OPTIMISING TRANSFORMER CENTRE SIZE. VISUAL IMPACT

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ABSTRACT

Co-operation with manufacturers has led to the development of new 24 kV transformer centres which, because of their size and simple installation, enhance the visual impact, price, ease and speed of installation. These transformer substations improve utility competitiveness and acceptance by society by placing a lower burden on architects and builders while providing environmental improvements.

INTRODUCTION

Although electricity distribution is acknowledged to be a natural monopoly to some degree, new European Directives are placing electric power distribution utilities in a competitive environment, and new measures are called for to respond to this situation.

Moreover, particularly because of the prevalence to date of monopolistic circumstances, environmental considerations demand attention to issues such as visual impact and reduction of losses.

The cost of facilities must also be lowered in order to remain competitive.

Distribution facilities, usually sited on public or private land not owned by the utility are tolerated as a necessary evil, at best.

Higher quality of supply and safety for people and property are also being demanded.

As users of the products supplied by manufacturing industry, utilities must adopt a clear policy regarding their needs, expressed in terms of network architecture as a whole. That is to say, the objective is to reduce transformer centre dimensions as far as transformer power permits in order to minimise visual impact and better integrate centres into their surroundings.

Several solutions are put forward to meet these requirements:

a) outdoor transformer centres in which customisation is minimised and close relations are maintained with our suppliers to make them aware of our needs;

b) transformer centres built entirely of brick and substantially smaller than conventional prefabricated centres to minimise visual impact (maximum transformer power is limited to 400 kVA);

c) transformer centres with detachable components; and

d) externally operated underground transformer centres.

BACKGROUND

Transformer centres were traditionally buildings which fitted in with their surroundings in terms of the construction materials but, because they took the place of an overhead line carrier, they tended to be tall. In the city, they were large, located in premises and had considerable installed power, with numerous low tension outlets to supply a large number of low-power customers.

Equipment manufacturers subsequently began to offer prefabricated solutions and, because of increasing demand for power, the space occupied by city transformer centres was reduced and the number of new centres was increased. Some distributors maintained the level of installed power at each centre, whereas others (such as Unión Fenosa) reduced it.

Rural transformer centres became outdoor facilities with no civil engineering by taking advantage of the end of line.

In Europe, manufacturers are generally ahead of the distributors in offering improvements.

Over the last five years, the policy of Unión Fenosa Distribution in Spain, where it has 3 million customers in a total land area of 82,000 sq. km., has been to work with engineering companies (UFISA) and manufacturers (e.g. Aplihorsa, Schneider, Ormazabal and others) to improve customer service management using products which are new to the market.
This policy prepares us for Directive 92/96/CE, which introduces competition into the sector while maintaining a degree of natural monopoly in distribution.

NEWLY-INSTALLED TRANSFORMER CENTRES

Power

Increased competition will have the desired effect of reducing the price of electricity and improving supply quality while boosting demand. This makes it necessary to use more transformer centres with a lower unit power. By reducing the degree of low-tension distribution, losses are reduced and the quality perceived by the customer is enhanced, which is what the European Directive addresses. Transformer centres have a maximum rated power of 400 kVA.

Price

The amount of custom work must be minimised. Transformer centres come finished from the factory, incorporating the latest technology and facilitating quality control and speedy installation.

Size

Since traditional transformers were operated internally, they required considerable space and there were additional problems in the event of failure of the operation; the result is that modern transformers are all operated externally.

Ventilation is obligatory because of losses. The latter must be reduced in order to reduce transformer size and gain additional environmental and economic benefits in the future.

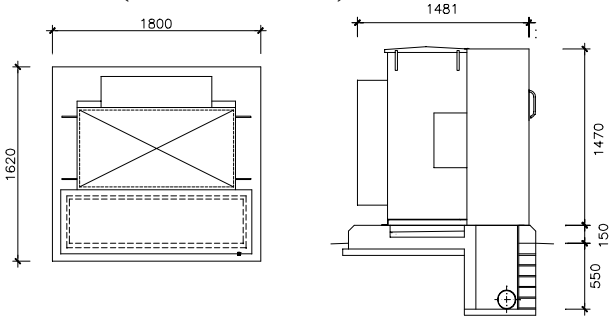
Smaller transformers facilitate our relations with architects, builders and property developers, which is important in a natural monopoly such as electricity distribution because of the lower visual impact, greater ease of integration into buildings and the fact that a transformer nearly always has to be installed, thereby removing the uncertainty as to whether a premises had to be set aside for this purpose.

