

PRESENTATION OF AN ORIGINAL STEP TO DEVELOP A NEW BOX FOR SINGLE SERVICE CONNECTIONS

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ABSTRACT

This article presents the step carried out by the distributor EDF for an evolution of its technical stage of boxes for LV single service connections. That led to the design of a new compact box called CIBE®.

After having pointed out the policy of the distributor as regards service connection, the principal characteristics of this box are detailed. Lastly, the step of development and validation is clarified.

INTRODUCTION

In France, at the beginning of the Nineties, the appearance of the remote report and the electronic meter made it possible to reintroduce the meter at the customer's installation while giving the distributor access to information which it contains.

In fact, then appeared a compact box for single service connection, dimensioned with the single stage of 90 A for single-phase current (and 60 A for three-phase current), facilitating the anticipation of the requests for increase in the contractual demand by the customer. This stage integrated the protection by fuses intended to complete the protection by circuit breaker as well as many functions such as refeeding, putting in short-circuit...

From the economic point of view, the increase in the cost of raw materials (copper, aluminium, synthetic materials) highlighted that this box had reached its technical economical limit.

It thus became convenient to wonder about the design of a new equipment according to two axes of reflection : the real need for customers and the techniques necessary to implement.

This new stage of box for single service connection has been called CIBE®.

POLICY OF REALIZATION OF THE SERVICE CONNECTIONS

The guiding principles of the distributor as regards policy of realization of the service connections are dependant :

- with the permanent access to the main fuse device intended to the breaking and protection of the single service connection,
- with the permanent access to the data of the meters,
- with the commercial orientations relating to tariff.

The changes of ways of life of the customers are at the origin of the evolutions of the structure of the service connection:

- The access to the meter initially installed inside the customers' premises was done more difficult with the externalisation of the activities of the family's members. Thus, with the whole beginning of the Seventies, the accessible boxes since the public domain and containing the meter appeared to limit the difficulties of access to the reading of the meter indexes.
- Afterwards, in the middle of the Nineties, the generalization of the electronic meter and the remote report of indexes made it possible to leave the meter at the customer's premises, therefore to build boxes accessible by the distributor and only containing the breaking-protection function.

Parallel to these evolutions, the commercial conditions were also arranged. The advent of the single-phase current 90 A for the service connection required to examine its dimensioning again.

The reasons of the position of a single-phase current supply hold in the technical and economic advantage that such a mode of connection presents for LV customers :

- From the technical point of view
The distribution of single-phase loads between the phases of a LV network is easier than when they are three-phase loads whose balancing is variable in time.
- From the economic point of view
The cost of the service connection and the indoor installation of the customer is weaker than in three-phase current. Moreover, taking into account the difficulty of distributing the loads in a three-phase installation well, the single-phase solution allows a better use of the contractual demand and consequently a profit on the amount of the subscription.

It is thus better to advise with the customers the choice of a single-phase current service connection except when the network does not support the additional load in single-phase current or in the case of specifically three-phase uses.

In the case of constructions other than of housing (tertiary, agricultural, small craft industry...) the same rules of dimensioning are retained.

The application of this policy explains the choice of a basic single-phase current product, while authorizing its adaptation in three-phase current.

In addition to the application of this policy for technical reasons, the new box CIBE® also results from economic considerations : strong objective of reduction of the purchase expenditures.

Indeed, the service connection is an important lever as regards cost for the distributor. In the residential field, it is carried out approximately 350 000 service connections of LV customers per annum for whom new box CIBE® will be used.

RANGE OF CIBE® EQUIPMENT

In addition to the need for finding a track to replace equipment which had reached their technical economic limits, the new equipment had to integrate the will to be discrete (thus of limited size), simpler to implement and more reliable.

The new range of boxes for single service connections called CIBE® includes envelopes and devices for protection and sectioning adapted to all the current stages of single service connections, but also associated equipment such as different models of grids intended to the disconnection of the LV mains cables and the supply of several LV service cables.

It makes it possible to ensure the majority of the needs for residential customers (more than 95% of those), with a stage 60 A in single-phase current (also answering 60 A in three-phase current).

A simple transformation allows its adaptation to the single-phase current 90 A stage with the possibility of satisfying a three-phase 90 A request (future need being studied).

