## SECTION – 2.25

## Scope of work of Existing 145 kV SF6 Circuit Breakers

### 1.0.0 INTRODUCTION

This section provides details of scope envisaged under this project for the existing 145 kV SF6, 31.5 kA, 3150 Amp, AIS Circuit Breakers The broad scope outlined herein is conceptual in nature and intended to provide an overall understanding of the work involved.

The Bidder shall review the available data, site conditions, and existing system configuration, and shall accordingly carry out the required work. All activities shall be aligned with applicable standards, OEM recommendations, and best industry practices, ensuring safe, reliability, and efficient operation of the system integration with the proposed BESS.

### 2.0.0 SCOPE OF WORK

#### 2.1. Name plate details

- Make : Crompton Greaves Limited, Nashik
- Type : SFM, $SF_6$ Gas Circuit Breaker, Puffer Type, Single Break

**Rated Parameters:**

- Rated Normal Current : 3150 A
- Rated Short Circuit Current : 31.5 kA for 3 seconds
- Closing & Opening Voltage : 110 V DC
- Auxiliary Supply : 415 V AC, 50 Hz
- Gas Pressure : 5 kg/cm² at 20°C
- Gas Weight : 9 kg
- Total Weight (with gas) : 2000 kg
- First Pole to Clear Factor : 1.5
- Operating Sequence : O – 0.3 sec – CO – 3 min – CO
- Rated Operating Pressure : 15 kg/cm²

#### 2.2. Details of existing isolators

The following drawings, details, and documents are included in the tender for general reference only. These may not necessarily represent the latest "as-built" or updated status.

The Bidder shall be solely responsible for verifying the actual site conditions, type, and quantum of work prior to submission of the bid.

No additional cost or claim shall be admissible on account of any discrepancies, deviations, or inaccuracies in the drawings, documents, or information provided herein.

All available details and documents have been provided in this tender. For any additional information, the bidder shall carry out necessary site assessment.

The Bidder is advised to visit the site to familiarize themselves with the site conditions. Site visits may be arranged with prior intimation and on a mutually convenient date and time.

1. Details of supports for MOM Box
2. Details of Operating pipe support for isolators.
3. 132 kV Single Line Diagram
4. Instruction manual of 132 kV Circuit Breaker
5. Switchyard Structure Layout Plan
6. Switchyard Structure Layout Sections
7. Erection Key Diagram – 132 kV Switchyard Sections.

2.3. List of 145 kV Circuit Breakers Revival in Scope of Bidder.

| Sr | Description of Circuit Breaker | Qty |
|---|---|---|
| 1 | Transmission Line-3 Feeder Bay | 1 |
| 2 | Transmission Line-4 Feeder Bay | 1 |
| 3 | 70 MVA Transformer Feeder Bay | 1 |
| 4 | Bus-coupler Bay | 1 |
| | Total Number 145 kV SF6 CB's | 4 |

Note: 160 MVA Transformer Bay (UT of GT-4) CB is not in scope of the Bidder.

## 3.0.0 CODES AND STANDARDS

3.1. All, replacement parts, and testing shall comply with relevant IS / IEC standards applicable to maintenance, upgrading, and refurbishment of existing high-voltage circuit breakers

3.2. The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the relevant IS / IEC standards including amendments, if any, except where modified and / or supplemented by this specification. Some of the applicable standards are listed below.

| | |
|---|---|
| IEC-62271-100 | High Voltage Alternating Current Circuit-Breaker |
| IEC-62271-1 | High-voltage switchgear and control gear - Part 1: |

| | |
|---|---|
| | Common specifications |
| IEC-62271-101 | High-voltage switchgear and control gear - Part 101: Synthetic testing |
| IS-12729:2004/IEC-60694 | Common Specification for High Voltage Control gear & Switchgear standard |
| IS-14658/IEC-1633 | H.V Alternating Current Circuit Breaker-Guide for Short Circuit & Switching Test Procedures for metal enclosed & dead tank Circuit Breaker |
| IEC-62155 | Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1000 V |
| IEC-62271-110 | High-voltage switchgear and control gear - Part 110: Inductive load switching |
| IS-14674:1999/IEC1166:1993 | H.V Alternating Current Circuit Breaker-Guide for Seismic qualification of HV A.C Circuit Breaker |
| IS-13118 | Specification for alternating current circuit breakers |
| IEC 62271-310 | High-voltage switchgear and control gear – Part 310: Electrical endurance testing for circuit breakers above a rated voltage of 52 kV. |
| IEC 60376 | Specification of technical grade Sulphur hexafluoride (SF6) and complementary gases tobe used in its mixtures for use in electrical equipment |
| IEC 60529 | Degrees of protection provided by enclosures (IPCode) |
| IEC 61439 | Standard for low-voltage switchgear and control gear assemblies |
| IS-325 | Specification for three phase induction motors |
| IS-2099 | High voltage porcelain bushings |
| IS-2147 | Degree of protection provided for enclosures for low voltage switchgear and control gear. |
| IS-2629 | Recommended practice for hot dip galvanizing |

| | |
|---|---|
| | ofiron and steel. |
| IS-4379 | Identification of the contents of Industrial Gas Cylinders. |
| IS-7311 | Seamless high carbon steel cylinders for permanent and high pressure liquefied gases. |

