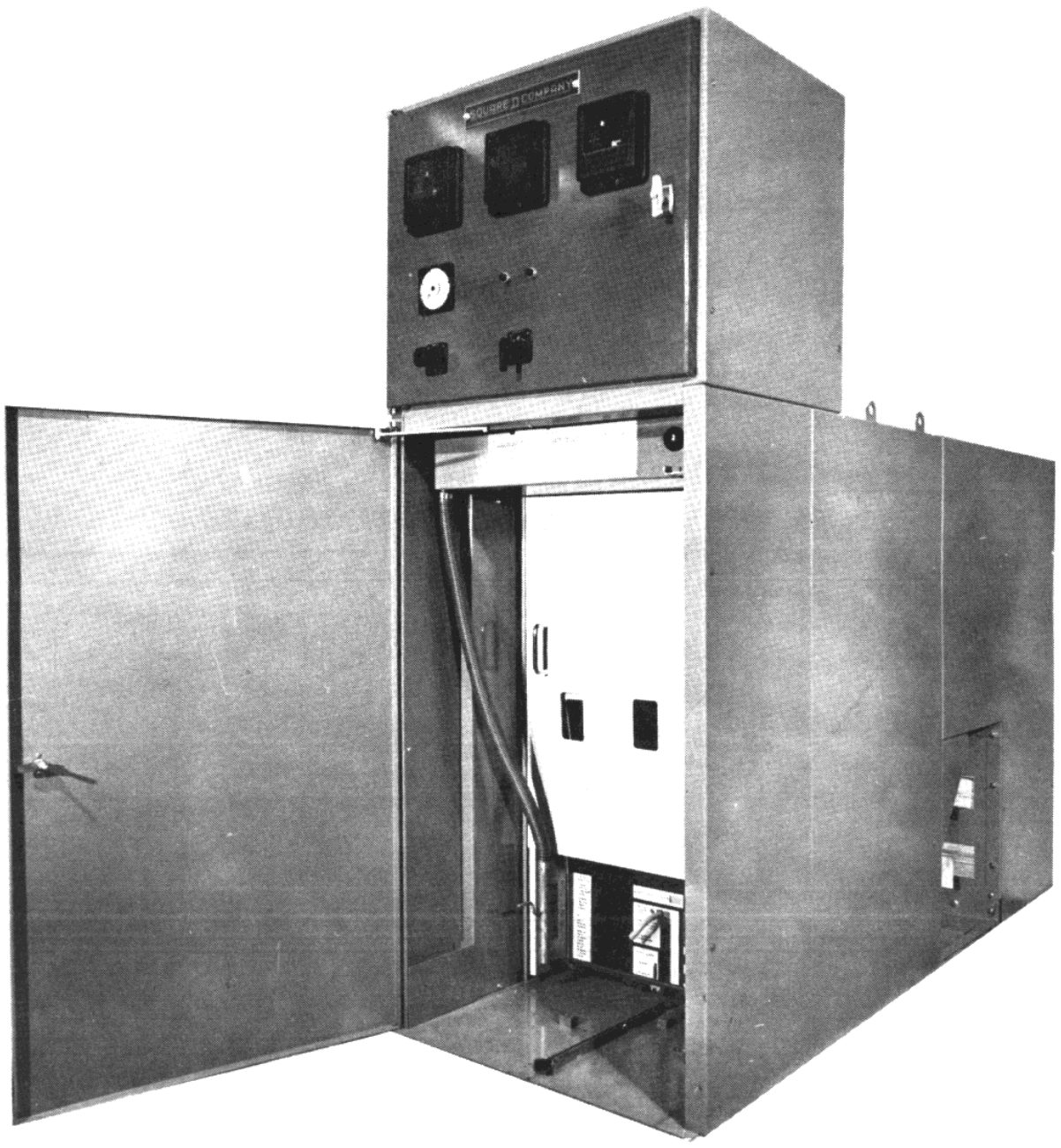
Product Data

Subject **Type DSE 5-15 kv Metal-Clad Switchgear**

File 6150

Re: ANSI Standards C37.04 - 1964
C37.06 - 1971 and C37.09 - 1964 (R-1969)



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USA Standard Rating Structure for AC High-Voltage Circuit Breakers, C37.04-1964 & C37.04a-1964, Reaffirmed 1969; Copyright 1970.

American National Standard Schedules of Preferred Ratings and Related Required Capabilities for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis, C37.06-1971; Copyright 1971.

American National Standard Test Procedure for AC High-Voltage Circuit Breakers, C37.09-1964 (R1969); Copyright 1964 & C37.09a-1970; Copyright 1970.

THE AMERICAN NATIONAL STANDARDS INSTITUTE, INC.
1430 Broadway
New York, New York 10018

TYPE DSE, 5-15 KV METAL-CLAD SWITCHGEAR

Re: ANSI Standard C37.06-1971

Type DSE 5-15 KV Metal-Clad switchgear is constructed and tested in accordance with ANSI specifications. Complete test data is on file in the Middletown Headquarters. This bulletin is a brief explanation of significant tests and records specific test data on one of the more popular breaker ratings. (Type DSE 65, 500 MVA, 13.8 KV, 1200 A)

Table 2 shown on page 4 is an excerpt from ANSI Standard C37.06-1971 which tabulates preferred circuit breaker ratings. The test data given on succeeding pages of this bulletin applies to the breaker listed on Line No. 11.

Five test categories required by ANSI Standard are summarized in the following subparagraphs. References are also given to attached Engineering File sheets which record test results.