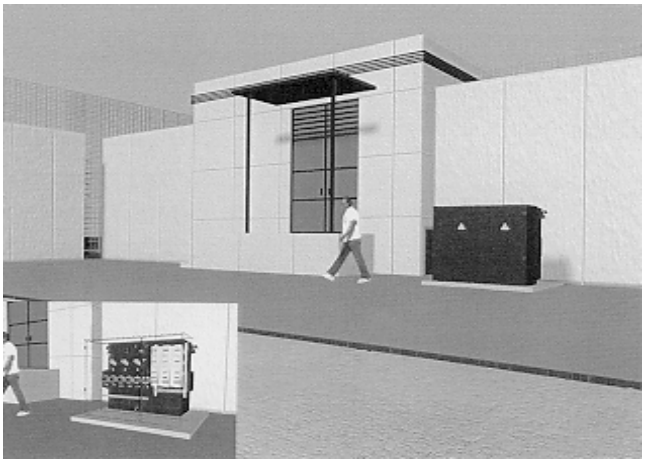
Types

All of them have a maximum power of 400 kVA, ring main unit and low-tension switchgear.

Compact transformer centre with metal enclosure

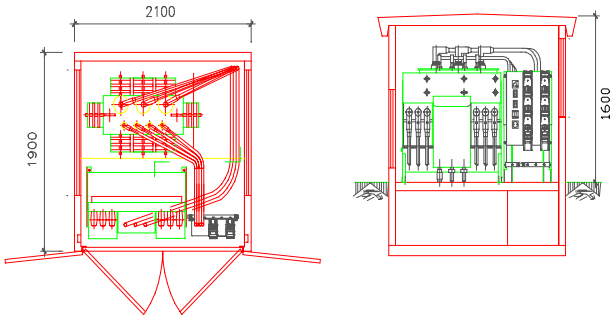
In 1995, Unión Fenosa adopted the U.S. "Pad Mounted" transformer, adapting it to the company's philosophy with he help of Cooper; the transformers have a 2.9 square metre footprint and their height above terrain (visual impact) is 1.5 metres (outdoor installation).





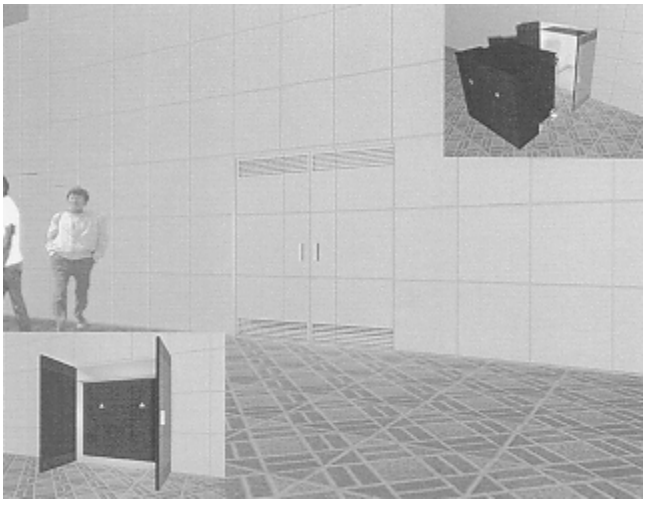
Compact transformer centre with concrete enclosure

