



stack type capacitor equipments for indoor or outdoor service

2400 volts and above • 300 kvar and above
3 phase • 60 cycles

price list

49-320

page 1

application

Stack type capacitor banks are made up of outdoor capacitor units grouped in series-parallel combinations to match the line voltage and kvar required. For any system voltage, table 1 indicates the number of series groups line-to-neutral and the

capacitor unit voltage. Tables 2 and 3 indicate the minimum size bank recommended, based on the number of series groups as determined from table 1.

table 1—circuit voltages

nominal kv	series groups	capacitor unit volts	nominal kv	series groups	capacitor unit volts	nominal kv	series groups	capacitor unit volts	nominal kv	series groups	capacitor unit volts
4.16	1	2400	24.9	6	2400	43.2	6	4180	74.8	6	7200
4.8	1	2770	24.9	3	4800	43.2	9	2770	79.3	6	7620
7.2	1	4180	24.9	2	7200	48.0	4	8640	80.8	7	6640
8.3	2	2400	26.4	2	7200	48.0	10	2770	82.7	6	7960
8.3	1	4800	27.6	2	7960	48.9	6	4800	83.1	10	4800
9.6	3	2770	28.8	4	4180	49.9	4	7200	87.3	7	7200
11.9	1	8640	28.8	6	2770	50.4	7	4180	92.0	8	6640
12.47	3	2400	29.1	7	2400	52.8	4	7960	93.4	7	7620
12.47	1	7200	32.2	8	2400	55.15	4	7960	96.8	7	7960
13.2	1	7620	33.2	4	4800	57.8	9	8640	99.8	8	7200
13.8	1	7960	33.6	7	2770	57.8	8	4180	102.5	8	6640
14.4	2	4180	34.3	3	8640	58.2	7	4800	106.8	6	7620
14.4	3	2770	36.0	8	4180	62.4	8	7200	110.3	8	7960
16.8	4	2400	37.4	8	2400	64.8	9	4180	112.3	9	7200
16.8	2	4800	37.4	3	7200	66.0	9	7620	115.6	10	6640
19.2	4	2770	38.4	8	2770	66.5	8	4800	118.8	9	7620
20.8	5	2400	39.8	3	7620	68.9	9	7960	124.1	9	7960
21.6	3	4180	41.4	3	7960	68.0	6	8640	124.7	10	7200
23.0	2	8640	41.8	10	2400	72.0	10	4180	132.0	10	7620
24.0	5	2770	41.8	9	4800	74.8	9	4800	137.8	10	7960

table 2—minimum kvar for ungrounded wye connected capacitor banks based on number of series groups as determined from table 1

number of series groups line-to-neutral	minimum number of units per group	minimum 3 phase kvar					
		using 25 kvar units		using 50 kvar units		using 100 kvar units	
		total bank	additional steps	total bank	additional steps	total bank	additional steps
1	4	300	75	600	150	1200	300
2	8	1200	150	2400	300	4800	600
3	12	2025	225	4050	450	8100	900
4	16	2700	300	5400	600	10800	1200
5	20	3780	378	7560	756	15120	1800
6	24	4860	450	9000	900	18000	1800
7	28	5250	525	10500	1050	21000	2100
8	32	6000	600	12000	1200	24000	2400
9	36	7425	675	14850	1350	29700	2700
10	40	8250	750	16500	1500	33000	3000

table 3—minimum kvar for grounded wye or delta connected capacitor banks based on number of series groups as determined from table 1

number of series groups line-to-neutral or line-to-line	minimum number of units per group	minimum 3 phase kvar					
		using 25 kvar units		using 50 kvar units		using 100 kvar units	
		total bank	additional steps	total bank	additional steps	total bank	additional steps
1	1	75	75	150	150	300	300
2	2	300	150	600	300	1200	600
3	3	1800	225	3600	450	7200	900
4	4	2700	300	5400	600	10800	1200
5	5	3375	375	6750	750	13500	1500
6	6	4050	450	8100	900	16200	1800
7	7	5250	525	10500	1050	21000	2100
8	8	6000	600	12000	1200	24000	2400
9	9	7425	675	14850	1350	29700	2700
10	10	8250	750	16500	1500	33000	3000

