OVR Three Phase Recloser 15 kV - 38 kV
Descriptive Bulletin
Always a Generation Ahead

ABB continually strives to bring customers the latest technological advances and superior performance. This is especially true of our feeder automation product line, where we are able to leverage our knowledge, experience and R&D through a common set of building blocks. These building blocks give our customers modularity and flexibility to obtain a product for today’s requirements, while allowing for future upgrades. The ABB OVR recloser is able to meet present recloser demands, plus offer advanced capabilities such as fault location, adaptive protection, control monitoring, power quality, communications, single phase tripping and loop control for tomorrow’s needs.
Industry Regulators

Industry regulators, or Public Utility Commissions, are increasingly considering performance-based regulation mechanisms, which explicitly state reliability penalty targets. These regulatory commissions are monitoring several indices such as:

- System Average Interruption Frequency (SAIFI)
- System Average Interruption Duration (SAIDI)
- Momentary Average Interruption Frequency (MAIFI).

These indices are accompanied by financial bonuses or penalties that directly impact the utility's bottom line.

Utilities are receiving pressure to improve reliability from three stakeholders:

- customers
- industry regulators
- company owners

Customers

Customers expect a level of reliability equal to, or better than, the reliability they have had. Furthermore, an increasing number of customers are operating businesses, which are sensitive to reliability and service quality.

Company Owners

Shareholders or company owners expect suitable rates of return. All capital, operational and maintenance expenditures are selected to maximize results.

Improved Distribution System Reliability

Conventional methods for improving system reliability include tree trimming, animal guards, lightening protection, and maintaining problem circuits. However, many of today's utilities are moving toward specialized system configurations, such as midpoint reclosers, tie reclosers, loop configurations, and single phase reclosing to improve reliability. These configurations, combined with remote communication, can substantially improve reliability indices, subsequently enhancing customer service and maximizing shareholder value.
Benefits of High Voltage Unit

- Compact, lightweight design for easy installation
- Superior life - rated for 10,000 operations
- Environmentally friendly - no oil or gas
- HCEP encapsulating material reduces weathering erosion and outdoor aging, improving life expectancy
- Vacuum interruption for maximum reliability and minimum maintenance
- Magnetic actuation with fewer moving parts and less maintenance
- Stainless steel enclosure to prevent corrosion in harsh environments
Benefits of Control Unit

- Simple, menu-driven programming for easy use
- Hot line tagging feature on faceplate for simple and safe operation
- Easy access front RS-232 port
- Button on front panel (Counters) for easy access to operational data
- Over 50 protection curves and 3 user programmable curves for superior coordination
- Single phase tripping option reduces outages
- Optional loop control module for fast restoration of distribution systems
- Fault location reduces outage time
- Convenient GFI receptacle for powering laptop
- Power quality software records voltage sags, swells and interruptions
- 304 stainless steel enclosure prevents corrosion in harsh environments
- Ample space for mounting communications equipment to save installation time and money
- UPS module allows wide range of control voltage input (85 - 265 VAC/DC)
Reliability by Design

**Pole assembly**
- Resistant to vandalism
- Maintenance free: tested to 10,000 mechanical operations without degradation
- Few moving parts
- High creepage pole design (38 inches to ground)
- Easy to replace individual poles
- Superior HCEP encapsulating material for outdoor applications

**Insulating material**
- Advanced epoxy (HCEP) encapsulating material
- Light weight for easy handling
- Increased weather durability and improved aging
- Improved performance in heavily polluted areas

**Vacuum interrupters**
- Maximum reliability
- Design ensures superior contact wear and long life
- Superior life: 10,000 load operations
- Minimal maintenance
- Environmentally friendly

**Integrated sensors**
- Provides required signals for current protection, metering and data gathering
- Sized for superior response up to the full-rated fault current
- Reliable and accurate data for waveform analysis
- One sensor per phase

**Mechanical trip**
- Pulling yellow handle down will mechanically open all three poles of the OVR unit
- Lockout function is conveniently performed using the available hot-line tagging switch on the OVR control unit
- Optional close block feature for manual trip
Position switch
- One per pole
- Determines pole open or closed positions
- Allows independent pole operation
- Provides positive pole position feedback to the OVR control unit
- Double break, galvanically separate contacts
- Self-cleaning contact points by wiping action
- Gold contacts for low currents and voltages at low contact transfer
- Transparent green housing allows the contact position and internal mechanism to be easily viewed

