

CASCADE NATURAL GAS

GAS METER  
STATISTICAL SAMPLING  
PROGRAM

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2014 RESULTS

# GAS METER STATISTICAL SAMPLING PROGRAM

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GAS METER PERFORMANCE FOR THE PERIOD JANUARY 1, 2014 – DECEMBER 31, 2014

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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, 2014 through December 31, 2014.

### **Sampling Summary**

Meters in the program at the beginning of the plan year	274,351
Meters in the program at the end of the plan year	277,983
Total meters removed during the year	4,008
Meters qualifying for analysis (not uniquely defective)	3,212
Uniquely defective meters	796
Meters statistically required for analysis (>10 yrs in svc)	1921
Meters provided through random selection (>10 yrs in svc)	1,291

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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 effective February 27, 2005 and Tariff Rule No. 6, part 1 filed in the state of Oregon effective June 15, 2007. 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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### DOMESTIC METERS 1000 CFH AND SMALLER

#### SUMMARY

#### **Beginning of Report Year 2014, In-Service Meters on 1/1/14**

Total Number of Meters For Random Sampling	274,351
Total Number of Test Families <sup>(a)</sup>	170
Number of Test Families $\geq$ 10 yrs old <sup>(b)</sup>	93
Number of Test Families to be Voluntarily Removed for Admin. Purposes <sup>(c)</sup>	0

#### **End of Report Year 2014 Meter Testing Quantities & Results**

Number of Meters Tested	3,212
Number of Meters Passed, (+/-) 2%	3,186
Number of Meters Failed, (+/-) 2%	26
Number of Meters, Uniquely Defective Test Result, (+/-) 10%	796
Meter Families With an Overall Fail Result	0
Meter Families With a Fast Fail Result	0
Meter Families Removed/Depleted During Report Year <sup>(d)</sup>	4

#### **Transition to 2015 Test Year**

Total Number of Meters For Random Sampling	277,983
Total Number of Test Families <sup>(a)</sup>	176
Number of Test Families $\geq$ 10 yrs old <sup>(b)</sup>	99
Number of Test Families to be Voluntarily Removed for Admin. Purposes <sup>(c)</sup>	0

- 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 2004 and earlier for the 2014 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) Number of meter families that were voluntarily removed for administrative reasons. Includes families with less than 10 meters in population and meter populations that were observed to be trending towards failure
- d) Total number of meter families depleted during the report year including those removed for administrative purposes.

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**RANDOM SAMPLING METER PERFORMANCE DATA**

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**DOMESTIC METERS 1000 CFH AND SMALLER  
SUMMARY**

**METER FAMILY TEST RESULTS**

Cascade Natural Gas Corp.

**2014 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	ROCKW	1	45	40	17	16	16	100	13	9	I	16	100	10	16	I	0	ACCEPTABLE
1982	SPRAG	1	75	50	20	20	20	100	13	10	I	20	100	10	19	I	0	ACCEPTABLE
1983	SPRAG	1	358	80	27	23	23	100	13	11	I	23	100	10	23	I	0	ACCEPTABLE
1986	AMERI	1	638	90	27	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE
1986	ROCKW	1	1659	100	45	34	34	100	11	11	I	34	100	8	24	I	0	ACCEPTABLE
1986	SPRAG	1	1053	90	29	28	28	100	12	11	I	28	100	9	24	I	0	ACCEPTABLE
1987	AMERI	1	2425	100	41	31	31	100	12	11	I	31	100	9	24	I	0	ACCEPTABLE
1987	ROCKW	1	2836	100	42	38	38	100	11	11	I	38	100	8	24	I	0	ACCEPTABLE
1987	SPRAG	1	1151	90	37	31	31	100	12	11	I	31	100	9	24	I	0	ACCEPTABLE
1988	AMERI	1	3336	125	49	34	34	100	11	11	I	34	100	8	24	I	0	ACCEPTABLE
1988	ROCKW	1	2425	100	42	33	32	96	11	17	I	33	100	9	24	I	0	ACCEPTABLE
1988	SPRAG	1	1869	100	43	33	33	100	11	11	I	33	100	9	24	I	0	ACCEPTABLE
1989	AMERI	1	5191	125	69	54	54	100	9	11	I	54	100	7	24	I	0	ACCEPTABLE
1989	ROCKW	1	4933	125	79	70	70	100	8	11	I	70	100	6	24	I	0	ACCEPTABLE
1989	SPRAG	1	3165	100	60	36	35	97	11	15	I	36	100	8	24	I	0	ACCEPTABLE
1990	AMERI	1	3834	125	45	33	33	100	11	11	I	33	100	9	24	I	0	ACCEPTABLE
1990	ROCKW	1	5575	125	67	54	54	100	9	11	I	54	100	7	24	I	0	ACCEPTABLE