Table 2
Schedule of Preferred Ratings for Indoor Oilless Circuit Breakers
(Symmetrical Current Basis of Rating)

Line No.	Identification		Rated Values								Related Required Capabilities			
			Voltage		Insulation Level		Current					Current Values		
					Rated Withstand Test Voltage							Max Symmetrical Interrupting Capability (9)	3 Second Short-Time Current Carrying Capability (10)	Closing and Latching Capability 1.6 K Times Rated Short-Circuit Current (10) (11) kA, rms
	Nominal Voltage Class (1)* kV, rms	Nominal 3 Phase MVA Class (1)	Rated Max Voltage (2) kV, rms	Rated Voltage Range Factor, K (3)	Low Frequency kV, rms	Impulse (4) kV, Crest	Rated Continuous Current at 60 Hz (5) Amperes, rms	Rated Short-Circuit Current (at Rated Max kV) (6) (7) kA, rms	Rated Interrupting Time (8) Cycles	Rated Permissible Tripping Delay, Y Seconds	Rated Max Voltage Divided by K kV, rms	K Times Rated Short-Circuit Current		
												kA, rms	kA, rms	
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11	Col 12	Col 13	Col 14
1	4.16	75	4.76	1.36	19	60	1200	8.8	5	2	3.5	12	12	19
2	4.16	150	4.76	1.36	19	60	1200	18	5	2	3.5	24	24	39
3	4.16	250	4.76	1.24	19	60	1200	29	5	2	3.85	36	36	58
4	4.16	250	4.76	1.24	19	60	2000	29	5	2	3.85	36	36	58
5	4.16	350	4.76	1.19	19	60	1200	41	5	2	4.0	49	49	78
6	4.16	350	4.76	1.19	19	60	3000	41	5	2	4.0	49	49	78
7	7.2	250	8.25	1.79	36	95	1200	17	5	2	4.6	30	30	49
8	7.2	500	8.25	1.25	36	95	1200	33	5	2	6.6	41	41	66
9	7.2	500	8.25	1.25	36	95	2000	33	5	2	6.6	41	41	66
10	13.8	250	15	2.27	36	95	1200	9.3	5	2	6.6	21	21	34
11	13.8	500	15	1.30	36	95	1200	18	5	2	11.5	23	23	37
12	13.8	500	15	1.30	36	95	2000	18	5	2	11.5	23	23	37
13	13.8	750	15	1.30	36	95	1200	28	5	2	11.5	36	36	58
14	13.8	750	15	1.30	36	95	2000	28	5	2	11.5	36	36	58
15	13.8	1000	15	1.30	36	95	1200	37	5	2	11.5	48	48	77
16	13.8	1000	15	1.30	36	95	3000	37	5	2	11.5	48	48	77

04-4.4 Rated Continuous Current. The rated continuous current of a circuit breaker is the designated limit of current in rms amperes at rated frequency which it shall be required to carry continuously without exceeding any of the limitations designated

04-4.4.2 ***Temperature Limitations***

04-4.4.2.1 *Limitations on Insulating Material.* The temperature of materials used to insulate the main power circuit conducting parts from phase to ground, from phase to phase, or from terminal to terminal of an open breaker shall be limited to the values listed in columns B and C in Table 2.

Table 2
Temperature Limitations on Insulating Material

Class of Material	Insulating Class Limits	Main Power Circuit Limits	
	Column A	Column B	Column C
	Hottest Spot Total Temperature, C	Hottest Spot Temperature Rise, C	Hottest Spot Total Temperature, C
O	90	40	80
A	105	55	95
B	130	80	120
F	155	105	145
H	180	130	170
C	220	180	220
Oil (see Note 4)	90	50	90

NOTES:
(1) Temperatures of materials used to insulate other than from phase to ground, from phase to phase, or from terminal to terminal of an open breaker shall be limited to the hottest spot temperatures listed in Column A. Multi-turn coils constitute an example.

(3) The total temperature of main power circuit conducting parts in contact with insulation shall be limited at the points of contact to the total temperature limit of the insulating material (see Column C).

04-4.4.2.2 *Limitations on Main Contacts.* The temperature of the main contacts used in circuit breakers shall not exceed the values listed in Table 3.

Table 3
Temperature Limitations on Main Contacts

Contact Surfaces	Limit of Hottest Spot Temperature Rise, C	Limit of Hottest Spot Total Temperature, C
Copper	30	70
Silver, Silver Alloy, or Equivalent	50 (in oil) 65 (in air)	90 (in oil) 105 (in air)

04-4.4.2.3 *Limitations on Conducting Joints*

04-4.4.2.3.1 Conducting Joints Other Than Terminals for Insulated Cable Connection. The temperature of conducting joints in the main power circuit of a circuit breaker shall not exceed the values listed in Table 4.

Conducting joints in other than oil or air may be operated at other temperatures providing it can be shown, by experience or test acceptable to the user, that accelerated deterioration will not occur. (Future consideration will be given to standardized values.)

Table 4
Temperature Limitations on Conducting Joints

Conducting Joint Surfaces	Limit of Hottest Spot Temperature Rise, C	Limit of Hottest Spot Total Temperature, C
Copper to Copper	30	70
Silver, Silver Alloy, or Equivalent	50 (in oil) 65 (in air)	90 (in oil) 105 (in air)

04-4.4.2.3.2 Terminals for Connection to Insulated Cable. Terminals of circuit breakers designed for direct cable connection shall not exceed 45 C rise or 85 C hottest spot total temperature when connected to 85 C maximum insulated cable, rated for the full continuous current rating of the circuit breaker.

Engr. File No. 21201.4 1.2 Page 1 and 2 (Reproduced as Page 6 and 7 of this bulletin.)

