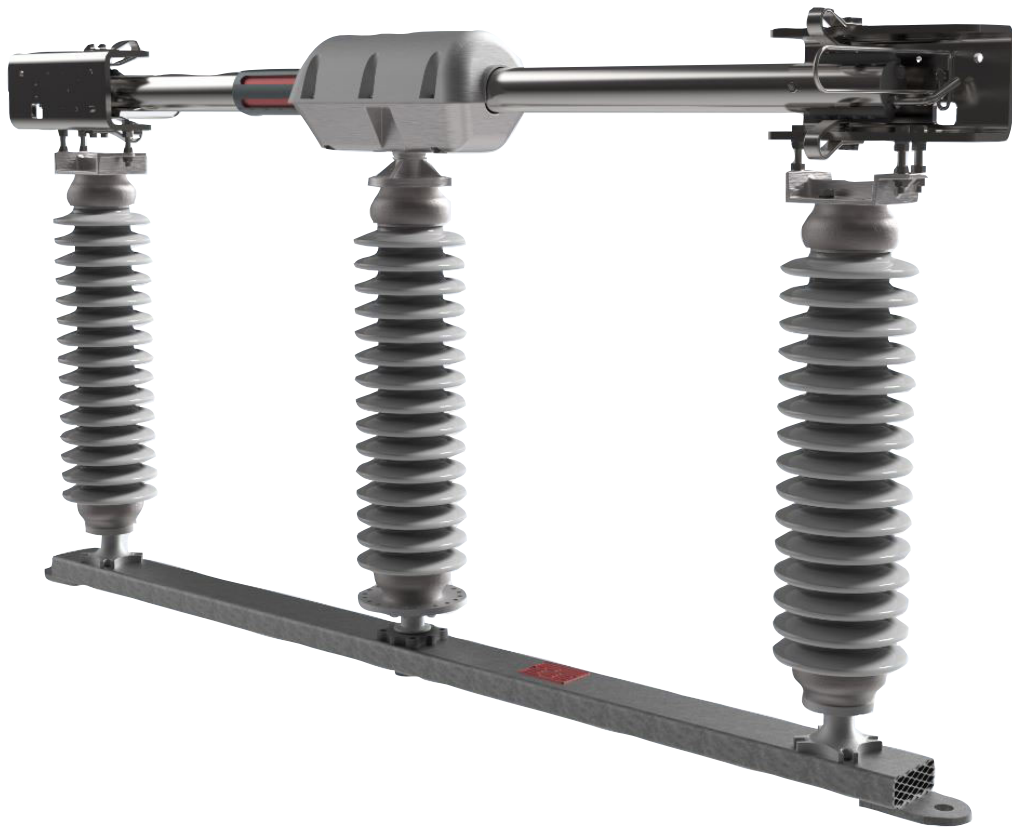


ALUMINUM DOUBLE END BREAK GROUP OPERATED AIR BREAK SWITCHES

RATED 15.5kV THROUGH 362kV

EFFECTIVE DATE: 10/25/16 REV B



Hubbell has a policy of continuous product improvement. Please visit hubbellpowersystems.com to confirm current design specifications.

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Scope

This specification covers the technical requirements for 15.5kV through 362kV outdoor, three-pole, group-operated air 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 grounding blades, arcing horns, insulators, motor operators, and other accessories, as specified.

General Requirements

Applicable Standards

The switches shall comply with the latest revisions of the following standards as of Effective Date 10/25/16 Rev B, as listed. The specific job technical requirements and this specification shall take final precedence in the event of conflict:

ANSI standards C37.30.1, C37.100

NEMA standard SG-6, the latest revision

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

Switch / Type

This specification covers switch types as listed in Table 1, ANSI C37.30.1 in ratings of 15.5kV through 362kV, 600 through 3000 Amperes.

- The switch type is TDEB, three-phase manually group-operated

Switch Ratings

Temperature Rise: The maximum allowable temperature rise as determined by ANSI C37.30.1 rated current shall be per the following:

___ 30°C X 53°C

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

For installations below 3300-ft. altitude, the rated withstand and radio influence voltages shall be as shown in Table 4. Per ANSI C37.100, altitude correction factors will apply for altitudes above 3300 ft.