1990	SPRAG	1	2601	100	62	38	36	94	11	22	I	38	100	8	24	I	0	ACCEPTABLE
1991	AMERI	1	4528	125	44	37	37	100	11	11	I	37	100	8	24	I	0	ACCEPTABLE
1991	ROCKW	1	3278	125	56	50	50	100	9	11	I	50	100	7	24	I	0	ACCEPTABLE
1991	SPRAG	1	2184	100	44	31	31	100	12	11	I	31	100	9	24	I	0	ACCEPTABLE
1992	AMERI	1	3015	100	38	29	29	100	12	11	I	29	100	9	24	I	0	ACCEPTABLE
1992	ROCKW	1	8016	125	77	59	59	100	9	11	I	59	100	6	24	I	0	ACCEPTABLE
1992	ROCKW	2	4	4	4	4	4	100	0	4	I	4	100	0	4	I	0	FAMILY DEPLETED
1992	SPRAG	1	1729	100	38	25	25	100	13	11	I	25	100	10	24	I	0	ACCEPTABLE
1993	AMERI	1	3365	125	45	32	32	100	12	11	I	32	100	9	24	I	0	ACCEPTABLE
1993	AMERI	3	20	20	14	14	14	100	10	7	I	14	100	7	11	I	0	ACCEPTABLE
1993	ROCKW	1	5721	125	46	42	42	100	10	11	I	42	100	8	24	I	0	ACCEPTABLE
1993	ROCKW	2	43	40	16	16	16	100	13	9	I	16	100	10	16	I	0	ACCEPTABLE
1993	SPRAG	1	5935	125	83	62	59	95	8	19	I	61	98	6	38	I	0	ACCEPTABLE
1994	AMERI	1	5501	125	63	44	44	100	10	11	I	44	100	7	24	I	0	ACCEPTABLE
1994	AMERI	3	31	31	15	15	15	100	12	8	I	15	100	9	14	I	0	ACCEPTABLE
1994	ROCKW	1	4079	125	62	48	48	100	9	11	I	48	100	7	24	I	0	ACCEPTABLE
1994	SPRAG	1	5850	125	82	51	51	100	9	11	I	51	100	7	24	I	0	ACCEPTABLE
1995	AMERI	1	3219	125	45	32	32	100	12	11	I	32	100	9	24	I	0	ACCEPTABLE
1995	AMERI	3	32	32	15	15	15	100	13	8	I	15	100	9	14	I	0	ACCEPTABLE
1995	ROCKW	1	2556	100	55	44	44	100	10	11	I	44	100	7	24	I	0	ACCEPTABLE
1995	ROCKW	2	49	40	18	17	17	100	13	9	I	17	100	10	16	I	0	ACCEPTABLE
1995	SPRAG	1	10321	200	77	45	45	100	10	11	I	45	100	7	24	I	0	ACCEPTABLE
1996	AMERI	1	419	80	30	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE
1996	AMERI	3	27	27	14	14	14	100	12	8	I	14	100	9	13	I	0	ACCEPTABLE

1996	ROCKW	1	981	90	31	29	29	100	12	11	I	29	100	9	24	I	0	ACCEPTABLE
1996	ROCKW	2	52	40	18	17	17	100	13	9	I	17	100	10	17	I	0	ACCEPTABLE
1996	SPRAG	1	4439	125	117	100	100	100	7	11	I	100	100	5	24	I	0	ACCEPTABLE
1997	AMERI	1	116	60	23	21	21	100	13	10	I	21	100	10	20	I	0	ACCEPTABLE
1997	AMERI	3	97	50	50	48	47	97	7	13	I	47	97	5	33	I	0	ACCEPTABLE
1997	ROCKW	1	481	80	24	23	23	100	13	11	I	23	100	10	23	I	0	ACCEPTABLE
1997	ROCKW	2	95	50	23	21	21	100	13	10	I	21	100	10	20	I	0	ACCEPTABLE
1997	SPRAG	1	7009	125	61	40	40	100	10	11	I	40	100	8	24	I	0	ACCEPTABLE
1998	AMERI	1	533	90	24	23	23	100	13	11	I	23	100	10	23	I	0	ACCEPTABLE
1998	AMERI	3	21	21	14	14	14	100	10	7	I	14	100	8	12	I	0	ACCEPTABLE
1998	ROCKW	1	7609	125	80	69	68	98	8	13	I	68	98	6	38	I	0	ACCEPTABLE
1998	ROCKW	2	229	70	22	22	22	100	13	10	I	22	100	10	22	I	0	ACCEPTABLE
1998	SPRAG	1	784	90	27	25	25	100	13	11	I	25	100	10	24	I	0	ACCEPTABLE
1999	AMERI	1	7228	125	43	35	35	100	11	11	I	35	100	8	24	I	0	ACCEPTABLE
1999	AMERI	3	197	70	23	23	23	100	13	10	I	23	100	10	22	I	0	ACCEPTABLE
1999	ROCKW	1	539	90	28	25	25	100	13	11	I	25	100	10	23	I	0	ACCEPTABLE
1999	ROCKW	2	149	60	64	62	56	90	6	34	I	56	90	5	60	Ila	0	ACCEPTABLE
1999	SPRAG	1	498	80	28	26	26	100	13	11	I	26	100	9	23	I	0	ACCEPTABLE
2000	AMERI	1	8390	125	83	75	75	100	8	11	I	75	100	6	24	I	0	ACCEPTABLE
2000	AMERI	3	191	70	41	40	40	100	9	10	I	40	100	7	22	I	0	ACCEPTABLE
2000	ROCKW	1	964	90	46	41	41	100	10	11	I	41	100	8	24	I	0	ACCEPTABLE
2000	ROCKW	2	171	70	25	21	21	100	13	10	I	21	100	10	21	I	0	ACCEPTABLE
2000	SPRAG	1	97	50	35	33	33	100	9	10	I	33	100	7	20	I	0	ACCEPTABLE
2000	SPRAG	3	19	19	17	17	17	100	5	7	I	17	100	4	11	I	0	ACCEPTABLE

