/4" knob diameter (View D)

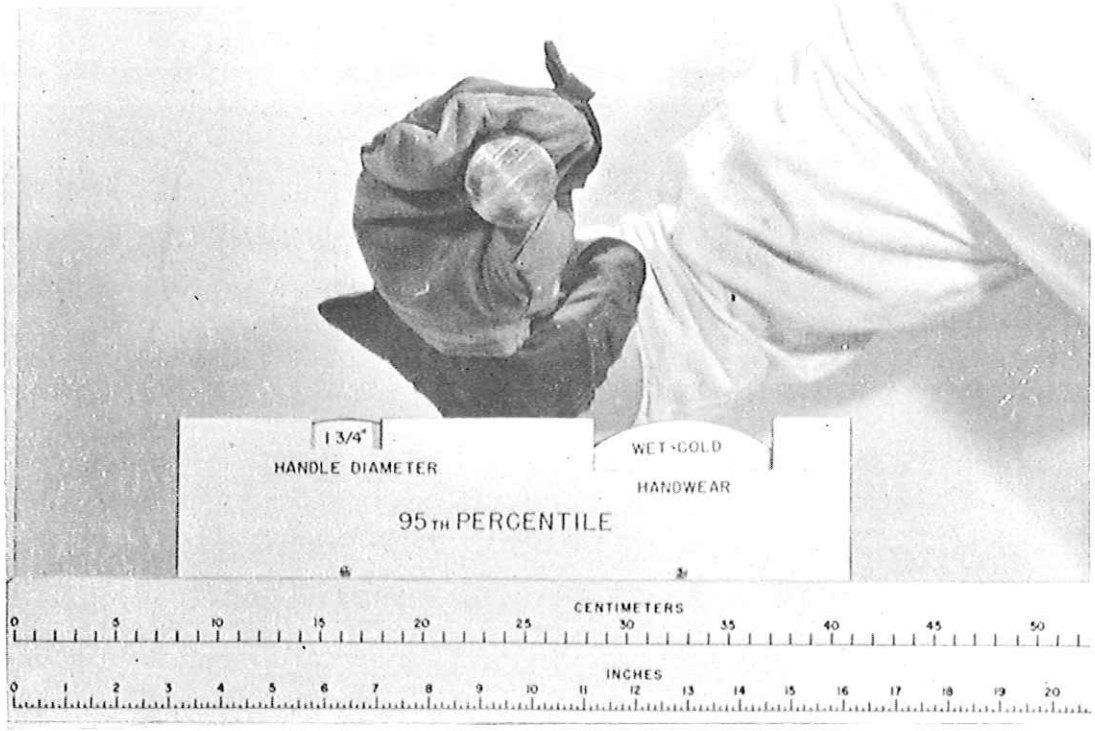

Figure 265. 1 3/4" knob diameter (View E)

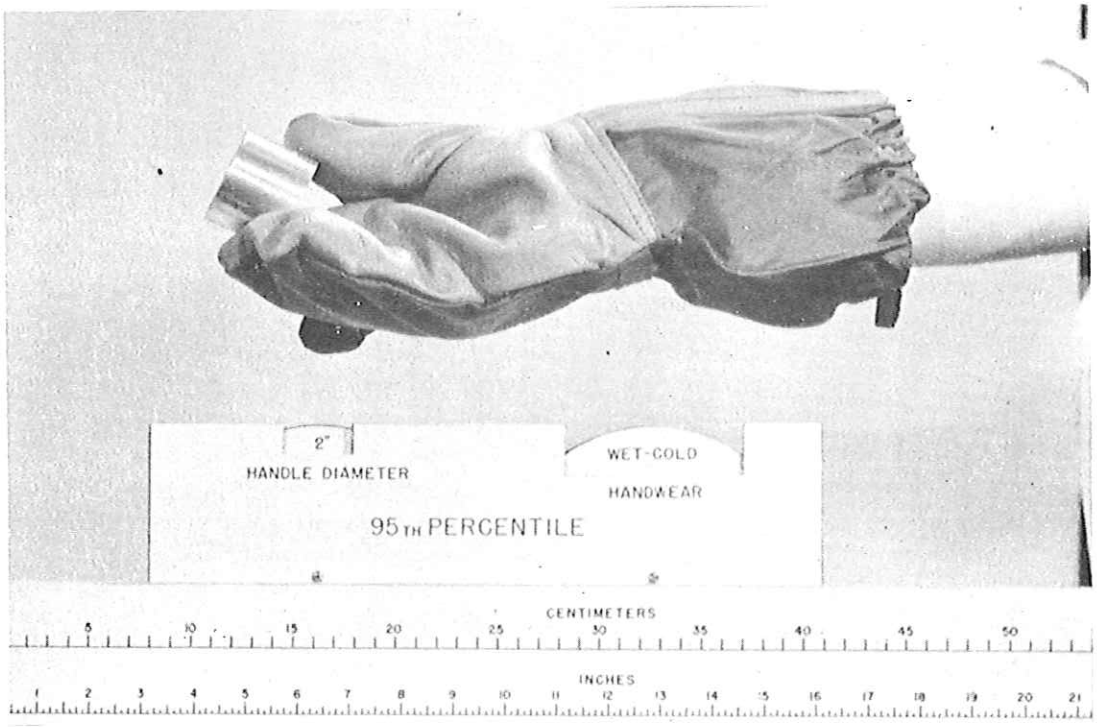

Figure 266. 2" knob diameter (View A)

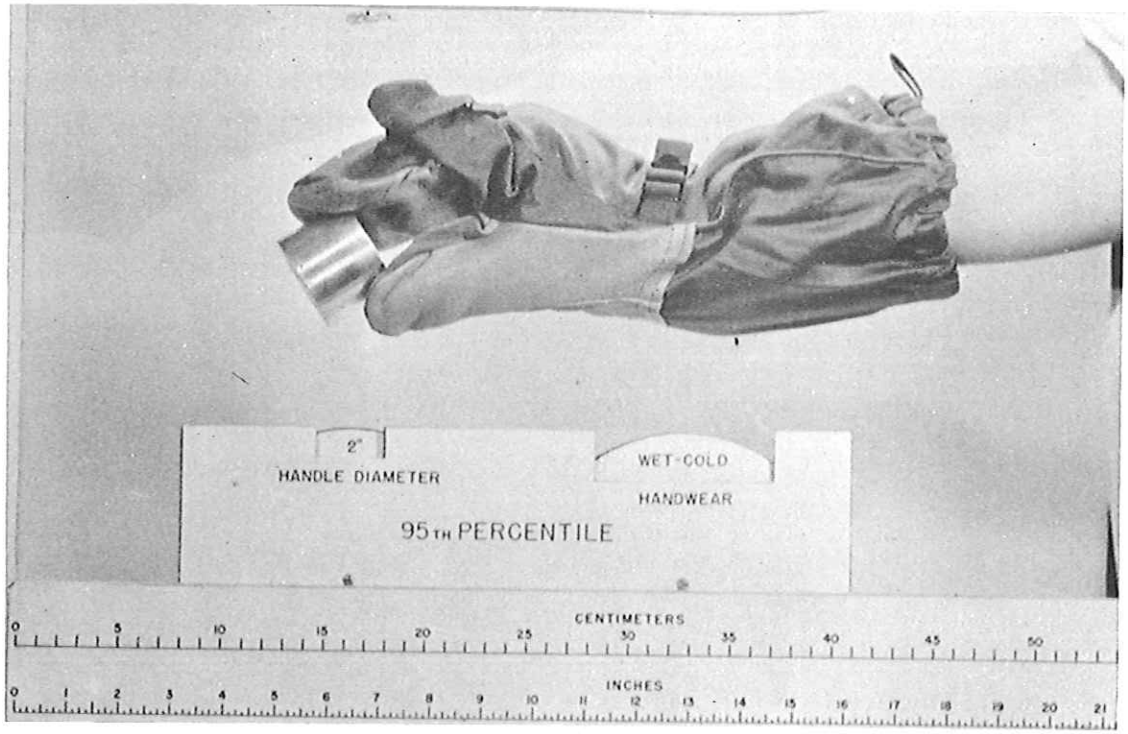

Figure 267. 2" knob diameter (View B)

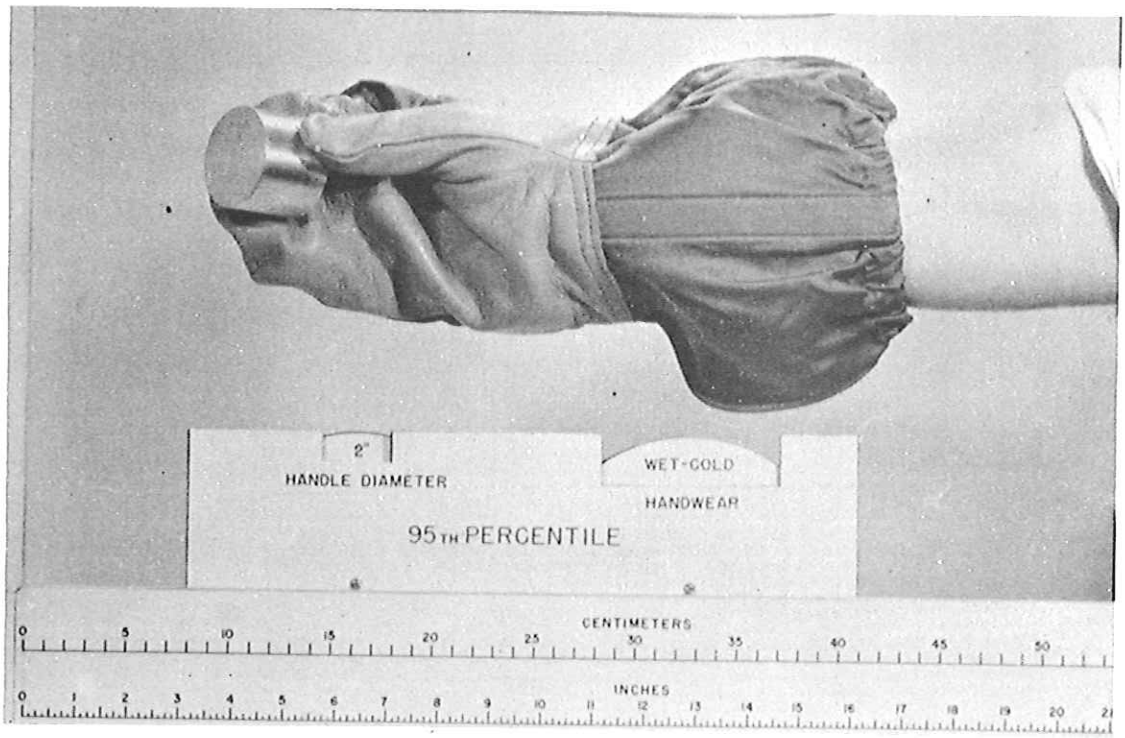

Figure 268. 2" knob diameter (View C)

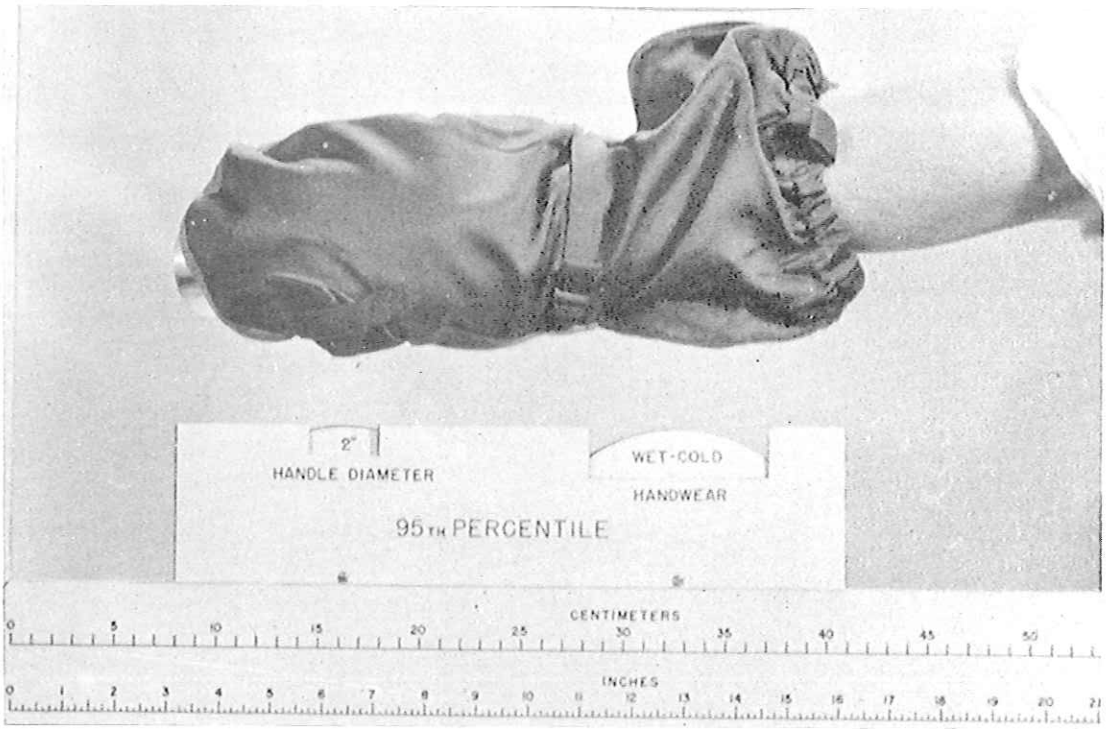

Figure 269. 2" knob diameter (View D)

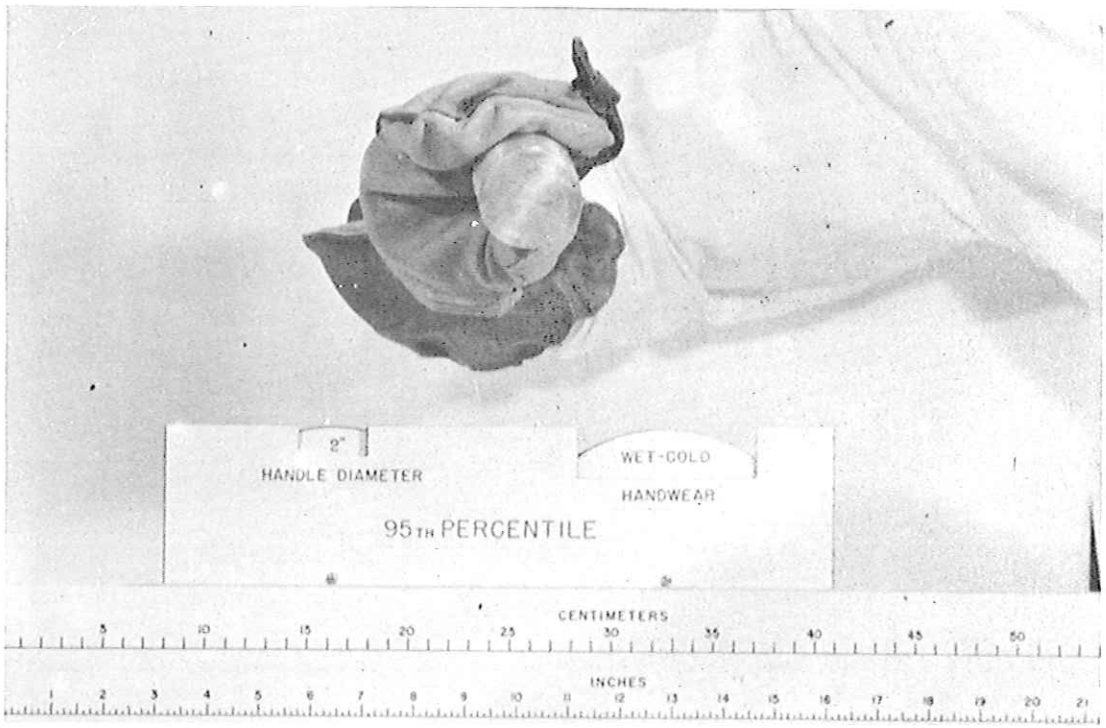

Figure 270. 2" knob diameter (View E)

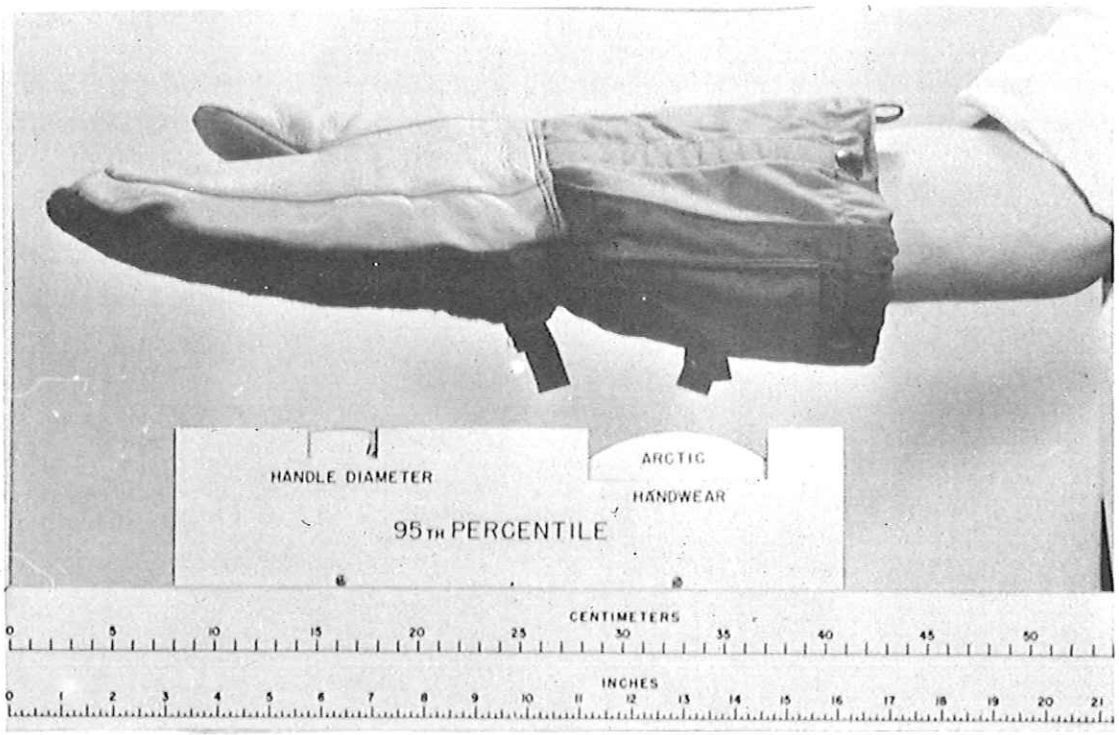

Figure 271. The hand extended flat (View A)

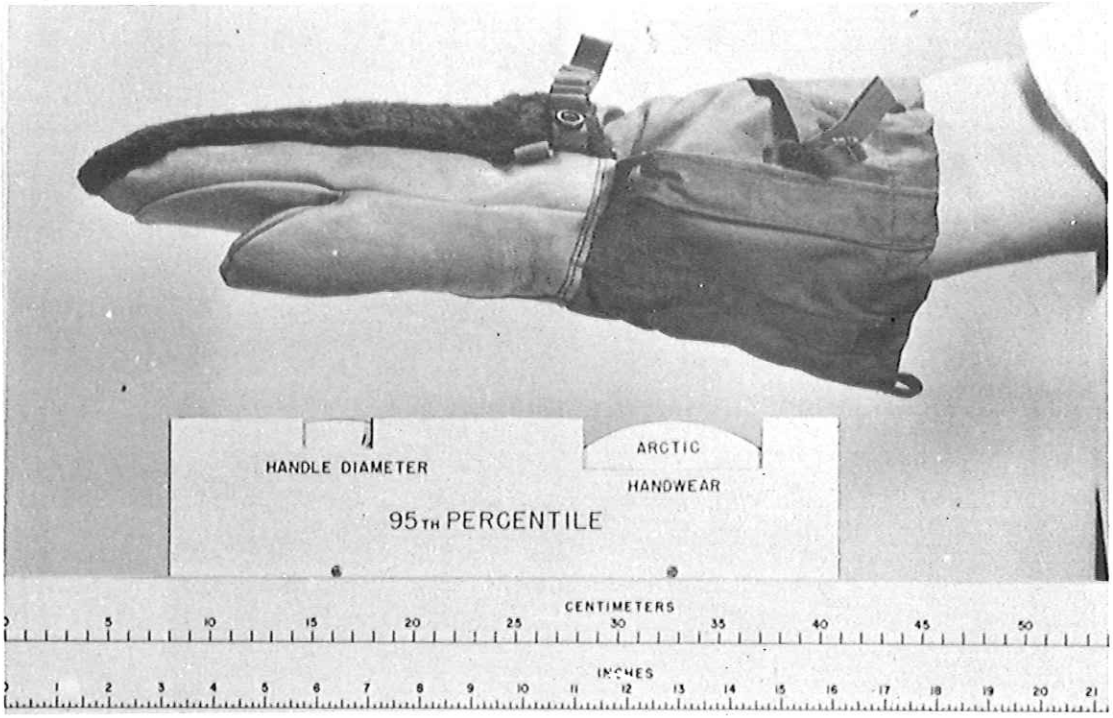

Figure 272. The hand extended flat (View B)

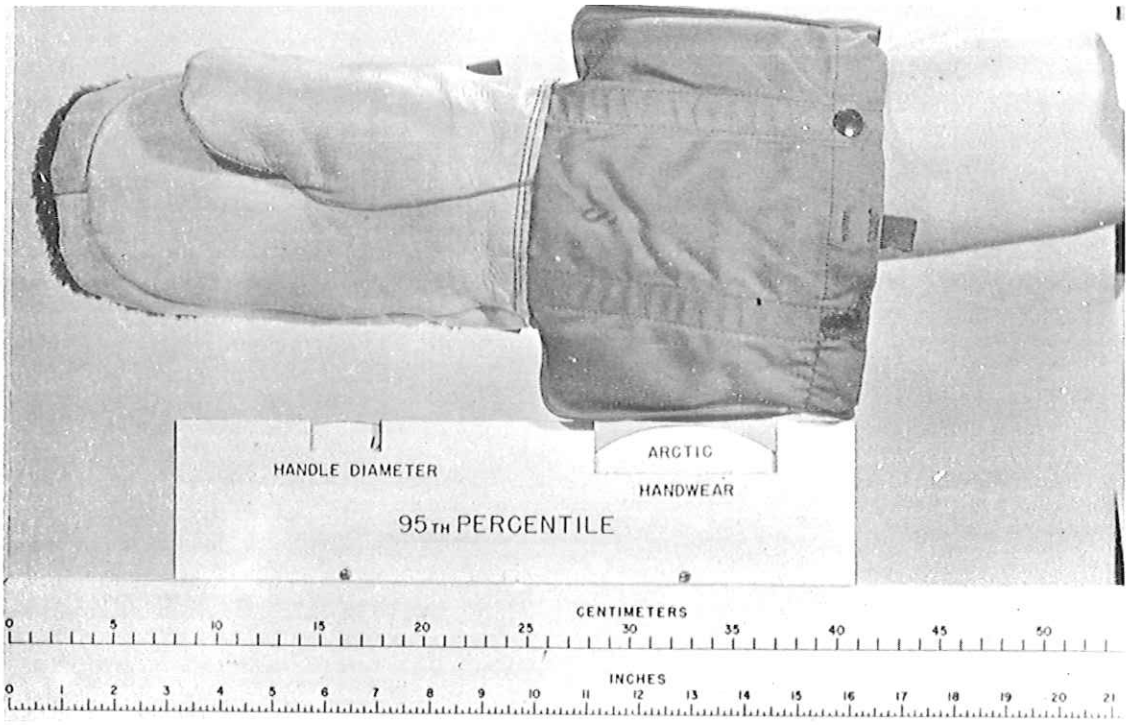

Figure 273. The hand extended flat (View C)

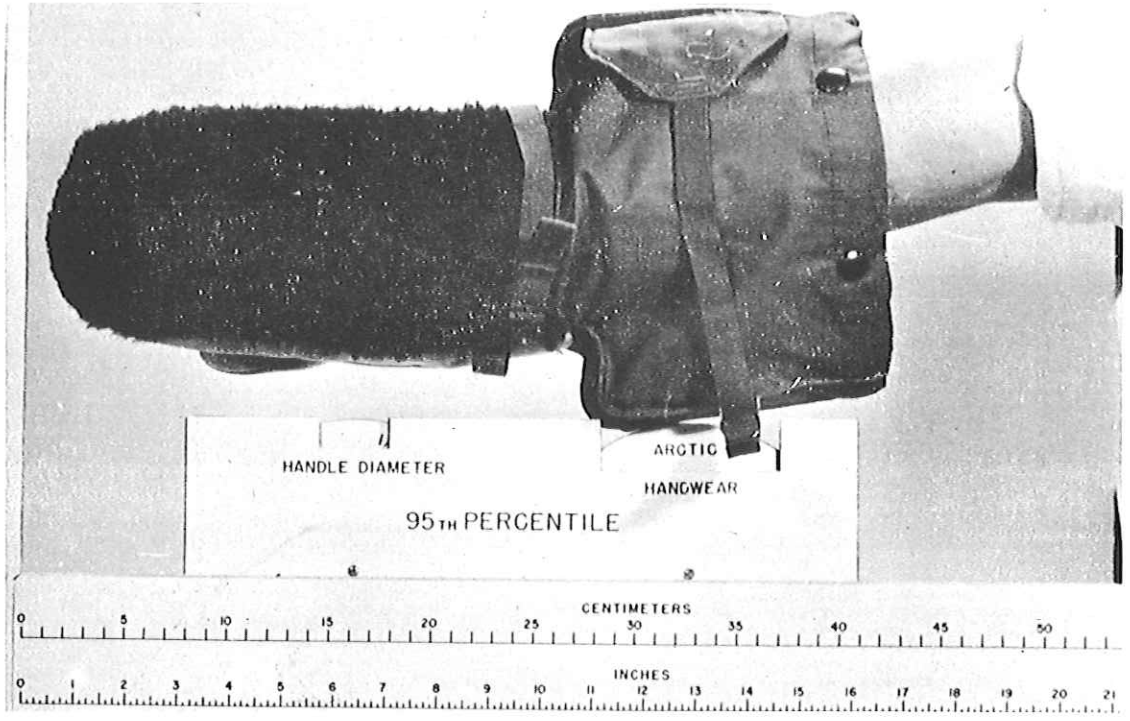

Figure 274. The hand extended flat (View D)

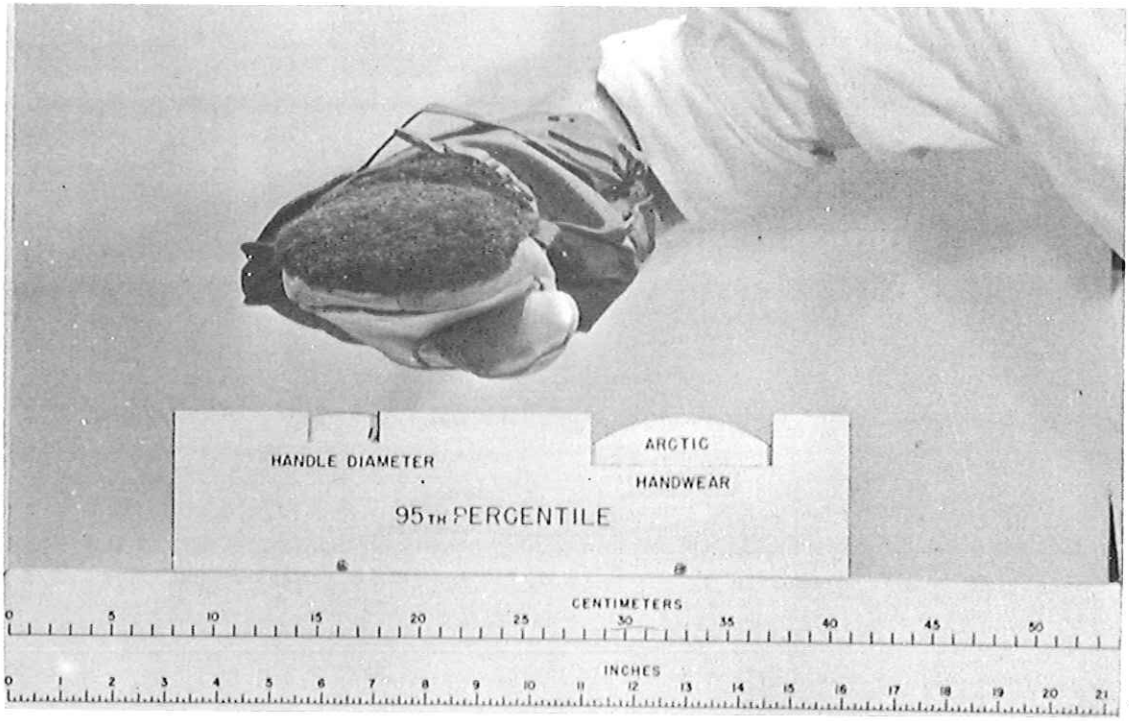

Figure 275. The hand extended flat (View E)

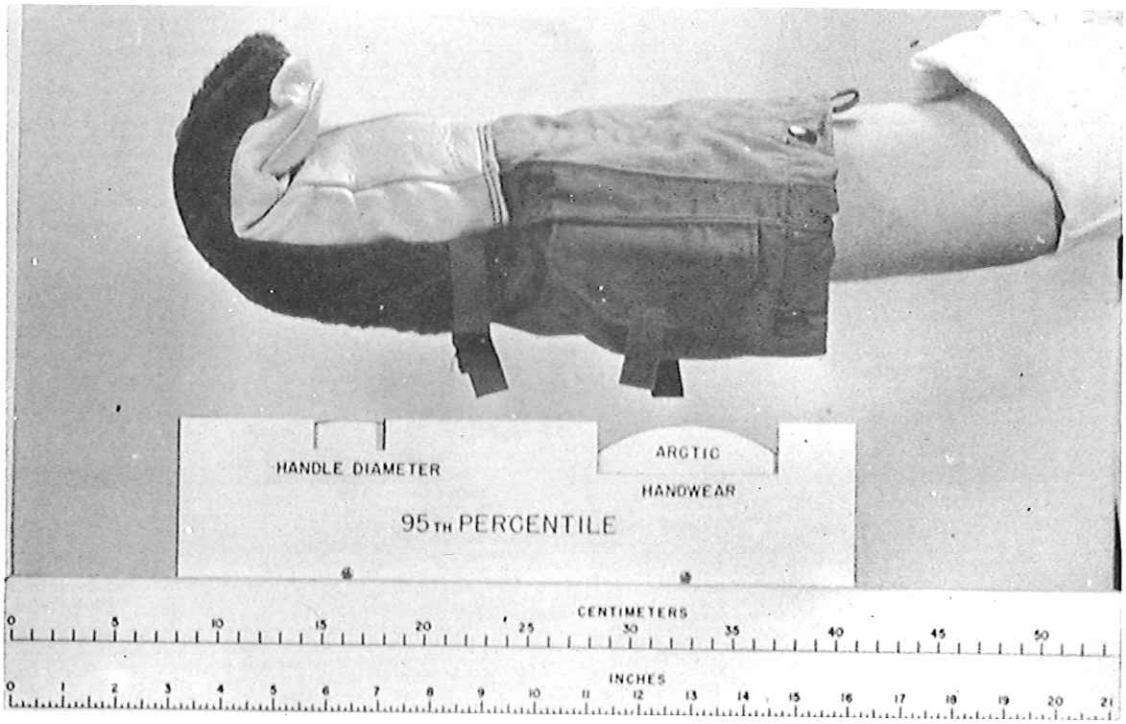

Figure 276. The hand closed as a fist (View A)

