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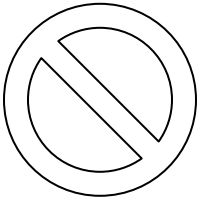
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February 15, 2018

Public Utility Commission of Oregon  
Attn: Filing Center  
P.O. Box 1088  
Salem, OR 97308-1088

**RE: RG-65, Cascade's Gas Meter Statistical Sampling Program, 2016 Results**

Enclosed is Cascade Natural Gas Corporation's (Cascade's or Company's) Gas Meter Statistical Sampling Program for all residential and small commercial meters in service as of December 31, 2017. These meters fall within the scope of the Company's Statistical Sampling Program as established in Rule 8, Meter Testing in the Company's Tariff.

All larger meters were tested according to their required periodic schedule. The total number of meters Cascade had in service in Oregon at the end of 2017 was 74,314.

If you have any questions, please call me at (509) 734-4573.

Sincerely,

*/s/ Brett Hudson*

Brett Hudson  
Manager, Measurement

cc: Lori Koho, OPUC  
Mike Eutsey, Operation Services, CNG

CASCADE NATURAL GAS

**GAS METER  
STATISTICAL SAMPLING  
PROGRAM**

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2017 RESULTS

# GAS METER STATISTICAL SAMPLING PROGRAM

## TABLE OF CONTENTS

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GAS METER PERFORMANCE FOR THE PERIOD JANUARY 1, 2017 – DECEMBER 31, 2017

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1. SCOPE
2. GENERAL
  - a. COMPLIANCE
  - b. TESTING METHODOLOGY
  - c. METER PERFORMANCE REQUIREMENTS
3. DEFINITIONS
4. RANDOM SAMPLING METER PERFORMANCE DATA
  - a. RANDOM SAMPLING – SUMMARY
  - b. RANDOM SAMPLING METER FAMILIES PASS/FAIL AND STATISTICAL RESULT SUMMARY
  - c. METER FAMILIES BELOW ACCEPTABLE THRESHOLD LIMITS
  - d. METER FAMILIES WITH INSUFFICIENTLY SIZED SAMPLE
  - e. STATUS OF METER FAMILIES PREVIOUSLY SCHEDULE FOR REMOVAL
5. APPENDIX
  - a. PROGRAM DOCUMENTATION

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## SCOPE

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This report covers the methodology, test results, and proceedings of Cascade Natural Gas Company gas meter statistical sampling program for residential and small commercial meters in the states of Washington and Oregon for the period of January 1, 2017 through December 31, 2017.

### **Sampling Summary**

Meters in the program at the start of the plan year	277,392
Meters in the program at the end of the plan year	269,147
Total meters removed during the year	8245
Meters qualifying for analysis (not uniquely defective)	6567
Uniquely defective meters	1678

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## GENERAL

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### COMPLIANCE

Gas meter testing requirements for Cascade Natural Gas are promulgated by the Washington Administrative Code (WAC), Chapter 480-90, Section 348 “Frequency of Periodic Meter Tests” and by the Oregon Administrative Rules (OAR), Chapter 860, Division 023 “Service Standards”, Section 0015 (Testing Gas and Electric Meters). Cascade’s sampling program complies with Part IV (‘In Service Performance”) of the 1992 version of ANSI standard B109.1 and B109.2 as specified in its Tariff Rule No. 7, part B filed in the state of Washington and Tariff Rule No. 6, part 1 filed in the state of Oregon. Cascade’s plan also conforms to generally accepted statistical methods within the industry for predicting the sampling distribution of the proportion of a population with a 90% degree of confidence.

### TESTING METHODOLOGY

Cascade Natural Gas current random meter measurement performance program is in accordance with its plan document entitled “Statistical Sample Program” dated August 18, 1995 (appendix). Random sampling and testing is conducted for all domestic meters rated at 1000 CFH and smaller.

### METER PERFORMANCE REQUIREMENTS

**Random Sampling** – Meters in this program are randomly selected for inspection by attribute per the plan document. Conforming meters are found to register accurately with a tolerance of  $\pm 2.0\%$ . The intent of the testing standard is to verify the following two parameters:

**Overall Performance** – Verify with approximately 90% certainty, that the portion of non-conforming meters does not exceed 20% of any installed meter population. For overall performance, equal weight is given to both the upper and lower specification limit (i.e. check and open reads are equally weighted and are averaged).

**Fast Direction Performance** – Verify with approximately 90% certainty that the portion of non-conforming fast meters (i.e. meters that register in excess of 102% of accuracy) does not exceed 10% of any installed meter population. For testing, equal weight is given to both the upper and lower specification limit (i.e. check and open reads are equally weighted and are averaged).

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## DEFINITIONS

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**Meter Population (Meter Family)** – Grouping of meters as defined by each company, may include reference to sub families as allowed by ANSI B109.1 and B109.2

**Open Test** – Meter proof test completed between 80 and 100 % of meter rated capacity or the maximum rated capacity of the test equipment.

**Check Test** – Meter proof test completed at approximately 20% of the meter rated capacity.

**Size / Class** – Grouping of meters, based on capacity, that display similar performance characteristics for all meters within the grouping. Size/Class may, at the company's discretion, include multiple-sized meters within the same size class as long as the meter performance testing of the individual meters is consistent with all meter in the size class.

**Random Meters** – Meters that are a selected at random to provide a statistically representative sample of a meter family.

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## RANDOM SAMPLING METER PERFORMANCE DATA

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### Beginning of Report Year 2017, In-Service Meters on 1/1/17

Total Number of Meters For Random Sampling	277,233
Total Number of Test Families <sup>(a)</sup>	168
Number of Test Families $\geq$ 10 yrs old <sup>(b)</sup>	91

### End of Report Year 2017 Meter Testing Quantities & Results

Number of Meters Tested	6,567
Number of Meters Passed, (+/-) 2%	6,197
Number of Meters Failed, (+/-) 2%	370
Number of Meters, Uniquely Defective Test Result, (+/-) 10%	1,678
Meter Families With an Overall Fail Result	2
Meter Families With a Fast Fail Result	2
Meter Families Removed/Depleted During Report Year <sup>(c)</sup>	5

### Transition to 2018 Test Year

Total Number of Meters For Random Sampling	291,442
Total Number of Test Families <sup>(a)</sup>	168
Number of Test Families $\geq$ 10 yrs old <sup>(b)</sup>	94

- a) Total number of meter populations includes meter test families that are less than 10 years old and are not yet subject to test requirements.
- b) Number of Meter Test Populations  $\geq$  10 years old (i.e. includes meters manufactured in the year 2008 and earlier for the 2018 test year). Small populations less than 20 years old are tested but with the restriction that a meter will not be retested within five (5) years.
- c) Total number of meter families depleted during the report year including those removed for administrative purposes.



