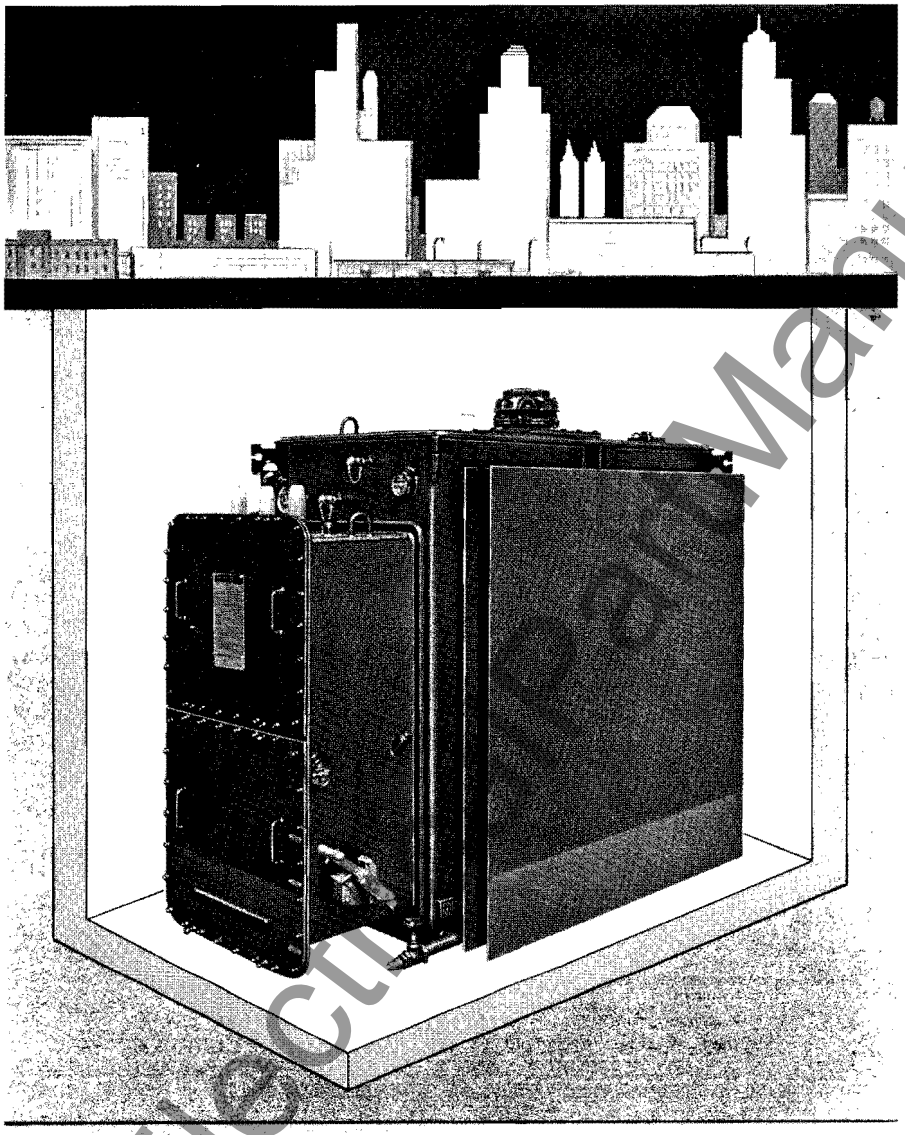
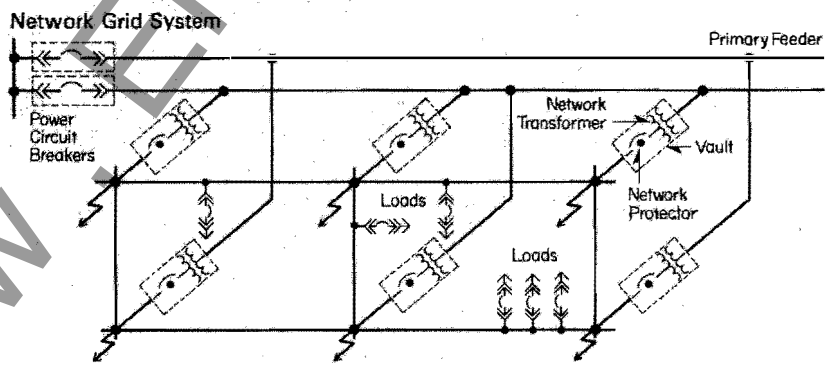
Westinghouse

Spacemiser Liquid-Immersed Network Transformers

300 to 2500 Kva, Three Phase,
60 Hertz, HV: 2400 to 34500 volts,
LV: 216Y/125 or 480Y/277 volts
Vault and Subway





Application

The Westinghouse Spacemiser Network transformer, as pictured, is designed for use in grid type secondary network systems. These systems are most commonly used where there exists a high load density such as in metropolitan areas.

A typical example of a grid system using this type of transformer is illustrated in the schematic drawing. This system is recognized as the most dependable system in use today because the loss of one element will not cause service interruption to any load on the system, i.e., if the power supply to any load is lost, that load will be serviced by the other power sources in the system.