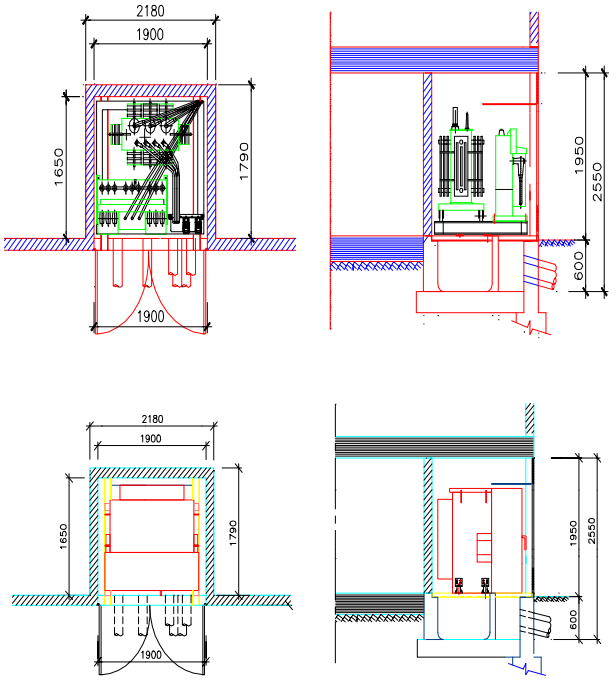
In 1997, with the assistance of Schneider, and in 1998, with the assistance of Ormazabal, a transformer centre within a concrete enclosure was developed with a 4 square metre footprint and a visual impact of 1.6 metres (outdoor installation).



Compact unenclosed transformer centre

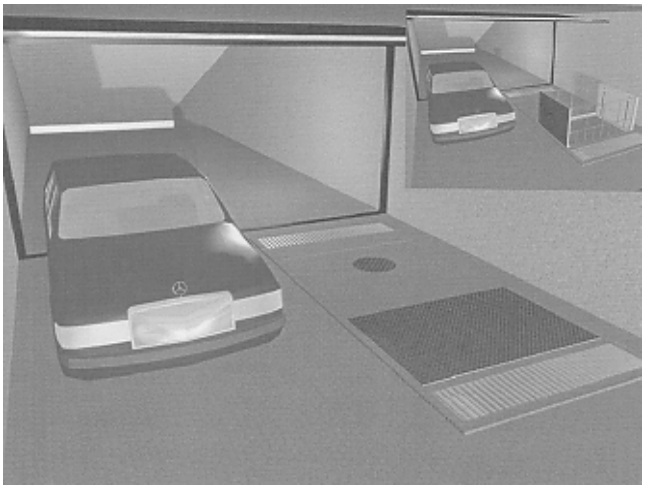
In parallel with the foregoing, a single item of equipment (transformer, two line positions and low-tension switchgear) was developed for rail-mounted installation building ground-floor or underground premises; these transformers are interchangeable with the metal enclosed centres without front protection; they occupy a 4.3 square metre footprint and require 2 metres of facade.

