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Draft Zambian Standard

ELECTRICITY SUPPLY POWER QUALITY AND RELIABILITY – Code of Practice

Part 2: Measurement and Reporting Procedures

DRAFT STANDARD FOR COMMITTEE DISCUSSION

ZAMBIA BUREAU OF STANDARDS

DATE OF PUBLICATION

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FOREWORD

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This part of DZS 387was prepared by the Electricity Supply Technical committee (TC 5/8)

This third edition cancels and replaces the second edition (ZS 387-2: 2011), which has been amended. The technical committee was guided by NRS and recommendations from International Electro-technical Commission (IEC), institutional (ZABS, IEEE, IEE) and British Standards Institute (BSI) and reports, and in reports and data available locally.

The revision was undertaken to ensure that the standard continued to meet the aspirations of stakeholders in the Zambian electricity supply industry.

Details of the changes between the first edition and this second edition are given in Annex D.

DZS 387consists of the following parts under the general title Electricity Supply – Power Quality and Reliability: -

Part 1: Overview of Implementation and Minimum Standards
Part 2: Measurement and Reporting Procedures
Part 3: Application Guidelines for Enterprises and Customers
Part 4: Instrumentation and Transducers for Voltage Quality Monitoring and Recording

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KEY WORDS

Power Quality and Reliability, Measurements, Reporting and Instrumentation.

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DRAFT ZAMBIAN STANDARD

ELECTRICITY SUPPLY - POWER QUALITY AND RELIABILITY – Code of Practice

Part 2: Measurement and Reporting Procedures

DRAFT STANDARD FOR COMMENT AND DISCUSSION

0. INTRODUCTION

In order to enforce the technical requirements for the quality of electricity supplied by the electricity supply industry, the ERB will require that enterprises install suitable measuring equipment at sufficient locations in their electrical networks to adequately characterize and report performance in terms of this part of DZS 387. In terms of the needs and principles of economical and affordable electricity supply in Zambia, it is essential that a balance be obtained between the cost and the adequacy of the measurement strategy.

This part of DZS 387 specifies the minimum requirements for Power Quality and Reliability (PQR) measurement at sites where consumers are connected. Enterprises should note that additional monitoring could be required to establish the PQR at bulk supply points and at other major network nodes. Additionally, instrumentation might be needed to be installed temporarily, for the investigation of consumer complaints.

1. SCOPE

This part of DZS 387specifies requirements for the measurement and reporting of Power Quality and Reliability (PQR) parameters by electricity enterprises to the Energy Regulation Board (ERB).

2. NORMATIVE REFERENCES

The following documents contain provisions which, through reference in this text, constitute provisions of DZS 387-2. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on DZS 387-2 are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from the Zambia Bureau of Standards.

DZS 387-1: Power Quality and Reliability – Part 1: Overview of Implementation and Minimum Standards

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3. DEFINITIONS AND ABBREVIATIONS

For the purposes of this part of DZS 387, the definitions and abbreviations given in DDZS 387-1 apply.

4. REQUIREMENTS

4.1 GENERAL

The Power Quality and Reliability to consumers will be continuously measured on a network sample basis, as outlined below. Data to be recorded shall be specified by the ERB in the forms such as those indicated in annex A and B. The results shall be reported to the ERB at least annually, at a date or dates to be determined by ERB.

The ERB is expected to publish a report indicating the compliance with the national minimum standards and comparative performance of the networks.

If an electricity consumer refers a complaint concerning PQR to the ERB, the complaint shall be investigated in the manner indicated in 4.5

4.2 CLASSIFICATION OF SITES FOR MEASUREMENT PURPOSES

For the purposes of Power Quality and Reliability measurements, sites are classified in the categories 1 to 6 listed below.

Category 1 sites are defined as points at transmission and distribution substations, which operate at nominal voltage levels that exceed 33kV, and at which end-consumers are directly connected.

Category 2 sites are defined as points at distribution substations which operate at voltages that exceed 1 kV and are less than or equal to 33kV, and at which end-consumers are directly connected (excluding the rural {category 3}).

