

CapCheck II

SUBSTATION TYPE - Model CC-II/100

Capacitor Checker

Operating & Instruction Manual



HD ELECTRIC COMPANY

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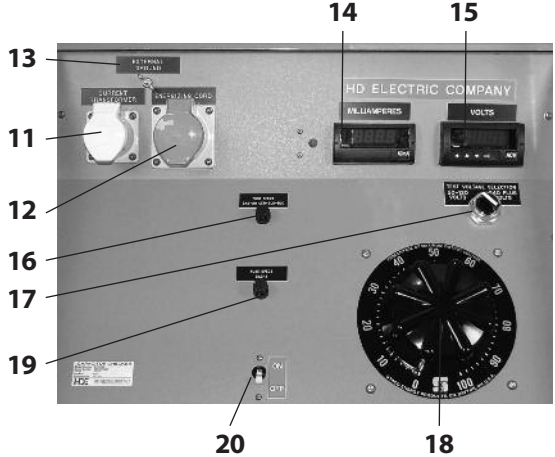
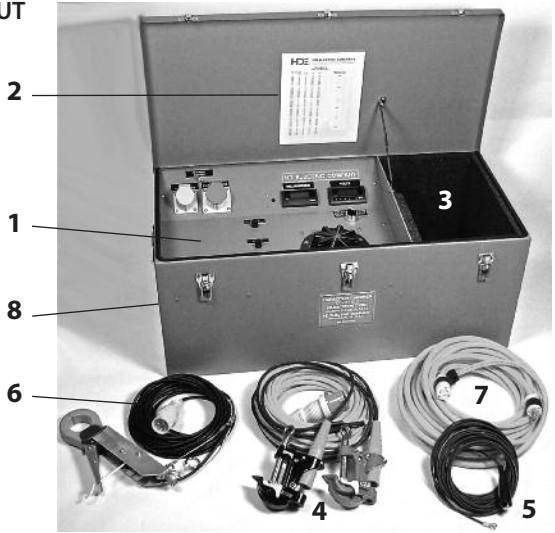
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COMPONENT IDENTIFICATION

CAP CHECK II Substation Type MODEL CC-II/100

OPERATING COMPONENTS LAYOUT

1. Instrument Panel
2. Pass / Fail Limit Rating Chart
3. Cordage / Transformer Storage Area
4. Energizing Cord with Clamps
5. Grounding Cable
6. Current Transformer and Cordage
7. Power Cord
8. 110 Volt AC Adapter Cord – 3 prong straight type
9. Hotstick Carrying Bag
10. 4 Section Hotstick
11. Plug for the Current Transformer
12. Polarized plug for the energizing leads
13. Cabinet Ground Stud
14. AC Milliamps Digital Meter
15. AC Volts Digital Meter
16. Variable Transformer Fuse
17. Test Voltage Selection Switch
18. Variable Transformer (Variac)
19. Panel Meter Fuse
20. ON/OFF Switch





CAUTION: Make certain capacitors are shorted and de-energized **COMPLETELY** prior to testing. **ALWAYS** be certain capacitor bank to be tested is out of service. Allow at least 5 minutes for capacitors to fully discharge.



CAUTION: Make certain leads **NEVER** cross phases or drape across bushings, live transformers, etc. Cordage must remain free and clear of all objects, including the human body, **AT ALL TIMES**.



CAUTION: Make certain maximum capacitor KVAR and voltage do not exceed the Cap Check II testing limits. Maximum KVAR for the Cap Check II can be noted on the Pass/Fail Limit Rating Chart located at the end of the manual.



CAUTION: Make certain the Cap Check II voltage (Variac) is set to zero (0) prior to turning the instrument on and energizing capacitors.



CAUTION: Always turn the Variac to zero after testing capacitors and before turning the Cap Check II off. This action will discharge the capacitor.

NOTE: Familiarize yourself with the Cap Check II instrument panel layout as diagrammed on the previous pages, prior to conducting your first test.

ADDITIONAL SAFETY NOTES

Please note that your Company may have additional safety rules and procedures, which should be employed while using this equipment. You must check to make certain that all safety considerations are properly addressed when using this equipment. These are recommended safety rules and are to be used as guidelines in establishing and integrating your own safe procedures.

