



*world unique*

# Circuit Breakers (MCB) **BONEGA® P-E-P**



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**GOLD AMPER**

the best product of the most prestigious czech fair



*2 World Patents*



# BONEGA® P-E-P Circuit Breakers (MCB) to 63 A



## What do you get by using MCB BONEGA® P-E-P ?



### Superior Security and Protection

**Your circuits will be better protected.** It's provided by a high short-circuit resistance (below 5 ms). The quicker the whole short-circuit process is finished, the less damage inflicted to the connected devices.

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### Guaranteed Reliability

**Unique resistant construction and careful product control ensure error free function.** We fully trust in our product – as we are one of the few that are able to guarantee a three-year-warranty.

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### Faster Assembly and Easy Maintenance

**Time saving.** Our research team (combined with installer and customer feedback) has incorporated many advantages to make assembling and maintenance easier and faster than ever before. For example: locking bars, avoiding an incorrect placing of a conductor, a variable input or output, a bigger locking bar, a user's inscription and more.

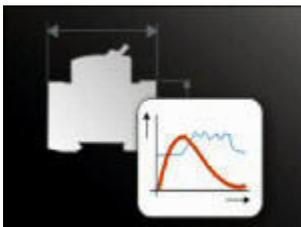
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### Price/quality

**You will get the highest quality possible MCB.** Even though it is one of the most advanced miniature circuit breakers in the world, high priced by experts (for example „Gold Amper 2005“, its very affordable.

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### World Unique Product

**You will work with one of the most useful MCB in the world.** BONEGA® P-E-P Circuit Breakers have reached this position thanks to technical parameters, which increase circuit protection to the new level.

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## **Superior security and protection**



P-E-P (Perfect Electric Protector)

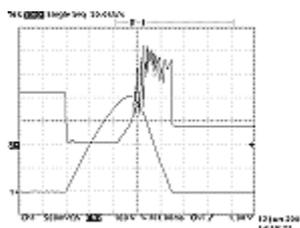
**Improvements that increase security and protection:**

- 1. Extraordinary High-speed Break**
- 2. Guaranteed Short-Circuit Resistance**
- 3. Reduction of Undesirable Power during a Short-Circuit**
- 4. Locking Protection**
- 5. Simultaneous Switching of the Multi-Module's**
- 6. Revolutionary Designed Extinguishing Chamber**
- 7. Durability**
- 8. Terminal Resistant to Inter-Phase Short-Circuit**
- 9. Vibration Resistance**
- 10. Protection Against Hacking of an MCB**
- 11. Higher Safety Standards**
- 12. Wide Selectivity**
- 13. Colored Control Levers**
- 14. The Ability to Seal the Lever in an ON or OFF position**



### **1. Extraordinary High-Speed Break**

***The sooner the entire short-circuit process is terminated, the less damage there is to connected devices and wiring.***



The BONEGA P-E-P MCB's have reached **the highest breaking rate of any MCB** (from 2 to 5 times higher than any other MCB).

An extraordinary high breaking rate beginning **from the initiation of a short-circuit to its termination amounts to max. 5 ms** (with a maximum load).

The BONEGA P-E-P MCB's do not reach that high rate to the detriment of the higher arc voltage which raises the risk of protected parts (e.g. motors) considerably. As compared to other MCB's, the arc voltage is equal or lower.

**The high-speed switch-off consists of three stages:**

- **stage 1 – disconnection of contacts**
- **stage 2 – arc running into the chamber**
- **stage 3 – arc burning termination**

The principal advantage of our MCB's consists of an extraordinary high speed within the first two stages. The third

stage is very quick, as well, but it is not so essential in the framework of the total speed. Within this last stage, it is most essential that the chamber is so well constructed that the arc does not “jump-out” in any direction (especially it does not come back to the contacts at all).

An almost textbook run of the short-circuit process is caused also by the suitable adjustment of the contact thrust. These contacts do not deviate by the influence of aerodynamic forces (as obvious from the charts at our webpages).

*Note: Some producers mention only the speed of contact disconnection (which is the first stage) instead of the total breaking speed. In the moment of contact disconnection, the power is still flowing through the circuit (voltage and current) because of the created arc. In this stage, the MCB has not disconnected the circuit yet.*

Conclusion:

- Our curve of breaking procedure is fully unique (an example how an MCB should protect).
- The extremely high breaking rate will not endanger the end user, but – in contrast – it will protect him better
- The extraordinary breaking rate of the BONEGA P-E-P MCB's provides the most sensitive protection of human lives, electrical devices within a circuit, and wiring itself.

More information: [oscilograms and graphs](#)

## 2. Guaranteed Short-Circuit Resistance

**The MCB's BONEGA P-E-P can be used under the most difficult short-circuit conditions.**

Our primacy consists in the **breaking capacity of 10 kA up to the highest value of 63A, even with the curve “D” pursuant to ČSN EN 60898** (nobody has reached it yet).

**Our worldwide uniqueness consists in integration of the following phenomena with the kept breaking capacity of 10 kA:**

**I.)** It is necessary to be aware of that the inside MCB's resistance affects – inter alia – the breaking capacity. **With the low nominal values** (e.g. 1A), almost every producer can pride himself that his MCB theoretically has an **unlimited breaking capacity**. The higher is the nominal current, the lower is the assistance of the inside MCB's resistance to absorb the short-circuit process. The nominal current crucial value is at 25A MCB's and the very critical ones is at the highest value, i.e. 63A within the curve “D”. If the experts want to detect the MCB's quality, so they always use the aforementioned crucial values (25A and 63A). Within these values, the design of the breaking mechanism, contacts, extinguishing chamber etc. becomes known very clearly.

The essential difference, as compared to the MCB's of several producers, consists in the **reached range of nominal currents**, which is reached with the mentioned breaking capacity (25 kA, 15kA, 10kA, 6kA ...). We are preparing the upper limit of the nominal currents, which can be reached by our MCB's within their breaking capacity 25 kA and 15kA.

**II.)** Another important difference consists in the **standard**, in accordance with which the producer has achieved his certification. In Europe, there are two basic standards, namely:

**a) the so-called „industrial“ standard ČSN EN 60947**

**b) the so-called „household“ standard ČSN EN 60898**

As to their relations to breaking capacities, the standards differ e.g. in their requirements of short-circuit quantity, which a MCB has to withstand without disablement of its function. That means one short circuit pursuant to the standard ČSN EN 60947 and three successive short-circuits pursuant to the standard ČSN EN 60898.

As resulting from the above, the industrial standard is significantly softer. For many people, that requirement of the standard seems to be illogical, but it takes into consideration the behavior of a user, after the circuit has been broken by a MCB. The reaction of the user in a household often is that he tries to switch-on the MCB for the first, second and third time and just after that he begins to trace the cause. In contrary, a professional electrician tries to switch-on it only once and if the MCB breaks again, he begins to trace the cause immediately.

**III.)** Take into account also the third significant difference – **the width of a MCB**. There are some MCB's with an even higher breaking capacity, but they are in a 1,5-modular or double-modular design.

**Notice at other producers, according to which standard and up to which nominal current values they**

**mention the breaking capacity.** You can be surprised by the results of worldwide-accredited producers.

The above parameters are caused by **the distinguishing chamber**, which is one of our two worldwide-acknowledged Czech patents within the MCB P-E-P. Its extraordinary properties could be seen also at the prepared DPN (there is a MCB + switch within one module of 17,5 mm). In this case, we have also overcome the breaking capacity limitation of 4,5 kA which had been reached worldwide pursuant to the standard ČSN EN 60898.

The MCB's with a short-circuit resistance up to 15 kA are tested now. As to the single-modular design of those MCB's (width 17,5 mm) and the **given range of nominal currents**, we would be the only ones worldwide. The prepared MCB's BONEGA P-E-P with the breaking capacity of 15 kA can find their application especially in special works where they can replace the 1,5 or double modular MCB's.

### 3. Reduction of Undesirable Power During a Short-Circuit

**The lower the power within a short-circuit,  
the less damage to the connected devices and wiring.**



It is a very important property of a MCB, which is often marginalized by the public. The quality of the MCB protection is also conditioned by the amount of power that "flows" through the MCB during short-circuit. Its amount is given by the relation:  $E = I^2t$ .

As resulting from the mentioned relation, the high breaking rate of the MCB's BONEGA P-E-P reduces that undesirable power. The standard CSN 60898+A1/A11 states the power limits based of which the MCB's are classified. The category (class) is mentioned on a MCB in the frame below the breaking capacity.

Our MCB's reach the limits of the 3rd (the highest possible) class without power limitation pursuant to CSN 60898+A1/A11, namely even with the nominal breaking capacity of 10 kA.

The following tables show the requirements of the standard for the MCB up to 16A and above 16A up to 32A incl., at various nominal short-circuit capacities.

