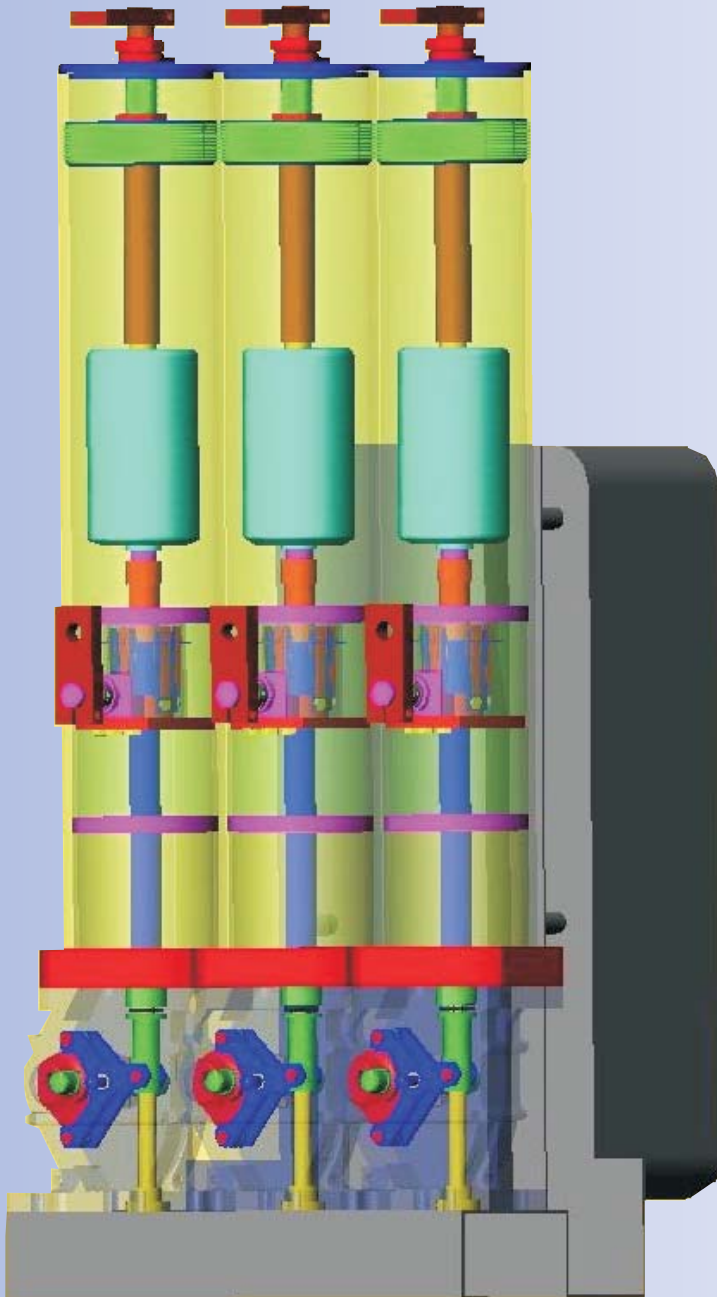




# THREE-POLE VACUUM CIRCUIT BREAKER 12-24 kV ... 1250 A 20-25 kA TYPE HGV

*(retrofit of minimum oil circuit breakers type HG)*



RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING  
I C M E T C R A I O V A

LABORATORY DEPARTMENT

**DEK** Calibration Laboratories:  
DSD-K-18701 - Force  
DSD-K-18702 - High Voltage  
DSD-K-18703 - Electromagnetic Field

**REVAR** Testing Laboratories:  
RENAR 001-M Force  
RENAR 003-L High Voltage-EMC  
RENAR 004-L High Power  
RENAR 123-L Electric Materials

No. 6914/12.09.2005

SUMMARY OF TESTS

According to Contract No. 3151 / 11.08.2005 within period September 5 - 12, 2005 at High Power Laboratory of ICMET-Craiova were carried out the following tests on Vacuum Circuit Breaker according to IEC 62271-100

Type	Type tests and parameters	Test result	Test Report No.
12 kV/1250 A/25 kA Vacuum Circuit Breaker type HGV	6.106. Basic short-circuit test duties: T10, T30, T60, T100s, T100s at I=25kA, Ur=12kV in cycle O-0.3s-CD-3min.-CO	Passed the test	9509
24 kV/1250 A/20 kA Vacuum Circuit Breaker type HGV	6.106. Basic short-circuit test duties: T10, T30, T60, T100s, T100s at I=25kA, Ur=24kV in cycle O-0.3s-CD-3min.-CO	Passed the test	9508

More details will be included in the Test Report Nos. 9508 and 9509 written in English language, in three original copies each, according to point 1.9 from Annex 2 of the Contract that will be sent to ENERGOINVEST Rasklopna Oprema a.d., Istoros Sarajevo 71126 Lukavica, 17 Vuka Karadzica, Bona i Hercegovina - Republika Srpska

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C ALFA DUCURESTI 144, 26011 CRAIOVA, ROMANIA, Manufacture certificate: F 56312799, Asambl. 1st. UNB: B07C32P04E024E7018E2E31E30B00KAGP04E02E018017001821 @BANCA COMERCIALA CARPATICA - S.C.M. Craiova.