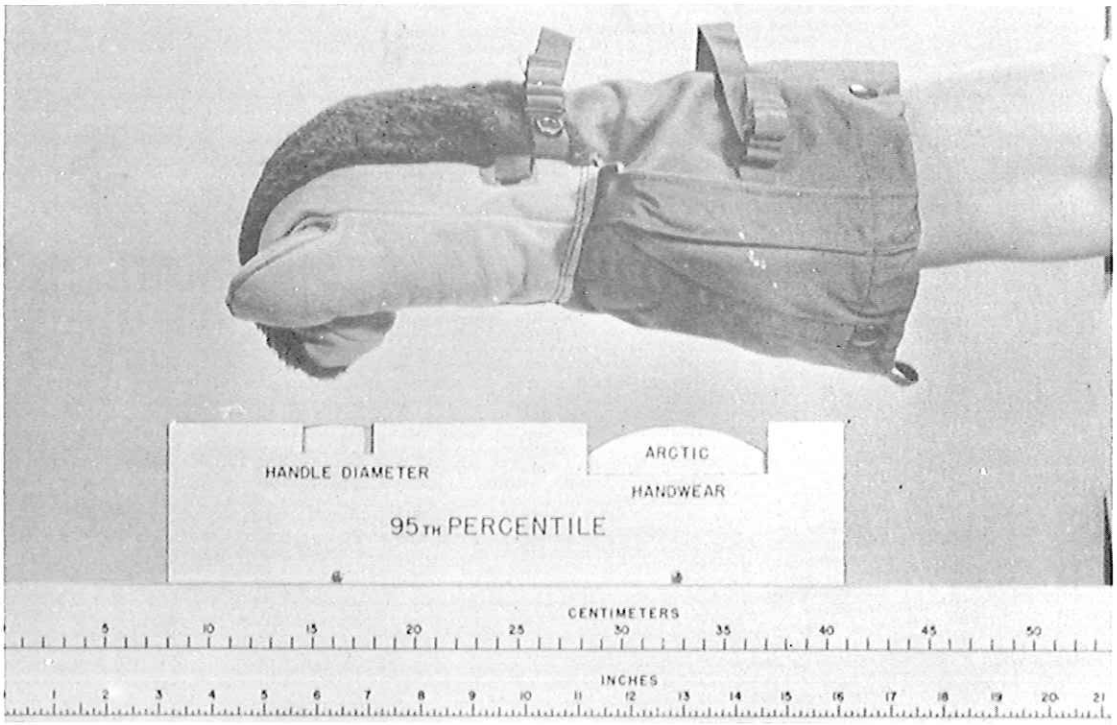

Figure 277. The hand closed as a fist (View B)

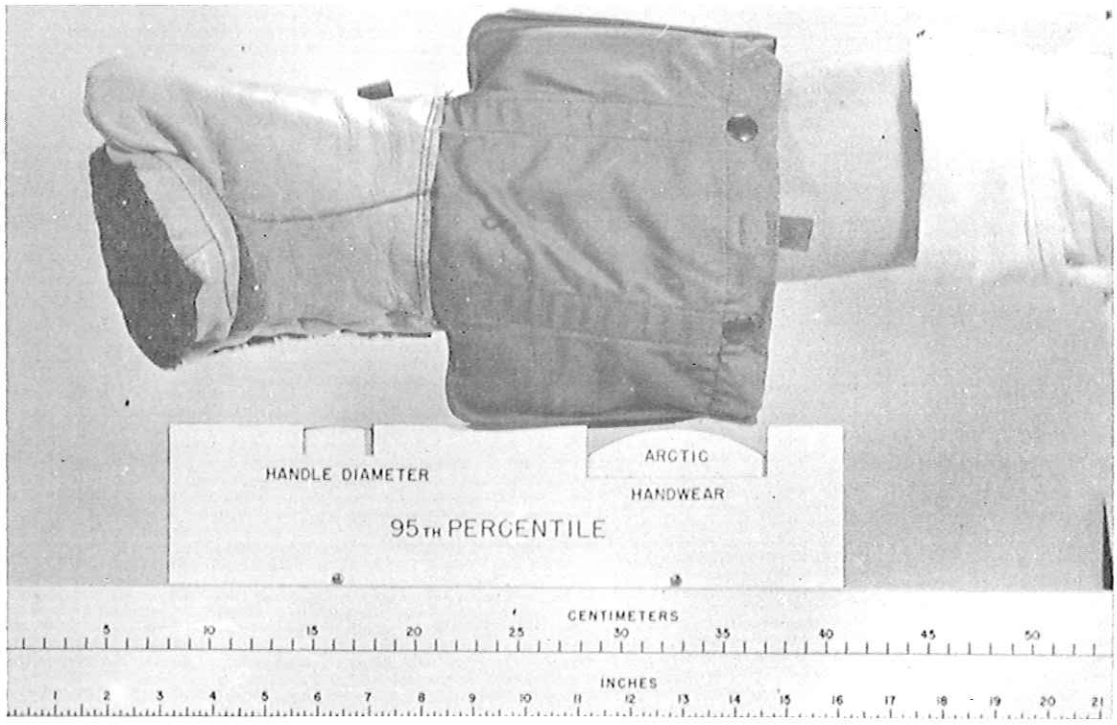

Figure 278. The hand closed as a fist (View C)

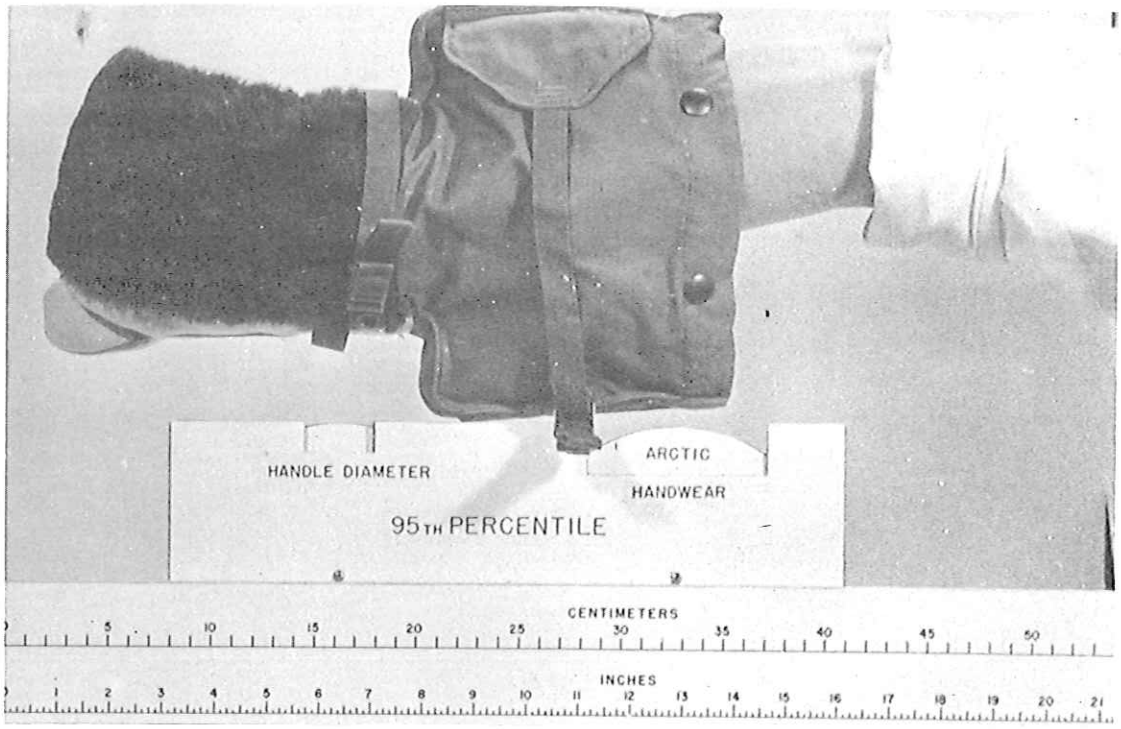

Figure 279. The hand closed as a fist (View D)

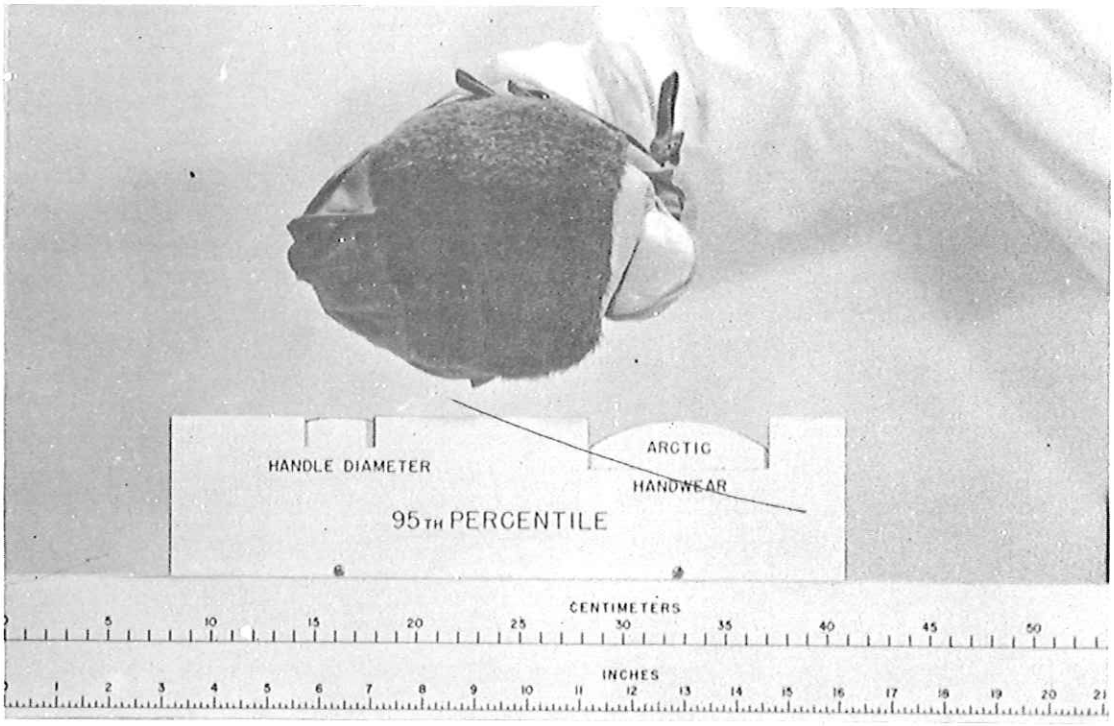

Figure 280. The hand closed as a fist (View E)

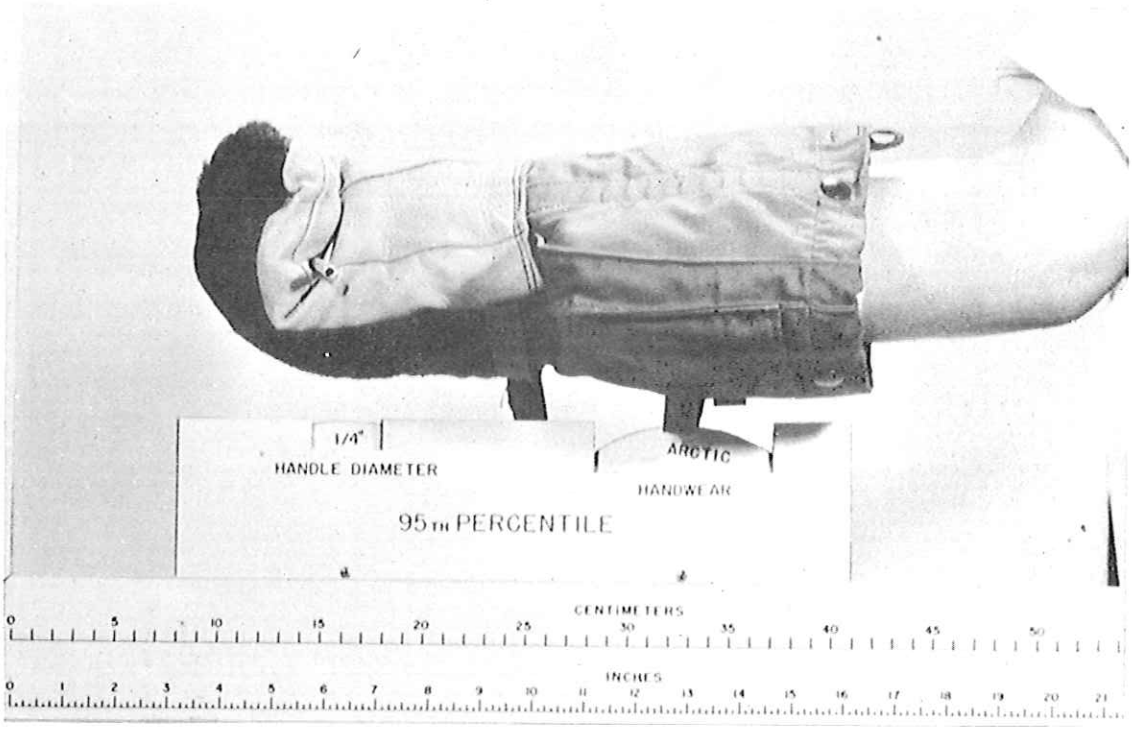

Figure 281. ¼" handle diameter (View A)

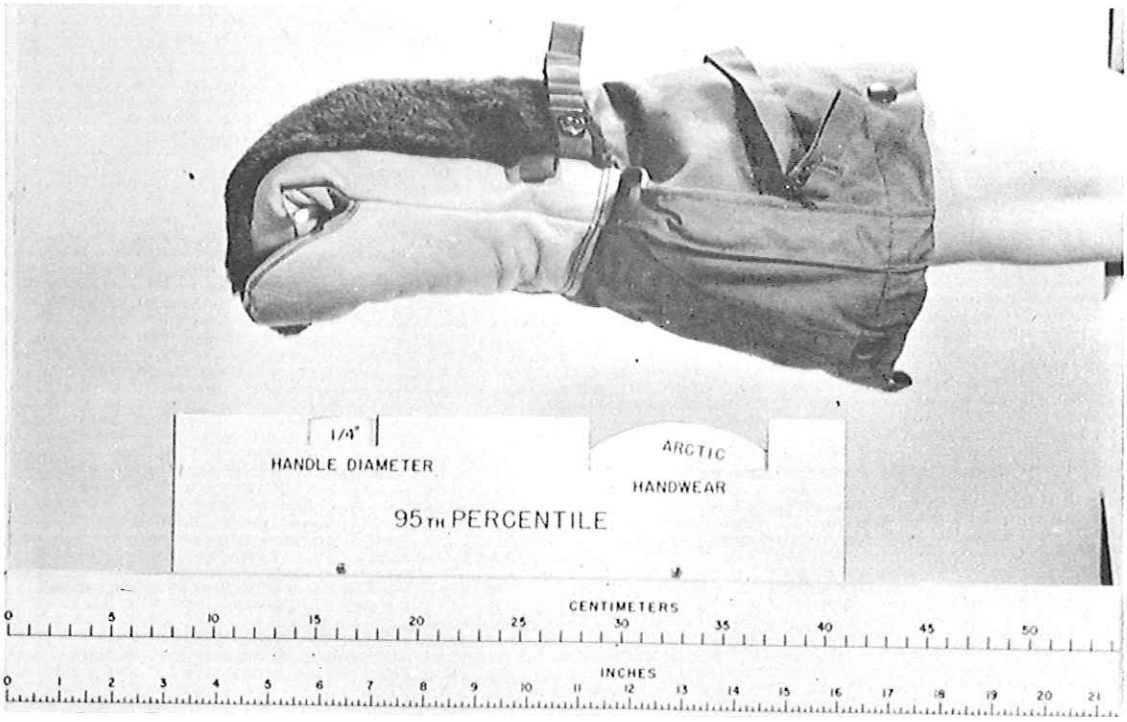

Figure 282. ¼" handle diameter (View B)

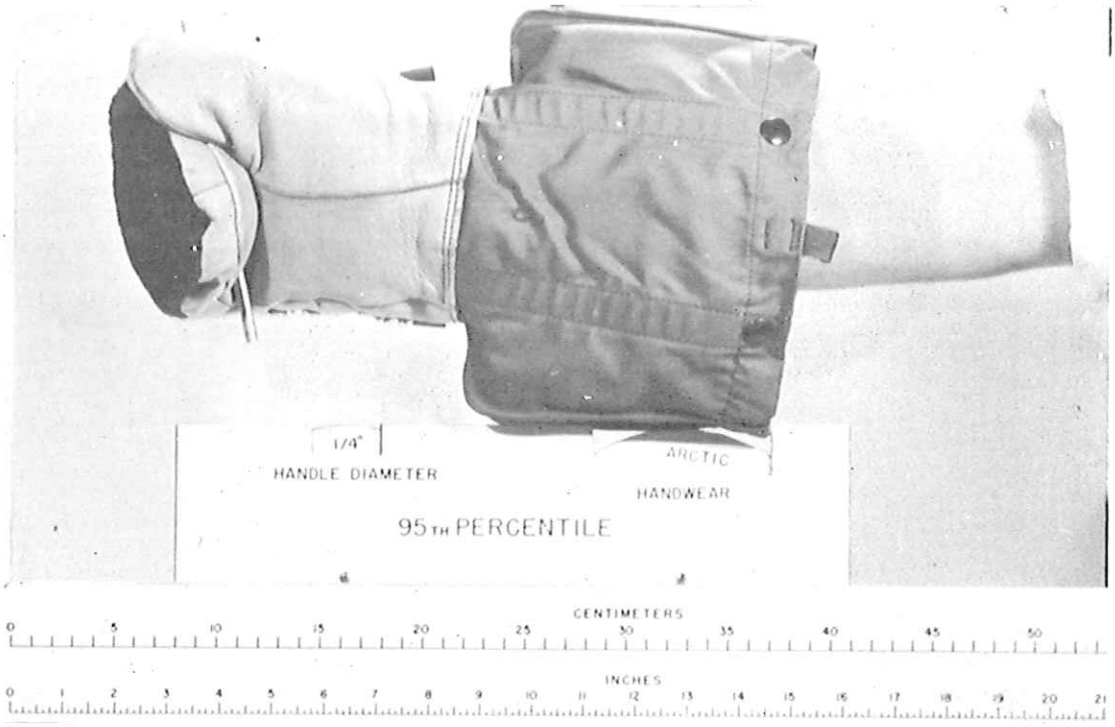

Figure 283. $\frac{1}{4}$" handle diameter (View C)

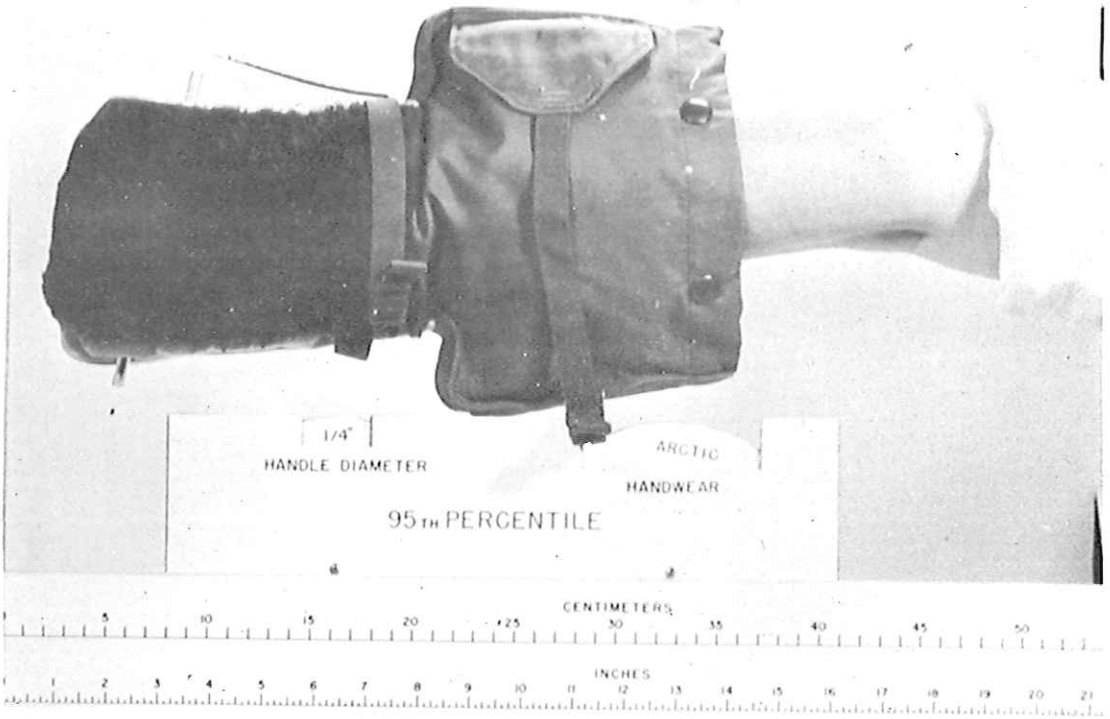

Figure 284. $\frac{1}{4}$" handle diameter (View D)

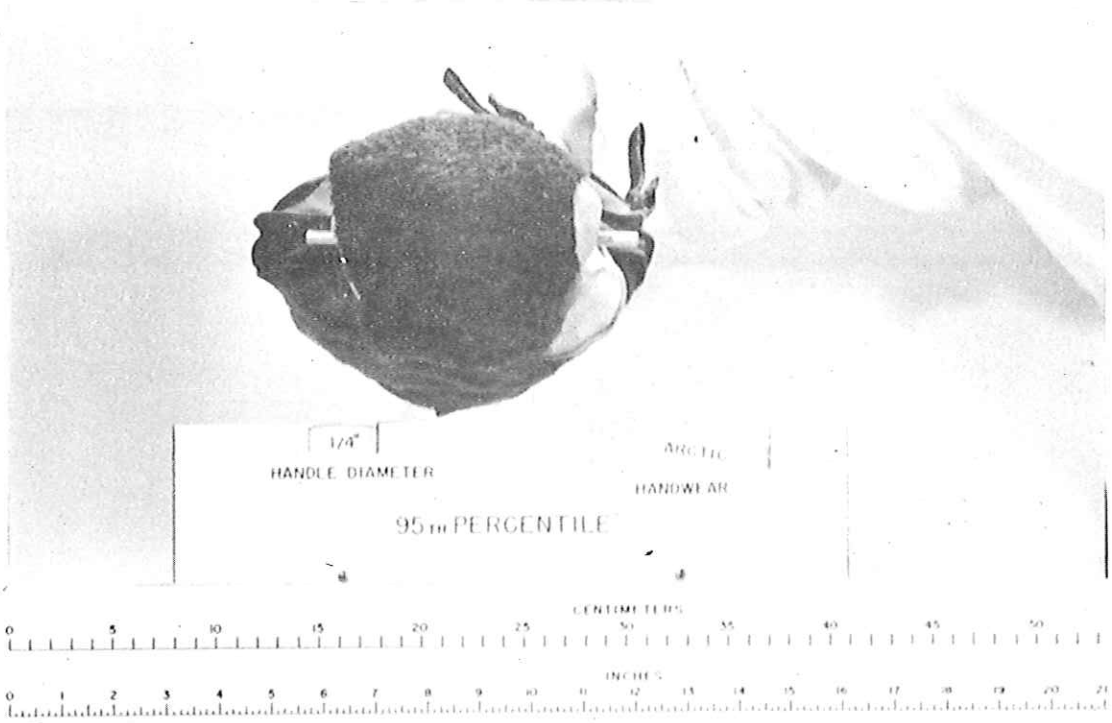

Figure 285. $\frac{1}{4}$" handle diameter (View E)

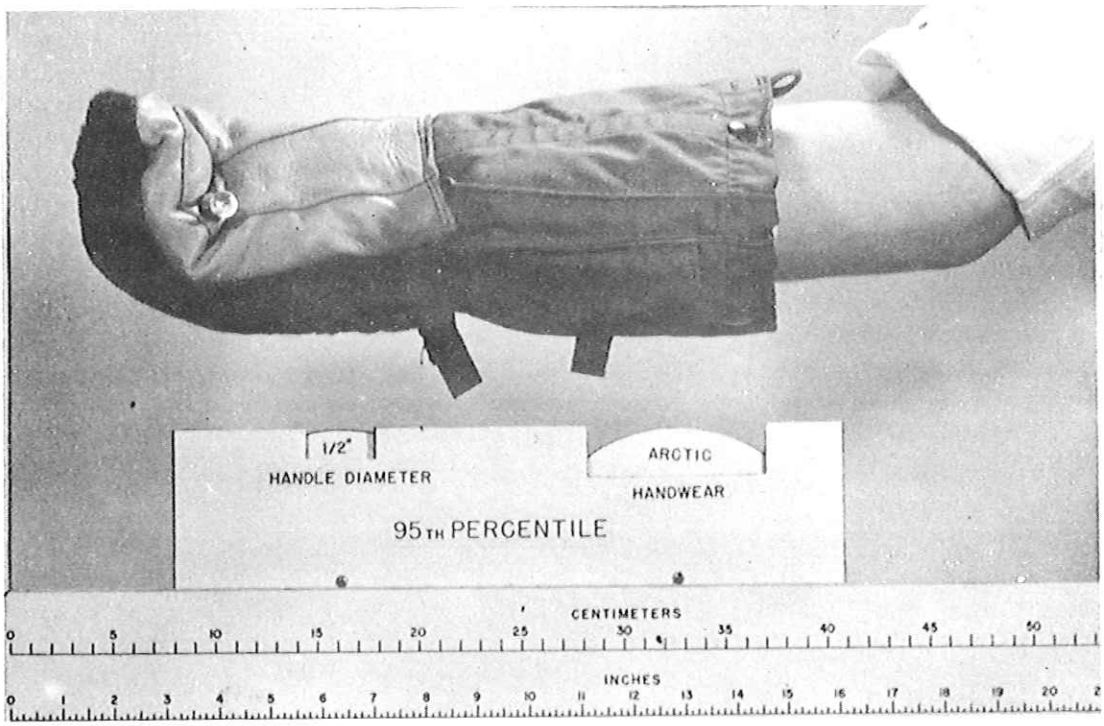

Figure 286. $\frac{1}{2}$" handle diameter (View A)

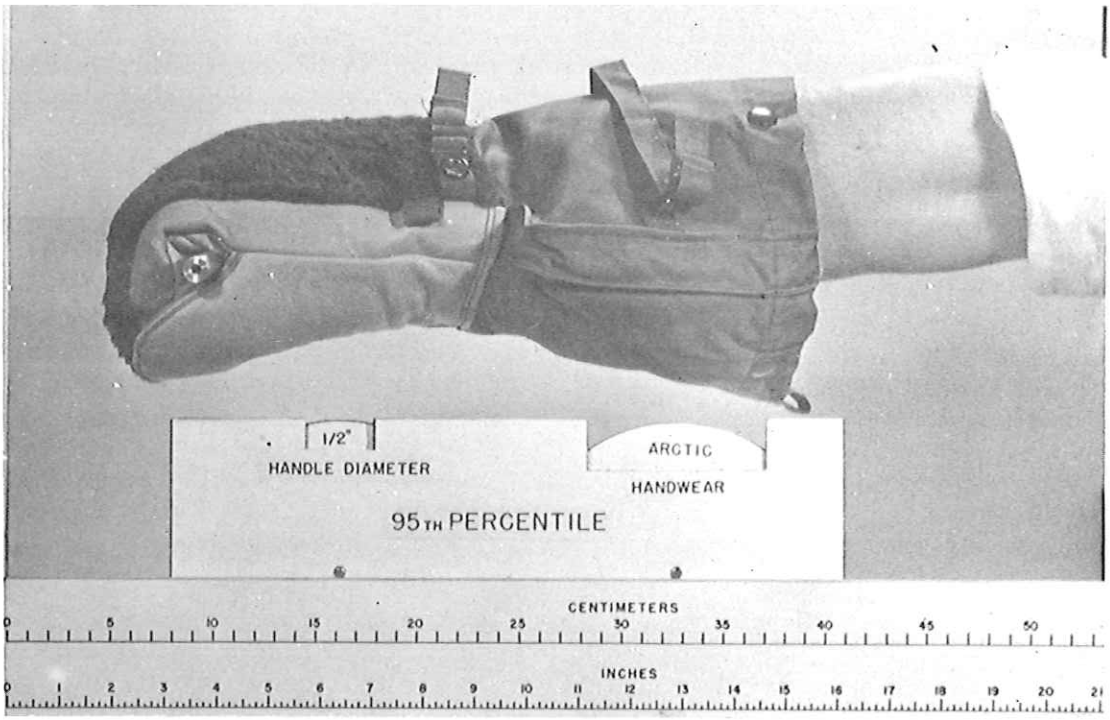

Figure 287. ½" handle diameter (View B)

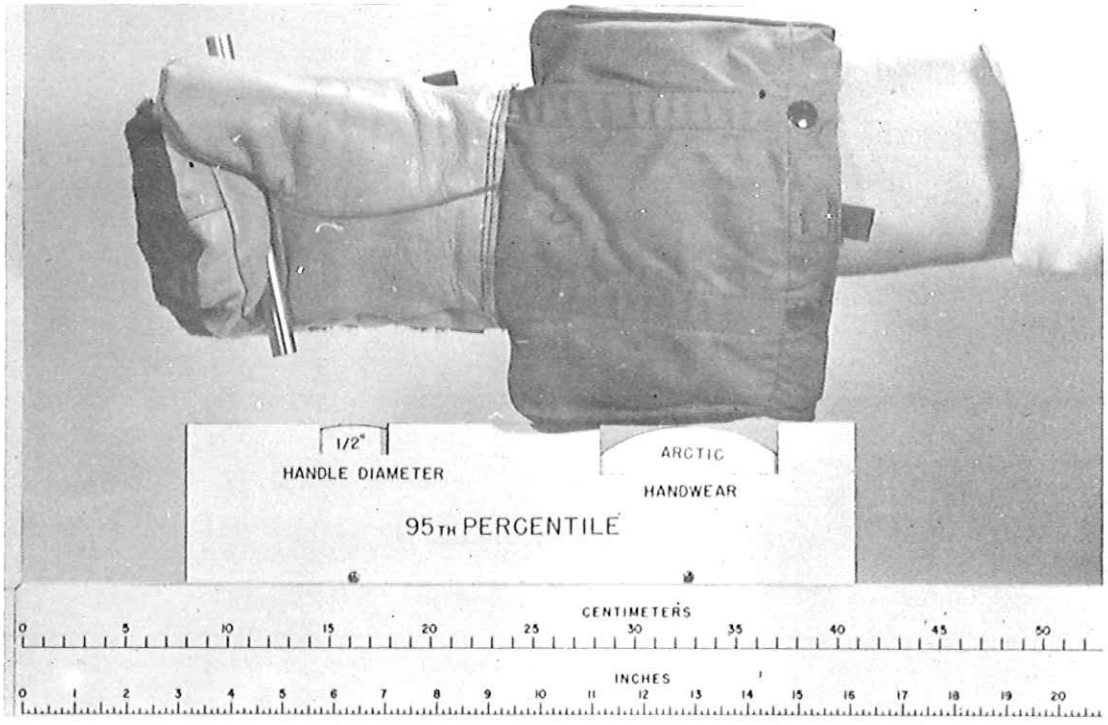

Figure 288. ½" handle diameter (View C)

