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Flow of Crushed Ice Physical and Mechanical Properties and Behavior
Volume 1: Data Collection Phase

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British Petroleum plc
Esso Resources Ltd.
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Minerals Management Service
Mobil Research and Development Corporation
National Research Council of Canada
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MEMORIAL UNIVERSITY
OF
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GEOTECH

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FLOW OF CRUSHED ICE
PHYSICAL AND MECHANICAL PROPERTIES AND BEHAVIOR

VOLUME 1: DATA COLLECTION PHASE

by

GEOTECHnical Resources Ltd.

&

Memorial University of Newfoundland

for

British Petroleum plc

Esso Resources Ltd.

Gulf Canada Resources Ltd.

Minerals Management Service

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SUMMARY

A laboratory test program was conducted which investigated the flow properties of crushed ice. A specifically designed load test frame allowed the collection of data between rectangular plattens of nominal dimension 500 x 750 mm. The ice was prevented from escaping from the long sides by steel plates. A 100 mm. layer of crushed ice of density 550 kg/m^3 and temperature -10^{o}C was placed in the apparatus. The velocity of the upper platten was controlled in the range 2.5 mm/s to 160 mm/s and mean platten pressures of up to 10.0 MPa were achieved. A set of 9 pressure cells at strategic locations allowed for the observation and measurement of the local pressure distribution within the extrusion zone. Nine tests were conducted with the lower platten covered with a thin layer of ice and 17 tests were conducted with the lower platten bare steel. The data were recorded via a digital data acquisition system with sampling rates up to 6.0 kHz per channel and at 12 bit resolution.

Considerable densification of the crushed ice occurred within the center portion of the platten with densities of up to 900 kg/m^3 and pressures of up to 40 MPa occurring. At the termination of the test the center portion of ice was scintered whereas the outside portion was still unbonded. The center portion was sectioned allowing for a density map to be produced. The ejection process produced "sawtooth" waveforms with a relatively slow rise and a rapid drop.

Four tests were conducted with the ends of the extrusion zone as well as the side blocked. These compaction tests indicated that the pressure was a simple exponential function of density. It was also found that the compaction pressure was independent of platten velocity.

Six tests were conducted in which there was a central strip of dyed ice. The test was stopped at a predetermined displacement of about 50 mm. and the

remaining ice sectioned and photographed. By this means the flow profile of the ice was revealed. A simple description did not emerge but there was clear evidence of slip lines at 45° to the platten surface.

A different set of tests were conducted which investigated the crushing as well as the extrusion process. A hollow cylinder was loaded with a solid ice sample. One end of the cylinder was blocked and the other contained a piston. Adjacent to the blocked end were a series of slots. The motion of the piston was controlled at speeds ranging from 2.0 to 125 mm./s. Five tests were conducted using solid ice samples and one test used crushed ice as the sample. The ice was crushed and extruded in a continuous manner. Preliminary interpretation indicates a linear relationship between piston speed and minimum pressure levels. The maximum pressure levels appear independent of speed.

This report contains a description of the data collection phase of the project. Data analysis and interpretation are contained within subsequent reports.

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1 INTRODUCTION

1.1 Background

During the interaction between floating ice sheets and various structures, for example: ships, drilling structures, wharves, the intact ice sheet is often broken into a large number of pieces. The size of the broken fragment can depend upon an array of factors involving at a minimum, the speed of interaction, the thickness of the ice sheet and the geometry of the interaction zone. In many of these interactions the size of the broken piece is the order of the thickness of the ice sheet. In interaction involving crushing and compressive failure of the ice sheet, the size of the ice fragments are the order of the crystal size rather than the thickness of the ice sheet. Field observations from offshore structures [1][1] and icebreaker bow impacts [2] indicate that a layer of crushed ice is generated between the structures and the ice feature. In the process, the crushed ice is extruded out of the interaction zone in a continuous process. The process does, however, have a pronounced cyclic behavior. This observation has the consequence that the whole ice structure interaction force is transmitted through the layer of crushed material.

The complete interaction process can be broken down into two aspects, the first one is the creation of crushed material from the parent ice sheet, the second aspect is the removal of this now crushed material from the interaction zone. The first aspect involves, in essence, the strength properties of the parent material and the second aspect, the flow properties of the crushed material. The literature contains a large number

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1 Square brackets are references listed in section 8.

of reports on the strength of ice but very little on the flow properties of the crushed material. The data are particularly limited at interaction pressures in the range 1 to 10 MPa and interaction speeds of 10 to 100 mm./s.

The major purpose of this test program was to study the flow properties of crushed ice under conditions similar to that experienced in the field. The tests were conducted with a specially constructed load frame which provided a platten size of nominally 0.5 by 0.75 m. Mean pressures of 10 MPa and approach speeds of 125 mm./s were achieved. The size of the platten was such that it could directly simulate the interaction of an ice sheet 0.75 m. in thickness.

A previous, smaller scale, laboratory test program conducted for Gulf Canada Resources [3] indicated that during the simulated extrusion process, considerable densification of the crushed ice occurred in the center portion of the zone. The densification would, no doubt, result in changes to the material properties of the flowing crushed material. This assumption makes it extremely difficult to relate average extrusion pressures to the material characteristics. In that test program it was also illustrated that local pressure measurements at strategic locations may, in principal, allow the extraction of material properties. Furthermore, the pressure gradients and mass flow in the extrusion direction could provide a way of distinguishing between the various candidate constitutive models that might be used to describe the crushed ice. Examples of such are a Mohr-Coulomb approach or a Viscous Fluid. The ultimate output of the test phase and the subsequent data interpretation and analysis phase is a mathematical description of the flow properties of the crushed ice.

A different set of tests were conducted which investigated the crushing as well as the extrusion process. A hollow cylinder was loaded with a solid ice sample. One end of the cylinder was blocked and the other contained a piston. Adjacent to the blocked end were a series of slots. The motion of the piston was controlled at speeds ranging from 2.0 to 125 mm/s. Five tests were conducted using solid ice samples and one test used crushed ice as the sample. The ice was crushed and extruded in a continuous manner. Preliminary interpretation indicates a linear relationship between piston speed and minimum pressure levels. The maximum pressure levels appear independent of speed.

Volume 1 of this project describes the conduct of the test program, as such it emphasizes the experimental aspects of the project. Volume 1 does not attempt to analyse or interpret the acquired data since this aspect will be covered in subsequent reports. Volume 1 was written by Dr. Paul Spencer.

1.1.1 Acknowledgments

The project team for GEOTECHnical Resources Ltd. consisted of the following people: Paul Spencer, Dan Masterson, Rob Carlyon, Trevor Stoetz, John Robertson, Jim Lucas, Randy Aalders and Michel Metge. A high level of professionalism and expertise was demonstrated. We also wish to acknowledge the significant and pertinent input into the test program by the attendees of the Participants Meetings, in particular, Ken Croasdale, Rick Weiss, Hari Iyer, Mike Jefferies, Jim Clarke, Roy Johnson, Bob Frederking and Ian Jordaan.

Special thanks to Lu Cerato for her excellent word processing capabilities in producing the final document.

1.2 Division of Responsibilities

Various organizations and individuals were involved in the project. The basic division of tasks is as follows:

1.2.1 Test Frame

The test frame was constructed for the National Research Council of Canada under a separate prior contract administered by Dr. R. Frederking. The cold room in which the test frame was situated was provided by GEOTECHnical Resources as was the computer data acquisition system for the duration of the project. Part of the load test frame, namely the actuator and the servo control valve, were provided by Dr. Ian Jordaan. of Memorial University of Newfoundland(M.U.N.). These components were donated to M.U.N. by Mobil of Canada.

1.2.2 Test Execution

Geotech had the responsibility for conducting the test program and generating the test phase report. Geotech had overall financial responsibilities for the project. The project manager for Geotech was Dr. Paul Spencer. Dr. Ian Jordaan. of M.U.N. and Dr. Bob Frederking. of N.R.C. had significant input into the test program.

1.2.3 Data Analysis

The data analysis is the responsibility of Dr. Ian Jordaan., M.U.N. who will also generate a report on that phase of the project. Dr. Paul Spencer had a significant input into the choice of analysis methodologies.

1.3 Test Plan

The test matrix for the extrusion tests was based on the test plan suggested in the proposal. It was modified and refined during two participants meetings which occurred in November 1988 and January 1989. As a result the following type and number of extrusion tests were conducted using crushed ice.

TABLE 1.1

TYPES OF EXTRUSION TESTS

TEST TYPE	NUMBER
Extrusion with lower platten steel	17
Extrusion with lower platten ice	9
Compaction Tests	4
Flow visualization with lower platten steel	2
Flow visualization with lower platten ice	4

As indicated in Table 1.1 there were three major types of tests: extrusion tests, compaction tests and flow visualization tests. During the extrusion tests average and local pressures were recorded during the ice extrusion. During the compaction tests, the ends of the extrusion apparatus were blocked and the crushed ice material compacted. Average and local pressure were again recorded. For the flow visualization tests, the crushed ice material was selectively stained and the test stopped at a predetermined point. The ice was subsequently sectioned and photographed to reveal the details of the flow pattern of the crushed ice.

For the test matrix indicated in Table 1.1 the approach speed of the platten was between 2.5 and 160 mm./s and the mean platten pressure at the stop of the test varied from approximately 0.1 to 10.0 MPa.

At the termination of the compaction and extrusion tests, thickness and density maps were made on the remaining material.

A second set of tests were executed as part of the test program. These sets were considered to be more speculative and were intended to simulate the complete crushing and extrusion process rather than just the extrusion part of the process. In these second tests a cylindrical <u>solid</u> ice sample was inserted into a hollow cylinder. Near the base were a series of slots which would allow the ejected of any crushed material. The sample was forced downwards by a piston controlled via a load test frame. Six tests were conducted in which the approach velocity was controlled between 2.0 mm./s and 125 mm./s. Solid ice was used in 5 tests and for one test the sample was manufactured from crushed ice.

2 MECHANICAL AND HYDRAULIC ASPECTS OF TEST FRAME

Appendix 1 contains the commissioning report on the construction of the load test frame by Geotech and its associated electronic servo controller. For reference, the principal characteristics of the system are provided in Table 2.1 [2].

The general arrangement of the load test frame is shown in figure 2.1 [3]. The principal elements of the load test frame are the base frame onto which was mounted the hydraulic actuator. The piston of the actuator was coupled to an instrumented upper platten. The crushed ice material was squeezed out from between the upper and lower plattens. Not shown in figure 2.1 are the 200 U.S. g.p.m. servo valve and the bank of eight air over oil piston accumulators. The accumulators were charged prior to a test and they provided the large flow rates required for these tests. The aim during the design of the frame was to manufacture a stiff frame within the budgetary limitations. Thus a simple design which had low manufacturing costs was chosen, this allowed for more money to be spent on increasing the amount of steel in the frame.

Figure 2.2 illustrates the location of the local pressure cells on the instrumented platten. Note that the instrumented platten is the upper platten. Figure 2.3 illustrates the construction of the local pressure cells. The sensing element is a miniature load cell manufactured by Sensotec, see Appendix 8 for details. The load is transferred to the load cell via the piston element. To reduce frictional losses, the piston element was Teflon coated. The full scale pressure range is determined by the diameter of the piston and the full scale range of the miniature load cell. Table 2.2 provides the various pressure ranges available. Table 2.3 provides the list

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2 Tables are found at the end of each chapter.

3 Figures are found at the end of each chapter after the Tables.

of pressure cell ranges chosen. The pressure ranges selected reflected our expectation that the pressure distribution within the extrusion zone would be strongly peaked near the geometrical center of the platten.

2.1 Accuracy of Pressure Measurements

The mean platten pressure is calculated from oil pressure measurements within the actuator. The formulae is as follows:

$$p = (1/A_p) \{A_e g_e (V_e + C_e) - A_r g_r (V_r + C_r)\} \qquad (2.1)$$

where

A_p	=	Platten Area
A_e	=	Area of piston, extend side
A_r	=	Area of piston, retract side
g_e, g_r	=	Transducer transfer function, extend or retract
V_e, V_r	=	Transducer output voltage, extend or retract
C_e, C_r	=	Offset voltage, extend or retract

The electrical offsets are small but they can be allowed for by choosing a suitable reference baseline to take as zero pressure. In general, a gap of 20 mm. was left between the upper surface of the crushed ice and the upper platten. This period provides the reference zero load. The accuracy of the electronic pressure transducers is approximately 0.25% of full scale. Using equation 2.1 the accuracy of the platten pressure measurement is about +/- 40 kPa.

The overall validity of equation 2.1 was tested by comparing the load calculated on the basis of pressure measurements with that measured by a load cell inserted between the plattens. The details are provided in the system commissioning report given in Appendix 1. The intercomparison indicated that frictional losses in the piston were less than about 1% of maximum load. The absolute accuracy of the load cell limited the comparison.

Figure 2.4 illustrates a typical platten pressure recording collected for a platten speed of 125 mm./s. At time zero the command signal starts and a few tens of milliseconds later, the actuator and upper platten start moving. A transient occurring up to about 75 ms is related to acceleration of the platten, etc. After the platten is at constant velocity the pressure level is constant. Its finite positive value is believed to be caused by dynamic frictional forces within the hydraulic actuator. At about 0.2 second, the upper platten comes into contact with the crushed ice layer. The time span, in this case, between about 0.1 and 0.2 seconds, is the best estimate of the zero load level.

The local pressure cells contain load cells which have an accuracy of +/- 0.25%. Friction between the piston and the wall would however introduce an additional source of error. However, based on the value of the device offset before and after a test, this effect is estimated to be less than 0.1% of full scale. Load cell #12 is of particular importance since the total pressures at that location were generally less than 0.1 MPa.

TABLE 2.1

PRINCIPAL CHARACTERISTICS OF TEST FRAME

Maximum load at 5000 psi hydraulic oil pressure	4.5 MN
Maximum stroke with plattens installed	175 mm.
Maximum controlled platten velocity	125 mm./s
Minimum controlled platten velocity	0.5 mm./s
Load determined by pressure transducers measuring oil pressures on both sides of the actuator piston.	
Displacement feedback provided by two wireline potentiometers between plattens.	
Platten size	nominal 500x700 mm.
Maximum platten pressure at stall	nominal 10 MPa

TABLE 2.2

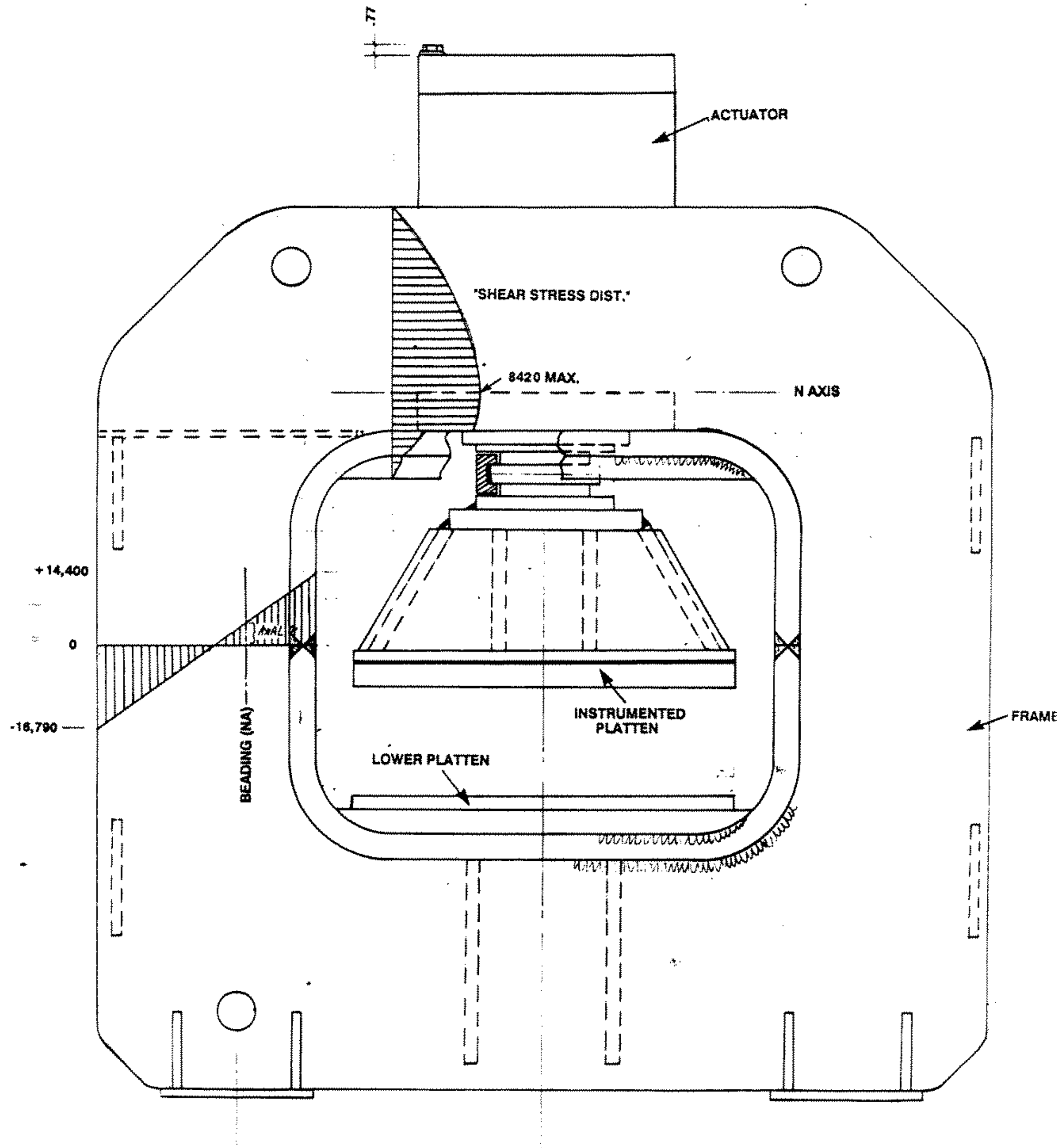
POSSIBLE FULL SCALE PRESSURE RANGES OF PRESSURE CELL, (MPa)

	PISTON DIAMETER	**3/8"**	**1/2"**	**5/8"**	**3/4"**	**7/8"**
LOAD CELL RANGE	2,000 lb.	124.9	70.3	45.0	31.2	22.9
	500 lb.	31.2	17.6	11.2	7.8	5.7
	250 lb.	15.6	8.8	5.6	3.9	2.9

TABLE 2.3

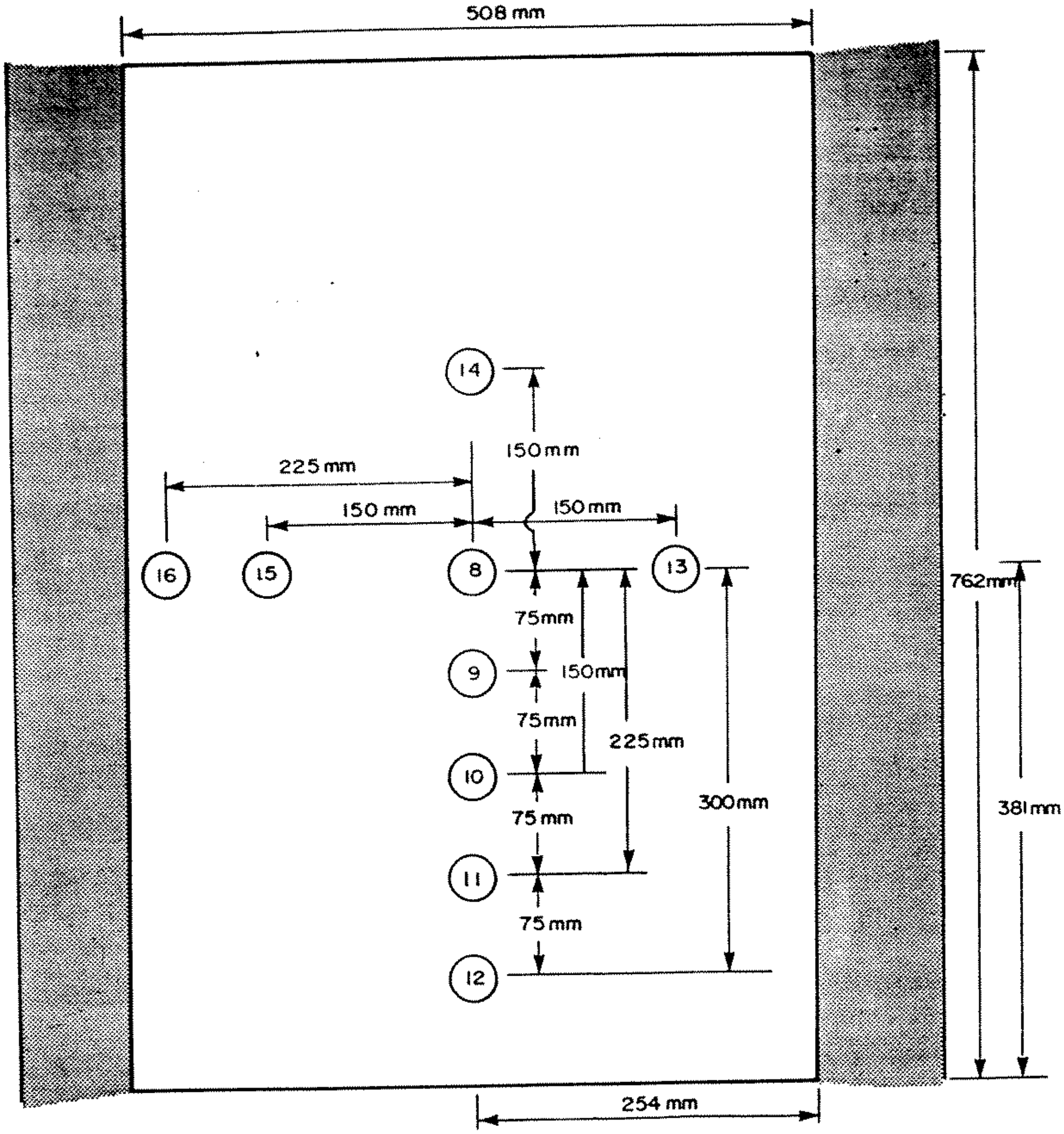
SELECTED RANGES FOR PRESSURE CELLS

CELL NUMBER	LOAD CELL RANGE (lbs.)	PISTON DIAMETER (inch)	FULL SCALE RANGE (MPa)
8	2,000	5/8	45.0
9	2,000	5/8	45.0
10	500	5/8	11.2
11	250	7/8	2.9
12	250	7/8	2.9
13	2,000	5/8	45.0
14	500	5/8	11.2
15	2,000	5/8	45.0
16	2,000	5/8	45.0



TEST FRAME
GENERAL ARRANGEMENT

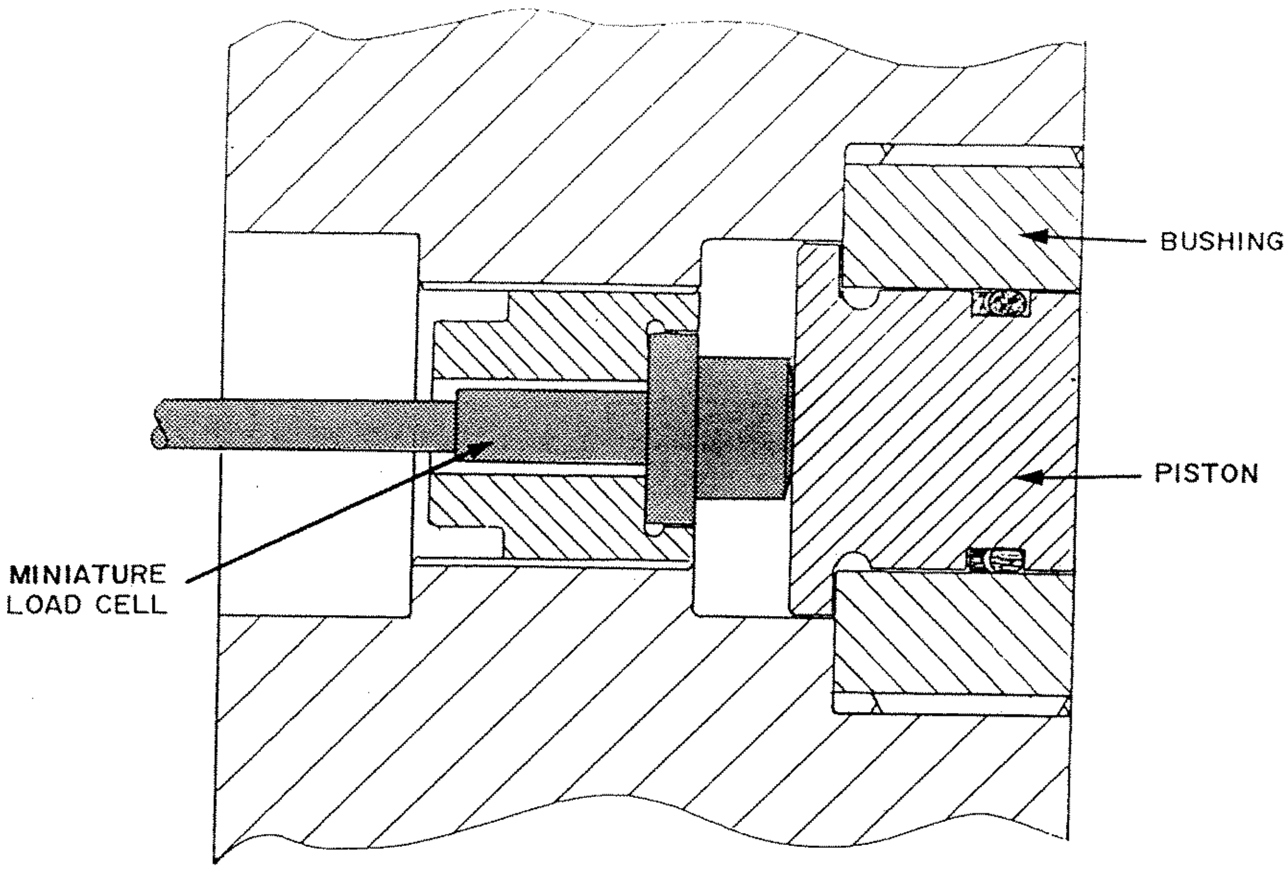
FIGURE 2.1



AREA = 0.387 m^2

LOCATION OF PRESSURE CELLS

FIGURE 2.2



X-SECTION SHOWING PRESSURE CELL
COMPONENTS INSTALLED

FIGURE 2.3

Mean Plate Pressure
vs.
TIME

Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03

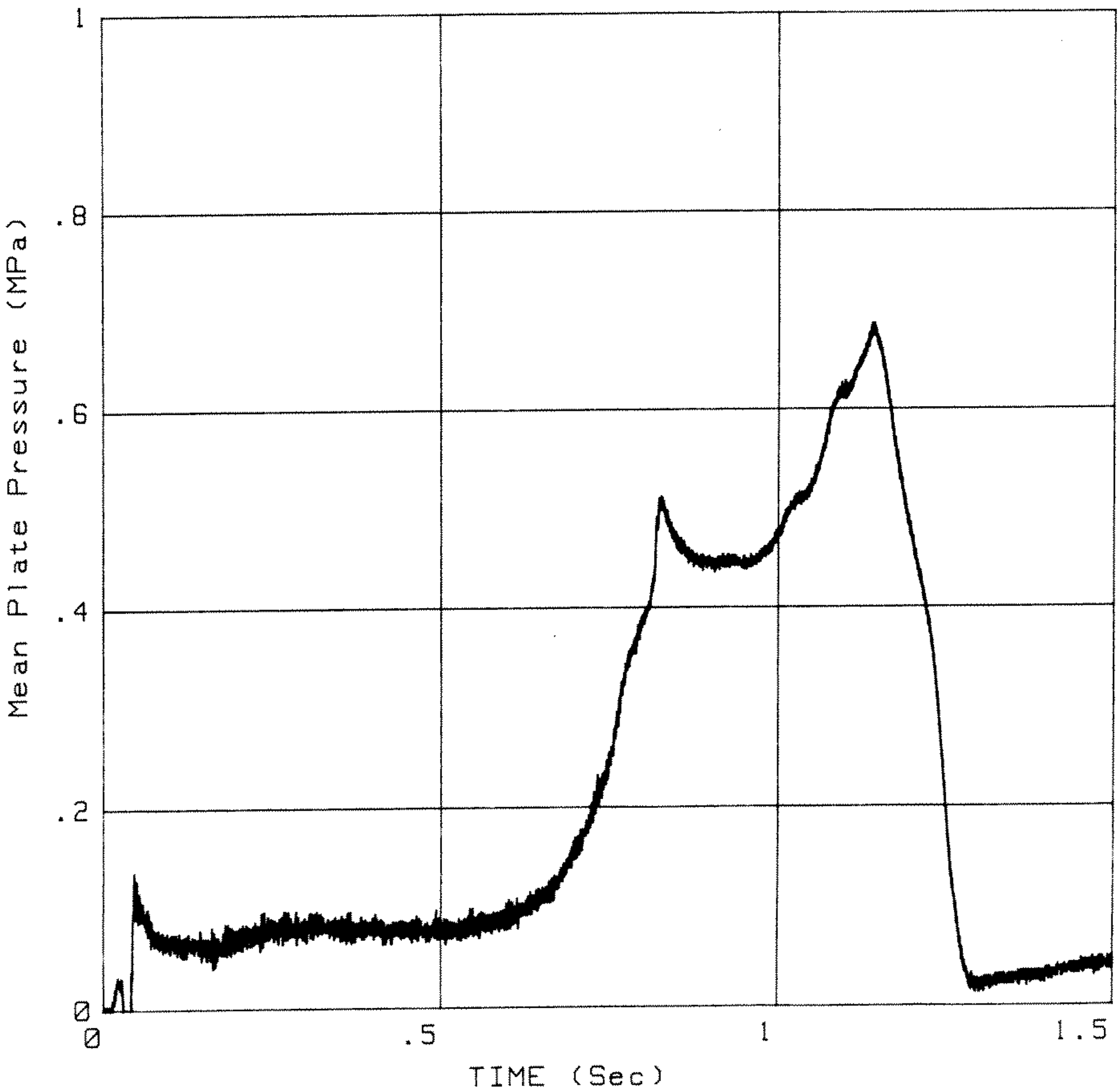


FIGURE 2.4

3 EXTRUSION TESTS

The major variables for the extrusion tests were: platten velocity, lower platten surface finish and the mean platten pressure at the end of the test. The test matrix is summarized in Table 3.1 which includes characteristic values of the experimentally controlled parameters. As indicated in Table 3.1, extrusion tests are tests x970 to x973 and x978 to x999. The interest in varying the platten velocity is due to that for a fluid model of the material, increasing the platten velocity would result in increased platten pressures. The interest in platten finish come about due to the assumption that there would be dissipative mechanisms, at the ice/platten interface as well as internally within the crushed ice layer. The reason for performing tests at different end points is the ability to then conduct a (destruction) density map of the material. Different mean pressures would correspond to different mean densities.

3.1 Servo Control

The upper limit of the mean platten pressure was set by a combination of various factors depending upon the particular test. For the tests, the servo-controller was in the "displacement feedback" mode of operation. In this mode the upper platten follows the prescribed displacement command signal. By adjusting the rate of change of the ramp command signal different platten velocities were achieved. The actual total load applied to the sample is thus, not a controlled quantity, the load being whatever is required to obtain the prescribed displacement.

The actual displacement can follow the prescribed displacement until the hydraulic capacity of the actuator is reached. At that point the machine has stalled and the forward motion of the plattens essentially stops. The total load, or mean platten pressure at this stall point is determined by the hydraulic oil working pressure for that particular test.

To stop the test at a mean platten pressure of less than the stall point, two different mechanisms can be used. The first one is to use the overload feature built into the servo-controller. When a particular load is reached, the platten is caused to retract by zeroing the command signal. Due to the finite response time of this overload detector, set to 50 m/s to avoid false retractions, and the finite response time of the servo-controller, about 10 mm., the actual peak load will be in excess of the set point overload. The actual amount of the overload will depend upon the effective stiffness of the crushed ice sample and the platten velocity. It was difficult to control the actual peak load at the high platten velocity to better than about 25%. This method did not work well at mean pressures of less than about 0.5 MPa due to small system transients and offsets.

The second method of limiting the maximum load is to limit the maximum displacement of the platten. This limit can be set by limiting the maximum value of the command signal. This method works if, from prior tests, the relationship between layer thickness and mean pressure is known. This method works well at platten pressures of less than about 1.0 MPa.

The method of limit control which was actually employed in a particular test can be determined by viewing the displacement time graphs. When the overload limit was reached the platten retracted immediately whereas when the displacement limit was reached the displacement remained at the set point. For a number of these type of tests the command signal was subsequently manually reset to zero thereby causing a retraction of the upper platten.

3.2 Data Aquisition System

The data acquisition system used a Hewlett Packard Series 300 computer with 2 Megabyte of memory. The analog to digital converter was an Infotek 200 A/D which had 16 channels of single ended input and a 12 bit resolution. The total sample rate was limited to 100 kHz and so for 16 channels of data the maximum sample rate was 6.25 kHz per channel. Each test consisted of collecting either 10,000 or 16,000 readings per channel. The software testing used in the program is provided in Appendix 2. There are two major programs, a data acquisition program and a data reduction and presentation program. The hardcopy data plots provided in Appendix 4 were generated by the "Analysis" program of Appendix 2.

Component specifications for the various sensors used in the project are provided in Appendix 8.

3.3 Crushed Ice Material

During the design phase of the project and particularly during the first participants meeting in November,1988, discussions were held on the appropriate size of the piece of ice and the distribution of sizes. The general consensus was that a distribution of grain sizes was required in order to obtain initial sample densities of about 550 kg/m^3 without performing considerable mechanical work on the sample. Secondly, another aspect of the work was the measurement of the density distribution of the sample at the end of the test and in obtaining information on the flow pattern of the ice.

To obtain reliable density information, the size of the grains should be much less than the overall dimension of the grid size of the density measurements. The target spatial resolution for the density measurement was a reading every 25 mm. The second aspect of flow visualization suggests that to obtain accurate flow patterns would require a grain size much less than the thickness of the crushed ice layer. For these tests, the layer thickness varied between about 100 mm. down to 10 mm. Both of these considerations indicate that grain sizes of less than about 1.0 mm. would be required.

For each extrusion test, approximately 22 kg of crushed ice was required to produce a layer 100mm. thick and with a target density of 550 kg/m^3. It was anticipated that, including initial system tests, about 40 tests would be conducted. Thus about 880 kg of crushed ice material would be required! In the test program conducted for Gulf [3], the crushed ice samples were manually prepared from blocks of solid ice using an electric planer and passed through a sieve. The rate of production of the crushed material by this method (about 1 kg/hr) indicated that such a method was not practical within the time and budgetary constraints of the current project.

Various methods of producing large quantities of the crushed ice of the required particle size were considered ranging from mechanical crushers to snow-making equipment. The final solution resulted from the realization that large quantities of finely crushed ice were produced as a by-product of smoothing the surface of the ice in hockey rinks. The manufacture of the crushed ice then consisted of coordinating the collection of the crushed ice with the schedule of the hockey rink. After collection, the bags of crushed ice were stored at -35^{o}C until used.

A sieve analysis was conducted on batch number 5 of the crushed ice material. The results were given in figure 3.1. As can be seen a distribution of particle sizes is evident with the mode of the distribution at about 0.85 mm. size. Also shown in figure 3.1 is a log-normal distribution curve fitted to the data. The fit appears to be good given the course scale of the measurements. As can be seen the majority of the crushed ice has particles less than about 1.0 mm. in size.

A log-normal distribution function is defined as [4]

$$P(x) = \frac{1}{\sqrt{2\pi S}} \exp - \frac{1}{2}\left(\frac{\log(x) - M}{S}\right)^2 \qquad (3.1)$$

where M and S are the mean and standard deviation of the log (x) distribution.

3.4 Preparation of Samples

A predetermined amount of crushed ice was weighed and mechanically separated to remove any lumps that were in the crushed material. The required weight was based on a sample thickness of 100 mm. and a target density of 550kg/m^3. It was then packed into the extrusion apparatus in layers of 25 to 30 mm. The layers were then hand tamped. During this process the ends of the extrusion chamber were temporarily blocked. The ends were then removed and the lower platten with the side plates slid into the test frame. Different tests used different batches of collected crushed ice, this is listed in Table 3.2. The cure time listed in Table 3.2 is the time between the finish of the sample preparation and the actual time of the test. The packing of the sample into the extrusion apparatus generally required 15 to 30 minutes.

3.5 Post Test Inspections

After the completion of the test the remaining crushed ice sample was sectioned into blocks approximately 25 by 50 mm. by the full ice thickness. The dimensions of the segments were recorded as was the weight of the sample. These measurements allowed the calculation of the mean sample thickness along with calculation of the local sample density. The results of these measurements are presented in tabular format and graphically in Appendix 3.

The sample was obtained from the parts of the sample indicated in figure 3.2. The general trends in the density data can be summarized as follows. Below a density of about 600 kg/m^3 density measurements were not available due to the crushed ice material still being a powder. At the center of the extrusion zone the crushed ice was fused into a cohesive material. The material was strong enough to be handled and could be cut with a bandsaw to produce the segments for weighing etc. The boundaries between the two types of ice was relatively sharp, its location depending upon the particular test conditions. In general the larger the mean platten pressure at the end of the test, the larger the zone of fused ice at the center of the apparatus.

The ice density decreased away from the centerline axis. The density was not uniform perpendicular to the extrusion axis, and was larger at the side walls than in the center. This presumably reflects the "edge effect" caused by the side walls of the extrusion apparatus. A review of the density data plots presented in Appendix 3 indicate that the "edge effect" extends inwards for about 100 mm.

The thickness data reveals a number of factors, firstly the upper and lower plattens are not perfectly parallel. Secondly there is greater variation in the thickness data for those tests which had a layer of ice on the lower platten. The nominal ice thickness was 2 - 3 mm. but local variations of +/- 1 mm. occur. An additional aspect is that the thickness data may be contaminated by elastic and delayed elastic creep of the crushed ice layer. For a number of tests the thickness appears to mimic the pressure distribution. On retraction of the upper platten, the ice layer would expand a distance depending on the local ice modulus and pressure levels. For example for a local pressure of 50 MPa, an ice modules of 1 GPa and a layer thickness of 25 mm. the elastic rebound would be 1.25 mm.

For the tests with the lower platten being ice, the ice layer was generally intact after the test. Furthermore, the crushed ice layer, even the fused layer could be removed from the lower ice layer. For some of the tests, at high local pressures, the lower ice layer was bonded to the crushed ice layer and caused some irregularities in the thickness data.

In many tests the maximum distance that the ice was ejected were recorded. From this data an estimate of the maximum extrusion velocity of this ejected material was made. The data given in Table 3.3. No allowance has been made for any air drag in these calculations. The theoretical maximum velocity has been calculated on the basis of the material flowing as a plug and using the minimum or final crushed ice layer thickness. No compaction of ice material was allowed for. As can be seen the maximum observed distance is generally in excess of the theoretical maximum. Note however that in most tests there was a pronounced pulsation to the ice ejection and a pronounced pulse waveform in the electronically recorded waveforms.

For a number of tests, thin sections were obtained from the remaining material. These thin section photographs are useful in indicating the grain size and shape of the material after the test. For reference, the thin section photographs are given in Appendix 5.

3.6 Platten Surface Finish

The upper platten was machined and zinc coated. The lower platten for the steel tests was bare steel which had been sand blasted to remove the zinc coating. For the tests using ice as the lower platten enough water was poured on to create an ice layer 2 to 3 mm. in thickness. The water was cooled to approximately 0°C before pouring onto the platten which was at -10°C. The water froze in less than one minute. No attempts were made to modify or smooth the resulting ice surface.

TABLE 3.1

TEST MATRIX FOR PLATTEN TESTS

Test Number	Test Type	Speed (mm./s)	Lower Platten	Initial Thickness (mm.)	Final Thickness (mm.)	Maximum Platten Pressure (MPa)
x999	Extrusion	25.0	Steel	130	20.0	10.0
x998	Extrusion	5.0	Steel	130	25.2	10.0
x997	Extrusion	125.0	Steel	100	31.6	0.7
x996	Extrusion	160.0	Steel	100	10.2	7.6
x995	Extrusion	125.0	Steel	100	27.8	0.5
x994	Extrusion	125.0	Steel	100	26.6	0.7
x993	Extrusion	125.0	Steel	100	19.8	4.8
x992	Extrusion	125.0	Steel	100	27.0	1.6
x991	Extrusion	25.0	Steel	100	23.8	3.1
x990	Extrusion	25.0	Steel	100	25.3	1.7
x989	Extrusion	25.0	Steel	100	23.1	3.0
x988	Extrusion	25.0	Steel	100	23.9	2.0
x987	Extrusion	2.5	Steel	100	23.8	8.9
x986	Extrusion	2.5	Steel	100	31.3	1.9
x985	Extrusion	2.5	Steel	100	27.8	4.1
x984	Extrusion	60.0	Steel	100	11.4	11.1
x983	Extrusion	125.0	Steel	50	10.2	11.7
x982	Extrusion	125.0	Ice	100	10.5	11.2
x981	Extrusion	125.0	Ice	100	11.2	11.6
x980	Extrusion	25.0	Ice	100	18.5	10.1
x979	Extrusion	25.0	Ice	100	17.3	10.0
x978	Extrusion	25.0	Ice	100	21.4	10.0
x977	Compaction	25.0	Steel	100	67.0	9.6
x976	Compaction	125.0	Steel	100	69.3	11.1
x975	Compaction	2.5	Steel	100	68.4	9.8
x974	Compaction	25.0	Steel	150	103.4	10.0
x973	Extrusion	125.0	Ice	100	16.1	4.2
x972	Extrusion	125.0	Ice	100	21.0	1.0
x971	Extrusion	25.0	Ice	100	19.4	2.6
x970	Extrusion	25.0	Ice	100	41.8	0.9
x967	Flow vis.	125.0	Steel	100	43.5	0.1
x966	Flow vis.	2.5	Steel	100	50.0	0.4
x965	Flow vis.	125.0	Ice	100	56.0	0.1
x964	Flow vis.	25.0	Ice	100	50.5	0.1
x963	Flow vis.	2.5	Ice	100	48.7	1.5
x962	Flow vis.	125.0	Steel	100	50.9	0.1

TABLE 3.2

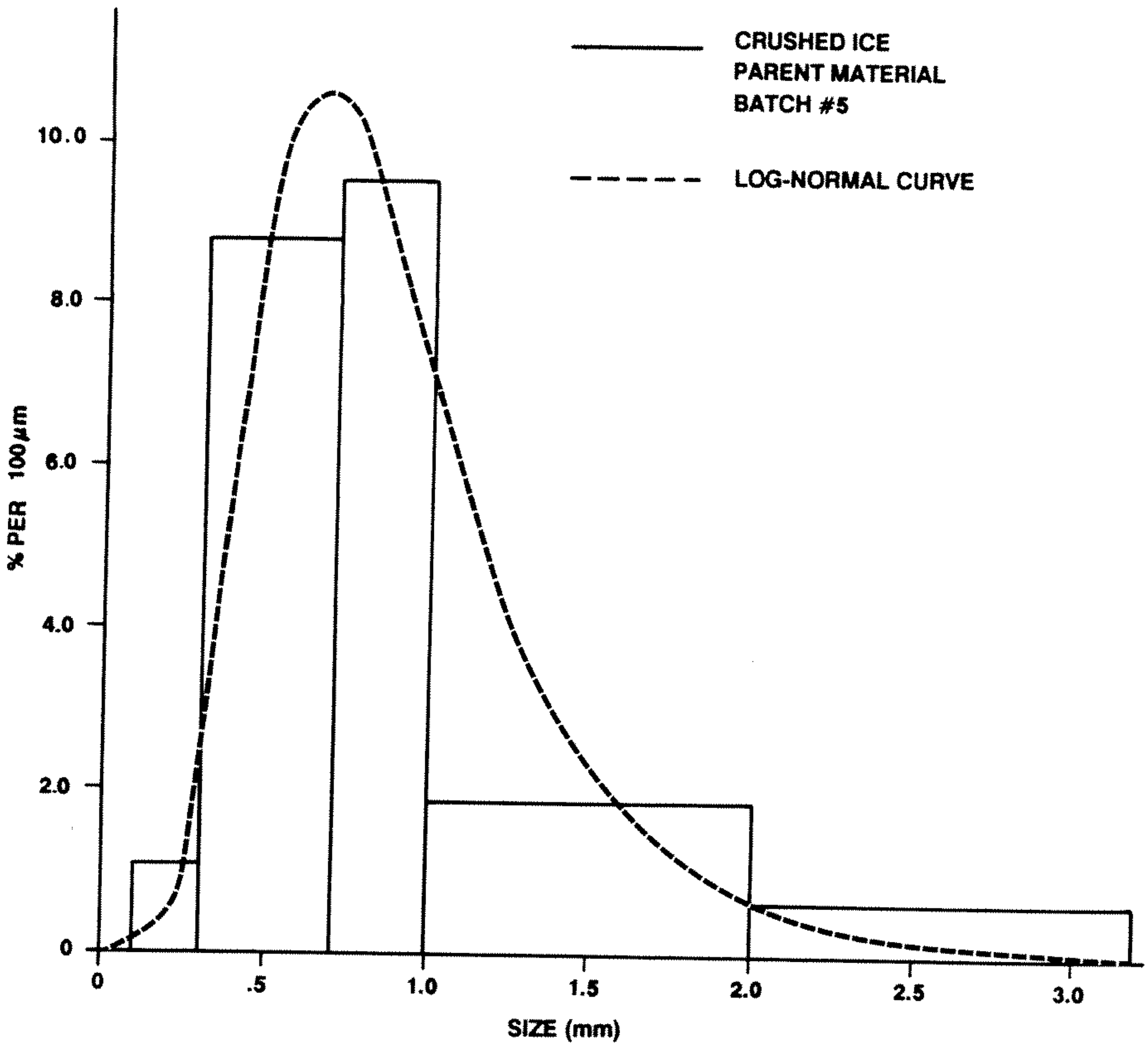
BATCHES OF CRUSHED ICE AND CURE TIME

TEST	ICE BATCH	CURE TIME (hr.)	TEST DATE
x999	1	0:30	29 Nov 88
x998	1	0:30	1 Dec 88
x997	1	0:30	5 Dec 88
x996	1	0:45	7 Dec 88
x995	1	2:00	9 Dec 88
x994	2	2:30	12 Dec 88
x993	2	1:00	13 Dec 88
x992	2	1:15	13 Dec 88
x991	2	0:30	14 Dec 88
x990	2	1:30	14 Dec 88
x989	2	0:15	14 Dec 88
x988	2	2:45	15 Dec 88
x987	2	0:15	15 Dec 88
x986	2	3:00	16 Dec 88
x985	2	0:30	16 Dec 88
x984	2	1:45	19 Dec 88
x983	2	0:30	19 Dec 88
x982	3	0:30	20 Dec 88
x981	3	1:15	20 Dec 88
x980	3	0:45	21 Dec 88
x979	3	0:30	21 Dec 88
x978	3	0:15	22 Dec 88
x977	3	1:00	16 Jan 89
x976	3	0:30	17 Jan 89
x975	3	1:00	18 Jan 89
x974	3	1:00	18 Jan 89
x973	5	0:30	30 Jan 89
x972	5	1:00	27 Jan 89
x971	5	0:15	27 Jan 89
x970	5	0:30	26 Jan 89
x967	3	0:15	19 Jan 89
x966	4	2:45	23 Jan 89
x965	4	0:30	23 Jan 89
x964	4	0:15	24 Jan 89
x963	4	0:15	24 Jan 89
x962	4	0:30	25 Jan 89

TABLE 3.3

MAXIMUM EJECTION VELOCITIES

TEST NUMBER	PLATTEN SPEED (mm./s)	THEORETICAL MAXIMUM EJECTION SPEED (mm./s)	EJECTION SPEED OBSERVED (mm./s)
x997	125	1.51×10^3	6.1×10^3(max)
x996	160	5.98×10^3	7.5×10^3(max)
x995	125	1.71×10^3	3.1×10^3(max)
x994	125	1.75×10^3	3.1×10^3(max)
x982	125	4.54×10^3	9.7×10^3(max)
x981	125	4.25×10^3	10.4×10^3(max)
x979	25	0.55×10^3	4.4×10^3(max)
x967	125	1.08×10^3	2.3×10^3(max)
x965	125	0.85×10^3	2.9×10^3(max)
x964	25	0.18×10^3	1.5×10^3(max)
x962	125	0.93×10^3	2.6×10^3(max)
x970	25	0.23×10^3	0.3×10^3(mode) 1.0×10^3(max)
x971	25	0.50×10^3	0.5×10^3(mode) 2.1×10^3(max)
x972	125	2.27×10^3	1.4×10^3(mode) 3.9×10^3(max)
x973	125	2.98×10^3	4.9×10^3(max)



SIEVE ANALYSIS OF CRUSHED ICE MATERIAL

FIGURE 3.1

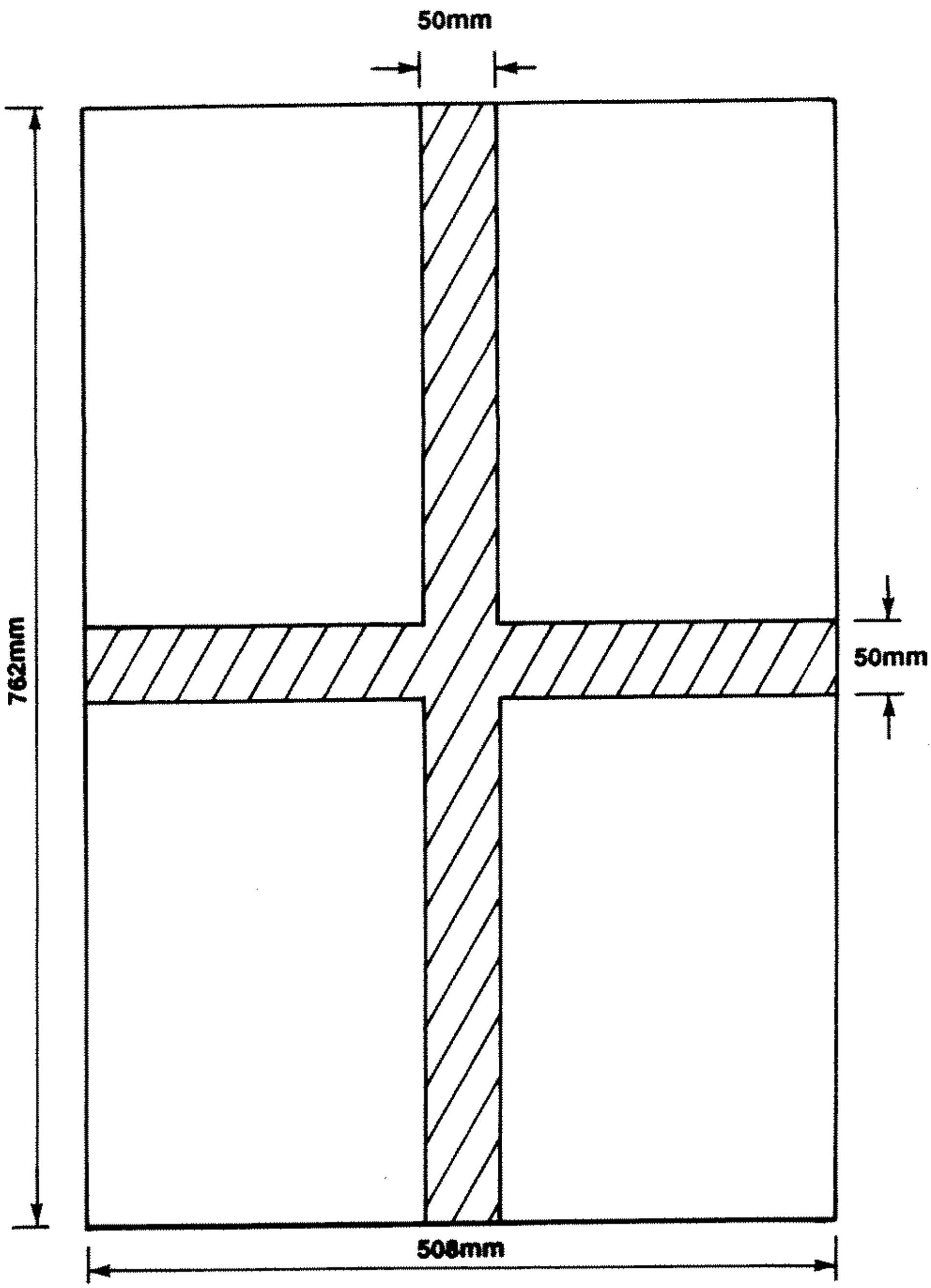


FIGURE 3.1

AREA OF SAMPLE USED IN DENSITY MEASUREMENTS

FIGURE 3.2

4 TRENDS IN EXTRUSION DATA

4.1 Initial and Final Pressures

Because of the difficulty in interpretation caused by the compaction of the material, attempts were made to look for any connection between <u>initial</u> extrusion pressures and platten velocity. The initial pressure is the pressure when the upper platten first comes into full contact with the crushed ice layer. As measures of the pressure, the initial pressure from pressure cell number 8 and cell number 12 were used. As shown in figure 2.2 cell number 8 is in the center of the platten and cell number 12 is adjacent to the free edge. The initial pressures are listed in Table 4.1. The ch 8 data are plotted as a function of platten speed in figure 4.1 and the ch 12 data in figure 4.2. There is not a clear unambiguous relationship between the two variables. As initial pressures may reflect the amount of scintering that has occurred within the sample after packing the initial pressures are shown plotted as a function of cure time, (listed in Table 3.2), in figure 4.3 and 4.4. The data for ch 8 appears to indicate a relationship between cure time and initial pressure. In this figure are highlighted data points collected at 125 mm./s and 25 mm./s. The trend line for these two sets of data points suggest that the pressures at 125 mm./s are greater than those at 25 mm./s.

The initial pressure data for channel 12, near the edge of the extrusion apparatus is less clear. No relationship is discernible. Note however that for the ch 12 data, the pressures are less than about 0.2% of the full scale range of the transducer. Furthermore for channel 12, a pressure of 0.01 MPa corresponds to a load of about 4 Newtons on the face of the piston. At such low force levels frictional forces in the piston seating may not be negligible. For the pressure transducer #8 while the pressures are still only about 0.2% of the full scale of the transducer, the force levels on the piston are about a factor of five larger than for transducer #12. Thus the frictional aspects are expected to be less significant for transducer number 12 than for transducer number 8.

The final pressure data was investigated by plotting the final layer thickness as a function of speed for the stall tests, the data values are contained in Table 3.1. For the stall tests the mean platten pressure was greater than 9.0 MPa. As can be seen from figure 4.5 there is evidence for an inverse relationship between final thickness and speed. As the speed increases, the final layer thickness decreases. There is not any obvious difference between data collected with steel plattens or ice plattens. The same final thickness data are plotted as a function of cure time in figure 4.6. There does not appear to be any obvious trend or relationship between the final thickness and the sample cure time.

4.2 Pressure as a Function of Layer Thickness

The general trends are that the mean and local pressures remain small for most of the extrusion and increase rapidly at the smaller thickness. An example of such data is shown for test x971 in figure 4.7. The figure shows a cross plot of mean plate pressure against layer thickness. The same data are shown on a log-log plot in figure 4.8. Below about a pressure of 0.01 MPa, the effect of noise becomes serious. However, as can be seen the data is reasonably represented by a straight line with a slope of about -6. The straight line is consistent with a power law relationship between mean pressure and layer thickness. Data for local pressure cells #8 and #10 are shown in a log-log format in figures 4.9 and 4.10. The data for cell number 8 appears to have two straight line segments. The slope of the upper pressure segment appears to be the same as for the mean plate pressure. The data for pressure cell number 10 also appears to have the same slope as for the mean plate pressure data. Again in this last figure, the pressures of less than about .005 MPa are severely affected by noise.

4.3 Pressure Distribution

One major aspect of the test program was the determination of the <u>shape</u> of the pressure distribution along the extrusion axis. The trend is that the pressure distribution is strongly peaked towards the center of the extrusion zone. The pressures along the axis perpendicular to the extrusion axis was not uniform and are significantly greater towards the sides of the zone. These general features are similar to the density distribution indicated earlier in section 3.4.

Examples of the pressure distribution along the extrusion axis are given in figures 4.11 and 4.12 for low and high mean plate pressures. Preliminary analysis indicate that towards the outside of the extrusion zone the pressure can be represented by an exponential function of distance. Towards the center and for local pressure greater than about 0.5 to 1.0 MPa the curve does not increase as fast as an exponential function.

4.4 Time Series Data

The platten or local pressure data do not always show a smooth monotonically increasing rise of pressure with time. The usual time series data contain large excursions about the generally increasing pressure data. The following characteristics have been noted:

- The shape is generally a "sawtooth" with a slow rise and a rapid drop.
- The waveshapes recorded by the local pressure cells are approximately in phase with each other.
- The waveshapes recorded by the local pressure cells are

approximately in phase with the platten pressure.

- The "sawtooth" waveshape occurs at pressures greater than about 0.5 MPa.
- As the pressure level increases the amplitude of the "sawtooth" increases.
- The minimum value of the "sawtooth" waveform is greater than zero.
- The frequency of the sawtooth depends upon the platten speed.

As an example are shown data from test x981 for the platten pressure, ch #8, ch #10, ch #12 and ch #16 in figures 4.13 to 4.17 respectively.

The data are further expanded in figures 4.18 to 4.22 which shows a 40 ms segment of the data for the platten pressure and pressure cells 8, 10, 12 and 16. For these particular tests the sampling rate per channel is in excess of 6 kHz which corresponds to 240 data points in the time window indicated. A number of characteristics become evident by inspecting the data at high time resolution. The waveshape of the various signals are significantly different while the mean plate pressure approximates the sawtooth waveform. The data from cells #8 and #16 are peaked showing a waveform the slope of which increases with time. Comparing data from #8 and #12 shows that the rapid drop in pressure at the center of the extrusion zone has been transferred into a rapid rise near the edge. There is also a time delay between ch 12 and ch 8 data. A possible explanation is that the material in the highly stressed central region fails resulting in an outward flow of material. This outward flow results in a pressure increase at the location of cell number 12. The data from pressure cell #10 is complex and intermediate in shape between that of #8 and #12. Comparing #8 with #16 indicates a slight phase shift amounting to about 0.6 ms between the two signals. This small time interval is however approaching the time resolution of the data set. Comparing the individual channels with the mean plate pressure strongly suggests that the pressure transducers are responding to the rapidly varying loads generated within the ice.

TABLE 4.1

INITIAL EXTRUSION PRESSURES

TEST	ch 12(MPa)	ch 8 (MPa)
X999	-	-
X998	-	-
X997	0.004	0.21
X996	0.010	0.18
X995	0.003	0.15
X994	0.0008	0.23
X993	0.0015	0.12
X992	0.006	0.08
X991	0.002	0.03
X990	0.002	0.10
X989	0.001	0.03
X988	0.003	0.03
X987	0.0015	0.06
X986	0.014	0.08
X985	0.007	0.12
X984	0.019	0.12
X983	0.002	0.15
X982	0.001	0.05
X981	0.001	0.07
X980	-	-
X979	-	-
X978	-	-
X973	0.012	0.12
X972	0.009	0.09
X971	0.004	0.04
X970	0.010	0.10
X967	0.004	0.015
X966	0.014	0.019
X965	0.007	0.09
X964	0.003	0.11
X963	0.013	0.06
X962	0.014	0.09

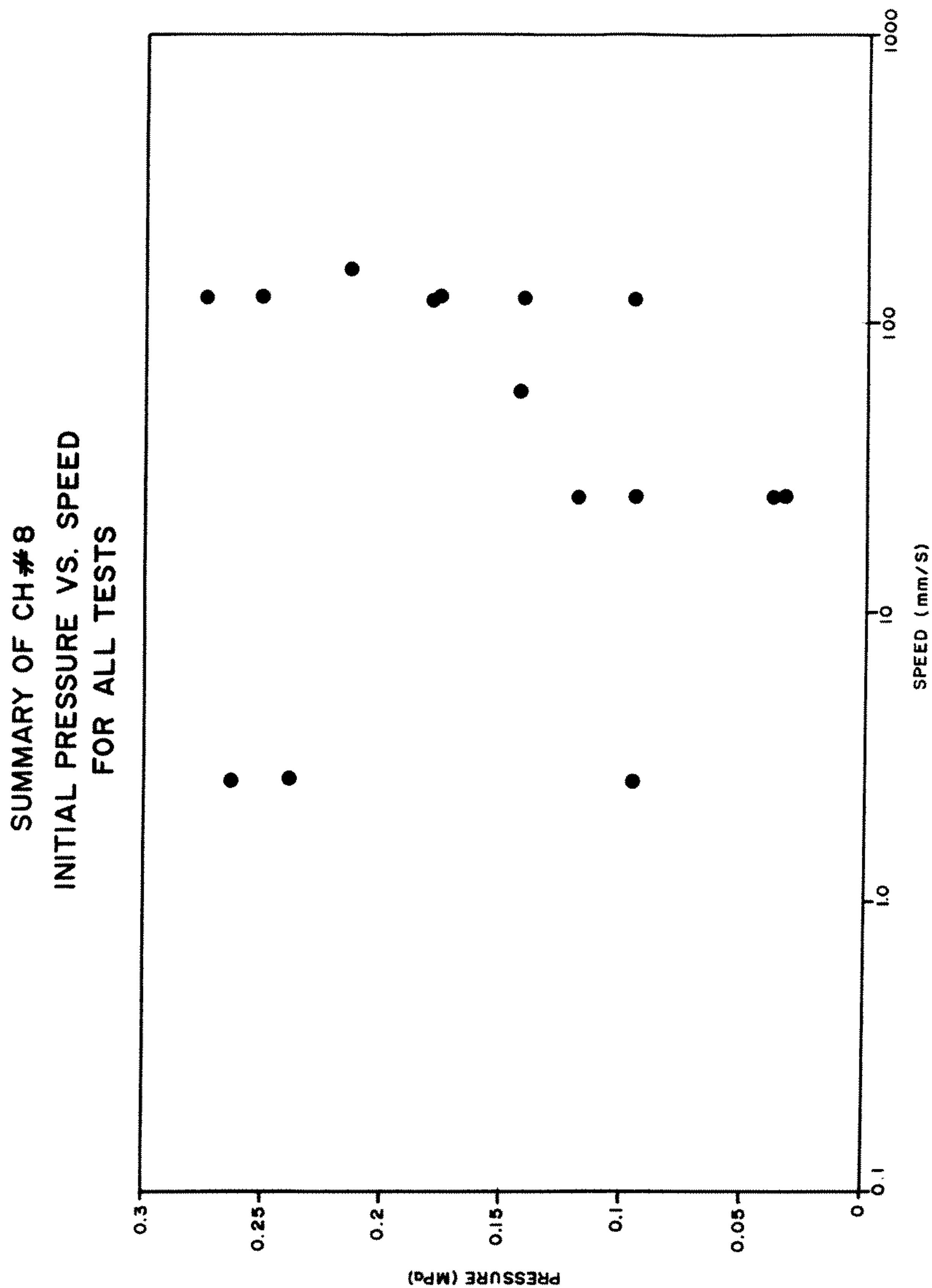

SUMMARY OF CH #8
INITIAL PRESSURE VS. SPEED
FOR ALL TESTS
PRESSURE (MPa)
0
0.05
0.1
0.15
0.2
0.25
0.3
SPEED (mm/S)
0.1
1.0
10
100
1000

FIGURE 4.1

SUMMARY OF CH #12
INITIAL PRESSURE VS. SPEED
FOR ALL TESTS

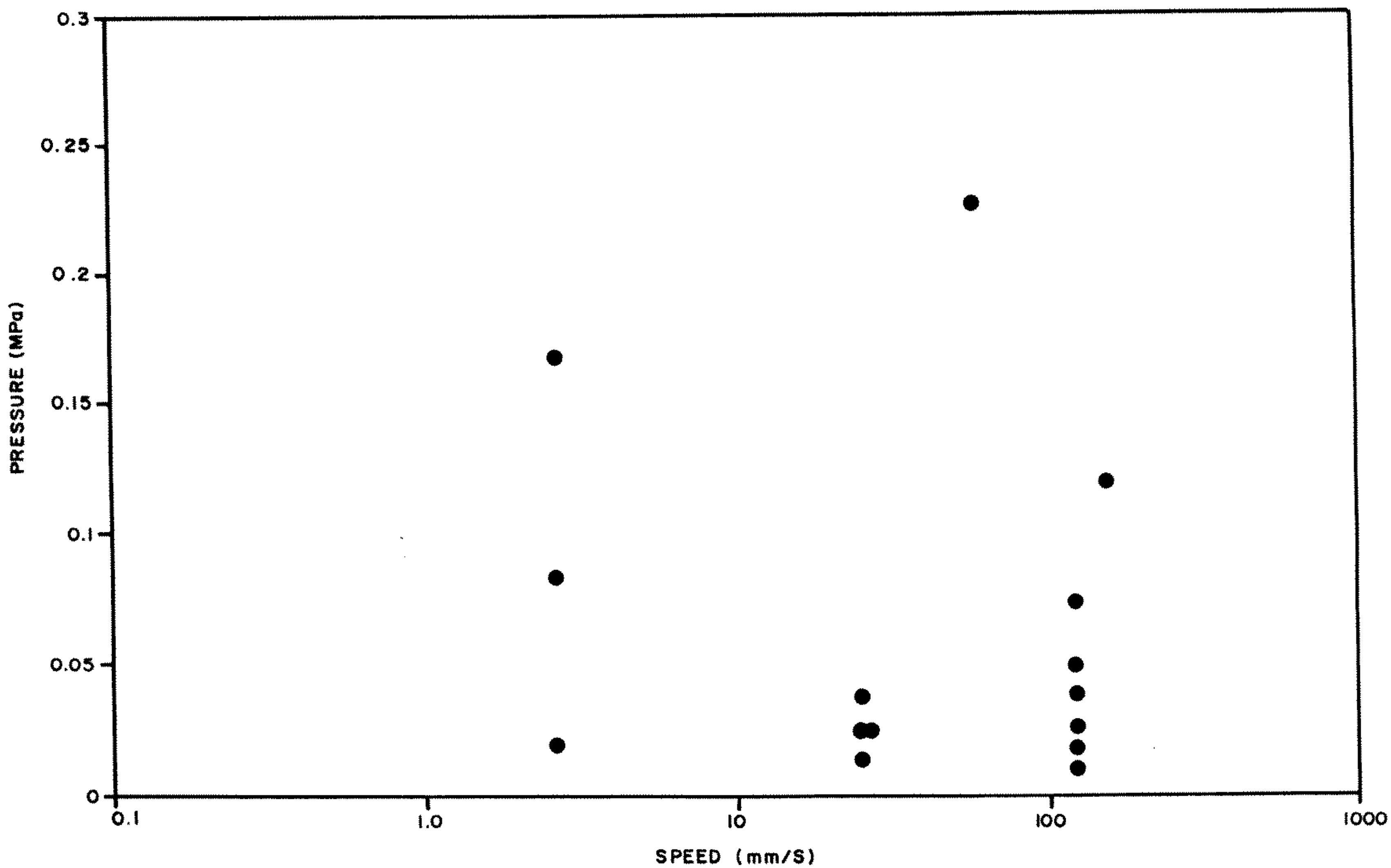
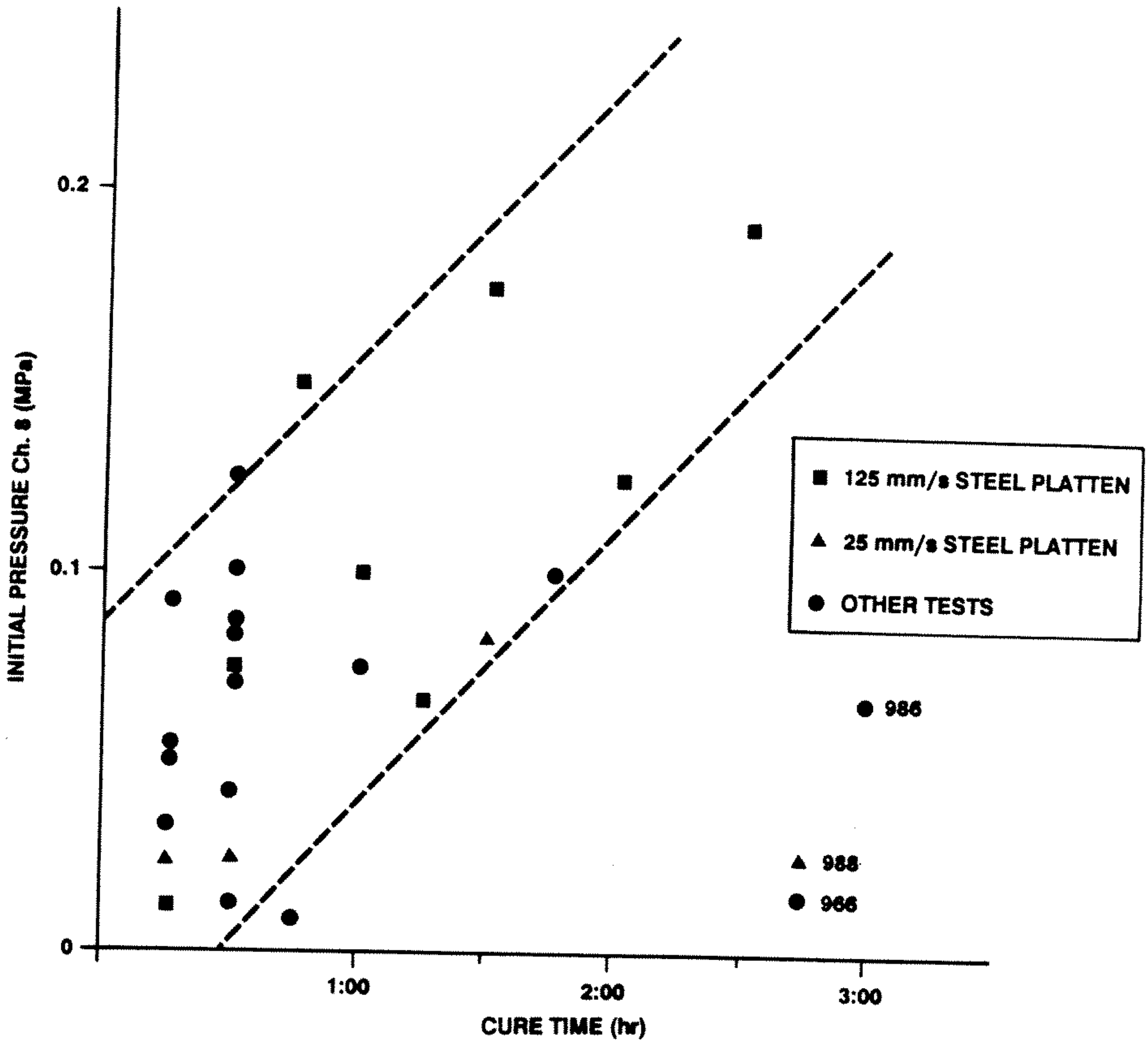
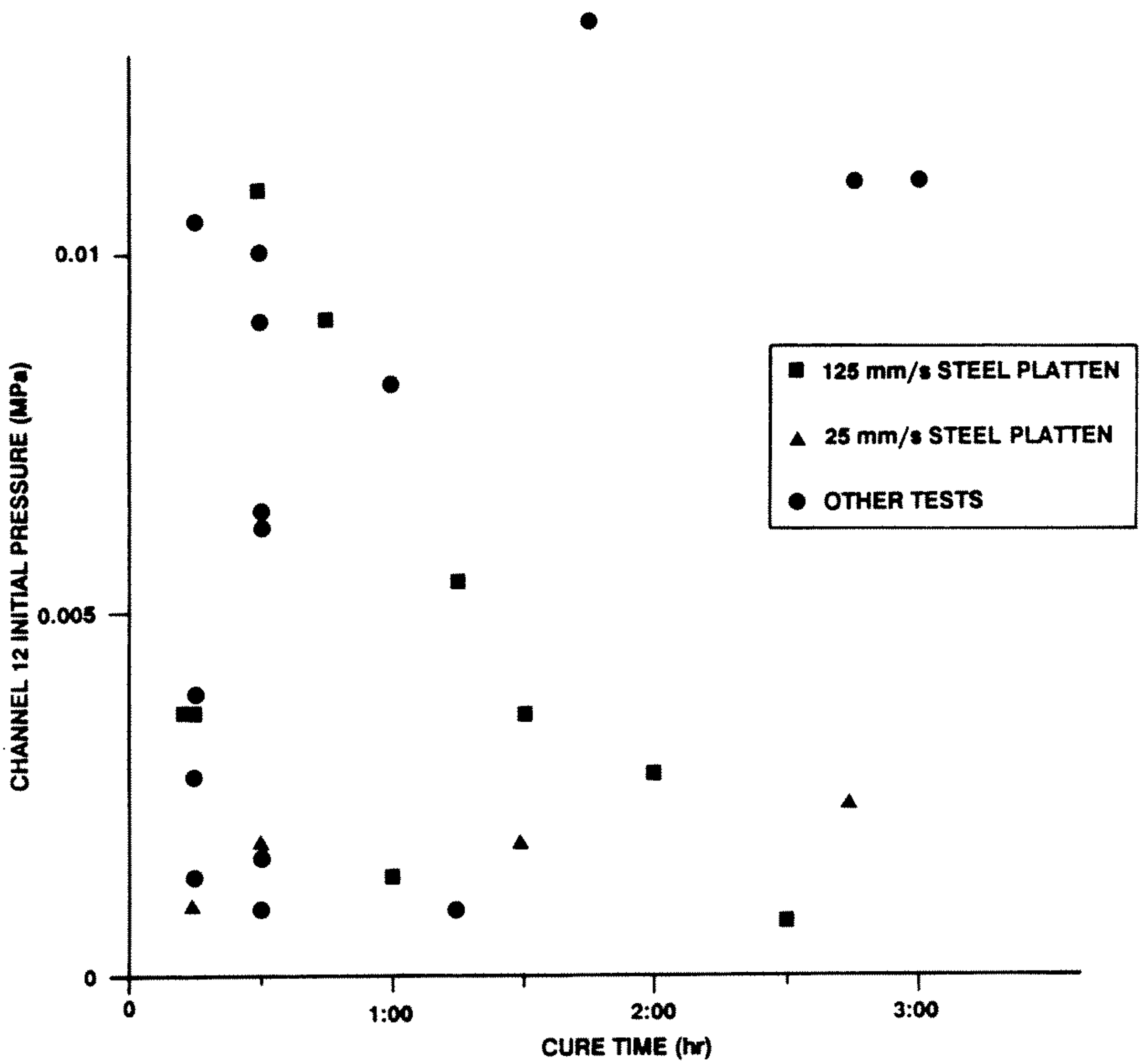


FIGURE 4.2



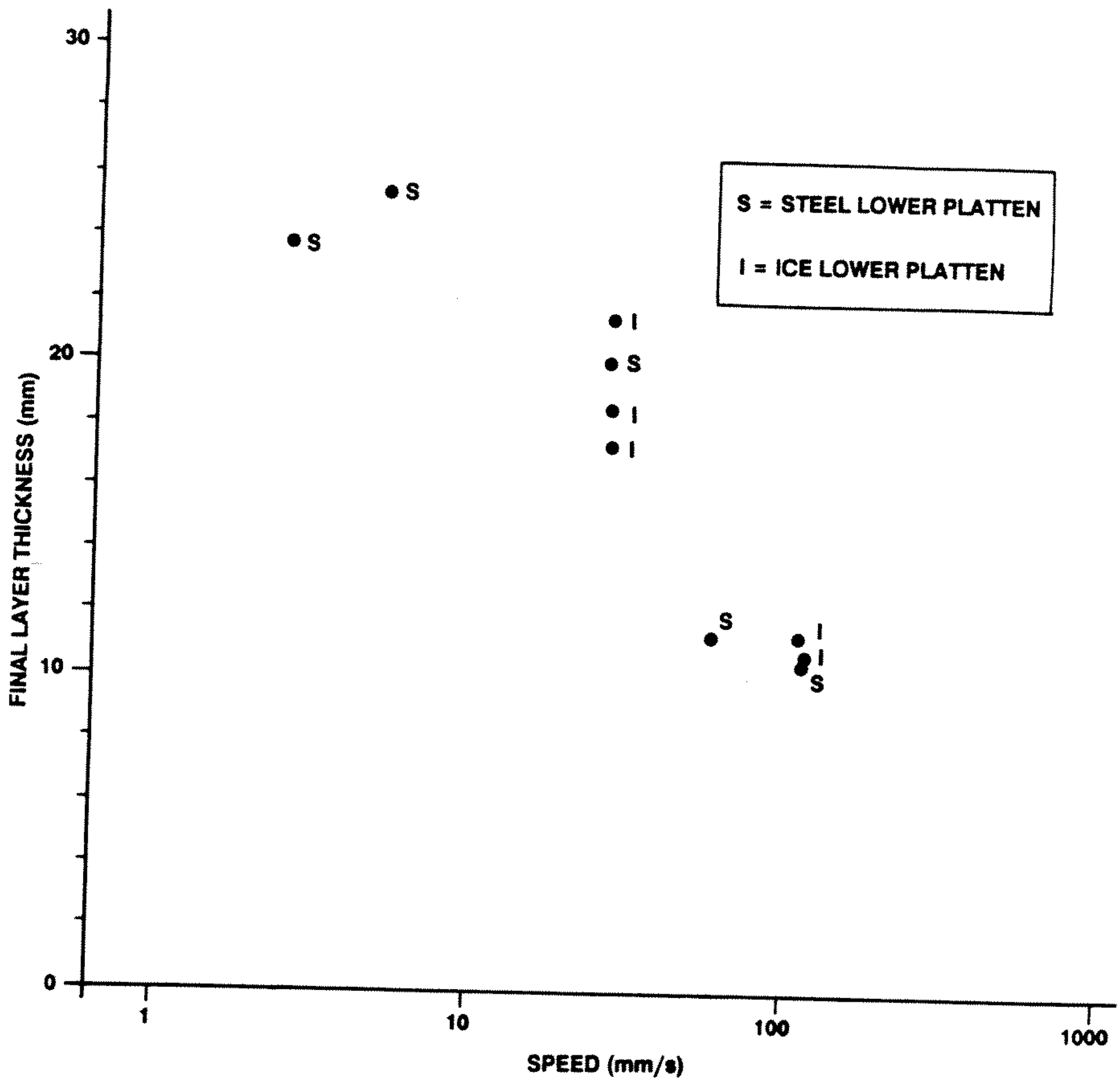
CHANNEL 8 INITIAL PRESSURE AS A FUNCTION OF CURE TIME

FIGURE 4.3



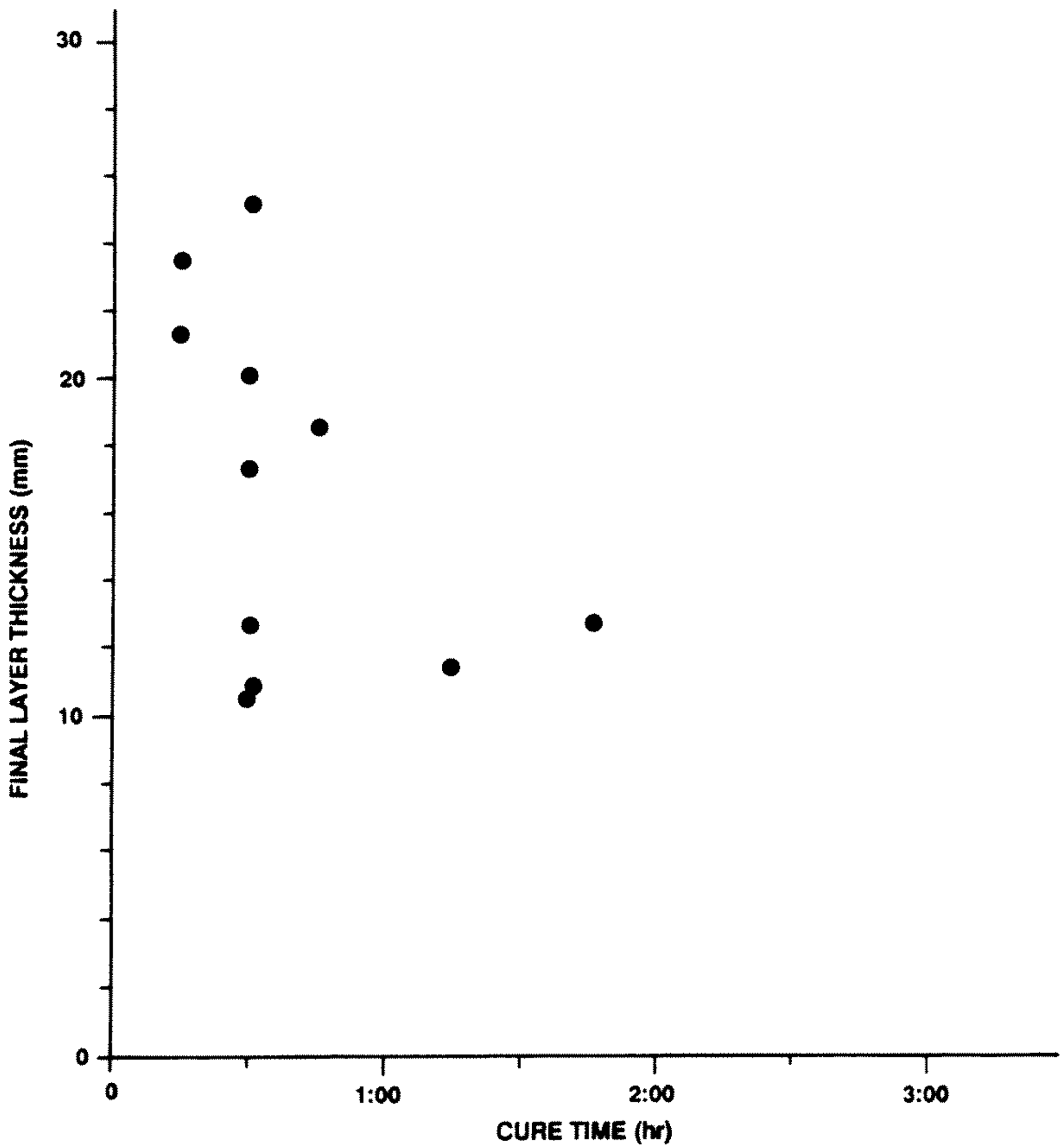
CHANNEL 12 INITIAL PRESSURE AS A FUNCTION OF CURE TIME

FIGURE 4.4



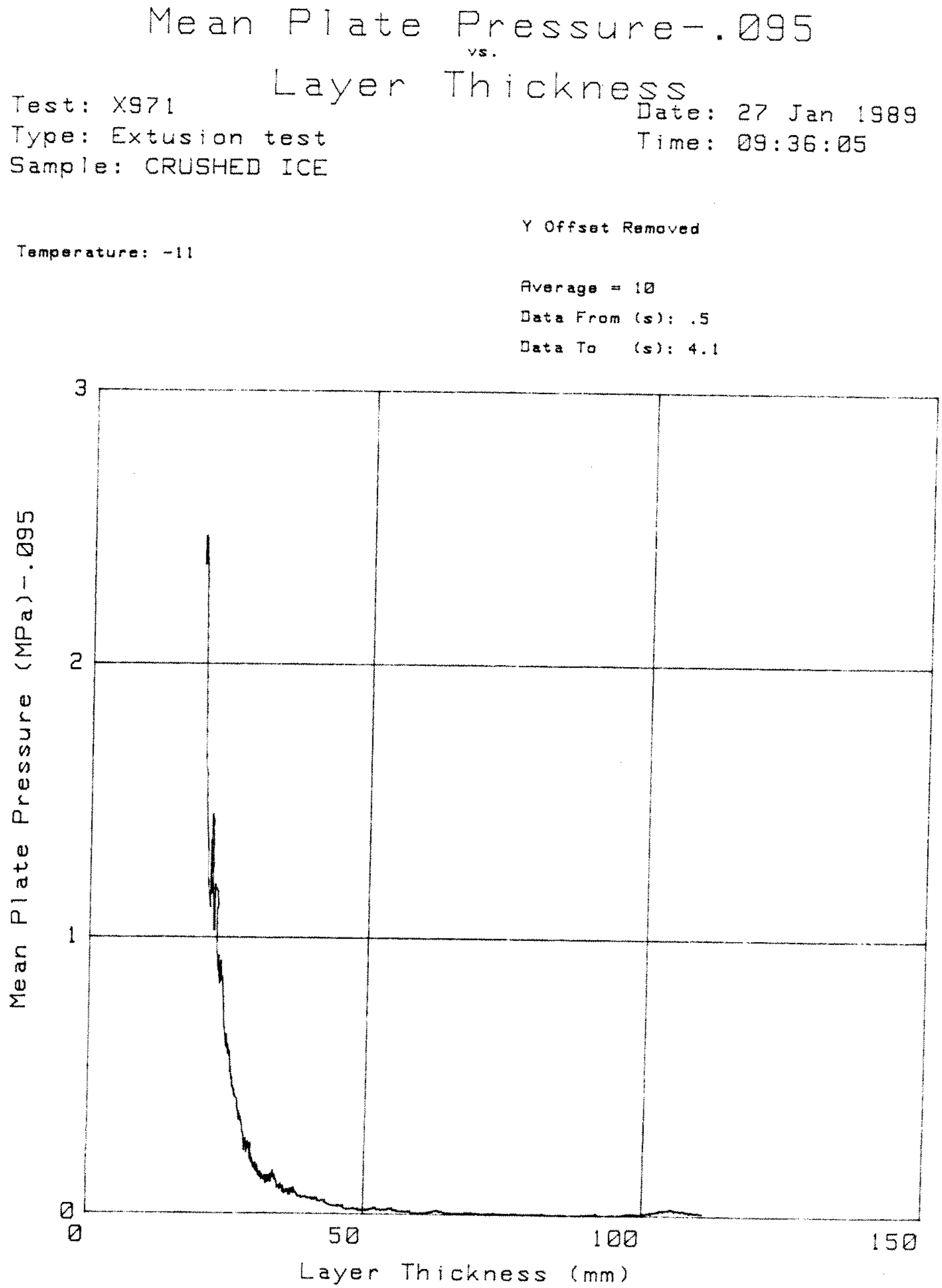
FINAL LAYER THICKNESS FOR TESTS WITH FINAL PRESSURE GREATER THAN 9 MPa AS A FUNCTION OF PLATTEN SPEED

FIGURE 4.5



FINAL LAYER THICKNESS FOR STALL TESTS AS A FUNCTION OF SAMPLE CURE TIME

FIGURE 4.6



Mean Plate Pressure-.095
vs.
Layer Thickness
Test: X971
Type: Extusion test
Sample: CRUSHED ICE
Date: 27 Jan 1989
Time: 09:36:05
Y Offset Removed
Temperature: -11
Average = 10
Data From (s): .5
Data To (s): 4.1
Mean Plate Pressure (MPa)-.095
Layer Thickness (mm)
0
1
2
3
0
50
100
150

FIGURE 4.7

LOG10(Mean Plate Pressure-.095)
vs.
LOG10(Layer Thickness)

Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 10
Data From (s): .5
Data To (s): 4.1

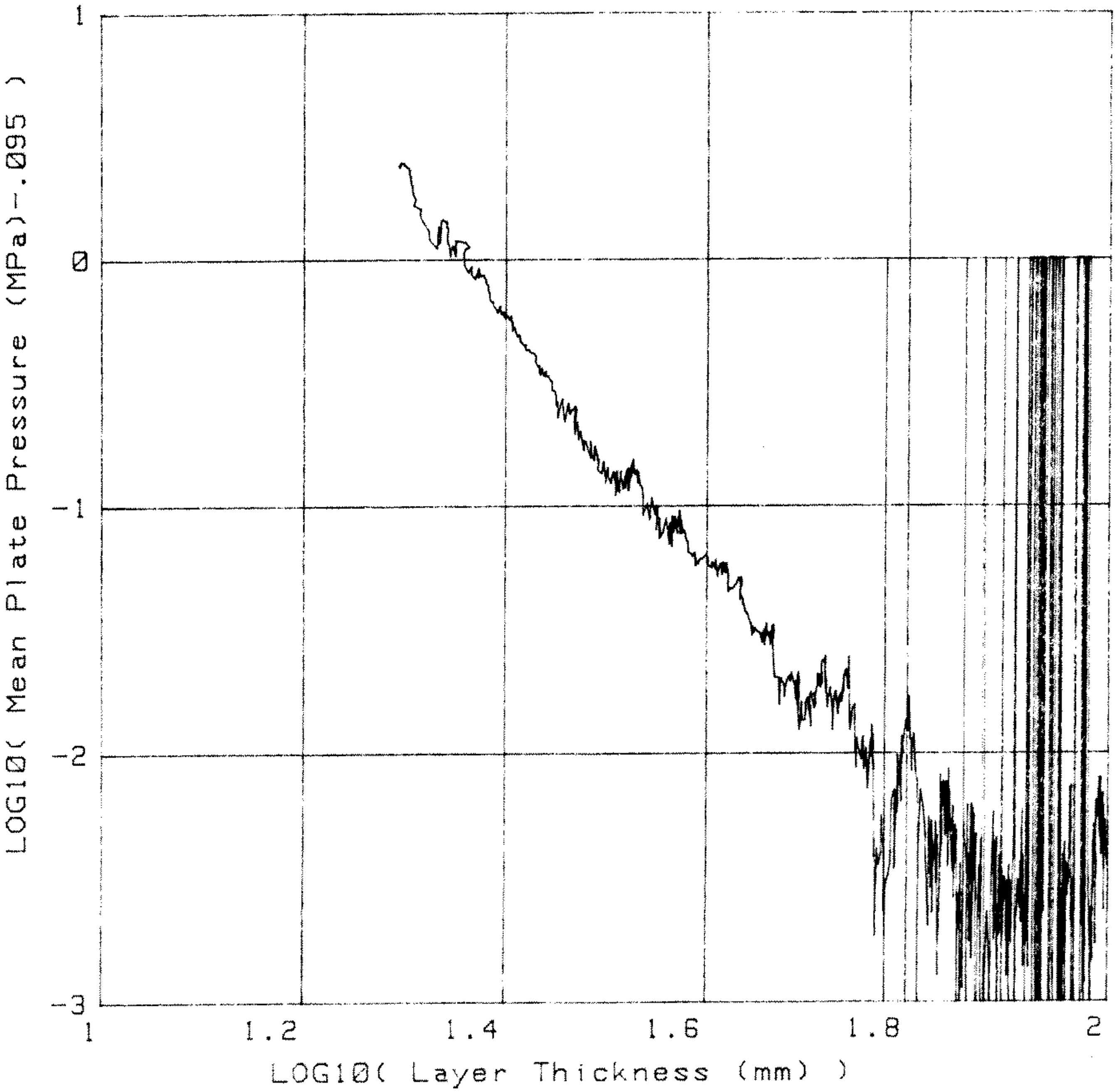


FIGURE 4.8

LOG10(Local Pressure #8)
vs.
LOG10(Layer Thickness)

Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Temperature: -11

Y Offset Removed

Average = 10
Data From (s): .5
Data To (s): 4.1

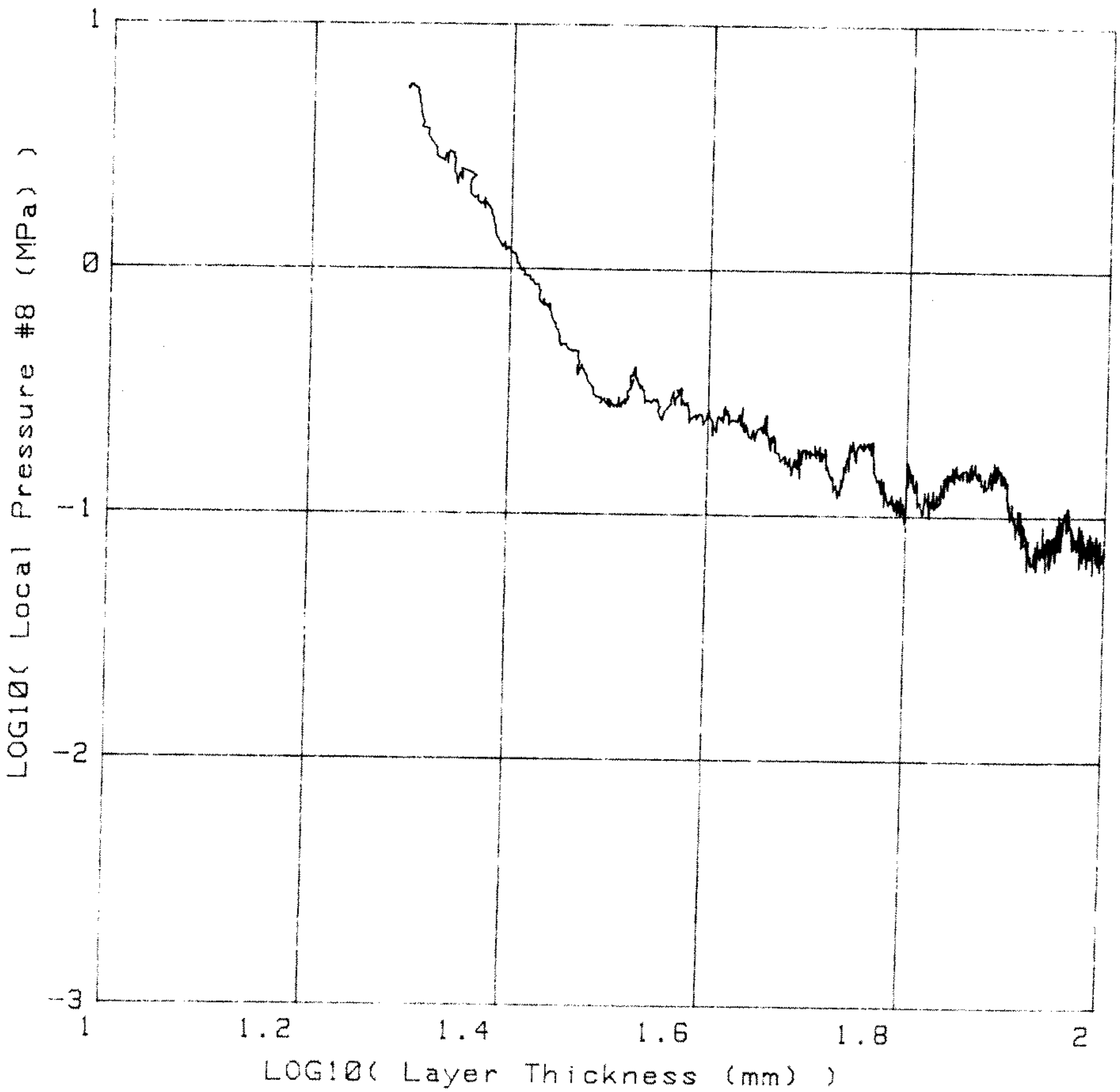


FIGURE 4.9

LOG10(Local Pressure #10)
vs.
LOG10(Layer Thickness)

Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 10
Data From (s): .5
Data To (s): 4.1

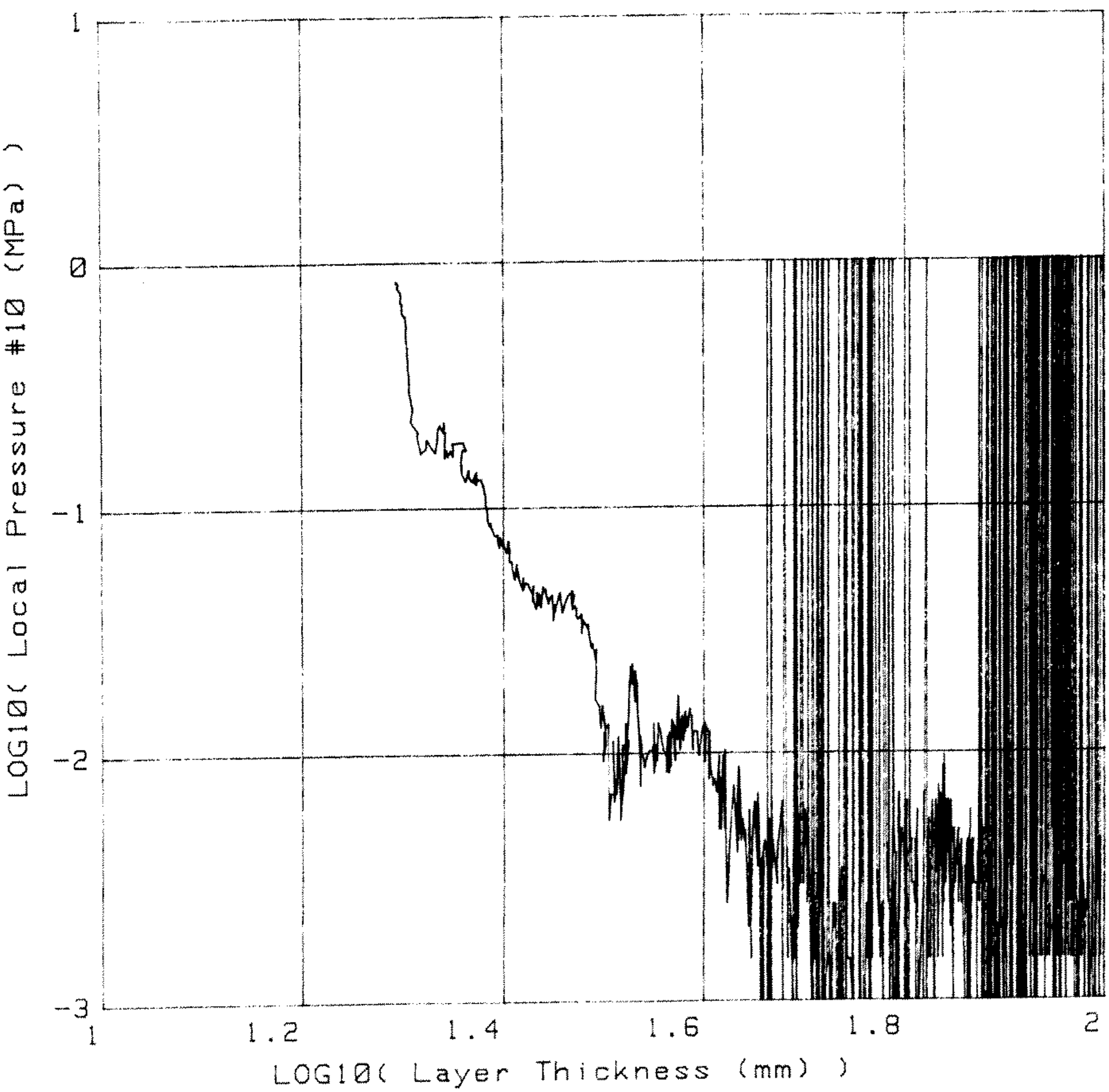


FIGURE 4.10

VARIATION OF PRESSURE WITH DISTANCE ALONG EXTRUSION AXIS

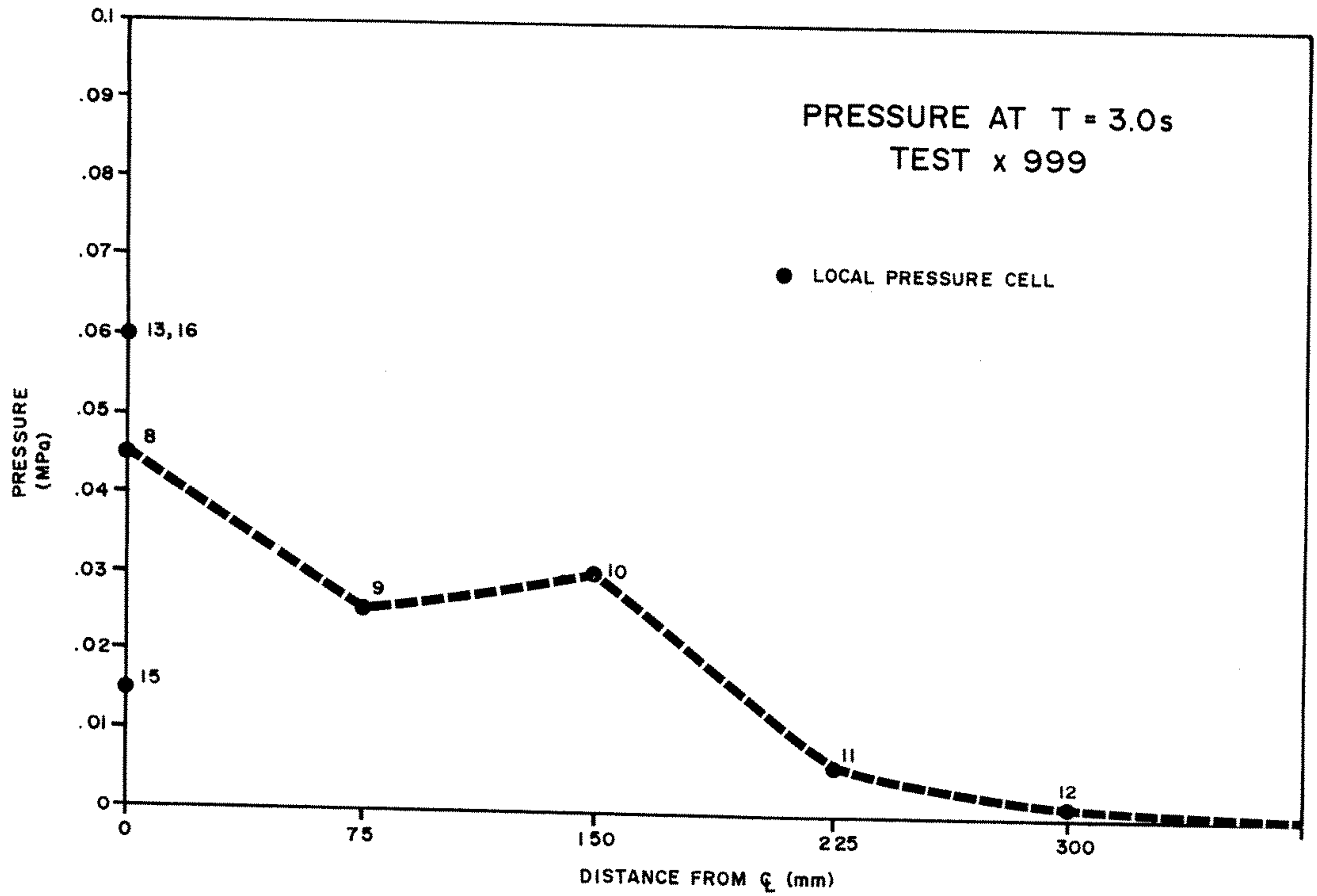
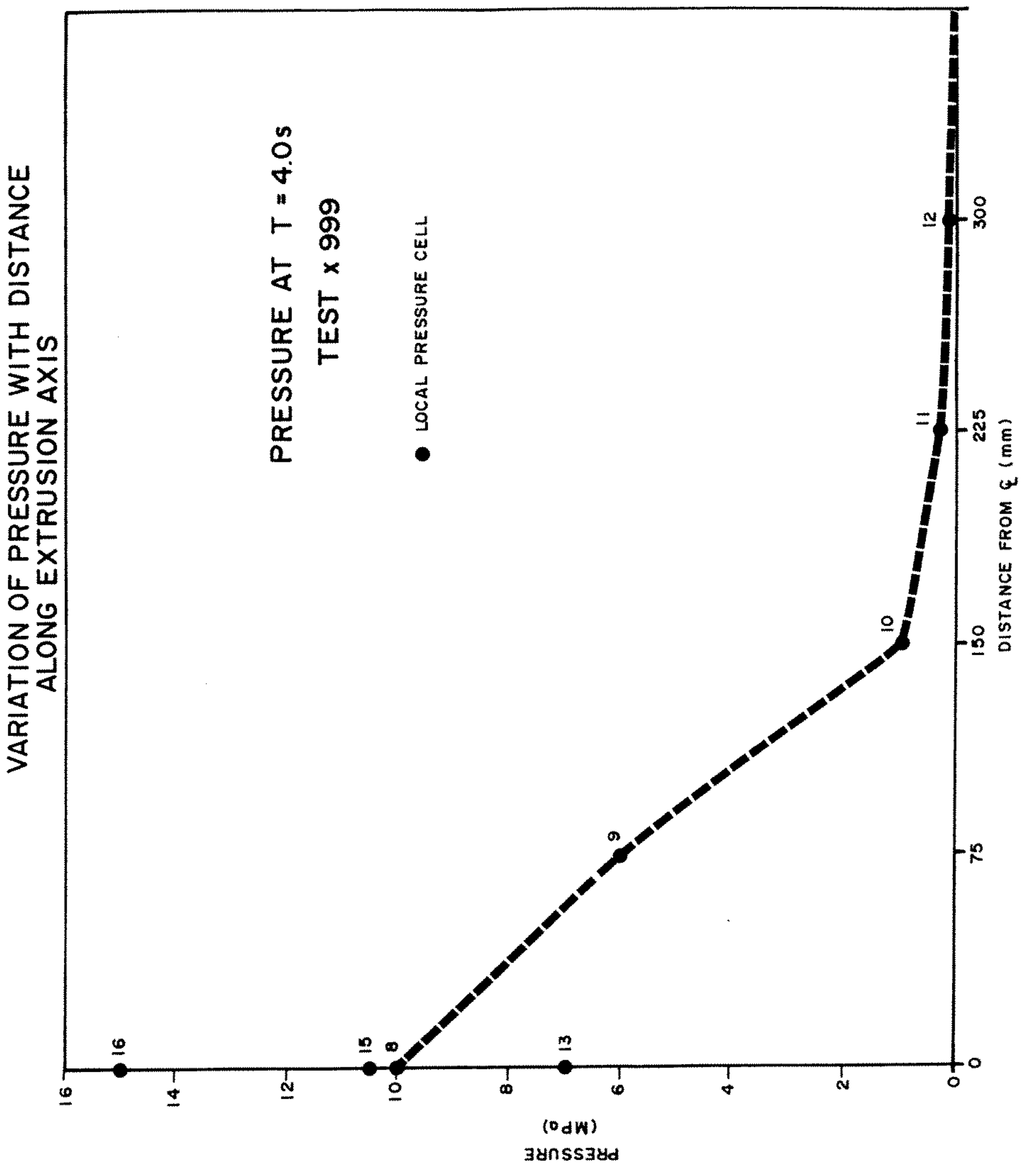


FIGURE 4.11



VARIATION OF PRESSURE WITH DISTANCE ALONG EXTRUSION AXIS
PRESSURE AT T = 4.0s
TEST x 999
LOCAL PRESSURE CELL
PRESSURE (MPa)
DISTANCE FROM ℄ (mm)
0
75
150
225
300
0
2
4
6
8
10
12
14
16
8
9
10
11
12
13
15
16

FIGURE 4.12

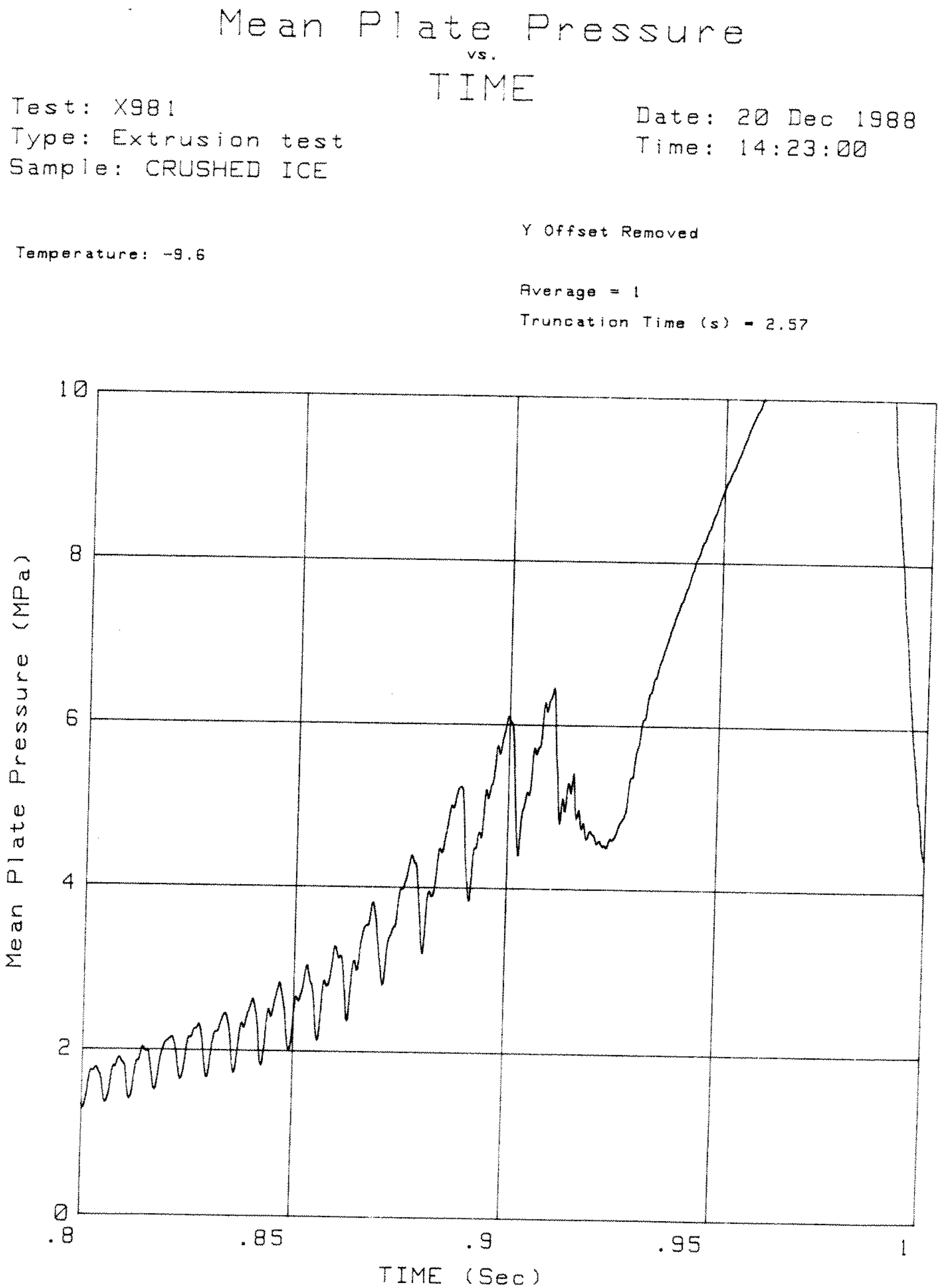

Mean Plate Pressure
vs.
TIME
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE
Date: 20 Dec 1988
Time: 14:23:00
Y Offset Removed
Temperature: -9.6
Average = 1
Truncation Time (s) = 2.57
10
8
6
4
2
0
Mean Plate Pressure (MPa)
.8
.85
.9
.95
1
TIME (Sec)

FIGURE 4.13

Local Pressure #8
vs.
TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57

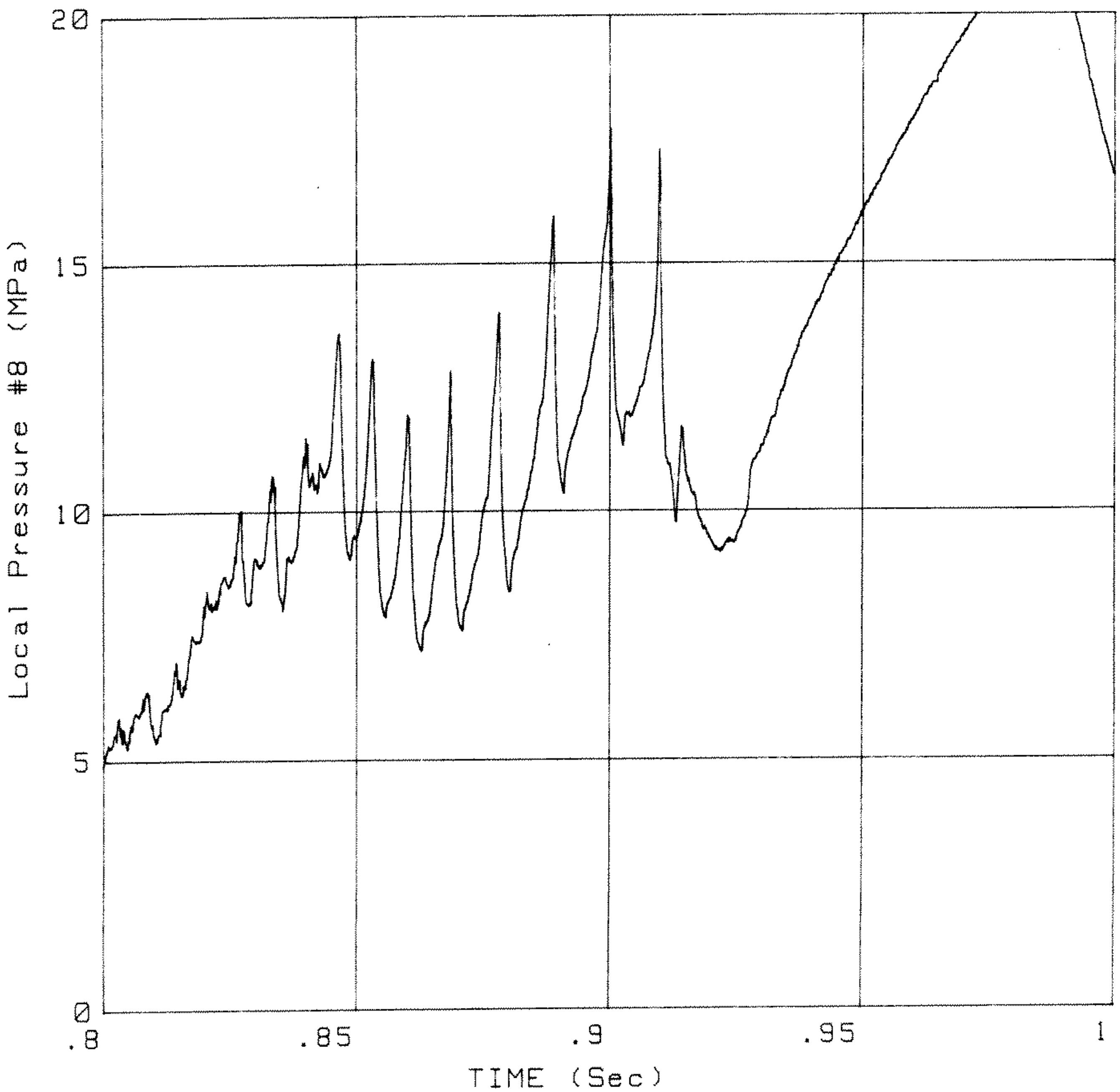
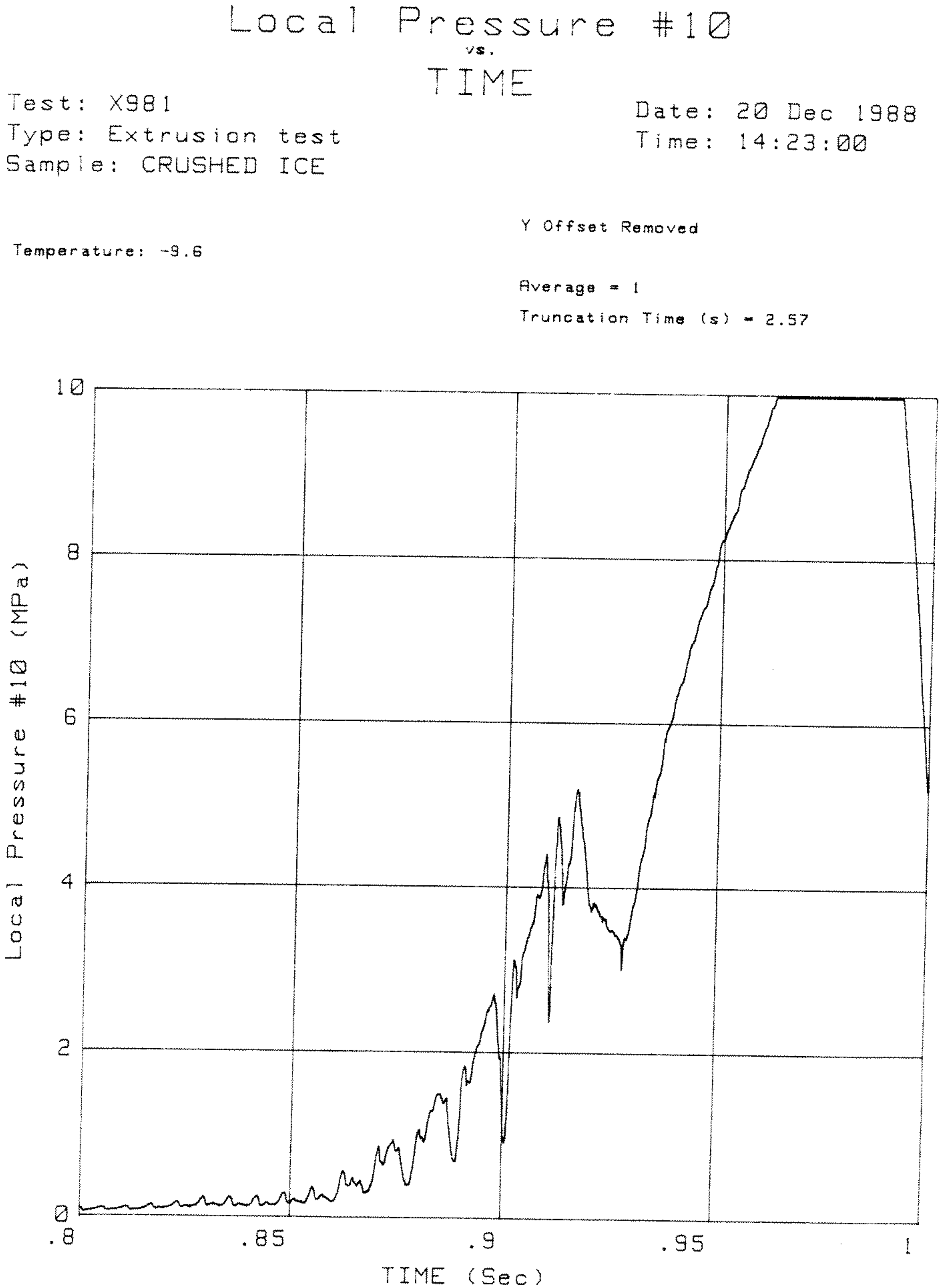


FIGURE 4.14



Local Pressure #10
vs.
TIME
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE
Date: 20 Dec 1988
Time: 14:23:00
Y Offset Removed
Temperature: -9.6
Average = 1
Truncation Time (s) = 2.57
10
8
6
4
2
0
.8
.85
.9
.95
1
TIME (Sec)
Local Pressure #10 (MPa)

FIGURE 4.15

Local Pressure #12
vs.
TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1

Truncation Time (s) = 2.57

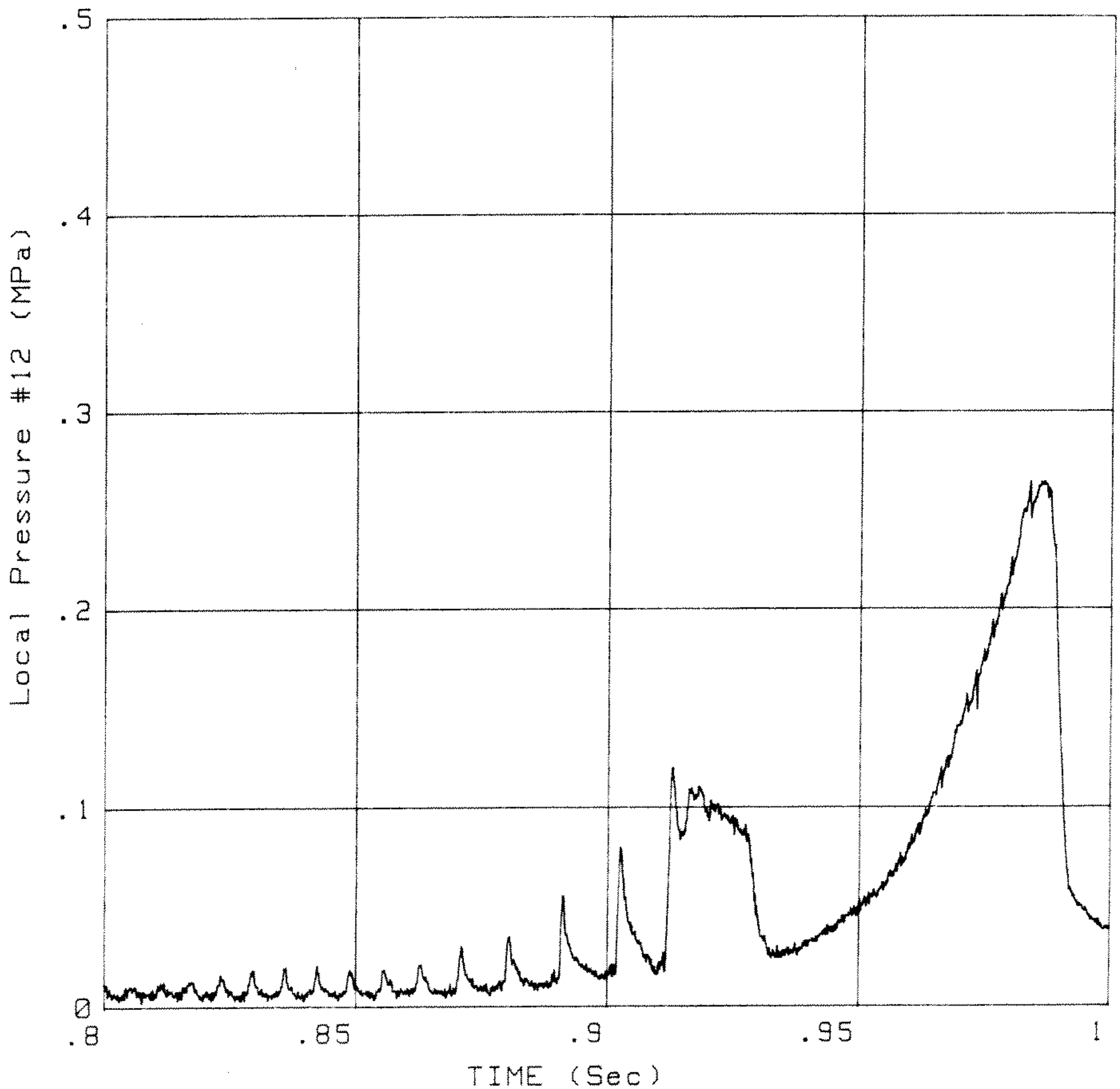
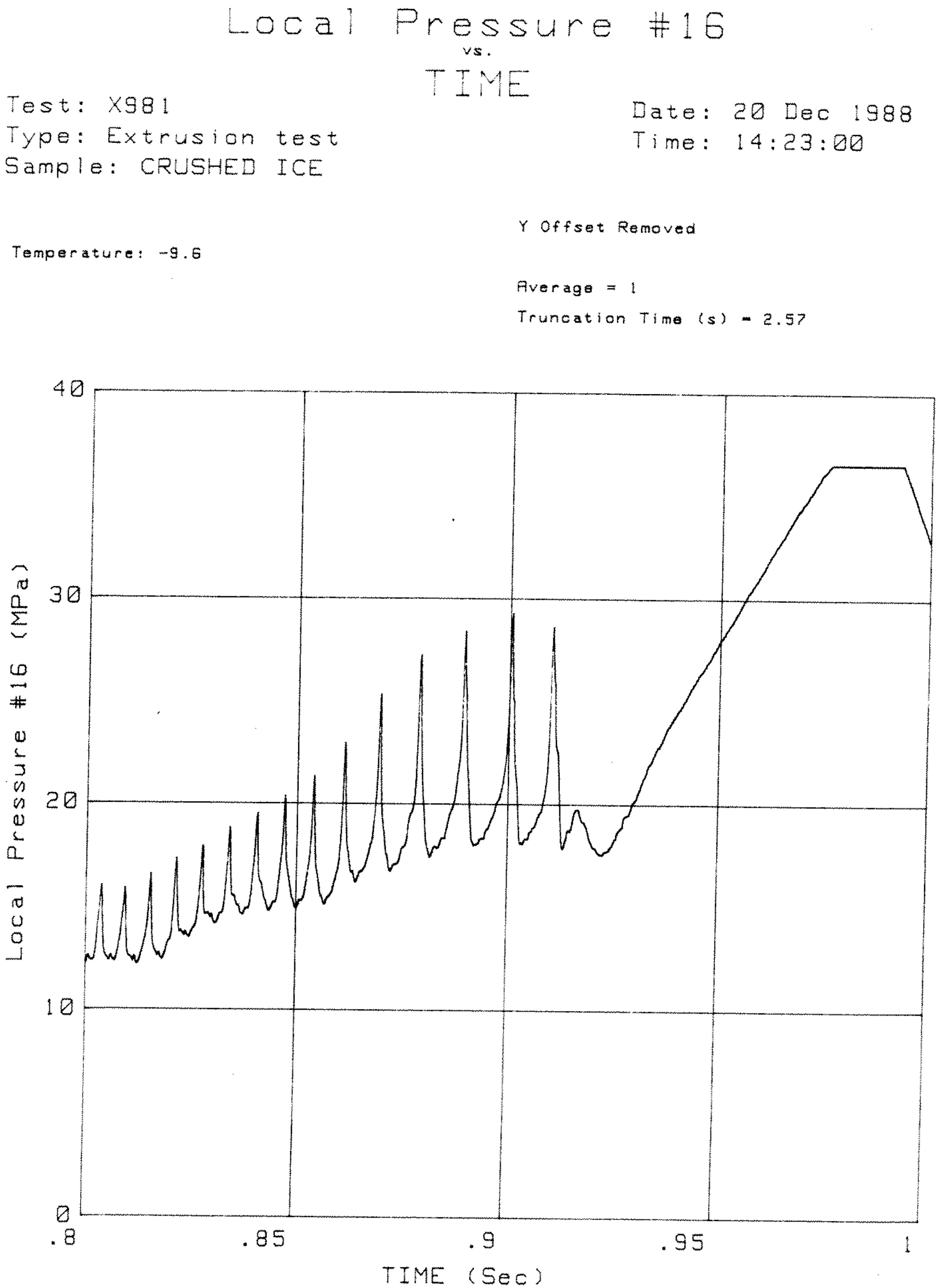
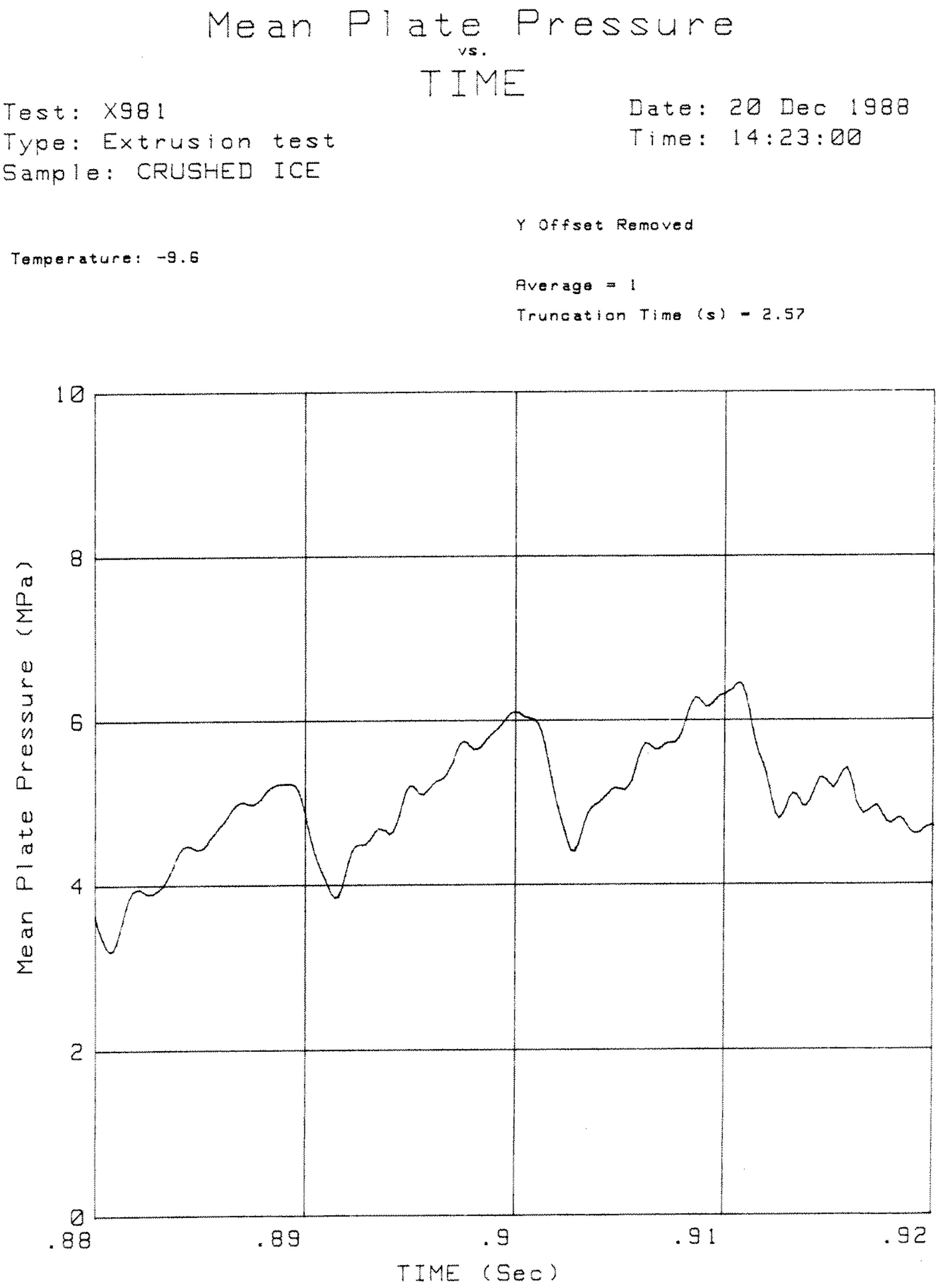


FIGURE 4.16



Local Pressure #16
vs.
TIME
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE
Date: 20 Dec 1988
Time: 14:23:00
Y Offset Removed
Temperature: -9.6
Average = 1
Truncation Time (s) = 2.57
40
30
20
10
0
.8
.85
.9
.95
1
Local Pressure #16 (MPa)
TIME (Sec)

FIGURE 4.17



Mean Plate Pressure
vs.
TIME
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE
Date: 20 Dec 1988
Time: 14:23:00
Y Offset Removed
Temperature: -9.6
Average = 1
Truncation Time (s) = 2.57
10
8
6
4
2
0
Mean Plate Pressure (MPa)
.88
.89
.9
.91
.92
TIME (Sec)

FIGURE 4.18

Local Pressure #8 vs. TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57

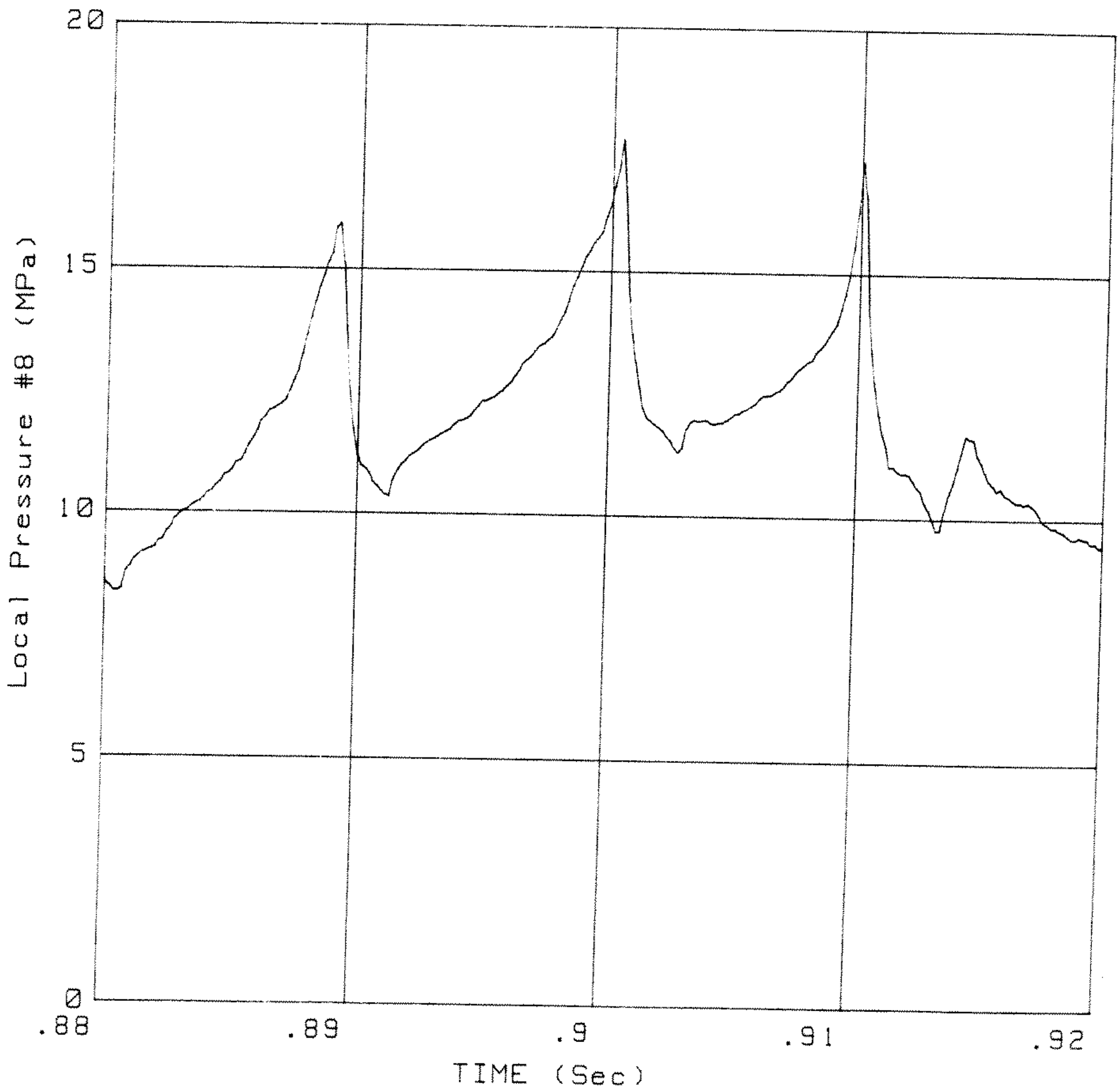
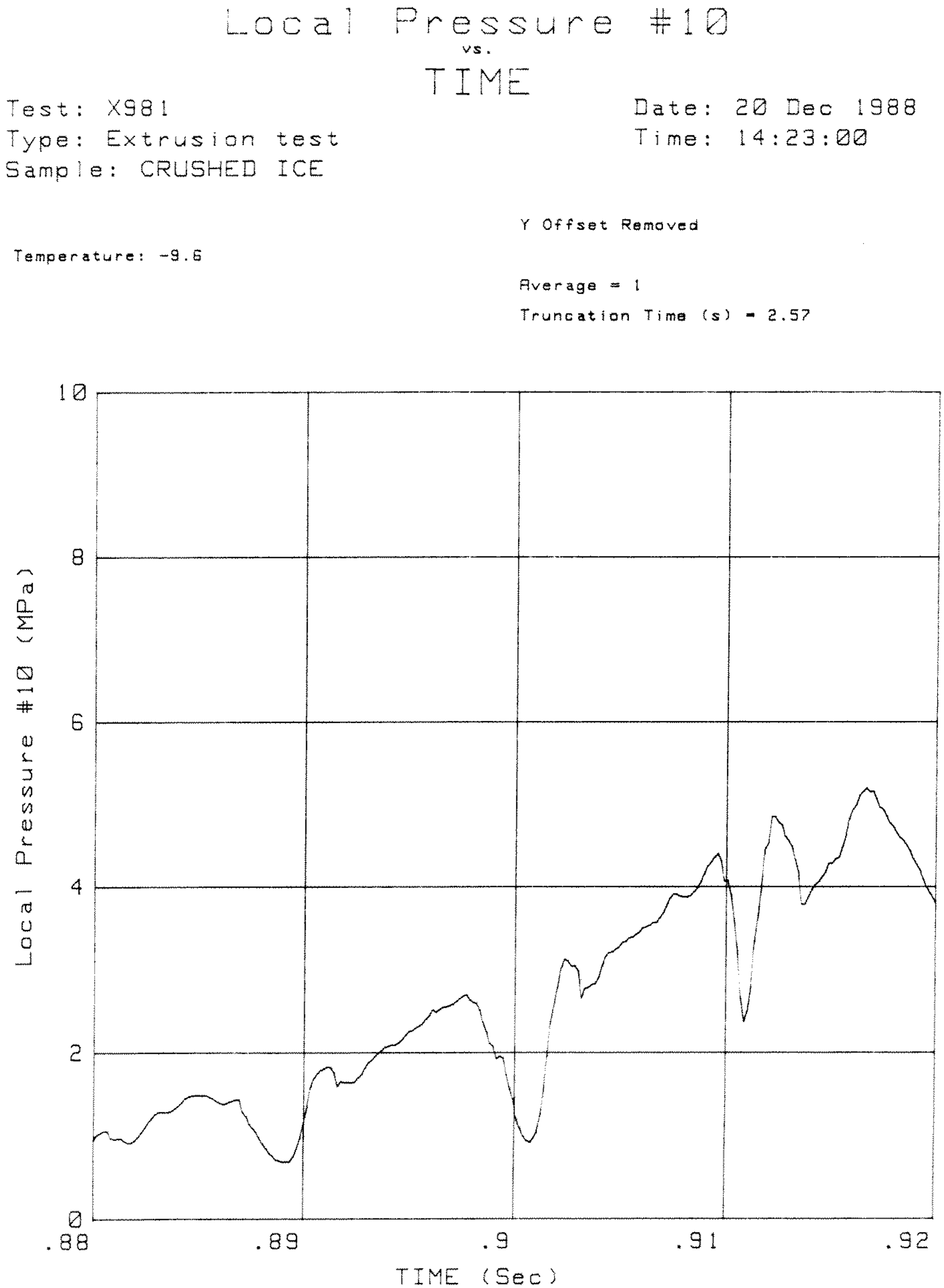


FIGURE 4.19



Local Pressure #10
vs.
TIME
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE
Date: 20 Dec 1988
Time: 14:23:00
Y Offset Removed
Temperature: -9.6
Average = 1
Truncation Time (s) = 2.57
10
8
6
4
2
0
.88
.89
.9
.91
.92
Local Pressure #10 (MPa)
TIME (Sec)

FIGURE 4.20

Local Pressure #12 vs. TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Temperature: -9.6

Y Offset Removed

Average = 1

Truncation Time (s) = 2.57

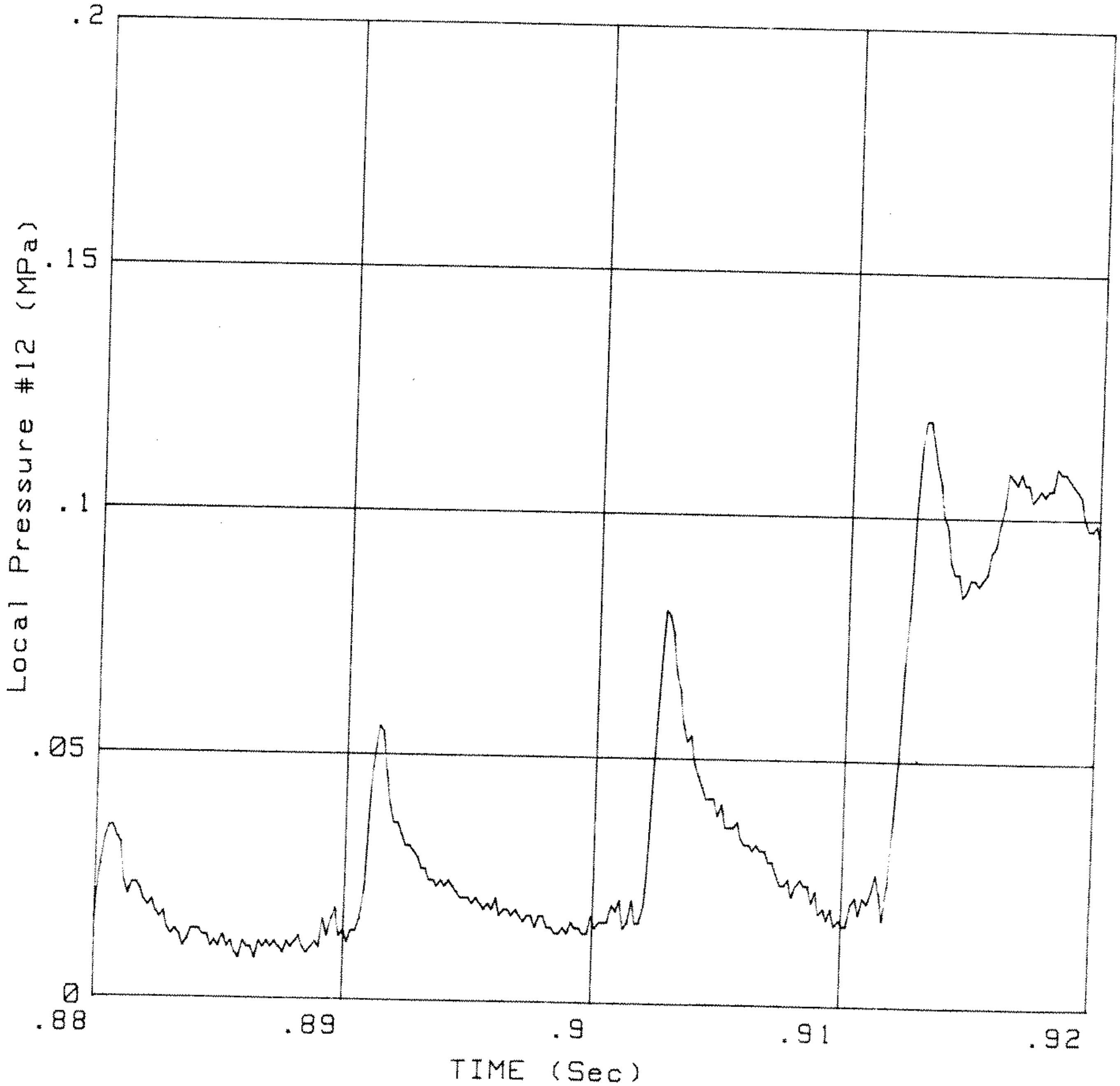


FIGURE 4.21

Local Pressure #16
vs.
TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57

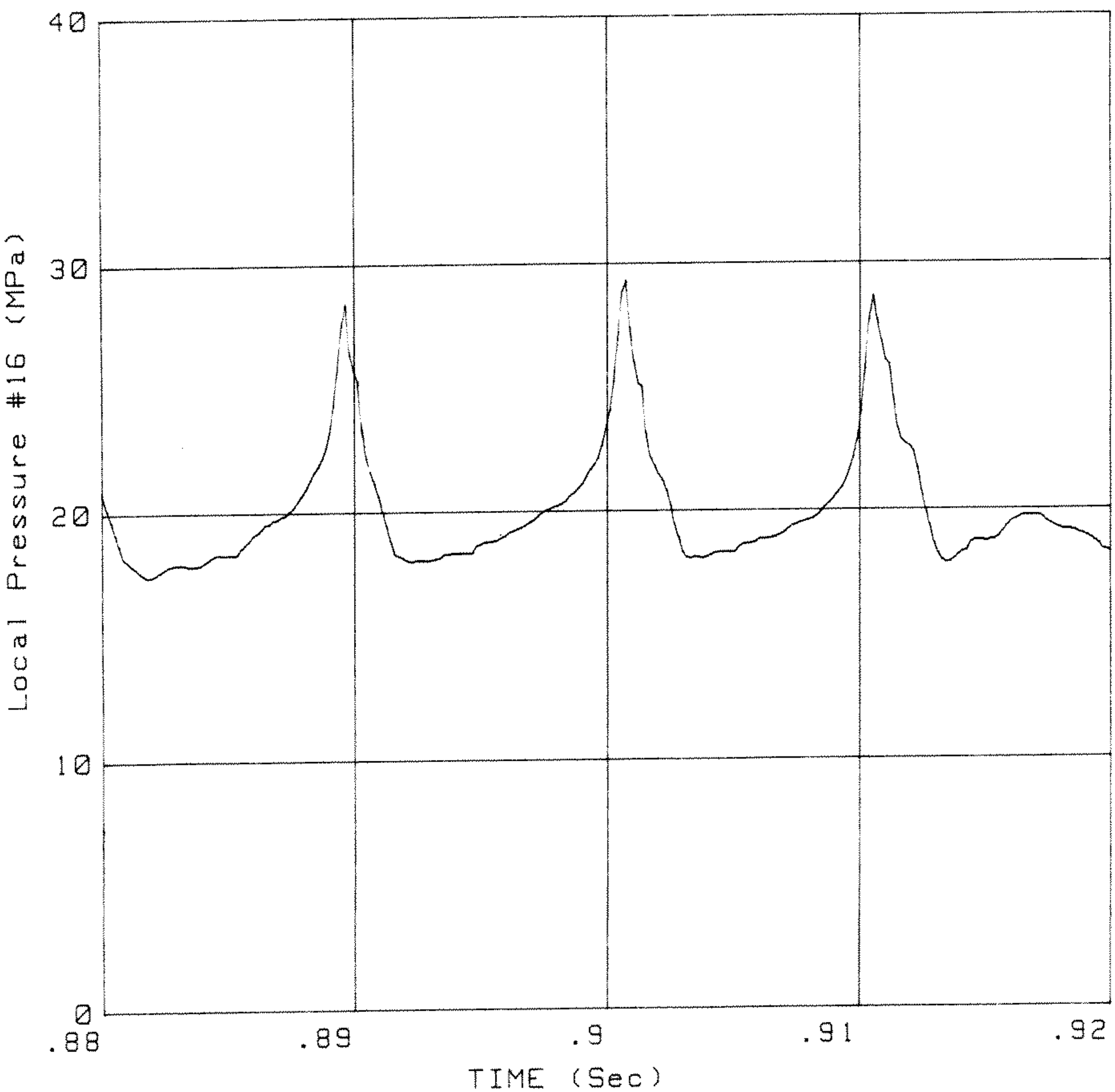


FIGURE 4.22

5 COMPACTION TESTS

During the extrusion tests there is compaction as well as flow out of the extrusion zone. The compaction will make it more difficult to relate pressures and pressure gradients to the flow. For this reason, it was decided to conduct a series of tests in which the ends of the extrusion zone would be blocked. The test numbers for these tests are listed in Table 3.1 and are tests x977, x976, x975, and x974.

For these tests, the 100 or 150 mm. crushed ice layer was prepared as described in section 3.2. The tests were all run until the stall point or maximum hydraulic capacity of the frame was reached. A density map was determined from the sample, the results given in Appendix 3.

The main variables for these tests were the platten speed, ranging from 2.5 mm./s to 125 mm./s. The speed was varied in order to investigate any relationship between platten speed and compaction pressure. The second variable was the layer thickness, one test being performed with a 150 mm. layer and three at 100 mm.

For these tests the mass of material within the test arrangement is fixed. Thus from the physical measurements of final average layer thickness, and average final density and the known displacement, the density at any displacement can be calculated. Thus it is possible to plot pressure as a function of density. Initial investigation revealed that all four tests provided a straight line relationship on a semi-log graph. These plots are given in figures 5.1 to 5.4. A similar relationship occurs between local pressures and densities. Initial inspection of this data did not reveal any systematic relationship between pressure and speed.

The mean trend line for these four tests can be approximated by

$$P = P_0 \exp(0.0199\rho) \quad (5.1)$$

where P = Pressure in MPa

$P_0 = 2.04 \times 10^{-6}$ MPa

ρ = Density (kg/m^3)

The conclusion is that the pressure is a function of density but independent of velocity. It is suggested that equation 5.1 or similar be used in the separation of flow and compaction in the extrusion tests. The relationship given in equation 5.1 may also be used to convert density data into pressure data. For example the density maps obtained at the termination of tests can be converted into a pressure distribution map to show more detailed information on the pressure distribution. This is particularly useful since local pressure cells were spaced every 75 mm. whereas the density data are obtained every 25 mm.

LOGe(Mean Plate Pressure)
vs.
Sample Density

Test: X977
Type: Compaction test
Sample: CRUSHED ICE

Date: 16 Jan 1989
Time: 14:14:27

Temperature: -10

Y Offset Removed

Average = 10
Data From (s): .575
Data To (s): 1.73

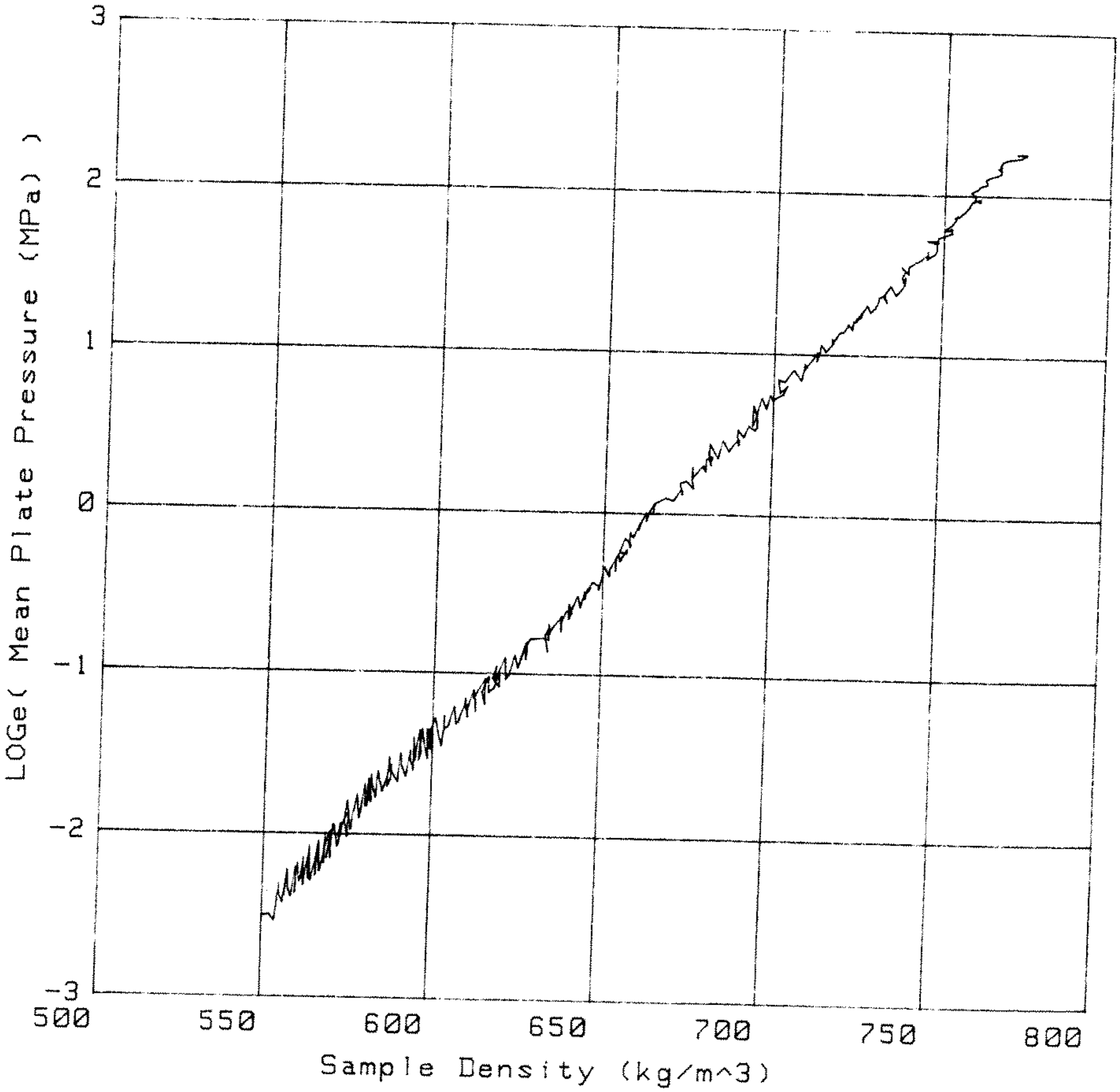


FIGURE 5.1

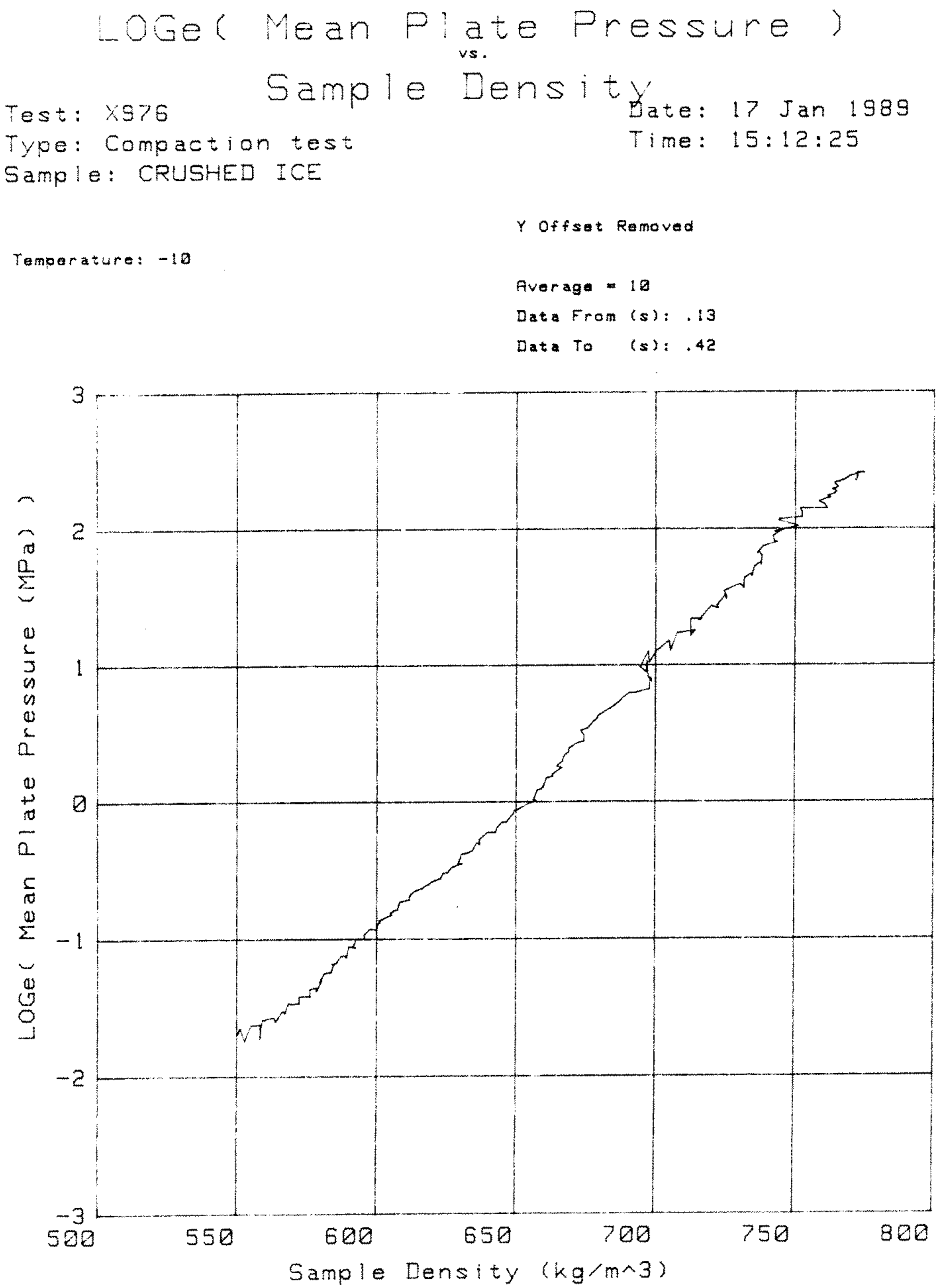

LOGe(Mean Plate Pressure)
vs.
Sample Density
Test: X976
Type: Compaction test
Sample: CRUSHED ICE
Date: 17 Jan 1989
Time: 15:12:25
Y Offset Removed
Temperature: -10
Average = 10
Data From (s): .13
Data To (s): .42
3
2
1
0
-1
-2
-3
500
550
600
650
700
750
800
LOGe(Mean Plate Pressure (MPa))
Sample Density (kg/m^3)

FIGURE 5.2

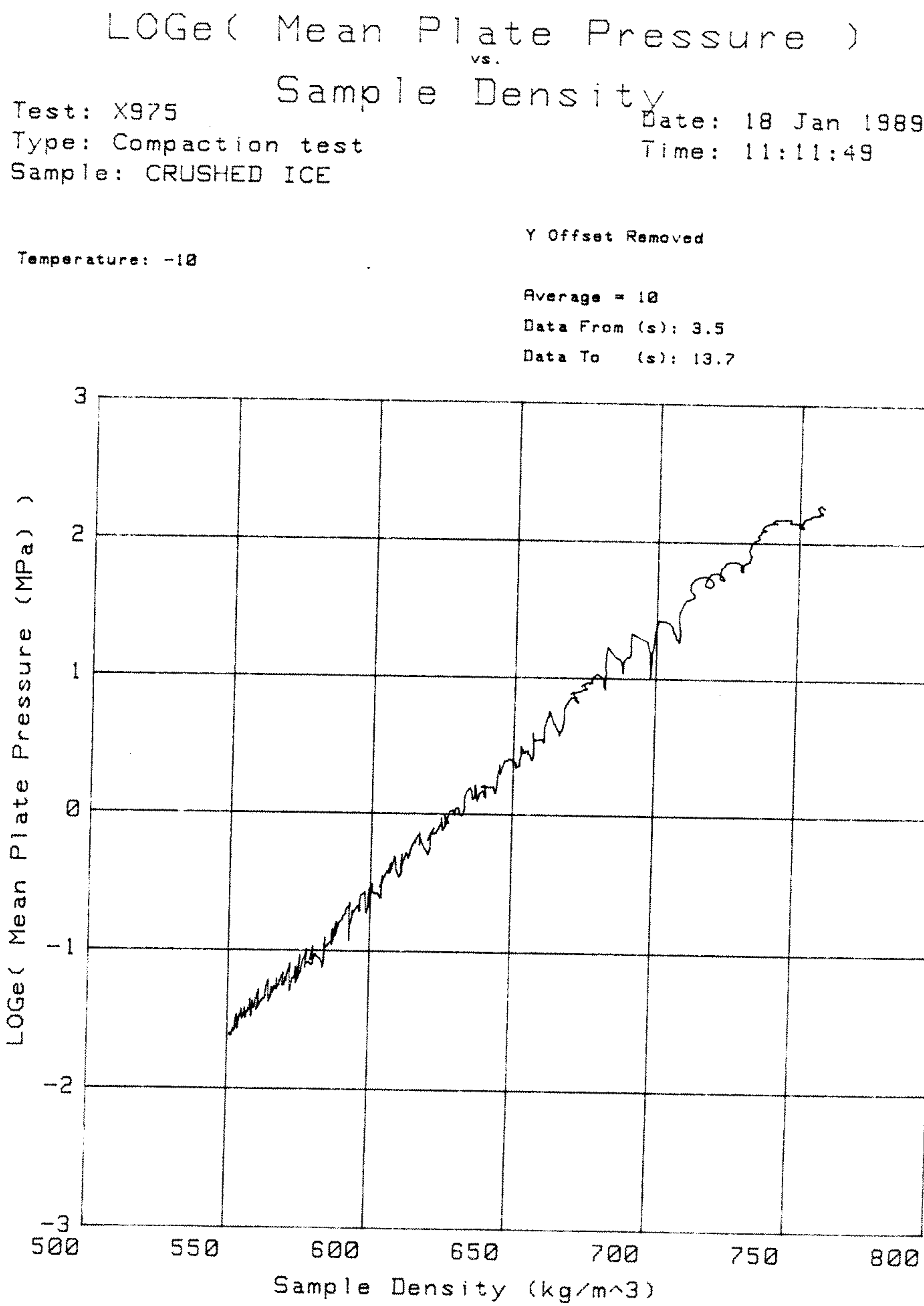
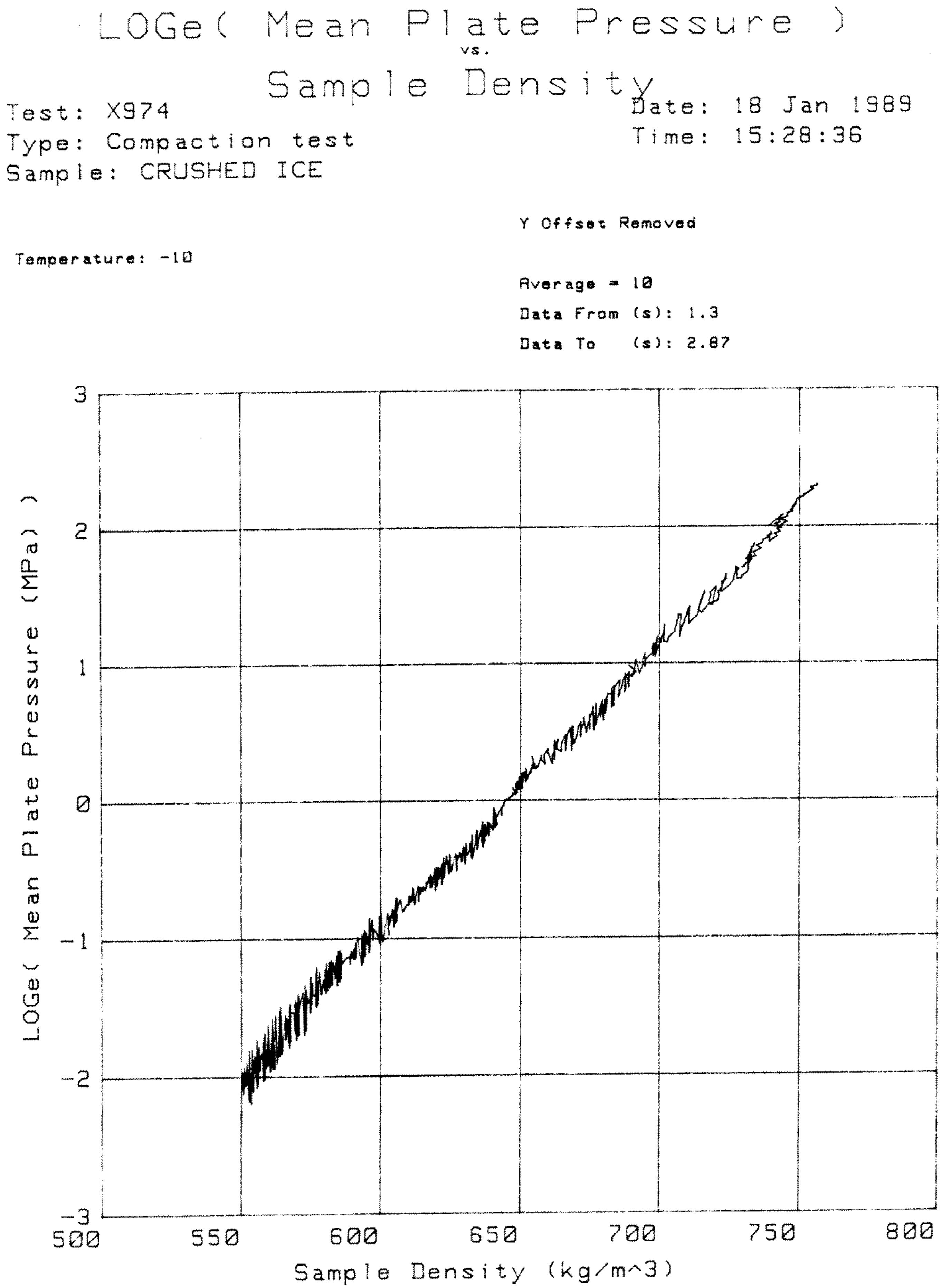

LOGe(Mean Plate Pressure)
vs.
Sample Density
Test: X975
Type: Compaction test
Sample: CRUSHED ICE
Date: 18 Jan 1989
Time: 11:11:49
Y Offset Removed
Temperature: -10
Average = 10
Data From (s): 3.5
Data To (s): 13.7
3
2
1
0
-1
-2
-3
500
550
600
650
700
750
800
LOGe(Mean Plate Pressure (MPa))
Sample Density (kg/m^3)

FIGURE 5.3



LOGe(Mean Plate Pressure)
vs.
Sample Density
Test: X974
Type: Compaction test
Sample: CRUSHED ICE
Date: 18 Jan 1989
Time: 15:28:36
Y Offset Removed
Temperature: -10
Average = 10
Data From (s): 1.3
Data To (s): 2.87
3
2
1
0
-1
-2
-3
500
550
600
650
700
750
800
LOGe(Mean Plate Pressure (MPa))
Sample Density (kg/m^3)

FIGURE 5.4

6 FLOW VISUALIZATION TESTS

To aid in the constitutive modeling of the material, a series of tests were conducted to illustrate the flow profile in the material. This was achieved by selectively dying the crushed ice material during packing, stopping the test at a predetermined position and then sectioning the material. The flow visualization tests were test numbers x967 to x962 inclusive as indicated in Table 3.1.

The crushed ice material was stained by mixing it with blue builder's chalk. A center strip of material was stained as shown in figure 6.1 for test x967. For the remaining tests a 75 mm. strip symmetrically located with respect to the axis was used. The edges of the dyed strip were perpendicular.

The tests were conducted at different speeds and with the lower plattens either had steel or with a layer of fresh water ice as indicated in Table 3.1. The displacement for these tests was limited to approximately 50 mm. At the termination of the test, the N side guide (see figure 6.1) was removed and a photograph taken. Then a slice 20 mm. thick was removed and a photograph of this remaining segment obtained. The process was repeated until the other side of the sample was reached.

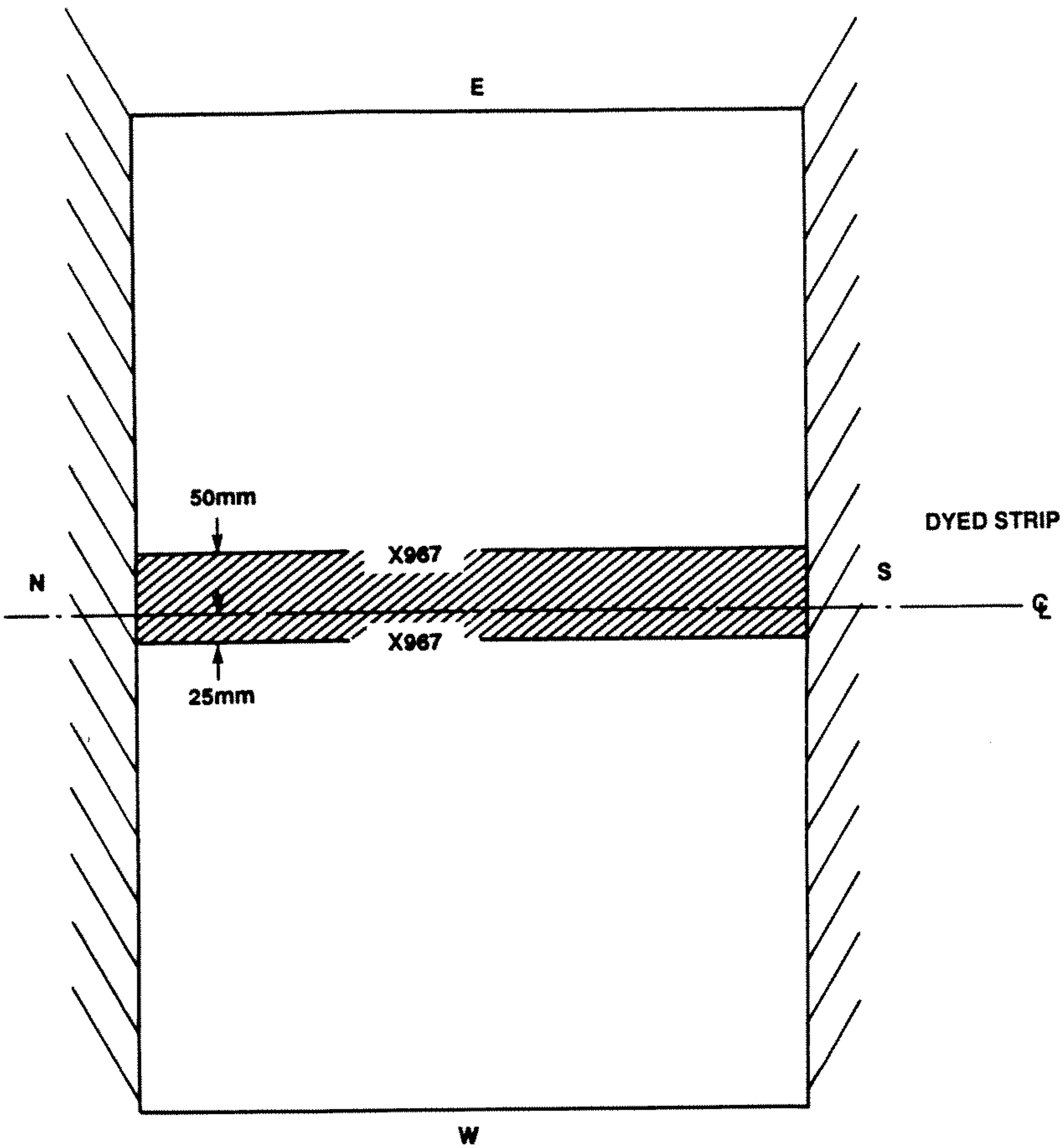
The anticipation at the beginning of the tests was that a parabolic flow profile would be observed based on the assumption of a viscous flow constitutive model. The observed front is not however that straight forward with a number of shapes being observed. In Table 6.1 are listed some general observations about the tests obtained by inspection of the photographs contained in Appendix 6.

The overall comment about the flow profile is that it does not appear to have a parabolic shape. The shape is more consistent with plug flow, but the variation between different photographs with the same set and between different tests is larger. A potentially significant observation is the crack system noticeable particularly in test x963.

TABLE 6.1

FLOW VISUALIZATION TESTS: Observations

TEST	**SPEED**	**LOWER PLATTEN**	**COMMENTS**
X967	125.0 mm./s	Steel	Large scale mixing, inclusions of white ice.
x966	2.5 mm./s	Steel	Some evidence at +480 mm., +320, +220 of ~45^{o} cracks. Inclusions of white ice.
x965	125.0 mm./s	Ice	Large inclusions at +80, +200, +240; 45^{o} shape inclusion at +320, +360.
x964	25.0 mm./s	Ice	Large scale mixing adjacent to lower platten.
x963	2.5 mm./s	Ice	Pronounced pattern of ~45^{o} cracks.
x962	125.0 mm./s	Steel	Small amount of mixing adjacent to lower platten, generally featureless.Temp -4.4^{o}C.



FLOW VISUALIZATION TESTS
INITIAL CONFIGURATION TEST X967

FIGURE 6.1

7 CRUSHING/EXTRUSION TESTS

7.1 Introduction

This series of tests were to try and simulate the complete crushing and extrusion process rather than just the extrusion part. They were considered to be more speculative than the ice extrusion part of the project since it was not established that the ice could be crushed and extruded in an essentially continuous manner. The overall crushing and extrusion apparatus is illustrated in figure 7.1. The elements of the apparatus are as described. A hollow steel cylinder had a piston at one end and is blocked at the other end. The piston has a diameter of 127 mm and the inner surface of the hollow cylinder was Teflon coated to reduce friction. Adjacent to the blocked end are four horizontal slots to allow for escape of the material. The slots were 12.7 mm. in height and each slot was 80 degrees of arc long. The complete apparatus was placed in a load test frame and the motion of the piston controlled via a hydraulic servo system. For these tests a different load test frame was used from the extrusion tests. A sample of ice was machined into a right cylinder and placed into the hollow cylinder. In addition to the load supplied by the piston, which was determined by measurements of the hydraulic oil pressure within the servo system, the displacement of the piston was recorded. As indicated in figure 7.1, a local pressure cell of identical design as was used in the extrusion apparatus was mounted on the centerline of the base. The pressure cell was from location #16 of the extrusion apparatus with a 3/8" diameter piston. It thus had a full scale range of 125MPa. By this means measurements of local pressures at the crushing zone were obtained.

The overall test matrix is given in Table 7.1. The variables of this test series was the velocity of the piston and the type of sample. Note that as for the remainder of the test program, fresh water ice was used and the testing temperature was -10°C. The displacement for these tests was limited to 100 mm. by the available travel of the hydraulic actuator. The final thickness of the sample is indicated in Table 7.1. At the beginning of test, a 2 to 3 mm. gap was left between the top of the sample and the piston. This was to allow the piston to attain the prescribed velocity before contacting the sample. The secondary reason was to provide a baseline level from which the applied load could be calculated. For test Y001, the sample was crushed ice batch number 3 (see Table 3.2) packed into the cylinder to a nominal density of 550 kg/m^3. As can be seen from figure 7.2, there was a steady rise in pressure during the early part of the test with some smooth release of material from the slots. In the latter part of the tests, ice was ejected out of the slots in bursts. As indicated in Table 7.1, considerable densification of the material occurred during this test.

For tests Y002, Y003, Y005, Y006 and Y007, a solid billet of ice was used to charge the cylinder. The ice was manufactured from the crushed ice material (batch 3). It was placed in a 20 cm diameter plastic mold in 50 mm. layers and soaked with water. It was then allowed to freeze at -35°C. After removal from the mold, the ice sample was machined on a lathe in the cold room at -10°C. For these tests, the approach speed was in the range 2 mm./s to 125 mm./s.

7.2 Particle Sizes

After some of the tests samples of the ejected ice were collected and their grain size distribution found. For pieces smaller than 3.35 mm., a sieve analysis was performed to estimate the grain size distribution.

These data is shown in figures 7.3 to 7.5. Superimposed on these grain size histograms are a logarithmic-normal probably distribution curves as defined by equation 3.1. The logarthmic-normal curve appears to be a good representation of the sieve data. The parameters of the histograms are very similar to the histogram obtained from the parent crushed ice material illustrated in figure 3.1. The close similarity suggests that in the crushing process, the existing defects and natural boundaries govern the size of crushed ice fragments created.

There was also a number of ice fragments considerably larger than the 3.35 mm. grid size of the coarsest sieve. These were photographed and their characteristic dimensions manually determined. Two such measurements were obtained, firstly the maximum length of the fragment, and secondly, a characteristic dimension perpendicular to the axis of the maximum length. A degree of error is included on this "minimum" dimension since it was estimated by visually representing the projected shape as an ellipse. The minimum dimensions would correspond to the minor axis of the ellipse and the major axis the maximum distance. A histogram for maximum and minimum fragment dimensions are presented in figures 7.6 and 7.7. On these histograms are superimposed a normal or gaussian probability curve. The most common maximum size being approximately 22 mm. and the most common minimum size 13 mm. The observation that these large pieces have a normal rather than a log-normal distribution strongly suggests that the mechanism of production are different. Observations on the <u>shape</u> of the pieces strongly suggest that they are created by spalling from the unsupported ice adjacent to the slots.

The overall grain size distribution function is thus bimodel with one peak at 22 mm. and the other peak at approximately 0.6 mm. size.

7.3 Trends

Some simple analyses of the data were performed, namely, minimum and maximum pressure values. If we exclude the initial failure peak a relatively constant minimum and maximum pressure value is observed. The minimum value of the plunger pressure is plotted as a function of piston speed in figure 7.8. As can be seen that for tests Y002, Y003, Y005, and Y006, a linear relationship exists between the two variables. The data for test Y001 does not lie on the curve, but remember that the sample was from crushed ice rather than solid ice. Secondly, there is an intercept pressure at zero speed. One should note that the measured pressure is the pressure applied to the top of the sample. Frictional forces between the ice sample and the walls of the cylinder will reduces the stress level so that the stress at the crushing interface will be less than the plunger pressure. The magnitude of this effect has not been estimated. Data from test Y007 at 125 mms does not follow the linear trends of tests between 2 and 25 mm./s.

The minimum value of the local pressure also appears to be linearly related to the piston speed although the scatter in the data is much greater. These data are illustrated in figure 7.9. This is to be expected since the local pressure data was collected from a sensor with a diameter of 3/8" as compared with 5" diameter of the piston. There is however still weak evidence that there is an intercept at zero speed. Again data from test Y007 at 125 mm./s does not appear to follow the linear trends of tests between 2 mm./s and 25 mm./s.

Maximum plunger and maximum local pressures do not appear to be linearly related to speed. These pressures appeared to be independent of the plunger speed.

7.4 Crushed Layer Thickness

The exit velocity of the ejected ice was estimated from the ejection trajectory. The geometry is illustrated in figure 7.10 and the collected data given in Table 7.2. Ignoring any air drag on the particles, the ejection velocity is calculated and given in Table 7.3. The data on the ejection velocity for point B, the most likely distance is shown in figure 7.11. From the data shown a direct relationship is seen between the most likely distance and the plunger speed. If we assume that the ice has a density of 500 kg/m^3 at the point of ejection, then the average thickness of the crushed layer is approximately 6.4 mm. If on the other hand we assume no density reduction in the crushed layer the thickness of the crushed layer corresponds to 3.5 mm. This later thickness would be a lower limit to the average layer thickness at the exit. For test Y007 at 125 mm./s where we also have an estimate of the minimum distance of ejection (point A), then assuming an ice density of 500 kg/m^3 provides a thickness of 14.0 mm. The actual thickness of the slot is 12.7 mm. in reasonable agreement with the above estimate. Exact agree can be obtained by assuming that the ice at the point of ejection had a density of 551 kg/m^3. For the extrusion tests the initial density was 550 kg/m^3 and near the edge of the extrusion zone stresses were generally less than 0.1 MPa. We thus think that the above estimates are reliable.

