FortisAlberta Power Quality Specifications

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Version	Date	Revision Details
2.0	Oct. 2023	Updated/added Normative references. Updated current distortion limits. Added clarities to voltage interharmonic ranges and limits. Updated AMR frequency bands. Added fluctuating load screening criteria. Updated Table 4-7 Flicker emission limits. Added clarifications to RVC requirements. Added RVC infrequent limit (July 2025)
1.0	Mar. 2021	Standard Issued

Table of Contents

1. Scope

1.1. This document is intended for existing/new customers with fluctuating loads, distortion emitting loads, distortion sinking devices and distributed energy resources (DER) that are or will be connected to FortisAlberta's System. As per Section 5.2.4 of FortisAlberta Terms & Conditions, the defined limits, requirements, and responsibilities in this document are intended to ensure that Customers do not cause undue interference with any other Facilities connected physically or electromagnetically to FortisAlberta's Distribution System.

1.2. This document will establish the Power Quality limits, requirements and responsibilities for load/generation fluctuations, distortion emission and distortion sinking at the point of common coupling (PCC) and within the FortisAlberta system. It will specifically define the following items.

1.2.1. The FortisAlberta Customer Distortion and Interference Limits which must be adhered to by all Customers to prevent harmful distortion levels on the FortisAlberta Distribution System.

1.2.2. The FortisAlberta Customer Interharmonic Limits & Requirements which must be adhered to by all Customers in order to protect the Automated Meter Reading Signals on the FortisAlberta Distribution System.

1.2.3. FortisAlberta Distortion limits which FortisAlberta endeavors to maintain.

1.2.4. FortisAlberta Customer Fluctuating Load/Generation Limits which must be adhered to by all Customers to prevent harmful voltage flicker and rapid voltage change (RVC) on the FortisAlberta Distribution System.

2. Normative References

2.1. The requirements in this document have been closely aligned with the following standards:

- IEEE 519-2022, *IEEE Standard for Harmonic Control in Electric Power Systems*
- CAN/CSA-C61000-3-6:09, *Electromagnetic Compatibility (EMC) Part 3-6: Limits – Assessment of Emission Limits for the Connection of Distorting Installations to MV, HV and EHV Power Systems*
- CAN/CSA-C22.3 No.3-98 Reaffirmed 2007, Electrical Coordination
- IEEE 776-2018, *IEEE Recommended Practice for Inductive Coordination of Electric Supply and Communication Lines*
- CAN/CSA C61000-3-7: 09, *Electromagnetic Compatibility (EMC) Part 3-7: Limits - Assessment of emission limits for the connection of fluctuating installations to MV, HV, and EHV power systems*
- CAN/CSA 61000-4-30, *Testing and measurement techniques – Power quality measurement methods.*
- IEC 61000-4-15: 2003, *Electromagnetic Compatibility (EMC) Part 4-15: Testing and Measurement Techniques – Flickermeter – Functional and design specifications*
- IEEE Std 1453-2004, *IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems*
- CSA 22.3 No. 9:20, *Interconnection of distributed energy resources and electricity supply systems*

- IEEE Std 1547-2018, *IEEE Standard for Interconnection, and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces*
- TransAlta Utilities, May 1998, *Understanding and Solving Audible Telephone Noise Problems Induced by Power Line Harmonic Currents.*
- CAN/CSA C61000-3-13, *Electromagnetic compatibility (EMC) Part 3-13: Limits – Assessment of emission limits for the connection of unbalanced installations to MV, HV and EHV power systems*

3. Glossary

Automatic Metering Read System (AMR): FortisAlberta utilizes power line carrier technology for the automatic metering read for information and billing purposes. The system uses specific interharmonic frequencies to allow two-way communications between the substation and meters.

Balance $I \times T$: An $I \times T$ value of the positive and negative sequence currents per phase. (See Telephone Interference for a definition of $I \times T$)

Distorting Load: Loads which produce harmonics and/or interharmonics. These include power electronic based equipment (drives, inverters, rectifiers, computers, led lights, etc.); and arcing devices (fluorescent lighting, welders, arc furnaces, etc.).

Distributed Energy Resource (DER): A source of electric power that is not directly connected to a bulk power transmission system.

Distortion Sinking Devices: includes capacitive devices (filters and capacitors)

Flicker (or light flicker): refers to the phenomenon of variable light production from lamps as a result of voltage fluctuation, which can be a nuisance to observers. Its severity depends on several factors including the magnitude, rate, and shape of voltage fluctuation, the type of lamp, and the human response to flickering light.