Cascade Natural Gas Corp.  
**2017 METER SAMPLING PROGRAM**  
**YEAR-END STATUS REPORT**

FAMILY STATISTICS				SAMPLE STATISTICS			'ACCURACY' TEST RESULTS					NOT FAST' TEST RESULTS					FURTHER ACTION OR STATUS	
YEAR	MAKE	CLS	SIZE	MAX. SAMP	NO. RMVD	SAMP. CNT	OK. CNT	PCT. OK	OK. LMT	MIN. SAMP	CTL. RGN	NF. CNT	PCT. NF	NF. LMT	MIN. SAMP	CTL. RGN	ADD. REQ	DISP. OF FAMILY
1982	SPRAG	1	4	4	4	4	2	50	0	4	III	4	100	0	4	I	0	FAMILY DEPLETED
1983	SPRAG	1	200	70	200	194	176	90	0	36	I	193	99	0	26	I	0	FAMILY DEPLETED
1986	AMERI	1	423	80	424	416	378	90	0	39	I	381	91	0	80	I	0	FAMILY DEPLETED
1986	ROCKW	1	1452	100	118	105	100	95	6	19	I	101	96	5	65	I	0	ACCEPTABLE
1986	SPRAG	1	955	90	107	95	93	97	6	15	I	94	98	5	37	I	0	ACCEPTABLE
1987	AMERI	1	2262	100	109	95	91	95	7	19	I	91	95	5	93	I	0	ACCEPTABLE
1987	ROCKW	1	2557	100	131	109	99	90	6	43	I	100	91	5	100	IIa	0	ACCEPTABLE
1987	SPRAG	1	1032	90	38	31	31	100	12	11	I	31	100	9	24	I	0	ACCEPTABLE
1988	AMERI	1	3088	100	68	39	39	100	10	11	I	39	100	8	24	I	0	ACCEPTABLE
1988	ROCKW	1	2135	100	82	57	50	87	9	85	IV	53	92	6	100	IV	0	ACCEPTABLE*
1988	SPRAG	1	1707	100	55	39	36	92	10	30	I	39	100	8	24	I	0	ACCEPTABLE
1989	AMERI	1	4965	125	68	34	34	100	11	11	I	34	100	8	24	I	0	ACCEPTABLE
1989	ROCKW	1	4693	125	162	134	125	93	6	25	I	128	95	4	95	I	0	ACCEPTABLE
1989	SPRAG	1	2918	100	148	101	93	92	6	30	I	100	99	5	30	I	0	ACCEPTABLE
1990	AMERI	1	3679	125	83	70	69	98	8	13	I	69	98	6	38	I	0	ACCEPTABLE
1990	ROCKW	1	5277	125	122	72	66	91	8	36	I	72	100	6	24	I	0	ACCEPTABLE
1990	SPRAG	1	2420	100	61	35	35	100	11	11	I	35	100	8	24	I	0	ACCEPTABLE

1991	AMERI	1	4385	125	67	45	45	100	10	11	I	45	100	7	24	I	0	ACCEPTABLE
1991	ROCKW	1	3012	100	73	47	41	87	10	86	IV	46	97	7	49	IV	0	ACCEPTABLE*
1991	SPRAG	1	1890	100	127	105	96	91	6	35	I	105	100	5	24	I	0	ACCEPTABLE
1992	AMERI	1	2870	100	121	97	93	95	7	19	I	95	97	5	49	I	0	ACCEPTABLE
1992	ROCKW	1	7772	125	99	68	65	95	8	19	I	66	97	6	49	I	0	ACCEPTABLE
1992	SPRAG	1	1522	100	77	54	48	88	9	65	IV	53	98	7	37	I	0	ACCEPTABLE*
1993	AMERI	1	3194	100	38	28	28	100	12	11	I	28	100	9	24	I	0	ACCEPTABLE
1993	ROCKW	1	5547	125	169	134	124	92	6	30	I	129	96	4	67	I	0	ACCEPTABLE
1993	SPRAG	1	5689	125	182	142	139	97	5	15	I	142	100	4	24	I	0	ACCEPTABLE
1994	AMERI	1	5241	125	138	105	97	92	6	30	I	97	92	5	125	IV	0	ACCEPTABLE*
1994	ROCKW	1	3883	125	171	138	134	97	6	15	I	135	97	4	49	I	0	ACCEPTABLE
1994	SPRAG	1	5608	125	79	37	37	100	11	11	I	37	100	8	24	I	0	ACCEPTABLE
1995	AMERI	1	3052	100	51	30	30	100	12	11	I	30	100	9	24	I	0	ACCEPTABLE
1995	ROCKW	1	2288	100	127	102	94	92	6	30	I	97	95	5	93	I	0	ACCEPTABLE
1995	SPRAG	1	10074	200	101	49	49	100	9	11	I	49	100	7	24	I	0	ACCEPTABLE
1996	AMERI	1	264	70	37	28	28	100	12	10	I	28	100	9	22	I	0	ACCEPTABLE
1996	ROCKW	1	811	90	104	91	83	91	7	34	I	86	94	5	90	Ila	0	ACCEPTABLE
1996	SPRAG	1	4264	125	70	36	36	100	11	11	I	36	100	8	24	I	0	ACCEPTABLE
1997	AMERI	1	18	18	13	11	11	100	13	7	I	11	100	10	11	I	0	ACCEPTABLE
1997	ROCKW	1	340	80	89	81	73	90	6	39	I	76	93	5	80	Ila	0	ACCEPTABLE
1997	SPRAG	1	6820	125	70	42	42	100	10	11	I	42	100	8	24	I	0	ACCEPTABLE
1998	AMERI	1	423	80	86	79	77	97	7	15	I	77	97	5	45	I	0	ACCEPTABLE
1998	ROCKW	1	7230	125	163	126	119	94	6	22	I	119	94	4	125	I	0	ACCEPTABLE
1998	SPRAG	1	695	90	54	40	39	97	10	15	I	40	100	8	24	I	0	ACCEPTABLE

