

**TECHNICAL SPECIFICATION TS-2A
FOR 2-WAY SIDE BREAK,
GROUP OPERATED, PHASE-OVER-PHASE,
AIR BREAK SWITCHES
RATED 15kV THROUGH 161kV**

INDEX

<u>SECTION</u>	<u>ITEM</u>	<u>PAGE</u>
1.0	Scope	2
2.0	General Requirements and Applicable Standards	2
3.0	Current Carrying Parts	4
4.0	Operation	5
5.0	Operating Mechanisms	5
6.0	Frames / Mounting Hardware	6
7.0	Nameplates	7
8.0	Insulators	7
9.0	Drawings	8
10.0	Shipping Requirements	8

TABLES

1	Rated Withstand Voltage	3
1A	Rated Momentary	3
3	Phase Spacing	4
4	Insulators (kV, BIL, TR)	7

ATTACHMENTS

Request For Proposal

1.0 SCOPE

This specification covers the technical requirements for 15kV through 161kV outdoor, three-pole, group-operated air break switches, and, also load break air switches for line and bus switching, loop sectionalizing, transformer-bank switching, and load-current switching. The switch shall include insulators, motor operators, vacuum interrupters and other accessories, as specified. Quantities and ratings of the switches shall be listed in the “Request for Proposal” (RFP).

2.0 GENERAL REQUIREMENTS

2.1 APPLICABLE STANDARDS

The switches shall comply with the latest revisions of the following standards in order of preference, as listed. The specific job technical requirements and this specification shall take final precedence in the event of conflict:

2.1.1 ANSI standards C34, C37, C37.30, C37.32, and C37.35.

2.1.2 NEMA standard SG-6, the latest revision.

2.1.3 ASTM standards A36-84, A123-84, A153-82, B98-83, and B221-83.

2.2 SWITCH / TYPE

This specification covers switch types as listed in Table 1, ANSI C37.32 in ratings of 15.5kV through 161kV, 600 through 2500 Amperes.

- The switch shall be a side break with one (1) blade on a common frame, in-line type manufactured by Turner Electric, catalog 2TSB, or equal.

2.3 SWITCH RATINGS

2.3.1 Temperature Rise:

The maximum allowable temperature rise 53° C, as determined by ANSI C37.30.

The manufacturer shall provide, upon request, certified test data on each type of switch to be furnished.

2.3.2 For installations below 3300-ft. altitude, the rated withstand and radio influence voltages shall be as shown in Table 1. Per ANSI C37.30-1971, Table 1 altitude correction factors will apply for altitudes above 3300 ft.

ANSI C37.32 TABLE 1 – RATED WITHSTAND VOLTAGE

Rated Voltage kV RMS (nominal)	Rated Voltage KV RMS (maximum)	Impulse 1.2x50 Micro Sec. Wave kV Crest	60 HZ kV MS		Radio Influence Test Vol. kV	Limit of Riv Micro Volts at 1MH
			Wet 10 sec	Dry 1 min		
15	15.5	110	45	50	9.4	--
23	25.8	150	60	70	15.7	--
34.5	38.0	200	80	95	23.0	--
46	48.3	250	100	120	29.3	--
69	72.5	350	145	175	44.0	--
115	121	550	230	280	73.4	500
138	145	650	275	335	88.0	500
161	169	750	315	385	102.5	500
230	242	900	385	465	147.0	500
230	242	1050	455	545	147.0	500
345	362	1300	525	610	220.0	500

2.3.3 The momentary current withstand shall be as shown in Table 1A

ANSI C37.32 TABLE 1A-RATED MOMENTARY

Continuous Current Rating (Amperes) RMS	Momentary Asymmetrical Current Rating (Thousands of Amperes) RMS	Three Second Rating Thousands of Amperes RMS**
600	40	25
1200	61	38.12
1600	70	43.75
2000	100	62.5
3000	120*	75.0
4000	120	75.0