*Give him a new heart and forget about him for the next 20 years!*

## 1 GENERAL

Using our rich experience so far in research and production of switching equipment, a project 'retrofit' has been realized, which enables an effective, economic and reliable modernization of medium voltage switchgear.

At domestic and foreign markets there are a significant number of switchgears with minimum oil circuit breakers that are in operation for a long time. Many of them are approaching to the end of their 'life age'. The maintenance of them requests more and more time and money. To replace them with new circuit breakers, mainly with vacuum ones, is connected with many problems, such as:

- New design of vacuum circuit breakers is of smaller dimension and different disposition comparing to the existing minimum oil circuit breakers;
- Panels with the existing minimum oil circuit breakers are of old design, and installation of new circuit breakers would request finishing of panels or adaptation of vacuum circuit breakers to the disposition of these panels;
- In the operation, there are many panels of different characteristic and concept that request many new types of circuit breakers;
- Adaptation should comprise both primary and secondary circles.

Instead of new vacuum circuit breakers installation adapted to certain panel types, a possible solution should be a reconstruction of the existing minimum oil circuit breakers, HG type, which are mainly built into the existing panels.

## 2. PROJECT RETROFIT

What is the project «retrofit» ?

After long time operation the majority of operated MV switchgears functions without any serious problems. Problems are with maintenance and repair of «heart» of switchgear. It is circuit breaker. Retrofit of existing minimum oil circuit breaker, production of Energoinvest, type HG is realized through vacuum circuit breaker type HGV.

Reconstruction comprises built of vacuum interrupters in the existing minimum oil circuit breakers cylindres, adaption of strokes and speeds, revision of the motor-spring operating mechanism and adequate testing. The process of this change goes gradually, circuit breaker by circuit breaker, and can be done at the site. These retrofited circuit breakers are cheaper than new vacuum circuit breakers and process of change does not request any adaption of the panel.



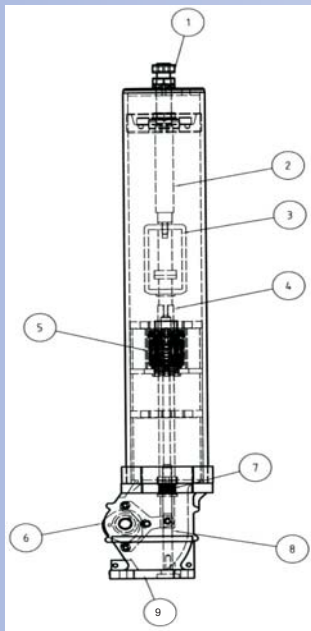
### 3. STANDARDS

On circuit breaker, HGV type, all type tests are done in accordance with IEC 6227 100 regulation at internationally recognized laboratories.

A customer gets a certificate and term of warranty together with mentioned circuit breaker.

### 4. DESCRIPTION OF CIRCUIT BREAKER

Figure presents cross section of one pole of HGV. Each pole consists of insulation cylinder fixed on the housing. Insulation cylinder is made of glass fiber impregnated by epoxy resin with high mechanical endurance. Upper and down clamps are mounted on the outer side of the cylinder. Upper clamp is fastened to upper current terminal which is connected to vacuum interrupter. Lower part of vacuum interrupter is connected to contact rod. Down contact system consists of contact fingers with pins where the down clamp is connected. Contact spring is placed between contact rod and levers. Its function is to keep contact pressure of facing contact in the vacuum interrupter. Required stroke determined by the type of the vacuum interrupter is achieved by means of mechanism placed in the pole housing.



#### Legend

1. Upper clamp
2. Upper terminal
3. Vacuum chamber
4. Contact rod
5. Down contact pin with connector
6. Cam
7. Contact springs
8. Levers Housing

HGV pole cross-section

### 5. DESCRIPTION OF OPERATING MECHANISM

Circuit breakers, HGV type, are equipped with motor spring operating mechanism BNR-IM type.

During 'retrofit' mentioned above an operating mechanism should be modified negligibly. Circuit breaker closing is performed by energy accumulated in closing springs. These springs accumulate energy tensioning by universal electrical motor (110V, 220V, AC, DC) and necessary time for charging is max. 12 seconds. In case of voltage supply failure springs can be charged manually.