**ANSI C37.30.1 TABLE 4 - PREFERRED VOLTAGE RATINGS FOR
STATION CLASS OUTDOOR AIR SWITCHES**

Line Number	Rated Maximum Voltage (rms kV)	Rated Withstand Voltage			Corona Voltage & RIV	
		Lightning Impulse (kV peak)	Power Frequency (rms kV)		Test Voltage (rms kV)	Limit of RIV (μV @ 1 MHz)
			Dry 1 min	Wet 10 s		
	(1)	(2)	(3)	(4)	(5)	(6)
1	8.3	95	38	30	--	--
2	15.5	110	50	45	--	--
3	25.8	150	70	60	--	--
4	38	200	95	80	--	--
5	48.3	250	120	100	--	--
6	72.5	250	120	100	--	--
7		350*	175	145	--	--
8	123	350	175	145	78	500
9		450	235	190	78	500
10		550*	280	230	78	500
11	145	350	335	145	92	500
12		450	235	190	92	500
13		550	280	230	92	500
14		650*	335	275	92	500
15	170	450	235	190	108	500
16		550	280	230	108	500
17		650	335	275	108	500
18		750*	385	315	108	500
19	245	550	280	230	156	500
20		650	335	275	156	500
21		750	385	315	156	500
22		900*	465	385	156	500
23		1050	545	455	156	500
24	362	1050	545	455	230	500
25		1300*	610	525	230	500
26	550	1550	710	620	349	500
27		1800*	810	710	349	500
28	800	2050	940	830	508	750

**ANSI C37.30.1 TABLE 14 - PHASE SPACING AND GROUND CLEARANCE FOR
STATION CLASS OUTDOOR AIR SWITCHES**

Line Number	Rated Maximum Voltage (rms kV)	Rating Lightning Impulse Withstand Voltage (kV peak)	Minimum Phase-to-Phase Metal-to-Metal Distance Disconnecting Switches		Ground Clearance				Centerline-to-centerline phase spacing					
					Recommended		Minimum		Vertical Break Disconnecting Switches and Bus Supports		Side Break (Horizontal Break) Disconnecting Switches		All Horn-Gap Switches (Vertical and Side Break)	
					(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
	(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)	
1	8.3	95	178	7	191	7.5	152	6	457	18	762	30	914	36
2	15.5	110	305	12	254	10	178	7	610	24	762	30	914	36
3	27	150	381	15	305	12	254	10	762	30	914	36	1220	48
4	38	200	457	18	381	15	330	13	914	36	1220	48	1520	60
5	48.3	250	533	21	457	18	432	17	1220	48	1520	60	1830	72
6	72.5	250	533	21	457	18	432	17	1220	48	1520	60	1830	72
7		350*	787	31	737	29	635	25	1520	60	1830	72	2130	84
8	123	350	787	31	737	29	635	25	1520	60	1830	72	2130	84
9		450	1120	44	991	39	846	34	1830	72	2310	91	2620	103
10		550*	1350	53	1190	47	1070	42	2130	84	2740	108	3050	120
11	145	350	787	31	737	29	635	25	2440	60	3350	72	2130	84
12		450	1120	44	991	39	846	34	1830	72	2310	91	2620	103
13		550	1350	53	1190	47	1070	42	2130	84	2740	108	3050	120
14		650*	1600	63	1330	52.5	1270	50	2440	96	3350	132	3660	144
15	170	450	1120	44	991	39	846	34	1830	72	2310	91	2620	103
16		550	1350	53	1190	47	1070	42	2130	84	2740	108	3050	120
17		650	1600	63	1330	52.5	1270	50	2440	96	3350	132	3660	144
18		750*	1830	72	1560	61.5	1470	58	2740	108	3960	156	4270	168
19	245	550	1350	53	1190	47	1070	42	2130	84	2740	108	3050	120
20		650	1600	63	1330	52.5	1270	50	2440	96	3350	132	3660	144
21		750	1830	72	1560	61.5	1470	58	2740	108	3960	156	4270	168
22		900*	2260	89	1930	76	1800	71	3350	132	4870	192	4870	192
23		1050	2670	105	2300	90.5	2110	83	3960	156	5500	216	5500	216
24	362	1050	2670	105	2300	90.5	2130	84	3960	156	5500	216	5500	216
25		1300*	3020	119	2690	106	2640	104	4430	174			6100	240
26	550	1550					3150	124					7620	300
27		1800*					3660	144	7620	300			8230	324
28	800	2050					4220	166					15240	600