1999	AMERI	1	7022	125	166	142	138	97	5	15	I	138	97	4	49	I	0	ACCEPTABLE
1999	AMERI	3	62	40	41	40	34	84	6	40	IIa	34	84	5	33	III	0	RECALL FAMILY
1999	ROCKW	1	441	80	88	78	72	92	7	28	I	75	96	5	59	I	0	ACCEPTABLE
1999	SPRAG	1	397	80	30	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE
2000	AMERI	1	8158	125	81	32	32	100	12	11	I	32	100	9	24	I	0	ACCEPTABLE
2000	AMERI	3	29	29	15	14	14	100	13	8	I	14	100	10	13	I	0	ACCEPTABLE
2000	ROCKW	1	825	90	39	24	24	100	13	11	I	24	100	10	24	I	0	ACCEPTABLE
2000	SPRAG	1	23	23	12	12	12	100	13	8	I	12	100	10	12	I	0	ACCEPTABLE
2001	AMERI	1	6503	125	58	36	35	97	11	15	I	35	97	8	49	IV	0	ACCEPTABLE*
2001	AMERI	3	134	60	60	60	53	88	6	45	I	53	88	5	60	IIb	0	ACCEPTABLE
2001	ROCKW	1	103	60	30	26	24	92	11	23	I	26	100	8	20	I	0	ACCEPTABLE
2001	ROCKW	2	143	60	67	62	58	93	6	22	I	58	93	5	60	IIa	0	ACCEPTABLE
2001	SPRAG	1	1091	90	31	26	26	100	13	11	I	26	100	10	24	I	0	ACCEPTABLE
2002	ACTAR	1	827	90	49	45	43	95	10	19	I	45	100	7	24	I	0	ACCEPTABLE
2002	AMERI	1	7651	125	168	136	123	90	6	43	I	123	90	4	125	IIa	0	ACCEPTABLE
2002	AMERI	3	54	40	43	39	36	92	6	20	I	36	92	4	40	IV	0	RECALL FAMILY
2002	ROCKW	1	640	90	90	82	79	96	7	17	I	79	96	5	61	I	0	ACCEPTABLE
2002	ROCKW	2	371	80	91	82	73	89	6	47	I	73	89	5	80	IIb	0	ACCEPTABLE
2002	SPRAG	1	368	80	40	38	36	94	10	21	I	38	100	8	23	I	0	ACCEPTABLE
2003	AMERI	1	776	90	54	48	47	97	9	15	I	47	97	7	47	I	0	ACCEPTABLE
2003	AMERI	3	253	70	253	248	215	86	1	70	I	215	86	0	70	III	0	FAMILY DEPLETED
2003	ROCKW	1	235	70	69	67	64	95	7	18	I	64	95	5	69	IV	0	ACCEPTABLE*
2003	ROCKW	2	120	60	27	25	25	100	12	10	I	25	100	9	20	I	0	ACCEPTABLE
2003	SPRAG	1	594	90	28	25	25	100	13	11	I	25	100	10	23	I	0	ACCEPTABLE

2004	AMERI	1	815	90	56	47	47	100	9	11	I	47	100	7	24	I	0	ACCEPTABLE
2004	AMERI	3	225	70	25	23	23	100	13	10	I	23	100	10	22	I	0	ACCEPTABLE
2004	ROCKW	1	254	70	75	71	68	95	7	18	I	68	95	5	70	I	0	ACCEPTABLE
2004	ROCKW	2	222	70	73	72	67	93	6	23	I	67	93	5	70	IIa	0	ACCEPTABLE
2004	SPRAG	1	46	40	21	20	20	100	11	9	I	20	100	8	16	I	0	ACCEPTABLE
2004	SPRAG	3	26	26	14	14	14	100	12	8	I	14	100	9	13	I	0	ACCEPTABLE
2005	AMERI	1	13377	200	304	210	197	93	5	26	I	197	93	3	200	I	0	ACCEPTABLE
2005	AMERI	3	148	60	62	61	54	88	6	47	I	54	88	5	60	IIb	0	ACCEPTABLE
2005	ROCKW	1	193	70	71	70	67	95	6	18	I	67	95	5	65	I	0	ACCEPTABLE
2005	ROCKW	2	403	80	85	82	75	91	6	33	I	75	91	5	80	IIa	0	ACCEPTABLE
2005	SPRAG	1	194	70	36	34	34	100	10	10	I	34	100	8	22	I	0	ACCEPTABLE
2005	SPRAG	3	7	7	7	7	6	85	0	7	I	7	100	0	7	I	0	FAMILY DEPLETED
2006	AMERI	1	13127	200	121	42	42	100	10	11	I	42	100	8	24	I	0	ACCEPTABLE
2006	AMERI	3	408	80	49	43	43	100	10	11	I	43	100	7	23	I	0	ACCEPTABLE
2006	ROCKW	1	81	50	23	19	19	100	13	10	I	19	100	10	19	I	0	ACCEPTABLE
2006	ROCKW	2	412	80	93	85	79	92	6	28	I	80	94	5	80	IIa	0	ACCEPTABLE
2006	SPRAG	1	146	60	30	29	29	100	11	10	I	29	100	8	21	I	0	ACCEPTABLE
2006	SPRAG	3	158	70	52	47	45	95	8	17	I	46	97	6	38	I	0	ACCEPTABLE
2007	ACTAR	1	16	16	10	10	10	100	13	7	I	10	100	10	10	I	0	ACCEPTABLE
2007	AMERI	1	2616	100	41	30	30	100	12	11	I	30	100	9	24	I	0	ACCEPTABLE
2007	AMERI	3	208	70	28	23	23	100	13	10	I	23	100	10	22	I	0	ACCEPTABLE
2007	ROCKW	1	306	80	24	23	23	100	13	10	I	23	100	10	23	I	0	ACCEPTABLE
2007	ROCKW	2	362	80	88	83	78	93	6	24	I	78	93	5	80	IIa	0	ACCEPTABLE
2007	SPRAG	1	304	80	41	38	38	100	10	10	I	38	100	8	23	I	0	ACCEPTABLE