Network transformers are also used in spot network system applications (See B-9458).

Westinghouse Network Transformers Feature:

A heavy duty, high temperature baked finish that allows continued operation of the unit in its normally corrosive environment.

Copper bearing steel for further corrosion resistance—assures reduction in repair and/or replacement costs.

Insuldur system of thermally stabilized insulating material—allows user 12% additional Kva capacity on 55/65° rated units or full Kva capacity at 40°C ambient.

Incorporation of a standard high voltage switch, a network transformer and a low voltage protector (See DB 35-550) into a self-contained installation—helps to reduce overall installation costs.

All aluminum windings for initial economy to the purchaser and continued availability of supply.

November, 1971
Supersedes DB 47-150, dated December, 1963
E,D,C/2081/DB

Design Features

Design Features

High Voltage Entrance

Standard top entry into the high voltage terminal chamber is made by one three conductor or three single-conductor brazed-on wiping sleeves.

Dial Type Top Oil Thermometer

The thermometer is hermetically sealed and shows accurate temperature of the top liquid. It has a resettable, red, peak temperature pointer.

Provision For Air Test Valve

A ½ inch pipe plug is located above the liquid level for accommodating air test fitting.

Cover Lifting Provisions

Magnetic Liquid Level Gauge

The gauge float assembly mounting disc is welded into the tank opening and is permanently pressure tight. The dial assembly with yellow scale on a dark background is easily removed and replaced without unsealing the transformer tank.

Low Voltage Neutral

The neutral is solidly grounded to the transformer tank.

Pressure Relief Device

This device is supplied on Inerteen® filled transformers. On oil filled units, a handhole is supplied in the same location. Disconnection of the low voltage neutral for testing can be made through the cover opening.

Panel Cooler

Spacemiser panel coolers allow maximum heat dissipation while operating within the severe space limitations of vaults. The wall thickness of coolers on vault type network units is 3/16 inches thick and on subway type networks is 5/16 inches thick.

Upper Filter Press Connection and Filling Plug

No-Load Tap Changer

The no-load tap changer mechanism is operated by means of a wrench through a 2 inch pipe plug in the top of the transformer. The tap changer mechanism has been designed to eliminate the possibility of accidentally leaving the tap changer between positions. A dial plate beneath the cover indicates tap positions.

Tank Cover

The tank walls are flanged outward at the top to form a platform for the cover plate which is welded on.

Lifting Lugs

Lifting the unit is accomplished by means of four lifting lugs.

Provision For Sampling Valve

A ½ inch pipe plug is provided for use with a top sampling valve (Inerteen Units Only).

Diagrammatic Nameplate

The diagrammatic nameplate lists all detailed information necessary for the identification of the transformer along with its electrical rating. Pertinent test results are indicated as well as necessary information for installation and operation of the unit.

High Voltage Switch (See Page 6)

Tank and Paint Finish

Both vault and subway type network units are pressure tested at 8 psi.

Each tank assembly is thoroughly cleaned and a primer coat of epoxy based paint is applied by a flow-coat method. This finish is then bake dried at high temperature.

Two black finish coats are then applied; the first finish coat is also flow-coated and bake dried while the second finish coat is sprayed just prior to the undercoating process.

Drain Valve, Sampling Plug and Filter Press Connection

The lower drain valve, and filter press connection assure bottom sampling and complete oil drainage. The valve is a 1-inch globe type, equipped with a pipe plug, suitable for use with oil and Inerteen.

Ground Pad

Undercoating

Additional protection against unusually severe corrosive elements is obtained by applying a heavy asphaltic coating to the base of the transformer tank and a distance up the sides to cover the bottom portion of the coolers.

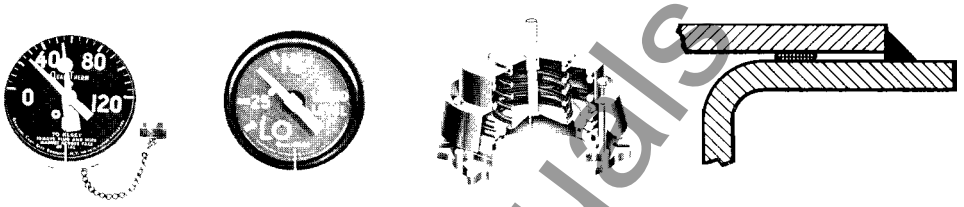
Low Voltage Throat (Not Visible)

