PRD-410
4-83

CASE NUMBER:

99-059

VI-C-58; Box 6

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PUBLIC SERVICE
COMMISSION

March 19, 2004

Honorable Thomas M. Dorman, Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
P. O. Box 615
Frankfort, Kentucky 40602

Subject: **Sample Meter Test Plan – Annual Report**
Case No. 99-059

Dear Mr. Dorman:

In compliance with the Commission's Order in the above referenced Case, Atmos Energy is hereby filing its annual report on the Company's Sample Meter Testing Program for the year 2003. We continue to be pleased with the results of this program and we intend to file an application for extending this pilot later this month.

If the Commission or Staff has any questions regarding this matter, please contact our Compliance Manager, Barry Wigginton, at 270-685-8171.

Sincerely,

Gary L. Smith
Vice President, Marketing & Regulatory Affairs

Cc: Rad Cook
Barry Wigginton
John Willis
Bruce Tucker

2401 New Hartford Road, Owensboro, Kentucky 42303-1312
P 270-685-8000 **F** 270-685-8052 atmosenergy.com

ATMOS
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March 8, 2004

ATMOS ENERGY KENTUCKY DIVISION
2003 METER SAMPLING ANNUAL REPORT

Atmos Energy Kentucky Division completed the fifth year of its statistical sampling of their meter population with the following results:

A total of 5,851 meters making up 76 control groups or meter families were sampled. All meter families were tested in accordance with the sampling as set forth in the Kentucky Public Service Commission's Order (Case Number 99-059) dated August 24, 1999.

The meter sampling program is proving to be excellent for both the company and the customers. The customer and the company benefit for the same reason; poor performing meters will be identified and removed from service. This allows quality meters to stay in service for and extended length of time.

Attached are the results of the 2003 meter sampling program. It shows all meter groups passed.

Should you have any questions, please call (270) 683-4068.

Sincerely,

Bruce Tucker

Bruce Tucker
Measurement Supervisor

2003 ATMOS ENERGY KENTUCKY METER SAMPLING RESULTS

Family Codes	Total Mtrs in Family	Total Sampled	Total Failed Meters	Total Rejects Allowed	2003 Family Status
AC250E	3376	200	1	15	Passed
AC250F	8351	200	4	22	Passed
AC250F89	3031	125	4	15	Passed
AC250G	9634	200	3	22	Passed
AC250G95	10000	200	3	22	Passed
AC250G98	8768	200	2	22	Passed
AL175A	4197	200	6	22	Passed
AL175B	6704	200	4	22	Passed
AL175C	5754	200	6	22	Passed
AL175D	9990	200	5	22	Passed
AL175E	1371	125	1	15	Passed
AL175F	31	8	0	2	Passed
AL175G	8720	200	4	22	Passed
AL225A	58	13	0	3	Passed
AL225A63	5213	200	2	22	Passed
AL225B	290	32	1	6	Passed
AL425C	162	32	0	6	Passed
AL425D	520	80	1	11	Passed
AL425E	226	32	0	6	Passed
AL425F	214	32	1	6	Passed
AL425G	1049	80	2	11	Passed
L250	2936	125	4	15	Passed
R175A	4347	200	5	22	Passed
R175B	5310	200	7	22	Passed
R175C	1246	125	0	15	Passed
R175G	155	32	3	6	Passed

R200C	1047	80	2	11	Passed
R200D	8614	200	6	22	Passed
R200E	3035	125	3	15	Passed
R200G	864	80	2	11	Passed
R250A	628	80	3	11	Passed
R250A63	4615	200	5	22	Passed
R250B	182	32	1	6	Passed
R275E	3642	200	9	22	Passed
R275F	4272	200	7	22	Passed
R275G	4172	200	4	22	Passed
R275G97	9317	200	6	22	Passed
R415A	460	50	2	8	Passed
R415A63	265	32	1	6	Passed
R415B	319	50	2	8	Passed
R415C	26	8	0	1	Passed
R415D	3	3	0	1	Passed
R415F	39	8	0	2	Passed
R415G	1	1	1	1	Passed
S175A	2	2	0	1	Passed
S250	2803	125	3	15	Passed
AL800c	13	3	0	1	Passed
AL800D	148	20	2	4	Passed
AL800E	194	32	3	6	Passed
AL800F	109	20	1	4	Passed
AL800G	27	5	1	2	Passed
R750	317	50	4	8	Passed
AL1000	488	50	4	8	Passed
Al1400	341	50	0	8	Passed

AI2300	343	50	0	8	Passed
250B	191	32	1	6	Passed
80B	89	13	0	3	Passed
500B	26	8	0	2	Passed
AL5000	75	13	0	3	Passed
DU5000	4	2	0	1	Passed
R3000	116	20	0	4	Passed
R10000	47	8	0	2	Passed
16M	58	13	0	3	Passed
23M	43	8	0	2	Passed
2M	49	8	0	2	Passed
2M ROMET	2	2	0	1	Passed
3.6M600	2	2	0	1	Passed
38M	22	5	0	2	Passed
3M	230	32	0	6	Passed
5M	129	20	0	4	Passed
7M	160	32	0	6	Passed
8C	26	8	0	2	Passed
11.5M400	2	2	0	1	Passed
11C	18	5	0	2	Passed
11M	86	13	0	3	Passed
1.5M	46	8	0	2	Passed
OBSOLETES	4844	4844			
TOTAL	154204	10695			

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January 30, 2003

Honorable Thomas M.Dorman
Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
P. O. Box 615
Frankfort, KY 40602

Subject: Annual Report - Sample Meter Test Plan
Case No. 99-059

Dear Mr. Dorman:

In compliance with the Commission's Order in the above referenced matter, Atmos Energy is hereby filing its second Annual Report.

All technical questions should be directed to Mr. Barry Wigginton, Manager of Compliance, at 270-685-8171.

Sincerely,

Gary Smith

Gary Smith
Vice President, Marketing

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Enclosures

cc: Mr. Barry Wigginton
Mr. John Willis

2401 New Hartford Road, Owensboro, Kentucky 42303-1312
P 270-685-8000 **F** 270-685-8052 atmosenergy.com

ATMOS
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January 15, 2003

ATMOS ENERGY KENTUCKY DIVISION
2002 METER SAMPLING ANNUAL REPORT

Atmos Energy Kentucky Division completed the fourth year of its statistical sampling of their meter population with the following results:

A total of 6,382 meters making up 103 control groups or meter families were sampled. All meter families were tested in accordance with the sampling as set forth in the Kentucky Public Service Commission's Order (Case No. 99-059) dated August 24, 1999.

The meter sampling program is proving to be excellent for both the company and customers. The customer and company benefit for the same reason; namely poor performing meters will be identified and removed from service. This allows quality meters to stay in service for an extended length of time.

Attached are the results of the 2002 meter sampling program. It shows all meter groups passed.

Also, please be advised that Atmos Energy, Kentucky Division, for the past five (5) years, has been utilizing Columbia Gas Companies Meter Shop as its meter testing and repair outsourcer. Beginning 2003 the Kentucky Division will be utilizing North American Service Group, a subsidiary of American Meter Company.

Should you have any questions, please call (270-685-8171).

Barry Wigginton

Barry Wigginton
Manager of Compliance

2401 New Hartford Road, Owensboro, Kentucky 42303-1312
P 270-685-8000 F 270-685-8052 atmosenergy.com

2002 ATMOS ENERGY KENTUCKY METER SAMPLING RESULTS

Samples taken for year 2002
1/15/2003

Family codes	Total Mtrs in Family	Total Sampled	Total Failed Meters	Total Rejects Allowed	2002 Family Status
	(a)	(b)	©	(d)	(e)
AC250D	1	1	0	1	passed
AC250E	3782	200	5	22	passed
AC250F	8805	200	2	22	passed
AC250F89	3150	125	6	15	passed
AC250G	3738	200	3	22	passed
AC250G98	8718	200	4	22	passed
AC250G94	6014	200	7	22	passed
AC250F95	10011	200	6	22	passed
AL1000	284	50	1	8	passed
AL175A63	34	32	2	6	passed
AL175A	4425	200	10	22	passed
A175B	7048	200	8	22	passed
AL175C	5959	200	10	22	passed
AL175D	8076	200	5	22	passed
AL175D79	2286	125	8	15	passed
AL175E	1496	125	1	15	passed
AL175F	39	8	0	2	passed
AL175G	8688	200	1	22	passed
AL225A63	9174	200	13	22	passed
AL225A	70	13	2	3	passed
AL225B	290	50	2	8	passed
AL225C	13	5	0	1	passed
AL225D	11	3	0	1	passed

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2002 Family Status
R415A63	633	80	3	11	passed
R415A	528	80	8	11	passed
R415B	361	50	2	8	passed
R415C	34	8	1	2	passed
R415D	4	2	0	1	passed
R415E	2	2	0	1	passed
R415F	45	8	0	2	passed
R415G	1	1	0	1	passed
R750A63	93	20	1	4	passed
R750A	84	13	0	3	passed
R750B	117	20	0	4	passed
R750C	3	2	0	1	passed
R750D	12	3	0	1	passed
R750E	3	2	0	1	passed
R750F	45	8	0	2	passed
R750G	25	5	0	2	passed
S-175	3	2	0	1	passed
S250F	2812	125	5	15	passed
R250A63	7787	200	14	22	passed
R250A	709	80	4	11	passed
R250B	214	32	2	6	passed
R250C	1	1	0	1	passed
R250D	25	5	1	2	passed
R250E	4	4	0	1	passed
11500400G	1	1	0	1	passed
11CG	8	2	0	1	passed
11MG	80	13	0	3	passed
15CG	38	8	0	2	passed

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000 Family Status
16MG	55	13	0	3	passed
1M600G	8	2	0	1	passed
23MG	43	8	0	2	passed
250BG	240	32	1	6	passed
2M175	36	8	0	1	passed
2MROMETG	2	2	0	1	passed
3600M600	2	2	0	1	passed
38MG	22	5	0	2	passed
3MG	220	32	0	6	passed
500BG	35	8	0	2	passed
5MG	102	20	0	4	passed
7MG	154	32	0	4	passed
80BG	111	20	0	4	passed
8CG	7	2	0	1	passed
5000DUG	4	2	0	1	passed
5000ALG	76	13	1	3	passed
10000RG	47	8	0	2	passed
3000RG	122	20	1	4	passed
AL1400G	343	50	0	8	passed
AL2300G	345	50	0	8	passed
AL425A	1	1	0	1	passed
AL425B	1	1	0	1	passed
AL425C	190	32	1	6	passed
AL425D	578	80	1	11	passed
AL425E	247	32	1	6	passed
AL425F	237	32	0	6	passed
AL425G	1088	80	3	11	passed
AL800C	15	3	0	2	passed
AL800D	171	32	0	6	passed
AL800E	216	32	0	6	passed

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000Family Status
AL800F	125	20	0	4	passed
AL800G	33	8	0	2	passed
L250G	2921	125	4	15	passed
R175A63	48	8	0	2	passed
R175A	4566	200	7	22	passed
R175B	5596	200	17	22	passed
R175C	1373	125	8	15	passed
R175D	20	2	0	2	passed
R175E	6	2	0	1	passed
R175F	3	2	0	1	passed
R175G	160	32	0	6	passed
R200B	2	2	0	1	passed
R200C	1131	80	1	15	passed
R200D	8850	200	4	22	passed
R200E	3177	125	2	22	passed
R200F	2	2	0	1	passed
R200G	870	80	1	11	passed
R275B	1	1	0	1	passed
R275E	3838	200	9	22	passed
R275F	4463	200	6	22	passed
R275G	4140	200	0	22	passed
R275G97	9279	200	11	22	passed
OBSOLETES	1810	1810			
TOTAL	162916	8192			

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March 15, 2002

Honorable Thomas M. Dorman
Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
P.O. Box 615
Frankfort, Kentucky 40602

Subject: Annual Report on Sample Meter Testing - Case No. 99-059

Dear Mr. Dorman:

Pursuant to the Commission's Order in the above-referenced case, I am enclosing the annual report on Western Kentucky Gas Company's Sample Meter Testing Program for the year 2001. We continue to be pleased with the results of this program.

Should the Staff or the Commission have any questions, please call our Compliance Manager, Barry Wigginton, at 1-270-683-4068.

Sincerely yours,

William J. Senter

William J. Senter
VP – Rates & Regulatory Affairs

Enclosures

Western Kentucky Gas Company 2401 New Hartford Road Owensboro, KY 42303 Phone: (270) 685-8000

WESTERN
KENTUCKY
GAS

WESTERN KENTUCKY GAS COMPANY
2001 METER SAMPLING ANNUAL REPORT

Western Kentucky Gas Company has completed the third year of statistically sampling its meter population with the following results:

A total of 6,432 meters making up 103 control groups or meter families were sampled. All meter families were tested in accordance with the sampling as set forth in the Kentucky Public Service Commission's Order (Case No. 99-059) dated August 24, 1999.

One of the meter groups failed. This group comprised of only one subject meter was removed, tested and retired. In the 2000 program, a group, identified as AC250C consisting of (5) five meters were pulled, tested and retired as outlined in the letter dated March 30, 2001.

Meter sampling continues to be an excellent program for both the company and customers. The customer and company benefit for the same reason; namely poor performing meters will be identified and removed from service. This allows quality meters to stay in service for an extended length of time.

Attached are the results of the program for 2001.

2001 WESTERN KENTUCKY GAS METER SAMPLING RESULTS

Samples taken for year 2001

2/26/02

Family codes	Total Mtrs in Family	Total Sampled	Total Failed Meters	Total Rejects Allowed	2001 Family Status	No. Failed Fast	No. Failed Slow
	(a)	(b)	©	(d)	(e)	(f)	(g)
AC250C	5	2	0	1	passed		
AC250D	4	2	0	1	passed		
AC250E	3782	200	1	22	passed		1
AC250F	8805	200	5	22	passed	3	2
AC250F89	3367	200	3	22	passed	2	1
AC250G	3933	200	2	22	passed		2
AC250G98	8747	200	1	22	passed		1
AC250G94	6213	200	3	22	passed	1	2
AC250F95	9985	200	4	22	passed	1	3
AL1000	321	50	0	8	passed		
AL175A63	42	8	0	2	passed		
AL175A	4635	200	0	22	passed		
A175B	7264	200	10	22	passed	7	3
AL175C	6171	200	13	22	passed	9	4
AL175D	8281	200	2	22	passed	2	
AL175E	1626	125	3	15	passed	2	1
AL175F	47	8	1	2	passed	1	
AL175G	8664	200	2	22	passed	1	1
AL225A63	9415	200	6	22	passed	4	2
AL225A	83	13	0	3	passed		
AL225B	341	50	3	8	passed	2	1
AL225C	18	5	0	2	passed		
AL225D	14	3	0	1	passed		
AL225E	4	2	0	1	passed		

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000 Family Status	No.Failed Fast	No. Failed Slow
AL225F	2	1	0	1	passed		
R415A63	702	80	9	11	passed	3	6
R415A	593	80	3	11	passed	2	1
R415B	396	50	0	8	passed		
R415C	39	8	0	2	passed		
R415D	6	2	0	1	passed		
R415E	4	1	0	1	passed		
R415F	49	8	0	2	passed		
R415G	1	1	0	1	passed		
R750A63	114	20	0	4	passed		
R750A	103	20	0	4	passed		
R750B	134	20	1	4	passed	1	
R750C	5	2	0	1	passed		
R750D	13	3	0	1	passed		
R750E	5	2	0	1	passed		
R750F	48	8	0	2	passed		
R750G	31	8	0	2	passed		
S250F	2790	125	1	15	passed	1	
R250A63	7984	200	3	22	passed	2	1
R250A	790	80	2	11	passed	2	
R250B	246	32	3	6	passed	1	2
R250C	**1**	**1**	**1**	**1**	**failed**	**1**	
R250D	32	8	0	2	passed		
R250E	6	2	0	1	passed		
11500400G	1	1	0	1	passed		
11CG	8	2	0	1	passed		
11MG	80	13	0	3	passed		
15CG	33	8	0	2	passed		

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000 Family Status	No.Failed Fast	No. Failed Slow
16MG	57	13	0	3	passed		
1M600G	8	2	0	1	passed		
23MG	43	8	0	2	passed		
250BG	240	32	0	6	passed		
2MG	1	1	0	1	passed		
2MROMETG	2	2	0	1	passed		
3600M600	2	2	0	1	passed		
38MG	22	5	0	2	passed		
3MG	205	32	0	6	passed		
500BG	37	8	0	2	passed		
5MG	102	20	0	4	passed		
7MG	150	20	0	4	passed		
80BG	127	20	0	4	passed		
8CG	7	2	0	1	passed		
5000DUG	3	2	0	1	passed		
5000ALG	79	13	0	3	passed		
10000RG	47	8	0	2	passed		
3000RG	123	20	0	4	passed		
AL1400G	345	50	0	8	passed		
AL2300G	344	50	0	8	passed		
AL425C	211	32	0	6	passed		
AL425D	646	80	1	11	passed		1
AL425E	273	32	0	6	passed		
AL425F	250	32	1	6	passed		1
AL425G	1081	80	0	11	passed		
AL800A	1	1	0	1	passed		
AL800B	1	1	0	1	passed		
AL800C	18	5	0	2	passed		
AL800D	198	32	0	6	passed		
AL800E	234	32	0	6	passed		

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000Family Status	No.Failed Fast	No. Failed Slow
AL800F	139	20	0	4	passed		
AL800G	33	8	0	2	passed		
L250G	2851	125	2	15	passed	2	
R175A63	61	13	0	3	passed		
R175A	4768	200	14	22	passed	9	5
R175B	5822	200	4	22	passed	2	2
R175C	1502	125	7	15	passed	2	5
R175D	25	5	1	2	passed		1
R175E	8	2	0	1	passed		
R175F	5	2	0	1	passed		
R175G	168	32	1	6	passed		1
R200B	4	2	0	1	passed		
R200C	1257	125	2	15	passed	2	
R200D	9072	200	3	22	passed	2	1
R200E	3388	200	5	22	passed	3	2
R200F	4	2	0	1	passed		
R200G	864	80	1	11	passed		1
R275E	4031	200	5	22	passed	4	1
R275F	4586	200	2	22	passed	2	
R275G	4117	200	5	22	passed	3	2
R275G97	9238	200	0	22	passed		
TOTAL	162783	6432	136	825		79	57

WESTERN
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COMMISSION

March 30, 2001

Honorable Thomas M. Dorman
Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
P.O. Box 615
Frankfort, Kentucky 40602

Subject: Annual Report - Sample Meter Test Plan
Case No. 99-059

Dear Mr. Dorman:

In compliance with the Commission's Order in the above referenced matter, Western Kentucky Gas Company is hereby filing its second Annual Report.

All technical questions should be directed to Mr. Barry Wigginton, Supervisor of Measurement, at 270-683-4068.

Sincerely yours,

William J. Senter

William J. Senter
VP – Rates & Regulatory Affairs

Enclosures

cc: Mr. Barry Wigginton
Mr.John Willis

Western Kentucky Gas Company 2401 New Hartford Road Owensboro, KY 42303 Phone: (270) 685-8000

March 30, 2001

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PUBLIC SERVICE
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WESTERN
KENTUCKY
GAS

WESTERN KENTUCKY GAS COMPANY
2000 METER SAMPLING ANNUAL REPORT

Western Kentucky Gas completed the second year for statistical sampling of their meter population with the following results:

A total of 7,602 meters making up 123 control groups or meter families were sampled. All meter families were tested in accordance with the sampling procedure as set forth in the Kentucky Public Service Commission's Order in Case No. (99-059) dated August 24, 1999.

Five of the meter groups failed. Three of the groups are comprised of eleven (11) field test turbine meters that will be tested again next year. The fourth group contained one meter and it was removed from service. The fifth group contained seven (7) meters of which two (2) were pulled with the remaining five (5) to be removed within the next eighteen (18) months.

The meter sampling program is proving to be a better program than the periodic testing program for both customers and the utility. The customer and the company benefits for the same reason; namely poor performing meters will be identified and removed from service. This allows quality meters to stay in service for an extended length of time.

Attached are the results of the program as requested by the order. Should you have any questions, please call (270) 683-4068.

Barry Wigginton

Barry Wigginton
Supervisor of Measurement

Western Kentucky Gas Company 2401 New Hartford Road Owensboro, KY 42303 Phone: (270) 685-8000

2000 WESTERN KENTUCKY GAS METER SAMPLING RESULTS

Family codes	Total Mtrs in Family	Total Sampled	Total Failed Meters	Total Rejects Allowed	2000 Family Status	No. Failed Fast	No. Failed Slow
AC250A	1	1	-	1	passed	-	-
AC250C	7	2	1	1	failed	1	-
AC250D	6	2	-	-	passed	-	-
AC250E	3,958	200	2	22	passed	2	-
AC250F	9,882	200	8	22	passed	6	2
AC250F8	3,561	200	-	22	passed	-	-
AC250G	3,949	200	-	22	passed	-	-
AC250G9	8,732	200	2	22	passed	2	-
AC250G9	6,383	200	4	22	passed	4	-
AC250F9	9,895	200	4	22	passed	2	2
AL1000A	429	50	-	8	passed	-	-
AL1000B	35	8	1	2	passed	-	1
AL1000C	22	5	-	2	passed	-	-
AL1000D	80	13	-	3	passed	-	-
AL1000E	86	13	-	3	passed	-	-
AL1000F	101	20	-	4	passed	-	-
AL1000G	86	13	-	3	passed	-	-
AL175A	4,750	200	8	22	passed	5	3
A175B	7,437	200	4	22	passed	3	1
AL175C	6,347	200	5	22	passed	5	-
AL175D	8,480	200	5	22	passed	4	1
AL175D7	2,523	125	5	15	passed	5	-
AL175E	1,741	125	-	15	passed	-	-
AL175F	13	3	-	1	passed	-	-
AL175G	8,606	200	8	22	passed	6	2
AL225A	6,938	200	5	22	passed	3	2
AL225B	393	50	3	8	passed	-	3
AL225C	23	5	-	2	passed	-	-
AL225D	18	5	-	2	passed	-	-
AL225E	6	2	-	1	passed	-	-
R415A	1,413	125	10	15	passed	3	7
R415B	443	50	2	8	passed	1	1
R415C	45	8	-	2	passed	-	-
R415D	8	2	-	1	passed	-	-
R415E	6	2	-	1	passed	-	-
R415F	62	13	1	3	passed	1	-
R415G	1	1	-	1	passed	-	-
AL2300G	350	50	-	8	passed	-	-
T306G	2	2	-	1	passed	-	-
AL1400G	344	50	-	8	passed	-	-
3000RG	125	20	1	4	passed	-	1

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000 Family Status	No.Failed Fast	No. Failed Slow
R750A	201	32	1	6	passed	-	1
R750B	150	20	1	4	passed	-	1
R750C	6	2	-	1	passed	-	-
R750D	16	5	1	2	passed	-	1
R750E	5	2	-	1	passed	-	-
R750F	55	13	-	3	passed	-	-
S250F	2,780	125	-	15	passed	-	-
R250A54	33	33	3	6	passed	1	2
R250A59	2,874	125	9	15	passed	8	1
R250A60	1,204	125	2	15	passed	2	-
R250A61	2,126	125	3	15	passed	3	-
R250A62	1,604	125	3	15	passed	2	1
R250A63	1,635	125	3	15	passed	2	1
R250A68	879	80	2	11	passed	1	1
R250B	279	32	1	6	passed	1	-
R250C	68	68	3	8	passed	3	-
R250D	40	8	-	2	passed	-	-
R250E	8	2	-	1	passed	-	-
R250F	2	2	-	1	passed	-	-
11500400	1	1	-	1	passed	-	-
11CG	1	1	-	1	passed	-	-
11MG	79	13	-	3	passed	-	-
15CG	15	3	-	1	passed	-	-
16MG	57	13	-	3	passed	-	-
1M600G	8	2	-	1	passed	-	-
23MG	42	8	-	2	passed	-	-
250BG	263	32	-	6	passed	-	-
2MG	1	1	-	1	passed	-	-
2MROME	2	2	-	1	passed	-	-
3600M60	2	2	-	1	passed	-	-
38MG	21	5	-	2	passed	-	-
3GTG	3	3	-	1	passed	-	-
3MG	184	32	-	6	passed	-	-
4GTG	9	9	1	1	failed	1	-
500BG	46	8	-	2	passed	-	-
5MG	101	20	-	4	passed	-	-
6GTG	1	1	1	1	failed	-	1
7MG	145	20	-	4	passed	-	-
80BG	155	32	1	6	passed	-	1
8CG	7	2	-	1	passed	-	-
8GTG	2	2	-	1	passed	-	-
5000DUG	3	2	-	1	passed	-	-
5000ALG	80	13	-	3	passed	-	-
10000RG	48	8	-	2	passed	-	-

Family codes	Total Mtrs in family	Total Sampled	Total Failed Meters	Total Reject Allowed	2000 Family Status	No.Failed Fast	No. Failed Slow
T608G	1	1	1	1	failed	1	-
AL425A	1	1	-	1	passed	-	-
AL425B	3	3	-	1	passed	-	-
AL425C	243	32	-	6	passed	-	-
AL425D	728	80	2	11	passed	1	1
AL425E	321	50	1	8	passed	1	-
AL425F	294	50	2	8	passed	1	1
AL425G	1,099	80	1	11	passed	-	1
AL800A	2	2	-	1	passed	-	-
AL800B	2	2	-	1	passed	-	-
AL800C	22	5	-	2	passed	-	-
AL800D	221	32	-	6	passed	-	-
AL800E	257	32	-	6	passed	-	-
AL800F	157	32	-	6	passed	-	-
AL800G	39	8	-	2	passed	-	-
L250G	2,871	125	1	15	passed	1	-
R175A	5,021	200	4	22	passed	1	3
R175B	6,012	200	6	22	passed	3	3
R175C	1,631	125	3	15	passed	2	1
R175D	33	8	-	2	passed	-	-
R175D	11	3	-	1	passed	-	-
R175F	1	1	1	1	failed	1	-
R175G	188	32	-	6	passed	-	-
R200A5	8,976	200	-	22	passed	-	-
R200B	6	2	-	1	passed	-	-
R200C	1,385	125	4	15	passed	3	1
R200D	9,284	200	6	22	passed	3	3
R200E	3,566	200	8	22	passed	4	4
R200F	6	2	-	1	passed	-	-
R200G	875	80	3	11	passed	2	1
R275A	2	2	-	1	passed	-	-
R275B	1	1	-	1	passed	-	-
R275D	1	1	-	1	passed	-	-
R275E	4,215	200	2	22	passed	1	1
R275F	4,677	200	2	22	passed	1	1
R275G	4,045	200	3	22	passed	3	-
R275G97	9,154	200	-	22	passed	-	-
S175	236	236	-	6	passed	-	-
Total	178,115	7,602	164	953		106	58

Western Kentucky Gas Company

WESTERN
KENTUCKY
GAS

April 7, 2000

RECEIVED
APR 11 2000
PUBLIC SERVICE
COMMISSION

Honorable Martin J. Huelsmann
Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
P.O. Box 615
Frankfort, Kentucky 40602

Subject: Annual Report - Sample Meter Test Plan
Case No. 99-059

Dear Mr. Huelsmann:

In compliance with the Commission's Order in the above referenced matter, Western Kentucky Gas Company is hereby filing its first Annual Report.

All technical questions should be directed to Mr. Barry Wigginton, Supervisor of Measurement, at 270-683-4068.

Sincerely yours,

William J. Senter

William J. Senter
VP – Rates & Regulatory Affairs

Enclosures

Cc: Mr. Barry Wigginton
Mr.John Willis

2401 New Hartford Road Owensboro, KY 42303 Phone: (502) 685-8150 Fax: (502) 685-8052

April 4, 2000

WESTERN KENTUCKY GAS COMPANY
1999 METER SAMPLING ANNUAL REPORT

Western Kentucky Gas completed the first year of its meter sampling program with the following results.

A total of 5,371 meters making up 66 control groups or meter families were sampled. All meter families were tested in accordance with the sampling procedure as set forth in the Kentucky Public Service Commission's Order in Case No. 99-059 dated August 24, 1999.

One meter group failed. This 92 meter group of Rockwell 250's has been examined to determine what was the cause for bad test results. The year purchased, last year tested, location of customer, service technician involved and actual test results were reviewed to find a trend. With only one year of data it is difficult to determine the problem. Therefore, the remaining meters in this group will be removed within the next eighteen months since no other means of identification of deviant meters can be determined.

For year 2000 testing, the remaining passing groups of Rockwell 250's will be subdivided into smaller groups in a proactive effort to further identify potential problems in the findings of next year's inquiry.

Administering and monitoring meter sampling is a complex program when compared to periodic testing. It is however, a better program for our customers and the utility. The customer and utility benefits because a poor performing group of meters will be identified and removed from service. This allows quality meters to stay in service for an extended length of time.

Attached are the results of the program as directed in the Commission's Order. All questions regarding this report should be directed to Barry Wigginton, Supervisor of Measurement, at 270-683-4068.

1999 WESTERN KENTUCKY GAS METER SAMPLING RESULTS

Samples taken for year 1999
0-500 cfh

Family codes	Total Mtrs in Family (a)	Total Mtrs Req'd in Program (b)	Total Sampled ©	Total Failed Meters (d)	Total Rejects Allowed (e)	1999 Family Status (f)	Ratio Failed (d/c=g)*100	No. Failed Fast (h)	No. Failed Slow (I)
030A	3	3	3	0	1	passed	0.0%		
030B	2	2	2	0	1	passed	0.0%		
030C	3	2	3	0	1	passed	0.0%		
030D	10	3	3	0	1	passed	0.0%		
030E	4379	200	200	2	22	passed	1.0%	2	
030F	9682	200	200	0	22	passed	0.0%		
030F89	3983	200	200	3	22	passed	1.5%	3	
030G98	9834	200	200	0	22	passed	0.0%		
030G95	9543	200	200	2	22	passed	1.0%	1	1
030G94	6933	200	200	3	22	passed	1.5%	3	
031A	5236	200	200	14	22	passed	7.0%	8	6
031B	8108	200	200	4	22	passed	2.0%		4
031C	6941	200	200	4	22	passed	2.0%	2	2
031E	1979	125	125	1	15	passed	0.8%	1	
031F	18	5	5	0	2	passed	0.0%		
031G	8351	200	200	1	22	passed	0.5%	1	
032A	7609	200	200	10	22	passed	5.0%	7	3
032B	502	80	80	3	11	passed	3.8%	1	2
032C	32	8	8	1	2	passed	12.5%	1	
032D	23	5	5	1	2	passed	20.0%		1
032E	8	2	2	0	1	passed	0.0%		
032F	1	2	1	0	1	passed	0.0%		
034A	3	2	2	0	1	passed	0.0%		
034B	2	2	2	0	1	passed	0.0%		
034C	213	32	32	0	6	passed	0.0%		
034D	827	80	80	4	11	passed	5.0%		4
034E	291	50	50	2	8	passed	4.0%	1	1
034F	347	50	50	2	8	passed	4.0%	1	1

Family codes	Total Mtrs in family	Total mtrs req in program	Total Sampled	Total Failed Meters	Total Reject Allowed	1999 Family Status	Ratio Failed	No.Failed Fast	No. Failed Slow
034G	943	80	80	4	11	passed	5.0%		4
053B	539	80	80	3	11	passed	3.8%	3	
053C	42	8	8	0	2	passed	0.0%		
053D	11	3	3	0	1	passed	0.0%		
053E	10	3	3	0	1	passed	0.0%		
053F	79	13	13	0	1	passed	0.0%		
053G	1	2	1	0	1	passed	0.0%		
059A	1	2	1	0	1	passed			
059B	10	3	3	0	1	passed	0.0%		
059C	1590	125	125	3	15	passed	2.4%	1	2
059D	9756	200	200	3	22	passed	1.5%		3
059E	3985	200	200	8	22	passed	4.0%		8
059F	8	2	2	0	1	passed	0.0%		
059G	690	80	80	1	11	passed	1.3%		1
060A	5491	200	200	11	22	passed	5.5%	5	6
060B	6613	200	200	7	22	passed	3.5%	3	4
060C	1865	125	125	4	15	passed	3.2%	1	3
060D	45	8	8	0	2	passed	0.0%		
060E	17	5	5	1	2	passed	20.0%		1
060F	3	2	2	0	1	passed	0.0%		
060G	85	13	13	1	3	passed	7.7%	1	
061A	2	2	2	0	1	passed	0.0%		
061B	3	2	2	0	1	passed	0.0%		
061C	2	2	2	0	1	passed	0.0%		
061D	3	2	2	0	1	passed	0.0%		
061E	4660	200	200	6	22	passed	3.0%	4	2
061F	5122	200	200	2	22	passed	1.0%	2	
061G	3987	200	200	1	22	passed	0.5%		1
061G97	9803	200	200	2	22	passed	1.0%	1	1
062A	8049	200	200	21	22	passed	10.5%	7	14
062B	349	50	50	6	8	passed	12.0%	4	2
062C	92	20	20	4	4	failed	20.0%		4

Family codes	Total Mtrs in family	Total mtrs req in program	Total Sampled	Total Failed Meters	Total Reject Allowed	1999 Family Status	Ratio Failed	No.Failed Fast	No. Failed Slow
062D	57	13	13	2	3	passed	15.4%		2
062E	12	3	3	0	1	passed	0.0%		
062F	6	2	2	0	1	passed	0.0%		
138F	3041	125	125	0	15	passed	0.0%		
210C	150	20	20	0	4	passed	0.0%		
210G	3071	125	125	2	15	passed	1.6%	2	
TOTAL	155056	5373	5371	149	648		2.8%	66	83

·The Law Firm Of·

sheffer·hutchinson·kinney

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ALL OTHERS ADMITTED IN KY ONLY

September 23, 1999

FEDERAL EXPRESS

Ms. Helen Helton
Executive Director
Public Service Commission
P.O. Box 615
730 Schenkel Lane
Frankfort, Kentucky 40602

RECEIVED
SEP 24 1999
PUBLIC SERVICE
COMMISSION

RE: Western Kentucky Gas Company
Case No. 99-059

Dear Helen:

By its Order of August 24, 1999, the Commission approved Western's proposed statistical sample meter test plan for a period of five years. The Commission's order directed Western to notify it of the time frame for implementation of the Plan.

Western will begin implementation of the Plan on October 1, 1999 which is the beginning of its next fiscal year (FY 2000). Western will file the first annual report with the Commission by April 1, 2000.

If you should need anything further please advise. Thanks.

Very truly yours,

SHEFFER-HUTCHINSON-KINNEY

Mark R. Hutchinson

MRH:bkk
c: Bill Senter
Jack Hughes

INDEX FOR CASE: 99-059
WESTERN KENTUCKY GAS COMPANY
Deviation
STATISTICAL SAMPLE METER TEST PLAN

IN THE MATTER OF THE APPLICATION OF WESTERN KENTUCKY GAS COMPANY, A DIVISION OF ATMOS ENERGY CORPORATION, FOR APPROVAL OF A STATISTICAL SAMPLE METER TEST PLAN FOR POSTIVE DISPLACEMENT METERS PURSUANT TO 807 KAR 5:022, SECTION 8(5)(C)

SEQ NBR	ENTRY DATE	REMARKS
0001	02/17/99	Application.
0002	02/18/99	Acknowledgment letter.
0003	04/02/99	Data Request Order; response due 4/19; schedules 4/30 informal conference.
M0001	04/19/99	MARK HUTCHINSON WESTERN KY GAS-RESPONSE TO ORDER OF APRIL 2,99
0004	05/03/99	Informal Conference Memorandum
M0002	05/14/99	MARK HUTCHINSON WESTERN KY GAS-RESPONSE TO INFORMAL CONFERENCE MEMO
M0003	06/02/99	MARK HUTCHINSON WESTERN KY GAS-REVISED GAS METER PERFORMANCE CONTROL PROGRAM
0005	06/24/99	Order entered; requests for hearing due 7/6 or case stands submitted
M0004	07/01/99	DOUGLAS WALTHER WESTERN KY GAS-MOTION FOR HEARING
0006	07/15/99	Order entered setting hearing for 10/7/99; IC schedule if response w/i 20 days.
M0005	08/04/99	MARK HUTCHINSON WESTERN KY GAD-RESPONSE TO PSC ORDER OF JULY 15,99
0007	08/24/99	FINAL ORDER APPROVING PROPOSED STATISTICAL SAMPLE METER TEST PLAN

COMMONWEALTH OF KENTUCKY
PUBLIC SERVICE COMMISSION
730 SCHENKEL LANE
POST OFFICE BOX 615
FRANKFORT, KY. 40602
(502) 564-3940

CERTIFICATE OF SERVICE

RE: Case No. 99-059
WESTERN KENTUCKY GAS COMPANY

I, Stephanie Bell, Secretary of the Public Service Commission, hereby certify that the enclosed attested copy of the Commission's Order in the above case was served upon the following by U.S. Mail on August 24, 1999.

See attached parties of record.

Stephanie Bell
Secretary of the Commission

SB/sa
Enclosure

Mr. William J. Senter
Vice President, Rates & Regulatory
Western Kentucky Gas Company
2401 New Harford Road
Owensboro, KY. 42303 1312

Honorable Mark R. Hutchinson
Attorney at Law
Sheffer-Hutchinson-Kinney
115 East Second Street
Owensboro, KY. 42303

Douglas Walther
Atmos Energy Corporation
P. O. Box 650250
Dallas, TX. 75265

Honorable Jack N. Hughes
Attorney at Law
124 West Todd Street
Frankfort, KY. 40601

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF WESTERN KENTUCKY)
GAS COMPANY, A DIVISION OF ATMOS ENERGY)
CORPORATION, FOR APPROVAL OF A)
STATISTICAL SAMPLE METER TEST PLAN FOR) CASE NO. 99-059
POSITIVE DISPLACEMENT METERS PURSUANT)
TO 807 KAR 5:022, SECTION 8(5)(C))

ORDER

On April 19, 1999, Western Kentucky Gas Company ("WKG") filed an application requesting approval of a statistical sample meter test plan for positive displacement gas meters pursuant to 807 KAR 5:022, Section 8(5)(c). On June 1, 1999, WKG filed a revised plan pursuant to the informal conference between WKG and Commission Staff on April 30, 1999. The Commission on June 24, 1999, by Order, notified WKG that Commission Staff will recommend that its plan be rejected for reasons stated in the Order. The Commission on July 15, 1999, by Order, scheduled a formal hearing for October 7, 1999 and an informal conference if WKG files a second revised sample meter test plan that addresses positively each of the eight issues set out in our June 24, 1999 Order.

On August 4, 1999, WKG filed a second amended plan consistent with the similar plan previously approved by the Commission for other gas utilities.[1] WKG's plan is based on American National Standard for Sampling Procedures and Tables for

---

[1] WKG's amended plan is attached to its August 4, 1999 second amended application as Attachment 1.

Inspection by Attributes that corresponds to ANSI/ASQC Z1.4-1993. WKG has requested to test samples of all its gas meters under the terms of the revised plan in lieu of 100 percent testing required under 807 KAR 5:022, Section 8(5). WKG has further requested to test samples of new gas meters under the terms of the revised plan in lieu of 100 percent testing required under 807 KAR 5:022, Section 8(3)(a)1.

WKG estimates annual savings of approximately $319,730 from implementing the statistical sample meter test plan, as compared to the costs of current periodic testing.

WKG states that the safety inspection will not be changed in any way with this program.

After consideration of the record and being otherwise sufficiently advised, the Commission finds that:

1. WKG's plan should be accepted for a pilot period of 5 years.

2. WKG should file an annual report with the Commission no later than April 1 of each year under this program.

3. At the end of the 5 year pilot program, WKG will file its final evaluation and analysis of the program and whether it intends to continue with the plan in lieu of the periodic testing.

4. The formal hearing scheduled for October 7, 1999 should be cancelled.

IT IS HEREBY ORDERED that:

1. WKG's proposed statistical sample meter test plan is approved for a period of 5 years from the date of this Order. WKG shall file its final evaluation of the

plan with the Commission along with any application to continue or notice of discontinuance of the plan no later than April 1, 2004.

2. WKG is granted a deviation from 807 KAR 5:022, Section 8(3)(a)1, for new gas meters for a period of the pilot sampling test plan.

3. Within 30 days of the date of this Order, WKG shall notify the Commission of the time frame for implementation of the plan. WKG shall file the first annual report no later than April 1, 2000 and subsequent reports within 12 months.

4. The hearing set for October 7, 1999 is cancelled.

Done at Frankfort, Kentucky, this 24th day of August, 1999.

By the Commission

ATTEST:

Executive Director

·The Law Firm Of·

sheffer·hutchinson·kinney

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[illegible]
AUG 0 4 1999
PUBLIC SERVICE
COMMISSION

August 3, 1999

FEDERAL EXPRESS

Ms. Helen Helton
Executive Director
Public Service Commission
P.O. Box 615
730 Schenkel Lane
Frankfort, Kentucky 40602

RE: Response of Western Kentucky Gas Company
Case No. 99-059

Dear Helen:

Please file the original and ten (10) copies, of the enclosed Response of Western Kentucky Gas Company to the Commission's order of July 15, 1999.

If there are any problems or questions with the enclosed, please do not hesitate to call me.

Very truly yours,

SHEFFER-HUTCHINSON-KINNEY

Mark R. Hutchinson

MRH:bkk

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

AUG 04 1999

[illegible]

In the Matter of:

THE APPLICATION OF WESTERN KENTUCKY)
GAS COMPANY, A DIVISION OF ATMOS ENERGY)
CORPORATION, FOR APPROVAL OF A STATISTICAL) CASE NO. 99-059
SAMPLE METER TEST PLAN FOR POSITIVE)
DISPLACEMENT METERS PURSUANT TO)
807 KAR 5:022, SECTION 8(5)(C))

RESPONSE

On July 15, 1999, the Commission issued an order setting an October 7, 1999, hearing date for Western's Gas Meter Performance Control Program. The order also required Western to file within twenty (20) days a second revised plan including a positive response to the eight issues raised in objection to Western's program in order for the Commission to set another informal conference on this matter. Since Western continues to maintain that many if not all of the issues to be heard can largely be resolved in an informal conference prior to hearing, Western is submitting a second revised Gas Meter Performance Control Program. For clarification purposes, Western submits the following responses to the concerns raised by the Staff. The eight concerns stated by the Staff are listed in bold print below, followed by a summary of Western's revised positions on these eight issues:

1. **WKG will not institute a sample to test new meters.**
   Western's program includes sample testing of new meter groups in accordance with ANSI Z1.4, normal inspection level II, and an AQL of 1.0. If the sample from any group fails the test, the entire group will be rejected.

2. **WKG's plan will test residential gas meters in year ten as the initial year for testing in lieu of year one. WKG will not be able to establish records for the meters installed during its proposed five year pilot plan.**
   Western has modified its plan so that meters will become eligible for sampling in a control group beginning in the first (1st) year of service with an Acceptable Quality Level (AQL) of 6.5.

3. **WKG's plan is deviating from a random selection of samples. WKG is proposing to include meters removed for other reasons during normal operations as a substitute for the random number generated by random generation program.**
   Western has modified its plan so that meters are not removed for other reasons

during normal operations as a substitute for the random number generated by the random generation program

4. **WKG's plan established a group size more than 10,000 meters. The Commission has limited the group size for other plans to 10,000 meters to control the limiting quality and the value of customer's risk within the required parameters.**
Western has removed Sample size group M, 10,001 to 35,000 , from its program.

5. **WKG's plan is not clear in specifying the changes to the inspection parameters. WKG used a general statement as referring to the broad spectrum of ANSI Z1.4 Standard.**
Page nine of ANSI Z1.4 is the flow chart for the "switching rules". This is applicable for all Z1.4 programs listed in the standard and explains the process very well. For clarity, Western will attach the chart to the filed plan. Control groups will be switched between tightened, normal and reduced testing per the ANSI Z1.4 flowchart.

6. **WKG's plan has not established a clear removal program for meters which fail in testing. The plan is changing the inspection level from one to another rather than removal of bad meters.**
Western commits that any control group that fails in testing will be subject to removal within 18 months. Reasonable effort will be made to identify a sub group that represents the bad meters during the 18 months. Otherwise, all meters in the control group will be removed.

7. **WKG's plan excludes the obsolete meter types from the program.**
Western has modified its plan to include all meters in its Gas Meter Performance Control Program.

8. **WKG's plan has not confirmed that the plan will not change the safety programs such as the inspection of safety regulators, curb boxes and other safety issues conducted during periodic meter testing.**
Western agrees to continue testing or inspection of service regulators, relief valves, vents and curb boxes operability in accordance with the KAR regulations in effect at the time of approval of this program or as subsequently amended. Western agrees that its Gas Meter Performance Control Program will not change, in any way, Western's safety programs or Western's handling of any other safety issues during periodic meter testing.

Attached hereto as Attachment 1 is Western's Revised Gas Meter Performance Control Program, which incorporates the changes discussed above. Although Western believes that the revisions reflected in the attached revised program should eliminate all of the Staff's concerns, Western nevertheless believes that it is appropriate to hold an informal conference in September to insure mutual understanding of Western's revised program.

Respectfully submitted this 3rd day of August, 1999.

Douglas Walther
Atmos Energy Corporation
P.O. Box 650250
Dallas, Texas 75265

Mark R. Hutchinson
SHEFFER-HUTCHINSON-KINNEY
115 East Second Street

John N. Hughes
124 W. Todd Street
Frankfort, Kentucky 40601

By:____________________
Attorneys for Atmos Energy

CERTIFICATE OF SERVICE

This is to certify that an original, plus ten copies, was this day served upon the Kentucky Public Service Commission, 730 Schenkel Lane, Frankfort, Kentucky 40602 by overnight Federal Express, on this the 3rd day of August, 1999.

____
Mark R. Hutchinson

II. CONTROL GROUP SAMPLING

The primary consideration in drawing a random sample is that each observance in the population must have an equal chance to be included in the sample. This ensures that the sample is representative of the population and the results of the sample are valid. Meters will be selected at random until there are enough meters in the sample to satisfy the sample size requirements.

A. As a part of this meter sampling plan, WKG will use the sample selection process as stated in ANSI Z1.4 Section 7.2 Sampling:

> When appropriate, the number of units in the sample shall be selected in proportion to the size of sublots or subbatches, or parts of the lot or batch, identified by some rational criterion. In so doing, the units from each part of the lot or batch shall be selected at random, as defined in ANSI/ASQC Standard A2-1987.

B. Sample sizes for each control group will be determined using the "Sample Size Code Letters" table for General Inspection Level II from ANSI Z1.4, using 6.5 as the designated Acceptable Quality Level (AQL). All control groups eligible will be accepted or rejected as allowed by ANSI Z1.4 with its designated AQL for single sampling.

C. Control groups will be switched between tightened, normal and reduced testing per ANSI Z1.4 Section 11.6. for accuracy, improvement or removal. When normal inspection is in effect, tightened inspection shall be instituted when a control group is operating within the high limits of the specified acceptable limits for five consecutive tests.

Single Sampling Plan (AQL = 6.5)

Lot or Batch Size	Sample	Normal Inspection			Tightened Inspection			Reduced Inspection		
	Size Code	Samples	Ac	Re	Samples	Ac	Re	Samples	Ac	Re
2 to 8	A	2	0	1	2	0	1	2	0	1
9 to 15	B	3	0	1	3	0	1	2	0	1
16 to 25	C	5	0	1	5	0	1	2	0	1
26 to 50	D	8	1	2	8	0	1	3	0	2
51 to 90	E	13	2	3	13	1	2	5	1	3
91 to 150	F	20	3	4	20	2	3	8	1	4
151 to 280	G	32	5	6	32	3	4	13	2	5
281 to 500	H	50	7	8	50	5	6	20	3	6
501 to 1200	J	80	10	11	80	8	9	32	5	8
1201 to 3200	K	125	14	15	125	12	13	50	7	10
3201 to 10000	L	200	21	22	200	18	19	80	10	13

Accept--(AC) --means accept the control group with no more than this quantity of defective meters.

Reject--(RE) --means reject the control group with equal or greater to this number of defective meters.

III. CREATION OF METER CONTROL GROUPS

Control groups of positive displacement gas meters will be created and maintained according to the following parameters:

A. Gas meters will be segregated into groups with similarly identifiable characteristics based on two criteria:

   1. Control groups of all gas meters being placed into service shall be established according to purchase, field test or remanufacture year, type, model, class, manufacturer and composition.

   2. Control Groups composed of like meters with different years of installation may be established. When this is done, the earliest installation year of all the combined like meters will become the controlling year of installation for the new control group.

B. When created, each group will be assigned a descriptive title and control group number to facilitate identification.

C. New control groups will be established and identified at the end of each year from those gas meters installed during the year between January 1 and December 31.

IV. INSPECTION PARAMETERS

All control groups will be switched between tightened, normal and reduced testing per the ANSI Z1.4 flowchart.

Gas meters, shall be deemed as accurate after removal from service if the average of the Open Test (full capacity) and Check Test (20 percent capacity) is not more than plus or minus 2 percent error.

A. A control group can become eligible for reduced sampling after ten years of sampling has been completed without failures. The reduced inspection level will be according to Reduced Sampling. At the first occurrence of unacceptable sampling the group will return to normal sampling.

B. A control group will be subjected to tightened inspection parameters when two out of five years fail the normal sampling criteria. The tightened inspection level will be according to Tightened Sampling. A control group will return to Normal Inspection from Tightened Inspection when five years of sampling has been completed with an acceptable level.

V. ACCURACY IMPROVEMENT

Any control group that fails in testing will be subject to removal within 18 months. Every effort will be made to identify a sub group that represents the bad meters during the 18 months. Otherwise, all meters in the control group will be removed.

A. The control group of meters in any sampling inspection plan may be subdivided in an effort to identify the deviant subgroup. If, by the removal of a specific sub-group of meters, it can be demonstrated that the original control group of meters now meets the accuracy standard under General Inspection Level II for Normal Inspection, the remaining meters in the original control group shall remain in service.

B. If a deviate sub-group of meters cannot be identified to improve the control group's accuracy, then every reasonable effort will be made to remove the entire control group of meters from the service within 18 months once it has failed the applicable governing standard for the control group under ANSI Z1.4.

Meters shall be excluded from the sampling criteria for the following reasons:

1. Damage not associated with normal operating conditions that may have altered how the meter was actually performing while in service.

2. Meters which WKG suspects have been tampered with or meters removed by theft and later recovered by WKG.

VI. PERFORMANCE CLASSIFICATION TIME PARAMETERS

Scheduled control group testing for each test year shall begin January 1 and be completed by December 31 of the test year. The finalized test results will be published for review and a copy submitted to the Public Service Commission. The annual published review of WKG's Gas Meter Performance Control Plan shall detail at minimum the following items for each control group:

- Control Group Identification Number
- Model
- Purchase or Repair Year
- Balance of Control Group on Jan 1 and Dec 31 of Each Test Year
- Number of Meters Removed Under Scheduled Sampling
- Number of Meters Removed for Other Reasons
    - Accept Level for Specified Test
    - Number of Meter Accepted
    - Reject Level For Specified Test
    - Number of Meters Rejected
    - Percentage of Rejected Meters Over 2 Percent Fast
    - Percentage of Rejected Meters Over 2 Percent Slow

VII. SAMPLING PLAN FOR NEW METERS

Testing new meters: The plan includes sample testing of new meter groups in accordance with ANSI Z1.4, normal inspection level II, and an AQL of 1.0. If the sample from any group fails the test, the entire group will be rejected.

VIII. PERIODIC TEST OPTION

If WKG, at a later date, decides to switch its entire meter population from Sample Testing back to the KPSC's current Periodic Test Schedule, a time frame equal to half of the average in service age of WKG's installed positive displacement meter population at that time shall be allowed for WKG to bring the service life of its meters into compliance with the KPSC's Periodic Test Schedule. Control groups that may fail within that period will continue to be removed within 18 months of issue of the Removal Order.

IX. MAXIMUM IN-SERVICE LIFE

No meter in this program will be in service more than 35 years. All meters still in service at 35 years will be removed from the system within 18 months.

X. ANNUAL REPORT

WKG proposes to file an annual report with the KPSC which will include identification and test results of each control group, test results for the new meters including manufacturer's test records, evaluation and analysis of the data, and any corrective action taken. WKG will also address direct cost savings and the overall effectiveness of this program.

XI. PUBLIC SAFETY

WKG agrees to continue testing or inspection of service regulators, relief valves, vents and curb boxes operability in accordance with the KAR regulations in effect at the time of approval of this plan or as subsequently amended. Western agrees that its Gas Meter Performance Control Program will not change, in any way, Western's safety programs or Western's handling of any other safety issues during periodic meter testing.