The power limiting class reached by a MCB is an essential element for assessment of its protective function. We have met the third power limiting class within the whole range requested (as one of few producers), even with the rated short-circuit capacity of 10 kA. The following tables present e.g. the standard requirements for the MCB up to 16 A, and above 16A up to 32A incl. with different rated short-circuit capacities.

Permitted values $I^2t$ for the MCB's with the rated current up to 16 A incl.					
Rated short-circuit capacity (A)	Power limiting classes				
	1	2		3	
	max. $I^2t$ A <sup>2</sup> s	max. $I^2t$ A <sup>2</sup> s		max. $I^2t$ A <sup>2</sup> s	
	type B a type C	type B	type C	type B	type C
3 000	The limits not stated	31 000	37 000	15 000	18 000
4 500		60 000	75 000	25 000	30 000
6 000		100 000	120 000	<b>35 000</b>	<b>42 000</b>
10 000		240 000	290 000	<b>70 000</b>	<b>84 000</b>

(the values written in bold digits are valid for our MCB's BONEGA®, series P-E-P):

Permitted values $I^2t$ for the MCB's with the rated current above 16 A and up to 32 A incl.					
Rated short-circuit capacity (A)	Power limiting classes				
	1	2		3	
	max. $I^2t$ A <sup>2</sup> s	max. $I^2t$ A <sup>2</sup> s		max. $I^2t$ A <sup>2</sup> s	
	type B a type C	type B	type C	type B	type C
3 000	The limits not stated	40 000	50 000	18 000	22 000
4 500		80 000	100 000	32 000	39 000
6 000		130 000	160 000	<b>45 000</b>	<b>55 000</b>
10 000		310 000	370 000	<b>90 000</b>	<b>110 000</b>

(the values written in bold digits are valid for our MCB's BONEGA®, series P-E-P):

## 4. Locking Protection

**The BONEGA P-E-P MCB's cannot be locked from the outside.**



As the most products, also the MCB's BONEGA P-E-P has an indication of the contact conditions. That indicates a real contact condition and not only a position of the switch-on lever. In case of "sintered" contacts and switched-off lever, the user is clearly informed about flowing current. As the only ones, our MCB's have that indication

### Reasons:

- Because the indication is closely connected with a movable contact, it happens on other MCB's that the movable contact is locked through the indication by means of a toothpick or a matchstick; thus the complete thermal and short-circuit protection of a MCB is out of function. **It is not possible to do this on the MCB BONEGA P-E-P, just because of that transparent sight-glass**
- Dust protection

This property **protects the electro installation companies** against claims, which are caused by the end user, who can be proved wrong with difficulties.

The philosophy of the colored indication ON/OFF is explained within [frequent questions](#) at our webpages.

## 5. Simultaneous Switching of the Multi-Module's

**Connected devices are less strained.**

A worldwide unique recently patented system of triggering mechanism which ensures a **safe, more accurate and simultaneous switching of all the contacts** at multi-module (pole) miniature circuit breakers; it has been reached a three-times longer switching distance than that reached by the best competitors world-wide.

This advantage enable e.g. continuous start of multi-fuse electric motors (all fuses are switched at the same time).

## 6. Revolutionary Designed Extinguishing Chamber

**The extinguishing chamber affects the breaking speed and breaking capacity.**

The extinguishing chamber is of a fully new patent-protected conception.

### a) a very fast "drawing-in" of an arisen electric arc into the chamber

When the movable contact is disconnected from the fixed one, it is necessary to "draw-in" the arisen arc into the extinguishing chamber as soon as possible and to interrupt the circuit definitely. The MCB's BONEGA P-E-P do not reach that high rate to the detriment of the higher arc voltage which rises the risk of protected parts (e.g. motors) considerably. This could be reached e.g. by higher number of sheets at the extinguishing chamber. Our chamber has only usual 13 interruptions. As compared to other MCB's, the arc voltage within the MCB's BONEGA P-E-P is equal or rather lower.

### b) it is not possible the arc to return to the contacts

In other MCB's, the arc can return to the contacts, so the circuit is connected again. Thanks to the design of the chamber, this phenomenon is not possible in the MCB's BONEGA P-E-P.

### c) fast arc extinction

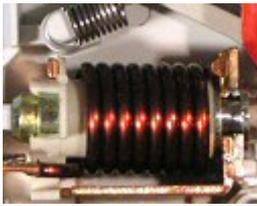
The sooner the arc is extinguished, the smaller amount of heat arises. This heat can affect the adjacent circuits (warming of an adjacent MCB)

### d) utilization of cold air at the extinguishing chamber for cooling the contacts

At the beginning of short-circuit process, the non-warmed air inside the chamber is used for cooling the contacts immediately before they are disconnected

## 7. Durability

### **Impact resistant.**



The design of the electromagnetic high-speed release with ejecting armature for short-circuit protection has been solved so that it has not any adjustable element. **The characteristic is given by the cross-section of the copper wire of the coil, by number of threads and spring pre-stressing in the core.** This solution thus excludes that our circuit breakers could change their presented value by a fall or shock.

## 8. Terminal Resistant to Inter-Phase Short-Circuit

### **MCB BONEGA P-E-P eliminates danger of inter-phase short-circuit e.g. just by air ionization.**



**Animation at**  
[www.bonega.cz](http://www.bonega.cz)

At the upper part of the terminal (serving for interconnection by means of forked strip), the MCB's body is equipped with partitions which can be broken of. Those partitions shall avoid a possible inter-phase short-circuit in case of interconnection of multi-module types by means of multi-phase interconnecting strips. This short-circuit can be caused by air ionization or humidity, that support electric arc.

## 9. Vibration Resistance

### **The BONEGA P-E-P MCB's can be used in equipment with strong vibrations (e.g. railway wagons, site switchboards).**

Strong vibrations can cause the short-circuit release to be put out of service (it loses its protective function) or the spot-welds to be disconnected (current interruption).

#### **a) measures avoiding the short-circuit release to be put out of service**



The MCB's BONEGA P-E-P are protected against the above phenomenon by a suitable seating of the structure elements, especially of the ejecting coil which is seated in a unique "cradle" (see the Fig.). This design has excluded the possibility to misalign and consequently to seize the movable core at the coil.

#### **b) measure avoiding the spot welds to be disconnected**

The quantity of spot-welds can be reduced significantly. The elements are interconnected by means of a modular design, or the parts are made of one piece.

## 10. Protection Against Hacking of an MCB

*We comply with the requirements of distribution companies for disassembly protection.*

The multi-pole MCB's BONEGA P-E-P cannot be disassembled in such a way that only the interconnection between stretching levers would be removed and the individual poles could function separately (e.g. through this, the day and night tariff rate could be influenced). Especially the distribution companies call for this property.

The mutual phases interconnection does not happen just between the levers, but also by means of pins which are put between the pole and they interfere directly into the inside mechanisms through a side hole. In addition, the multi-pole design is connected with rivets. The interconnecting and covering strip, which is between the levers, is **visibly depreciated**. Any interference in a MCB is obvious at first sight.

## 11. Higher Safety Standards

*Construction of the cover eliminates electrical current injury caused by touching the circuit breaker.*



All locking bars are protected against danger touch and penetration of small foreign objects ([\*IP protection 20\*](#)).

## 12. Wide Selectivity

*The MCB's can be used within combined projects.*

The selectivity means a coordination of two successive breaking devices so that just the disabled wiring part can be switch-off upon a failure. A wide scale of current values and curves B, C and D enables our MCB's to be put together to various safety cascades. Because of the above, the desired selectivity can be reached.

## 13. Colored Control Levers

*The colored levers improve the transparency and comply with the requirements of power plants.*

We supply both **coloured levers** in accordance with the nominal current values (corresponding to the marking of turn fuses) and **black levers**.

0,2 A - 1,6 A	black	
2 A	pink	
4 A	brown	
6 A	green	
8 A	light green	
10 A	red	
13 A	sandy	

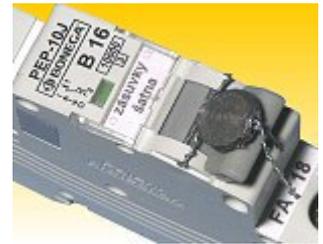
16 A	grey	
20 A	blue	
25 A	yellow	
32 A	purple	
40 A	black	
50 A	white	
63 A	copper-coloured	

## 14. Sealing Under Certain Conditions

**The ability to seal the lever in an ON or OFF position.**



The lever can be sealed because of openings in both guiding sidewalls of the switch-off lever. Through these openings, a sealing wire can be fed. This sealing wire passes also through a groove on the movable lever. This groove has been engraved in **OFF and ON positions** and it disables the motion of the lever itself. If the lever is sealed in the ON position, **the immobility does not render the function of the circuit breaker impossible**. In the event of short-circuit or overload, the circuit will be shutdown (independently on the fixed position of the lever). The MCB case enables the lever **to be sealed independently** on placing the adjacent MCB's.