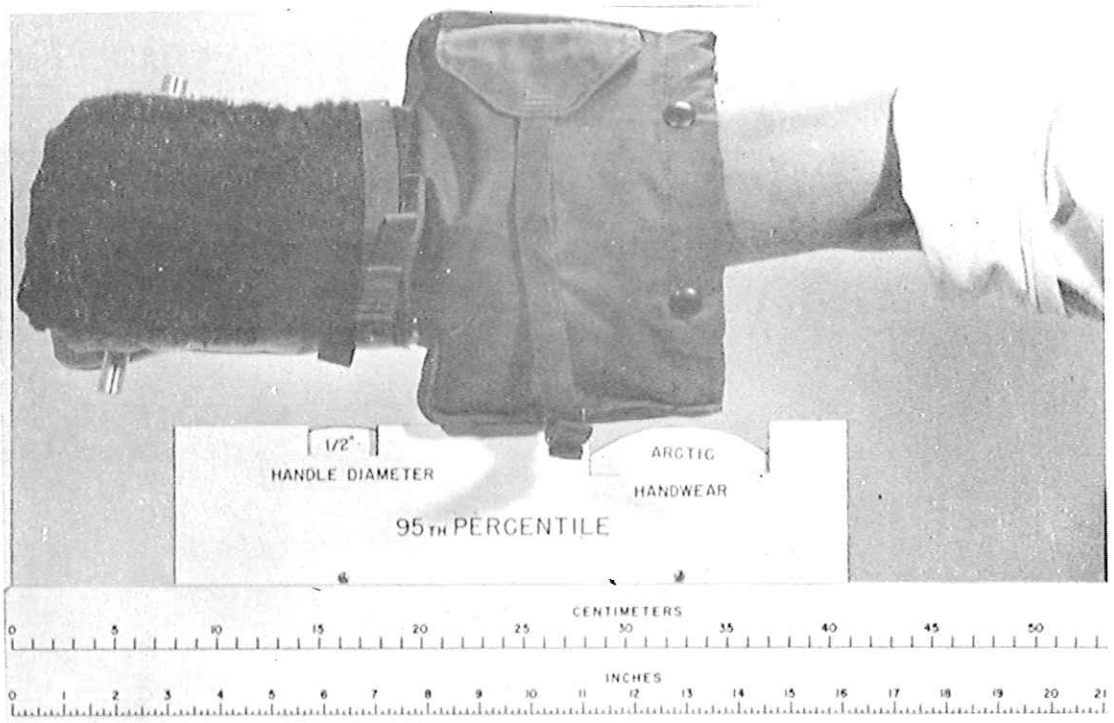

Figure 289. ½" handle diameter (View D)

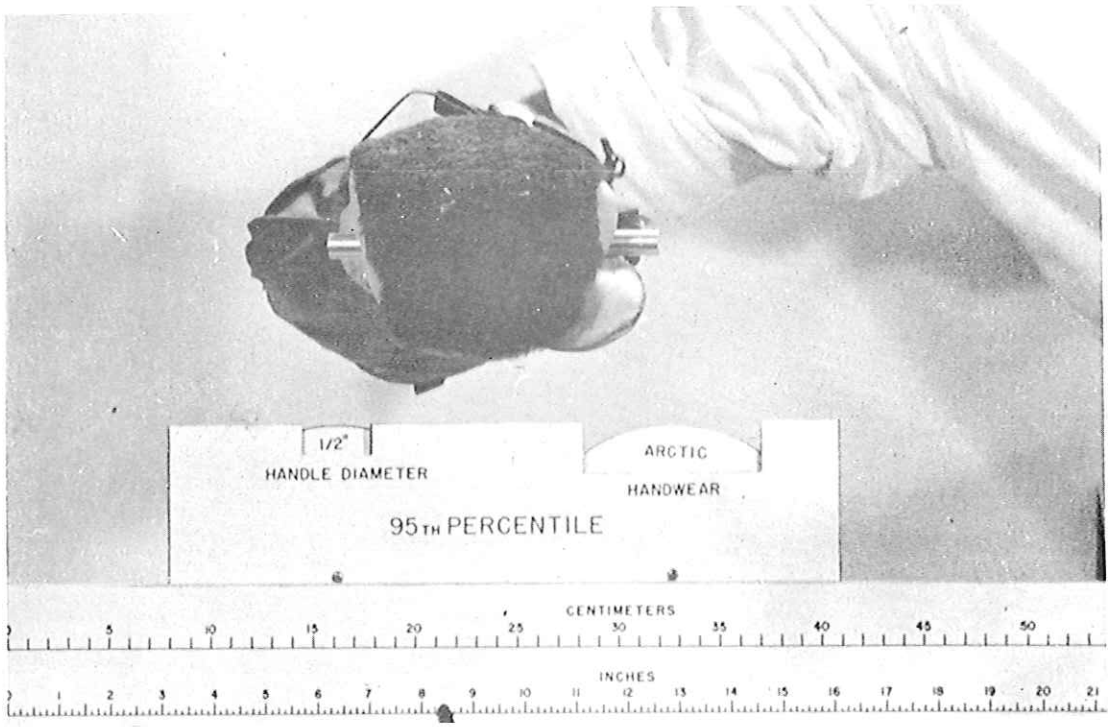

Figure 290. ½" handle diameter (View E)

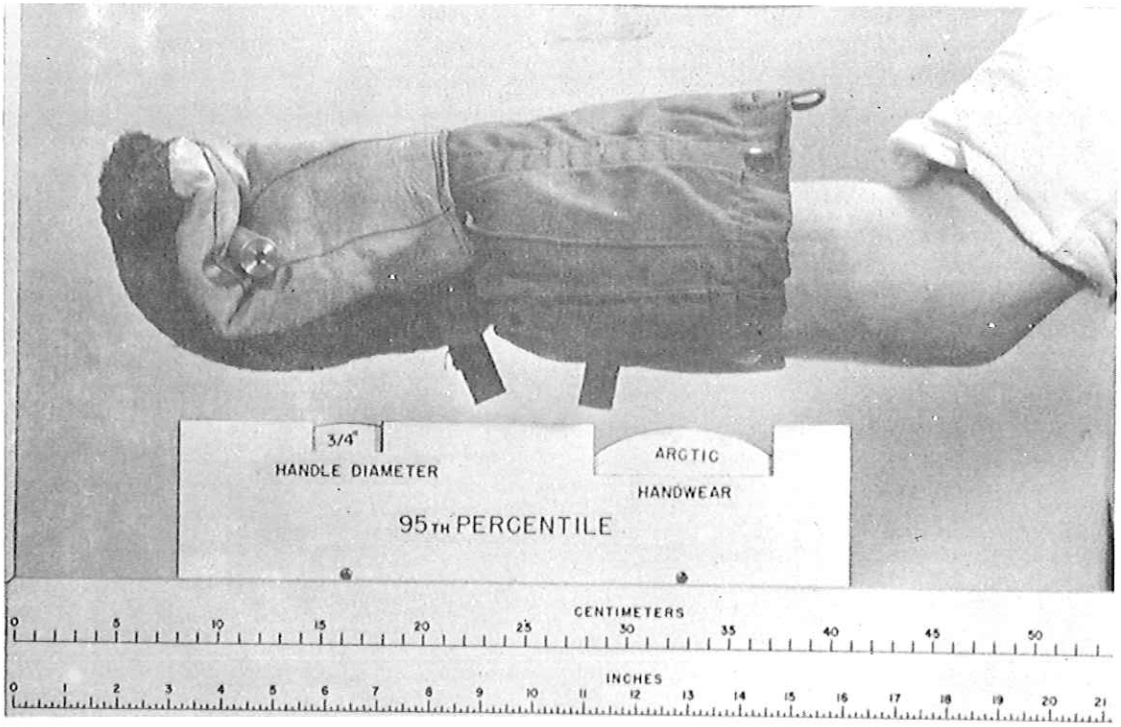

Figure 291. 3/4" handle diameter (View A)

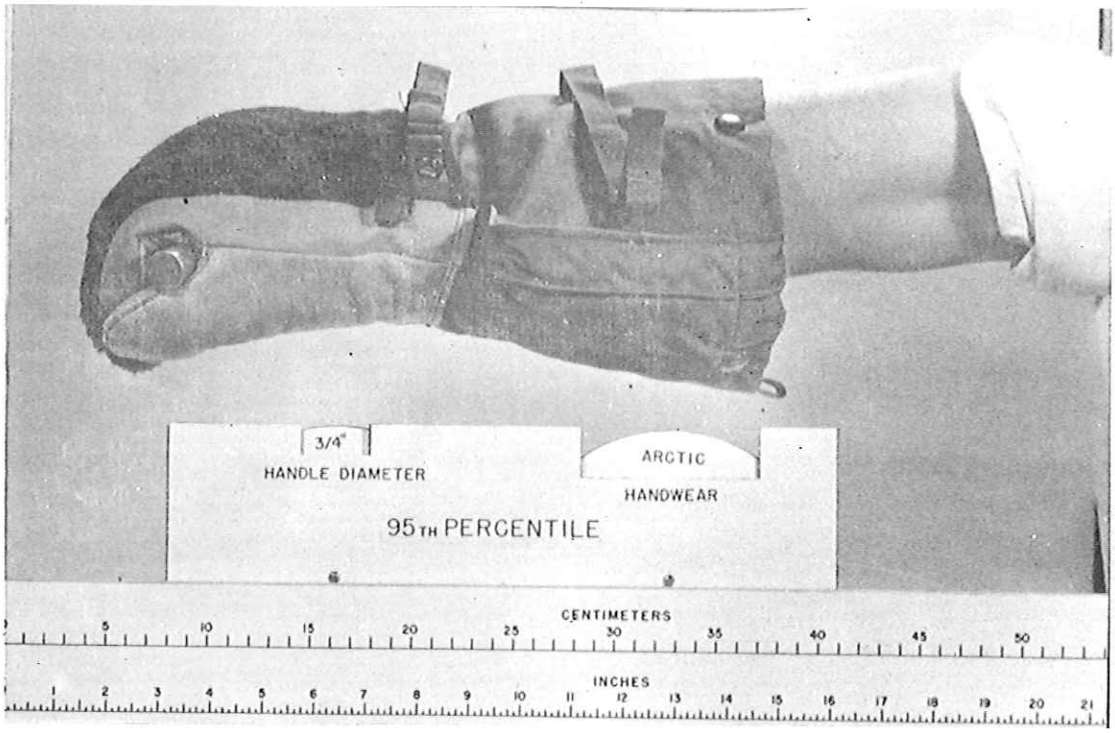

Figure 292. 3/4" handle diameter (View B)

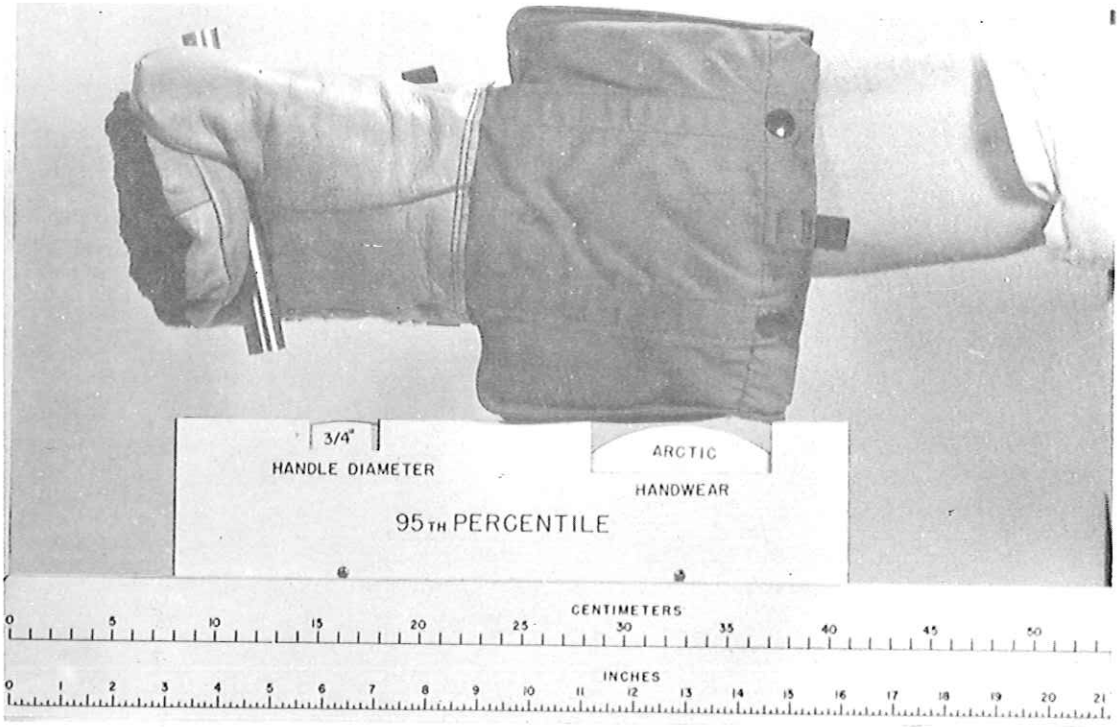

Figure 293. 3/4" handle diameter (View C)

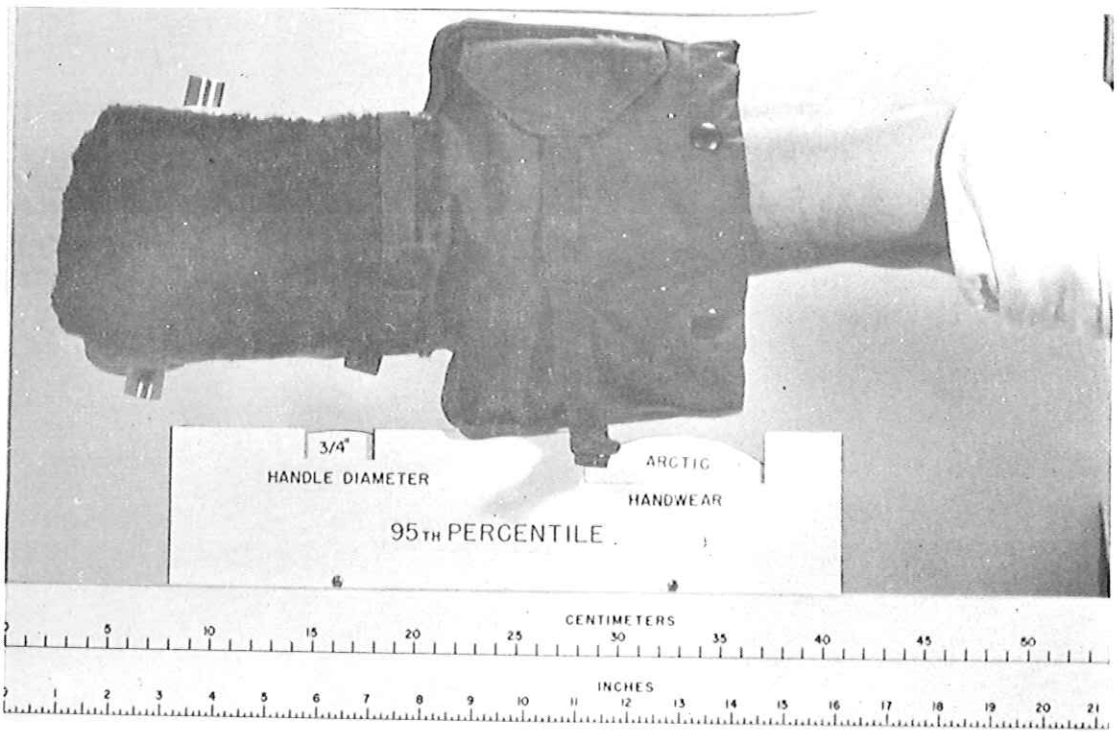

Figure 294. 3/4" handle diameter (View D)

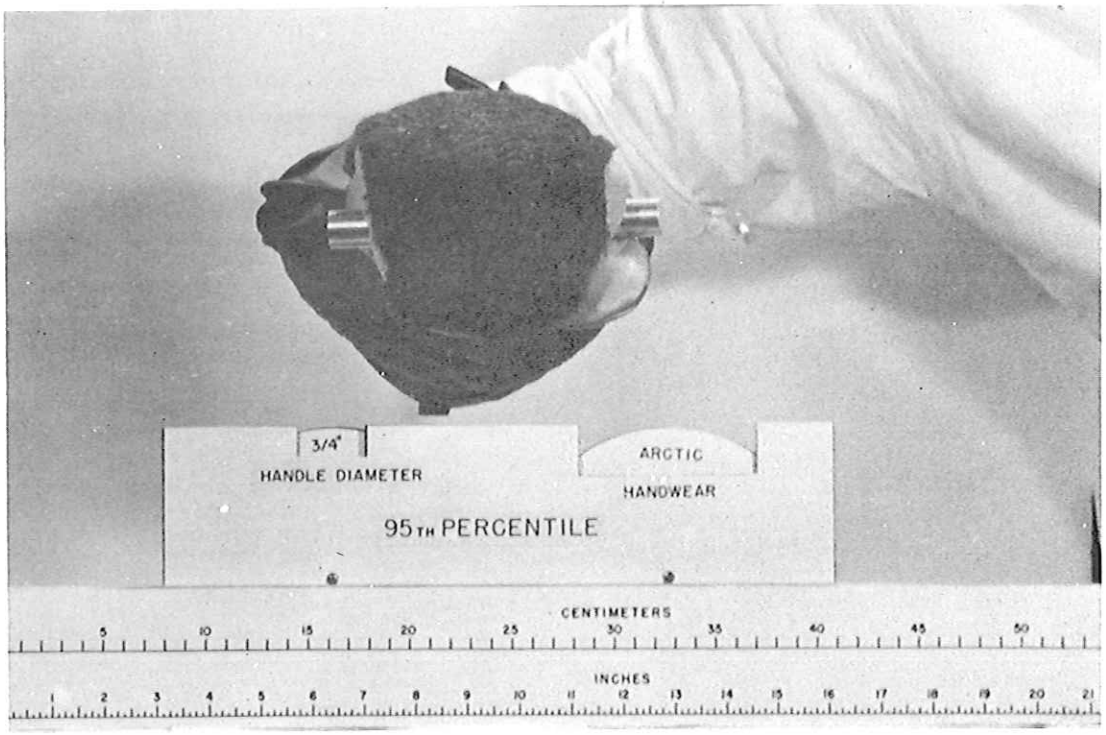

Figure 295. 3/4" handle diameter (View E)

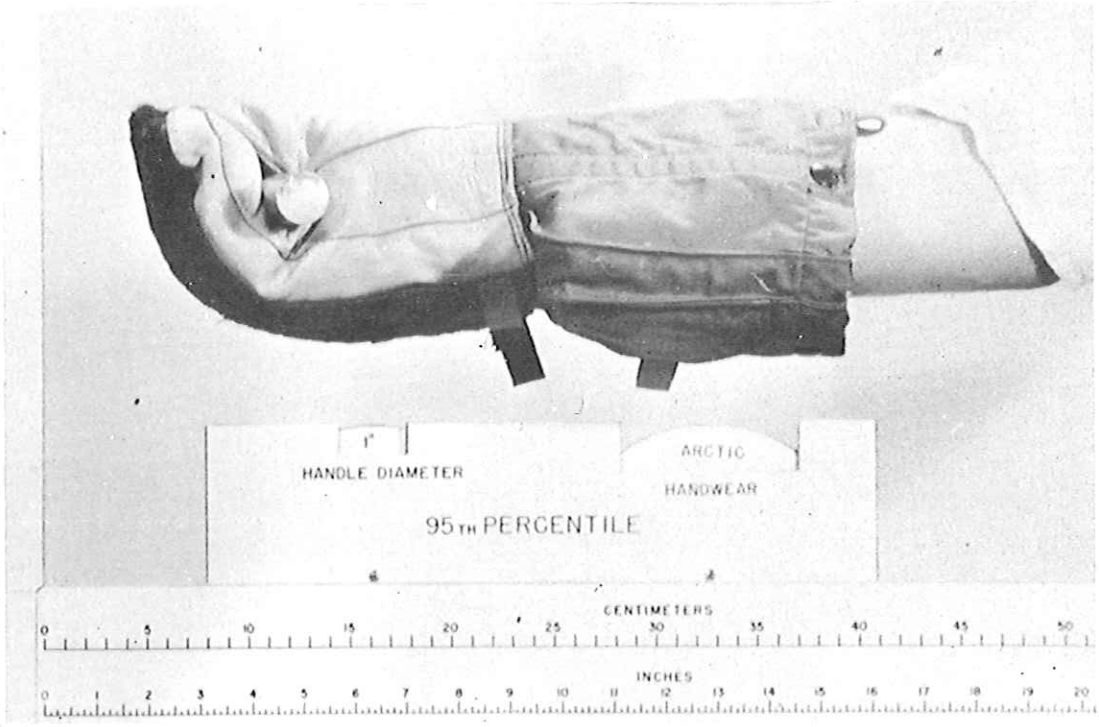

Figure 296. 1" handle diameter (View A)

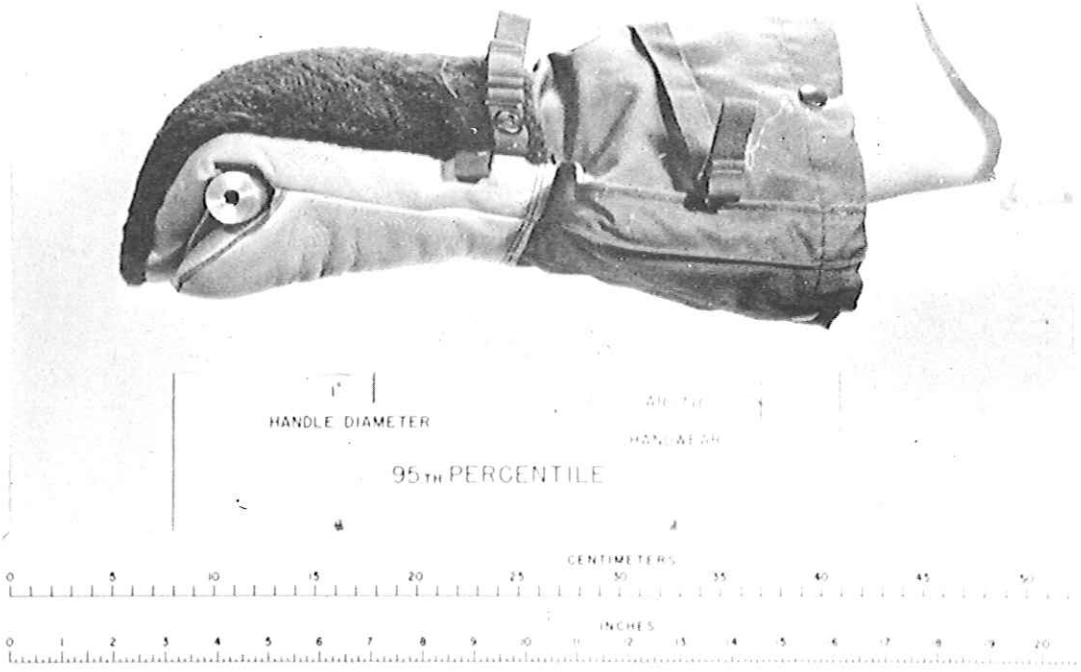

Figure 297. 1" handle diameter (View B)

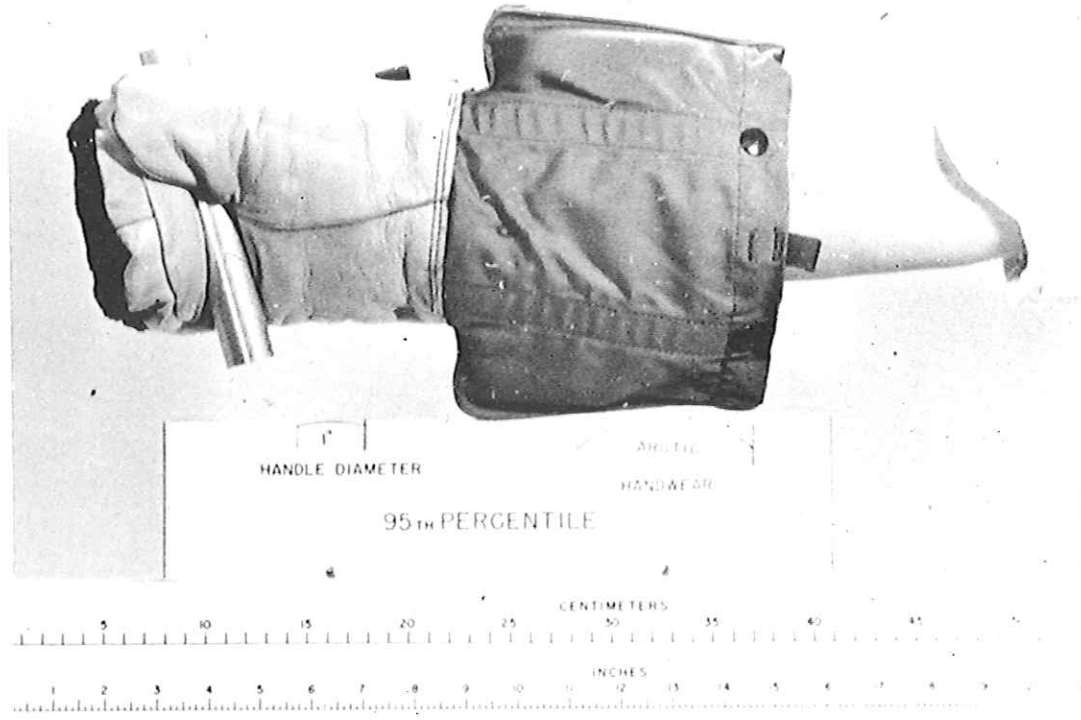

Figure 298. 1" handle diameter (View C)

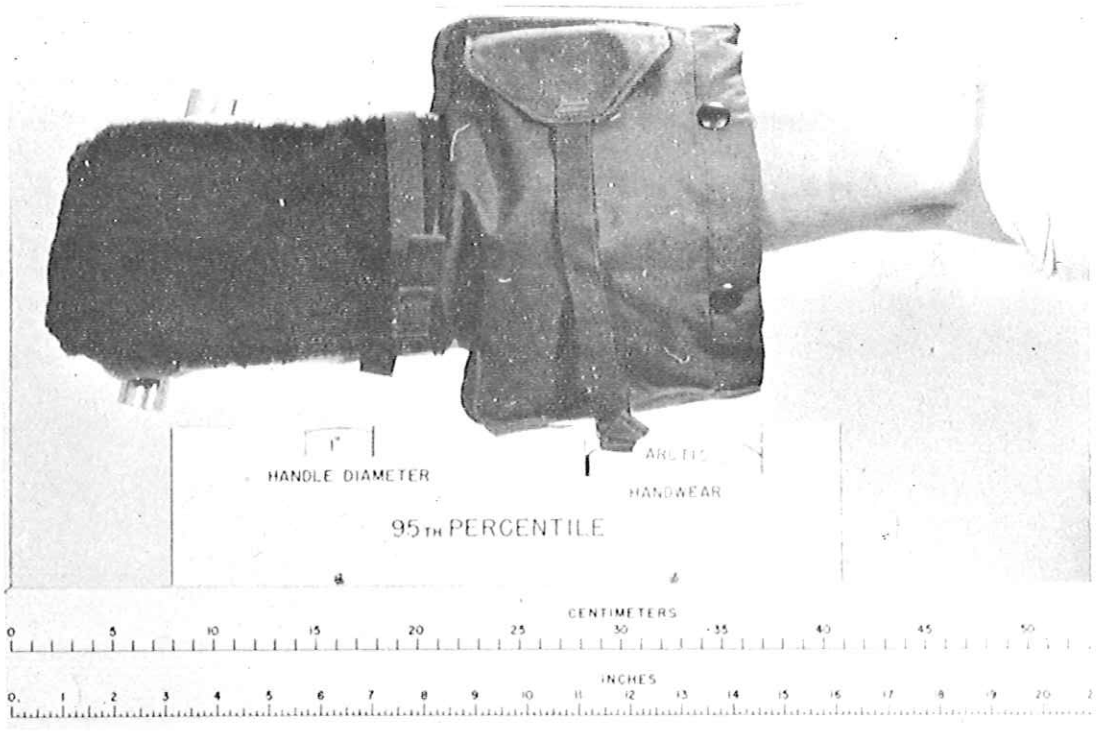

Figure 299. 1" handle diameter (View D)

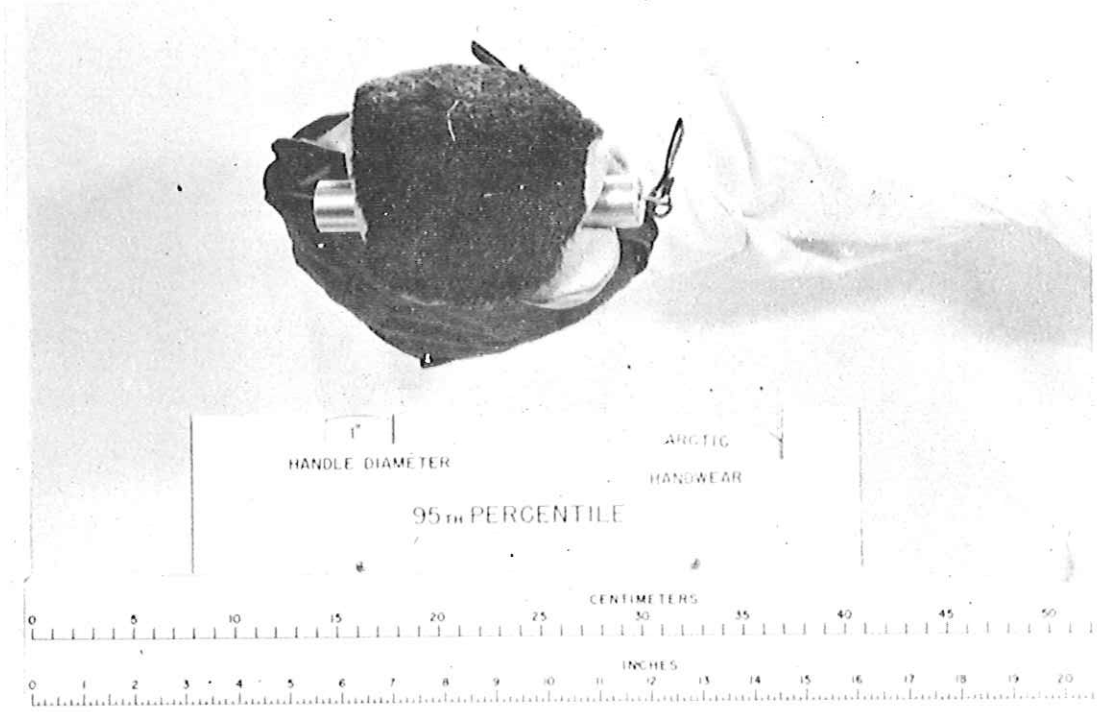

Figure 300. 1" handle diameter (View E)