OPERATING PRINCIPLE

The Cap Check operates by measuring the current flowing through the capacitor under test. The operating convenience of this tester comes from the fact that a bank of paralleled capacitors is energized but currents are measured individually without opening any connections. Of course, the current drawn by the paralleled group must not exceed the capacity of the power supply.

SET UP PROCEDURE

IMPORTANT: THE PROCEDURES DESCRIBED ARE GENERAL AND MUST BE REVIEWED AND MODIFIED AS NECESSARY TO CONFORM TO THE USER'S SAFETY RULES, STANDARDS AND REGULATIONS.

ALWAYS REMEMBER THAT THE DISTRIBUTION EQUIPMENT UNDER TEST OPERATES AT HIGH VOLTAGE. THE CAPACITOR BANKS MUST BE DE-ENERGIZED AND COMPLETELY DISCHARGED BEFORE THE TESTING AT THE RELATIVELY LOW VOLTAGE IS PERFORMED.

Every group of paralleled capacitors must be discharged. If these parallel groups are not equipped with shorting switches this must be accomplished in accordance with the user's standard safe operating procedures.

SET UP AND TESTING

To obtain correct results it is necessary that the Cap Check energizing leads be connected across the single parallel group of capacitors being tested. If shorting switches are installed, these can limit the energized capacitors to those under test. If switches are not available it will be necessary to use jumpers. The energizing leads may then be attached to the phase lead and the neutral. It is also possible to attach the energizing leads to each of the paralleled sections, but this defeats the timesaving feature of the Cap Check.

Other arrangements of jumpers or switching can be devised to suit the network under test.

When the system consists of paralleled series-parallel groups it probably will not be necessary to switch or jumper the parallel leg – as a matter of fact, that leg must not be shorted or too much of it jumped to avoid drawing excessive power from the tester.

After the test of all parallel groups is completed the tester voltage should be turned down to minimum and the supply should be de-energized. This action will discharge the capacitors which were last tested.

DESIGN OF THE PROCEDURE

The objectives to be considered when establishing a test procedure must put safety first and then consider the convenience and efficiency of the work crew. The basic consideration will be to minimize the number of jumper shifts during the course of testing.

PROCEDURE REVIEW

HD Electric Company will be happy to discuss special problem networks or to review proposed test sequences, but the responsibility for the safe design of these procedures and the safe operation of the test set lies with the using authority.

INTRODUCTION

This Substation Capacitor Checker applies a low AC, 60 Hz voltage to a group of parallel-connected capacitor units. Capacitors are measured individually with a clamp-type ammeter probe to determine if the capacitor units have a defect. The defect may be either a partial or complete short or an open pack. To test the entire capacitor bank, the test voltage energizing leads must be moved around the capacitor bank and connected to each group of parallel capacitors. The capacitors being tested remain connected to the bus through their individual fuses.

EXCEPTION: A capacitor which has its individual fuse blown will not be energized when voltage is applied to the main bus.

STEP 1. Verify that the capacitor bank is out of service and isolated from its source. If the capacitor bank is in service, open the source device and wait a full five (5) minutes for the capacitors to discharge. Then temporarily short circuit the capacitors with the bank shorting switch. Ground the bank according to the approved methods. **NOTE:** Capacitor structures and associated shorting and grounding devices vary between locations.

FOR TESTING CAPACITORS WITH BLOWN FUSES

Capacitor units which have had their protective fuses blown must be temporarily shorted and grounded on an individual basis and test leads subsequently connected to each capacitor. To obtain the individual capacitor reading, clamp the Current Transformer around the ground lead from the capacitor under test. See the following instructions.

STEP 2. Disconnect and remove the following type capacitors from the bank:

1. Any visually bulged units.
2. Any unit which shows an insulating liquid leak. These leaks may occur at the phase bushings, the neutral attachment, the fill hole or a seam. Any loss in insulating liquid may result in an internal flashover to the case and possible case rupture. The packs and leads are very confined and a void in the insulating liquid can precipitate a failure.

A leaking capacitor may test OK because a pack hasn't completely shorted or open. However, the gas generated from a pack in the process of failing can cause tank swelling or force liquid out a weakened seal or seam.

SAFETY PLEASE NOTE A CAPACITOR MUST BE SHORT CIRCUITED AT THE TERMINALS BEFORE IT CAN BE CONSIDERED DE-ENERGIZED.

