

# **Outdoor circuit breaker GVR Recloser Whipp & Bourne Switchgear**

**rated voltage 15, 27 and 38 kV  
rated current 630 A**



## Outdoor circuit breakers GVR Recloser

GVR switchgear brings the reliability of modern materials and technology to overhead distribution networks

The reliability of a system is achieved through:

- a new, patented, single coil magnetic actuator mechanism which allows the GVR to operate independently of the HV supply and to be tested in an ordinary workshop;
- environmentally friendly vacuum interruption produces no by-products;
- the lightweight aluminium tank makes the GVR easier to transport and install;
- the EPDM rubber bushings are resistant to damage from vandalism or mishandling;
- by extensive use of insulated mouldings, in particular the bushings, the total number of parts has been reduced by a factor of x 20 and the number of moving parts by x 50.

## Environmental design

The award-winning GVR gas-filled vacuum recloser combines the high reliability of vacuum interruption with the controlled environment and high dielectric strength of SF<sub>6</sub>, in a compact, maintenance-free unit. Since SF<sub>6</sub> is only used as insulation, there is no health hazard from toxic by-products of arcing. Electrical life is well in excess of ANSI and IEC requirements.

The magnetic actuator provides consistent performance and a dramatic reduction in the number of moving parts. Materials and finishes have been carefully chosen for reliability – from EPDM bushings, tested for tracking and erosion to IEC 1109, in salt fog and other environments, to the neodymium iron boron permanent magnets used in the mechanism.

## Application

The GVR can be pole mounted or substation mounted and can operate as a stand-alone recloser without the need for an additional auxiliary supply, or it can be integrated into the most advanced distribution automation schemes.

By using the advanced control and protection functions, the GVR can also be used in applications where reclosers have not traditionally been used such as closed rings and under frequency load shedding schemes.

**There is up to 10 years or 10 000 operations between services.**

## Type tests

- general: by ANSI C37.60,
- electromagnetic: by IEC 801,
- protection: by IEC 255.

## Technical data

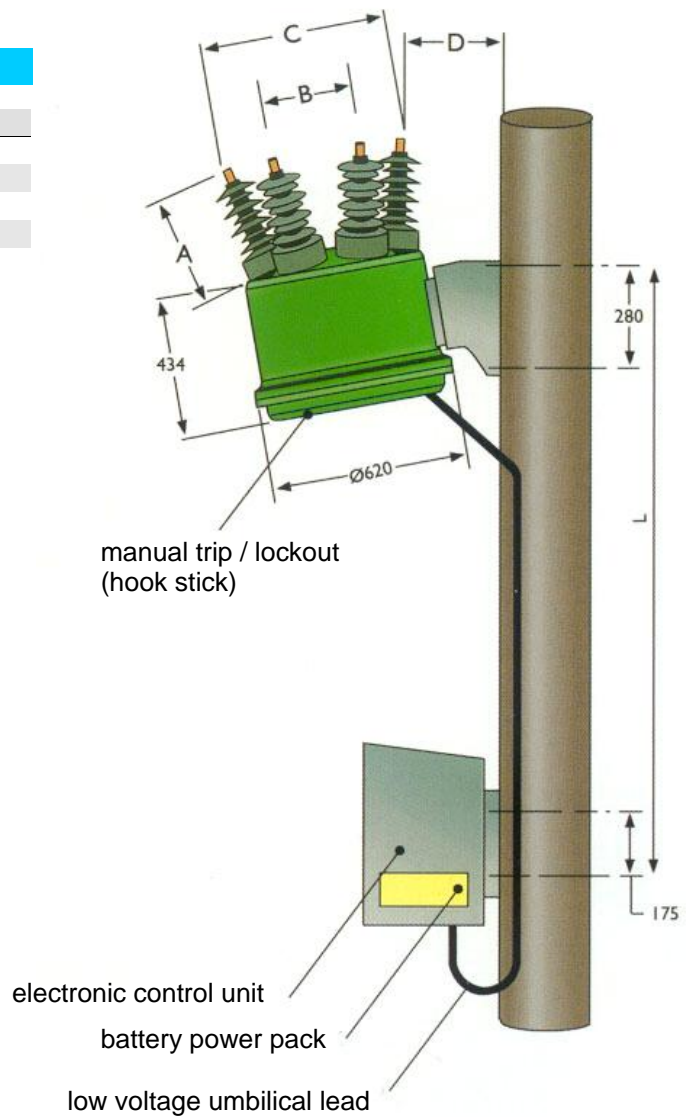
Type		GVR15	GVR27	GVR38
maximum system voltage	kV	15,5	27	38
rated current	A	630	630	630
interrupting current	kA	6/12,5	12,5	8
impulse voltage withstand	kV	110	125(150)	150 (internal) 170 (external)
power frequency withstand				
dry	kV	50	60	70
wet	kV	50	50	60
rated gas pressure for above		atmospheric	atmospheric	0,3 bar(gauge)
number of operations		10 000	10 000	10 000
weight	kg	145	145	155

