AEROSPACE STANDARD

AS4088™	REV. F

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Superseding AS4088E

Aerospace Rod Scraper Gland Design Standard

RATIONALE

AS4088 has been updated to include a technical correction to the gland sidewall diameter for -337 in Table 1 and some editorial corrections.

FOREWORD

This SAE Aerospace Standard (AS) was originally released with a gland design for a one backup groove width generally per AS4716 and with either a solid or a split gland construction to facilitate the installation of the scraper. The atmosphere side of the gland had a larger clearance than normally specified in AS4716 to prevent the entrapment of foreign matter.

Since the original release of this document, due to space constraints, many applications using scrapers in a zero backup groove width have been used successfully.

In addition, mechanical spring energized Polytetrafluoroethylene (PTFE) scrapers (MSE scrapers) have become more prevalent to utilize scraper designs offering inert properties that makes them compatible with almost all fluids and temperature ranges used in aerospace fluid power applications. To facilitate the scraper installation into a one-piece gland construction, this design requires a reduced outer lip (known as a click-fit gland) on the atmosphere sidewall.

This AS now includes four basic gland dimensional configurations as a result of the developments described above and to permit the use of the latest scraper designs.

1. SCOPE

This SAE Aerospace Standard (AS) defines gland details for scrapers for rod diameters from 1/4 to 15-1/2 inch (6.35 to 393.70 mm) inclusive, corresponding to AS568 O-ring Dash No. sizes -108/-111, -206/-222, -325/-349, and -425/-460.

The gland details herein allow the use of more stable, efficient, and reliable scraper devices than MS33675 glands.

NOTE: Scraper configurations are not specified in this document.

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https://www.sae.org/standards/content/AS4088F

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS568 Aerospace Size Standard for O-Rings

AS4052 Gland Design: Scraper, Landing Gear, Installation

AS4716 Gland Design, O-ring and Other Seals

2.2 U.S. Government Publications

Copies of these documents are available at https://quicksearch.dla.mil.

MS33675 Scraper Installation, Packing, Gland Ring (Inactive for New Design)

3. GENERAL INSTALLATION DETAILS

The gland details in this specification provide more axial space than the MS33675 gland widths and use dimensions that are essentially the same as zero backup width (Types A_0 and B_0) and one backup width (Types A_1 and B_1) grooves per AS4716 (see 3.2 for detail description). This is in order to enable more efficient, more stable, and more reliable scrapers to be provided.

The atmospheric side of the Type A_0 and Type A_1 glands are designed to provide sufficient retention for scrapers while allowing clearance to avoid contaminants becoming trapped. This is referred to elsewhere in this document as “Full Depth Sidewall Gland” with the ID denoted as “ØT”. Type A_0 and Type A_1 glands may be of split construction (see Figure 1) to facilitate the installation of the scraper particularly for smaller sizes (consult the scraper manufacturer for advice on the gland design).

Mechanical spring energized scrapers (MSE scrapers) may be installed in Type B glands of zero backup width (Type B_0) or one backup width (Type B_1). Type B glands are known as “click-fit” glands and elsewhere in this document are referred to as “Reduced Depth Sidewall Gland” and have a height from the groove diameter denoted as “L”. Generally, MSE scrapers can be installed in glands to Figure 2, but it may not be possible for some of the smaller sizes (consult the MSE scraper manufacturer for advice). In this case, a Type A split gland construction per Figure 1 should be used. In this case the reduced depth sidewall gland is not permissible.

Scraper configurations are not provided in this standard although some comments on scraper design precautions and installation methods are included in Section 6.

4. GLAND DESIGN AND APPLICATION

4.1 General

Rod and gland diameters, gland widths and tolerances are in accordance with AS4716 with the exceptions described in 4.3 and 4.5. It should also be noted that hardware dimensions for dash sizes -206 through -209 are extrapolated from AS4716 dimensions.

Dash sizes -206 through -209 use the same rod diameters as AS4716 dash sizes -112 through -115.

Gland diameters are defined for each rod diameter from 1/4 to 15-1/2 inches, (6.35 to 393.70 mm) inclusive using essentially the same dash size designations as AS4716.

4.2 Gland Types

These are designated as follows:

4.2.1 Type A Glands

See Figure 1.

Type A_0 - Full depth sidewall gland, zero backup width G_0

Type A_1 - Full depth sidewall gland, one backup width G_1

4.2.2 Type B Glands

See Figure 2.

