VAULT VPVI, TWO POSITION, LINEAR PUFFER SWITCHGEAR

PART 1- GENERAL

1.1 DESCRIPTION
A. The switch shall consist of manually operated load interrupting, SF6 insulated, 600A linear puffer switches and manually operated vacuum interrupter fault interrupting tap switches, electronically controlled.

1.2 QUALITY ASSURANCE
A. Manufacturer Qualifications: The chosen manufacturer shall have at least 20 years experience in manufacturing SF6 insulated medium voltage switchgear. The manufacturer of the switches shall be completely and solely responsible for the performance of the load break switch and fault interrupter as well as the complete integrated assembly as rated.

B. The manufacturer shall furnish certification of ratings of the load break switch, fault interrupter and the integrated switch assembly upon request.

C. The switch shall comply with requirements of the latest revisions of applicable industry standards, including:
   (a) IEEE C37.71, IEEE C37.74, IEEE C37.60, IEEE 386, IEC 60265-1


1.3 DELIVERY, STORAGE, AND HANDLING
A. Load break switches and fault interrupters shall be shipped preassembled at the factory. No field assembly shall be required.

B. The contractor, if applicable, shall handle, transfer and move the switches in accordance with manufacturer's recommendations.

PART 2- PRODUCTS

2.1 SWITCH CONFIGURATION
A. Each switch shall be equipped with 3-phase load switch ways, (quantity) 3-phase vacuum interrupter tapped way(s) with gang linked operating handles, and single phase vacuum interrupter tapped way(s) with individual operating handles, as indicated on the one-line diagram.

B. Switches shall be designed for front access to cables and operators.

2.2 SWITCH CONSTRUCTION
A. General
All switch components and entrances shall be assembled in a totally welded mild steel tank. Entrances shall be internally connected by copper conductors capable of handling momentary and continuous current duty. The switch shall contain no electrically floating metallic parts or components. Construction shall be a deadfront design. Switch tanks shall be painted ASA70 light gray using a corrosion-resistant epoxy paint.
B. Load Break Switch
Each switching way is to be equipped with an internally mounted operating mechanism capable of providing quick-make, quick-break operation in either switching direction. The mechanism must be capable of delivering sufficient torque and shall be provided with latches for each position to assure load interrupting, fault closing and momentary ratings. All switch positions are to be clearly identified, padlockable and adaptable to keylock schemes. The operating mechanism shall be actuated from outside the switch tank with an operating handle. The operating shaft shall be made of stainless steel providing maximum corrosion resistance. A double "O" ring type operating shaft seal shall be used for a leak resistant, long life seal. Switch contacts shall be a tulip-bayonet design and made of plated, high-conductivity copper alloy with arcing tips of copper/tungsten alloy to assure permanent low resistance and to avoid sticking during operation. The contacts shall be designed such that arcing does not occur in the area of main current interchange and contact pressure will increase with increased current flow. The stationary contacts shall be supported independent of the cable entrance bushings, eliminating possible misalignment. The contact nozzle shall have a converging/diverging geometry which improves the flow of SF6 into the arc zone. Contact travel shall be a minimum of 3 inches and have sufficient open contact separation to assure efficient arc extinction and to withstand field DC testing levels and maintain BIL levels. Switch contacts shall be clearly visible in the open position through viewing windows. Auxiliary blades used for load interruption are not acceptable.

C. Vacuum Interrupters
The vacuum interrupter shall consist of vacuum bottles and a spring-assisted operating mechanism. The mechanism used shall be designated Model VI for single or three phase operation. The mechanism consists of a single vacuum bottle mechanically linked to a spring-assisted operation mechanism. For three phase operation, the single phase mechanisms are mechanically linked externally with an operating handle assembly. The vacuum interrupter operating mechanism shall consist of the support assembly, linkage, spring latch mechanism, and solenoid utilized for electronic tripping. Maximum interrupting time shall be three cycles (50 msec). The movable contact shaft shall be flagged to indicate the contact position, open or closed. This contact position indicator shall be fully visible through viewing windows supplied in the switch tank. Each tap phase is to be equipped with an individual 600A vacuum interrupter fully enclosed in an SF6 insulated switch tank. Electrical opening shall be by a solenoid that is activated from sources external to the switch tank. Closing (reset) of the vacuum interrupter shall be mechanical with the use of an external operating handle. The mechanical linkage assembly shall provide for a "trip-free" operation which allows the vacuum interrupter to interrupt independent of the operating lever.

2.3 DESIGN RATINGS

A. Load Break Switches
The switch shall be rated (choose appropriate column):

<table>
<thead>
<tr>
<th>SELECTION OF RATINGS</th>
<th>IEEE/IEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Design Voltage, kV</td>
<td>15.5 27 38</td>
</tr>
<tr>
<td>Impulse Level (BIL) Voltage, kV</td>
<td>110 125 150</td>
</tr>
<tr>
<td>Continuous Current, Amperes</td>
<td>630 630 630</td>
</tr>
<tr>
<td>Load break Current, Amperes</td>
<td>630 630 630</td>
</tr>
<tr>
<td>One Minute Withstand (dry), AC kV</td>
<td>34 40 50</td>
</tr>
<tr>
<td>Production Test Rating</td>
<td>34 40 50</td>
</tr>
<tr>
<td>15 Minute Withstand, DC kV</td>
<td>53 78 103</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Momentary Current, kA, ASYM</td>
<td></td>
</tr>
<tr>
<td>Fault-Close Current, kA, ASYM</td>
<td>40</td>
</tr>
<tr>
<td>One Second Current, kA, SYM</td>
<td>25</td>
</tr>
<tr>
<td>Load Break Operations at 600 Amperes</td>
<td>1200</td>
</tr>
</tbody>
</table>