STEP 3. Suggested Cap Check Hookup Procedure

- A. Connect the Cap Check cabinet ground to the station ground.
- B. Plug the polarized plug of the Energizing Leads into the Cap Check. Connect the energizing leads via live line clamp to the section of bank to be checked (red clamp to phase bus, black to neutral bus). Use rigorous and approved hotstick work precautions.
- C. Verify that the Cap Check On/Off switch is in the **OFF** position and that the Variable Transformer is at **zero (0)**.
- D. Connect the Cap Check power supply cord to a 120-volt outlet (120 volt, 20-amp circuit required). Adapter pigtailed are provided for twist-lock and non-twist-lock connectors.

STEP 4. A. Outdoor Substation Racks

Attach the Current Transformer to the hotstick to permit measuring individual capacitors while the operator stands at ground level. The hotstick consists of four eight-foot sections. Also assemble the Actuating Rope.

B. Pad Mounted Enclosure Capacitor Rack

The Current Transformer may be operated without the hotstick, but rubber gloves are required because bare connections are energized at 120 volts. Hotsticks are still advised under all conditions.

STEP 5. Determine the rating of the capacitors under test and determine the test voltage to be applied by referencing the Pass/Fail Limit Rating Chart located at the end of the manual. Set the Test Voltage Selection Switch to the correct position for that voltage. **NOTE:** It is possible to attain the 50 and 120 Volt setting in the 240 Plus position. This action can yield incorrect readings and can cause serious damage to the internal components of this tester.

STEP 6. With the Variable Transformer at zero turn the Cap Check on. The digital meters will light and may flash at random for a few seconds. Slowly advance the Variable Transformer and observe the rate of voltage and current increase. If this rate appears slower than when the Test Loop is used or the input circuit breaker trips, an overload is indicated. This condition will rarely be found in banks with individually fused capacitors. It is a likely occurrence when testing isolated capacitors. A completely shorted capacitor is the extreme case of this type.

If this condition is found, try searching with a lower than listed voltage using the Current Transformer. The bad capacitor will have a very high current when compared to good capacitors. The digital meter has a maximum reading of 2000 milliamperes and flashes zero above that value. Do not attempt a long search unless some other clamp-on current meter is used to limit the search current to 8 amperes at 50 volts and even then, do not exceed 30 minutes.

When measuring suspected individual capacitors that are disconnected from the bank, place the Current Transformer on the bushing prior to applying the test voltage. Shorted capacitors will provide high current readings even with less than normal testing voltage.

STEP 7. Verify with the Current Transformer that each capacitor is within the range specified on the Pass/Fail Limit Rating Chart.

NOTE: Capacitors which have **LOW** readings may have open packs or corroded terminals, either on the capacitor or at the fuse connection to the bus. Corrosion results in an excessive voltage drop and an incorrect reading. Wire brush the connections and reconduct the test if this is observed. Values **ABOVE** the accepted range indicate one or more groups of packs are shorted. Replace the units not in the acceptable range indicated on the Pass/Fail Limit Rating Chart.

STEP 8. When the group check is complete, return the Variable Transformer to zero to short out the capacitors. Turn the Cap Check off.

STEP 9. Repeat Steps 1 – 8 for the remaining groups to be tested.

STEP 10. Upon completion of the test, store the leads in the appropriate drawers in the Cap Check.

NOTE: The unit is not weatherproof. Exercise care to prevent moisture damage.

SERIES-PARALLEL GROUP TESTS

The use of series-parallel capacitor groups is common to obtain the necessary voltage and capacity ratings for substation banks.

The Cap Check has been designed to test these capacitor groups without the need for disconnecting any leads. The series connection of parallel groups may require the use of some shorting jumpers or movement of the energizing lead connection points.

It is necessary that the energizing voltage appear directly across the capacitors under test. It is necessary to locate the leads or jumpers to accomplish this.

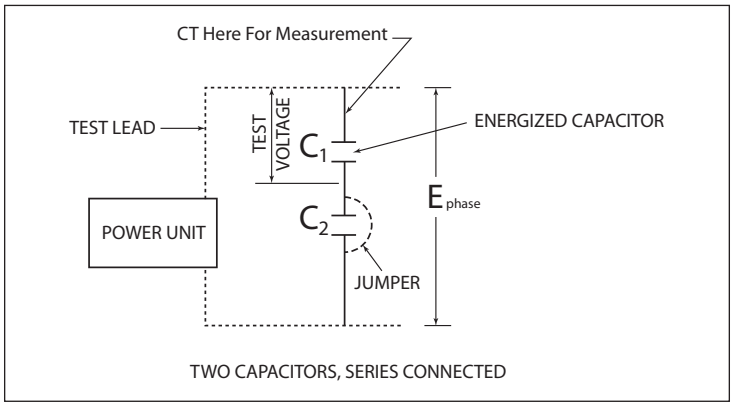


Figure 1

FIGURE 1 shows a pair of series connected capacitors.