Switching Rules for ANSI Z1.4 System

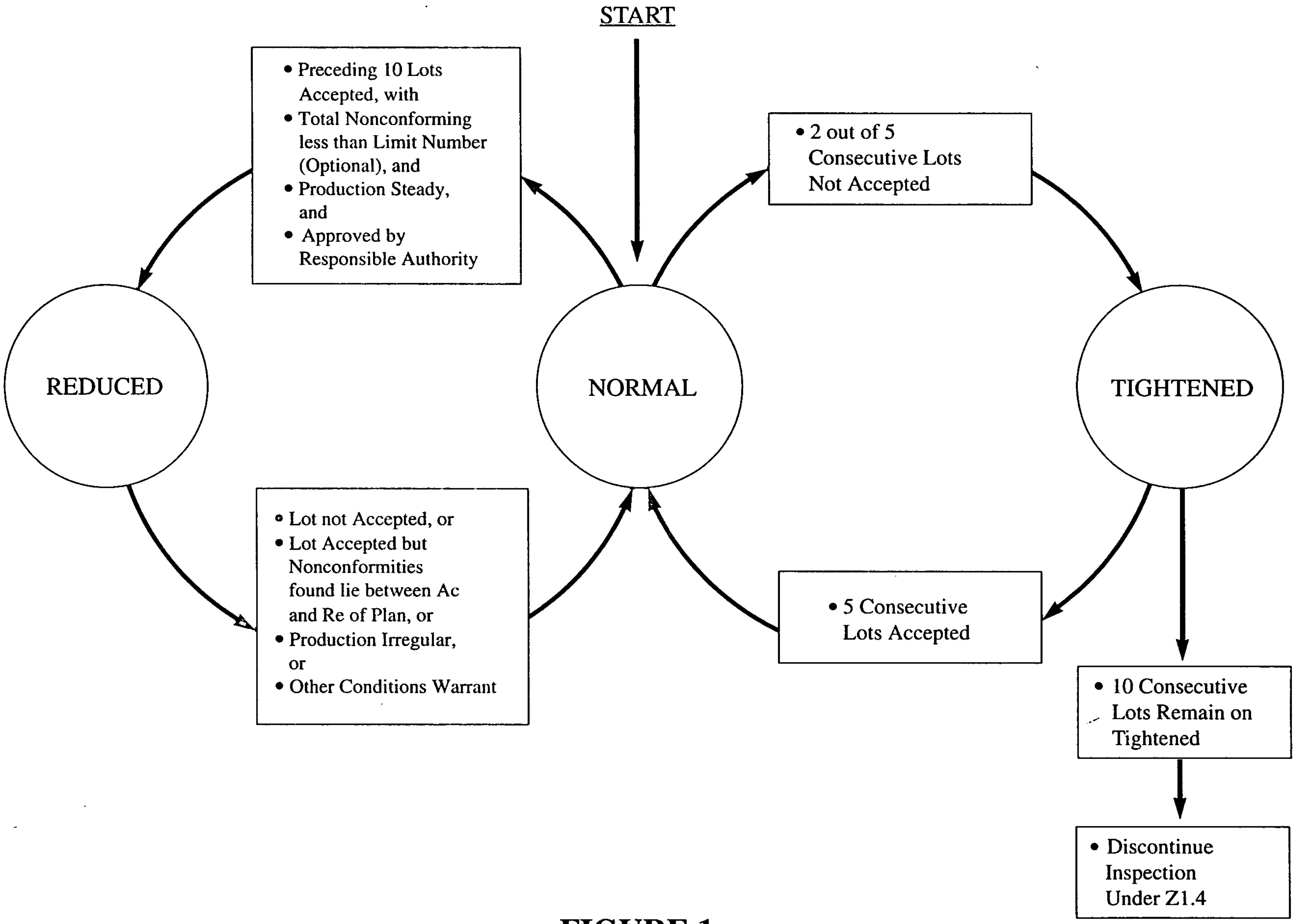
START
REDUCED
NORMAL
TIGHTENED
• Preceding 10 Lots Accepted, with
• Total Nonconforming less than Limit Number (Optional), and
• Production Steady, and
• Approved by Responsible Authority
• 2 out of 5 Consecutive Lots Not Accepted
• Lot not Accepted, or
• Lot Accepted but Nonconformities found lie between Ac and Re of Plan, or
• Production Irregular, or
• Other Conditions Warrant
• 5 Consecutive Lots Accepted
• 10 Consecutive Lots Remain on Tightened
• Discontinue Inspection Under Z1.4

FIGURE 1

COMMONWEALTH OF KENTUCKY
PUBLIC SERVICE COMMISSION
730 SCHENKEL LANE
POST OFFICE BOX 615
FRANKFORT, KY. 40602
(502) 564-3940

July 15, 1999

To: All parties of record

RE: Case No. 99-059

We enclose one attested copy of the Commission's Order in the above case.

Sincerely,

Stephanie Bell
Secretary of the Commission

SB/rlm
Enclosure

Mr. William J. Senter
Vice President, Rates & Regulatory
Western Kentucky Gas Company
2401 New Harford Road
Owensboro, KY 42303 1312

Honorable Mark R. Hutchinson
Attorney at Law
Sheffer-Hutchinson-Kinney
115 East Second Street
Owensboro, KY 42303

Douglas Walther
Atmos Energy Corporation
P. O. Box 650250
Dallas, TX 75265

Honorable Jack N. Hughes
Attorney at Law
124 West Todd Street
Frankfort, KY 40601

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF WESTERN KENTUCKY)
GAS COMPANY, A DIVISION OF ATMOS ENERGY)
CORPORATION, FOR APPROVAL OF A STATISTICAL) CASE NO. 99-059
SAMPLE METER TEST PLAN FOR POSTIVE)
DISPLACEMENT METERS PURSUANT TO)
807 KAR 5:022, SECTION 8(5)(C))

ORDER

On July 1, 1999, applicant, Western Kentucky Gas Company ("WKG"), by counsel, filed a motion for hearing pursuant to the Commission's Order entered on June 24, 1999 and, in addition, requested a second informal conference (a copy of the June 24, 1999 Order is attached for reference). On April 30, 1999, an informal conference was conducted and WKG's application which requested a deviation from the regulations in order to allow WKG to use a statistical sample meter test plan was fully and completely discussed. Subsequently, WKG filed a revised application/test plan. During the informal conference it was determined by Commission Staff that WKG's sample meter test plan was deficient in eight (8) specific areas. WKG's revised test plan did not resolve the eight (8) deficiencies. After consulting with Commission Staff, reviewing the record and being otherwise sufficiently advised, IT IS ORDERED as follows:

1. A formal hearing in this matter shall be conducted on October 7, 1999, at 10:00 a.m., Eastern Daylight Time, in Hearing Room 1 of the Commission's offices at 730 Schenkel Lane, Frankfort, Kentucky.

2. A second informal conference will be scheduled if WKG files a second revised sample meter test plan which addresses positively each of the eight (8) specific

deficiencies as set out in the attached Order entered on June 24, 1999 within 20 days of the date of this Order.

3. The matter is subject to information request by Commission Staff in order to further examine and re-examine all aspects of WKG's sample meter test plan(s) including but not limited to any such plan(s) filed subsequent to the date of this Order.

Done at Frankfort, Kentucky, this 15th day of July, 1999.

By the Commission

ATTEST:

Executive Director

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF WESTERN KENTUCKY)
GAS COMPANY, A DIVISION OF ATMOS ENERGY)
CORPORATION, FOR APPROVAL OF A) CASE NO. 99-059
STATISTICAL SAMPLE METER TEST PLAN FOR)
POSITIVE DISPLACEMENT METERS PURSUANT)
TO 807 KAR 5:022, SECTION 8(5)(C))

ORDER

On April 19, 1999, Western Kentucky Gas Company ("WKG") filed an application requesting approval of a statistical sample meter test plan for positive displacement gas meters pursuant to 807 KAR 5:022, Section 8(5)(c). On June 1, 1999, WKG filed a revised plan pursuant to the informal conference between WKG and Commission Staff on April 30, 1999. The plan is based on American National Standard for Sampling Procedures and Tables for Inspection by Attributes ("ANSI Z1.4"). WKG has requested to test samples of new or remanufactured gas meters under the terms of the revised plan in lieu of 100 percent testing required under the regulation.

After consideration of the record, Commission Staff is prepared to recommend to the Commission that WKG's application pursuant to 807 KAR 5:022, Section 8(5)(c) for approval of a statistical sample meter test plan be denied for the following reasons:

1. WKG's plan will not institute a sample to test new meters.

2. WKG's plan will test residential gas meters in year ten as the initial year for testing in lieu of year one. WKG will not be able to establish records for the meters installed during its proposed five year pilot plan.

3. WKG's plan is deviating from a random selection of samples. WKG is proposing to include meters removed for other reasons during normal operations as a substitute for the random number generated by random generation program.

4. WKG's plan established group size more than 10,000 meters. The Commission has limited the group size for other plans to 10,000 meters to control the limiting quality and the value of customer's risk within the required parameters.

5. WKG's plan is not clear in specifying the changes to the inspection parameters. WKG used a general statement as referring to the broad spectrum of ANSI Z1.4 Standard.

6. WKG's plan has not established a clear removal program for meters which fail in testing. The plan is changing the inspection level from one to another rather than removal of bad meters.

7. WKG's plan excludes the obsolete meter types from the program.

8. WKG's plan has not confirmed that the plan will not change the safety programs such as the inspection of safety regulators, curb boxes and other safety issues conducted during periodic meter testing.

WKG estimates annual savings of approximately $319,730 from implementing the statistical sample meter test plan, as compared to the costs of current periodic testing.

IT IS HEREBY ORDERED that WKG has 10 days from the date of this Order to file a written request for a hearing. If no request for a hearing is filed, the matter will be submitted to the Commission for a decision on the record.

Done at Frankfort, Kentucky, this 24th day of June, 1999.

By the Commission

ATTEST:

Helen C Helton
Executive Director

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

RECEIVED
JUL - 1 1999
PUBLIC SERVICE
COMMISSION

In the Matter Of:

THE APPLICATION OF WESTERN)
KENTUCKY GAS COMPANY FOR)
APPROVAL OF A STATISTICAL METER) CASE NO. 99-059
TEST PLAN FOR POSITIVE DISPLACEMENT)
METERS PURSUANT TO 807 KAR 5:022)
SECTION 8(5)(C))

MOTION FOR HEARING

Western Kentucky Gas Company, (Western), by counsel, pursuant to the Commission's order of June 24, 1999, requests a hearing in this matter.

To facilitate the disposition of this matter, resolve a number of issues and limit the scope of the hearing, Western requests that an informal conference be scheduled at least two weeks prior to the hearing. This will provide the parties the opportunity to prepare for and address at the hearing the issues identified at the conference.

Respectfully submitted:

Douglas Walther
Atmos Energy Corporation
P.O. Box 650205
Dallas, TX 75265

Mark R. Hutchinson
SHEFFER - HUTCHINSON - KINNEY
115 E. Second St.
Owensboro, KY 42303

John N. Hughes
124 West Todd Street
Frankfort, KY 40601
(502) 227-7270

By: John N. Hughes
Attorneys for Western Kentucky
Gas Company

BELLSOUTH

BellSouth Telecommunications, Inc.
P.O. Box 32410
Louisville, Kentucky 40232

502 582-8219
Fax 502 582-1573

Creighton E. Mershon, Sr.
General Counsel – Kentucky

June 30, 1999

RECEIVED
JUL - 1 1999
PUBLIC SERVICE
COMMISSION

Helen C. Helton
Executive Director
Public Service Commission
730 Schenkel Lane
P.O. Box 615
Frankfort, KY 40602

RE: Approval of the Resale Agreement Negotiated by BellSouth Telecommunications, Inc., and DAVCO, Inc., Pursuant to Sections 251 and 252 of the Telecommunications Act of 1996
KPSC Case No. 98-196

Dear Helen:

In late April 1998, BellSouth filed with the Commission the Resale Agreement between BellSouth and DAVCO. On July 17, 1998, the Commission approved the agreement subject to the filing of an amendment in the case reflecting accurate federal charges. As indicated in BellSouth's Motions for Extension of Time filed last August and October, BellSouth has been unsuccessful in its numerous attempts to obtain from DAVCO a signed amendment reflecting the accurate charge. In order that the Commission may close this case, on June 21, 1999, the Commission requested that BellSouth file a statement confirming that it is in fact charging DAVCO the accurate federal charge.

BellSouth states that DAVCO is no longer providing service in its region and that service to DAVCO was disconnected on February 1, 1999, for non payment. Should DAVCO provide service in BellSouth's region in the future, BellSouth will confirm with the Commission that it is charging DAVCO the accurate federal charge.

Please contact me if I can be of further assistance in this matter.

Sincerely,

Creighton E. Mershon, Sr. by

Creighton E. Mershon, Sr.

Dorothy J Chambers

COMMONWEALTH OF KENTUCKY
PUBLIC SERVICE COMMISSION
730 SCHENKEL LANE
POST OFFICE BOX 615
FRANKFORT, KY. 40602
(502) 564-3940

June 24, 1999

To: All parties of record

RE: Case No. 99-059

We enclose one attested copy of the Commission's Order in the above case.

Sincerely,

Stephanie J. Bell

Stephanie Bell
Secretary of the Commission

SB/sa
Enclosure

Mr. William J. Senter
Vice President, Rates & Regulatory
Western Kentucky Gas Company
2401 New Harford Road
Owensboro, KY 42303 1312

Honorable Mark R. Hutchinson
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Dallas, TX 75265

Honorable Jack N. Hughes
Attorney at Law
124 West Todd Street
Frankfort, KY 40601

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF WESTERN KENTUCKY)
GAS COMPANY, A DIVISION OF ATMOS ENERGY)
CORPORATION, FOR APPROVAL OF A) CASE NO. 99-059
STATISTICAL SAMPLE METER TEST PLAN FOR)
POSITIVE DISPLACEMENT METERS PURSUANT)
TO 807 KAR 5:022, SECTION 8(5)(C))

ORDER

On April 19, 1999, Western Kentucky Gas Company ("WKG") filed an application requesting approval of a statistical sample meter test plan for positive displacement gas meters pursuant to 807 KAR 5:022, Section 8(5)(c). On June 1, 1999, WKG filed a revised plan pursuant to the informal conference between WKG and Commission Staff on April 30, 1999. The plan is based on American National Standard for Sampling Procedures and Tables for Inspection by Attributes ("ANSI Z1.4"). WKG has requested to test samples of new or remanufactured gas meters under the terms of the revised plan in lieu of 100 percent testing required under the regulation.

After consideration of the record, Commission Staff is prepared to recommend to the Commission that WKG's application pursuant to 807 KAR 5:022, Section 8(5)(c) for approval of a statistical sample meter test plan be denied for the following reasons:

1. WKG's plan will not institute a sample to test new meters.

2. WKG's plan will test residential gas meters in year ten as the initial year for testing in lieu of year one. WKG will not be able to establish records for the meters installed during its proposed five year pilot plan.

3. WKG's plan is deviating from a random selection of samples. WKG is proposing to include meters removed for other reasons during normal operations as a substitute for the random number generated by random generation program.

4. WKG's plan established group size more than 10,000 meters. The Commission has limited the group size for other plans to 10,000 meters to control the limiting quality and the value of customer's risk within the required parameters.

5. WKG's plan is not clear in specifying the changes to the inspection parameters. WKG used a general statement as referring to the broad spectrum of ANSI Z1.4 Standard.

6. WKG's plan has not established a clear removal program for meters which fail in testing. The plan is changing the inspection level from one to another rather than removal of bad meters.

7. WKG's plan excludes the obsolete meter types from the program.

8. WKG's plan has not confirmed that the plan will not change the safety programs such as the inspection of safety regulators, curb boxes and other safety issues conducted during periodic meter testing.

WKG estimates annual savings of approximately $319,730 from implementing the statistical sample meter test plan, as compared to the costs of current periodic testing.

IT IS HEREBY ORDERED that WKG has 10 days from the date of this Order to file a written request for a hearing. If no request for a hearing is filed, the matter will be submitted to the Commission for a decision on the record.

Done at Frankfort, Kentucky, this 24th day of June, 1999.

By the Commission

ATTEST:

Helen C Helton

Executive Director

·The Law Firm Of·
sheffer·hutchinson·kinney

115 EAST SECOND STREET
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OF COUNSEL
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ALL OTHERS ADMITTED IN KY ONLY

May 26, 1999

Honorable Helen C. Helton
Executive Director
Kentucky Public Service Commission
730 Schenkel Drive
Frankfort, Kentucky 40602

RECEIVED
JUN 01 1999
PUBLIC SERVICE
COMMISSION

RE: Case No. 99-059
Western Kentucky Gas Company

Dear Ms. Helton:

Enclosed is Western's revised Gas Meter Performance Control Program. Western personnel met with members of the Commission Staff in an informal conference on April 30. The staff made various suggestions for changes to Western's Program. The enclosed revised Program incorporates several of the Staff's suggestions. As to those suggestions which have not been incorporated, I am enclosing a Memorandum which explains why Western does not concur with the Staff.

Very truly yours,

SHEFFER-HUTCHINSON-KINNEY

Mark R. Hutchinson

MRH:bkk

cc: Mr. Eddie Smith, PSC
Mr. Dale Wright, PSC
Mr. Bill Senter, WKG
Mr. David Doggette, WKG
Mr. John Willis, WKG
Mr. Douglas Walther, Senior Attorney

BOWLING GREEN EVANSVILLE FRANKFORT HENDERSON LOUISVILLE OWENSBORO PADUCAH

RECEIVED
JUN 01 1999
PUBLIC SERVICE
COMMISSION

MEMORANDUM

TO: KY Public Service Commission Staff

FROM: David H. Doggette, and
John M. Willis

DATE: May 21, 1999

SUBJECT: Case 99-059
Response to Informal Conference Issues
expressed via KPSC Staff Memorandum of April 30, 1999

Attached is our revised Gas Meter Performance Control Program which incorporates some, but not all, of the Staff's recommendations. For those recommendations which were not incorporated into the plan we have provided an explanation below.

1. **"WKG will institute a tightened inspection to improve the performance of control groups operating within the high limits of the specified acceptable standard."**
   See the revised Gas Meter Performance Control Program.

2. **"WKG will sample test the meters in year one."**
   WKG's submission of test data for meter failure and in-test results of the prior twenty years warrants statistical consideration for year ten as the initial year for testing. Other natural gas distribution companies have similar programs that have had successful results.

3. **"WKG will clarify the random selection of sample for any control group."**
   WKG will perform the sample testing for the correct, specified number of meters based on the control group size in accordance with the ANSI Z1.4. One of WKG's objectives is to provide excellent customer service by minimizing interruptions of service as stated in 807 KAR 5:022 section 1 (2) (b) which states "each utility shall make all reasonable efforts to prevent interruptions of service...". This will be accomplished by a random number generation program or by other removals as the opportunity randomly occurs through normal operations.

4. **"WKG will confirm that the sample test will not change the schedule for testing service regulators, relief valves, vents and curb boxes operability."**
   See the revised Gas Meter Performance Control Program.

5. **"WKG will sample test new meters."**
   WKG believes it appropriate to rely on the test results of KPSC certified meter shops. The quality assurance for transporting meters was explained in the previous informal meeting. The ANSI Z1.4 sampling program does not require initial sampling of previously tested meters.

6. **"WKG will limit meter life without testing to 35 years."**
   See the revised Gas Meter Performance Control Program.

7. **"WKG will limit the group size to 10,000 meters."**
   Former Mil Std 105D made no provision for additional samples to be pulled for groups above 10,000. This standard has been replaced by ANSI Z1.4, which has provisions for establishing a larger group size with a corresponding larger sample size. However, few groups are expected to be established above the 10,000 size as documented in the previously supplied groupings.

8. **"WKG will clarify the method of segregating the meters into homogeneous groups."**
   See the revised Gas Meter Performance Control Program.

ATTACHMENT 1

WESTERN KENTUCKY GAS COMPANY

GAS METER PERFORMANCE CONTROL PROGRAM

RECEIVED
JUN 01 1999
PUBLIC SERVICE
COMMISSION

Introduction

Western Kentucky Gas Company's Gas Meter Performance Control Program is a procedure designed to provide a continuous high level of quality in the measurement of gas delivered to our customers while controlling metering cost. A high level of accuracy will be achieved by applying modern sampling and statistical techniques in the evaluation of gas meter performance. The primary goal of the program is the detection and removal of groups of like meters not meeting prescribed performance standards as defined by the Kentucky Public Service Commission (KPSC). In accomplishing this goal, WKG expects to create an in-service environment that will produce a high level of metering accuracy while prolonging gas meter service life. To that end, WKG will achieve significant savings by reducing unnecessary testing of high quality, better performing meters. Specifically, WKG estimates that this program will result in approximately nine thousand (9,000) fewer meters being tested annually. WKG proposes that this sampling program, once initiated, run for a test period of five years and be re-evaluated to ensure WKG and KPSC objectives are achieved.

I. GENERAL DESCRIPTION OF PROGRAM

WKG's Gas Meter Performance Control Program is based on the American National Standard ANSI/ASQC Z1.4: Sampling Procedures and Tables for Inspection by Attributes, covering all classes of positive displacement diaphragm gas meters. Under Performance Control, WKG's gas meter populations will be classified into control groups representing populations of equivalent makes and sizes purchased or repaired within five consecutive years at a maximum. Once created, a control group would be subject to sample testing based on its rated capacity class as follows:

A. Residential class—rated capacity up to and including 500 cubic feet per hour

All new and remanufactured residential class meters will be tested under the current guidelines of the KPSC prior to installation. Meters will become eligible for sampling in a control group beginning in the 10th year of service with an Acceptable Quality Level (AQL) of 6.5.

B. Commercial class—501 cubic feet per hour up to 1500 cubic feet per hour

Positive displacement meters will become eligible for sampling in a control group beginning in the 1st year of service with an AQL of 6.5.

C. Commercial class—above 1500 cubic feet per hour

Positive displacement meters will become eligible for sampling in a control group beginning in the 1st year of service with an AQL of 6.5.

II. CONTROL GROUP SAMPLING

The primary consideration in drawing a random sample is that each observance in the population must have an equal chance to be included in the sample. This ensures that the sample is representative of the population and the results of the sample are valid. Meters will be selected at random until there are enough meters in the sample to satisfy the sample size requirements.

A. As a part of this meter sampling plan, WKG will use the sample selection process as stated in ANSI Z1.4 Section 7.2 Sampling:

> When appropriate, the number of units in the sample shall be selected in proportion to the size of sublots or subbatches, or parts of the lot or batch, identified by some rational criterion. In so doing, the units from each part of the lot or batch shall be selected at random, as defined in ANSI/ASQC Standard A2-1987.

B. Sample sizes for each control group will be determined using the "Sample Size Code Letters" table for General Inspection Level II from ANSI Z1.4, using 6.5 as the designated Acceptable Quality Level (AQL). All control groups eligible will be accepted or rejected as allowed by ANSI Z1.4 with its designated AQL for single sampling.

C. Control groups will be switched between tightened, normal and reduced testing per ANSI Z1.4 Section 11.6. for accuracy, improvement or removal. When normal inspection is in effect, tightened inspection shall be instituted when a control group is operating within the high limits of the specified acceptable limits for five consecutive tests.

Single Sampling Plan (AQL = 6.5)										
Lot or Batch Size	Sample	Normal Inspection			Tightened Inspection			Reduced Inspection		
	Size Code	Samples	Ac	Re	Samples	Ac	Re	Samples	Ac	Re
2 to 8	A	2	0	1	2	0	1	2	0	1
9 to 15	B	3	0	1	3	0	1	2	0	1
16 to 25	C	5	0	1	5	0	1	2	0	1
26 to 50	D	8	1	2	8	0	1	3	0	2
51 to 90	E	13	2	3	13	1	2	5	1	3
91 to 150	F	20	3	4	20	2	3	8	1	4
151 to 280	G	32	5	6	32	3	4	13	2	5
281 to 500	H	50	7	8	50	5	6	20	3	6
501 to 1200	J	80	10	11	80	8	9	32	5	8
1201 to 3200	K	125	14	15	125	12	13	50	7	10
3201 to 10000	L	200	21	22	200	18	19	80	10	13
10001 to 35000	M	315	21	22	315	18	19	125	10	13

Accept--(AC) --means accept the control group with no more than this quantity of defective meters.

Reject--(RE) --means reject the control group with equal or greater to this number of defective meters.

Control group sampling will, where possible, be accomplished through the testing of meters randomly selected for sample testing. Other routine meter changes and removals obtained during the calendar year may be included as part of the random sample for any control group if it can be properly documented that the integrity of ANSI Z1.4 Section 7.2 Sampling is maintained.

III. CREATION OF METER CONTROL GROUPS

Control groups of positive displacement gas meters will be created and maintained according to the following parameters:

A. Gas meters will be segregated into groups with similarly identifiable characteristics based on two criteria:

  1. Control groups of all gas meters being placed into service shall be established according to purchase, field test or remanufacture year, type, model, class, manufacturer and composition.

  2. Control Groups composed of like meters with different years of installation may be established. When this is done, the earliest installation year of all the combined like meters will become the controlling year of installation for the new control group.

B. When created, each group will be assigned a descriptive title and control group number to facilitate identification.

C. New control groups will be established and identified at the end of each year from those gas meters installed during the year between January 1 and December 31.

IV. INSPECTION PARAMETERS

All control groups will begin testing according to the ANSI/ASQC Z1.4 General Inspection Level II for Normal Sampling. All changes to the inspection parameters will be done according to Section 11.6.

Gas meters, shall be deemed as accurate after removal from service if the average of the Open Test (full capacity) and Check Test (20 percent capacity) is not more than plus or minus 2 percent error.

A. A control group can become eligible for reduced sampling after ten years of sampling has been completed without failures. The reduced inspection level will be according to Reduced Sampling. At the first occurrence of unacceptable sampling the group will return to normal sampling.

B. A control group will be subjected to tightened inspection parameters when two out of five years fail the normal sampling criteria. The tightened inspection level will be according to Tightened Sampling. A control group will return to Normal Inspection from Tightened Inspection when five years of sampling has been completed with an acceptable level.

V. ACCURACY IMPROVEMENT

When a control group is classified in a tightened status and a failure occurs, one of the following actions will occur:

A. The control group of meters in any sampling inspection plan may be subdivided in an effort to identify the deviant subgroup. If, by the removal of a specific sub-group of meters, it can be demonstrated that the original control group of meters now meets the accuracy standard under General Inspection Level II for Normal Inspection, the remaining meters in the original control group shall remain in service.

B. If a deviate sub-group of meters cannot be identified to improve the control group's accuracy, then every reasonable effort will be made to remove the entire control group of meters from the service within 18 months once it has failed the applicable governing standard for the control group under ANSI Z1.4.

Meters shall be excluded from the sampling criteria for the following reasons:

1. Damage not associated with normal operating conditions that may have altered how the meter was actually performing while in service.

2. Meters which WKG suspects have been tampered with or meters removed by theft and later recovered by WKG.

VI. PERFORMANCE CLASSIFICATION TIME PARAMETERS

Scheduled control group testing for each test year shall begin January 1 and be completed by December 31 of the test year. The finalized test results will be published for review and a copy submitted to the Public Service Commission. The annual published review of WKG's Gas Meter Performance Control Plan shall detail at minimum the following items for each control group:

- Control Group Identification Number
- Model
- Purchase or Repair Year
- Balance of Control Group on Jan 1 and Dec 31 of Each Test Year
- Number of Meters Removed Under Scheduled Sampling
- Number of Meters Removed for Other Reasons
    - Accept Level for Specified Test
    - Number of Meter Accepted
    - Reject Level For Specified Test
    - Number of Meters Rejected
    - Percentage of Rejected Meters Over 2 Percent Fast
    - Percentage of Rejected Meters Over 2 Percent Slow

VII. SAMPLING PLAN FOR METER OUT-TEST

All new meters purchased by WKG will be subject to 100 percent testing by the manufacturer before shipment to WKG. The manufacturer's test results for each meter must accompany the meter at the time it is received by WKG or before shipment The calibration standard for all new remanufactured, and repaired gas meters being placed into service shall comply with the KPSC rules.

VIII. FIRST YEAR REPLACEMENT OF OBSOLETE METER TYPES

WKG will exclude all obsolete meter types from the sampling program. These meters have been identified through an analysis of historical meter performance and testing data. Our intent is to remove these meters during the first year of the statistical sampling program in addition to the randomly sampled meters selected for first year testing.

IX. PERIODIC TEST OPTION

If WKG, at a later date, decides to switch its entire meter population from Sample Testing back to the KPSC's current Periodic Test Schedule, a time frame equal to half of the average in service age of WKG's installed positive displacement meter population at that time shall be allowed for WKG to bring the service life of its meters into compliance with the KPSC's Periodic Test Schedule. Control groups that may fail within that period will continue to be removed within 18 months of issue of the Removal Order.

X. MAXIMUM IN-SERVICE LIFE

No meter in this program will be in service more than 35 years. All meters still in service at 35 years will be removed from the system within 18 months.

XI. ANNUAL REPORT

WKG proposes to file an annual report with the KPSC which will include identification and test results of each control group, test results for the new meters including manufacturer's test records, evaluation and analysis of the data, and any corrective action taken. WKG will also address direct cost savings and the overall effectiveness of this program.

XII. PUBLIC SAFETY

WKG will continue testing or inspection of service regulators, relief valves, vents and curb boxes operability in accordance with the KAR regulations in effect at the time of approval of this plan or as subsequently amended.

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ALL OTHERS ADMITTED IN KY ONLY

RECEIVED
MAY 14 1999
PUBLIC SERVICE
COMMISSION

May 11, 1999

Kentucky Public Service Commission
720 Schenkel Lane
Frankfort, Kentucky 40601

Attention: Helen Helton, Executive Director

RE: Case No. 99-059
Western Kentucky Gas Company

Dear Helen:

Western Kentucky Gas Company concurs with the file memo by the Commission Staff regarding the Informal Conference on April 30 with representatives of Western Kentucky Gas Company. Western will submit a revised Gas Meter Performance Control Program by the end of the month. The Company does want to reiterate that some areas of disagreement identified at the Informal Conference will not be revised; and, the Company reserves its right to request a hearing before the Commission on those items on which we cannot reach agreement with the Staff. The Company looks forward to discussing its revisions with the Staff at a follow up Informal Conference as soon as possible following our re-submission to see if agreement can be reached.

Very truly yours,

SHEFFER HUTCHINSON KINNEY

Mark R. Hutchinson

c: Mr. Eddie Smith, PSC
Mr. Dale Wright, PSC
Mr. Bill Senter, WKG
Mr. David Doggette, WKG
Mr. John Willis, WKG
Mr. Douglas Walther, Senior Attorney

BOWLING GREEN EVANSVILLE FRANKFORT HENDERSON LOUISVILLE OWENSBORO PADUCAH

COMMONWEALTH OF KENTUCKY
PUBLIC SERVICE COMMISSION
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Paul E. Patton
Governor

Ronald B. McCloud, Secretary
Public Protection and
Regulation Cabinet

Helen Helton
Executive Director
Public Service Commission

May 3, 1999

Hon. Mark R. Hutchinson
Sheffer-Hutchinson-Kinney
115 East Second Street
Owensboro, Kentucky 42303

Hon. John N. Hughes
124 West Todd Street
Frankfort, Kentucky 40601

Re: Case No. 99-059
Western Kentucky Gas Company

Gentlemen:

Attached is a copy of the memorandum which is being filed into the record of the above-referenced case. If you have any comments that you would like to make regarding the contents of the informal conference memorandum, please do so within five days of receipt of this letter. Please distribute this memorandum to your client.

Should you have any questions regarding same, please contact Dale Wright of our Legal Division at (502) 564-3940, Extension 235.

Sincerely,

Helen C. Helton

Helen C. Helton
Executive Director

Attachment

EDUCATION
PAYS

AN EQUAL OPPORTUNITY EMPLOYER M/F/D

INTRA – AGENCY MEMORANDUM

KENTUCKT PUBLIC SERVICE COMMISSION

TO: Main Case File
Case No. 99-059

THROUGH: William Bowker, Director
Division of Engineering

FROM: Faud Sharifi, Team Leader

DATE: April 30, 1999

SUBJECT: Informal Conference

On April 30, 1999 an informal conference was held at the Commission offices in the above referenced case. Attendees at the meeting were listed in the attached attendee's sheet.

Staff and Western Kentucky Gas Company "WKG" discussed WKG's response to the Commission's information order dated April 2, 1999, and other issues related to the proposed sample meter-testing plan.

By May 31, 1999 WKG will file an amended sample testing plan and may include the following information:

1. WKG will institute a tightened inspection to improve the performance of control groups operating within the high limits of the specified acceptable standard.
2. WKG will sample test the meters in year one.
3. WKG will clarify the random selection of sample for any control group.
4. WKG will confirm that the sample testing will not change the schedule for testing service regulators, relief valves, vents, and curb boxes operability.
5. WKG will sample test new meters.
6. WKG will limit meter life without testing to 35 years.
7. WKG will limit the group size to 10,000 meters.
8. WKG will clarify the method of segregating the meters into homogeneous groups.

FS:

IC - WKG Case NO. 99-059.

Dennis Hildenbrand	PSC/Meter Standards Laboratory
LARRY AMBURGEY	PSC/ENGINEERING
David Doggette	WKG
John Willi	WKG
Bill Senter	WKG
Farid Sharifi	PSC.
Walt Wright	PSC

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APR 19 1999

PUBLIC SERVICE
COMMISSION

April 16, 1999

FEDERAL EXPRESS

Ms. Helen Helton
Executive Director
Public Service Commission
P.O. Box 615
730 Schenkel Lane
Frankfort, Kentucky 40602

RE: Response of Western Kentucky Gas Company
Case No. 99-059

Dear Helen:

Please file the original and ten (10) copies, of the enclosed Response of Western Kentucky Gas Company to the Commission's order of April 2, 1999.

If there are any problems or questions with the enclosed, please do not hesitate to call me.

Very truly yours,

SHEFFER-HUTCHINSON-KINNEY

Randy

Mark R. Hutchinson

MRH:bkk

BOWLING GREEN EVANSVILLE FRANKFORT HENDERSON LOUISVILLE OWENSBORO PADUCAH

RECEIVED
APR 1 9 1999
PUBLIC SERVICE
COMMISSION

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of :

The Application of Western Kentucky Gas)
Company, a division of Atmos Energy)
Corporation, for Approval of a Statistical) Case No. 99 - 059
Sample Meter Test Plan for Positive)
Displacement Meters Pursuant to 807 KAR)
5:022, Section 8 (5)(c))

RESPONSE OF WESTERN KENTUCKY GAS COMPANY TO THE COMMISSION'S INFORMATION REQUEST DATED APRIL 2, 1999

NOW COMES, Western Kentucky Gas Company ("WKG") in the above-referenced matter pertaining to WKG's proposed Gas Meter Performance Control Program and offers the following responses to the information request issued by the Commission on April 2, 1999:

1. **Explain how the statistical sampling test plan will improve WKG's meter quality and meter maintenance program.**

Response

The Gas Meter Performance Control Program is designed to improve meter quality by providing the same if not higher level of quality in the measurement of gas delivered to our customers while reducing metering cost. A high level of accuracy will be achieved by applying modern sampling and statistical techniques in the evaluation of gas meter performance. The primary goal of the program is the early detection and removal of groups of like meters not meeting prescribed performance standards as defined by the Commission. In accomplishing this goal, WKG expects to create an in-service environment that will produce a high level of metering accuracy while prolonging gas meter service life. To that end, WKG will achieve significant savings by reducing unnecessary testing and unnecessary removal of high quality, better performing meters, and allowing us to place appropriate attention to lesser performing meters requiring changeout and/or maintenance.

The primary benefits of the program are long-term metering accuracy and lower operational costs. This equates to an improvement in the quality of our meter program.

Witness: John Willis

2. **Provide statistical records and bar graphs for meter testing for the past 20 years.**

Response
See attached Schedule A with 20 year bar graphs and data. Also, the meter test results have been provided to the commission quarterly for the past twenty years.

Witness: John Willis

3. **Refer to Attachment 1 of WKG's filing. Provide the following:**

   a. **Why do the residential class meters become eligible for sample testing in year 10 and not the first year in service.**

      Response
      Historic data for WKG's meter population has indicated that a failure prior to ten years has seldom occurred. The stringent quality requirements for the meter manufacturers set by the PSC have helped ensure exceptional quality during first part of the meter's life.

      Witness: John Willis

   b. **How does WKG define a random selection of a sample? Will the inclusion of meters removed from service for other reasons than sample testing contradict the random selection of a sample?**

      Response
      The entire meter population records are placed in a Microsoft Access database. A query is then run against the records assigning a random number to every record. The randomizing feature in Microsoft is a random number generator. The meters in each control group are then sorted in ascending random number order. Meters are then selected from the top until the sample requirements are met. Each year this process is repeated. ANSI Z1.4 does not imply that the inclusion of meters removed from service for other reasons will impact the randomness of the program.

      Witness: John Willis

c. **How is a group subjected to tightened inspection?**

Response

ANSI Z1.4 Section 11.6 is very specific how the testing is conducted. Previously, MIL STD 105D did not address this area and therefore it has been a variable of statistical sampling plans. WKG will follow the requirements of ANSI Z1.4, General Inspection Level II, single sampling and an AQL of 6.5.

Witness: John Willis

d. **What are the obsolete meters? Provide number, type, years of service and any data available for these meters.**

Response

Please refer to the attached Schedule B which includes the requested information for all meters that will not be considered for sampling.

Witness: John Willis

e. **Under what conditions would WKG propose to go back to periodic testing? Explain in detail.**

Response

Our industry is constantly being bombarded with change. The full impact of unbundling, changes in the meter manufacturing industry and emerging technologies could potentially cause any conditions which make re-establishing periodic testing necessary.

Witness: John Willis

4. **Why was 40 years maximum life in service proposed by WKG's plan?**

Response

As the program moves forward through the years, the number of groups will increase and the quantity of meters in the mature groups will be greatly reduced. The management of the control groups will eventually become a burden for the small number of meters still in service. WKG believes that the active meters after 40 years can be removed without greatly impacting the total number tested each year.

Witness: John Willis

5. **Refer to Attachment 2. What is the anticipated largest group size and its sample size for residential, commercial and industrial meters?**

Response
Statistical sampling is not class of service dependent. The largest group submitted is 27,534 and its associated sample size is 315, which is fully dependent upon the statistical sampling requirement. It is anticipated that as the program continues more groups will be added to the list. Only a reduction in size of the groups is expected.

Witness: John Willis

6. **Using WKG's current meter database, provide the following:**

   a. **Number and size of control groups. Is there a limit for the size of the control groups?**

   Response
   Please refer to Attachment 2 in WKG's filing. The size is determined by the criteria.

   Witness: John Willis

   b. **Criteria for segregating the meters into homogeneous control groups. Will the year placed in service be considered one of the criteria?**

   Response
   Yes. Please refer to Attachment 1, III. Creation of Meter Control Groups.

   Witness: John Willis

   c. **Criteria for combining control groups.**

   Response
   There is no anticipated combining of groups.

   Witness: John Willis

   d. **Criteria for subdividing a control group.**

   Response
   Subdivision of a group will be determined on each specific case. The criteria will be targeted to identifying poor performers in the group.

   Witness: John Willis

7. **Provide WKG's shipping procedure to assure that the meters tested by the manufacturer or WKG's meter shop conform to the limits set forth in the test facility.**

Response
WKG has instituted a procedure ensuring that the accuracy of meters is the same upon arrival at their destination as they were when they left the meter shop. There are two meters used in verifying the accuracy of transit meters. One is an American AC250 and the other is an Equimeter R-200. These meters have the tops painted red, so no one will be confused as to the purpose of these meters. They are tested and routinely loaded on the meter truck and shipped to all points of delivery. After which they are returned to the provers for testing to determine if there was a shift in proof while in transit.

Witness: John Willis

8. **How does WKG propose to improve the performance of a control group which has a test record within the high limit of the specified acceptable standard?**

Response
If a control group is within acceptable standards, no action is required.

Witness: John Willis

9. **What corrective action will be taken for a group under reduced inspection when the group is rejected? Will it be removed or re-inspected under normal inspection?**

Response
ANSI Z1.4 Section 10 is very specific how the corrective action is conducted. Previously, MIL STD 105D did not address this area and therefore it has been a variable of statistical sampling plans. WKG will follow the requirements of ANSI Z1.4, General Inspection Level II, single sampling and an AQL of 6.5.

Witness: John Willis

10. **Will WKG continue its safety inspections on customers' service lines as it currently does if the sample testing plan is implemented? Explain.**

Response
Yes. WKG will continue to make systematic inspections of its system to ensure that the Commission's safety requirements are being met.

Witness: John Willis

11. **How often will WKG test the customer's piping for leaks under the proposed plan?**

Response
WKG will test the customer's piping for leaks whenever service is initiated or reestablished.

Witness: John Willis

12. **Document the frequency with which WKG's personnel find safety problems when inspecting a customer's premises during meter changes.**

Response
WKG needs more time to provide a response to this request. A response will be provided as soon as possible but no later than April 30, the date scheduled for an Informal Conference on this matter.

Witness: John Willis

13. **Refer to 807 KAR 5:006, Section 25(5)(C). Will the proposed plan change the interval for curb box and curb valve inspections?**

Response
No. The curb box and curb valve inspection program is currently independent of and will continue to be independent of the meter changeout program.

Witness: John Willis

14. **Will the proposed plan change the test interval for individual residential customer service regulators, vents and relief valves?**

Response
Yes. The test interval will change to coincide with the frequency of meter changeouts.

Witness: John Willis

15. **In the proposed plan, how many times in a 5-year period would WKG employees be on a customer's premises (excluding meter reading)?**

Response
A WKG employee will be on a customer's premises at least once in a five year period to conduct a leak survey.

Witness: John Willis

CERTIFICATE OF SERVICE

This is to certify that an original, plus ten (10) copies, of Western Kentucky Gas Company's Response was this day forwarded to the Kentucky Public Service Commission, 730 Schenkel Road, Frankfort, Kentucky 40601, by Federal Express, on this the 16 day of April, 1999.

SCHEDULE A

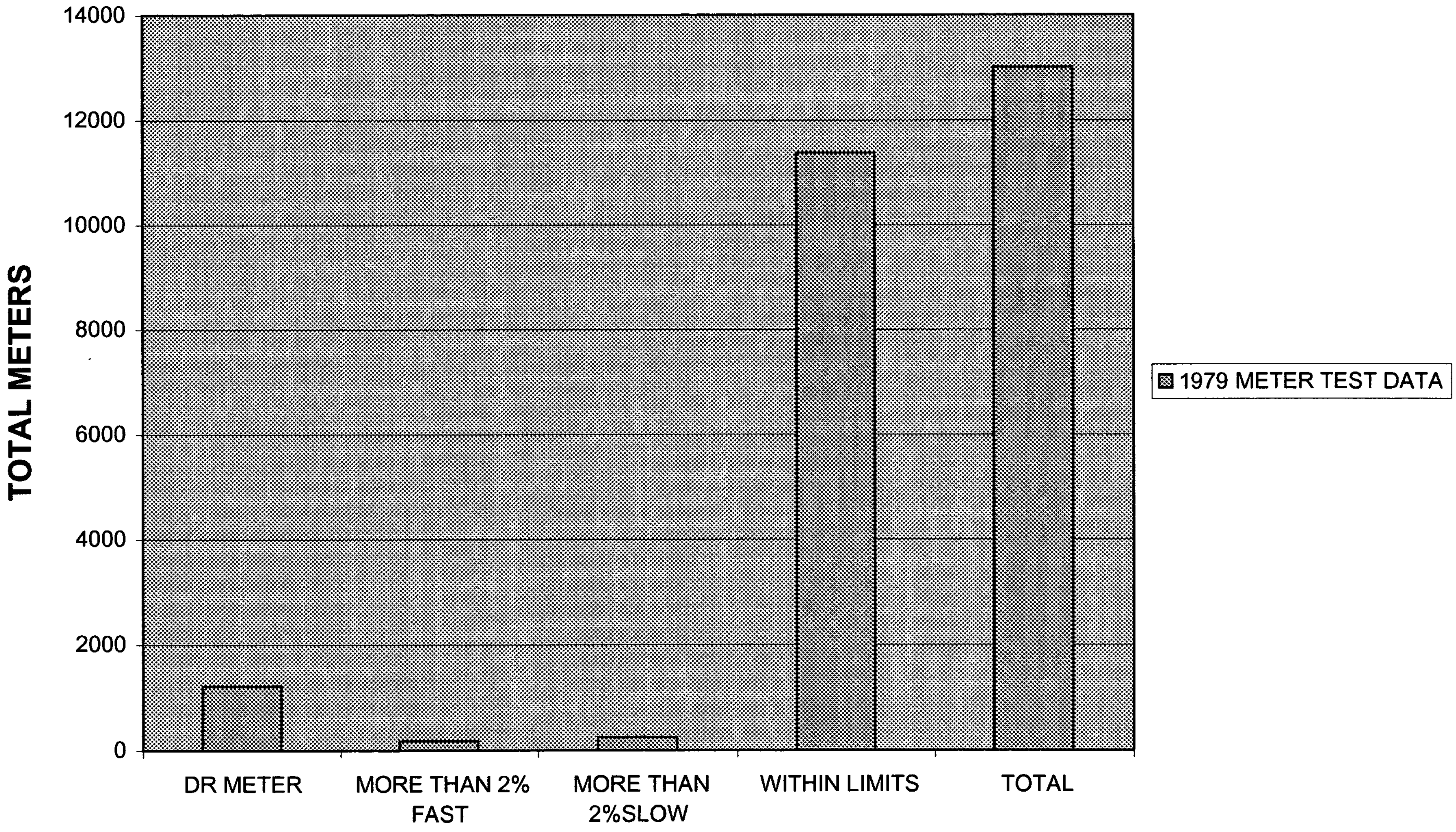
- Records: 20 Years Data for Domestic Meters for WKG
  - Bar Graphs

20 YEARS DATA FOR DOMESTIC METERS FOR WKG

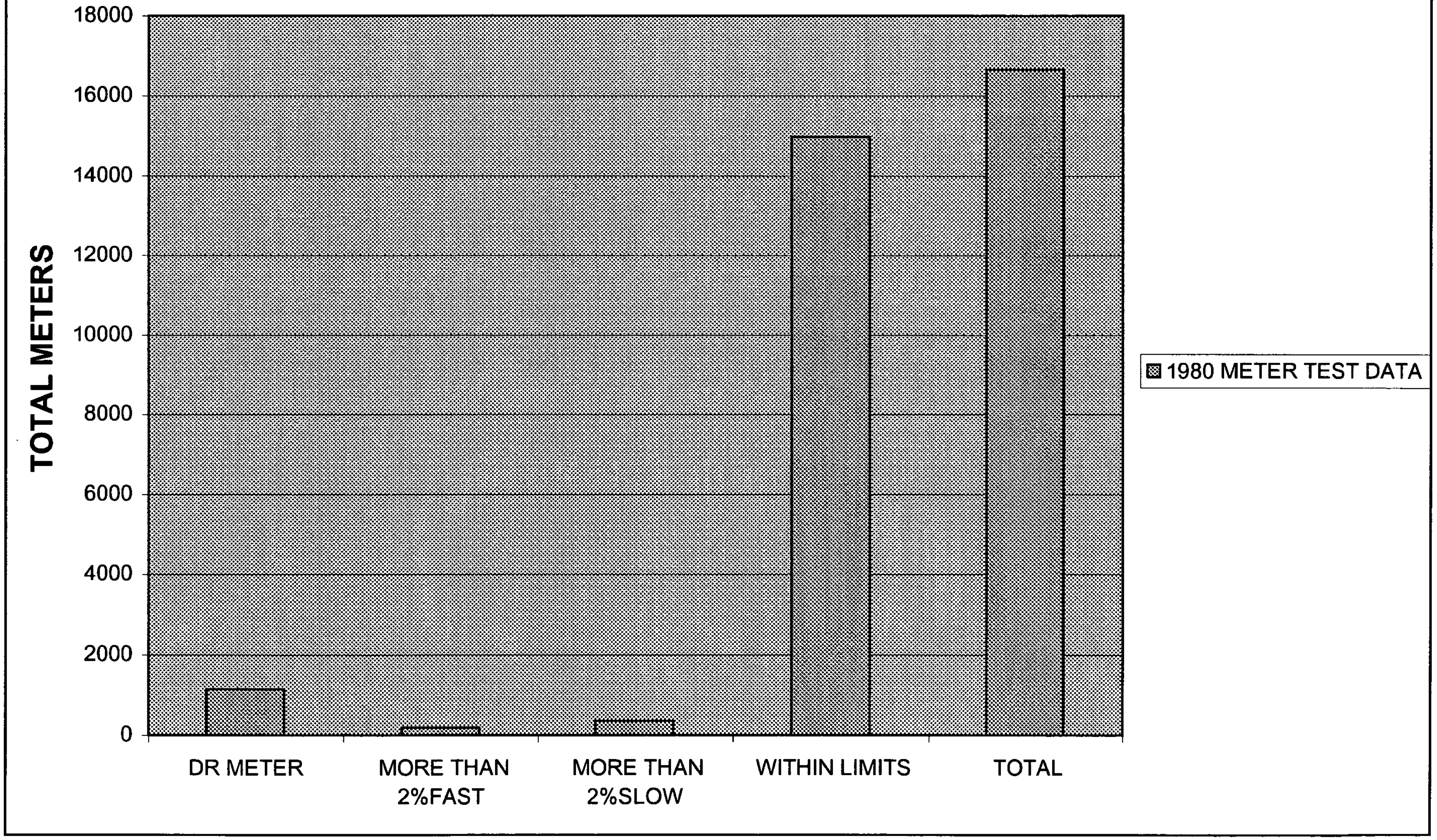
DATE	DR METERS	MORE THAN 2% FAST	MORE THAN 2% SLOW	WITHIN LIMITS	TOTAL	% Failure
1998	435	32	158	12423	13048	1.51%
1997	831	32	192	15093	16148	1.46%
1996	707	51	419	15937	17114	2.86%
1995	629	23	478	15614	16744	3.11%
1994	689	43	476	16094	17302	3.12%
1993	500	45	315	13731	14591	2.55%
1992	639	22	336	14127	15124	2.47%
1991	780	12	437	15693	16922	2.78%
1990	795	33	380	13774	14982	2.91%
1989	677	51	365	14276	15369	2.83%
1988	691	51	365	13986	15093	2.89%
1987	698	98	480	14761	16037	3.77%
1986	710	102	467	15850	17129	3.47%
1985	886	85	422	14114	15507	3.47%
1984	954	58	318	13313	14643	2.75%
1983	*					
1982	•					
1981	660	247	323	11760	12990	4.62%
1980	1141	187	357	14975	16660	3.51%
1979	1215	177	243	11376	13011	3.56%

* INSUFFICIENT DATA FOR THE YEAR.