TABLE 7.1

TEST MATRIX CRUSHING/EXTRUSION TESTS

TEST NUMBER	**SAMPLE**	**SPEED (mm./s)**	**DENSITY (kg/m³)**	**FINAL THICKNESS (mm.)**
Y001	Crushed Ice	4	886	53.6
Y002	Solid Ice	4	891	68.4
Y003	Solid Ice	2	891	68.0
Y005	Solid Ice	25	889	68.0
Y006	Solid Ice	15	893	68.0
Y007	Solid Ice	125	891	68.0

TABLE 7.2

CRUSHING/EXTRUSION TESTS: EJECTION DISTANCES

TEST	PLUNGER SPEED (mm./s)	DISTANCE A* (mm.)	DISTANCE B* (mm.)	DISTANCE C* (mm.)	DISTANCE D* (mm.)
Y005	25	0	75	-	550
Y006	15	0	45	130	500
Y007	125	150	330+/-20	470	>~760

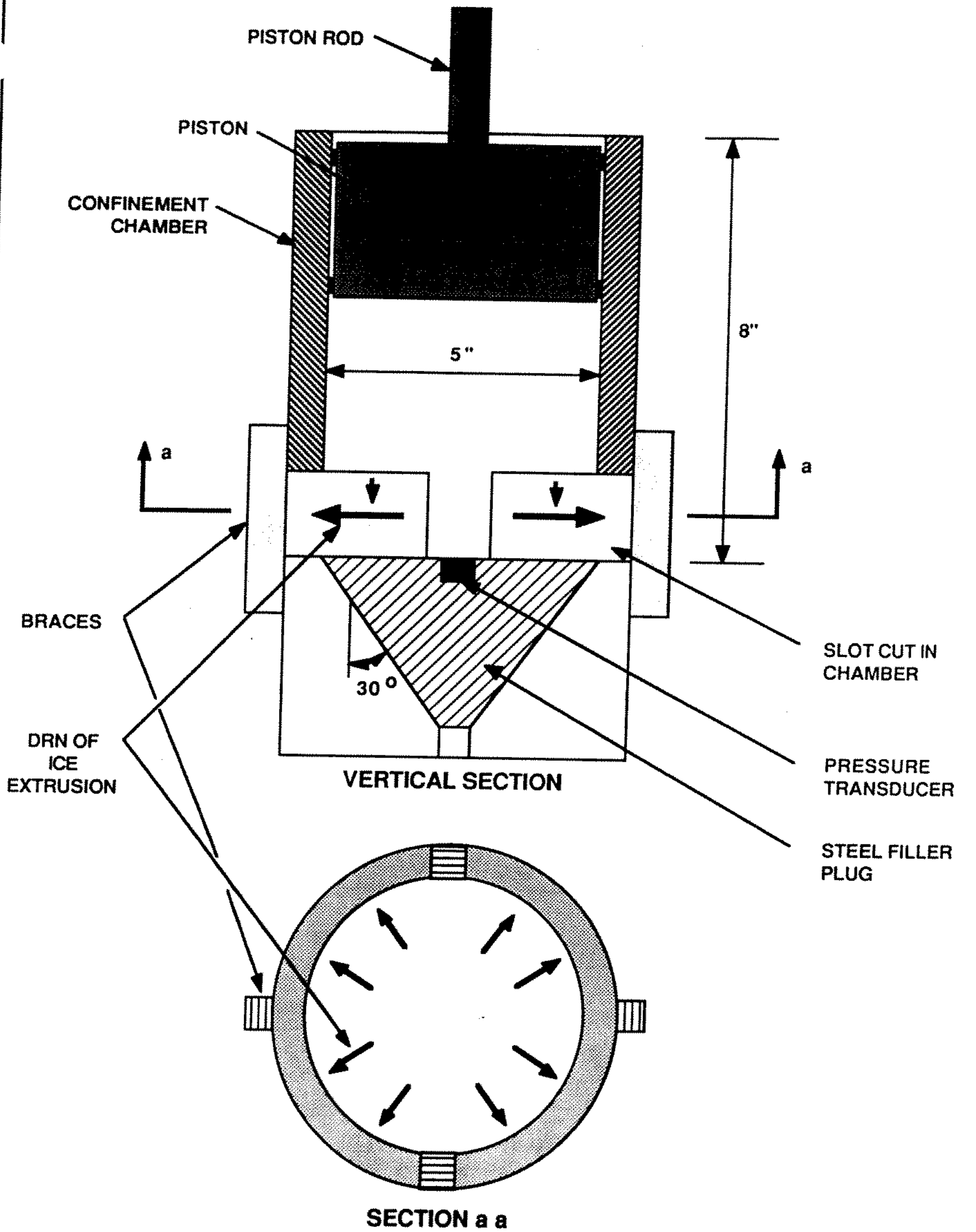
* see figure 7.10 for explanation

TABLE 7.3

CRUSHING/EXTRUSION TESTS: EJECTION VELOCITY

TEST	**PLUNGER SPEED (mm./s)**	**SPEED A* (mm./s)**	**SPEED B* (mm./s)**	**SPEED C* (mm./s)**	**SPEED D* (mm./s)**
Y005	25	0	0.28×10^3	-	2.1×10^3
Y006	15	0	0.17×10^3	0.48×10^3	1.9×10^3
Y007	125	0.56×10^3	1.23×10^3	1.7×10^3	$>2.8 \times 10^3$

* see figure 7.10 for explanation



APPARATUS FOR ICE CRUSHING AND EXTRUSION

FIGURE 7.1

Plunger Pressure
vs.
TIME

Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 29.15

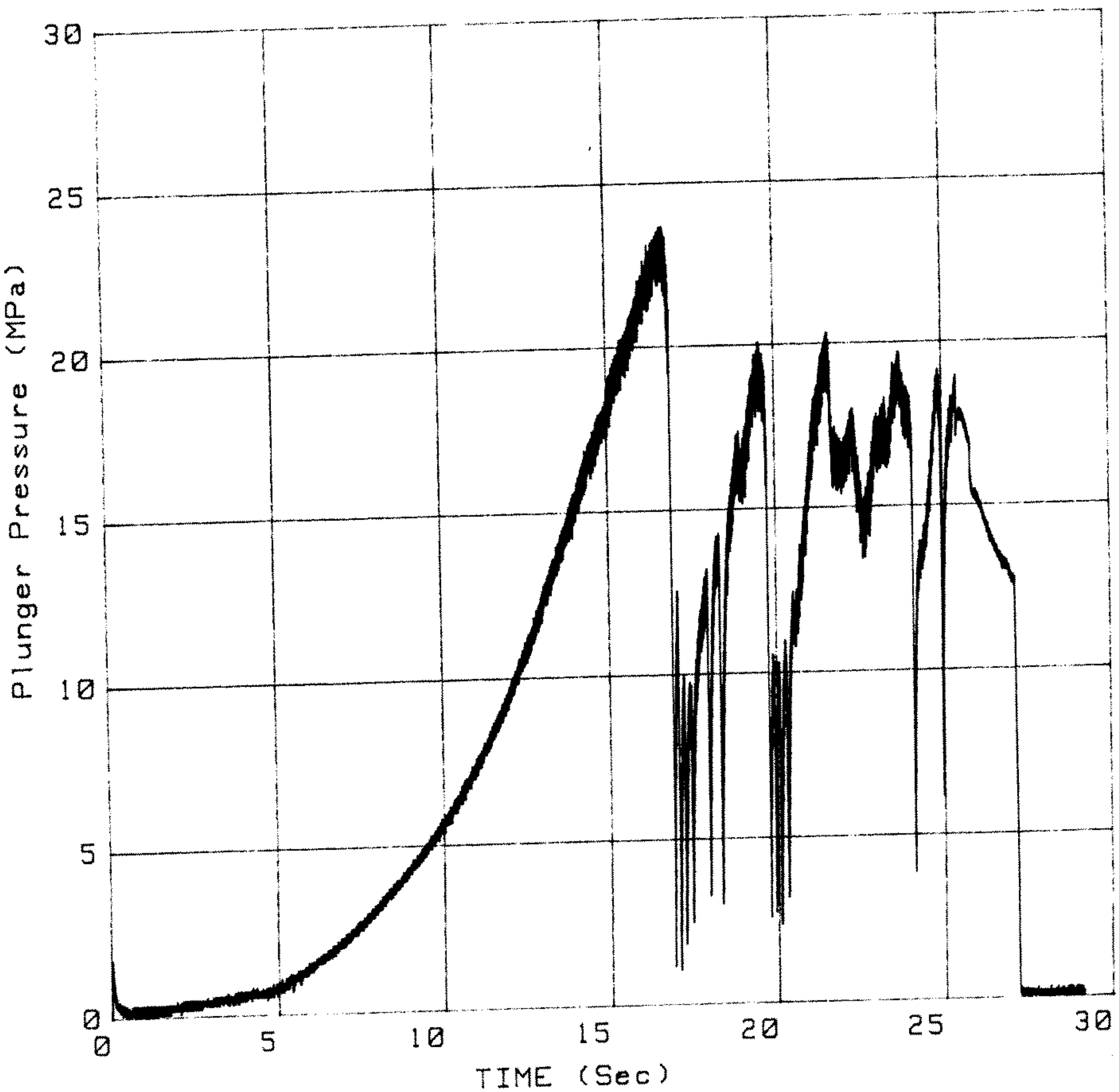
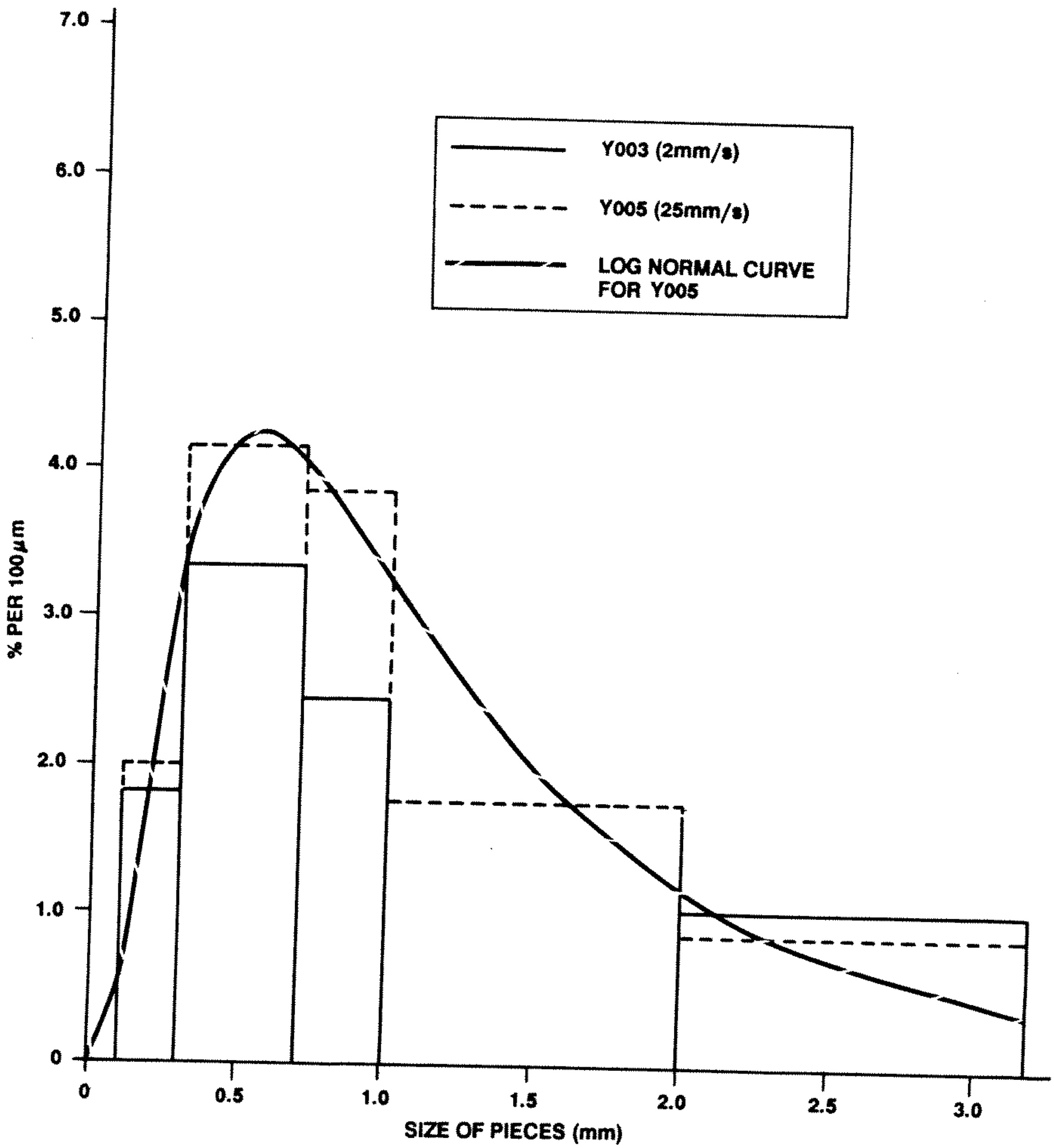
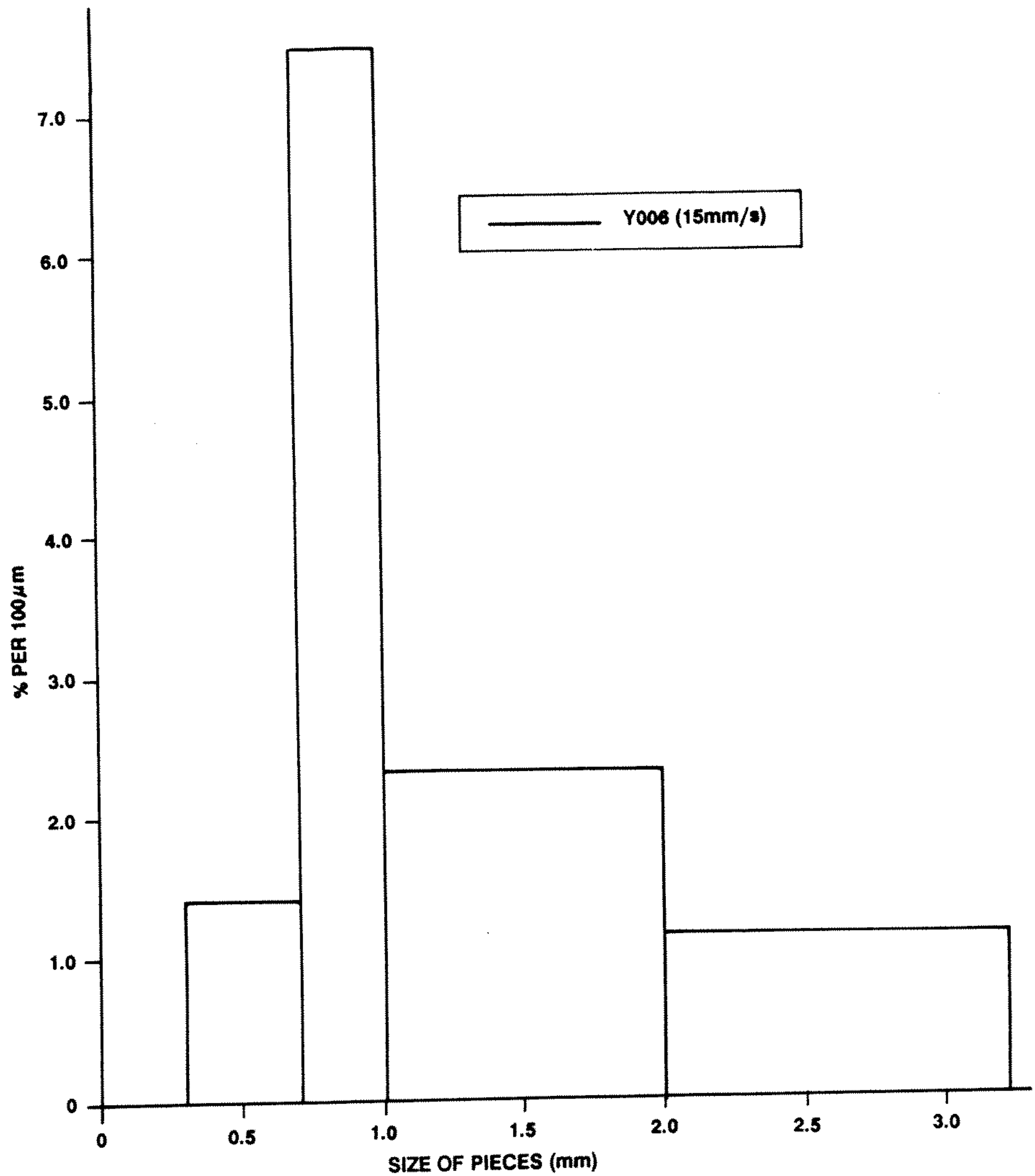


FIGURE 7.2



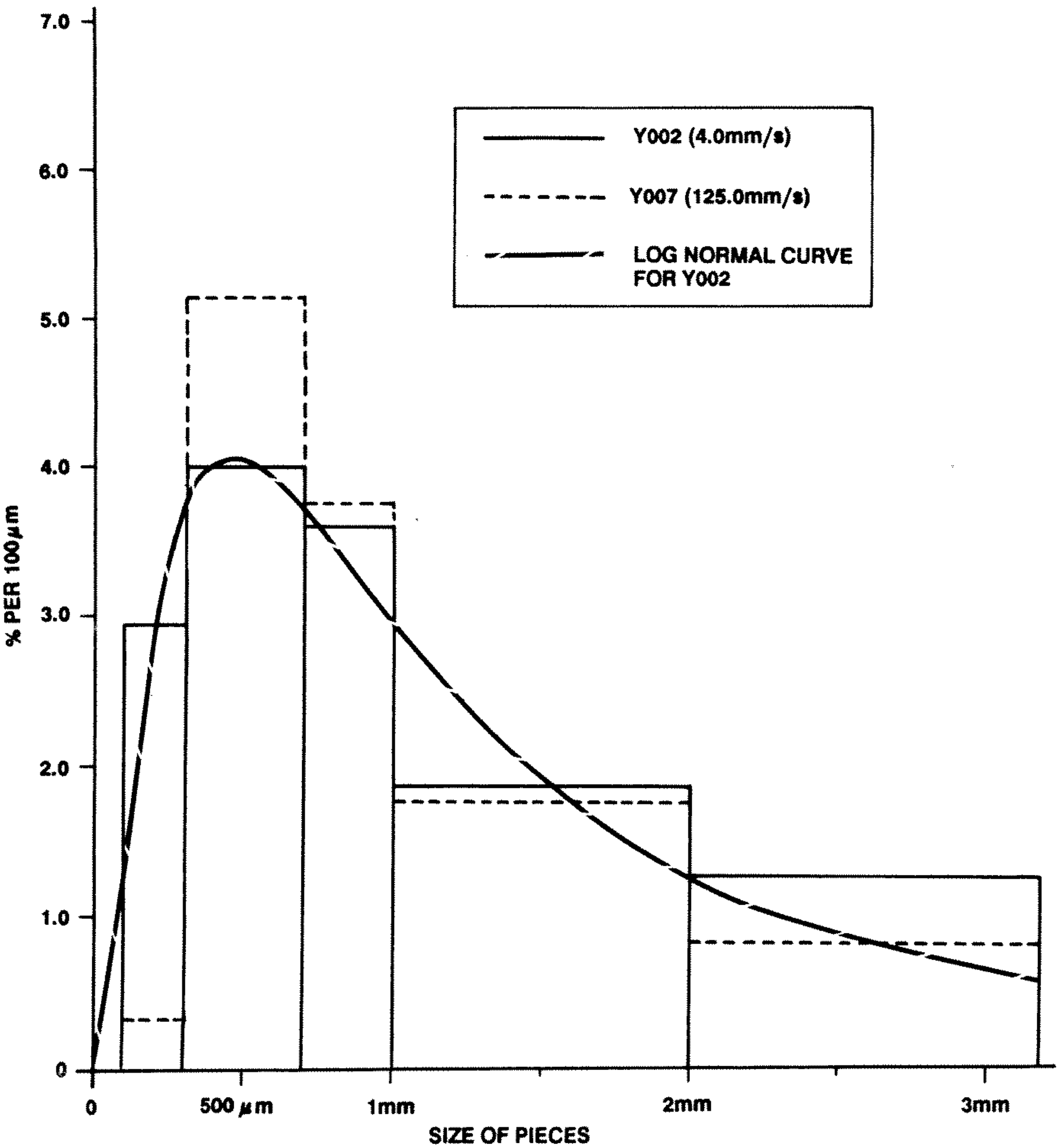
SIEVE ANALYSIS TESTS Y003, Y005

FIGURE 7.3



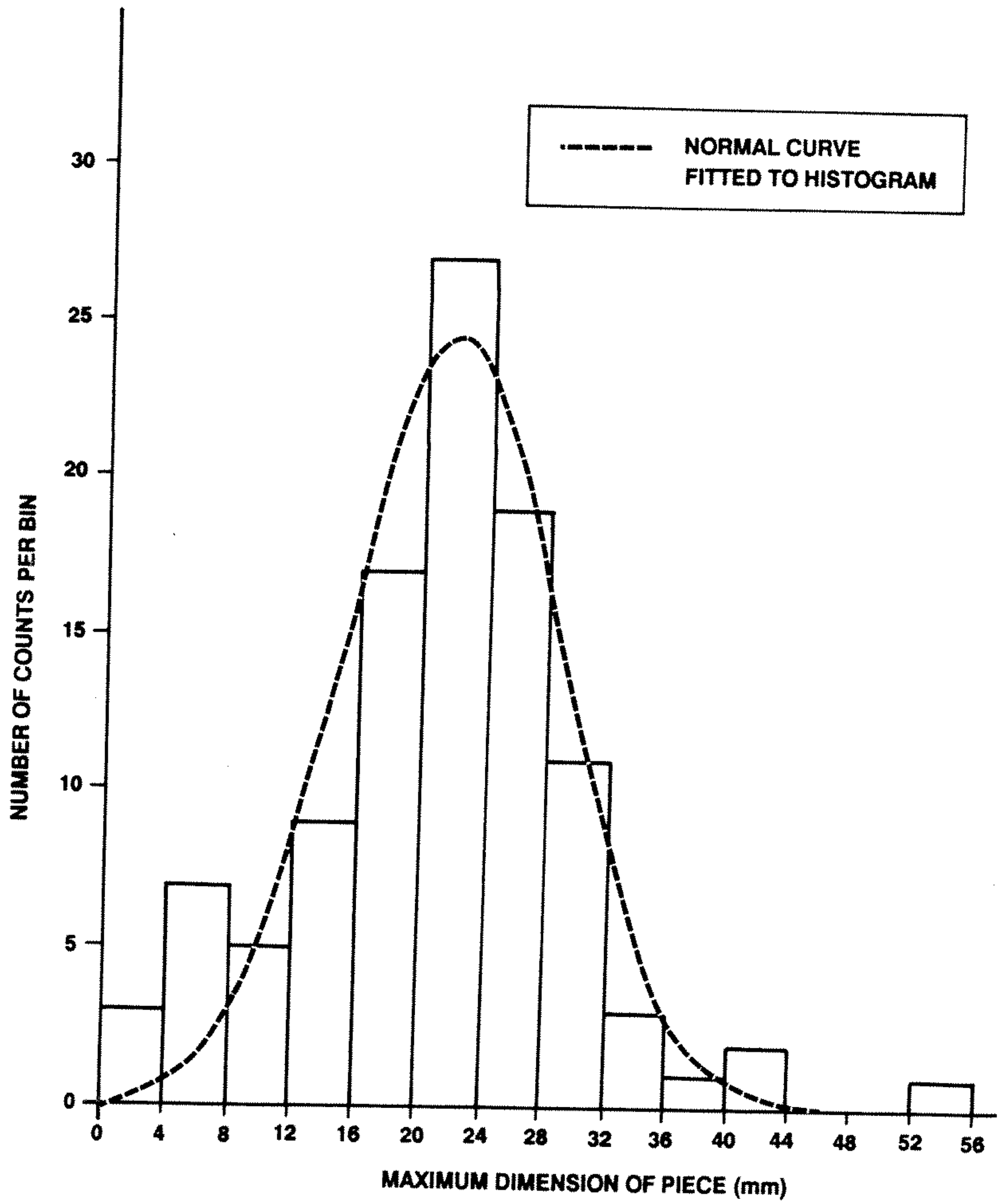
SIEVE ANALYSIS TEST Y006

FIGURE 7.4



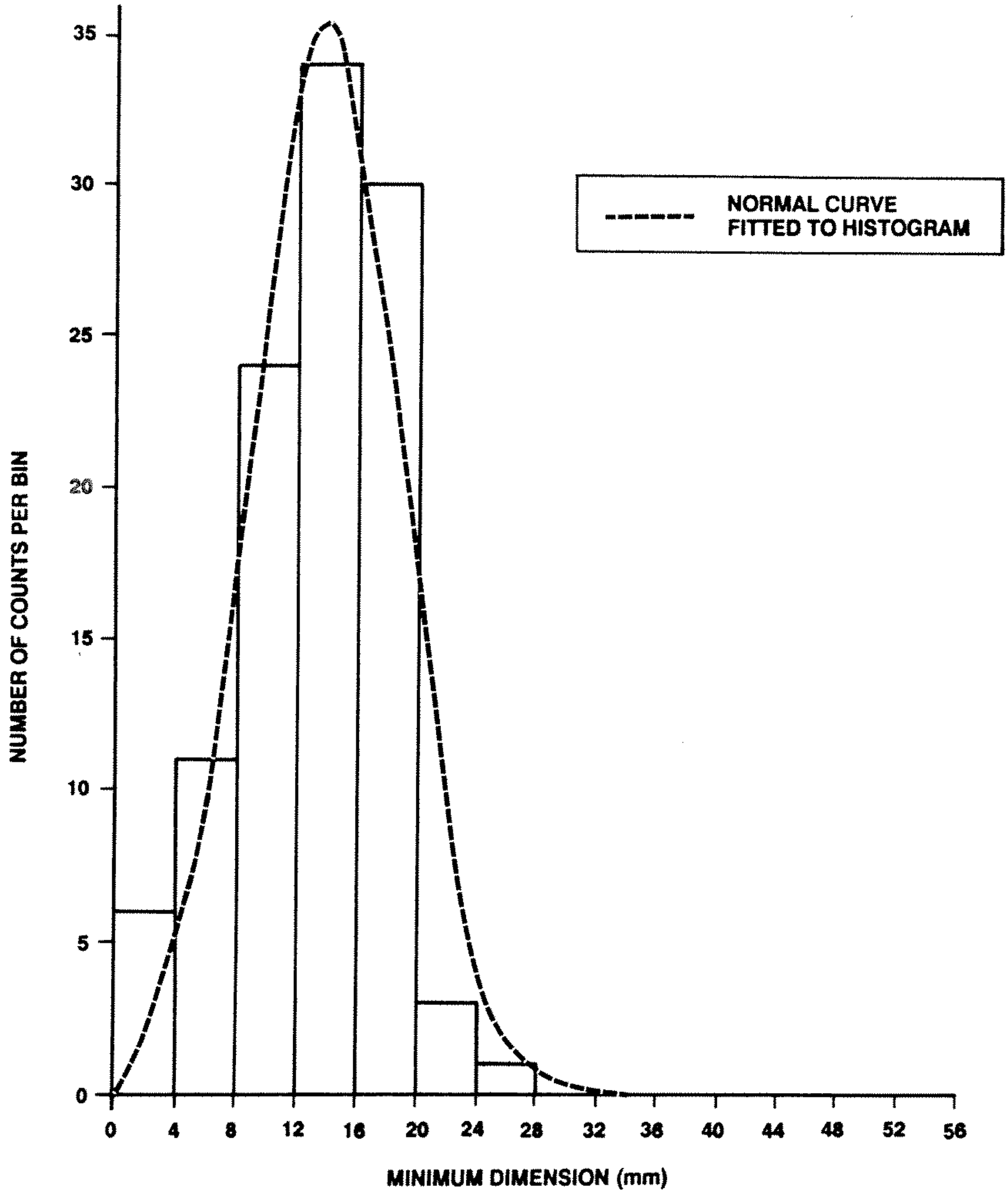
SIEVE ANALYSIS TESTS Y002, Y007

FIGURE 7.5



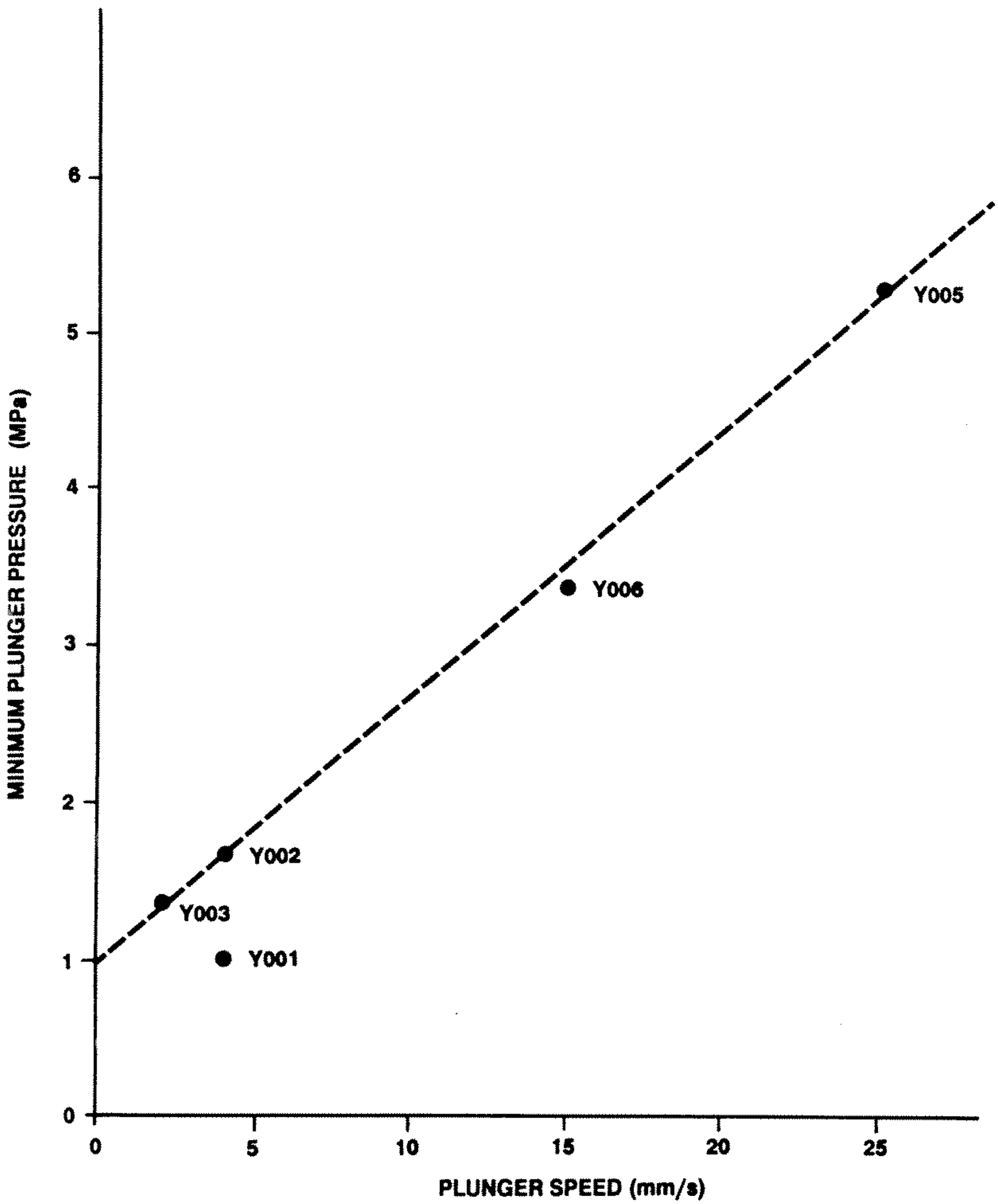
HISTOGRAM OF LARGE PIECE SIZES
TESTS Y002, Y003, Y006 AND Y007

FIGURE 7.6



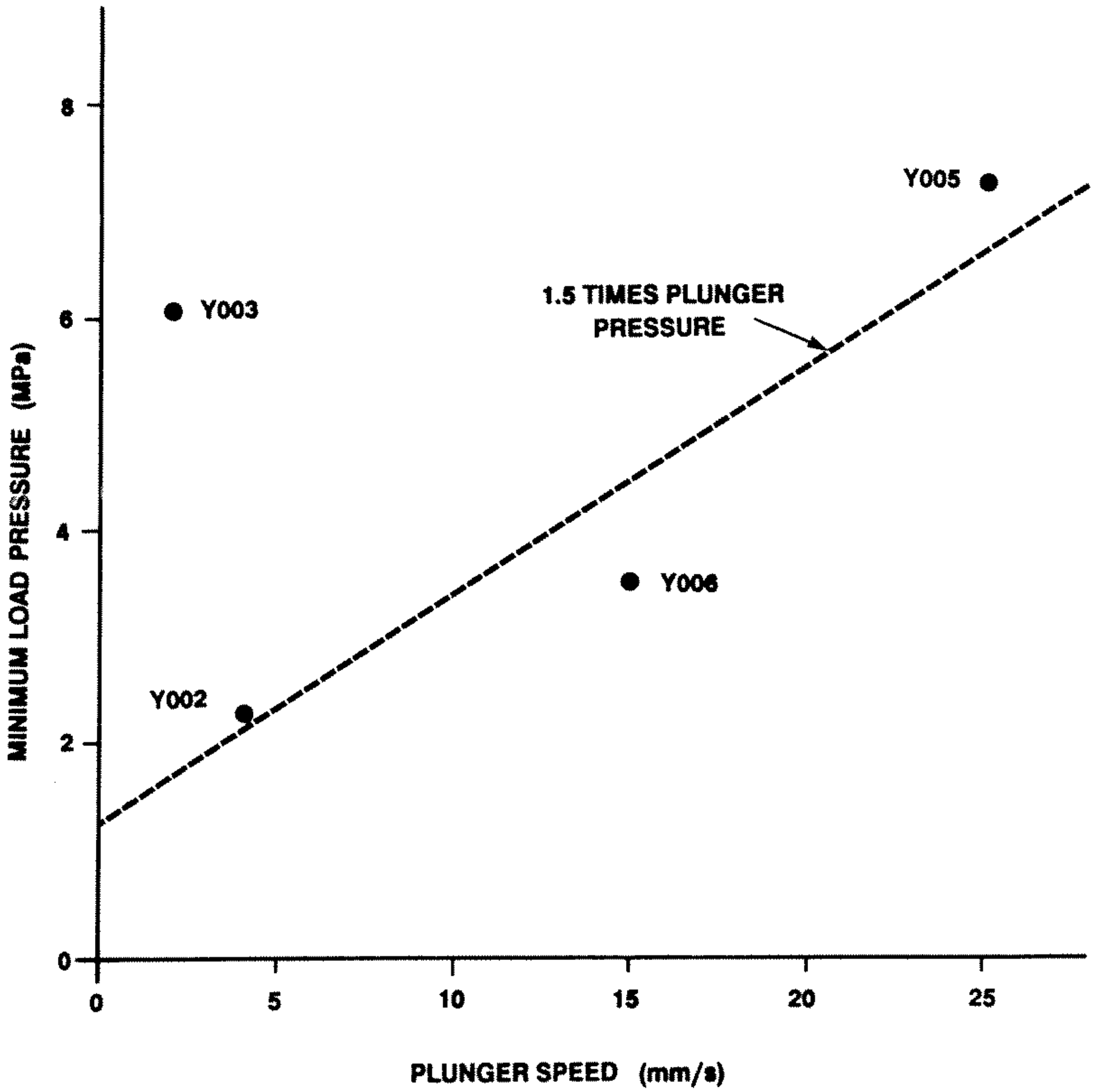
HISTOGRAM OF LARGE PIECE SIZES
TESTS Y002, Y003, Y006 AND Y007 MINIMUM DIMENSION

FIGURE 7.7



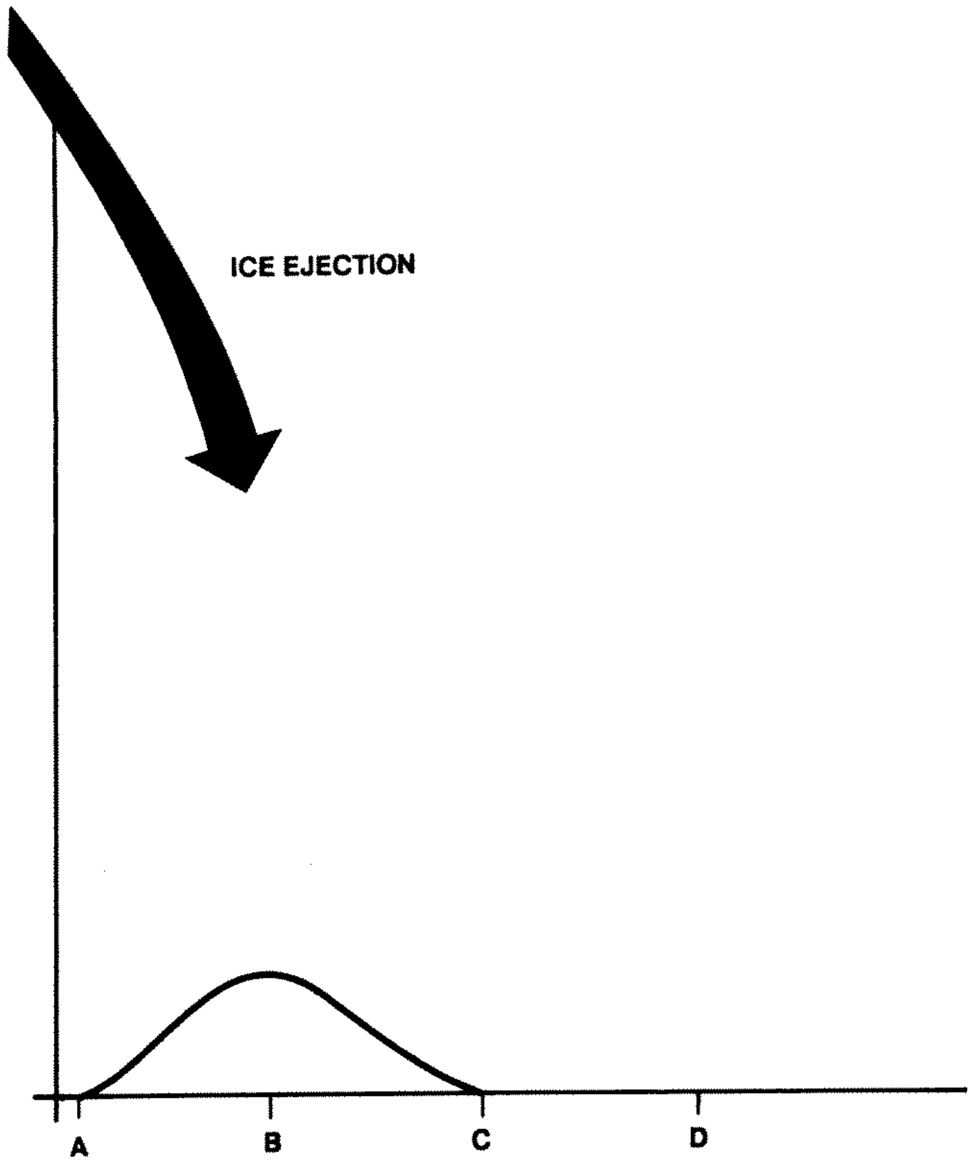
MINIMUM PLUNGER PRESSURE AS A FUNCTION OF PLUNGER SPEED EXCLUDING INITIAL FAILURE

FIGURE 7.8



MINIMUM LOCAL PRESSURE AS A FUNCTION OF PLUNGER SPEED
EXCLUDING INITIAL FAILURE

FIGURE 7.9



A - MINIMUM DISTANCE

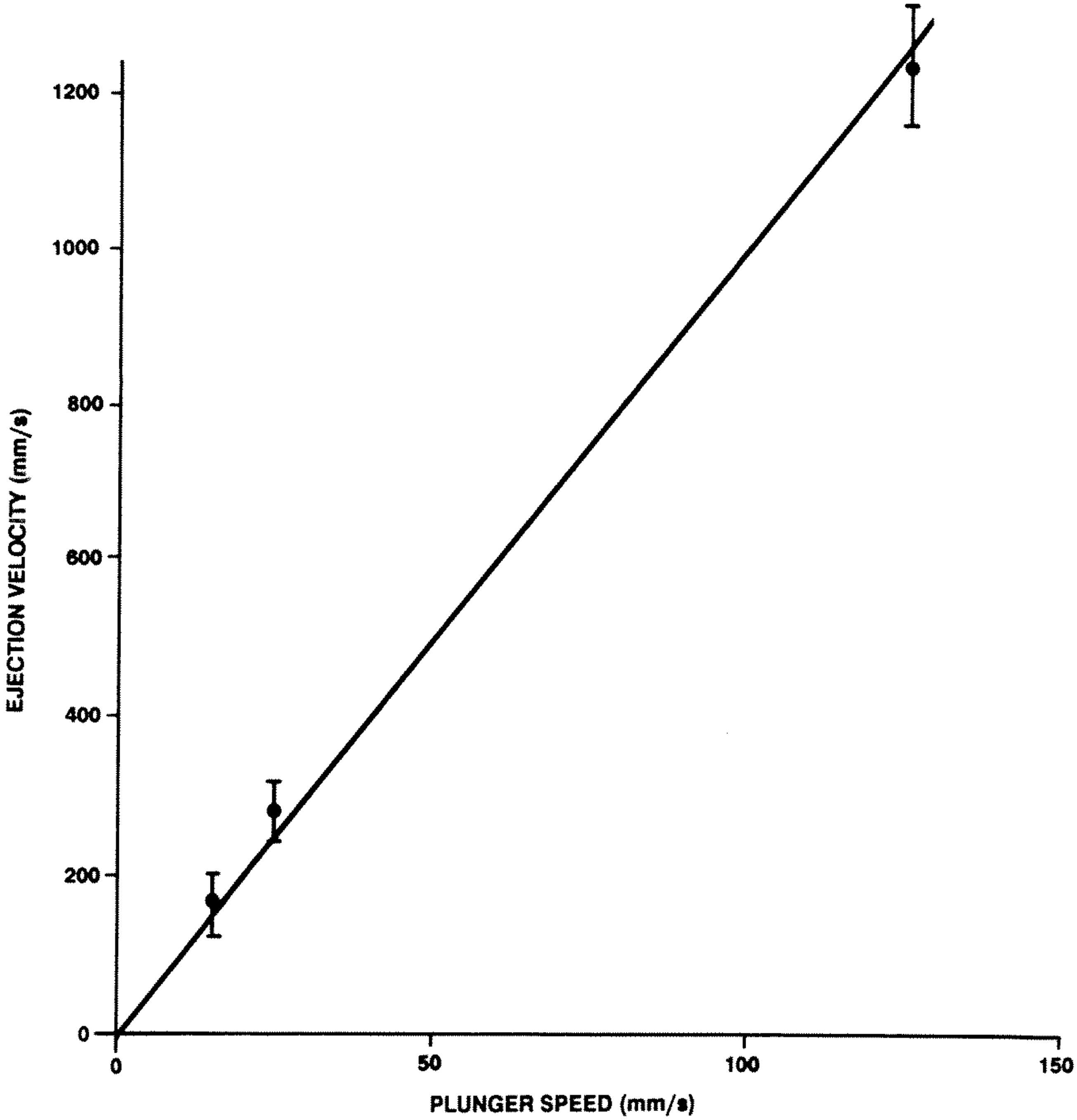
B - MOST COMMON DISTANCE

C - MAXIMUM OF CONTINUOUS COVERAGE

D - MAXIMUM DISTANCE FOR DISCRETE PIECES

ICE EJECTION DISTANCE

FIGURE 7.10



EJECTION VELOCITY AS A FUNCTION OF PLUNGER SPEED FOR MOST LIKELY EJECTION DISTANCE DATA

FIGURE 7.11

8 REFERENCES

1 Molipak reference

2 Canmar Kigoriak Impact Tests

3 GEOTECH's Crushed Ice Tests for Gulf

4 Log-normal Distribution

9 APPENDIX

9.1 Mechanical Drawings

The machine drawings and the commissioning of the test frame are included in this section. Note that the test frame was constructed for the National Research Council of Canada under Contract No.31944-7-004.

The data contained within this appendix is thus not covered by the confidentiality restrictions of the project. This appendix material is included for completeness only.

SSC FILE NO. 31944-7-0004

FINAL REPORT

LABORATORY TEST SYSTEM FOR ICE CRUSHING AND EXTRUSION

For the National Research Council of Canada

GEOTECHnical resources ltd.
4500 - 5 Street N.E.,
Calgary, Alberta T2E 7C3

Ice Crushing and Extrusion Test System

Table of Contents

1.0 INTRODUCTION

1.0 General

The project to provide an ice crushing and extrusion test system was divided into two phases.

Phase I was concerned primarily with the design and manufacture of a load testing frame and certain system control components.

Phase II involved the assembly of the items made in Phase I to other equipment made available by Memorial University of Newfoundland, the National Research Council of Canada and GEOTECHnical resources ltd. In total this equipment provides a complete material testing system.

The load testing machine and certain accessories have been installed in the GEOTECH cold room facilities and commissioning tests performed. Currently the system is being utilized to perform research for the benefit of the NRC, Memorial University and an industry group.

Phase I of the project was completed according to schedule however the second phase was delayed because of other commitments and also a rather protracted debugging of the electrical and data acquisition components. This delay has had minimal impact on the scheduling of the subsequent research work with the equipment.

2.0 REVIEW OF WORK CONDUCTED

2.1 Mechanical

2.1.1 To the load frame that was made in Phase I have been added:

- o hydraulic actuator
- o servo valve
- o high pressure oil filters for power and pilot valve supply

- pressure gauges and pressure transducers that are used in load measurement
- displacement transducers that are used for displacement measurement and feedback control

2.1.2 An instrumented upper platen has been made which provides nine locations for sensing pressure. The "pressure cells" comprise a sensing piston and matching bushing. A miniature load cell (provided by NRC) is installed at each pressure cell. The size of the piston and the rating of the load cell may be selected from a range to suit the anticipated pressures generated on the platen during ice testing.

A lower platen and matching side plates has been made. The platen provides a superior surface on which a sample may be made prior to positioning the lower platen under the upper platen. The upper platen normally remains attached to the test machine.

Additionally the lower platen may be coated with a variety of materials such as teflon (PTFE) or Inerta (a proprietary epoxy based paint used on ice breaker hulls) to evaluate their effects on the extrusion process.

2.1.3 Hydraulic power system components have been set up outside the cold room. Power and return lines were run to the test machine which is inside the cold room. Some maintenance and repair work was required to this equipment during the course of commissioning.

2.2 Electrical

2.2.1 The servo controller was installed in an equipment rack located in the GEOTECH control room. Actuator pressure, platen displacement and pressure cell signals are fed to the controller and to the GEOTECH data acquisition system.

An electrical circuit has been provided which uses actuator pressure signals to generate a system load signal.

2.3 Frame Installation

The GEOTECH cold room had to be partially disassembled and then reinforced to accept the test machine. The frame was designed to fit into an existing space without requiring any major modifications to the cold room. Assembled weight of the machine without accessories is about 4500 kg.

2.4 Commissioning

A variety of tests have been performed to confirm proper operation of the system to establish some measures of the performance of the equipment. The results of the performance evaluation are described in Appendix C.

The commissioning process became rather protracted as a result of spray electrical signals interfering with the data acquisition system. These problems have been rectified.

The system is now being used to generate research information on the crushing and extrusion of ice.

3.0 PROJECT RESULTS

3.1 The operational system which includes the hardware items covered in this contract is complete and performing per specification.

The hardware items covered in the contract are presently located at the premises of GEOTECHnical resources where they are being used for research as per the requirements of NRC.

APPENDIX A

System Specification

1.0 Physical Dimensions and Weight

Load testing frame with hoist, loading table and all non-NRC equipment removed.

Height	71 in
Length	70 in
Width	36 in
Approx Weight	7400 lb
Frame load capacity	1 x 106 lbf

Bearing Pad

Dimensions	14.34 x 20 x 30 in
Approximate weights	650 lb

2.0 Loading Table and Hoist Capacity — 2200 lb

3.0 Plattens

Dimensions of crushing faces	20 x 30 in
Pressure cells, qty	9
Available pressure cell ratings	250-18,000 lb/in^2 (1.7 - 125 MPa)

Pressure cell rating depends upon selection of piston size and load cell capacity.

The following additional specifications apply to the system as configured with various components on loan from Memorial University.

1. **Hydraulic System**

Pressure rating	5000 lb/in2
Actuator static load capacity	1×10^6 lb
Total displacement of actuator rod	12 in
Maximum available displacement with upper and lower platten fitted	7.5 in

2. **Servo Valve**

Moog, 3 stage D079-211

Rating: 200 US pgm for 1000 lb/in2 drop across valve

Pressure rating: 5000 lb/in2

3. **Servo Controller**

GEOTECH design incorporating Moog servo controller components

APPENDIX C

Commissioning Test Results

1.0 PARALLELISM CHECK

The parallelity of the upper platen and the working surface of the test frame was checked. The method was to use lead blocks located on a rectangular grid under the upper platen. Initial size of the blocks was 12 x 12 x 12 mm.

The upper platen was lowered to compress the blocks to approximately 7 mm thick. The final thickness of each block was measured with a micrometer. The results are displayed on the following page. "Front" refers to the area on the frame where the loading table is attached.

The results indicate that for most purposes the working surface is sufficiently parallel to the upper platen. Where greater control of parallelism is required, the lower platen may be used. The two platens may be brought into uniform contact and gaps under the lower platen filled with an epoxy type grouting. The underside of the lower platen should have been previously prepared to prevent adhesion of the grouting compound.

2.0 STALL TEST

The hydraulic supply system, including the actuators were pressured to 5500 - lb/in^2 with the upper platen in contact with the lower working surface. This applied a load of 1.14 x 10 lbf to the bearing pad and frame. No problems were observed.

Subsequently the hydraulic supply system,up to but not including the actuator, was pressurized to 7500 lb/in^2.

DEVIATION — LOWER WORKSURFACE RELATIVE TO UPPER PLATTEN

FRONT

20" x 30" PLATTEN

1	2	3	4	5	6
0.00	0.10	0.29	0.45	0.48	0.55
7	8	9	10	11	12
0.10	0.28	0.48	0.57	0.54	0.50
13	14	15	16	17	18
0.35	0.55	0.65	0.67	0.71	0.69
19	20	21	22	23	24
0.48	0.69	0.82	0.87	0.83	0.77
25	26	27	28	29	30
0.50	0.67	0.70	0.71	0.70	0.63
31	32	33	34	35	36
0.63	0.72	0.84	0.79	0.76	0.70

VALUES IN MM.
ADD 6.40 MM TO VALUES TO GET
ACTUAL MEASURED VALUE.

PROJ 9545
14 OCT 88

3.0 FRAME STIFFNESS TEST

Stiffness of the load testing frame was checked by positioning two LVDT's across opposite sides of the opening to the work area. The LVDT's were secured to the edges of the flange which forms the opening.

With the system pressure at approximately 4500 lb/in^2, the upper platen was lowered to the work surface and stalled out.

LVDT measured displacements and applied load are shown in graphs from Test C006.

The measured stiffness of the frame is 0.14mm/MN or 0.61mm for the rated load of 4.45MN. This figure compares favourably with the published stiffness values for an MTS four column frame of similar rating. [MTS model 311.51 rated for 5.0 MN has frame deflection of 0.76 mm].

4.0 DISPLACEMENT VERSUS TIME

Displacement versus time tests were performed to check measured displacement rates for various ramped commands. Test C007 is typical of a slow speed test. The tests were performed before optimum system gain was selected.

5.0 STEP INPUT TESTS

A range of tests was performed showing system response to a rectangular step input command. The servo system gain was varied. From the results the desired system gain was selected. These tests were performed with approximately 4500 lb/in^2 hydraulic supply pressure.

It can be seen that the maximum displacement rates for this supply pressure are approximately 210 mm/sec extending and 160 mm/sec retracting. These are no load values.

As the gain is increased ('G' value in graph heading) the system more quickly adjusts to specified inputs. The displacement rates are essentially independent of the gain settings since the step input sets the valve fully open in all cases.

MATERIALS TEST ANALYSIS PROGRAM
--TEST PARAMETERS AND INFORMATION--

Test name C006	Test duration 84.996	Sec.
Test date ..... 18 Oct 1988	Strain rate 6E-4	1/Sec
Test time 15:49:20	Sample rate 117.647058824	Hz
Test type ..... Mega newt	Sample size (wdh). 100 x 100 x 250	mm
Sample name ... STIFFNESS TEST	Temperature 20	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C006_ch1	Displacement 1	107.2635	0	mm/V
C006_ch2	Displacement 2	107.2635	0	mm/V
C006_ch3	Mean Displacement	107.2635	0	mm/V
C006_ch4	Extend Load	.9265	0	MN/V
C006_ch5	Retract Load	.5217	0	MN/V
C006_ch6	Load	1	0	MN/V
C006_ch7	Command	1	0	V/V
C006_ch11	Lvdt # 1	1.3288	0	mm/V
C006_ch12	Lvdt # 2	1.2473	0	mm/V

Lvdt # 1
vs.
TIME

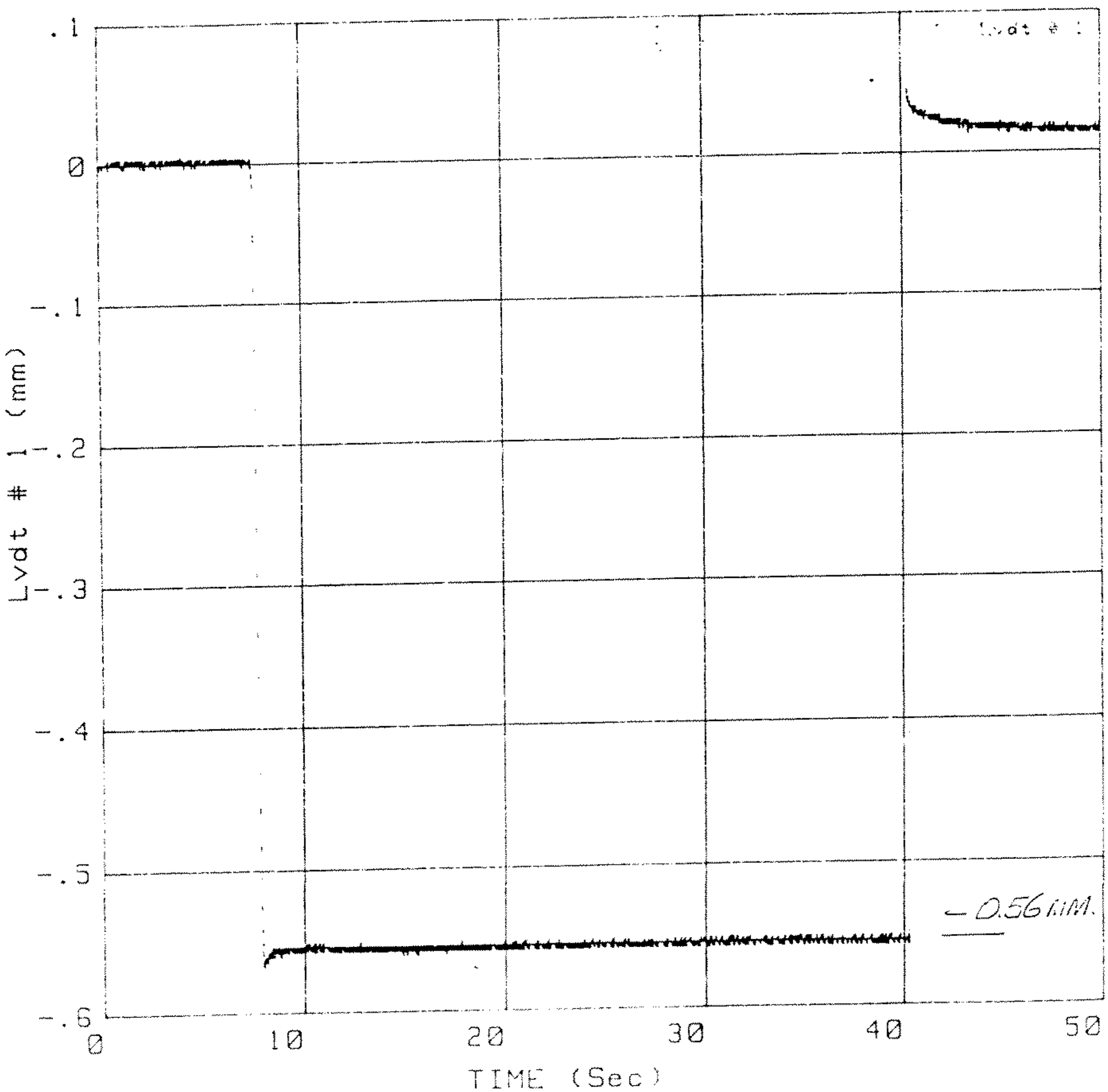
Test: C006
Type: Mega newt
Sample: STIFFNESS TEST

Date: 18 Oct 1988
Time: 15:49:20

Y Offset Removed

Temperature: 20

Average = 2
Truncation Time (s) = 50



Lvdt # 2
vs.
TIME

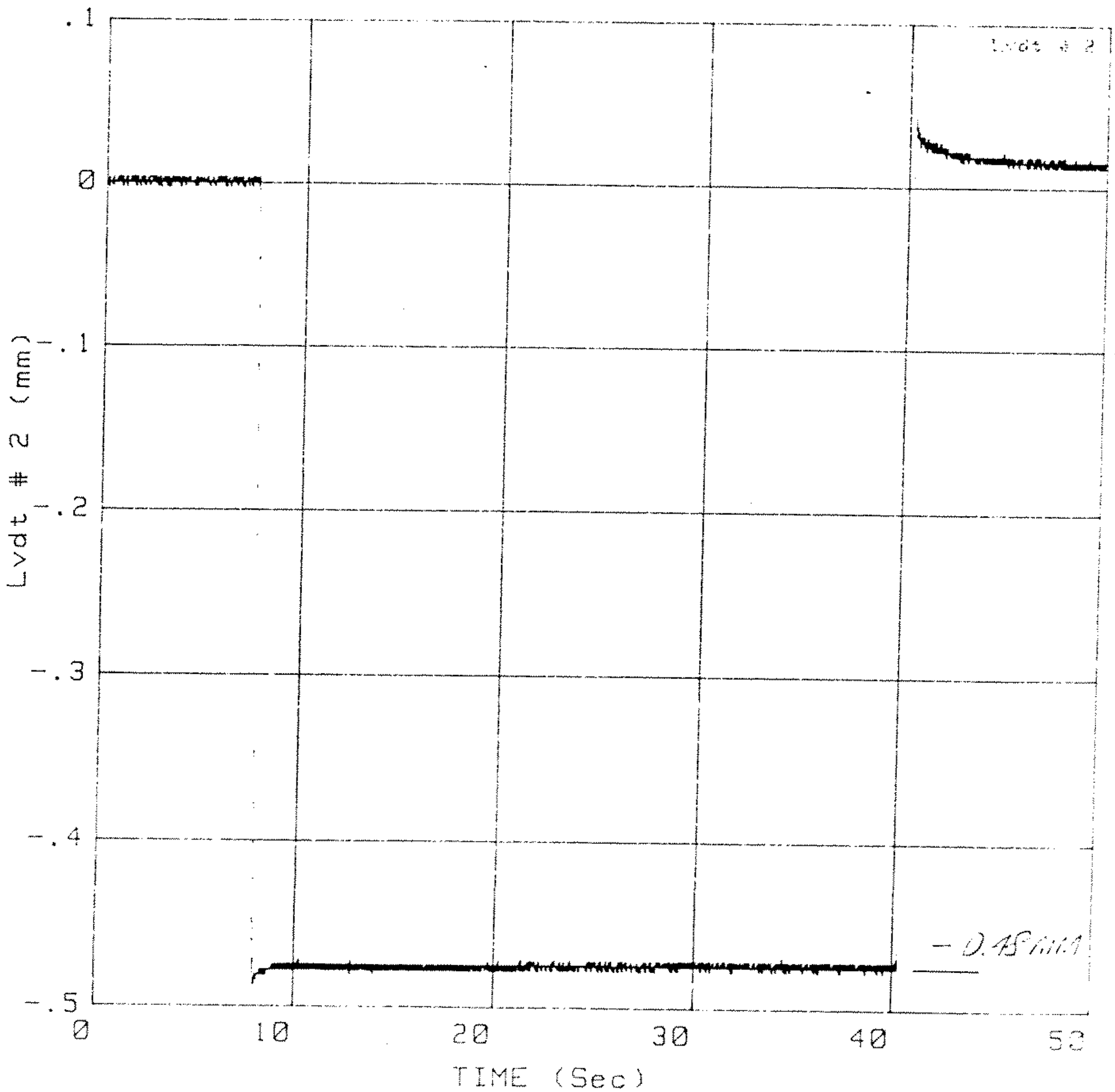
Test: C006
Type: Mega newt
Sample: STIFFNESS TEST

Date: 18 Oct 1988
Time: 15:49:20

Temperature: 20

Y Offset Removed

Average = 2
Truncation Time (s) = 50



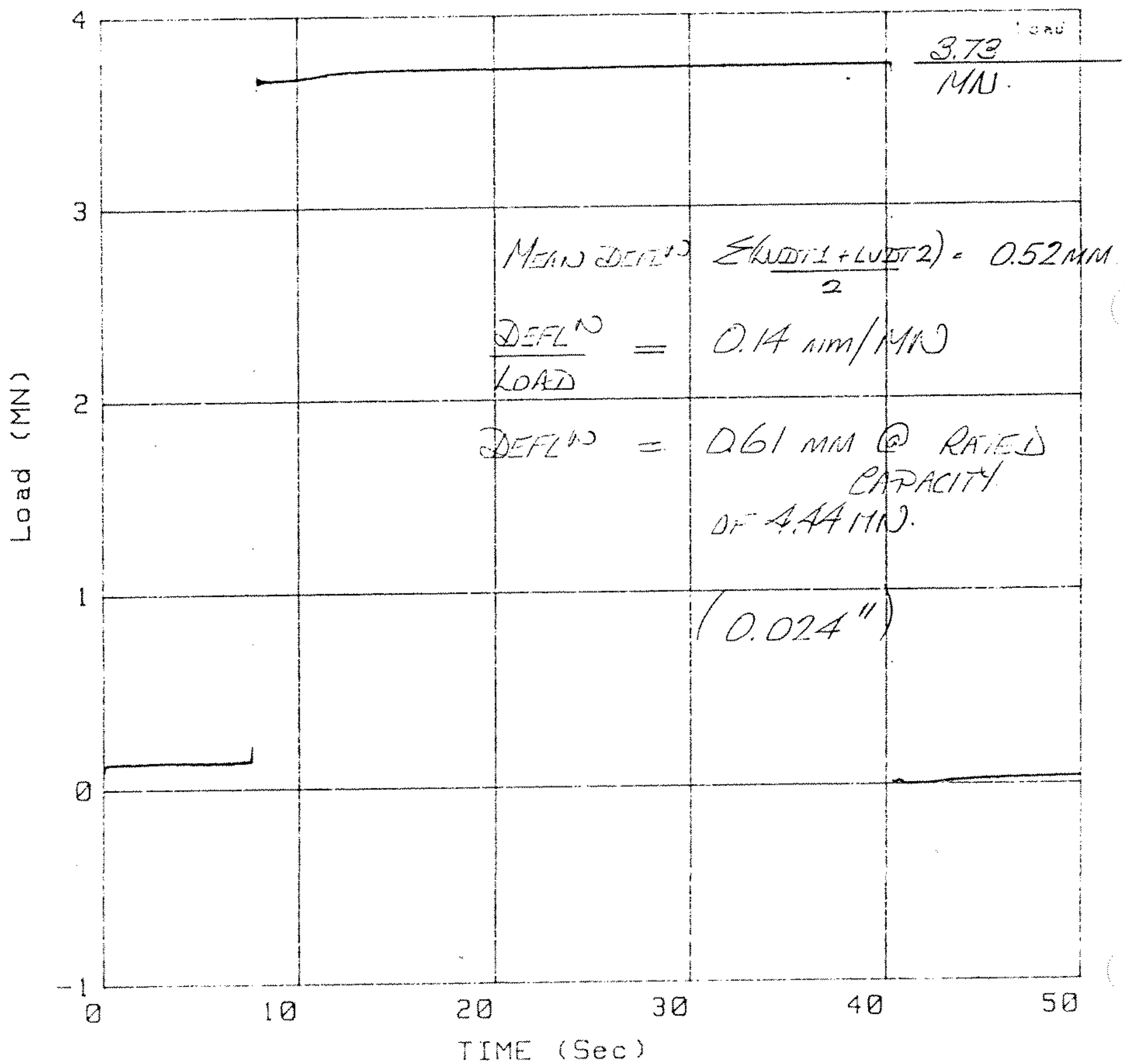
Load
vs.
TIME

Test: C006
Type: Mega newt
Sample: STIFFNESS TEST

Date: 18 Oct 1988
Time: 15:49:20

Temperature: 20

Average = 2
Truncation Time (s) = 50



MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name C007		Test duration	84.996	Sec.
Test date ..... 18 Oct 1988		Strain rate	6E-4	1/Sec
Test time 16:46:35		Sample rate	117.647058824	Hz
Test type ..... Mega newt		Sample size (wdh).	100 x 100 x 250	mm
Sample name ... SLOW TEST		Temperature	20	C.
Sample shape .. Rectangular				

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C007_ch1	Displacement 1	107.2635	0	mm/V
C007_ch2	Displacement 2	107.2635	0	mm/V
C007_ch3	Mean Displacement	107.2635	0	mm/V
C007_ch4	Extend Load	.9265	0	MN/V
C007_ch5	Retract Load	.5217	0	MN/V
C007_ch6	Load	1	0	MN/V
C007_ch7	Command	1	0	V/V
C007_ch11	Lvdt # 1	1.3288	0	mm/V
C007_ch12	Lvdt # 2	1.2473	0	mm/V

DISPLACEMENT:
6 S
STA

Mean Displacement
vs.
TIME

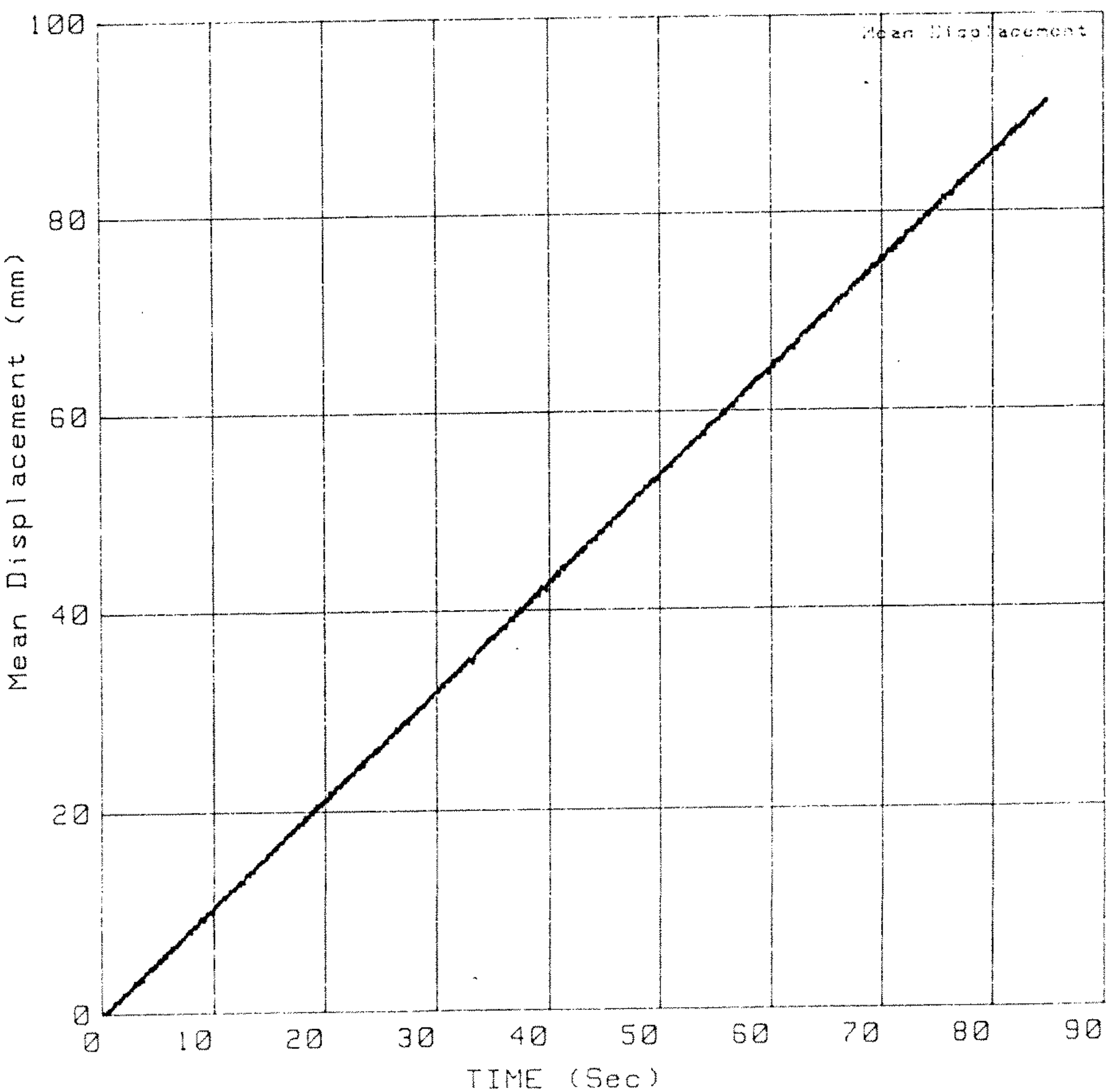
Test: C007
Type: Mega newt
Sample: SLOW TEST

Date: 18 Oct 1988
Time: 16:46:35

Y Offset Removed

Temperature: 20

Average = 2
Truncation Time (s) = 85



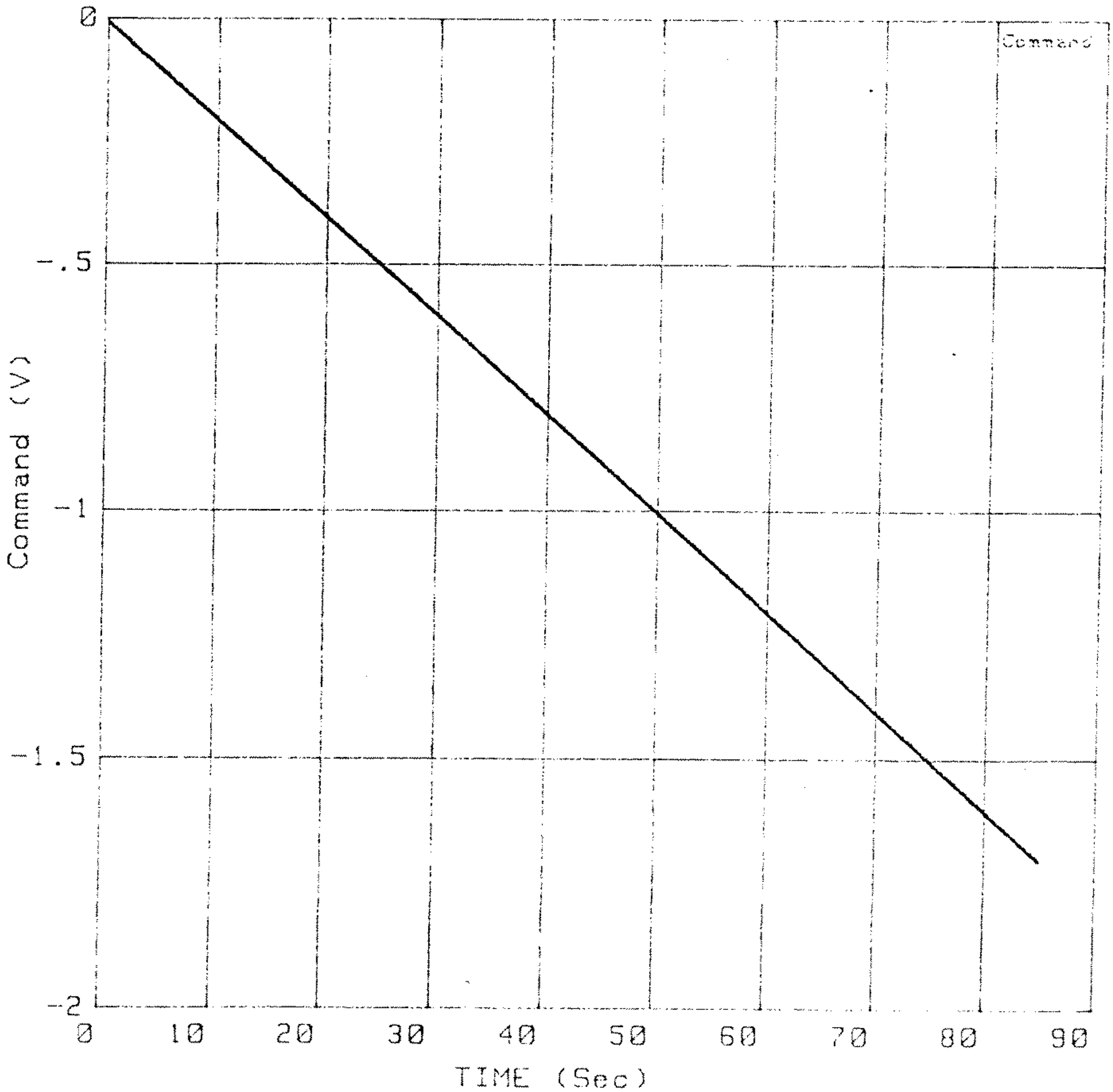
Command
vs.
TIME

Test: C007
Type: Mega newt
Sample: SLOW TEST

Date: 18 Oct 1988
Time: 16:46:35

Temperature: 20

Average = 2
Truncation Time (s) = 85



MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name C011	Test duration	10.197	Sec.
Test date ..... 26 Oct 1988	Strain rate	5E-3	1/Sec
Test time 10:53:26	Sample rate	980.392156863	Hz
Test type ..... Mega newt	Sample size (wdh).	100 x 100 x 250	mm
Sample name ... STEP INPUT G=1.99	Temperature	20	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C011_ch1	Displacement 1	107.2635	0	mm/V
C011_ch2	Displacement 2	107.2635	0	mm/V
C011_ch3	Mean Displacement	107.2635	0	mm/V
C011_ch4	Extend Load	.9265	0	MN/V
C011_ch5	Retract Load	.5217	0	MN/V
C011_ch6	Load	1	0	MN/V
C011_ch7	Command	1	0	V/V
C011_ch11	Lvdt # 1	1.3288	0	mm/V
C011_ch12	Lvdt # 2	1.2473	0	mm/V

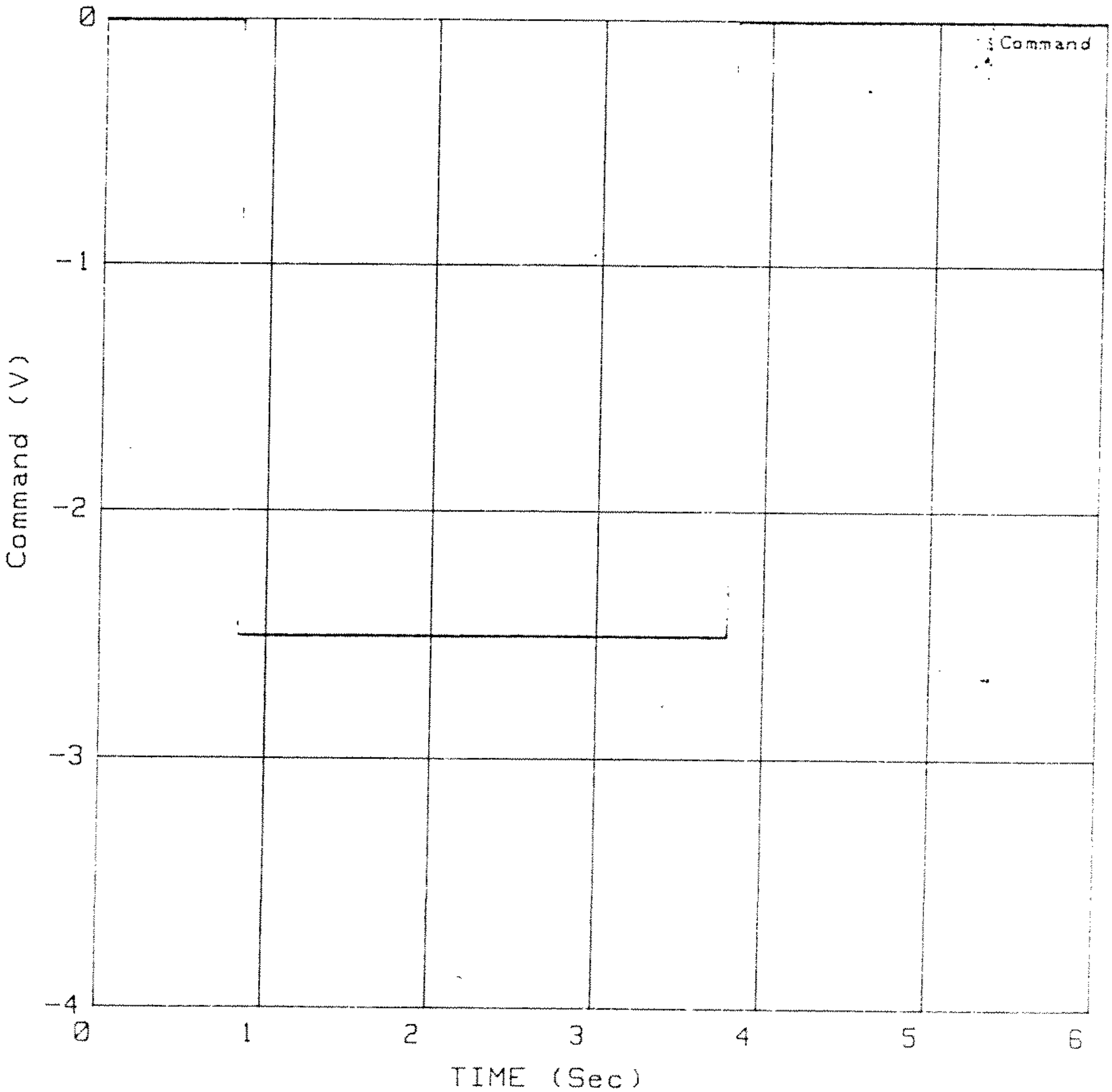
Command vs. TIME

Test: C011
Type: Mega newt
Sample: STEP INPUT G=1.99

Date: 26 Oct 1988
Time: 10:53:26

Temperature: 20

Average = 5
Truncation Time (s) = 6



Mean Displacement
vs.
TIME

Test: C011
Type: Mega newt
Sample: STEP INPUT G=1.99

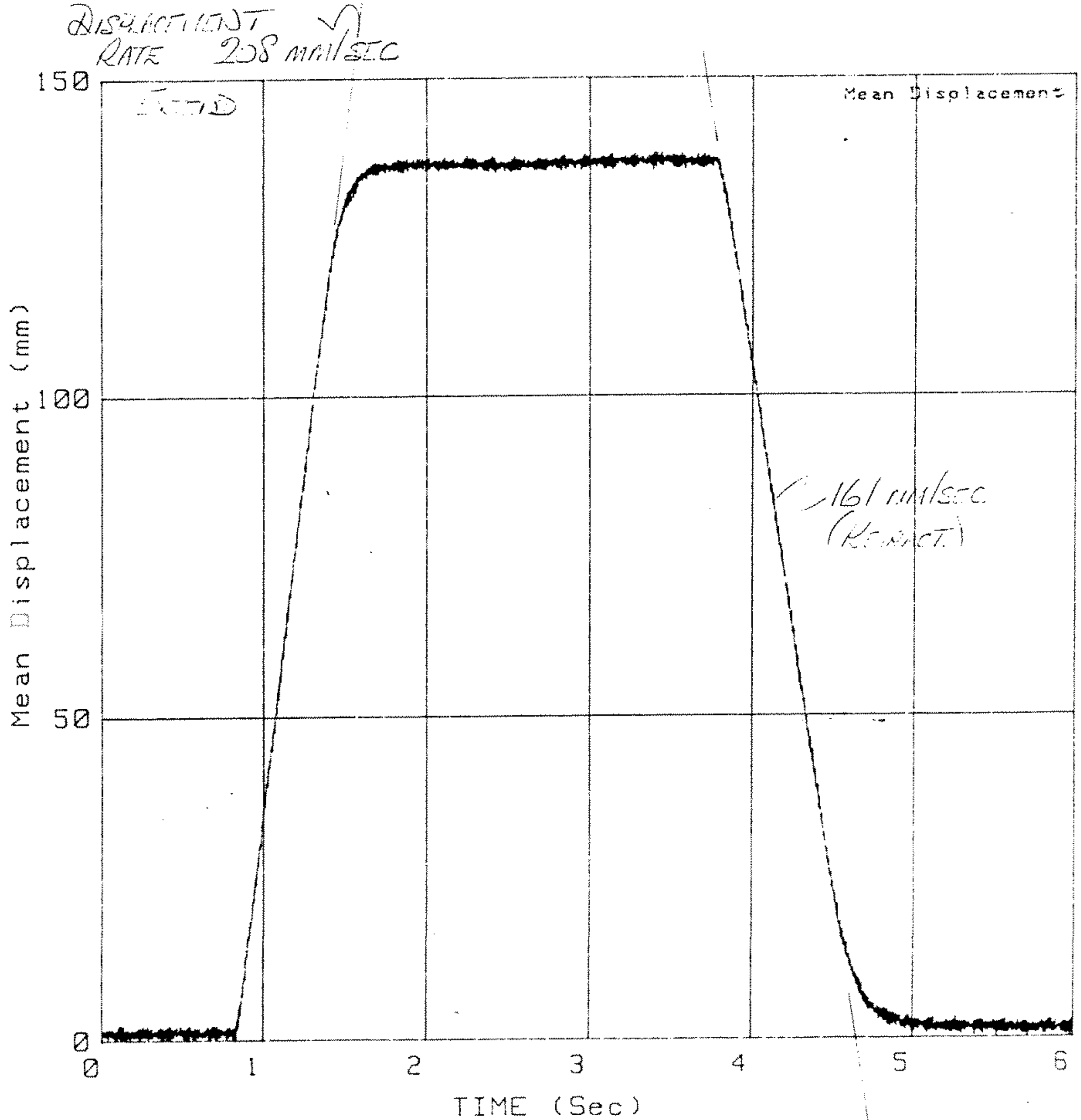
Date: 26 Oct 1988
Time: 10:53:26

Y Offset Removed

Temperature: 20

Average = 5

Truncation Time (s) - 6



MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name C018	Test duration 10.197	Sec.
Test date ..... 26 Oct 1988	Strain rate 5E-3	1/Sec
Test time 16:47:35	Sample rate 980.392156863	Hz
Test type ..... Mega newt	Sample size (wdh). 100 x 100 x 250	mm
Sample name ... STEP INPUT G=5	Temperature 20	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C018_ch1	Displacement 1	107.2635	0	mm/V
C018_ch2	Displacement 2	107.2635	0	mm/V
C018_ch3	Mean Displacement	107.2635	0	mm/V
C018_ch4	Extend Load	.9265	0	MN/V
C018_ch5	Retract Load	.5217	0	MN/V
C018_ch6	Load	1	0	MN/V
C018_ch7	Command	1	0	V/V
C018_ch11	Lvdt # 1	1.3288	0	mm/V
C018_ch12	Lvdt # 2	1.2473	0	mm/V

Mean Displacement
vs.
TIME

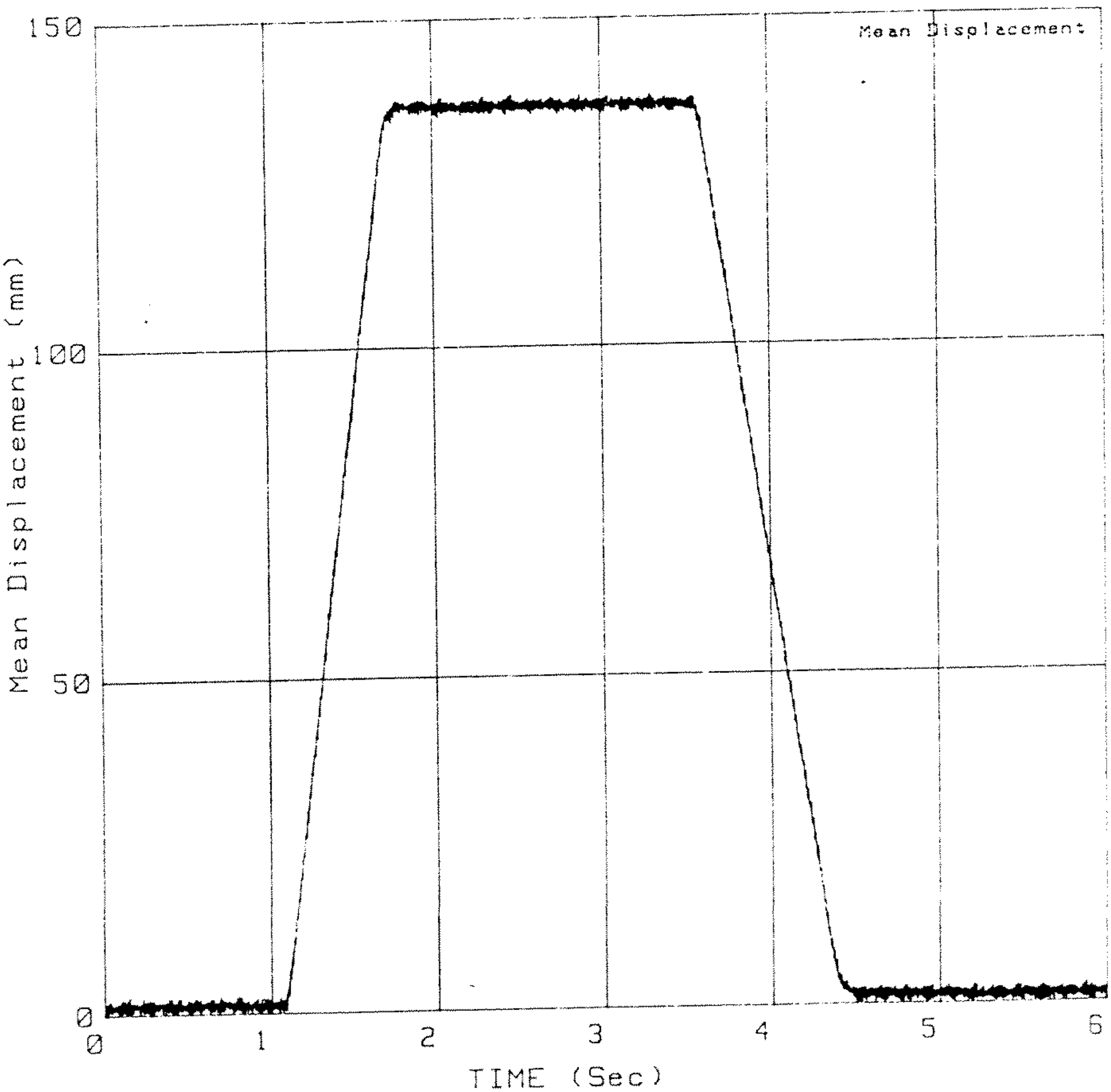
Test: C018
Type: Mega newt
Sample: STEP INPUT G=5

Date: 26 Oct 1988
Time: 16:47:35

Y Offset Removed

Temperature: 20

Average = 5
Truncation Time (s) = 6



MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name C024
Test date ..... 27 Oct 1988
Test time 09:38:15
Test type ..... Mega newt
Sample name ... STEP INPUT G=10
Sample shape .. Rectangular

Test duration .... 10.197 Sec.
Strain rate 5E-3 1/Sec
Sample rate ...... 980.392156863 Hz
Sample size (wdh). 100 x 100 x 250 mm
Temperature ...... 20 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C024_ch1	Displacement 1	107.2635	0	mm/V
C024_ch2	Displacement 2	107.2635	0	mm/V
C024_ch3	Mean Displacement	107.2635	0	mm/V
C024_ch4	Extend Load	.9265	0	MN/V
C024_ch5	Retract Load	.5217	0	MN/V
C024_ch6	Load	1	0	MN/V
C024_ch7	Command	1	0	V/V
C024_ch11	Lvdt # 1	1.3288	0	mm/V
C024_ch12	Lvdt # 2	1.2473	0	mm/V

Mean Displacement
vs.
TIME

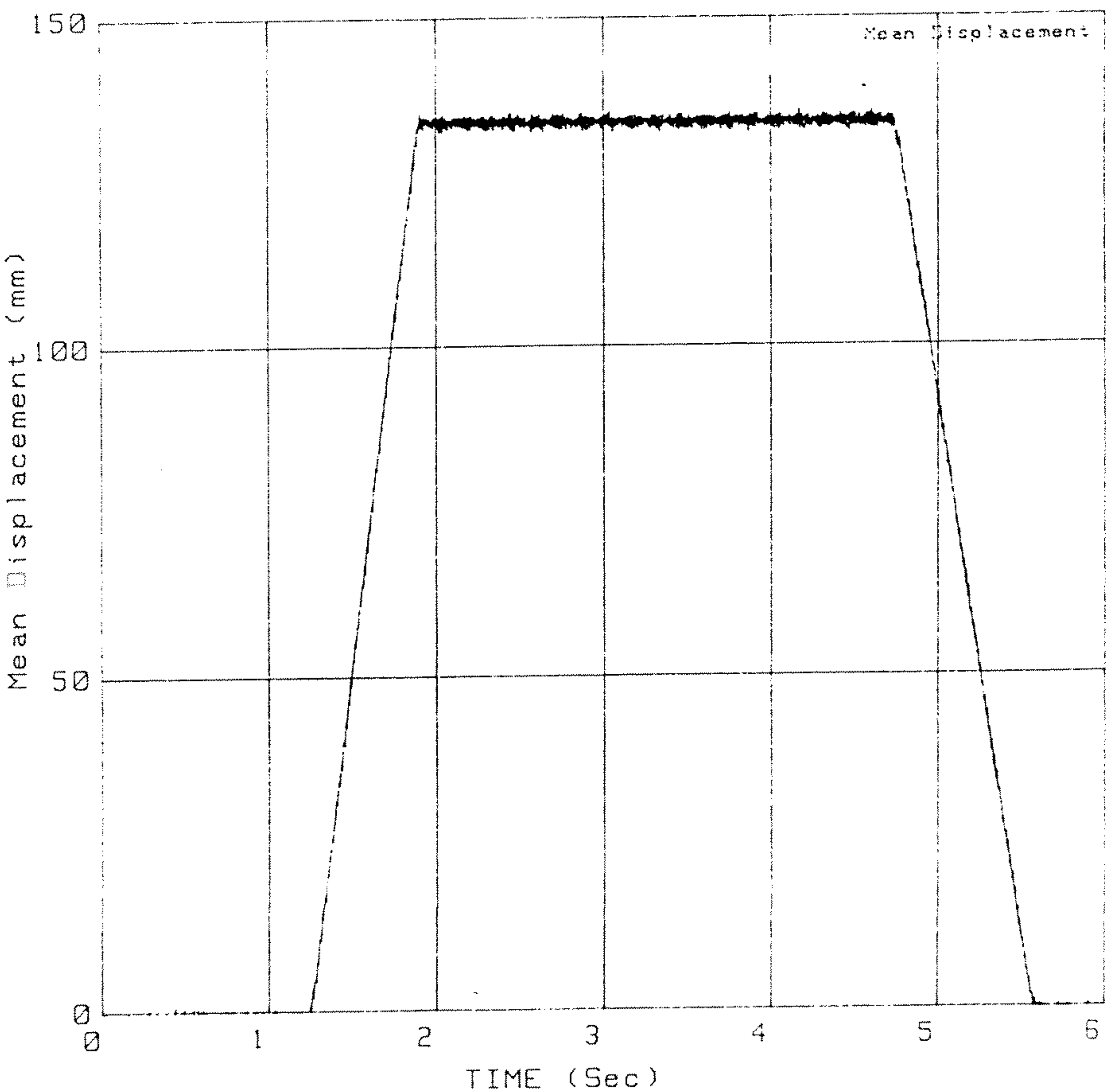
Test: C024
Type: Mega newt
Sample: STEP INPUT G=10

Date: 27 Oct 1988
Time: 09:38:15

Y Offset Removed

Temperature: 20

Average = 5
Truncation Time (s) = 6



MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name C027	Test duration	10.197	Sec.
Test date ..... 27 Oct 1988	Strain rate	5E-3	1/Sec
Test time 11:12:44	Sample rate	980.392156863	Hz
Test type ..... Mega newt	Sample size (wdh).	100 x 100 x 250	mm
Sample name ... STEP INPUT G=25	Temperature	20	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C027_ch1	Displacement 1	107.2635	0	mm/V
C027_ch2	Displacement 2	107.2635	0	mm/V
C027_ch3	Mean Displacement	107.2635	0	mm/V
C027_ch4	Extend Load	.9265	0	MN/V
C027_ch5	Retract Load	.5217	0	MN/V
C027_ch6	Load	1	0	MN/V
C027_ch7	Command	1	0	V/V
C027_ch11	Lvdt # 1	1.3288	0	mm/V
C027_ch12	Lvdt # 2	1.2473	0	mm/V

Mean Displacement vs. TIME

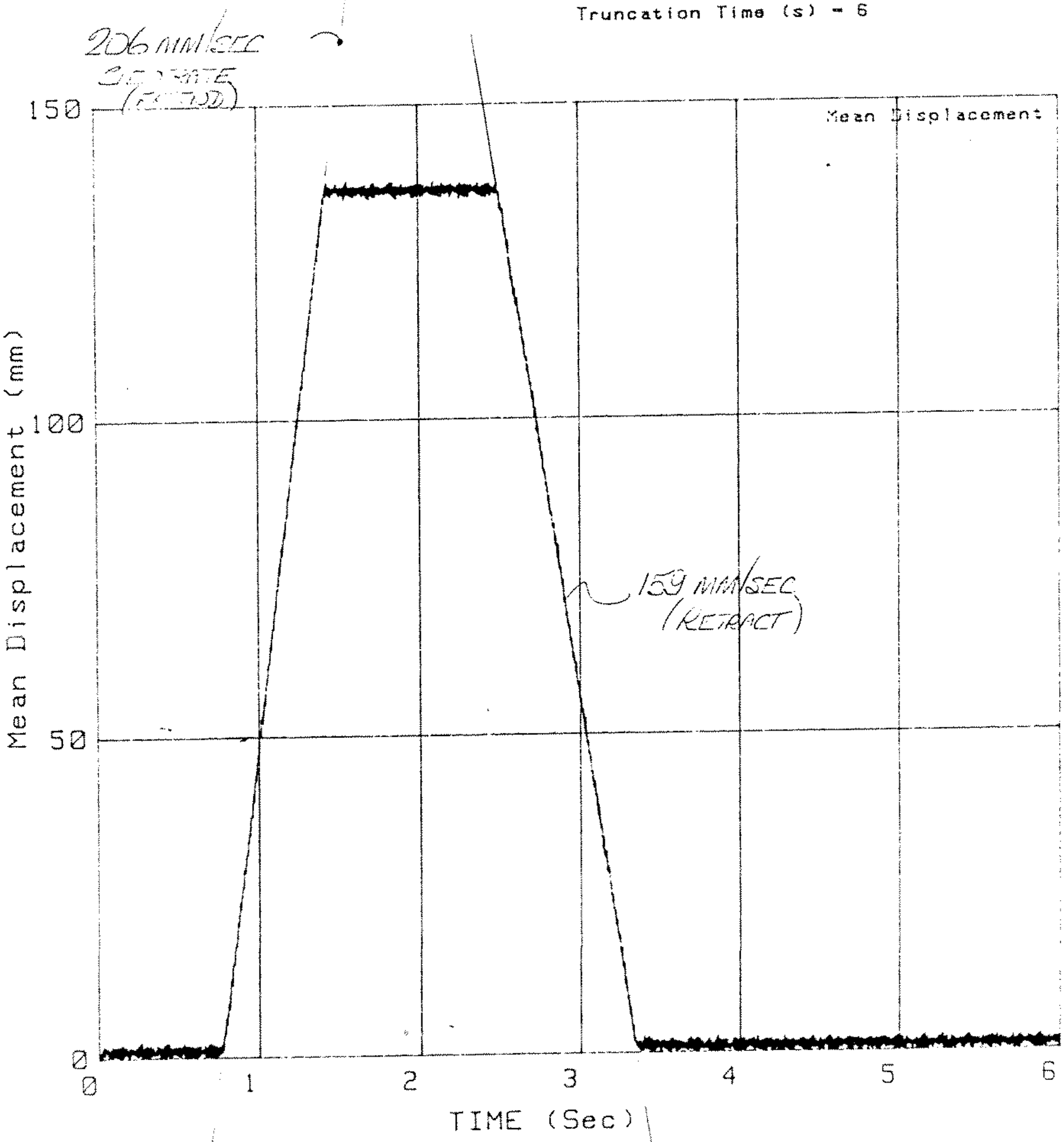
Test: C027
Type: Mega newt
Sample: STEP INPUT G=25

Date: 27 Oct 1988
Time: 11:12:44

Y Offset Removed

Temperature: 20

Average = 5
Truncation Time (s) = 6



Only when the preset value is being approached is system control being exercised.

6.0

A number of tests were performed (including C029) to see how rapidly load could be developed in the system.

Optimally the actuator should be almost fully retracted in order to minimize the fluid volume in the actuator subject to compression. In addition if the actuator is brought up to maximum speed by using a step input (command) the delay associated with valve response is eliminated.

Test C029 shows the result of rapid loading onto a 1 x 10d6 lbf load cell. The cell was of sufficient height as to almost completely fill the available space between upper platen and work surface. The upper platen was brought down to just contact the load cell (i.e., valve response is included in this result).

The result obtained is a function of valve response, available supply pressure and flow rate and system stiffness. Unlike the simple static frame stiffness test, this step input test gives some measure of the combined stiffness of all components in the load chain.

Our system was capable of developing load at a rate of 72.5 MN/sec (5 MN in 0.069 sec) with approximately 4500 lb/in2 supply pressure.

It should be noted that the overload protection system that is provided with the servo controller was not effective at preventing overloads during these tests. The overload feature incorporates a time delay which prevents the system shutting down in response to very short duration overloads (less than 0.025 sec approx.)

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name C029
Test date ..... 31 Oct 1988
Test time 17:45:56
Test type ..... Mega newt
Sample name ... LOAD RATE
Sample shape .. Rectangular

Test duration .... 10.199 Sec.
Strain rate 5E-3 1/Sec
Sample rate ...... 980.392156863 Hz
Sample size (wdh). 100 x 100 x 250 mm
Temperature ......-10 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
C029_ch1	Displacement 1	107.2635	0	mm/V
C029_ch2	Displacement 2	107.2635	0	mm/V
C029_ch3	Mean Displacement	107.2635	0	mm/V
C029_ch4	Extend Load	.9265	0	MN/V
C029_ch5	Retract Load	.5217	0	MN/V
C029_ch6	Load	1	0	MN/V
C029_ch7	Command	1	0	V/V

Command
vs.
TIME

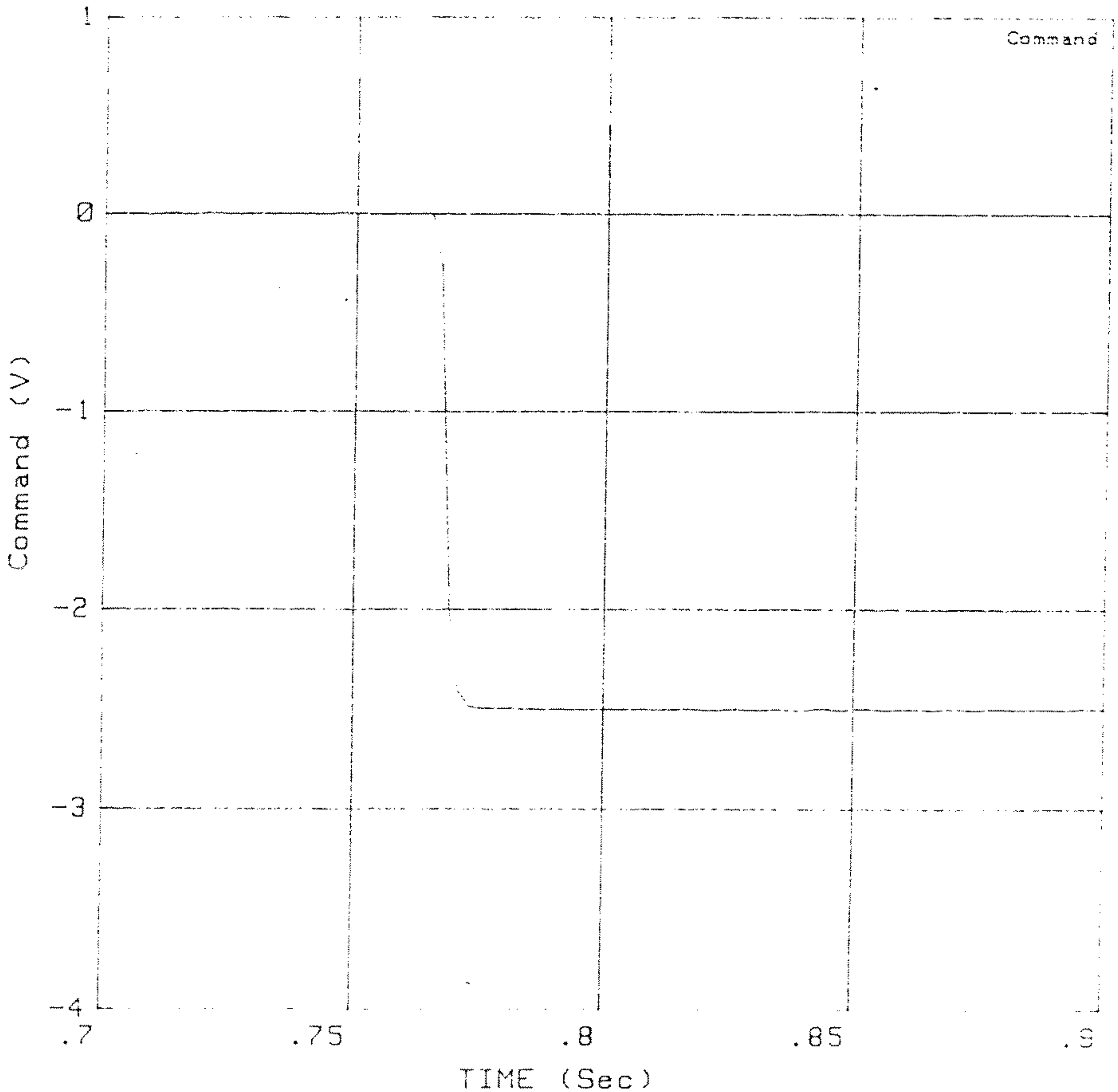
Test: C029
Type: Mega newt
Sample: LOAD RATE

Date: 31 Oct 1988
Time: 17:45:56

Y Offset Removed

Temperature: -10

Average = 2
Truncation Time (s) = 3



Load
vs.
TIME

Test: C029
Type: Mega newt
Sample: LOAD RATE

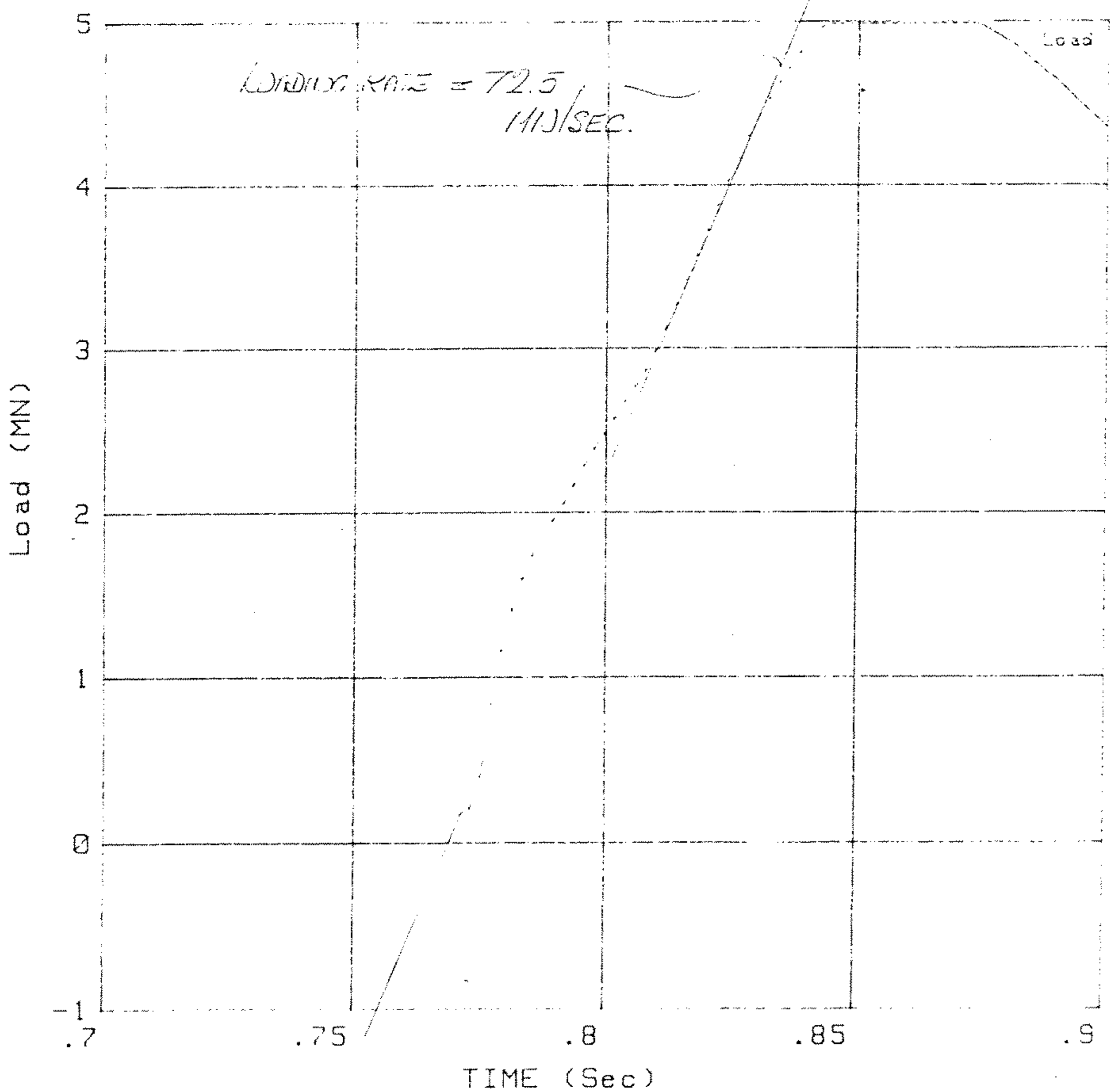
Date: 31 Oct 1988
Time: 17:45:56

Y Offset Removed

Temperature: -10

Average = 2

Truncation Time (s) = 3



7.0

A final series of tests (C040 - C046) were used to check the pressure transducers method of measuring load on the actuator.

At design concept stage for this machine it was decided to use pressure transducers as a means of measuring the applied load on the specimens. To place a load cell in the load path was not considered desirable because of the potential for damage to the cell by large offset loads.
GEOTECH have available a number of 1 x 10 lbf compression load cells which happen to fit in the test machine. These load cells have not been calibrated recently however it was decided that by using 3 cells for calibration purposes we would get a reliable reading of the load measuring system.

Two pressure transducers are mounted on the actuator, one on the piston side, the other on the rod side. Given that the piston and rod area are known it is possible to determine the load exerted by the actuator. The outputs from the two pressure transducers are processed electrically to give a load signal. This load signal may be displayed and/or used for feedback purposes.

The tests were intended to check the accuracy of the 'load' output. The actuator was run at constant velocity to eliminate pressure differentials associated with actuator acceleration.

There was some expectation that load measurement using the pressure transducers might not be very accurate when there were high flow rates into or out of the actuator. From the results obtained it is clear that even at displacement rates of 100 mm/sec, the pressure transducers give good correspondence with the load cells. By using separate sensing ports for the pressure transducers flow in the vicinity of these transducers is minimized.

Some variation can be seen in the slope of the Load versus Load Cell plots. Cell L1 and L2 give slopes of less than 45°, while L4 shows slightly more than 45°.

The load signal circuit has been left as originally set. Without a more precise calibration standard being available there was no clear indication for adjusting the circuit.

Mean Displacement
vs.
TIME

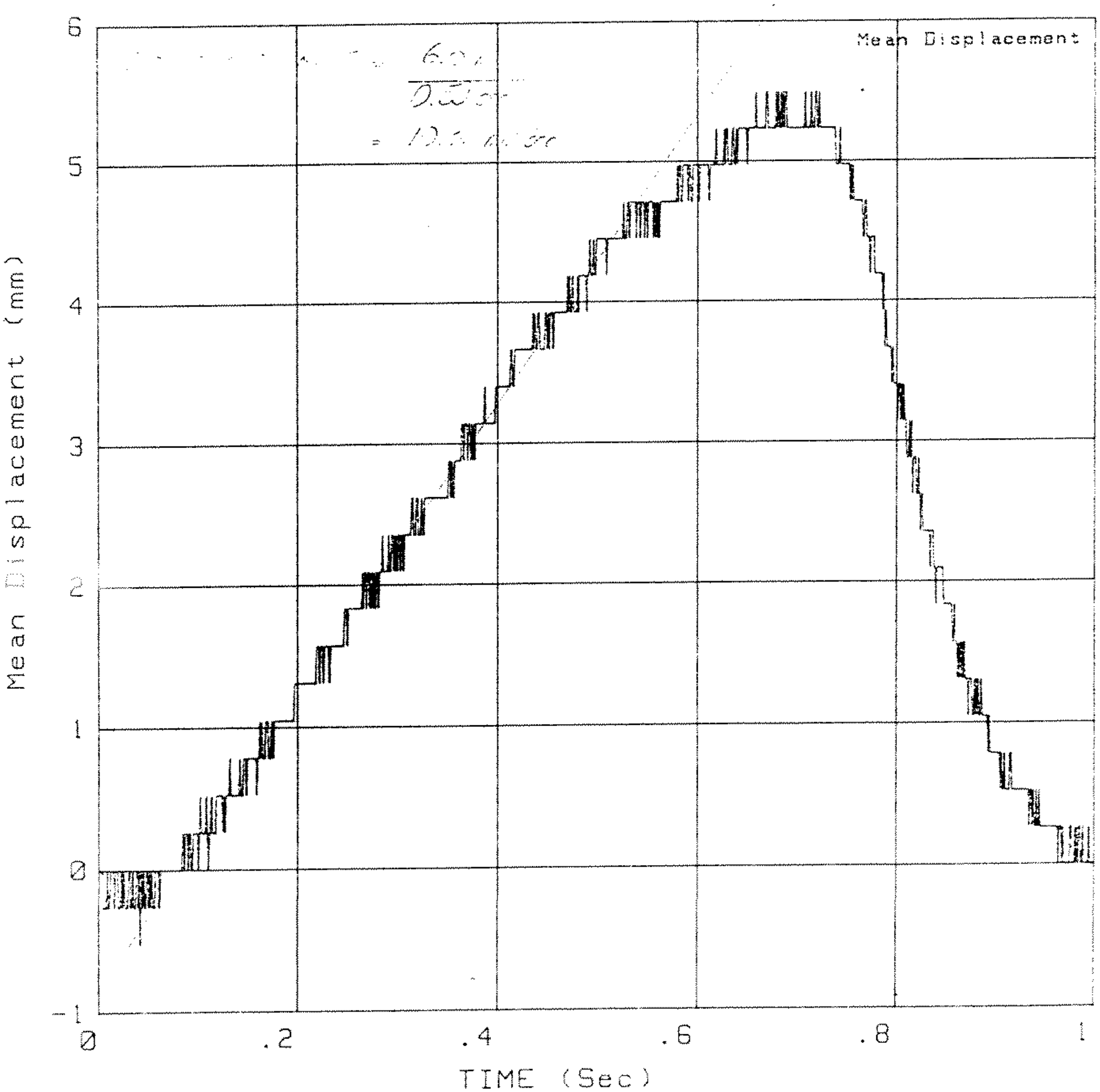
Test: C040
Type: Mega newt
Sample: LOAD CELL L-1

Date: 23 Nov 1988
Time: 11:14:12

Y Offset Removed

Temperature: 0

Average = 2
Truncation Time (s) = 1



Load cell
vs.
TIME

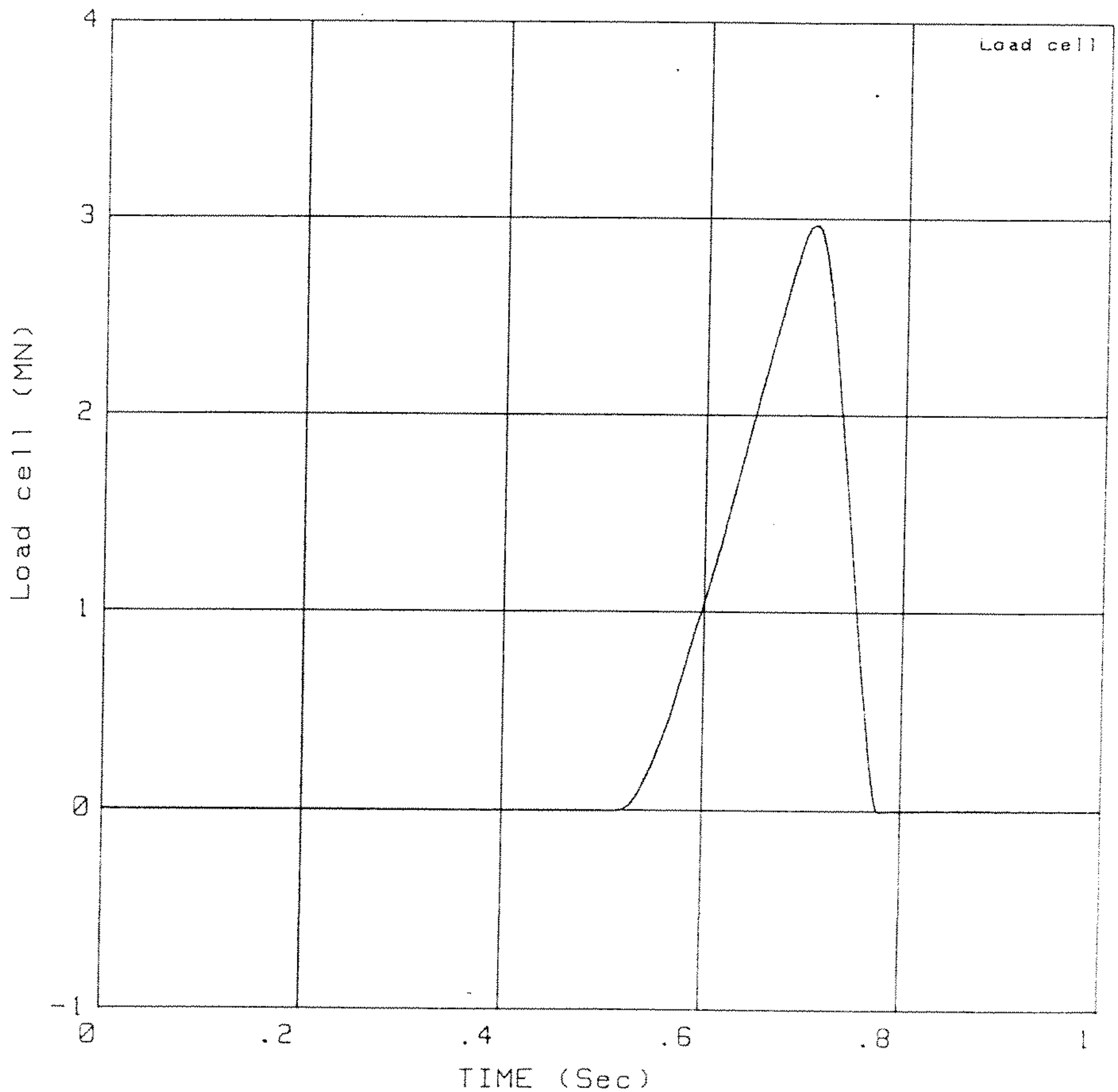
Test: C040
Type: Mega newt
Sample: LOAD CELL L-1

Date: 23 Nov 1988
Time: 11:14:12

Y Offset Removed

Temperature: 0

Average = 2
Truncation Time (s) = 1



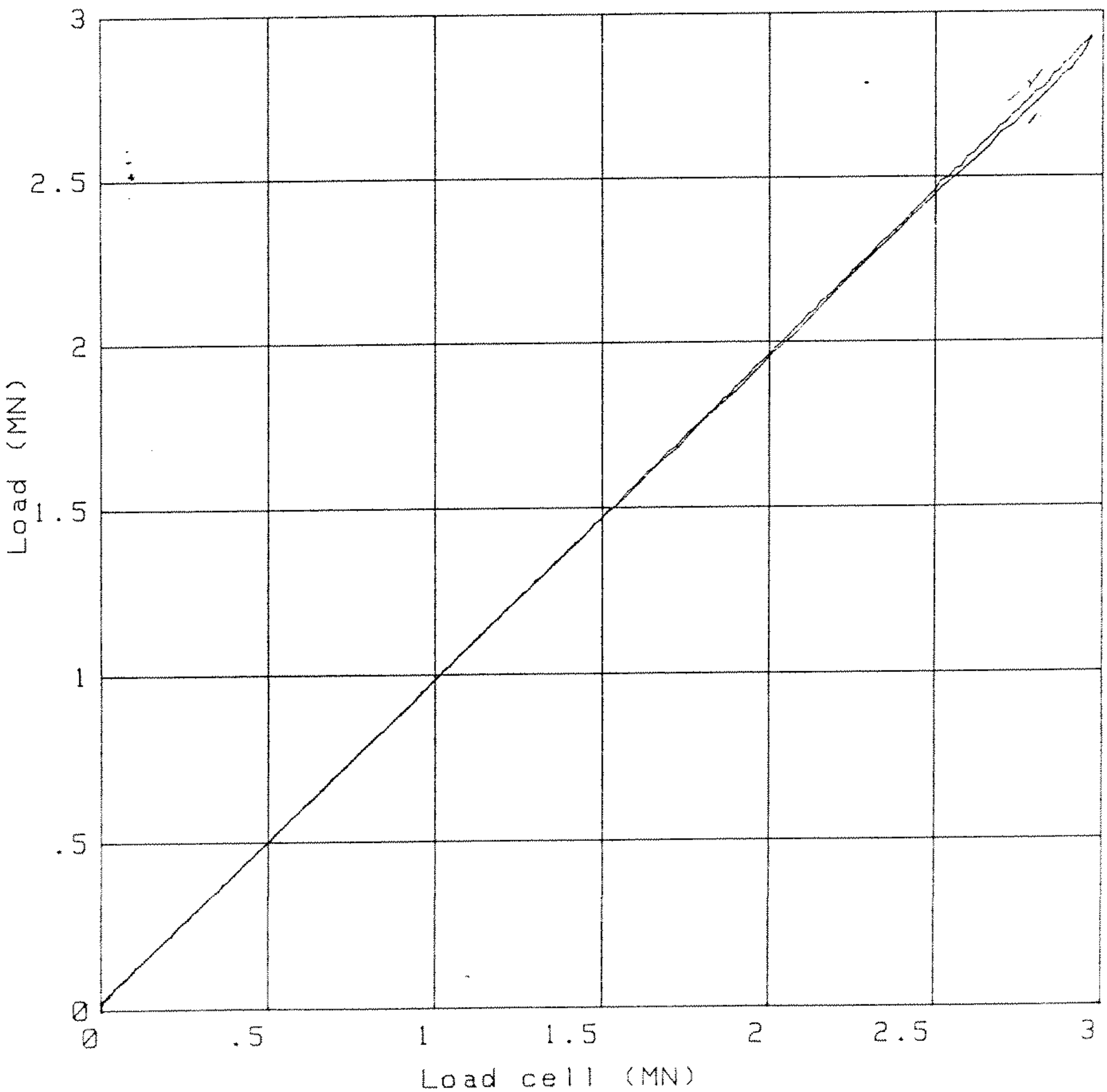
Load
vs.
Load cell

Test: C040
Type: Mega newt
Sample: LOAD CELL L-1

Date: 23 Nov 1988
Time: 11:14:12

Temperature: 0

Y Offset Removed
X Offset Removed
Average = 2
Truncation Time (s) = 1



Mean Displacement vs. TIME

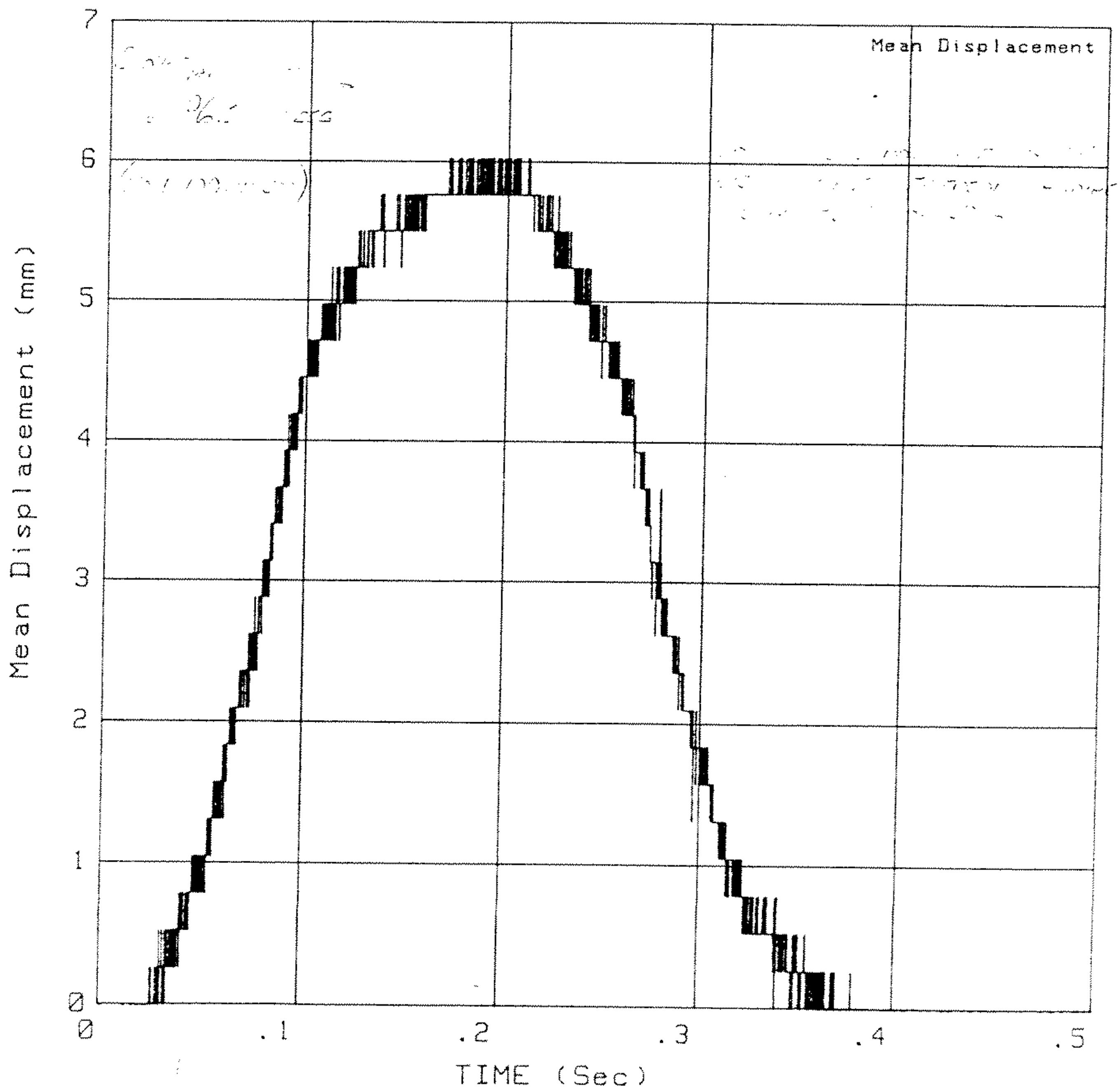
Test: C041
Type: Mega newt
Sample: LOAD CELL L-1

Date: 23 Nov 1988
Time: 13:02:22

Y Offset Removed

Temperature: 0

Average = 2
Truncation Time (s) = .5



Load cell
vs.
TIME

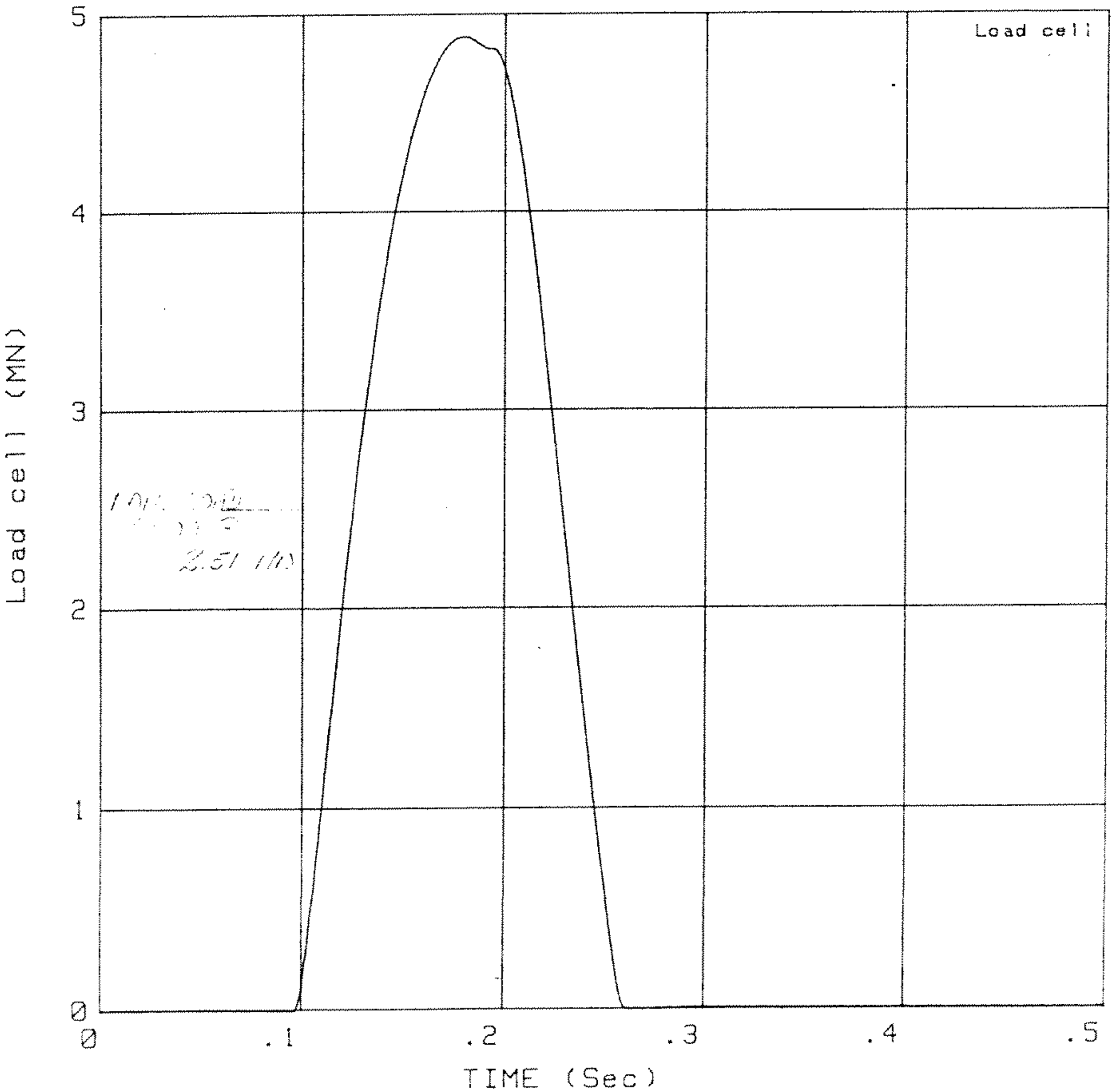
Test: C041
Type: Mega newt
Sample: LOAD CELL L-1 (MIN MB)

Date: 23 Nov 1988
Time: 13:02:22

Y Offset Removed

Temperature: 0

Average = 2
Truncation Time (s) = .5



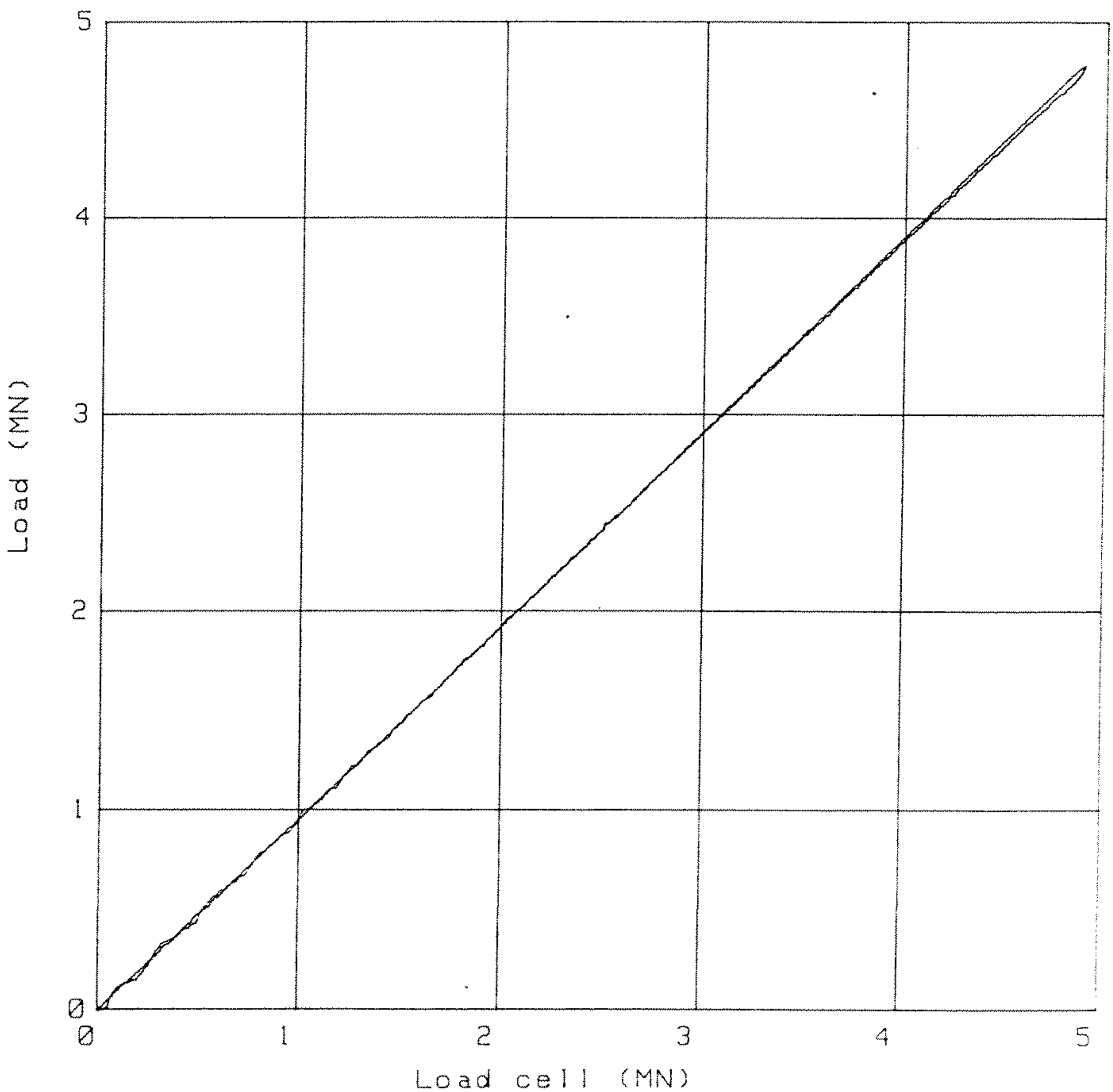
Load
vs.
Load cell

Test: C041
Type: Mega newt
Sample: LOAD CELL L-1

Date: 23 Nov 1988
Time: 13:02:22

Temperature: 0

Y Offset Removed
X Offset Removed
Average = 2
Truncation Time (s) = .5



Mean Displacement vs. TIME

Test: C044
Type: Mega newt
Sample: LOAD CELL L-2

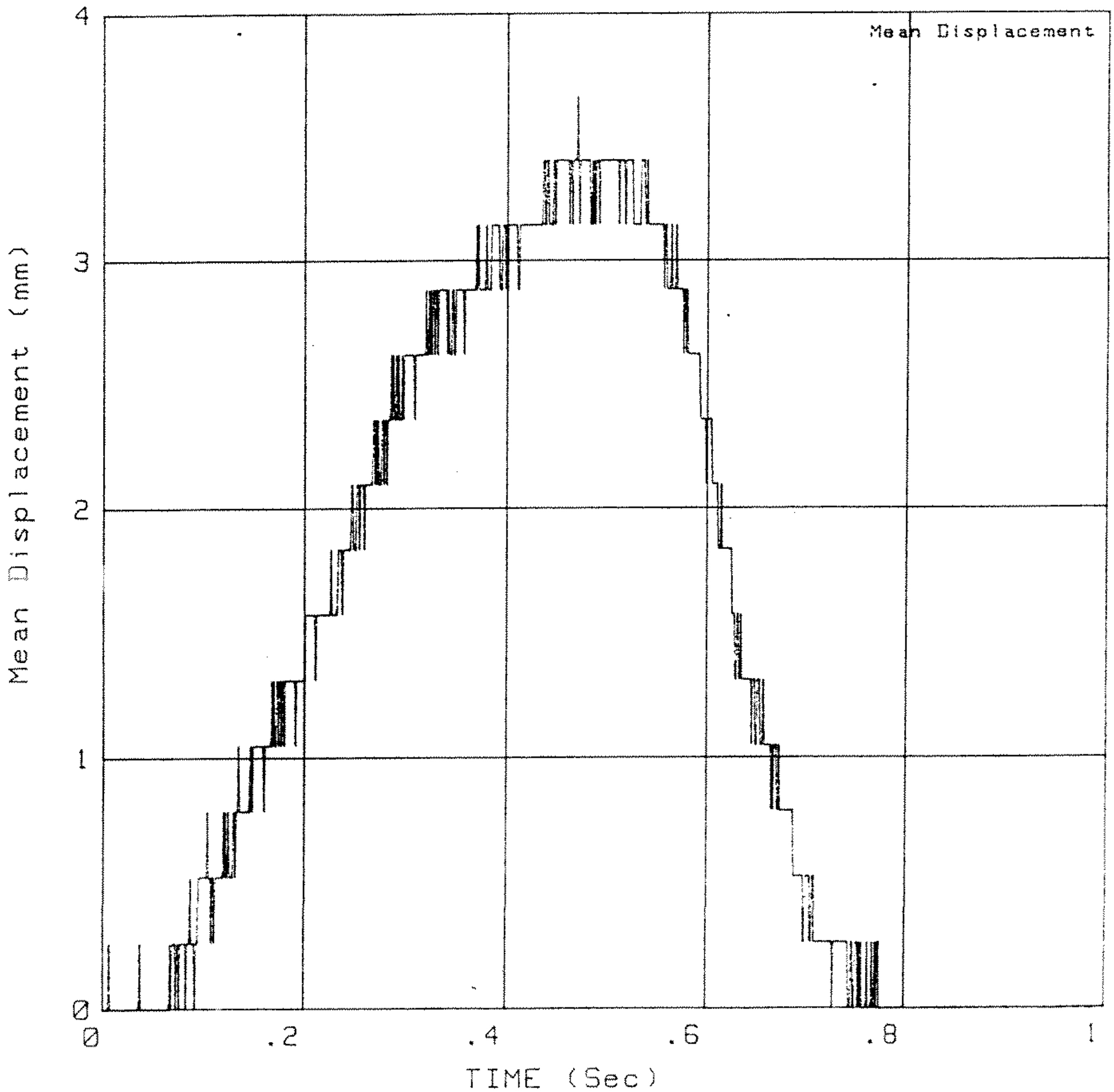
Date: 23 Nov 1988
Time: 15:47:21

Y Offset Removed

Temperature: 0

Average = 2

Truncation Time (s) = 1



Load
vs.
TIME

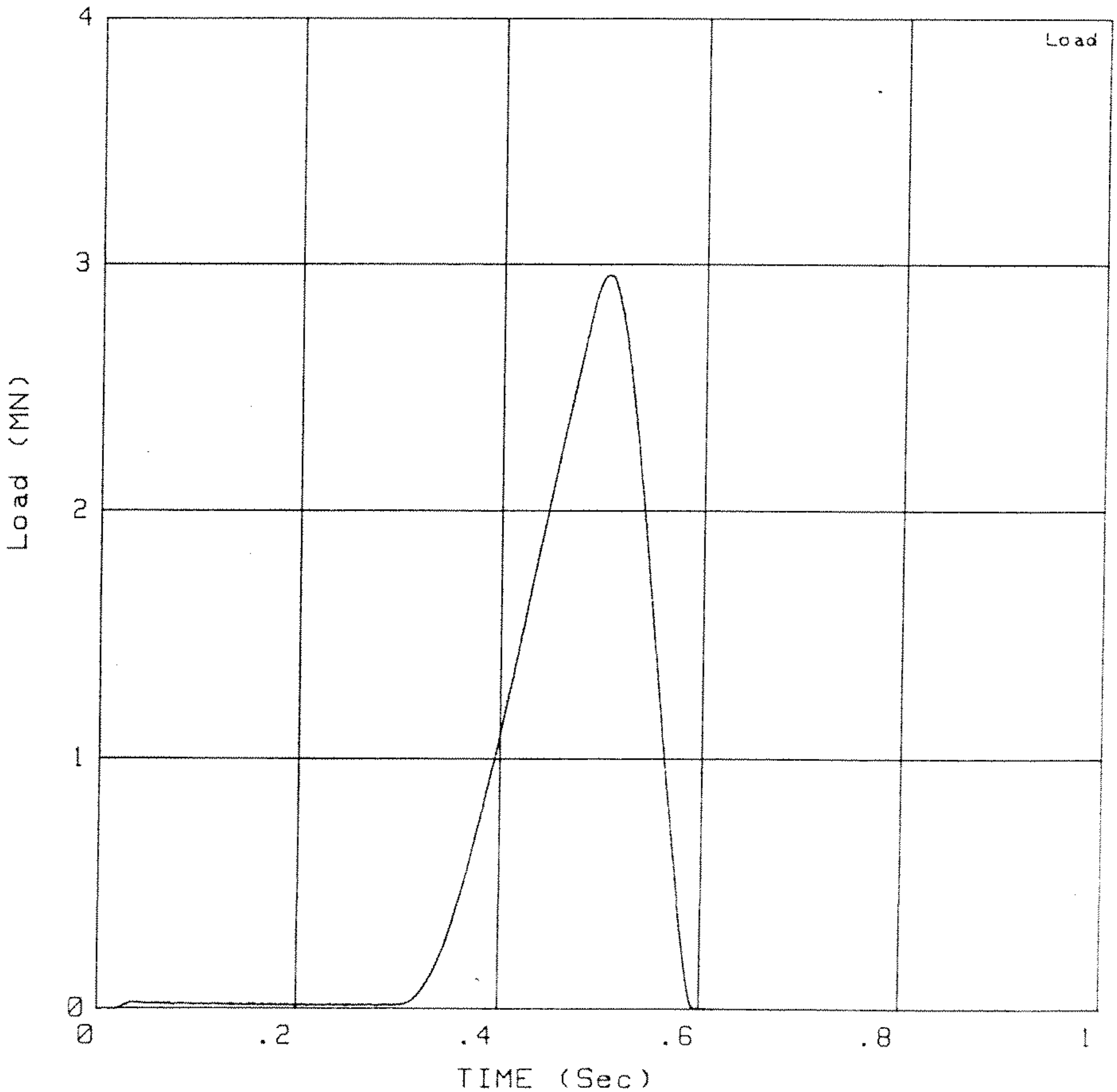
Test: C044
Type: Mega newt
Sample: LOAD CELL L-2

Date: 23 Nov 1988
Time: 15:47:21

Y Offset Removed

Temperature: 0

Average = 2
Truncation Time (s) = 1



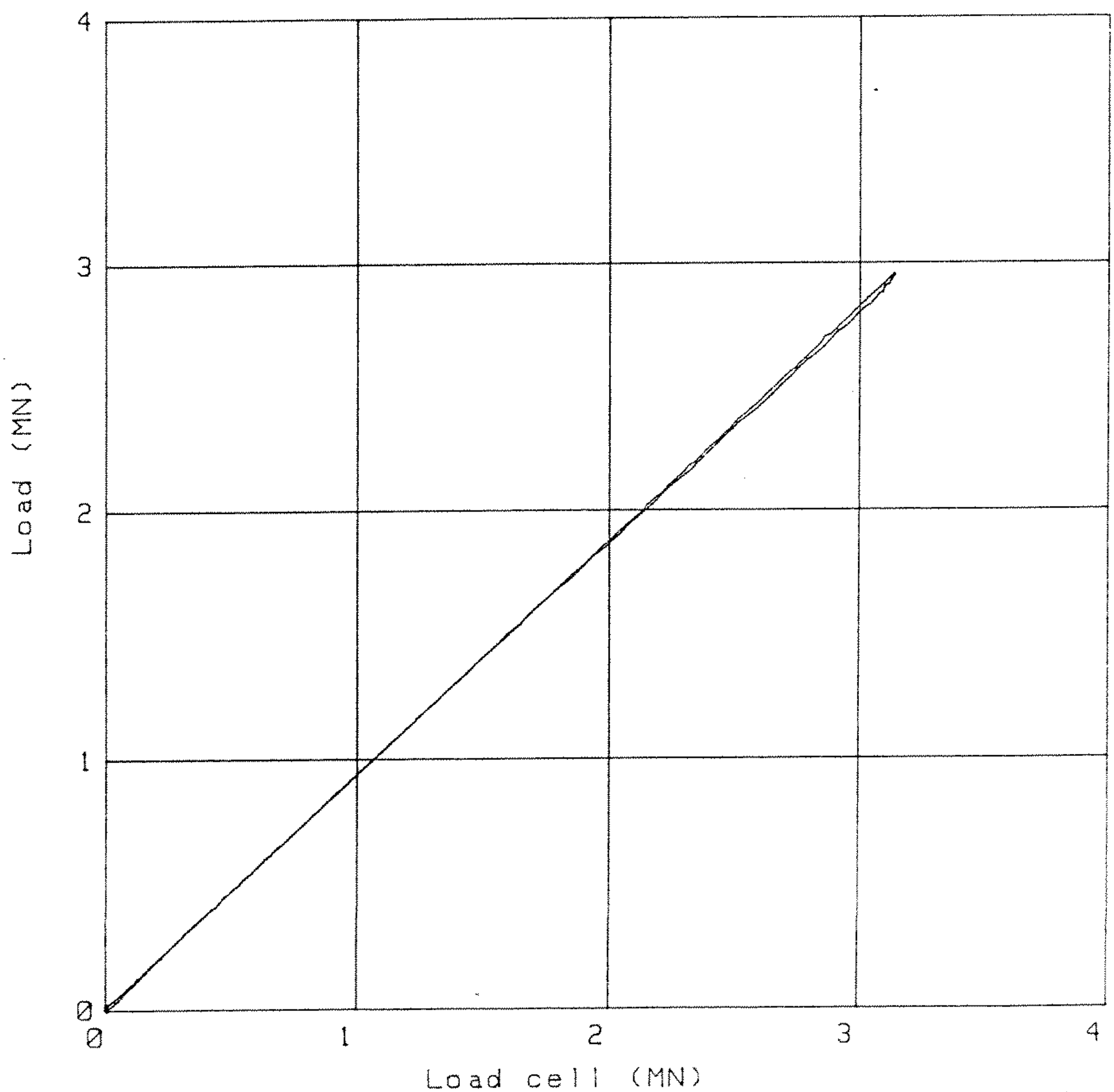
Load
vs.
Load cell

Test: C044
Type: Mega newt
Sample: LOAD CELL L-2 (MAIN 153.6)

Date: 23 Nov 1988
Time: 15:47:21

Temperature: ~~0~~ -9°

Y Offset Removed
X Offset Removed
Average = 2
Truncation Time (s) = 1



Mean Displacement
vs.
TIME

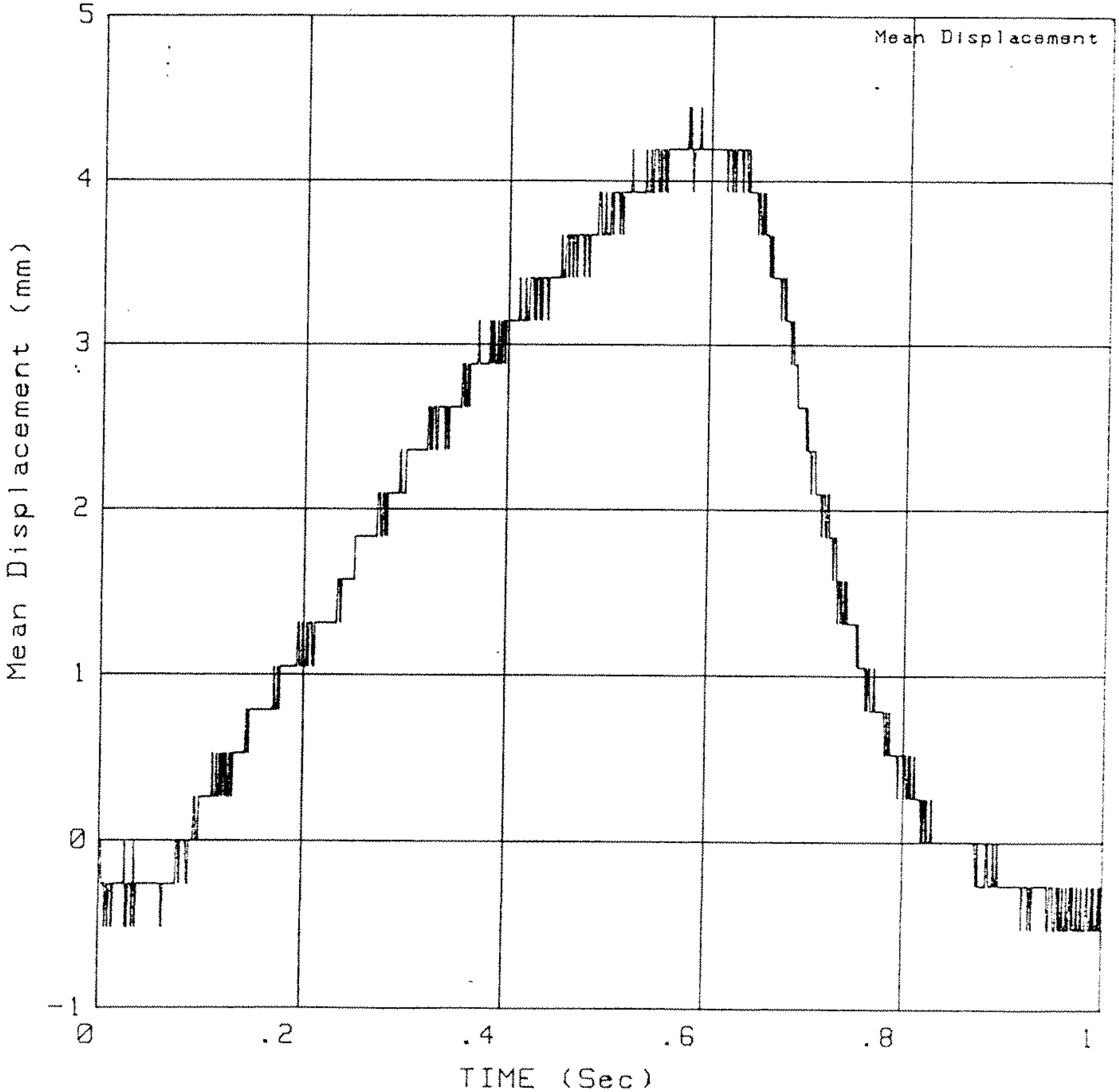
Test: C045
Type: Mega newt
Sample: LOAD CELL L-4

Date: 23 Nov 1988
Time: 16:15:10

Y Offset Removed

Temperature: 0 - 9°C

Average = 2
Truncation Time (s) = 1



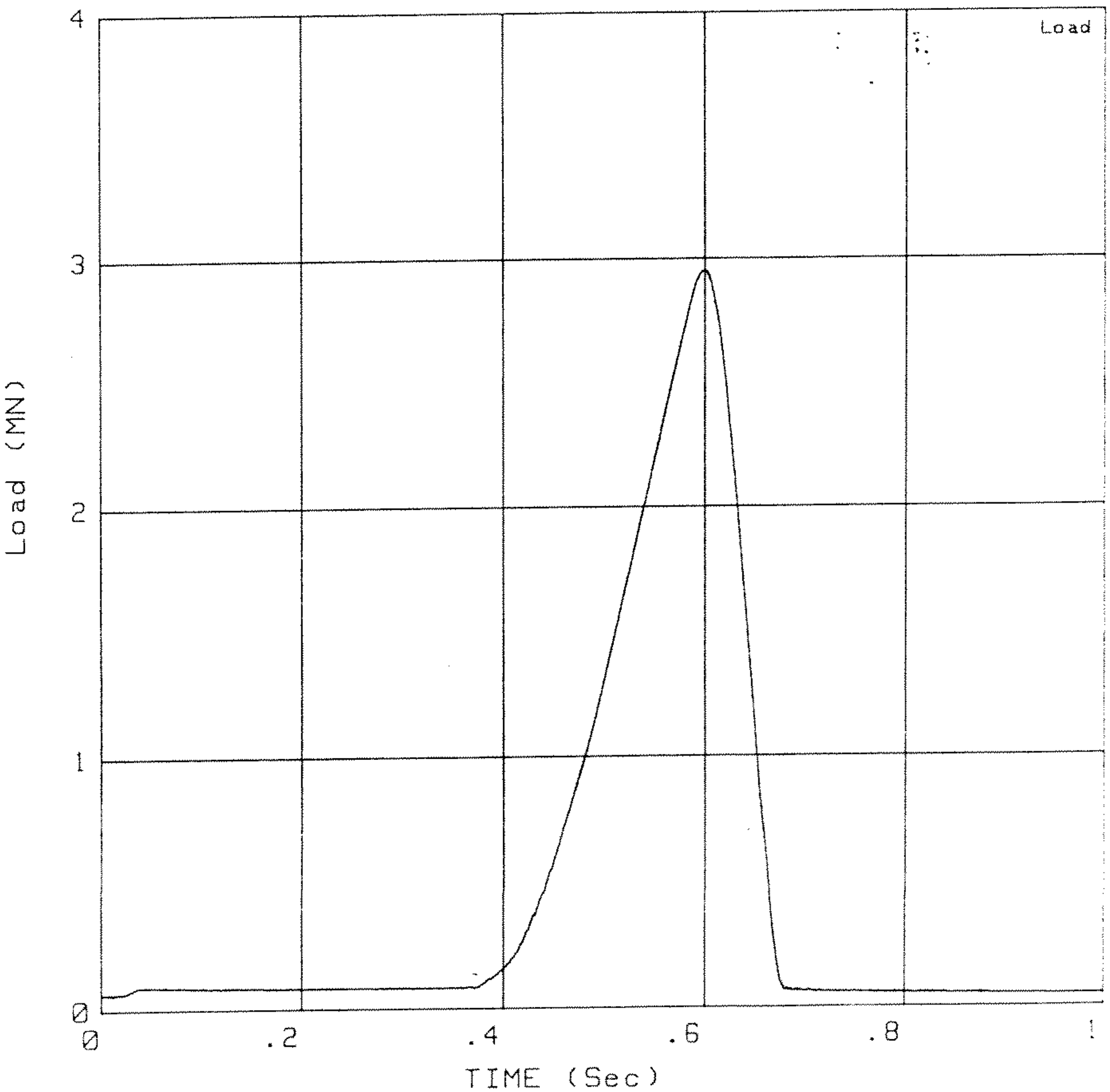
Load
vs.
TIME

Test: C045
Type: Mega newt
Sample: LOAD CELL L-4

Date: 23 Nov 1988
Time: 16:15:10

Temperature: 0

Average = 2
Truncation Time (s) = 1



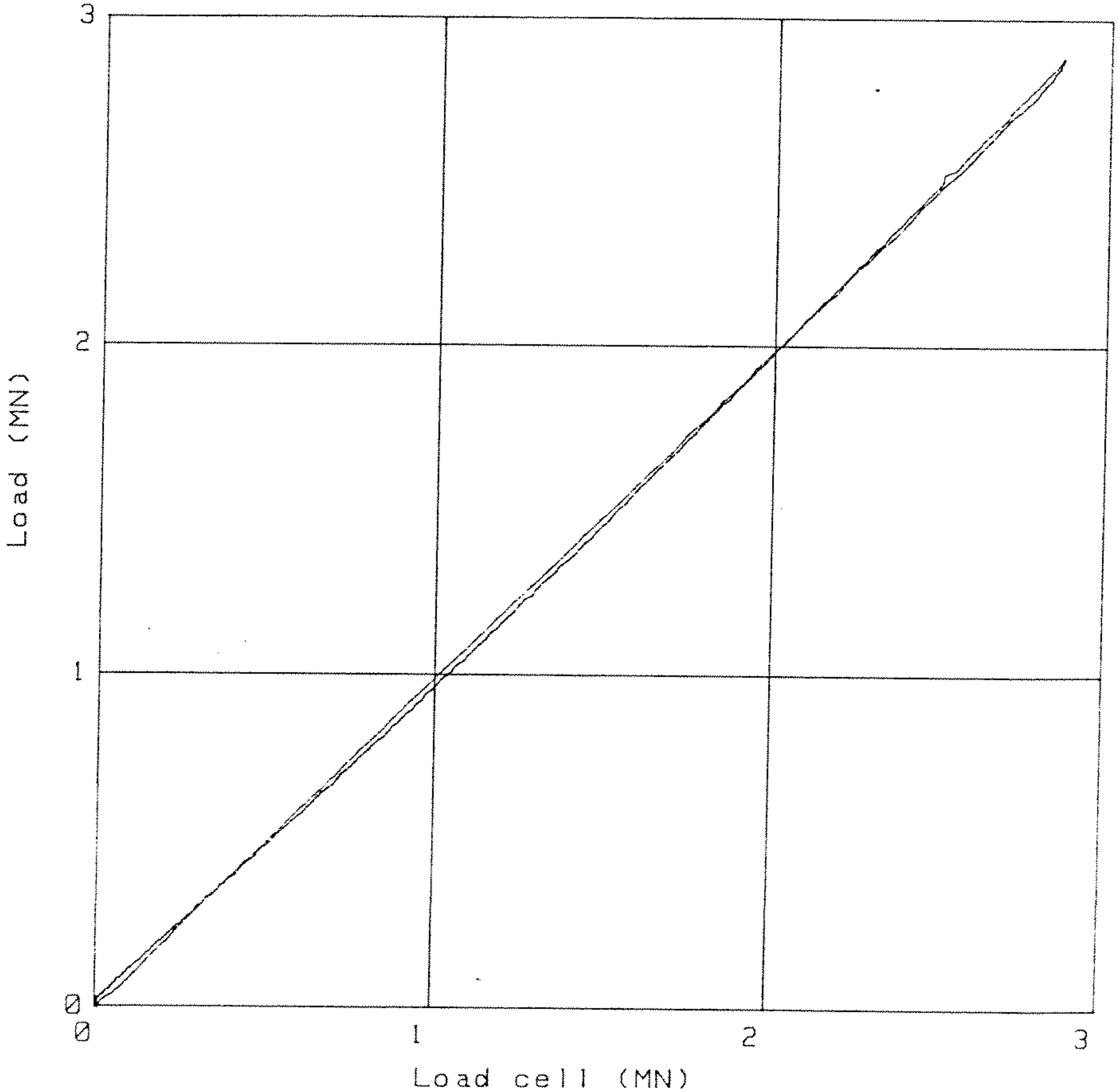
Load
vs.
Load cell

Test: C045
Type: Mega newt
Sample: LOAD CELL L-4

Date: 23 Nov 1988
Time: 16:15:10

Temperature: 0

Y Offset Removed
X Offset Removed
Average = 2
Truncation Time (s) = 1



MeMean Displacement
vs.
TIME

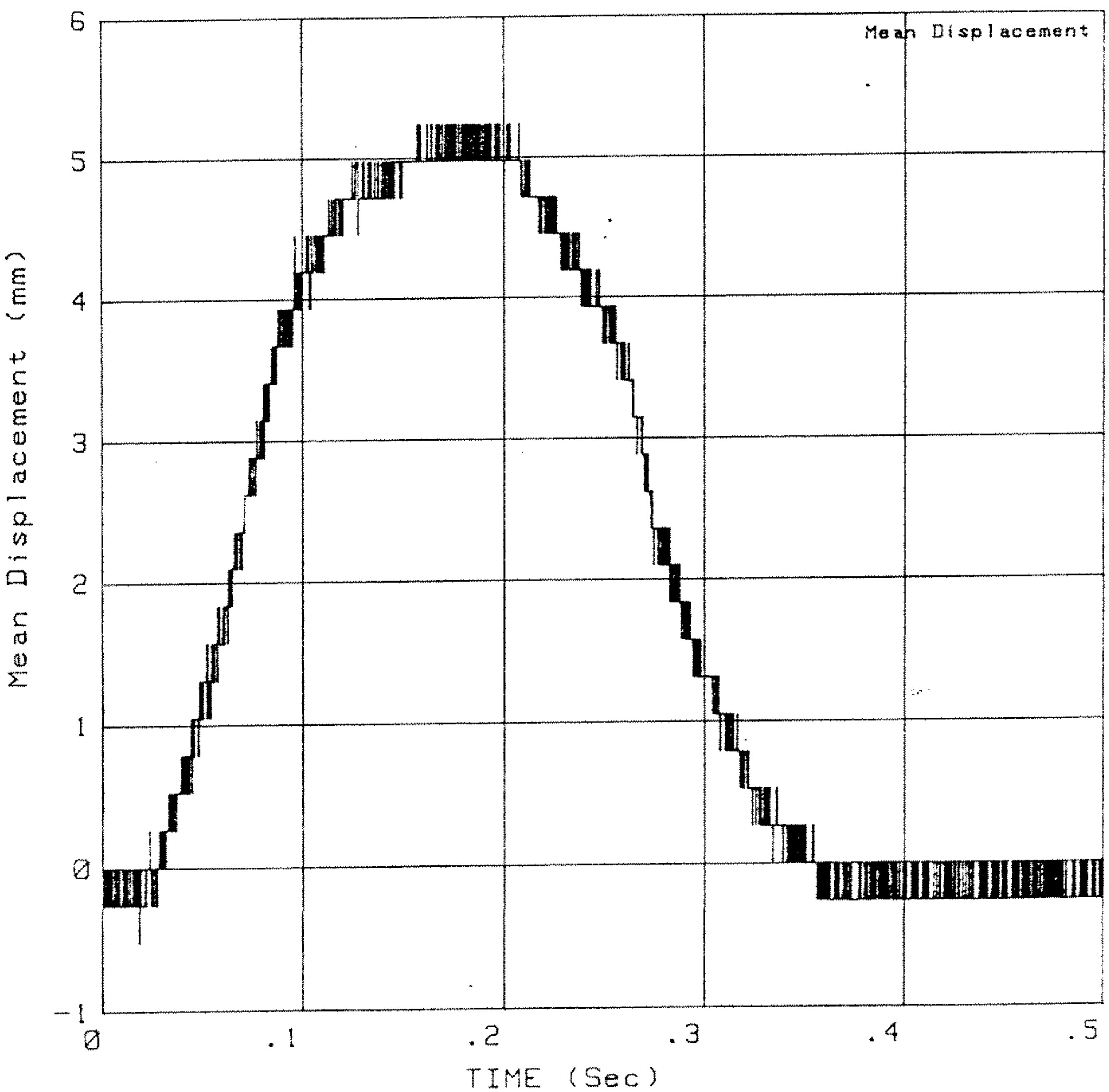
Test: C046
Type: Mega newt
Sample: LOAD CELL L-4

Date: 25 Nov 1988
Time: 08:58:45

Y Offset Removed

Temperature: -9

Average = 2
Truncation Time (s) = .5



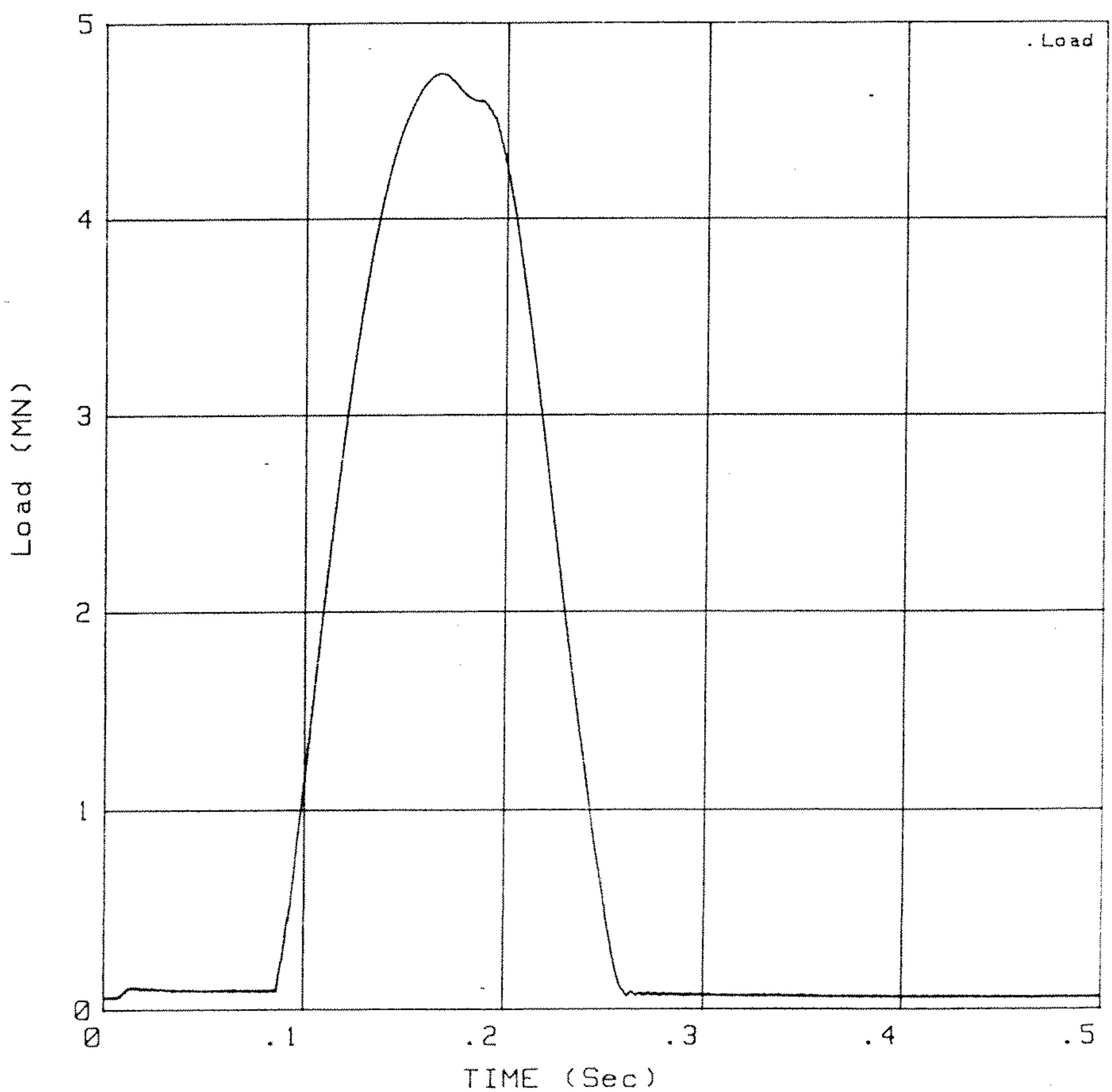
Load vs. TIME

Test: C046
Type: Mega newt
Sample: LOAD CELL L-4

Date: 25 Nov 1988
Time: 08:58:45

Temperature: -9

Average = 2
Truncation Time (s) = .5



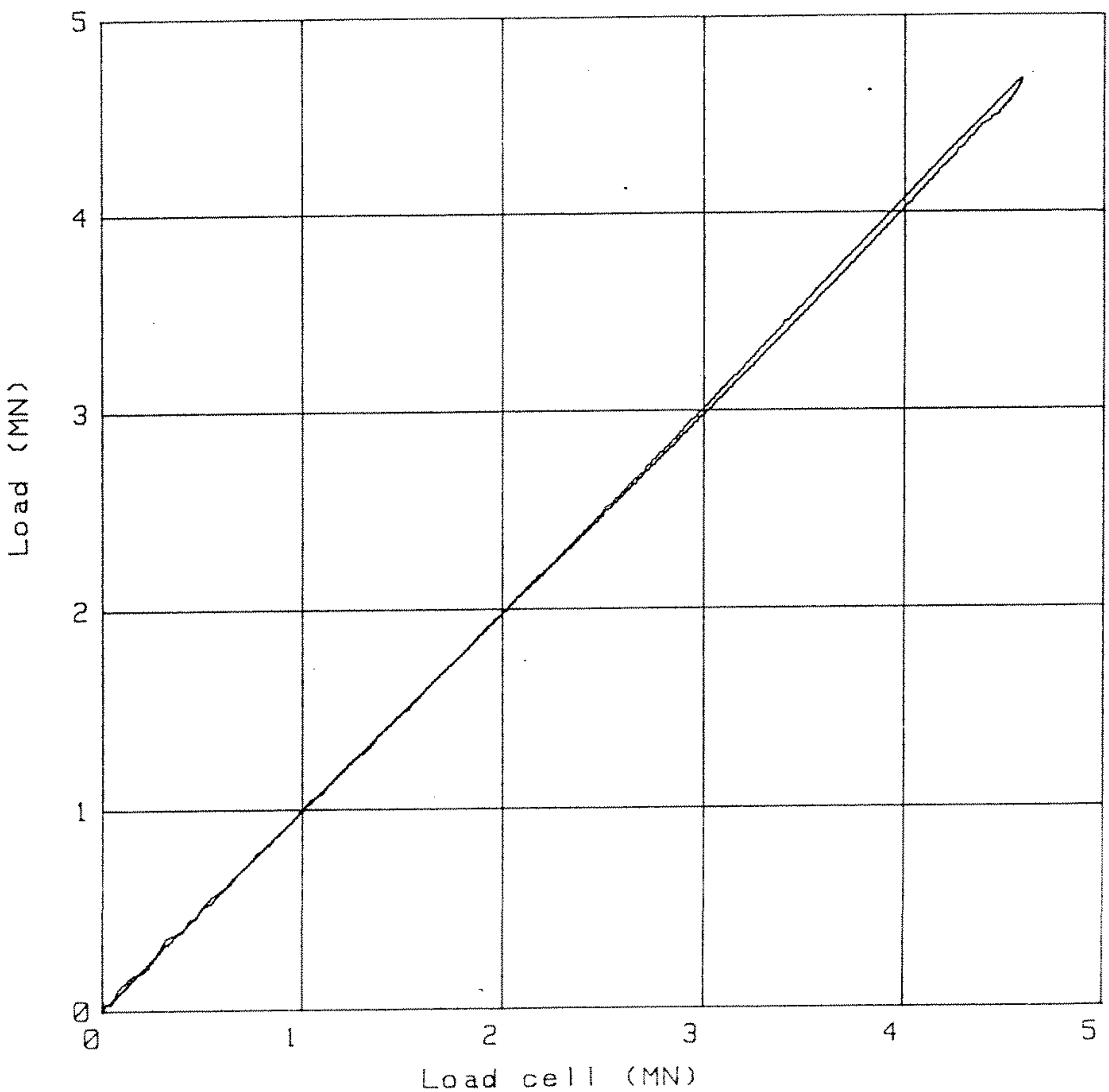
Load
vs.
Load cell

Test: C046
Type: Mega newt
Sample: LOAD CELL L-4

Date: 25 Nov 1988
Time: 08:58:45

Temperature: -9

Y Offset Removed
X Offset Removed
Average = 2
Truncation Time (s) = .5



Project 9545: Mega Newt

Servo Control/Monitor Unit

Description:

1.0 Channel Selection/Routing

The terminal block has 5 power connections +/-15, +28, +5 and COM; and 16 transducer input/AD200 channel outputs. Each channel consists of S+, S-, E+ and E-, the sense and excitation signals. All the S+ signals are wired to the BNC connectors labelled channels 1 to 16 on the front panel and to the respective A to D input channel on the AD200 DB37 connector.

Channels 1 and 2 are the displacement transducer inputs. Channel 3 is the average displacement as calcualted by the signal conditioner board. Channels 4 and 5 are the forward and backward (extend and retract) pressures input from the actuator. Channel 6 is the load calculated from the signal conditioner board. Channel 7 is the command signal as output from the logic circuitry.

Channels 8 to 16 are reserved for pressure cells.

2.0 Front Panel Controls

2.1 Power Switch - self explanatory

2.2 +/- 15 LED's:

Indicate +/- 15 volts output from internal power supply - check fuses on rear if not lit.

2.3 Panic:

Disconnects the command terminal of the servo control board from the COMMAND IN signal on rear. This causes the actuator to retract as the command terminal of the servo control goes to zero volts as an RC circuit discharges (on the Logic Circuit).

2.4 Reset:

Connects command terminal of the servo control to the command IN signal if there is no overload condition present.

2.5 Fault LED:

Indicates when the overload threshold has been exceeded by the LOAD.

2.6 Armed:

Indicates that command terminal of servo control is connected to command IN.

2.7 Overload Threshold:

Set PT: - pot to adjust the threshold which exceeded by the LOAD will cause a FAULT.

OUT: - monitor of Overload threshold.

2.8 Load Zero:

Pot to adjust zeroing of LOAD signal

2.9 Load Out:

Monitor of LOAD signal

2.10 Disp Zero:

Pot to adjust zeroing of displacement signal

2.11 Disp. Out:

Monitor for displacement signal

2.12 LOAD/Displacement Feedback:

Switch that connects either the load or displacement signal to the feedback terminal of the servo control.

2.13 Coarse Set Pt:

Adjust set point of servo control as displayed by ERROR meter.

2.14 ERROR Out:

Monitor for ERROR signal

2.15 Gain:

Gain pot for Servo Control

2.16 Fine Set Pt:

Adjust set point but with 10% or 1% of the range of the Coarse Set Pt as determined by the 1%/10% FINE RANGE switch.

3.0 Rear Panel

3.1 Servo Valve:

Connector for servo valve

3.2 LVDT:

Connector for LVDT

3.3 Command IN:

Ramp in signal that is switched by Logic Circuit before connection to servo control.

3.4 AD200:

DB37 connector for AD200

*3.5 +28, +5, GND

Connections for input of +28, +5 Volts from external power supply.

3.6 +/- 15, GND

Connections for output of +/- 15V from internal power supply (GND is common).

3.7 Fuses:

As indicated

* need +5V input to operate logic circuit

4.0 Adjustments on Vero Board

4.1 Dither Frequency:

Change values of R_T, $R_T{}^1$ and C_T located at C/D-39, C/D-40 and C/D-37 respectively.

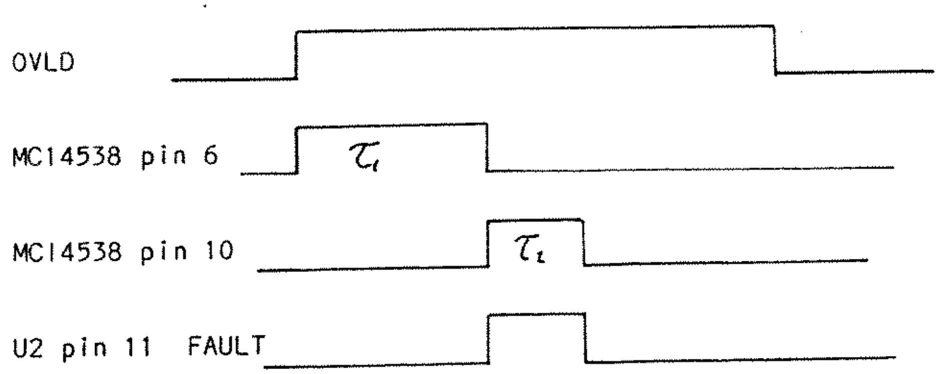
4.2 Dither Amplitude:

Change pot R_S at E-41, 42, 43

4.3 OVLD Timing

(Time that overload must be present before a fault occurs) - refer to logic circuit.

Adjust values Rx_2, C_{x2} to adjust T_1 (G/H-11, G/H-13)



adjust values R_{x3} C_{x3} to adjust T_2 (L/M-11, L/M-13)

4.4 Command IN:

Delay rate (on Fault or Panic)

Adjust values R_c and C_c located at E/f-37 and E/F-39

4.5 P1 Scale:

Adjust R2 at A -1, 2, 3 (initially set so G = .9225)

4.6 P2 Scale:

Adjust R4 at A -4, 5, 6 (initially set so G = .5128)

4.7 D1 Scale:

Adjust R6 at F -1, 2, 3 (initially set so G = 1.0)

4.8 D2 Scale:

Adjust R8 at F -4, 5, 6 (initially set so G = 1.0)

4.9 Displacement Average Scale:

Want $\frac{D1 + D2}{2}$ so want G = 1/2 - adjust R12 at F-10, 11, 12

250 ma / Loop

Model 122-142 Servoamplifier

This Snap-Trac module contains a complete dc servo-amplifier. It is recommended for closed loop applications having single or multiple inputs and feedbacks. The output is an excellent current driver for almost any Moog servovalve.

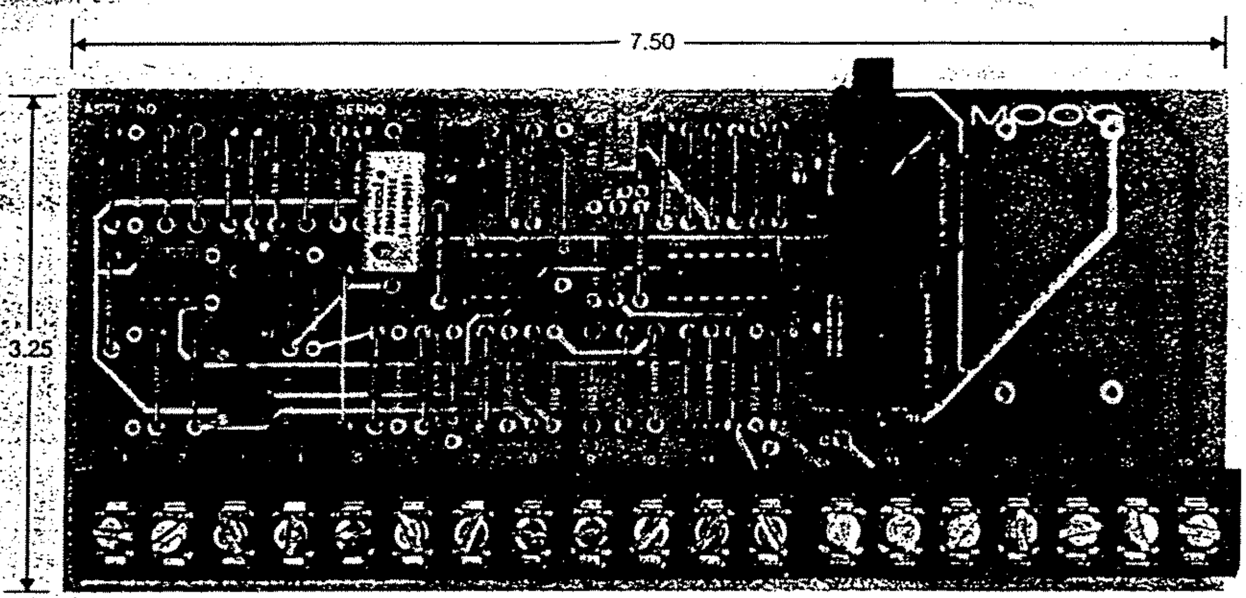
The Model 122-142 requires a ± regulated dc power supply. This supply is provided by the Model 121-132 Servocontroller, so the Model 122-142 is usually used as an add-on where more than one servoamplifier is required. The serovamplifier portion of the Model 121-132 is identical to the circuitry in the Model 122-142.

Proportional or Integral Control

- remove capacitor C4 for proportional control
- remove resistor R12 for integral control

Adjustments

- GAIN 1 and 2 (R4 and R43) - provide about 21:1 range of gain control
- SCALE (R9) - provides 0 to 110% sensitivity for input at terminal 3
- BIAS (R16) - provides ±100% servovalve bias control
- CUR LIMIT (R34) - adjusts max servovalve current between ~ 9 madc and full output



Maximum Component Height 2.42

±15V 100 ma

Specifications

Inputs

- Three standard inputs at terminals 1, 2 and 3
  - other input resistors from 10KΩ to 1MΩ may be used
  - signal levels from ±5 mvdc to ±200 vdc
- special inputs at terminals 6 and 7
  - other type servocontrol with various combinations of C7, R37, C8, R36 and R38
  - for differential input remove R39 and R41, replace R41 = R38 and insert R40 = R37
- additional inner loop
  - proportional feedback at terminal 10
  - derivative-lag feedback at terminal 8 with insertion of capacitor C3 and resistor R1

Output

- range of output current:
  - Model 122A142 ± 60 madc
  - Model 122B142 ± 120 madc
- saturation current output:

$$i_0 \max \geq \frac{12}{R_{27} + R_{31} + R_L} \text{ amps}$$

R_L = load resistance in ohms across terminals 12 and 13

- resistors R27 and R28 or R29 provide momentary ground shorting protection

Model 122-142 continued

Gain

- outer loop gains at terminals 1, 2 and 3:
  - o approximately 10 to 210 ma/volt standard proportional control
  - o approximately 20 to 420 (ma/sec)/volt for standard integral control
  - o general expression for proportional gain with R4 and R9 fully CW (i.e. GAIN and SCALE potentiometers at highest settings):

$$i_o \sim \frac{R_{12} \cdot R_{21} \cdot R_{30} \cdot (1 + R_4/R_3)}{R_{20} \cdot (R_{22} + R_{23}) \cdot R_{31}} \left(\frac{e_1}{R_7} + \frac{e_2}{R_8} + \frac{e_3}{R_{10}}\right)$$

  - o general expression for integral gain:

$$i_o \sim \frac{R_{21} \cdot R_{30} \cdot (1 + R_4/R_3)}{R_{20} \cdot (R_{22} + R_{23}) \cdot R_{31} \cdot C_4} \left(\frac{e_1}{R_7} + \frac{e_2}{R_8} + \frac{e_3}{R_{10}}\right)$$

- inner loop gains:
  - o general expression for inner loop gain at terminal 10:

$$i_o \sim \frac{R_{21} \cdot R_{30}}{R_{31} \cdot (R_{22} + R_{23})} \left(\frac{e_{10}}{R_{46}}\right)$$

  - o general expression for inner loop gain at terminal 8:

$$i_o \sim \frac{R_2 \cdot R_{30}}{R_{31} \cdot (R_{22} + R_{23})} \left[\frac{C_3 e_8}{(R_1 + R_2) C_3 + 1}\right]$$

Drift

- with 100KΩ inputs and servoamplifier gain greater than 5 madc/volt, max drift (referred to the input) is 0.15 mv/°C over the temperature range 0°C to 50°C

Circuitry

The Model 122-142 Servoamplifier consists of an input stage (A1A), a gain control stage (A1B), an inner loop input stage (A2A) and a current drive stage (A2B and Q_1/Q_2) with current limiting amplifiers (A2C/A2D). An additional input stage (A3A) and gain control stage (A3B) can be used for proportional, integral, lag-lead or derivative-lag control of inner loop feedback signals.

The input stage (A1A) sums signals applied to terminals 1, 2 and 3. Servo feedback is normally connected to terminal 1 and servo command to terminal 3. An additional feedback or command can be connected to terminal 2.

The feedback elements around A1A determine the type of servocontrol - proportional, integral or lag-lead. Every servoamplifier card contains components for both proportional control and integral control, so it is necessary to remove the undesired component by clipping its leads.

When one of the inner loops is used for servovalve spool position feedback, null bias of the servovalve can be accomplished by inserting suitable resistor R18 and removing R15. This allows the outer closed loop gain to be adjusted without upsetting the servovalve bias.

Diodes D1 and D2 protect A1A from inadvertent over-signal conditions. When A1A is used as a differential amplifier (R7 removed, suitable resistor R6 inserted) diodes D1 and D2 should be removed.

The output of summing amplifier A1A is amplified by A1B and is available at terminal 4. Note that the positive signal input of A1B is used so that the output is non-inverting. This arrangement is advantageous when using terminal 8 (C3 and R1 inserted) for differentiation of the feedback signal.

The additional input stage (A3A) sums signals applied at terminals 6 and 7. This summed signal is applied to the positive terminal of A3B to obtain a non-inverted amplified signal. An output signal is available at terminal 9 or can be summed at stage A2A with the insertion of plug-in resistor R45.

The input at terminal 10 is typically used to provide dither on the output current if required.

Component locations R22 and C9 may be used to add a first order roll-off filter.

Operational amplifiers A2C and A2D can limit the output current by limiting the voltage input to the current drive stage (A2B).

The output stage, A2B, controls the voltage across the sampling resistor R31 when a load is connected between terminals 12 and 13. Since R31 << R30, the current thru the load is approximately equal to the voltage across the sampling resistor divided by its resistance in ohms. This current drive output stage makes the servoamplifier gain independent of changes in coil resistance and minimizes dynamic effects of servovalve coil inductance.

CONTROLLER BOARD 122-142 MODIFICATIONS

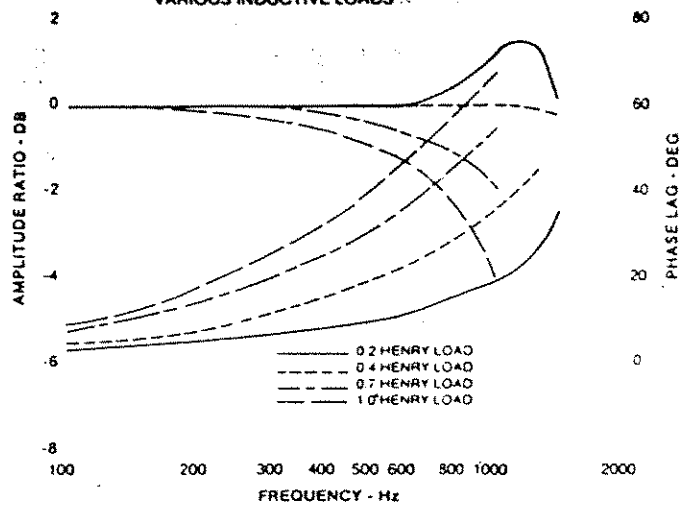
Frequency Response

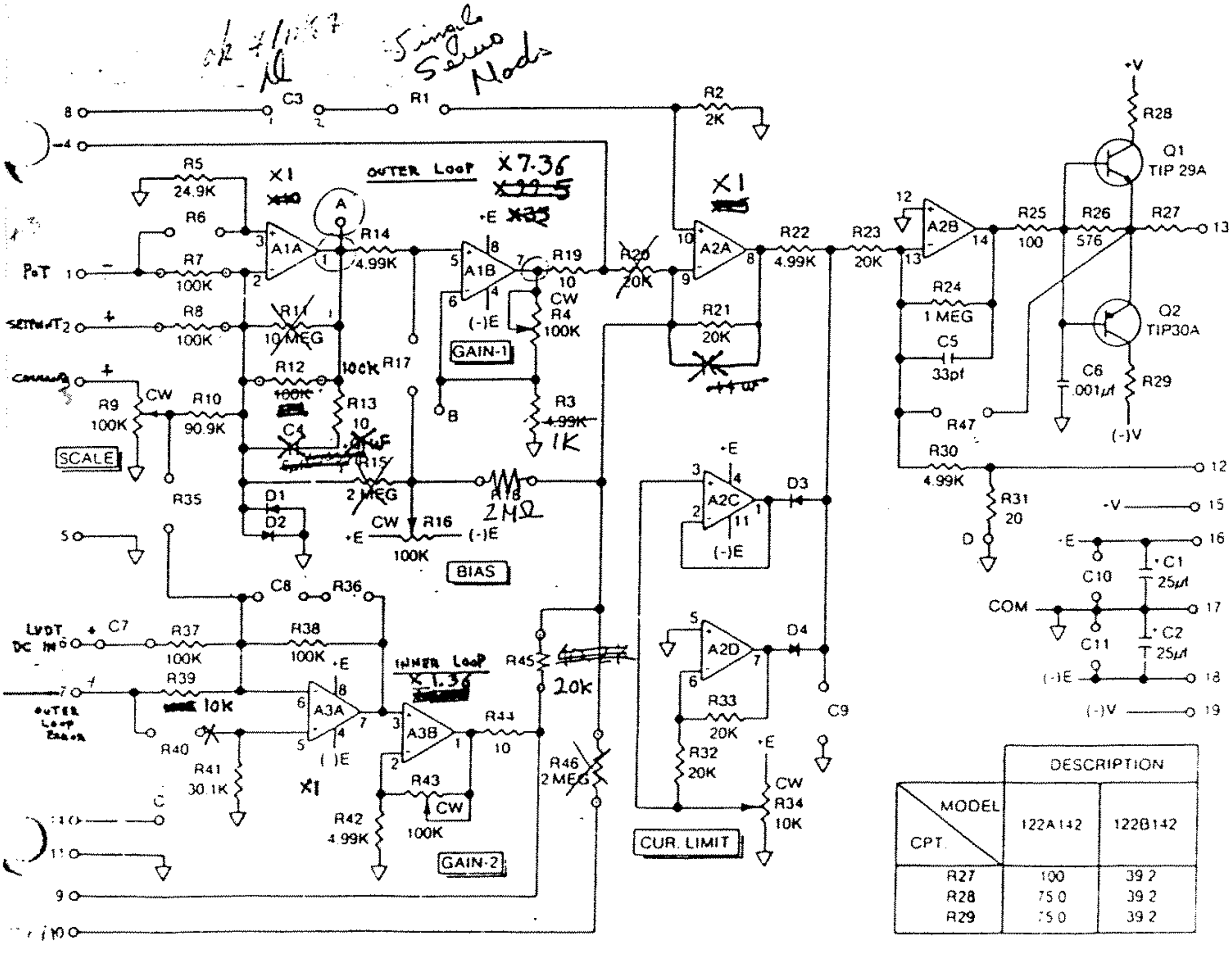
- Figure at right shows frequency response of a proportional servocontroller within voltage saturation limits for several inductive loads.

Electrical Power Required

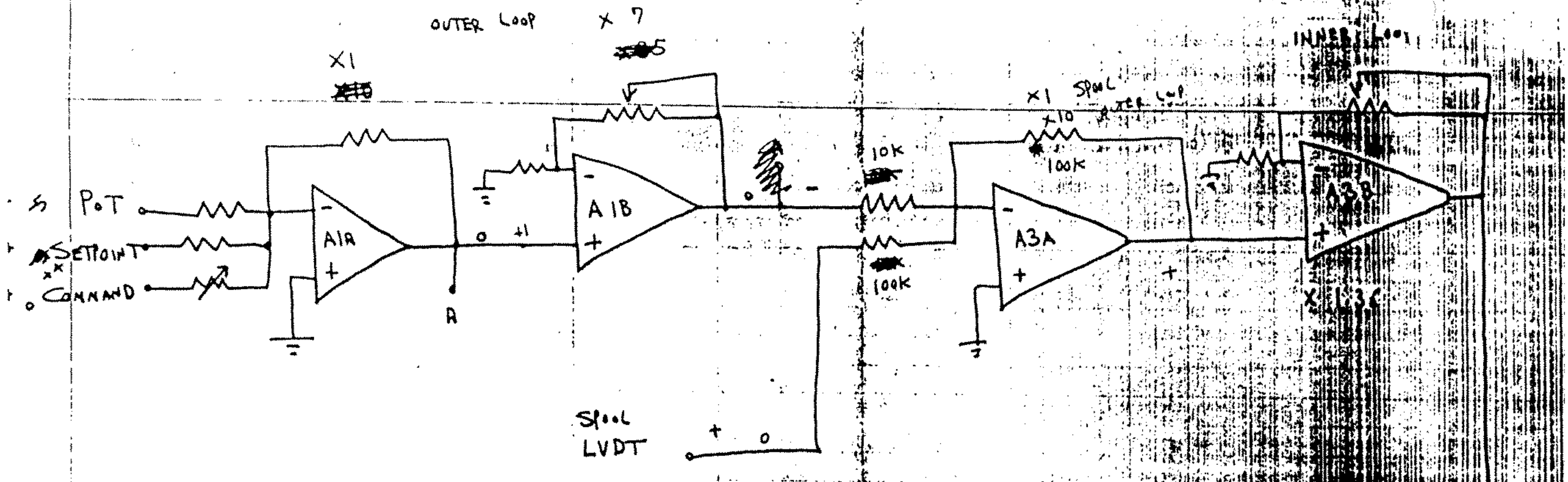
- ±15.0 vdc, regulated, 3-wire (±E) at ±26 madc, and ±15 to ±22 vdc, unregulated, 3-wire, (±V) to supply the + or – output current
- these voltages available from Model 121-132 Snap Trac Servocontroller
- the unregulated power (±V) can be supplied from the regulated power supply (±E) if adequate capacity is available. (Jumper +E to +V and –E to –V.)

FREQUENCY RESPONSE OF MODEL 122-142 WITH VARIOUS INDUCTIVE LOADS



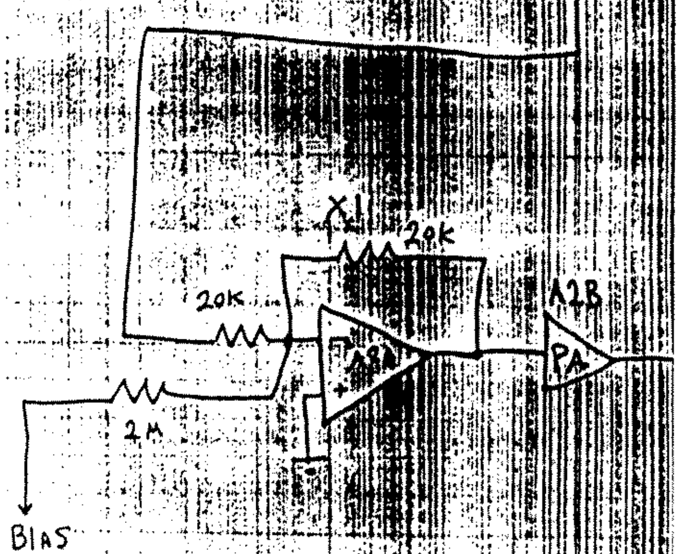


	DESCRIPTION	
CPT. \ MODEL	122A142	122B142
R27	100	39.2
R28	75.0	39.2
R29	75.0	39.2

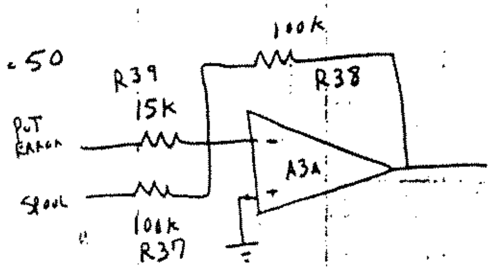


(7.5) (10) = 75

12k, 6 = 8.33
8.33 x 2.5 = 62.5



(7.5) (6.67) .50



7 × 10 = 70

7 × 7 = 49

Change R39 to 12k

1202
1502

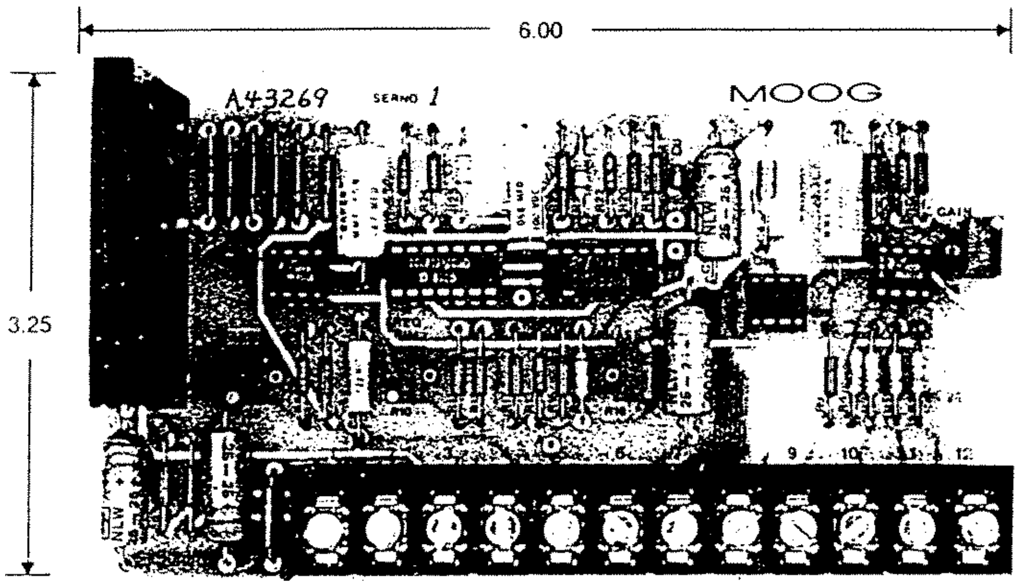
57.5

Model 123-134 Exciter/Demodulator

This Snap Trac module contains a power oscillator and a demodulator for use with LVDT's, synchros and other carrier excited, amplitude modulated, transducers. Three standard carrier frequencies (400, 2000 and 6000 Hz) are available.

Adjustments

- FREQ TRIM (R10) - provides trimming capability for oscillator frequency (factory set)
- EXC AMPL (R28) - trims excitation amplitude
- GAIN (R5) - provides approximately 11:1 gain adjustment of the signal to be demodulated
- PHASE (R16) - adjusts timing of trigger pulse for peak sampling of signal to be demodulated



Maximum Component Height 2.42

Specifications

Input

- differential input across terminals 10 and 11
  - ac input signal level should be from 0.7 to 7.0 vrms for ±10 vdc output
  - input impedance can be assumed to be 40KΩ (with standard valves of R1, R2, R3 and R4)

Outputs

- excitation output
  - amplitude stability ≤350 ppm/°C
- demodulator output
  - output signal range at terminal 12 = 0 to ±10 vdc
  - ripple <15 mvpp at the carrier frequency <1.0 volt for 2 μsec of switching transient
  - non-linearity ≤±0.25%
  - output gain stability = ±250 ppm/°C ±0.2 mv/°C
  - output load impedance = 5KΩ min

Demodulator Gain

- general expression for gain of the dc voltage at terminal 12 assuming R2 = R4, R1 = R3 and R5 fully CW (i.e. max gain setting)

$$e_{12} = 1.41 \left(\frac{R_3}{R_4}\right)\left(1 + \frac{R_8}{R_7}\right)\left(e_{11} - e_{10}\right) \text{ vdc}$$

where e_{10} and e_{11} are vrms (sine)

Frequency Response

- phase lag of demodulator output signal increases linearily from 0° to 180° as frequency of modulation increases from zero to the carrier frequency.

Power Required

- ±15.0 vdc at ±50 madc, regulated, 3-wire (±E) at terminals 6, 7 and 8, 90 ma
  and
  ±15 to ±22 vdc at ±40 madc, unregulated, 3-wire (±V) at terminals 1, 2 and 7
- this power is available from the Model 121-132 Snap Trac Servocontroller

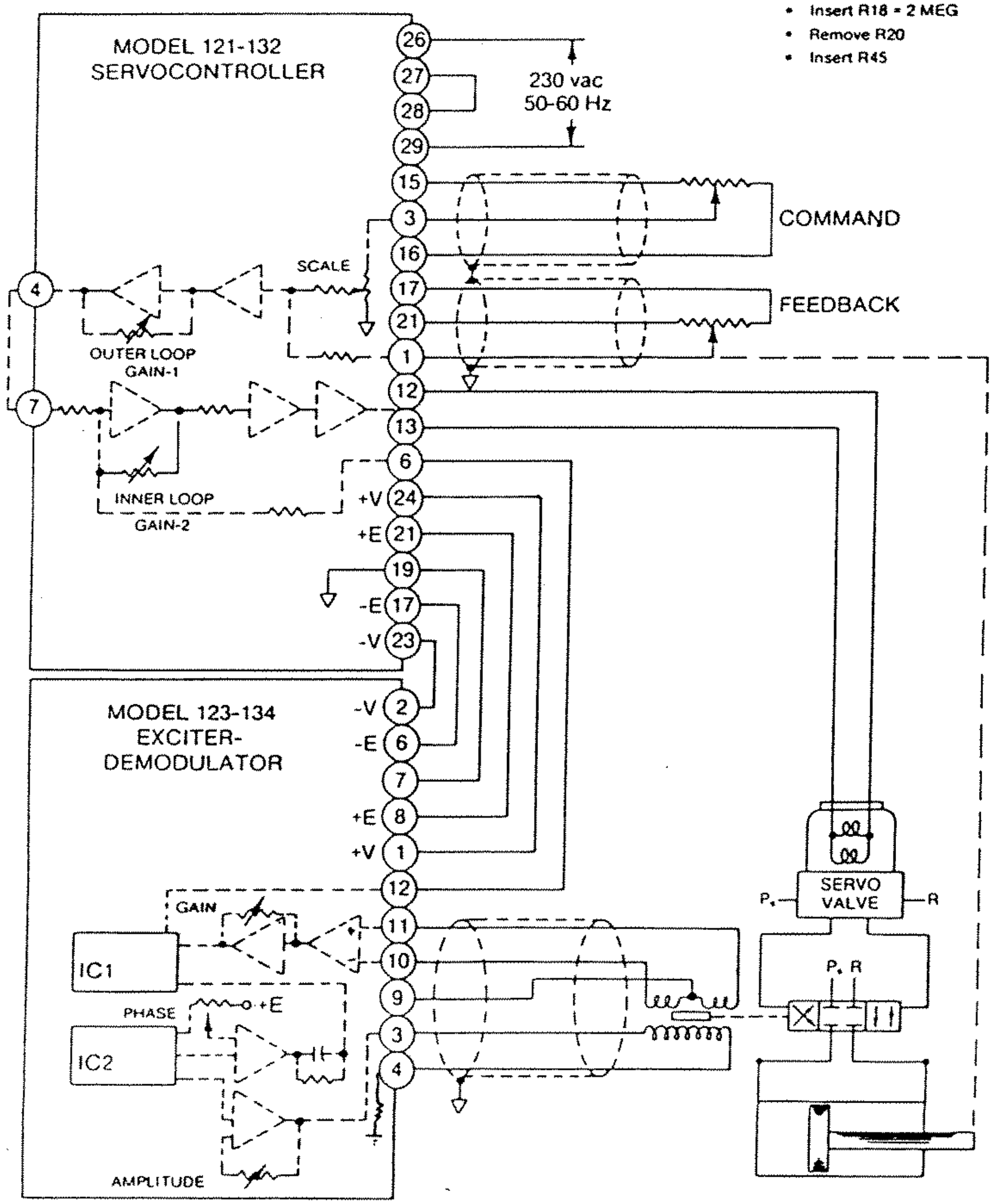
Closed-Loop Position Servo with Three Stage Servovalve

This example illustrates the use of the Model 123-134 Exciter-Demodulator to adapt the LVDT used in Moog three-stage servovalves for inner loop servo-control. The dc voltage from terminal 12 of the Model 123-134 is proportional to the position of the servovalve third-stage spool. This dc voltage is used with the Model 121-132, together with the signal from a piston position feedback transducer, to create a position servo. The inner loop gain can be adjusted independently from the outer loop gain.

CIRCUIT CARD MODIFICATIONS

On Model 121-132:

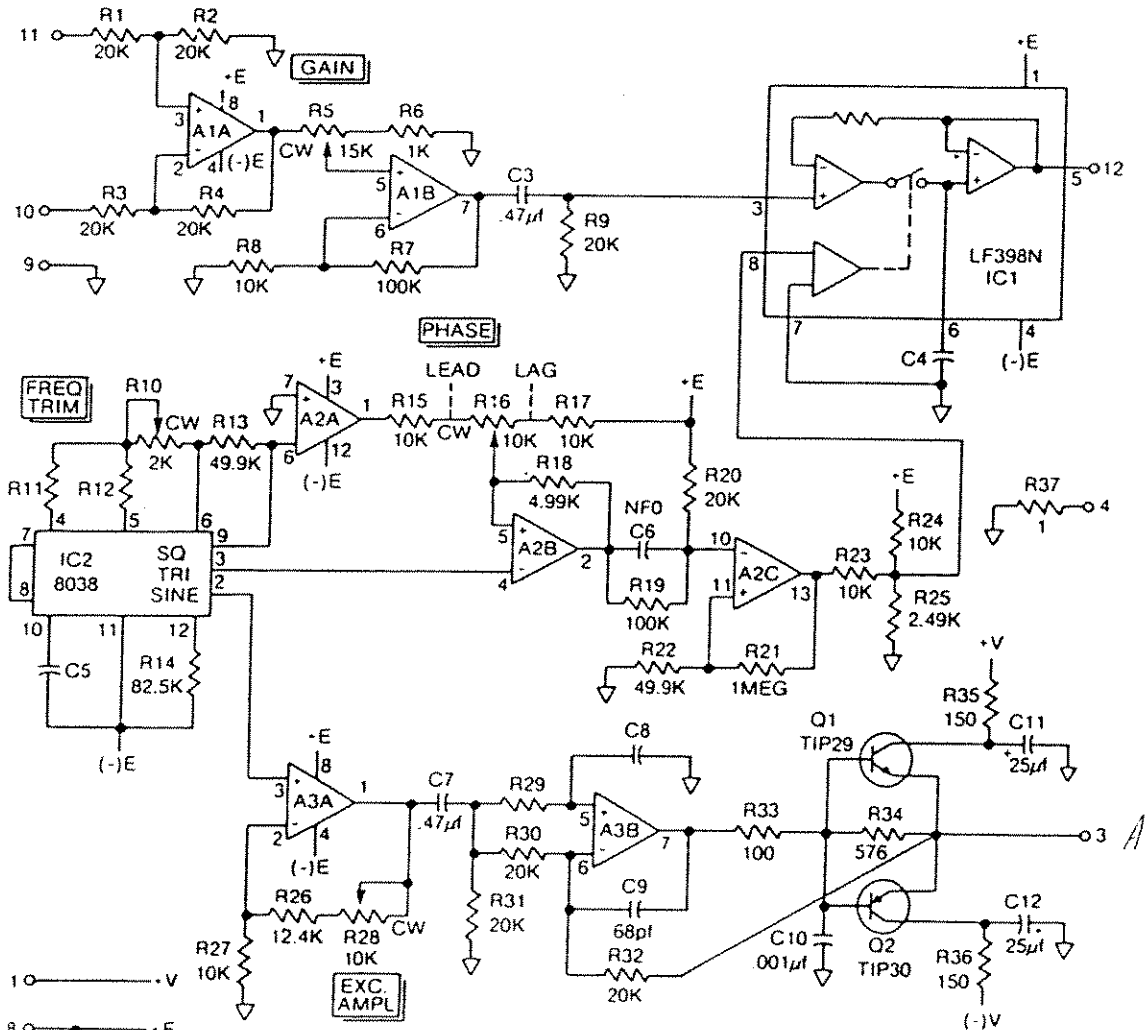
- Remove C4
- Remove R15
- Insert R18 = 2 MEG
- Remove R20
- Insert R45

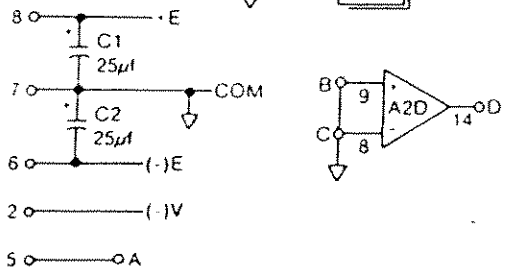


Circuitry

A precision waveform generator (IC2) provides square, triangular and sinusoidal signals. The frequency of these signals is controlled by R10, R11, R12 and C5. A3A controls the amplitude of the sine wave between ±10 and ±14 volts peak-to-peak depending upon the setting of potentiometer R28. The excitation output stage (A3B and Q1, Q2) has 90° lag compensation around A3B. Transistors Q1 and Q2 provide output power drive capability. The load to be excited is connected between terminals 3 and 4. One ohm resistor R37 provides a convenient means for measuring the excitation current.