*(contact: center 6)*

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## **Guaranteed Reliability**



*P-E-P (Perfect Electric Protector)*

**Improvements that increase reliability:**

- 1. Quality Control**
- 2. Pride of Workmanship**
- 3. Instantaneous Switching of Contacts**
- 4. Casing Resistance to Gaping Upon Terminal Installation**
- 5. Extremely Rigid Design of Terminals**
- 6. Durability**
- 7. Thermal Dilatation Resistance**
- 8. Vibration Resistance**
- 9. Extraordinary MCB's Body Strength**
- 10. Two Side Molds**

It enables us to provide a **three year warranty**.



### **1. Quality Control**

**Every MCB is thoroughly tested.**



The high quality of our product is due to a combination of materials, design and thorough testing of each miniature circuit breaker.

- a. **a triple** check of the electromagnetic high-speed release with ejecting armature **for short-circuit protection**

Every piece manufactured passes through a testing stand controlled by the computer. At that stand, there is verified the function of the circuit breaker on the undermost limit of the required nominal current value for given characteristics (B, C or D) by which the switch-off must not occur yet; after that, the current test of the upper limit of the nominal current value of the given characteristic follows immediately - under this current the velocity of circuit-breaker switching-off must not exceed 0,1 s. This test procedure is repeated three-times.

- b. **a double** check of the time-limit thermal release **for overload protection** (if the circuit has not been

damaged but a significant overload occurred which could damage the electrical installation)

The thermal release test is done two-times at least until the bi-metal is not mechanically adjusted to the required value. Between particular tests, the circuit breaker is left to cool down!

**The complete test pursuant to CSN EN 60898** - a long-term test of the thermal release at random chosen samples - is performed at least once a shift.

- c. **at least a fivefold mechanical reliability check:** This test is a part of the two aforementioned tests during which the switching-on and switching-off mechanisms are verified.

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## 2. Pride of Workmanship

***Increased responsibility during assembly.***

Every circuit breaker is stamped describing the characteristics, nominal current value, month of manufacture (since the beginning of the production) and the **number of the individual worker** who has assembled the product. In this way the **workers are motivated** to bear the liability of their labor.

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## 3. Instantaneous Switching of Contacts

***Instantaneous switching extends the mechanical and electrical life of BONEGA P-E-P MCB's.***



A worldwide unique, recently patented principle of the instantaneous switching where the forces are transmitted only into the middle of segments – therefore no crossing occurs (no world manufacturer has developed that solution yet). This solution has a big influence on extension of both mechanical and electrical lifetimes in connection with the number of switching cycles.

This unique principle of instantaneous switching of contacts is based on the following facts: even when the MCB lever is stretched very slowly, during the first stage the contacts inside the MCB only come near to each other to a distance which cannot create the condition for electric arc. In this moment the „coming-near“ is interrupted, even if the lever continues to be stretched (switched-on). In this moment the second stage begins – i.e. pre-stressing only inside the instantaneous mechanism when the contacts does not come near to each other more, but the lever is moved. Upon the pre-stressing, stated in advance, the third stage begins – i.e. a heavy high-speed switching of internal contacts. This switching is, however, fully independent on the rate of contact lever motion.

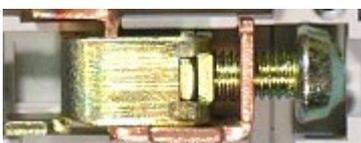
The above principle offers the following advantages:

- the contacts can never be burnt even not with a very slow MCB lever motion („stretching“); sometimes the terms „short-circuiting“ or so-called „burning-out“ of contacts are used. It is thus impossible to destroy the MCB in that way.
- by a heavy high-speed switching of contacts, a perfect touch is secured even at very low values of nominal current – such touch excludes any wrong power transfer
- burning of contacts is reduced to a minimum level
- the total MCB's lifetime is extended

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## 4. Casing Resistance to Gaping Upon Terminal Installation

***There is no gaping of the MCB casing or cross threading of the terminal in the casing.***



It is a usual problem on other MCB's – upon tightening of the terminal, the casing opens or the terminal cross threads in the casing. On some MCB's, even the joints and thus the circuit are broken.

It is avoided on the MCB's BONEGA P-E-P by means of:

- plastic guides for the movable parts of the terminal, which has been chosen properly
- press-pieces in the casing body
- places for rivets, chosen properly
- plastic pins (the casing has no butt joints)

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## 5. Extremely Rigid Design of Terminals

***Even with excessive pressure,  
it is not possible to strip the thread.***



The movable terminal has been made of one piece. In contrast to most other MCB's, the joint has been solved by means of an overlapping and not by a so-called "puzzle joint". Through this overlapping goes a screw. It has a double thread length available, which **restricts the breaks – "stripping" the thread essentially**. The possibility to break it when being mounted is fully excluded even if the torque allowed by the standard is exceeded (more than 2 N.m).

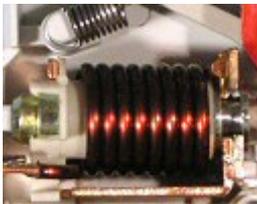
In the bottom part of the clip terminals is the cross **grooves which avoid the conductor to be taken out from the terminal** (after tightening, the conductor sinks into the grooves). Simultaneously, the contact resistances are limited. (because of the enlargement of the transmission area the burning of the conductor is not possible).

The junction of a conductor and BONEGA® P-E-P MCB is very rigid and reliable.

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## 6. Durability

***Impact resistant.***



The design of the electromagnetic high-speed release with ejecting armature for short-circuit protection has been solved so that it has not any adjustable element. **Its characteristic is given by the cross-section of the copper wire of the coil, by number of threads and spring pre-stressing in the core**. This solution thus excludes that our circuit breakers could change their presented value by a fall or shock.

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## 7. Thermal Dilatation Resistance

***The reliability of BONEGA® P-E-P MCB is guaranteed  
even if the operational temperatures vary rapidly.***

**The mechanism's function is not affected by thermal dilatation.** The design allows possible plays (by dilatation, shock, wearing) to be accepted without any affect on the function of movable parts, such as switching mechanism, movable contact, ejecting coil, indication etc. This unique solution improves the quality essentially but especially it warrants the reliability under different, even very extreme operational conditions.

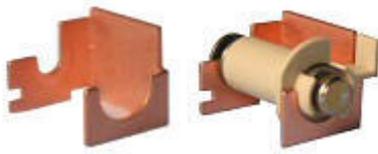
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## 8. Vibration Resistance

***The BONEGA P-E-P MCB's can be used in equipment with strong  
vibration (e.g. railway wagons, site switchboards).***

Strong vibrations can cause the short-circuit release to be put out of service (it loses its protective function) or the spot-welds to be disconnected (current interruption).

#### a) measures avoiding the short-circuit release to be put out of service



The MCB's BONEGA P-E-P are protected against the above phenomenon by a suitable seating of the structure elements, especially of the ejecting coil which is seated in a unique "cradle" (see the Fig.). This design has excluded the possibility to misalign and consequently to seize the movable core at the coil.

#### b) measure avoiding the spot welds to be disconnected

The quantity of spot-welds can be reduced significantly. The elements are interconnected by means of a modular design, or the parts are made of one piece.

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### 9. Extraordinary MCB's Body Strength

#### *Extended mechanical reliability of the multi-module design.*



The casing design ensures strength not only of a single-module type, but even in case of multi-module circuit breakers.

Strength:

- a sophisticated placing and number of rivets
- amount of pivot joints
- design of the casing with stabilizing locks and pivot joints.

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### 10. Two Side Molds

#### *Increased reliability thanks to higher dimensional accuracy of components.*

The press pieces of all parts, except for the lever, are made from two-side molds. Because of this technology, we have reached much higher dimensional accuracy, thus higher quality, resulting in higher operational reliability.

