Distribution Planning Code

Power Quality Requirement

By :

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KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

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Distribution Code Awareness Programme Funded by Akaun Amanah Industri Bekalan Elektrik (AAIBE)

Overview of Distribution Planning Code (1)

- The Distribution Planning Code (DPC) sets out the requirements for planning the Distribution System focusing on normal requirements of supply to Users.

- The DPC sets out the security and quality of supply characteristics and limits of the Distribution System and how these are achieved by cross reference to the Distributor's License Standards where appropriate.

Overview of Distribution Planning Code (2)

- These requirement highlight the typical power system characteristics – based on regulatory requirement and intrinsic behavior of the power system.

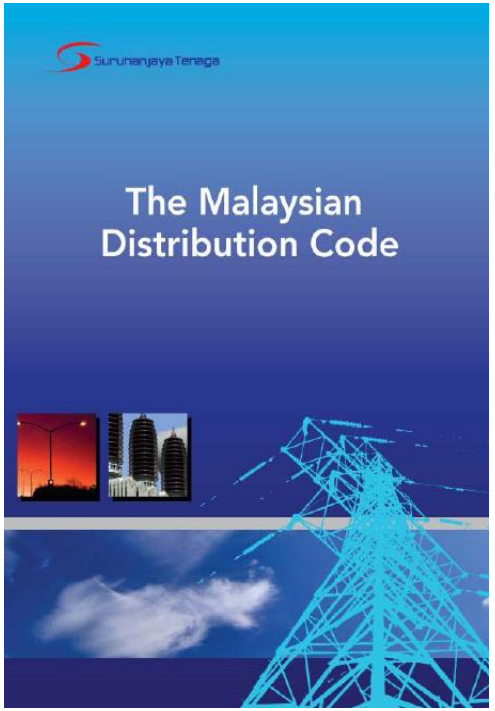
- The compatibility requirement for new equipment for both immunity & emission is also highlighted in the DPC.

- NEW users must always ensure their electrical equipment are always compatible with the power system characteristics.

Steady State Characteristics

5.4.3 System Frequency

5.4.4 Steady-State Supply Voltage Variation



5.4.3 System Frequency

System Frequency

Steady State Frequency

- Normal condition is within ±1% (49.5Hz and 50.5Hz).
- Contingency conditions. (≥ 52Hz or ≤ 47Hz)

The Distributor's Distribution System and any User connections to that Distribution System shall be designed to operate within the normal operating frequency range of 49.5Hz and 50.5 Hz and withstand short time operation within the range 47Hz and 52 Hz.

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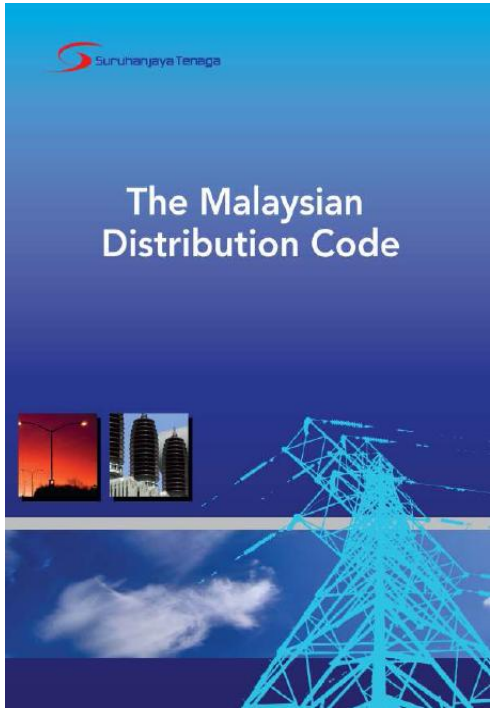
5.4.4 Steady-State Supply Voltage Variation

Steady State Supply Voltage Variation

- Steady-State Supply Voltage Variation (Normal)
  - Medium Voltage (6.6, 11, 22, 33 kV): ± 5%
  - Low Voltage of 400/230 V:+10% % and -6%

- Steady-State Supply Voltage Variation (Contingency)
  - Medium Voltage (6.6, 11, 22, 33 kV): ± 10%
  - Low Voltage of 400/230 V:+10% % and -6%

5.4.5 Short Duration Voltage Variations Standards on Electromagnetic Environment



Definition of Power Quality

- IEEE Std 1100: Power quality is the concept of powering and grounding sensitive equipment in a matter that is suitable to the operation of the equipment.

