**Typical Specification**

**Single-Phase Two-way Solid Dielectric Fault Interrupter with Visible Break**

**Part 1-GENERAL**

* 1. **DESCRIPTION**

The switch shall consist of a solid dielectric insulated manually operated resettable vacuum fault interrupter electronically controlled. The switch shall include a blade type switch incorporated within the solid dielectric module to provide a visible break of the circuit.

* 1. **QUALITY ASSURANCE**
1. Manufacturer Qualifications: The chosen manufacturer shall have at least 10 years experience in manufacturing solid dielectric insulated medium voltage switchgear. The manufacturer shall be completely and solely responsible for the performance of the fault interrupter as rated.
2. The manufacturer shall furnish certification of ratings of the fault interrupter upon request.
3. The switch shall comply with requirements of the latest revision of applicable industry standards, including:

IEEE C37.74, IEEEC37.60, ANSI/IEEE 386, IEC60529, IEEE 592

1. The switch shall be tested to IEC 60529 for submersibilty. The switch shall be rated IP68 for 20 days with a 20 foot head of water.
2. The switch manufacturer shall be ISO 9001 and 14001 certified.
3. The switch shall be RUS approved
	1. **DELIVERY, STORAGE, AND HANDLING**
4. The fault interrupter shall be shipped preassembled at the factory. No field assembly shall be required.
5. The contractor, if applicable, shall handle, transfer and move the switches in accordance with manufacturer’s recommendations.

**PART 2-PRODUCTS**

**2.1 SWITCH CONFIGURATION**

1. The interrupter shall be a two way device
2. The interrupter shall be designed for front access to cables and operators
	1. **SWITCH CONSTRUCTION**
3. The interrupter shall be a dead-front design. The operating mechanism housing shall be stainless steel with a viewing window for verification of vacuum interrupter contact position. The housing shall be painted ANSI 70 light gray using corrosion-resistant epoxy paint. Operating handles shall be padlockable and adaptable to keylock schemes. The operating shaft shall be stainless steel providing maximum corrosion resistance. A double "O" ring shaft seal shall be used for a leak resistant, long life seal.
4. The solid dielectric module must be coated with a semi-conductive layer of epoxy, providing a completely dead front device. The semi-conductive layer must be tested to IEEE 592 to ensure it can carry fault current to ground so as to ensure operator safety.
5. The interrupter shall be designed for long term operation in the harshest environments. The interrupter design must be tested to IEC60529 and achieve a protection rating of IP68, subjected to a 20’ head of water pressure for 20 days.
6. The interrupter shall be equipped with an integral blade type disconnect switch incorporated within the solid dielectric module to provide a true visible break. The Visible Break Switch shall be in series with the vacuum interrupter and provide a clear visible break of the circuit. The visible break must be easily seen through a viewing window molded as an integral part of each solid dielectric module.

1. The interrupter shall interrupt all load and fault currents within the vacuum bottle. The interrupter shall include two mechanical interlocks, one external and one internal, for safe operation.
2. The fault interrupter mechanism shall consist of a vacuum bottle assembly mechanically linked to a spring-assisted operating mechanism. A current transformer and associated secondary leads are to be completely encapsulated within the solid dielectric interrupter module, protecting them from environmental conditions. The CT is dual ratio and preset for either 500:1 or 1000:1. Manual opening and closing of the interrupter shall be via an operating handle. The mechanical linkage assembly shall provide for a "trip- free" operation, which allows the fault interrupter to electrically open in the event of a fault, independent of any movement of the operating handle.

**2.3 DESIGN RATINGS**

A. The fault interrupter shall be rated:

|  |  |
| --- | --- |
|  |  |
| Maximum Design Voltage, kV | 15.5 |
| Impulse Level (BIL) Voltage, kV | 95 |
| Continuous Current, Amperes | 630 |
| Load break Current, Amperes | 630 |
| One Minute Withstand (dry), AC kV | 35 |
| Production Test Rating | 34 |
| Symmetrical Interrupting Rating, kA | 12.5 |
| Asymmetrical Interrupting Rating, kA | 20 |
| Interrupter Mechanical Endurance, Operations | 2000 |

 IEEE C37.60 Fault Interrupting Duty

|  |  |  |
| --- | --- | --- |
| **Percent of Maximum Interrupting Rating** | **Approximate Interrupting: Current, Amps** | **No. of Fault: Interruptions** |
| 15-20% | 2000 | 44 |
| 45-55% | 6000 | 56 |
| 90-100% | 12500 | 16 |
| Total Number of Fault Interruptions: 116 |

**2.4 CABLE ENTRANCES**

Cable entrances shall be tested to IEEE 386 and be, as indicated on the switch drawing:

\_\_\_\_ 15.5KV 95KV BIL 600A Dead break Apparatus Bushings per IEEE 386 Figure 11

