Date: 16/07/2007	

Pre design specification

Hypermarket

Contents

Project definition

General definition

Activity

This project is in the domain of:

Activity: Hypermarket

Definition:
Any building designed to receive customers with the ultimate purpose of selling equipment and services to individual

- Ground sales surface: 5 000m^2 to 15 000m^2 with car park,
- 3 000 to 5 000 food product references
- 20 000 to 30 000 non food product references.

Description:
- There are usually five main zones: sales surface, laboratories or workshops, checkouts, offices, storage and delivery areas.
- The geographic breakdown of loads in the store is standard for each store name and concept.
- Retrofitting takes place every 5 to 10 years and a major extension between 5 and 15 years.
- Electrical distribution
  - The presence and dimension of food section has a significant impact on the building electrical distribution needs.
  - The energy need depends on: the surface for the sales area (dominant parameter), the choice of energy for heating/air conditioning and bakery/pastry shop ovens (electrical or gas), the power required for food cold production.
  - According to the needs the installed power may vary from 1 600kVA minimum to 3 200kVA for a surface of 12 000m^2 with maximum equipment.

The needs are:
- guarantee ongoing sales (maximum power interruption of:0.1 s for checkouts, 10 to 30 sec for background lighting, several minutes for shelves, 15 min for refrigeration, 1 hour for HVAC),
- cost cutting especially in energy savings and maintenance cost,
- fast delivery of the building.

The answers for electrical distribution are:
- electrical distribution architecture oriented to increase continuity of supply (lighting, cash register) and facilitating maintenance (by non specialist/ remote access),
- system which allows simplify on site assembly and implementation : Busbar Trunking Systems, factory built and standard connection solutions,
- energy monitoring system.

Site Topology

This project is intended for a Single One Floor Building
The site surface is: ≤ 10 000 m²

Power Demand

The Power Demand of the project is between 630 kVA and 1250 kVA

See also Glossary for explanation of circuit characteristics.

Definition of supplied circuit

- Circuit: Lighting
  - Installation flexibility: Till installation
  - Load Distribution: Uniform
  - Power interruption sensitivity: Short Interruption Acceptable
  - Disturbance sensitivity: Medium
  - Environment, atmosphere: Standard
  - Maintainability: Standard

- Circuit: HVAC distribution
  - Installation flexibility: Till installation
  - Load Distribution: Uniform
  - Power interruption sensitivity: Long Interruption Acceptable
  - Disturbance sensitivity: Low
  - Environment, atmosphere: Standard
  - Maintainability: Minimum

- Circuit: HVAC production
  - Installation flexibility: No
  - Load Distribution: Localised
  - Power interruption sensitivity: Long Interruption Acceptable
  - Disturbance sensitivity: Medium
  - Environment, atmosphere: Standard
  - Maintainability: Minimum

- Circuit: Refrigeration distribution
  - Installation flexibility: Till installation
  - Load Distribution: Uniform
  - Power interruption sensitivity: Short Interruption Acceptable
  - Disturbance sensitivity: Medium
  - Environment, atmosphere: Standard
  - Maintainability: Standard

- Circuit: Refrigeration production
  - Installation flexibility: No
  - Load Distribution: Localised
  - Power interruption sensitivity: Short Interruption Acceptable
  - Disturbance sensitivity: Medium
  - Environment, atmosphere: Standard
  - Maintainability: Standard

- Circuit: Cash register
  - Installation flexibility: Till installation
  - Load Distribution: Uniform
  - Power interruption sensitivity: No Interruption Acceptable
  - Disturbance sensitivity: Medium
  - Environment, atmosphere: Standard
  - Maintainability: Enhanced

- Circuit: Laboratories
  - Installation flexibility: No
  - Load Distribution: Localised
  - Power interruption sensitivity: Long Interruption Acceptable

  - Disturbance sensitivity: Low
  - Environment, atmosphere: Enhanced
  - Maintainability: Minimum

- Circuit: Com center shop feeding
  - Installation flexibility: Till operation
  - Load Distribution: Uniform
  - Power interruption sensitivity: Short Interruption Acceptable
  - Disturbance sensitivity: Low
  - Environment, atmosphere: Standard
  - Maintainability: Minimum

- Circuit: Com center common lighting
  - Installation flexibility: No
  - Load Distribution: Uniform
  - Power interruption sensitivity: Short Interruption Acceptable
  - Disturbance sensitivity: Medium
  - Environment, atmosphere: Standard
  - Maintainability: Minimum

General installation design

Power supply

Upstream network

The project electrical installation is connected to Utility

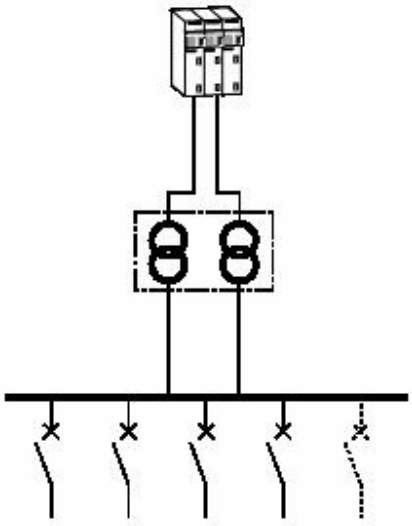
Connection scheme

The upstream connection scheme is Single Line

Service reliability

The upstream network allows us to expect a Standard service reliability.

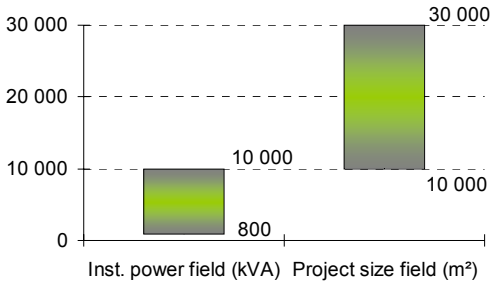
Main distribution general diagram : 1 Substation- N Transfo NC

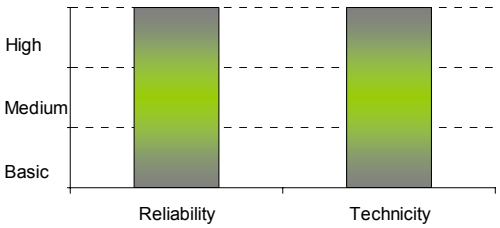


1 Substation - N Transformers - Normally Closed Connection

Usual use context of this architecture

Synthesis





Installed power
The installed power is usually greater than 1250 kVA. But this solution can be used for smaller installed power in case of:
- redundancy requirements,
- accessibility constraints to the substation (it's sometimes worthwhile having 2 small transformers instead of a big one).

In practice, this solution will be limited to 4 transformers (2 for typical applications), so the installed power can reach about 10 MVA, and typically will be from 4 to 6 MVA.

Project size
The size of the site usually doesn't exceed 30000 m². Up to this limit it is not relevant do distribute the LV power from a single centralized substation.

Interruption sensitivity
This solution contains more than one transformer. Consequently, it is possible to use back-up operation modes preventing installation shut down in case of transformer failure.
In nominal operation mode, all the transformers are connected.
In back-up operation mode, part of the transformers can feed the downstream installation:
- with load shedding, (in that case the redundancy will be partial),
- without load shedding, which gives a whole redundancy in the case of 2 transformers.

Back-up operation modes are generally limited to n-1 failure, which means that in case of more than one transformer failure the operation is not inevitably kept.

Disturbance sensitivity
In this solution, transformers are connected in nominal operation mode. Therefore, the equivalent short circuit power is high, and allow the connection of loads with medium sensitivity to disturbance without utilization of special transformer with low ucc. Connection of high sensitivity loads and non linear ones, has to be checked by comparing the installed power of non linear loads to the total available power of the transformer. Generally it can be considered that, there is no problem if the ratio between non linear load installed power and transformer power is lower than 10 to 15%.

Flexibility
Generally single substation solutions are used for installation with low need of flexibility.
Indeed, installation flexibility can be managed by taking into account extra power to size the transformers and by including spare capacity in the main LV switchboards with appropriate service rating.

Implementation recommendations

Consequently to the presence of a single substation, it should ideally be placed as close as possible to the barycenter of the loads dispatch on the project.
The utility connection can be either single line or ring main or parallel.
Concerning MV substation:
- MV metering is required for the substation because of more than 1 transformer,
- it can be realized with prefabricated substation which allows, installation time reduction and reliability improvement (but limited to 2 transformers).

As far as possible:
- the transformer power is lower or equal to 1250 kVA,
- they are all localized in the same substation,
- they are strictly similar (same rated power, same rated impedance voltage, same load losses, and same transformation ratio).

As the transformers are connected in nominal utilization, the short circuit current for the downstream switchboards and installation is high and require reinforced equipment.
The following table gives example of short circuit current level for some transformers power and number.