* 100 KA for center break and side break switches

** Obtained by dividing momentary rating by 1.6

2.3.4 Phase Spacing: Phase spacing of switching equipment to be furnished will not be less than the following values.

MINIMUM / MAXIMUM PHASE SPACING TABLE

SWITCH	MIN PHASE	STD PHASE
1AD-15	4' - 0"	6' - 0"
1AD-15 TR1 1 BOTTLE	4' - 0"	7' - 0"
1AD-23	4' - 9"	6' - 0"
1AD-23 TR 1 BOTTLE	4' - 9"	7' - 0"
1AD-34	6' - 0"	8' - 0"
1AD-34 TR2 2 BOTTLE	6' - 0"	9' - 0"
1AD46	6' - 8"	8' - 0"
1AD-46 TR2 2 BOTTLE	6' - 8"	9' - 0"
1AD-69	8' - 6"	9' - 0"
1AD-69 TR 3 BOTTLE	8' - 6"	10' - 0"
1AD-115	Consult factory	
1AD-115 TR 5 BOTTLE		
1AD-138		
1AD-138 TR 6 BOTTLE		
1AD-161		
1AD-161 TR 7 BOTTLE		

NOTES:

- (1) Values listed are for altitudes of 3,300 ft (1000 meters) or less. For higher altitudes, the altitude correction factors per ANSI C37.30 1971 Table 1 shall apply.

3.0 CURRENT CARRYING PARTS

3.1 CONTACTS

Current carrying parts shall be of copper or aluminum alloy construction with silver-to-silver alloy current transfer contacts.

Contacts shall be of the reverse-loop, self-wiping type. All fixed contacts shall be backed by stainless steel. The current carrying path shall not be springs, pins, or bearings.

Exposed contacts shall be self-wiping silver-to-silver. All other current carrying contacts, including hinged end contacts, shall be silver-to-silver, and sealed and insulated from contamination and corrosion. Internal sealed contacts shall be silver-to-silver. All exposed contacts, both fixed and moveable, shall be replaceable in the field without field welding or brazing.

External silver-to-silver contact surfaces that are applied to copper may be either a brazed silver alloy inlay plated or an approved silver (flame) spray application. Minimum thickness of either type surface shall be .002 inches.

Silver applied to aluminum is NOT acceptable.

3.2 BLADES

3.2.1 The switch blades shall be tubular and 6063-T6 aluminum or copper alloy.

The switch blades and other live parts shall be designed to prevent the accumulation of water.

Hinge current transfer shall be enclosed and threaded.

3.2.2 For rotating blades, vertical break switches; a single and simple linkage between the rotating insulator stack and the blade shall achieve the rotation and vertical movement of the blade. Blade shall be field-adjustable. Blade tips must be field-replaceable.

Vertical break switches specified for underhung or vertical mounting shall have a 70° - 75° open blade stop. Switches specified for upright mounting shall have provisions for the addition of such stops if the switches are converted to another position.

Vertical break switches specified for upright mounting shall open more than 90°.

3.3 TERMINAL PADS

All terminal pads shall be machined and either copper or aluminum. The pads shall be equipped with tin-plated copper shields in a NEMA configuration to reduce galvanic corrosion.

All switches with ratings at 1200 amps or below shall have two or more holes on NEMA 1 ¾-inch bolt spacing. Bolt holes shall be 9/16-inch.

Switches with ampere ratings between 600 and 2000 shall have terminal pads with four holes on a NEMA spacing of 1 ¾-inch. Bolt holes shall be 9/16-inch. There shall be three different termination points on the hinge and jaw end of the switch

4.0 OPERATION

- 4.1 Switch blades shall be under positive control at all times and the travel from the fully closed position to the fully open position shall be accomplished with one smooth continuous motion.

5.0 OPERATING MECHANISMS

- 5.1 Each gang-operated switch unit shall be furnished with an operating mechanism as specified on the Switch Requirement sheet.

Operating mechanisms shall be complete with galvanized steel vertical operating pipe, group operating pipe, and interphase pipe; galvanized steel or malleable iron bell cranks, outboard bearings, pipe guides, operating levers or cranks, universal joints, as needed; and galvanized steel mounting channels, angles, or plates. Details of structural members necessary to support the switches and operating mechanisms on the steel structures will be provided as required.

Galvanized steel shims, bolts, nuts, flatwashers, palnuts, or lockwashers and beveled washers shall be provided for all operator support brackets, bases, etc., required for attachment to the steel structure

- 5.2 Operating mechanisms shall be suitable for operating the switches from grade elevation. The design of the operating mechanism shall provide smooth, completely controlled, synchronized movement of the switch blades throughout the entire cycle of operation of closing or opening.
- 5.3 Galvanized steel control and interphase pipes shall be of sufficient size and design to eliminate twist in the torsional operating pipes and significant sag in push-pull interphase pipes.
- 5.4 All switches shall include provisions for interphase adjustment of each individual switch pole. These provisions shall be of a continuously adjustable type for correction of any misalignment in the switch insulators, bases, and operating pipes. It shall be mechanically impossible, after final adjustment has been made, for any switch to remain in a partially open or closed position at the completion of any operator cycle.
- 5.5 The rotating insulator stack on each switch pole and the outboard bearing shall have maintenance free sealed bearings to provide smooth and trouble free operation of the switch.