## Bushing dimensions

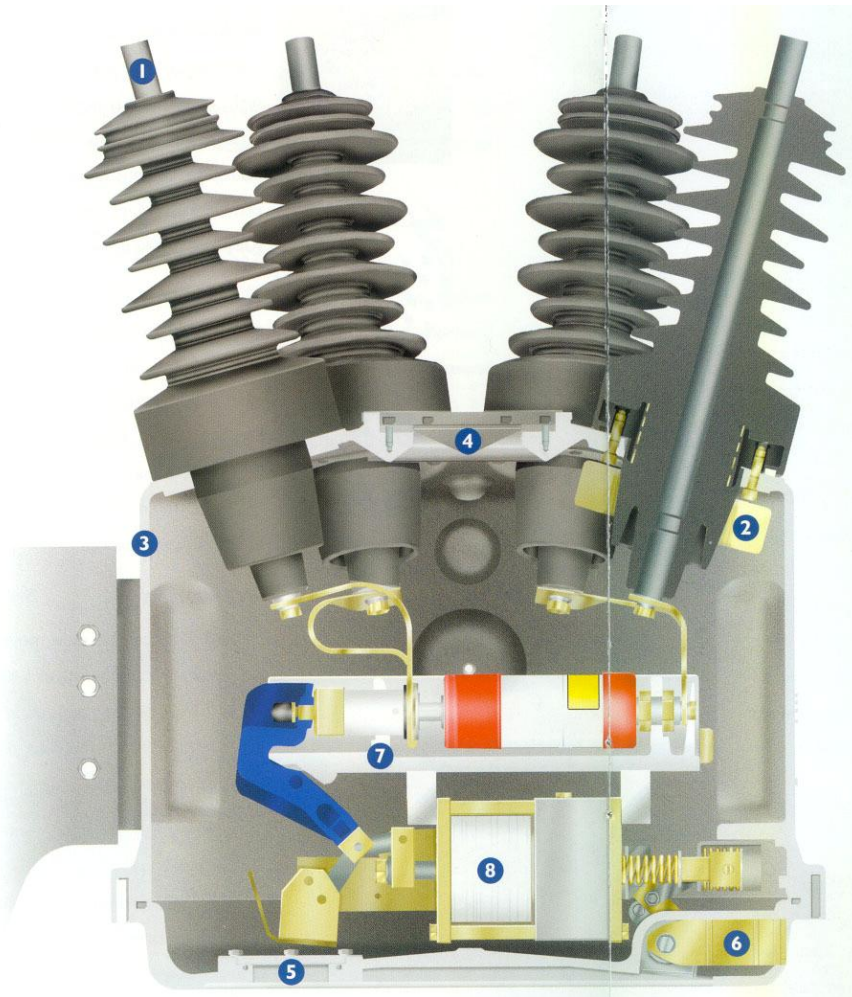
Voltage	Creepage	A	B	C	D
up to 27 kV	830 mm	369	286	571	298
38 kV	1178 mm	469	312	623	412