Upstream Psc: 250 MVA – 20 kV		
S Transf.	**Ik3 - 2 // transf.**	**Ik3 - 3 // transf.**
630 kVA	26 kA	38 kA
800 kVA	33 kA	47 kA
1000 kVA	40 kA	56 kA
1250 kVA	48 kA	67 kA
1600 kVA	59 kA	81 kA
2000 kVA	71 kA	95 kA
2500 kVA	84 kA	111 kA

Typical short circuit current level with parallel transformers

In case of transformer failure, no changeover system is required if the remaining transformers are sized to feed the whole installation.
Main LV switchboard feeds directly the main loads of the installation (generally up to 100 kW), in particular when they are close from it. Other circuits are connected via sub-distribution equipment.
When limited to 2 or 3 transformers, main LV switchboards can be implemented in the same enclosure.

Typical applications

Industrial buildings
Supermarket
Shopping center
Hospital

Circuit distribution

- Circuit: Lighting
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS

- Circuit: HVAC distribution
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: No UPS

- Circuit: HVAC production
  - Distribution principle: Centralized
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: No UPS

- Circuit: Refrigeration distribution
  - Distribution principle: Distributed
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- Circuit: Refrigeration production
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  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS

- Circuit: Cash register
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: UPS

- Circuit: Laboratories
  - Distribution principle: Centralized
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: No UPS

- Circuit: Com center shop feeding
  - Distribution principle: Distributed

  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS

- Circuit: Com center common lighting
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS

Technical specification for material and installation conditions

MV equipment

MV switchboard equipment technical specification

General conditions

The following specifications apply to modular indoor switchboards comprising factory built, metal-enclosed switchgear assembles.
The equipment to be supplied shall consist of modular cubicles satisfying the following criteria:

- open-ended design,
- easy to install,
- safe and easy to operate,
- compact design,
- low maintenance.

The supplier must be able to prove its extensive possess experience in the field of MV switchgear, and has already supplied equipment of the same type & production process, in which has been in operation for at least three years.

Standards

The switchgear shall comply with the latest issues of the following IEC recommendations:

- IEC 62 271-200 Alternative current metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV,
- IEC 60265 High voltage switches for rated voltages of 52 kV and above ,
- IEC 62271-102 High voltage alternative current disconnectors and earthing switches,
- IEC 60694 Common specifications for high voltage switchgear and controlgear standard,
- IEC 62271-105 High Voltage alternative current switch-fuse combinations,
- IEC 62271-100 High Voltage alternative current circuit breakers,
- IEC 60282-1 MV fuses,
- IEC 60185 Current transformers,
- IEC 60186 Voltage transformers,
- IEC 60801 Electromagnetic compatibility for industrial process measurement and control equipment.
- IEC60529 Degrees of protection provided by enclosures (IP code).

MV switchboard equipment proposal

MV switchboard equipment could be of the following type:

SM6

Equipment of type: SM6 24 kV - MV metal enclosed modular cubicles

Environment

- working temperature from -5°C up to +40°C,
- a setting up at an altitude bellow 1000m,
- Average Relative humidity / month : max 90% referring to IEC 62271-200

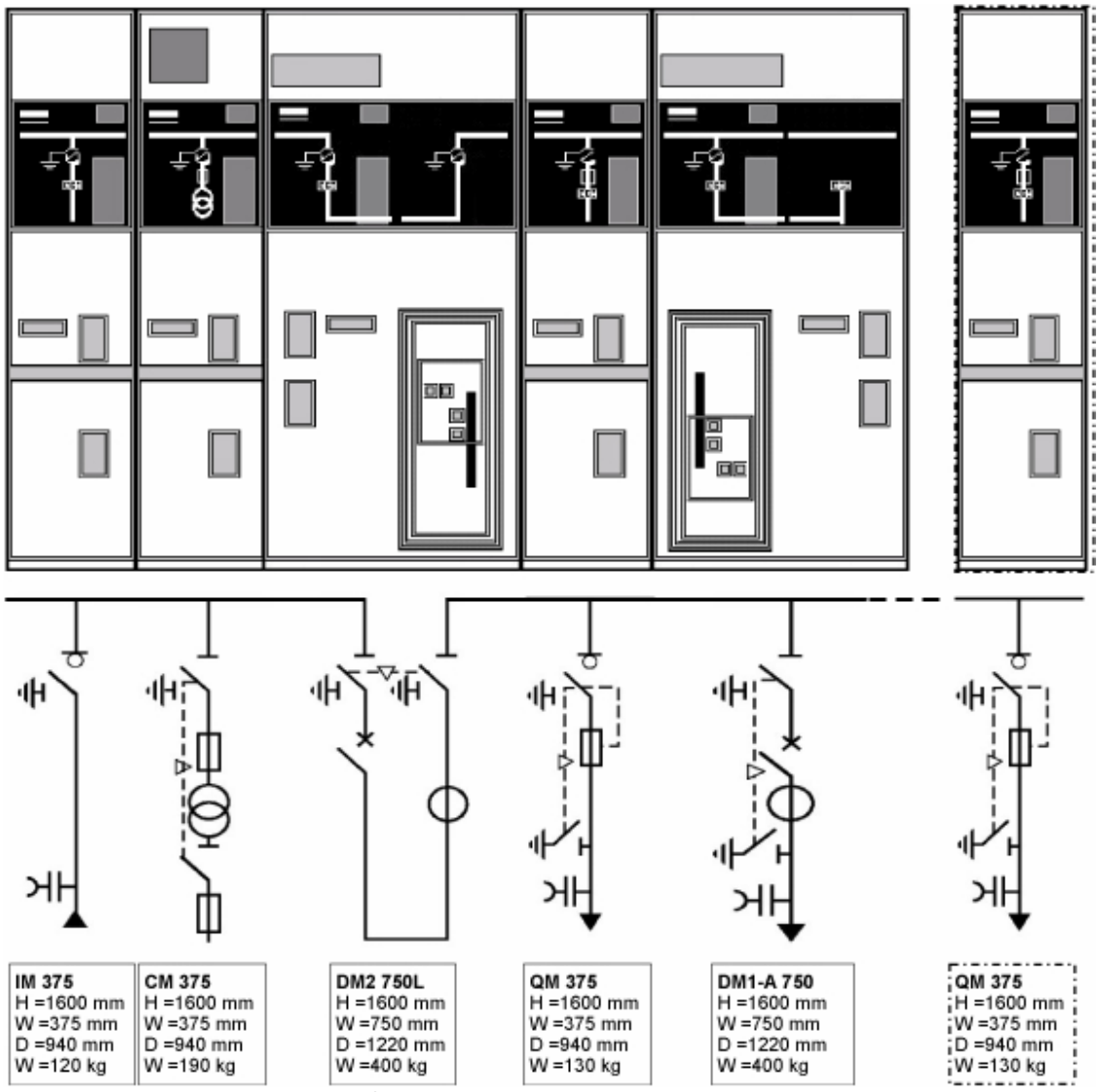
Electrical characteritics

- Short circuit withstand: [12,5 - 16] kA
- Nominal current: [400 - 630] A

Insulation level		7,2 kV	12 kV	17,5 kV	24 kV
50 Hz, 1min (kV)	Insulation	20	28	38	50
1.2/50 μs (kV peak)	Insulation	60	75	95	125

Internal arc withstand	
Standard	12.5 kA. 0.7 s
Enhanced	16 kA. 1 s

Switchboard design requirements



Single line services - MV metering
Several outgoing to MV/LV transformers (QM if rated power<2000kVA, DM1-A else) with radial connection

External influences

- Protection index classes : PI (insulating partition)
- Loss of service continuity classes : LSC2A
- Degree of protection units : IP2XC for units, IP2x between compartments

Connections

Cold fitted connection technologies shall be ease to install that favours resistance over time.
Network cables are connected:
- on the switch terminals;
- on the lower fuse holders;
- on the circuit breaker's connectors.

The cable terminals are:
- round connection and shank for cables δ 300 mm_2;
- square connection round shank for cables > 300 mm_2 only.

Crimping of lugs to cables must be carried out by stamping.
The end connectors are of cold fitted type wherever possible for better resistance over time.
The maximum admissible cable cross section:
- 630 mm_2 for 1250 A incomer and feeder cables;

– 300 mm^2 for 400 - 630 A incomer and feeder cables ;
– 95 mm^2 for transformer protection cubicles with fuses.
Access to the compartment is interlocked with the closing of the earthing disconnector.
The reduced cubicle depth makes it easier to connect all phases.
A 12 mm Ø pin integrated with the field distributor enables the cable end lug
to be positioned and attached with one hand. Use a torque wrench set to 50 mN.