2007	SPRAG	2	23	23	17	15	14	93	10	12	I	15	100	8	12	I	0	ACCEPTABLE
2007	SPRAG	3	51	40	40	33	31	93	7	17	I	32	96	5	29	I	0	ACCEPTABLE
2008	ACTAR	1	2	2	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2008	AMERI	1	12068	200	83	49	46	93	9	26	I	46	93	7	200	IV	0	ACCEPTABLE
2008	AMERI	3	595	90	10	8	7	87	<<>>	77	IV	7	87	<<>>	90	IV	0	ACCEPTABLE
2008	ROCKW	1	238	70	0	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2008	ROCKW	2	659	90	10	4	4	100	<<>>	11	IV	4	100	<<>>	24	IV	0	ACCEPTABLE
2008	ROOTS	3	1	1	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2008	SPRAG	1	88	50	3	1	1	100	<<>>	10	IV	1	100	<<>>	19	IV	0	ACCEPTABLE
2008	SPRAG	2	22	22	0	0	0	NaN	N/A	11	IV	0	NaN	N/A	11	IV	0	ACCEPTABLE
2008	SPRAG	3	35	35	1	1	1	100	<<>>	8	IV	1	100	<<>>	15	IV	0	ACCEPTABLE
2009	ACTAR	1	15	15	0	0	0	NaN	N/A	8	IV	0	NaN	N/A	8	IV	0	ACCEPTABLE
2009	AMERI	1	4858	125	39	15	14	93	17	25	IV	14	93	<<>>	125	IV	0	ACCEPTABLE
2009	AMERI	3	376	80	9	7	7	100	<<>>	11	IV	7	100	<<>>	23	IV	0	ACCEPTABLE
2009	ROCKW	1	500	80	10	2	2	100	<<>>	11	IV	2	100	<<>>	23	IV	0	ACCEPTABLE
2009	ROCKW	2	548	90	9	3	3	100	<<>>	11	IV	3	100	<<>>	23	IV	0	ACCEPTABLE
2009	SPRAG	1	471	80	12	6	6	100	<<>>	11	IV	6	100	<<>>	23	IV	0	ACCEPTABLE
2009	SPRAG	2	15	15	0	0	0	NaN	N/A	8	IV	0	NaN	N/A	8	IV	0	ACCEPTABLE
2009	SPRAG	3	36	36	2	2	2	100	<<>>	9	IV	2	100	<<>>	15	IV	0	ACCEPTABLE
2010	ACTAR	1	3	3	0	0	0	NaN	N/A	2	N/A	0	NaN	N/A	2	N/A	0	ACCEPTABLE
2010	AMERI	1	3509	125	36	24	24	100	13	11	I	24	100	10	24	I	0	ACCEPTABLE
2010	AMERI	3	474	80	10	8	7	87	<<>>	75	IV	7	87	<<>>	80	IV	0	ACCEPTABLE
2010	ROCKW	1	245	70	4	3	3	100	<<>>	10	IV	3	100	<<>>	22	IV	0	ACCEPTABLE
2010	ROCKW	2	213	70	0	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE

2010	SPRAG	1	329	80	5	4	4	100	<<>>	11	IV	4	100	<<>>	23	IV	0	ACCEPTABLE
2010	SPRAG	2	12	12	0	0	0	NaN	N/A	6	IV	0	NaN	N/A	6	IV	0	ACCEPTABLE
2010	SPRAG	3	143	60	8	2	2	100	<<>>	10	IV	2	100	<<>>	21	IV	0	ACCEPTABLE
2011	ACTAR	1	6	6	1	0	0	NaN	N/A	3	N/A	0	NaN	N/A	3	N/A	0	ACCEPTABLE
2011	AMERI	1	4698	125	29	16	16	100	16	11	I	16	100	<<>>	24	IV	0	ACCEPTABLE
2011	AMERI	3	365	80	5	4	4	100	<<>>	11	IV	4	100	<<>>	23	IV	0	ACCEPTABLE
2011	ROCKW	1	228	70	2	1	1	100	<<>>	10	IV	1	100	<<>>	22	IV	0	ACCEPTABLE
2011	ROCKW	2	681	90	10	5	5	100	<<>>	11	IV	5	100	<<>>	24	IV	0	ACCEPTABLE
2011	SPRAG	1	243	70	2	1	1	100	<<>>	10	IV	1	100	<<>>	22	IV	0	ACCEPTABLE
2011	SPRAG	2	24	24	1	0	0	NaN	N/A	12	IV	0	NaN	N/A	12	IV	0	ACCEPTABLE
2011	SPRAG	3	24	24	0	0	0	NaN	N/A	12	IV	0	NaN	N/A	12	IV	0	ACCEPTABLE
2012	ACTAR	1	22	22	1	1	1	100	<<>>	7	IV	1	100	<<>>	12	IV	0	ACCEPTABLE
2012	AMERI	1	3771	125	22	12	12	100	19	11	I	12	100	<<>>	24	IV	0	ACCEPTABLE
2012	AMERI	3	217	70	3	1	1	100	<<>>	10	IV	1	100	<<>>	22	IV	0	ACCEPTABLE
2012	ROCKW	1	225	70	2	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2012	ROCKW	2	519	90	2	1	1	100	<<>>	11	IV	1	100	<<>>	23	IV	0	ACCEPTABLE
2012	ROOTS	3	1	1	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2012	SPRAG	1	226	70	4	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2012	SPRAG	2	21	21	0	0	0	NaN	N/A	11	IV	0	NaN	N/A	11	IV	0	ACCEPTABLE
2012	SPRAG	3	39	39	2	1	1	100	<<>>	9	IV	1	100	<<>>	15	IV	0	ACCEPTABLE
2013	ACTAR	1	22	22	0	0	0	NaN	N/A	11	IV	0	NaN	N/A	11	IV	0	ACCEPTABLE
2013	AMERI	1	5644	125	24	13	13	100	18	11	I	13	100	<<>>	24	IV	0	ACCEPTABLE
2013	AMERI	2	198	70	3	2	2	100	<<>>	10	IV	2	100	<<>>	22	IV	0	ACCEPTABLE
2013	AMERI	3	483	80	8	8	7	87	<<>>	75	IV	7	87	<<>>	80	IV	0	ACCEPTABLE

2013	ROCKW	1	247	70	2	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2013	ROCKW	2	205	70	5	4	4	100	<<>>	10	IV	4	100	<<>>	22	IV	0	ACCEPTABLE
2013	SPRAG	1	205	70	1	1	1	100	<<>>	10	IV	1	100	<<>>	22	IV	0	ACCEPTABLE
2013	SPRAG	2	18	18	0	0	0	NaN	N/A	9	IV	0	NaN	N/A	9	IV	0	ACCEPTABLE
2013	SPRAG	3	74	50	6	3	3	100	<<>>	10	IV	3	100	<<>>	19	IV	0	ACCEPTABLE
2014	ACTAR	1	33	33	1	0	0	NaN	N/A	17	IV	0	NaN	N/A	17	IV	0	ACCEPTABLE
2014	AMERI	1	663	90	11	6	6	100	<<>>	11	IV	6	100	<<>>	24	IV	0	ACCEPTABLE
2014	AMERI	2	414	80	4	4	4	100	<<>>	11	IV	4	100	<<>>	23	IV	0	ACCEPTABLE
2014	AMERI	3	506	90	7	5	5	100	<<>>	11	IV	5	100	<<>>	23	IV	0	ACCEPTABLE
2014	ROCKW	1	8214	125	29	17	17	100	16	11	I	17	100	<<>>	24	IV	0	ACCEPTABLE
2014	ROCKW	2	273	70	2	2	1	50	<<>>	5	IV	2	100	<<>>	22	IV	0	ACCEPTABLE
2014	ROOTS	3	5	5	0	0	0	NaN	N/A	3	N/A	0	NaN	N/A	3	N/A	0	ACCEPTABLE
2014	SPRAG	1	228	70	0	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2014	SPRAG	2	10	10	0	0	0	NaN	N/A	5	IV	0	NaN	N/A	5	IV	0	ACCEPTABLE
2015	ACTAR	1	33	33	0	0	0	NaN	N/A	17	IV	0	NaN	N/A	17	IV	0	ACCEPTABLE
2015	AMERI	1	764	90	255	244	236	96	3	17	I	236	96	3	62	I	0	ACCEPTABLE
2015	AMERI	2	721	90	5	4	4	100	<<>>	11	IV	4	100	<<>>	24	IV	0	ACCEPTABLE
2015	AMERI	3	732	90	9	8	8	100	<<>>	11	IV	8	100	<<>>	24	IV	0	ACCEPTABLE
2015	ROCKW	1	450	80	3	1	1	100	<<>>	11	IV	1	100	<<>>	23	IV	0	ACCEPTABLE
2015	ROCKW	2	416	80	10	2	2	100	<<>>	11	IV	2	100	<<>>	23	IV	0	ACCEPTABLE
2015	SPRAG	1	6192	125	33	16	16	100	16	11	I	16	100	<<>>	24	IV	0	ACCEPTABLE
2015	SPRAG	2	19	19	0	0	0	NaN	N/A	10	IV	0	NaN	N/A	10	IV	0	ACCEPTABLE
2015	SPRAG	3	1	1	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2016	ACTAR	1	19	19	0	0	0	NaN	N/A	10	IV	0	NaN	N/A	10	IV	0	ACCEPTABLE

