

ELECTRICAL POWER QUALITY ANALYSIS ELECTRICAL PROTECTION

PRESENTATION OF THE PROJECTX-FINAL LEVEL 2.

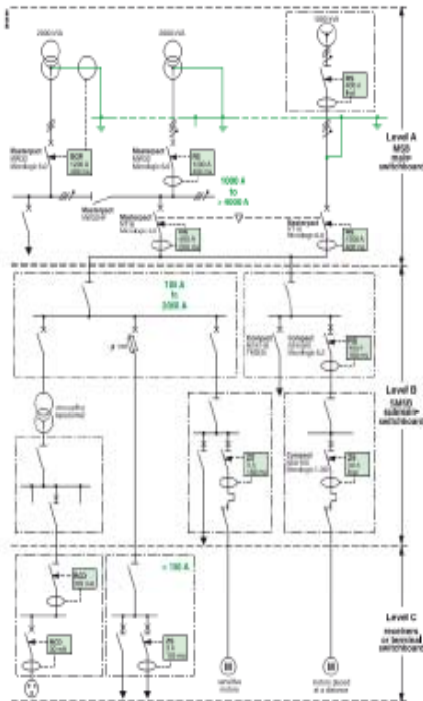
Lycée Polyvalent
ISAAC NEWTON

GENERAL / KNOWLEDGE: ELECTRICITY

PARTICULAR / ACTIVITY: quality tool for three phase power / industrial equipment

Learning Outcomes achieved (to be developed in the future related with ECVET credit system)

1. Compare an electrical installation to the IEC international standards
2. Assess the electric safety and availability of an electrical installation
3. Generate an electrical audit of a 3 phase power supply



Ground fault protection

Objectives of the theoretical knowledge

- 1 To study the Load
- 2 To verify electrical system capacity
- 3 To confirm the current carrying capacity of a cable , methods of installation
- 4 To check the protection of goods/Protection of electrical equipment (fuse – circuit breaker)
- 5 To check the protection of person / Ground fault protection / Residual current devices
- 6 To verify the coordination between protections
- 7 Evaluate the power factor (the need of correction)
- 8 To study Variable-frequency drive effects / harmonics

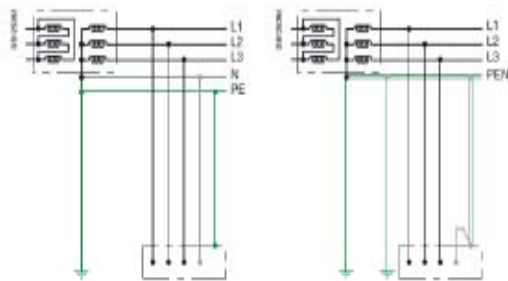


Diagram 1a - "TN-S system"

Diagram 1b - "TN-C system"

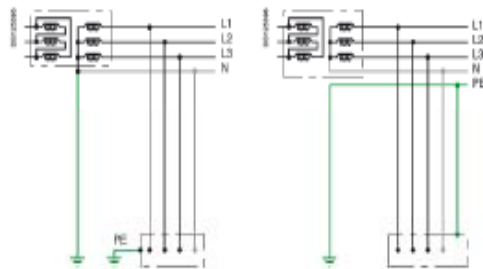
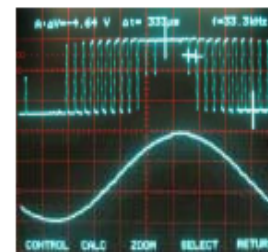
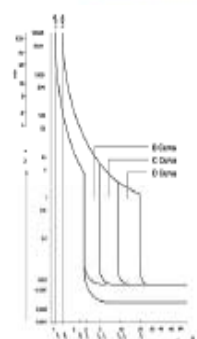


Diagram 2a - "TT system"

Diagram 2b - "IT system"

Country	L1	L2	L3	Neutral	Ground / protective earth
Available and New Zealand as per AS/NZS 3000:2007 Figure 3.7 or as per IEC 60446 as approved by AS 3000	White (or black) ⁽¹⁾ (see note)	Black (or blue) ⁽¹⁾ (see note)	Red (or blue) ⁽¹⁾ (see note)	Blue (or blue)	Green/yellow striped (green is top and yellow is bottom)
Canada (mandatory) ⁽²⁾	Red	Black	Blue	White or Gray	Green or Green copper
Canada (optional three-phase installation) ⁽³⁾	Orange	Brown	Yellow	White	Green
European Union and all countries who use European CENELEC standards April 2004 (IEC 60446), Hong Kong from July 2007, Singapore from March 2008	Brown	Black	Grey	Blue	Green/yellow striped
Other European (IEC 60446, unless by country) ⁽¹⁾	Black or brown	Black or brown or grey	Black or brown or grey	Blue	Green/yellow striped
UK and April 2008, Hong Kong until April 2009, South Africa, Malaysia, Singapore until February 2011	Red	Yellow	Blue	Black	Green/yellow striped (green on horizontal cables & 15°)
India and Pakistan	Red	Yellow	Black	Black	Green/yellow striped, or green
Former USSR, Ukraine, Kazakhstan and Peoples Republic of China per GB 50133-2002 Section 9.2.2.5	Yellow	Green	Red	Blue/White	Green/yellow striped
Germany	Black	White/Gray	Green	Blue	Green/yellow striped, blue ring for ring cables & blue striped
United States (common practice) ⁽⁴⁾	Black	Red	Blue	White or grey	Green, green/yellow striped, or a bare copper wire
United States (alternative practice) ⁽⁵⁾	Brown	Orange, black, and purple	Yellow	Grey or white	Green



Cable sizing calculation and color code /CENELEC Cable standard
Breaker choice , size , curve / harmonics from an inverter

Brief description of the Practice

1. Make an Energy assessment
2. The objective is to quantify energy consumption for each machine in the school laboratories
3. The objective is to check Quality of service compliance – validate incoming power quality at the service entrance
4. Valid the protection devices (circuit breaker / fuse / RCD ..)

Steps or activities to be performed by the student

1. Choose a safety measurement protocol
2. Perform the quantity and quality electrical energy audit (A,V,cos phi , harmonics , kWh ...)
3. Propose improvements if necessary to the teacher