Operating mechanism

The operating mechanism shall include a switch and earthing switch position indicator fixed directly to the shaft of the moving pole, thereby satisfying the positive break criteria.
The front cover of the operating mechanism is suitable for the application of all symbols, mimic diagrams, nameplates and padlocking fixtures required by the function implemented.
All switch and earthing switch operations shall be carried out with an anti-reflex lever and shall be independent of the action of the operator after charging the operating mechanism springs.

Auxiliaries

Auxiliary equipment shall satisfy section 5.4 of IEC 62 271-200 recommendations.
The LV cables shall be class 2 type with a 2000 V insulation level.
They shall be marked at each end for easy verification during maintenance or servicing work.
The cable cross-sections shall not be less than 2.5 sqmm for circuits carrying high currents, or 1 sqmm for other circuits.

Interlocks

Mechanical interlocking (padlocking) systems shall be provided to prevent incorrect operations such as the closing of the earthing switch with the switch or disconnector in closed position.

Surface treatment

The galvanised and electro-galvanised sheet metal and metal fittings shall be painted to provide protection against corrosion. The epoxy-based paint shall have a thickness of at least 50 micronsmeter and shall be applied to both sides of all sheet metal. The colour shall correspond to the RAL colour range proposed.

MV/LV transformer technical specification

These transformers will be in compliance with the following standards:

- IEC 60076-1 to 60076-5: power transformers.

They will be manufactured in accordance with:

- a quality system in conformity with ISO 9001,
- an environmental management system in conformity with ISO 14001, both certified by an official independent organisation.

A five years guarantee should be possible of dry-type transformers.

Routine tests

These tests will be carried out on all the transformers after the manufacturing, enabling an official test certificate to be produced for each one:

- applied voltage dielectric test,
- induced voltage dielectric test,
- measurement of no load loss and no load current,
- measurement of windings resistance,
- measurement of impedance voltage and load loss,
- measurement of the transformation ratio and vector group.

Type tests and special tests

These tests can be requested as option, but are subject to prior agreement of the supplier:

- temperature rise test,
- lightning impulse test,
- measurement of partial discharges (routine test for Trihal transformer),
- short circuit test (implemented in an approved laboratory)
- noise level measurements.

(All these tests are defined in the IEC 60076-1 to 60076-5 standards)

Electrical protection

Protection relay :

The installation must have a protection relay to protect the transformer from:

- overload,
- short circuits (internal or external),
- earth faults,
- overflow.

MV surge arresters :

It is advisable to check that the installation will not be subjected to overvoltage of any kind (atmospheric or switching overvoltage).

If there is a risk, the transformer should be protected by phase-earth surge arresters installed directly on the MV connection terminals (top or bottom).

Phase-earth surge arresters are absolutely essential in the following cases:

- if the lightning impact level Nk is greater than 25. The risk of direct or induced atmospheric overvoltage is directly proportional to Nk.
- during the occasional switching (less than 10 operations a year) of a transformer with a weak load, or during a magnetisation period.

They are highly recommended in the following case:

- if the substation is supplied by a network including overhead parts, then a cable which is longer than 20 m (for example, an overhead-underground network).

MV/LV Transformer equipment proposal

MV/LV transformer could be of the following type:

Trihal

Equipment of type : Trihal cast resin transformer

Environnement

- Altitude: <= 1000m
- Ambient temperature range: -25°C to +40°C
- Average daily temperature: 30°C
- Average annual temperature: 20°C

Electrical requirements

- Rated Power: [160 - 250 - 400 - 630 - 800 - 1000 - 1250 - 1600 - 2000 - 2500 - 3150] kVA
- Insulation voltage: [12 – 17,5 - 24 – 36] kV
- Rated impedance voltage: Normal
- Power losses at 120 C°: Normal - Reduced

Operating conditions

- Neutral system : [TNS - TNC - TT - IT]

Metal Enclosure

The transformer will be equipped with a metal enclosure for indoor installation comprising an integral IP 31 IK 07 that can be dismantle on request with:

- an anti-corrosion protection in the manufacturer's standard painting RAL 9002,
- lifting lugs enabling the transformer and enclosure assembly to be handled,
- a bolted access panel on the enclosure front to allow access to the HV connections and to the tapping.

Accessories and standard equipment

The transformer will be equipped with:

- 4 flat bi-directional rollers,
- lifting lugs,
- haulage holes on the underbase,
- 2 earthling terminals,
- 1 rating plate,
- 1 "Danger Electricity" warning label (T 10 warning),
- 1 routine tests certificate,
- 1 instruction manual for installation, commissioning and maintenance in English.

MV connection

The MV connections will be made from above on the top of the connection bars. Each bar will be drilled with a 13 mm hole ready for connection of cable lugs on terminal plates.
The MV connection bars will be in rigid copper bars protected by heat shrinkable tubing.
HV connections in cables are not allowed, in order to avoid all risk of contact, due to cables flapping.
The MV connections will be in copper.

LV connections

The LV connections will be made from above onto bars located at the top of the coils on the opposite side to the HV connections.

Connection of the LV neutral will be directly made to the LV terminals between the LV phase bars.
The LV connection bars will be in copper or in tinned aluminium (according to preference of the manufacturer).
The output from each LV winding will comprise a tin-plated aluminium or copper connection terminal, enabling all connections to be made without using a contact interface (grease, bi-metallic strip).
These will be assembled according to current practices, notably using spring washers under the fixings and nuts.
Devices in the 630 to 2500 kVA range will be easy to connect using factory-built electrical ducting through an optional interface. Stress withstand in the instance of a bolted short circuit on the connector will be guaranteed by the manufacturer.

MV tapping

The tapping which act on the highest voltage adapting the transformer to the real supply voltage value, will be off-circuit bolted links.
Tapping with connection cables are not allowed.
These bolted links will be attached to the HV coils.

Thermal protection

The transformer will be equipped with a thermal protection device which will comprise:
- 2 sets of 3 PTC sensors one sensor for "Alarm 1", one for "Alarm 2" per phase, installed in the coils of the transformer and placed in a tube to enable them to be replaced if necessary,
- an electronic converter with two independent monitoring circuits equipped with a changeover switch, one for "Alarm 1" the other for "Alarm 2" with 3 coloured light indicator to indicate the position of the relays and the presence of voltage installed on the front of the converter,
- a plug-in terminal block for connection of the PTC sensors to the electronic converter.

The PTC sensors will be supplied assembled and wired to the terminal block fixed on the upper part of the transformer. The converter will be supplied loose with the transformer, packaged complete with its wiring diagram.

Main characteristics of construction

Magnetic core

This will be made from laminations of grain oriented silicon steel, insulated with mineral oxide and will be protected against corrosion with a coat of varnish. In order to reduced the power consumption due to transformer no-load losses, the magnetic core is stacked using overlapping-interlocking technology, with at least 6 overlaps. In order to reduce the noise produced by the magnetic core, it is equipped with noise-damping devices.

LV windings

The LV winding is produced using aluminium or copper foils (according to the manufacturer's preference) in order to cancel out axial stress during short circuit ; this foil will be insulated between each layer using a heat-reactivated class F pre-impregnated epoxy resin film
The ends of the winding are protected and insulated using a class F insulating material, covered with heat reactivated epoxy resin
The whole winding assembly will be polymerised throughout by being autoclaved for 2 hours at 130°C, which will ensure :
High level of resistance to industrial environments
Excellent dielectric withstand
Very good resistance to radial stress in the instance of a bolted short circuit.

HV windings

They will be separated from the LV windings to give an air gap between the MV and LV circuits in order to avoid depositing of dust on the spacers placed in the radical electrical field and to make maintenance easier.
These will be independent of the LV windings and will be made of aluminium or copper wire or foil (according to the manufacturer's preference) with class F insulation.
The HV windings will be vacuum cast in a class F fireproof epoxy resin casting system composed of :
- an epoxy resin
- an anhydride hardener with a flexibilising additive
- a flame-retardant filler.

The flame-retardant filler will be thoroughly mixed with the resin and hardener. It will be composed of trihydrated alumina powder (or aluminium hydroxide) or other flame-retardant products to be specified, either mixed with silica or not.
The casting system will be of class F. The interior and exterior of the windings will be reinforced with a combination of glass fibre to provide thermal shock withstand

MV winding support spacers

These spacers:

- will provide sufficient support in transport, operation and during bolted short circuit conditions as well as in the case of an earthquake,
- will be circular in shape for easy cleaning and will give an extended tracking line to give better dielectric withstand under humid or high dust conditions,
- will include an elastomer cushion that will allow it to absorb expansion according to load conditions and will be incorporated in the spacer to prevent it being deteriorated by air or UV.

Climatic and environmental classification

The transformer will be of climatic class C2 and of environmental class E2 as defined in IEC 60076-11. C2 and E2 classes will be indicated on the rating plate.

Fire behaviour classification

The transformer will be of class F1 as defined in IEC 60076-11. F1 class will be indicated on the rating plate.

