Control & Relay Protection Philosophy for 400KV AMRELI Sub Station

A) Bus Bar Configuration

- **400kV System**: Three Bus (Two Main and Transfer)
- **220kV System**: Three Bus (Two Main and Transfer)
- **66KV System**: Two Bus (One Main and Transfer)

- Isolator system
  - **400kV System**: Four isolator configuration (Three Bus isolators and a Line isolator)
  - **220kV System**: Four isolator configuration (Three Bus isolators and a Line isolator)
  - **66KV System**: Three isolator configuration (Two Bus and a Line isolator)

B) Control Voltage

- 220V DC

C) Control & Relay panels

- Existing Bays – Conventional Control & Relay Panels mounted in Control Room to be retrofitted for SCADA compatibility.
- New Bays – SCADA compatible Control & Protection Panels to be mounted in Yard Kiosk

D) PLCC panels

- PLCC Panels to be mounted in Control Room
- PLCC BCU panel to be mounted in Control Room for interface between Control & protection Panels and PLCC Panels, through GOOSE commands

E) Existing Protection system

- **400KV**:
  1. **Feeder**:
     Distance Protection Relays – Main-I & Main-II (Distance) Protection Numerical Relay with IEC 61850 Protocol
     LBB Protection – Separate Static Relay
     Over Voltage Protection
     - Stage -1 – Electromechanical / Static Relay,
     - Stage -2 – Electromechanical / Static Relay
  2. **ICT**:
     - Differential Protection Relay - Numerical (Non IEC- 61850) MiCOM P632
     - Directional O/C-E/F Protection Relay - Numerical Relay with IEC 61850 Protocol
     - REF Protection Relay - Electromechanical Relay
     LBB Protection – Separate Static Relay
  3. **Bus Reactor**:
     - Differential protection Relay - Numerical Relay with IEC 61850 Protocol
     - Backup Impedance Protection Relay - Numerical Relay with IEC 61850 Protocol
     - REF protection - Electromechanical Relay
     LBB Protection – Separate Static Relay
  4. **Bus Coupler**:
     - Directional O/C-E/F protection Relay - Numerical Relay with IEC 61850 Protocol
     LBB Protection – Separate Static Relay
  5. **TBC**:
     - Non-Directional O/C-E/F protection Relay - Numerical Relay with IEC 61850 Protocol
     LBB Protection – Separate Static Relay
6. Bus Bar Protection
   ABB make Static scheme - RADSS

   220KV:
   1. Feeder:
      Distance Protection Relays – Numerical Relay with IEC 61850 Protocol
      Directional O/C-E/F protection Relay - Numerical Relay with IEC 61850 Protocol
      LBB Protection – Separate Static Relay
   2. ICT LV:
      Directional O/C-E/F Protection Relay - Numerical Relay with IEC 61850 Protocol
      LBB Protection – Separate Static Relay
   3. Transformer:
      Differential protection Relay - Numerical (Non IEC 61850) MiCOM P632
      Directional O/C-E/F Protection Relay - Numerical Relay with IEC 61850 Protocol
      REF protection Relay - Electromechanical Relay
      LBB Protection – Separate Static Relay
   4. Bus Coupler:
      Non-Directional O/C-E/F protection Relay - Numerical Relay with IEC 61850 Protocol
      LBB Protection – Separate Static Relay
   5. TBC:
      Directional O/C-E/F protection Relay - Numerical Relay with IEC 61850 Protocol
      LBB Protection – Separate Static Relay

6. Bus Bar Protection
   ABB make Static scheme - RADSS

   66KV:
   1. Feeder:
      O/C-E/F protection Relay - Electromechanical or Numerical (Non IEC 61850) Relays
   2. Transformer LV:
      O/C-E/F protection Relay - Numerical (Non-IEC 61850) Relays
   3. Station Transformer:
      O/C-E/F protection Relay - Numerical (Non-IEC 61850) Relays

   Disturbance Recorder & Event Logger – Stand alone DR & EL Panels

F) Retrofitting in Existing C&R Panels

   400KV:
   1. ICT:
      Differential protection Relay - Numerical (Non IEC- 61850) MiCOM P632
      (To be converted in to IEC 61850 compatible protection relay).
   2. Bus Bar Protection:
      Existing ABB make static RADSS scheme is to be replaced with numerical IEC 61850 compatible Busbar protection scheme as per protection philosophy.

   220KV:
   1. Transformer:
      Differential protection Relay - Numerical (Non IEC- 61850) MiCOM P632
      (To be converted in to IEC 61850 compatible protection relay)
   2. Bus Bar Protection:
      Existing ABB make static RADSS scheme is to be replaced with numerical IEC 61850 compatible Busbar protection scheme as per protection philosophy.
66KV :-

1. Feeder:-
O/C-E/F protection Relay shall be replaced with Numerical IEC 61850 compatible Bay Control & Protection Relays as per protection philosophy.