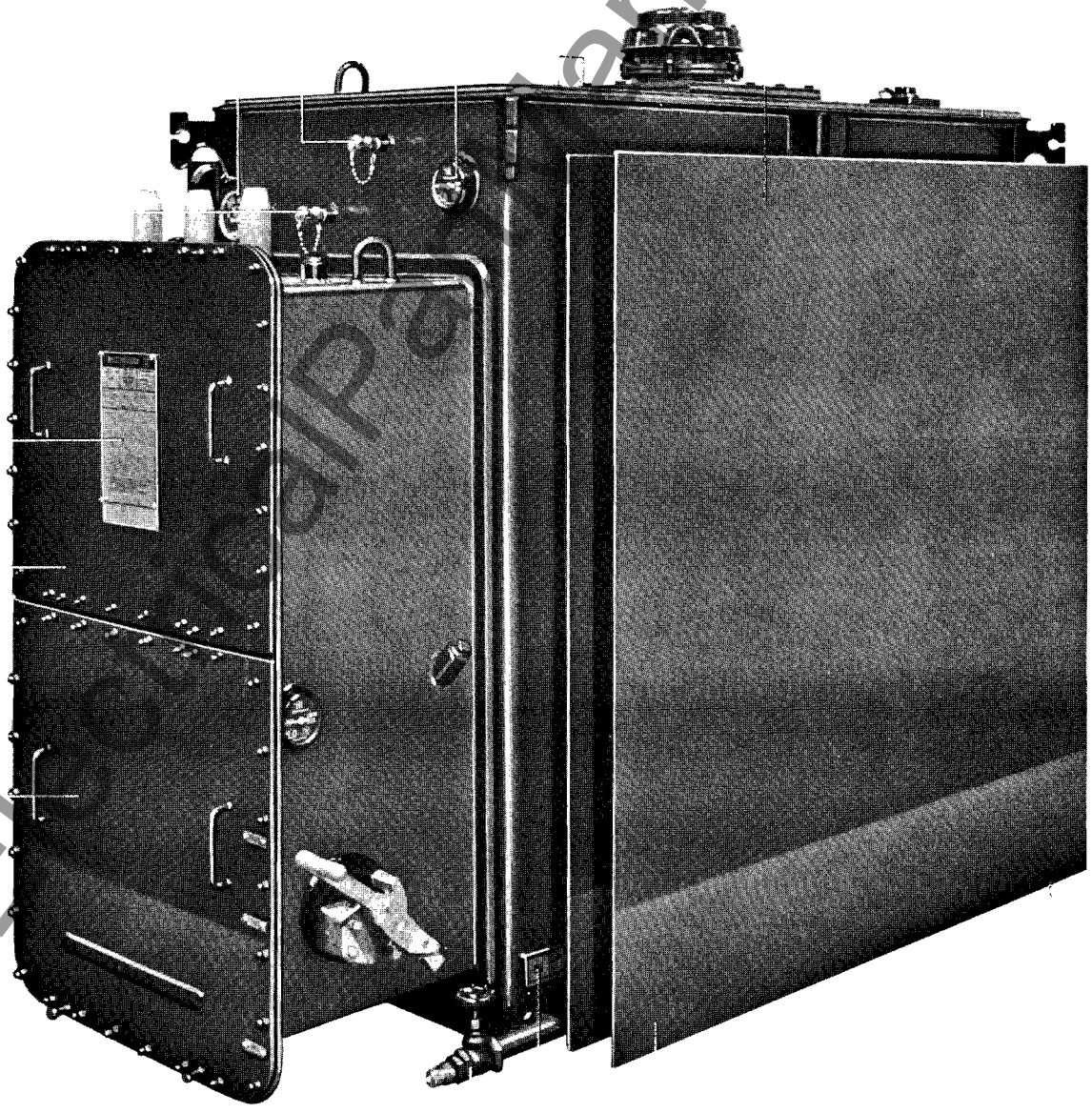
This throat is welded to the tank and drilled and tapped for bolting to a standard network protector.

Universal Design

All Spacemiser network transformers, 15 Kv and below, are designed for oil or Inerteen. By following simple flushing procedure, oil units can be filled with Inerteen if required.

Design Features





Rectangular Core and Coils

WSS Tap Changer

The Westinghouse externally operated WSS tap changer provides positive sequence line voltage changes under no-load conditions. An in-line assembly, the WSS features through-type stationary contact studs rigidly supported by a molded plastic channel. Moving contacts are spring loaded, silver plated copper which move along the stationary line by means of a rack and pinion.

This design has no rivets, bolts or nuts, thus assures the proper contact of current carrying parts when taps are changed. With **no** reported outages, the WSS benefits the user through a reduction of repair or replacement costs by eliminating faulty tap changer operation, the cause of failure in 20% of all power transformers.