The demodulator consists of a differential amplifier (A1A), an adjustable gain amplifier (A1B), and a sample and hold integrated circuit (IC1). The sampling pulse for IC1 is generated when the voltage of the triangular wave rises above an adjustable reference voltage (R16). Potentiometer R16 adjusts the phase of the sampling pulse over a 150° range of the signal to be demodulated. This allows triggering of the sample and hold circuit at the peak amplitude. The demodulated signal is available at terminal 12.



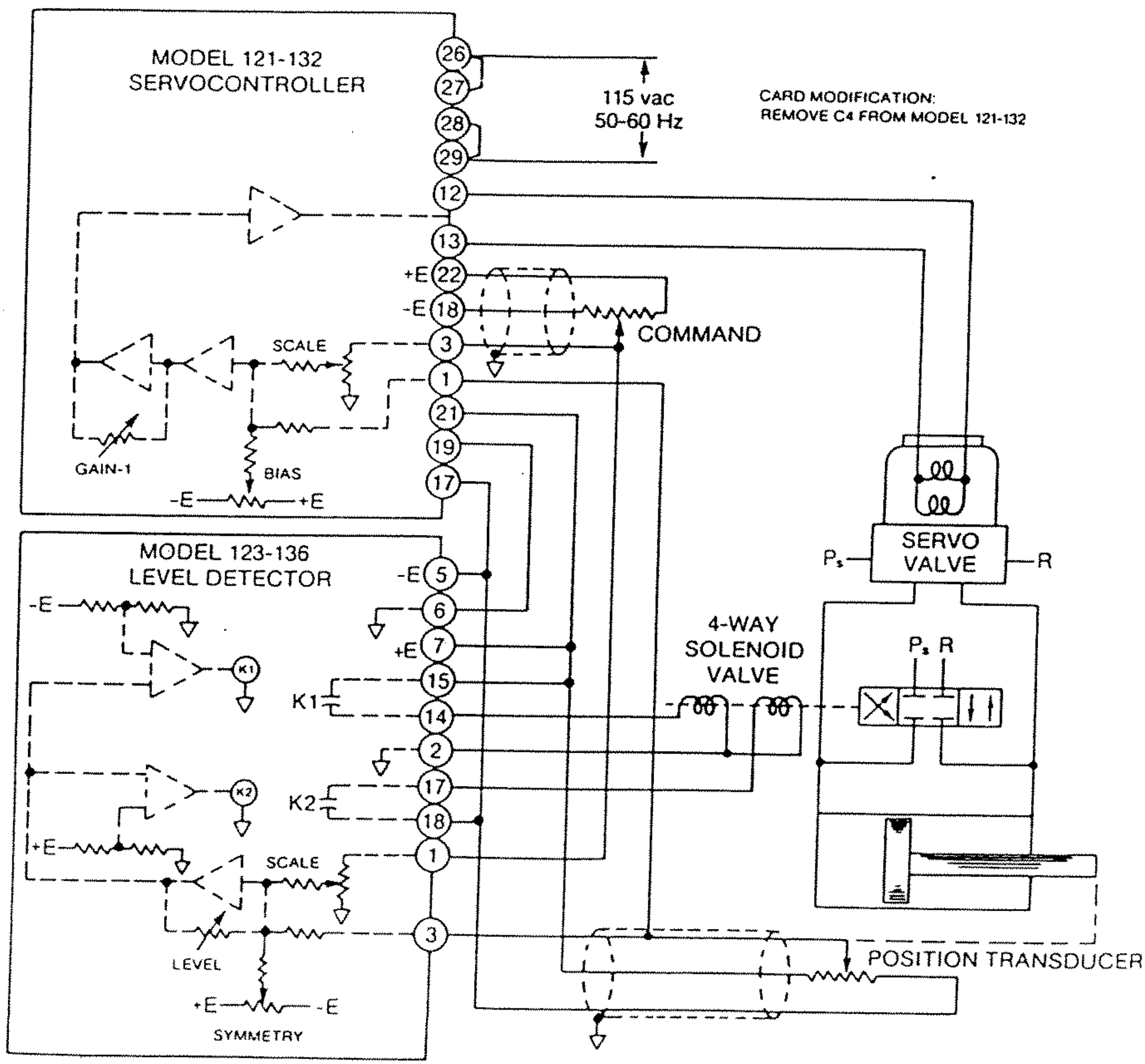


MODEL / CPT.	123A134 400Hz	123B134 2000Hz	123C134 6000Hz
C4	3300pf	1000pf	1000pf
C5	.068µf	.015µf	3000pf
C6	680pf	220pf	220pf
C8	.022µf	3300pf	1500pf
R11	10K	9.09K	10K
R12	10K	9.09K	10K
R29	18.2K	24.3K	17.8K

Position Servo with Rapid Traverse

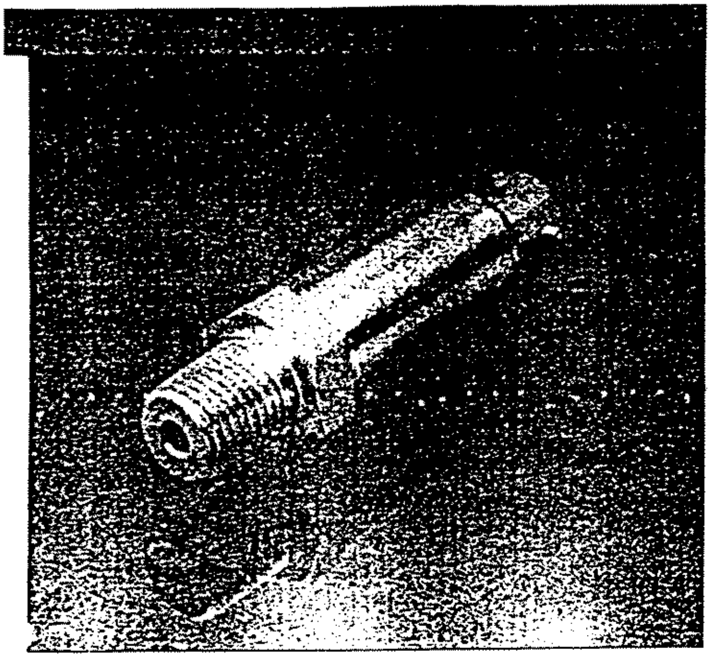
This example illustrates the use of the Model 123-136 Null/Level Detector. A four-way solenoid valve is used, along with the Null/Level Detector, to obtain the high flow of a large valve while maintaining the superior positioning of a lower flow servovalve. Model 121-132 Servocontroller is used as a proportional servoamplifier driving a low flow servovalve to obtain accurate positioning of the actuator.

When point-to-point commands become sufficiently large (adjustable by the level pot), Model 123-136 activates the appropriate relay (K1 or K2). This energizes a four-way solenoid valve which provides high flow to the actuator. The response time of the solenoid valve must be sufficiently fast to be compatible with the system dynamic requirements.



Ψ PSI-TRONIX PSI-5000

High Level Output Pressure Transducer



Highly Accurate Pressure Transducer for Minute Pressure Ranges

Features

- Low Cost
- Accuracy (Linearity, Hysteresis, Repeatability): ±.25% F.S. (B.F.S.L.)
- Hybrid Electronics

Description

Strain Gage Transducer Accepts Unregulated Input.

The PSI-5000 offers pressure ranges of 0-15 to 0-10,000 psi, gage or absolute, all stainless steel construction, high burst pressure, and high accuracy of ±.25% F.S. (B.F.S.L.).

The sensor consists of silicon piezoresistive strain gages, mounted on a flat diaphragm, and arranged in a wheatstone bridge configuration. The output is conditioned for 5.0 volts output for all units.

The highly accurate sensor, with hybrid electronics is packaged in a stainless steel housing for use in most environments.

Basic Applications

PSI-5000 is the economical answer for all applications requiring high accuracy over a wide range of pressures. The unit's small size (2 oz.), integrated hybrid electronics, wide operating temperature range (-65°F to +200°F), extreme reliability, durability, and long life, make the PSI-5000 the perfect instrument for most static and dynamic pressure measurement where a high level output signal is desired.

SEE REVERSE SIDE FOR SPECIFICATIONS AND OPTIONS

4509 Runway St., Simi Valley, California 93063 • (805) 584-6617 • (818) 993-9790

High Level Output Pressure Transducer

Specifications

PERFORMANCE

Pressure Ranges (gage or absolute): 0 to 15, 25, 50, 100, 250, 500, 1000, 3000, 5000, and 10,000 psi
Overpressure: 2x Range
Burst Pressure: 10x full scale or 20,000 psi, whichever is less
Pressure Cavity Volume: 0.025 in³
Output: 5.050 Vdc ±.050 Vdc
Accuracy (linearity, hysteresis, and repeatability): ±.25% of full scale (B.F.S.L.)
Zero Balance: ±1.0% of full scale
Temperature Range: 0-130° F
Thermal Zero Shift: ±0.01% F.S./° F
Thermal Sensitivity Shift: ±0.01% F.S./° F
Resolution: Infinite
Life: Millions of cycles

ELECTRICAL

Excitation: 16 to 32 Vdc
Input Impedance: 2800Ω min.
Output/Input: non-isolated, 3-wire

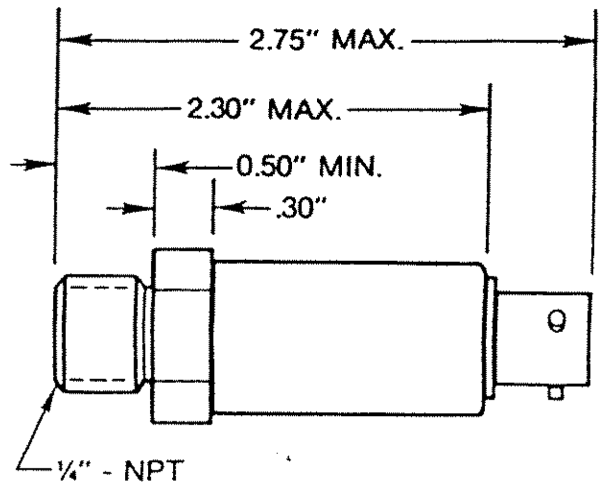
ENVIRONMENTAL

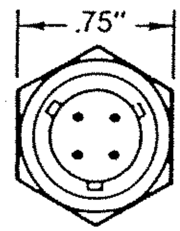
Maximum Temperature Operating Range: -65° F to +200° F
Compensated Range: 0° F to 130° F

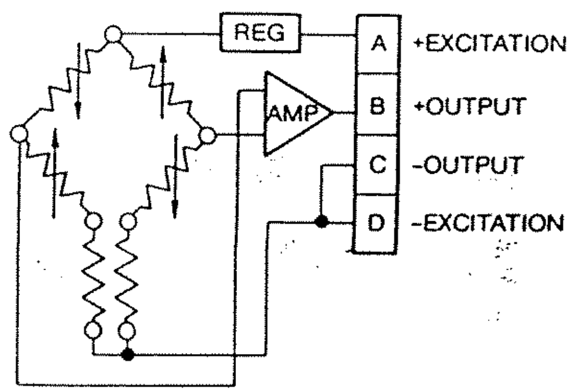
PHYSICAL

Weight: 2 ounces
Construction Materials: Stainless Steel 17-4P.H. and 316 S.S.T. (no O-rings)
Media: Compatible with 17-4P.H. and 316 S.S.T.
Connectors:
Electrical Recptl.: Bendix PT1H-8-4 PN or equivalent
Mating Connector: Bendix PT06A-8-45 (SR) or equivalent
(mating connector not supplied)

Installation Diagrams







Options:

- Special Fittings and excitation on Request
- Consult Factory for Custom Designs for Special Applications

Ordering Information

PSI-5000 — 1000 — G

- PSI-5000: Model No.
- 1000: Pressure Range(psi)
- G: G=gage, A=absolute

4509 Runway St., Simi Valley, California 93063 • (805) 584-6617 • (818) 993-9790

GEOTECH

PROJECT NO. 9545 PROJECT NRC LOAD TESTING FRAME

DRAWING REGISTER ENGINEER [initials] DRAFTER

DRAWING NO.	TITLE	DATE	REMARKS
9545-D-001-01	FRAME. DESIGN LAYOUT	16 MAR 88	[initials]
9545-D-002-01	FRAME WELDMENT	16 MAR 88	[initials]
9545-D-003-01	BEARING PAD.	22 MAR 88	[initials]
9545-C-004-01	ACTUATOR. MODIFICATIONS	22 MAR 88	"
9545-B-005-01	ANGLE	23 MAR 88	"
9545-C-006-01	UPPER PLATEN OBSOLETE	23 MAR	"
9545-C-007-01	COLLAR	24 MAR 88	"
9545-D-008-01	LOAD TESTING FRAME. PARTS LIST ONLY.		[initials]
9545-D-009-01	UPPER PLATEN	13 APR 88	[initials]
9545-B-010-01	PISTON (FOR USE WITH PLATEN 9545-C-006-01)	NOT DRAWN —	[initials]
9545-C-011-01	≡05 PISTON	7 APR 88	[initials]
9545-C-012-01	≡05 BUSHING	12 APR 88	[initials]
9545-B-013-01	FIXTURE, PISTON-BUSHING FINISHING.	13 APR 88	[initials]
9545-B-014-01	SCREW, TRANSDUCER RETAINING	14 APR 88	[initials]
9545-B-015-01	SCREW, DUMMY	14 APR 88	[initials]
9545-B-016-01	INSTALLATION TOOL, BUSHINGS	19 APR 88	[initials]
9545-A-017-01	TIE ROD.	19 APR.	[initials]
9545-B-018-01	PLATEN ASSY. PARTS LIST ONLY.	20 APR 88	[initials]
9545-D-019-01	LOADING TABLE	20 APR 88	[initials]
9545-D-020-01	HOIST KIT	21 APR 88	[initials]
9545-B-021-01	ACTUATOR	21 APR 88	[initials]
9545-C-022-01	FRAME INSTL'N IN COLD ROOM	16 JUN 88	[initials]
9545-C-023-01	LOWER PLATEN	15 SEP 88	[initials]
9545-B-024-01	SIDE PLATE	15 SEP 88	[initials]
9545-A-025-01	TIE PLATE	15 SEP 88	[initials]

GEOTECH

DRAWING REGISTER

PROJECT NO. 9545 PROJECT NRC LOAD TESTING FRAME

ENGINEER

DRAFTER

DRAWING NO.	TITLE		DATE	REMARKS
9545-B-026-01	TIE PLATE		21 NOV 88	
9545-B-027-01	END PLATE		2 DEC 88	
9545-B-028-01	BLOCK DIAG. (2 SHTS)	ELEC.	JUL 88	PAUL KAM…
9545-B-029-01	LOGIC CIRCUIT (3 SHTS)	ELEC	— " —	— " —
9545-B-030-01	SERVO CONTROL/MONITOR UNIT	ELEC	"	"
9545-B-031-01	SERVO CONTROLLER	ELEC	"	"
9545-B-032-01	DITHER CIRCUIT	ELEC	"	"
9545-B-033-01	SIGNAL CONDITIONER	ELEC	"	"
9545-B-034-01	POWER SUPPLY	ELEC	"	"
9545-B-035-01	FRONT PANEL	ELEC	"	"
9545-B-036-01	CHANNEL TERMINATION LIST	ELEC	"	"

GEOTECH

GEOTECHnical resources ltd.
Calgary, Alberta, Canada

PARTS LIST

9545-D-002-01

SHEET OF

PREPARED	BY [signature]	DATE 23mar88
CHECKED		
RELEASED		

TITLE: FRAME WELDMENT

PROJECT: NRC LOAD FRAME

ITEM	PART/DRAWING NO.	DESCRIPTION		QTY.
1.	FRONT/BACK PL	STEEL PLATE CSA G40.21 GR 44W		2
		2" PL x 70" x 70"		
2.	FLANGE	STEEL PLATE CSA G40.21 GR 44W		2
		2" PL x 27 x 64" DEV. LENGTH		
3	TOP PL	STEEL PLATE CSA G40.21 GR 44W		1
		2" PL x 24½ x 32		
		(USE CUT-OUT FROM FRONT/BACK PL)		
4	BOTTOM PL	STEEL PLATE CSA G40.21 GR 44W		1
		2" PL x 30½ x 32		
		(USE CUT-OUT FROM FRONT/BACK PL)		
5	BOTTOM WEB	STEEL PLATE CSA G40.21 GR 44W		2
		1" PL x 16 x 20½		
6	TIE PLATE	STEEL PLATE CSA G40.21 GR 44W		4
		1" PL x 8 x 20½		
7	FOOT PLATE	STEEL PLATE CSA G40.21 GR 44W		2
		1" PL x 12 x 36		
8	GUSSET	STEEL PLATE CSA G40.21 GR 44W		8
		1" PL x 5½ x 5½ ~ MAKES 2 PC		

REVISION									
DATE									
RELEASE									

9.2 Software Listing

```
10!RE-STORE "MTD_A_91"
20 !   ******************************************************************
30 !   |              ---MATERIALS TEST DATA AQUISITION PROGRAM---          |
40 !   |                                                                    |
50 !   |Calling name: MTD_A_91                     Revision: 1.1            |
60 !   |Programmers : N Chalk                      Date     : 25 Jan 1988   |
70 !   |--------------------------------------------------------------------|
80 !   |This programme is the Infotek AD-200 based Materials Test data      |
90 !   |acquisition system.                                                 |
100!   |In order to customize the system, the following step must be performed:|
110!   |   - change the number of samples and/or the number of channels,    |
120!   |     "EDIT Set_buffer_size" and alter array "Buff(*)" dimensions;   |
130!   |   - change number of channels or channel parameters,               |
140!   |     "EDIT Transducers" and follow directions;                      |
150!   |   - also "EDIT Summary" and check "Temp(*)" >= No_samples.         |
160!   |                                                                    |
170!   | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  |
180!   |Name composition:                                                   |
190!   |  a. programme type  :  xxx  (e.g.  MTD = Materials Test - DAS)     |
200!   |  b. acquisition type:  yy   (e.g.  A = AD200, M = Multiprogarammer)|
210!   |  c. revision level  :  nnn  (e.g.  211 = Rev. 2.11)                |
220!   | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  |
230!   |Parent programme: DAS                                               |
240!   |____________________________________________________________________|
250!   |Modification History                               |Date       |By     |
260!   |---------------------------------------------------|-----------|-------|
270!   | 1. This version setup for Mega Newton test frame. | 28 Sep 88 | NC    |
280!   | 2. This version for "Turd-maker"                  | 03 Jan 89 | PAS   |
290!   | 3.                                                |           |       |
300!   | 4.                                                |           |       |
310!   | 5.                                                |           |       |
320!   ******************************************************************
330    OPTION BASE 1
340    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
350    COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
360    COM /Ad_setup3/ Min_time,Max_time,Flag
370    COM /Files/ Ch_data$(16,3)[28],Gains(16,3),Test_text$(15)[30],Test_data(30
380    !==================================================================
390    DIM Msus$[9],File$[10],Ch_desc$(17)[9]
400    !
410    OUTPUT KBD;"K";
420    PRINT CHR$(129)
430    PRINT TABXY(10,10);" MATERIAL TEST DATA ACQUISITION PROGRAMME -- AD-200 VE
440    PRINT TABXY(26,11);" GEOTECHnical resources ltd. "
450    DISP CHR$(129)
460    INPUT " Press ENTER to continue. ",Ans$
470    !
480 Restore:                                              !
490    DISP CHR$(129)
500    INPUT " SAVE changes? (Y/N) ",Ans$
510    SELECT Ans$
520    CASE "Y"
530      PRINT CHR$(128)
540      PRINT TABXY(1,19);"SAVING changes."
550      RE-STORE "MTD_A_91:,700,0"
560      PRINT TABXY(1,19);RPT$(" ",80)
570    CASE "N"
580     !INPUT " Are you sure? (Y/N) ",Ans$
590     !IF Ans$<>"Y" THEN GOTO Restore
600      GOTO Set_buffer_size
```

```
610   CASE ELSE
620     BEEP
630     GOTO Restore
640   END SELECT
650   PRINT CHR$(128)
660   DISP CHR$(128)
670   !
680   !++++++++++++++++++++++++ << **** N.B. **** >> ++++++++++++++++++++++++
690   !
700 Set_buffer_size:!                               !Change dimensions to new
710   INTEGER Buff(16000,5) BUFFER                 !number of samples/number?
720   !                                             !of channels respectively.
730   !+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
740   !
750 Set_variables:                                  !Set initial conditions
760   Ad_addr=10
770   Area=0
780   Diameter=0
790   Duration=0
800   File$="#"
810   Flag=0
820   Height=0
830   Max_channels=SIZE(Ch_data$,1)
840   Max_time=500000000                            ! \AD200 period
850   Min_time=10000                                ! /in nanoseconds
860   Msus$=":,700,0"
870   No_channels=SIZE(Buff,2)
880   No_samples=SIZE(Buff,1)
890   Period=0
900   Sample$="#"
910   Sample_rate=0
920   Strain_rate$="#"
930   Trigger=0
940   !
950 Reset_arrays:                                   !Set arrays to initial
960   MAT Buff= (0)                                 !conditions
970   MAT Ch_data$= ("#")
980   MAT Ch_desc$= ("#")
990   MAT Gains= (0)
1000  MAT Sw_gain= (0)
1010  MAT Test_data= (0)
1020  MAT Test_text$= ("#")
1030  !
1040 Housekeeping:!
1050  CONTROL 1,12;1                                !Menu off
1060  CONTROL 1,21;0                                !Non-compatibility mode
1070  CONTROL 2,2;1                                 !User menu = 1
1080! OUTPUT KBD;"SCRATCH KEY";CHR$(255)&CHR$(88);  !Scrub user softkeys
1090  CONTROL 1,4;0                                 !Display functions off
1100  CONTROL 1,15;0                                !Force user menu
1110  CONTROL 2,1;0                                 !Printall off
1120  OUTPUT KBD;"K";                               !Clear screen
1130  PRINTER IS CRT
1140  !======================================================================
1150 Top:                                           !Primary calls
1160  Setup_table
1170  Setup_test
1180  Build_files(Ch_desc$(*),Msus$)
1190  !
1200  Das_ad200(Buff(*))
```

```
1210  File_data(Buff(*),Ch_desc$(*),Msus$)
1220  !
1230! Summary(Ch_desc$(*),Msus$)
1240  !
1250  Exit
1260  END
1270  !***********************************************************************
1280  !***********************************************************************
1290 Setup_test:SUB Setup_test
1300  !
1310  !This module prompts for the test data and performs pre-test calculations.
1320  !
1330  !Inputs:
1340  !     Ch_data$(*)     = channel data array
1350  !     Gains(*)        = channel gain array
1360  !
1370  !Outputs:
1380  !     Test_data(*)    = setup parameter array containing:
1390  !              (1)      = sample diameter
1400  !              (2)      = sample height
1410  !              (3)      = sample cross-sectional area
1420  !              (4)      = actual sample rate / channel
1430  !              (5)      = sampling period in nanoseconds
1440  !              (6)      = total acquisition duration in seconds
1450  !              (7)      = duration to end of test in seconds
1460  !              (8)      = total samples / channel
1470  !              (9)      = samples to end of test / channel
1480  !              (10)     = logging duration         \ From data acquisition
1490  !              (11)     = samples logged           / routine "Das_ad200"
1500  !              (12)     = sample width
1510  !              (13)     = sample depth
1520  !              (14)     = number of active channels
1530  !              (15)     = maximum number of channels
1540  !              (16)     = test chamber temperature
1550  !     Test_text$(*)   = setup text array containing:
1560  !               (1)     = test name  (e.g. "T123")
1570  !               (2)     = test type  (e.g. "Triaxial")
1580  !               (3)     = time test was initiated
1590  !               (4)     = date test was initiated
1600  !               (5)     = test sample name or description
1610  !               (6)     = strain rate
1620  !               (7)     = sample shape
1630  !=======================================================================
1640    OPTION BASE 1
1650    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
1660    COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
1670    COM /Ad_setup3/ Min_time,Max_time,Flag
1680    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
1690    !-----------------------------------------------------------------------
1700    DIM Rate$(10:16)[80],Clear_screen$[2],Home$[2],Marker$[6]
1710    DIM Test_name$[4],Test_type$[20],Test_time$[11]
1720    ALLOCATE Set_rate$(7)[10],Set_freq(7),Set_duration(7)
1730    REAL Number,Samples
1740    INTEGER Point,Select,Exp,I
1750    !
1760    Clear_screen$="K"                           ! (Control-Clr Scr)
1770    DISP CHR$(129)
1780    !
1790 Init:                                          !Set up printer
1800    ON TIMEOUT 7,1 RECOVER Not_on
```

```
1810     OUTPUT PRT;"";
1820     OFF TIMEOUT
1830     !
1840 Paper:                                              !
1850     PRINT TABXY(1,40);" Check printer paper is at top-of-form."
1860     Ans$="y"
1870     INPUT " Printer setup completed? (default is yes) ",Ans$
1880     IF UPC$(Ans$[1,1])<>"Y" THEN Paper
1890     OUTPUT KBD;Clear_screen$;
1900     !
1910     Test_time$=TIME$(TIMEDATE)                     !Set test time / date
1920     Test_date$=DATE$(TIMEDATE)
1930     !
1940 Name:                                              !Enter test name
1950     OUTPUT KBD;Clear_screen$;Home$;
1960     PRINT TABXY(23,4);"Enter the TEST NAME in the form:"
1970     PRINT TABXY(19,6);"                    Xnnn"
1980     PRINT TABXY(19,8);"where X is one of the following letters:"
1990     PRINT TABXY(19,9);"            1. ""B"" = Bulk compressibility;"
2000     PRINT TABXY(19,10);"           2. ""T"" = Triaxial;"
2010     PRINT TABXY(19,11);"           3. ""U"" = Uniaxial;"
2020     PRINT TABXY(19,12);"           4. ""_"" = Any non-standard identifier"
2030     PRINT TABXY(19,13);"and ""nnn"" is a number: 000 <= range <= 999."
2040     PRINT TABXY(19,15);"Exempli gratia: ""T123"", ""t001"", etc."
2050     !
2060 ! Test_name$="T123"                              !<<<
2070     INPUT " TEST NAME is: ",Test_name$
2080     Test_name$=UPC$(Test_name$)
2090     PRINT TABXY(1,19);" TEST NAME entered is """;Test_name$;"""."
2100     IF Test_name$="" THEN
2110       BEEP
2120       PRINT " Invalid TEST NAME!!!"
2130       WAIT 2
2140       GOTO Name
2150     END IF
2160     Ans$="n"
2170     INPUT " Change TEST NAME? (default is no) ",Ans$
2180     IF UPC$(Ans$[1,1])="Y" THEN Name
2190     !
2200     IF LEN(Test_name$)>4 THEN Name_error          !Check test name format
2210     ON ERROR GOTO Num_error
2220     IF NUM(Test_name$[2;1])<48 OR NUM(Test_name$[2;1])>57 THEN Name_error
2230     IF NUM(Test_name$[3;1])<48 OR NUM(Test_name$[3;1])>57 THEN Name_error
2240     IF NUM(Test_name$[4])<48 OR NUM(Test_name$[4])>57 THEN Name_error
2250     OFF ERROR
2260     !
2270     SELECT Test_name$[1,1]                         !Identify test type
2280     CASE "B"
2290       Test_type$="Bulk Compressibility"
2300     CASE "T"
2310       Test_type$="Triaxial"
2320     CASE "U"
2330       Test_type$="Uniaxial"
2340     CASE ELSE
2350       PRINT TABXY(1,19);" Non-standard TEST IDENTIFIER entered""";Test_name$
2360       Ans$="y"
2370       INPUT " Change TEST IDENTIFIER? (default is yes) ",Ans$
2380       IF UPC$(Ans$[1,1])="Y" THEN
2390         GOTO Name
2400       ELSE
```

```
2410        PRINT TABXY(1,19);RPT$(" ",80)
2420        INPUT " Enter non-standard TEST TYPE. ",Test_type$
2430        Test_type$=UPC$(Test_type$[1,1])&LWC$(Test_type$[2,20])
2440        PRINT TABXY(1,19);" Non-standard TEST TYPE entered is """;Test_type$
2450        Ans$="n"
2460        INPUT " Change non-standard TEST TYPE? (default is no) ",Ans$
2470        IF UPC$(Ans$[1,1])="Y" THEN Name
2480      END IF
2490    END SELECT
2500    OUTPUT KBD;Clear_screen$;
2510    PRINT TABXY(15,10);" Enter the following information...."
2520    PRINT TAB(15);RPT$("-",51)
2530    !
2540 Sample:                                               !Sample stuff
2550    PRINT TABXY(1,19);RPT$(" ",80)
2560    INPUT " Enter SAMPLE DESCRIPTOR. ",Sample$
2570    PRINT TABXY(1,19);"SAMPLE DESCRIPTOR entered is """;Sample$;"""."
2580    Ans$="n"
2590    INPUT " Change SAMPLE DESCRIPTOR? (default is no) ",Ans$
2600    IF UPC$(Ans$[1,1])="Y" THEN Sample
2610    PRINT TABXY(1,19);RPT$(" ",80)
2620    !
2630 Shape:                                                !
2640    Shape$="Circular"
2650    PRINT "Default SAMPLE SHAPE is CIRCULAR."
2660    Ans$="n"
2670    INPUT " Change SAMPLE SHAPE to RECTANGULAR? (Default is no) ",Ans$
2680    IF UPC$(Ans$[1,1])="Y" THEN Shape$="Rectangular"
2690    PRINT TABXY(1,19);RPT$(" ",80)
2700    !
2710 Sample_size:                                          !
2720    SELECT UPC$(Shape$[1,1])
2730    CASE "C"
2740      Diameter=100                  !{{{
2750      Height=250                    !{{{
2760      PRINT TABXY(1,19);"Default CIRCULAR SIZE is ";Diameter;" x ";Height;"
2770      INPUT " Enter DIAMETER in millimeters. ",Diameter
2780      INPUT " Enter HEIGHT in millimeters. ",Height
2790      PRINT TABXY(1,19);RPT$(" ",80)
2800      PRINT TABXY(1,19);"SAMPLE SIZE entered is ";Diameter;" x ";Height;" (d
2810      Ans$="n"
2820      INPUT " Change SAMPLE SIZE? (default is no) ",Ans$
2830      IF UPC$(Ans$[1,1])="Y" THEN Sample_size
2840      Area=(INT(.5+((PI*(Diameter/2)^2)*100)))/100
2850    CASE "R"
2860      Width=100                     !{{{
2870      Depth=100                     !{{{
2880      Height=250
2890      PRINT TABXY(1,19);"Default RECTANGULAR SIZE is ";Width;" x ";Depth;" x
2900      INPUT " Enter WIDTH in millimeters. ",Width
2910      INPUT " Enter DEPTH in millimeters. ",Depth
2920      INPUT " Enter HEIGHT in millimeters. ",Height
2930      PRINT TABXY(1,19);RPT$(" ",80)
2940      PRINT TABXY(1,19);"SAMPLE SIZE entered is ";Width;" x ";Depth;" x ";He
2950      Ans$="n"
2960      INPUT " Change SAMPLE SIZE? (default is no) ",Ans$
2970      IF UPC$(Ans$[1,1])="Y" THEN Sample_size
2980      Area=(INT(.5+(Width*Depth)*100))/100
2990    END SELECT
3000    PRINT TABXY(1,19);RPT$(" ",80)
```

```
3010    !
3020 Temperature:                                          !Test chamber temp
3030    Temp=0
3040    INPUT " Enter test chamber TEMPERATURE (Default is 0 C.) ",Temp
3050    PRINT TABXY(1,19);"TEMPERATURE entered is ";Temp;" C."
3060    Ans$="n"
3070    INPUT " Change TEMPERATURE? (Default is no) ",Ans$
3080    IF UPC$(Ans$[1,1])="Y" THEN GOTO Temperature
3090    PRINT TABXY(1,19);RPT$(" ",80)
3100    !-----
3110 Rate_menu:                                            !Setup rate menu
3120    Entries=7                                          ! (Change "Entries" if
3130    !****|-----------|-------|----------|              !  data statements added
3140    !****|Strain-rate|S Freq | Duration |              !  or deleted.)
3150    !****|-----------|-------|----------|
3160    DATA "1.0E-5"    ,2       ,5100
3170    DATA "1.0E-4"    ,20      ,510
3180    DATA "1.0E-3"    ,200     ,51
3190    DATA "1.0E-2"    ,2000    ,5.1
3200    DATA "1.0E-1"    ,20000   ,0.51
3210    DATA "1.0E+0"    ,200000  ,0.051
3220    DATA "Other"
3230    !
3240    RESTORE Rate_menu
3250    FOR Line_no=1 TO Entries-1
3260      READ Set_rate$(Line_no),Set_freq(Line_no),Set_duration(Line_no)
3270    NEXT Line_no
3280    READ Set_rate$(Entries)
3290    !
3300 Menu:                                                 !Build rate menu
3310    OUTPUT KBD;Clear_screen$;Home$;
3320    DISP CHR$(129)
3330    CONTROL 2,2;1                                      ! (Select user Menu 1)
3340    !
3350    PRINT TABXY(15,2);"To make a selection, move the pointer to the desired"
3360    PRINT TAB(15);"Strain Rate using the ""UP"" and ""DOWN"" keys, and"
3370    PRINT TAB(15);"then press the ""SELECT"" key.  If the Strain Rate"
3380    PRINT TAB(15);"required is not listed, select ""Other""."
3390    PRINT TABXY(15,7);RPT$("_",50)
3400    PRINT TAB(15);"STRAIN RATE";TAB(30);"SAMPLE RATE";TAB(45);"DURATION"
3410    PRINT TAB(15);RPT$("-",50)
3420    !
3430    FOR L=1 TO Entries-1
3440      PRINT TAB(15);Set_rate$(L);TAB(30);Set_freq(L);TAB(45);Set_duration(L)
3450    NEXT L
3460    PRINT TAB(15);Set_rate$(Entries)
3470    !
3480    ON KEY 1 LABEL "  MOVE      UP    " GOSUB Move_up
3490    ON KEY 2 LABEL "  MOVE     DOWN   " GOSUB Move_down
3500    ON KEY 3 LABEL "                  " GOSUB Not_used
3510    ON KEY 4 LABEL "                  " GOSUB Not_used
3520    ON KEY 5 LABEL " SELECT   STRAIN  " GOTO Selector
3530    ON KEY 6 LABEL "                  " GOSUB Not_used
3540    ON KEY 7 LABEL "                  " GOSUB Not_used
3550    ON KEY 8 LABEL "  EXIT            " CALL Exit
3560    !
3570    Select=0                                           !Activate rate menu
3580    Point=10
3590    Indent=15
3600    Menu_line=1
```

```
3610    Min_point=Point
3620    Max_point=Point+Entries-1
3630    PRINT TABXY(Indent,Point);CHR$(129);Set_rate$(1)
3640    CONTROL 1,12;2                                   ! (User menu lit)
3650    !
3660 Spin:GOTO Spin                                      !Zzzz..............
3670    !
3680 Selector:                                           !Wake up
3690    OFF KEY
3700    CONTROL 1,12;1                                   ! (User menu off)
3710    PRINT CHR$(128)
3720    Strain_rate$=Set_rate$(Menu_line)
3730    Flag=0
3740    IF Strain_rate$[1;5]="Other" THEN GOTO Other
3750    PRINT CHR$(128)
3760    !
3770    Sample_rate=Set_freq(Menu_line)                  !Calculate parameters
3780 Other_rate:                                         !
3790    Actual_rate=Sample_rate
3800    Rate=Sample_rate
3810 Rate:                                               !
3820    Time_inc=1/(Rate*No_channels)
3830    Period=50*(Time_inc DIV 5.0E-8)
3840    Rate=1/(Period*1.E-9*No_channels)
3850    IF Rate<Actual_rate THEN
3860      Rate=Rate+50
3870      GOTO Rate
3880    END IF
3890    IF Period<Min_time OR Period>Max_time THEN
3900      PRINT TABXY(1,18);" PERIOD outside bounds: ";Min_time;" < PERIOD < ";M
3910      IF Period<Min_time THEN
3920        Period=Min_time
3930        PRINT "PERIOD set to ";Min_time
3940      END IF
3950      IF Period>Max_time THEN
3960        Period=Max_time
3970        PRINT "PERIOD set to ";Max_time
3980      END IF
3990      Actual_rate=INT(1.E+9/Period/No_channels)
4000      BEEP
4010      WAIT 5
4020    END IF
4030    !
4040    Duration=(INT(1000*(Period*1.0E-9*No_samples*No_channels)))/1000
4050    Actual_duration=Duration
4060    Samples=No_samples
4070    Actual_samples=Samples
4080    IF Flag<>1 THEN
4090      IF Duration>Set_duration(Menu_line) THEN
4100        Actual_duration=Set_duration(Menu_line)
4110        Actual_samples=INT(Actual_duration*Actual_rate)
4120      END IF
4130    END IF
4140    !
4150    GOSUB Text                                       !Build test array
4160    GOSUB Data                                       !Build parameter array
4170    !
4180    OUTPUT KBD;Clear_screen$;                        !Print setup table
4190    GOSUB Print_setup
4200    !
```

```
4210     Ans$="Y"
4220     INPUT " TEST PARAMETERS ok? (default is yes) ",Ans$
4230     IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Name
4240     Ans$="n"
4250     INPUT " Printout TEST PARAMETER file? (default is no) ",Ans$
4260     IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Quit
4270     PRINTER IS PRT
4280     GOSUB Print_setup
4290     PRINTER IS CRT
4300     !
4310 Quit:DISP CHR$(128)
4320     SUBEXIT
4330     !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4340 Not_on:                                     !Printer time-out
4350     OFF TIMEOUT
4360     PRINT TABXY(1,40);"Printer timeout. Check power on, etc."
4370     Ans$="y"
4380     INPUT " Printer fault cleared? (default is yes) ",Ans$
4390     IF UPC$(Ans$[1,1])<>"Y" THEN
4400       DISP "Printer error in ""Setup_test"". Process terminated!"
4410       STOP
4420     ELSE
4430       OUTPUT KBD;Clear_screen$;
4440     END IF
4450     GOTO Init
4460     !
4470 Print_setup:                                !
4480     PRINT "MATERIALS TEST SETUP PARAMETERS"
4490     PRINT
4500     PRINT TAB(6);"Name.......: ";Test_name$;TAB(50);"Date...: ";DATE$(TIMEDA
4510     PRINT TAB(6),"Test type..: ";Test_type$;TAB(50);"Time...: ";Test_time$
4520     PRINT TAB(6);"Sample.....: ";Sample$;TAB(50);"Shape..: ";Shape$
4530     PRINT
4540     PRINT TAB(8);"Strain Rate ..................  ";Strain_rate$[1,10];TAB(5
4550     PRINT TAB(8);"Selected Sample Rate ......... ";Sample_rate;TAB(58);"Hz /
4560     PRINT TAB(8);"Actual Sample Rate ........... ";Actual_rate;TAB(58);"Hz /
4570     PRINT TAB(8);"Sample period ................ ";Period;TAB(58);"Nanosecon
4580     SELECT Actual_duration
4590     CASE >=1.0
4600       IF Duration>1800 THEN
4610         PRINT TAB(8);"Acquisition Duration ......... ";INT(10*Duration/3600)
4620       ELSE
4630         PRINT TAB(8);"Acquisition Duration ......... ";INT(10*Duration)/10;T
4640       END IF
4650       IF Actual_duration>1800 THEN
4660         PRINT TAB(8);"Actual Test Duration ......... ";INT(10*Actual_duratio
4670       ELSE
4680         PRINT TAB(8);"Actual Test Duration ......... ";INT(10*Actual_duratio
4690       END IF
4700     CASE <1.0
4710       PRINT TAB(8);"Acquisition Duration ......... ";INT(1000*Duration);TAB(
4720       PRINT TAB(8);"Actual Test Duration ......... ";INT(1000*Actual_duratio
4730     END SELECT
4740     PRINT TAB(8);"Acquired Samples ............. ";Samples;TAB(58);"Words /
4750     PRINT TAB(8);"Samples in Test Matrix........ ";Actual_samples;TAB(58);"W
4760     SELECT UPC$(Shape$[1,1])
4770     CASE "C"
4780       PRINT TAB(8);"Sample size(dh) .............. ";Diameter;"x";Height;TAB
4790     CASE "R"
4800       PRINT TAB(8);"Sample size(dwh) ............. ";Depth;"x";Width;"x";Hei
```

```
4810    END SELECT
4820    PRINT TAB(8);"Sample cross-sectional area .. ";Area;TAB(58);"Square mill
4830    PRINT TAB(8);"Test chamber temperature...... ";Temp;TAB(58);"Celcius"
4840    RETURN
4850    !
4860 Name_error:                                        !
4870    DISP " TEST NAME entered incorrectly. Try again."
4880    BEEP
4890    WAIT 1.5
4900    GOTO Name
4910    !
4920 Num_error:                                         !
4930    IF ERRN=33 THEN GOTO Name_error
4940    BEEP
4950    BEEP
4960    DISP "Unexpected error in ""Setup_test"". Process terminated!"
4970    STOP
4980    !
4990 Strain_error:                                      !
5000    DISP " STRAIN RATE entered is out-of-range. Try again."
5010    BEEP
5020    WAIT 2
5030    GOTO Other
5040    !
5050 Move_up:!
5060    PRINT TABXY(Indent,Point);CHR$(128);Set_rate$(Menu_line)
5070    Point=Point-1
5080    IF Point<Min_point THEN
5090      Point=Max_point
5100      Menu_line=Entries+1
5110    END IF
5120    Menu_line=Menu_line-1
5130    PRINT TABXY(Indent,Point);CHR$(129);Set_rate$(Menu_line)
5140    RETURN
5150    !
5160 Move_down:!
5170    PRINT TABXY(Indent,Point);CHR$(128);Set_rate$(Menu_line)
5180    Point=Point+1
5190    IF Point>Max_point THEN
5200      Point=Point-Entries
5210      Menu_line=0
5220    END IF
5230    Menu_line=Menu_line+1
5240    PRINT TABXY(Indent,Point);CHR$(129);Set_rate$(Menu_line)
5250    RETURN
5260    !
5270 Not_used:DISP CHR$(128)
5280    DISP "Undefined key"
5290    BEEP
5300    WAIT 1
5310    DISP
5320    DISP CHR$(129)
5330    RETURN
5340    !
5350 Other:                                             !
5360    Flag=1
5370    CONTROL 1,12;1                                  !Menu off
5380    OUTPUT KBD;Clear_screen$;
5390    PRINT TABXY(10,5);"Enter the Strain Rate in the form:"
5400    PRINT TABXY(10,7);"                         n.nE-m"
```

```
5410    PRINT TABXY(10,9);"where:"
5420    PRINT TABXY(10,10);"    1. ""n.n"" is a number: 1.0 <= range <= 9.9;"
5430    PRINT TABXY(10,11);"    2. ""E"" specifies exponentiation;"
5440    PRINT TABXY(10,12);"    3. ""m"" is a power: 3 <= range <= 8."
5450    PRINT TABXY(10,13);"Exempli gratia: ""3.7E-4""."
5460    !
5470    INPUT " What Strain Rate? ",Strain_rate$
5480    !
5490    Strain_rate$=UPC$(Strain_rate$)                     !Check Strain Rate format
5500    IF VAL(Strain_rate$)<1.0E-8 OR Strain_rate>1.0E-2 THEN GOTO Strain_error
5510    !
5520    Duration=.051/VAL(Strain_rate$)
5530    Sample_rate=1/(Duration/No_samples)
5540    PRINT TABXY(1,17);"Strain rate             = ";Strain_rate$;TAB(40);" 1/se
5550    Duration_hr=INT(100*Duration/3600)*.01
5560    PRINT "Test duration          =";Duration;TAB(40);" Seconds";TAB(60);Dura
5570    PRINT "Sample rate / channel =";Sample_rate;TAB(40);" Hz"
5580    !
5590    Ans$="y"
5600    INPUT " Are these ok? (Default is yes) ",Ans$
5610    IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Other
5620    GOTO Other_rate
5630    !
5640 Text:                                                   !Text array
5650    Test_text$(1)=Test_name$
5660    Test_text$(2)=Test_type$
5670    Test_text$(3)=Test_time$
5680    Test_text$(4)=Test_date$
5690    Test_text$(5)=Sample$
5700    Test_text$(6)=Strain_rate$
5710    Test_text$(7)=Shape$
5720    RETURN
5730    !
5740 Data:                                                   !Parameter array
5750    Test_data(1)=Diameter
5760    Test_data(2)=Height
5770    Test_data(3)=Area
5780    Test_data(4)=Actual_rate
5790    Test_data(5)=Period
5800    Test_data(6)=Duration
5810    Test_data(7)=Actual_duration
5820    Test_data(8)=Samples
5830    Test_data(9)=Actual_samples
5840    Test_data(12)=Width
5850    Test_data(13)=Depth
5860    Test_data(14)=No_channels
5870    Test_data(15)=Max_channels
5880    Test_data(16)=Temp
5890    RETURN
5900  SUBEND
5910  !_______________________________________________________________________
5920  !
5930 Build_files:SUB Build_files(Ch_desc$(*),Msus$)
5940  !
5950  !This module checks for sufficient disk space to store the files and
5960  !creates the files if room is available.
5970  !
5980  !Inputs:
5990  !    Ch_data$(*)     = channel data array containing:
6000  !    Test_text$(*)   = setup text array containing:
```

```
6010  !    Msus$          = destination disk
6020  !Outputs:
6030  !    Ch_desc$(*)    = array of active channel file names
6040  !Calls
6050  !    File_error
6060  !========================================================================
6070     OPTION BASE 1
6080     COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
6090     COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
6100     COM /Ad_setup3/ Min_time,Max_time,Flag
6110     COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
6120     !---------------------------------------------------------------------
6130     ALLOCATE File$[16],Cat_string$(4)[80]
6140     !
6150     DISP " Checking disk space and creating data files..... "
6160     WAIT 2
6170     !
6180     Data_blocks=INT(1+(No_samples*2/256))        !Define file sizes
6190     Size_1=SIZE(Ch_data$,1)*SIZE(Ch_data$,2)*24
6200     Size_2=SIZE(Gains,1)*SIZE(Gains,2)
6210     Size_3=SIZE(Test_text$,1)*30
6220     Size_4=SIZE(Test_data,1)
6230     Header_blocks=INT((Size_1+Size_2+Size_3+Size_4)/256)+1
6240     !
6250     Space=Header_blocks+(Data_blocks*No_channels) !Check disk space
6260     CAT Msus$ TO Cat_string$(*)
6270     Dsk_spc=VAL(Cat_string$(4)[17,23])
6280     PRINT
6290     PRINT "DISK REQUIREMENTS"
6300     PRINT
6310     PRINT TAB(10);"Required disk space...: ";RPT$(" ",10-LEN(VAL$(Space)));S
6320     PRINT TAB(10);"Available disk space..: ";RPT$(" ",10-LEN(VAL$(Dsk_spc)))
6330     IF Space<Dsk_spc THEN
6340       PRINT TAB(10);"Remaining disk space..:";RPT$(" ",10-LEN(VAL$(Dsk_space
6350       WAIT 2
6360     ELSE
6370       DISP " Insufficient disk space remaining. Cannot continue.....!!! "
6380       PAUSE
6390     END IF
6400     !
6410     Flag=0
6420 Build:                                          !
6430     ON ERROR GOTO Error
6440     Ch=Max_channels+1
6450     Ch_desc$(Ch)=Test_text$(1)&"_hdr"
6460     CREATE BDAT Ch_desc$(Ch)&Msus$,Header_blocks
6470     FOR Ch=1 TO Max_channels
6480       IF Ch_data$(Ch,1)<>"#" THEN
6490         Ch_desc$(Ch)=Test_text$(1)&"_ch"&Ch_data$(Ch,1)
6500         CREATE BDAT Ch_desc$(Ch)&Msus$,Data_blocks
6510       END IF
6520     NEXT Ch
6530     OFF ERROR
6540     !
6550     DISP
6560     SUBEXIT
6570     !+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
6580 Error:                                          !Check file error
6590     OFF ERROR
6600     File_error(Ch_desc$(Ch),Msus$)
```

```
6610    GOTO Build
6620  SUBEND
6630  !_______________________________________________________________________
6640  !
6650 File_data:SUB File_data(INTEGER Data(*) BUFFER,Ch_desc$(*),Msus$)
6660  !
6670  !This module downloads the header file and then passes off to
6680  !Demux_data.
6690  !
6700  !Inputs:
6710  !    Data(*)     = multiplexed integer buffer data
6720  !    Ch_desc$(*) = file name array
6730  !    Msus$       = target disk
6740  !Calls:
6750  !    Demux_data
6760  !    File_error
6770  !======================================================================
6780    OPTION BASE 1
6790    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
6800    COM /Ad_setup2/ INTEGER Sw_gain(*),Ad_addr(*),Trigger,Max_channels
6810    COM /Ad_setup3/ Min_time,Max_time,Flag
6820    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
6830    !---------------------------------------------------------------------
6840    INTEGER I,Columns
6850    !
6860    DISP "Transmitting header and data files."
6870    WAIT 2
6880    !
6890    ASSIGN @File TO Ch_desc$(Max_channels+1)&Msus$
6900    ON ERROR GOTO Error
6910    OUTPUT @File;Ch_data$(*)
6920    OUTPUT @File;Gains(*)
6930    OUTPUT @File;Test_data(*)
6940    OUTPUT @File;Test_text$(*)
6950    OFF ERROR
6960    ASSIGN @File TO *
6970    !
6980    Demux_data(Data(*),Ch_desc$(*),Msus$)        !Demux and transmit data
6990    !
7000    DISP
7010    SUBEXIT
7020    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
7030 Error:                                          !Check file error
7040    OFF ERROR
7050    File_error(Ch_desc$(Max_channels+1),Msus$)
7060    GOTO Build_files
7070  SUBEND
7080  !_______________________________________________________________________
7090  !
7100 Demux_data:SUB Demux_data(INTEGER Data(*) BUFFER,Ch_desc$(*),Msus$)
7110  !
7120  !This module takes an array containing multiplexed data and swaps rows
7130  !(data) for columns (channels).  It then transfers each channel to its
7140  !own file by repositioning the "fill pointer" to the end of each channel.
7150  !
7160  !Inputs:
7170  !    Data(*)     = two-dimensional data array to be demultiplexed
7180  !    Ch_desc$(*) = array containing file names in which each channel is to
7190  !                  be stored
7200  !
```

```
7210  !======================================================================
7220    OPTION BASE 1
7230    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
7240    COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
7250    COM /Ad_setup3/ Min_time,Max_time,Flag
7260    !--------------------------------------------------------------------
7270    INTEGER Ch
7280    REAL Buffsize,Emt,Fill
7290    !
7300    Buffsize=0                                  !Current number of samples
7310    Emt=0                                       !Current fill ptr position
7320    Fill=0
7330    Ch=0
7340    !
7350    DISP "Demultiplexing data."
7360    !
7370    ALLOCATE INTEGER Temp(No_samples,No_channels) !Transpose data array
7380    MAT Temp= TRN(Data)
7390    MAT Data= Temp
7400    DEALLOCATE Temp(*)
7410    !
7420    ASSIGN @Data TO BUFFER Data(*)              !Demultiplex data
7430    STATUS @Data,2;Buffsize
7440    Flag=0
7450    ON ERROR GOTO Error
7460    FOR Ch=1 TO Max_channels
7470      IF Ch_desc$(Ch)<>"#" THEN
7480        ASSIGN @Outfile TO Ch_desc$(Ch)&Msus$
7490        STATUS @Data,5;Emt
7500        Fill=No_samples*2+Emt
7510        IF Fill>Buffsize THEN Fill=1
7520        CONTROL @Data,3;Fill
7530        TRANSFER @Data TO @Outfile;END
7540      END IF
7550    NEXT Ch
7560    OFF ERROR
7570    ASSIGN @Data TO *
7580    ASSIGN @Outfile TO *
7590    !
7600    DISP
7610    SUBEXIT
7620    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
7630 Error:                                        !Check file error
7640    OFF ERROR
7650    DISP "File error in demux...PAUSE!!! Now what???"
7660    PAUSE
7670    File_error(Ch_desc$(Ch),Msus$)
7680  SUBEND
7690  !_____________________________________________________________________
7700  !
7710 Summary:SUB Summary(Ch_desc$(*),Msus$)
7720  !
7730  !This module creats a test summary table. It finds the minimum and maximum
7740  !values in a selected channel, determines the indices of these values,
7750  !which it uses to get values from the rest of the data files. Raw and
7760  !transducer engineering values are then produced and displayed for check-
7770  !ing.
7780  !
7790  !Inputs:
7800  !    Ch_desc$(*) = array of active channel file names
```

```
7810  !     Msus$        = source disk
7820  !======================================================================
7830     OPTION BASE 1
7840     COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
7850     COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
7860     COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
7870     !-------------------------------------------------------------------
7880     ALLOCATE Tx_min(Max_channels),Tx_max(Max_channels)
7890     INTEGER Temp(16000) BUFFER,Ch_min(16),Ch_max(16)
7900     !
7910     DISP "Building summary table."
7920     WAIT 2
7930     !
7940     REDIM Temp(No_samples)                              !Get min, max values
7950     FOR Ch=1 TO Max_channels
7960       IF Ch_desc$(Ch)<>"#" THEN
7970         ASSIGN @Infile TO Ch_desc$(Ch)&Msus$
7980         ENTER @Infile;Temp(*)
7990         ASSIGN @Infile TO *
8000         Ch_min(Ch)=MIN(Temp(*))
8010         Ch_max(Ch)=MAX(Temp(*))
8020       END IF
8030     NEXT Ch
8040     !
8050     FOR Ch=1 TO Max_channels                            !Calculate transducer min,
8060       IF Ch_desc$(Ch)<>"#" THEN                         !max values
8070         Gain=Gains(Ch,1)*(Gains(Ch,2)+Gains(Ch,3))!y = m(x + b)
8080         Tx_min(Ch)=(INT(Ch_min(Ch)*Gain*100))/100
8090         Tx_max(Ch)=(INT(Ch_max(Ch)*Gain*100))/100
8100       END IF
8110     NEXT Ch
8120     !
8130     GOSUB Print_summary                                 !Print setup table
8140     !
8150     Ans$="n"
8160     DISP CHR$(129)
8170     INPUT " Print summary? (Default is no) ",Ans$
8180     DISP CHR$(128)
8190     IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Quit
8200     PRINTER IS PRT
8210     GOSUB Print_summary
8220     !
8230 Quit:                                                   !
8240     PRINTER IS CRT
8250     SUBEXIT
8260     !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
8270 Print_summary:                                          !Summary table
8280     PRINT
8290     PRINT TAB(28);"*** SUMMARY DATA ***"
8300     PRINT
8310     PRINT "Ch #";TAB(7);"Channel Description";TAB(30);"Min raw";TAB(40);"Max
8320     PRINT RPT$("-",75)
8330 Format:IMAGE 1X,2A,3X,22A,2X,6D,4X,6D,3X,5D.1D,3X,5D.1D,4X,8A
8340     FOR Ch=1 TO Max_channels
8350       IF Ch_desc$(Ch)<>"#" THEN
8360         PRINT USING Format;Ch_data$(Ch,1),Ch_data$(Ch,3),Ch_min(Ch),Ch_max(C
8370       END IF
8380     NEXT Ch
8390     PRINT
8400     PRINT "
```

```
                Test duration = ";INT(1000*Test_data(10))/1000;" Sec."
8410    PRINT "Number of samples / channel = ";Test_data(11);" words."
8420    IF SYSTEM$("PRINTER IS")="701" THEN PRINT "
```

```
8430     RETURN
8440   SUBEND
8450   !________________________________________________________________________
8460   !
8470 File_error:SUB File_error(File$,Msus$)
8480   !
8490   !This module either automatically purges a file(s) or checks if it is safe
8500   !to do so. If the error which caused the branch was not a duplicate file
8510   !error, it assumes the error is fatal, prints the error message, and
8520   !stops.
8530   !The ON ERROR which calls this module cannot do so directly; it must pass
8540   !contol to a label which then calls it.  The line following the call
8550   !statement must then branch back to the statement that caused the error.
8560   !
8570   !Inputs:
8580   !     Msus$ = target disk
8590   !     File$ = file to purge
8600   !     Flag  = "0" for conditional purge, "1" for auto purge
8610   !=========================================================================
8620     OPTION BASE 1
8630     COM /Ad_setup3/ Min_time,Max_time,Flag
8640     !-----------------------------------------------------------------------
8650     DISP CHR$(129)
8660     !
8670     SELECT ERRN
8680     CASE =54                                        !Duplicate file name
8690       IF Flag=1 THEN
8700         IF File$[5,7]="_ch" THEN GOTO Delete
8710         PURGE File$&Msus$
8720       ELSE
8730         BEEP
8740         INPUT " Duplicate file! Okay to erase it? (Y/N) ",Ans$
8750         IF UPC$(Ans$[1,1])="Y" THEN
8760           Flag=1
8770           IF File$[5,7]="_ch" THEN GOTO Delete
8780           PURGE File$&Msus$
8790         ELSE
8800           DISP " Duplicate file! Unable to continue.....!!! "
8810           BEEP
8820           BEEP
8830           PAUSE
8840         END IF
8850       END IF
8860     CASE ELSE
8870 Oops:PRINT "Unexpected error in File_error.  Process terminated."
8880       PRINT ERRM$
8890       BEEP
8900       STOP
8910     END SELECT
8920     !
8930 End:DISP CHR$(128)
8940     SUBEXIT
8950     !-----------------------------------------------------------------------
8960 Delete:!
8970     ON ERROR GOTO Ouch
8980     FOR Ch=1 TO 16
8990       File_name$=File$[1,7]&VAL$(Ch)
9000       PURGE File_name$&Msus$
9010       IF File_name$[8,9]=VAL$(16) THEN Quit
```

```
9020 Next:NEXT Ch
9030 Ouch:IF ERRN=56 THEN
9040       IF File_name$[8,9]=VAL$(16) THEN Quit
9050       GOTO Next
9060    ELSE
9070       GOTO Oops
9080    END IF
9090 Quit:OFF ERROR
9100    GOTO End
9110  SUBEND
9120  !_________________________________________________________________________
9130  !
9140  SUB Rd_buffptr(@Membuff,Fill_ptr,No_bytes,Emty_ptr)
9150  !
9160  !This module determines the position of the read/write pointers and the
9170  !number of bytes of data in a buffer.
9180  !
9190  !Inputs:
9200  !     @Membuff = I/O path to target buffer
9210  !Outputs:
9220  !     Fill_ptr = position of write pointer
9230  !     Emty_ptr = position of read pointer
9240  !     No_bytes = number of bytes of data in the buffer
9250  !-------------------------------------------------------------------------
9260    OPTION BASE 1
9270    STATUS @Membuff,3;Fill_ptr
9280    STATUS @Membuff,4;No_bytes
9290    STATUS @Membuff,5;Emty_ptr
9300  SUBEND
9310  !_________________________________________________________________________
9320  !
9330 Exit:SUB Exit
9340  !
9350  !Exit module.
9360  !-------------------------------------------------------------------------
9370    OPTION BASE 1
9380    OUTPUT KBD;"K";
9390    CONTROL 2,2;0
9400    CONTROL 1,12;2
9410    LOAD "AUTOST:,700"
9420  SUBEND
9430  !_________________________________________________________________________
9440  !
9450 Das_ad200:SUB Das_ad200(INTEGER Buff(*) BUFFER)
9460  !
9470  !This module is the single-card Infotek Systems AD-200 Data Aquisition
9480  !System. It generates the card command string, sets up the card, checks
9490  !for setup errors, and logs the data.
9500  !
9510  !Inputs:
9520  !     Ad_addr     = system address of Infotek AD_200 ADC card
9530  !     Duration    = logging period in seconds
9540  !     No_channels = number of active data channels
9550  !     No_samples  = total number of samples
9560  !     Period      = period between samples in nanoseconds
9570  !     Sw_gain(*)  = array of channel total gains
9580  !     Trigger     = determines Ad-200 start mode (INTERNAL/EXTERNAL)
9590  !Outputs:
9600  !     Buff(*)     = data buffer
9610  !Calls
```

```
9620  !    Command_error
9630  !===================================================================
9640    OPTION BASE 1
9650    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
9660    COM /Ad_setup2/ INTEGER Sw_gain(*),Ad_addr,Trigger,Max_channels
9670    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
9680    !-----------------------------------------------------------------
9690    ALLOCATE Cmg$[200],Trigger$[8],Cmd_txt$(2)[200],Cmd_text$[400]
9700    !
9710    DISP CHR$(129)
9720    DISP " Initializing the Ad-200 card. "
9730    WAIT 1
9740    !
9750    SELECT Trigger                                   !Set up AD-200 mode
9760    CASE 0
9770      Trigger$="INTERNAL"
9780    CASE 1
9790      Trigger$="EXTERNAL"
9800    CASE ELSE
9810      PRINT "Eek!  AD-200 mode neither INTERNAL nor EXTERNAL in Das_ad200!"
9820      PAUSE
9830    END SELECT
9840    !
9850    FOR Ch=1 TO Max_channels                         !Build command strings
9860      IF Sw_gain(Ch)<>0 THEN
9870        Cmg$=Cmg$&Ch_data$(Ch,1)&"S"&VAL$(Sw_gain(Ch))&","
9880      END IF
9890    NEXT Ch
9900    Cmd_txt$(1)="RESET,"&Trigger$&",SELECT,"&Cmg$&"END,DELAYON,HOLDOFF"
9910    !
9920    Count=No_samples*No_channels
9930    Time=Period
9940    OUTPUT Cmd_txt$(2) USING "#,K,8D,K,9D,K";",COUNT,";Count;",TIME,";Time
9950    !
9960    Cmd_text$=Cmd_txt$(1)&Cmd_txt$(2)
9970    !
9980    Dummy=READIO(Ad_addr,5)                          !Fix for power-up hang
9990    WRITEIO Ad_addr,0;0                              !problem
10000   RESET Ad_addr
10010   !
10020   ASSIGN @Adc TO Ad_addr                           !Init card and check it
10030   OUTPUT @Adc;Cmd_text$
10040!  PRINT RPT$("_",60)                               ! *Debugging aid - display
10050!  PRINT "Command text Das_ad200: ";Cmd_text$       ! *command sent
10060   Command_check(@Adc,"(during setup)")
10070   !
10080   ASSIGN @Buff TO BUFFER Buff(*)                   !Get set
10090   ASSIGN @Adc TO Ad_addr;WORD
10100   GOSUB Start                                      !Start logging
10110   DISP " LOGGING DATA.............. "
10120   Start=TIMEDATE
10130   TRANSFER @Adc TO @Buff;WAIT
10140   Stop=TIMEDATE
10150   Rd_buffptr(@Buff,Fill_ptr,No_bytes,Emty_ptr)
10160   ASSIGN @Buff TO *
10170   !
10180   ASSIGN @Adc TO Ad_addr                           !Check for logging errors
10190   Command_check(@Adc,"(post logging)")
10200   OUTPUT @Adc;"RESET"
10210   ASSIGN @Adc TO *
```

```
10220    !
10230    Logging_time=Stop-Start                          !Get logging time/samples
10240    Samples_logged=No_bytes DIV (2*No_channels)
10250    Test_data(10)=Logging_time
10260    Test_data(11)=Samples_logged
10270    !
10280    DISP CHR$(128);" "
10290    SUBEXIT
10300    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
10310 Start:                                              !Pre-logging checks
10320    Ans$="n"
10330    INPUT " RAMP GENERATOR ready? (default is no) ",Ans$
10340    IF UPC$(Ans$[1,1])<>"Y" THEN Start
10350    Ans$="n"
10360    INPUT " SERVO SYSTEM ready? (default is no) ",Ans$
10370    IF UPC$(Ans$[1,1])<>"Y" THEN Start
10380    Ans$="n"
10390    INPUT " START LOGGING DATA?????? (default is no) ",Ans$
10400    IF UPC$(Ans$[1,1])<>"Y" THEN Start
10410    RETURN
10420 SUBEND
10430 !_______________________________________________________________________
10440 !
10450 Setup_table:SUB Setup_table
10460 !
10470 !This module contains information, entered by the operator,  which is used
10480 !to setup the current test.  It is divided into four major blocks; the
10490 !first two are for data entry, and the last two do the actual setup and
10500 !checks.  The blocks are:
10510 !     1. basic test information;
10520 !     2. transducer data;
10530 !     3. operational checks and setup;
10540 !     4. AD-200 calculations.
10550 !If an error is detected during the setup operation, the error is posted
10560 !and the process terminated.
10570 !
10580 !Outputs:
10590 !     Ch_data$(*)     = channel data array containing:
10600 !             (Ch,1)   = channel number
10610 !             (Ch,2)   = transducer engineering units
10620 !             (Ch,3)   = channel description
10630 !     Gains(*)        = channel gain array containing:
10640 !          (Ch,1)      = channel gain
10650 !          (Ch,2)      = transducer gain
10660 !          (Ch,3)      = transducer offset
10670 !======================================================================
10680    OPTION BASE 1
10690    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
10700    COM /Ad_setup2/ INTEGER Sw_gain(*),Ad_addr(*),Trigger,Max_channels
10710    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
10720    !---------------------------------------------------------------------
10730    DIM Channel_no(16),Ad_gain(16),Tx_gain(16),Tx_offset(16)
10740    DIM Tx_units$(16)[8],Ch_desc$(16)[28]
10750    !
10760    DISP "Reading Transducer and A/D setup data."
10770    !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
10780 Transducers:!This table contains setup information for the AD-200 ADC     !
10790    !card, tranducer data and channel information. The number of channels !
10800    !must equal the number of data statements. Inactive channels must be  !
10810    !commented out.                                                        !
```

```
10820   ! S/W gain  1 = 5.0V FS
10830   !           2 = 2.5V FS
10840   !           5 = 1.0V FS
10850   !          10 = 0.5V FS
10860   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
10870   !***|Ad200|             Transducer               |           Channel           |
10880   !***|-----|--------------------------------------|-----------------------------|
10890   !***|Ch|SW|  Gain   |  Offset  |   Gain   |           Descriptor          |
10900   !***|no|gn|         |          |   Units  |                               |
10910   !***|--|--|---------|----------|----------|-----------------------------|
10920 Card1:!
10930 ! DATA  1, 1, 107.2635,        0,       "mm",            "Displacement 1"
10940 ! DATA  2, 1, 107.2635,        0,       "mm",            "Displacement 2"
10950   DATA  3, 1, 20.19   ,        0,       "mm",              "Displacement"
10960   DATA  4, 2,   1.3834,        0,       "MN",               "Extend Load"
10970   DATA  5, 2,   1.0476,        0,       "MN",              "Retract Load"
10980 ! DATA  6, 1,     1.00,        0,       "MN",                      "Load"
10990   DATA  7, 1,   2.0000,        0,        "V",                   "Command"
11000 ! DATA  8, 1,     8.99,        0,      "MPa",         "Local Pressure #8"
11010 ! DATA  9, 1,     8.99,        0,      "MPa",         "Local Pressure #9"
11020 ! DATA 10, 1,    2.248,        0,      "MPa",        "Local Pressure #10"
11030 ! DATA 11, 1,   0.5735,        0,      "MPa",        "Local Pressure #11"
11040 ! DATA 12, 1,   0.5735,        0,      "MPa",        "Local Pressure #12"
11050 ! DATA 13, 1,     8.99,        0,      "MPa",        "Local Pressure #13"
11060 ! DATA 14, 1,    2.248,        0,      "MPa",        "Local Pressure #14"
11070 ! DATA 15, 1,     8.99,        0,      "MPa",        "Local Pressure #15"
11080   DATA 16, 2,    49.94,        0,      "MPa",            "Local Pressure"
11090   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
11100 Checks:                                              !Operational checks and
11110                                                      !setup
11120   RESTORE Transducers                                !Read transducer table and
11130   ON ERROR GOTO Err_no_data                          !check for errors
11140   FOR Ch=1 TO No_channels
11150     READ Channel_no(Ch),Ad_gain(Ch),Tx_gain(Ch),Tx_offset(Ch)
11160     READ Tx_units$(Ch),Ch_desc$(Ch)
11170   NEXT Ch
11180   ON ERROR GOTO Okay
11190   READ Channel_no(No_channels+1)
11200   GOTO Err_more_data
11210 Okay:                                                !
11220   IF ERRN<>36 AND ERRN<>17 THEN
11230     PRINT "Unexpected error while reading Transducer setup table."
11240     PRINT ERRM$
11250     BEEP
11260     STOP
11270   END IF
11280   OFF ERROR
11290   !
11300   PRINT "ACTIVE CHANNEL LIST"                        !Print channel check list
11310   PRINT
11320   PRINT "Ch";TAB(7);"Channel Description";TAB(41);"Tx Gain";TAB(52);"Tx Of
11330   PRINT RPT$("-",68)
11340 Format:IMAGE 2D,4X,28A,3X,4D.5D,3X,4D.5D,4X,8A
11350   FOR Ch=1 TO No_channels
11360     PRINT USING Format;Channel_no(Ch),Ch_desc$(Ch),Tx_gain(Ch),Tx_offset(C
11370   NEXT Ch
11380   PRINT
11390   !
11400   Data_words=No_samples*No_channels+3.E+4       !Check memory availability
11410   Mem_words=VAL(SYSTEM$("AVAILABLE MEMORY")) DIV 2
```

```
11420   PRINT "MEMORY REQUIREMENTS"
11430   PRINT
11440   PRINT TAB(10);"Require......:";RPT$(" ",10-LEN(VAL$(Data_words)));Data_w
11450   PRINT TAB(10);"Have.........:";RPT$(" ",10-LEN(VAL$(Mem_words)));Mem_wor
11460   IF Data_words>Mem_words THEN
11470     DISP CHR$(129);" Insufficient memory.  Cannot continue........!!! "
11480     BEEP
11490     BEEP
11500     PAUSE
11510   ELSE
11520     PRINT TAB(10);"Remaining....:";RPT$(" ",10-LEN(VAL$(Mem_words-Data_wor
11530     PRINT
11540   END IF
11550   PRINT
11560   !
11570   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
11580   ! Gain equation:                                                       !
11590   ! y = mx, where y   = channel gain          (eng units / bit)          !
11600   !               m   = transducer gain       (eng units / volt)         !
11610   !               x   = AD-200 gain           (volts / bit)              !
11620   ! Note: Ex_gain = MONITOR PANEL voltage divider correction             !
11630   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
11640   Hw_gain=1                                   !Build data arrays from
11650   Ex_gain=1                                   !transducer table
11660   FOR I=1 TO No_channels
11670     Ch=Channel_no(I)
11680     Sw_gain(Ch)=Ad_gain(I)
11690     Gains(Ch,1)=Ex_gain*Tx_gain(I)*(5/(2048*Ad_gain(I)*Hw_gain))
11700     Gains(Ch,2)=Tx_gain(I)
11710     Gains(Ch,3)=Tx_offset(I)
11720     Ch_data$(Ch,1)=VAL$(Channel_no(I))
11730     Ch_data$(Ch,2)=Tx_units$(I)
11740     Ch_data$(Ch,3)=Ch_desc$(I)
11750   NEXT I
11760   !
11770   Ch_count=0                                  !Check if software gain
11780   FOR Ch=1 TO Max_channels                    !and number of channels is
11790     SELECT Sw_gain(Ch)                        !valid
11800     CASE 1,2,5,10
11810       Ch_count=Ch_count+1
11820     CASE 0
11830       !(channel not implimented)
11840     CASE ELSE
11850       GOTO Err_invld_gain
11860     END SELECT
11870   NEXT Ch
11880   IF Ch_count<>No_channels THEN GOTO Err_no_channels
11890   SUBEXIT
11900   !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
11910 Err_invld_gain:BEEP
11920   PRINT "Invalid gain: Channel ";Ch_data$(Ch,1);" gain =";Sw_gain(Ch);"!!"
11930   PAUSE
11940   !
11950 Err_no_channels:BEEP
11960   PRINT "Sw_gain array does not add up to No_channels!"
11970   PAUSE
11980   !
11990 Err_no_data:BEEP
12000   IF ERRN=36 THEN
12010     PRINT "More channels than DATA statements in Transducer setup table!"
```

```
12020   ELSE
12030     PRINT ERRM$
12040   END IF
12050   PAUSE
12060   !
12070 Err_more_data:BEEP
12080   PRINT "More DATA statements than channels in Transducer setup table!"
12090   PAUSE
12100 SUBEND
12110 !____________________________________________________________________________
12120 !
12130 Command_check:SUB Command_check(@Path,Subname$)
12140 !
12150 !This module reads the status register in the AD-200 card, and, if it
12160 !contains errors, prints an error list and stops the programme.
12170 !----------------------------------------------------------------------------
12180   OPTION BASE 1
12190   DIM Status$[10]
12200   !
12210   OUTPUT @Path;"STATUS"
12220   ENTER @Path;Status$
12230   !
12240   IF Status$<>"--------" THEN
12250     DISP CHR$(129);"Status error in AD200 ";Subname$;" = """;Status$;"""."
12260     BEEP
12270     PRINT RPT$("_",28);" Command Error List ";RPT$("_",28)
12280     IF Status$[1,1]<>"-" AND Status$[4,4]<>"-" THEN
12290       PRINT "Unused status point error...???"
12300     END IF
12310     IF Status$[2,2]="p" THEN
12320       PRINT "Illegal PERIOD ... "
12330     END IF
12340     IF Status$[3,3]="u" THEN
12350       PRINT "Unrecognized command ..."
12360     END IF
12370     IF Status$[5,5]="s" THEN
12380       PRINT "SELECT error ... "
12390     END IF
12400     IF Status$[6,6]="c" THEN
12410       PRINT "COUNT error ... "
12420     END IF
12430     IF Status$[7,7]="t" THEN
12440       PRINT "TIME error ... "
12450     END IF
12460     IF Status$[8,8]="o" THEN
12470       PRINT "Buffer over-run ... "
12480     END IF
12490     PRINT RPT$("_",76)
12500     PAUSE
12510   END IF
12520 SUBEND
12530 !***************************************************************************
12540 !***************************************************************************
```

```
10!RE-STORE "MTD A 91"
20 !   ************************************************************************
30 !   |                ---MATERIALS TEST DATA AQUISITION PROGRAM---                |
40 !   |                                                                            |
50 !   |Calling name: MTD_A_91                          Revision: 1.1              |
60 !   |Programmers : N Chalk                           Date     : 25 Jan 1988     |
70 !   |----------------------------------------------------------------------------|
80 !   |This programme is the Infotek AD-200 based Materials Test data             |
90 !   |acquisition system.                                                         |
100!   |In order to customize the system, the following step must be performed:|
110!   |   - change the number of samples and/or the number of channels,           |
120!   |     "EDIT Set_buffer_size" and alter array "Buff(*)" dimensions;           |
130!   |   - change number of channels or channel parameters,                      |
140!   |     "EDIT Transducers" and follow directions;                               |
150!   |   - also "EDIT Summary" and check "Temp(*)" >= No_samples.                  |
160!   |                                                                            |
170!   | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |
180!   |Name composition:                                                           |
190!   |  a. programme type  :  xxx  (e.g.  MTD = Materials Test - DAS)            |
200!   |  b. acquisition type:  yy   (e.g.  A = AD200, M = Multiprogarammer)       |
210!   |  c. revision level  :  nnn  (e.g.  211 = Rev. 2.11)                       |
220!   | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |
230!   |Parent programme: DAS                                                       |
240!   |____________________________________________________________________________|
250!   |Modification History                                  |Date        |By      |
260!   |------------------------------------------------------|------------|--------|
270!   | 1. This version setup for Mega Newton test frame.   | 28 Sep 88  | NC     |
280!   | 2. This version for "Turd-maker"                     | 03 Jan 89  | PAS    |
290!   | 3.                                                   |            |        |
300!   | 4.                                                   |            |        |
310!   | 5.                                                   |            |        |
320!   ************************************************************************
330   OPTION BASE 1
340   COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
350   COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
360   COM /Ad_setup3/ Min_time,Max_time,Flag
370   COM /Files/ Ch_data$(16,3)[28],Gains(16,3),Test_text$(15)[30],Test_data(30
380   !========================================================================
390   DIM Msus$[9],File$[10],Ch_desc$(17)[9]
400   !
410   OUTPUT KBD;"K";
420   PRINT CHR$(129)
430   PRINT TABXY(10,10);" MATERIAL TEST DATA ACQUISITION PROGRAMME -- AD-200 VE
440   PRINT TABXY(26,11);" GEOTECHnical resources ltd. "
450   DISP CHR$(129)
460   INPUT " Press ENTER to continue. ",Ans$
470   !
480 Restore:                                              !
490   DISP CHR$(129)
500   INPUT " SAVE changes? (Y/N) ",Ans$
510   SELECT Ans$
520   CASE "Y"
530     PRINT CHR$(128)
540     PRINT TABXY(1,19);"SAVING changes."
550     RE-STORE "MTD_A_11:,700,0"
560     PRINT TABXY(1,19);RPT$(" ",80)
570   CASE "N"
580    !INPUT " Are you sure? (Y/N) ",Ans$
590    !IF Ans$<>"Y" THEN GOTO Restore
600     GOTO Set_buffer_size
```

```
610   CASE ELSE
620     BEEP
630     GOTO Restore
640   END SELECT
650   PRINT CHR$(128)
660   DISP CHR$(128)
670   !
680   !++++++++++++++++++++++++ << **** N.B. **** >> +++++++++++++++++++++++++
690   !
700 Set_buffer_size:!                               !Change dimensions to new
710   INTEGER Buff(16000,16) BUFFER               !number of samples/number?
720   !                                             !of channels respectively.
730   !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
740   !
750 Set_variables:                                  !Set initial conditions
760   Ad_addr=10
770   Area=0
780   Diameter=0
790   Duration=0
800   File$="*"
810   Flag=0
820   Height=0
830   Max_channels=SIZE(Ch_data$,1)
840   Max_time=500000000                            ! \AD200 period
850   Min_time=10000                                ! /in nanoseconds
860   Msus$=":,700,0"
870   No_channels=SIZE(Buff,2)
880   No_samples=SIZE(Buff,1)
890   Period=0
900   Sample$="*"
910   Sample_rate=0
920   Strain_rate$="*"
930   Trigger=0
940   !
950 Reset_arrays:                                   !Set arrays to initial
960   MAT Buff= (0)                                 !conditions
970   MAT Ch_data$= ("*")
980   MAT Ch_desc$= ("*")
990   MAT Gains= (0)
1000  MAT Sw_gain= (0)
1010  MAT Test_data= (0)
1020  MAT Test_text$= ("*")
1030  !
1040 Housekeeping:!
1050  CONTROL 1,12;1                                !Menu off
1060  CONTROL 1,21;0                                !Non-compatibility mode
1070  CONTROL 2,2;1                                 !User menu = 1
1080! OUTPUT KBD;"SCRATCH KEY";CHR$(255)&CHR$(88);  !Scrub user softkeys
1090  CONTROL 1,4;0                                 !Display functions off
1100  CONTROL 1,15;0                                !Force user menu
1110  CONTROL 2,1;0                                 !Printall off
1120  OUTPUT KBD;"K";                              !Clear screen
1130  PRINTER IS CRT
1140  !=========================================================================
1150 Top:                                           !Primary calls
1160  Setup_table
1170  Setup_test
1180  Build_files(Ch_desc$(*),Msus$)
1190  !
1200  Das_ad200(Buff(*))
```

```
1210  File_data(Buff(*),Ch_desc$(*),Msus$)
1220  !
1230! Summary(Ch_desc$(*),Msus$)
1240  !
1250  Exit
1260  END
1270  !*********************************************************************
1280  !*********************************************************************
1290 Setup_test:SUB Setup_test
1300  !
1310  !This module prompts for the test data and performs pre-test calculations.
1320  !
1330  !Inputs:
1340  !    Ch_data$(*)    = channel data array
1350  !    Gains(*)       = channel gain array
1360  !
1370  !Outputs:
1380  !    Test_data(*)   = setup parameter array containing:
1390  !             (1)      = sample diameter
1400  !             (2)      = sample height
1410  !             (3)      = sample cross-sectional area
1420  !             (4)      = actual sample rate / channel
1430  !             (5)      = sampling period in nanoseconds
1440  !             (6)      = total acquisition duration in seconds
1450  !             (7)      = duration to end of test in seconds
1460  !             (8)      = total samples / channel
1470  !             (9)      = samples to end of test / channel
1480  !             (10)     = logging duration        \ From data acquisition
1490  !             (11)     = samples logged          / routine "Das_ad200"
1500  !             (12)     = sample width
1510  !             (13)     = sample depth
1520  !             (14)     = number of active channels
1530  !             (15)     = maximum number of channels
1540  !             (16)     = test chamber temperature
1550  !    Test_text$(*)  = setup text array containing:
1560  !              (1)     = test name  (e.g. "T123")
1570  !              (2)     = test type  (e.g. "Triaxial")
1580  !              (3)     = time test was initiated
1590  !              (4)     = date test was initiated
1600  !              (5)     = test sample name or description
1610  !              (6)     = strain rate
1620  !              (7)     = sample shape
1630  !=====================================================================
1640    OPTION BASE 1
1650    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
1660    COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
1670    COM /Ad_setup3/ Min_time,Max_time,Flag
1680    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
1690    !--------------------------------------------------------------------
1700    DIM Rate$(10:16)[80],Clear_screen$[2],Home$[2],Marker$[6]
1710    DIM Test_name$[4],Test_type$[20],Test_time$[11]
1720    ALLOCATE Set_rate$(7)[10],Set_freq(7),Set_duration(7)
1730    REAL Number,Samples
1740    INTEGER Point,Select,Exp,I
1750    !
1760    Clear_screen$="K"                          ! (Control-Clr Scr)
1770    DISP CHR$(129)
1780    !
1790 Init:                                         !Set up printer
1800    ON TIMEOUT 7,1 RECOVER Not_on
```

```
1810     OUTPUT PRT;"";
1820     OFF TIMEOUT
1830     !
1840 Paper:                                              !
1850     PRINT TABXY(1,40);" Check printer paper is at top-of-form."
1860     Ans$="y"
1870     INPUT " Printer setup completed? (default is yes) ",Ans$
1880     IF UPC$(Ans$[1,1])<>"Y" THEN Paper
1890     OUTPUT KBD;Clear_screen$;
1900     !
1910     Test_time$=TIME$(TIMEDATE)                      !Set test time / date
1920     Test_date$=DATE$(TIMEDATE)
1930     !
1940 Name:                                               !Enter test name
1950     OUTPUT KBD;Clear_screen$;Home$;
1960     PRINT TABXY(23,4);"Enter the TEST NAME in the form:"
1970     PRINT TABXY(19,6);"                   Xnnn"
1980     PRINT TABXY(19,8);"where X is one of the following letters:"
1990     PRINT TABXY(19,9);"            1. ""B"" = Bulk compressibility;"
2000     PRINT TABXY(19,10);"            2. ""T"" = Triaxial;"
2010     PRINT TABXY(19,11);"            3. ""U"" = Uniaxial;"
2020     PRINT TABXY(19,12);"            4. ""_"" = Any non-standard identifier"
2030     PRINT TABXY(19,13);"and ""nnn"" is a number: 000 <= range <= 999."
2040     PRINT TABXY(19,15);"Exempli gratia: ""T123"", ""t001"", etc."
2050     !
2060   ! Test_name$="T123"                          !{{{
2070     INPUT " TEST NAME is: ",Test_name$
2080     Test_name$=UPC$(Test_name$)
2090     PRINT TABXY(1,19);" TEST NAME entered is """;Test_name$;"""."
2100     IF Test_name$="" THEN
2110       BEEP
2120       PRINT " Invalid TEST NAME!!!"
2130       WAIT 2
2140       GOTO Name
2150     END IF
2160     Ans$="n"
2170     INPUT " Change TEST NAME? (default is no) ",Ans$
2180     IF UPC$(Ans$[1,1])="Y" THEN Name
2190     !
2200     IF LEN(Test_name$)>4 THEN Name_error            !Check test name format
2210     ON ERROR GOTO Num_error
2220     IF NUM(Test_name$[2;1])<48 OR NUM(Test_name$[2;1])>57 THEN Name_error
2230     IF NUM(Test_name$[3;1])<48 OR NUM(Test_name$[3;1])>57 THEN Name_error
2240     IF NUM(Test_name$[4])<48 OR NUM(Test_name$[4])>57 THEN Name_error
2250     OFF ERROR
2260     !
2270     SELECT Test_name$[1,1]                          !Identify test type
2280     CASE "B"
2290       Test_type$="Bulk Compressibility"
2300     CASE "T"
2310       Test_type$="Triaxial"
2320     CASE "U"
2330       Test_type$="Uniaxial"
2340     CASE ELSE
2350       PRINT TABXY(1,19);" Non-standard TEST IDENTIFIER entered""";Test_name$
2360       Ans$="y"
2370       INPUT " Change TEST IDENTIFIER? (default is yes) ",Ans$
2380       IF UPC$(Ans$[1,1])="Y" THEN
2390         GOTO Name
2400       ELSE
```

```
2410        PRINT TABXY(1,19);RPT$(" ",80)
2420        INPUT " Enter non-standard TEST TYPE. ",Test_type$
2430        Test_type$=UPC$(Test_type$[1,1])&LWC$(Test_type$[2,20])
2440        PRINT TABXY(1,19);" Non-standard TEST TYPE entered is """;Test_type$
2450        Ans$="n"
2460        INPUT " Change non-standard TEST TYPE? (default is no) ",Ans$
2470        IF UPC$(Ans$[1,1])="Y" THEN Name
2480      END IF
2490    END SELECT
2500    OUTPUT KBD;Clear_screen$;
2510    PRINT TABXY(15,10);" Enter the following information...."
2520    PRINT TAB(15);RPT$("-",51)
2530    !
2540 Sample:                                            !Sample stuff
2550    PRINT TABXY(1,19);RPT$(" ",80)
2560    INPUT " Enter SAMPLE DESCRIPTOR. ",Sample$
2570    PRINT TABXY(1,19);"SAMPLE DESCRIPTOR entered is """;Sample$;"""."
2580    Ans$="n"
2590    INPUT " Change SAMPLE DESCRIPTOR? (default is no) ",Ans$
2600    IF UPC$(Ans$[1,1])="Y" THEN Sample
2610    PRINT TABXY(1,19);RPT$(" ",80)
2620    !
2630 Shape:                                             !
2640    Shape$="Circular"
2650    PRINT "Default SAMPLE SHAPE is CIRCULAR."
2660    Ans$="n"
2670    INPUT " Change SAMPLE SHAPE to RECTANGULAR? (Default is no) ",Ans$
2680    IF UPC$(Ans$[1,1])="Y" THEN Shape$="Rectangular"
2690    PRINT TABXY(1,19);RPT$(" ",80)
2700    !
2710 Sample_size:                                       !
2720    SELECT UPC$(Shape$[1,1])
2730    CASE "C"
2740      Diameter=100                  !{{{
2750      Height=250                    !{{{
2760      PRINT TABXY(1,19);"Default CIRCULAR SIZE is ";Diameter;" x ";Height;"
2770      INPUT " Enter DIAMETER in millimeters. ",Diameter
2780      INPUT " Enter HEIGHT in millimeters. ",Height
2790      PRINT TABXY(1,19);RPT$(" ",80)
2800      PRINT TABXY(1,19);"SAMPLE SIZE entered is ";Diameter;" x ";Height;" (d
2810      Ans$="n"
2820      INPUT " Change SAMPLE SIZE? (default is no) ",Ans$
2830      IF UPC$(Ans$[1,1])="Y" THEN Sample_size
2840      Area=(INT(.5+((PI*(Diameter/2)^2)*100)))/100
2850    CASE "R"
2860      Width=100                     !{{{
2870      Depth=100                     !{{{
2880      Height=250
2890      PRINT TABXY(1,19);"Default RECTANGULAR SIZE is ";Width;" x ";Depth;" x
2900      INPUT " Enter WIDTH in millimeters. ",Width
2910      INPUT " Enter DEPTH in millimeters. ",Depth
2920      INPUT " Enter HEIGHT in millimeters. ",Height
2930      PRINT TABXY(1,19);RPT$(" ",80)
2940      PRINT TABXY(1,19);"SAMPLE SIZE entered is ";Width;" x ";Depth;" x ";He
2950      Ans$="n"
2960      INPUT " Change SAMPLE SIZE? (default is no) ",Ans$
2970      IF UPC$(Ans$[1,1])="Y" THEN Sample_size
2980      Area=(INT(.5+(Width*Depth)*100))/100
2990    END SELECT
3000    PRINT TABXY(1,19);RPT$(" ",80)
```

```
3010     !
3020 Temperature:                                          !Test chamber temp
3030     Temp=0
3040     INPUT " Enter test chamber TEMPERATURE (Default is 0 C.) ",Temp
3050     PRINT TABXY(1,19);"TEMPERATURE entered is ";Temp;" C."
3060     Ans$="n"
3070     INPUT " Change TEMPERATURE? (Default is no) ",Ans$
3080     IF UPC$(Ans$[1,1])="Y" THEN GOTO Temperature
3090     PRINT TABXY(1,19);RPT$(" ",80)
3100     !-----
3110 Rate_menu:                                            !Setup rate menu
3120     Entries=7                                         ! (Change "Entries" if
3130     !****|-----------|-------|----------|             !  data statements added
3140     !****|Strain-rate|S Freq | Duration |             !  or deleted.)
3150     !****|-----------|-------|----------|
3160     DATA "1.0E-5"     ,2        ,5100
3170     DATA "1.0E-4"     ,20       ,510
3180     DATA "1.0E-3"     ,200      ,51
3190     DATA "1.0E-2"     ,2000     ,5.1
3200     DATA "1.0E-1"     ,20000    ,0.51
3210     DATA "1.0E+0"     ,200000   ,0.051
3220     DATA "Other"
3230     !
3240     RESTORE Rate_menu
3250     FOR Line_no=1 TO Entries-1
3260       READ Set_rate$(Line_no),Set_freq(Line_no),Set_duration(Line_no)
3270     NEXT Line_no
3280     READ Set_rate$(Entries)
3290     !
3300 Menu:                                                 !Build rate menu
3310     OUTPUT KBD;Clear_screen$;Home$;
3320     DISP CHR$(129)
3330     CONTROL 2,2;1                                     ! (Select user Menu 1)
3340     !
3350     PRINT TABXY(15,2);"To make a selection, move the pointer to the desired"
3360     PRINT TAB(15);"Strain Rate using the ""UP"" and ""DOWN"" keys, and"
3370     PRINT TAB(15);"then press the ""SELECT"" key.  If the Strain Rate"
3380     PRINT TAB(15);"required is not listed, select ""Other""."
3390     PRINT TABXY(15,7);RPT$("_",50)
3400     PRINT TAB(15);"STRAIN RATE";TAB(30);"SAMPLE RATE";TAB(45);"DURATION"
3410     PRINT TAB(15);RPT$("-",50)
3420     !
3430     FOR L=1 TO Entries-1
3440       PRINT TAB(15);Set_rate$(L);TAB(30);Set_freq(L);TAB(45);Set_duration(L)
3450     NEXT L
3460     PRINT TAB(15);Set_rate$(Entries)
3470     !
3480     ON KEY 1 LABEL "  MOVE      UP    " GOSUB Move_up
3490     ON KEY 2 LABEL "  MOVE    DOWN    " GOSUB Move_down
3500     ON KEY 3 LABEL "                  " GOSUB Not_used
3510     ON KEY 4 LABEL "                  " GOSUB Not_used
3520     ON KEY 5 LABEL " SELECT  STRAIN   " GOTO Selector
3530     ON KEY 6 LABEL "                  " GOSUB Not_used
3540     ON KEY 7 LABEL "                  " GOSUB Not_used
3550     ON KEY 8 LABEL "  EXIT            " CALL Exit
3560     !
3570     Select=0                                          !Activate rate menu
3580     Point=10
3590     Indent=15
3600     Menu_line=1
```

```
3610    Min_point=Point
3620    Max_point=Point+Entries-1
3630    PRINT TABXY(Indent,Point);CHR$(129);Set_rate$(1)
3640    CONTROL 1,12;2                                    ! (User menu lit)
3650    !
3660 Spin:GOTO Spin                                       !Zzzz...............
3670    !
3680 Selector:                                            !Wake up
3690    OFF KEY
3700    CONTROL 1,12;1                                    ! (User menu off)
3710    PRINT CHR$(128)
3720    Strain_rate$=Set_rate$(Menu_line)
3730    Flag=0
3740    IF Strain_rate$[1;5]="Other" THEN GOTO Other
3750    PRINT CHR$(128)
3760    !
3770    Sample_rate=Set_freq(Menu_line)                   !Calculate parameters
3780 Other_rate:                                          !
3790    Actual_rate=Sample_rate
3800    Rate=Sample_rate
3810 Rate:                                                !
3820    Time_inc=1/(Rate*No_channels)
3830    Period=50*(Time_inc DIV 5.0E-8)
3840    Rate=1/(Period*1.E-9*No_channels)
3850    IF Rate<Actual_rate THEN
3860      Rate=Rate+50
3870      GOTO Rate
3880    END IF
3890    IF Period<Min_time OR Period>Max_time THEN
3900      PRINT TABXY(1,18);" PERIOD outside bounds: ";Min_time;" < PERIOD < ";M
3910      IF Period<Min_time THEN
3920        Period=Min_time
3930        PRINT "PERIOD set to ";Min_time
3940      END IF
3950      IF Period>Max_time THEN
3960        Period=Max_time
3970        PRINT "PERIOD set to ";Max_time
3980      END IF
3990      Actual_rate=INT(1.E+9/Period/No_channels)
4000      BEEP
4010      WAIT 5
4020    END IF
4030    !
4040    Duration=(INT(1000*(Period*1.0E-9*No_samples*No_channels)))/1000
4050    Actual_duration=Duration
4060    Samples=No_samples
4070    Actual_samples=Samples
4080    IF Flag<>1 THEN
4090      IF Duration>Set_duration(Menu_line) THEN
4100        Actual_duration=Set_duration(Menu_line)
4110        Actual_samples=INT(Actual_duration*Actual_rate)
4120      END IF
4130    END IF
4140    !
4150    GOSUB Text                                        !Build test array
4160    GOSUB Data                                        !Build parameter array
4170    !
4180    OUTPUT KBD;Clear_screen$;                         !Print setup table
4190    GOSUB Print_setup
4200    !
```

```
4210    Ans$="Y"
4220    INPUT " TEST PARAMETERS ok? (default is yes) ",Ans$
4230    IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Name
4240    Ans$="n"
4250    INPUT " Printout TEST PARAMETER file? (default is no) ",Ans$
4260    IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Quit
4270    PRINTER IS PRT
4280    GOSUB Print_setup
4290    PRINTER IS CRT
4300    !
4310 Quit:DISP CHR$(128)
4320    SUBEXIT
4330    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4340 Not_on:                                          !Printer time-out
4350    OFF TIMEOUT
4360    PRINT TABXY(1,40);"Printer timeout. Check power on, etc."
4370    Ans$="y"
4380    INPUT " Printer fault cleared? (default is yes) ",Ans$
4390    IF UPC$(Ans$[1,1])<>"Y" THEN
4400      DISP "Printer error in ""Setup_test"". Process terminated!"
4410      STOP
4420    ELSE
4430      OUTPUT KBD;Clear_screen$;
4440    END IF
4450    GOTO Init
4460    !
4470 Print_setup:                                     !
4480    PRINT "MATERIALS TEST SETUP PARAMETERS"
4490    PRINT
4500    PRINT TAB(6);"Name.......: ";Test_name$;TAB(50);"Date...: ";DATE$(TIMEDA
4510    PRINT TAB(6),"Test type..: ";Test_type$;TAB(50);"Time...: ";Test_time$
4520    PRINT TAB(6);"Sample.....: ";Sample$;TAB(50);"Shape..: ";Shape$
4530    PRINT
4540    PRINT TAB(8);"Strain Rate ..................  ";Strain_rate$[1,10];TAB(5
4550    PRINT TAB(8);"Selected Sample Rate ......... ";Sample_rate;TAB(58);"Hz /
4560    PRINT TAB(8);"Actual Sample Rate ........... ";Actual_rate;TAB(58);"Hz /
4570    PRINT TAB(8);"Sample period ................ ";Period;TAB(58);"Nanosecon
4580    SELECT Actual_duration
4590    CASE >=1.0
4600      IF Duration>1800 THEN
4610        PRINT TAB(8);"Acquisition Duration ......... ";INT(10*Duration/3600)
4620      ELSE
4630        PRINT TAB(8);"Acquisition Duration ......... ";INT(10*Duration)/10;T
4640      END IF
4650      IF Actual_duration>1800 THEN
4660        PRINT TAB(8);"Actual Test Duration ......... ";INT(10*Actual_duratio
4670      ELSE
4680        PRINT TAB(8);"Actual Test Duration ......... ";INT(10*Actual_duratio
4690      END IF
4700    CASE <1.0
4710      PRINT TAB(8);"Acquisition Duration ......... ";INT(1000*Duration);TAB(
4720      PRINT TAB(8);"Actual Test Duration ......... ";INT(1000*Actual_duratio
4730    END SELECT
4740    PRINT TAB(8);"Acquired Samples ............. ";Samples;TAB(58);"Words /
4750    PRINT TAB(8);"Samples in Test Matrix........ ";Actual_samples;TAB(58);"W
4760    SELECT UPC$(Shape$[1,1])
4770    CASE "C"
4780      PRINT TAB(8);"Sample size(dh) .............. ";Diameter;"x";Height;TAB
4790    CASE "R"
4800      PRINT TAB(8);"Sample size(dwh) ............. ";Depth;"x";Width;"x";Hei
```

```
4810    END SELECT
4820    PRINT TAB(8);"Sample cross-sectional area .. ";Area;TAB(58);"Square mill
4830    PRINT TAB(8);"Test chamber temperature...... ";Temp;TAB(58);"Celcius"
4840    RETURN
4850    !
4860 Name_error:                                        !
4870    DISP " TEST NAME entered incorrectly. Try again."
4880    BEEP
4890    WAIT 1.5
4900    GOTO Name
4910    !
4920 Num_error:                                         !
4930    IF ERRN=33 THEN GOTO Name_error
4940    BEEP
4950    BEEP
4960    DISP "Unexpected error in ""Setup_test"". Process terminated!"
4970    STOP
4980    !
4990 Strain_error:                                      !
5000    DISP " STRAIN RATE entered is out-of-range. Try again."
5010    BEEP
5020    WAIT 2
5030    GOTO Other
5040    !
5050 Move_up:!
5060    PRINT TABXY(Indent,Point);CHR$(128);Set_rate$(Menu_line)
5070    Point=Point-1
5080    IF Point<Min_point THEN
5090      Point=Max_point
5100      Menu_line=Entries+1
5110    END IF
5120    Menu_line=Menu_line-1
5130    PRINT TABXY(Indent,Point);CHR$(129);Set_rate$(Menu_line)
5140    RETURN
5150    !
5160 Move_down:!
5170    PRINT TABXY(Indent,Point);CHR$(128);Set_rate$(Menu_line)
5180    Point=Point+1
5190    IF Point>Max_point THEN
5200      Point=Point-Entries
5210      Menu_line=0
5220    END IF
5230    Menu_line=Menu_line+1
5240    PRINT TABXY(Indent,Point);CHR$(129);Set_rate$(Menu_line)
5250    RETURN
5260    !
5270 Not_used:DISP CHR$(128)
5280    DISP "Undefined key"
5290    BEEP
5300    WAIT 1
5310    DISP
5320    DISP CHR$(129)
5330    RETURN
5340    !
5350 Other:                                             !
5360    Flag=1
5370    CONTROL 1,12;1                                  !Menu off
5380    OUTPUT KBD;Clear_screen$;
5390    PRINT TABXY(10,5);"Enter the Strain Rate in the form:"
5400    PRINT TABXY(10,7);"                         n.nE-m"
```

```
5410      PRINT TABXY(10,9);"where:"
5420      PRINT TABXY(10,10);"   1. ""n.n"" is a number: 1.0 <= range <= 9.9;"
5430      PRINT TABXY(10,11);"   2. ""E"" specifies exponentiation;"
5440      PRINT TABXY(10,12);"   3. ""m"" is a power: 3 <= range <= 8."
5450      PRINT TABXY(10,13);"Exempli gratia: ""3.7E-4""."
5460      !
5470      INPUT " What Strain Rate? ",Strain_rate$
5480      !
5490      Strain_rate$=UPC$(Strain_rate$)               !Check Strain Rate format
5500      IF VAL(Strain_rate$)<1.0E-8 OR Strain_rate>1.0E-2 THEN GOTO Strain_error
5510      !
5520      Duration=.051/VAL(Strain_rate$)
5530      Sample_rate=1/(Duration/No_samples)
5540      PRINT TABXY(1,17);"Strain rate          = ";Strain_rate$;TAB(40);" 1/se
5550      Duration_hr=INT(100*Duration/3600)*.01
5560      PRINT "Test duration         =";Duration;TAB(40);" Seconds";TAB(60);Dura
5570      PRINT "Sample rate / channel =";Sample_rate;TAB(40);" Hz"
5580      !
5590      Ans$="y"
5600      INPUT " Are these ok? (Default is yes) ",Ans$
5610      IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Other
5620      GOTO Other_rate
5630      !
5640 Text:                                               !Text array
5650      Test_text$(1)=Test_name$
5660      Test_text$(2)=Test_type$
5670      Test_text$(3)=Test_time$
5680      Test_text$(4)=Test_date$
5690      Test_text$(5)=Sample$
5700      Test_text$(6)=Strain_rate$
5710      Test_text$(7)=Shape$
5720      RETURN
5730      !
5740 Data:                                               !Parameter array
5750      Test_data(1)=Diameter
5760      Test_data(2)=Height
5770      Test_data(3)=Area
5780      Test_data(4)=Actual_rate
5790      Test_data(5)=Period
5800      Test_data(6)=Duration
5810      Test_data(7)=Actual_duration
5820      Test_data(8)=Samples
5830      Test_data(9)=Actual_samples
5840      Test_data(12)=Width
5850      Test_data(13)=Depth
5860      Test_data(14)=No_channels
5870      Test_data(15)=Max_channels
5880      Test_data(16)=Temp
5890      RETURN
5900   SUBEND
5910   !______________________________________________________________________
5920   !
5930 Build_files:SUB Build_files(Ch_desc$(*),Msus$)
5940   !
5950   !This module checks for sufficient disk space to store the files and
5960   !creates the files if room is available.
5970   !
5980   !Inputs:
5990   !    Ch_data$(*)     = channel data array containing:
6000   !    Test_text$(*)   = setup text array containing:
```

```
6010 !    Msus$           = destination disk
6020 !Outputs:
6030 !    Ch_desc$(*)     = array of active channel file names
6040 !Calls
6050 !    File_error
6060 !=======================================================================
6070   OPTION BASE 1
6080   COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
6090   COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
6100   COM /Ad_setup3/ Min_time,Max_time,Flag
6110   COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
6120   !--------------------------------------------------------------------
6130   ALLOCATE File$[16],Cat_string$(4)[80]
6140   !
6150   DISP " Checking disk space and creating data files..... "
6160   WAIT 2
6170   !
6180   Data_blocks=INT(1+(No_samples*2/256))         !Define file sizes
6190   Size_1=SIZE(Ch_data$,1)*SIZE(Ch_data$,2)*24
6200   Size_2=SIZE(Gains,1)*SIZE(Gains,2)
6210   Size_3=SIZE(Test_text$,1)*30
6220   Size_4=SIZE(Test_data,1)
6230   Header_blocks=INT((Size_1+Size_2+Size_3+Size_4)/256)+1
6240   !
6250   Space=Header_blocks+(Data_blocks*No_channels) !Check disk space
6260   CAT Msus$ TO Cat_string$(*)
6270   Dsk_spc=VAL(Cat_string$(4)[17,23])
6280   PRINT
6290   PRINT "DISK REQUIREMENTS"
6300   PRINT
6310   PRINT TAB(10);"Required disk space...: ";RPT$(" ",10-LEN(VAL$(Space)));S
6320   PRINT TAB(10);"Available disk space..: ";RPT$(" ",10-LEN(VAL$(Dsk_spc)))
6330   IF Space<Dsk_spc THEN
6340     PRINT TAB(10);"Remaining disk space..:";RPT$(" ",10-LEN(VAL$(Dsk_space
6350     WAIT 2
6360   ELSE
6370     DISP " Insufficient disk space remaining. Cannot continue.....!!! "
6380     PAUSE
6390   END IF
6400   !
6410   Flag=0
6420 Build:                                              !
6430   ON ERROR GOTO Error
6440   Ch=Max_channels+1
6450   Ch_desc$(Ch)=Test_text$(1)&"_hdr"
6460   CREATE BDAT Ch_desc$(Ch)&Msus$,Header_blocks
6470   FOR Ch=1 TO Max_channels
6480     IF Ch_data$(Ch,1)<>"#" THEN
6490       Ch_desc$(Ch)=Test_text$(1)&"_ch"&Ch_data$(Ch,1)
6500       CREATE BDAT Ch_desc$(Ch)&Msus$,Data_blocks
6510     END IF
6520   NEXT Ch
6530   OFF ERROR
6540   !
6550   DISP
6560   SUBEXIT
6570   !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
6580 Error:                                              !Check file error
6590   OFF ERROR
6600   File_error(Ch_desc$(Ch),Msus$)
```

```
6610     GOTO Build
6620   SUBEND
6630   !_____________________________________________________________________________
6640   !
6650 File_data:SUB File_data(INTEGER Data(*) BUFFER,Ch_desc$(*),Msus$)
6660   !
6670   !This module downloads the header file and then passes off to
6680   !Demux_data.
6690   !
6700   !Inputs:
6710   !     Data(*)     = multiplexed integer buffer data
6720   !     Ch_desc$(*) = file name array
6730   !     Msus$       = target disk
6740   !Calls:
6750   !     Demux_data
6760   !     File_error
6770   !=============================================================================
6780     OPTION BASE 1
6790     COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
6800     COM /Ad_setup2/ INTEGER Sw_gain(*),Ad_addr(*),Trigger,Max_channels
6810     COM /Ad_setup3/ Min_time,Max_time,Flag
6820     COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
6830     !---------------------------------------------------------------------------
6840     INTEGER I,Columns
6850     !
6860     DISP "Transmitting header and data files."
6870     WAIT 2
6880     !
6890     ASSIGN @File TO Ch_desc$(Max_channels+1)&Msus$
6900     ON ERROR GOTO Error
6910     OUTPUT @File;Ch_data$(*)
6920     OUTPUT @File;Gains(*)
6930     OUTPUT @File;Test_data(*)
6940     OUTPUT @File;Test_text$(*)
6950     OFF ERROR
6960     ASSIGN @File TO *
6970     !
6980     Demux_data(Data(*),Ch_desc$(*),Msus$)          !Demux and transmit data
6990     !
7000     DISP
7010     SUBEXIT
7020     !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
7030 Error:                                             !Check file error
7040     OFF ERROR
7050     File_error(Ch_desc$(Max_channels+1),Msus$)
7060     GOTO Build_files
7070   SUBEND
7080   !_____________________________________________________________________________
7090   !
7100 Demux_data:SUB Demux_data(INTEGER Data(*) BUFFER,Ch_desc$(*),Msus$)
7110   !
7120   !This module takes an array containing multiplexed data and swaps rows
7130   !(data) for columns (channels).  It then transfers each channel to its
7140   !own file by repositioning the "fill pointer" to the end of each channel.
7150   !
7160   !Inputs:
7170   !     Data(*)     = two-dimensional data array to be demultiplexed
7180   !     Ch_desc$(*) = array containing file names in which each channel is to
7190   !                   be stored
7200   !
```

```
7210  !=========================================================================
7220    OPTION BASE 1
7230    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
7240    COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
7250    COM /Ad_setup3/ Min_time,Max_time,Flag
7260    !------------------------------------------------------------------------
7270    INTEGER Ch
7280    REAL Buffsize,Emt,Fill
7290    !
7300    Buffsize=0                                        !Current number of samples
7310    Emt=0                                             !Current fill ptr position
7320    Fill=0
7330    Ch=0
7340    !
7350    DISP "Demultiplexing data."
7360    !
7370    ALLOCATE INTEGER Temp(No_samples,No_channels) !Transpose data array
7380    MAT Temp= TRN(Data)
7390    MAT Data= Temp
7400    DEALLOCATE Temp(*)
7410    !
7420    ASSIGN @Data TO BUFFER Data(*)                   !Demultiplex data
7430    STATUS @Data,2;Buffsize
7440    Flag=0
7450    ON ERROR GOTO Error
7460    FOR Ch=1 TO Max_channels
7470      IF Ch_desc$(Ch)<>"#" THEN
7480        ASSIGN @Outfile TO Ch_desc$(Ch)&Msus$
7490        STATUS @Data,5;Emt
7500        Fill=No_samples*2+Emt
7510        IF Fill>Buffsize THEN Fill=1
7520        CONTROL @Data,3;Fill
7530        TRANSFER @Data TO @Outfile;END
7540      END IF
7550    NEXT Ch
7560    OFF ERROR
7570    ASSIGN @Data TO *
7580    ASSIGN @Outfile TO *
7590    !
7600    DISP
7610    SUBEXIT
7620    !+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
7630 Error:                                              !Check file error
7640    OFF ERROR
7650    DISP "File error in demux...PAUSE!!! Now what???"
7660    PAUSE
7670    File_error(Ch_desc$(Ch),Msus$)
7680  SUBEND
7690  !________________________________________________________________________
7700  !
7710 Summary:SUB Summary(Ch_desc$(*),Msus$)
7720  !
7730  !This module creats a test summary table. It finds the minimum and maximum
7740  !values in a selected channel, determines the indices of these values,
7750  !which it uses to get values from the rest of the data files. Raw and
7760  !transducer engineering values are then produced and displayed for check-
7770  !ing.
7780  !
7790  !Inputs:
7800  !    Ch_desc$(*) = array of active channel file names
```

```
7810 !    Msus$        = source disk
7820 !========================================================================
7830    OPTION BASE 1
7840    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
7850    COM /Ad_setup2/ INTEGER Sw_gain(16),Ad_addr,Trigger,Max_channels
7860    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
7870    !-----------------------------------------------------------------------
7880    ALLOCATE Tx_min(Max_channels),Tx_max(Max_channels)
7890    INTEGER Temp(16000) BUFFER,Ch_min(16),Ch_max(16)
7900    !
7910    DISP "Building summary table."
7920    WAIT 2
7930    !
7940    REDIM Temp(No_samples)                          !Get min, max values
7950    FOR Ch=1 TO Max_channels
7960      IF Ch_desc$(Ch)<>"#" THEN
7970        ASSIGN @Infile TO Ch_desc$(Ch)&Msus$
7980        ENTER @Infile;Temp(*)
7990        ASSIGN @Infile TO *
8000        Ch_min(Ch)=MIN(Temp(*))
8010        Ch_max(Ch)=MAX(Temp(*))
8020      END IF
8030    NEXT Ch
8040    !
8050    FOR Ch=1 TO Max_channels                        !Calculate transducer min,
8060      IF Ch_desc$(Ch)<>"#" THEN                     !max values
8070        Gain=Gains(Ch,1)*(Gains(Ch,2)+Gains(Ch,3))!y = m(x + b)
8080        Tx_min(Ch)=(INT(Ch_min(Ch)*Gain*100))/100
8090        Tx_max(Ch)=(INT(Ch_max(Ch)*Gain*100))/100
8100      END IF
8110    NEXT Ch
8120    !
8130    GOSUB Print_summary                             !Print setup table
8140    !
8150    Ans$="n"
8160    DISP CHR$(129)
8170    INPUT " Print summary? (Default is no) ",Ans$
8180    DISP CHR$(128)
8190    IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Quit
8200    PRINTER IS PRT
8210    GOSUB Print_summary
8220    !
8230 Quit:                                              !
8240    PRINTER IS CRT
8250    SUBEXIT
8260    !+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
8270 Print_summary:                                     !Summary table
8280    PRINT
8290    PRINT TAB(28);"*** SUMMARY DATA ***"
8300    PRINT
8310    PRINT "Ch #";TAB(7);"Channel Description";TAB(30);"Min raw";TAB(40);"Max
8320    PRINT RPT$("-",75)
8330 Format:IMAGE 1X,2A,3X,22A,2X,6D,4X,6D,3X,5D.1D,3X,5D.1D,4X,8A
8340    FOR Ch=1 TO Max_channels
8350      IF Ch_desc$(Ch)<>"#" THEN
8360        PRINT USING Format;Ch_data$(Ch,1),Ch_data$(Ch,3),Ch_min(Ch),Ch_max(C
8370      END IF
8380    NEXT Ch
8390    PRINT
8400    PRINT "
```

```
                Test duration = ";INT(1000*Test_data(10))/1000;" Sec."
8410    PRINT "Number of samples / channel = ";Test_data(11);" words."
8420    IF SYSTEM$("PRINTER IS")="701" THEN PRINT "
```

```
8430    RETURN
8440  SUBEND
8450  !_______________________________________________________________________
8460  !
8470 File_error:SUB File_error(File$,Msus$)
8480  !
8490  !This module either automatically purges a file(s) or checks if it is safe
8500  !to do so. If the error which caused the branch was not a duplicate file
8510  !error, it assumes the error is fatal, prints the error message, and
8520  !stops.
8530  !The ON ERROR which calls this module cannot do so directly; it must pass
8540  !contol to a label which then calls it.  The line following the call
8550  !statement must then branch back to the statement that caused the error.
8560  !
8570  !Inputs:
8580  !     Msus$ = target disk
8590  !     File$ = file to purge
8600  !     Flag  = "0" for conditional purge, "1" for auto purge
8610  !=======================================================================
8620    OPTION BASE 1
8630    COM /Ad_setup3/ Min_time,Max_time,Flag
8640    !---------------------------------------------------------------------
8650    DISP CHR$(129)
8660    !
8670    SELECT ERRN
8680    CASE =54                                        !Duplicate file name
8690      IF Flag=1 THEN
8700        IF File$[5,7]="_ch" THEN GOTO Delete
8710        PURGE File$&Msus$
8720      ELSE
8730        BEEP
8740        INPUT " Duplicate file! Okay to erase it? (Y/N) ",Ans$
8750        IF UPC$(Ans$[1,1])="Y" THEN
8760          Flag=1
8770          IF File$[5,7]="_ch" THEN GOTO Delete
8780          PURGE File$&Msus$
8790        ELSE
8800          DISP " Duplicate file! Unable to continue.....!!! "
8810          BEEP
8820          BEEP
8830          PAUSE
8840        END IF
8850      END IF
8860    CASE ELSE
8870 Oops:PRINT "Unexpected error in File_error.  Process terminated."
8880      PRINT ERRM$
8890      BEEP
8900      STOP
8910    END SELECT
8920    !
8930 End:DISP CHR$(128)
8940    SUBEXIT
8950    !---------------------------------------------------------------------
8960 Delete:!
8970    ON ERROR GOTO Ouch
8980    FOR Ch=1 TO 16
8990      File_name$=File$[1,7]&VAL$(Ch)
9000      PURGE File_name$&Msus$
9010      IF File_name$[8,9]=VAL$(16) THEN Quit
```

```
9020 Next:NEXT Ch
9030 Ouch:IF ERRN=56 THEN
9040        IF File_name$[8,9]=VAL$(16) THEN Quit
9050        GOTO Next
9060     ELSE
9070        GOTO Oops
9080     END IF
9090 Quit:OFF ERROR
9100     GOTO End
9110  SUBEND
9120  !__________________________________________________________________________
9130  !
9140  SUB Rd_buffptr(@Membuff,Fill_ptr,No_bytes,Emty_ptr)
9150  !
9160  !This module determines the position of the read/write pointers and the
9170  !number of bytes of data in a buffer.
9180  !
9190  !Inputs:
9200  !     @Membuff = I/O path to target buffer
9210  !Outputs:
9220  !     Fill_ptr = position of write pointer
9230  !     Emty_ptr = position of read pointer
9240  !     No_bytes = number of bytes of data in the buffer
9250  !--------------------------------------------------------------------------
9260    OPTION BASE 1
9270    STATUS @Membuff,3;Fill_ptr
9280    STATUS @Membuff,4;No_bytes
9290    STATUS @Membuff,5;Emty_ptr
9300  SUBEND
9310  !__________________________________________________________________________
9320  !
9330 Exit:SUB Exit
9340  !
9350  !Exit module.
9360  !--------------------------------------------------------------------------
9370    OPTION BASE 1
9380    OUTPUT KBD;"K";
9390    CONTROL 2,2;0
9400    CONTROL 1,12;2
9410    LOAD "AUTOST:,700"
9420  SUBEND
9430  !__________________________________________________________________________
9440  !
9450 Das_ad200:SUB Das_ad200(INTEGER Buff(*) BUFFER)
9460  !
9470  !This module is the single-card Infotek Systems AD-200 Data Aquisition
9480  !System. It generates the card command string, sets up the card, checks
9490  !for setup errors, and logs the data.
9500  !
9510  !Inputs:
9520  !     Ad_addr     = system address of Infotek AD_200 ADC card
9530  !     Duration    = logging period in seconds
9540  !     No_channels = number of active data channels
9550  !     No_samples  = total number of samples
9560  !     Period      = period between samples in nanoseconds
9570  !     Sw_gain(*)  = array of channel total gains
9580  !     Trigger     = determines Ad-200 start mode (INTERNAL/EXTERNAL)
9590  !Outputs:
9600  !     Buff(*)     = data buffer
9610  !Calls
```

```
9620  !    Command_error
9630  !==========================================================================
9640    OPTION BASE 1
9650    COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
9660    COM /Ad_setup2/ INTEGER Sw_gain(*),Ad_addr,Trigger,Max_channels
9670    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
9680    !-----------------------------------------------------------------------
9690    ALLOCATE Cmg$[200],Trigger$[8],Cmd_txt$(2)[200],Cmd_text$[400]
9700    !
9710    DISP CHR$(129)
9720    DISP " Initializing the Ad-200 card. "
9730    WAIT 1
9740    !
9750    SELECT Trigger                                !Set up AD-200 mode
9760    CASE 0
9770      Trigger$="INTERNAL"
9780    CASE 1
9790      Trigger$="EXTERNAL"
9800    CASE ELSE
9810      PRINT "Eek!  AD-200 mode neither INTERNAL nor EXTERNAL in Das_ad200!"
9820      PAUSE
9830    END SELECT
9840    !
9850    FOR Ch=1 TO Max_channels                       !Build command strings
9860      IF Sw_gain(Ch)<>0 THEN
9870        Cmg$=Cmg$&Ch_data$(Ch,1)&"S"&VAL$(Sw_gain(Ch))&","
9880      END IF
9890    NEXT Ch
9900    Cmd_txt$(1)="RESET,"&Trigger$&",SELECT,"&Cmg$&"END,DELAYON,HOLDOFF"
9910    !
9920    Count=No_samples*No_channels
9930    Time=Period
9940    OUTPUT Cmd_txt$(2) USING "#,K,8D,K,9D,K";",COUNT,";Count;",TIME,";Time
9950    !
9960    Cmd_text$=Cmd_txt$(1)&Cmd_txt$(2)
9970    !
9980    Dummy=READIO(Ad_addr,5)                       !Fix for power-up hang
9990    WRITEIO Ad_addr,0;0                           !problem
10000   RESET Ad_addr
10010   !
10020   ASSIGN @Adc TO Ad_addr                        !Init card and check it
10030   OUTPUT @Adc;Cmd_text$
10040!  PRINT RPT$("_",60)                            ! *Debugging aid - display
10050!  PRINT "Command text Das_ad200: ";Cmd_text$    ! *command sent
10060   Command_check(@Adc,"(during setup)")
10070   !
10080   ASSIGN @Buff TO BUFFER Buff(*)                !Get set
10090   ASSIGN @Adc TO Ad_addr;WORD
10100   GOSUB Start                                   !Start logging
10110   DISP " LOGGING DATA.............. "
10120   Start=TIMEDATE
10130   TRANSFER @Adc TO @Buff;WAIT
10140   Stop=TIMEDATE
10150   Rd_buffptr(@Buff,Fill_ptr,No_bytes,Emty_ptr)
10160   ASSIGN @Buff TO *
10170   !
10180   ASSIGN @Adc TO Ad_addr                        !Check for logging errors
10190   Command_check(@Adc,"(post logging)")
10200   OUTPUT @Adc;"RESET"
10210   ASSIGN @Adc TO *
```

```
10220   !
10230   Logging_time=Stop-Start                       !Get logging time/samples
10240   Samples_logged=No_bytes DIV (2*No_channels)
10250   Test_data(10)=Logging_time
10260   Test_data(11)=Samples_logged
10270   !
10280   DISP CHR$(128);" "
10290   SUBEXIT
10300   !+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
10310 Start:                                          !Pre-logging checks
10320   Ans$="n"
10330   INPUT " RAMP GENERATOR ready? (default is no) ",Ans$
10340   IF UPC$(Ans$[1,1])<>"Y" THEN Start
10350   Ans$="n"
10360   INPUT " SERVO SYSTEM ready? (default is no) ",Ans$
10370   IF UPC$(Ans$[1,1])<>"Y" THEN Start
10380   Ans$="n"
10390   INPUT " START LOGGING DATA?????? (default is no) ",Ans$
10400   IF UPC$(Ans$[1,1])<>"Y" THEN Start
10410   RETURN
10420 SUBEND
10430 !______________________________________________________________________
10440 !
10450 Setup_table:SUB Setup_table
10460 !
10470 !This module contains information, entered by the operator,  which is used
10480 !to setup the current test.  It is divided into four major blocks; the
10490 !first two are for data entry, and the last two do the actual setup and
10500 !checks.  The blocks are:
10510 !     1. basic test information;
10520 !     2. transducer data;
10530 !     3. operational checks and setup;
10540 !     4. AD-200 calculations.
10550 !If an error is detected during the setup operation, the error is posted
10560 !and the process terminated.
10570 !
10580 !Outputs:
10590 !     Ch_data$(*)    = channel data array containing:
10600 !             (Ch,1)   = channel number
10610 !             (Ch,2)   = transducer engineering units
10620 !             (Ch,3)   = channel description
10630 !     Gains(*)       = channel gain array containing:
10640 !          (Ch,1)      = channel gain
10650 !          (Ch,2)      = transducer gain
10660 !          (Ch,3)      = transducer offset
10670 !=====================================================================
10680   OPTION BASE 1
10690   COM /Ad_setup1/ Sample_rate,Duration,Period,No_samples,No_channels
10700   COM /Ad_setup2/ INTEGER Sw_gain(*),Ad_addr(*),Trigger,Max_channels
10710   COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
10720   !--------------------------------------------------------------------
10730   DIM Channel_no(16),Ad_gain(16),Tx_gain(16),Tx_offset(16)
10740   DIM Tx_units$(16)[8],Ch_desc$(16)[28]
10750   !
10760   DISP "Reading Transducer and A/D setup data."
10770   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
10780 Transducers:!This table contains setup information for the AD-200 ADC     !
10790   !card, tranducer data and channel information. The number of channels  !
10800   !must equal the number of data statements. Inactive channels must be   !
10810   !commented out.                                                        !
```

```
10820   ! S/W gain  1 = 5.0V FS
10830   !           2 = 2.5V FS
10840   !           5 = 1.0V FS
10850   !          10 = 0.5V FS
10860   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~|
10870   !***|Ad200|           Transducer           |          Channel            |
10880   !***|-----|--------------------------------|-----------------------------|
10890   !***|Ch|SW|  Gain   |  Offset |   Gain     |         Descriptor          |
10900   !***|no|gn|         |         |   Units    |                             |
10910   !***|--|--|---------|---------|------------|-----------------------------|
10920 Card1:!
10930   DATA  1, 1, 107.2635,        0,       "mm",          "Displacement 1"
10940   DATA  2, 1, 107.2635,        0,       "mm",          "Displacement 2"
10950   DATA  3, 1, 107.2635,        0,       "mm",       "Mean Displacement"
10960   DATA  4, 1,    .9265,        0,       "MN",            "Extend Load"
10970   DATA  5, 1,    .5217,        0,       "MN",           "Retract Load"
10980   DATA  6, 1,     1.00,        0,       "MN",                   "Load"
10990   DATA  7, 1,   2.0000,        0,        "V",                "Command"
11000   DATA  8, 1,     8.99,        0,      "MPa",      "Local Pressure #8"
11010   DATA  9, 1,     8.99,        0,      "MPa",      "Local Pressure #9"
11020   DATA 10, 1,    2.248,        0,      "MPa",     "Local Pressure #10"
11030   DATA 11, 1,   0.5735,        0,      "MPa",     "Local Pressure #11"
11040   DATA 12, 1,   0.5735,        0,      "MPa",     "Local Pressure #12"
11050   DATA 13, 1,     8.99,        0,      "MPa",     "Local Pressure #13"
11060   DATA 14, 1,    2.248,        0,      "MPa",     "Local Pressure #14"
11070   DATA 15, 1,     8.99,        0,      "MPa",     "Local Pressure #15"
11080   DATA 16, 1,     8.99,        0,      "MPa",     "Local Pressure #16"
11090   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~|
11100 Checks:                                          !Operational checks and
11110                                                  !setup
11120   RESTORE Transducers                            !Read transducer table and
11130   ON ERROR GOTO Err_no_data                      !check for errors
11140   FOR Ch=1 TO No_channels
11150     READ Channel_no(Ch),Ad_gain(Ch),Tx_gain(Ch),Tx_offset(Ch)
11160     READ Tx_units$(Ch),Ch_desc$(Ch)
11170   NEXT Ch
11180   ON ERROR GOTO Okay
11190   READ Channel_no(No_channels+1)
11200   GOTO Err_more_data
11210 Okay:                                            !
11220   IF ERRN<>36 AND ERRN<>17 THEN
11230     PRINT "Unexpected error while reading Transducer setup table."
11240     PRINT ERRM$
11250     BEEP
11260     STOP
11270   END IF
11280   OFF ERROR
11290   !
11300   PRINT "ACTIVE CHANNEL LIST"                    !Print channel check list
11310   PRINT
11320   PRINT "Ch";TAB(7);"Channel Description";TAB(41);"Tx Gain";TAB(52);"Tx Of
11330   PRINT RPT$("-",68)
11340 Format:IMAGE 2D,4X,28A,3X,4D.5D,3X,4D.5D,4X,8A
11350   FOR Ch=1 TO No_channels
11360     PRINT USING Format;Channel_no(Ch),Ch_desc$(Ch),Tx_gain(Ch),Tx_offset(C
11370   NEXT Ch
11380   PRINT
11390   !
11400   Data_words=No_samples*No_channels+3.E+4        !Check memory availability
11410   Mem_words=VAL(SYSTEM$("AVAILABLE MEMORY")) DIV 2
```

```
11420   PRINT "MEMORY REQUIREMENTS"
11430   PRINT
11440   PRINT TAB(10);"Require......:";RPT$(" ",10-LEN(VAL$(Data_words)));Data_w
11450   PRINT TAB(10);"Have.........:";RPT$(" ",10-LEN(VAL$(Mem_words)));Mem_wor
11460   IF Data_words>Mem_words THEN
11470     DISP CHR$(129);" Insufficient memory.  Cannot continue........!!! "
11480     BEEP
11490     BEEP
11500     PAUSE
11510   ELSE
11520     PRINT TAB(10);"Remaining....:";RPT$(" ",10-LEN(VAL$(Mem_words-Data_wor
11530     PRINT
11540   END IF
11550   PRINT
11560   !
11570   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
11580   ! Gain equation:                                                        !
11590   ! y = mx, where y   = channel gain          (eng units / bit)           !
11600   !               m   = transducer gain       (eng units / volt)          !
11610   !               x   = AD-200 gain           (volts / bit)               !
11620   ! Note: Ex_gain = MONITOR PANEL voltage divider correction              !
11630   !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~!
11640   Hw_gain=1                                  !Build data arrays from
11650   Ex_gain=1                                  !transducer table
11660   FOR I=1 TO No_channels
11670     Ch=Channel_no(I)
11680     Sw_gain(Ch)=Ad_gain(I)
11690     Gains(Ch,1)=Ex_gain*Tx_gain(I)*(5/(2048*Ad_gain(I)*Hw_gain))
11700     Gains(Ch,2)=Tx_gain(I)
11710     Gains(Ch,3)=Tx_offset(I)
11720     Ch_data$(Ch,1)=VAL$(Channel_no(I))
11730     Ch_data$(Ch,2)=Tx_units$(I)
11740     Ch_data$(Ch,3)=Ch_desc$(I)
11750   NEXT I
11760   !
11770   Ch_count=0                                 !Check if software gain
11780   FOR Ch=1 TO Max_channels                   !and number of channels is
11790     SELECT Sw_gain(Ch)                       !valid
11800     CASE 1,2,5,10
11810       Ch_count=Ch_count+1
11820     CASE 0
11830       !(channel not implimented)
11840     CASE ELSE
11850       GOTO Err_invld_gain
11860     END SELECT
11870   NEXT Ch
11880   IF Ch_count<>No_channels THEN GOTO Err_no_channels
11890   SUBEXIT
11900   !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
11910 Err_invld_gain:BEEP
11920   PRINT "Invalid gain: Channel ";Ch_data$(Ch,1);" gain =";Sw_gain(Ch);"!!"
11930   PAUSE
11940   !
11950 Err_no_channels:BEEP
11960   PRINT "Sw_gain array does not add up to No_channels!"
11970   PAUSE
11980   !
11990 Err_no_data:BEEP
12000   IF ERRN=36 THEN
12010     PRINT "More channels than DATA statements in Transducer setup table!"
```

```
12020   ELSE
12030     PRINT ERRM$
12040   END IF
12050   PAUSE
12060   !
12070 Err_more_data:BEEP
12080   PRINT "More DATA statements than channels in Transducer setup table!"
12090   PAUSE
12100 SUBEND
12110 !____________________________________________________________________________
12120 !
12130 Command_check:SUB Command_check(@Path,Subname$)
12140 !
12150 !This module reads the status register in the AD-200 card, and, if it
12160 !contains errors, prints an error list and stops the programme.
12170 !----------------------------------------------------------------------------
12180   OPTION BASE 1
12190   DIM Status$[10]
12200   !
12210   OUTPUT @Path;"STATUS"
12220   ENTER @Path;Status$
12230   !
12240   IF Status$<>"--------" THEN
12250     DISP CHR$(129);"Status error in AD200 ";Subname$;" = """;Status$;"""."
12260     BEEP
12270     PRINT RPT$("_",28);" Command Error List ";RPT$("_",28)
12280     IF Status$[1,1]<>"-" AND Status$[4,4]<>"-" THEN
12290       PRINT "Unused status point error...???"
12300     END IF
12310     IF Status$[2,2]="p" THEN
12320       PRINT "Illegal PERIOD ... "
12330     END IF
12340     IF Status$[3,3]="u" THEN
12350       PRINT "Unrecognized command ..."
12360     END IF
12370     IF Status$[5,5]="s" THEN
12380       PRINT "SELECT error ... "
12390     END IF
12400     IF Status$[6,6]="c" THEN
12410       PRINT "COUNT error ... "
12420     END IF
12430     IF Status$[7,7]="t" THEN
12440       PRINT "TIME error ... "
12450     END IF
12460     IF Status$[8,8]="o" THEN
12470       PRINT "Buffer over-run ... "
12480     END IF
12490     PRINT RPT$("_",76)
12500     PAUSE
12510   END IF
12520 SUBEND
12530 !***************************************************************************
12540 !***************************************************************************
```

```
5130 10 !RE-STORE "MTA_A_32:,700,0"
12 !   *********************************************************************
14 !   |                  ---MATERIALS TEST ANALYSIS PROGRAM---                |
16 !   |                                                                       |
18 !   |Calling name: MTA_A_32              Revision: 3.2                      |
20 !   |Progammer   : P Spencer             Date     :  03 Jan 1989            |
22 !   |-----------------------------------------------------------------------|
24 !   |This programme is the AD-200 Materials Test Facility analytical        |
26 !   |software.                                                              |
28 !   |****************CUSTOM VERSION FOR MEGA-NEWT PROJECT 9538**************|
30 !   | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |
32 !   |Name composition:                                                      |
34 !   |   a. programme type   :  xxx  (e.g.  MTA = Materials Test - Analysis) |
36 !   |   b. acquisition type:  yy   (e.g.  A = AD200, M = Multiprogrammer, & |
38 !   |                                     AM = AD200 & Multiprogrammer)     |
40 !   |   c. revision level   :  nnn  (e.g.  211 = Rev. 2.11)                 |
42 !   | - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - |
44 !   |Parent programme: MTA_A_31                                             |
46 !   |_______________________________________________________________________|
48 !   |Modification history                               |Date       |By     |
50 !   |---------------------------------------------------|-----------|-------|
52 !   | 1. LINE 3236 AVERAGE ON REAL RATHER THAN INTEGER  |29 NOV     |PAS    |
54 !   | 2. VERSION 3 MAJOR MODS                           |30 NOV 88  |PAS    |
56 !   | 3. VERSION 3.1                                    |09 DEC 88  |PAS    |
58 !   | 4. VERSION 3.2 INCORPORATE "TURD_MAKER" ROUTINES  |03 JAN 89  |PAS    |
60 !   | 5. VERSION 3.2 INCORPORATE DENSITY  CALC          |13 JAN 89  |PAS    |
62 !   *********************************************************************
64     OPTION BASE 1
66     COM /Index_string/ Buff_id$(16,2)[10],Buff_title$(16,2)[30],Buff_units$(16
68     COM /Index_real/ Buff_freq(16,2),Gain(16,2),Offset(16,2)
70     COM /Index_integer/ INTEGER No_buffers(2),INTEGER Buff_points(16,2)
72     COM /Accumulators/ Acc1(16000),Acc2(16000),Acc3(16000),Acc4(16000),Acc_siz
74     COM /Buffers/ INTEGER Inbuff(32000) BUFFER
76     COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
78     COM /Sample/ Diameter,Height,Area,Width,Depth
80     COM /Msus/ Msus_raw$[15],File_name1$[4]
82     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(13)[40],Auto
84     COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
86     COM /Files/ Ch_data$(16,3)[28],Gains(16,3),Test_text$(15)[30],Test_data(30
88     COM /Menu_1/ Menu_1$(15)[75],Menu_2$(16)[40],Menu_3$(16)[40],Menu_4$(16)[4
90     COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
92     COM /Filter/ Amp_elast,Tau(10),Amp(10),No_steps,Last_average
94     COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
96     !=====================================================================
98     !
100    OUTPUT KBD;"K";
102    PRINT CHR$(129)
104    PRINT TABXY(14,10);" MATERIALS TEST ANALYSIS PROGRAMME -- AD-200 VERSION "
106    PRINT TABXY(26,11);" GEOTECHnical resources ltd. "
108    INPUT " Press ENTER to continue. ",Ans$
110    PRINT CHR$(128)
112    !~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
114 Housekeeping:!
116   CONTROL 1,12;1                                    !Menu off
118   CONTROL 1,21;0                                    !Non-compatibility mode
120   CONTROL 2,2;1                                     !User menu = 1
122  !OUTPUT KBD;"SCRATCH KEY";CHR$(255)&CHR$(88);      !Scratch user softkeys
124   CONTROL 1,4;0                                     !Display functions off
126   CONTROL 2,1;0                                     !Printall off
128   OUTPUT KBD;"K";                                   !Clear screen
```

```
130   PRINTER IS CRT
132   !
134 Set_variables:!                                         !Initialize variables
136   Area=0
138   Depth=0
140   Diameter=0
142   Duration=0
144   Height=0
146   Max_channels=0
148   Max_samples=SIZE(Acc1,1)
150   Newtest_flag=0
152   No_channels=0
154   No_samples=0
156   Msus_raw$=":HP9133,700,0"
158   Width=0
160   Average=0
162   Window_flag=0
164   !
166 Set_arrays:                                             !Initialize arrays
168   MAT Buff_id$= ("#")
170   MAT No_buffers= (0)
172   !
174 Constants:!
176   X_gdu=100*MAX(1,RATIO)                                !Graphics hard clip
178   Y_gdu=100*MAX(1,1/RATIO)
180   Viewxmin=.060*X_gdu
182   Viewxmax=.750*X_gdu
184   Viewymax=.050*Y_gdu
186   Viewymax=.900*Y_gdu
188   Acc_size=FNSize_acc
190   !=========================================================================
192 Top:                                                    !Main programme
194   Test_data
196   Calc_variables
198   Select_plot(Test_duration,Samples,Newtest_flag)
200   IF Newtest_flag=1 THEN GOTO Housekeeping
202   END
204   !
206   !*************************************************************************
208   !*************************************************************************
210   !
212 Test_data:SUB Test_data
214   !
216   !This module recovers the test parameters and related information from the
218   !specified test header; after the data has been displayed, it asks the
220   !user if the data is to be output to the printer.  It also generates part
222   !of the plotter message, which is incorporated into the graph header.
224   !
226   !=========================================================================
228     OPTION BASE 1
230     COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
232     COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
234     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
236     COM /Index_integer/ INTEGER No_buffers(*),INTEGER Buff_points(*)
238     COM /Sample/ Diameter,Height,Area,Width,Depth
240     COM /Msus/ Msus_raw$,File_name1$
242     COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
244     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
246     !-----------------------------------------------------------------------
248     DIM Name$[10],Type$[20],Test_time$[10],Date$[15]
```

```
250     ALLOCATE File$[25]
252     !
254     OUTPUT KBD;"K";
256     DISP CHR$(129)
258     !
260 Init_printer:                                        !Set printer form feed
262     ON TIMEOUT 7,1 RECOVER No_printer
264     OUTPUT PRT;"";
266     OFF TIMEOUT
268     !
270 Set_paper:                                           !
272     PRINT TABXY(1,40);" Check printer PAPER is at TOP-OF-FORM. "
274     Ans$="y"
276     INPUT " PRINTER setup ok? (default is yes) ",Ans$
278     IF UPC$(Ans$[1,1])<>"Y" THEN GOTO Set_paper
280     OUTPUT KBD;"K";
282     !
284 Name:                                                !Enter source file name
286   ! Test_name$="T123"                                !{{{
288     INPUT " Enter TEST NAME. ",Test_name$
290     Ans$="n"
292     Test_name$=UPC$(Test_name$)
294     PRINT TABXY(1,40);" TEST NAME entered is ";Test_name$
296     INPUT " Change TEST NAME? (default is no) ",Ans$
298     IF UPC$(Ans$[1,1])<>"N" THEN Name
300     OUTPUT KBD;"K";
302     !
304     File_name1$=Test_name$
306     Chg_disk(Msus_raw$)
308     !
310     File$=Test_name$&"_hdr"&Msus_raw$                !Get file header data
312     ON ERROR GOTO File_error
314     ASSIGN @File TO File$
316     ENTER @File;Ch_data$(*)
318     ENTER @File;Gains(*)
320     ENTER @File;Test_data(*)
322     ENTER @File;Test_text$(*)
324     ASSIGN @File TO *
326     OFF ERROR
328     !
330     GOTO Decompose                                   !Use to modify header!!!
332     ON ERROR GOTO File_error
334     ASSIGN @File TO File$
336     OUTPUT @File;Ch_data$(*)
338     OUTPUT @File;Gains(*)
340     OUTPUT @File;Test_data(*)
342     OUTPUT @File;Test_text$(*)
344     ASSIGN @File TO *
346     OFF ERROR
348     !
350 Decompose:                                           !Set test variables
352     Diameter=Test_data(1)
354     Height=Test_data(2)
356     Area=Test_data(3)
358     Duration=Test_data(10)                           ! \Logging data
360     No_samples=Test_data(11)                         ! /
362     Width=Test_data(12)
364     Depth=Test_data(13)
366     No_channels=Test_data(14)
368     Max_channels=Test_data(15)
```

```
370     Shape$=Test_text$(7)
372     !
374 Eng_data:                                              !
376     Ch=Max_channels
378     ALLOCATE Eng_data(Ch),Eng_titles$(Ch)[20],Eng_units$(Ch)[10]
380     Eng_data(1)=10^3/Area                              !Define eng'g conversions
382     Eng_data(2)=1
384     Eng_data(3)=100/Height
386     IF Diameter>0 THEN
388       Eng_data(4)=100/Diameter
390       Eng_data(5)=100/Diameter
392     END IF
394     Eng_data(6)=1
396     Eng_data(7)=0
398     Eng_data(8)=100/Height
400     Eng_data(9)=0
402     Eng_data(10)=0
404     Eng_data(11)=0
406     Eng_data(12)=0
408     Eng_data(13)=0
410     Eng_data(14)=0
412     Eng_data(15)=0
414     Eng_data(16)=0
416     !
418     Eng_titles$(1)="AXIAL STRESS"                      !Define eng'g titles
420     Eng_titles$(2)="CONFINING STRESS"
422     Eng_titles$(3)="AXIAL STRAIN"
424     Eng_titles$(4)="DIAMETRAL 1 STRAIN"
426     Eng_titles$(5)="DIAMETRAL 2 STRAIN"
428     Eng_titles$(6)="COMMAND"
430     Eng_titles$(7)="INTENSIFIER STRAIN"
432     Eng_titles$(8)="AXIAL STRAIN"
434     Eng_titles$(9)="#"
436     Eng_titles$(10)="#"
438     Eng_titles$(11)="#"
440     Eng_titles$(12)="#"
442     Eng_titles$(13)="#"
444     Eng_titles$(14)="#"
446     Eng_titles$(15)="#"
448     Eng_titles$(16)="#"
450     !
452     Eng_units$(1)="MPa"                                !Define eng'g units
454     Eng_units$(2)="MPa"
456     Eng_units$(3)="%"
458     Eng_units$(4)="%"
460     Eng_units$(5)="%"
462     Eng_units$(6)="V"
464     Eng_units$(7)="%"
466     Eng_units$(8)="%"
468     Eng_units$(9)="#"
470     Eng_units$(10)="#"
472     Eng_units$(11)="#"
474     Eng_units$(12)="#"
476     Eng_units$(13)="#"
478     Eng_units$(14)="#"
480     Eng_units$(15)="#"
482     Eng_units$(16)="#"
484     !
486     Create_index(Eng_data(*),Eng_titles$(*),Eng_units$(*))
488     DEALLOCATE Eng_data(*),Eng_titles$(*),Eng_units$(*)
```

```
490      !
492      Plot_msg$(1)="Test: "&Test_text$(1)              !Build plot messages
494      Plot_msg$(2)="Type: "&Test_text$(2)
496      Plot_msg$(3)="Sample: "&Test_text$(5)
498      Plot_msg$(4)="Date: "&Test_text$(4)
500      Plot_msg$(5)="Time: "&Test_text$(3)
502      Plot_msg$(7)="Temperature: "&VAL$(Test_data(16))
504      !
506      GOSUB Print
508      !
510      Ans$="n"
512      INPUT " Print TEST DATA? (default is no) ",Ans$
514      IF UPC$(Ans$[1,1])<>"Y" THEN Quit
516      PRINTER IS PRT
518      GOSUB Print
520      PRINTER IS CRT
522      !
524 Quit:                                                 !
526      OUTPUT KBD;"K";
528      DISP CHR$(128)
530      SUBEXIT
532      !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
534 File_error:                                           !
536      PRINT TABXY(1,19);CHR$(129);
538      SELECT ERRN
540      CASE 56
542        BEEP
544        PRINT " File """;File$;""" not found!!! "
546      CASE 59
548        BEEP
550        PRINT " File """;File$;""" incompatable!!! "
552        PRINT " ";ERRM$;" "
554      CASE 80
556        BEEP
558        PRINT " No floppy in drive!!! "
560      CASE ELSE
562        BEEP
564        PRINT " Unexpected file error in """;File$;"!!! "
566        PRINT " ";ERRM$;" "
568        PAUSE
570      END SELECT
572      PRINT CHR$(128)
574      GOTO Name
576      !
578 Print:                                       !Print test data
580      PRINT TABXY(24,1);"MATERIALS TEST ANALYSIS PROGRAM"
582      PRINT TAB(22);"--TEST PARAMETERS AND INFORMATION--"
584      PRINT
586      PRINT "Test name ..... ";Test_text$(1);
588      SELECT Test_data(6)
590      CASE >=1
592        PRINT TAB(35);"Test duration ....";Test_data(6);TAB(74);"Sec."
594      CASE <1
596        PRINT TAB(35);"Test duration ....";INT(1000*Test_data(6));TAB(74);"mse
598      END SELECT
600      PRINT "Test date ..... ";Test_text$(4);
602      PRINT TAB(35);"Strain rate ...... ";Test_text$(6);TAB(74);"1/Sec"
604      PRINT "Test time ..... ";Test_text$(3);
606      PRINT TAB(35);"Sample rate ......";Test_data(4);TAB(74);"Hz"
608      PRINT "Test type ..... ";Test_text$(2);
```

```
610      SELECT UPC$(Shape$[1,1])
612      CASE ="C"
614        PRINT TAB(35);"Sample size (dh)..";Test_data(1);"x";Test_data(2);TAB(7
616      CASE ="R"
618        PRINT TAB(35);"Sample size (wdh).";Width;"x";Depth;"x";Height;TAB(74);
620      END SELECT
622      PRINT "Sample name ... ";Test_text$(5);
624      PRINT TAB(35);"Temperature ......";Test_data(16);TAB(74);"C."
626      PRINT "Sample shape .. ";Shape$
628      PRINT
630      PRINT
632      PRINT TAB(3);"FILE";TAB(15);"DESCRIPTION";TAB(45);"TX GAIN";TAB(58);"TX
634      PRINT
636      FOR Ch=1 TO Max_channels                          !Print header data
638        IF Ch_data$(Ch,1)<>"#" THEN
640          PRINT TAB(3);Buff_id$(Ch,1);TAB(15);Buff_title$(Ch,1);TAB(45);Gains(
642        END IF
644      NEXT Ch
646      RETURN
648      !
650 No_printer:                                          !Printer error
652      PRINT TABXY(1,40);" Check printer turned on, etc. "
654      Ans$="y"
656      INPUT " Printer fault corrected? (default is yes) ",Ans$
658      IF UPC$(Ans$[1,1])<>"Y" THEN
660        DISP "Printer error in Test_data.  Process stopped."
662        STOP
664      ELSE
666        OUTPUT KBD;"K";
668      END IF
670      GOTO Init_printer
672    SUBEND
674    !_____________________________________________________________________________
676    !
678 Calc_variables:SUB Calc_variables
680    !
682    !=============================================================================
684      OPTION BASE 1
686      COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
688      COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
690      COM /Msus/ Msus_raw$,File_name1$
692      COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
694      COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
696      COM /Sum_range/ REAL Min_ch(1),Max_ch(1)
698      COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
700      !---------------------------------------------------------------------------
702      ALLOCATE Values(16,5)
704      !
706      OUTPUT KBD;"K";                                  !Clear screen
708      !
710      Set_time
712      !
714      Ans$="n"
716      DISP CHR$(129)
718      INPUT " Calculate special variables? (e.g. Poisson's Ratio, etc.) (Defau
720      DISP CHR$(128)
722      IF UPC$(Ans$[1,1])="N" THEN Quit
724      !
726      DISP "Calculating variables..."
728      !
```

```
730     MAT Accl= Accl-(Accl(1))                              !Find pointers
732     Ref_max=-3000
734     FOR Sample=1 TO Max_samples
736       IF Accl(Sample)>Ref_max THEN
738         Ref_max=Accl(Sample)
740         Ptr_max=Sample
742       END IF
744     NEXT Sample
746     Ref_min=3000
748     FOR Sample=1 TO Max_samples
750       IF Accl(Sample)<Ref_min THEN
752         Ref_min=Accl(Sample)
754         Ptr_min=Sample
756       END IF
758     NEXT Sample
760     Ptr_35=INT(.35*(Ptr_max-Ptr_min))
762     Ptr_50=INT(.50*(Ptr_max-Ptr_min))
764     Ptr_65=INT(.65*(Ptr_max-Ptr_min))
766     !
768     Acc_no=1
770     FOR Ch=1 TO Max_channels                               !Get indexed values
772       IF Buff_id$(Ch,1)<>"#" THEN
774         Raw_to_acc(Buff_id$(Ch,1),Acc_no)
776         Values(Ch,1)=Accl(Ptr_min)*Gains(Ch,1)*Gains(Ch,2)
778         Values(Ch,2)=Accl(Ptr_35)*Gains(Ch,1)*Gains(Ch,2)
780         Values(Ch,3)=Accl(Ptr_50)*Gains(Ch,1)*Gains(Ch,2)
782         Values(Ch,4)=Accl(Ptr_65)*Gains(Ch,1)*Gains(Ch,2)
784         Values(Ch,5)=Accl(Ptr_max)*Gains(Ch,1)*Gains(Ch,2)
786       END IF
788     NEXT Ch
790     !
792     SELECT Test_text$(1)[1,1]                              !Calculate variables
794     CASE "B"
796       IF Buff_id$(2,1)=" " THEN Missing_file
798       IF Buff_id$(3,1)=" " THEN Missing_file
800       IF Buff_id$(4,1)=" " THEN Missing_file
802       IF Buff_id$(5,1)=" " THEN Missing_file
804       Bulk_comp=(Values(2,5)/(ABS(Values(3,5))+ABS(Values(4,5))+ABS(Values(5
806       PRINT "Bulk compressibility = ";Bulk_comp
808       Plot_msg$(10)="BULK COMPRESSIBILITY: "&VAL$(INT(Bulk_comp+.5))&" MPa"
810     CASE "T","U"
812       IF Buff_id$(1,1)=" " THEN Missing_file
814       IF Buff_id$(3,1)=" " THEN Missing_file
816       IF Buff_id$(4,1)=" " THEN Missing_file
818       IF Buff_id$(5,1)=" " THEN Missing_file
820       Tangent_modulus=((Values(1,4)-Values(1,2))/(Values(3,4)-Values(3,2)))*
822       Secant_modulus=(Values(1,3)/Values(3,3))*100
824       IF Values(4,3)<>0 AND Values(5,3)<>0 THEN
826         Poissons_ratio=((Values(4,3)-Values(5,3))/2)/Values(3,3)
828       ELSE
830         IF Values(4,3)=0 THEN Poissons_ratio=Values(5,3)/Values(3,3)
832         IF Values(5,3)=0 THEN Poissons_ratio=Values(4,3)/Values(3,3)
834       END IF
836       PRINT "Tangent mod = ";Tangent_modulus
838       PRINT "Secant mod = ";Secant_modulus
840       PRINT "Poisson's ratio = ";Poissons_ratio
842       Plot_msg$(7)="CONFINING PRESSURE: "&VAL$(Values(1,5))&" MPa"
844       Plot_msg$(9)="PEAK STRESS:        "&VAL$(Values(1,5))&" MPa"
846       Plot_msg$(10)="TANGENT MODULUS:    "&VAL$(INT(Tangent_modulus+.5))&" M
848       Plot_msg$(11)="POISSON'S RATIO:    "&VAL$(INT(Poissons_ratio+.5))&" MP
```

```
850     CASE ELSE
852       GOTO Quit
854     END SELECT
856     !
858 New_ref:                                        !Select different channel?
860     DISP CHR$(129)
862     Ans$="n"
864     INPUT " Select new index REFERENCE CHANNEL? (Default is no) ",Ans$
866     IF UPC$(Ans$[1,1])="Y" THEN CALL Calc_variables
868     !
870 Quit:                                           !
872     OUTPUT KBD;"K";
874     DISP CHR$(128)
876     DEALLOCATE Values(*)
878     SUBEXIT
880     !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
882 Missing_file:                                   !No data file
884     PRINT TABXY(1,18);"Required data file not present!!!"
886     PRINT TABXY(1,19);"Unable to calculate specified variable(s)....."
888     GOTO New_ref
890   SUBEND
892   !______________________________________________________________________
894   !
896 Select_plot:SUB Select_plot(Duration,Samples,Newtest_flag)
898   !
900   !======================================================================
902     OPTION BASE 1
904     COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
906     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
908     COM /Index_integer/ INTEGER No_buffers(*),Buff_points(*)
910     COM /Msus/ Msus_raw$,File_name1$
912     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
914     COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
916     COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
918     !----------------------------------------------------------------------
920     DIM Plot$(10)[75],Clear_screen$[2]
922     INTEGER Point,Select,Column,Max_position
924     !
926     PRINTER IS CRT
928     GRAPHICS OFF
930     Clear_screen$=CHR$(255)&CHR$(75)
932     !
934 Menu:                                           !
936     Menu_select=1
938     Build_menu(Buff_id$(*),Buff_title$(*))
940     !
942     Menu_select=1
944     Menu_line=5                                 !Menu y-position
946     Indent=10                                   !Menu x-position
948     First_line=Menu_line
950     Print_menu
952     GOSUB Menu_keys
954     !
956     CONTROL 1,12;2                              ! (Menu keys lit)
958     !
960 Spin:                                           !Zzzz...............
962     GOTO Spin
964     !
966     SUBEXIT
968     !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
970 Menu_keys:                                                    !
972     ON KEY 1 LABEL "  MOVE     UP   " CALL Move_up
974     ON KEY 2 LABEL "  MOVE    DOWN  " CALL Move_down
976     ON KEY 3 LABEL "                " GOSUB Not_used
978     ON KEY 4 LABEL "                " GOSUB Not_used
980     ON KEY 5 LABEL " SELECT   PLOT  " GOTO Selector
982     ON KEY 6 LABEL "                " GOSUB Not_used
984     ON KEY 7 LABEL "  NEW     TEST  " GOTO New_test
986     ON KEY 8 LABEL "  EXIT  ANALYSIS" CALL Exit
988     RETURN
990     !
992 Selector:                                                     !Select plot
994     PRINT CHR$(128)
996     OUTPUT KBD;"K";
998     CONTROL 1,12;1                                            ! (Menu keys doused)
1000    SELECT Menu_line-First_line+1
1002    CASE 1                                                    !Stress vs. Time
1004      Generate_plot1(1)
1006    CASE 2                                                    !Stress vs. Strain
1008      Generate_plot2(1)
1010    CASE 3                                                    !Strain vs. Time
1012      Generate_plot3
1014    CASE 4                                                    !Stress vs. Time
1016      Generate_plot1(2)
1018    CASE 5                                                    !Stress vs. Strain
1020      Generate_plot2(2)
1022    CASE 6                                                    !\Confining Stress vs.
1024      Generate_plot4                                          !/Axial Stress
1026    CASE 7                                                    !\Volumetric Strain vs.
1028      Generate_plot5                                          !/Time
1030    CASE 8                                                    !\Volumetric Strain vs.
1032      Generate_plot6                                          !/Stress
1034    CASE 9                                                    !Channel n vs. Time
1036      Generate_plot7
1038    CASE 10                                                   !Channel n vs. channel n
1040      Generate_plot8
1042    CASE 11                                                   !Set duration limit
1044      Set_time
1046    CASE 12                                                   !Applied Load vs. MEDOF
1048      Generate_plot9
1050    CASE 13                                                   !\Applied Pressure vs.
1052      Generate_plot10                                         !/MEDOF
1054    CASE 14                                                   !\Volumetric Strain vs.
1056      Generate_plot11                                         !/Strain
1058    CASE 15                                                   !\4-MN calculated Load
1060      Generate_plot12                                         !/vs. Time
1062    CASE ELSE
1064      PRINT "Plot selection error in Select_plot."
1066      PAUSE
1068    END SELECT
1070    GOTO Menu
1072    !
1074 Not_used:                                                    !Undefined key
1076    RETURN
1078    !
1080 New_test:                                                    !
1082    Newtest_flag=1
1084  SUBEND
1086  !________________________________________________________________________
1088  !
```

```
1090 Plot1:SUB Generate_plot1(Ch)
1092   !
1094   !This module is the driver for plotting the Stress vs. Time.
1096   !=======================================================================
1098     OPTION BASE 1
1100     COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
1102     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
1104     COM /Msus/ Msus_raw$,File_name1$
1106     COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
1108     COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
1110     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
1112     !---------------------------------------------------------------------
1114     ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[30]
1116     !
1118     OUTPUT KBD;"K";
1120     !
1122     Acc_no=1
1124     Average=0
1126     Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1128     MAT Acc1= Acc1*(Gain(Ch,1))
1130     MAT Acc1= Acc1*(Gain(Ch,2))
1132     !
1134     Xmin=0                                      !Set plot limits
1136     Xmax=Time
1138     Ymin=MIN(Acc1(*))
1140     Ymax=MAX(Acc1(*))
1142     !
1144     Title$(1)="TIME"                            !Define labels
1146     Title$(2)=Buff_title$(Ch,2)
1148     Label$(1)="TIME (Sec)"
1150     Label$(2)=Buff_title$(Ch,2)&" ("&Buff_units$(Ch,2)&")"
1152     !
1154     SELECT Ch                                   !Select plot sub-label
1156     CASE 1
1158       Desc$="Axial Stress"
1160     CASE 2
1162       Desc$="Confining Stress"
1164     END SELECT
1166     !
1168     Time_inc=X_inc*Average
1170     !
1172 Plot:                                          !
1174     Pen=3
1176     Plot_msg$(11)="Average = "&VAL$(Average)
1178     Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
1180     Plot_time(Time_inc,Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
1182     !
1184     Ans$="N"
1186     DISP CHR$(129)
1188     INPUT "CHANGE SCALES ? (Default is NO)",Ans$
1190     Ans$=UPC$(Ans$[1,10])
1192     IF Ans$="Y" THEN Plot
1194     DISP CHR$(128)
1196     !
1198     Ans$="y"
1200     DISP CHR$(129)
1202     INPUT " Plot GRAPH? (default is yes) ",Ans$
1204     DISP CHR$(128)
1206     IF UPC$(Ans$[1,1])="Y" THEN
1208       Change_plotter(705)
```

```
1210      GOTO Plot
1212    END IF
1214    IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
1216    !
1218    OUTPUT KBD;"K";
1220    DEALLOCATE Label$(*),Title$(*),Desc$
1222  SUBEND
1224  !______________________________________________________________________
1226  !
1228 Plot2:SUB Generate_plot2(Ch)
1230  !
1232  !This module is the driver for plotting the Stress vs. Strain.
1234  !======================================================================
1236    OPTION BASE 1
1238    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
1240    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
1242    COM /Msus/ Msus_raw$,File_name1$
1244    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
1246    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
1248    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
1250    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
1252    COM /Sample/ Diameter,Height,Area,Width,Depth
1254    !--------------------------------------------------------------------
1256    ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[30]
1258    !
1260    OUTPUT KBD;"K";
1262    !
1264    Acc_no=1
1266    Average=0
1268    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1270    New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
1272    REDIM Acc1(1:New_size)
1274    MAT Acc1= Acc1*(Gain(Ch,1))
1276    MAT Acc1= Acc1*(Gain(Ch,2))
1278    !
1280    Ymin=MIN(Acc1(*))
1282    Ymax=MAX(Acc1(*))
1284    Title$(2)=Buff_title$(Ch,2)
1286    Label$(2)=Buff_title$(Ch,2)&" ("&Buff_units$(Ch,2)&")"
1288    !
1290    SELECT Ch                                    !Select plot sub-label
1292    CASE 1
1294      Desc$="Axial Stress"
1296    CASE 2
1298      Desc$="Confining Stress"
1300    END SELECT
1302    !
1304    !CALCULATES THE MEAN OF LVDT1 & LVDT2
1306    !
1308    Ch=3                                         !Get LVDT #1
1310    Acc_no=2
1312    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1314    REDIM Acc2(1:New_size)
1316    MAT Acc2= Acc2*(Gain(Ch,1))
1318    MAT Acc2= Acc2-(Acc2(1))
1320  ! Ch=12                                        !Get LVDT #2
1322  ! Acc_no=3
1324  ! Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1326  ! REDIM Acc3(1:New_size)
1328  ! MAT Acc3= Acc3*(Gain(Ch,1))
```

```
1330  ! MAT Acc3= Acc3-(Acc3(1))
1332  ! MAT Acc2= Acc2+Acc3
1334  ! MAT Acc2= Acc2*(.5)
1336    MAT Acc2= Acc2*(1.E+2/Height)
1338    !
1340    Xmin=MIN(Acc2(*))
1342    Xmax=MAX(Acc2(*))
1344    Title$(1)="STRAIN"
1346    Label$(1)=Title$(1)&" (%)"
1348    !
1350 Plot:                                            !Get channel #4
1352    Ch=4
1354    Acc_no=3
1356    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1358    REDIM Acc3(1:New_size)
1360    MAT Acc3= Acc3*(Gain(Ch,1))
1362    MAT Acc3= Acc3*(Gain(Ch,2))
1364    MAT Acc3= Acc3-(Acc3(1))
1366    !
1368    Desc$="Axial Strain"
1370    Pen=3
1372    Plot_msg$(11)="Average = "&VAL$(Average)
1374    Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
1376    Plot_xy(Acc2(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
1378    !
1380    Pen=4
1382    Desc$="Diametral 1 Strain"
1384    Plot_xy(Acc3(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,2,Desc$)
1386    !
1388    Ch=5                                          !Get Channel #5
1390    Acc_no=3
1392    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1394    REDIM Acc3(1:New_size)
1396    MAT Acc3= Acc3*(Gain(Ch,1))
1398    MAT Acc3= Acc3*(Gain(Ch,2))
1400    MAT Acc3= Acc3-(Acc3(1))
1402    !
1404    Pen=5
1406    Desc$="Diametral 2 Strain"
1408    Plot_xy(Acc3(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,3,Desc$)
1410    !
1412    Ans$="N"
1414    DISP CHR$(129)
1416    INPUT "CHANGE SCALES ? (Default is NO)",Ans$
1418    Ans$=UPC$(Ans$[1,10])
1420    IF Ans$="Y" THEN Plot
1422    DISP CHR$(128)
1424    !
1426    Ans$="y"
1428    DISP CHR$(129)
1430    INPUT " Plot GRAPH? (default is yes) ",Ans$
1432    DISP CHR$(128)
1434    IF UPC$(Ans$[1,1])="Y" THEN
1436      Change_plotter(705)
1438      GOTO Plot
1440    END IF
1442    IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
1444    !
1446    OUTPUT KBD;"K";
1448    DEALLOCATE Label$(*),Title$(*),Desc$
```

```
1450  SUBEND
1452  !______________________________________________________________________________
1454  !
1456 Plot3:SUB Generate_plot3
1458  !
1460  !This module is the driver for plotting the Strain vs. Time.
1462  !=============================================================================
1464    OPTION BASE 1
1466    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
1468    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
1470    COM /Msus/ Msus_raw$,File_name1$
1472    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
1474    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
1476    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
1478    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
1480    COM /Sample/ Diameter,Height,Area,Width,Depth
1482    !---------------------------------------------------------------------------
1484    ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[30]
1486    !
1488    OUTPUT KBD;"K";
1490    !
1492    !CALCULATES MEAN OF LVDT1 & LVDT2
1494    !
1496    Ch=3                                             !LVDT1
1498    Acc_no=1
1500    Average=0
1502    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1504    MAT Acc1= Acc1*(Gain(Ch,1))
1506    MAT Acc1= Acc1-(Acc1(1))
1508    !
1510  ! Ch=12                                            !LVDT2
1512  ! Acc_no=2
1514  ! Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1516  ! MAT Acc2= Acc2*(Gain(Ch,1))
1518  ! MAT Acc2= Acc2-(Acc2(1))
1520  ! MAT Acc1= Acc1+Acc2
1522  ! MAT Acc1= Acc1*(.5)
1524    MAT Acc1= Acc1*(1.E+2/Height)
1526    !
1528    Xmin=0
1530    Xmax=Time
1532    Ymin=MIN(Acc1(*))
1534    Ymax=MAX(Acc1(*))
1536    Title$(1)="TIME"
1538    Title$(2)="STRAIN"
1540    Label$(1)="TIME (Sec)"
1542    Label$(2)=Title$(2)&" %"
1544    !
1546    Ch=4                                             !Get Channel #4
1548    Acc_no=2
1550    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1552    MAT Acc2= Acc2*(Gain(Ch,1))
1554    MAT Acc2= Acc2*(Gain(Ch,2))
1556    MAT Acc2= Acc2-(Acc2(1))
1558    !
1560    Ch=5
1562    Acc_no=3
1564    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1566    MAT Acc3= Acc3*(Gain(Ch,1))
1568    MAT Acc3= Acc3*(Gain(Ch,2))
```

```
1570     MAT Acc3= Acc3-(Acc3(1))
1572     !
1574     Time_inc=X_inc*Average
1576     !
1578 Plot:   !
1580     Pen=3
1582     Desc$="Axial Strain"
1584     Plot_msg$(11)="Average = "&VAL$(Average)
1586     Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
1588     Plot_time(Time_inc,Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
1590     !
1592     Pen=4
1594     Desc$="Diametral 1 Strain"
1596     Plot_time(Time_inc,Acc2(*),Xmin,Xmax,Ymin,Ymax,Pen,2,Desc$)
1598     !
1600     Pen=5
1602     Desc$="Diametral 2 Strain"
1604     Plot_time(Time_inc,Acc3(*),Xmin,Xmax,Ymin,Ymax,Pen,3,Desc$)
1606     !
1608     Ans$="N"
1610     DISP CHR$(129)
1612     INPUT "CHANGE SCALES ? (Default is NO)",Ans$
1614     Ans$=UPC$(Ans$[1,10])
1616     IF Ans$="Y" THEN Plot
1618     DISP CHR$(128)
1620     !
1622     Ans$="y"
1624     DISP CHR$(129)
1626     INPUT " Plot GRAPH? (default is yes) ",Ans$
1628     DISP CHR$(128)
1630     IF UPC$(Ans$[1,1])="Y" THEN
1632       Change_plotter(705)
1634       GOTO Plot
1636     END IF
1638     IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
1640     !
1642     OUTPUT KBD;"K";
1644     DEALLOCATE Label$(*),Title$(*),Desc$
1646   SUBEND
1648   !_____________________________________________________________________
1650   !
1652 Plot4:SUB Generate_plot4
1654   !
1656   !This module is the driver for plotting the Confining Stress vs. Axial
1658   !Stress.
1660   !=====================================================================
1662     OPTION BASE 1
1664     COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
1666     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
1668     COM /Msus/ Msus_raw$,File_name1$
1670     COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
1672     COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
1674     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
1676     COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
1678     !---------------------------------------------------------------------
1680     ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[30]
1682     !
1684     OUTPUT KBD;"K";
1686     !
1688     Ch=1
```

```
1690    Acc_no=1
1692    Average=0
1694    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1696    MAT Acc1= Acc1*(Gain(Ch,1))
1698    MAT Acc1= Acc1*(Gain(Ch,2))
1700    !
1702    Xmin=MIN(Acc1(*))
1704    Xmax=MAX(Acc1(*))
1706    Title$(1)=Buff_title$(Ch,2)
1708    Label$(1)=Buff_title$(Ch,2)&" ("&Buff_units$(Ch,2)&")"
1710    !
1712    Ch=2                                              !Get Channel #2
1714    Acc_no=2
1716    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1718    MAT Acc2= Acc2*(Gain(Ch,1))
1720    MAT Acc2= Acc2*(Gain(Ch,2))
1722    !
1724    Ymin=MIN(Acc2(*))
1726    Ymax=MAX(Acc2(*))
1728    Title$(2)=Buff_title$(Ch,2)
1730    Label$(2)=Buff_title$(Ch,2)&" ("&Buff_units$(Ch,2)&")"
1732    !
1734 Plot:   !
1736    Pen=3
1738    Desc$="Confining Strain vs. Axial Strain"
1740    Plot_msg$(11)="Average = "&VAL$(Average)
1742    Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
1744    Plot_xy(Acc2(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
1746    !
1748    Ans$="N"
1750    DISP CHR$(129)
1752    INPUT "CHANGE SCALES ? (Default is NO)",Ans$
1754    Ans$=UPC$(Ans$[1,10])
1756    IF Ans$="Y" THEN Plot
1758    DISP CHR$(128)
1760    !
1762    Ans$="y"
1764    DISP CHR$(129)
1766    INPUT " Plot GRAPH? (default is yes) ",Ans$
1768    DISP CHR$(128)
1770    IF UPC$(Ans$[1,1])="Y" THEN
1772      Change_plotter(705)
1774      GOTO Plot
1776    END IF
1778    IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
1780    !
1782    OUTPUT KBD;"K";
1784    DEALLOCATE Label$(*),Title$(*),Desc$
1786  SUBEND
1788  !_______________________________________________________________________
1790  !
1792 Plot5:SUB Generate_plot5
1794  !
1796  !This module is the driver for plotting Volumetric Strain vs Time. Two
1798  !algorithms are utilized: the first employs the Diametral Strains, while
1800  !the second uses the Intensifier Strain in the calculations.
1802  !
1804  !Diametral Algorithm:
1806  ! % Vol. Strain = ((1 + (delta w) / w)^2 * (1 + (delta h) / h) - 1) * 100
1808  !                 where: delta w = change in sample diameter (strain)
```

```
1810  !                                    (diametral 1 + diametral 2) / 2
1812  !                       w       = initial sample diameter
1814  !                       delta h = change in sample height (axial strain)
1816  !                       h       = initial sample height
1818  !
1820  !Intensifier Algorithm:
1822  ! % Vol. Strain = (((delta V(1))-(delta V(2))) / V) * x * 100
1824  !              where: delta V(1) = change in Intensifier volume
1826  !                     delta V(2) = change in Actuator volume
1828  !                     V          = initial sample volume
1830  !========================================================================
1832    OPTION BASE 1
1834    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
1836    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
1838    COM /Msus/ Msus_raw$,File_name1$
1840    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
1842    COM /Sample/ Diameter,Height,Area,Width,Depth
1844    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
1846    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
1848    !-----------------------------------------------------------------------
1850    ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[50]
1852    !
1854    OUTPUT KBD;"K";
1856    !
1858    DISP CHR$(129)
1860    Algorithm$="Diametral"
1862    PRINT TABXY(1,18);"Volumetric Strain calculated using Intensifier or Dia
1864 Change:                                                 !
1866    Ans$="n"
1868    PRINT TABXY(1,19);"Algorithm uses ";Algorithm$
1870    INPUT " CHANGE algorithm? (Default is no) ",Ans$
1872    IF UPC$(Ans$[1,1])="Y" THEN
1874      SELECT UPC$(Algorithm$[1,1])
1876      CASE "D"
1878        Algorithm$="Intensifier"
1880        GOTO Change
1882      CASE "I"
1884        Algorithm$="Diametral"
1886        GOTO Change
1888      END SELECT
1890      PRINT TABXY(1,19);RPT$(" ",80)
1892    END IF
1894    DISP CHR$(128)
1896    !
1898    Average=0
1900    SELECT UPC$(Algorithm$[1,1])
1902    CASE "D"                                       !Diametral algorithm
1904      Desc$="Volumetric Strain from Diametrial Strain"
1906      !
1908      Ch=4
1910      Acc_no=1
1912      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1914      MAT Acc1= Acc1*(Gain(Ch,1))
1916      MAT Acc1= Acc1-(Acc1(1))
1918      !
1920      Ch=5
1922      Acc_no=2
1924      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1926      MAT Acc2= Acc2*(Gain(Ch,1))
1928      MAT Acc2= Acc2-(Acc2(1))
```

```
1930        !
1932        MAT Acc1= Acc1+Acc2
1934        MAT Acc1= Acc1/(2*Diameter)
1936        MAT Acc1= Acc1+(1)
1938        MAT Acc1= Acc1 . Acc1
1940        !
1942        Ch=11     !LVDT #1
1944        Acc_no=2
1946        Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1948        MAT Acc2= Acc2*(Gain(Ch,1))
1950        MAT Acc2= Acc2-(Acc2(1))
1952        !
1954        Ch=12      !LVDT #2
1956        Acc_no=3
1958        Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1960        MAT Acc3= Acc3*(Gain(Ch,1))
1962        MAT Acc3= Acc3-(Acc3(1))
1964        !
1966        MAT Acc2= Acc2+Acc3
1968        MAT Acc2= Acc2*(.5)
1970        MAT Acc2= Acc2/(-Height)                      ! (Sense correction!!)
1972        MAT Acc2= Acc2+(1)
1974        !
1976        MAT Acc1= Acc1 . Acc2
1978        MAT Acc1= Acc1-(1)
1980        MAT Acc1= Acc1*(100)
1982      CASE "I"                                        !Intensifier algorithm
1984        Desc$="Volumetric Strain from Intensifier Strain"
1986        !
1988        Ch=8    !ACTUATOR DISPLACEMENT
1990        Acc_no=1
1992        Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
1994        MAT Acc1= Acc1*(Gain(Ch,1))
1996        Cs_area_act=(PI*(3*25.4)^2)/4
1998        MAT Acc1= Acc1*(Cs_area_act)
2000        MAT Acc1= Acc1-(Acc1(1))
2002        !
2004        Ch=7     !INTENSIFIER DISPLACEMENT
2006        Acc_no=2
2008        Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2010        MAT Acc2= Acc2*(Gain(Ch,1))
2012        !
2014        ! CORRECTION OF INTENSIFIER DISPLACEMENT DUE TO CONFINING PRESSURE
2016        !CHANGES. DATA ON EFFECTIVE SYSTRM STIFNESSS FROM TEST B469 (SHELL)
2018        !PRESSURE CORRECTION ONLY APPLIED IF FIRST PRESSURE IS GREATER THN
2020        !1 MPa. THIS IS TO AVOID DOING CORRECTION ON BULK MODULUS TESTS.
2022        !
2024        Ch=2  !GET CONFINING PRESSURE
2026        Acc_no=3
2028        Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2030        MAT Acc3= Acc3*(Gain(Ch,1))
2032        First_pressure=Acc3(1)
2034        IF First_pressure>1 THEN
2036          Ln_first=LOG(First_pressure)
2038          FOR I=1 TO SIZE(Acc3,1)
2040            Acc3(I)=6.74*(Acc3(I)-First_pressure)+6.06*(LOG(Acc3(I))-Ln_first)
2042          NEXT I
2044          MAT Acc2= Acc2-Acc3
2046        END IF
2048        Cs_area_int=(PI*(2*25.4)^2)/4
```

```
2050       MAT Acc2= Acc2*(-Cs_area_int)                  ! (Sense correction!!)
2052       MAT Acc2= Acc2-(Acc2(1))
2054       !
2056       MAT Acc1= Acc2-Acc1
2058       MAT Acc1= Acc1/(Area*Height)
2060       MAT Acc1= Acc1*(100)
2062       !
2064    !  Ch=3
2066    !  Acc_no=2
2068    !  Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2070    !  MAT Acc2= Acc2*(Gain(Ch,1))
2072    !  MAT Acc2= Acc2*(1.272*(PI*50^2*250/(Area*Height)))
2074    !  MAT Acc2= Acc1+Acc2
2076     END SELECT
2078     OUTPUT KBD;"K";
2080     !
2082     Xmin=0                                           !Set plot limits
2084     Xmax=Time
2086     Ymin=MIN(Acc1(*))
2088     Ymax=MAX(Acc1(*))
2090     !
2092     Title$(1)="TIME"                                 !Define labels
2094     Title$(2)="VOLUMETRIC STRAIN"
2096     Label$(1)="TIME (Sec)"
2098     Label$(2)="VOLUMETRIC STRAIN (%)"
2100     !
2102     Time_inc=X_inc*Average
2104     !
2106 Plot:                                                !
2108     Pen=3
2110     Plot_msg$(11)="Average = "&VAL$(Average)
2112     Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
2114     Plot_time(Time_inc,Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
2116     !
2118     Ans$="N"
2120     DISP CHR$(129)
2122     INPUT "CHANGE SCALES ? (Default is NO)",Ans$
2124     Ans$=UPC$(Ans$[1,10])
2126     IF Ans$="Y" THEN Plot
2128     DISP CHR$(128)
2130     !
2132     Ans$="y"
2134     DISP CHR$(129)
2136     INPUT " Plot GRAPH? (default is yes) ",Ans$
2138     DISP CHR$(128)
2140     IF UPC$(Ans$[1,1])="Y" THEN
2142       Change_plotter(705)
2144       GOTO Plot
2146     END IF
2148     IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
2150     !
2152     OUTPUT KBD;"K";
2154     DEALLOCATE Label$(*),Title$(*),Desc$
2156  SUBEND
2158  !________________________________________________________________________
2160  !
2162 Plot6:SUB Generate_plot6
2164  !
2166  !This module is the driver for plotting Volumetric Strain vs. Deviator
2168  !Stress. Two algorithms are utilized: the first employs the Diametral
```

```
2170  !Strains, while the second uses the Intensifier Strain in the
2172  !calculations.
2174  !CAN PLOT AGAINST AXIAL OR CONFINING STRESS
2176  !Diametral Algorithm:
2178  ! % Vol. Strain = ((1 + (delta w) / w)^2 * (1 + (delta h) / h) - 1) * 100
2180  !                where: delta w = change in sample diameter (strain)
2182  !                                 (diametral 1 + diametral 2) / 2
2184  !                       w       = initial sample diameter
2186  !                       delta h = change in sample height (axial strain)
2188  !                       h       = initial sample height
2190  !
2192  !Intensifier Algorithm:
2194  ! % Vol. Strain = (((delta V(1))-(delta V(2))) / V) * x * 100
2196  !                where: delta V(1) = change in Intensifier volume
2198  !                       delta V(2) = change in Actuator volume
2200  !                       V          = initial sample volume
2202  !==========================================================================
2204    OPTION BASE 1
2206    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
2208    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
2210    COM /Msus/ Msus_raw$,File_name1$
2212    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
2214    COM /Sample/ Diameter,Height,Area,Width,Depth
2216    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
2218    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
2220    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
2222    !-----------------------------------------------------------------------
2224    ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[50]
2226    !
2228    OUTPUT KBD;"K";
2230    !
2232    DISP CHR$(129)
2234    Algorithm$="Diametral"
2236  Change:
2238    PRINT TABXY(1,18);"Volumetric Strain calculated using Intensifier or Dia
2240    Ans$="n"
2242    PRINT TABXY(1,19);"Algorithm uses ";Algorithm$
2244    INPUT " CHANGE algorithm? (Default is no) ",Ans$
2246    IF UPC$(Ans$[1,1])="Y" THEN
2248      SELECT UPC$(Algorithm$[1,1])
2250      CASE "D"
2252        Algorithm$="Intensifier"
2254        GOTO Change
2256      CASE "I"
2258        Algorithm$="Diametral"
2260        GOTO Change
2262      END SELECT
2264      PRINT TABXY(1,19);RPT$(" ",80)
2266    END IF
2268    DISP CHR$(128)
2270    !
2272    PRINT CHR$(12)  !CLEAN UP SCREEN
2274    !
2276    DISP CHR$(129)
2278    Stress$="Axial"
2280  Change_stress:   !
2282    PRINT TABXY(1,18);" Axial or Confining Stress.? "
2284    Ans$="n"
2286    PRINT TABXY(1,19);" Current uses ";Stress$
2288    INPUT " CHANGE Stress ? (Default is no) ",Ans$
```

```
2290     IF UPC$(Ans$[1,1])="Y" THEN
2292       SELECT UPC$(Stress$[1,1])
2294       CASE "A"
2296         Stress$="Confining"
2298         GOTO Change_stress
2300       CASE "C"
2302         Stress$="Axial"
2304         GOTO Change_stress
2306       END SELECT
2308       PRINT TABXY(1,19);RPT$(" ",80)
2310     END IF
2312     DISP CHR$(128)
2314     !
2316     Average=0
2318     SELECT UPC$(Algorithm$[1,1])
2320     CASE "D"                                       !Diametral algorithm
2322       Desc$="Volumetric Strain from Diametrial Strain"
2324       !
2326       Ch=4                                         !DIAMETRAL 1
2328       Acc_no=1
2330       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2332       New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
2334       REDIM Acc1(1:New_size)
2336       MAT Acc1= Acc1*(Gain(Ch,1))
2338       MAT Acc1= Acc1-(Acc1(1))
2340       !
2342       Ch=5                                         !Diametral 2
2344       Acc_no=2
2346       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2348       REDIM Acc2(1:New_size)
2350       MAT Acc2= Acc2*(Gain(Ch,1))
2352       MAT Acc2= Acc2-(Acc2(1))
2354       !
2356       MAT Acc1= Acc1+Acc2
2358       MAT Acc1= Acc1/(2*Diameter)
2360       MAT Acc1= Acc1+(1)
2362       MAT Acc1= Acc1 . Acc1
2364       !
2366       Ch=3                                         !LVDT #1
2368       Acc_no=2
2370       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2372       REDIM Acc2(1:New_size)
2374       MAT Acc2= Acc2*(Gain(Ch,1))
2376       MAT Acc2= Acc2-(Acc2(1))
2378       !
2380     ! Ch=12                                         !LVDT#2
2382     ! Acc_no=3
2384     ! Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2386     ! REDIM Acc3(1:New_size)
2388     ! MAT Acc3= Acc3*(Gain(Ch,1))
2390     ! MAT Acc3= Acc3-(Acc3(1))
2392     ! MAT Acc2= Acc2+Acc3
2394     ! MAT Acc2= Acc2*(.5)
2396       !
2398       MAT Acc2= Acc2/(-Height)                     ! (Sense correction!!)
2400       MAT Acc2= Acc2+(1)
2402       !
2404       MAT Acc1= Acc1 . Acc2
2406       MAT Acc1= Acc1-(1)
2408       MAT Acc1= Acc1*(100)
```

```
2410     CASE "I"                                          !Intensifier algorithm
2412       Desc$="Volumetric Strain from Intensifier Strain"
2414       !
2416       Ch=8                                            !ACTUATOR DISPLACEMENT
2418       Acc_no=1
2420       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2422       New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
2424       REDIM Acc1(1:New_size)
2426       MAT Acc1= Acc1*(Gain(Ch,1))
2428       Cs_area_act=(PI*(3*25.4)^2)/4
2430       MAT Acc1= Acc1*(Cs_area_act)
2432       MAT Acc1= Acc1-(Acc1(1))
2434       !
2436       Ch=7                                            !INTENSIFIER DISPLACEMENT
2438       Acc_no=2
2440       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2442       REDIM Acc2(1:New_size)
2444       MAT Acc2= Acc2*(Gain(Ch,1))
2446       !
2448       ! CORRECTION OF INTENSIFIER DISPLACEMENT DUE TO CONFINING PRESSURE
2450       !CHANGES. DATA ON EFFECTIVE SYSTEM STIFFNESSS FROM TEST B469 (SHELL)
2452       !PRESSURE CORRECTION ONLY APPLIED IF FIRST PRESSURE IS GREATER THAN
2454       !1 MPa. THIS IS TO AVOID DOING CORRECTION ON BULK MODULUS TESTS.
2456       !
2458       Ch=2                                            !GET CONFINING PRESSURE
2460       Acc_no=3
2462       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2464       REDIM Acc3(1:New_size)
2466       MAT Acc3= Acc3*(Gain(Ch,1))
2468       First_pressure=Acc3(1)
2470       IF First_pressure>1 THEN
2472         Ln_first=LOG(First_pressure)
2474         FOR I=1 TO SIZE(Acc3,1)
2476           Acc3(I)=6.74*(Acc3(I)-First_pressure)+6.06*(LOG(Acc3(I))-Ln_first)
2478         NEXT I
2480         MAT Acc2= Acc2-Acc3
2482       END IF
2484       Cs_area_int=(PI*(2*25.4)^2)/4
2486       MAT Acc2= Acc2*(-Cs_area_int)                   ! (Sense correction!!)
2488       MAT Acc2= Acc2-(Acc2(1))
2490       !
2492       MAT Acc1= Acc2-Acc1
2494       MAT Acc1= Acc1/(Area*Height)
2496       MAT Acc1= Acc1*(100)
2498       !
2500     END SELECT
2502     OUTPUT KBD;"K";
2504     !
2506     SELECT UPC$(Stress$[1,1])
2508     CASE "A"
2510       Ch=1    !GET AXIAL LOAD
2512       Acc_no=2
2514       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2516       REDIM Acc2(1:New_size)
2518       MAT Acc2= Acc2*(Gain(Ch,1))
2520       MAT Acc2= Acc2*(Gain(Ch,2)) !CALCULATE STRESS
2522     !
2524       Title$(1)="AXIAL STRESS"                        !Define labels
2526       Title$(2)="VOLUMETRIC STRAIN"
2528       Label$(1)="AXIAL STRESS (MPa)"
```

```
2530        Label$(2)="VOLUMETRIC STRAIN (%)"
2532      !
2534      CASE "C"
2536        Ch=2   !GET CONFINING PRESSURE
2538        Acc_no=2
2540        Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
2542        REDIM Acc2(1:New_size)
2544        MAT Acc2= Acc2*(Gain(Ch,1))
2546      !
2548        Title$(1)="CONFINING STRESS"                       !Define labels
2550        Title$(2)="VOLUMETRIC STRAIN"
2552        Label$(1)="CONFINING STRESS (MPa)"
2554        Label$(2)="VOLUMETRIC STRAIN (%)"
2556      END SELECT
2558      !
2560      Xmin=MIN(Acc2(*))                                  !Set plot limits
2562      Xmax=MAX(Acc2(*))
2564      Ymin=MIN(Acc1(*))
2566      Ymax=MAX(Acc1(*))
2568      !
2570      !
2572 Plot:                                                  !
2574      Pen=3
2576      Plot_msg$(11)="Average = "&VAL$(Average)
2578      Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
2580      Plot_xy(Acc2(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
2582      !
2584      Ans$="N"
2586      DISP CHR$(129)
2588      INPUT "CHANGE SCALES ? (Default is NO)",Ans$
2590      Ans$=UPC$(Ans$[1,10])
2592      IF Ans$="Y" THEN Plot
2594      DISP CHR$(128)
2596      !
2598      Ans$="y"
2600      DISP CHR$(129)
2602      INPUT " Plot GRAPH? (default is yes) ",Ans$
2604      DISP CHR$(128)
2606      IF UPC$(Ans$[1,1])="Y" THEN
2608        Change_plotter(705)
2610        GOTO Plot
2612      END IF
2614      IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
2616      !
2618      OUTPUT KBD;"K";
2620      DEALLOCATE Label$(*),Title$(*),Desc$
2622    SUBEND
2624    !________________________________________________________________________
2626    !
2628 Plot7:SUB Generate_plot7
2630    !
2632    !This module is the driver for plotting the a selected channel vs. Time.
2634    !=======================================================================
2636      OPTION BASE 1
2638      COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
2640      COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
2642      COM /Msus/ Msus_raw$,File_name1$
2644      COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
2646      COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
2648      COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
```

```
2650    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
2652    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
2654    !---------------------------------------------------------------------------
2656    ALLOCATE Label$(2)[40],Title$(2)[40],Desc$[30],Calc_label$(2)[40]
2658    ALLOCATE User_message_y$[40]
2660    !
2662    OUTPUT KBD;"K";
2664    !
2666 Menu:                                                    !
2668    Data_adjust_y=0
2670    Flag_y=0
2672    Const_y_flag=0
2674    Plot_msg$(9)=""
2676    Plot_msg$(10)=""
2678    User_message_y$=""
2680    GOSUB Keys3
2682    CONTROL 1,12;2                                        ! (Menu keys lit)
2684    !
2686    GOSUB Spin
2688    !
2690 Get_channel:                                             !
2692    OUTPUT KBD;"K";
2694    Acc_no=4
2696    Average=0
2698    IF Ch_y<50 THEN
2700      Raw_to_acc(Buff_id$(Ch_y,1),Acc_no,Average)
2702      New_size=MIN(Max_samples,INT(Time/(X_inc*Average)))
2704      REDIM Acc4(1:New_size)
2706      MAT Acc4= Acc4*(Gain(Ch_y,1))
2708      Calc_label$(1)=Buff_title$(Ch_y,1)
2710      Calc_label$(2)=Buff_title$(Ch_y,1)&" ("&Buff_units$(Ch_y,1)&")"
2712    ELSE
2714      Calc_type=Ch_y
2716      Calc_quantity(Average,Calc_label$(*),Calc_type,No_more)
2718      New_size=MIN(Max_samples,INT(Time/(X_inc*Average)))
2720      REDIM Acc4(1:New_size)
2722    !
2724    END IF
2726    Data_adjust=Data_adjust_y
2728    Flag=Flag_y
2730    Exponent=N_y
2732    Constant=Const_y
2734    Const_flag=Const_y_flag
2736    Data_manipulate(Data_adjust,Flag,Exponent,Constant,Const_flag)
2738    MAT Acc1= Acc4
2740    Fix_labels(Calc_label$(*),Data_adjust,Exponent,Constant,Const_flag)
2742    IF Flag_y THEN
2744      Plot_msg$(9)="Y Offset Removed"
2746    END IF
2748    Title$(2)=Calc_label$(1)
2750    Label$(2)=Calc_label$(2)
2752    !
2754    Xmin=0                                                !Set plot limits
2756    Xmax=Time
2758    Ymin=MIN(Acc1(*))
2760    Ymax=MAX(Acc1(*))
2762    !
2764    Title$(1)="TIME"                                      !Define labels
2766    Label$(1)="TIME (Sec)"
2768    !
```

```
2770    Time_inc=X_inc*Average
2772    Plot_msg$(11)="Average = "&VAL$(Average)
2774    !
2776 Plot:                                                         !
2778    Pen=3
2780    Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
2782    Plot_time(Time_inc,Accl(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
2784    !
2786    Ans$="N"
2788    DISP CHR$(129)
2790    INPUT "CHANGE SCALES ? (Default is NO)",Ans$
2792    Ans$=UPC$(Ans$[1,10])
2794    IF Ans$="Y" THEN Plot
2796    DISP CHR$(128)
2798    !
2800    Ans$="y"
2802    DISP CHR$(129)
2804    INPUT " Plot GRAPH? (default is yes) ",Ans$
2806    DISP CHR$(128)
2808    IF UPC$(Ans$[1,1])="Y" THEN
2810      Change_plotter(705)
2812      GOTO Plot
2814    END IF
2816    IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
2818    OUTPUT KBD;"K";
2820    GOTO Menu
2822    !
2824 Quit:                                                         !
2826    OUTPUT KBD;"K";
2828    PRINT CHR$(128)
2830    DEALLOCATE Label$(*),Title$(*),Desc$,Calc_label$(*)
2832    Plot_msg$(9)=""
2834    Plot_msg$(10)=""
2836    Plot_msg$(11)=""
2838    SUBEXIT
2840    !+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
2842 Spin:                                                         !Zzzz...............
2844    GOTO Spin
2846    RETURN
2848    !
2850    !
2852 Keys3:                                                        !Setup menu keys
2854    Menu_select=3
2856    Build_menu(Buff_id$(*),Buff_title$(*))
2858    Ref_line=4                                                 !Menu y-position
2860    Indent=45                                                  !Menu x-position
2862    Menu_line=Ref_line
2864    PRINT CHR$(12)
2866    Print_menu
2868    ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
2870    ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
2872    ON KEY 3 LABEL "  CALC    DATA   " GOSUB Keys4
2874    ON KEY 4 LABEL " SELECT    Y     " GOTO Select_y
2876    ON KEY 5 LABEL "                 " GOSUB Not_used
2878    ON KEY 6 LABEL "                 " GOSUB Not_used
2880    ON KEY 7 LABEL "                 " GOSUB Not_used
2882    ON KEY 8 LABEL "  QUIT           " GOTO Quit
2884    CONTROL 1,12;2
2886    RETURN
2888    !
```

```
2890 Keys4:                                                   !Setup menu keys
2892    Menu_select=6
2894    Build_menu(Buff_id$(*),Buff_title$(*))
2896    Ref_line=4                                            !Menu y-position
2898    Indent=45                                             !Menu x-position
2900    Menu_line=Ref_line
2902    PRINT CHR$(12)
2904    Print_menu
2906                                                          !
2908    ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
2910    ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
2912    ON KEY 3 LABEL "   RAW    DATA   " GOSUB Keys3
2914    ON KEY 4 LABEL " SELECT    Y     " GOTO Select_y_calc
2916    ON KEY 5 LABEL "                 " GOSUB Not_used
2918    ON KEY 6 LABEL "                 " GOSUB Not_used
2920    ON KEY 7 LABEL "                 " GOSUB Not_used
2922    ON KEY 8 LABEL "  QUIT           " GOTO Quit
2924    CONTROL 1,12;2
2926    RETURN
2928    !
2930 Keys6:         !KEYS FOR DATA MANIPULATION OPTION  y
2932                !
2934    ON KEY 1 LABEL "REMOVE    OFFSET" GOSUB Offset_y
2936    ON KEY 2 LABEL "LOGe(Y)          " GOSUB Man_1_y
2938    ON KEY 3 LABEL "LOG10(Y)         " GOSUB Man_2_y
2940    ON KEY 4 LABEL "E^(Y)            " GOSUB Man_3_y
2942    ON KEY 5 LABEL "10^(Y)           " GOSUB Man_4_y
2944    ON KEY 6 LABEL "(Y)^N            " GOSUB Man_5_y
2946    ON KEY 7 LABEL "ADD     CONSTANT" GOSUB Constant_y
2948    ON KEY 8 LABEL "  CONT           " GOTO Get_channel
2950    CONTROL 1,12;2
2952    RETURN
2954    !
2956    !
2958 Select_y:                                                 !Select Y-axis plot
2960    OFF KEY
2962    CONTROL 1,12;1                                        ! (Menu keys doused)
2964    OUTPUT KBD;"K";
2966    PRINT CHR$(128)
2968    Ch_y=VAL(Menu_3$(Menu_line-Min_line+1)[2,3])
2970    PRINT "Y-channel: ";Buff_title$(Ch_y,1)
2972    GOSUB Keys6
2974    GOSUB Spin
2976    !
2978 Select_y_calc:   !
2980    OFF KEY
2982    CONTROL 1,12;1                                        ! (Menu keys doused)
2984    OUTPUT KBD;"K";
2986    PRINT CHR$(128)
2988    Ch_y=VAL(Menu_4$(Menu_line-Min_line+1)[2,3])
2990    PRINT "Y-channel: ";Menu_4$(Ch_y-49)
2992    GOSUB Keys6
2994    GOSUB Spin
2996    !
2998                 !
3000 Offset_y:                                                !
3002    Flag_y=NOT Flag_y
3004    GOSUB User_message_y
3006    RETURN
3008    !
```

```
3010 Constant_y:   !
3012    INPUT "ENTER VALUE OF CONSTANT",Const_y
3014    Const_y_flag=1
3016    GOSUB User_message_y
3018    RETURN
3020    !
3022 Man_1_y:   !
3024    Data_adjust_y=1
3026    GOSUB User_message_y
3028    RETURN
3030            !
3032 Man_2_y:   !
3034    Data_adjust_y=2
3036    GOSUB User_message_y
3038    RETURN
3040            !
3042 Man_3_y:   !
3044    Data_adjust_y=3
3046    GOSUB User_message_y
3048    RETURN
3050            !
3052 Man_4_y:   !
3054    Data_adjust_y=4
3056    GOSUB User_message_y
3058    RETURN
3060            !
3062 Man_5_y:   !
3064    Data_adjust_y=5
3066    INPUT "ENTER THE VALUE OF THE EXPONENT",N_y
3068    GOSUB User_message_y
3070    RETURN
3072            !
3074                    !
3076 Not_used:                                              !Undefined key
3078    RETURN
3080    !
3082 User_message_y:   !
3084    IF Flag_y THEN
3086      Part1$="Y OFFSET REMOVED "
3088    ELSE
3090      Part1$=""
3092    END IF
3094    IF Const_y_flag THEN
3096      Part1a$=" "&VAL$(Const_y)
3098    ELSE
3100      Part1a$=""
3102    END IF
3104    Case_selector=Data_adjust_y
3106    Temp_flag$="Y"
3108    SELECT Case_selector
3110    CASE 0
3112      Part2$=""
3114    CASE 1
3116      Part2$=" LOGe(X)"
3118    CASE 2
3120      Part2$=" LOG10(X)"
3122    CASE 3
3124      Part2$=" EXP(X)"
3126    CASE 4
3128      Part2$=" 10^(X)"
```

```
3130     CASE 5
3132       Part2$=" (X)^N"
3134     CASE ELSE
3136     END SELECT
3138     DISP Part1$&Part1a$&Part2$
3140     IF Temp_flag$="Y" THEN
3142       User_message_y$=Part1$&Part1a$&Part2$
3144     END IF
3146     RETURN
3148     !
3150   SUBEND
3152   !________________________________________________________________________
3154   !
3156 Create_index:SUB Create_index(Eng_data(*),Eng_titles$(*),Eng_units$(*))
3158   !
3160   !This module creates an index used to access both raw data files and data
3162   !buffer files and their associated parameters, etc.
3164   !
3166   !The row of each array corresponds to each disk buffer.
3168   !The column number of each array corresponds as follows:
3170   !                        = "1" for raw data files
3172   !                        = "2" for data buffer files
3174   !
3176   !Index string:
3178   !    Buff_id$(Ch,1)     = raw file name
3180   !            (Ch,2)     = temporary engineering file (future)
3182   !    Buff_title$(Ch,1) = channel descriptor (eg axial load)
3184   !               (Ch,2) = engineering descriptor (eg pressure)
3186   !    Buff_units$(Ch,1) = transducer gain units (e.g. kN)
3188   !               (Ch,2) = engineering gain units (e.g. MPa)
3190   !
3192   !Index real:
3194   !    Buff_freq(Ch,1)    = (future)
3196   !             (Ch,2)    = temporary file averaging (future)
3198   !    Gain(Ch,1)         = transducer gain
3200   !        (Ch,2)         = engineering gain
3202   !
3204   !Index integer:
3206   !    No_buffers         = current number of disk buffers in use
3208   !    Buff_points        = Number of samples in buffer
3210   !=========================================================================
3212     OPTION BASE 1
3214     COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
3216     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
3218     COM /Index_integer/ INTEGER No_buffers(*),INTEGER Buff_points(*)
3220     COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
3222     COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
3224     !-----------------------------------------------------------------------
3226     FOR Ch=1 TO Max_channels
3228       IF Ch_data$(Ch,1)<>"#" THEN
3230         Buff_id$(Ch,1)=Test_text$(1)&"_ch"&Ch_data$(Ch,1)
3232         Buff_title$(Ch,1)=Ch_data$(Ch,3)
3234         Buff_title$(Ch,2)=Eng_titles$(Ch)
3236         Buff_units$(Ch,1)=Ch_data$(Ch,2)
3238         Buff_units$(Ch,2)=Eng_units$(Ch)
3240         Gain(Ch,1)=Gains(Ch,1)
3242         Gain(Ch,2)=Eng_data(Ch)
3244       END IF
3246     NEXT Ch
3248   SUBEND
```

```
3250  !______________________________________________________________________
3252  !
3254 Check_index:SUB Check_index(Id$,INTEGER Index_flag,OPTIONAL Index_no)
3256  !
3258  !This module checks the index for the existence and duplication of the
3260  !buffer "Id$".
3262  !
3264  !Inputs:
3266  !    Id$ = Channel identifier;
3268  !    Index_no = "1" for raw data buffers;
3270  !             = "2" for disk data buffers.
3272  !
3274  !Outputs:
3276  !    Index_flag = 0 if the buffer identifier does not exist;
3278  !               = row of index if it currently exists.
3280  !======================================================================
3282    OPTION BASE 1
3284    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
3286    !----------------------------------------------------------------------
3288    INTEGER I
3290    !
3292    IF Id$="#" THEN
3294      PRINT TABXY(1,19);"File ";Id$;" does not exist!!!"
3296      Select_plot(Duration,Samples,Newtest_flag)
3298    END IF
3300    !
3302    SELECT NPAR
3304    CASE 2
3306      Index=2
3308    CASE 3
3310      Index_flag=0
3312      FOR Ch=1 TO SIZE(Buff_id$,1)
3314        IF Buff_id$(Ch,Index_no)=Id$ THEN
3316          IF Index_flag>0 THEN
3318            PRINT TABXY(1,19);
3320            PRINT "Oh oh! Buffer ";Buff_id$(I,Index_no);"is duplicated."
3322            PAUSE
3324          ELSE
3326            Index_flag=Ch
3328          END IF
3330        END IF
3332      NEXT Ch
3334    CASE ELSE
3336      PRINT "Incorrect no. of parameters in check_index"
3338      STOP
3340    END SELECT
3342  SUBEND
3344  !______________________________________________________________________
3346  !
3348 Raw_to_acc:SUB Raw_to_acc(File_name$,Acc_no,OPTIONAL Average)
3350  !
3352  !This module is the driver which controls loading and storing of data
3354  !files.
3356  !======================================================================
3358    OPTION BASE 1
3360    COM /Msus/ Msus_raw$,File_name1$
3362    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
3364    !----------------------------------------------------------------------
3366    ALLOCATE Indata(Acc_size)
3368    !
```

```
3370     SELECT NPAR
3372     CASE 2
3374       Raw_to_temp(File_name$,Indata(*))
3376     CASE 3
3378       Raw_to_temp(File_name$,Indata(*),Average)
3380     END SELECT
3382     Temp_to_acc(Acc_no,Indata(*))
3384     !
3386     DEALLOCATE Indata(*)
3388   SUBEND
3390   !_____________________________________________________________________
3392   !
3394 Raw_to_temp:SUB Raw_to_temp(File_name$,Indata(*),OPTIONAL Average)
3396   !
3398   !This module loads raw data from "File_name$" and puts it into "Inbuff".
3400   !
3402   !Inputs:
3404   !     Filename$   = Name of disk file
3406   !     Max_samples = number of samples in truncated data set
3408   !     Tempdata    = data to transfer
3410   !     No_avg      = (See "Loadbuffer" Subprogram)
3412   !=====================================================================
3414     OPTION BASE 1
3416     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
3418     COM /Buffers/ INTEGER Inbuff(*) BUFFER
3420     COM /Msus/ Msus_raw$,File_name1$
3422     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
3424     COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
3426     !-------------------------------------------------------------------
3428     INTEGER I,Index_row
3430     !
3432     Check_index(File_name$,Index_row,1)           !Check for file
3434     IF Index_row=0 THEN
3436       BEEP
3438       DISP "Raw data file ";Filename$;" not found"
3440       WAIT 3
3442       Test_data(Plot_msg$(*))
3444     END IF
3446     !
3448     No_avg=0
3450     Blocks=1+(No_samples DIV (1+SIZE(Indata,1)))
3452 Retry:                                            !Select average
3454     SELECT NPAR
3456     CASE 2
3458       No_avg=No_avg+1
3460     CASE 3
3462       IF Average=0 THEN
3464         Average=Blocks
3466         PRINT TABXY(1,19);"Minimum averaging is ";Blocks;" to 1"
3468         DISP CHR$(129)
3470         INPUT " Number to AVERAGE is ",Average
3472         DISP CHR$(128)
3474       END IF
3476       No_avg=Average
3478     END SELECT
3480     IF No_avg<Blocks THEN Retry
3482     !
3484     DISP " Loading raw data... "
3486     REDIM Inbuff(No_samples)
3488     ASSIGN @Inbuff TO BUFFER Inbuff(*);FORMAT OFF
```

```
3490    ASSIGN @Raw TO File_name$&Msus_raw$
3492    SELECT No_avg
3494    CASE 1                                          !No averaging
3496      ON END @Raw GOTO Done
3498      ENTER @Raw;Inbuff(*)
3500 Done:                                              !
3502      REDIM Inbuff(No_samples)
3504      Samples=No_samples
3506    CASE >1                                         !Average data
3508      PRINT TABXY(1,19);"Averaging ";No_avg;" input samples to 1 output samp
3510      Samples=0
3512      Blocks=No_avg
3514      Samples_left=No_samples
3516      Block_size=(MIN(SIZE(Indata,1),No_samples) DIV No_avg)*No_avg
3518      ALLOCATE INTEGER Avgbuff(Block_size,1),Sumbuff(Block_size/No_avg)
3520      FOR Block=1 TO Blocks
3522        Block_size=MIN(SIZE(Indata,1),Samples_left)
3524        IF Block_size>=No_avg THEN
3526          Rows=Block_size DIV No_avg
3528          REDIM Avgbuff(Rows,No_avg),Sumbuff(Rows)
3530          ON END @Raw GOTO Sum_it
3532          ENTER @Raw;Avgbuff(*)
3534 Sum_it:  MAT Sumbuff= RSUM(Avgbuff)
3536          OUTPUT @Inbuff;Sumbuff(*)
3538          Samples=Samples+Rows
3540          Samples_left=Samples_left-(Rows*No_avg)
3542        END IF
3544      NEXT Block
3546      DEALLOCATE Avgbuff(*),Sumbuff(*)
3548 !    MAT Inbuff= Inbuff/(No_avg)
3550      REDIM Inbuff(Samples)
3552    END SELECT
3554    ASSIGN @Raw TO *
3556    ASSIGN @Inbuff TO *
3558    !
3560    REDIM Indata(MIN(Max_samples,Samples))
3562    MAT Indata= Inbuff
3564    MAT Indata= Indata*(1/No_avg)
3566  SUBEND
3568  !______________________________________________________________________
3570  !
3572 Temp_to_acc:SUB Temp_to_acc(Acc_no,Indata(*))
3574  !
3576  !This module transfers data from the data array to one of the
3578  !accumulators.
3580  !======================================================================
3582    OPTION BASE 1
3584    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
3586    !----------------------------------------------------------------------
3588    SELECT Acc_no
3590    CASE 1
3592      REDIM Acc1(SIZE(Indata,1))
3594      MAT Acc1= (0)
3596      MAT Acc1= Indata
3598    CASE 2
3600      REDIM Acc2(SIZE(Indata,1))
3602      MAT Acc2= (0)
3604      MAT Acc2= Indata
3606    CASE 3
3608      REDIM Acc3(SIZE(Indata,1))
```

```
3610      MAT Acc3= (0)
3612      MAT Acc3= Indata
3614    CASE 4
3616      REDIM Acc4(SIZE(Indata,1))
3618      MAT Acc4= (0)
3620      MAT Acc4= Indata
3622    CASE ELSE
3624      DISP "Accumulator spec out of range: acc = ";Acc_no
3626      BEEP
3628      PAUSE
3630      PRINT "in Acc_to_temp"
3632    END SELECT
3634  SUBEND
3636  !______________________________________________________________________
3638  !
3640  DEF FNSize_acc
3642  !======================================================================
3644    OPTION BASE 1
3646    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
3648    !---------------------------------------------------------------------
3650    RETURN SIZE(Acc1,1)
3652  FNEND
3654  !______________________________________________________________________
3656  !
3658 Plot_label:SUB Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Msg$(*))
3660  !
3662  !  VARIABLES:
3664  !         Xmin->Ymax        Self-explanatory
3666  !         Xlbl$             Label for x-axis
3668  !         Ylbl$             Label for y-axis
3670  !         Msg1-11$          Messages to be printed above graph (Date, etc.)
3672  !======================================================================
3674    OPTION BASE 1
3676    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
3678    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
3680    COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
3682    !---------------------------------------------------------------------
3684    IF SYSTEM$("PLOTTER IS")<>"705" THEN
3686      CALL Crt_plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*))
3688      SUBEXIT
3690    END IF
3692    !
3694    Xtick=-5                                        !Set variables based on
3696    Ytick=-5                                        !number of parameters
3698    Xmajor=-5
3700    Ymajor=-5
3702    Xvalues=-2
3704    Yvalues=-2
3706    !
3708    ON KEY 5,14 RECOVER Exit_plot                   !Abort plot
3710    !
3712    IF SYSTEM$("PLOTTER IS")="705" THEN             !Select plotter
3714      GINIT
3716      PLOTTER IS 705,"HPGL"
3718    ELSE
3720      GINIT
3722      PLOTTER IS 3,"INTERNAL"
3724    END IF
3726    !                                               !Calculate number of ticks
3728    Plotgeo$="Yes"                                  !to use for the scale
```

```
3730    Set_scales(Xmin,Xmax,Ymin,Ymax,Xtick,Ytick,Xmajor,Ymajor,Xvalues,Yvalues
3732    IF Window_flag THEN
3734      Msg$(12)="Data From (s): "&VAL$(Data_start)
3736      Msg$(13)="Data To   (s): "&VAL$(Data_stop)
3738    END IF
3740    ALPHA OFF
3742    GRAPHICS ON
3744    !
3746    DEG                                               !Print title
3748    LDIR 270
3750    LORG 5
3752    CSIZE 5
3754    IF SYSTEM$("PLOTTER IS")="705" THEN
3756      OUTPUT 705;"SP2"
3758    END IF
3760    MOVE 125,(Viewymax*1.1/2)
3762    LABEL (Title$(2))
3764    CSIZE 2
3766    MOVE 122.4,(Viewymax*1.1/2)
3768    LABEL ("vs.")
3770    CSIZE 5
3772    MOVE 119,(Viewymax*1.1/2)
3774    LABEL (Title$(1))
3776    IF SYSTEM$("PLOTTER IS")="705" THEN
3778      OUTPUT 705;"SP"
3780    END IF
3782    !
3784    IF Plotgeo$="Yes" THEN                            !Geotech label
3786      Geotech_label
3788    END IF
3790    !
3792    IF SYSTEM$("PLOTTER IS")="705" THEN               !Labels in top left
3794      OUTPUT 705;"SP1"
3796    END IF
3798    MOVE 118,Viewymax*1.13
3800    LDIR 270
3802    CSIZE 3
3804    LORG 3
3806    LABEL " "&Msg$(1)
3808    MOVE 115,Viewymax*1.13
3810    LABEL " "&Msg$(2)
3812    MOVE 112,Viewymax*1.13
3814    LABEL " "&Msg$(3)
3816    !
3818    MOVE 118,Viewymax*1.1/3                           !Labels in top right
3820    LORG 3
3822    LABEL Msg$(4)&" "
3824    MOVE 115,Viewymax*1.1/3
3826    LABEL Msg$(5)&" "
3828    !
3830    CSIZE 2                                           !Labels in lower top left
3832    LORG 3
3834    MOVE 106,Viewymax*1.1
3836    LABEL Msg$(6)
3838    MOVE 103,Viewymax*1.1
3840    LABEL Msg$(7)
3842    MOVE 100,Viewymax*1.1
3844    LABEL Msg$(8)
3846    !
3848    LORG 3                                            !Labels in lower top right
```

```
3850     MOVE 106,(Viewymin+Viewymax)/2
3852     LABEL Msg$(9)
3854     MOVE 103,(Viewymin+Viewymax)/2
3856     LABEL Msg$(10)
3858     MOVE 100,(Viewymin+Viewymax)/2
3860     LABEL Msg$(11)
3862     MOVE 97,(Viewymin+Viewymax)/2
3864     IF NOT Window_flag THEN
3866       Time_plot$=VAL$(DROUND(Time,4))
3868       LABEL "Truncation Time (s) = "&Time_plot$
3870     ELSE
3872       LABEL Msg$(12)
3874       MOVE 94,(Viewymin+Viewymax)/2
3876       LABEL Msg$(13)
3878     END IF
3880     !
3882     MOVE Viewxmax*1.08/2,Viewymax+(Viewymax*.1)    !Label X-axis
3884     LORG 6
3886     LDIR 0
3888     CSIZE 3
3890     LABEL (Label$(2))
3892     !
3894     LDIR 270                                       !Label Y-axis
3896     LORG 4
3898     MOVE 0,Viewymax*1.08/2
3900     LABEL (Label$(1))
3902     !
3904     VIEWPORT Viewxmin,Viewxmax,Viewymin,Viewymax   !Draw grid
3906     WINDOW Ymin,Ymax,(-1.*Xmax),(-1*Xmin)
3908     CLIP ON
3910     GRID (Ymax-Ymin)/Yvalues,(Xmax-Xmin)/Xvalues,Ymin,-1*Xmin,1,1,2
3912     CLIP OFF
3914     !
3916     CSIZE 3                                        !Number Y-axis
3918     LDIR 270
3920     LORG 8
3922     FOR I=Ymin TO Ymax STEP (Ymax-Ymin)/Yvalues
3924       IF ABS(I)<1.E-4*ABS(Ymax-Ymin) THEN
3926         I_temp=0
3928       ELSE
3930         I_temp=I
3932       END IF
3934       MOVE I_temp,ABS(Xmax-Xmin)*.01-Xmin
3936       LABEL USING "#,K";DROUND(I_temp,3)
3938     NEXT I
3940     !
3942     LORG 9                                         !Number X-axis
3944     FOR I=Xmin*(-1) TO Xmax*1.0001*(-1) STEP (Xmax-Xmin)/Xvalues*(-1)
3946       IF ABS(I)<1.E-4*ABS(Xmax-Xmin) THEN
3948         I_temp=0
3950       ELSE
3952         I_temp=I
3954       END IF
3956       MOVE -.01*ABS(Ymax-Ymin)+Ymin,I_temp
3958       LABEL USING "#,K";DROUND(-1*I_temp,3)
3960     NEXT I
3962     !
3964     LORG 2
3966 Exit_plot:OFF KEY 14
3968   SUBEND
```

```
3970  !________________________________________________________________________
3972  !
3974 Geotech_label:SUB Geotech_label
3976  !
3978  !------------------------------------------------------------------------
3980    OPTION BASE 1
3982    !
3984    IF SYSTEM$("PLOTTER IS")="705" THEN
3986      OUTPUT 705;"SP3"
3988      OUTPUT 705;"SC0,128,0,100"
3990      OUTPUT 705;"FT1"
3992      OUTPUT 705;"PAPU128,0PD"
3994      OUTPUT 705;"PA128,15,127,19,124,19,124,2,125,0"
3996      OUTPUT 705;"PA128,0,127,2,124,2,127,2,127,19,121,19"
3998      OUTPUT 705;"PA121,2,124,2,121,2,122,0,128,0"
4000      OUTPUT 705;"PAPU121,2;RA124,19"
4002      OUTPUT 705;"PAPU127,15.1;RA128,2"
4004      OUTPUT 705;"PAPU127,19;WG4,-90,14"
4006      OUTPUT 705;"PAPU128,0;WG2.1,90,90"
4008      OUTPUT 705;"PAPU125,2;RA127,0"
4010      OUTPUT 705;"PAPU125,0;WG2,90,28"
4012      OUTPUT 705;"SP2;SI.275,.320"
4014      OUTPUT 705;"PAPU124.5,18;DI0,-1;LBGEOTECH"
4016      OUTPUT 705;"SI"
4018      OUTPUT 705;"SC"
4020    ELSE
4022      LDIR 270
4024      CSIZE 4
4026      MOVE 128,0
4028      LORG 9
4030      LABEL "GEOTECH"
4032    END IF
4034 Quit:SUBEND
4036  !________________________________________________________________________
4038  !
4040 Plot_time:SUB Plot_time(Time_inc,Data(*),Xmin,Xmax,Ymin,Ymax,Pen_no,OPTIONA
4042  !
4044  !This module plots the data in Data(*) against time on the plotter.  If
4046  !the optional parameters are present, it then prints the Y-axis data
4048  !identifier Label$ in the upper right hand corner of the graph (redundent
4050  !for one set of data).
4052  !
4054  !Inputs:
4056  !    Time_inc            = interval between data points (X-axis)
4058  !    Data(*)             = data (plotted on Y-axis)
4060  !    Xmin,Xmax,Ymin,Ymax = data limits
4062  !    Line_no             = location of Label$
4064  !    Label$              = graph identifier in multi-graph plots
4066  !========================================================================
4068    OPTION BASE 1
4070    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
4072    !----------------------------------------------------------------------
4074    WINDOW Ymin,Ymax,-1*Xmax,-1*Xmin                    !Setup plot
4076    DEG
4078    CLIP ON
4080    !
4082    IF SYSTEM$("PLOTTER IS")<>"705" THEN          !Plotter is CRT
4084      SELECT NPAR
4086      CASE 7
4088        Crt_plot_time(Time_inc,Data(*),Xmin,Xmax,Ymin,Ymax)
```

```
4090      CASE 9
4092        Crt_plot_time(Time_inc,Data(*),Xmin,Xmax,Ymin,Ymax,Line_no,Label$)
4094      CASE ELSE
4096        PRINT "Unexpected error in plot_time.  Process discontinued."
4098        STOP
4100      END SELECT
4102      GOTO Quit
4104    ELSE
4106      OUTPUT 705;"SP"&VAL$(Pen_no)
4108    END IF
4110    !
4112    Lower_index=MAX(1,INT(Xmin/Time_inc)-1)
4114    Upper_index=MIN(SIZE(Data,1),INT(Xmax/Time_inc)+1)
4116    FOR I=Lower_index TO Upper_index               !Plot data
4118      PLOT Data(I),Time_inc*(-I)
4120    NEXT I
4122    !
4124    IF NPAR=9 THEN                                 !Print label (optional)
4126      CSIZE 2
4128      LDIR 270
4130      LORG 8
4132      MOVE (Ymax)-(Ymax-Ymin)*.02*Line_no,-Xmax
4134      LABEL Label$&" "
4136    END IF
4138    !
4140    PENUP
4142    OUTPUT 705;"SP"
4144    MOVE 0,0
4146 Quit:CLIP OFF
4148  SUBEND
4150  !_____________________________________________________________________
4152  !
4154 Plot_xy:SUB Plot_xy(Data1(*),Data2(*),Xmin,Xmax,Ymin,Ymax,Pen_no,OPTIONAL L
4156  !
4158  !This module plots the data in Data1(*) against that in Data2(*) on the
4160  !plotter.  If the optional parameters are present, it then prints the
4162  !Y-axis data identifier Label$ in the upper right hand corner of the graph
4164  !(redundent for one set of data).
4166  !
4168  !Inputs:
4170  !    Data1(*),data2(*)   = X- and Y-data, respectively
4172  !    Xmin,Xmax,Ymin,Ymax = data limits
4174  !    Line_no             = location of Label$
4176  !    Label$              = graph identifier in multi-graph plots
4178  !    Com /Viewport/      = soft clip
4180  !=====================================================================
4182    OPTION BASE 1
4184    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
4186    !-------------------------------------------------------------------
4188    DEG                                            !Setup plot
4190    WINDOW Ymin,Ymax,Xmax*(-1.),Xmin*(-1)
4192    CLIP ON
4194    !
4196    IF SYSTEM$("PLOTTER IS")<>"705" THEN           !Plot data on CRT
4198      SELECT NPAR
4200      CASE 7
4202        CALL Crt_plot_xy(Data1(*),Data2(*),Xmin,Xmax,Ymin,Ymax)
4204      CASE 9
4206        CALL Crt_plot_xy(Data1(*),Data2(*),Xmin,Xmax,Ymin,Ymax,Line_no,Label
4208      CASE ELSE
```

```
4210        PRINT "Unexpected error in plot_xy.  Process discontinued."
4212        STOP
4214      END SELECT
4216      GOTO Quit
4218    ELSE
4220      OUTPUT 705;"SP"&VAL$(Pen_no)
4222    END IF
4224    !
4226    Window_index(Start_index,Stop_index)
4228    FOR I=Start_index TO Stop_index                  !Plot data
4230      PLOT Data2(I),Data1(I)*(-1)
4232    NEXT I
4234    !
4236    IF NPAR=9 THEN                                   !Print label (optional)
4238      CSIZE 2
4240      LDIR 270
4242      LORG 8
4244      MOVE (Ymax)-(Ymax-Ymin)*.02*Line_no,-Xmax
4246      LABEL Label$&" "
4248    END IF
4250    !
4252    PENUP
4254    OUTPUT 705;"SP"
4256    MOVE 0,0
4258 Quit:CLIP OFF
4260  SUBEND
4262  !______________________________________________________________________
4264  !
4266 Crt_plot_label:SUB Crt_plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*))
4268  !
4270  !  VARIABLES:
4272  !        Xmin->Ymax        Self-explanatory
4274  !        Xlbl$             Label for x-axis
4276  !        Ylbl$             Label for y-axis
4278  !======================================================================
4280    OPTION BASE 1
4282    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
4284    !-------------------------------------------------------------------
4286    DEG
4288    Xtick=-5                                         !Set variables based on
4290    Ytick=-5                                         !number of parameters
4292    Xmajor=-5
4294    Ymajor=-5
4296    Xvalues=-2
4298    Yvalues=-2
4300    !
4302    ON KEY 5,14 RECOVER Exit_plot                    !Exit during plot
4304    !
4306    GINIT                                            !Setup CRT
4308    PLOTTER IS 3,"INTERNAL"
4310    !                                                !Calculate the number of
4312    Plotgeo$="Yes"                                   !ticks for the scale
4314    !
4316    Set_scales(Xmin,Xmax,Ymin,Ymax,Xtick,Ytick,Xmajor,Ymajor,Xvalues,Yvalues
4318    !
4320    ALPHA OFF
4322    GRAPHICS ON
4324    !
4326    MOVE Viewxmax*1.30/2,Viewymax*1.08               !Print title
4328    LORG 5
```

```
4330    LDIR 0
4332    CSIZE 5
4334    LABEL (Title$(2)&" vs. "&Title$(1))
4336    !
4338    MOVE Viewxmax*1.30/2,Viewymin+5                    !Label X_axis
4340    LORG 6
4342    LDIR 0
4344    CSIZE 4
4346    LABEL (Label$(1))
4348    !
4350    LDIR 90                                            !Label Y-axis
4352    LORG 6
4354    MOVE 0,Viewymax*1.08/2
4356    LABEL (Label$(2))
4358    !
4360    !                                                  !Setup plot window
4362    VIEWPORT .100*Viewxmin/.050,.900*Viewxmax/.750,Viewymin+10,.800*Viewymax
4364    WINDOW Xmin,Xmax,Ymin,Ymax
4366    CLIP ON
4368    !
4370    GRID (Xmax-Xmin)/Xvalues,(Ymax-Ymin)/Yvalues,0,0,1,1,2
4372    CLIP OFF
4374    !
4376    CSIZE 3                                            !Print X-axis values
4378    LDIR 0
4380    LORG 6
4382    FOR I=Xmin TO Xmax STEP (Xmax-Xmin)/Xvalues
4384      MOVE I,Ymin-(.01*(Ymax-Ymin))
4386      LABEL USING "#,K";DROUND(I,3)
4388    NEXT I
4390    !
4392    LORG 8                                             !Print Y-axis values
4394    FOR I=Ymin TO Ymax STEP (Ymax-Ymin)/Yvalues
4396      MOVE Xmin-(.005*(Xmax-Xmin)),I
4398      LABEL USING "#,K";DROUND(I,3)
4400    NEXT I
4402    !
4404    LORG 2
4406 Exit_plot:OFF KEY 14
4408  SUBEND
4410  !______________________________________________________________________
4412  !
4414 Crt_plot_time:SUB Crt_plot_time(Time_inc,Data(*),Xmin,Xmax,Ymin,Ymax,OPTION
4416  !
4418  !This module plots the data in Data(*) against time on the CRT.  If the
4420  !optional parameters are present, it then prints the Y-axis data
4422  !identifier Label$ in the upper right hand corner of the graph (redundent
4424  !for one set of data).
4426  !
4428  !Inputs:
4430  !    Time_inc              = interval between data points (X-axis)
4432  !    Data(*)               = data (plotted on Y-axis)
4434  !    Xmin,Xmax,Ymin,Ymax   = data limits (defines the window)
4436  !    Line_no               = location of Label$
4438  !    Label$                = graph identifier in multi-graph plots
4440  !=====================================================================
4442    OPTION BASE 1
4444    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
4446    !-------------------------------------------------------------------
4448    WINDOW Xmin,Xmax,Ymin,Ymax                         !Setup plot
```

```
4450    DEG
4452    CLIP ON
4454    !
4456    Lower_index=MAX(1,INT(Xmin/Time_inc)-1)
4458    Upper_index=MIN(SIZE(Data,1),INT(Xmax/Time_inc)+1)
4460    FOR I=Lower_index TO Upper_index              !Plot data
4462      PLOT Time_inc*I,Data(I)
4464    NEXT I
4466    !
4468    IF NPAR=8 THEN                                !Print label (optional)
4470      CSIZE 3
4472      LDIR 0
4474      LORG 8
4476      MOVE Xmax,(Ymax-Ymin)-(Ymax-Ymin)*.035*Line_no
4478      LABEL Label$&" "
4480    END IF
4482    !
4484    CLIP OFF
4486  SUBEND
4488  !______________________________________________________________________
4490  !
4492 Crt_plot_xy:SUB Crt_plot_xy(Data1(*),Data2(*),Xmin,Xmax,Ymin,Ymax,OPTIONAL
4494  !
4496  !This module plots the data in Data1(*) against that in Data2(*) on the
4498  !CRT.  If the optional parameters are present, it then prints the Y-axis
4500  !data identifier Label$ in the upper right hand corner of the graph
4502  !(redundent for one set of data).
4504  !
4506  !Inputs:
4508  !     Data1(*),data2(*)   = X- and Y-data, respectively
4510  !     Xmin,Xmax,Ymin,Ymax = data limits (defines the window)
4512  !     Line_no             = location of Label$
4514  !     Label$              = graph identifier in multi-graph plots
4516  !======================================================================
4518    OPTION BASE 1
4520    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
4522    !----------------------------------------------------------------------
4524    DEG                                           !Setup plot
4526    WINDOW Xmin,Xmax,Ymin,Ymax
4528    CLIP ON
4530    !
4532    Window_index(Start_index,Stop_index)
4534    FOR I=Start_index TO Stop_index               !Plot data
4536      PLOT Data1(I),Data2(I)
4538    NEXT I
4540    !
4542    IF NPAR=8 THEN                                !Plot label (optional)
4544      CSIZE 3
4546      LDIR 0
4548      LORG 8
4550      MOVE Xmax,(Ymax-Ymin)-(Ymax-Ymin)*.035*Line_no
4552      LABEL Label$&" "
4554    END IF
4556    !
4558    CLIP OFF
4560  SUBEND
4562  !______________________________________________________________________
4564  !
4566 Change_plotter:SUB Change_plotter(Plotter)
4568  !
```

```
4570  !This module selects one of the plot devices avaliable.
4572  !
4574  !Input:
4576  !   plotter = "0" to change the plotter to the other device
4578  !           = "6" to change the plotter to the CRT
4580  !           = "705" to change to the external plotter
4582  !=========================================================================
4584    OPTION BASE 1
4586    !
4588    DISP CHR$(129)
4590    !
4592 Select_plotter:                                      !
4594    SELECT Plotter
4596    CASE 0                                            !Switch plot device
4598      IF SYSTEM$("PLOTTER IS")="6" THEN
4600        ON TIMEOUT 7,10 GOTO No_plotter
4602        PLOTTER IS 705,"HPGL"
4604        OUTPUT 705;"SP0"
4606        OFF TIMEOUT
4608        GOSUB Paper
4610      ELSE
4612        PLOTTER IS CRT,"INTERNAL"
4614      END IF
4616    CASE 6                                            !Select CRT
4618      PLOTTER IS CRT,"INTERNAL"
4620    CASE 705                                          !Select plotter
4622      ON TIMEOUT 7,10 GOTO No_plotter
4624      PLOTTER IS 705,"HPGL"
4626      OFF TIMEOUT
4628      GOSUB Paper
4630    CASE ELSE
4632      PRINT TABXY(1,19);"No such PLOTTER!?! in ""Change_plotter"""
4634      PAUSE
4636    END SELECT
4638    !
4640    DISP CHR$(128)
4642    SUBEXIT
4644    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4646 Paper:                                               !Check for paper
4648    OUTPUT 705;"OS"
4650    ENTER 705;Status
4652    IF NOT (Status=16 OR Status=24) THEN
4654      PRINT TABXY(1,19);"PLOTTER ERROR! Check paper properly loaded."
4656      Ans$="y"
4658      INPUT " PLOTTER ERROR corrected? (Default is yes) ",Ans$
4660      IF UPC$(Ans$[1,1])<>"Y" THEN
4662        DISP "Plot ABORTED."
4664        WAIT 3
4666        PLOTTER IS CRT,"INTERNAL"
4668      END IF
4670      OUTPUT KBD;"K";
4672      IF UPC$(Ans$[1,1])="Y" THEN GOTO Paper
4674    END IF
4676    RETURN
4678    !
4680 No_plotter:                                          !
4682    Ans$="y"
4684    PRINT "PLOTTER not found!?!...(check power, cables, etc.)"
4686    INPUT " PLOTTER ready? (Default is yes) ",Ans$
4688    IF UPC$(Ans$[1,1])="Y" THEN
```

```
4690      GOTO Select_plotter
4692    ELSE
4694      PLOTTER IS CRT,"INTERNAL"
4696    END IF
4698    DISP CHR$(128)
4700  SUBEND
4702  !_____________________________________________________________________
4704  !
4706 Set_scales:SUB Set_scales(Xmin,Xmax,Ymin,Ymax,Xtick,Ytick,Xmajor,Ymajor,Xva
4708    COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
4710          !
4712  ! TO ALLOW FOR A SELECTED TIME WINDOW OF DATA TO BE PLOTTED
4714  !PAUL SPENCER DEC 04 1988
4716  !  Set_scales                       Last mod: 02/08/86
4718  !
4720  !  Purpose: to check for 0 values of Ymax and Xmax
4722  !           to separate into a separate subprogram
4724  !
4726  !
4728  !  This subprogram modifies the max and min limits before plotting
4730  !  given the limits of the data.  It also sets the tick marks, etc.
4732  !  for the Plot_label subprogram.
4734  !  It is called from the Plot_label subprogram.
4736  !  VARIABLES:
4738  !         Xmin->Ymax        Limits of the data, rounded in program.
4740  !         Xtick             Number of ticks on the x axis
4742  !         Ytick             Number of ticks on the y axis
4744  !         Xmajor,Ymajor     Number of minor ticks per major tick
4746  !         Xnos,Ynos         Number of values printed on each axis
4748  !
4750  !-----------------------------------------------------------------
4752    DIM Tick_array(1:20),Major_array(1:20),Value_array(1:20)
4754    INTEGER Range_calc
4756    !
4758    Range_calc=0
4760    DISP "Setting scales...."
4762     !----------------------------!
4764  ! This puts the values of tick marks, major ticks, values into arrays.
4766     !----------------------------!
4768    READ Tick_array(*)
4770    READ Major_array(*)
4772    READ Value_array(*)
4774  !       1   2   3  4  5   6  7  8  9  10 11 12 13 14 15 16 17 18 19  20
4776    DATA 100,100,60,80,100,60,70,80,90,100,55,60,65,70,75,80,85,90,95,100
4778    DATA  10, 25,10,10, 10,10,10,10,10, 10, 5,10, 5,10,15,10,10,20,10, 20
4780    DATA   5,  4, 6, 4, 5 , 6, 7, 4, 9,  5,11, 6,13, 7, 5, 8,17, 9, 9,  5
4782  !--------------------------------
4784  ! This adjusts the values of Ymin and Ymax
4786  !--------------------------------
4788 Set_y_scales:   !
4790    IF Ymax<>0 THEN                                ! Check for 0 value
4792      Maxpower=INT(LGT(ABS(Ymax)))
4794      Maxmantissa=10^FRACT(LGT(ABS(Ymax)))
4796      IF Ymax<0 THEN
4798        Maxmantissa=-1*Maxmantissa
4800      END IF
4802    ELSE
4804      Maxpower=1
4806      Maxmantissa=0
4808    END IF
```

```
4810    IF Ymin<>0 THEN                             ! Check for 0 value
4812      Minpower=INT(LGT(ABS(Ymin)))
4814      Minmantissa=10^FRACT(LGT(ABS(Ymin)))
4816      IF Ymin<0 THEN
4818        Minmantissa=-1*Minmantissa
4820      END IF
4822    ELSE
4824      Minpower=1
4826      Minmantissa=0
4828    END IF
4830    Signsum=SGN(Ymax)+SGN(Ymin)                 ! SELECT the sum of the
4832    SELECT Signsum                              ! signs of Ymax and Ymin
4834    !
4836    CASE 2,1                                    ! CASE both positive, or
4838      Minmantissa=0                             ! one positive, one zero
4840      I=0
4842      LOOP
4844        I=I+1
4846        IF Maxmantissa<I THEN
4848          Maxmantissa=I
4850        END IF
4852      EXIT IF Maxmantissa=I
4854      END LOOP
4856    !
4858    CASE -2,-1                                  ! CASE both negative, or
4860      Maxmantissa=0                             ! one negative, one zero
4862      I=0
4864      LOOP
4866        I=I-1
4868        IF Minmantissa>I THEN
4870          Minmantissa=I
4872        END IF
4874      EXIT IF Minmantissa=I
4876      END LOOP
4878    !
4880    CASE 0                                      ! CASE one negative and
4882      I=0                                       ! one positive
4884      LOOP
4886        I=I+1
4888        IF Maxmantissa<I THEN
4890          Maxmantissa=I
4892        END IF
4894      EXIT IF Maxmantissa=I
4896      END LOOP
4898      I=0
4900      LOOP
4902        I=I-1
4904        IF Minmantissa>I THEN
4906          Minmantissa=I
4908        END IF
4910      EXIT IF Minmantissa=I
4912      END LOOP
4914      IF Maxpower>Minpower THEN
4916        Minmantissa=-1.0
4918        Minpower=Maxpower
4920      END IF
4922      IF Minpower>Maxpower THEN
4924        Maxmantissa=1.0
4926        Maxpower=Minpower
4928      END IF
```

```
4930     !
4932     CASE ELSE
4934       PRINT "SIGNSUM INCORRECT"
4936       PAUSE  !
4938     END SELECT
4940     Ymax=Maxmantissa*10^Maxpower
4942     Ymin=Minmantissa*10^Minpower
4944     GOSUB Y_limits
4946   !--------------------------------!
4948   ! If automatic sequence is being executed,
4950   ! use predefined time window to set X-axis.
4952   !--------------------------------!
4954     IF Seq_flag=1 THEN
4956       GOTO Set_to_window
4958     ELSE
4960       GOTO Set_x_scales
4962     END IF
4964   !--------------------------------
4966   ! Set Ytick, Ymajor, Yvalues (Subroutine)
4968   !--------------------------------
4970 Y_limits:      !
4972     IF Range_calc=0 THEN
4974       Yrange=10^FRACT(LGT(ABS(Ymax-Ymin)))
4976     END IF
4978     IF Yrange<>0 THEN
4980   !   IF Auto<>-1 THEN PRINT TABXY(64,1);"Range=";Yrange
4982       Ytick=Tick_array(Yrange)
4984       Ymajor=Major_array(Yrange)
4986       Yvalues=Value_array(Yrange)
4988     ELSE
4990       PRINT "RANGE=0:  error in Auto_scale subprogram (Set_y_scales)"
4992       PAUSE
4994     END IF
4996     RETURN
4998   !--------------------------------
5000   ! This adjusts the values of Xmin and Xmax
5002   !--------------------------------
5004 Set_x_scales:  !
5006     IF Xmax<>0 THEN                              ! Check for 0 value
5008       Maxpower=INT(LGT(ABS(Xmax)))
5010       Maxmantissa=10^FRACT(LGT(ABS(Xmax)))
5012       IF Xmax<0 THEN
5014         Maxmantissa=-1*Maxmantissa
5016       END IF
5018     ELSE
5020       Maxpower=1
5022       Maxmantissa=0
5024     END IF
5026     IF Xmin<>0 THEN                              ! Check for 0 value
5028       Minpower=INT(LGT(ABS(Xmin)))
5030       Minmantissa=10^FRACT(LGT(ABS(Xmin)))
5032       IF Xmin<0 THEN
5034         Minmantissa=-1*Minmantissa
5036       END IF
5038     ELSE
5040       Minpower=0
5042       Minmantissa=0
5044     END IF
5046     Signsum=SGN(Xmax)+SGN(Xmin)                  ! SELECT the sum of the
5048     SELECT Signsum                               ! signs of Xmax and Xmin
```

```
5050     !
5052     CASE 2,1                                        ! CASE both positive, or
5054       Minmantissa=0                                 ! one positive, one zero
5056       I=0
5058       LOOP
5060         I=I+1
5062         IF Maxmantissa<I THEN
5064           Maxmantissa=I
5066         END IF
5068       EXIT IF Maxmantissa=I
5070       END LOOP
5072     !
5074     CASE -2,-1                                      ! CASE both negative, or
5076       Maxmantissa=0                                 ! one negative, one zero
5078       I=0
5080       LOOP
5082         I=I-1
5084         IF Minmantissa>I THEN
5086           Minmantissa=I
5088         END IF
5090       EXIT IF Minmantissa=I
5092       END LOOP
5094     !
5096     CASE 0                                          ! CASE one negative,
5098       I=0                                           ! one positive
5100       LOOP
5102         I=I+1
5104         IF Maxmantissa<I THEN
5106           Maxmantissa=I
5108         END IF
5110       EXIT IF Maxmantissa=I
5112       END LOOP
5114       I=0
5116       LOOP
5118         I=I-1
5120         IF Minmantissa>I THEN
5122           Minmantissa=I
5124         END IF
5126       EXIT IF Minmantissa=I
5128       END LOOP
5130       IF Maxpower>Minpower THEN
5132         Minmantissa=-1.0
5134         Minpower=Maxpower
5136       END IF
5138       IF Minpower>Maxpower THEN
5140         Maxmantissa=1.0
5142         Maxpower=Minpower
5144       END IF
5146     !
5148     CASE ELSE
5150       PRINT "SIGNSUM INCORRECT"
5152       PAUSE  !
5154     END SELECT
5156     Xmax=Maxmantissa*10^Maxpower
5158     Xmin=Minmantissa*10^Minpower
5160     GOSUB X_limits
5162     GOTO Set_keys
5164   !--------------------------------
5166   ! Set Xtick, Xmajor, Xvalues (Subroutine)
5168   !--------------------------------
```

```
5170 X_limits:   !
5172    IF Range_calc=0 THEN
5174      Xrange=10^FRACT(LGT(ABS(Xmax-Xmin)))
5176    END IF
5178    IF Xrange<>0 THEN
5180 !    IF Auto<>-1 THEN PRINT TABXY(25,1);"Range=";Xrange
5182      Xtick=Tick_array(Xrange)
5184      Xmajor=Major_array(Xrange)
5186      Xvalues=Value_array(Xrange)
5188    ELSE
5190      PRINT "RANGE=0:  error in Auto_scale subprogram (Set_x_scales)"
5192      PAUSE
5194    END IF
5196    RETURN
5198 !--------------------------------
5200 ! Display values
5202 !--------------------------------
5204 Set_keys:                                       !
5206    STATUS 1,12;Keys_status
5208    IF Keys_status=1 OR Keys_status=0 THEN
5210      OUTPUT KBD;"!";
5212    END IF
5214    ON KEY 1 LABEL "  Con-   tinue  " GOTO No_changes
5216    ON KEY 2 LABEL " Change  values " GOTO Change_values
5218    ON KEY 3 LABEL " Recal-  culate " GOTO Recalc
5220    ON KEY 4 LABEL " Change  range  " GOTO Change_range
5222 ! ON KEY 5 LABEL " Set to  window " GOTO Set_to_window
5224    ON KEY 5 LABEL "                " GOTO Loope_start
5226    ON KEY 6 LABEL " GEO lbl   ON   " GOTO Set_geo_lbl
5228    ON KEY 7 LABEL "                " GOTO Loope_start
5230    ON KEY 8 LABEL "                " GOTO Loope_start
5232    IF Computer$<>"9816" THEN
5234      ON KEY 1 LABEL "  Con-   tinue  ",3 GOTO No_changes
5236      ON KEY 3 LABEL " Recal-  culate ",3 GOTO Recalc
5238    END IF
5240    !
5242 Satisfied: !
5244    IF Auto=(-1) THEN GOTO End_auto_scale
5246    GRAPHICS OFF
5248    OUTPUT KBD;"K";
5250    PRINT TABXY(0,1);"X-axis maximum=";Xmax;"       ";TABXY(40,1);"Range=";Xr
5252    PRINT TABXY(0,2);"X-axis minimum=";Xmin;"       "
5254    PRINT TABXY(0,3);"There are";Xtick;"ticks, each";(Xmax-Xmin)/Xtick;"unit
5256    PRINT TABXY(0,4);"Every";Xmajor;"ticks there's a major tick.        "
5258    PRINT TABXY(0,5);"There are";Xvalues;"values on the axis.        "
5260    PRINT TABXY(0,8);"Y-axis maximum=";Ymax;"       ";TABXY(40,8);"Range=";Yr
5262    PRINT TABXY(0,9);"Y-axis minimum=";Ymin;"   "
5264    PRINT TABXY(0,10);"There are";Ytick;"ticks, each";(Ymax-Ymin)/Ytick;"uni
5266    PRINT TABXY(0,11);"Every";Ymajor;"ticks there's a major tick.     "
5268    PRINT TABXY(0,12);"There are";Yvalues;"values on the axis.     "
5270    IF Window_flag THEN
5272      PRINT TABXY(0,13);"Data Start Time (s) =";Data_start
5274      PRINT TABXY(0,14);"Data Stop Time  (s) =";Data_stop
5276      PRINT TABXY(0,16);"Plot GEOTECH label - ";Plotgeo$
5278    ELSE
5280      PRINT TABXY(0,14);"Plot GEOTECH label - ";Plotgeo$
5282    END IF
5284 !--------------------------------
5286 ! If correct, continue.  If (R)ecalc, then calculate Xtick, etc.
5288 ! If (C)hange range, then calculate Xtick, etc. without calc. range.
```

```
5290  !--------------------------------
5292    !
5294 Loope_start:DISP "AUTOSCALE MENU"
5296    GOTO Loope_start
5298    !
5300 Recalc:   !
5302    GOSUB Y_limits
5304    GOSUB X_limits
5306    GOTO Satisfied!??????
5308 Set_to_window: !
5310    Xmin=Start_time
5312    Xmax=Stop_time
5314    GOSUB X_limits
5316    GOTO Satisfied!??????
5318 Change_range:   !
5320      !-----
5322    PRINT TABXY(40,1);"Range=";CHR$(129);Xrange;CHR$(128)
5324    INPUT "Range= ",Xrange
5326    PRINT TABXY(40,1);"Range=";Xrange;"    "
5328      !-----
5330    PRINT TABXY(40,8);"Range=";CHR$(129);Yrange;CHR$(128)
5332    INPUT "Range= ",Yrange
5334    PRINT TABXY(40,8);"Range=";Yrange;"    "
5336      !-----
5338    Range_calc=1
5340    GOSUB Y_limits
5342    GOSUB X_limits
5344    Range_calc=0
5346    GOTO Satisfied  !??????
5348  !--------------------------------
5350  ! Change the values for Xmin, etc. manually
5352  !--------------------------------
5354 Change_values: !
5356    Inv$=CHR$(129)
5358    Nor$=CHR$(128)
5360    PRINT TABXY(0,1);"X-axis maximum=";Inv$;Xmax;Nor$
5362    INPUT "Xmax = ",Xmax
5364    PRINT TABXY(0,1);"X-axis maximum=";Xmax;"       "
5366      !-----
5368    PRINT TABXY(40,1);"Range=";Xrange
5370      !-----
5372    PRINT TABXY(0,2);"X-axis minimum=";Inv$;Xmin;Nor$
5374    INPUT "Xmin = ",Xmin
5376    PRINT TABXY(0,2);"X-axis minimum=";Xmin;"       "
5378      !-----
5380    PRINT TABXY(0,3);"There are";Inv$;Xtick;Nor$;"ticks, each";(Xmax-Xmin)/X
5382    INPUT "Xtick = ",Xtick
5384    PRINT TABXY(0,3);"There are";Xtick;"ticks, each";(Xmax-Xmin)/Xtick;"unit
5386      !-----
5388    PRINT TABXY(0,4);"Every";Inv$;Xmajor;Nor$;"ticks there's a major tick."
5390    INPUT "Xmajor = ",Xmajor
5392    PRINT TABXY(0,4);"Every";Xmajor;"ticks there's a major tick.   "
5394      !-----
5396    PRINT TABXY(0,5);"There are";Inv$;Xvalues;Nor$;"values on the axis."
5398    INPUT "Xvalues = ",Xvalues
5400    PRINT TABXY(0,5);"There are";Xvalues;"values on the axis.        "
5402      !-----
5404    PRINT TABXY(0,8);"Y-axis maximum=";Inv$;Ymax;Nor$
5406    INPUT "Ymax = ",Ymax
5408    PRINT TABXY(0,8);"Y-axis maximum=";Ymax;"       "
```

```
5410    PRINT TABXY(40,8);"Range=";Yrange
5412      !-----
5414    PRINT TABXY(0,9);"Y-axis minimum=";Inv$;Ymin;Nor$
5416    INPUT "Ymin = ",Ymin
5418    PRINT TABXY(0,9);"Y-axis minimum=";Ymin;"                    "
5420      !-----
5422    PRINT TABXY(0,10);"There are";Inv$;Ytick;Nor$;"ticks, each";(Ymax-Ymin)/
5424    INPUT "Ytick = ",Ytick
5426    PRINT TABXY(0,10);"There are";Ytick;"ticks, each";(Ymax-Ymin)/Ytick;"uni
5428      !-----
5430    PRINT TABXY(0,11);"Every";Inv$;Ymajor;Nor$;"ticks there's a major tick."
5432    INPUT "Ymajor = ",Ymajor
5434    PRINT TABXY(0,11);"Every";Ymajor;"ticks there's a major tick.   "
5436      !-----
5438    PRINT TABXY(0,12);"There are";Inv$;Yvalues;Nor$;"values on the axis."
5440    INPUT "Yvalues = ",Yvalues
5442    PRINT TABXY(0,12);"There are";Yvalues;"values on the axis.          "
5444      !-----
5446    !
5448 Input_window:   !
5450    IF Window_flag THEN
5452      PRINT TABXY(0,13);"Data Start Time (s) =";Inv$;Data_start;Nor$
5454      INPUT "Data Start Time (s) =",Data_start
5456      PRINT TABXY(0,13);"Data Start Time (s) =";Data_start
5458      !-----
5460      PRINT TABXY(0,14);"Data Stop Time  (s) =";Inv$;Data_stop;Nor$
5462      INPUT "Data Stop Time  (s) = ",Data_stop
5464      PRINT TABXY(0,14);"Data Stop Time  (s) =";Data_stop
5466      IF Data_stop<=Data_start THEN
5468        DISP "START TIME >= STOP TIME"
5470        BEEP
5472        GOTO Input_window
5474      END IF
5476    END IF
5478 Set_geo_lbl:                                             !
5480    SELECT UPC$(Plotgeo$[1,1])
5482    CASE "N"
5484      Plotgeo$="Yes"
5486      ON KEY 6 LABEL " GEO lbl   ON   " GOTO Set_geo_lbl
5488    CASE "Y"
5490      Plotgeo$="No"
5492      ON KEY 6 LABEL " GEO lbl  OFF   " GOTO Set_geo_lbl
5494    END SELECT
5496      !-----
5498    GOTO Satisfied  !??????
5500    !
5502 No_changes:   !
5504    STATUS 1,12;Keys_status
5506    IF Keys_status=2 THEN
5508      OUTPUT KBD;"!";
5510    END IF
5512    OUTPUT KBD;"K";
5514 End_auto_scale:!
5516  SUBEND
5518  !____________________________________________________________________
5520  !
5522 Set_time:SUB Set_time
5524  !
5526  !====================================================================
5528    OPTION BASE 1
```

```
5530    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
5532    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
5534    COM /Msus/ Msus_raw$,File_name1$
5536    COM /Sum_range/ REAL Min_ch(*),Max_ch(*)
5538    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
5540    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
5542    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
5544    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
5546    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
5548    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
5550    COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
5552    !-----------------------------------------------------------------------
5554    ALLOCATE Label$(2)[30],Title$(2)[25]
5556    !
5558    Time=Duration                                     !Set variables
5560    Max_samples=No_samples
5562    X_inc=Duration/No_samples
5564    !
5566    Menu_select=2                                     !Load menu
5568    Build_menu(Buff_id$(*),Buff_title$(*))
5570 Menu:                                                !
5572    Menu_line=4                                       !Menu y-position
5574    Indent=27                                         !Menu x-position
5576    Print_menu
5578    GOSUB Menu_keys
5580    CONTROL 1,12;2                                    ! (Menu keys lit)
5582    !
5584 Spin:                                                !Zzzz..........
5586    GOTO Spin
5588    !
5590 Get_channel:                                         !
5592    Acc_no=1
5594    Raw_to_acc(Buff_id$(Ch,1),Acc_no)
5596    MAT Acc1= Acc1*(Gain(Ch,1))
5598    Init_acc_size=SIZE(Acc1,1)
5600    !
5602    Xmin=0                                            !Set plot limits
5604    Xmax=Time
5606    Ymin=MIN(Acc1(*))
5608    Ymax=MAX(Acc1(*))
5610    !
5612    Title$(1)="TIME"                                  !Define labels
5614    Title$(2)=Buff_title$(Ch,1)
5616    Label$(1)="TIME (Sec)"
5618    Label$(2)=Buff_title$(Ch,1)&" ("&Buff_units$(Ch,1)&")"
5620    !
5622    Time_inc=Duration/(SIZE(Acc1,1))
5624    !
5626 Again:                                               !Plot data
5628    Pen=3
5630    Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
5632    Plot_time(Time_inc,Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen)
5634    !
5636 Change_time:                                         !Truncate data
5638    BEEP
5640    Ans$="n"
5642    DISP CHR$(129)
5644    INPUT " Truncate DATA? (Default is no) ",Ans$
5646    IF UPC$(Ans$[1,1])="Y" THEN
5648      INPUT " Enter new TRUNCATE TIME ",Time
```

```
5650      DISP CHR$(128)
5652      IF Time<=0 OR Time>Duration THEN Change_time
5654      Max_samples=INT(Init_acc_size*Time/Duration)
5656      REDIM Acc1(Max_samples)
5658      Xmax=Time
5660      OUTPUT KBD;"K";
5662      GOTO Again
5664    END IF
5666    !
5668 Change_channel:
5670    Ans$="n"
5672    INPUT " Select different CHANNEL? (Default is no) ",Ans$
5674    DISP CHR$(128)
5676    IF UPC$(Ans$[1,1])="Y" THEN
5678      OUTPUT KBD;"K";
5680      Max_samples=No_samples
5682      Time=Duration
5684      GOTO Menu
5686    END IF
5688    !
5690    Data_start=0
5692    Data_stop=Time
5694    OUTPUT KBD;"K";
5696    DEALLOCATE Label$(*),Title$(*)
5698    SUBEXIT
5700    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5702 Menu_keys:                                              !Setup menu keys
5704    ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
5706    ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
5708    ON KEY 3 LABEL "                 " GOSUB Not_used
5710    ON KEY 4 LABEL "                 " GOSUB Not_used
5712    ON KEY 5 LABEL " SELECT          " GOTO Selector
5714    ON KEY 6 LABEL "                 " GOSUB Not_used
5716    ON KEY 7 LABEL "                 " GOSUB Not_used
5718    ON KEY 8 LABEL "                 " GOSUB Not_used
5720    RETURN
5722    !
5724 Selector:                                               !Select plot
5726    OFF KEY
5728    OUTPUT KBD;"K";
5730    CONTROL 1,12;1                                       ! (Menu keys lit)
5732    PRINT CHR$(128)
5734    Ch=VAL(Menu_3$(Menu_line-Min_line+1)[2,3])
5736    GOTO Get_channel
5738    !
5740 Not_used:                                               !Undefined key
5742    RETURN
5744  SUBEND
5746  !____________________________________________________________________
5748  !
5750 Exit:SUB Exit
5752  !
5754  !Exit module
5756  !--------------------------------------------------------------------
5758    OPTION BASE 1
5760    !
5762    OUTPUT KBD;"K";
5764    CONTROL 2,2;0
5766    CONTROL 1.12;2
5768    LOAD "AUTOST",1
```

```
5770  SUBEND
5772  !______________________________________________________________________
5774  !
5776 Chg_disk:SUB Chg_disk(Msus$)
5778  !
5780  !This module toggles the specified msus.
5782  !----------------------------------------------------------------------
5784    OPTION BASE 1
5786    !
5788    IF Msus$[2,7]="HP9133" THEN
5790      PRINT TABXY(1,19);
5792      IF VAL(Msus$[13,13])=0 THEN PRINT "Source disk is HARD.";
5794      IF VAL(Msus$[13,13])=1 THEN PRINT "Source disk is FLOPPY.";
5796      Ans$="n"
5798      INPUT " Change source DISK? (Default is no) ",Ans$
5800      IF UPC$(Ans$[1,1])="Y" THEN
5802        PRINT TABXY(1,19);RPT$(" ",80);
5804        DISP ""
5806        SELECT VAL(Msus$[13,13])
5808        CASE 0
5810          Msus$[13,13]="1"
5812          PRINT "Source disk is FLOPPY."
5814        CASE 1
5816          Msus$[13,13]="0"
5818          PRINT "Source disk is HARD."
5820        END SELECT
5822        Chg_disk(Msus$)
5824      END IF
5826    END IF
5828    PRINT TABXY(1,19);RPT$(" ",80);
5830  SUBEND
5832  !______________________________________________________________________
5834  !
5836 Move_up:SUB Move_up
5838  !
5840  !======================================================================
5842    OPTION BASE 1
5844    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
5846    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
5848    !-------------------------------------------------------------------
5850    !
5852    SELECT Menu_select
5854    CASE 1
5856      PRINT TABXY(Indent,Menu_line);CHR$(128);Menu_1$(Menu_line-Min_line+1)
5858      GOSUB Move
5860      PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_1$(Menu_line-Min_line+1);
5862    CASE 2,3,4
5864      PRINT TABXY(Indent,Menu_line);CHR$(128);Menu_3$(Menu_line-Min_line+1)
5866      GOSUB Move
5868      PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_3$(Menu_line-Min_line+1);
5870    CASE 5,6
5872      PRINT TABXY(Indent,Menu_line);CHR$(128);Menu_4$(Menu_line-Min_line+1)
5874      GOSUB Move
5876      PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_4$(Menu_line-Min_line+1);
5878    CASE ELSE
5880      PRINT "Error in Move_up."
5882      PAUSE
5884    END SELECT
5886    PRINT CHR$(128)
5888    SUBEXIT
```

```
5890    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5892 Move:                                                   !
5894    Menu_line=Menu_line-1
5896    IF Menu_line<Min_line THEN
5898      Menu_line=Max_line
5900    END IF
5902    RETURN
5904  SUBEND
5906  !____________________________________________________________________________
5908  !
5910 Move_down:SUB Move_down
5912  !
5914  !========================================================================
5916    OPTION BASE 1
5918    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
5920    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
5922    !--------------------------------------------------------------------
5924    !
5926    SELECT Menu_select
5928    CASE 1
5930      PRINT TABXY(Indent,Menu_line);CHR$(128);Menu_1$(Menu_line-Min_line+1)
5932      GOSUB Move
5934      PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_1$(Menu_line-Min_line+1);
5936    CASE 2,3,4
5938      PRINT TABXY(Indent,Menu_line);CHR$(128);Menu_3$(Menu_line-Min_line+1)
5940      GOSUB Move
5942      PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_3$(Menu_line-Min_line+1);
5944    CASE 5,6
5946      PRINT TABXY(Indent,Menu_line);CHR$(128);Menu_4$(Menu_line-Min_line+1)
5948      GOSUB Move
5950      PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_4$(Menu_line-Min_line+1);
5952    CASE ELSE
5954      PRINT "Error in Move_down."
5956      PAUSE
5958    END SELECT
5960    PRINT CHR$(128)
5962    SUBEXIT
5964    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5966 Move:                                                   !
5968    Menu_line=Menu_line+1
5970    IF Menu_line>Max_line THEN
5972      Menu_line=Min_line
5974    END IF
5976    RETURN
5978  SUBEND
5980  !____________________________________________________________________________
5982 Build_menu:SUB Build_menu(Buff_id$(*),Buff_title$(*))
5984  !
5986  !========================================================================
5988    OPTION BASE 1
5990    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
5992    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
5994    COM /Msus/ Msus_raw$,File_name1$
5996    !--------------------------------------------------------------------
5998    Test_type$=UPC$(File_name1$[1,1])
6000    Entries=0
6002    SELECT Menu_select
6004    !
6006    CASE 1                                        !Master graph menu
6008      Entries=SIZE(Menu_1$,1)
```

```
6010 Menu_1:                                                      !
6012      DATA " Axial Stress                    vs.   Time "
6014      DATA " Axial Stress                    vs.   Axial & Diametral Strain "
6016      DATA " Axial & Diametral Strain        vs.   Time "
6018      DATA " Confining Stress                vs.   Time "
6020      DATA " Confining Stress                vs.   Axial & Diametral Strain "
6022      DATA " Confining Stress                vs.   Axial Stress "
6024      DATA " Volumetric Strain               vs.   Time "
6026      DATA " Volumetric Strain               vs.   Stress "
6028      DATA " Channel                         vs.   Time "
6030      DATA " Channel                         vs.   Channel "
6032      DATA " Set time                              (Truncate data) "
6034      DATA " Pressure Panel                  vs.   Applied Load"
6036      DATA " Filter Medof                    vs.   Time       "
6038      DATA " Volumetric Strain               vs.   Strain "
6040      DATA " Channel Statistics Routine                  "
6042      RESTORE Menu_1
6044      READ Menu_1$(*)
6046    !
6048    CASE 2,3,4                                  !Select channel menu
6050      FOR Line=1 TO SIZE(Buff_id$,1)
6052        IF Buff_id$(Line,1)<>"#" THEN
6054          Entries=Entries+1
6056          IF Line<10 THEN
6058            Menu_3$(Entries)="  "&VAL$(Line)&"    "&Buff_title$(Line,1)&" "
6060          ELSE
6062            Menu_3$(Entries)=" "&VAL$(Line)&"    "&Buff_title$(Line,1)&" "
6064          END IF
6066        END IF
6068      NEXT Line
6070    !
6072    CASE 5,6
6074      SELECT Test_type$
6076      CASE "X"
6078        Menu_4$(1)=" 50    Calc Displacement"
6080        Menu_4$(2)=" 51    Layer Thickness"
6082        Menu_4$(3)=" 52    Mean Plate Pressure"
6084        Entries=3
6086        IF File_name1$="X977" OR File_name1$="X976" OR File_name1$="X975" OR
6088        Menu_4$(4)=" 53    Mean Sample Density"
6090        Entries=4
6092        END IF
6094      CASE "Y"
6096        Menu_4$(1)=" 50    Layer Thickness"
6098        Menu_4$(2)=" 51    Plunger Pressure"
6100        Entries=2
6102      !
6104      CASE ELSE
6106        Entries=0
6108      END SELECT
6110    CASE ELSE
6112      PRINT "Error in Build_menu."
6114      PAUSE
6116    END SELECT
6118  SUBEND
6120  !____________________________________________________________________
6122  !
6124 Print_menu:SUB Print_menu
6126  !
6128  !====================================================================
```

```
6130     OPTION BASE 1
6132     COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
6134     COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
6136     !----------------------------------------------------------------------
6138     !
6140     OUTPUT KBD;Clear_screen$;Home$;
6142     PRINT CHR$(128)
6144     CONTROL 2,2;1
6146     Min_line=Menu_line
6148     Max_line=Min_line+Entries-1
6150     !
6152     SELECT Menu_select
6154     CASE 1
6156       PRINT TABXY(20,2);"***** MASTER GRAPH SELECTION MENU *****"
6158       PRINT
6160       FOR Line=1 TO Entries
6162         PRINT TABXY(Indent,Min_line+Line-1);Menu_1$(Line)
6164       NEXT Line
6166       PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_1$(1)
6168     CASE 2
6170       PRINT TABXY(21,2);"*****  SET TIME SELECTION MENU  *****"
6172       PRINT
6174       FOR Line=1 TO Entries
6176         PRINT TABXY(Indent,Min_line+Line-1);Menu_3$(Line)
6178       NEXT Line
6180       PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_3$(1)
6182     CASE 3
6184       PRINT TABXY(18,2);"*****  CHANNEL vs TIME SELECTION MENU  *****"
6186       PRINT
6188       FOR Line=1 TO Entries
6190         PRINT TABXY(Indent,Min_line+Line-1);Menu_3$(Line)
6192       NEXT Line
6194       PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_3$(1)
6196     CASE 4
6198       PRINT TABXY(16,2);"*****  CHANNEL vs CHANNEL SELECTION MENU  *****"
6200       PRINT
6202       FOR Line=1 TO Entries
6204         PRINT TABXY(Indent,Min_line+Line-1);Menu_3$(Line)
6206       NEXT Line
6208       PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_3$(1)
6210     CASE 5
6212       PRINT TABXY(16,2);"*****  CHANNEL vs CHANNEL SELECTION MENU  *****"
6214       PRINT
6216       FOR Line=1 TO Entries
6218         PRINT TABXY(Indent,Min_line+Line-1);Menu_4$(Line)
6220       NEXT Line
6222       PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_4$(1)
6224     CASE 6
6226       PRINT TABXY(18,2);"*****  CHANNEL vs TIME SELECTION MENU  *****"
6228       PRINT
6230       FOR Line=1 TO Entries
6232         PRINT TABXY(Indent,Min_line+Line-1);Menu_4$(Line)
6234       NEXT Line
6236       PRINT TABXY(Indent,Menu_line);CHR$(129);Menu_4$(1)
6238     CASE ELSE
6240       PRINT "Error in Print_menu."
6242       PAUSE
6244     END SELECT
6246   SUBEND
6248   !______________________________________________________________________
```

```
6250  !
6252 Plot8:SUB Generate_plot8
6254  !
6256  !This module is the driver for plotting the a selected channel vs. a
6258  !selected channel.
6260  !=========================================================================
6262    OPTION BASE 1
6264    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
6266    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
6268    COM /Msus/ Msus_raw$,File_name1$
6270    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
6272    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
6274    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
6276    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
6278    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
6280    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
6282    COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
6284    !-----------------------------------------------------------------------
6286    ALLOCATE Label$(2)[40],Title$(2)[40],Desc$[30],Calc_label$(2)[40]
6288    ALLOCATE User_message_x$[40],User_message_y$[40]
6290    !
6292    OUTPUT KBD;"K";
6294    !
6296 Menu:                                                    !
6298    Window_flag=1
6300    Data_adjust_x=0
6302    Data_adjust_y=0
6304    Flag_x=0
6306    Const_x_flag=0
6308    Flag_y=0
6310    Const_y_flag=0
6312    Plot_msg$(9)=""
6314    Plot_msg$(10)=""
6316    User_message_x$=""
6318    User_message_y$=""
6320    GOSUB Keys1
6322    CONTROL 1,12;2                                        ! (Menu keys lit)
6324    !
6326    GOSUB Spin
6328    !
6330 Get_channel:                                             !
6332    OUTPUT KBD;"K";
6334    Acc_no=4
6336    Average=0
6338    IF Ch_y<50 THEN
6340      Raw_to_acc(Buff_id$(Ch_y,1),Acc_no,Average)
6342  !   New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
6344  !   REDIM Acc4(1:New_size)
6346      MAT Acc4= Acc4*(Gain(Ch_y,1))
6348      Calc_label$(1)=Buff_title$(Ch_y,1)
6350      Calc_label$(2)=Buff_title$(Ch_y,1)&" ("&Buff_units$(Ch_y,1)&")"
6352    ELSE
6354      Calc_type=Ch_y
6356      Calc_quantity(Average,Calc_label$(*),Calc_type,No_more)
6358    !
6360    END IF
6362    Data_adjust=Data_adjust_y
6364    Flag=Flag_y
6366    Exponent=N_y
6368    Constant=Const_y
```

```
6370     Const_flag=Const_y_flag
6372     Data_manipulate(Data_adjust,Flag,Exponent,Constant,Const_flag)
6374     MAT Acc1= Acc4
6376     Fix_labels(Calc_label$(*),Data_adjust,Exponent,Constant,Const_flag)
6378     IF Flag_y THEN
6380       Plot_msg$(9)="Y Offset Removed"
6382     END IF
6384     Title$(2)=Calc_label$(1)
6386     Label$(2)=Calc_label$(2)
6388     !
6390     IF Ch_x<50 THEN
6392       Raw_to_acc(Buff_id$(Ch_x,1),Acc_no,Average)
6394  !    New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
6396  !    REDIM Acc4(1:New_size)
6398       MAT Acc4= Acc4*(Gain(Ch_x,1))
6400       Calc_label$(1)=Buff_title$(Ch_x,1)
6402       Calc_label$(2)=Buff_title$(Ch_x,1)&" ("&Buff_units$(Ch_x,1)&")"
6404     !
6406     ELSE
6408       Calc_type=Ch_x
6410       Calc_quantity(Average,Calc_label$(*),Calc_type,No_more)
6412     END IF
6414     Data_adjust=Data_adjust_x
6416     Flag=Flag_x
6418     Exponent=N_x
6420     Constant=Const_x
6422     Const_flag=Const_x_flag
6424     Data_manipulate(Data_adjust,Flag,Exponent,Constant,Const_flag)
6426     MAT Acc2= Acc4
6428     Fix_labels(Calc_label$(*),Data_adjust,Exponent,Constant,Const_flag)
6430     Title$(1)=Calc_label$(1)
6432     IF Flag_x THEN
6434       Plot_msg$(10)="X Offset Removed"
6436     END IF
6438     Label$(1)=Calc_label$(2)
6440     !
6442     Xmin=MIN(Acc2(*))                               !Set plot limits
6444     Xmax=MAX(Acc2(*))
6446     Ymin=MIN(Acc1(*))
6448     Ymax=MAX(Acc1(*))
6450     !
6452     !
6454     Plot_msg$(11)="Average = "&VAL$(Average)
6456     Average_no=Average
6458     !
6460 Plot:                                            !
6462     Pen=3
6464     Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
6466     Plot_xy(Acc2(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
6468     !
6470     Ans$="N"
6472     DISP CHR$(129)
6474     INPUT "CHANGE SCALES ? (Default is NO)",Ans$
6476     Ans$=UPC$(Ans$[1,10])
6478     IF Ans$="Y" THEN Plot
6480     DISP CHR$(128)
6482     !
6484     Ans$="y"
6486     DISP CHR$(129)
6488     INPUT " Plot GRAPH? (default is yes) ",Ans$
```

```
6490    DISP CHR$(128)
6492    IF UPC$(Ans$[1,1])="Y" THEN
6494      Change_plotter(705)
6496      GOTO Plot
6498    END IF
6500    IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
6502    OUTPUT KBD;"K";
6504    GOTO Menu
6506    !
6508 Quit:                                                  !
6510    OUTPUT KBD;"K";
6512    PRINT CHR$(128)
6514    DEALLOCATE Label$(*),Title$(*),Desc$,Calc_label$(*)
6516    Plot_msg$(9)=""
6518    Plot_msg$(10)=""
6520    Plot_msg$(11)=""
6522    Window_flag=0
6524    SUBEXIT
6526    !++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
6528 Spin:                                                  !Zzzz...............
6530    GOTO Spin
6532    RETURN
6534    !
6536 Keys1:                                                 !Setup menu keys
6538    Menu_select=4
6540    Build_menu(Buff_id$(*),Buff_title$(*))
6542    Ref_line=4                                          !Menu y-position
6544    Indent=45                                           !Menu x-position
6546    Menu_line=Ref_line
6548    PRINT CHR$(12)
6550    Print_menu
6552    ON KEY 1 LABEL "  MOVE     UP   " CALL Move_up
6554    ON KEY 2 LABEL "  MOVE    DOWN  " CALL Move_down
6556    ON KEY 3 LABEL "  CALC    DATA  " GOSUB Keys2
6558    ON KEY 4 LABEL " SELECT    X    " GOTO Select_x
6560    ON KEY 5 LABEL "                " GOSUB Not_used
6562    ON KEY 6 LABEL "                " GOSUB Not_used
6564    ON KEY 7 LABEL "                " GOSUB Not_used
6566    ON KEY 8 LABEL "  QUIT          " GOTO Quit
6568    CONTROL 1,12;2
6570    RETURN
6572    !
6574 Keys2:                                                 !Setup menu keys
6576    Menu_select=5
6578    Build_menu(Buff_id$(*),Buff_title$(*))
6580    Ref_line=4                                          !Menu y-position
6582    Indent=45                                           !Menu x-position
6584    Menu_line=Ref_line
6586    PRINT CHR$(12)
6588    Print_menu
6590    ON KEY 1 LABEL "  MOVE     UP   " CALL Move_up
6592    ON KEY 2 LABEL "  MOVE    DOWN  " CALL Move_down
6594    ON KEY 3 LABEL "   RAW    DATA  " GOSUB Keys1
6596    ON KEY 4 LABEL " SELECT    X    " GOTO Select_x_calc
6598    ON KEY 5 LABEL "                " GOSUB Not_used
6600    ON KEY 6 LABEL "                " GOSUB Not_used
6602    ON KEY 7 LABEL "                " GOSUB Not_used
6604    ON KEY 8 LABEL "  QUIT          " GOTO Quit
6606    CONTROL 1,12;2
6608    RETURN
```

```
6610     !
6612 Keys3:                                                  !Setup menu keys
6614     Menu_select=4
6616     Build_menu(Buff_id$(*),Buff_title$(*))
6618     Ref_line=4                                          !Menu y-position
6620     Indent=45                                           !Menu x-position
6622     Menu_line=Ref_line
6624     Print_menu
6626     ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
6628     ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
6630     ON KEY 3 LABEL "  CALC    DATA   " GOSUB Keys4
6632     ON KEY 4 LABEL " SELECT     Y    " GOTO Select_y
6634     ON KEY 5 LABEL "                 " GOSUB Not_used
6636     ON KEY 6 LABEL "                 " GOSUB Not_used
6638     ON KEY 7 LABEL "                 " GOSUB Not_used
6640     ON KEY 8 LABEL "  QUIT           " GOTO Quit
6642     CONTROL 1,12;2
6644     RETURN
6646     !
6648 Keys4:                                                  !Setup menu keys
6650     Menu_select=5
6652     Build_menu(Buff_id$(*),Buff_title$(*))
6654     Ref_line=4                                          !Menu y-position
6656     Indent=45                                           !Menu x-position
6658     Menu_line=Ref_line
6660     PRINT CHR$(12)
6662     Print_menu
6664                                                         !
6666     ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
6668     ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
6670     ON KEY 3 LABEL "   RAW    DATA   " GOSUB Keys3
6672     ON KEY 4 LABEL " SELECT     Y    " GOTO Select_y_calc
6674     ON KEY 5 LABEL "                 " GOSUB Not_used
6676     ON KEY 6 LABEL "                 " GOSUB Not_used
6678     ON KEY 7 LABEL "                 " GOSUB Not_used
6680     ON KEY 8 LABEL "  QUIT           " GOTO Quit
6682     CONTROL 1,12;2
6684     RETURN
6686     !
6688 Keys5:          !KEYS FOR DATA MANIPULATION OPTION x
6690                 !
6692     ON KEY 1 LABEL "REMOVE    OFFSET" GOSUB Offset_x
6694     ON KEY 2 LABEL "LOGe(X)         " GOSUB Man_1_x
6696     ON KEY 3 LABEL "LOG10(X)        " GOSUB Man_2_x
6698     ON KEY 4 LABEL "E^(X)           " GOSUB Man_3_x
6700     ON KEY 5 LABEL "10^(X)          " GOSUB Man_4_x
6702     ON KEY 6 LABEL "(X)^N           " GOSUB Man_5_x
6704     ON KEY 7 LABEL "ADD     CONSTANT" GOSUB Constant_x
6706     ON KEY 8 LABEL "  CONT          " GOSUB Keys3
6708     CONTROL 1,12;2
6710     RETURN
6712     !
6714 Keys6:          !KEYS FOR DATA MANIPULATION OPTION  y
6716                 !
6718     ON KEY 1 LABEL "REMOVE    OFFSET" GOSUB Offset_y
6720     ON KEY 2 LABEL "LOGe(Y)         " GOSUB Man_1_y
6722     ON KEY 3 LABEL "LOG10(Y)        " GOSUB Man_2_y
6724     ON KEY 4 LABEL "E^(Y)           " GOSUB Man_3_y
6726     ON KEY 5 LABEL "10^(Y)          " GOSUB Man_4_y
6728     ON KEY 6 LABEL "(Y)^N           " GOSUB Man_5_y
```

```
6730    ON KEY 7 LABEL "ADD     CONSTANT" GOSUB Constant_y
6732    ON KEY 8 LABEL "  CONT          " GOTO Get_channel
6734    CONTROL 1,12;2
6736    RETURN
6738    !
6740    !
6742 Select_x:                                      !Select X-axis plot
6744    OFF KEY
6746    CONTROL 1,12;1                              ! (Menu keys doused)
6748    OUTPUT KBD;"K";
6750    Ch_x=VAL(Menu_3$(Menu_line-Min_line+1)[2,3])
6752    PRINT CHR$(128)
6754    PRINT TABXY(1,18);"X-channel: ";Buff_title$(Ch_x,1);User_message_x$
6756    PRINT CHR$(129)
6758    GOSUB Keys5
6760    GOSUB Spin
6762    !
6764 Select_x_calc:   !
6766    OFF KEY
6768    CONTROL 1,12;1                              ! (Menu keys doused)
6770    OUTPUT KBD;"K";
6772    Ch_x=VAL(Menu_4$(Menu_line-Min_line+1)[2,3])
6774    PRINT CHR$(128)
6776    PRINT TABXY(1,18);"X-channel: ";Menu_4$(Ch_x-49);User_message_x$
6778    PRINT CHR$(129)
6780    GOSUB Keys5
6782    GOSUB Spin
6784    !
6786 Select_y:                                      !Select Y-axis plot
6788    OFF KEY
6790    CONTROL 1,12;1                              ! (Menu keys doused)
6792    OUTPUT KBD;"K";
6794    PRINT CHR$(128)
6796    Ch_y=VAL(Menu_3$(Menu_line-Min_line+1)[2,3])
6798    IF Ch_x<50 THEN
6800      PRINT TABXY(1,18);"X-channel: ";Buff_title$(Ch_x,1);User_message_x$
6802    ELSE
6804      PRINT TABXY(1,18);"X-channel: ";Menu_4$(Ch_x-49);User_message_x$
6806    END IF
6808    PRINT "Y-channel: ";Buff_title$(Ch_y,1)
6810    GOSUB Keys6
6812    GOSUB Spin
6814    !
6816 Select_y_calc:   !
6818    OFF KEY
6820    CONTROL 1,12;1                              ! (Menu keys doused)
6822    OUTPUT KBD;"K";
6824    PRINT CHR$(128)
6826    Ch_y=VAL(Menu_4$(Menu_line-Min_line+1)[2,3])
6828    IF Ch_x<50 THEN
6830      PRINT TABXY(1,18);"X-channel: ";Buff_title$(Ch_x,1);User_message_x$
6832    ELSE
6834      PRINT TABXY(1,18);"X-channel: ";Menu_4$(Ch_x-49);User_message_x$
6836    END IF
6838    PRINT "Y-channel: ";Menu_4$(Ch_y-49)
6840    GOSUB Keys6
6842    GOSUB Spin
6844    !
6846 Offset_x:                                      !
6848    Flag_x=NOT Flag_x
```

```
6850    GOSUB User_message_x
6852    RETURN
6854    !
6856 Constant_x:   !
6858    INPUT "ENTER VALUE OF CONSTANT",Const_x
6860    Const_x_flag=1
6862    GOSUB User_message_x
6864    RETURN
6866             !
6868 Offset_y:
6870    Flag_y=NOT Flag_y
6872    GOSUB User_message_y
6874    RETURN
6876    !
6878 Constant_y:   !
6880    INPUT "ENTER VALUE OF CONSTANT",Const_y
6882    Const_y_flag=1
6884    GOSUB User_message_y
6886    RETURN
6888    !
6890    !
6892 Man_1_x:   !
6894    Data_adjust_x=1
6896    GOSUB User_message_x
6898    RETURN
6900            !
6902 Man_2_x:   !
6904    Data_adjust_x=2
6906    GOSUB User_message_x
6908    RETURN
6910            !
6912 Man_3_x:   !
6914    Data_adjust_x=3
6916    GOSUB User_message_x
6918    RETURN
6920            !
6922 Man_4_x:   !
6924    Data_adjust_x=4
6926    GOSUB User_message_x
6928    RETURN
6930            !
6932 Man_5_x:   !
6934    Data_adjust_x=5
6936    INPUT "ENTER THE VALUE OF THE EXPONENT",N_x
6938    GOSUB User_message_x
6940    RETURN
6942    !
6944            !
6946 Man_1_y:   !
6948    Data_adjust_y=1
6950    GOSUB User_message_y
6952    RETURN
6954            !
6956 Man_2_y:   !
6958    Data_adjust_y=2
6960    GOSUB User_message_y
6962    RETURN
6964            !
6966 Man_3_y:   !
6968    Data_adjust_y=3
```

```
6970    GOSUB User_message_y
6972    RETURN
6974             !
6976 Man_4_y:    !
6978    Data_adjust_y=4
6980    GOSUB User_message_y
6982    RETURN
6984             !
6986 Man_5_y:    !
6988    Data_adjust_y=5
6990    INPUT "ENTER THE VALUE OF THE EXPONENT",N_y
6992    GOSUB User_message_y
6994    RETURN
6996             !
6998                      !
7000 Not_used:                                              !Undefined key
7002    RETURN
7004    !
7006 User_message_y:    !
7008    IF Flag_y THEN
7010      Part1$="Y OFFSET REMOVED "
7012    ELSE
7014      Part1$=""
7016    END IF
7018    IF Const_y_flag THEN
7020      Part1a$=" "&VAL$(Const_y)
7022    ELSE
7024      Part1a$=""
7026    END IF
7028    Case_selector=Data_adjust_y
7030    Temp_flag$="Y"
7032    GOTO Selection
7034 User_message_x:    !
7036    Case_selector=Data_adjust_x
7038    IF Flag_x THEN
7040      Part1$="X OFFSET REMOVED "
7042    ELSE
7044      Part1$=""
7046    END IF
7048    IF Const_x_flag THEN
7050      Part1a$=" "&VAL$(Const_x)
7052    ELSE
7054      Part1a$=""
7056    END IF
7058    Temp_flag$="X"
7060 Selection:                    !
7062    SELECT Case_selector
7064    CASE 0
7066      Part2$=""
7068    CASE 1
7070      Part2$=" LOGe(X)"
7072    CASE 2
7074      Part2$=" LOG10(X)"
7076    CASE 3
7078      Part2$=" EXP(X)"
7080    CASE 4
7082      Part2$=" 10^(X)"
7084    CASE 5
7086      Part2$=" (X)^N"
7088    CASE ELSE
```

```
7090     END SELECT
7092     DISP Part1$&Part1a$&Part2$
7094     IF Temp_flag$="Y" THEN
7096       User_message_y$=Part1$&Part1a$&Part2$
7098     END IF
7100     IF Temp_flag$="X" THEN
7102       User_message_x$=Part1$&Part1a$&Part2$
7104     END IF
7106     RETURN
7108   SUBEND
7110   !______________________________________________________________________
7112   !
7114 Plot9:SUB Generate_plot9
7116   !
7118   !This module is the driver for plotting the APPLIED LOAD VS PANEL OUTPUT
7120   !CALCULATES LOAD FROM ACTUATOR OIL PRESSURES PUSH SIDE IN CH15
7122   !PULL SIDE IN CH 16. PRESSURE PANEL OUTPUTS ON CH 13 &CH 14
7124   !======================================================================
7126     OPTION BASE 1
7128     COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
7130     COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
7132     COM /Msus/ Msus_raw$,File_name1$
7134     COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
7136     COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
7138     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
7140     COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
7142     !--------------------------------------------------------------------
7144     ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[30]
7146     !
7148     OUTPUT KBD;"K";
7150     !
7152 Choose_panel: !
7154     Reply$="U"
7156     INPUT "UPPER OR LOWER PANEL OR BOTH  DEFAULT IS UPPER (U,L,B)?",Reply$
7158     Reply$=UPC$(Reply$[1,1])
7160     IF Reply$<>"U" AND Reply$<>"L" AND Reply$<>"B" THEN Choose_panel
7162     !
7164     SELECT Reply$
7166     CASE "U"
7168       Ch=14
7170       Acc_no=1
7172       Average=0
7174       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7176       MAT Acc1= Acc1*(Gain(Ch,1))
7178  !  MAT Acc1= Acc1*(Gain(Ch,2))
7180       MAT Acc1= Acc1-(Acc1(1))        !REMOVE OFFSET
7182       Title$(2)=Buff_title$(Ch,1)
7184       Label$(2)=Buff_title$(Ch,1)&" ("&Buff_units$(Ch,1)&")"
7186     CASE "L"
7188       Ch=13
7190       Acc_no=1
7192       Average=0
7194       Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7196       MAT Acc1= Acc1*(Gain(Ch,1))
7198  !  MAT Acc1= Acc1*(Gain(Ch,2))
7200       MAT Acc1= Acc1-(Acc1(1))        !REMOVE OFFSET
7202       Title$(2)=Buff_title$(Ch,1)
7204       Label$(2)=Buff_title$(Ch,1)&" ("&Buff_units$(Ch,1)&")"
7206     CASE "B"
7208       Ch=13
```

```
7210      Acc_no=1
7212      Average=0
7214      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7216      MAT Acc1= Acc1*(Gain(Ch,1))
7218  ! MAT Acc1= Acc1*(Gain(Ch,2))
7220      MAT Acc1= Acc1-(Acc1(1))         !REMOVE OFFSET
7222      Ch=14
7224      Acc_no=2
7226      Average=0
7228      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7230      MAT Acc2= Acc2*(Gain(Ch,1))
7232  ! MAT Acc2= Acc2*(Gain(Ch,2))
7234      MAT Acc2= Acc2-(Acc2(1))         !REMOVE OFFSET
7236      MAT Acc1= Acc1+Acc2              !SUM BOTH PANELS
7238      Title$(2)="BOTH PANELS"
7240      Label$(2)="Both Panels (KPa)"
7242    END SELECT
7244    !
7246    !
7248    Ymin=MIN(Acc1(*))
7250    Ymax=MAX(Acc1(*))
7252    Title$(1)="APPLIED LOAD"
7254    Label$(1)="Applied Load (KN)"
7256    Desc$=""
7258    !
7260    !
7262    Ch=16                                                !Get Channel #16
7264    Acc_no=2
7266    Average=0
7268    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7270    MAT Acc2= Acc2*(Gain(Ch,1))
7272  ! MAT Acc2= Acc2*(Gain(Ch,2))
7274    MAT Acc2= Acc2*(50.164)                       !CONVERT TO KN
7276    !
7278    !
7280    Ch=15                                                 !GET CHANNEL 15
7282    Acc_no=3
7284    Average=0
7286    Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7288    MAT Acc3= Acc3*(Gain(Ch,1))
7290  ! MAT Acc3= Acc3*(Gain(Ch,2))
7292    MAT Acc3= Acc3*(38.003)                               !CONVERT TO KN
7294    MAT Acc2= Acc2-Acc3                                  !APPLIED LOAD IN KN
7296    !
7298    Xmin=MIN(Acc2(*))
7300    Xmax=MAX(Acc2(*))
7302    !
7304 Plot:   !
7306    Pen=3
7308    Plot_msg$(11)="Average = "&VAL$(Average)
7310    Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
7312    Plot_xy(Acc2(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
7314    !
7316    Ans$="N"
7318    DISP CHR$(129)
7320    INPUT "CHANGE SCALES ? (Default is NO)",Ans$
7322    Ans$=UPC$(Ans$[1,10])
7324    IF Ans$="Y" THEN Plot
7326    DISP CHR$(128)
7328    !
```

```
7330    Ans$="y"
7332    DISP CHR$(129)
7334    INPUT " Plot GRAPH? (default is yes) ",Ans$
7336    DISP CHR$(128)
7338    IF UPC$(Ans$[1,1])="Y" THEN
7340      Change_plotter(705)
7342      GOTO Plot
7344    END IF
7346    IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
7348    !
7350    OUTPUT KBD;"K";
7352    DEALLOCATE Label$(*),Title$(*),Desc$
7354  SUBEND
7356  !______________________________________________________________________
7358 Plot10:SUB Generate_plot10
7360  !
7362  !This module is the driver for FILTERING MEDOF PANEL DATA
7364  !TAKES APPLIED PRESSURE DATA FILTERS IT AND COMPARES WITH THE PANEL
7366  !PULL SIDE IN CH 16. PRESSURE PANEL OUTPUTS ON CH 13 &CH 14
7368  !======================================================================
7370    OPTION BASE 1
7372    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
7374    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
7376    COM /Msus/ Msus_raw$,File_name1$
7378    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
7380    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
7382    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
7384    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
7386    COM /Filter/ Amp_elast,Tau(*),Amp(*),No_steps,Last_average
7388    !----------------------------------------------------------------------
7390    ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[30]
7392    !
7394    OUTPUT KBD;"K";
7396    !
7398    PRINT "PREVIOUS VALUES"
7400    PRINT "---------------"
7402    PRINT "NO OF TAPS   =",No_steps
7404    PRINT "LAST AVERAGE =",Last_average
7406    PRINT "RANGE OF FILTER (s) =",No_steps*Last_average*X_inc
7408    PRINT "AMP_ELASTIC  =            ",Amp_elast
7410    FOR I=1 TO SIZE(Tau,1)
7412      IF Amp(I)<>0 THEN
7414        PRINT "I =",I,"AMP(I) =",Amp(I),"TAU(I)",Tau(I)
7416      END IF
7418    NEXT I
7420    !
7422 Parameters: !
7424    PRINT ""
7426    PRINT "YOU ENTER AN ELASTIC AMPLITUDE AND A SERIES OF "
7428    PRINT "EXPONENTIAL ELEMENTS . THESE ARE SPECIFIED AS "
7430    PRINT "AMP(I) &TAU(I) . YOU CAN ENTER UP TO 10 PAIRS "
7432    PRINT "TO STOP ENTERING MORE ELEMENTS ENTER TAU(I)=0"
7434    PRINT "IF YOU WANT TO USE LAST VALUE HIT RETURN"
7436    INPUT "ENTER AMP_ELASTIC",Amp_elast
7438    PRINT ""
7440    PRINT "CURRENT VALUES"
7442    PRINT "----------------"
7444    PRINT "AMP_ELASTIC  =           ",Amp_elast
7446    FOR I=1 TO SIZE(Tau,1)
7448      INPUT "AMP(I),TAU(I) ",Amp(I),Tau(I)
```

```
7450       PRINT "I =",I,"AMP(I) =",Amp(I),"TAU(I)",Tau(I)
7452       IF Amp(I)=0 OR Tau(I)=0 THEN
7454         Element_no=I-1
7456         GOTO After_loop
7458       END IF
7460     NEXT I
7462 After_loop:   !
7464     Reply$="N"
7466     INPUT "CHANGE PARAMETERS Y or N (N is default)",Reply$
7468     IF UPC$(Reply$[1,1])="Y" THEN Parameters
7470     !
7472     INPUT "INPUT NO OF TAPS IN FILTER,AVERAGE",No_steps,Last_average
7474     PRINT "NO_STEPS,AVERAGE",No_steps,Last_average
7476     PRINT ""
7478     ALLOCATE REAL F(1:No_steps),H(1:No_steps),Temp(1:1)
7480     ALLOCATE INTEGER Shift_vector(1:No_steps)
7482     !
7484 Basic_data:   !
7486     Ch=15       ! FLATJACK PRESSURE
7488     Acc_no=1
7490     Raw_to_acc(Buff_id$(Ch,1),Acc_no,Last_average)
7492     New_size=MIN(No_samples,INT(Time/(X_inc*Last_average)))
7494     REDIM Acc1(1:New_size)
7496     MAT Acc1= Acc1*(Gain(Ch,1))
7498     MAT Acc1= Acc1-(Acc1(1))         !REMOVE OFFSET
7500       !
7502     Ch=16       !MICROLOGIC SENSOR
7504     Acc_no=2
7506     Raw_to_acc(Buff_id$(Ch,1),Acc_no,Last_average)
7508     REDIM Acc2(1:New_size)
7510     MAT Acc2= Acc2*(Gain(Ch,1))
7512     MAT Acc2= Acc2-(Acc2(1))         !REMOVE OFFSET
7514       !
7516 Impulse_fn:     !
7518     DISP "CALCULATING IMPULSE FUNCTION"
7520     Time_inc=X_inc*Last_average
7522     MAT H= (0)
7524     H(1)=Amp_elast
7526     FOR I=1 TO No_steps
7528       IF Element_no>0 THEN
7530         FOR J=1 TO Element_no
7532           H(I)=H(I)+(Amp(J)*Time_inc/Tau(J))*EXP(-1*(I-1)*Time_inc/Tau(J))
7534         NEXT J
7536       END IF
7538     NEXT I
7540                   !
7542 Do_filter: !
7544     REDIM Acc3(1:New_size)
7546     FOR I=2 TO No_steps
7548       Shift_vector(I)=I-1
7550     NEXT I
7552     Shift_vector(1)=No_steps
7554     MAT F= (Acc1(1))
7556     FOR J=1 TO SIZE(Acc1,1)
7558       DISP "DOING FILTERING OF FLATJACK DATA   STEP",J
7560       MAT Temp= F*H
7562       Acc3(J)=Temp(1)
7564       MAT REORDER F BY Shift_vector
7566       F(1)=Acc1(J)
7568     NEXT J
```

```
7570   !
7572     MAT Acc2= Acc2-Acc3
7574 Plot:   !
7576     Xmin=0
7578     Xmax=Time
7580     Ymin=MIN(MIN(Acc3(*)),MIN(Acc2(*)))
7582     Ymax=MAX(MAX(Acc3(*)),MAX(Acc2(*)))
7584     Title$(1)="TIME"                              !Define labels
7586     Title$(2)="FILTERED MEDOF"
7588     Label$(1)="TIME (Sec)"
7590     Label$(2)=Title$(2)&" (mm)"
7592     Pen=3
7594     Plot_msg$(11)="Average = "&VAL$(Last_average)
7596     Desc$="FILTERED FLATJACK PRESSURE"
7598     Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
7600     Plot_time(Time_inc,Acc3(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
7602     Desc$="ERROR SIGNAL"
7604     Pen=4
7606     Plot_time(Time_inc,Acc2(*),Xmin,Xmax,Ymin,Ymax,Pen,2,Desc$)
7608     !
7610     Ans$="N"
7612     DISP CHR$(129)
7614     INPUT "CHANGE SCALES ? (Default is NO)",Ans$
7616     Ans$=UPC$(Ans$[1,10])
7618     IF Ans$="Y" THEN Plot
7620     DISP CHR$(128)
7622     !
7624     Ans$="y"
7626     DISP CHR$(129)
7628     INPUT " Plot GRAPH? (default is yes) ",Ans$
7630     DISP CHR$(128)
7632     IF UPC$(Ans$[1,1])="Y" THEN
7634       Change_plotter(705)
7636       GOTO Plot
7638     END IF
7640     IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
7642     !
7644     OUTPUT KBD;"K";
7646     DEALLOCATE Label$(*),Title$(*),Desc$
7648  SUBEND
7650  !____________________________________________________________________________
7652 Plot11:SUB Generate_plot11
7654  !
7656  !This module is the driver for plotting Volumetric Strain vs. Deviator
7658  !Stress. Two algorithms are utilized: the first employs the Diametral
7660  !Strains, while the second uses the Intensifier Strain in the
7662  !calculations.
7664  !CAN PLOT AGAINST AXIAL OR CONFINING STRESS
7666  !Diametral Algorithm:
7668  ! % Vol. Strain = ((1 + (delta w) / w)^2 * (1 + (delta h) / h) - 1) * 100
7670  !                  where: delta w = change in sample diameter (strain)
7672  !                                   (diametral 1 + diametral 2) / 2
7674  !                         w       = initial sample diameter
7676  !                         delta h = change in sample height (axial strain)
7678  !                         h       = initial sample height
7680  !
7682  !Intensifier Algorithm:
7684  ! % Vol. Strain = (((delta V(1))-(delta V(2))) / V) * x * 100
7686  !                  where: delta V(1) = change in Intensifier volume
7688  !                         delta V(2) = change in Actuator volume
```

```
7690  !                         V           = initial sample volume
7692  !==================================================================
7694    OPTION BASE 1
7696    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
7698    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
7700    COM /Msus/ Msus_raw$,File_name1$
7702    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
7704    COM /Sample/ Diameter,Height,Area,Width,Depth
7706    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
7708    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
7710    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
7712    !-----------------------------------------------------------------
7714    ALLOCATE Label$(2)[30],Title$(2)[30],Desc$[50]
7716    !
7718    OUTPUT KBD;"K";
7720    !
7722    DISP CHR$(129)
7724    Algorithm$="Diametral"
7726 Change:                                                !
7728    PRINT TABXY(1,18);"Volumetric Strain calculated using Intensifier or Dia
7730    Ans$="n"
7732    PRINT TABXY(1,19);"Algorithm uses ";Algorithm$
7734    INPUT " CHANGE algorithm? (Default is no) ",Ans$
7736    IF UPC$(Ans$[1,1])="Y" THEN
7738      SELECT UPC$(Algorithm$[1,1])                  !Algorithm switcheroo
7740      CASE "D"
7742        Algorithm$="Intensifier"
7744        GOTO Change
7746      CASE "I"
7748        Algorithm$="Diametral"
7750        GOTO Change
7752      END SELECT
7754      PRINT TABXY(1,19);RPT$(" ",80)
7756    END IF
7758    DISP CHR$(128)
7760    PRINT CHR$(12)                                  !CLEAN UP SCREEN
7762    !
7764    Average=0                                       !Y-axis: volumetric strain
7766    SELECT UPC$(Algorithm$[1,1])
7768    CASE "D"                                        !Diametral algorithm
7770      Desc$="Volumetric Strain from Diametrial Strain"
7772      !
7774      Ch=4                                          !DIAMETRAL 1
7776      Acc_no=1
7778      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7780      New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
7782      REDIM Acc1(1:New_size)
7784      MAT Acc1= Acc1*(Gain(Ch,1))
7786      MAT Acc1= Acc1-(Acc1(1))
7788      !
7790      Ch=5                                          !Diametral 2
7792      Acc_no=2
7794      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7796      REDIM Acc2(1:New_size)
7798      MAT Acc2= Acc2*(Gain(Ch,1))
7800      MAT Acc2= Acc2-(Acc2(1))
7802      !
7804      MAT Acc1= Acc1+Acc2
7806      MAT Acc1= Acc1/(2*Diameter)
7808      MAT Acc1= Acc1+(1)
```

```
7810      MAT Acc1= Acc1 . Acc1
7812      !
7814      Ch=3                                          !LVDT #1
7816      Acc_no=2
7818      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7820      REDIM Acc2(1:New_size)
7822      MAT Acc2= Acc2*(Gain(Ch,1))
7824      MAT Acc2= Acc2-(Acc2(1))
7826      !
7828    ! Ch=12                                         !LVDT#2
7830    ! Acc_no=3
7832    ! Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7834    ! REDIM Acc3(1:New_size)
7836    ! MAT Acc3= Acc3*(Gain(Ch,1))
7838    ! MAT Acc3= Acc3-(Acc3(1))
7840    ! MAT Acc2= Acc2+Acc3
7842    ! MAT Acc2= Acc2*(.5)
7844      !
7846      MAT Acc2= Acc2/(-Height)                      ! (Sense correction!!)
7848      MAT Acc2= Acc2+(1)
7850      !
7852      MAT Acc1= Acc1 . Acc2
7854      MAT Acc1= Acc1-(1)
7856      MAT Acc1= Acc1*(100)
7858    CASE "I"                                        !Intensifier algorithm
7860      Desc$="Volumetric Strain from Intensifier Strain"
7862      !
7864      Ch=8                                          !ACTUATOR DISPLACEMENT
7866      Acc_no=1
7868      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7870      New_size=MIN(No_samples,INT(Time/(X_inc*Average)))
7872      REDIM Acc1(1:New_size)
7874      MAT Acc1= Acc1*(Gain(Ch,1))
7876      Cs_area_act=(PI*(3*25.4)^2)/4
7878      MAT Acc1= Acc1*(Cs_area_act)
7880      MAT Acc1= Acc1-(Acc1(1))
7882      !
7884      Ch=7                                          !INTENSIFIER DISPLACEMENT
7886      Acc_no=2
7888      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7890      REDIM Acc2(1:New_size)
7892      MAT Acc2= Acc2*(Gain(Ch,1))
7894      !
7896      ! CORRECTION OF INTENSIFIER DISPLACEMENT DUE TO CONFINING PRESSURE
7898      !CHANGES. DATA ON EFFECTIVE SYSTEM STIFFNESSS FROM TEST B469 (SHELL)
7900      !PRESSURE CORRECTION ONLY APPLIED IF FIRST PRESSURE IS GREATER THAN
7902      !1 MPa. THIS IS TO AVOID DOING CORRECTION ON BULK MODULUS TESTS.
7904      !
7906      Ch=2                                          !GET CONFINING PRESSURE
7908      Acc_no=3
7910      Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7912      REDIM Acc3(1:New_size)
7914      MAT Acc3= Acc3*(Gain(Ch,1))
7916      First_pressure=Acc3(1)
7918      IF First_pressure>1 THEN
7920        Ln_first=LOG(First_pressure)
7922        FOR I=1 TO SIZE(Acc3,1)
7924          Acc3(I)=6.74*(Acc3(I)-First_pressure)+6.06*(LOG(Acc3(I))-Ln_first)
7926        NEXT I
7928        MAT Acc2= Acc2-Acc3
```

```
7930       END IF
7932       Cs_area_int=(PI*(2*25.4)^2)/4
7934       MAT Acc2= Acc2*(-Cs_area_int)                    ! (Sense correction!!)
7936       MAT Acc2= Acc2-(Acc2(1))
7938       !
7940       MAT Acc1= Acc2-Acc1
7942       MAT Acc1= Acc1/(Area*Height)
7944       MAT Acc1= Acc1*(100)
7946       !
7948     END SELECT
7950     OUTPUT KBD;"K";
7952     !
7954     Ch=3                                               !X-axis: Deviator strain
7956     Acc_no=2
7958     Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
7960     REDIM Acc2(1:New_size)
7962     MAT Acc2= Acc2*(Gain(Ch,1))
7964     MAT Acc2= Acc2-(Acc1(1))
7966     MAT Acc2= Acc2*(1.E+2/Height)
7968     !
7970     Title$(1)="STRAIN"                                 !Define labels
7972     Title$(2)="VOLUMETRIC STRAIN"
7974     Label$(1)="STRAIN (%)"
7976     Label$(2)="VOLUMETRIC STRAIN (%)"
7978     !
7980     Xmin=MIN(Acc2(*))                                  !Set plot limits
7982     Xmax=MAX(Acc2(*))
7984     Ymin=MIN(Acc1(*))
7986     Ymax=MAX(Acc1(*))
7988     !
7990 Plot:                                                  !
7992     Pen=3
7994     Plot_msg$(11)="Average = "&VAL$(Average)
7996     Plot_label(Xmin,Xmax,Ymin,Ymax,Label$(*),Title$(*),Plot_msg$(*))
7998     Plot_xy(Acc2(*),Acc1(*),Xmin,Xmax,Ymin,Ymax,Pen,1,Desc$)
8000     !
8002     Ans$="N"
8004     DISP CHR$(129)
8006     INPUT "CHANGE SCALES ? (Default is NO)",Ans$
8008     Ans$=UPC$(Ans$[1,10])
8010     IF Ans$="Y" THEN Plot
8012     DISP CHR$(128)
8014     !
8016     Ans$="y"
8018     DISP CHR$(129)
8020     INPUT " Plot GRAPH? (default is yes) ",Ans$
8022     DISP CHR$(128)
8024     IF UPC$(Ans$[1,1])="Y" THEN
8026       Change_plotter(705)
8028       GOTO Plot
8030     END IF
8032     IF SYSTEM$("PLOTTER IS")<>"6" THEN CALL Change_plotter(6)
8034     !
8036     OUTPUT KBD;"K";
8038     DEALLOCATE Label$(*),Title$(*),Desc$
8040   SUBEND
8042   !______________________________________________________________________
8044 Plot12:SUB Generate_plot12
8046   !NEW ROUTINE FOR VERSION 3
8048   !PAUL SPENCER DECEMBER 07 1988
```

```
8050  !PROJECT 9538
8052  !
8054  !THIS ROUTINE GENERATES STATISTICS OF THE VARIOUS DATA PLUS CALCULATED
8056  !QUANTITIES
8058  !=======================================================================
8060    OPTION BASE 1
8062    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
8064    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
8066    COM /Msus/ Msus_raw$,File_name1$
8068    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
8070    COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
8072    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
8074    COM /Menu_1/ Menu_1$(*),Menu_2$(*),Menu_3$(*),Menu_4$(*),Menu_select
8076    COM /Menu_2/ Indent,Menu_line,Min_line,Max_line,Entries
8078    COM /Ch_data/ No_samples,No_channels,Max_channels,Duration
8080    COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
8082    COM /Files/ Ch_data$(*),Gains(*),Test_text$(*),Test_data(*)
8084    !----------------------------------------------------------------------
8086 Mainline:   !
8088    GOSUB Init
8090    GOSUB Keys1
8092 Spin:!
8094    GOTO Spin
8096!
8098 Init:!
8100    DIM Channel_x(1:16),Calc_ch(50:55)
8102    DIM Stats_x(1:16,1:4)
8104    !STATS_X(I,J)      I=RAW DATA CHANNEL
8106    !                  J=1    MIN
8108    !                  J=2    MAX
8110    !                  J=3    MEAN
8112    !                  J=4    STD
8114    DIM Stats_calc(50:55,1:4)
8116    !STATS_CALC(I,J)  I=CALC CHANNEL
8118    !                  J=1    MIN
8120    !                  J=2    MAX
8122    !                  J=3    MEAN
8124    !                  J=4    STD
8126    Start_temp=Data_start
8128    Stop_temp=Data_stop
8130    Window_flag=1
8132    DIM Calc_label$(2)[40],Print_label$(50:55)[40]
8134    INTEGER Sort_vector(1:16000)
8136    Max_flag=0
8138    Value_flag=0
8140    RETURN
8142      !
8144 Keys1:!
8146      !
8148    ON KEY 1 LABEL "  ALL      RAW    " GOSUB All_raw
8150    ON KEY 2 LABEL "  ALL      CALC   " GOSUB All_calc
8152    ON KEY 3 LABEL "  CHOOSE   CHNL   " GOSUB Choose_channel
8154    ON KEY 4 LABEL "                  " GOSUB Not_used
8156    ON KEY 5 LABEL "                  " GOSUB Not_used
8158    ON KEY 6 LABEL "                  " GOSUB Not_used
8160    ON KEY 7 LABEL "  CONT            " GOSUB Continue
8162    ON KEY 8 LABEL "  QUIT            " GOTO Quit
8164    CONTROL 1,12;2
8166    RETURN
8168    !
```

```
8170 Keys2:!
8172     Menu_select=4
8174     Build_menu(Buff_id$(*),Buff_title$(*))
8176     Ref_line=4                                    !Menu y-position
8178     Indent=45                                     !Menu x-position
8180     Menu_line=Ref_line
8182     PRINT CHR$(12)
8184     Print_menu
8186     ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
8188     ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
8190     ON KEY 3 LABEL "  CALC    DATA   " GOSUB Keys3
8192     ON KEY 4 LABEL " SELECT          " GOTO Select_x
8194     ON KEY 5 LABEL "                 " GOSUB Not_used
8196     ON KEY 6 LABEL "                 " GOSUB Not_used
8198     ON KEY 7 LABEL "  CONT           " GOSUB Keys4
8200     ON KEY 8 LABEL "  QUIT           " GOTO Quit
8202     CONTROL 1,12;2
8204        !
8206     RETURN
8208     !
8210 Keys3:!
8212     Menu_select=5
8214     Build_menu(Buff_id$(*),Buff_title$(*))
8216     Ref_line=4                                    !Menu y-position
8218     Indent=45                                     !Menu x-position
8220     Menu_line=Ref_line
8222     PRINT CHR$(12)
8224     Print_menu
8226     ON KEY 1 LABEL "  MOVE     UP    " CALL Move_up
8228     ON KEY 2 LABEL "  MOVE    DOWN   " CALL Move_down
8230     ON KEY 3 LABEL "   RAW    DATA   " GOSUB Keys2
8232     ON KEY 4 LABEL " SELECT          " GOTO Select_x_calc
8234     ON KEY 5 LABEL "                 " GOSUB Not_used
8236     ON KEY 6 LABEL "                 " GOSUB Not_used
8238     ON KEY 7 LABEL "  CONT           " GOSUB Keys4
8240     ON KEY 8 LABEL "  QUIT           " GOTO Quit
8242     CONTROL 1,12;2
8244        !
8246     RETURN
8248     !
8250 Keys4:!
8252     ON KEY 1 LABEL "  MAX   BETWEEN " GOSUB Max_between
8254     ON KEY 2 LABEL "  VALUE   AT    " GOSUB Value_at
8256     ON KEY 3 LABEL "                " GOSUB Not_used
8258     ON KEY 4 LABEL "                " GOSUB Not_used
8260     ON KEY 5 LABEL "                " GOSUB Not_used
8262     ON KEY 6 LABEL "                " GOSUB Not_used
8264     ON KEY 7 LABEL "                " GOSUB Not_used
8266     ON KEY 8 LABEL "  QUIT          " GOTO Quit
8268     CONTROL 1,12;2
8270        !
8272     RETURN
8274     !
8276 Keys5:!
8278     ON KEY 1 LABEL "  DISP  ON CRT  " GOSUB Disp_on_crt
8280     ON KEY 2 LABEL "  PRINT ON 701  " GOSUB Print_external
8282     ON KEY 3 LABEL "                " GOSUB Not_used
8284     ON KEY 4 LABEL "                " GOSUB Not_used
8286     ON KEY 5 LABEL "                " GOSUB Not_used
8288     ON KEY 6 LABEL "                " GOSUB Not_used
```

```
8290    ON KEY 7 LABEL "                   " GOSUB Not_used
8292    ON KEY 8 LABEL "  QUIT             " GOTO Quit
8294    CONTROL 1,12;2
8296      !
8298    RETURN
8300    !
8302 Not_used:   !
8304    RETURN
8306    !
8308 Continue:   !
8310             !
8312    IF Choose_flag THEN
8314      GOSUB Keys2
8316    ELSE
8318      GOSUB Keys4
8320    END IF
8322    RETURN
8324             !
8326 All_raw:           !
8328    All_raw_flag=NOT All_raw_flag
8330    IF All_raw_flag THEN
8332      Part1$=" ALL RAW"
8334      FOR I=1 TO 16
8336        IF Buff_id$(I,1)<>"#" THEN
8338          Channel_x(I)=1
8340        END IF
8342      NEXT I
8344    ELSE
8346      Part1$=""
8348      MAT Channel_x= (0)
8350    END IF
8352    DISP Part1$&Part2$&Part3$
8354                       !
8356    RETURN
8358 All_calc:                    !
8360    All_calc_flag=NOT All_calc_flag
8362    IF All_calc_flag THEN
8364      Part2$=" ALL CALC"
8366      MAT Calc_ch= (1)
8368    ELSE
8370      Part2$=""
8372      MAT Calc_ch= (0)
8374    END IF
8376    DISP Part1$&Part2$&Part3$
8378                                  !
8380    RETURN
8382 Choose_channel:                              !
8384    Choose_flag=NOT Choose_flag
8386    IF Choose_flag THEN
8388      Part3$=" CHANNEL"
8390      Part1$=""
8392      Part2$=""
8394      MAT Channel_x= (0)
8396      MAT Calc_ch= (0)
8398    ELSE
8400      Part3$=""
8402    END IF
8404    DISP Part1$&Part2$&Part3$
8406                                              !
8408    RETURN
```

```
8410 Select_x:                                    !
8412     OFF KEY
8414     CONTROL 1,12;1                                    ! (Menu keys doused)
8416     OUTPUT KBD;"K";
8418     Ch_x=VAL(Menu_3$(Menu_line-Min_line+1)[2,3])
8420     Channel_x(Ch_x)=1
8422     Y_row=10
8424     FOR I=1 TO 16
8426       IF Channel_x(I)=1 THEN
8428         Y_row=Yrow+1
8430         PRINT CHR$(128)
8432         PRINT TABXY(1,Y_row);"X-channel: ";Buff_title$(Ch_x,1)
8434         PRINT CHR$(129)
8436       END IF
8438     NEXT I
8440     GOSUB Keys2
8442     GOTO Spin
8444                                  !
8446     RETURN
8448     !
8450 Select_x_calc:                               !
8452     OFF KEY
8454     CONTROL 1,12;1                                    ! (Menu keys doused)
8456     OUTPUT KBD;"K";
8458     Ch_x=VAL(Menu_4$(Menu_line-Min_line+1)[2,3])
8460     Calc_ch(Ch_x)=1
8462     Y_row=10
8464     FOR I=50 TO 55
8466       IF Calc_ch(I)=1 THEN
8468         Y_row=Y_row+1
8470         PRINT CHR$(128)
8472         PRINT TABXY(1,Y_row);"X-channel: ";Menu_4$(Ch_x-49)
8474         PRINT CHR$(129)
8476       END IF
8478     NEXT I
8480     GOSUB Keys3
8482     GOTO Spin
8484                                              !
8486     RETURN
8488     !
8490 Max_between:!
8492     Max_flag=1
8494 Input_time:                      !
8496     INPUT "INPUT START TIME (s) AND STOP TIME (s) FOR DATA SEARCH(Tmin,Tmax)
8498     IF Tmin>=Tmax THEN Input_time
8500     Data_start=Tmin
8502     Data_stop=Tmax
8504     Average=0
8506     Counter=0
8508     FOR I=1 TO 16
8510       IF Channel_x(I)=1 THEN
8512         Counter=Counter+1
8514         PRINT TABXY(10,15),"PROCESSING CHANNEL",I
8516         Acc_no=4
8518         REDIM Acc4(1:Acc_size)
8520         Raw_to_acc(Buff_id$(I,1),Acc_no,Average)
8522         MAT Acc4= Acc4*(Gain(I,1))
8524         Average_no=Average
8526         Window_index(Start_index,Stop_index,Acc_no)
8528         GOSUB Redim_data
```

```
8530         Stats_x(I,1)=MIN(Acc4(*))
8532         Stats_x(I,2)=MAX(Acc4(*))
8534         Stats_x(I,3)=SUM(Acc4)/(Stop_index-Start_index)
8536         MAT Acc4= Acc4-(Stats_x(I,3))
8538         MAT Acc3= Acc4*Acc4
8540         Stats_x(I,4)=SQR(SUM(Acc3)/(Stop_index-Start_index))
8542     !
8544       END IF
8546     NEXT I
8548     !
8550     FOR I=50 TO 55
8552       IF Calc_ch(I)=1 THEN
8554         Counter=Counter+1
8556         PRINT TABXY(10,15),"PROCESSING CHANNEL",I
8558         Calc_type=I
8560         REDIM Acc4(1:Acc_size)
8562         Calc_quantity(Average,Calc_label$(*),Calc_type,No_more)
8564         IF No_more THEN
8566           Calc_ch(I)=0
8568           GOTO Somewhere
8570         END IF
8572         Print_label$(I)=Calc_label$(2)
8574         Average_no=Average
8576         Window_index(Start_index,Stop_index,Acc_no)
8578         GOSUB Redim_data
8580         Stats_calc(I,1)=MIN(Acc4(*))
8582         Stats_calc(I,2)=MAX(Acc4(*))
8584         Stats_calc(I,3)=SUM(Acc4)/(Stop_index-Start_index)
8586         MAT Acc4= Acc4-(Stats_calc(I,3))
8588         MAT Acc3= Acc4*Acc4
8590         Stats_calc(I,4)=SQR(SUM(Acc3)/(Stop_index-Start_index))
8592     !
8594 Somewhere:    !
8596       END IF
8598     NEXT I
8600           !
8602     DISP ""
8604     GOSUB Keys5
8606     RETURN
8608     !
8610 Value_at:!
8612     Value_flag=1
8614 Input_times:          !
8616     INPUT "INPUT START TIME (s) AND STOP TIME (s) FOR DATA SEARCH",Tmin,Tmax
8618     INPUT "INPUT TIME INCREMENT FOR CALCULATING VALUES OF CHANNELS (s)",Delt
8620     IF Tmin>=Tmax THEN Input_times
8622     IF Delta_t=0 THEN Input_times
8624     IF Delta_t>(Tmax-Tmin) THEN Input_times
8626     INPUT "INPUT HALF SPAN OVER WHICH LEAST SQUARE FIT OPERATES (s)",Span
8628 Calc_num_cases:   !
8630     Num_cases=INT((Tmax-Tmin)/Delta_t)+1
8632     !DESCRIPTION OF VALUE_AT &VALUE_CALC
8634     !VALUE_AT IS FOR RAW DATA CHANNELS AND VALUE_CALC IS FOR CALCULATED
8636     !FIRST INDEX IS CHANNEL NUMBER
8638     !SECOND INDEX IS THE INDENTIFIER FOR WHICH TIME CALCULATING
8640     !THIRD INDEX =1 IS VALUE     =2 IS STANDARD ERROR OF VALUE
8642     ALLOCATE REAL Value_x(1:16,1:Num_cases,1:2),Value_calc(50:55,1:Num_cases
8644     Span_index=INT(Span/X_inc)+1
8646     Step_index=INT(Delta_t/X_inc)
8648     ALLOCATE REAL Output_y(2)
```

```
8650    Data_start=Tmin
8652    Data_stop=Tmax
8654    Average=1
8656    Average_no=Average
8658    Window_index(Start_index,Stop_index,Acc_no)
8660    Num_terms=3
8662    FOR I=1 TO 16
8664      IF Channel_x(I)=1 THEN
8666        PRINT TABXY(10,15),"PROCESSING CHANNEL",I
8668        Acc_no=4
8670        REDIM Acc4(1:Acc_size)
8672        Raw_to_acc(Buff_id$(I,1),Acc_no,Average)
8674        MAT Acc4= Acc4*(Gain(I,1))
8676        FOR J=1 TO Num_cases
8678        !
8680          Lower_index=Start_index+(J-1)*Step_index-Span_index
8682          IF Lower_index<1 THEN
8684            Lower_index=1
8686          END IF
8688          IF Lower_index>SIZE(Acc4,1) THEN
8690            Lower_index=SIZE(Acc4,1)
8692          END IF
8694          Upper_index=Start_index+(J-1)*Step_index+Span_index
8696          IF Upper_index<1 THEN
8698            Upper_index=1
8700          END IF
8702          IF Upper_index>SIZE(Acc4,1) THEN
8704            Upper_index=SIZE(Acc4,1)
8706          END IF
8708          ALLOCATE REAL X_array(1:Upper_index-Lower_index+1),Y_array(1:Upper
8710          Loop_number=0
8712          FOR Jj=Lower_index TO Upper_index
8714            Loop_number=Loop_number+1
8716            X_array(Loop_number)=(Jj-1)*X_inc
8718            Y_array(Loop_number)=Acc4(Jj)
8720          NEXT Jj
8722          Num_points=Loop_number
8724          IF Upper_index<>Lower_index THEN
8726            Input_x=Tmin+Delta_t*(J-1)
8728            Least_square(X_array(*),Y_array(*),Num_points,Num_terms,Input_x,
8730            FOR K=1 TO 2
8732              Value_x(I,J,K)=Output_y(K)
8734            NEXT K
8736          END IF
8738          DEALLOCATE X_array(*),Y_array(*)
8740        NEXT J
8742    !
8744      END IF
8746    NEXT I
8748    !
8750    FOR I=50 TO 55
8752      IF Calc_ch(I)=1 THEN
8754        PRINT TABXY(10,15),"PROCESSING CHANNEL",I
8756        Calc_type=I
8758        REDIM Acc4(1:Acc_size)
8760        Calc_quantity(Average,Calc_label$(*),Calc_type,No_more)
8762        IF No_more THEN
8764          Calc_ch(I)=0
8766          GOTO Somewhere2
8768        END IF
```

```
8770        Print_label$(I)=Calc_label$(2)
8772        FOR J=1 TO Num_cases
8774          Lower_index=Start_index+(J-1)*Step_index-Span_index
8776          IF Lower_index<1 THEN
8778            Lower_index=1
8780          END IF
8782          IF Lower_index>SIZE(Acc4,1) THEN
8784            Lower_index=SIZE(Acc4,1)
8786          END IF
8788          Upper_index=Start_index+(J-1)*Step_index+Span_index
8790          IF Upper_index<1 THEN
8792            Upper_index=1
8794          END IF
8796          IF Upper_index>SIZE(Acc4,1) THEN
8798            Upper_index=SIZE(Acc4,1)
8800          END IF
8802          ALLOCATE REAL X_array(1:Upper_index-Lower_index+1),Y_array(1:Upper
8804          Loop_number=0
8806          FOR Jj=Lower_index TO Upper_index
8808            Loop_number=Loop_number+1
8810            X_array(Loop_number)=(Jj-1)*X_inc
8812            Y_array(Loop_number)=Acc4(Jj)
8814          NEXT Jj
8816          Num_points=Loop_number
8818          IF Upper_index<>Lower_index THEN
8820            Input_x=Tmin+Delta_t*(J-1)
8822            Least_square(X_array(*),Y_array(*),Num_points,Num_terms,Input_x,
8824            FOR K=1 TO 2
8826              Value_calc(I,J,K)=Output_y(K)
8828            NEXT K
8830          END IF
8832          DEALLOCATE X_array(*),Y_array(*)
8834        NEXT J
8836    !
8838 Somewhere2:   !
8840      END IF
8842    NEXT I
8844             !
8846    DISP ""
8848    !
8850    GOSUB Keys5
8852    RETURN
8854    !
8856 Disp_on_crt:   !
8858    PRINTER IS CRT
8860    PRINT CHR$(12)
8862    GOSUB Print_header
8864    GOSUB Print_data
8866                !
8868    RETURN
8870                !
8872 Print_external: !
8874    PRINTER IS 701
8876    GOSUB Print_header
8878    GOSUB Print_data
8880                             !
8882    RETURN
8884                             !
8886 Print_header: !
8888    PRINT "STATISTICS ANALYSIS OF TEST : "&File_name1$
```

```
8890    PRINT
8892    PRINT "ANALYSIS DATE : "&DATE$(TIMEDATE)
8894    PRINT
8896    IF Max_flag THEN
8898      PRINT "DATA INSPECTED BETWEEN "&VAL$(Tmin)&" (s) AND "&VAL$(Tmax)&" (s
8900      PRINT "SAMPLE FREQUENCY (hz) ="&VAL$(Test_data(4))
8902      PRINT "SAMPLE AVERAGING BEFORE STATS = ",Average_no
8904      PRINT "NUMBER OF SAMPLES INSPECTED BY STATS = "&VAL$(Stop_index-Start_
8906      PRINT
8908      PRINT "CHANNEL",TAB(24),"UNITS",TAB(33),"MIN",TAB(45),"MAX",TAB(57),"M
8910    END IF
8912    IF Value_flag THEN
8914      PRINT "SAMPLE FREQUENCY (hz) ="&VAL$(Test_data(4))
8916      PRINT "SAMPLE AVERAGING BEFORE STATS = ",Average_no
8918      PRINT "+- RANGE OVER WHICH FIT WAS PERFORMED (s) =",Span
8920      IF Num_terms=2 THEN
8922        PRINT "LINEAR FIT TO DATA PEFORMED"
8924      END IF
8926      IF Num_terms=3 THEN
8928        PRINT "QUADRATIC FIT TO DATA PERFORMED"
8930      END IF
8932      PRINT
8934      PRINT "CHANNEL",TAB(24),"UNITS",TAB(33),"TIME",TAB(45),"VAL",TAB(57),"
8936    !
8938    END IF
8940    RETURN
8942                                                             !
8944 Print_data: !
8946                                                                        !
8948    IF Max_flag THEN
8950      FOR I=1 TO 16
8952        IF Channel_x(I)=1 THEN
8954          PRINT Buff_title$(I,1),TAB(24),Buff_units$(I,1);
8956          PRINT TAB(30);
8958          PRINT USING "4(SD.DDDE,XX)";Stats_x(I,1),Stats_x(I,2),Stats_x(I,3)
8960        END IF
8962      NEXT I
8964      PRINT
8966      FOR I=50 TO 55
8968        IF Calc_ch(I)=1 THEN
8970          PRINT Print_label$(I);
8972          PRINT TAB(30);
8974          PRINT USING "4(SD.DDDE,XX)";Stats_calc(I,1),Stats_calc(I,2),Stats_
8976        END IF
8978      NEXT I
8980    END IF
8982    !
8984    IF Value_flag THEN
8986      FOR I=1 TO 16
8988        IF Channel_x(I)=1 THEN
8990          FOR J=1 TO Num_cases
8992            Time_value=(J-1)*Delta_t+Tmin
8994            PRINT Buff_title$(I,1),TAB(24),Buff_units$(I,1);
8996            PRINT TAB(30);
8998            PRINT USING "3(SD.DDDE,XX)";Time_value,Value_x(I,J,1),Value_x(I,
9000          NEXT J
9002          PRINT
9004        END IF
9006      NEXT I
9008      PRINT
```

```
9010      FOR I=50 TO 55
9012        IF Calc_ch(I)=1 THEN
9014          FOR J=1 TO Num_cases
9016            Time_value=(J-1)*Delta_t+Tmin
9018            PRINT Print_label$(I);
9020            PRINT TAB(30);
9022            PRINT USING "3(SD.DDDE,XX)";Time_value,Value_calc(I,J,1),Value_c
9024          NEXT J
9026          PRINT
9028        END IF
9030      NEXT I
9032    !
9034    END IF
9036    RETURN
9038    !
9040 Redim_data: !
9042!THIS BIT TO ENSURE THAT THE CORECT DATA IS IN THE ARRAY AFTER REDIM
9044    IF Counter=1 THEN
9046 !
9048      REDIM Sort_vector(1:SIZE(Acc4,1))
9050      FOR J=1 TO (SIZE(Acc4,1)-Start_index+1)
9052        Sort_vector(J)=Start_index-1+J
9054      NEXT J
9056      FOR J=1 TO Start_index-1
9058        Sort_vector(J+SIZE(Acc4,1)-Start_index+1)=J
9060      NEXT J
9062    END IF
9064                                                                  !
9066    MAT REORDER Acc4 BY Sort_vector
9068    REDIM Acc4(Start_index:Stop_index)
9070    REDIM Acc3(Start_index:Stop_index)
9072    RETURN
9074    !
9076 Quit:!
9078    Data_start=Start_temp
9080    Data_stop=Stop_temp
9082      !
9084    PRINTER IS CRT
9086    PRINT CHR$(12)
9088    Window_flag=0
9090    !
9092  SUBEND
9094  !______________________________________________________________________
9096 Calc_quantity:SUB Calc_quantity(Average,Calc_label$(*),Calc_type,No_more)
9098              !
9100              !THIS ROUTINE CALCULATES DERIVEDE QUANTITIES FROM  THE RAW DATA
9102              !CHANNELS. DONE HERE SO THAT CALCULATED QUANTITIES CAN BE
9104              !ACCSESSED FROM CHANNEL vs. TIME AND CHANNEL vs. CHANNEL
9106              !A NEW MODULE IN VERSION 3.
9108              !PAUL SPENCER  NOV 30 1988
9110              !
9112              !IN THIS SUBPROGRAMME YOU ENTER THE FINAL LAYER THICKNESS INFO
9114              !ON A TEST BY TEST BASIS.
9116              !VERSION 3.2 ADDITIONS
9118              !TURD MAKER ASSUMES THAT FILE NAME STARTS WITH A "Y"
9120              !THE MEGA NEWT APPARATUS TESTS START WITH AN "X"
9122  !======================================================================
9124    OPTION BASE 1
9126    COM /Index_string/ Buff_id$(*),Buff_title$(*),Buff_units$(*)
9128    COM /Index_real/ Buff_freq(*),Gain(*),Offset(*)
```

```
9130     COM /Msus/ Msus_raw$,File_name1$
9132     COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
9134     COM /Viewport/ Viewxmin,Viewxmax,Viewymin,Viewymax
9136     COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
9138     !----------------------------------------------------------------------
9140     No_more=0
9142     Test_type$=UPC$(File_name1$[1,1])
9144     SELECT Test_type$
9146     CASE "X"
9148     !*******************************
9150     !MEGA NEWT CALCULATIONS GO HERE
9152     !*******************************
9154       SELECT Calc_type
9156       CASE 50
9158     !CALCULATES MEAN DISPLACEMENT FROM THE INDIVIDUAL DISPLACEMENTS
9160         Ch=1
9162         Acc_no=4
9164         Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9166         MAT Acc4= Acc4*(Gain(Ch,1))
9168         MAT Acc4= Acc4-(Offset(Ch,1))
9170         Ch=2
9172         Acc_no=3
9174         Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9176         MAT Acc3= Acc3*(Gain(Ch,1))
9178         MAT Acc3= Acc3-(Offset(Ch,1))
9180         MAT Acc4= Acc4+Acc3
9182         MAT Acc4= Acc4*(.5)
9184         SELECT File_name1$
9186         CASE "X996"
9188           MAT Acc4= Acc4*(5/3.5)!SCREW UP IN EXITATION VOLTAGE
9190         END SELECT
9192         Calc_label$(1)="Calc Displacement"
9194         Calc_label$(2)="Calc Displacement (mm)"
9196     !
9198       CASE 51,53
9200     !CALCULATES LAYER THICKNESS
9202 Get_final_thick:   !
9204   !YOU MUST PUT IN THE FINAL LAYER THICKNESS IN THIS SECTION
9206   !BY EXTENDING THE CASE STRUCTURE BELOW AND ADDING IN THE VALUE OF THE
9208   !FINAL THICKNESS. THIS ARRANGEMENT AVOIDS HAVING TO ENTER IT FROM THE
9210   !
9212         SELECT File_name1$
9214         CASE "X001"         !UNITS OF FINAL_THICK IS mm
9216           Final_thick=25.7
9218         CASE "X002"
9220           Final_thick=26.4
9222         CASE "X003"
9224           Final_thick=34.8
9226         CASE "X999"
9228           Final_thick=15
9230         CASE "X998"
9232           Final_thick=24.7
9234         CASE "X997"
9236           Final_thick=31.4
9238         CASE "X996"
9240           Final_thick=24.5
9242         CASE "X995"
9244           Final_thick=28.5
9246           CASE "X977"
9248           Final_thick=66.9
```

```
9250            Final_density=775    !UNITS Kg/m^3
9251            CASE "X976"
9252            Final_thick=67
9253            Final_density=775
9255          CASE ELSE
9256            PRINT "NO FINAL THICKNESS DATA YET :  EDIT GET_FINAL_THICK"
9257            BEEP
9258            INPUT "PRESS RETURN TO CONTINUE",Reply$
9260          END SELECT
9262          Ch=1
9264          Acc_no=4
9266          Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9268          MAT Acc4= Acc4*(Gain(Ch,1))
9270          MAT Acc4= Acc4-(Offset(Ch,1))
9272          Ch=2
9274          Acc_no=3
9276          Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9278          MAT Acc3= Acc3*(Gain(Ch,1))
9280          MAT Acc3= Acc3-(Offset(Ch,1))
9282          MAT Acc4= Acc4+Acc3
9284          MAT Acc4= Acc4*(.5)
9286          SELECT File_name1$
9288          CASE "X996"
9290            MAT Acc4= Acc4*(5/3.5)!SCREW UP IN EXITATION VOLTAGE
9292          END SELECT
9294        !
9296          Max_disp=MAX(Acc4(*))
9298          MAT Acc4= Acc4*(-1)
9300          MAT Acc4= Acc4+(Max_disp+Final_thick)
9302          Calc_label$(1)="Layer Thickness"
9304          Calc_label$(2)="Layer Thickness (mm)"
9306          !
9308          IF Calc_type=53 THEN
9310          !CALCULATES DENSITY FOR COMPACTION TESTS
9312          !SELECTION OF ALLOWABLE TESTS IS DONE IN BUILD_MENU
9314          !
9316          !
9318          MAT Acc4= (Final_thick*Final_density)/Acc4
9320          Calc_label$(1)="Sample Density "
9322          Calc_label$(2)="Sample Density (kg/m^3)"
9324          END IF
9326      !
9328        CASE 52
9330      !CALCULATES PRESSURE FROM EXTEND AND RETRACT LOAD
9332          Ch=4!EXTEND LOAD
9334          Acc_no=4
9336          Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9338          MAT Acc4= Acc4*(Gain(Ch,1))
9340          MAT Acc4= Acc4-(Offset(Ch,1))
9342          Ch=5!RETRACT LOAD
9344          Acc_no=3
9346          Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9348          MAT Acc3= Acc3*(Gain(Ch,1))
9350          MAT Acc3= Acc3-(Offset(Ch,1))
9352          MAT Acc4= Acc4-Acc3
9354          Platten_area=20*30*(2.54E-2)^2    !AREA IN m^2
9356          MAT Acc4= Acc4*(1/Platten_area)
9358          MAT Acc4= Acc4-(Acc4(1))
9360          Calc_label$(1)="Mean Plate Pressure"
9362          Calc_label$(2)="Mean Plate Pressure (MPa)"
```

```
9364     !
9366       CASE ELSE
9368     !
9370     !SET A FLAG TO INDICATE NO MORE .TO BE USED IN STATS
9372         No_more=1
9374       END SELECT
9376     CASE "Y"
9378     !*********************************
9380     !STUFF FOR TURD MAKER GOES IN HERE
9382     !*********************************
9384       SELECT Calc_type
9386     !
9388       CASE 50
9390     !CALCULATES LAYER THICKNESS
9392 Final_thick:   !
9394   !YOU MUST PUT IN THE FINAL LAYER THICKNESS IN THIS SECTION
9396   !BY EXTENDING THE CASE STRUCTURE BELOW AND ADDING IN THE VALUE OF THE
9398   !FINAL THICKNESS. THIS ARRANGEMENT AVOIDS HAVING TO ENTER IT FROM THE
9400   !
9402         SELECT File_name1$
9404         CASE "Y001"          !UNITS OF FINAL_THICK IS mm
9406           Final_thick=(55.16+55.52+53.63)/3
9408         CASE "Y002"
9410           Final_thick=0
9412         CASE "Y003"
9414           Final_thick=0
9416         CASE "Y004"
9418           Final_thick=0
9420         CASE "Y005"
9422           Final_thick=0
9424         CASE "Y006"
9426           Final_thick=0
9428         CASE "Y007"
9430           Final_thick=0
9432         CASE "Y008"
9434           Final_thick=0
9436         CASE ELSE
9438           PRINT "NO FINAL THICKNESS DATA YET :  EDIT FINAL_THICK"
9440           BEEP
9442           INPUT "PRESS RETURN TO CONTINUE",Reply$
9444         END SELECT
9446         Ch=3
9448         Acc_no=4
9450         Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9452         MAT Acc4= Acc4*(Gain(Ch,1))
9454         MAT Acc4= Acc4-(Offset(Ch,1))
9456       !
9458         Max_disp=MAX(Acc4(*))
9460         MAT Acc4= Acc4*(-1)
9462         MAT Acc4= Acc4+(Max_disp+Final_thick)
9464         Calc_label$(1)="Total Thickness"
9466         Calc_label$(2)="Total Thickness (mm)"
9468     !
9470       CASE 51
9472     !CALCULATES PRESSURE FROM EXTEND AND RETRACT LOAD
9474         Ch=4!EXTEND LOAD
9476         Acc_no=4
9478         Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9480         MAT Acc4= Acc4*(Gain(Ch,1))
9482         MAT Acc4= Acc4-(Offset(Ch,1))
```

```
9484         Ch=5!RETRACT LOAD
9486         Acc_no=3
9488         Raw_to_acc(Buff_id$(Ch,1),Acc_no,Average)
9490         MAT Acc3= Acc3*(Gain(Ch,1))
9492         MAT Acc3= Acc3-(Offset(Ch,1))
9494         MAT Acc4= Acc4-Acc3
9496         Plunger_area=PI*(2.5*2.54E-2)^2    !AREA IN m^2
9498         MAT Acc4= Acc4*(1/Plunger_area)
9500         MAT Acc4= Acc4-(Acc4(1))
9502         Calc_label$(1)="Plunger Pressure"
9504         Calc_label$(2)="Plunger Pressure (MPa)"
9506     !
9508       CASE ELSE
9510     !SET A FLAG TO INDICATE NO MORE .TO BE USED IN STATS
9512         No_more=1
9514     !
9516       END SELECT
9518     !
9520     CASE ELSE
9522     END SELECT
9524              !
9526 The_end:            !
9528     SUBEXIT
9530   SUBEND
9532   !_______________________________________________________________
9534 Manipulate:SUB Data_manipulate(Data_adjust,Flag,Exponent,Constant,Const_fla
9536     COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
9538     !
9540   !THIS SUBROUTINE PEFORMS THE DATA MANIPULATION OF CHANNELS EITHER RAW
9542   !OR CALCULATED. THE TYPE OF MANIPULATION IS DETERMINED BY THE VALUE OF
9544   !THE VARIABLE DATA_ADJUST
9546   !DATA_ADJUST=1               :LOGe(X)
9548   !DATA_ADJUST=2               :LOG10(X)
9550   !DATA_ADJUST=3               :E^(X)
9552   !DATA_ADJUST=4               :10^(X)
9554   !DATA_ADJUST=5               :(X)^EXPONENT
9556   !DATA_ADJUST=6               :ADD CONSTANT BEFORE DOING 1 TO 5
9558   !IF THE VARIABLE FLAG IS TRUE REMOVE OFFSET ELSE DO NOT
9560   !THE INPUT AND OUTPUT DATA ARE IN ACC4(*)
9562   !
9564     IF Flag THEN
9566       MAT Acc4= Acc4-(Acc4(1))
9568     END IF
9570     IF Const_flag THEN
9572       MAT Acc4= Acc4+(Constant)
9574     END IF
9576     ON ERROR GOSUB Error_routine
9578     SELECT Data_adjust
9580     CASE 0
9582       GOTO The_end
9584     CASE 1
9586       FOR I=1 TO SIZE(Acc4,1)
9588         Acc4(I)=LOG(Acc4(I))
9590       NEXT I
9592     CASE 2
9594       FOR I=1 TO SIZE(Acc4,1)
9596         Acc4(I)=LGT(Acc4(I))
9598       NEXT I
9600     CASE 3
9602       FOR I=1 TO SIZE(Acc4,1)
```

```
9604         Acc4(I)=EXP(Acc4(I))
9606       NEXT I
9608     CASE 4
9610       FOR I=1 TO SIZE(Acc4,1)
9612         Acc4(I)=10^(Acc4(I))
9614       NEXT I
9616     CASE 5
9618       FOR I=1 TO SIZE(Acc4,1)
9620         Acc4(I)=(Acc4(I))^Exponent
9622       NEXT I
9624     CASE ELSE
9626       DISP "UNEXPECTED DATA MANIPULATION TYPE"
9628       BEEP
9630       PAUSE
9632     END SELECT
9634 The_end: !
9636     OFF ERROR
9638     SUBEXIT
9640  !
9642 Error_routine:!
9644     SELECT ERRN
9646     CASE 28              !LGT OR LOG OF NON_POS
9648       Acc4(I)=1
9650     CASE 27              !NEGATIVE BASE TO NON_INTEGER POWER
9652       Acc4(I)=1
9654     CASE 22              !REAL OVERFLOW
9656       Acc4(I)=1
9658     CASE 136             !REAL UNDERFLOW
9660       Acc4(I)=1
9662     CASE 26              !ZERO TO NEGATIVE POWER
9664       Acc4(I)=1
9666     CASE 31              !DIVIDE BY ZERO
9668       Acc4(I)=1
9670     CASE ELSE
9672       DISP ERRM$
9674       BEEP
9676       PAUSE
9678     END SELECT
9680     RETURN
9682  SUBEND
9684  !______________________________________________________________________
9686 Fix_labels:SUB Fix_labels(Calc_label$(*),Data_adjust,Exponent,Constant,Cons
9688     IF Const_flag THEN
9690       IF Constant<0 THEN
9692         Const_add$=VAL$(Constant)
9694       ELSE
9696         Const_add$="+"&VAL$(Constant)
9698       END IF
9700       FOR I=1 TO 2
9702         Calc_label$(I)=Calc_label$(I)&Const_add$
9704       NEXT I
9706     END IF
9708     SELECT Data_adjust
9710     CASE 0
9712       GOTO The_end
9714     CASE 1
9716       FOR I=1 TO 2
9718         Calc_label$(I)="LOGe( "&Calc_label$(I)&" )"
9720       NEXT I
9722     CASE 2
```

```
9724      FOR I=1 TO 2
9726        Calc_label$(I)="LOG10( "&Calc_label$(I)&" )"
9728      NEXT I
9730            !
9732    CASE 3
9734      FOR I=1 TO 2
9736        Calc_label$(I)="EXP( "&Calc_label$(I)&" )"
9738      NEXT I
9740    CASE 4
9742      FOR I=1 TO 2
9744        Calc_label$(I)="10^( "&Calc_label$(I)&" )"
9746      NEXT I
9748    CASE 5
9750      FOR I=1 TO 2
9752        Calc_label$(I)="( "&Calc_label$(I)&" )^ "&VAL$(Exponent)
9754      NEXT I
9756    CASE 6
9758      !NO MODS TO LABEL REQUIRED
9760    CASE ELSE
9762      DISP " UNEXPECTED DATA MANIPULATION IN FIX_LABEL"
9764      BEEP
9766      PAUSE
9768            !
9770    END SELECT
9772 The_end:           !
9774    SUBEXIT
9776  SUBEND
9778  !____________________________________________________________________________
9780 Window_index:SUB Window_index(Start_index,Stop_index,OPTIONAL Acc_no)
9782    COM /Data_window/ Window_flag,Data_start,Data_stop,Average_no
9784    COM /Plot_stuff/ Max_samples,X_inc,Time,Plot_msg$(*),Auto
9786    COM /Accumulators/ Acc1(*),Acc2(*),Acc3(*),Acc4(*),Acc_size
9788    IF NPAR=2 THEN
9790      IF Window_flag THEN
9792        Start_index=INT(Data_start/X_inc/Average_no)
9794        Start_index=MAX(1,Start_index)
9796        Stop_index=INT(Data_stop/X_inc/Average_no)
9798        Stop_index=MIN(Stop_index,SIZE(Acc1,1),SIZE(Acc2,1))
9800      ELSE
9802        Start_index=1
9804        Stop_index=MIN(SIZE(Acc1,1),SIZE(Acc2,1))
9806      END IF
9808    ELSE
9810      IF Window_flag THEN
9812        Start_index=INT(Data_start/X_inc/Average_no)
9814        Start_index=MAX(1,Start_index)
9816        Stop_index=INT(Data_stop/X_inc/Average_no)
9818        Stop_index=MIN(Stop_index,SIZE(Acc4,1))
9820      ELSE
9822        Start_index=1
9824        Stop_index=MIN(SIZE(Acc4,1))
9826      END IF
9828    END IF
9830    SUBEXIT
9832  SUBEND
9834  !_________________________________________________________
9836 Least_square:SUB Least_square(X_array(*),Y_array(*),Num_points,Num_terms,In
9838                  !
9840                  !LEAST SQUARE ROUTINE TO A SECOND ORDER POLYNOMIAL
9842                  !INPUT DATA IS THE X_ARRAY(*) AND THE Y_ARRAY(*)
```

```
9844                 !EACH POINT HAS EQUAL WEIGHT
9846                 !THE NUMBER OF POINTS IS NUM_POINTS
9848                 !THE OUTPUT IS THE Y VALUE AT A PARTICULAR X VALUE
9850                 !PLUS THE ERROR IN THE Y VALUE
9852                 !NUM_TERMS SPECIFIESTHE ORDER OF THE FIT
9854                 !PAUL SPENCER DEC 11
9856                 !
9858      SELECT Num_terms
9860      CASE 2
9862        IF Num_points>2 THEN
9864          ALLOCATE REAL Xx(1:Num_points),Xy(1:Num_points)
9866          MAT Xx= X_array*X_array
9868          MAT Xy= X_array*Y_array
9870          Sum_x=SUM(X_array)
9872          Sum_xx=SUM(Xx)
9874          Sum_y=SUM(Y_array)
9876          Sum_xy=SUM(Xy)
9878          D=Num_points*Sum_xx-Sum_x*Sum_x
9880          A1=(1/D)*(Sum_xx*Sum_y-Sum_x*Sum_xy)
9882          A2=(1/D)*(Num_points*Sum_xy-Sum_x*Sum_y)
9884          A3=0
9886          Output_y(1)=A2*Input_x+A1
9888          GOSUB Error_calc
9890          DEALLOCATE Xx(*),Xy(*)
9892        ELSE
9894          Output_y(1)=SUM(Y_array)/Num_points
9896          Output_y(2)=0
9898        END IF
9900      CASE 3
9902        IF Num_points>3 THEN
9904          ALLOCATE REAL Xx(1:Num_points),Xxx(1:Num_points),Xxxx(1:Num_points),
9906          ALLOCATE REAL Delta(1:3,1:3),Beta(1:3,1:3)
9908          MAT Xx= X_array . X_array
9910          MAT Xxx= Xx . X_array
9912          MAT Xxxx= Xx . Xx
9914          MAT Xy= X_array . Y_array
9916          MAT Xxy= Xx . Y_array
9918          Sum_x=SUM(X_array)
9920          Sum_xx=SUM(Xx)
9922          Sum_xxx=SUM(Xxx)
9924          Sum_xxxx=SUM(Xxxx)
9926          Sum_y=SUM(Y_array)
9928          Sum_xy=SUM(Xy)
9930          Sum_xxy=SUM(Xxy)
9932          Delta(1,1)=Num_points
9934          Delta(1,2)=Sum_x
9936          Delta(1,3)=Sum_xx
9938          Delta(2,1)=Sum_x
9940          Delta(2,2)=Sum_xx
9942          Delta(2,3)=Sum_xxx
9944          Delta(3,1)=Sum_xx
9946          Delta(3,2)=Sum_xxx
9948          Delta(3,3)=Sum_xxxx
9950          D=DET(Delta)
9952          MAT Beta= Delta
9954          Beta(1,1)=Sum_y
9956          Beta(2,1)=Sum_xy
9958          Beta(3,1)=Sum_xxy
9960          A1=DET(Beta)/D
9962          MAT Beta= Delta
```

```
9964         Beta(2,1)=Sum_y
9966         Beta(2,2)=Sum_xy
9968         Beta(2,3)=Sum_xxy
9970         A2=DET(Beta)/D
9972         MAT Beta= Delta
9974         Beta(3,1)=Sum_y
9976         Beta(3,2)=Sum_xy
9978         Beta(3,3)=Sum_xxy
9980         A3=DET(Beta)/D
9982         Output_y(1)=A1+A2*Input_x+A3*Input_x*Input_x
9984         GOSUB Error_calc
9986         DEALLOCATE Xx(*),Xxx(*),Xxxx(*),Xy(*),Xxy(*)
9988         DEALLOCATE Delta(*),Beta(*)
9990       ELSE
9992         Output_y(1)=SUM(Y_array)/Num_points
9994         Output_y(2)=0
9996       END IF
9998     !
10000    CASE ELSE
10002      DISP "UNEXPECTED NUM_TERMS IN LEAST_SQUARE"
10004      BEEP
10006      PAUSE
10008    END SELECT
10010    SUBEXIT
10012 Error_calc: ! SEE FUNDAMENTAL FORMUALES OF PHYSICS D.H.MENZEL DOVER BOOKS
10014             !PAGE 119. CALCULATES REDUCED CHI_SQ AND THE ERROR ASSOCIATED
10016             !WITH A POINT ON THE LINE. THE FORMULAE IS STRICTLY SPEAKING
10018             !FOR A STRAIGHT LINE AND SO AN APPROXIMATION  FOR THE
10020             !QUADRATIC FIT.
10022    IF (Num_points-Num_terms)>1 THEN
10024      MAT X_array= (A2)*X_array
10026      MAT Xx= (A3)*Xx
10028      MAT Xx= Xx+X_array
10030      MAT Xx= Xx+(A1)
10032      MAT Xx= Y_array-Xx
10034      MAT Xy= Xx*Xx
10036      Chi=SQR(SUM(Xy)/(Num_points-Num_terms))
10038      Output_y(2)=Chi*SQR((1/Num_points)+(Input_x-(1/Num_points)*Sum_x)^2/(S
10040    ELSE
10042      Output_y(2)=0
10044    END IF
10046    RETURN
10048 SUBEND
```

