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dated August, 1973

Southern States, Inc.

Type RDA-1 ALUMINUM

GROUP OPERATED, AIR BREAK SWITCHES

The RDA-1 is a double side break aluminum air switch that conforms to all NEMA, IEEE, and ANSI standards. It may be applied in sectionalizing, main line disconnecting, and by-passing service in substations and on transmission lines.

The RDA-1 meets the requirements of today's increased loads with the most advanced engineering techniques. Using the latest metallurgical knowledge, the RDA-1 is modern, completely reliable, and will give many years of dependable, trouble-free service. This switch incorporates design refinements resulting from a continuing program of product development and improvement at Southern States. These design modifications plus a high degree of quality control make the RDA-1 an outstanding performer of great reliability. Today, thousands of these switches are in service in all types of environments.

Using high strength, high conductivity aluminum for most live parts, the RDA-1 features rugged construction and great durability while allowing substantial reductions in weight.

This design is especially suited for higher voltages; one version of this switch is rated at 1,100 kV which is the highest operating voltage of any switch in the world.

FIGURE 1 – Installation view of an RDA-1 345 kV, 3000 amp switch.

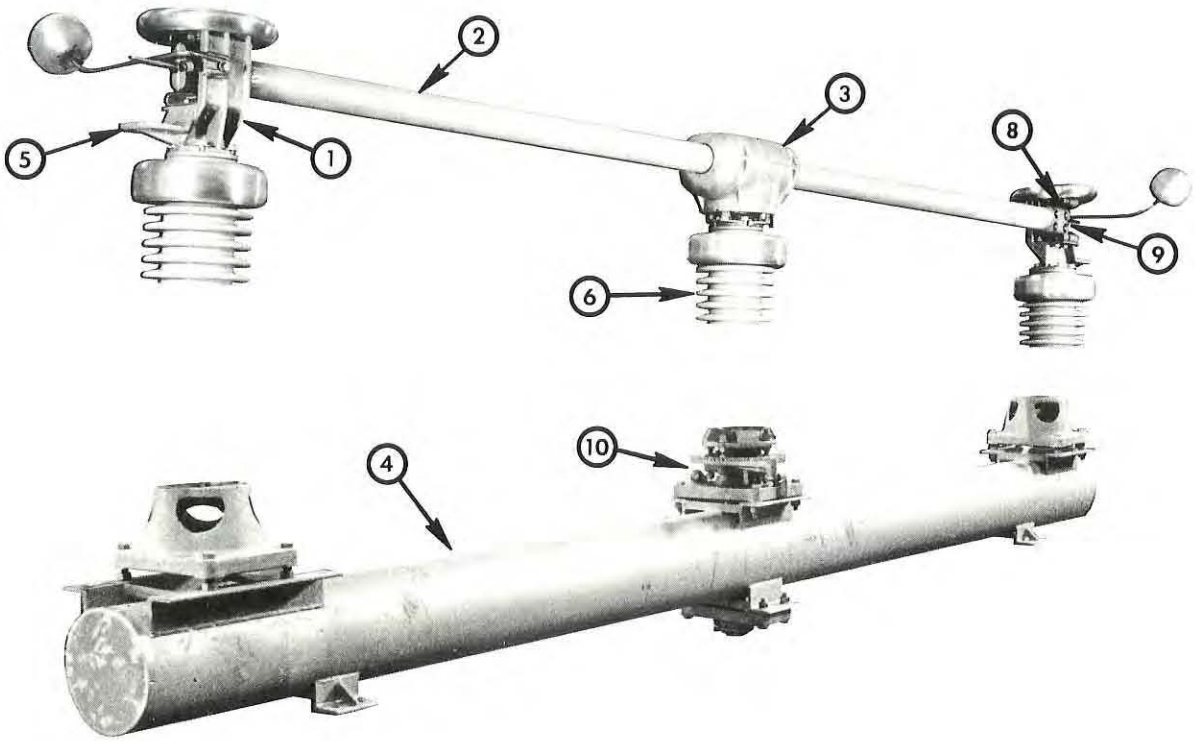


FIGURE 2 – Switch illustrated is an RDA-1 345 kV, 2000 amp.

Components And Design Features

(1) **SWITCH JAWS AND TERMINAL PADS** – One piece cast aluminum (Alloy 356-T6). There are no welded joints in the current path of the RDA-1 jaw, and the terminal pad is an integral part of the jaw.

(2) **SWITCH BLADE** – One piece continuous aluminum tubing (Alloy 6063-T6; 50% minimum conductivity) is used for the blade to provide maximum strength and conductivity while allowing light weight.