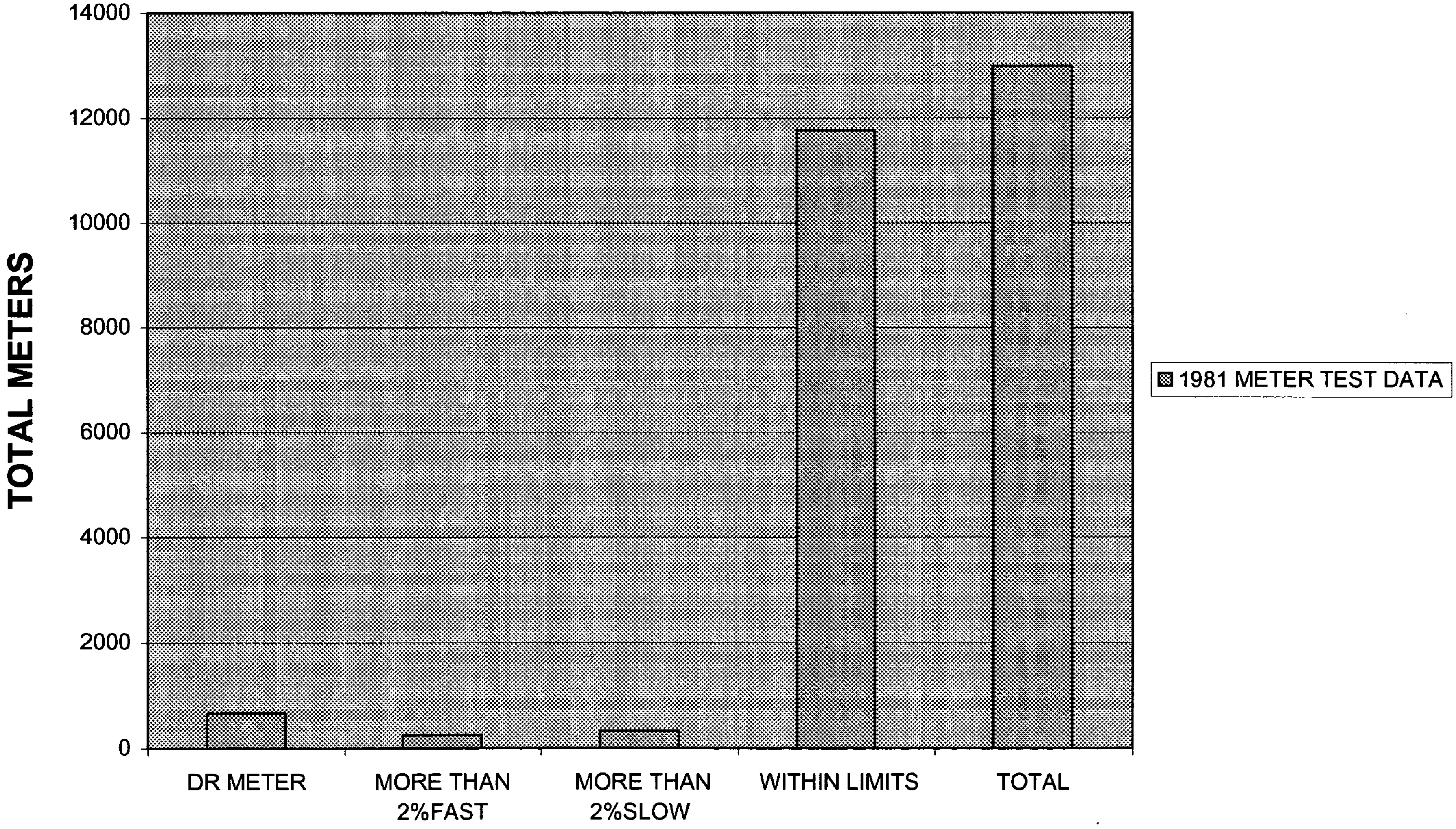
1979 METER TEST DATA



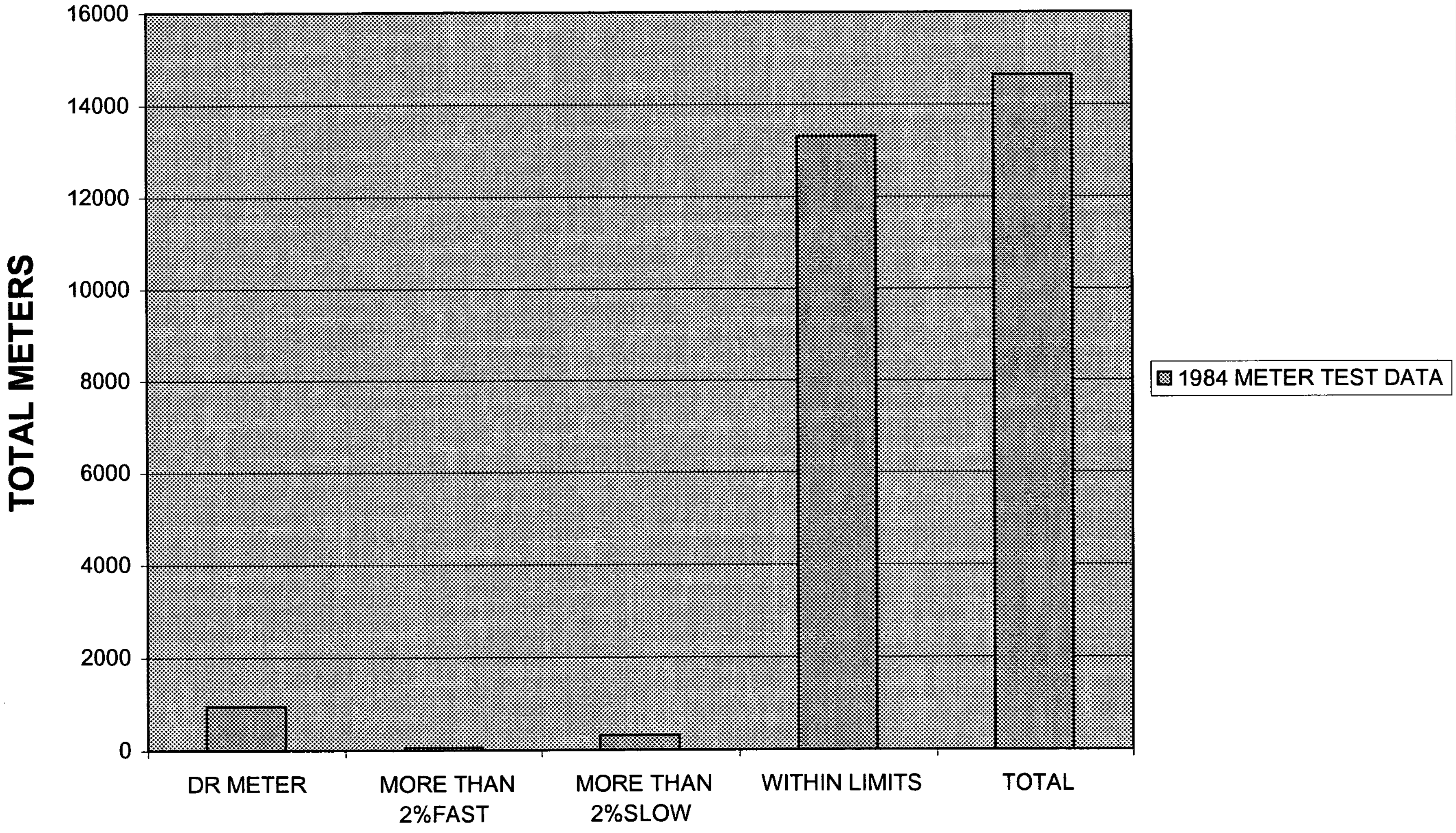
1980 METER TEST DATA



1981 METER TEST DATA



1984 METER TEST DATA



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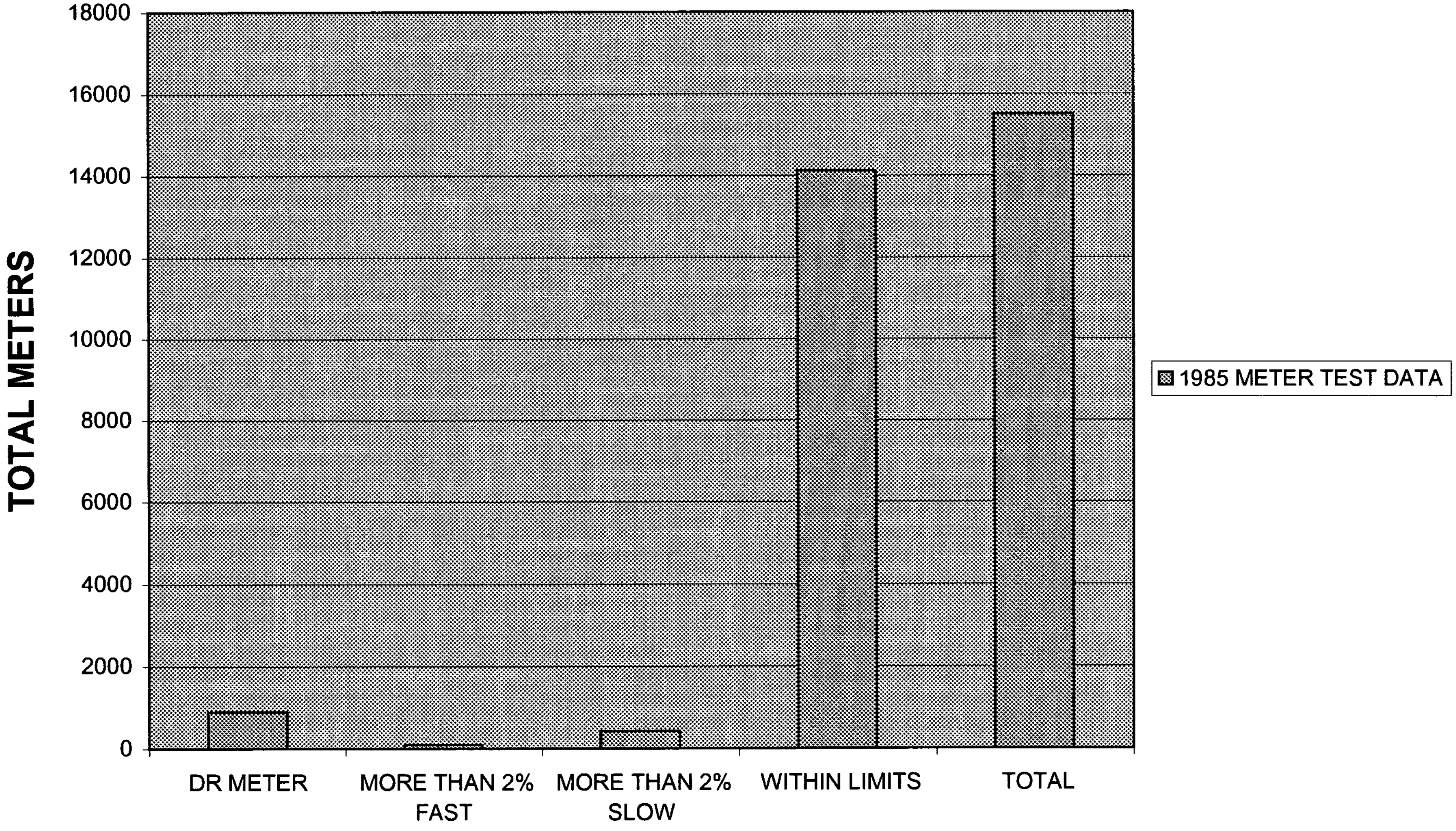
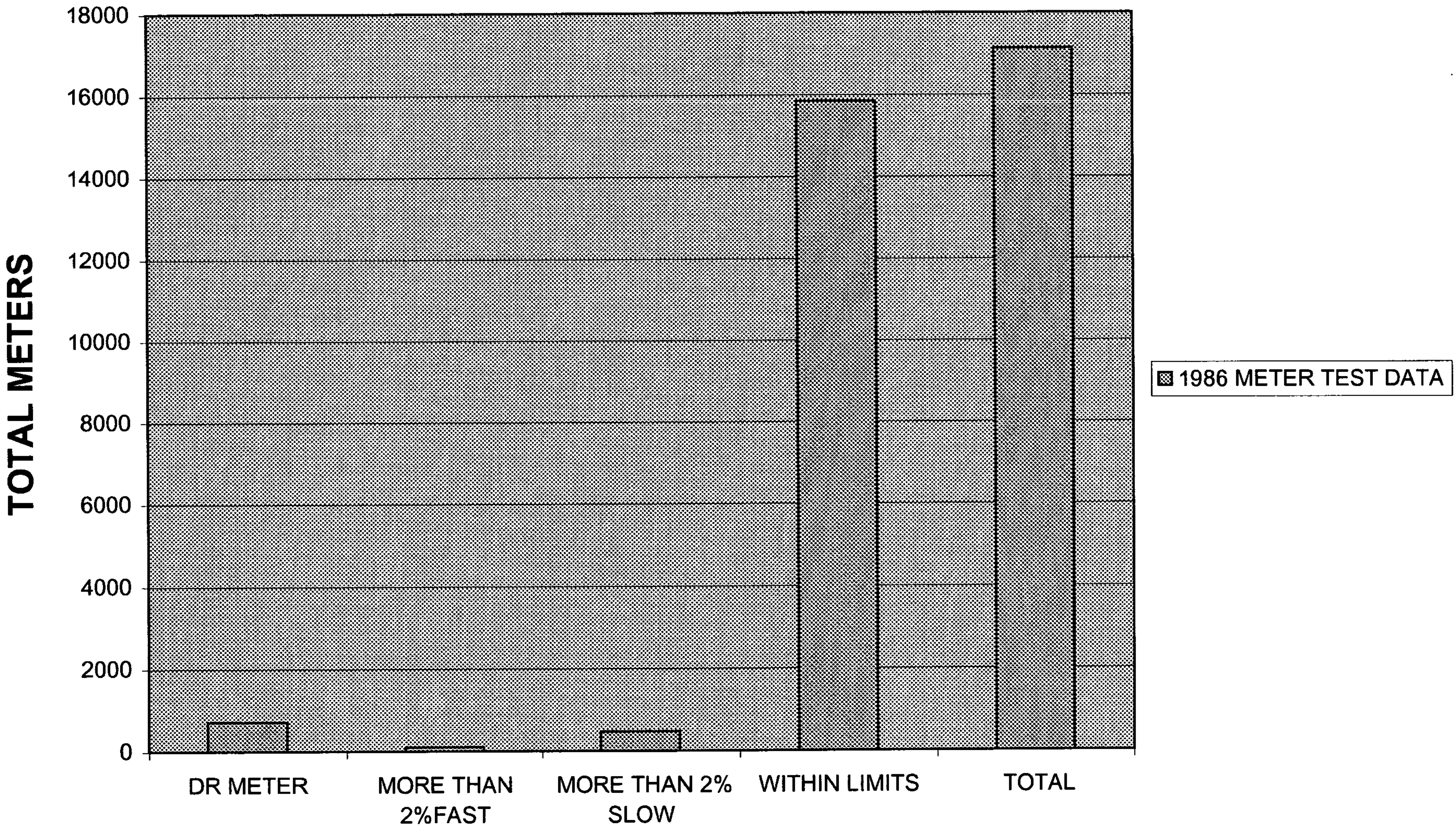
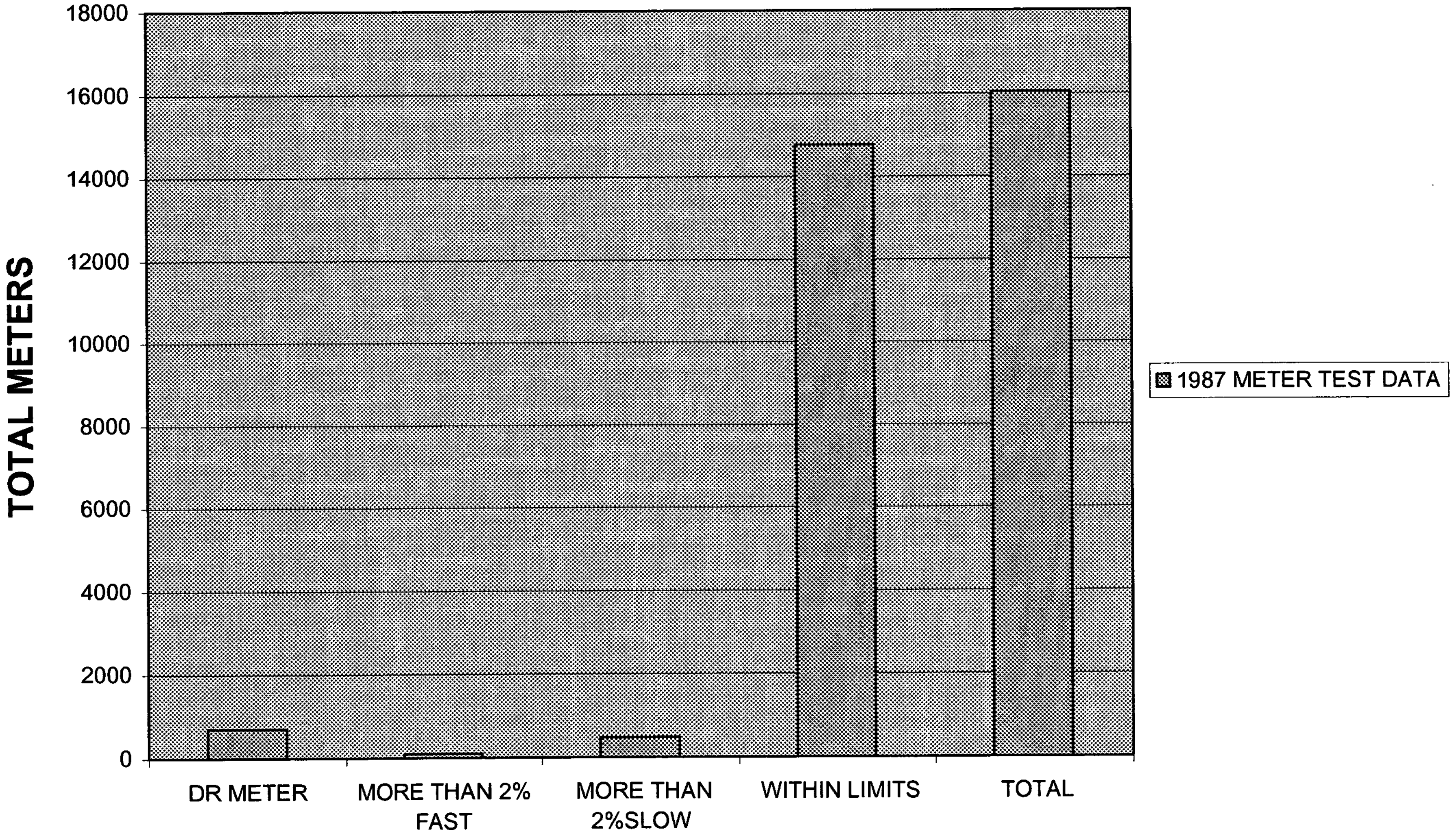


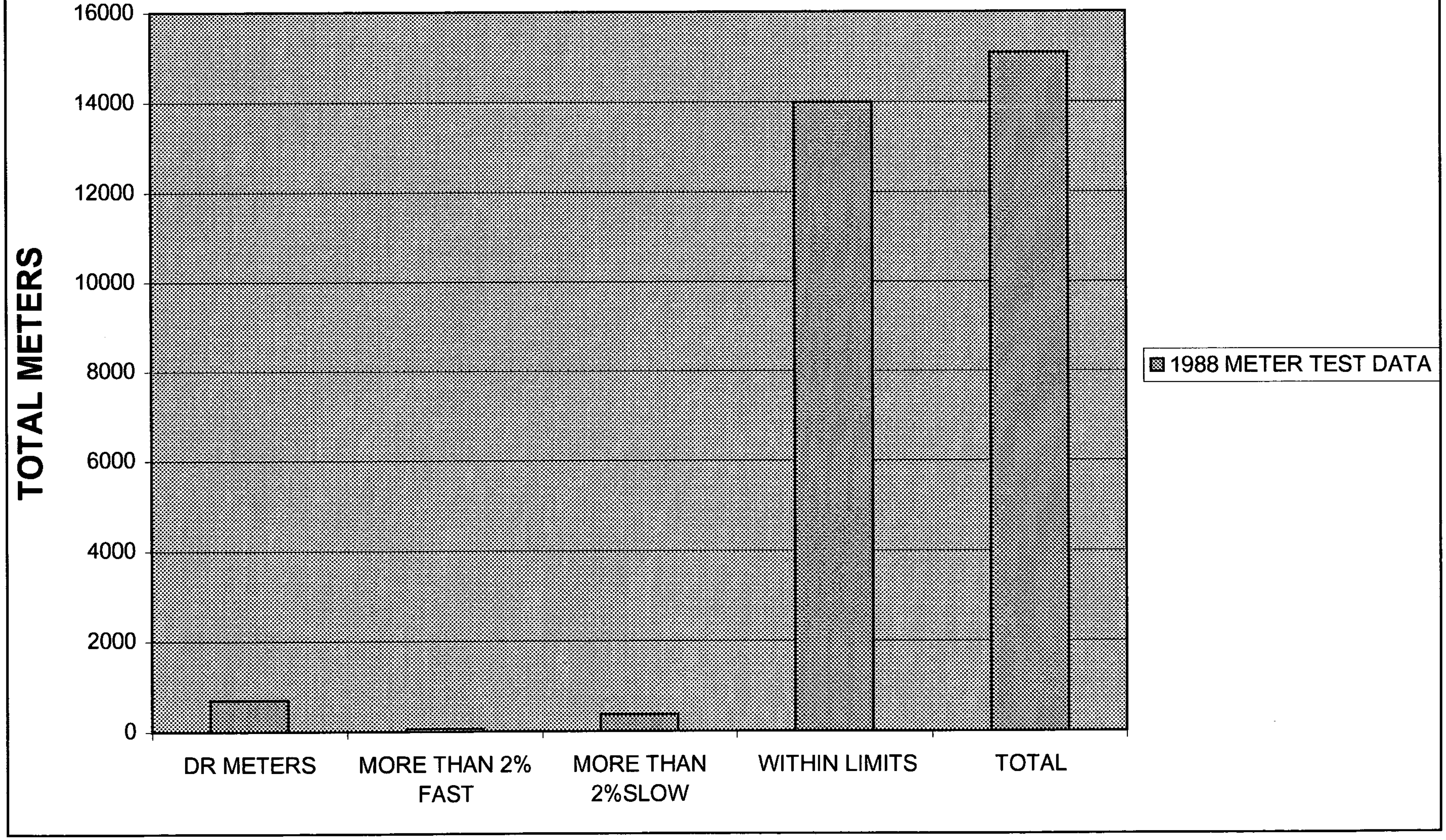
1986 METER TEST DATA



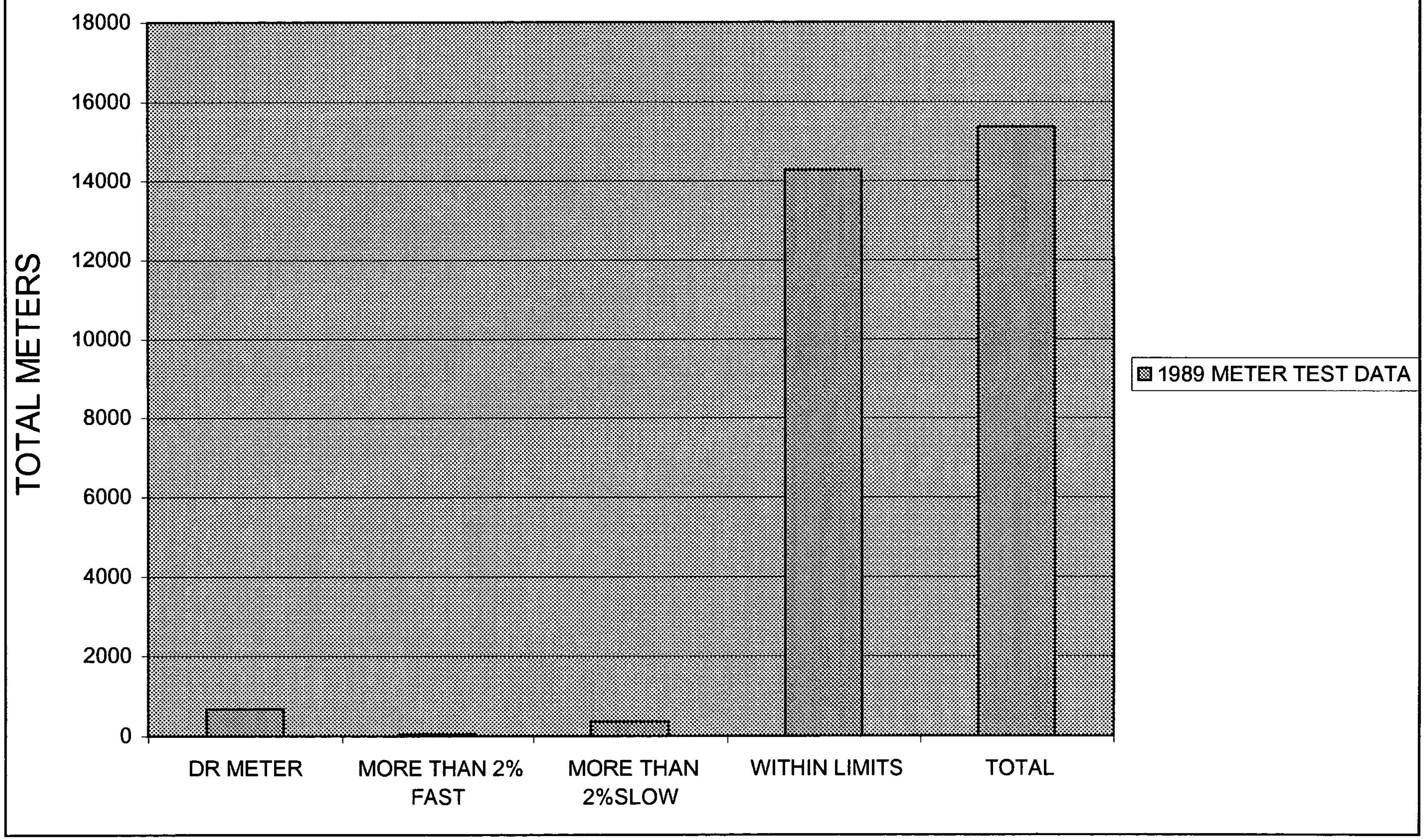
1987 METER TEST DATA



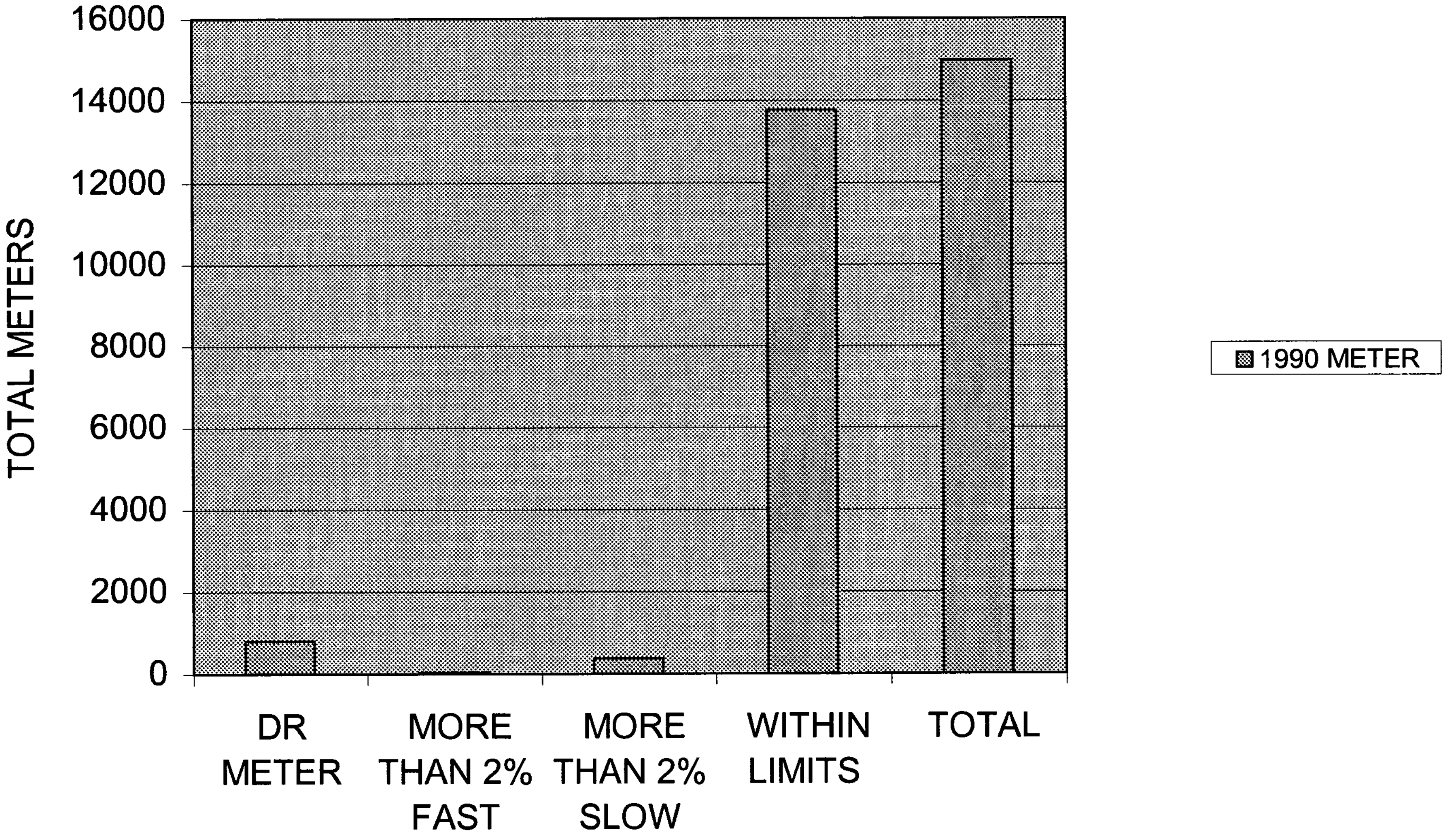
1988 METER TEST DATA



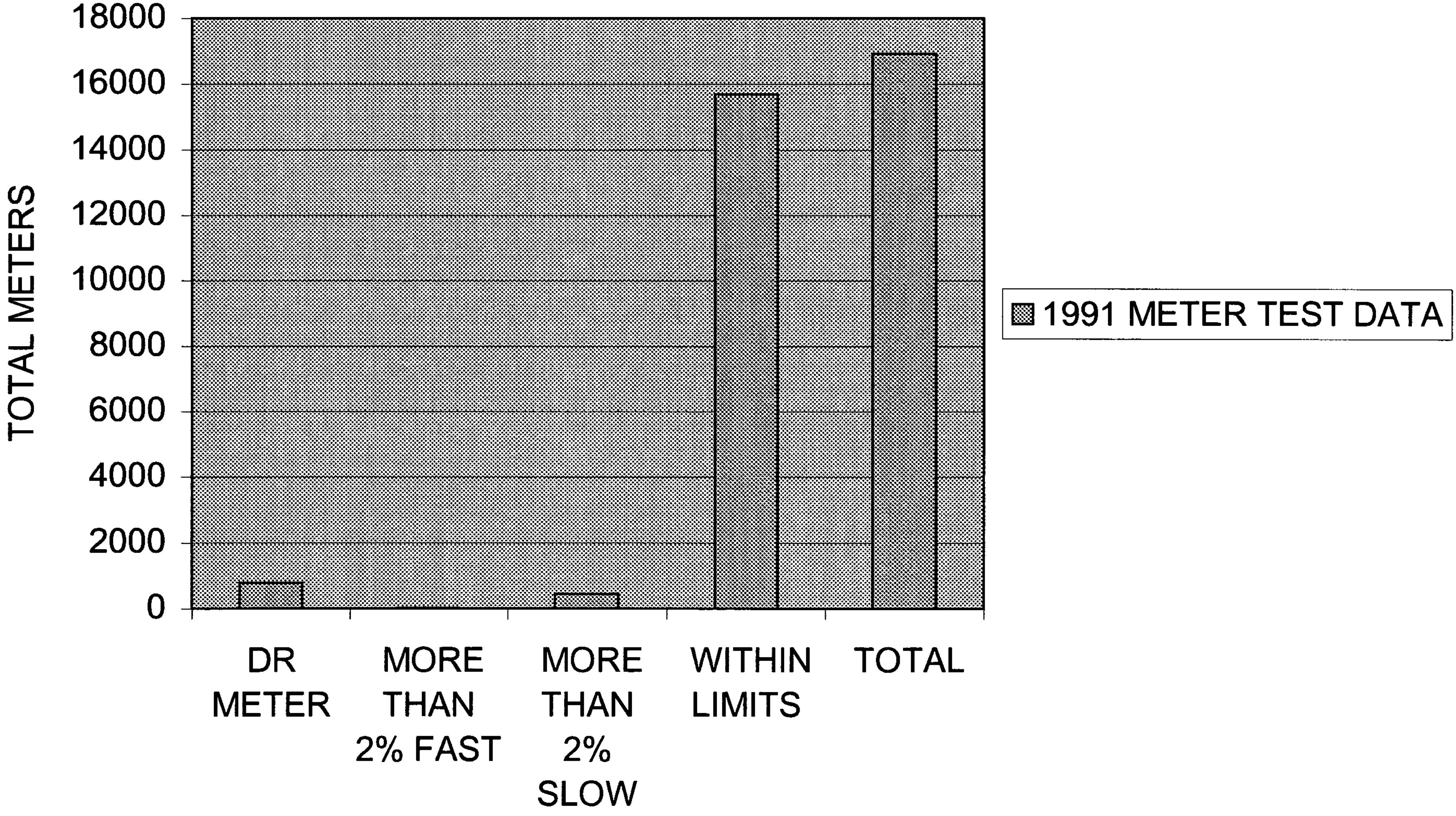
1989 METER TEST DATA

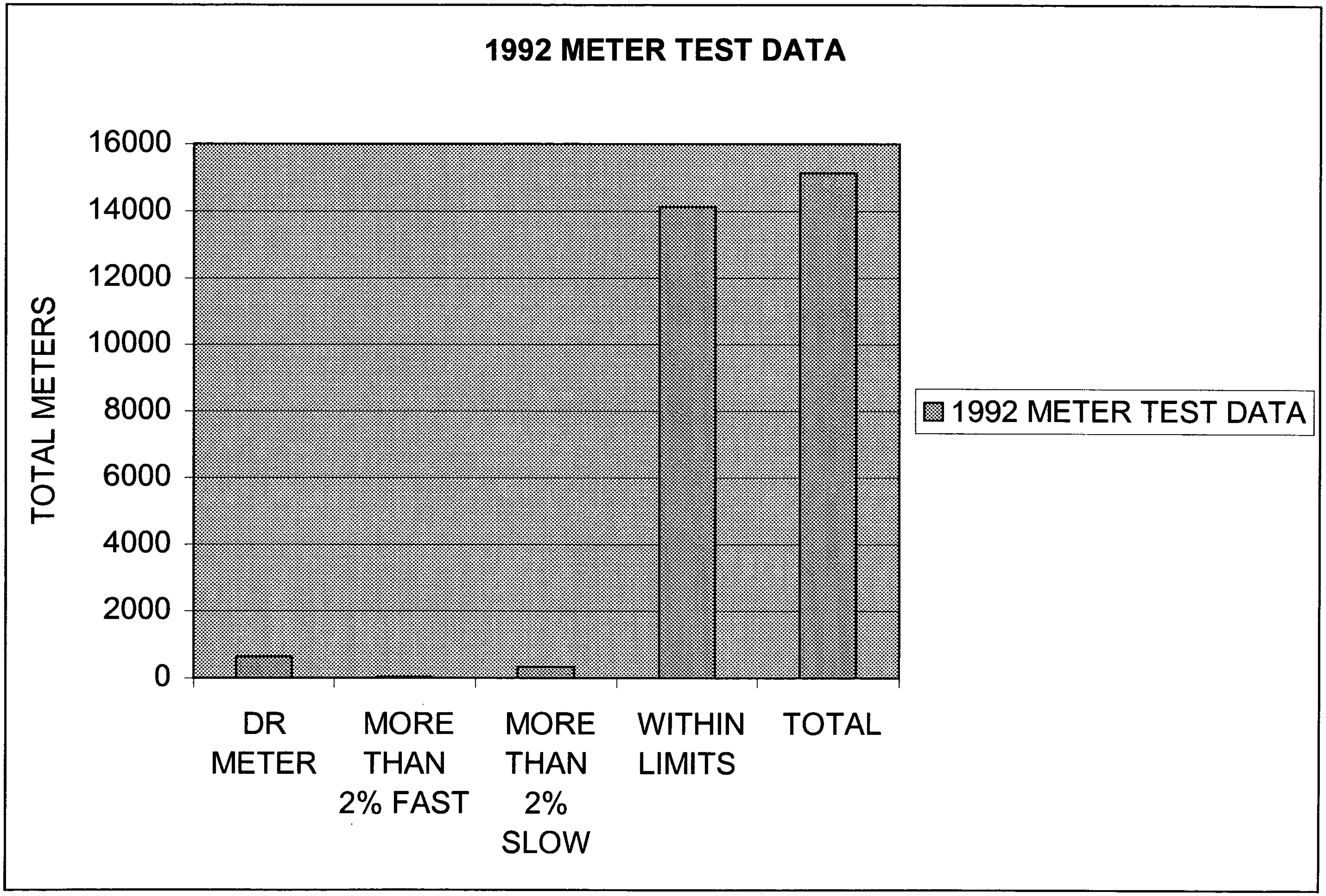


1990 METER TEST DATA

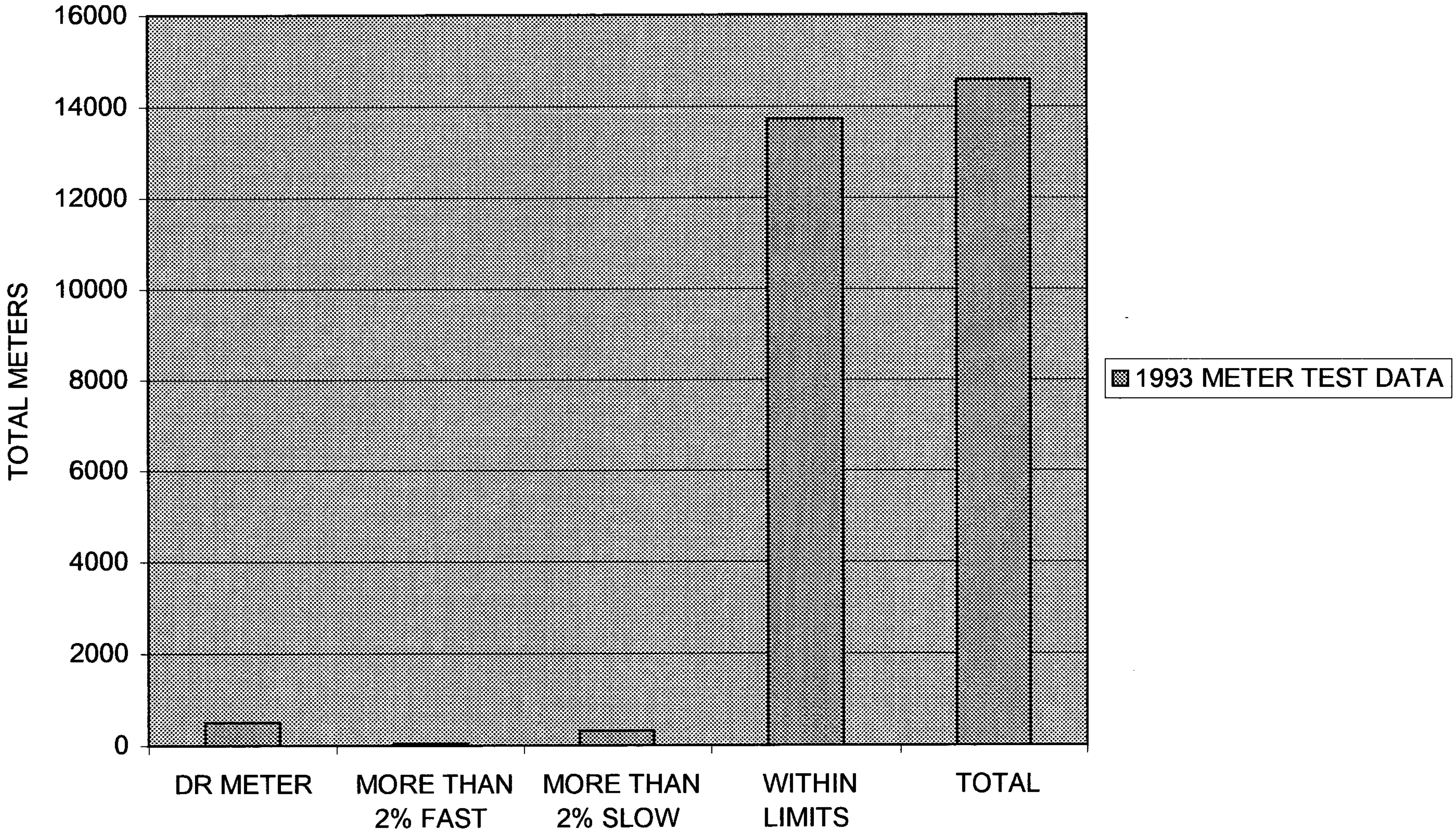


1991 METER TEST DATA

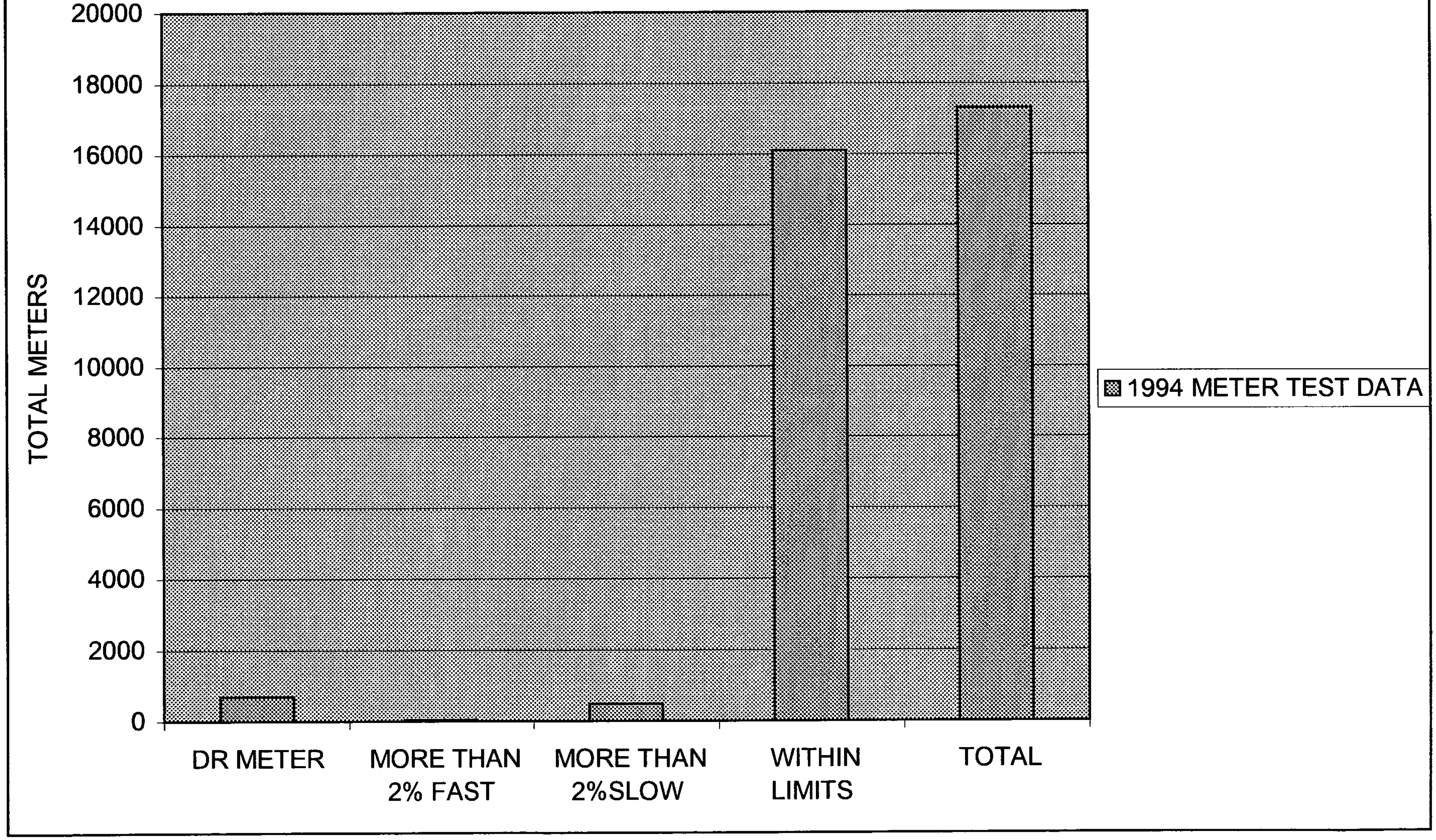



1992 METER TEST DATA
TOTAL METERS
16000
14000
12000
10000
8000
6000
4000
2000
0
DR METER
MORE THAN 2% FAST
MORE THAN 2% SLOW
WITHIN LIMITS
TOTAL
1992 METER TEST DATA

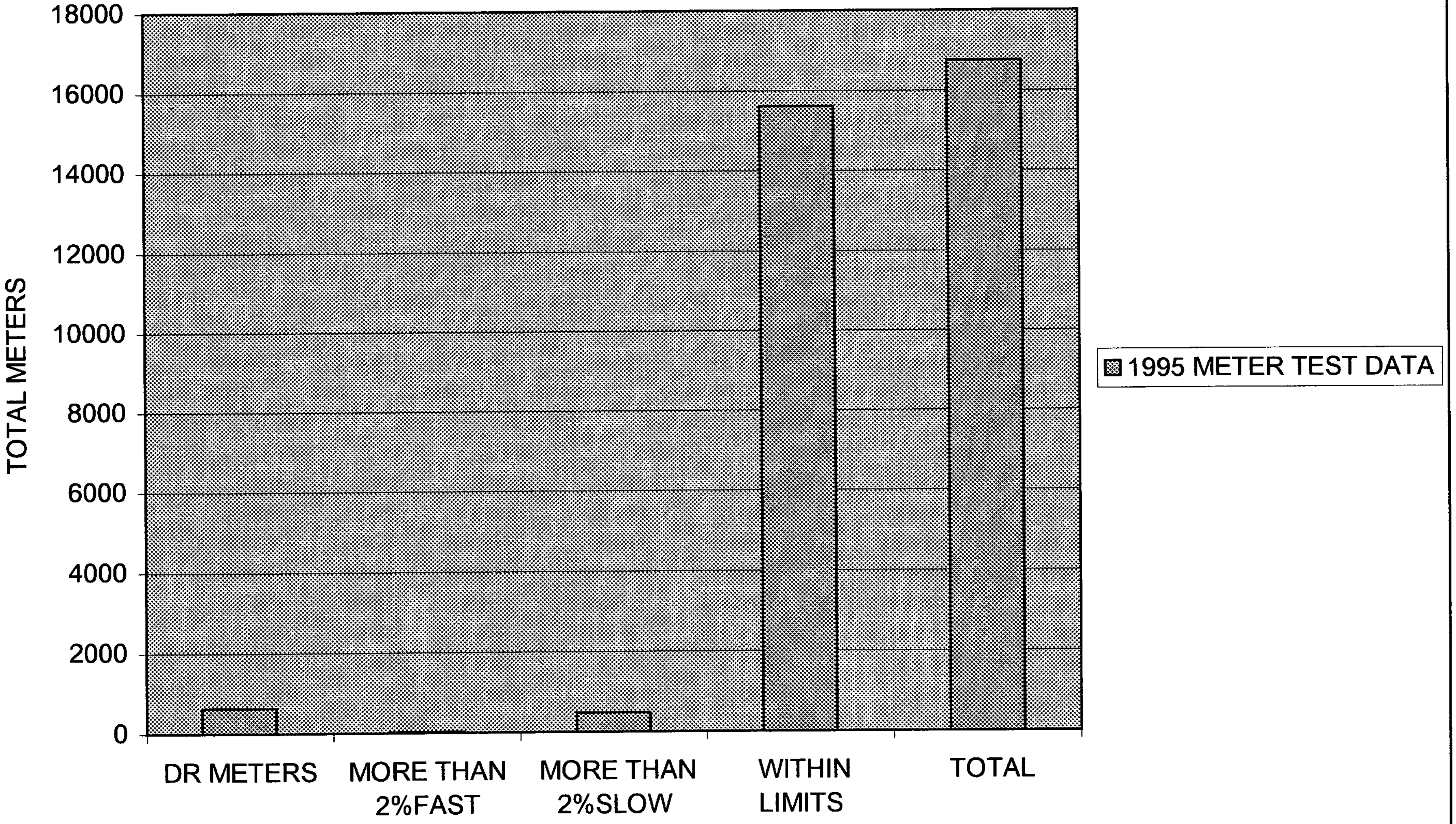
1993 METER TEST DATA

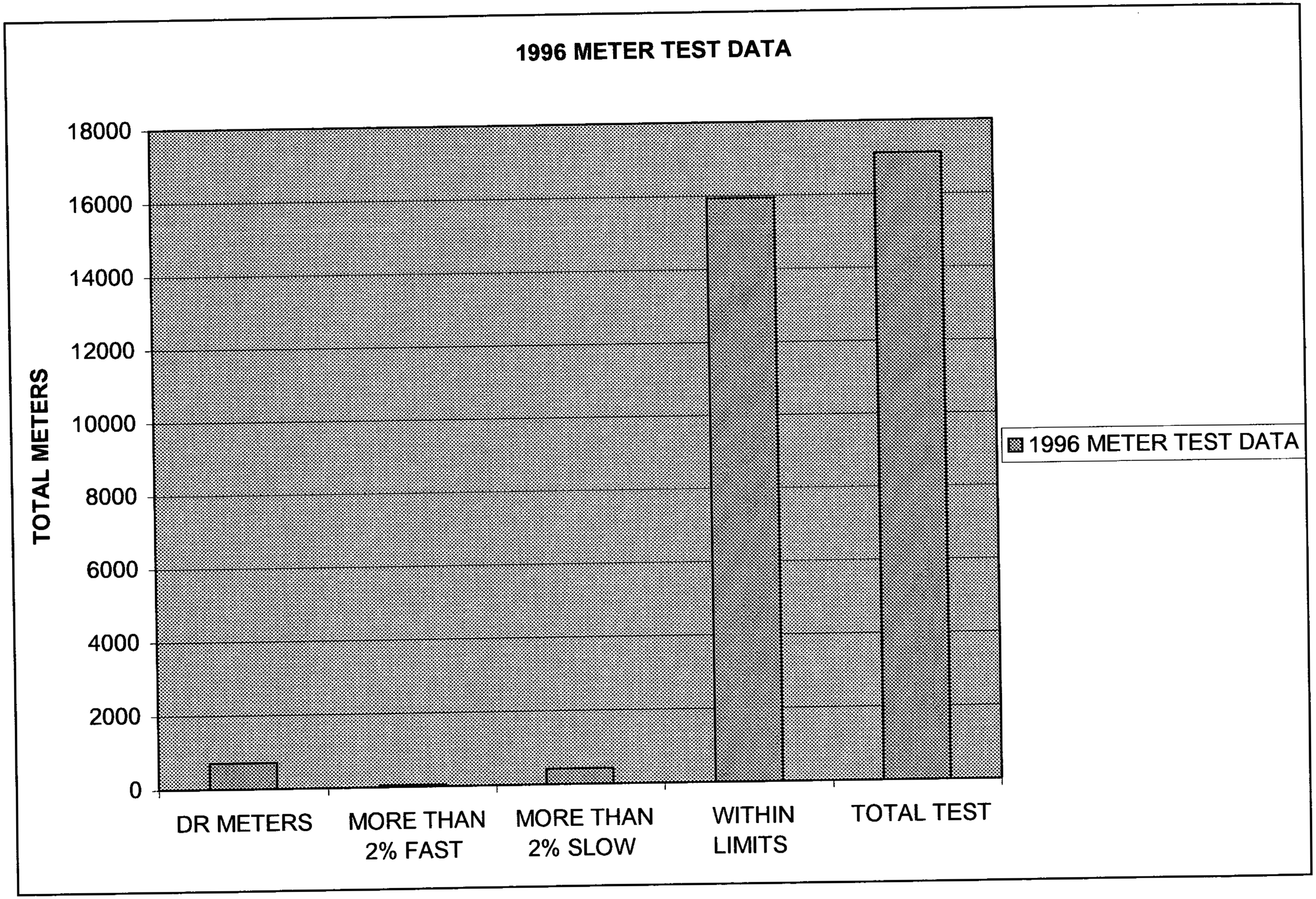


1994 METER TEST DATA

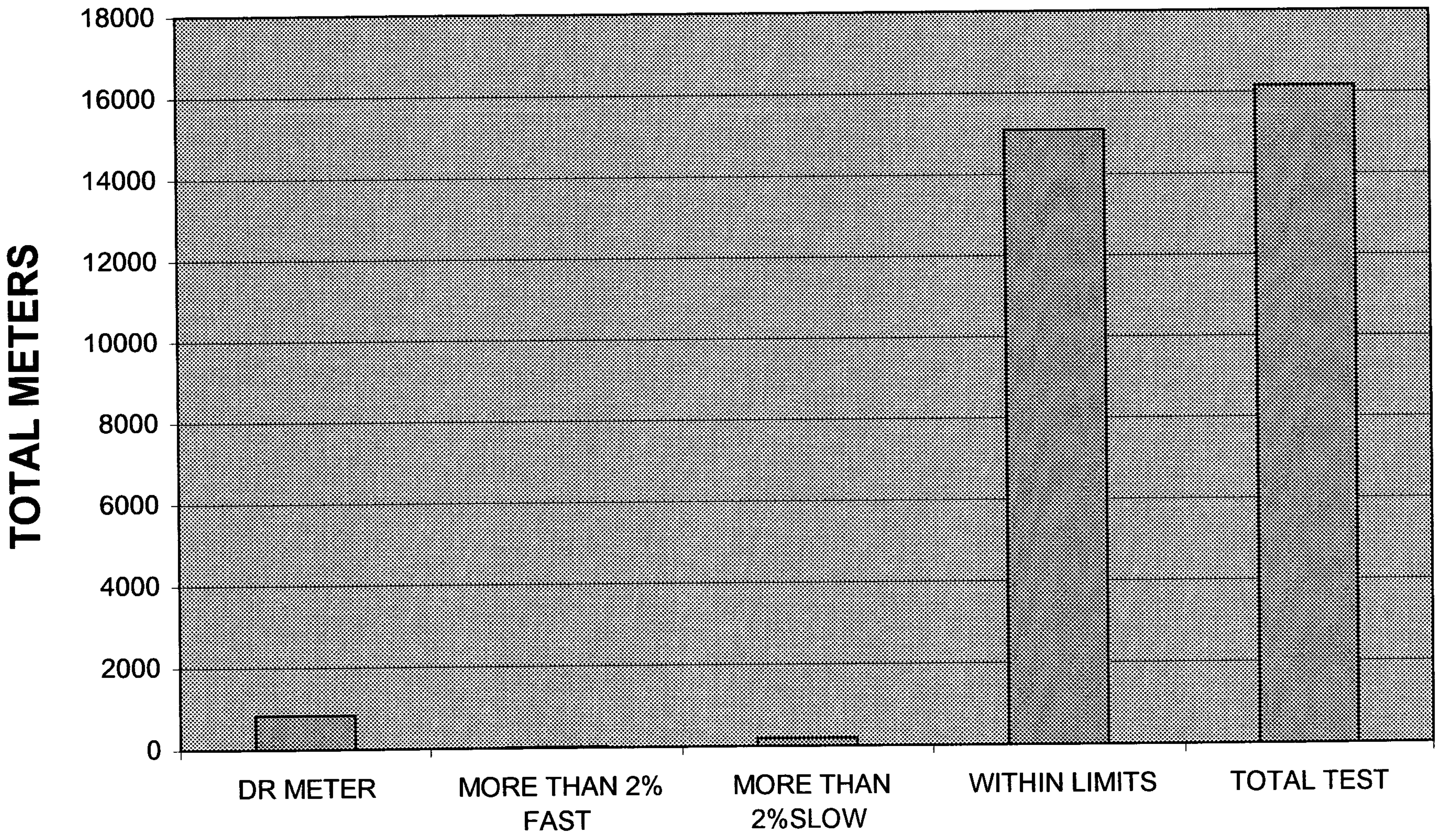


1995 METER TEST DATA

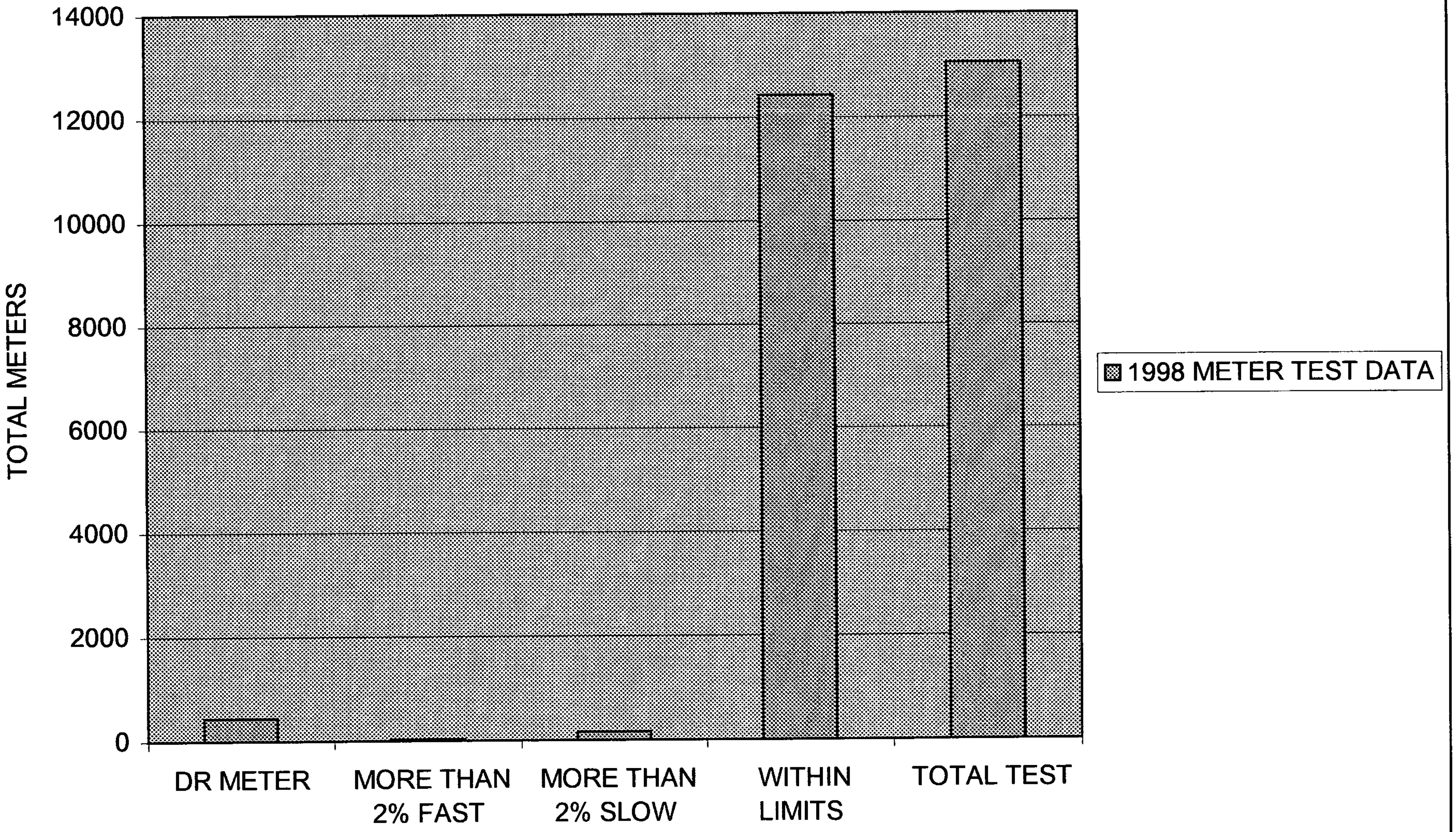



1996 METER TEST DATA
TOTAL METERS
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
DR METERS
MORE THAN 2% FAST
MORE THAN 2% SLOW
WITHIN LIMITS
TOTAL TEST
▨ 1996 METER TEST DATA

1997 METER TEST DATA



1998 METER TEST DATA



SCHEDULE B

- Obsoletes

Size Code	Brand	Model	Meter Number	Account Number	Purchase Date	Last Test
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010	American	5-B	4200123	551020034100	54	1188
010	American	5-B	4111947	560010060500	54	1088
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COMMONWEALTH OF KENTUCKY
PUBLIC SERVICE COMMISSION
730 SCHENKEL LANE
POST OFFICE BOX 615
FRANKFORT, KY. 40602
(502) 564-3940

April 2, 1999

To: All parties of record

RE: Case No. 99-059

We enclose one attested copy of the Commission's Order in the above case.