*(contact: center 6)*

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## **Faster Assembly and Easy Maintenance**



P-E-P (Perfect Electric Protector)



[Animations at www.bonega.cz](http://www.bonega.cz)

**Elements making assembling easier:**

1. Locking Bar
2. Two-Line User's Inscription
3. Two Places for Installation Labels
4. Convenient Short Dimensions
5. Casing Resistance to Gaping Upon Terminal Installation
6. Attach the MCB onto a Flat Surface without DIN Strip
7. Increased Vertical Stability on the DIN Strip
8. Interconnect by Forked or Reed (Rack) Strips
9. Connection of Input or Output on Either End
10. Large Terminals
11. Strong Design of Terminals
12. Locking Protection
13. An Easy Link-Up of the Accessories from Both Sides of the MCB
14. Versatility
15. Quick Removal of the MCB from the DIN Strip, even if the MCB's are Interconnected with a Strip
16. Higher Safety Standard
17. Superior Cover Design
18. A Pawl with Unique Characteristics
19. Variable Design of the Pawl
20. Extraordinary MCB's Body Strength
21. Colored Control Levers
22. Sealing Under Certain Conditions
23. Smoother than any Switch you'll Find



### **1. Locking Bar**

***A conductor will never be connected incorrectly.***



Terminal with locking bar:



A

B

C



[3D animation at www.bonega.cz](http://www.bonega.cz)

The design is based on the fact that each terminal has so-called „flat locking bar“ in its bottom section. When tightening the screw, this bar occurs step by step at the inlet hole and closes the space under the terminal. So it avoids the conductor to be put-in under the terminal clip where it cannot be interconnected with the inlet or outlet from the MCB.

The clip terminals have cross grooves at the bottom section – those grooves avoid the conductor to be drawn-half out from the terminal because after being tightened, the conductor „sinks“ into the grooves; in addition, the transfer surface is extended and the contact resistances are limited essentially.

This is an unique solution which helps to avoid problems in case when the terminal cannot be seen during installation. This principle excludes the possibility to place the conductor under the terminal. In this way, frequent (latent) claim defects can be avoided. Such defects occurred mostly at the end user and the switchboard manufacturers had to bear additional expenses for „simple“ removal of such defects.

This solution avoids claims, makes assembling faster and increases reliability.

---

## 2. Two-Line User's Inscription

**Even if the cover plate of a switchboard has been removed, you can still see which circuit is protected by the MCB.**



Each pole is equipped with an aesthetic transparent swing cover placed above the switching-off lever. Under that cover, there is a paper two-line inscription label put into slots. It is also possible to write on the plastic surface. The cover has an arrestment in the upper open position.



[3D animation at www.bonega.cz](http://www.bonega.cz)



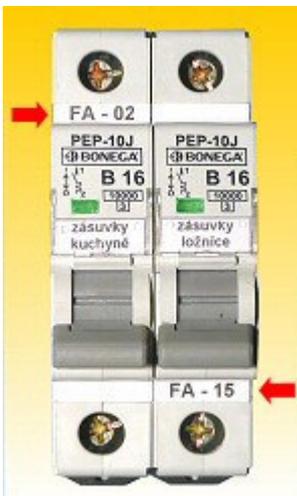
**Create & print your own inscription**

» [Download templates](http://www.bonega.cz) at [www.bonega.cz](http://www.bonega.cz)

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## 3. Two Places for Installation Labels

**The installation instructions can always be easily seen.**



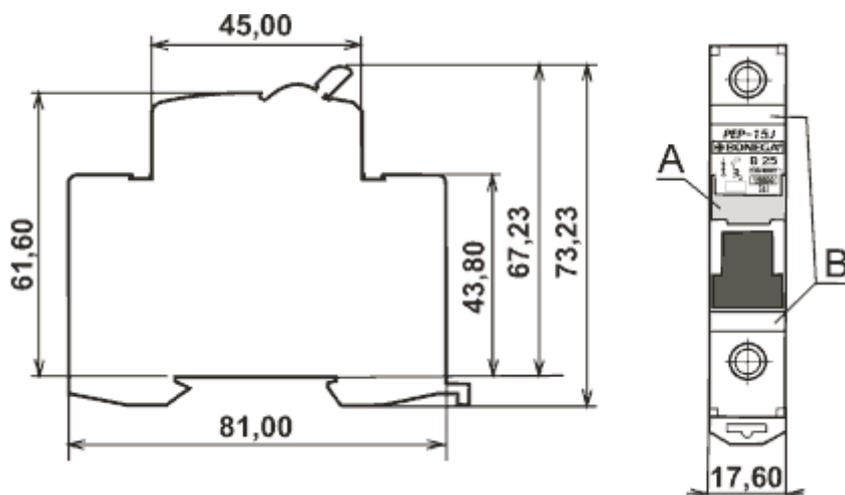
On each body, there are two facets, dimensions 4,8 x 17,6 x 0,5 mm, with a dovetail lock for installation labels. See the photos above (on the left side, an upper label marked as FA – 02, on the right side a bottom label marked as FA – 15).

The places have been selected so that it would be possible to use the upper labeled facet, when the MCB is installed below the eye level; when installed above the eye level, it is suitable to use the bottom labeled facet.

You can download [templates of installation labels](#) to edit & print.

#### 4. Convenient Short Dimensions

**There is more space for connecting the conductors on the switchboard.**



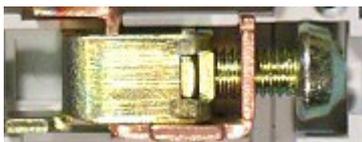
As to the available information, because of their extraordinary short dimensions (especially the width of only 81 mm), our P-E-P MCB's are classified as among the smallest MCB's over the world in the category of short-circuit resistance up to 10 kA. In the category of 15 kA, we have the shortest dimensions worldwide (see the dimensioned chart).

- total height from the pawl incl. lever at switched-off position 72,23 mm
- total height from the DIN strip incl. lever at switched-off position 67,23 mm
- total height from the DIN strip up to the surface is 61,6 mm
- total height from the DIN strip up to the surface of terminals is 43,8 mm
- total width is 81 mm + 5,2 mm
- width of controlling part 45 mm
- distance between the upper supporting part of the terminal and the DIN strip 19,0 mm
- distance between the supporting part of the terminal for placing the forked interconnecting strip and the DIN strip is 33,0 mm
- module width 17,6 mm
- bottom assembly label – width 4,8 x 17,6 x 0,5 mm
- upper users' label – width 6,2 x 15,4 x 0,3 mm

Thus there is more space for conducting and connecting the conductors in the installation section which is covered at a switchboard. This property can be appreciated especially when using these MCB's at small apartment switchboards.

#### 5. Casing Resistance to Gaping Upon Terminal Installation

**There is no gaping of the MCB casing or cross threading of the terminal in the casing.**



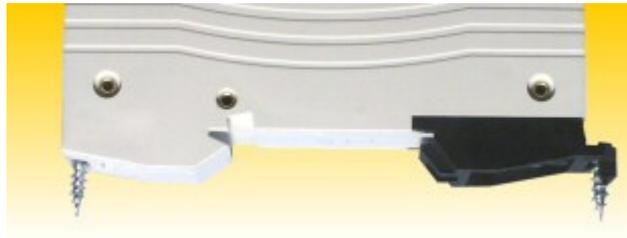
It is a relatively usual problem on other MCB's – upon an excessive screwing-up of the terminal, the casing opens or the terminal crosses in the casing. On some MCB's, even the joints and thus the circuit are broken.

It is avoided on the MCB's BONEGA P-E-P by means of:

- plastic guides for the movable parts of the terminal, which has been chosen properly
- press-pieces in the casing body
- places for rivets, chosen properly
- plastic pins (the casing has no butt joints)

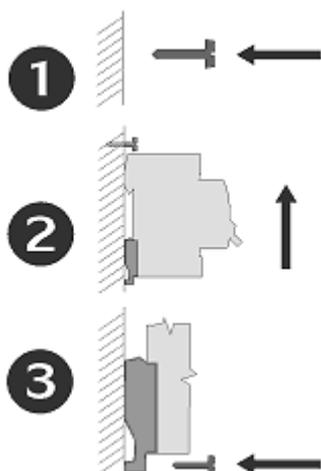
## 6. Attach the MCB onto a Flat Surface without DIN Strip

**No problem in assembling to an old breaker box.**



3D animation at [www.bonega.cz](http://www.bonega.cz)

You will appreciate that advantage – a possible attachment of our MCB directly onto the flat surface without using the DIN strip - especially when repairing old switchboards.



**This possibility do not require any modification of the MCB.**

**How to do it:**

1. Screw a flat-headed screw into the flat area at the required position. Leave that screw at a distance of approx. 5 mm from the surface (not fully screwed).
2. Onto the prepared screw put the MCB which has a corresponding cut in its upper part.
3. Draw out the arresting pawl to its final „open“ position in the bottom part and then fasten the MCB by another screw to the flat surface through a hole in this pawl.

The connection created in such a way is unusually strong.

## 7. Increased Vertical Stability on the DIN Strip

**When tightening the terminals, the MCB on a DIN strip will be straight.**



Another new concerning the BONEGA P-E-P circuit breakers is a very essential improvement of stability, while the conductors are connected to the MCB. When drawing up the terminals, the MCB's tend to incline and it is necessary to "pre-stress" them manually.