By definition, $C = 1/(1/C1 + 1/C2)$ and $KVAR = 2 \pi fC (kV)^2 \times 10^{-3}$; C in μFd .

We may calculate the following for a selected case:

| VOLTAGE | KVAR | CMFD |
|---------|------|---|
| 7960 | 100 | 4.19; two such units in series give: |
| 15920 | 200* | 2.10; * the 200 KVAR has been calculated for the 2.1 μFd |

Therefore, when two identical capacitors are connected in series to permit operation at a doubled voltage, the KVAR value will be the sum of the total KVAR rating of the two units.

The energizing leads may be placed across the group of capacitors under test as shown in **FIGURE 2** below. This will place the balance of the groups in series and reduce the current load presented by them. The loading effect of these capacitors strung in series will be equal to $1/n \times \text{group KVAR}$; where n is the number of groups in series loading the power unit. In the case shown in Figure 2, the loading effect would be $1/4 \times \text{group KVAR}$.

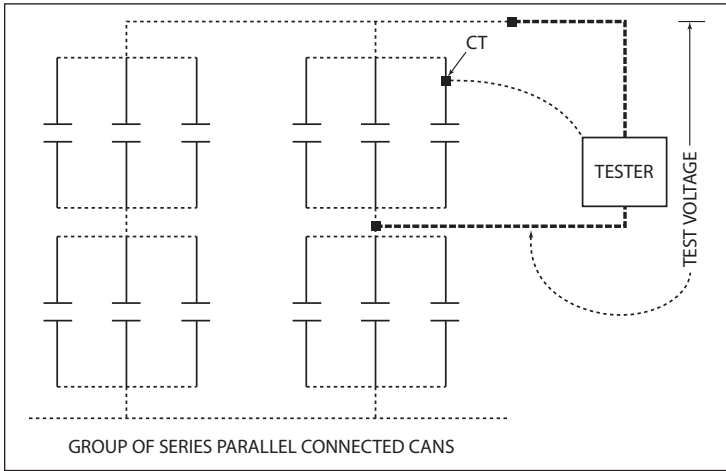


Figure 2

FIGURE 3 below shows the same group of capacitors with a different energizing lead connection, which would require the use of a jumper. This would increase the effective load on the power unit. If the bank load does not exceed the capacity of the unit, any connection arrangement may be used.

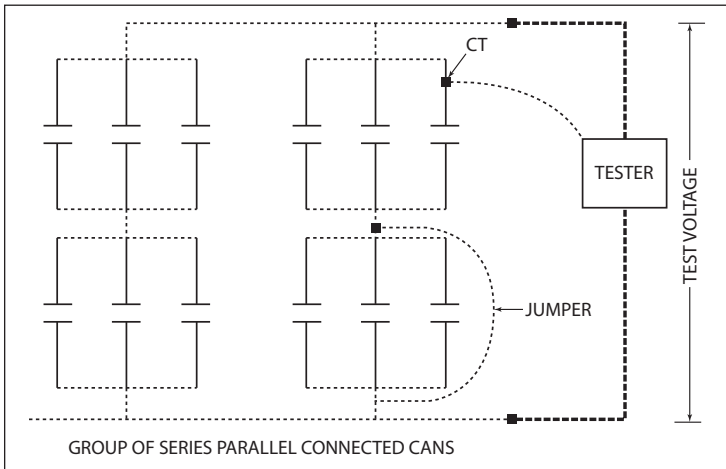


Figure 3

The Pass/Fail Limit Rating Chart at the end of the manual provides a maximum load per phase for the Cap Check. These values are for continuous duty and some overload capacity is available.

HD Electric Company will be happy to review questions presented regarding jumper arrangements and the load capacity of the Cap Check, but cannot assume responsibility for safe operation and the design of operating procedures.

