

**HARMONIC SPECIFICATIONS FOR HARMONIC
PRODUCING CUSTOMERS CONNECTED TO
FORTISALBERTA'S ELECTRIC DISTRIBUTION
SYSTEM**

Table of Contents

1.0	INTRODUCTION.....	2
2.0	EVALUATION PROCESS FOR DISTORTING CUSTOMERS	3
2.1	Introduction to the Process	3
2.2	Facility Identification	3
2.3	Multi-Grounded Neutral Requirement.....	3
2.4	Simple Evaluation: Facility Distorting Load Identification.....	4
2.5	Simple Evaluation: Distorting Load Size and Capacitor Resonance.....	4
2.6	Information Exchange for Detailed Design	5
2.7	Customer Compliance Report	5
2.8	Commissioning	6
2.9	Non-Detailed Commissioning	6
2.10	Detailed Commissioning	7
3.0	RESPONSIBILITIES FOR MITIGATION	8
3.1	Customer Responsibility	8
3.2	FortisAlberta Responsibility	9
4.0	FORTISALBERTA’S CUSTOMER DISTORTING FACILITY ACCEPTANCE LIMITS	10
5.0	FORTISALBERTA CUSTOMER DISTORTION AND INTERFERENCE LIMITS	11
5.1	Current Distortion Limits	11
5.2	Telephone Interference Limits	12
5.3	FortisAlberta Measurement Assessment Procedure Of Current Emissions.....	13
6.0	FORTISALBERTA DISTORTION LIMITS	14
6.1	System Harmonic Voltage Distortion	14
6.2	System Interharmonic Voltage Distortion.....	14
7.0	DEFINITION OF TERMS	16
8.0	REFERENCE DOCUMENTS	17
	APPENDIX A	18
	APPENDIX B	19
	APPENDIX C	20
	APPENDIX D	21

1.0 Introduction

This document is intended for existing/new Commercial and Oil & Gas Customers with Distorting Load¹ that are or will be connected to FortisAlberta's System. As per Section 5.2.4 of FortisAlberta Terms & Conditions, the criteria in this document is intended to ensure Customers do not cause undue harmonic interference to any other facilities.

This document will establish the limits and responsibilities for distortion and interference at the point of common coupling (PCC) and within the FortisAlberta system. It will specifically define the following items:

1. The procedure by which distorting load will be added to the FortisAlberta distribution system in order to ensure any distortion or interference problems are avoided.
2. The responsibilities of FortisAlberta and its Customers when Customer facilities or the FortisAlberta distribution system do not meet the FortisAlberta Customer Distorting Facility Acceptance Limits, the FortisAlberta Customer Distortion and Interference Limits and/or the FortisAlberta Distortion Limits.
3. FortisAlberta Customer Distorting Facility Acceptance Limits
4. FortisAlberta Customer Distortion and Interference Limits
5. FortisAlberta Distortion Limits

¹Distorting Loads include power electronic equipment (drives, inverters, rectifiers, computers, etc); and arcing devices (fluorescent lighting, welders, arc furnaces, etc)

2.0 Evaluation Process for Distorting Customers

2.1 Introduction to the Process

This section outlines the procedure for all Customer distorting load additions. FortisAlberta will be involved with the Customer from facility inception throughout its lifecycle. FortisAlberta will not be responsible for any Customer design engineering. FortisAlberta's involvement with respect to distortion/interference will be to ensure the Customer's facility does not exceed distortion acceptance limits or distortion and interference limits as described in Section 4 and Section 5 of this document respectively.

2.2 Facility Identification

Customers will identify if they are or will be a distorting Customer through one of the following two ways:

1. Completing the online "*New/Upgrade Service Form*", found by going to www.fortisalberta.com and going to Customer Service / appropriate customer type (i.e. Oil and Gas) / New/Upgraded Service / Online New/Upgraded Service Form or Offline Excel New/Upgraded Service Form.
2. Calling FortisAlberta at 310-WIRE to set up an Open Item # for the facility. A few business days after calling 310-WIRE, a FortisAlberta New Connects Agent will call the Customer to discuss the facility in more detail.