SQUARE D COMPANY

MIDDLETOWN OHIO

CERTIFIED
LABORATORY TEST DATA

DEVICE TESTED: DSE 65 with Standard Cubicle
RATING: 13.8 KV – 1200 A. – 500 MVA
TEST: Continuous Current (Temp. Rise)

DATE OF TEST: 2-15-72
TEST PERFORMED PER: C37-04, 09

TEST CONDITIONS: 2 Bus Bars – 5/16" x 2" with Insulation, Short Circuit Bridge was 2 bars – 3/16" x 3-9/64", All equipment required for normal circuit breaker operation was installed. Main Contacts and Main Disconnects are silver to silver.

AMBIENT TEMPERATURE: 17.5°C.

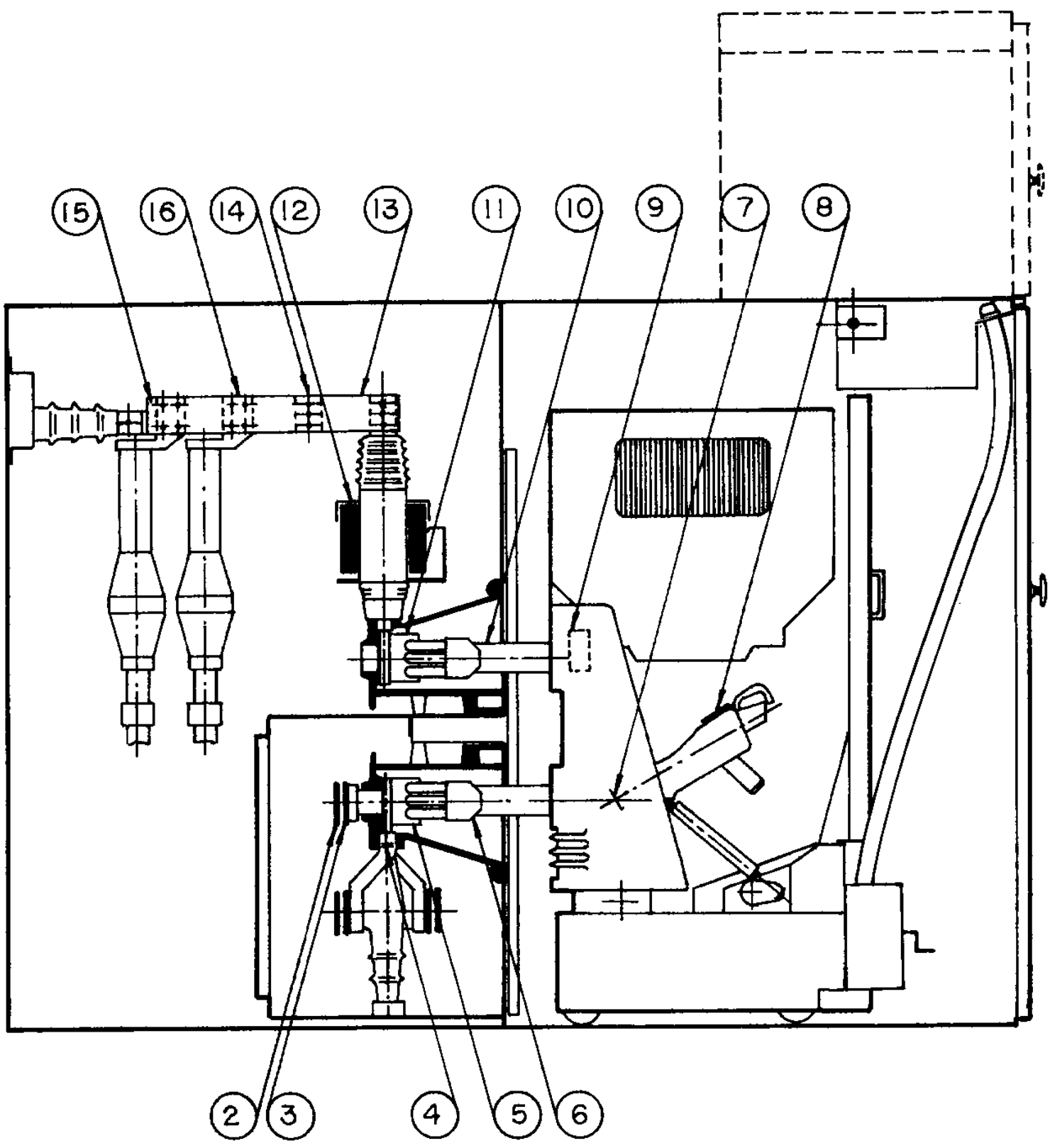
TEMPERATURE RUSES: Bus Compartment $\Delta T = 13.5^{o}C$.
Circuit Breaker Compartment $\Delta T = 16^{o}C$.
Cable Compartment $\Delta T = 21.5^{o}C$.

NUMBER*	PHASE A TEMPERATURE RISES °C	PHASE B TEMPERATURE RISES °C	PHASE C TEMPERATURE RISES °C
2	34.5	32.5	32
3	35.5	33	33
4	33.5	37	35.5
5	39	40.5	40
6	38.5	42	41.5
7	36.5	39	35.5
8	40	44.5	40.5
9	39.5	45.5	43.5
10	44.5	49.5	46.5
11	45.5	41	49.5
12	44.5	47	43
13	46.5	47.5	44.5
14	47	48	45
15	42.5	44.5	43
16	45.5	46	43.5

* REFERENCE DIAGRAM NEXT PAGE

I hereby certify that this test has been performed in accordance with the applicable stated standards and the results accurately recorded.

Dana Lee Swindler Chief Engineer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09-4.10 Dielectric Withstand Tests. Dielectric withstand tests on high-voltage circuit breakers are tests made to determine the ability of the insulating materials and spacings used to withstand overvoltages without damage or flashover.