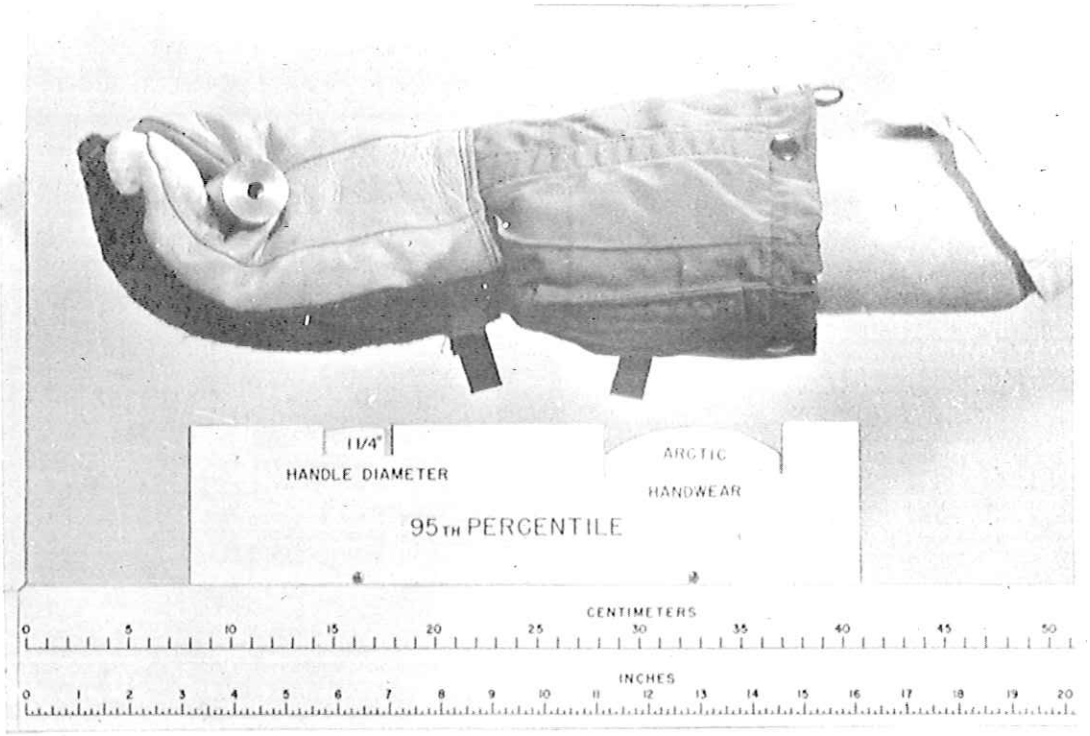

Figure 301. 1¼" handle diameter (View A)

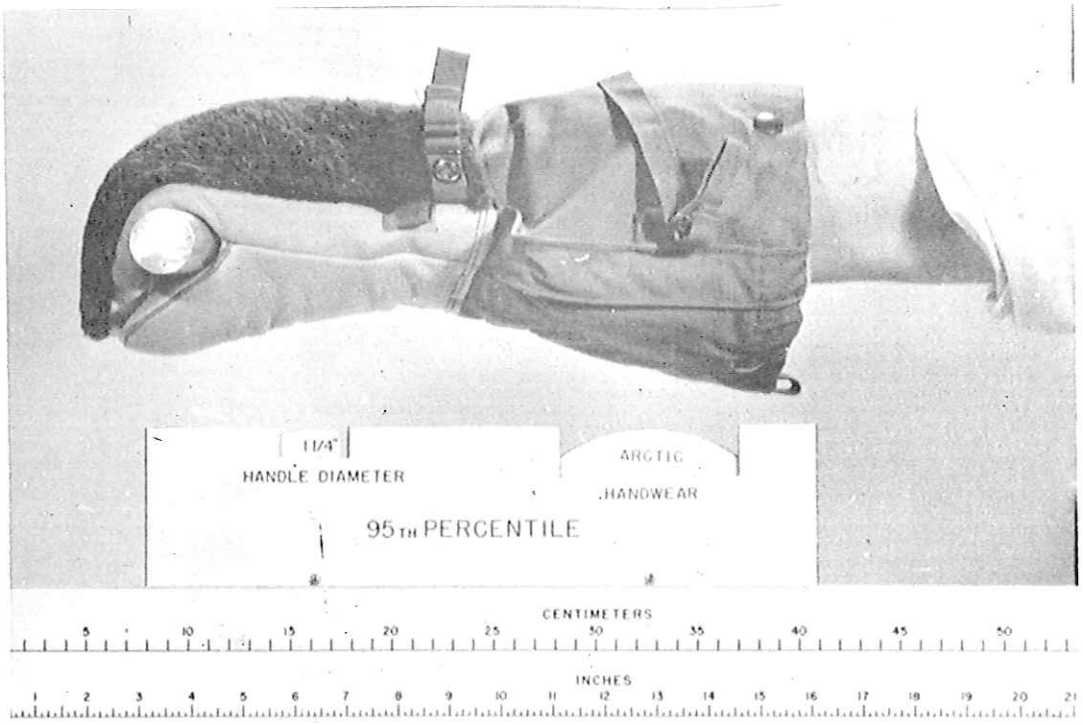

Figure 302. 1¼" handle diameter (View B)

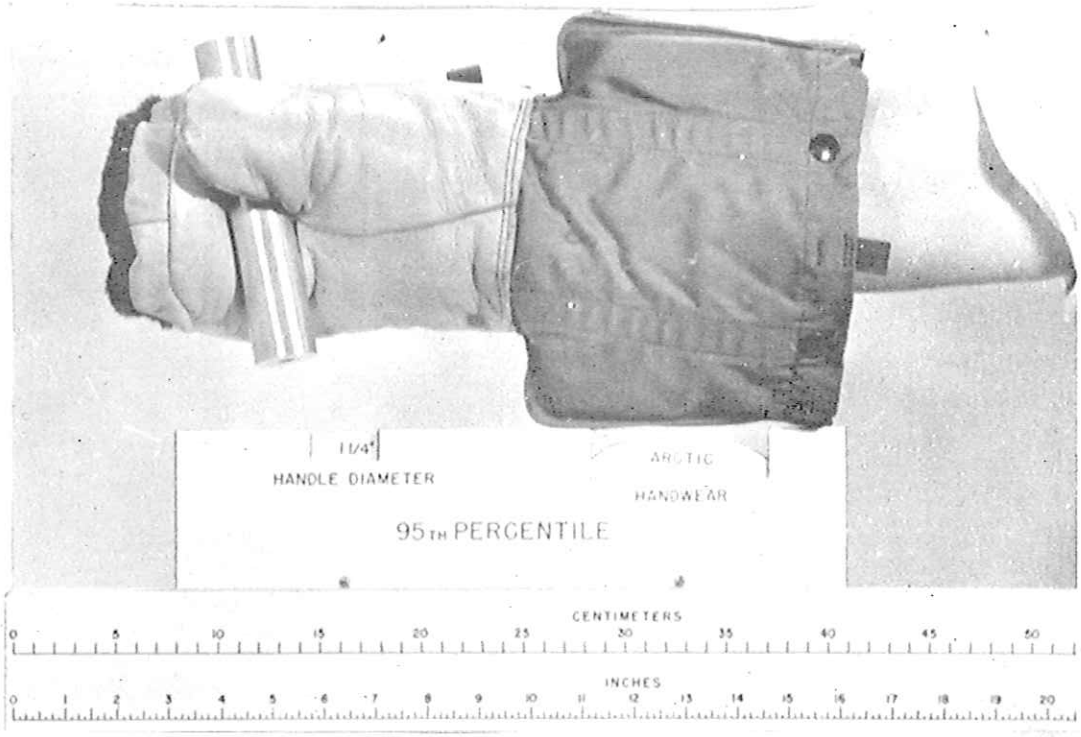

Figure 303. 1¼" handle diameter (View C)

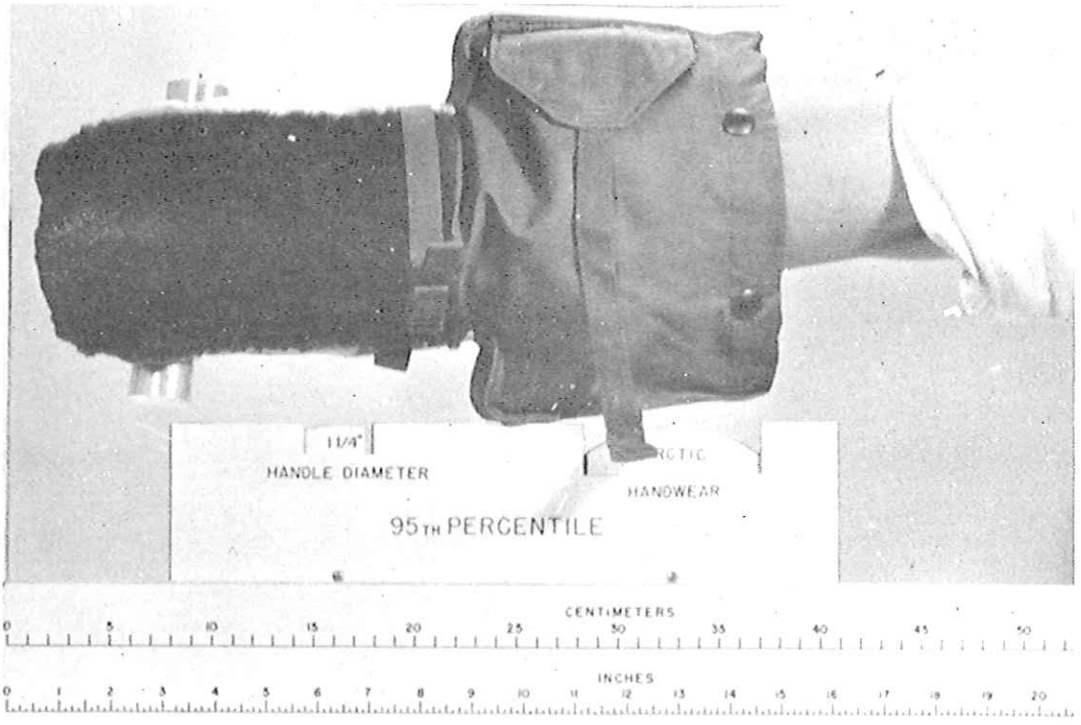

Figure 304. 1¼" handle diameter (View D)

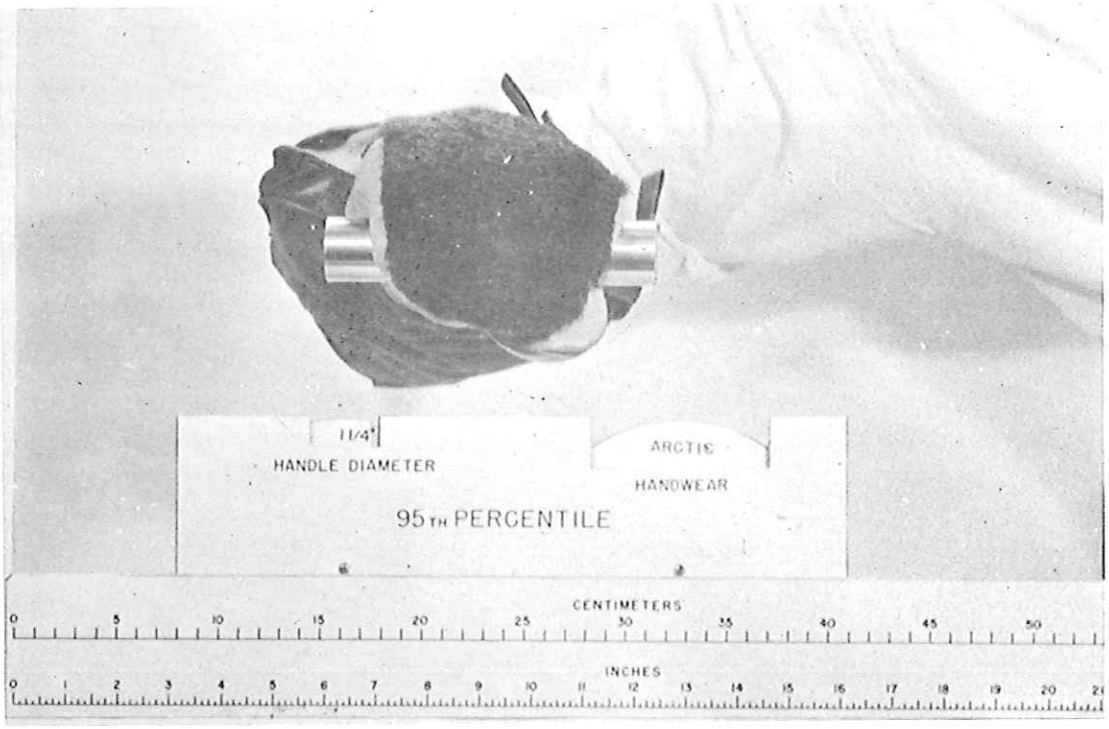

Figure 305. 1¼" Handle diameter (View E)

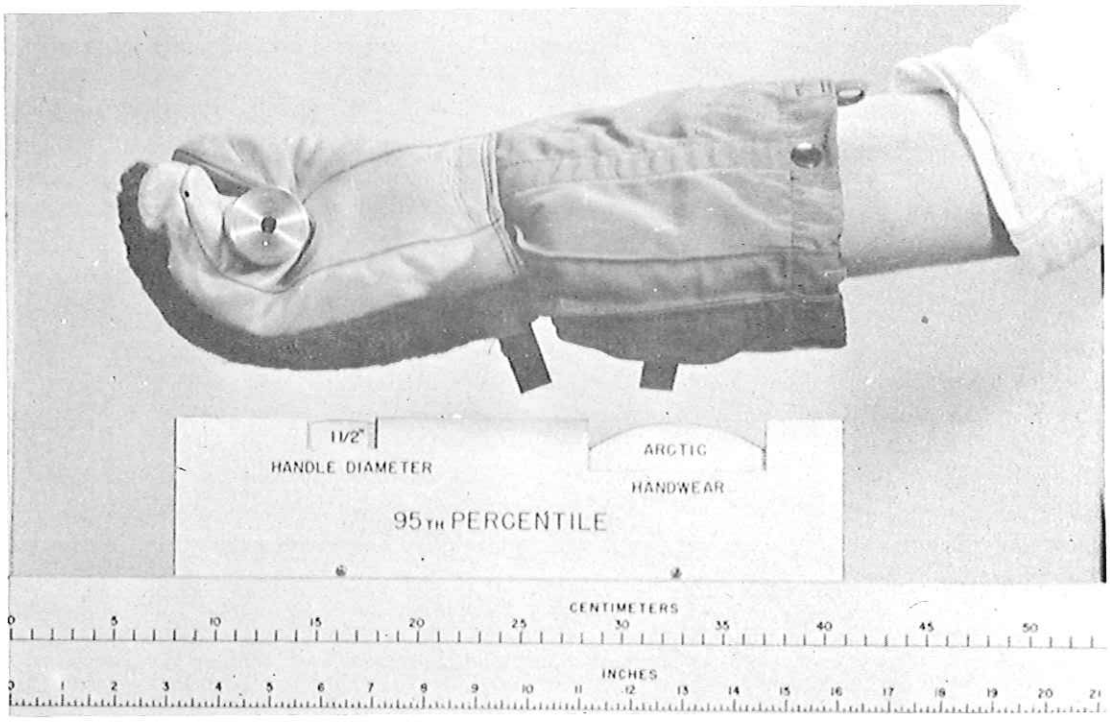

Figure 306. 1½" handle diameter (View A)

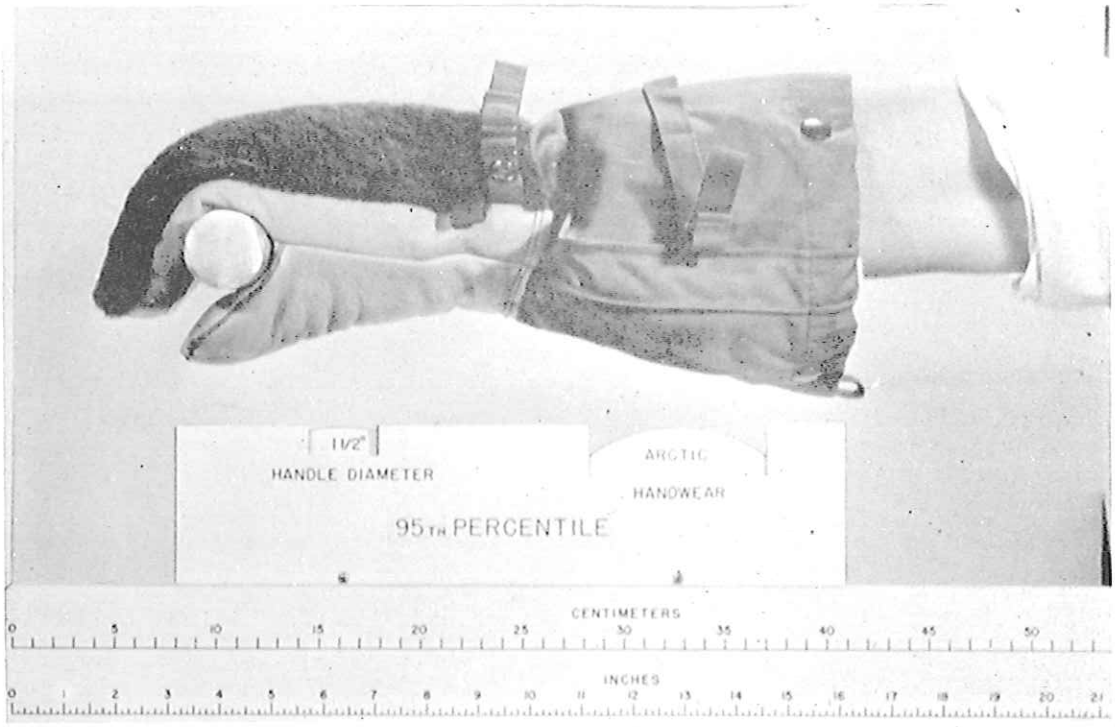

Figure 307. $1\frac{1}{2}$" handle diameter (View B)

Figure 308. $1\frac{1}{2}$" handle diameter (View C)

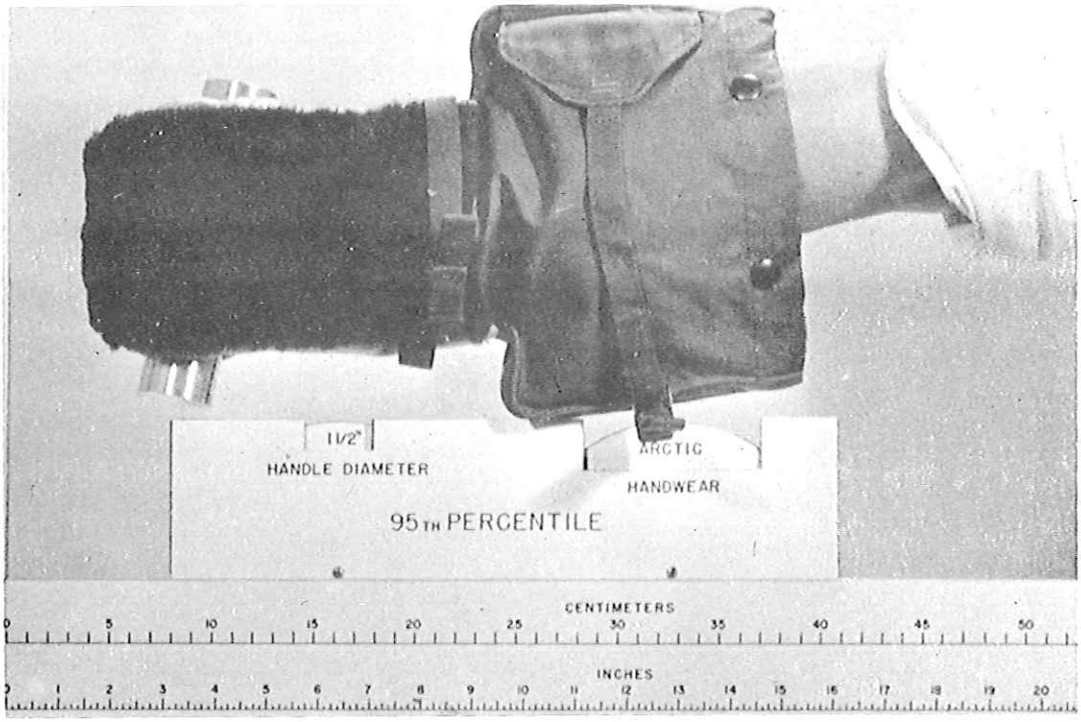

Figure 309. 1½" handle diameter (View D)

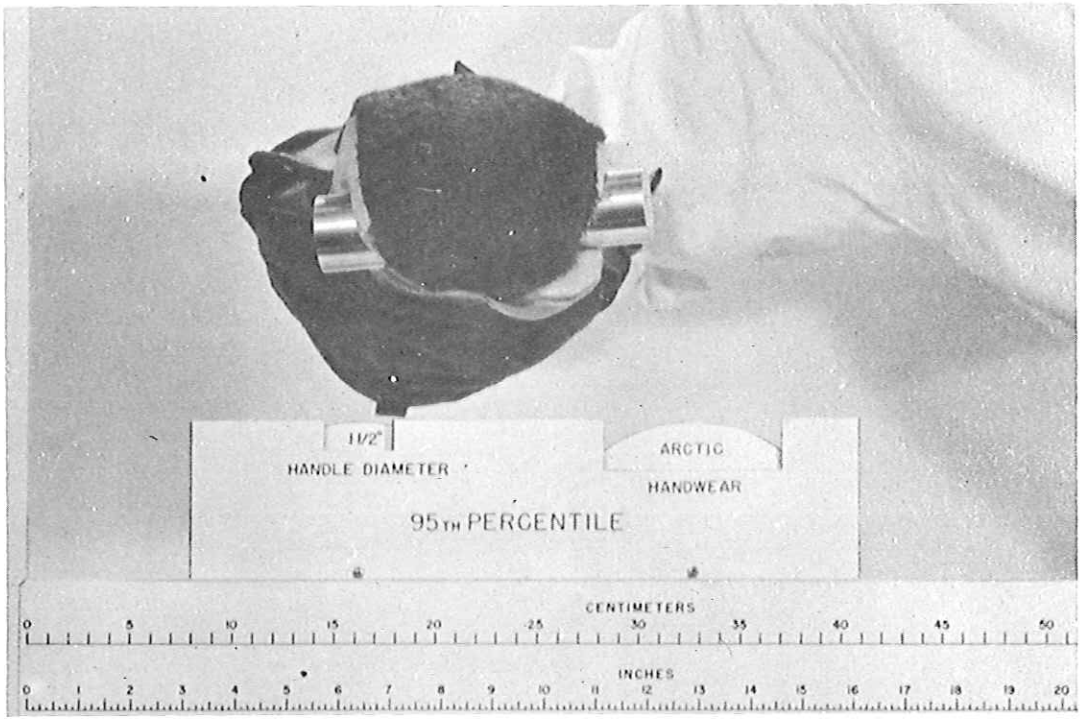

Figure 310. 1½" handle diameter (View E)

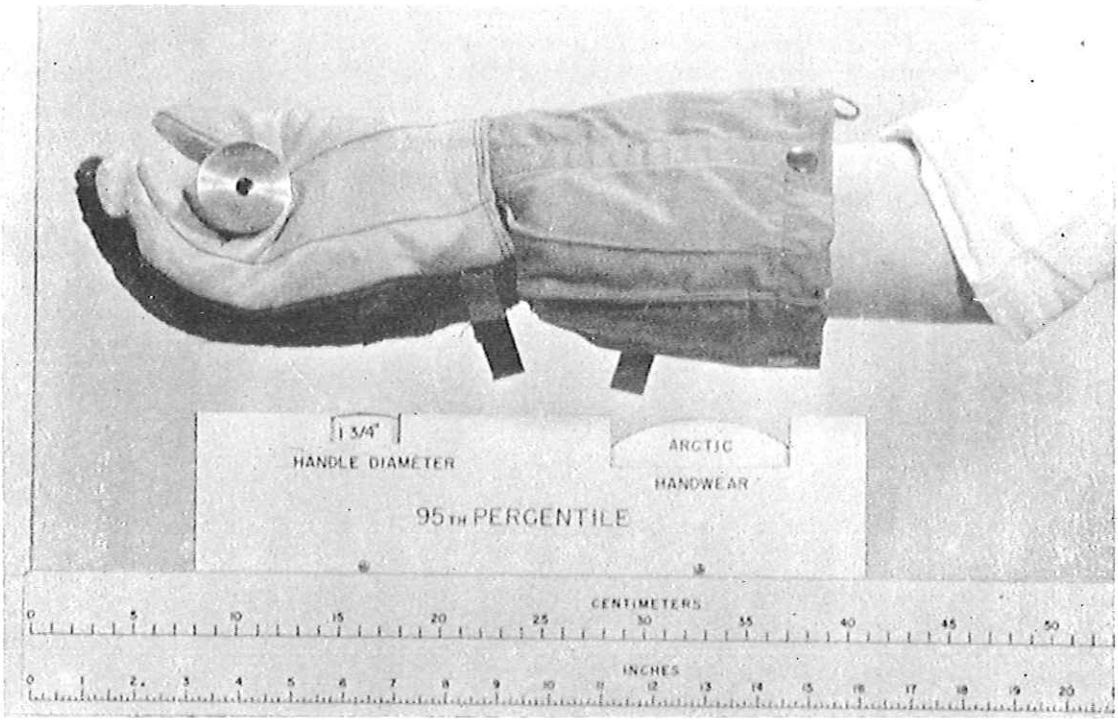

Figure 311. 1 3/4" handle diameter (View A)

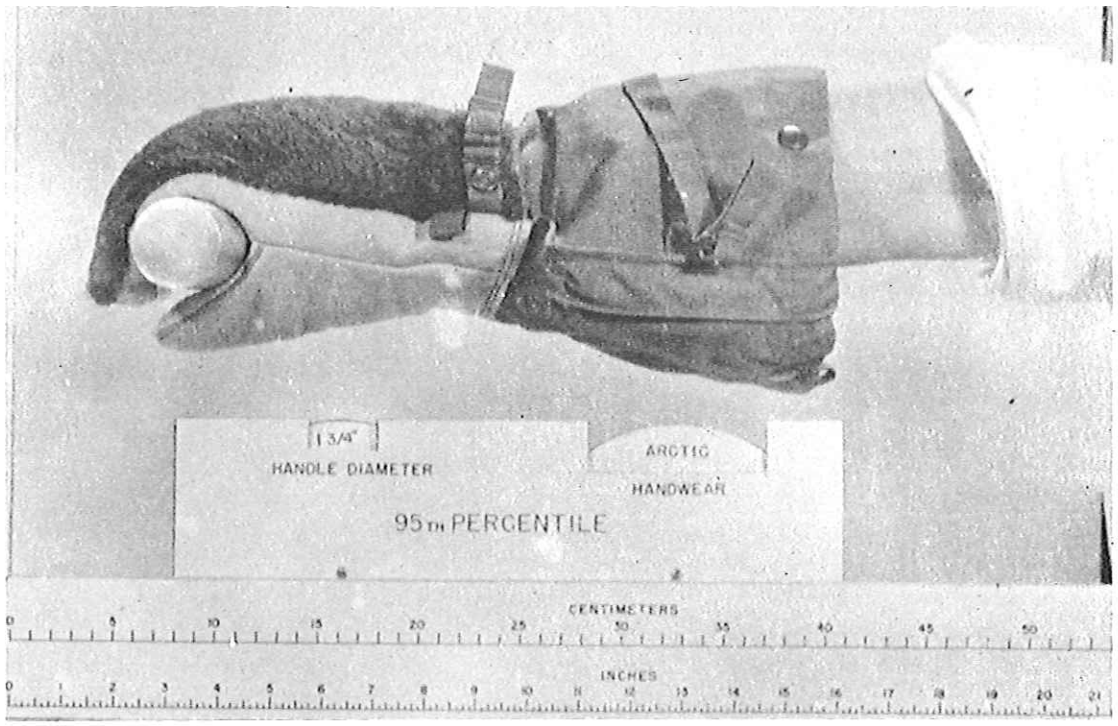

Figure 312. 1 3/4" handle diameter (View B)

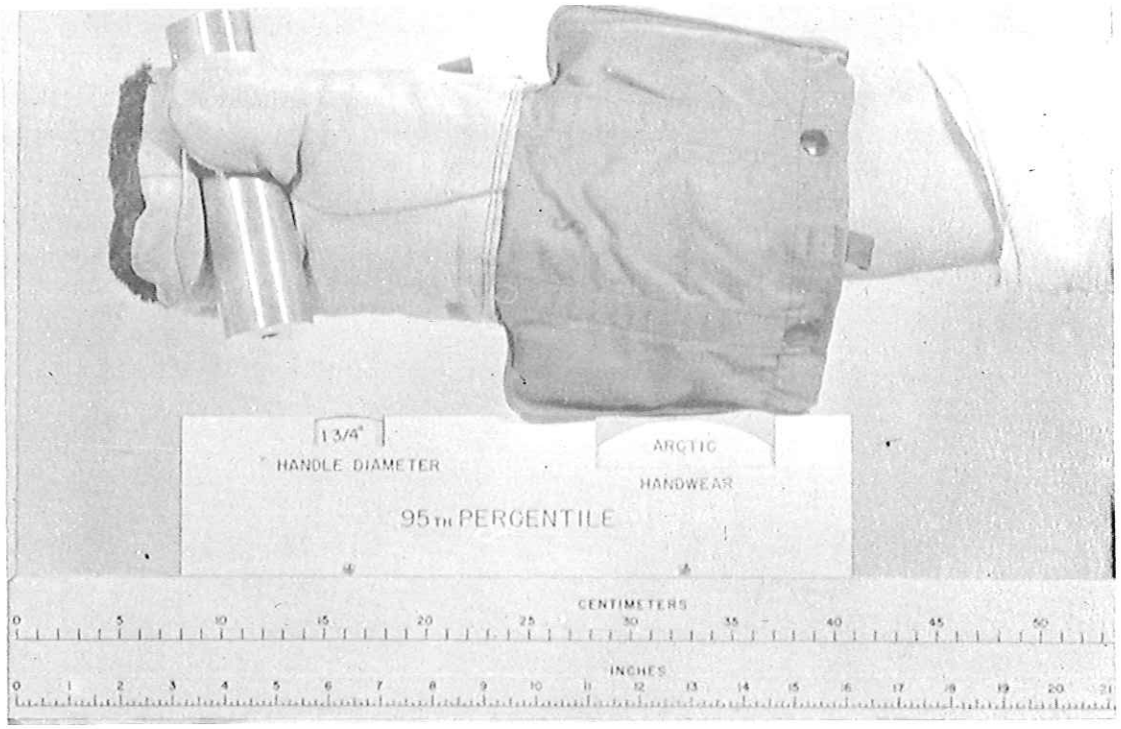

Figure 313. 1 3/4" handle diameter (View C)