Magnetic actuators
- Increased reliability - rated to 10,000 operations
- Simple design
- Bi-stable - no power required to hold contacts open or closed
- Few moving parts mean low maintenance and high reliability
- Three individual actuators eliminate complicated linkages

Open/Close indicators (on bottom)
- Individual phase position indicators
- Highly visible from the ground
- Large and easy to view
- Open/close symbols
- Reflective so the position can be seen at night with a flashlight

Outdoor cabinet
- 304 stainless steel enclosure prevents corrosion
- Eliminates environmental and maintenance concerns of oil or gas
- Option for up to six voltage inputs into the high voltage cabinet eliminates the need to run cables to the low voltage cabinet
- Shunt resistors allow for disconnecting control cable without open circuiting current sensors
Innovative Pole Design Leads to Reliability

- Improved Interrupter
- Advanced Design Technology
- Cutting Edge Material

ABB Vacuum Interruption: Improved Interrupter

ABB has been developing and manufacturing vacuum interrupters since the early 1980's. Worldwide, more than one million ABB vacuum interrupters are in service. ABB's vacuum interrupter facility uses the latest technologies in high quality mass production to produce the next generation of vacuum interrupter. This new generation vacuum interrupter is robust for universal application.

Vacuum interrupters are compact, maintenance-free, with a long service life, and excellent environmental compatibility. Vacuum technology fits very well with the recloser requirements since it can easily handle frequent operations. Additionally, vacuum interrupters do not need any extra time to recover, so even the first reclosing operation (after 100-300 msec) is not a problem.

3D Modeling: Advanced Design Technology

Advances in simulation software allow for the virtual design and testing of poles and actuators prior to any actual manufacturing and testing. This gives ABB the ability to use 3D electrostatic modeling on the poles to design improvements, minimize partial discharge and construct dielectrically robust poles. This design process minimizes the risk of field failures over the life of the product.
Taking a lead from nature.

Reliability by Design

HCEP: Cutting Edge Insulating Material

The OVR insulating material is Hydrophobic Cycloaliphatic Epoxy (HCEP). HCEP is the next generation of Cycloaliphatic Epoxy (CEP).

Hydrophobicity means resistance to water. It is advantageous for outdoor applications because it prevents water from developing completely wetted, resistive conductive surfaces. Leakage currents are therefore reduced, which helps to reduce the flashover risk. The result is enhanced reliability. Furthermore, less discharge activity means less attack and therefore less surface erosion, improving insulators’ life expectancy.

From CEP to HCEP

<table>
<thead>
<tr>
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<th>CEP</th>
<th>HCEP</th>
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<tbody>
<tr>
<td>Design versatility</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Manufacturing process</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>No. of interfaces</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Animal attack</td>
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<td>+</td>
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<tr>
<td>Hydrophobicity</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Thermal shock resistance</td>
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<td>+</td>
</tr>
<tr>
<td>Low flash-over probability</td>
<td>0</td>
<td>+</td>
</tr>
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</table>

Advantages of HCEP over CEP

- Improved performance in heavily polluted areas
- Improved weatherability and outdoor aging
- Increased life expectancy
- Enhanced reliability

Why do we need Hydrophobicity?

- Improved water beading and runoff
- Lower leakage currents
- Less discharge activity
- Lower flash-over probability
- Less erosion
- Better reliability
- Improved life expectancy
Reliability by Design

PCD Control Unit

1 Local human-machine interface
   - Enlarged LCD (1” x 5”) with large characters (two lines of 20 characters)
   - Simple menu-driven programming using large six-button keypad
   - Backlit display indicates metering values, fault information and location
   - Temperature compensated

2 Indicator lights
   - Continual self-checking with status indication
   - Pickup and lockout indication

3 Front panel pushbuttons
   - Remote or local selection between three setting groups: Primary, Alternate 1 (Alt 1) and Alternate 2 (Alt 2)
   - Front panel button to set Alt 1 settings
   - Ground blocked, remote blocked, and reclose blocked pushbuttons
   - Sensitive Earth Fault (SEF) is optional, recommended for ungrounded or Delta CT applications
   - PROG 1 battery test feature preprogrammed
   - User programmable LEDs for alarms, additional targets, etc.
   - Counters button for easy access to number of operations and overcurrent trip information