Type B_0 - Reduced depth sidewall gland (click-fit), zero backup width G_0

Type B_1 - Reduced depth sidewall gland (click-fit), one backup width G_1

NOTES:

1. The glands covered in AS4052 are similar to this standard for -300 and -400 series dash sizes using Type A_1 and Type B_1 glands.

2. The diametral clearance on the ambient side of Type A_0 and Type A_1 glands is greater than those specified in AS4716. This is in order to minimize the possibility of trapping contaminants in the rod and gland bushing diametral clearance, while still providing sufficient retention for the scraper. This is shown in Figure 1 as diameter T_1.

3. A two-piece Type A_0 and Type A_1 gland is shown as optional in Figure 1. This gland construction may be used where installation of scrapers into Type A or Type B glands would be difficult, for example:

   - Small sizes of elastomer energized slipper type scrapers where deformation of the part into a suitable shape for installation (kidney shape) would be difficult due to the ratio between the part radial cross-section and its diameter.

   - Small sizes of MSE scrapers where a reduction in the outer diameter of the part to pass through diameter T_2 for installation would likely cause irreparable damage to the spring energizer and thereby rend the part ineffective.

4. Rod diameter “B” and gland bore “H” are per AS4716 or an extrapolation of AS4716 for dash sizes -206 through -209.

5. GLAND DIMENSIONS AND TOLERANCES

See Figure 1 for gland construction and dimensions for full depth sidewall glands, Type A_0 and Type A_1.

See Figure 2 for reduced depth sidewall gland construction Type B_0 and Type B_1, to be used for MSE scrapers only.