Rectangular Aluminum Wound Coils

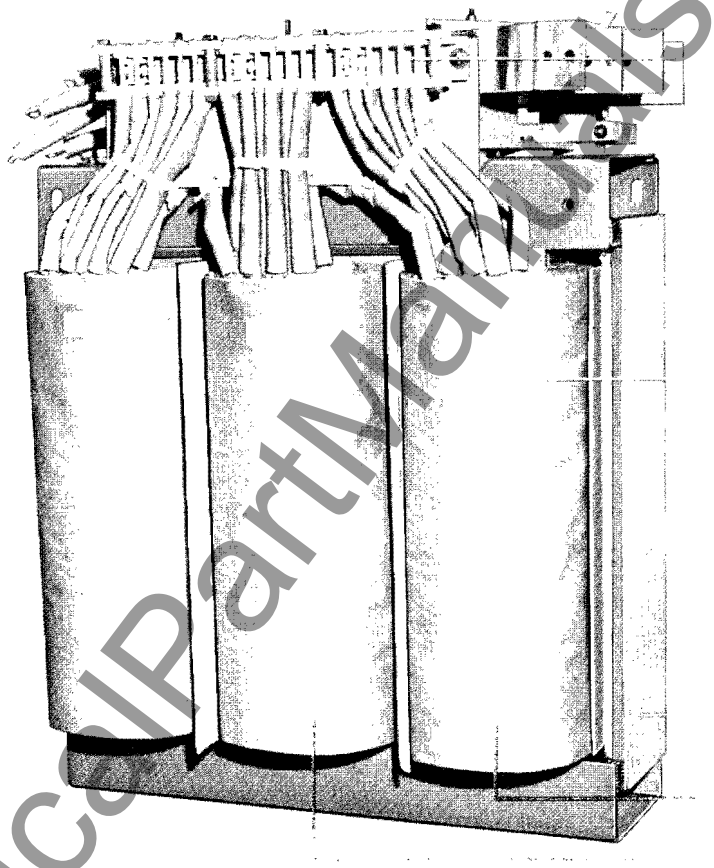
The Westinghouse rectangular wound coil features aluminum conductor in both high and low voltage windings. The low voltage winding is accomplished on a constant tension machine and consists of full width sheet aluminum extending the full height of the coil. High voltage strap aluminum is wound directly over the low voltage winding on a constant tension traversing machine. Layer to layer and high to low insulation is diamond epoxy paper which when heat treated bonds the complete coil into a solid configuration.

The advantage of low voltage sheet aluminum is a continuous cross section of conductor that allows the electrical centers of high and low voltage windings to easily align themselves, virtually eliminating the vertical component of short circuit force.

The benefit is a coil so uniform and compact, the chance of windings overlapping during short circuit is minimized, reducing failure rate, repair and/or replacement cost.

Welded Frame

The Westinghouse exclusive welded frame provides a superior six piece supporting structure for the core and coils. End plates are thick steel slabs that are assembled in a mechanical and pressure jig around the core and coils, then welded to top and bottom plates to form a rigid structure that will not loosen during assembly, shipment, or in service. To determine the thickness of members used (even the thickness of welds), a short circuit calculation is made for each unit to determine the forces of short circuit.



The result is an assembly that restrains more effectively vertical and horizontal components of force, decreasing the probability of failure during severe short circuits.

This benefits the user by a reduction in repair or replacement costs and a reduction in downtime that means loss of service or lost production.

Step-Lap Core

The Westinghouse exclusive stacked core provides a superior flux path by utilizing the patented step-lap joining of core legs to top and bottom yokes. Hand stacked Hypersil steel punchings with interlocking laminations can be more uniformly and rigidly braced to prevent shifting during service.

The user can benefit through reduced sound levels, lowered iron and total losses, and decreased exciting current to lower total operating cost.

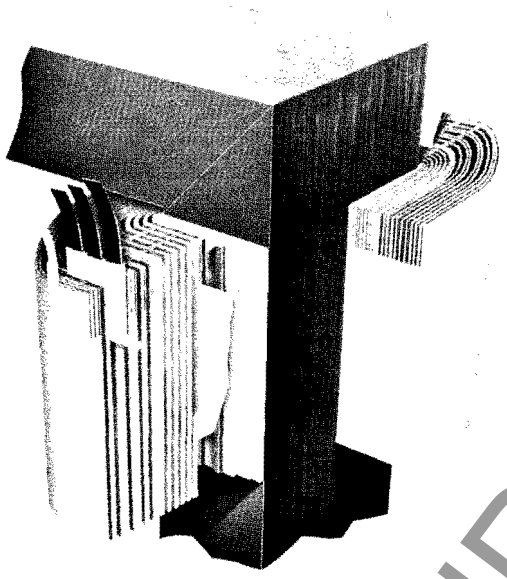
On wye-wye units a fourth leg is added to provide a path for circulating third harmonic flux during unbalance condition.

Super Insuldur Insulation

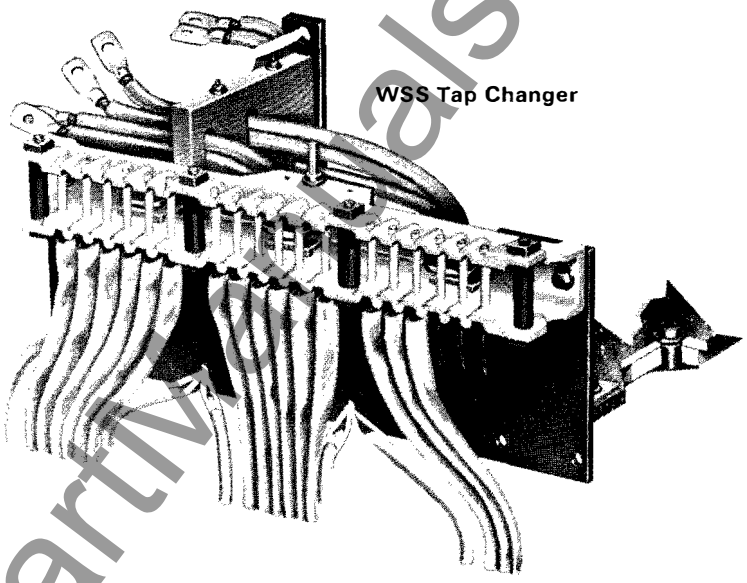
The Westinghouse Super Insuldur insulation effectively upgrades cellulose insulating materials thermally for increased load and overload capability. Retarding insulation breakdown under severe temperature conditions, the chemical stabilizers in the insuldur process minimize dimensional changes in the insulating materials insuring a tighter structure, contributing to greater strength and coil integrity throughout the life of the transformer.