Dielectric withstand tests on circuit breakers are of two types:

(1) Low-frequency one-minute withstand tests

(2) Impulse withstand tests

Dielectric withstand tests on circuit breakers shall be made at the factory under temperature and humidity conditions normally obtained under conditions of commercial testing. The circuit breaker shall be clean and in good condition and shall not have been put into commercial service. The voltage for dielectric tests shall be measured in accordance with Voltage Measurements, American **Natl Std** for Measurement of Voltage in Dielectric Tests, C68.1-1953. In all tests, normally grounded metal parts shall be connected to the grounded side of the test circuit. If the dielectric strength of a circuit breaker depends upon the taping of the leads or the use of special insulation, such taping or special insulation may be used when the factory test is made.

09-4.10.1 ***Low-Frequency Withstand Voltage Tests.*** Low-frequency withstand voltage tests are made on circuit breakers to demonstrate their ability to withstand short-time overvoltages at rated frequency. In these tests, an alternating voltage shall be used, having a frequency within ± 20 percent of the rated frequency of the apparatus being tested, and having a crest value equal to $\sqrt{2}$ times the rated low-frequency withstand voltage given in American **Natl Std** C37.06-1964. A sine wave shape is recommended. The test voltage shall be applied to the terminals of the breaker for a period of 60 seconds without damage or flashover, in each of the following methods:

(1) With the breaker contacts open, apply the test voltage simultaneously to the terminals on one side of the breaker with the frame and other terminals grounded.

(2) With the breaker contacts closed,

(a) Apply the test voltage simultaneously to all terminals.

(b) Apply the test voltage to the terminals of one phase with the terminals of the other phases grounded. On three- or four-pole breakers, the voltage shall be applied to the interior phase or phases. This test is not required on single-pole breakers or when the phase-to-phase spacing is greater than the spacing between the terminals of one pole.

09-4.10.2 ***Impulse Withstand Tests.*** Impulse withstand tests are made on circuit breakers to demonstrate their ability to withstand momentary overvoltage surges from lightning or momentary system disturbances. In these tests, both positive and negative voltages having a crest value equal to the rated impulse withstand voltage given in American **Natl Std** C37.06-1964, and having a wave shape of 1½ × 40 microseconds, shall be applied to the terminals of the circuit breaker three consecutive times without causing damage or flashover in each of the following methods:

(1) With the breaker contacts open, apply the test voltage simultaneously to the terminals on one side of the breaker with the frame and other terminals grounded.

(2) With the breaker contacts closed,

(a) Apply the impulse test voltage simultaneously to all terminals.

(b) Apply the impulse test voltage to the terminals of one phase with the terminals of the other phases grounded. On three- or four-pole breakers, the voltage shall be applied to the interior phase or phases. This test is not required on single-pole breakers or when the phase-to-phase spacing is greater than the spacing between the terminals of one pole.

If, during the first of a group of three consecutive tests, flashover occurs on one test of a group, a second group of three tests shall be made. If the circuit breaker successfully withstands all three of the second group of tests, the flashover in the first group shall be considered a random flashover and the circuit breaker shall be considered as having successfully passed that test.

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SQUARE D COMPANY

MIDDLETOWN, OHIO

CERTIFIED
LABORATORY TEST DATA

DEVICE TESTED: DSE 65 **DATE OF TEST:** 2-15-74

RATING: 13,8 KV – 1200 A. – 500 MVA **TEST PERFORMED PER:** C37-04, 06, 09

TEST: Dielectric Withstand

TEST CONDITIONS: I. Low frequency one minute withstand at 50 HZ. II. 1.2 x 50 micro sec, positive and negative impulses.

I. LOW FREQUENCY ONE MINUTE WITHSTAND

1. Circuit breaker contacts OPEN, voltage applied to line side terminals with load side terminals and structure grounded.

In cubicle	Open
50 KV	62 KV

2. Circuit breaker contacts OPEN, voltage applied to load side terminals with line side terminals and structure grounded.

In cubicle	Open
50 KV	62 KV

3. Circuit breaker contacts CLOSED, voltage applied to all terminals simultaneously with structure grounded.

In cubicle	Open
50 KV	65 KV

4. Circuit breaker contacts CLOSED, voltage applied on each phase with the remaining phases being grounded.

	In cubicle	Open
Voltage Phase 1	50 KV	65 KV
Voltage Phase 2	50 KV	65 KV
Voltage Phase 3	50 KV	65 KV

CERTIFIED LABORATORY TEST DATA

II. IMPULSE WITHSTAND

1. Circuit breaker contacts OPEN, impulses applied to line side terminals with load side terminals and structure grounded.

5 impulses + polarity	98 KV
5 impulses – polarity	98 KV

2. Circuit breaker contacts OPEN, impulses applied to load side terminals with line side terminals and structure grounded.

5 impulses + polarity	98 KV
5 impulses –polarity	98 KV

3. Circuit breaker contacts OPEN, impulses applied simultaneously to all terminals with structure groundec

5 impulses + polarity	98 KV
5 impulses – polarity	98 KV

4. Circuit breaker contacts CLOSED, impulses applied to one phase with the other phases and structure grounded.

Phase 1	5 impulses + polarity	98 KV
	5 impulses – polarity	98 KV
Phase 2	5 impulses + polarity	98 KV
	5 impulses – polarity	98 KV
Phase 3	5 impulses + polarity	98 KV
	5 impulses – polarity	98 KV

CONCLUSION: All low frequency potentials and impulses were performed without flash over or dielectric breakdown.

I hereby certify that this test has been performed in accordance with the applicable stated standards and the results accurately recorded.

 Dana Lee Sumdler Chief Engineer

LOAD CURRENT SWITCHING

Applicable paragraphs from ANSI Standard C37.09

9-4.14.1 ***Required Load Current Switching Capability.*** Tests are made to determine the ability of the breaker to switch load currents such as may be encountered in normal service.