Sincerely,

Stephanie J. Bell

Stephanie Bell
Secretary of the Commission

SB/sa
Enclosure

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Vice President, Rates & Regulatory
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COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF WESTERN KENTUCKY)
GAS COMPANY, A DIVISION OF ATMOS ENERGY)
CORPORATION, FOR APPROVAL OF A)
STATISTICAL SAMPLE METER TEST PLAN FOR) CASE NO. 99-059
POSITIVE DISPLACEMENT METERS PURSUANT)
TO 807 KAR 5:022, SECTION 8(5)(C))

ORDER

IT IS ORDERED that Western Kentucky Gas Company ("WKG") shall file the original and 10 copies of the following information with the Commission with a copy to all parties of record no later than 15 days from the date of this Order. WKG shall furnish with each response the name of the witness who will be available to respond to questions concerning each item of information should a public hearing be scheduled.

IT IS FURTHER ORDERED that an informal conference will be held on April 30, 1999 at 10:00 a.m. Eastern Time, in Hearing Room No. 2 of the Commission's offices at 677 Comanche Trail, Frankfort, Kentucky to discuss WKG's statistical sample gas meter test plan and the responses requested herein.

1. Explain how the statistical sampling test plan will improve WKG's meter quality and meter maintenance program.

2. Provide statistical records and bar graphs for meter testing for the past 20 years.

3. Refer to Attachment 1 of WKG's filing. Provide the following:

a. Why do the residential class meters become eligible for sample testing in year 10 and not the first year in service?

b. How does WKG define a random selection of a sample? Will the inclusion of meters removed from service for other reasons than sample testing contradict the random selection of a sample?

c. How is a group subjected to tightened inspection?

d. What are the obsolete meters? Provide number, type, years of service, and any data available for these meters.

e. Under what conditions would WKG propose to go back to periodic testing? Explain in detail.

4. Why was 40 years maximum life in service proposed by WKG's plan?

5. Refer to Attachment 2. What is the anticipated largest group size and its sample size for residential, commercial, and industrial meters?

6. Using WKG's current meter database, provide the following:

a. Number and size of control groups. Is there a limit for the size of the control groups?

b. Criteria for segregating the meters into homogeneous control groups. Will the year placed in service be considered one of the criteria?

c. Criteria for combing control groups.

d. Criteria for subdividing a control group.

7. Provide WKG's shipping procedure to assure that the meters tested by the manufacturer or WKG's meter shop conform to the limits set forth in the test facility.

8. How does WKG propose to improve the performance of a control group which has a test record within the high limit of the specified acceptable standard?

9. What corrective action will be taken for a group under reduced inspection when the group is rejected? Will it be removed or re-inspected under normal inspection?

10. Will WKG continue its safety inspections on customers' service lines as it currently does if the sample testing plan is implemented? Explain.

11. How often will WKG test the customer's piping for leaks under the proposed plan?

12. Document the frequency with which WKG's personnel find safety problems when inspecting a customer's premises during meter changes.

13. Refer to 807 KAR 5:006, Section 25(5)(c). Will the proposed plan change the interval for curb box and curb valve inspections?

14. Will the proposed plan change the test interval for individual residential customer service regulators, vents, and relief valves?

15. In the proposed plan, how many times in a 5-year period would WKG employees be on a customer's premises (excluding meter reading)?

Done at Frankfort, Kentucky, this 2nd day of April, 1999.

By the Commission

ATTEST:

Helen C. Helton

Executive Director

COMMONWEALTH OF KENTUCKY
PUBLIC SERVICE COMMISSION
730 SCHENKEL LANE
POST OFFICE BOX 615
FRANKFORT, KY. 40602
(502) 564-3940

February 18, 1999

To: All parties of record

RE: Case No. 99-059
WESTERN KENTUCKY GAS COMPANY
(Deviation) FROM 807 KAR 5:022 SECTION 8(A)(1-3)

This letter is to acknowledge receipt of initial application in the above case. The application was date-stamped received February 17, 1999 and has been assigned Case No. 99-059. In all future correspondence or filings in connection with this case, please reference the above case number.

If you need further assistance, please contact my staff at 502/564-3940.

Sincerely,

Stephanie Bell
Secretary of the Commission

SB/jc

Conrad Gruber
President
Western Kentucky Gas Company
2401 New Harford Road
Owensboro, KY. 42303 1312

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February 16, 1999

Honorable Helen C. Helton
Executive Director
Kentucky Public Service Commission
730 Schenkel Drive
Frankfort, Kentucky 40602

Case 99-059

Subject: **Application of Western Kentucky Gas Company for Approval of a Statistical Sample Meter Test Plan for Positive Displacement Meters Correspondence Regarding Western Kentucky Gas Company**

Dear Ms. Helton:

Enclosed is an Application by Western Kentucky Gas Company for approval of its Gas Meter Performance Control Program as a deviation from the Kentucky Public Service Commission's Rule 807 KAR 5:022 Section 8(5)(a)(1-3). This rule requires that all meters be changed out every 10 years. WKG's proposed five-year pilot program exercises an option provided for under 807 KAR 5:02 Section 8(5)(a)(c). As designed, WKG's program is expected to achieve long-term productivity gains in meter management while assuring the highest levels of meter accuracy.

In addition to the application and attached program descriptions, and to assist the Staff in its review, enclosed also is a copy of the American National Standard ANSI/ASQC Z1.4-1993, Sampling Procedures and Tables for Inspection by Attributes, the industry standard statistical guide relied upon in the development of this program. This document replaced the Military Standard 105D previously submitted by LG&E and Columbia Gas in their programs.

The Staff's assistance in ensuring a prompt review and approval of this application will be greatly appreciated. If you have any questions, please feel free to call me, or at WKG, Bill Senter at 502-685-8072 or John Willis at 502-685-8015.

Very truly yours,

SHEFFER-HUTCHINSON-KINNEY

Mark R. Hutchinson

MRH:bkk

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of :

The Application of Western Kentucky Gas)
Company, a division of Atmos Energy)
Corporation, for Approval of a Statistical) Case No. 99 - 059
Sample Meter Test Plan for Positive)
Displacement Meters Pursuant to 807 KAR)
5:022, Section 8 (5)(c))

RECEIVED
FEB 17 1999
PUBLIC SERVICE
COMMISSION

APPLICATION OF WESTERN KENTUCKY GAS COMPANY FOR APPROVAL OF A STATISTICAL SAMPLE METER TEST PLAN FOR POSITIVE DISPLACEMENT METERS

Western Kentucky Gas Company (WKG), by counsel, petitions the Commission for an order authorizing the use of statistical sampling for meter testing under a pilot program for a period of five years.

(a) WKG is engaged in the business of furnishing natural gas service to the public at retail in certain counties in the Commonwealth of Kentucky, pursuant to authority granted by the Commission.

(b) WKG's full name and address is:

Western Kentucky Gas Company
2401 New Hartford Road
Owensboro, KY 42303

(c) WKG's Articles of Incorporation have been previously filed with the Commission in Case No. 95-010 and are incorporated herein by reference.

(d) The Commission's rules provide in 807 KAR 5:022, Section 8(5)(a)(1-3):

(5) Periodic tests.

(a) Periodic tests of all meters shall be made according to the following schedule based on rate capacities. Rated meter capacity is defined as the capacity of the meter at five tenths (0.5) of one (1) inch water column differential for diaphragm meters and as specified by the manufacturer for all other meters.

1. Positive-displacement meters, with rated capacity up to and including 500 cubic feet per hour, shall be tested at least once every ten (10) years.
2. Positive-displacement meters, with rated capacity above 500 cubic feet per hour up to and including 1500 cubic feet per hour shall be tested at least once every year.
3. Positive-displacement meters above 1500 cubic feet per hour shall be tested at least once every year.

(e) The Commission rules further provide that the Commission may approve the adoption of a statistical sample meter plan in lieu of the tests prescribed in 807 KAR 5:022, Section 8(5)(a)(1-3). The applicable regulation - 807 KAR 5:022, Section 8(5)(c) provides:

> (c) A utility desiring to adopt a scientific sample meter test plan for positive displacement meters in accordance with parameters established by the commission shall submit its application to the commission for approval. Upon approval, the sample testing plan may be followed in lieu of tests prescribed in subsections (3) and (5) of this section and 807 KAR 5:006, Section 13(1).

(f) WKG is seeking Commission approval for implementation of a statistical sample meter test plan for all positive displacement meters pursuant to 807 KAR 5:022, Section 8 (5)(c). WKG's proposed plan (hereafter referred to as its "Gas Meter Performance Control Program") is detailed in Attachment 1.

(g) Pursuant to 807 KAR 5:022, Section 8(5)(c) the foregoing explanation and Attachment 1, both of which detail WKG's proposal to adopt its Gas Meter Performance Control Program for positive displacement meters, demonstrate good cause which will justify deviation from 807 KAR 5:022, Section 8(a)(1-3).

(h) The primary goal of WKG's Gas Meter Performance Control Program is the detection and early removal of any group of meters that does not meet prescribed performance standards. WKG's program will employ modern sampling techniques in the evaluation of gas meter performance and is specifically designed to provide a high level of accuracy in the measurement of gas to WKG's customers while controlling metering cost.

(i) The primary benefits of the program are long-term metering accuracy and operational cost control. WKG estimates that the implementation of this program will reduce the number of meters it has to test on an annual basis by approximately nine thousand (9000). Attachment 2 provides the initial control groups and samples for the first year of the proposed program.

(j) WKG anticipates overall average annual direct cost savings of $319,730 given that the approximate average direct cost of periodic changing and testing each domestic size meter is $35.53. See Attachment 3. These savings and related productivity gains are reflected in WKG's current and future fiscal years' operational, manpower and financial plans.

(k) WKG proposes to introduce its Gas Meter Performance Control Program as a five-year pilot program. Upon conclusion of the pilot period, WKG will re-evaluate the program to ensure WKG and Commission objectives were being achieved. If appropriate, WKG will propose changes to the program based upon the results of the pilot.

For these reasons, WKG believes that its proposal to initiate its Gas Meter Performance Control Program is in the best interest of WKG and its customers and should be approved by the Commission.

WHEREFORE, WKG requests that the Public Service Commission of the Commonwealth of Kentucky issue an order authorizing WKG to implement its Gas Meter Performance Control Program for positive displacement meters as a pilot program for five years pursuant to 807 KAR 5:022, Section 8(5)(c), and grant WKG permission to deviate from 807 KAR 5:022, Section 8(a)(1-3).

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Attorneys for Atmos Energy

ATTACHMENT 1

WESTERN KENTUCKY GAS COMPANY

GAS METER PERFORMANCE CONTROL PROGRAM

Introduction

Western Kentucky Gas Company's Gas Meter Performance Control Program is a procedure designed to provide a continuous high level of quality in the measurement of gas delivered to our customers while controlling metering cost. A high level of accuracy will be achieved by applying modern sampling and statistical techniques in the evaluation of gas meter performance. The primary goal of the program is the detection and removal of groups of like meters not meeting prescribed performance standards as defined by the Kentucky Public Service Commission (KPSC). In accomplishing this goal, WKG expects to create an in-service environment that will produce a high level of metering accuracy while prolonging gas meter service life. To that end, WKG will achieve significant savings by reducing unnecessary testing of high quality, better performing meters. Specifically, WKG estimates that this program will result in approximately nine thousand (9,000) fewer meters being tested annually. WKG proposes that this sampling program, once initiated, run for a test period of five years and be re-evaluated to ensure WKG and KPSC objectives are achieved.

I. GENERAL DESCRIPTION OF PROGRAM

WKG's Gas Meter Performance Control Program is based on the American National Standard ANSI/ASQC Z1.4: Sampling Procedures and Tables for Inspection by Attributes, covering all classes of positive displacement diaphragm gas meters. Under Performance Control, WKG's gas meter populations will be classified into control groups representing populations of equivalent makes and sizes purchased or repaired within five consecutive years at a maximum. Once created, a control group would be subject to sample testing based on its rated capacity class as follows:

A. Residential class—rated capacity up to and including 500 cubic feet per hour

All new and remanufactured residential class meters will be tested under the current guidelines of the KPSC prior to installation. Meters will become eligible for sampling in a control group beginning in the 10th year of service with an Acceptable Quality Level (AQL) of 6.5.

B. Commercial class—501 cubic feet per hour up to 1500 cubic feet per hour

Positive displacement meters will become eligible for sampling in a control group beginning in the 1st year of service with an AQL of 6.5.

C. Commercial class—above 1500 cubic feet per hour

Positive displacement meters will become eligible for sampling in a control group beginning in the 1st year of service with an AQL of 6.5.

II. CONTROL GROUP SAMPLING

The primary consideration in drawing a random sample is that each observance in the population must have an equal chance to be included in the sample. This ensures that the sample is representative of the population and the results of the sample are valid. Meters will be selected at random until there are enough meters in the sample to satisfy the sample size requirements.

A. As a part of this meter sampling plan, WKG will use the sample selection process as stated in ANSI Z1.4 Section 7.2 Sampling:

> When appropriate, the number of units in the sample shall be selected in proportion to the size of sublots or subbatches, or parts of the lot or batch, identified by some rational criterion. In so doing, the units from each part of the lot or batch shall be selected at random, as defined in ANSI/ASQC Standard A2-1987.

B. Sample sizes for each control group will be determined using the "Sample Size Code Letters" table for General Inspection Level II from ANSI Z1.4, using 6.5 as the designated Acceptable Quality Level (AQL). All control groups eligible will be accepted or rejected as allowed by ANSI Z1.4 with its designated AQL for single sampling.

C. Control groups will be switched between tightened, normal and reduced testing per ANSI Z1.4 Section 11.6. for accuracy, improvement or removal.

Single Sampling Plan (AQL = 6.5)

Lot or Batch Size	Sample	Normal Inspection			Tightened Inspection			Reduced Inspection		
	Size Code	Samples	Ac	Re	Samples	Ac	Re	Samples	Ac	Re
2 to 8	A	2	0	1	2	0	1	2	0	1
9 to 15	B	3	0	1	3	0	1	2	0	1
16 to 25	C	5	0	1	5	0	1	2	0	1
26 to 50	D	8	1	2	8	0	1	3	0	2
51 to 90	E	13	2	3	13	1	2	5	1	3
91 to 150	F	20	3	4	20	2	3	8	1	4
151 to 280	G	32	5	6	32	3	4	13	2	5
281 to 500	H	50	7	8	50	5	6	20	3	6
501 to 1200	J	80	10	11	80	8	9	32	5	8
1201 to 3200	K	125	14	15	125	12	13	50	7	10
3201 to 10000	L	200	21	22	200	18	19	80	10	13
10001 to 35000	M	315	21	22	315	18	19	125	10	13

Accept--(AC) --means accept the control group with no more than this quantity of defective meters.

Reject--(RE) --means reject the control group with equal or greater to this number of defective meters.

Control group sampling will, where possible, be accomplished through the testing of meters randomly selected for sample testing. Other routine meter changes and removals obtained during the calendar year may be included as part of the random sample for any control group if it can be properly documented that the integrity of ANSI Z1.4 Section 7.2 Sampling is maintained.

III. CREATION OF METER CONTROL GROUPS

Control groups of positive displacement gas meters will be created and maintained according to the following parameters:

A. Gas meters will be segregated into groups with similarly identifiable characteristics based on two criteria:

1. Control groups of all gas meters being placed into service shall be established according to purchase, field test or remanufacture year, type, grade, class, manufacturer and composition.

2. Control Groups composed of like meters with different years of installation may be established. When this is done, the earliest installation year of all the combined like meters will become the controlling year of installation for the new control group.

B. When created, each group will be assigned a descriptive title and control group number to facilitate identification.

C. New control groups will be established and identified at the end of each year from those gas meters installed during the year between January 1 and December 31.

IV. INSPECTION PARAMETERS

All control groups will begin testing according to the ANSI/ASQC Z1.4 General Inspection Level II for Normal Sampling. All changes to the inspection parameters will be done according to Section 11.6.

Gas meters, shall be deemed as accurate after removal from service if the average of the Open Test (full capacity) and Check Test (20 percent capacity) is not more than plus or minus 2 percent error.

A. A control group can become eligible for reduced sampling after ten years of sampling has been completed without failures. The reduced inspection level will be according to Reduced Sampling. At the first occurrence of unacceptable sampling the group will return to normal sampling.

B. A control group will be subjected to tightened inspection parameters when two out of five years fail the normal sampling criteria. The tightened inspection level will be according to Tightened Sampling. A control group will return to Normal Inspection from Tightened Inspection when five years of sampling has been completed with an acceptable level.

V. ACCURACY IMPROVEMENT

When a control group is classified in a tightened status and a failure occurs, one of the following actions will occur:

A. The control group of meters in any sampling inspection plan may be subdivided in an effort to identify the deviant subgroup. If, by the removal of a specific sub-group of meters, it can be demonstrated that the original control group of meters now meets the accuracy standard under General Inspection Level II for Normal Inspection, the remaining meters in the original control group shall remain in service.

B. If a deviate sub-group of meters cannot be identified to improve the control group's accuracy, then every reasonable effort will be made to remove the entire control group of meters from the service within 18 months once it has failed the applicable governing standard for the control group under ANSI Z1.4.

Meters shall be excluded from the sampling criteria for the following reasons:

1. Damage not associated with normal operating conditions that may have altered how the meter was actually performing while in service.

2. Meters which WKG suspects have been tampered with or meters removed by theft and later recovered by WKG.

VI. PERFORMANCE CLASSIFICATION TIME PARAMETERS

Scheduled control group testing for each test year shall begin January 1 and be completed by December 31 of the test year. The finalized test results will be published for review and a copy submitted to the Public Service Commission. The annual published review of WKG's Gas Meter Performance Control Plan shall detail at minimum the following items for each control group:

- Control Group Identification Number
- Model
- Purchase or Repair Year
- Balance of Control Group on Jan 1 and Dec 31 of Each Test Year
- Number of Meters Removed Under Scheduled Sampling
- Number of Meters Removed for Other Reasons
  - Accept Level for Specified Test
  - Number of Meter Accepted
  - Reject Level For Specified Test
  - Number of Meters Rejected
  - Percentage of Rejected Meters Over 2 Percent Fast
  - Percentage of Rejected Meters Over 2 Percent Slow

VII. SAMPLING PLAN FOR METER OUT-TEST

All new meters purchased by WKG will be subject to 100 percent testing by the manufacturer before shipment to WKG. The manufacturer's test results for each meter must accompany the meter at the time it is received by WKG or before shipment The calibration standard for all new remanufactured, and repaired gas meters being placed into service shall comply with the KPSC rules.

VIII. FIRST YEAR REPLACEMENT OF OBSOLETE METER TYPES

WKG will exclude all obsolete meter types from the sampling program. These meters have been identified through an analysis of historical meter performance and testing data. Our intent is to remove these meters during the first year of the statistical sampling program in addition to the randomly sampled meters selected for first year testing.

IX. PERIODIC TEST OPTION

If WKG, at a later date, decides to switch its entire meter population from Sample Testing back to the KPSC's current Periodic Test Schedule, a time frame equal to half of the average in service age of WKG's installed positive displacement meter population at that time shall be allowed for WKG to bring the service life of its meters into compliance with the KPSC's Periodic Test Schedule. Control groups that may fail within that period will continue to be removed within 18 months of issue of the Removal Order.

X. MAXIMUM IN-SERVICE LIFE

No meter in this program will be in service more than 40 years. All meters still in service at 40 years will be removed from the system within 18 months.

XI. ANNUAL REPORT

WKG proposes to file an annual report with the KPSC which will include identification and test results of each control group, test results for the new meters including manufacturer's test records, evaluation and analysis of the data, and any corrective action taken. WKG will also address direct cost savings and the overall effectiveness of this program.

ATTACHMENT 2

Western Kentucky Gas 1999 Program

Group Code	Group Model	Number in Group	Sample Size Code	Number Samples	Group Code	Group Model	Number in Group	Sample Size Code	Number Samples
030A	AC-250	3	A	2	037G	AL-1000	73	E	13
030B	AC-250	2	A	2	053B	R-415	539	J	80
030C	AC-250	10	B	3	053C	R-415	42	D	8
030D	AC-250	10	B	3	053D	R-415	11	B	3
030E	AC-250	4379	L	200	053E	R-415	10	B	3
030F	AC-250	13665	M	315	053F	R-415	79	E	13
030G	AC-250	27534	M	315	053G	R-415	1	A	1
031A	AL-175	5236	L	200	059A	R-200	1	A	1
031B	AL-175	8108	L	200	059B	R-200	10	B	3
031C	AL-175	6941	L	200	059C	R-200	1590	K	125
031E	AL-175	1979	K	125	059D	R-200	10210	M	315
031F	AL-175	18	C	5	059E	R-200	3985	L	200
031G	AL-175	8351	L	200	059F	R-200	8	A	2
032A	AL-225	7609	L	200	059G	R-200	690	J	80
032B	AL-225	502	J	80	060A	R-175	5491	L	200
032C	AL-225	32	D	8	060B	R-175	6613	L	200
032D	AL-225	23	C	5	060C	R-175	1865	K	125
032E	AL-225	8	A	2	060D	R-175	45	D	8
032F	AL-225	1	A	1	060E	R-175	17	C	5
034A	AL-425	3	A	2	060F	R-175	3	A	2
034B	AL-425	5	A	2	060G	R-175	85	E	13
034C	AL-425	213	G	32	061A	R-275	2	A	2
034D	AL-425	827	J	80	061B	R-275	3	A	2
034E	AL-425	291	H	50	061C	R-275	2	A	2
034F	AL-425	347	H	50	061D	R-275	3	A	2
034G	AL-425	943	J	80	061E	R-275	4660	L	200
036A	AL-800	2	A	2	061F	R-275	5122	L	200
036B	AL-800	30	D	8	061G	R-275	13790	M	315
036C	AL-800	26	D	8	062A	R-250	8049	L	200
036D	AL-800	227	G	32	026B	R-250	349	H	50
036E	AL-800	268	G	32	062C	R-250	92	F	20
036F	AL-800	164	G	32	062D	R-250	57	E	13
036G	AL-800	21	C	5	062E	R-250	12	B	3
037B	AL-1000	34	D	3	062F	R-250	6	A	2
037C	AL-1000	22	C	5	138F	S-250	3041	K	125
037D	AL-1000	81	E	13	210C	L-210	150	F	20
037E	AL-1000	85	E	13	210G	L-210	3071	K	125
037F	AL-1000	38	D	8					

Total Meters in Plan	157,815
Obsoletes Added to First Year	2,351
First Year Periodic Changeouts	7,555

ATTACHMENT 3

WESTERN KENTUCKY GAS COMPANY
GAS METER PERFORMANCE CONTROL PROGRAM
ANALYSIS OF EXPECTED DIRECT ANNUAL COST SAVINGS (Note 1)

Estimated average annual reduction in number of meters tested			**9,000**

Based upon change from 10 year changeout
to expected average life of 24 years and
more than 157,815 meters in service

Approximate average cost for periodic changing and testing each domestic size meter (Note 2):

New meter	(4,000)	$49.82	
Repaired meter	(5,000)	$24.09	
Total			**$35.53**
Estimated average annual savings			**$319,730**

Note 1
The annual savings are a combination of reduced capital expenditures and reduced expenses. The annual savings reflect reductions in the growth of future operating costs not net reductions from current operating cost levels.

Note 2
Average quantity of meters either repaired, remanufactured, tested only, or retired per year is estimated at 5000 units with an average cost at $24.09.

Average quantity of new meters installed per year is estimated at 4000.

ANSI/ASQC Z1.4-1993

AMERICAN NATIONAL STANDARD

Sampling Procedures and Tables for Inspection By Attributes

AMERICAN SOCIETY FOR QUALITY
611 EAST WISCONSIN AVENUE
MILWAUKEE, WISCONSIN 53202

ANSI/ASQC Z1.4-1993

AMERICAN NATIONAL STANDARD

Sampling Procedures and Tables for Inspection by Attributes

Prepared by
American Society for Quality Standards Committee
For
AMERICAN NATIONAL STANDARDS COMMITTEE
Z-1 ON QUALITY ASSURANCE

Sponsor and Secretariat
AMERICAN SOCIETY FOR QUALITY

Abstract
Sampling Procedures and Tables for Inspection by Attributes is an acceptance sampling system to be used with switching rules on a continuing stream of lots for AQL specified. It provides tightened, normal, and reduced plans to be applied for attributes inspection for percent nonconforming or nonconformities per 100 units.

AMERICAN NATIONAL STANDARD: An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

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Foreword

(This foreword is not a part of American National Standard —*Sampling Procedures and Tables for Inspection by Attributes*, Z1.4-1993)

This standard is a revision of ANSI Z1.4-1971, "Sampling Procedures and Tables for Inspection by Attributes," which corresponds directly to MIL-STD-105E. The present revision ANSI/ASQC Z1.4-1993 was undertaken to modernize terminology and to emphasize the system aspect of the procedure through incorporation of the operating characteristic curves and other measures computed for scheme performance reflecting the basic strategy including the switching rules.

All tables, table numbers, and procedures used in MIL-STD-105E were retained. The tables are unchanged to make the tabular content completely compatible with MIL-STD-105E. Modifications from the MIL-STD-105E format beyond editorial refinements include:

1) Substitution of the word "nonconformity" for "defect" throughout, in conformance with ANSI/ASQC A2-1978. Substitution of the word "nonacceptance" for "rejection" when it refers to a result of following the procedure. Forms of the word "reject" are retained when they refer to actions the customer may take. The term "rejection number" is retained when it refers to the nomenclature on Tables II, III, IV and X to be consistent with tables of the same numbers in MIL-STD-105E.

2) Presentation of the switching rules to put them in conformance with ANSI Z1.9-1980, the ANSI version of MIL-STD-414. This includes an option for reduced inspection without use of limit numbers (as in ANSI Z1.9-1980). Use without the limit numbers improves the performance of a scheme by accepting more lots at the AQL, with no change in discrimination below the indifference quality level.

3) Introduction of the following tables:
  - Table XI Average Outgoing Quality Limit Factors for ANSI Z1.4 Scheme Performance (Single Sampling)
  - Table XII Limiting Quality for ANSI Z1.4 Scheme Performance for which $P_a = 10$ Percent (Single Sampling)
  - Table XIII Limiting Quality for ANSI Z1.4 Scheme Performance for which $P_a = 5$ Percent (Single Sampling)
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4) The titles of Tables V-A and V-B have been changed to read, "Approximate values for average outgoing quality limits." These are different from the titles in MIL-STD-105E.

5) The tables contained in this Standard cover situations where the quality level is specified in percentages as low as 0.01%. It should be noted that 0.01% is equal to 100 parts per million (PPM). Sampling procedures for quality levels of fewer PPM are not included in this Standard.

6) Substitution of
Section 2 Definitions and Terminology
for
Section 2 Classification of Defects and Defectives
Reference is made to classification of nonconformities in Section 6.3.

7) Reference to the use of operating properties of the scheme and the meaning of scheme performance is made in Section 11.

8) Addition of Section 11.6 spelling out proper use of individual plans when extracted from the ANSI Z1.4 system as a whole.

9) Addition of Figure 1 showing the switching procedure to enhance understanding of the switching aspect of the system.

10) Addition of replotted OC curves.

Note: A compatible and interchangeable standard for variables inspection is ANSI Z1.9-1993.

Suggestions for improvement of this standard will be welcome. They should be sent to the sponsor, ASQC, 611 East Wisconsin Avenue, Milwaukee, WI 53202.

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SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES

1. SCOPE

1.1 PURPOSE. This publication establishes sampling plans and procedures for inspection by attributes. When specified by the responsible authority, this publication shall be referenced in the specification, contract, inspection instructions, or other documents and the provisions set forth herein shall govern. The "responsible authority" shall be designated in one of the above documents, as agreed to by the purchaser and seller or producer and user.

1.2 APPLICATION. Sampling plans designated in this publication are applicable, but not limited, to inspection of the following:

a. End items.

b. Components and raw materials.

c. Operations

d. Materials in process.

e. Supplies in storage.

f. Maintenance operations.

g. Data or records.

h. Administrative procedures.

These plans are intended primarily to be used for a continuing series of lots or batches. The plans may also be used for the inspection of isolated lots or batches, but, in this latter case, the user is cautioned to consult the operating characteristic curves to find a plan which will yield the desired protection (see 11.6).

1.3 INSPECTION. Inspection is the process of measuring, examining, testing, or otherwise comparing the unit of product (see 1.5) with the requirements.

1.4 INSPECTION BY ATTRIBUTES. Inspection by attributes is inspection whereby either the unit of product is classified simply as conforming or nonconforming, or the number of nonconformities in the unit of products is counted, with respect to a given requirement or set of requirements.

1.5 UNIT OF PRODUCT. The unit of product is the unit inspected in order to determine its classification as conforming or nonconforming or to count the number of nonconformities. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The unit of product may or may not be the same as the unit of purchase, supply, production, or shipment.

2. DEFINITIONS AND TERMINOLOGY

The definitions and terminology employed in this standard are in accord with ANSI/ASQC Standard A2-1987 (Terms, Symbols, and Definitions for Acceptance Sampling). The following two definitions are particularly important in applying the standard.

> DEFECT: A departure of a quality characteristic from its intended level or state that occurs with a severity sufficient to cause an associated product or service not to satisfy intended normal, or foreseeable, usage requirements.
>
> NONCONFORMITY: A departure of a quality characteristic from its intended level or state that occurs with severity sufficient to cause an associated product or service not to meet a specification requirement.

These acceptance sampling plans for attributes are given in terms of the percent or proportion of product in a lot or batch that depart from some requirement. The general terminology used within the document will be given in terms of percent of nonconforming units or number of nonconformities, since these terms are likely to constitute the most widely used criteria for acceptance sampling.

In the use of this standard it is helpful to distinguish between:

a. an individual sampling plan—a specific plan that states the sample size or sizes to be used, and the associated acceptance criteria.

b. a sampling scheme—a combination of sampling plans with switching rules and possibly a provision for discontinuance of inspection. In this standard the terms "sampling scheme" and "scheme performance" will be used in the restricted sense described in Sec. 11.1.

c. a sampling system—a collection of sampling schemes. This standard is a sampling system indexed by lot-size ranges, inspection levels, and AQLs.

3. PERCENT NONCONFORMING AND NONCONFORMITIES PER HUNDRED UNITS

3.1 EXPRESSION OF NONCONFORMANCE. The extent of nonconformance of product shall be expressed either in terms of percent nonconforming or in terms of nonconformities per hundred units.

3.2 PERCENT NONCONFORMING. The percent nonconforming of any given quantity of units of product is one hundred times the number of nonconforming units divided by the total number of units of product, i.e.:

$$\text{Percent nonconforming} = \frac{\text{Number nonconforming}}{\text{Number of units inspected}} \times 100$$

3.3 NONCONFORMITIES PER HUNDRED UNITS. The number of nonconformities per hundred units of any given quantity of units of product is one hundred times the number of nonconformities contained therein (one or more nonconformities being possible in any unit of product) divided by the total number of units of product, i.e.:

$$\begin{array}{c}\text{Nonconformities per}\\ \text{hundred units}\end{array} = \frac{\text{Number of nonconformities}}{\text{Number of units inspected}} \times 100$$

It is assumed that nonconformities occur randomly and with statistical independence within and between units.

4. ACCEPTABLE QUALITY LEVEL (AQL)

4.1 USE. The AQL together with the Sample Size Code Letter, is used for indexing the sampling plans provided herein.

4.2 DEFINITION. The AQL is the maximum percent nonconforming (or the maximum number of nonconformities per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average (see 11.2).

4.3 NOTE ON THE MEANING OF AQL. When a consumer designates some specific value of AQL for a certain nonconformity or group of nonconformities, it indicates to the supplier that the consumer's acceptance sampling plan will accept the great majority of the lots or batches that the supplier submits, provided the process average level of percent nonconforming (or nonconformities per hundred units) in these lots or batches be no greater than the designated value of AQL. Thus, the AQL is a designated value of percent nonconforming (or nonconformities per hundred units) that the consumer indicates will be accepted most of the time by the acceptance sampling procedure to be used. The sampling plans provided herein are so arranged that the probability of acceptance at the designated AQL value depends upon the sample size, being generally higher for large samples than for small ones, for a given AQL.

Note that AQL is a parameter of the sampling scheme and should not be confused with process average which describes the operating level of the manufacturing process. It is expected that the process average will be less than or equal to the AQL to avoid excessive rejections under this system.

It is necessary to refer to the operating characteristic curves of the scheme and its constituent plans, to determine what protection the consumer will have.

The AQL alone does not describe the protection to the consumer for individual lots or batches, but more directly relates to what might be expected from a series of lots or batches, provided the steps indicated in this publication are taken.

4.4 LIMITATION. The designation of an AQL shall not imply that the supplier has the right to knowingly supply any nonconforming unit of product.

4.5 SPECIFYING AQLs. The AQL to be used will be designated in the contract or by the responsible authority. Different AQLs may be designated for groups of nonconformities considered collectively, or for individual nonconformities. For example, Group A may include nonconformities of a type felt to be of the highest concern for the product or service and therefore be assigned a small AQL value; Group B may include nonconformities of the next highest degree of concern and therefore be assigned a larger AQL value than for Group A and smaller than that of Group C, etc. The classification into groups should be appropriate to the quality requirements of the specific situation. An AQL for a group of nonconformities may be designated in addition to AQLs for individual nonconformities, or subgroups, within that group. AQL values of 10.0 or less may be expressed either in percent nonconforming or in nonconformities per hundred units; those over 10.0 shall be expressed in nonconformities per hundred units only.

4.6 PREFERRED AQLs. The values of AQLs given in these tables are known as preferred AQLs. If, for any product, an AQL be designated other than a preferred AQL, these tables are not applicable.

5. SUBMISSION OF PRODUCT

5.1 LOT OR BATCH. The term lot or batch shall mean "inspection lot" or "inspection batch," i.e., a collection of units of product from which a sample is to be drawn and inspected to determine conformance with the acceptability criteria, and may differ from a collection of units designated as a lot or batch for other purposes (e.g., production, shipment, etc).

5.2 FORMATION OF LOTS OR BATCHES. The product shall be assembled into identifiable lots, sublots, batches, or in such other manner as may be prescribed (see 5.4). Each lot or batch shall, as far as is practicable, consist of units of product of a single type, grade, class, size, and composition, manufactured under essentially the same conditions, and at essentially the same time.

5.3 LOT OR BATCH SIZE. The lot or batch size is the number of units of product in a lot or batch.

5.4 PRESENTATION OF LOTS OR BATCHES. The formation of the lots or batches, lot or batch size, and the manner in which each lot or batch is to be presented and identified by the supplier shall be designated or approved by the responsible authority. As necessary, the supplier shall provide adequate and suitable storage space for each lot or batch, equipment needed for proper identification and presentation, and personnel for all handling of product required for drawing of samples.

6. ACCEPTANCE AND NON-ACCEPTANCE

6.1 ACCEPTABILITY OF LOTS OR BATCHES. Acceptability of a lot or batch will be determined by the use of a sampling plan or plans associated with the designated AQL or AQLs.

In the use of this standard a statement that a lot is acceptable means simply that sample results satisfy the standard's acceptance criteria. The acceptance of a lot is not intended to provide information about lot quality. If a stream of lots from a given process is inspected under an acceptance sampling scheme such as provided in this standard, some lots will be accepted and others will not. If all incoming lots are assumed to be at the same process average and if the nonconforming items that are discovered and replaced by conforming items during sample inspection are ignored, it will be found that both the set of accepted lots and the set of non-accepted lots will have the same long run average quality as the original set of lots submitted for inspection. Inspection of incoming lots whose quality levels vary around a fixed long run average quality level will divide the lots into a set of accepted lots and a set of non-accepted lots, but it will be found that the long run average quality of the accepted lots is only slightly better than the long run average quality of the non-accepted lots. Replacement of the nonconforming items that are discovered during sample inspection does not alter this finding because the samples are a small fraction of the lots.

The purpose of this standard is, through the economic and psychological pressure of lot non-acceptance, to induce a supplier to maintain a process average at least as good as the specified AQL while at the same time providing an upper limit on the consideration of the consumer's risk of accepting occasional poor lots. The standard is not intended as a procedure for estimating lot quality or for segregating lots.

In acceptance sampling, when sample data do not meet the acceptance criteria, it is often stated that the lot is to be "rejected". In this connection, the words "to reject" generally are used. Rejection in an acceptance sampling sense means to decide that a batch, lot or quantity of product, material or service has not been shown to satisfy the acceptance criteria based on the information obtained from the sample(s).

In acceptance sampling, the words "to reject" generally are used to mean "to not accept" without direct implication of product usability. Lots which are "rejected" may be scrapped, sorted (with or without nonconforming units being replaced), reworked, re-evaluated against more specific usability criteria, held for additional information, etc. Since the common language usage of "reject" often results in an inference of unsafe or unusable product, it is recommended that "not accept" be understood rather than "reject" in the use of this standard.

The word "non-acceptance" is used here for "rejection" when it refers to the result of following the procedure. Forms of the word "reject" are retained when they refer to actions the customer may take, as in "rejection number".

6.2 NONCONFORMING UNITS. The right is reserved to reject any unit of product found nonconforming during inspection whether that unit of product forms a part of a sample or not, and whether the lot or batch as a whole is accepted or rejected. Rejected units may be repaired or corrected and resubmitted for inspection with the approval of, and in the manner specified by, the responsible authority.

6.3 SPECIAL RESERVATION FOR DESIGNATED NONCONFORMITIES. Since most acceptance sampling involves evaluation of more than one quality characteristic, and since these may differ in importance in terms of quality and/or economic effects, it is often desirable to classify the types of nonconformity according to agreed upon groupings. Specific assignment of types of nonconformities to each class is a function of agreement on specific sampling applications. In general, the function of such classification is to permit the use of a set of sampling plans having a common sample size, but different acceptance numbers for each class having a different AQL, such as in Tables II, III, and IV.

The supplier may be required at the discretion of the responsible authority to inspect every unit of the lot or batch for designated classes of nonconformities. The right is reserved to inspect every unit submitted by the supplier for specified nonconformities, and to reject the lot or batch immediately, when a nonconformity of this class is found. The right is reserved also to sample, for specified classes of nonconformities, lots or batches submitted by the supplier and to reject any lot or batch if a sample drawn therefrom is found to contain one or more of these nonconformities.

6.4 RESUBMITTED LOTS OR BATCHES. Lots or batches found unacceptable shall be resubmitted for reinspection only after all units are re-examined or re-tested and all nonconforming units are removed or nonconformities corrected. The responsible authority shall determine whether normal or tightened inspection shall be used on reinspection and whether reinspection shall include all types or classes of nonconformities or only the particular types or classes of nonconformities which caused initial rejection.

7. DRAWING OF SAMPLES

7.1 SAMPLE. A sample consists of one or more units of product drawn from a lot or batch, the units of the sample being selected at random without regard to their quality. The number of units of product in the sample is the sample size.

7.2 SAMPLING. When appropriate, the number of units in the sample shall be selected in proportion to the size of sublots or subbatches, or parts of the lot or batch, identified by some rational criterion. In so doing, the units from each part of the lot or batch shall be selected at random, as defined in ANSI/ASQC Standard A2-1987.

7.3 TIME OF SAMPLING. Samples may be drawn after all the units comprising the lot or batch have been produced, or samples may be drawn during production of the lot or batch.

7.4 DOUBLE OR MULTIPLE SAMPLING. When double or multiple sampling is to be used, each sample shall be selected over the entire lot or batch.

8. NORMAL, TIGHTENED AND REDUCED INSPECTION

8.1 INITIATION OF INSPECTION. Normal inspection will be used at the start of inspection unless otherwise directed by the responsible authority.

8.2 CONTINUATION OF INSPECTION. Normal, tightened or reduced inspection shall continue unchanged on successive lots or batches except where the switching procedures given below require change.

8.3 SWITCHING PROCEDURES.

8.3.1 NORMAL TO TIGHTENED. When normal inspection is in effect, tightened inspection shall be instituted when 2 out of 5 consecutive lots or batches have been non-acceptable on original inspection (i.e., ignoring resubmitted lots or batches for this procedure).

8.3.2 TIGHTENED TO NORMAL. When tightened inspection is in effect, normal inspection shall be instituted when 5 consecutive lots or batches have been considered acceptable on original inspection.

8.3.3 NORMAL TO REDUCED. When normal inspection is in effect, reduced inspection shall be instituted providing that all of the following conditions are satisfied:

a. The preceding 10 lots or batches (or more, as indicated by the note to Table VIII) have been on normal inspection and all have been accepted on original inspection; and

b. The total number of nonconforming units (or nonconformities) in the samples from the preceding 10 lots or batches (or such other number as was used for condition "a" above) is equal to or less than the applicable number given in Table VIII. If double or multiple sampling is in use, all samples inspected should be included, not "first" samples only; and

c. Production is at a steady rate; and

d. Reduced inspection is considered desirable by the responsible authority.

8.3.4 REDUCED TO NORMAL. When reduced inspection is in effect, normal inspection shall be instituted if any of the following occur on original inspection:

a. A lot or batch is rejected; or

b. A lot or batch is considered acceptable under the procedures for reduced inspection given in 10.1.4; or

c. Production becomes irregular or delayed; or

d. Other conditions warrant that normal inspection shall be instituted.

8.4 DISCONTINUATION OF INSPECTION. In the event that 10 consecutive lots or batches remain on tightened inspection (or such other number as may be designated by the responsible authority), inspection under the provisions of this document should be discontinued pending action to improve the quality of submitted material.

8.5 LIMIT NUMBERS FOR REDUCED INSPECTION. When agreed upon by responsible authority for both parties to the inspection, that is, the supplier and the end item customer, the requirements of 8.3.3b may be dropped. This action will have little effect on the operating properties of the scheme.

8.6 SWITCHING SEQUENCE. A schematic diagram describing the sequence of application of the switching rules is shown in Figure 1.

9. SAMPLING PLANS

9.1 SAMPLING PLAN. A sampling plan indicates the number of units of product from each lot or batch which are to be inspected (sample size or series of sample sizes) and the criteria for determining the acceptability of the lot or batch (acceptance and rejection numbers).

9.2 INSPECTION LEVEL. The inspection level determines the relationship between the lot or batch size and the sample size. The inspection level to be used for any particular requirement will be prescribed by the responsible authority. Three inspection levels: I, II and III are given in Table I for general use. Unless otherwise specified, Inspection Level II will be used. However, Inspection Level I may be specified when less discrimination is needed, or Level III may be specified for greater discrimination. Four additional special levels: S-1, S-2, S-3, and S-4, are given in the same table and may be used where relatively small sample sizes are necessary and large sampling risks can or must be tolerated.

NOTE: In the designation of inspection levels S-1 to S-4, care must be exercised to avoid AQLs inconsistent with these inspection levels.

9.3 CODE LETTERS. Sample sizes are designated by code letters. Table I shall be used to find the applicable code letter for the particular lot or batch size and the prescribed inspection level.

9.4 OBTAINING SAMPLING PLAN. The AQL and the code letter shall be used to obtain the sampling plan from Tables II, III, or IV. When no sampling plan is available for a given combination of AQL and code letter, the tables direct the user to a different letter. The sample size to be used is given by the new code letter not by the original letter. If this procedure leads to different sample sizes for different classes of nonconformities, the code letter corresponding to the largest sample size derived may be used for all classes of nonconformities when designated or approved by the responsible authority. As an alternative to a single sampling plan with an acceptance number of 0, the plan with an acceptance number of 1 with its correspondingly larger sample size for a designated AQL (where available), may be used when designated or approved by the responsible authority.

9.5 TYPES OF SAMPLING PLANS. Three types of sampling plans: Single, Double and Multiple, are given in Tables II, III and IV, respectively. When several types of plans are available for a given AQL and code letter, any one may be used. A decision as to type of plan, either single, double, or multiple, when available for a given AQL and code letter, will usually be based upon the comparison between the administrative difficulty and the average sample sizes of the available plans. The average sample size of multiple plans is less than for double (except in the case corresponding to single acceptance number 1) and both of these are always less than a single sample size (see Table IX). Usually the administrative difficulty for single sampling and the cost per unit of the sample are less than for double or multiple.

10. DETERMINATION OF ACCEPTABILITY

10.1 PERCENT NONCONFORMING INSPECTION. To determine acceptability of a lot or batch under percent nonconforming inspection, the applicable sampling plan shall be used in accordance with 10.1.1, 10.1.2, 10.1.3 and 10.1.4.

10.1.1 SINGLE SAMPLING PLAN. The number of sample units inspected shall be equal to the sample size given by the plan. If the number of nonconforming units found in the sample is equal to or less than the acceptance number, the lot or batch shall be considered acceptable. If the number of nonconforming units is equal to or greater than the rejection number, the lot or batch shall be considered not acceptable.

10.1.2 DOUBLE SAMPLING PLAN. The number of sample units first inspected shall be equal to the first sample size given by the plan. If the number of nonconforming units found in the first sample is equal to or less than the first acceptance number, the lot or batch shall be considered acceptable. If the number of nonconforming units found in the first sample is equal to or greater than the first rejection number, the lot or batch shall be considered not acceptable. If the number of nonconforming units found in the first sample is between the first acceptance and rejection numbers, a second sample of the size given by the plan shall be inspected. The number of nonconforming units found in the first and second samples shall be accumulated. If the cumulative number of nonconforming units is equal to or less than the second acceptance number, the lot or batch shall be considered acceptable. If the cumulative number of nonconforming units is equal to or greater than the second rejection number, the lot or batch shall be considered not acceptable.

10.1.3 MULTIPLE SAMPLE PLAN. Under multiple sampling, the procedure shall be similar to that specified in 10.1.2, except that the number of successive samples required to reach a decision might be more than two.

10.1.4 SPECIAL PROCEDURE FOR REDUCED INSPECTION. Under reduced inspection, the sampling procedure may terminate without making a decision. In these circumstances, the lot or batch will be considered acceptable, but normal inspection will be reinstated starting with the next lot or batch (see 8.3.4(b)).

10.2 NONCONFORMITIES PER HUNDRED UNITS INSPECTION. To determine the acceptability of a lot or batch under Nonconformities per Hundred Units inspection, the procedure specified for Percent Nonconforming inspection above shall be used, except that the word "nonconformities" shall be substituted for "nonconforming units".

11. SUPPLEMENTARY INFORMATION

11.1 OPERATING CHARACTERISTIC CURVES. Operating characteristic curves and other measures of performance presented in this standard are of two types. Those for the individual plans that represent the elements of the schemes are presented in Tables V, VI, VII, IX, and X. Analogous curves and other measures of overall scheme performance when the switching rules are used are given in Tables XI, XII, XIII, XIV, and XV. Scheme performance is defined as the composite proportion of lots accepted at a stated percent nonconforming when the switching rules are applied. The term scheme performance is used here in a very restrictive sense. It refers to how the ANSI Z1.4 scheme of switching rules would operate at a given process level under the assumption that the process stays at that level even after switching to tightened inspection or discontinuation of inspection. This gives a conservative "worst case" description of the performance of the scheme for use as a base-line in the sense that if the psychological and economic pressures associated with the switching rules are considered, the protection of the scheme may be somewhat better than that shown.