May 23, 1959

supersedes price list 49-320 dated January 24, 1958
mailed to: E/398/PL: D66JH: C31-18

prices effective 5-23-59; subject to change without notice

discount symbol CC 18

selling policy 49 000

NPC00016094

207820



pricing example

A complete stack type capacitor bank consists of:

component parts

1. required number of stacking units
2. required number of base insulators to match system kv
3. 1—set of connecting material including hardware, connectors, terminals, and spacing insulators where necessary

optional features which may be included are:

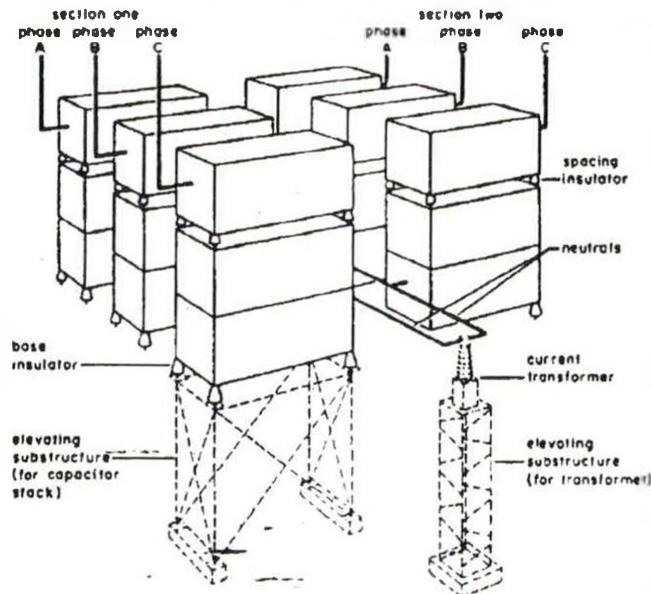
1. elevating substructures
2. current limiting capacitor fuses
3. current or potential transformers
4. protective relaying
5. switching equipment
6. automatic control

example:

required:

1—10800 kvar bank for 34.5 kv system (see figure below). The bank will be divided into two equal sections with a neutral current phase unbalance detection scheme and elevating substructures. Use 50 kvar capacitor units.

If the bank is to be divided into two or more sections for step switching, the individual steps shall be priced as completely separate banks.



solution:

From table 1, page 1, 34.5 kv bank contains 3 series groups of 6640 volt capacitor units.

From table 2, page 1, minimum size bank with 3 series groups is 4050 kvar. Since this bank is divided into two sections, each section must be equal to, or larger than, 4050 kvar.

10800
----- = 5400 kvar per section which is OK
2 sections
5400 kvar/section 1800 kvar/phase/section
3 phases 50 kvar/unit
36 units/phase/section
----- = 12 units/series group/phase/section
3 series groups

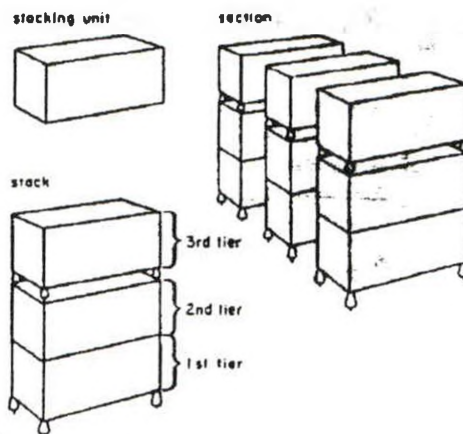
price makeup:

18--12 unit stacking units 6640 volt at \$3698 list each (from table 4, page 3)	=	\$64764
24--34.5 kv base insulators at \$43 list each (from table 5, page 4)	=	1032
1--set of connection material (from table 6, page 4)	=	1200
		\$66996

optional equipment:

6--elevating substructures for capacitor stacks at \$416 list each	=	2496
1--elevating substructure for transformer at \$200 list each	=	200
1--neutral current unbalance detection scheme	=	1900
		Total \$71696 list

Each section of the bank will be arranged into 3 stacks, each stack 3 tiers high. Each stacking unit will contain 12 capacitor units connected in parallel and 3 stacking units are connected in series line-to-neutral. The complete bank will look like the illustration to the left.