2.3 Multi-Grounded Neutral Requirement

FortisAlberta will install a Multi-Grounded Neutral (MGN) at Customer cost on all 150KW or greater distorting loads. This measure will provide some harmonic mitigation and reduce equipment damage by reducing temporary over voltages during line-ground faults. The Customer is responsible for notifying FortisAlberta of any 150KW or greater distorting load.

Notes: See Appendix C - Part 1

2.4 Simple Evaluation: Facility Distorting Load Identification

If FortisAlberta has determined the Total Facility Load is significant, the facility will undergo at minimum a Simple Evaluation. In order to perform this, FortisAlberta will send the Customer a Quotation Package which includes the:

- Proposal Letter
- *Distorting Load Information Sheet*
- This document, titled *Harmonic Specifications for Harmonic Producing Customers Connected to FortisAlberta's Electric Distribution System*.

After receiving the Quotation Package from FortisAlberta, the Customer will confirm if the Facility plan will move forward by signing the proposal letter. If the Customer will use distorting loads the "*Distorting Load Information Sheet*" must be filled out in its entirety and returned to FortisAlberta with the proposal letter. If there is no distorting load, indicate this by answering only the first question and return it with the proposal letter. It is solely the Customer's responsibility to notify FortisAlberta of distorting loads at the site.

The questions asked in the "*Distorting Load Information Sheet*" are required for FortisAlberta to do the Distorting Load Size and Capacitor Resonance Limits Evaluation (see Section 2.5). The information asked includes:

- contractor information for distorting load
- detailed distorting equipment information and mitigation
- distorting equipment operation
- power factor correction capacitor information

2.5 Simple Evaluation: Distorting Load Size and Capacitor Resonance

If the Customer's facility uses distorting load and was not previously approved in Section 2.3, then the conditions in Section 4 must be met for the facility to be accepted without adhering to the FortisAlberta Customer Distortion and Interference Limits (Section 5).

Note: See Appendix C - Part 1

2.6 Information Exchange for Detailed Design

If the facility was not approved in Section 2.3 or Section 2.5, the Customer must complete a detailed distortion evaluation to ensure the facility adheres to the FortisAlberta Customer Distortion and Interference Limits (Section 5). A FortisAlberta Planner will provide the following information to enable this evaluation:

- This document, “*Harmonic Specification for Harmonic Producing Customers Connected to FortisAlberta’s Electric Distribution System,*” which outlines FortisAlberta’s:
 - Distorted Current Limit (Section 5)
 - Residual I*T Limit (Section 5)
 - Balanced I*T Limit (Section 5)
- FortisAlberta Short Circuit Apparent Power (S_{FSC}) at the PCC.
- Map of Impedance Levels at Primary (60Hz)
 - Conductor sizes, type and material lengths
 - Customer Load Servicing Transformer information such as X/R and winding configuration
 - Positive, Negative and Zero sequence Impedances at the 25KV bus of the substation and at the Customers PCC.
- A Frequency Scan at the PCC up to the 50th harmonic.
- Additional information required by the Customer regarding the FortisAlberta distribution system

2.7 Customer Compliance Report

The Customer will assess the facility design according to FortisAlberta Customer Distortion and Interference Limits (Section 5) and make any changes as needed.

The Customer must provide a compliance report to FortisAlberta that includes:

- facility identification
- final results summarized and compared to the FortisAlberta Customer Distortion and Interference Limits (Section 5)
- final single line diagram of installation
- transformer ratings and impedance
- cable impedance that should be included for distortion analysis
- all non-distortion producing loads
- all distortion producing loads and their harmonic spectrums
- power factor correction capacitor and filter information, if applicable
- appendices (background information such as calculations, models, etc.)

