PACIFIC GAS AND ELECTRIC COMPANY

SAN FRANCISCO, CALIFORNIA

ELECTRICAL ENGINEERING DEPARTMENT

SEISMIC TEST PROCEDURE FOR DIABLO CANYON 4160V CLASS 1E SWITCHGEAR BUS UNDERVOLTAGE RELAYS

DATE: November 27, 1978

APPROVED BY:

J. E. Herbst
D. Nielsen
J. W. Colwell

TEST PROCEDURE

4160V Class 1E Switchgear, Undervoltage Relays

1. Description of Equipment

Device 27HHT1, 4160V Bus "H" Undervoltage Trip Relay, is a General Electric Type 12IAV54F1A Relay.

Device 27HHT2, 4160V Bus "H" Undervoltage Trip Relay, is a Westinghouse Type SV Relay, Catalog No. 1876094.

Device 27XHHT, 4160V Bus "H" Undervoltage Trip Auxiliary Relay, is an Electro Switch Company Type LOR/ER Lock-out Relay with Electric Reset Feature, Catalog No. 7825DD.

Door Cell H13, containing all the devices above, is a steel panel 26 inches wide and 90 inches high. Refer to Attachment "A", showing 4160V Switchgear Test Specimen during the earlier test with door H13 at the right.

2. Test Criteria and Plan

This test procedure requires additional seismic testing of Undervoltage Relays 27HHT1 and 27HHT2 in conjunction with the associated Auxiliary Relay 27XHHT. The Relays were tested earlier in a steady state condition, both energized and deenergized, as part of the 4160V Class 1E Switchgear. Refer to Diablo Canyon FSAR Section 10.3.26. This test shall demonstrate the Relays performance while being switched on and off during the shake. Relay 27XHHT must be tripped and reset when Relays 27HHT1 and 27HHT2 are switched off and on respectively.

The plan is to test the door of Cell H13 separatley with its full Relay compliment. The shake table motions (biaxial) shall be such that the accelerometer responses of location 9 from the earlier Switchgear test will be duplicated or exceeded. Refer to Attachment "B". WYLE Laboratories designated the accelerometers for location 9 as 25 (front to back), 26 (side to side) and 27 (vertical). Refer to Attachment "C". The Response Spectrums for the 4160V Switchgear SSE runs 16, 17, 19, 20 (side to side and vertical), 31, 33, 34 and 35 (front to back and vertical) for the above accelerometers are attached. (Attachment "D", 24 Sheets.) For this purpose the door Cell H13 must be mounted rigidly to the shake table in its normal upright position.

3. Test Procedure and Set-Up

Since the equipment was already tested for its performance under steady state conditions, only one SSE test sequence each in the side to side and front to back orientation of the Cell H13 door is required. These runs must envelope the response spectrums of the four SSE runs for the approbiate orientation of the 4160V Switchgear testing as shown in Attachment "D".

The Relays shall be wired per Test Connection, Attachment "E" employing 1-phase 120VAC and 125V DC. The Relays will be set at 82V their normal operating setting. One pole of Switch S energizes or deenergizes Relays 27HHT1 and 27HHT2 while the second pole indicates all switching on a direct readout recorder. Contact 45 - 47 of Relay 27XHHT will be connected to a second channel of the direct readout recorder. It must indicate change of state immediately after Switch S is being closed, and change state after a short time delay when Switch S is opened because Relay 27HHT1 has a time delay on deenergization.

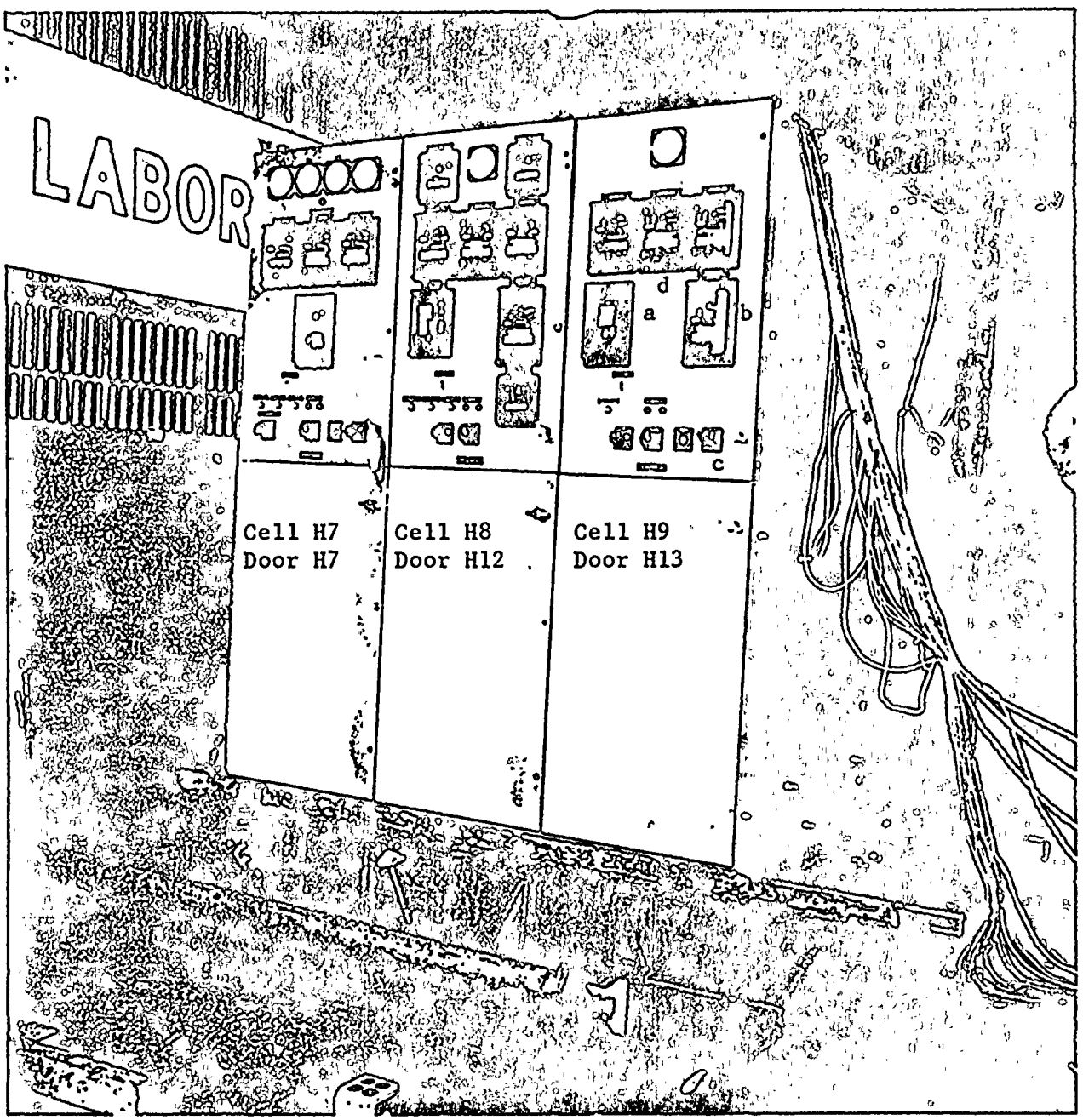
Switch S shall be operated during each run as follows:

Run Time	0 seconds	Switch S Closed
Run Time	8 seconds	Open Switch
Run Time	15 seconds	Close Switch
Run Time	18 seconds	Open Switch
Run Time	25 seconds	Close Switch

The timing given are for guidance only and need not be accurate.

Before and after the test runs the performance of the Relays shall be documented on the direct readout recorder by operating Switch S in the same sequence as during the runs.

In addition to the contact status for Switch S and Relay 27XHHT the horizontal and vertical time histories of the table and a time trace shall be recorded.

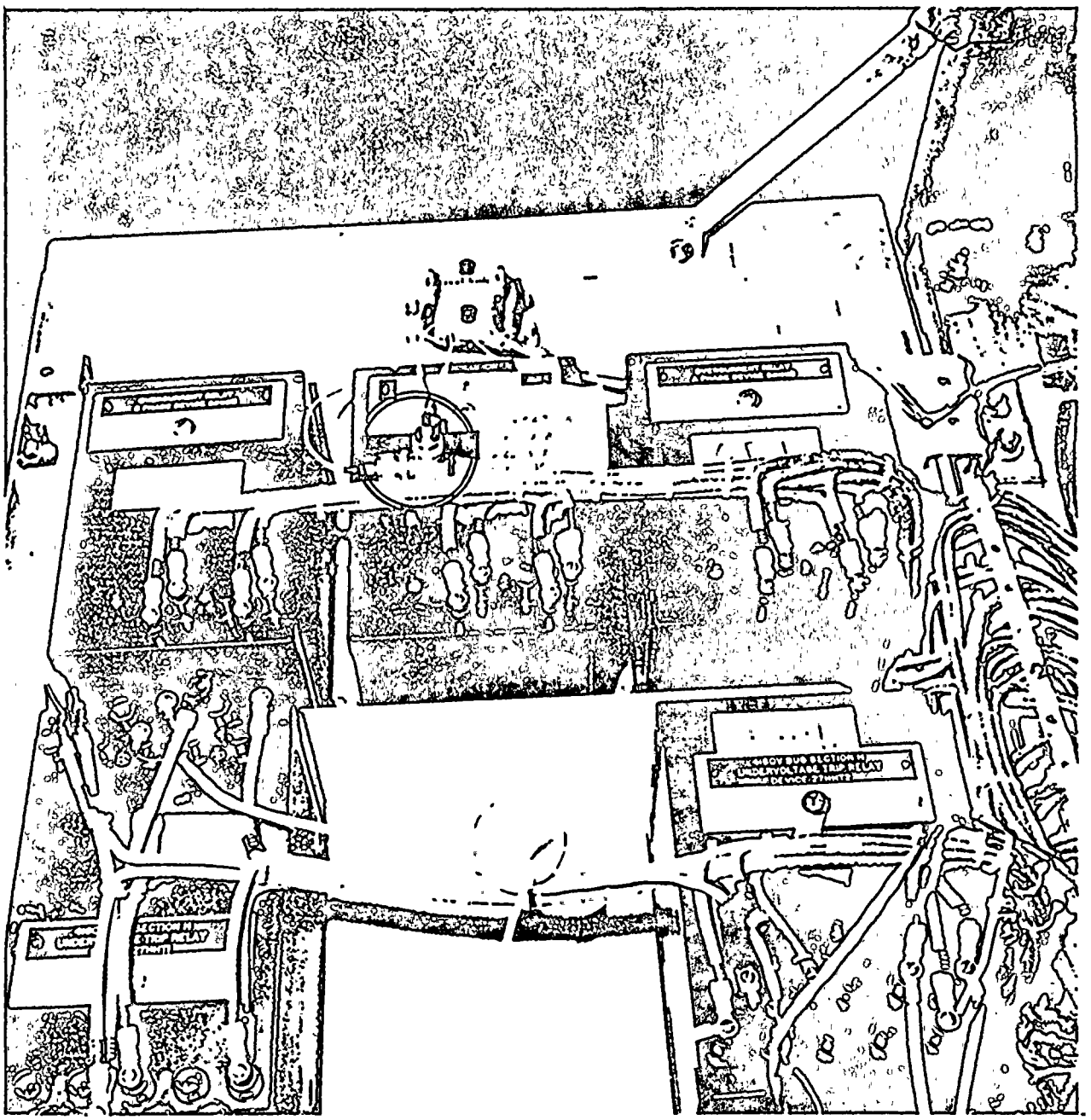


PHOTOGRAPH 2

FRONT TO BACK AXIS SETUP
4160 SWITCHGEAR

a = Undervoltage Relay 27HHT2
b = Undervoltage Relay 27HHT1
c = Auxiliary Relay 27XHHT
d = Accelerometer 9 Location
in Back of the Overcurrent Relay

ATTACHMENT "A"



PHOTOGRAPH 12

ACCELEROMETER LOCATION: NO. 9

WYLE LABORATORIES

DATA SHEET

Report No. 58255-1
Page No. 20

CUSTOMER PG&E
Test Title: SEISMIC RANDOM
Specimen 4160V SWITCHGEAR
Part No. SEE REL INSP
Job No. 58235
S/N SEE REL INSP
Date 8-10-78

ACCELEROMETER LOCATION DATA

GENERAL ELECTRIC LOCATION NO.	WYLE ACCEL NO. & AXIS FB	SS	V
1	3	4	
2	5	6	7
3	8	9	
4	10	11	12
5	13	14	15
6	16	17	18
7	19	20	21
8	22	23	24
9	25	26	27
10	28	29	30
11	31	32	33
12 NOT USED	—	—	—
13	34	35	36

W 614 B

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SHEET ____ OF ____
ATTACHMENT "C"