B. Vacuum Interrupters

The vacuum interrupter assembly shall be rated *(choose appropriate column)*:

<table>
<thead>
<tr>
<th>SELECTION OF RATINGS</th>
<th>IEEE/IEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Design Voltage, kV</td>
<td>15.5</td>
</tr>
<tr>
<td>Impulse Level (BIL) Voltage, kV</td>
<td>95</td>
</tr>
<tr>
<td>Continuous Current, Amperes</td>
<td>600</td>
</tr>
<tr>
<td>Load break Current, Amperes</td>
<td>600</td>
</tr>
<tr>
<td>One Minute Withstand (dry), AC kV</td>
<td>34</td>
</tr>
<tr>
<td>Production Test Rating</td>
<td>34</td>
</tr>
<tr>
<td>Symmetrical Interrupting Rating, kA</td>
<td>12*</td>
</tr>
<tr>
<td>Asymmetrical Interrupting Rating, kA</td>
<td>19.2*</td>
</tr>
</tbody>
</table>

* Optional 32kA asymmetrical/ 20 kA symmetrical rating

IEEE C37.60 Fault Interrupting Duty

<table>
<thead>
<tr>
<th>Percent of Maximum: Interrupting Rating</th>
<th>Approx. Interrupting: Current Amps</th>
<th>No. of Fault: Interruptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-20%</td>
<td>2000</td>
<td>44</td>
</tr>
<tr>
<td>45-55%</td>
<td>6000</td>
<td>56</td>
</tr>
<tr>
<td>90-100%</td>
<td>12000</td>
<td>16</td>
</tr>
</tbody>
</table>

Total Number of Fault Interruptions: 116

2.4 CABLE ENTRANCES

A. Load Break Puffer Switches

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

- 600 amp G&W Quik-Change disconnectable apparatus bushing,
- 600 amp Apparatus bushing,
- 600 amp Universal bushing, or
- 200 amp Deepwell bushing.
B. Vacuum Interrupters
   Cable entrances shall be tested to IEEE 386 and be, as indicated on the switch drawing:
   • ____ 600 amp G&W Quik-Change disconnectable apparatus bushing,
   • ____ 600 amp Apparatus bushing,
   • ____ 600 amp Universal bushing, or
   • ____ 200 amp Deepwell bushing.

2.5 VACUUM INTERRUPTER CONTROL
   An electronic assembly shall be provided to sense load and fault current on each phase of the load tap circuits. The electronic control shall be powered from the current transformers mounted inside the SF6 insulated switch tank. No external power source shall be required for overcurrent protection. The electronic control shall monitor the current on the individual phases of the load tap circuits using input from the internal current transformers. Electronic trip capability shall be selectable for each phase. Temperature range shall be -30°C to +50°C. Minimum trip selection shall be accomplished with selector knobs inside the electronic enclosure. Trip time current characteristics (TCC) shall be field selectable using a dip switch. 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 load taps energized.

2.6 FACTORY PRODUCTION TESTS
   The bulk SF6 gas supply and each individual switch shall be tested for moisture content. Each individual switch shall undergo a mechanical operation check and a leak test. The switch shall be factory filled with SF6 and AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts. Circuit resistance shall be checked on all ways. Switches will be shipped factory filled with SF6 gas. Tank shall be designed to withstand 15 psig internal pressure and an external pressure of 14 psig without affecting the performance of the switch.

2.7 STANDARD COMPONENTS
   The following shall be included as standard:
   • Welded steel tank painted light gray with stainless steel and brass fasteners.
   • Lifting provisions.
   • Gas pressure gauge and fill valve.
   • Grounding provisions for switch tank and all cable entrances.
   • Stainless steel three line diagram and corrosion-resistant nameplates.
   • Parking stands.
   • Switch operating handle(s) with padlock provision and end stops.
   • Type 1 vacuum interrupter electronic package including a selector switch for single or 3-phase operation and individual phase trip level.

2.8 OPTIONS
   The following options shall be supplied: (check as appropriate):
   □ Stainless steel tank, type 304 or 316
   □ Stainless steel enclosure, type 304 or 316
   □ Temperature compensating pressure gauge
   □ Low pressure warning device
   □ SF6 density switch
   □ 4/0 brass ground lug
   □ Key interlock provisions
   □ Key interlocks to lock in open position
   □ Current transformers for load break ways
   □ Potential transformers for voltage monitoring and/or control power
   □ Automatic transfer control type ATC451-4
   □ Motor actuators for remote switch operation
   □ Auxiliary switches for remote switch position indication
   □ Stationary switch controls for remote switch operation and SCADA integration
   □ Portable switch controls for remote switch operation
Remote terminal units and communication packages for SCADA integration
- Operation counters
- Analog voltage sensors
- Digital voltage sensors
- 200A deepwell bushings
- 600A apparatus bushings
- 600A voltage sensing bushings
- 600A Quik-Change apparatus bushings
- 600A Universal bushings (through 25kV)
- Type 2 vacuum interrupter control including ground fault trip and time delay selector switches (three phase only)
- Type 3 vacuum interrupter control including ground fault trip, inrush restraint, programmable
- Vacuum fluorescent display (VFD) and RS232/485 port
- Type 4 vacuum interrupter control (same as Type 3 with laptop programming only)
- Clear window cover for Type 1, Type 2, Type 3 or Type 4 interrupter controls
- Submersible NEMA 6P enclosure for vacuum interrupter control
- SEL relays including 751A, 501, 551 and others
- External power / trip for vacuum interrupter control
- Refill kit consisting of regulator, hose and SF6 bottle

2.9 LABELING

A. Hazard Alerting Signs
   The exterior of the padmounted 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, Burns, 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.