CAP CHECK II PASS / FAIL LIMIT RATING

| V | NAMEPLATE DATA | | TEST CURRENT | | MAXIMUM ENERGIZED BANK LOAD, KVAR |
|------|----------------|--------|--------------|------|-----------------------------------|
| | KVAR | V TEST | MIN | MAX | |
| 2200 | 15 | 50 | 138 | 186 | 1050 |
| 2200 | 25 | 50 | 232 | 313 | |
| 2200 | 50 | 50 | 467 | 628 | |
| 2200 | 100 | 50 | 937 | 1260 | |
| 2200 | 150 | 50 | 1407 | 1891 | |
| 2200 | 300 | 50 | 2817 | 3785 | |
| 2200 | 600 | 50 | 5637 | 7572 | |
| 2400 | 15 | 50 | 115 | 157 | 1300 |
| 2400 | 25 | 50 | 194 | 263 | |
| 2400 | 50 | 50 | 392 | 528 | |
| 2400 | 100 | 50 | 787 | 1058 | |
| 2400 | 150 | 50 | 1182 | 1588 | |
| 2400 | 200 | 50 | 1577 | 2118 | |
| 2400 | 400 | 50 | 3157 | 4238 | |
| 2400 | 800 | 50 | 6316 | 8477 | |
| 2400 | 15 | 120 | 284 | 375 | 500 |
| 2400 | 25 | 120 | 475 | 625 | |
| 2400 | 50 | 120 | 953 | 1250 | |
| 2400 | 100 | 120 | 1909 | 2500 | |
| 2400 | 200 | 120 | 3820 | 5000 | |
| 4000 | 50 | 50 | 139 | 188 | 3600 |
| 4000 | 100 | 50 | 281 | 375 | |
| 4000 | 150 | 50 | 424 | 563 | |
| 4000 | 200 | 50 | 566 | 750 | |
| 4000 | 400 | 50 | 1135 | 1500 | |
| 4000 | 800 | 50 | 2272 | 3000 | |

CAP CHECK II PASS / FAIL LIMIT RATING *continued*

| V | NAMEPLATE DATA | | TEST CURRENT | | MAXIMUM ENERGIZED BANK LOAD, KVAR |
|------|----------------|--------|--------------|------|-----------------------------------|
| | KVAR | V TEST | MIN | MAX | |
| 4000 | 15 | 120 | 99 | 135 | 1500 |
| 4000 | 25 | 120 | 168 | 225 | |
| 4000 | 50 | 120 | 338 | 450 | |
| 4000 | 100 | 120 | 680 | 900 | |
| 4000 | 200 | 120 | 1362 | 1800 | |
| 4000 | 400 | 120 | 2727 | 3600 | |
| 4160 | 50 | 50 | 129 | 173 | 3900 |
| 4160 | 100 | 50 | 262 | 347 | |
| 4160 | 150 | 50 | 394 | 520 | |
| 4160 | 200 | 50 | 526 | 693 | |
| 4160 | 400 | 50 | 1056 | 1387 | |
| 4160 | 800 | 50 | 2114 | 2774 | |
| 4160 | 15 | 120 | 94 | 125 | 1600 |
| 4160 | 25 | 120 | 156 | 208 | |
| 4160 | 50 | 120 | 315 | 416 | |
| 4160 | 100 | 120 | 632 | 832 | |
| 4160 | 200 | 120 | 1267 | 1664 | |
| 4160 | 400 | 120 | 2538 | 3328 | |
| 4800 | 50 | 50 | 96 | 130 | 5200 |
| 4800 | 100 | 50 | 196 | 260 | |
| 4800 | 150 | 50 | 295 | 391 | |
| 4800 | 200 | 50 | 395 | 521 | |
| 4800 | 400 | 50 | 792 | 1042 | |
| 4800 | 800 | 50 | 1587 | 2083 | |
| 4800 | 15 | 120 | 69 | 94 | 2150 |
| 4800 | 25 | 120 | 116 | 156 | |
| 4800 | 50 | 120 | 236 | 313 | |
| 4800 | 100 | 120 | 474 | 625 | |
| 4800 | 200 | 120 | 951 | 1250 | |
| 4800 | 400 | 120 | 1905 | 2500 | |
| 6640 | 15 | 300 | 92 | 122 | 1650 |
| 6640 | 15 | 120 | 37 | 49 | 4150 |
| 6640 | 25 | 120 | 61 | 82 | |
| 6640 | 50 | 120 | 122 | 163 | |
| 6640 | 100 | 120 | 245 | 327 | |
| 6640 | 150 | 120 | 367 | 490 | |
| 6640 | 200 | 120 | 490 | 653 | |
| 6640 | 400 | 120 | 980 | 1306 | |
| 6640 | 800 | 120 | 1960 | 2613 | |