Fluctuating Installations: An electrical installation as a whole (i.e. including fluctuating and non-fluctuating parts) which is characterized by repeated or sudden power fluctuations, or start-up or inrush currents which can produce flicker or rapid voltage changes on the supply system to which it is connected. (Fluctuating installations not only include loads, but also DER plants)

Fluctuating Loads: includes arc furnaces and welders; installations with frequent motor starts (air conditioner units, fans, elevators); motor drives with cyclic operation (mine hoists, rolling mills); equipment with excessive motor speed changes (woodchippers, car shredders); motors that use motor jogging and jamming or have variable loads.

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

Harmonics: Harmonics are sinusoidal voltages or currents having frequencies that are integer multiples of the frequency at which the supply system is designed to operate (60Hz).

Interharmonics: Interharmonics are voltages or currents having frequency components that are not integer multiples of the frequency at which supply system is designed to operate (60 Hz).

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

Point of Common Coupling (PCC): The PCC is defined as the FortisAlberta point closest to the 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.

Rapid Voltage Changes (RVC): refers to a quick r.m.s voltage transition caused by load or generation. These voltage changes could be over several cycles and could also be in the form of cyclic variations. This phenomenon is usually caused by start-ups, inrush currents or switching operation of equipment.

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

Telephone Interference ($I \times T$): The $I \times T$ 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 A.

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.

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

Total Demand Distortion (TDD): The total demand distortion is the ratio of the root mean square of the harmonic current to the rms value of the rated or maximum demand fundamental current. The value is expressed as a percentage of the rated of maximum demand fundamental current.

4. FortisAlberta Installations Distortion and Interference Limits

4.1. Distorting Load Size Limits

4.1.1. Distorting Loads that satisfy section 8.1.1 and 8.1.2 of the CAN/CSA-C61000-3-6:09 will be accepted without additional examination.

4.1.2. FortisAlberta uses distorting current limits as shown in Table 4-1 to establish distorting load size limits. The limit will be dependent on the location, sizes of different types of the distorting load and peak total operating load.

4.1.3. In cases where distorting currents are not available for assessment, the Distorting Load Size calculation methods and limits will be based upon the CAN/CSA-C61000-3-6:09 assessment criterion. Note that FortisAlberta will use current distortion limits if power quality monitoring is required to establish compliance.

4.2. Capacitor Resonance Limits

4.2.1. If the Customer's facility contains power factor correction capacitors, the facility must meet the following limits:

$$|h_r - h_{CD}| > 0.35$$

$$|h_r - h_{ED}| > 0.10$$

$$|h_r - h_{TD}| > 0.15$$

Where:

h_r – The calculated harmonic (h) resonance (r) point of the Customer capacitor bank.

$$h_r = \sqrt{\frac{S_{iSC}}{Q_{iC}}}$$

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…).

4.3. Voltage Unbalance Limit

4.3.1. Voltage unbalance limits for MV networks are adapted from assessment methods found in CSA 61000-3-13.

4.3.2. To properly compare a Customer's facility 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 1.8%, where unbalance is defined as,

$$\%\ \boldsymbol{voltage\ unbalance} = \frac{\textbf{Negative sequence voltage component}}{\textbf{Positive sequence voltage component}} \times \mathbf{100}\%$$

4.3.3. FortisAlberta considers voltage unbalance of **up to 3%** to be acceptable. For compliance purposes, FortisAlberta will consider the voltage unbalance to be compliant if 95% of weekly 10-minute voltage unbalance aggregates do not exceed 3%.

4.4. Current Distortion Limits

4.4.1. The Customer's facility PCC shall not have calculated or measured values for current distortion that exceed the limits shown in Table 4-1.

Table 4-1: Distorted Current (rms) Limits

$\frac{I_{iSC}}{I_{iM}}$	$\%I_{ID}$ 2≤H<11[a]	$\%I_{ID}$ 11≤H<17	$\%I_{ID}$ 17≤H<23	$\%I_{ID}$ 23≤H<35	$\%I_{ID}$ 35≤H≤50	$\%I_{TDD}$
< 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:	a. For H≤6, even harmonics are limited to 50% of the harmonic limits shown in this table. b. Current distortions that result in a dc offset (e.g. half-wave converters) are not permitted.					

Where:

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

- $\%I_{TDD}$ – 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 be equal I_i. For measurement purposes it is the maximum 10-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 harmonic frequency to fundamental frequency) excluding non-integer harmonic orders (interharmonics).