All facilities must have a topology whereby if mitigation equipment is needed for the facility to adhere to the FortisAlberta Customer Distortion and Interference Limits (Section 5), then that mitigation equipment must operate when the

distorting equipment is operating, and must cease operation when the distorting equipment is not operating.

The final compliance report should then be given to the FortisAlberta Planner for approval. By approving the Customer's compliance report, FortisAlberta is simply acknowledging that the compliance report is complete and the numbers indicated meet limits and design topology requirements. Approval does not mean that FortisAlberta is taking responsibility for report contents.

Note:

1. The facility will not be energized until the compliance report is approved by FortisAlberta.
2. Note: See Appendix C - Part 4

2.8 Commissioning

When all FortisAlberta service criteria are met and the facility's compliance report has been approved, FortisAlberta will design the Customer's service and determine the required facility commissioning process. The requirement for detailed or non-detailed commissioning will be dependent on the characteristics of the Customer Facility and the electrical environment in the area.

2.9 Non-Detailed Commissioning

FortisAlberta will energize the facility and take distortion and interference measurements once normal Customer operation has commenced.

If the facility's data show that normal operation is at or below the FortisAlberta Customer Distortion and Interference Limits (Section 5), the facility harmonic acceptance is complete.

If the facility's data show that the normal operation is above the FortisAlberta Customer Distortion and Interference Limits (Section 5), the facility may be de-energized and returned to the Customer Compliance Report Stage (Section 2.7).

Note: See Appendix C, - Part 2 and 3.

2.10 Detailed Commissioning

If detailed commissioning is needed before the Customer's facility is energized, FortisAlberta will take background measurements at or near the facility PCC. These measurements may include:

- Voltage unbalance
- Voltage THD
- Telephone Probe Wire I*T

These measurements will provide a benchmark for the FortisAlberta distribution system, and allow FortisAlberta to identify and fix any pre-existing problems in the area.

FortisAlberta will then energize the facility and take distortion and interference measurements once normal customer operation has commenced.

If the facility's data show that normal operation is at or below the FortisAlberta Customer Distortion and Interference Limits (Section 5), the facility harmonic acceptance is complete.

If the facility's data show that the normal operation is above the FortisAlberta Customer Distortion and Interference Limits (Section 5), the facility may be de-energized and returned to the Customer Compliance Report Stage (Section 2.7).

Note: See Appendix C, - Part 2 and 3.

3.0 Responsibilities for Mitigation

3.1 Customer Responsibility

1. Obligation to Help in the Investigation

If FortisAlberta determines the Customer's equipment may be the source of unacceptable distortion or interference on FortisAlberta's distribution system, the Customer is obligated to help FortisAlberta by providing:

- Required up-to-date facility information which includes:
 - final single line diagram of the facility
 - transformer ratings and impedance
 - cable impedance that should be included for distortion analysis
 - all non-distortion producing loads
 - all distortion producing loads and their harmonic spectrums
 - power factor correction capacitor and filter information, if applicable
- Necessary access for monitoring equipment.

2. Timely Correction of Deficiencies

If an undesirable distribution system disturbance or interference is being caused by the Customer's facility not adhering to the limits in Section 4 or Section 5, the Customer will be required to cease operation of the offending equipment until satisfactory corrective action has been taken by the Customer at the Customer's cost. If the Customer does not take such action within a time frame considered reasonable by FortisAlberta, FortisAlberta may disconnect the supply of energy to the Customer or purchase and install mitigation equipment at Customer cost.

Note: See Appendix C, Part 2 & 3.

3. Dynamic Mitigation Strategies

Due to the dynamic nature of the FortisAlberta distribution system, the system impedance envelope may change in a negative way such that the Customers service connection or distribution access service starts to be in violation of the limits listed in this document, "*Harmonic Specification for Harmonic Producing Customers Connected to FortisAlberta's Electrical Distribution System*". In such a case, the Customer will be responsible for resolving the new distortion issues at the PCC.

The Customer is encouraged to develop mitigation strategies independent of system changes to avoid this risk.