WYLE LABORATORIES

Report No. _____

CUSTOMER P.G. & E. Job No. 58255-1 Page No. _____

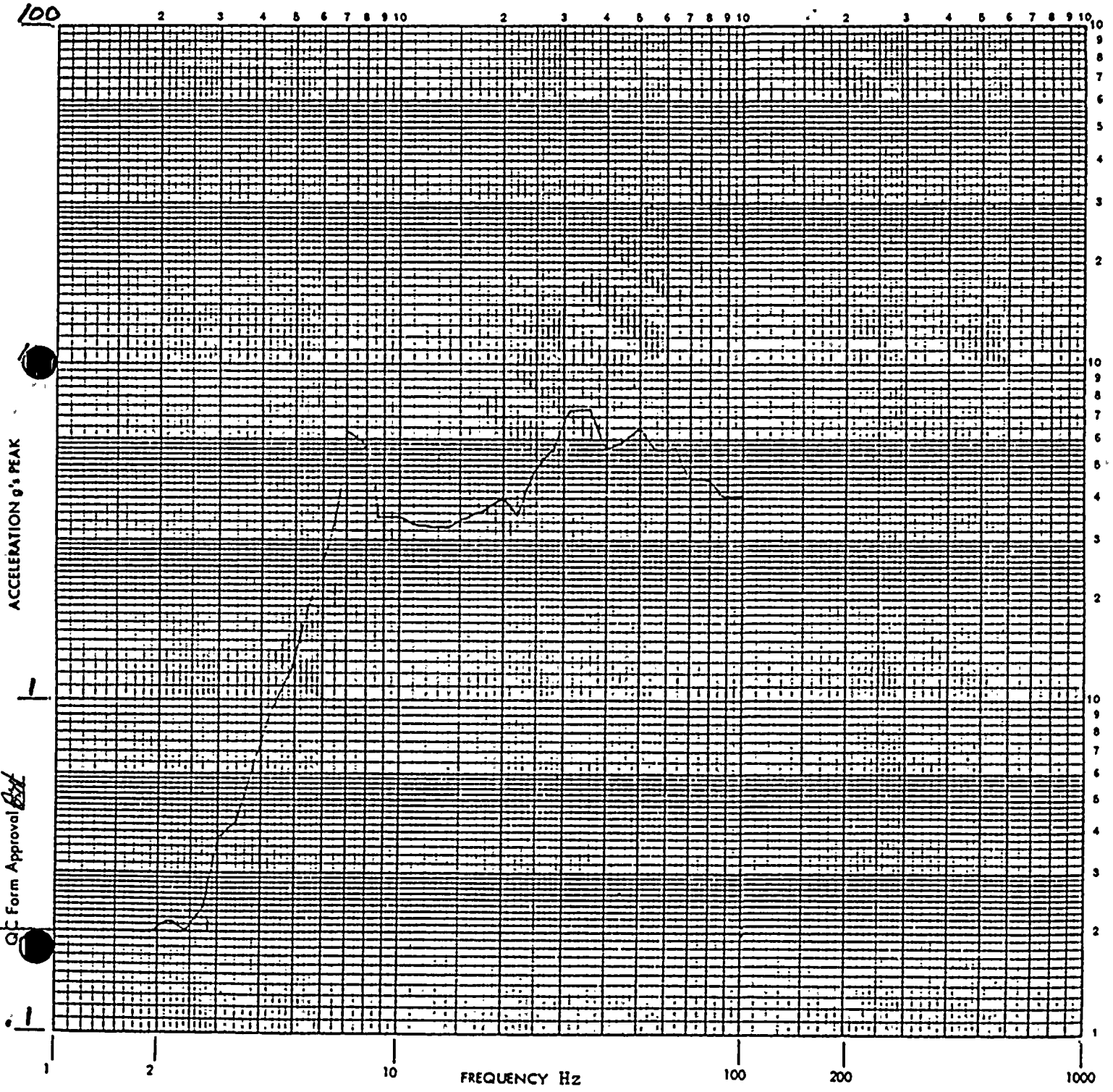
Full Scale 100 g Accel. No. 25 Control ( ) Response (4)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test SSV

RUN H 16

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

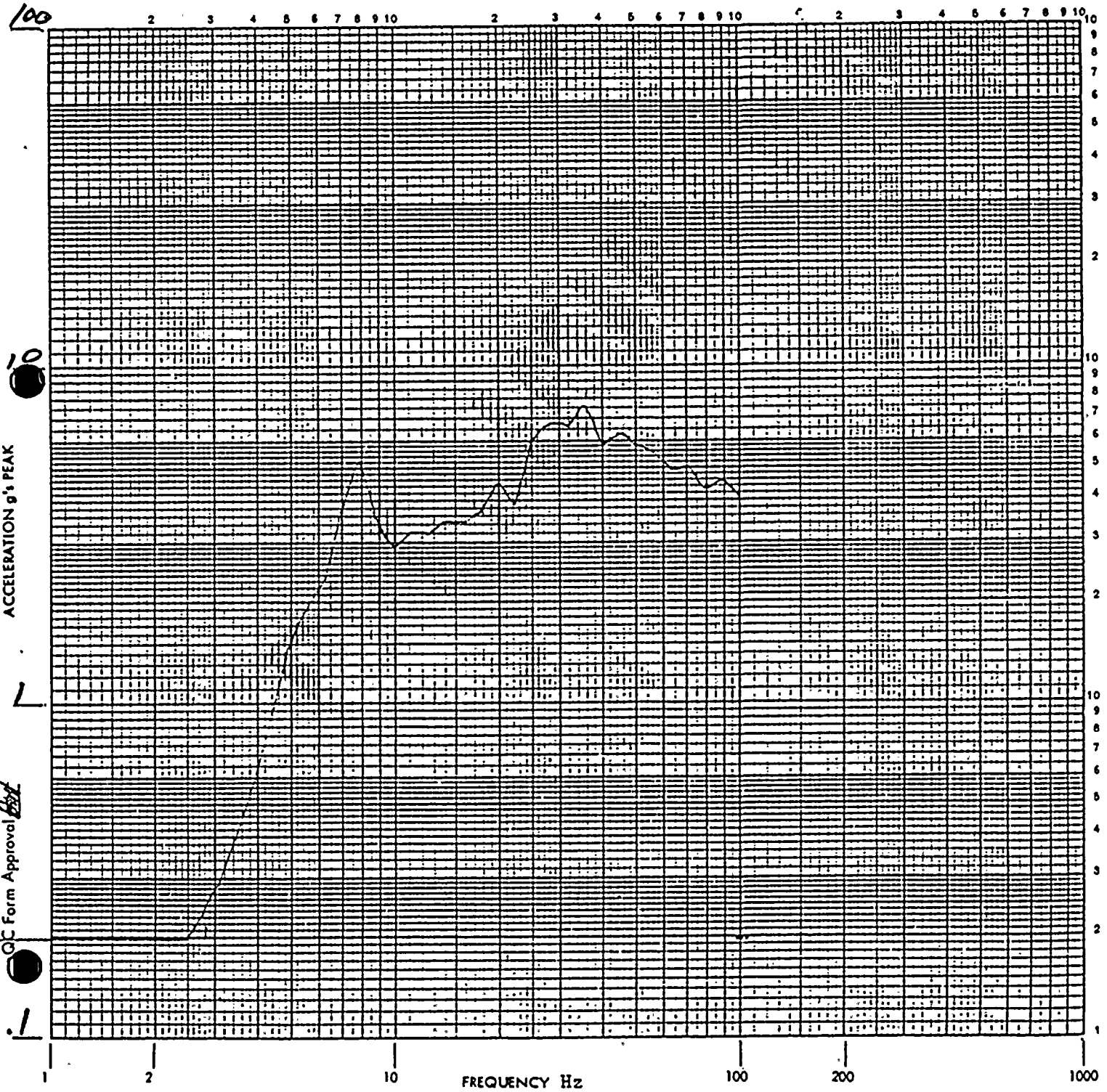
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.

RUN # 17

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

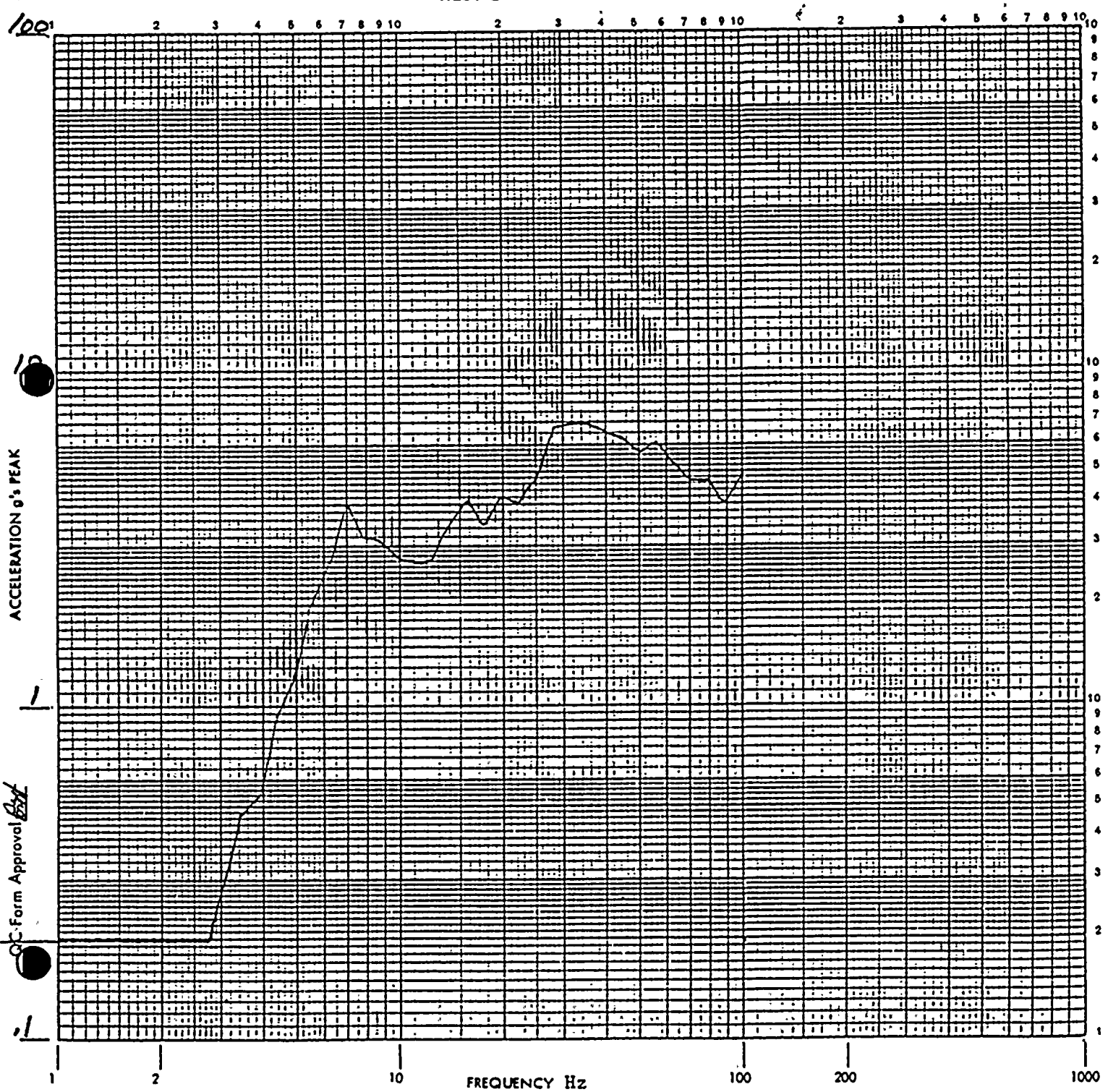
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.

RON # 19

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

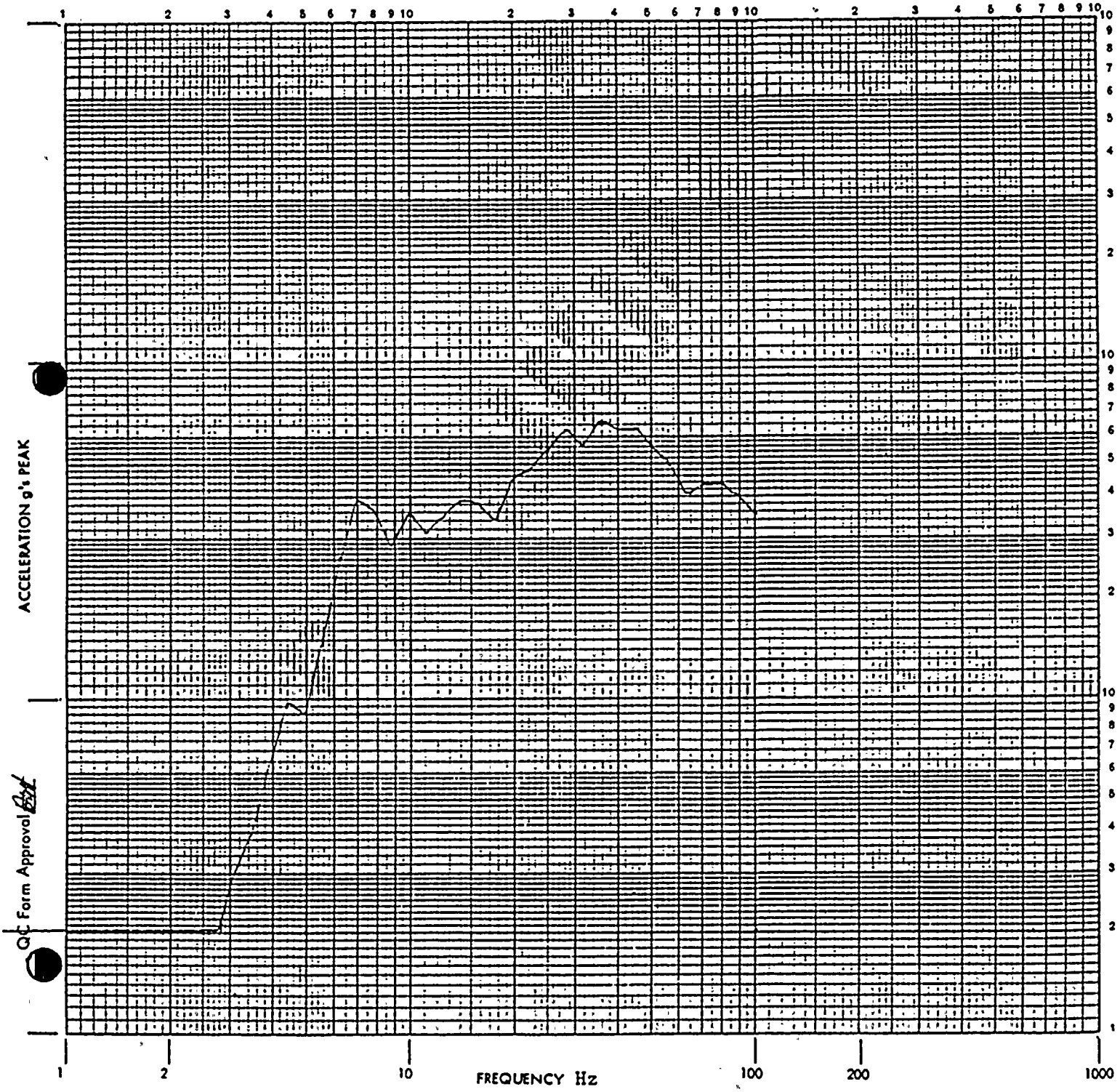
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.