CAP CHECK II PASS / FAIL LIMIT RATING *continued*

| NAMEPLATE DATA | | | TEST CURRENT | | MAXIMUM ENERGIZED BANK LOAD, KVAR |
|----------------|------|--------|--------------|------|--------------------------------------|
| V | KVAR | V TEST | MIN | MAX | |
| 7200 | 15 | 300 | 76 | 104 | 1950 |
| 7200 | 25 | 120 | 52 | 69 | 4900 |
| 7200 | 50 | 120 | 104 | 139 | |
| 7200 | 100 | 120 | 208 | 278 | |
| 7200 | 150 | 120 | 313 | 417 | |
| 7200 | 200 | 120 | 417 | 556 | |
| 7200 | 300 | 120 | 625 | 833 | |
| 7200 | 600 | 120 | 1250 | 1667 | |
| 7200 | 1200 | 120 | 2500 | 3333 | |
| 7300 | 100 | 120 | 203 | 270 | 5050 |
| 7300 | 150 | 120 | 304 | 405 | |
| 7300 | 200 | 120 | 405 | 540 | |
| 7300 | 300 | 120 | 608 | 811 | |
| 7300 | 600 | 120 | 1216 | 1621 | |
| 7300 | 1200 | 120 | 2432 | 3243 | |
| 7620 | 15 | 300 | 70 | 93 | 2200 |
| 7620 | 25 | 300 | 116 | 155 | |
| 7620 | 50 | 120 | 93 | 124 | 5500 |
| 7620 | 100 | 120 | 186 | 248 | |
| 7620 | 150 | 120 | 279 | 372 | |
| 7620 | 200 | 120 | 372 | 496 | |
| 7620 | 300 | 120 | 558 | 744 | |
| 7620 | 600 | 120 | 1116 | 1488 | |
| 7620 | 1200 | 120 | 2232 | 2976 | |
| 7960 | 15 | 300 | 64 | 85 | 2400 |
| 7960 | 25 | 300 | 107 | 142 | |
| 7960 | 50 | 120 | 85 | 114 | 6000 |
| 7960 | 100 | 120 | 170 | 227 | |
| 7960 | 150 | 120 | 256 | 341 | |
| 7960 | 200 | 120 | 341 | 455 | |
| 7960 | 400 | 120 | 682 | 909 | |
| 7960 | 800 | 120 | 1364 | 1818 | |
| 8320 | 15 | 300 | 59 | 78 | 2600 |
| 8320 | 25 | 300 | 98 | 130 | |

CAP CHECK II PASS / FAIL LIMIT RATING *continued*

| V | NAMEPLATE DATA | | TEST CURRENT | | MAXIMUM ENERGIZED BANK LOAD, KVAR |
|-------|----------------|--------|--------------|------|--------------------------------------|
| | KVAR | V TEST | MIN | MAX | |
| 8320 | 50 | 120 | 78 | 104 | 6550 |
| 8320 | 100 | 120 | 156 | 208 | |
| 8320 | 150 | 120 | 234 | 312 | |
| 8320 | 200 | 120 | 312 | 416 | |
| 8320 | 400 | 120 | 624 | 832 | |
| 8320 | 800 | 120 | 1248 | 1664 | |
| 9960 | 200 | 50 | 91 | 121 | 22550 |
| 9960 | 300 | 50 | 136 | 181 | |
| 9960 | 100 | 120 | 109 | 145 | 9400 |
| 9960 | 150 | 120 | 163 | 218 | |
| 9960 | 200 | 120 | 218 | 290 | |
| 9960 | 300 | 120 | 327 | 435 | |
| 9960 | 600 | 120 | 653 | 871 | |
| 9960 | 1200 | 120 | 1306 | 1742 | |
| 10300 | 100 | 120 | 102 | 136 | 10050 |
| 10300 | 150 | 120 | 153 | 204 | |
| 10300 | 200 | 120 | 204 | 271 | |
| 10300 | 400 | 120 | 407 | 543 | |
| 10300 | 800 | 120 | 814 | 1086 | |
| 10800 | 200 | 120 | 185 | 247 | 11050 |
| 13200 | 25 | 480 | 62 | 83 | 4100 |
| 13200 | 50 | 480 | 124 | 165 | |
| 13200 | 100 | 480 | 248 | 331 | |
| 13200 | 50 | 300 | 77 | 103 | 6600 |
| 13200 | 100 | 300 | 155 | 207 | |
| 13200 | 150 | 120 | 93 | 124 | 16500 |
| 13200 | 200 | 120 | 124 | 165 | |
| 13200 | 400 | 120 | 248 | 331 | |
| 13200 | 800 | 120 | 496 | 661 | |
| 13280 | 50 | 300 | 77 | 102 | 6650 |
| 13280 | 100 | 300 | 153 | 204 | |
| 13280 | 150 | 300 | 230 | 306 | |