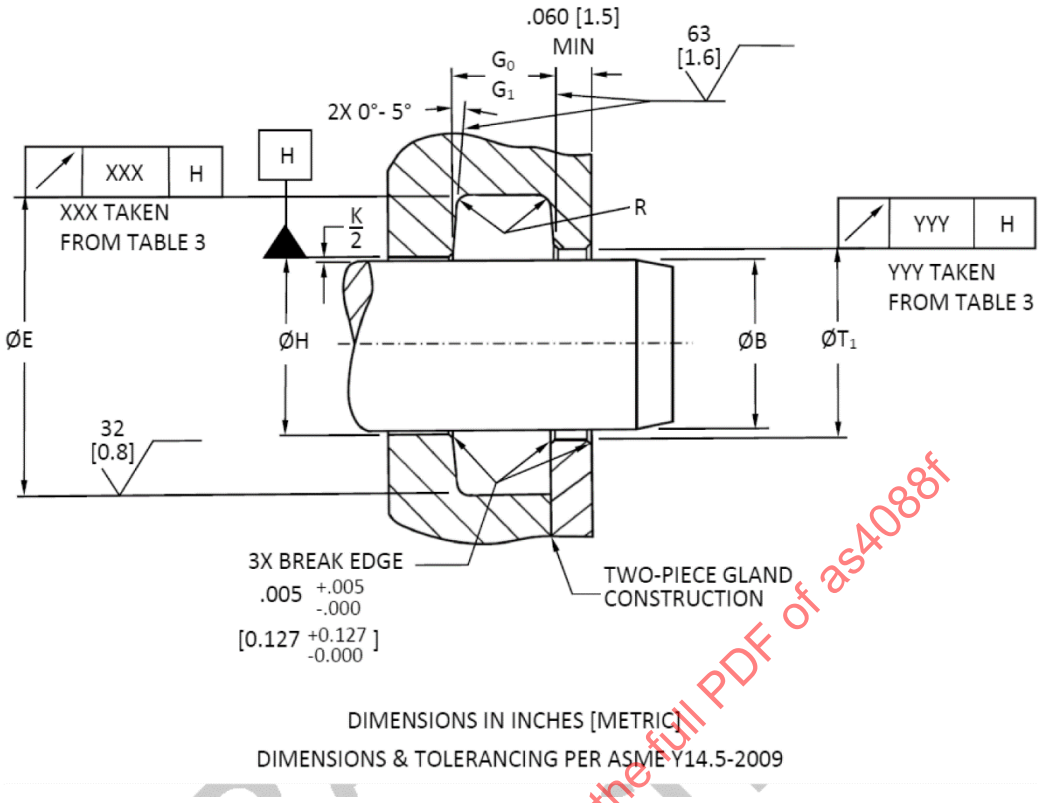

Figure 1 - Type A_0 and Type A_1 gland details

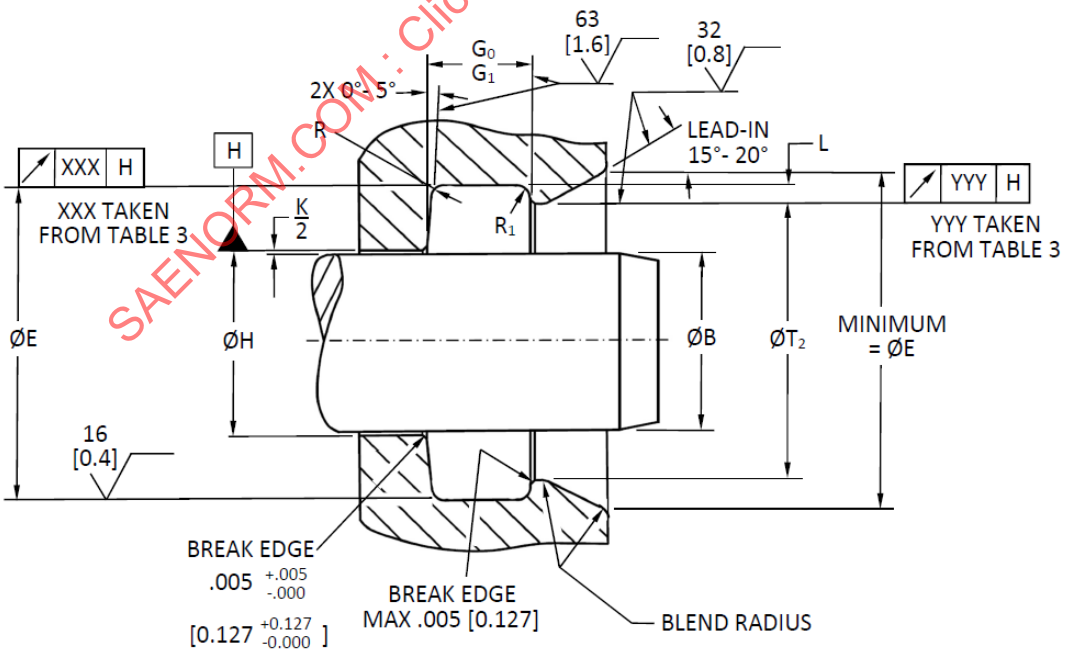

Figure 2 - Type B_0 and Type B_1 gland details

5.1 Gland Diameters

Table 1 lists the gland diameters.