## Umbilical dimensions

L	Cable length
up to 2000	3000
2001 – 3000	4000
3001 – 4000	5000
4001 – 5000	6000

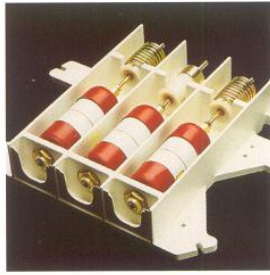


## Function description

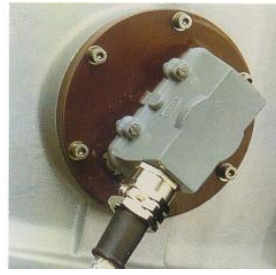


### Main features:

- ① Single piece, aluminium or copper-cored EPDM or silicone rubber bushings, with grooves to take optional wildlife guards / HV boots.
- ② Current transformers are mounted within the tank's controlled environment, while capacitive voltage dividers moulded into the bushings on both sides of the GVR.
- ③ Aluminium housing with lightweight, moulded base plate, secured by stainless steel bolts and incorporating rubber "O" rings seals.
- ④ Optional pressure-relief disc, to comply with IEC 298 Appendix AA, offers the highest levels of safety.
- ⑤ Mechanical ON / OFF position indication visible through clear viewing window from ground level.
- ⑥ Hook stick-operated manual trip and lockout control.
- ⑦ A single moulding supports the three phase vacuum interrupter assembly, magnetic actuator mechanism and one-piece drive beam.
- ⑧ The single coil magnetic actuator is based on a solenoid plunger, held in the tripped or closed position by a permanent magnet.



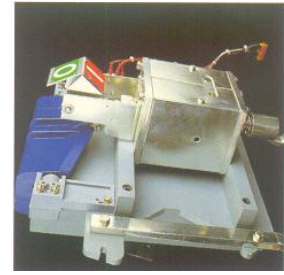
Vacuum bottles in monoblock



Umbilical plug and socket



Position indicator



Magnetic actuator

### Single coil magnetic actuator

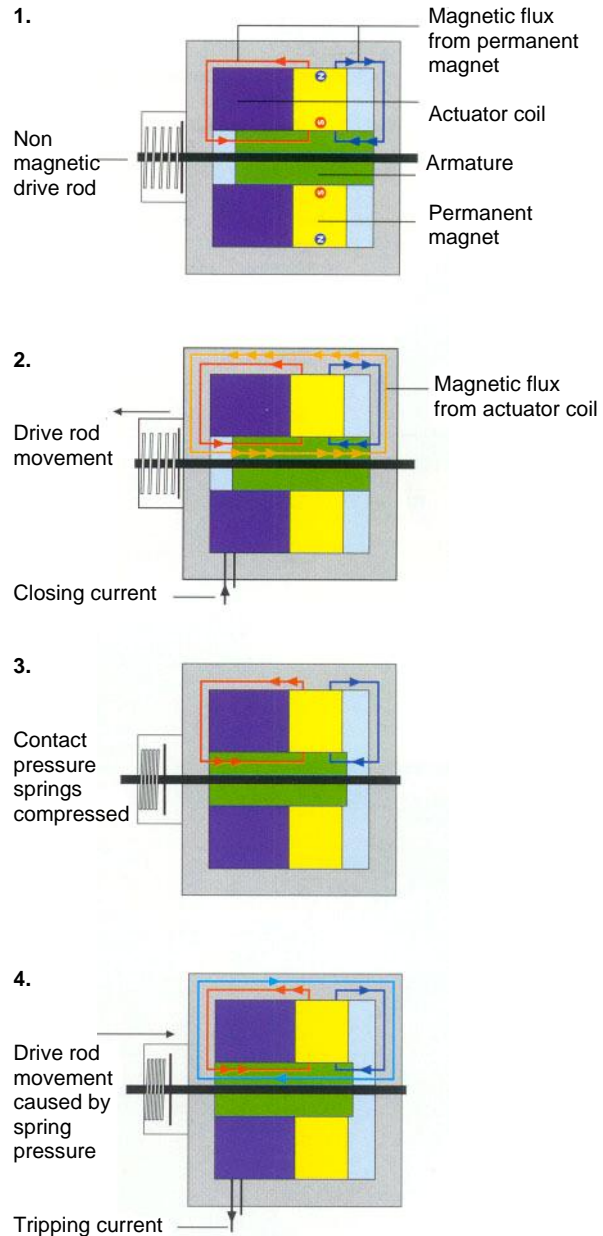
The actuator coil is energised in one direction to power close the GVR and in the opposite direction to open it by de-latching the holding force. This is a unique feature of the single coil actuator design used in the GVR and ensures reliable tripping operation under all battery conditions and even for manual trip.