9.3 Density Data

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X963 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9										ERR	ERR	ERR	ERR	ERR
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7										ERR	ERR	ERR	ERR	ERR
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: ERR

Std. Deviation: ERR

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. Y963

Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9	35.70	35.62	27.00	26.98	27.40	48.88	48.90	48.90	32.5	35.66	27.13	48.89	47.30	0.687
33	-190.5										ERR	ERR	ERR	ERR	ERR
34	-165.1	28.44	28.34	16.88	17.06	17.60	48.62	48.64	48.64	16.0	28.39	17.18	48.63	23.72	0.675
35	-139.7	45.68	45.56	22.46	22.90	22.70	48.50	48.70	48.64	35.8	45.62	22.69	48.61	50.31	0.712
36	-114.3	46.48	46.46	22.00	21.20	21.10	48.60	48.58	48.40	33.8	46.47	21.43	48.53	48.33	0.699
37	-88.9	30.08	30.34	15.74	15.86	15.60	48.56	48.66	48.62	16.5	30.21	15.73	48.61	23.11	0.714
38	-63.5	28.60	29.00	17.76	17.00	17.30	48.70	48.68	48.60	17.6	28.80	17.35	48.66	24.32	0.724
39	-38.1	57.10	59.00	22.60	22.80	23.10	48.64	48.70	48.60	45.9	58.05	22.83	48.65	64.48	0.712
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1	63.08	64.10	21.40	21.90	21.60	48.70	48.56	48.60	48.4	63.59	21.63	48.62	66.88	0.724
43	63.5	48.00	47.96	17.10	18.10	18.60	48.40	48.64	48.90	29.5	47.98	17.93	48.65	41.86	0.705
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1										ERR	ERR	ERR	ERR	ERR
48	190.5										ERR	ERR	ERR	ERR	ERR
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 48.65

Std. Deviation: 0.09

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X963A

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9										ERR	ERR	ERR	ERR	ERR
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7										ERR	ERR	ERR	ERR	ERR
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: ERR

Std. Deviation: ERR

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y963A Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9	57.30	57.56	26.98	25.90	25.74	48.60	48.30	48.30	45.2	57.43	26.21	48.40	72.84	0.621
33	-190.5	56.74	57.00	25.70	25.44	25.00	48.40	48.38	48.54	44.5	56.87	25.38	48.44	69.92	0.636
34	-165.1	52.16	52.70	24.64	24.62	24.70	48.44	48.48	48.60	40.6	52.43	24.65	48.51	62.70	0.648
35	-139.7	51.54	52.40	26.00	26.06	25.98	48.40	48.56	48.60	42.8	51.97	26.01	48.52	65.59	0.652
36	-114.3	51.24	51.80	24.40	24.00	24.24	48.50	48.50	48.40	40.0	51.52	24.21	48.47	60.46	0.662
37	-88.9	50.90	51.50	24.70	24.10	24.66	48.30	48.40	48.44	40.9	51.20	24.49	48.38	60.65	0.674
38	-63.5	50.90	51.40	22.72	22.88	22.90	48.30	48.40	48.60	37.1	51.15	22.83	48.43	56.57	0.656
39	-38.1	51.10	51.70	21.40	21.56	21.58	48.30	48.40	48.40	33.5	51.40	21.51	48.37	53.48	0.626
40	-12.7	50.98	51.66	20.92	21.20	21.30	48.40	48.20	48.00	32.4	51.32	21.14	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1	59.88	60.10	22.54	22.60	22.78	48.10	48.02	47.90	42.8	59.99	22.64	48.01	65.20	0.656
48	190.5	60.04	60.30	23.84	23.76	23.82	48.10	48.00	48.10	45.8	60.17	23.81	48.07	68.85	0.665
49	215.9	60.40	60.60	24.22	24.72	24.90	48.04	48.04	47.70	46.5	60.50	24.61	47.93	71.37	0.652
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 48.32

Std. Deviation: 0.20

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X970

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9	50.68	51.14	24.50	24.82	24.58	41.72	41.66	41.62	31.8	50.91	24.63	41.67	52.25	0.609
13	-63.5	51.52	51.80	24.06	24.00	23.90	41.64	41.62	41.62	32.7	51.66	23.99	41.63	51.58	0.634
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7	50.16	50.24	28.92	28.24	28.04	41.70	41.72	41.66	40.7	50.20	28.40	41.69	59.44	0.685
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 41.66

Std. Deviation: 0.03

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y970 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9										ERR	ERR	ERR	ERR	ERR
33	-190.5										ERR	ERR	ERR	ERR	ERR
34	-165.1										ERR	ERR	ERR	ERR	ERR
35	-139.7										ERR	ERR	ERR	ERR	ERR
36	-114.3										ERR	ERR	ERR	ERR	ERR
37	-88.9										ERR	ERR	ERR	ERR	ERR
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1	52.08	52.58	26.28	25.66	25.34	41.58	41.60	41.56	38.3	52.33	25.76	41.58	56.05	0.683
43	63.5	51.62	52.00	23.16	23.24	22.66	41.44	41.42	41.36	34.1	51.81	23.02	41.41	49.38	0.691
44	88.9	51.02	51.20	24.72	24.46	24.10	41.20	41.28	41.18	35.4	51.11	24.43	41.22	51.46	0.688
45	114.3	50.84	50.60	24.18	24.54	25.00	41.10	41.06	41.12	35.2	50.72	24.57	41.09	51.22	0.687
46	139.7	52.04	51.54	24.58	24.76	24.60	41.14	41.08	41.12	36.2	51.79	24.65	41.11	52.48	0.690
47	165.1	52.06	52.24	23.50	23.60	23.54	41.00	40.94	40.96	34.4	52.15	23.55	40.97	50.31	0.684
48	190.5	52.34	52.36	28.00	28.24	28.24	40.80	40.80	41.00	41.9	52.35	28.16	40.87	60.24	0.695
49	215.9	52.04	51.96	22.20	22.28	22.00	40.74	40.74	40.78	31.5	52.00	22.16	40.75	46.96	0.671
North50	241.3	52.08	51.58	24.88	24.86	24.80	40.66	40.66	40.68	36.8	51.83	24.85	40.67	52.37	0.703

Mean Thickness: 41.07

Std. Deviation: 0.28

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X971

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9	55.26	55.30	17.06	17.40	17.64	16.90	17.00	17.40	9.9	55.28	17.37	17.10	16.42	0.603
8	-190.5	54.80	55.00	23.20	23.26	23.18	18.60	18.50	18.72	13.6	54.90	23.21	18.61	23.71	0.574
9	-165.1	55.00	55.00	24.23	24.50	24.48	18.64	18.80	18.92	15.2	55.00	24.40	18.79	25.21	0.603
10	-139.7	55.00	54.92	23.20	23.60	23.70	18.88	19.00	19.04	15.4	54.96	23.50	18.97	24.51	0.628
11	-114.3	54.86	54.92	24.12	24.40	24.30	18.94	19.02	19.18	16.7	54.89	24.27	19.05	25.38	0.658
12	-88.9	47.18	47.52	22.10	22.22	22.40	19.50	19.36	19.48	13.3	47.35	22.24	19.45	20.48	0.649
13	-63.5	53.70	53.80	27.80	27.70	27.66	19.22	19.22	19.30	19.4	53.75	27.72	19.25	28.68	0.677
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7	51.80	51.80	23.20	25.54	26.70	23.00	23.16	23.04	21.0	51.80	25.15	23.07	30.05	0.699
16	12.7	51.64	51.68	25.50	25.80	24.80	23.10	23.10	23.08	21.4	51.66	25.37	23.09	30.26	0.707
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9	49.20	49.32	23.44	24.14	24.08	19.70	19.80	19.90	13.8	49.26	23.89	19.80	23.30	0.592
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 19.72

Std. Deviation: 1.81

EXTRUSION OF CRUSHED ICE　　　　PROJECT 9538

Sample Thickness and Density Data

Test No. Y971　　　　Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9										ERR	ERR	ERR	ERR	ERR
33	-190.5										ERR	ERR	ERR	ERR	ERR
34	-165.1										ERR	ERR	ERR	ERR	ERR
35	-139.7										ERR	ERR	ERR	ERR	ERR
36	-114.3										ERR	ERR	ERR	ERR	ERR
37	-88.9	36.10	36.14	25.70	25.80	26.50	22.78	22.80	22.94	14.8	36.12	26.00	22.84	21.45	0.690
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1	51.18	51.20	22.90	22.96	22.84	23.00	23.00	23.02	18.7	51.19	22.90	23.01	26.97	0.693
40	-12.7										ERR	ERR	23.08	ERR	0.703
41	12.7										ERR	ERR	23.08	ERR	0.703
42	38.1	42.64	42.90	22.20	23.10	23.40	23.10	23.16	22.56	15.3	42.77	22.90	22.94	22.47	0.681
43	63.5	50.00	50.00	23.90	24.20	24.70	23.24	23.24	23.26	20.7	50.00	24.27	23.25	28.21	0.734
44	88.9	50.26	50.20	22.46	22.40	22.60	23.20	23.40	23.40	19.7	50.23	22.49	23.33	26.36	0.747
45	114.3	50.60	50.40	21.18	21.30	21.20	23.20	23.20	23.28	18.9	50.50	21.23	23.23	24.90	0.759
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1	50.00	49.80	23.90	23.54	23.80	23.30	23.28	23.30	21.8	49.90	23.75	23.29	27.60	0.790
48	190.5	50.40	50.30	24.70	24.74	25.00	23.36	23.30	23.46	23.6	50.35	24.81	23.37	29.20	0.808
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.14

Std. Deviation: 0.17

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X972

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9										ERR	ERR	ERR	ERR	ERR
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7										ERR	ERR	ERR	ERR	ERR
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: ERR

Std. Deviation: ERR

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y972 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	50.74	50.82	28.66	28.48	28.20	21.24	21.28	21.22	21.2	50.78	28.45	21.25	30.69	0.691
32	-215.9	50.52	50.70	22.36	22.86	22.86	21.14	21.22	21.16	16.3	50.61	22.69	21.17	24.32	0.670
33	-190.5	50.44	50.22	22.92	23.00	22.94	21.08	21.22	21.18	16.1	50.33	22.95	21.16	24.44	0.659
34	-165.1	49.72	49.64	24.70	24.70	24.08	21.06	21.08	21.16	17.0	49.68	24.49	21.10	25.68	0.662
35	-139.7										ERR	ERR	ERR	ERR	ERR
36	-114.3										ERR	ERR	ERR	ERR	ERR
37	-88.9										ERR	ERR	ERR	ERR	ERR
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7	48.20	49.34	26.20	26.84	26.74	20.68	20.72	20.96	18.0	48.77	26.59	ERR	ERR	ERR
42	38.1	50.22	49.72	24.52	24.38	24.68	20.84	20.78	20.72	16.8	49.97	24.53	20.78	25.47	0.660
43	63.5	50.46	50.56	25.40	25.26	25.10	20.76	20.70	20.76	17.6	50.51	25.25	20.74	26.45	0.665
44	88.9	50.50	50.62	23.20	23.38	23.30	20.58	20.60	20.70	16.2	50.56	23.29	20.63	24.29	0.667
45	114.3	50.44	50.54	24.60	24.92	25.00	20.70	20.50	20.40	17.3	50.49	24.84	20.53	25.75	0.672
46	139.7	50.80	50.72	26.04	26.08	25.96	20.54	20.48	20.34	18.6	50.76	26.03	20.45	27.02	0.688
47	165.1	50.90	51.46	23.34	23.50	23.44	20.14	20.34	20.40	16.8	51.18	23.43	20.29	24.33	0.690
48	190.5	51.64	51.84	24.00	24.12	24.30	20.34	20.44	20.12	18.0	51.74	24.14	20.30	25.35	0.710
49	215.9	52.06	52.26	25.54	25.70	25.70	20.12	20.12	20.18	19.6	52.16	25.65	20.14	26.94	0.727
North50	241.3	41.90	41.92	26.40	26.28	26.50	20.10	20.16	20.18	15.8	41.91	26.39	20.15	22.29	0.709

Mean Thickness: 20.67

Std. Deviation: 0.39

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X973 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
											ERR	ERR	ERR	ERR	ERR
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3									12.6	53.48	22.13	15.69	18.58	0.678
12	-88.9	53.72	53.24	22.08	22.10	22.22	15.84	15.64	15.60	15.1	52.50	24.66	16.02	20.74	0.728
13	-63.5	52.70	52.30	24.50	24.70	24.78	16.12	15.94	16.00	15.8	51.81	25.17	16.02	20.89	0.756
14	-38.1	52.14	51.48	24.54	25.58	25.40	16.10	16.00	15.96	14.0	49.74	24.61	16.14	19.76	0.70[illegible]
15	-12.7	49.60	49.88	23.64	24.90	25.30	16.08	16.16	16.18		ERR	ERR	ERR	ERR	ERR
16	12.7										ERR	ERR	ERR	ERR	ERR
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3														

Mean Thickness: 15.97

Std. Deviation: 0.17

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. 1973 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	50.44	50.28	22.16	21.80	23.10	16.00	16.12	15.90	13.6	50.36	22.35	16.01	18.02	0.755
32	-215.9	50.30	50.40	22.70	22.96	23.10	16.00	16.16	15.98	14.0	50.35	22.92	16.05	18.52	0.756
33	-190.5	50.70	50.56	25.58	26.00	25.94	16.00	15.96	15.90	15.8	50.63	25.84	15.95	20.87	0.757
34	-165.1	50.80	50.76	23.34	23.50	23.80	16.08	16.60	16.00	14.3	50.78	23.55	16.23	19.40	0.737
35	-139.7	49.68	50.10	27.10	27.22	27.06	16.16	16.04	16.00	16.2	49.89	27.13	16.07	21.74	0.745
36	-114.3	49.90	49.86	21.06	21.10	21.14	16.00	16.00	15.86	11.9	49.88	21.10	15.95	16.79	0.709
37	-88.9	49.90	50.18	25.80	26.30	26.38	16.00	16.00	15.90	15.2	50.04	26.16	15.97	20.90	0.727
38	-63.5	50.10	50.10	26.10	25.70	25.30	16.08	16.10	16.00	14.8	50.10	25.70	16.06	20.68	0.716
39	-38.1	47.40	46.98	26.06	26.26	24.40	16.00	16.04	16.22	12.6	47.19	25.57	16.09	19.41	0.649
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5	48.00	47.98	25.48	25.34	24.70	16.00	15.96	15.96	13.6	47.99	25.17	15.97	19.30	0.705
44	88.9	48.18	48.28	25.00	25.00	25.00	15.88	15.90	15.74	13.7	48.23	25.00	15.84	19.10	0.717
45	114.3	48.34	48.30	21.84	21.80	21.80	15.86	15.84	15.70	11.9	48.32	21.81	15.80	16.65	0.715
46	139.7	48.78	48.66	28.22	28.50	29.00	15.84	15.96	15.84	16.3	48.72	28.57	15.88	22.11	0.737
47	165.1	52.26	52.10	21.50	20.60	20.40	15.64	15.78	15.70	12.1	52.18	20.83	15.71	17.07	0.709
48	190.5	52.38	52.20	24.98	25.40	25.48	15.60	15.60	15.60	15.4	52.29	25.29	15.60	20.63	0.747
49	215.9	52.50	52.80	23.80	23.94	23.96	15.54	15.56	15.50	14.7	52.65	23.90	15.53	19.55	0.752
North50	241.3	52.70	52.80	24.06	23.96	23.80	15.58	15.52	15.36	15.1	52.75	23.94	15.49	19.56	0.772

Mean Thickness: 15.89

Std. Deviation: 0.20

EXTRUSION OF CRUSHED ICE PROJECT 5538

Sample Thickness and Density Data

Test No. X974 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5	103.12	102.66	50.64	50.78	50.96	102.70	102.76	102.60	401.8	102.89	50.79	102.69	536.65	0.749
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5	127.10	126.40	50.20	50.32	51.42	104.22	103.42	103.44	510.4	126.75	50.65	103.69	665.66	0.767
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9	98.14	98.70	49.90	49.94	51.30	103.30	103.28	103.22	395.4	98.42	50.38	103.27	512.04	0.772
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7										ERR	ERR	ERR	ERR	ERR
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 103.22

Std. Deviation: 0.41

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y974 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9										ERR	ERR	ERR	ERR	ERR
33	-190.5	132.12	131.08	54.22	53.54	53.40	104.40	103.76	102.04	536.9	131.60	53.72	103.40	730.99	0.734
34	-165.1										ERR	ERR	ERR	ERR	ERR
35	-139.7										ERR	ERR	ERR	ERR	ERR
36	-114.3										ERR	ERR	ERR	ERR	ERR
37	-88.9	99.86	98.16	53.80	52.60	53.18	102.78	102.90	102.70	416.7	99.01	53.19	102.79	541.38	0.770
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1	152.72	152.06	52.60	53.38	53.10	102.46	102.40	104.68	647.5	152.39	53.03	103.18	833.77	0.777
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1										ERR	ERR	ERR	ERR	ERR
48	190.5	125.30	126.80	56.74	53.86	54.50	104.10	103.70	103.50	526.0	126.05	55.03	103.77	719.82	0.731
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 103.29

Std. Deviation: 0.35

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X975 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1	48.84	48.56	22.46	22.46	22.66	69.50	69.86	69.62	59.2	48.70	22.53	69.66	76.42	0.775
5	-266.7	48.70	48.70	25.92	26.06	26.08	69.74	69.22	69.22	69.3	48.70	26.02	69.39	87.93	0.788
6	-241.3	48.62	48.52	25.50	25.60	25.70	69.12	69.16	69.28	67.9	48.57	25.60	69.19	86.03	0.789
7	-215.9	49.10	49.10	24.20	24.24	24.30	69.20	69.02	69.10	64.5	49.10	24.25	69.11	82.27	0.784
8	-190.5	49.54	49.52	20.86	20.90	21.00	69.20	69.04	69.00	56.0	49.53	20.92	69.08	71.58	0.782
9	-165.1	49.44	49.54	25.30	25.30	25.40	69.10	69.10	68.94	68.0	49.49	25.33	69.05	86.57	0.786
10	-139.7	49.28	49.24	26.24	26.54	26.84	68.82	69.22	68.90	71.2	49.26	26.54	68.98	90.18	0.790
11	-114.3	49.60	49.74	24.70	24.76	24.78	68.80	68.78	68.90	66.3	49.67	24.75	68.83	84.60	0.784
12	-88.9	50.00	50.30	22.34	22.30	22.40	68.92	68.80	68.72	60.9	50.15	22.35	68.81	77.12	0.790
13	-63.5	49.90	50.00	25.60	25.64	25.82	68.84	68.70	68.78	69.2	49.95	25.69	68.77	88.24	0.784
14	-38.1	50.12	50.30	22.72	22.70	22.70	68.70	68.60	68.64	61.0	50.21	22.71	68.65	78.26	0.779
15	-12.7	50.46	50.70	24.72	24.70	24.80	68.50	68.50	68.56	67.1	50.58	24.74	68.52	85.74	0.783
16	12.7	50.68	50.94	26.34	26.34	26.30	68.40	68.46	69.40	71.6	50.81	26.33	68.75	91.97	0.779
17	38.1	50.98	51.10	26.10	26.12	25.96	68.32	68.50	68.34	70.8	51.04	26.06	68.39	90.96	0.778
18	63.5	51.10	51.46	23.10	23.20	23.18	68.16	68.10	68.10	62.2	51.28	23.16	68.12	80.90	0.769
19	88.9	51.26	51.88	24.72	24.98	25.20	67.90	67.90	68.00	66.7	51.57	24.97	67.93	87.47	0.763
20	114.3	51.62	52.30	25.00	25.30	25.46	67.78	67.74	67.70	67.7	51.96	25.25	67.74	88.89	0.762
21	139.7	51.88	52.50	23.92	24.00	24.00	67.62	67.54	67.64	64.3	52.19	23.97	67.60	84.58	0.760
22	165.1	51.90	52.54	24.30	24.20	24.10	67.40	67.44	67.46	64.3	52.22	24.20	67.43	85.22	0.755
23	190.5	51.50	52.18	23.74	23.82	23.90	67.28	67.20	67.18	63.1	51.84	23.82	67.22	83.01	0.760
24	215.9	51.66	52.18	24.54	24.60	24.58	67.00	67.04	67.08	63.1	51.92	24.57	67.04	85.53	0.738
25	241.3	52.52	51.88	24.20	24.20	24.26	67.56	67.50	67.40	62.5	52.20	24.22	67.49	85.32	0.733
26	266.7	52.12	52.50	24.70	24.92	24.86	67.56	67.50	67.50	65.2	52.31	24.83	67.52	87.69	0.744
27	292.1	52.60	52.92	24.56	24.52	24.40	67.52	67.46	67.50	62.8	52.76	24.49	67.49	87.22	0.720
28	317.5	53.20	53.50	24.22	24.48	24.40	67.42	67.40	67.56	63.0	53.35	24.37	67.46	87.70	0.718
29	342.9	52.92	53.46	23.90	24.02	24.00	67.36	67.40	67.50	61.7	53.19	23.97	67.42	85.97	0.718
West 30	368.3	52.60	52.86	28.50	28.40	28.60	67.34	67.36	67.38	69.9	52.73	28.50	67.36	101.23	0.691

Mean Thickness: 68.26

Std. Deviation: 0.76

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y975 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.24	51.40	23.18	24.80	24.70	67.56	67.88	68.24	65.4	51.32	24.23	67.89	84.41	0.775
32	-215.9	50.98	50.90	20.20	20.32	20.20	68.10	67.86	67.80	54.0	50.94	20.24	67.92	70.03	0.771
33	-190.5	50.62	50.74	25.00	25.14	25.18	67.72	68.00	67.90	67.2	50.68	25.11	67.87	86.36	0.778
34	-165.1	50.86	51.00	25.42	25.50	25.46	69.10	69.20	68.86	68.6	50.93	25.46	69.05	89.54	0.766
35	-139.7	51.96	52.32	27.06	27.20	27.10	68.10	68.38	68.10	74.2	52.14	27.12	68.19	96.43	0.769
36	-114.3	53.10	53.40	25.00	25.16	25.10	68.20	68.10	68.00	70.0	53.25	25.09	68.10	90.97	0.769
37	-88.9	53.50	53.72	24.34	24.40	24.38	68.30	68.18	68.14	66.3	53.61	24.37	68.21	89.12	0.744
38	-63.5	53.50	53.90	23.26	23.24	23.12	68.23	68.30	68.34	66.2	53.70	23.21	68.29	85.10	0.778
39	-38.1	53.90	54.04	26.60	26.50	26.80	68.52	68.36	68.20	77.1	53.97	26.63	68.36	98.26	0.785
40	-12.7										ERR	ERR	68.64	ERR	0.781
41	12.7										ERR	ERR	68.64	ERR	0.781
42	38.1	51.70	51.90	23.80	24.10	24.20	68.70	68.40	68.30	65.9	51.80	24.03	68.47	85.24	0.773
43	63.5	52.40	52.68	23.90	23.92	23.90	68.42	68.36	68.40	67.2	52.54	23.91	68.39	85.91	0.782
44	88.9	52.60	52.90	25.28	25.32	25.30	68.40	68.30	68.34	71.6	52.75	25.30	68.35	91.21	0.785
45	114.3	52.60	52.90	25.00	24.98	25.00	68.30	68.30	68.14	70.8	52.75	24.99	68.25	89.98	0.787
46	139.7	53.00	53.24	25.16	25.22	25.20	68.20	68.46	68.42	72.2	53.12	25.19	68.36	91.48	0.789
47	165.1	53.30	53.50	24.20	24.40	24.72	68.32	68.24	68.10	70.0	53.40	24.44	68.22	89.03	0.786
48	190.5										ERR	ERR	ERR	ERR	ERR
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 68.31

Std. Deviation: 0.29

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X976

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3	51.74	51.86	28.56	29.92	30.56	67.66	67.78	67.86	80.0	51.80	29.68	67.77	104.19	0.768
7	-215.9	51.16	51.50	23.58	23.60	23.62	68.08	68.06	67.80	63.4	51.33	23.60	67.98	82.35	0.770
8	-190.5	51.66	51.58	21.20	21.50	21.76	67.90	68.00	68.40	57.8	51.62	21.49	68.10	75.53	0.765
9	-165.1	53.74	55.40	26.48	26.48	26.42	68.18	68.48	68.60	77.0	54.57	26.46	68.42	98.79	0.779
10	-139.7	53.34	54.92	25.20	25.28	25.20	68.30	68.34	68.70	72.1	54.13	25.23	68.45	93.47	0.771
11	-114.3	53.20	55.02	24.70	24.68	24.60	68.68	68.44	68.50	71.2	54.11	24.66	68.54	91.46	0.779
12	-88.9	53.40	55.28	23.60	23.66	23.60	68.86	68.60	68.40	68.7	54.34	23.62	68.62	88.07	0.780
13	-63.5	53.20	54.88	24.36	24.40	24.40	68.84	69.00	69.12	70.3	54.04	24.39	68.99	90.91	0.773
14	-38.1	54.14	52.70	21.26	21.60	21.48	69.10	69.14	69.30	61.2	53.42	21.45	69.18	79.26	0.772
15	-12.7	53.40	53.70	26.50	26.48	26.40	69.48	69.42	69.20	77.0	53.55	26.46	69.37	98.29	0.783
16	12.7	52.62	54.20	22.08	21.98	21.78	69.22	69.14	69.18	62.0	53.41	21.95	69.18	81.09	0.765
17	38.1	53.50	55.24	28.82	30.60	31.40	69.24	69.18	69.30	90.2	54.37	30.27	69.24	113.97	0.791
18	63.5	51.84	52.86	24.00	23.98	23.78	69.36	69.38	69.48	70.6	52.35	23.92	69.41	86.91	0.812
19	88.9	52.20	53.20	25.20	25.20	25.18	69.54	69.40	69.22	74.2	52.70	25.19	69.39	92.12	0.805
20	114.3	52.04	53.70	20.90	20.94	20.94	69.42	69.38	70.00	61.5	52.87	20.93	69.60	77.00	0.799
21	139.7	51.98	53.36	26.66	27.14	27.04	69.40	69.50	69.30	79.1	52.67	26.95	69.40	98.50	0.803
22	165.1	51.70	53.28	23.54	23.84	23.90	69.30	69.44	69.40	69.0	52.49	23.76	69.38	86.53	0.797
23	190.5	51.88	52.40	23.14	23.20	23.20	69.30	69.50	69.58	65.3	52.14	23.18	69.46	83.95	0.778
24	215.9	52.00	50.40	25.20	25.32	25.40	69.50	69.46	69.60	71.1	51.20	25.31	69.52	90.08	0.789
25	241.3	50.48	51.38	24.14	24.40	24.40	69.46	69.50	69.50	67.3	50.93	24.31	69.49	86.04	0.782
26	266.7	52.46	51.20	25.80	26.56	26.70	69.38	69.50	69.54	73.8	51.83	26.35	69.47	94.89	0.778
27	292.1	53.00	51.62	24.58	24.30	24.80	69.48	69.50	69.58	67.8	52.31	24.56	69.52	89.31	0.759
28	317.5	51.90	53.08	24.50	24.62	24.64	69.74	69.62	69.60	69.4	52.49	24.59	69.65	89.89	0.772
29	342.9	51.92	53.16	22.10	22.92	22.84	69.70	69.76	69.70	60.9	52.54	22.62	69.72	82.86	0.735
West 30	368.3	51.82	53.22	28.80	28.60	28.22	69.80	69.70	69.68	79.5	52.52	28.54	69.73	104.51	0.761

Mean Thickness: 69.10

Std. Deviation: 0.56

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y976 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	55.76	55.64	19.56	20.84	20.90	69.30	69.28	69.34	60.1	55.70	20.43	69.31	78.88	0.762
32	-215.9	55.44	55.38	27.70	27.90	27.72	69.12	69.20	69.36	85.1	55.41	27.77	69.23	106.53	0.799
33	-190.5	55.58	55.50	26.10	25.80	25.74	69.10	69.26	69.30	80.8	55.54	25.88	69.22	99.50	0.812
34	-165.1	56.06	56.02	21.62	21.60	21.50	69.20	69.28	69.48	67.3	56.04	21.57	69.32	83.81	0.803
35	-139.7	55.88	55.80	24.70	24.76	24.70	69.14	69.26	69.34	76.6	55.84	24.72	69.25	95.59	0.801
36	-114.3	54.80	54.80	27.48	27.56	27.50	69.20	69.28	69.22	82.8	54.80	27.51	69.23	104.39	0.793
37	-88.9	53.70	53.80	22.00	22.00	22.02	69.10	69.38	69.40	66.0	53.75	22.01	69.29	81.96	0.805
38	-63.5	53.30	53.30	25.92	26.02	26.08	69.20	69.32	69.30	76.4	53.30	26.01	69.27	96.02	0.796
39	-38.1	52.90	52.90	22.70	22.46	22.04	69.18	69.20	69.28	64.8	52.90	22.40	69.22	82.02	0.790
40	-12.7										ERR	ERR	69.27	ERR	0.774
41	12.7										ERR	ERR	69.27	ERR	0.774
42	38.1	52.84	53.18	25.68	25.04	24.50	69.22	69.00	69.02	71.5	53.01	25.07	69.08	91.82	0.779
43	63.5	52.70	53.00	23.46	23.52	23.54	68.90	68.80	68.90	67.4	52.85	23.51	68.87	85.55	0.788
44	88.9	52.56	52.86	23.80	23.90	23.88	68.70	68.74	68.70	68.0	52.71	23.86	68.71	86.42	0.787
45	114.3	53.80	53.22	25.22	25.46	25.32	68.50	68.58	68.76	71.4	53.51	25.33	68.61	93.01	0.768
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1										ERR	ERR	ERR	ERR	ERR
48	190.5										ERR	ERR	ERR	ERR	ERR
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 69.14

Std. Deviation: 0.22

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X977

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3	52.70	52.92	25.00	25.06	25.10	66.86	66.98	66.96	68.2	52.81	25.05	66.93	88.56	0.770
2	-342.9	52.30	53.12	26.02	26.00	25.94	66.80	66.88	66.80	70.8	52.71	25.99	66.83	91.54	0.773
3	-317.5	52.22	51.90	25.00	25.00	24.96	66.86	66.80	66.92	67.7	52.06	24.99	66.86	86.97	0.778
4	-292.1	52.10	51.70	20.24	20.22	20.26	66.76	66.88	67.20	54.9	51.90	20.24	66.95	70.32	0.781
5	-266.7	52.12	51.68	26.26	26.24	26.16	66.76	66.98	66.90	71.2	51.90	26.22	66.88	91.01	0.782
6	-241.3	52.08	51.68	26.26	26.28	26.26	67.14	67.06	66.98	71.2	51.88	26.27	67.06	91.38	0.779
7	-215.9	52.12	51.48	23.74	24.10	23.78	66.88	67.00	66.88	64.0	51.80	23.87	66.92	82.76	0.773
8	-190.5	52.70	52.52	25.80	27.80	27.16	66.88	66.92	66.98	74.3	52.61	26.92	66.93	94.79	0.784
9	-165.1	51.70	51.80	23.00	22.98	22.98	66.86	66.90	67.08	61.0	51.75	22.99	66.95	79.64	0.766
10	-139.7	50.68	50.78	20.00	20.10	20.00	66.90	66.88	67.10	52.5	50.73	20.03	66.96	68.05	0.771
11	-114.3	49.78	49.70	28.74	28.76	28.72	66.88	66.90	67.00	75.1	49.74	28.74	66.93	95.67	0.785
12	-88.9	50.14	50.00	23.22	23.24	23.26	67.00	67.04	66.90	61.3	50.07	23.24	66.98	77.94	0.787
13	-63.5	50.82	50.68	23.16	23.22	23.40	67.14	67.12	67.04	62.1	50.75	23.26	67.10	79.21	0.784
14	-38.1	51.00	50.78	24.90	25.14	25.30	66.98	67.00	67.00	65.2	50.89	25.11	66.99	85.62	0.762
15	-12.7	50.68	50.90	25.30	25.18	25.14	67.06	67.16	67.12	66.7	50.79	25.21	67.11	85.92	[illegible]
16	12.7	50.86	51.64	28.34	28.64	28.80	67.14	67.06	67.00	74.5	51.25	28.59	67.07	98.28	0.758
17	38.1	51.24	50.70	23.14	23.12	23.74	66.88	66.96	66.88	61.2	50.97	23.33	66.91	79.57	0.769
18	63.5	51.10	51.00	23.48	23.50	23.48	66.88	66.88	66.86	61.4	51.05	23.49	66.87	80.18	0.766
19	88.9	52.40	52.70	24.46	24.48	24.50	66.76	66.74	66.78	65.0	52.55	24.48	66.76	85.88	0.757
20	114.3	54.00	53.80	23.02	23.10	23.10	66.60	66.70	66.70	61.9	53.90	23.07	66.67	82.91	0.747
21	139.7	54.80	54.88	25.94	25.84	26.00	66.60	66.80	66.70	72.0	54.84	25.93	66.70	94.84	0.759
22	165.1	54.16	54.32	24.14	24.20	24.20	66.68	66.50	66.60	65.3	54.24	24.18	66.59	87.34	0.748
23	190.5	52.16	52.20	25.98	26.00	26.10	66.64	66.56	66.62	68.0	52.18	26.03	66.61	90.46	0.752
24	215.9	50.48	50.42	24.36	24.30	24.08	66.40	66.50	66.48	61.9	50.45	24.25	66.46	81.30	0.761
25	241.3	50.96	51.02	22.90	22.96	23.08	66.38	66.44	66.28	58.8	50.99	22.98	66.37	77.77	0.756
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 66.85

Std. Deviation: 0.19

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. Y977 Date:

Y-AXIS

Sample Number	Position (mm) Y co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	52.32	52.62	28.84	28.60	28.70	67.10	67.22	67.08	75.9	52.47	28.71	67.13	101.14	0.750
32	-215.9	52.10	52.34	20.10	20.50	20.48	67.06	66.98	67.00	54.7	52.22	20.36	67.01	71.25	0.768
33	-190.5	52.52	53.00	24.88	24.62	24.00	67.10	67.00	67.10	66.5	52.76	24.50	67.07	86.69	0.767
34	-165.1	53.26	53.70	20.26	20.30	20.30	67.06	67.20	67.28	55.8	53.48	20.29	67.18	72.89	0.766
35	-139.7	54.52	55.10	26.12	26.08	26.18	67.10	67.30	67.20	74.0	54.81	26.13	67.20	96.23	0.769
36	-114.3	55.50	55.90	24.68	24.70	24.66	67.10	67.04	67.10	71.2	55.70	24.68	67.08	92.21	0.772
37	-88.9	55.60	56.18	25.30	25.36	25.42	67.04	67.08	67.12	72.4	55.89	25.36	67.08	95.08	0.761
38	-63.5	54.86	55.36	25.24	25.26	25.24	67.00	67.18	67.06	72.7	55.11	25.25	67.08	93.33	0.779
39	-38.1	54.46	53.92	25.92	25.90	25.90	67.08	67.10	67.12	73.3	54.19	25.91	67.10	94.20	0.778
40	-12.7	54.96	54.90	24.70	25.62	25.70	66.88	66.94	66.92	72.1	54.93	25.34	67.09	93.38	0.767
41	12.7										ERR	ERR	67.09	ERR	0.767
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1										ERR	ERR	ERR	ERR	ERR
48	190.5										ERR	ERR	ERR	ERR	ERR
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 67.10

Std. Deviation: 0.05

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X978 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(cm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9	50.36	50.60	21.58	21.90	21.54	18.00	17.96	18.40	13.4	50.48	21.67	18.12	19.82	0.676
8	-190.5	50.42	50.62	26.08	26.16	25.98	18.14	18.12	18.16	16.8	50.52	26.07	18.14	23.89	0.703
9	-165.1	50.70	51.28	24.22	24.18	24.62	18.24	18.28	18.38	16.2	50.99	24.34	18.30	22.71	0.713
10	-139.7	51.36	51.40	23.64	23.50	23.64	18.40	18.50	18.60	16.4	51.38	23.59	18.50	22.43	0.731
11	-114.3	51.50	51.50	23.78	23.90	24.14	18.58	18.70	18.86	17.5	51.50	23.94	18.71	23.07	0.758
12	-88.9	51.58	51.66	22.92	22.72	23.14	20.20	19.30	18.96	17.5	51.62	22.93	19.49	23.06	0.759
13	-63.5	51.66	51.70	27.60	26.80	25.90	20.88	18.96	19.40	20.8	51.68	26.77	19.75	27.32	0.761
14	-38.1	55.30	55.28	23.54	24.06	24.64	21.02	21.16	21.10	22.0	55.29	24.08	21.09	28.08	0.783
15	-12.7	53.90	54.10	22.80	23.84	24.50	21.20	21.66	21.52	21.2	54.00	23.71	21.46	27.48	0.771
16	12.7	54.18	54.3	30.14	29.66	29.1	21.3	21.42	21.44	29.1	54.24	29.63	21.39	34.38	0.847
17	38.1	52.20	52.26	24.86	23.60	22.10	21.44	21.48	21.52	21.2	52.23	23.52	21.48	26.39	0.803
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9	53.64	53.50	27.08	26.68	26.54	21.44	21.40	21.42	25.2	53.57	26.77	21.42	30.71	0.820
20	114.3	52.84	52.10	22.08	22.06	21.92	21.40	21.54	21.64	20.1	52.47	22.02	21.53	24.87	0.808
21	139.7	51.44	51.44	24.64	24.84	24.76	21.50	21.38	21.38	21.8	51.44	24.75	21.42	27.27	0.800
22	165.1	51.58	51.46	25.86	25.76	25.80	21.60	21.44	21.50	22.2	51.52	25.81	21.51	28.60	0.776
23	190.5	51.70	52.10	24.98	25.16	25.10	21.32	21.30	21.40	21.0	51.90	25.08	21.34	27.78	0.756
24	215.9	52.18	52.22	24.90	25.00	25.00	20.00	20.60	20.54	17.9	52.20	24.97	20.38	26.56	0.674
25	241.3	52.80	53.28	23.60	23.74	24.16	17.50	17.72	18.00	14.7	53.04	23.83	17.74	22.43	0.656
26	266.7	53.62	53.86	24.50	24.54	23.78	17.40	17.44	17.40	14.6	53.74	24.27	17.41	22.71	0.643
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 19.96