Additional standards

In addition to general requirements for MV/LV transformers, it will be in compliance with IEC 60076-11, Dry type transformers standard and with the following CENELEC Harmonisation Documents:

- HD 538-2 S1: 1995 for three-phase dry-type distribution transformers 50 Hz, from 100 to 2500 kVA with highest voltage for equipment not exceeding 24 kV,
- IEC 60905 : 1987 - Load guide for dry-type power transformers.

Main switchboards and main LV distribution equipment

Main LV switchboard equipment technical specification

The following paragraph describes the general rules to guarantee the maximum level of quality and performances for a Low Voltage Switchboard.
In the aim to reach this requirement, the entire equipment must be in appliance according to the specifications defines in the ***IEC Standard : 60439-1***

The IEC 60439-1 applies to low voltage switchgear and control gear assemblies for a voltage which does not exceed 1000V in alternative current at frequencies not exceeding 1000 Hz, or for 1500 V in d.c.

This Standard is also applicable for all Assemblies intended for use in connection with the generation, transmission, distribution and conversion of electric energy, and for the control of electric energy consuming equipment.

To guarantee the installation consistency during the switchboard life cycle, the installation systems and the devices must be supplied by the same manufacturer.

The Manufacturer Requirements

In order to be conform to the IEC 60439-1, the Switchboard has amongst other things to succeed Seven tests in the most critical configurations.
Hereafter the detail of those 7 type tests :
No. 1 - temperature rise limits
No. 2 - dielectric properties
No. 3 - short-circuit withstand
No. 4 - protective circuit effectiveness
No. 5 - clearances and creepage distances
No. 6 - mechanical operation
No. 7 - degree of protection

Thanks to the full achievement of those 7 type tests, the Switchboard exploiters have the insurance that the equipment properly assembled (according the manufacturers rules) is capable to support the maximum performances announced by the assembler.

The Switchboard supplier must provide a copy of the first page of theses seven certificates.

The Switchboard Assembler requirements

To complete the conformity to the standard, the switchboard assembler has to achieve three others tests after the complete assembly.
Hereafter the 3 type tests performed by the assembler :
No. 8 - general inspection
No. 9 - insulation / dielectric test
No. 10 - protection measures.

Thanks to the full achievement of those 3 type tests, the Switchboard exploiters have the insurance that the equipment is conformed to the electrical drawings and to the manufacturer rules.

A copy of these routines tests fully completed by the assembler must be present within or close to the switchboard on its exploitation site.

Main LV switchboard equipment proposal

The main LV switchboard could be of the following type:

Prisma Plus P

Equipment of type : Prisma Plus System P

Environment

- Altitude : ≤ 2000m
- Ambient temperature : standard
- Average ambient temperature over a period of 24h : 35°C
- Relative humidity : standard (80% - 35°C)
- Climatic ambience : standard

Electrical requirements

- Rated Voltage : till 1000 V
- Frequency : 50 Hz
- Rated current : [630 - 800 - 1000 - 1250 - 1600 - 2000 – 3200] A
- Icw : 85 kA
- Earthing system Main Busbar: [TNS – TNC – TT – IT]

Switchboard design requirements

Enclosures :

- Degree of protection IP : [30 - 31 - 55]
- Degree of mechanical protection IK : [07 - 08 - 10]
- Form : [2a - 2b - 3a - 3b - 4a - 4b], for safety reasons and especially when the door will be opened during the switchboard working, all busbars have to be covered by barriers onto the whole perimeter of the busbars zone.
- Painting : standard RAL 9001
- Door : with locking (key RONIS n° 405)

In order to facilitate the access within the switchboard for the maintenance, its covering panels must be dismountable on all surfaces for any IP degree.
To insure the maximum protection of people around the electrical installation, front plates must be installed in front of all control and protection equipment in order to avoid a direct access without a tool to the devices and consequently to the active parts.

Busbars :

- Main busbar rated current : …… A according to the degree of protection IP ……

The design will provide compactness, lightness, improved natural convection, by using channelled aluminium bars. To insure a good electrical contact, aluminium will be covered with a high velocity projected copper, on all the height of the bar.
In the aim to limit the volume of copper inside the switchboards for cost and weight reasons, we strongly advice to design the electrical architecture in associating horizontal and vertical busbars.
The horizontal busbar purpose is to bring energy to all vertical busbars
The vertical busbar purpose is to distribute energy to all outgoers with a double interest :

1/ If you compare this architecture against horizontal busbar only, you reduce the length of electrical conductors inside the switchboard by 20% which reduces consequently the global project costs.
2/ Second advantage, the assembling quality, thanks to the hz. / vert. architecture, we accelerate the mounting time thanks to the upstream connection manufacturing (same length along the cubicle height).
Besides, from the ergonomic point of view, it's better to connect the busbar with the device by front access.
And if you really want to improve this asset, we strongly advice to install a vertical busbar with each bar separated in depth and in width each others.

Functionnal units :

Architecture of the switchboard : single incomer / changeover / multiple incomers

Incomer(s):

In (A)	Nb	Connect.	Withdrawability	Switchgear	Type	RCD
[250 – 630] A	…	WFD (*)	Disconnectable	Compact NS	Circuit breaker	No
[250 – 630] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	No
[630 - 1600] A	…	WWW	Withdrawable on chassis	Masterpact NT/NW	Circuit breaker	No
[1600 - 4000] A	…	WWW	Withdrawable on chassis	Masterpact NW	Circuit breaker	No

Feeders :

In (A)	Nb	Connect.	Withdrawability	Switchgear	Type	RCD
[0 – 63] A	…	FFF	Fixed	Multi9 – C60	Circuit breaker	In TT
[63 – 125] A	…	FFF	Fixed	Multi9 – NG125	Circuit breaker	In TT
[125 – 250] A	…	FFF	Fixed	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	FFF	Fixed	Compact NS	Circuit breaker	In TT
[630 - 1600] A	…	FFF	Fixed	Masterpact NT/NW	Circuit breaker	In TT
[1600 - 4000] A	…	FFF	Fixed	Masterpact NW	Circuit breaker	In TT
[0 – 63] A	…	WFD (*)	Disconnectable	Multi9 – C60	Circuit breaker	In TT
[63 – 125] A	…	WFD (*)	Disconnectable	Multi9 – NG125	Circuit breaker	In TT
[125 – 250] A	…	WFD (*)	Disconnectable	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	WFD (*)	Disconnectable	Compact NS	Circuit breaker	In TT
[0 – 63] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[63 – 125] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[125 – 250] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[125 – 250] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[630 - 1600] A	…	WWW	Withdrawable on chassis	Masterpact NT/NW	Circuit breaker	In TT
[1600 - 4000] A	…	WWW	Withdrawable on chassis	Masterpact NW	Circuit breaker	In TT

(*) in disconnectable Prisma Plus P cubicle

All the devices must be installed onto dedicated mounting plate designed for one or several switchgears of the same type. The objective of that point is to regroup the protection equipment of the same nature each others and distinguish inside the switchboard the function of each device or group of devices.
Theses mounting plates will have an independent fixing system affording them to be transformed and moved anywhere in the switchboard and especially to make it easier the installation evolution.

Spare capacity

- Spare capacity : : ..... % - The reserve shall not be equipped, as switchboard modular design allows easy upgrading.

Maintenance

Due to the continual evolutions of the electrical needs for the buildings or for the factories, the distribution switchboards must be made the way to have the capacity to follow those evolutions.
That's the reason why, they need to meet the following requirements:

- To make it easier and quicker, the switchboard offer must include dedicated components affording the adjunction of one or several wall mounting & floor standing enclosures or cubicles on the exploitation site. In order to facilitate the current maintenance, e.g. infra red measurement, the devices zone has to be accessible in one operation.
- The final customers will have the possibility to obtain some spare parts ten years after the commercialisation ending of the switchboard offer in order to be able to replace some components for maintenance or evolution needs.
- For maintenance needs, the cubicle extraction and reintegration in the middle of the switchboard must be made without operation onto the adjacent cubicles.

Aesthetics

In order to avoid a dedicated room for low voltage switchboards (general or divisionary), the envelop colour and shapes should be appropriated to be integrated inside all building ambiances.
This specification reduces the facility surface and consequently afford to save money.
Besides, a nice enclosure aesthetic makes possible the installation of the Switchboard in the most accessible areas of buildings. This ability improves the access of the electrical network in reducing the intervention time of maintenance while keeping the safety intact thanks to the partitioning and protection degrees.

LV switchboard and distribution equipment

LV Distribution Switchboard technical specification

The following paragraph describes the general rules to guarantee the maximum level of quality and performances for a Low Voltage Switchboard.
In the aim to reach this requirement, the entire equipment must be in appliance according to the specifications defines in the ***IEC Standard : 60439-1***

The IEC 60439-1 applies to low voltage switchgear and control gear assemblies for a voltage which does not exceed 1000V in alternative current at frequencies not exceeding 1000 Hz, or for 1500 V in d.c.