## 4.0.0 DESIGN CRITERIA

### 4.1. General

i. All replacement items shall be new and of approved make.

ii. Any items, activities, or requirements not explicitly mentioned but necessary for intended completeness, safety, reliability, and operation shall be deemed to be included in the bidder's scope.

iii. Work shall comply with relevant IEC/IS standards

iv. Proper labelling, tagging, and documentation shall be provided

v. Workmanship shall be of high standard.

vi. For ANSI code mention in this section, Bidder is requested refer existing schematics , drawing and documentation.

**Wiring**

4.2. Wiring shall be complete in all respects to ensure proper functioning of the control, protection, monitoring and interlocking schemes.

4.3. DC circuit for trip coil 1 & 2 shall be wired separately so as to connect with duplicate DC supply.

4.4. Wiring shall be done with flexible 1100V grade, PVC insulated, switchboard wires with 2.5 $mm^2$ stranded copper conductor

4.5. Each wire shall be identified at both ends with permanent markers bearing wire numbers as per Contractor's wiring diagram.

## 5.0.0 SCOPE OF WORK - MECHANICAL HOUSING CUBICLE REVIVAL

The scope includes complete retrofitting, rewiring, and functional restoration of the housing cubicle of the 145 kV circuit breaker.

### 1. Testing

a) Insulation Resistance (IR) Test

Measure IR between:

i. Phase to Phase
ii. Phase to Earth.
iii. Control Circuit Wiring.

b) Contact Resistance Measurement (CRM)

i. Measure resistance across each pole using a micro-ohmmeter
ii. Compare values between phases

c) Breaker Timing Test

Measure:

i. Opening time
ii. Closing time
iii. Contact bounce
iv. Synchronization between poles
v. Verify results with OEM specifications

d) Comprehensive Functional checks of control schemes

i. Local & Remote operations
ii. Trip and Close operations (5 times),
iii. Anti-Pumping.
iv. Indications and Alarms.
v. Interlocks.

**2. Repair and Replacement of eroded sections (partial)**

At present, no major eroded portions have been identified. However, any localized (internal or external) areas affected by erosion or corrosion shall be identified during inspection and shall be repaired accordingly. The repair shall involve cutting out all deteriorated or weakened sections and welding in new sheet metal inserts of matching material grade and equivalent thickness. All welding joints shall be continuous, fully sealed, and free from defects to ensure complete watertight integrity and to prevent any ingress of water.

All repaired areas shall be properly finished and prepared, including cleaning and surface treatment, prior to the application of the specified painting.

**3. Painting**

The following shall be cleaned, de-rusted, and painted:

i. Mechanical housing cubicle (internal & external)
ii. Supporting columns
iii. Base frame.
iv. Housing for horizontal road assembly.

v. Compressor and its motor.
vi. Air Reservoir.
vii. Any other parts that may requires painting.
viii. Colour Shade RAL-7035
ix. Finish: Glossy.

## 4. Replacement of Electrical Components

All existing aged/damaged electrical components inside the cubicle shall be replaced with new components of as per approved make specified in the tender.

### a. Contactors

All contactors shall be replaced including but not limited to:

- Power Contactors (88ACM, etc.)
- Control & Auxiliary Contactors (52Y,52C,52T1, 52T2, 63AGX etc.)

Power Contactors shall be of AC-3 Duty and DIN Mounted. Current rating and number of Poles / Auxiliary contacts shall be as per existing or better.

### b. Terminal Blocks

- Stud-type terminal blocks shall be provided
- Mounted on perforated DIN channels
- Proper segregation for control and power circuits

### c. MCBs (DC)

- Suitable DC-rated MCBs shall be provided for control circuits. (80, 8A , 8SH)

### d. MCBs (AC)

- AC MCBs shall be provided for auxiliary supply distribution.

### e. Control Wiring

- Complete rewiring of cubicle.
- Wires shall be ferruled and properly dressed.
- Wiring shall comply with relevant standards.
- The cross-sectional area of the wires shall be equal to or greater than that of the existing wiring, ensuring adequate current-carrying capacity and compliance with applicable standards. However, its shall not be less than 2.5 Sqmm.
- All wires shall be of copper only.

- Wire colour coding shall be maintained as per the existing system, or upgraded to a standardized and clearly identifiable scheme, ensuring ease of identification and compliance with applicable standards.

**f. Control Switches**

The following switches shall be provided:

- Local/Remote selector switch (43-LR)
- Trip-Neutral-Close (TNC) switch (11-52)
- Door limit switch (DO)

**g. Protection Devices**

- Overload Relay and Single-Phase Preventer (49M)

**h. Cubicle Accessories**

- Internal illumination lamp (IL)
- Power socket with switch (SO)

**5. Air Compressor (Including its drive motor)**

- Compress Make & Model: Ingersoll-Rand, Model 234
- Motor Overhaul including replacement of Bearings (FAG / SKF certified only)
- Replacement of Drive Belts (Two belts for each compressor)
- Replacement of compressor Oil as per OEM recommendations.