Std. Deviation: 1.52

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X978 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	56.28	56.40	24.86	24.58	24.18	20.88	20.80	20.74	23.2	56.34	24.54	20.81	28.77	0.806
32	-215.9	55.88	56.20	24.40	24.70	24.90	20.94	20.82	20.74	24.3	56.04	24.67	20.83	28.80	0.844
33	-190.5	54.80	55.10	25.46	25.70	25.90	21.00	21.08	21.22	25.1	54.95	25.69	21.10	29.78	0.843
34	-165.1	54.30	54.42	22.90	22.02	23.00	20.90	21.00	21.18	22.1	54.36	22.64	21.03	25.88	0.854
35	-139.7	54.44	54.32	26.16	26.30	26.52	21.24	21.16	20.98	25.6	54.38	26.33	21.13	30.25	0.846
36	-114.3	54.00	54.40	22.90	22.90	23.00	21.40	21.10	21.16	21.9	54.20	22.93	21.22	26.38	0.830
37	-88.9	53.82	53.90	23.90	24.10	23.74	21.20	21.10	21.12	22.8	53.86	23.91	21.14	27.23	0.837
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	21.42	ERR	0.809
41	12.7										ERR	ERR	21.42	ERR	0.809
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9	49.62	49.88	26.70	26.70	26.90	21.18	21.28	21.32	23.9	49.75	26.77	21.26	28.31	0.844
45	114.3	50.00	50.26	21.04	21.02	21.10	21.04	21.18	21.18	18.3	50.13	21.05	21.13	22.30	0.820
46	139.7	50.24	50.32	23.80	23.82	24.00	20.44	21.30	21.32	20.9	50.28	23.87	21.02	25.23	0.828
47	165.1	50.52	50.48	25.20	25.26	25.30	21.40	21.20	21.26	22.2	50.50	25.25	21.29	27.15	0.819
48	190.5	50.46	50.48	27.00	27.10	27.00	20.70	20.80	20.92	23.8	50.47	27.03	20.81	28.39	0.838
49	215.9	50.64	50.86	24.10	24.28	24.30	20.60	20.84	21.16	21.4	50.75	24.23	20.87	25.66	0.834
North50	241.3	50.80	50.90	26.00	25.32	25.16	20.50	20.74	20.80	22.5	50.85	25.49	20.68	26.81	0.839

Mean Thickness: 21.07

Std. Deviation: 0.22

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X979 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5	53.90	54.00	24.50	25.60	25.50	13.44	13.46	13.40	12.8	53.95	25.20	13.43	18.26	0.701
9	-165.1	53.70	54.00	23.62	23.90	24.20				14.3	53.85	23.91	ERR	ERR	ERR
10	-139.7	53.66	53.54	20.62	20.58	21.08				13.7	53.60	20.76	ERR	ERR	ERR
11	-114.3	53.40	53.26	15.76	15.70	15.64				10.5	53.33	15.70	ERR	ERR	ERR
12	-88.9	50.92	50.30	27.02	26.30	26.32	17.32	16.86	16.90	17.9	50.61	26.55	17.03	22.88	0.782
13	-63.5	52.28	52.82	19.54	19.62	19.80	16.98	17.20	17.52	14.4	52.55	19.65	17.23	17.80	0.809
14	-38.1	53.26	54.28	20.00	20.30	20.44	17.08	17.10	17.12	15.7	53.77	20.25	17.10	18.62	0.843
15	-12.7	52.98	52.82	17.68	18.00	18.08	17.24	17.28	17.18	13.7	52.90	17.92	17.23	16.34	0.839
16	12.7	48.84	48.40	26.50	27.00	27.20	17.42	17.60	17.50	19.6	48.62	26.90	17.51	22.90	0.856
17	38.1	48.60	48.82	23.58	22.84	22.60	17.28	17.26	17.40	16.6	48.71	23.01	17.31	19.40	0.856
18	63.5	54.46	54.24	26.10	27.12	28.00	17.22	17.26	17.50	21.2	54.35	27.07	17.33	25.50	0.832
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3	52.80	53.00	23.78	23.70	23.84	17.14	17.14	17.18	17.1	52.90	23.77	17.15	21.57	0.793
21	139.7	52.64	52.62	22.92	22.26	22.10	17.06	17.00	17.10	15.3	52.63	22.43	17.05	20.13	0.760
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 16.84

Std. Deviation: 1.14

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X979 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.20	51.32	26.38	25.86	25.74	17.16	17.20	17.14	19.2	51.26	25.99	17.17	22.87	0.839
32	-215.9	51.58	51.46	23.34	23.50	23.52	17.26	17.16	17.18	18.0	51.52	23.45	17.20	20.78	0.866
33	-190.5	51.50	51.64	25.20	25.30	25.20	17.30	17.20	17.14	19.5	51.57	25.23	17.21	22.40	0.871
34	-165.1	51.64	51.80	23.86	23.80	23.82	17.20	17.62	17.50	18.5	51.72	23.83	17.44	21.49	0.861
35	-139.7	51.82	52.00	26.22	26.24	26.18	17.20	17.34	17.40	20.3	51.91	26.21	17.31	23.56	0.862
36	-114.3	52.30	52.34	23.10	22.88	23.00	17.12	17.20	17.20	17.9	52.32	22.99	17.17	20.66	0.866
37	-88.9	52.00	51.76	25.10	25.14	25.22	17.28	17.20	17.16	18.5	51.88	25.15	17.21	22.46	0.824
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1	53.76	54.10	21.50	21.56	22.00	17.30	17.30	17.28	17.4	53.93	21.69	17.29	20.23	0.860
40	-12.7										ERR	ERR	17.37	ERR	0.847
41	12.7										ERR	ERR	17.37	ERR	0.847
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9	47.80	47.70	25.10	25.34	25.74	17.00	17.06	17.10	17.7	47.75	25.39	17.05	20.68	0.856
45	114.3	48.24	48.30	22.88	23.10	23.20	16.92	16.98	16.98	16.4	48.27	23.06	16.96	18.88	0.869
46	139.7	48.44	49.10	25.18	25.80	26.20	16.90	17.00	17.08	18.3	48.77	25.73	16.99	21.32	0.858
47	165.1	51.30	51.46	24.22	24.12	24.04	17.00	17.00	17.00	18.1	51.38	24.13	17.00	21.07	0.859
48	190.5	51.30	51.32	24.50	24.70	24.68	16.74	16.70	16.72	18.4	51.31	24.63	16.72	21.13	0.871
49	215.9	51.00	50.94	24.20	24.04	23.94	16.72	16.70	16.60	17.8	50.97	24.06	16.67	20.45	0.871
North50	241.3	50.68	50.78	25.04	25.86	25.90	16.66	16.62	16.48	18.2	50.73	25.60	16.59	21.54	0.845

Mean Thickness: 17.10

Std. Deviation: 0.25

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X980 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7	51.48	50.98	20.40	21.18	22.30	15.84	15.68	15.50	11.6	51.23	21.29	15.67	17.10	0.678
6	-241.3	53.70	53.82	25.72	25.90	25.88	14.90	14.40	14.10	14.0	53.76	25.83	14.47	20.09	0.697
7	-215.9	53.38	53.84	25.10	24.60	24.60	14.60	14.68	14.44	14.2	53.61	24.77	14.57	19.35	0.734
8	-190.5	53.78	53.64	23.30	23.58	23.66		14.80	14.76	15.0	53.71	23.51	14.78	18.67	0.804
9	-165.1	53.64	53.70	22.52	22.36	22.48			14.82	15.0	53.67	22.45	14.82	17.86	0.840
10	-139.7	52.60	53.78	24.28	24.52	24.52	16.20	16.20	15.98	17.0	53.19	24.44	16.13	20.96	0.811
11	-114.3	53.58	53.50	23.56	23.04	23.14	16.12	16.38	16.74	16.2	53.54	23.25	16.41	20.43	0.793
12	-88.9	53.38	53.40	21.84	21.90	21.90	18.70	18.48	18.34	16.7	53.39	21.88	18.51	21.62	0.772
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7	55.00	54.80	26.52	26.32	25.80	19.44	19.40	19.40	22.0	54.90	26.21	19.41	27.94	0.787
17	38.1	54.78	54.74	22.66	23.50	23.30	19.24	19.30	19.40	20.2	54.76	23.15	19.31	24.49	0.825
18	63.5	54.64	54.40	23.10	23.12	23.24	19.10	19.30	19.34	19.2	54.52	23.15	19.25	24.30	0.790
19	88.9	54.30	54.28	26.40	26.28	26.04	19.00	19.10	19.38	21.1	54.29	26.24	19.16	27.29	0.773
20	114.3	54.18	54.30	22.42	22.46	22.46	18.88	19.00	19.08	16.8	54.24	22.45	18.99	23.12	0.727
21	139.7	54.10	54.00	23.44	23.90	23.74	17.74	17.84	17.88	16.8	54.05	23.69	17.82	22.82	0.736
22	165.1	53.98	53.84	18.84	19.90	19.10	17.50	17.58	17.64	12.7	53.91	19.28	17.57	18.27	0.695
23	190.5	54.70	54.10	19.50	19.70	19.60	17.44	17.46	17.50	12.9	54.40	19.60	17.47	18.62	0.693
24	215.9	53.90	54.00	23.80	23.92	23.90	17.38	17.40	17.62	15.2	53.95	23.87	17.47	22.50	0.676
25	241.3	53.30	53.32	24.72	24.62	24.72	17.56	17.60	17.58	15.5	53.31	24.69	17.58	23.14	0.670
26	266.7	53.04	53.06	22.62	22.20	22.14	17.00	17.40	17.50	12.9	53.05	22.32	17.30	20.48	0.630
27	292.1	52.42	52.82	23.70	24.10	23.80	17.28	17.30	17.38	13.3	52.62	23.87	17.32	21.75	0.612
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 17.20

Std. Deviation: 1.63

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X980 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	36.08	36.20	22.16	22.24	22.46	15.10	15.16	15.20	9.9	36.14	22.29	15.15	12.21	0.811
32	-215.9	53.58	53.70	22.20	22.22	22.18	15.40	15.40	15.38	15.7	53.64	22.20	15.39	18.33	0.856
33	-190.5	52.56	52.96	22.48	26.58	26.60	15.80	15.92	15.72	18.0	52.76	25.22	15.81	21.04	0.855
34	-165.1	52.32	52.58	24.40	24.48	24.60	16.12	16.14	16.00	17.3	52.45	24.49	16.09	20.67	0.837
35	-139.7	51.50	52.00	23.62	23.70	23.82	16.40	16.50	16.44	16.8	51.75	23.71	16.45	20.18	0.832
36	-114.3	49.82	51.44	24.40	24.60	24.70	16.88	16.60	16.72	17.4	50.63	24.57	16.73	20.81	0.836
37	-88.9										ERR	ERR	ERR	ERR	ERR
38	-63.5	57.14	57.14	21.48	21.82	22.16	16.72	17.46	17.34	18.0	57.14	21.82	17.17	21.41	0.841
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1	52.62	54.54	21.70	21.60	21.30	19.62	18.64	18.50	16.9	53.58	21.53	18.92	21.83	0.774
43	63.5	52.40	52.54	23.52	23.70	23.80	18.60	19.42	19.50	20.0	52.47	23.67	19.17	23.82	0.840
44	88.9	52.40	52.56	24.52	24.52	24.50	18.70	19.30	19.30	20.5	52.48	24.51	19.10	24.57	0.834
45	114.3	52.76	52.66	22.50	22.72	22.92	18.84	19.60	19.40	18.9	52.71	22.71	19.28	23.08	0.819
46	139.7	53.00	52.84	22.76	23.10	23.12	19.36	19.38	19.38	19.7	52.92	22.99	19.37	23.57	0.836
47	165.1	53.20	53.10	25.32	25.20	25.14	19.36	19.28	19.14	21.8	53.15	25.22	19.26	25.82	0.844
48	190.5	53.82	53.90	26.98	26.96	26.98	19.20	19.08	19.10	24.1	53.86	26.97	19.13	27.79	0.867
49	215.9	54.02	54.04	23.40	23.48	23.40	18.94	19.22	19.00	20.9	54.03	23.43	19.05	24.12	0.867
North50	241.3	54.22	54.12	26.18	27.12	27.88	18.80	18.92	18.90	22.9	54.17	27.06	18.87	27.67	0.828

Mean Thickness: 17.81

Std. Deviation: 1.56

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X981 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9	51.00	51.24	21.48	21.82	21.80	10.54	10.40	10.34	7.7	51.12	21.70	10.43	11.57	0.666
8	-190.5	51.70	51.94	25.50	25.52	25.60	10.44	10.50	10.34	9.9	51.82	25.54	10.43	13.80	0.717
9	-165.1	44.18	44.12	23.18	23.20	23.22	10.84	11.18	11.38	8.3	44.15	23.20	11.13	11.40	0.728
10	-139.7	37.86	37.70	26.16	26.30	26.40	10.72	10.84	10.79	8.0	37.78	26.29	10.78	10.71	0.747
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9	49.14	49.52	26.68	26.50	27.06	10.84	11.10	11.02	11.3	49.33	26.75	10.99	14.50	0.780
13	-63.5	38.24	40.00	23.02	23.14	23.18	11.06	11.10	10.98	7.6	39.12	23.11	11.05	9.99	0.761
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7	34.02	34.00	22.90	22.80	22.88	11.08	11.18	11.26	6.9	34.01	22.86	11.17	8.69	0.794
17	38.1	46.20	46.10	24.40	24.48	24.90	11.28	11.30	11.20	10.0	46.15	24.59	11.26	12.78	0.782
18	63.5	50.90	51.68	26.10	26.06	26.04	11.30	11.20	11.00	11.7	51.29	26.07	11.17	14.93	0.784
19	88.9	50.82	51.00	25.94	26.04	26.00	11.44	11.04	10.82	11.4	50.91	25.99	11.10	14.69	0.776
20	114.3	49.40	49.32	22.66	22.76	22.70	11.58	11.80	11.68	10.0	49.36	22.71	11.69	13.10	0.763
21	139.7	49.10	48.94	28.20	28.14	28.22	11.58	12.00	11.48	12.3	49.02	28.19	11.69	16.15	0.759
22	165.1	50.10	50.66	22.40	22.48	22.60	11.58	11.40	11.30	9.7	50.38	22.49	11.43	12.95	0.749
23	190.5	35.40	35.30	20.32	20.30	20.40	11.30	11.30	11.32	5.9	35.35	20.34	11.31	8.13	0.726
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 11.12

Std. Deviation: 0.37

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X981

Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9										ERR	ERR	ERR	ERR	ERR
33	-190.5	54.32	54.22	25.88	26.14	26.30	10.60	10.60	10.78	12.3	54.27	26.11	10.66	15.10	0.814
34	-165.1	54.10	54.40	25.70	25.80	25.84	10.68	10.48	10.42	12.0	54.25	25.78	10.53	14.72	0.815
35	-139.7	54.10	53.70	24.80	24.90	24.94	10.94	10.80	10.46	11.7	53.90	24.88	10.73	14.39	0.813
36	-114.3	53.36	54.00	25.00	24.80	24.72	10.94	10.94	11.00	11.7	53.68	24.84	10.96	14.61	0.801
37	-88.9	53.78	53.58	22.10	22.32	22.34	10.90	10.80	11.08	10.6	53.68	22.25	10.93	13.05	0.812
38	-63.5	53.50	53.50	22.70	22.80	22.80	10.88	11.00	11.20	10.9	53.50	22.77	11.03	13.43	0.812
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7	38.22	36.84	26.18	26.40	26.54	10.60	10.80	11.00	8.0	37.53	26.37	10.80	10.69	0.748
47	165.1										ERR	ERR	ERR	ERR	ERR
48	190.5	48.40	48.78	25.08	25.04	25.18	8.50	10.00	10.22	9.3	48.59	25.10	9.57	11.68	0.797
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 10.65

Std. Deviation: 0.44

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X982 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7	48.70	48.90	25.00	24.60	24.54	10.06	10.04	9.76	9.0	48.80	24.71	9.95	12.00	0.750
11	-114.3	49.00	49.38	25.30	25.34	25.30	9.92	9.90	9.98	9.3	49.19	25.31	9.93	12.37	0.752
12	-88.9	49.34	49.40	21.80	21.78	21.88	10.00	10.20	9.84	8.4	49.37	21.82	10.01	10.79	0.779
13	-63.5	49.08	48.78	25.70	25.88	26.10	10.50	10.08	10.06	10.0	48.93	25.89	10.21	12.94	0.773
14	-38.1	50.00	50.36	25.40	25.18	25.40	10.30	10.34	10.64	11.0	50.18	25.33	10.43	13.25	0.830
15	-12.7	49.08	48.66	25.00	25.30	25.60	10.60	10.70	10.58	10.4	48.87	25.30	10.63	13.14	0.792
16	12.7	47.50	48.82	23.30	23.74	23.90	10.44	10.68	10.64	9.3	48.16	23.65	10.59	12.06	0.771
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5	29.24	29.24	25.56	25.70	25.80	10.30	10.50	10.42	5.8	29.24	25.69	10.41	7.82	0.742
19	88.9	53.98	54.10	23.60	23.00	22.80	10.30	10.28	10.36	9.6	54.04	23.13	10.31	12.89	0.745
20	114.3	54.16	54.32	22.70	22.74	22.88	10.34	10.60	10.60	9.3	54.24	22.77	10.51	12.99	0.716
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 10.30

Std. Deviation: 0.25

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X982 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3										ERR	ERR	ERR	ERR	ERR
32	-215.9										ERR	ERR	ERR	ERR	ERR
33	-190.5	52.20	52.42	24.60	24.30	24.30	9.60	9.80	9.66	9.8	52.31	24.40	9.69	12.36	0.793
34	-165.1	37.80	37.66	21.58	21.88	22.00	9.88	10.00	9.86	6.3	37.73	21.82	9.91	8.16	0.772
35	-139.7										ERR	ERR	ERR	ERR	ERR
36	-114.3	55.64	55.60	24.82	24.84	25.10	9.98	10.00	10.06	10.2	55.62	24.92	10.01	13.88	0.735
37	-88.9	55.84	55.92	23.40	24.00	24.22	10.80	10.20	10.20	10.5	55.88	23.87	10.40	13.87	0.757
38	-63.5	56.00	55.82	22.50	22.88	22.40	10.08	10.22	10.22	10.5	55.91	22.59	10.17	12.85	0.817
39	-38.1	50.70	50.80	19.28	19.54	19.54	10.32	10.30	10.18	7.9	50.75	19.45	10.27	10.14	0.779
40	-12.7										ERR	ERR	10.61	ERR	0.781
41	12.7										ERR	ERR	10.61	ERR	0.781
42	38.1	55.30	55.30	23.52	23.20	22.60	10.68	10.72	10.60	10.7	55.30	23.11	10.67	13.63	0.785
43	63.5	55.40	55.40	25.50	25.52	25.70	10.66	10.68	10.70	12.6	55.40	25.57	10.68	15.13	0.833
44	88.9	55.50	55.32	25.10	24.68	24.52	10.50	10.70	10.66	12.1	55.41	24.77	10.62	14.57	0.830
45	114.3	54.30	54.50	22.00	22.18	22.20	10.28	10.60	10.60	10.0	54.40	22.13	10.49	12.63	0.792
46	139.7	37.64	36.90	24.42	24.64	24.82	9.80	10.20	10.10	7.2	37.27	24.63	10.03	9.21	0.782
47	165.1	42.00	41.60	22.82	22.20	22.46	9.82	9.88	9.80	7.5	41.80	22.49	9.83	9.25	0.811
48	190.5	25.00	25.70	26.72	27.00	26.82	9.58	9.60	9.60	5.1	25.35	26.85	9.59	6.53	0.781
49	215.9										ERR	ERR	ERR	ERR	ERR
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 10.24

Std. Deviation: 0.36

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X983 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5	53.88	54.00	24.24	25.84	26.66	9.50	9.48	9.48	9.8	53.94	25.58	9.49	13.09	0.749
9	-165.1	53.46	53.78	24.06	24.46	24.42	9.62	9.70	9.70	9.5	53.62	24.31	9.67	12.61	0.753
10	-139.7	53.56	53.74	26.42	26.26	26.20	9.70	9.80	9.84	11.1	53.65	26.29	9.78	13.80	0.805
11	-114.3	53.60	53.60	27.68	27.64	27.98	9.88	9.94	10.00	12.0	53.60	27.77	9.94	14.79	0.811
12	-88.9	53.48	53.42	24.00	24.12	24.10	9.94	9.96	10.00	10.6	53.45	24.07	9.97	12.82	0.827
13	-63.5	53.32	53.22	27.90	27.78	27.96	10.00	10.24	10.20	12.4	53.27	27.88	10.15	15.07	0.823
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7	53.90	54.10	27.46	27.10	26.98	9.50	9.50	9.48	11.8	54.00	27.18	9.49	13.93	0.847
17	38.1	54.16	54.40	24.98	24.90	25.00	9.50	9.48	9.40	10.7	54.28	24.96	9.46	12.82	0.835
18	63.5	54.46	54.60	24.86	25.44	25.40	9.38	9.30	9.20	10.6	54.53	25.23	9.29	12.79	0.829
19	88.9	54.48	54.72	22.16	22.22	22.16	9.32	9.24	9.20	9.2	54.60	22.18	9.25	11.21	0.821
20	114.3	54.86	55.10	23.20	22.80	22.96	9.20	9.20	9.20	9.4	54.98	22.99	9.20	11.63	0.808
21	139.7	55.10	55.30	22.66	22.66	22.60	9.12	9.14	9.10	8.9	55.20	22.64	9.12	11.40	0.781
22	165.1	55.70	55.60	24.00	24.28	24.20	9.10	8.80	8.60	8.4	55.65	24.16	8.83	11.88	0.707
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 9.51

Std. Deviation: 0.36

EXTRUSION OF CRUSHED ICE — PROJECT 9538

Sample Thickness and Density Data

Test No. X983 — Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	48.48	48.50	27.48	27.42	27.18	9.72	9.84	9.80	11.0	48.49	27.36	9.79	12.98	0.847
32	-215.9	48.14	48.24	22.70	22.80	23.00	9.82	9.80	9.78	9.2	48.19	22.83	9.80	10.78	0.853
33	-190.5	47.84	47.90	23.88	24.00	23.86	9.78	9.80	9.80	9.6	47.87	23.91	9.79	11.21	0.856
34	-165.1	47.98	47.98	22.08	22.28	24.10	9.86	9.92	9.88	9.2	47.98	22.82	9.89	10.82	0.850
35	-139.7	47.90	48.00	26.70	26.40	26.48	9.90	10.00	9.92	10.6	47.95	26.53	9.94	12.64	0.838
36	-114.3	48.00	47.94	23.50	23.70	23.80	9.98	10.00	9.92	9.6	47.97	23.67	9.97	11.32	0.848
37	-88.9	47.90	48.00	23.20	23.40	23.20	9.96	10.02	9.95	9.3	47.95	23.27	9.98	11.13	0.836
38	-63.5	47.40	47.66	23.44	23.32	23.20	10.10	10.16	10.08	9.5	47.53	23.32	10.11	11.21	0.847
39	-38.1	47.30	47.36	25.94	26.14	26.04	10.08	10.12	10.14	9.8	47.33	26.04	10.11	12.46	0.786
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1	49.60	49.60	24.14	23.94	23.50	10.10	10.10	10.08	9.8	49.60	23.86	10.09	11.95	0.820
43	63.5	49.52	49.64	25.30	25.48	25.30	9.96	10.00	10.00	10.6	49.58	25.36	9.99	12.56	0.844
44	88.9	49.80	49.84	24.02	24.00	24.22	9.88	9.96	9.90	10.0	49.82	24.08	9.91	11.89	0.841
45	114.3	49.90	49.82	23.00	22.80	23.14	9.76	9.90	9.92	9.9	49.86	22.98	9.86	11.30	0.876
46	139.7	49.50	49.70	26.80	26.96	27.20	9.76	9.78	9.84	11.0	49.60	26.99	9.79	13.11	0.839
47	165.1	49.70	49.80	24.22	24.40	24.42	9.70	9.74	9.62	9.3	49.75	24.35	9.69	11.73	0.793
48	190.5	49.58	49.72	23.28	23.34	23.34	9.48	9.58	9.50	9.4	49.65	23.32	9.52	11.02	0.853
49	215.9	49.90	47.20	24.58	24.76	24.70	9.54	9.52	9.40	10.0	48.55	24.68	9.49	11.37	0.880
North50	241.3	50.40	50.32	23.40	23.66	24.22	9.30	9.60	9.40	9.6	50.36	23.76	9.43	11.29	0.850

Mean Thickness: 9.84

Std. Deviation: 0.20

EXTRUSION OF CRUSHED ICE — PROJECT 9538

Sample Thickness and Density Data

Test No. X984 — Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9	36.16	36.14	27.38	27.58	27.76	10.78	10.74	10.76	7.3	36.15	27.57	10.76	10.73	0.681
8	-190.5	61.08	60.92	25.70	25.62	25.42	10.90	10.80	10.26	12.0	61.00	25.58	10.65	16.62	0.722
9	-165.1	60.80	60.66	25.48	25.44	25.70	10.90	10.62	10.62	11.7	60.73	25.54	10.71	16.62	0.704
10	-139.7	60.50	60.84	20.20	20.12	20.20	11.08	11.24	11.20	9.8	60.67	20.17	11.17	13.68	0.717
11	-114.3	61.00	60.92	25.30	25.42	25.46	11.16	11.12	11.18	12.4	60.96	25.39	11.15	17.27	0.718
12	-88.9	60.00	60.32	26.18	26.44	26.00	11.28	11.30	11.16	13.0	60.16	26.21	11.25	17.73	0.733
13	-63.5	59.04	59.20	23.56	24.00	24.00	11.40	11.70	11.40	11.9	59.12	23.85	11.50	16.22	0.734
14	-38.1	58.16	57.30	24.22	24.16	25.00	11.50	11.50	11.56	12.3	57.73	24.46	11.52	16.27	0.756
15	-12.7	36.96	36.90	24.00	23.76	23.60	11.56	11.58	11.50	7.5	36.93	23.79	11.55	10.14	0.739
16	12.7	29.88	29.30	23.86	23.84	23.80	11.56	11.56	11.62	6.3	29.59	23.83	11.58	8.17	0.771
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9	43.52	.43.88	21.04	21.16	21.28	11.34	11.38	11.40	8.1	43.70	21.16	11.37	10.52	0.770
20	114.3	39.84	40.16	26.80	27.08	27.14	11.30	11.40	11.28	9.3	40.00	27.01	11.33	12.24	0.760
21	139.7	54.44	54.50	23.60	23.78	23.40	11.20	11.16	11.20	10.6	54.47	23.59	11.19	14.38	0.737
22	165.1	53.60	54.70	23.38	24.40	24.40	11.00	11.04	11.08	10.9	54.15	24.06	11.04	14.38	0.758
23	190.5	54.30	53.96	26.18	26.30	26.30	10.80	10.88	10.90	11.0	54.13	26.26	10.86	15.44	0.713
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3	39.80	40.12	21.60	21.70	22.50	10.70	10.70	10.70	6.0	39.96	21.93	10.70	9.38	0.640
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 11.15

Std. Deviation: 0.31

EXTRUSION OF CRUSHED ICE PROJECT 9536

Sample Thickness and Density Data

Test No. X984 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	52.64	52.24	23.32	23.60	23.90	11.24	11.40	11.30	11.7	52.44	23.61	11.31	14.01	0.835
32	-215.9	52.00	51.98	24.70	25.10	24.80	11.28	11.36	11.30	12.2	51.99	24.87	11.31	14.63	0.834
33	-190.5	52.08	52.12	23.80	24.00	23.80	11.34	11.38	11.34	11.6	52.10	23.87	11.35	14.12	0.822
34	-165.1	52.20	52.16	22.50	22.74	22.90	11.38	11.44	11.40	11.0	52.18	22.71	11.41	13.52	0.814
35	-139.7	51.94	52.10	26.06	26.20	26.16	11.38	11.46	11.34	12.7	52.02	26.14	11.39	15.49	0.820
36	-114.3	52.16	52.08	26.34	26.70	26.50	11.40	11.40	11.40	12.9	52.12	26.51	11.40	15.75	0.819
37	-88.9	51.90	52.08	23.50	23.54	24.08	11.40	11.50	11.48	11.6	51.99	23.71	11.46	14.12	0.821
38	-63.5	51.74	52.00	23.30	23.10	23.00	11.44	11.54	11.50	11.1	51.87	23.13	11.49	13.79	0.805
39	-38.1	52.06	51.98	16.60	15.96	15.48	11.56	11.60	11.58	7.5	52.02	16.01	11.58	9.65	0.778
40	-12.7										ERR	ERR	11.56	ERR	0.755
41	12.7										ERR	ERR	11.56	ERR	0.755
42	38.1	47.00	47.00	22.28	22.94	23.30	11.40	11.58	11.48	9.2	47.00	22.84	11.49	12.33	0.746
43	63.5	47.46	47.20	25.50	25.58	25.40	11.38	11.40	11.38	11.2	47.33	25.49	11.39	13.74	0.815
44	88.9	47.50	48.12	25.44	25.58	25.40	11.28	11.38	11.24	11.0	47.81	25.47	11.30	13.76	0.799
45	114.3	48.30	48.30	21.60	21.60	21.66	11.08	11.14	11.10	9.5	48.30	21.62	11.11	11.60	0.819
46	139.7	48.60	48.70	24.90	24.88	24.90	11.08	11.40	11.00	10.8	48.65	24.89	11.16	13.52	0.799
47	165.1	48.84	49.16	25.80	25.74	25.50	11.20	10.96	10.98	11.3	49.00	25.68	11.05	13.90	0.813
48	190.5	49.46	49.70	24.30	24.40	24.40	10.70	10.80	10.86	10.6	49.58	24.37	10.79	13.03	0.813
49	215.9	50.08	50.20	23.74	23.40	23.44	11.08	10.88	10.74	10.4	50.14	23.53	10.90	12.86	0.809
North50	241.3	50.40	50.58	25.40	26.10	26.28	10.50	10.70	10.80	11.7	50.49	25.93	10.67	13.96	0.838

Mean Thickness: 11.28

Std. Deviation: 0.25

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X985 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3	53.88	54.56	21.62	21.76	22.00	27.36	27.42	27.40	22.5	54.22	21.79	27.39	32.37	0.695
12	-88.9	54.82	55.14	24.78	25.24	24.94	27.36	27.52	27.62	27.2	54.98	24.99	27.50	37.78	0.720
13	-63.5	54.90	54.74	18.24	20.20	21.00	27.46	27.64	27.86	21.5	54.82	19.81	27.65	30.04	0.716
14	-38.1	40.00	39.60	27.90	28.36	28.22	27.92	27.68	27.66	23.5	39.80	28.16	27.75	31.11	0.756
15	-12.7	39.92	39.90	23.66	23.70	23.68	27.88	27.80	27.92	20.3	39.91	23.68	27.87	26.34	0.771
16	12.7	40.00	39.70	25.10	25.02	25.00	27.92	27.91	27.92	21.0	39.85	25.04	27.92	27.86	0.754
17	38.1	40.60	40.16	24.18	24.50	24.38	27.76	27.64	27.78	20.0	40.38	24.35	27.73	27.27	0.734
18	63.5	46.38	46.48	24.30	24.54	24.60	27.58	27.70	27.68	21.9	46.43	24.48	27.65	31.43	0.697
19	88.9	46.30	46.76	24.20	23.24	23.24	27.56	27.50	27.50	20.0	46.53	23.56	27.52	30.17	0.664
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7	51.20	52.80	21.84	22.40	22.56	27.32	27.30	27.60	20.6	52.00	22.27	27.41	31.73	0.649
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 27.64

Std. Deviation: 0.17

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X985 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	49.46	49.62	23.08	23.38	23.40	27.66	27.76	27.66	25.9	49.54	23.29	27.69	31.95	0.811
32	-215.9	49.40	49.42	28.00	28.00	28.12	27.60	27.68	27.70	30.9	49.41	28.04	27.66	38.32	0.806
33	-190.5	49.30	49.30	20.56	20.56	20.42	27.70	27.58	27.56	21.8	49.30	20.51	27.61	27.93	0.781
34	-165.1	49.50	49.02	25.66	25.76	25.84	27.90	27.86	27.66	26.8	49.26	25.75	27.81	35.28	0.760
35	-139.7	48.94	48.98	27.14	27.06	26.88	27.64	27.64	27.70	28.0	48.96	27.03	27.66	36.60	0.765
36	-114.3	48.89	49.10	21.88	21.98	22.04	27.66	27.68	27.68	23.0	49.00	21.97	27.67	29.78	0.772
37	-88.9	49.40	49.52	25.00	25.10	25.12	27.66	27.68	27.60	26.5	49.46	25.07	27.65	34.29	0.773
38	-63.5	49.50	49.78	24.52	23.70	24.00	27.70	27.68	27.64	25.1	49.64	24.07	27.67	33.07	0.759
39	-38.1	49.64	50.06	24.60	24.62	24.64	27.90	27.86	27.76	25.8	49.85	24.62	27.84	34.17	0.755
40	-12.7										ERR	ERR	27.89	ERR	0.762
41	12.7										ERR	ERR	27.89	ERR	0.762
42	38.1	52.60	53.08	24.08	24.20	24.16	27.72	27.74	27.84	26.6	52.84	24.15	27.77	35.43	0.751
43	63.5	54.10	54.00	21.40	22.20	23.16	27.70	27.60	27.58	25.2	54.05	22.25	27.63	33.23	0.758
44	88.9	54.02	53.94	22.20	22.74	22.24	27.56	27.60	27.64	26.2	53.98	22.39	27.60	33.36	0.785
45	114.3	53.70	54.14	27.40	27.44	27.40	27.40	27.46	27.48	31.4	53.92	27.41	27.45	40.57	0.774
46	139.7	54.40	54.36	23.40	23.34	23.22	27.46	27.62	27.64	26.9	54.38	23.32	27.57	34.97	0.769
47	165.1	54.48	54.54	24.50	24.64	24.70	27.30	27.30	27.30	28.6	54.51	24.61	27.30	36.63	0.781
48	190.5	54.70	54.52	24.34	24.58	24.90	27.18	27.12	27.16	28.9	54.61	24.61	27.15	36.49	0.792
49	215.9	54.50	54.40	27.30	27.22	26.98	27.02	27.08	27.00	31.7	54.45	27.17	27.03	39.99	0.793
North50	241.3	54.04	54.00	23.84	24.00	24.08	27.00	26.94	26.94	27.8	54.02	23.97	26.96	34.91	0.796

Mean Thickness: 27.58

Std. Deviation: 0.26

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X986 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1	39.06	39.00	16.52	16.20	15.70	30.98	30.80	30.90	11.5	39.03	16.14	30.89	19.46	0.591
10	-139.7	52.08	52.16	15.88	15.34	15.40	31.08	31.00	29.94	15.2	52.12	15.54	30.67	24.84	0.612
11	-114.3	51.70	51.62	22.22	22.30	22.00	30.98	31.24	31.00	23.7	51.66	22.17	31.07	35.59	0.666
12	-88.9	51.64	51.70	24.96	24.80	24.88	31.16	31.10	31.06	26.4	51.67	24.88	31.11	39.99	0.660
13	-63.5	51.58	51.66	21.02	21.08	21.16	31.16	31.16	31.06	22.3	51.62	21.09	31.13	33.88	0.658
14	-38.1	52.00	52.06	28.20	28.68	29.26	31.20	31.26	31.34	33.3	52.03	28.71	31.27	46.71	0.713
15	-12.7	52.36	52.20	25.90	25.30	25.00	31.24	31.28	31.38	31.3	52.28	25.40	31.30	41.56	0.753
16	12.7	52.36	52.66	21.34	22.06	21.90	31.40	31.36	31.40	26.7	52.51	21.77	31.39	35.87	0.744
17	38.1	51.34	51.94	26.82	26.90	26.80	31.20	31.14	31.26	31.7	51.64	26.84	31.20	43.24	0.733
18	63.5	53.30	53.40	23.40	23.40	23.40	31.16	31.18	31.28	26.7	53.35	23.40	31.21	38.96	0.685
19	88.9	53.00	53.14	24.26	24.34	24.00	31.08	31.10	31.06	27.1	53.07	24.20	31.08	39.92	0.679
20	114.3	53.40	53.36	25.80	25.60	25.44	31.18	31.08	31.12	28.1	53.38	25.61	31.13	42.56	0.660
21	139.7	52.80	52.50	26.00	27.50	27.66	31.00	30.90	30.92	26.6	52.65	27.05	30.94	44.07	0.604
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 31.11

Std. Deviation: 0.18

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X986 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.60	51.50	26.98	26.40	25.94	31.24	31.30	31.60	32.6	51.55	26.44	31.38	42.77	0.762
32	-215.9	51.68	51.80	25.18	25.48	25.86	31.30	31.26	31.42	30.8	51.74	25.51	31.33	41.34	0.745
33	-190.5	51.70	51.92	23.60	23.76	23.60	31.36	31.30	31.30	28.1	51.81	23.65	31.32	38.38	0.732
34	-165.1	51.96	51.98	23.88	24.26	24.50	31.40	31.24	31.62	29.5	51.97	24.21	31.42	39.54	0.746
35	-139.7	51.94	51.86	23.58	23.58	23.64	31.22	31.40	31.56	28.5	51.90	23.60	31.39	38.45	0.741
36	-114.3	51.80	51.92	22.08	22.16	22.16	31.26	31.28	31.38	26.0	51.86	22.13	31.31	35.93	0.724
37	-88.9	51.86	51.80	23.00	23.10	23.20	31.22	31.26	31.24	27.3	51.83	23.10	31.24	37.40	0.730
38	-63.5	51.52	51.88	24.82	25.00	25.02	31.26	31.28	31.22	29.3	51.70	24.95	31.25	40.31	0.727
39	-38.1	51.88	51.90	26.50	26.76	27.14	31.30	31.34	31.38	31.4	51.89	26.80	31.34	43.58	0.720
40	-12.7										ERR	ERR	31.34	ERR	0.749
41	12.7										ERR	ERR	31.34	ERR	0.749
42	38.1	56.10	56.00	21.44	22.68	22.40	31.20	31.18	31.16	27.7	56.05	22.17	31.18	38.75	0.715
43	63.5	56.10	56.10	24.46	24.30	24.10	31.00	31.00	30.98	30.6	56.10	24.29	30.99	42.23	0.725
44	88.9	56.00	56.00	24.56	24.80	24.60	30.88	30.96	31.00	31.2	56.00	24.65	30.95	42.72	0.730
45	114.3	55.78	56.06	26.28	26.50	26.64	30.80	31.10	31.00	33.6	55.92	26.47	30.97	45.84	0.733
46	139.7	55.20	55.50	22.14	22.16	22.10	30.74	30.92	30.88	27.3	55.35	22.13	30.85	37.79	0.722
47	165.1	55.10	55.40	26.48	26.60	26.60	30.70	30.80	30.80	32.6	55.25	26.56	30.77	45.15	0.722
48	190.5	54.90	55.30	26.42	26.38	26.30	30.64	30.74	30.70	33.0	55.10	26.37	30.69	44.59	0.740
49	215.9	54.50	54.66	24.70	24.68	24.78	30.54	31.00	30.64	31.3	54.58	24.72	30.73	41.46	0.755
North50	241.3	54.02	54.32	23.60	23.64	24.10	30.40	30.40	30.60	30.6	54.17	23.78	30.47	39.25	0.780

Mean Thickness: 31.11

Std. Deviation: 0.28

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X987 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3	42.10	43.62	28.26	28.04	27.60	23.18	23.28	23.20	17.7	42.86	27.97	23.22	27.83	0.636
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5	53.16	55.08	25.48	25.70	24.70	23.40	23.50	23.50	22.1	54.12	25.29	23.47	32.12	0.688
9	-165.1	54.84	54.54	26.18	26.00	25.64	23.60	23.68	23.68	24.5	54.69	25.94	23.65	33.56	0.730
10	-139.7	54.70	55.06	23.14	23.60	23.60	23.60	23.64	23.64	23.5	54.88	23.45	23.63	30.40	0.773
11	-114.3	55.30	55.18	22.52	22.50	22.24	23.80	23.74	23.90	23.2	55.24	22.42	23.81	29.49	0.787
12	-88.9	55.30	55.50	22.70	22.50	23.20	23.68	23.86	24.10	22.6	55.40	22.80	23.88	30.16	0.749
13	-63.5	54.62	54.80	28.20	28.80	30.00	23.90	23.86	23.86	32.6	54.71	29.00	23.87	37.88	0.861
14	-38.1	54.90	54.92	22.34	22.30	22.10	23.90	24.00	24.00	24.8	54.91	22.25	23.97	29.28	0.847
15	-12.7	54.74	54.86	24.82	24.80	24.70	24.00	23.90	24.08	27.1	54.80	24.77	23.99	32.57	0.832
16	12.7	54.82	54.86	23.14	23.64	23.22	23.80	23.84	23.94	24.0	54.84	23.33	23.86	30.53	0.786
17	38.1	55.50	55.56	29.56	30.20	30.30	23.80	23.76	23.78	29.7	55.53	30.02	23.78	39.64	0.749
18	63.5	56.60	55.40	22.04	22.52	22.06	23.66	23.70	23.70	22.2	56.00	22.21	23.69	29.46	0.754
19	88.9	56.20	55.98	23.24	23.30	23.30	23.78	23.50	23.44	22.4	56.09	23.28	23.57	30.78	0.728
20	114.3	56.50	56.20	20.30	20.12	20.80	23.00	23.54	23.64	19.4	56.35	20.41	23.39	26.90	0.721
21	139.7	57.44	57.86	29.00	29.10	29.68	23.20	23.40	23.40	25.8	57.65	29.26	23.33	39.36	0.655
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.67

Std. Deviation: 0.23

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X987 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.50	51.56	26.18	25.82	25.62	23.46	23.56	23.60	27.5	51.53	25.87	23.54	31.38	0.876
32	-215.9	51.80	51.94	21.08	21.00	20.94	23.58	23.58	23.60	22.5	51.87	21.01	23.59	25.70	0.875
33	-190.5	52.10	51.88	28.32	28.50	28.36	23.60	23.64	23.64	30.0	51.99	28.39	23.63	34.88	0.861
34	-165.1	52.52	52.46	21.62	21.74	21.54	23.66	24.00	24.08	23.2	52.49	21.63	23.91	27.15	0.854
35	-139.7	52.24	54.44	26.12	26.14	25.94	23.66	24.00	23.80	27.9	53.34	26.07	23.82	33.12	0.842
36	-114.3	52.16	52.10	23.78	23.86	24.30	23.70	23.70	23.78	25.2	52.13	23.98	23.73	29.66	0.850
37	-88.9	51.94	51.96	22.70	22.70	22.36	23.72	23.76	23.88	23.5	51.95	22.59	23.79	27.91	0.842
38	-63.5	51.84	51.88	23.58	23.40	23.64	23.90	23.92	24.00	24.7	51.86	23.54	23.94	29.23	0.845
39	-38.1	51.78	51.80	25.10	25.38	25.68	23.30	23.86	23.90	25.7	51.79	25.39	23.69	31.14	0.825
40	-12.7										ERR	ERR	23.93	ERR	0.809
41	12.7										ERR	ERR	23.93	ERR	0.809
42	38.1	51.46	51.48	20.12	20.26	20.80	23.84	23.90	23.80	21.4	51.47	20.39	23.85	25.03	0.855
43	63.5	51.70	51.60	24.18	24.10	23.80	23.74	23.84	23.94	24.5	51.65	24.03	23.84	29.58	0.828
44	88.9	51.88	51.88	23.84	23.78	23.82	23.80	23.84	23.70	24.7	51.88	23.81	23.78	29.38	0.841
45	114.3	51.96	52.10	22.48	22.56	22.50	23.70	23.70	23.70	23.4	52.03	22.51	23.70	27.76	0.843
46	139.7	51.84	52.00	24.00	24.14	24.16	23.70	23.80	23.80	25.0	51.92	24.10	23.77	29.74	0.839
47	165.1	52.10	52.00	27.10	27.20	27.30	23.40	23.58	23.64	28.3	52.05	27.20	23.54	33.33	0.849
48	190.5	51.96	51.92	24.80	24.84	24.84	23.30	23.32	23.46	26.1	51.94	24.83	23.36	30.12	0.866
49	215.9	52.00	52.30	25.20	25.14	24.92	23.30	23.44	23.60	26.7	52.15	25.09	23.45	30.67	0.870
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.72

Std. Deviation: 0.17

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X988

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7	49.96	50.10	23.54	22.80	22.06	23.90	23.88	24.00	17.6	50.03	22.80	23.93	27.29	0.645
11	-114.3	55.04	54.50	23.64	23.66	23.74	24.10	24.00	24.04	20.3	54.77	23.68	24.05	31.19	0.651
12	-88.9										ERR	ERR	ERR	ERR	ERR
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1	54.88	54.90	24.00	24.12	24.34	24.12	22.30	22.78	23.6	54.89	24.15	23.07	30.58	0.77[illegible]
15	-12.7	54.84	54.88	23.10	23.14	23.50	24.30	21.72	22.30	22.2	54.86	23.25	22.77	29.04	0.764
16	12.7	55.62	54.70	23.40	24.30	23.50	24.26	23.40	22.38	22.9	55.16	23.73	23.35	30.56	0.749
17	38.1	54.90	55.50	23.70	23.62	23.78	23.48	22.50	22.00	22.3	55.20	23.70	22.66	29.64	0.752
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9	55.78	55.20	26.50	26.60	26.98	23.94	24.00	24.40	24.4	55.49	26.69	24.11	35.72	0.683
20	114.3	47.60	46.90	24.60	24.18	23.54	24.00	24.00	24.00	17.6	47.25	24.11	24.00	27.34	0.644
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.49

Std. Deviation: 0.56

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X988 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	29.82	29.40	23.70	24.30	24.58	23.80	23.84	23.98	11.9	29.61	24.19	23.87	17.10	0.696
32	-215.9	51.10	51.00	25.72	25.92	26.10	24.00	23.84	23.80	22.1	51.05	25.91	23.88	31.59	0.700
33	-190.5	50.70	51.00	23.96	24.06	24.28	24.10	23.98	23.90	20.6	50.85	24.10	23.99	29.40	0.701
34	-165.1	50.80	50.74	25.34	25.50	25.40	24.00	23.96	24.08	21.6	50.77	25.41	24.01	30.98	0.696
35	-139.7	50.90	50.88	24.40	24.44	24.60	23.84	23.94	23.76	20.8	50.89	24.48	23.85	29.71	0.700
36	-114.3	50.74	50.60	25.90	26.14	26.10	23.90	24.00	24.02	21.7	50.67	26.05	23.97	31.64	0.686
37	-88.9	30.30	31.00	22.26	22.26	21.82	23.86	23.92	23.90	11.3	30.65	22.11	23.89	16.19	0.698
38	-63.5	23.20	23.34	23.00	23.24	23.30	23.86	23.90	23.88	9.5	23.27	23.18	23.88	12.88	0.738
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	23.06	ERR	0.757
41	12.7										ERR	ERR	23.06	ERR	0.757
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3	46.70	47.00	25.38	25.80	25.88	24.10	23.98	24.18	23.1	46.85	25.69	24.09	28.99	0.797
46	139.7	46.80	47.16	24.00	24.40	24.30	24.44	24.10	24.28	21.7	46.98	24.23	24.27	27.63	0.785
47	165.1	46.10	46.68	26.10	26.56	25.84	23.90	24.30	24.44	23.2	46.39	26.17	24.21	29.39	0.789
48	190.5	45.00	45.64	24.50	24.60	24.40	23.86	23.80	24.00	21.3	45.32	24.50	23.89	26.52	0.803
49	215.9	44.18	44.30	22.10	22.70	22.86	23.82	23.90	23.80	19.6	44.24	22.55	23.84	23.79	0.824
North50	241.3	44.30	44.16	23.90	23.60	23.58	23.92	24.00	24.00	20.3	44.23	23.69	23.97	25.12	0.808

Mean Thickness: 23.86

Std. Deviation: 0.33

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X989 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	gm/cm3 Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3	44.24	43.80	24.36	24.40	24.30	23.06	22.96	23.08	16.2	44.02	24.35	23.03	24.69	0.656
12	-88.9	59.82	59.30	23.04	23.10	23.26	22.88	23.00	23.00	22.2	59.56	23.13	22.96	31.63	0.703
13	-63.5	59.00	58.70	15.40	15.21	15.40	22.90	23.00	23.00	15.0	58.85	15.34	22.97	20.73	0.77
14	-38.1	58.24	58.70	21.90	22.10	21.88	23.28	23.18	23.18	21.5	58.47	21.96	23.21	29.81	0.72
15	-12.7	58.00	57.90	25.60	25.88	26.08	23.24	23.26	23.28	28.4	57.95	25.85	23.26	34.85	0.815
16	12.7	57.90	57.78	21.90	22.08	22.10	23.14	23.24	23.04	24.0	57.84	22.03	23.14	29.48	0.814
17	38.1	57.90	58.44	24.60	24.60	25.00	23.00	23.06	23.20	25.5	58.17	24.73	23.09	33.22	0.768
18	63.5	54.40	54.54	26.88	27.12	27.30	22.90	22.92	22.96	23.7	54.47	27.27	22.93	34.05	0.696
19	88.9	52.90	52.68	19.98	19.90	19.72	22.88	22.98	23.00	16.8	52.79	19.87	22.95	24.07	0.698
20	114.3	51.90	51.86	22.40	22.60	22.42	22.66	23.12	22.96	16.5	51.88	22.47	22.91	26.72	0.618
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.05

Std. Deviation: 0.12

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X989

Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.18	51.20	27.90	28.70	28.90	23.04	22.60	22.76	27.0	51.19	28.50	22.80	33.26	0.812
32	-215.9	51.00	51.00	25.54	25.74	25.80	22.66	22.68	22.76	23.9	51.00	25.69	22.70	29.75	0.803
33	-190.5	50.90	50.84	19.12	19.06	18.80	22.70	22.78	22.94	17.5	50.87	18.99	22.81	22.04	0.794
34	-165.1	51.00	50.92	24.90	25.00	24.86	22.88	23.36	22.92	22.9	50.96	24.92	23.05	29.28	0.782
35	-139.7	50.98	51.70	23.00	23.24	23.30	22.96	23.00	22.88	21.3	51.34	23.18	22.95	27.31	0.780
36	-114.3	50.62	50.50	26.80	26.94	27.00	22.92	23.00	22.96	24.4	50.56	26.91	22.96	31.24	0.781
37	-88.9	50.40	50.18	23.22	23.42	23.30	23.00	23.00	23.00	21.0	50.29	23.31	23.00	26.97	0.779
38	-63.5	50.04	49.84	22.00	22.02	22.20	23.00	23.10	23.32	20.3	49.94	22.07	23.14	25.51	0.796
39	-38.1	49.84	49.90	20.84	20.88	21.08	23.08	23.18	23.20	19.3	49.87	20.93	23.15	24.17	0.798
40	-12.7										ERR	ERR	23.20	ERR	0.815
41	12.7										ERR	ERR	23.20	ERR	0.815
42	38.1	48.30	48.58	23.76	24.20	24.40	23.12	22.86	23.08	20.5	48.44	24.12	23.02	26.90	0.762
43	63.5	48.40	48.52	21.68	21.70	21.94	22.94	23.04	23.08	19.6	48.46	21.77	23.02	24.29	0.807
44	88.9	48.20	48.20	26.80	27.08	27.14	23.00	23.00	23.00	24.2	48.20	27.01	23.00	29.94	0.808
45	114.3	47.96	48.00	23.60	23.54	23.54	22.92	22.88	23.00	20.1	47.98	23.56	22.93	25.92	0.775
46	139.7	47.50	47.80	22.70	22.90	22.70	22.92	22.94	23.00	20.1	47.65	22.77	22.95	24.90	0.807
47	165.1	47.62	47.50	26.64	26.90	27.10	22.88	23.18	23.20	24.0	47.56	26.88	23.09	29.51	0.813
48	190.5	47.52	47.40	23.12	23.34	23.70	23.00	22.90	22.90	20.8	47.46	23.39	22.93	25.45	0.817
49	215.9	47.30	47.26	27.40	27.20	27.10	22.90	23.00	23.22	24.6	47.28	27.23	23.04	29.67	0.829
North50	241.3	47.48	47.36	22.70	23.40	22.97	23.08	22.92	22.86	20.6	47.42	23.02	22.95	25.06	0.822

Mean Thickness: 23.00

Std. Deviation: 0.13

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X990

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3	53.88	54.20	23.76	23.14	21.76	25.22	25.28	25.30	19.0	54.04	22.89	25.27	31.25	0.608
12	-88.9	54.34	55.10	23.14	23.80	23.66	25.26	25.26	25.36	21.3	54.72	23.53	25.29	32.57	0.654
13	-63.5	55.08	55.22	26.14	26.28	26.22	25.22	25.32	25.20	23.8	55.15	26.21	25.25	36.50	0.65
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7										ERR	ERR	ERR	ERR	ERR
16	12.7	26.64	26.76	25.90	25.70	25.90	25.40	25.50	25.54	13.2	26.70	25.83	25.48	17.57	0.751
17	38.1	55.20	55.30	26.58	26.58	25.90	24.78	24.84	24.90	24.1	55.25	26.35	24.84	36.17	0.666
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9	54.30	54.46	24.70	25.90	26.10	25.34	25.58	25.20	22.2	54.38	25.57	25.37	35.28	0.629
20	114.3	53.48	53.64	23.66	22.70	21.66	25.90	25.26	25.40	19.4	53.56	22.67	25.52	30.99	0.624
21	139.7	52.36	51.78	28.40	28.62	28.48	25.14	25.54	25.32	22.6	52.07	28.50	25.33	37.59	0.601
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 25.29

Std. Deviation: 0.19

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X990 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) volume	(gm/cm3) Density
South31	-241.3	48.38	48.50	24.40	24.64	24.84	25.30	25.40	25.70	23.4	48.44	24.63	25.47	30.38	0.770
32	-215.9	48.50	48.62	21.80	21.84	21.90	25.50	25.54	25.78	20.6	48.56	21.85	25.61	27.17	0.756
33	-190.5	48.34	48.48	25.92	26.00	26.00	25.34	25.70	25.48	24.7	48.41	25.97	25.51	32.07	0.769
34	-165.1	48.08	48.16	23.84	23.08	23.40	25.70	25.92	25.70	21.7	48.12	23.44	25.77	29.07	0.746
35	-139.7	47.50	47.62	27.50	27.66	27.40	25.50	25.46	25.56	24.6	47.56	27.52	25.51	33.38	0.737
36	-114.3	47.90	47.76	25.80	25.74	25.98	25.30	25.48	25.44	21.9	47.83	25.84	25.41	31.40	0.696
37	-88.9										ERR	ERR	ERR	ERR	ERR
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	ERR	ERR	ERR
41	12.7										ERR	ERR	ERR	ERR	ERR
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7	52.06	52.03	25.78	25.80	25.44	25.10	25.40	25.40	24.5	52.05	25.67	25.30	33.81	0.725
47	165.1	52.56	52.60	25.58	25.80	25.76	25.12	25.10	25.10	25.8	52.58	25.71	25.11	33.94	0.759
48	190.5	47.20	47.18	23.70	24.28	24.38	24.92	25.14	25.00	22.3	47.19	24.12	25.02	28.48	0.783
49	215.9	46.98	47.14	22.06	22.16	22.08	25.26	25.16	25.00	20.5	47.06	22.10	25.14	26.15	0.784
North50	241.3	46.94	47.00	25.90	25.40	25.02	24.96	25.00	24.90	24.5	46.97	25.44	24.95	29.82	0.820

Mean Thickness: 25.34

Std. Deviation: 0.25

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X991

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9	52.40	52.08	25.40	25.64	25.66	23.90	23.98	23.86	20.0	52.24	25.57	23.91	31.94	0.626
8	-190.5	52.80	52.14	23.78	23.18	24.40	23.90	23.94	23.92	21.5	52.47	23.79	23.92	29.85	0.720
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7	56.44	56.62	25.60	24.78	24.00	23.24	24.00	24.12	24.2	56.53	24.79	23.79	33.34	0.726
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9										ERR	ERR	ERR	ERR	ERR
13	-63.5	36.70	37.26	22.60	22.70	22.90	24.40	24.30	24.30	16.6	36.98	22.73	24.33	20.46	0.8[illegible]
14	-38.1	55.20	54.60	27.70	27.80	28.00	24.30	24.30	24.50	29.8	54.90	27.83	24.37	37.23	0.8[illegible]
15	-12.7	54.82	54.60	22.22	22.10	21.80	23.60			22.6	54.71	22.04	23.60	28.46	0.794
16	12.7	54.88	54.84	23.94	24.00	24.00	23.44	23.54	24.10	23.4	54.86	23.98	23.69	31.17	0.751
17	38.1	54.44	54.50	22.60	22.54	22.50	23.74	23.82	24.30	20.7	54.47	22.55	23.95	29.42	0.704
18	63.5	54.34	54.00	26.00	27.10	26.10	24.28	23.92	23.92	24.5	54.17	26.40	24.04	34.38	0.711
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3	39.08	38.50	27.56	26.68	26.30	23.96	23.92	23.87	15.0	38.79	26.85	23.92	24.91	0.602
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.95

Std. Deviation: 0.23

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X991 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	50.00	49.86	25.10	25.20	25.46	24.20	24.10	24.46	25.0	49.93	25.25	24.25	30.58	0.818
32	-215.9	50.06	50.10	24.34	24.30	24.20	24.18	24.04	24.40	23.8	50.08	24.28	24.21	29.43	0.809
33	-190.5	49.88	49.92	25.00	25.24	25.16	24.20	24.22	24.18	24.5	49.90	25.13	24.20	30.35	0.807
34	-165.1	50.08	50.14	24.30	24.12	24.26	24.34	24.50	24.10	23.4	50.11	24.23	24.31	29.52	0.793
35	-139.7	49.92	50.00	23.70	23.34	23.20	24.30	24.28	23.20	22.3	49.96	23.41	23.93	27.99	0.797
36	-114.3										ERR	ERR	ERR	ERR	ERR
37	-88.9										ERR	ERR	ERR	ERR	ERR
38	-63.5	51.20	51.34	21.06	21.00	21.00	23.50			20.5	51.27	21.02	23.50	25.33	0.809
39	-38.1	51.00	51.56	25.42	25.40	25.10	23.50			21.4	51.28	25.31	23.50	30.50	0.702
40	-12.7										ERR	ERR	23.65	ERR	0.772
41	12.7										ERR	ERR	23.65	ERR	0.772
42	38.1										ERR	ERR	ERR	ERR	ERR
43	63.5										ERR	ERR	ERR	ERR	ERR
44	88.9										ERR	ERR	ERR	ERR	ERR
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7	51.62	51.66	24.78	24.96	24.98	21.82	23.70	23.88	20.6	51.64	24.91	23.13	29.75	0.691
47	165.1	51.16	50.64	26.00	26.14	25.90	23.00	23.70	23.86	22.9	50.90	26.01	23.52	31.14	0.735
48	190.5	50.06	49.10	25.74	25.64	25.70	23.80	23.80	23.86	24.0	49.58	25.69	23.82	30.34	0.791
49	215.9	34.72	34.50	24.50	24.60	24.42	23.74	24.20	23.92	16.4	34.61	24.51	23.95	20.32	0.805
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 23.82

Std. Deviation: 0.35

EXTRUSION OF CRUSHED ICE

PROJECT 9538

Sample Thickness and Density Data

Test No. X992

Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	gm/cm3 Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3	52.16	53.64	25.14	25.00	24.68	27.36	26.54	26.56	22.9	52.90	24.94	26.82	35.38	0.647
12	-88.9	54.00	53.70	23.80	24.44	24.68	26.74	26.78	27.16	24.4	53.85	24.31	26.89	35.20	0.693
13	-63.5	53.50	53.54	26.20	26.54	27.06	26.76	25.90	26.88	24.0	53.52	26.60	26.51	37.75	[illegible]
14	-38.1	53.00	52.94	26.72	26.78	26.88	26.90	27.00	27.80	26.9	52.97	26.79	27.23	38.65	[illegible]
15	-12.7	52.56	52.64	22.24	22.34	22.46	27.14	27.16	27.06	24.7	52.60	22.35	27.12	31.88	0.775
16	12.7	52.18	52.08	26.36	26.00	26.14	26.90	26.84	26.98	27.0	52.13	26.33	26.91	36.94	0.731
17	38.1	51.60	52.00	23.88	24.66	24.24	26.90	26.86	27.00	24.4	51.80	24.26	26.92	33.83	0.721
18	63.5	52.44	52.60	26.40	27.20	27.40	27.18			23.2	52.52	27.00	27.18	38.54	0.602
19	88.9	50.82	52.92	24.36	24.48	24.54	26.80	26.90	26.88	22.4	51.87	24.46	26.86	34.08	0.657
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 26.94

Std. Deviation: 0.21

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X992 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.20	51.75	25.28	25.54	26.00	26.70	26.88	26.96	28.0	51.49	25.61	26.85	35.40	0.791
32	-215.9	51.18	52.44	21.86	21.70	21.50	26.68	26.84	26.90	23.2	51.81	21.69	26.81	30.12	0.770
33	-190.5	51.10	51.40	26.64	26.48	26.20	26.74	26.94	27.08	27.4	51.25	26.44	26.92	36.48	0.751
34	-165.1										ERR	ERR	ERR	ERR	ERR
35	-139.7										ERR	ERR	ERR	ERR	ERR
36	-114.3										ERR	ERR	ERR	ERR	ERR
37	-88.9										ERR	ERR	ERR	ERR	ERR
38	-63.5										ERR	ERR	ERR	ERR	ERR
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	27.01	ERR	0.753
41	12.7										ERR	ERR	27.01	ERR	0.753
42	38.1	51.80	51.94	21.20	20.62	20.30	26.88	26.94	27.00	21.0	51.87	20.71	26.94	28.94	0.726
43	63.5	52.10	52.46	25.86	26.10	26.40	26.82	26.78	26.78	26.2	52.28	26.12	26.79	36.59	0.716
44	88.9	52.12	52.50	24.54	24.82	24.56	26.90	26.86	26.86	27.8	52.31	24.64	26.87	34.64	0.803
45	114.3	53.00	52.96	24.30	24.80	25.34	26.70	26.38	25.50	25.0	52.98	24.81	26.19	34.43	0.726
46	139.7	53.06	52.94	24.50	24.70	24.60	26.74	26.82	24.60	25.2	53.00	24.60	26.05	33.97	0.740
47	165.1	53.46	53.60	23.56	23.70	23.74	26.70	26.72	26.90	26.0	53.53	23.67	26.77	33.92	0.767
48	190.5	53.50	53.60	24.90	24.76	24.70	26.58	26.52	26.66	27.1	53.55	24.79	26.59	35.29	0.768
49	215.9	53.58	53.70	22.22	22.10	22.08	26.60	26.88	26.78	25.1	53.64	22.13	26.75	31.76	0.790
North50	241.3	53.70	53.70	27.00	27.70	28.20	26.40	26.70	26.58	31.3	53.70	27.63	26.56	39.41	0.794

Mean Thickness: 26.72

Std. Deviation: 0.28

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X993 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5	52.10	54.60	26.30	26.34	26.30	19.08	19.24	19.30	18.7	53.35	26.31	19.21	26.96	0.694
9	-165.1	53.42	54.50	24.10	24.10	23.90	19.62	19.22	18.50	17.6	53.96	24.03	19.11	24.79	0.710
10	-139.7	53.80	54.80	23.94	23.90	24.30	19.60	19.20	18.80	18.1	54.30	24.05	19.20	25.07	0.722
11	-114.3	53.60	53.70	22.00	22.60	22.68	19.18	19.04	17.56	16.7	53.65	22.43	18.59	22.37	0.746
12	-88.9	55.54	54.80	29.90	29.62	29.10	18.18	18.10	19.08	22.1	55.17	29.51	18.45	30.04	0.736
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1	34.20	33.90	24.90	24.50	23.80	19.60	19.60	19.00	13.0	34.05	24.40	19.40	16.12	[illegible]
15	-12.7	53.40	53.40	26.48	26.42	27.00	20.20	20.00	19.90	23.6	53.40	26.63	20.03	28.49	0.827
16	12.7	53.28	53.20	25.00	24.80	24.60	20.20	20.00	20.00	21.9	53.24	24.80	20.07	26.50	0.827
17	38.1	53.50	53.26	23.90	24.18	24.32	19.40	19.00	19.60	20.1	53.38	24.13	19.33	24.91	0.807
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9	53.38	53.86	23.32	23.72	23.70	18.56	18.16	17.70	17.6	53.62	23.58	18.14	22.94	0.767
20	114.3	54.20	55.50	22.22	22.64	22.86	19.36	17.90	18.40	16.4	54.85	22.57	18.55	22.97	0.714
21	139.7	54.72	54.84	25.90	25.70	26.00	19.38	18.40	16.90	16.9	54.78	25.87	18.23	25.83	0.654
22	165.1	53.60	53.58	24.80	23.68	23.70	19.12	19.26	19.36	16.0	53.59	24.06	19.25	24.82	0.646
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 19.04

Std. Deviation: 0.60

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X993 Date:

Y-AXIS

Sample	Position (mm)	(mm)								(gm)	Mean	Mean	Mean	(cm3)	(gm/cm3)
Number	X co-ord	Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	Mass	Length	Width	Thickness	Volume	Density
South31	-241.3	57.56	59.10	24.04	24.47	23.80	19.54	19.40	19.47	21.6	58.33	24.10	19.47	27.37	0.787
32	-215.9	57.26	57.10	26.16	26.28	26.90	19.46	19.56	19.58	21.0	57.18	26.45	19.53	29.54	0.711
33	-190.5	56.92	56.80	23.20	23.28	23.60	19.60	19.72	19.68	20.0	56.86	23.36	19.67	26.12	0.766
34	-165.1	56.58	56.72	25.88	25.96	25.90	20.14	20.00	20.00	22.7	56.65	25.91	20.05	29.43	0.771
35	-139.7	56.20	56.10	26.20	26.00	26.00	20.10	19.70	19.70	18.7	56.15	26.07	19.83	29.03	0.644
36	-114.3	56.02	56.08	23.88	23.10	23.04	19.80	19.56	19.66	22.0	56.05	23.34	19.67	25.74	0.855
37	-88.9	56.08	56.08	25.24	25.14	25.08	19.60	19.60	19.20	22.2	56.08	25.15	19.47	27.46	0.808
38	-63.5	55.96	55.76	22.54	22.62	22.60	20.24	19.84	19.76	20.1	55.86	22.59	19.95	25.17	0.798
39	-38.1	55.50	55.30	22.34	22.80	23.48	19.80	19.80	19.24	19.1	55.40	22.87	19.61	24.85	0.768
40	-12.7										ERR	ERR	20.05	ERR	0.827
41	12.7										ERR	ERR	20.05	ERR	0.827
42	38.1	52.96	53.90	25.92	25.96	25.18	19.54	19.62	19.48	20.0	53.43	25.69	19.55	26.83	0.747
43	63.5	52.90	53.00	24.16	24.04	24.02	19.40	19.40	19.40	20.1	52.95	24.07	19.40	24.73	0.811
44	88.9	52.96	52.90	23.38	23.30	23.38	19.30	19.30	19.10		52.93	23.35	19.23	23.77	0.000
45	114.3	52.96	52.96	26.70	26.80	26.88	19.28	19.30	19.10	21.3	52.96	26.79	19.23	27.28	0.781
46	139.7	53.38	53.22	21.70	21.52	21.60	19.70	19.60	19.30		53.30	21.61	19.53	22.50	0.000
47	165.1	53.60	53.70	25.18	25.04	25.00	19.02	19.22	19.14		53.65	25.07	19.13	25.73	0.000
48	190.5	53.12	53.34	24.70	24.72	24.82	19.00	19.02	19.06	22.1	53.23	24.75	19.03	25.06	0.882
49	215.9	52.80	53.00	23.64	23.52	23.30	19.00	19.06	19.00		52.90	23.49	19.02	23.63	0.000
North50	241.3	52.50	52.70	23.30	23.82	23.06	19.20	19.10	19.00		52.60	23.39	19.10	23.50	0.000

Mean Thickness: 19.53

Std. Deviation: 0.33

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X994 Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9	45.10	45.06	24.40	22.34	22.90	25.48	25.50	25.54	16.3	45.08	23.21	25.51	26.69	0.611
13	-63.5										ERR	ERR	ERR	ERR	ERR
14	-38.1										ERR	ERR	ERR	ERR	ERR
15	-12.7	52.26	52.36	21.38	20.66	20.42	25.84	25.56	25.76	20.0	52.31	20.82	25.72	28.01	0.714
16	12.7	51.74	51.90	21.90	21.38	20.56	25.80	25.56	25.90	20.8	51.82	21.28	25.75	28.40	0.732
17	38.1	37.96	38.64	24.76	25.16	25.24	25.44	25.44	25.56	16.6	38.30	25.05	25.48	24.45	0.679
18	63.5	50.40	51.10	22.26	22.42	22.52	25.44	25.66	25.36	19.0	50.75	22.40	25.49	28.97	0.656
19	88.9						25.18				ERR	ERR	25.18	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7						25.12	25.08	25.06		ERR	ERR	25.09	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 25.46

Std. Deviation: 0.23

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X994 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	49.78	49.50	23.70	22.90	22.56	25.40	25.56	25.50	21.6	49.64	23.05	25.49	29.17	0.741
32	-215.9	49.06	48.46	21.70	21.90	21.84	25.44	25.42	25.50	20.0	48.76	21.81	25.45	27.07	0.739
33	-190.5	47.74	46.60	27.22	27.46	27.56	25.60	25.52	25.46	23.9	47.17	27.41	25.53	33.01	0.724
34	-165.1	49.84	49.90	24.16	24.00	24.00	25.44	25.52	25.54	21.4	49.87	24.05	25.50	30.59	0.700
35	-139.7	49.64	49.70	25.46	25.70	25.74	25.46	25.50	25.52	23.3	49.67	25.63	25.49	32.46	0.718
36	-114.3	49.52	49.76	26.26	25.70	25.16	25.50	25.46	25.48	23.6	49.64	25.71	25.48	32.51	0.726
37	-88.9	49.20	48.88	25.20	26.18	25.80	25.42	25.50	25.50	23.5	49.04	25.73	25.47	32.14	0.731
38	-63.5	50.10	50.38	23.60	23.70	23.90	25.60	25.56	25.48	22.1	50.24	23.73	25.55	30.46	0.726
39	-38.1	50.10	50.46	23.14	23.84	23.90	25.66	25.56	25.52	22.1	50.28	23.63	25.58	30.39	0.727
40	-12.7										ERR	ERR	25.74	ERR	0.723
41	12.7										ERR	ERR	25.74	ERR	0.723
42	38.1	47.70	47.94	24.62	24.16	23.00	25.50	25.50	25.56	21.4	47.82	23.93	25.52	29.20	0.733
43	63.5	48.40	48.56	21.38	20.62	19.36	25.48	25.50	25.48	18.7	48.48	20.45	25.49	25.27	0.740
44	88.9	53.14	52.96	26.04	25.40	25.04	25.42	25.38	25.40	24.9	53.05	25.49	25.40	34.35	0.725
45	114.3	53.10	53.00	23.42	23.78	24.44	25.34	25.38	25.36	23.1	53.05	23.88	25.36	32.13	0.719
46	139.7	50.14	49.74	23.44	24.54	25.48	25.38	25.48	25.44	22.3	49.94	24.49	25.43	31.10	0.717
47	165.1	38.86	39.46	24.70	25.54	26.42	25.34	25.40	25.54	18.6	39.16	25.55	25.43	25.44	0.731
48	190.5	40.18	40.72	25.16	26.16	26.62	25.36	25.34	25.26	19.5	40.45	25.98	25.32	26.61	0.733
49	215.9	41.28	41.00	22.60	22.96	22.76	25.30	25.36	25.34	17.9	41.14	22.77	25.33	23.73	0.754
North50	241.3	40.98	41.20	23.14	22.60	23.70	25.26	25.34	25.44	18.5	41.09	23.15	25.35	24.11	0.767

Mean Thickness: 25.48

Std. Deviation: 0.11

EXTRUSION OF CRUSHED ICE　　　　PROJECT 9508

Sample Thickness and Density Data

Test No. X995　　　　Date:

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3	53.88	54.56	21.62	21.76	22.00	27.36	27.42	27.40	22.5	54.22	21.79	27.39	32.37	0.695
12	-88.9	54.82	55.14	24.78	25.24	24.94	27.36	27.52	27.62	27.2	54.98	24.99	27.50	37.78	0.72[illegible]
13	-63.5	54.90	54.74	18.24	20.20	21.00	27.46	27.64	27.86	21.5	54.82	19.81	27.65	30.04	0.7[illegible]
14	-38.1	40.00	39.60	27.90	28.36	28.22	27.92	27.68	27.66	23.5	39.80	28.16	27.75	31.11	0.756
15	-12.7	39.92	39.90	23.66	23.70	23.68	27.88	27.80	27.92	20.3	39.91	23.68	27.87	26.34	0.771
16	12.7	40.00	39.70	25.10	25.02	25.00	27.92	27.91	27.92	21.0	39.85	25.04	27.92	27.86	0.754
17	38.1	40.60	40.16	24.18	24.50	24.38	27.76	27.64	27.78	20.0	40.38	24.35	27.73	27.27	0.734
18	63.5	46.38	46.48	24.30	24.54	24.60	27.58	27.70	27.68	21.9	46.43	24.48	27.65	31.43	0.697
19	88.9	46.30	46.76	24.20	23.24	23.24	27.56	27.50	27.50	20.0	46.53	23.56	27.52	30.17	0.664
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7	51.20	52.80	21.84	22.40	22.56	27.32	27.30	27.60	20.6	52.00	22.27	27.41	31.73	0.649
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 27.64

Std. Deviation: 0.17

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X995 Date:

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	49.46	49.62	23.08	23.38	23.40	27.66	27.76	27.66	25.9	49.54	23.29	27.69	31.95	0.811
32	-215.9	49.40	49.42	28.00	28.00	28.12	27.60	27.68	27.70	30.9	49.41	28.04	27.66	38.32	0.806
33	-190.5	49.30	49.30	20.56	20.56	20.42	27.70	27.58	27.56	21.8	49.30	20.51	27.61	27.93	0.781
34	-165.1	49.50	49.02	25.66	25.76	25.84	27.90	27.86	27.66	26.8	49.26	25.75	27.81	35.28	0.760
35	-139.7	48.94	48.98	27.14	27.06	26.88	27.64	27.64	27.70	28.0	48.96	27.03	27.66	36.60	0.765
36	-114.3	48.89	49.10	21.88	21.98	22.04	27.66	27.68	27.68	23.0	49.00	21.97	27.67	29.78	0.772
37	-88.9	49.40	49.52	25.00	25.10	25.12	27.66	27.68	27.60	26.5	49.46	25.07	27.65	34.29	0.773
38	-63.5	49.50	49.78	24.52	23.70	24.00	27.70	27.68	27.64	25.1	49.64	24.07	27.67	33.07	0.759
39	-38.1	49.64	50.06	24.60	24.62	24.64	27.90	27.86	27.76	25.8	49.85	24.62	27.84	34.17	0.755
40	-12.7										ERR	ERR	27.89	ERR	0.762
41	12.7										ERR	ERR	27.89	ERR	0.762
42	38.1	52.60	53.08	24.08	24.20	24.16	27.72	27.74	27.84	26.6	52.84	24.15	27.77	35.43	0.751
43	63.5	54.10	54.00	21.40	22.20	23.16	27.70	27.60	27.58	25.2	54.05	22.25	27.63	33.23	0.758
44	88.9	54.02	53.94	22.20	22.74	22.24	27.56	27.60	27.64	26.2	53.98	22.39	27.60	33.36	0.785
45	114.3	53.70	54.14	27.40	27.44	27.40	27.40	27.46	27.48	31.4	53.92	27.41	27.45	40.57	0.774
46	139.7	54.40	54.36	23.40	23.34	23.22	27.46	27.62	27.64	26.9	54.38	23.32	27.57	34.97	0.769
47	165.1	54.48	54.54	24.50	24.64	24.70	27.30	27.30	27.30	28.6	54.51	24.61	27.30	36.63	0.781
48	190.5	54.70	54.52	24.34	24.58	24.90	27.18	27.12	27.16	28.9	54.61	24.61	27.15	36.49	0.792
49	215.9	54.50	54.40	27.30	27.22	26.98	27.02	27.08	27.00	31.7	54.45	27.17	27.03	39.99	0.793
North50	241.3	54.04	54.00	23.84	24.00	24.08	27.00	26.94	26.94	27.8	54.02	23.97	26.96	34.91	0.796

Mean Thickness: 27.58

Std. Deviation: 0.26

EXTRUSION OF CRUSHED ICE

PROJECT 9536

Sample Thickness and Density Data

Test No. 996

Date: 06-Dec-88

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1										ERR	ERR	ERR	ERR	ERR
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3										ERR	ERR	ERR	ERR	ERR
12	-88.9										ERR	ERR	ERR	ERR	ERR
13	-63.5						10.10	10.34			ERR	ERR	10.22	ERR	ERR
14	-38.1						10.48	10.40			ERR	ERR	10.44	ERR	ERR
15	-12.7	49.56	50.84	24.44	24.22	24.16	10.20	10.30	10.30	10.9	50.20	24.27	10.27	12.51	0.871
16	12.7						10.38	10.24	10.32		ERR	ERR	10.31	ERR	ERR
17	38.1										ERR	ERR	ERR	ERR	ERR
18	63.5										ERR	ERR	ERR	ERR	ERR
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3										ERR	ERR	ERR	ERR	ERR
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 10.31

Std. Deviation: 0.08

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. 996 Date: 08-Dec-88

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	51.50	51.78	22.04	22.56	22.00	9.90	10.00	9.92	10.0	51.64	22.20	9.94	11.40	0.879
32	-215.9	52.04	51.90	25.18	25.62	25.50	9.80	9.98	10.00	10.4	51.97	25.43	9.93	13.12	0.793
33	-190.5	52.04	52.10	24.04	23.58	22.92	9.90	10.06	9.94	10.3	52.07	23.51	9.97	12.20	0.844
34	-165.1	52.26	52.16	23.64	24.10	24.44	9.84	10.08	10.04	10.6	52.21	24.06	9.99	12.54	0.845
35	-139.7	52.50	52.46	24.70	25.40	25.66	9.92	10.02	9.94	11.2	52.48	25.25	9.96	13.20	0.848
36	-114.3	53.30	52.92	23.92	23.78	23.66	10.00	10.18	10.06	10.7	53.11	23.79	10.08	12.73	0.840
37	-88.9	54.04	53.80	25.24	25.74	26.40	10.34	10.36	10.00	12.0	53.92	25.79	10.23	14.23	0.843
38	-63.5	53.30	53.22	24.30	23.82	23.36	10.06	10.20	10.30	11.2	53.26	23.83	10.19	12.93	0.866
39	-38.1	54.24	54.26	24.46	24.18	23.14	10.14	10.18	10.22	10.4	54.25	23.93	10.18	13.21	0.787
40	-12.7										ERR	ERR	10.29	ERR	ERR
41	12.7										ERR	ERR	10.29	ERR	ERR
42	38.1	52.64	52.20	23.82	24.56	24.34	10.24	10.30	10.38	11.1	52.42	24.24	10.31	13.10	0.848
43	63.5	52.60	52.84	22.40	22.20	22.34	10.28	10.30	10.24	10.2	52.72	22.31	10.27	12.09	0.844
44	88.9	51.54	51.94	26.82	26.82	27.00	10.20	10.20	10.24	12.0	51.74	26.88	10.21	14.20	0.845
45	114.3	51.40	51.40	23.54	24.00	23.90	10.06	10.12	10.00	10.5	51.40	23.81	10.06	12.31	0.853
46	139.7	51.62	51.46	23.40	23.64	23.74	10.08	10.10	10.04	10.3	51.54	23.59	10.07	12.25	0.841
47	165.1	51.96	51.70	22.50	22.16	21.90	10.06	9.90	9.96	9.8	51.83	22.19	9.97	11.47	0.855
48	190.5	52.52	52.18	25.90	26.00	27.00	9.90	9.86	9.96	10.7	52.35	26.30	9.91	13.64	0.784
49	215.9	52.80	52.90	25.30	25.84	25.60	9.74	9.82	10.02	11.6	52.85	25.58	9.86	13.33	0.870
North50	241.3	43.68	44.62	21.30	21.42	21.50	9.72	9.86	10.00	8.2	44.15	21.41	9.86	9.32	0.880

Mean Thickness: 10.08

Std. Deviation: 0.15

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X997 Date: 07-Dec-88

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9										ERR	ERR	ERR	ERR	ERR
3	-317.5										ERR	ERR	ERR	ERR	ERR
4	-292.1										ERR	ERR	ERR	ERR	ERR
5	-266.7										ERR	ERR	ERR	ERR	ERR
6	-241.3										ERR	ERR	ERR	ERR	ERR
7	-215.9										ERR	ERR	ERR	ERR	ERR
8	-190.5										ERR	ERR	ERR	ERR	ERR
9	-165.1	46.46	47.50	29.76	29.18	28.74	31.08	31.02	31.00	24.9	46.98	29.23	31.03	42.61	0.584
10	-139.7										ERR	ERR	ERR	ERR	ERR
11	-114.3	49.16	49.16	23.68	24.06	24.58	31.00	31.04	31.10	22.5	49.16	24.11	31.05	36.79	0.612
12	-88.9	50.30	50.36	28.30	28.24	28.68	31.40	31.38	31.34	28.2	50.33	28.41	31.37	44.85	0.629
13	-63.5						31.36	31.46	31.56		ERR	ERR	31.46	ERR	ERR
14	-38.1	29.62	29.80	21.82	21.40		31.52	31.48		13.3	29.71	21.61	31.50	20.22	0.658
15	-12.7	49.76	49.44	24.26	24.26	24.56	31.54	31.70	31.74	27.0	49.60	24.36	31.66	38.25	0.706
16	12.7										ERR	ERR	ERR	ERR	ERR
17	38.1	51.08	50.82	21.10	21.50	22.20	21.50	22.44	23.34	16.3	50.95	21.60	22.43	24.68	0.660
18	63.5	51.12	51.26	21.04	21.98	22.66	23.10	23.28	22.50	16.4	51.19	21.89	22.96	25.73	0.637
19	88.9										ERR	ERR	ERR	ERR	ERR
20	114.3	50.66	50.76	24.58	24.48	24.88	31.60	31.60	31.66	23.8	50.71	24.65	31.62	39.52	0.602
21	139.7										ERR	ERR	ERR	ERR	ERR
22	165.1										ERR	ERR	ERR	ERR	ERR
23	190.5										ERR	ERR	ERR	ERR	ERR
24	215.9										ERR	ERR	ERR	ERR	ERR
25	241.3										ERR	ERR	ERR	ERR	ERR
26	266.7										ERR	ERR	ERR	ERR	ERR
27	292.1										ERR	ERR	ERR	ERR	ERR
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 29.45

Std. Deviation: 3.62

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X997 Date: 07-Dec-88

Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	29.70	30.36	21.44	20.80	19.96	31.80	31.74	31.78	13.9	30.03	20.73	31.77	19.78	0.703
32	-215.9	40.54	40.26	27.46	27.16	26.32	31.74	31.64	31.66	25.7	40.40	26.98	31.68	34.53	0.744
33	-190.5	31.08	31.06	24.04	23.54		31.64	31.68		16.4	31.07	23.79	31.66	23.40	0.701
34	-165.1	40.00	39.80	24.12	23.76	23.14	31.62	31.70	31.80	20.8	39.90	23.67	31.71	29.95	0.695
35	-139.7	49.44	49.58	23.64	24.24	24.80	31.72	31.76	31.64	26.2	49.51	24.23	31.71	38.03	0.689
36	-114.3	48.30	48.24	27.52	27.48	27.20	31.82	31.70	31.84	28.9	48.27	27.40	31.79	42.04	0.687
37	-88.9	48.30	48.64	23.82	24.30	24.70	31.70	31.84	31.82	26.2	48.47	24.27	31.79	37.40	0.701
38	-63.5	42.06	42.10	26.38	26.26	25.92	31.72	31.72	31.62	24.2	42.08	26.19	31.69	34.92	0.693
39	-38.1	41.66	41.86	23.60	23.74	23.98	31.38	31.50	31.34	21.9	41.76	23.77	31.41	31.18	0.702
40	-12.7										ERR	ERR	31.66	ERR	0.706
41	12.7										ERR	ERR	31.66	ERR	0.706
42	38.1	40.84	41.06	26.86	27.26	27.92	31.50	31.48	31.70	24.9	40.95	27.35	31.56	35.34	0.705
43	63.5	41.32	41.12	24.50	24.50	24.44	31.40	31.40	31.40	22.7	41.22	24.48	31.40	31.68	0.716
44	88.9	41.60	41.54	25.70	25.64	24.60	31.34	31.34	31.42	23.3	41.57	25.31	31.37	33.01	0.706
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7	50.00	50.10	24.16	24.82	25.16	31.38	31.36	31.36	27.5	50.05	24.71	31.37	38.80	0.709
47	165.1	49.80	49.64	26.46	26.36	26.30	31.20	31.30	31.26	29.2	49.72	26.37	31.25	40.98	0.713
48	190.5	51.34	51.66	21.94	21.86	22.10	31.22	31.18	31.22	25.2	51.50	21.97	31.21	35.30	0.714
49	215.9	51.18	50.84	24.92	24.98	24.30	31.38	31.14	31.18	28.9	51.01	24.73	31.23	39.41	0.733
North50	241.3	50.00	50.50	23.24	23.38	23.64	31.28	31.24	31.10	27.5	50.25	23.42	31.21	36.73	0.749

Mean Thickness: 31.53

Std. Deviation: 0.21

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

Test No. X998 Date: 05-Dec-88

X-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	cm3 Volume	gm/cm3 Density
East 1	-368.3										ERR	ERR	ERR	ERR	ERR
2	-342.9	52.36	52.30	23.60	23.88	23.78	23.74	23.70	23.80	19.1	52.33	23.75	23.75	29.52	0.647
3	-317.5	52.90	52.76	23.54	23.22	23.00	24.10	24.00	24.08	19.8	52.83	23.25	24.06	29.56	0.670
4	-292.1	52.16	52.34	23.96	24.00	23.94	24.20	24.16	24.20	20.2	52.25	23.97	24.19	30.29	0.667
5	-266.7	52.44	52.14	23.80	24.12	24.22	24.28	24.34	24.31	22.2	52.29	24.05	24.31	30.57	0.726
6	-241.3	51.90	52.00	23.14	23.14	22.76	24.24	24.30	24.26	21.7	51.95	23.01	24.27	29.01	0.748
7	-215.9	51.78	51.84	23.86	24.00	24.30	24.32	24.32	24.40	23.8	51.81	24.05	24.35	30.34	0.784
8	-190.5	51.54	51.86	24.64	24.94	24.50	24.50	24.46	24.00	25.2	51.70	24.69	24.32	31.05	0.812
9	-165.1	51.42	51.38	23.90	23.84	24.16	24.70	24.64	24.62	25.3	51.40	23.97	24.65	30.37	0.833
10	-139.7	51.34	51.00	22.74	23.62	23.54	24.78	24.76	24.78	25.7	51.17	23.30	24.77	29.54	0.870
11	-114.3	50.20	51.00	24.20	24.30	25.10	24.82	24.82	24.78	27.1	50.60	24.53	24.81	30.79	0.880
12	-88.9	50.18	50.16	24.00	24.12	24.10	24.86	24.90	24.86	26.2	50.17	24.07	24.87	30.04	0.872
13	-63.5	50.20	50.32	24.26	24.20	23.94	25.16	25.10	25.06	26.9	50.26	24.13	25.11	30.45	0.883
14	-38.1	49.16	49.60	24.10	24.06	23.40	25.20	25.30	25.28	26.6	49.38	23.85	25.26	29.75	0.8[illegible]
15	-12.7	49.70	49.26	22.10	22.64	22.90	25.20	25.20	25.20	25.2	49.48	22.55	25.20	28.11	0.896
16	12.7	50.14	50.70	25.30	25.50	25.64	25.40	25.20	25.16	28.8	50.42	25.48	25.25	32.44	0.888
17	38.1	50.46	50.50	17.40	18.00	17.80	24.66	24.98	25.00	19.4	50.48	17.73	24.88	22.27	0.871
18	63.5	50.66	50.36	25.30	25.30	24.76	24.90	24.94	24.94	26.3	50.51	25.12	24.93	31.63	0.832
19	88.9	50.88	51.20	24.66	24.40	23.96	24.80	24.80	24.80	25.0	51.04	24.34	24.80	30.81	0.811
20	114.3	51.26	51.10	23.54	23.42	23.40	24.58	24.60	24.60	23.9	51.18	23.45	24.59	29.52	0.810
21	139.7	50.70	50.50	17.10	16.60	16.30	24.66	24.76	24.58	16.5	50.60	16.67	24.67	20.80	0.793
22	165.1	50.40	50.20	25.10	25.18	25.00	24.56	24.62	24.72	24.0	50.30	25.09	24.63	31.09	0.772
23	190.5	50.40	50.26	24.32	24.30	24.24	24.50	24.48	24.56	21.7	50.33	24.29	24.51	29.96	0.724
24	215.9	49.22	50.10	24.00	24.30	24.20	24.22	24.40	24.60	20.2	49.66	24.17	24.41	29.29	0.690
25	241.3	48.64	48.90	26.36	25.58	25.20	24.24	24.22	24.36	20.9	48.77	25.71	24.27	30.44	0.687
26	266.7	48.56	48.54	24.30	24.70	24.44	24.38	24.38	24.36	19.3	48.55	24.48	24.37	28.97	0.666
27	292.1	48.00	48.40	25.00	24.40	24.14	24.40	24.26	24.36	17.9	48.20	24.51	24.34	28.76	0.622
28	317.5										ERR	ERR	ERR	ERR	ERR
29	342.9										ERR	ERR	ERR	ERR	ERR
West 30	368.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 24.60

Std. Deviation: 0.38

EXTRUSION OF CRUSHED ICE PROJECT 9538

Sample Thickness and Density Data

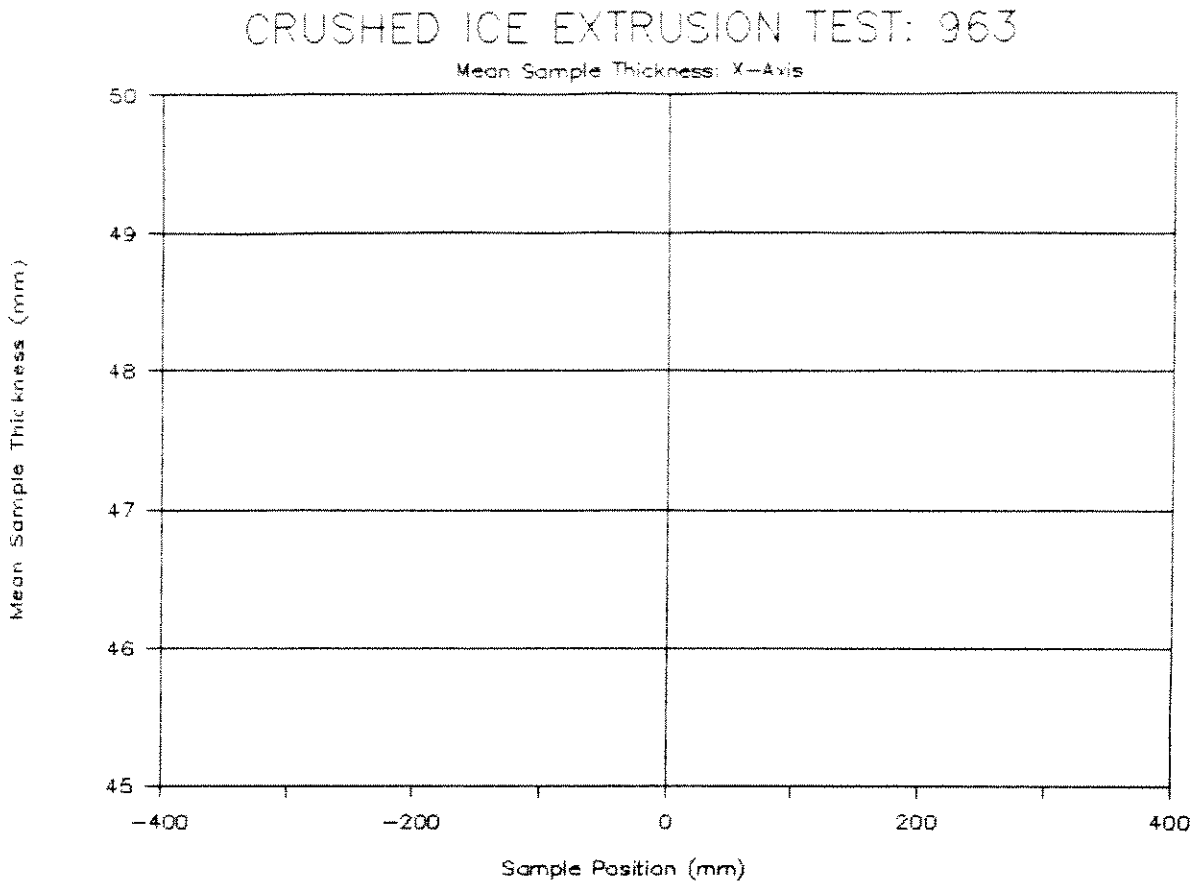
Test No. X998 Date: 05-Dec-88

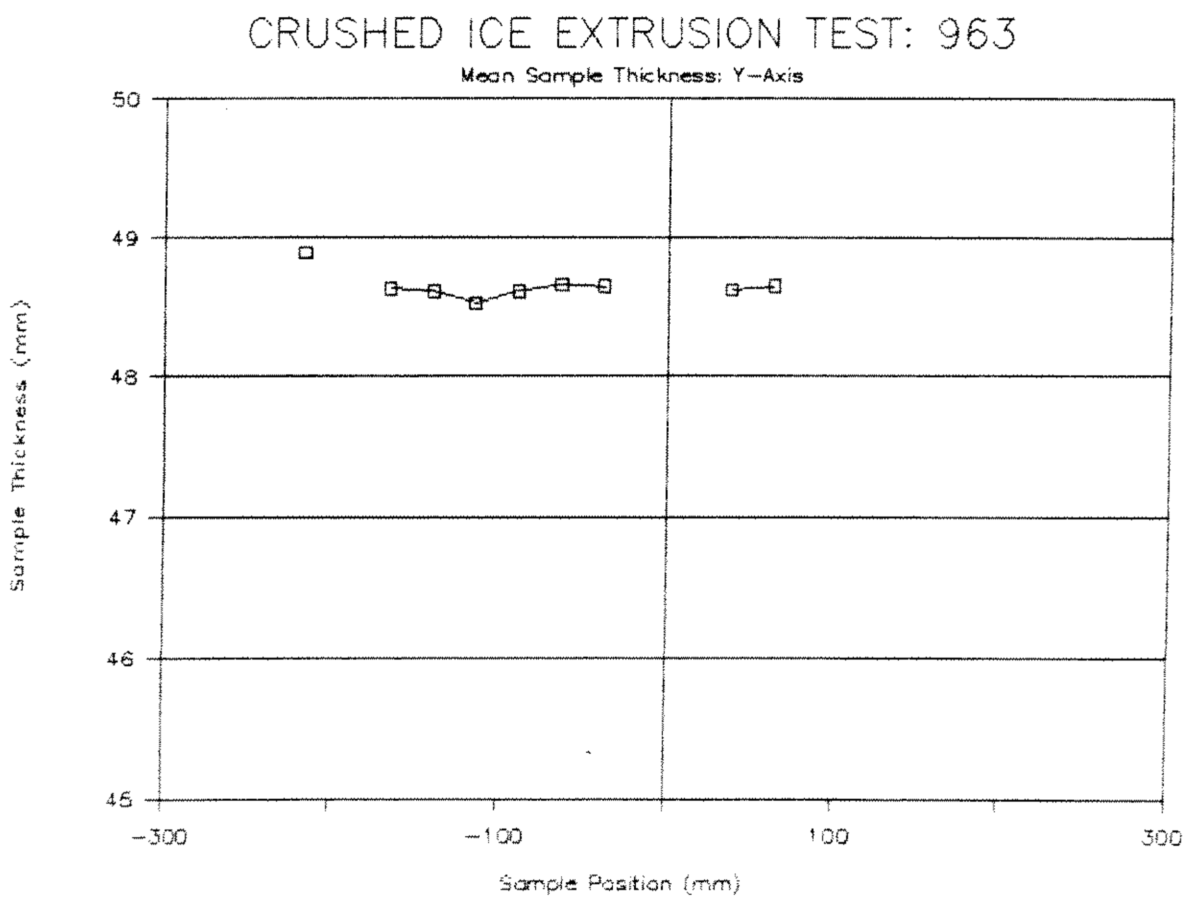
Y-AXIS

Sample Number	Position (mm) X co-ord	(mm) Length1	Length2	Width1	Width2	Width3	Thickness1	Thickness2	Thickness3	(gm) Mass	Mean Length	Mean Width	Mean Thickness	(cm3) Volume	(gm/cm3) Density
South31	-241.3	50.54	50.60	23.82	24.00	24.28	25.30	25.30	25.50	27.4	50.57	24.03	25.37	30.83	0.889
32	-215.9	50.64	50.56	22.00	22.44	22.86	25.50	25.66	25.40	25.5	50.60	22.43	25.52	28.97	0.880
33	-190.5	50.60	50.72	25.74	25.60	25.20	25.40	25.46	25.60	29.1	50.66	25.51	25.49	32.94	0.883
34	-165.1	50.86	50.82	23.54	23.88	24.22	25.48	25.50	25.44	27.4	50.84	23.88	25.47	30.93	0.886
35	-139.7	51.40	51.10	25.80	25.82	25.54	25.34	25.32	25.30	29.5	51.25	25.72	25.32	33.38	0.884
36	-114.3	51.64	51.70	23.30	23.70	24.30	25.10	25.16	25.32	27.2	51.67	23.77	25.19	30.94	0.879
37	-88.9	34.56	34.32	25.82	25.30	24.92	25.10	25.16	25.16	19.2	34.44	25.35	25.14	21.95	0.875
38	-63.5	33.34	34.16	21.38	21.70	21.90	25.20	25.30	25.32	16.1	33.75	21.66	25.27	18.48	0.871
39	-38.1										ERR	ERR	ERR	ERR	ERR
40	-12.7										ERR	ERR	25.23	ERR	0.892
41	12.7										ERR	ERR	25.23	ERR	0.892
42	38.1	42.18	41.40	25.00	24.30	23.56	25.18	25.12	25.10	22.3	41.79	24.29	25.13	25.51	0.874
43	63.5	42.88	42.36	24.00	23.96	24.10	25.00	25.06	25.06	22.4	42.62	24.02	25.04	25.63	0.874
44	88.9	43.34	43.12	23.70	24.22	24.26	25.00	25.02	25.00	22.8	43.23	24.06	25.01	26.01	0.877
45	114.3										ERR	ERR	ERR	ERR	ERR
46	139.7										ERR	ERR	ERR	ERR	ERR
47	165.1	35.80	35.64	22.62	22.90	23.14	24.90	25.00	24.92	17.6	35.72	22.89	24.94	20.39	0.863
48	190.5	51.00	50.94	26.20	25.58	25.74	24.74	24.80	24.82	28.9	50.97	25.84	24.79	32.65	0.885
49	215.9	51.26	51.30	23.14	23.50	23.00	24.76	24.80	24.74	26.2	51.28	23.21	24.77	29.48	0.889
North50	241.3										ERR	ERR	ERR	ERR	ERR

Mean Thickness: 25.18

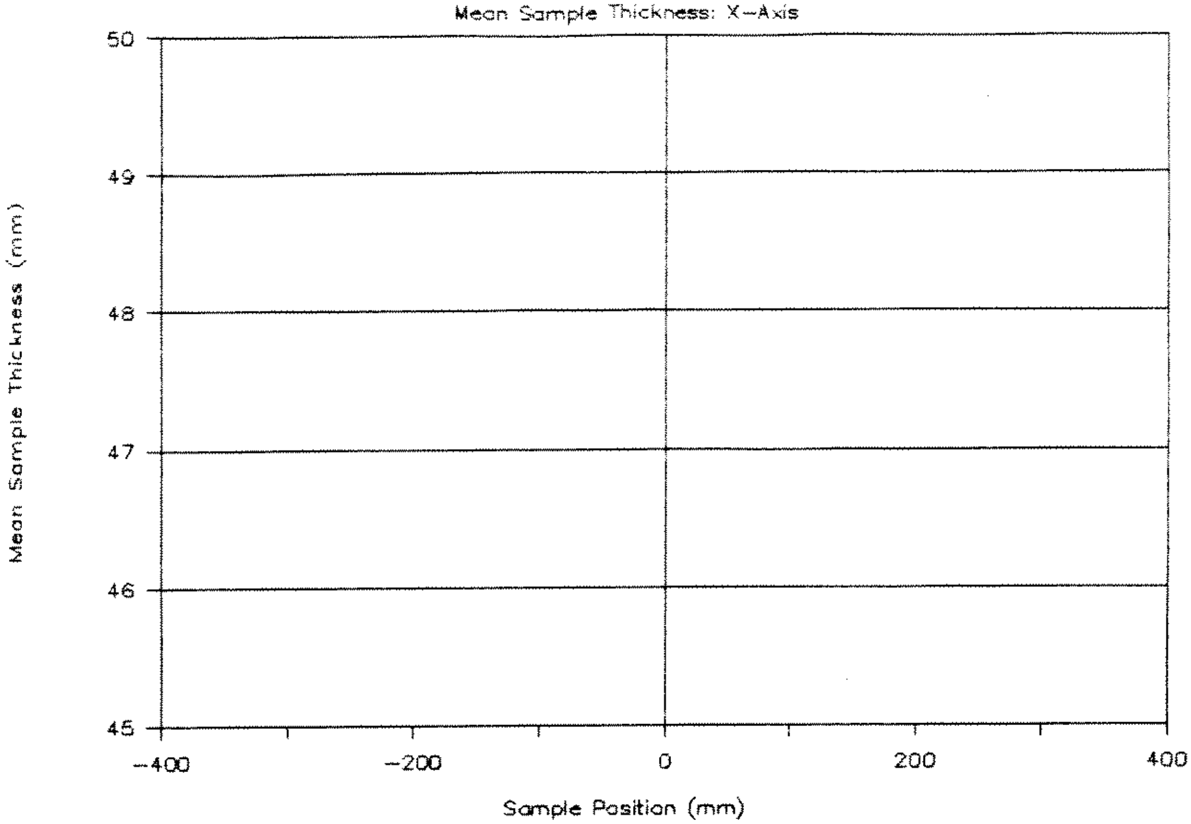
Std. Deviation: 0.22


CRUSHED ICE EXTRUSION TEST: 963
Mean Sample Thickness: X-Axis
50
49
48
47
46
45
Mean Sample Thickness (mm)
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 963
Mean Sample Thickness: Y-Axis
50
49
48
47
46
45
Sample Thickness (mm)
-300
-100
100
300
Sample Position (mm)

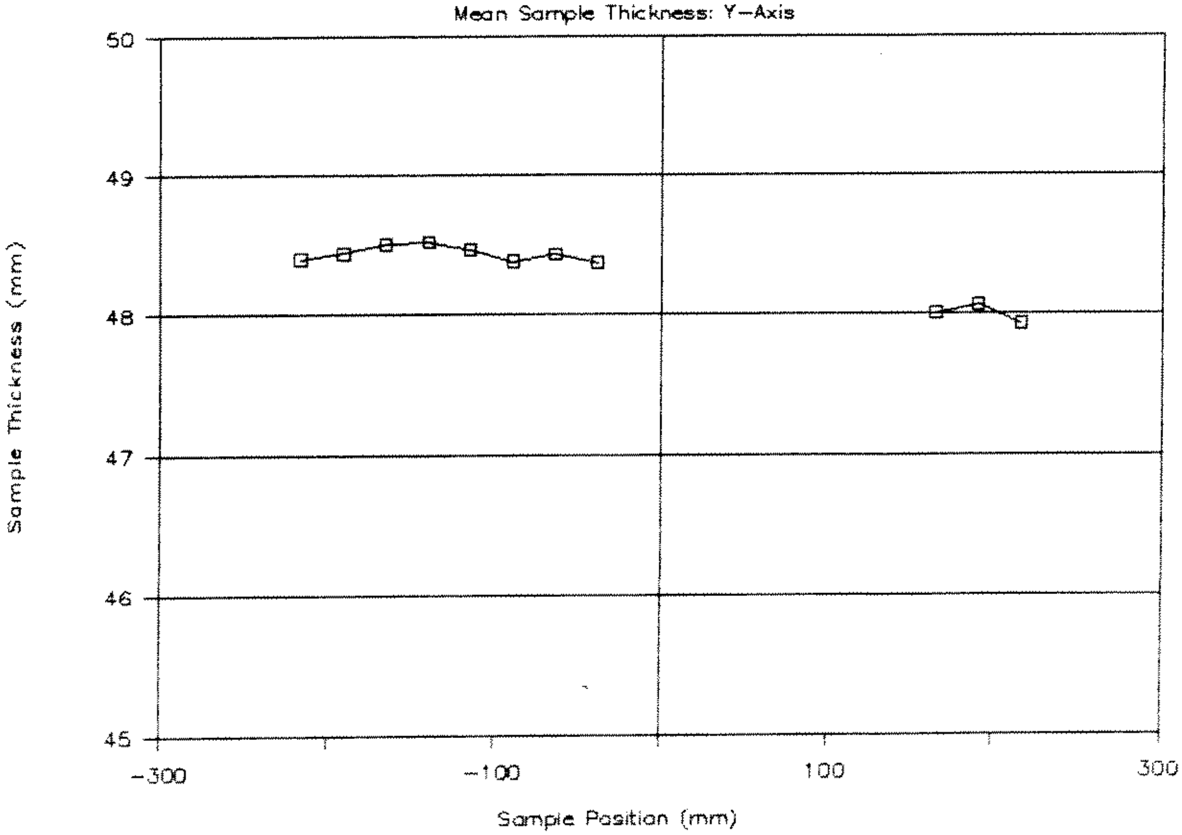
CRUSHED ICE EXTRUSION TEST: 963A

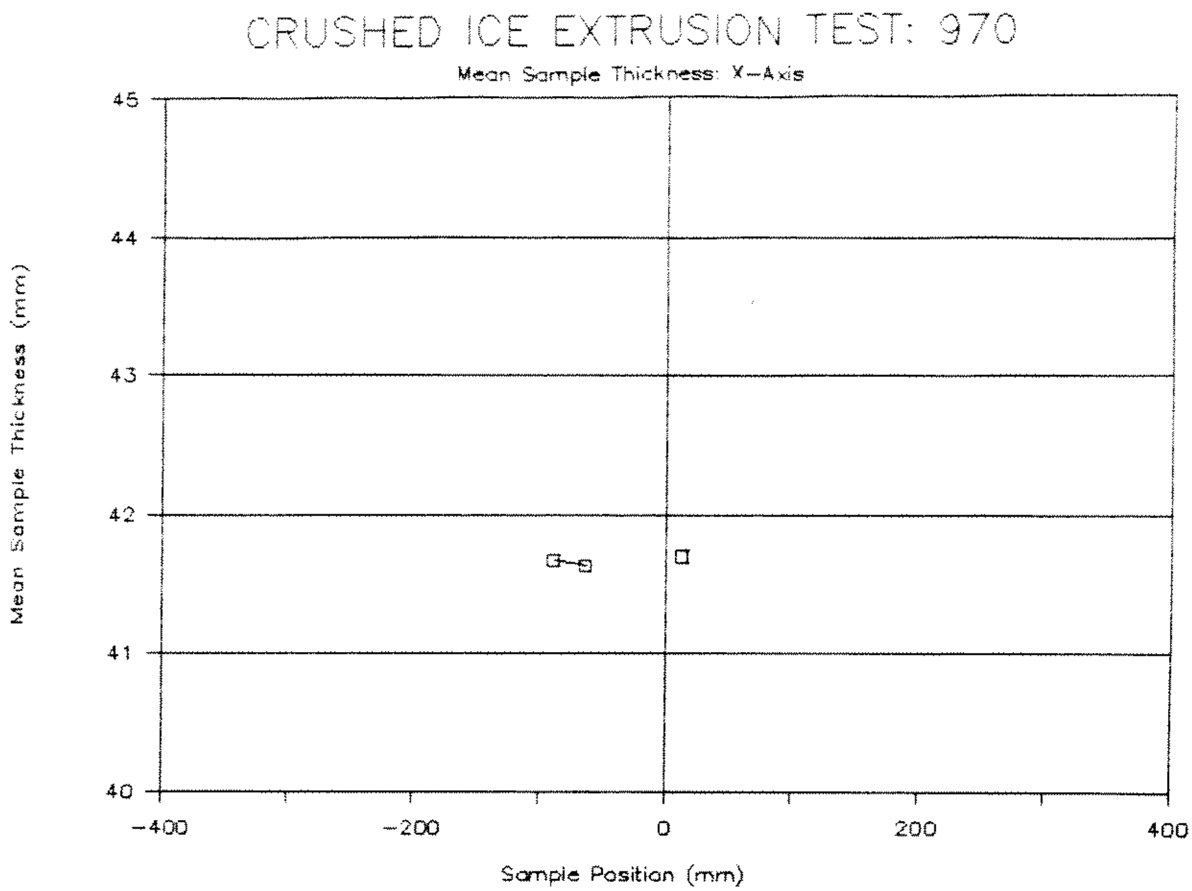
Mean Sample Thickness: X-Axis

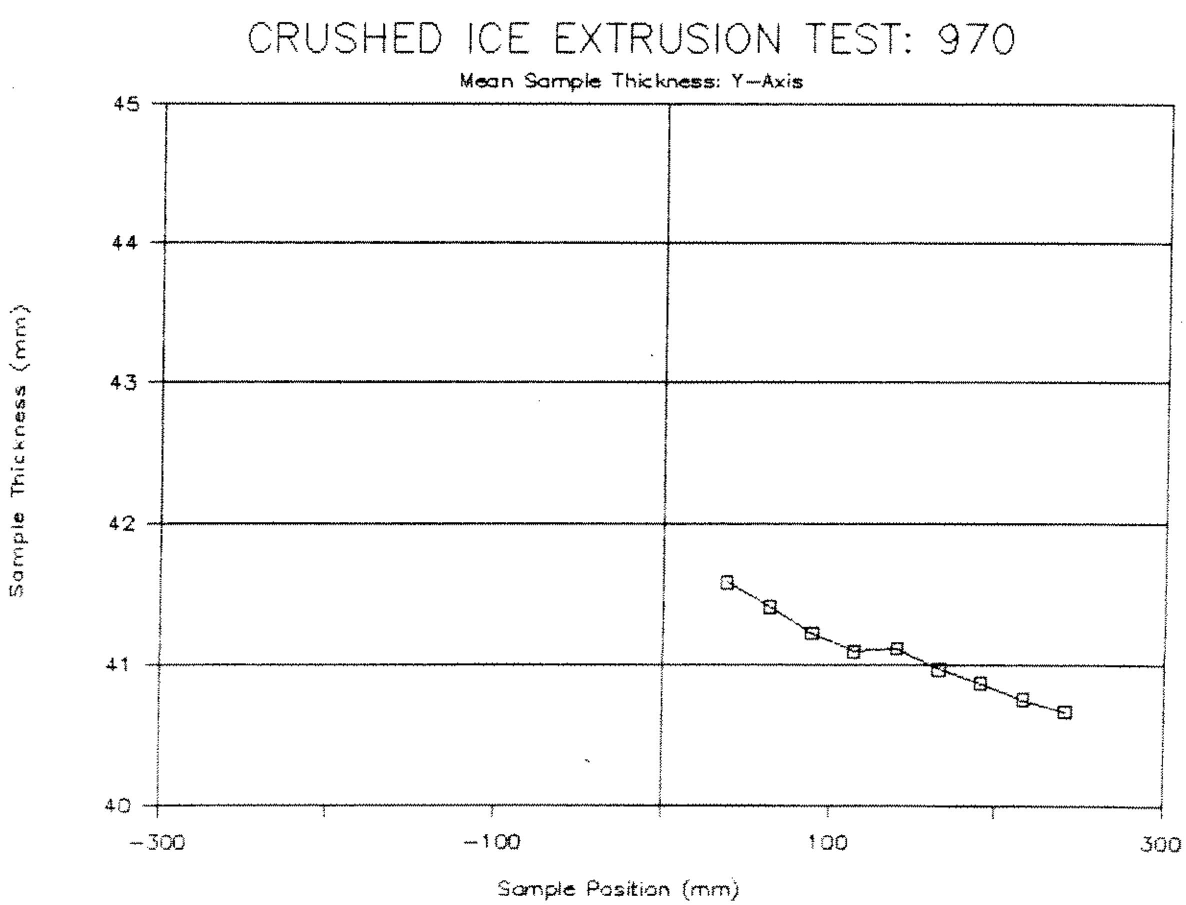


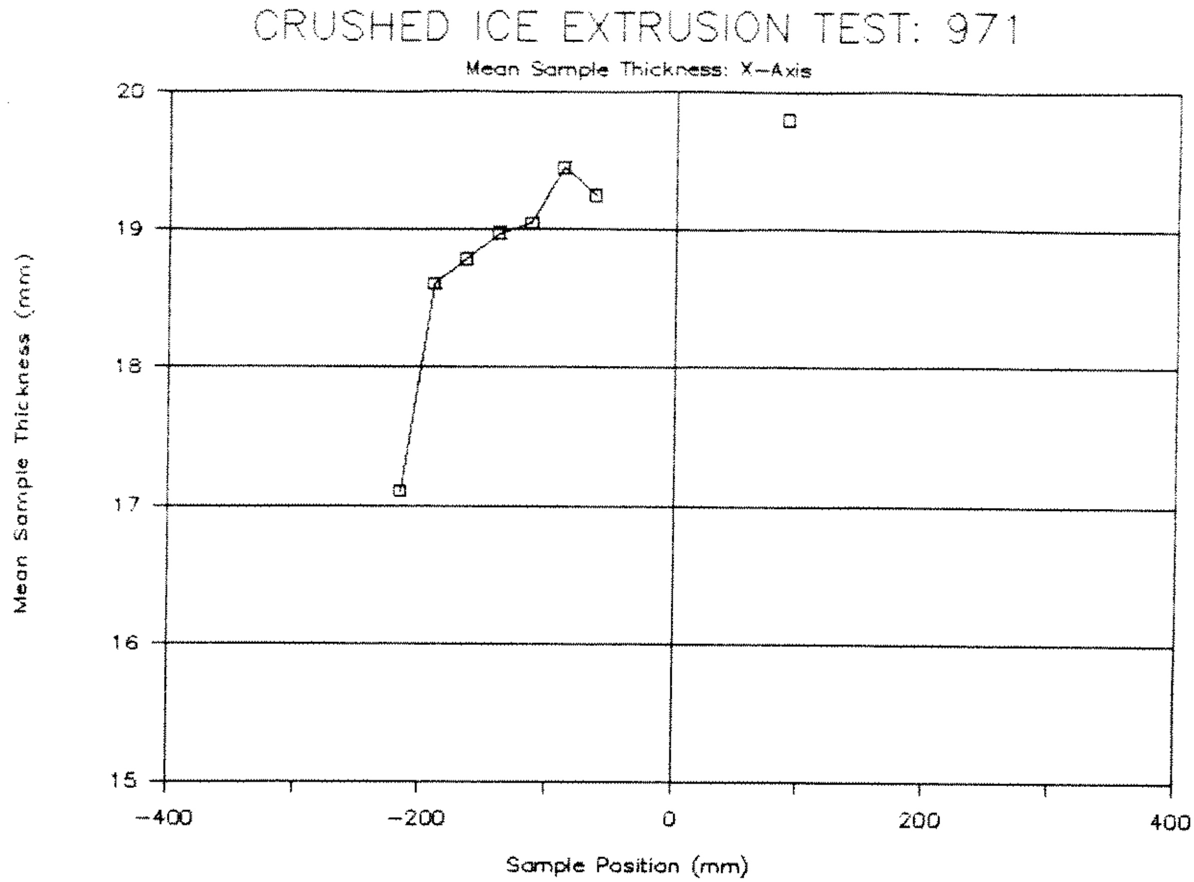
CRUSHED ICE EXTRUSION TEST: 963A

Mean Sample Thickness: Y-Axis

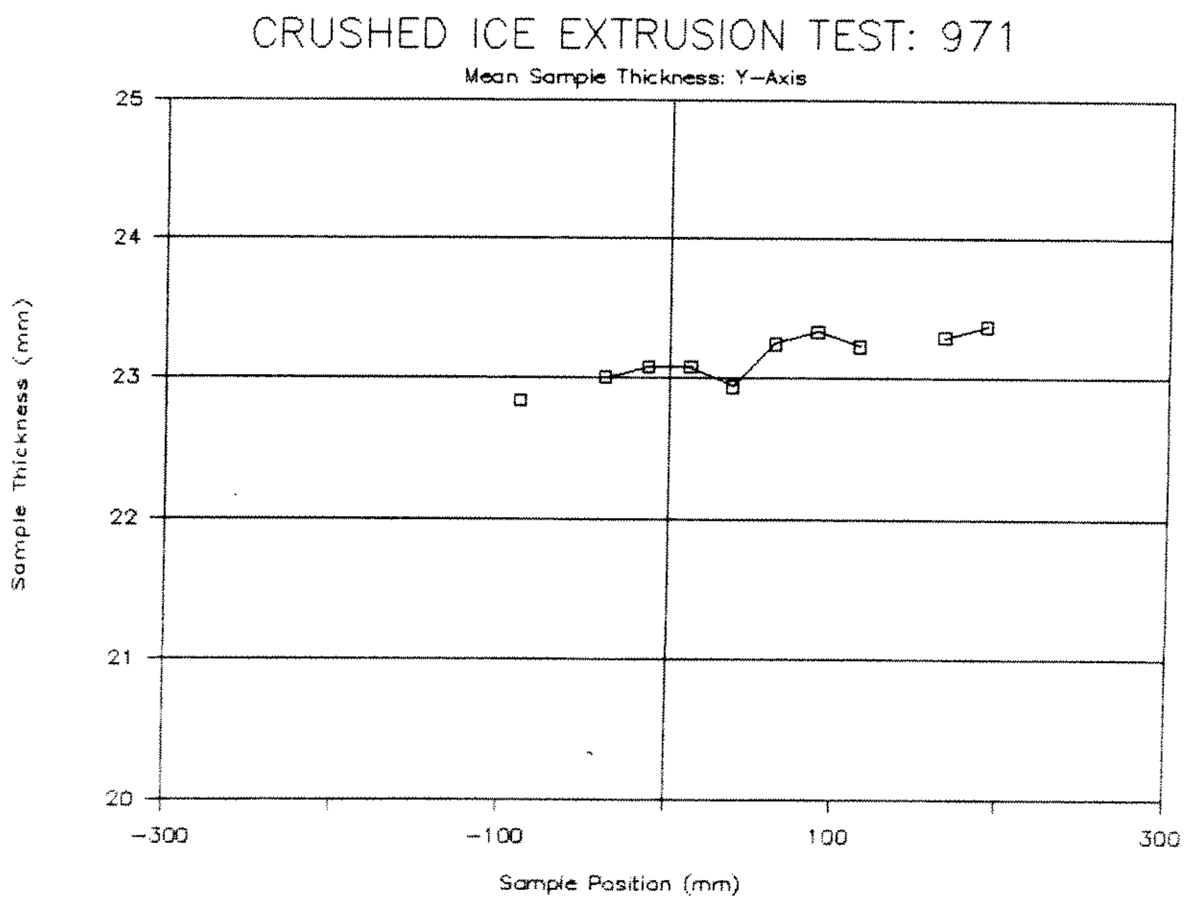



CRUSHED ICE EXTRUSION TEST: 970
Mean Sample Thickness: X–Axis
Mean Sample Thickness (mm)
Sample Position (mm)
45
44
43
42
41
40
–400
–200
0
200
400


CRUSHED ICE EXTRUSION TEST: 970
Mean Sample Thickness: Y–Axis
Sample Thickness (mm)
Sample Position (mm)
45
44
43
42
41
40
–300
–100
100
300

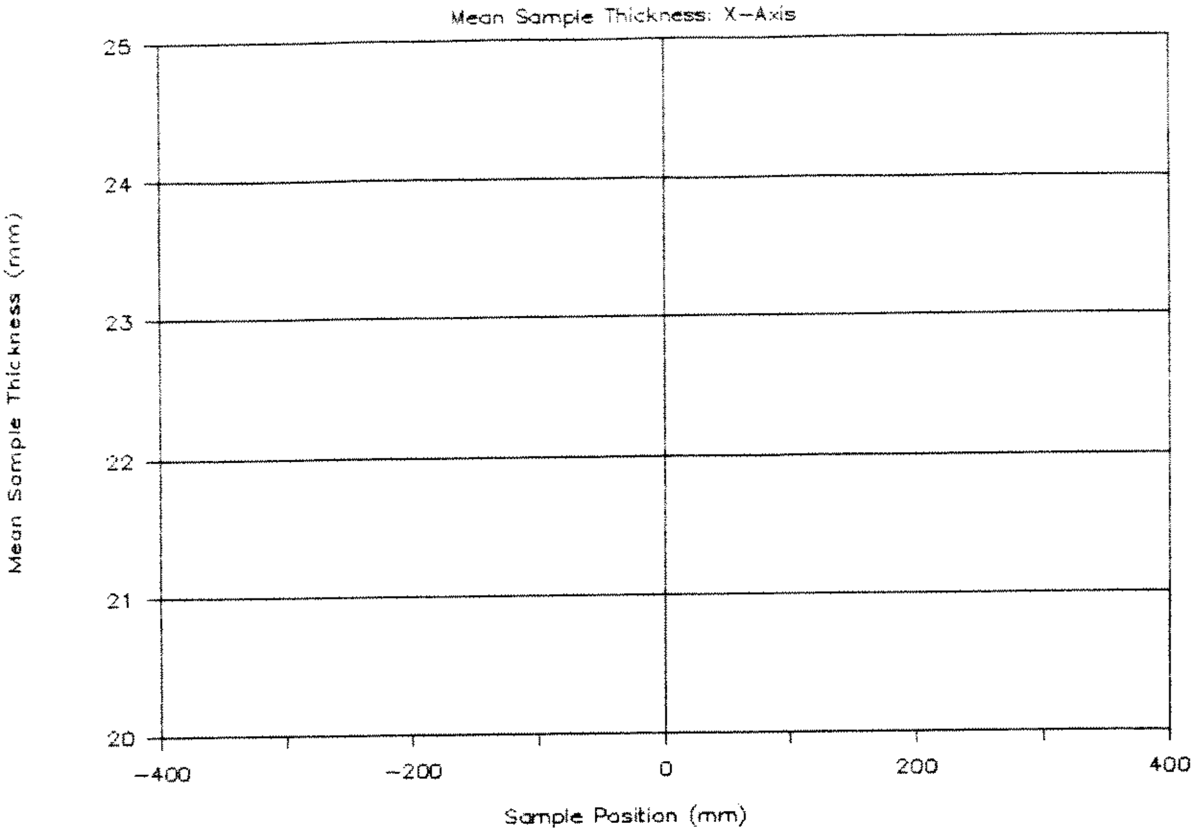


CRUSHED ICE EXTRUSION TEST: 971
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
20
19
18
17
16
15
-400
-200
0
200
400
Sample Position (mm)

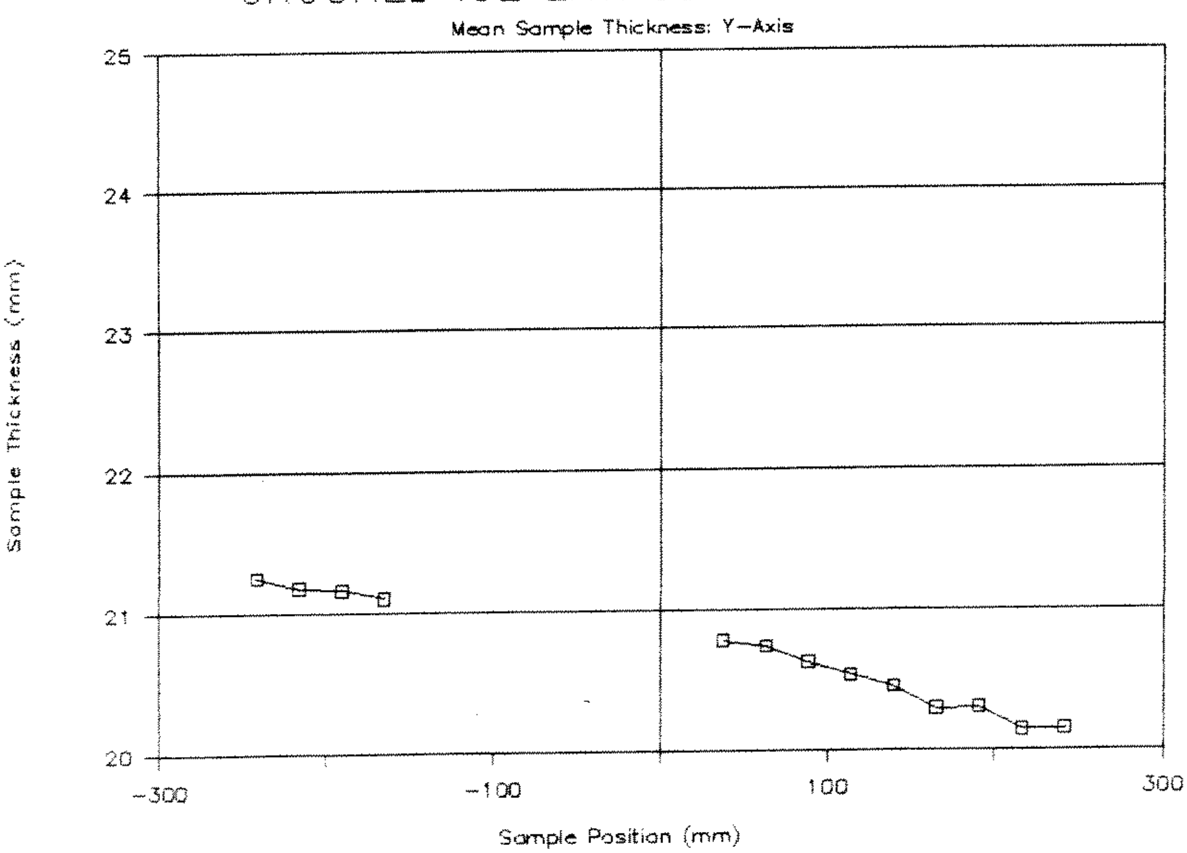


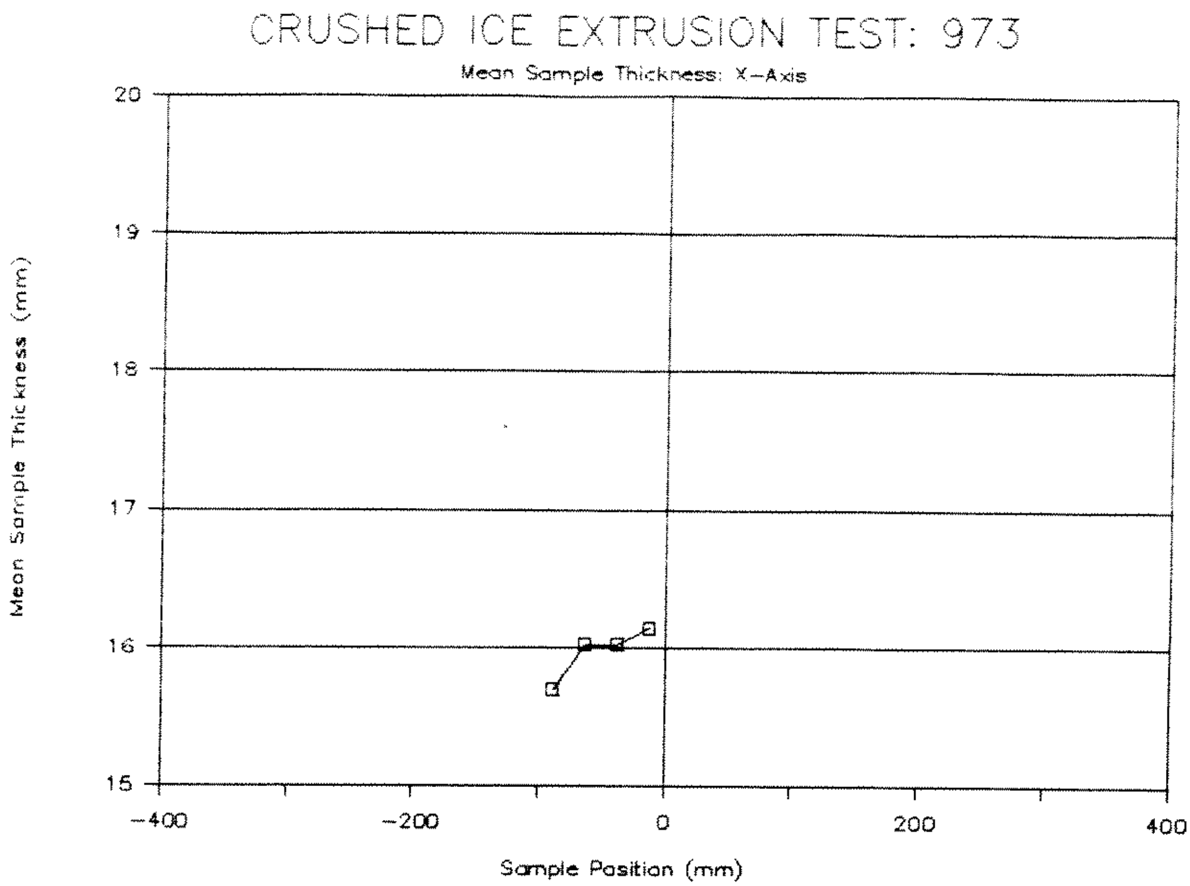
CRUSHED ICE EXTRUSION TEST: 971
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
25
24
23
22
21
20
-300
-100
100
300
Sample Position (mm)

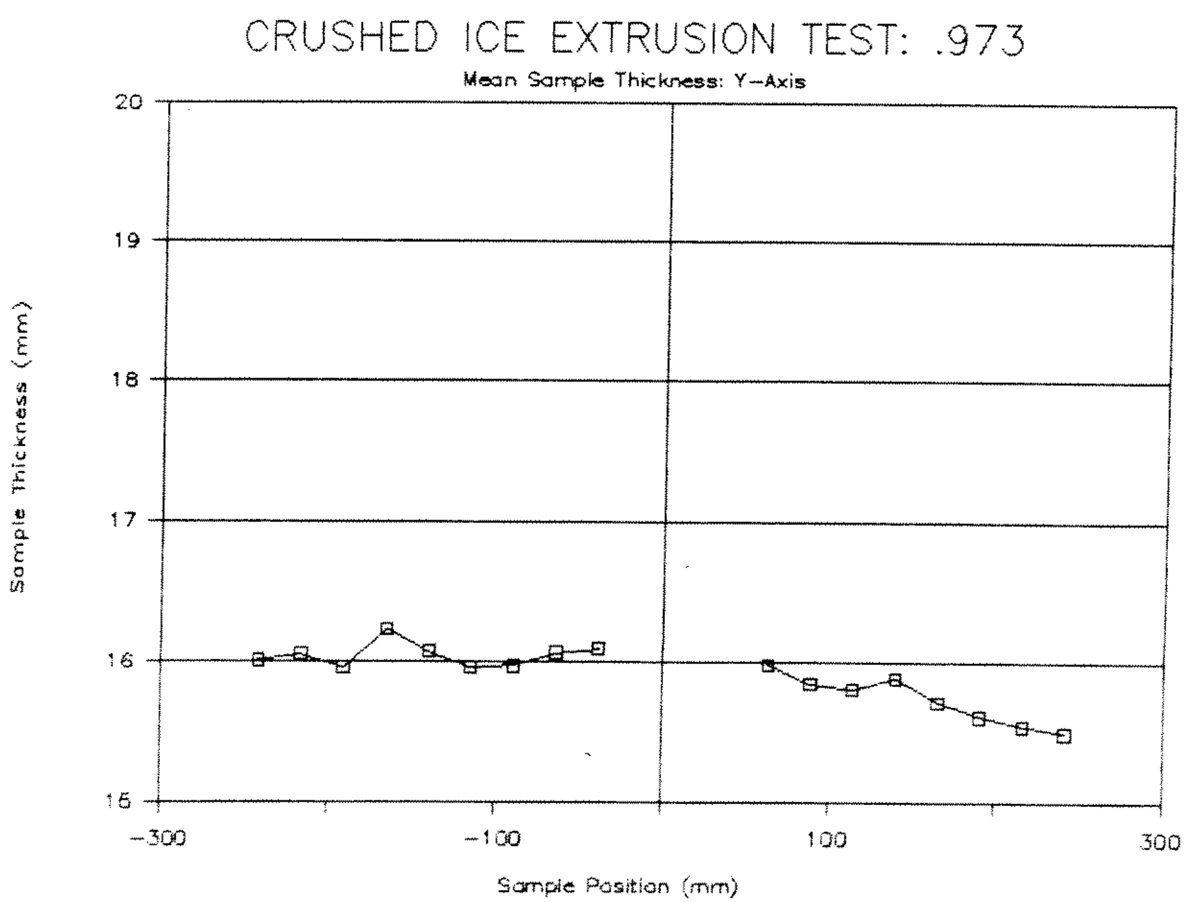
CRUSHED ICE EXTRUSION TEST: 972

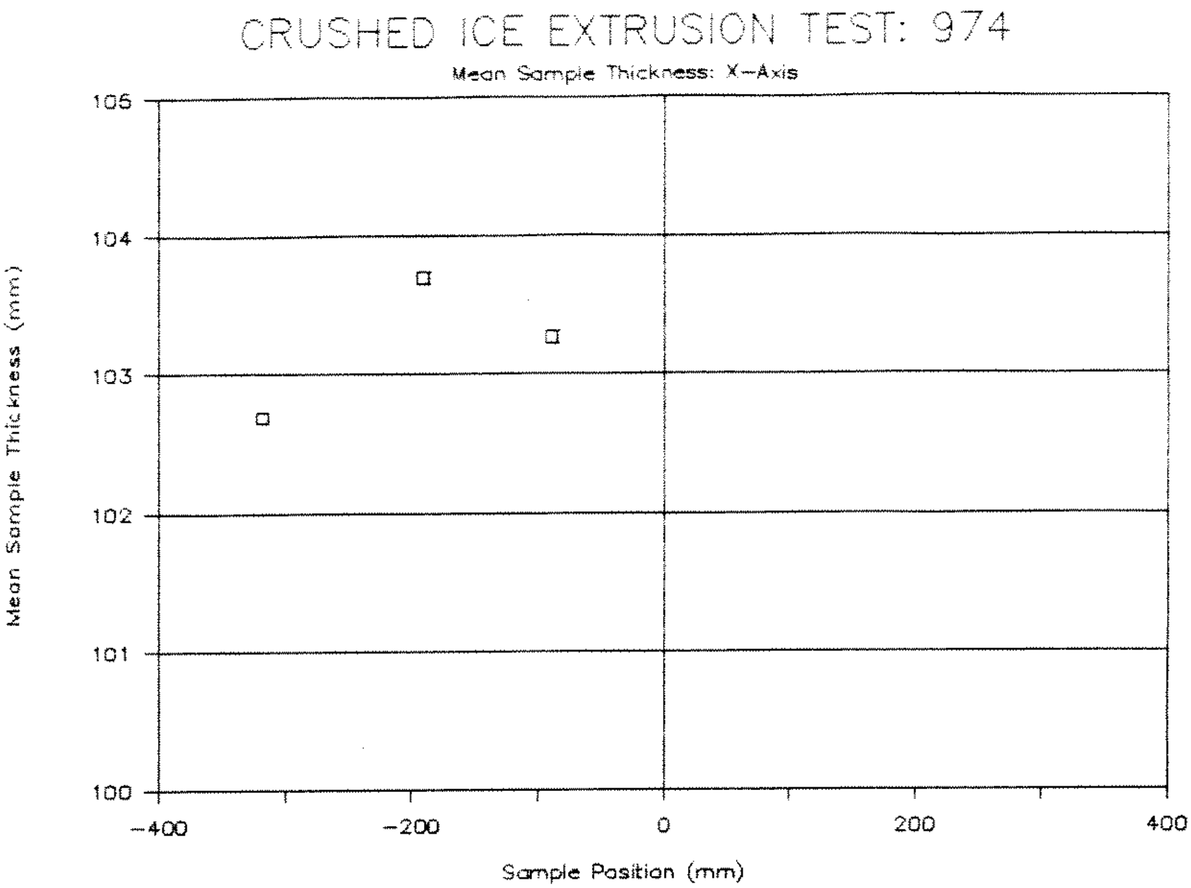


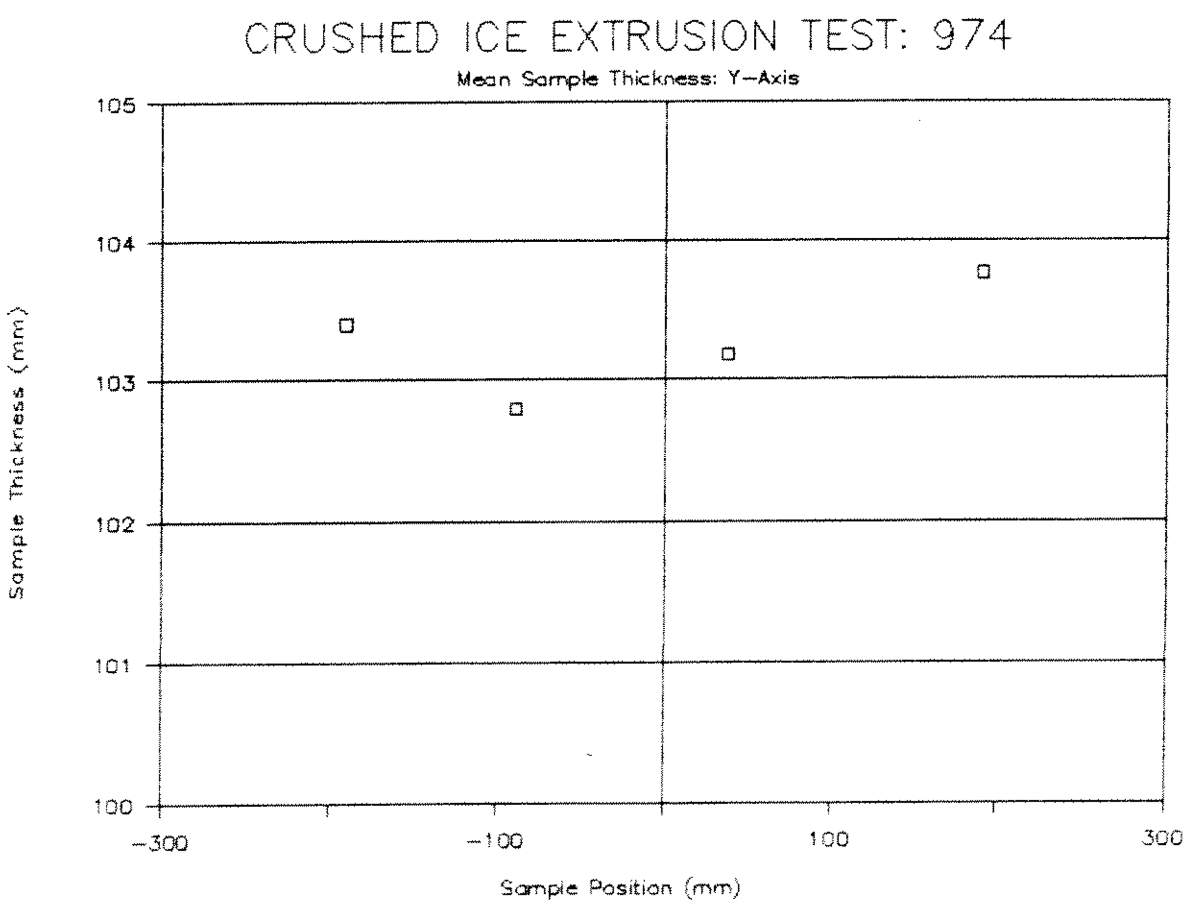
CRUSHED ICE EXTRUSION TEST: 972

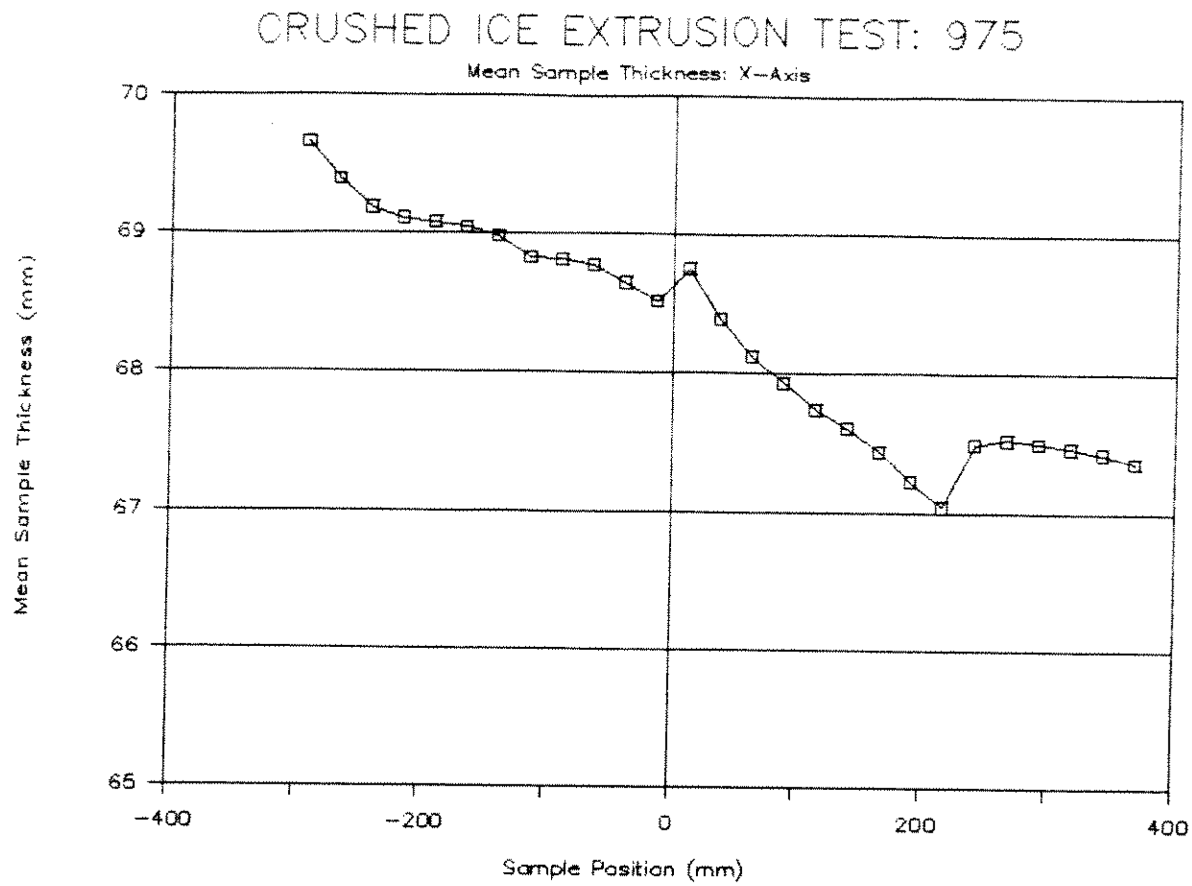


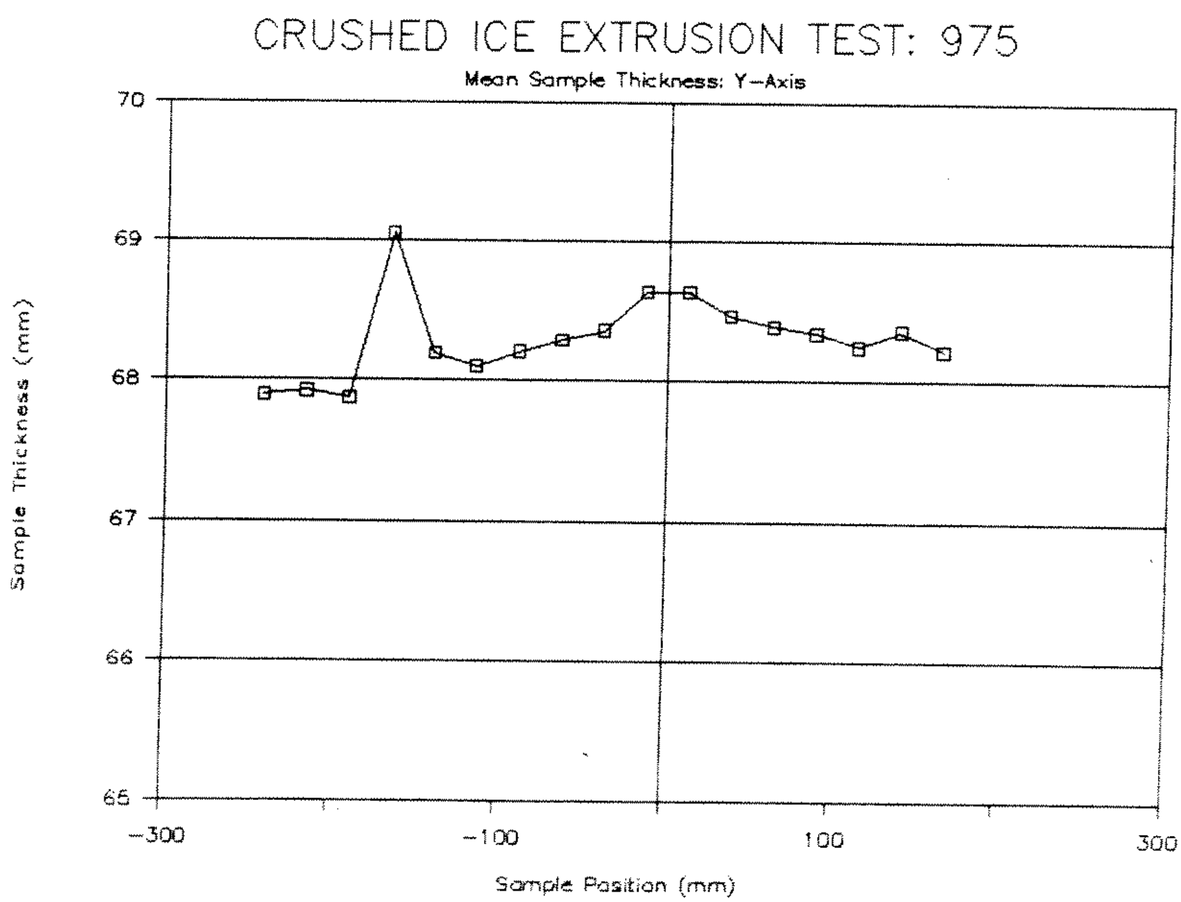

CRUSHED ICE EXTRUSION TEST: 973
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
20
19
18
17
16
15
-400
-200
0
200
400
Sample Position (mm)

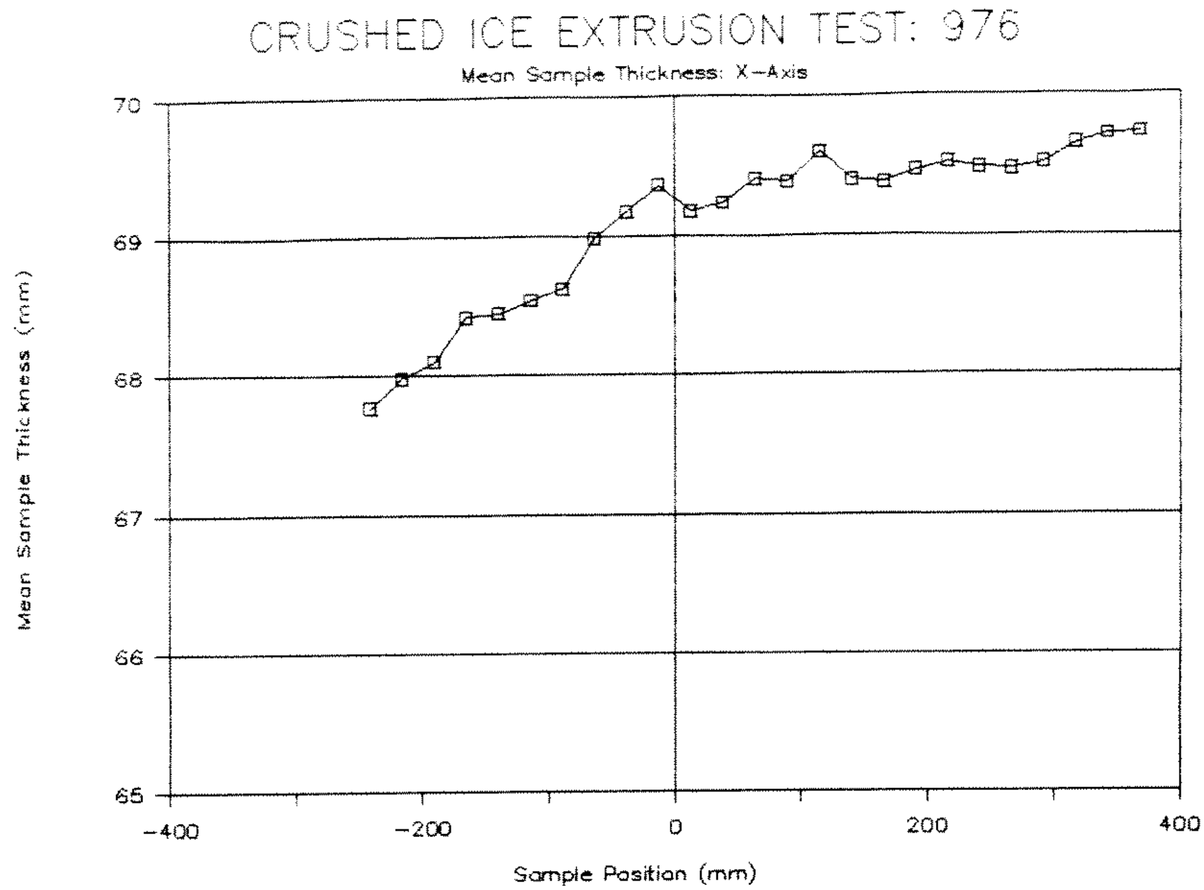

CRUSHED ICE EXTRUSION TEST: .973
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
20
19
18
17
16
15
-300
-100
100
300
Sample Position (mm)

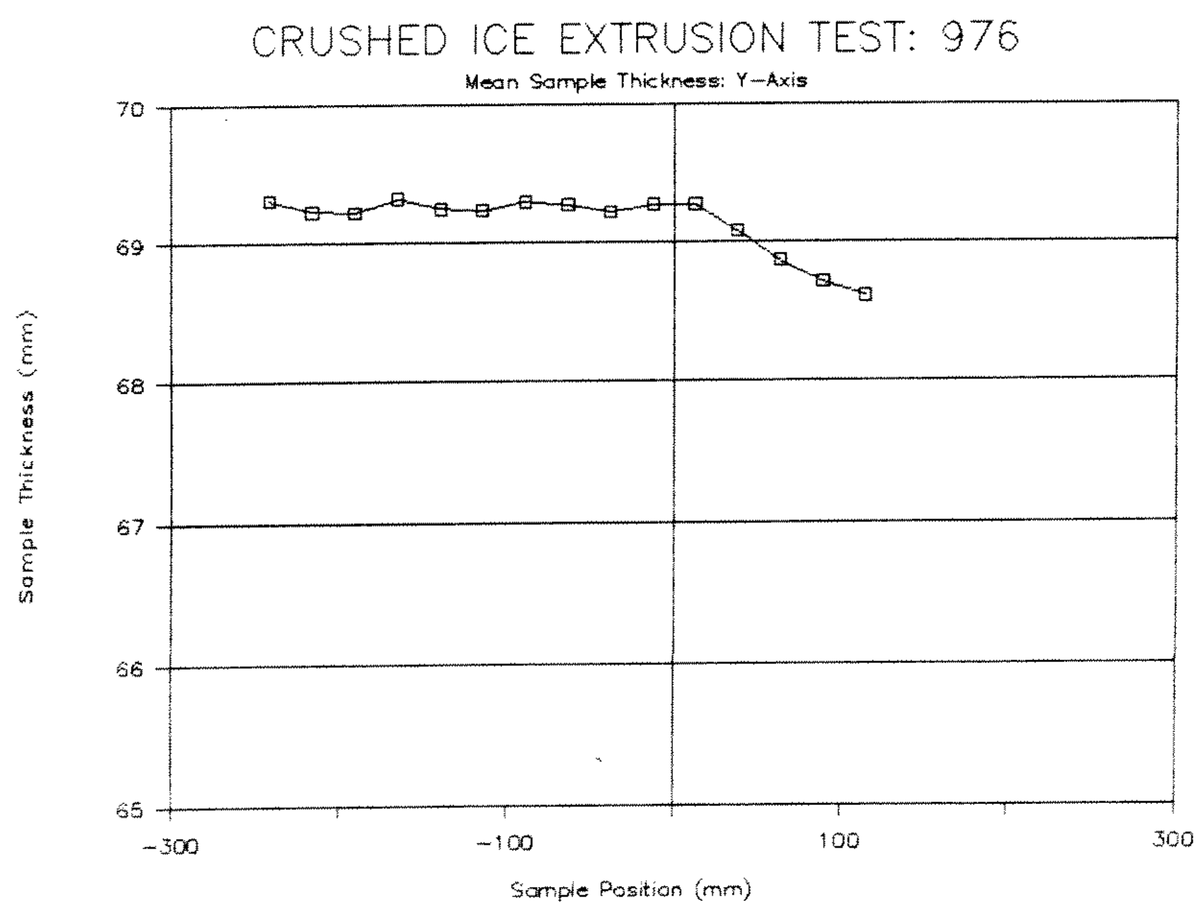

CRUSHED ICE EXTRUSION TEST: 974
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
105
104
103
102
101
100
-400
-200
0
200
400
Sample Position (mm)

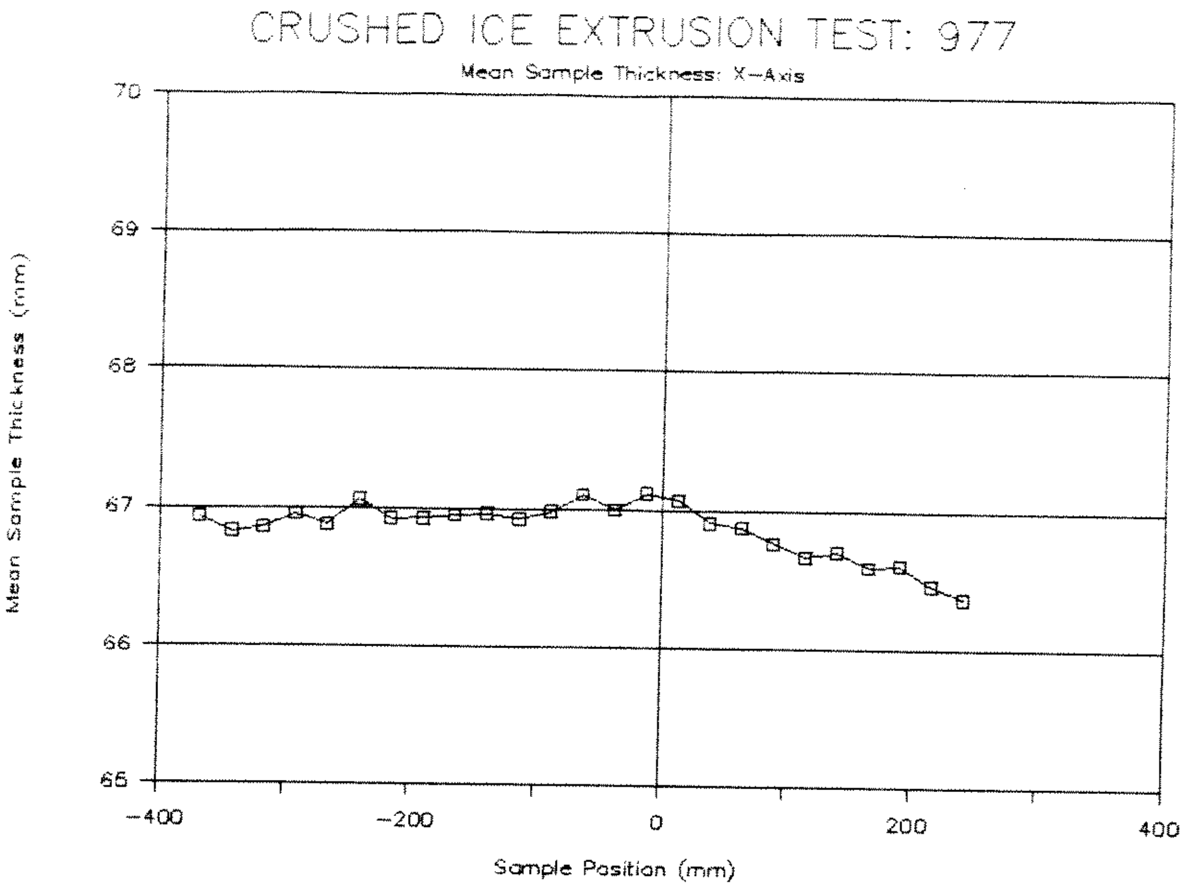

CRUSHED ICE EXTRUSION TEST: 974
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
105
104
103
102
101
100
-300
-100
100
300
Sample Position (mm)

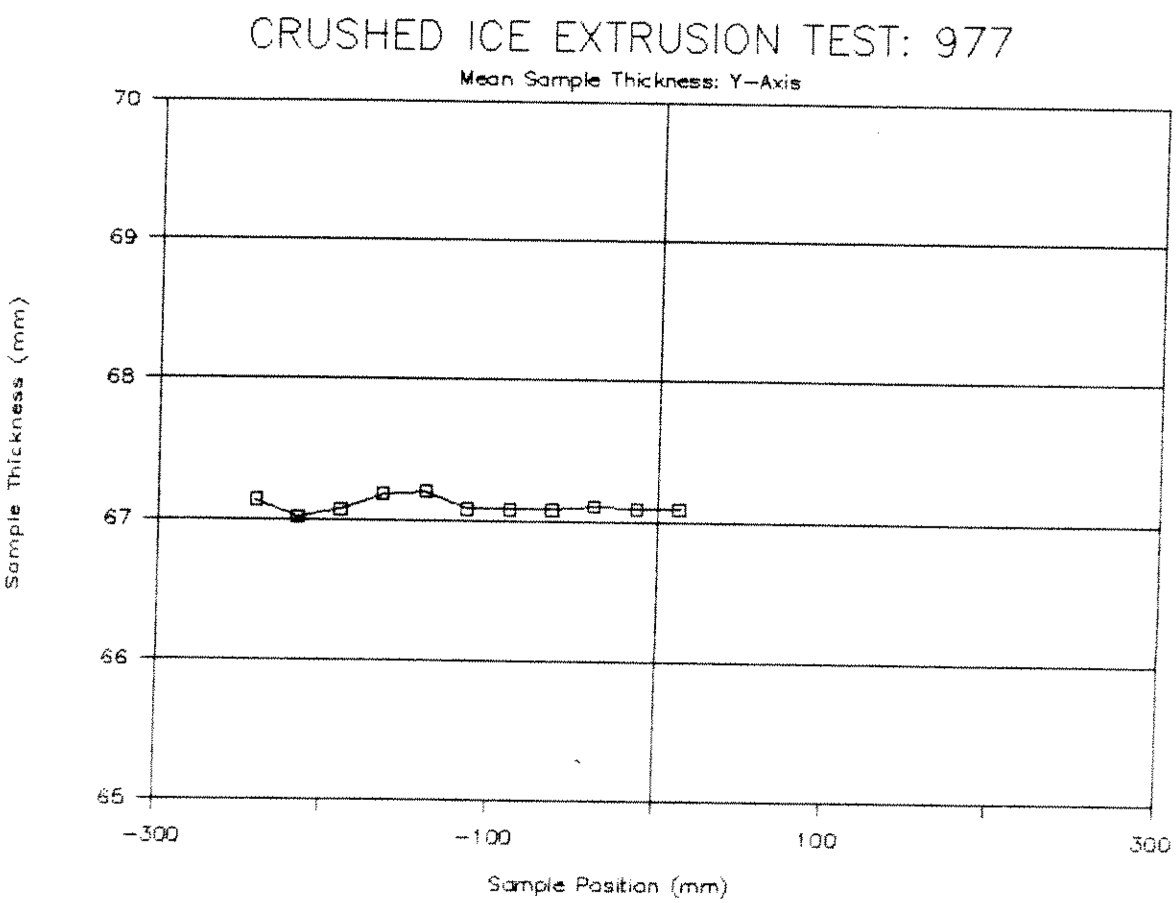

CRUSHED ICE EXTRUSION TEST: 975
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
70
69
68
67
66
65
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 975
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
70
69
68
67
66
65
-300
-100
100
300
Sample Position (mm)

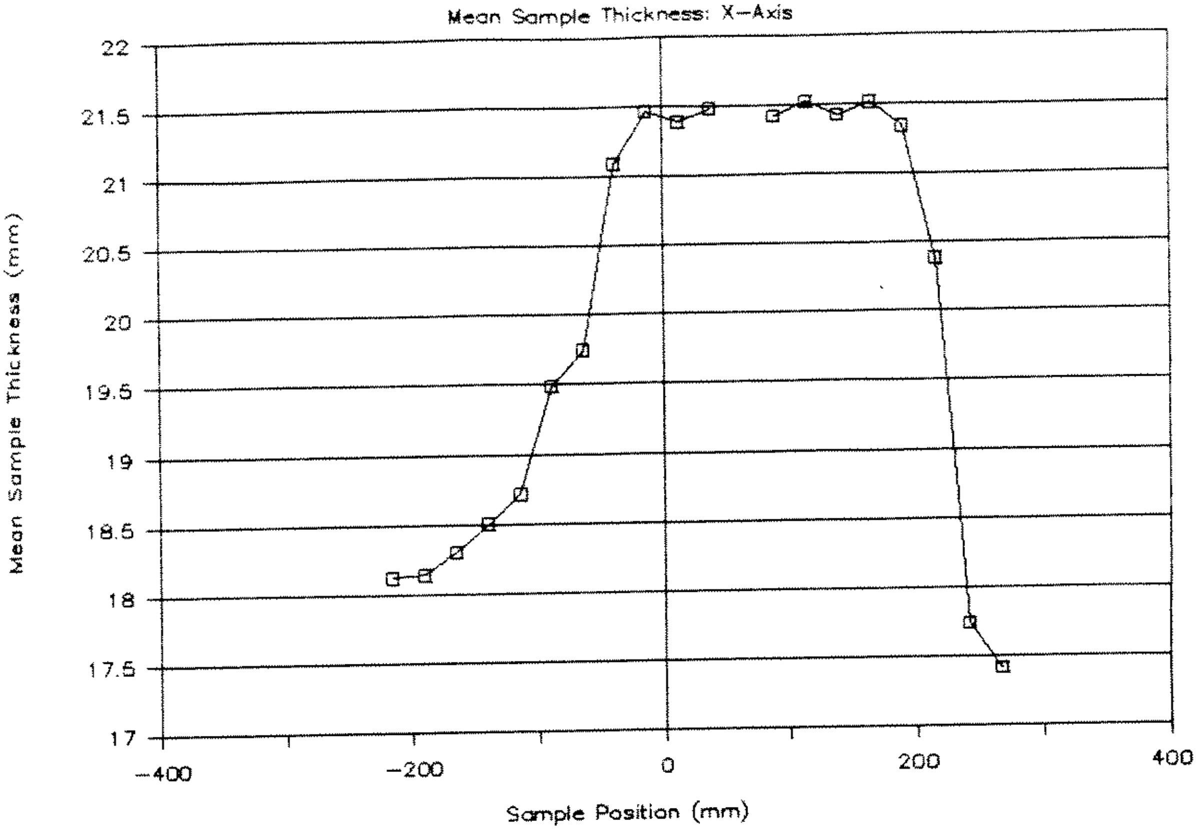

CRUSHED ICE EXTRUSION TEST: 976
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
70
69
68
67
66
65
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 976
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
70
69
68
67
66
65
-300
-100
100
300
Sample Position (mm)

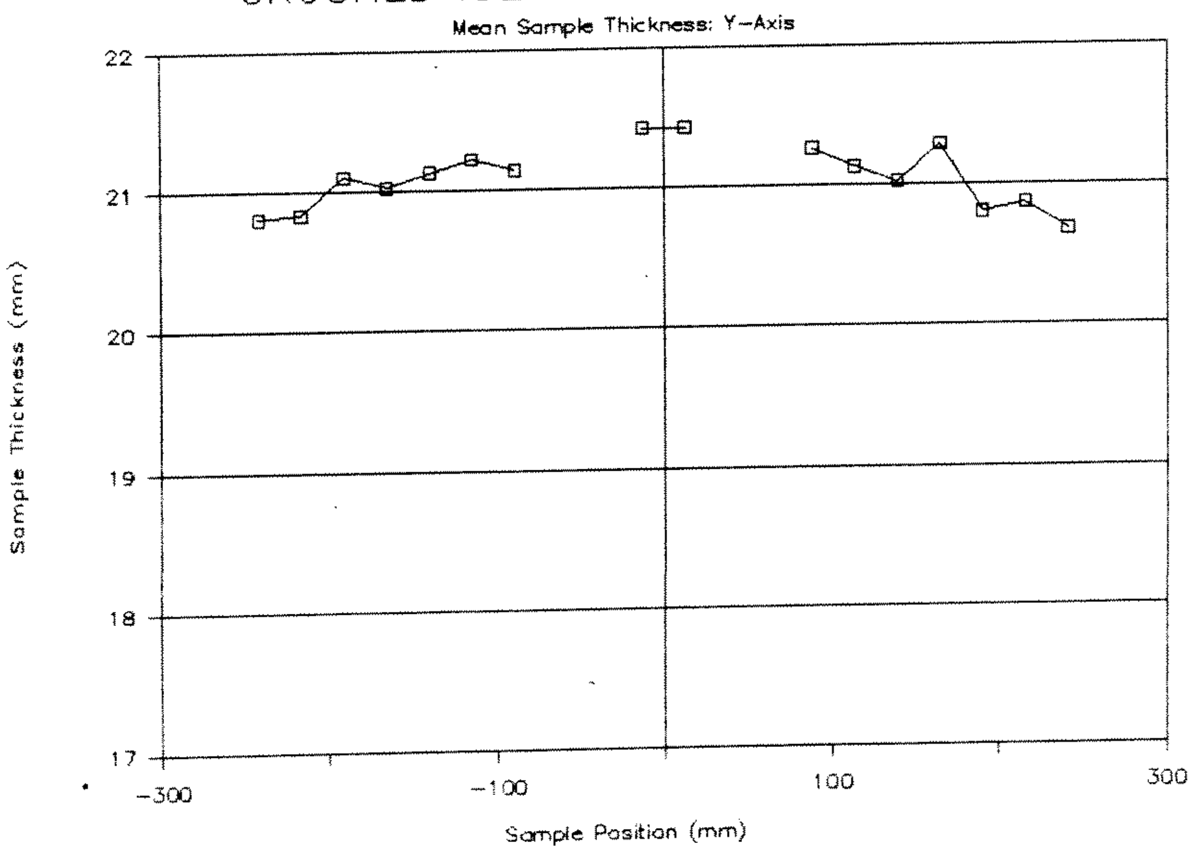

CRUSHED ICE EXTRUSION TEST: 977
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
70
69
68
67
66
65
-400
-200
0
200
400
Sample Position (mm)

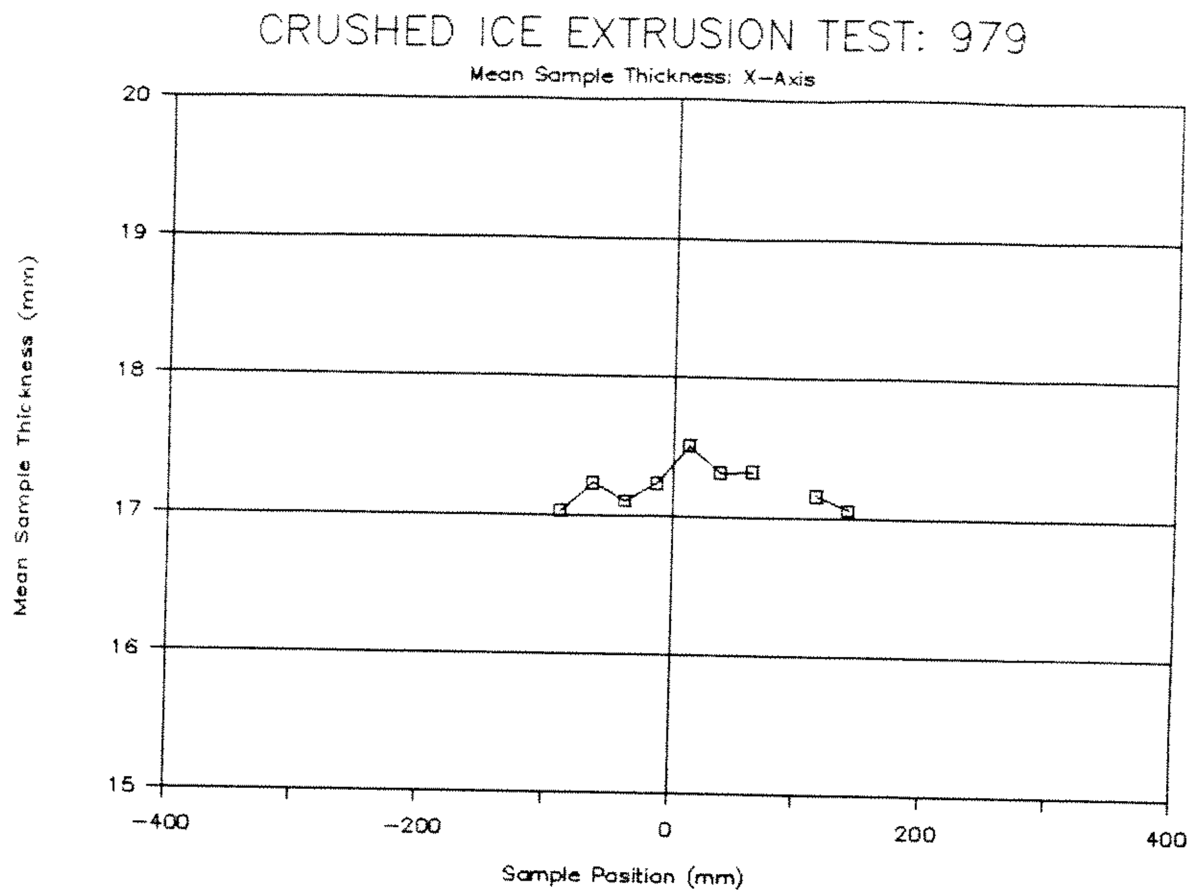

CRUSHED ICE EXTRUSION TEST: 977
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
70
69
68
67
66
65
-300
-100
100
300
Sample Position (mm)

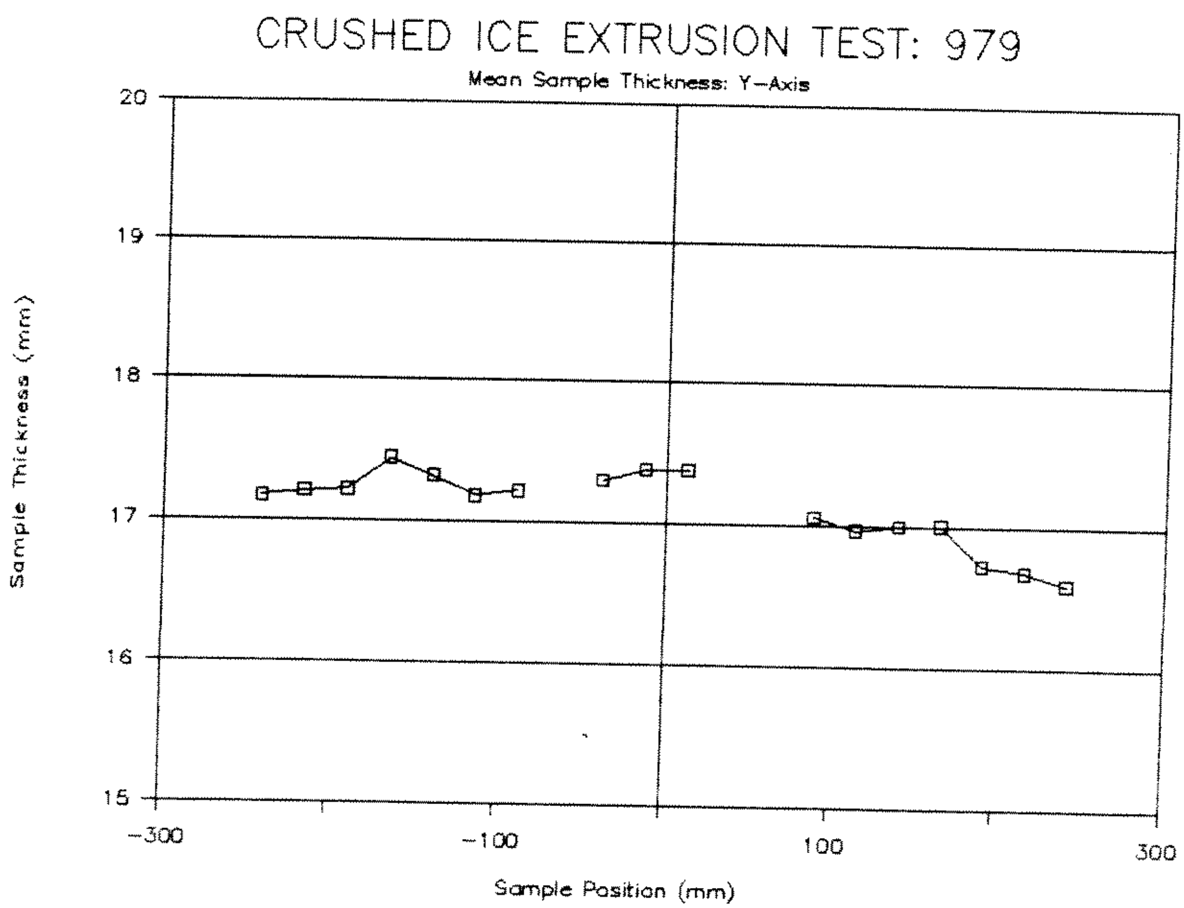
CRUSHED ICE EXTRUSION TEST: 978

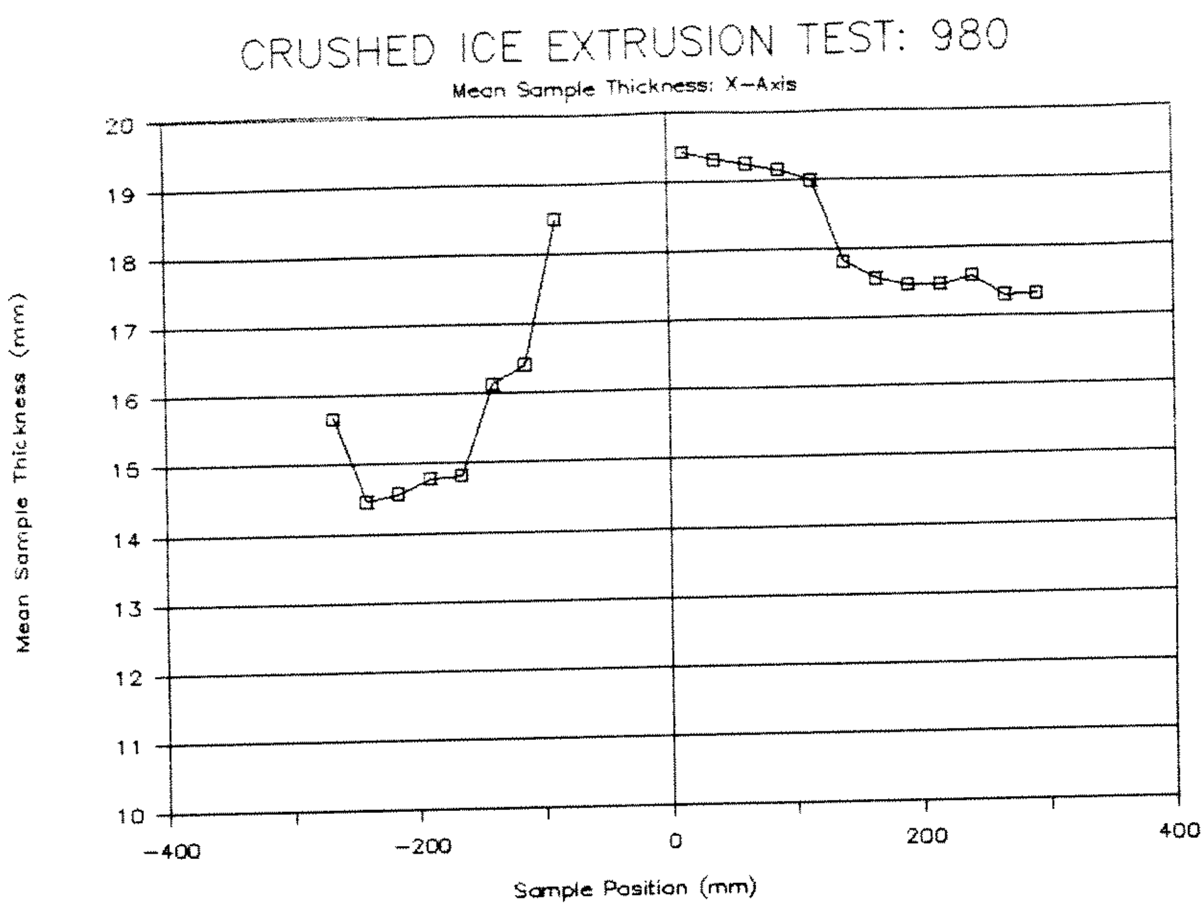


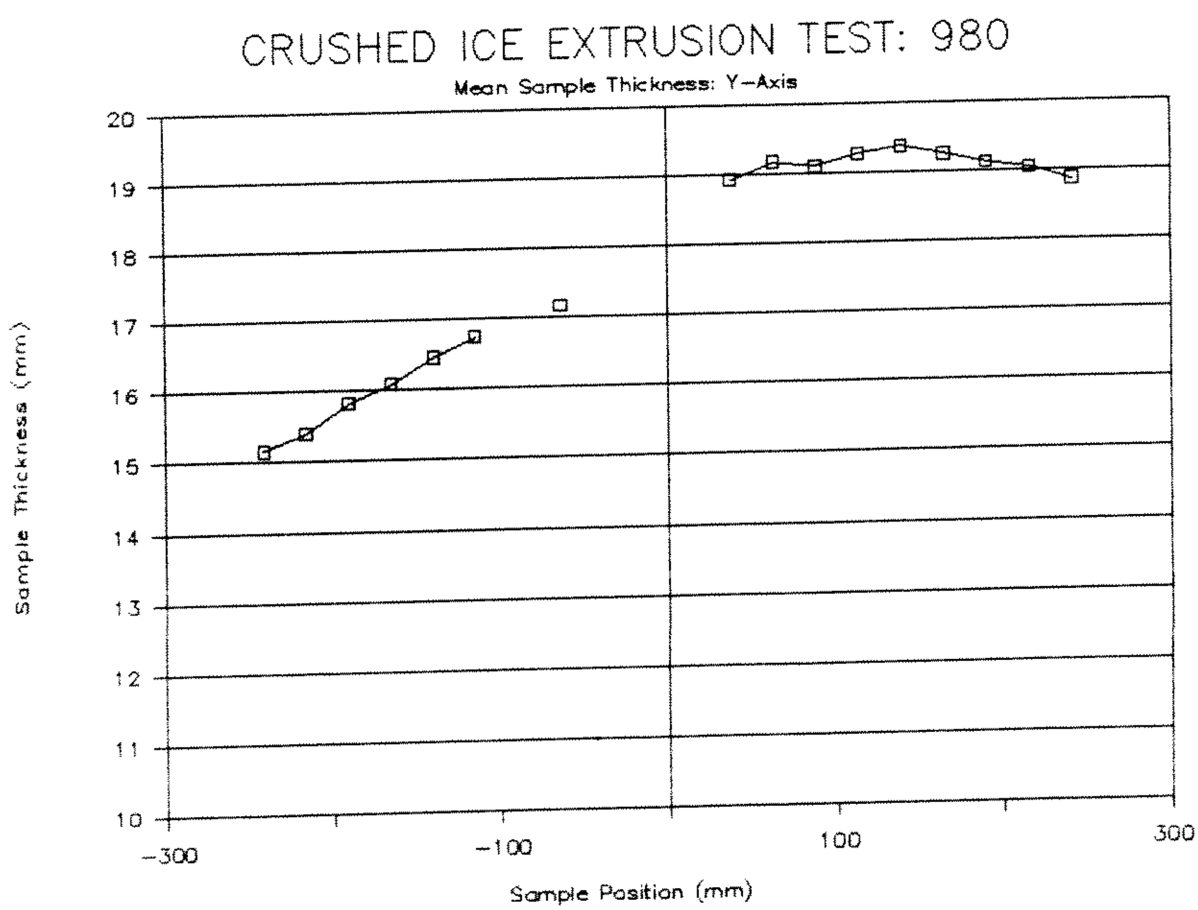
CRUSHED ICE EXTRUSION TEST: 978

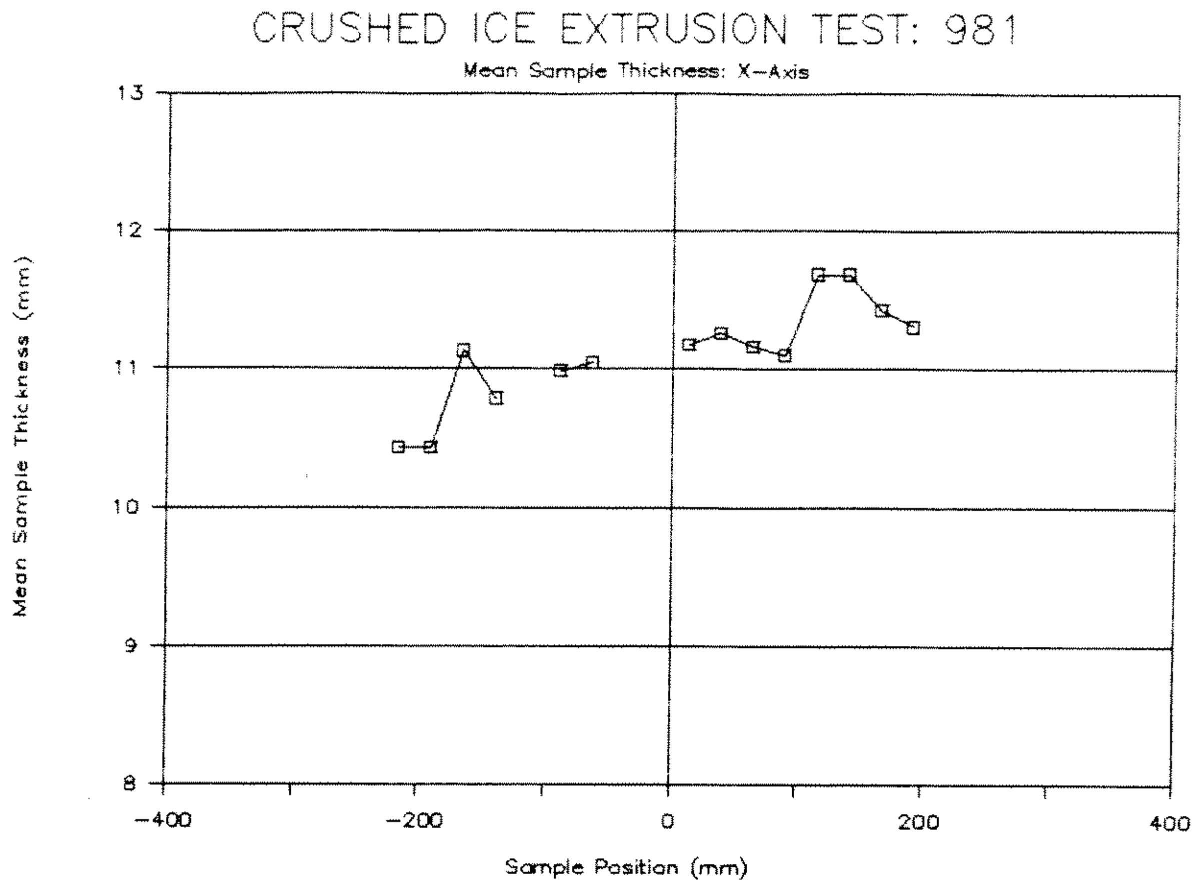


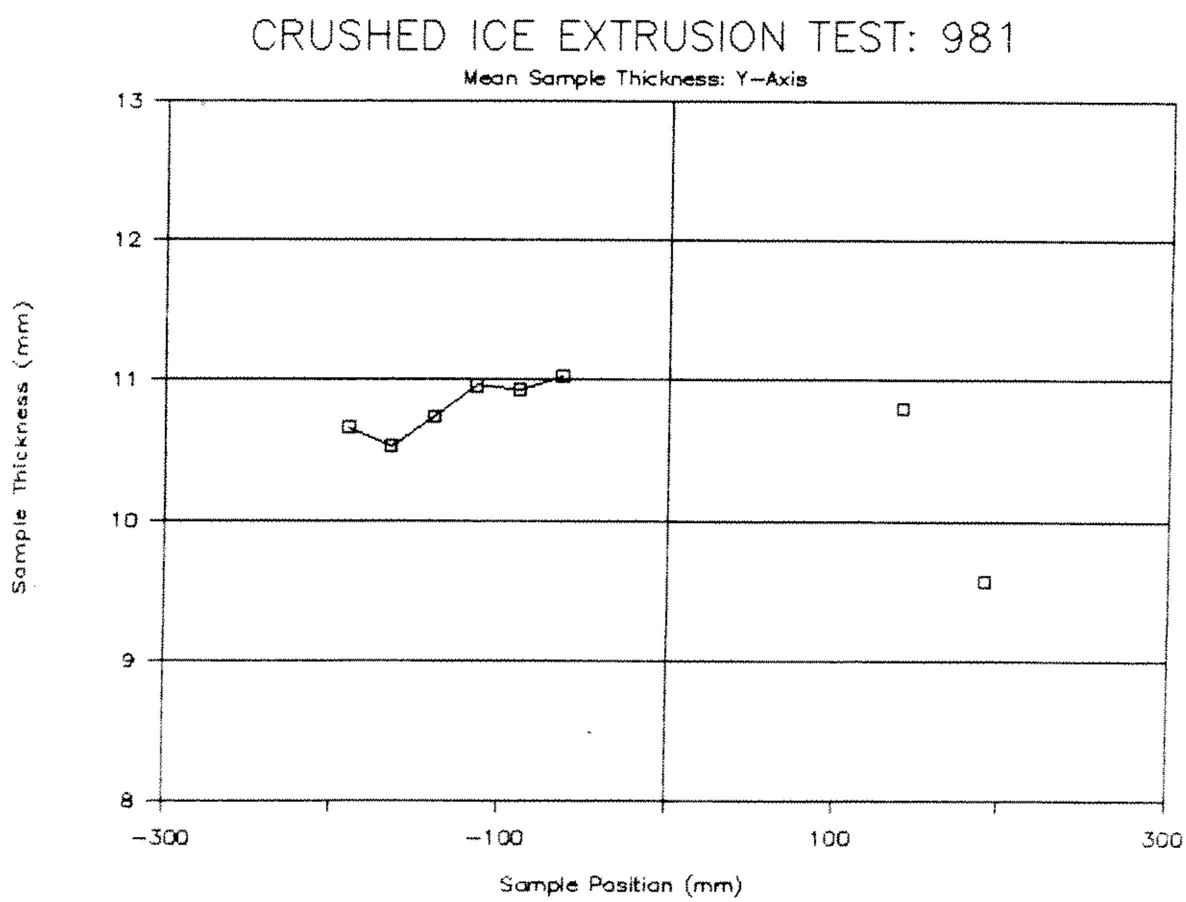

CRUSHED ICE EXTRUSION TEST: 979
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
Sample Position (mm)
20
19
18
17
16
15
-400
-200
0
200
400


CRUSHED ICE EXTRUSION TEST: 979
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
Sample Position (mm)
20
19
18
17
16
15
-300
-100
100
300

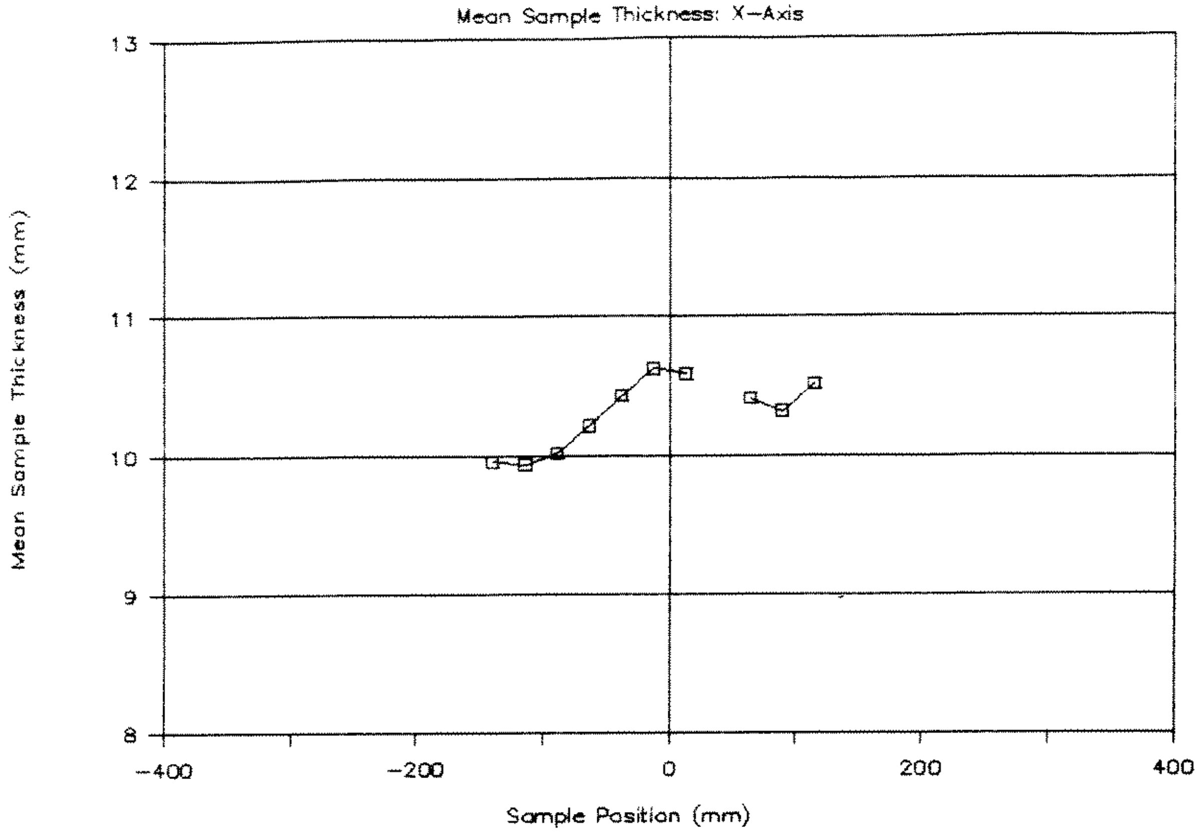

CRUSHED ICE EXTRUSION TEST: 980
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
20
19
18
17
16
15
14
13
12
11
10
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 980
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
20
19
18
17
16
15
14
13
12
11
10
-300
-100
100
300
Sample Position (mm)