### Closing

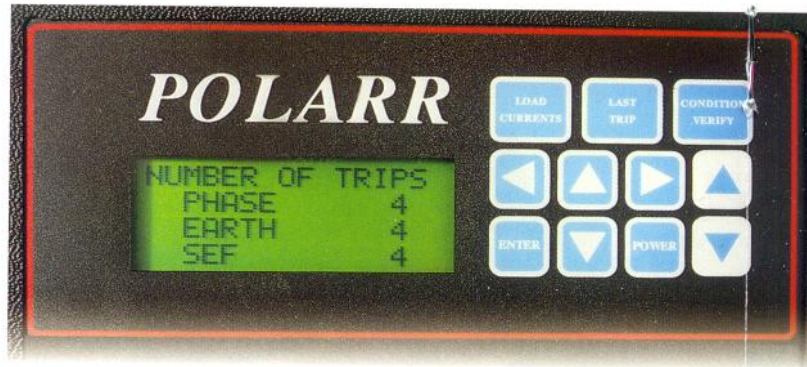
The bi-stable design ensures that the plunger is held back in the open position (1) until the solenoid current rises above the level required to guarantee closure. Once the holding force is overcome (2), the circuit breaker closes positively (3), due to the stored energy in the solenoid and permanent magnets.

### Tripping

The solenoid is energised in the reverse direction (4) to overcome the magnetic hold-on force and de-latch the actuator. Opening is then completed by the energy stored during the closing stroke in the contact pressure and opening springs and is completely independent of the power supply during electrical opening, and of the operator during manual opening. The energy required to trip is approximately 1 / 30<sup>th</sup> of that required to close.



## Stand alone control and protection Polarr



### Principle of operation

The Polarr is the standard relay package for the GVR. It measures the 3 phase and residual currents using CTs located in the GVR, and performs auto-reclosing over current, earth fault and sensitive earth fault protection. The low power, microprocessor architecture of the Polarr is unique to the power industry. Its design has been perfected over several years and offers the user significant benefits through the elimination of the need for any external power supply. In addition to this, the Polarr offers several advanced auto-reclosing functions in a comprehensive but cost effective package.



### Weather protection

The Polarr relay and lithium batteries are housed in a control box located on the pole at ground height underneath the GVR. Connection to the GVR is via an umbilical cable and weatherproof plug and socket that is used to carry the CT currents and the GVR control signals. The IP 67 sealed control box is made from hot dip galvanised steel, with an outer double skinned sun shield of polyester-coated galvalite. It protects against the harshest environment and maintains an even internal temperature keeping the relay condensation-free.

### Lithium batteries

High energy density lithium battery technology makes the GVR with Polarr ideal for applications where an auxiliary power supply is not available.

### Programming protection settings

Protection settings can be programmed via the dot matrix display and keypad or downloaded through the serial port from a hand held PDA or directly from a notebook computer using libraries of settings created in Windows based software.

## Data logging

Historical, diagnostic and load current data can be accessed through the local display or the serial port. The Polarr history is held in non-volatile memory, and includes the time and date of the last 20 sequences together with number of trips in the sequence and fault magnitude of each of the elements.