(3) **LINKAGE COMPONENTS** – Using materials best suited for the job, the operating linkage of the RDA-1 will not deteriorate or become hard to operate with the passage of time. The components are completely maintenance free, and consist of bronze gear segments and toggle linkages, stainless steel springs, and stainless steel pins. The operating linkage is enclosed in a cast aluminum housing and isolated from the environment. The switch blade rotates on ultra-high molecular weight polyethylene bearing sleeves which are also maintenance free and will never bind or warp. The housing rotates on roller bearings of stainless steel.

All linkage components are completely set and tested at the factory, eliminating critical field adjustments. (See the cutaway drawings of the switch linkage on page 5).

(4) **BASES** – Unless otherwise specified by the customer the following galvanized steel bases are supplied as standard: 69 kV, 3 inch bolt circle insulators – single channel base; 69 kV, 5 inch bolt circle insulators – double channel base; 115, 138, 161, and 230 kV – double channel base; 345 kV and above – tubular base. The design details of a switch base may vary to meet requirements for most efficient use of materials or customer specifications.

(5) **TERMINAL HARDWARE** – NEMA standard, four hole terminal pads are standard on all switches through 345 kV. Current ratings of 1200 amperes have 3" square pads; 4" square pads are supplied on 1600 amp. and above. Special drilling is available at extra cost, as are expansion, rigid, or multi-conductor terminals. Conductor size and type should be specified when ordering.

(6) **INSULATORS** – Virtually any type insulator from any manufacturer can be specified for the RDA-1.

(7) **INSTALLATION OF THE RDA-1** is an uncomplicated procedure because there are no critical adjustments to be made in the field. Switch assembly is merely a matter of mounting the base to the structure, the insulator stacks to the base, and the com-

pletely pre-assembled live parts to the insulators. The insulators are completely and easily adjustable by the time-tested jack screw method, and operating mechanisms are conventional, easily-installed designs.

(8) CONTACTS – Like all Southern States switches the RDA-1 employs Amplitact® self-cleaning, silver-to-silver, high pressure contacts. The reverse-loop configuration of these contacts takes advantage of the intense electro-magnetic fields generated during high faults to apply additional high contact pressure when it is needed the most. There has never been a reported failure of a Southern States Amplitact®

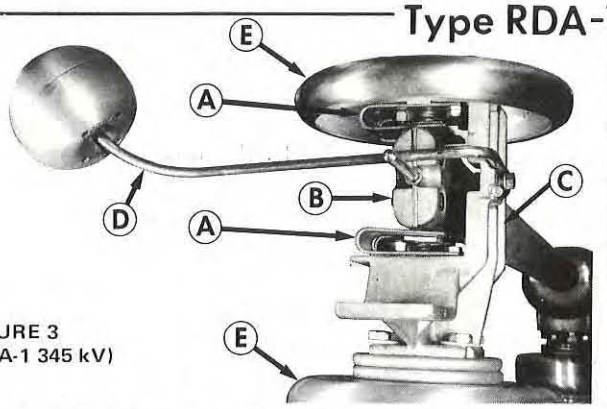


FIGURE 3
(RDA-1 345 kV)

DETAIL: (A) Reverse loop, jaw contacts (silver strips brazed to bus copper). (B) Blade tip. (C) One piece, cast aluminum jaw. (D) Arcing horn (copper with cast aluminum ball). (E) Corona shield (345 kV and above) spun aluminum. All bolts and contact backup springs are stainless steel.

(9) BLADE TIPS – Proven reliable in thousands of demanding applications, the RDA-1 blade tip is shown in detail at the right. (A) Cast aluminum blade tip halves. (B) Solid copper bar, hot tin dipped. (C) Oxidation inhibitor applied on all copper/tin–aluminum interfaces to prevent corrosion. (D) Four bolts join assembly. Bolts, washers, lockwashers, nuts are stainless steel for strength and corrosion resistance. (E) Dome silver strips (43 mils thick) brazed to copper bar. These components make contact with coin silver inserts on contact leaves, establishing silver-to-silver current transfer points. (F) Blade (aluminum tubing) welded to blade tip assembly.