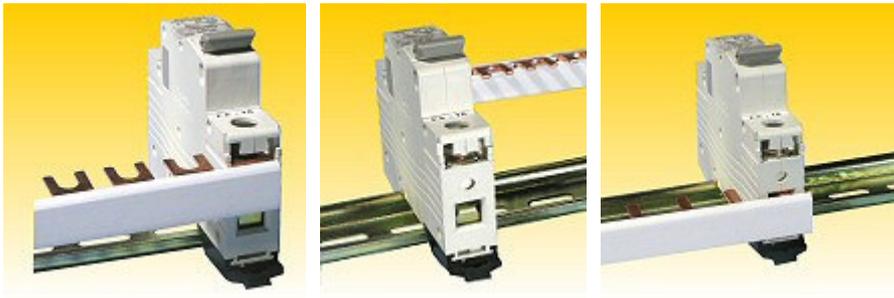
The high stability has been reached by a plastic stop on the MCB bottom. After attachment of the MCB to a DIN strip, this stop functions as the "contra-pressure" (with the torsional stress of the MCB's body). In contrast to the competitors, the movable pawl has only the holding function.

The other hand does not have to engage itself with "pre-stressing" of the MCB and can concentrate only to hold the conductor to be connected.

This measure accelerates the installation and makes is easier.

## 8. Interconnect by Forked or Reed (Rack) Strips

You can choose any system to interconnect the terminals.



3D animation at  
[www.bonega.cz](http://www.bonega.cz)

For the P-E-P miniature circuit breakers you can use both the forked and the reed (rack) standardized interconnecting strips. The opinions of application of those two types differ.

### Forked strips:

- **advantages**
  - being put under the screw head, into the upper part of a double terminal, they do not take any space in the bottom part of the terminal. Because of what is written above they **enable an unperturbed connection of input conductors**.
- **disadvantages**
  - when tightening the terminal screws, the forks can distend (only by some suppliers when it concerns a cross-section of only 10 mm<sup>2</sup> and soft copper), thus the transmission area as well as current load rating is reduced. (sometimes such an imperfect connection can cause the “burning-out” of the connection resulting in a full devaluation of the MCB’s or devices interconnected in that way)
  - with other types of MCB’s which do not have a sufficient insulation between separate terminals, the inter-phase short-circuit can occur under specific circumstances. The MCB’s BONEGA P-E-P can avoid that phenomenon safely.

### Reed (rack) ones:

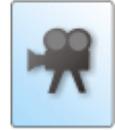
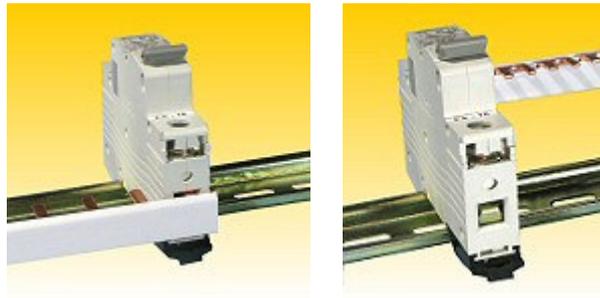
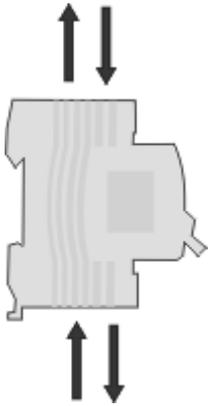
- **advantages**
  - a rack (reed) is also the pressure (second) area of the terminal pressing onto the out-in conductor, thus it **limits any possible contact resistance to the minimum**
  - if you use two interconnecting strips with outputs at the edge of the strips, the height seating of the terminal enables those two interconnecting strips to be put in opposite to each other and to reach a double transmission load rating
  - e.g. the current load capacity of such a strip with an cross-section 16 mm<sup>2</sup> with the power supply away from the strip edge is 80 A.; with two interconnected strips located in opposite and supplied away from the strip edge it is up to 160 A; with two interconnected strips located in opposite even up to 260 A
- **disadvantages**
  - being put into the bottom part of the terminal, they take a part of its cross-section, thus they make the connection of input conductors more complicated

The strips are supplied either with the cross-sections of 16 mm<sup>2</sup> or 10 mm<sup>2</sup>, always with insulating material made of self-extinguishing ABS-VO. The copper contacts (reeds) are located closed at the strip edges. See our offer of [MCB’s accessories](#).

The single-pole MCB’s can be interconnected also in the so-called “German” way, i.e. with a special strip without any insulation. When accepting this method, it is necessary to break off both barriers against the inter-phase short-circuit (see [protection against an inter-phase short-circuit](#)).

## 9. Connection of Input or Output on Either End

**A possibility to connect the input as needed.**



[3D animation at www.bonega.cz](http://www.bonega.cz)

Input or output can be connected both onto the upper and lower terminals **without impairing the function of the miniature circuit breaker in any way**. Through this advantage, the mounting is easier and the distribution arrangements at the switchboards can be variable.

You will appreciate it especially in the switchboards with a multi-row arrangement – you can connect the input between two rows (saving of conductors and time)

## 10. Large Terminals

**Designed to accept a large conductor.**



The cross-section 35 mm<sup>2</sup> for solid conductor and the cross-section 25 mm<sup>2</sup> for stranded conductor is stated for the range up to In 63 A. The geometric cross-section of the terminal, however, is 50 mm<sup>2</sup>. You will appreciate the terminal cross-section of 35 mm<sup>2</sup> with all nominal values, when mounting any bigger cross-sections of the conductors which must be dimensioned for higher power inputs.

**You do not need to solve such problems by means of additional terminals on which the contact resistances could occur.**

## 11. Strong Design of Terminals

**Impossible to strip the threads even with excessive stress.**



The movable terminal has been made of one piece. In contrast to other MCB's, the joint has been solved by means of an overlapping and not by a so-called "puzzle joint". Through this overlapping, there goes a screw. It has a double thread length available, which **restricts the breaks – "stripping" the thread essentially**. The possibility to break it when being mounted is fully excluded even if the torsional stress allowed by the standard is exceeded. (more than 2 N.m)

The clip terminals themselves have in their bottom part also the cross **grooves which avoid the conductor to be taken out from the terminal** (after being drawn up, the conductor sinks into the grooves). Simultaneously, the **contact resistances are limited**. (because of the enlargement of the transmission area the burning of the conductors is not possible).

**The junction of a conductor and a MCB is very rigid and reliable.**

## 12. Locking Protection

**The BONEGA P-E-P MCB's cannot be locked from the outside.**



red I - ON  
green 0 - OFF

This property **protects the electro installation companies** against claims, which are caused by the end user, who can be proved wrong with difficulties.

As the most products, also the MCB's BONEGA P-E-P has an indication of the contact conditions. That indicates a real contact condition and not only a position of the switch-on lever. In case of "sintered" contacts and switched-off lever, the user is clearly informed about flowing current. As the only ones, our MCB's have that indication **covered with a transparent plastic sight-glass with a lens (magnifying) effect**.

### Reasons:

- Because the indication is closely connected with a movable contact, it happens on other MCB's that the movable contact is locked through the indication by means of a toothpick or a matchstick; thus the complete thermal and short-circuit protection of a MCB is out of function. **It is not possible to do that on the MCB BONEGA P-E-P, just because of that transparent sight-glass**
- Dust protection

The MCB is equipped with a colored indication of contact condition, which is independent on the lever position, and it depends just on the real contact condition. In addition, this indication is protected against dust penetration into the MCB by a transparent plastic cover with magnifying effect.

The philosophy of the colored indication ON/OFF is explained within [frequent questions](#).

## 13. An Easy Link-Up of the Accessories from Both Sides of the MCB

**A fast connection of the accessories.**



The numerous accessories can be linked-up from both sides of the MCB. The interconnection with the MCB is done as follows:

1. Remove the grey self-adhesive plate, which covers the interconnecting pole on the left or right side (with nail or screwdriver) in accordance with the type of the accessories.
2. Set up the MCB into the OFF position.
3. With an easy "snapping" into place without any tools, connect the accessories to the MCB.

The miniature circuit breakers are compatible with the accessories of one of the best producers in Europe: MERLIN – GERIN.

Their system includes low-volt releases, ejecting coils, auxiliary contacts, etc. All those elements extend the application of the MCB by overvoltage or undervoltage protection, control, regulation, remote control, remote

indication of switch-on and switch-off positions of the circuit breaker, programming and measurement. Those combinations enable the circuit breakers to be applied in the range of control of the complicated automated processes.

These elements can be mutually interconnected (e.g. MCB + undervoltage release + auxiliary indicating contact etc.), thus they can form different combinations.

See our offer [accessories for the MCB's](#).