4.5. Voltage Distortion Limits

4.5.1. FortisAlberta shall maintain the normal maximum harmonic voltage distortion (at the PCC) limits listed in Table 4-2, which apply to normal operating conditions (conditions lasting longer than one hour). For shorter periods, during start-ups or unusual conditions, the limits may be exceeded by up to 50%.

Table 4-2: Maximum Harmonic Voltage Distortion at the PCC

Nominal Bus Voltage	$\%E_{ID}$	**% E_{THD}**
1.0 kV or less	5.0	8.0
1.0 kV to 25 kV	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 EID at the PCC of the facility. The value is expressed as a percentage (%) of the nominal fundamental voltage.

4.6. Customer Interharmonic Limits and Requirements

4.6.1. The Customer shall maintain the normal maximum interharmonic voltage distortion (at the PCC) limits listed in Table 4-3, in accordance with standard C61000-3-6.

Table 4-3: Interharmonic Voltage Distortion Limits

Interharmonic	**% E_{IIHD}**
<180 Hz	0.2
>180 Hz to <1140 Hz	0.2[a]

>1140 Hz to 2,500 Hz	0.5[a]
2,500 Hz to <5,000 Hz	0.3[a]

Note:

a) the emission limits only apply to non-AMR frequencies within the stated frequency bandwidth. For AMR bandwidths (Table 4-4), emission limits shall be kept much lower level to not cause any interference.

Where:

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

4.6.2. FortisAlberta utilizes interharmonic frequencies inside the bandwidths listed in Table 4-4 for the purposes of the Automated Metering System (AMR). Customers shall not cause interference with the operation of the AMR by emitting noise or by sinking the AMR signal. If FortisAlberta determines that a customer facility is interfering with the AMR signal, it is a Customer's responsibility to modify the service to correct the problem.

Table 4-4: AMR bandwidths

AMR Bandwidth
>300 Hz to <800 Hz
>960 Hz to <1080 Hz
>2,000 Hz to <5,000 Hz

4.7. Telephone Interference Limits

4.7.1. The Customer's facility shall not have calculated or measured $I \times T$ values that exceed the limits shown in Table 4-5

Table 4-4: I×T Limits

Nominal Bus Voltage	$I \times T_B$	$I \times T_R$
25 kV or less	3000	150

Note: The limits for ITB and ITR can be as low as 1500 and 100 based on network configuration and extent of noise interference problems in the area.

Where:

- $I \times T_B$ – The product of the root sum square of $I \times T_{iB}$.

- $\boldsymbol{I} \times \boldsymbol{T}_{\boldsymbol{R}}$ – The product of the root sum square of $\boldsymbol{I} \times \boldsymbol{T}_{\boldsymbol{iR}}$.
- $\boldsymbol{I} \times \boldsymbol{T}_{\boldsymbol{iR}}$ – The individual residual $I \times T$ harmonic injection current from the Customer facilities PCC
    - $\boldsymbol{I} \times \boldsymbol{T}_{\boldsymbol{iR}} = (\boldsymbol{I}_{\boldsymbol{iDZ}} \times \boldsymbol{T})$
- $\boldsymbol{I} \times \boldsymbol{T}_{\boldsymbol{iB}}$ – The individual balanced $I \times T$ harmonic injection current from the Customer facilities PCC
    - $\boldsymbol{I} \times \boldsymbol{T}_{\boldsymbol{iB}} = (\boldsymbol{I}_{\boldsymbol{iDNP}} \times \boldsymbol{T})$
- $\boldsymbol{I}_{\boldsymbol{iDZ}}$ – The individual harmonic current distortion values (Amps converted to 25kV) which are zero sequence from the Customer facilities PCC
- $\boldsymbol{I}_{\boldsymbol{iDNP}}$ – The individual harmonic current distortion values (Amps converted to 25kV) which are negative and positive sequence from the Customer facilities PCC
- $\boldsymbol{T}$ – The single harmonic current weighting factor (Annex A)

4.8. Fluctuating Installation Requirements

4.8.1. These requirements are intended to control the phenomena of flicker and rapid voltage changes.

4.8.2. It is the Customer's responsibility to ensure that the Customer's facility loads do not introduce voltage fluctuations beyond limits specified in this document.

4.8.3. The connection of a fluctuating load can be accepted without further analysis if the ratio of the apparent power variations ΔS to the system short circuit power S_{sc}, are within the limits at the PCC.