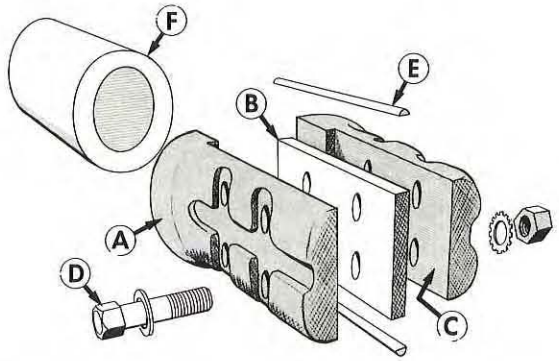


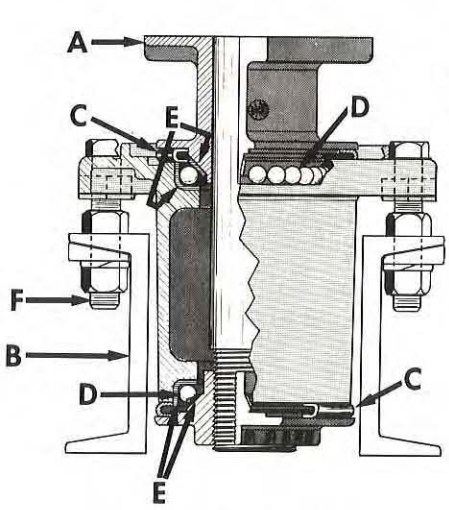
FIGURE 4 – Blade tip construction

(10) BEARINGS – The cutaway views of typical double channel and tubular base bearings below show the attention to detail that makes them so reliable and highly resistant to side thrusts. Note the stainless steel bearings and races. These components will never need maintenance or even periodic lubrication.

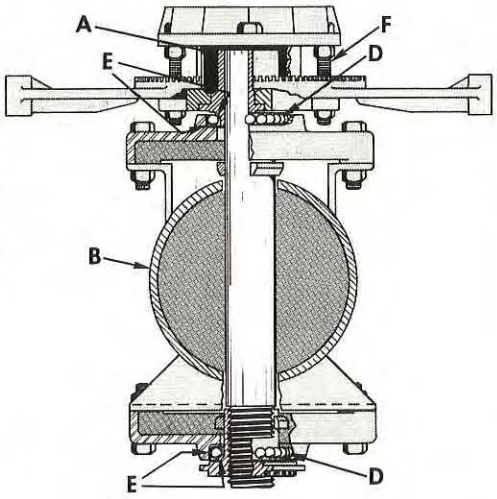
FIGURE 5

DETAIL:

A–Bearing hub
B–Base
C–Seals (standard on vertical mounting; optional on upright and underhung)
D–Stainless steel ball bearings
E–Heat treated, high strength, stainless steel races
F–Jack screws (bearing tilt angle adjustments)



DOUBLE CHANNEL



TUBULAR

Stability, Standard Phase Spacing, Excellent Ice Performance, Low Silhouette, Low Corona and RIV

Operational Characteristics

STABILITY – The three insulator configuration of the RDA-1 is very stable and is especially suitable for large air switch applications. As equipment of this nature grows larger, mechanical stability becomes an increasingly serious consideration, and the field proven stability of the double side break switch makes it the obvious choice for EHV and UHV applications.

With a center insulator supporting the blade center, positive switch operation is assured even in high winds and heavy ice. The end insulators are stationary, further contributing to the overall rigidity of this switch. The rigid mounting of the jaws minimizes the problem of contact pitting and erosion that could result from movement and vibration. The RDA-1 is a rugged performer even under the most adverse operating conditions.

In addition, the double side break design behaves well under short circuit conditions. The electromagnetic forces generated by high faults do not tend to force the switch blade open, and the proven capabilities of the Amplitact® reverse loop contacts make the RDA-1 a completely reliable switch during overcurrents.

WIND LOADING – As the size of switches increase, closing in high winds can become a critical factor. Because of the shortened cantilever blade span, the RDA-1 is stable in high winds, and the problems of misalignment are minimized.

PHASE SPACING – The RDA-1 will reliably and safely perform all conventional air break switch functions without costly additional phase spacing. This statement is supported by extensive laboratory tests and many field installations all of which show that the double side break switch requires no additional phase spacing over the vertical break designs. (See IEEE Paper No. 31 TP 65-84 and Southern States Special Report on EHV for further information on phase spacing of double side break switches.)

OPERATION UNDER ICE – The double side break design of the RDA-1 is the best configuration yet devised for reliable operation in heavy ice. The extreme moment of a vertically opening blade loaded with ice is not a problem with the RDA-1. Since blade movement is horizontal, the blade is balanced regardless of the build-up of ice. Because the blade does not have to be lifted, this switch can be operated with a minimem of additional effort even with the heaviest ice loads.

In addition, the horizontal opening of the jaws does not tend to trap ice. The icing problems of the exposed upright jaw characteristic of vertical break switches are minimized.

The fully enclosed operating linkage of the RDA-1 also contributes to its excellent performance in ice. Completely isolated from the elements, the linkage cannot get clogged with ice, sleet, or snow.