4 Hot line tagging feature
   - On faceplate for simpler and safer operation
   - Can be mapped for multiple applications

5 Front mounted RS-232 port
   - Independent from rear mounted RS-232 port
   - Easy download and upload of data on-site using WinPCD

6 Separate open and close pushbuttons
   - Separate indicator light for easier viewing
   - ANSI or IEC coloring for individual practices
Control cabinet
- 304 stainless steel cabinet, NEMA 3R with drip shield
- Battery provides full operational capability for 48+ hours
- Ample space for mounting communications equipment
- Single-point latching with padlockable handle
- Vented design

GFI
- Ground fault receptacle provides AC power for a laptop

Communication & I/O ports
- Isolated RS-232 and RS-485 ports
- ST fiber optic ports for interference-free communication; fiber optic signals are fully regenerated at each unit for successful daisy chaining
- Programmable I/O ports: 6 inputs, 4 outputs standard with UPS
- Programmable I/O ports: 10 inputs, 7 outputs standard with PS
- Field upgradeable to meet future communication requirements

Loop Control Module (optional)
- Speeds restoration on distribution power systems
- Reduces the number of outages
- Compatible with the PCD
- Isolates the faulted section
- Sectionalizes or removes the faulted section from the distribution system
- Algorithm detects loss and restoration of voltage
- Works in single and three phase mode
- Includes direct access to alternate 2 settings
- Ability to monitor/accept six voltage inputs

Single phase tripping (optional)
- Reduces unnecessary three phase interruptions and outages due to single phase faults
- Single phase tripping options of only picked up phases (OPUP) or one or all phases (OOAP)
- Each step of reclose cycle can be individually configured to single or three phase trip or lockout for optimum coordination

Oscillographic data
- Storage capacity of 64 cycles of monitored waveform data at 32 samples per cycle
- All data can be downloaded on-site or remotely through communication interfaces

Fault recording
- Records last 128 operations of:
  - phase and ground fault amperes
  - phase and ground voltage
  - tripping element
  - reclose time
  - distance to fault
  - estimated fault resistance
  - time stamp
- Stores 512 operation records
Remote communications
- RS-232 port includes RTS/CTS handshaking
- Modbus ASCII and RTU, and DNP 3.0™ protocols included with all units
- DNP 3.0™ is compliant to Level 2

Fault location*
- Patented algorithm estimates fault impedance and computes apparent distance to fault
- Works in background mode to maintain protection integrity
*requires homogeneous distribution line, three phase voltage source, and does not apply in single phase tripping mode

Power quality**
- Records voltage sags, swells and interruptions
- Implemented per ANSI/IEEE Std. 1159 and includes programmable voltage thresholds
- Triggers oscillographic capture
**three phase voltage source required

Metering
- Meters current and voltage (with voltage input supplied) to ±1% accuracy
- Measures kW and kVARh, power factor, demand Watts and VARs, and frequency to ±2% accuracy
- User-selectable load profile data sampling 5, 15, 30, 60 minute time internal which will contain 13.3, 40, 80 or 160 days of information
- All data can be downloaded on-site or remotely through communications interface

Protective functions
- Phase time overcurrent protection (51P)
- Phase instantaneous overcurrent protection (50P-1)
- Two definite time overcurrent settings (50P-2, 50P-3)
- Ground overcurrent protection (51N)
- Ground instantaneous overcurrent protection (50N-1)
- Two definite time ground overcurrent settings (50N-2, 50N-3)
- Negative sequence overcurrent protection (46)
- Phase and ground directional overcurrent protection (67P, 67N)
- Two independent steps for load shed, restoration, and over-frequency (81S, 81R, 81O)
- Undervoltage and overvoltage control and alarm (27/59)
- Up to four reclose cycles (define a recloser cycle 79-1 --> 79-5) close four times / trip five
- Adaptive reclosing shots: each reclose sequence allows independent programming
  of protective functions
- Sensitive Earth Fault protection with directional features (optional)
- Available with up to 38 recloser curves, nine ANSI curves, four IEC curves and three user programmable curves