- IEC 61000-2-1: Power quality is defined as conducted electromagnetic disturbances present in electrical supply network in the frequency range from 0 to 10 kHz, with an extension up to 148.5 kHz.

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5.4.5 Short Duration Voltage Variations

Short Duration Supply Voltage Variation

Definition:

- Voltage events with duration is between 0-10ms and 10ms-60s,
- Types of short duration supply voltage fluctuations: voltage dips, voltage swells, momentary interruptions and temporary interruptions in supply.
- These events are part of the electromagnetic environment for the electrical supply network

Causes of Short Duration Supply Variation (1)

- Under fault and circuit switching conditions in the Distributor's own Distribution System or in other interconnected Systems including the Transmission System, the voltage may fall and rise momentarily.

- The fall and rise in voltage will be affected by the type and location of faults, and earthing of the neutral points of the Distributor's Distribution System, Transmission System and User's System.

Causes of Short Duration Supply Variation (2)

- Short duration voltage fluctuations may also arise due to switching on the Distribution System, including the use of auto-reclosing, which gives rise to temporary interruptions.

- Short duration voltage fluctuations may also arise due to the switching of User loads and from the operation of User Equipment.

Impact of Short Duration Voltage Variation (1)

- These voltage fluctuations may result in mal-operation of voltage-sensitive Equipment connected to the system.

- Both Distributors and Users shall take adequate measures to limit the frequency, magnitude and duration of such voltage fluctuations.

- Distributors and Users shall be aware of their responsibilities in limiting the impacts of the short duration voltage fluctuations as follows :-

Impact of Short Duration Voltage Variation (2)

a) The Distributor shall investigate complaints from Users on short duration voltage fluctuations and make proposals to reduce the frequency, magnitude and duration of the voltage fluctuations originating from the Distributor's own Distribution System to the level required as per the Distribution Code.

b) In case, a User requires protection beyond the level specified in the Distribution Code, he shall install suitable protection devices designed to limit the fluctuations to that required by his system.

Impact of Short Duration Voltage Variation (3)

c) Users with voltage-sensitive loads or intending to connect voltage sensitive loads to the Distribution System shall take into account this short duration variation in voltage in planning their installation and selecting Equipment from appropriate specifications or standards to ensure sufficient intrinsic immunity to short duration voltage fluctuations

d) This initiative will ensure minimum deterioration of performance or lapse in operation of sensitive equipment due to short duration voltage fluctuations.

Data availability from Distributor

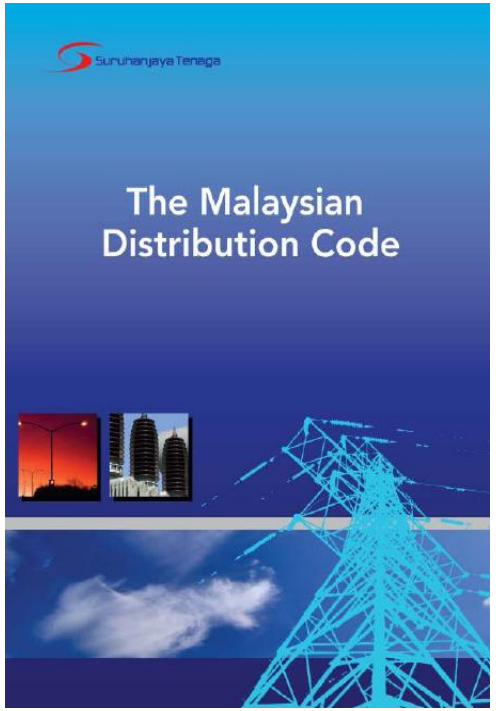
- In line with MS 1760: 2004, the Distributor shall make available, upon the request of Users appropriate information at any monitored point in the network on the magnitude, duration and number of short duration voltage fluctuations for any given period of time.