This Standard is also applicable for all Assemblies intended for use in connection with the generation, transmission, distribution and conversion of electric energy, and for the control of electric energy consuming equipment.

To guarantee the installation consistency during the switchboard life cycle, the installation systems and the devices must be supplied by the same manufacturer.

The Manufacturer Requirements

In order to be conform to the IEC 60439-1, the Switchboard has amongst other things to succeed Seven tests in the most critical configurations.
Hereafter the detail of those 7 type tests :
No. 1 - temperature rise limits
No. 2 - dielectric properties
No. 3 - short-circuit withstand
No. 4 - protective circuit effectiveness
No. 5 - clearances and creepage distances
No. 6 - mechanical operation
No. 7 - degree of protection

Thanks to the full achievement of those 7 type tests, the Switchboard exploiters have the insurance that the equipment properly assembled (according the manufacturers rules) is capable to support the maximum performances announced by the assembler.

The Switchboard supplier must provide a copy of the first page of theses seven certificates.

The Switchboard Assembler requirements

To complete the conformity to the standard, the switchboard assembler has to achieve three others tests after the complete assembly.
Hereafter the 3 type tests performed by the assembler :
No. 8 - general inspection
No. 9 - insulation / dielectric test
No. 10 - protection measures.

Thanks to the full achievement of those 3 type tests, the Switchboard exploiters have the insurance that the equipment is conformed to the electrical drawings and to the manufacturer rules.

A copy of these routines tests fully completed by the assembler must be present within or close to the switchboard on its exploitation site.

Circuits connected to switchboard

- Circuit: HVAC production
  - Distribution principle: Centralized
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: No UPS
  - Withdrawability : FFF
  - Form : 1
  - IS : 111
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : Prisma Plus G, Prisma Plus P

- Circuit: Refrigeration production
  - Distribution principle: Centralized
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS
  - Withdrawability : FFF
  - Form : 1
  - IS : 211
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : Prisma Plus G, Prisma Plus P

- Circuit: Laboratories
  - Distribution principle: Centralized
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: No UPS
  - Withdrawability : FFF
  - Form : 1
  - IS : 111
  - IP : IP ≥ 43
  - IK : IK ≥ 08
  - Equipment : Prisma Plus G, Prisma Plus P

Prisma Plus G

Equipment of type : Prisma Plus System G

Environment

- Altitude : ≤ 2000m
- Ambient temperature : standard
- Average ambient temperature over a period of 24h : 35°C
- Relative humidity : standard (80% - 35°C)
- Climatic ambience : standard

Electrical requirements

- Rated Voltage : till 1000 V
- Frequency : 50 Hz
- Rated current : [160 - 250 - 400 - 630] A
- Icw : 25 kA
- Earthing system Main Busbar: [TNS - TNC - TT – IT]

Switchboard design requirements

The wall-mounting and floor-standing cabinets will be of modular, combinable and evolutive structure. They will be composed of a rear panel supporting the functional mounting plates and of panelling elements, quickly removable in order to make easier the site interventions.

Enclosures :

- Degree of protection IP : .....
- Degree of mechanical protection IK : .....

For safety reasons and especially when the door will be opened during the switchboard working, all busbars have to be covered by barriers onto the whole perimeter of the busbars zone.

- Painting : standard RAL 9001
- Door : with locking (key RONIS n° 405)

The doors will be easily reversible in order to be compatible with any lay-out in the premises. According to the switchboard surrounding they will be plain for a maximal protection or transparent to evidence the switchgear inside.

It will be possible to realise any required configuration by combining the wall-mounting or floor-fixing cabinets, whatever the degree of protection is. The design will allow a total site evolutivity by combination of new enclosures to the already installed ones.

Clipped gland plates will allow easy implementation. They can be equipped with suitable devices in order to maintain the degree of protection. The cables will be connected to specific bar tails or terminals

Busbars :

- Main busbar rated current : …… A according to the degree of protection IP ……

The busbar will be composed of rectangular copper bars, quality Cu-ETP R240. It will allow a large connection capacity and easy installation and modification. It will be protected against directs contacts IPxxB. The busbar will be supplied by a standardised and tested power supply block associated to the incoming switchgear.

Functionnal units :

Architecture of the switchboard : single incomer / changeover

Incomer(s):

In (A)	Nb	Connect.	Withdrawability	Switchgear	Type	RCD
[250 – 630] A	…	FFF	Fixed	Compact NS	Switch	Yes/No

A standardised incoming connection device, tested in coherence with the whole installation system and with the switchgear, will allow the connection of incoming cables without bending. It will be protected IPxxB. The assembly incoming connection/incoming switchgear/power supply block/busbar will form a compact functional unit, completely covered and clearly evidencing the power running.Connection of the base at its nominal current shall allow free upgrading of rating

Feeders :

In (A)	Nb	Connect.	Withdrawability	Switchgear	Type	RCD
[0 – 63] A	…	FFF	Fixed	Multi9 – C60	Circuit breaker	Yes/No
[63 – 125] A	…	FFF	Fixed	Multi9 – NG125	Circuit breaker	Yes/No
[125 – 250] A	…	FFF	Fixed	Compact NS	Circuit breaker	Yes/No
[250 – 630] A	…	FFF	Fixed	Compact NS	Circuit breaker	Yes/No

All functional units of the same type and rating shall be interchangeable from the front.
The mounting devices will be equipped with guides and marks for easy positioning of the switchgear. The devices will be fitted to the mounting plate by screws, without nuts to avoid any accidental fall of nuts in the equipment.The switchgear mounting plates will be equipped with cable fastening tabs.

Spare capacity

- Spare capacity : : .....% - The reserve shall not be equipped, as switchboard modular design allows easy upgrading.

Aesthetics

In order to avoid a dedicated room for low voltage switchboards, the envelop colour and shapes should be appropriated to be integrated inside all building ambiances. This specification reduces the facility surface and consequently affords to save money.
Besides, a nice enclosure aesthetic makes possible the installation of the Switchboard in the most accessible areas of buildings.

Prisma Plus P

Equipment of type : Prisma Plus System P

Environment

- Altitude : ≤ 2000m
- Ambient temperature : standard
- Average ambient temperature over a period of 24h : 35°C
- Relative humidity : standard (80% - 35°C)
- Climatic ambience : standard

Electrical requirements

- Rated Voltage : till 1000 V
- Frequency : 50 Hz
- Rated current : [630 - 800 - 1000 - 1250 - 1600 - 2000 – 3200] A
- Icw : 85 kA
- Earthing system Main Busbar: [TNS – TNC – TT – IT]

Switchboard design requirements

Enclosures :

- Degree of protection IP : [30 - 31 - 55]
- Degree of mechanical protection IK : [07 - 08 - 10]
- Form : [2a - 2b - 3a - 3b - 4a - 4b], for safety reasons and especially when the door will be opened during the switchboard working, all busbars have to be covered by barriers onto the whole perimeter of the busbars zone.
- Painting : standard RAL 9001
- Door : with locking (key RONIS n° 405)

In order to facilitate the access within the switchboard for the maintenance, its covering panels must be dismountable on all surfaces for any IP degree.
To insure the maximum protection of people around the electrical installation, front plates must be installed in front of all control and protection equipment in order to avoid a direct access without a tool to the devices and consequently to the active parts.

Busbars :

- Main busbar rated current : …… A according to the degree of protection IP ……

The design will provide compactness, lightness, improved natural convection, by using channelled aluminium bars. To insure a good electrical contact, aluminium will be covered with a high velocity projected copper, on all the height of the bar.
In the aim to limit the volume of copper inside the switchboards for cost and weight reasons, we strongly advice to design the electrical architecture in associating horizontal and vertical busbars.
The horizontal busbar purpose is to bring energy to all vertical busbars
The vertical busbar purpose is to distribute energy to all outgoers with a double interest :
1/ If you compare this architecture against horizontal busbar only, you reduce the length of electrical conductors inside the switchboard by 20% which reduces consequently the global project costs.
2/ Second advantage, the assembling quality, thanks to the hz. / vert. architecture, we accelerate the mounting time thanks to the upstream connection manufacturing (same length along the cubicle height).

Besides, from the ergonomic point of view, it's better to connect the busbar with the device by front access. And if you really want to improve this asset, we strongly advice to install a vertical busbar with each bar separated in depth and in width each others.