RUN # 20

RESPONSE SPECTRUM



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Report No. _____

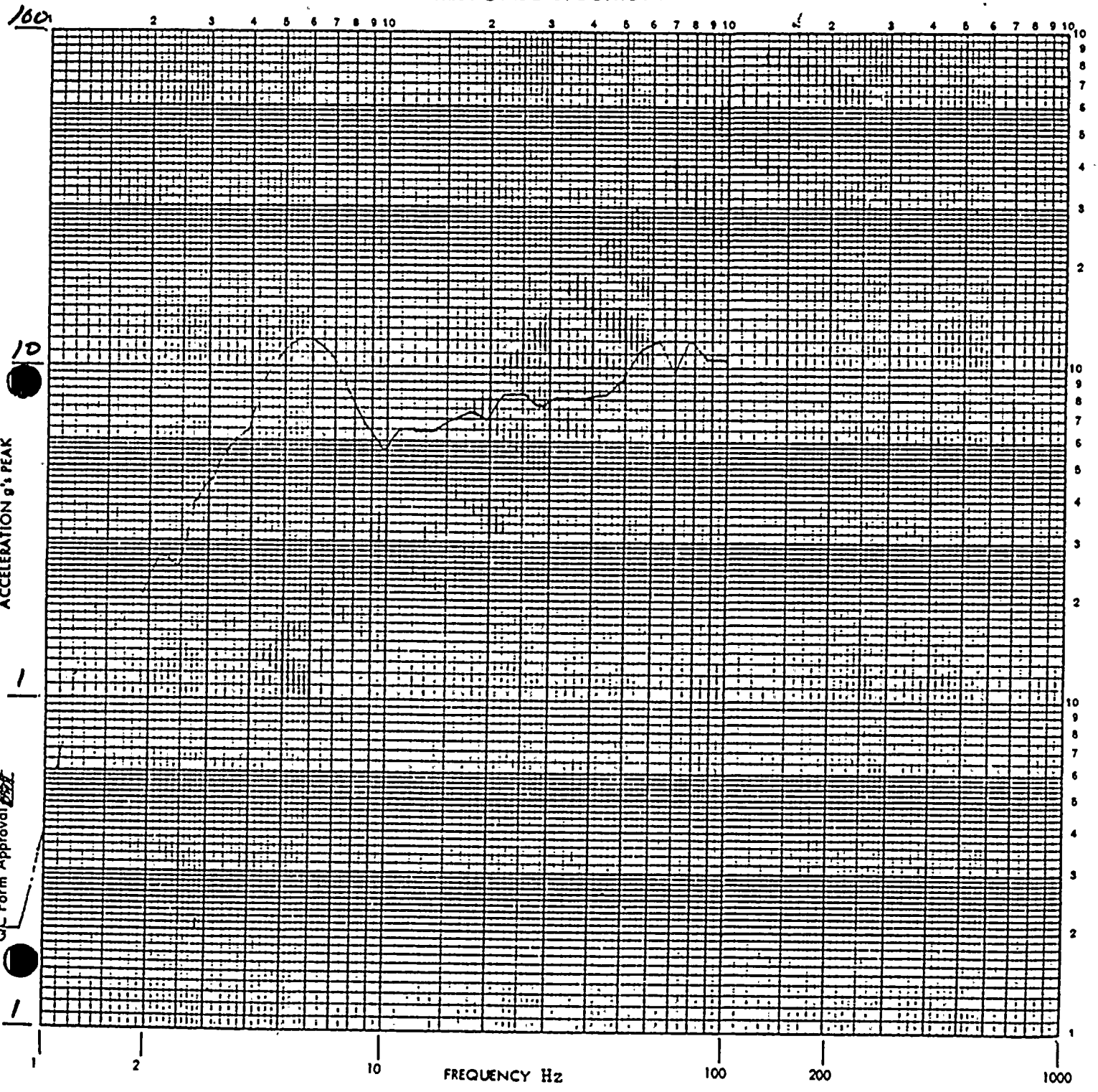
CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

Full Scale 100 g Accel. No. 26 Control ( ) Response (L)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.
RUN# 16

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

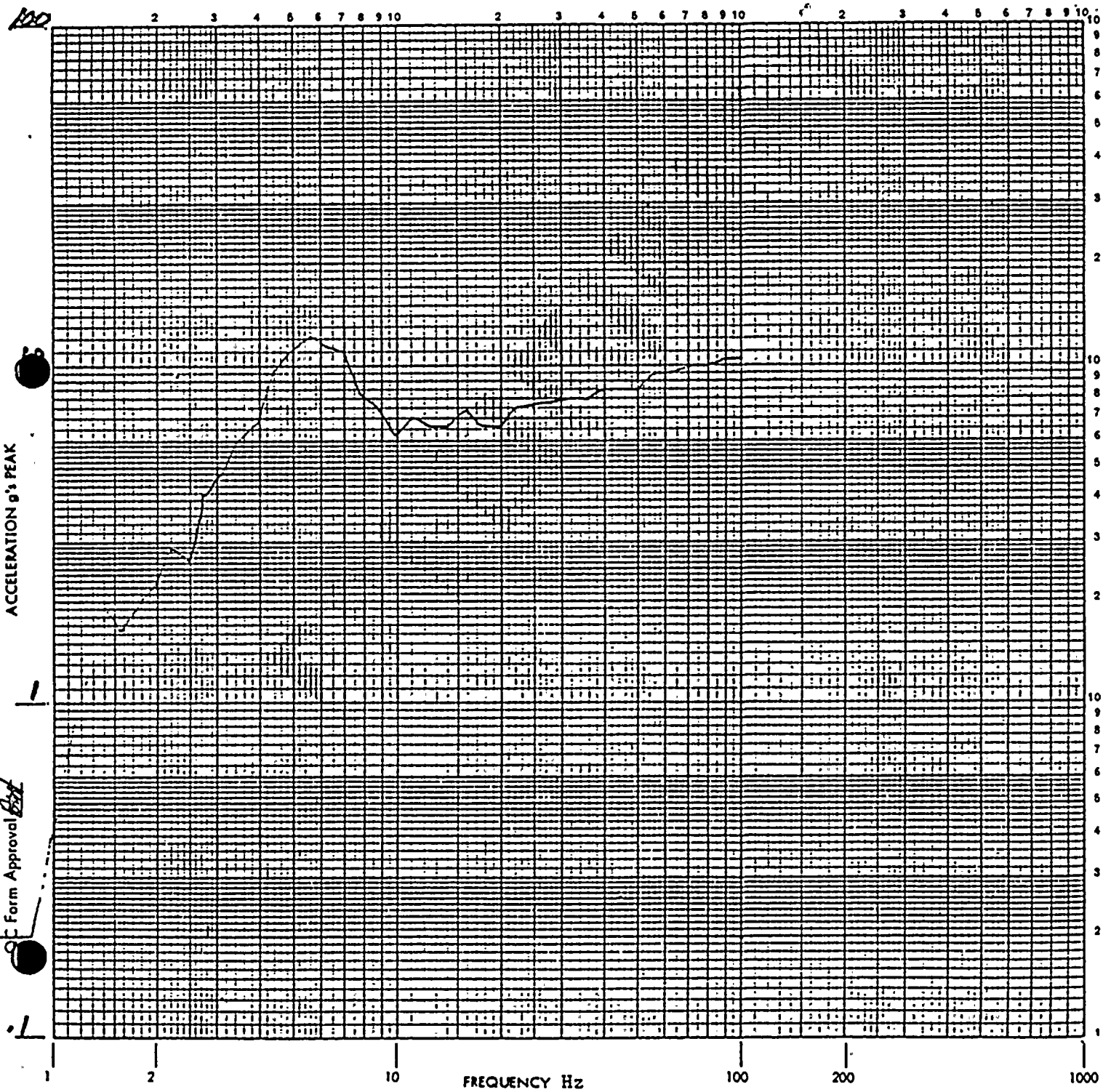
Full Scale 100 g Accel. No. 26 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.

RUN # 17

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

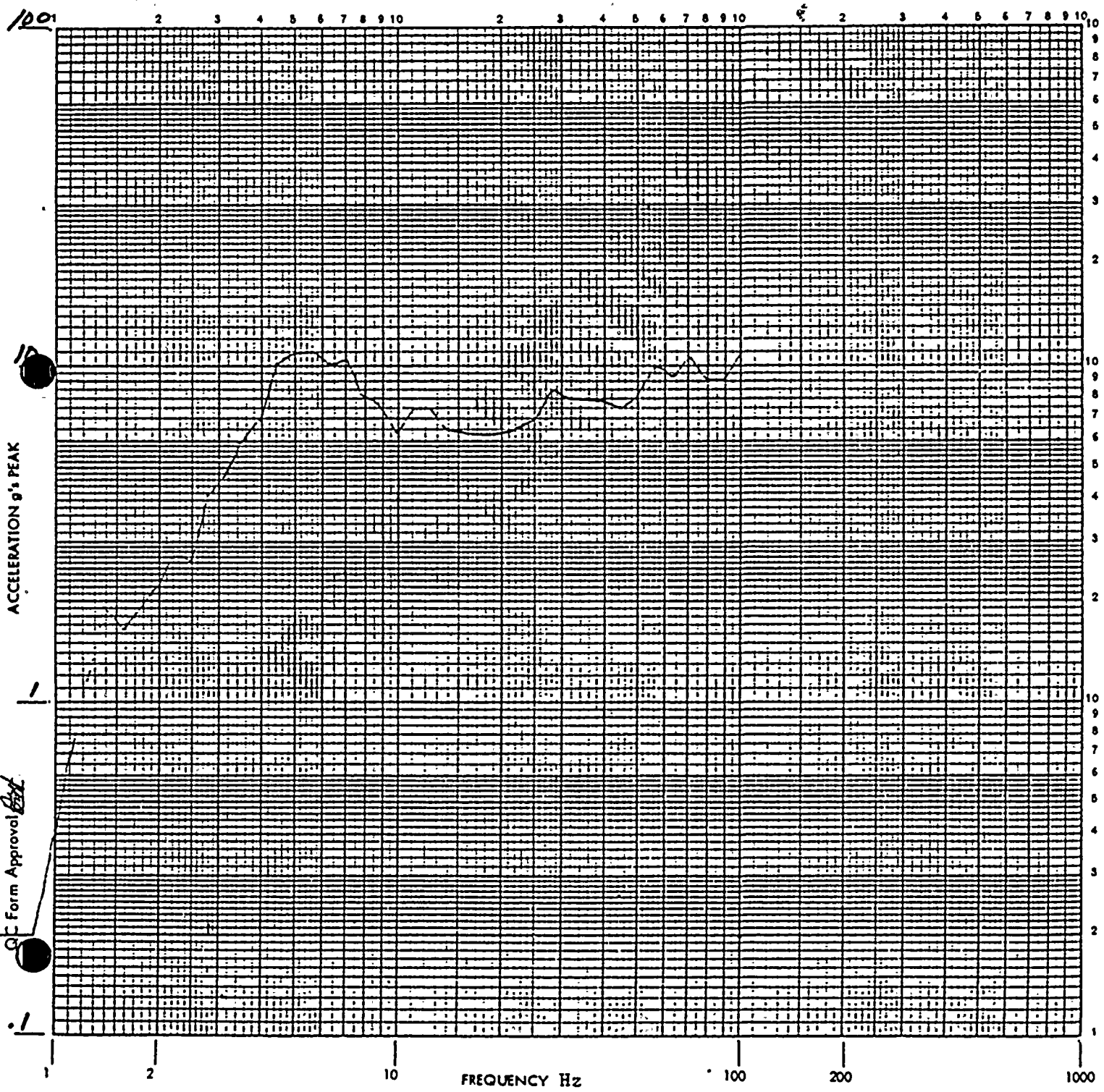
Full Scale 100 g Accel. No. 26 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.