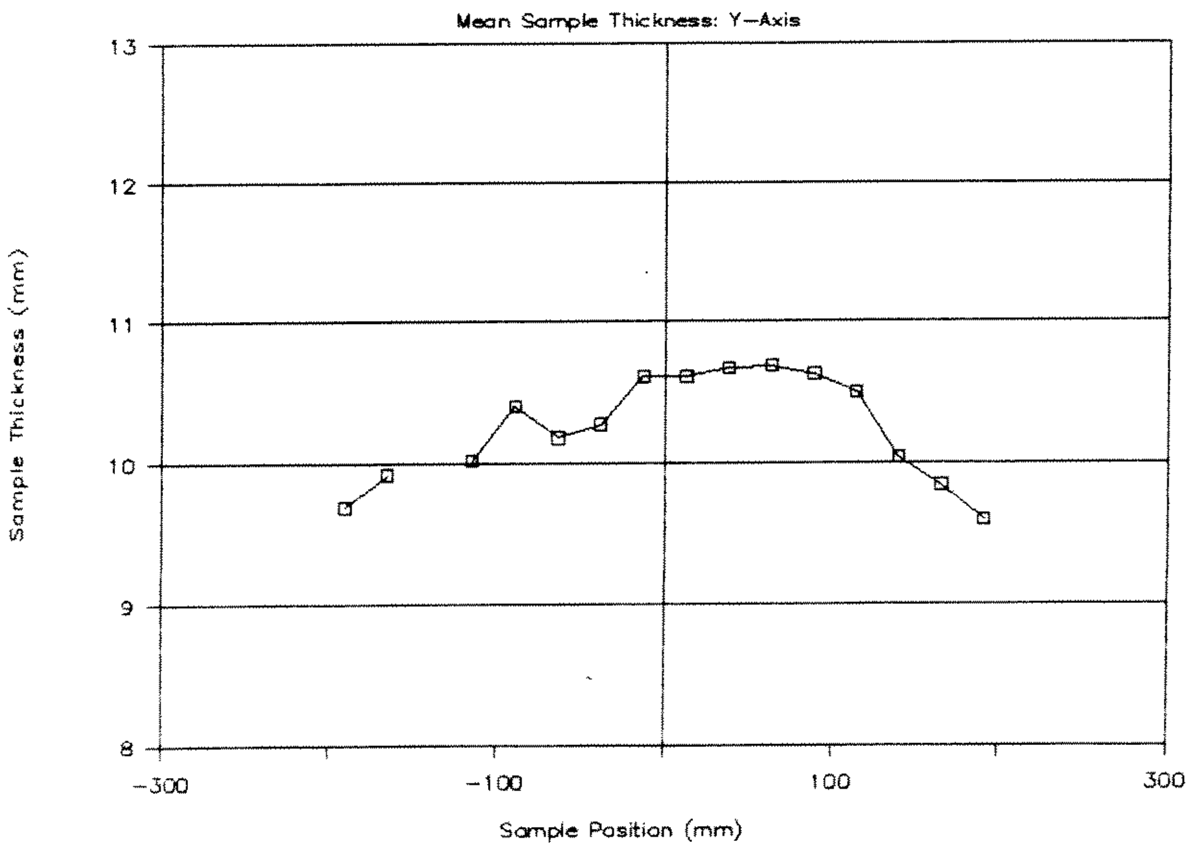

CRUSHED ICE EXTRUSION TEST: 981
Mean Sample Thickness: X–Axis
Mean Sample Thickness (mm)
13
12
11
10
9
8
–400
–200
0
200
400
Sample Position (mm)

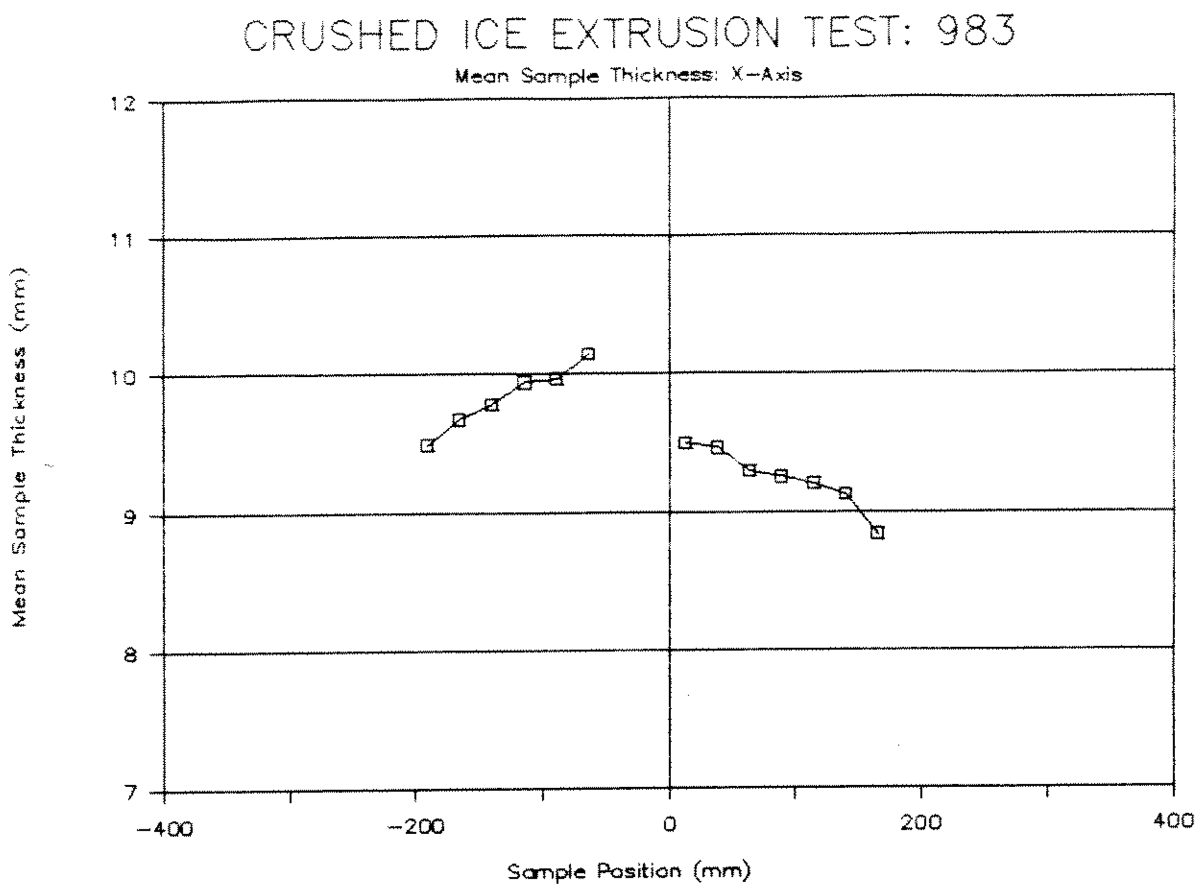

CRUSHED ICE EXTRUSION TEST: 981
Mean Sample Thickness: Y–Axis
Sample Thickness (mm)
13
12
11
10
9
8
–300
–100
100
300
Sample Position (mm)

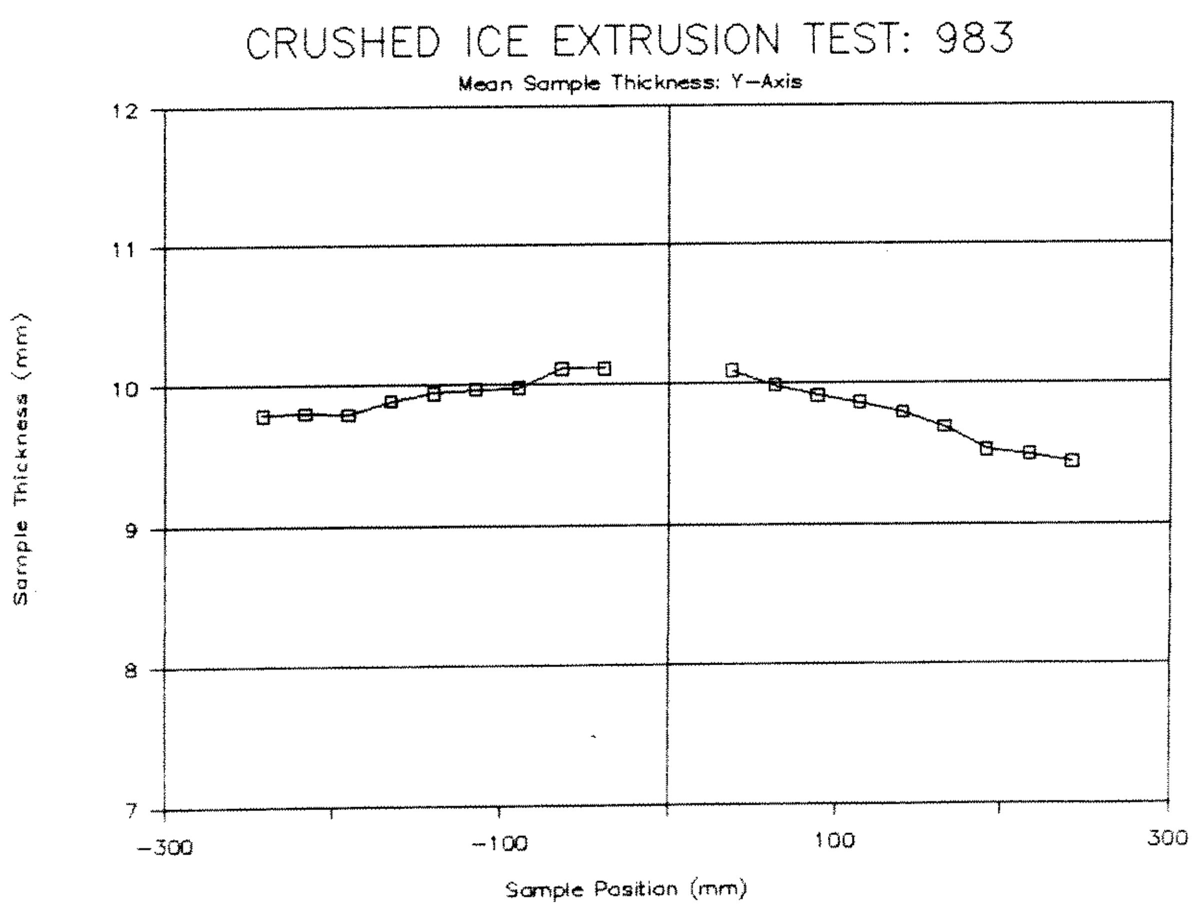
CRUSHED ICE EXTRUSION TEST: 982

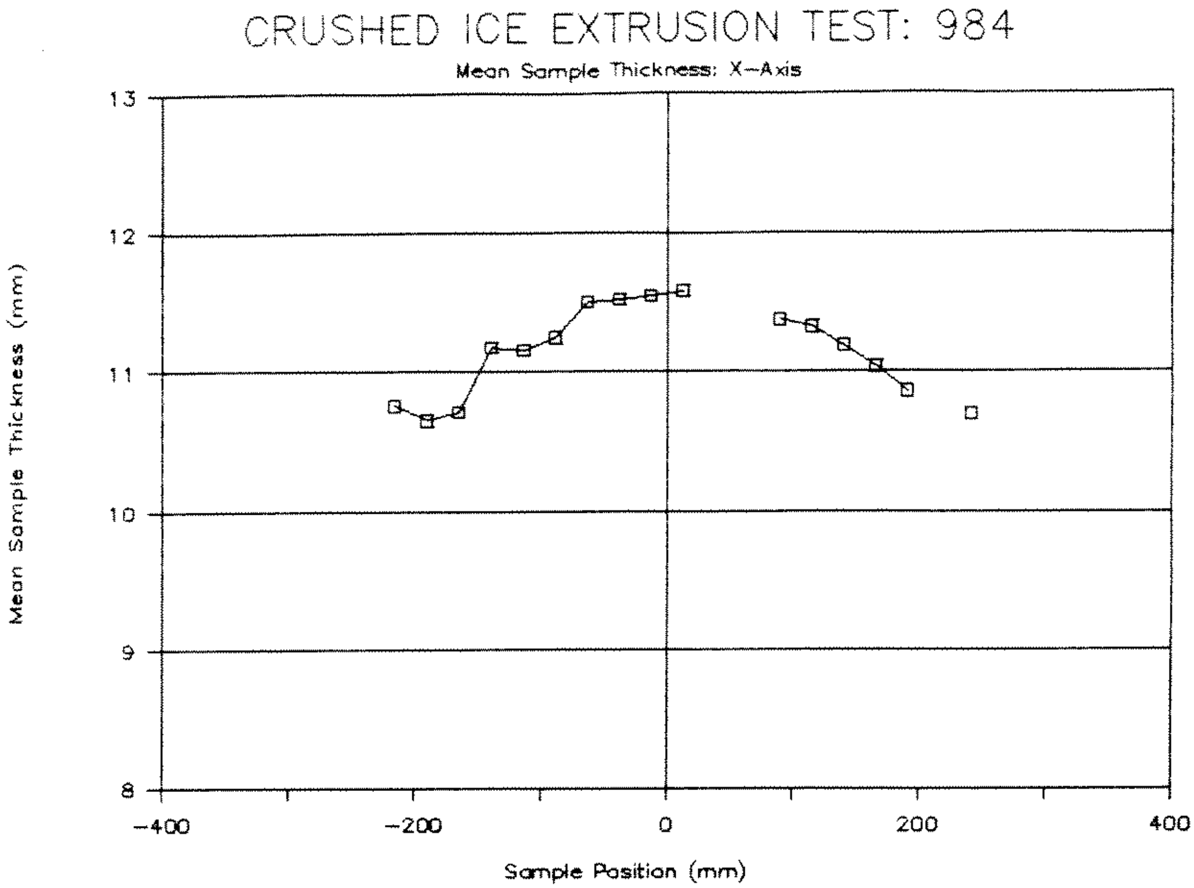


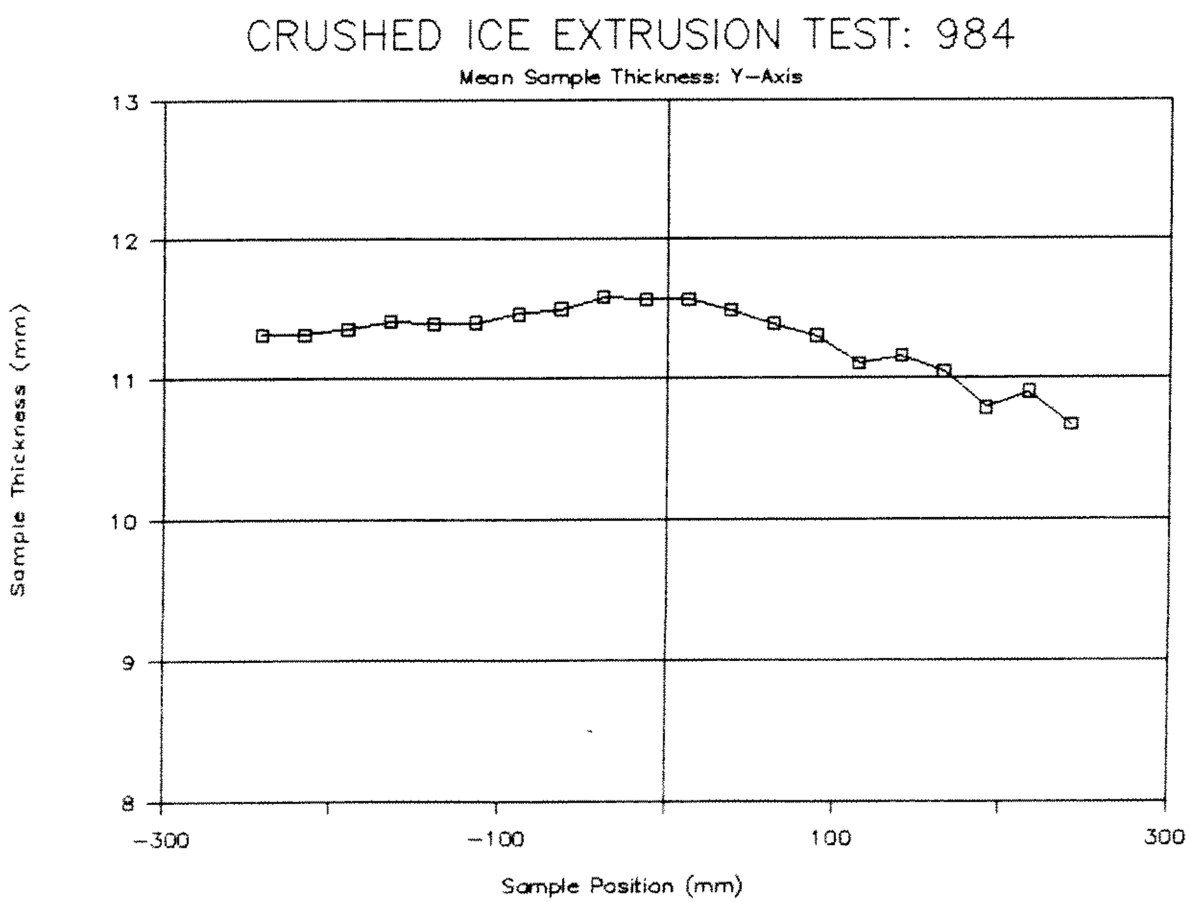
CRUSHED ICE EXTRUSION TEST: 982

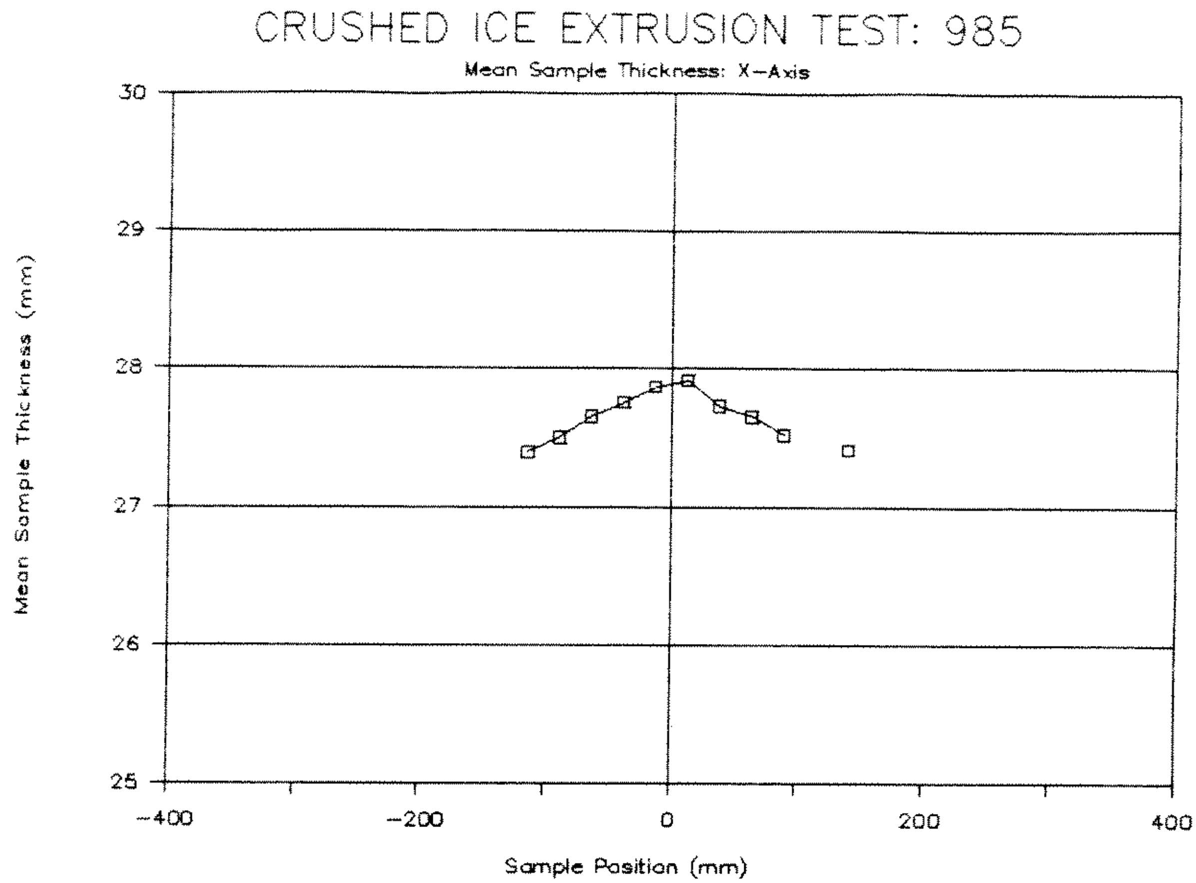



CRUSHED ICE EXTRUSION TEST: 983
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
12
11
10
9
8
7
-400
-200
0
200
400
Sample Position (mm)

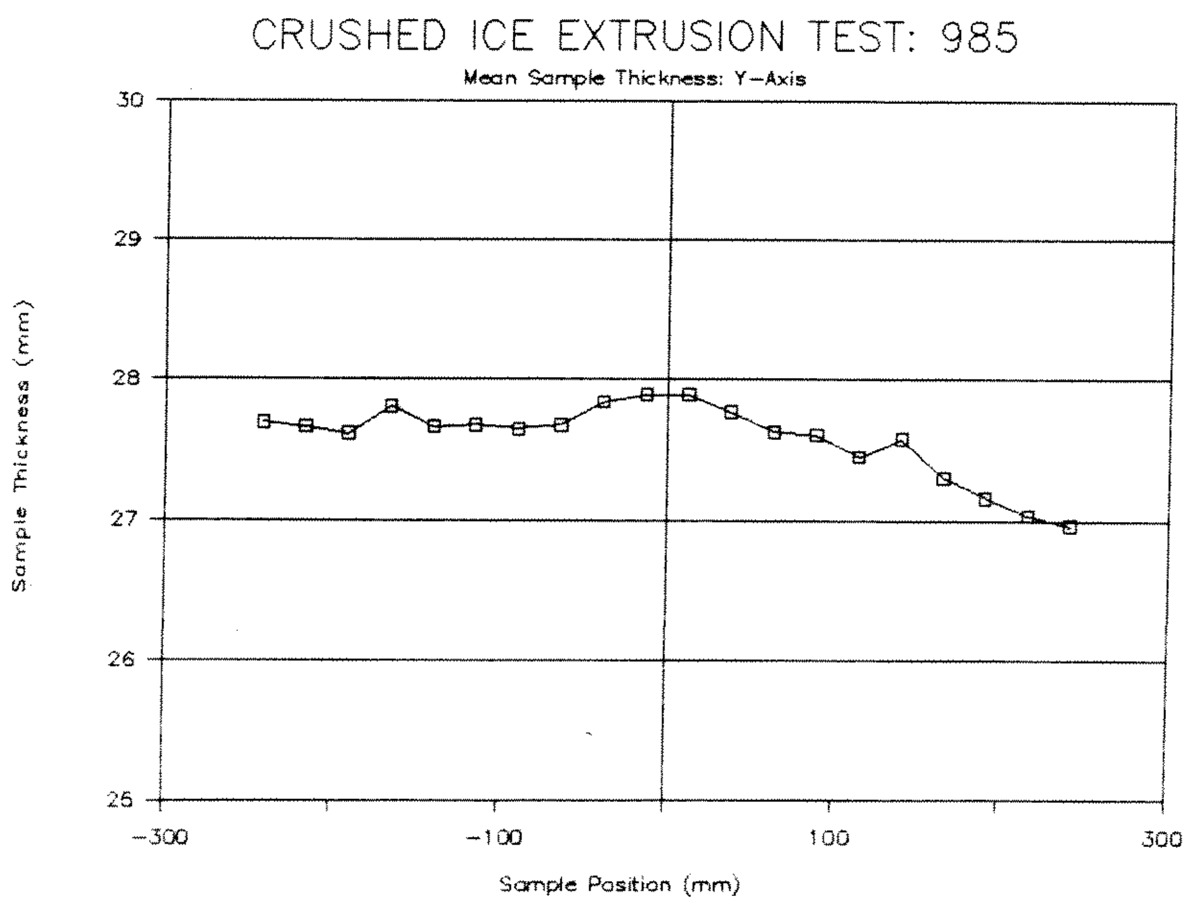

CRUSHED ICE EXTRUSION TEST: 983
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
12
11
10
9
8
7
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 984
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
13
12
11
10
9
8
-400
-200
0
200
400
Sample Position (mm)

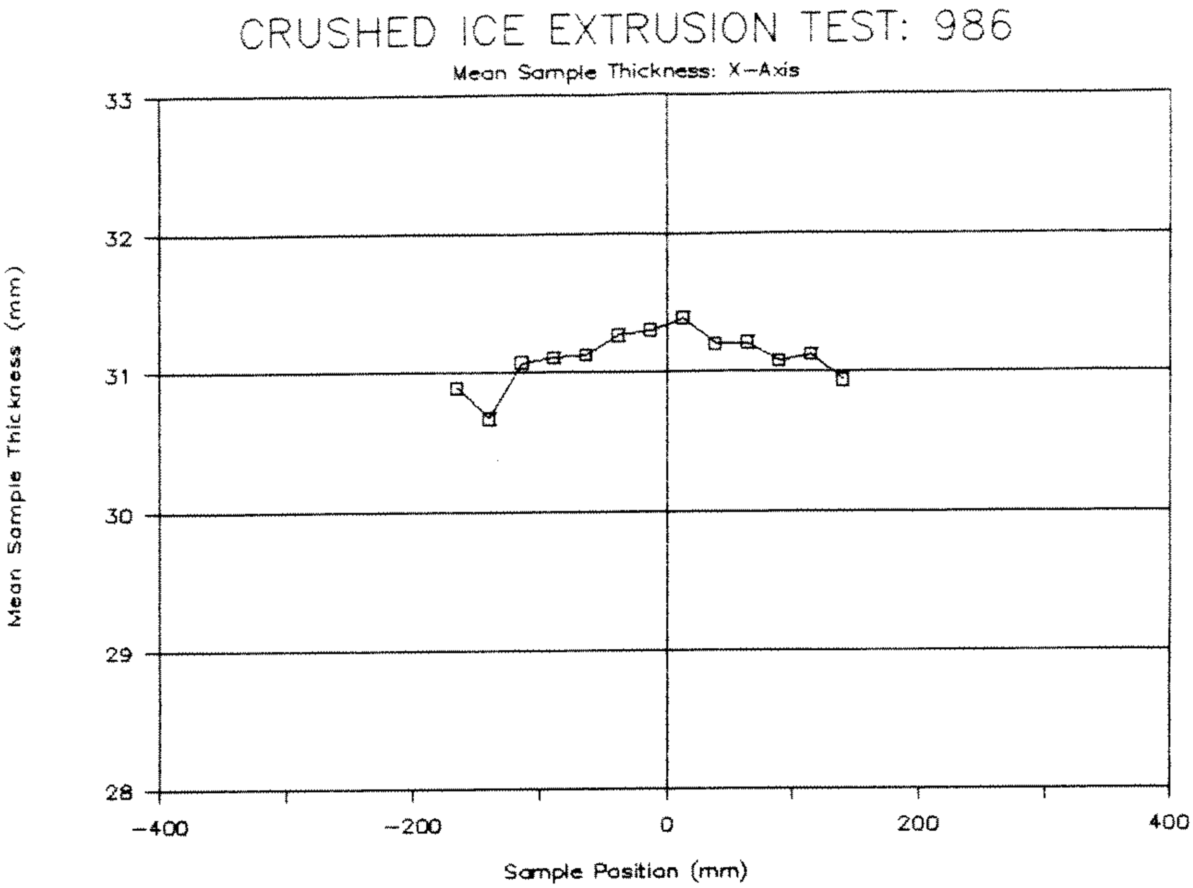

CRUSHED ICE EXTRUSION TEST: 984
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
13
12
11
10
9
8
-300
-100
100
300
Sample Position (mm)

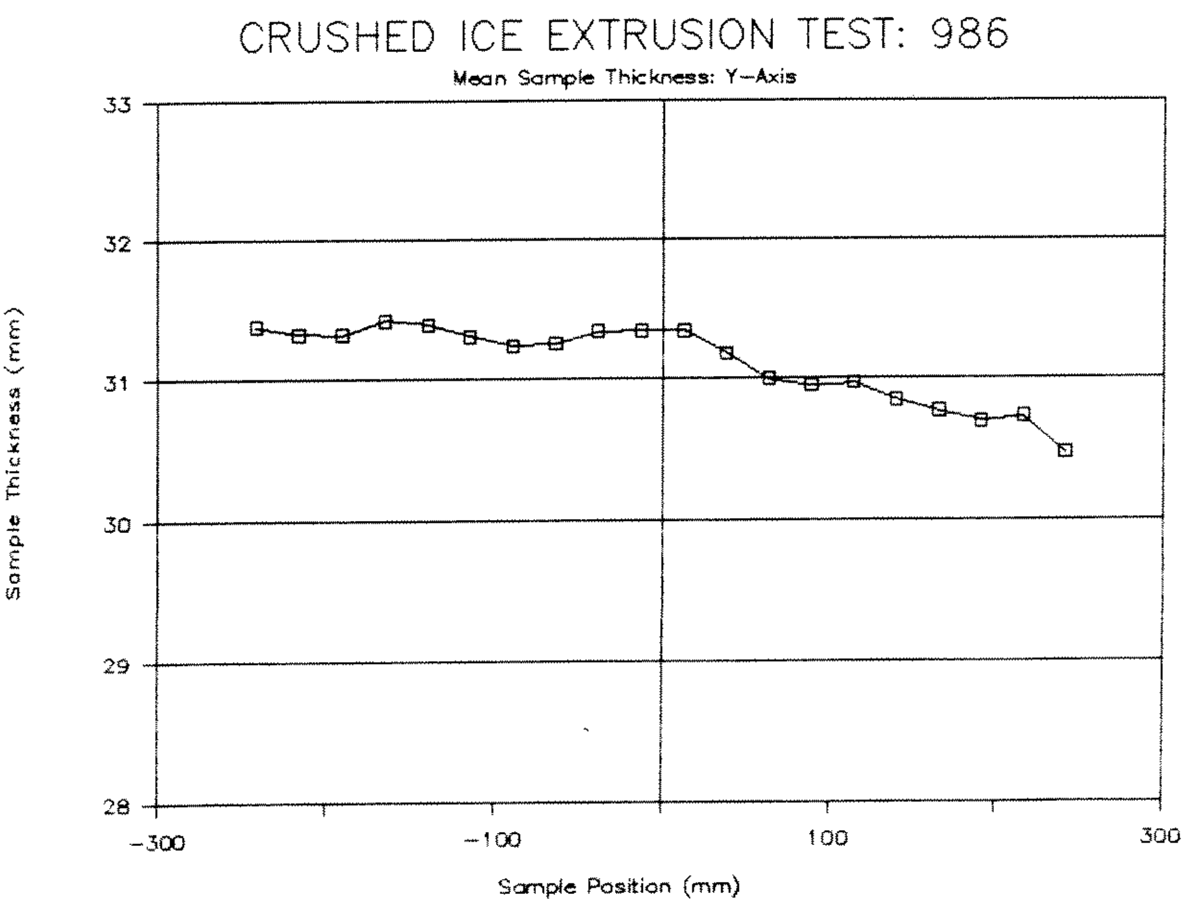


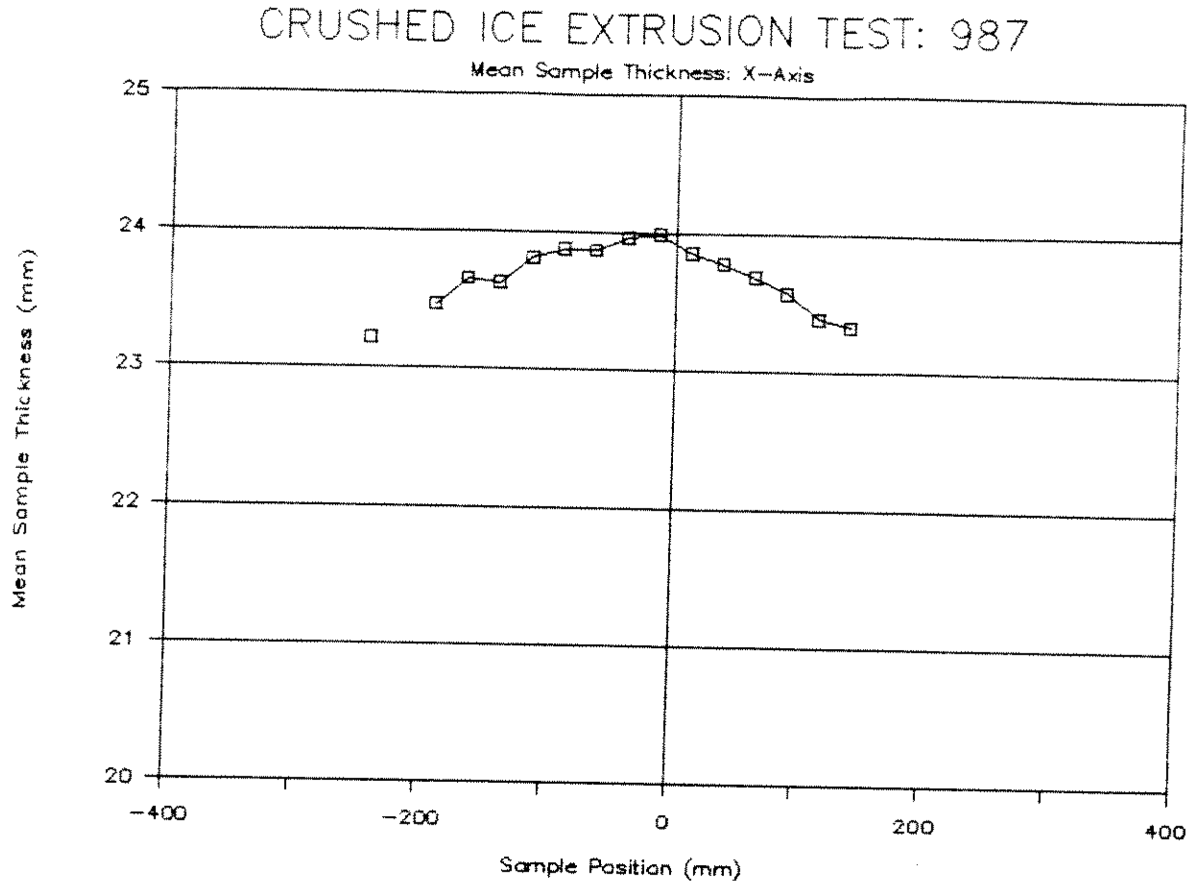
CRUSHED ICE EXTRUSION TEST: 985
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
Sample Position (mm)
30
29
28
27
26
25
-400
-200
0
200
400

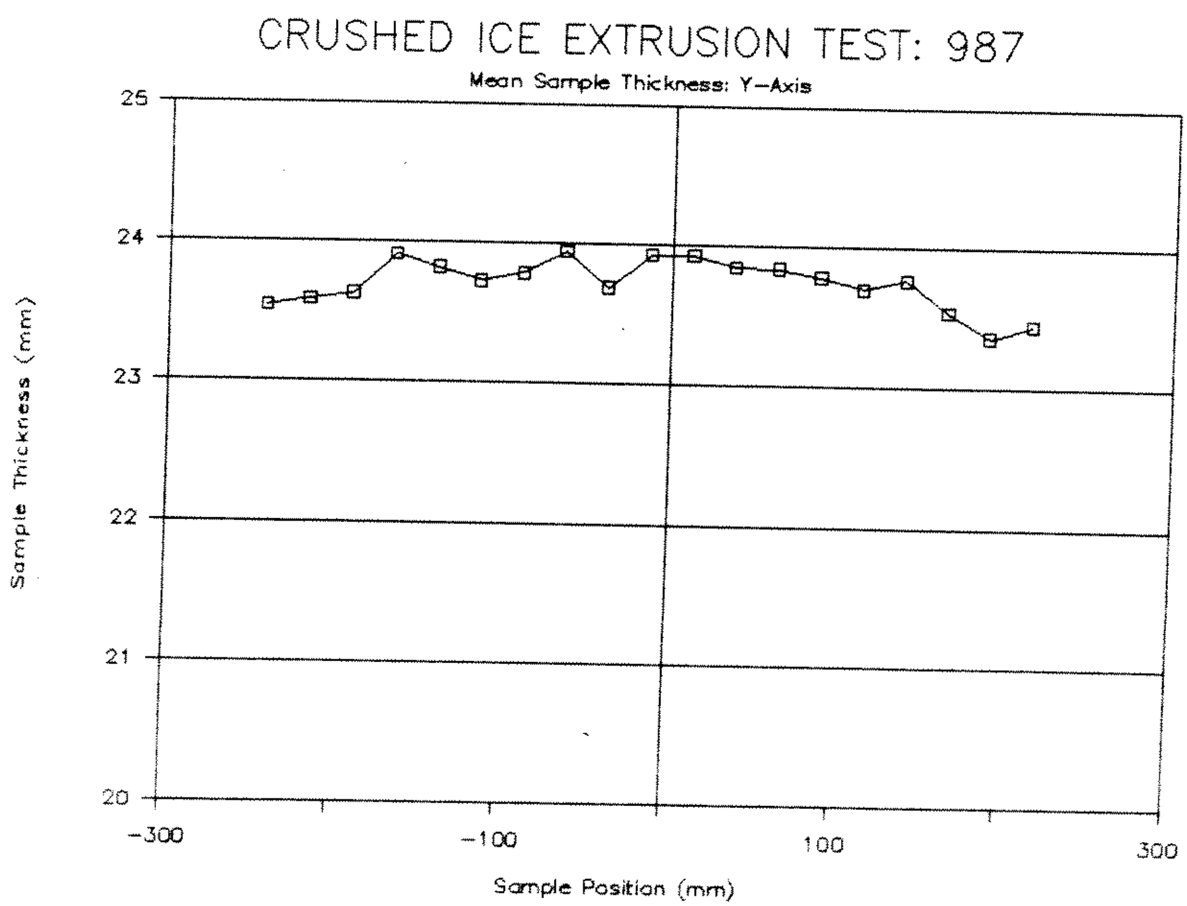


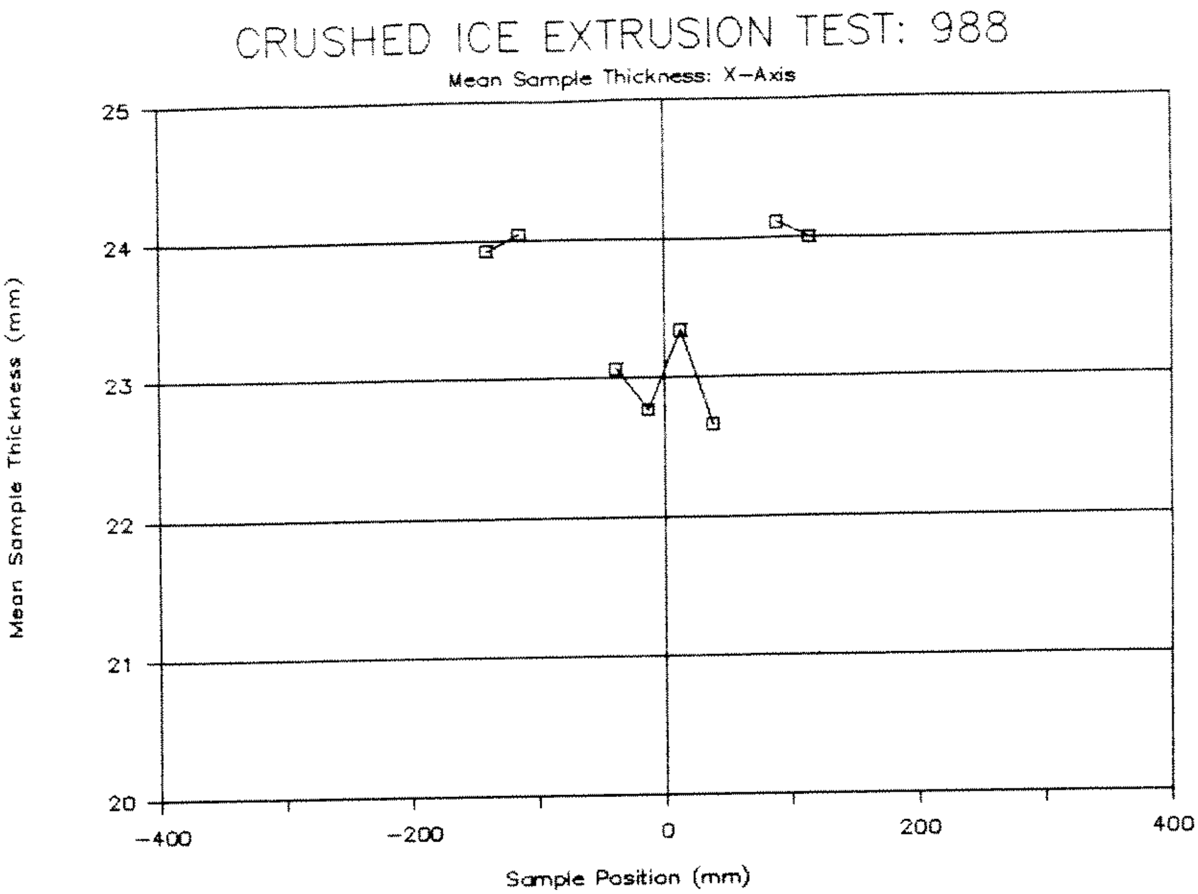
CRUSHED ICE EXTRUSION TEST: 985
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
Sample Position (mm)
30
29
28
27
26
25
-300
-100
100
300

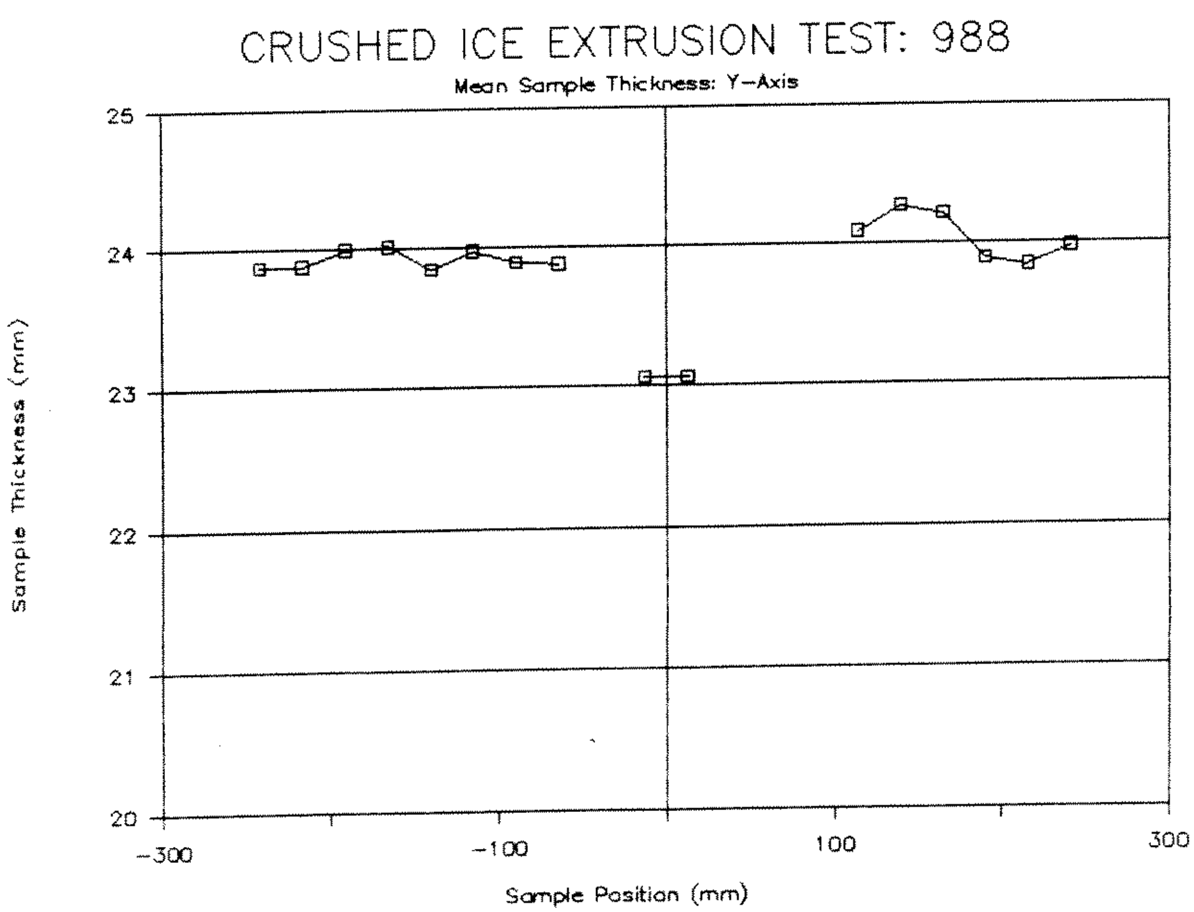

CRUSHED ICE EXTRUSION TEST: 986
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
33
32
31
30
29
28
-400
-200
0
200
400
Sample Position (mm)

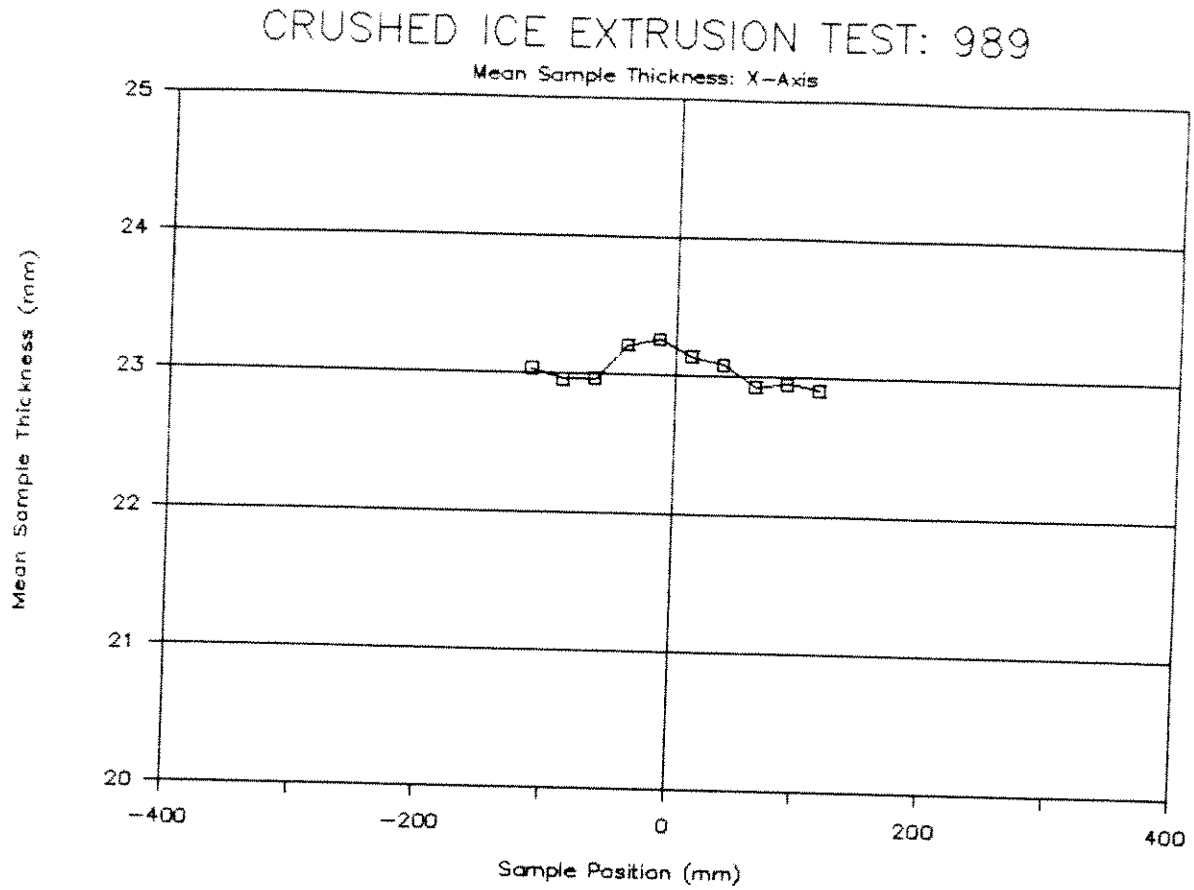

CRUSHED ICE EXTRUSION TEST: 986
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
33
32
31
30
29
28
-300
-100
100
300
Sample Position (mm)

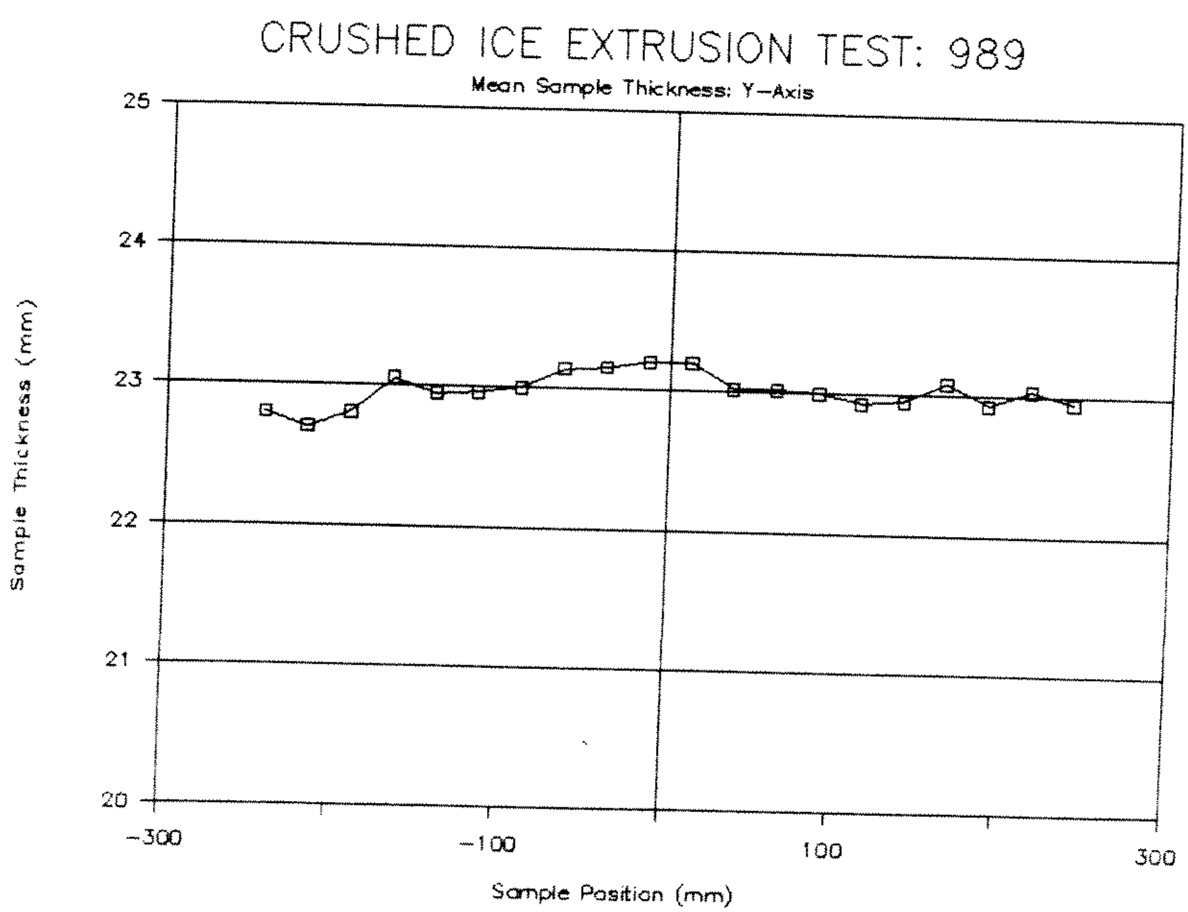

CRUSHED ICE EXTRUSION TEST: 987
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
Sample Position (mm)
25
24
23
22
21
20
-400
-200
0
200
400

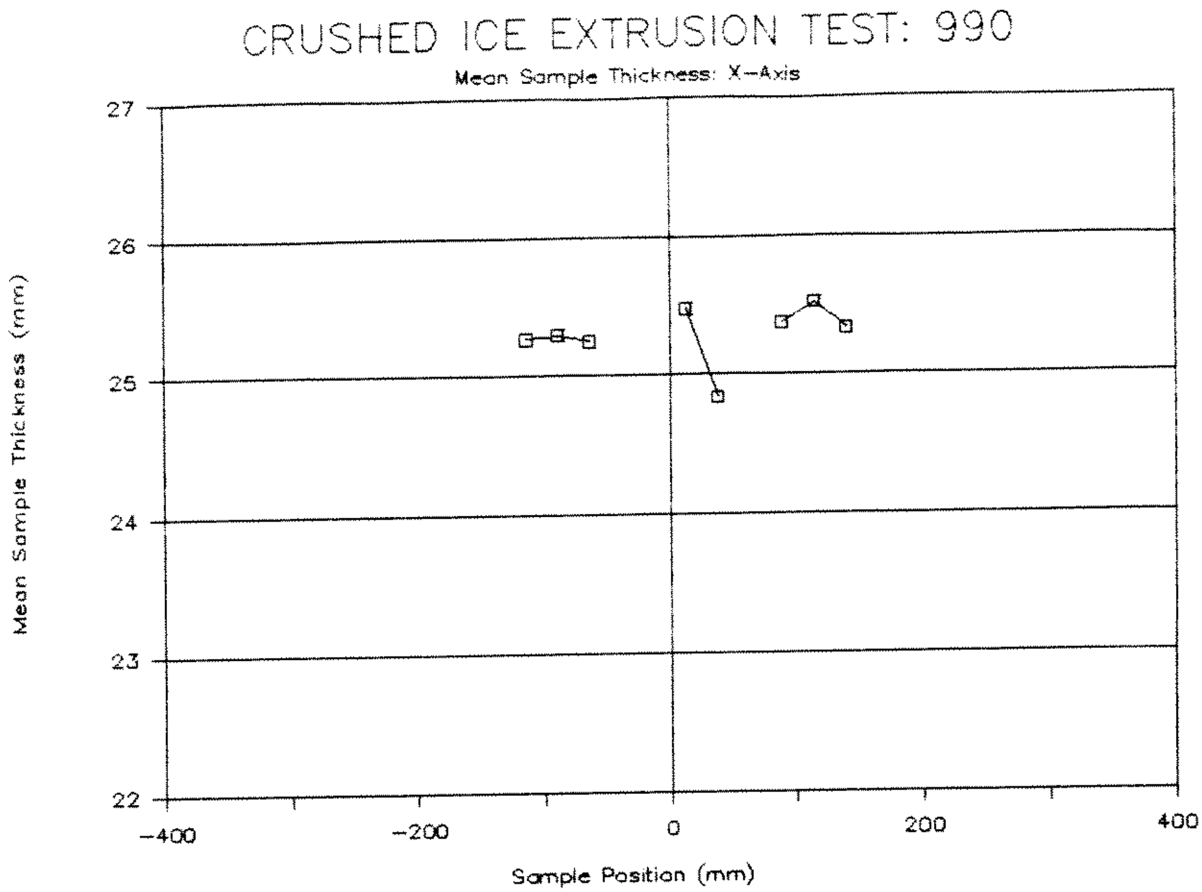

CRUSHED ICE EXTRUSION TEST: 987
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
Sample Position (mm)
25
24
23
22
21
20
-300
-100
100
300

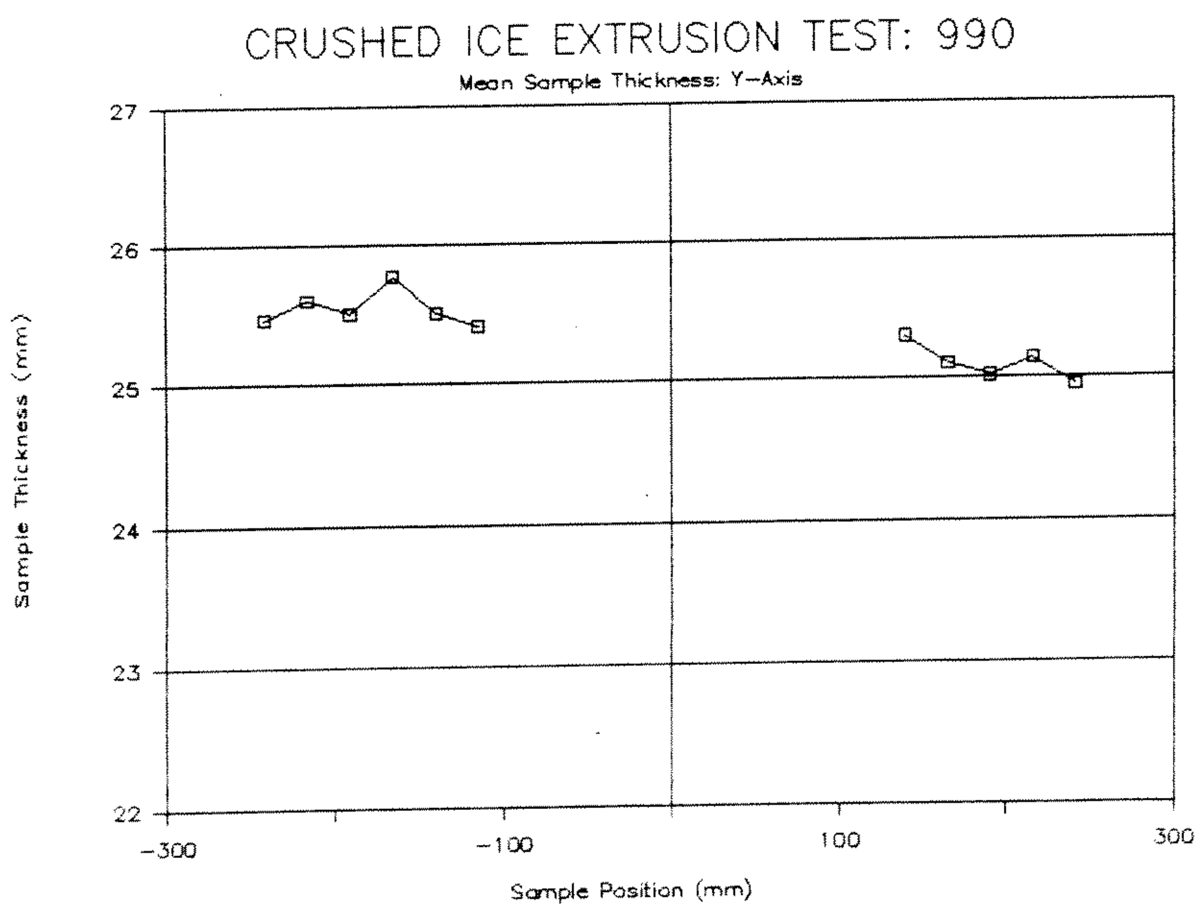

CRUSHED ICE EXTRUSION TEST: 988
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
25
24
23
22
21
20
-400
-200
0
200
400
Sample Position (mm)

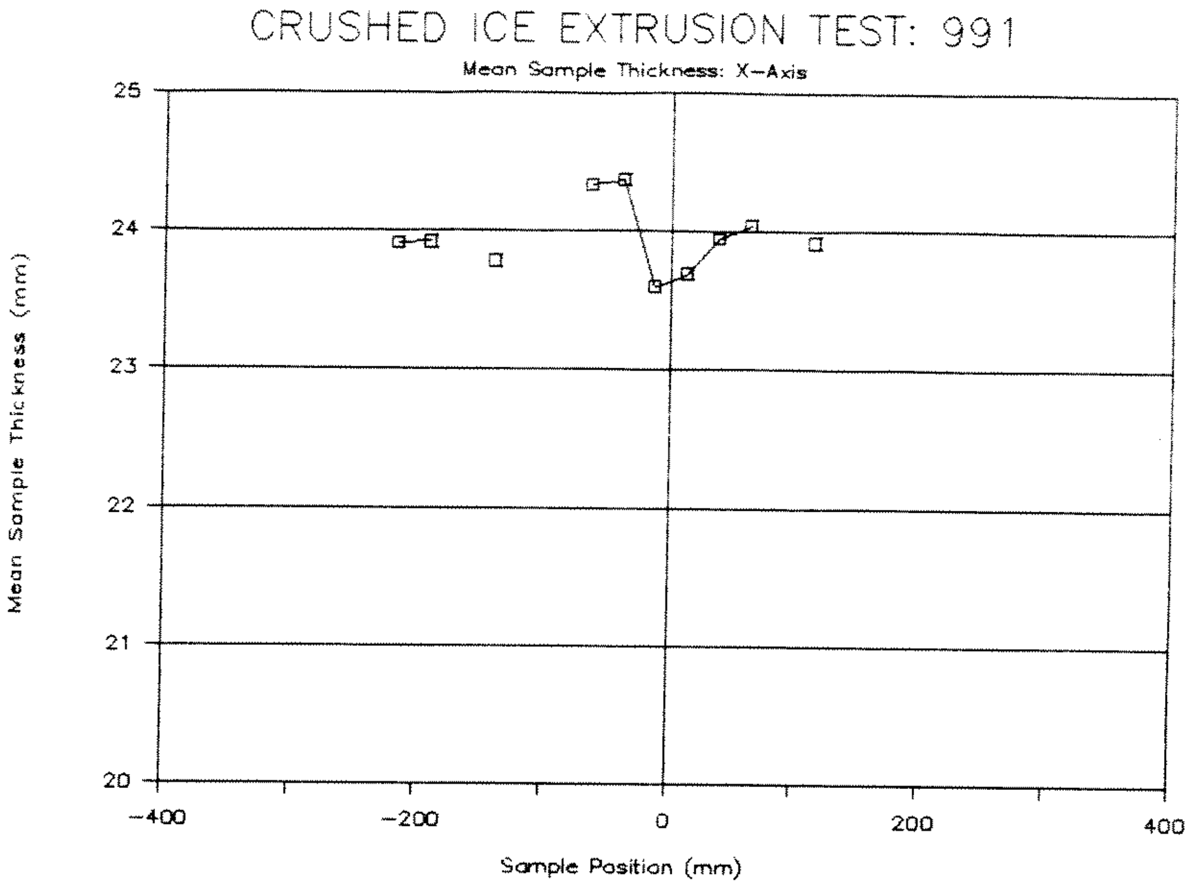

CRUSHED ICE EXTRUSION TEST: 988
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
25
24
23
22
21
20
-300
-100
100
300
Sample Position (mm)

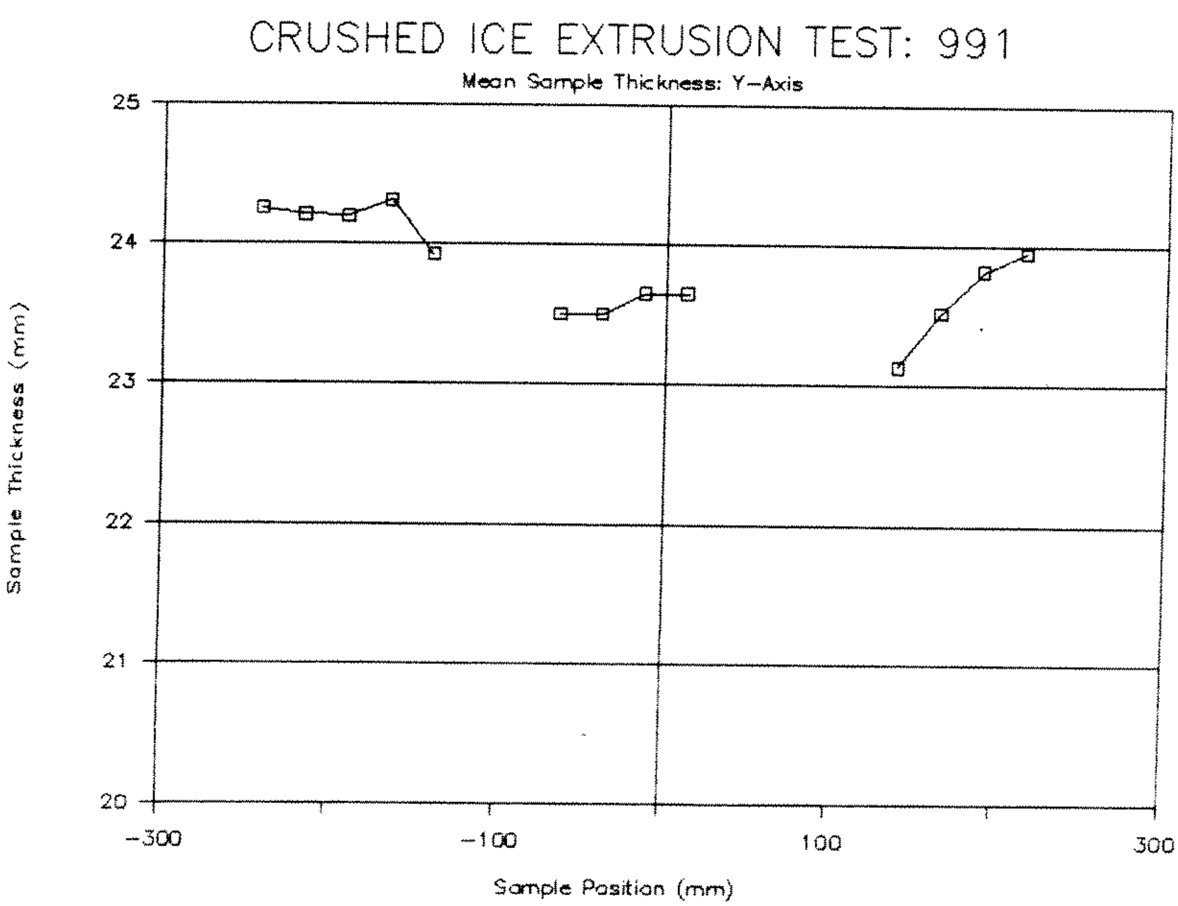

CRUSHED ICE EXTRUSION TEST: 989
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
25
24
23
22
21
20
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 989
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
25
24
23
22
21
20
-300
-100
100
300
Sample Position (mm)

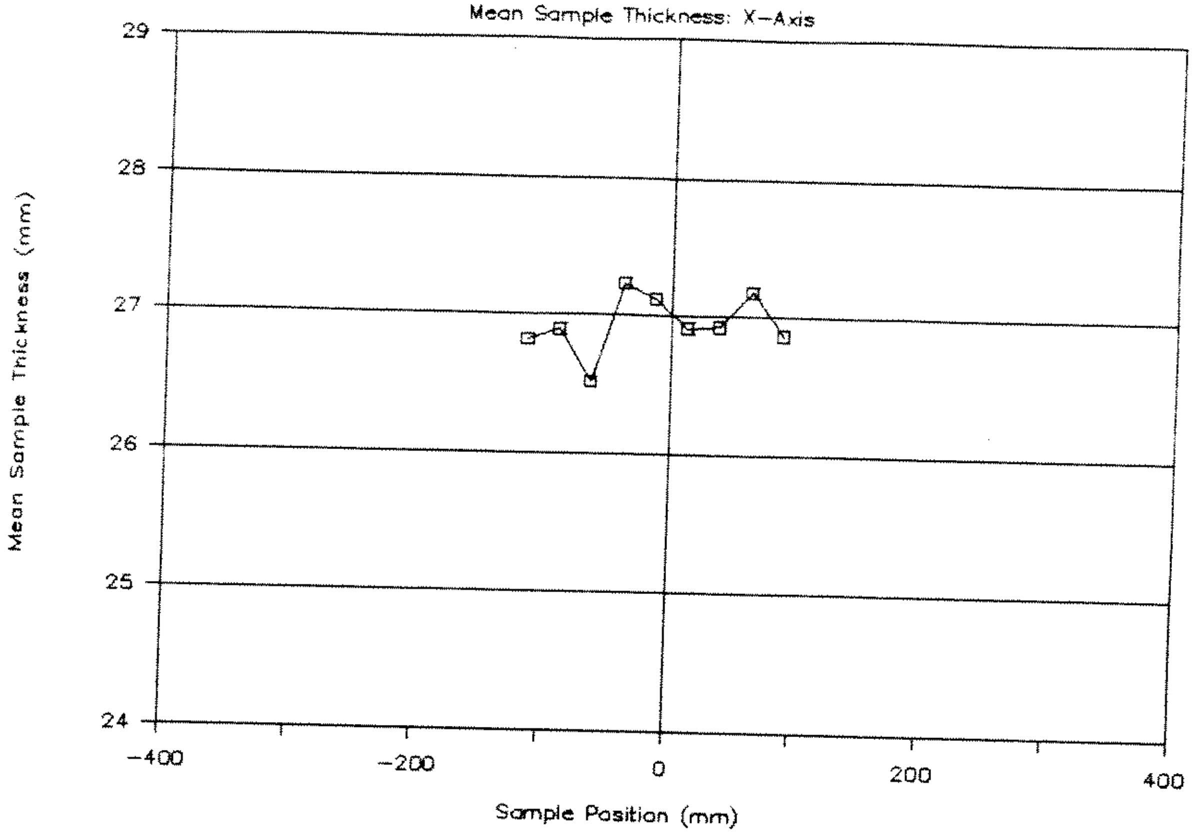

CRUSHED ICE EXTRUSION TEST: 990
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
27
26
25
24
23
22
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 990
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
27
26
25
24
23
22
-300
-100
100
300
Sample Position (mm)

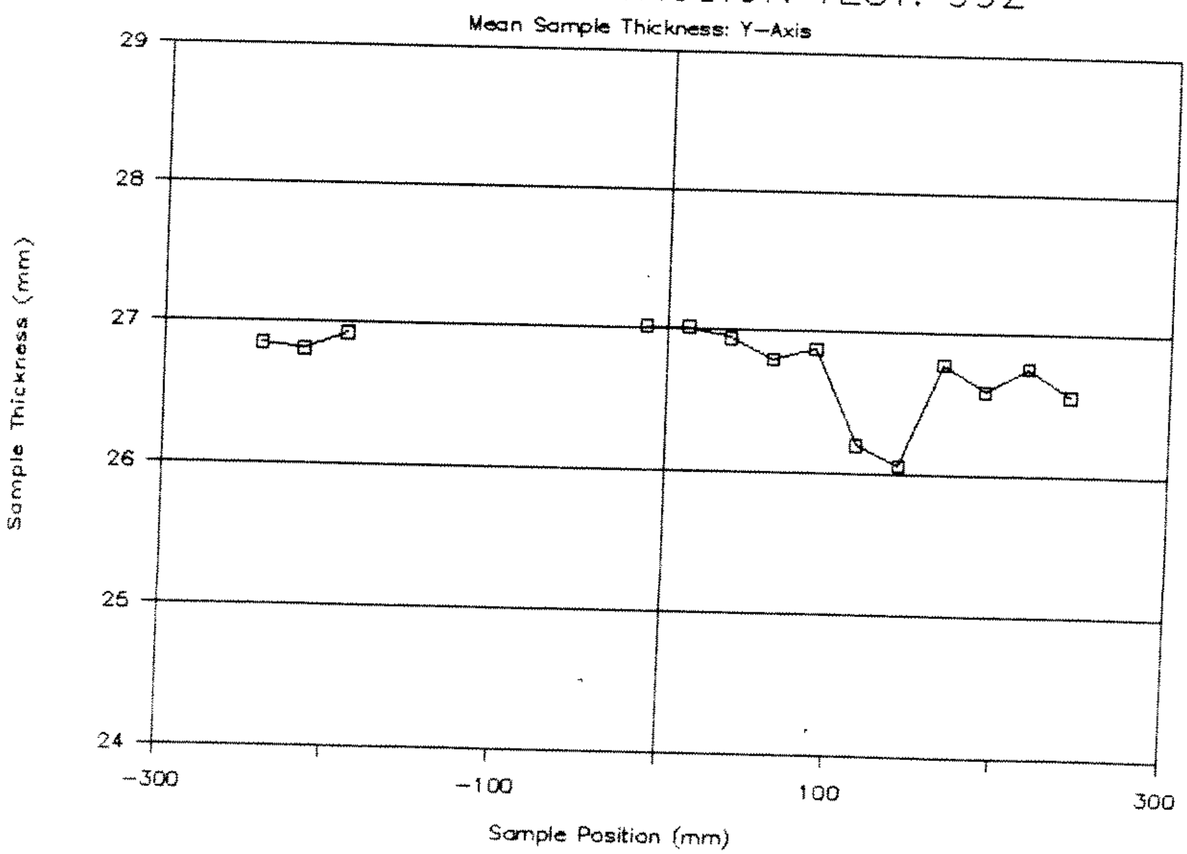

CRUSHED ICE EXTRUSION TEST: 991
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
25
24
23
22
21
20
-400
-200
0
200
400
Sample Position (mm)

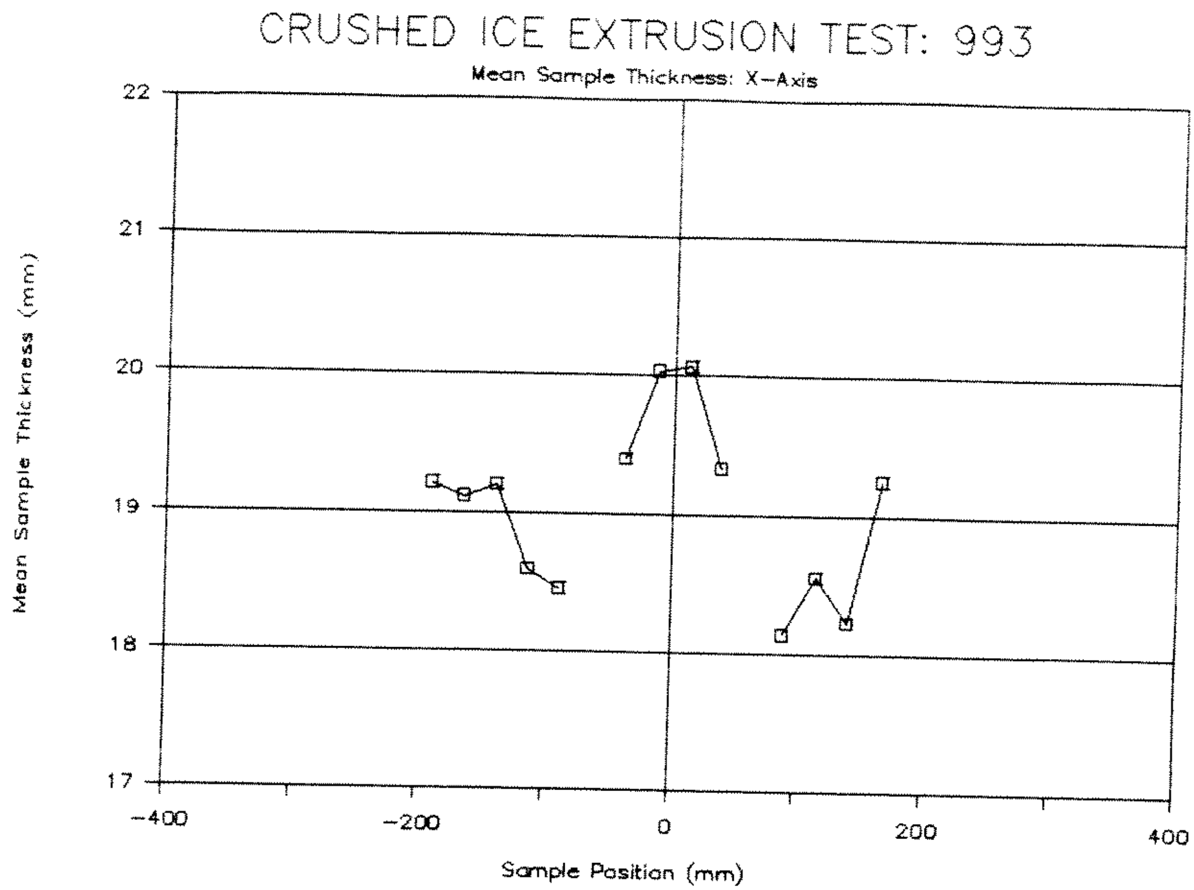

CRUSHED ICE EXTRUSION TEST: 991
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
25
24
23
22
21
20
-300
-100
100
300
Sample Position (mm)

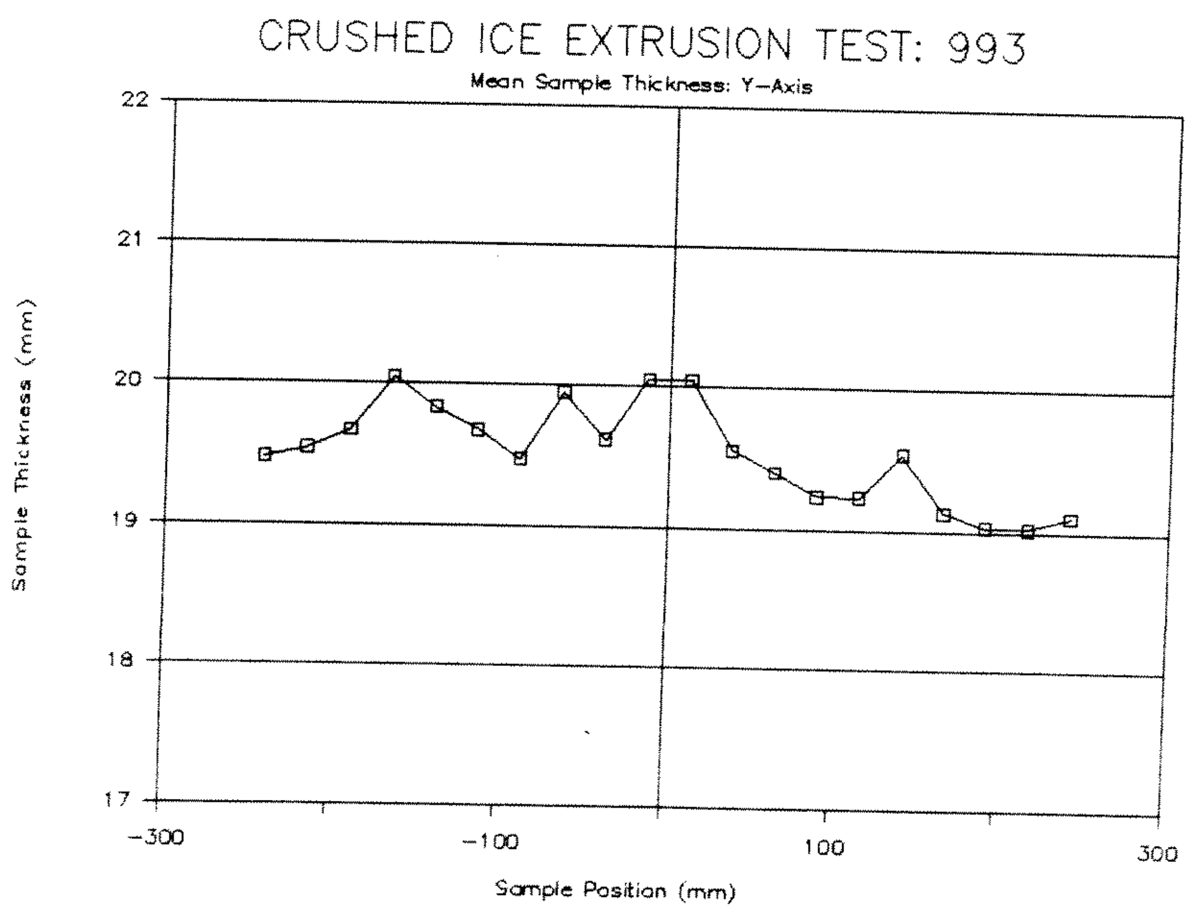
CRUSHED ICE EXTRUSION TEST: 992

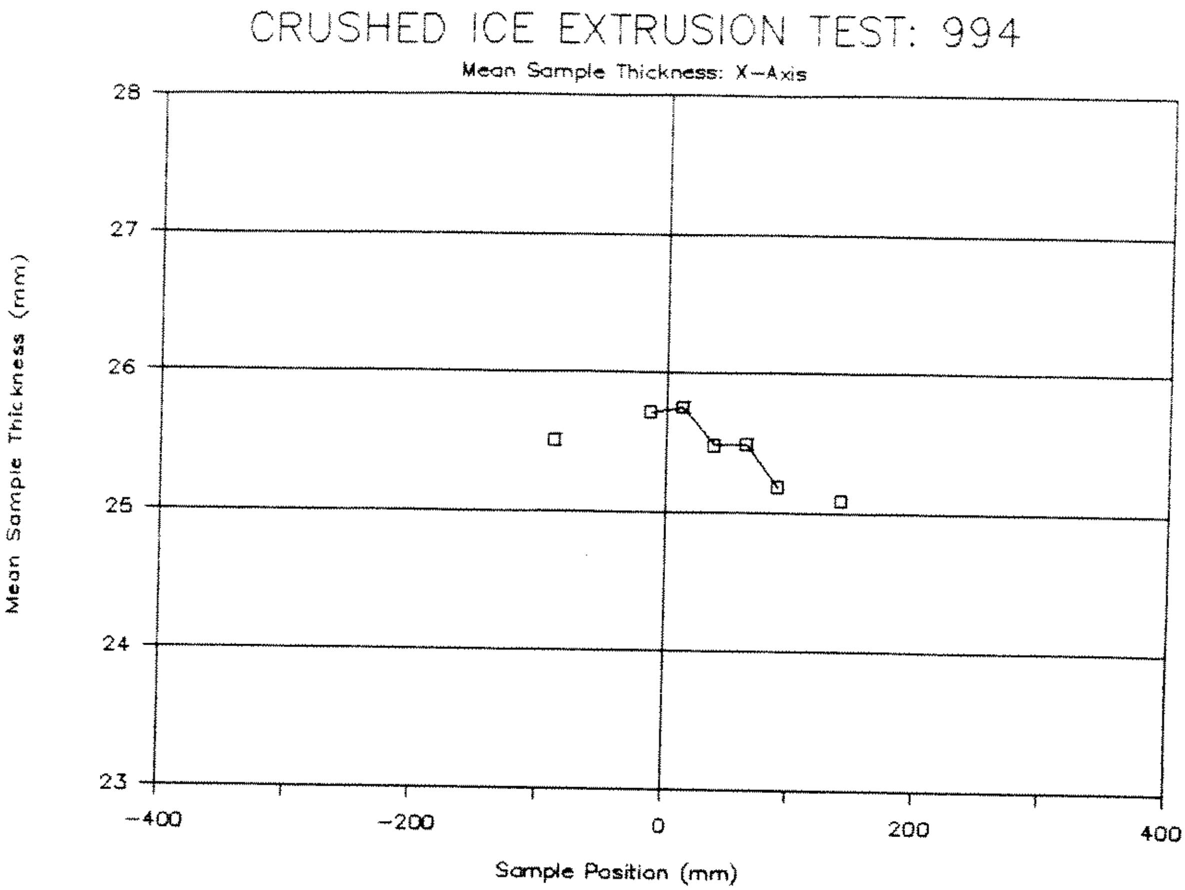


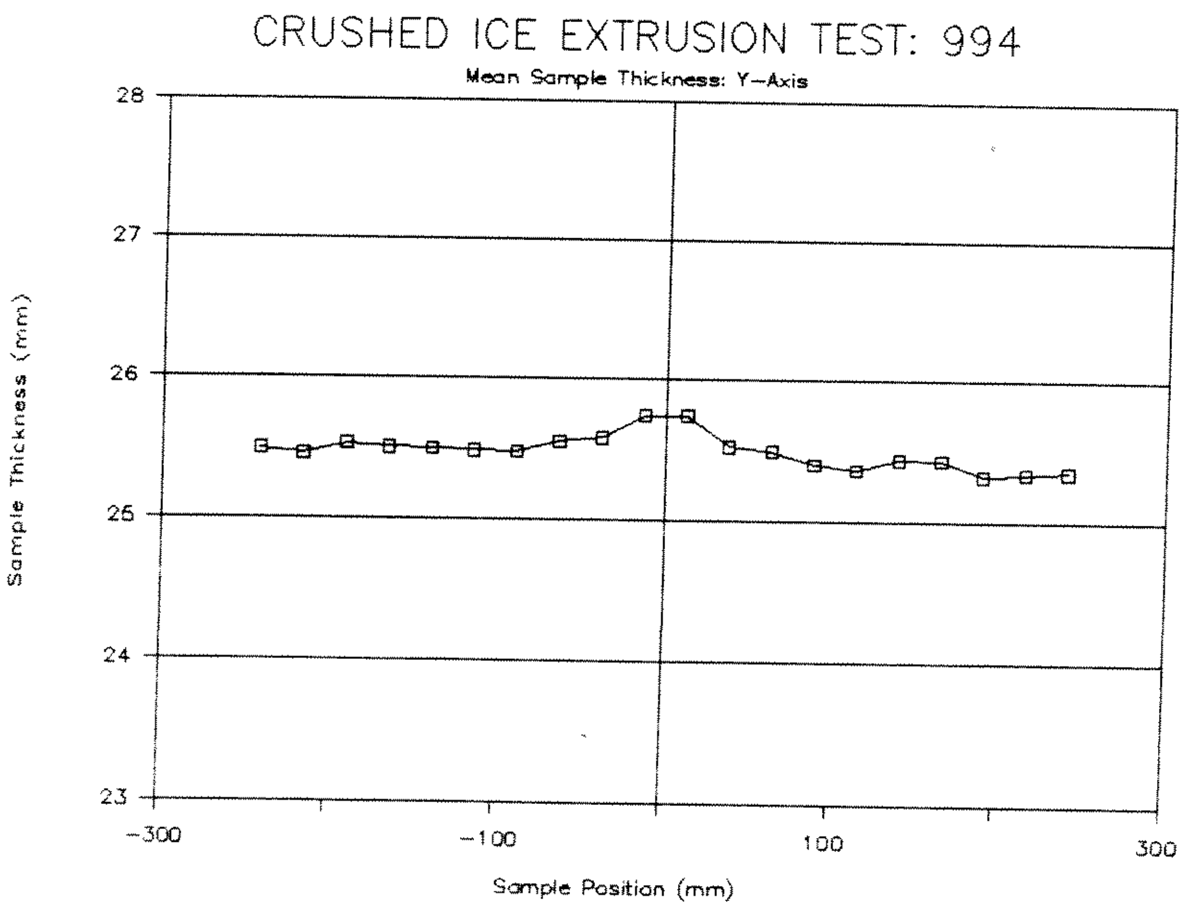
CRUSHED ICE EXTRUSION TEST: 992

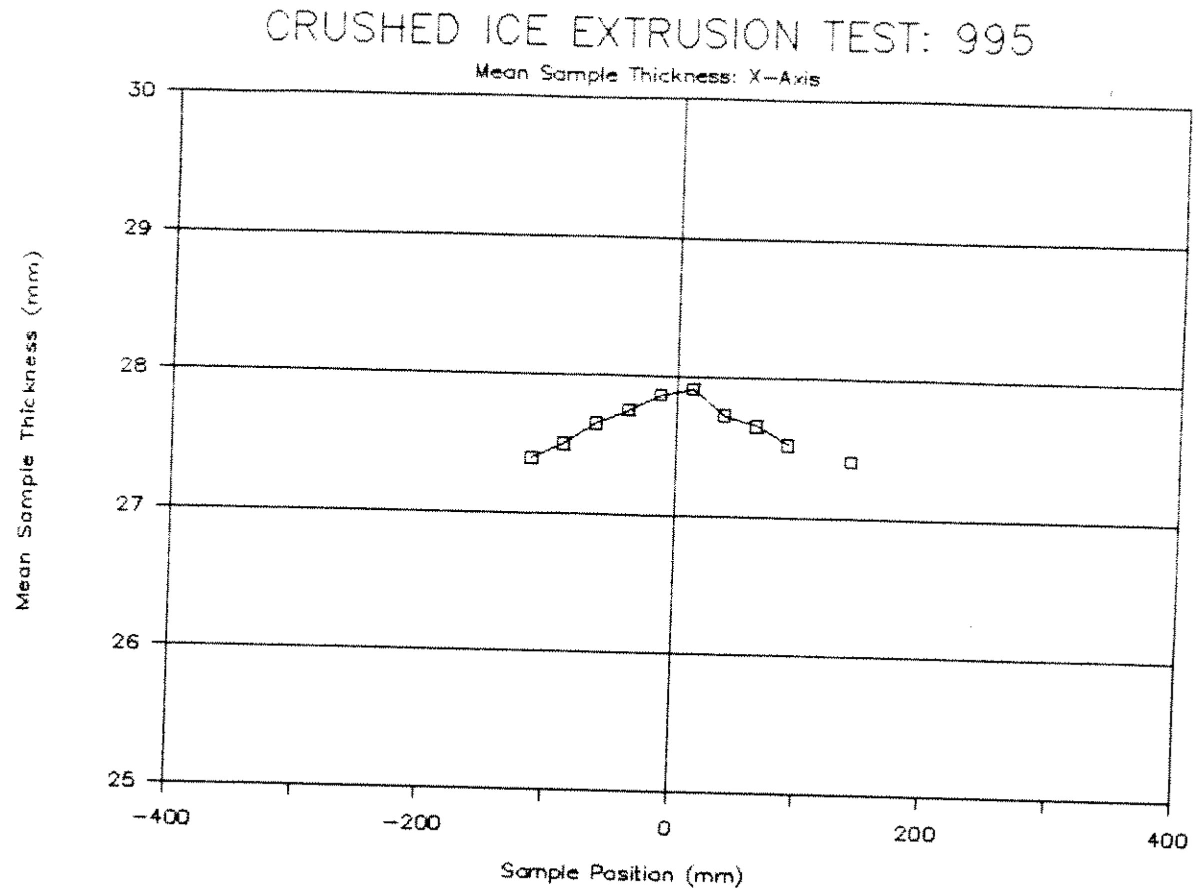


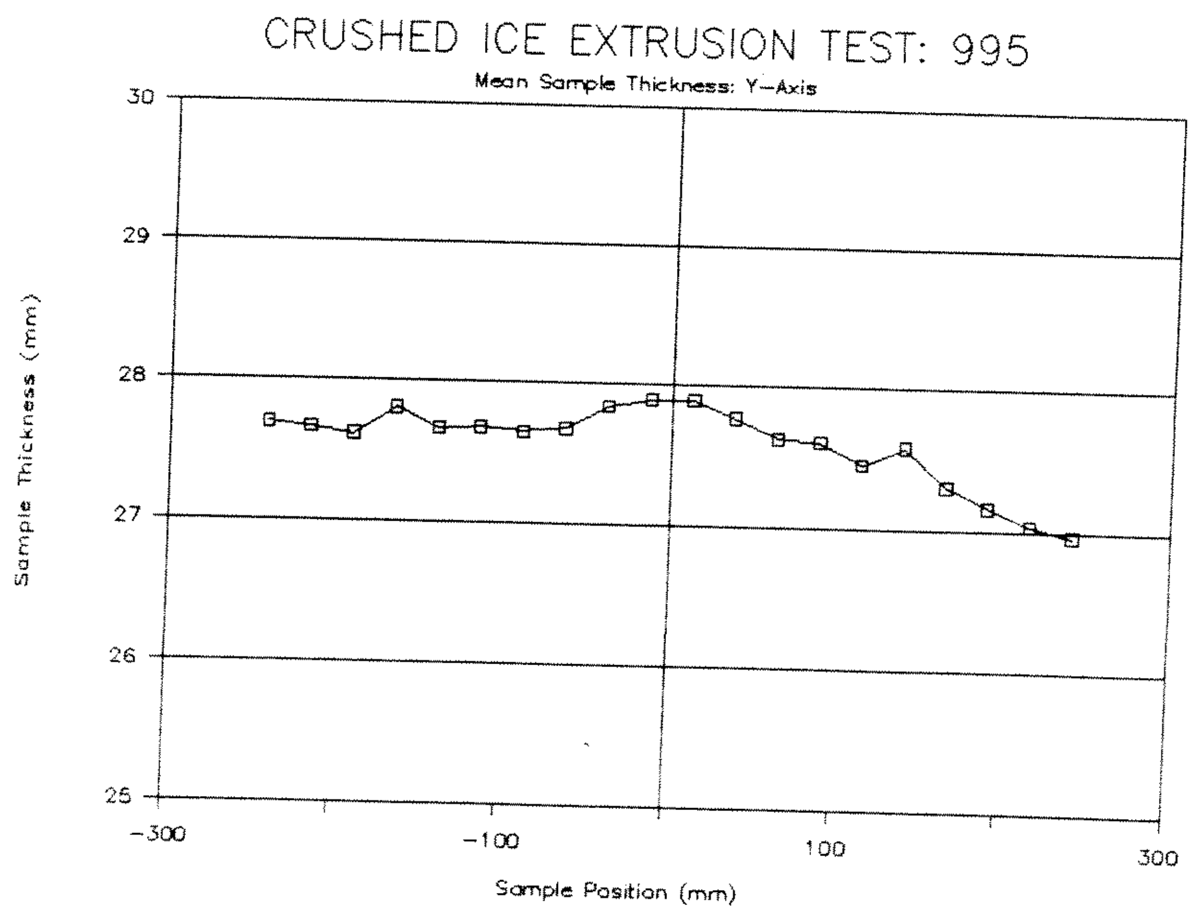

CRUSHED ICE EXTRUSION TEST: 993
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
22
21
20
19
18
17
-400
-200
0
200
400
Sample Position (mm)

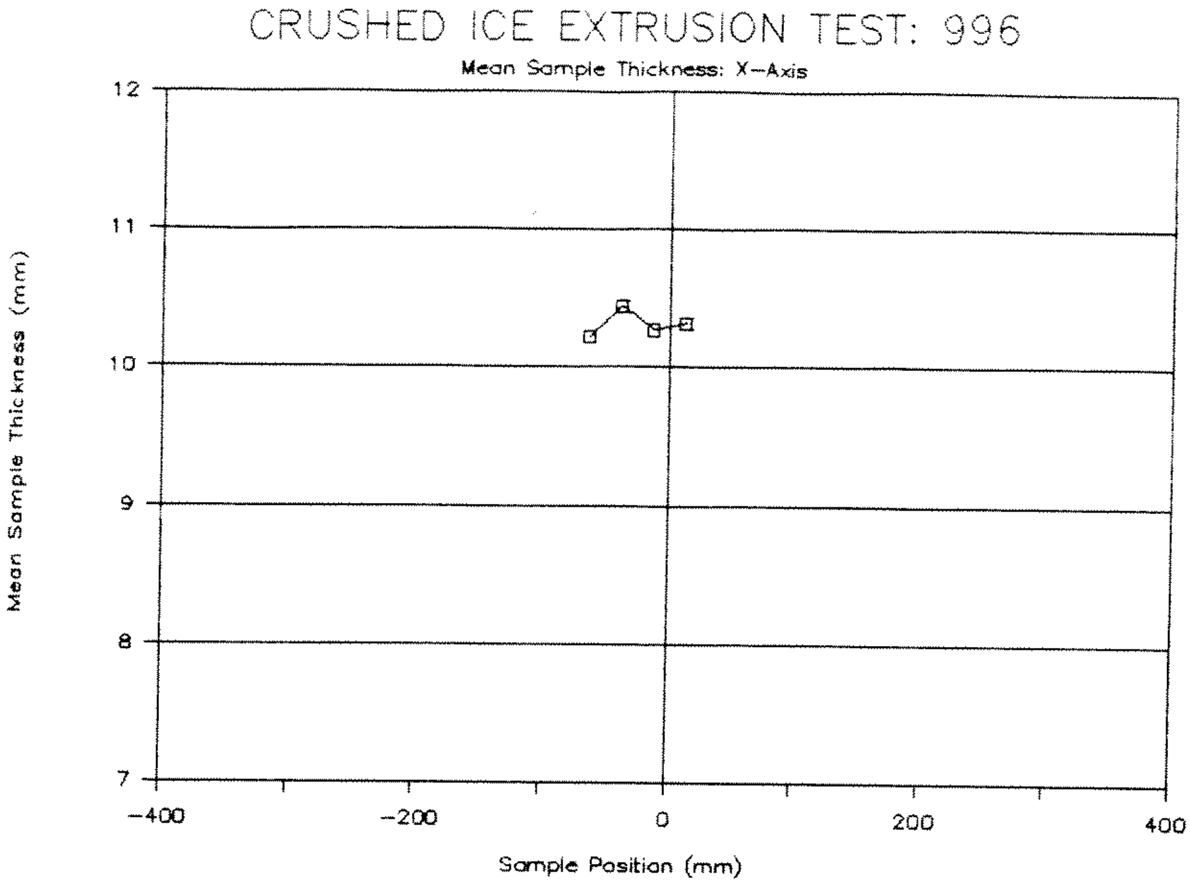

CRUSHED ICE EXTRUSION TEST: 993
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
22
21
20
19
18
17
-300
-100
100
300
Sample Position (mm)

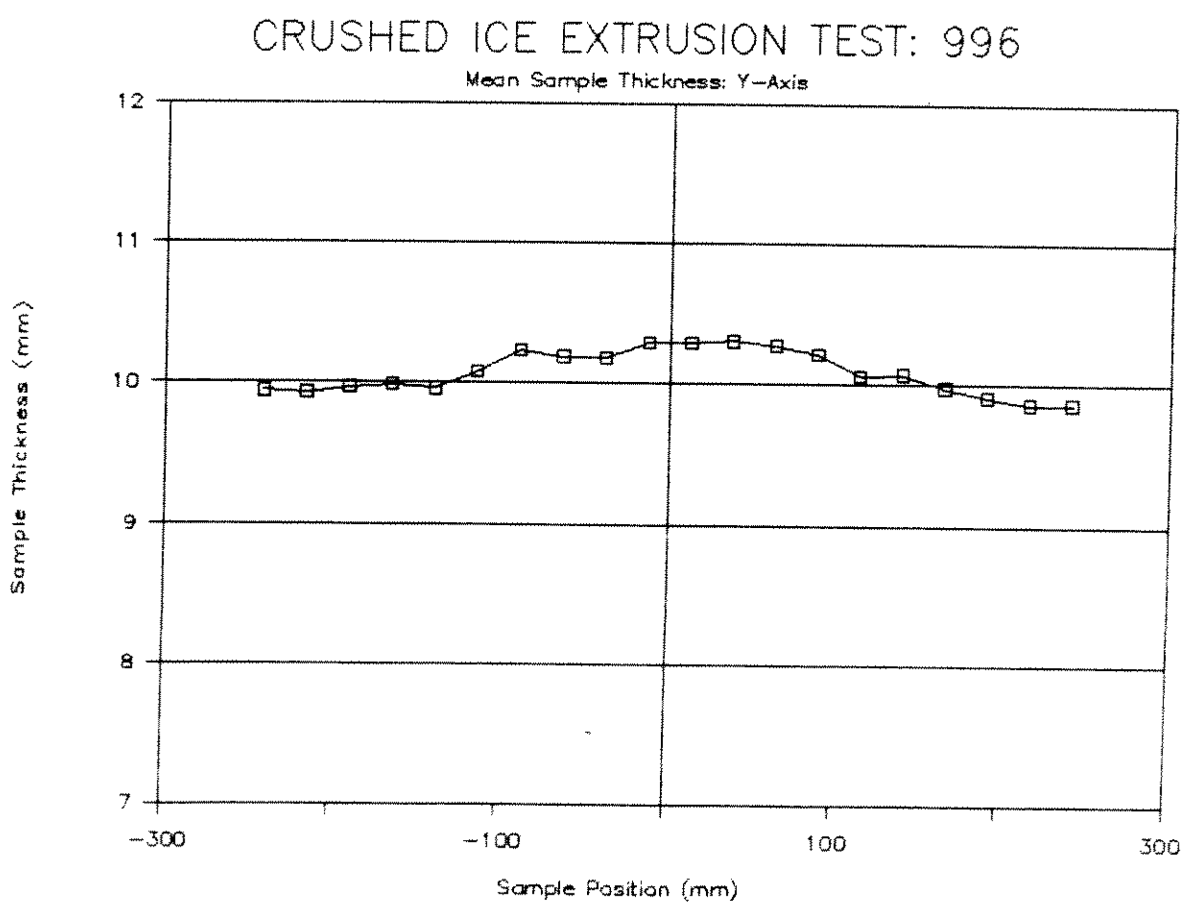

CRUSHED ICE EXTRUSION TEST: 994
Mean Sample Thickness: X-Axis
28
27
26
25
24
23
-400
-200
0
200
400
Mean Sample Thickness (mm)
Sample Position (mm)

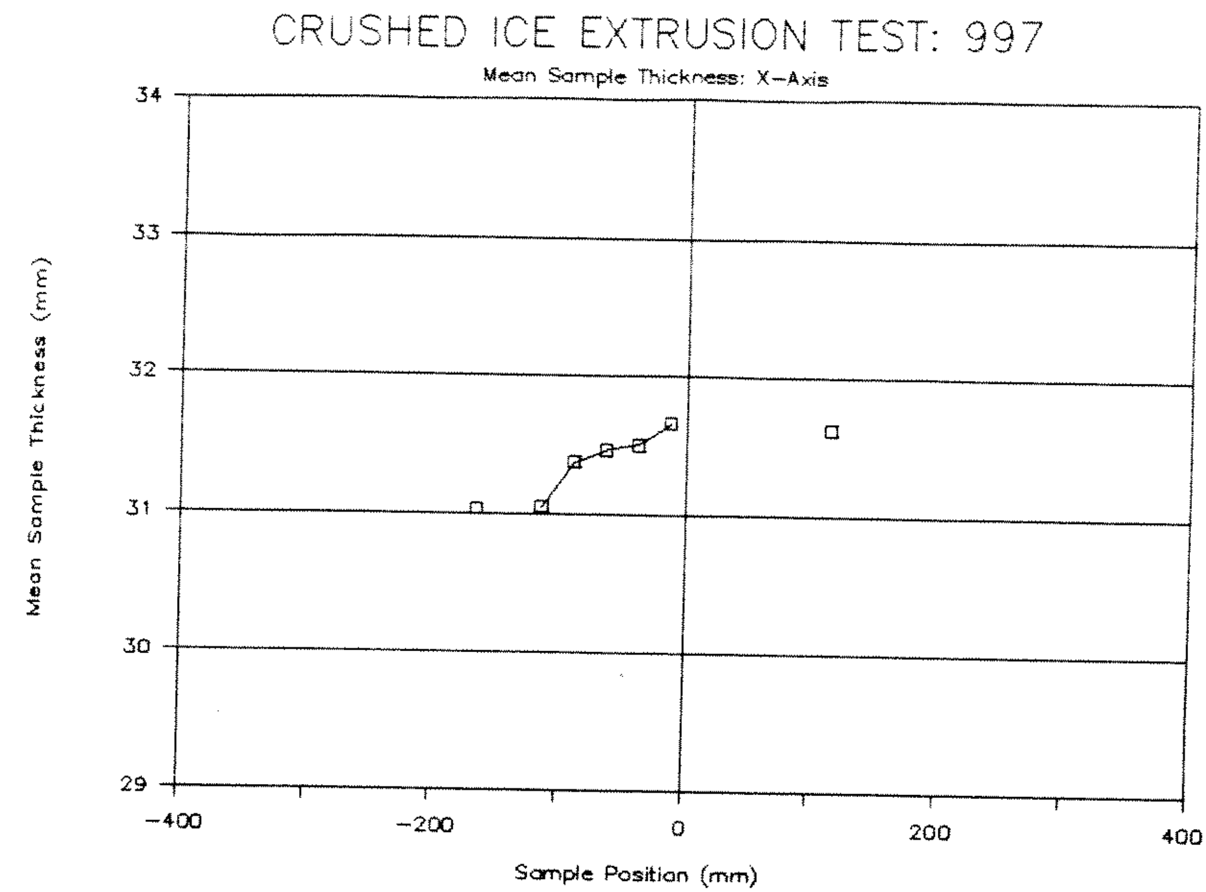

CRUSHED ICE EXTRUSION TEST: 994
Mean Sample Thickness: Y-Axis
28
27
26
25
24
23
-300
-100
100
300
Sample Thickness (mm)
Sample Position (mm)

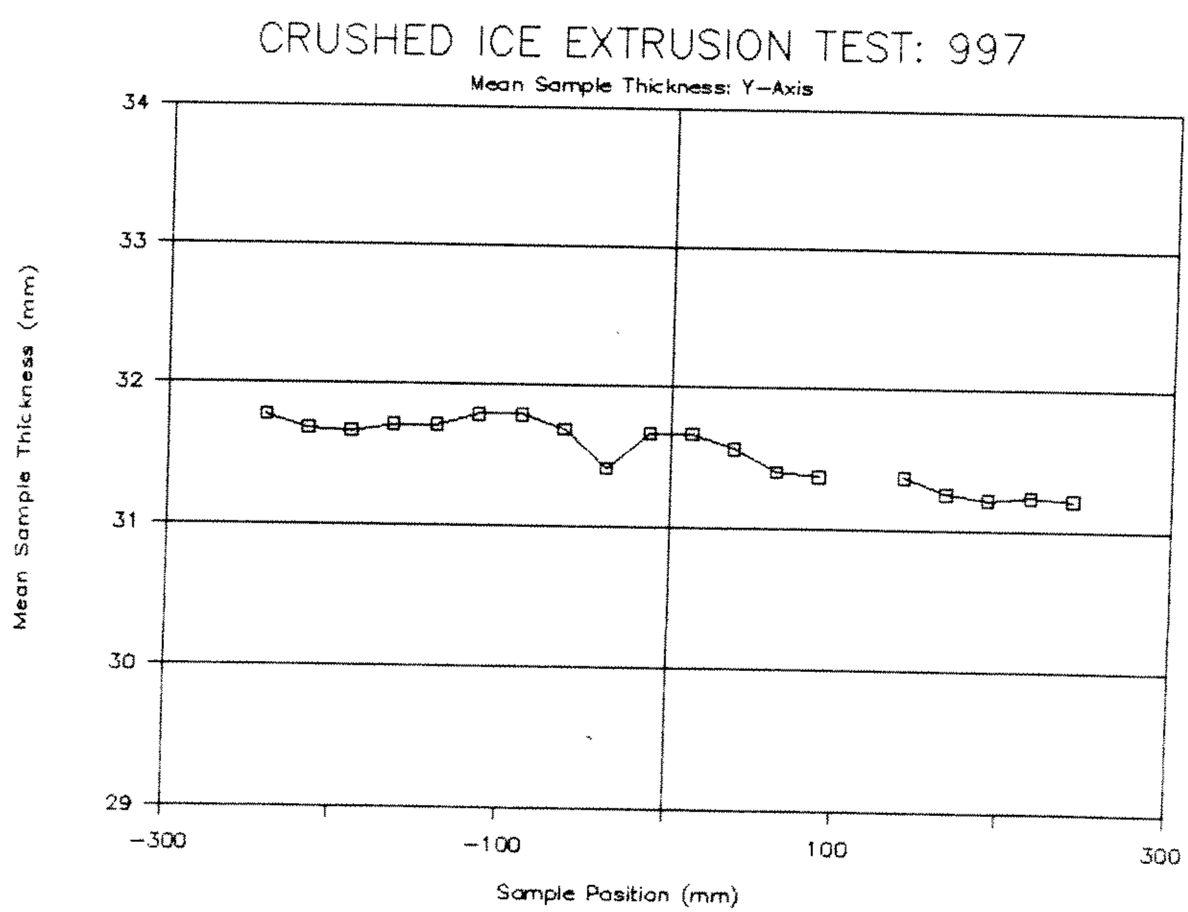

CRUSHED ICE EXTRUSION TEST: 995
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
Sample Position (mm)
30
29
28
27
26
25
-400
-200
0
200
400

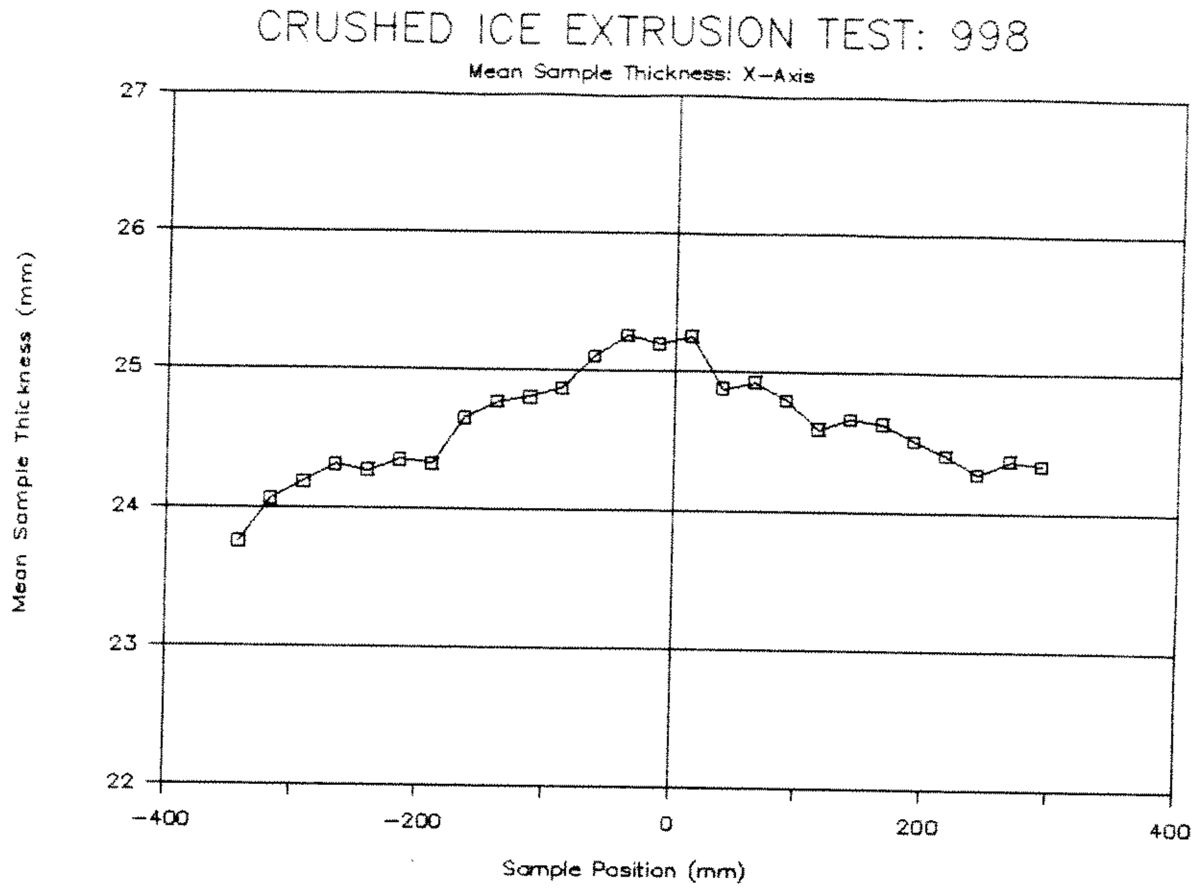

CRUSHED ICE EXTRUSION TEST: 995
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
Sample Position (mm)
30
29
28
27
26
25
-300
-100
100
300

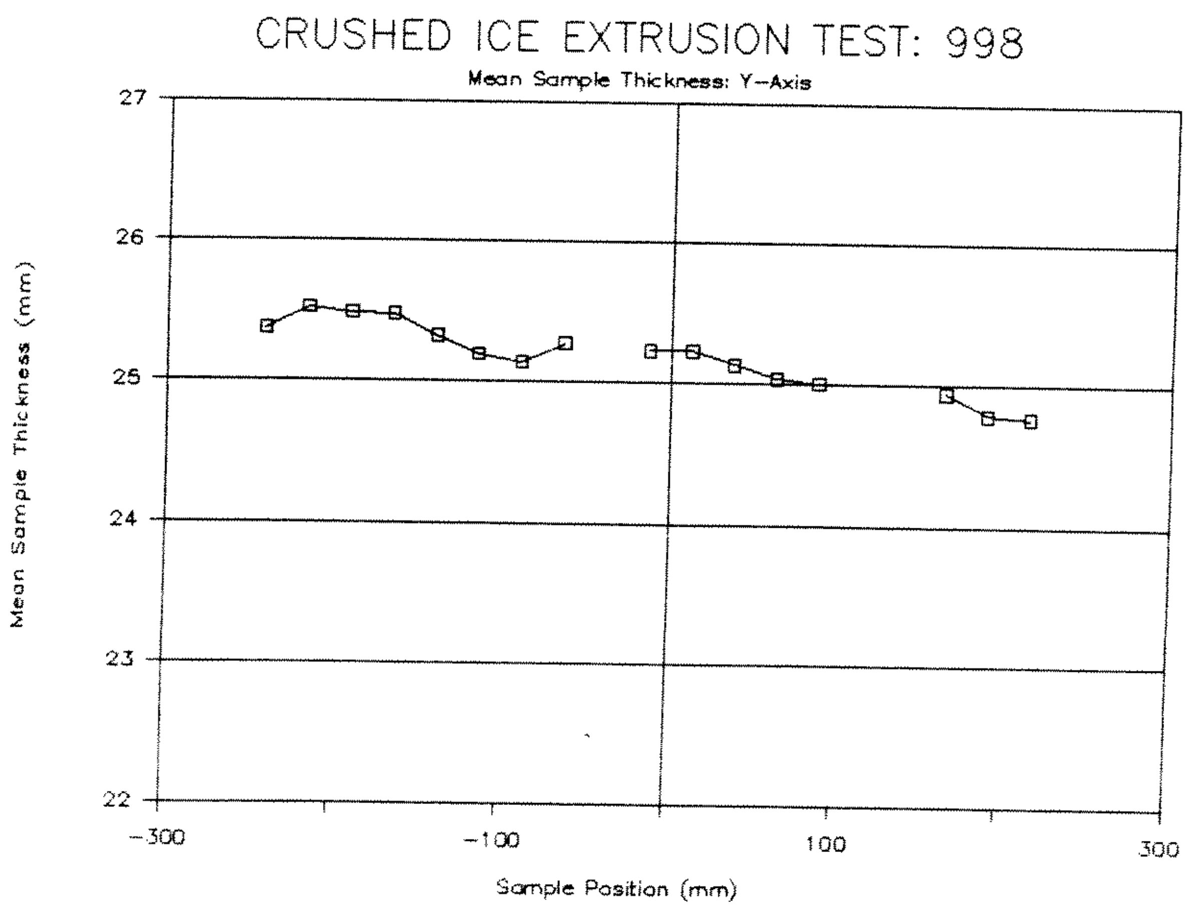

CRUSHED ICE EXTRUSION TEST: 996
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
Sample Position (mm)
12
11
10
9
8
7
-400
-200
0
200
400

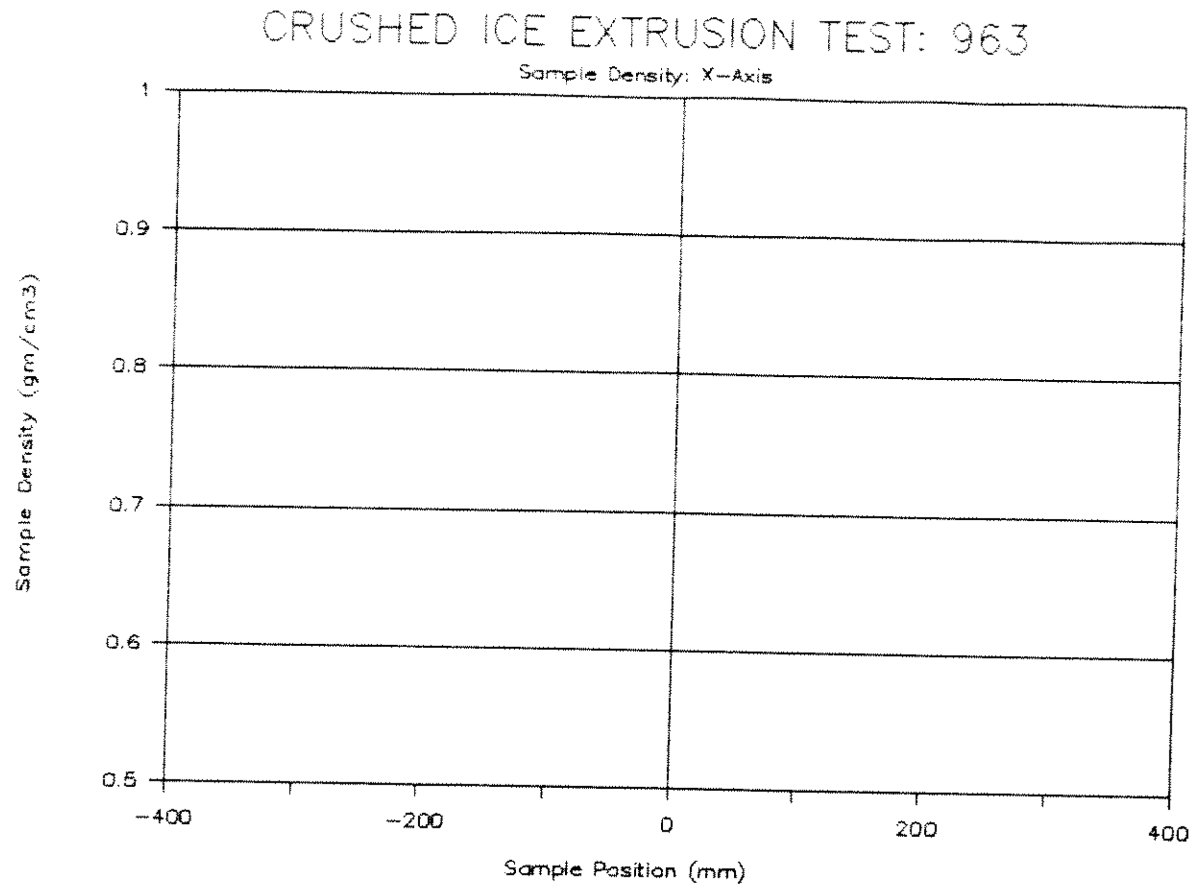

CRUSHED ICE EXTRUSION TEST: 996
Mean Sample Thickness: Y-Axis
Sample Thickness (mm)
Sample Position (mm)
12
11
10
9
8
7
-300
-100
100
300


CRUSHED ICE EXTRUSION TEST: 997
Mean Sample Thickness: X-Axis
Mean Sample Thickness (mm)
34
33
32
31
30
29
-400
-200
0
200
400
Sample Position (mm)

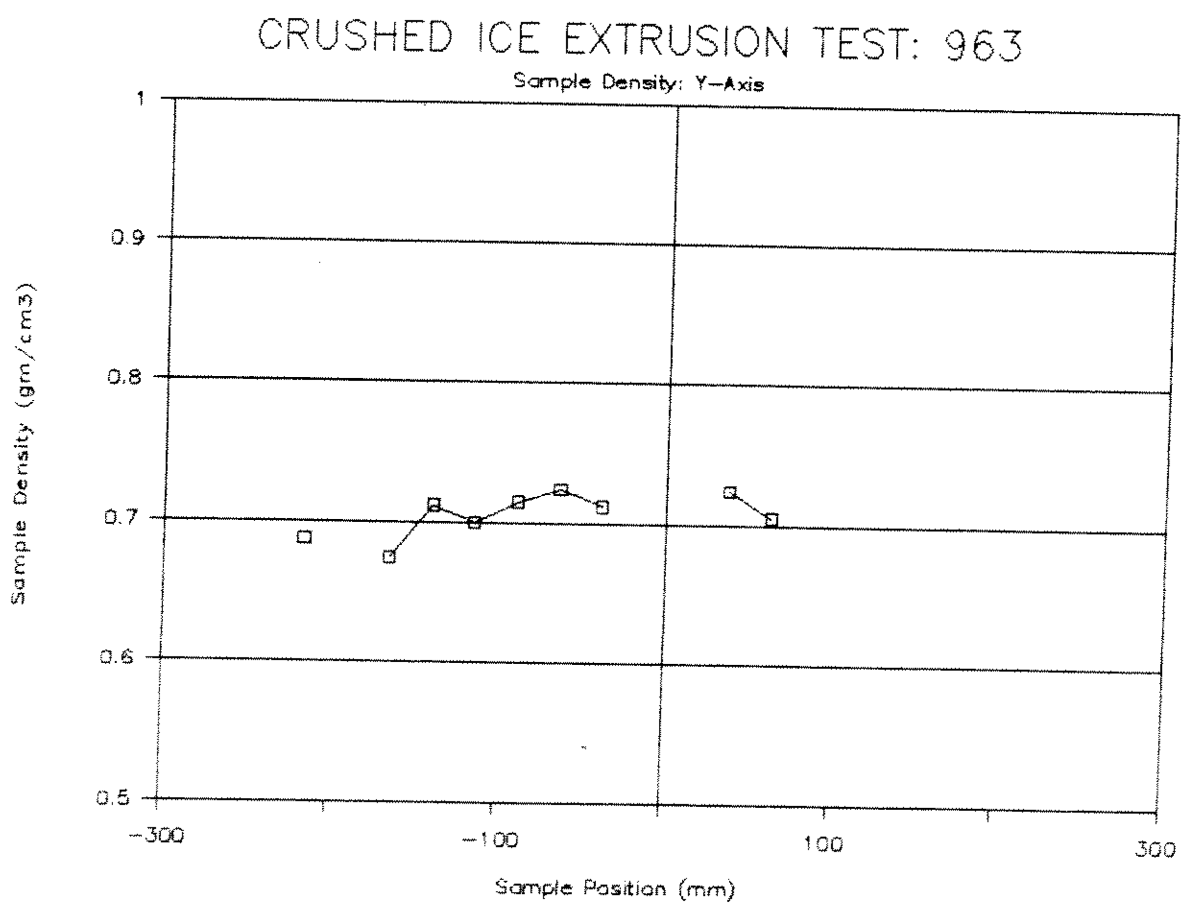

CRUSHED ICE EXTRUSION TEST: 997
Mean Sample Thickness: Y-Axis
Mean Sample Thickness (mm)
34
33
32
31
30
29
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 998
Mean Sample Thickness: X–Axis
Mean Sample Thickness (mm)
Sample Position (mm)
27
26
25
24
23
22
–400
–200
0
200
400

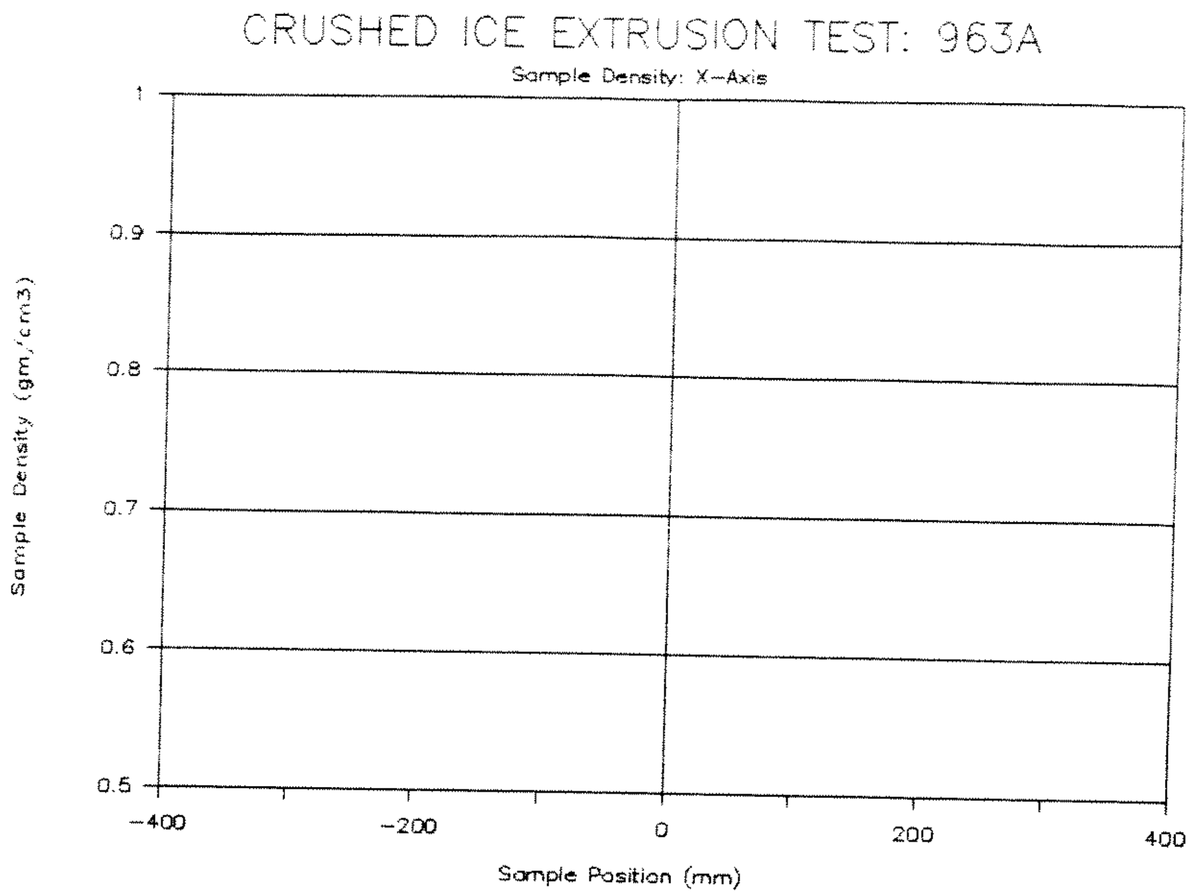

CRUSHED ICE EXTRUSION TEST: 998
Mean Sample Thickness: Y–Axis
Mean Sample Thickness (mm)
Sample Position (mm)
27
26
25
24
23
22
–300
–100
100
300

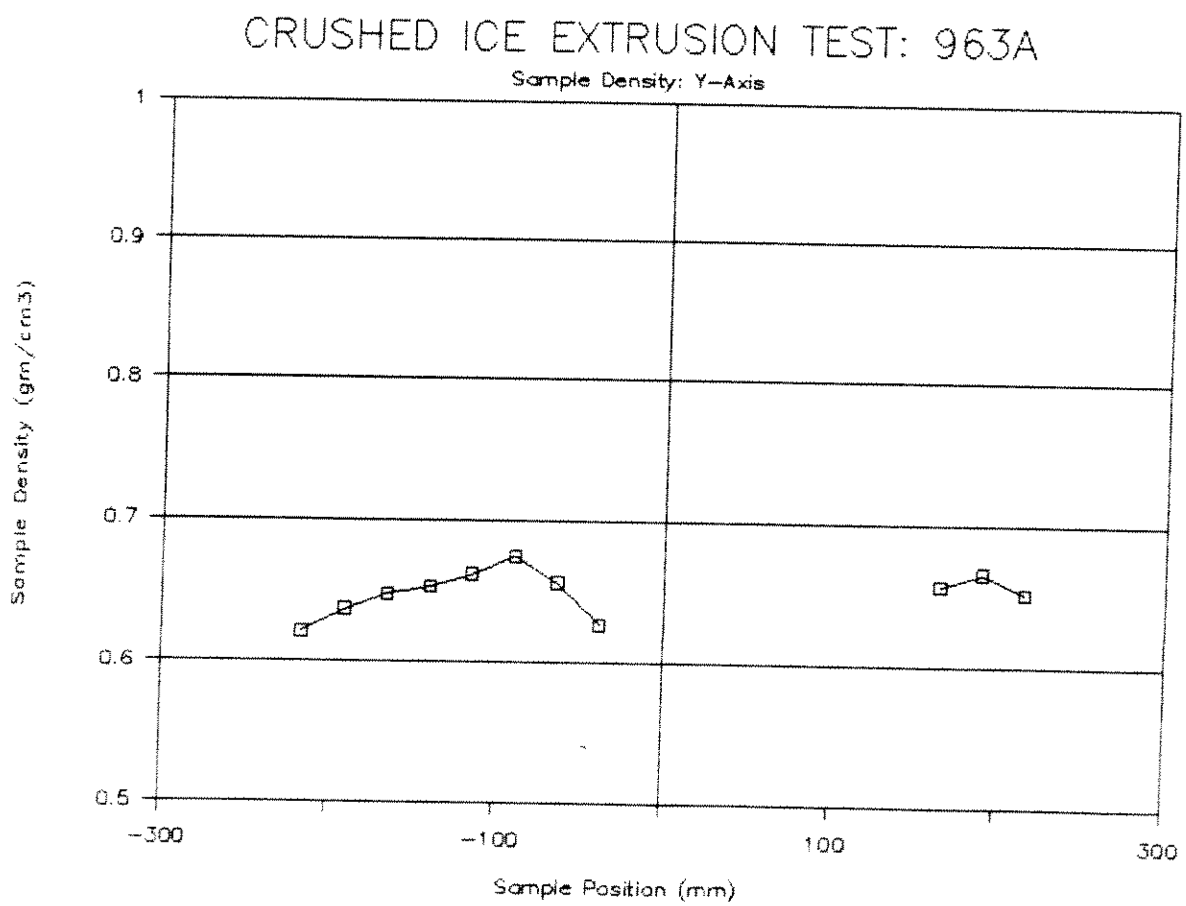


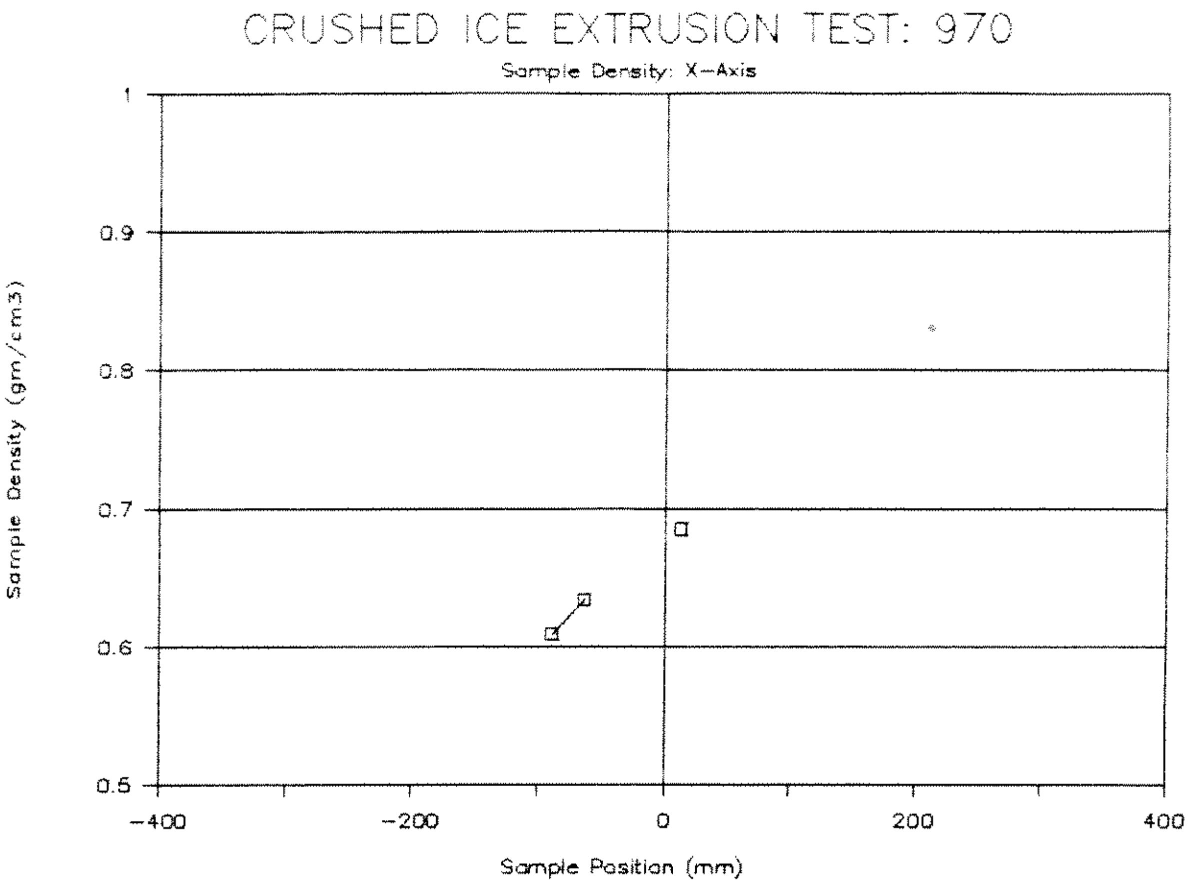
CRUSHED ICE EXTRUSION TEST: 963
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

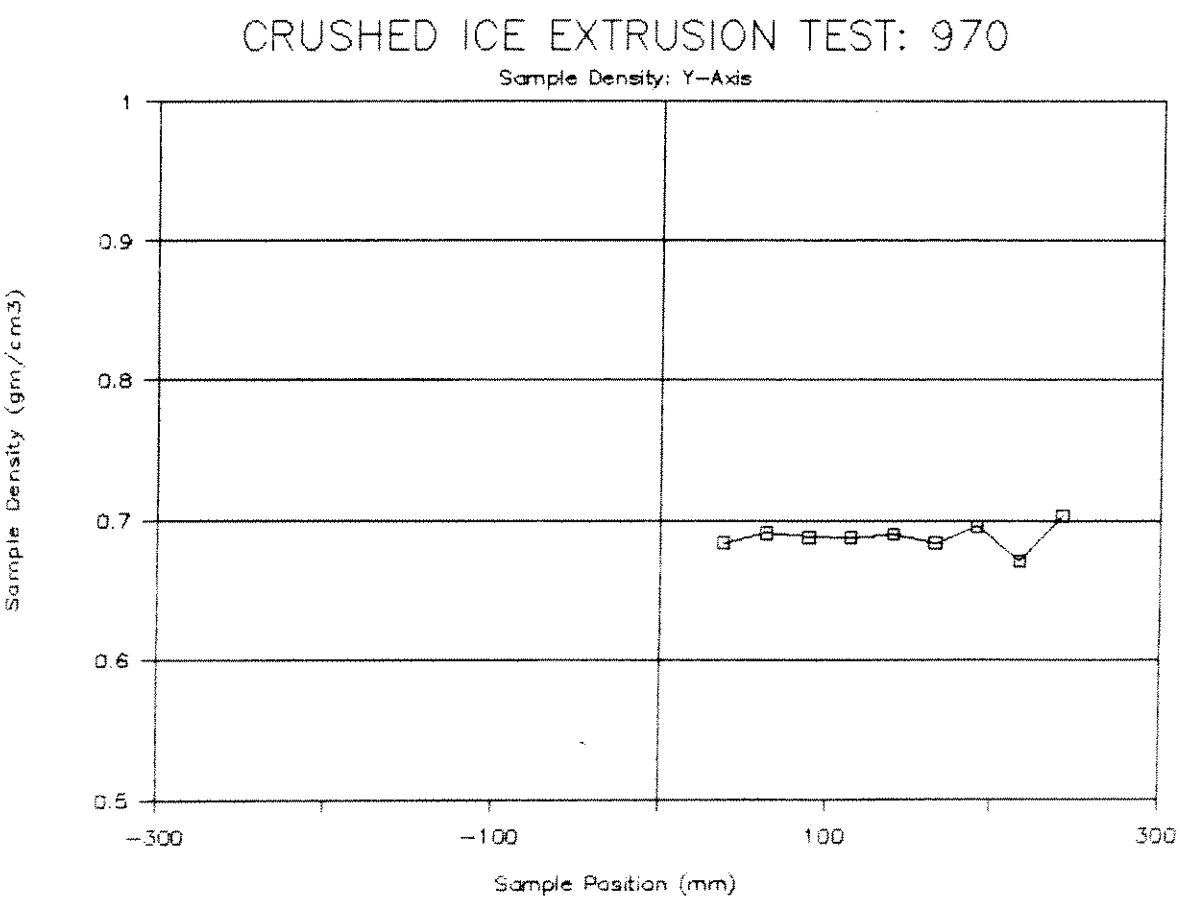


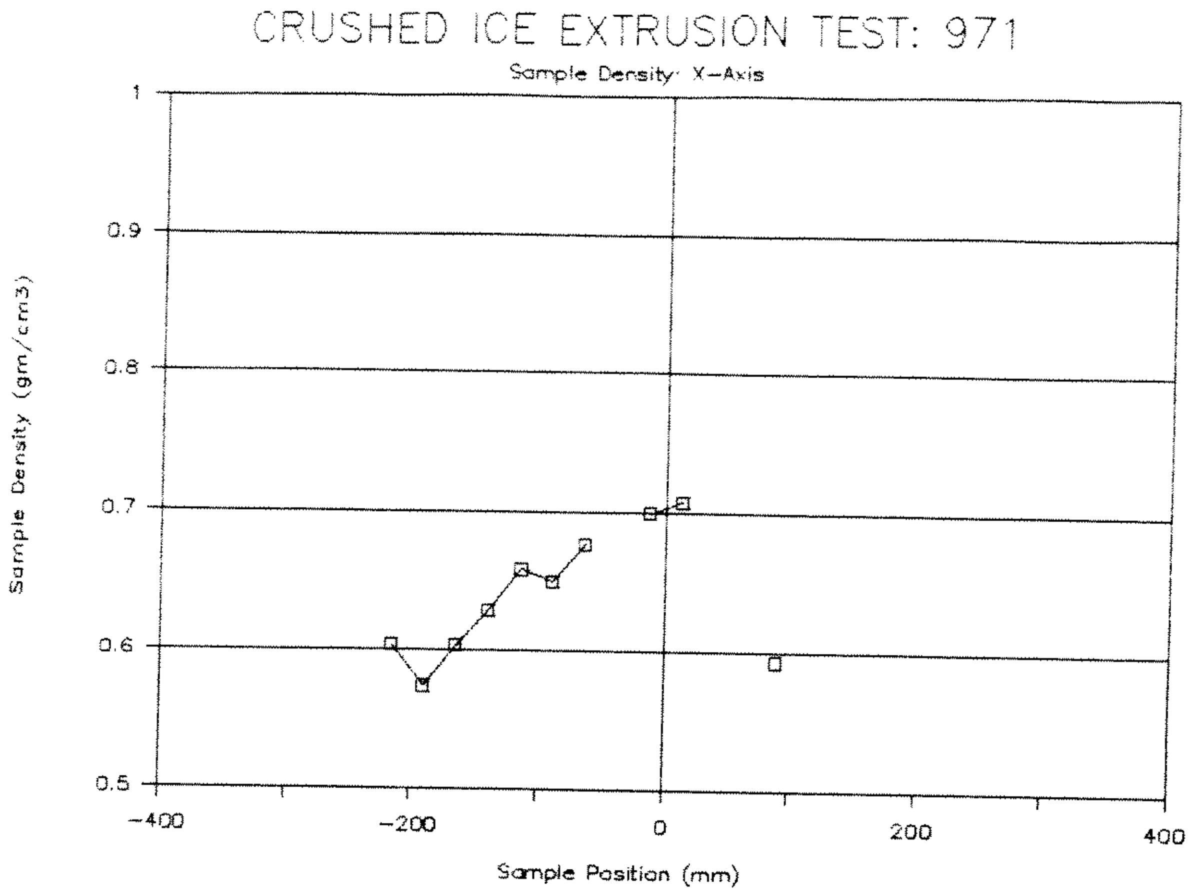
CRUSHED ICE EXTRUSION TEST: 963
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

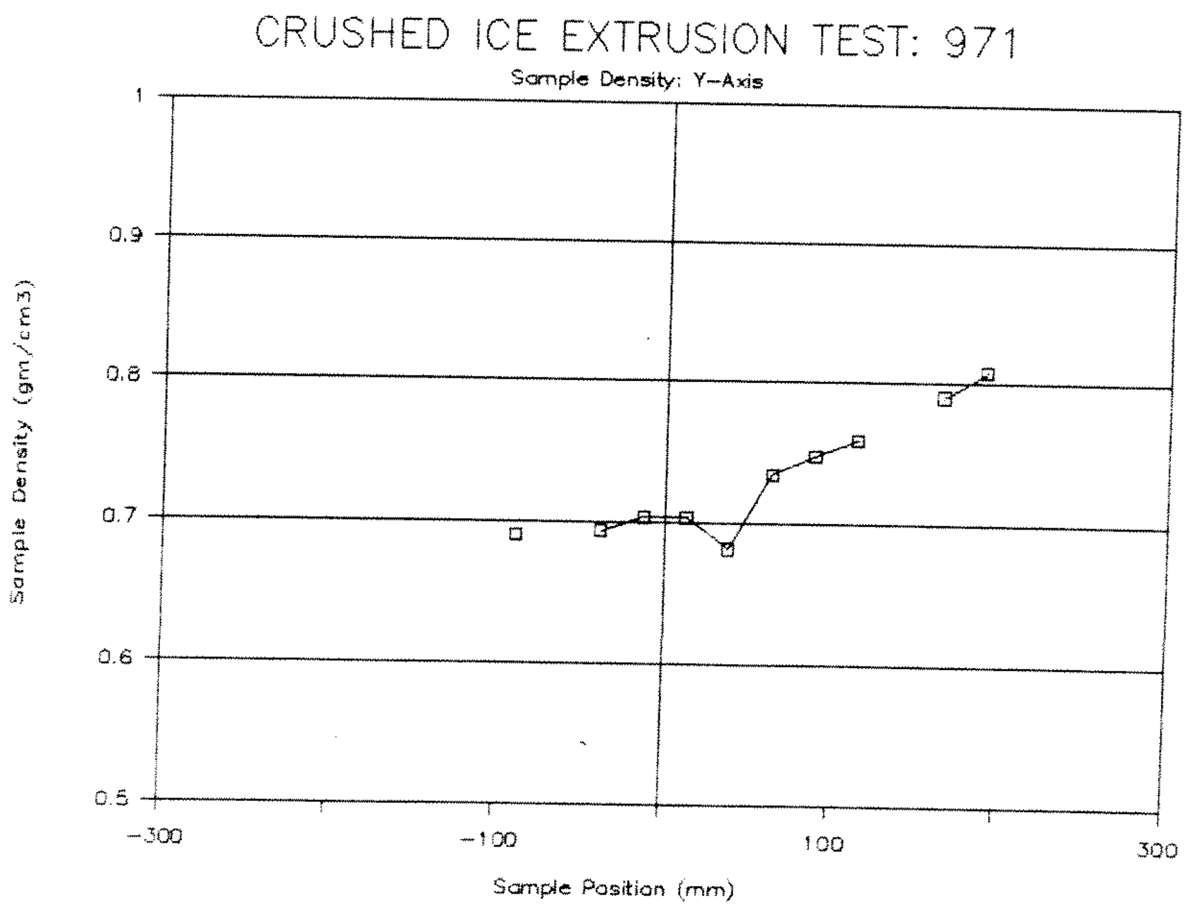

CRUSHED ICE EXTRUSION TEST: 963A
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

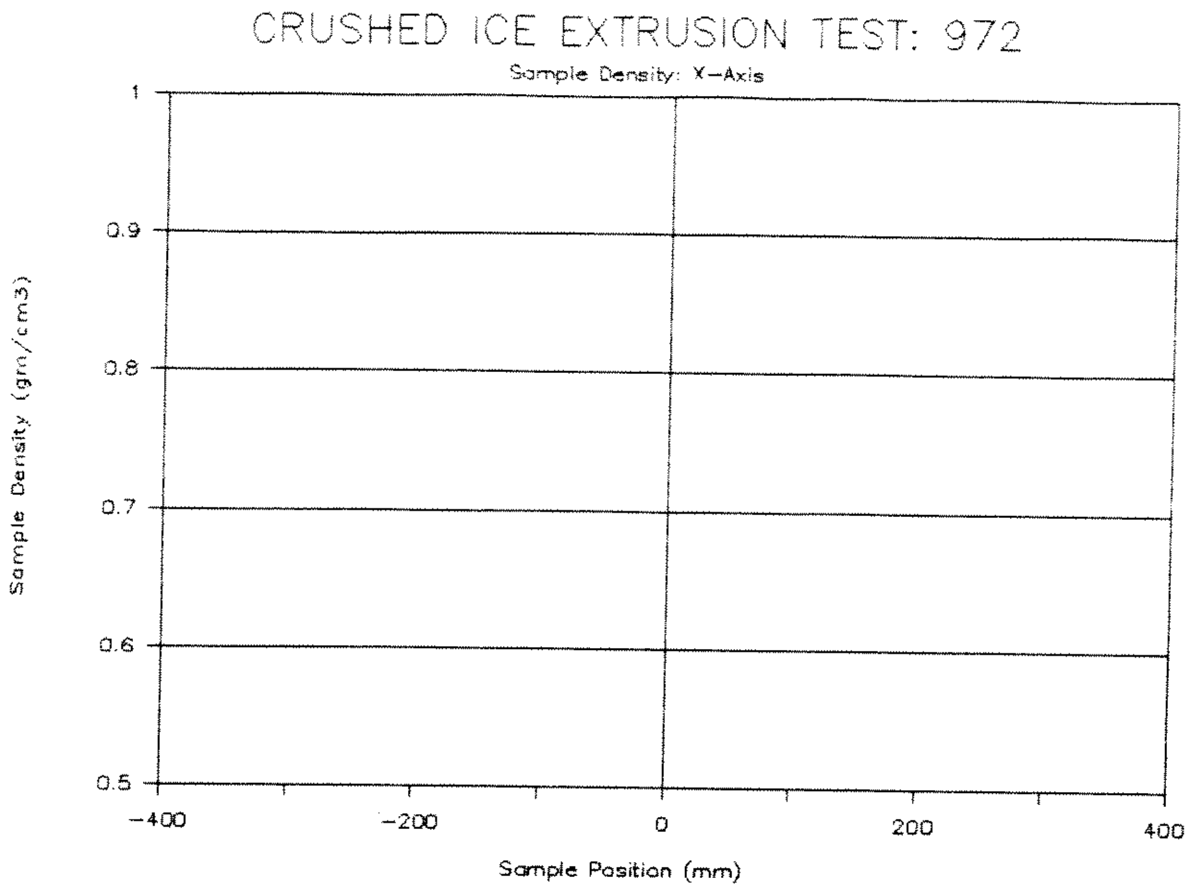

CRUSHED ICE EXTRUSION TEST: 963A
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

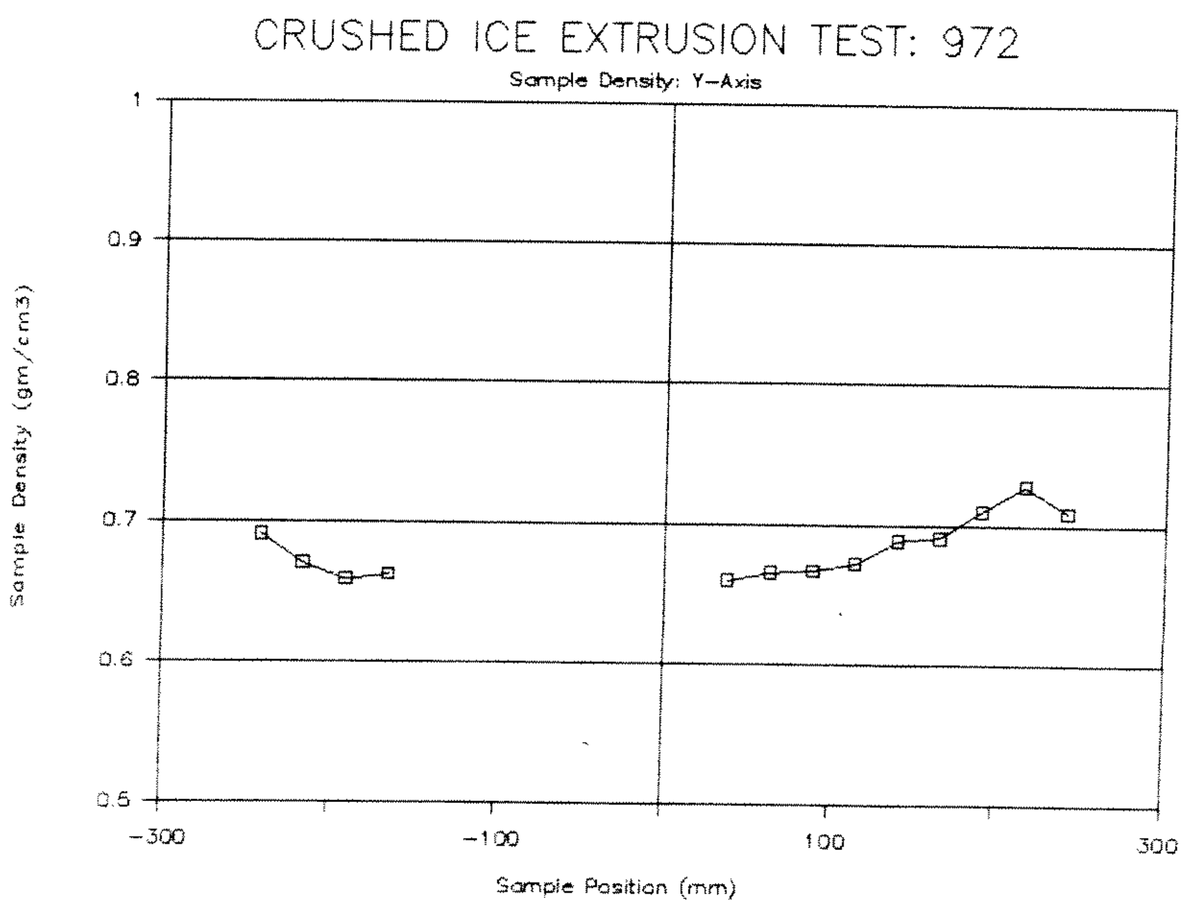

CRUSHED ICE EXTRUSION TEST: 970
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
−400
−200
0
200
400
Sample Position (mm)

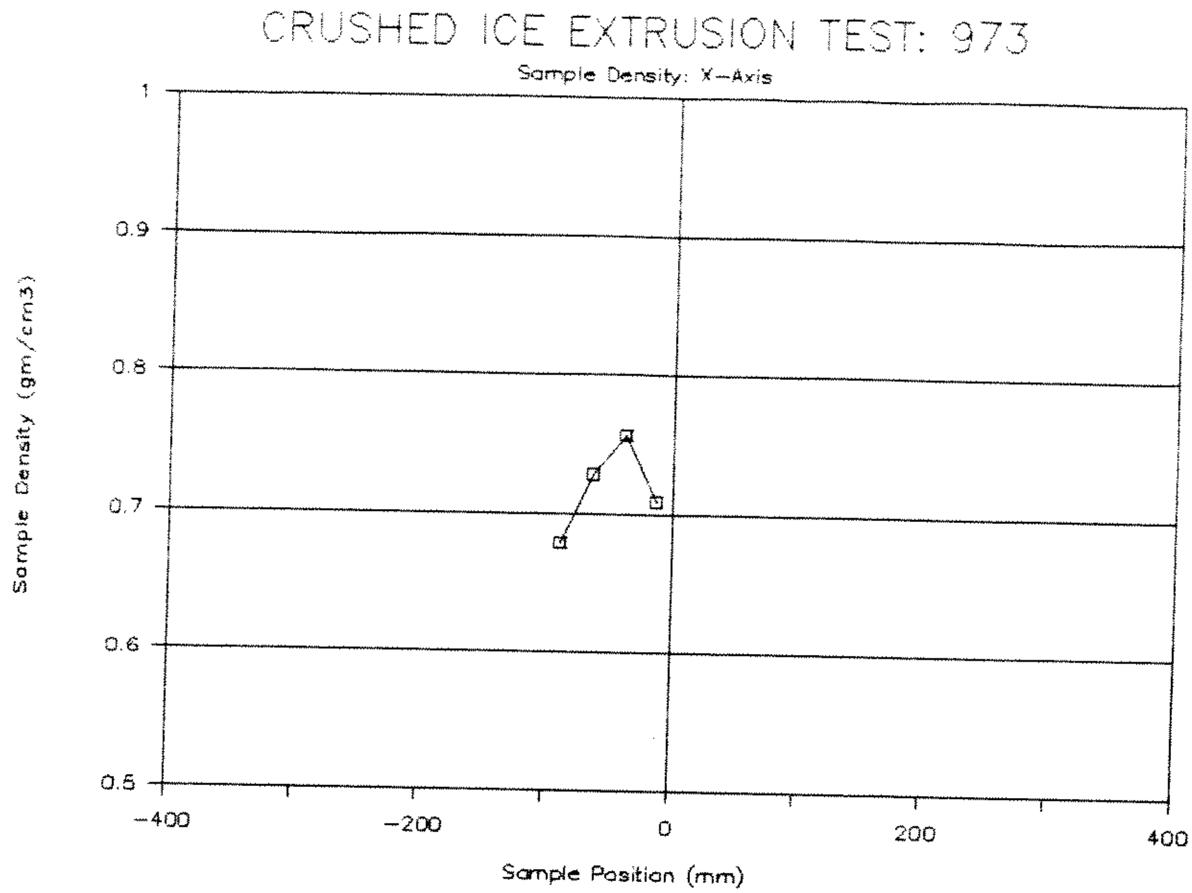

CRUSHED ICE EXTRUSION TEST: 970
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
−300
−100
100
300
Sample Position (mm)

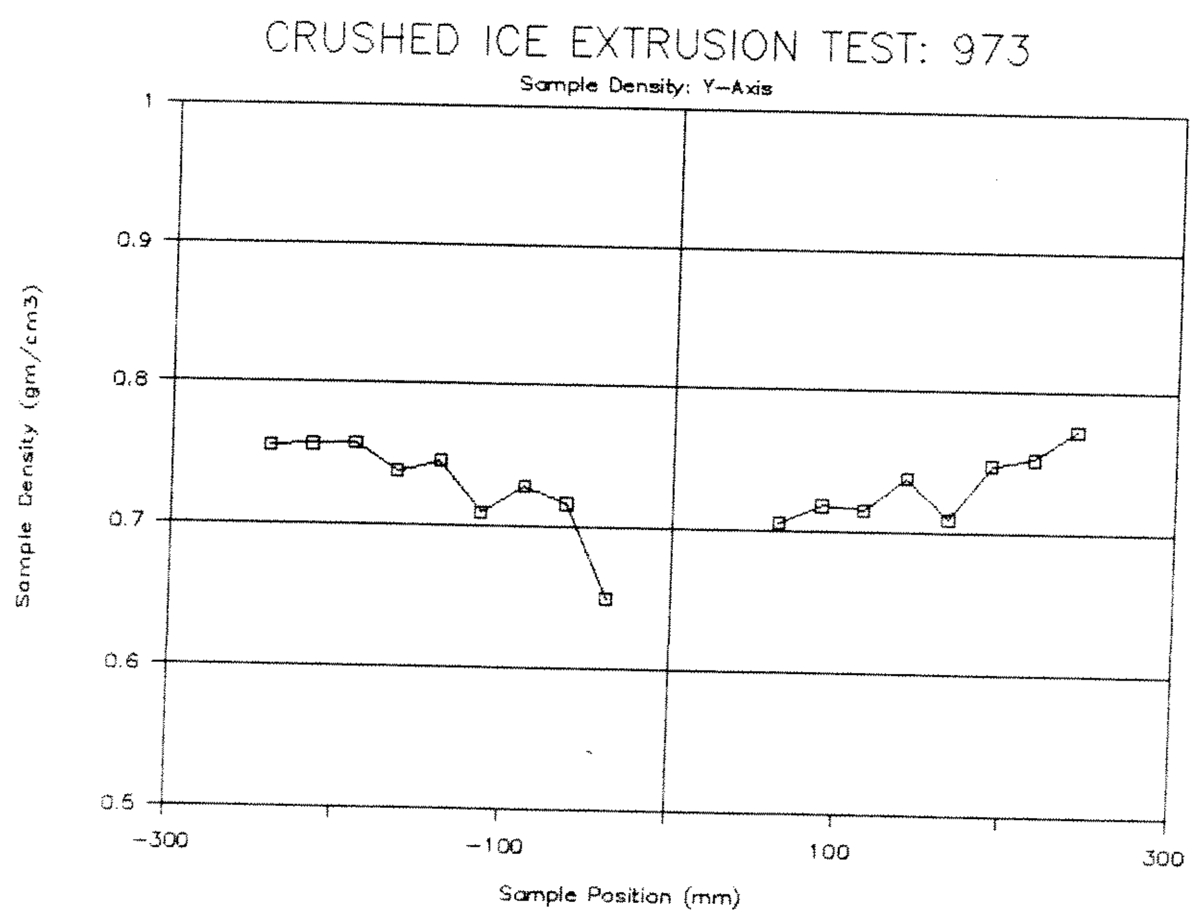

CRUSHED ICE EXTRUSION TEST: 971
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

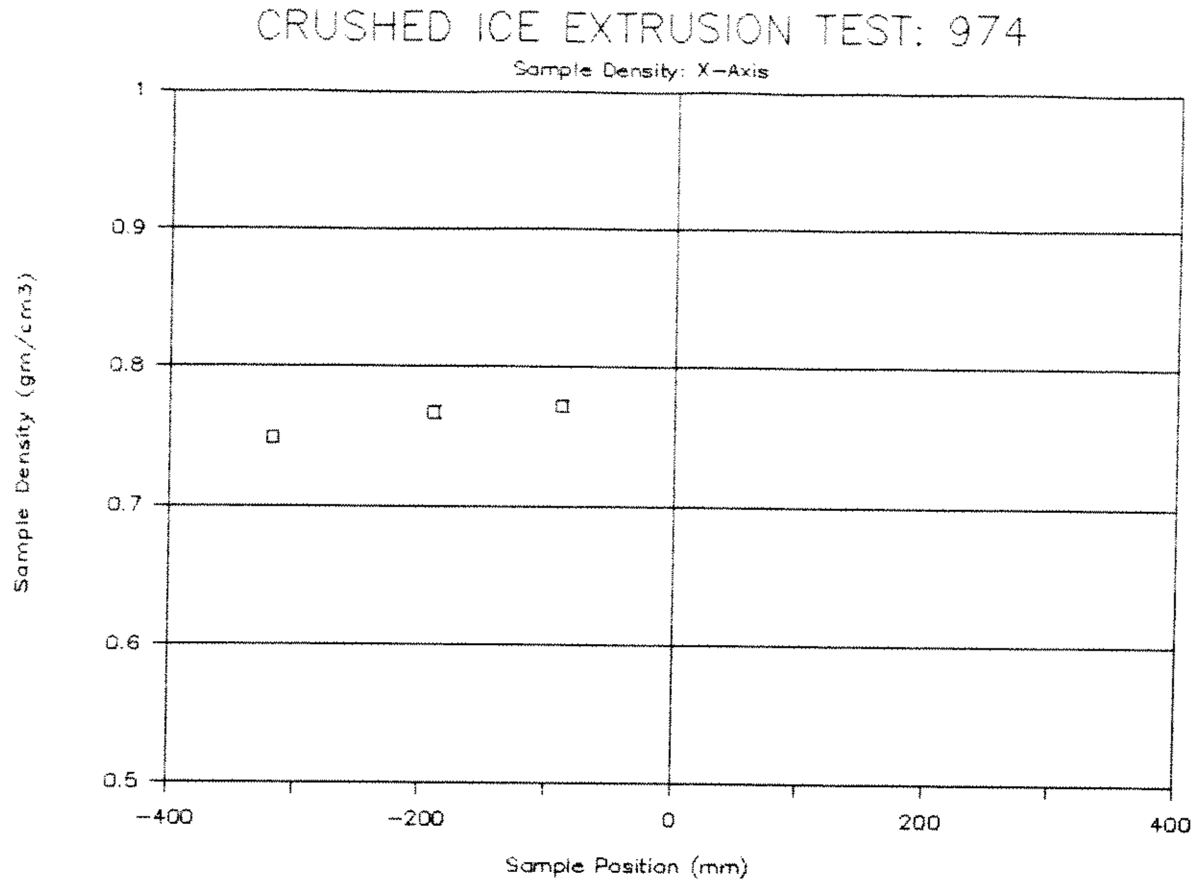

CRUSHED ICE EXTRUSION TEST: 971
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

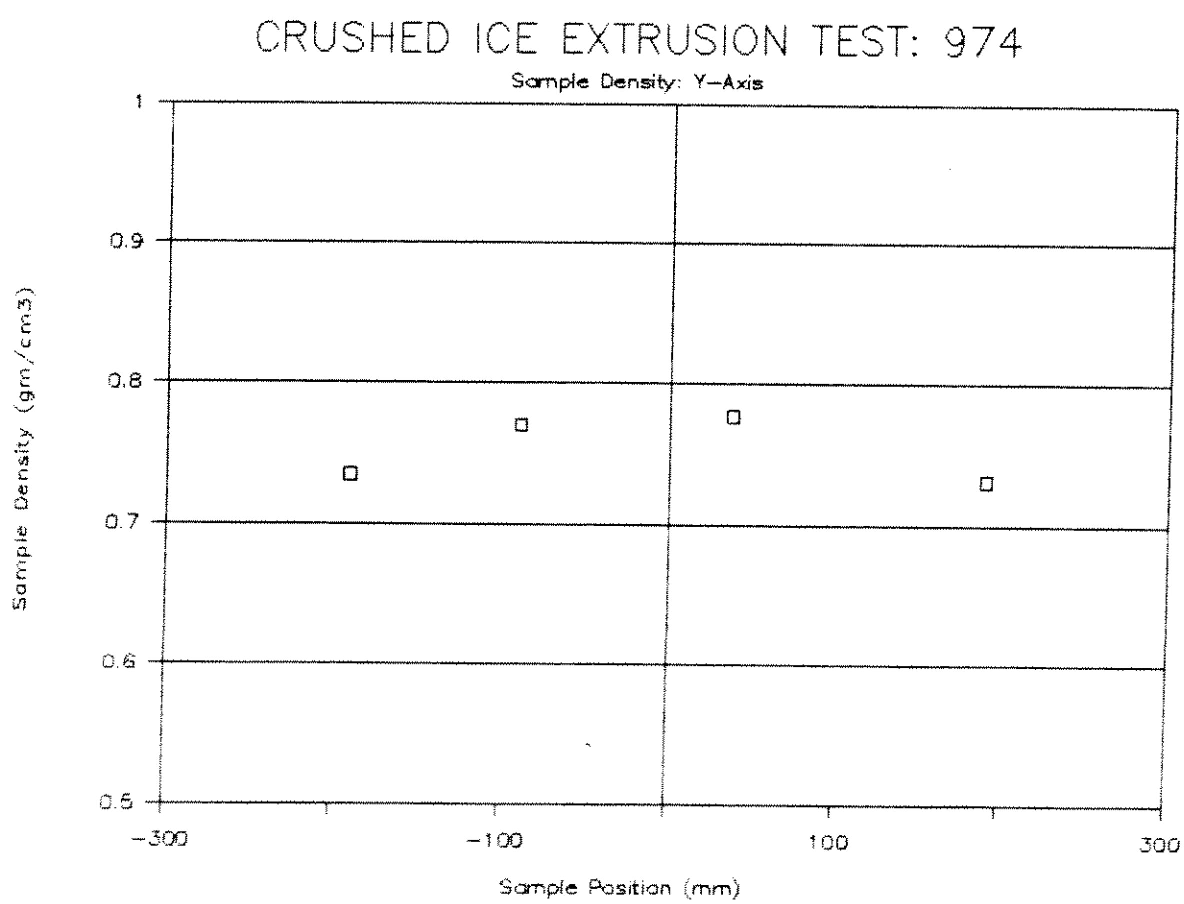

CRUSHED ICE EXTRUSION TEST: 972
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

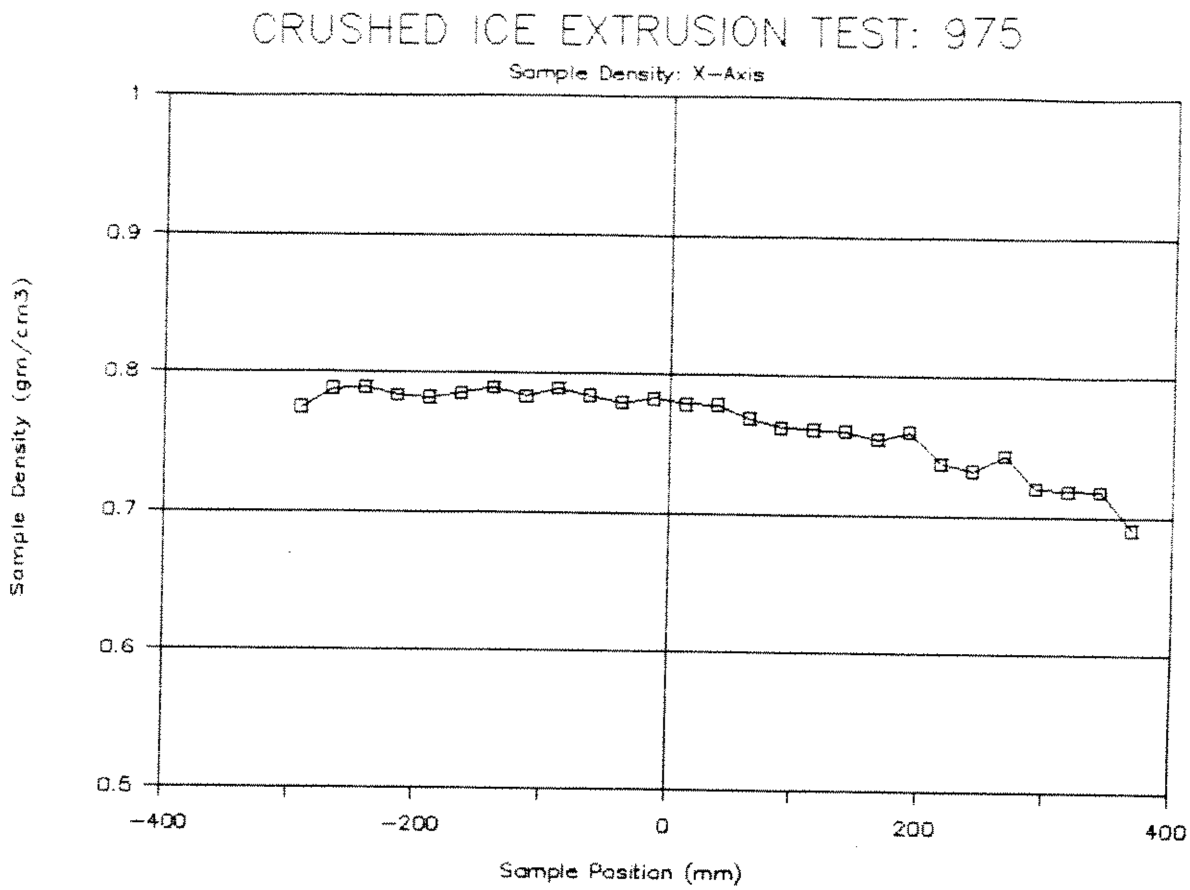

CRUSHED ICE EXTRUSION TEST: 972
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

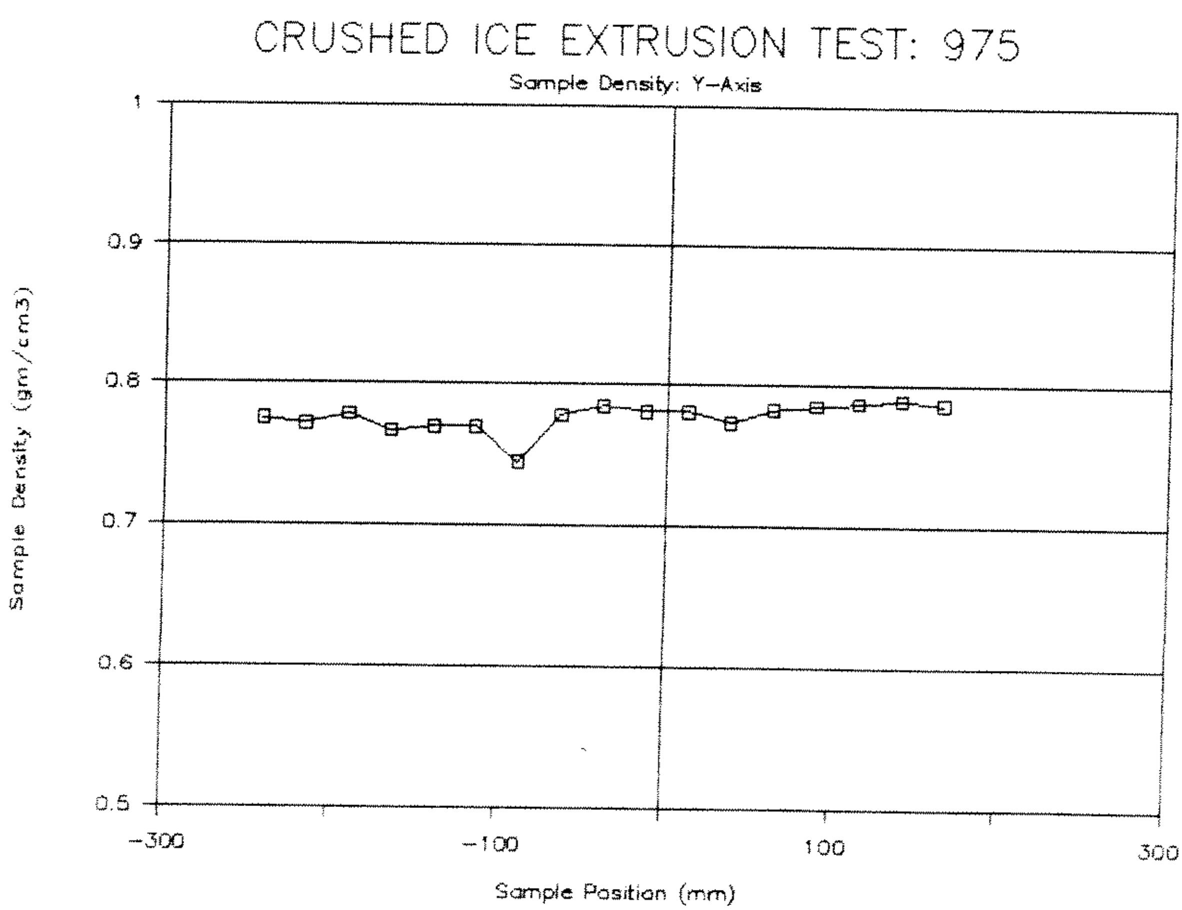

CRUSHED ICE EXTRUSION TEST: 973
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

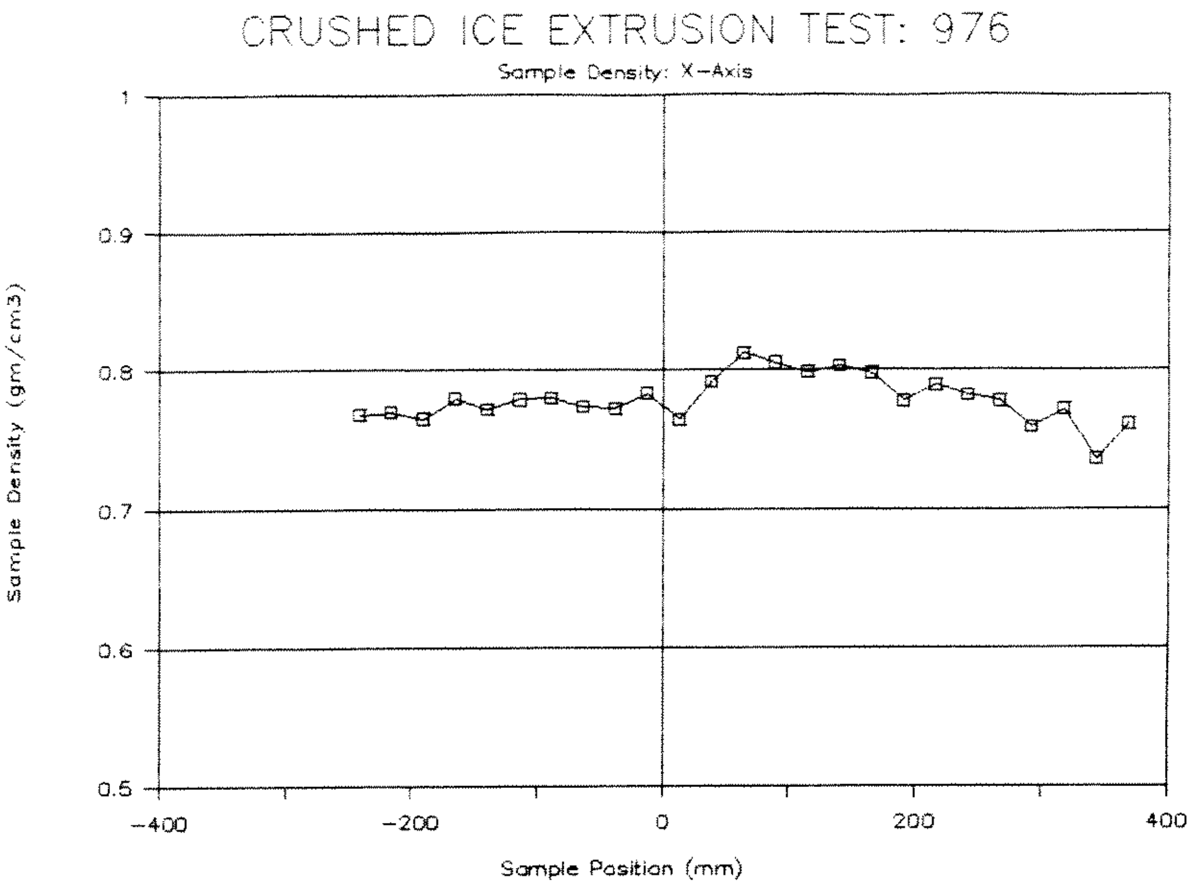

CRUSHED ICE EXTRUSION TEST: 973
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

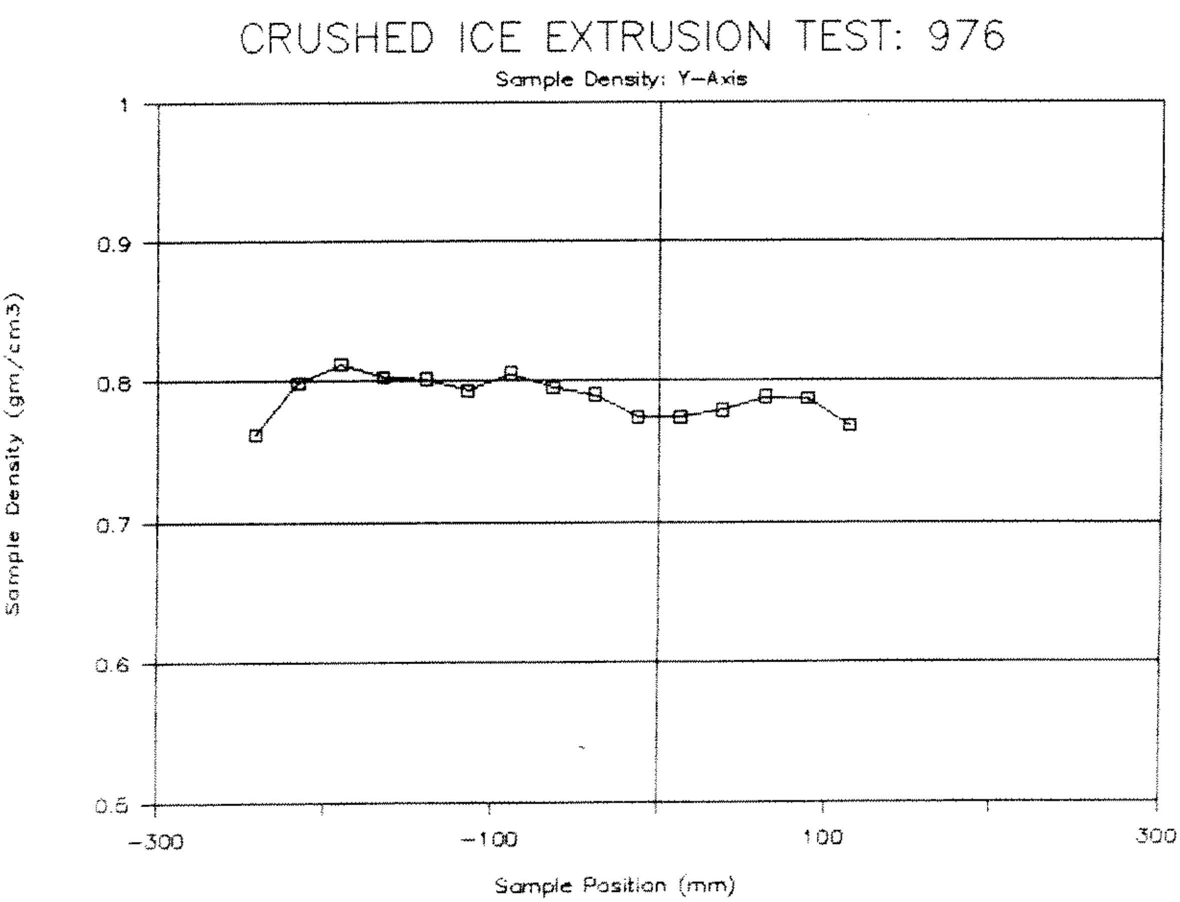

CRUSHED ICE EXTRUSION TEST: 974
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

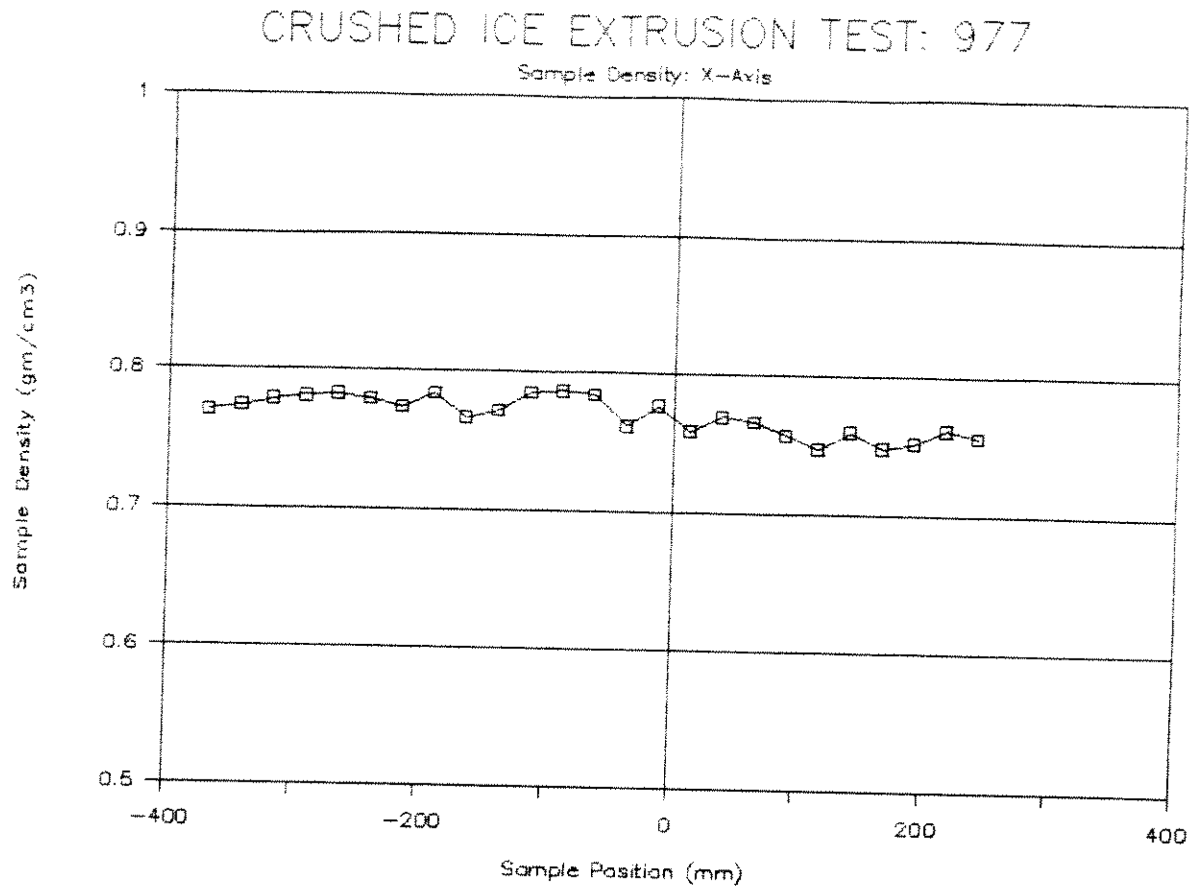

CRUSHED ICE EXTRUSION TEST: 974
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 975
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

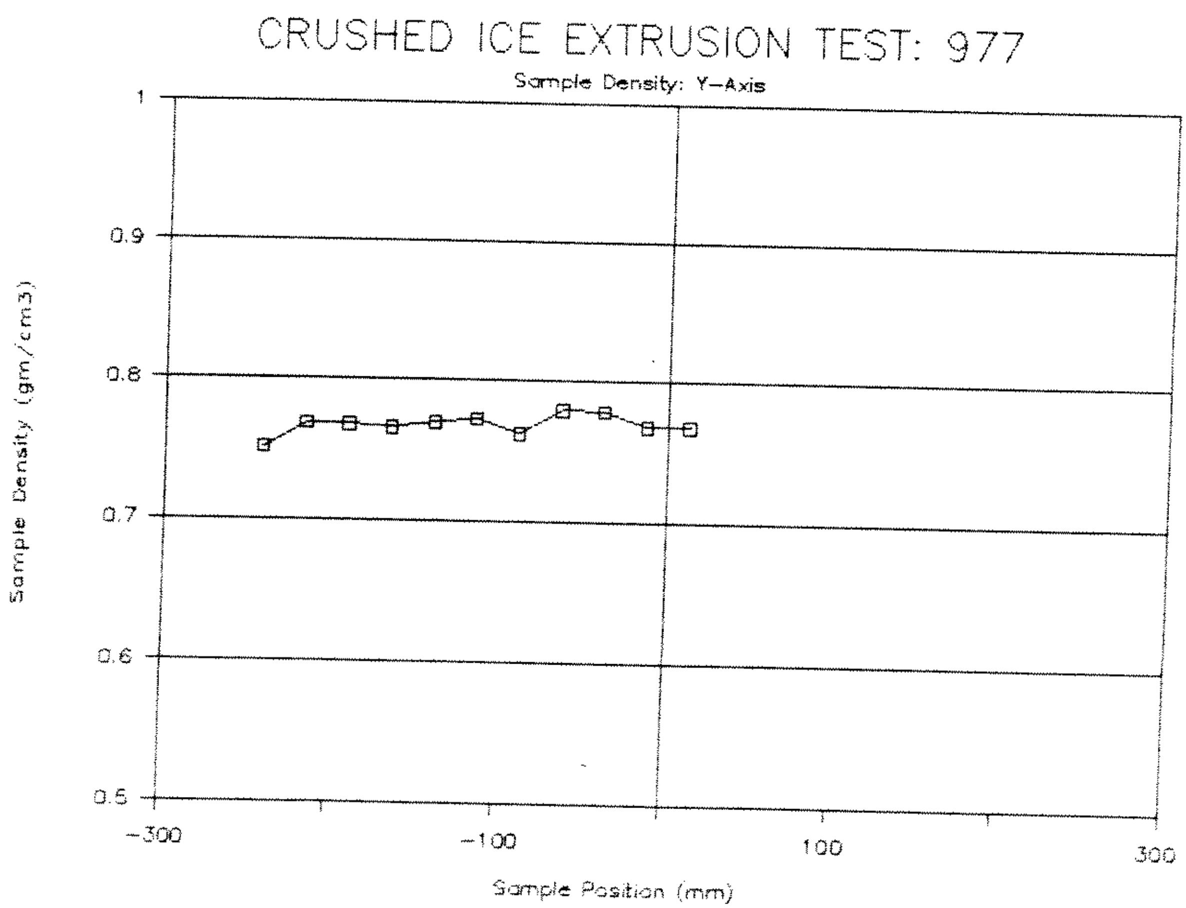

CRUSHED ICE EXTRUSION TEST: 975
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 976
Sample Density: X-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400

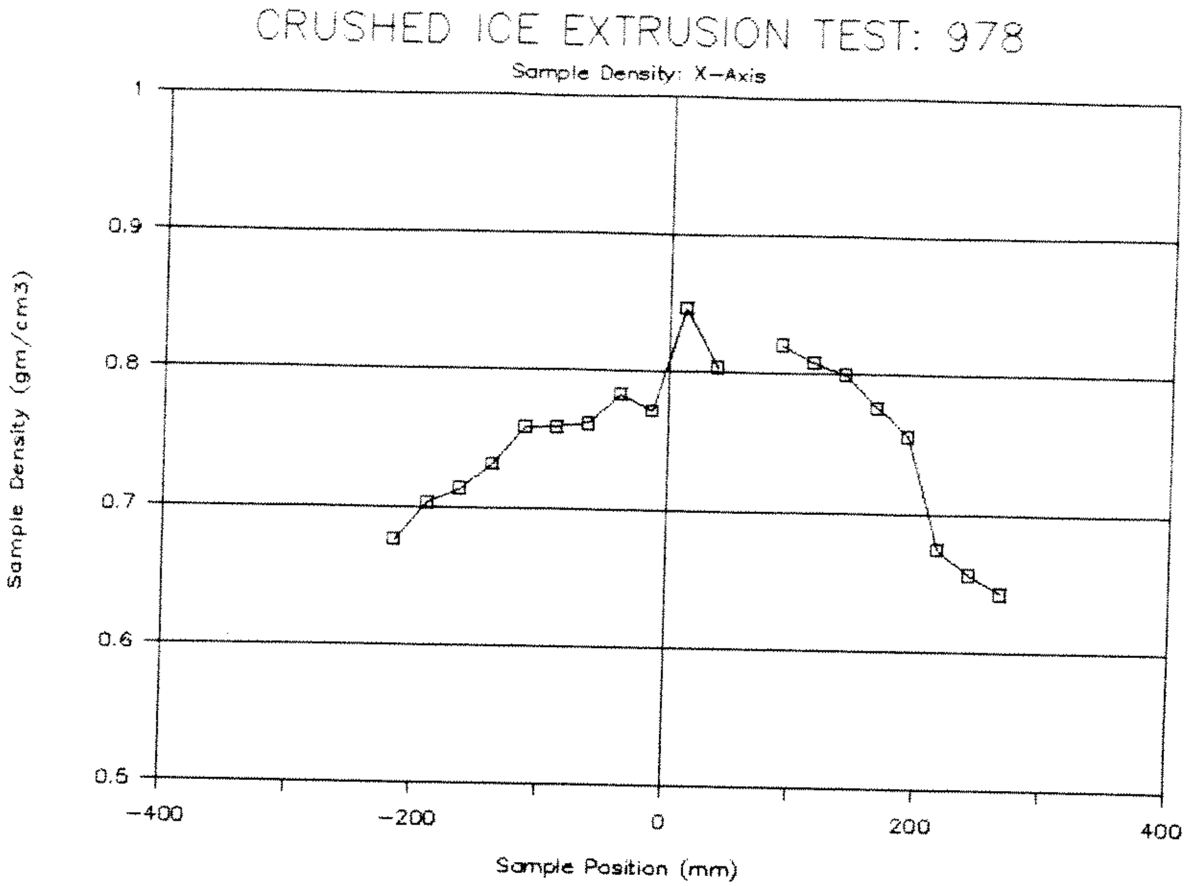

CRUSHED ICE EXTRUSION TEST: 976
Sample Density: Y-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300

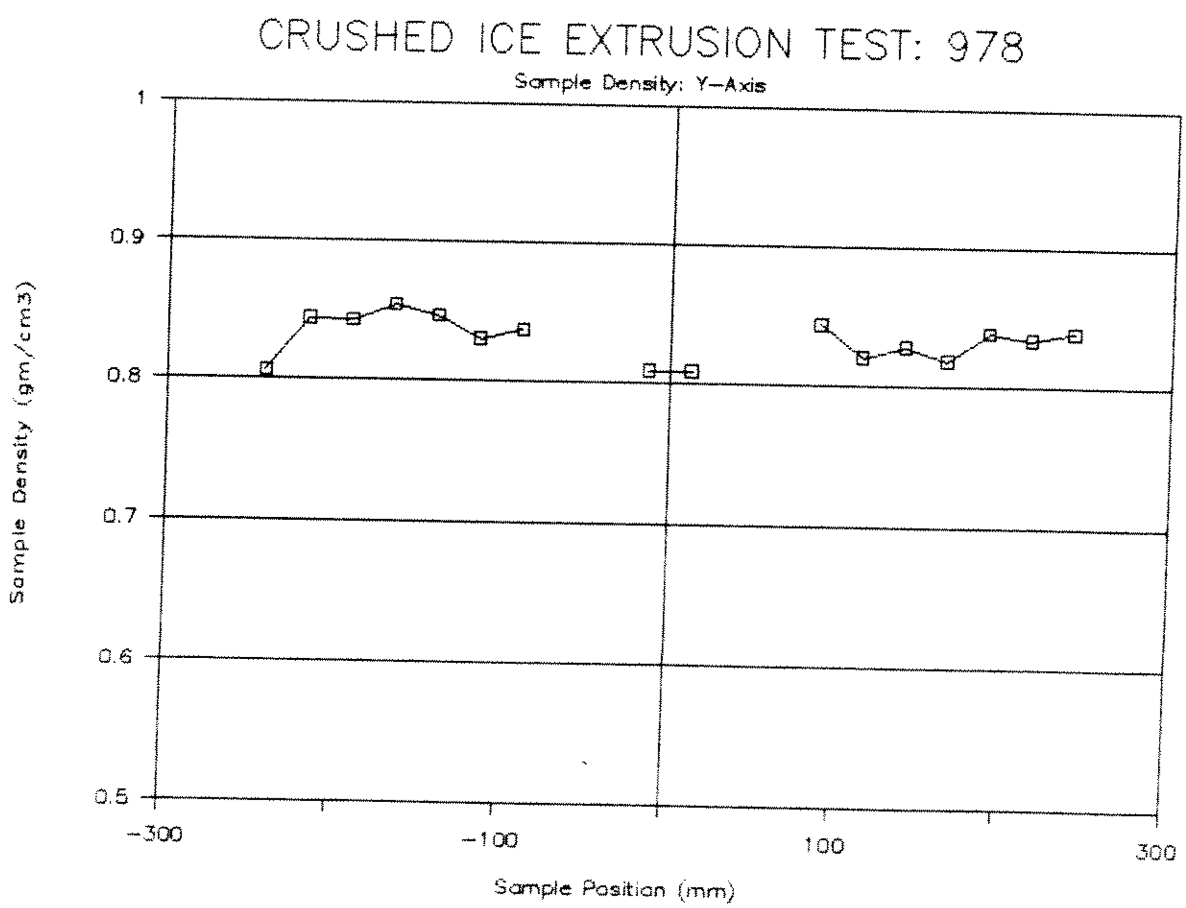


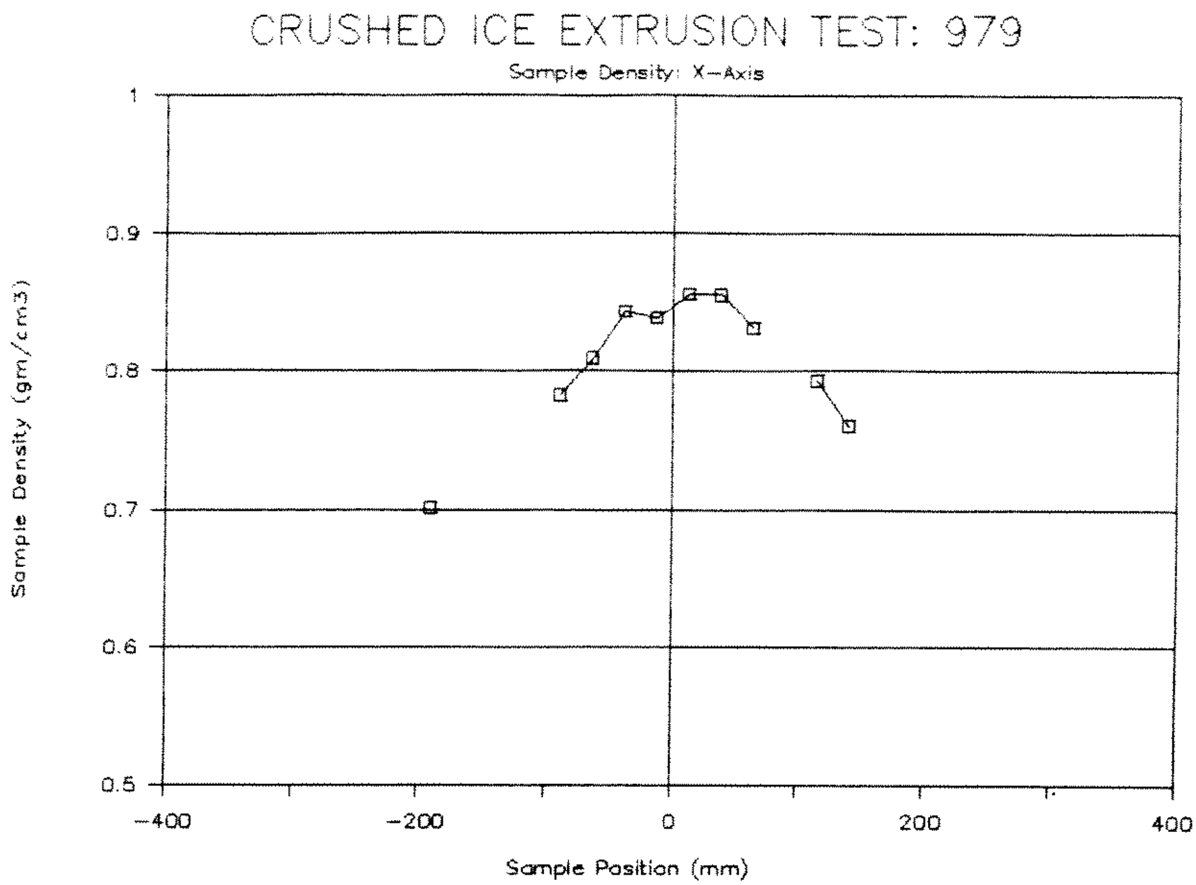
CRUSHED ICE EXTRUSION TEST: 977
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