2. Transformer LV:-
O/C-E/F protection Relay shall be replaced with Numerical IEC 61850 compatible Bay Control & Protection Relays as per protection philosophy.

3. Station Transformer:-
Differential protection relay as per protection philosophy shall be provided
O/C-E/F protection Relay shall be replaced with Numerical IEC 61850 compatible Bay Control & Protection Relays as per protection philosophy.

G) Control & Protection for New Bays

It shall be as per Control & Protection philosophy tabulated as under.

H) Nos. of Bays & Bus Bar Protection

400 KV System

- Line W/o Reactor Bay – 2 Nos.
- ICT Bay – 2 Nos.
- Bus Reactor Bay – 1 No.
- TBC Bay – 1 No.
- Bus Coupler Bay – 1 No.
- New Line w/o Reactor Bays to be added – 6 Nos.
- New Line with Reactor Bays to be added – 2 Nos.
- Bays to be connected to Bus Bar Protection - 15 Nos.
- Future bays – 1 Nos.
- Total bays in the Sub Station will be - 16

Bus Bar Protection
- Control Unit - 24 Bays
- Bay Units – 16 Nos (15 +1 Spare) - 8 Nos to be provided in Control Room Bus Bar Panel
  - 8 Nos to be provided in C&P Panel in Yard Kiosk

220 KV System

- Feeder Bay – 4 Nos.
- ICT LV Bays – 2 Nos.
- 220/66KV Transformer Bays – 3 Nos.
- Bus Coupler Bay – 1 No.
- TBC Bay – 1 No.
- New Feeder Bays to be added – 2 Nos.
- Bays to be connected to Bus Bar Protection - 13 Nos.
- Future bays – 5 No.
- Total bays in the Sub Station will be – 18 Nos.

Bus Bar Protection
- Control Unit - 24 Bays
- Bay Units – 14 Nos (13+1 Spare) - 12 Nos to be provided in Control Room Bus Bar Panel
  - 2 Nos to be provided in C&P Panel in Yard Kiosk

66KV System

- Feeder Bay – 4 Nos.
- 220/66KV Transformer LV Bays – 3 Nos
Control Philosophy – AMRELI Sub Station

<table>
<thead>
<tr>
<th>System</th>
<th>Controlling Device to be Adopted</th>
<th>Type of Controlling Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 KV Bay</td>
<td>Bay Control Unit</td>
<td>BCU with IEC 61850 Protocol</td>
</tr>
<tr>
<td>220 KV Bay</td>
<td>Bay Control Unit</td>
<td>BCU with IEC 61850 Protocol</td>
</tr>
<tr>
<td>66 KV Bay</td>
<td>Bay Control &amp; Protection Unit</td>
<td>BCPU with IEC 61850 Protocol</td>
</tr>
</tbody>
</table>

Protection Philosophy – AMRELI Sub Station

A) Feeder Protection

<table>
<thead>
<tr>
<th>400KV Feeders</th>
<th>Protection to be Adopted</th>
<th>Type of Relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 KV Line W/o Reactor</td>
<td>1 Two Distance Protection</td>
<td>Numerical Relay with IEC 61850 Protocol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[shall be of two different make (i.e. from different manufacturers) or of same make with two different platforms with same specifications]</td>
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<tr>
<td></td>
<td></td>
<td>- Main-I Protection &amp; - Main II Protection</td>
</tr>
<tr>
<td>400 KV Line with Reactor</td>
<td>2 Two Stage Over Voltage Protection</td>
<td>Integrated in Main I &amp; Main II Protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Stage I - Stage II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Separate Static y - Integrated in Main I &amp; Main II Protection</td>
</tr>
<tr>
<td>3 Local Breaker Backup (LBB) Protection.</td>
<td>3</td>
<td>Integrated in Main I Protection and Bus Bar protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>66/11KV Transformer Bay – 1 No.</th>
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</thead>
<tbody>
<tr>
<td>➢ Total bays in the Sub Station – 8 Nos.</td>
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<tr>
<td>7</td>
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<td>8</td>
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<tr>
<td>10</td>
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<tr>
<td><strong>220 KV Feeders</strong></td>
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<tr>
<td></td>
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<tr>
<td><strong>E) Bus Bar Protection</strong></td>
</tr>
<tr>
<td><strong>400 KV Bus bar</strong></td>
</tr>
<tr>
<td><strong>220 KV Bus bar</strong></td>
</tr>
<tr>
<td><strong>F) Disturbance Recorder &amp; Event Loggers</strong></td>
</tr>
<tr>
<td>Integrated feature of protective relays is used to provide the information about the Disturbance and to log the events.</td>
</tr>
<tr>
<td><strong>G) GPS based Time Synchronizing Equipment</strong></td>
</tr>
<tr>
<td>400 KV Sub station is to be provided with IEC 61850 compatible Global Positioning System based Time Synchronizing Equipment to synchronize all the protections.</td>
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