The user benefit is a coil that better withstands short circuit and allows an operation at 10°C higher temperature on a 55°C rated unit with a 12% increase in KVA capacity.

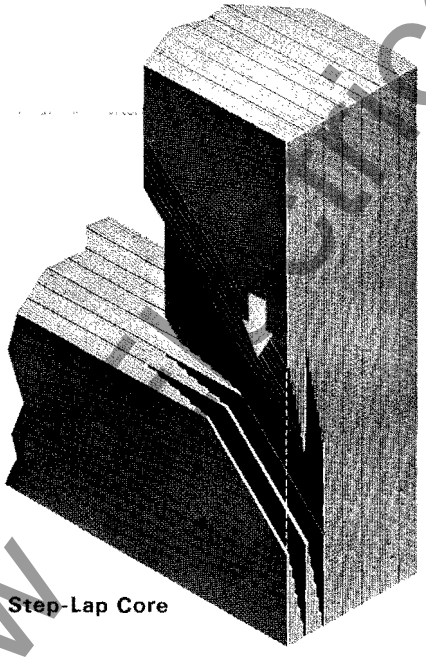
Rectangular Core and Coils



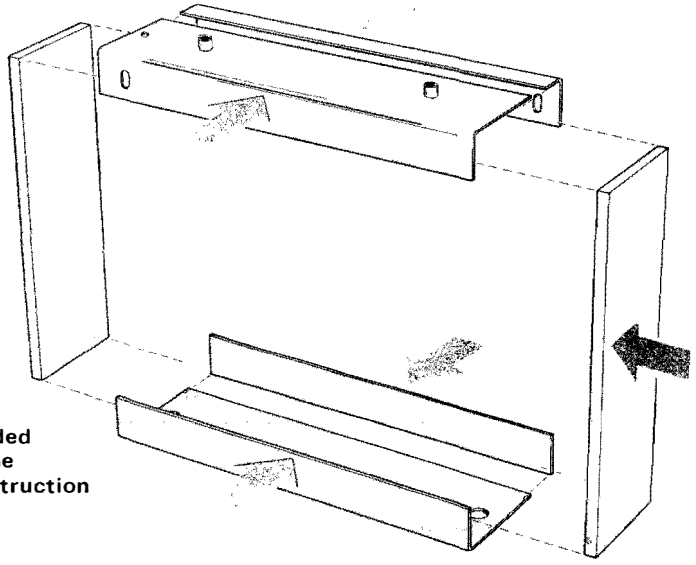
Rectangular Aluminum Wound Coils



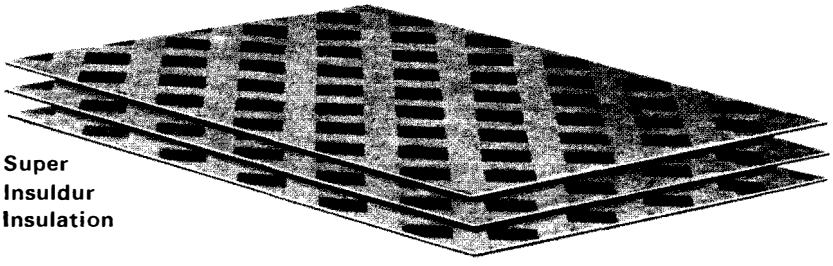
WSS Tap Changer



Step-Lap Core



Welded
Frame
Construction



Super
Insuldur
Insulation

Bushings and Terminal Chamber

Bushings
Low Voltage Type RFW
Standard on network transformers is the low voltage rolled flange welded RFW bushing. This completely sealed hermetic bushing utilizes rolled flange construction for attaching the hardware to the porcelain.

The hardware is inert-arc welded to the tank and stud. The result is a very high strength joint but with resilient mounting so that mechanical shock is not transmitted to the porcelain. The porcelain of the RFW bushing is externally removable without untanking the transformer.

High Voltage Switch and Terminal Chamber
The primary switch is of the rotary type. The three operating positions, indicated by the position of the external switch handle, are: open, closed and ground. No sequence-enforcing device is necessary because the sequence is inherent in the design.