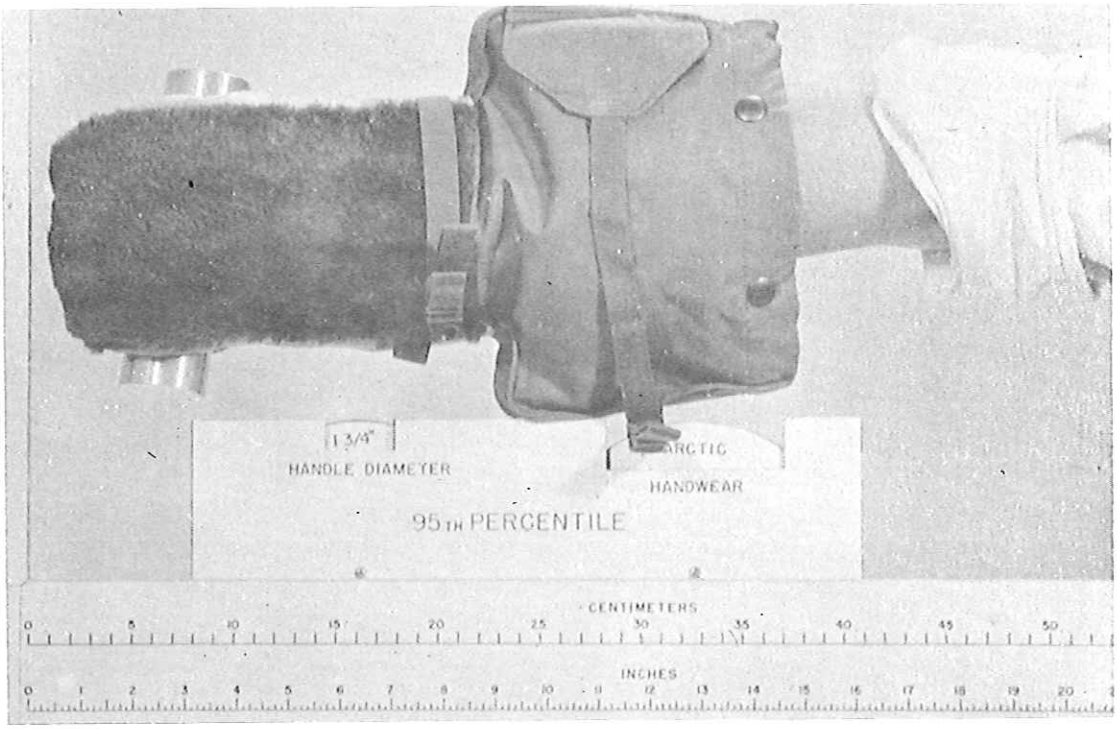

Figure 314. 1 3/4" handle diameter (View D)

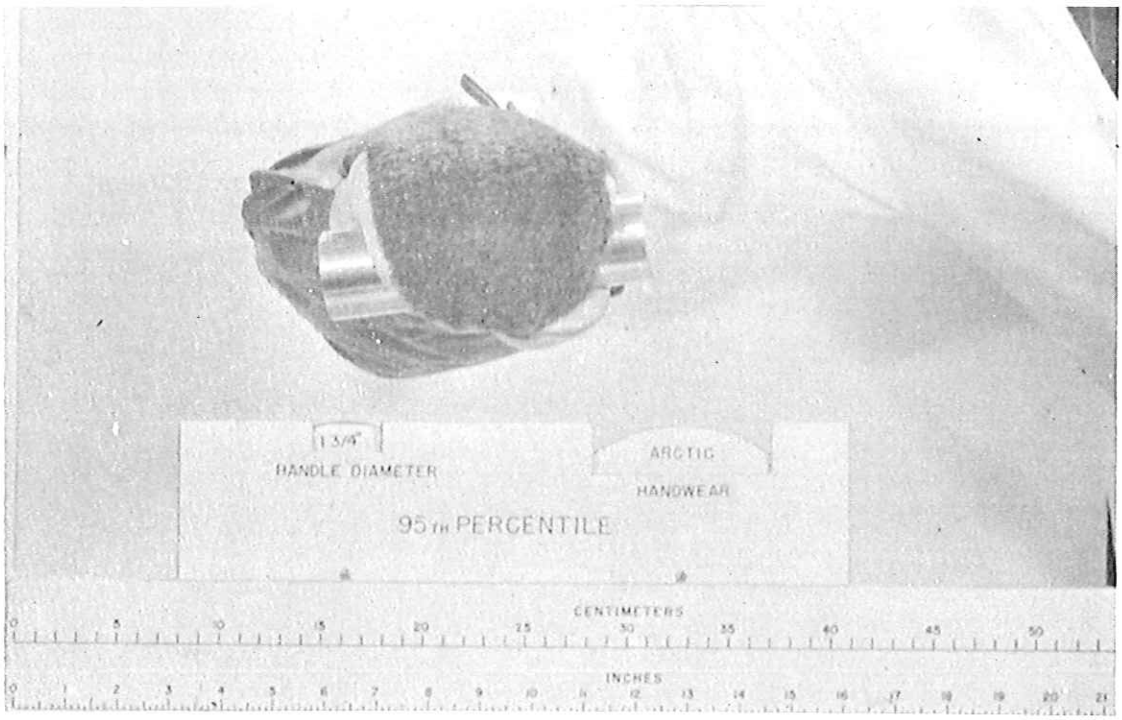

Figure 315. 1 3/4" handle diameter (View E)

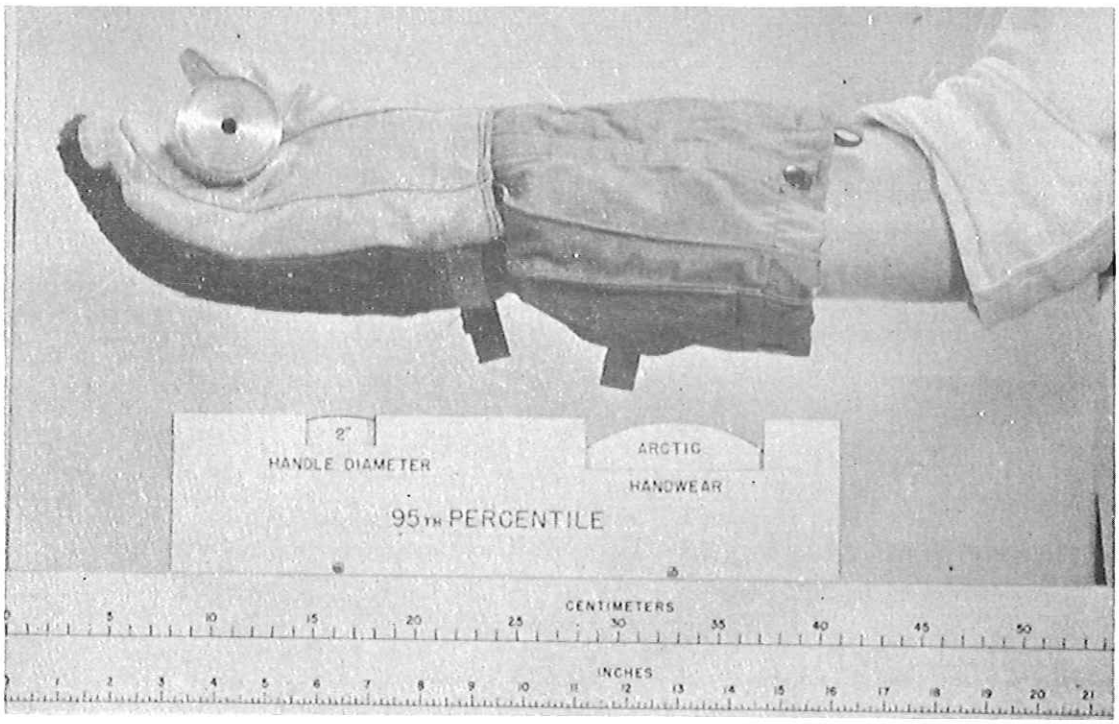

Figure 316. 2" handle diameter (View A)

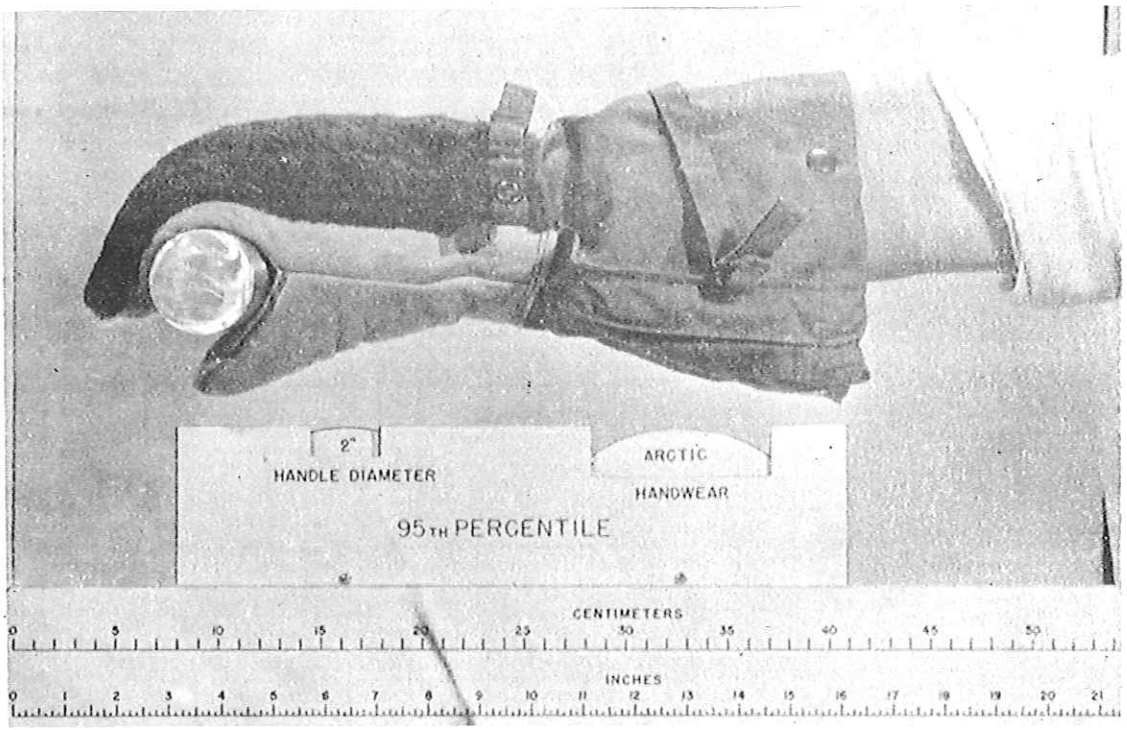

Figure 317. 2" handle diameter (View B)

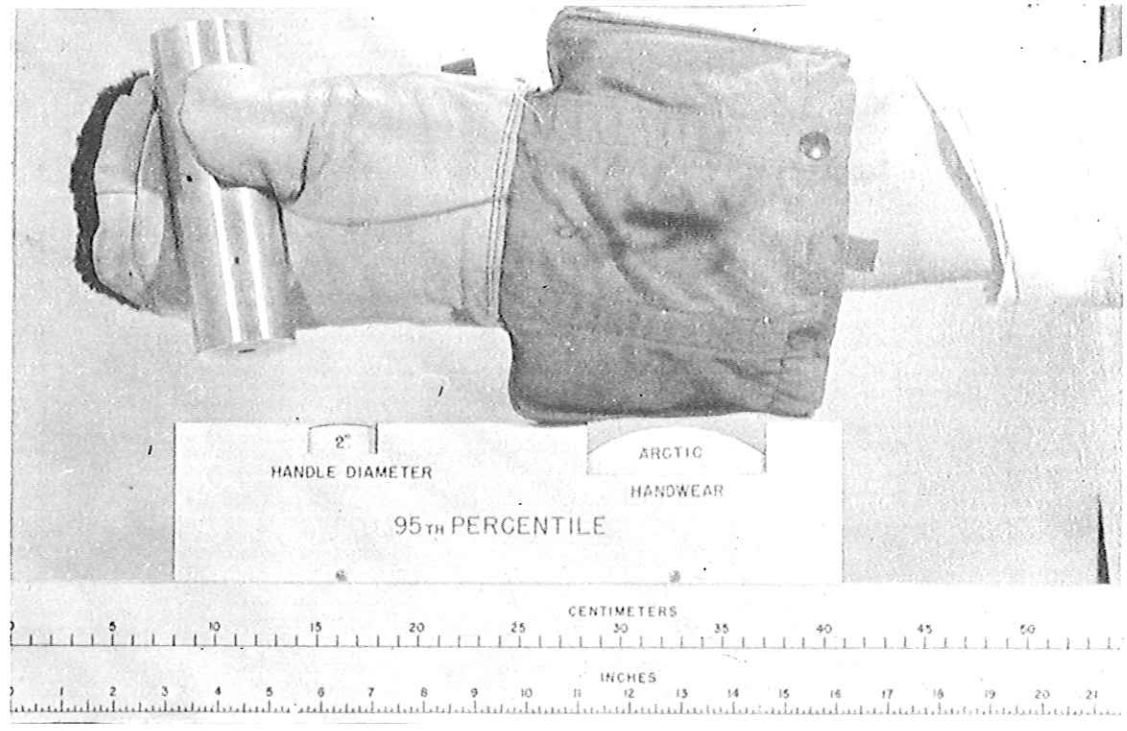

Figure 318. 2" handle diameter (View C)

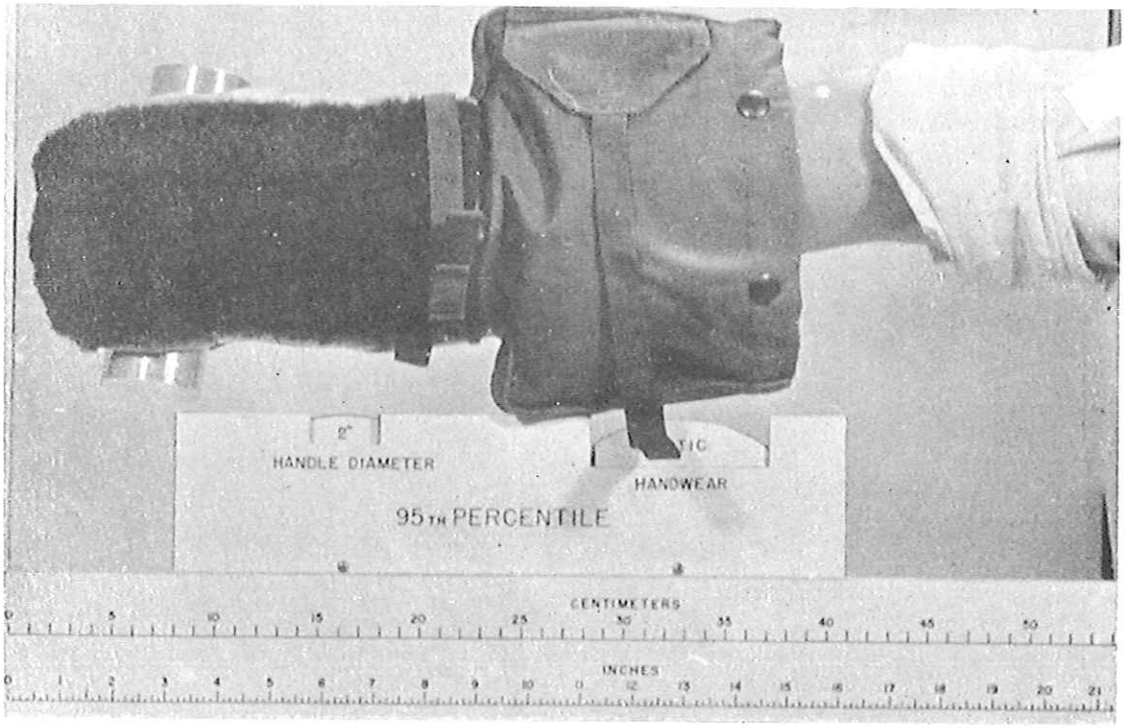

Figure 319. 2" handle diameter (View D)

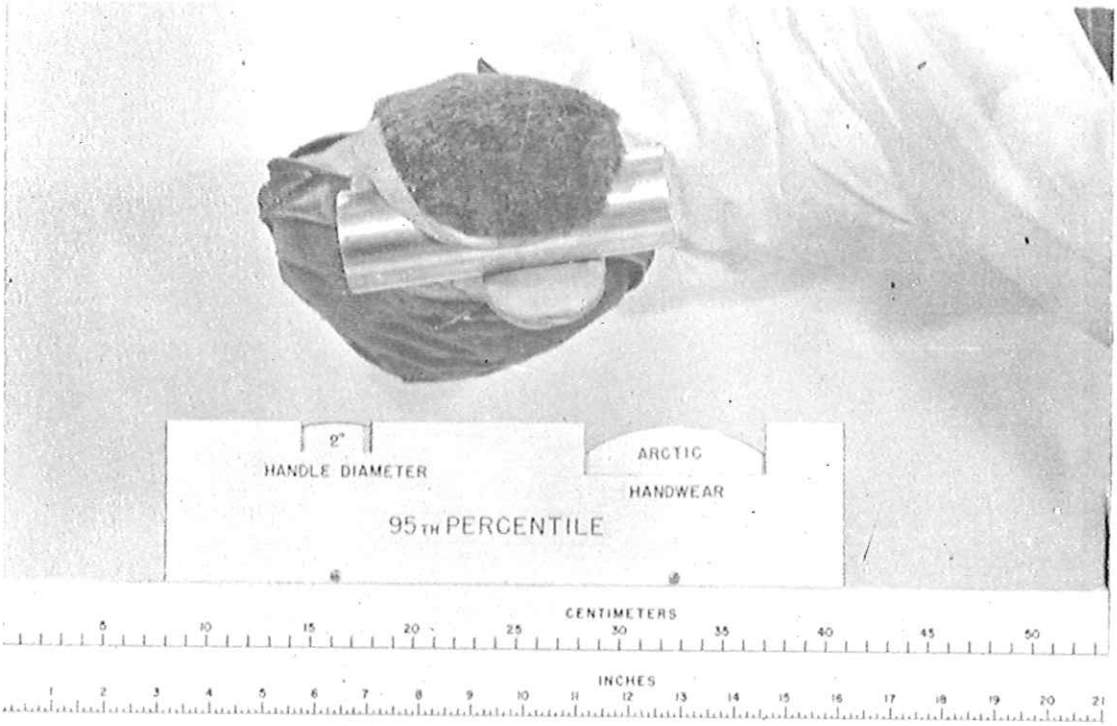

Figure 320. 2" handle diameter (View E)

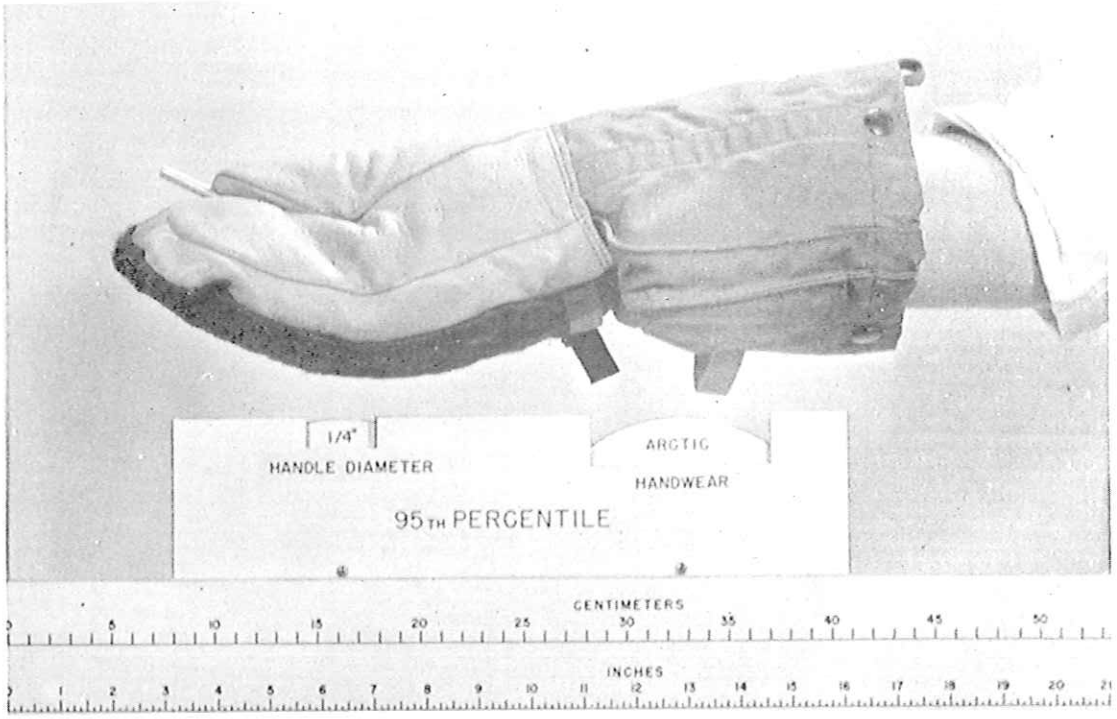

Figure 321. $\frac{1}{4}$" knob diameter (View A)

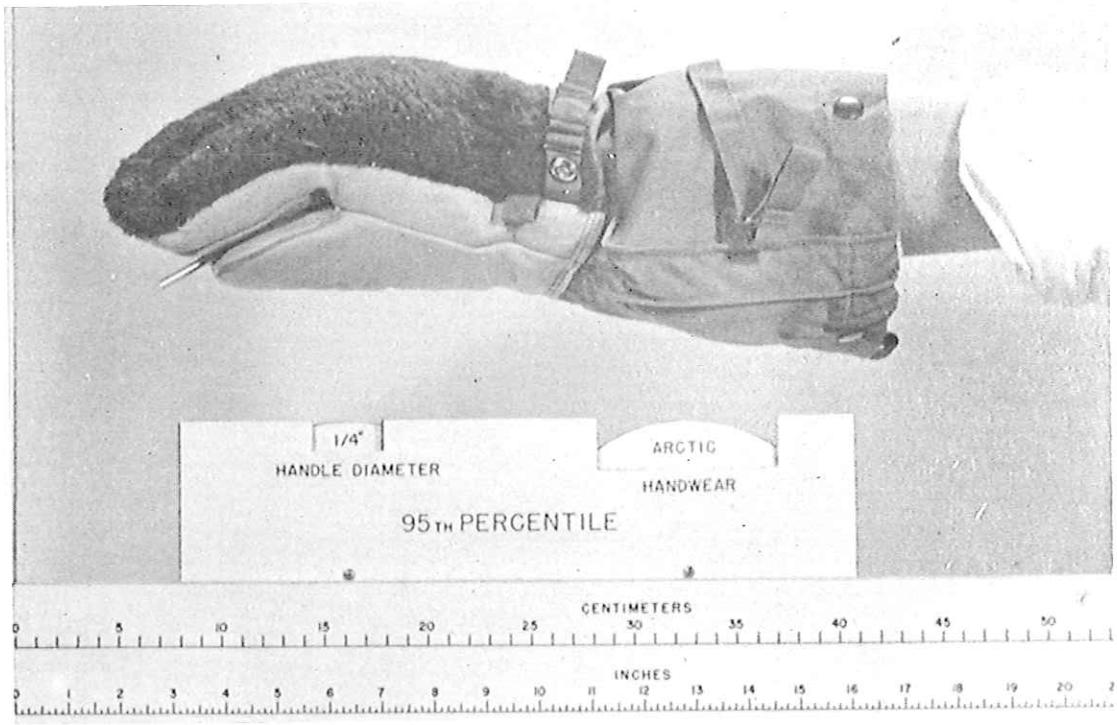

Figure 322. $\frac{1}{4}$" knob diameter (View B)

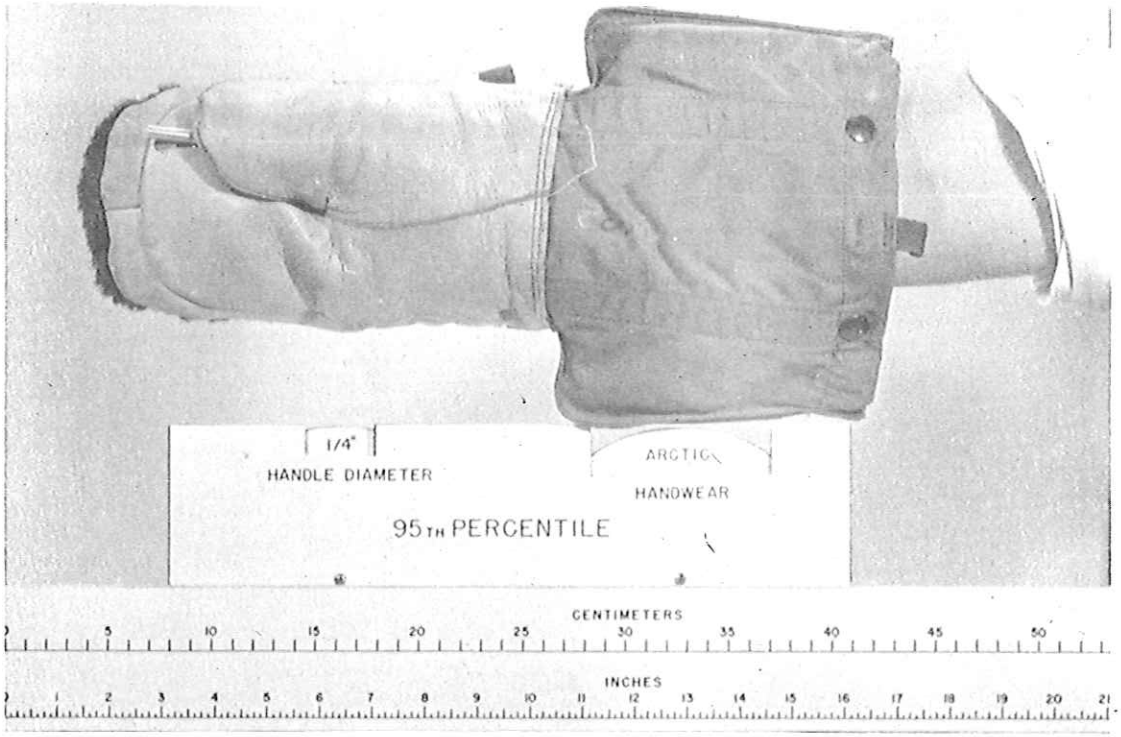

Figure 323. $\frac{1}{4}$" knob diameter (View C)

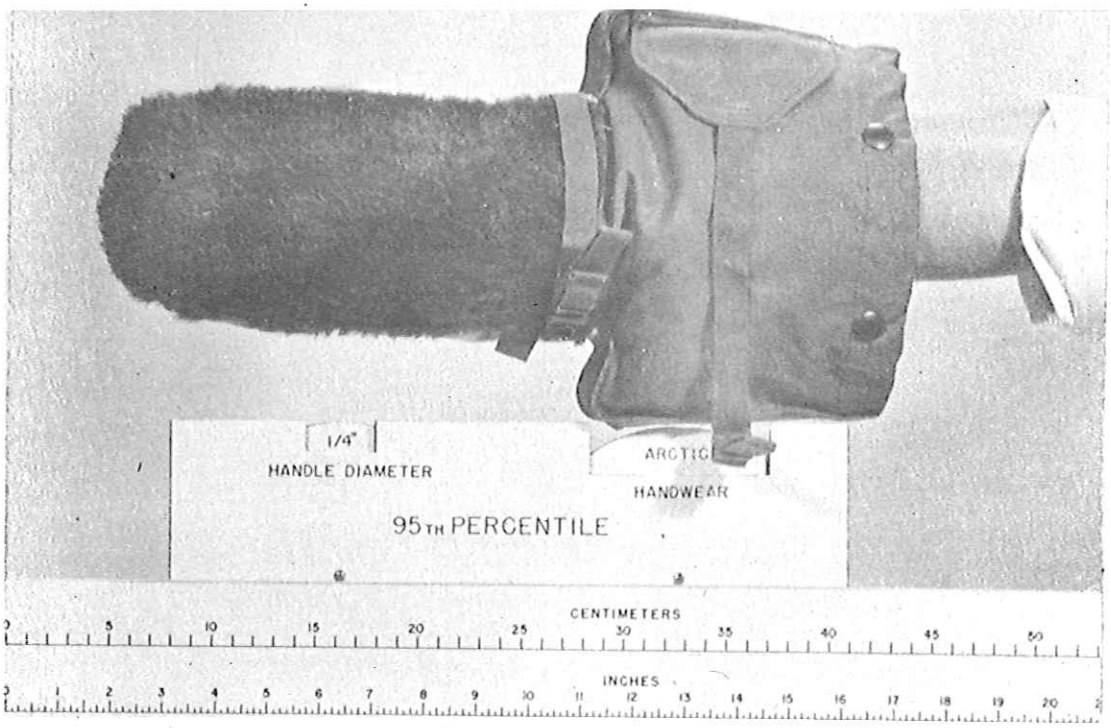

Figure 324. $\frac{1}{4}$" knob diameter (View D)

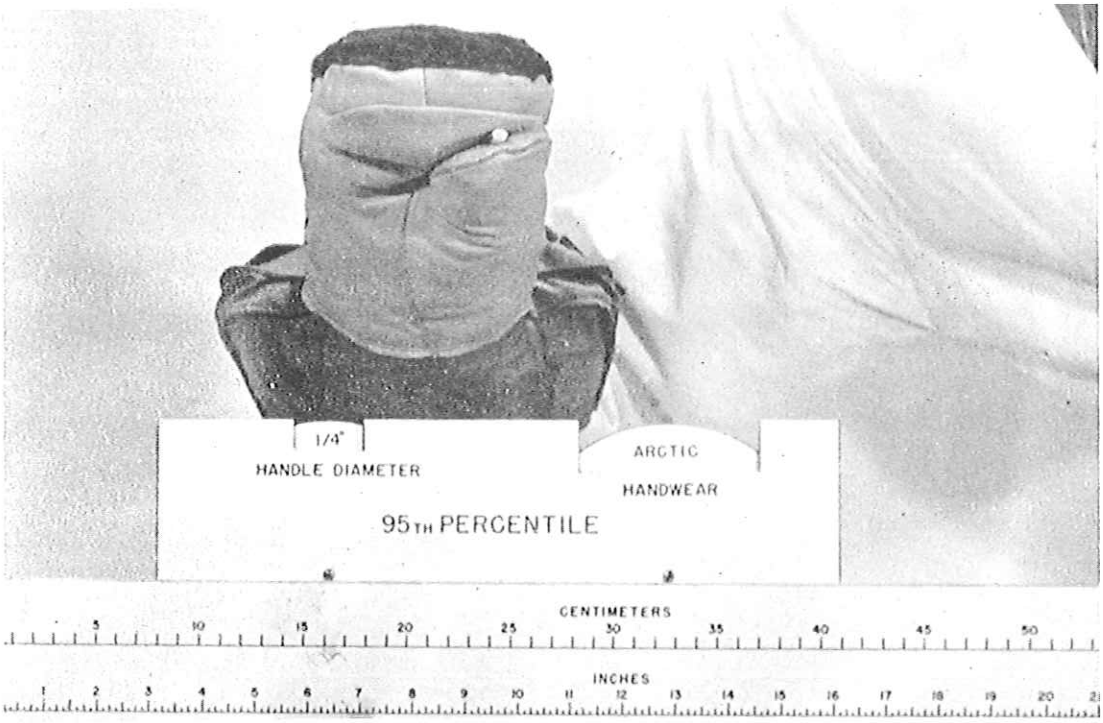

Figure 325. $\frac{1}{4}$" knob diameter (View E)