Category 3 sites are defined as points on rural networks which operate at voltages that are less than or equal to 33kV and at which end-consumers are directly connected.

Category 4 sites are defined as points as close as possible to points of supply at voltages that are less than or equal to 1kV in **developed** urban networks.

Category 5 sites are defined as points as close as possible to points of supply at voltages that are less than or equal to 1kV in **developing** urban networks.

Category 6 sites are defined as the busbars at licensed generation stations and facilities with an output which is ultimately sold to consumers.

4.3 MEASUREMENTS REQUIRED AT EACH SITE CATEGORY

The minimum requirements for the measurement of PQR parameters at each of the site categories referred to above are shown in Table 1.

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Table 1 — Parameters to be measured at site categories

Site category	Definition	Minimum sample size	Harmonics (Note 1)	Voltage Unbalance	Dips	Interruptions	Regulation (Note 6)	Frequency
1	>33kV	100 %	**X**	**x**	**x**	**X**	**x**	
2	>1 kV and ≤ 33kV (excluding 33kV rural cat.3)	2 %	**X**	**x**	**x**	**X**	**x**	
3	≤ 33kV rural	2 %				**X**	**x**	
4	≤ 1 kV urban developed	0.05 %				**X**	**x**	
5	≤ 1 kV urban developing	0.05 %				**X**	**x**	
6	Licensed generators	100 %		**x**		**X**	**x**	**x**

NOTES:
1. At least the 5th, 7th, 11th and 13th harmonic shall be measured in the sample measurements.
2. The number of days during the assessment period that the level of any harmonic or the THD level exceeded the applicable compatibility level in Table 1 of DZS 387- 1 shall be recorded.
3. The number of days during the assessment period that the unbalance exceeded the applicable compatibility level in section 5.3.1 of DZS 387- 1 shall be recorded.
4. The number of days during the assessment period that the voltage regulation was outside the applicable compatibility levels in Section 5.8.1 of DZS 387- 1 shall be recorded.
5. The number of days during the assessment period that the frequency was outside the applicable compatibility levels in section 5.9.1 of DZS 387- 1 shall be recorded.
6. Where applicable, at least one of the monitored sites shall be at the end of a rural feeder.

Flicker measurements are only required when potential flicker problems are being investigated (see Section 4.5).

(For details of reporting of PQR parameters measured at monitored sites, see section 4.7.)

4.4 NUMBER OF SITES TO BE MONITORED

All enterprises with sites as categorized in section 4.2 will be required to monitor the relevant percentage of sites as shown in column 3 of Table 1, except that, where the percentage is a number less than three sites, at least three sites, of each category shall be monitored within the enterprise's area of supply. Sites shall be chosen such that representative measurements are obtained from areas of known poor PQR performance, average PQR performance and good PQR performance. In cases where there are only one or two sites in a category, those sites shall be monitored.

Where additional sites are permanently monitored, the results of the monitoring shall be declared and made available to the ERB as if the monitoring were required in terms of this part of ZS 387.

4.5 MEASUREMENTS IN THE EVENT OF CONSUMER COMPLAINTS

It is expected that the consumer and the enterprise will have tried to resolve the complaint concerning poor Power Quality and Reliability before referring the matter to the ERB.

If a complaint concerning poor Power Quality and Reliability is referred to the ERB, the ERB shall resolve the matter using its own specified procedures.

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4.6 INSTRUMENTATION

Instrumentation shall comply with the applicable requirements of DZS 387-4

Instrumentation used to collect statistical data for the ERB shall have its basic calibration checked periodically and shall have valid certificate of calibration.

In addition, instrumentation used to collect data for use in potential contractual disputes with consumers shall be certified as having been as calibrated with standard reference instruments that are traceable through accredited laboratories.

Enterprises shall keep an inventory of all PQR instruments in use in the licensed area of supply during the period of reporting. This shall include instruments used by a service provider contracted to provide a PQR monitoring service for enterprise. The instruments in use shall be listed as shown in Table 2.