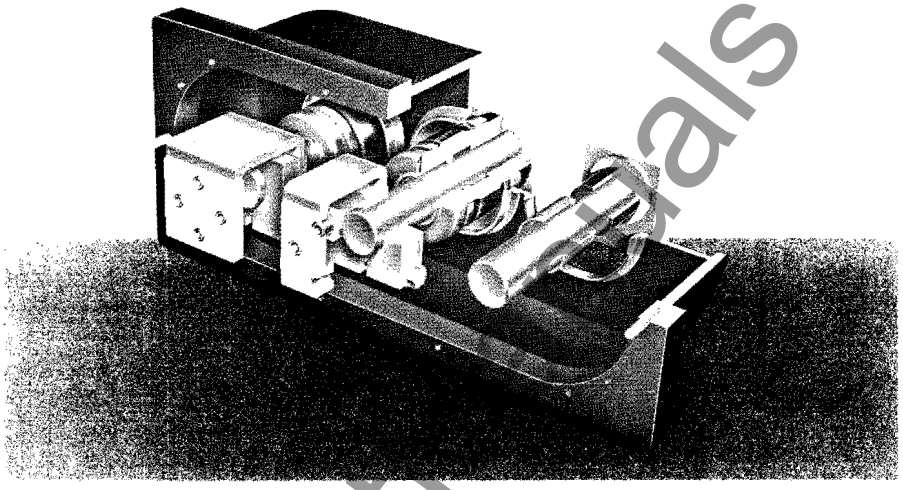
The switch is designed so that when it is moved from open to ground or from ground to open the operator must pause in the closed position until he disengages a mechanical stop. This pause allows time for an electrical interlock to engage, if the transformer is energized, and prevent further movement of the switch.

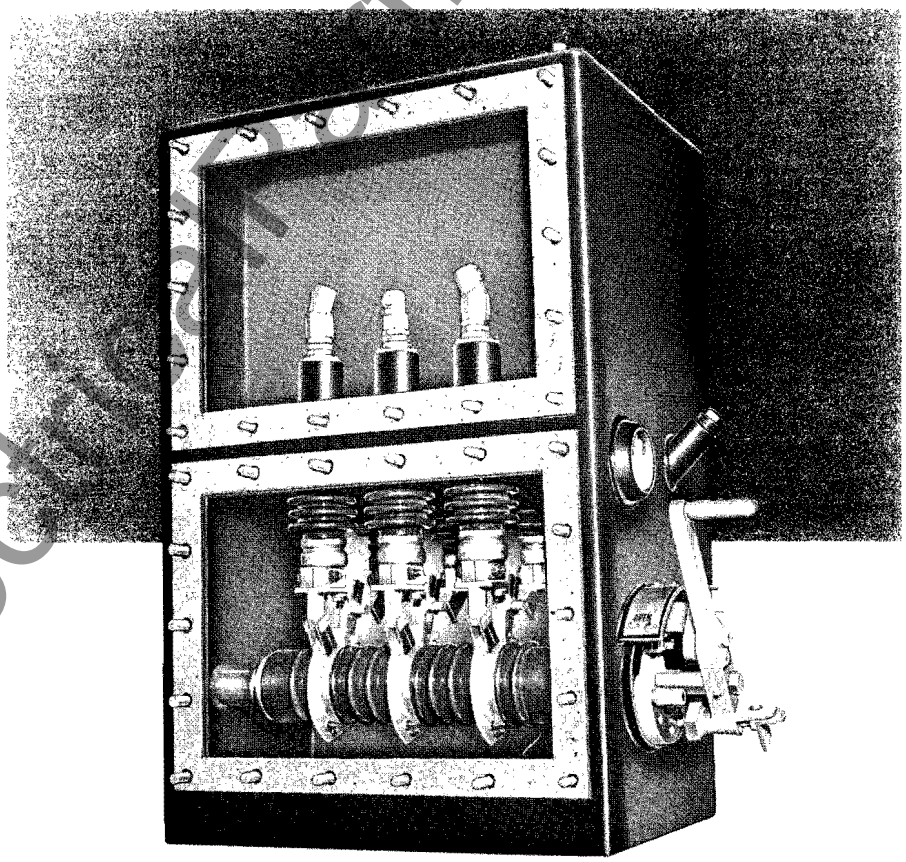
In any position, the switch handle is held against accidental movement by a spring-loaded latch which must be released by the operator before he can change positions. This latch also makes it possible to padlock the switch in any position.

The use of one-piece rotary insulating drum with sliding contacts babbitted accurately into place eliminates alignment problems. A stainless steel operating shaft with a spring-loaded silicone rubber packing gland assembly eliminates the leakage problems in this area.

High conductivity copper in blades and contacts will carry 400 amperes continuously without exceeding a 55C temperature rise. In the ground position the switch will withstand 15000 amperes for five seconds without damage.

The switch chamber is furnished with a filling plug, magnetic liquid level gauge, and combination drain valve and sampling plug.



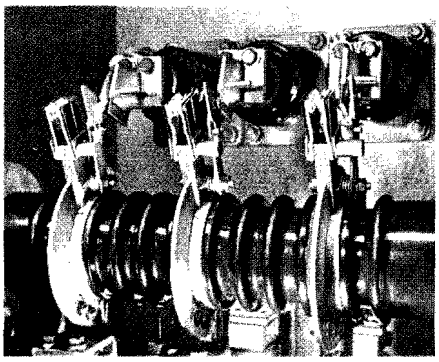


The standard switch assembly is welded to the transformer tank with terminal chamber compartment located above switch compartment on Spacemiser network transformers.