LOW SILHOUETTE – Breaking in a horizontal rather than a vertical plane, the RDA-1 is especially suited for applications where low vertical clearance prohibits the use of a vertical break switch.

The horizontal break design reduces the zone of protection against lightning with corresponding savings in structures.

The switch blade is balanced in all positions; no counterbalancing mechanism is required, resulting in a smoother contoured design.

Greater visual appeal is an additional feature of the RDA-1, and this is becoming increasingly important in today's trend to low profile, aesthetically appealing substations.

CORONA SUPPRESSION – The smooth, streamlined contours of this switch, which result from its lack of exposed operating parts, reduce corona and radio influence voltage to a minimum. The RDA-1 does not require corona shielding below 345 kV. With the extra high voltage switch finding greater application in urban areas, the use of the "silent" switch is an increasingly important consideration.

ARC INTERRUPTION – The double side break design has better arc interrupting characteristics than a vertical break switch for two reasons: The double side break switch generates a greater gap in the same angular movement as the vertical break switch, and its direction of break is transverse to the normal path of arc migration.

Mechanical

All ratings of the RDA-1 employ the same basic mechanism to operate the switch. The illustrations at right show a blade closing sequence. The center insulator rotates from the fully open 70° angle* until the blade makes contact with the blade stop in each jaw. The support insulator continues another 45° rotation which is transferred through gear segments to rotate the blade in the contacts to establish high pressure within the contact springs. Total stack rotation is 115°.

The stack is rotated by the conventional crank arm and interphase pipe arrangement. Although all crank arms are fully adjustable, they are pre-set at the factory for proper rotation. All operating pipes and clevis connections supplied as standard equipment are heavy duty components.

*On switches equipped with grounding switches toward the open gap, the fully open angle is 80°.

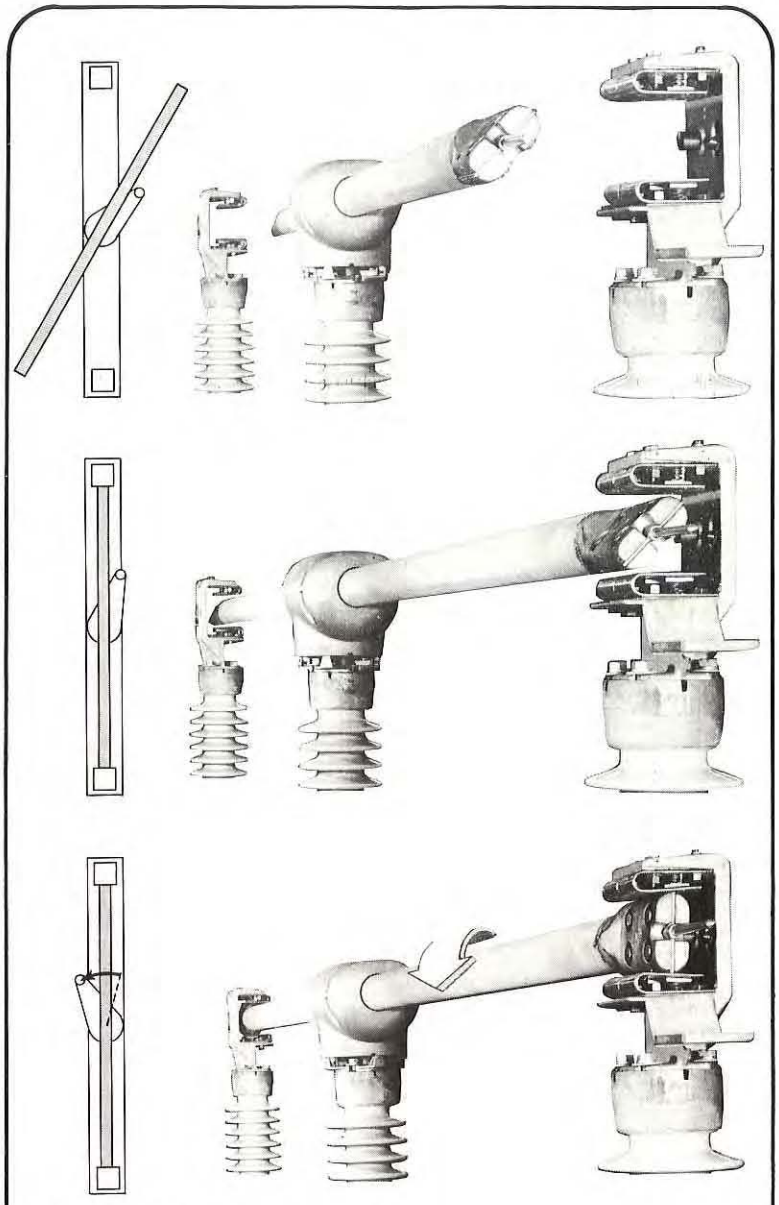


FIGURE 6 – CLOSING SEQUENCE

When the blade moves into the jaws and hits the blade stops, the rotating insulator continues to rotate an additional 45°. This rotation is transferred through gear segments to the blade, which rotates in the jaw, establishing high contact pressure. Schematic drawing "B" below shows this operation.