5.6 The operating assembly shall have position indicators and provisions for pad locking in both the open and closed position. It shall be provided with a 1/0-grounding conductor, 24" in length.

5.7 The maximum operating effort shall be fifty pounds for a swing handle operator.

A _____ swing handle / _____ motor operator is required.

6.0 FRAMES / MOUNTING HARDWARE

All switches shall be provided with bases, clips, shims, galvanized mounting bolts, nuts, split washers, lockwashers, beveled washers, and specified fittings to meet dimensions shown on the drawings.

6.1 The base shall be constructed of ASTM A36, steel or aluminum, with sufficient rigidity to maintain proper alignment at the tops of the insulators and adjustment of the blades and contact under all climatic and loading conditions. All steel shall be hot-dipped galvanized in accordance with ASTM A123, the latest revision.

6.2 Mounting dimensions shall conform to those shown on the drawings accompanying the order.

6.3 Provisions shall be made for the adjustment of the alignment of all insulator stacks. Adjustments shall be made by use of tipping the screws located under the insulator. The use of shims as a means of adjustment is NOT acceptable.

7.0 NAMEPLATES

7.1 All switches shall be equipped with a non-corrosive nameplate in accordance with ANSI C37.30, permanently attached. In addition to the requirements of ANSI C37.30, the manufacturer's CO, S.O. or JO number shall be stamped on the nameplate.

8.0 INSULATORS

Supplied insulators, if specified on the RFP, shall be in accordance with the latest revisions of ANSI C29.8 and C29.9 and shall conform to the following table. The insulator type and color, other than ANSI 70 (Sky Grey) is to be noted on the RFP.

TABLE 4

kV	BIL	POST
-----------	------------	-------------

15.5	110	TR 205
25.8	150	TR 208
38.0	200	TR 210
48.3	250	TR 214
72.5	350	TR 216
121	550	TR 286
145	650	TR 288
169	750	TR 291

- 8.1 Station post insulators shall be supplied with the proper fittings required to develop the impulse level and to support the jumpers or switch parts, as required. Bolts and other hardware for joining the units or stacks shall be furnished.

Galvanized hardware shall be furnished for mounting live parts and bases to insulators. The hardware shall include galvanized lockwashers and sized for the insulator specified.

9.0 DRAWINGS

9.1 APPROVAL DRAWINGS

Within thirty (30) days of receipt of order, three (3) copies of the approval drawings or CAD files, in AutoCAD, DWG, or DXF format, will be submitted for approval.

9.2 FINAL DRAWINGS

Final drawings, three (3) copies and instruction manuals will be sent within forty-five (45) after receipt of approved drawings for file in AutoCAD, DWG, and DXF format.

9.3 FIELD DRAWINGS

One copy of all drawings and installation instructions will be sent with each switch in a sealed waterproof envelope

10.0 SHIPPING REQUIREMENTS

- 10.1 Switches shall be shipped with all insulator pedestals and bearings assembled and bolted into position on the frames. Each three-pole switch shall be crated in a manner suitable for stacking. Operating pipes and interphase bars shall be shipped unassembled and banded together, one set per switch properly identified and protected against damage. All live parts and loose parts for each switch shall be shipped in a wooden box properly identified.

Each bundle, crate, or pallet shall be marked utilizing a weatherproof marking as follows:

Contract or Purchase Order number, Part number, and Item number.

Bundle, Crate, or Box number 1 of ____ No. of bundles
____ No. of boxes
____ No. of crates

Manufacturing Order No. _____

10.2 SHIPMENT:

All switches and accessories shall be shipped F. O. B., factory, prepaid and add unless noted otherwise.

All equipment and materials under the same schedule shall be shipped at the same time, if possible.