Optional Features and Tests

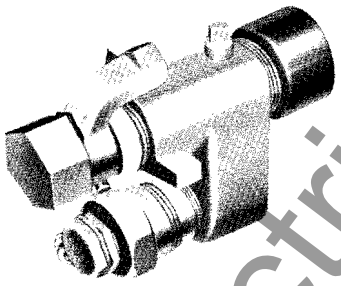
Optional Features

Mag Break Switch



An ingenious, yet simple and reliable, quick-break mechanism is available for use when it is desired to break transformer exciting current. An extra electrical interlock is provided to keep the switch from breaking load current. This feature is applicable for both oil-immersed and Inerteen immersed switches.

Rotary Sampling Device



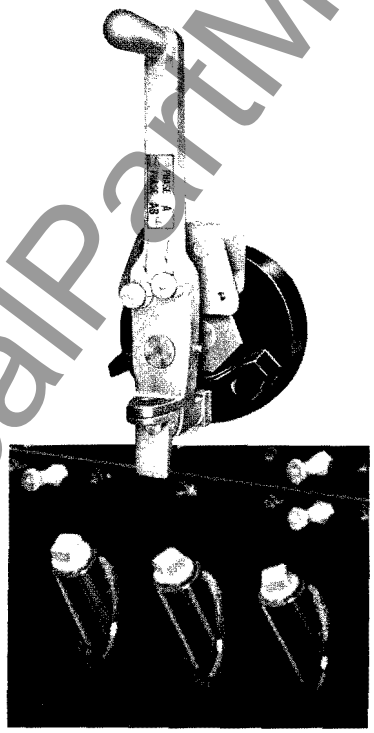
Available for Inerteen-filled transformers to provide a convenient means of obtaining a sample from the surface of the Inerteen for test purposes. It also affords a means of applying pressure tests or for air sampling.

Filling Compound

Upon request in general order write up, filling compound is furnished for the high voltage terminal chamber.

Phasing Out High Voltage Cable

When it is desired to phase out the high voltage cable by external means only, special phasing out contacts can be provided. This includes 3 grounding contacts of varying lengths inside the switch compartment. Two indicating buttons are provided on the switch handle to cause an indicating position when moving the switch handle from transformer toward ground and thus allow phase A to make internal ground contact leaving phases B and C ungrounded. Similarly, phases B and C can be identified.



Three one-inch openings with pipe plugs may be provided in or near the top of the switch chamber if required, where phasing means is desired but sequence grounding is not furnished.

Other Optional Features

Viewing windows on switch cover.
Potheads instead of terminal chamber for cable termination.
High voltage bayonet receptacles.
High voltage terminal chamber.
High voltage bushing wells for use with elbow terminators.
Low voltage terminal chamber.

Tests

The following routine tests are made on all Westinghouse network transformers. All tests are made in accordance with ANSI test code for distribution, power and regulating transformers, C57.12.90.

Ratio Tests: On all connections, both windings.

Resistance Measurements: On all windings.

Polarity and Phase Relation Tests: On the rated voltage connection.

Impedance and Load Loss: At rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating manufactured at the same time.

No-Load Loss: At rated voltage on the rated voltage connection.

Temperature Tests: Made on one unit only of a given rating manufactured for the first time. Subsequent units will have temperature tests omitted whenever tests of a duplicate or essential duplicate unit are available.

Applied Potential Tests

Induced Potential Tests

Further Information

Prices: Price List 47-120
Description:
Ventilated Dry Type—
Descriptive Bulletin 47-151
Sealed Dry Type—
Descriptive Bulletin 47-152
Network Protectors—
Descriptive Bulletin 35-550

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60 Hertz, HV: 2400 to 34500 volts,
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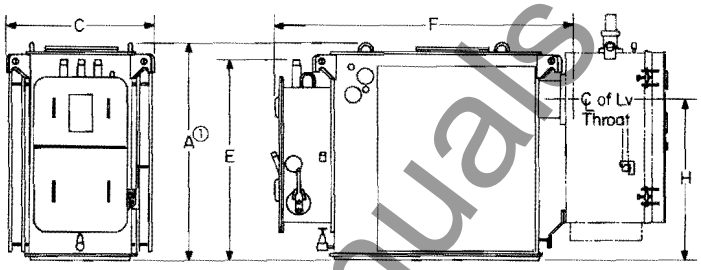

