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AUTH. NAME   AUTHOR AFFILIATION
WHITE, L. D.   Rochester Gas & Electric Corp.
RECIP. NAME   RECIPIENT AFFILIATION
ZIEMANN, D. L.   Operating Reactors Branch 2

SUBJECT: Forwards addl info re pressure shielding steel diaphragm, in response to questions raised during review of 790517 submittal.

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LEON D. WHITE, JR.
VICE PRESIDENT

TELEPHONE
AREA CODE 716 546-2700

July 6, 1979

REGULATORY DOCKET FILE COPY

Director of Nuclear Reactor Regulation
Attention: Mr. Dennis L. Ziemann, Chief
Operating Reactors Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Pressure Shielding Steel Diaphragm
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Ziemann:

This letter is in response to questions raised by members of your Staff during the course of their review of our submittal dated May 17, 1979. The questions and responses are provided below.

In our May 17 letter, the pressure transients resulting from pipe breaks in the turbine building were discussed. The assumptions employed in the analysis were summarized and the plots of pressures as a function of time for the transients resulting in the peak pressures were presented. In response to a request for the plots for the remaining (non-limiting) cases, we have provided in Enclosure I to this letter the plots of pressure as a function of time for both nodes for the five cases reported in our May 17 submittal.

A question was raised as to whether credit was taken for cold condensing surfaces in the turbine building. Since the duration of the transient is short, no credit was claimed for any condensing surfaces in any of the calculations.

A question was raised concerning the use of the Moody correlation with subcooled liquid. Our analysis shows that the fluid immediately upstream of the feedwater line break reaches saturation pressure within 4 msec. Thus, determination of break flow using the Moody correlation without a multiplier is valid.

Members of your Staff requested that we investigate the consequences of an instantaneous double-ended guillotine break in either the 24" or the 36" main steam lines in the turbine building. This request was made recognizing that such breaks are precluded by the augmented inservice inspection program which has previously

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been reviewed and approved by the NRC Staff. Nonetheless, the two breaks have been analyzed. The peak pressures on the mezzanine and operating levels from a 24" steam line break on the operating level are 0.507 psid and 0.589 psid respectively. The results for the 36" main steam line break on the mezzanine level for the mezzanine and operating levels are 1.264 psid and 0.742 psid, respectively. Curves of pressure vs. time for these two breaks are provided in Enclosure II to this letter. In the calculation of the pressure transient following a 24" steam line break, credit was taken for failure of a section of block wall as described and justified in our letter of May 17, 1979. In the calculation of the pressure transient resulting from a 36" steam line break, credit was taken for failure of the block wall and for failure of the building exterior siding. The exterior siding will fail at a pressure of 0.93 psi. This failure pressure is based on consideration of the siding design and method of attachment to the building and is set as the ultimate capacity of the aluminum panels in tension. A total of 2166 $ft^2$ on the mezzanine/basement elevations is assumed to fail. Since the pressure on the operating level for the 36" steam line break does not reach 0.93 psi, the siding at that elevation is assumed to remain in place.

A question was raised concerning the vent area between the basement and the mezzanine levels of the turbine building. The total free vent area between the basement and the mezzanine levels is at least 3800 $ft^2$. A discussion of the distribution of the vent areas is presented in Enclosure III to this letter.

Members of your Staff requested some additional discussion of the depressurization which occurs for a short period of time immediately following a feedwater line break. Information is provided in Enclosure IV.

Very truly yours,

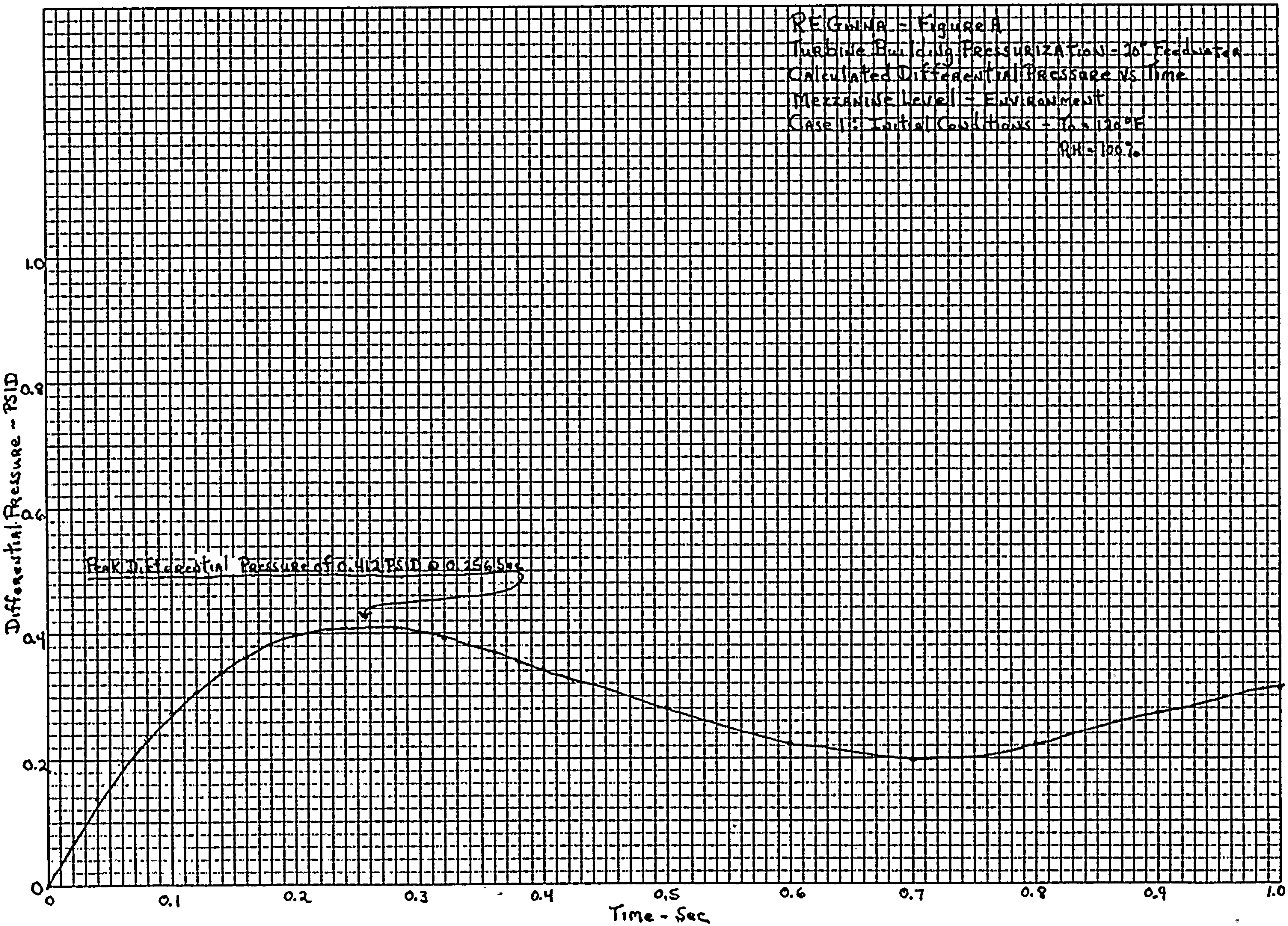
L D White, Jr.

L. D. White, Jr.

Enclosures

# Enclosure I

This enclosure provides the plots of pressure as a function of time for the pipe break events reported in our submittal of May 17, 1979.