Table 4-6: Limits for automatic acceptance for fluctuating loads

Changes per minute	ΔV (%)
<10	0.4
10 to 200	0.2
>200	0.1

Where:

- ΔV(%)=ΔS / S_{sc} x 100
- For induction motors, ΔS is typically 6-8 times the rated horsepower or kW
- For Induction furnaces, ΔS is typically 2-4 times the rated load or MVA.
- S_{sc} is the short circuit power (MVA) available at the PCC supplied by FortisAlberta.

4.8.4. Flicker

4.8.4.1. Flicker severity is measured in two quantities: perception of flicker in the short term ($\boldsymbol{P}_{\boldsymbol{st}}$) and perception of flicker in long term ($\boldsymbol{P}_{\boldsymbol{lt}}$). $\boldsymbol{P}_{\boldsymbol{st}}$ is the standard output of a flickermeter which is measured over 10-minute intervals, and $\boldsymbol{P}_{\boldsymbol{lt}}$ is derived from 12 consecutive values of $\boldsymbol{P}_{\boldsymbol{st}}$ (obtained over 2-hour intervals) using the following formula:

$$P_{lt} = \sqrt[3]{\frac{1}{12}\sum_{j=1}^{12} P_{st_j}^{3}}$$

4.8.4.2. It is assumed that when determining the global flicker emission limits, that there is no flicker on the high voltage grid, and therefore, the flicker coefficient of short-term and long-term high voltage to medium voltage network is equal to 0. The planning level short-term and long-term flicker for the high voltage grid is equal to 0.

4.8.4.3. With the above assumptions, the planning level short-term (P_{st}) and long-term (P_{lt}) flicker for the FortisAlberta network is equal to the overall global contribution of flicker in short-term ($G_{P_{st}}$) and long-term ($G_{P_{lt}}$). For the FortisAlberta network values see Table 4-7.

Table 4-7: Flicker Global/Planning Emission Limits

Flicker Global/Planning Emission Limits	
G_{Pst},	0.9
G_{Plt}	0.7

4.8.4.4. It is the Customer's responsibility to ensure that their design meets the emission limits and have reasonable margin to accommodate potential future changes. FortisAlberta will supply the Customer with necessary system information upon request including the short-circuit power (MVA) and line impedance at the PCC. This information is only valid at the time of request and is subject to change due to potential system work.

4.8.4.5. The calculation of emission limits is to determine the individual portion of the overall contribution ($G_{P_{st}}$, $G_{P_{lt}}$) to be allocated to the Customer:

$$E_{\mathrm{Psti}} = G_{\mathrm{Pst}} * \sqrt[3]{\frac{S_i}{(S_t - S_{LV})}}$$

$$E_{\mathrm{Plti}} = G_{\mathrm{Plt}} * \sqrt[3]{\frac{S_i}{(S_t - S_{LV})}}$$

Where:

- E_{Psti}, E_{Plti} – The flicker emission limits for the customer's install 'i' directly supplied at FortisAlberta's network.
- G_{Pst}, G_{Plt} – The maximum global contributions to the flicker levels of all the fluctuating installations that can be connected to the considered system.
- S_i– The agreed power the Customer's installation 'i' or the MVA rating of the considered fluctuating installation.
- S_t– The ultimate supply capacity of the system equal to 39 MVA.
- S_{LV}– The total power of the installations supplied directly at the low voltage level. Assumed to be 0.

4.8.4.6. Flicker limits for fluctuating installations connected to low or medium voltage system shall not exceed Table 4-7.

Table 4-7: Flicker Global/Planning Emission Limits

Voltage	Load/DER Rated	Flicker Limit	
Low (<1kV)	≤75A per phase (CSA 61000-3-3/ CSA 61000-3-11)	P_{st}	1.0
		P_{lt}	0.65
	>75A per phase (CSA61000-3-5)	P_{st_limit}	0.6 to 1.0*
		P_{lt_limit}	$0.65 \times P_{st\_limit}$
Medium (>1kV to 25kV)	All current ratings (CSA61000-3-7)	$E_{P_{sti}}$	Calculated
		E_{Plti}	Calculated

* Note: If calculated limit is less than 0.6, then it will be set to 0.6

Where:

- P_{st_limit} – The emission limit for the short-term flicker (P_{st}) severity determined by $P_{st\_limit} = 0.65 \times \sqrt[3]{\frac{S_L}{S_{TR}}}$.; where S_L is the rated apparent power of the DER/load to be connected and S_{TR} is the apparent power of the distribution transformer the DER/load is connected to.
- P_{lt_limit} – The emission limit for the long-term flicker (P_{lt}) severity.