Table 2 — Quality of Service in Instruments in use

1	2	3	4	5
Manufacturer	**Instrument type i.e A, B or C (see NRS 048-5)**	**Serial number**	**Date purchased**	**Last calibration date**

4.7 INFORMATION TO BE SUBMITTED TO THE ERB

The ERB will prescribe the periodic return of information collected on PQR parameters and related data. Further information and reporting forms are given in Annexes A and D

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ANNEX A

(Normative)

TECHNICAL INFORMATION TO BE SUBMITTED TO THE ERB ABOUT EACH SUPPLY AREA

A.1 Information in Annex C shall be provided and returned by each licensed electricity distributor, for the periods stipulated by the ERB. The following explanatory notes should be referred to when completing the form.

A.2 SUPPLY ENTERPRISE AND DISTRIBUTION AREA

A return for each region of electricity distribution shall be provided to the ERB while data in these areas would be separately maintained.

A.3 DETAILS OF BULK SUPPLY POINTS

Bulk supply points refer to points where the designated distribution area receives a bulk (metered) supply of electricity. For security of supply there is likely to be more than one (1) bulk supply circuit at each bulk supply point.

A guide on the information to be provided is outlined in Table C1 of Annex C.

A.4 DETAILS OF GENERATION CAPACITY

The generation capacity information is the total installed generation capacity (as operated by the supply enterprise) which contributes to the supply of electricity in that distribution region but which is not included as a bulk supply point.

A guide on the information to be provided is outlined in Table C2 of Annex C.

A.5 MAXIMUM DIVERSIFIED DEMAND

For reference purposes, the maximum diversified demand shall be taken as the sum of the diversified half-hourly load measurements at all bulk supply points and internal generators, for the 12-month period prior to the start of the period covered by the return.

The maximum diversified demand of each distribution area shall be recorded as shown in Table A.1.

Table A.1 – Maximum diversified demand

1	2
Distribution area name(s)	**Maximum diverisified demand**

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	in MVA or MW

A.6 NUMBER OF CONSUMERS

The number of consumers shall be recorded as the number of consumers (including those temporarily disconnected) serviced in that distribution region as at the first day of the period covered by the return.

A guide on the information to be provided is outlined in Table C.1 of Annex C.

A.7 NUMBER OF SITES AT WHICH PQR PARAMETERS ARE TO BE MONITORED

The Power Quality and Reliability parameters to be measured for each of the site categories are specified in Table 1 of this part of ZS 387.

A guide on the information to be provided is outlined in Table C.3 of Annex C.

A.8 DETAILS OF PLANT

Transformers shall be grouped according to their primary voltage, and using nominal ratings to calculate installed capacity. The installed capacity of transformers, which do not contribute directly to the capacity to supply customers shall be excluded. For example, 33kV/11kV transformers that interconnect 33kV networks to 11kV networks should be excluded.

The total reactive compensation capacity shall be shown in the voltage category at which the compensation equipment is connected. Compensation includes static and rotating plant specifically installed for the purpose of reactive compensation.

Service connections shall be excluded from the LV network data.

A guide on the information to be provided is outlined in Table C.4 of Annex C.

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ANNEX B

(Normative)

INFORMATION TO BE PROVIDED TO THE ERB ON FORCED INTERRUPTIONS, AND ON OTHER PQR PARAMETERS AT MONITORED SITES

B.1 RETURN OF FORCED INTERRUPTION INDICES

Information as in Annex C shall be provided and returned as and when required by the ERB, for the periods stipulated by the ERB. The following explanatory notes should be referred to so that the information required is recorded and provided in a consistent manner. Only the overall calculated index for all forced interruptions in this category shall be submitted for the stipulated period in this return to the ERB, but enterprises are advised to maintain their own records of indices for each forced interruption and to calculate month-end totals.

B.2 DISTRIBUTION VOLTAGE NETWORK FORCED INTERRUPTION INDICES

Information to be provided in Table C.5 in Annex C using the data for the distribution network above ≥ 33kV and up to 66kV.