Electromagnetic Environment

- The electromagnetic environment of the Distribution System is described in Malaysian Standards MS 1760 based on (IEC 61000-2-8), MS IEC 61000-2-2, MS IEC 61000-2-4 and MS IEC 61000-2-12 which describe the frequency and severity of voltage fluctuations experienced on Distribution Systems over a period of time.

5.4.6 Power Quality and Disturbing Loads

5.4.7 Superimposed Signals



5.4.6 Power Quality and Disturbing Loads

Types of Disturbing Loads

- Certain types of User Equipment connected to the Distributor's Distribution System may give rise to voltage fluctuations and/or distortion which result in disturbance to other Users or damage to the Distribution System or connected User Equipment.

- Voltage fluctuations include voltage step changes due to switching of User or Distributor Demand or Equipment, voltage flicker due to the operation of User Equipment such as welding machines and arc furnaces, Voltage Unbalance due to unbalanced loads and harmonic distortion of voltage

Requirement to manage Disturbing Loads

- The Distributor shall plan the Distribution System to maintain voltage harmonic distortion and voltage fluctuations within the planning limits specified in the License Standards agreed with the Commission or, where no such standards are required to be agreed with the Commission, in accordance with Malaysian Standards (MS) or IEC Standards (IEC 61000 series) or other appropriate standards.

Technical Standards for Harmonics (1)

- The applicable standards for voltage fluctuations are IEC Standards 61000-3-7 for the MV Distribution System and MS IEC 61000-3-3, MS IEC 61000-3-5 and MS IEC 61000-3-11 for the LV Distribution System.

- The applicable standards for harmonic voltages distortion are Standards 61000-3-6 for the MV Distribution System and MS IEC 61000-3-2, IEC 61000-3-4 and MS IEC 61000-3-12 for the LV Distribution System

Technical Standards for Harmonics (2)

The maximum total levels of Harmonic Distortion at any **Connection Point** on the **Distribution System** from all sources under both planned outage and unplanned outage conditions, unless abnormal conditions prevail, shall not exceed:

i)at 33kV ,22kV, 11kV and 6.6 kV : a Total Harmonic Distortion of 6.5%

ii)at 400V and below, a Total Harmonic Distortion of 5%

The limits for individual components of harmonic voltage distortion are given in the **Licence Standards** and the **IEC** Standard 61000-3-6 at **MV** and **IEC** Standard 61000-3-4, MS **IEC** Standard 61000-3-2 and MS **IEC** Standard 61000-3-12 at **LV**.

Technical Standards for Unbalance

- Voltage Unbalance electromagnetic compatibility levels are based on United Kingdom Energy Networks Association Engineering Recommendation P29.

i) The maximum negative phase sequence component of the phase voltage on the **Distribution System (Voltage Unbalance)** shall remain below 1% unless abnormal conditions prevail.

ii) Infrequent short duration peaks with a maximum value of 2% are permitted for **Voltage Unbalance**, subject to the prior agreement of the **Distributor** under the **Connection Agreement**. The **Distributor** will only agree following a specific assessment of the impact of these levels on the **Distributor's** other **Users' Equipment**.

iii) At the terminals of a **User's** installation the unbalance voltage shall not exceed 1% for 5 occasions within any 30 minute time period.

Technical Standards for Voltage Step Change

Load Starting/Switching	Limit of Voltage Change
Starting/switching once or twice a year	6%
Infrequent single starting/switching or disconnection of **Load** – once in two hours or more hours, including capacitor or reactor banks	3%
Frequent starting/switching and/or disconnection of **Load** (e.g., Many times in a day)	1%

United Kingdom Energy Networks Association Engineering Recommendation P29.

Technical Standards for Voltage Flickers

Distribution System and Transmission System Voltage Level at which the Fluctuating Load is Connected	Absolute Short Term Flicker Severity (P_{st})	Absolute Long Term Flicker Severity (P_{lt})
Voltage Level >35 kV	0.8	0.6
Voltage Level <35 kV	0.9	0.7

The terms (Pst) and (Plt) are defined in the Licence Standard and IEC Standards 61000-3-7

PQ Compliance for New Equipment

When selecting Equipment and planning and operating the User's System, the User shall take account the level of distortion of voltage which may occur on the Distribution System in respect of voltage step changes, voltage flicker, Voltage Unbalance and harmonic content .