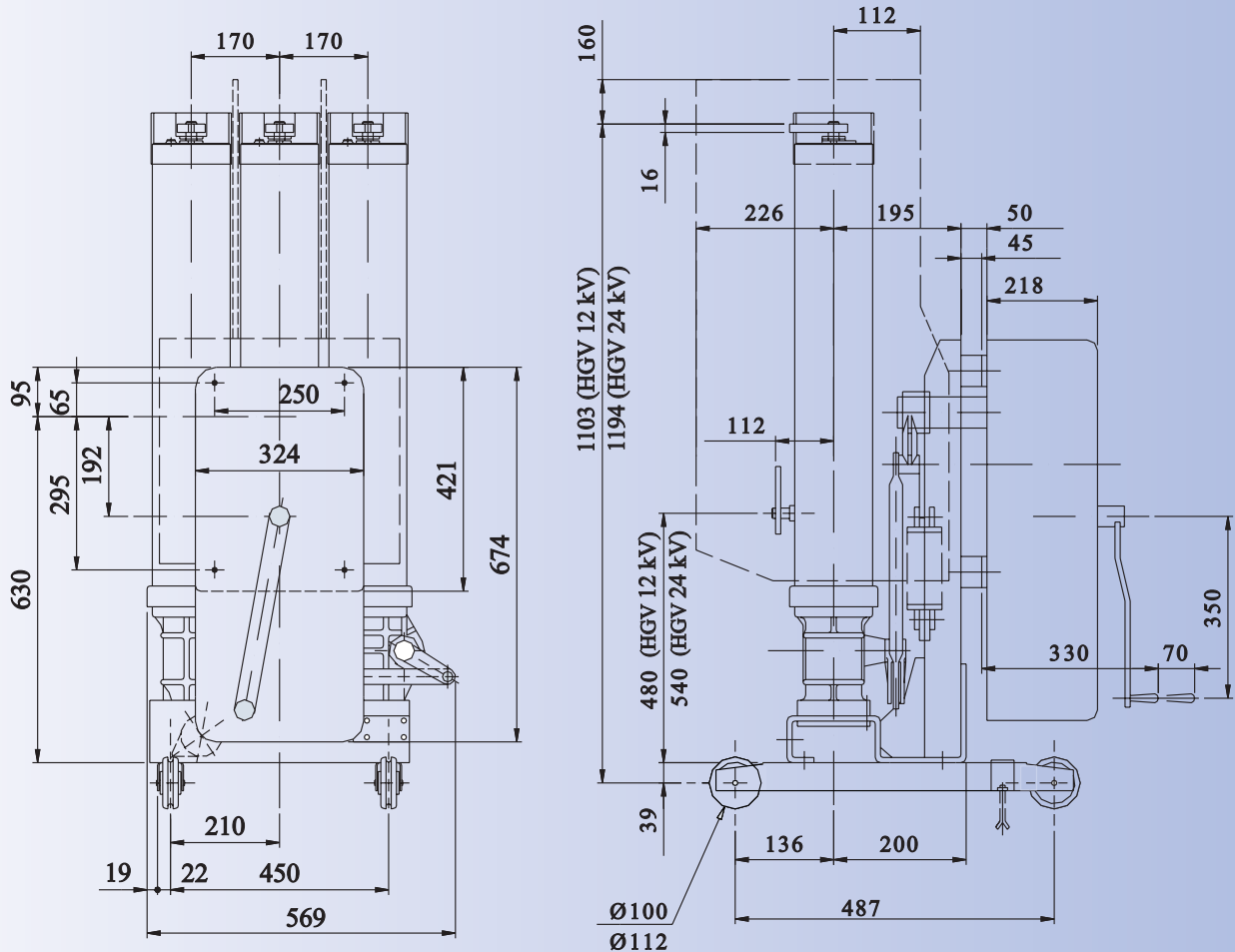
Accumulated energy provides the following circuit breaker operations without need for repeated charging:

- Starting from 'Open' position:  
Closing – Breaking
- Starting from 'Close' position:  
Breaking – Closing – Breaking.

Operating mechanism has a possibility of re-closing so the breaking power is tested in the following sequence: O 0, 3 sec CO 3 min CO.

## 6. TECHNICAL CHARACTERISTICS

Type	Replacement for...	Rated Voltage	Rated current	Breaking capacity	Rated operation sequence V	Type of operating mechanism	Total mass	Short time withstand current
HGV 12 kV	HG 4a/8c	(7,2) 12	630	25	0-03s-CO-3min.-CO	BNR-1M	179 kg.	25
	HG 4a/8f		1250					
HGV 24 kV	HG 6a/8c	24	630	20	0-03s-CO-3min.-CO	BNR-1M	179 kg.	20
	HG 6a/8f		1250					



## 7. AREA AND EFFECTS OF APPLICATION

Project « retrofit » applies for the modernization of all types of switchgears with minimum oil circuit breakers type HG and practically can be performed in voltage condition of switgear. The most important part of switchgear would be modernized without reconstruction of panels. Vacuum interrupters is provided to withstand 50 rated short circuit current in normal operation condition. With this reconstruction users of old equipment get possibility of taking vacuum technique in. This is the way of the most economical reconstruction of medium voltage switchgears and does great technical step in the development of new technical solutions, production of the equipment, operations and maintenance of electrical systems.