RUN # 19

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P. G. & E. Job No. 85255-1 Page No. _____

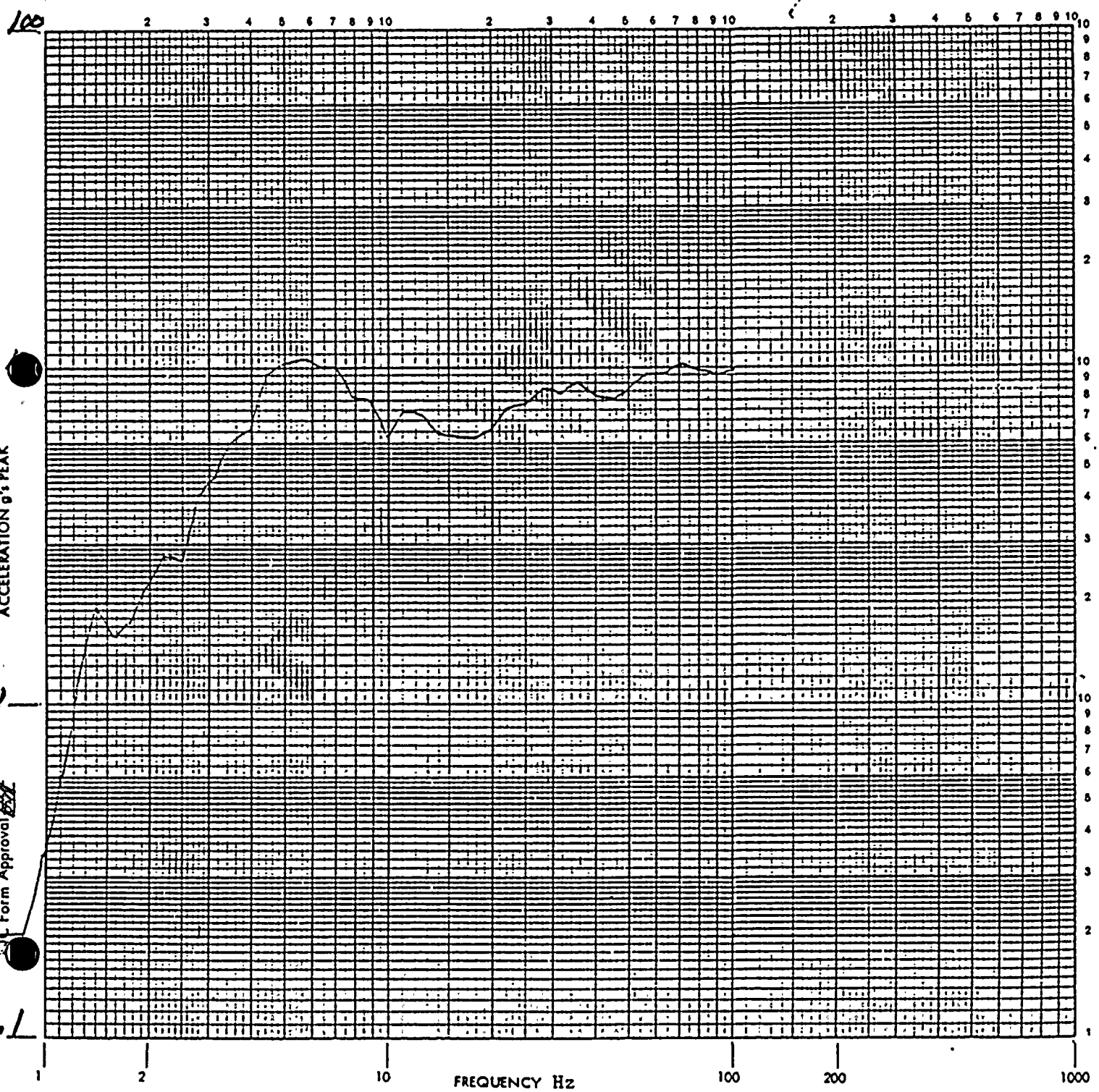
Full Scale 100 g Accel. No. 26 Control ( ) Response (↩)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-28 Damping 5 % Axis of Test S.S. V.

RUN # 20

RESPONSE SPECTRUM



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Report No. _____

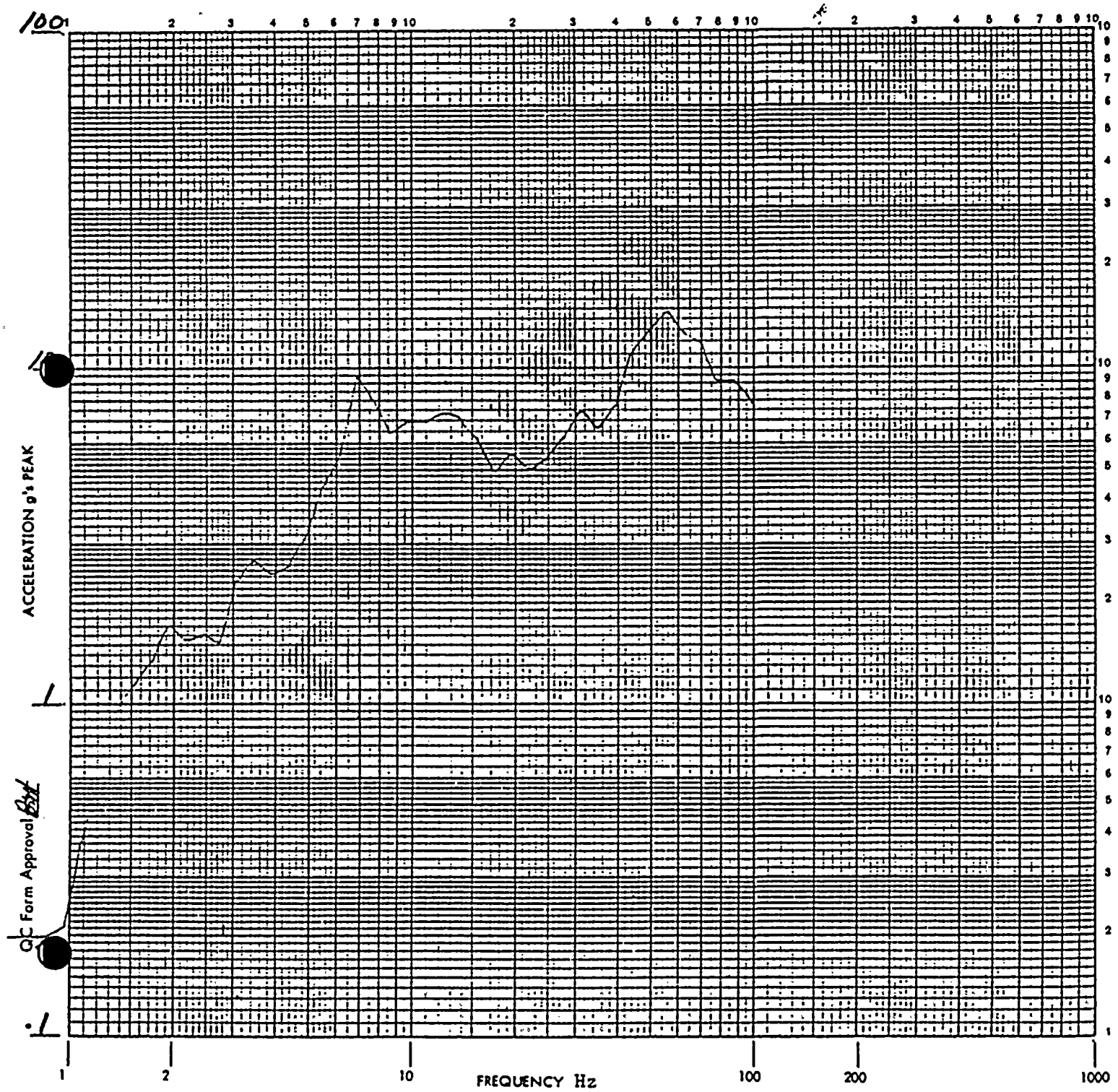
CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

Full Scale 100 g Accel. No. 22 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.V.
RUN # 16

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P. G. & E. Job No. 58255-1 Page No. _____

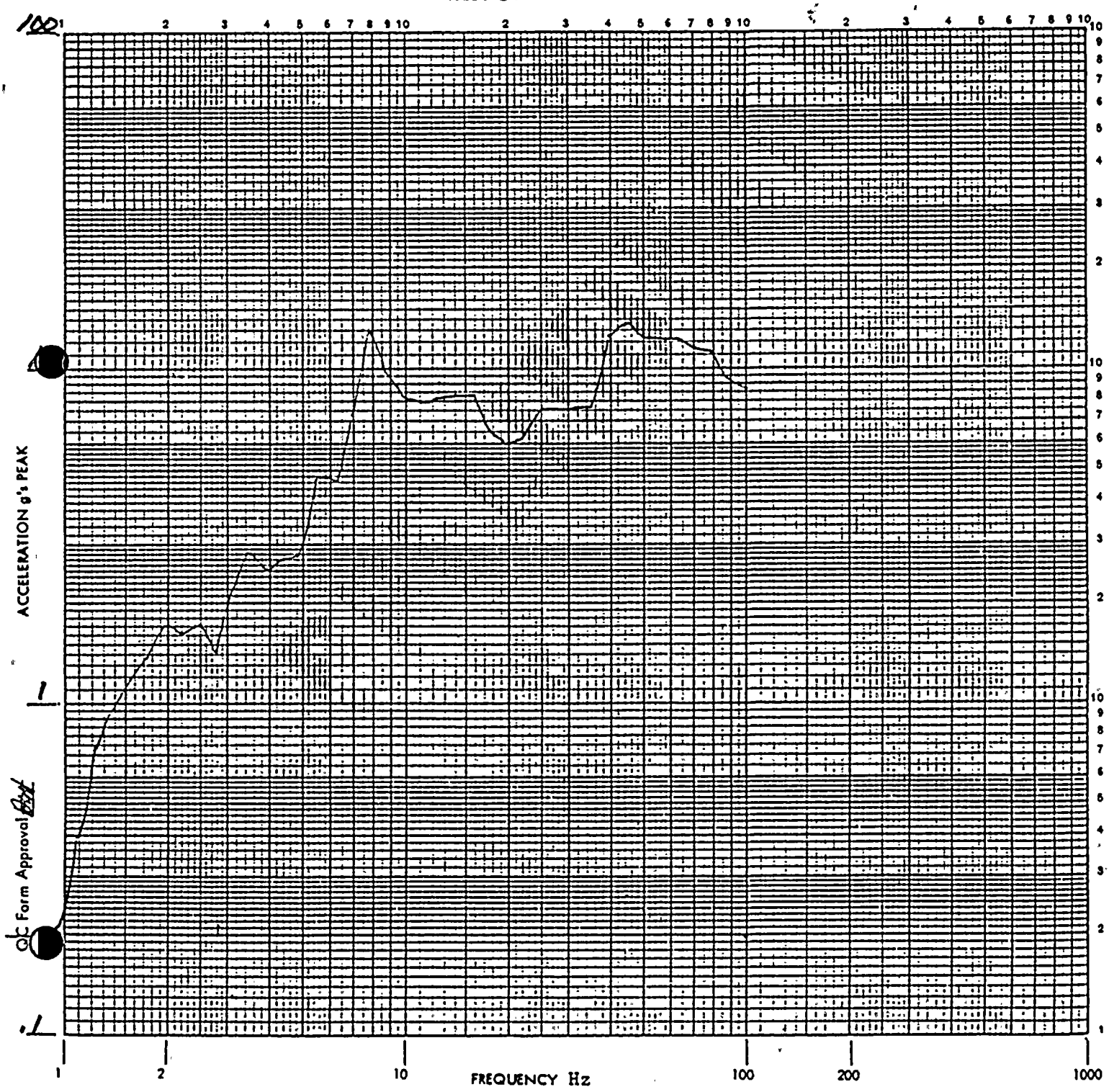
Full Scale 100 g Accel. No. 27 Control ( ) Response (x)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S. V.

RUN # 17

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P. G. & E. Job No. 58255-1 Page No. _____

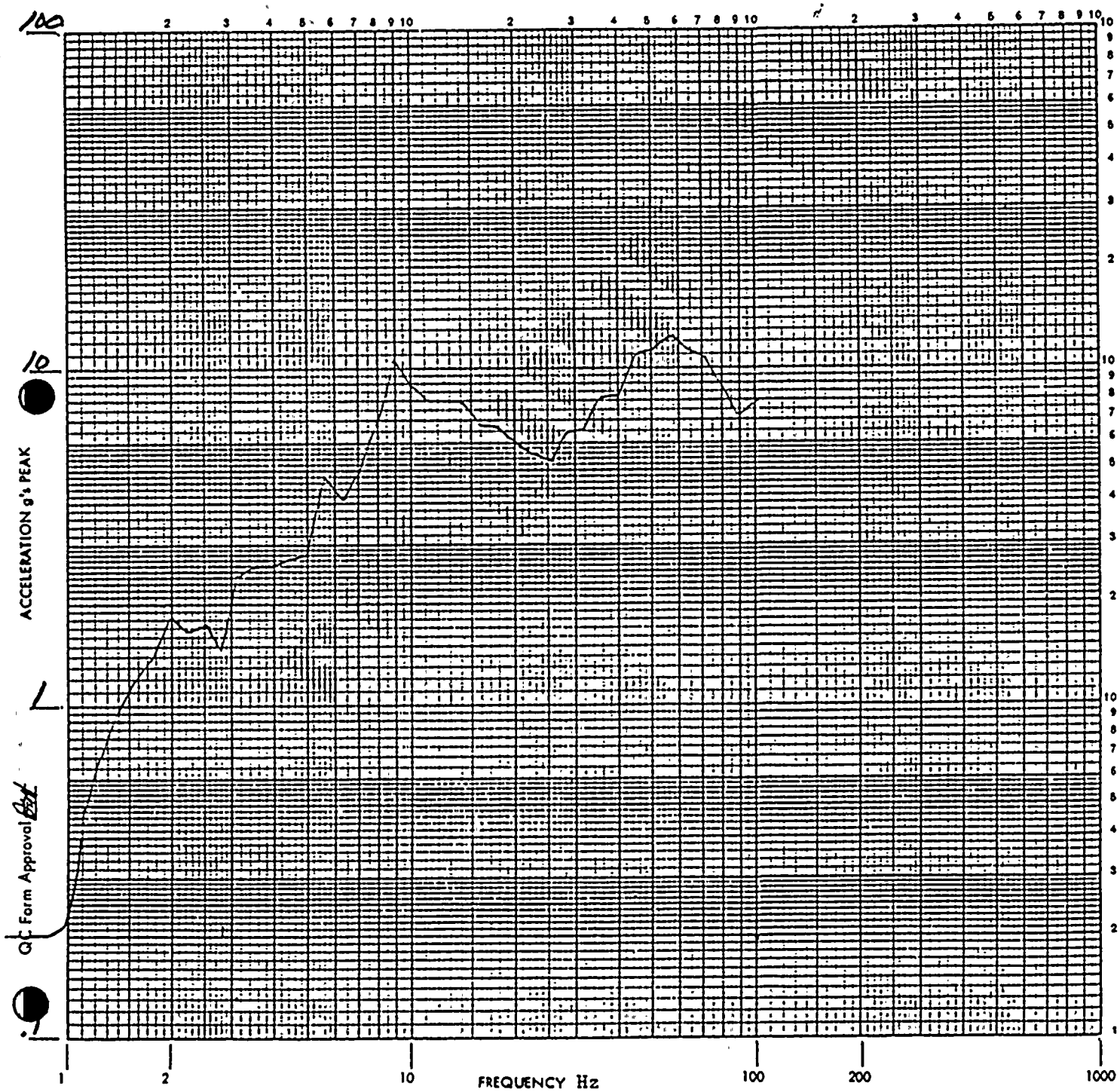
Full Scale 100 g Accel. No. 27 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S. V.