R E GINNA - Figure A
Turbine Building Pressurization - 20" Feedwater
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Case 1: Initial Conditions - T0 = 120°F
RH = 100%
Peak Differential Pressure of 0.412 PSID @ 0.256 Sec
Differential Pressure - PSID
0
0.2
0.4
0.6
0.8
1.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec

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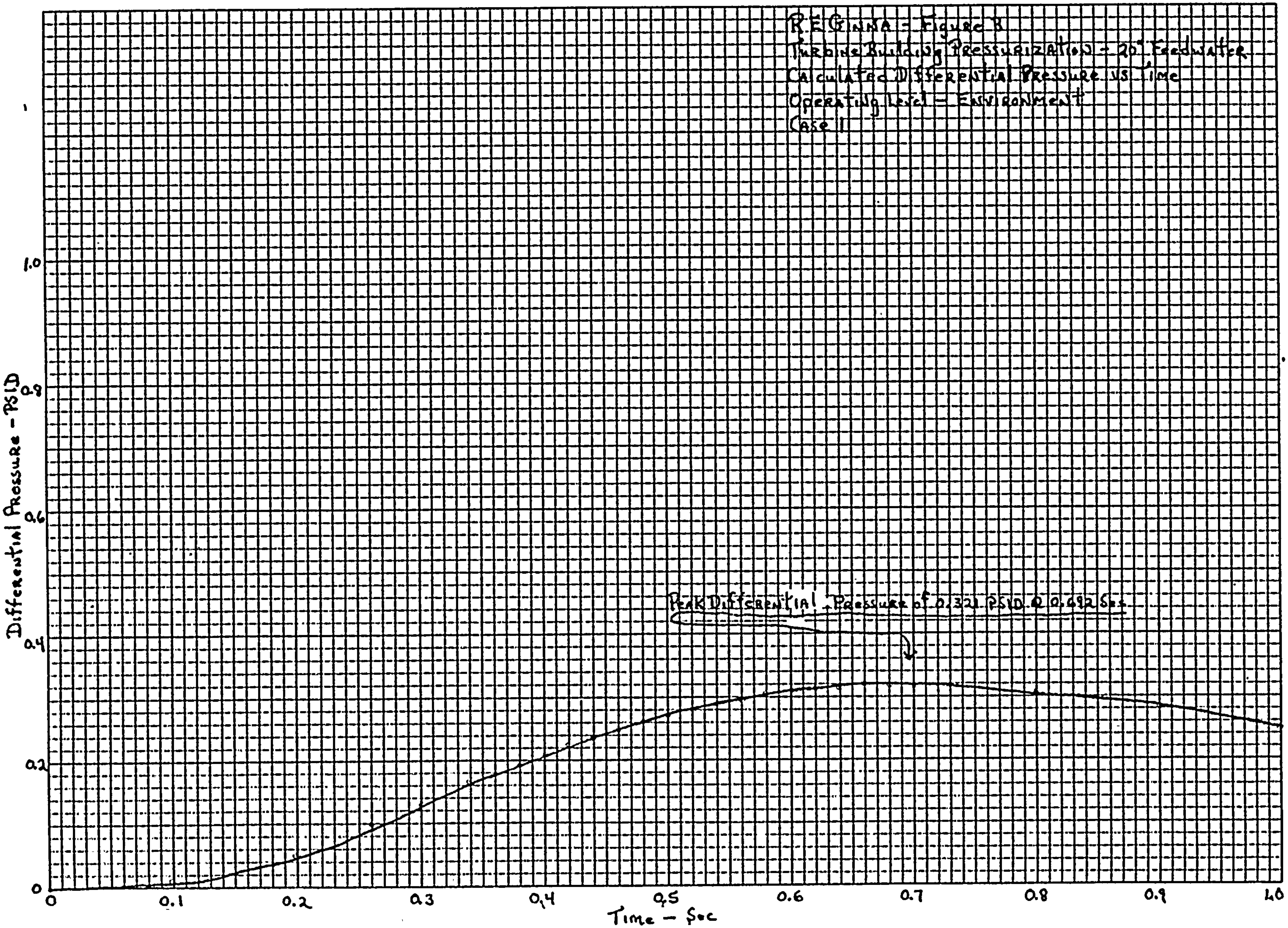

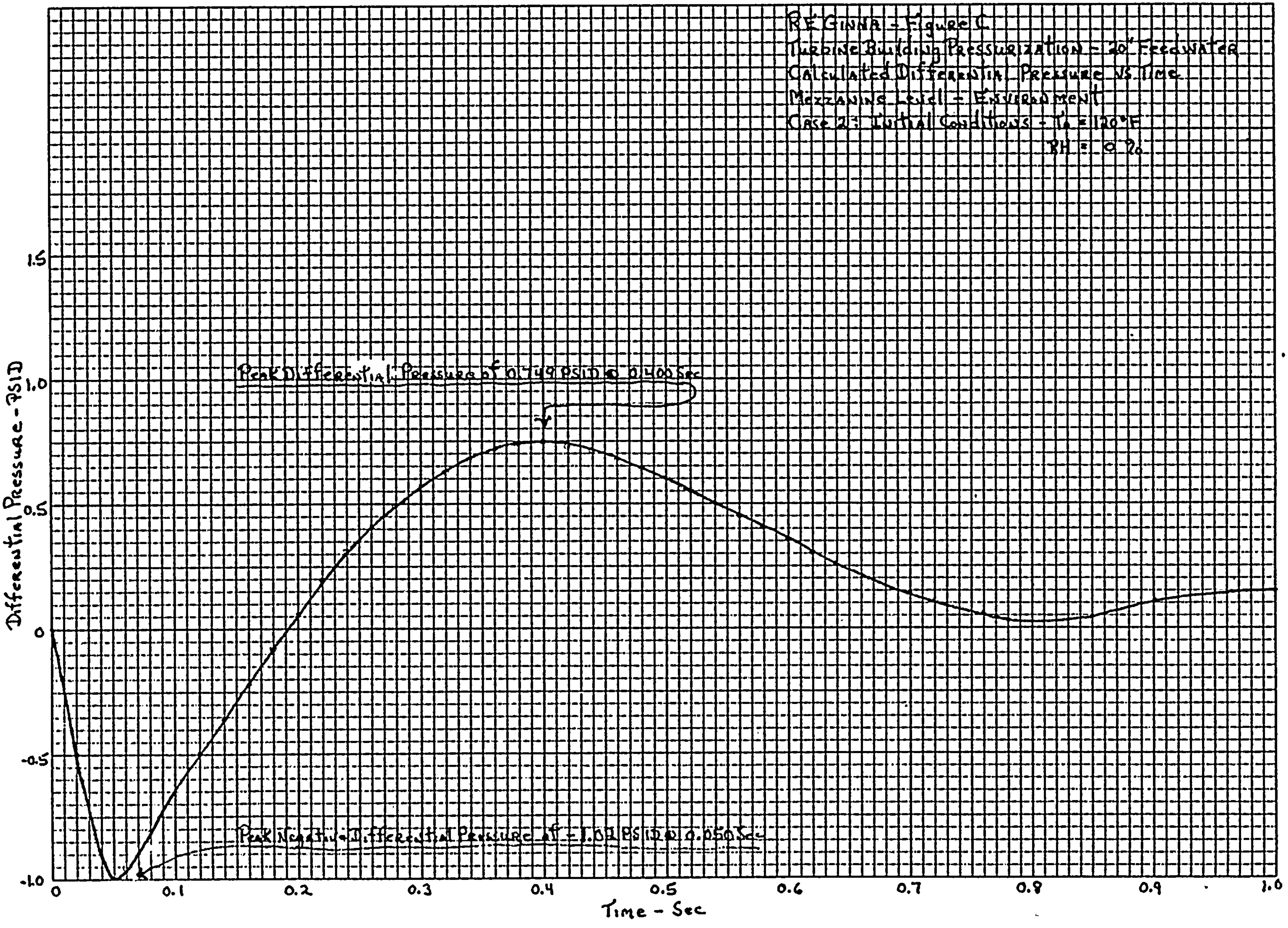
R.E. GINNA - Figure C
Turbine Building Pressurization - 20" Feedwater
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Case 2: Initial Conditions - Ta = 120°F
RH = 0 %
Peak Differential Pressure of 0.749 PSID @ 0.400 Sec
Peak Negative Differential Pressure of -1.02 PSID @ 0.050 Sec
Differential Pressure - PSID
1.5
1.0
0.5
0
-0.5
-1.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec

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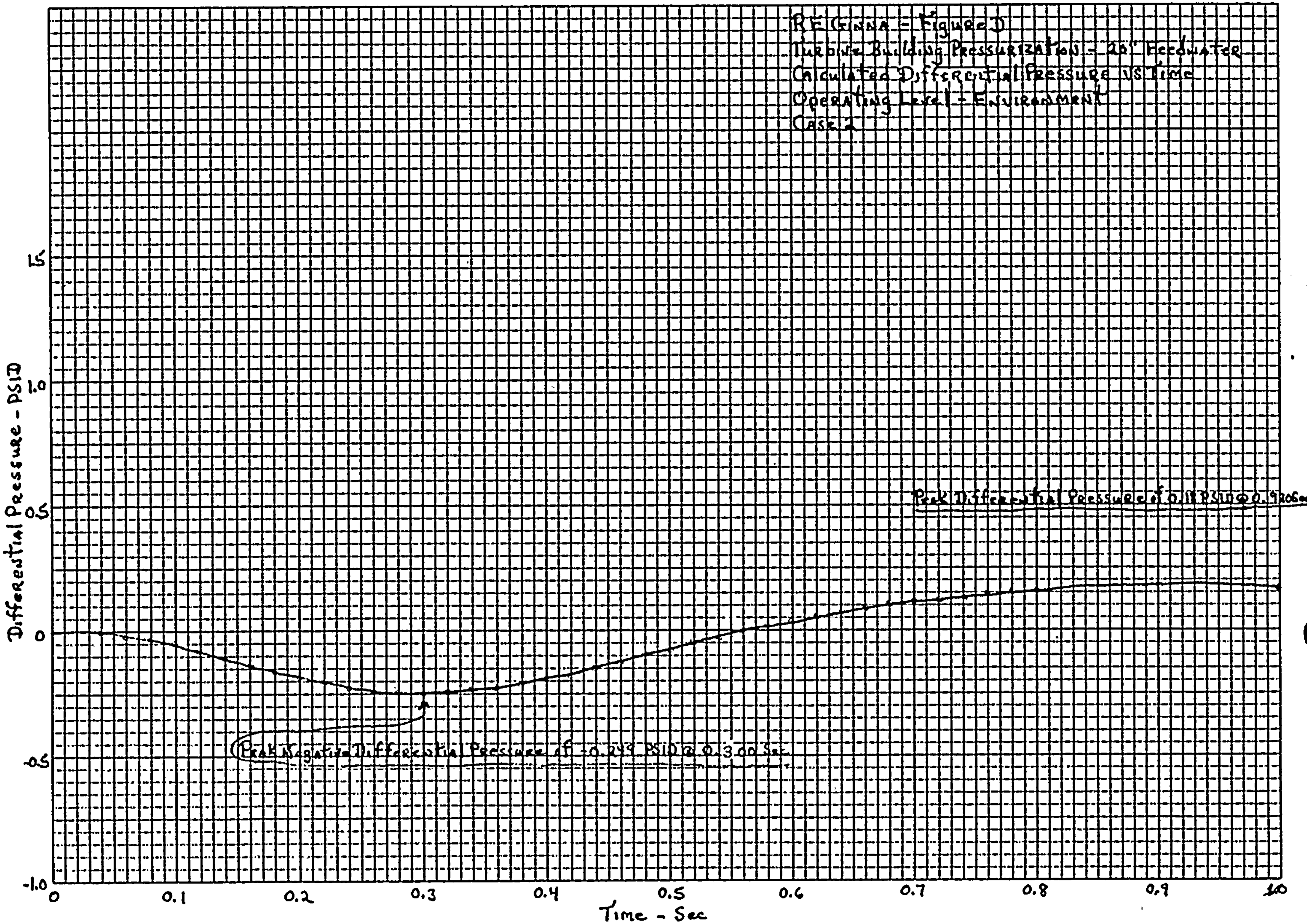

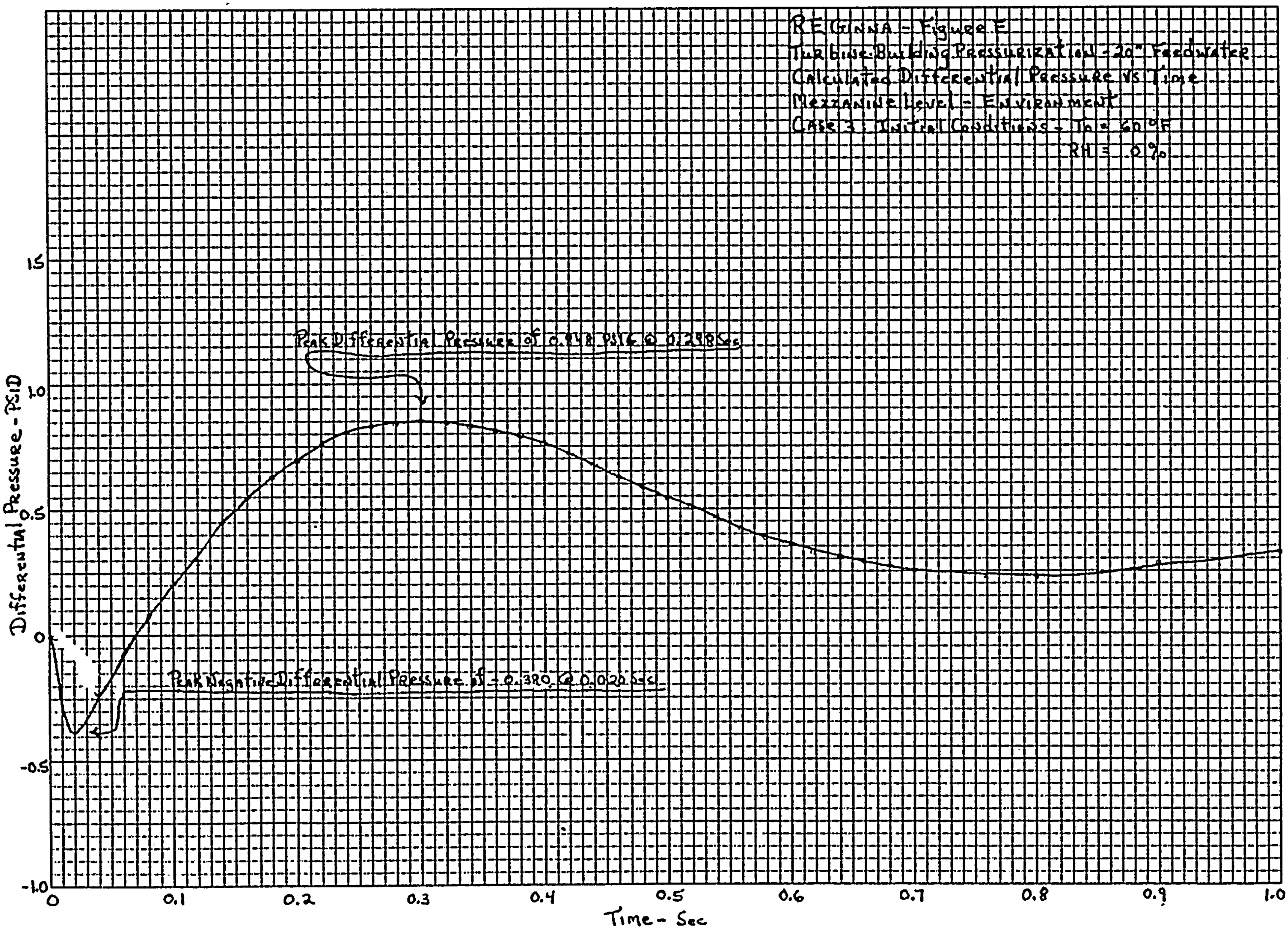
RE GINNA - Figure E
Turbine Building Pressurization - 20" Feedwater
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Case 3: Initial Conditions - T = 60 °F
RH = 0 %
Peak Differential Pressure of 0.848 PSIG @ 0.298 Sec
Peak Negative Differential Pressure of -0.380 @ 0.020 Sec
Differential Pressure - PSID
1.5
1.0
0.5
0
-0.5
-1.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec

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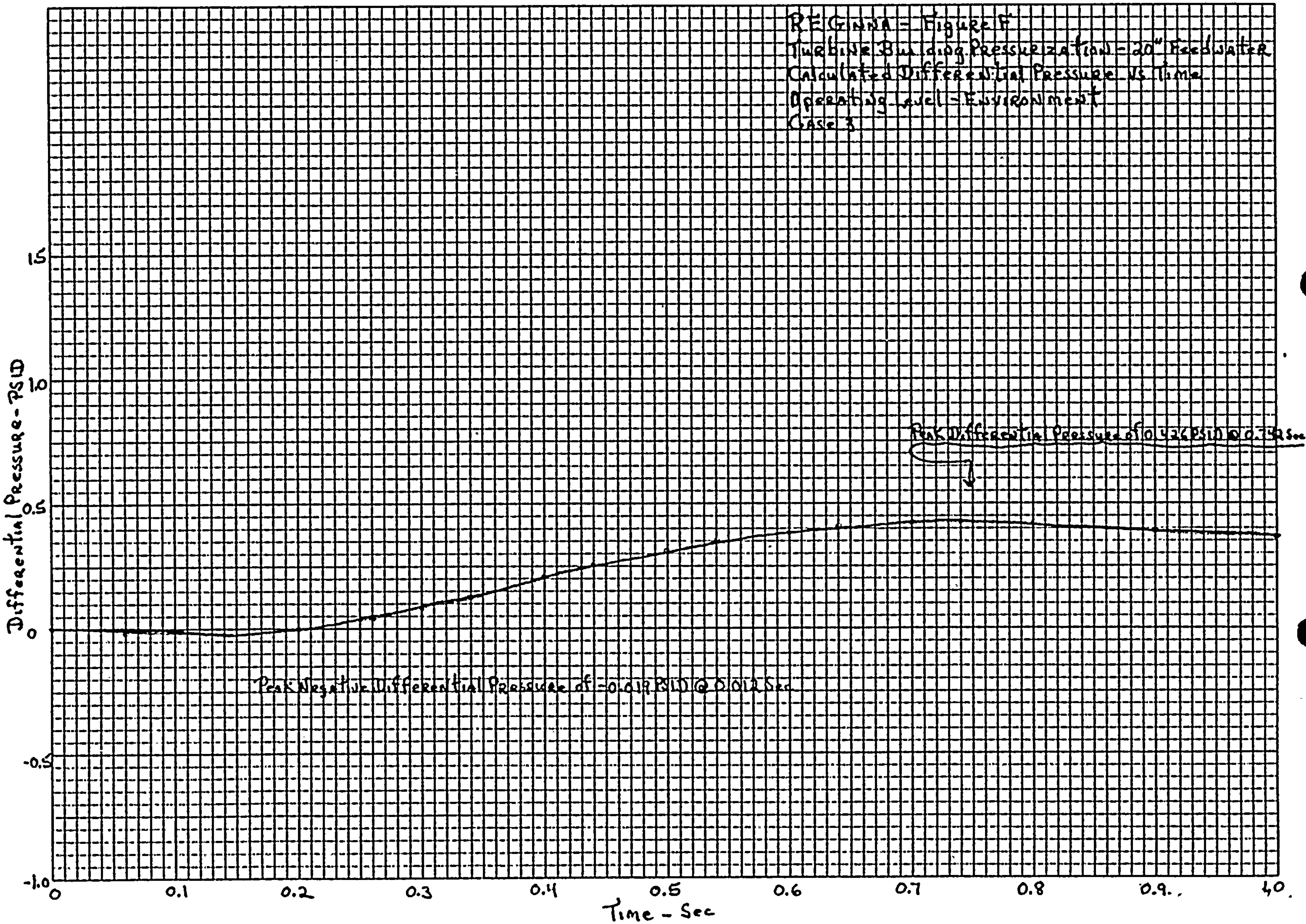

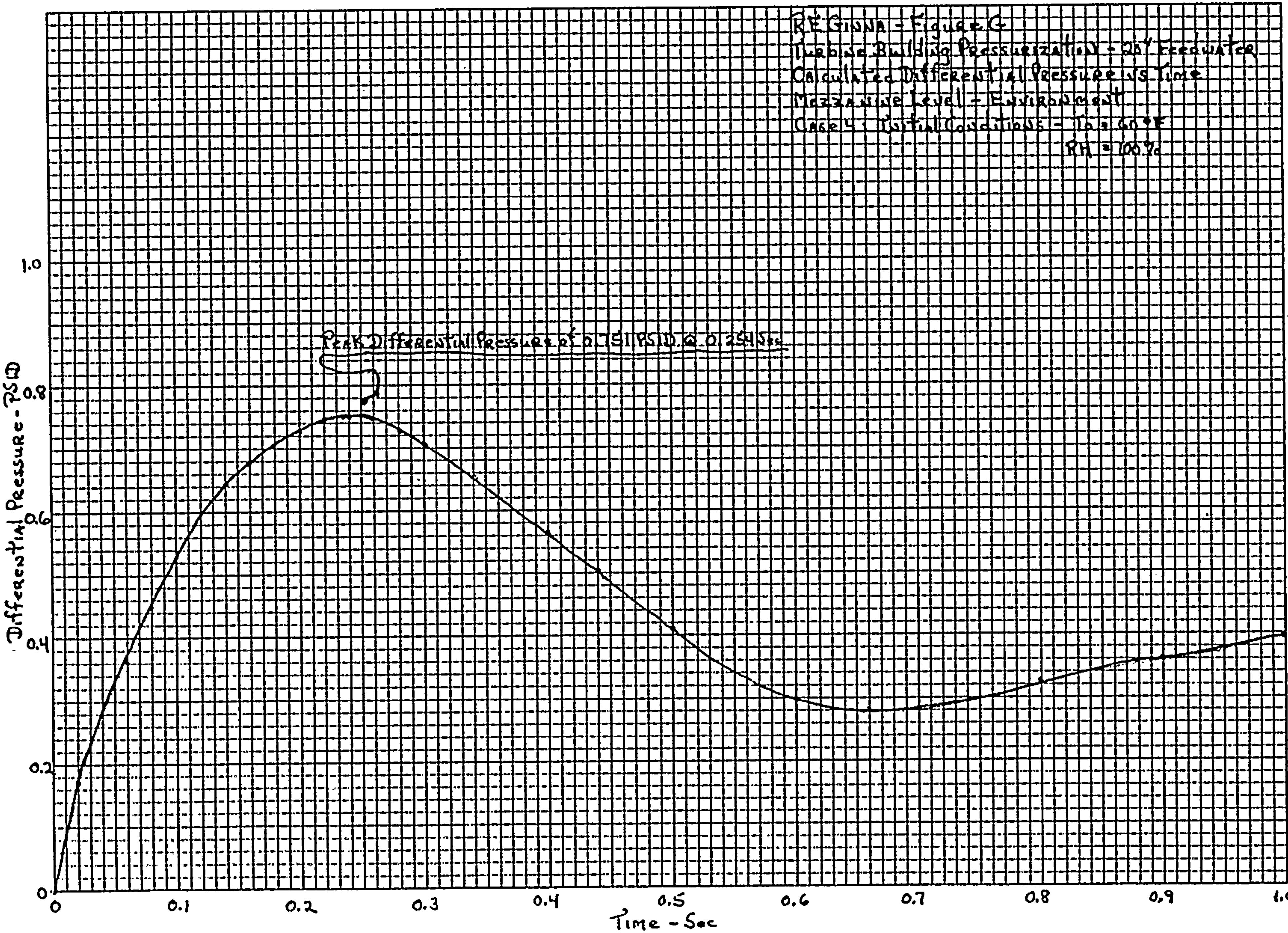
R.E. Ginna - Figure G
Turbine Building Pressurization - 20" Feedwater
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Case 4: Initial Conditions - To = 60°F
RH = 100%
Peak Differential Pressure of 0.751 PSID @ 0.254 sec
Differential Pressure - PSID
1.0
0.8
0.6
0.4
0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec

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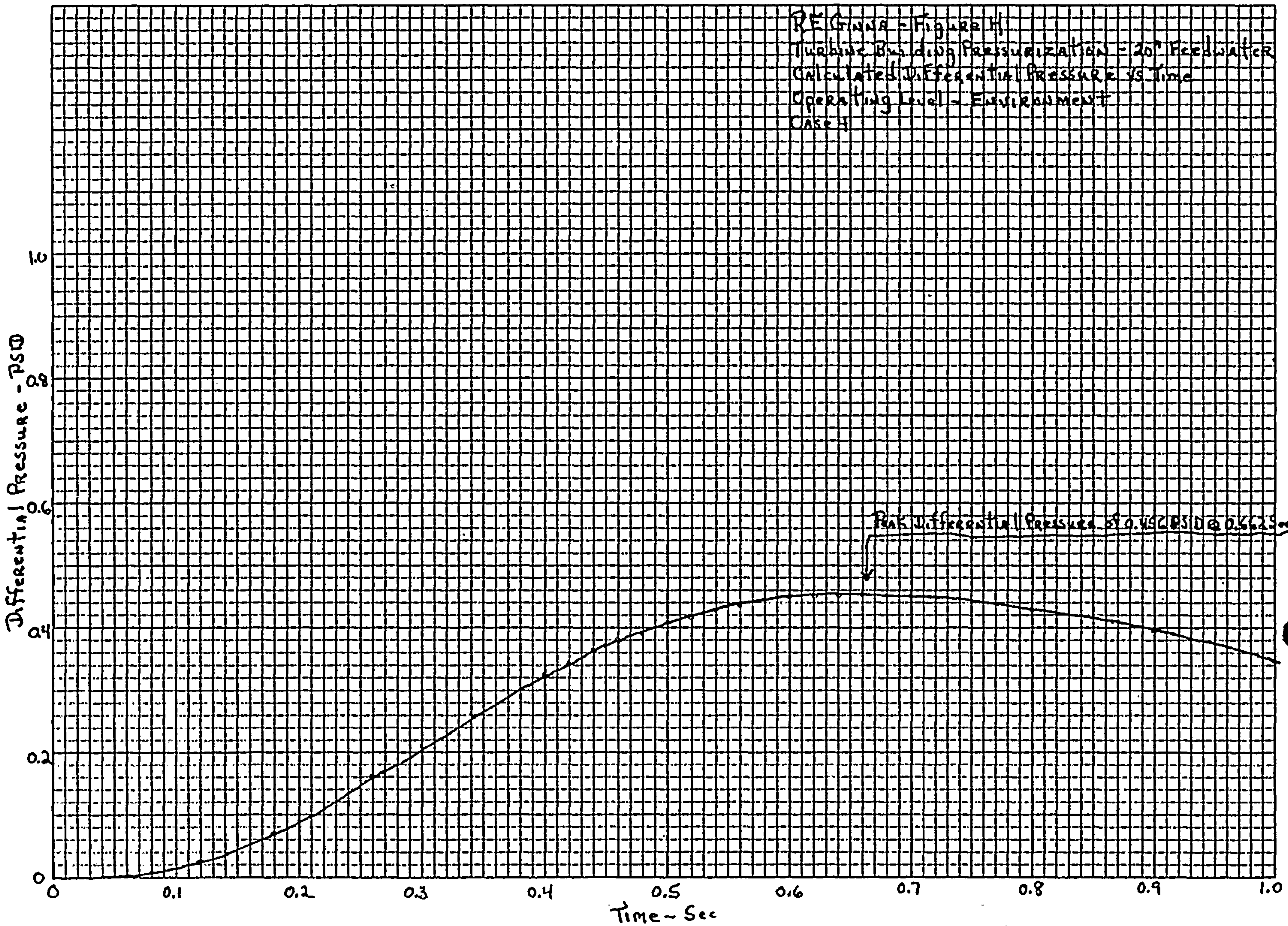