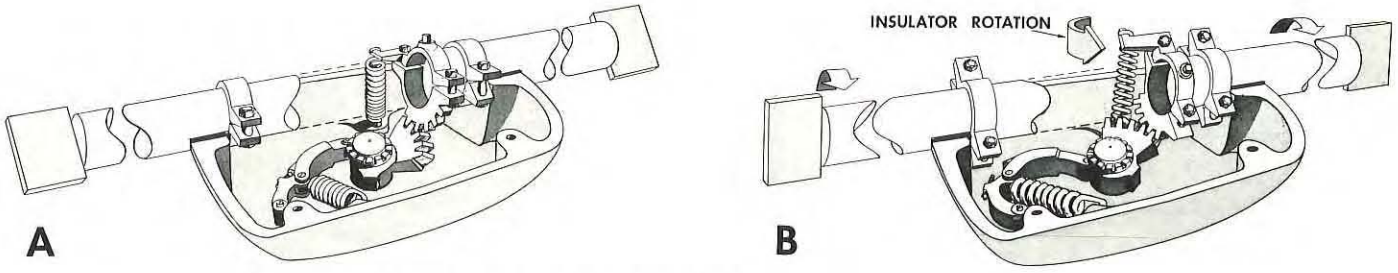
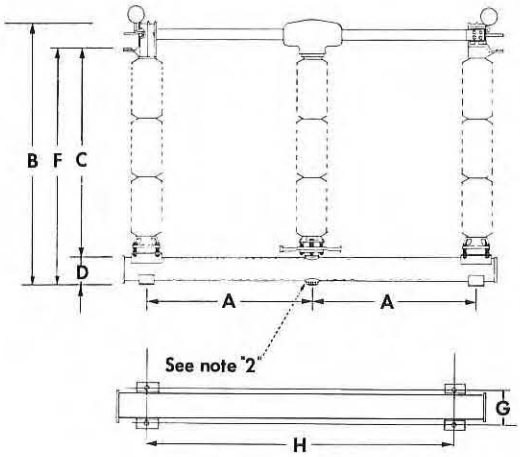
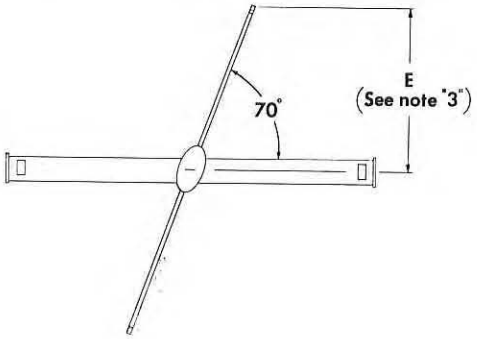


FIGURE 7 – OPERATING LINKAGE SCHEMATIC
(No Scale. Top of housing removed. Components exaggerated for clarity.)