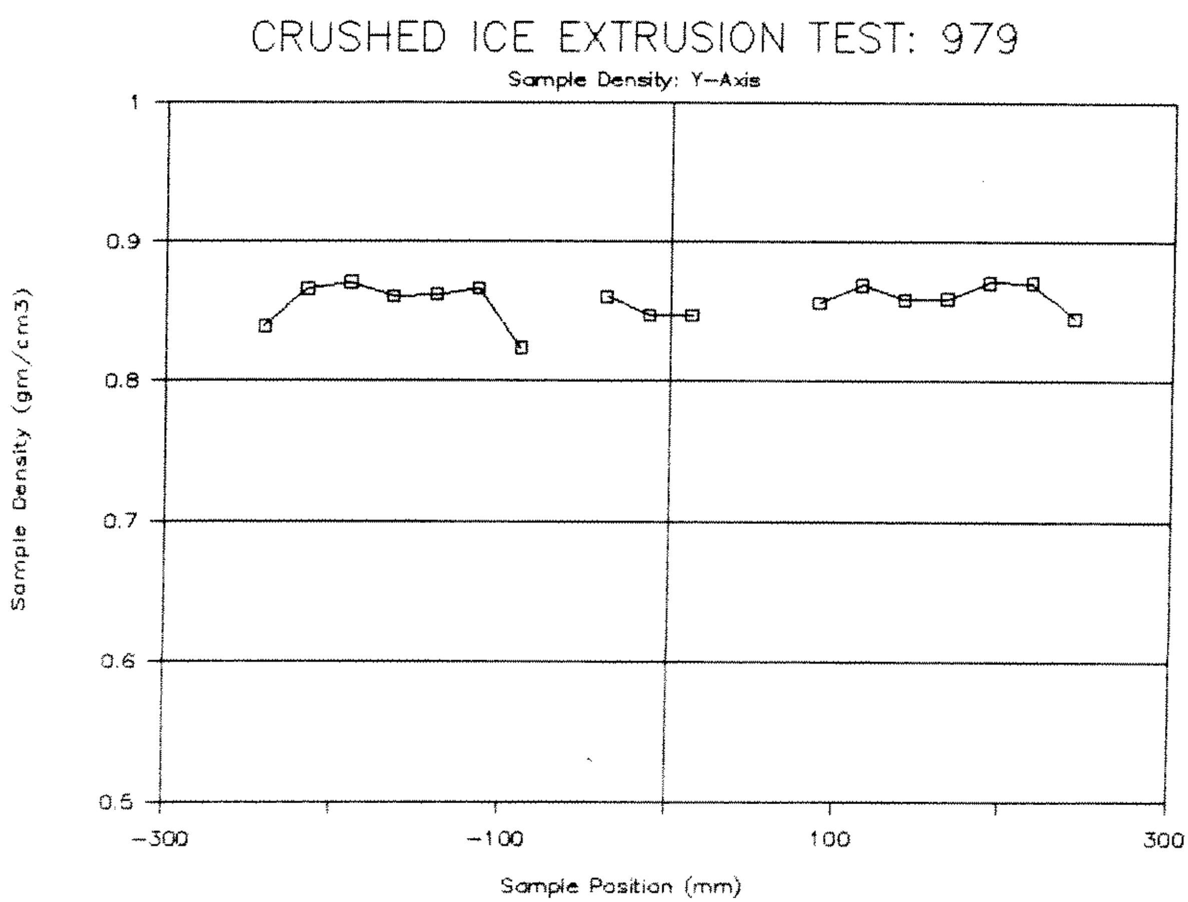


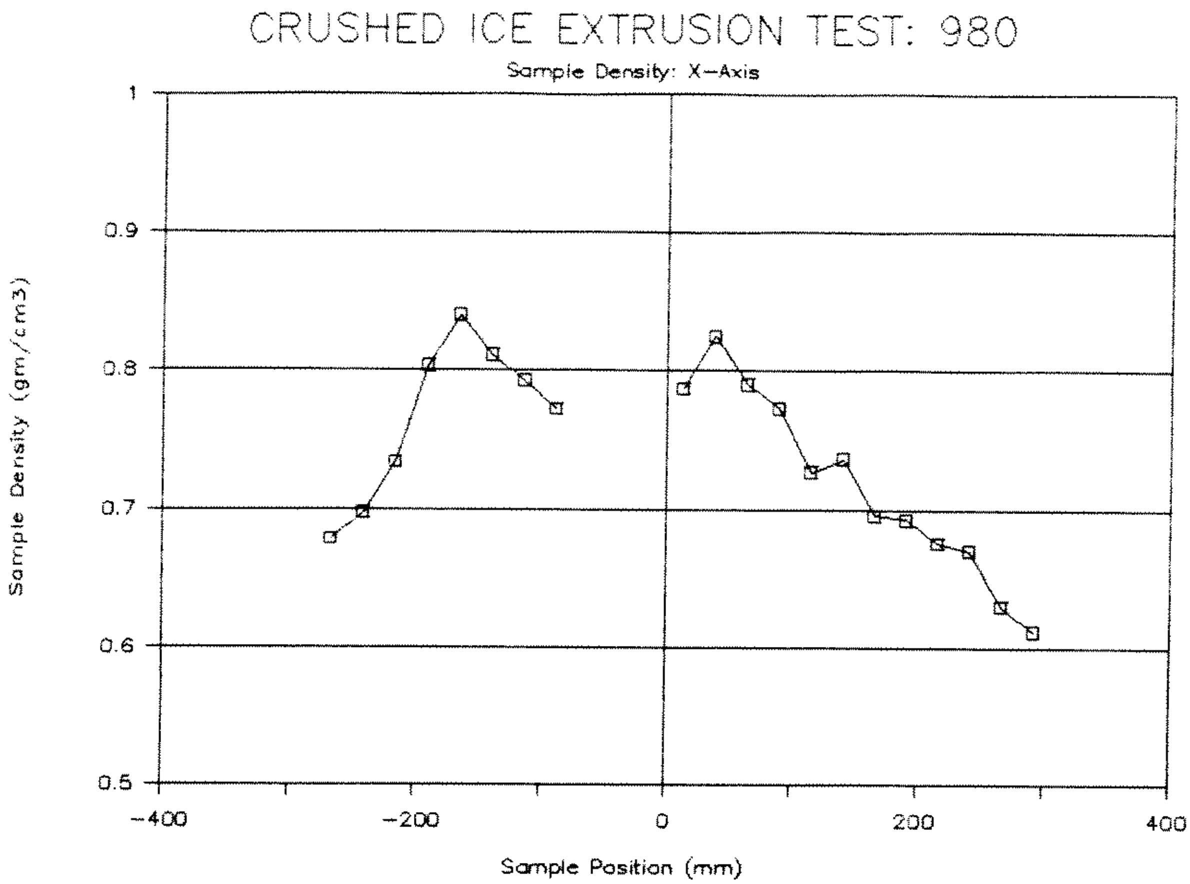
CRUSHED ICE EXTRUSION TEST: 977
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

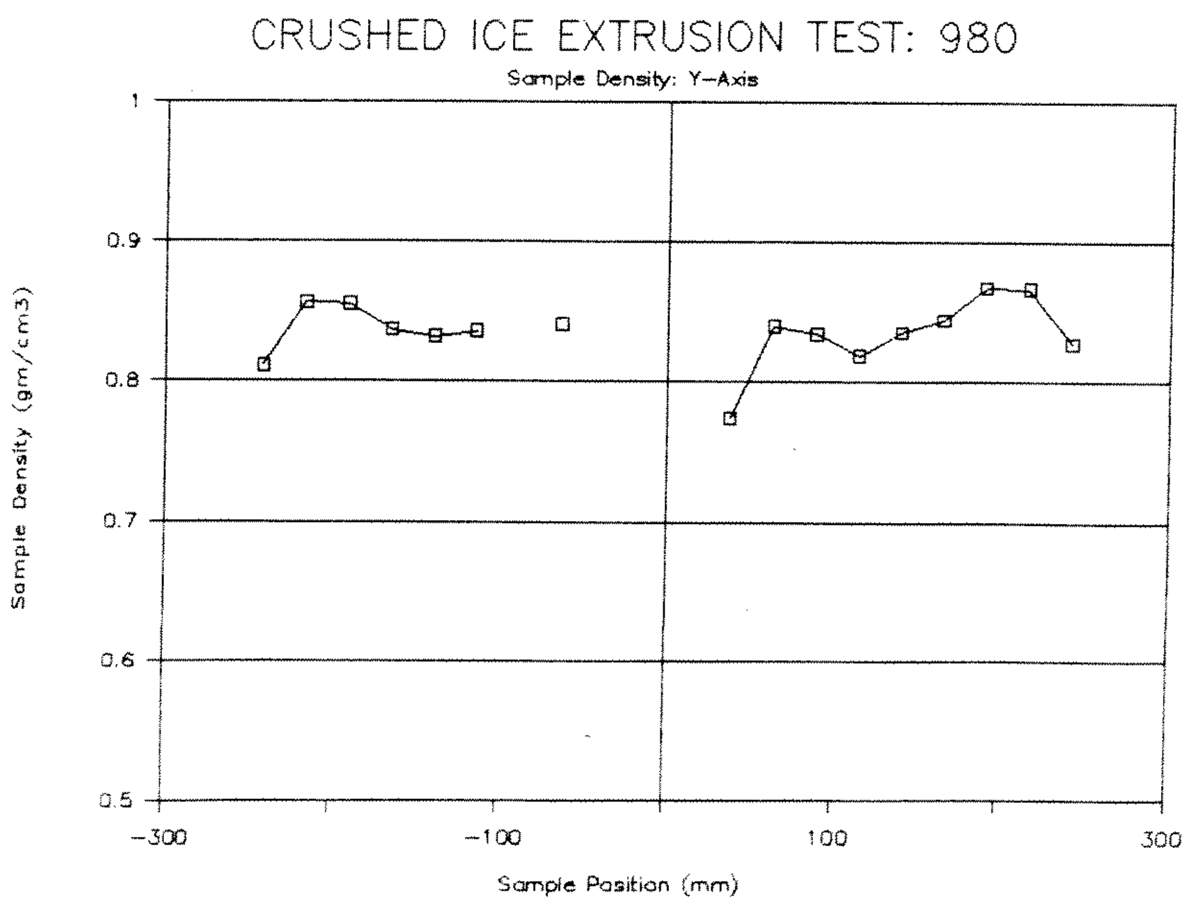

CRUSHED ICE EXTRUSION TEST: 978
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

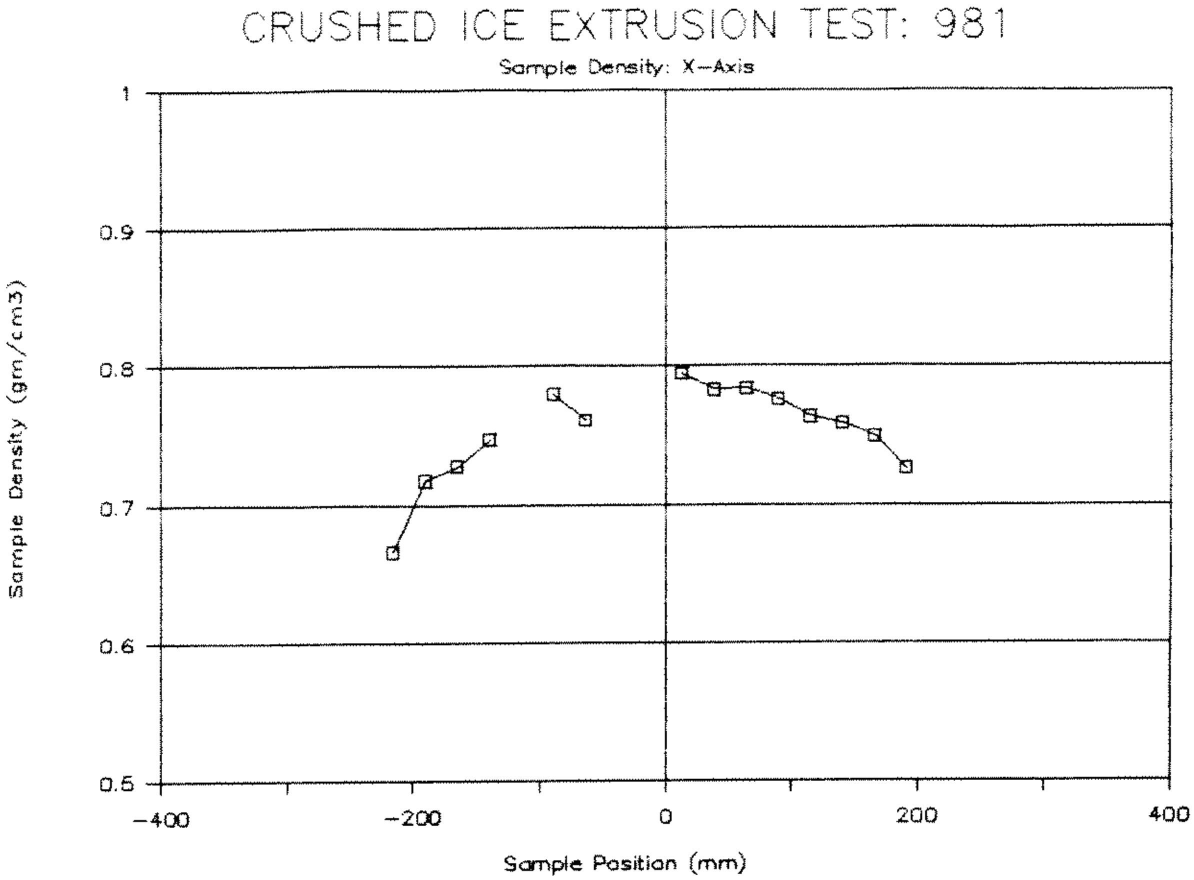

CRUSHED ICE EXTRUSION TEST: 978
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

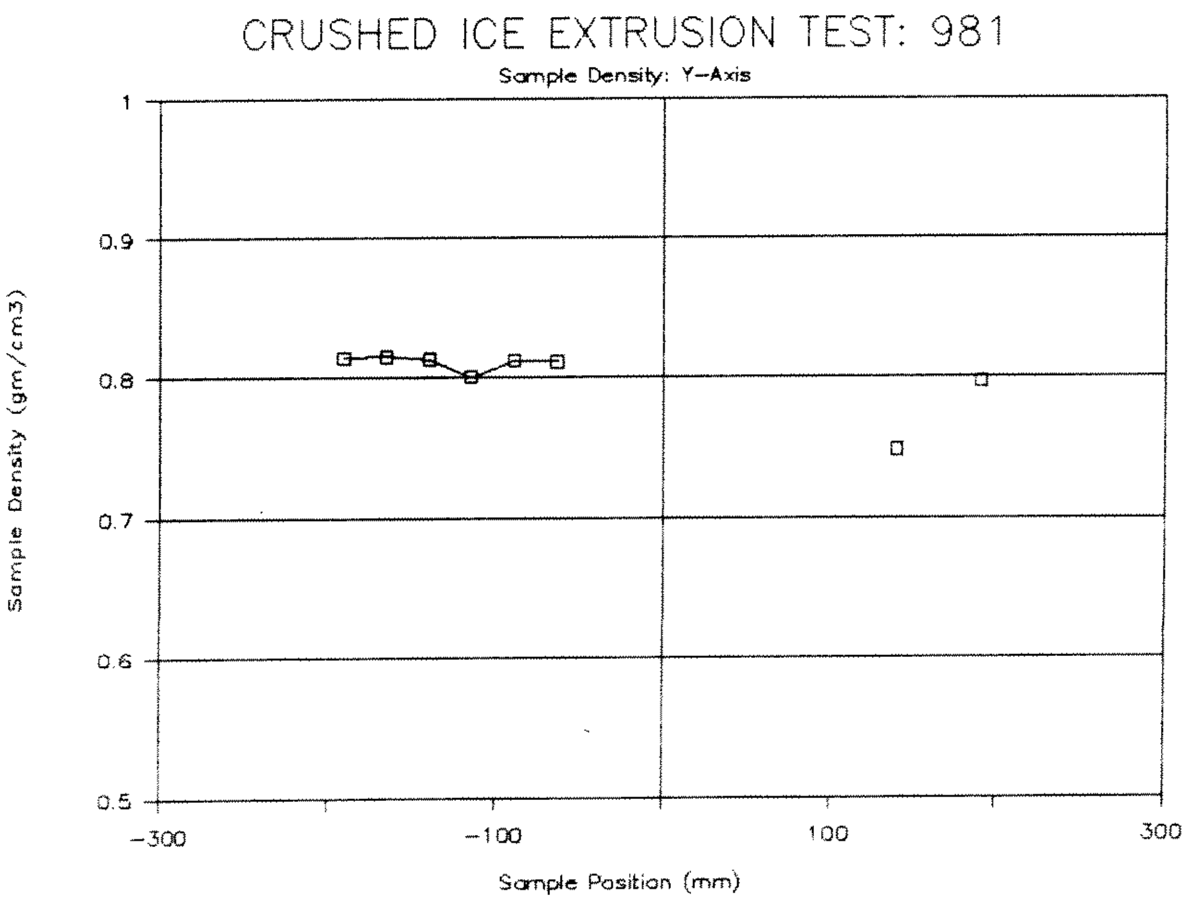

CRUSHED ICE EXTRUSION TEST: 979
Sample Density: X-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
−400
−200
0
200
400


CRUSHED ICE EXTRUSION TEST: 979
Sample Density: Y-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
−300
−100
100
300


CRUSHED ICE EXTRUSION TEST: 980
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

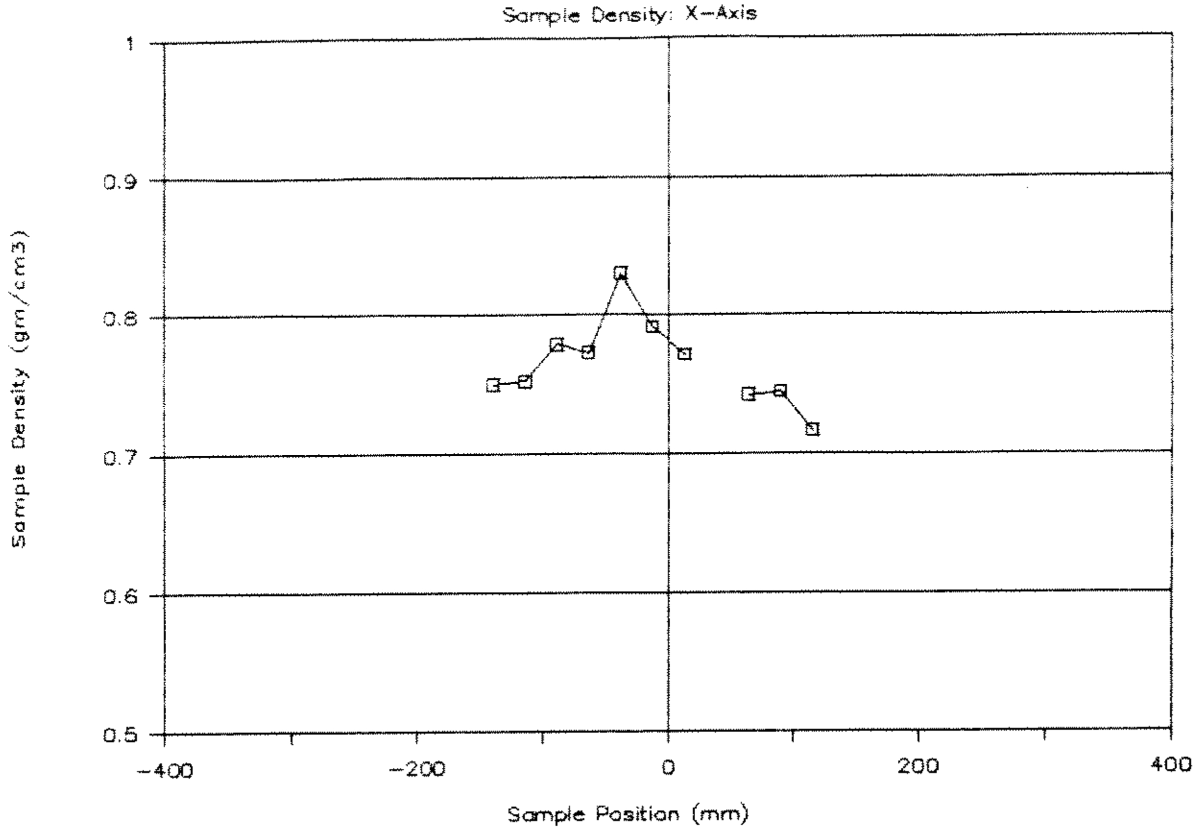

CRUSHED ICE EXTRUSION TEST: 980
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 981
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 981
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

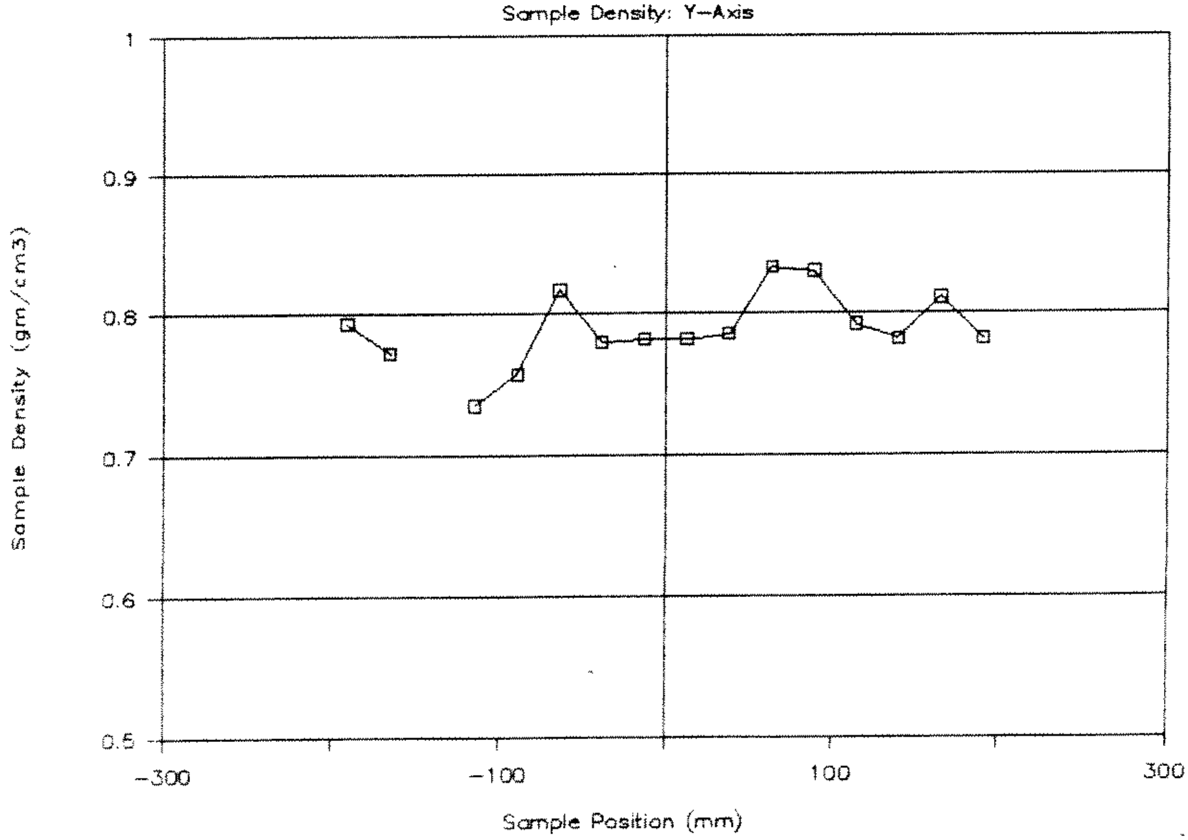
CRUSHED ICE EXTRUSION TEST: 982

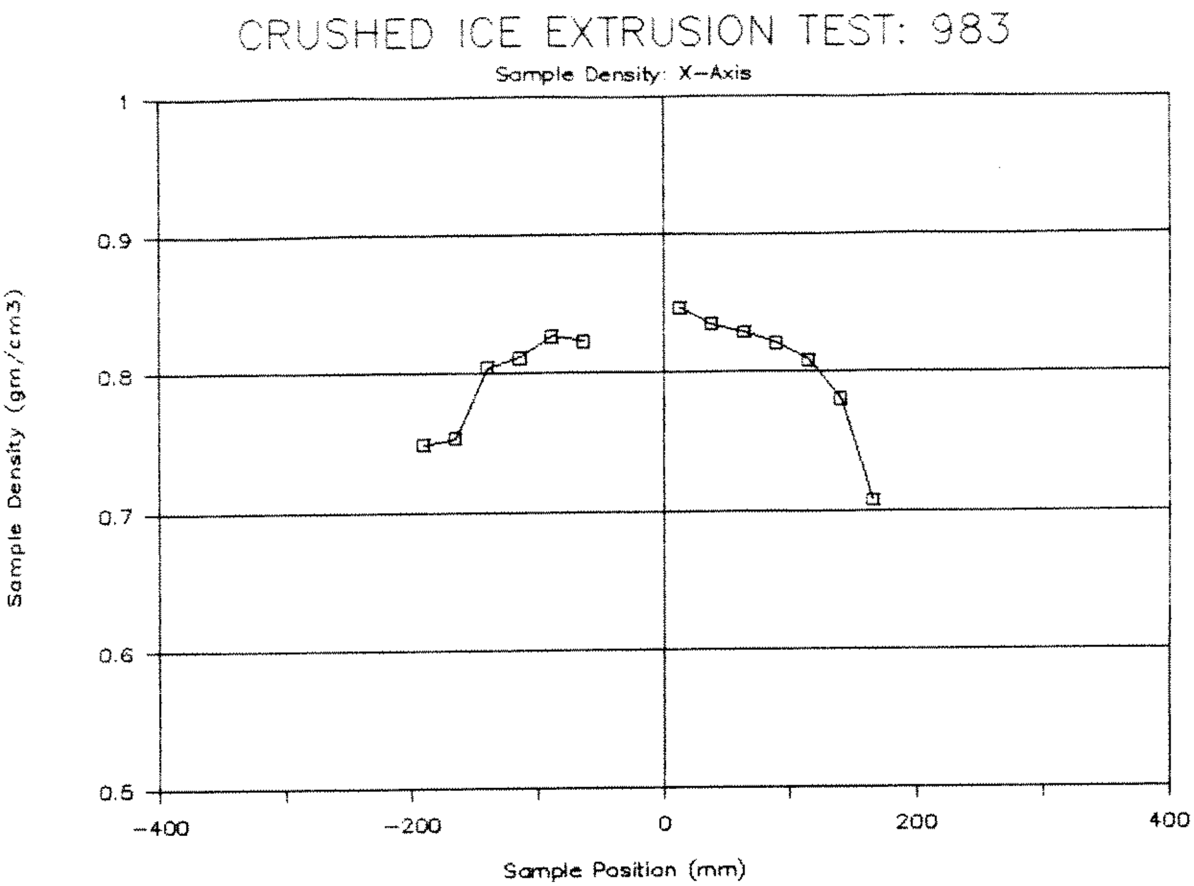
Sample Density: X-Axis

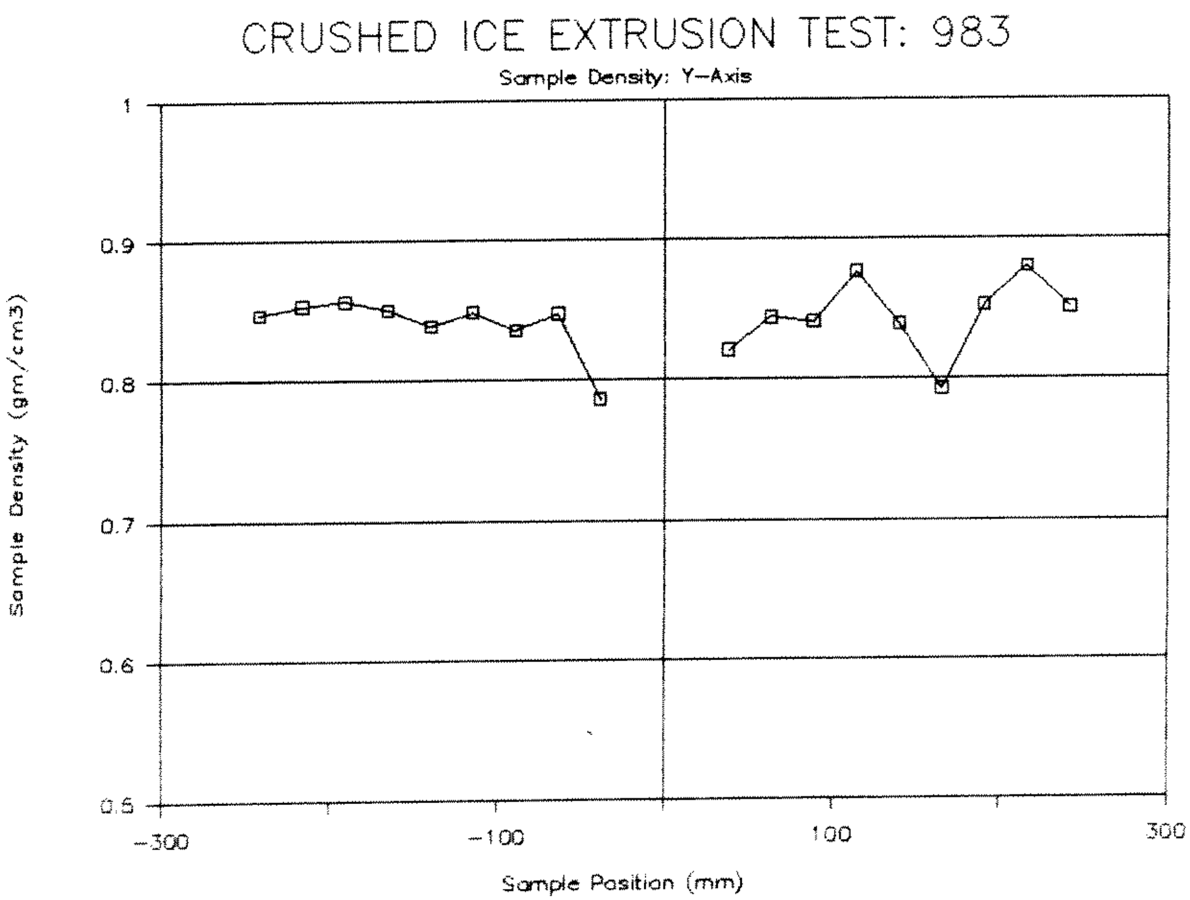


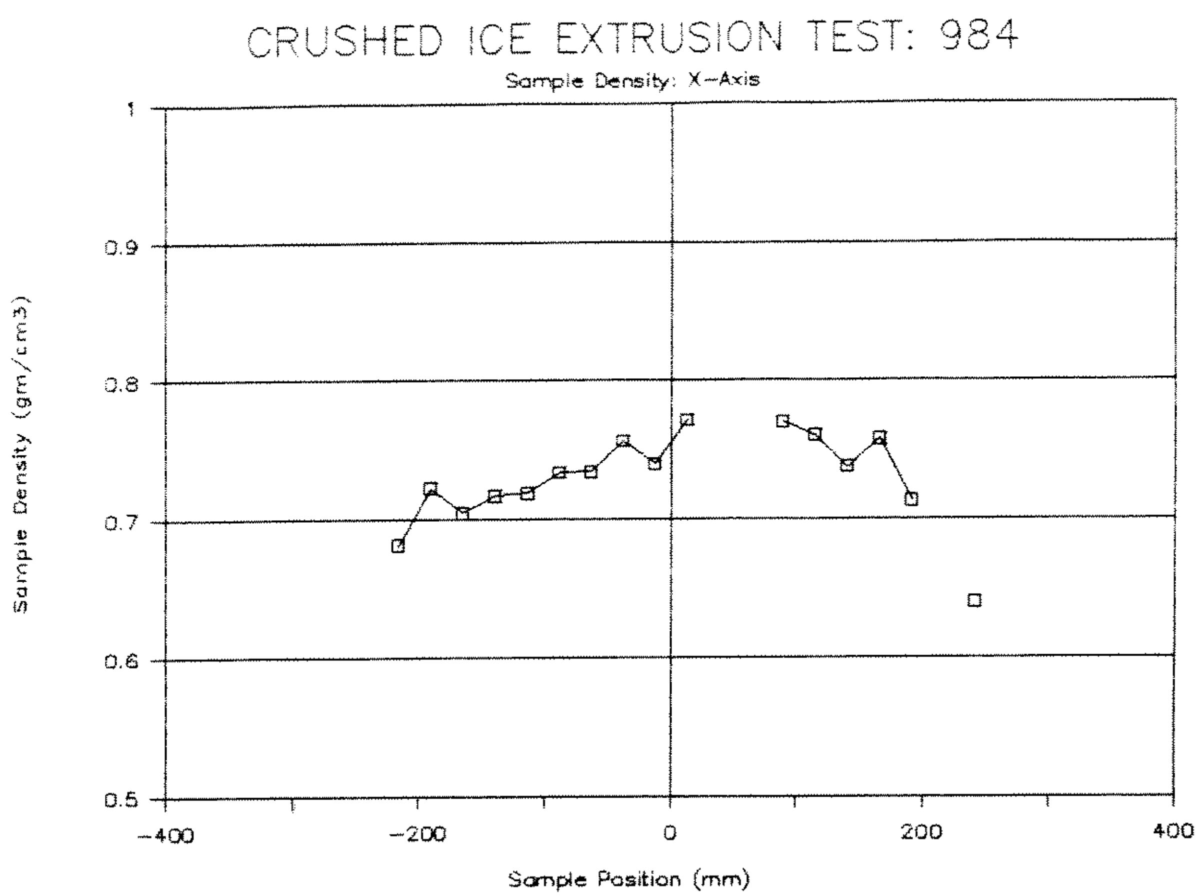
CRUSHED ICE EXTRUSION TEST: 982

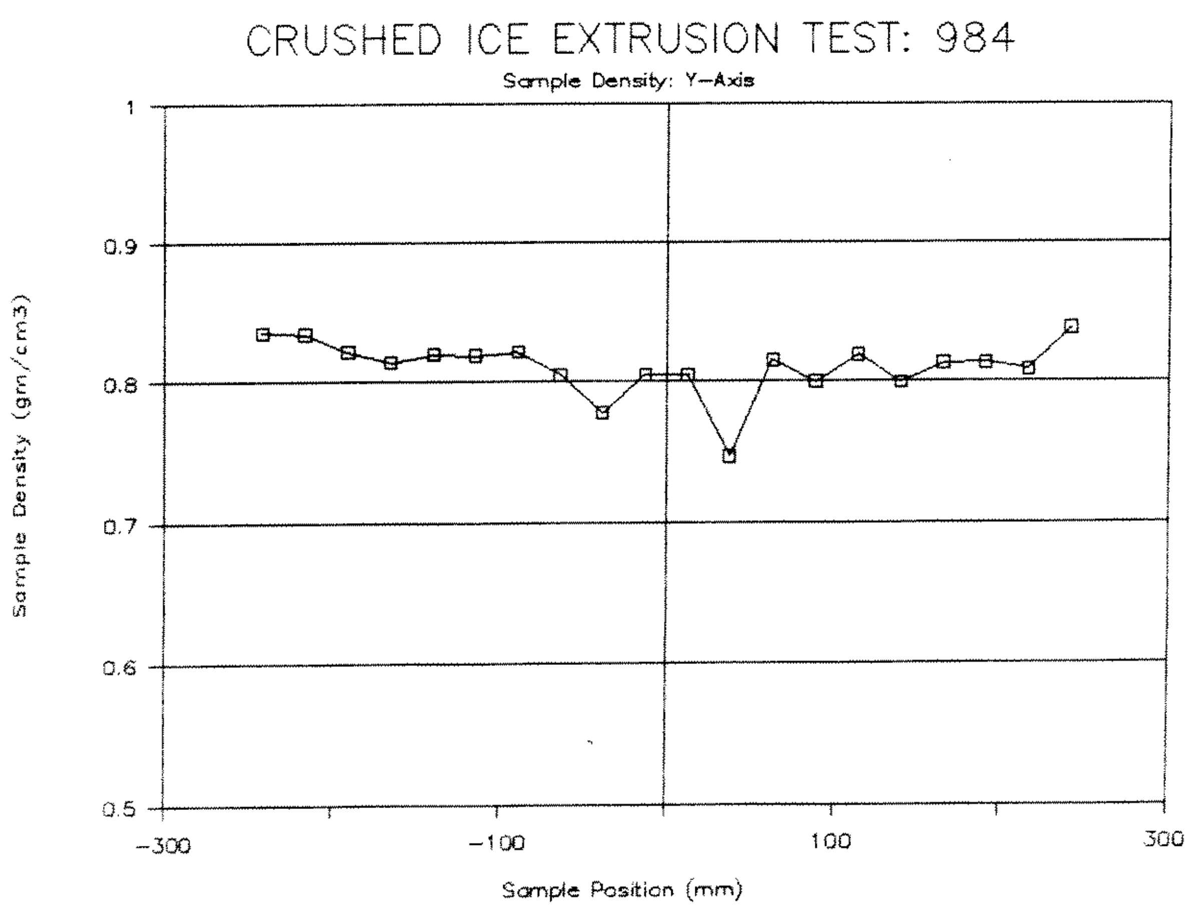
Sample Density: Y-Axis

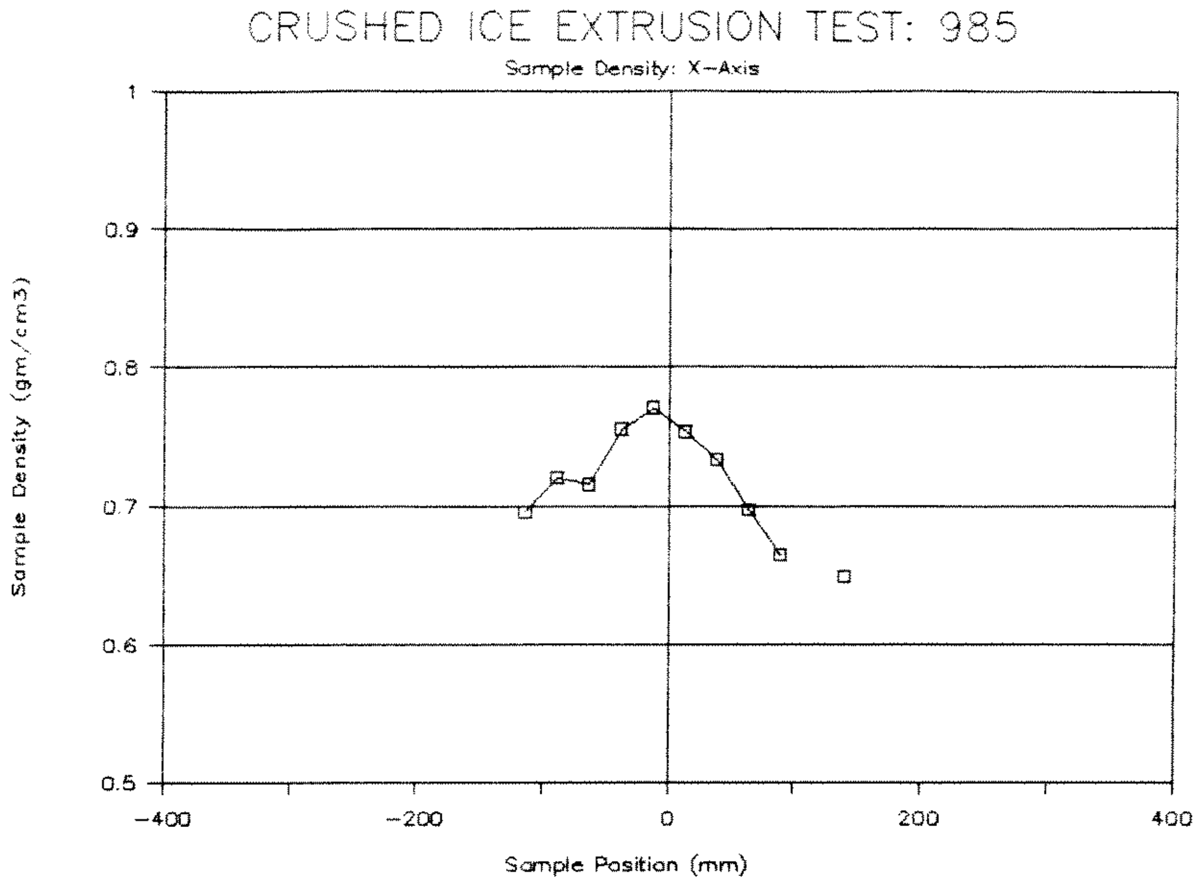



CRUSHED ICE EXTRUSION TEST: 983
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

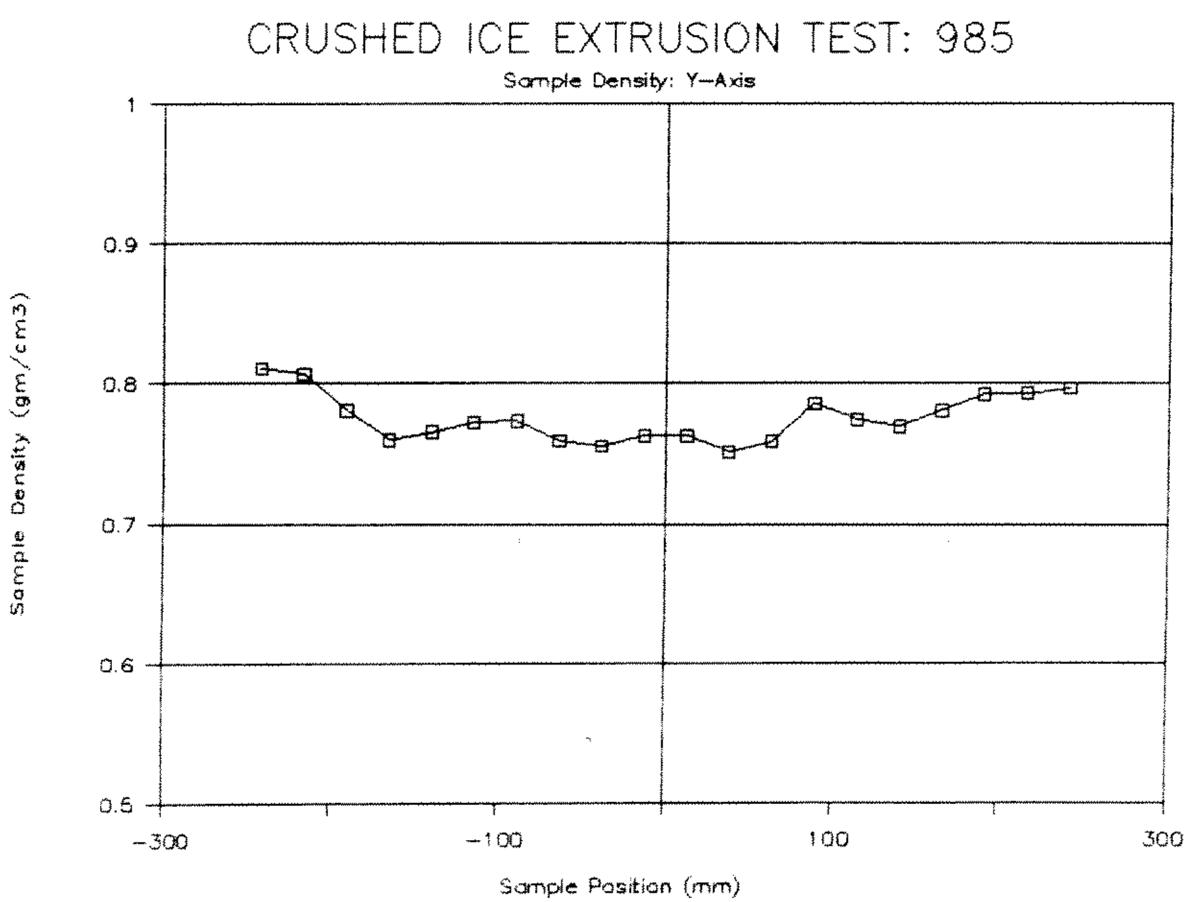

CRUSHED ICE EXTRUSION TEST: 983
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 984
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 984
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)



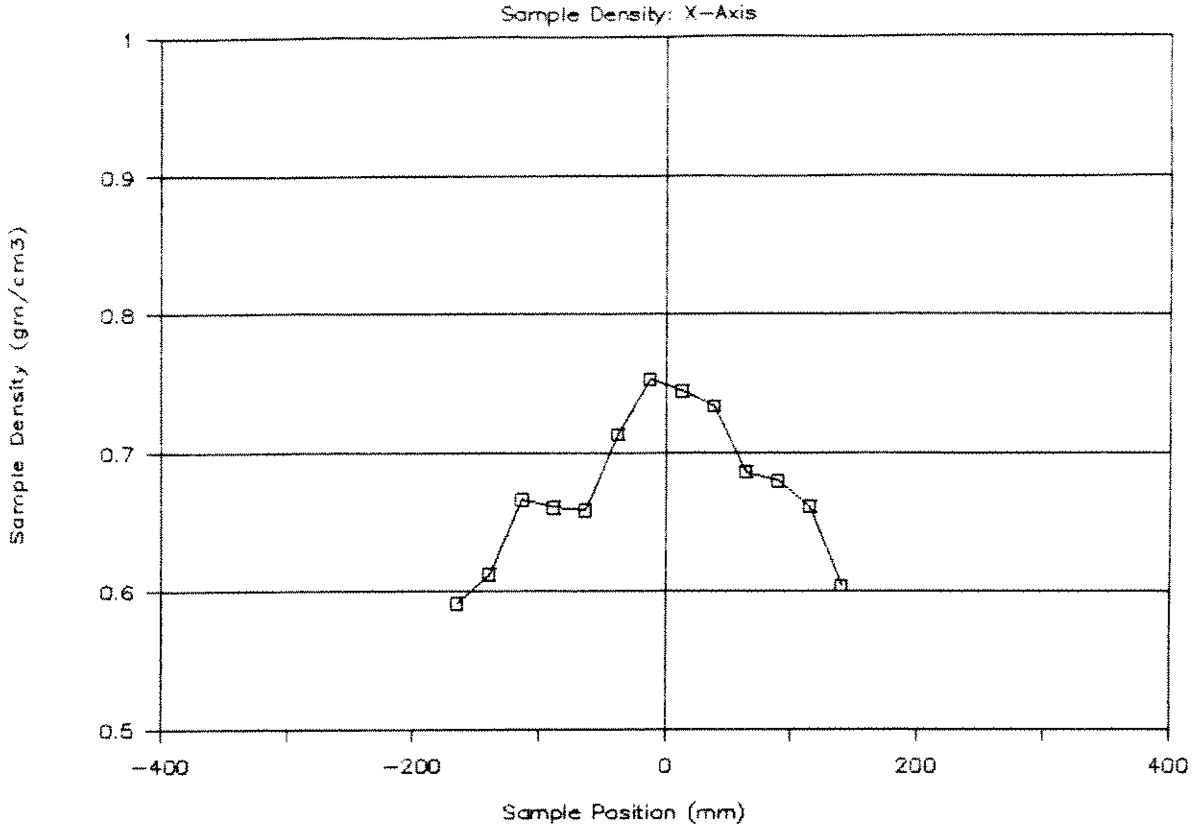
CRUSHED ICE EXTRUSION TEST: 985
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)



CRUSHED ICE EXTRUSION TEST: 985
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

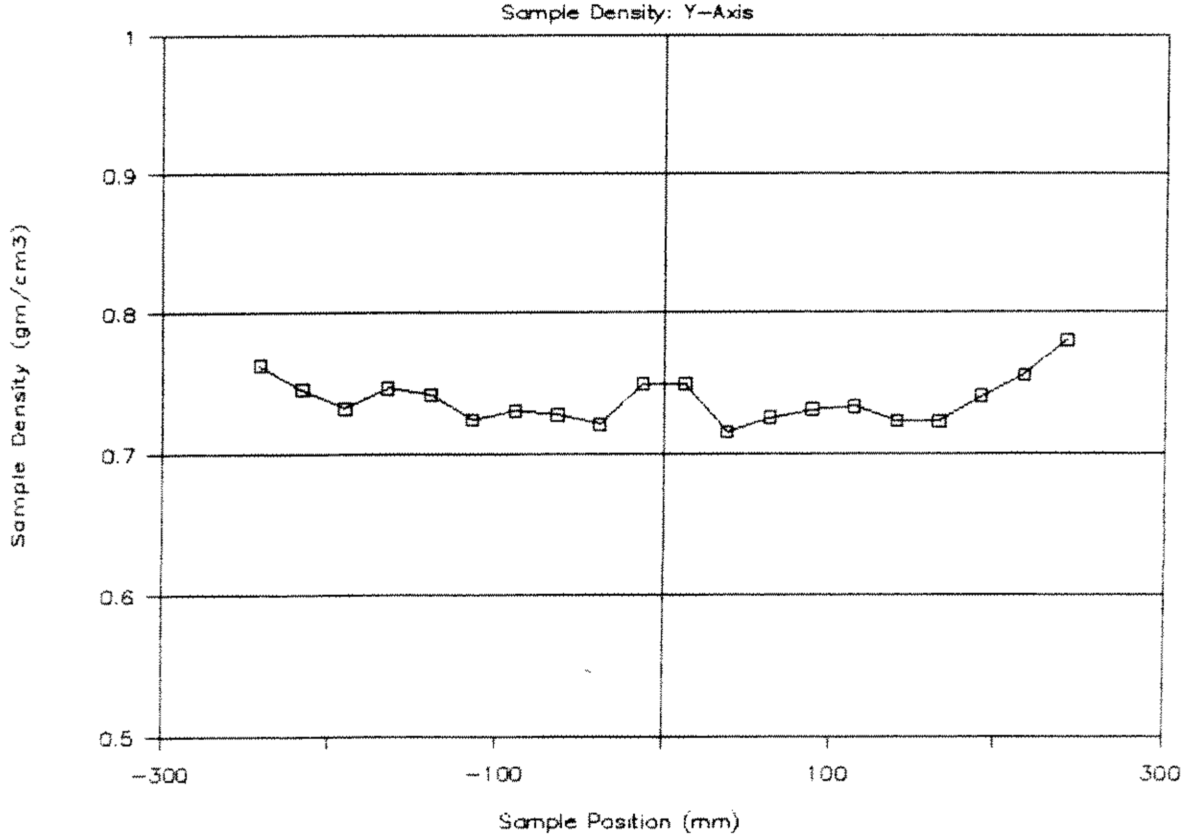
CRUSHED ICE EXTRUSION TEST: 986

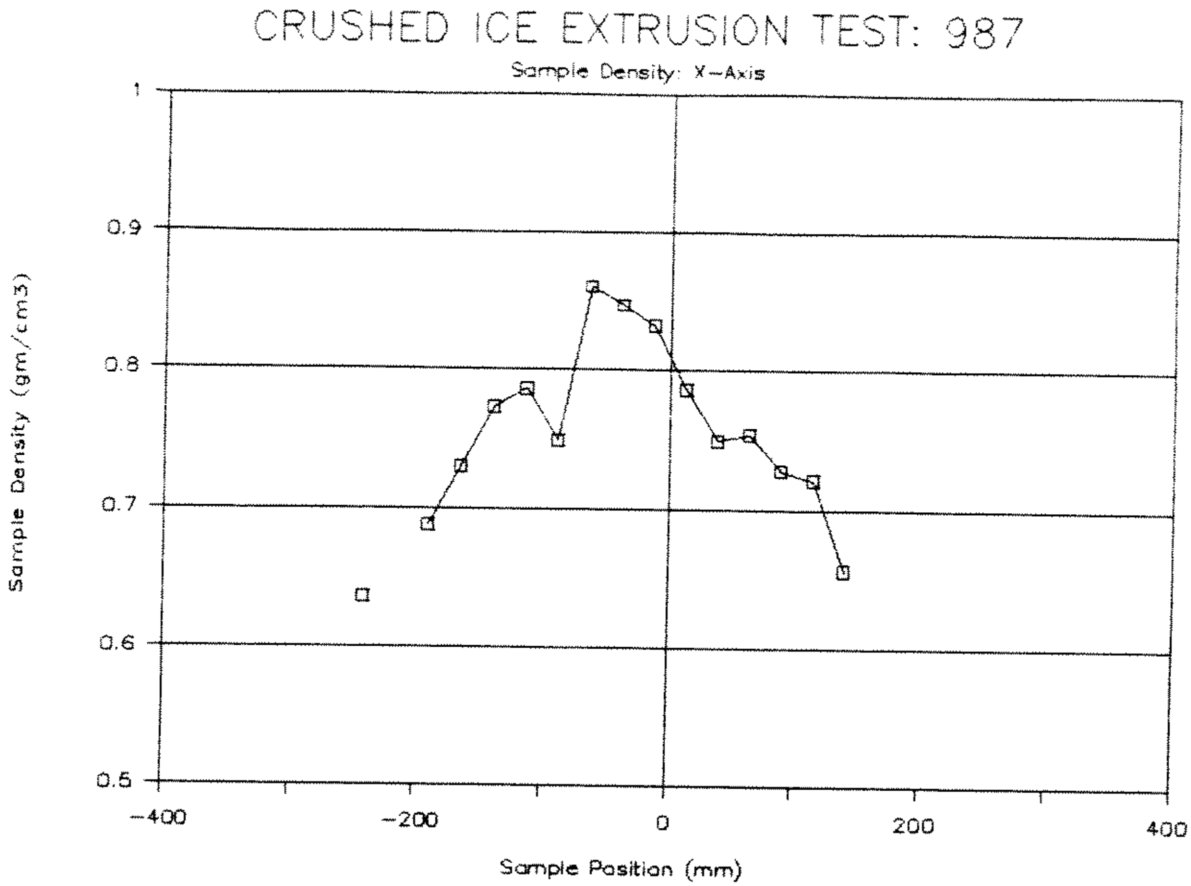
Sample Density: X-Axis

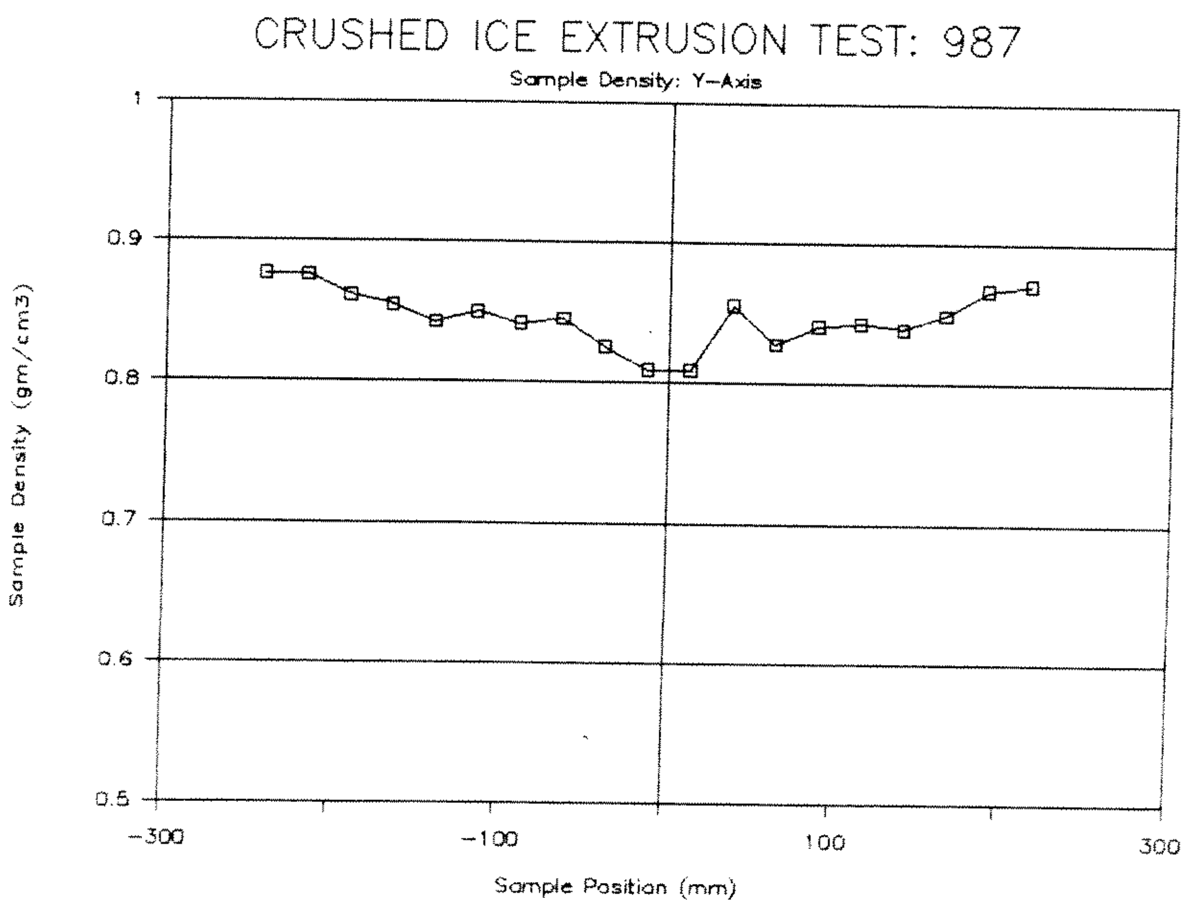


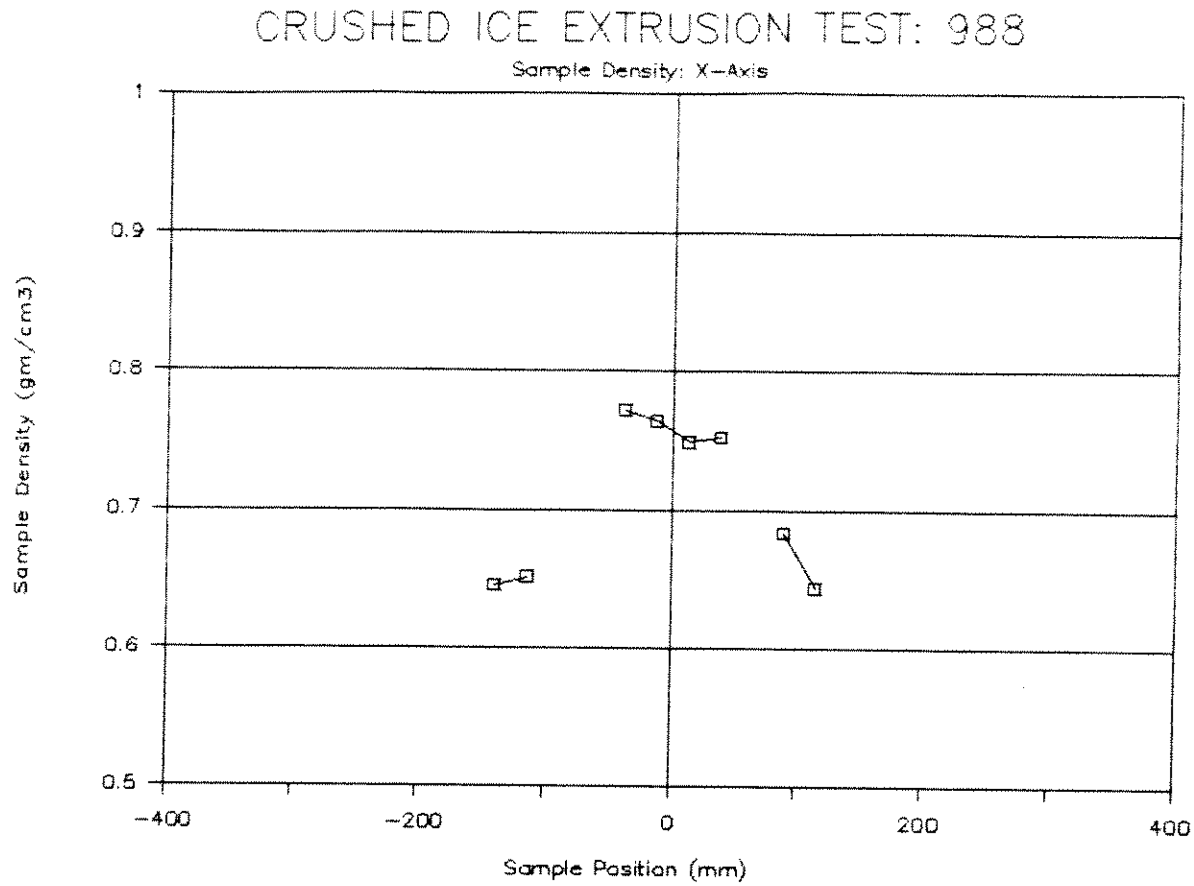
CRUSHED ICE EXTRUSION TEST: 986

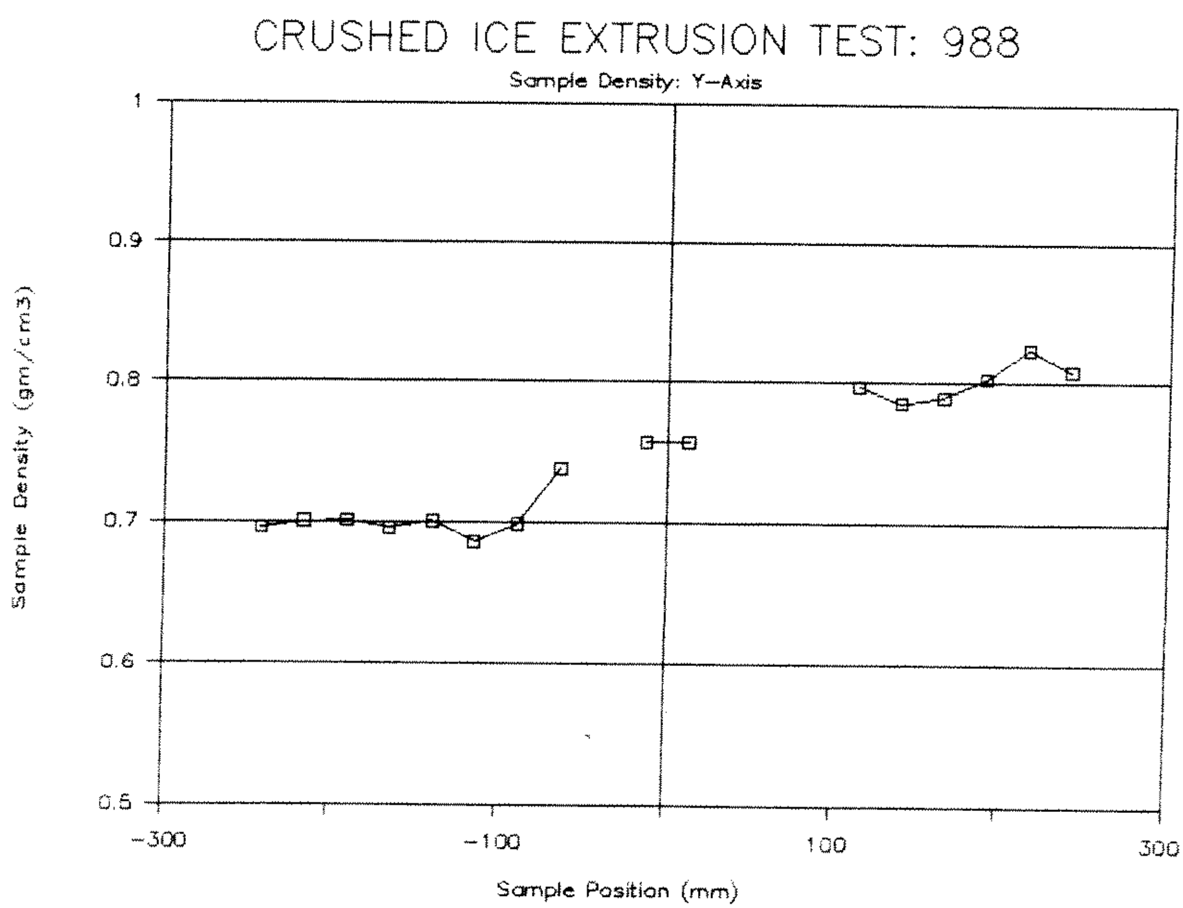
Sample Density: Y-Axis




CRUSHED ICE EXTRUSION TEST: 987
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

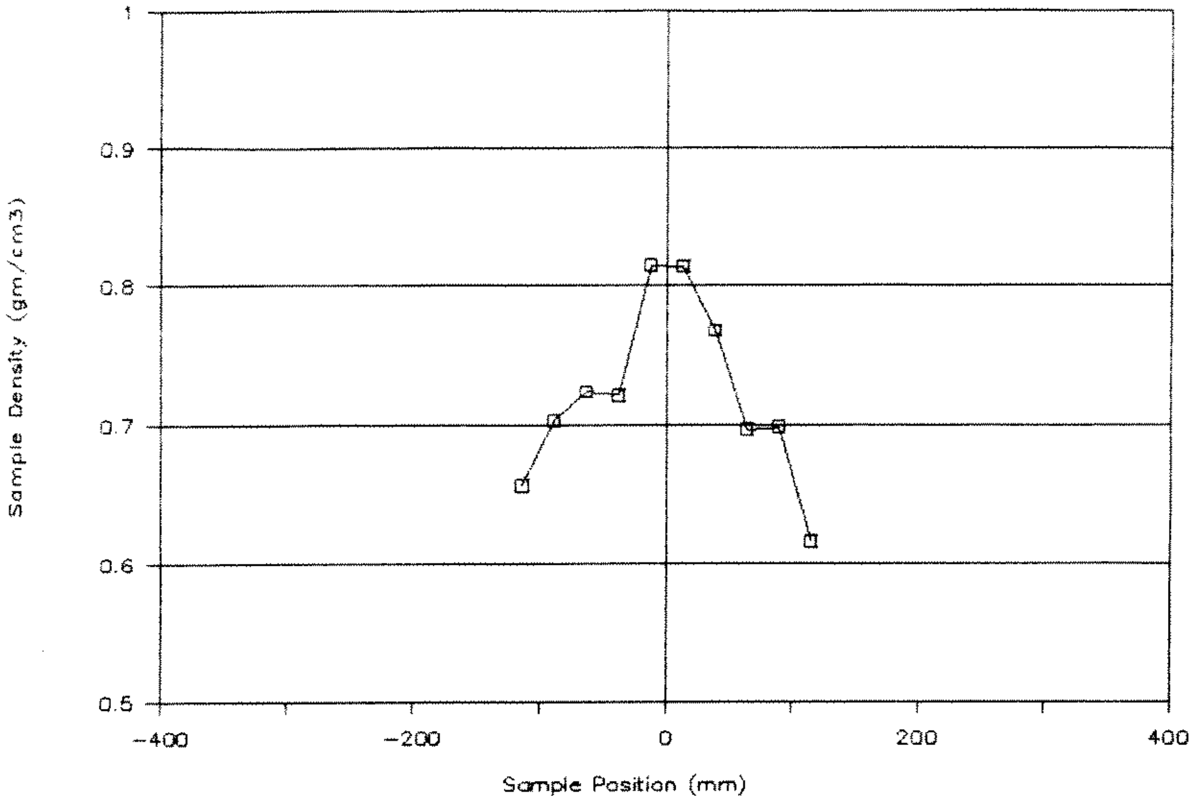

CRUSHED ICE EXTRUSION TEST: 987
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 988
Sample Density: X-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400


CRUSHED ICE EXTRUSION TEST: 988
Sample Density: Y-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300

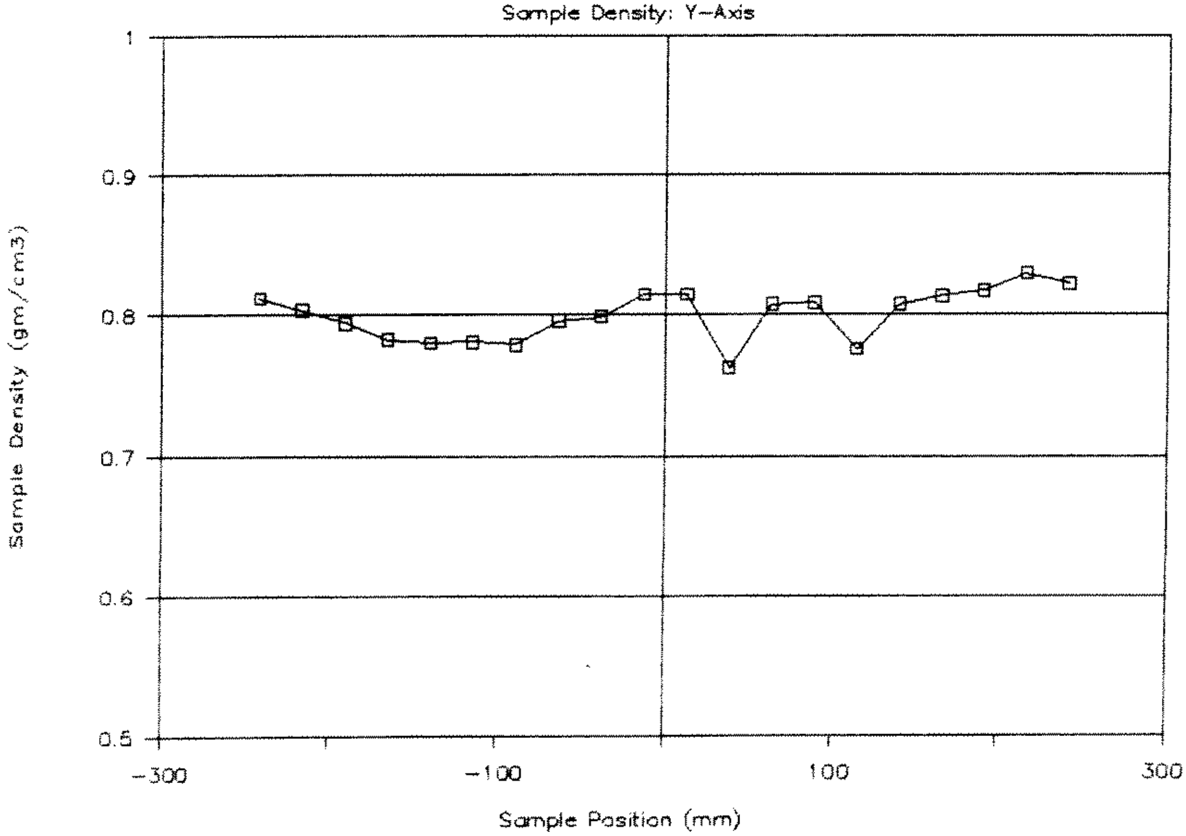
CRUSHED ICE EXTRUSION TEST: 989

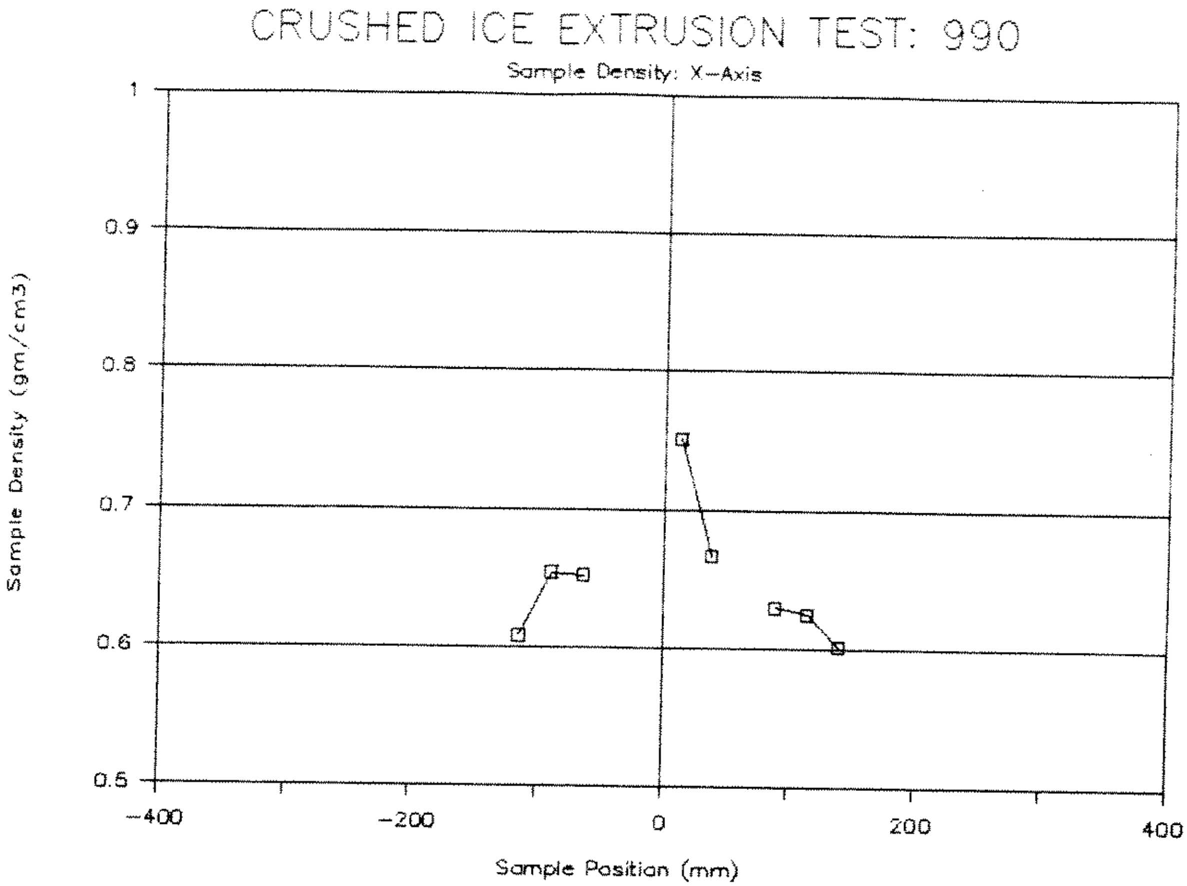
Sample Density: X-Axis

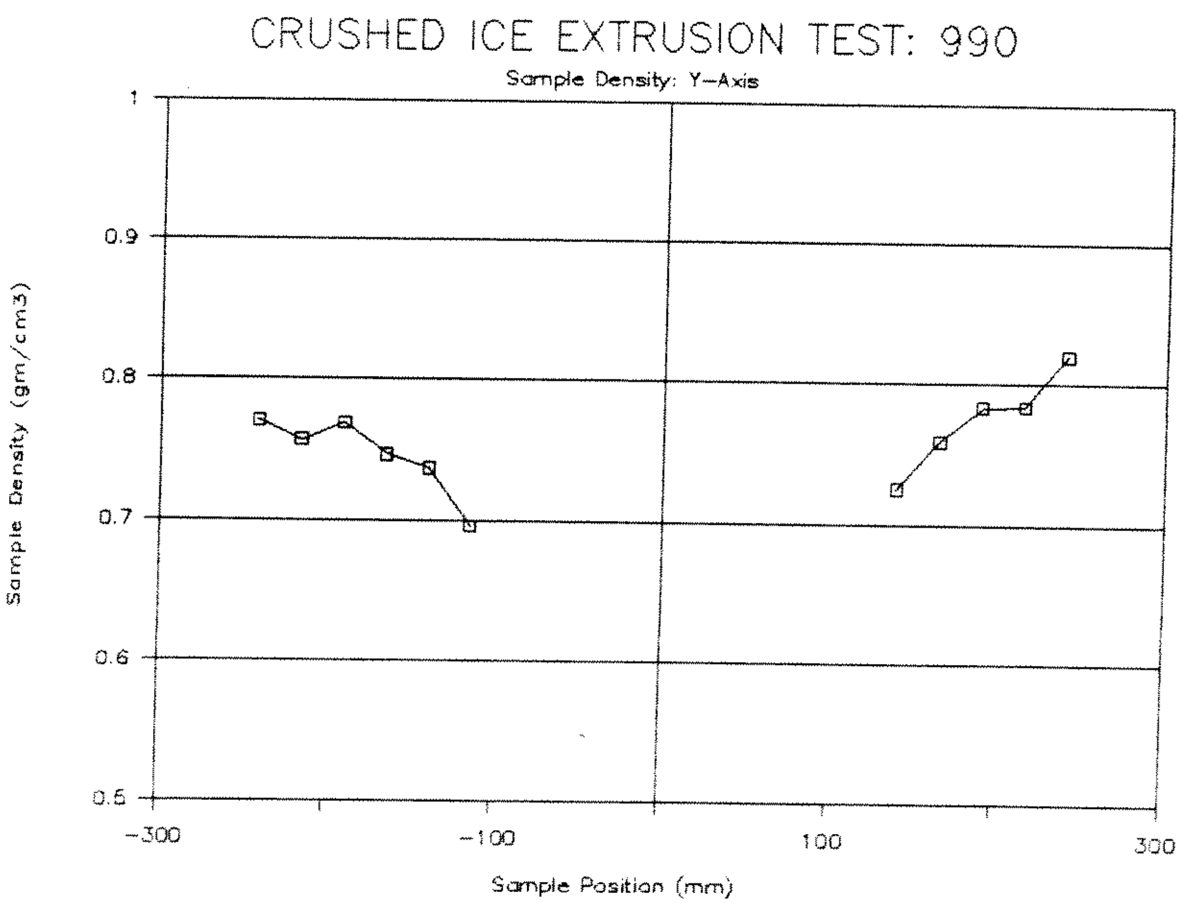


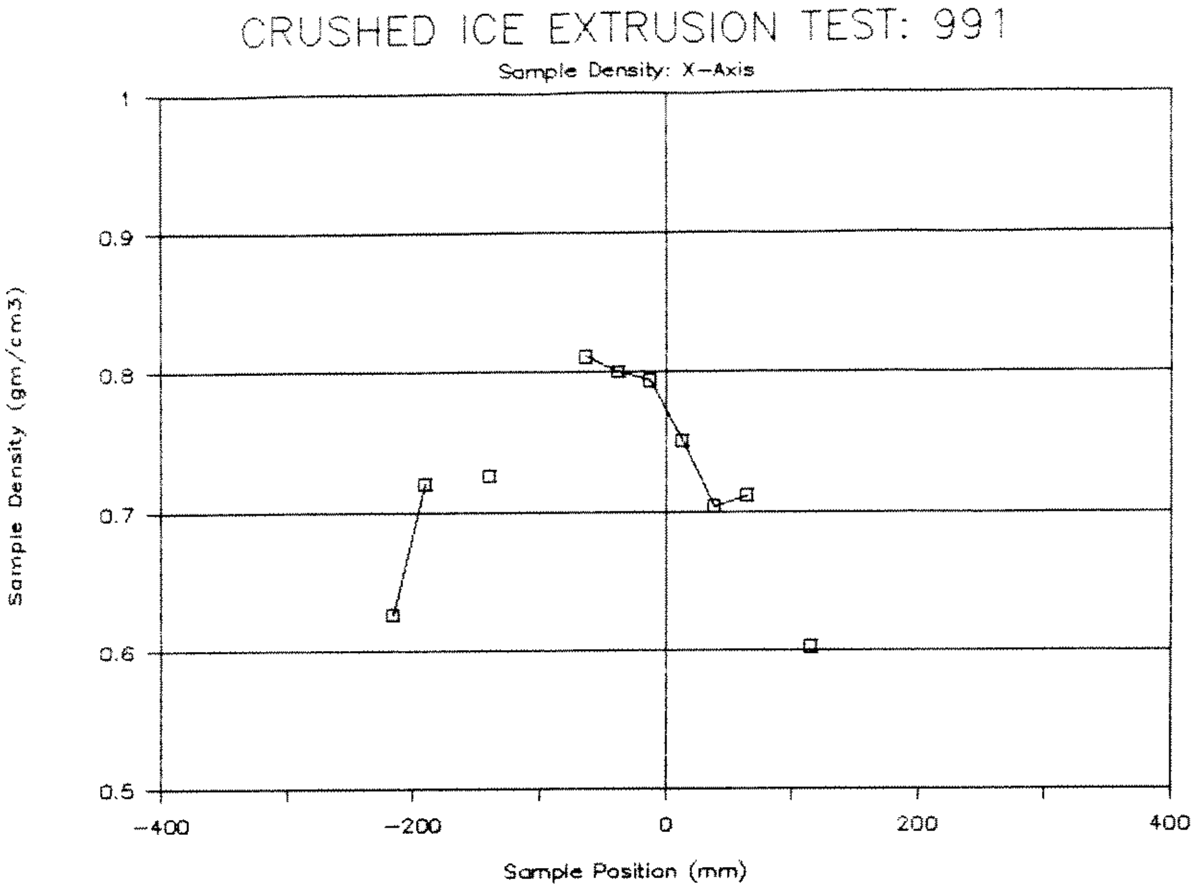
CRUSHED ICE EXTRUSION TEST: 989

Sample Density: Y-Axis

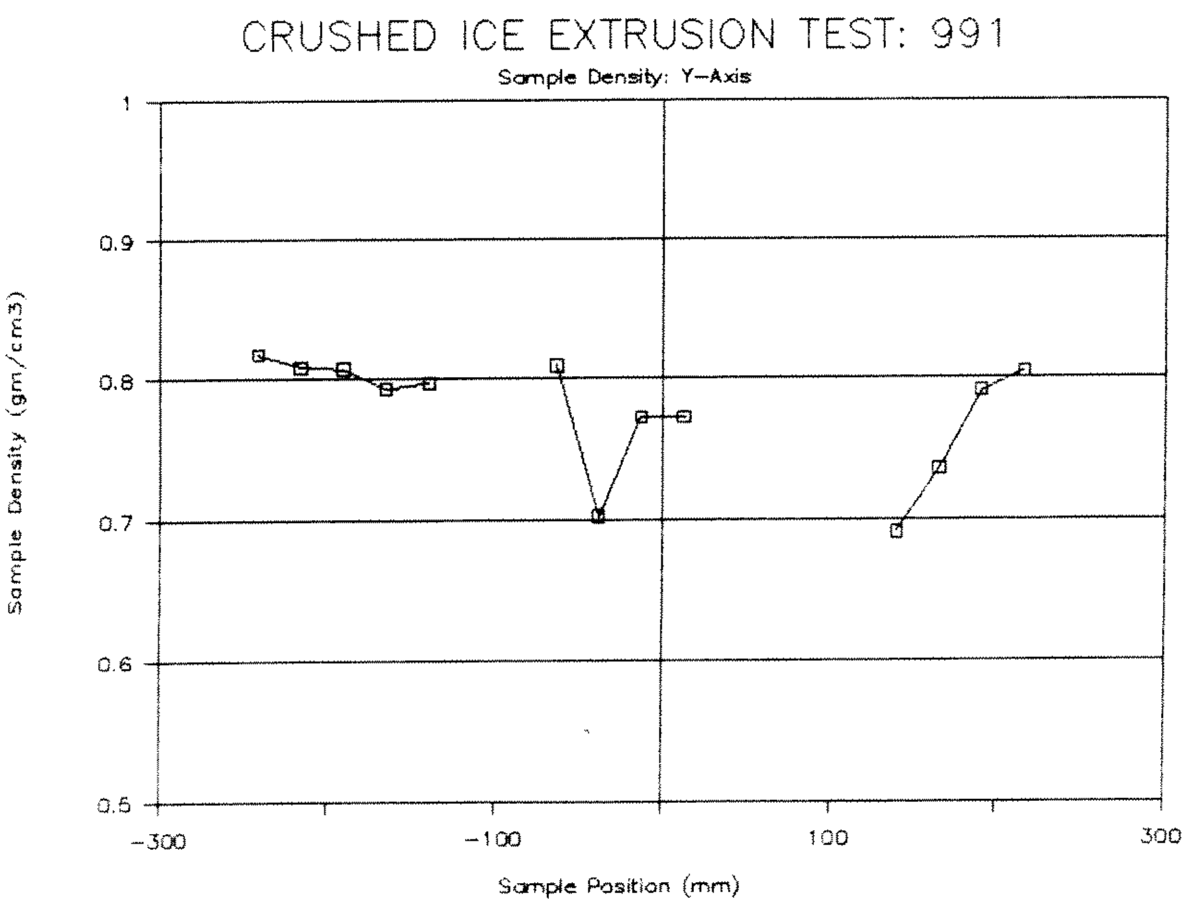



CRUSHED ICE EXTRUSION TEST: 990
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

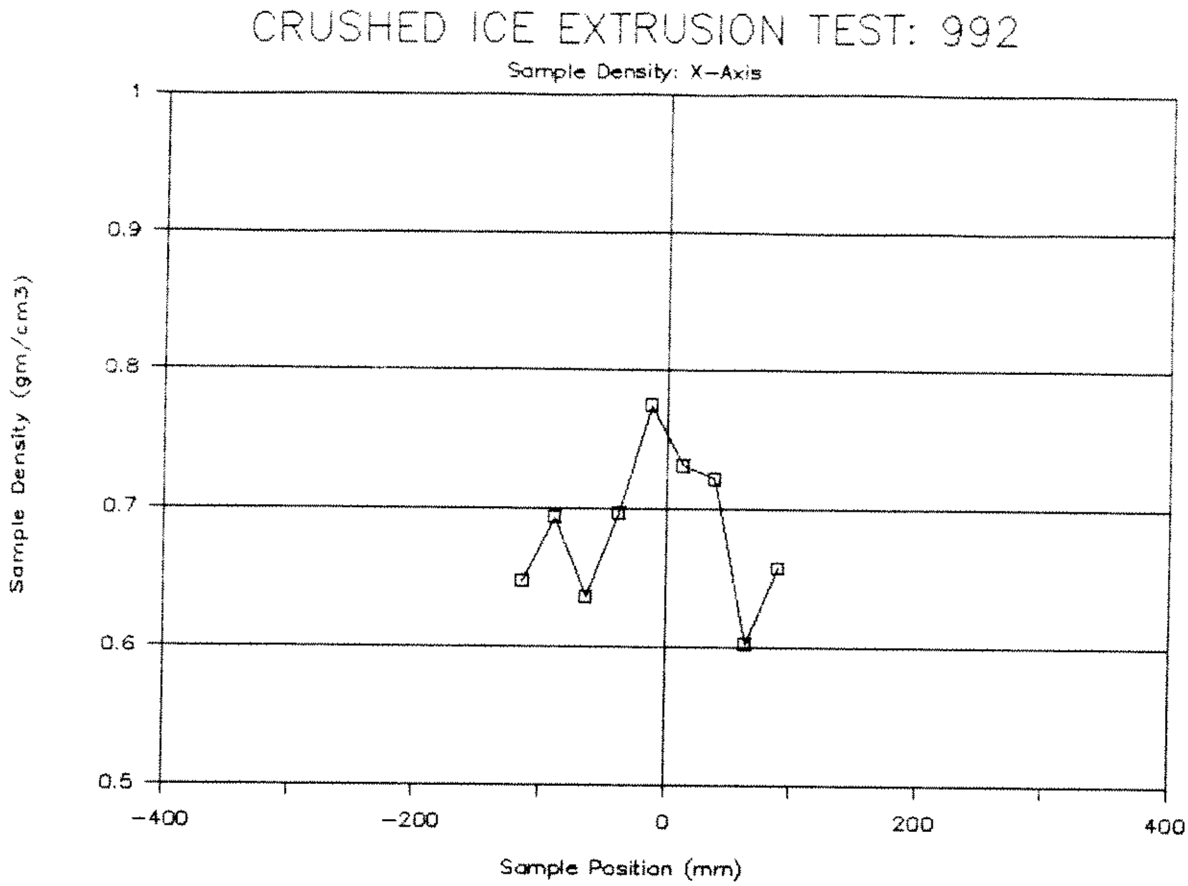

CRUSHED ICE EXTRUSION TEST: 990
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)

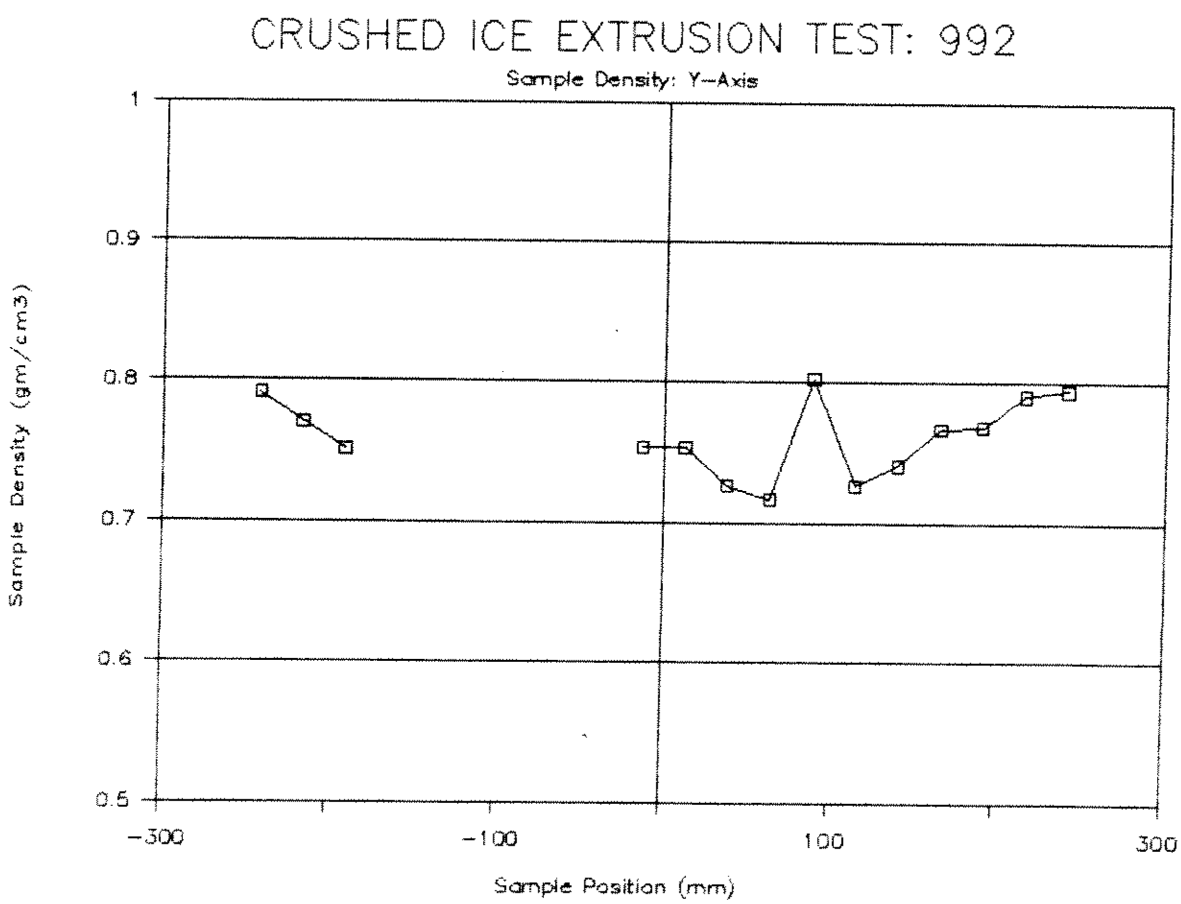


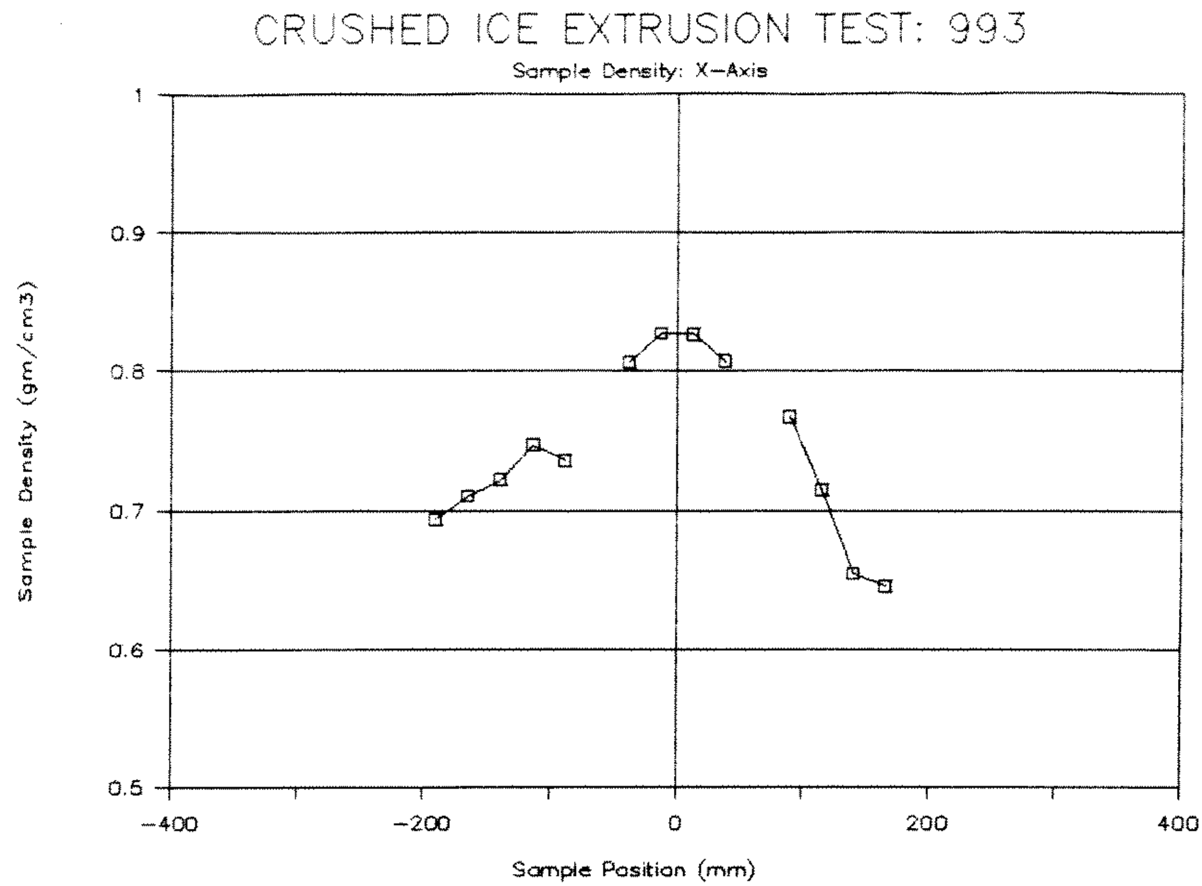
CRUSHED ICE EXTRUSION TEST: 991
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

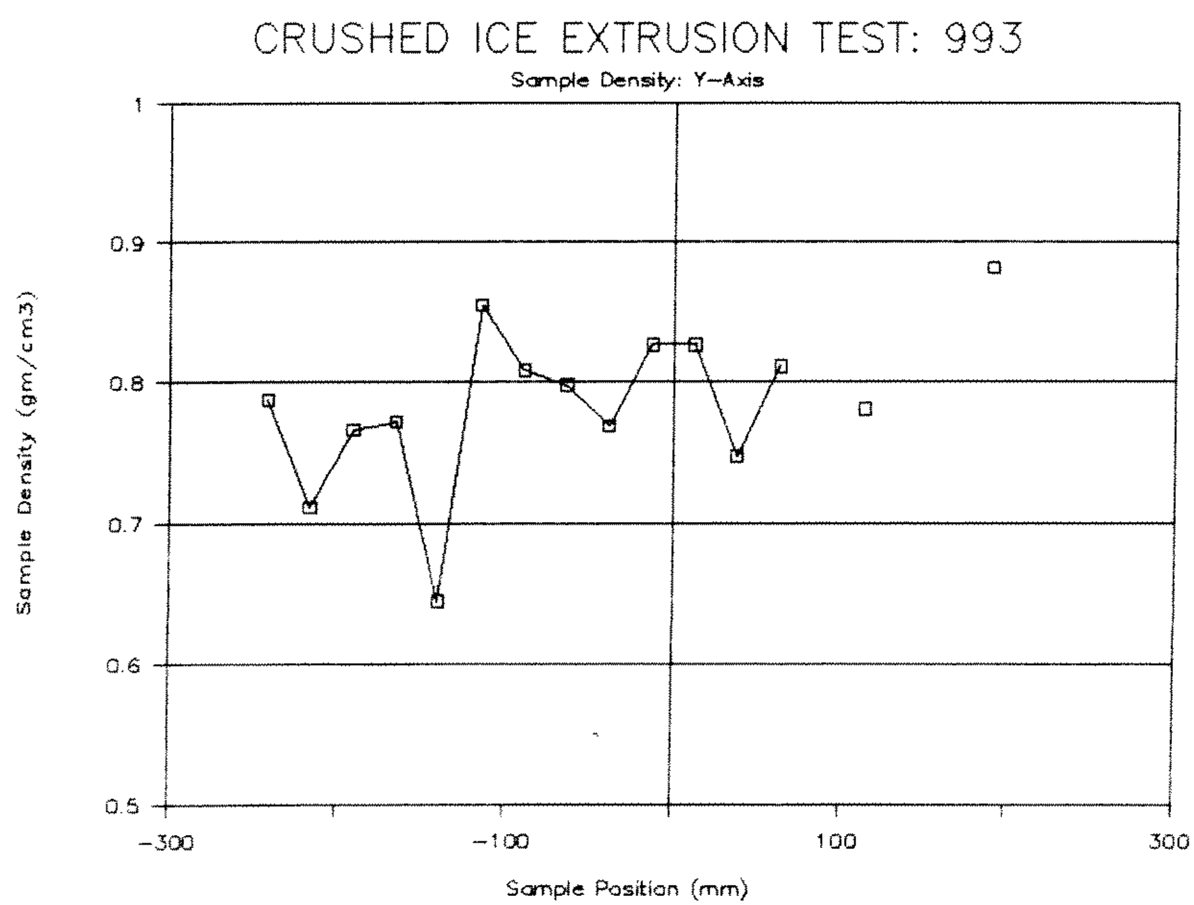


CRUSHED ICE EXTRUSION TEST: 991
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 992
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

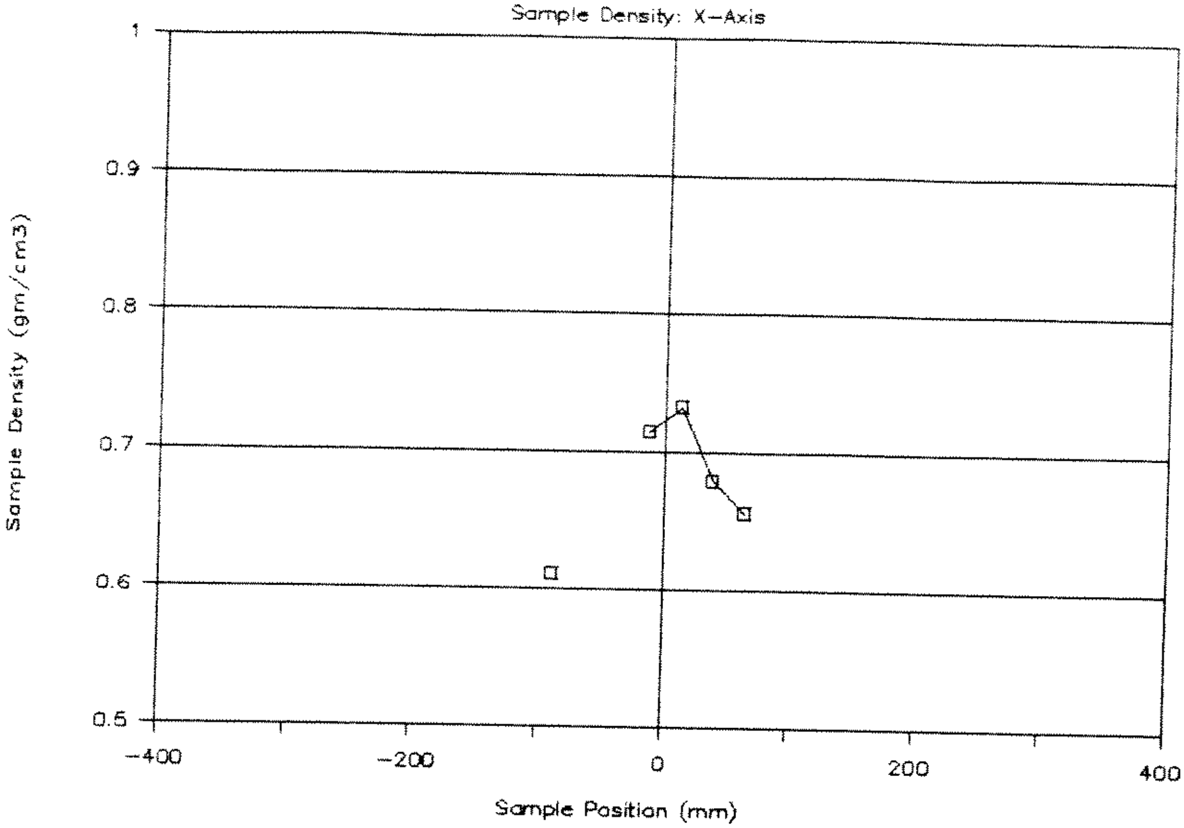

CRUSHED ICE EXTRUSION TEST: 992
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 993
Sample Density: X-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400


CRUSHED ICE EXTRUSION TEST: 993
Sample Density: Y-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300

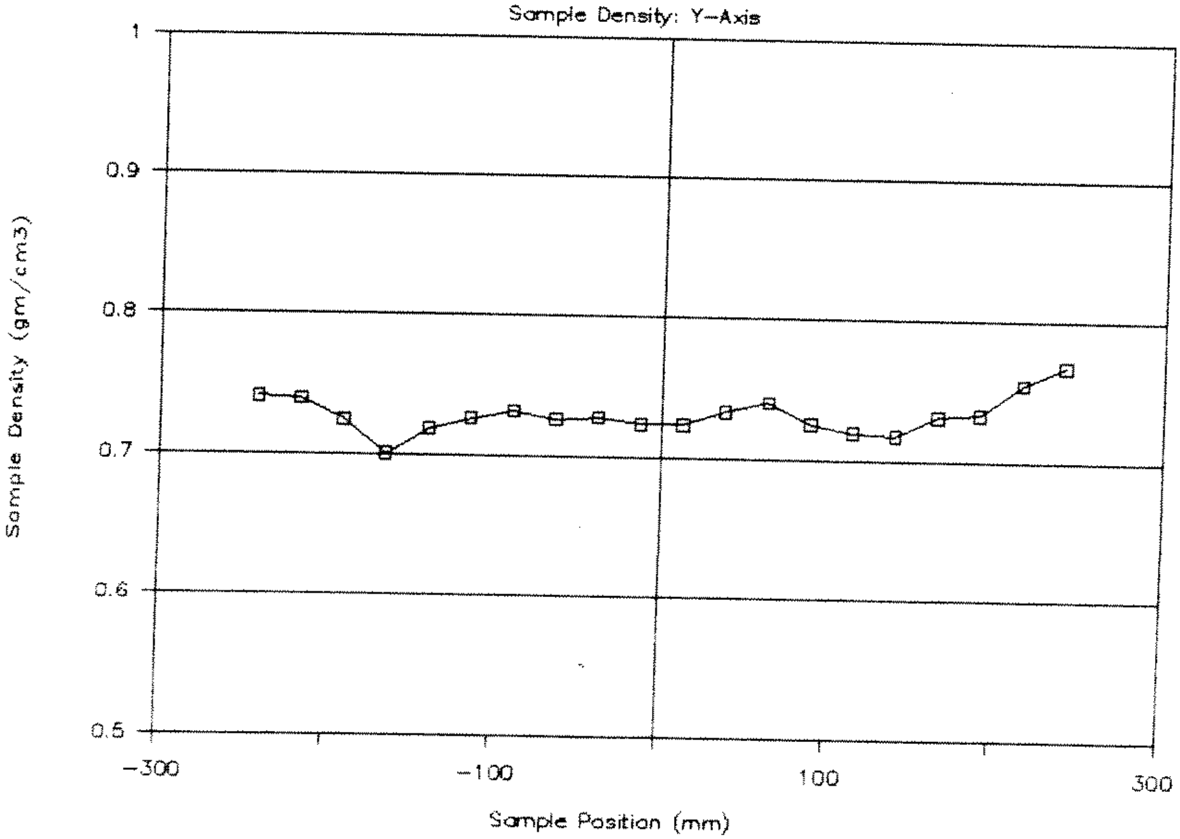
CRUSHED ICE EXTRUSION TEST: 994

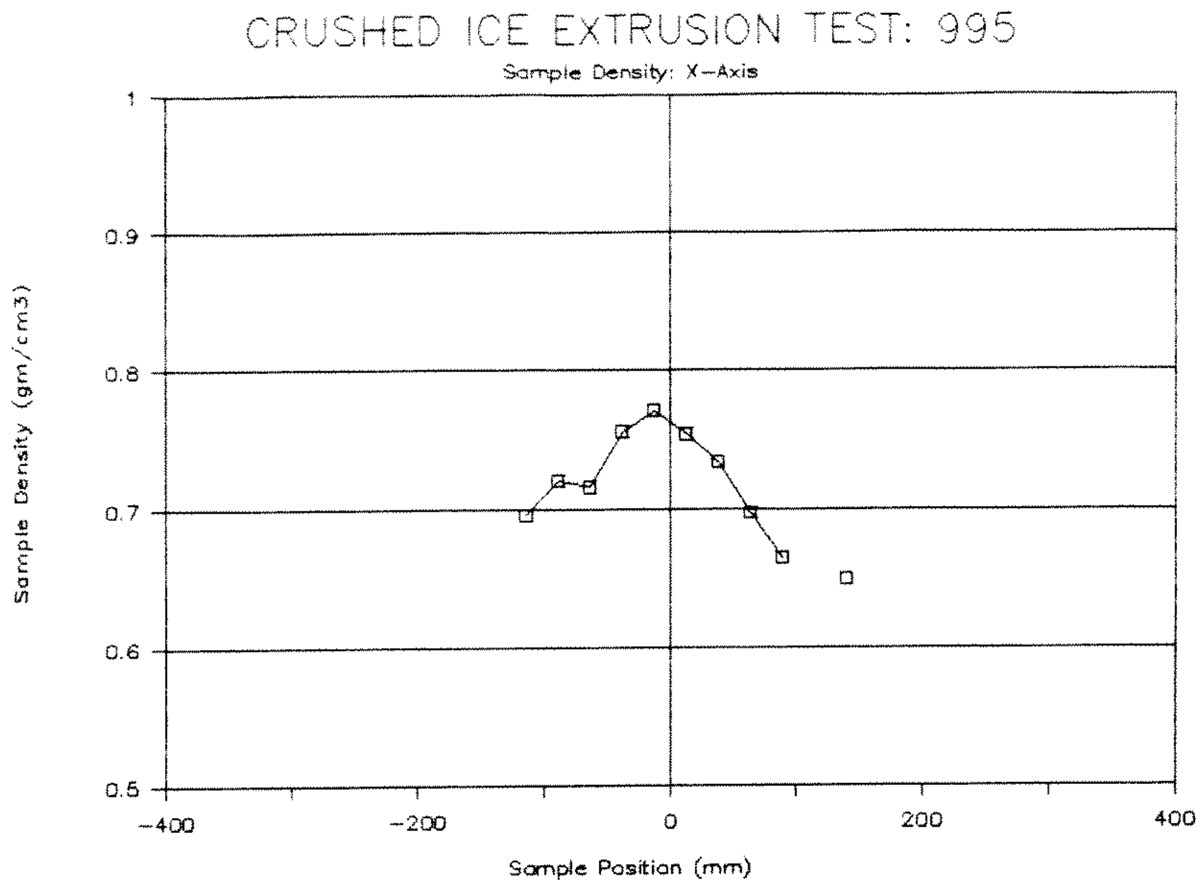
Sample Density: X-Axis

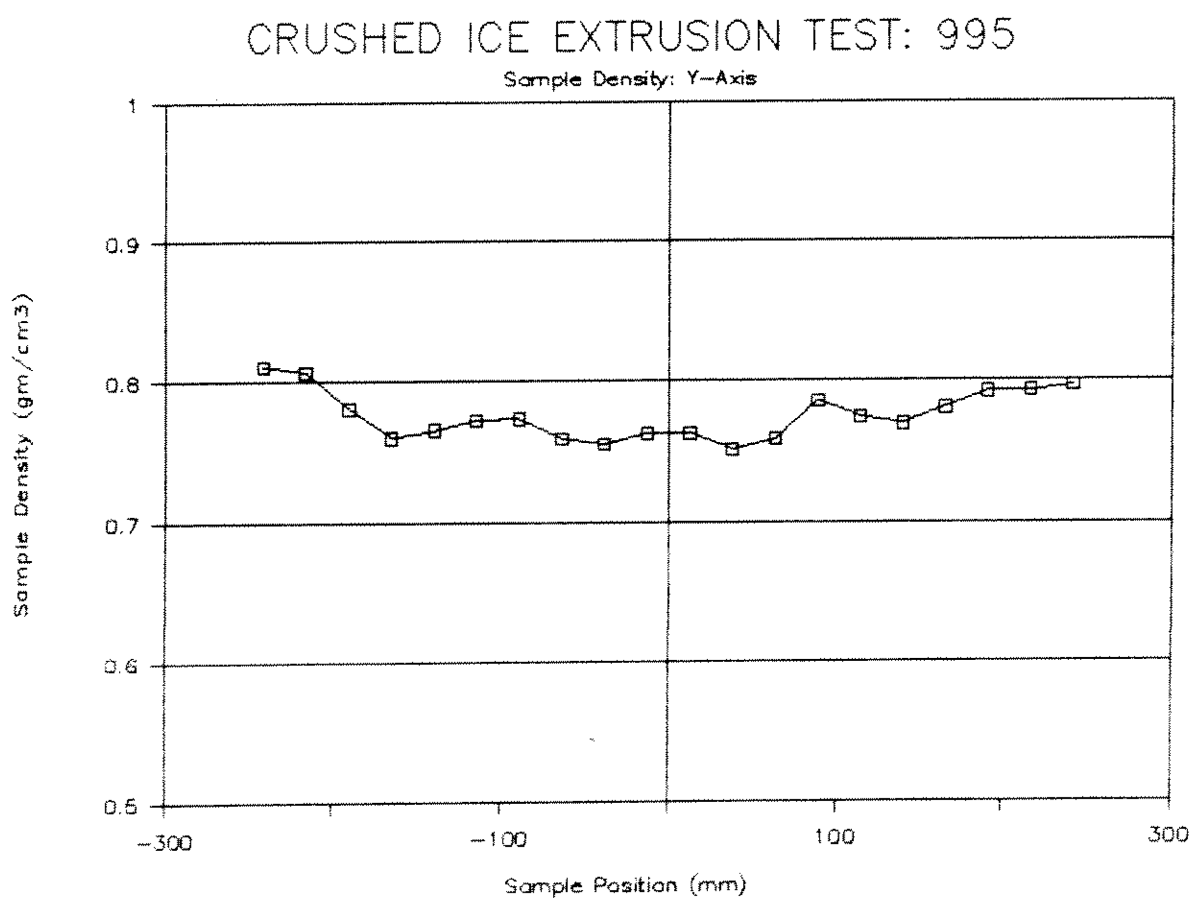


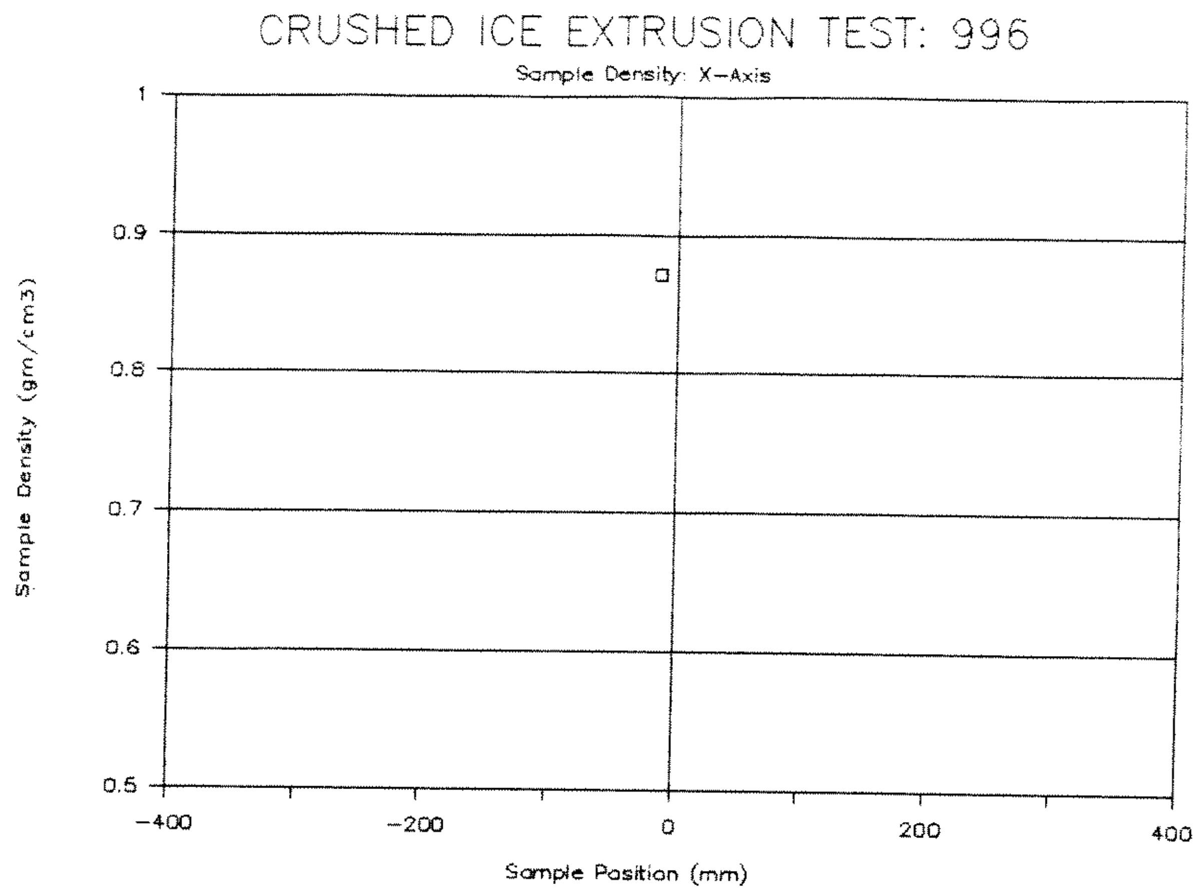
CRUSHED ICE EXTRUSION TEST: 994

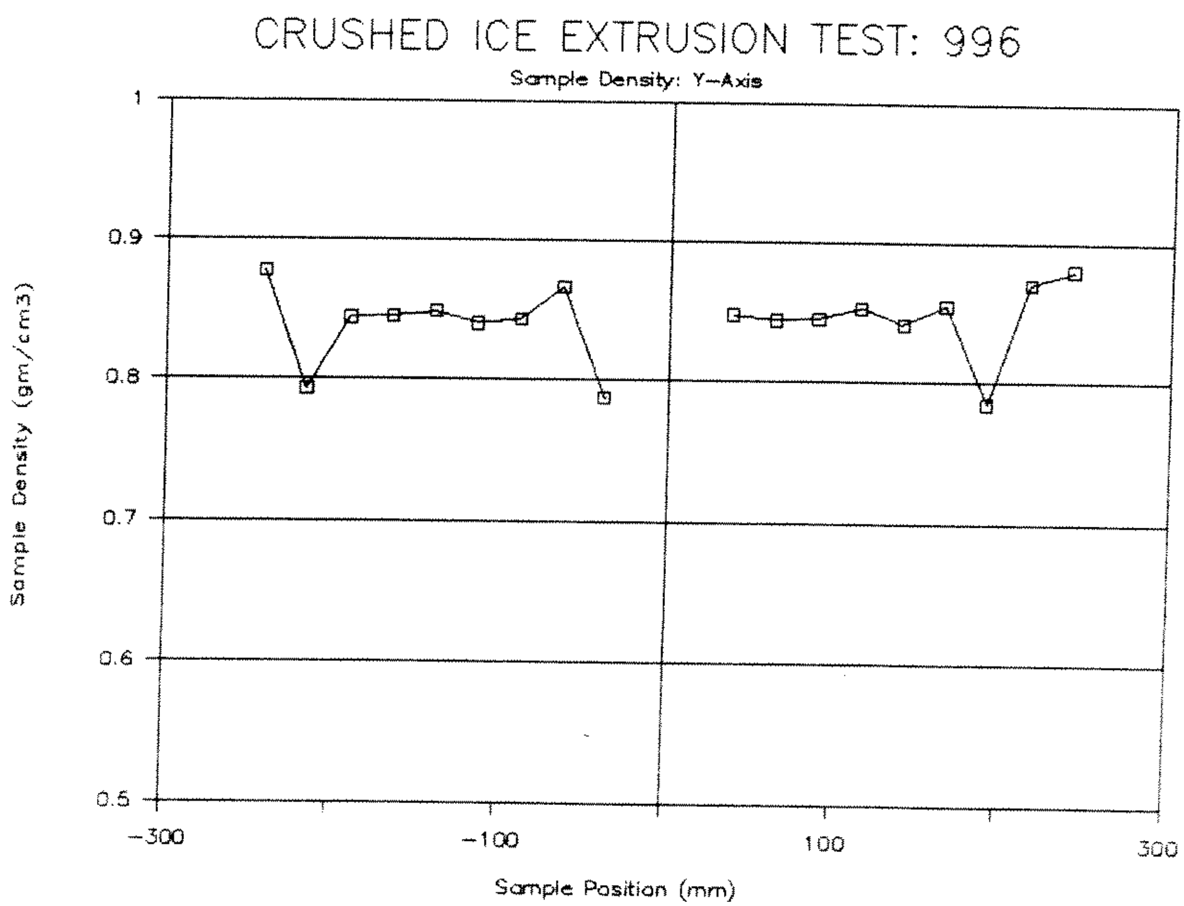
Sample Density: Y-Axis

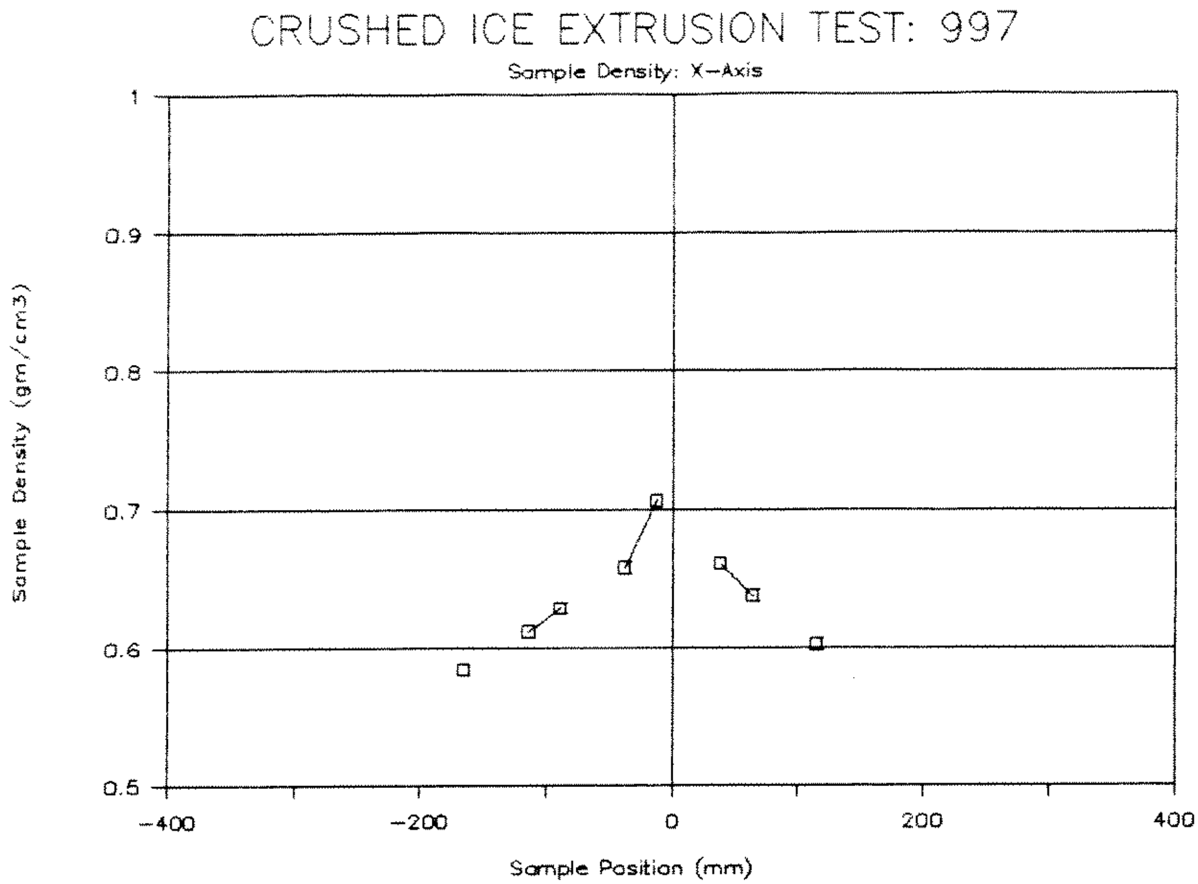



CRUSHED ICE EXTRUSION TEST: 995
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)

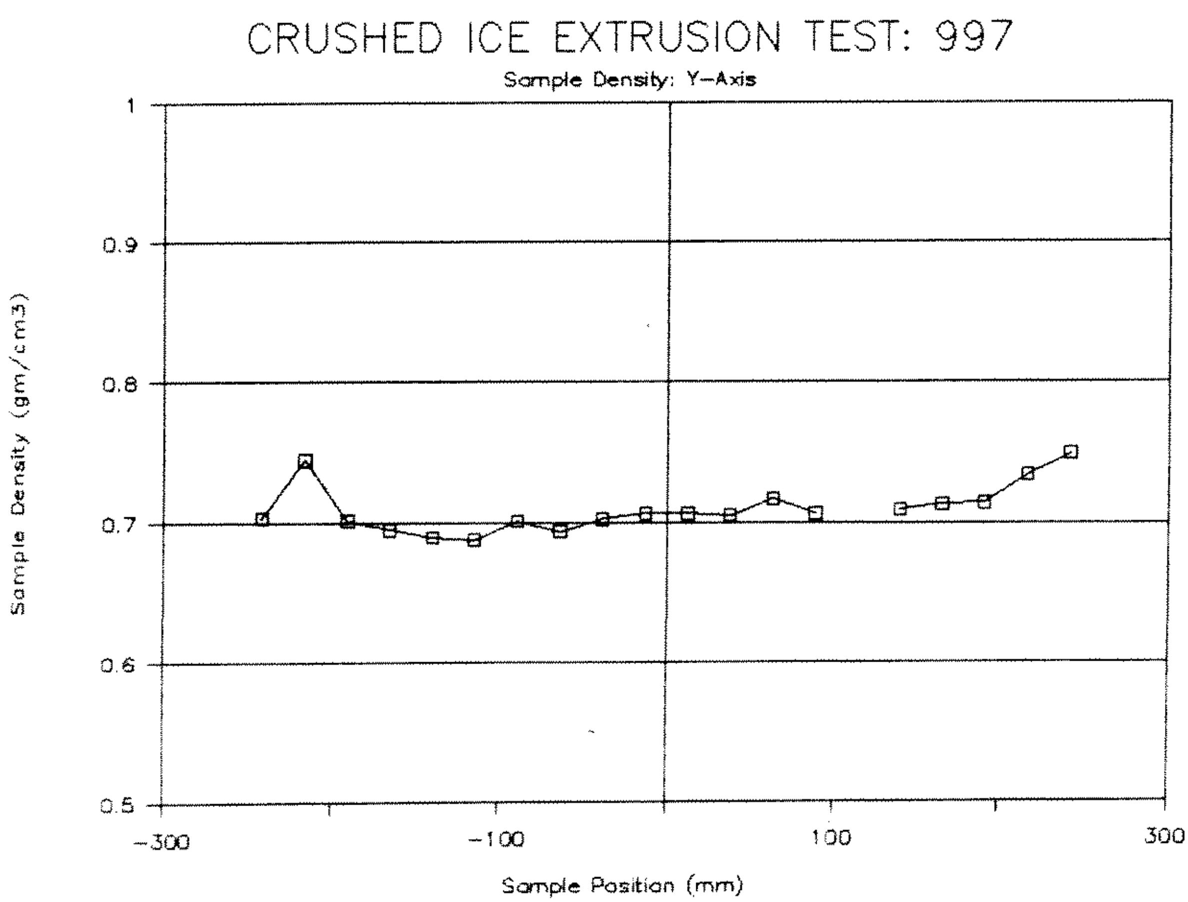

CRUSHED ICE EXTRUSION TEST: 995
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 996
Sample Density: X-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400

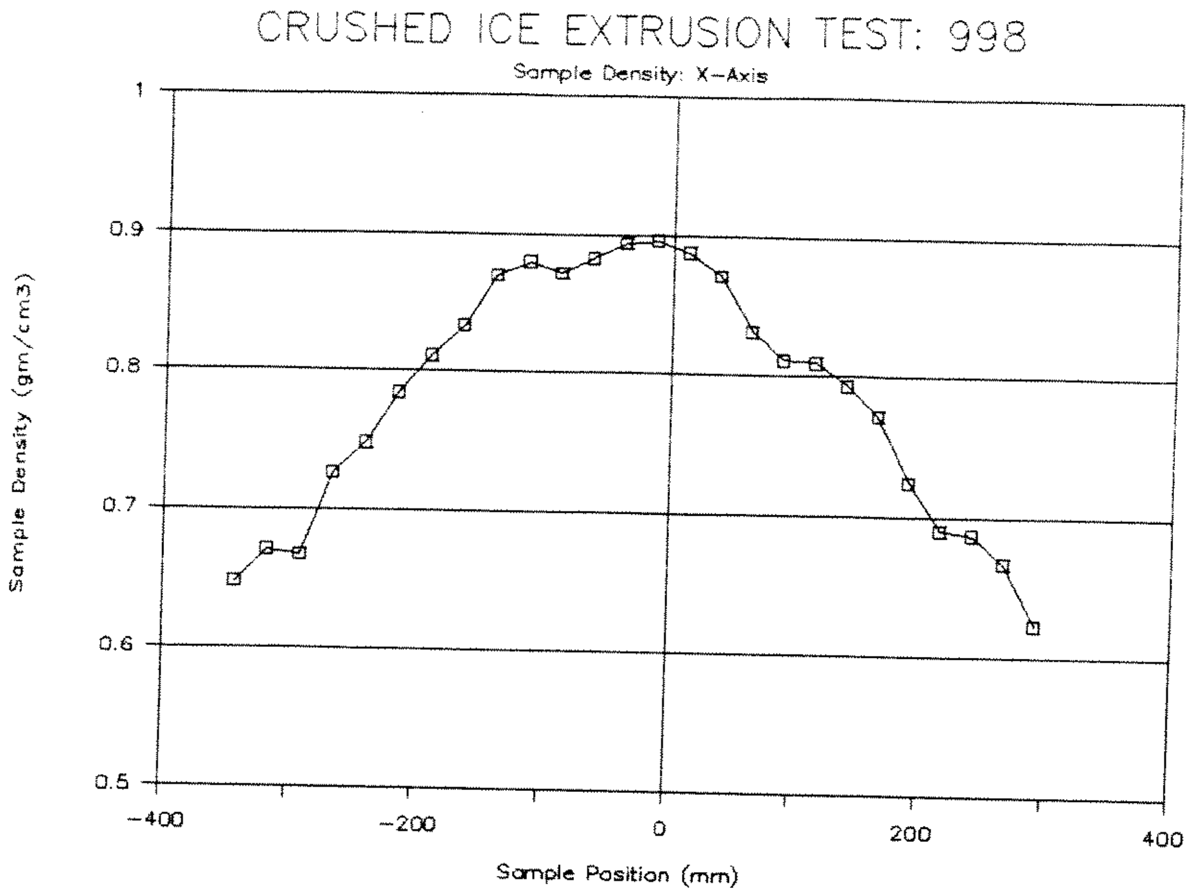

CRUSHED ICE EXTRUSION TEST: 996
Sample Density: Y-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300

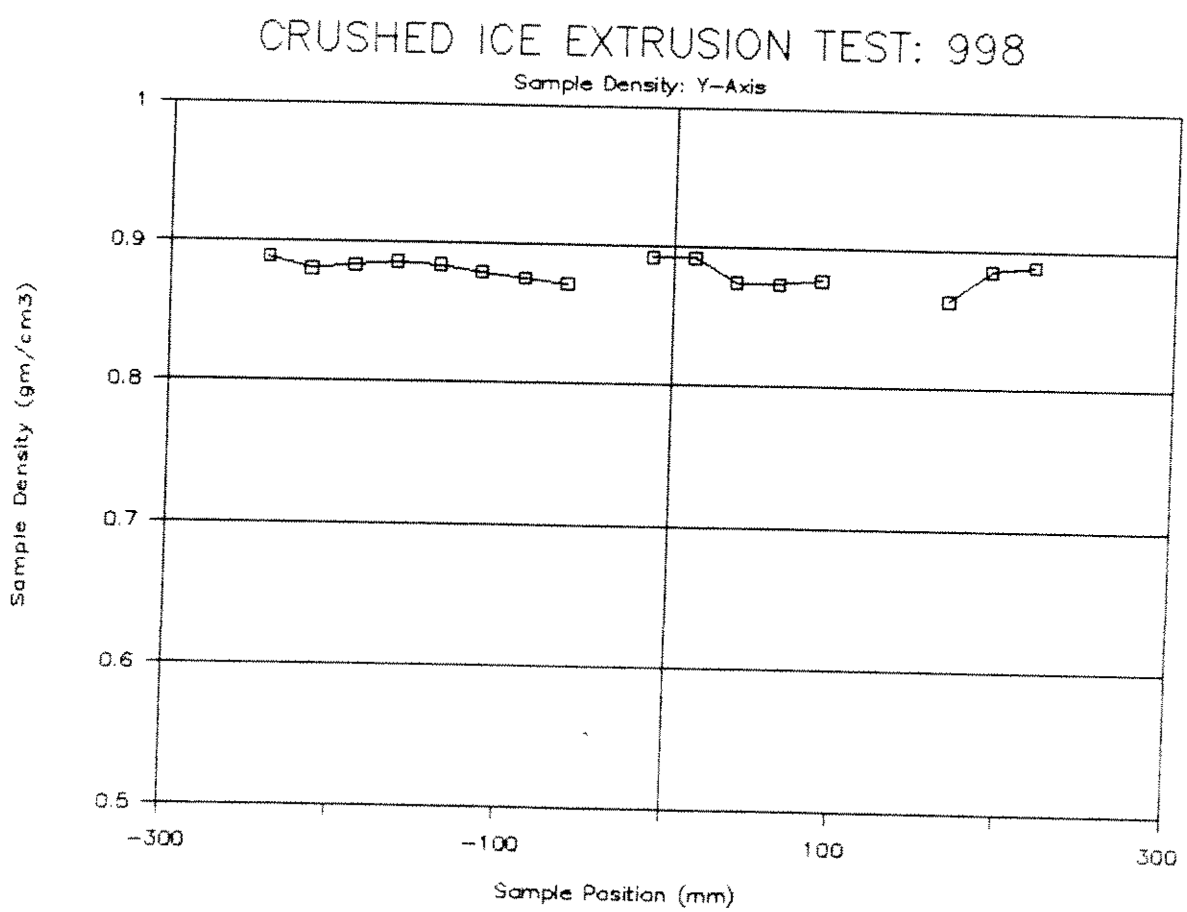


CRUSHED ICE EXTRUSION TEST: 997
Sample Density: X-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400
Sample Position (mm)



CRUSHED ICE EXTRUSION TEST: 997
Sample Density: Y-Axis
Sample Density (gm/cm3)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300
Sample Position (mm)


CRUSHED ICE EXTRUSION TEST: 998
Sample Density: X-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-400
-200
0
200
400


CRUSHED ICE EXTRUSION TEST: 998
Sample Density: Y-Axis
Sample Density (gm/cm3)
Sample Position (mm)
1
0.9
0.8
0.7
0.6
0.5
-300
-100
100
300

9.4 Selected Data Plots

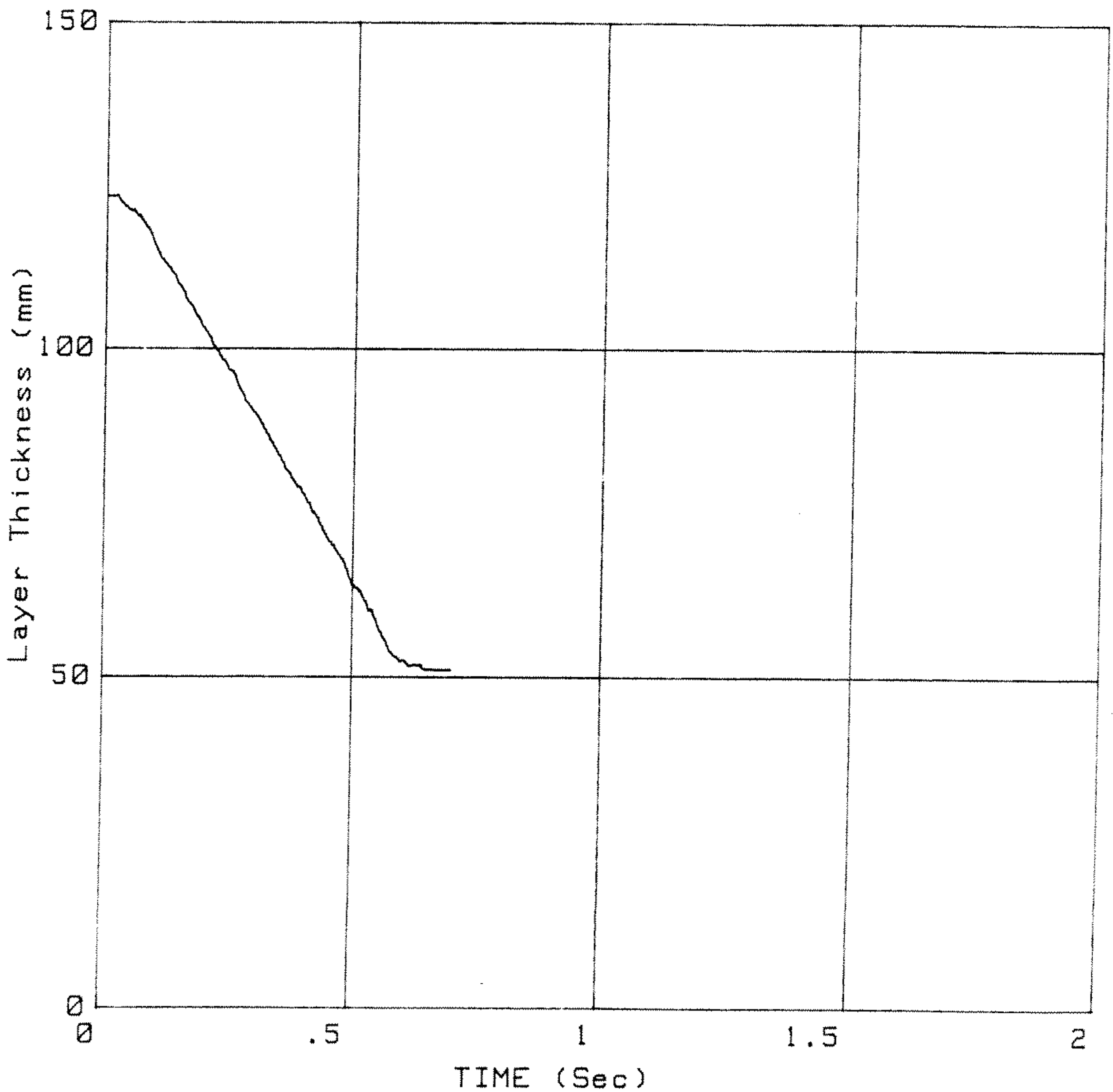
Layer Thickness
vs.
TIME

Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Temperature: -4.4

Average = 10
Truncation Time (s) = .7



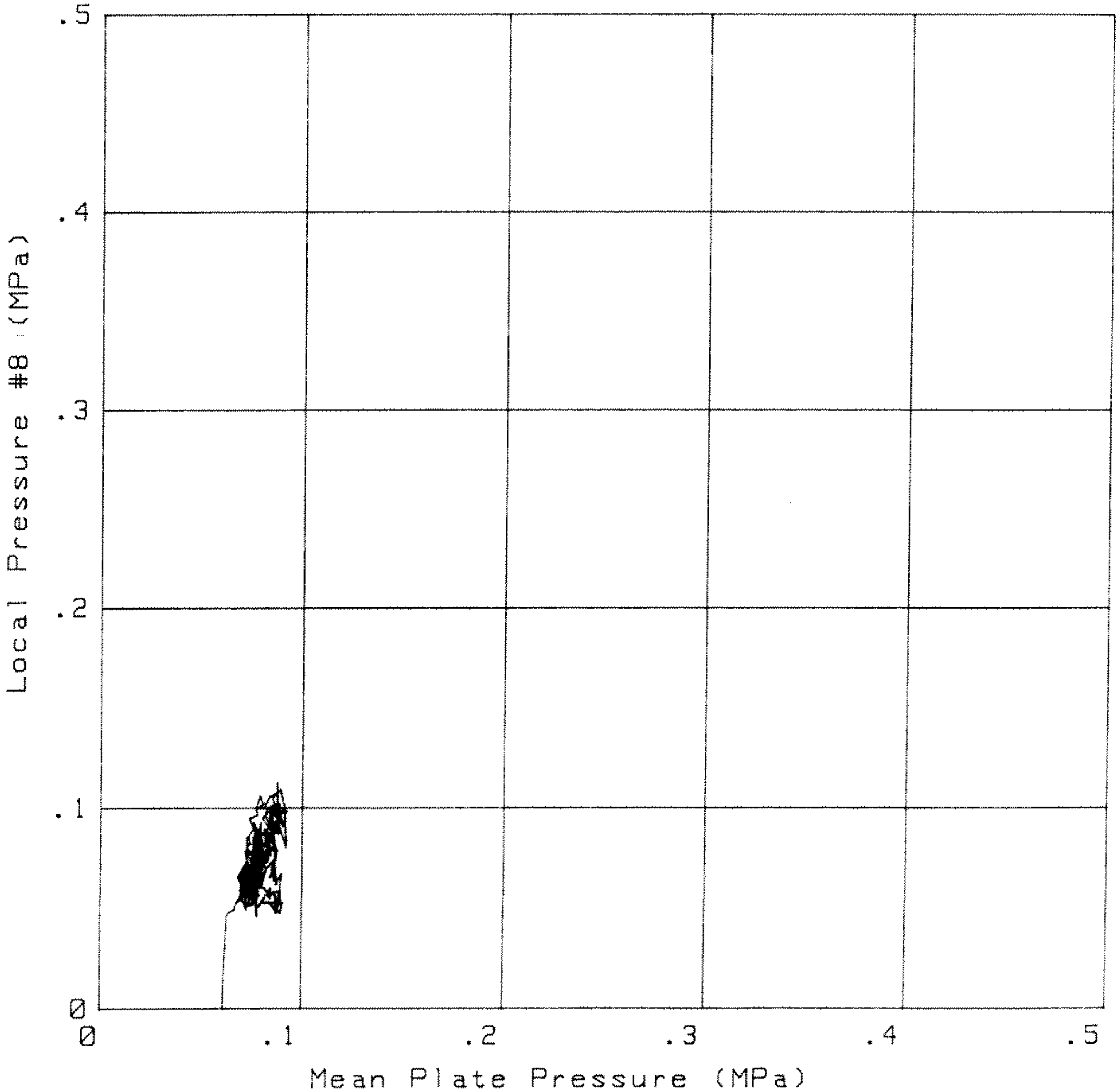
Local Pressure #8
vs.
Mean Plate Pressure

Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Temperature: -4.4

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .125
Data To (s): .65



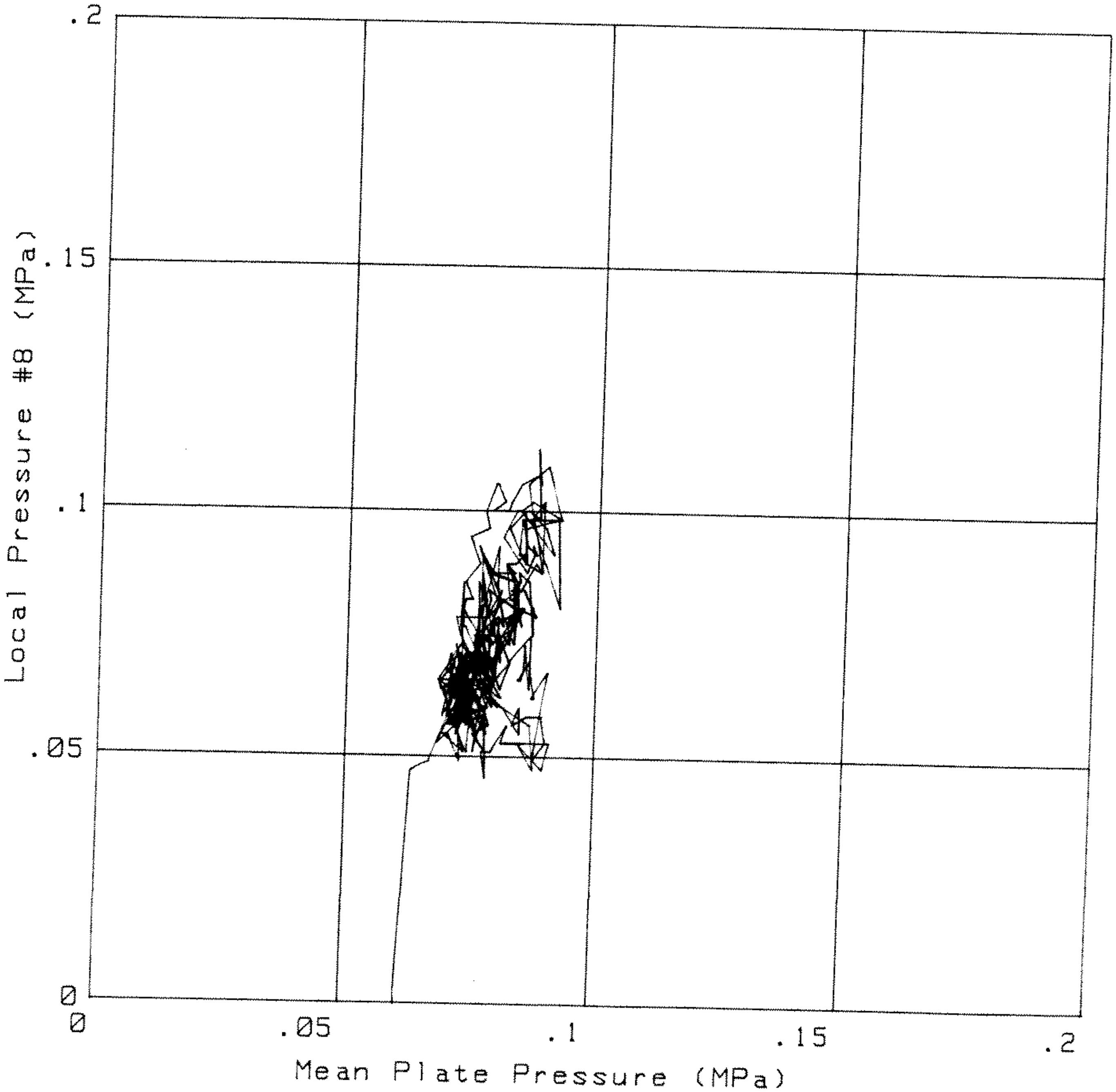
Local Pressure #8
vs.
Mean Plate Pressure

Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Temperature: -4.4

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .125
Data To (s): .65



Mean Plate Pressure
vs.
TIME

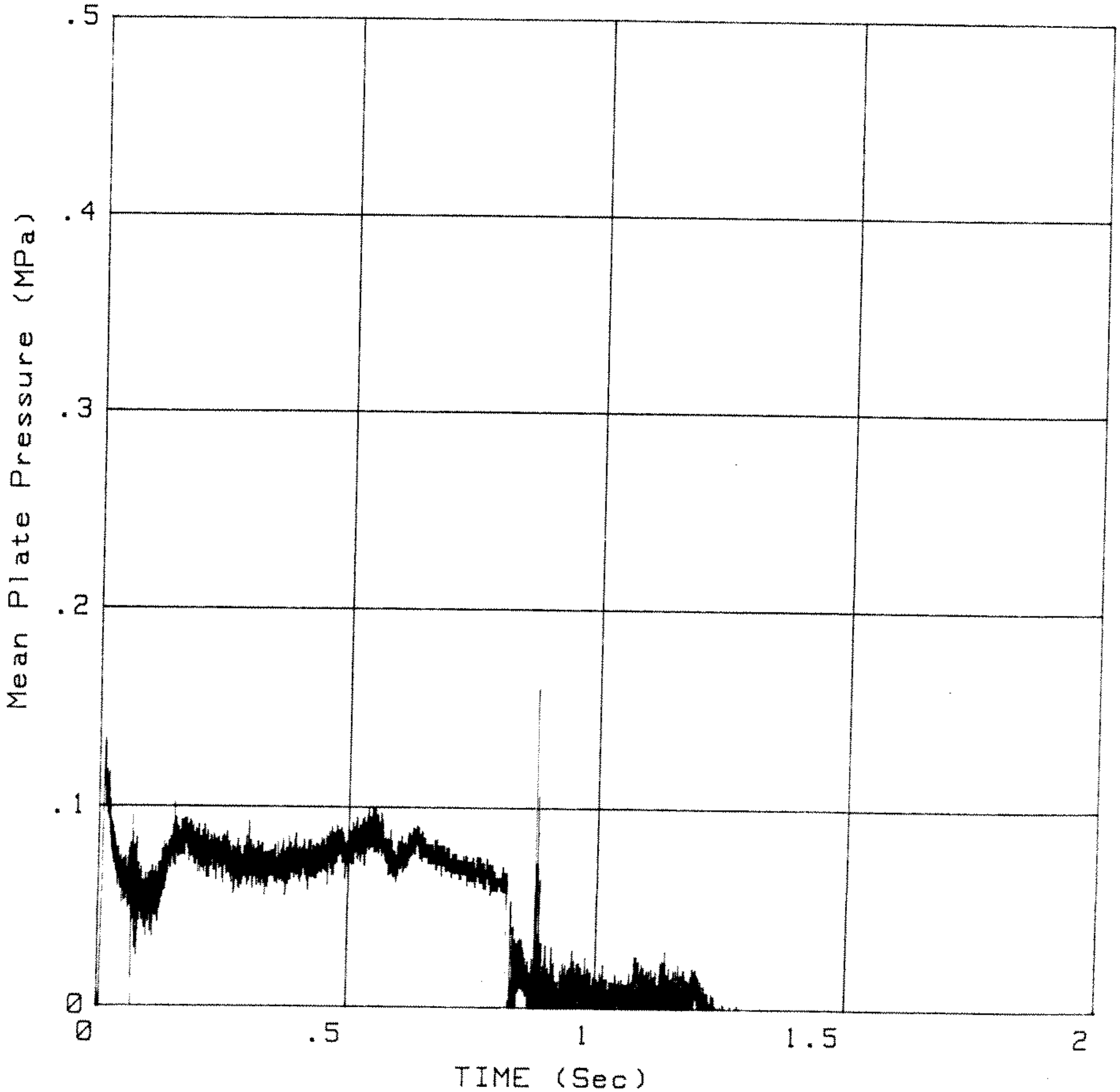
Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Y Offset Removed

Temperature: -4.4

Average = 1
Truncation Time (s) = 2.57



Local Pressure #12
vs.
TIME

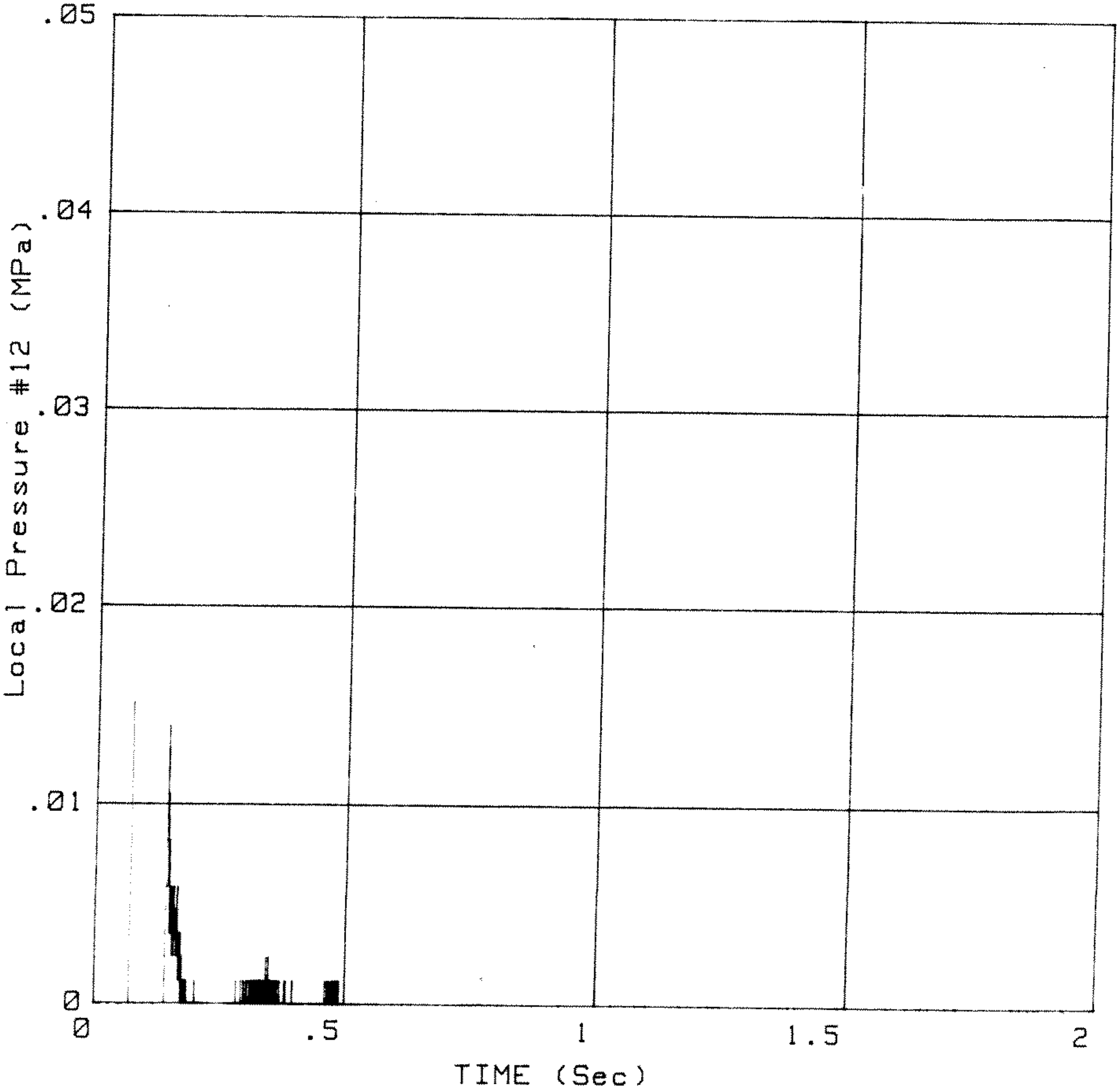
Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Temperature: -4.4

Y Offset Removed

Average = 1
Truncation Time (s) = 2.57



Local Pressure #10
vs.
TIME

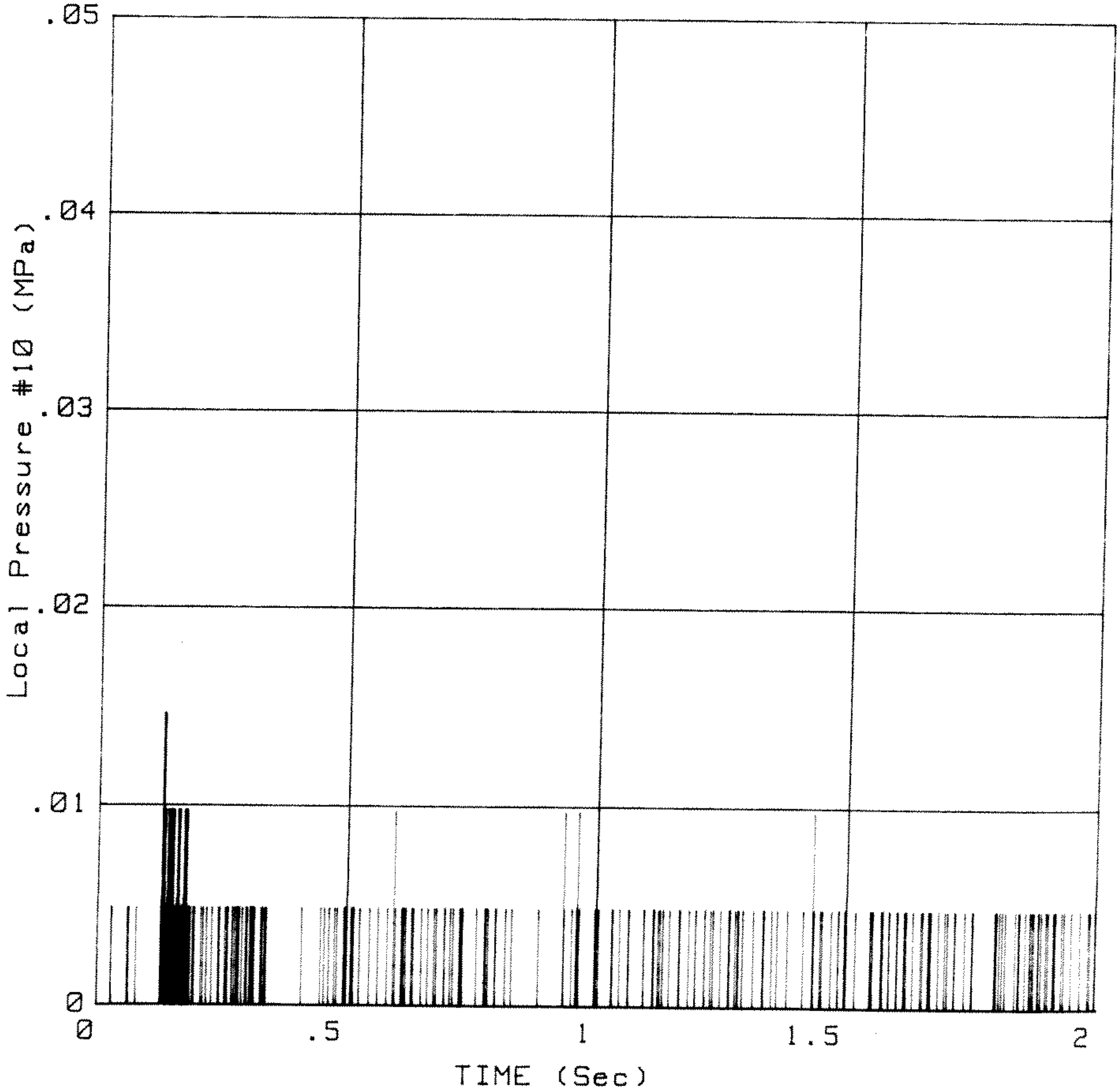
Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Y Offset Removed

Temperature: -4.4

Average = 1
Truncation Time (s) = 2.57



Local Pressure #16
vs.
TIME

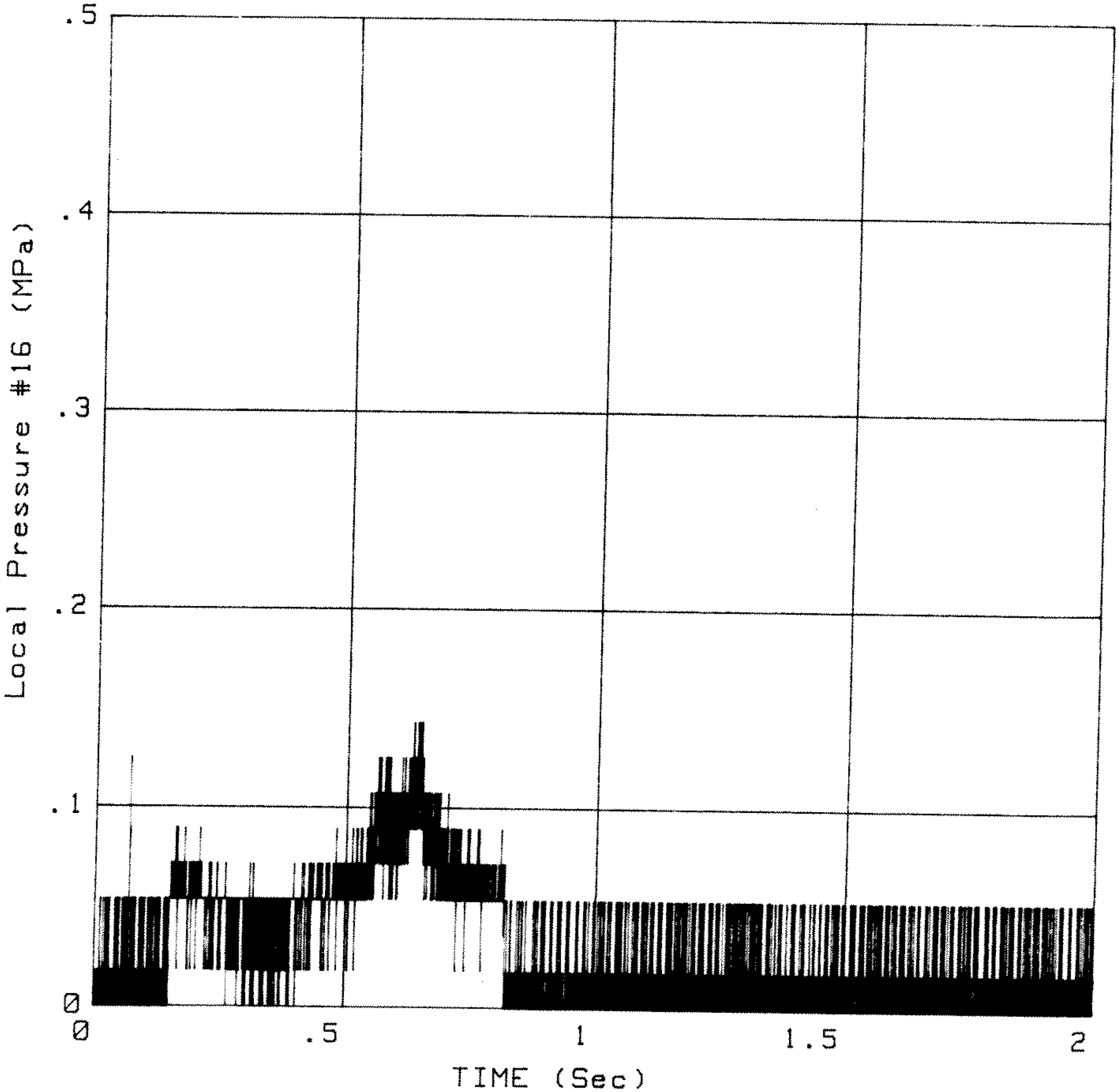
Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Y Offset Removed

Temperature: -4.4

Average = 1
Truncation Time (s) = 2.57



Local Pressure #8
vs.
TIME

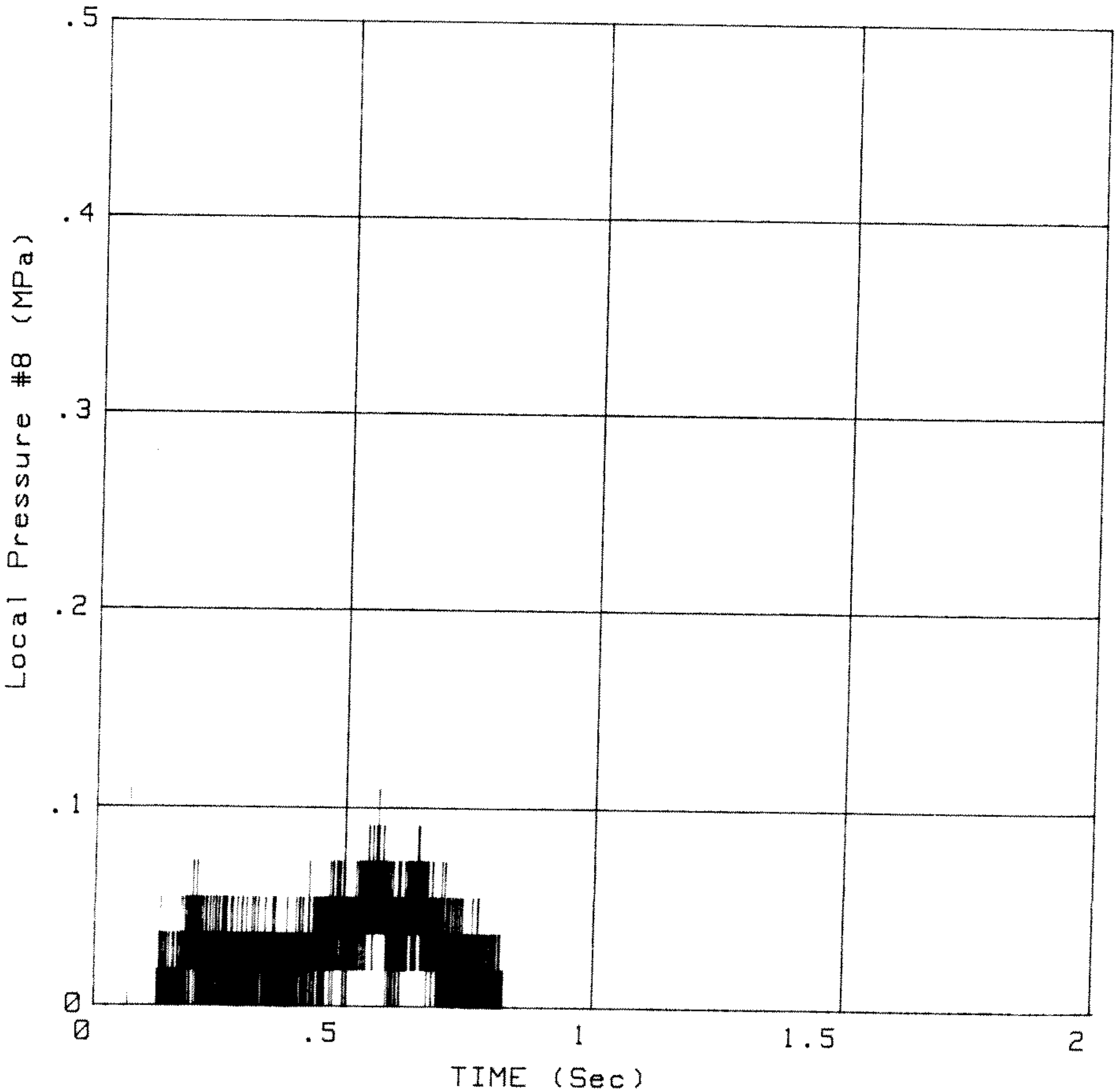
Test: X962
Type: Extrusion test
Sample: CRUSHED ICE

Date: 25 Jan 1989
Time: 14:37:52

Temperature: -4.4

Y Offset Removed

Average = 1
Truncation Time (s) = 2.57



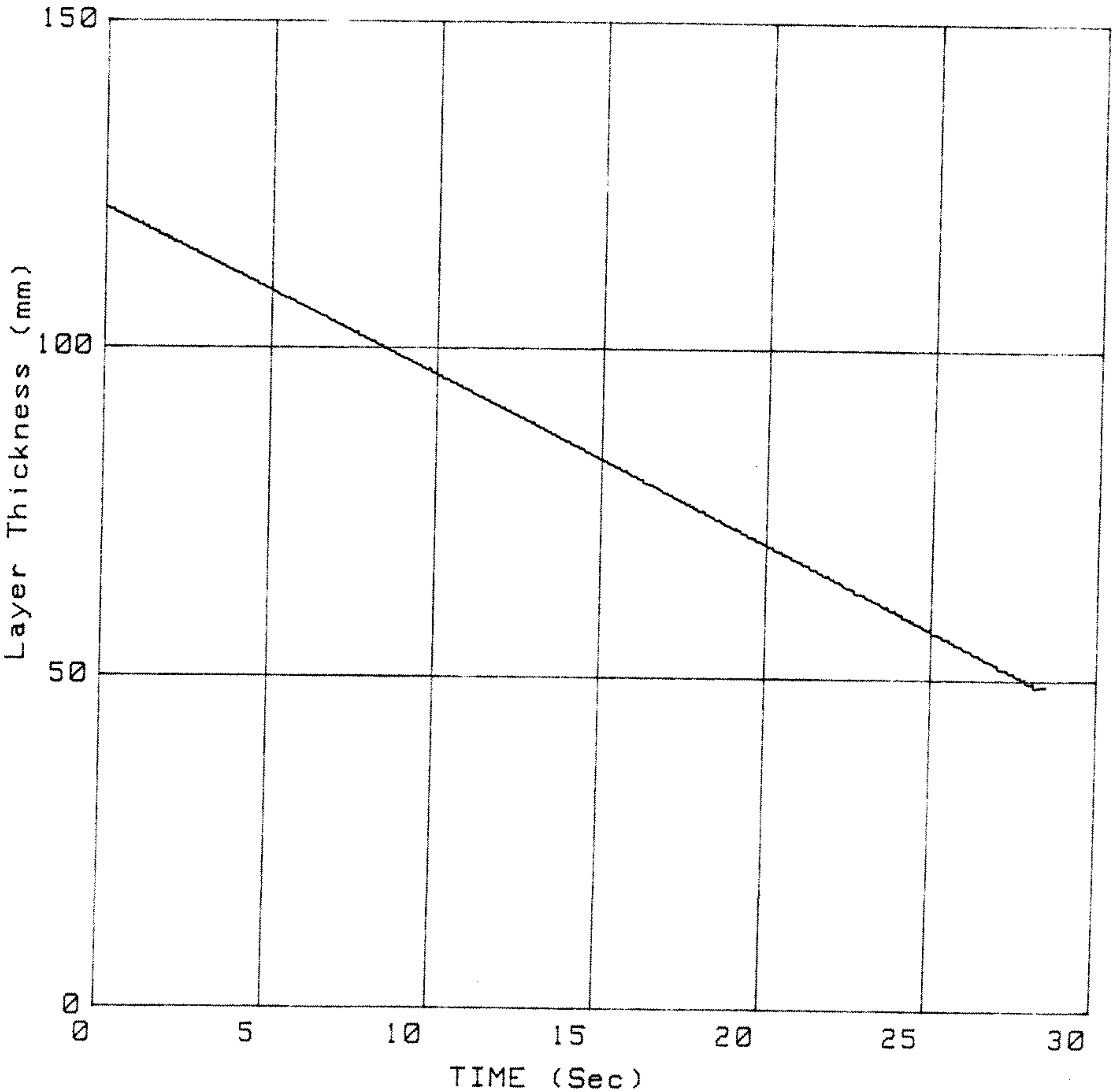
Layer Thickness
vs.
TIME

Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Temperature: -9.8

Average = 10
Truncation Time (s) = 28.5



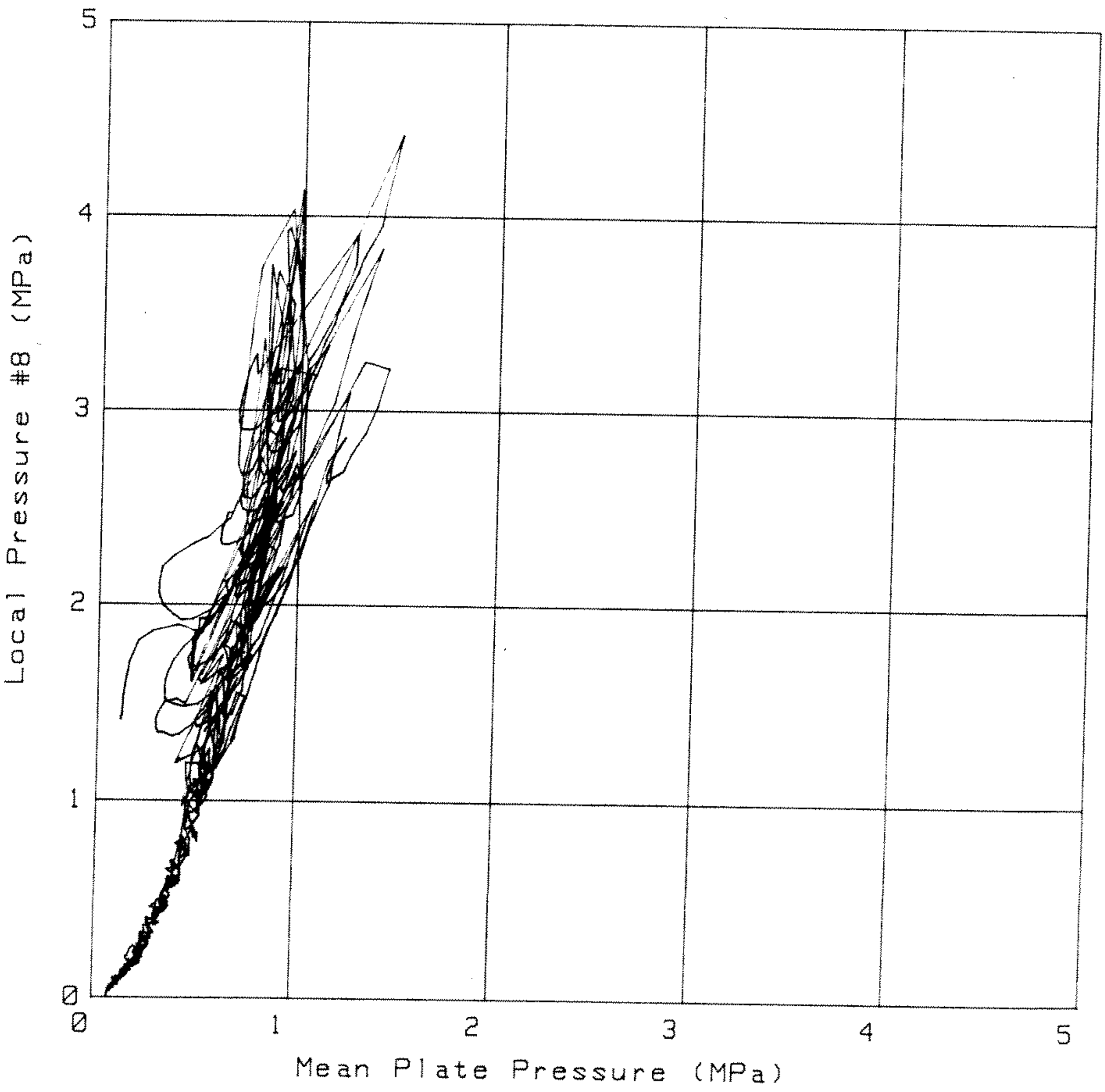
Local Pressure #8
vs.
Mean Plate Pressure

Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 5.03
Data To (s): 28.5



Local Pressure #12
vs.
TIME

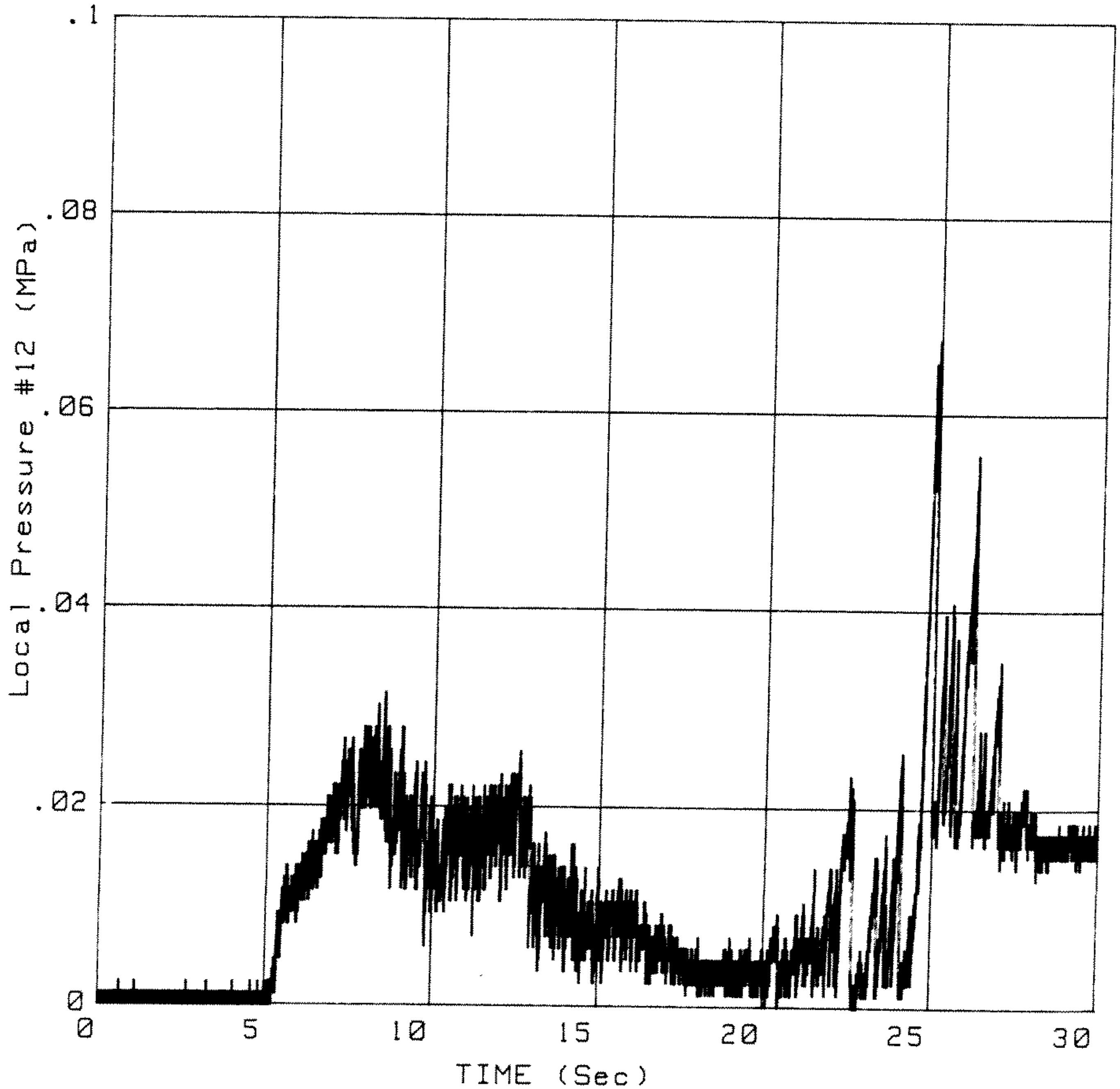
Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 30



Mean Plate Pressure vs. TIME

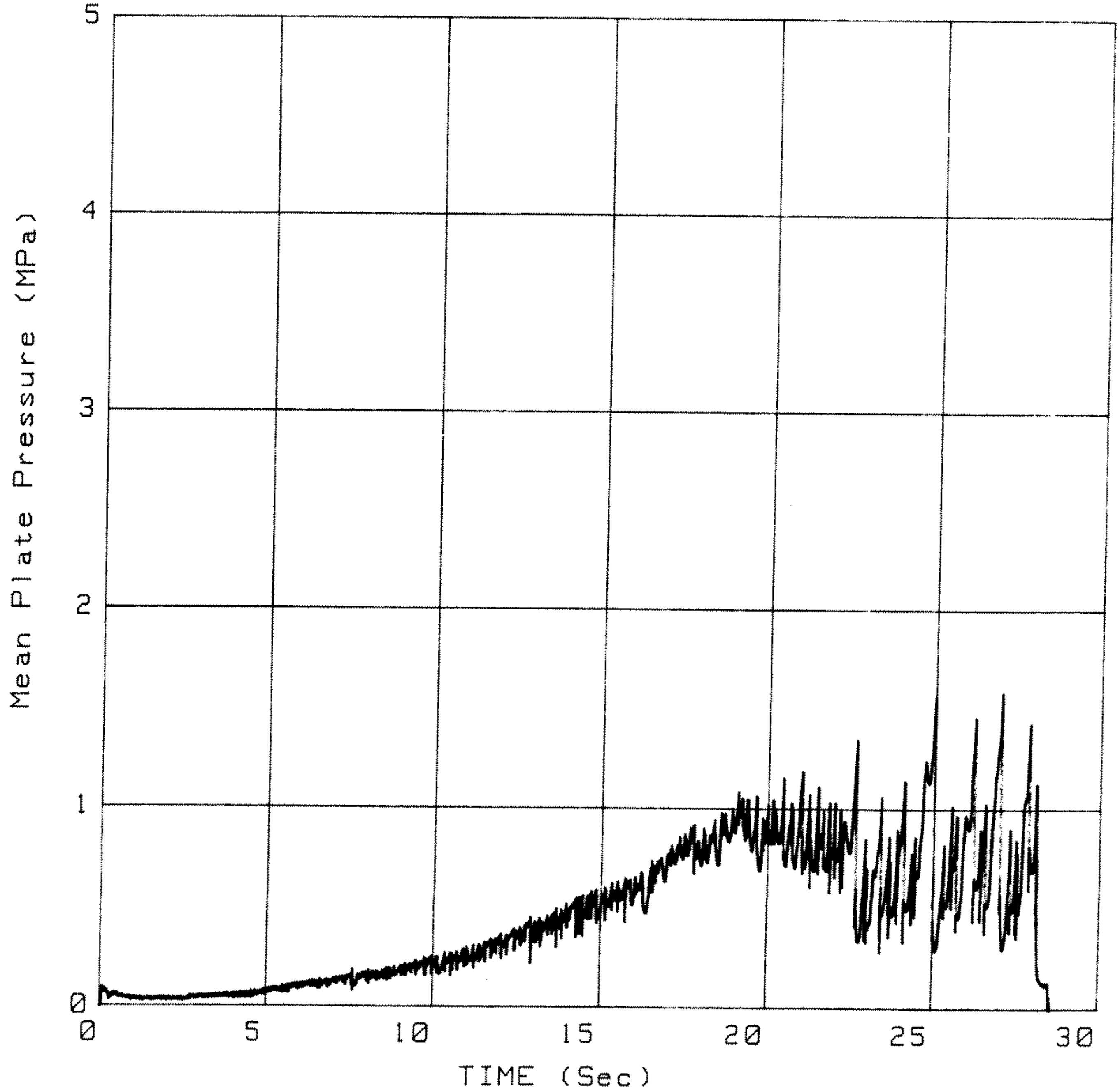
Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 30



Local Pressure #8
vs.
TIME

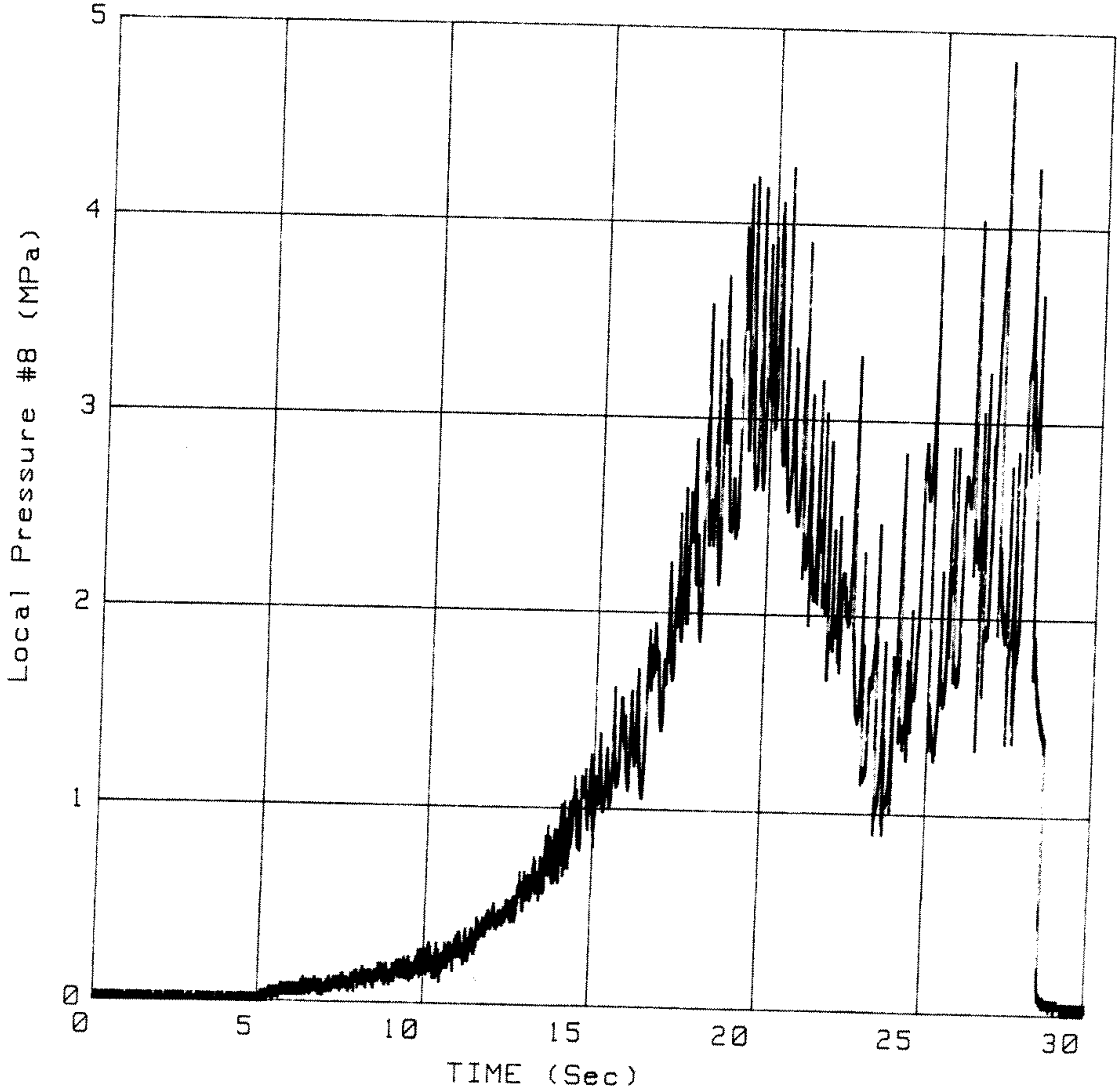
Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 30



Local Pressure #16
vs.
TIME

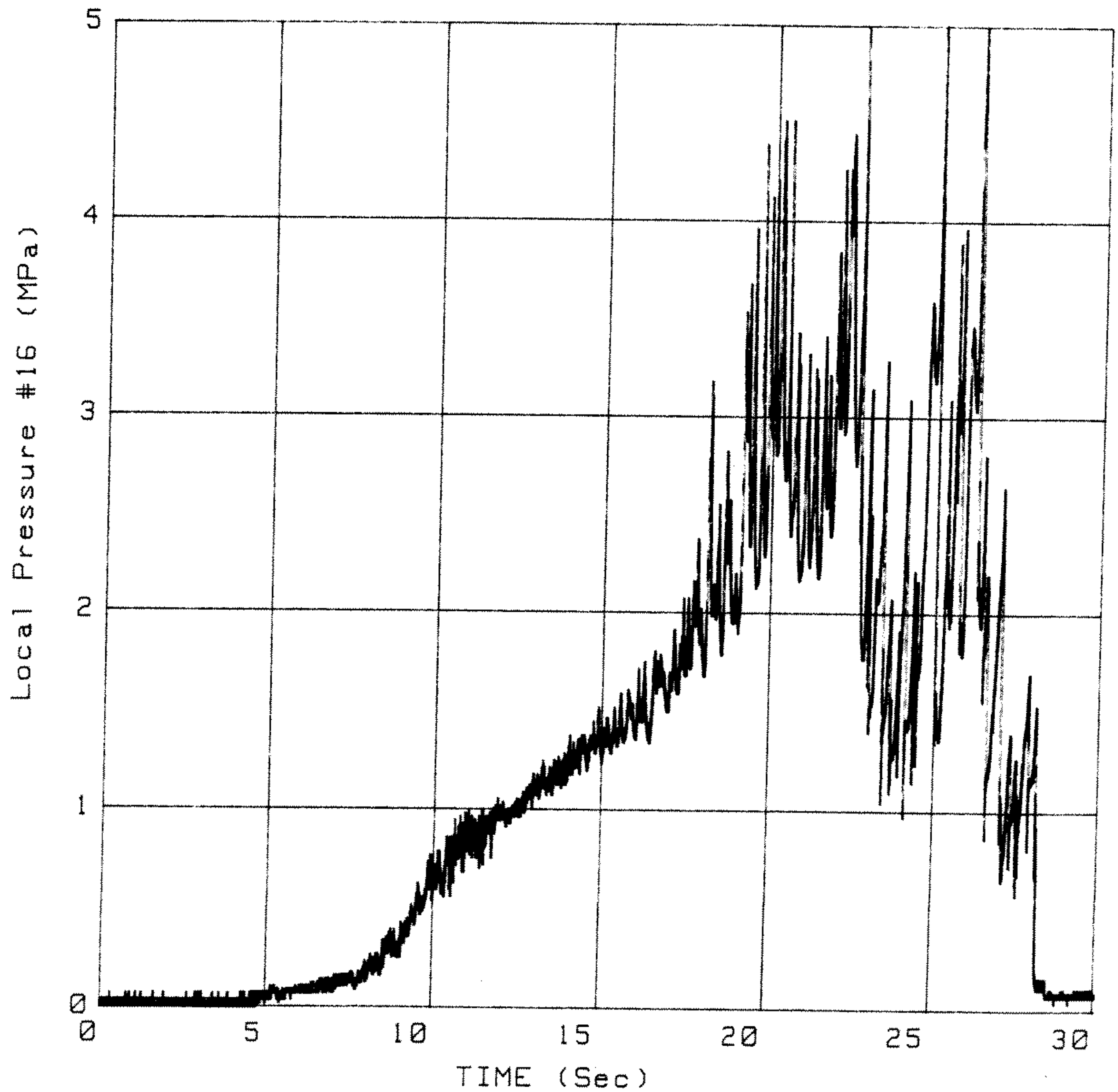
Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 30



Local Pressure #10
vs.
TIME

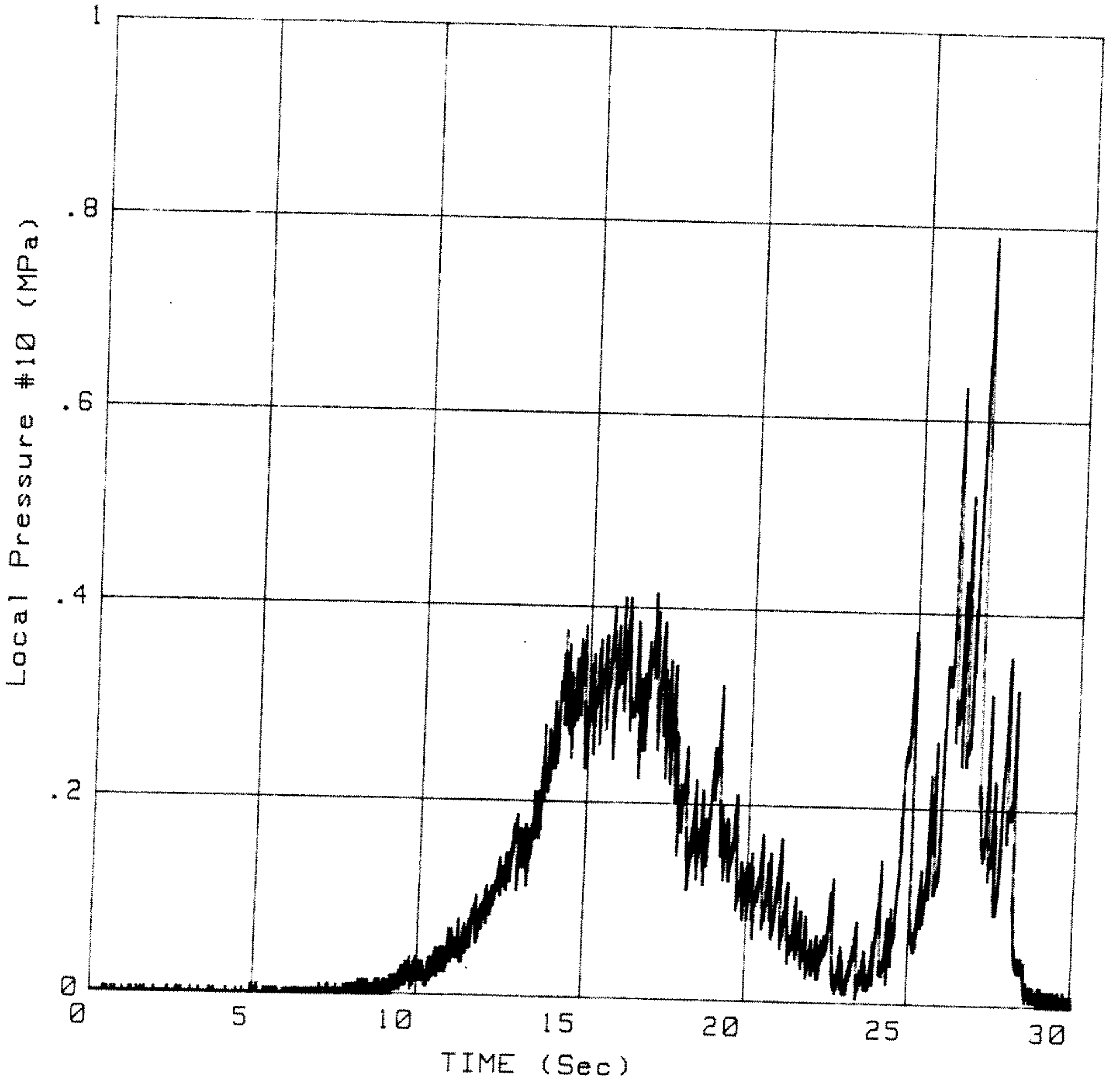
Test: X963
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 16:16:59