NPC00016095

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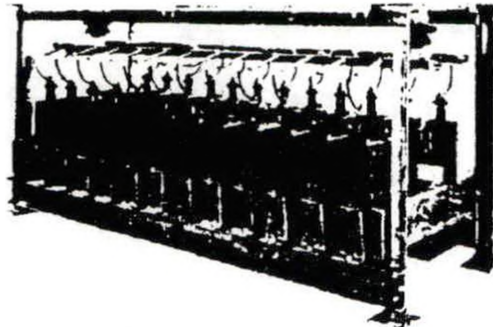
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component parts

Prices determined from this price list may be used for estimating purposes only. All final prices must be secured from Distribution Apparatus Department, Bloomington, Ind.

table 4—stacking units: single phase only, single bus arrangement



List price includes:

1. galvanized steel mounting frame (capacity as specified)
2. individual capacitor units—25, 50 or 100 kvar—single phase—single bushing (quantity and rating as specified); two bushing capacitor units furnished if specified
3. individual capacitor unit fuses—outdoor expulsion type
4. fuse links
5. fuse element ejectors and indicators
6. bus bar assembly
7. bus and grounding interconnections
8. complete factory assembly and wiring

List price does not include:

1. non-standard features (see "optional items", page 4)

stacking unit		list price		approx net weight (pounds)	list price		approx net weight (pounds)
unit capacity maximum	one phase kvar	5 kv class			8.67 kv class		
		standard voltage 2400, 2770, 4180 volts	special voltages		standard voltage 4800, 8640, 7200, 7620, 7960 volts	special voltages	
with 25 kvar capacitor units :							
10	250	\$ 1991	\$2066	1104	\$2069	\$ 2155	1144
12	300	2314	2390	1263	1432	2900	1313
14	350	2623	2731	1421	2779	2857	1491
16	400	2932	3064	1579	3096	3206	1659
18	450	3271	3397	1774	3433	3579	1864
20	500	3590	3730	1936	3770	3910	2036
22	550	3909	4062	2099	4107	4263	2209
24	600	4228	4396	2261	4444	4612	2381
26	650	4547	4729	2423	4781	4963	2553
28	700	4866	5062	2585	5118	5314	2725
with 50 kvar capacitor units :							
8	400	\$ 2412	\$2500	1420	\$2532	\$ 2620	1470
10	500	2818	2933	1670	3000	3109	1730
12	600	3219	3350	1960	3398	3507	2020
14	700	3581	3730	2240	3731	3859	2330
16	800	4024	4200	2510	4064	4206	2600
18	900	4427	4631	2800	4407	4563	2900
20	1000	4830	5060	3070	4750	4920	3190
22	1100	5233	5478	3340	5093	5263	3470
24	1200	5636	5890	3610	5436	5624	3750
26	1300	6039	6293	3880	5779	5961	4030
28	1400	6442	6706	4150	6122	6308	4310
30	1500	6845	7119	4420	6465	6705	4590
32	1600	7248	7532	4690	6808	7048	4870
34	1700	7651	7945	4960	7151	7391	5150
36	1800	8054	8358	5230	7494	7734	5430
with 100 kvar capacitor units :							
6	600	\$ 3410	\$3550	1980	\$3590	\$ 3742	2040
8	800	4024	4200	2590	4064	4206	2630
10	1000	4638	4830	3130	4678	4820	3230
12	1200	5252	5478	3760	5292	5454	3880
14	1400	5866	6119	4320	5906	6081	4460
16	1600	6480	6750	4900	6520	6705	5060
18	1800	7094	7378	5460	7134	7329	5640

Stacking units with 25 kvar units may be stacked a maximum of 4 tiers high; stacking units with 50 or 100 kvar units may be stacked a maximum of 3 tiers high.

prices effective -- -- -- -- -- to change without notice

discount symbol CC-50

selling policy 49-000

NPC00016096

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table 5—base insulation

BIL NEMA standard heavy duty 5-inch bolt circle outdoor apparatus insulator supports					
base insulation					
kv	NEMA reference number	units per insulator stack	insulator style number	list price per insulator stack	
95	7.8	41	1	1408 309	8 34
110	18	44	1	1295 335	24
180	23	46	1	1176 130	31
200	34.5	49	1	1176 131	43
380	81	56	2	948 788	113
550	118	18	2	948 788	169
780	163	25	4	948 788	257
800	196	27	8	1408 412	425
1050	230	28	6	1408 412	519

optional items

1. phase unbalance relay protection

list price includes:

1. ungrounded wye connected banks

scheme 1—single wye	scheme 2—double wye
3—outdoor potential transformers, system kv	1—outdoor current transformer, system kv
1—relay cabinet "A"	1—relay cabinet "A"

2. grounded wye connected banks

scheme 3—single wye	scheme 4—double wye
1—outdoor current transformer, 15 kv, with primary gap	2—outdoor current transformers, 15 kv, with primary gap
1—relay cabinet "B"	1—relay cabinet "A"

Relay cabinet "A" is a weatherproof enclosure containing: one relay for an alarm circuit on small unbalance; a second relay for tripping a circuit breaker on greater unbalance; one indicating ammeter (or voltmeter) and ammeter switch—this scheme for detecting individual capacitor unit fuse operations.