Adaptive protection
- Three independent protection groups
- Zone sequence coordination
- Cold load pick-up
- Reverse power reconfiguration (32P, 32N)
In today's utility environment, distribution system reliability is becoming more important. There are several indices developed for reliability of service that utilities account for and track. These indices include System Average Interruption Frequency Index (SAIDI), System Average Interruption Duration (SAIDI), and Momentary Average Interruption Frequency Index (MAIFI). Currently, most utilities are measured by the Public Utilities Commission to assure they meet a minimum requirement with respect to these indices. These measurements are being utilized to assess penalty/performace-based rates at the utilities, making it is necessary to achieve higher reliability. Below are some examples of how current technology can improve reliability and reduce system outages.

### Case 1: Typical Distribution Line (with reclosing relay)

- **SAIDI:** 3.3 hrs/yr
- **SAIFI:** 1.6 int/cust/yr
- **MAIFI:** 8.7 mom/yr

### Single Phase Tripping

The OVR recloser is the first of its kind in the industry. It includes fast acting, maintenance free, independent-pole, magnetic actuation instead of a ganged-pole mechanism. The single phase tripping option is flexible by design in order to meet virtually all current and future customer needs.

The three global modes available are:

1. Three phase tripping
2. Single phase tripping OPUP (only picked up phases trip)
3. Single phase tripping OOAP (one or all phases trip)

Each step of the reclose cycle can be individually configured to single or three phase trip to lockout for each of the protective functions. Two common examples would be:

1. The recloser is set to trip on single phase and lockout on all three phases if fault is permanent.
2. The recloser is set up to both trip and lockout on single phase.

### Case 2: Three Phase Midpoint Recloser without Single Phase Tripping

- **SAIDI:** 2.6 hrs/yr (21% reduction)
- **SAIFI:** 1.2 int/cust/yr (25% reduction)
- **MAIFI:** 6.5 mom/yr (25% reduction)

### Three Phase Midpoint Recloser with Single Phase Tripping

- **SAIDI:** 2.3 hrs/yr (30% reduction)
- **SAIFI:** 1.1 int/cust/yr (31% reduction)
- **MAIFI:** 5.4 mom/yr (38% reduction)
Loop Control

ABB's Loop Control Module (LCM) is completely compatible with the PCD. The LCM detects either normal voltage or loss of voltage, from one or two sources. It initiates preprogrammed logical steps to isolate the faulted section, depending upon the voltage configuration and feeder location.

The LCM provides a loop control function to sectionalize or remove the faulted section from the distribution system. This control module provides sectionalizing control of either a recloser or a switch, and restores the distribution system by closing the tie-point recloser from another electrical source.

The LCM allows individual reclosers to act as a sectionalizer, midpoint or tie, without physical connections to other reclosers, allowing it to be installed in existing feeder automation systems.

<table>
<thead>
<tr>
<th>Case 3: Loop Configuration without Single Phase Tripping</th>
<th>Loop Configuration with Single Phase Tripping</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAIDI: 2.1 hrs/yr (36% reduction)</td>
<td>SAIDI: 1.8 hrs/yr (45% reduction)</td>
</tr>
<tr>
<td>SAIFI: 1.0 int/cust/yr (37% reduction)</td>
<td>SAIFI: 0.8 int/cust/yr (50% reduction)</td>
</tr>
<tr>
<td>MAIFI: 6.8 mom/yr (22% reduction)</td>
<td>MAIFI: 3.1 mom/yr (64% reduction)</td>
</tr>
</tbody>
</table>

**Application Summary**

The OVR's feature sets are well-suited for these specialty applications. Through the use of single phase tripping and loop control schemes, utilities can reduce their yearly outage time up to 45%.
Excellent Customer Support

OVR

Customer Support:
• Free 24-7 technical support line
• Feeder Automation Users website features:
  - News
  - Frequently Asked Questions
  - Discussion Board
  - Technical Information
  - Product Brochures
  - Software Downloads
  - Contact Information
  - Instruction Manuals
  - Programming Shortcuts
  - Drawings
• Training
  - Multi-Track Factory Based Training
    • Lineman Track
    • Engineering Track
  - Multi-Track Field Based Training
    • Lineman Track
    • Engineering Track
  - Mobile Training Aids
    • Unique tool incorporates a complete VR-3S and PCD with the LCM and simulates loop schemes using four PCDs with LCMs to visually demonstrate the schemes. Simulation can be tailored to customer specific schemes to provide the greatest benefit.
    - PCD Training Aids with Simulators
      • Includes a PCD with a simulator box
      • Enables tabletop practice and simulation of the PCD
• Three Year Warranty
### OVR ratings