ANSI C37.30.1 TABLE 6 - PREFERRED CONTINUOUS AND WITHSTAND CURRENTS FOR STATION CLASS OUTDOOR AIR SWITCHES

Line Number	Rated continuous current (A)	Withstand currents		
		Short-time withstand (kA)	Peak withstand (kA)	
			60 Hz	50Hz
(1)	(2)	(3)	(4)	
1	600	25	65	63
2	1200	38	99	95
3	1600	44	114	110
4	2000	44	114	110
5	2000	63	164	158
6	3000	63	164	158
7	3000	75	195	188
8	4000	75	195	188

Note: Please check IEEE 37.30.1 specification for most up-to-date information.

Current Carrying Parts

Contacts

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

Contacts shall be of the reverse loop, self-wiping type. The current carrying path shall not be through springs, pins, or bearings.

Exposed contacts shall be self-wiping silver-to-copper and silver-to-silver. All other current carrying contacts, including hinged-end contacts, shall be silver-to-silver, unless sealed and insulated from contamination and corrosion. Internal sealed contacts may be either silver-to-silver or silver-to-copper.

External silver-to-silver contact surfaces that are applied to copper shall be plated application. Minimum thickness of either type surface shall be .0005 inches.

Silver applied to aluminum is NOT acceptable.

Blades

The switch blades shall be tubular and 6063-T6 aluminum.

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

The blade must be designed such that it is locked into the jaw upon closing.

The switch blade must have a distinct 2-color indicator, showing only 1-color when the blade is fully open, and only the other color when the blade is closed.

The blade must rotate in the jaw contact upon opening, releasing all contact pressure and releasing the lock assembly.

Terminal Pads

All terminal pads shall be machined aluminum. The pads shall be equipped with tin-plated copper shields in a NEMA configuration, or plated to a minimum thickness of .0005 where required.

Switches with ampere ratings between 600 and 3000 shall have terminal pads with four holes on a NEMA spacing of 1 ¾-inch. Bolt holes shall be 9/16-inch.

Corona Protection

Switches rated at 245Kv and 362Kv shall come equipped with protection from corona effects.

Operation

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.

To close the switch, sufficient speed must be used to ensure the blade latch is fully engaged when the blade comes to a complete stop.

Operating Mechanisms

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 supporting structures will be provided as required.

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

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. Optional stops on the switch bases shall be incorporated in the design for open position to prevent misalignment of the switch blades.

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.

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 partially closed position at the completion of any operator cycle.

The rotation 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.

The operating mechanism shall have position indicators and provisions for pad locking in both the open and closed positions. It shall be provided with a 1/0-grounding conductor, and length will be dependent on switch type.

The maximum operating effort shall be fifty pounds for a swing handle operator or thirty-five pounds for a manually-operated gear mechanism.

Bases / Mounting Hardware

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

The base shall be constructed of ASTM A36 steel or 6061-T6 aluminum, the latest revision, 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.

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

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

Nameplates

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 marked on the nameplate.

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.

kV	BIL	POST
15.5	110	TR 205 OR 225
27	150	TR 208 OR 227
38	200	TR 210 OR 231
48.3	250	TR 214 OR 267
72.5	350	TR 216 OR 278
121	550	TR 286
145	650	TR 288
169	750	TR 291
245	900	TR 304
245	1050	TR 312
365	1300	TR 367

Station post insulators shall be supplied with the proper fittings required to develop the impulse level and to support the busses 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 lock washers and sized for the insulator specified.

Drawings

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.

Final Drawings

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

Field Drawings

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

Shipping Requirements

Switches can be shipped with all live parts and bearings assembled and bolted into position on the bases with the blades securely wired closed into the contacts. 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 other loose parts for each switch shall be shipped in a wooden box properly identified. Switches rated 161kV and below can include the insulators assembled, when required.

Each bundle, crate, or pallet shall be marked utilizing a weatherproof marking.

Shipment

For freight and shipping please refer to HPS Terms and Conditions of Sales.

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

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