RUN # 19

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

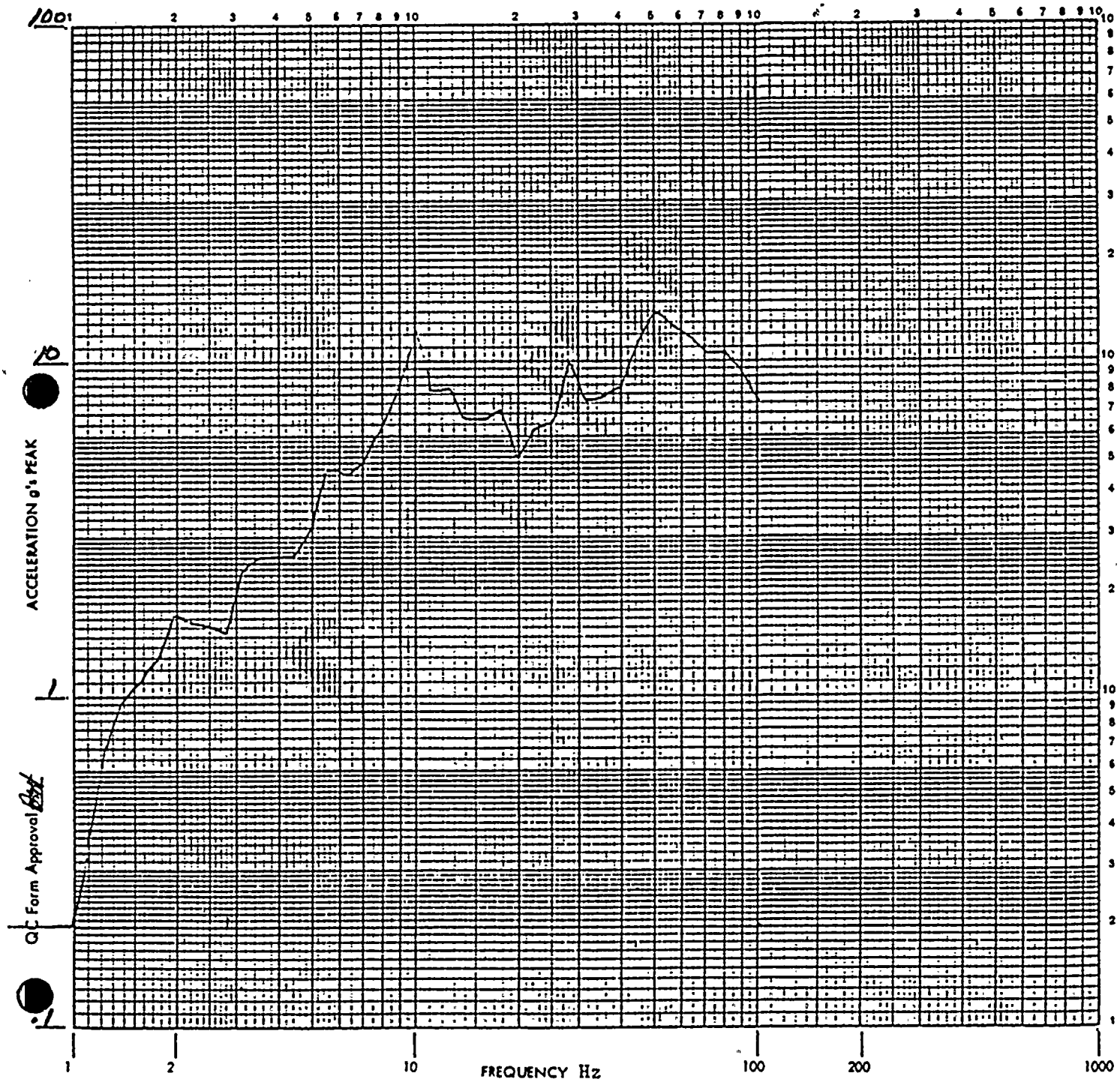
Full Scale 100 g Accel. No. 27 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-5-78 Damping 5 % Axis of Test S.S.U.

RUN # 20

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P. G. & E Job No. 58255-1 Page No. _____

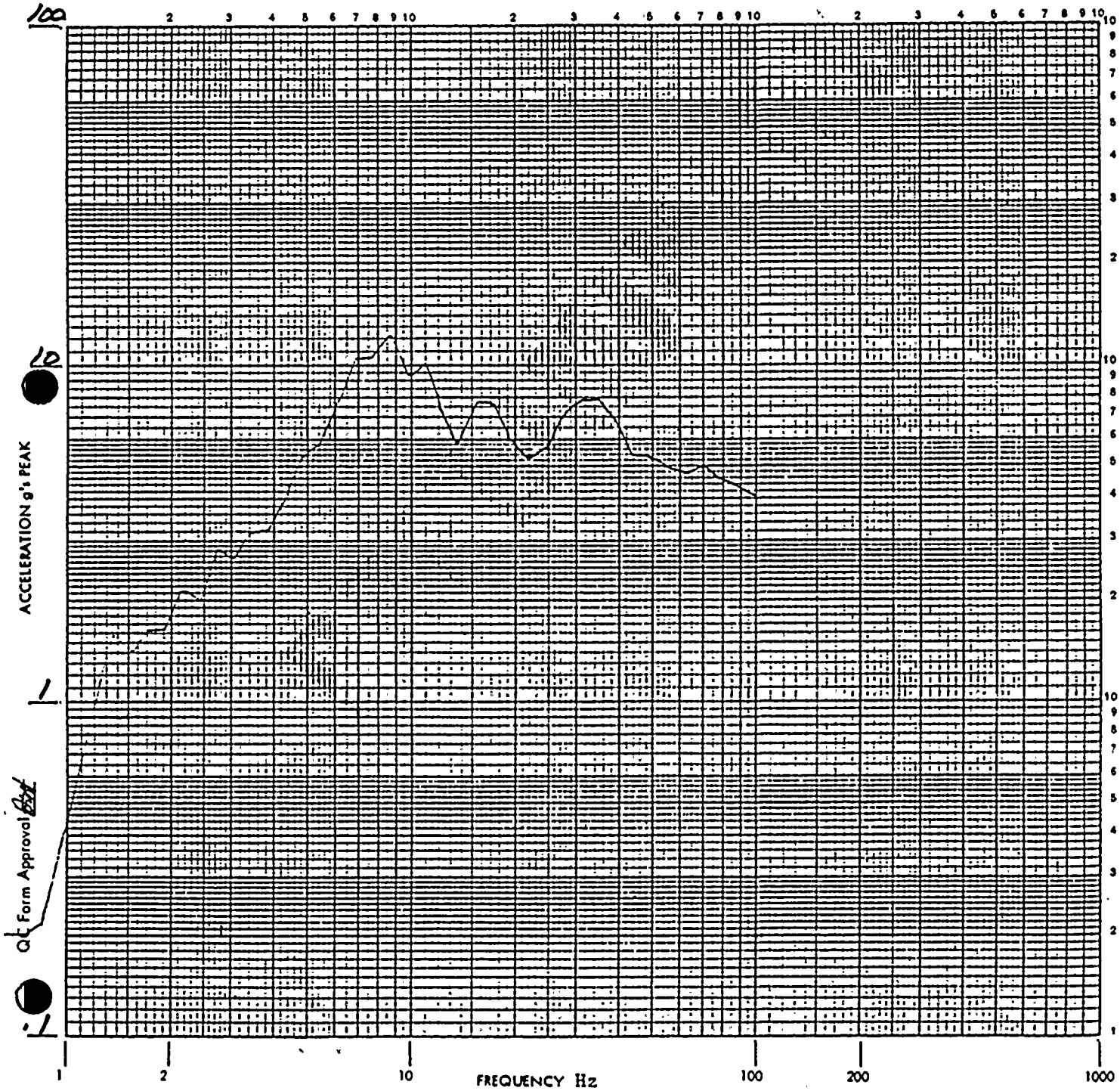
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

81

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

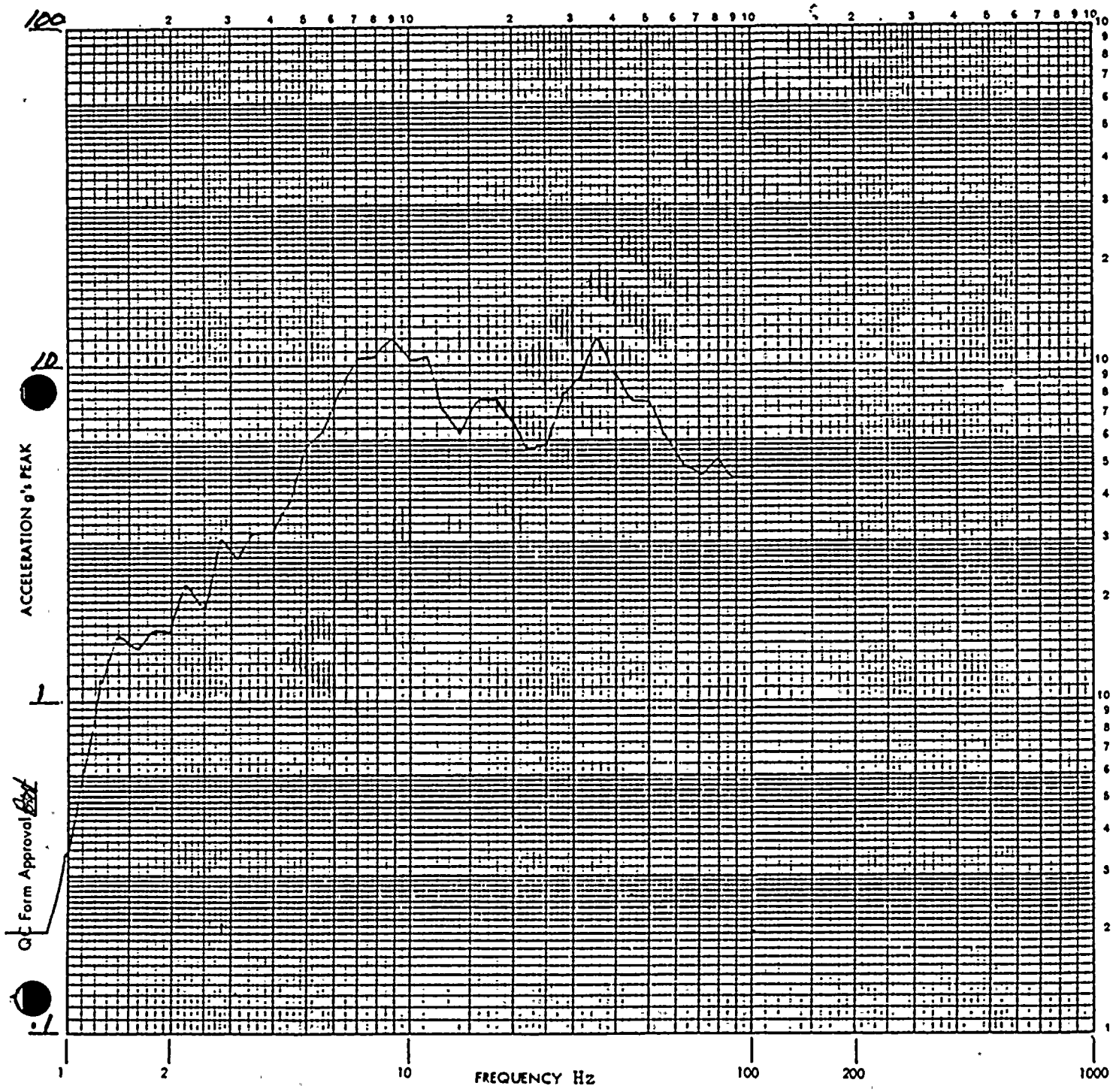
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN# 33

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P. G. & E. Job No. 58255-1 Page No. _____

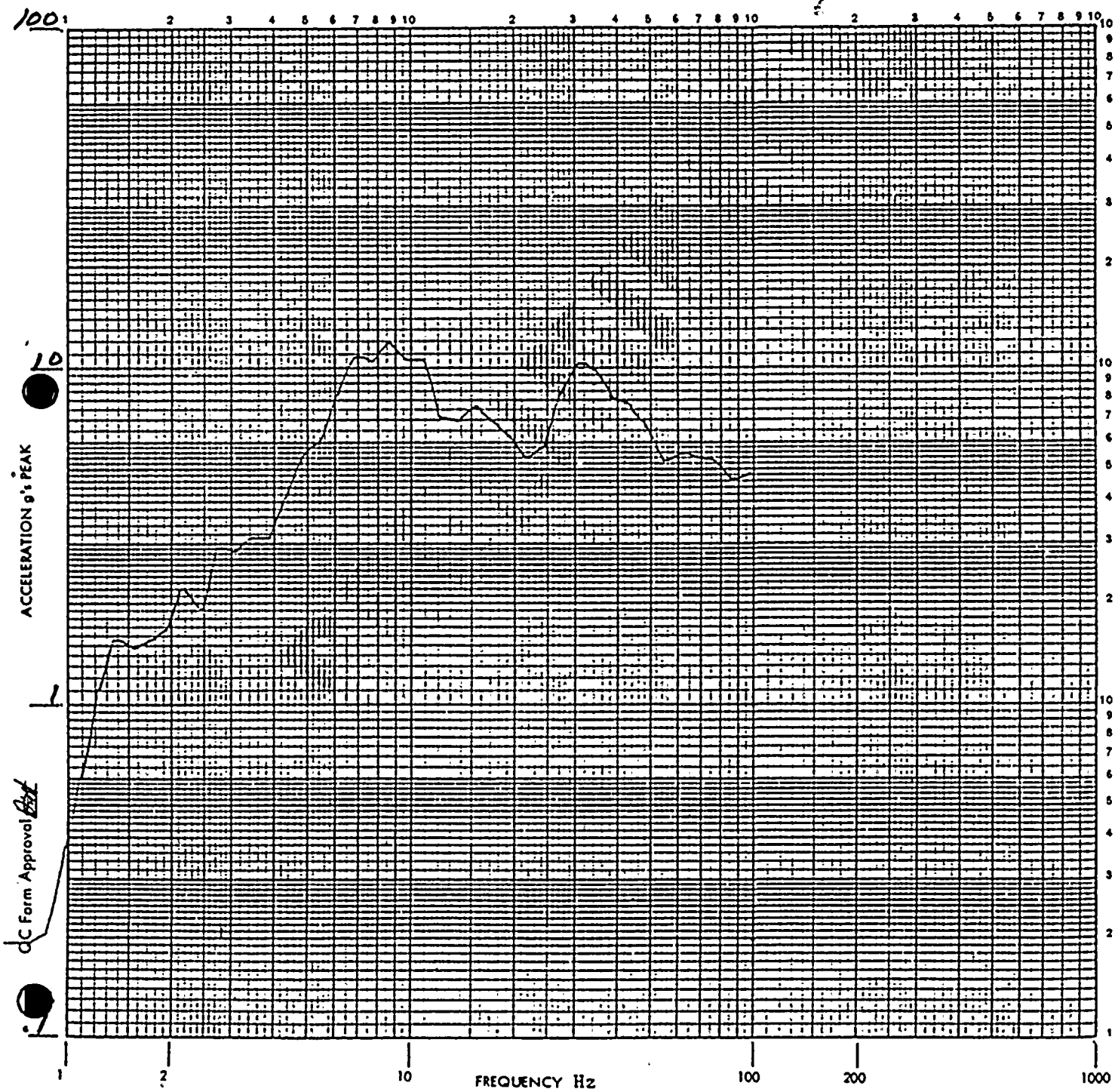
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN # 34