<table>
<thead>
<tr>
<th>Nom. operating voltage:</th>
<th>2.4-14.4</th>
<th>24.9</th>
<th>34.5</th>
<th>kV</th>
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<tbody>
<tr>
<td>Max. design voltage:</td>
<td>15.5</td>
<td>27</td>
<td>38</td>
<td>kV</td>
</tr>
<tr>
<td>Max. continuous current:</td>
<td>630/800*</td>
<td>630/800*</td>
<td>630/800*</td>
<td>A</td>
</tr>
<tr>
<td>Max. interrupting current:</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>kA</td>
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<tr>
<td>BIL:</td>
<td>110/125*</td>
<td>125</td>
<td>170</td>
<td>kV</td>
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<td>Dry withstand 60 Hz 1 Min.:</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>kV</td>
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<tr>
<td>Wet withstand 60 Hz 10 Sec.:</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>kV</td>
</tr>
<tr>
<td>Phase Spacing:</td>
<td>15.50 (394)</td>
<td>15.50 (394)</td>
<td>15.50 (394)</td>
<td>inches (mm)</td>
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<tr>
<td>External creep distance, H2-ground:</td>
<td>38.00 (960)</td>
<td>38.00 (960)</td>
<td>50.70 (1288)</td>
<td>inches (mm)</td>
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<tr>
<td>External creep distance, H1-H2:</td>
<td>45.00 (1160)</td>
<td>45.00 (1160)</td>
<td>49.8 (1260)</td>
<td>inches (mm)</td>
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<tr>
<td>Min. external strike distance:</td>
<td>9.5 (240)</td>
<td>9.5 (240)</td>
<td>14.4 (367)</td>
<td>inches (mm)</td>
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<td>Max. interrupting time:</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
<td>sec max</td>
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<tr>
<td>Max. closing time:</td>
<td>0.060</td>
<td>0.060</td>
<td>0.060</td>
<td>sec max</td>
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</tbody>
</table>

- Materials: Vacuum interrupter encapsulated in hydrophobic cycloaliphatic epoxy with 304 stainless steel cabinets
- Current sensors: One per phase encapsulated into the pole
- Operating temperature: -40° to +70° C
- Control voltage: 85 - 265 VAC-DC with UPS; 24, 48, 125, 250 VDC with PS

#### Battery
- Sealed lead acid rechargeable battery pack
- Monitor locally and remotely
- Easily accessible for changing
- Allows for 48+ hour carryover and multiple operations upon loss of power
- Includes capacitor backup for battery assistance

#### Summary specifications

- Accuracy:
  - Voltage: ± 1% accuracy
  - Current: ± 1% accuracy

- Load profile data (requires voltage input):
  - kWh and kVARh (± 2% accuracy)
  - Power Factor
  - Demand Watts and VARs
  - Frequency

#### OVR testing

- ANSI: Meets all applicable recloser standards (ANSI 37.60, IEEE, IEC and NEMA)
- Life test: 10,000 mechanical operations without degradation

#### PCD testing

- Transient Immunity:
  - Surge Withstand Capability: SWC and fast transient tests per ANSI C37.90.1 and IEC 255-22-1 class III and 255-22-4 class IV for all connections except comm ports
  - Isolated comm ports per ANSI 37.90.1 using oscillatory SWC Test Wave only, and per IEC 255-22-1 class III
  - EMI test per ANSI C37.90.2

* available optional ratings
## Pole Mounted Dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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<tbody>
<tr>
<td><strong>15 &amp; 27 kV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>in</td>
<td>49.82</td>
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<td>11.10</td>
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<td>38.01</td>
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<td>1265.45</td>
<td>1060.45</td>
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<td>965.51</td>
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<tr>
<td><strong>38 kV</strong></td>
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<td>in</td>
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### Substation Mounted Dimensions

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<th>D</th>
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