All types of breakers shall interrupt currents up to rated continuous current with a normal-frequency line-to-line recovery voltage not less than rated maximum voltage. Three opening tests with random tripping time with respect to the current wave shall be made with a power factor of 0.8 lagging or less. Tests are to be made at rated continuous current and at any current below rated continuous current at which the breaker exhibits a maximum arcing time if that current is not demonstrated by other required tests. A demonstration of the interruption of power-load currents with leading power factors or with lagging power factors greater than 0.8 is not required, because these currents are considered easier to interrupt. For capacitor and line charging, see 09-4.14.3 and 09-4.14.4.

When resistance is added to control power factor, it shall be connected in series with the reactor.

Breakers designed to meet this standard are expected to be capable of performing the load-switching operations shown in Column 4 of Table 6 of American Natl Std C37.06-1964 in a circuit having a power factor of 0.8 lagging to 0.8 leading. They are also expected to be able to close circuits having making currents 600 percent of rated continuous current for the number of times shown in Column 6 of Table 6 of American Natl Std C37.06-1964.

Design tests to demonstrate these capabilities are not specified because, if a circuit breaker has successfully met the service capability requirements for short-circuit conditions in accordance with 09-4.5.4.3, it will be assumed that it is capable of meeting these load switching capabilities.

Table 6-C37.06 is reproduced on page 12 of this bulletin.

Engr. File No. 21201.4 1-5A Page 1 (Reproduced as Page 13 of this bulletin.)

Table 6
Schedule of Required Load Current Switching Capability and Life for AC High-Voltage Circuit Breakers

Circuit Breaker Ratings	Number of Operations					
	Max Number Between Servicing	No Load Mechanical (5) (6)*	Full Load Nonfault (1) (3) (5) (7)	Full Load Fault (1) (4) (5) (7) (8)	Inrush Nonfault (2) (3) (5) (7)	Inrush Fault (2) (4) (5) (7) (8)
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
Indoor Oil Circuit Breakers						
15.0 kV and below, 600 to 2000 A	2000	5000	1000†	250	250	100
15.5 kV and 38 kV, 1200 A	250	1500	500	100	250	100
15.5 kV and 38 kV, above 1200 A	250	500	250	100	250	100
Indoor Oilless Circuit Breakers						
4.76 kV, 1200 A, 29 kA and below 8.25 kV, 1200 A 15 kV, 1200 A, 23 kA and below	2000	10 000	5000	1000	3000	750
4.76, 8.25, and 15 kV, 2000 A	2000	10 000	3000	1000	2000	750
4.76 kV, 1200 and 3000 A, 40 kA 15 kV, 1200 and 3000 A, 37 kA	1000	5000	2500	500	1500	400
15.5 and 38 kV, 1200 to 4000 A	250	1500	250	150	150	100
15.5 and 38 kV, 5000 A	250	500	150	100	100	50
Outdoor Circuit Breakers						
15.5 and 25.8 kV, 600 and 1200 A 18 kA and below	500	2500	500	100	350	100
All voltages up to and including 72.5 kV, except breakers in immediately preceding lines:						
(1) 600 and 1200 A	500	1500	500	100	350	100
(2) 2000 A and above	250	500	125	100	125	100
All voltages 121 kV and above	250	750	125	100	125	100

SQUARE D COMPANY

MIDDLETOWN OHIO

CERTIFIED
LABORATORY TEST DATA

DEVICE TESTED: DSE 65
RATINGS: 13.8 KV – 1200.A. – 500 MVA
TEST: Load Current Switching – Full Load Fault
DATE OF TEST: Feb. - March 1973
TEST PERFORMED PER: C37-04, 06, 09

TEST CONDITIONS: 1000 Close-Open Operations were performed with a line to line voltage of 14.5 KV and a load current interrupted of 1330 amperes. One operation was performed every minute. After performing the above test, four opening tests were performed, two at 15.5 KV with 18 KA and two at 11.5 KV with 23.7 KA. All test were performed with a power factor of less than 0.15.

OPERATIONS	ARCING TIME MILLISECOND	MAKING CURRENT AMPERES PEAK
50 TH.	28	3300
100 TH.	23	3400
200 TH.	23	3600
300 TH.	23	3400
400 TH.	23	3700
500 TH.	35	3700
600 TH.	28	3700
700 TH.	23	3700
800 TH.	28	3600
900 TH.	23	3600
1000 TH.	23	3700

OPERATIONS	ARCING TIME MILLISECOND	CURRENT INTERRUPTED KA	VOLTAGE KV
OPEN	6	18	15.5
OPEN	6	18	15.5
OPEN	11	23.8	11.5
OPEN	6	23.6	11.5

CONCLUSION: No servicing or repair was performed during testing. All interruptions were without restrikes and the test laboratory circuit breaker did not operate during the test sequence.

I hereby certify that this test has exceeded that required by applicable stated standards and the results accurately recorded.

Dave Lee Sundler Chief Engineer

MECHANICAL LIFE

Applicable paragraphs from ANSI Standard C37.09

09-4.15 Mechanical Life. No-load mechanical operation tests are made on a complete power circuit breaker to ensure its satisfactory operation in normal service without excessive maintenance. All mechanical operation tests shall be made at rated control voltage or air pressure, or both, except as noted below, without repair or replacement of any major part and with the number of operations between servicing at least equal to the number shown in Column 2 of Table 6 of American Natl Std C37.06-1964. Mechanical operation tests may be made with any interval between operations which does not overheat bearings, momentary-rated coils, valves, rectifiers, or other auxiliary devices. A mechanical operation test shall consist of the number of close operations followed by opening operations shown in Column 3 of Table 6 of American Natl Std C37.06-1964.