RESPONSE SPECTRUM



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Report No. _____

CUSTOMER P.G.&E. Job No. 58855-1 Page No. _____

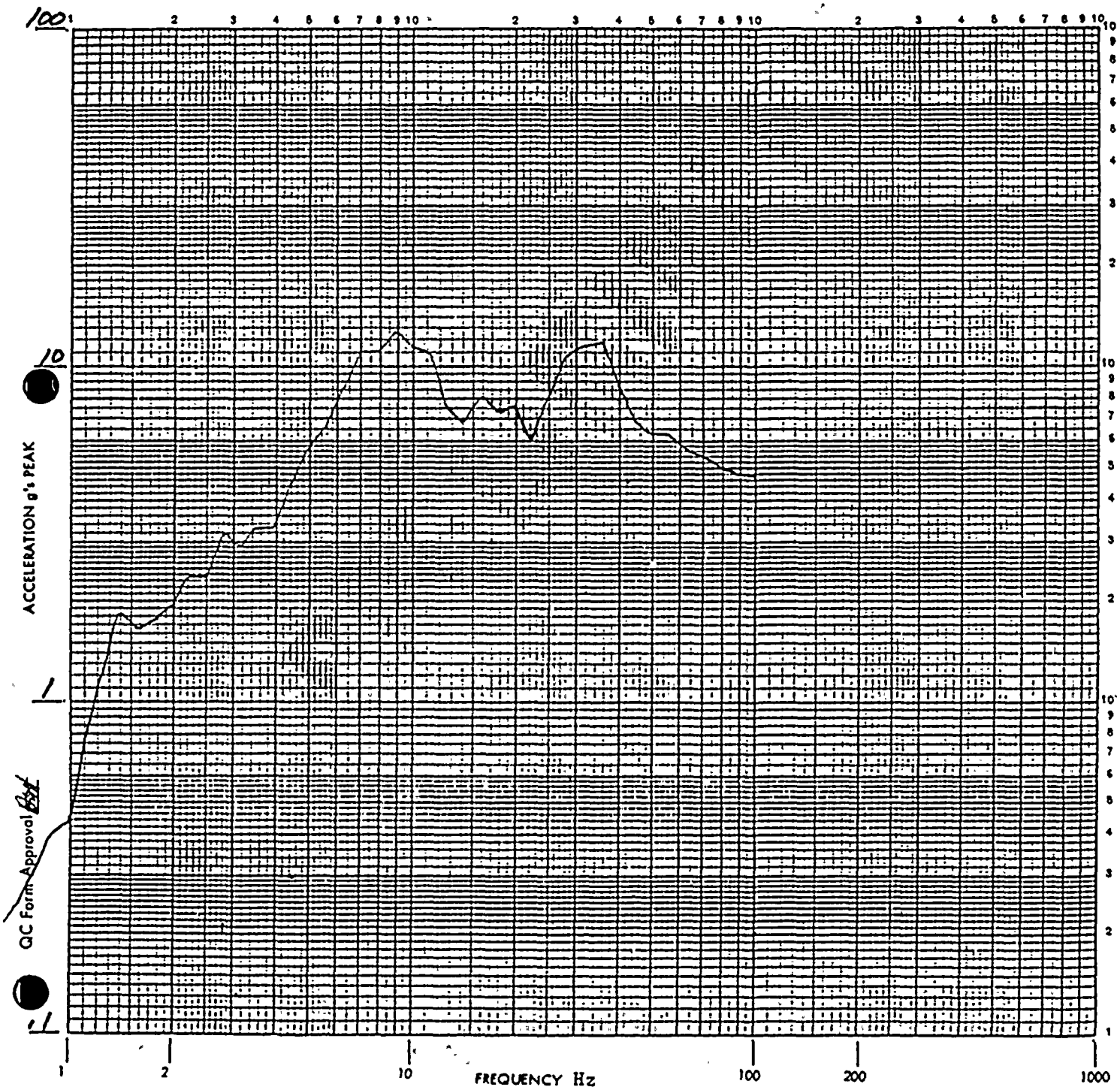
Full Scale 100 g Accel. No. 25 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN # 35

RESPONSE SPECTRUM



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Report No. _____

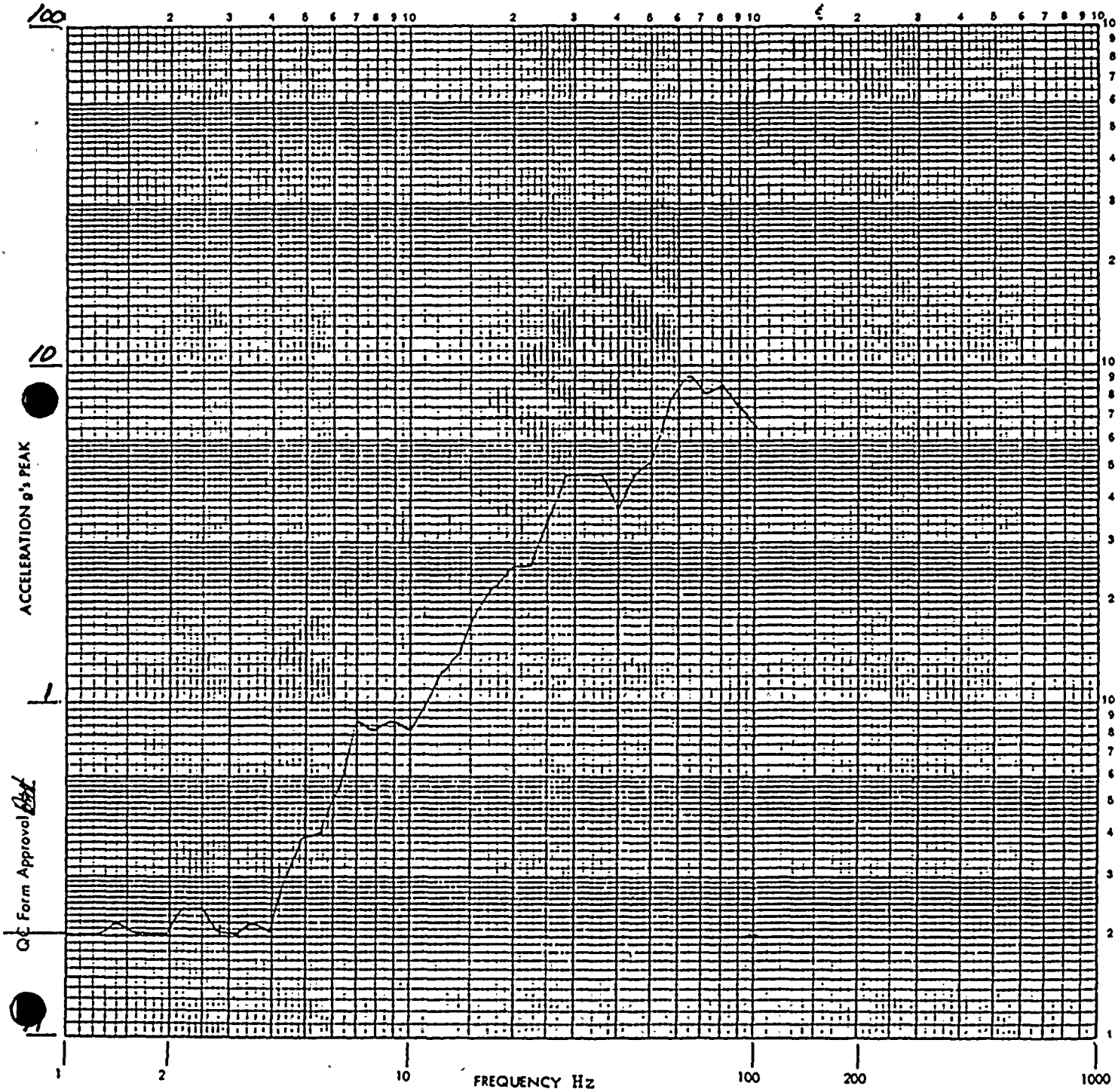
CUSTOMER P.G. & E. Job No. 58255-1 Page No. _____

Full Scale 100 g Accel. No. 26 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.
RUN # 31

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. _____

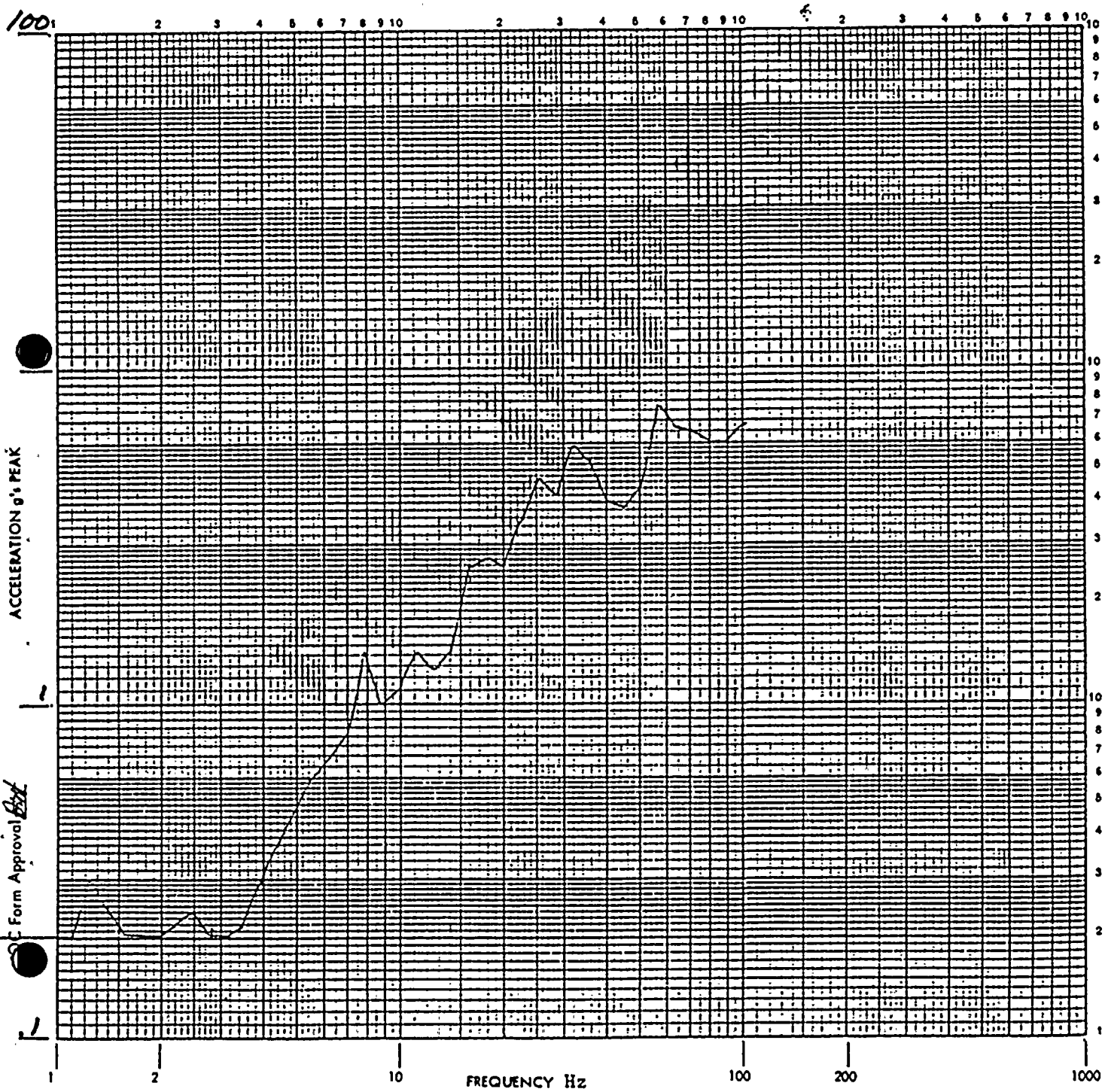
CUSTOMER P. G. & E. Job No. 58255-1 Page No. _____

Full Scale 100 g Accel. No. 26 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F. B. V.
RUN # 33