CAP CHECK II PASS / FAIL LIMIT RATING *continued*

| V | NAMEPLATE DATA | | TEST CURRENT | | MAXIMUM ENERGIZED BANK LOAD, KVAR |
|-------|----------------|--------|--------------|-----|--------------------------------------|
| | KVAR | V TEST | MIN | MAX | |
| 13280 | 100 | 120 | 61 | 82 | 16700 |
| 13280 | 150 | 120 | 92 | 122 | |
| 13280 | 200 | 120 | 122 | 163 | |
| 13280 | 300 | 120 | 184 | 245 | |
| 13280 | 600 | 120 | 367 | 490 | |
| 13280 | 1200 | 120 | 735 | 980 | |
| 13800 | 25 | 480 | 57 | 76 | 4500 |
| 13800 | 50 | 480 | 113 | 151 | |
| 13800 | 50 | 300 | 71 | 95 | 7200 |
| 13800 | 100 | 300 | 142 | 189 | |
| 13800 | 100 | 120 | 57 | 76 | 18050 |
| 13800 | 150 | 120 | 85 | 113 | |
| 13800 | 200 | 120 | 113 | 151 | |
| 13800 | 400 | 120 | 227 | 302 | |
| 13800 | 800 | 120 | 454 | 605 | |
| 14400 | 25 | 480 | 52 | 69 | 4900 |
| 14400 | 50 | 480 | 104 | 139 | |
| 14400 | 100 | 480 | 208 | 278 | |
| 14400 | 50 | 300 | 65 | 87 | 7850 |
| 14400 | 100 | 300 | 130 | 174 | |
| 14400 | 100 | 120 | 52 | 69 | 19650 |
| 14400 | 150 | 120 | 78 | 104 | |
| 14400 | 200 | 120 | 104 | 139 | |
| 14400 | 300 | 120 | 156 | 208 | |
| 14400 | 600 | 120 | 313 | 417 | |
| 14400 | 1200 | 120 | 625 | 833 | |
| 15200 | 150 | 120 | 70 | 93 | 21900 |
| 16000 | 200 | 120 | 84 | 113 | 24250 |
| 17000 | 300 | 300 | 280 | 374 | 10950 |
| 19920 | 200 | 120 | 54 | 73 | 37600 |
| 19920 | 300 | 120 | 82 | 109 | |

CAP CHECK II PASS / FAIL LIMIT RATING *continued*

| V | NAMEPLATE DATA | | TEST CURRENT | | MAXIMUM ENERGIZED BANK LOAD, KVAR |
|-------|----------------|--------|--------------|-----|-----------------------------------|
| | KVAR | V TEST | MIN | MAX | |
| 19920 | 50 | 480 | 54 | 73 | 9400 |
| 19920 | 100 | 480 | 109 | 145 | |
| 19920 | 150 | 300 | 102 | 136 | 15000 |
| 19920 | 200 | 300 | 136 | 181 | |
| 19920 | 300 | 300 | 204 | 272 | |
| 21600 | 150 | 300 | 87 | 116 | 17650 |
| 21600 | 200 | 300 | 116 | 154 | |
| 21600 | 50 | 480 | 46 | 62 | 11050 |
| 21600 | 100 | 480 | 93 | 123 | |
| 21600 | 150 | 480 | 139 | 185 | |
| 21600 | 200 | 480 | 185 | 247 | |
| 22130 | 100 | 480 | 88 | 118 | 11600 |
| 22130 | 150 | 480 | 132 | 176 | |
| 22130 | 200 | 480 | 176 | 235 | |
| 22500 | 50 | 480 | 43 | 57 | 11950 |
| 22500 | 100 | 480 | 85 | 114 | |
| 22500 | 150 | 480 | 128 | 171 | |
| 22500 | 200 | 480 | 171 | 228 | |
| 25000 | 100 | 480 | 69 | 92 | 14800 |
| 25000 | 150 | 480 | 104 | 138 | |
| 25000 | 200 | 480 | 138 | 184 | |