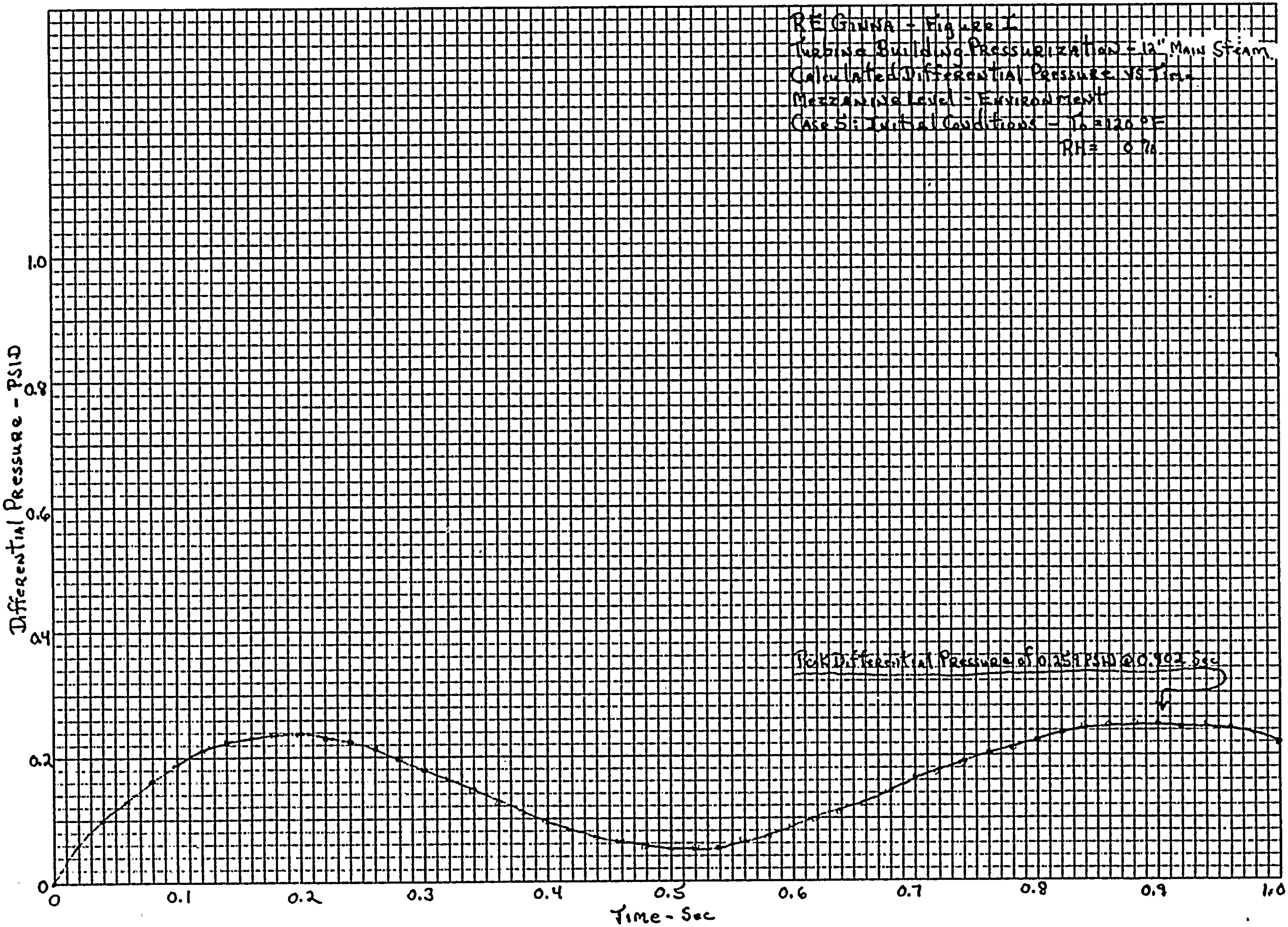
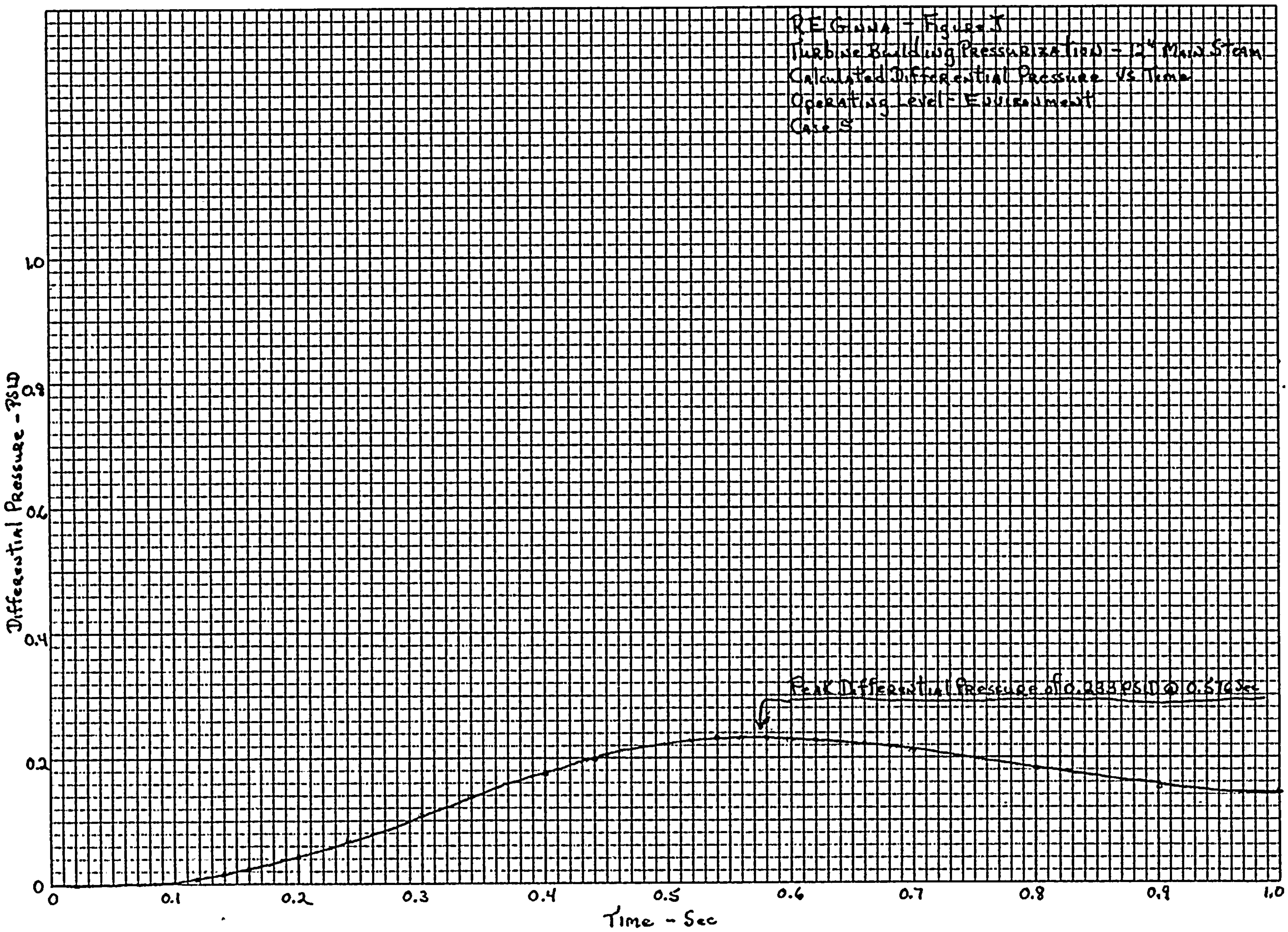
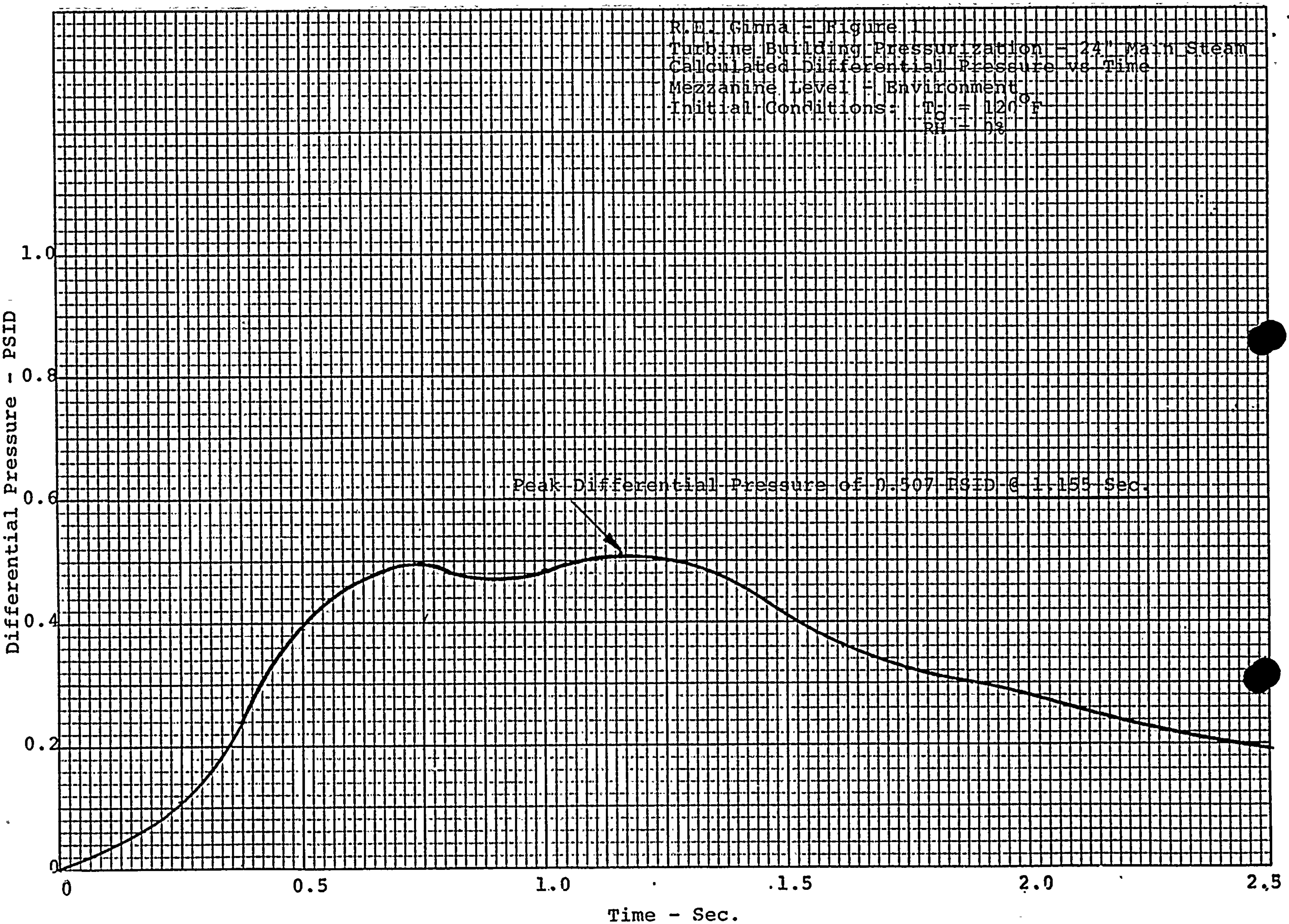