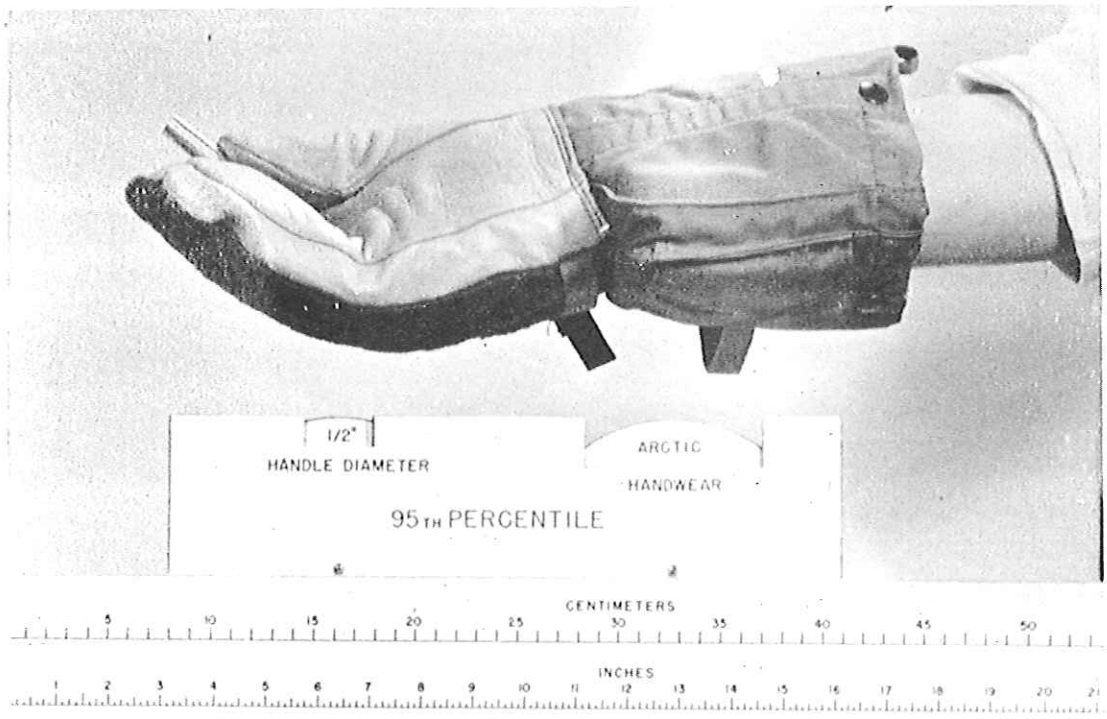

Figure 326. $\frac{1}{2}$" knob diameter (View A)

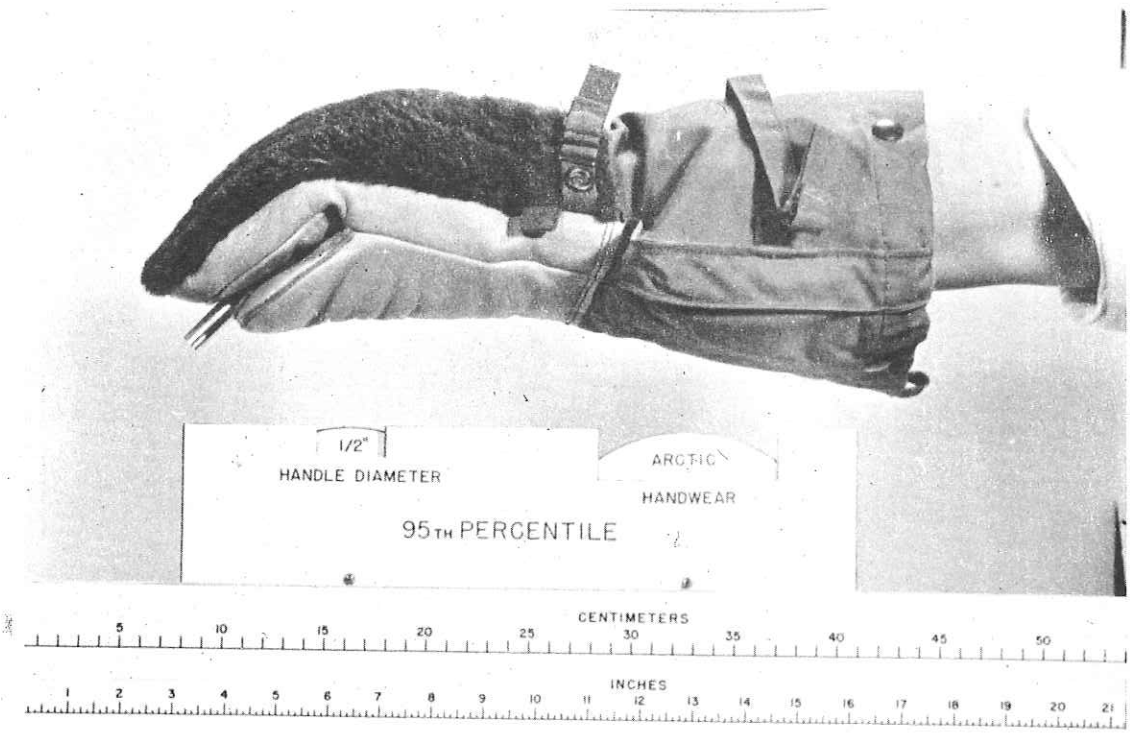

Figure 327. ½" knob diameter (View B)

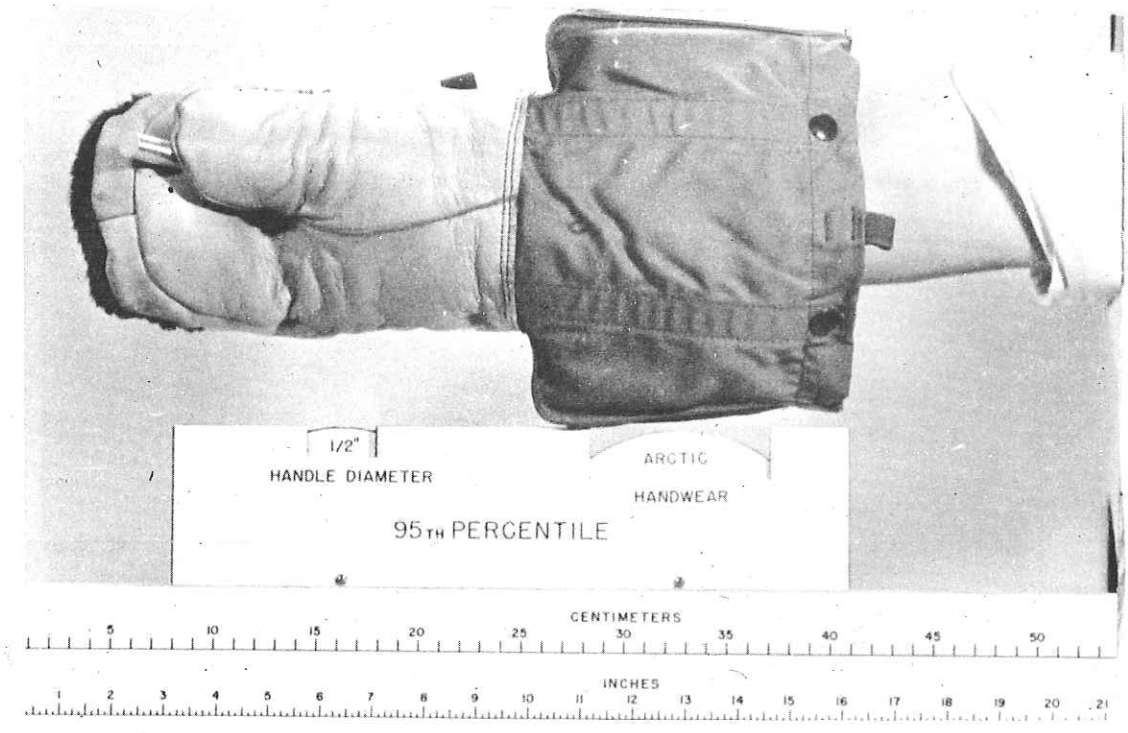

Figure 328. ½" knob diameter (View C)

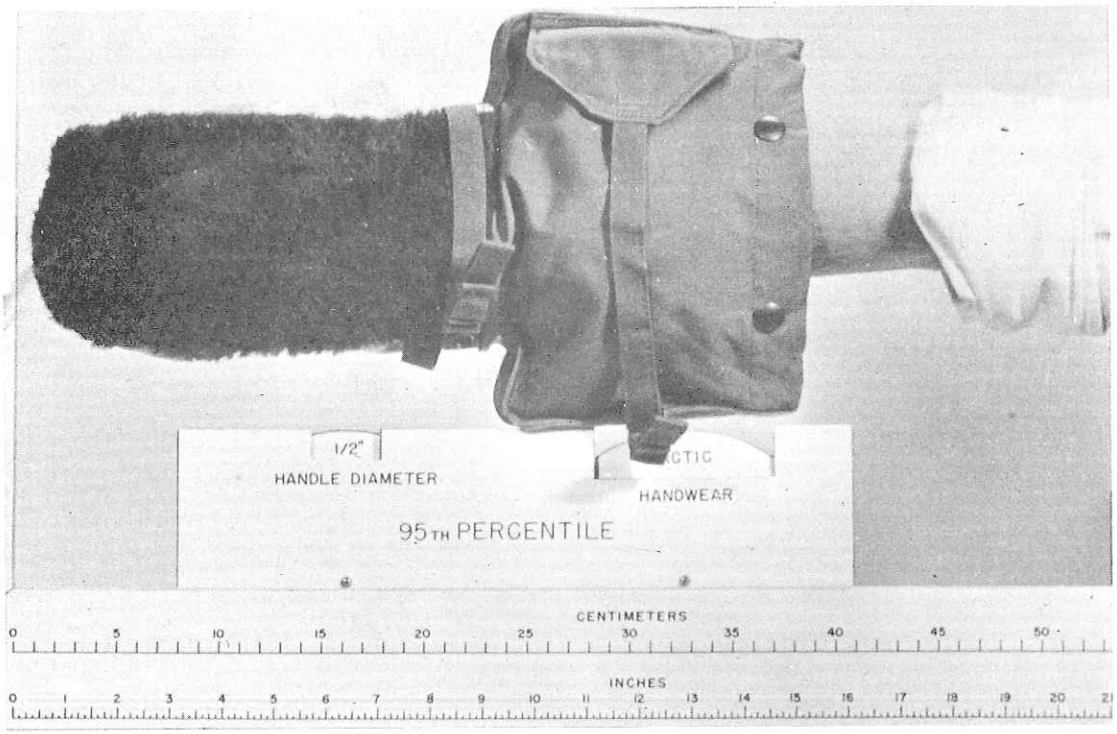

Figure 329. ½" knob diameter (View D)

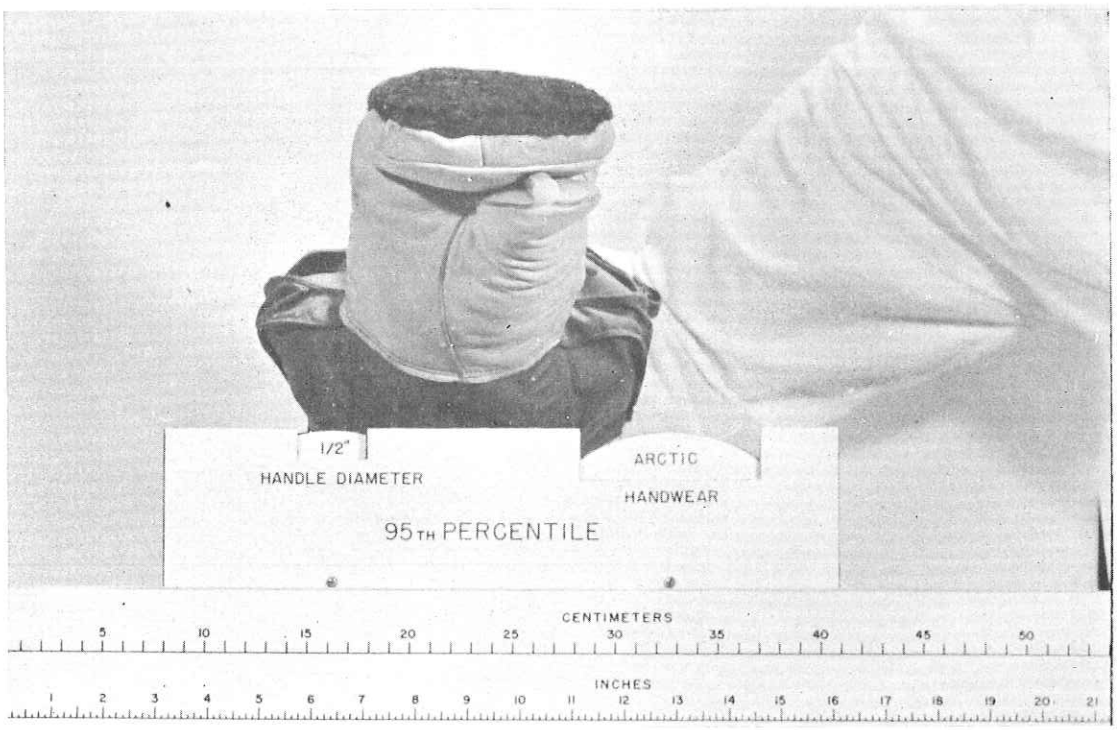

Figure 330. ½" knob diameter (View E)

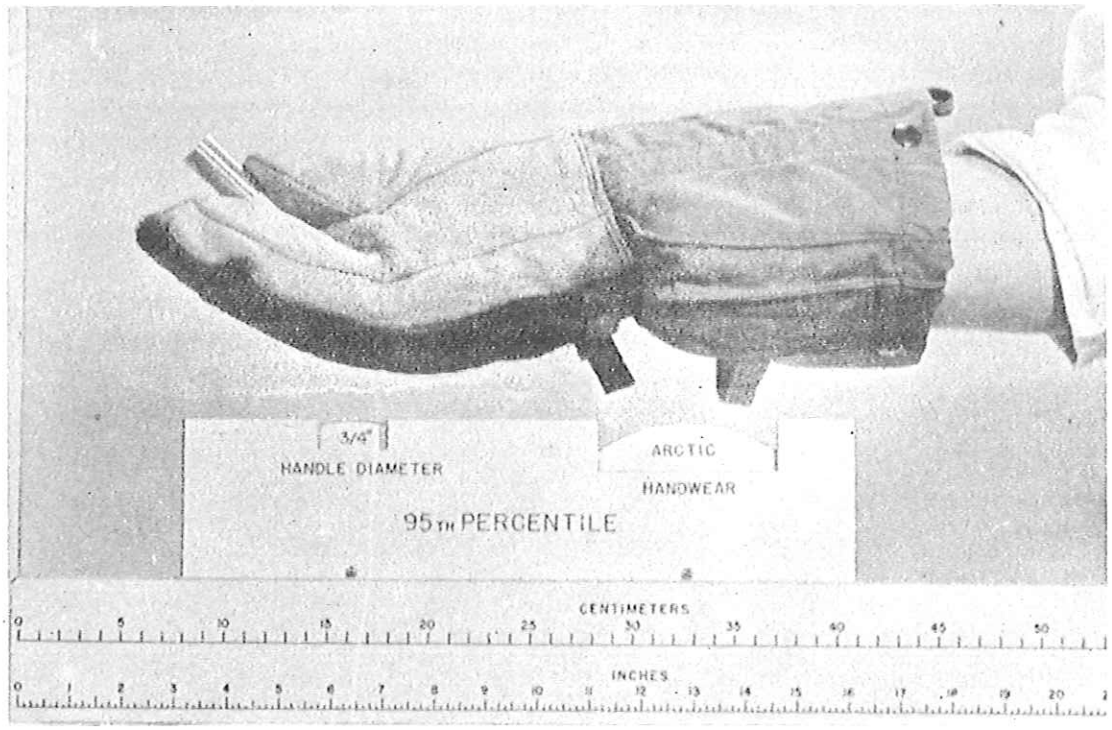

Figure 331. 3/4" knob diameter (View A)

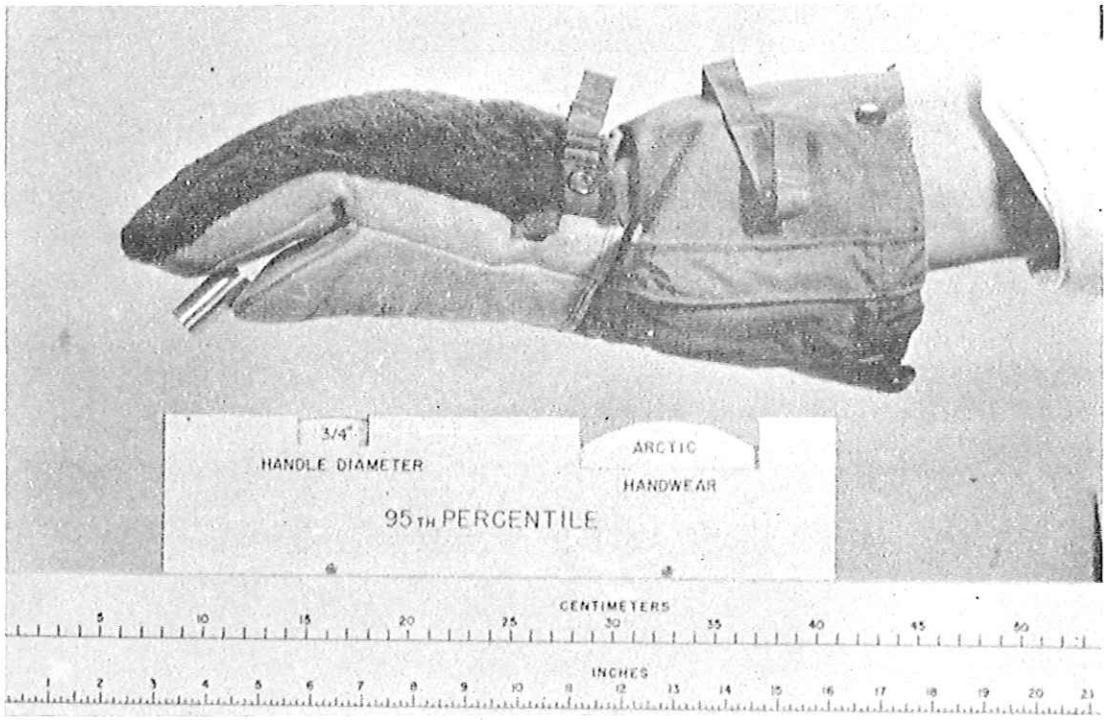

Figure 332. 3/4" knob diameter (View B)

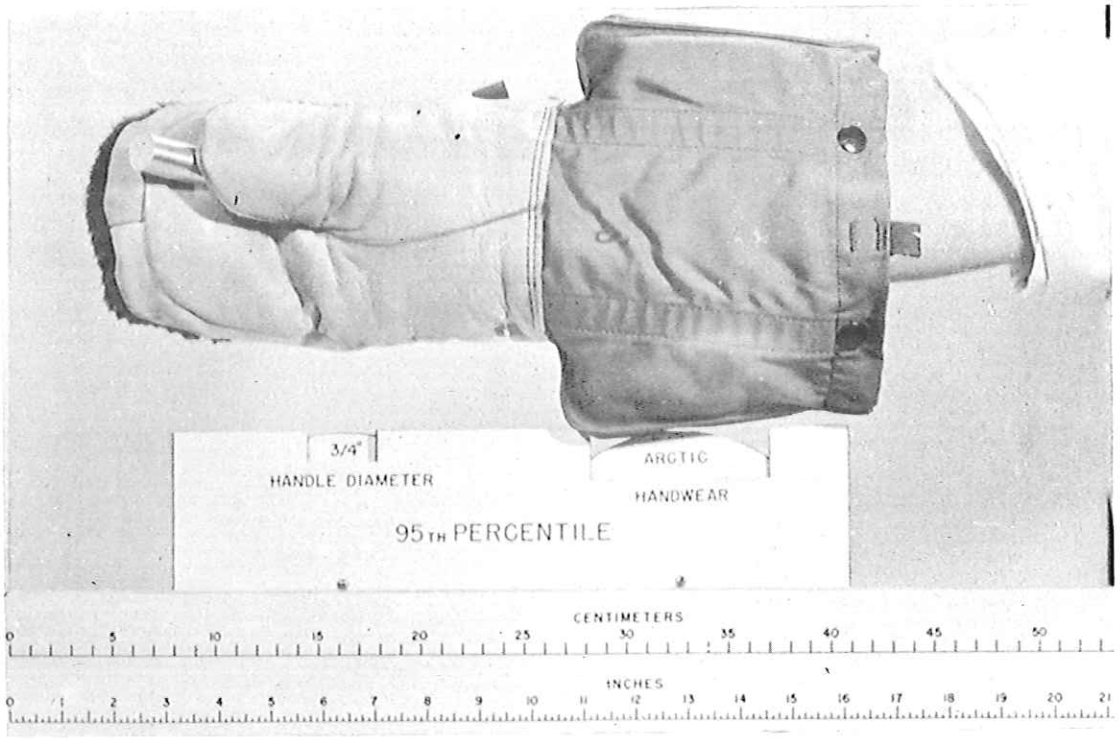

Figure 333. 3/4" knob diameter (View C)

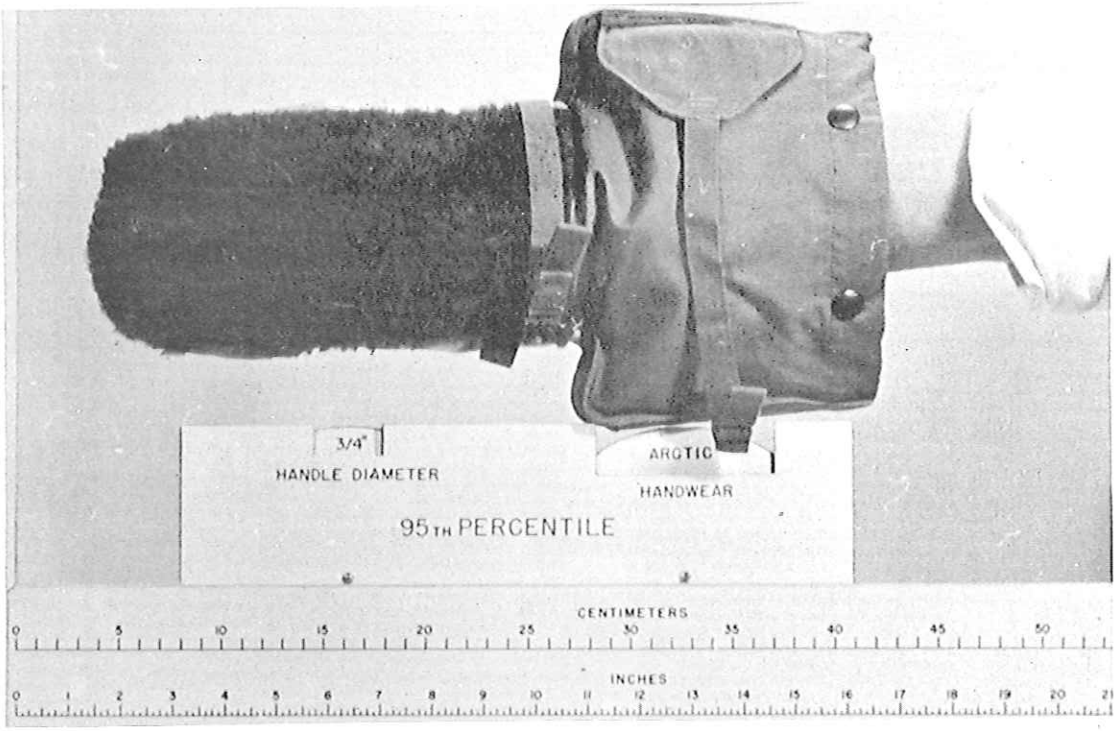

Figure 334. 3/4" knob diameter (View D)

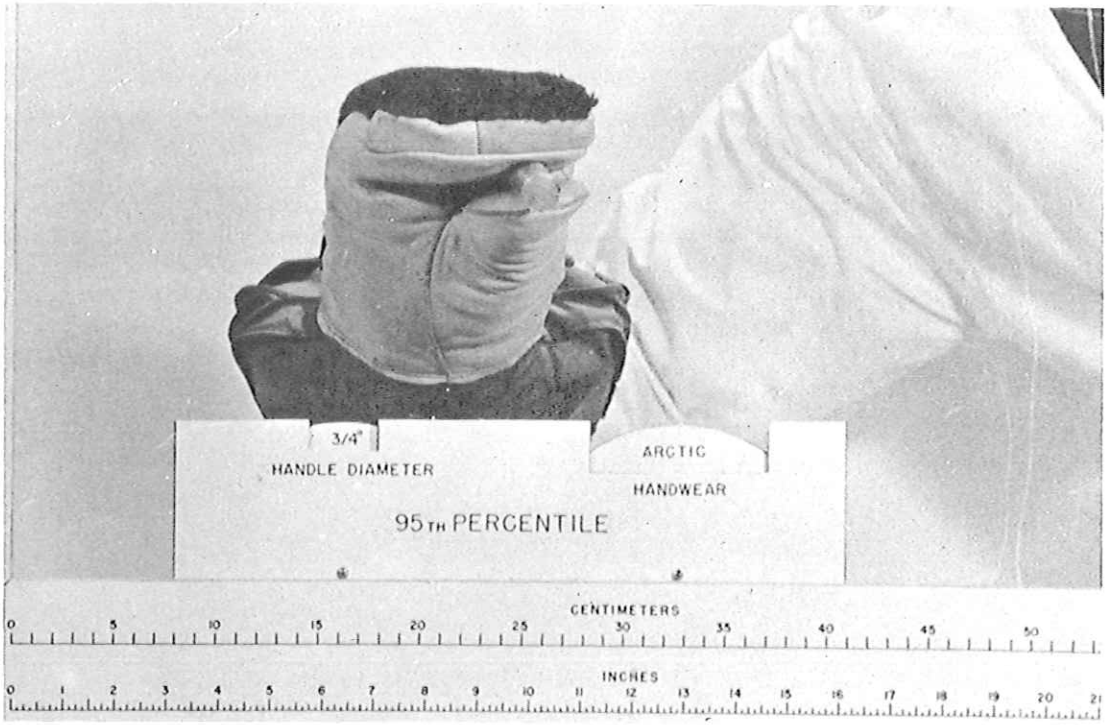

Figure 335. 3/4" knob diameter (View E)

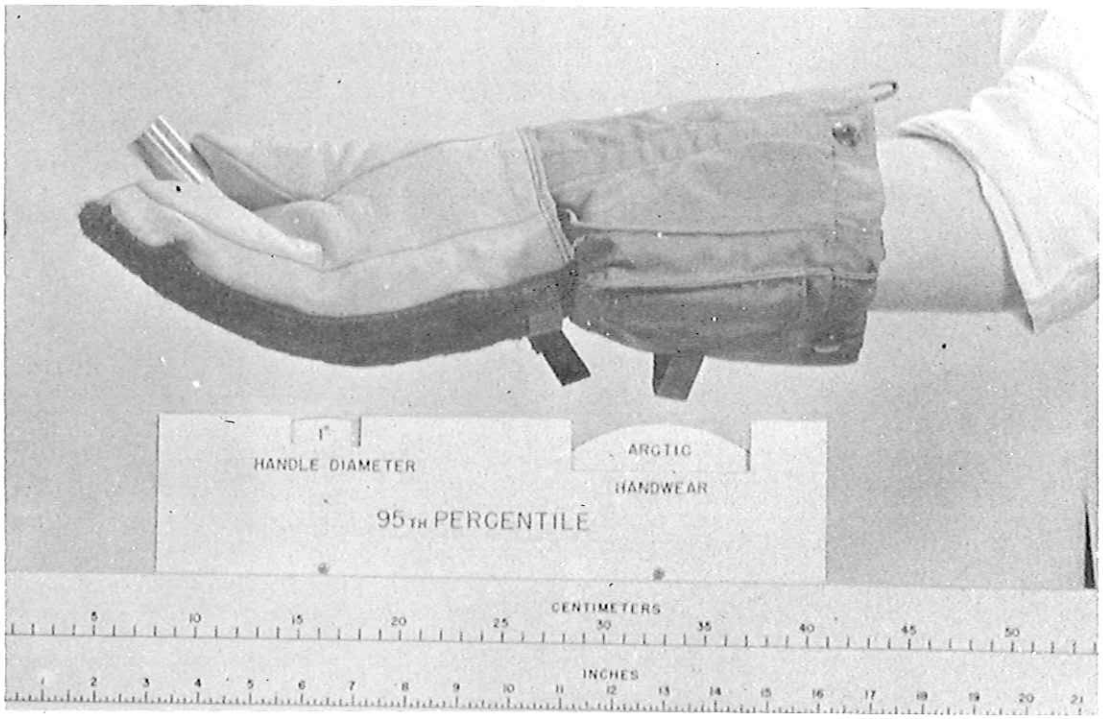

Figure 336. 1" knob diameter (View A)

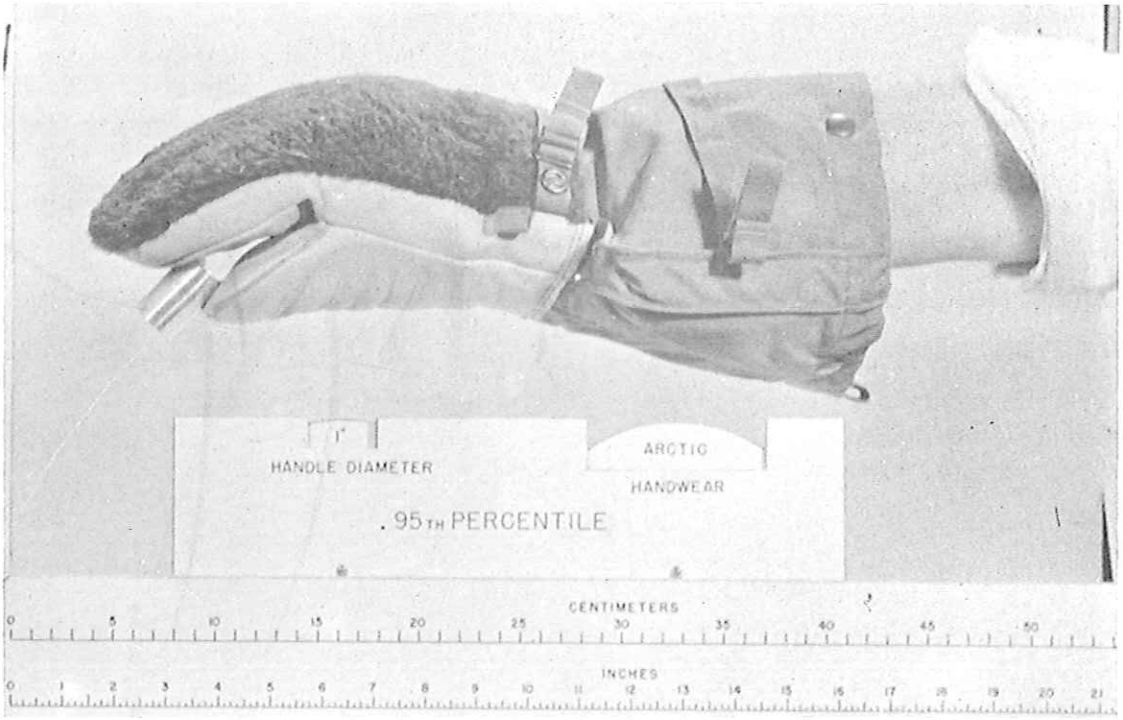

Figure 337. 1" knob diameter (View B)