B.2.1 Forced interruptions in the distribution networks defined in clause B.2 shall be reported as an index derived as follows:

$$F_1 = \frac{A\ B}{T}$$

where

F_1 is the forced interruption index, in hours.

A is the loss of supply measured for simplicity as the sum of the installed transformer capacity (in kilovolt amperes) connected to the distribution voltage circuit affected by the forced supply interruption, plus the maximum demand or installed capacity of any consumers connected directly to that circuit (see note 1);

B is the duration of the forced interruption, recorded in hours (see B.2.2); and

T is the total installed transformer capacity (in kVA) connected to the distribution networks (see note 2), plus the sum of the maximum demand of consumers directly connected to those networks (see note 1).

NOTES:

1. The maximum demand or installed capacity of consumers may be determined by any declared means. In practice, it will be convenient to use the highest recorded demand for the previous year.

2. This figure is recorded under the subtotal for the installed transformer capacity, under distribution voltage (total) under plant details in Annex C.

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3. Short-term interruptions caused by successful auto-reclose operations are classified as in Section 4.5.1.4 of DZS 387-2.

B.2.2 For the purposes of calculation, the duration of any forced interruption is measured from the time of the first alarm/supervisory indication until restoration of supply to all consumers affected by that forced interruption except where separate sections of the faulted network are restored progressively, the index may be calculated separately for each stage of the restoration, if this would be significantly different from an overall index for the incident that caused the interruption.

B.2.3 Medium voltage network forced interruptions are to be categorised as in the Table C.5 in Annex C.

B.3 TRANSMISSION VOLTAGE NETWORK FORCED INTERRUPTION INDICES

B.3.1 Information shall be provided in Table C.6 in Annex C using the data for the networks operating at voltages above 66kV.

B.3.2 Forced interruptions caused by faults on this part of the network (or loss of supply at bulk supply points) shall be recorded in terms of an index calculated as follows:

$$\text{Forced interruption index (system minutes)} = \frac{D\,x\,E}{F}\ \text{(minutes)}$$

where

D = actual loss of load (measured or assessed), in MVA

E = duration of forced interruption, in minutes (see B.2.2 apply)

F = Total system maximum diversified demand (see note)

NOTE — The total maximum diversified demand is as recorded in Annex C.

B.4 FORCED INTERRUPTIONS TO LARGE END-USER CONSUMERS

B.4.1 Information shall be provided in Table C.7 in Annex C with details of all the forced interruptions that affected consumers that have a notified maximum demand that exceeds 5 MVA. Each incident shall be recorded separately.

B.4.2 Enterprises, which have few or no customers with a maximum demand over 5MVA, should submit details of interruptions affecting their customers with maximum demands above 1 MVA.

NOTE — Such incidents are also included in other tables, where applicable.

B.5 MAJOR SUPPLY INTERRUPTIONS

B.5.1 Information shall be provided in Form Table C.8 in Annex C with details of any single events that resulted in the loss of supply to a 1000 consumers or large end-user consumers such that the loss of load resulted in a forced interruption index greater than 5 system-minutes.

NOTE — Such incidents are also included in other Forms, where applicable.

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B.5.2 Incidents shall be categorized according to the primary cause, as follows:

a. **Equipment failure**: interruptions that result from the di-electric breakdown or mechanical failure of plant.

b. **Mal-operation**: interruptions that result from operator error or the malfunction of protection/control equipment.

c. **3rd party causes**: interruptions resulting from damage to the enterprise's equipment by another party, e.g., cable damage by a contractor who is laying water pipes; motor vehicle accidents; theft of conductor; or where a consumer's protection fails to clear a fault and the resultant enterprise system protection operation results in the loss of supply to other consumers.

d. **Natural events**: interruptions that result from lightning (except surge arrestor failure), wind storm, fire, etc

e. **Bulk supply**: interruptions that result from loss of supply at a supply point. This could also include the correct operation of under-frequency devices outside the control of the reporting enterprise.

f. **Unknown**: interruptions for which there is no known cause. Use of this category should be avoided if at all possible.