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. _____

CUSTOMER P. G. & E Job No 58255-1 Page No. _____

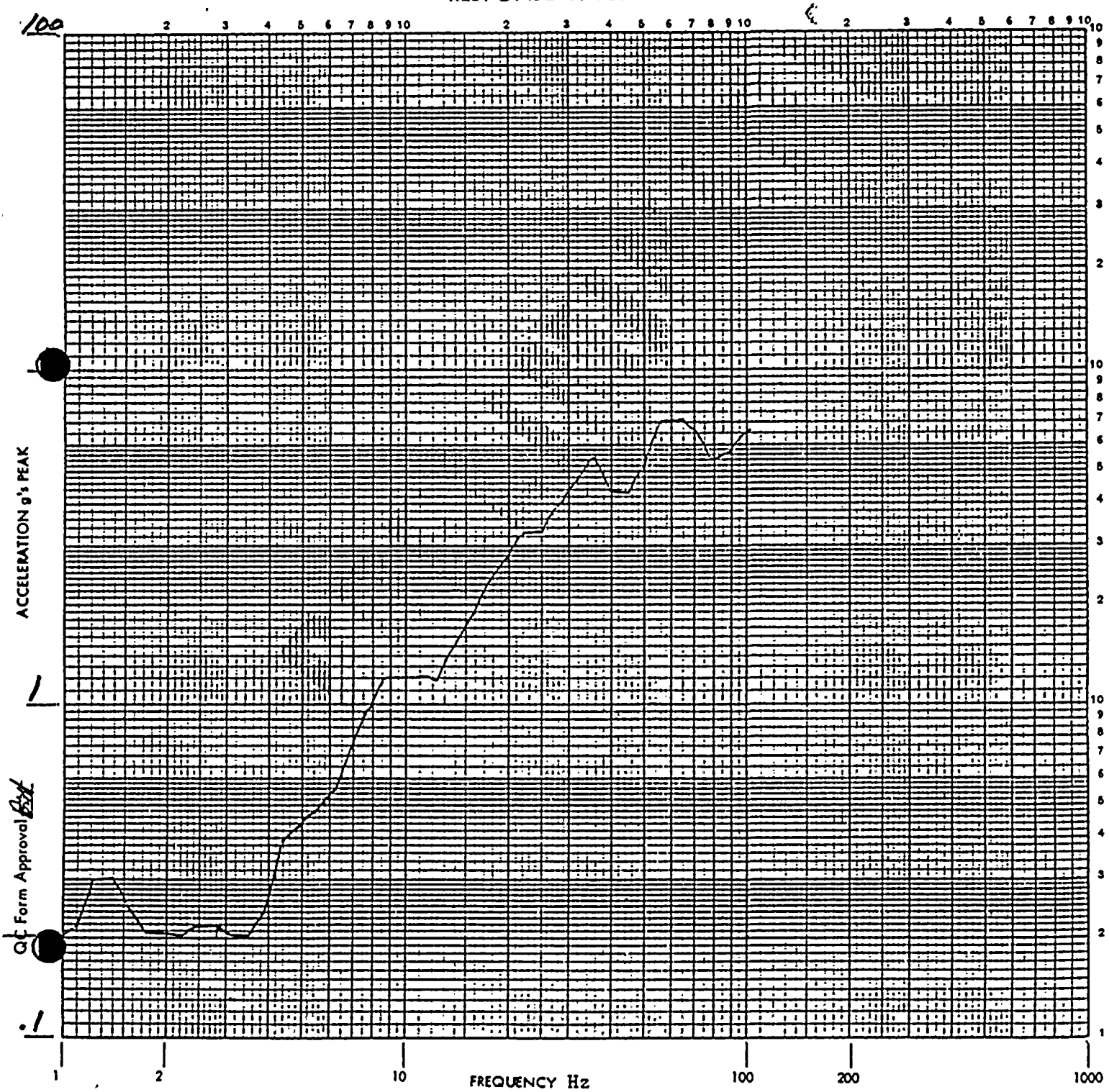
Full Scale 100 g Accel. No. 26 Control ( ) Response ↵

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN # 34

RESPONSE SPECTRUM



WYLE LABORATORIES

Report No. _____

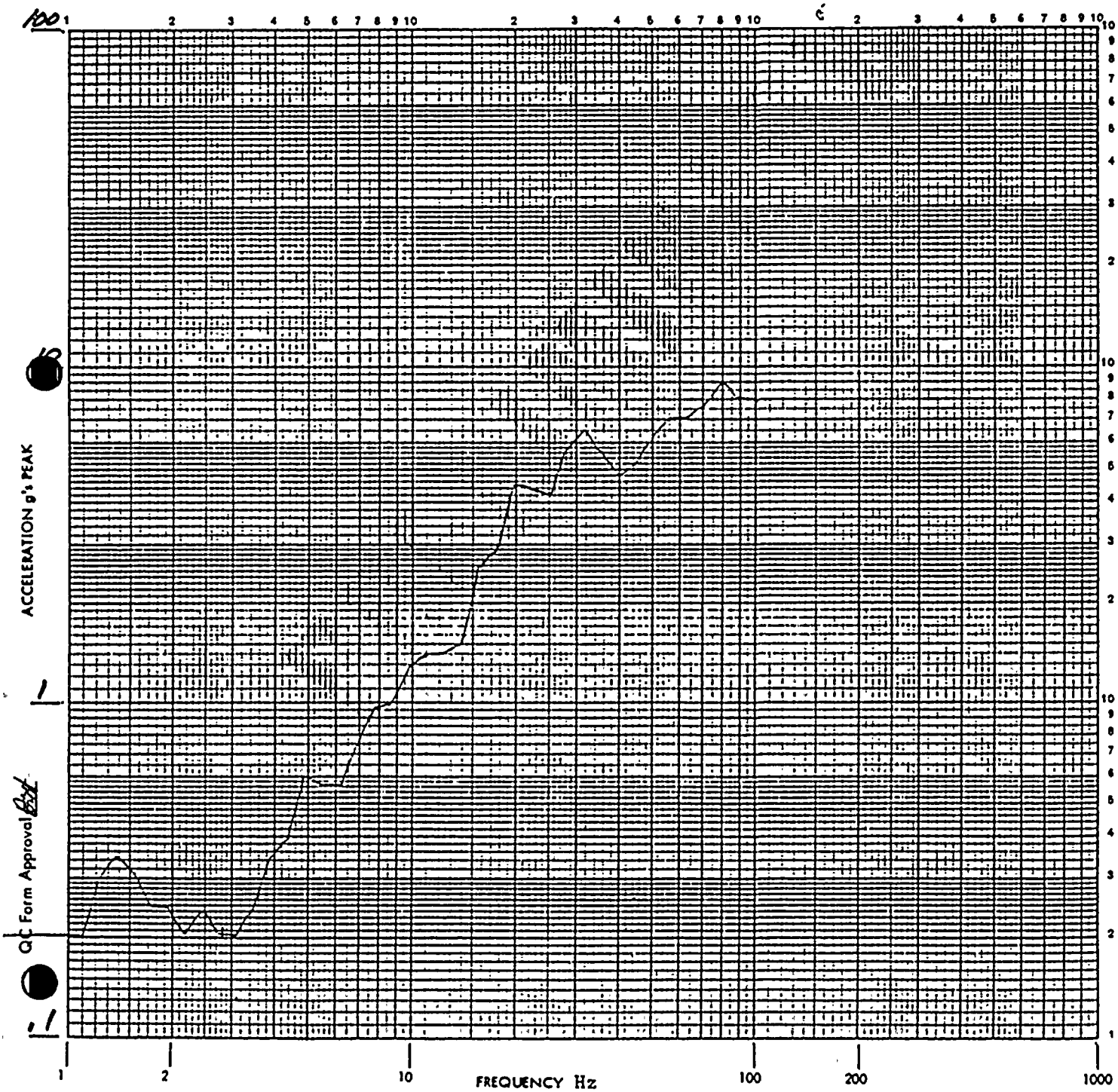
CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

Full Scale 100 g Accel. No. 26 Control ( ) Response (✓)

Operator MCEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.
RUN # 35

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. _____

CUSTOMER P.G.&E. Job No. _____ Page No. _____

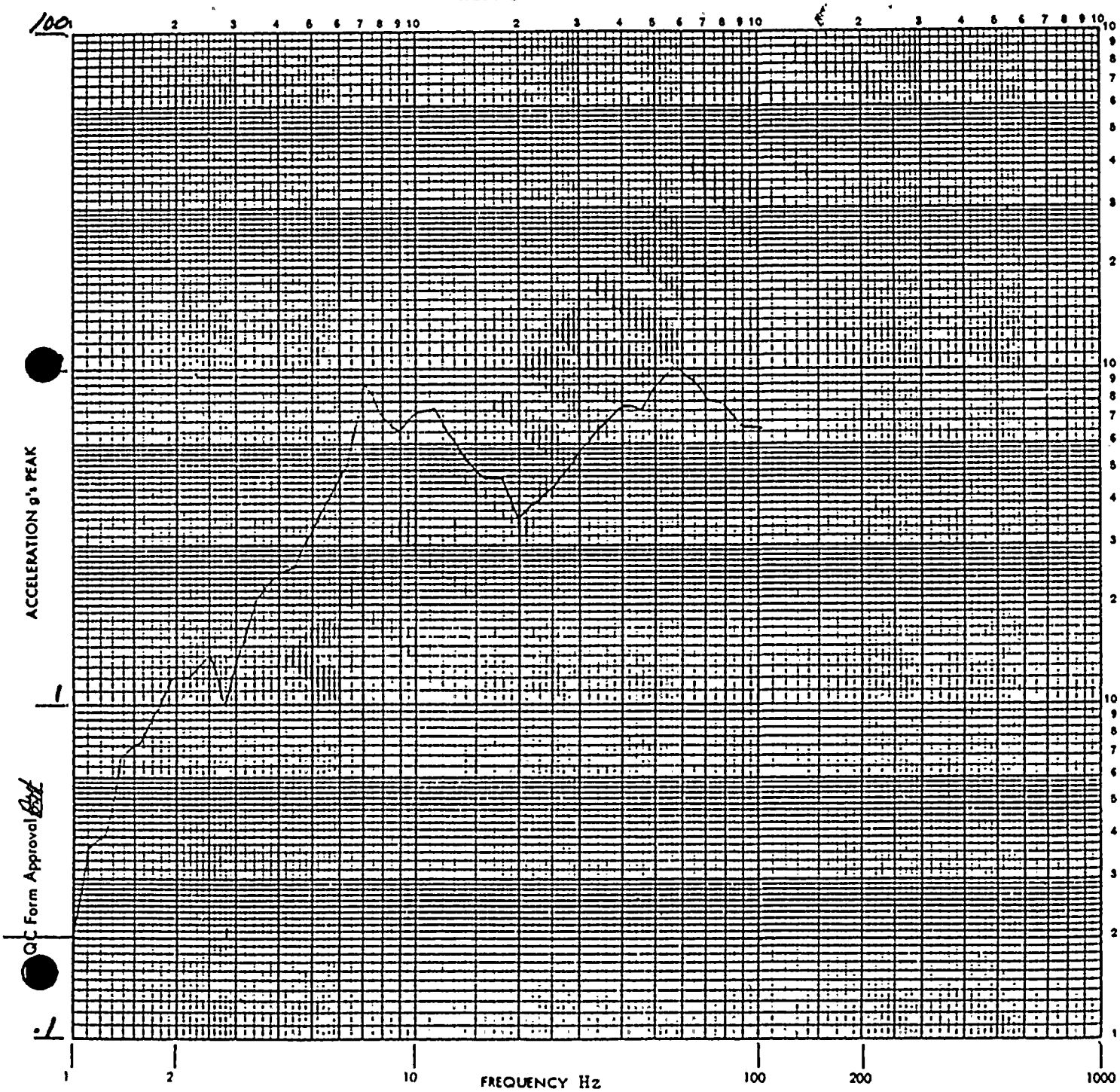
Full Scale 100 g Accel. No. 27 Control ( ) Response (↵)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN # 31

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. _____

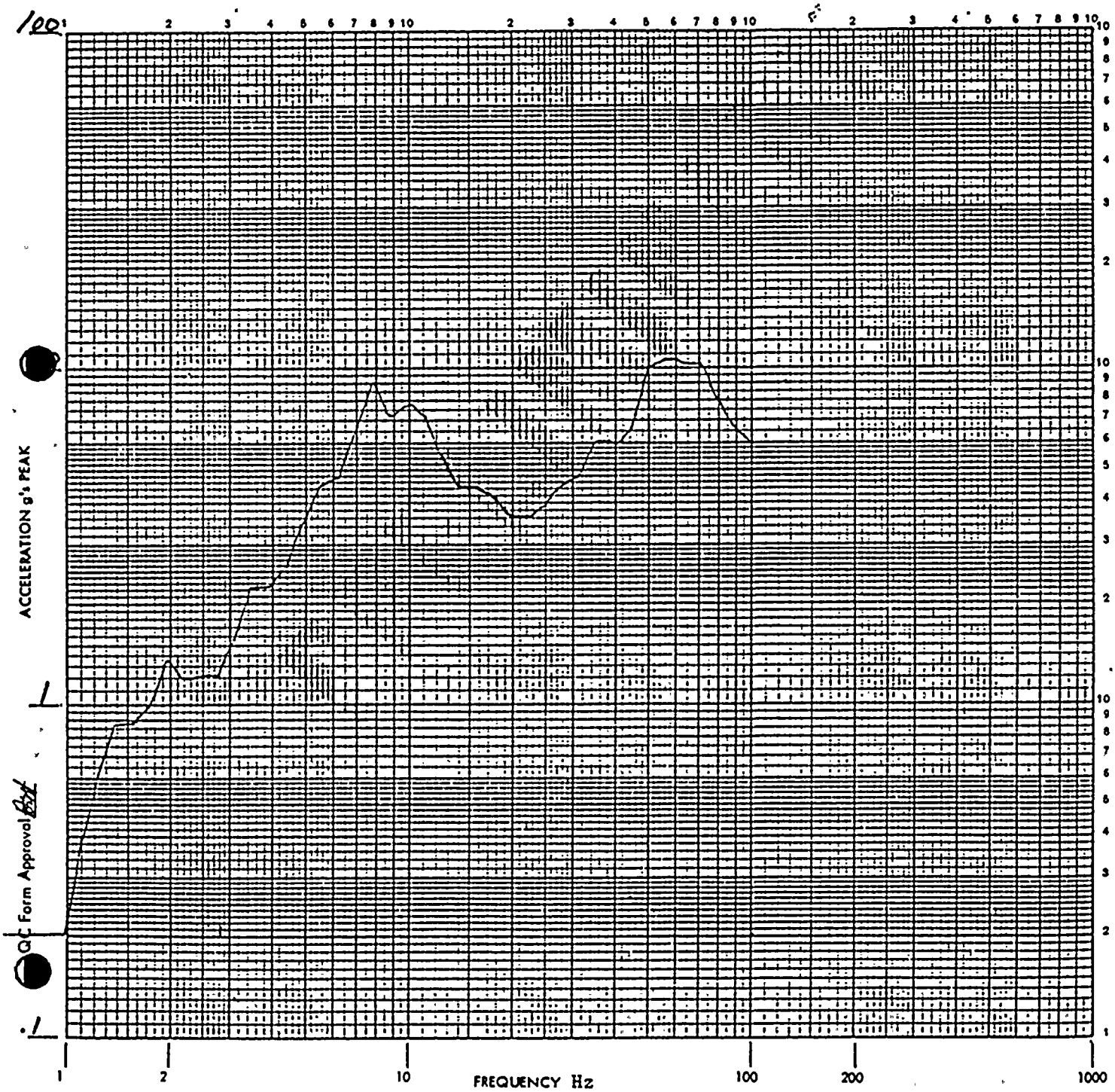
CUSTOMER P. G. & E. Job No. 58255-1 Page No. _____