4. Maintaining Facility Distortion Mitigation

All facilities must maintain a facility configuration whereby if mitigation equipment is needed for the facility to meet the limits stipulated in this document, then that mitigation equipment must be in working order and operating at all times while the distorting equipment is operating. It must also cease operation when the distorting equipment is not operating. If the Customer facility configuration changes it is the responsibility of the Customer to provide documentation of this change to FortisAlberta.

3.2 FortisAlberta Responsibility

1. Diagnostic Investigations

FortisAlberta will conduct diagnostic investigations in reaction to Customer complaints. The investigations will seek to determine the source of problem distortion and/or interference. A partnership will then be developed between FortisAlberta and the Customer to resolve the issue.

2. Limiting Distortion Levels on the FortisAlberta Distribution System

FortisAlberta is ultimately responsible for limiting distortion voltages on its system. For new connections, FortisAlberta will be involved in the facility from its inception to ensure that it will meet FortisAlberta's Customer Distorting Facility Acceptance Limits (Section 4) or FortisAlberta's Customer Distortion and Interference Limits (Section 5). If these limits are not met, FortisAlberta has the right to deny electricity service.

When Customers have met the required limits and distortion/interference still remains on FortisAlberta's distribution system, FortisAlberta is responsible for reducing this distortion/interference.

4.0 FortisAlberta's Customer Distorting Facility Acceptance Limits

Distorting Load Size Limits

- $S_{IDW}/S_{FSC} < 0.1\%$
 - where $S_{IDW} = \sum(S_D \times W_D)$

Where:

- S_{IDW} : The weighted (W) apparent power (S) of the Customer facility's (i) distorting equipment (D).
- S_D : The apparent power (S) of an individual distorting piece of equipment (D) in the Customers facility in KVA.
- W_D : The Weighting factor (W) for an individual distorting equipment (D) in the facility (i) in pu. See Appendix A.

Capacitor Resonance Limits

If the facility contains power factor correction capacitors, the facility must meet the following limits:

- $|hr - h_{CD}| > 0.35$
- $|hr - h_{ED}| > 0.10$
- $|hr - h_{TD}| > 0.15$

Where:

- hr: The calculated harmonic (h) resonance (r) point of the Customer capacitor bank.
 - $hr = \sqrt{S_{ISC}/Q_{IC}}$
 - S_{ISC} : Short Circuit (SC) Apparent Power (S) level at the capacitor bank location in the facility (i) in KVA.
 - Q_{IC} : Total installed Reactive Power (Q) generated by the capacitors (C) and cables in the facility (i) in KVAR.
- h_{CD} : The characteristic (C) harmonics (h) of the distorting equipment (D). (i.e. 5, 7, 11, 13, 17....)
- h_{ED} : The even (E) harmonics (h) of the distorting equipment (D). (i.e. 2, 4, 6, 8, 10.....)
- h_{TD} : The triplen (T) harmonics (h) of the distorting equipment (D). (i.e. 3, 9, 15, 21, 27...)

5.0 FortisAlberta Customer Distortion and Interference Limits

5.1 Current Distortion Limits

The Customer's facility PCC shall not have calculated or measured values for current distortion that exceed the limits shown in Table 5.1 if the facility does not meet any of the conditions in Section 4.

In order to properly compare a Customer's calculated total distorted load current emissions with the FortisAlberta Customer Current Distortion and Interference Limits, the Customer's design shall account for unbalance in the voltage supply of 3.0%, where unbalance is defined as the ratio of negative sequence voltage to positive sequence voltage, or alternatively,

$$\%unbalance = \frac{\text{Highest deviation from the average voltage of the 3 phases}}{\text{Average voltage of the 3 phases}}$$