(a) New Users shall indicate the distortion and flicker that the loads could generate by performing a complete system study based on a given „Weak System Condition' (minimum fault level). The full report of the study shall be submitted to the Distributors for approval at the stage of supply application.

(b) If the all studies indicate the harmonic and flicker planning limits are violated, the customer shall install suitable compensator/filter (up to 100% compensation) to reduce the overall distortion and flicker below the allowable limits.

Disconnection of Supply due to incompliance

- Where a User's Equipment causes voltage fluctuations, Voltage Unbalance, or harmonic voltage distortion to exceed the limits set out in the DPC, so as to persistently cause interference with the electricity supply to other Users……. then the Distributor may discontinue electricity supply to that User until the situation is resolved and supply can be continued without causing interference with the electricity supply to other Users

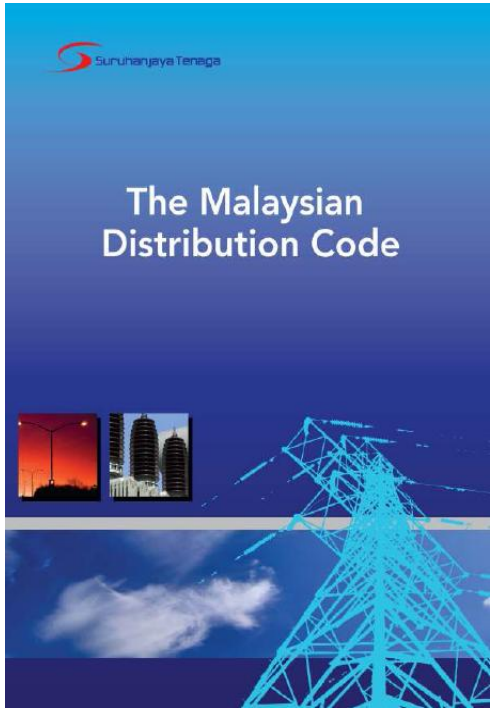
EMC requirement for New Equipment

5.4.7 Superimposed Signals

5.5 Specification of Equipment

5.4.8 Transient Overvoltages

5.6 Earthing



5.4.7 Superimposed Signals

Where a User intends to install mains borne signalling equipment which may superimpose signals on the LV Distribution System, the User's Equipment shall comply with IEC standard 61000-3-8 as amended from time to time. Where a User proposes to use such Equipment to superimpose signals on the LV Distribution System, the prior agreement of the Distributor is required.

IEC 61000-3-8

Electromagnetic compatibility (EMC) - Part 3: Limits - Section 8: Signalling on low-voltage electrical installations - Emission levels, frequency bands and electromagnetic disturbance levels

5.5 Specification of Equipment

Standard for New Plant/Apparatus

Plant and Apparatus to be connected to the Distribution System and at the User interface is required to meet and conform to relevant technical standards and be compatible with the parameters (voltage, frequency, current rating and short circuit current rating and insulation level) of the Distribution System. These relevant technical standards shall include:

(a) Malaysian National Standards (MS);
(b) International, European technical standards, such as IEC, ISO and EN standards; and
(c) Other national standards such as BS, DIN and ASA.
(d) License Standards.
(e) The Distributor's own standards and specifications.

The User shall ensure that the specification of Plant and Apparatus at the Connection Point shall be such as to permit operation within the applicable safety procedures agreed between the Distributor and the User.

5.4.8 Transient Overvoltages

Basic Insulation Level

Typical Basic Impulse Insulation Levels (BIL) of the Distribution System are:-

System Voltage (kV)	BIL (kV)
33	170
22	125
11	75
6.6	75

- The Customer's Plant and Apparatus shall be compatible with the insulation levels of the Distribution System.
- The Distributor shall inform the User on request, the Basic Insulation Level of the Distribution System.

5.6 Earthing

Earthing Systems

- Earthing of the User's installation shall be in accordance with the Electricity Supply Laws (IEC 60364, IEEE 1100-2005) and compatible with the earthing arrangements on the Distribution System.

- The Distributor shall provide details of the Distribution System earthing arrangements to the User on reasonable request of the User.

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