Operating characteristic curves are given in Table X for individual sampling plans for normal and tightened inspection. The operating characteristic curve for unqualified acceptance under reduced inspection can be found by using the AQL index of the normal plan with the sample size(s) and acceptance number(s) of the reduced plan. The curves shown are for single sampling; curves for double and multiple sampling are matched as closely as practicable. The O.C. curves shown for AQLs greater than 10.0 are based on the Poisson distribution and apply for nonconformities per hundred units inspection; those for AQLs of 10.0 or less and sample sizes of 80 or less are based on the binomial distribution and apply for percent nonconforming inspection; those for AQLs of 10.0 or less and sample sizes larger than 80 are based on the Poisson distribution and apply either for nonconformities per hundred units inspection, or for percent nonconforming inspection (the Poisson distribution being an adequate approximation to the binomial distribution under these conditions). Tabulated values corresponding to selected values of probabilities of acceptance

(P_a in percent) are given for each of the curves shown, and, in addition, are indexed for tightened inspection, and also show values for nonconformities per hundred units for AQLs of 10.0 or less and sample sizes of 80 or less.

The operating characteristic curves for scheme performance shown in Table XV indicate the percentage of lots or batches which may be expected to be accepted under use of the switching rules with the various sampling plans for a given process quality subject to the restrictions stated above. The operating characteristic curves of scheme performance are based on the use of limit numbers in switching to reduced inspection and are approximately correct when the limit numbers for reduced inspection are not used under Option 8.5. The curves also assume a return to tightened inspection when inspection is resumed after discontinuation has been imposed. This is also true of average outgoing quality limit and average sample size for ANSI Z1.4 scheme performance.

Note that the operating characteristic curve for scheme performance is approximately that of the normal plan for low levels of percent nonconforming and that of the tightened plan for high levels of percent nonconforming. Use of the reduced plan increases scheme probability of acceptance only for extremely low levels of percent nonconforming.

11.2 PROCESS AVERAGE. The process average is the average percent nonconforming or average number of nonconformities per hundred units (whichever is applicable) of product submitted by the supplier for original inspection. Original inspection is the first inspection of a particular quantity of product as distinguished from the inspection of product which has been resubmitted after prior rejection. When double or multiple sampling is used, only first sample results shall be included in the process average calculation.

11.3 AVERAGE OUTGOING QUALITY (AOQ). The AOQ is the average quality of outgoing product including all accepted lots or batches, plus all lots or batches which are not accepted after such lots or batches have been effectively 100 percent inspected and all nonconforming units replaced by conforming units.

11.4 AVERAGE OUTGOING QUALITY LIMIT (AOQL). The AOQL is the maximum of the AOQs for all possible incoming qualities for a given acceptance sampling plan. AOQL values are given in Table V-A for each of the single sampling plans for normal inspection and in Table V-B for each of the single sampling plans for tightened inspection. AOQL values for ANSI Z1.4 scheme performance are given in Table XI subject to the restrictions of 11.1. They show the average outgoing quality limits for scheme performance when using single sampling. AOQL will be slightly higher when the limit numbers for reduced inspection are not used under Option 8.5.

11.5 AVERAGE SAMPLE SIZE CURVES. Average sample size curves for double and multiple sampling as compared to the single sampling plan for each acceptance number are in Table IX. These show the average sample sizes which may be expected to occur under the various sampling plans for a given process quality level. The curves assume no curtailment of inspection and are approximate to the extent that they are based upon the Poisson distribution, and that the sample sizes at each stage for double and multiple sampling are assumed to be 0.631n and 0.25n respectively, where n is the equivalent single sample size. Average sample size tables for ANSI Z1.4 scheme performance are given in Table XIV. They show the average sample size for scheme performance when using single sampling.

11.6 LIMITING QUALITY PROTECTION.

11.6.1 USE OF INDIVIDUAL PLANS. This standard is intended to be used as a system employing tightened, normal, and reduced inspection on a continuing series of lots to achieve consumer protection while assuring the producer that acceptance will occur most of the time if quality is better than the AQL.

11.6.2 IMPORTANCE OF SWITCHING RULES. Occasionally specific individual plans are selected from the standard and used without the switching rules. This is not the intended application of the ANSI Z1.4 system and its use in this way should not be referred to as inspection under ANSI Z1.4. When employed in this way, this document simply represents a repository for a collection of individual plans indexed by AQL. The operating characteristics and other measures of a plan so chosen must be assessed individually for that plan from the tables provided.

11.6.3 LIMITING QUALITY TABLES. If the lot or batch is of an isolated nature, it is desirable to limit the selection of sampling plans to those, associated with a designated AQL value, that provide not less than a specified limiting quality protection. Sampling plans for this purpose can be selected by choosing a Limiting Quality (LQ) and a consumer's risk to be associated with it. Limiting Quality is the percentage of nonconforming units (or nonconformities) in a batch or lot for which for purposes of acceptance sampling, the consumer wishes the probability of acceptance to be restricted to a specified low value.

Tables VI and VII give process levels for which the probabilities of lot acceptance under various sampling plans are 10 percent and 5 percent respectively. If a different value of consumer's risk is required, the O.C. curves and their tabulated values may be used. For individual lots with percents nonconforming or nonconformities per 100 units equal to the specified Limiting Quality (LQ) values, the probabilities of lot acceptance are less than 10 percent in the case of plans listed in Table VI and less than 5 percent in the case of plans listed in Table VII. When there is reason for avoiding more than a limiting percentage of nonconforming units (or nonconformities) in a lot or batch, Tables VI and VII may be useful for fixing minimum sample sizes to be associated with the AQL and Inspection Level specified for the inspection of a series of lots or batches. For example, if an LQ of 5 percent is desired for individual lots with an associated P_a of 10 percent or less, then if an AQL of 1.5 percent is designated for inspection of a series of lots or batches, Table VI indicates that the minimum sample size must be that given by Code Letter M.

Where there is interest in a limiting *process level*, Tables XII and XIII, which give LQ values and ANSI Z1.4 scheme performance, may be used in a similar way to fix minimum sample sizes.

In the case of an isolated lot, it is preferable for the customer to adapt a sampling plan with a small consumer's risk. The ideal method of calculating the sample size and risk is by use of the hypergeometric probability function. ANSI/ASQC Q3 contains sampling plans that have been calculated on this basis and therefore provide a more accurate set of tables for these situations.

Switching Rules for ANSI Z1.4 System

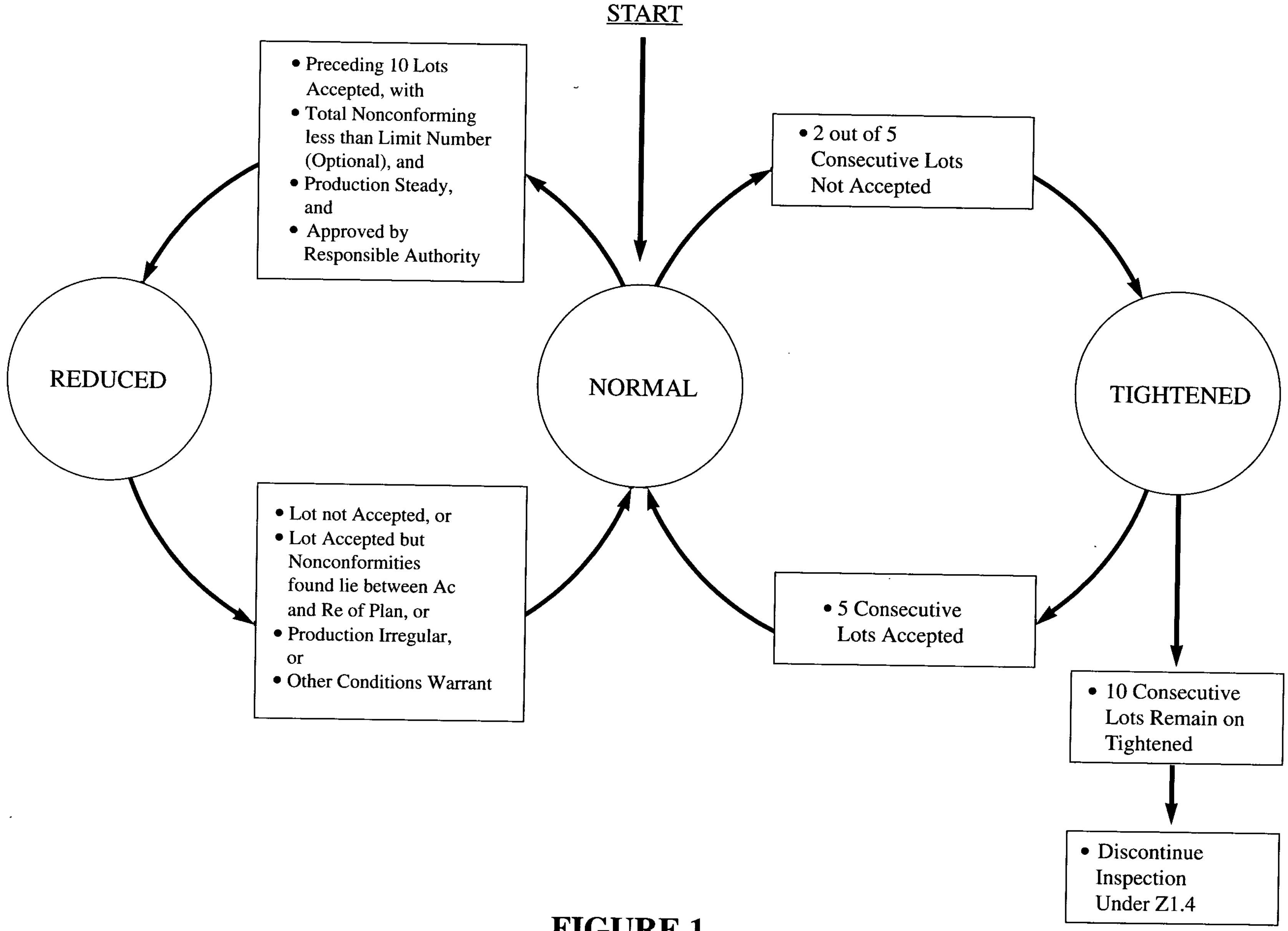
START
• Preceding 10 Lots Accepted, with
• Total Nonconforming less than Limit Number (Optional), and
• Production Steady, and
• Approved by Responsible Authority
• 2 out of 5 Consecutive Lots Not Accepted
REDUCED
NORMAL
TIGHTENED
• Lot not Accepted, or
• Lot Accepted but Nonconformities found lie between Ac and Re of Plan, or
• Production Irregular, or
• Other Conditions Warrant
• 5 Consecutive Lots Accepted
• 10 Consecutive Lots Remain on Tightened
• Discontinue Inspection Under Z1.4

FIGURE 1

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TABLE I—Sample size code letters

(See 9.2 and 9.3)

Lot or batch size	Special inspection levels				General inspection levels		
	S-1	S-2	S-3	S-4	I	II	III
2 to 8	A	A	A	A	A	A	B
9 to 15	A	A	A	A	A	B	C
16 to 25	A	A	B	B	B	C	D
26 to 50	A	B	B	C	C	D	E
51 to 90	B	B	C	C	C	E	F
91 to 150	B	B	C	D	D	F	G
151 to 280	B	C	D	E	E	G	H
281 to 500	B	C	D	E	F	H	J
501 to 1200	C	C	E	F	G	J	K
1201 to 3200	C	D	E	G	H	K	L
3201 to 10000	C	D	F	G	J	L	M
10001 to 35000	C	D	F	H	K	M	N
35001 to 150000	D	E	G	J	L	N	P
150001 to 500000	D	E	G	J	M	P	Q
500001 and over	D	E	H	K	N	Q	R

CODE LETTERS

SINGLE NORMAL PLANS

Table II-A—Single sampling plans for normal inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample size	Acceptable Quality Levels (normal inspection)																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑	↑	↑
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑
G	32	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑
H	50	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑
J	80	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	125	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	200	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	315	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	500	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	800	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	1250	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	2000	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.

Table II-B—Single sampling plans for tightened inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample size	Acceptable Quality Levels (tightened inspection)																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	↑
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	↑	↑
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	27 28	41 42	↑	↑	↑
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑
G	32	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑
H	50	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑
J	80	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	125	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	200	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	315	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	500	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	800	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	1250	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	2000	0 1	↑	↓	1 2	2 3	3 4	5 6	8 9	12 13	18 19	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
S	3150		↑	1 2								↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.

Table II-C—Single sampling plans for reduced inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample size	Acceptable Quality Levels (reduced inspection)†																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	2 4	3 5	5 6	7 8	10 11	14 15	21 22	30 31
C	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑
D	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑	↑
E	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	21 24	↑	↑	↑
F	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑
G	13	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑
H	20	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑
J	32	↓	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	50	↓	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	80	↓	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	125	↓	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	200	↓	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	315	↓	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	500	0 1	↑	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	800	↑	↑	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.
† = If the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot, but reinstate normal inspection (see 10.1.4).

Table III-A—Double sampling plans for normal inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (normal inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	✱	✱	✱	✱	✱	✱	✱	✱	✱
B	First Second	2 2	2 4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	17 22 37 38	25 31 56 57
C	First Second	3 3	3 6	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	17 22 37 38	25 31 56 57	↑
D	First Second	5 5	5 10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	17 22 37 38	25 31 56 57	↑	↑
E	First Second	8 8	8 16	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	17 22 37 38	25 31 56 57	↑	↑	↑
F	First Second	13 13	13 26	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑
G	First Second	20 20	20 40	↓	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑
H	First Second	32 32	32 64	↓	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑
J	First Second	50 50	50 100	↓	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	First Second	80 80	80 160	↓	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	First Second	125 125	125 250	↓	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	First Second	200 200	200 400	↓	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	First Second	315 315	315 630	↓	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	First Second	500 500	500 1000	↓	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	First Second	800 800	800 1600	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	5 9 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	First Second	1250 1250	1250 2500	↑	↑	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 8 9	5 9 12 13	7 11 18 19	11 16 26 27	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.
✱ = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).

Table III-B—Double sampling plans for tightened inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (tightened inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	✱	✱	✱	✱	✱	✱	✱
B	First Second	2 2	2 4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	15 20 34 35	23 29 52 53
C	First Second	3 3	3 6	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	15 20 34 35	23 29 52 53	↑
D	First Second	5 5	5 10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	15 20 34 35	23 29 52 53	↑	↑
T	First Second	8 8	8 16	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	15 20 34 35	23 29 52 53	↑	↑	↑
F	First Second	13 13	13 26	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑
G	First Second	20 20	20 40	↓	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑
H	First Second	32 32	32 64	↓	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑
J	First Second	50 50	50 100	↓	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	First Second	80 80	80 160	↓	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	First Second	125 125	125 250	↓	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	First Second	200 200	200 400	↓	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	First Second	315 315	315 630	↓	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	First Second	500 500	500 1000	↓	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	First Second	800 800	800 1600	↓	✱	↓	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	First Second	1250 1250	1250 2500	✱	↑	↓	0 2 1 2	0 3 3 4	1 4 4 5	2 5 6 7	3 7 11 12	6 10 15 16	9 14 23 24	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
S	First Second	2000 2000	2000 4000			0 2 1 2																							

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.

↑ = Use first sampling plan above arrow.

Ac = Acceptance number.

Re = Rejection number.

✱ = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).

Table III-C—Double sampling plans for reduced inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (reduced inspection)†																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	*	*	*	*	*	*	*	*	*
B				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	*	*	*	*	*	*	*	*	*	*
C				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	*	*	*	*	*	*	*	*	*	*	↑
D	First Second	2 2	2 4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	7 12 18 22	11 17 26 30	↑	↑
E	First Second	3 3	3 6	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	7 12 18 22	11 17 26 30	↑	↑	↑
F	First Second	5 5	5 10	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑
G	First Second	8 8	8 16	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑
H	First Second	13 13	13 26	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑
J	First Second	20 20	20 40	↓	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑
K	First Second	32 32	32 64	↓	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
L	First Second	50 50	50 100	↓	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
M	First Second	80 80	80 160	↓	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
N	First Second	125 125	125 250	↓	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
P	First Second	200 200	200 400	↓	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Q	First Second	315 315	315 630	*	↑	↓	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
R	First Second	500 500	500 1000	↑	↑	0 2 0 2	0 3 0 4	0 4 1 5	0 4 3 6	1 5 4 7	2 7 6 9	3 8 8 12	5 10 12 16	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.
* = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).
† = If, after the second sample, the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot, but reinstate normal inspection (see 10.1.4).

MULTIPLE
NORMAL
PLANS

Table IV-A—Multiple sampling plans for normal inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (normal inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	*	*	*	*	*	*	*	*	*
B																	*	↑		++	++	++	++	++	++	++	++	++	++
C																*	↑	↓	++	++	++	++	++	++	++	++	++	++	↑
D	First	2	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	4 12	6 16	↑	↑
	Second	2	4															# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14	11 19	17 27		
	Third	2	6															0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19	19 27	29 39		
	Fourth	2	8															0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25	27 34	40 49		
	Fifth	2	10															1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29	36 40	53 58		
	Sixth	2	12															1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33	45 47	65 68		
	Seventh	2	14															2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38	53 54	77 78		
E	First	3	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	4 12	6 16	↑	↑	↑
	Second	3	6														# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14	11 19	17 27			
	Third	3	9														0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19	19 27	29 39			
	Fourth	3	12														0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25	27 34	40 49			
	Fifth	3	15														1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29	36 40	53 58			
	Sixth	3	18														1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33	45 47	65 68			
	Seventh	3	21														2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38	53 54	77 78			
F	First	5	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑	↑	↑	↑	↑	↑
	Second	5	10													# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14						
	Third	5	15													0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19						
	Fourth	5	20													0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25						
	Fifth	5	25													1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29						
	Sixth	5	30													1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33						
	Seventh	5	35													2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38						
G	First	8	8	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑	↑	↑	↑	↑	↑	↑
	Second	8	16												# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14							
	Third	8	24												0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19							
	Fourth	8	32												0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25							
	Fifth	8	40												1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29							
	Sixth	8	48												1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33							
	Seventh	8	56												2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38							
H	First	13	13	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑	↑	↑	↑	↑	↑	↑	↑
	Second	13	26											# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14								
	Third	13	39											0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19								
	Fourth	13	52											0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25								
	Fifth	13	65											1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29								
	Sixth	13	78											1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33								
	Seventh	13	91											2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38								
J	First	20	20	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	20	40										# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14									
	Third	20	60										0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19									
	Fourth	20	80										0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25									
	Fifth	20	100										1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29									
	Sixth	20	120										1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33									
	Seventh	20	140										2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38									

↓ = Use first sampling plan below arrow (refer to continuation of table on following page, when necessary.) If sample size equals or exceeds lot or batch size, do 100 percent inspection.

↑ = Use first sampling plan above arrow.

* = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).

++ = Use corresponding double sampling plan (or alternatively, use multiple sampling plan below, where available).

Ac = Acceptance number.

Re = Rejection number.

= Acceptance not permitted at this sample size.

Table IV-A—Multiple sampling plans for normal inspection (Master table)

(Continued)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (normal inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
K	First	32	32	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	32	64									# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14										
	Third	32	96									0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19										
	Fourth	32	128									0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25										
	Fifth	32	160									1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29										
	Sixth	32	192									1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33										
	Seventh	32	224									2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38										
L	First	50	50					*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑										
	Second	50	100								# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14											
	Third	50	150								0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19											
	Fourth	50	200								0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25											
	Fifth	50	250								1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29											
	Sixth	50	300								1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33											
	Seventh	50	350								2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38											
M	First	80	80				*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑											
	Second	80	160							# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14												
	Third	80	240							0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19												
	Fourth	80	320							0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25												
	Fifth	80	400							1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29												
	Sixth	80	480							1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33												
	Seventh	80	560							2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38												
N	First	125	125			*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑												
	Second	125	250						# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14													
	Third	125	375						0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19													
	Fourth	125	500						0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25													
	Fifth	125	625						1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29													
	Sixth	125	750						1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33													
	Seventh	125	875						2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38													
P	First	200	200		*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑													
	Second	200	400					# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14														
	Third	200	600					0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19														
	Fourth	200	800					0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25														
	Fifth	200	1000					1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29														
	Sixth	200	1200					1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33														
	Seventh	200	1400					2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38														
Q	First	315	315	*	↑	↓	# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑														
	Second	315	630				# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14															
	Third	315	945				0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19															
	Fourth	315	1260				0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25															
	Fifth	315	1575				1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29															
	Sixth	315	1890				1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33															
	Seventh	315	2205				2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38															
R	First	500	500	↑		# 2	# 2	# 3	# 4	0 4	0 5	1 7	2 9	↑															
	Second	500	1000			# 2	0 3	0 3	1 5	1 6	3 8	4 10	7 14																
	Third	500	1500			0 2	0 3	1 4	2 6	3 8	6 10	8 13	13 19																
	Fourth	500	2000			0 3	1 4	2 5	3 7	5 10	8 13	12 17	19 25																
	Fifth	500	2500			1 3	2 4	3 6	5 8	7 11	11 15	17 20	25 29																
	Sixth	500	3000			1 3	3 5	4 6	7 9	10 12	14 17	21 23	31 33																
	Seventh	500	3500			2 3	4 5	6 7	9 10	13 14	18 19	25 26	37 38																

↓ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.

Ac = Acceptance number.

Re = Rejection number.

↑ = Use first sampling plan above arrow (refer to preceding page, when necessary).

* = Use corresponding single sample plan (or alternatively, use multiple plan below, where available).

# = Acceptance not permitted at this sample size.

MULTIPLE NORMAL PLANS

Table IV-B—Multiple sampling plans for tightened inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (tightened inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	*	*	*	*	*	*	*
B				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	++	++	++	++	++	++	++	++	++
C				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	++	++	++	++	++	++	++	++	++	↑
D	First	2	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	3 10	6 15	↑	↑
	Second	2	4																# 2	0 3	0 3	1 5	2 7	3 9	6 12	10 17	16 25		
	Third	2	6																0 2	0 3	1 4	2 6	4 9	7 12	11 17	17 24	26 36		
	Fourth	2	8																0 3	1 4	2 5	3 7	6 11	10 15	16 22	24 31	37 46		
	Fifth	2	10																1 3	2 4	3 6	5 8	9 12	14 17	22 25	32 37	49 55		
	Sixth	2	12																1 3	3 5	4 6	7 9	12 14	18 20	27 29	40 43	61 64		
	Seventh	2	14																2 3	4 5	6 7	9 10	14 15	21 22	32 33	48 49	72 73		
E	First	3	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	3 10	6 15	↑	↑	↑
	Second	3	6															# 2	0 3	0 3	1 5	2 7	3 9	6 12	10 17	16 25			
	Third	3	9															0 2	0 3	1 4	2 6	4 9	7 12	11 17	17 24	26 36			
	Fourth	3	12															0 3	1 4	2 5	3 7	6 11	10 15	16 22	24 31	37 46			
	Fifth	3	15															1 3	2 4	3 6	5 8	9 12	14 17	22 25	32 37	49 55			
	Sixth	3	18															1 3	3 5	4 6	7 9	12 14	18 20	27 29	40 43	61 64			
	Seventh	3	21															2 3	4 5	6 7	9 10	14 15	21 22	32 33	48 49	72 73			
F	First	5	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑	↑	↑	↑	↑	↑
	Second	5	10														# 2	0 3	0 3	1 5	2 7	3 9	6 12						
	Third	5	15														0 2	0 3	1 4	2 6	4 9	7 12	11 17						
	Fourth	5	20														0 3	1 4	2 5	3 7	6 11	10 15	16 22						
	Fifth	5	25														1 3	2 4	3 6	5 8	9 12	14 17	22 25						
	Sixth	5	30														1 3	3 5	4 6	7 9	12 14	18 20	27 29						
	Seventh	5	35														2 3	4 5	6 7	9 10	14 15	21 22	32 33						
G	First	8	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑	↑	↑	↑	↑	↑	↑
	Second	8	16													# 2	0 3	0 3	1 5	2 7	3 9	6 12							
	Third	8	24													0 2	0 3	1 4	2 6	4 9	7 12	11 17							
	Fourth	8	32													0 3	1 4	2 5	3 7	6 11	10 15	16 22							
	Fifth	8	40													1 3	2 4	3 6	5 8	9 12	14 17	22 25							
	Sixth	8	48													1 3	3 5	4 6	7 9	12 14	18 20	27 29							
	Seventh	8	56													2 3	4 5	6 7	9 10	14 15	21 22	32 33							
H	First	13	13	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑	↑	↑	↑	↑	↑	↑	↑
	Second	13	26												# 2	0 3	0 3	1 5	2 7	3 9	6 12								
	Third	13	39												0 2	0 3	1 4	2 6	4 9	7 12	11 17								
	Fourth	13	52												0 3	1 4	2 5	3 7	6 11	10 15	16 22								
	Fifth	13	65												1 3	2 4	3 6	5 8	9 12	14 17	22 25								
	Sixth	13	78												1 3	3 5	4 6	7 9	12 14	18 20	27 29								
	Seventh	13	91												2 3	4 5	6 7	9 10	14 15	21 22	32 33								
J	First	20	20	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	20	40										# 2	0 3	0 3	1 5	2 7	3 9	6 12									
	Third	20	60										0 2	0 3	1 4	2 6	4 9	7 12	11 17									
	Fourth	20	80										0 3	1 4	2 5	3 7	6 11	10 15	16 22									
	Fifth	20	100										1 3	2 4	3 6	5 8	9 12	14 17	22 25									
	Sixth	20	120										1 3	3 5	4 6	7 9	12 14	18 20	27 29									
	Seventh	20	140										2 3	4 5	6 7	9 10	14 15	21 22	32 33									

↓ = Use first sampling plan below arrow (refer to continuation of table on following page, when necessary).
If sample size equals or exceeds lot or batch size, do 100 percent inspection.

* = Use corresponding single sampling plan (or alternatively, use double sampling plan below, where available).

↑ = Use first sampling plan above arrow.

= Acceptance not permitted at this sample size.

Ac = Acceptance number.

Re = Rejection number.

Table IV-B—Multiple sampling plans for tightened inspection (Master table)

(Continued)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (normal inspection)																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
K	First	32	32	↓	↓	↓	↓	↓	↓	*	↓	↓	# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	32	64										# 2	0 3	0 3	1 5	2 7	3 9	6 12										
	Third	32	96										0 2	0 3	1 4	2 6	4 9	7 12	11 17										
	Fourth	32	128										0 3	1 4	2 5	3 7	6 11	10 15	16 22										
	Fifth	32	160										1 3	2 4	3 6	5 8	9 12	14 17	22 25										
	Sixth	32	192										1 3	3 5	4 6	7 9	12 14	18 20	27 29										
	Seventh	32	224										2 3	4 5	6 7	9 10	14 15	21 22	32 33										
L	First	50	50						*	↓		# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑										
	Second	50	100									# 2	0 3	0 3	1 5	2 7	3 9	6 12											
	Third	50	150									0 2	0 3	1 4	2 6	4 9	7 12	11 17											
	Fourth	50	200									0 3	1 4	2 5	3 7	6 11	10 15	16 22											
	Fifth	50	250									1 3	2 4	3 6	5 8	9 12	14 17	22 25											
	Sixth	50	300									1 3	3 5	4 6	7 9	12 14	18 20	27 29											
	Seventh	50	350									2 3	4 5	6 7	9 10	14 15	21 22	32 33											
M	First	80	80					*	↓		# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑											
	Second	80	160								# 2	0 3	0 3	1 5	2 7	3 9	6 12												
	Third	80	240								0 2	0 3	1 4	2 6	4 9	7 12	11 17												
	Fourth	80	320								0 3	1 4	2 5	3 7	6 11	10 15	16 22												
	Fifth	80	400								1 3	2 4	3 6	5 8	9 12	14 17	22 25												
	Sixth	80	480								1 3	3 5	4 6	7 9	12 14	18 20	27 29												
	Seventh	80	560								2 3	4 5	6 7	9 10	14 15	21 22	32 33												
N	First	125	125				*	↓		# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑												
	Second	125	250							# 2	0 3	0 3	1 5	2 7	3 9	6 12													
	Third	125	375							0 2	0 3	1 4	2 6	4 9	7 12	11 17													
	Fourth	125	500							0 3	1 4	2 5	3 7	6 11	10 15	16 22													
	Fifth	125	625							1 3	2 4	3 6	5 8	9 12	14 17	22 25													
	Sixth	125	750							1 3	3 5	4 6	7 9	12 14	18 20	27 29													
	Seventh	125	875							2 3	4 5	6 7	9 10	14 15	21 22	32 33													
P	First	200	200			*	↓		# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑													
	Second	200	400						# 2	0 3	0 3	1 5	2 7	3 9	6 12														
	Third	200	600						0 2	0 3	1 4	2 6	4 9	7 12	11 17														
	Fourth	200	800						0 3	1 4	2 5	3 7	6 11	10 15	16 22														
	Fifth	200	1000						1 3	2 4	3 6	5 8	9 12	14 17	22 25														
	Sixth	200	1200						1 3	3 5	4 6	7 9	12 14	18 20	27 29														
	Seventh	200	1400						2 3	4 5	6 7	9 10	14 15	21 22	32 33														
Q	First	315	315		*	↓		# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑														
	Second	315	630					# 2	0 3	0 3	1 5	2 7	3 9	6 12															
	Third	315	945					0 2	0 3	1 4	2 6	4 9	7 12	11 17															
	Fourth	315	1260					0 3	1 4	2 5	3 7	6 11	10 15	16 22															
	Fifth	315	1575					1 3	2 4	3 6	5 8	9 12	14 17	22 25															
	Sixth	315	1890					1 3	3 5	4 6	7 9	12 14	18 20	27 29															
	Seventh	315	2205					2 3	4 5	6 7	9 10	14 15	21 22	32 33															
R	First	500	500	*	↑		# 2	# 2	# 3	# 4	0 4	0 6	1 8	↑															
	Second	500	1000				# 2	0 3	0 3	1 5	2 7	3 9	6 12																
	Third	500	1500				0 2	0 3	1 4	2 6	4 9	7 12	11 17																
	Fourth	500	2000				0 3	1 4	2 5	3 7	6 11	10 15	16 22																
	Fifth	500	2500				1 3	2 4	3 6	5 8	9 12	14 17	22 25																
	Sixth	500	3000				1 3	3 5	4 6	7 9	12 14	18 20	27 29																
	Seventh	500	3500				2 3	4 5	6 7	9 10	14 15	21 22	32 33																
S	First	800	800			# 2																							
	Second	800	1600			# 2																							
	Third	800	2400			0 2																							
	Fourth	800	3200			0 3																							
	Fifth	800	4000			1 3																							
	Sixth	800	4800			1 3																							
	Seventh	800	5600			2 3																							

↑ = Use first sampling plan below arrow. If sample size equals or exceeds lot or batch size, do 100 percent inspection.

↓ = Use first sampling plan above arrow (refer to preceding page, when necessary).

= Acceptance not permitted at this sample size.

Ac = Acceptance number.

Re = Rejection number.

* = Use corresponding single sampling plan (or alternatively, use multiple sampling plan below, where available).

MULTIPLE TIGHTENED PLANS

Table IV-C—Multiple sampling plans for reduced inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (reduced inspection)†																									
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↓	↓	*	*	*	*	*	*	*	*	*
B				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	*	↑	↓	*	*	*	*	*	*	*	*	*	*
C				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↑	↓	*	*	*	*	*	*	*	*	*	*	↑
D				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↑	↑	↓	++	++	++	++	++	++	++	++	++	++	↑	↑
E				↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	++	++	++	++	++	++	++	++	++	++	↑	↑	↑
F	First	2	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑
	Second	2	4													# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9						
	Third	2	6													0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12						
	Fourth	2	8													0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15						
	Fifth	2	10													0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17						
	Sixth	2	12													0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20						
	Seventh	2	14													1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22						
G	First	3	3	↓	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑
	Second	3	6												# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9							
	Third	3	9												0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12							
	Fourth	3	12												0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15							
	Fifth	3	15												0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17							
	Sixth	3	18												0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20							
	Seventh	3	21												1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22							
H	First	5	5	↓	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑
	Second	5	10											# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9								
	Third	5	15											0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12								
	Fourth	5	20											0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15								
	Fifth	5	25											0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17								
	Sixth	5	30											0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20								
	Seventh	5	35											1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22								
J	First	8	8	↓	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	8	16										# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9									
	Third	8	24										0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12									
	Fourth	8	32										0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15									
	Fifth	8	40										0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17									
	Sixth	8	48										0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20									
	Seventh	8	56										1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22									
K	First	13	13	↓	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	13	26									# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9										
	Third	13	39									0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12										
	Fourth	13	52									0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15										
	Fifth	13	65									0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17										
	Sixth	13	78									0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20										
	Seventh	13	91									1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22										

↓ = Use first sampling plan below arrow (refer to continuation of table on following page, when necessary).
If sample size equals or exceeds lot or batch size, do 100 percent inspection.
↑ = Use first sampling plan above arrow.
* = Use corresponding single sampling plan (or alternatively, use multiple sampling plan below, where available).
++ = Use corresponding double sampling plan (or alternatively, use multiple sampling plan below, where available).

Ac = Acceptance number.
Re = Rejection number.
# = Acceptance not permitted at this sample size.
† = If, after the final sample, the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot but reinstate normal inspection (see 10.1.4).

Table IV-C—Multiple sampling plans for reduced inspection (Master table)

(Continued)

(See 9.4 and 9.5)

Sample size code letter	Sample	Sample size	Cumulative sample size	Acceptable Quality Levels (reduced inspection)†																								
				0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
				Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
L	First	20	20	↓	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	20	40								# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9										
	Third	20	60								0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12										
	Fourth	20	80								0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15										
	Fifth	20	100								0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17										
	Sixth	20	120								0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20										
	Seventh	20	140								1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22										
M	First	32	32	↓	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	32	64							# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9											
	Third	32	96							0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12											
	Fourth	32	128							0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15											
	Fifth	32	160							0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17											
	Sixth	32	192							0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20											
	Seventh	32	224							1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22											
N	First	50	50	↓	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	50	100						# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9												
	Third	50	150						0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12												
	Fourth	50	200						0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15												
	Fifth	50	250						0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17												
	Sixth	50	300						0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20												
	Seventh	50	350						1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22												
P	First	80	80	↓	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	80	160					# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9													
	Third	80	240					0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12													
	Fourth	80	320					0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15													
	Fifth	80	400					0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17													
	Sixth	80	480					0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20													
	Seventh	80	560					1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22													
Q	First	125	125	*	↑	↓	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	125	250				# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9														
	Third	125	375				0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12														
	Fourth	125	500				0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15														
	Fifth	125	625				0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17														
	Sixth	125	750				0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20														
	Seventh	125	875				1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22														
R	First	200	200	↑	↑	# 2	# 2	# 3	# 3	# 4	# 4	0 5	0 6	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Second	200	400			# 2	# 3	# 3	0 4	0 5	1 6	1 7	3 9															
	Third	200	600			0 2	0 3	0 4	0 5	1 6	2 8	3 9	6 12															
	Fourth	200	800			0 3	0 4	0 5	1 6	2 7	3 10	5 12	8 15															
	Fifth	200	1000			0 3	0 4	1 6	2 7	3 8	5 11	7 13	11 17															
	Sixth	200	1200			0 3	1 5	1 6	3 7	4 9	7 12	10 15	14 20															
	Seventh	200	1400			1 3	1 5	2 7	4 8	6 10	9 14	13 17	18 22															

↓ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.

↑ = Use first sampling plan above arrow (refer to preceding page when necessary).

Ac = Acceptance number.

Re = Rejection number.

# = Acceptance not permitted at this sample size.

† = If, after the final sample, the acceptance number has been exceeded, but the rejection number has not been reached, accept the lot, but reinstate normal inspection (see 10.1.4).

Table V-A—Factors for Determining Approximate Values for Average Outgoing Quality Limits for Normal Inspection (Single Sampling)

(See 11.4)

Code Letter	Sample size	Acceptable Quality Level																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2															18			42	69	97	160	220	330	470	730	1100
B	3														12			28	46	63	110	150	220	310	490	720	1100
C	5													7.4			17	27	39	63	90	130	190	290	430	660	
D	8												4.6			11	17	24	40	56	82	120	180	270	410		
E	13											2.8			6.5	11	15	24	34	50	72	110	170	250			
F	20										1.8			4.2	6.9	9.7	16	22	33	47	73						
G	32									1.2			2.6	4.3	6.1	9.9	14	21	29	46							
H	50								0.74			1.7	2.7	3.9	6.3	9.0	13	19	29								
J	80							0.46			1.1	1.7	2.4	4.0	5.6	8.2	12	18									
K	125						0.29			0.67	1.1	1.6	2.5	3.6	5.2	7.5	12										
L	200					0.18			0.42	0.69	0.97	1.6	2.2	3.3	4.7	7.3											
M	315				0.12			0.27	0.44	0.62	1.00	1.4	2.1	3.0	4.7												
N	500			0.074			0.17	0.27	0.39	0.63	0.90	1.3	1.9	2.9													
P	800		0.046			0.11	0.17	0.24	0.40	0.56	0.82	1.2	1.8														
Q	1250	0.029			0.067	0.11	0.16	0.25	0.36	0.52	0.75	1.2															
R	2000			0.042	0.069	0.097	0.16	0.22	0.33	0.47	0.73																

Note: For a more accurate AOQL, the above values must be multiplied by $\left(1 - \frac{\text{Sample size}}{\text{Lot or Batch size}}\right)$ (See 11.4)

Table V-B—Factors for Determining Approximate Values for Average Outgoing Quality Limits for Tightened Inspection (Single Sampling)

(See 11.4)

Code Letter	Sample size	Acceptable Quality Level																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2																			42	69	97	160	260	400	620	970
B	3															12			28	46	65	110	170	270	410	650	1100
C	5														7.4			17	27	39	63	100	160	250	390	610	
D	8													4.6			11	17	24	40	64	99	160	240	380		
E	13												2.8			6.5	11	15	24	40	61	95	150	240			
F	20											1.8			4.2	6.9	9.7	16	26	40	62						
G	32										1.2			2.6	4.3	6.1	9.9	16	25	39							
H	50									0.74			1.7	2.7	3.9	6.3	10	16	25								
J	80								0.46			1.1	1.7	2.4	4.0	6.4	9.9	16									
K	125							0.29			0.67	1.1	1.6	2.5	4.1	6.4	9.9										
L	200						0.18			0.42	0.69	0.97	1.6	2.6	4.0	6.2											
M	315					0.12			0.27	0.44	0.62	1.0	1.6	2.5	3.9												
N	500				0.074			0.17	0.27	0.39	0.63	1.0	1.6	2.5													
P	800			0.046			0.11	0.17	0.24	0.40	0.64	0.99	1.6														
Q	1250		0.029			0.067	0.11	0.16	0.25	0.41	0.64	0.99															
R	2000	0.018			0.042	0.069	0.097	0.16	0.26	0.40	0.62																
S	3150			0.027																							

Note: For a more accurate AOQL, the above values must be multiplied by $\left(1 - \frac{\text{Sample size}}{\text{Lot or Batch size}}\right)$ (See 11.4)

Table VI-A—Limiting Quality (in percent nonconforming) for Which P_a = 10 Percent (for Normal Inspection, Single Sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level															
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10
A	2															68	
B	3														54		
C	5													37			58
D	8												25			41	54
E	13											16			27	36	44
F	20										11			18	25	30	42
G	32									6.9			12	16	20	27	34
H	50								4.5			7.6	10	13	18	22	29
J	80							2.8			4.8	6.5	8.2	11	14	19	24
K	125						1.8			3.1	4.3	5.4	7.4	9.4	12	16	23
L	200					1.2			2.0	2.7	3.3	4.6	5.9	7.7	10	14	
M	315				0.73			1.2	1.7	2.1	2.9	3.7	4.9	6.4	9.0		
N	500			0.46			0.78	1.1	1.3	1.9	2.4	3.1	4.0	5.6			
P	800		0.29			0.49	0.67	0.84	1.2	1.5	1.9	2.5	3.5				
Q	1250	0.18			0.31	0.43	0.53	0.74	0.94	1.2	1.6	2.3					
R	2000			0.20	0.27	0.33	0.46	0.59	0.77	1.0	1.4						

Table VI-B—Limiting Quality (in nonconformities per hundred units) for Which $P_a = 10$ Percent (for Normal Inspection, Single Sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2															120			200	270	330	460	590	770	1000	1400	1900
B	3														77			130	180	220	310	390	510	670	940	1300	1800
C	5													46			78	110	130	190	240	310	400	560	770	1100	
D	8												29			49	67	84	120	150	190	250	350	480	670		
E	13											18			30	41	51	71	91	120	160	220	300	410			
F	20										12			20	27	33	46	59	77	100	140						
G	32									7.2			12	17	21	29	37	48	63	88							
H	50								4.6			7.8	11	13	19	24	31	40	56								
J	80							2.9			4.9	6.7	8.4	12	15	19	25	35									
K	125						1.8			3.1	4.3	5.4	7.4	9.4	12	16	23										
L	200					1.2			2.0	2.7	3.3	4.6	5.9	7.7	10	14											
M	315				0.73			1.2	1.7	2.1	2.9	3.7	4.9	6.4	9.0												
N	500			0.46			0.78	1.1	1.3	1.9	2.4	3.1	4.0	5.6													
P	800		0.29			0.49	0.67	0.84	1.2	1.5	1.9	2.5	3.5														
Q	1250	0.18			0.31	0.43	0.53	0.74	0.94	1.2	1.6	2.3															
R	2000			0.20	0.27	0.33	0.46	0.59	0.77	1.0	1.4																

Table VII-A—Limiting Quality (in percent nonconforming) for Which $P_a = 5$ Percent (for Normal Inspection, Single Sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level															
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10
A	2															78	
B	3														63		
C	5													45			66
D	8												31			47	60
E	13											21			32	41	50
F	20										14			22	28	34	46
G	32									8.9			14	18	23	30	37
H	50								5.8			9.1	12	15	20	25	32
J	80							3.7			5.8	7.7	9.4	13	16	20	26
K	125						2.4			3.8	5.0	6.2	8.4	11	14	18	24
L	200					1.5			2.4	3.2	3.9	5.3	6.6	8.5	11	15	
M	315				0.95			1.5	2.0	2.5	3.3	4.2	5.4	7.0	9.6		
N	500			0.60			0.95	1.3	1.6	2.1	2.6	3.4	4.4	6.1			
P	800		0.38			0.59	0.79	0.97	1.3	1.6	2.1	2.7	3.8				
Q	1250	0.24			0.38	0.50	0.62	0.84	1.1	1.4	1.8	2.4					
R	2000			0.24	0.32	0.39	0.53	0.66	0.85	1.1	1.5						

Table VII-B—Limiting Quality (in nonconformities per hundred units) for Which $P_a = 5$ Percent (for Normal Inspection, Single Sampling)

(See 11.6)

Code letter	Sample size	Acceptable Quality Level																									
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A	2															150			240	320	390	530	660	850	1100	1500	2000
B	3														100			160	210	260	350	440	570	730	1000	1400	1900
C	5													60			95	130	160	210	260	340	440	610	810	1100	
D	8												38			59	79	97	130	160	210	270	380	510	670		
E	13											23			37	48	60	81	100	130	170	230	310	440			
F	20										15			24	32	39	53	66	85	110	150						
G	32									9.4			15	20	24	33	41	53	68	95							
H	50								6.0			9.5	13	16	21	26	34	44	61								
J	80							3.8			5.9	7.9	9.7	13	16	21	27	38									
K	125						2.4			3.8	5.0	6.2	8.4	11	14	18	24										
L	200					1.5			2.4	3.2	3.9	5.3	6.6	8.5	11	15											
M	315				0.95			1.5	2.0	2.5	3.3	4.2	5.4	7.0	9.6												
N	500			0.60			0.95	1.3	1.6	2.1	2.6	3.4	4.4	6.1													
P	800		0.38			0.59	0.79	0.97	1.3	1.6	2.1	2.7	3.8														
Q	1250	0.24			0.38	0.50	0.62	0.84	1.1	1.4	1.8	2.4															
R	2000			0.24	0.32	0.39	0.53	0.66	0.85	1.1	1.5																

Table VIII—Limit Numbers for Reduced Inspection

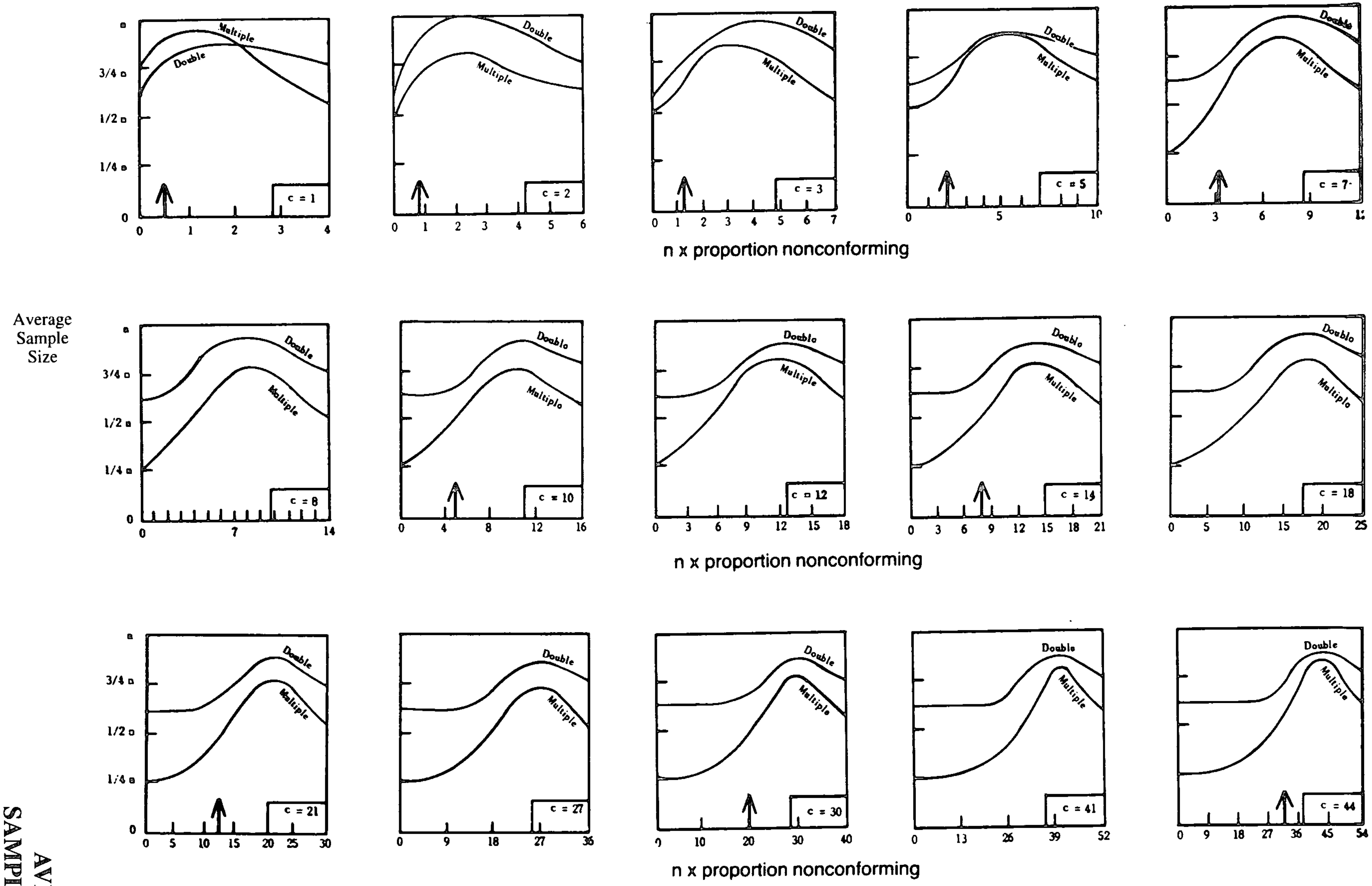
(See 4.7.3)

Number of sample units from last 10 lots or batches	Acceptable Quality Level																									
	0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
20–29	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	2	4	8	14	22	40	68	115	181
30–49	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	1	3	7	13	22	36	63	105	178	277
50–79	*	*	*	*	*	*	*	*	*	*	*	*	*	0	0	2	3	7	14	25	40	63	110	181	301	
80–129	*	*	*	*	*	*	*	*	*	*	*	*	0	0	2	4	7	14	24	42	68	105	181	297		
130–199	*	*	*	*	*	*	*	*	*	*	*	0	0	2	4	7	13	25	42	72	115	177	301	490		
200–319	*	*	*	*	*	*	*	*	*	*	0	0	2	4	8	14	22	40	68	115	181	277	471			
320–499	*	*	*	*	*	*	*	*	*	0	0	1	4	8	14	24	39	68	113	189						
500–799	*	*	*	*	*	*	*	*	0	0	2	3	7	14	25	40	63	110	181							
800–1249	*	*	*	*	*	*	*	0	0	2	4	7	14	24	42	68	105	181								
1250–1999	*	*	*	*	*	*	0	0	2	4	7	13	24	40	69	110	169									
2000–3149	*	*	*	*	*	0	0	2	4	8	14	22	40	68	115	181										
3150–4999	*	*	*	*	0	0	1	4	8	14	24	38	67	111	186											
5000–7999	*	*	*	0	0	2	3	7	14	25	40	63	110	181												
8000–12499	*	*	0	0	2	4	7	14	24	42	68	105	181													
12500–19999	*	0	0	2	4	7	13	24	40	69	110	169														
20000–31499	0	0	2	4	8	14	22	40	68	115	181															
31500 & Over	0	1	4	8	14	24	38	67	111	186																

* = Denotes that the number of sample units from the last ten lots or batches is not sufficient for reduced inspection for this AQL. Is this instance more than ten lots or batches may be used for the calculation, provided that the lots or batches used are the most recent ones in sequence, that they have all been on normal inspection, and that none has been rejected while on original inspection.