To demonstrate that an outdoor breaker can operate with an ambient of —30 C, a few of these tests should be made on it after the breaker has come to a steady temperature in that ambient. However, if testing facilities do not permit this demonstration (as is usually the case), the performance of important components of the breaker may be demonstrated in this ambient temperature.

To verify that the circuit breaker is in a condition meeting the requirements specified in Paragraphs 1 and 2 of 04-4.5.3.3 of American Natl Std C37.04-1964, after completion of the no-load mechanical operations test, the breaker shall be inspected visually and the travel records taken before and after the tests shall be substantially the same.

Table 6-C37.06 is reproduced on page 12 of this bulletin.

Engr. File No. 21201.4 1-4 Page 1 of 1 (Reproduced as page 15 of this bulletin.)

SQUARE D COMPANY

MIDDLETOWN OHIO

CERTIFIED
LABORATORY TEST DATA

DEVICE TESTED: DSE 65 **DATE OF TEST:** 1972

RATING: 13.8 KV – 1200 A. –500 MVA **TEST PERFORMED PER:** C37-04, 06, 09

TEST: Mechanical Life

TEST CONDITIONS: Close-Open duty cycle performed at the rate of three operations per minute using 125 V. DC control circuits with the main circuits de-energized. Maintenance was performed at intervals of 3000 operations.

NO. OF OPERATIONS	CONTROL VOLTAGE	OPENING SPEED	CLOSING SPEED
0	125 V. DC	6.5 Meters/Sec	4.5 Meters/Sec
1000	100 V. DC	6.45 Meters/Sec	4.55 Meters/Sec
2000	137 V. DC	6.40 Meters/Sec	4.60 Meters/Sec
3000	125 V. DC	6.45 Meters/Sec	4.80 Meters/Sec
5000	125 V. DC	6.35 Meters/Sec	4.85 Meters/Sec
10,000	125 V. DC	6.30 Meters/Sec	4.40 Meters/Sec
15,000	125 V. DC	6.00 Meters/Sec	4.55 Meters/Sec
20,000	125 V. DC	5.80 Meters/Sec	4.40 Meters/Sec

CONCLUSION: After dismantling the circuit breaker, only normal wear of the mechanical parts existed. The arcing contacts required replacement.

I hereby certify that this test has been performed in accordance with the applicable stated standards and the results accurately recorded.

Dana Lee Sumaller Chief Engineer

SHORT CIRCUIT RATING

Applicable paragraphs from ANSI Standard C37.09

09-4.5 Short-Circuit Rating. The short-circuit rating of a circuit breaker is demonstrated by an extensive series of tests. These tests demonstrate the rated short-circuit current and the related required capabilities of the circuit breaker when used on grounded and ungrounded systems. These tests are outlined in Tables 1 and 2 and described in the following sections.

Tests to demonstrate the required capabilities of the circuit breaker are made in accordance with the conditions specified in 09-4.5.4, under specified testing conditions in 09-4.5.5, and in 09-4.5.6.

09-4.5.1 ***Rated Short-Circuit Current.*** The rated short-circuit current is the highest value of the symmetrical component of the polyphase current which the breaker may be required to interrupt at rated maximum voltage. The rated short-circuit current is demonstrated by the interruption of a symmetrical current of the rated value with a normal-frequency recovery voltage equal to the rated maximum voltage. This is Test Duty 4 in Tables 1 and 2.

09-4.5.2 ***Related Required Capability.*** For a circuit breaker to have a rated short-circuit current, it must also have the other capabilities listed in 04-4.5.2 of American **Natl Std**, C37.04-1964.

09-4.5.2.1 *Symmetrical Interrupting Capability for Polyphase and Line-to-Line Faults.* The required symmetrical interrupting capability varies inversely with the normal-frequency recovery voltage from a minimum value at rated maximum voltage to K times this value at rated maximum voltage/K. The lower value is the rated short-circuit current demonstrated by Test Duty 4 in Tables 1 and 2. The higher value is demonstrated by Test Duty 5 in Tables 1 and 2.

09-4.5.2.2 *Asymmetrical Interrupting Capability for Polyphase and Line-to-Line Faults.* The required asymmetrical interrupting capability varies inversely with the normal-frequency recovery voltage from a minimum value at rated maximum voltage to K times this value at rated maximum voltage/K. The value at rated maximum voltage is demonstrated by Test Duty 6 in Tables 1 and 2. The value at rated maximum voltage/K is demonstrated by Test Duty 7 in Tables 1 and 2.

09-4.5.2.3 *Interrupting Capability for Single Line-to-Ground Faults.* The required interrupting capabilities for single line-to-ground faults both symmetrical and asymmetrical usually vary with normal-frequency recovery voltage (see 04-4.5.2.3 of American **Natl Std** C37.04-1964). They are demonstrated for service at rated maximum voltage by Test Duties 13 and 14 in Table 1 and for the maximum currents by Test Duties 5 and 7 in Tables 1 and 2. Single-pole tests at 0.58 times rated maximum voltage/K are not specified because in all or practically all cases, Test Duties 4 and 6 in Table 2 at 0.87 times rated maximum voltage and slightly lower currents will be more severe.

09-4.5.2.4 *Closing, Latching, Carrying, and Interrupting Capability.* The required capability to close against a fault current, to latch or the equivalent, to carry the current as long as is necessary, and then to interrupt the current, specified in 04-4.5.2.4 of American **Natl Std** C37.04-1964, is demonstrated by Test Duty 11 in Tables 1 and 2.

09-4.5.2.5 *Short-Time Current-Carrying Capability.* The required short-time current carrying capability of a circuit breaker is demonstrated by Test Duty 12 in Tables 1 and 2.