NOTE: Maximum Energized Bank Load, KVAR refers to the capacitors which the Cap Check II can energize as a group. The operating manual includes information on load calculations for series-parallel connected banks.

When more than one test voltage is listed for a capacitor nameplate rating, select the highest value while considering the Cap Check bank capacity rating.

LIMITED WARRANTY AND LIMITATION OF LIABILITY

This warranty applies to all products sold by HD Electric Company (the "Products"); provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty; [should you have any question regarding whether a separate warranty applies, please contact HD Electric Company].

NOTICE: READ THIS LIMITATION OF WARRANTY AND LIABILITY BEFORE BUYING OR USING THE PRODUCTS CONTAINED HEREIN.

It is impossible to eliminate all risks associated with the use of the Products. Risks of serious injury or death, including risks associated with electrocution, arcing and thermal burns, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which Products may be applied, the manner of use or application, weather and environmental conditions or other unknown factors, all of which are beyond the control of HD Electric Company.

HD Electric Company does not agree to be an insurer of these risks.

WHEN YOU BUY OR USE THESE PRODUCTS, YOU AGREE TO ACCEPT THESE RISKS.

HD Electric Company warrants to the original purchaser that the Products (excluding any third party products purchased through HD Electric Company, for which no warranties are made) will be free from defects in material and workmanship, under normal use and regular service, and preventative maintenance for a period of one (1) year from the date of shipment (the "Warranty Period"). Should any failure to conform with this warranty be found during the Warranty Period, you must notify HD Electric Company of your claim within thirty (30) days of discovery, and within the Warranty Period. Your failure to give notice of claims of breach of warranty within the Warranty Period shall be deemed an absolute and unconditional waiver of claims for such defects. HD Electric Company will have no responsibility to honor claims received after the date the applicable Warranty Period expires.

Upon notice of your claim, HD Electric Company will provide a return authorization number, and further instructions on how to return the product for service. You must follow HD Electric Company's instruction. You are responsible for all Product removal, handling, re-installation, and shipping (both to and from HD Electric Company). Products returned for repair, as well as repaired or replacement Products shall be sent postage / freight prepaid. After receipt of a product which HD Electric Company determines is defective, HD Electric will, at its option, either (1) repair (or authorize the repair of) the Product or (2) replace the Product, subject to the following: The Products are made using parts sourced from a variety of manufacturers. Due to the rapidly changing technology environment, parts may become obsolete / unavailable over time (end of life). In the event that a Product cannot be repaired or replaced due to unavailability of parts, HD Electric Company will use commercially reasonable efforts to obtain substitute parts or conduct work around design, but cannot guarantee its ability to do so.

Items not found defective will be returned at your expense, or failing receipt of instruction from you on return of such items within five (5) business days of our notice to you that the product is not defective, HD Electric may dispose of the product at its discretion and with no liability to you. HD Electric Company's determination of defects is final. Products repaired or replaced during the Warranty Period shall be covered by the foregoing warranties for the remainder of the original Warranty Period or ninety (90) days from the date of delivery of the repaired or replaced Products, whichever is longer.

LIMITATIONS:

This warranty is void in the event of misuse, alteration, faulty installation, or misapplication of the product. This warranty does not cover failure of product or components due to any ACT OF NATURE; lightning, floods, hurricanes, tornadoes or any other such catastrophic events.

HD Electric Company does not warrant any third party products or associated hardware or their performance or suitability for use and application. Such items are provided "as-is".

All repairs must be authorized by HD Electric Company. Unauthorized repairs will not be reimbursed under any circumstances.

HD Electric Company is not required to make replacement or loaner equipment available while Products are being repaired or replaced, or to compensate you for any in/out labor charges or expenses associated with removal, handling or re-installation of the Products.

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