**6. Gasket Replacement**

- Replacement of gaskets for front and rear doors of mechanical housing cubicle.
- Any other gasket or "O-ring" within Mechanical Housing Cubicle.

**7. Emergency Manual Trip**

- Provision/repair of manual emergency hand trip actuator mechanism.

**8. Air System**

- Replacement/provision of air reservoir drain valve.

**9. Cable Works**

- Removal of existing cables up to remote end
- Provision of new gland plates

**10. Anti-Vibration Mounting Blocks**

Anti-vibration rubber mounts shall be provided for:

- Terminal blocks (minimum 6 nos. OR as required)
- Pressure switch mounting plates (8 nos.)

**11. Channels for mounting of all electrical components**

- Suitable DIN Channels (Perforated) shall be provided for mounting of
- Contactors
- Terminal Blocks
- MCB's
- Overload Relays and Single Phase Preventer.

**12. Viewing Glass**

- Front Door Viewing Glass (Toughened) with suitable Gasket

**13. Lugs**

- Power Circuit Lugs shall be long barrel heavy duty ring type.
- Control Circuit lugs shall be ring type with sleeves.

**14. Glands**

- Double compression Nickle Plated Brass Glands are to be used.

**15. SF6 Gas and Pneumatic Circuit leakages**

- Currently, **no known** leakages are observed. However, diagnosis and identification of any leakages, as well as attending to minor leakages, shall be included in the scope of the bidder

**16. SF6 Gas Cylinder**

- The bidder shall supply 3 Nos. of $SF_6$ gas cylinders, each having a gas content of approximately 12 kg, as specified under the mandatory spares section of the General Technical Specifications (GTS) of the tender.
- Services for topping up $SF_6$ gas, as required, shall be included in the scope of the bidder.
- Any additional $SF_6$ gas remaining after commissioning shall be handed over to the owner.

**17. General Tools & Tackles, Special tools & Tackles, Testing equipment lifting-shifting equipment, consumable and sundry items.**

All tools tackles, equipment, testing equipment and consumables, sundry item are included in the scope. This may include, but is not limited to, the following.

- Special tools, as required, shall be provided in accordance with the OEM instruction manual (Appendix-4) and shall be included in the bidder's scope
- Insulation Tester
- CRM Kit.
- Insulation tester.
- Digital Multi-meters.
- SF6 Leak detector.
- Nut, Bolts, Plain and Spring Washer ( for replacement wherever required).
- Clearing material.
- Dew Point Meter (If required).

Any other miscellaneous items necessary for the successful completion of the job shall be provided by the bidder within the scope of work.

## 6.0.0 GUARANTEE / DEFECT LIABILITY

- Minimum 12 months guarantee from date of commissioning
- Any defect arising during this period shall be rectified free of cost

## 7.0.0 SPARES

The bidder shall submit the List of mandatory Spares, and the bidder has to furnish an undertaking that the spares required for satisfactory operation of the offered system.

## 8.0.0 AVAILABLE DRAWINGS/ DOCUMENTS

The following drawings/documents are available and form part of this tender:

a. GA Drawing of Circuit Breaker
b. Schematic/Control Wiring Diagrams
c. Terminal Arrangement Drawings
d. Mechanical Housing Layout
e. OEM Instruction Manual

Notes:

- All available details and documents have been included in this tender. Bidders shall carry out site assessments for any additional information required.

## 9.0.0 DOCUMENTATION AND HANDOVER

The contractor shall submit:

- As-is drawing including outgoing cable terminations.
- As-built wiring diagrams
- Test reports
- List of replaced components
- Final comprehensive commissioning report

## 10.0.0 EXCLUSIONS / OWNER'S SCOPE

The following items are excluded from contractor's scope:

1. Overhaul of main poles.
2. Pressure switches:
   - Air Circuit (63AL, 63AG, 63AR, 63AA)
   - $SF_6$ Gas Circuit (63GA, 63GL)
   - Compressor lube oil circuit (63OA)
3. Air pipe assembly
4. Gas pipe assembly
5. Closing coils (52C)
6. Tripping coils (52T1, 52T2)
7. Main auxiliary switches (52A, 52B)
8. Compressor system components (safety valve, NRV, belts) .
9. $SF_6$ gas circuit valves (Gas Valve, Stop Valve with adaptor).
10. Castle interlock (wherever equipped)
11. Gas pressure gauge.
12. Air pressure gauge.

In the event that any major work, not included in the scope of work (as determined by the owner and its consultant, whose decision shall be final and binding on the bidder), is identified, the contractor shall submit a techno-commercial proposal for the additional work. Execution of such work shall proceed only after receiving a written change order from the owner. It shall be mandatory for the contractor to carry out the additional work once approval is accorded by the owner.