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## 14. Versatility

**No need to buy any expensive combined devices elsewhere.**

The height of the MCB terminals corresponds to other electrical devices BONEGA® , such as current protectors, modular switches etc. the mutual interconnection enables to form combined devices.

For example, the combination of the MCB 1P + N along with a double-pole protective switch or the MCB 3P + N along with a four-pole current protective switches (see [protective switches](#) ). This interconnection can be reached easily by means of a 2P or 4P interconnecting strip (see [accessories to the MCB's](#) ).

---

## 15. Quick Removal of the MCB from the DIN Strip, even if the MCB's are Interconnected with a Strip

**You need not dismantle the interconnecting strip.**



A unique auxiliary mechanism enables the MCB to be easily removed from a row of devices, which are mutually interconnected by a forked or reed (rack) strip **without necessity to dismantle the complete interconnecting strip, which is otherwise necessary.**



[3D animation at www.bonega.cz](#)

Other advantages of this solution:

- the mechanism does not fall out from the MCB's body
- arrestment in extreme positions available
- no steel spring, so is does not subject to climate influences

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## 16. Higher Safety Standards

**Construction of the cover eliminates electrical current injury caused by touching the circuit breaker.**



All locking bars are protected against danger touch and penetration of small foreign objects ([IP protection 20](#)).

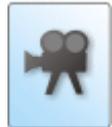
## 17. Superior Cover Design

**The screws on the clip terminals are kept from falling out of the circuit-breaker body by our unique design.**

The clip terminals are seated in the circuit-breaker casing so that the screws of the terminals cannot fall out from the circuit-breaker body, even if they are fully unscrewed from the terminal. This advantage has been reached because the diameter of the hole at the plastic box (casing) for a screwdriver is less than the diameter of the screw head. The screw head has been modified both for cross and flat screwdrivers.

## 18. A Pawl with Unique Characteristics

**Quick installation and release.**



**3D animation at**  
[www.bonega.cz](http://www.bonega.cz)



The fastening mechanism with a movable pawl enables, as follows:

### a) the MCB can be fastened to the DIN strip by a simple “snapping”

1. Move the pawl from the B position into the A position (the production position), if it has not been done yet.
2. Suspend the MCB in the upper on a projection on the DIN strip's upper part and snap it on the DIN strip's bottom part with a swinging motion.

### b) the fast dismantling from the DIN strip



1. From the fixed condition in the position 3, move the pawl to the Pos. 1 by means of e.g. screwdriver, which is to be put through the pawl hole and to be drawn-half out.
2. The pawl keeps arrested in the Pos. 1 and the screwdriver can be removed.
3. Now remove from the DIN strip.

You will appreciate this advantage especially when erecting the multi-pole MCB's when you need just one instrument because the pawls can be drawn-half to the final arresting positions (position 1). With other MCB's you have to use e.g. two screwdrivers and to take out the MCB from the DIN strip simultaneously. The installation is essentially easier and faster with the MCB's BONEGA P-E-P.

## 19. Variable Design of the Pawl

### Attaching to a DIN strip with a different thickness.



The MCB is intended to be attached onto the DIN strip EN 50 022 (width - 35 mm, thickness 0,8 - 2 mm). At European market, there are DIN strips with higher dimension tolerances available. Our variable design of the pawl has been fitted to those strips.

It can correspond with less exact performance of the DIN strips.

## 20. Extraordinary MCB's Body Strength

### Extended mechanical reliability of the multi-module design.



The casing design ensures a very high stiffness not only at a single-module type, but even in case of multi-module circuit breakers.

Strength:

- a sophisticated placing and number of rivets
- amount of pivot joints
- by the design of the casing with stabilizing locks and pivot joints.

## 21. Colored Control Levers

### The colored levers improve the transparency and comply with the requirements of power plants.

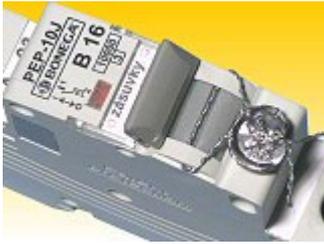
We supply both colored levers and black levers in accordance with the nominal current values (corresponding to the marking of turn fuses).

0,2 A - 1,6 A	black	
2 A	pink	
4 A	brown	
6 A	green	
8 A	light green	
10 A	red	
13 A	sandy	

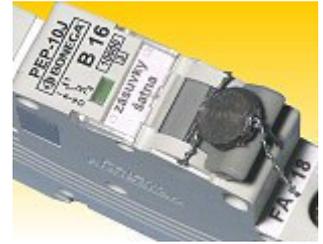
16 A	grey	
20 A	blue	
25 A	yellow	
32 A	purple	
40 A	black	
50 A	white	
63 A	copper-coloured	

## 22. Sealing Under Certain Conditions

**The ability to seal the lever in an ON or OFF position.**



The lever can be sealed because of openings in both guiding sidewalls of the switch-off lever. Through these openings, a sealing wire can be fed. This sealing wire passes also through a groove on the movable lever. This groove has been engraved in **OFF and ON positions** and it disables the motion of the lever itself. If the lever is sealed in the ON position, **the immobility does not render the function of the circuit breaker impossible**. In the event of short-circuit or overload, the circuit will be shutdown (independently on the fixed position of the lever). The MCB case enables the lever **to be sealed independently** on placing the adjacent MCB's.



## 23. Smoother than any Switch you'll Find

**You'll think it's not even on ...**

The most excellent and balanced design of a switching mechanism. Extremely easy running when switching-on the lever even in case

*(contact: center 6)*

**Sales Department:** - paní Libuše Možnarová, tel. /fax 518 335 216, email : [libuse.moznarova@bonega.cz](mailto:libuse.moznarova@bonega.cz), 696 66 Sudoměřice nad Moravou 302

**Secretary of the Company:** ing. Roman Hudeček 603 542 347, [roman.hudecek@bonega.cz](mailto:roman.hudecek@bonega.cz)

## **Commercial Advantages**



*P-E-P (Perfect Electric Protector)*

### **List of advantages:**

- 1. Excellent Quality**
- 2. Three Year Warranty**
- 3. Full Range of Products**
- 4. Custom Orders**
- 5. Colored Control Levers**
- 6. Worldwide Unique MCB**
- 7. Awards**
- 8. Always Something More**
- 9. Patented**
- 10. Versatility**
- 11. An Easy Link-Up of the Accessories from Both Sides of the MCB**
- 12. Protection Against Hacking of an MCB**
- 13. Production Flexibility**
- 14. Conveniently Packed and Labeled**
- 15. BONEGA P-E-P MCB's Work Reliably with a Frequency of both 50, and 60 Hz**
- 16. International Certification**
- 17. Aesthetical Design**
- 18. BONEGA P-E-P the Future**



[Download price list](#)



---

### **1. Excellent Quality**

***You will get the highest quality MCB.***

Even though it is one of the most advanced miniature circuit breakers in the world Gold Amper 2005 is very affordable.

---

### **2. Three Year Warranty**

***Guaranteed high quality and reliability.***





The unique resistant construction and careful product control ensure error free use backed by our three year warranty.

230/400V~	50/60 Hz
IP 20	CE
35/25 mm'	
EN 60898	
GARANCE 3 ROKY	

### 3. Full Range of Products

**All combinations as well as special types.**

The entire conception for individual combinations is based on the production of just single-module MCB's from which it is possible **to form any combinations**, e.g. 1P (pole), 2P, 3P, 4P, 1P+N (zero = switch), 3P+N. All the combinations are available both with the curve B,C, and D.

It is possible to produce the values from 0,5 up to 63A (in any ampere value, i.e. scale even with only 1 A).

They have been designed for alternative current (AC), but can be used for direct current (DC)\*.

\* Contact [technical support](#).

**Our superior quality DC MCB's are available by special order. [Contact us](#)** for more details.

### 4. Custom Orders

**Custom orders at a competitive price.**

We can tailor make your order.

### 5. Colored Control Levers

**The colored levers improve the transparency and comply with the requirements of power plants.**

We supply both colored levers and black levers in accordance with the nominal current values (corresponding to the marking of turn fuses).

0,2 A - 1,6 A	black	
2 A	pink	
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8 A	light green	
10 A	red	
13 A	sandy	

16 A	grey	
20 A	blue	
25 A	yellow	
32 A	purple	
40 A	black	
50 A	white	
63 A	copper-coloured	

### 6. Worldwide Unique MCB

**One of the most outstanding MCB's in the world.**

No MCB has such excellent parameters with so many advantages.

**We are leading the way in MCB future technology.**

## 7. Awards

**The awards prove the exceptional capacity of the MCB's BONEGA P-E-P.**

- MCB's BONEGA P-E-P was awarded the Gold Amper and has become the best product of the most prestigious Czech Fair AMPER 2005.