09-4.5.2.6 *Reclosing Capability.* Reclosing duty cycles in American **Natl Std** Interrupting Capability Factors for Reclosing Service for AC High-Voltage Circuit Breakers, C37.07-1964, are based on reclosing operations with intentional time delays varying from 0 to 15 seconds. The capability to make a reclosure with zero intentional time delay is demonstrated by Test Duties 9 and 10 of Tables 1 and 2 and with 15 second time delay by Test Duties 6-1 and 7-1 of Tables 1 and 2.

09-4.5.3 ***Interrupting Performance.*** When tested up to its rated short-circuit current, the interrupting performance of the circuit breaker shall be in accordance with 04-4.5.3 of American Standard C37.04-1964.

09-4.5.3.3 *Service Capability and Breaker Condition.* The capability of a circuit breaker to meet its service capabilities (see 04-4.5.3.3 of American **Natl Std** C37.04-1964) is demonstrated by Test Duties 7A or 8 of Tables 1 and 2.

Table 1-C37.09 is reproduced on page 17 of this bulletin.

Engr. File No. 21201.4 1-1 Page 1 and 2 (Reproduced as pages 18 and 19.)

Table 1
Test for Demonstrating the Short-Circuit Rating of a Power Circuit Breaker by Method I
(Testing a Three-Pole Breaker on a Three-Phase Circuit)

Test Duty (see 09-4.5)	Operating Duty (15)*	Phases	Voltages, Initial and Recovery, Normal-Frequency Line-to-Line Volts, rms (1) (2) (14)	Making Current at First Major Peak (1) (3)		Current Interrupted at Contact Separation		Tripping Delay (Approximate) (60-Cycle Base) Cycles	Control Voltage and Operating Pressure Before First Operation
				Amperes, rms	Amperes, Peak	Magnitude, Amperes, rms	Asymmetry, Percent		
1	2	3	4	5	6	7	8	9	10
1	One O and one CO	3	*V*	—	—	0.07 *I* to 0.13 *I* (3)	50 to 100 (3)	½	Rated
2	One O and one CO	3	*V*	—	—	0.2 *I* to 0.3 *I* (10)	Less than 20 (10)	—	Rated
3	One O and one CO	3	*V*	—	—	0.4 *I* to 0.6 *I* (3)	50 to 100 (3)	½	Rated
4 (5) (18)	O-15 sec (1)-O, O-15 sec (1)-CO, or CO-15 sec (1)-CO	3	*V*	—	—	*I* (1) (9)	Less than 20	(4)	Rated (17)
5 (5) (18)	O-15 sec (1)-O, O-15 sec (1)-CO, or CO-15 sec (1)-CO	3	*V/K*	—	—	*KI* (1) (9)	Less than 20	(4)	Rated (17)
6-1 (7)	CO-15 sec (1)-CO	3	*V*	1.6 *KI*	2.7 *KI*	*SI* (1) (3)	50 to 100 (3)	½	Rated (16)
6-2 (7)	C	3	*V*	1.6 *KI*	2.7 *KI*	—	—	—	Rated (16)
6-3 (7)	O-15 sec (1)-O	3	*V*	—	—	*SI* (1) (3)	50 to 100 (3)	½ (4)	Rated
	For all other breakers:								
7B-1 (7)	CO-15 sec-CO-1 hour-CO	3	*V/K*	1.6 *KI*	2.7 *KI*	*KSI* (1) (3)	50 to 100 (3)	½	Rated (6) (16)
7B-2 (7)	C-15 sec (1)-C-1 hour-C	3	*V/K*	1.6 *KI*	2.7 *KI*	—	—	—	Rated (16)
7B-3 (7)	O-15 sec (1)-O-1 hour-O	3	*V/K*	—	—	*KSI* (1) (3)	50 to 100 (3)	½ (4)	Rated (6)
8 (13)	Several O and CO operations-1 hour-CO	3	*V/K*	—	—	(13)	Random	½	Rated (6)
9 (11) (12)	O-0 sec-CO or CO-0 sec-CO	3	*V*	—	—	*RSI* (1) (3)	50 to 100 (3)	½	Rated
10 (11)	O-0 sec-CO or CO-0 sec-CO	3	*V/K*	—	—	*RKSI* (1) (3)	50 to 100 (3)	½	Rated
11	C-*T* sec-O	3	*V/K*	1.6 *KI*	2.7 *KI*	*KI*	0	*T*	Rated (16)
12	In closed position (8)	1	—	—	—	—	—	—	—
13	One O and one CO or two O	1	0.58 *V*	—	—	Smaller of 1.15 *I* or *KI*	Less than 20	(4)	Rated
14	One O and one CO or two O	1	0.58 *V*	—	—	Smaller of 1.15 *SI* or *KSI* (1)	50 to 100 (3)	½ (4)	Rated

* Numbers in parentheses refer to the corresponding numbers of the explanatory notes on the facing page.

Eng. File 21201.4.1-1
DSE 65

Short-Circuit Performance Test Summary

October 23, 1975

Apparatus Tested	
Manufacturer	Square D
Interrupters	Solenarc
Type of circuit breaker	Air
Number of poles	Three
Actuating device	Stored energy
Opening time with rated short-circuit current	48 Milliseconds
Opening speed in region of arc	6.5 Meters/second
Closing speed in region of arc	4.5 Meters/second.
Rating	
Rated maximum voltage	15KV
Voltage range factor, K	1.3
Rated frequency	50-60 HZ
Rated short-circuit current	18 KA
Rated interrupting time	5 Cycles
Rated control voltage	Various
Rated fluid operating pressure	Does not apply
Rated reclosing time	30 Cycles
Required Capabilities	
Voltage range	
Maximum voltage	15.3 KV to 15.5 KV
1/K x maximum voltage	11.4 KV to 11.7 KV
Making current	63 KA Peak
Required symmetrical interrupting capability	
At rated maximum voltage	
Three phase	18.5 KA
Single phase	21 KA
At 1/K x maximum voltage	
Three phase	23.5 KA
Single phase	*
Required asymmetrical interrupting capability	
At rated maximum voltage	
Three phase	20.6 KA
Single phase	23.5 KA
At 1/K x maximum voltage	
Three phase	28 KA
Single phase	*
Short-time current-carrying capability in closed position	
Amperes	29.7 KA
Time	3 Seconds
Short-time current-carrying capability on C-Y sec. -O test duty	
Amperes	23.14 KA
Time	2 Seconds
Test Circuit	
Frequency	50 HZ
Power factors for range or for specific circuits	5-14%

All tests were performed at KEMA, MG, and EDF Test Labs.