Table 1 - Gland diameters in inches and millimeters

AS4088 Dash No.	MS33675 Dash No. for Reference Only	Inches					Millimeters			
		ØB Rod Dia Nominal	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	$ØT_1$ Gland Sidewall Dia	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	$ØT_1$ Gland Sidewall Dia
-108	1/4	1/4	0.248	0.250	0.423	0.278	6.299	6.350	10.744	7.061
			0.247	0.251	0.424	0.288	6.274	6.375	10.770	7.315
-109	5/16	5/16	0.310	0.312	0.486	0.340	7.874	7.925	12.344	8.636
			0.309	0.313	0.487	0.350	7.849	7.950	12.370	8.890
-110	3/8	3/8	0.373	0.375	0.546	0.403	9.474	9.525	13.919	10.236
			0.371	0.376	0.548	0.413	9.423	9.550	13.868	10.490
-111	7/16	7/16	0.435	0.437	0.609	0.465	11.049	11.100	15.469	11.811
			0.433	0.438	0.611	0.475	10.998	11.125	15.519	12.065
-206	-01	1/2	0.498	0.500	0.741	0.528	12.649	12.700	18.821	13.411
			0.496	0.501	0.743	0.538	12.598	12.725	18.872	13.665
-207	-02	9/16	0.560	0.562	0.803	0.590	14.224	14.275	20.396	14.986
			0.558	0.563	0.805	0.600	14.173	14.300	20.447	15.240
-208	-03	5/8	0.623	0.625	0.866	0.653	15.824	15.875	21.996	16.586
			0.621	0.626	0.868	0.663	15.773	15.900	22.047	16.840
-209	-04	11/16	0.685	0.687	0.928	0.715	17.399	17.450	23.571	18.161
			0.683	0.688	0.930	0.725	17.348	17.475	23.622	18.415
-210	-05	3/4	0.748	0.750	0.989	0.778	18.999	19.050	25.121	19.761
			0.746	0.751	0.991	0.788	18.948	19.075	25.171	20.015
-211	-06	13/16	0.810	0.812	1.051	0.852	20.574	20.625	26.695	21.641
			0.808	0.813	1.053	0.862	20.523	20.650	26.746	21.895
-212	-07	7/8	0.873	0.875	1.115	0.915	22.174	22.225	28.321	23.241
			0.871	0.876	1.117	0.925	22.123	22.250	28.372	23.495
-213	-08	15/16	0.935	0.937	1.177	0.977	23.749	23.800	29.896	24.816
			0.933	0.938	1.179	0.987	23.698	23.825	29.947	25.070
-214	-09	1	0.998	1.000	1.240	1.040	25.349	25.400	31.496	26.416
			0.996	1.001	1.242	1.050	25.298	25.425	31.547	26.670
-215	-10	1 1/16	1.060	1.062	1.302	1.102	26.924	26.975	33.071	27.991
			1.058	1.063	1.304	1.112	26.873	27.000	33.122	28.245
-216	-11	1 1/8	1.123	1.125	1.365	1.165	28.524	28.575	34.671	29.591
			1.121	1.126	1.367	1.175	28.473	28.600	34.722	29.845
-217	-12	1 3/16	1.185	1.187	1.427	1.227	30.099	30.150	36.246	31.166
			1.183	1.188	1.429	1.237	30.048	30.175	36.297	31.420
-218	-13	1 1/4	1.248	1.250	1.490	1.290	31.699	31.750	37.846	32.766
			1.246	1.251	1.492	1.300	31.648	31.775	37.897	33.020
-219	-14	1 5/16	1.310	1.312	1.552	1.352	33.274	33.325	39.421	34.341
			1.308	1.313	1.554	1.362	33.223	33.350	39.472	34.595

Table 1 - Gland diameters in inches and millimeters (continued)

AS4088 Dash No.	MS33675 Dash No. for Reference Only	Inches					Millimeters			
		ØB Rod Dia Nominal	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	ØT$_1$ Gland Sidewall Dia	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	ØT$_1$ Gland Sidewall Dia
-220	-15	1 3/8	1.373	1.375	1.615	1.415	34.874	34.925	41.021	35.941
			1.371	1.376	1.617	1.425	34.823	34.950	41.072	36.195
-221	-16	1 7/16	1.435	1.437	1.677	1.477	36.449	36.500	42.596	37.516
			1.433	1.438	1.679	1.487	36.398	36.525	42.647	37.770
-222	-17	1 1/2	1.498	1.500	1.740	1.540	38.049	38.100	44.196	39.116
			1.496	1.501	1.742	1.550	37.998	38.125	44.247	39.370
-325	-17	1.5	1.498	1.500	1.870	1.540	38.049	38.100	47.498	39.116
			1.496	1.502	1.872	1.550	37.998	38.151	47.549	39.370
-326	-18	1 5/8	1.623	1.625	1.995	1.665	41.224	41.275	50.673	42.291
			1.621	1.627	1.997	1.675	41.173	41.326	50.724	42.545
-327	-19	1 3/4	1.748	1.750	2.120	1.790	44.399	44.450	53.848	45.466
			1.746	1.752	2.122	1.800	44.348	44.501	53.899	45.720
-328	-20	1 7/8	1.873	1.876	2.245	1.915	47.574	47.650	57.023	48.641
			1.871	1.878	2.247	1.925	47.523	47.701	57.074	48.895
-329	-21	2	1.998	2.001	2.370	2.040	50.749	50.825	60.198	51.816
			1.996	2.003	2.372	2.050	50.698	50.876	60.249	52.070
-330	-22	2.125	2.123	2.126	2.495	2.165	53.924	54.000	63.373	54.991
			2.121	2.128	2.497	2.175	53.873	54.051	63.424	55.245
-331	-23	2 1/4	2.248	2.251	2.620	2.290	57.099	57.175	66.548	58.166
			2.246	2.253	2.622	2.300	57.048	57.226	66.599	58.420
-332	-24	2.375	2.373	2.376	2.745	2.415	60.274	60.350	69.723	61.341
			2.371	2.378	2.747	2.425	60.223	60.401	69.774	61.595
-333	-25	2 1/2	2.498	2.501	2.870	2.540	63.449	63.525	72.898	64.516
			2.496	2.503	2.872	2.550	63.398	63.576	72.949	64.770
-334	-26	2 5/8	2.623	2.626	2.995	2.665	66.624	66.700	76.073	67.691
			2.621	2.628	2.997	2.675	66.573	66.751	76.124	67.945
-335	-27	2 3/4	2.748	2.751	3.120	2.790	69.799	69.875	79.248	70.866
			2.746	2.753	3.122	2.800	69.748	69.926	79.299	71.120
-336	-28	2 7/8	2.873	2.876	3.245	2.915	72.974	73.050	82.423	74.041
			2.871	2.878	3.247	2.925	72.923	73.101	82.474	74.295
-337	-29	3	2.997	3.000	3.369	3.039	76.124	76.200	85.573	77.191
			2.995	3.002	3.371	3.049	76.073	76.251	85.623	77.445
-338	-30	3.125	3.122	3.125	3.494	3.164	79.299	79.375	88.748	80.366
			3.120	3.127	3.496	3.174	79.248	79.426	88.798	80.620
-339	-31	3 1/4	3.247	3.250	3.619	3.289	82.474	82.550	91.923	83.541
			3.245	3.252	3.621	3.299	82.423	82.601	91.973	83.795