2016	AMERI	1	976	90	12	4	4	100	<<>>	11	IV	4	100	<<>>	24	IV	0	ACCEPTABLE
2016	AMERI	2	265	70	4	3	3	100	<<>>	10	IV	3	100	<<>>	22	IV	0	ACCEPTABLE
2016	AMERI	3	437	80	11	8	8	100	<<>>	11	IV	8	100	<<>>	23	IV	0	ACCEPTABLE
2016	ROCKW	1	567	90	3	2	2	100	<<>>	11	IV	2	100	<<>>	23	IV	0	ACCEPTABLE
2016	ROCKW	2	455	80	11	5	5	100	<<>>	11	IV	5	100	<<>>	23	IV	0	ACCEPTABLE
2016	SPRAG	1	13369	200	49	36	36	100	11	11	I	36	100	8	24	I	0	ACCEPTABLE
2016	SPRAG	2	3	3	0	0	0	NaN	N/A	2	N/A	0	NaN	N/A	2	N/A	0	ACCEPTABLE
GRAND TOTALS			277233		8245	6567	6197					6300					0	

\*Test results were combined from samples taken in years 2015, 2016 and 2017 to obtain a sufficiently sized sample.



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## RANDOM SAMPLING METER PERFORMANCE DATA

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### DOMESTIC METERS 1000 CFH AND SMALLER STATUS REPORT NOTES

#### Notes to Year-End Status Report:

#### **1) TEST FAMILY : Naming designation of each family.**

- a) **YEAR/MAKE/(SIZE) CLASS:** Components of the family designation or name.
- b) **FAMILY SIZE:** Count of number of meters in test family at the start of the test year being reported.

#### **2) SAMPLE STATISTICS: Statistics pertaining to representative sample taken from each family.**

- a) **MAX.SAMP:** Maximum number of meters that would be required in a sample in order to make a valid determination of the family's future disposition.
- b) **NO.RMVD:** Number of meters in each family removed during the course of the plan year.
- c) **SAMP.CNT:** Total number of meters qualified for use in each sample. Meters determined to be uniquely defective are excluded from the sample count and any sample determination.

#### **3) OVERALL "ACCURACY" TEST RESULTS: Compilation of test results to determine the proportion of the sample meeting the "accuracy" test (i.e. 98.0 to 102.0 percent accurate).**

- a) **OK.CNT:** Number of meters in the sample found 98.0 to 102.0 percent accurate.
- b) **PCT.OK:** Percent or proportion of the sample found "accurate".
- c) **OK.LMT:** The control limits above or below the 80% proportion threshold.
- d) **MIN.SAMP:** The minimum number of meters required in each sample to provide a statistically valid sample.
- e) **CTL.RGN:** Control region in which the sample is determined to be on the "meters accurate" control chart provided in the program document.

#### **4) "NOT FAST" TEST RESULTS: Compilation of test results to determine the proportion of the sample meeting the "not fast" test (i.e. not more than 102.0 percent accurate).**

- a) **NF.CNT:** Number of meters in the sample found not exceeding 102.0 percent accurate.
- b) **PCT..NF:** Percent or proportion of sample found "not fast".
- c) **NF.LMT:** The control limits above and below the 90% proportion threshold.
- d) **MIN.SAMP:** The minimum number of meters required in each sample to provide a statistically valid sample.
- e) **CTL.RGN:** Control region in which the sample is determined to be on the "meters not fast" control chart provided in the program document.

#### **5) FURTHER ACTION OR STATUS: Further action(s) that may be necessary to ensure the sample is of sufficient size and the family remains in compliance with program guidelines.**

- a) **ADD.REQ:** Additional number of meters required to meet or exceed minimum sample size.
- b) **DISP.OF.FAMILY:** Future disposition or status of each family as determined by the decision tree provided in the program document.

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**RANDOM SAMPLING METER PERFORMANCE DATA**

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**DOMESTIC METERS 1000 CFH AND SMALLER**

**METER FAMILIES BELOW ACCEPTABLE THRESHOLD LIMITS**

*Two meter families in service ten or more years were found below the acceptable threshold limits (i.e. fall in region III).*

<b>Meter Family</b>	<b>Disposition Status</b>	<b>Year Disposition Initiated</b>	<b>Planned Year to Complete Disposition</b>
<b>1999Ameri3</b>	<b>Recall Family</b>	<b>2018</b>	<b>2018</b>
<b>2002Ameri3</b>	<b>Recall Family</b>	<b>2018</b>	<b>2018</b>

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**RANDOM SAMPLING METER PERFORMANCE DATA**

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**DOMESTIC METERS 1000 CFH AND SMALLER**

**METER FAMILIES WITH INSUFFICIENTLY SIZED SAMPLE**

*No meter families in service ten or more years were found to have an insufficient sized sample.*

<b>Meter Family</b>	<b>Family Size</b>	<b>Min Sample Size Required</b>	<b>Meters Qualifying for Sample in 2015</b>
N/A			

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**RANDOM SAMPLING METER PERFORMANCE DATA**

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**DOMESTIC METERS 1000 CFH AND SMALLER**

**STATUS OF METER FAMILIES PREVIOUSLY SCHEDULED FOR REMOVAL**

*Two meter families were previously scheduled for removal in 2017.*

<b>Meter Family</b>	<b>Disposition Status</b>	<b>Year Disposition Initiated</b>	<b>Year Disposition Completed</b>
<b>2003 AMERI1</b>	<b>Partial Recall Family</b>	<b>2016</b>	<b>2017</b>
<b>2004 AMERI1</b>	<b>Partial Recall Family</b>	<b>2016</b>	<b>2017</b>

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## APPENDIX

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### Cascade Natural Gas Corporation **Statistical Sample Program**

August 18, 1995

(Revised November 3, 2014)

#### **Program Description**

Using knowledge of the operating histories of similar meters, the company may elect to keep particular meters in service for intervals beyond those specified in applicable state regulations, provided the meter performance meets the criteria of the company's Statistical Sample Program. Eligible meters are diaphragm type meters with a rated capacity of up to 3,000 ft<sup>3</sup>/hr.