NOTE – such incidents are also included in other tables where applicable

B.6 SAMPLING STATISTICS

B.6.1 GENERAL

All sites for which measurements are available shall be listed and the details provided in the appropriate tables.

NOTES:

1. It is recognized that full compliance with the requirements of this part of DZS 387in respect of monitoring of sample sites might only be achieved over an extended period. However, the ERB shall formulate programmes to ensure that the monitoring compliance is achieved in a specified period.

2. For an explanation of site categories and the number and type of sites to be monitored, refer to Section 4.2 and 4.4.

B.6.2 FORCED INTERRUPTIONS

Information shall be provided in Table C.9 in Annex C to record the interruptions measured at sites monitored in accordance with the statistical sampling prescribed in Table 1 (see section 4.3).

B.6.3 VOLTAGE HARMONICS

Information shall be provided in Table C.11 in Annex C to record all out-of-limits incidents for voltage harmonics measured at sites monitored in accordance with the statistical sampling prescribed in Table 1 (see section 4.3).

B.6.4 VOLTAGE UNBALANCE

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Information shall be provided in Table C.12 in Annex C to record all out-of-limits incidents for voltage unbalance measured at sites monitored in accordance with the statistical sampling prescribed in Table 1 (see section 4.3).

B.6.5 VOLTAGE DIPS

Information shall be provided in Table C.13 in Annex C to record all voltage dips measured at sites monitored in accordance with the statistical sampling prescribed in Table 1 (see section 4.3).

B.6.6 VOLTAGE REGULATION

Information shall be provided in Table C.14 in Annex C to record all out-of-limits incidents for voltage regulation measured at sites monitored in accordance with the statistical sampling prescribed in Table 1 (see section 4.3).

B.6.7 FREQUENCY

Information shall be provided in Table C.15 in Annex C to record all out-of-limits incidents of frequency measured at generating station sites monitored in accordance with the statistical sampling prescribed in Table 1 (see section 4.3).

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ANNEX C

Table C.1 - Bulk Supply Details

Technical information for regions of licensed electricity distributors for the period

.....……..... to …….....

Enterprise: .....

Distribution region: .....

Maximum diversified demand: ..... MVA

Voltage	No. of supply points	No. of intake circuits

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ANNEX C
(continued)

Table C.2 - Total Installed Generation Capacity

Technical information for regions of licensed electricity distributors for the period

.....……..... to …….....

Enterprise: .....

Distribution region: .....

Maximum diversified demand: ..... MVA

Base load (MW)	**Peak** (MW)	**Standby/mothballed** (MW)

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ANNEX C
(Continued)

Table C.3 - Number of consumers and number of sites monitored

Technical information for regions of licensed electricity distributors for the period

..... to .....

Enterprise: .....

Distribution region: .....

Maximum diversified demand: ..... MVA

Category	Supply voltage	No. of consumers	No. of sites monitored
1	> 33 kV		
2	> 1 kV to ≤ 33 kV, excluding rural cat. 3		
3	≤ 33 kV rural		
4	≤ 1 kV urban developed		
5	≤ 1 kV urban developing		
6	Generators		
	Total		

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ANNEX C
(Continued)

Table C.4 - Plant Details

Technical information for regions of licensed electricity distributors for the period

..... to .....

Enterprise: .....

Distribution region: .....

Maximum diversified demand: ..... MVA

Voltage category		O/H lines	Cables	Transformers installed capacity		Reactive compensation	
		Circuit km	Circuit km	Number	Total MVA	Number	Total Mvar
Distribution							
<3.3 kV	Urban						
6.6 kV							
11 kV	Urban						
	Rural						
33 kV	Urban						
	Rural						
66 kV	Urban						
	Rural						
Total Distribution	Urban						
	Rural						
Transmission	88 kV						
	132 kV						
	220 kV						
	330 kV						

ANNEX C

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(Continued)

Table C.5 - Distribution Network Indices

Return of forced interruption indices for the period

……..... to …….....

Enterprise: .....

Distribution region: .....