Note: See Appendix C - Part 4

Table 5.1: Distorted Current (rms) Limits

I_{ISC}/I_{IM}	$\%I_{ID}$ H<11	$\%I_{ID}$ 11≤H<17	$\%I_{ID}$ 17≤H<23	$\%I_{ID}$ 23≤H<35	$\%I_{ID}$ 35≤H	$\%I_{THD}$
< 20*	4.0	2.0	1.5	0.6	0.3	5.0
20 to <50	7.0	3.5	2.5	1.0	0.5	8.0
50 to <100	10.0	4.5	4.0	1.5	0.7	12.0
100 to <1000	12.0	5.5	5.0	2.0	1.0	15.0
≥1000	15.0	7.0	6.0	2.5	1.4	20.0

Notes:

1. Even harmonics are limited to 25% of the harmonic limits above.
2. Current distortions that result in a dc offset (i.e. half-wave converters) are not allowed.
3. *All power generation equipment is limited to these values of current distortion, regardless of actual I_{ISC}/I_{IM}

Where:

- I_{ID} : The individual current (I) harmonic distortion (D) values at the PCC of the facility (i) as calculated or measured (see Section 5.3).
- $\%I_{ID}$: I_{ID} expressed as a percentage (%) of the maximum fundamental current component I_{IM} .

- %I_{THD}: The root sum square of the magnitudes of individual current harmonic distortion (I_{ID}) at the PCC of the facility. The value is expressed as a percentage (%) of the maximum fundamental current component (I_{IM}).
- I_{IM}: The maximum (m) fundamental demand load current (I) for the facility (i) at the PCC in Amperes. For calculation purposes this value will equal I_i. For measurement purposes it is the maximum 15 minute demand current.
- I_i: The rated current (I) of the Customer's total facility (i) load derived from the agreed upon S_i.
- I_{ISC}: Maximum short circuit (SC) current (I) at the facilities (i) PCC in Amperes.
- H: Harmonic Order (ratio of Odd harmonic frequency to fundamental frequency) including non-integer harmonic orders (interharmonics)..

5.2 Telephone Interference Limits

The Customer's facility shall not have calculated or measured I*T values that exceed the limits shown in Table 5.2.

Note: See Appendix C - Part 4

Table 5.2: I*T Limits

Nominal Bus Voltage	I*T _B	I*T _R
25 kV or less	1500	100

Where:

- I*T_B: The product of the root sum square of I*T_{iB}.
- I*T_R: The product of the root sum square of I*T_{iR}.
- I*T_{iR}: The individual residual (R) I*T harmonic injection current from the Customer facilities (i) PCC.
 - $I^*T_{iR} = (I_{iDZ} * T)$
- I*T_{iB}: The individual balanced (B) I*T harmonic injection current from the Customer facilities (i) PCC.
 - $I^*T_{iB} = (I_{iDNP} * T)$
- I_{iDZ}: The individual harmonic current distortion values (I_{ID}) which are zero sequence (Z) from the Customer facilities (i) PCC.
- I_{iDNP}: The individual harmonic current distortion values (I_{ID}) which are negative and positive (NP) sequence from the Customer facilities (i) PCC.
- T: The Single Harmonic Current Weighting Factor (T). (Appendix B)

5.3 FortisAlberta Measurement Assessment Procedure Of Current Emissions

The following list shows how FortisAlberta will compare a Customer's measured total distorted load current emissions with the FortisAlberta Customer Current Distortion and Interference Limits (Section 5).

1. The minimum measurement period should be one week (168 hour period) during typical production load levels. Although one week is preferable, FortisAlberta reserves the right to choose the date/time and duration of the measurements.
2. The greatest 95 % very-short value (r.m.s. values for individual harmonic components, I_{iD} over "very short" 3s periods) during normal operating cycles should not exceed the FortisAlberta Customer Current Distortion Limits.
3. The maximum very-short value (r.m.s. values for individual harmonic components, I_{iD} over "very short" 3s periods) during normal operating cycles should not exceed 1.5 times the FortisAlberta Customer Current Distortion Limits 99% of the time.
4. The maximum very-short value (r.m.s. values for individual harmonic components, I_{iD} over "very short" 3s periods) during normal operating cycles should never exceed 2 times the FortisAlberta Customer Current Distortion Limits.
5. The maximum short value (r.m.s. value of individual harmonics components, I_{iD} over "short" 10 min periods) should not exceed the FortisAlberta Customer Current Distortion Limits.