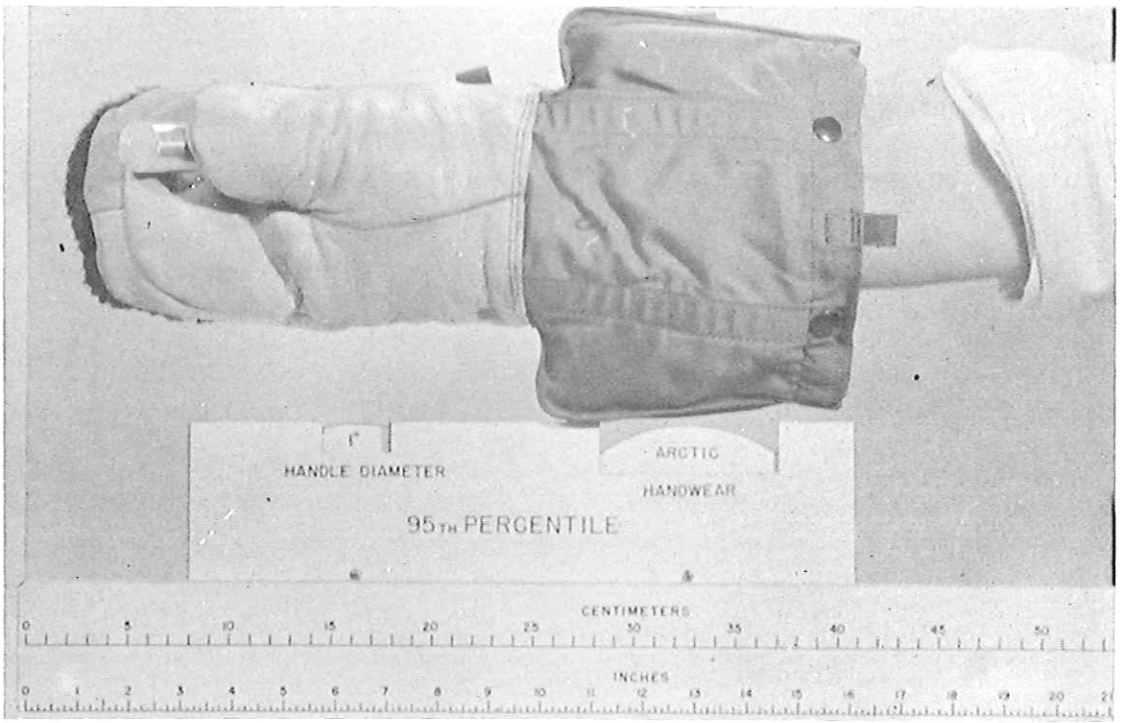

Figure 338. 1" knob diameter (View C)

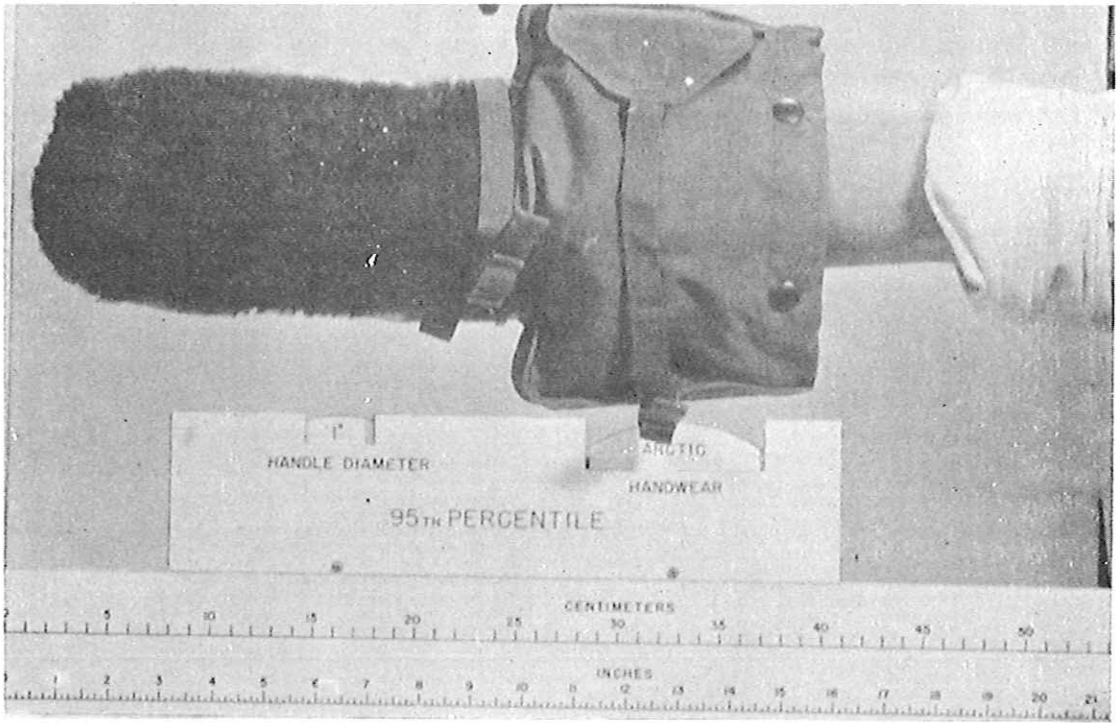

Figure 339. 1" knob diameter (View D)

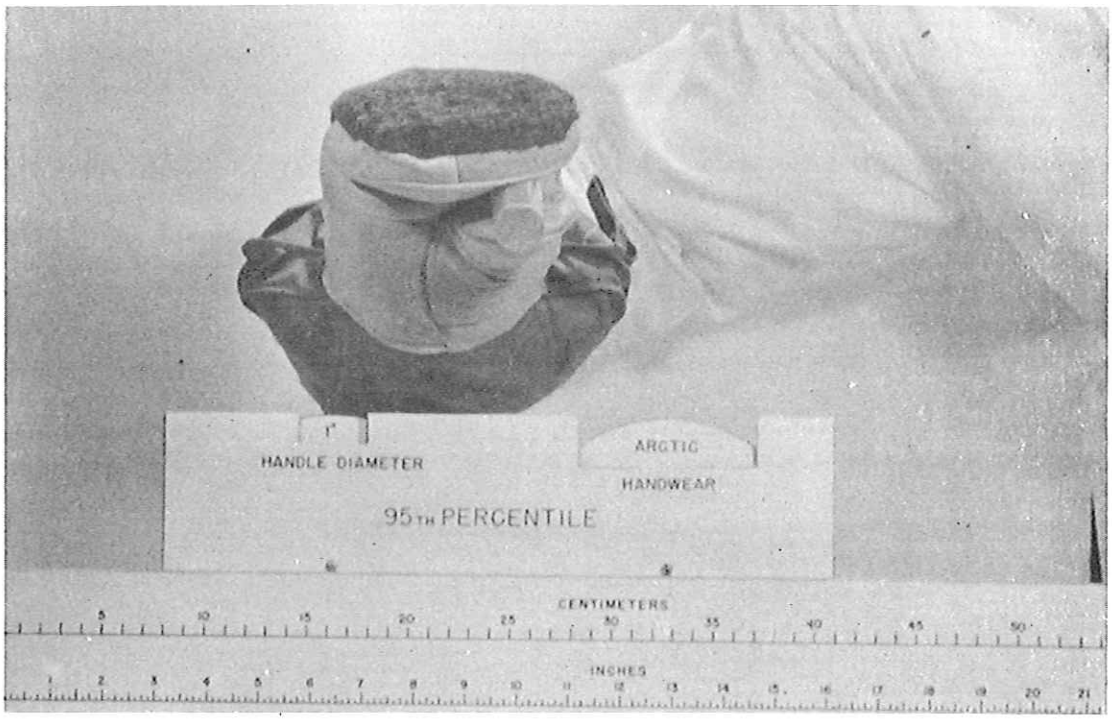

Figure 340. 1" knob diameter (View E)

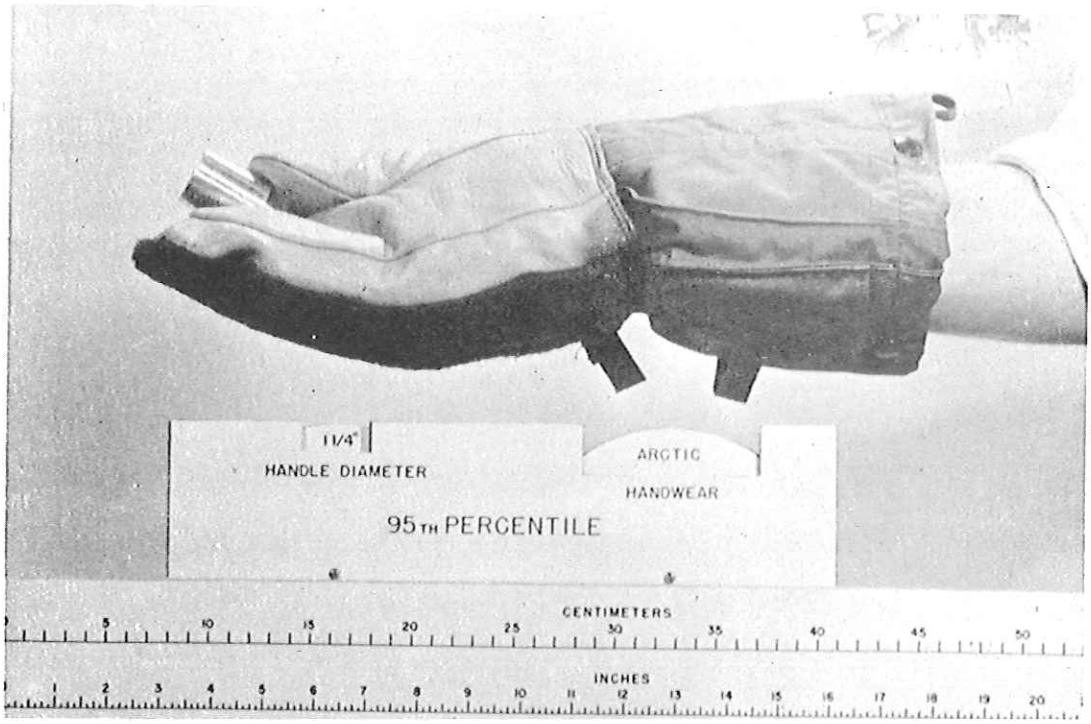

Figure 341. 1¼" knob diameter (View A)

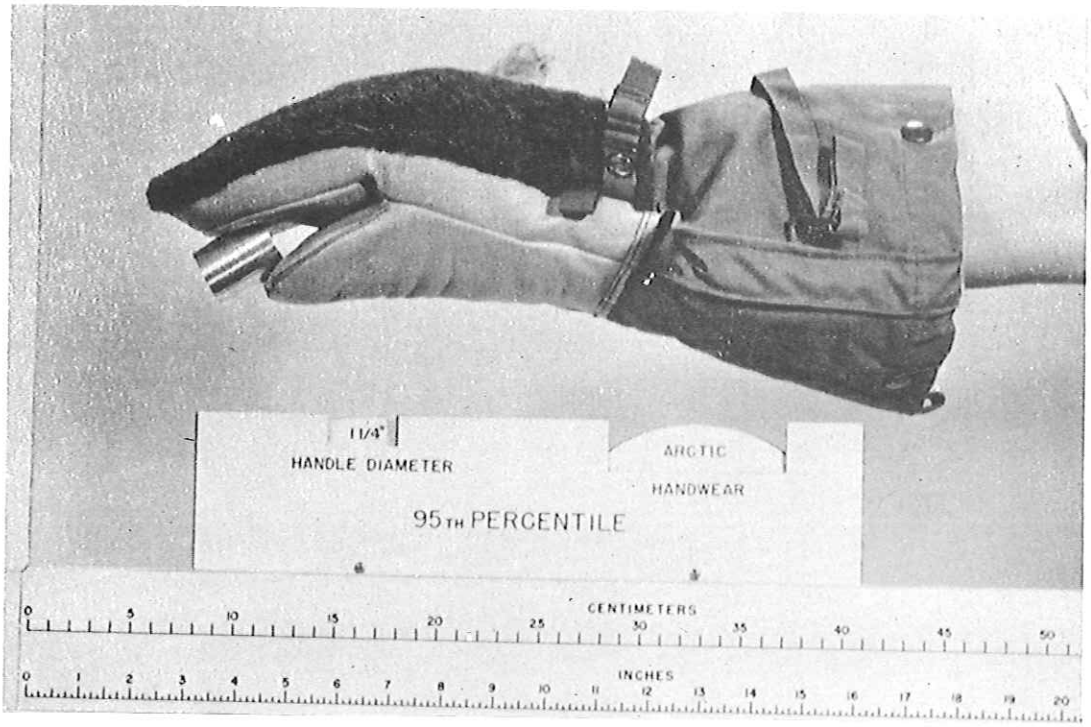

Figure 342. 1¼" knob diameter (View B)

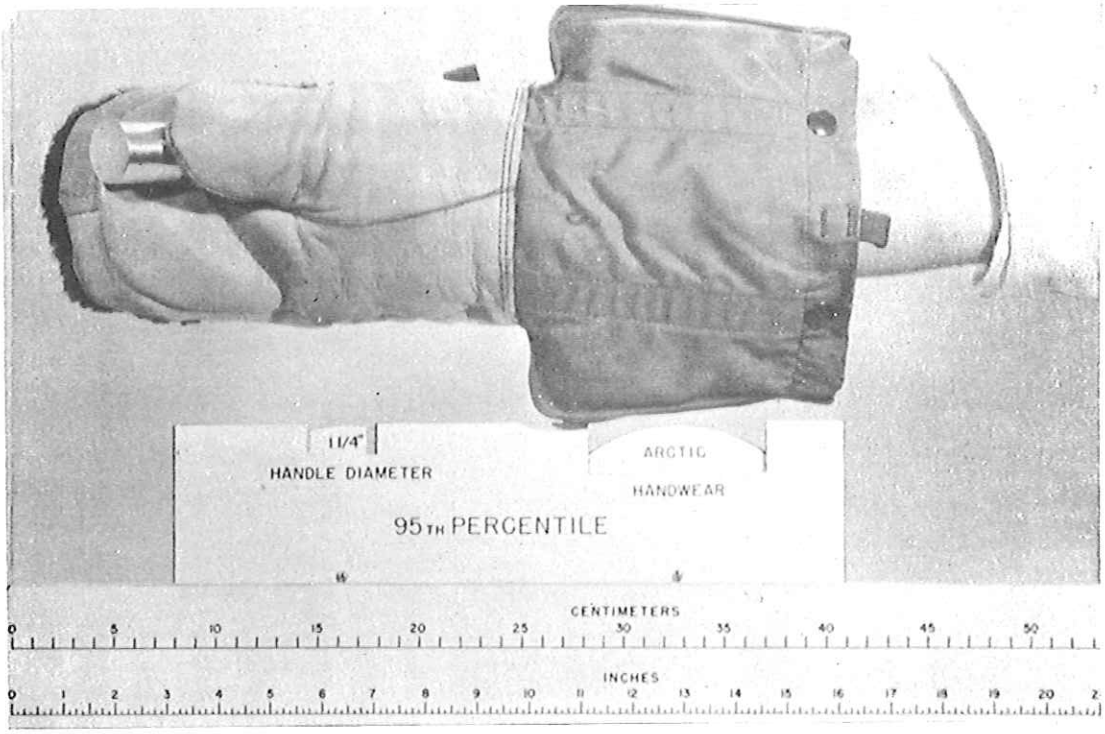

Figure 343. $1\frac{1}{4}$" knob diameter (View C)

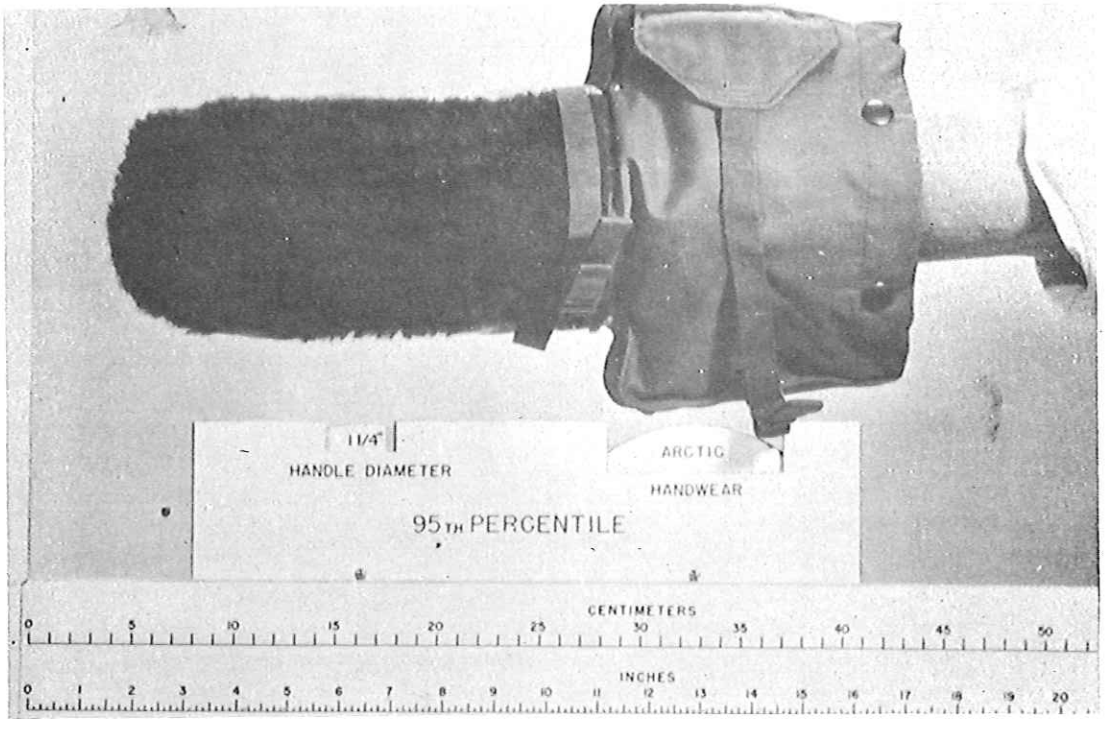

Figure 344. $1\frac{1}{4}$" knob diameter (View D)

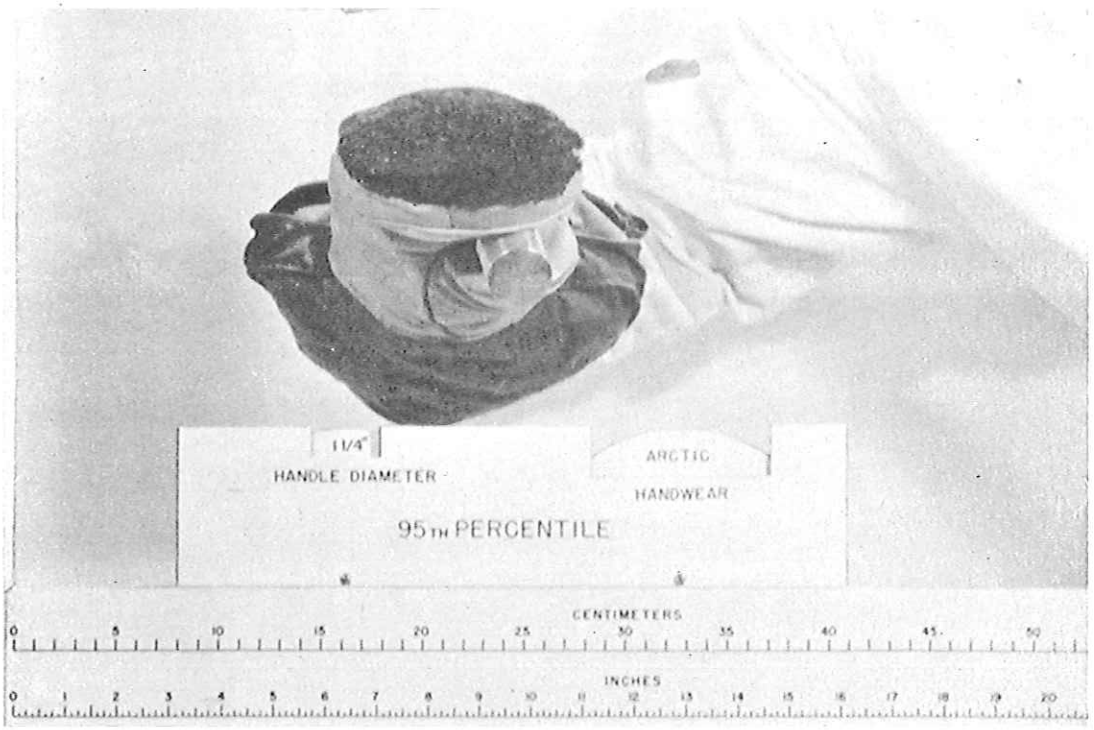

Figure 345. 1¼" knob diameter (View E)

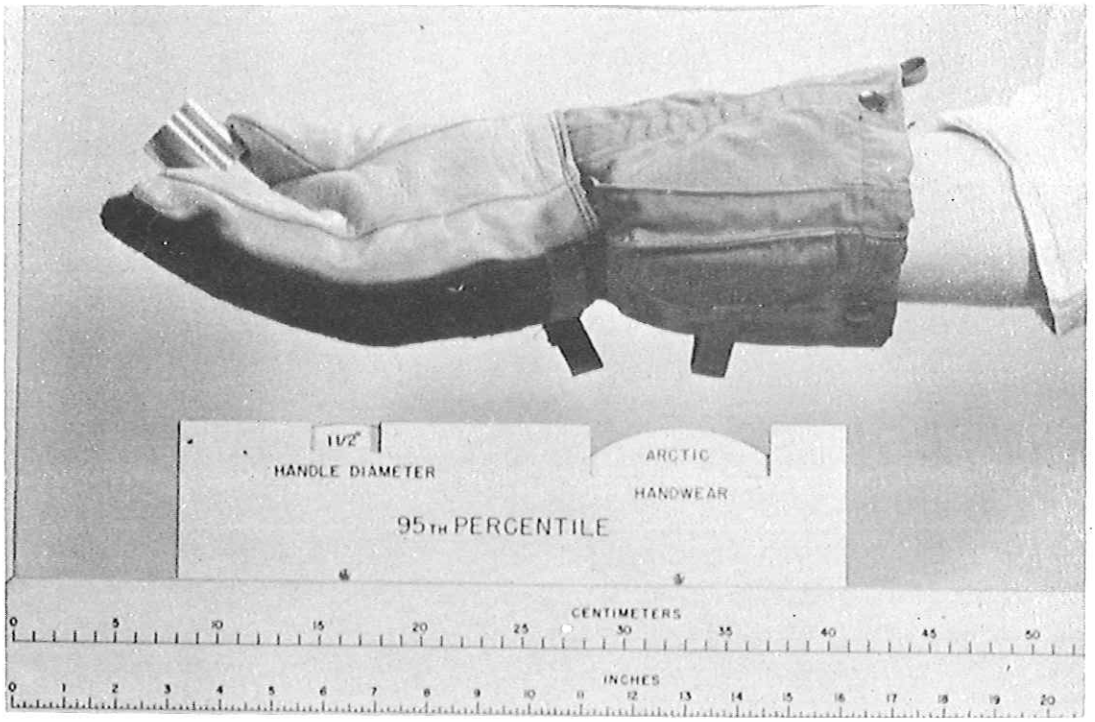

Figure 346. 1½" knob diameter (View A)

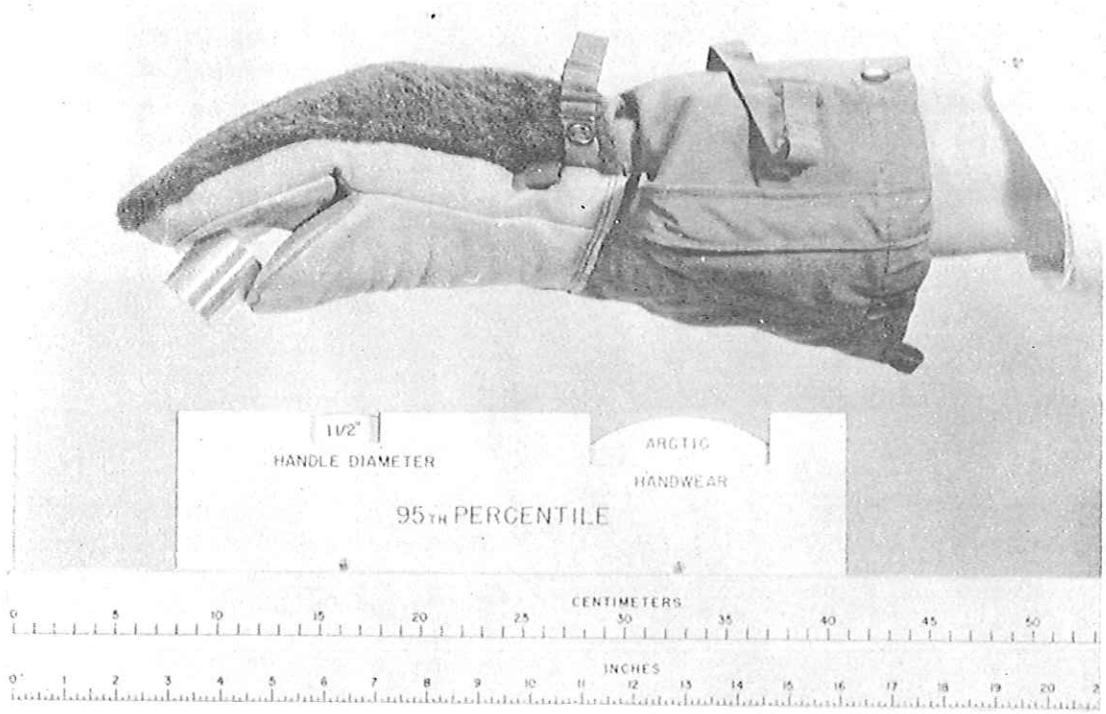

Figure 347. 1½" knob diameter (View B)

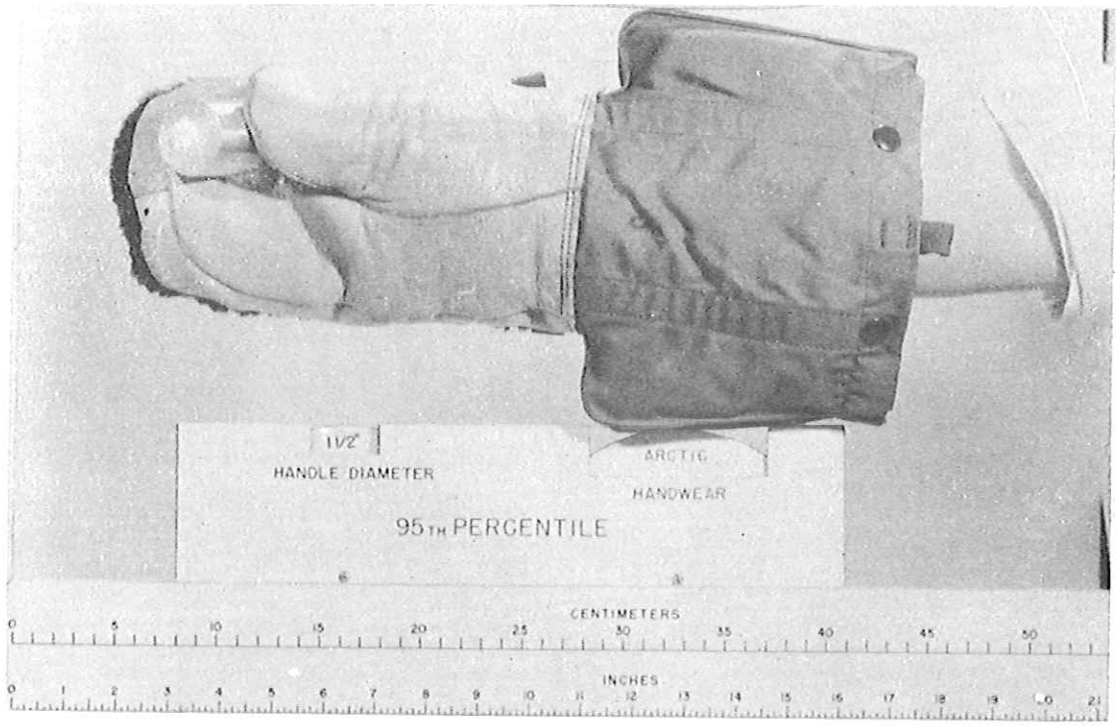

Figure 348. 1½" knob diameter (View C)

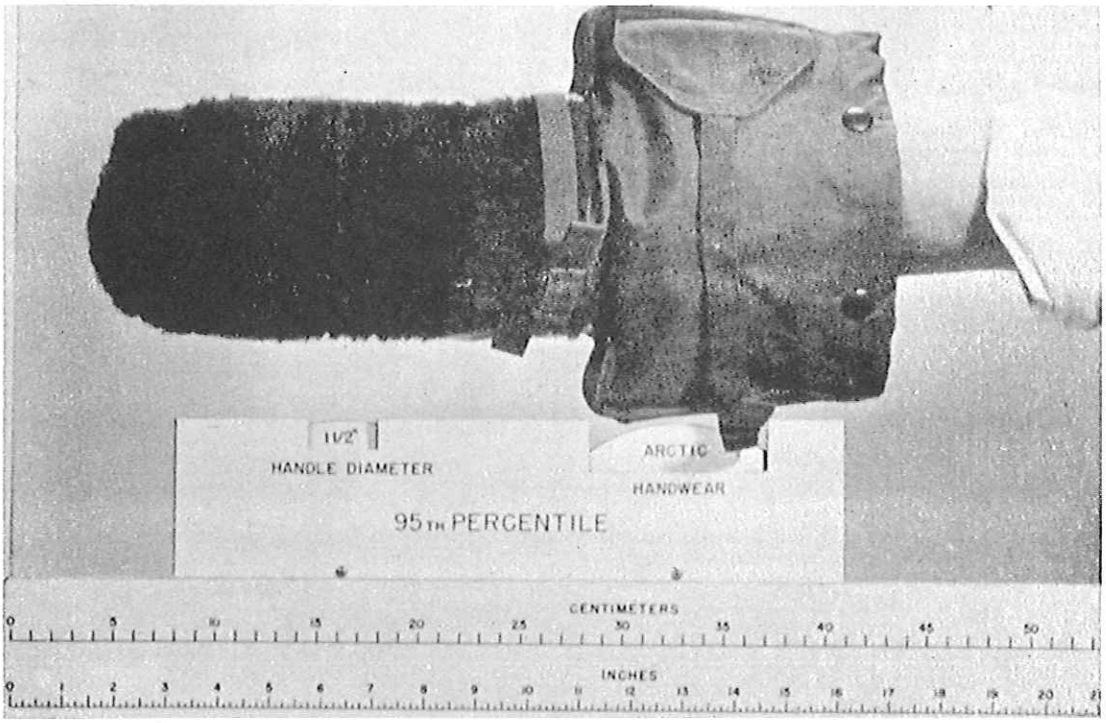

Figure 349. 1½" knob diameter (View D)