Table IX—Average sample size curves for double and multiple sampling plans (normal and tightened inspection)

(See 11.5)



n = Equivalent single sample size

c = Single sample acceptance number

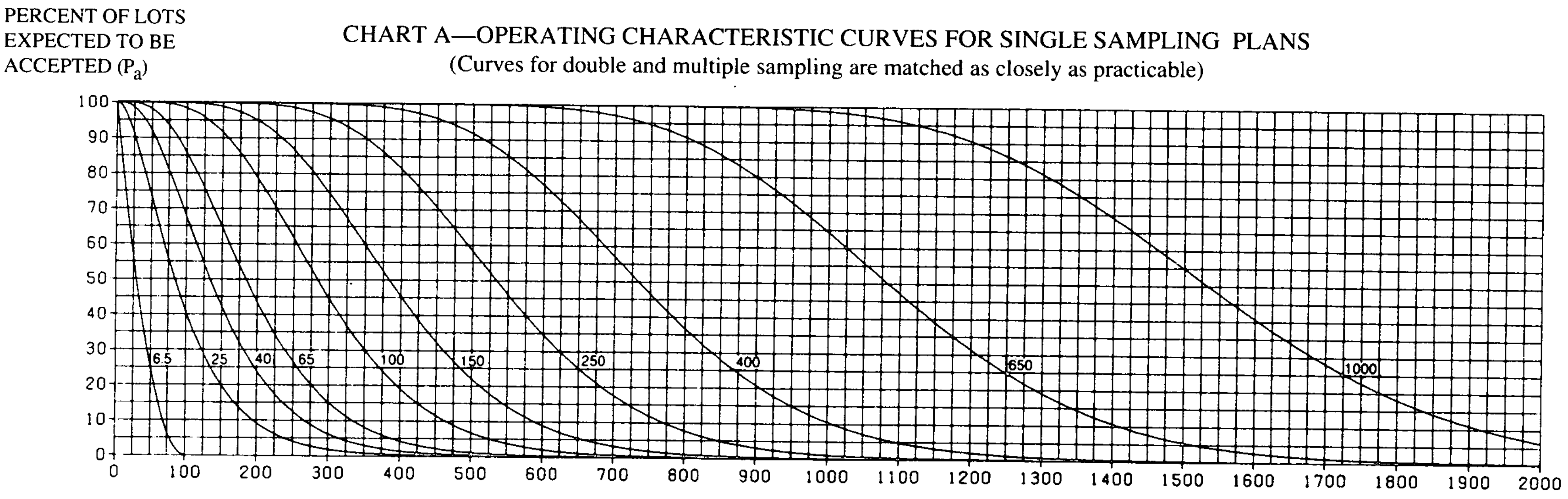
↑ = Reference point, shows performance at AQL for normal inspection

Table X-A–Tables for sample size code letter: A

INDIVIDUAL PLANS

CHART A—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-A-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)														
	6.5	6.5	25	40	65	100	150	X	250	X	400	X	625	X	1000
	p (in percent nonconforming)	p (in nonconformities per hundred units)													
99.0	0.501	0.503	7.43	21.8	41.2	89.3	145	175	239	305	374	517	629	859	977
95.0	2.53	2.56	17.8	40.9	68.3	131	199	235	308	384	462	622	745	995	1122
90.0	5.13	5.27	26.6	55.1	87.2	158	233	272	351	432	515	684	812	1073	1206
75.0	13.4	14.4	48.1	86.4	127	211	298	342	431	521	612	795	934	1214	1354
50.0	29.3	34.7	83.9	134	184	284	383	433	533	633	733	933	1083	1383	1533
25.0	50.0	69.3	135	196	255	371	484	540	651	761	870	1087	1248	1568	1728
10.0	68.4	115	194	266	334	464	589	650	770	889	1006	1238	1409	1748	1916
5.0	77.6	150	237	315	388	526	657	722	848	972	1094	1335	1512	1862	2035
1.0	90.0	230	332	420	502	655	800	870	1007	1141	1272	1529	1718	2088	2270
		X	40	65	100	150	X	250	X	400	X	650	X	1000	X
	Acceptable Quality Levels (tightened inspection)														

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-A-2—Sampling Plans for Sample Size Code Letter: A

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																		Cumulative sample size
		Less than 6.5	6.5	X	10	15	25	40	65	100	150	X	250	X	400	X	650	X	1000	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	2	∇	0 1	Use Code Letter D	Use Code Letter C	Use Code Letter B	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	2
Double		∇	*				(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	
Multiple		∇	*				*	*	*	*	*	*	*	*	*	*	*	*	*	
		Less than 10	X	10	15	25	40	65	100	150	X	250	X	400	X	650	X	1000	X	
		Acceptable Quality Levels (tightened inspection)																		

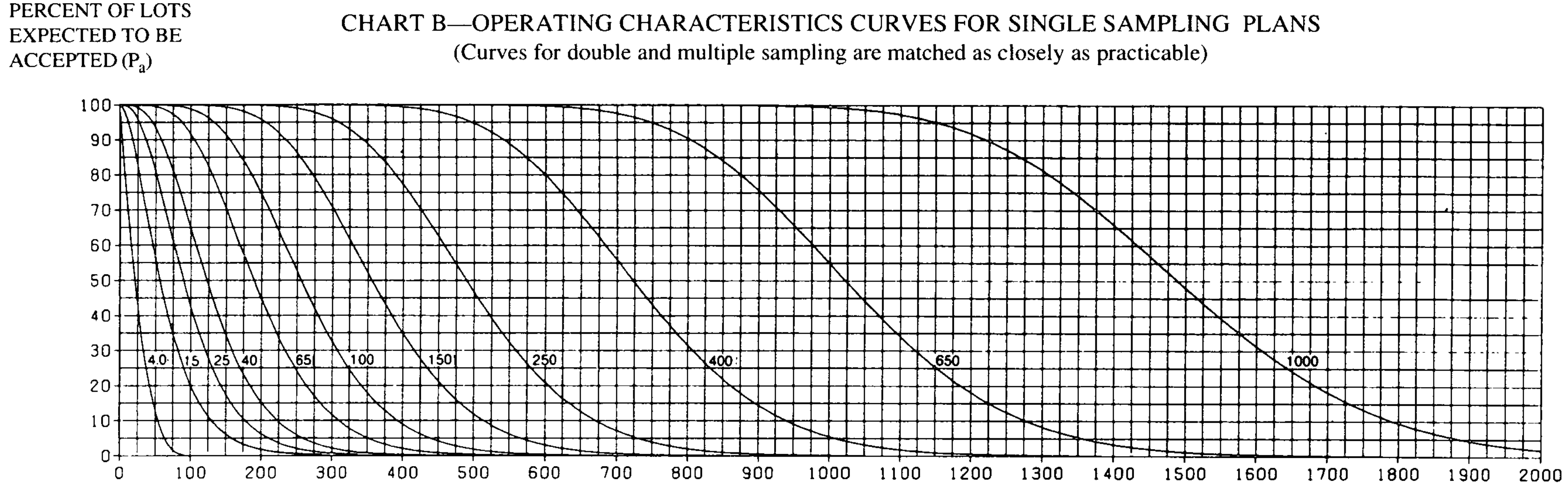
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter D).
(*) = Use single sampling (or alternatively use code letter B).

Table X-B—Tables for sample size code letter: B

INDIVIDUAL PLANS

CHART B—OPERATING CHARACTERISTICS CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-B-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)															
	4.0	4.0	15	25	40	65	100	X	150	X	250	X	400	X	650	X	1000
	p (in percent nonconforming)	p(in nonconformities per hundred units)															
99.0	0.33	0.335	4.95	14.5	27.4	59.5	96.9	117	159	203	249	345	419	572	651	947	1029
95.0	1.70	1.71	11.8	27.3	45.5	87.1	133	157	206	256	308	415	495	663	748	1065	1152
90.0	3.45	3.51	17.7	36.7	58.2	105	155	181	234	288	343	456	541	716	804	1131	1222
75.0	9.14	9.59	32.0	57.6	84.5	141	199	228	287	347	408	530	623	809	903	1249	1344
50.0	20.6	23.1	55.9	89.1	122	189	256	289	356	422	489	622	722	922	1022	1389	1489
25.0	37.0	46.2	89.8	131	170	247	323	360	434	507	580	724	832	1045	1152	1539	1644
10.0	53.6	76.8	130	177	223	309	392	433	514	593	671	825	939	1165	1277	1683	1793
5.0	63.2	99.9	158	210	258	350	438	481	565	648	730	890	1008	1241	1356	1773	1886
1.0	78.5	154	221	280	335	437	533	580	671	761	848	1019	1145	1392	1513	1951	2069
	6.5	6.5	25	40	65	100	X	150	X	250	X	400	X	650	X	1000	X
	Acceptable Quality Levels (tightened inspection)																

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-B-2—Sampling Plans for Sample Size Code Letter: B

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																				Cumulative sample size
		Less than 4.0	4.0	6.5	X	10	15	25	40	65	100	X	150	X	250	X	400	X	650	X	1000	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	3	∇	0 1	Use Code Letter A	Use Code Letter D	Use Code Letter C	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	41 42	44 45	3
Double	2	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	15 20	17 22	23 29	25 31	2
	4						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27	34 35	37 38	52 53	56 57	4
Multiple		∇	*				++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	
		Less than 6.5	6.5	X	10	15	25	40	65	100	X	150	X	250	X	400	X	650	X	1000	X	
		Acceptable Quality Levels (tightened inspection)																				

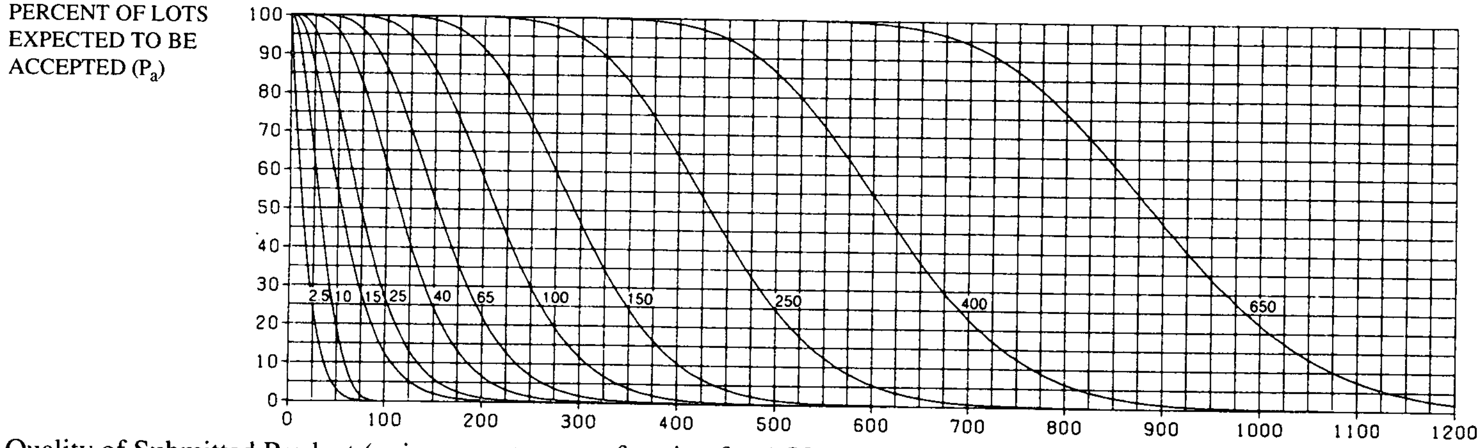
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter E).
+ + = Use double sampling plan above (or alternatively use code letter D).

Table X-C—Tables for sample size code letter: C

INDIVIDUAL PLANS

CHART C—OPERATING CHARACTERISTICS CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-C-1— TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																	
	2.5	10	2.5	10	15	25	40	65	X	100	X	150	X	250	X	400	X	650
	p (in percent nonconforming)		p (in nonconformities per hundred units)															
99.0	0.201	3.27	0.201	2.97	8.72	16.5	37.5	58.1	70.1	95.4	122	150	207	251	343	391	568	618
95.0	1.02	7.64	1.03	7.11	16.4	27.3	52.3	79.6	93.9	123	154	185	249	298	398	449	639	691
90.0	2.09	11.2	2.11	10.6	22.0	34.9	63.0	93.1	109	140	173	206	273	325	429	482	679	733
75.0	5.59	19.4	5.75	19.2	34.5	50.7	84.4	119	137	172	208	245	318	374	485	542	749	806
50.0	12.9	31.4	13.9	33.6	53.5	73.4	113	153	173	213	253	293	373	433	553	613	833	893
25.0	24.2	45.4	27.7	53.9	78.4	102	148	194	216	260	304	348	435	499	627	691	923	986
10.0	36.9	58.4	46.1	77.8	106	134	185	235	260	308	356	403	495	564	699	766	1010	1076
5.0	45.1	65.7	59.9	94.9	126	155	210	263	289	339	389	438	534	605	745	814	1064	1131
1.0	60.2	77.8	92.1	133	168	201	262	320	348	403	456	509	612	687	835	908	1171	1241
	4.0	X	4.0	15	25	40	65	X	100	X	150	X	250	X	400	X	650	X
	Acceptable Quality Levels (tightened inspection)																	

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-C-2—Sampling Plans for Sample Size Code Letter: C

Type of sampling plan	Cumulative sample size	Less than 2.5	2.5	4.0	X	6.5	10	15	25	40	65	X	100	X	150	X	250	X	400	X	650	1000	Cumulative sample size
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	5	∇	0 1	Use Code Letter B	Use Code Letter E	Use Code Letter D	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	41 42	44 45	Use Code Letter B	5
Double	3	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	15 20	17 22	23 29	25 31		3
	6						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27	34 35	37 38	52 53	56 57		6
Multiple		∇	*				++	++	++	++	++	++	++	++	++	++	++	++	++	++	++		
		Less than 4.0	4.0	X	6.5	10	15	25	40	65	X	100	X	150	X	250	X	400	X	650	X	1000	
		Acceptable Quality Levels (tightened inspection)																					

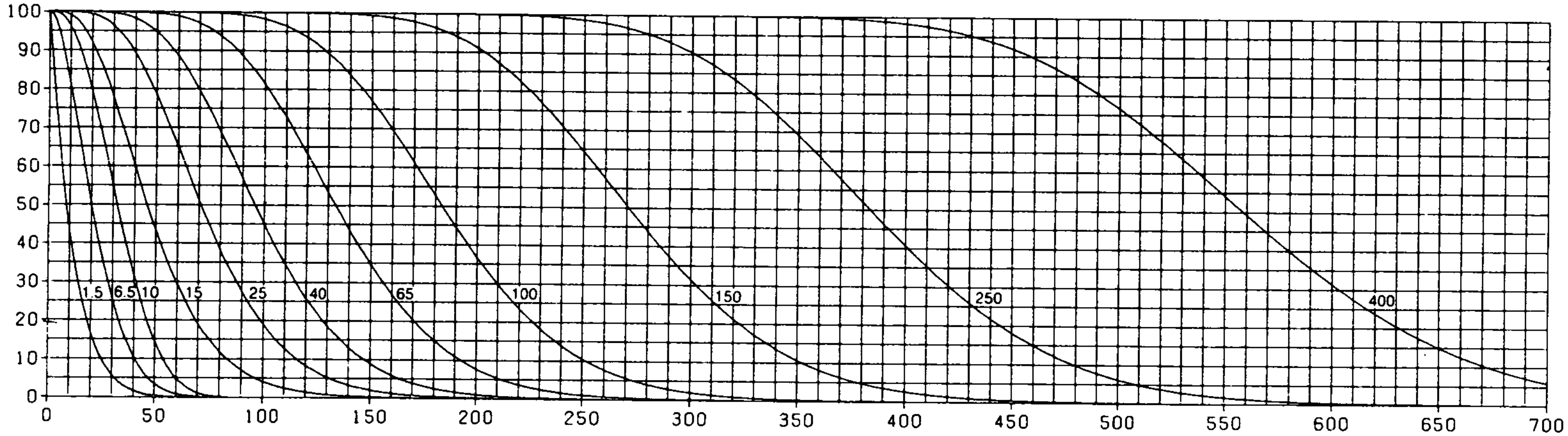
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter F).
++ = Use double sampling plan above (or alternatively use code letter D).

Table X-D—Tables for sample size code letter: D

INDIVIDUAL PLANS

CHART D—OPERATING CHARACTERISTICS CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-D-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																		
	1.5	6.5	10	1.5	6.5	10	15	25	40	X	65	X	100	X	150	X	250	X	450
	p (in percent nonconforming)			p (in nonconformities per hundred units)															
99.0	0.126	1.97	6.08	0.126	1.86	5.45	10.3	22.3	36.3	43.8	59.6	76.2	93.5	129	157	215	244	355	386
95.0	0.639	4.64	11.1	0.641	4.44	10.2	17.1	32.7	49.8	58.7	77.1	96.1	116	156	186	249	281	399	432
90.0	1.32	6.88	14.7	1.31	6.65	13.8	21.8	39.4	58.2	67.9	87.8	108	129	171	203	268	301	424	458
75.0	3.53	12.1	22.1	3.60	12.0	21.6	31.7	52.7	74.5	85.5	108	130	153	199	234	303	339	468	504
50.0	8.30	20.1	32.1	8.66	21.0	33.4	45.9	70.9	95.9	108	133	158	183	233	271	346	383	521	558
25.0	15.9	30.3	43.3	17.3	33.7	49.0	63.9	92.8	121	135	163	190	217	272	312	392	432	577	617
10.0	25.0	40.6	53.8	28.8	48.6	66.5	83.5	116	147	162	193	222	252	309	352	437	479	631	672
5.0	31.2	47.1	60.0	37.4	59.3	78.7	96.9	131	164	180	212	243	274	334	378	465	509	665	707
1.0	43.8	59.0	70.7	57.6	83.0	105	126	164	200	218	252	285	318	382	429	522	568	732	776
	2.5	10	X	2.5	10	15	25	40	X	65	X	100	X	150	X	250	X	400	X
	Acceptable Quality Levels (tightened inspection)																		

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-D-2—Sampling Plans for Sample Size Code Letter: D

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																					Cumulative sample size
		Less than 1.5	1.5	2.5	X	4.0	6.5	10	15	25	40	X	65	X	100	X	150	X	250	X	400	Higher than 400	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	8	∇	0 1	Use Code Letter C	Use Code Letter F	Use Code Letter E	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	41 42	44 45	Δ	8
Double	5	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	15 20	17 22	23 29	25 31	Δ	5
	10						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27	34 35	37 38	52 53	56 57		10
Multiple	2	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	3 10	4 12	6 15	6 16	Δ	2
	4						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14	10 17	11 19	16 25	17 26		4
	6						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19	17 24	19 27	26 36	29 39		6
	8						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25	24 31	27 34	37 46	40 49		8
	10						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29	32 37	36 40	49 55	53 58		10
	12						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33	40 43	45 47	61 64	65 68		12
	14						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38	48 49	53 54	72 73	77 78		14
		Less than 2.5	2.5	X	4.0	6.5	10	15	25	40	X	65	X	100	X	150	X	250	X	400	X	Higher than 400	
		Acceptable Quality Levels (tightened inspection)																					

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter G).
# = Acceptance not permitted at this sample size.

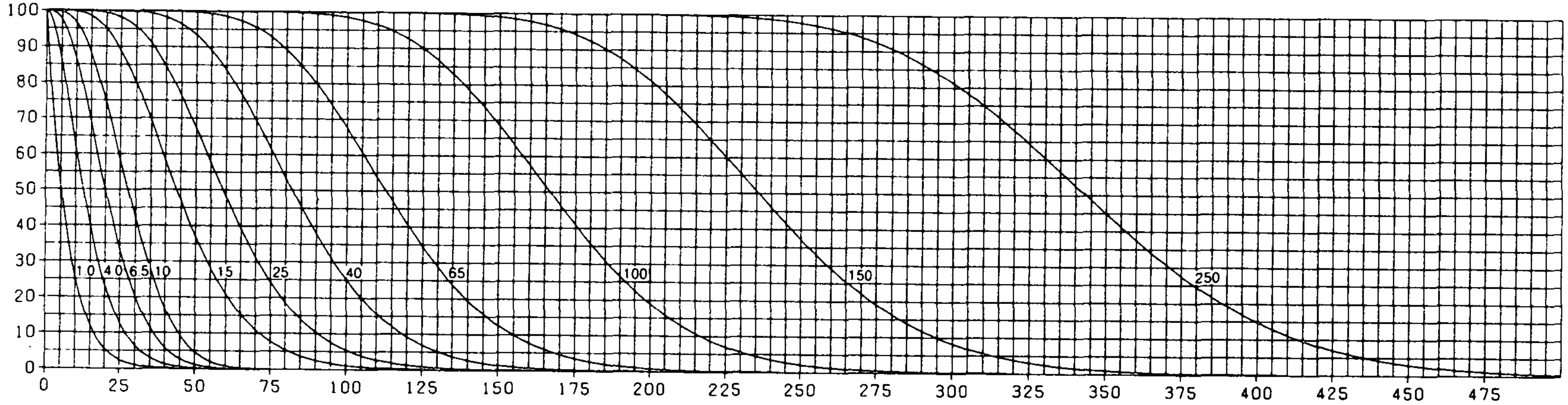
Table X-E—Tables for sample size code letter: E

INDIVIDUAL PLANS

CHART E—OPERATING CHARACTERISTICS CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)

PERCENT OF LOTS EXPECTED TO BE ACCEPTED (P_a)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-E-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																			
	1.0	4.0	6.5	10	1.0	4.0	6.5	10	15	25	X	40	X	65	X	100	X	150	X	150
	p (in percent nonconforming)				p (in nonconformities per hundred units)															
99.0	0.077	1.18	3.58	6.95	0.077	1.15	3.35	6.33	13.7	22.4	27.0	36.7	46.9	57.5	79.6	96.7	132	150	219	238
95.0	0.394	2.81	6.60	11.3	0.395	2.73	6.29	10.5	20.1	30.6	36.1	47.5	59.2	71.1	95.7	115	153	173	246	26
90.0	0.807	4.17	8.80	14.2	0.810	4.09	8.48	13.4	24.2	35.8	41.8	54.0	66.5	79.2	105	125	165	185	261	282
75.0	2.19	7.41	13.4	19.9	2.21	7.39	13.3	19.5	32.5	45.8	52.6	66.3	80.2	94.1	122	144	187	208	288	310
50.0	5.19	12.6	20.0	27.5	5.33	12.9	20.6	28.2	43.6	59.0	66.7	82.1	97.4	113	144	167	213	236	321	344
25.0	10.1	19.4	28.0	36.1	10.7	20.7	30.2	39.3	57.1	74.5	83.1	100	117	134	167	192	241	266	355	379
10.0	16.2	26.8	36.0	44.4	17.7	29.9	40.9	51.4	71.3	90.5	100	119	137	155	190	217	269	295	388	414
5.0	20.6	31.6	41.0	49.5	23.0	36.5	48.4	59.6	80.9	101	111	130	150	168	205	233	286	313	409	435
1.0	29.8	41.3	50.6	58.8	35.4	51.1	64.7	77.3	101	123	134	155	176	196	235	264	321	349	450	477
	1.5	6.5	10	X	1.5	6.5	10	15	25	X	40	X	65	X	100	X	150	X	250	X
	Acceptable Quality Levels (tightened inspection)																			

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-E-2—Sampling Plans for Sample Size Code Letter: E

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																					Cumulative sample size
		Less than 1.0	1.0	1.5	X	2.5	4.0	6.5	10	15	25	X	40	X	65	X	100	X	150	X	250	Higher than 250	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	13	∇	0 1	Use Code Letter D	Use Code Letter G	Use Code Letter F	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	27 28	30 31	41 42	44 45	Δ	13
Double	8	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	15 20	17 22	23 29	25 31	Δ	8
	13						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27	34 35	37 38	52 53	56 57		13
Multiple	3	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	3 10	4 12	6 15	6 16	Δ	3
	6						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14	10 17	11 19	16 25	17 27		6
	9						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19	17 24	19 27	26 36	29 39		9
	12						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25	24 31	27 34	37 46	40 49		12
	15						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29	32 37	36 40	49 55	53 58		15
	18						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33	40 43	45 47	61 64	65 68		18
	21						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38	48 49	53 54	72 73	77 78		21
		Less than 1.5	1.5	X	2.5	4.0	6.5	10	15	25	X	40	X	65	X	100	X	150	X	250	X	Higher than 250	
		Acceptable Quality Levels (tightened inspection)																					

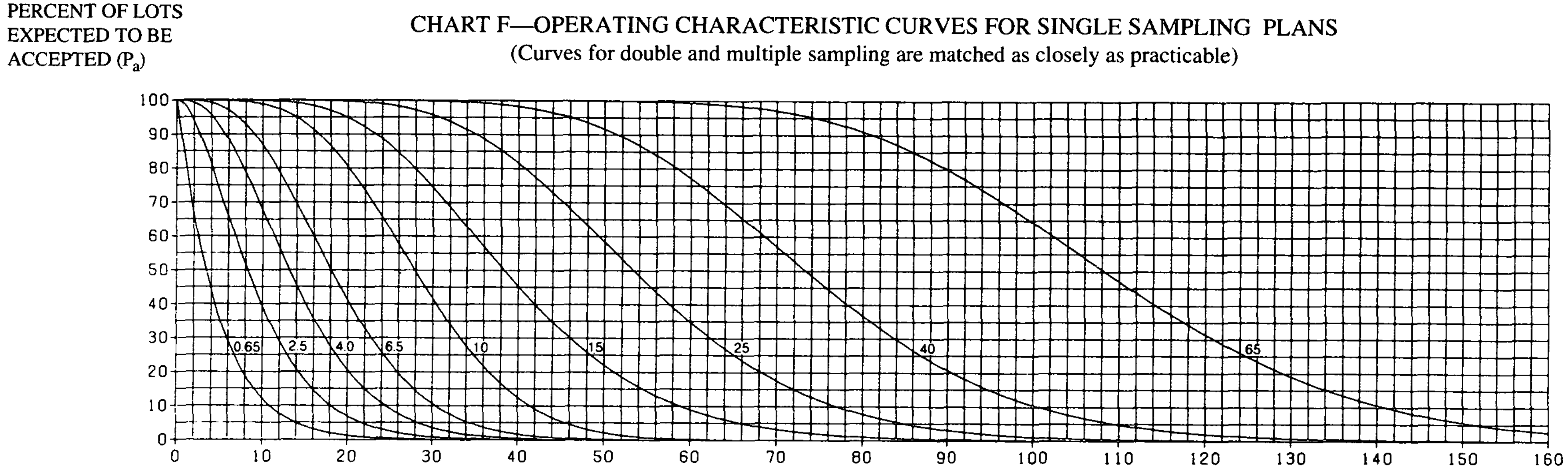
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter H).
# = Acceptance not permitted at this sample size.

Table X-F—Tables for sample size code letter: F

INDIVIDUAL PLANS

CHART F—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-F-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																
	0.65	2.5	4.0	6.5	10	0.65	2.5	4.0	6.5	10	15	X	25	X	40	X	65
	p (in percent nonconforming)					p (in nonconformities per hundred units)											
99.0	0.0502	0.759	2.27	4.36	9.75	0.0503	0.743	2.18	4.12	8.93	14.5	17.5	23.9	30.5	37.4	51.7	62.9
95.0	0.256	1.80	4.22	7.14	14.0	0.256	1.78	4.09	6.83	13.1	19.9	23.5	30.8	38.4	46.2	62.2	74.5
90.0	0.525	2.69	5.64	9.03	16.6	0.527	2.66	5.51	8.72	15.8	23.3	27.2	35.1	43.2	51.5	68.4	81.2
75.0	1.43	4.81	8.70	12.8	21.6	1.44	4.81	8.65	12.7	21.1	29.8	34.2	43.1	52.1	61.2	79.5	93.4
50.0	3.41	8.25	13.1	18.1	27.9	3.47	8.39	13.4	18.4	28.4	38.3	43.3	53.3	63.3	73.3	93.3	108
25.0	6.70	12.9	18.7	24.2	34.8	6.93	13.5	19.6	25.5	37.1	48.4	54.0	65.1	76.1	87.0	109	125
10.0	10.9	18.1	24.5	30.4	41.5	11.5	19.4	26.6	33.4	46.4	58.9	65.0	77.0	88.9	101	124	141
5.0	13.9	21.6	28.3	34.4	45.6	15.0	23.7	31.5	38.8	52.6	65.7	72.2	84.8	97.2	109	133	151
1.0	20.6	28.9	35.8	42.1	53.2	23.0	33.2	42.0	50.2	65.5	80.0	87.0	101	114	127	153	172
	1.0	4.0	6.5	10	X	1.0	4.0	6.5	10	15	X	25	X	40	X	65	X
	Acceptable Quality Levels (tightened inspection)																

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-F-2—Sampling Plans for Sample Size Code Letter: F

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		Less than 0.65	0.65	1.0	X	1.5	2.5	4.0	6.5	10	15	X	25	X	40	X	65	Higher than 65	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	20	∇	0 1	Use Code Letter E	Use Code Letter H	Use Code Letter G	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	20
Double	13	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	13
	26						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		26
Multiple	5	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	5
	10						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		10
	15						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		15
	20						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		20
	25						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		25
	30						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		30
	35						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		35
		Less than 1.0	1.0	X	1.5	2.5	4.0	6.5	10	15	X	25	X	40	X	65	X	Higher than 65	
		Acceptable Quality Levels (tightened inspection)																	

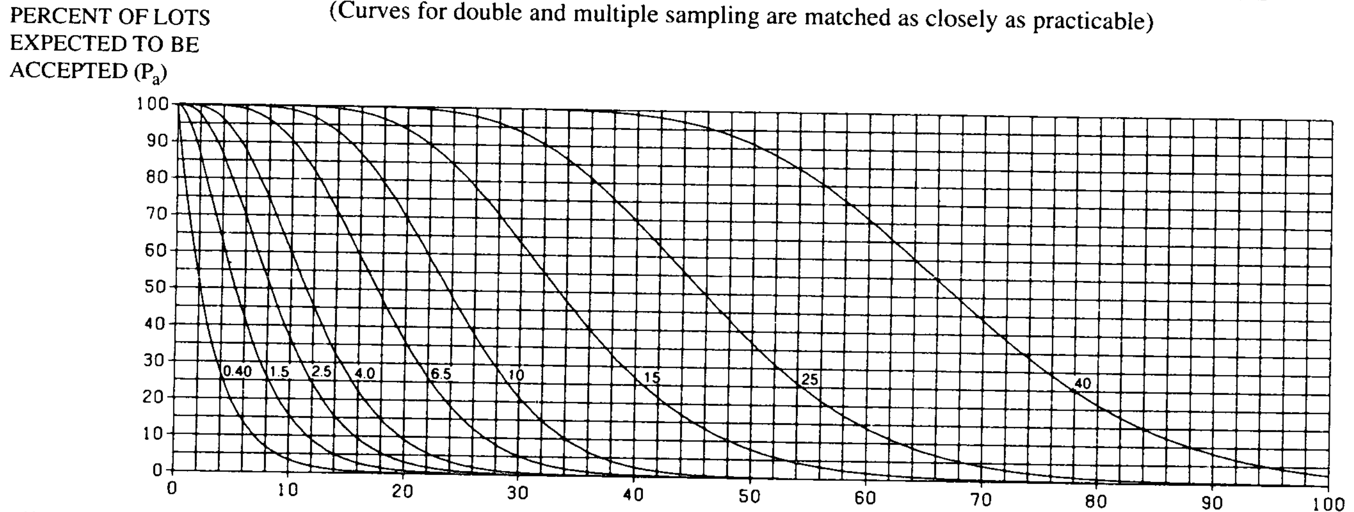
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter J).
# = Acceptance not permitted at this sample size.

Table X-G—Tables for sample size code letter: G

INDIVIDUAL PLANS

CHART G—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-G-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																	
	0.40	1.5	2.5	4.0	6.5	10	0.40	1.5	2.5	4.0	6.5	10	X	15	X	25	X	40
	p (in percent nonconforming)						p (in nonconformities per hundred units)											
99.0	0.0314	0.471	1.40	2.67	5.88	9.73	0.0314	0.464	1.36	2.57	5.58	9.08	11.0	14.9	19.1	23.4	32.3	39.3
95.0	0.160	1.12	2.60	4.38	8.50	13.1	0.160	1.11	2.56	4.26	8.17	12.4	14.7	19.3	24.0	28.9	38.9	46.5
90.0	0.329	1.67	3.49	5.56	10.2	15.1	0.329	1.66	3.44	5.45	9.85	14.6	17.0	21.9	27.0	32.2	42.7	50.8
75.0	0.895	3.01	5.42	7.98	13.4	19.0	0.899	3.00	5.40	7.92	13.2	18.6	21.4	26.9	32.6	38.2	49.7	58.4
50.0	2.14	5.19	8.27	11.4	17.5	23.7	2.17	5.24	8.36	11.5	17.7	24.0	27.1	33.3	39.6	45.8	58.3	67.7
25.0	4.24	8.19	11.9	15.4	22.3	29.0	4.33	8.41	12.3	16.0	23.2	30.3	33.8	40.7	47.6	54.4	67.9	78.0
10.0	6.94	11.6	15.8	19.7	27.1	34.1	7.20	12.2	16.6	20.9	29.0	36.8	40.6	48.1	55.6	62.9	77.4	88.1
5.0	8.94	14.0	18.4	22.5	30.1	37.2	9.36	14.8	19.7	24.2	32.9	41.1	45.1	53.0	60.8	68.4	83.4	94.5
1.0	13.4	19.0	23.8	28.1	36.0	43.2	14.4	20.7	26.3	31.4	41.0	50.0	54.4	63.0	71.3	79.5	95.6	107
	0.65	2.5	4.0	6.5	10	X	0.65	2.5	4.0	6.5	10	X	15	X	25	X	40	X
	Acceptable Quality Levels (tightened inspection)																	

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-G-2—Sampling Plans for Sample Size Code Letter: G

Type of sampling plan	Cumu-lative sample size	Acceptable Quality Levels (normal inspection)																	Cumu-lative sample size
		Less than 0.40	0.40	0.65	X	1.0	1.5	2.5	4.0	6.5	10	X	15	X	25	X	40	Higher than 40	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	32	∇	0 1	Use Code Letter F	Use Code Letter J	Use Code Letter H	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	32
Double	20	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	20
	40						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		40
Multiple	8	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	8
	16						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		16
	24						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		24
	32						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		32
	40						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		40
	48						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		48
	56						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		56
		Less than 0.65	0.65	X	1.0	1.5	2.5	4.0	6.5	10	X	15	X	25	X	40	X	Higher than 40	
		Acceptable Quality Levels (tightened inspection)																	

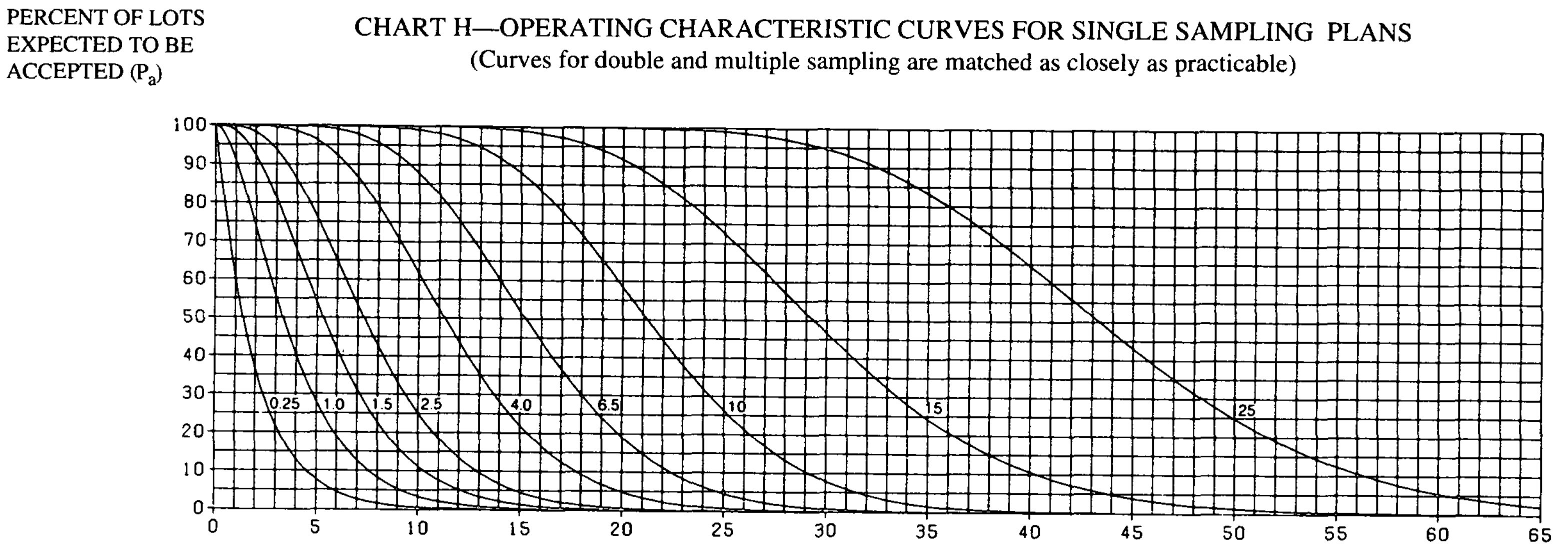
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter K).
# = Acceptance not permitted at this sample size.

Table X-H—Tables for sample size code letter: H

INDIVIDUAL PLANS

CHART H—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-H-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																			
	0.25	1.0	1.5	2.5	4.0	6.5	X	10	0.25	1.0	1.5	2.5	4.0	6.5	X	10	X	15	X	25
	p (in percent nonconforming)								p (in nonconformities per hundred units)											
99.0	0.0201	0.300	0.886	1.68	3.69	6.07	7.36	10.1	0.0201	0.297	0.872	1.65	3.57	5.81	7.01	9.54	12.2	15.0	20.7	25.1
95.0	0.103	0.715	1.66	2.78	5.36	8.22	9.72	12.9	0.103	0.711	1.64	2.73	5.23	7.96	9.39	12.3	15.4	18.5	24.9	29.8
90.0	0.211	1.07	2.22	3.53	6.43	9.54	11.2	14.5	0.210	1.06	2.20	3.49	6.30	9.31	10.9	14.0	17.3	20.6	27.3	32.5
75.0	0.574	1.92	3.46	5.10	8.51	12.0	13.8	17.5	0.575	1.92	3.45	5.07	8.44	11.9	13.7	17.2	20.8	24.5	31.8	37.4
50.0	1.38	33.3	5.31	7.29	11.3	15.2	17.2	21.2	1.39	3.36	5.35	7.34	11.3	15.3	17.3	21.3	25.3	29.3	37.3	43.3
25.0	2.73	5.29	7.69	10.0	14.5	18.8	21.0	25.2	2.77	5.39	7.84	10.2	14.8	19.4	21.6	26.0	30.4	34.8	43.5	49.9
10.0	4.50	7.56	10.3	12.9	17.8	22.4	24.7	29.1	4.61	7.78	10.6	13.4	18.5	23.5	26.0	30.8	35.6	40.3	49.5	56.4
5.0	5.82	9.14	12.1	14.8	19.9	24.7	27.0	31.6	5.99	9.49	12.6	15.5	21.0	26.3	28.9	33.9	38.9	43.8	53.4	60.5
1.0	8.80	12.6	15.8	18.7	24.2	29.2	31.7	36.3	9.21	13.3	16.8	20.1	26.2	32.0	34.8	40.3	45.6	50.9	61.1	68.7
	0.40	1.5	2.5	4.0	6.5	X	10	X	0.40	1.5	2.5	4.0	6.5	X	10	X	15	X	25	X
	Acceptable Quality Levels (tightened inspection)																			

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-H-2—Sampling Plans for Sample Size Code Letter: H

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																Cumulative sample size
		Less than 0.25	0.25	0.40	X	0.65	1.0	1.5	2.5	4.0	6.5	X	10	X	15	X	25	Higher than 25	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	50	∇	0 1	Use Code Letter G	Use Code Letter K	Use Code Letter J	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	50
Double	32	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	32
	64						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		64
Multiple	13	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	13
	26						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		26
	39						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		39
	52						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		52
	65						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		65
	78						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		78
	91						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		91
		Less than 0.40	0.40	X	0.65	1.0	1.5	2.5	4.0	6.5	X	10	X	15	X	25	X	Higher than 25	
		Acceptable Quality Levels (tightened inspection)																	

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter L).
# = Acceptance not permitted at this sample size.

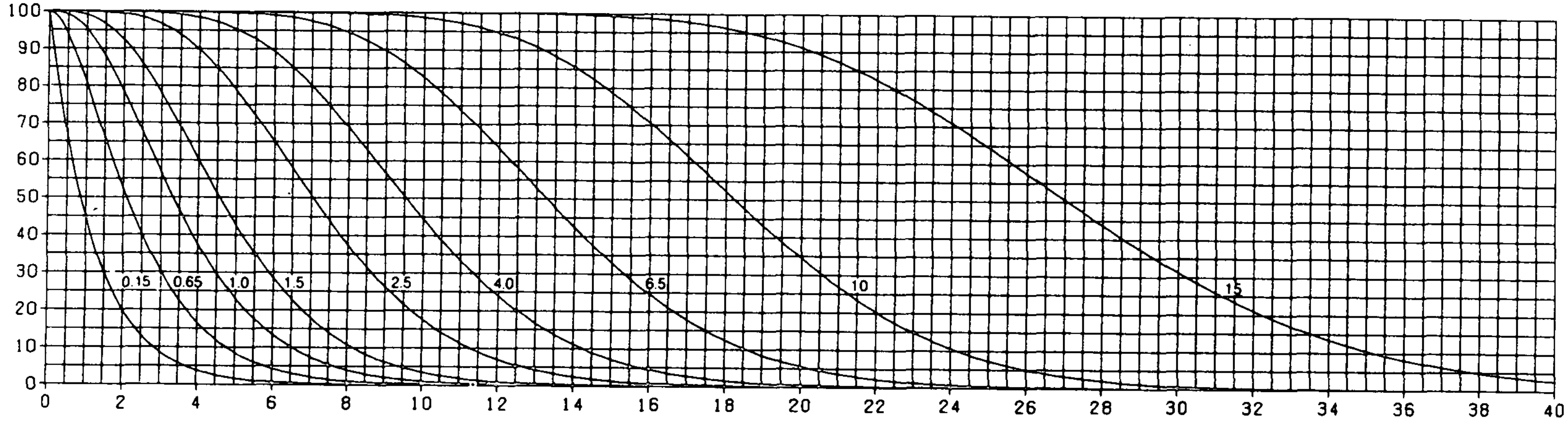
Table X-J—Tables for sample size code letter: J

INDIVIDUAL PLANS

CHART J—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)

PERCENT OF LOTS
EXPECTED TO BE
ACCEPTED (P_a)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-J-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)																			
	0.15	0.65	1.0	1.5	2.5	4.0	X	6.5	X	10	0.15	0.65	1.0	1.5	2.5	4.0	X	6.5	X	10	X	15
	p (in percent nonconforming)										p (in nonconformities per hundred units)											
99.0	0.0126	0.187	0.550	1.04	2.28	3.73	4.51	6.17	7.93	9.76	0.0126	0.186	0.545	1.03	2.23	3.63	4.38	5.96	7.62	9.35	12.9	15.7
95.0	0.0641	0.446	1.03	1.73	3.32	5.07	6.00	7.91	9.89	11.9	0.064	0.444	1.02	1.71	3.27	4.98	5.87	7.71	9.61	11.6	15.6	18.6
90.0	0.132	0.667	1.39	2.20	3.99	5.91	6.90	8.95	11.0	13.2	0.132	0.665	1.38	2.18	3.94	5.82	6.79	8.78	10.8	12.9	17.1	20.3
75.0	0.359	1.201	2.16	3.18	5.30	7.50	8.61	10.9	13.2	15.5	0.360	1.20	2.16	3.17	5.27	7.45	8.55	10.8	13.0	15.3	19.9	23.4
50.0	0.863	2.09	3.33	4.57	7.06	9.55	10.8	13.3	15.8	18.3	0.866	2.10	3.34	4.59	7.09	9.59	10.8	13.3	15.8	18.3	23.3	27.1
25.0	1.72	3.33	4.84	6.30	9.14	11.9	13.3	16.0	18.6	21.3	1.73	3.37	4.90	6.39	9.28	12.1	13.5	16.3	19.0	21.7	27.2	31.2
10.0	2.84	4.78	6.52	8.16	11.3	14.3	15.7	18.6	21.4	24.2	2.88	4.86	6.65	8.35	11.6	14.7	16.2	19.3	22.2	25.2	30.9	35.2
5.0	3.68	5.79	7.66	9.41	12.7	15.8	17.3	20.3	23.2	26.0	3.74	5.93	7.87	9.69	13.1	16.4	18.0	21.2	24.3	27.4	33.4	37.8
1.0	5.59	8.01	10.1	12.0	15.6	18.9	20.5	23.6	26.6	29.5	5.76	8.30	10.5	12.6	16.4	20.0	21.8	25.2	28.5	31.8	38.2	42.9
	0.25	1.0	1.5	2.5	4.0	X	6.5	X	10	X	0.25	1.0	1.5	2.5	4.0	X	6.5	X	10	X	15	X
	Acceptable Quality Levels (tightened inspection)																					

Note: Binomial distribution used for percent nonconforming computations; Poisson for nonconformities per hundred units.

Table X-J-2—Sampling Plans for Sample Size Code Letter: J

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		Less than 0.15	0.15	0.25	X	0.40	0.65	1.0	1.5	2.5	4.0	X	6.5	X	10	X	15	Higher than 15	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	80	∇	0 1	Use Code Letter H	Use Code Letter L	Use Code Letter K	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	80
Double	50	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	50
	100						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		100
Multiple	20	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	20
	40						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		40
	60						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		60
	80						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		80
	100						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		100
	120						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		120
	140						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		140
		Less than 0.25	0.25	X	0.40	0.65	1.0	1.5	2.5	4.0	X	6.5	X	10	X	15	X	Higher than 15	
		Acceptable Quality Levels (tightened inspection)																	

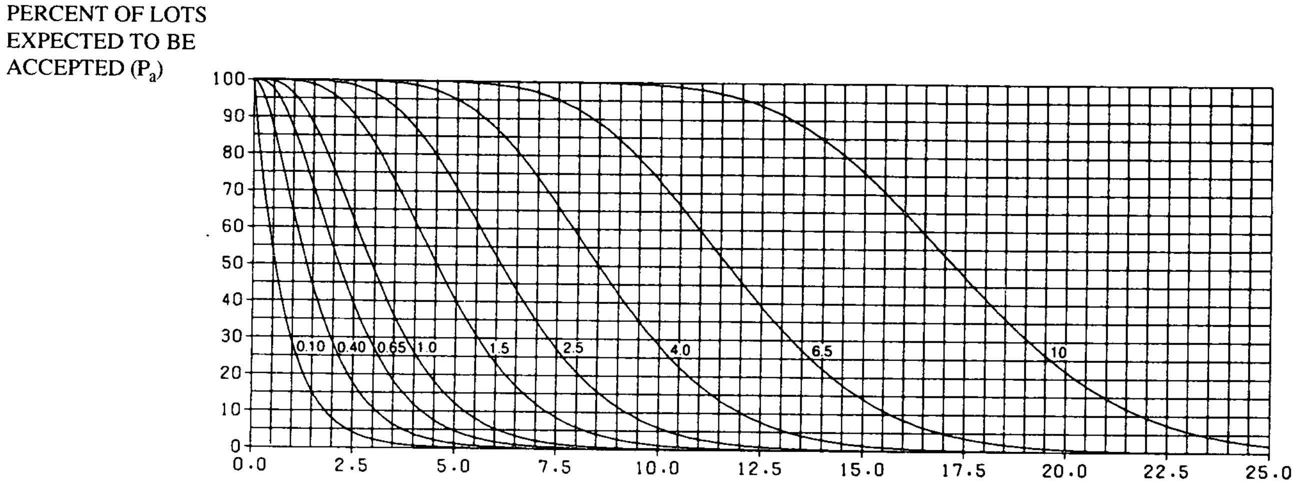
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter M).
# = Acceptance not permitted at this sample size.

Table X-K—Tables for sample size code letter: K

INDIVIDUAL PLANS

CHART K—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-K-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.10	0.40	0.65	1.0	1.5	2.5	X	4.0	X	6.5	X	10
	p (in percent nonconforming or nonconformities per hundred units)											
99.0	0.00804	0.119	0.349	0.659	1.43	2.32	2.81	3.82	4.88	5.98	8.28	10.1
95.0	0.0410	0.284	0.654	1.09	2.09	3.18	3.76	4.94	6.15	7.40	9.95	11.9
90.0	0.0843	0.425	0.882	1.40	2.52	3.72	4.35	5.62	6.92	8.24	10.9	13.0
75.0	0.230	0.769	1.38	2.03	3.38	4.76	5.47	6.90	8.34	9.79	12.7	14.9
50.0	0.555	1.34	2.14	2.94	4.54	6.14	6.94	8.53	10.1	11.7	14.9	17.3
25.0	1.11	2.15	3.14	4.09	5.94	7.75	8.64	10.4	12.2	13.9	17.4	20.0
10.0	1.84	3.11	4.26	5.34	7.42	9.42	10.4	12.3	14.2	16.1	19.8	22.54
5.0	2.40	3.80	5.04	6.20	8.41	10.5	11.5	13.6	15.6	17.5	21.4	24.2
1.0	3.68	5.31	6.72	8.04	10.5	12.8	13.9	16.1	18.3	20.4	24.5	27.5
	0.15	0.65	1.0	1.5	2.5	X	4.0	X	6.5	X	10	X
	Acceptable Quality Levels (tightened inspection)											

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-K-2—Sampling Plans for Sample Size Code Letter: K

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		Less than 0.10	0.10	0.15	X	0.25	0.40	0.65	1.0	1.5	2.5	X	4.0	X	6.5	X	10	Higher than 10	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	125	∇	0 1	Use Code Letter J	Use Code Letter M	Use Code Letter L	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	125
Double	80	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	80
	160						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		160
Multiple	32	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	32
	64						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		64
	96						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		96
	128						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		128
	160						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		160
	192						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		192
	224						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		224
		Less than 0.15	0.15	X	0.25	0.40	0.65	1.0	1.5	2.5	X	4.0	X	6.5	X	10	X	Higher than 10	
		Acceptable Quality Levels (tightened inspection)																	

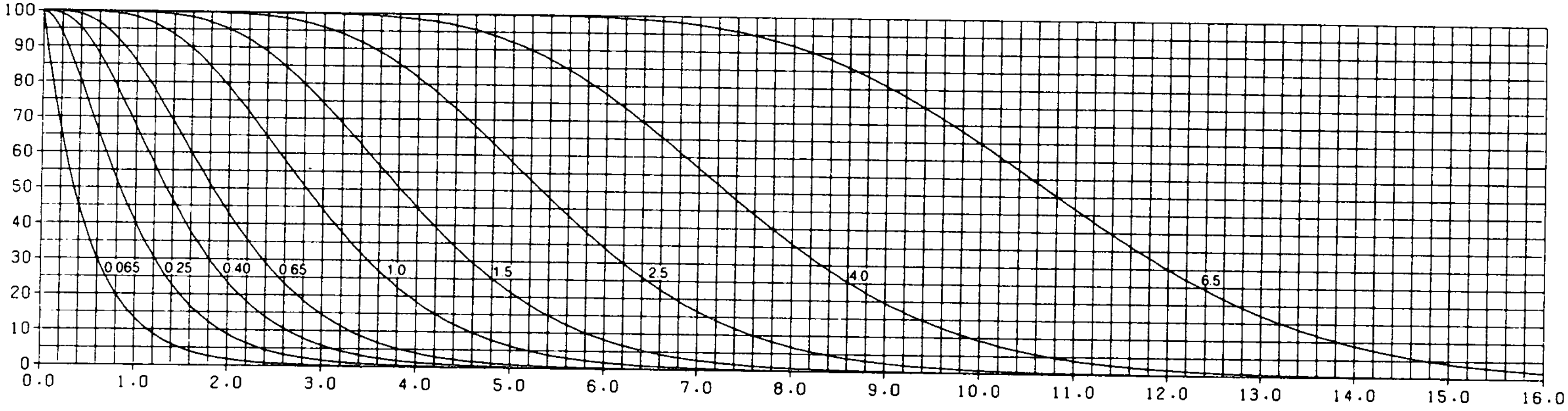
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter N).
# = Acceptance not permitted at this sample size.

Table X-L—Tables for sample size code letter: L

INDIVIDUAL PLANS

CHART L—OPERATING CHARACTERISTICS CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-L-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.065	0.25	0.40	0.65	1.0	1.5	X	2.5	X	4.0	X	6.5
	p (in percent nonconforming or nonconformities per hundred units)											
99.0	0.00503	0.0743	0.218	0.412	0.893	1.45	1.75	2.39	3.05	3.74	5.17	6.29
95.0	0.0256	0.178	0.409	0.683	1.31	1.99	2.35	3.08	3.84	4.62	6.22	7.45
90.0	0.0527	0.266	0.551	0.872	1.58	2.33	2.72	3.51	4.32	5.15	6.84	8.12
75.0	0.144	0.481	0.864	1.27	2.11	2.98	3.42	4.31	5.21	6.12	7.95	9.34
50.0	0.347	0.839	1.34	1.84	2.84	3.83	4.33	5.33	6.33	7.33	9.33	10.8
25.0	0.693	1.35	1.96	2.55	3.71	4.84	5.40	6.51	7.61	8.70	10.9	12.5
10.0	1.15	1.94	2.66	3.34	4.64	5.89	6.50	7.70	8.89	10.1	12.4	14.1
5.0	1.50	2.37	3.15	3.88	5.26	6.57	7.22	8.48	9.72	10.9	13.3	15.1
1.0	2.30	3.32	4.20	5.02	6.55	8.00	8.70	10.1	11.4	12.7	15.3	17.2
	1.0	0.40	0.65	1.0	1.5	X	2.5	X	4.0	X	6.5	X
	Acceptable Quality Levels (tightened inspection)											

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-L-2—Sampling Plans for Sample Size Code Letter: L

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		Less than 0.065	0.065	0.10	X	0.15	0.25	0.40	0.65	1.0	1.5	X	2.5	X	4.0	X	6.5	Higher than 6.5	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	200	∇	0 1	Use Code Letter K	Use Code Letter N	Use Code Letter M	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	200
Double	125	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	125
	250						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		250
Multiple	50	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	50
	100						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		100
	150						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		150
	200						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		200
	250						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		250
	300						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		300
	350						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		350
		Less than 0.10	0.10	X	0.15	0.25	0.40	0.65	1.0	1.5	X	2.5	X	4.0	X	6.5	X	Higher than 6.5	
		Acceptable Quality Levels (tightened inspection)																	

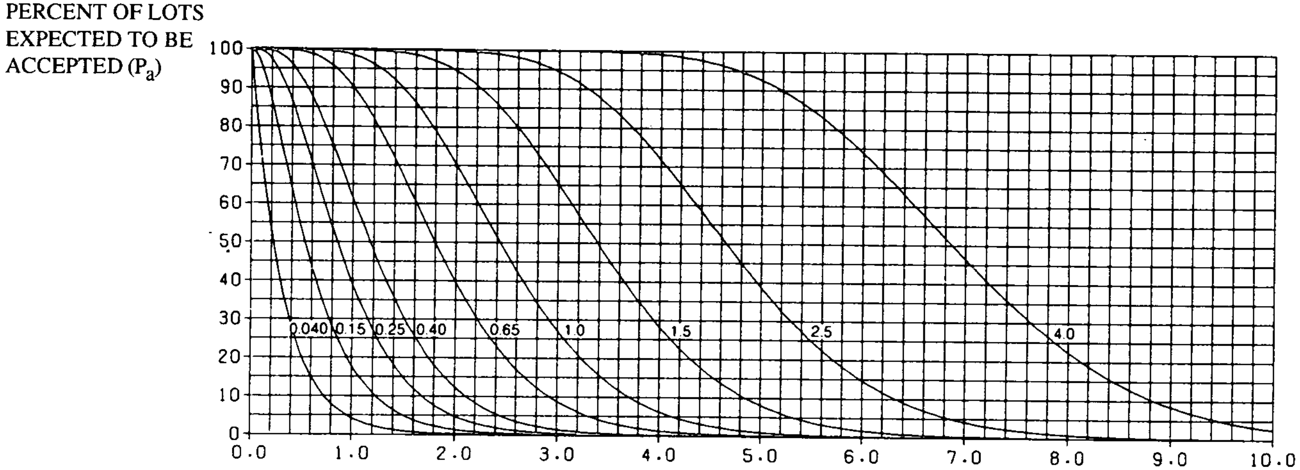
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter P).
# = Acceptance not permitted at this sample size.