Functionnal units :

Architecture of the switchboard : single incomer / changeover / multiple incomers

Incomer(s):

In (A)	Nb	Connect.	Withdrawability	Switchgear	Type	RCD
[250 – 630] A	…	WFD (*)	Disconnectable	Compact NS	Circuit breaker	No
[250 – 630] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	No
[630 - 1600] A	…	WWW	Withdrawable on chassis	Masterpact NT/NW	Circuit breaker	No
[1600 - 4000] A	…	WWW	Withdrawable on chassis	Masterpact NW	Circuit breaker	No

Feeders :

In (A)	Nb	Connect.	Withdrawability	Switchgear	Type	RCD
[0 – 63] A	…	FFF	Fixed	Multi9 – C60	Circuit breaker	In TT
[63 – 125] A	…	FFF	Fixed	Multi9 – NG125	Circuit breaker	In TT
[125 – 250] A	…	FFF	Fixed	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	FFF	Fixed	Compact NS	Circuit breaker	In TT
[630 - 1600] A	…	FFF	Fixed	Masterpact NT/NW	Circuit breaker	In TT
[1600 - 4000] A	…	FFF	Fixed	Masterpact NW	Circuit breaker	In TT
[0 – 63] A	…	WFD (*)	Disconnectable	Multi9 – C60	Circuit breaker	In TT
[63 – 125] A	…	WFD (*)	Disconnectable	Multi9 – NG125	Circuit breaker	In TT
[125 – 250] A	…	WFD (*)	Disconnectable	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	WFD (*)	Disconnectable	Compact NS	Circuit breaker	In TT
[0 – 63] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[63 – 125] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[125 – 250] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[125 – 250] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[250 – 630] A	…	WWW	Plug-in on base	Compact NS	Circuit breaker	In TT
[630 - 1600] A	…	WWW	Withdrawable on chassis	Masterpact NT/NW	Circuit breaker	In TT
[1600 - 4000] A	…	WWW	Withdrawable on chassis	Masterpact NW	Circuit breaker	In TT

(*) in disconnectable Prisma Plus P cubicle

All the devices must be installed onto dedicated mounting plate designed for one or several switchgears of the same type. The objective of that point is to regroup the protection equipment of the same nature each others and distinguish inside the switchboard the function of each device or group of devices.
Theses mounting plates will have an independent fixing system affording them to be transformed and moved anywhere in the switchboard and especially to make it easier the installation evolution.

Spare capacity

- Spare capacity : : .....% - The reserve shall not be equipped, as switchboard modular design allows easy upgrading.

Maintenance

Due to the continual evolutions of the electrical needs for the buildings or for the factories, the distribution switchboards must be made the way to have the capacity to follow those evolutions.
That's the reason why, they need to meet the following requirements:

- To make it easier and quicker, the switchboard offer must include dedicated components affording the adjunction of one or several wall mounting & floor standing enclosures or cubicles on the exploitation site. In order to facilitate the current maintenance, e.g. infra red measurement, the devices zone has to be accessible in one operation.
- The final customers will have the possibility to obtain some spare parts ten years after the commercialisation ending of the switchboard offer in order to be able to replace some components for maintenance or evolution needs.
- For maintenance needs, the cubicle extraction and reintegration in the middle of the switchboard must be made without operation onto the adjacent cubicles.

Aesthetics

In order to avoid a dedicated room for low voltage switchboards (general or divisionary), the envelop colour and shapes should be appropriated to be integrated inside all building ambiances.
This specification reduce the facility surface and consequently afford to save money.
Besides, a nice enclosure aesthetic makes possible the installation of the Switchboard in the most accessible areas of buildings. This ability improves the access of the electrical network in reducing the intervention time of maintenance while keeping the safety intact thanks to the partitioning and protection degrees.

Busbar Trunking system technical specification

General

The busbar trunking system shall be of low impedance and sandwiched typed technology. It shall be totally enclosed prelacquered galvanised steel; suitable for a 3 phases 5 wires system with full neutral and continuous internal copper earth bar of half size similar to the Telemecanique Canalis range.
All busbar trunking fittings (elbow, tees, end Cable Tap Box, etc.) shall be IP55 in accordance to IEC 529 and from the same manufacturer as the busbar trunking system.
The busbar trunking system shall be capable of being mounted in any position without derating. Plug-in and feeder sections shall be interchangeable without the use of special adapter joint covers. The complete installation shall be coordinated throughout and where possible, shall consist of standard 4m sections with special sections and fittings provided to suit the installation.
Horizontal runs of busbar trunking system shall be supported by hangers at every 3 meters. Vertical runs of busbar trunking system shall be supported by hangers not more than 4m apart.
Busbar trunking system shall be terminated by 'end closure'
.

Conformity To Standard

It shall be constructed in accordance with the applicable requirements of the latest IEC 60439
Part 1 and Part 2.
Verification of fire barrier in accordance of the latest ISO 834
Resistance to flame propagation conforming IEC 60332 Part 3.
Resistance of the materials to abnormal heat conforming IEC 60695 Part 2.

Environment

The busbar trunking system shall be suitable for continuous operation without derating at an average ambient temperature of 35^{o} C for 24h (40°C maximum peak)

Circuit connected to busbar trunking system

- Circuit: Lighting
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : KNA, KSA, KB

- Circuit: HVAC distribution
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: No UPS
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : KNA, KSA, KB

- Circuit: Refrigeration distribution
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : KNA, KSA, KB

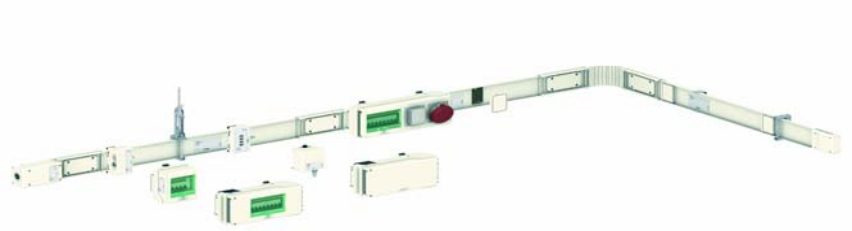
- Circuit: Cash register
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: No Generator
  - UPS: UPS
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : KNA, KSA, KB

- Circuit: Com center shop feeding
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : KNA, KSA, KB

- Circuit: Com center common lighting
  - Distribution principle: Distributed
  - Circuit configuration: Radial
  - Genset: LV Generator
  - UPS: No UPS
  - IP : IP ≥ 20
  - IK : IK ≥ 07
  - Equipment : KNA, KSA, KB

KNA

Equipment of type : Canalis KNA - Low power distribution



Environment

- Altitude : ≤ 2000m
- Ambient temperature : standard
- Average ambient temperature over a period of 24h : 35°C
- Relative humidity : standard (80% - 35°C)
- Climatic ambience : standard

Electrical requirements

- Rated Current: [40 - 63 - 100 - 160] A
- Rated insulation voltage: 500 V
- Conductor organisation:3L+N+PE
- Icw : [0,5 - 1,3 - 2,8 - 2, 8] kA

BTS composition

Straight lengths design

- Enclosure will be made of sheet steel, galvanised and prelacquered RAL 9001.
- 4 Conductors will be fitted with bimetal silver-plated copper/ aluminium laminate riders, electrically welded at junctions and tap-off outlet positions.
- 3 additional copper conductors will be available on request as remote-control circuit
- Junction block will be equipped with flexible contacts for the mechanical junction between two components to manage the difference in expansion between the conductors and the enclosure
- There will be tap-off outlets every 0.5 or 1 metre on one side of the trunking. Tap-off outlets will be equipped with automatic shutters that avoid accidental contact with live parts.
- The junction block will be maintenance free.

Fixing bracket design

- The fixing brackets are designed for suspension or fixing to a wall every 3 metres (unless otherwise specified)
- There will be spring mechanism available to adjust the length of the threaded rod fastly and without tool (no rod or nuts)

Tap-off unit

- Tap off unit jaws will be made of silver plated copper contacts suitable for all ratings of busbar
- the contact of the protective conductor will ensure automatic opening first of the shutters
- there will be no access to live parts when the cover of the tap-off unit is open (wire 1 mm in diameter, IPxxD),
- Connection and disconnection will be impossible with the cover closed
- It is not possible to close the cover before the tap-off unit is mechanically locked on the trunking

Embedded switchgear

In (A)	Switchgear	Type
[0 – 100] A	Multi9	Circuit breaker

External influences requirements

- Degree of protection IP : 55
- Degree of mechanical protection IK : 08

- Painting : standard RAL 9001
- Sprinkler proof

KSA

Equipment of type : Canalis KSA - Medium power distribution

Environment

- Altitude : ≤ 2000m
- Ambient temperature : standard
- Average ambient temperature over a period of 24h : 35°C
- Relative humidity : standard (80% - 35°C)
- Climatic ambience : standard

Electrical requirements

- Rated Current: [100 - 160 - 250 - 400 - 500 - 630 - 800 - 1000] A
- Rated insulation voltage: 690 V
- Conductor organisation: 3L+N+PE>
- Icw : [2,6 - 4,45 - 10 - 18,8 - 26,2 - 32,1 - 37,4 - 37,4] kA

BTS composition

Straight lengths design

- Enclosure will be made of sheet steel, galvanised and prelacquered RAL 9001.
- 4 Conductors will be fitted with bimetal silver-plated copper/ aluminium laminate riders, electrically welded at junctions and tap-off outlet positions.
- 3 additional copper conductors will be available on request as remote-control circuit
- Junction block will be equipped with flexible contacts for the mechanical junction between two components to manage the difference in expansion between the conductors and the enclosure
- There will be tap-off outlets every 0.5 or 1 metre on one side of the trunking. Tap-off outlets will be equipped with automatic shutters that avoid accidental contact with live parts.
- The junction block will be maintenance free.