* Does not apply to method I, table I C37-09

SQUARE D COMPANY

(DWG. TITLE BLOCK INFORMATION)

SHORT CIRCUIT PERFORMANCE DATA

DSE 65 | 500 MVA-13.8KV.-1200A. 3φ CIRCUIT BREAKER

DATE 10/20/75 | Eng. File 21201.4-1

BY D. BARSALOU | Revision A – T.D. 9 & 10

APPROVED BY D. SWINDLER | DATE 10/22/75

SQUARE D COMPANY

ELECTRICAL EQUIPMENT

REMARKS

I HEREBY CERTIFY THAT THESE TESTS HAVE BEEN PERFORMED AND HAVE SUCCESSFULLY PASSED IN ACCORDANCE WITH C 37-03, 04, 05, 06, 07 AND 09 FOR BREAKER QUALIFICATION.

CHIEF ENGINEER

TEST DUTY NO.	OPERATION DUTY	PHASES	NORMAL-FREQUENCY VOLTAGE			MAKING CURRENT PEAK-KA.	INTERRUPTING CURRENT			TIME			TEST REPORT IDENTIFICATION
			INITIAL RMS. KV.	RECOVERY			AC COM-PONENT KA.	TOTAL RMS. KA.	% ASSYMMETRY	ARCING CYCLES	INTER-RUPTING CYCLE	RECLOSING CYCLES	
				POLE-UNIT RMS. KV.	PERCENT SPECIFIED								
1	O+	ALL	15.5	15.4	103	–	1.87	2.25	56	1.2	4.08	–	AC 77 300 005 13th NOV.
	CO		15.5	15.3	102	–	1.86	2.45	68	1.14	3.96	–	AC 77 300 006
2	O+	ALL	15.6	15.5	103	–	4.1	4.1	14 MAX.	0.84	3.66	–	AC 77 300 010 13th NOV.
	CO		15.6	15.5	103	–	4.13	4.13		0.78	3.72	–	AC 77 300 012
3	O+	ALL	15.5	15	100	–	9.1	11.6	54	1.02	3.84	–	AC 77 300 007 13th NOV.
	CO		15.5	15	100	–	9.1	11.5	53	1.02	3.90	–	AC 77 300 008
4	CO-15 SEC.-CO	ALL	15.4	15.3	102	44.5	18.5	18.5	10 MAX.	0.66		–	HM 051-07.202 407
			15.4	15.3	102	46.0	18.5	18.5		0.66		–	HM 051-07.202 408
5	CO-15 SEC.-CO	ALL	11.4	11.4	99	57.5	23.5	23.5	11 MAX.	0.66		–	HM 051-07.202 412
			11.4	11.4	99	60	23.5	23.5		0.66		–	HM 051-07.202 413
6	C-O-15 SEC.-O-O	ALL	15.5	15.4	103	24- 63- 55	18.7 18.7 16.6	18.7 18.7 20.6	52	0.72 0.72 0.72	3.54	–	AC 77- 300 002 14th NOV. AC 77- 300 004 AC 77- 300 005 AC 77- 300 007
7B	C-15 SEC.-C-10 MIN.-C O-15 SEC.-O-O	ALL	11.8	11.7	102	63- 57- 71 57 MAX.	24 24 22.5	24 24 28	54	0.60 0.66 0.78	3.60	–	AC 77-300 008 AC 77-300 012 AC 77-300 009 AC 77-300 013 14th NOV. AC 77-300 010 AC 77-300 015
8	O-8 MIN.-CO-6 MIN.-O-5 MIN-CO-5 MIN.-O-30 MIN-CO	ALL	11.8	11.6	101	–	5 opens at 16.3 KA 1 open at 23.6 KA $\Sigma I^2 = 105.1$KA		RANDOM	0.54 TO 0.78	3.42 TO 3.66	–	AC 77-300 017 AC 77-300 020 AC 77-300 018 AC 77-300 021 14th NOV. AC 77-300 019 AC 77-300 023
9	O-CO	ALL	16.5	15.9	106	–	17.2	22.25	58	.6	2.2	17.48	AC 180a-3750707008
10	O-CO	ALL	13.5	12.7	110	63	20.4	25.5	53	.5	2.15	16.7	AC 180a-3750707006
11	C-2 SEC. EQUIVALENT-O	ALL	11.6	11.5	100	59 AV. 70 MAX.	24.5	24.5	–	0.42		–	AB 2112 200 006 AND 200 007 31.5KA FOR 1.08 SEC. EQUIVALENT TO 23.14KA FOR 2 SEC.
12	CLOSED	ALL	–	–	–	67.7	–	–	–	–	–	–	HM 051-07.202 303 32.0KA FOR 2.6SEC. EQUIVALENT TO 29.7KA FOR 3 SEC.
13	O+O	SINGLE PHASE	9	8.8	101	–	21	21	4	0.66	–	–	AC 72A 300 005 AC 72A 300 006
14	O+O	SINGLE PHASE	9.1	8.8	101	–	18.9	23.5	52	0.72	–	–	AC 72A 300 007 AC 72A 300 008