Specifications

VOLTAGE kV NOM.	MAX.	BIL	CURRENT AMPERES CONT.	MAX.	INSULATOR TR NO. CAP & PIN	POST	CATALOG NO.	WT. in LBS. NET	SHIP	WT. in KG NET	SHIP
69	72.5	350	1200	61,000	16	216	RDA-1-691200	1297	1466	588	664
69	72.5	350	1600	70,000	16	216	RDA-1-691600	2206	2516	1000	1141
69	72.5	350	2000	80,000	*	*	RDA-1-692000	2313	2640	1048	1197
115	121	550	1200	61,000	19	286	RDA-1-1151200	3295	3720	1494	1687
115	121	550	1600	70,000	19	286	RDA-1-1151600	3301	3760	1497	1705
115	121	550	2000	100,000	19	286	RDA-1-1152000	3381	3818	1533	1731
115	121	550	3000	100,000	19	286	RDA-1-1153000	3484	3947	1580	1790
138	145	650	1200	61,000	22	288	RDA-1-1381200	3476	3925	1576	1780
138	145	650	1600	70,000	22	288	RDA-1-1381600	3541	3999	1605	1813
138	145	650	2000	100,000	22	288	RDA-1-1382000	3558	4018	1613	1822
138	145	650	3000	100,000	22	288	RDA-1-1383000	3716	4154	1685	1883
161	169	750	1200	61,000	25	291	RDA-1-1611200	4174	4706	1892	2134
161	169	750	1600	70,000	25	291	RDA-1-1611600	4274	5145	1938	2333
161	169	750	2000	100,000	25	291	RDA-1-1612000	4650	5255	2108	2383
161	169	750	3000	100,000	25	291	RDA-1-1613000	4820	5425	2185	2460
230	242	900	1200	61,000		304	RDA-1-2301209	6529	7377	2960	3345
230	242	900	1600	70,000		304	RDA-1-2301609	6668	7535	3023	3417
230	242	900	2000	100,000		304	RDA-1-2302009	6770	7663	3070	3475
230	242	900	3000	100,000		304	RDA-1-2303009	6950	7843	3152	3557
230	242	1050	1200	61,000		316	RDA-1-2301210	6873	7766	3117	3522
230	242	1050	1600	70,000		316	RDA-1-2301610	6896	7812	3127	3543
230	242	1050	2000	100,000		316	RDA-1-2302010	7008	7905	3178	3585
230	242	1050	3000	100,000		316	RDA-1-2303010	7188	8085	3260	3667
345	362	1050	1600	70,000		316	RDA-1-3451610	7303	8203	3312	3720
345	362	1050	2000	100,000		316	RDA-1-3452010	7418	8333	3365	3779
345	362	1050	3000	100,000		316	RDA-1-3453010	7543	8465	3421	3839
345	362	1300	1600	70,000		324	RDA-1-3451613	7954	8975	3607	4070
345	362	1300	2000	100,000		324	RDA-1-3452013	8126	9148	3685	4149
345	362	1300	3000	100,000		324	RDA-1-3453013	8299	9322	3764	4228
345	362	1300	4000	100,000		324	RDA-1-3454013	8488	9511	3849	4313
500	550	1550	2000	70,000		*	RDA-1-5002015	*	*	*	*
500	550	1550	3000	100,000		*	RDA-1-5003015	*	*	*	*
500	550	1800	2000	70,000		*	RDA-1-5002018	*	*	*	*
500	550	1800	3000	70,000		*	RDA-1-5003018	*	*	*	*
765	*	*	*	*		*		*	*	*	*





NOTES:

1. Due to continuing product improvements some of the dimensions shown here may vary slightly from the current product. **Do not use these dimensions for construction purposes, but rather refer to the factory for certified prints.**
2. On 69 kV, 1200 and 1600 amp models the bearing extends 2-9/16" below the mounting surface. Refer to factory.
3. When grounding switch is mounted toward open gap, refer to factory for clearance dimension.
4. Weight includes 3 pole switch unit with insulators, less controls.

*Refer to factory.