The maximum permissible error in the registration of meters placed in service is  $\pm 2.0\%$  at both the open and check rates. For the purposes of the Statistical Sample Program, the definition of a meter registering with an error of  $-2.0\%$  is one that registers 98.0% of accuracy and a meter registering with a  $+2.0\%$  error is one that registers 102.0% of accuracy. A meter, therefore, must register between 98.0% and 102.0% of accuracy at each test rate, before being placed in service.

Each meter in the Statistical Sample Program will be assigned to a meter group or "family" according to its manufacturer, meter size, meter class, and test year. At the option of the company, meters in any family may be further subdivided according to meter type, size, location, age, or other factors that may be disclosed by test data to have an effect on the performance of the meters. Subsequently, meter families may be modified or combined as justified by the performance records.

The program year shall begin on January 1 and end on December 31 of the same year.

#### **Sample Selection and Evaluation**

The performance evaluation of each meter family will be based on an evaluation of test results from random sampling of the family. Sample data collected during a given program year will be analyzed, and a decision regarding meter family disposition will be made in the first quarter of the following calendar year. The performance and status, including disposition, of each meter family will be reported to the regulatory commissions as part of the annual meter report.

The random sample for each family will include meters which are removed from service on a routine basis, e.g. meters not in use, too large, too small, damaged index cover, service relocation or replacement, etc. If more meters are required for testing than have been removed from service for routine purposes, a random sample of meters within that family will be removed from service and included in the sample.

All non-contaminated, testable meters will be tested in accordance with ANSI B109.1, and B109.2, using an average of the open and check in-test results to evaluate each meter's performance. For purposes of evaluating the performance of each meter family, the analysis of the test results will exclude data on meters which are damaged, meters which do not register, meters which do not pass gas, and meters which measure either less than 90.0 percent accurate or more than 110.0 percent accurate.

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## APPENDIX

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A meter family will be considered to be acceptable if the sample of the family indicates:

- a) a minimum proportion of .80 of the family measures between 98.0 percent and 102.0 percent accurate ("accuracy" requirement); and
- b) a minimum proportion of .90 of the family measures no more than 102.0 percent accurate ("not fast" requirement).

To determine the significance of the proportions measured from sampling, the test results will be compared with threshold proportions and control limits on a control chart. The control limits will be defined as follows:

$$P_{.90} = p_t \pm 1.645 * [p_t(1-p_t)/n]^{.5} * [(N-n)/(N-1)]^{.5}$$

where:

$P_{.90}$  is the upper and lower proportion corresponding with an interval which will have a 90 percent probability of including the proportion from a random sample of size  $n$  (drawn without replacement) from a population of size  $N$  and a proportion equal to  $p_t$ .  $p_t$  is the threshold proportion, equal to the minimum acceptable proportion of the meter family and is:

= .80 for meters registering between 98.0% and 102% accurate, or

= .90 for meters registering no more than 102% accurate.

$n$  is the sample size.

$N$  is the meter family size prior to sampling.

1.645 is the factor necessary to provide the interval estimate associated with the threshold proportion, such that, nine times out of ten, the sample proportion will be included within that interval.

Each proportion measured from sampling will specify a particular region (I, II, III, or IV) on the control chart within which the sample data would plot. The regions (I, IIa, IIb, III, and IV) are outlined by the control limits and the threshold proportions, and will be as defined by figures 1 and 2. The vertical line between the regions II(a and b) and IV on the control chart will be established according to the following schedule:

<u>Remaining Family Size</u>	<u>Division line between Regions II(a and b) and IV on the Control Chart</u>
1 to 65	40 (or family size if less)
66 to 100	50
101 to 150	60
151 to 280	70
281 to 500	80
501 to 1200	90
1201 to 3200	100
3201 to 10000	125
10001 and over	200

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## APPENDIX

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The performance of each family will be characterized by the regions on the control chart according to the following table:

	Meter Family < 10 yrs old -----	Meter Family ≥ 10 yrs old -----
Region I	Satisfactory	Satisfactory
Region II a	Satisfactory	Satisfactory
Region II b	Satisfactory	Satisfactory
Region III	At/below Limits	At/below Limits
Region IV	Satisfactory	Insufficient Sample

### Meter Family Disposition

Meter family disposition will be determined according to the following steps:

1. The proportion of the meters in the sample that measure between 98.0 percent and 102.0 percent accurate will be calculated, and the respective region on the "Accuracy" control chart determined.
2. The proportion of the meters in the sample which measure not more than 102.0 percent accurate will be calculated, and the respective region on the "Not Fast" control chart determined.
3. If the region is determined to be "IV" on either the "Accuracy" control chart or "Not Fast" control chart, additional random samples shall be taken so that the combined sample is sufficient to move the sample into any region other than "IV". However, if meters tested in the fourth quarter of the plan year cause the family to fall into region "IV" unexpectedly, leaving insufficient time to obtain the additional number of meters required to complete the sample, the company may elect to increase the sample size of the family by combining the current sample with the samples from the previous two years so that a sufficiently sized sample is obtained to cause the family to fall in a region other than "IV". The disposition of this "multiple year family" shall then be subject to the same rules of the plan as any other family in the plan. "Multiple year families" that fall in region I shall be subject to aggressive sampling in the following plan year so that a follow up determination is made within the first six months without any need to combine multiple years.
4. The results from steps 1 and 2 (provided neither are region "IV") will be applied to the conditions outlined in the decision tree, shown in figures 3a and 3b.
5. Meters in families falling in regions I and IIa are determined to be satisfactory and will be allowed to remain in service, subject to sample testing and review in succeeding years.
6. Meters in families falling in region IIb are subject to change-out at the company's discretion. The decision as to their removal will be based on economic and operating factors. If the meters remain in service, they will be subject to sample testing and review in