2001	AMERI	1	6650	125	43	37	37	100	11	11	I	37	100	8	24	I	0	ACCEPTABLE
2001	AMERI	3	322	80	27	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE
2001	ROCKW	1	199	70	24	22	22	100	13	10	I	22	100	10	22	I	0	ACCEPTABLE
2001	ROCKW	2	286	80	27	25	25	100	13	10	I	25	100	9	23	I	0	ACCEPTABLE
2001	SPRAG	1	1191	90	31	26	26	100	13	11	I	26	100	10	24	I	0	ACCEPTABLE
2001	SPRAG	3	46	40	18	17	17	100	13	9	I	17	100	10	16	I	0	ACCEPTABLE
2002	ACTAR	1	915	90	34	28	28	100	12	11	I	28	100	9	24	I	0	ACCEPTABLE
2002	AMERI	1	8041	125	131	98	96	97	7	15	I	96	97	5	49	I	0	ACCEPTABLE *
2002	AMERI	3	225	70	37	35	35	100	10	10	I	35	100	8	22	I	0	ACCEPTABLE
2002	ROCKW	1	792	90	27	27	27	100	12	11	I	27	100	9	24	I	0	ACCEPTABLE
2002	ROCKW	2	481	80	30	26	26	100	13	11	I	26	100	9	23	I	0	ACCEPTABLE
2002	SPRAG	1	473	80	31	26	26	100	13	11	I	26	100	9	23	I	0	ACCEPTABLE
2002	SPRAG	3	4	4	4	4	4	100	0	4	I	4	100	0	4	I	0	FAMILY DEPLETED
2003	AMERI	1	9720	125	131	76	73	96	8	17	I	73	96	6	67	I	0	ACCEPTABLE *
2003	AMERI	3	448	80	25	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE
2003	ROCKW	1	368	80	23	23	22	95	13	18	I	23	100	10	23	I	0	ACCEPTABLE
2003	ROCKW	2	212	70	25	24	24	100	13	10	I	24	100	10	22	I	0	ACCEPTABLE
2003	SPRAG	1	708	90	28	24	24	100	13	11	I	24	100	10	24	I	0	ACCEPTABLE
2003	SPRAG	2	8	8	8	6	6	100	0	8	I	6	100	0	8	I	0	FAMILY DEPLETED
2004	ACTAR	1	14	14	10	10	10	100	12	6	I	10	100	9	9	I	0	ACCEPTABLE
2004	AMERI	1	13796	200	149	73	71	97	8	15	I	71	97	6	50	I	0	ACCEPTABLE *
2004	AMERI	3	364	80	29	29	29	100	12	11	I	29	100	9	23	I	0	ACCEPTABLE
2004	ROCKW	1	399	80	25	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE
2004	ROCKW	2	367	80	24	24	24	100	13	11	I	24	100	10	23	I	0	ACCEPTABLE