Table 1 - Gland diameters in inches and millimeters (continued)

AS4088 Dash No.	MS33675 Dash No. for Reference Only	Inches					Millimeters			
		ØB Rod Dia Nominal	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	ØT$_1$ Gland Sidewall Dia	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	ØT$_1$ Gland Sidewall Dia
-340	-32	3 3/8	3.372	3.375	3.744	3.414	85.649	85.725	95.098	86.716
			3.370	3.377	3.746	3.424	85.598	85.776	95.148	86.970
-341	-33	3 1/2	3.497	3.500	3.869	3.539	88.824	88.900	98.273	89.891
			3.495	3.502	3.871	3.549	88.773	88.951	98.323	90.145
-342	-34	3 5/8	3.622	3.625	3.994	3.664	91.999	92.075	101.448	93.066
			3.620	3.627	3.996	3.674	91.948	92.126	101.498	93.320
-343	-35	3 3/4	3.747	3.750	4.119	3.789	95.174	95.250	104.623	96.241
			3.745	3.752	4.121	3.799	95.123	95.301	104.673	96.495
-344	-36	3 7/8	3.872	3.875	4.244	3.914	98.349	98.425	107.798	99.416
			3.870	3.877	4.246	3.924	98.298	98.476	107.848	99.670
-345	-37	4	3.997	4.000	4.369	4.039	101.524	101.600	110.973	102.591
			3.995	4.002	4.371	4.049	101.473	101.651	111.023	102.845
-346	-38	4.125	4.122	4.125	4.494	4.164	104.699	104.775	114.148	105.766
			4.120	4.127	4.496	4.174	104.648	104.826	114.198	106.020
-347	-39	4.25	4.247	4.250	4.619	4.289	107.874	107.950	117.323	108.941
			4.245	4.252	4.621	4.299	107.823	108.001	117.373	109.195
-348	-40	4 3/8	4.372	4.375	4.744	4.414	111.049	111.125	120.498	112.116
			4.370	4.377	4.746	4.424	110.998	111.176	120.548	112.370
-349	-41	4 1/2	4.497	4.500	4.869	4.539	114.224	114.300	123.673	115.291
			4.495	4.502	4.871	4.549	114.173	114.351	123.723	115.545
-425	-41	4 1/2	4.497	4.501	4.974	4.539	114.224	114.325	126.340	115.291
			4.494	4.503	4.977	4.549	114.148	114.376	126.416	115.545
-426	-42	4 5/8	4.622	4.626	5.099	4.664	117.399	117.500	129.515	118.466
			4.619	4.628	5.102	4.674	117.323	117.551	129.591	118.720
-427	-43	4 3/4	4.747	4.751	5.224	4.789	120.574	120.675	132.690	121.641
			4.744	4.753	5.227	4.799	120.498	120.726	132.766	121.895
-428	-44	4 7/8	4.872	4.876	5.349	4.914	123.749	123.850	135.865	124.816
			4.869	4.878	5.352	4.924	123.673	123.901	135.941	125.070
-429	-45	5	4.997	5.001	5.474	5.039	126.924	127.025	139.040	127.991
			4.994	5.003	5.477	5.049	126.848	127.076	139.116	128.245
-430	-46	5 1/8	5.122	5.126	5.599	5.164	130.099	130.200	142.215	131.166
			5.119	5.128	5.602	5.174	130.023	130.251	142.291	131.420
-431	-47	5 1/4	5.247	5.251	5.724	5.289	133.274	133.375	145.390	134.341
			5.244	5.253	5.727	5.299	133.198	133.426	145.466	134.595
-432	-48	5 3/8	5.372	5.376	5.849	5.414	136.449	136.550	148.565	137.516
			5.369	5.378	5.852	5.424	136.373	136.601	148.641	137.770