Relay cabinet "B" is a weatherproof enclosure containing: one EX-642 protector tube; one CV-8 voltage relay; one timing relay; one resistor—this scheme for detecting arc-over of a series group.

system voltage kv	list price			
	scheme 1	scheme 2	scheme 3	scheme 4
15	\$ 1840	\$ 1840		
25	4236	1776		
34.5	7863	1808		
46	9853	2201	3801	\$1310
69	12511	2706	all kv ratings	all kv ratings
92	23992	6413		
118	36128	6507		
138	48078	7828		
181	84236	10546		

note: if relays and cabinet are not required, deduct \$700 list for relay cabinet "A"; \$800 list for relay cabinet "B"

2. steel substructures

list price includes:

complete fabricated and galvanized steel substructure 8 feet high to support one capacitor stack or transformer for capacitor stack—\$416 list each for CT or PT —\$200 list each

table 6—connection material

list price includes:	number of stacking units	list price connection material ⁽¹⁾
1. one set of NEMA standard, one piece wet process porcelain bus and interconnection supports for each phase	3	\$ 360
2. one set of connecting material for each phase—cut to size	6	950
3. one set of solderless connectors and clamp type terminals for each phase assembly	9	728
	12	808
	18	1040
4. required number of wet process porcelain spacing insulators	10	1800
	21	1340
	24	1620
	27	1800
	30	1940

list price does not include:

1. connections from power supply to phase leads of capacitor bank

⁽¹⁾ For banks containing more than 30 stacking units, the charge for connection material shall be \$140 list for each group of three stacking units in excess of 30. For quantities of stacking units not divisible by three, use connection material price for next larger quantity which is divisible by three.

3. omission of individual unit fuses: Individual unit fuses are necessary and are furnished on all stack type capacitor units. There will be no deduction allowed for the omission of fuses.

4. fuses having higher interrupting capacity: Stack type capacitor units are supplied with indicating type expulsion fuses (type CXP) as standard equipment. Current limiting fuses having higher interrupting capacity can be substituted for the standard fuses using the following price modifications:

If high interrupting capacity, current limiting fuses are required, make an addition of \$13 list per fuse when used with capacitor units rated 6600 volts and below, and \$18 list each when used with capacitor units 6601 volts and above.

5. divided bus: The bus within a stacking unit may be divided into 2 separate buses to facilitate grouping and connections, or into 3 separate buses to make a 3 phase assembly.

For double bus, add \$38 list per stacking unit.
For 3 phase bus, add \$69 list per stacking unit.

6. fewer than standard number of capacitor units in stacking units shall be priced as follows: Use the list price of the complete standard stacking unit and deduct the total list price of the number of units omitted using the list price of the corresponding units given in Price List 49-110. There will be no further deduction for omission of individual unit fuses.

7. short-circuiting switches may be assembled on stacking units to ground bus to stacking unit frame at a price addition of \$30 list per switch.

8. automatic switching control for separate mounting actuated by changes in circuit voltage, current, or kvar, should be priced from Price Modifications 49-200. If automatic control is to be mounted on or with the controlling circuit breaker, the control shall be priced and furnished by the supplier of the circuit breaker.

9. circuit breakers or switching devices for the control of stack type capacitor banks are separately mounted and priced. For available ratings of circuit breakers, refer to Technical Data 33-063.

Inquiries should contain complete data on the capacitor to be switched, adjacent capacitor banks if any, and the system on which applied.

10. isolating or grounding disconnecting switches are separately mounted and should be quoted by the Headquarters Section responsible for their application and sale.

further information

application: application data 49-320

description: descriptive bulletin 49-320

Westinghouse Electric Corporation

Distribution Apparatus Department: Bloomington Plant • Bloomington, Ind.

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