Distribution voltage network category	Forced interruption indices					
	66 kV	33 kV	11 kV	3.3kV,	6.6KV	Total
Urban						
Rural						

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ANNEX C
(Continued)

Table C.6 -Transmission Network Indices

Return of forced interruption indices for the period

..... to .....

Enterprise: .....

Distribution region: .....

Transmission voltage network category	Forced interruption indices (system – minutes)		
88 kV			
132 kV			
220 kV			
330 kV			
Total			

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ANNEX C
(Continued)

Table C.7 - Forced Interruptions to Large Consumers

Return of forced interruption indices for the period

..... to .....

Enterprise: .....

Distribution region: .....

Consumer	Maximum demand	Estimated loss of load	Date of incident	Duration of interruption (Minutes)

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ANNEX C
(Continued)

Table C.8 - Major Supply Interruptions

Return of forced interruption indices for the period

..... to .....

Enterprise: .....

Distribution region: .....

Incident		**Category of Fault**	**Estimated loss of load**	**Duration of interruption**
Date	**Time**		MVA	(Minutes)
			Total	

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ANNEX C
(Continued)

Table C.9 - Sampling statistics
(all site categories)

Return of forced interruption indices for the period

..... to .....

Enterprise: .....

Distribution region: .....

Location	Period monitored if less than full period (days)	Voltage kV	Category of site	Performance category (see note)	Number of interruptions recorded	Sum of all durations of interruption (Minutes)
NOTE — Use the indicators “P”, “A”, and “G” to indicate whether the locations are representative of areas of “poor”, “average” or “good” PQR performance.						

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ANNEX C
(Continued)

Table C.11 - Return of out-of-limits days for voltage harmonics
(site category 1 & 2 only)

Return of PQR parameters from monitored sites for the period

..... to .....

Enterprise: .....

Distribution region: .....

NOTE — In each table under "performance category", use the indicators "P", "A", and "G" to indicate whether the locations are representative of regions of "poor", "average", or "good" PQR performance.

Location	Period monitored if less than full period (days)	Voltage KV	Performance category (see note)	Number of incidents that THD exceeded 8%	Total period recorded (Min)

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ANNEX C
(Continued)

Table C.12 - Return of out-of-limits days for voltage unbalance

Return of PQR parameters from monitored sites for the period

..... to .....

Enterprise: .....

Distribution region: .....

NOTE - In each table under "performance category", use the indicators "P", "A", and "G" to indicate whether the locations are representative of regions of "poor", "average", or "good" PQR performance.

Location	**Period monitored if less than full period** days	**Voltage** KV	**Performance category** (see note)	**Number of days that unbalance limit was exceeded**	**Total period recorded** **(Min)**

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ANNEX C
(Continued)

Table C.13 - Return of Voltage Dips

Return of PQR parameters from monitored sites for the period

..... to .....

Enterprise: .....

Distribution region: .....

NOTE — In each table under "performance category", use the indicators "P", "A", and "G" to indicate whether the locations are representative of regions of "poor", "average", or "good" PQR performance.

Location	Voltage	Category of site	Performance category	Number of voltage dips				
	kV		(see note)	Z	T	S	X	Y

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ANNEX C
(Continued)

Table C.14 - Voltage Regulation

Return of PQR parameters from monitored sites for the period

..... to .....

Enterprise: .....

Distribution region: .....

NOTE — In each table under "performance category", use the indicators "P", "A", and "G" to indicate whether the locations are representative of regions of "poor", "average", or "good" PQR performance

Location	**Voltage** KV	**Category of site**	**Performance category** (see note)	**Number of days that limit was exceeded** (days)		**Total period recorded** (Min)	
				Above limit	**Below limit**	**Above limit**	**Below limit**

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ANNEX C
(Concluded)

Table C.15 - Frequency
(generators only)

Return of PQR parameters from monitored sites for the period

..... to .....

Enterprise: .....

Distribution region: .....