APPROXIMATE DIMENSIONS (INCHES) (1)												APPROXIMATE DIMENSIONS (METERS) (1)										
POST INSULATORS								CAP & PIN				POST INSULATORS								CAP & PIN		
A	B	C	D	E	F	G	H	B	C	D		A	B	C	D	E	F	G	H	B	C	F
34	47-7/8	38-7/8	2-1/2	34-1/8	39-3/8	9-1/4	*	46-7/8	35-7/8	38-3/8		.864	1.216	.987	.064	.867	1.000	.235	*	1.911	.911	.975
34	50-3/8	38-7/8	2-1/2	39-1/4	39-3/8	9-1/4	*	50-7/8	35-7/8	38-3/8		.864	1.280	.987	.064	.997	1.000	.235	*	1.292	.911	.975
34	53-1/8	36-3/8	6	39-1/4	43-3/8	8-1/4	*	52-1/8	36-3/8	42-3/8		.864	1.349	.924	.152	.997	1.102	.210	*	1.324	.937	1.076
42	66-7/8	52-3/8	6	41-1/4	58-3/8	8-1/4	*	64-3/8	49-7/8	55-7/8		1.067	1.699	1.330	.152	1.046	1.483	.210	*	1.635	1.266	1.420
42	68-1/2	52-3/8	6	48-3/4	58-3/8	8-1/4	*	58	49-7/8	55-7/8		1.067	1.740	1.330	.152	1.237	1.483	.210	*	1.473	1.266	1.420
42	68-1/2	52-3/8	6	48-3/4	58-3/8	8-1/4	*	58	49-7/8	55-7/8		1.067	1.740	1.330	.152	1.237	1.483	.210	*	1.473	1.266	1.420
48	69-3/8	54-1/2	6	55-1/2	60-1/2	8-1/4	*	66-7/8	52	58		1.219	1.762	1.384	.152	1.410	1.537	.210	*	1.699	1.321	1.473
48	75-7/8	61-3/8	6	46-3/4	67-3/8	8-1/4	*	70-7/8	56-3/8	62-3/8		1.219	1.927	1.559	.152	1.189	1.711	.210	*	1.800	1.432	1.584
48	77-1/2	61-3/8	6	54-3/8	67-3/8	8-1/4	*	72-1/2	56-3/8	62-3/8		1.219	1.969	1.559	.152	1.381	1.711	.210	*	1.842	1.432	1.584
48	77-1/2	61-3/8	6	54-3/8	67-3/8	8-1/4	*	72-1/2	56-3/8	62-3/8		1.219	1.969	1.559	.152	1.381	1.711	.210	*	1.842	1.432	1.584
54	78-3/8	63-1/2	6	61	69-1/2	8-1/4	*	78-3/8	58-1/2	64-1/2		1.372	1.991	1.613	.152	1.549	1.765	.210	*	1.991	1.486	1.638
54	83-7/8	69-3/8	6	52-1/2	75-3/8	8-1/4	*	79-7/8	65-3/8	71-3/8		1.372	2.130	1.762	.152	1.334	1.915	.210	*	2.029	1.661	1.813
54	85-1/2	69-3/8	6	60	75-3/8	8-1/4	*	81-1/2	65-3/8	71-3/8		1.372	2.172	1.762	.152	1.524	1.915	.210	*	2.070	1.661	1.813
54	85-1/2	69-3/8	6	60	75-3/8	8-1/4	*	81-1/2	65-3/8	71-3/8		1.372	2.172	1.762	.152	1.524	1.915	.210	*	2.070	1.661	1.813
60	86-3/8	71-1/2	6	66-3/4	77-1/2	8-1/4	*	82-3/8	67-1/2	73-1/2		1.524	2.194	1.816	.152	1.695	1.969	.210	*	2.092	1.715	1.867
60	117-1/4	91-3/8	10	62-3/4	101-3/8	11	*					1.524	2.978	2.321	.254	1.594	2.575	.279	*			
60	117-1/4	91-3/8	10	65-5/8	101-3/8	11	*					1.524	2.978	2.321	.254	1.667	2.575	.279	*			
60	117-1/4	91-3/8	10	65-5/8	101-3/8	11	*					1.524	2.978	2.321	.254	1.667	2.575	.279	*			
64	117-1/4	93-1/2	10	66-3/4	103-1/2	11	*					1.524	2.978	2.375	.254	1.695	2.629	.279	*			
66	129-3/8	103-3/8	10	68-1/2	113-3/8	11	*					1.676	3.286	2.626	.254	1.742	2.880	.279	*			