Table 1 - Gland diameters in inches and millimeters (continued)

AS4088 Dash No.	MS33675 Dash No. for Reference Only	Inches					Millimeters			
		ØB Rod Dia Nominal	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	ØT$_1$ Gland Sidewall Dia	ØB Rod Dia	ØH Gland Bore Dia	ØE Groove Dia	ØT$_1$ Gland Sidewall Dia
-433	-49	5 1/2	5.497	5.501	5.974	5.539	139.624	139.725	151.740	140.691
			5.494	5.503	5.977	5.549	139.548	139.776	151.816	140.945
-434	-50	5 5/8	5.622	5.626	6.099	5.664	142.799	142.900	154.915	143.866
			5.619	5.628	6.102	5.674	142.723	142.951	154.991	144.120
-435	-51	5 3/4	5.747	5.751	6.224	5.789	145.974	146.075	158.090	147.041
			5.744	5.753	6.227	5.799	145.898	146.126	158.166	147.295
-436	-52	5 7/8	5.872	5.876	6.349	5.914	149.149	149.250	161.265	150.216
			5.869	5.878	6.352	5.924	149.073	149.301	161.341	150.470
-437	-53	6	5.997	6.001	6.474	6.039	152.324	152.425	164.440	153.391
			5.994	6.003	6.477	6.049	152.248	152.476	164.516	153.645
-438	-54	6 1/4	6.247	6.251	6.724	6.289	158.674	158.775	170.790	159.741
			6.244	6.253	6.727	6.299	158.598	158.826	170.866	159.995
-439	-55	6 1/2	6.497	6.501	6.974	6.539	165.024	165.125	177.140	166.091
			6.494	6.504	6.977	6.549	164.948	165.202	177.216	166.345
-440	-56	6 3/4	6.747	6.751	7.224	6.789	171.374	171.475	183.490	172.441
			6.744	6.754	7.227	6.799	171.298	171.552	183.566	172.695
-441	-57	7	6.997	7.001	7.474	7.039	177.724	177.825	189.840	178.791
			6.994	7.004	7.477	7.049	177.648	177.902	189.916	179.045
-442	-58	7 1/4	7.247	7.251	7.724	7.289	184.074	184.175	196.190	185.141
			7.244	7.254	7.727	7.299	183.998	184.252	196.266	185.395
-443	-59	7 1/2	7.497	7.501	7.974	7.539	190.424	190.525	202.540	191.491
			7.494	7.504	7.977	7.549	190.348	190.602	202.616	191.745
-444	-60	7 3/4	7.747	7.751	8.224	7.789	196.774	196.875	208.890	197.841
			7.744	7.754	8.227	7.799	196.698	196.952	208.966	198.095
-445	-61	8	7.997	8.001	8.474	8.039	203.124	203.225	215.240	204.191
			7.994	8.004	8.477	8.049	203.048	203.302	215.316	204.445
-446	-62	8 1/2	8.497	8.501	8.974	8.539	215.824	215.925	227.940	216.891
			8.494	8.504	8.977	8.549	215.748	216.002	228.016	217.145
-447	-63	9	8.997	9.001	9.474	9.039	228.524	228.625	240.640	229.591
			8.994	9.004	9.477	9.049	228.448	228.702	240.716	229.845
-448	-64	9 1/2	9.497	9.501	9.974	9.539	241.224	241.325	253.340	242.291
			9.494	9.504	9.977	9.549	241.148	241.402	253.416	242.545
-449	-65	10	9.997	10.001	10.474	10.039	253.924	254.025	266.040	254.991
			9.994	10.004	10.477	10.049	253.848	254.102	266.116	255.245
-450	66	10 1/2	10.497	10.501	10.974	10.539	266.624	266.725	278.740	267.691
			10.494	10.504	10.977	10.549	266.548	266.802	278.816	267.945