**Specification Defining Outdoor, Group Operated, Air Break Transmission Line Disconnect
Switches for Purposes of Requesting Quotation to Supply**

- | | |
|---|--|
| <p>1.0. SWITCH</p> <p>1.01. Number of assemblies required _____
Each assembly to consist of switches, switch frames and operating mechanism required for the installation specified in Section 4.0 of these specifications.</p> <p>1.02. Type of assembly required.
One way ____, Two way ____, Three way ____,
Three way, bussed one way ____;
Mounted horizontally ____
Phase-over-phase ____, Triangular ____</p> <p>1.03. Rated voltage ____ kV</p> <p>1.04. Rated BIL ____ kV</p> <p>1.05. Rated Current ____ Amperes at 30° C temperature rise.</p> <p>1.06. Momentary current rating ____ Amperes.</p> <p>1.07. NEMA standard insulators. Porcelain glaze color shall be light gray No. 70 Munsell notation 5.0 BG 7.0/0 .4.</p> <p>1.08. Switches shall ____, shall not ____, be furnished with load interrupter devices.</p> <p>1.09. Load interrupters to break load of ____ Amperes.</p> <p>1.10. Switches shall ____, shall not ____, be capable of accepting load interrupters.</p> <p>1.11. Switches shall ____, shall not ____, be furnished with arcing horns.</p> | <p>1.14. Switches shall be furnished with connectors suitable for conductors specified in Section 4.04 of these specifications.</p> <p>1.15. Switches shall meet most recent requirements of NEMA Standards.</p> <p>2.0. SWITCH FRAMES</p> <p>2.01. Switch frames to be fabricated from structural aluminum.</p> <p>2.02. Switch frames to be rigid ____, flexible ____</p> <p>2.03. Switch frames to be mounted on framed tower ____, wood pole ____, or galvanized steel pole ____ (steel required 115kV and up).</p> <p>2.04. Structure shall ____, shall not ____ be furnished with switches.</p> <p>3.0. Operating Mechanism</p> <p>3.01. Switches shall be furnished with manual operating mechanism.</p> <p>3.02. Operating mechanism shall be furnished with single ____, double ____, locking device.</p> <p>3.03. Switches shall ____, shall not ____, be furnished with motor operator. Motor operator specification No. attached ____.</p> <p>4.01. Switching required in Line 1 ____, Line 2 ____, Line 3 ____.</p> |
|---|--|

- 1.12. Arcing horns shall be capable of breaking charging current of _____ Amperes.
- 1.13. Switch terminal pads shall be flat, unplated, And drilled in accordance with NEMA Standards. Four bolts for 600kV and above.

4.02. Switches to be located on tap structure _____, Separate structure _____.

4.03 **SWITCH STRUCTURE**

4.03.1. Switch to be mounted on one pole ____, two poles ____, three poles ____, wood structure.

Specification Defining Outdoor, Group Operated, Air Break Transmission Line Disconnect Switches for Purposes of Requesting Quotation to Supply

- 4.03.2 Wood poles shall be:
Length _____
Class _____
Species _____
- 4.03.2. Frame switch tower shall be _____ ft. in height.
- 4.03.3. Low phase to be _____ ft. above ground elevation.
- 4.03.4. Vertical spacing between phases shall be _____ ft.
- 4.04. Conductor
- 4.04.1. Line 1 _____ at _____ # max. tension.
- 4.04.2. Line 2 _____ at _____ # max. tension.
- 4.04.3. Line 3 _____ at _____ # max. tension.
- 4.05. Line Angles
- 4.05.1 Line 1 _____, Line 2 _____

5.0. **INFORMATION REQUIRED WITH QUOTATION**

- 5.01. Electrical Ratings.
- 5.02. Momentary Ratings.
- 5.03. Phase Spacing.
- 5.04. Length and size of operating rods.
- 5.05. Type of arcing horns.
- 5.06. Type of switch frame and mounting arrangement.
- 5.07. Mechanical strength of frame.
- 5.08. Motor operator (where applicable).
a.) Type
B.) Electrical requirements.
C.) Operating Time
- 5.09. **DELIVERY DATE.**
- 5.10. Exceptions to these specifications.
- 6.0. Approval Drawings
- 6.01. _____ paper prints of the switch assembly must be furnished by the successful bidder and approved by the customer before fabrication begins.
- 7.0. **RECORD DRAWINGS**
- 7.01. A two- (2) mil Mylar reproducible tracing shall be furnished for the complete switch assembly within two (2) weeks after shipment.

Betty/Technical specification TS-2