Full Scale 100 g Accel. No. 27 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F. B. V.
RUN# 33

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

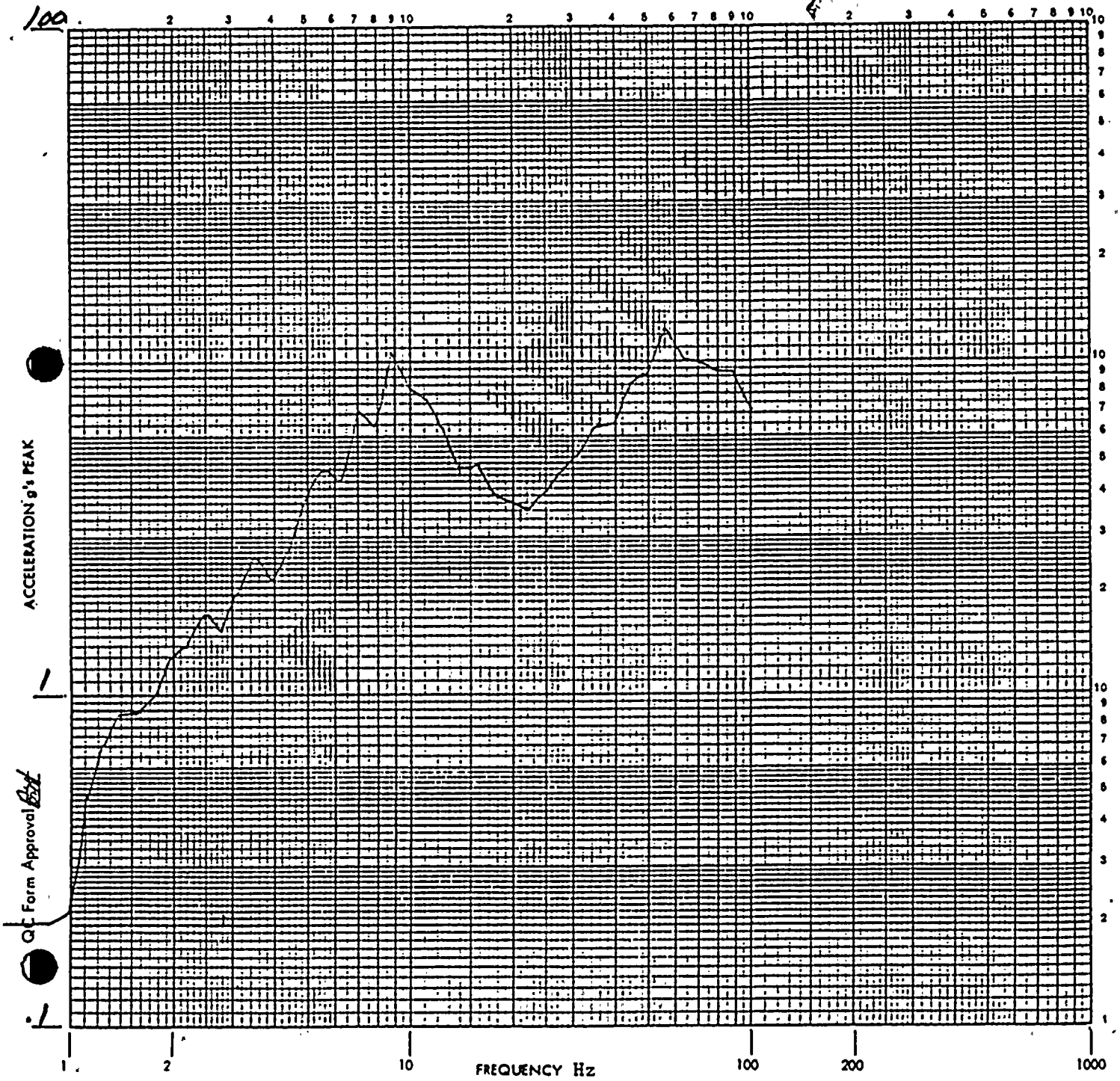
Full Scale 100 g Accel. No. 27 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN # 34

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. _____

CUSTOMER P.G.&E. Job No. 58255-1 Page No. _____

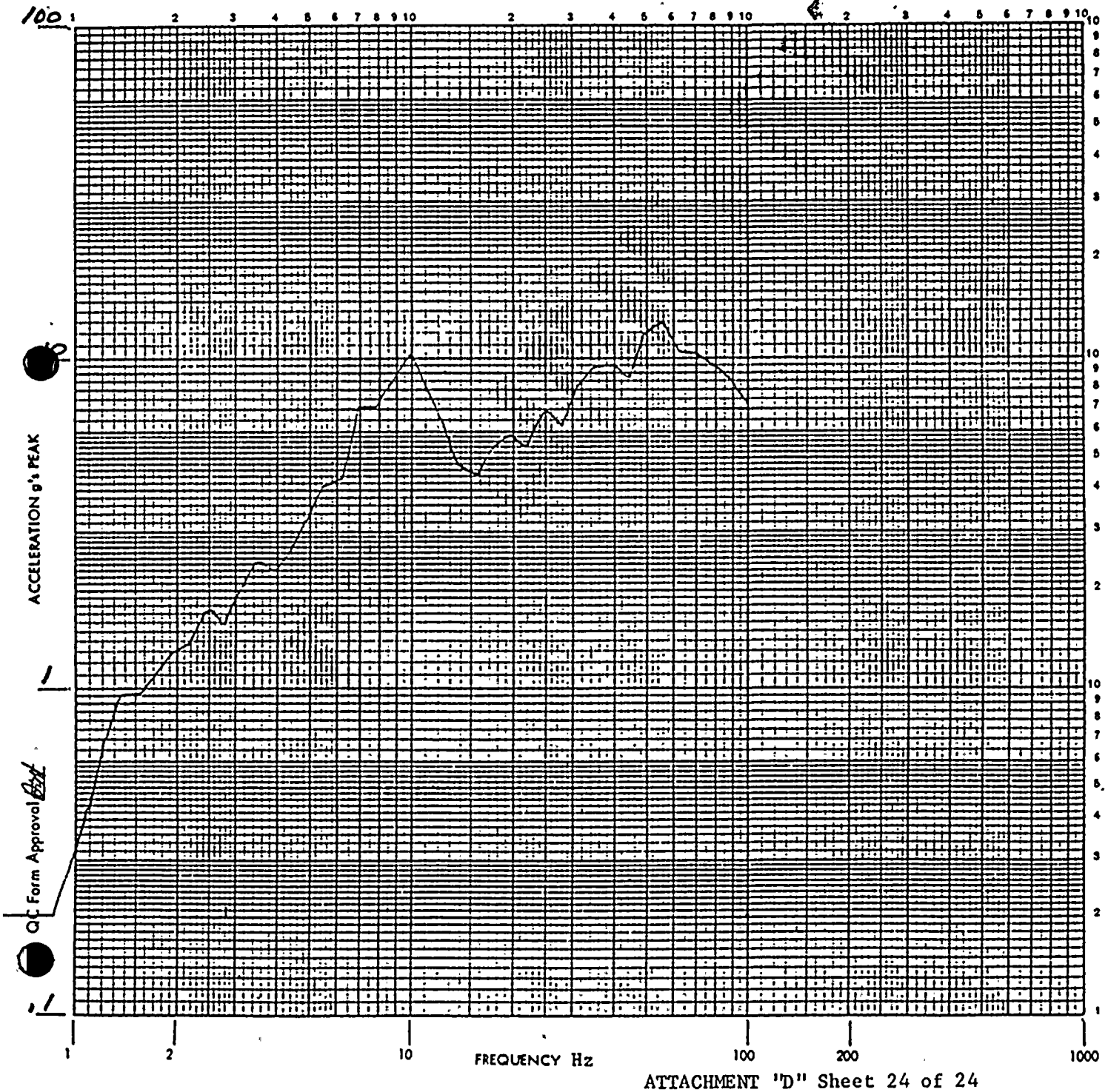
Full Scale 100 g Accel. No. 22 Control ( ) Response (✓)

Operator MEEHAN Specimen 4160 SWITCHGEAR

Date 8-6-78 Damping 5 % Axis of Test F.B.V.

RUN # 34 35 JEH

RESPONSE SPECTRUM



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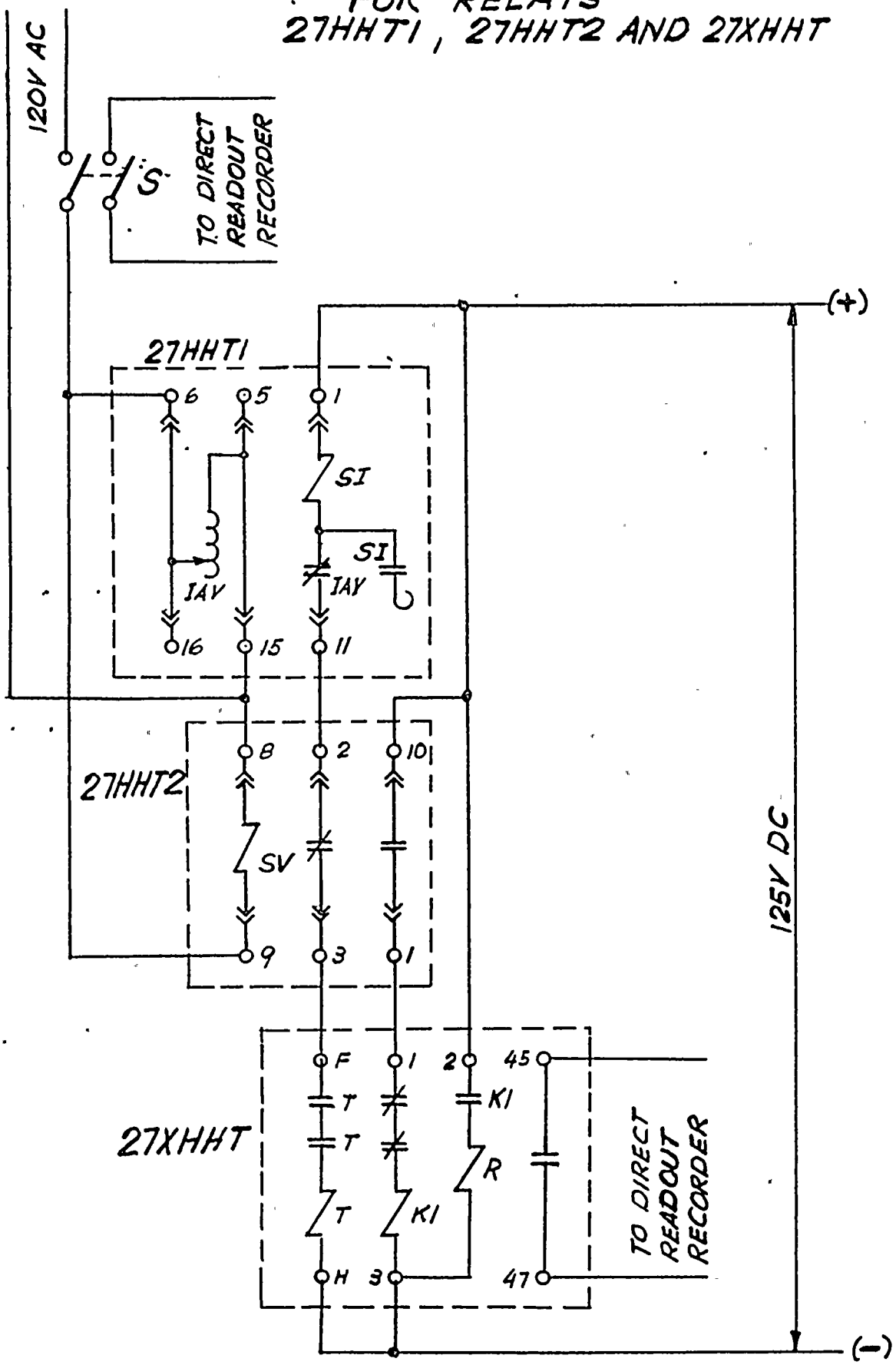
SEISMIC TEST CONNECTIONS FOR RELAYS 27HHT1, 27HHT2 AND 27XHHT



ATTACHMENT "E"