2004	ROOTS	3	5	5	5	5	5	100	0	5	I	5	100	0	5	I	0	FAMILY DEPLETED
2004	SPRAG	1	119	60	23	20	20	100	13	10	I	20	100	10	20	I	0	ACCEPTABLE
2004	SPRAG	2	13	13	9	9	9	100	13	6	I	9	100	9	9	I	0	ACCEPTABLE
2004	SPRAG	3	104	60	22	22	22	100	13	10	I	22	100	9	20	I	0	ACCEPTABLE
2005	ACTAR	1	4	4	0	0	0	NaN	N/A	2	N/A	0	NaN	N/A	2	N/A	0	ACCEPTABLE
2005	AMERI	1	13832	200	77	31	28	90	12	43	IV	28	90	9	200	IV	0	ACCEPTABLE
2005	AMERI	3	294	80	4	3	3	100	<<>>	10	IV	3	100	<<>>	23	IV	0	ACCEPTABLE
2005	ROCKW	1	262	70	4	2	2	100	<<>>	10	IV	2	100	<<>>	22	IV	0	ACCEPTABLE
2005	ROCKW	2	521	90	6	6	6	100	<<>>	11	IV	6	100	<<>>	23	IV	0	ACCEPTABLE
2005	SPRAG	1	249	70	3	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2005	SPRAG	2	25	25	0	0	0	NaN	N/A	13	IV	0	NaN	N/A	13	IV	0	ACCEPTABLE
2005	SPRAG	3	52	40	0	0	0	NaN	N/A	20	IV	0	NaN	N/A	20	IV	0	ACCEPTABLE
2006	ACTAR	1	1	1	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2006	AMERI	1	13454	200	56	33	33	100	11	11	I	33	100	9	24	I	0	ACCEPTABLE
2006	AMERI	3	444	80	6	5	5	100	<<>>	11	IV	5	100	<<>>	23	IV	0	ACCEPTABLE
2006	ROCKW	1	145	60	2	2	2	100	<<>>	10	IV	2	100	<<>>	21	IV	0	ACCEPTABLE
2006	ROCKW	2	518	90	7	5	5	100	<<>>	11	IV	5	100	<<>>	23	IV	0	ACCEPTABLE
2006	SPRAG	1	186	70	1	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2006	SPRAG	2	12	12	1	1	1	100	<<>>	6	IV	1	100	<<>>	8	IV	0	ACCEPTABLE
2006	SPRAG	3	247	70	3	3	3	100	<<>>	10	IV	3	100	<<>>	22	IV	0	ACCEPTABLE
2007	ACTAR	1	16	16	0	0	0	NaN	N/A	8	IV	0	NaN	N/A	8	IV	0	ACCEPTABLE
2007	AMERI	1	2646	100	8	8	8	100	<<>>	11	IV	8	100	<<>>	24	IV	0	ACCEPTABLE
2007	AMERI	3	217	70	5	5	5	100	<<>>	10	IV	5	100	<<>>	22	IV	0	ACCEPTABLE
2007	ROCKW	1	312	80	0	0	0	NaN	N/A	40	IV	0	NaN	N/A	40	IV	0	ACCEPTABLE

2007	ROCKW	2	373	80	4	3	3	100	<<>	11	IV	3	100	<<>	23	IV	0	ACCEPTABLE
2007	SPRAG	1	310	80	2	2	2	100	<<>	10	IV	2	100	<<>	23	IV	0	ACCEPTABLE
2007	SPRAG	2	25	25	0	0	0	NaN	N/A	13	IV	0	NaN	N/A	13	IV	0	ACCEPTABLE
2007	SPRAG	3	53	40	2	2	2	100	<<>	9	IV	2	100	<<>	17	IV	0	ACCEPTABLE
2008	ACTAR	1	3	3	0	0	0	NaN	N/A	2	N/A	0	NaN	N/A	2	N/A	0	ACCEPTABLE
2008	AMERI	1	12233	200	58	49	49	100	9	11	I	49	100	7	24	I	0	ACCEPTABLE
2008	AMERI	3	630	90	12	11	11	100	20	11	I	11	100	<<>	23	IV	0	ACCEPTABLE
2008	ROCKW	1	243	70	4	4	4	100	<<>	10	IV	4	100	<<>	22	IV	0	ACCEPTABLE
2008	ROCKW	2	676	90	10	8	8	100	<<>	11	IV	8	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	91	50	1	0	0	NaN	N/A	25	IV	0	NaN	N/A	25	IV	0	ACCEPTABLE
2008	SPRAG	2	22	22	1	0	0	NaN	N/A	11	IV	0	NaN	N/A	11	IV	0	ACCEPTABLE
2008	SPRAG	3	40	40	1	0	0	NaN	N/A	20	IV	0	NaN	N/A	20	IV	0	ACCEPTABLE
2009	ACTAR	1	16	16	1	1	1	100	<<>	7	IV	1	100	<<>	10	IV	0	ACCEPTABLE
2009	AMERI	1	4905	125	10	7	7	100	<<>	11	IV	7	100	<<>	24	IV	0	ACCEPTABLE
2009	AMERI	3	387	80	6	5	5	100	<<>	11	IV	5	100	<<>	23	IV	0	ACCEPTABLE
2009	ROCKW	1	506	90	3	3	3	100	<<>	11	IV	3	100	<<>	23	IV	0	ACCEPTABLE
2009	ROCKW	2	569	90	10	9	9	100	<<>	11	IV	9	100	<<>	23	IV	0	ACCEPTABLE
2009	SPRAG	1	493	80	10	7	7	100	<<>	11	IV	7	100	<<>	23	IV	0	ACCEPTABLE
2009	SPRAG	2	17	17	0	0	0	NaN	N/A	9	IV	0	NaN	N/A	9	IV	0	ACCEPTABLE
2009	SPRAG	3	52	40	13	13	13	100	16	9	I	13	100	<<>	17	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	3578	125	22	14	14	100	18	11	I	14	100	<<>	24	IV	0	ACCEPTABLE
2010	AMERI	2	1	1	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE

2010	AMERI	3	496	80	3	2	2	100	<<>>	11	IV	2	100	<<>>	23	IV	0	ACCEPTABLE
2010	ROCKW	1	250	70	3	3	3	100	<<>>	10	IV	3	100	<<>>	22	IV	0	ACCEPTABLE
2010	ROCKW	2	221	70	6	3	3	100	<<>>	10	IV	3	100	<<>>	22	IV	0	ACCEPTABLE
2010	SPRAG	1	334	80	4	2	2	100	<<>>	11	IV	2	100	<<>>	23	IV	0	ACCEPTABLE
2010	SPRAG	2	13	13	0	0	0	NaN	N/A	7	IV	0	NaN	N/A	7	IV	0	ACCEPTABLE
2010	SPRAG	3	161	70	6	4	4	100	<<>>	10	IV	4	100	<<>>	21	IV	0	ACCEPTABLE
2011	ACTAR	1	6	6	0	0	0	NaN	N/A	3	N/A	0	NaN	N/A	3	N/A	0	ACCEPTABLE
2011	AMERI	1	4704	125	11	9	9	100	<<>>	11	IV	9	100	<<>>	24	IV	0	ACCEPTABLE
2011	AMERI	3	319	80	5	4	4	100	<<>>	11	IV	4	100	<<>>	23	IV	0	ACCEPTABLE
2011	ROCKW	1	233	70	4	2	2	100	<<>>	10	IV	2	100	<<>>	22	IV	0	ACCEPTABLE
2011	ROCKW	2	638	90	10	7	7	100	<<>>	11	IV	7	100	<<>>	23	IV	0	ACCEPTABLE
2011	ROOTS	2	1	1	0	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2011	SPRAG	1	249	70	4	1	1	100	<<>>	10	IV	1	100	<<>>	22	IV	0	ACCEPTABLE
2011	SPRAG	2	23	23	0	0	0	NaN	N/A	12	IV	0	NaN	N/A	12	IV	0	ACCEPTABLE
2011	SPRAG	3	26	26	0	0	0	NaN	N/A	13	IV	0	NaN	N/A	13	IV	0	ACCEPTABLE
2012	ACTAR	1	23	23	0	0	0	NaN	N/A	12	IV	0	NaN	N/A	12	IV	0	ACCEPTABLE
2012	AMERI	1	3740	125	28	13	13	100	18	11	I	13	100	<<>>	24	IV	0	ACCEPTABLE
2012	AMERI	3	224	70	5	4	4	100	<<>>	10	IV	4	100	<<>>	22	IV	0	ACCEPTABLE
2012	ROCKW	1	230	70	0	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2012	ROCKW	2	470	80	7	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	231	70	3	2	2	100	<<>>	10	IV	2	100	<<>>	22	IV	0	ACCEPTABLE
2012	SPRAG	2	20	20	0	0	0	NaN	N/A	10	IV	0	NaN	N/A	10	IV	0	ACCEPTABLE
2012	SPRAG	3	40	40	1	1	1	100	<<>>	9	IV	1	100	<<>>	15	IV	0	ACCEPTABLE

2013	ACTAR	1	18	18	0	0	0	NaN	N/A	9	IV	0	NaN	N/A	9	IV	0	ACCEPTABLE
2013	AMERI	1	2115	100	26	16	16	100	16	11	I	16	100	<<>>	24	IV	0	ACCEPTABLE
2013	AMERI	2	1	1	6	0	0	NaN	N/A	1	N/A	0	NaN	N/A	1	N/A	0	ACCEPTABLE
2013	AMERI	3	106	60	8	8	8	100	<<>>	10	IV	8	100	<<>>	20	IV	0	ACCEPTABLE
2013	ROCKW	1	209	70	2	1	1	100	<<>>	10	IV	1	100	<<>>	22	IV	0	ACCEPTABLE
2013	ROCKW	2	97	50	4	3	3	100	<<>>	10	IV	3	100	<<>>	20	IV	0	ACCEPTABLE
2013	SPRAG	1	180	70	1	0	0	NaN	N/A	35	IV	0	NaN	N/A	35	IV	0	ACCEPTABLE
2013	SPRAG	2	13	13	1	0	0	NaN	N/A	7	IV	0	NaN	N/A	7	IV	0	ACCEPTABLE
2013	SPRAG	3	43	40	4	4	4	100	<<>>	9	IV	4	100	<<>>	16	IV	0	ACCEPTABLE
GRAND TOTALS			274349		4008	3212	3186					3193					292	