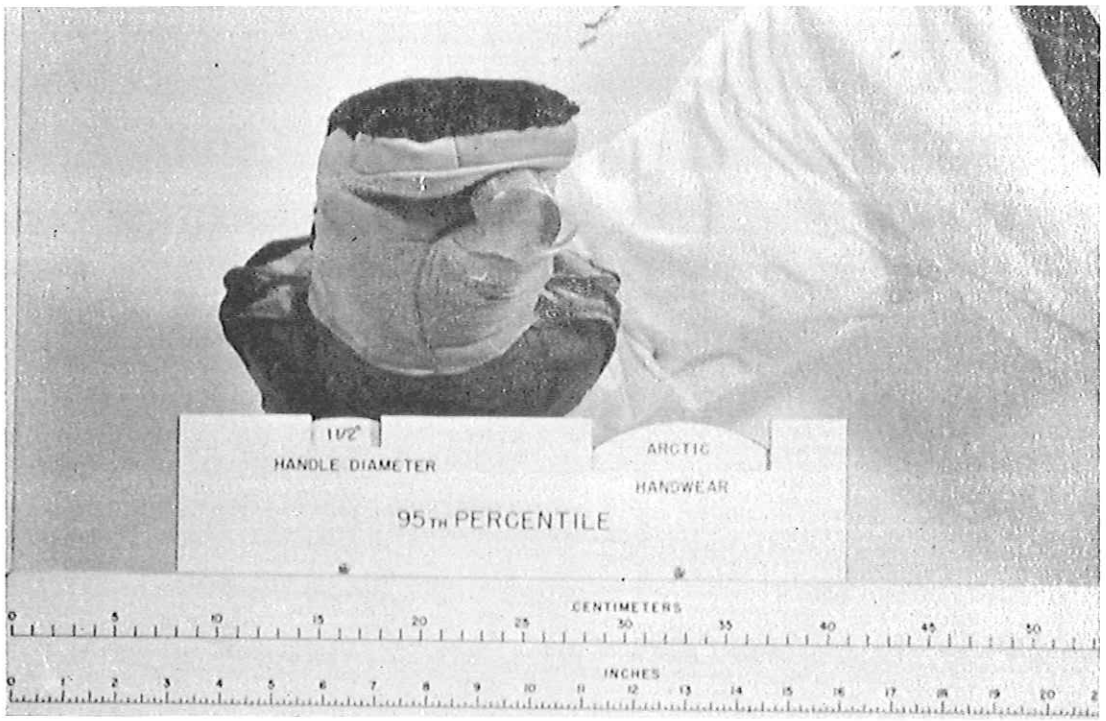

Figure 350. 1½" knob diameter (View E)

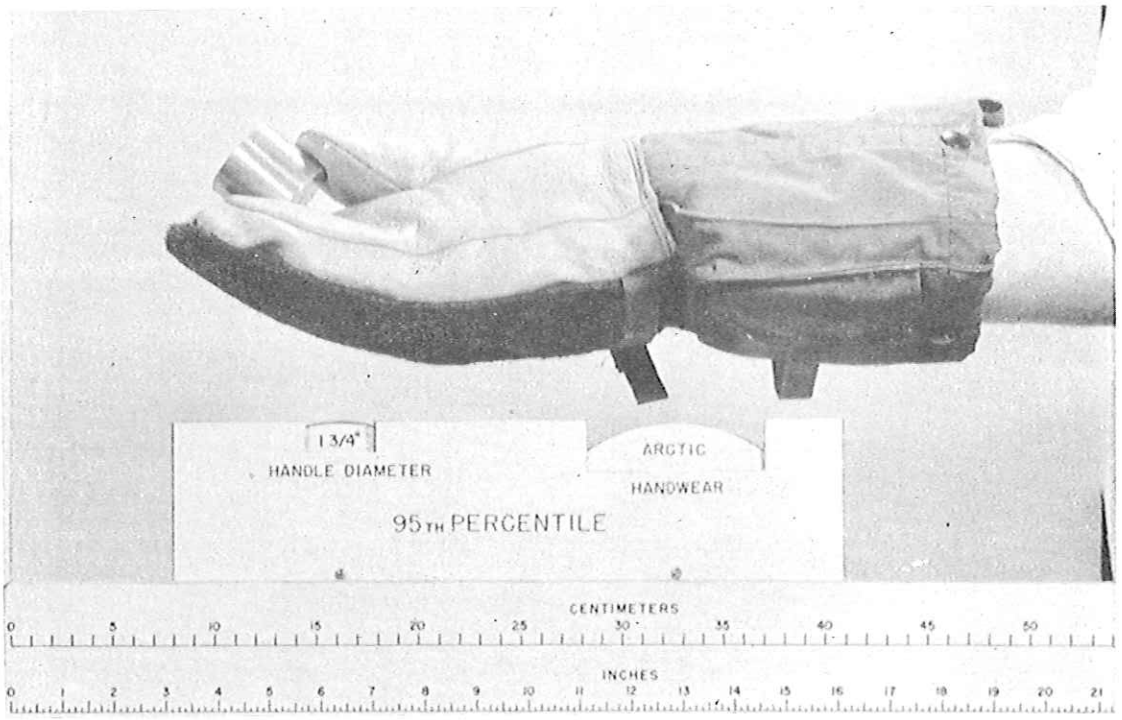

Figure 351. 1 3/4" knob diameter (View A)

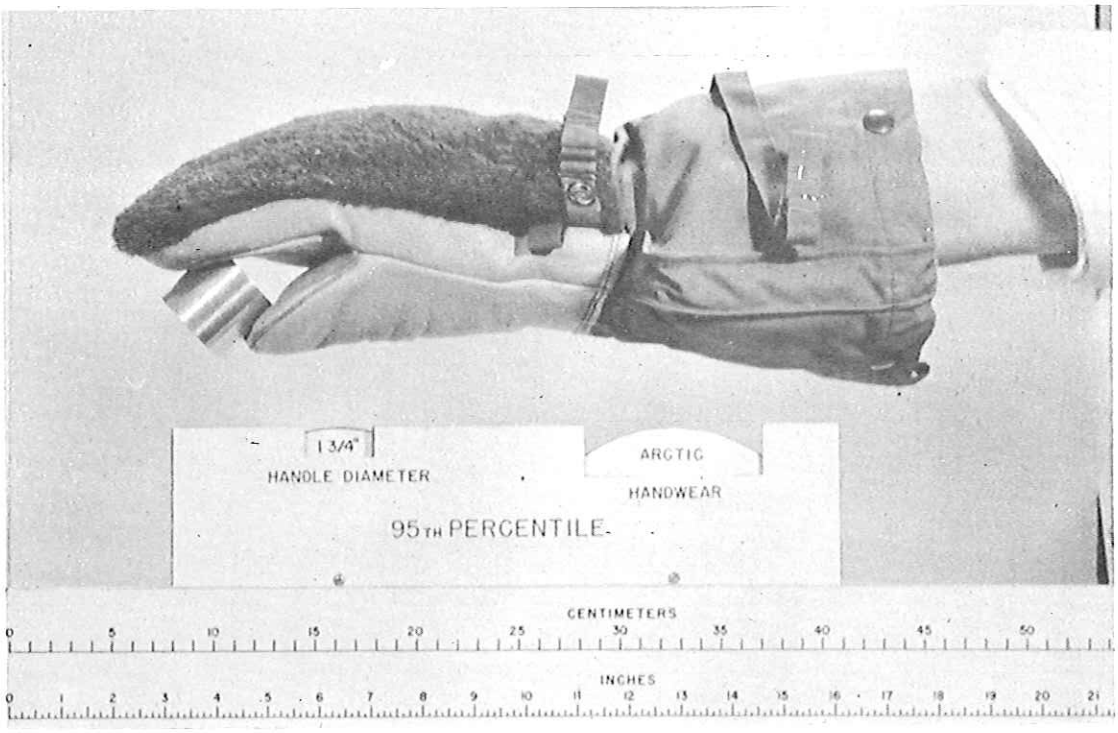

Figure 352. 1 3/4" knob diameter (View B)

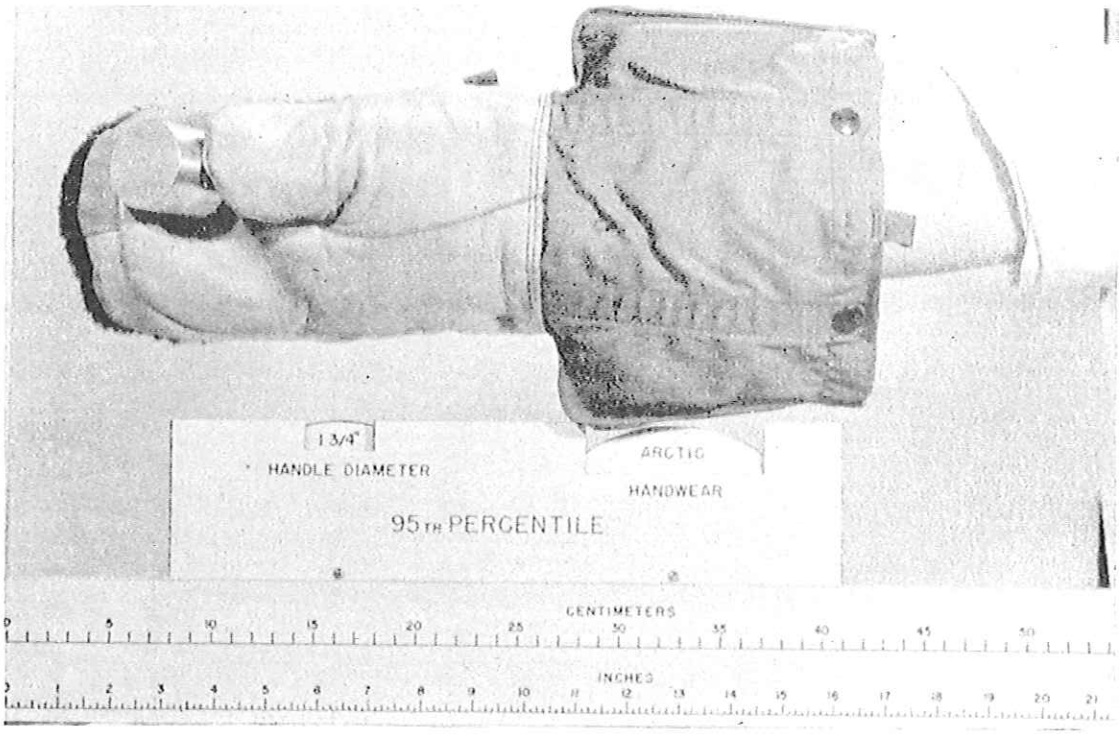

Figure 353. 1 3/4" knob diameter (View C)

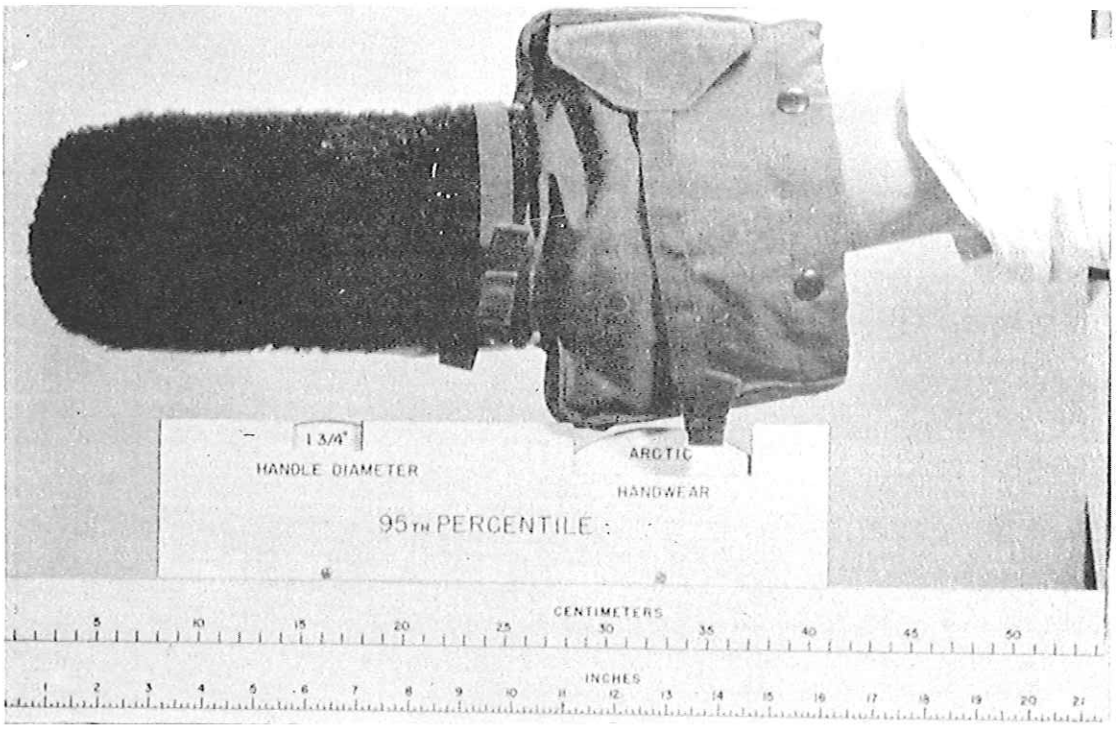

Figure 354. 1 3/4" knob diameter (View D)

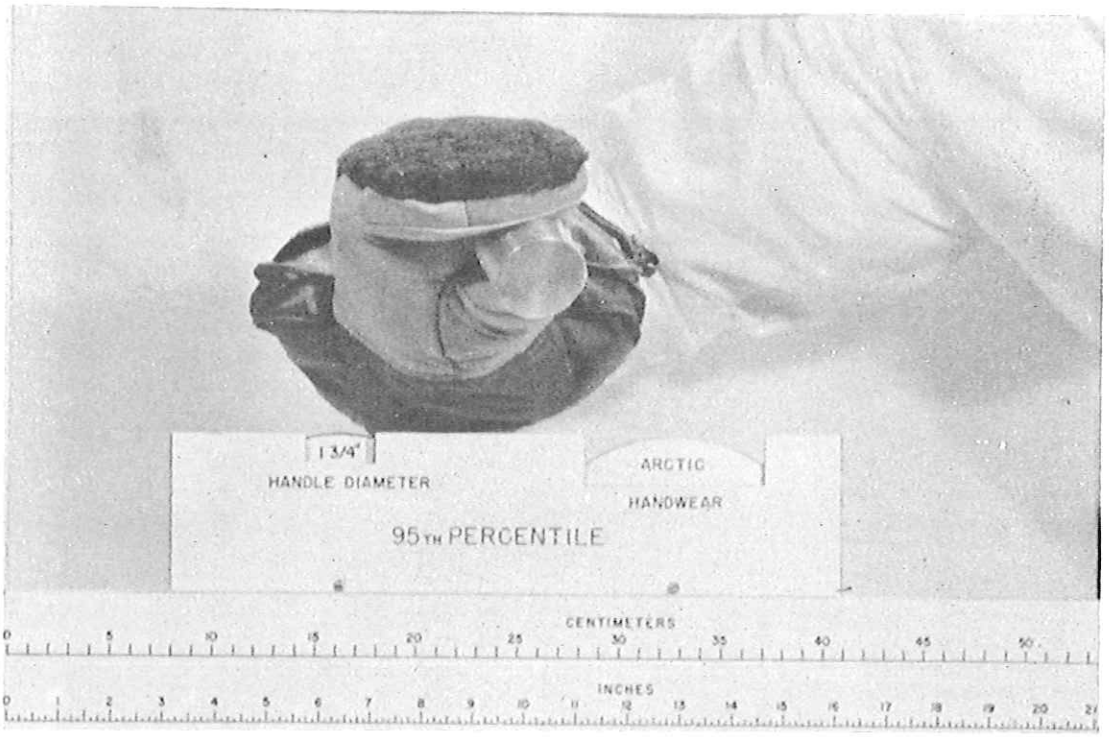

Figure 355. 1 3/4" knob diameter (View E)

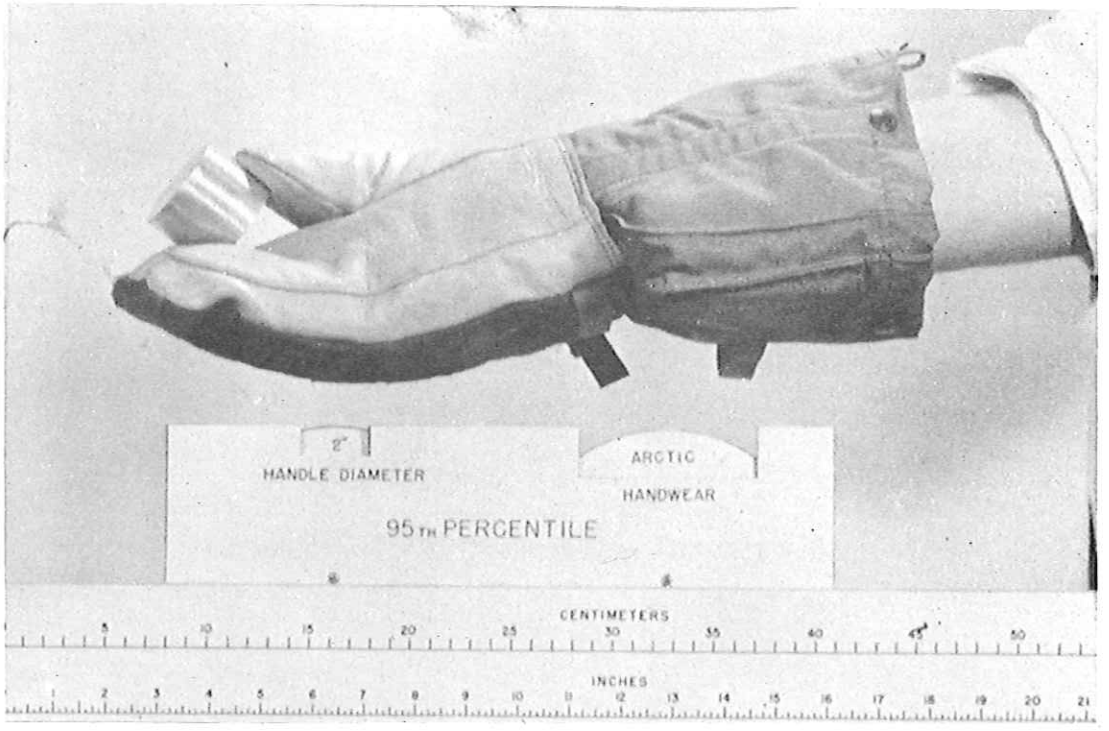

Figure 356. 2" knob diameter (View A)

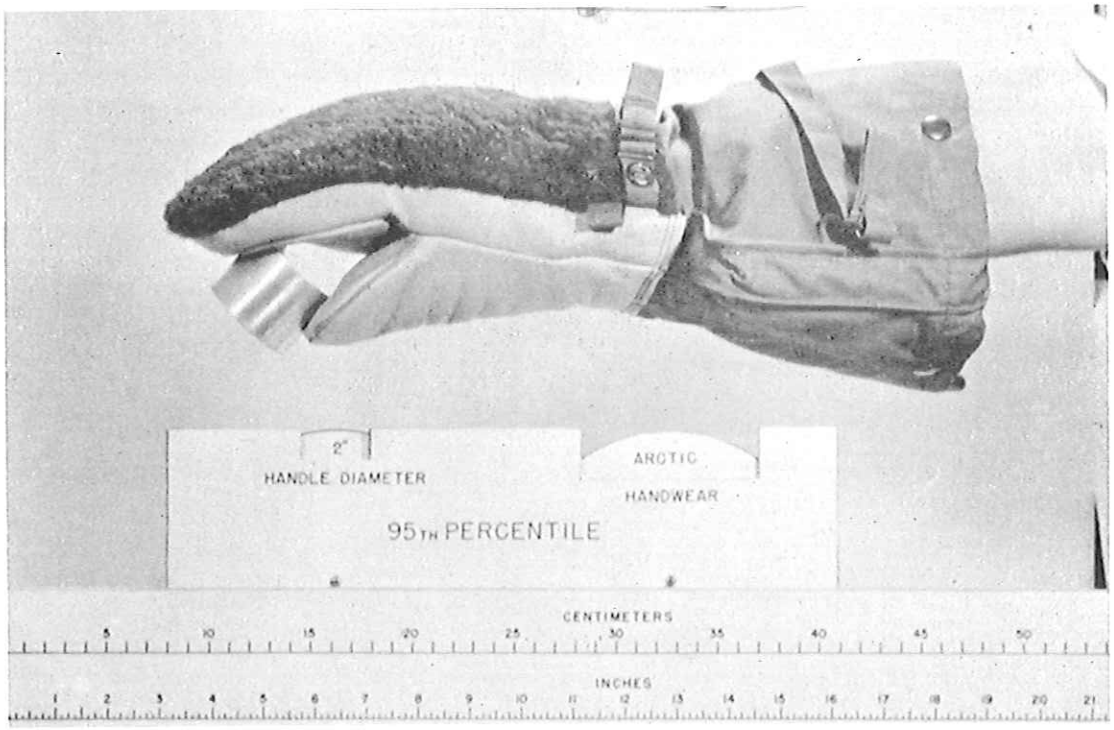

Figure 357. 2" knob diameter (View B)

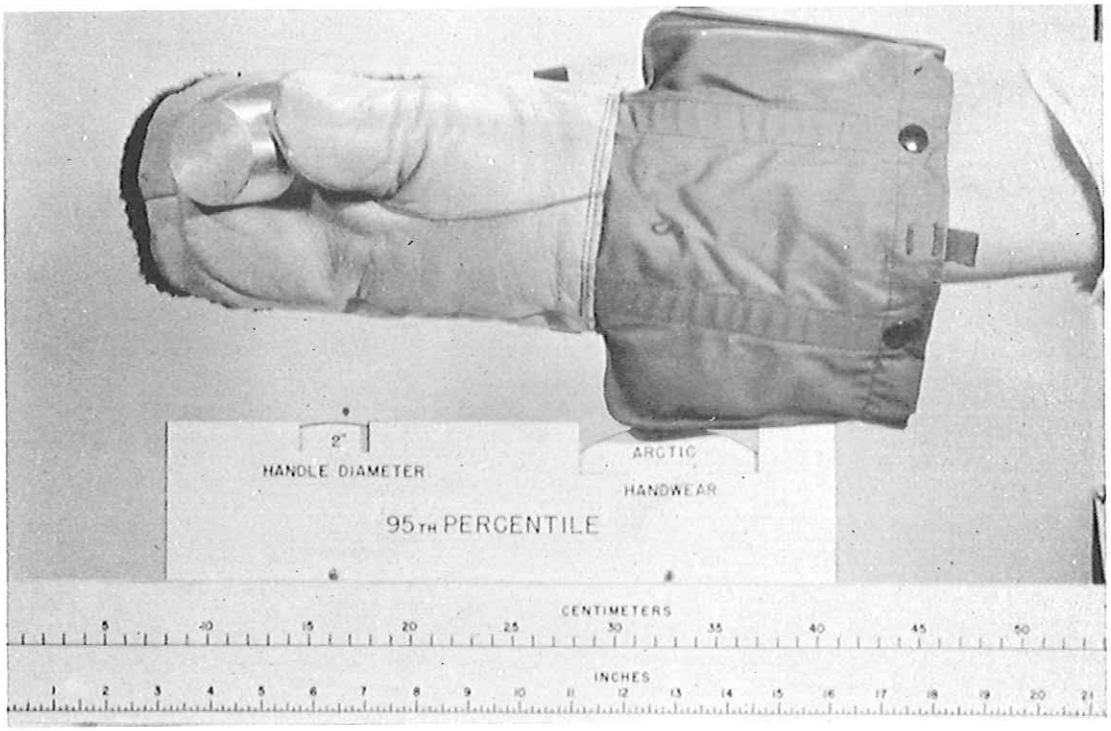

Figure 358. 2" knob diameter (View C)

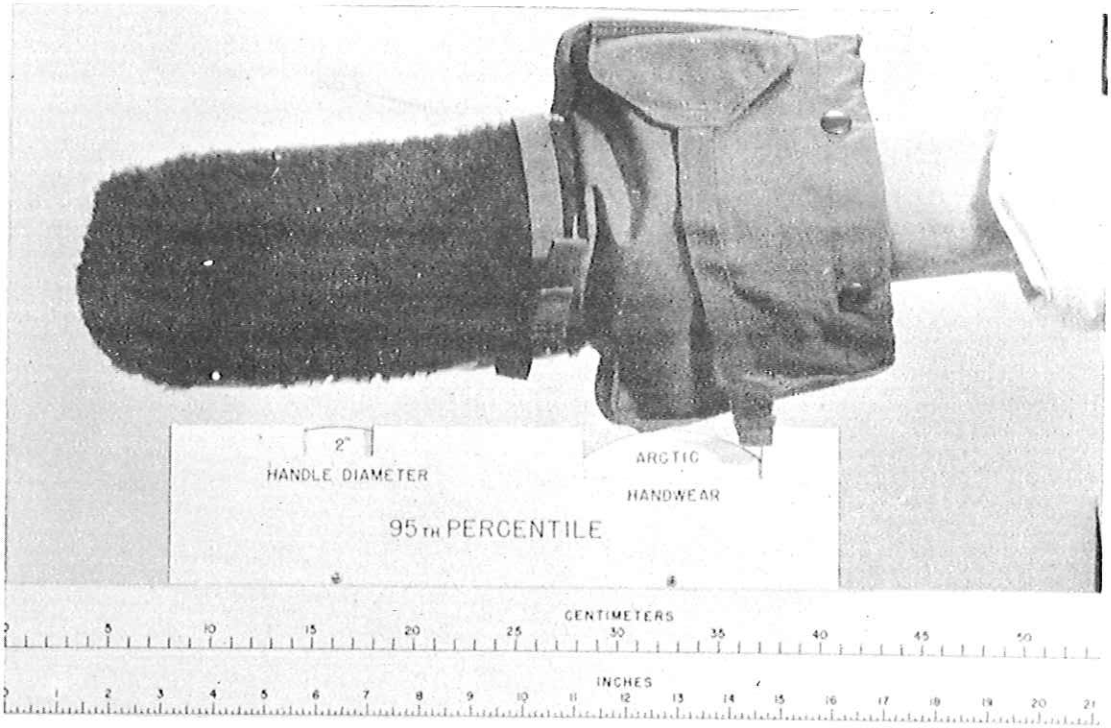

Figure 359. 2" knob diameter (View D)

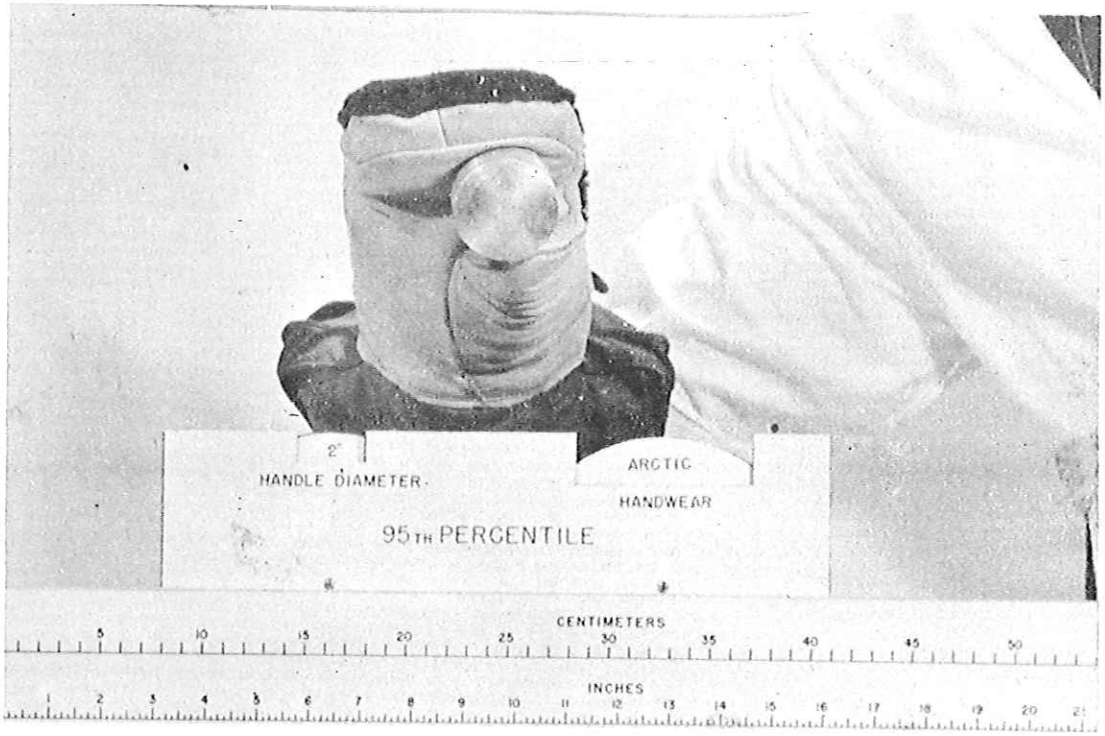

Figure 360. 2" knob diameter (View E)

4. Summary

This report furnishes information on the size of the hand wearing Army cold-weather handwear as an aid to the determination of size and space allowances in the design of hand-operated equipment.

The data describe the upper limit of hand size of the military population by using a subject representative of the 95th percentile of the Army distribution of bare hand size and using size "Large" handwear.

The data are presented in a series of pictures containing both the subject's gloved hand and a linear index scale. Handwear dimensions in the pictures are merely referred to the index scales to obtain the actual size.

5. Acknowledgement

The author wishes to express his appreciation to Mr. Fred Cataldo, Northeastern University student, for his patience and helpful cooperation in serving as the subject in this study. Appreciation is also due Mr. D. R. Linnaberry, QM R&D Center, for his invaluable advice and assistance regarding photographic equipment and technique.

6. References

1. Hertzberg, H. T., G. S. Daniels and E. Churchill. Anthropometry of flying personnel - 1950, WADC Technical Report 52-321, Wright Air Development Center, Wright-Patterson Air Force Base, 1953.

2. Kobrick, J. L. QM human engineering handbook series: I. Spatial dimensions of the 95th percentile Arctic soldier, Report No. EP-39, US Army, QM R&D Command, Natick, Massachusetts, September 1956.

3. Newman, R. W. and R. M. White. Reference anthropometry of army men, Report No. 180, Environmental Protection Section, Quartermaster Climatic Research Laboratory, September 1951.