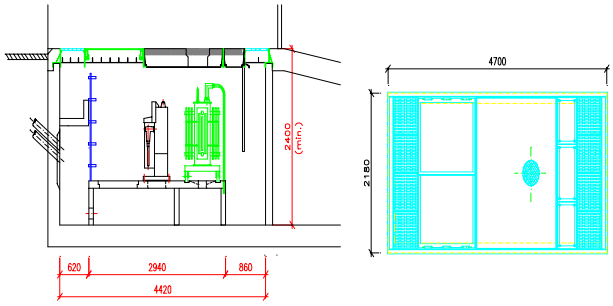


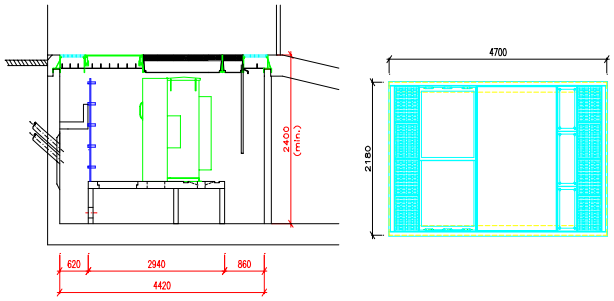


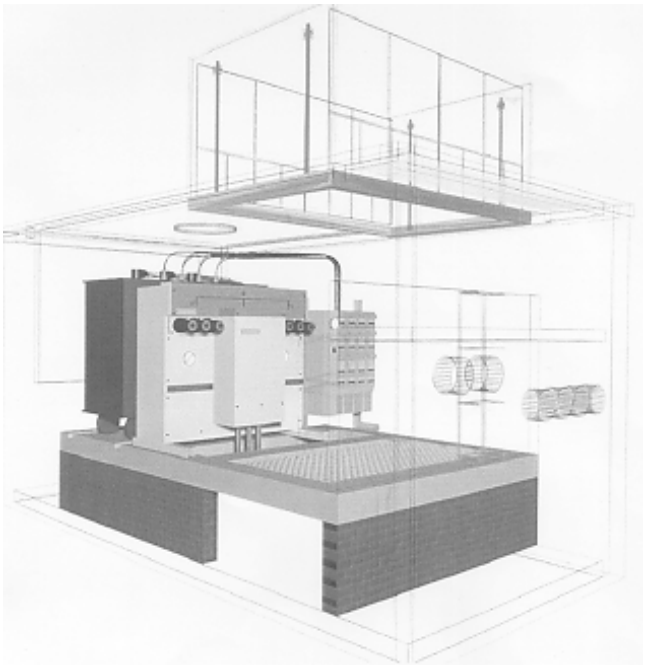
Plans and other specifications were also developed, mainly with UFISA, for the civil engineering work required for underground installation, where they occupy a 10.3 square metre footprint and require only 25.3 cubic metres to be excavated.

External operation is conducted with the personnel access doors open.







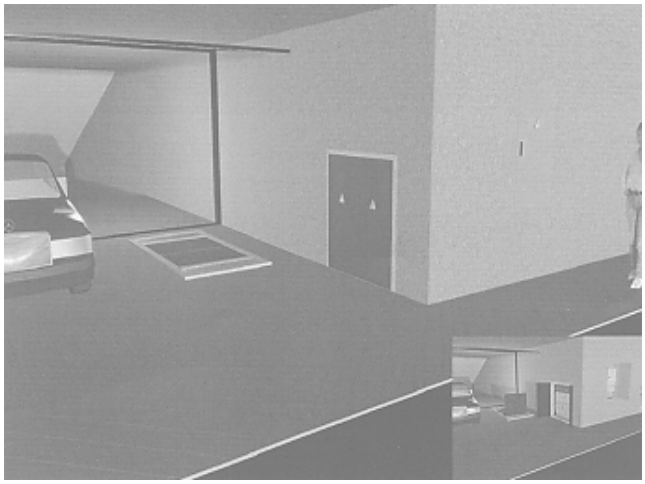


Locations

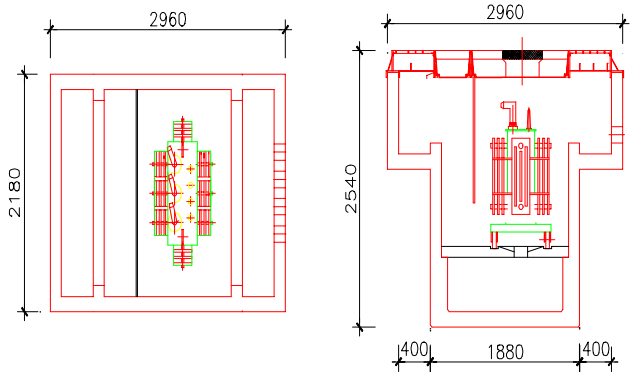
In addition to the foregoing locations (outdoors, building ground floor and underground), it is possible to totally or partially separate the components such as the transformer ring main unit and the low-tension switchgear.

Ring main unit and the low tension switchgear: constructed into facade.