NOTE — In each table under "performance category", use the indicators "P", "A", and "G" to indicate whether the locations are representative of regions of "poor", "average", or "good" PQR performance

Station/ unit name	Generating capacity	Grid or islanded	Number of days that limit was exceeded (days)		Total period recorded (Min)	
			Above limit	Below limit	Above limit	Below limit

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ANNEX D
(Normative)

ANALYSIS OF FAULTS (FORCED INTERRUPTION INCIDENT FREQUENCY AND DURATION)

C.1 The information set out in form D3 shall be provided for all levels of the network above 1kV.

C.2 The index for the frequency of incidents in each section should be determined as

Where

$$\frac{N x 100}{C}$$

N = number of forced interruption incidents

C = total number of consumers, as recorded on form D1, for the period under consideration.

C.3 The index for the duration of incidents in each category should be determined as follows:

$$\frac{D}{C}$$

Where

D = the duration of all interruptions in that category, in minutes, and

C = total number of consumers, as recorded on form D1, for the period under consideration.

C.4 The categories for incidents shall be those given in B.5.2.

C.5 Incidents that result in the partial interruption of supply to a customer supplied by multiple infeed circuits should be included.

C.6 Interruptions that are allowed in terms of special supply agreements should be excluded.

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ANNEX E
(Informative)

CHANGES BETWEEN DZS 387-3: 2011 AND DZS 387-2: 2022

Note. After merging DZS 387-1 and DZS 387-2 to form one standard, DZS 387-3 was re-numbered DZS 387-2.

Table D.1 — Changes between DZS 387-3: 2011 and DZS 387-2: 2022

DZS 387-3: 2000 Clause No.	Paragraph/ Figure/ Table/ Note	Addition (A) or ~~Deletion~~ (D)	Amended text
Title page	Standard Number	D	~~ZS 387: PART 3~~
		A	DZS 387-2:2022
	Sub title	D	~~Part 3: Measurement and Reporting Procedures~~
		A	Part 2: Measurement and Reporting Procedures
0	Para 1 Line 2	D	~~…the ERB will require that undertakings install…~~
		A	… the ERB will require that enterprises install…
	Para 2 Line 2	D	~~Undertakings should note that…~~
		A	Enterprises should note that…
1	Line 2	D	~~Reliability (PQR) parameters by electricity undertakings to the…~~
		A	Reliability (PQR) parameters by electricity enterprises to the…
2	Para 1	D	~~The following documents are referred to in the text. At the time of publication, the editions indicated were valid. All standards are subject to revision and the users of this standard are recommended to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the Zambia Bureau of Standards.~~
		A	The following documents contain provisions which, through reference in this text, constitute provisions of DZS 387-2. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on DZS 387-2 are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from the Zambia Bureau of Standards.
		D	~~DZS 387-1: Power Quality and Reliability – Part 1: Overview of Implementation of Standards and Procedures; Glossary of terms~~
		A	DZS 387-1: Power Quality and Reliability – Part 1: Overview of Implementation and Minimum Standards
		D	~~DZS 387-2: Power Quality and Reliability – Part 2: Minimum Standards~~
4.1	Para 1 Line 3	D	~~… the ERB at least annually, at a date or dates to be determined.~~
		A	… the ERB at least annually, at a date or dates to be determined by mutual agreement.