- MCB's BONEGA P-E-P was awarded *Zlatý výrobek* (The Gold Product) at the BAEL FAIR 2004.



## 8. Always Something More

**Compare our products.**

Compare our miniature circuit breaker with any other MCB of the same category. You can find always something more with the MCB BONEGA® P-E-P.

## 9. Patented

**The BONEGA P-E-P MCB's are patent-protected.**



Our MCB's are patent-protected.

The whole MCB is also protected as an industrial design.



## 10. Versatility

**No need to buy any expensive combined devices elsewhere.**

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For example, the combination of the MCB 1P + N along with a double-pole protective switch or the MCB 3P + N along with a four-pole current protective switches (see [protective switches](#)). This interconnection can be reached easily by means of a 2P or 4P interconnecting strip (see [accessories to the MCB's](#)).

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**A fast connection of the accessories.**



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1. Remove the grey self-adhesive plate, which covers the interconnecting pole on the left or right side (with nail or screwdriver) in accordance with the type of the accessories.
2. Set up the MCB into the OFF position.
3. With an easy “snapping” into place without any tools, connect the accessories to the MCB.

The miniature circuit breakers are compatible with the accessories of one of the best producers in Europe: MERLIN – GERIN.

Their system includes low-volt releases, ejecting coils, auxiliary contacts, etc. All those elements extend the application of the MCB by overvoltage or undervoltage protection, control, regulation, remote control, remote indication of switch-on and switch-off positions of the circuit breaker, programming and measurement. Those combinations enable the circuit breakers to be applied in the range of control of the complicated automated processes.

These elements can be mutually interconnected (e.g. MCB + undervoltage release + auxiliary indicating contact etc.), thus they can form different combinations.

See our offer [accessories for the MCB's](#).

---

## 12. Protection Against Hacking of an MCB

**We comply with the requirements of distribution companies for disassembly protection.**

The multi-pole MCB's BONEGA P-E-P cannot be disassembled in such a way that only the interconnection between stretching levers would be removed and the individual poles could function separately (e.g. through this, the day and night tariff rate could be influenced). Especially the distribution companies call for this property.

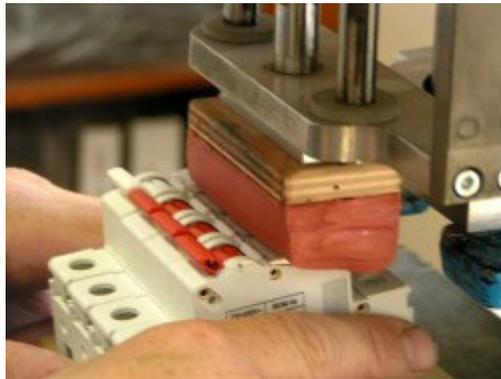
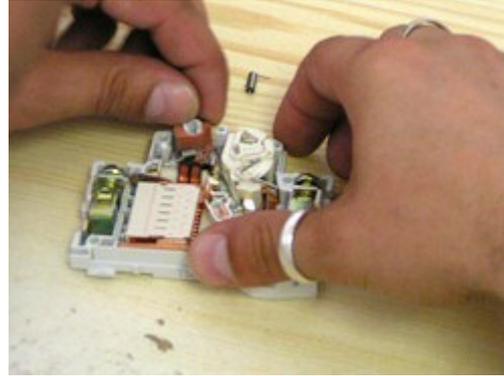
The mutual phases interconnection does not happen just between the levers, but also by means of pins which are put between the pole and they interfere directly into the inside mechanisms through a side hole. In addition, the multi-pole design is connected with rivets. The interconnecting and covering strip, which is between the levers, is **visibly depreciated**.

Any interference in a MCB is obvious at first sight.

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### 13. Production Flexibility

*We will reply to special requests within 48 hours.*



Production is flexible and special types are made upon request, usually within 48 hours.

---

### 14. Conveniently Packed and Labeled

*MCB's come in an easy access case.*

The cases are intended for **12 modules** so there are either 12 pcs. single-pole MCB's, 6 pcs. two-poles MCB's, 4 pcs. three-pole MCB's or three pcs. four-pole MCB's in one case (total weight of circuit breakers in one case amounts to approx. 1,3 kg).

» Exact weights are at [www.bonega.cz](http://www.bonega.cz)

One side of the case, there is a label put on, describing especially the type, curve, nominal current value and number of pieces.

If there are **more types in one case, types and number of pieces are marked on the label** to be added manually, when packing. We are sure you will appreciate this type of packing not only on collection of the delivered goods, but also on job site.

---

### 15. BONEGA P-E-P MCB's Work Reliably with a Frequency of Both 50 and 60 Hz

*Suitable for US.*

The change of frequency has no influence on the MCB function.

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## 16. International Certification

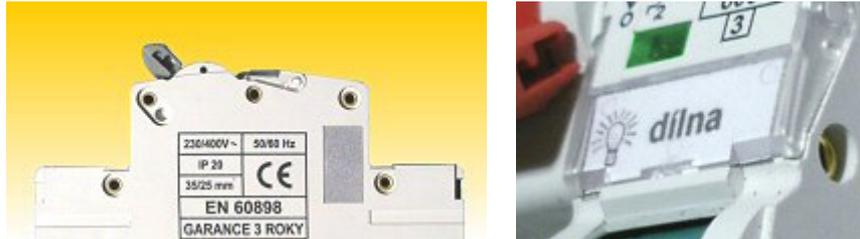
*Sale abroad is even easier.*

Thanks to the successful **CB test**, which is valid in **46 countries worldwide**, the approval procedure for our MCB's and their industrial installation can be accelerated significantly.

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## 17. Aesthetically Designed

*Modern round shapes.*



Because of its aesthetic appearance, they'll fit together with the modern switchboard.

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## 18. BONEGA P-E-P ... the Future

*On the horizon.*

BONEGA P-E-P's planned products:

- module switchers
- current protectors
- DPN (1P+N) up to 40 A (a switcher and MCB associated at one module with the width of 17 mm) – because of the snap chamber and switching-off mechanism we expect the short-circuit resistance of 6 kA to be reached (the products with the short-circuit resistance of only up to 4 kA are known over the world)
- module contactors
- current protector and MCB (associated in two modules – 2 x 17 mm)
- DPN + current protector in two modules (2 x 17 mm)
- module series of MCB's from 60 A to 125 A

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*(contact: center 6)*

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## Miniature Circuit Breakers BONEGA® P-E-P

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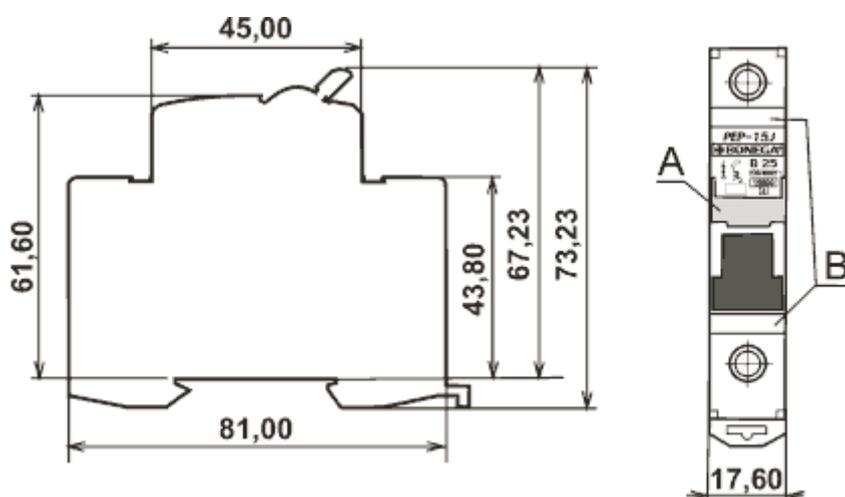
1. Dimensioned chart
2. Charakteristics and application of our MCB's
3. Technical data
4. Influence of ambient temperature on nominal currents



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### 1. DIMENSIONED CHART



As to the available information, because of their extraordinary short dimensions (especially the width of only 81 mm), our P-E-P MCB's are classified as among the smallest MCB's over the world in the category of short-circuit resistance up to 10 kA. In the category of 15 kA, we have the shortest dimensions worldwide (see the dimensioned chart).

- total height from the pawl incl. lever at switched-off position 72,23 mm
- total height from the DIN strip incl. lever at switched-off position 67,23 mm
- total height from the DIN strip up to the surface is 61,6 mm
- total height from the DIN strip up to the surface of terminals is 43,8 mm
- total width is 81 mm + 5,2 mm
- width of controlling part 45 mm
- distance between the upper supporting part of the terminal and the DIN strip 19,0 mm
- distance between the supporting part of the terminal for placing the forked interconnecting strip and the DIN strip is 33,0 mm
- module width 17,6 mm
- bottom assembly label – width 4,8 x 17,6 x 0,5 mm
- upper users' label – width 6,2 x 15,4 x 0,3 mm

Thus there is more space for conducting and connecting the conductors in the installation section which is covered at a switchboard. This property can be appreciated especially when using these MCB's at small apartment switchboards.