 \_\_\_\_15.5KV 95KV BIL 200A Bushing Wells per IEEE 386 Figure 3

**2.5 VACUUM INTERRUPTER CONTROL**

An electronic control shall be provided to monitor load and fault current on the interrupter. The current transformer encapsulated within the solid dielectric modules provide control power and current sensing. No external power source shall be required for overcurrent protection. Operational temperature range of the control shall be -40°C to +65°C. Maximum time for power up and ready to trip when closing on a circuit shall be ten percent of the trip time or 1/2 cycle, whichever is greater. Trip selection may be made with the interrupter energized. The range of Phase Overcurrent minimum trip settings shall be 15-300A (500:1 CT) or 30-600A (1000:1 CT) (the specifier must choose one)

*Select one of the following controls:*

Type 5

The Type 5.0 Vacuum Interrupter Control shall allow for the initiation of a trip command to the vacuum interrupter after executing a time delay corresponding to the monitored phase current. The Type 5.0 Vacuum Interrupter Control shall be designed to emulate the time current characteristics (TCC) of an oil fuse cutout fuse link and shall be factory preset to a single trip level.

Type 7 EZSet

The control shall include 30 Time Current Characteristic (TCC) curves. All setting options shall be inputted via a computer. The control shall allow for multiple TCC curve modification options, including Instantaneous Trip, Inrush Restraint, and Phase Time Delay. The control shall include a Sequence of Events Recorder (SER) which shall record the last 16 causes of trip. The control programming software shall include password protection, the ability to download the SER, and the ability to save and print setting files. Switches equipped with a Type 7 control shall include a 6’ programming cable that is submersible, and suitable for permanent attachment to the interrupter while in service. The programming cable shall allow the user to stand up to 6’ away from the device during programming.

Type 7 Plus

The control shall include 60 pre-loaded and 5 user created time current characteristic (TCC). All setting options shall be accomplished using a computer. The control shall allow for multiple curve modification options for each minimum trip setting including Instantaneous Trip, Inrush Restraint, and Phase Time Delay. The control shall allow for two settings groups (protection and alternate). The control shall include a Sequence of Events Recorder (SER) which shall include the last 16 causes of trip. The control programming software shall include password protection, the ability to download the SER, and the ability to save and print setting files. Switches equipped with a Type 7 control shall include a 6’ long programming cable extension that is submersible and capable of permanent attachment to the device while in service.

**2.6 FACTORY PRODUCTION TESTS**

Each interrupter shall undergo the following production testing. Test reports must be available upon request

* A mechanical operation check
* AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts
* Circuit resistance shall be checked.
* Each solid dielectric module shall undergo an X-ray inspection and a partial discharge test to ensure void-free construction.
* Leak test to insure the integrity of all seals and gaskets
* Primary current injection test to test CTs, trip mechanism, and electronic control

**2.7 STANDARD COMPONENTS**

The following shall be included as standard:

* Welded stainless steel mechanism housing painted light gray with stainless steel and brass fasteners.
* Lifting provisions
* ½”-13 nuts to provide sufficient grounding provisions for interrupter and all cable entrances.
* Stainless steel one line diagram and corrosion-resistant nameplates.
* Switch operating handle with padlock provision.
* Removable parking stands
* Mounting bracket
* Operating handles for the vacuum interrupter and for the visible break switch, secured with cotter pins, and suitable for operation via rope or hot stick

**2.8 OPTIONS**

(Choose as necessary for the application)

The following options shall be supplied:

* Mounting frame to bolt switch to the floor (specify galvanized or stainless steel construction. Specify height of lowest bushing)
* 4/0 brass ground lugs
* One (1) Form C contact for remote monitoring of the position of the vacuum bottle contact.
* Junction box for wiring Form C contact (specify NEMA 4X for dry applications or NEMA 6P for wet/damp applications)
* Motor operator package – includes motor operator, portable motor control, & 50 foot cable.

**2.9 LABELING**

A. Hazard Alerting Signs

The exterior of the pad mount enclosure (if furnished) shall be provided with “Warning--Keep Out--Hazardous Voltage Inside--Can Shock, Burn, or Cause Death” signs. Each unit of switchgear shall be provided with a “Danger--Hazardous Voltage--Failure to Follow These Instructions Will Likely Cause Shock, Burn, or Death” sign. The text shall further indicate that operating personnel must know and obey the employer’s work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment. Each unit of switchgear shall be provided with a “Danger--Keep Away--Hazardous Voltage--Will Shock, Burn, or Cause Death” sign.

B. Nameplates, Ratings Labels, and Connection Diagrams

Each unit of switchgear shall be provided with a nameplate indicating the manufacturer’s name, catalog number, model number, date of manufacture, and serial number. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault interrupter ratings including interrupting and duty-cycle fault-closing; and load break switch ratings including duty-cycle fault-closing and short-time.