\*Test results were combined from samples taken in years 2012, 2013 and 2014 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**

*No meter families in service ten or more years were found below the acceptable threshold limits (i.e. fall in region III).*

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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**

<b>Meter Family</b>	<b>Family Size</b>	<b>Min Sample Size Required</b>	<b>Meters Qualifying for Sample in 2014</b>
2002 AMERI1	8,041	125	37
2003AMERI1	9,720	125	35
2004AMERI1	13,796	200	37

*Unexpected test results late in the year caused the above three meter families to fall in region IV, thus requiring much larger samples to be obtained. Due to size of these families, along with time and logistical constraints, the requisite sample size could not be achieved prior to the year-end deadline. Instead, these families were evaluated by combining test results from a three year period January 1, 2012 through December 31, 2014. This allowed a statistically valid sample to be analyzed for each of these families. All three families were found to be within acceptable limits for the three year period. As a result, these families were permitted to remain in service another year pending further testing. Maximum sized samples are being drawn from these families in the first half of 2015 for analysis to avoid the need to analyze multiple year samples again and to ensure an early determination of the status of these families for 2015. Since these are larger families, this will also facilitate strategic planning for the future disposition of any family found below acceptable limits (Region III).*

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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**

*No meters were previously scheduled for removal in 2014*

<b>Meter Family</b>	<b>Disposition Status</b>	<b>Year Disposition Initiated</b>	<b>Year Disposition Completed</b>
N/A			

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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

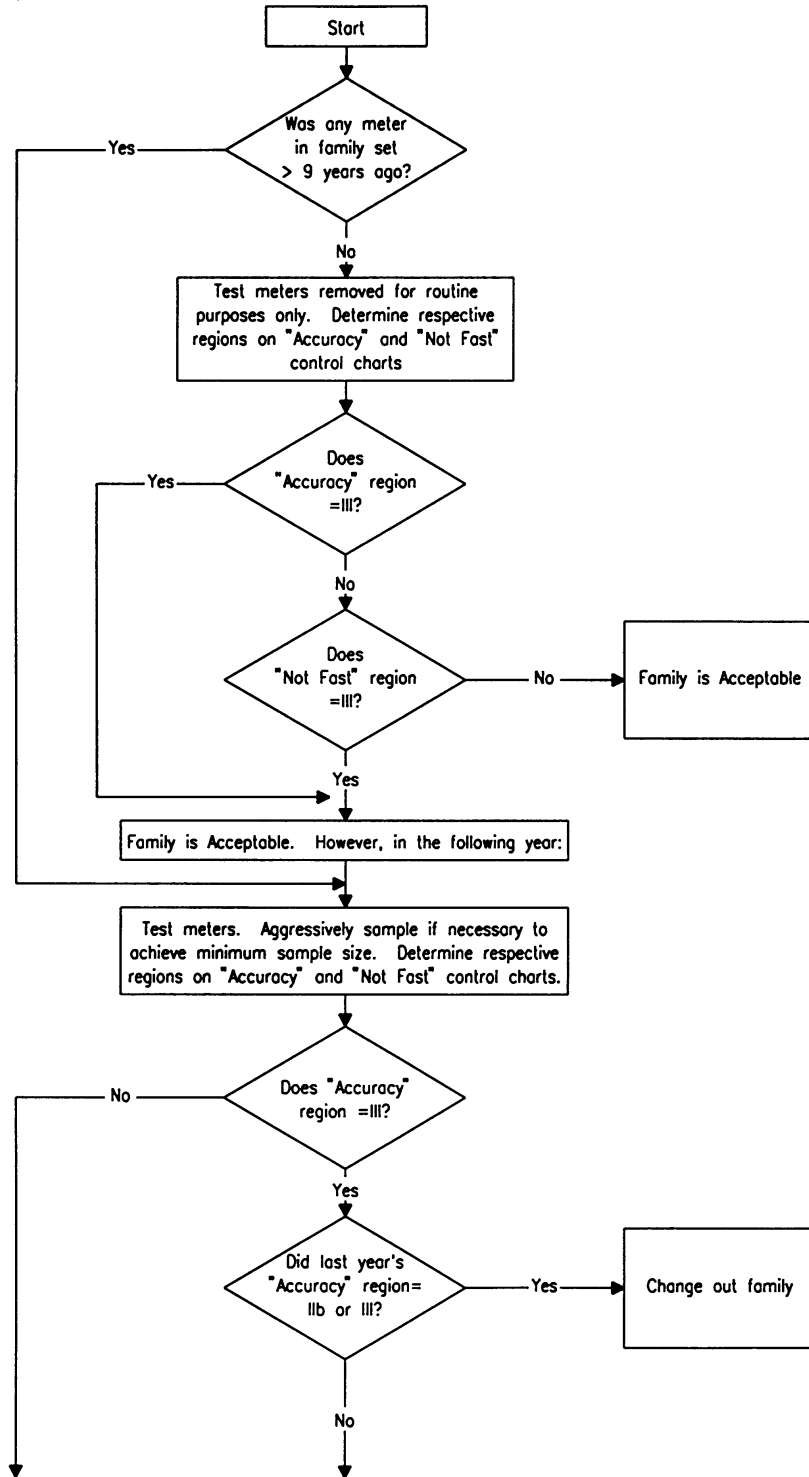
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succeeding years.