## 2. CHARACTERISTICS AND APPLICATION OF OUR MCB'S

The limiting miniature circuit breakers BONEGA® P-E-P-15J have two different releases acting onto the switching mechanism:



- 1.) **thermal over-current release** for over-current protection, working with time lag
- 2.) electromagnetic **high-speed release** with ejecting armature for immediate short-circuit protection

They are thus intended to **protect the electrical distribution systems** and electrical devices **against short-circuit** (if the defect has been caused by failure or incorrect connection) and to protect the electrical distribution system against **overload** (if the circuit has not been damaged but an extreme thermal overload occurred which could damaged the wiring).

They are suitable especially for common installation into switchboards and switching points of low-voltage end circuits. They are designed mostly for **alternating current** but they can be **used also for direct current** for which the reduction of short-circuit resistance by approx. about 20% has to be taken into account (because of a higher stress of contacts).

With their design and technical parameters, the miniature circuit breakers BONEGA® P-E-P-15J conform to the current technical top level world-wide.

They are marked with a logo with a trademark BONEGA®. It is a traditional brand since 1992 which shall be introduced to the markets over the world. The name BONEGA comes from the ESPERANTO language and in that language, Bonega means excellent, good.

The name of the P-E-P series conceals the English term *Perfect Electric Protector*, stressing its extraordinary high quality supported by a long guarantee).

The miniature circuit breakers are manufactured in accordance with a particular European standard CSN EN 60898, as amended. They are able to comply with any design requirements for arrangement of MCB's with regard to the selectivity and requirements for individual characteristics B, C and D.



- the product has received the certificate of the Electrotechnical Testing Institute of the Czech Republic



- the product complies with the conditions necessary for evaluation if our product conforms to the Czech rules

CB TEST - the product has fulfilled the European conditions for application thereof



- the product complies with the European conditions for Declaration on Conformity



- the product has received a prestigious SEMCO Certificate

The MCB's BONEGA®, series P-E-P have more than **50 user's advantages**

The miniature circuit breakers BONEGA®, series P-E-P, can be mutually interconnected by means of single-pole to four-poles **interconnecting forked and reed (rack) strips**.

The miniature circuit breakers BONEGA®, series P-E-P, enable the plentiful **accessories** of one of the best producers in Europe, **MERLIN – GERIN to be linked very easily**. This system includes inter alia low-volt releases, voltage releases, ejecting coils, auxiliary contacts etc. All those elements provide protection, easy control, regulation, and remote control, remote indication of switch-on and switch-off positions of the circuit breaker, programming and measurement. By means of what has been mentioned above, those elements enable our circuit breakers to be applied in the range of control automatization of different industrial processes. These elements can be mutually interconnected as well, thus they can form different combinations to get thorough operational information.

### 3. TECHNICAL DATA

Technical data	
<b>Number of poles:</b>	<b>1,2,3,4, 1+N,3+N</b>
<b>Nominal currents In (A):</b>	1,2,3,4,6,10,13,16,20,25,32,40,50,63
<b>Characteristics:</b>	<p>B (or L), also "V" before. The short-circuit release is to be set up to 3 In through 5 In. It serves especially for protection of circuits with such devices which do not cause any current surges (lights or socket circuits etc.)</p> <p>C (or U), also K before. The short-circuit release is to be set up to 5 In through 10 In. It serves especially for protection of circuits with such devices which cause some current surges (groups of bulbs, motors etc.)</p> <p>D (or M), also „-----“, before. The short-circuit release is to be set up to 10 In through 20 In. It serves especially for protection of circuit with devices which cause high current surges (transformers, double-pole motors, motors with heavy start etc.)</p>
<b>Nominal voltage:</b>	<p>1 P (single-pole) ~ 230/400 V 50/60 Hz</p> <p>3 P (three-pole) ~ 400 V 50/60 Hz</p>
<b>Rupturing capacity:</b>	EN 60898 - 15.000 A (nominal short-circuit and operational rupturing capacity)
<b>Protection:</b>	<p>IP 20 for a sole MCB - with its design, it protects against a hazardous finger touch as well as against small foreign objects; it is without any protection against water leakage ( water protection is to be solved with design of the switchboard casing )</p> <p>IP 40 for a sole MCB - with its design, it protects against a hazardous finger or instrument touch as well as against very small foreign objects; it is without any protection against water leakage ( water protection is to be solved with design of the switchboard casing )</p>
<b>Ambient temperature:</b>	- 5 °C to +40 °C pursuant to ČSN EN 60898
<b>Gauging temperature:</b>	+30 °C pursuant to CSN (it is possible to agree upon different temperature)
<b>Max. pre-inserted fuse:</b>	100 A gG (>10 kA)
<b>Mechanical lifetime:</b>	>= 20.000 cycles
<b>Electrical lifetime:</b>	>= 8.000 cycles
<b>Operational position:</b>	arbitrary
<b>Fastening:</b>	by means of an unique snap mechanism (with arrestment in final positions) the carrying DIN strip EN 50022, width 35 mm, or even onto the flat surface by means of screws
<b>Removal from the DIN strip</b>	by means of an unique auxiliary snap mechanism; the MCB's can be removed even from a row of devices mutually interconnected by a forked or reed (rack) strip without necessity to dismantle the whole interconnecting strip
<b>Input terminals:</b>	<ul style="list-style-type: none"> <li>- clip terminals (with barrier layer), snap- locked against the worse input of a conductor</li> <li>- the input and output can be interchanged</li> <li>- they enable more conductors as well as interconnecting strips to be connected</li> </ul>
<b>Connectability of conductors (maximum cross-sections):</b>	35 mm <sup>2</sup> solid conductor, 25 mm <sup>2</sup> stranded conductor
<b>Terminal protection:</b>	IP 20
<b>Tightening moment for terminals::</b>	2 Nm (combined slotted-head screw)
<b>Manufactured according to the standard:</b>	ČSN EN 60898
<b>Power limiting class</b>	3
<b>Switch-off speed (see <i>oscilograms</i>):</b>	under 5 ms

<b>Coloured levers:</b> For better distinction among circuits in the switchboards, we supply also miniature circuit breakers with distinction of nominal currents by means of <b>colored levers corresponding to the colours of turn fuses:</b>	0,2 A - 1,6 A	black	
	2 A	pink	
	4 A	brown	
	6 A	green	
	8 A	light green	
	10 A	red	
	13 A	sandy	
	16 A	grey	
	20 A	blue	
	25 A	yellow	
	32 A	purple	
	40 A	black	
	50 A	white	
63 A	copper-coloured		
Can be delivered also with only black levers	1-63 A	black	

#### 4. INFLUENCE OF AMBIENT TEMPERATURE ON NOMINAL CURRENTS

Influence of ambient temperature on nominal currents of the MCB's BONEGA® P-E-P-15J										
Nominal current of MCB ( A )	Internal resistance (mOhm)	Power loss (W)	Max. impedance of impedance loop (Ohm)			Thermal correction of nominal currents				
			Char. B	Char. C	Char. D	Ambient temp. 20°C	Ambient temp. 30°C	Ambient temp. 40°C	Ambient temp. 50°C	Ambient temp. 60°C
1	1215,69	1,24	46,20	25,70	14,40	1,05	1	0,95	0,90	0,85
2	343,28	1,38	21,60	12,02	6,73	2,08	2	1,92	1,84	1,74
3	128,09	1,15	16,90	9,40	5,26	3,18	3	2,82	2,61	2,37
4	105,53	1,68	10,68	5,94	3,33	4,24	4	3,76	3,52	3,24
6	29,22	1,08	7,14	3,97	2,22	6,24	6	5,76	5,52	5,30
10	14,49	1,55	3,87	2,15	1,21	10,60	10	9,30	8,60	7,80
16	10,00	2,56	2,24	1,25	0,70	16,80	16	15,20	14,20	13,30
20	8,02	3,32	1,55	0,86	0,48	21,00	20	19,00	17,80	16,80
25	3,11	2,00	2,43	1,35	0,76	26,20	25	23,70	22,20	20,70
32	3,05	3,17	1,27	0,71	0,40	33,50	32	30,40	28,40	27,50
40	2,16	3,40	0,60	0,33	0,19	42,00	40	38,00	35,60	33,20
50	1,65	4,20	0,71	0,39	0,22	52,50	50	47,40	44,00	40,50
63	1,68	6,30	0,47	0,26	0,15	66,20	63	58,00	54,20	49,20

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