The general functionalities and uses are based on two envelopes being able to receive a sensor ensuring the remote reading of the indexes of the meter :

- The box for fixing on wall or embedded fixing,
- The terminal for ground-mounted or embedded fixing.

The envelopes can contain various modules with the following functions :

- Principal single fuse 60 A in single-phase current transformable in three-phase current using a three-phase kit 60 A,
- Principal double fuse 60 A for a double connection 60 A in single-phase current,
- Principal single fuse 90 A in single-phase current possibly transformable in three-phase current by means of a three-phase kit 90 A (future need),
- Grid intended to the supply of several LV service connections, for terminal (with or without principal single fuse),
- Grid intended to the supply of several LV service connections though LV mains cables , for box (without principal single fuse), for cables with cross-section 150 mm²,
- Grids intended to the disconnection of the LV mains

cables and the supply of several LV service cables (without principal single fuse), for terminal, for cables with cross-section 150 mm²,



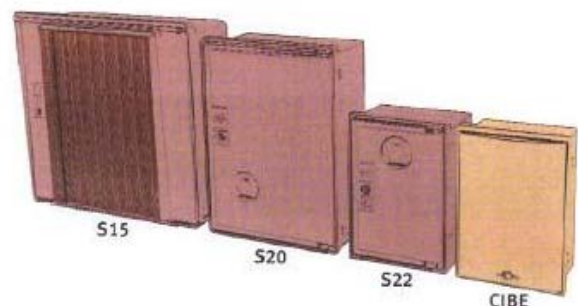
Example of box for double connection 60 A in single-phase current

Among the general design features, let us quote :

- The degrees of protection IK10 and IP43 (minimum IP2X with envelope open),
- The possibility of installation of seals,
- The locking by means of a padlock,
- The use of fuses with bars (size 00),
- The interfaces for the checking of absence of voltage,
- The interfaces for refeeding,
- The terminals for the connection of the service cables, with calibrated breakable heads, able to receive cables with cross-sections from 16 to 35 mm²,
- The terminals for the connection of the mains cables, with calibrated breakable heads, able to receive cables with cross-sections from 50 to 150 mm².

The technological projections of the product are as follows :

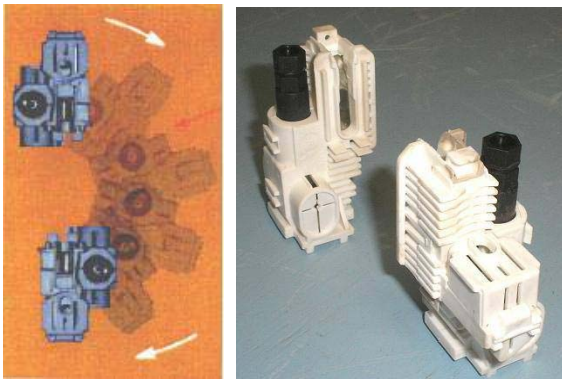
- A less deep envelope which easily makes it possible to ensure a separation firebreak, at the back of the products which are installed,
- The fuse holder connector,
- The retractable device for padlocking,
- A coherent and complete range.



Evolution of the boxes for single service connections

An innovation : the fuse holder connector :

- It improves ergonomics of wiring : without distortion the terminal is threaded on the conductor out of the envelope before installation,
- It improves the legibility of the electric diagram,
- It integrates an interface for the checking of the absence of voltage and an interface for refeeding,
- It ensures more safety against the contacts with the active parts by means of an integrated insulation.



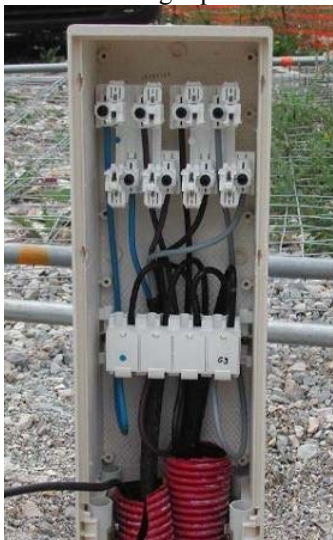
The fuse holder connectors

An innovation as regards padlocking : a retractable device which makes it possible (when necessary) to install a padlock on the closing system of the envelopes.