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## APPENDIX

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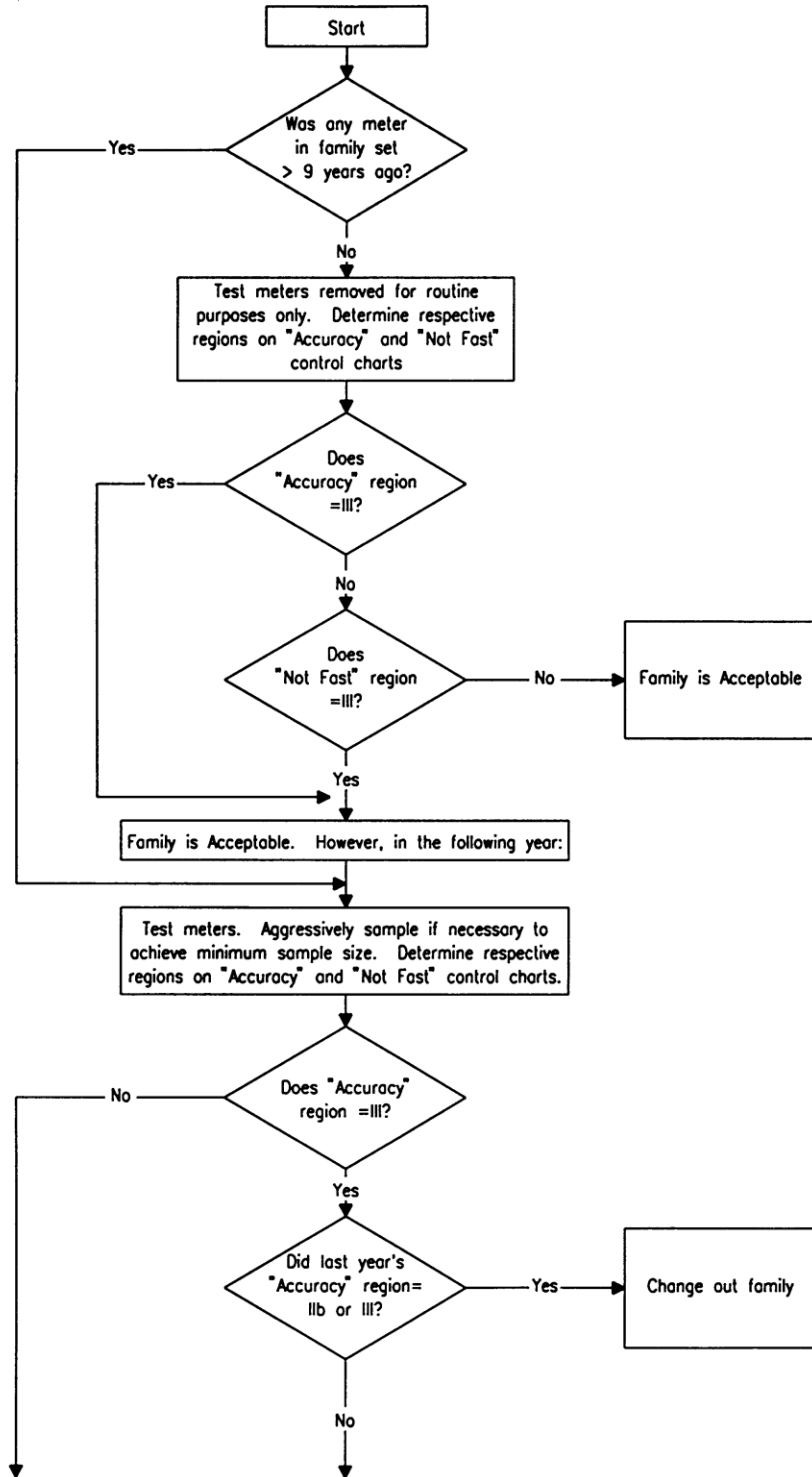
succeeding years.

7. Meters in families falling in region III shall be removed from service by December 31 of the second year following the determination (i.e. two years following the program year when the samples were taken.) However, if in any given year the total number of meters to be removed from service exceeds four percent of the number of meters in the Statistical Sample Program, the company may, at its option and with Commission approval, extend the change-out schedule so that each meter family is changed within a maximum of four years from determination that change-out is required (i.e. four years following the program year when the samples were taken).

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## Decision Tree for Meter Families in Meter Sample Program



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Figure 3.a.

APPENDIX

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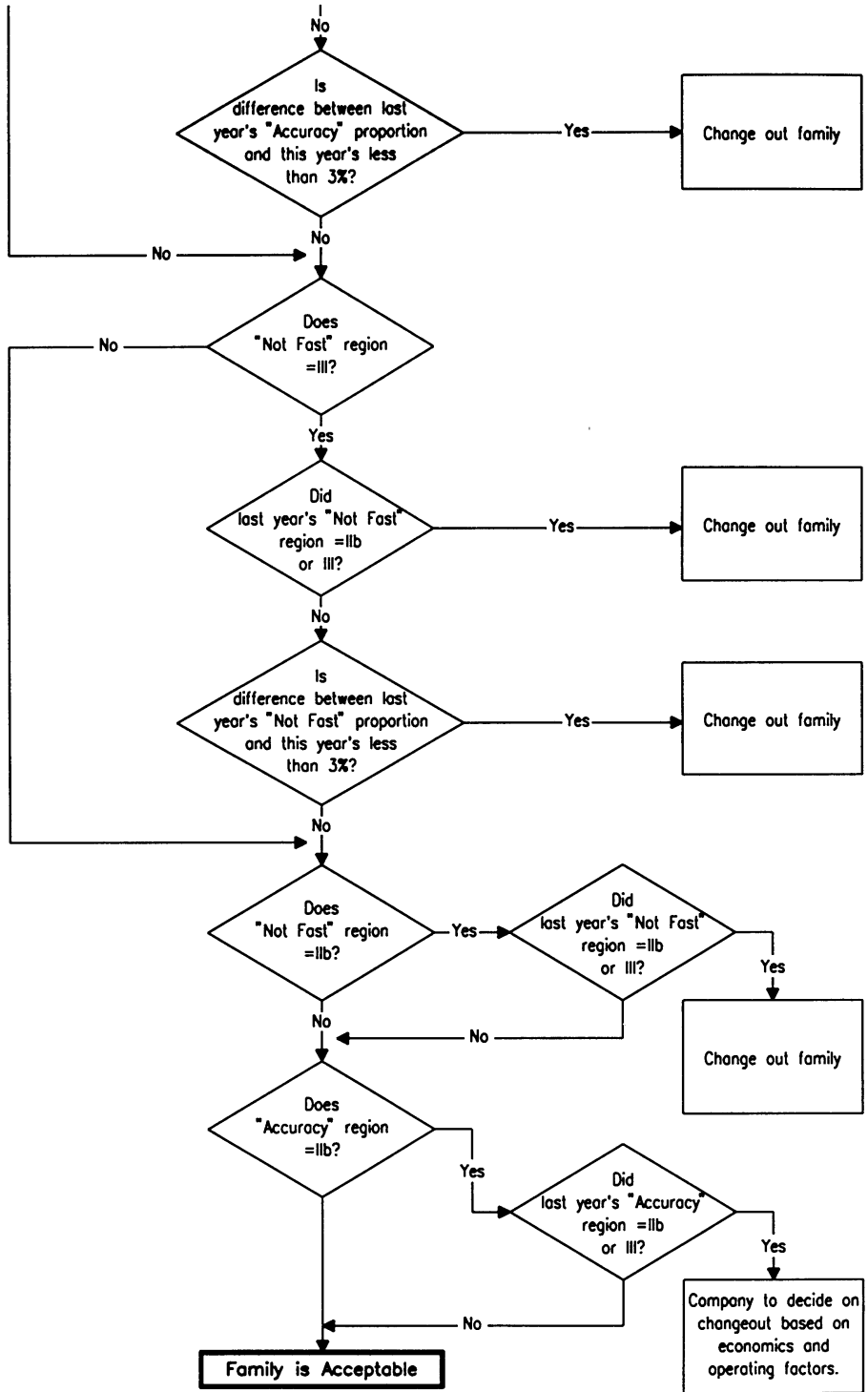