Fixing bracket design

- The fixing brackets are designed for suspension or fixing to a wall every 3 metres (unless otherwise specified)
- There will be spring mechanism available to adjust the length of the threaded rod fastly and without tool (no rod or nuts)

Tap-off unit

- Tap off unit jaws will be made of silver plated copper contacts suitable for all ratings of busbar
- the contact of the protective conductor will ensure automatic opening first of the shutters
- there will be no access to live parts when the cover of the tap-off unit is open (wire 1 mm in diameter, IPxxD),
- Connection and disconnection will be impossible with the cover closed
- It is not possible to close the cover before the tap-off unit is mechanically locked on the trunking

Embedded switchgear

In (A)	Switchgear	Type
[0 – 100] A	Multi9	Circuit breaker
[100 – 250] A	Compact NS	Circuit breaker
[250 – 400] A	Compact NS	Circuit breaker

External influences requirements

- Degree of protection IP : 55
- Degree of mechanical protection IK : 08
- Painting : standard RAL 9001
- Sprinkler proof

KB

Equipment of type : Canalis KBA & KBB - Low power distribution

Environment

- Altitude : ≤ 2000m
- Ambient temperature : 35°C in any position

Electrical requirements

- Rated Current: [25 - 40] A
- Rated insulation voltage: 690 V
- Conductor organisation : [1L+N+PE - 3L+N+PE], 1 circuit for KBA, 2 circuits for KBB
- Icw : [0,44 - 0,94] kA

BTS composition

Straight lengths design

The carrier rail, which shall also ensure the function of protective earth conductor (PE), shall be crimp closed, made of hot-galvanised sheet steel.
As an option, it shall be pre-lacquered with RAL 9010 white painting.
0, 2, 3, 2+1 or 3+2 tap-off outlets shall be available on the busbar trunking.
Thanks to its great rigidity, the distance between two fixing points shall be able to be up to 5 metres.
The installation of the luminaires shall be possible at any point on the line, including the jointing units.
2 and 3 metres long busbar trunkings shall be available.
Electrical and mechanical jointings shall be carried out simultaneously. Proper tightening at the end of the assembly operation shall be ensured by a captive screw with a notched base.
The electrical jointing unit shall ensure automatic and simultaneous connection of all live conductors. The contacts shall be clamp and spring type and exert no forces on the plastic parts.
Flexible lengths shall be available to change direction or avoid obstacles.
2 or 4 conductors per circuit shall be insulated and made of tin-plated copper on the whole length, to ensure reliable and better contacts.
As an option, a factory-fitted dedicated earth conductor isolated from earth shall be available on the main circuit.

Plug in connectors

The busbar bar trunking system shall derive the electrical power by means of a range of plug-in connectors, compatible with all the ranges of busbar trunkings, from 20 to 40A, of the same manufacturer.

Connection and disconnection of the plug-in connectors shall be possible, even when they are energised and under live conditions.
No live part can be able to be accessed at any time, before, during and after the plugging.
For a better safety, during the connection of the plug-in connectors, the PE connection shall occur prior to the connection of the phases and the neutral.
Phase selection plug-in connectors shall be available, to balance 3-phase distribution systems; the selection shall be visible via a transparent window.
Among the range of plug-in connectors, 10A units, ensuring both the supply and the control of the lighting, with following options, shall be available :
-control by single-circuit switch
-control by double-circuit switch
-control by two-way switch
-control by impulse switch or timer
The quality of the live contacts between the busbar trunking and the plug-in connectors shall be ensured by means of a spring clamp system.

Fixing systems

Fixing systems for the mounting of both the trunking and the luminaires, with final automatic locking around the trunking shall be available.
To run adjacent circuits such as telephone lines, emergency lighting, etc, cable brackets or cable duct support systems with cable duct, easily adaptable on the busbar trunking itself ,shall be available.
Supports ensuring the mounting of both the busbar trunking and VDI cables, shall be available.

Communication bus

A factory mounted communication bus shall be available, as an option. It shall allow the transmission of electrical signals of low level (up to ± 50V) for the control and the transmission of data under MODBUS protocol.

External influences requirements

- Degree of protection IP : 55 (*) , in any positions, in accordance with IEC 60529.
- Degree of mechanical protection IK : 06
- Painting : standard RAL 9010
- sprinkler tested, with no need of additional accessories

(*) After the dismantling of a tap-off unit, the IP55 shall be restored by installing the blanking plate initially factory fitted.

Technical appendix: circuit distribution principle

Centralized Layout

Description

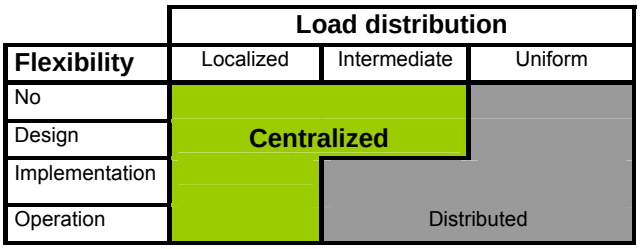
It consists in connecting consumers to sources via a star connection. The cables are suitable for centralized layout, with point-to-point links between the Main Low Voltage Switchboard and current consumers or sub-distribution boards.

Recommendations

Centralized Layout is recommended when:

- Installation flexibility is low,
- Load distribution is localized: high unit power loads, non-uniform.

Power supply by cables gives greater independence of circuits, reducing the consequences of a fault from the point of view of power availability.



Distributed Layout

Description

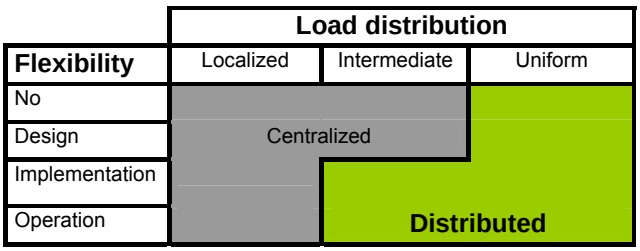
It consists in connecting consumers to sources via a busway. Busbar Trunking System (BTS) are well suited to distributed distribution layout, to supply many loads that are spread out, making it easy to change, move or add connections..

Recommendations

Distributed Layout is recommended when:

- Installation flexibility is high (moving of workstation),
- Load distribution is uniform: loads evenly distributed of low and homogenous unit power.

The use of BTS allows load power circuits to be combined and saves on conductors by taking advantage of a clustering coefficient. The choice between cable and BTS, according to the clustering coefficient, allows us to find an economical optimum between investment costs, implementation costs and operating costs.



Technical appendix: circuit configuration

Radial Configuration

Description

This is the reference and the most simple configuration. A load is only connected to one single source. This configuration provides a minimum level of availability, since there is no redundancy in case of failure of the power source.

Recommendations

This configuration is recommended depending on the load interruption sensitivity and the double-ended connection requirement

	Sheddable configuration required	
Interruption Sensitivity	No	Yes
Sheddable	Sheddable	**Radial**
Long interruption Short interruption No interruption	**Radial**	Double connection

Technical appendix: backup generator

LV Back-up Generator

Description

The electrical power supply is produced by an alternator driven by a thermal engine. Its back-up time depends on the quantity of available fuel.
A back-up generator functions generally disconnected from the network. A source change-over system is therefore necessary. According to the generator's capacity to supply power to all or only part of the installation, there's either total or partial redundancy.

Recommendations

Main characteristics to be considered for implementing a LV generator are:
load sensitivity to power interruption
availability of the upstream connection energy

	Upstream connection energy availability		
Interruption Sensitivity	Minimum	Standard	Enhanced
Sheddable		No LV generator	
Long interruption	**LV generator**		
Short interruption		**LV generator**	
No interruption		No LV generator	

The source-changeover can be automated to take into account the status of the normal and back up sources before switching.
The automatic source-changeover system requires no human intervention and switching form the normal to the replacement source takes place in less than 1 second.
This changeover system is made up of:
- 2 or 3 circuit breakers,
- 1 mechanical and electrical interlocking system,
- 1 controller.