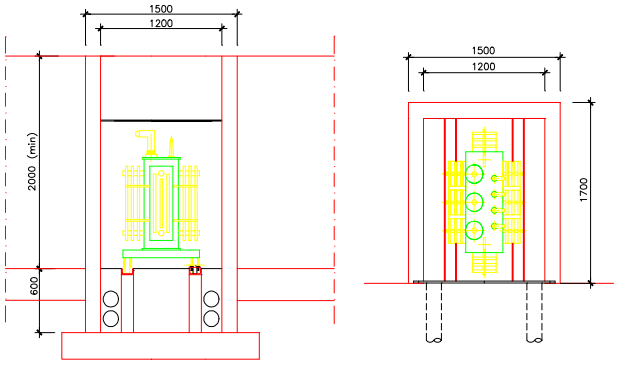
Transformer: underground.



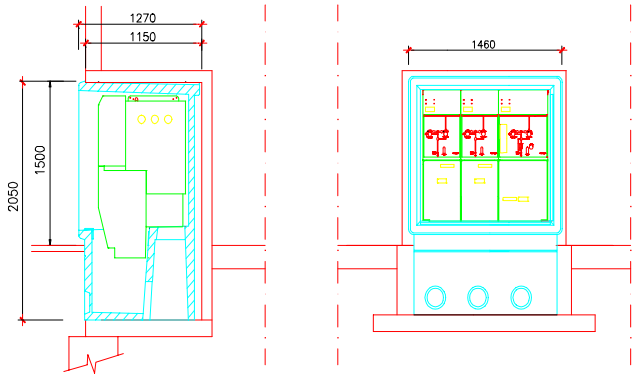
Transformer: underground



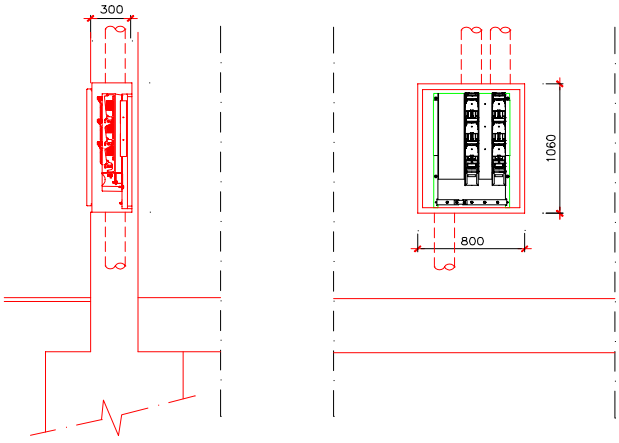
Transformer: constructed into facade



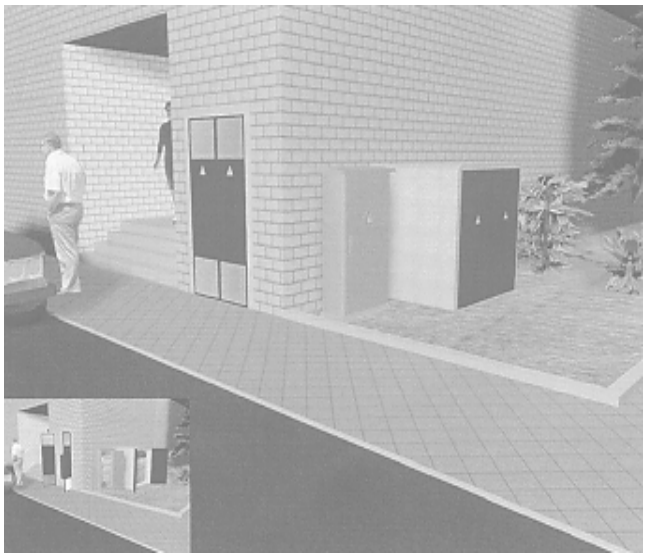
Ring main units: constructed into facade



Low tension switchgear: constructed into facade



Ring main unit, the low tension switchgear and the transformer: facade semidetached.



VISUAL IMPACT

Since electricity distribution is a natural monopoly, additional efforts must be made to gain public approval.

The demand for environmental improvements has led us to reduce losses and visual impact, for which purpose it is necessary to modify as little of the environment as possible in order to pass unnoticed. In cities, urban furniture must not be more than 1.6 metres high in order not to obstruct pedestrian views, and this is the standard height of vehicles allowed to park in city centres; by maintaining the same height as people and vehicles, transformer centres go unnoticed to the layperson.