4.8.4.7. For customers having a low agreed power, this calculation approach may yield impractically low limitations. Emission limits shall then be set at values given in Table 4-8.

Table 4-8: Minimum Emission Limits at MV

E_{Psti}	0.35
E_{Plti}	0.25

4.8.5. Rapid Voltage Changes

4.8.5.1. Rapid Voltage Changes assessment shall be based on measured changes in r.m.s voltage over several cycles considering only the fundamental frequency component. RVC magnitude as shown in Figure 1 shall not exceed limits in Table 4-9. Note that Figure 1 is not representative of all possible durations and rate of changes.

4.8.5.2. There is no limit applied to RVC duration, and it can be from one or two cycles to several seconds long. Longer RVC durations can cause increase in flicker severity. The rate of change from steady state to maximum RVC magnitude will also impact resulting flicker severity with higher change rates having the most impact.

4.8.5.3. The measurement method used for defining frequency and magnitude of RVCs shall be in accordance with the latest version and edition of CSA 61000-4-30.

4.8.5.4. To determine compliance with RVC emission limits, r.m.s voltage measurements must be measured and recorded with a power quality meter with Class A performance as defined by CSA 61000-4-30.

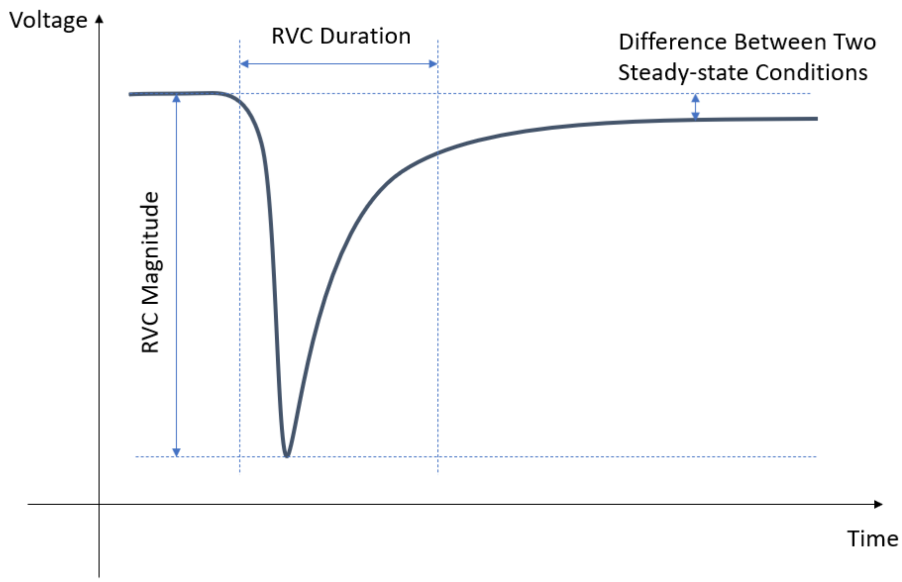

Figure 1: Rapid Voltage Change Example

4.8.5.5. Most common causes of RVCs may include protection operation due to faults, motor starting, capacitor switching, abrupt step load changes, and transformer energizations.

4.8.5.6. The customer shall not exceed the limits in Table 4-9 as per CSA 61000-3-7. The levels are defined in terms of maximum voltage deviation over the nominal system voltage $\Delta V_{max}/V_{n.}$ These apply to both load and DER customers.

Table 4-9: Rapid Voltage Change Limits

Number of changes (n)	**% RVC**
n ≤ 4 per day	5
n ≤ 2 per hour and > 4 per day	4
2 < n ≤ 10 per hour	3

4.8.5.7. RVCs that are infrequent in nature shall follow the relaxed RVC limit characteristics outlined in IEEE 1453-2022 standard. Infrequent events are due to commissioning, fault restoration, or maintenance typically not planned for more than once per year. Exceeding this RVC limit for infrequent RVCs will not be accepted.

Annex A (Informative)

A1. Telephone influence factor (TIF)

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

A1.1. Note: If the non-linear three phase equipment has no neutral connection, the harmonics (3rd, 9th, 15th, etc.) shown to be zero sequence in the above table, are then assumed to be positive or negative sequence only. For non-linear phase to neutral connected equipment the harmonics (3rd, 9th, 15th, etc.) are correctly labeled as zero sequence in the above table. -