The controller can be of type BA or UA:
BA controller, for a simple source-changeover system (automatic switching between the normal and replacement sources depending on theirstatus).
UA controller, for a source-changeover system integrating the following automatic functions:
- automatic switching between sources,
- control and management of engine generating sets,
- load shedding for non-priority circuits,
- switching to the replacement source if one of the phases of the normal source is absent.

A communication option based on the Schneider internal bus is available for the UA controller.

Range	**Compact**			**Masterpact**	
Type of device	NS100 to 250	NS100 to 250	NS100 to 250	NT 06 to 16	NW08 to 63
Mechanical interlocking					
On mounting plate	■	■			
By rods		■	■	■	
By cable		■	■	■	■
Electrical interlocking					
By diagram	■	■	■	■	■
With IVE unit	■	■	■	Only with UA or BA	Only with UA or BA
Source changeover controller					
BA controller	■	■	■	■	■
UA controller	■	■	■	■	■
Remote communication via bus					
Device status indications	■	■	■	■	■
Device remote control	■	■	■	■	■
Remote setting of 4-position switch			■	■	■
Indication and identification of protection status and alarms		■	■	■	■
Transmission of measurement		■	■	■	■

Technical appendix: uninterruptible power supply

UPS

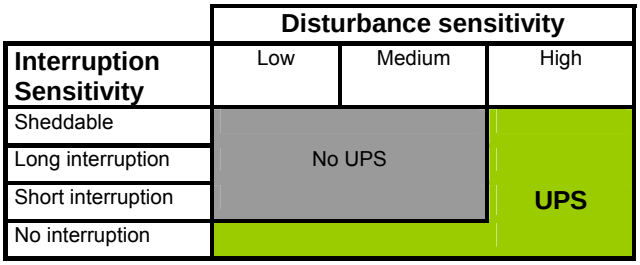
Description

This system is used to avoid any power failure. The back-up time of the system is limited: from several minutes to several hours.
The simultaneous presence of a back-up generator and a UPS allows a permanent supply of loads for which no interruption is acceptable.
The back-up time of the UPS must be compatible with maximum time for the back-up generator to start-up and be brought on line.
A UPS is also used to supply power to loads that are sensitive to disturbances.

Recommendations

Main characteristics to be considered for implementing a UPS are:

- load sensitivity to power interruption
- load sensitivity to disturbances



Technical specification for UPS :

UPS :

Galaxy 6000 and Galaxy 5000 UPS are ideal for high power data centres and industrial applications.

Technical Characteristics

	Galaxy 6000	**Galaxy 5000**
Normal AC supply input		
Input voltage range	320V to 470V 3 phase	250V to 470V 3 phase
Input Mains 1 and Mains 2	Separate or common	Separate or common
Frequency	50Hz / 60Hz +/- 10%	50Hz / 60Hz +/- 8%
Input current total harmonic distorsion (THDI)	< 4% with harmonic filter	< 3%
Input power factor	> 0.95 with active harmonic filter	> 0.99
Bypass system input		
Nominal input voltage	320V to 470V 3 phase + neutral	340V to 470V 3 phase + neutral
Frequency	50Hz / 60Hz +/- 10%	50Hz / 60Hz +/- 8%
Output		
Output voltages	380V, 400V, 415V +/- 3% 3 phase + neutral	380V, 400V, 415V +/- 3% 3 phase + neutral
Voltage regulation	+/- 1%	+/- 1%
Frequency	50Hz / 60Hz	50Hz / 60Hz
Over load	165% 1 minutes, 125% 10 minutes	150% 1 minutes, 125% 10 minutes
Output voltage total harmonic distorsion	THDU < 3%	THDU < 2%
Max load crest factor	3:1	3:1
Variation of voltage with 100% load step	+/- 5%	NA
Batteries		
Backup time	8-10-15-20-30-60 minutes, other on request	5 min to 8 h with standard internal charger
Type	sealed lead acid, open lead acid, Ni-Cd	sealed lead acid, open lead acid, Ni-Cd
Over all efficiency		
Double conversion mode	up to 95%	up to 94%
Economy mode	NA	up to 97%
Environmental conditions and noise		
Storage temperature	-25°C to +45°C	-25°C to +45°C
Operating temperature	up to 40°C for 8 hours, 35°C continuously	up to 40°C
Noise level (dBA)	Less or equal to 72	
Operating altitude	1000 m	1000 m
Standards and approvals		
Performance and safety	IEC/EN 62040-1, IEC/EN 60950	IEC/EN 62040-1, IEC/EN 60950
Performance and design	IEC/EN 62040-3	IEC/EN 62040-3
Design and manufacturing	ISO 14001, ISO 9001, IEC 60146	ISO 14001, ISO 9001, IEC 60146
EMC immunity	IEC 61000-4	IEC 61000-4 – 2 to 6
EMC emission	IEC 62040-2 C3	IEC 62040-2 C3
Approvals	TUV – LCIE – CEM – CE Mark	TUV – LCIE – CEM – CE Mark

Glossary

Service reliability

Definition: the ability of a power system to meet its supply function under stated conditions for a specified period of time.

Different categories:

- Minimum: this level of service reliability implies risk of interruptions related to constraints that are geographical (separate network, area distant from power production centers), technical (overhead line, poorly meshed system), or economic (insufficient maintenance, under-dimensioned generation).
- Standard
- Enhanced: this level of service reliability can be obtained by special measures taken to reduce the probability of interruption (underground network, strong meshing, etc.)

Installation flexibility

Definition: possibility of easily moving electricity delivery points within the installation, or to easily increase the power supplied at certain points. Flexibility is a criterion which also appears due to the uncertainty of the building during the pre-project summary stage (APS).

Different categories:

- No flexibility: the position of loads is fixed throughout the lifecycle, due to the high constraints related to the building construction or the high weight of the supplied process. E.g.: smelting works.
- Flexibility of design: the number of delivery points, the power of loads or their location are not precisely known.
- Implementation flexibility: the loads can be installed after the installation is commissioned.
- Operating flexibility: the position of loads will fluctuate, according to process reorganization.
  Examples:
  - industrial building: extension, splitting and changing usage
  - office building: splitting

Load distribution

Definition: a characteristic related to the uniformity of load distribution (in kVA / m²) over an area, or throughout the building.

Different categories:

- uniform distribution: the loads are generally of an average or low unit power and spread throughout the surface area or over a large area of the building (uniform density). E.g.: lighting, individual workstations
- intermediate distribution: the loads are generally of medium power, placed in groups over the whole building surface area. E.g.: machines for assembly, conveying, workstations, modular logistics “sites”
- localized loads: the loads are generally high power and localized in several areas of the building (non-uniform density). E.g.: HVAC

Power interruption sensitivity

Definition: the aptitude of a circuit to accept a power interruption

Different categories:

- “Sheddable” circuit: possible to shut down at any time for an indefinite duration
- Long interruption acceptable: interruption time > 3 minutes *
- Short interruption acceptable: interruption time < 3 minutes *
- No interruption acceptable.

Disturbance sensitivity

Definition: the ability of a circuit to work correctly in presence of an electrical power disturbance.

A disturbance can lead to varying degrees of malfunctioning. E.g.: stopping working, incorrect working, accelerated ageing, increase of losses, etc…
Types of disturbances with an impact on circuit operations:

- brown-outs,
- overvoltages
- voltage distortion,
- voltage fluctuation,
- voltage imbalance.

Different categories:

- low sensitivity: disturbances in supply voltages have very little effect on operations. E.g.: heating device.
- medium sensitivity: voltage disturbances cause a notable deterioration in operations. E.g.: motors, lighting.
- high sensitivity: voltage disturbances can cause operation stoppages or even the deterioration of the supplied equipment. E.g.: IT equipment.

The sensitivity of circuits to disturbances determines the design of shared or dedicated power circuits. Indeed it is better to separate “sensitive” loads from “disturbing” loads. E.g.: separating lighting circuits from motor supply circuits.
This choice also depends on operating features. E.g.: separate power supply of lighting circuits to enable measurement of power consumption.

Environment, atmosphere

Definition: a notion taking account of all of the environmental constraints (average ambient temperature, altitude, humidity, corrosion, dust, impact, etc.) and bringing together protection indexes IP and IK.

Different categories:

- Standard: no particular environmental constraints
- Enhanced: severe environment, several environmental parameters generate important constraints for the installed equipment
- Specific: atypical environment, requiring special enhancements

Maintainability

Definition: level of features input during design to limit the impact of maintenance actions on the operation of the whole or part of the installation.

Different categories:

- Minimum: the installation must be stopped to carry out maintenance operations.
- Standard: maintenance operations can be carried out during installation operations, but with deteriorated performance. These operations must be preferably scheduled during periods of low activity. Example: several transformers with partial redundancy and load shedding.
- Enhanced: special measures are taken to allow maintainance operations without disturbing the installation operations. Example: double-ended configuration.