Rise	Low Voltage	High Voltage Class: kv	Kva	Lv Amperes	Approximate Dimensions: Inches					Approximate Net Weight: Lbs.				Gals. Liquid
					A①	C	E	F	H②	Vault Oil	Vault Inerteen	Subway Oil	Subway Inerteen	
55/65C	216Y/125	5 Through 15	300/336	802/898	56	39	46	74	38	6070	7070	6500	7370	185
			500/560	1336/1497	58	43	46	77	39	7400	8500	8000	9050	200
			750/840	2005/2245	64	44	52	82	42	9265	10655	10100	11490	260
			1000/1120	2673/2994	71	48	55	87	53	12270	13970	13500	15200	310
		25 Oil	500/560	1336/1497	65	43	52	82	46	8820	.....	9220	.....	280
			750/840	2005/2245	71	44	52	89	48	10570	.....	11070	.....	310
			1000/1120	2673/2994	71	47	59	91	48	13000	.....	13880	.....	320
		34.5 Oil 25 Inerteen	500/560	1336/1497	66	44	52	85	46	9000	10700	9400	11100	306
			750/840	2005/2245	71	45	52	92	48	12600	14400	13100	14900	325
			1000/1120	2673/2994	71	48	59	94	48	13100	15400	13900	16200	415
	480Y/277	5 Through 15	300/336	361/404	56	39	46	74	38	6070	7070	6500	7370	185
			500/560	601/674	58	43	46	77	39	7400	8500	8000	9050	200
			750/840	902/1010	64	44	52	82	42	9265	10655	10100	11490	260
			1000/1120	1203/1347	71	48	55	87	53	12270	13970	13500	15200	310
			1500/1680	1804/2021	84	59	67	89	52	15400	17550	16800	19090	420
			2000/2240	2406/2694	94	68	70	97	65	19420	22400	21120	24100	490
			2500/2800	3007/3368	101	70	73	108	65	24200	27500	25500	28800	610
		25 Oil	500/560	601/674	65	43	52	82	46	8820	.....	9220	.....	280
			750/840	902/1010	71	44	52	89	48	10570	.....	11070	.....	310
			1000/1120	1203/1347	72	47	59	91	48	13000	.....	13800	.....	320
			1500/1680	1804/2021	86	61	67	91	52	16000	.....	17400	.....	450
			2000/2240	2406/2694	96	69	70	99	65	19800	.....	21600	.....	550
			2500/2800	3007/3368	106	71	73	109	65	24000	.....	25500	.....	650
		34.5 Oil 25 Inerteen	500/560	601/674	65	44	52	85	46	9000	10700	9400	11100	306
			750/840	902/1010	71	45	52	92	48	12600	14400	13100	14900	325
			1000/1120	1203/1347	71	48	59	94	48	13100	15400	13900	16200	415
			1500/1680	1804/2021	86	62	67	92	52	16600	19360	18000	20760	500
			2000/2240	2406/2694	96	70	70	100	65	20200	23500	22000	25300	600
			2500/2800	3007/3368	106	72	73	110	65	24500	28350	26000	29850	700
65C	216Y/125	5 Through 15	300	802	56	38	45	72	38	6000	6930	6500	7430	170
			500	1336	58	42	45	75	39	6900	8000	7400	8500	200
			750	2005	64	43	52	78	42	9080	10380	9640	10940	240
			1000	2673	69	48	55	81	53	10500	11940	11500	12940	260
		25 Oil	500	1336	59	41	56	83	44	7500	.....	7900	.....	230
			750	2005	65	44	52	84	47	9300	.....	9800	.....	250
			1000	2673	71	46	59	86	50	10500	.....	11300	.....	280
		34.5 Oil 25 Inerteen	500	1336	59	42	56	84	44	7670	9000	8070	9390	240
			750	2005	65	45	52	85	47	9500	10930	10000	11430	260
			1000	2673	71	47	59	87	50	10880	12480	11680	13280	290
	480Y/277	5 Through 15	300	361	56	38	45	72	38	6000	6930	6500	7430	170
			500	601	58	42	45	76	39	7000	8100	7500	8600	200
			750	902	64	43	52	80	42	9080	10380	9640	10940	240
			1000	1203	69	48	55	81	53	10500	11940	11500	12940	260
			1500	1804	83	52	61	87	50	13380	15400	14500	17150	370
			2000	2406	85	58	65	94	52	16600	19250	18000	20650	480
			2500	3007	87	65	67	98	56	19800	22830	22000	25030	550
		25 Oil	500	601	59	41	56	83	44	7500	.....	7900	.....	230
			750	902	65	44	52	84	47	9300	.....	9800	.....	250
			1000	1203	71	46	59	86	50	10500	.....	11300	.....	280
			1500	1804	85	57	61	91	50	14200	.....	15600	.....	420
			2000	2406	87	65	65	96	52	17800	.....	19600	.....	500
			2500	3007	89	71	67	99	56	21000	.....	22500	.....	585
		34.5 Oil 25 Inerteen	500	601	59	42	56	84	44	7670	9000	8070	9370	240
			750	902	65	45	52	85	47	9500	10930	10000	11430	260
			1000	1203	71	47	59	87	50	10880	12480	11680	13280	290
			1500	1804	85	58	61	92	50	14600	17080	16000	18480	430
			2000	2406	87	66	65	97	52	18200	20000	20000	21800	515
			2500	3007	91	72	67	100	56	21500	24800	23000	26300	600

①Dimension A is for oil units. For Inerteen units add 6 inches for relief device.
②Dimension H is to center line of the throat. On throats for 2500 amp and larger protectors subtract ¾" from "H" dimension to get dimensions to center line of bushings.

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