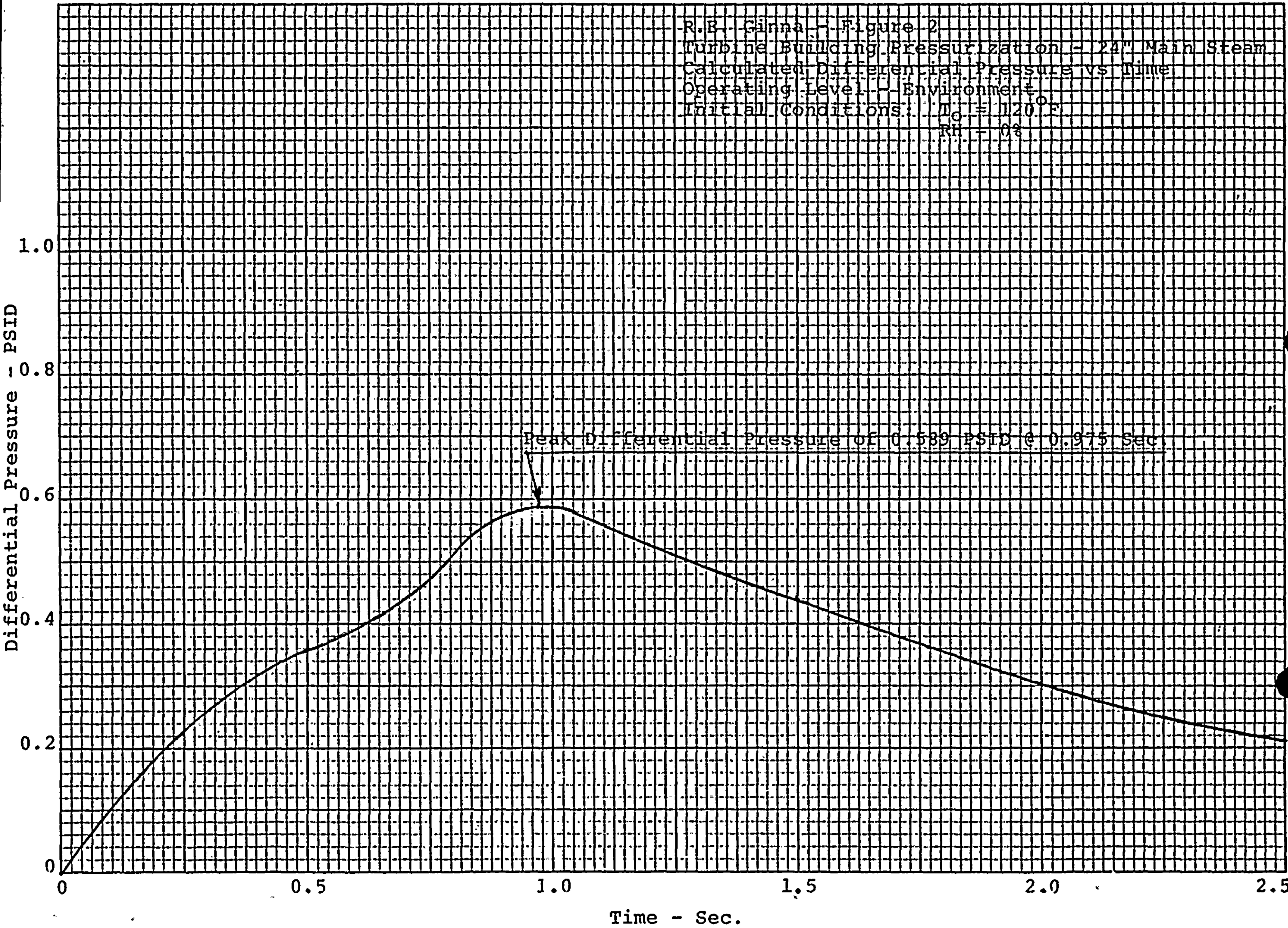

RE Ginna - Figure 1
Turbine Building Pressurization - 12" Main Steam
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Case 5: Initial Conditions - To = 120 °F
RH = 0 %
Peak Differential Pressure of 0.259 PSID @ 0.902 Sec
Differential Pressure - PSID
0
0.2
0.4
0.6
0.8
1.0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec


RE Ginna - Figure X
Turbine Building Pressurization - 12" Main Steam
Calculated Differential Pressure VS Time
Operating Level - Environment
Case S
Peak Differential Pressure of 0.233 PSID @ 0.576 Sec
Differential Pressure - PSID
1.0
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec

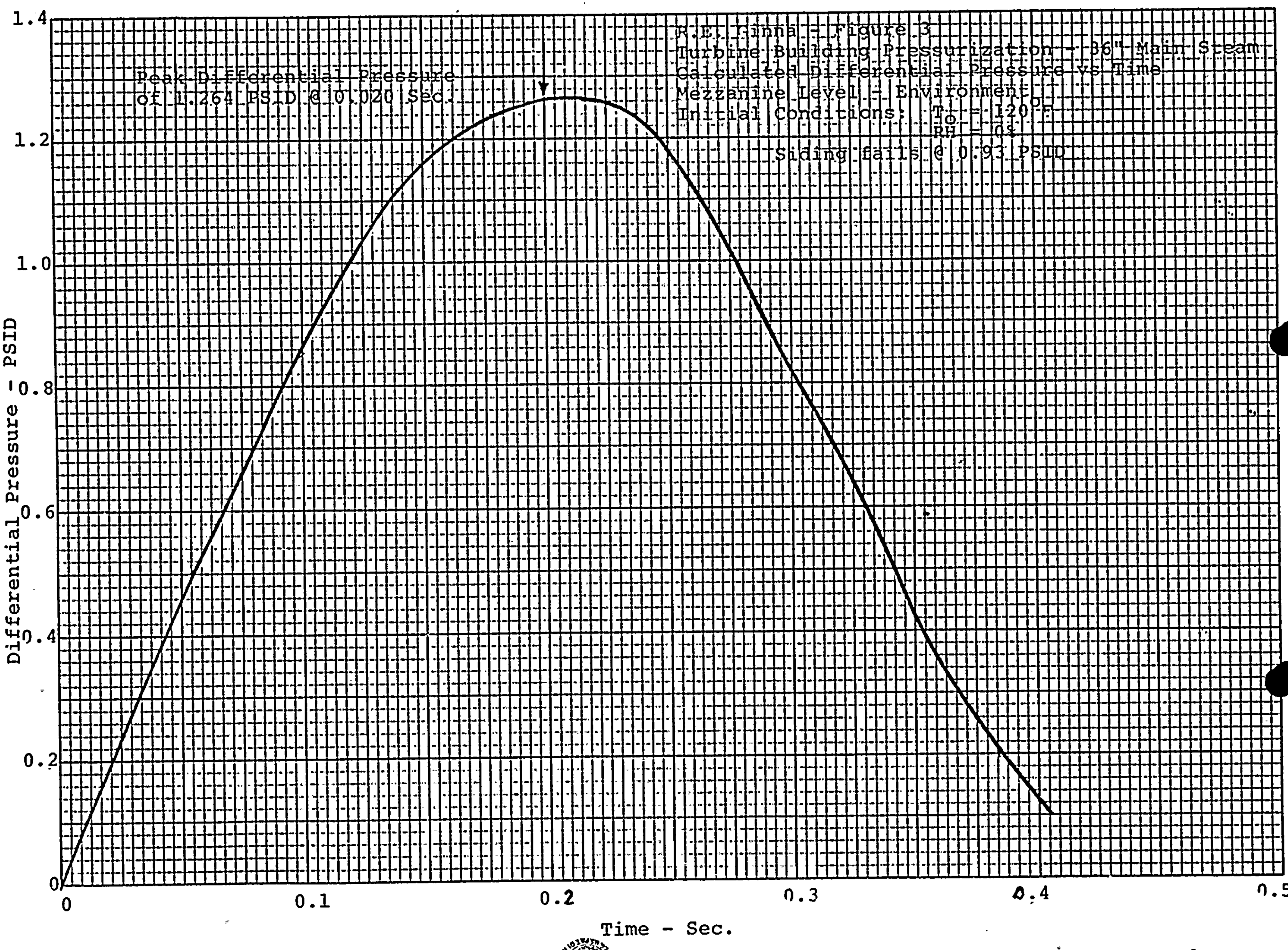
Enclosure II

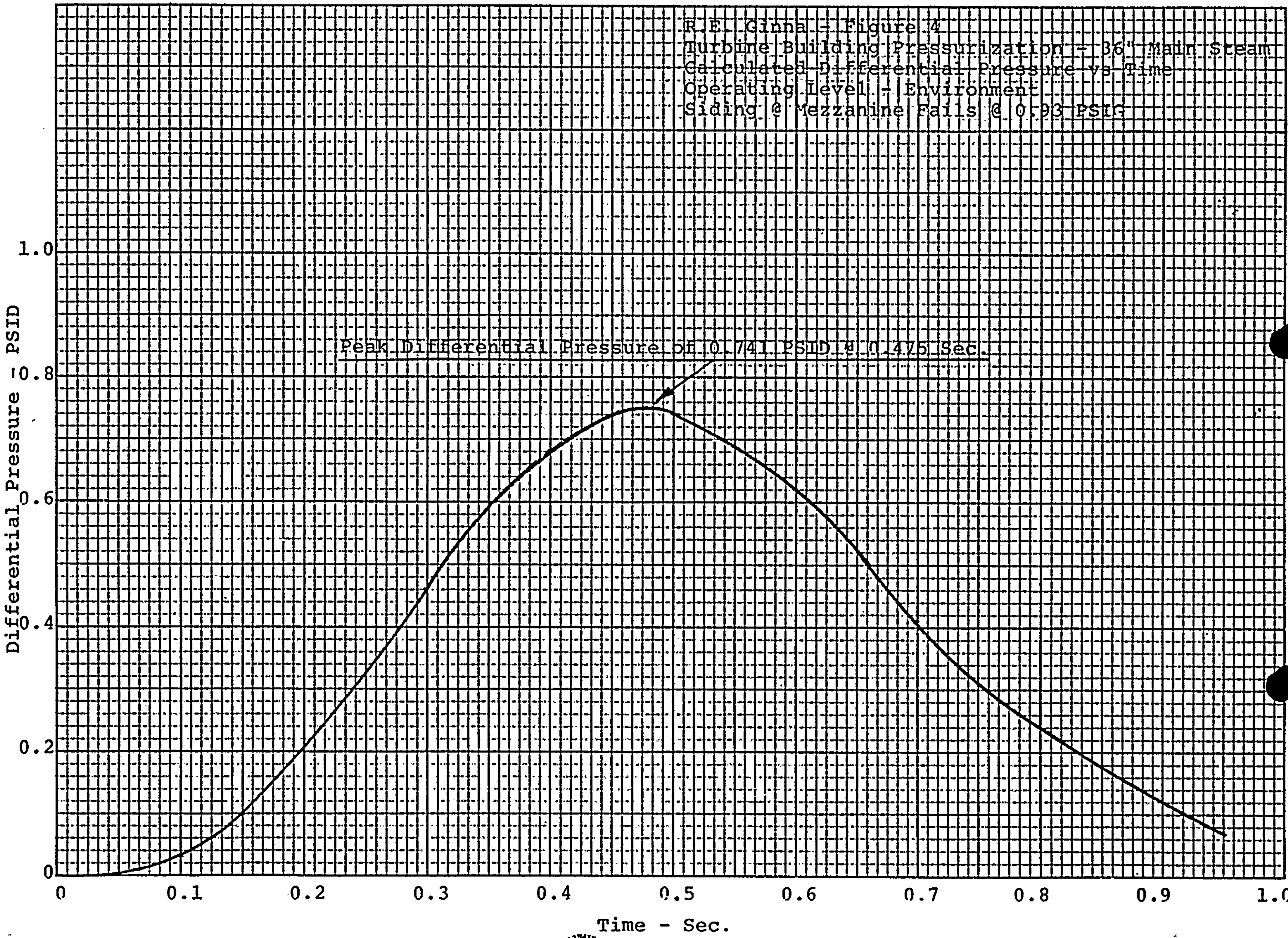
This enclosure provides the plots of pressure as a function of time for the two nodes for a 24" steam line break on the operating floor and a 36" steam line break on the mezzanine level.


R.E. Ginna - Figure 1
Turbine Building Pressurization - 24" Main Steam
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Initial Conditions: $T_o$ = 120°F
RH = 0%
Peak Differential Pressure of 0.507 PSID @ 1.155 Sec.
Differential Pressure - PSID
1.0
0.8
0.6
0.4
0.2
0
0
0.5
1.0
1.5
2.0
2.5
Time - Sec.



R.E. Ginna - Figure 2
Turbine Building Pressurization - 24" Main Steam
Calculated Differential Pressure vs Time
Operating Level - Environment
Initial Conditions: $T_o$ = 120°F
RH = 0%
Peak Differential Pressure of 0.589 PSID @ 0.975 Sec.
Differential Pressure - PSID
0
0.2
0.4
0.6
0.8
1.0
0
0.5
1.0
1.5
2.0
2.5
Time - Sec.


R.E. Ginna - Figure 3
Turbine Building Pressurization - 36" Main Steam
Calculated Differential Pressure vs Time
Mezzanine Level - Environment
Initial Conditions: To = 120°F
RH = 0%
Siding fails @ 0.93 PSID
Peak Differential Pressure
of 1.264 PSID @ 0.020 Sec.
Differential Pressure - PSID
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
Time - Sec.


R.E. Ginna - Figure 4
Turbine Building Pressurization - 36" Main Steam
Calculated Differential Pressure vs Time
Operating Level - Environment
Siding @ Mezzanine Fails @ 0.93 PSIG
Peak Differential Pressure of 0.741 PSID @ 0.475 Sec.
Differential Pressure - PSID
1.0
0.8
0.6
0.4
0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time - Sec.

Enclosure III

The turbine building at Ginna Station is a three story structure with large openings between the three floors. These openings are shown in FSAR Figures 1.2-3 and 1.2-4.

The total open area between the operating floor and the lower levels is 1160 $ft^2$. The major opening is an open access hatch (52.5 feet by 19 feet) which is located on the north side of the floor. The balance of the open area is comprised of three stairwells.

As noted in our May 17 submittal, the analyses assume one node for the mezzanine and basement levels. An open area of 3800 $ft^2$ exists between the mezzanine and the basement levels. The largest opening is an open hatch and grated area (69.5 feet by 39 feet) which is located on the north side of the mezzanine floor directly below the operating level open access hatch. A second major open area is located in the western portion of the mezzanine floor. This area (33'4" by 14'8") is in the immediate vicinity of the main steam and feedwater lines. Additional area is available from the condensate pump withdrawal hatch, the heater drain pump withdrawal hatch, open and grating space around the moisture separators, and three stairwells.

For breaks on the mezzanine level, significant open areas between the mezzanine and basement levels are found in the immediate vicinity of the major steam and feedwater lines. The additional openings elsewhere in the building make further contributions to maintaining pressure equalization between the two levels.

It should be noted that the large openings between floors and the relatively unrestricted area around the major piping make these analyses substantially different from pressurization analyses typically performed for major pipe breaks in containment. Limited opening between floors in containment and compartmentalization of the reactor coolant system increase the need for more detailed treatment of the containment volume. The design of the turbine building, as described above and as depicted in the FSAR, is seen to be substantially less restricted.

For breaks located on the operating level, an important factor in minimizing the pressure differential between the mezzanine and basement floors is the location of the floor openings. As can be seen from the figures, there are larger openings in the mezzanine floor below each opening in the operating floor. This facilitates steam flow from the operating level to both of the lower levels.

Enclosure IV

Whenever subcooled water or a two-phase mixture is introduced into an environment at less than 100% relative humidity, a short-term depressurization transient will occur until the atmosphere becomes saturated. The phenomena occurs for breaks such as a feedwater line or a primary system rupture. The magnitude and duration of the depressurization is dependent on the energy of the water and the volume considered.

More specifically, the short-term depressurization phase after a postulated subcooled water or two-phase line pipe rupture is due to evaporative cooling or the process of adiabatic saturation. The fluid leaving the ruptured line separates into steam and water fractions depending on fluid enthalpy and environmental conditions. If the atmosphere is not saturated, the water will evaporate into the atmosphere. This mass transfer process, or mass diffusion, is due to the vapor mass concentration difference between the water surface and the environment (Fick's Law). The water vapor will diffuse from the water surface to the lower concentration point in the atmosphere at a rate determined by the interfacial area, mass transfer coefficient, and the driving force due to the concentration difference. This process is analogous to the heat transfer process which is driven by temperature differences. This change in phase from liquid to vapor requires the addition of latent heat to the liquid which must be supplied by the air. Thus, the energy of the air, and consequently, the temperature and pressure, decrease. This process continues until the atmosphere becomes saturated or the water inventory is evaporated.