Figure 3.b.

## Meter Performance Control Charts

Figure 1. For Meters Accurate

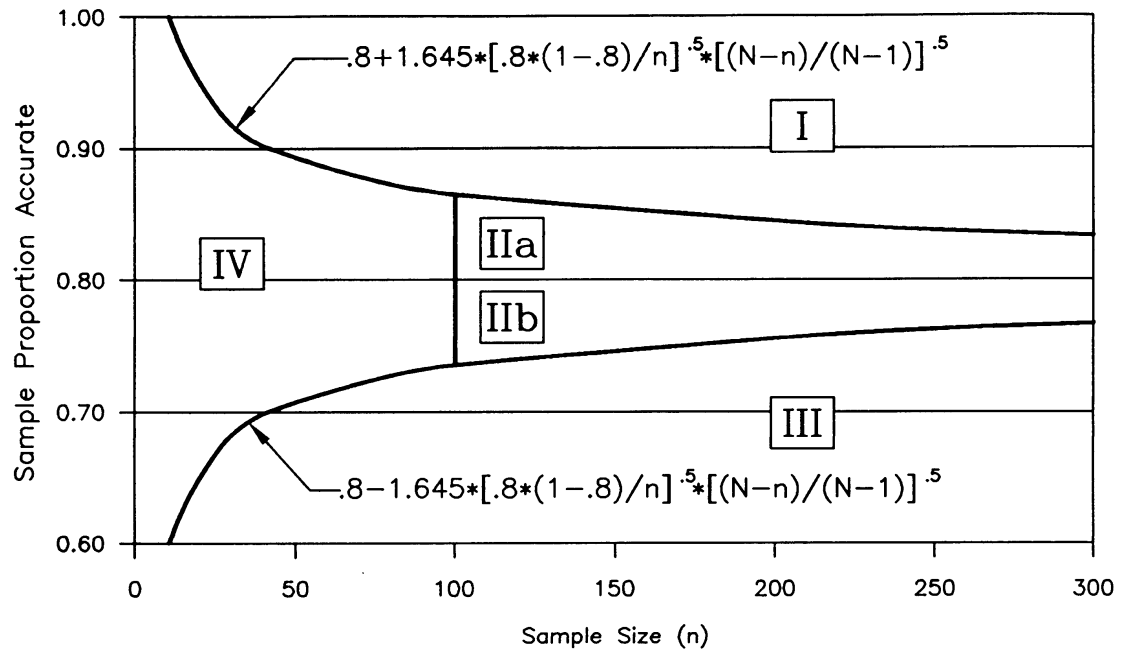
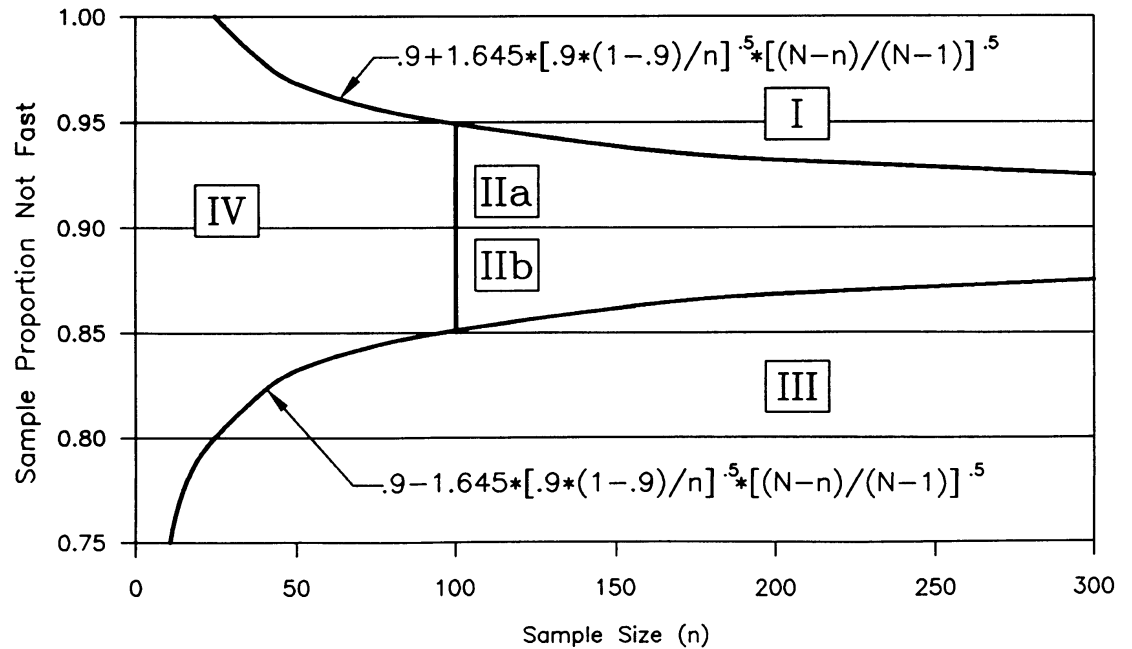


Figure 2. For Meters Not Fast



\*Example where family size (N) = 3000