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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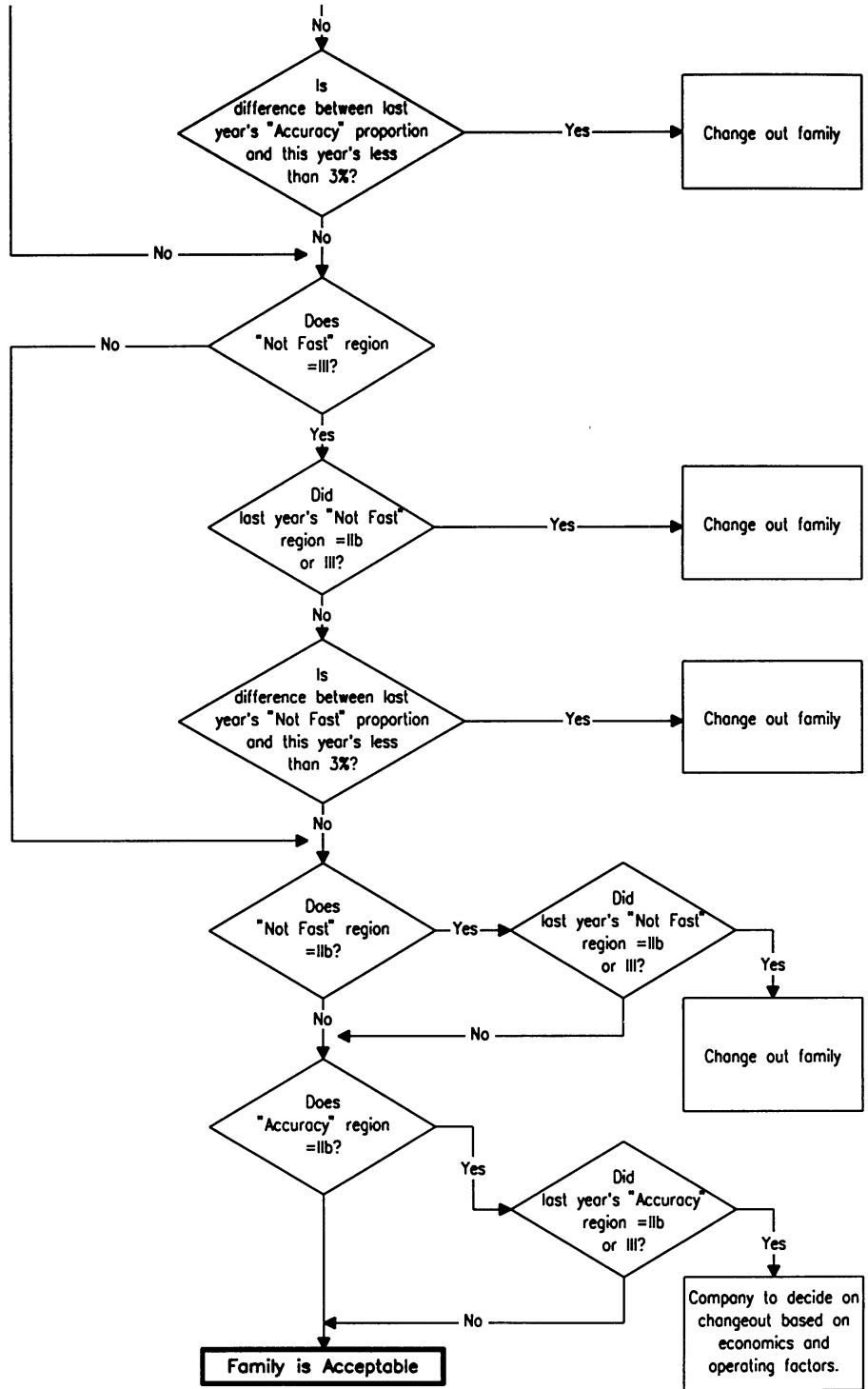
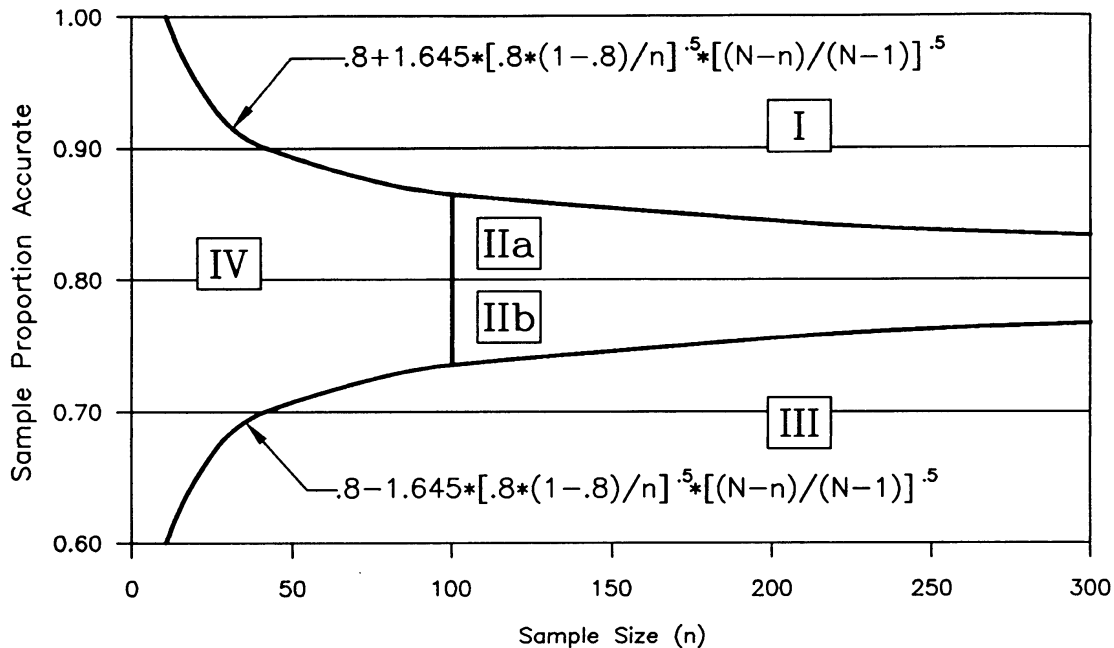