66	129-3/8	103-3/8	10	71-1/4	113-3/8	11	*					1.676	3.286	2.626	.254	1.810	2.880	.279	*			
66	129-3/8	103-3/8	10	71-1/4	113-3/8	11	*					1.676	3.286	2.626	.254	1.810	2.880	.279	*			
66	129-3/8	105-1/2	10	72-3/8	115-1/2	11	*					1.676	3.286	2.629	.254	1.838	2.934	.279	*			
66	129-3/8	103-1/2	12-3/4	72-3/8	113-1/2	11	*					1.676	3.286	2.629	.324	1.838	2.883	.279	*			
66	146-1/2	119-1/2	12-3/4	72-3/8	131-1/2	11	*					1.676	3.721	3.035	.324	1.836	3.340	.279	*			
66	146-1/2	121-5/8	12-3/4	72-3/8	133-5/8	11	*					1.676	3.721	3.089	.324	1.838	3.400	.279	*			
84	144-1/4	120-7/8	12-3/4	88-3/8	133-5/8	11	*					2.134	3.664	3.070	.324	2.245	3.394	.279	*			
84	144-1/4	120-7/8	12-3/7	88-3/8	133-5/8	11	*					2.134	3.664	3.070	.324	2.245	3.394	.279	*			
84	144-1/4	120-7/8	12-3/4	88-3/8	133-5/8	11	*					2.134	3.664	3.070	.324	2.245	3.394	.279	*			
84	144-1/4	120-7/8	12-3/4	88-3/8	133-5/8	11	*					2.134	3.664	3.070	.324	2.245	3.394	.279	*			
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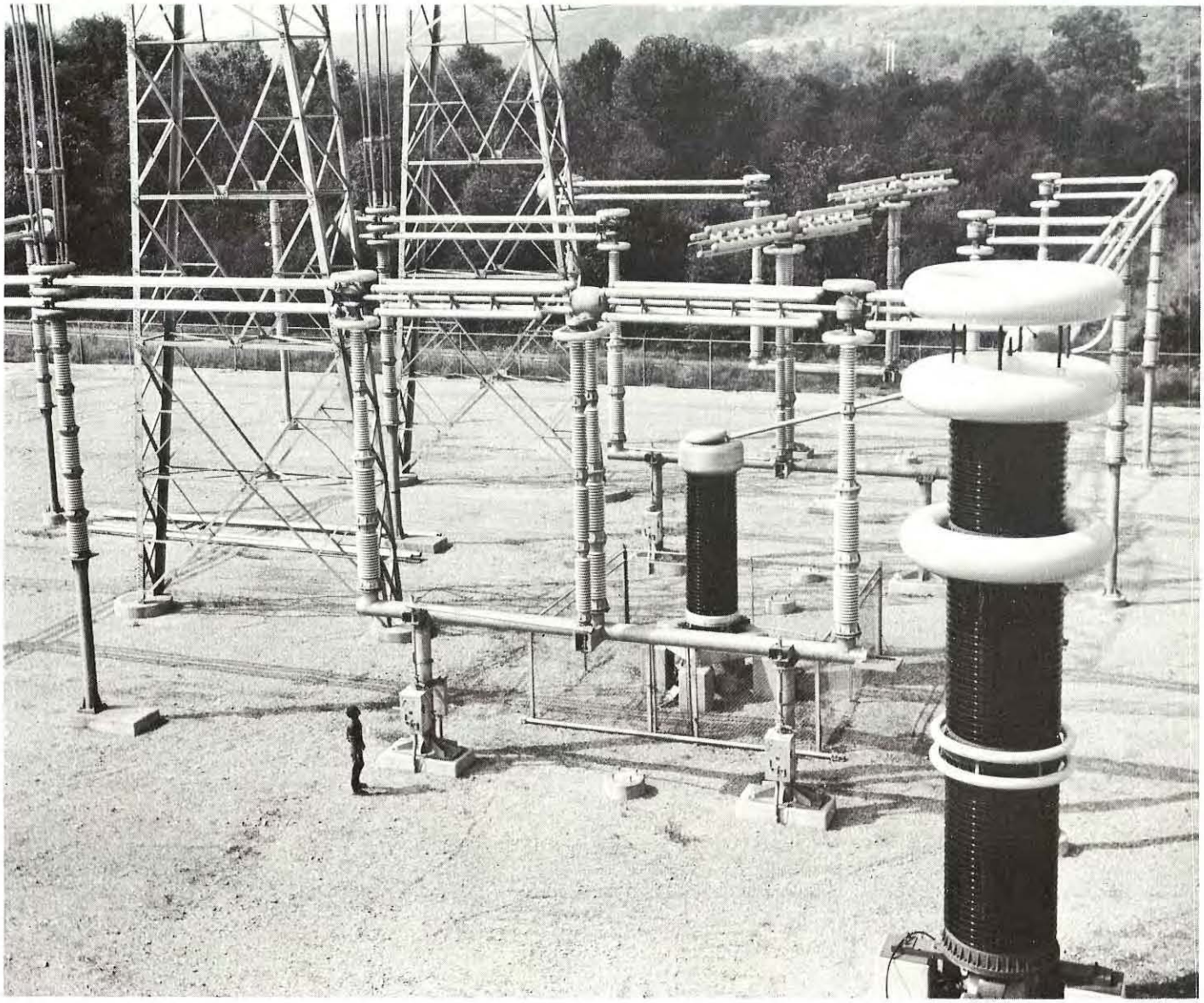

Above – RDA 1,100 kV, 3000 amp installation. For scale, note the size of the figure in the foreground.

Reliability at over one million volts

This is the giant switch designed by Southern States and installed in Waltz Mill, Pa. It has a 24 foot gap distance, stands over 22 feet tall, and has a phase spacing of 49 feet. It is part of the Electric Research Council Underground Transmission Testing Facility, which was built by Westinghouse and is being operated by this firm under a contract with Edison Electric Institute.

Designed, engineered, built, and tested by Southern States, the switch components are all Southern States equipment, including the motor operators and grounding switches.

The engineering requirements were rigorous. On the electrical side there was the 1100 kV corona problem. On the mechanical side there was the problem of moving the switch, especially under an ice load. The insulators used had to provide strong, rigid support for the live parts which are 22 feet in the air. In solving these major problems, Southern States engineers gained invaluable knowledge not only to build this enormous switch, but to build *any* switch for the ultra high voltages of the future.

No wonder when people look for leadership in transmission and distribution equipment, they look to Southern States.

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