Table X-M—Tables for sample size code letter: M

INDIVIDUAL PLANS

CHART M—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-M-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.040	0.15	0.25	0.40	0.65	1.0	X	1.5	X	2.5	X	4.0
	p (in percent nonconforming or nonconformities per hundred units)											
99.0	0.0039	0.0472	0.138	0.261	0.567	0.923	1.11	1.51	1.94	2.37	3.28	3.99
95.0	0.0163	0.113	0.260	0.434	0.830	1.26	1.49	1.96	2.44	2.94	3.95	4.73
90.0	0.0335	0.169	0.350	0.554	1.00	1.48	1.72	2.23	2.74	3.27	4.34	5.16
75.0	0.0913	0.305	0.548	0.805	1.34	1.89	2.17	2.74	3.31	3.89	5.05	5.93
50.0	0.220	0.533	0.849	1.17	1.80	2.43	2.75	3.39	4.02	4.66	5.93	6.88
25.0	0.440	0.855	1.24	1.62	2.36	3.07	3.43	4.13	4.83	5.52	6.90	7.92
10.0	0.731	1.23	1.69	2.12	2.94	3.74	4.13	4.89	5.64	6.39	7.86	8.95
5.0	0.951	1.51	2.00	2.46	3.34	4.17	4.58	5.38	6.17	6.95	8.47	9.60
1.0	1.46	2.11	2.67	3.19	4.16	5.08	5.52	6.40	7.24	8.08	9.71	10.9
	0.065	0.25	0.40	0.65	1.0	X	1.5	X	2.5	X	4.0	X
	Acceptable Quality Levels (tightened inspection)											

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-M-2—Sampling Plans for Sample Size Code Letter: M

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		Less than 0.040	0.040	0.065	X	0.10	0.15	0.25	0.40	0.65	1.0	X	1.5	X	2.5	X	4.0	Higher than 4.0	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	315	∇	0 1	Use Code Letter L	Use Code Letter P	Use Code Letter N	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	315
Double	200	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	200
	315						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		400
Multiple	80	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	80
	160						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		160
	240						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		240
	320						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		320
	400						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		400
	480						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		480
	560						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		560
		Less than 0.065	0.065	X	0.10	0.15	0.25	0.40	0.65	1.0	X	1.5	X	2.5	X	4.0	X	Higher than 4.0	
		Acceptable Quality Levels (tightened inspection)																	

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

Re = Rejection number.

* = Use single sampling plan above (or alternatively use code letter Q).

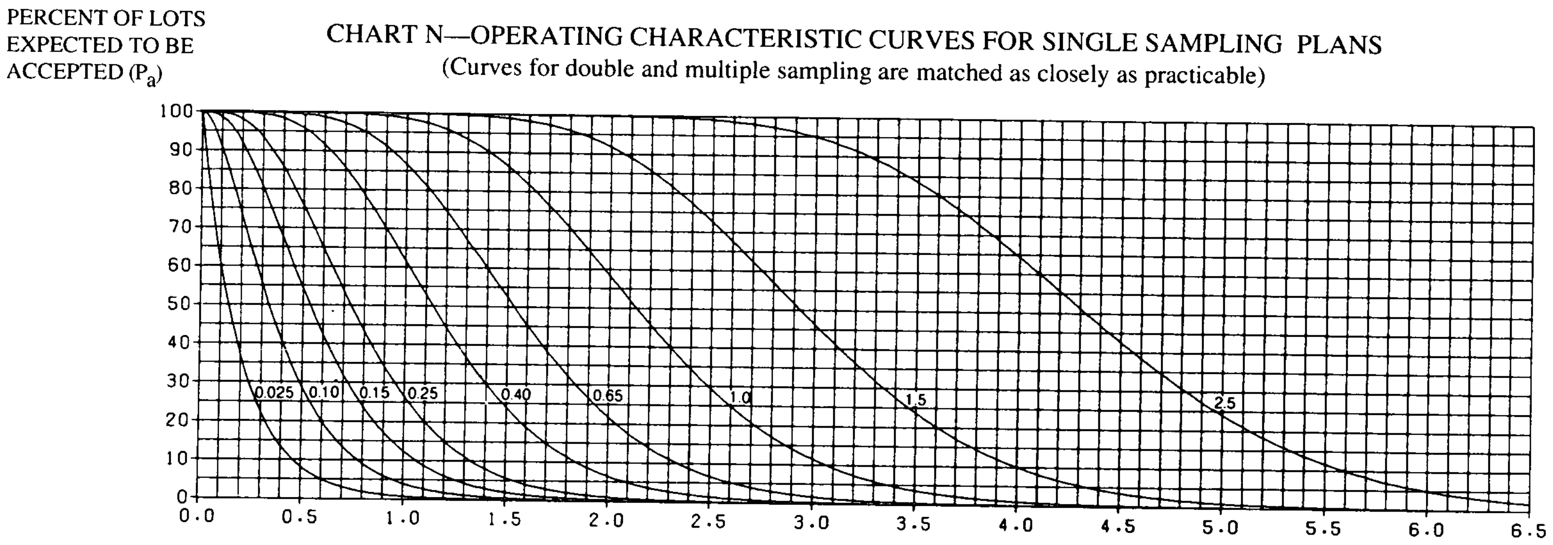
= Acceptance not permitted at this sample size.

Table X-N—Tables for sample size code letter: N

INDIVIDUAL PLANS

CHART N—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-N-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.025	0.10	0.15	0.25	0.40	0.65	X	1.0	X	1.5	X	2.5
	p (in percent nonconforming or nonconformities per hundred units)											
99.0	0.00201	0.0297	0.087	0.165	0.357	0.581	0.701	0.954	1.22	1.50	2.07	2.51
95.0	0.0103	0.0711	0.164	0.273	0.523	0.796	0.939	1.23	1.54	1.85	2.49	2.98
90.0	0.0211	0.106	0.220	0.349	0.630	0.931	1.09	1.40	1.73	2.06	2.73	3.25
75.0	0.0575	0.192	0.345	0.507	0.844	1.19	1.37	1.72	2.08	2.45	3.18	3.74
50.0	0.139	0.336	0.535	0.734	1.13	1.53	1.73	2.13	2.53	2.93	3.73	4.33
25.0	0.277	0.539	0.784	1.02	1.48	1.94	2.16	2.60	3.04	3.48	4.35	4.99
10.0	0.461	0.778	1.06	1.34	1.85	2.35	2.60	3.08	3.56	4.03	4.95	5.64
5.0	0.599	0.949	1.26	1.55	2.10	2.63	2.89	3.39	3.89	4.38	5.34	6.05
1.0	0.921	1.33	1.68	2.01	2.62	3.20	3.48	4.03	4.56	5.09	6.12	6.87
	0.040	0.15	0.25	0.40	0.65	X	1.0	X	1.5	X	2.5	X
	Acceptable Quality Levels (tightened inspection)											

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-N-2—Sampling Plans for Sample Size Code Letter: N

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		Less than 0.025	0.025	0.040	X	0.065	0.10	0.15	0.25	0.40	0.65	X	1.0	X	1.5	X	2.5	Higher than 2.5	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	500	∇	0 1	Use Code Letter N	Use Code Letter R	Use Code Letter Q	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	500
Double	315	∇	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	315
	630						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		630
Multiple	125	∇	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	125
	250						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		250
	375						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		375
	500						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		500
	615						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		625
	750						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		750
	875						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		875
		Less than 0.040	0.040	X	0.065	0.10	0.15	0.25	0.40	0.65	X	1.0	X	1.5	X	3.5	X	Higher than 2.5	
		Acceptable Quality Levels (tightened inspection)																	

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
∇ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above (or alternatively use code letter R).
# = Acceptance not permitted at this sample size.

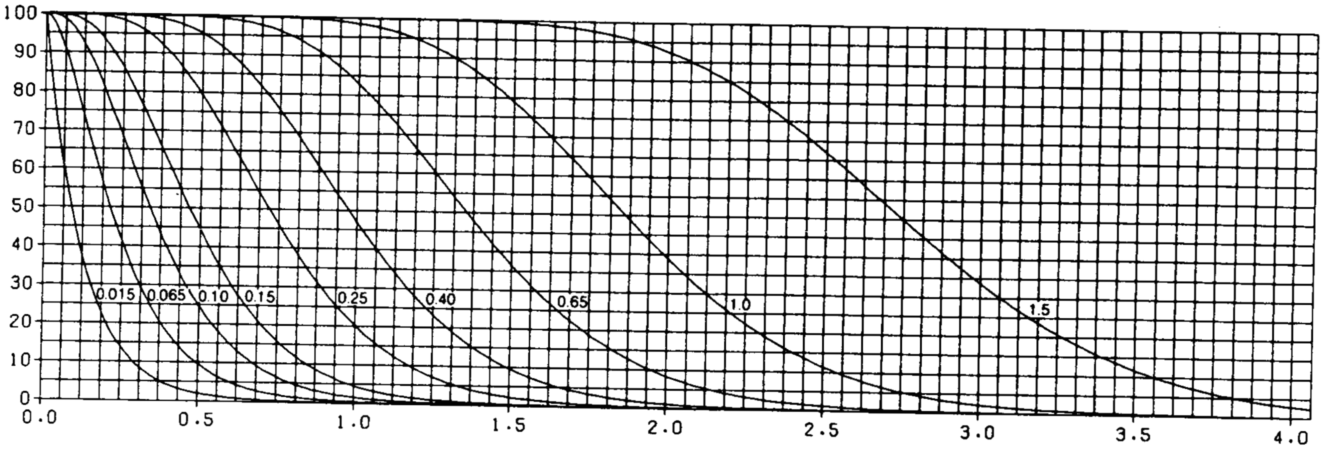
Table X-P—Tables for sample size code letter: P

INDIVIDUAL PLANS

PERCENT OF LOTS EXPECTED TO BE ACCEPTED (P_a)

CHART P—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-P-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.015	0.065	0.10	0.15	0.25	0.40	X	0.65	X	1.0	X	1.5
	p (in percent nonconforming or nonconformities per hundred units)											
99.0	0.00126	0.0186	0.0545	0.103	0.223	0.363	0.438	0.596	0.762	0.935	1.29	1.57
95.0	0.00641	0.0444	0.102	0.171	0.327	0.498	0.587	0.771	0.961	1.16	1.56	1.86
90.0	0.0132	0.0665	0.138	0.218	0.394	0.582	0.679	0.878	1.08	1.29	1.71	2.03
75.0	0.0360	0.120	0.216	0.317	0.527	0.745	0.855	1.08	1.30	1.53	1.99	2.34
50.0	0.0866	0.210	0.334	0.459	0.709	0.959	1.08	1.33	1.58	1.83	2.33	2.71
25.0	0.173	0.337	0.490	0.639	0.928	1.21	1.35	1.63	1.90	2.17	2.72	3.12
10.0	0.288	0.486	0.665	0.835	1.16	1.47	1.62	1.93	2.22	2.52	3.09	3.52
5.0	0.374	0.593	0.787	0.969	1.31	1.64	1.80	2.12	2.43	2.74	3.34	3.78
1.0	0.576	0.830	1.05	1.26	1.64	2.00	2.18	2.52	2.85	3.18	3.82	4.29
	0.025	0.10	0.15	0.25	0.40	X	0.65	X	1.0	X	1.5	X
	Acceptable Quality Levels (tightened inspection)											

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-P-2—Sampling Plans for Sample Size Code Letter: P

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		0.010	0.015	0.025	X	0.040	0.065	0.10	0.15	0.25	0.40	X	0.65	X	1.0	X	1.5	Higher than 1.5	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	800	▽	0 1	Use Code Letter N	Use Code Letter R	Use Code Letter Q	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	800
Double	500	▽	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	500
	1000						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		1000
Multiple	200	▽	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	200
	400						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		400
	600						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		600
	800						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		800
	1000						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		1000
	1200						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		1200
	1400						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		1400
		Less than 0.025	0.025	X	0.040	0.065	0.10	0.15	0.25	0.40	X	0.65	X	1.0	X	1.5	X	Higher than 1.5	
		Acceptable Quality Levels (tightened inspection)																	

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.

▽ = Use next subsequent sample size code letter for which acceptance and rejection numbers are available.

Ac = Acceptance number.

Re = Rejection number.

* = Use single sampling plan above.

= Acceptance not permitted at this sample size.

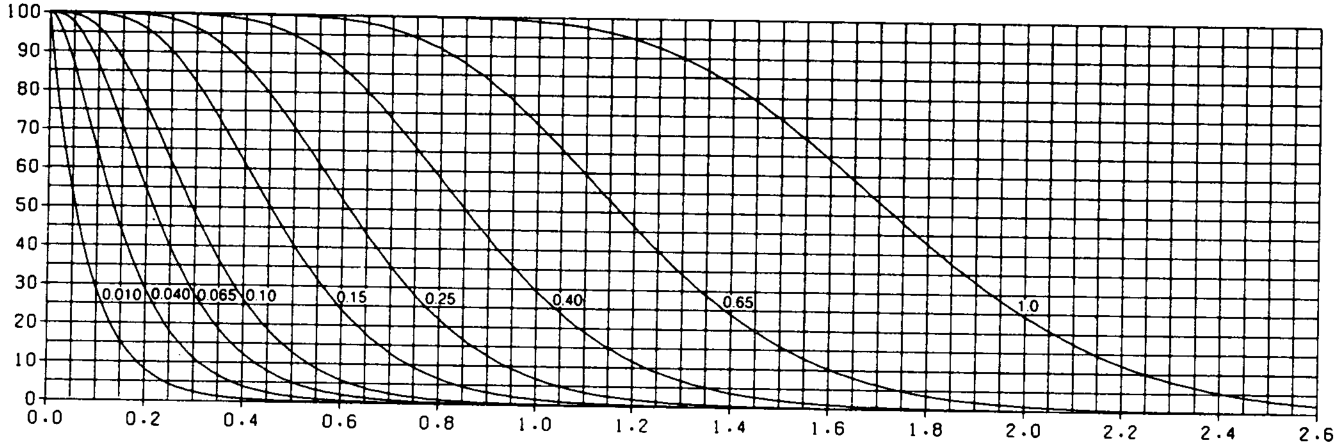
Table X-Q—Tables for sample size code letter: Q

INDIVIDUAL PLANS

PERCENT OF LOTS EXPECTED TO BE ACCEPTED (P_a)

CHART Q—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-Q-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)											
	0.010	0.040	0.065	0.10	0.15	0.25	X	0.40	X	0.65	X	1.0
	p (in percent nonconforming or nonconformities per hundred units)											
99.0	0.000804	0.0119	0.0349	0.0659	0.143	0.232	0.281	0.382	0.488	0.598	0.828	1.01
95.0	0.00410	0.0284	0.0654	0.109	0.209	0.318	0.376	0.494	0.615	0.740	0.995	1.19
90.0	0.00843	0.0425	0.0882	0.140	0.252	0.372	0.435	0.562	0.692	0.824	1.09	1.30
75.0	0.0230	0.0769	0.138	0.203	0.338	0.476	0.547	0.690	0.834	0.979	1.27	1.49
50.0	0.0555	0.134	0.214	0.294	0.454	0.614	0.694	0.853	1.01	1.17	1.49	1.73
25.0	0.111	0.215	0.314	0.409	0.594	0.775	0.864	1.04	1.22	1.39	1.74	2.00
10.0	0.184	0.311	0.426	0.534	0.742	0.942	1.04	1.23	1.42	1.61	1.98	2.25
5.0	0.240	0.380	0.504	0.620	0.841	1.05	1.15	1.36	1.56	1.75	2.14	2.42
1.0	0.368	0.531	0.672	0.804	1.05	1.28	1.39	1.61	1.83	2.04	2.45	2.75
	0.015	0.065	0.10	0.15	0.25	X	0.40	X	0.65	X	1.0	X
	Acceptable Quality Levels (tightened inspection)											

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-Q-2—Sampling Plans for Sample Size Code Letter: Q

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																	Cumulative sample size
		X	0.010	0.015	X	0.025	0.040	0.065	0.10	0.15	0.25	X	0.40	X	0.65	X	1.0	Higher than 1.0	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	1250	Use Code Letter R	0 1	Use Code Letter P	Use Code Letter S	Use Code Letter R	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	1250
Double	800		*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	800
	1600						1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		1600
Multiple	315		*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	315
	630						# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		630
	945						0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		945
	1260						0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		1260
	1575						1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		1575
	1890						1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		1890
	2205						2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		2205
		0.010	0.015	X	0.025	0.040	0.065	0.10	0.15	0.25	X	0.40	X	0.65	X	1.0	X	Higher than 1.0	
		Acceptable Quality Levels (tightened inspection)																	

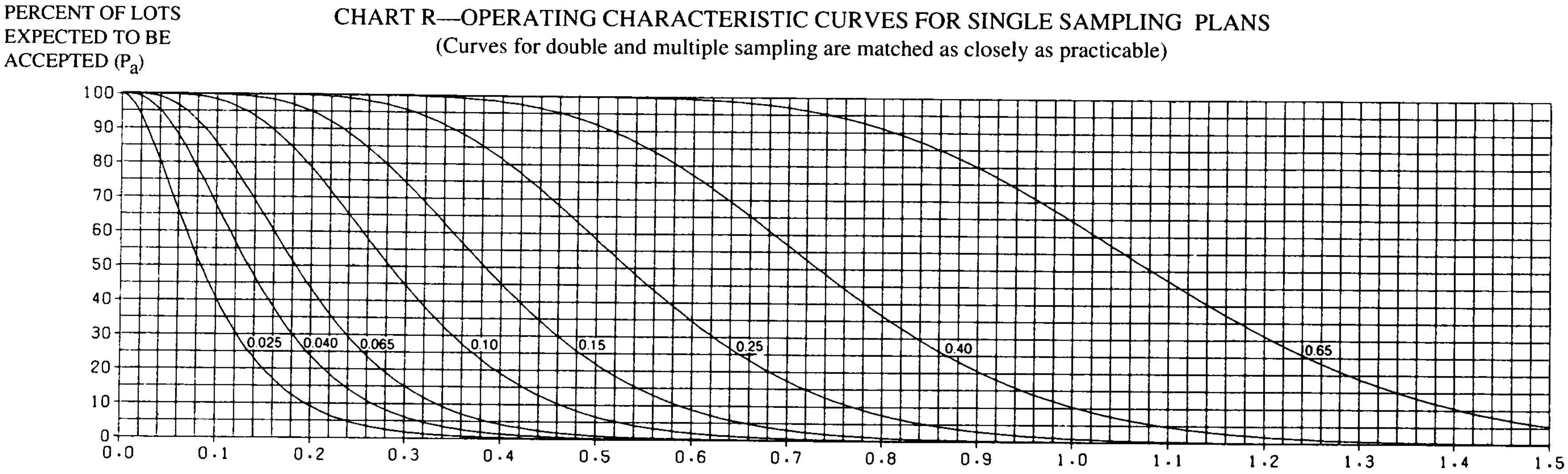
Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above.
# = Acceptance not permitted at this sample size.

Table X-R—Tables for sample size code letter: R

INDIVIDUAL PLANS

CHART R—OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of Submitted Product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE X-R-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptance Quality Levels (normal inspection)										
	0.025	0.040	0.065	0.10	0.15	X	0.25	X	0.40	X	0.65
	p (in percent nonconforming or nonconformities per hundred units)										
99.0	0.00743	0.0218	0.0412	0.0893	0.145	0.175	0.239	0.305	0.374	0.517	0.629
95.0	0.0178	0.0409	0.0683	0.131	0.199	0.235	0.308	0.384	0.462	0.622	0.745
90.0	0.0266	0.0551	0.0872	0.158	0.233	0.272	0.351	0.432	0.515	0.684	0.812
75.0	0.0481	0.0864	0.127	0.211	0.298	0.342	0.431	0.521	0.612	0.795	0.934
50.0	0.0839	0.134	0.184	0.284	0.383	0.433	0.533	0.633	0.733	0.933	1.08
25.0	0.135	0.196	0.255	0.371	0.484	0.540	0.651	0.761	0.870	1.09	1.25
10.0	0.194	0.266	0.334	0.464	0.589	0.650	0.770	0.889	1.01	1.24	1.41
5.0	0.237	0.315	0.388	0.526	0.657	0.722	0.848	0.972	1.09	1.33	1.51
1.0	0.332	0.420	0.502	0.655	0.800	0.870	1.01	1.14	1.27	1.53	1.72
	0.040	0.065	0.10	0.15	X	0.25	X	0.40	X	0.65	X
	Acceptable Quality Levels (tightened inspection)										

Note: Values given in the Table above are based on the Poisson distribution as an approximation to the binomial distribution (See 11.1 for details).

Table X-R-2—Sampling Plans for Sample Size Code Letter: R

Type of sampling plan	Cumulative sample size	Acceptable Quality Levels (normal inspection)																Cumulative sample size
		X	0.010	0.015	X	0.025	0.040	0.065	0.10	0.15	X	0.25	X	0.40	X	0.65	Higher than 0.65	
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
Single	2000	0 1	Use Code Letter Q	Use Code Letter P	Use Code Letter S	1 2	2 3	3 4	5 6	7 8	8 9	10 11	12 13	14 15	18 19	21 22	Δ	2000
Double	1250	*				0 2	0 3	1 4	2 5	3 7	3 7	5 9	6 10	7 11	9 14	11 16	Δ	1250
	2500					1 2	3 4	4 5	6 7	8 9	11 12	12 13	15 16	18 19	23 24	26 27		2500
Multiple	500	*				# 2	# 2	# 3	# 4	0 4	0 4	0 5	0 6	1 7	1 8	2 9	Δ	500
	1000					# 2	0 3	0 3	1 5	1 6	2 7	3 8	3 9	4 10	6 12	7 14		1000
	1500					0 2	0 3	1 4	2 6	3 8	4 9	6 10	7 12	8 13	11 17	13 19		1500
	2000					0 3	1 4	2 5	3 7	5 10	6 11	8 13	10 15	12 17	16 22	19 25		2000
	2500					1 3	2 4	3 6	5 8	7 11	9 12	11 15	14 17	17 20	22 25	25 29		2500
	3000					1 3	3 5	4 6	7 9	10 12	12 14	14 17	18 20	21 23	27 29	31 33		3000
	3500					2 3	4 5	6 7	9 10	13 14	14 15	18 19	21 22	25 26	32 33	37 38		3500
		0.010	0.015	X	0.025	0.040	0.065	0.10	0.15	X	0.25	X	0.40	X	0.65	X	Higher than 0.65	
		Acceptable Quality Levels (tightened inspection)																

Δ = Use next preceding sample size code letter for which acceptance and rejection numbers are available.
Ac = Acceptance number.
Re = Rejection number.
* = Use single sampling plan above.
# = Acceptance not permitted at this sample size.

Table X-S—Tables for Sample Size Code Letter: S

Type of sampling plan	Cumulative sample size	Acceptable Quality Level (normal inspection)	
		X	
		Ac	Re
Single	3150	1	2
Double	2000	0	2
	4000	1	2
Multiple	800	#	2
	1600	#	2
	2400	0	2
	3200	0	3
	4000	1	3
	4800	1	3
	5600	2	3
		0.025	
		Acceptable Quality Level (tightened inspection)	

Ac = Acceptance number.
Re = Rejection number.
# = Acceptance not permitted at this sample size.

Table XI—Average Outgoing Quality Limit Factors for ANSI-Z1.4 Scheme Performance

(In nonconformities per hundred units, also applicable to percent nonconforming for AQL less than 15 with specific values for percent nonconforming shown in parentheses)

Code Letter	Acceptable Quality Level																									
	0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A															(11) 13			30	48	78	130	200	310	450	710	1100
B														(6.8) 7.5			19	32	52	84	130	210	300	480	710	1100
C													(4.4) 4.7			(12) 12	20	31	51	78	130	180	290	430	660	
D												(2.8) 2.9			(7.0) 7.0	(13) 12	20	32	49	76	120	180	270	410		
E											(1.9) 1.9			(4.5) 4.5	(7.5) 7.4	(13) 12	20	30	47	69	110	170	260			
F										(1.2) 1.2			(2.9) 2.9	(4.9) 4.8	(7.9) 7.8	(14) 13	20	31	45	71						
G									(.74) .75			(1.8) 1.8	(3.0) 3.0	(4.9) 4.9	(8.7) 7.9	(13) 13	18	28	45							
H								(.47) .47			(1.2) 1.2	(2.0) 2.0	(3.2) 3.1	(5.1) 5.1	(8.0) 7.8	(13) 13	18	29								
J							(.30) .30			(.72) .72	(1.2) 1.2	(2.0 2.0	(3.2) 3.2	(5.0) 4.9	(7.7) 7.6	(12) 12	18									
K						.19			.46	.77	1.3	2.1	3.2	4.9	7.2	12										
L					.12			.29	.48	.78	1.3	2.0	3.1	4.5	7.1											
M				.075			.18	.31	.50	.80	1.3	2.0	2.9	4.5												
N			.047			.12	.20	.31	.51	.78	1.3	1.8	2.9													
P		.030			.072	.12	.20	.32	.49	.76	1.2	1.8														
Q	.019			.046	.077	.13	.21	.32	.49	.72	1.2															
R			.029	.048	.078	.13	.20	.31	.45	.71																

Note: For a better approximation to the AOQL, the above values must be multiplied by $\left(1 - \frac{\text{Normal Plan Sample Size}}{\text{Lot or Batch Size}}\right)$

Table XII–Limiting Quality for ANSI-Z1.4 Scheme Performance for Which $P_a = 10$ Percent

(In nonconformities per hundred units, also applicable to percent nonconforming for AQL less than 15 with specific values for percent nonconforming shown in parentheses)

Code Letter	Acceptable Quality Level																									
	0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A															(53.6) 76.7			130	194	266	334	464	650	889	1240	1750
B														(36.9) 46.0			77.8	130	177	223	309	433	593	825	1170	1680
C													(25.0) 28.8			(40.6) 48.6	77.8	106	134	185	260	356	495	699	1010	
D												(16.2) 17.7			(26.8) 29.9	(40.6) 48.6	66.5	83.5	116	162	222	309	437	631		
E											(10.9) 11.5			(18.1) 19.4	(26.8) 29.9	(36.0) 40.9	51.4	71.3	100	137	190	269	388			
F										(6.94) 7.19			(11.6) 12.2	(18.1) 19.4	(24.5) 26.6	(30.4) 33.4	46.4	65.0	88.9	124						
G									(4.50) 4.60			(7.56) 7.78	(11.6) 12.2	(15.8) 16.6	(19.7) 20.9	(27.1) 29.0	40.6	55.6	77.4							
H								(2.84) 2.88			(4.77) 4.86	(7.56) 7.78	(10.3) 10.6	(12.9) 13.4	(17.8) 18.5	(24.7) 26.0	35.6	49.5								
J							(1.83) 1.84			(3.08) 3.11	(4.77) 4.86	(6.52) 6.65	(8.16) 8.35	(11.3) 11.6	(15.7) 16.2	(21.4) 22.2	30.9									
K						1.15			1.94	3.11	4.26	5.34	7.42	10.4	14.2	19.8										
L					.731			1.23	1.94	2.66	3.34	4.64	6.50	8.89	12.4											
M				.460			.778	1.23	1.69	2.12	2.94	4.13	5.64	7.86												
N			.288			.486	.778	1.06	1.34	1.85	2.60	3.56	4.95													
P		.184			.311	.486	.665	.835	1.16	1.62	2.22	3.09														
Q	.115			.194	.311	.426	.534	.742	1.04	1.42	1.98															
R			.123	.194	.266	.334	.464	.650	.889	1.24																

Table XIII—Limiting Quality for ANSI-Z1.4 Scheme Performance for Which $P_a = 5$ Percent

(In nonconformities per hundred units, also applicable to percent nonconforming for AQL less than 15 with specific values for percent nonconforming shown in parentheses)

Code Letter	Acceptable Quality Level																									
	0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000
A															(63.2) 99.8			158	237	315	388	526	722	972	1340	1860
B														(45.1) 59.9			94.9	158	210	258	350	481	648	890	1240	1770
C													(31.2) 37.4			(47.1) 59.3	94.9	126	155	210	289	389	534	745	1060	
D												(20.6) 23.0			(31.6) 36.5	(47.1) 59.3	78.7	96.9	131	180	243	334	465	665		
E											(13.9) 15.0			(21.6) 23.7	(31.6) 36.5	(41.0) 48.4	59.6	80.9	111	150	205	286	409			
F										(8.94) 9.36			(14.0) 14.8	(21.6) 23.7	(28.3) 31.5	(34.4) 38.8	52.6	72.2	97.2	133						
G									(5.81) 5.99			(9.14) 9.49	(14.0) 14.8	(18.4) 19.7	(22.5) 24.2	(30.1) 32.9	45.1	60.8	83.4							
H								(3.68) 3.74			(5.79) 5.93	(9.14) 9.49	(12.1) 12.6	(14.8) 15.5	(19.9) 21.0	(27.0) 28.9	38.9	53.4								
J							(2.37) 2.40			(3.74) 3.79	(5.79) 5.93	(7.66) 7.87	(9.41) 9.69	(12.7) 13.1	(17.3) 18.0	(23.2) 24.3	33.4									
K						1.50			2.37	3.79	5.04	6.20	8.41	11.5	15.6	21.4										
L					.951			1.51	2.37	3.15	3.88	5.26	7.22	9.72	13.3											
M				.599			.949	1.51	2.00	2.46	3.34	4.58	6.17	8.47												
N			.374			.593	.949	1.26	1.55	2.10	2.89	3.89	5.34													
P		.240			.379	.593	.787	.969	1.31	1.80	2.43	3.34														
Q	.150			.237	.379	.504	.620	.841	1.15	1.56	2.14															
R			.151	.237	.315	.388	.526	.722	.972	1.33																

Table XIV–Average Sample Size Tables for ANSI-Z1.4 Scheme Performance (Single Sampling)

A

Table XIV—A Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code A

P_a	Acceptable Quality Levels (normal inspection)													
	6.5	6.5	25	40	65	100	150	250	400	650	1000			
	*	p (in nonconformities per hundred units)												
99.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
95.0	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
90.0	2.1	2.1	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
75.0	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
50.0	2.9	2.9	2.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
25.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
10.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
5.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			
1.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0			

B

Table XIV—B Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code B

P_a	Acceptable Quality Levels (normal inspection)														
	4.0	4.0	15	25	40	65	100	150	250	400	650	1000			
	*	p (in nonconformities per hundred units)													
99.0	2.1	2.1	2.7	2.6	2.5	2.7	2.4	2.7	2.5	2.7	2.4	2.7			
95.0	2.6	2.6	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
90.0	3.1	3.1	3.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
75.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
50.0	4.8	4.8	4.8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
25.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
10.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			
1.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			

C

Table XIV—C Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code C

P_a	Acceptable Quality Levels (normal inspection)													
	2.5	10	2.5	10	15	25	40	65	100	150	250	400	650	
	p (in percent nonconforming)		p (in nonconformities per hundred units)											
99.0	2.4	3.7	2.4	3.6	3.5	4.0	4.2	4.1	4.1	4.2	4.3	4.0	3.4	
95.0	3.6	4.8	3.6	4.8	4.8	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
90.0	4.7	5.4	4.7	5.4	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
75.0	6.5	6.5	6.5	6.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
50.0	7.8	7.7	7.8	7.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
25.0	8.0	8.0	8.0	8.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
10.0	8.0	8.0	8.0	8.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
5.0	8.0	8.0	8.0	8.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
1.0	8.0	8.0	8.0	8.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	

D

Table XIV—D Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code D

P_a	Acceptable Quality Levels (normal inspection)														
	1.5	6.5	10	1.5	6.5	10	15	25	40	65	100	150	250	400	
	p (in percent nonconforming)			p (in nonconformities per hundred units)											
99.0	3.7	5.8	5.3	3.7	5.7	5.1	6.2	6.6	6.6	5.9	5.8	7.0	6.1	5.4	
95.0	5.7	7.7	7.4	5.7	7.6	7.2	7.8	7.9	8.0	7.9	7.9	8.0	8.0	7.9	
90.0	7.4	8.6	7.9	7.4	8.6	7.8	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
75.0	11	11	8.0	11	11	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
50.0	13	13	8.0	13	13	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
25.0	13	13	8.0	13	13	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
10.0	13	13	8.0	13	13	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
5.0	13	13	8.0	13	13	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
1.0	13	13	8.0	13	13	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	

* p (in percent nonconforming)

Table XIV–Average Sample Size Tables for ANSI-Z1.4 Scheme Performance (Single Sampling)

Table XIV—E Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code E

E

Pa	Acceptable Quality Levels (normal inspection)														
	1.0	4.0	6.5	10	1.0	4.0	6.5	10	15	25	40	65	100	150	250
	p (in percent nonconformities)				p (in nonconformities per hundred units)										
99.0	6.0	9.4	8.6	11	6.0	9.3	8.4	10	11	10	9.8	8.9	10	11	8.6
95.0	9.2	12	12	13	9.2	12	12	13	13	13	13	13	13	13	13
90.0	12	14	13	13	12	14	13	13	13	13	13	13	13	13	13
75.0	17	17	13	13	17	17	13	13	13	13	13	13	13	13	13
50.0	19	19	13	13	19	19	13	13	13	13	13	13	13	13	13
25.0	20	20	13	13	20	20	13	13	13	13	13	13	13	13	13
10.0	20	20	13	13	20	20	13	13	13	13	13	13	13	13	13
5.0	20	20	13	13	20	20	13	13	13	13	13	13	13	13	13
1.0	20	20	13	13	20	20	13	13	13	13	13	13	13	13	13

Table XIV—F Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code F

F

Pa	Acceptable Quality Levels (normal inspection)														
	.65	2.5	4.0	6.5	10	.65	2.5	4.0	6.5	10	15	25	40	65	
	p (in perent nonconforming)					p (in nonconformities per hundred units)									
99.0	9.5	14.6	13.4	15.7	17.9	9.5	14.5	13.2	15.3	16.8	17.8	16.2	15.1	15.7	
95.0	14.4	19.1	18.5	19.5	19.0	14.4	19.0	18.3	19.3	19.8	20.0	19.9	19.8	19.9	
90.0	18.6	21.5	19.7	19.9	20.0	18.6	21.5	19.6	19.9	20.0	20.0	20.0	20.0	20.0	
75.0	26.1	26.2	20.0	20.0	20.0	26.0	26.2	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
50.0	31.0	30.9	20.0	20.0	20.0	31.0	30.9	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
25.0	32.0	32.0	20.0	20.0	20.0	32.0	32.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
10.0	32.0	32.0	20.0	20.0	20.0	32.0	32.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
5.0	32.0	32.0	20.0	20.0	20.0	32.0	32.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	
1.0	32.0	32.0	20.0	20.0	20.0	32.0	32.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	

Table XIV—G Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code G

G

Pa	Acceptable Quality Levels (normal inspection)														
	.4	1.5	2.5	4.0	6.5	10	.4	1.5	2.5	4.0	6.5	10	15	25	40
	p (in percent nonconforming)						p (in nonconformities per hundred units)								
99.0	15.5	25.1	21.4	25.0	28.1	28.6	15.5	24.9	21.3	24.6	27.1	27.0	26.8	24.4	26.3
95.0	23.1	31.7	29.5	31.2	31.9	32.0	23.1	31.7	29.4	31.0	31.7	31.8	31.9	31.8	31.9
90.0	29.7	34.6	31.4	31.9	32.0	32.0	29.7	34.6	31.4	31.8	32.0	32.0	32.0	32.0	32.0
75.0	41.1	41.4	32.0	32.0	32.0	32.0	41.1	41.4	32.0	32.0	32.0	32.0	32.0	32.0	32.0
50.0	48.6	48.3	32.0	32.0	32.0	32.0	48.6	48.3	32.0	32.0	32.0	32.0	32.0	32.0	32.0
25.0	50.0	50.0	32.0	32.0	32.0	32.0	50.0	50.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
10.0	50.0	50.0	32.0	32.0	32.0	32.0	50.0	50.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
5.0	50.0	50.0	32.0	32.0	32.0	32.0	50.0	50.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
1.0	50.0	50.0	32.0	32.0	32.0	32.0	50.0	50.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0

Table XIV—H Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code H

H

Pa	Acceptable Quality Levels (normal inspection)															
	.25	1.0	1.5	2.5	4.0	6.5	10	.25	1.0	1.5	2.5	4.0	6.5	10	15	25
	p (in percent nonconforming)							p (in nonconformities per hundred units)								
99.0	23.8	36.3	35.6	40.3	43.1	42.4	43.4	23.8	36.2	35.3	39.8	42.1	40.8	40.5	41.9	42.7
95.0	36.0	47.7	47.8	49.2	49.7	49.8	50.0	36.0	47.6	47.7	49.0	49.6	49.6	49.8	49.9	50.0
90.0	46.5	53.7	49.6	49.9	50.0	50.0	50.0	46.5	53.7	49.6	49.9	49.9	50.0	50.0	50.0	50.0
75.0	65.1	65.6	50.0	50.0	50.0	50.0	50.0	65.1	65.6	50.0	50.0	50.0	50.0	50.0	50.0	50.0
50.0	77.6	77.1	50.0	50.0	50.0	50.0	50.0	77.6	77.2	50.0	50.0	50.0	50.0	50.0	50.0	50.0
25.0	79.9	79.9	50.0	50.0	50.0	50.0	50.0	79.9	79.9	50.0	50.0	50.0	50.0	50.0	50.0	50.0
10.0	80.0	80.0	50.0	50.0	50.0	50.0	50.0	80.0	80.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
5.0	80.0	80.0	50.0	50.0	50.0	50.0	50.0	80.0	80.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
1.0	80.0	80.0	50.0	50.0	50.0	50.0	50.0	80.0	80.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

* p (in percent nonconforming)

Table XIV–Average Sample Size Tables for ANSI-Z1.4 Scheme Performance (Single Sampling)

J

Table XIV—J Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code J

P_a	Acceptable Quality Levels (normal inspection)																
	.15	.65	1.0	1.5	2.5	4.0	6.5	10	.15	.65	1.0	1.5	2.5	4.0	6.5	10	15
	p (in percent nonconforming)								p (in nonconformities per hundred units)								
99.0	38.3	58.0	52.9	64.2	68.3	68.7	64.2	64.7	38.3	57.9	52.8	63.7	67.3	67.1	61.7	60.5	73.5
95.0	57.5	76.2	73.4	78.6	79.5	79.7	79.6	79.8	57.5	76.1	73.2	78.5	79.3	79.6	79.3	79.3	80.0
90.0	74.0	85.5	78.5	79.8	79.9	80.0	80.0	80.0	74.0	85.4	78.4	79.8	79.9	80.0	80.0	80.0	80.0
75.0	103	103	80.0	80.0	80.0	80.0	80.0	80.0	103	103	80.0	80.0	80.0	80.0	80.0	80.0	80.0
50.0	121	121	80.0	80.0	80.0	80.0	80.0	80.0	121	121	80.0	80.0	80.0	80.0	80.0	80.0	80.0
25.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	80.0
10.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	80.0
5.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	80.0
1.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	125	125	80.0	80.0	80.0	80.0	80.0	80.0	80.0

K

Table XIV—K Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code K

P_a	Acceptable Quality Levels (normal inspection)														
	.10	.40	.65	1.0	1.5	2.5	4.0	6.5	10						
	p (in nonconformities per hundred units)														
99.0	59.6	90.5	82.4	99.6	109	105	101	92.6	107						
95.0	90.1	119	114	123	124	124	124	124	125						
90.0	116	134	123	125	125	125	125	125	125						
75.0	163	164	125	125	125	125	125	125	125						
50.0	194	193	125	125	125	125	125	125	125						
25.0	200	200	125	125	125	125	125	125	125						
10.0	200	200	125	125	125	125	125	125	125						
5.0	200	200	125	125	125	125	125	125	125						
1.0	200	200	125	125	125	125	125	125	125						

L

Table XIV—L Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code L

P_a	Acceptable Quality Levels (normal inspection)														
	.065	.25	.40	.65	1.0	1.5	2.5	4.0	6.5						
	p (in nonconformities per hundred units)														
99.0	95.6	145	132	153	168	178	162	151	157						
95.0	144	190	183	193	198	200	199	198	199						
90.0	185	214	196	199	200	200	200	200	200						
75.0	258	260	200	200	200	200	200	200	200						
50.0	306	304	200	200	200	200	200	200	200						
25.0	315	315	200	200	200	200	200	200	200						
10.0	315	315	200	200	200	200	200	200	200						
5.0	315	315	200	200	200	200	200	200	200						
1.0	315	315	200	200	200	200	200	200	200						

M

Table XIV—M Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code M

P_a	Acceptable Quality Levels (normal inspection)														
	.04	.15	.25	.40	.65	1.0	1.5	2.5	4.0						
	p (in nonconformities per hundred units)														
99.0	149	244	207	240	264	263	268	242	263						
95.0	226	312	288	304	312	313	314	313	315						
90.0	292	342	309	313	315	315	315	315	315						
75.0	408	411	315	315	315	315	315	315	315						
50.0	485	483	315	315	315	315	315	315	315						
25.0	500	499	315	315	315	315	315	315	315						
10.0	500	500	315	315	315	315	315	315	315						
5.0	500	500	315	315	315	315	315	315	315						
1.0	500	500	315	315	315	315	315	315	315						

Table XIV–Average Sample Size Tables for ANSI-Z1.4 Scheme Performance (Single Sampling)

Table XIV—N Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code N

P_a	Acceptable Quality Levels (normal inspection)														
	.025	.10	.15	.25	.40	.65	1.0	1.5	2.5						
	p (in nonconformities per hundred units)														
99.0	238	362	353	398	421	407	405	419	427						
95.0	360	476	477	490	496	496	498	499	499						
90.0	465	537	496	499	499	500	500	500	500						
75.0	651	656	500	500	500	500	500	500	500						
50.0	776	772	500	500	500	500	500	500	500						
25.0	799	799	500	500	500	500	500	500	500						
10.0	800	800	500	500	500	500	500	500	500						
5.0	800	800	500	500	500	500	500	500	500						
1.0	800	800	500	500	500	500	500	500	500						

Table XIV—P Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code P

P_a	Acceptable Quality Levels (normal inspection)														
	.015	.065	.10	.15	.25	.40	.65	1.0	1.5						
	p (in nonconformities per hundred units)														
99.0	378	576	523	634	670	667	610	598	730						
95.0	572	759	730	784	793	795	792	793	800						
90.0	738	854	784	798	799	800	800	800	800						
75.0	1027	1035	800	800	800	800	800	800	800						
50.0	1214	1208	800	800	800	800	800	800	800						
25.0	1249	1249	800	800	800	800	800	800	800						
10.0	1250	1250	800	800	800	800	800	800	800						
5.0	1250	1250	800	800	800	800	800	800	800						
1.0	1250	1250	800	800	800	800	800	800	800						

Table XIV—Q Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code Q

P_a	Acceptable Quality Levels (normal inspection)														
	.01	.04	.065	.10	.15	.25	.40	.65	1.0						
	p (in nonconformities per hundred units)														
99.0	596	905	824	996	1090	1050	1010	926	1070						
95.0	901	1190	1140	1230	1240	1240	1250	1240	1250						
90.0	1160	1340	1230	1250	1250	1250	1250	1250	1250						
75.0	1630	1640	1250	1250	1250	1250	1250	1250	1250						
50.0	1940	1930	1250	1250	1250	1250	1250	1250	1250						
25.0	2000	2000	1250	1250	1250	1250	1250	1250	1250						
10.0	2000	2000	1250	1250	1250	1250	1250	1250	1250						
5.0	2000	2000	1250	1250	1250	1250	1250	1250	1250						
1.0	2000	2000	1250	1250	1250	1250	1250	1250	1250						

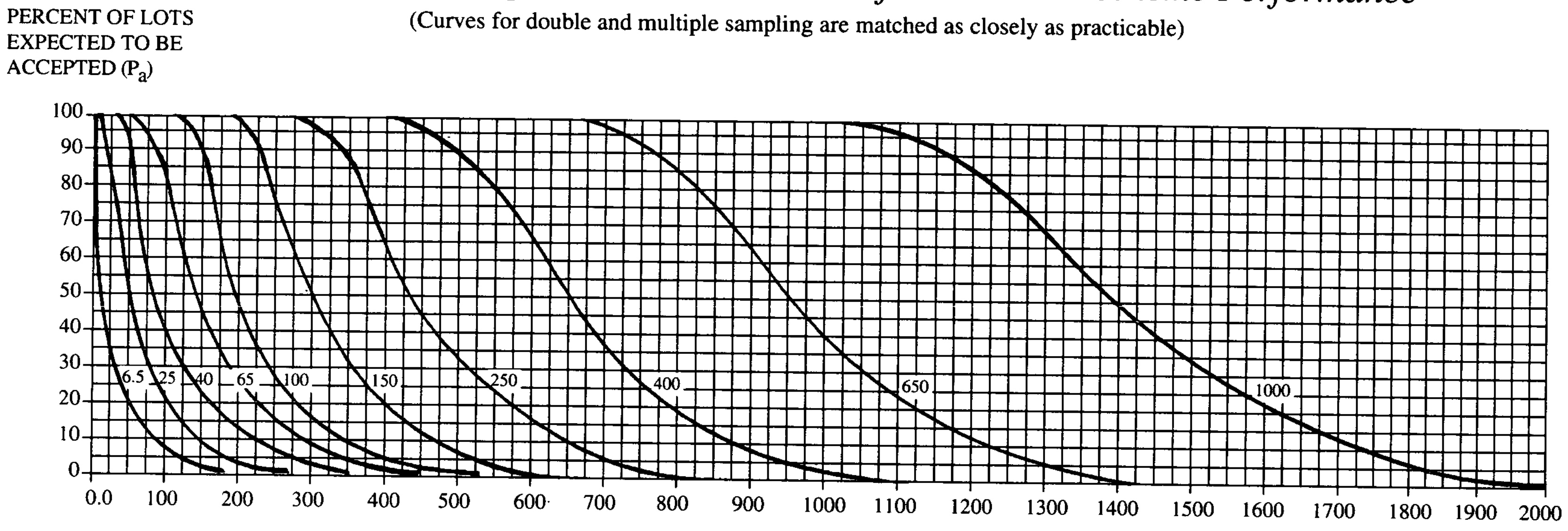
Table XIV—R Tabulated Values for Average Sample Size for ANSI-Z1.4 Scheme Performance Code R

P_a	Acceptable Quality Levels (normal inspection)														
	.025	.040	.065	.10	.15	.25	.40	.65							
	p (in nonconformities per hundred units)														
99.0	1450	1320	1530	1680	1780	1620	1510	1570							
95.0	1900	1830	1930	1980	2000	1990	1980	1990							
90.0	2140	1960	1990	2000	2000	2000	2000	2000							
75.0	2600	2000	2000	2000	2000	2000	2000	2000							
50.0	3040	2000	2000	2000	2000	2000	2000	2000							
25.0	3150	2000	2000	2000	2000	2000	2000	2000							
10.0	3150	2000	2000	2000	2000	2000	2000	2000							
5.0	3150	2000	2000	2000	2000	2000	2000	2000							
1.0	3150	2000	2000	2000	2000	2000	2000	2000							

Scheme Performance with Switching Rules

Chart XV-A Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

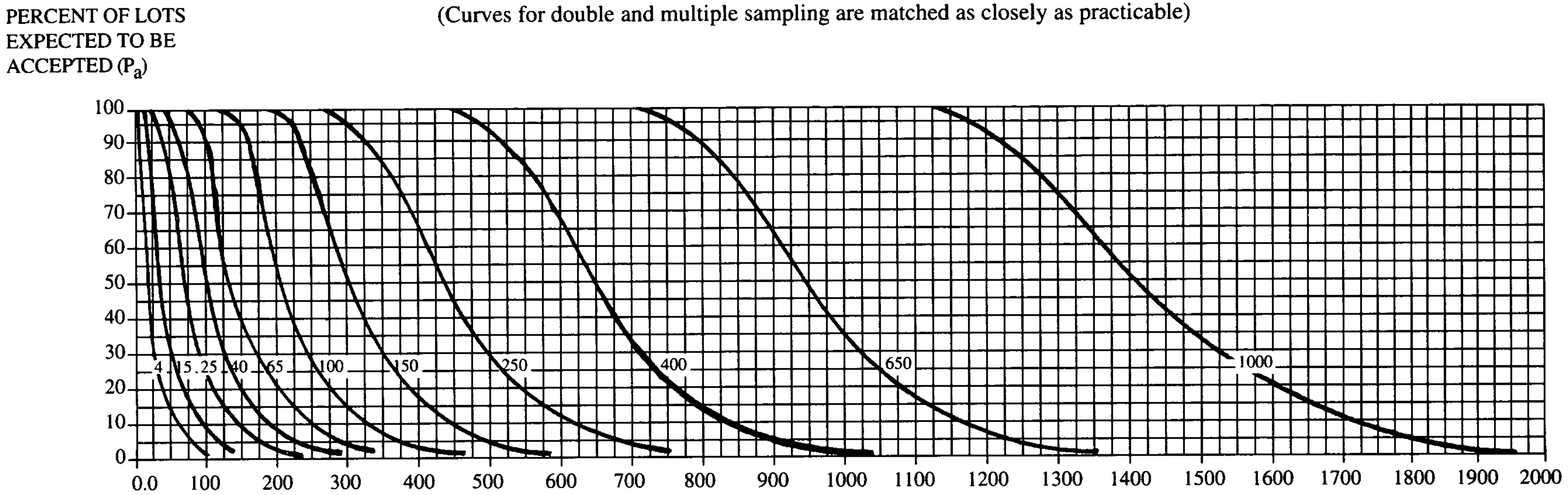
TABLE XV-A-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	6.5	6.5	25	40	65	100	150	250	400	650	1000				
	p (in percent nonconforming)	p (in nonconformities per hundred units)													
99.0	0.501	0.502	7.43	21.8	41.2	89.1	145	239	374	628	977				
95.0	2.50	2.53	17.5	38.7	66.1	123	192	302	456	734	1110				
90.0	4.84	4.96	24.6	47.9	79.9	138	214	333	497	783	1180				
75.0	10.8	11.4	38.0	63.7	103	162	248	380	560	855	1270				
50.0	21.2	23.8	57.8	88.5	138	195	294	443	642	948	1400				
25.0	37.0	46.3	89.9	135	196	256	372	540	761	1090	1570				
10.0	53.6	76.7	130	194	266	334	464	650	889	1240	1750				
5.0	63.2	99.8	158	237	315	388	526	722	972	1340	1860				
1.0	78.4	154	221	332	420	502	655	871	1140	1530	2090				