6.0 FortisAlberta Distortion Limits

6.1 System Harmonic Voltage Distortion

FortisAlberta shall normally maintain the normal maximum harmonic voltage distortion (at the PCC) limits listed in Table 6.1, which are the “worst case” for normal operation (conditions lasting longer than one hour). For shorter periods, during start-ups or unusual conditions, the limits may be exceeded by 50%.

Table 6.1

Normal Maximum System Harmonic Voltage Distortion at the PCC

<u>Nominal Bus Voltage</u>	$\%E_{ID}$	$\% E_{THD}$
25 kV or less	3.0	5.0

Where:

- E_{ID} : The normal maximum individual harmonic voltage (E) distortion (D) values at the PCC of the facility (i) expressed in Volts.
- $\%E_{ID}$: The E_{ID} expressed as a percentage (%) of the nominal fundamental frequency voltage.
- $\% E_{THD}$: The total harmonic distortion (THD) voltage (E) at the PCC of the facility, which is the root sum square of the E_{ID} at the PCC of the facility. The value is expressed as a percentage (%) of the nominal fundamental voltage.

6.2 System Interharmonic Voltage Distortion

FortisAlberta shall normally maintain the normal maximum interharmonic voltage distortion (at the PCC) limits listed in Table 6.2, which are the “worst case” for normal operation (conditions lasting longer than one hour). For shorter periods, during start-ups or unusual conditions, the limits may be exceeded by 50%.

Table 6.2

Normal Maximum System Interharmonic Voltage Distortion at the PCC

<u>Interharmonic</u>	$\%E_{IHD}$
< 180Hz	0.2
180Hz - 2,500Hz	0.5
2,500Hz - 3,000Hz	0.3

Where:

- E_{IIHD} : The normal maximum individual interharmonic (IH) voltage (E) distortion (D) values at the PCC of the facility (i) expressed in Volts.
- $\%E_{IIHD}$: The E_{IIHD} expressed as a percentage (%) of the nominal fundamental frequency voltage.

7.0 Definition of Terms

Balanced I*T: An I*T value of the positive and negative sequence currents per phase. (See Telephone Interference for a definition of I*T)

Distorting Loads: Loads which produce harmonics and/or interharmonics.

Fundamental Component: The current or voltage value with a frequency of 60Hz.

Line I*T: A measurement method for I*T levels. Harmonic currents are measured directly off the power line and through a series of calculations I*T levels can be determined. This is the normal measurement method for I*T levels at the PCC.

Point of Common Coupling (PCC): The PCC is defined as the FortisAlberta point closest to the harmonic producing Customer that is also common to other FortisAlberta Customers. Normally, the primary terminals of the Customer supply transformer would be the PCC; however, this may be subject to change depending on the situation. In all situations, FortisAlberta shall identify the PCC.

Probe-Wire I*T: A measurement method for I*T levels. A wire, grounded on both ends, is placed on the ground under and parallel to an overhead power line. This wire is used to get measurements of the induced voltage from the magnetic field produced by harmonic currents flowing in the above overhead power line. From the induced harmonic voltage on the probe wire, the harmonic currents in the power line can be determined. This is the normal method for measuring I*T levels for primary distribution power lines.

Residual I*T: An I*T value of the zero sequence or neutral (ground return) current.

Telephone Interference (I*T): The I*T is the product of the root sum square of the rms current (I) and the Telephone Influence Weighting Factor of the current waveform (T), see Appendix B.