From a global point of view, the new box proves more making safe by its design, its integrated padlocking, its closing panel...

The compactness of the products makes it possible to carry out more discrete installations, with increased performances (until 3 x 90A) and authorizing interesting combinations, among which :

- A grid with connectors 90A, intended to the supply of several LV service connections,
- Double connections single-phase currents 60 A.



Example of assembly in terminal accommodating a principal 60 A in three-phase current with grid intended to the supply of several LV service

connections

THE STEP OF DEVELOPMENT AND VALIDATION

With a view to reduction of the purchase costs, the distributor EDF analyzed the conditions of an evolution of the equipment of service connections, and for this reason, conducted a global step which can be described as original under the two following aspects :

- A global technical solution,
- A new step of purchase compared to its practices.

A global technical solution

The various following parameters were taken into account :

- The contractual demands by the customers,
- The types of boxes used,
- The different components of these boxes,
- The types and quantities of materials used entering the composition of the products,
- The functionalities meeting the real needs,
- The comparable technical solutions,
- The associated costs.

They allowed the analysis of the complete cost of several screenplays implementing different combinations of functionalities, equipment and materials, as well as the consequences on the whole of the EDF purchases of boxes.

Various tracks drawn from these elements allowed the establishment and the finalization of a targeted screenplay representing the best technical economic compromise.

This screenplay corresponds to the awaited technical stage described above :

- A single-phase or three-phase equipment dimensioned 60 A, with possible evolution to 90 A,
- An interoperability of the internal components between different manufacturers and stages.

This screenplay made it possible to define a complete range with objective prices, then the drafting of two functional specifications (box and terminal with their principal single fuse on the one hand, and grids of networks and service connections on the other hand).

The use of a vocabulary, stripped of any connotation referring to known technical provisions, voluntarily left a broad margin of initiative to the future manufacturer, while being sufficiently complete to guarantee a high level of safety and reliability.

A new method of purchase

The strategy of purchase retained for this equipment is not within the framework of a traditional invitation to tender, by EDF, for equipment of distribution.

A first invitation to tender being based on preceding technical work (objective prices and functional

specifications) arrived at the concluding of a single contract of study, development, tests, with only one supplier : EDF became owner of the study and the rights relating to it, and the manufacturer obtained in compensation a guarantee of minimal volumes on the market of series to come.

The property of the rights related with the study confers at EDF the following advantages :

- Recording of the knowledge to make,
- Deposit of mark CIBE®,
- Deposit of models CIBE® (protection regarding the reproduction of model of boxes and terminals),
- Deposit of a patent.

In a second stage, the market of industrial series was opened with other suppliers chosen within the framework of a second invitation to tender.

Those will have to carry out a copy of the product with nevertheless a few degrees of freedom : indeed, beyond the protected characteristics (related to the deposit of models), each manufacturer will be able to put forward his capacity of innovation by proposing his own solutions.

According to the degree of fidelity in the reproduction of the product, they will be able to make it qualify by EDF on the basis of compliance certificate of the type established within the framework of the initial invitation to tender (source of potential economies).

Anticipated profits

The awaited profits are evaluated on the annual difference between the purchase costs which would have involved the maintenance of the current generation of boxes and the probable purchase costs of the new equipment.

These profits appear on the individual cost of each product. Their evolution is obviously proportional to the volume of acquisition of the new boxes. This variation was annualised over 10 years starting from the industrialization of the products.

These profits, substantial for the distributor EDF, represent several percents of the annual purchase amount of equipment of the previous generation.

Other benefits

Other potential benefits, now difficult to estimate, are awaited :

- Reduction in times of implementation,
- Extension of the use of the CIBE® to other configurations of service connections.

CONCLUSIONS AND PROSPECTS

The step carried out by the distributor EDF, for an evolution of its technical stage of boxes for LV single service connections, led to the design of a new compact box called

CIBE®.

This step was based on two innovative aspects for EDF :

- A global technical approach,
- A method of purchase in rupture compared to the usual practices at EDF.

The progressive installation of this new equipment from November 2006 represent real hopes of profits. In addition to the economic aspects, the new equipment has technical advantages in terms of safety and simplicity of implementation.