## Minimum trip currents

The multi-ratio CTs located in the GVR and a wide range of programmable minimum trip settings ensure that the GVR and Polarr can be used at any point in the network, from substation through to the feeder ends with the earth fault currents as low as one ampere.

## Short cut keys

In addition to large, clear control keys, LED indication and a menu-driven display for entering settings and viewing historic data, the front panel also incorporates three push-buttons for instant access to load current, fault target and battery condition information.

## Sequence co-ordination

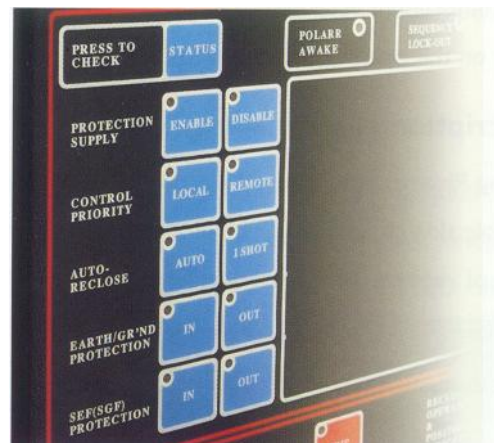
The Polarr's advance sequence co-ordination logic and fast response times of the relay allow co-ordinating delays as low as 60 ms to ensure that only the recloser closest to the fault operates.

## Local control

Push buttons are provided for the standard auto-recloser functions, while separate keys and LED indication are used for the circuit breaker control.

## Remote control

All of these functions are also available through a parallel SCADA port on the back of relay, accessible through a gland plate in the control box. Voltage free contacts and opto-isolated inputs offer a standard interface to a third party RTU of the customer's choice. Alternatively, an enlarged control box to house an RTU and rechargeable battery pack can be provided.



## Operating sequence

Up to 4 trips to lockout are available for over current, earth fault and sensitive earth fault sequences. The time between GVR clearing the fault and reclosing is known as the dead time and is selectable for each trip. If the fault is temporary, the protection will begin to reclaim after reclosing. If the fault is permanent, the GVR will lockout after the last trip. A Cold Load Pickup feature avoids spurious tripping when manually closing onto de-energised loads.

trips to lockout	1 to 4
dead times (s)	0,25 to 180
reclaim times (s)	5 to 180

## Minimum trip settings

The GVR is supplied with multi-tapped protection CTs with ratios of 300/200/100:1. Minimum trip settings selections within the relay ensure suitable operation at any point in a network.

	Polarr
$I > (x I_n)$	0,2 to 3,2
$I_o > (x I_n)$	0,1 to 1,6
$I_{...} > (x I_n)$	0,01 to 0,16

## Time current characteristics

Time current characteristics are programmable for every trip in the sequence. There is choice of time dependant curves of definite time. The curves can be modified using time multipliers, additional delays and minimum response times. Instantaneous protection offers the fastest fault clearing times and can be used with additional delays for sequence co-ordination.

	Polarr
curves (t>)	IEC 255 (IDMTL, VIDMTL, EIDMTL) & McGraw Edison
inst. I >>(x I <sub>n</sub> )	1 to 20-krát

## Accessories

### Optional extras

- surge arrestors for lightning protection
- aluminium bushing conductor material
- fully insulated HV joint boots
- pressure relief device for internal arc withstand to EATS 41-27 & IEC 298 appendix AA
- metering CTs
- SF<sub>6</sub> pressure sensor and indication
- umbilical lead length
- user programmable protection curves

### Accessories

- Psion hand held terminal for data input and retrieval
- software and RS 232 cable for data input, retrieval and storage using IBM PC
- portable test set
- dummy sealing plug for use when umbilical lead disconnected from housing
- gas filling equipment
- hand held pressure gauge
- SF<sub>6</sub> gas detector

### Accuracy

- protection: ± 5% of time to IEC 255
- instrumentation: ± 5 % standard with capacitive voltage dividers or option for ± 2 % with separate VT