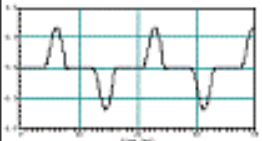
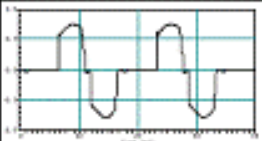
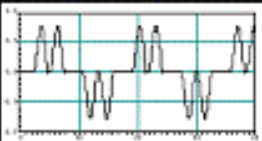
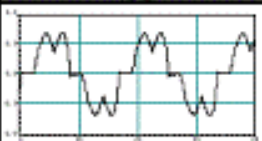
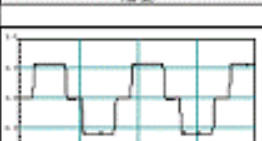
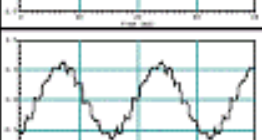
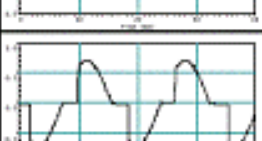
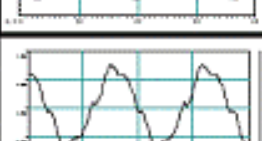
Total Harmonic Distortion (THD): The total harmonic distortion of a waveform is the root sum square of the magnitudes of each individual harmonic/interharmonic distortion, divided by the magnitude of the fundamental frequency. The value of THD is usually expressed in both voltage and current as a percentage of the fundamental component.

$$\text{THD (voltage)} = \frac{\sqrt{(V_2^2 + V_3^2 + \dots + V_n^2)}}{V_1}, \quad \text{THD (current)} = \frac{\sqrt{(I_2^2 + I_3^2 + \dots + I_n^2)}}{I_1}$$

8.0 Reference Documents

1. IEEE 519-1992, *IEEE Recommended Practices and Requirements for Harmonic Control.*
2. IEC 61000-3-6: 1996, *Electromagnetic Compatibility (EMC) Part 3: Limits – Section 6: Assessment of Emission Limits for Non-linear Loads in MV and HV Power Systems – Basic EMC Publication.*
3. CAN/CSA-C22.3 No.3-98 Reaffirmed 2007, *Electrical Coordination*
4. IEEE 776-1992, *IEEE Recommended Practice for Inductive Coordination of Electric Supply and Communication Lines.*
5. ATCO Electric: June 13, 2005, *System Standard for the Installation of New Loads.*
6. TransAlta Utilities, May 1998, *Understanding and Solving Audible Telephone Noise Problems Induced by Power Line Harmonic Currents.*

APPENDIX A

Type of Load	Typical Waveform	Current Distortion	Weighting Factor (W_D)
Single Phase Power Supply		80% (high 3rd)	2.5
Semiconverter		high 2nd,3rd, 4th at partial loads	2.5
6 Pulse Converter, capacitive smoothing, no series inductance		80%	2.0
6 Pulse Converter, capacitive smoothing with series inductance > 3%, or dc drive		40%	1.0
6 Pulse Converter with large inductor for current smoothing		28%	0.8
12 Pulse Converter		15%	0.5
ac Voltage Regulator		varies with firing angle	0.7
Fluorescent Lighting		20%	0.5

Note:

- If the characteristics of the harmonic producing load are unknown, a weighting of 2.5 will be assumed.
- If > 12 pulse converter please use a weighting factor of 0.5.

Table taken from IEC 1000-3-6.