Scheme Performance with Switching Rules

Chart XV-B Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

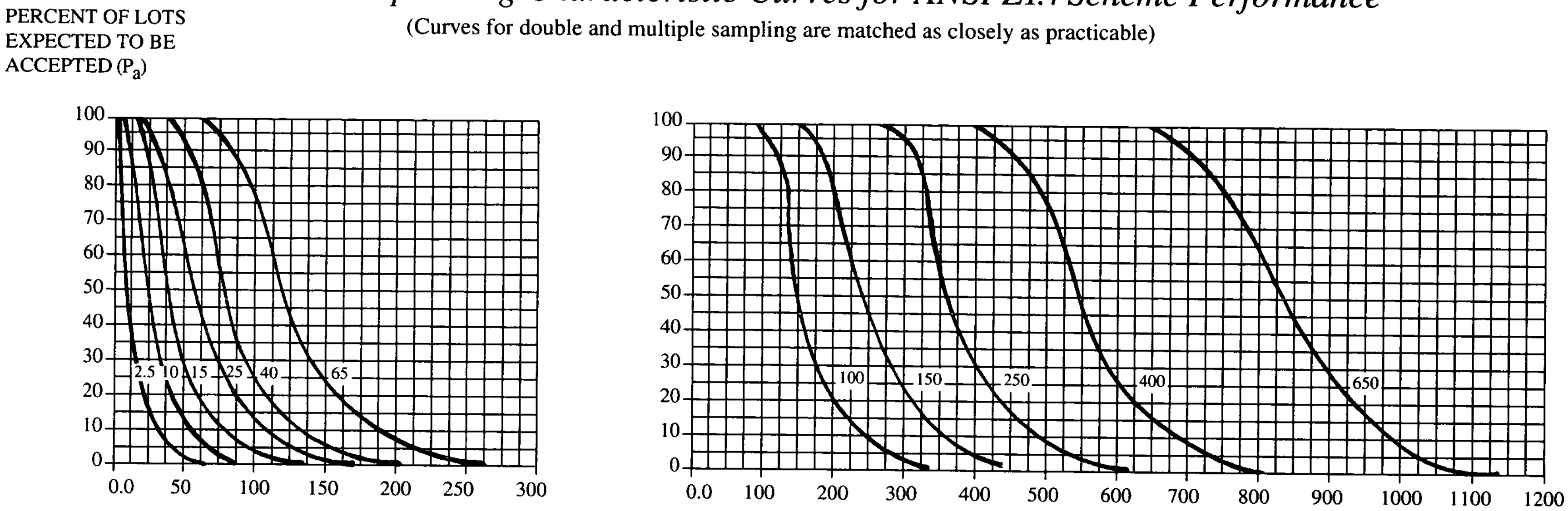
TABLE XV-B-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	4.0	4.0	15	25	40	65	100	150	250	400	650	1000			
	p (in percent nonconforming)	p (in nonconformities per hundred units)													
99.0	0.467	0.468	5.46	16.2	31.4	60.2	92.5	154	244	401	637	1010			
95.0	1.96	1.98	11.6	25.8	44.4	81.9	128	201	304	489	742	1150			
90.0	3.40	3.46	15.9	31.9	53.3	92.2	143	222	332	522	785	1200			
75.0	6.94	7.19	23.8	42.4	68.8	108	165	253	373	570	850	1290			
50.0	13.4	14.4	35.1	59.0	92.0	130	196	295	428	632	931	1400			
25.0	24.2	27.8	53.9	89.9	131	171	248	360	507	725	1050	1540			
10.0	36.9	46.0	77.8	130	177	223	309	433	593	825	1170	1680			
5.0	45.1	59.9	94.9	158	210	258	350	481	648	890	1240	1770			
1.0	60.2	92.2	133	221	280	335	437	581	761	1020	1390	1950			

Scheme Performance with Switching Rules

Chart XV-C Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

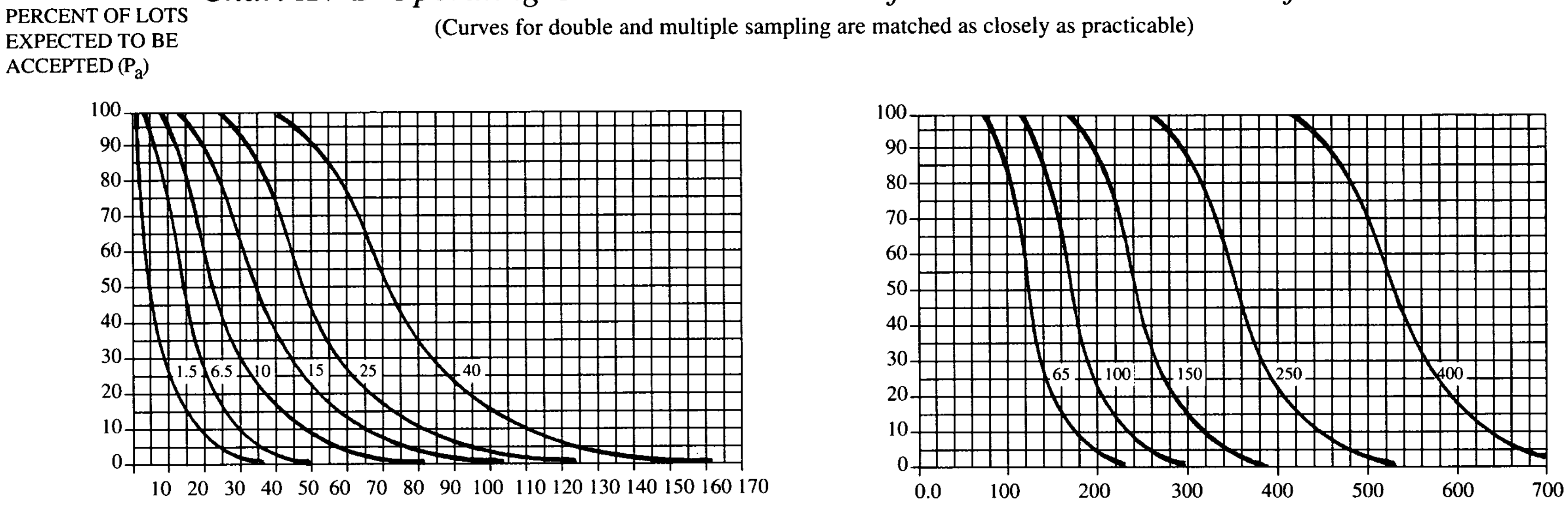
TABLE XV-C-1— TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	2.5	10	2.5	10	15	25	40	65	100	150	250	400	650		
	p (in percent nonconforming)		p (in nonconformities per hundred units)												
99.0	0.416	4.16	0.416	3.83	10.8	18.4	37.7	61.3	100	154	256	399	640		
95.0	1.42	7.73	1.43	7.29	15.7	26.6	49.2	76.9	121	183	294	445	689		
90.0	2.26	10.2	2.29	9.79	19.2	32.0	55.3	85.7	133	199	313	471	722		
75.0	4.36	14.7	4.46	14.6	25.5	41.3	64.7	99.0	152	224	342	510	774		
50.0	8.58	20.9	8.98	21.8	35.4	55.2	77.8	117	177	257	379	559	838		
25.0	15.9	30.3	17.3	33.07	53.9	78.5	102	149	216	304	435	627	924		
10.0	25.0	40.6	28.8	48.6	77.8	106	134	185	260	356	495	699	1010		
5.0	31.2	47.1	37.4	59.3	94.9	126	155	210	289	389	534	745	1060		
1.0	43.7	58.9	57.6	83.0	133	168	201	262	348	457	612	835	1170		

Scheme Performance with Switching Rules

Chart XV-D Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

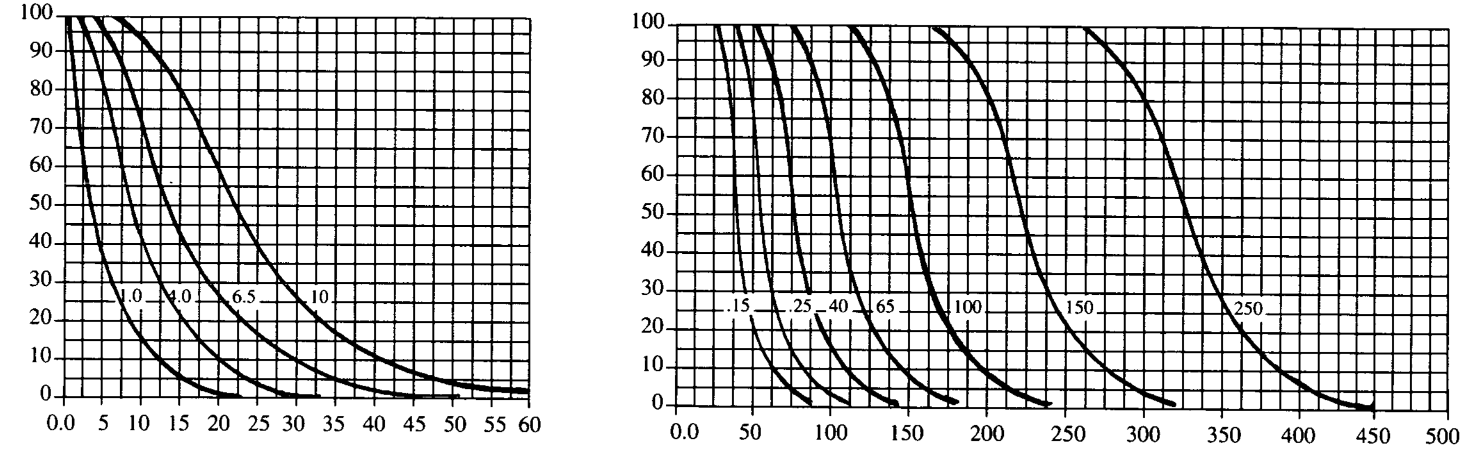
TABLE XV-D-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	1.5	6.5	10	1.5	6.5	10	15	25	40	65	100	150	250	400	
	p (in percent nonconforming)			p (in nonconformities per hundred units)											
99.0	0.272	2.55	7.86	0.273	2.43	7.20	11.6	23.7	38.3	64.1	99.7	160	252	403	
95.0	0.911	4.73	10.7	0.915	4.57	10.1	16.6	30.8	48.0	75.7	114	184	278	431	
90.0	1.43	6.26	12.7	1.44	6.10	12.1	20.0	34.6	53.5	83.2	124	196	294	451	
75.0	2.73	9.10	16.2	2.77	9.07	15.9	25.8	40.4	61.9	95.0	140	214	319	484	
50.0	5.38	13.1	21.3	5.53	13.5	22.1	34.5	48.6	73.4	111	161	237	349	524	
25.0	10.1	19.4	30.3	10.7	20.7	33.7	49.0	64.0	92.9	135	190	272	392	577	
10.0	16.2	26.8	40.6	17.7	29.9	48.6	66.5	83.5	116	162	222	309	437	631	
5.0	20.6	31.6	47.1	23.0	36.5	59.3	78.7	96.9	131	180	243	334	465	665	
1.0	29.8	41.3	58.9	35.5	51.1	83.0	105	126	164	218	285	382	522	732	

Scheme Performance with Switching Rules

Chart XV-E Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

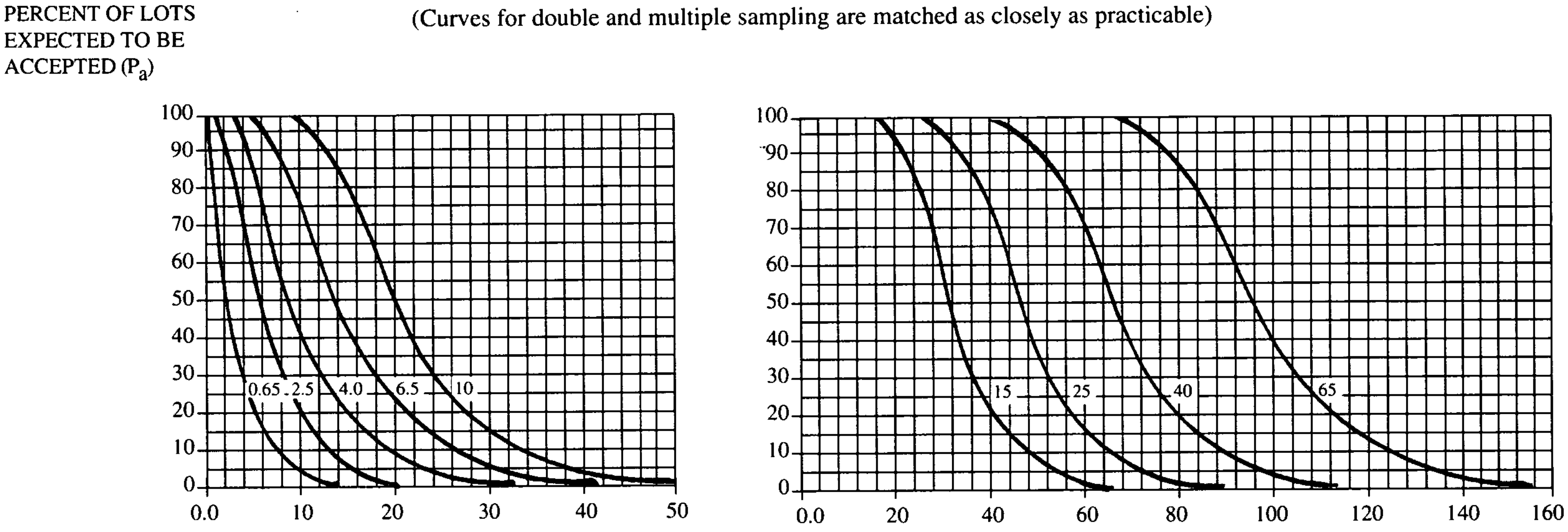
TABLE XV-E-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P$_a$	Acceptable Quality Levels (normal inspection)														
	1.0	4.0	6.5	10	1.0	4.0	6.5	10	15	25	40	65	100	150	250
	p (in percent nonconforming)			p (in nonconformities per hundred units)											
99.0	0.165	1.53	4.64	7.62	0.165	1.48	4.41	7.13	14.4	23.7	39.3	62.2	100	153	248
95.0	0.558	2.88	6.42	10.9	0.560	2.82	6.19	10.2	18.9	29.6	46.6	70.6	113	171	265
90.0	0.889	3.86	7.64	12.9	0.893	3.80	7.42	12.3	21.3	32.9	51.2	76.5	120	181	278
75.0	1.74	5.77	9.88	16.2	1.75	5.76	9.80	15.9	24.9	38.1	58.4	86.2	132	196	298
50.0	3.51	8.55	13.3	20.7	3.58	8.70	13.6	21.2	29.9	45.2	68.1	98.8	146	215	322
25.0	6.70	12.9	19.4	28.0	6.94	13.5	20.7	30.2	39.4	57.2	83.1	117	167	241	355
10.0	10.9	18.1	26.8	36.0	11.5	19.4	29.9	40.9	51.4	71.3	100	137	190	269	388
5.0	13.9	21.6	31.6	41.0	15.0	23.7	36.5	48.4	59.6	80.9	111	150	205	286	409
1.0	20.6	28.9	41.3	50.6	23.1	33.2	51.1	64.7	77.3	101	134	176	235	321	450

Scheme Performance with Switching Rules

Chart XV-F Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

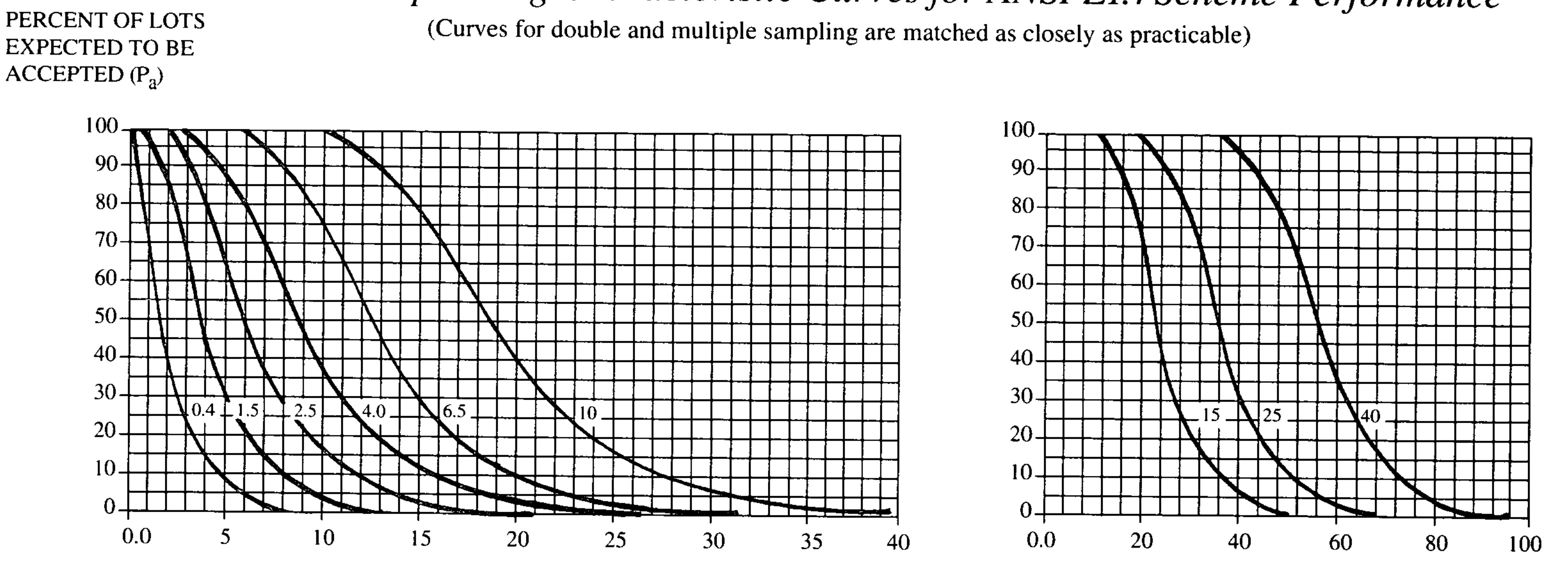
TABLE XV-F-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	.65	2.5	4.0	6.5	10	.65	2.5	4.0	6.5	10	15	25	40	65	
	p (in percent nonconforming)					p (in nonconformities per hundred units)									
99.0	0.104	.978	2.94	4.93	10.1	0.104	.958	2.84	4.72	9.41	15.0	25.0	39.5	64.9	
95.0	0.357	1.85	4.11	6.94	13.0	0.358	1.82	4.02	6.69	12.3	19.2	30.2	45.7	73.4	
90.0	0.571	2.47	4.91	8.24	14.4	0.572	2.45	4.82	8.00	13.8	21.4	33.3	49.7	78.3	
75.0	1.11	3.66	6.40	10.4	16.5	1.11	3.66	6.37	10.3	16.2	24.8	38.0	56.0	85.5	
50.0	2.22	5.40	8.71	13.6	19.2	2.24	5.46	8.85	13.8	19.5	29.4	44.3	64.2	94.8	
25.0	4.24	8.21	12.9	18.7	24.3	4.34	8.43	13.5	19.6	25.6	37.2	54.0	76.1	109	
10.0	6.94	11.6	18.1	24.5	30.4	7.19	12.2	19.4	26.6	33.4	46.4	65.0	88.9	124	
5.0	8.94	14.0	21.6	28.3	34.4	9.36	14.8	23.7	31.5	38.8	52.6	72.2	97.2	133	
1.0	13.4	19.0	28.9	35.8	42.1	14.4	20.7	33.2	42.0	50.2	65.5	87.1	114	153	

Scheme Performance with Switching Rules

Chart XV-G Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection)

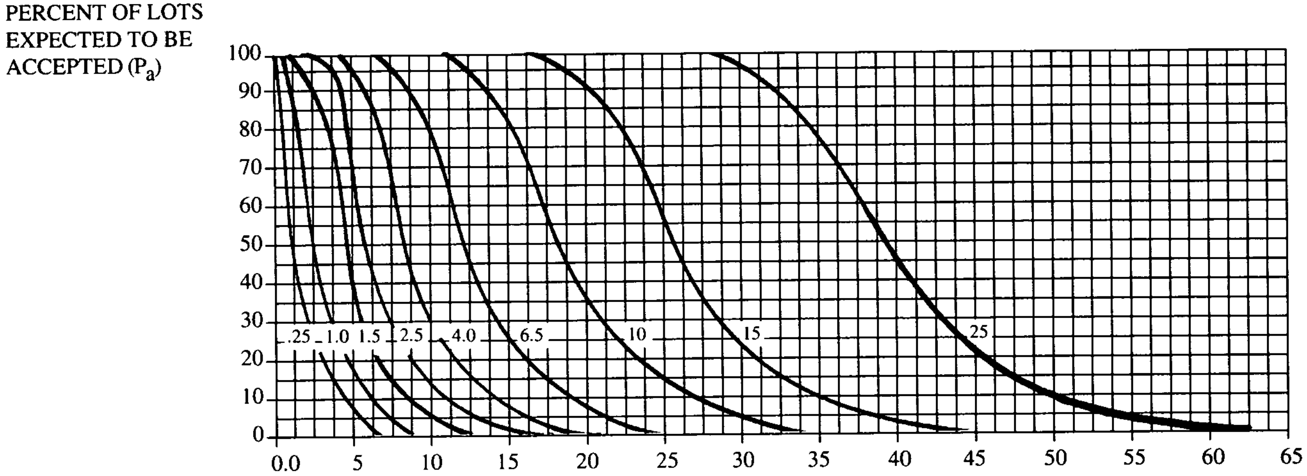
TABLE XV-G-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	.4	1.5	2.5	4.0	6.5	10	.4	1.5	2.5	4.0	6.5	10	15	25	40
	p (in percent nonconforming)						p (in nonconformities per hundred units)								
99.0	0.0643	0.571	1.80	3.02	6.12	10.0	0.0643	.564	1.77	2.95	5.88	9.49	15.5	24.6	40.3
95.0	0.223	1.12	2.54	4.28	7.96	12.6	0.223	1.11	2.51	4.18	7.69	12.0	18.9	28.6	45.9
90.0	0.357	1.53	3.05	5.09	8.87	13.9	0.358	1.52	3.01	5.00	8.64	13.4	20.8	31.1	48.9
75.0	0.703	2.32	3.99	6.49	10.2	15.7	0.706	2.32	3.98	6.45	10.1	15.5	23.7	35.0	53.4
50.0	1.42	3.46	5.48	8.54	12.1	18.2	1.43	3.48	5.53	8.63	12.2	18.3	27.7	40.1	59.2
25.0	2.74	5.30	8.21	11.9	15.5	22.3	2.78	5.39	8.43	12.3	16.0	23.2	33.8	47.6	67.9
10.0	4.50	7.56	11.6	15.8	19.7	27.1	4.60	7.78	12.2	16.6	20.9	29.0	40.6	55.6	77.4
5.0	5.81	9.14	14.0	18.4	22.5	30.1	5.99	9.49	14.8	19.7	24.2	32.9	45.1	60.8	83.4
1.0	8.80	12.5	19.0	23.8	28.1	36.0	9.22	13.3	20.7	26.3	31.4	41.0	54.4	71.4	95.6

Scheme Performance with Switching Rules

Chart XV-H Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

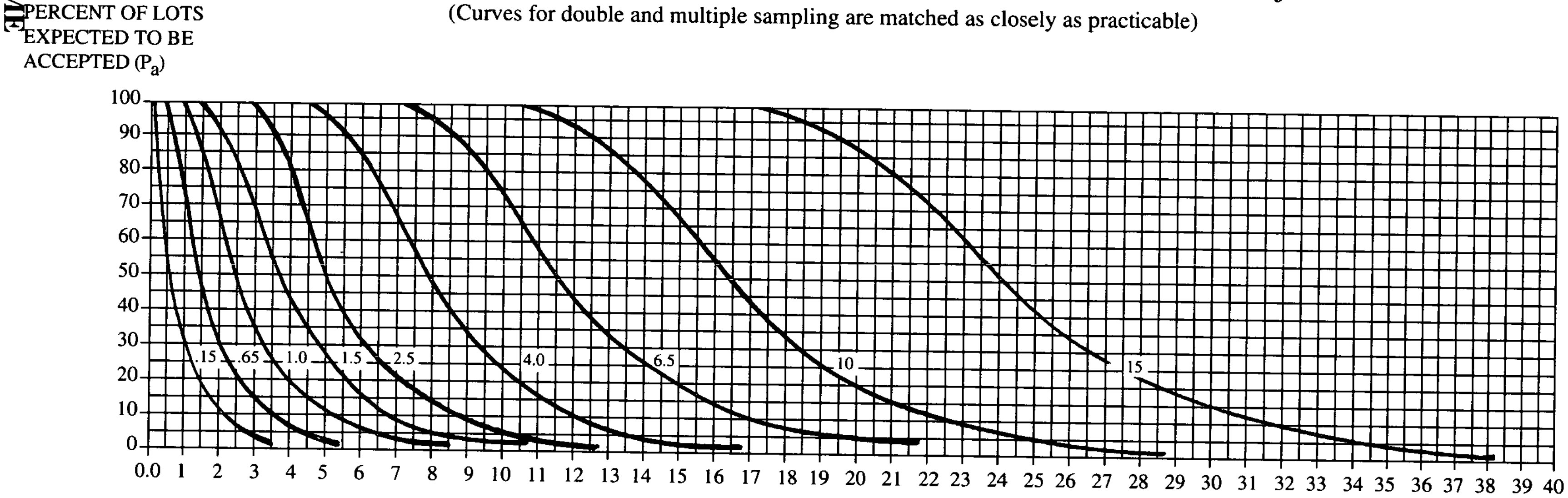
TABLE XV-H-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)															
	.25	1.0	1.5	2.5	4.0	6.5	10	.25	1.0	1.5	2.5	4.0	6.5	10	15	25
	p (in percent nonconforming)							p (in nonconformities per hundred units)								
99.0	0.0416	0.386	1.09	1.87	3.86	6.33	10.4	0.0416	0.383	1.08	1.84	3.77	6.14	10.0	15.4	25.6
95.0	0.143	0.733	1.59	2.70	5.03	7.92	12.6	0.143	0.729	1.57	2.66	4.92	7.69	12.1	18.3	29.4
90.0	0.229	0.983	1.93	3.23	5.62	8.76	13.7	0.229	0.979	1.92	3.20	5.53	8.57	13.3	19.9	31.3
75.0	0.445	1.46	2.55	4.15	6.52	10.0	15.4	0.446	1.46	2.55	4.13	6.47	9.90	15.2	22.4	34.2
50.0	0.893	2.17	3.52	5.49	7.74	11.7	17.6	0.898	2.18	3.54	5.52	7.78	11.7	17.7	25.7	37.9
25.0	1.72	3.34	5.30	7.70	10.0	14.5	21.0	1.73	3.37	5.39	7.85	10.2	14.9	21.6	30.4	43.5
10.0	2.84	4.77	7.56	10.3	12.9	17.8	24.7	2.88	4.86	7.78	10.6	13.4	18.5	26.0	35.6	49.5
5.0	3.68	5.79	9.14	12.1	14.8	19.9	27.0	3.74	5.93	9.49	12.6	15.5	21.0	28.9	38.9	53.4
1.0	5.59	8.01	12.5	15.8	18.7	24.1	31.6	5.76	8.30	13.3	16.8	20.1	26.2	34.8	45.7	61.2

Scheme Performance with Switching Rules

Chart XV-J Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

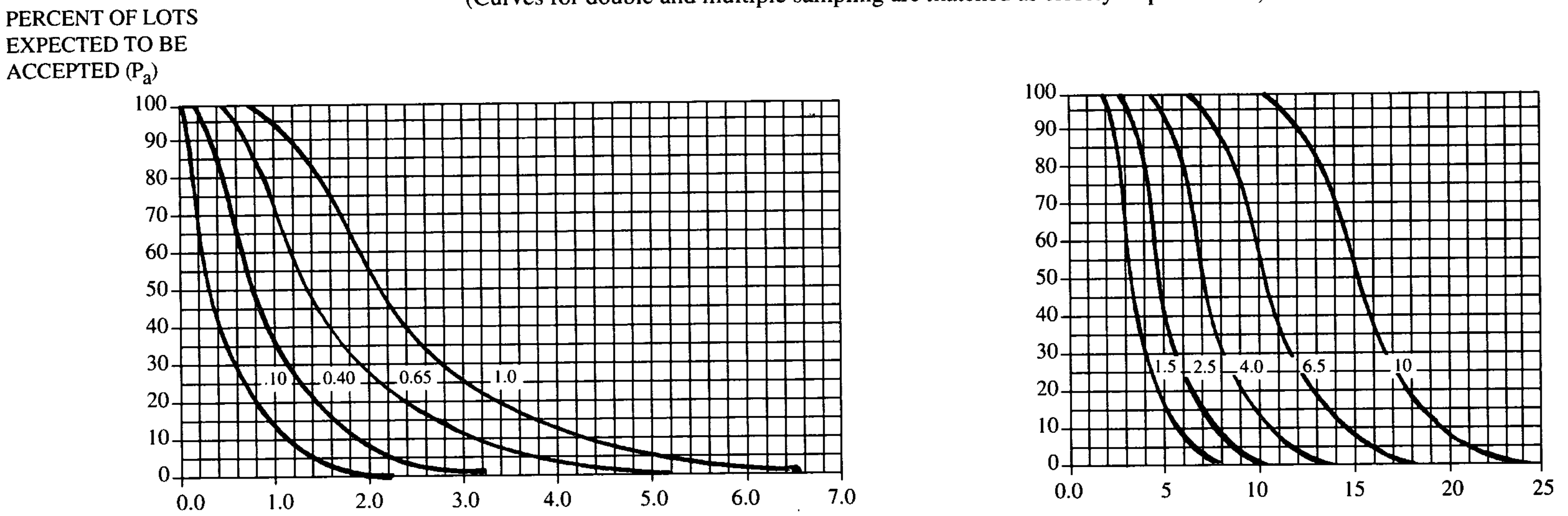
TABLE XV-J-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)																
	.15	.65	1.0	1.5	2.5	4.0	6.5	10	.15	.65	1.0	1.5	2.5	4.0	6.5	10	15
	p (in percent nonconforming)								p (in nonconformities per hundred units)								
99.0	0.0260	0.240	0.715	1.16	2.39	3.88	6.49	10.2	0.0260	0.239	0.710	1.15	2.35	3.80	6.35	9.87	15.9
95.0	0.0896	0.458	1.01	1.68	3.12	4.89	7.74	11.8	0.0897	0.457	1.00	1.66	3.08	4.80	7.56	11.4	18.4
90.0	0.144	0.617	1.21	2.01	3.49	5.43	8.48	12.7	0.144	0.615	1.20	2.00	3.46	5.35	8.32	12.4	19.6
75.0	0.282	0.928	1.59	2.59	4.06	6.23	9.58	14.2	0.282	0.928	1.59	2.58	4.04	6.19	9.50	14.0	21.4
50.0	0.571	1.39	2.20	3.44	4.85	7.31	11.0	16.0	0.573	1.39	2.21	3.45	4.86	7.34	11.1	16.1	23.7
25.0	1.10	2.14	3.34	4.85	6.32	9.15	13.3	18.6	1.11	2.16	3.37	4.90	6.40	9.29	13.5	19.0	27.2
10.0	1.83	3.08	4.77	6.52	8.16	11.3	15.7	21.4	1.84	3.11	4.86	6.65	8.35	11.6	16.2	22.2	30.9
5.0	2.37	3.74	5.79	7.66	9.41	12.7	17.3	23.2	2.40	3.79	5.93	7.87	9.69	13.1	18.0	24.3	33.4
1.0	3.62	5.19	8.01	10.1	12.0	15.6	20.5	26.6	3.69	5.31	8.30	10.5	12.6	16.4	21.8	28.5	38.2

Scheme Performance with Switching Rules

Chart XV-K Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

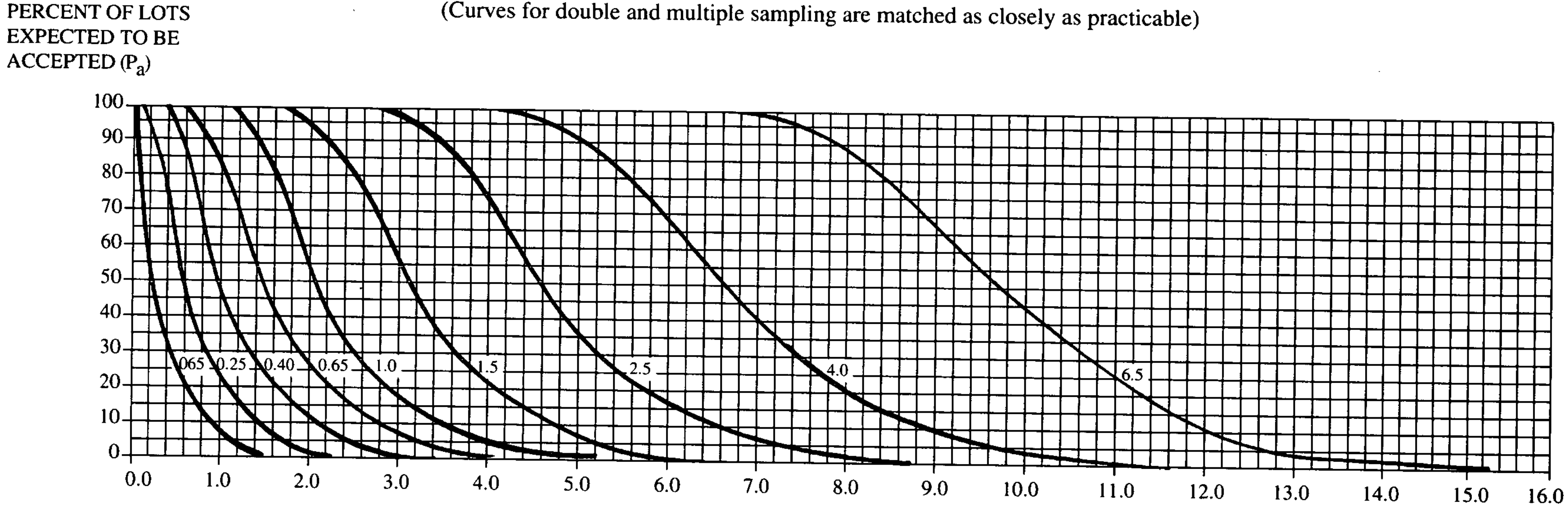
TABLE XV-K-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	.10	.40	.65	1.0	1.5	2.5	4.0	6.5	10						
	p (in percent nonconforming or nonconformities per hundred units)														
99.0	0.0167	0.153	0.455	0.738	1.49	2.43	4.01	6.34	10.3						
95.0	0.0573	0.292	0.643	1.06	1.97	3.07	4.84	7.32	11.7						
90.0	0.0916	0.392	0.771	1.28	2.21	3.43	5.33	7.96	12.5						
75.0	0.178	0.586	1.02	1.65	2.59	3.96	6.08	8.96	13.7						
50.0	0.359	0.873	1.42	2.21	3.11	4.70	7.08	10.3	15.2						
25.0	0.694	1.35	2.16	3.14	4.10	5.94	8.65	12.2	17.4						
10.0	1.15	1.94	3.11	4.26	5.34	7.42	10.4	14.2	19.8						
5.0	1.50	2.37	3.79	5.04	6.20	8.41	11.5	15.6	21.4						
1.0	2.31	3.32	5.31	6.73	8.04	10.5	13.9	18.3	24.5						

Scheme Performance with Switching Rules

Chart XV-L Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

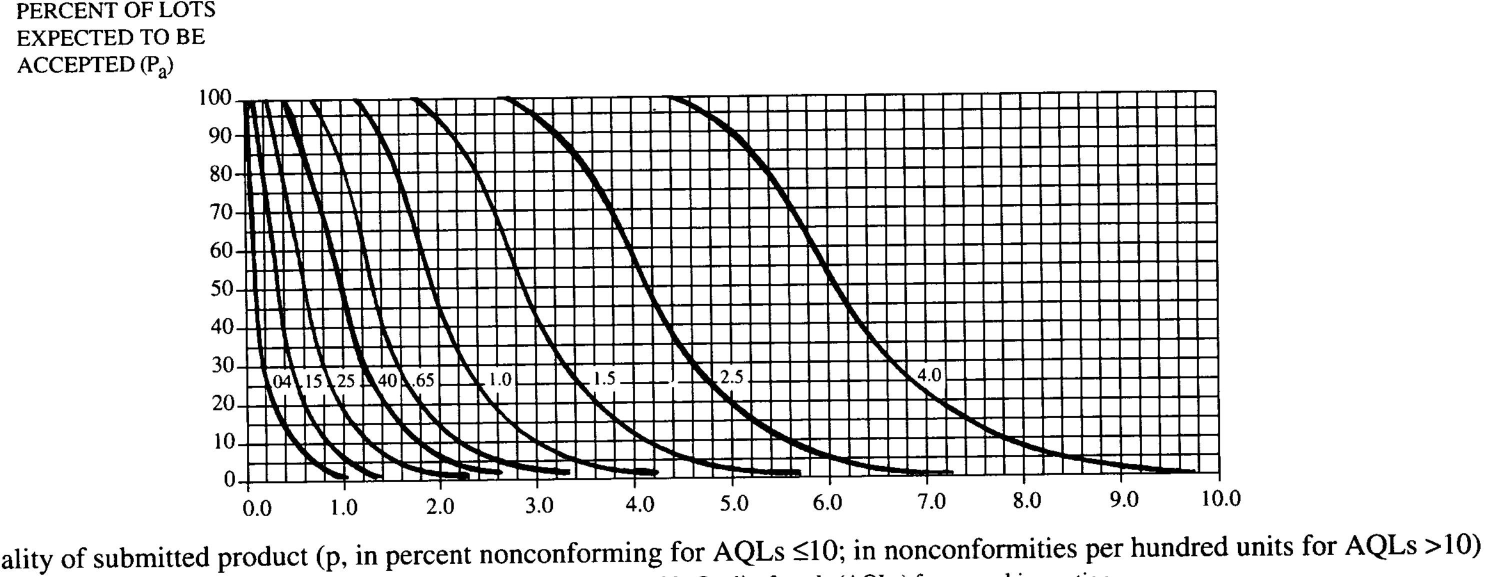
TABLE XV-L-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR SINGLE SAMPLING PLANS

P_a	Acceptable Quality Levels (normal inspection)													
	.065	.25	.40	.65	1.0	1.5	2.5	4.0	6.5					
	p (in percent nonconforming or nonconformities per hundred units)													
99.0	0.0104	0.0957	0.284	0.472	0.941	1.50	2.50	3.95	6.49					
95.0	0.0358	0.183	0.402	0.669	1.23	1.92	3.02	4.57	7.34					
90.0	0.0574	0.246	0.482	0.800	1.38	2.14	3.33	4.97	7.83					
75.0	0.112	0.369	0.637	1.03	1.62	2.48	3.80	5.60	8.55					
50.0	0.228	0.554	0.885	1.38	1.95	2.94	4.43	6.42	9.48					
25.0	0.441	0.856	1.35	1.96	2.56	3.72	5.40	7.61	10.9					
10.0	0.731	1.23	1.94	2.66	3.34	4.64	6.50	8.89	12.4					
5.0	0.951	1.51	2.37	3.15	3.88	5.26	7.22	9.72	13.3					
1.0	1.46	2.11	3.32	4.20	5.02	6.55	8.71	11.4	15.3					

Scheme Performance with Switching Rules

Chart XV-M Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

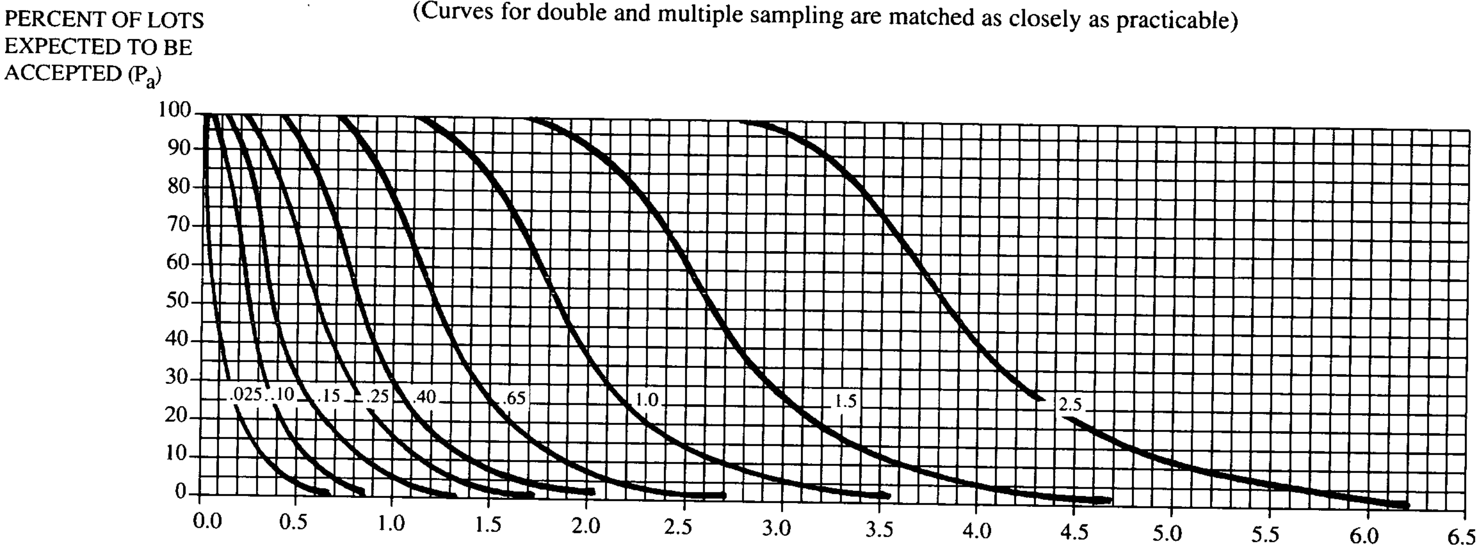
TABLE XV-M-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)													
	.04	.15	.25	.40	.65	1.0	1.5	2.5	4.0					
	p (in percent nonconforming or nonconformities per hundred units)													
99.0	0.00665	0.0574	0.181	0.300	0.598	0.967	1.57	2.50	4.08					
95.0	0.0228	0.113	0.255	0.425	0.781	1.22	1.92	2.90	4.66					
90.0	0.0364	0.154	0.306	0.508	0.878	1.36	2.11	3.16	4.97					
75.0	0.0711	0.233	0.404	0.655	1.03	1.57	2.41	3.56	5.43					
50.0	0.143	0.349	0.562	0.876	1.23	1.86	2.81	4.08	6.02					
25.0	0.278	0.539	0.856	1.25	1.63	2.36	3.43	4.83	6.90					
10.0	0.460	0.778	1.23	1.69	2.12	2.94	4.13	5.64	7.86					
5.0	0.599	0.949	1.51	2.00	2.46	3.34	4.58	6.17	8.47					
1.0	0.922	1.33	2.11	2.67	3.19	4.16	5.53	7.25	9.71					

Scheme Performance with Switching Rules

Chart XV-N Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Quality of submitted product (p, in percent nonconforming for AQLs ≤10; in nonconformities per hundred units for AQLs >10)

Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

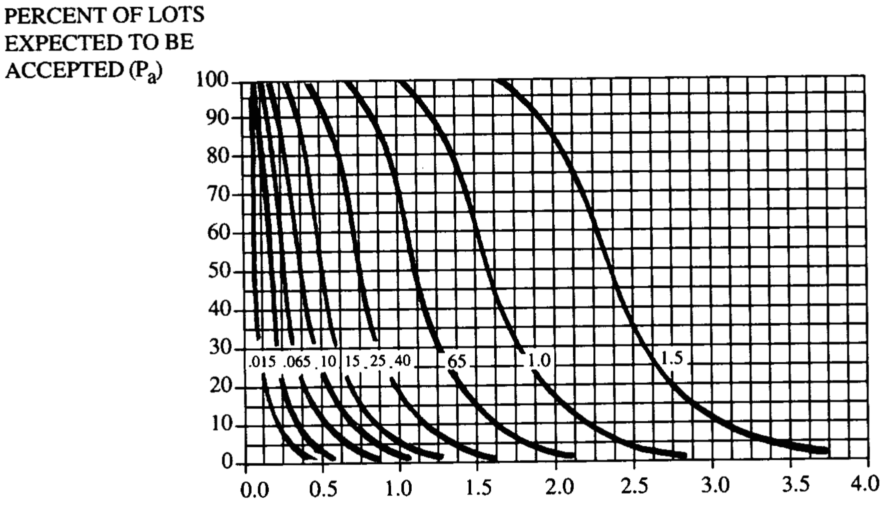
TABLE XV-N-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	.025	.10	.15	.25	.40	.65	1.0	1.5	2.5						
	p (in percent nonconforming or nonconformities per hundred units)														
99.0	0.00416	0.0383	0.108	0.184	0.377	0.613	1.00	1.54	2.56						
95.0	0.0143	0.0729	0.157	0.266	0.492	0.769	1.21	1.83	2.94						
90.0	0.0229	0.0979	0.192	0.320	0.553	0.857	1.33	1.99	3.13						
75.0	0.0446	0.146	0.255	0.413	0.647	0.990	1.52	2.24	3.42						
50.0	0.0898	0.218	0.354	0.552	0.778	1.17	1.77	2.57	3.79						
25.0	0.174	0.337	0.539	0.785	1.02	1.49	2.16	3.04	4.35						
10.0	0.288	0.486	0.778	1.06	1.34	1.85	2.60	3.56	4.95						
5.0	0.374	0.593	0.949	1.26	1.55	2.10	2.89	3.89	5.34						
1.0	0.576	0.830	1.33	1.68	2.01	2.62	3.48	4.57	6.12						

Scheme Performance with Switching Rules

Chart XV-P Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

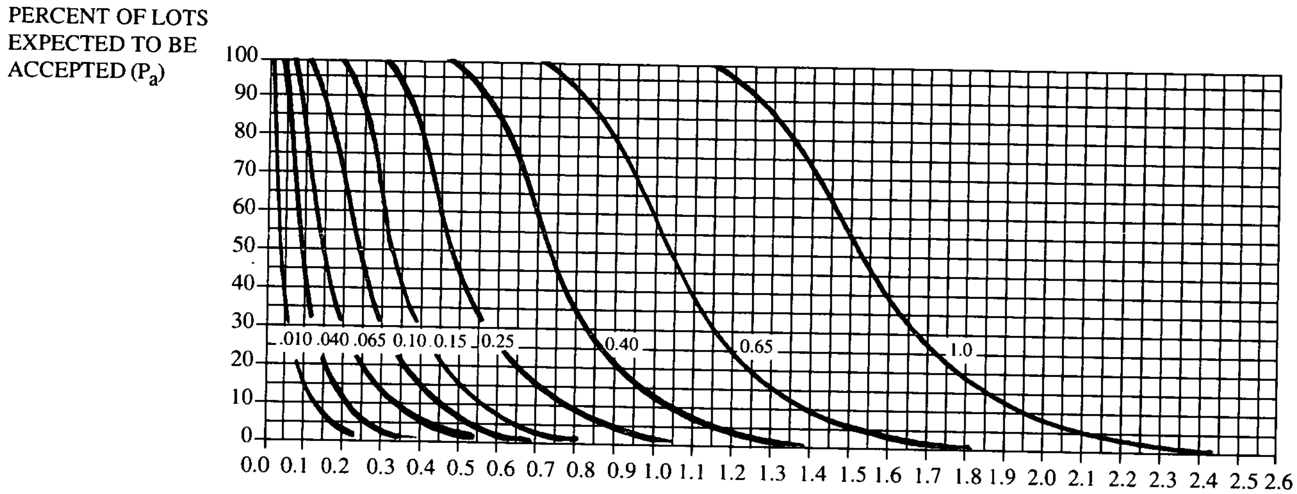
TABLE XV-P-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	.015	.065	.10	.15	.25	.40	.65	1.0	1.5						
	p (in percent nonconforming or nonconformities per hundred units)														
99.0	0.00263	0.0240	0.0713	0.116	0.236	0.381	0.636	0.989	1.59						
95.0	0.00901	0.0457	0.101	0.166	0.308	0.480	0.757	1.14	1.84						
90.0	0.0144	0.0616	0.121	0.200	0.346	0.535	0.832	1.24	1.96						
75.0	0.0283	0.0928	0.159	0.258	0.404	0.619	0.950	1.40	2.14						
50.0	0.0573	0.139	0.221	0.345	0.486	0.734	1.11	1.61	2.37						
25.0	0.111	0.216	0.337	0.490	0.640	0.929	1.35	1.90	2.72						
10.0	0.184	0.311	0.486	0.665	0.835	1.16	1.62	2.22	3.09						
5.0	0.240	0.379	0.593	0.787	0.969	1.31	1.80	2.43	3.34						
1.0	0.369	0.531	0.830	1.05	1.26	1.64	2.18	2.85	3.82						

Scheme Performance with Switching Rules

Chart XV-Q Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

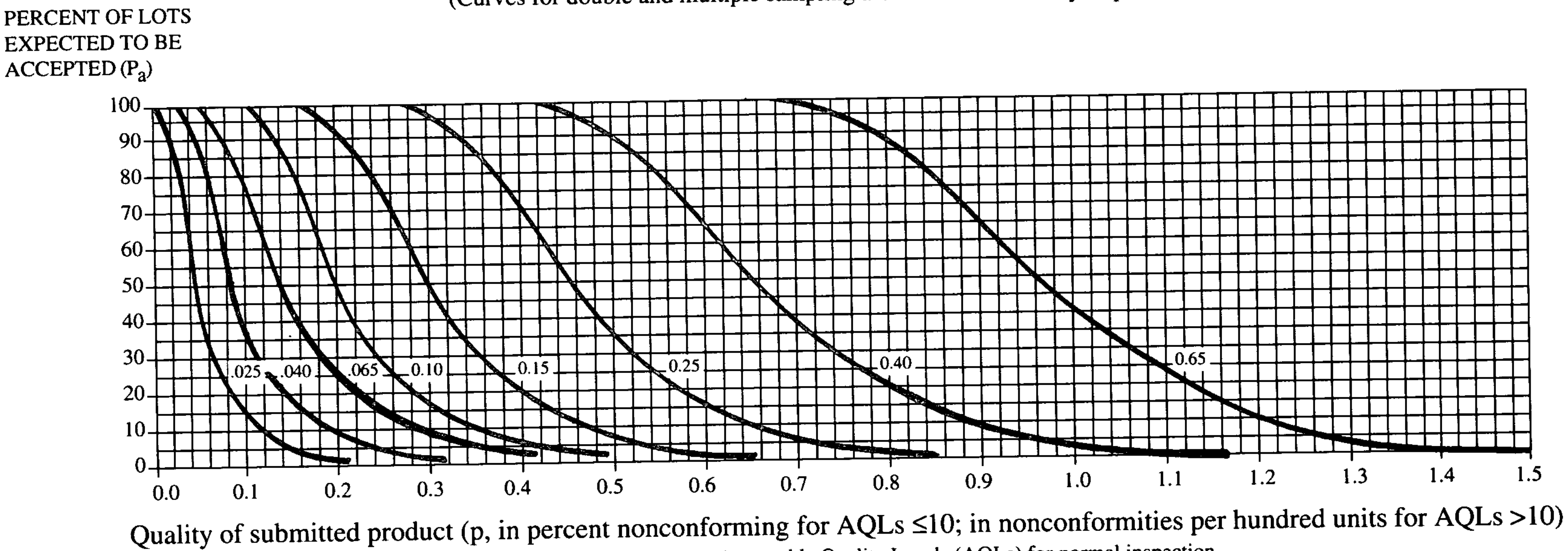
TABLE XV-Q-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)													
	.01	.04	.065	.10	.15	.25	.40	.65	1.0					
	p (in percent nonconforming or nonconformities per hundred units)													
99.0	0.00167	0.0153	0.0455	0.0738	0.149	0.243	0.401	0.634	1.03					
95.0	0.00573	0.0292	0.0643	0.106	0.197	0.307	0.484	0.732	1.17					
90.0	0.00915	0.0392	0.0771	0.128	0.221	0.343	0.533	0.796	1.25					
75.0	0.0178	0.0586	0.102	0.165	0.259	0.396	0.608	0.896	1.37					
50.0	0.0358	0.0873	0.142	0.221	0.311	0.470	0.708	1.03	1.52					
25.0	0.0694	0.135	0.216	0.314	0.410	0.594	0.865	1.22	1.74					
10.0	0.115	0.194	0.311	0.426	0.534	0.742	1.04	1.42	1.98					
5.0	0.150	0.237	0.379	0.504	0.620	0.841	1.15	1.56	2.14					
1.0	0.231	0.332	0.531	0.673	0.804	1.05	1.39	1.83	2.45					

Scheme Performance with Switching Rules

Chart XV-R Operating Characteristic Curves for ANSI Z1.4 Scheme Performance

(Curves for double and multiple sampling are matched as closely as practicable)



Note: Figures on curves are Acceptable Quality Levels (AQLs) for normal inspection.

TABLE XV-R-1—TABULATED VALUES FOR OPERATING CHARACTERISTIC CURVES FOR ANSI Z1.4 SCHEME PERFORMANCE

P_a	Acceptable Quality Levels (normal inspection)														
	.025	.040	.065	.10	.15	.25	.40	.65							
	p (in percent nonconforming or nonconformities per hundred units)														
99.0	0.00957	0.0284	0.0473	0.0941	0.150	0.250	0.395	0.649							
95.0	0.0183	0.0402	0.0669	0.123	0.192	0.302	0.457	0.734							
90.0	0.0246	0.0482	0.0800	0.138	0.214	0.333	0.497	0.783							
75.0	0.0369	0.0637	0.103	0.162	0.248	0.380	0.560	0.855							
50.0	0.0554	0.0885	0.138	0.195	0.294	0.443	0.642	0.948							
25.0	0.0856	0.135	0.196	0.256	0.372	0.540	0.761	1.09							
10.0	0.123	0.194	0.266	0.334	0.464	0.650	0.889	1.24							
5.0	0.151	0.237	0.315	0.388	0.526	0.722	0.972	1.33							
1.0	0.211	0.332	0.420	0.502	0.656	0.871	1.14	1.53							

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