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4.4	Para 1	D	~~All undertakings with sites as categorized in section 4.2 will be required to monitor the relevant percentage of sites as shown in column 3 of table 1, except that, where the percentage is a number less than three sites, at least three sites, of each category shall be monitored within the undertaking's area of supply.~~
		A	All enterprises with sites as categorized in section 4.2 will be required to monitor the relevant percentage of sites as shown in column 3 of table 1, except that, where the percentage is a number less than three sites, at least three sites, of each category shall be monitored within the enterprise's area of supply.
4.5	Para 1 Line 1	D	~~It is expected that the consumer and the undertaking will have tried to resolve the…~~
		A	It is expected that the consumer and the enterprise will have tried to resolve the…
	Bullet a.	D	~~a. The ERB will call for the results of the PQR monitoring and any other records maintained by the undertaking in an attempt to resolve the issue. The undertaking will be given reasonable time to demonstrate that they have met minimum PQR standards (DZS 387-2).~~
		A	The ERB will call for the results of the PQR monitoring and any other records maintained by the enterprise in an attempt to resolve the issue. The enterprise will be given reasonable time to demonstrate that they have met minimum PQR standards (DZS 387-1).
	Bullet b.	D	~~b. If such information is insufficient to enable the ERB to resolve the complaint, the ERB or its agent will investigate the undertaking's network to ascertain whether or not the Power Quality and Reliability standards have been met.~~
		A	If such information is insufficient to enable the ERB to resolve the complaint, the ERB or its agent will investigate the enterprise's network to ascertain whether or not the Power Quality and Reliability standards have been met.
	Bullet i.	D	~~If the undertaking does not meet the minimum standards required, the cost shall be recovered from the undertaking.~~
		A	If the enterprise does not meet the minimum standards required, the cost shall be recovered from the enterprise.
	Bullet ii.	D	~~If the undertaking meets the standards required, the cost shall be recovered from the consumer.~~
		A	If the enterprise meets the standards required, the cost shall be recovered from the consumer.
	Note	D	~~The amount to be recovered from a consumer for a PQR investigation may be limited to a fee set by the ERB to approximate the average cost of the required test(s), and may depend on the size/category of consumers.~~
		A	The amount to be recovered from a consumer for a PQR investigation will be limited to a fee set by the ERB to approximate the average cost of the required test(s), and may depend on the size/category of consumers.
4.6	Para 1	D	~~Instrumentation shall comply with the applicable requirements of DZS 387-5~~
		A	Instrumentation shall comply with the applicable requirements of DZS 387-4
	Para 2	D	~~Instrumentation used to collect statistical data shall have its basic calibration checked periodically.~~
		A	Instrumentation used to collect statistical data for the ERB shall have its basic calibration checked periodically and shall have valid certificate of calibration.

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4.7	Note	D	~~Further information and reporting forms are given in the Annex.~~
		A	Further information and reporting forms are given in the Annexes.
A.2	Heading	D	~~Supply undertaking and distribution area~~
		A	SUPPLY ENTERPRISE AND DISTRIBUTION AREA
A.4		D	~~…installed generation capacity (as operated by the supply undertaking) which contributes…~~
		A	... installed generation capacity (as operated by the supply enterprise) which contributes…
A.5		D	~~…the sum of the diversified half hourly or hourly load measurements at all bulk supply points…~~
		A	… the sum of the diversified half-hourly load measurements at all bulk supply points…
A.8	Para 3	D	~~Service connections shall be excluded form the LV network data.~~
		A	Service connections shall be excluded from the LV network data.
B.1	Para 1	D	~~Only the overall calculated index for all forced interruptions in this category shall be submitted for the stipulated period in this return to the ERB, but undertakings are…~~
		A	Only the overall calculated index for all forced interruptions in this category shall be submitted for the stipulated period in this return to the ERB, but enterprises are…
B.3.2	Formula	D	~~forced interrupti on index (system minutes) = $\frac{D \times E}{F}$ (minutes)~~
		A	Forced interruption index (system minutes) = $\frac{D x E}{F}$ (minutes)
B.4.2		D	~~Undertakings, which have few or no customers…~~
		A	Enterprises, which have few or no customers…
B.5.2	Line 1	D	~~3rd party causes: interruptions resulting from damage to the undertaking's…~~
		A	3rd party causes: interruptions resulting from damage to the enterprise's…
	Line 3	D	~~… undertaking system protection operation results in the loss of supply to other consumers.~~
		A	… enterprise system protection operation results in the loss of supply to other consumers.
B.6.1	Note 1	D	~~It is recognized that full compliance with the requirements of this part of DZS 387in respect of monitoring of sample sites might only be achieved over an extended period.~~
		A	It is recognized that full compliance with the requirements of this part of DZS 387in respect of monitoring of sample sites might only be achieved over an extended period. However, the ERB shall formulate programmes to ensure that the monitoring compliance is achieved in a specified period.
Annex C		D	~~Forms to be completed to provide the ERB with the required information on PQR parameters~~

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