APPENDIX B

Single Harmonic Weighting Factors

Harmonic	Frequency	Weighing	Sequence	Harmonic	Frequency	Weighing	Sequence	Harmonic	Frequency	Weighing	Sequence
1	60	0.5	POS	23	1380	6370	NEG	45	2700	10480	ZERO
2	120	10	NEG	24	1440	6650	ZERO	46	2760	10350	POS
3	180	30	ZERO	25	1500	6680	POS	47	2820	10210	NEG
4	240	105	POS	26	1560	6790	NEG	48	2880	9960	ZERO
5	300	225	NEG	27	1620	6970	ZERO	49	2940	9820	POS
6	360	400	ZERO	28	1680	7060	POS	50	3000	9670	NEG
7	420	650	POS	29	1740	7320	NEG	51	3060	9230	ZERO
8	480	950	NEG	30	1800	7570	ZERO	52	3120	8880	POS
9	540	1320	ZERO	31	1860	7820	POS	53	3180	8740	NEG
10	600	1790	POS	32	1920	8070	NEG	54	3240	8410	ZERO
11	660	2260	NEG	33	1980	8330	ZERO	55	3300	8090	POS
12	720	2760	ZERO	34	2040	8580	POS	56	3360	7680	NEG
13	780	3360	POS	35	2100	8830	NEG	57	3420	7470	ZERO
14	840	3830	NEG	36	2160	9080	ZERO	58	3480	7080	POS
15	900	4350	ZERO	37	2220	9330	POS	59	3540	6730	NEG
16	960	4690	POS	38	2280	9590	NEG	60	3600	6460	ZERO
17	1020	5100	NEG	39	2340	9840	ZERO	61	3660	6130	POS
18	1080	5400	ZERO	40	2400	10090	POS	62	3720	5620	NEG
19	1140	5630	POS	41	2460	10340	NEG	63	3780	5080	ZERO
20	1200	5860	NEG	42	2520	10480	ZERO	64	3840	4610	POS
21	1260	6050	ZERO	43	2580	10600	POS	65	3900	4400	NEG
22	1320	6230	POS	44	2640	10610	NEG	66	3960	3960	ZERO

Referenced from the **IEEE 519-1992** and the Canadian Electrical Association.

APPENDIX C**Notes**

- [1] Due to the fact that harmonic emissions from distorting Customers have the potential to adversely affect other facilities parallel to the supply power lines, FortisAlberta will attempt to gain needed third party stakeholder approval for the service. If this approval is not obtained, further evaluation and/or mitigation may be required.
- [2] Under special circumstances a Customer may be allowed to temporarily emit disturbances beyond the FortisAlberta Current Distortion Limits, if the power and telephone systems are capable of absorbing the harmonics without an adverse result. This will be determined through the conditions described below.
- a. Where the measurements on telephone lines parallel to the feeder that serves the Customer's facility are below the maximum acceptable level to the telephone provider.
 - b. Where the measured voltage distortion at the Customer facility PCC meets the limits in Section 6.0.
- [3] If note [2] conditions are met the Customer will be given a Notice of Temporary Energization (Appendix D).
- [4] FortisAlberta will measure harmonic current to the 63rd harmonic during commissioning.

APPENDIX D**NOTICE OF
TEMPORARY ENERGIZATION DUE TO HARMONIC NON-COMPLIANCE**

Date: _____

TO: (Insert Name and Address of Customer)

FROM: (Insert Name, Title, FortisAlberta, and Address)

The FortisAlberta Limits as shown in the “*Harmonic Specifications for Harmonic Producing Customers Connected to FortisAlberta’s Electric Distribution System*” document was not met by the Customer, _____ at their facility named, _____, located at land location/address, _____. Under part (b) of section 10.3.2 in FortisAlberta’s Customer Terms and Conditions of Distribution Access Service, FortisAlberta may exercise the right to disconnect the facility with notice because the Customer is in violation of 5.2.4 part (b) of the Terms and Conditions with FortisAlberta.

FortisAlberta has ruled to temporarily forgo its right to disconnect (with notice) this facility. However, FortisAlberta will immediately exercise its right to disconnect (with notice) this facility if:

- (i) The Customer has failed to demonstrate to FortisAlberta its will to comply with the above mentioned limits by not using adequate resources to meet the limits within a timely manner.
 - a. A timely manner is defined by a maximum of 6 months from the date of this Notice to have a final design solution submitted to FortisAlberta, and a reasonable time there after for the solution to be installed based upon equipment availability.
- (ii) FortisAlberta suspects that not meeting the above mentioned limits at this facility is negatively affecting another facility.

If you have comments, questions or concerns please contact:

Name: _____
Title: _____
Organization: _____
Phone: _____
Cell: _____
Fax: _____
E-mail: _____