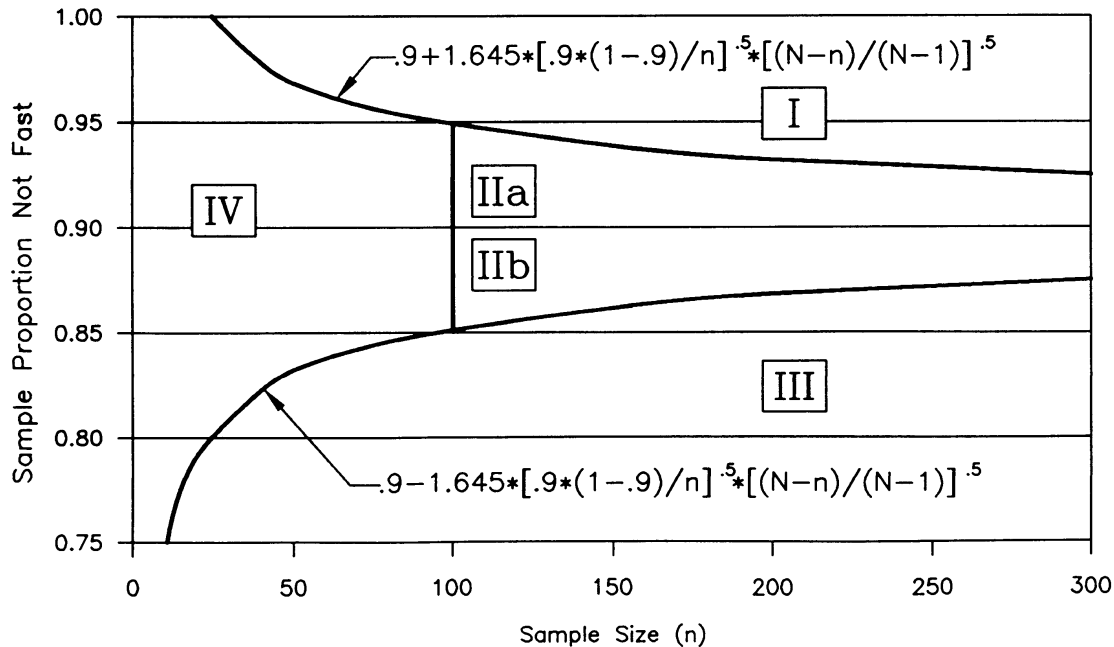
Figure 3.b.

## Meter Performance Control Charts

**Figure 1. For Meters Accurate**



**Figure 2. For Meters Not Fast**



\*Example where family size (N) = 3000