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 30



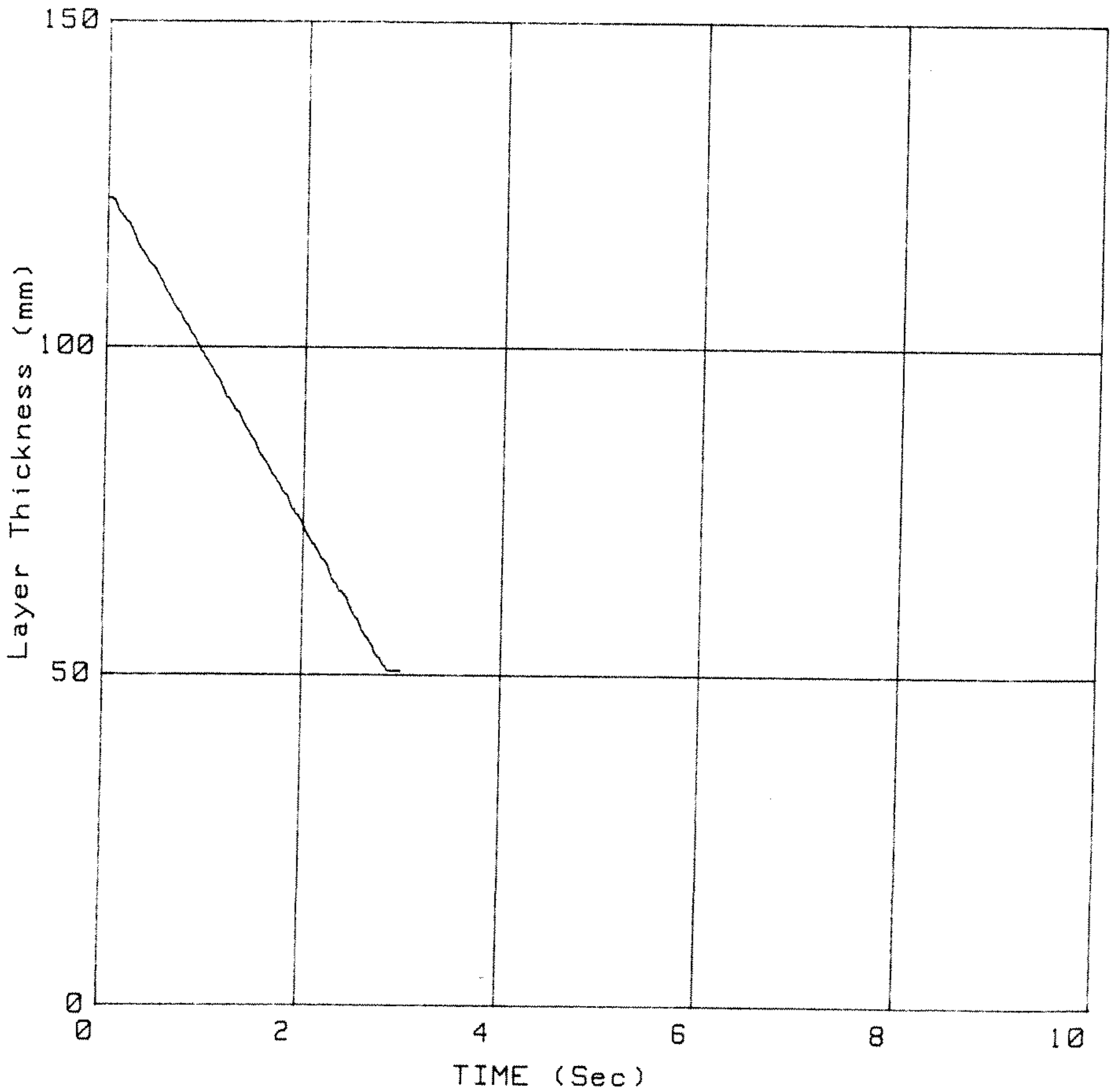
Layer Thickness
vs.
TIME

Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 11:39:57

Temperature: -9.8

Average = 10
Truncation Time (s) = 3



Local Pressure #8
vs.
TIME

Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

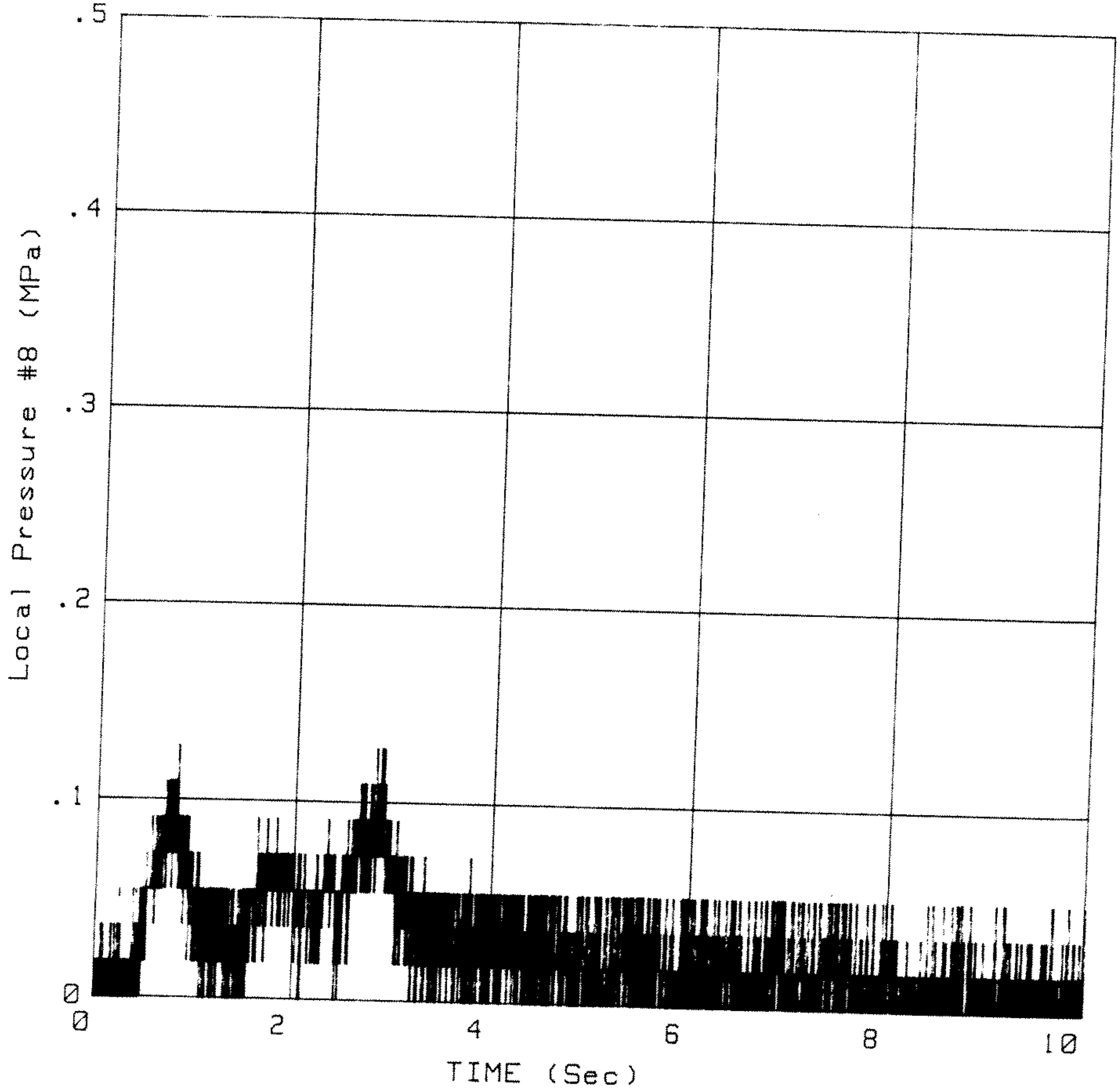
Date: 24 Jan 1989
Time: 11:39:57

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 30



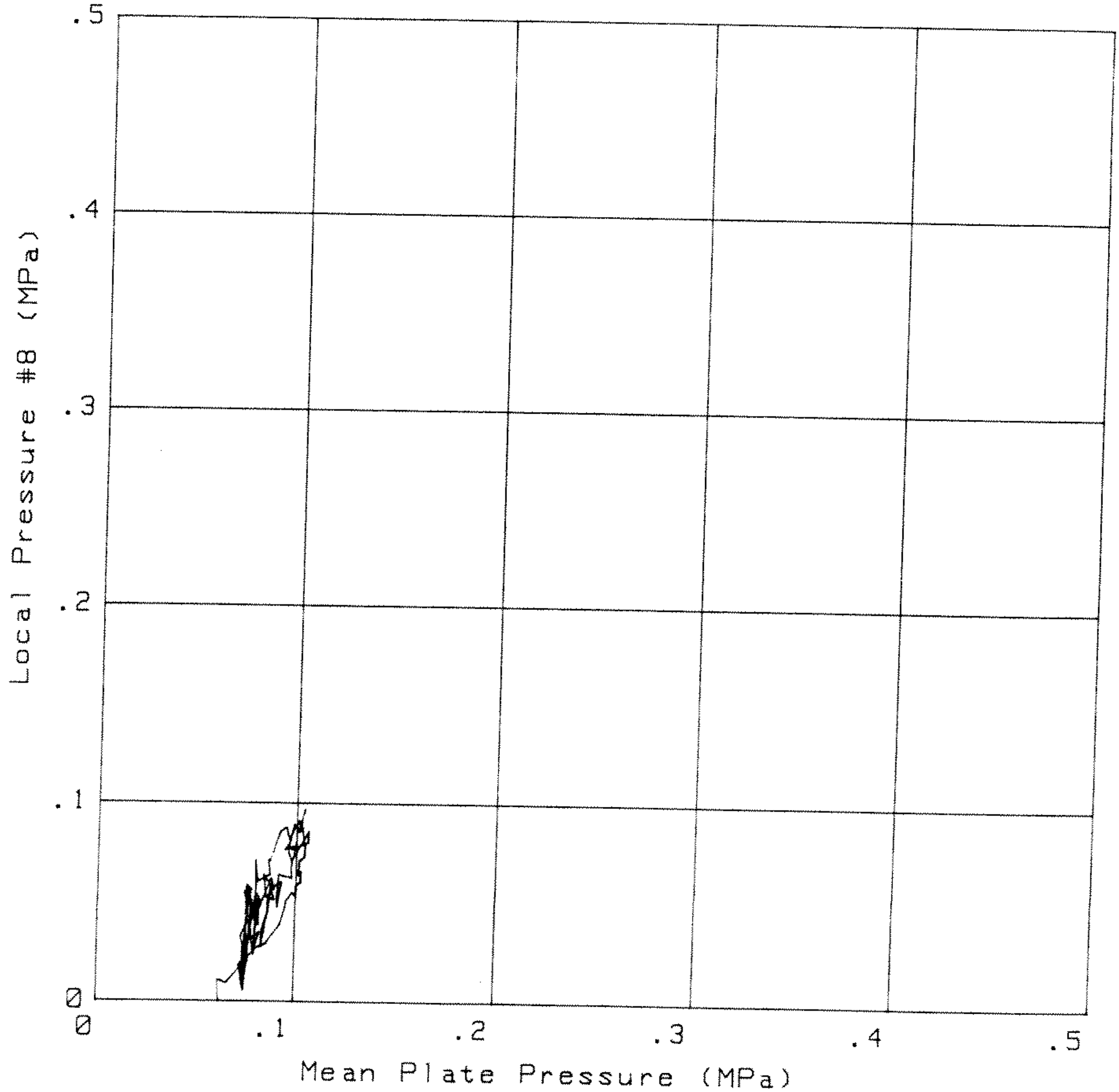
Local Pressure #8
vs.
Mean Plate Pressure

Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 11:39:57

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .42
Data To (s): 2.9



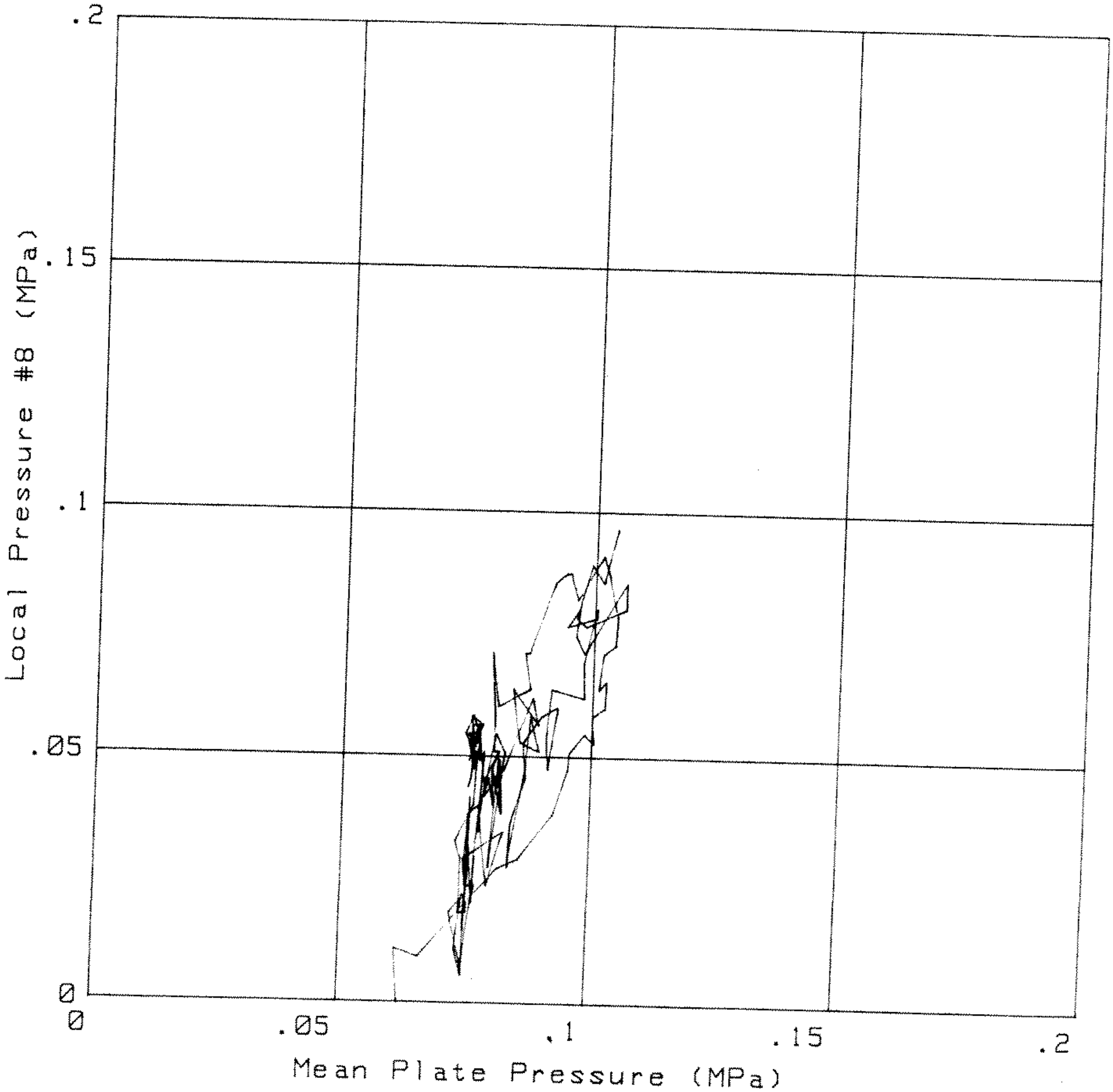
Local Pressure #8
vs.
Mean Plate Pressure

Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 11:39:57

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .42
Data To (s): 2.9



Local Pressure #16
vs.
TIME

Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

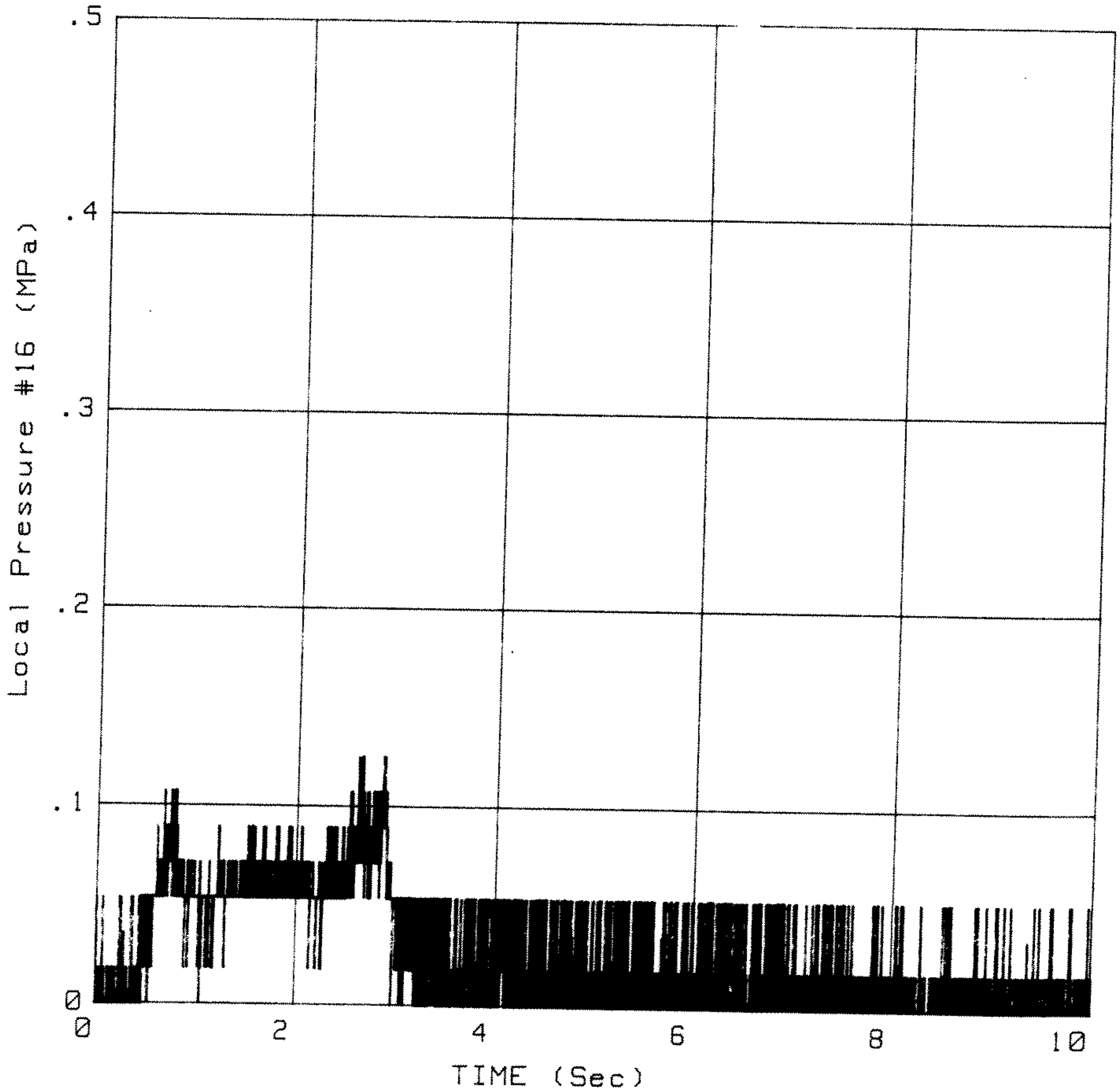
Date: 24 Jan 1989
Time: 11:39:57

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 30



Local Pressure #12
vs.
TIME

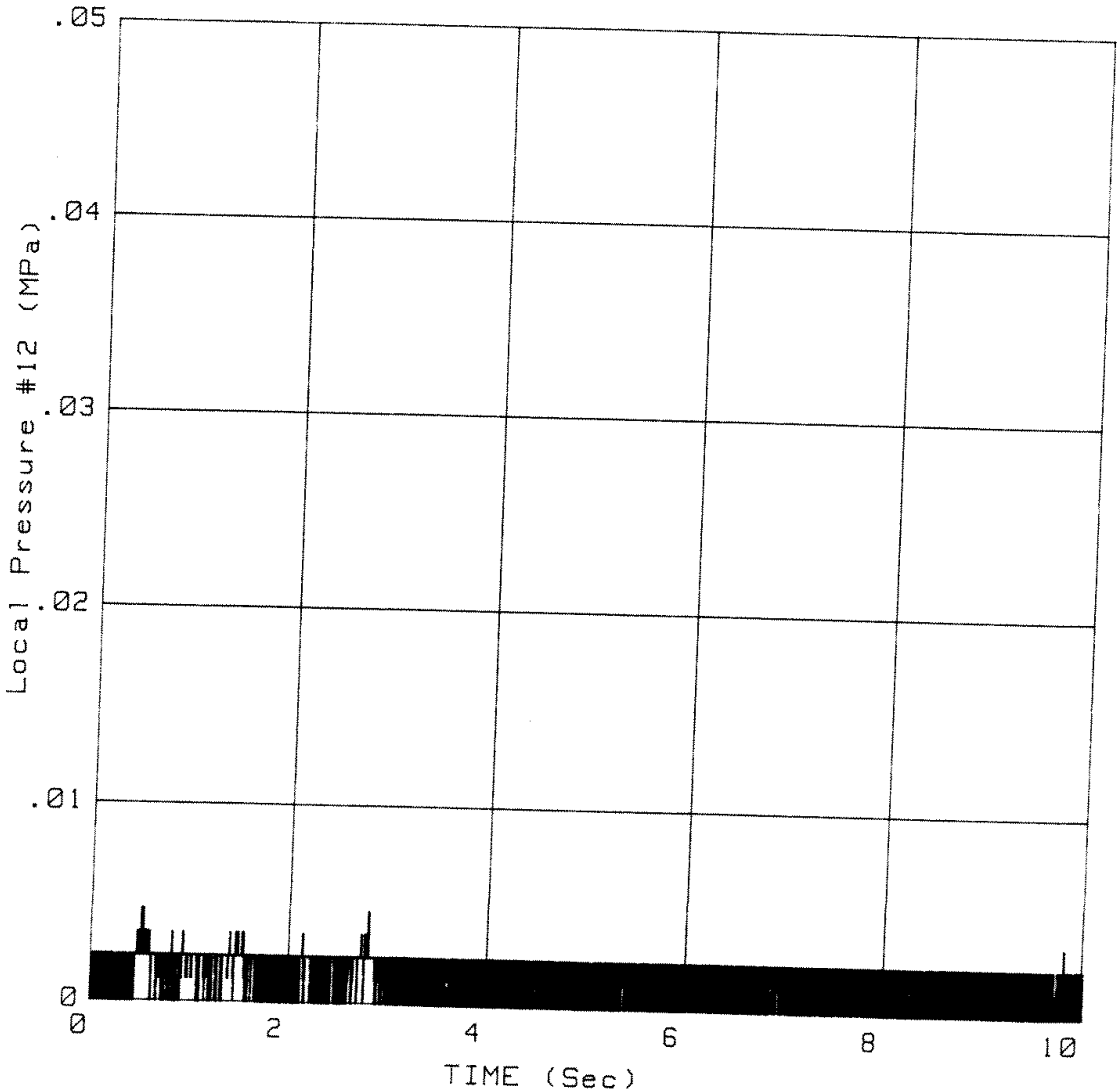
Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 11:39:57

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 30



Local Pressure #10
vs.
TIME

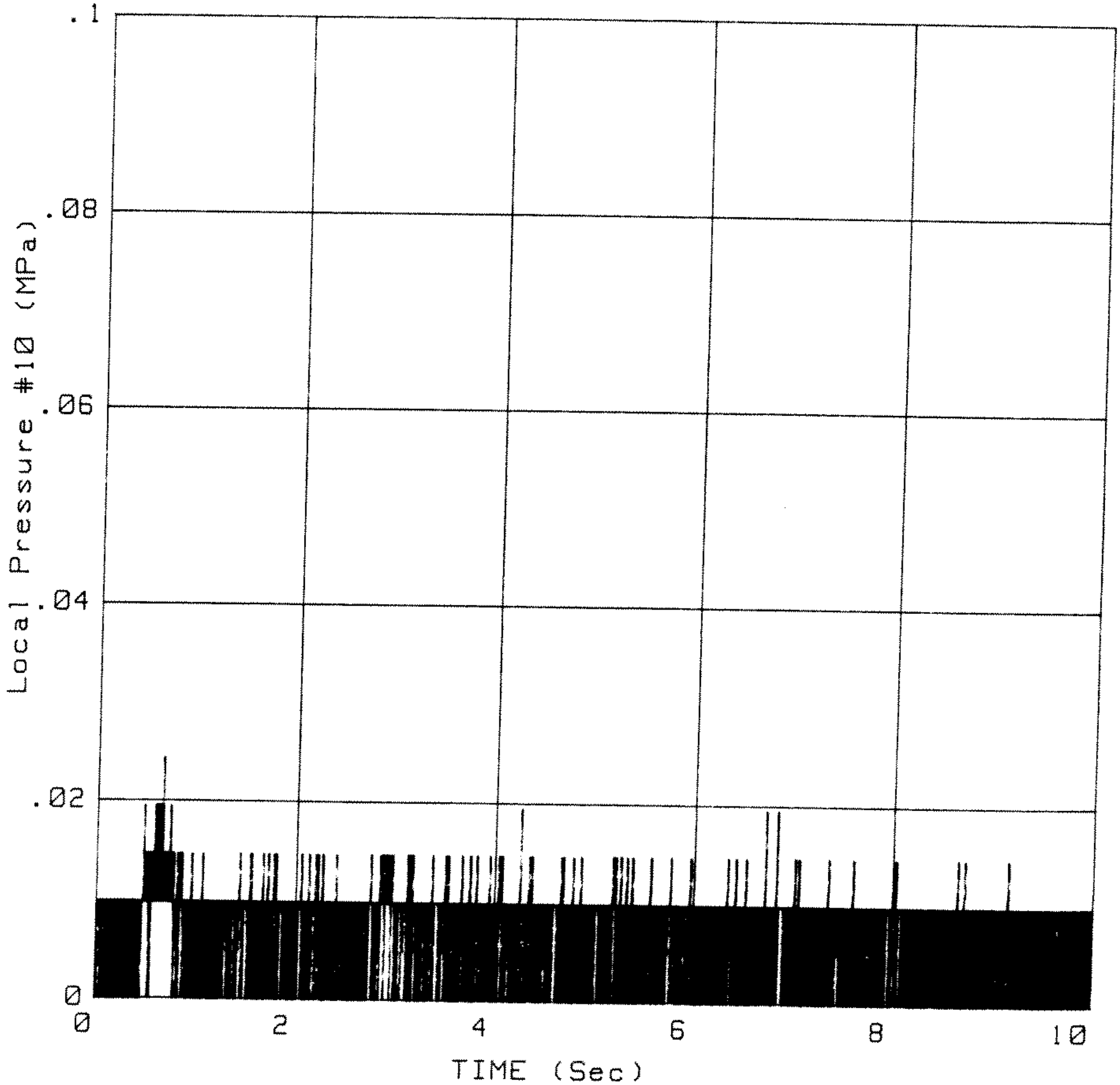
Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 11:39:57

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 30



Mean Plate Pressure
vs.
TIME

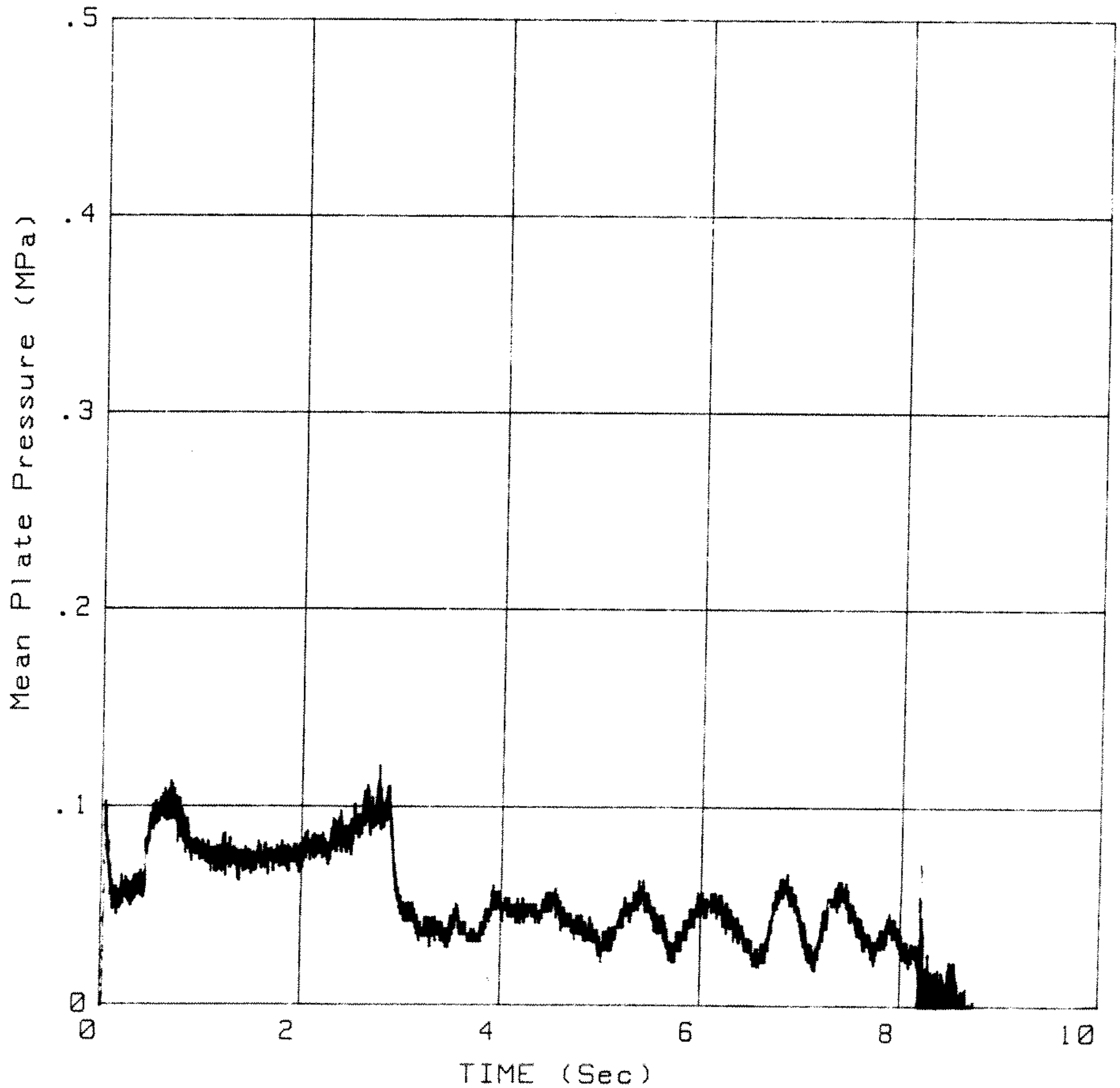
Test: X964
Type: Extrusion test
Sample: CRUSHED ICE

Date: 24 Jan 1989
Time: 11:39:57

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 30



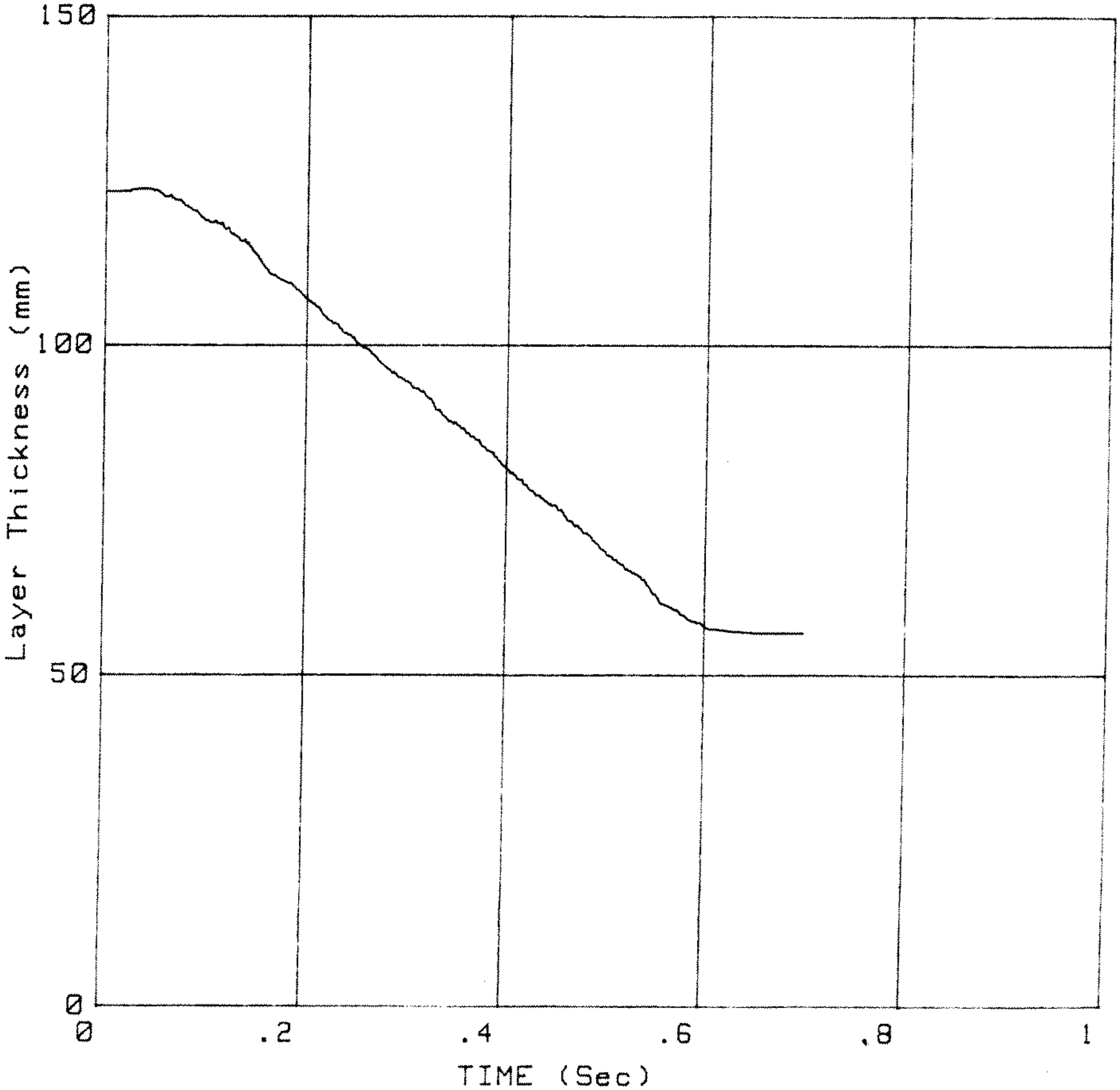
Layer Thickness
vs.
TIME

Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Temperature: -9.8

Average = 10
Truncation Time (s) = .7



Mean Plate Pressure vs. TIME

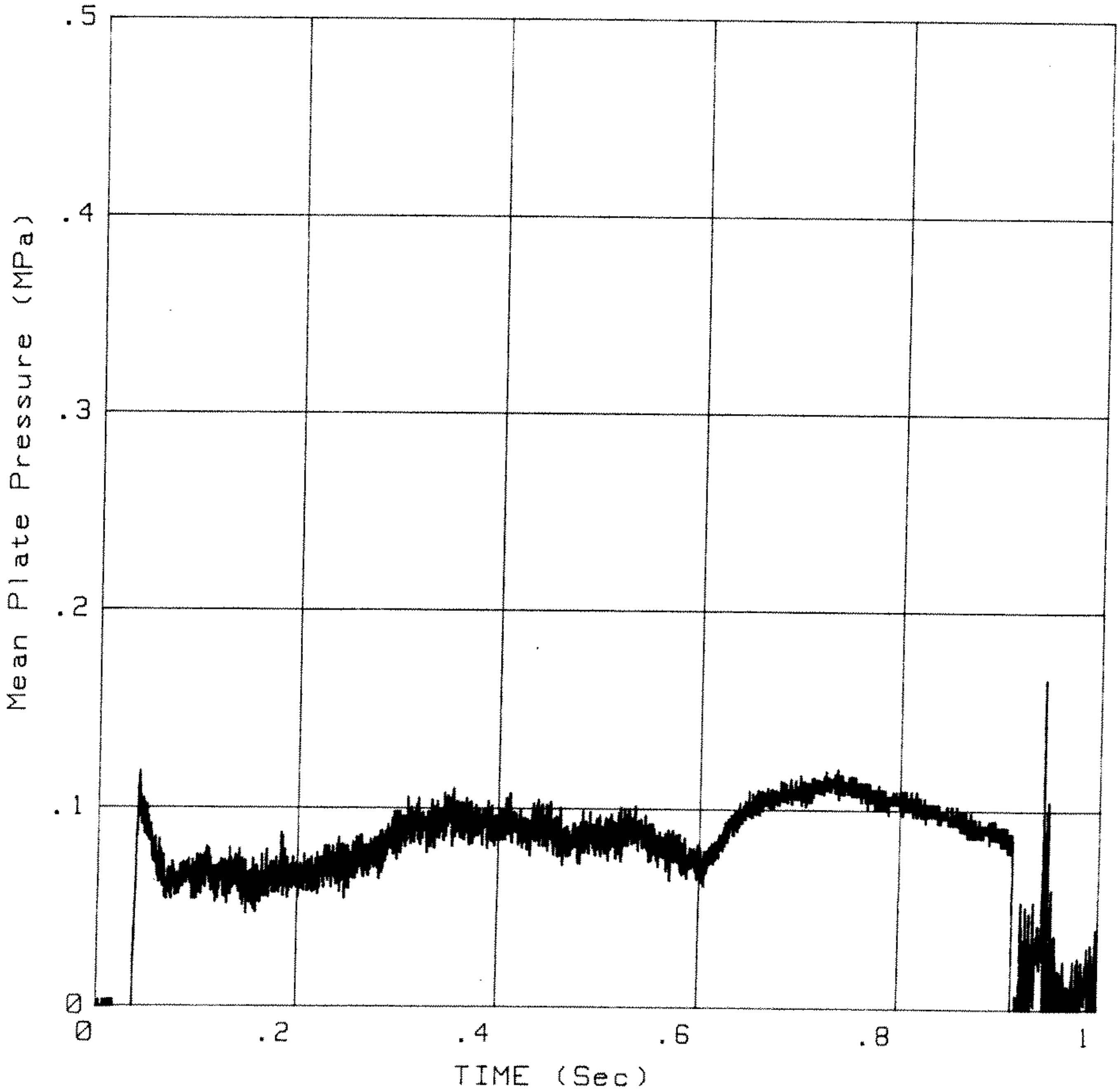
Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 2.57



Local Pressure #10
vs.
TIME

Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

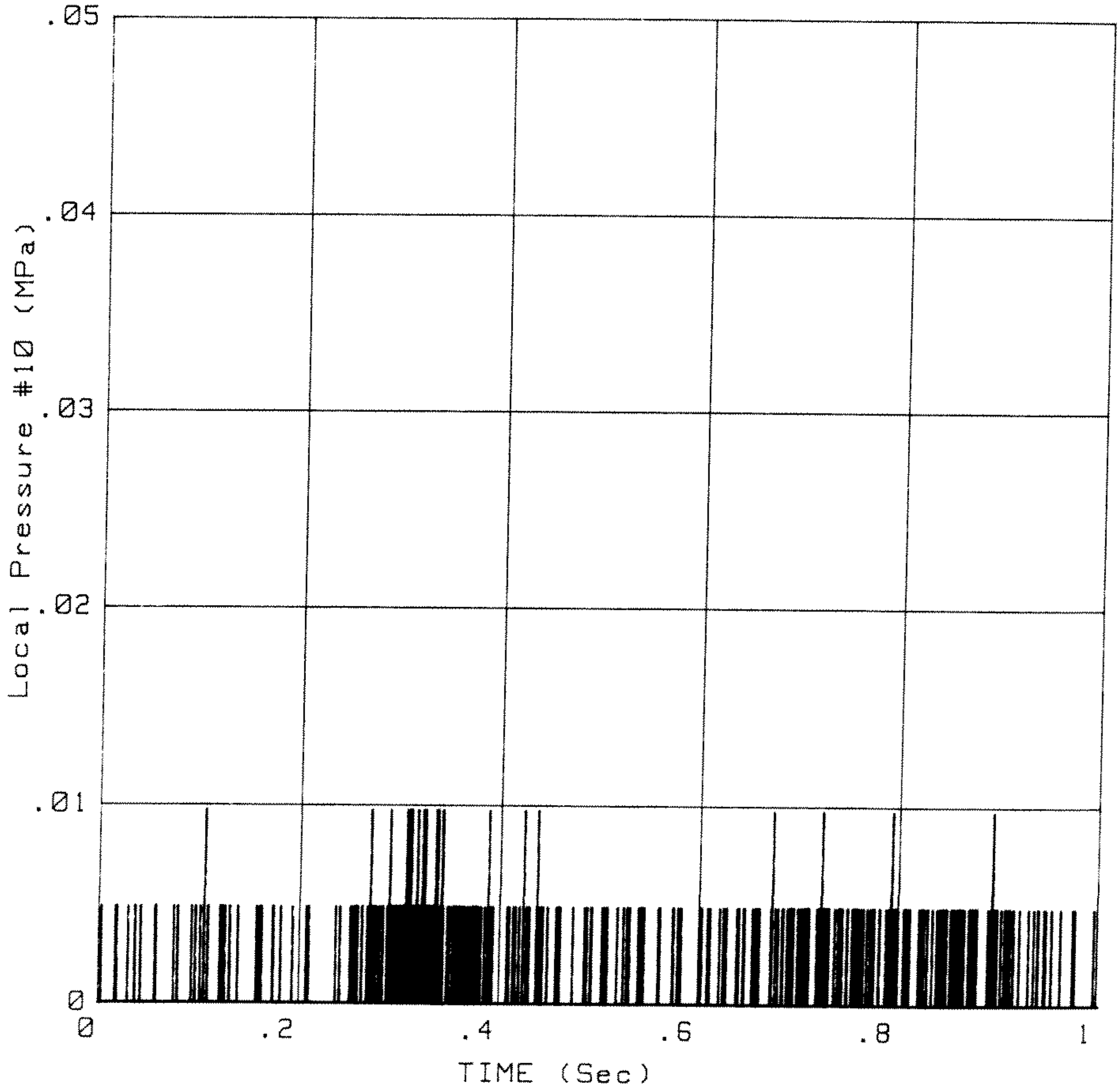
Date: 23 Jan 1989
Time: 16:12:24

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 2.57



Local Pressure #16
vs.
TIME

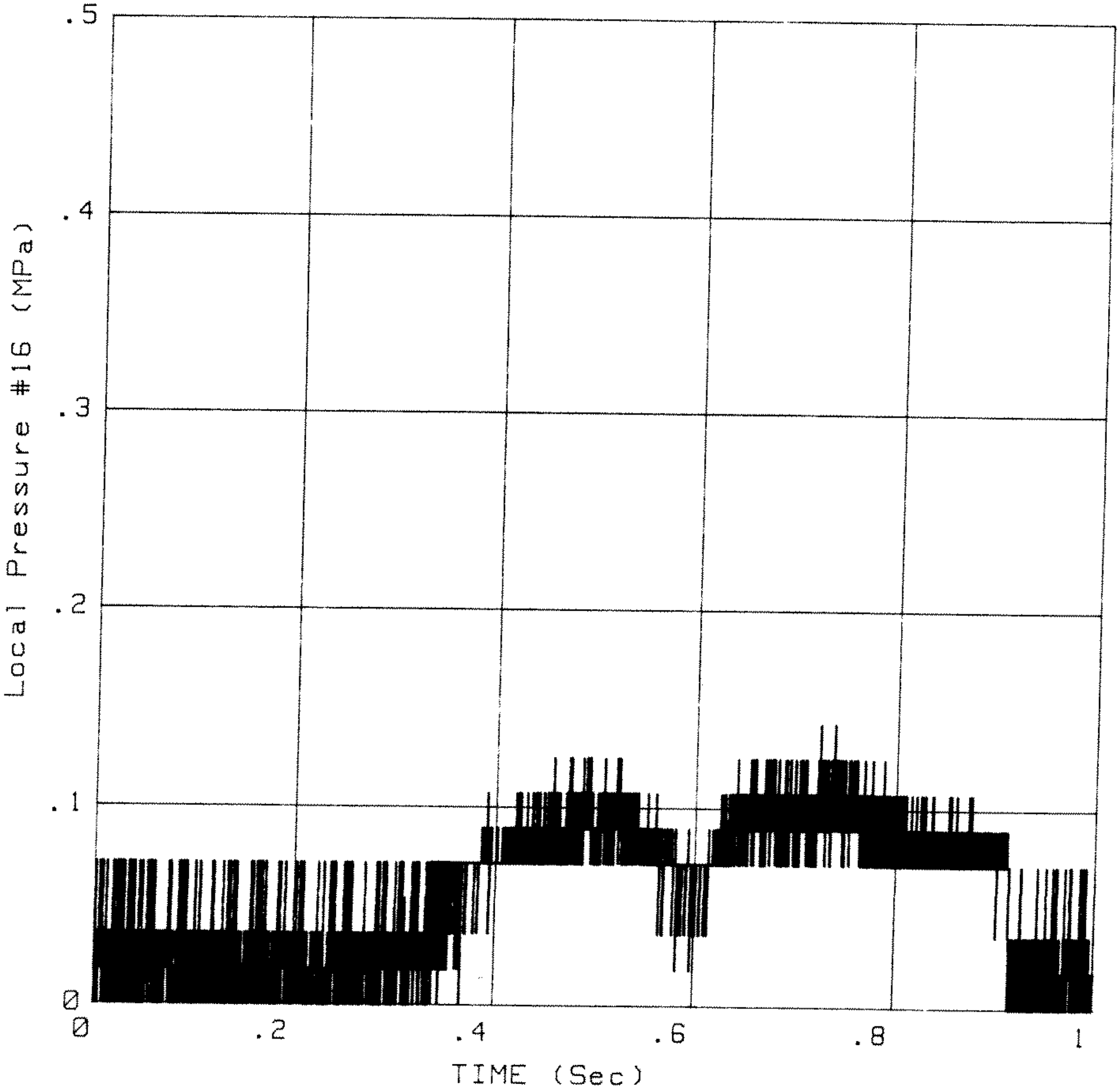
Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 2.57



Local Pressure #8
vs.
TIME

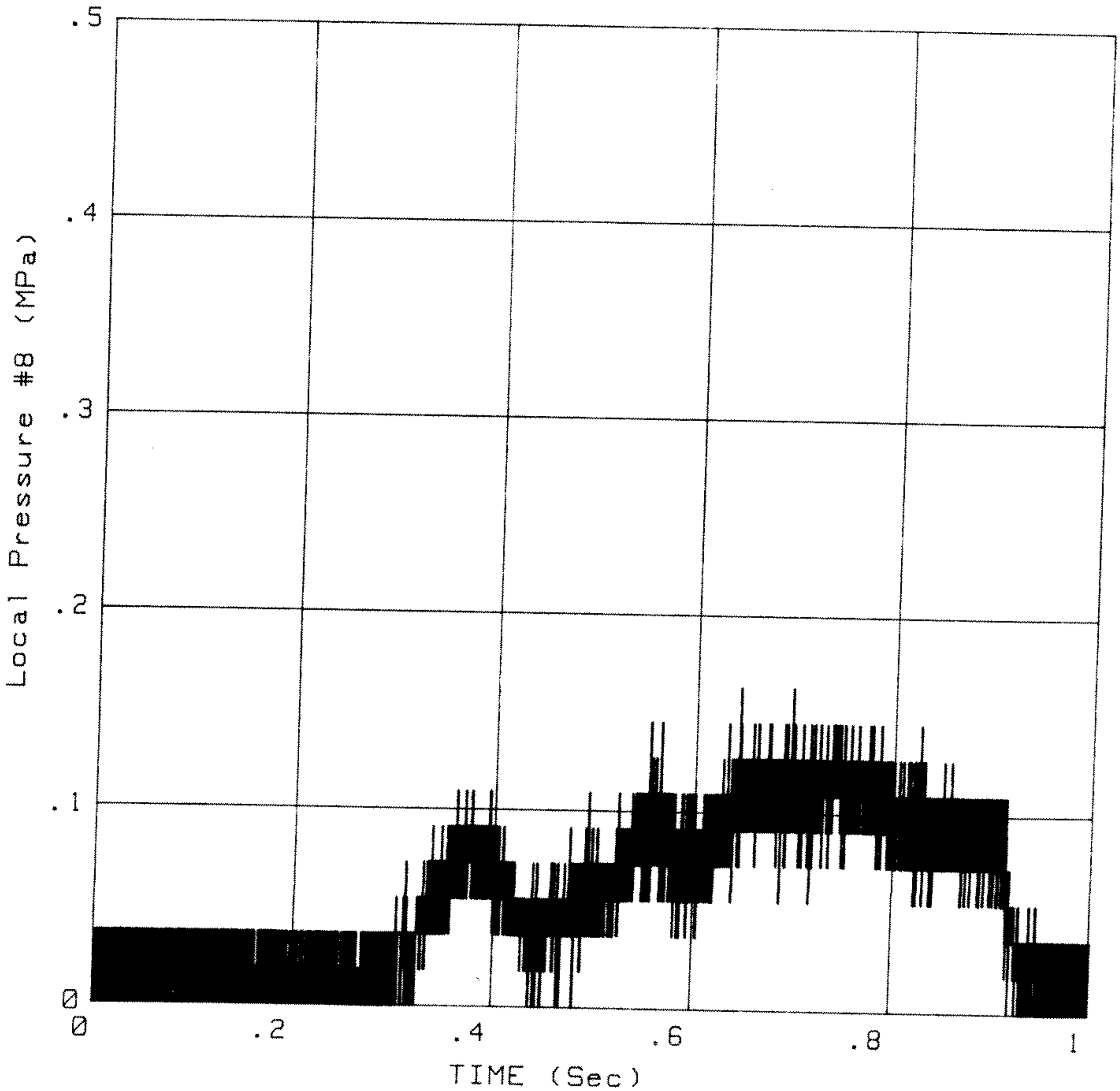
Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 2.57



Local Pressure #12
vs.
TIME

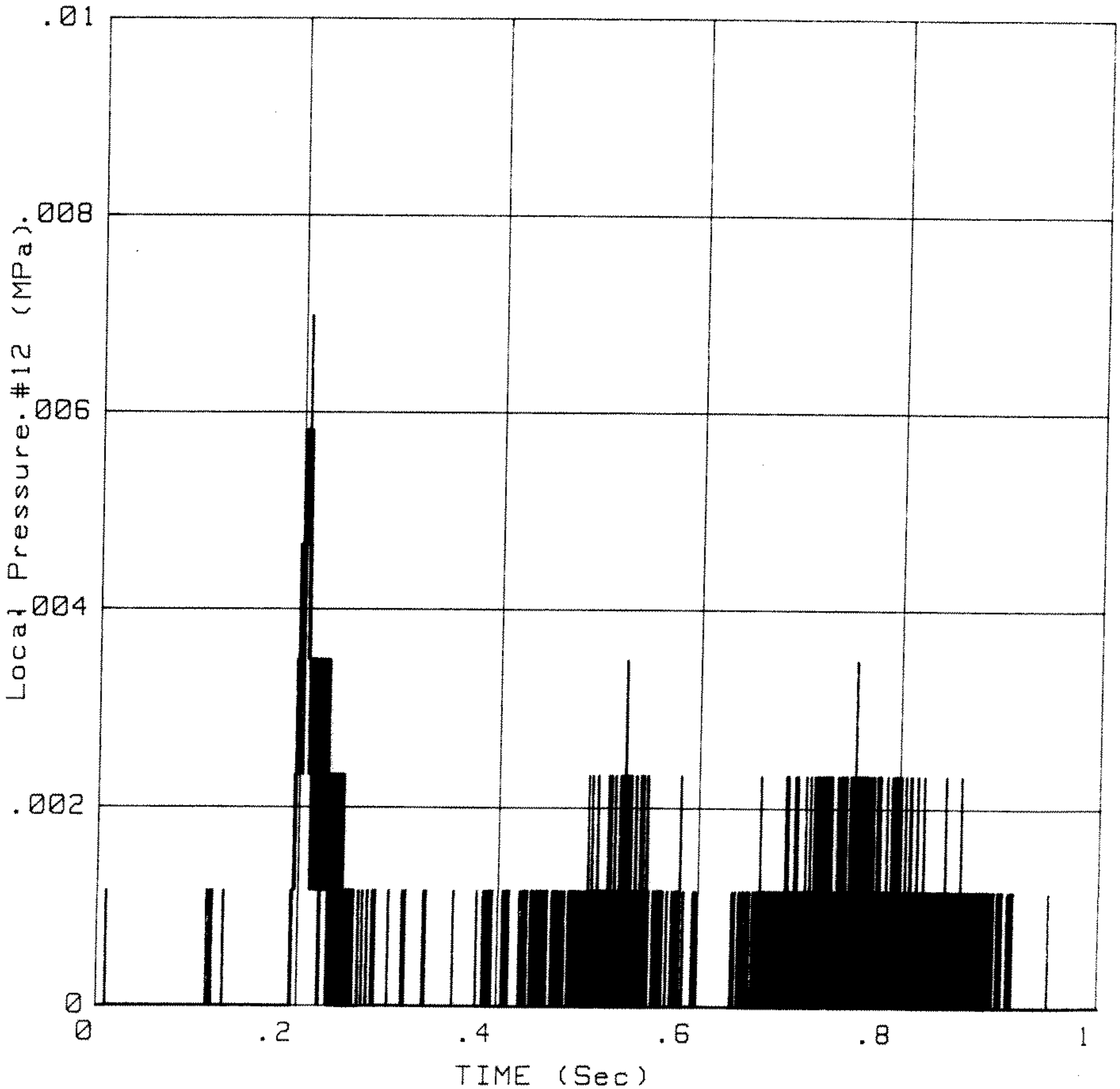
Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 2.57



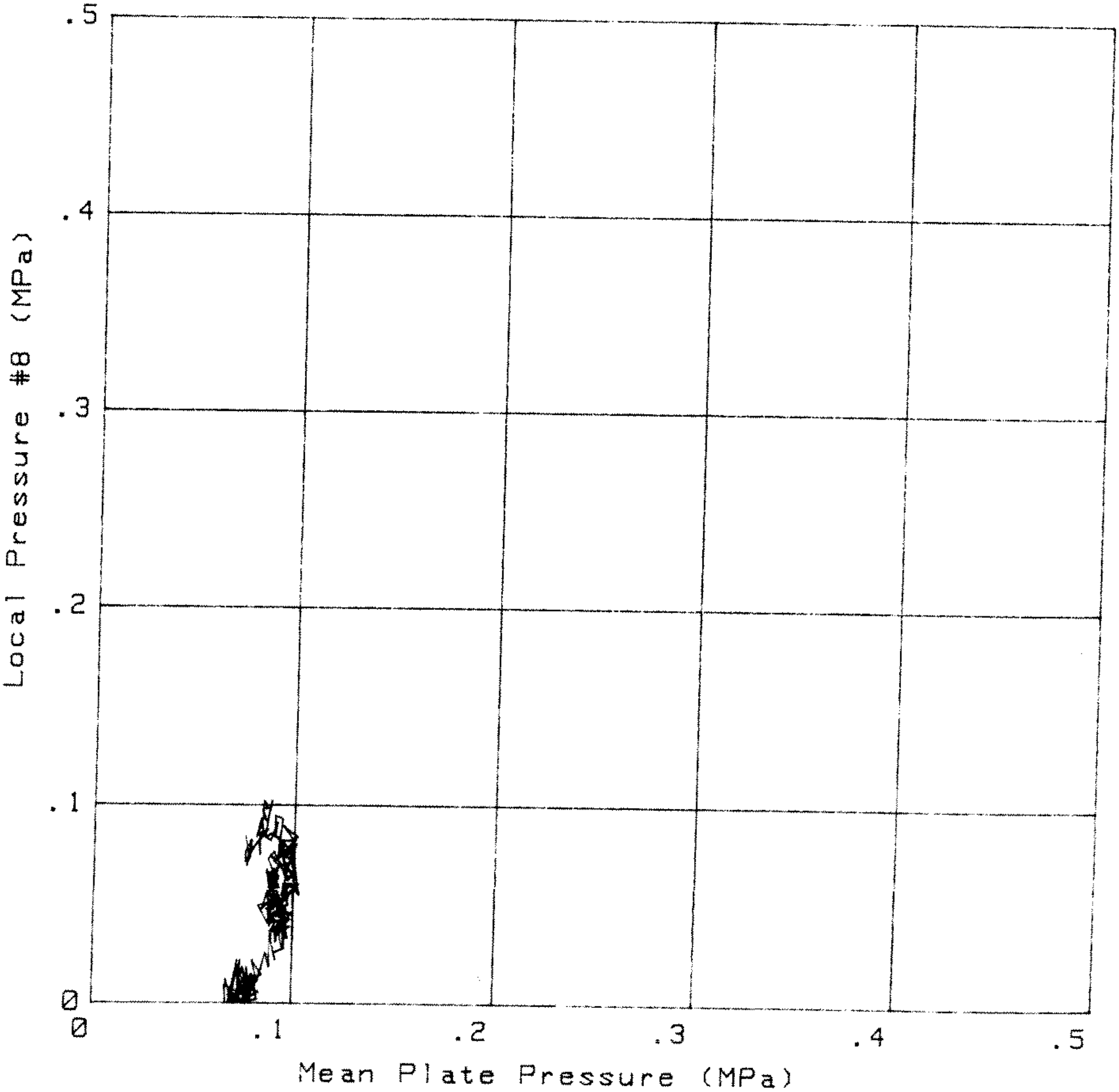
Local Pressure #8
vs.
Mean Plate Pressure

Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .2
Data To (s): .6



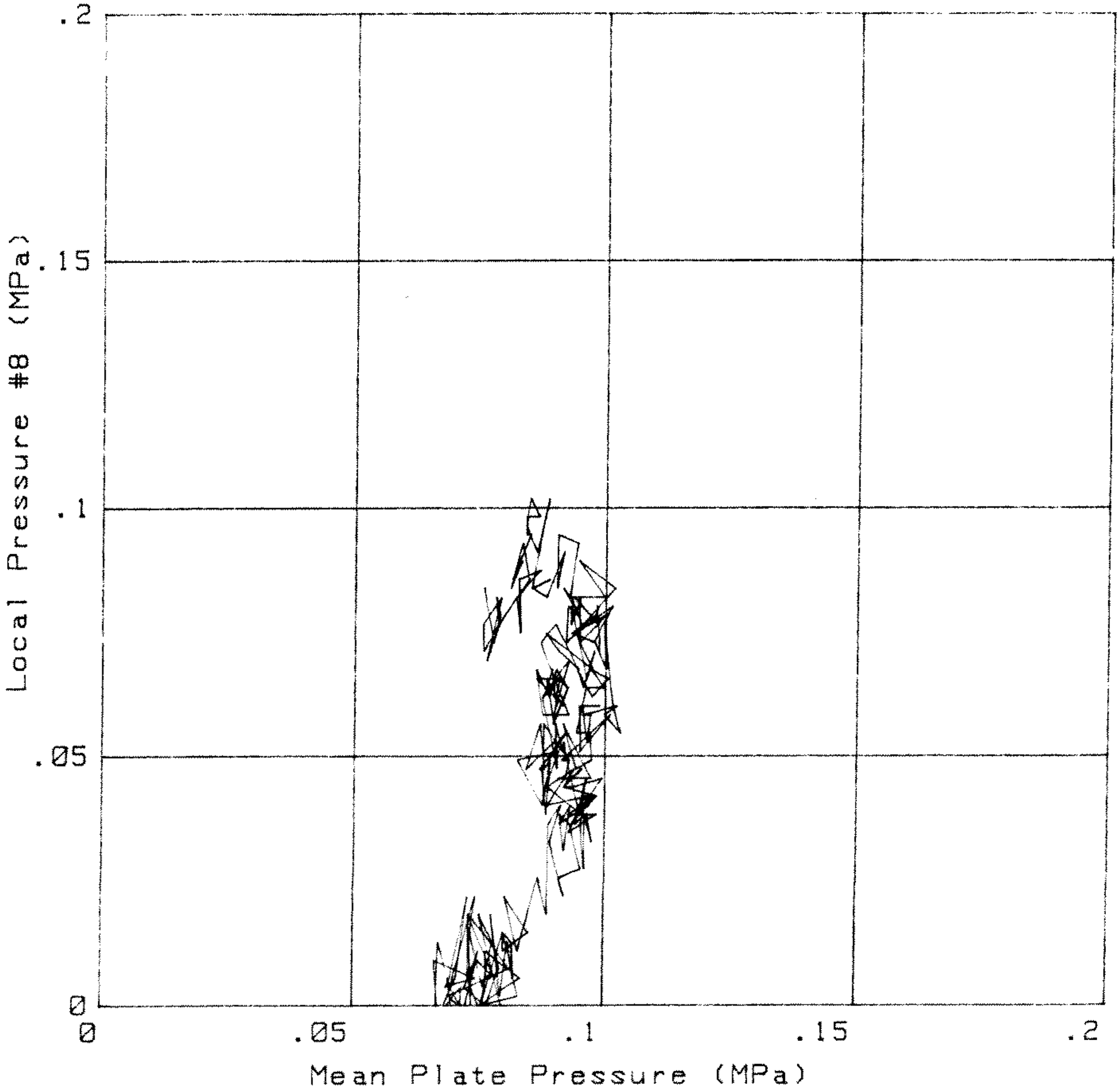
Local Pressure #8
vs.
Mean Plate Pressure

Test: X965
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 16:12:24

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .2
Data To (s): .6



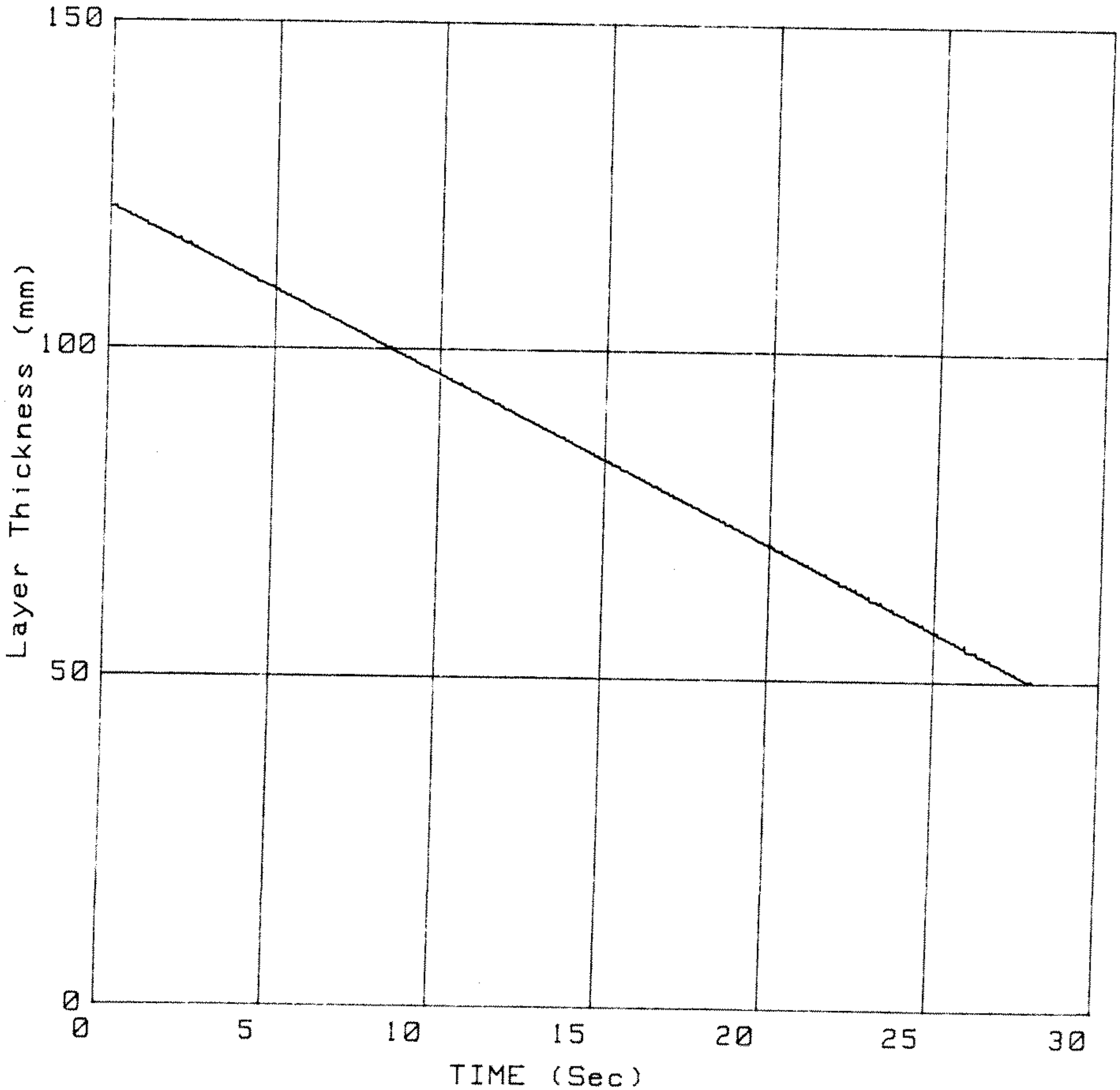
Layer Thickness vs. TIME

Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 13:13:35

Temperature: -10

Average = 10
Truncation Time (s) = 28



Mean Plate Pressure
vs.
TIME

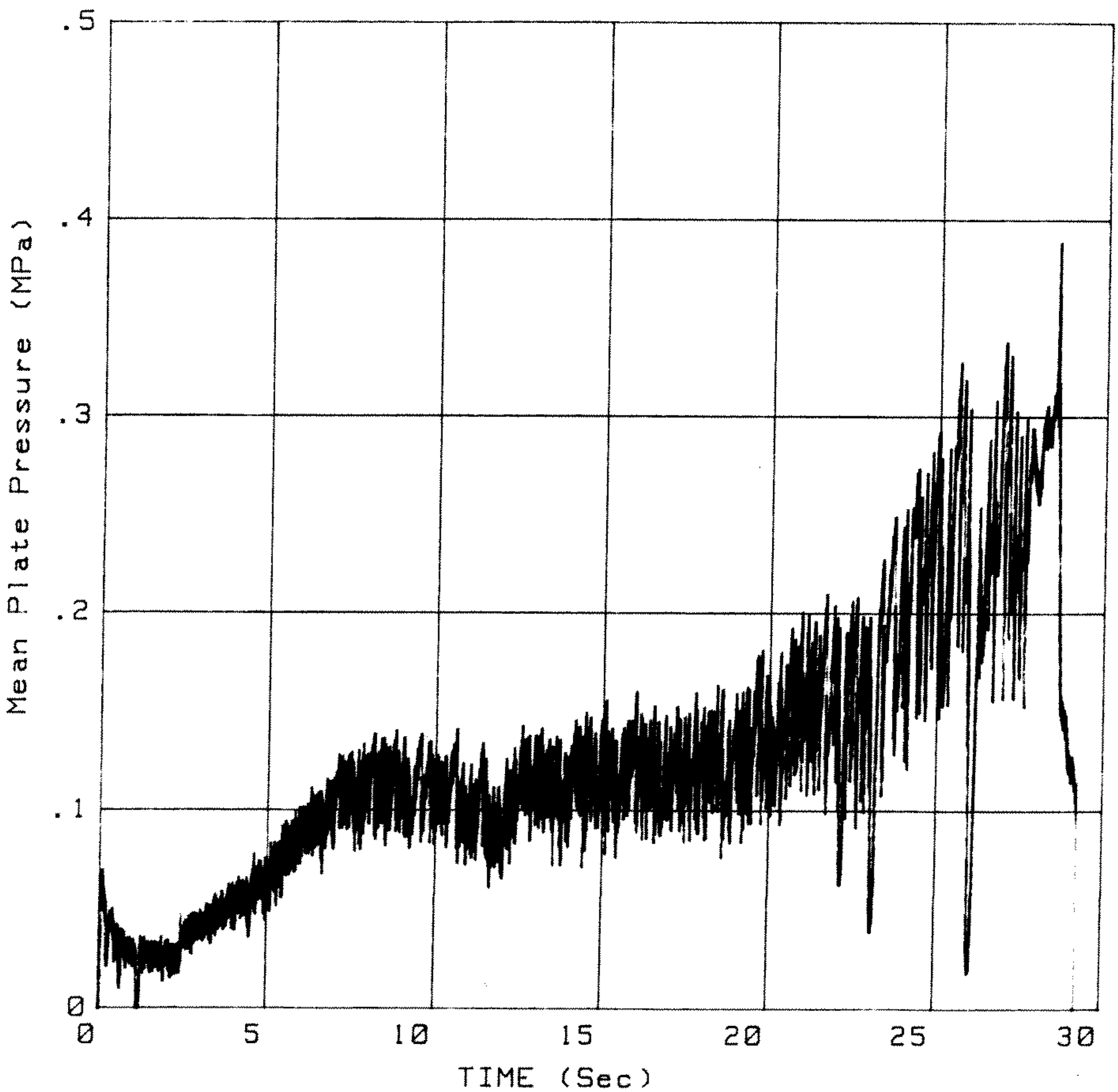
Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 13:13:35

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 30



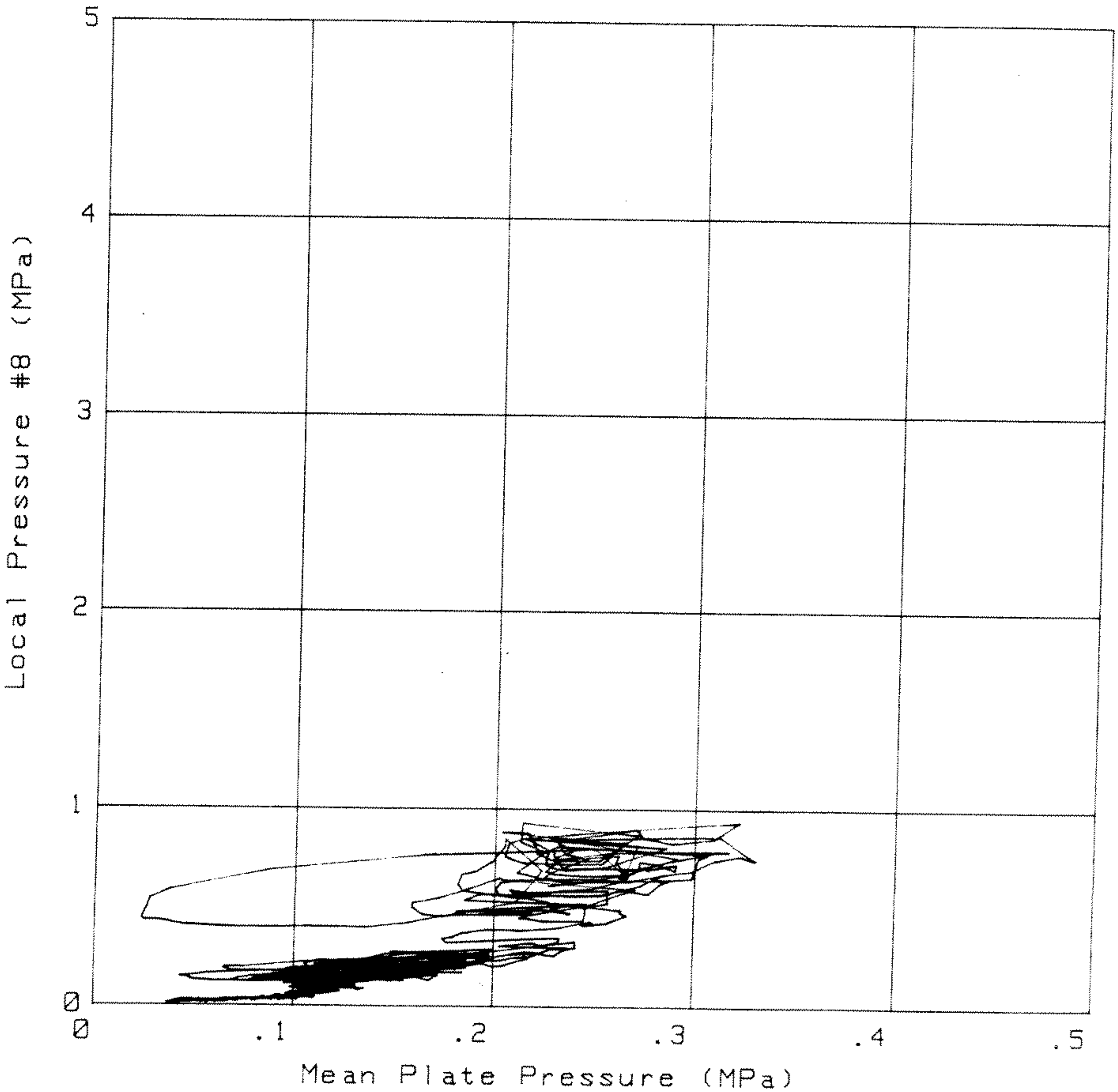
Local Pressure #8
vs.
Mean Plate Pressure

Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 13:13:35

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 2.8
Data To (s): 28



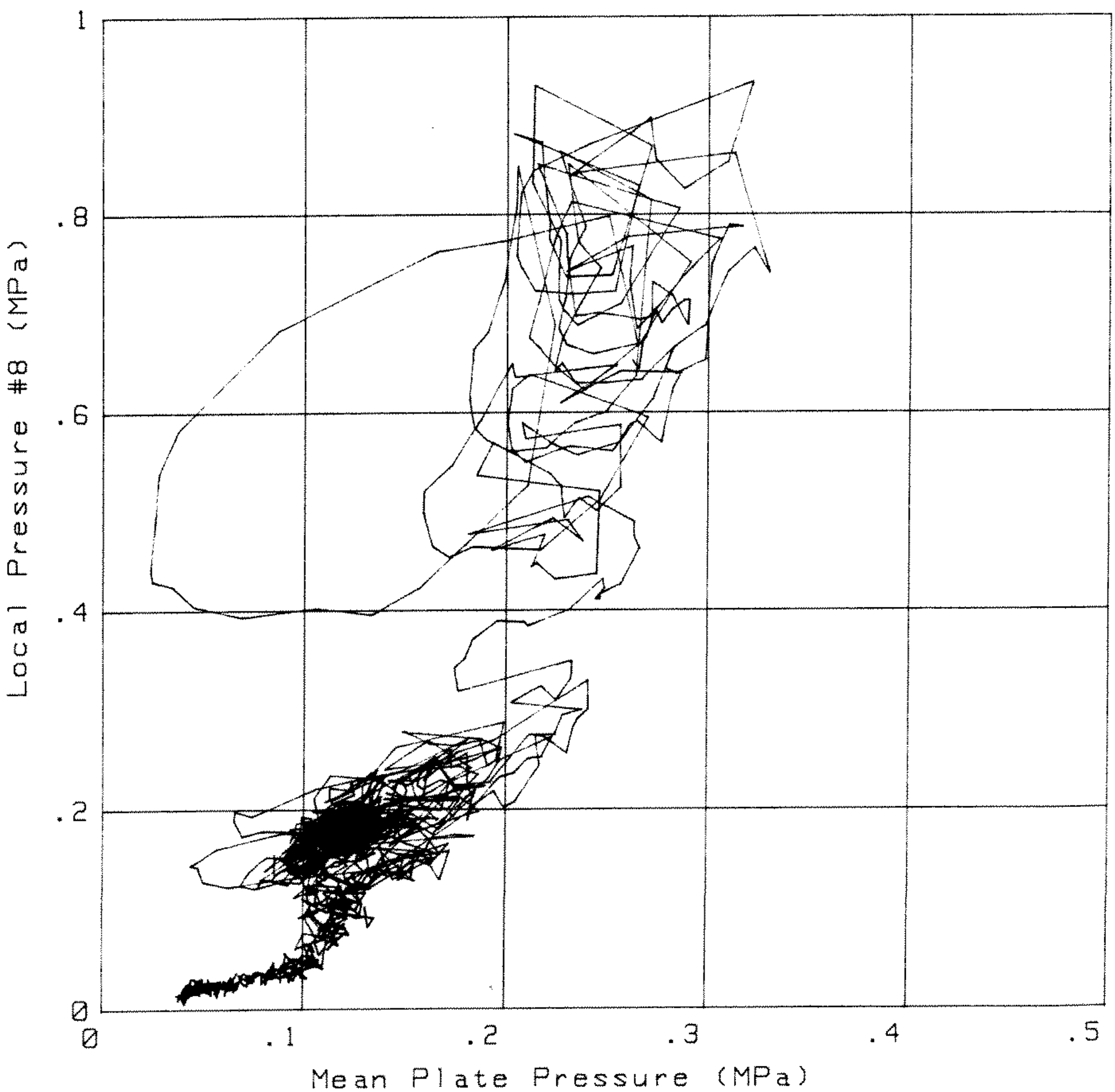
Local Pressure #8
vs.
Mean Plate Pressure

Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 13:13:35

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 2.8
Data To (s): 28



Local Pressure #12
vs.
TIME

Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

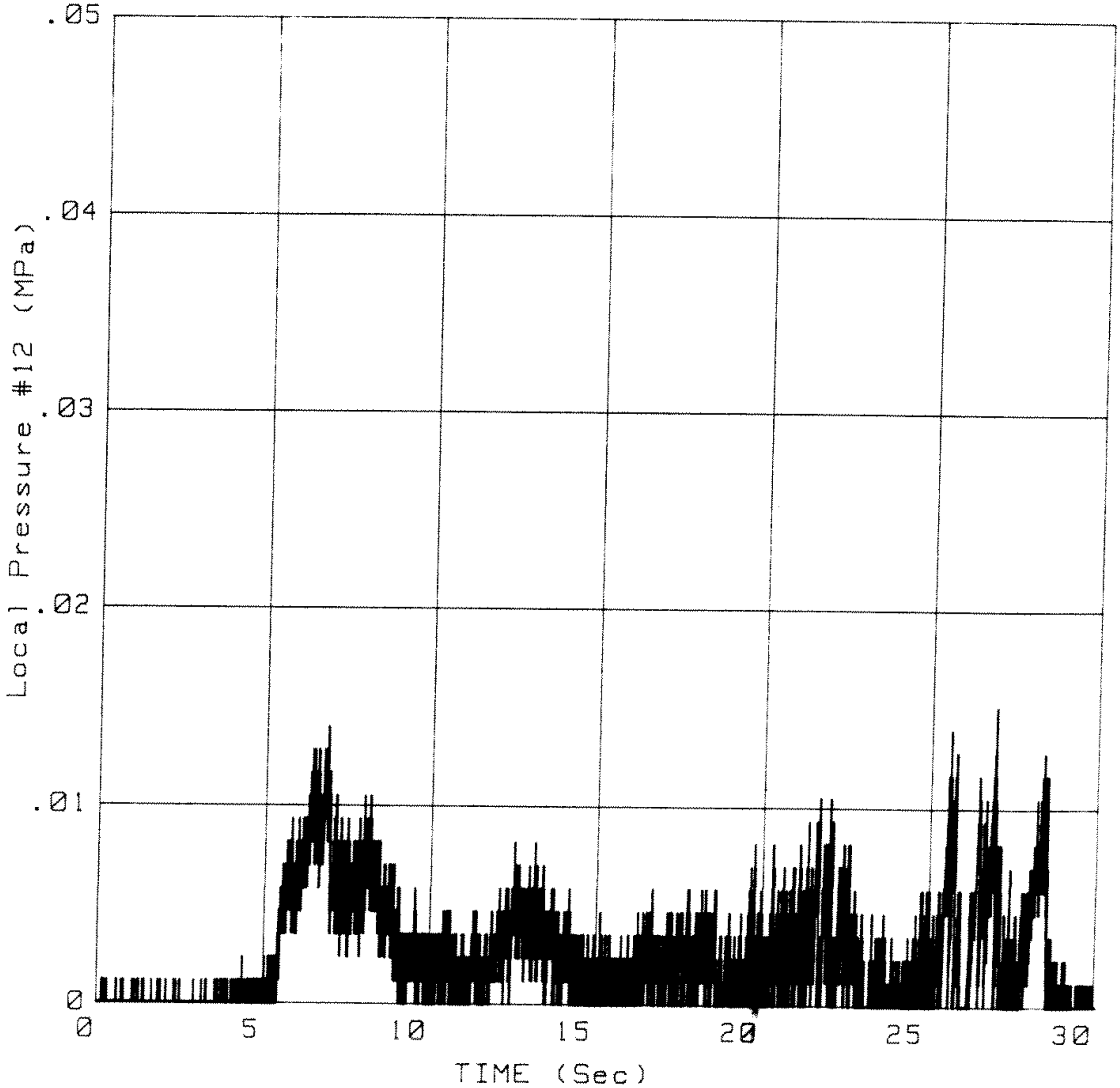
Date: 23 Jan 1989
Time: 13:13:35

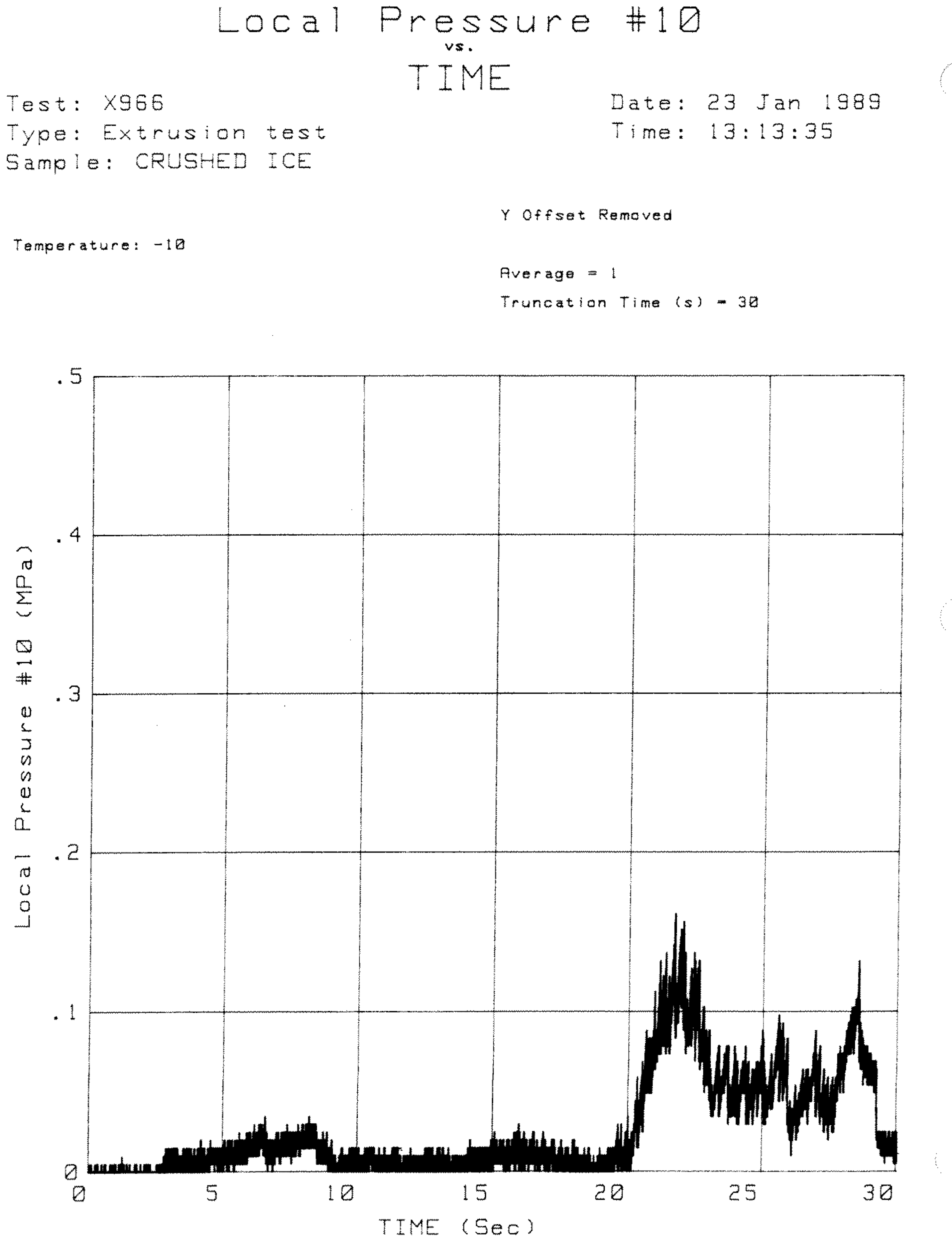
Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 30




Local Pressure #10
vs.
TIME
Test: X966
Type: Extrusion test
Sample: CRUSHED ICE
Date: 23 Jan 1989
Time: 13:13:35
Y Offset Removed
Temperature: -10
Average = 1
Truncation Time (s) = 30
Local Pressure #10 (MPa)
.5
.4
.3
.2
.1
0
0
5
10
15
20
25
30
TIME (Sec)

Local Pressure #16
vs.
TIME

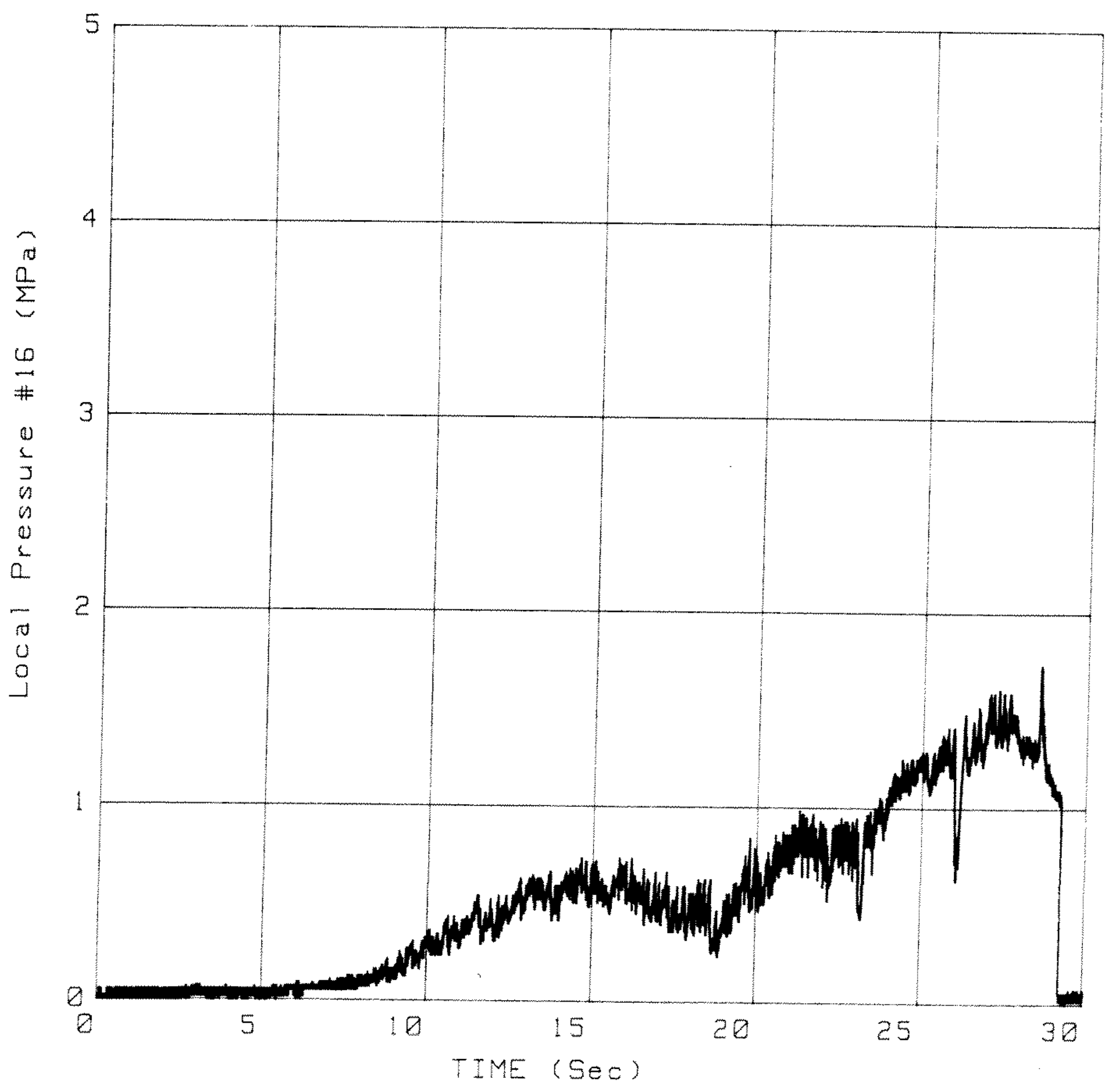
Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

Date: 23 Jan 1989
Time: 13:13:35

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 30



Local Pressure #8
vs.
TIME

Test: X966
Type: Extrusion test
Sample: CRUSHED ICE

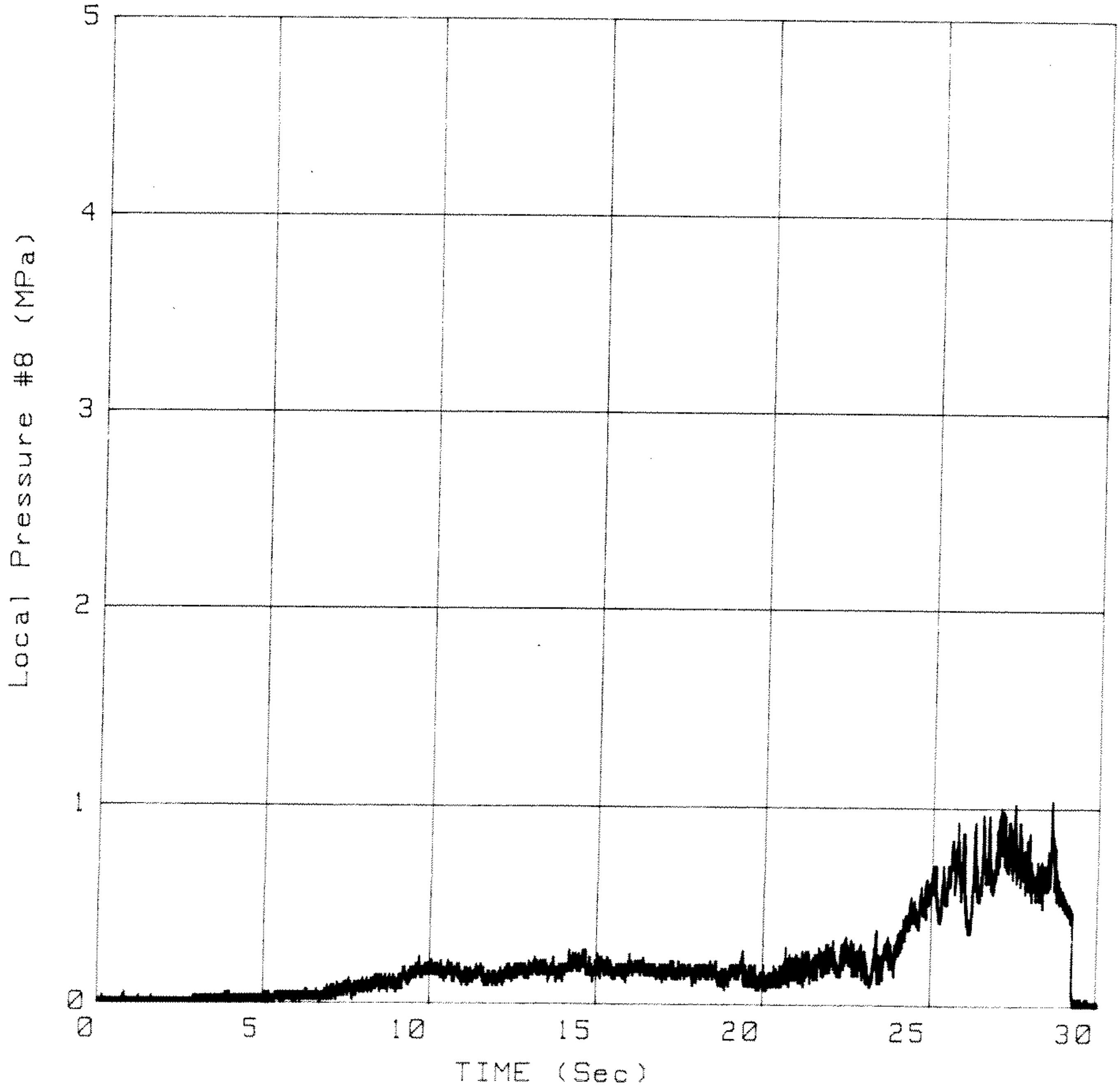
Date: 23 Jan 1989
Time: 13:13:35

Temperature: -10

Y Offset Removed

Average = 1

Truncation Time (s) = 30



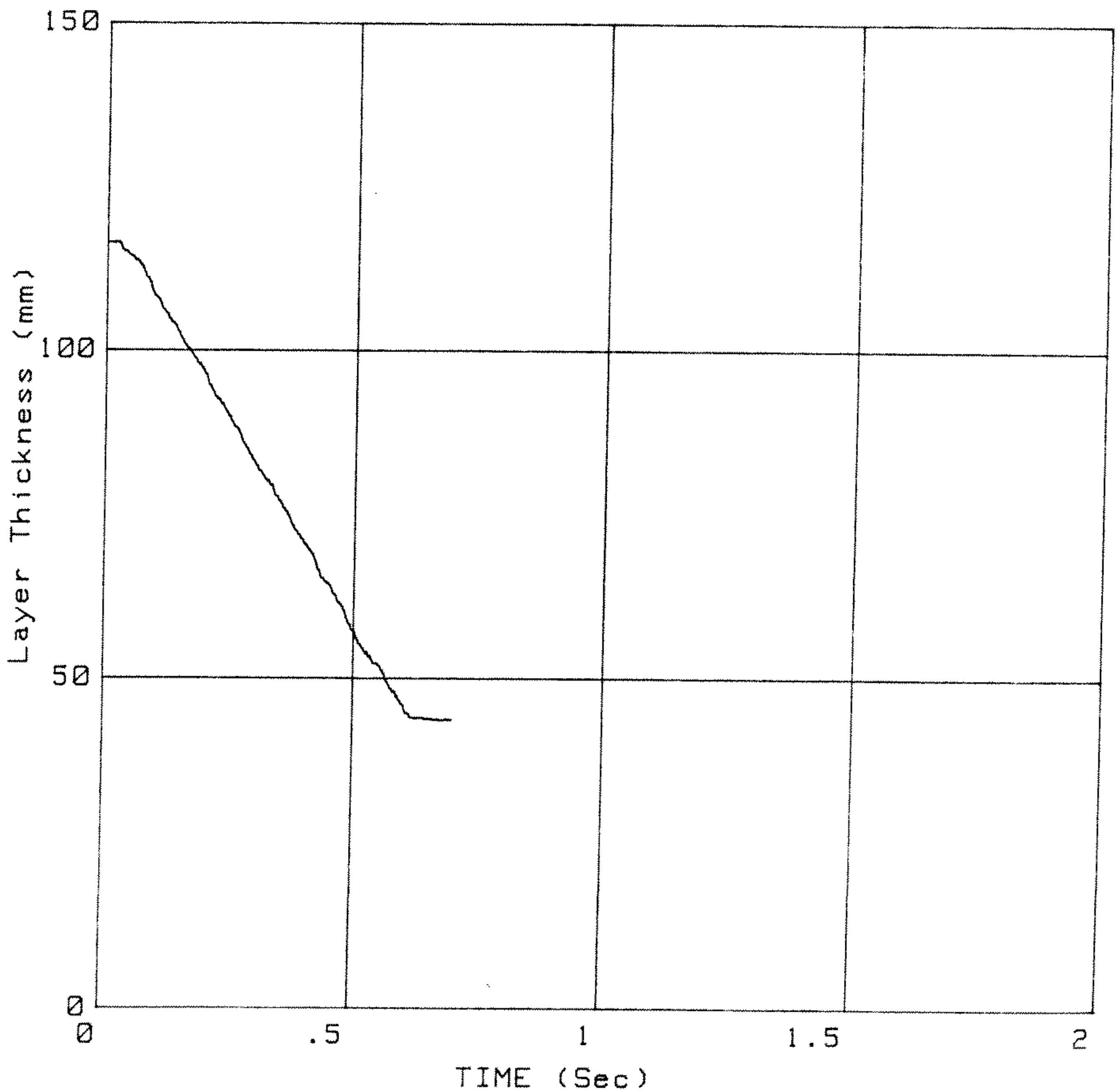
Layer Thickness vs. TIME

Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Temperature: -10

Average = 10
Truncation Time (s) = .7



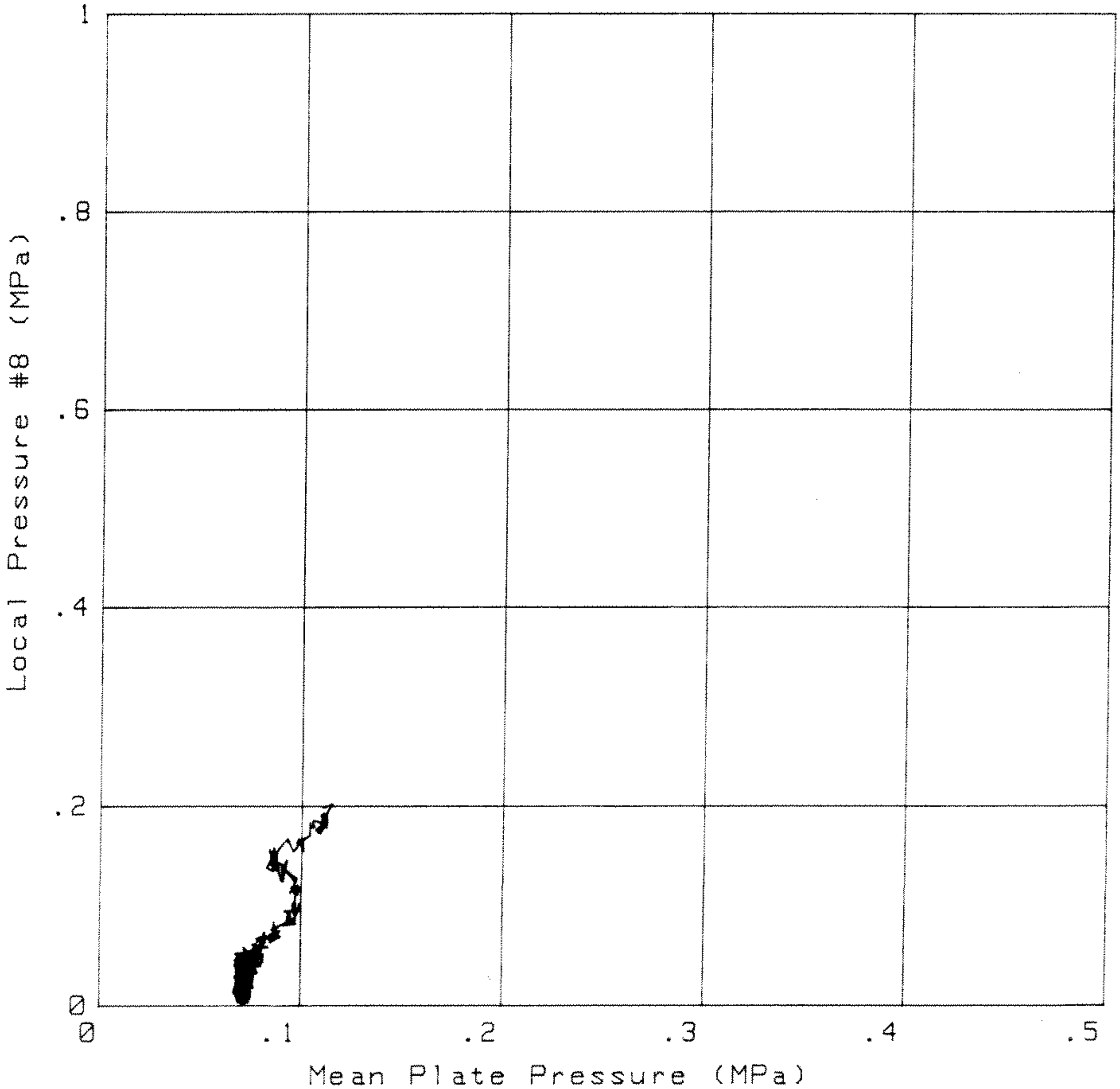
Local Pressure #8
vs.
Mean Plate Pressure

Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .15
Data To (s): .68



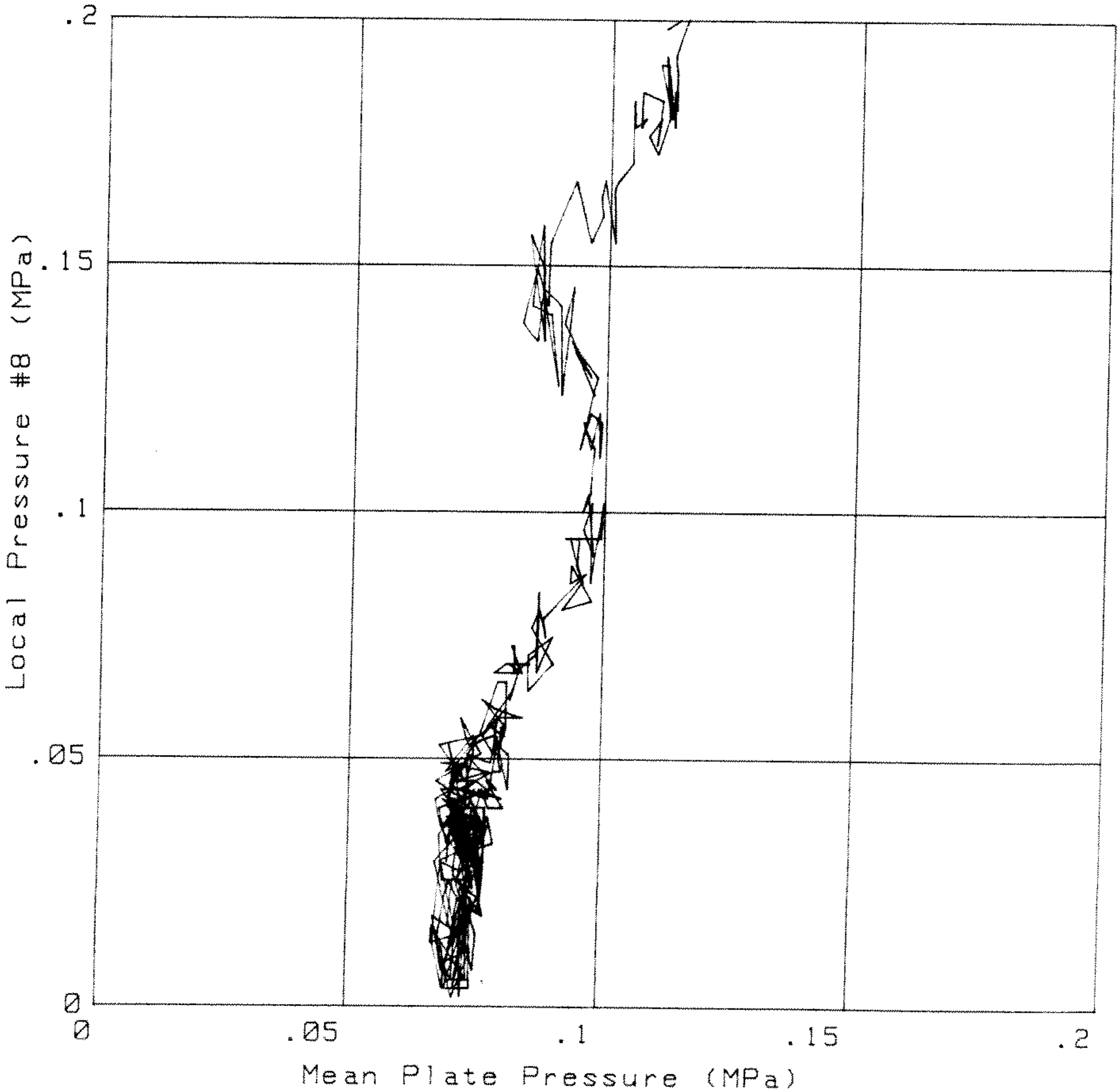
Local Pressure #8
vs.
Mean Plate Pressure

Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .15
Data To (s): .68



Local Pressure #8
vs.
TIME

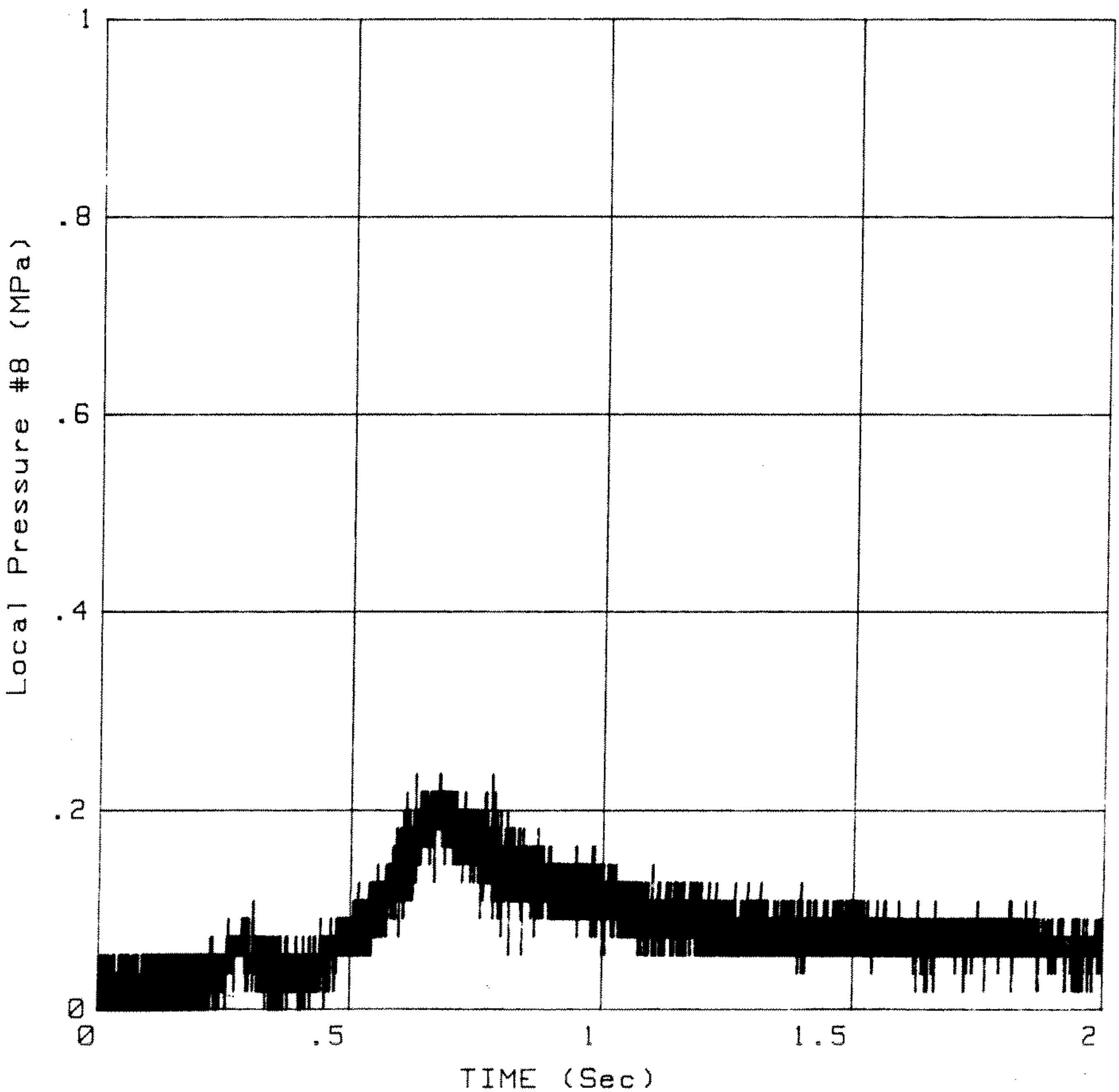
Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2



Local Pressure #16
vs.
TIME

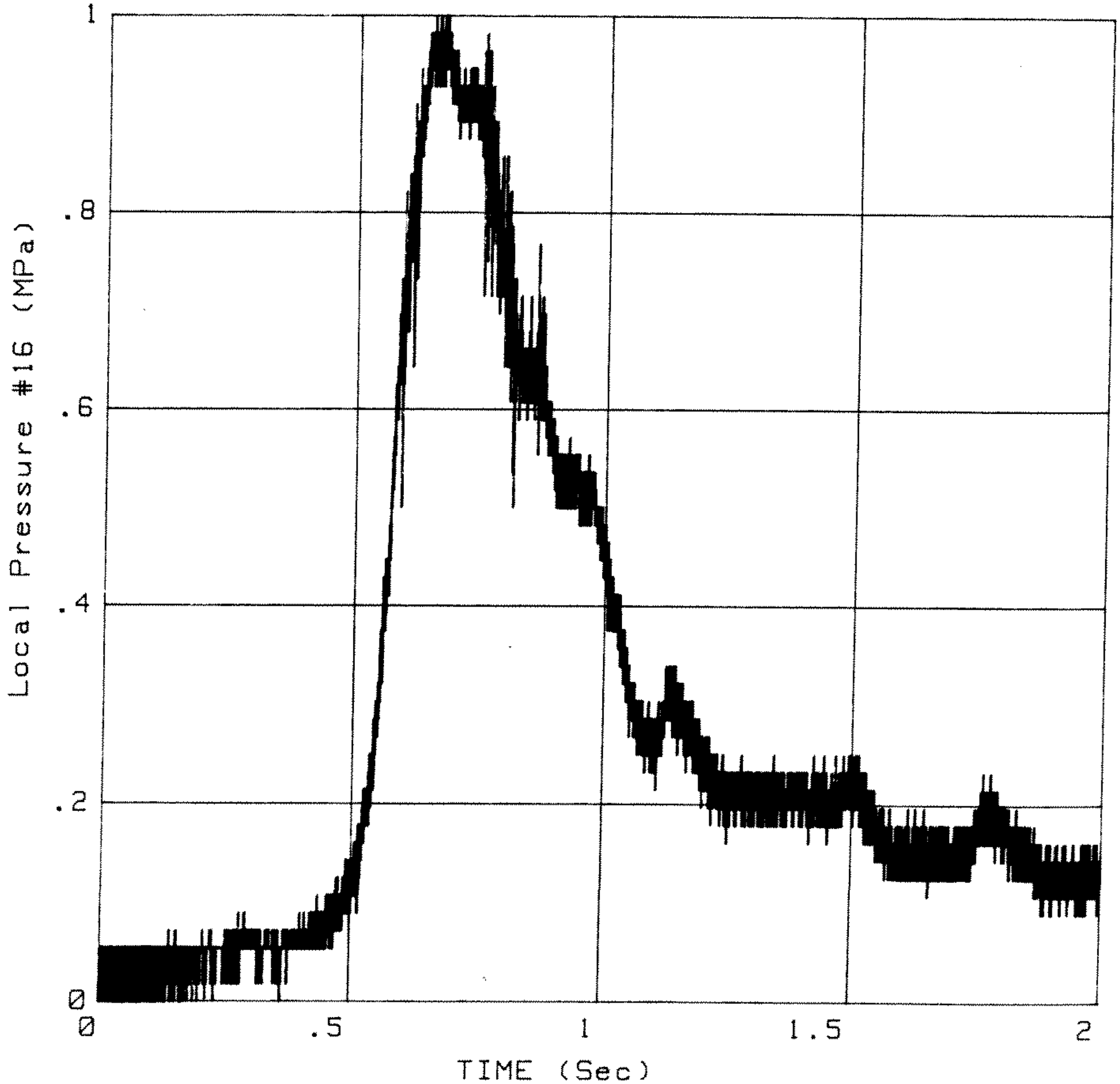
Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2



Local Pressure #10
vs.
TIME

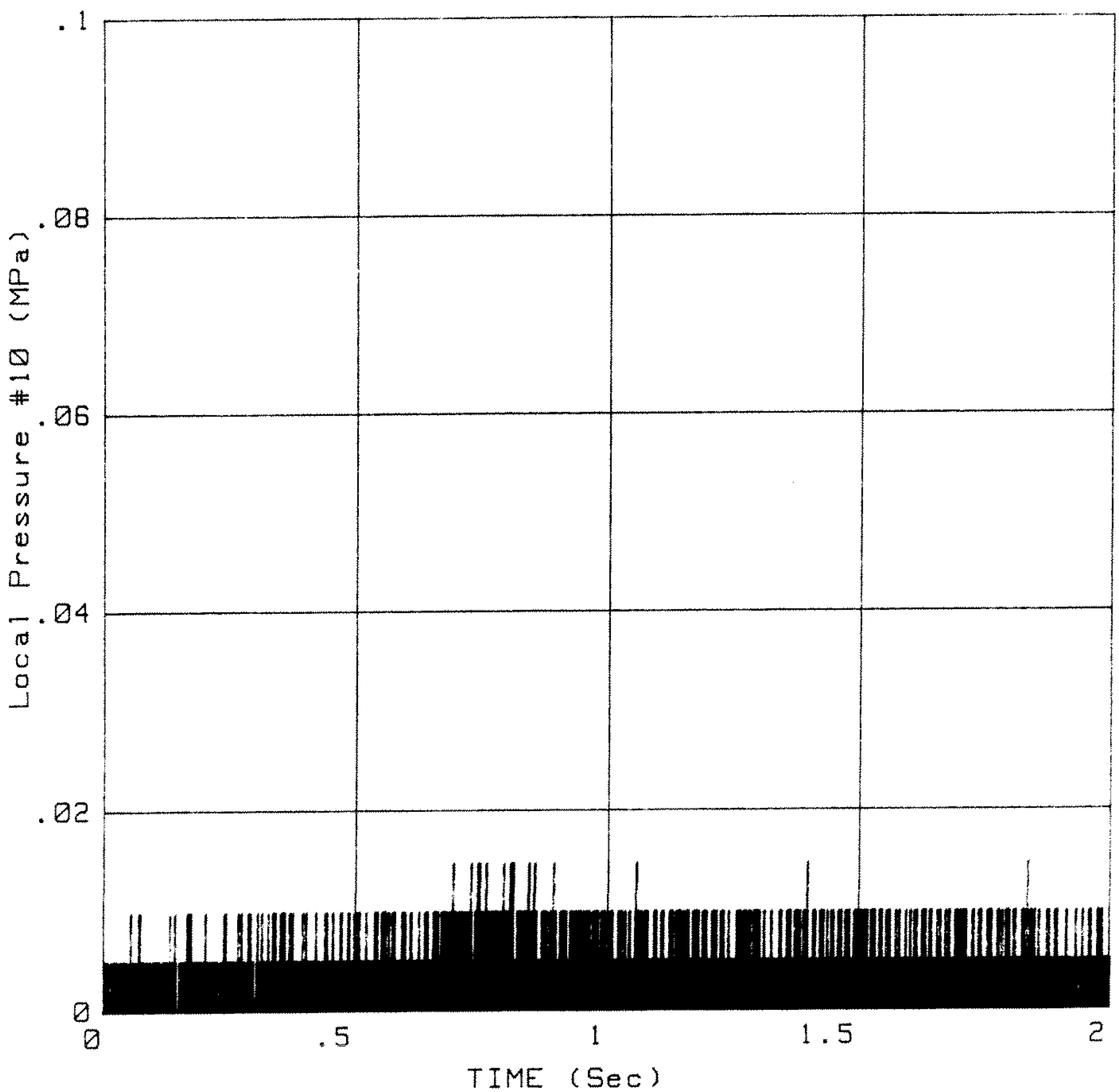
Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2



Local Pressure #12
vs.
TIME

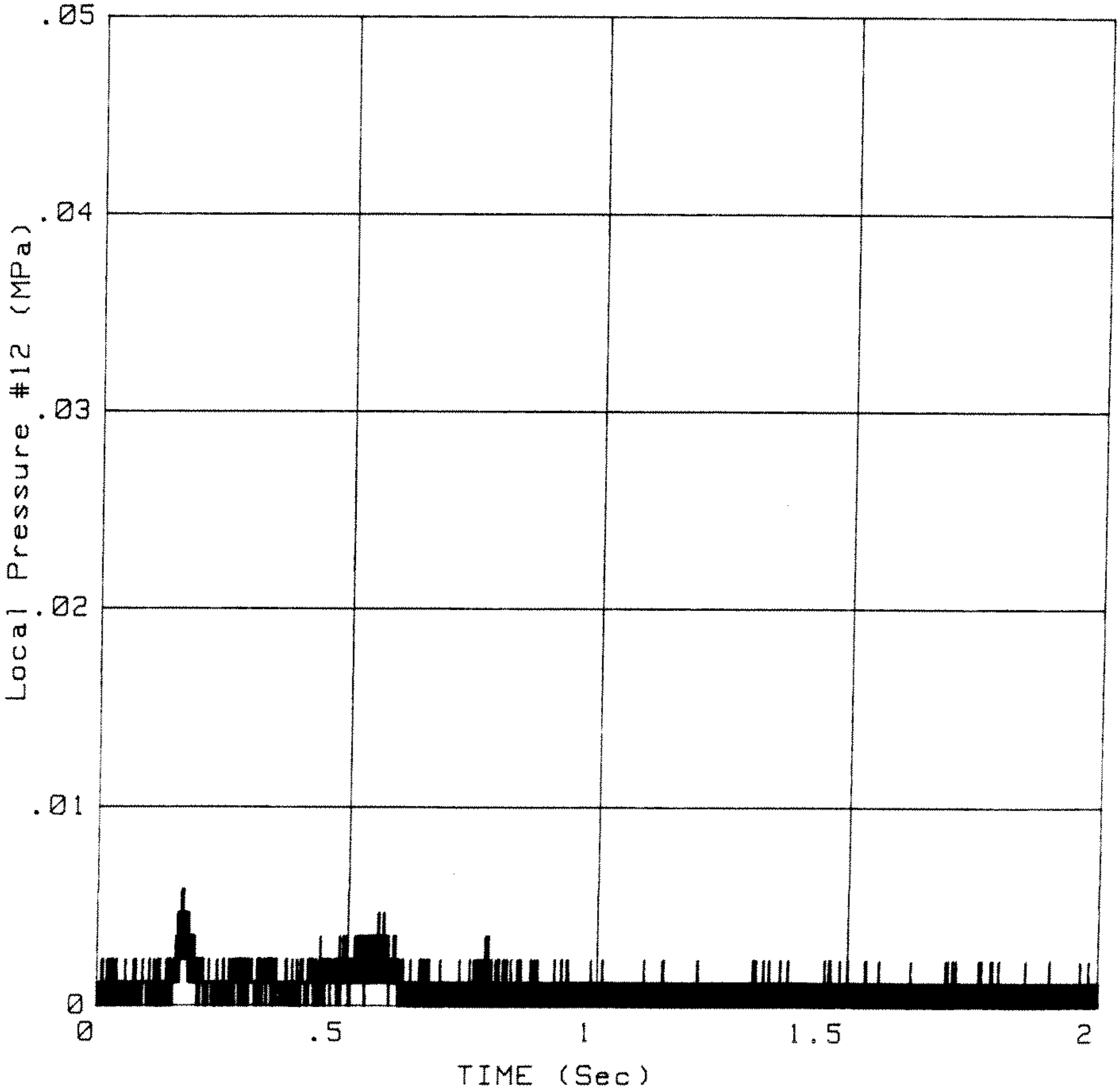
Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2



Mean Plate Pressure
vs.
TIME

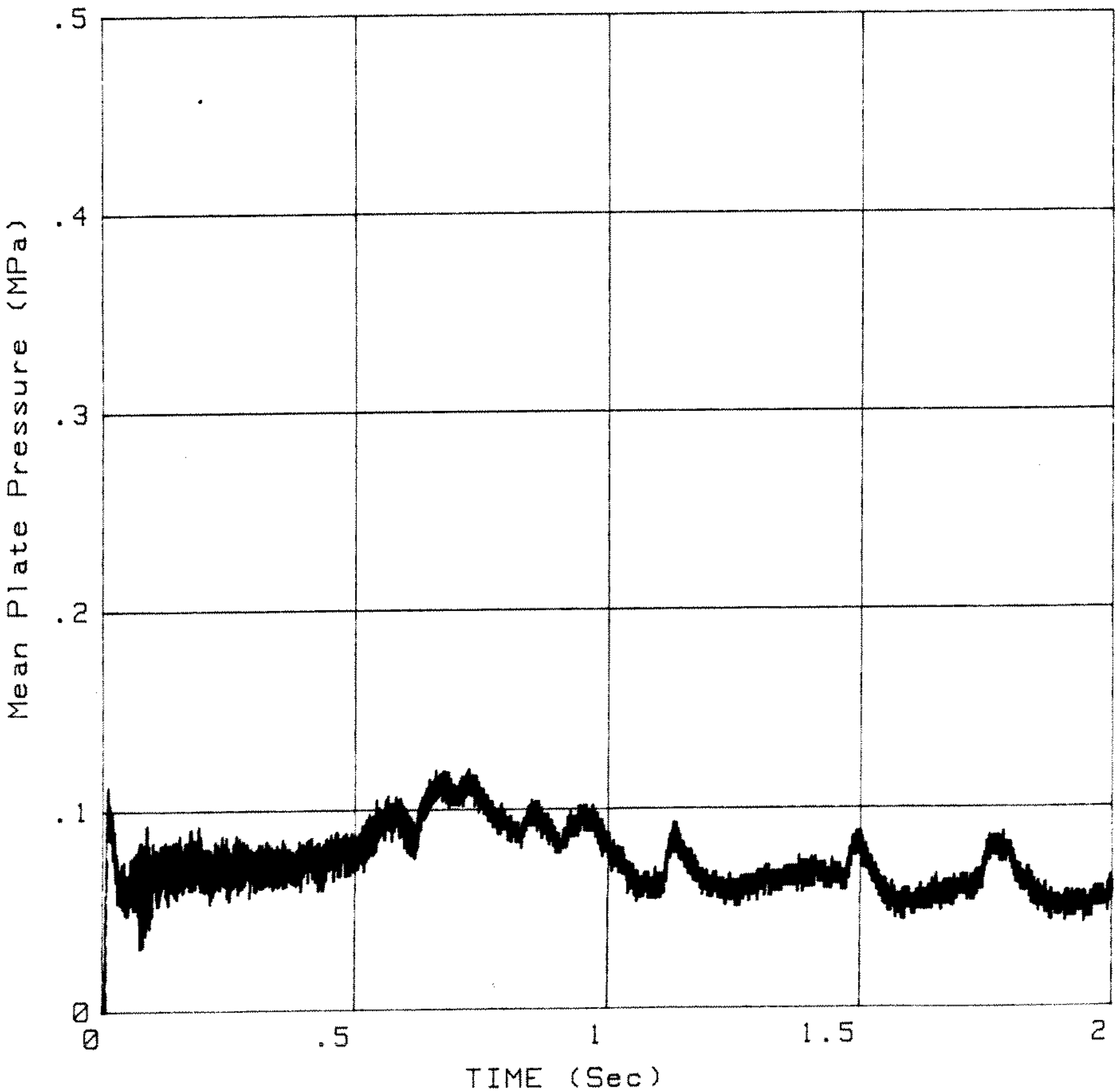
Test: X967
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Jan 1989
Time: 15:31:17

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2



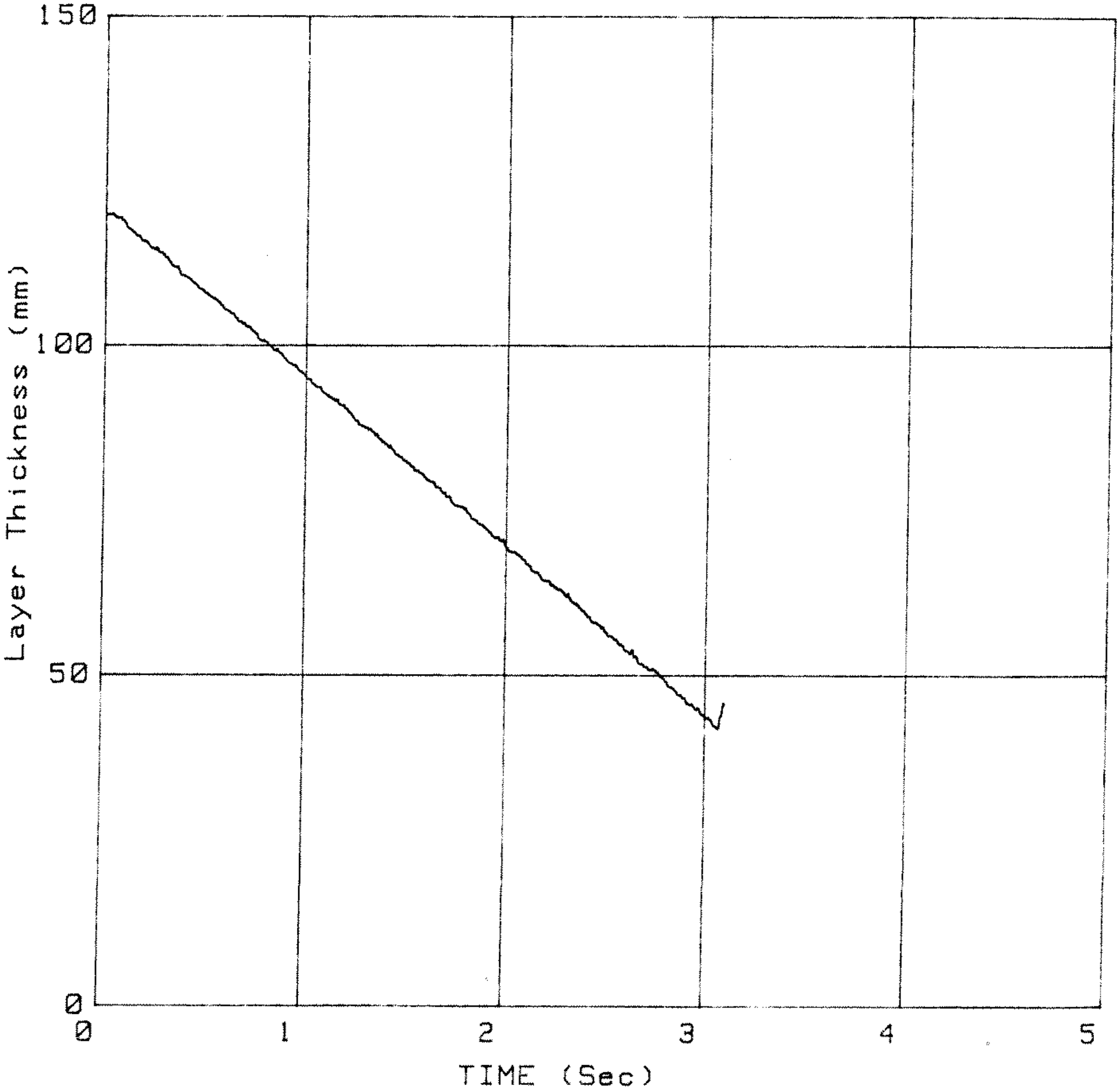
Layer Thickness
vs.
TIME

Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

Date: 26 Jan 1989
Time: 13:40:07

Temperature: -10.6

Average = 10
Truncation Time (s) = 3.1



Mean Plate Pressure
vs.
TIME

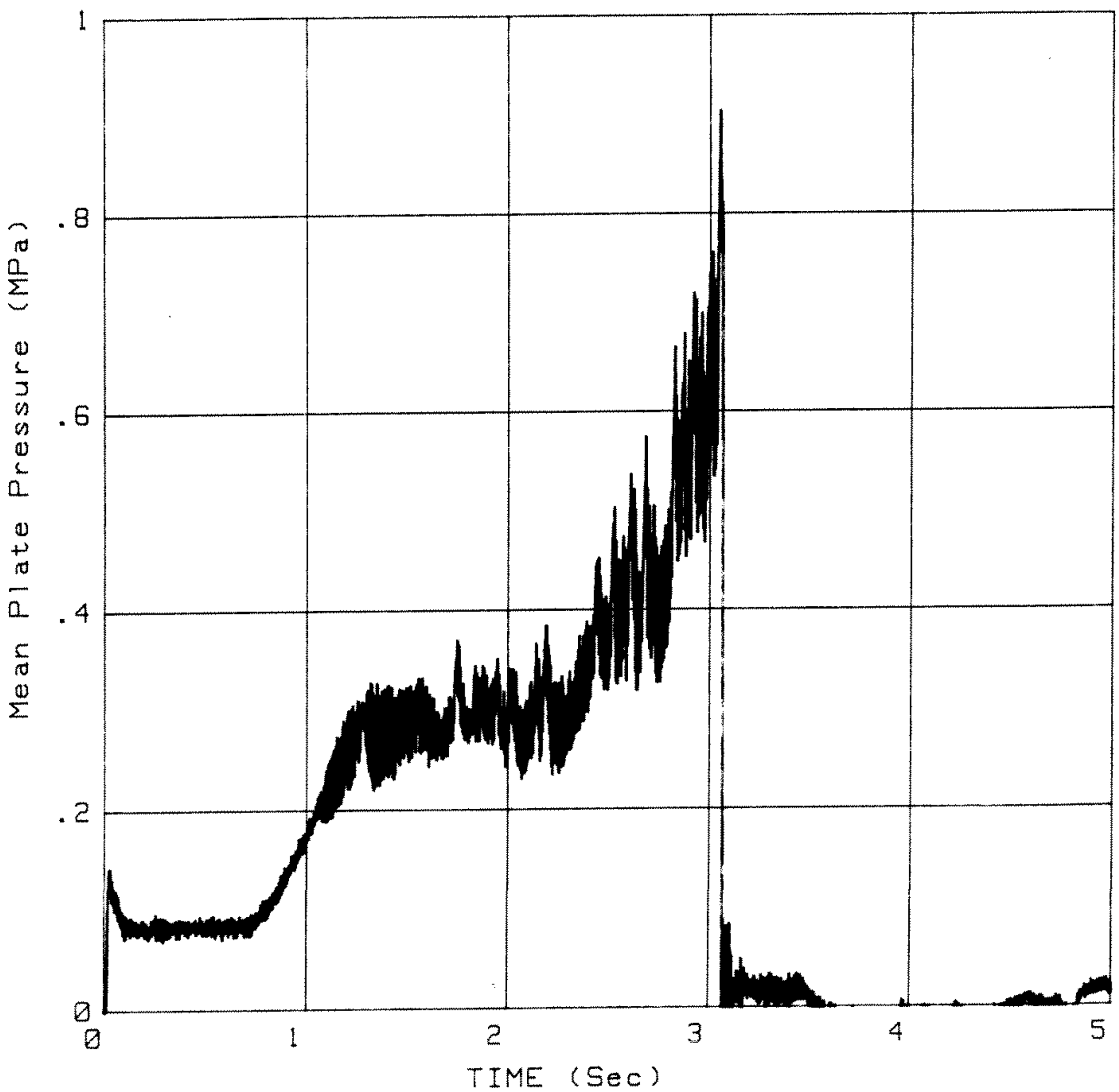
Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

Date: 26 Jan 1989
Time: 13:40:07

Y Offset Removed

Temperature: -10.6

Average = 1
Truncation Time (s) = 5.1



Local Pressure #8
vs.
TIME

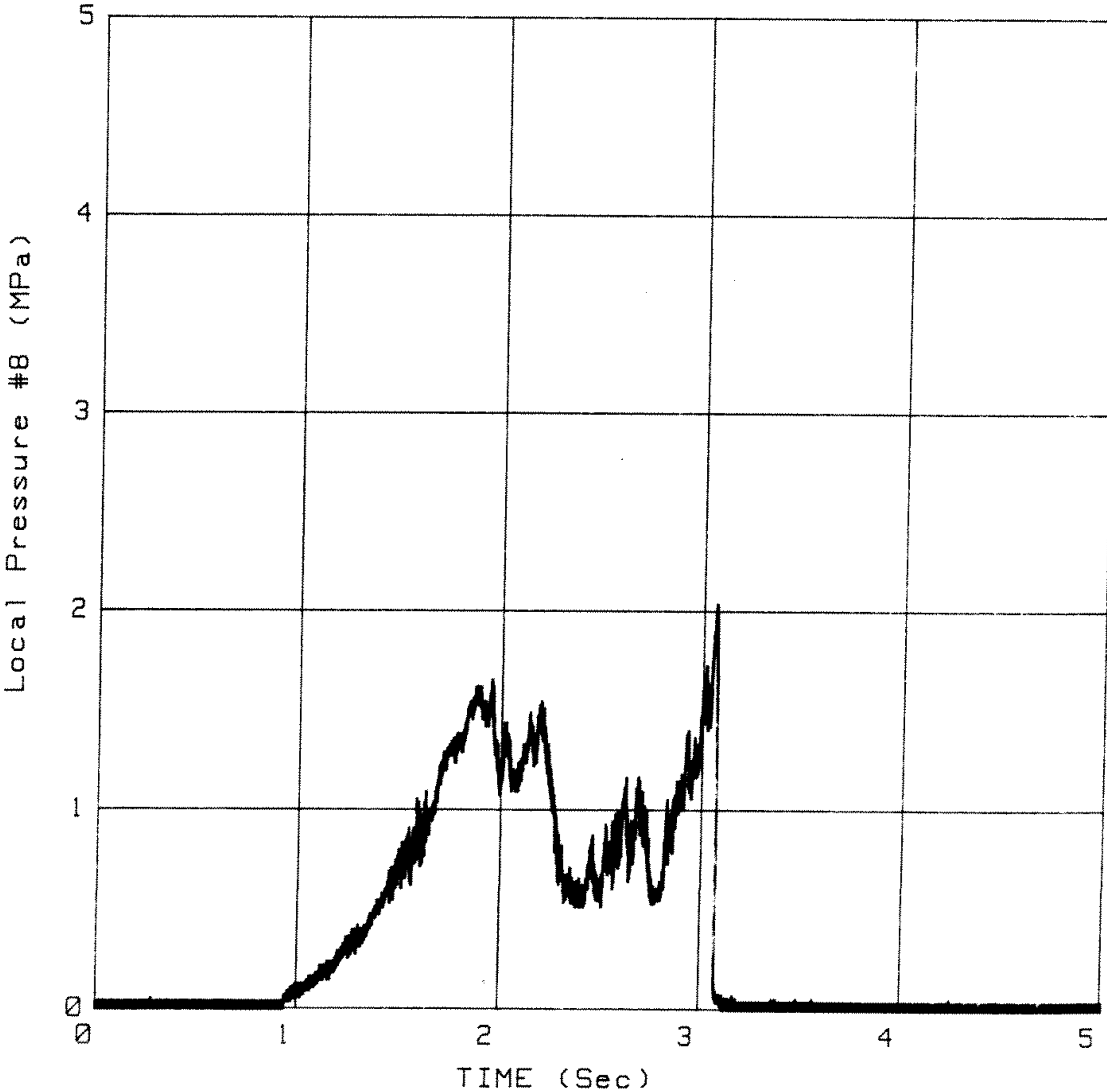
Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

Date: 26 Jan 1989
Time: 13:40:07

Y Offset Removed

Temperature: -10.6

Average = 1
Truncation Time (s) = 5.1



Local Pressure #10
vs.
TIME

Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

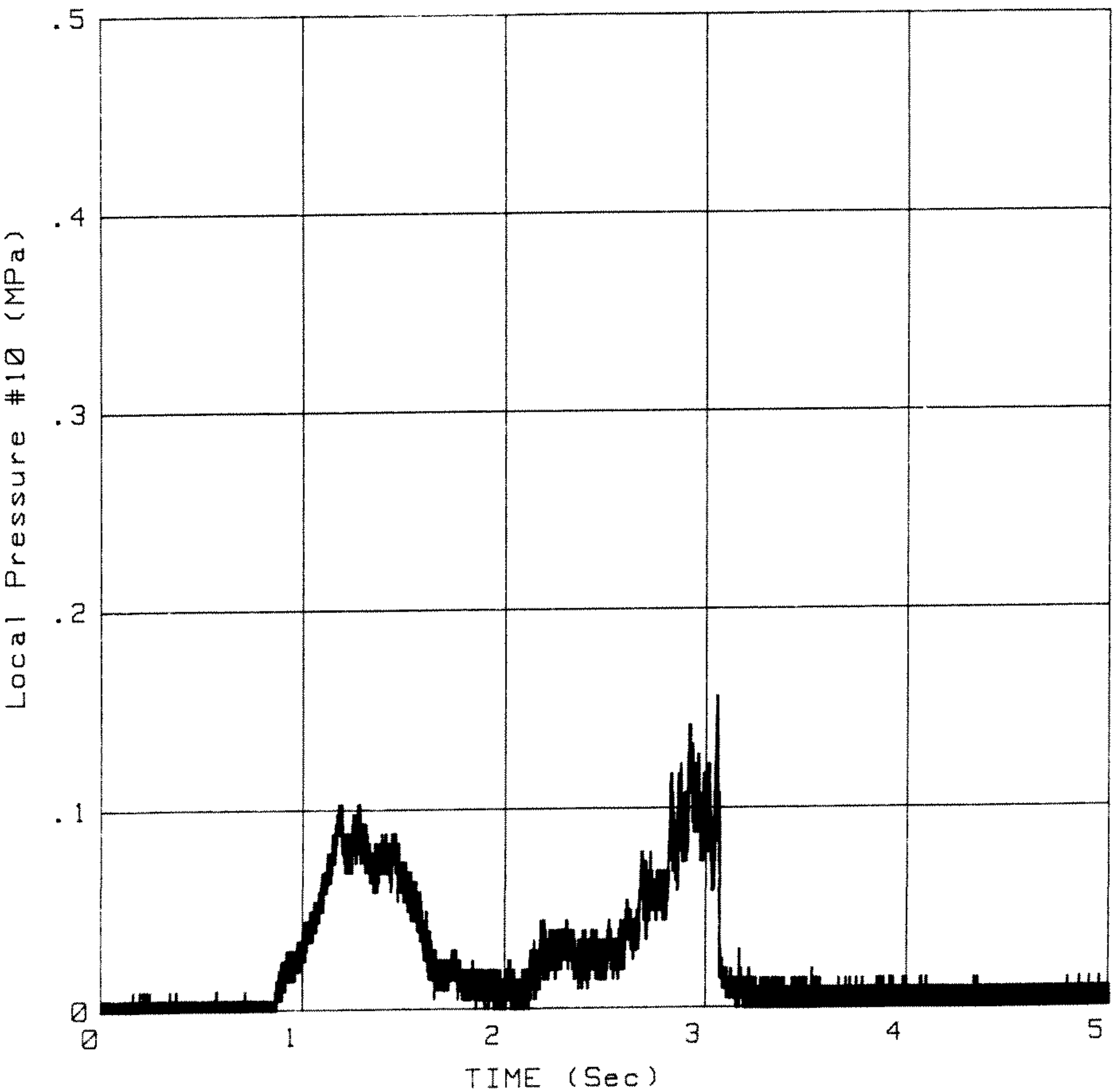
Date: 26 Jan 1989
Time: 13:40:07

Y Offset Removed

Temperature: -10.6

Average = 1

Truncation Time (s) = 5.1



Local Pressure #12
vs.
TIME

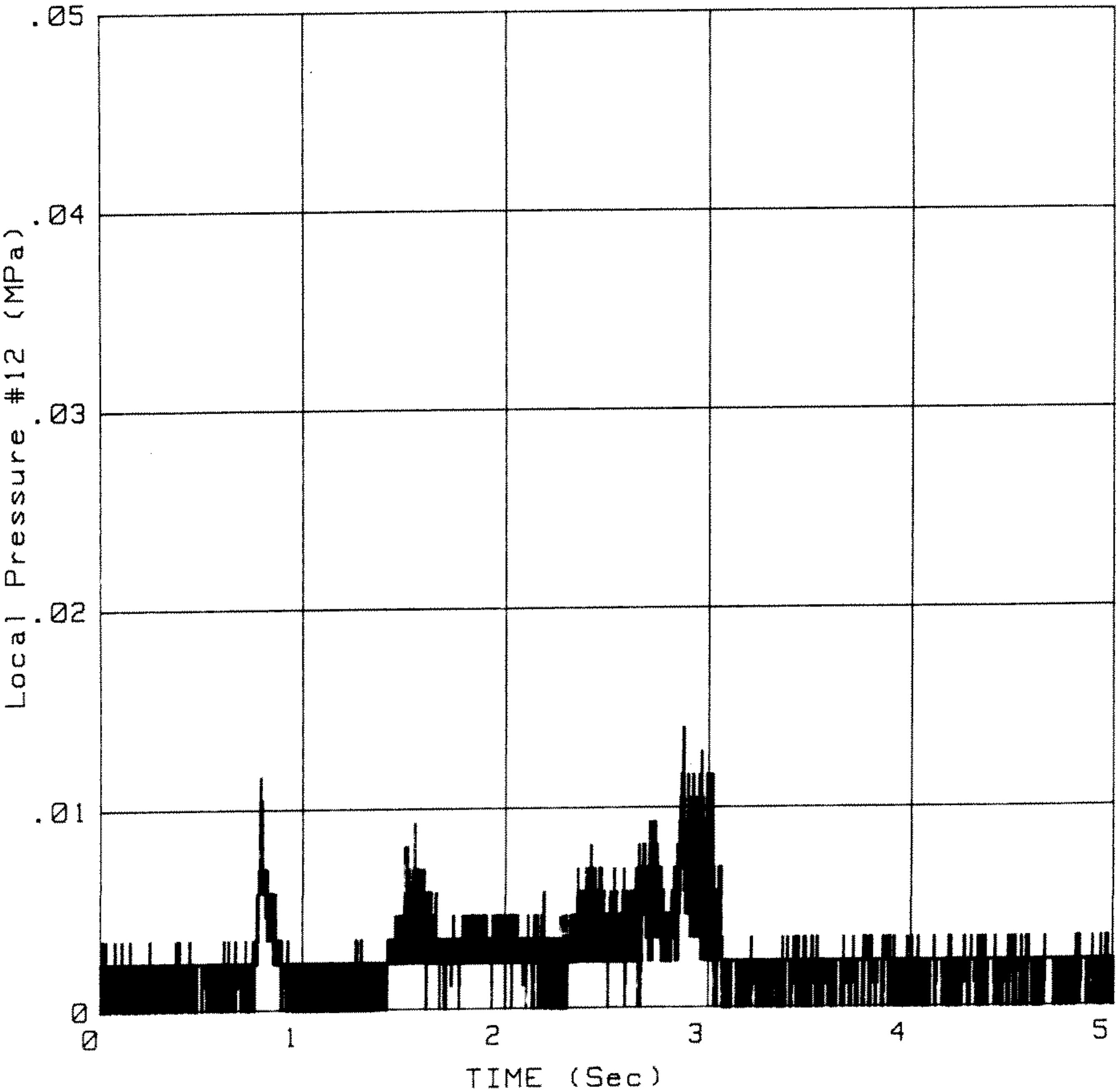
Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

Date: 26 Jan 1989
Time: 13:40:07

Y Offset Removed

Temperature: -10.6

Average = 1
Truncation Time (s) = 5.1



Local Pressure #16
vs.
TIME

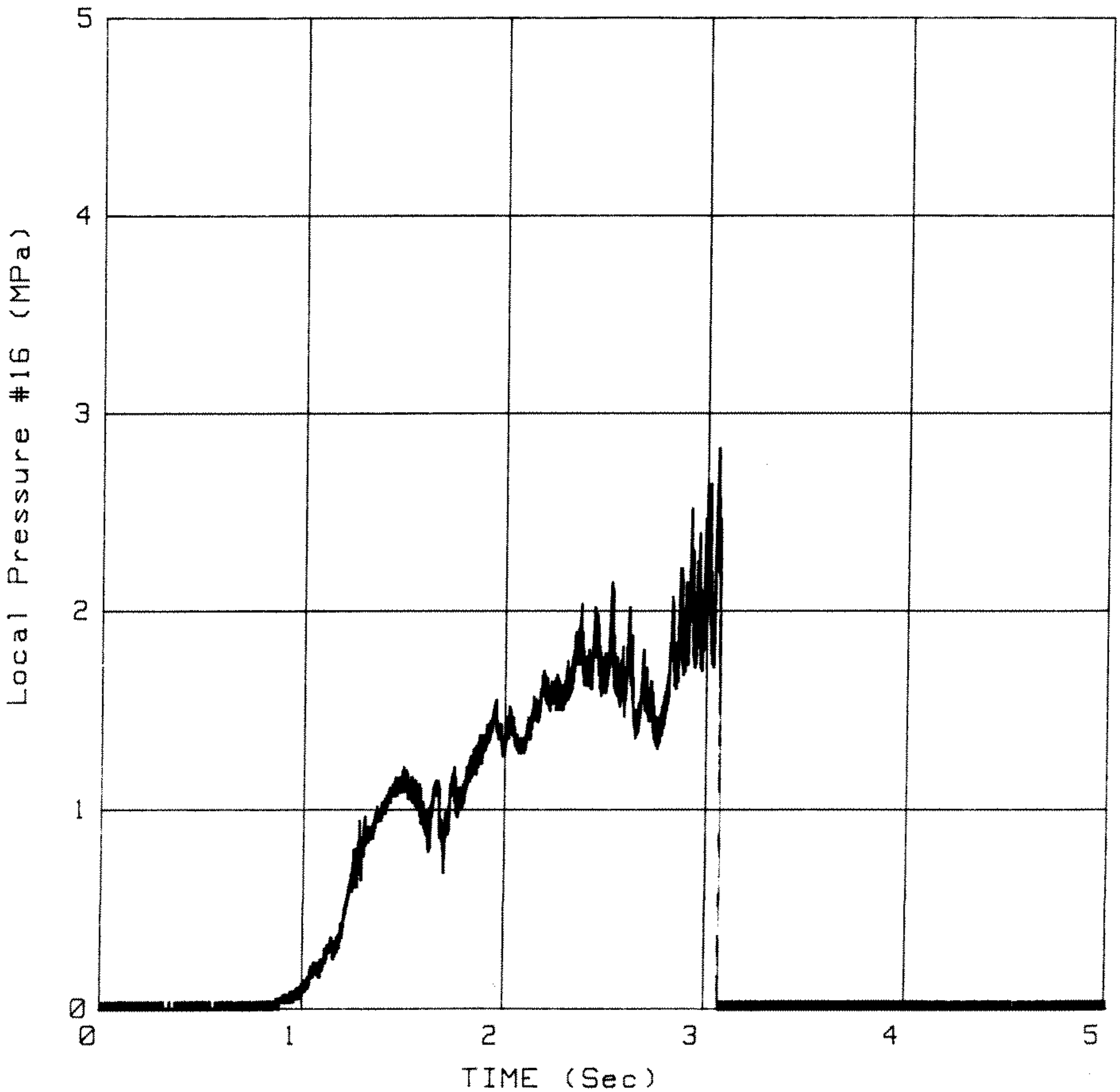
Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

Date: 26 Jan 1989
Time: 13:40:07

Y Offset Removed

Temperature: -10.6

Average = 1
Truncation Time (s) = 5.1



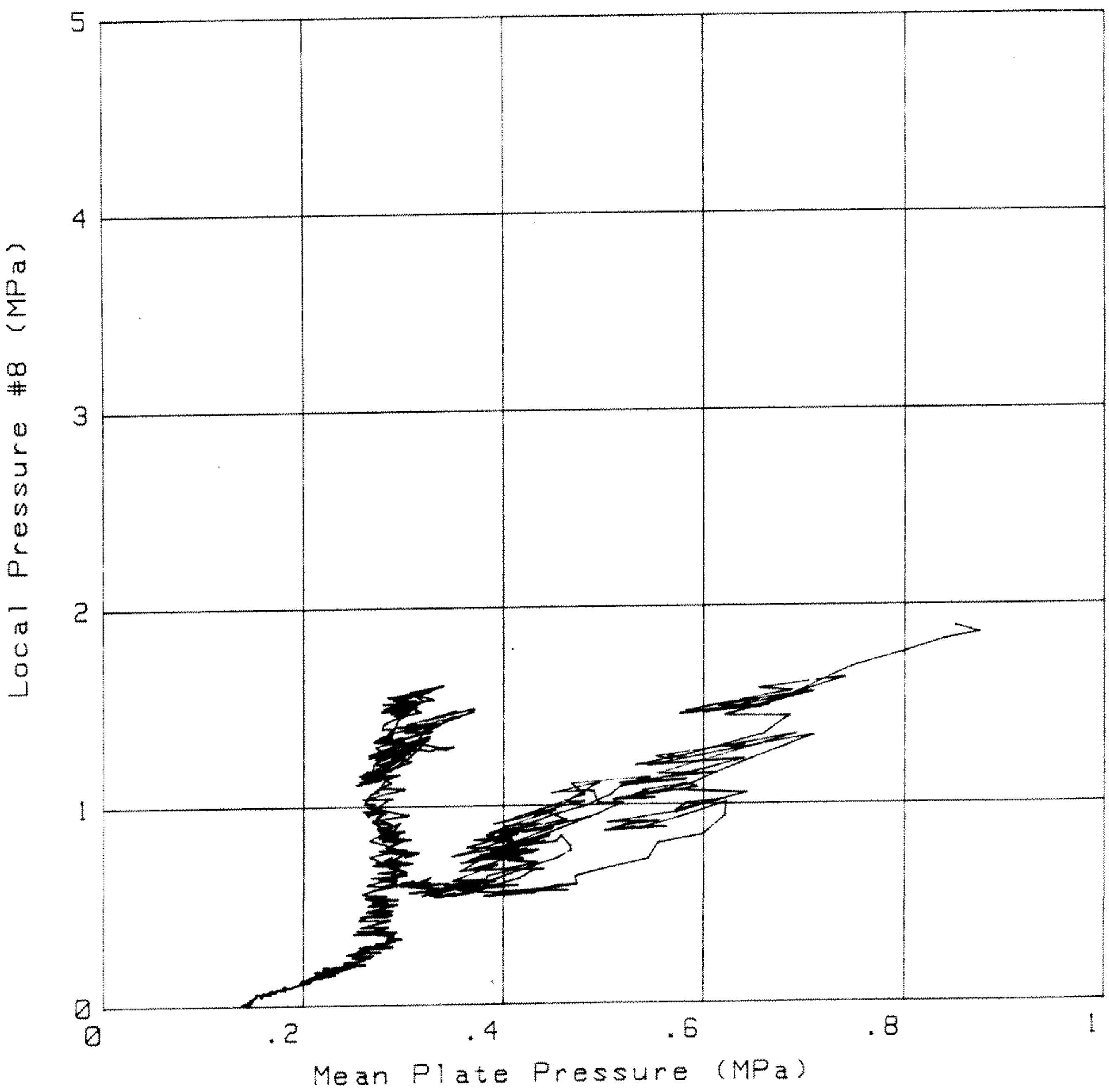
Local Pressure #8
vs.
Mean Plate Pressure

Test: X970
Type: Extrusion test
Sample: CRUSHED ICE

Date: 26 Jan 1989
Time: 13:40:07

Temperature: -10.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .92
Data To (s): 3.06



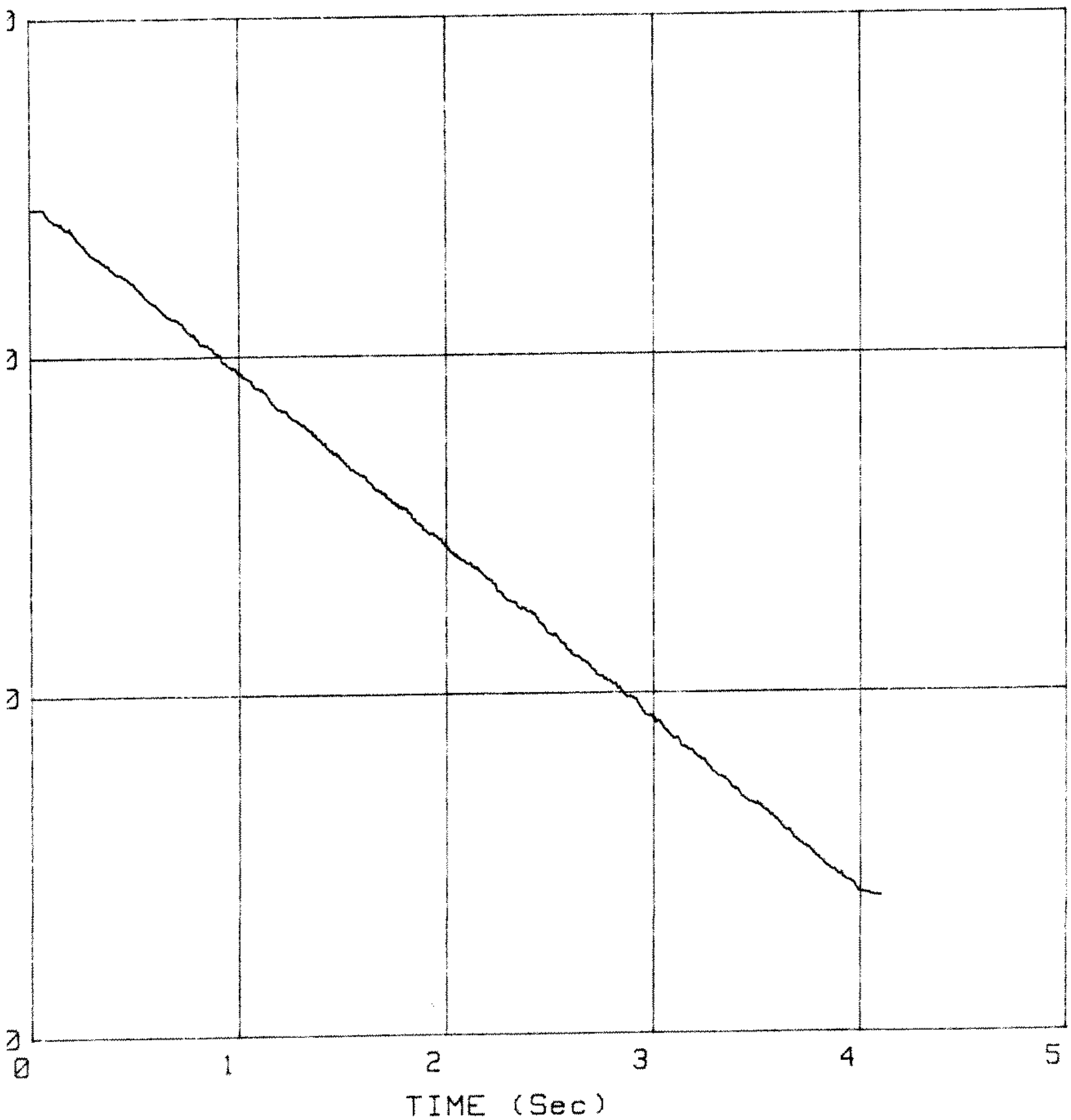
Layer Thickness
vs.
TIME

X971
Extusion test
e: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

ature: -11

Average = 10
Truncation Time (s) = 4.1



Mean Plate Pressure
vs.
TIME

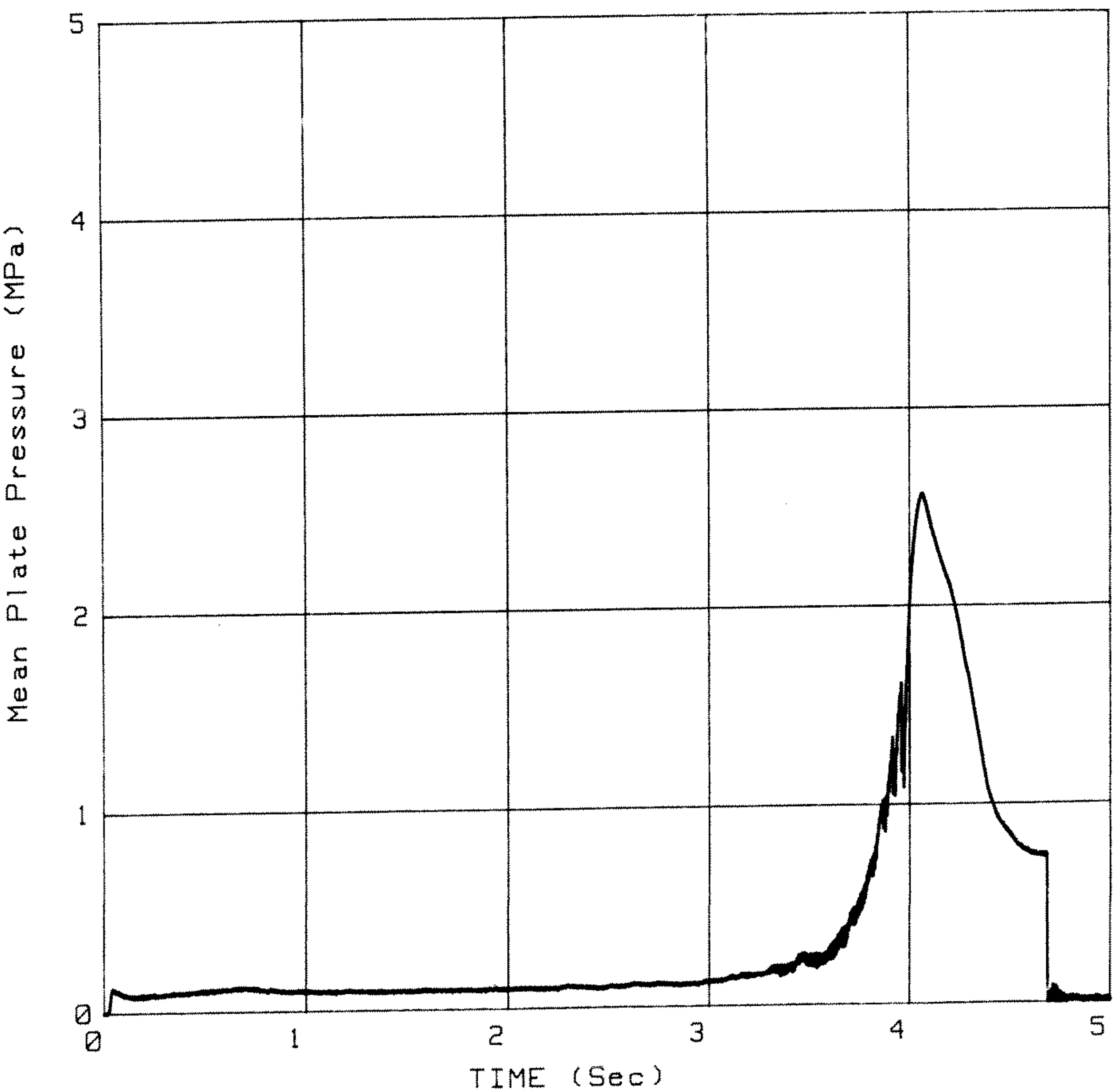
Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 5.1



Local Pressure #10
vs.
TIME

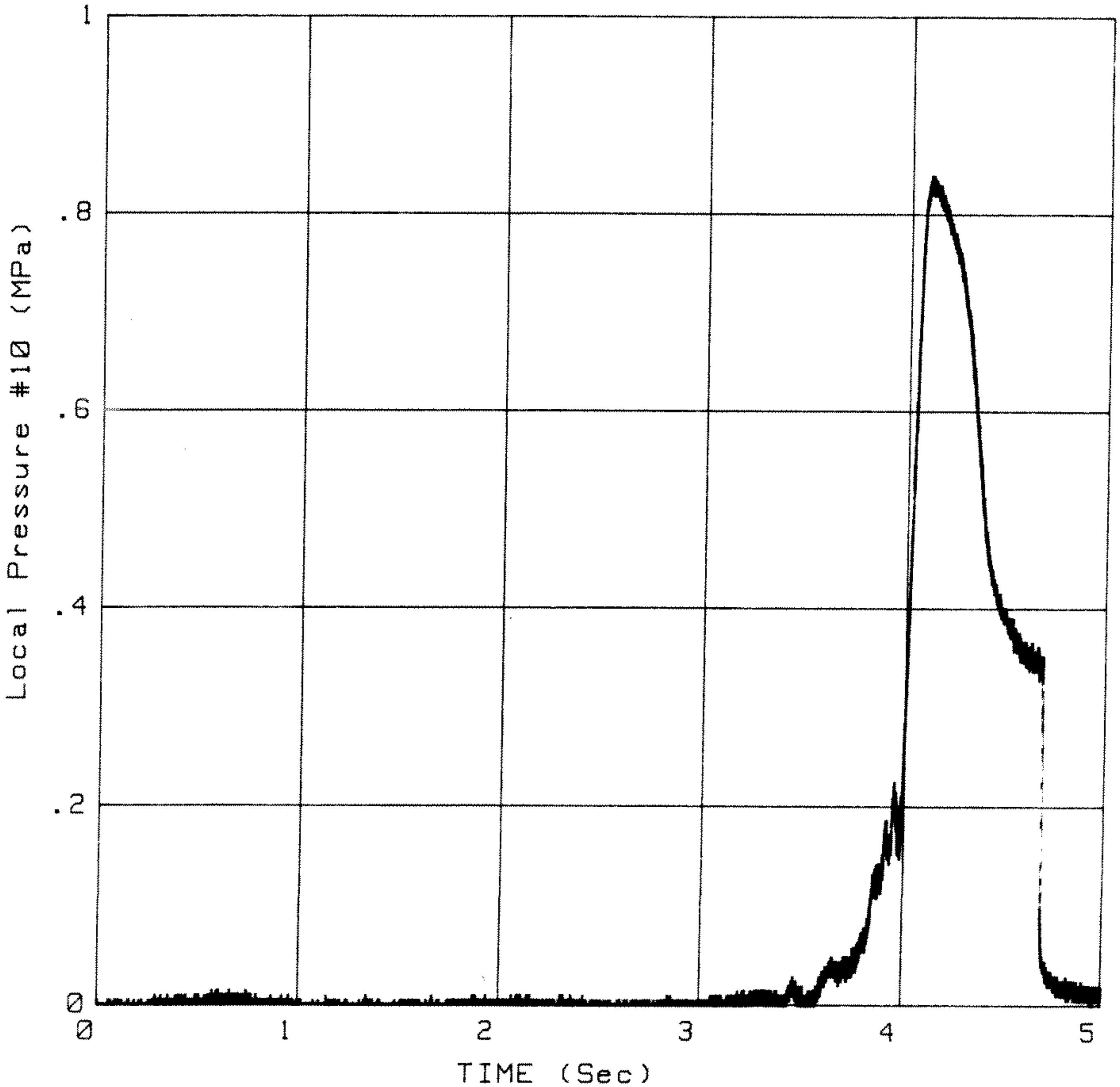
Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 5.1



Local Pressure #12
vs.
TIME

Test: X971
Type: Extusion test
Sample: CRUSHED ICE

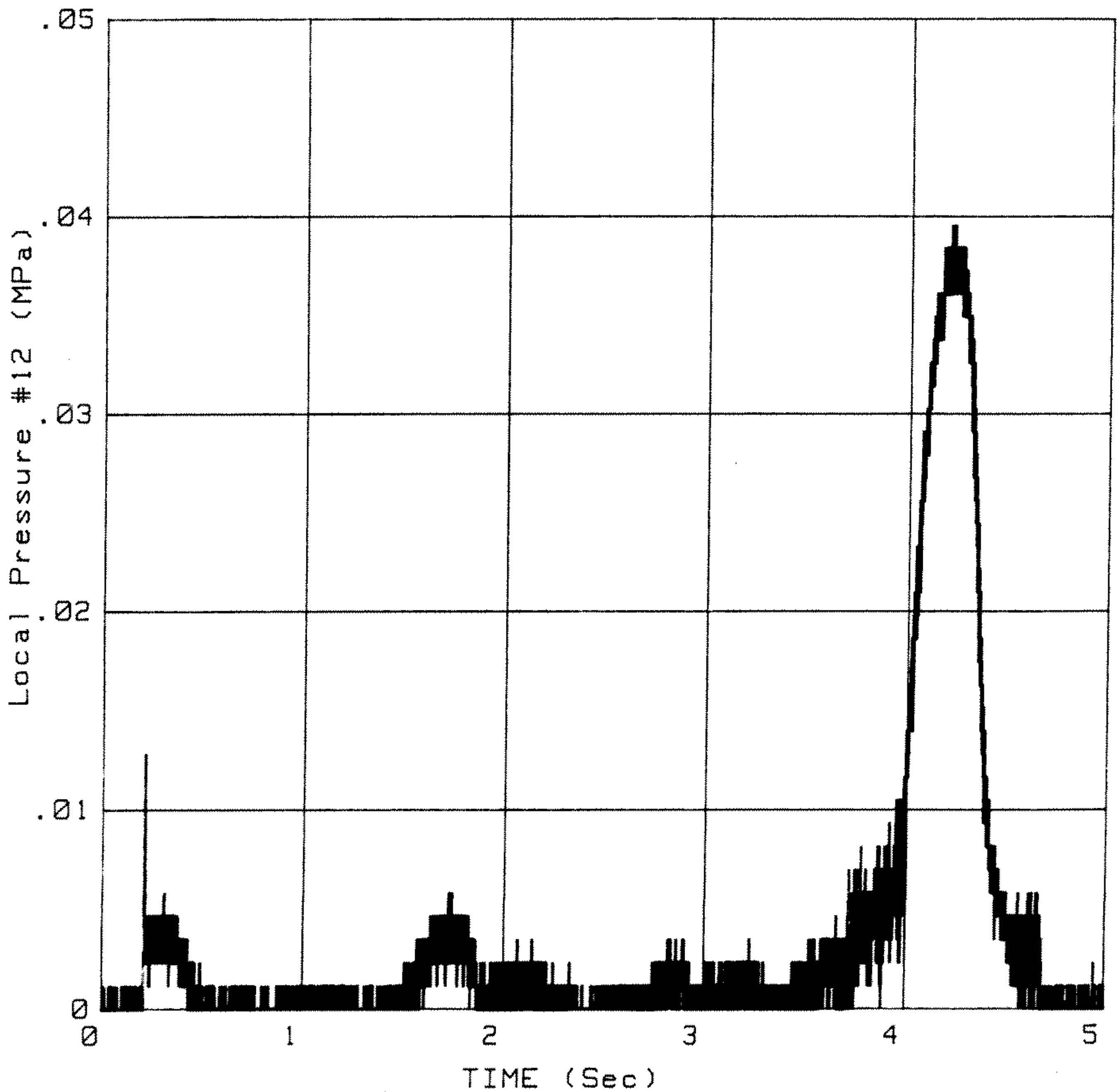
Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 1

Truncation Time (s) = 5.1



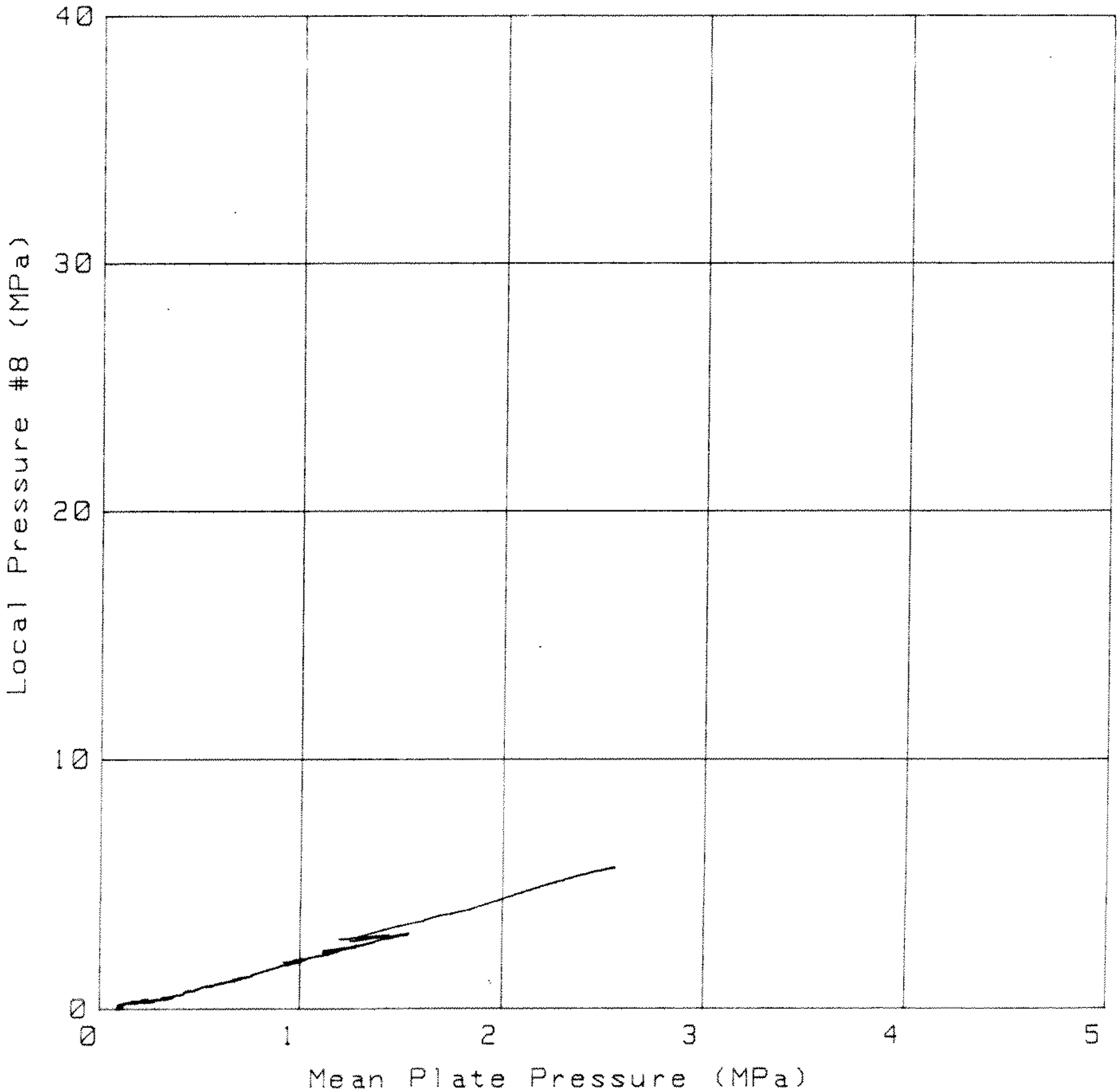
Local Pressure #8
vs.
Mean Plate Pressure

Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Temperature: -11

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .33
Data To (s): 4.07



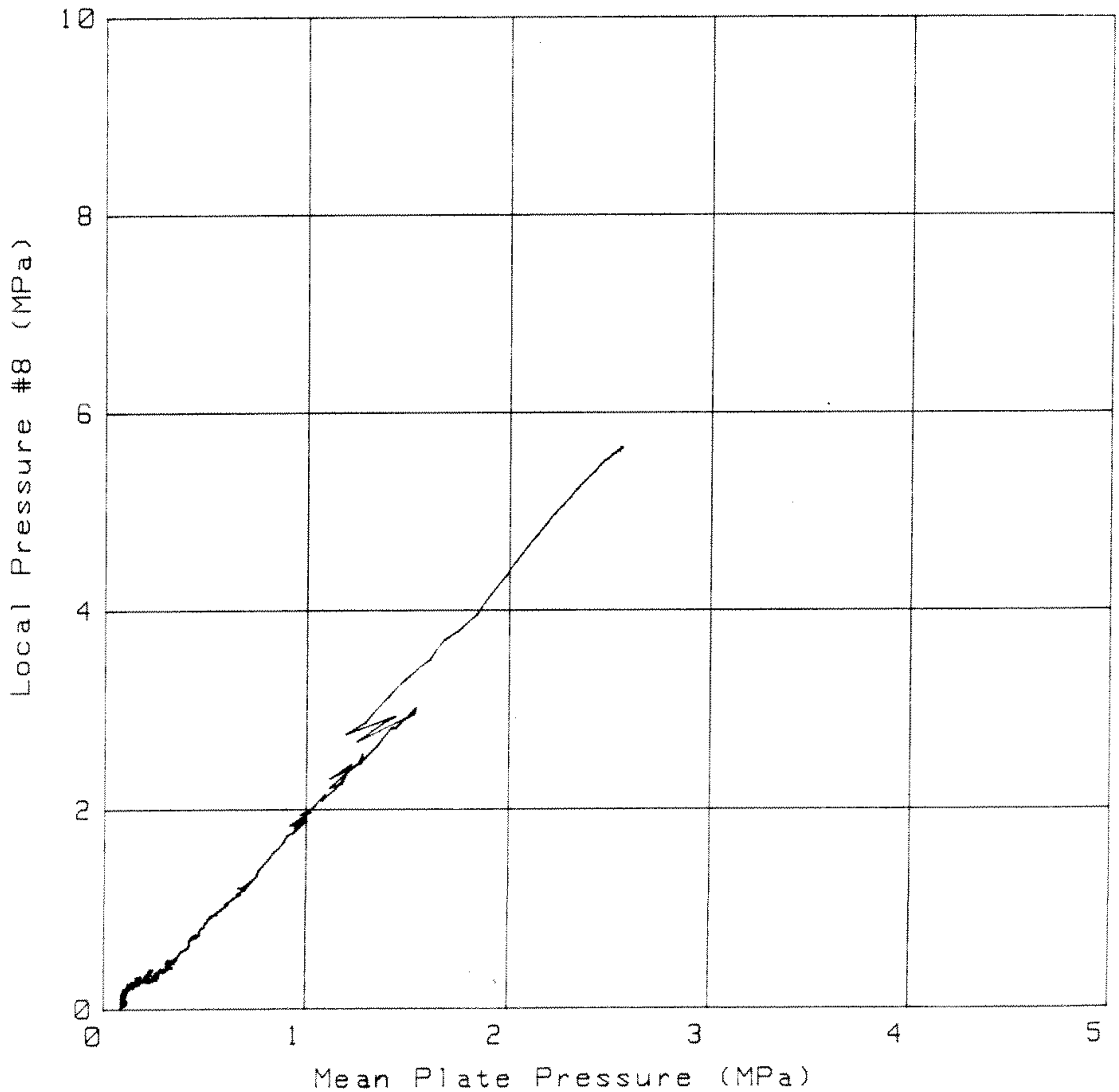
Local Pressure #8
vs.
Mean Plate Pressure

Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Temperature: -11

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .33
Data To (s): 4.07



Local Pressure #16
vs.
TIME

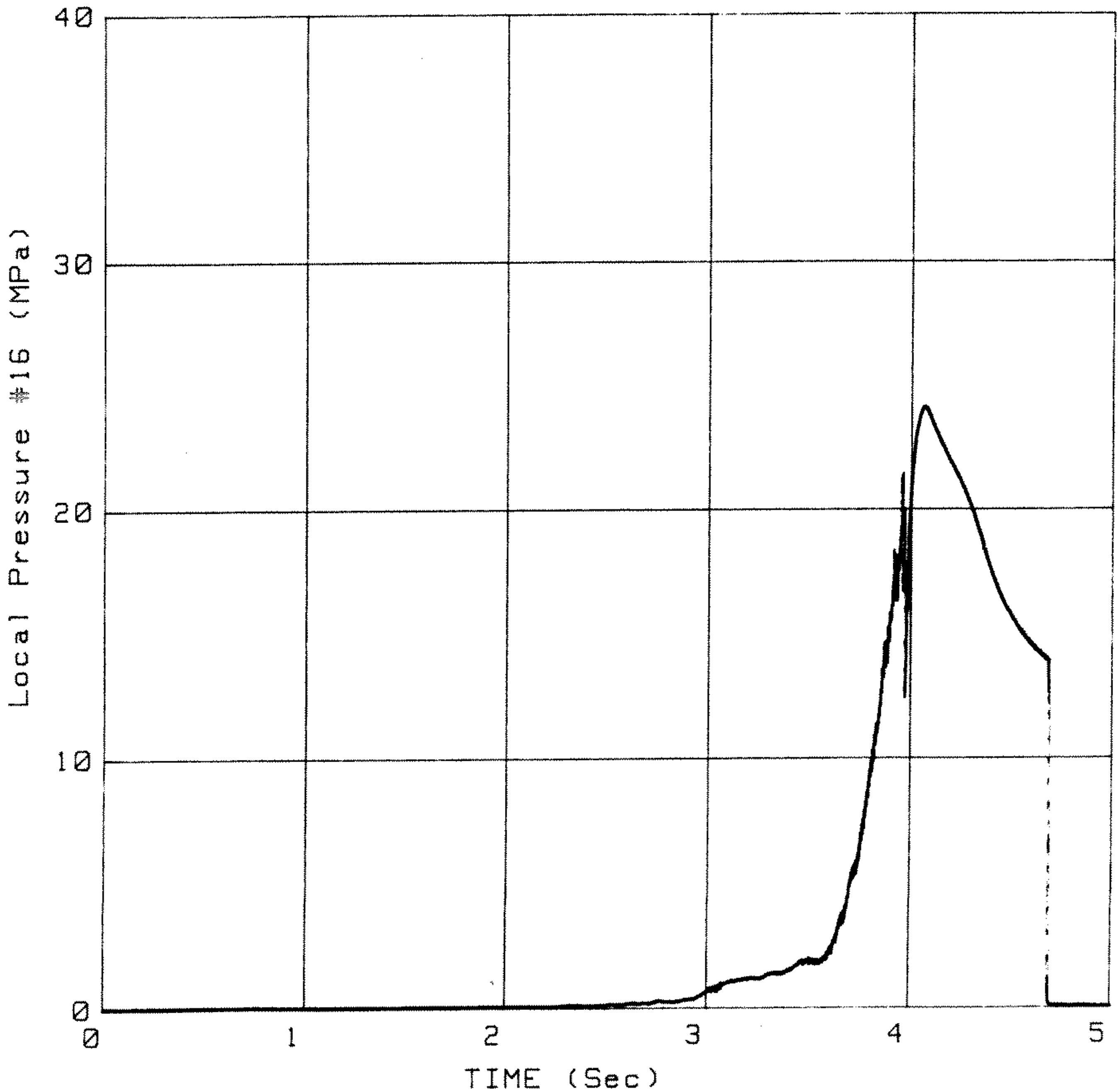
Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 5.1



Local Pressure #8
vs.
TIME

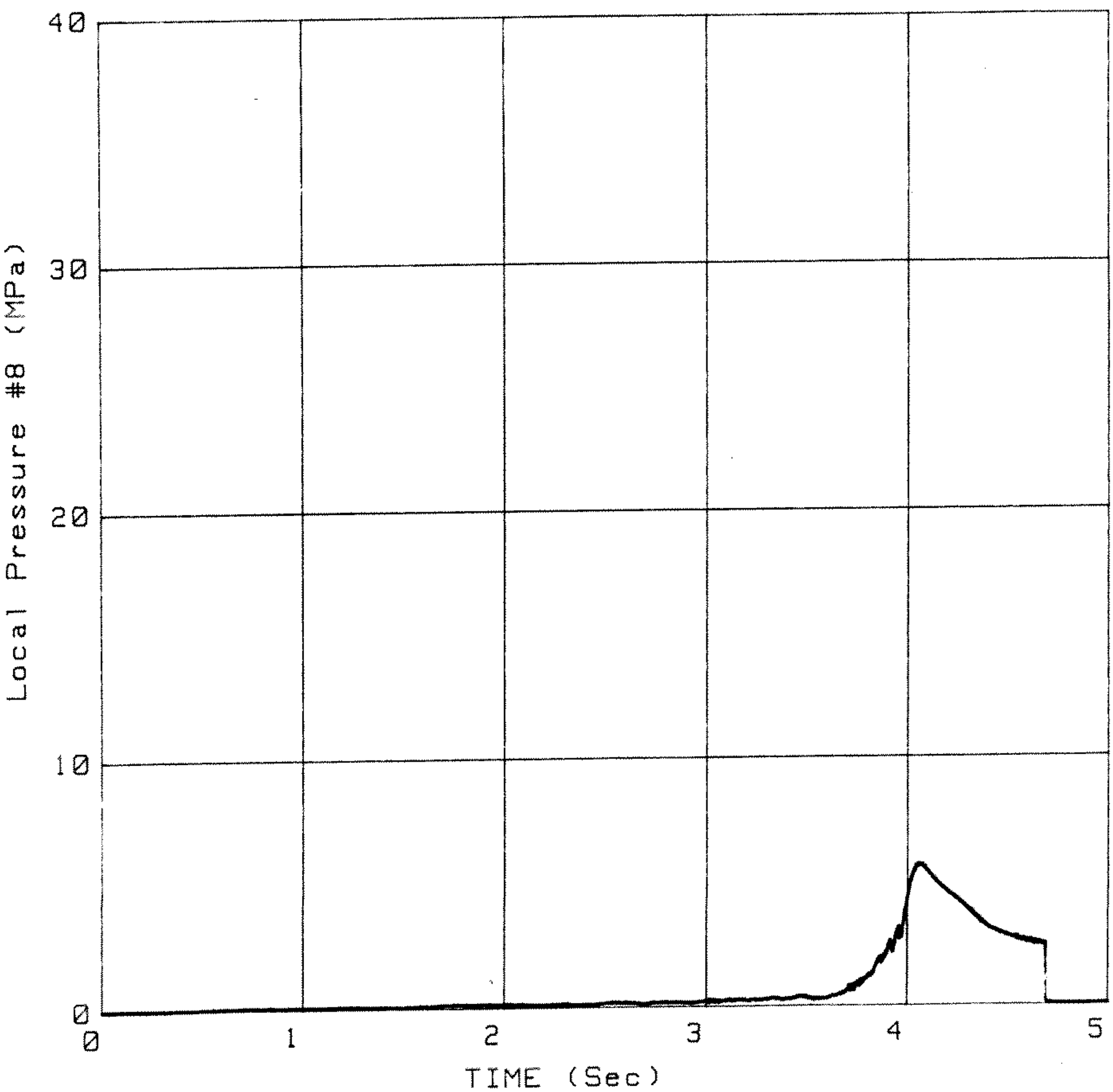
Test: X971
Type: Extusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 09:36:05

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 5.1



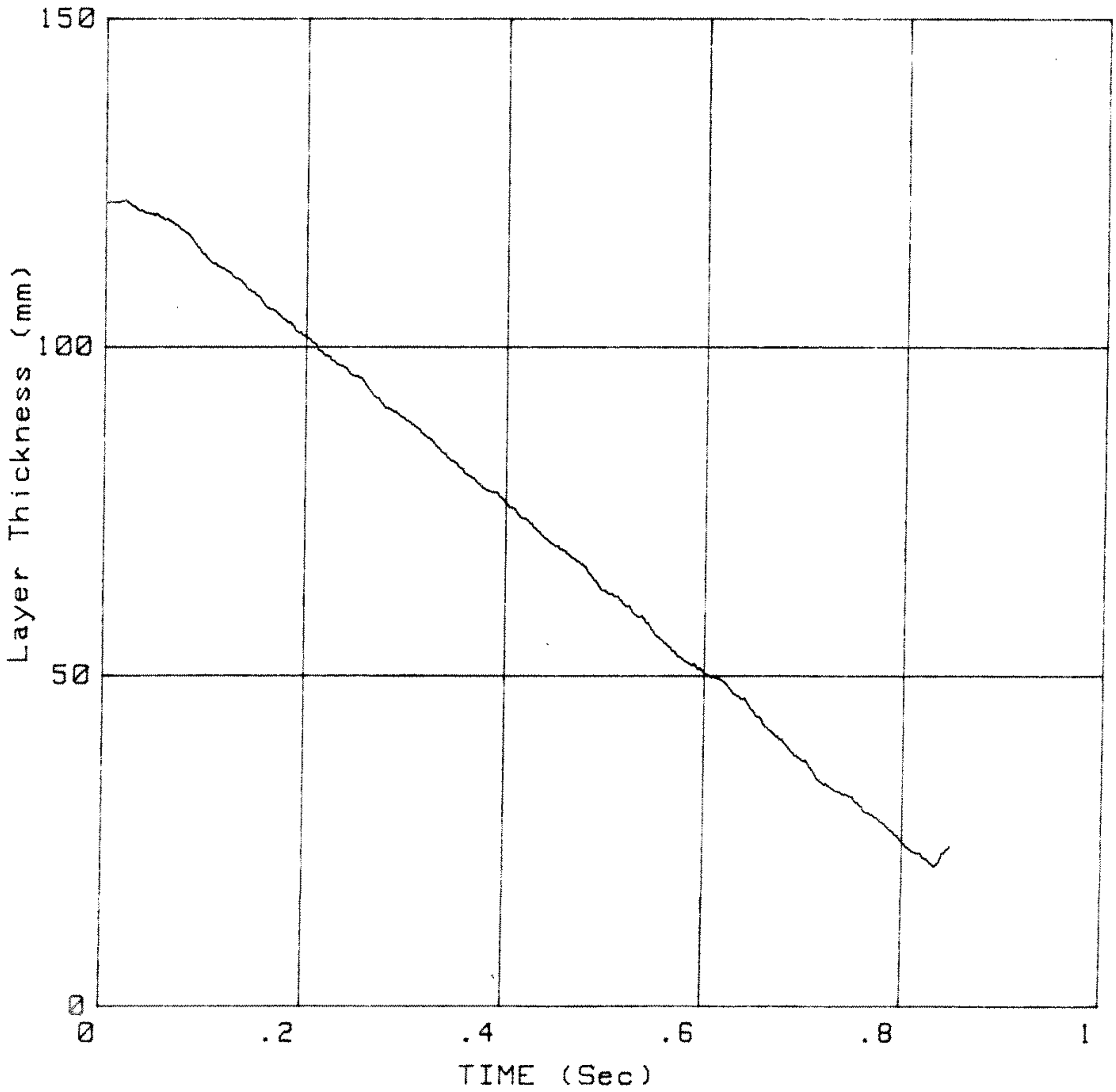
Layer Thickness
vs.
TIME

Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Temperature: -11

Average = 10
Truncation Time (s) = .85



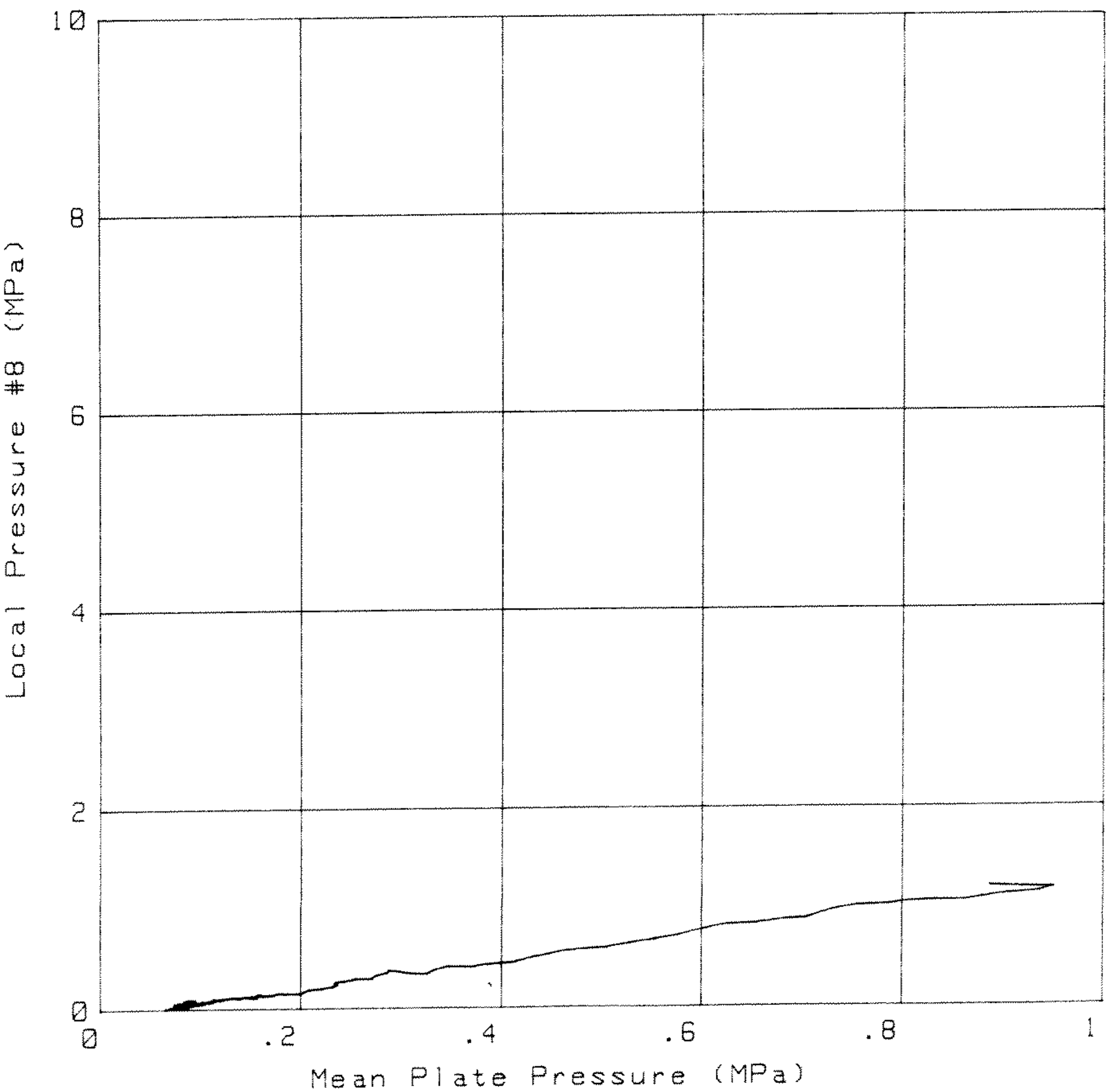
Local Pressure #8
vs.
Mean Plate Pressure

Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Temperature: -11

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .09
Data To (s): .832



Local Pressure #12
vs.
TIME

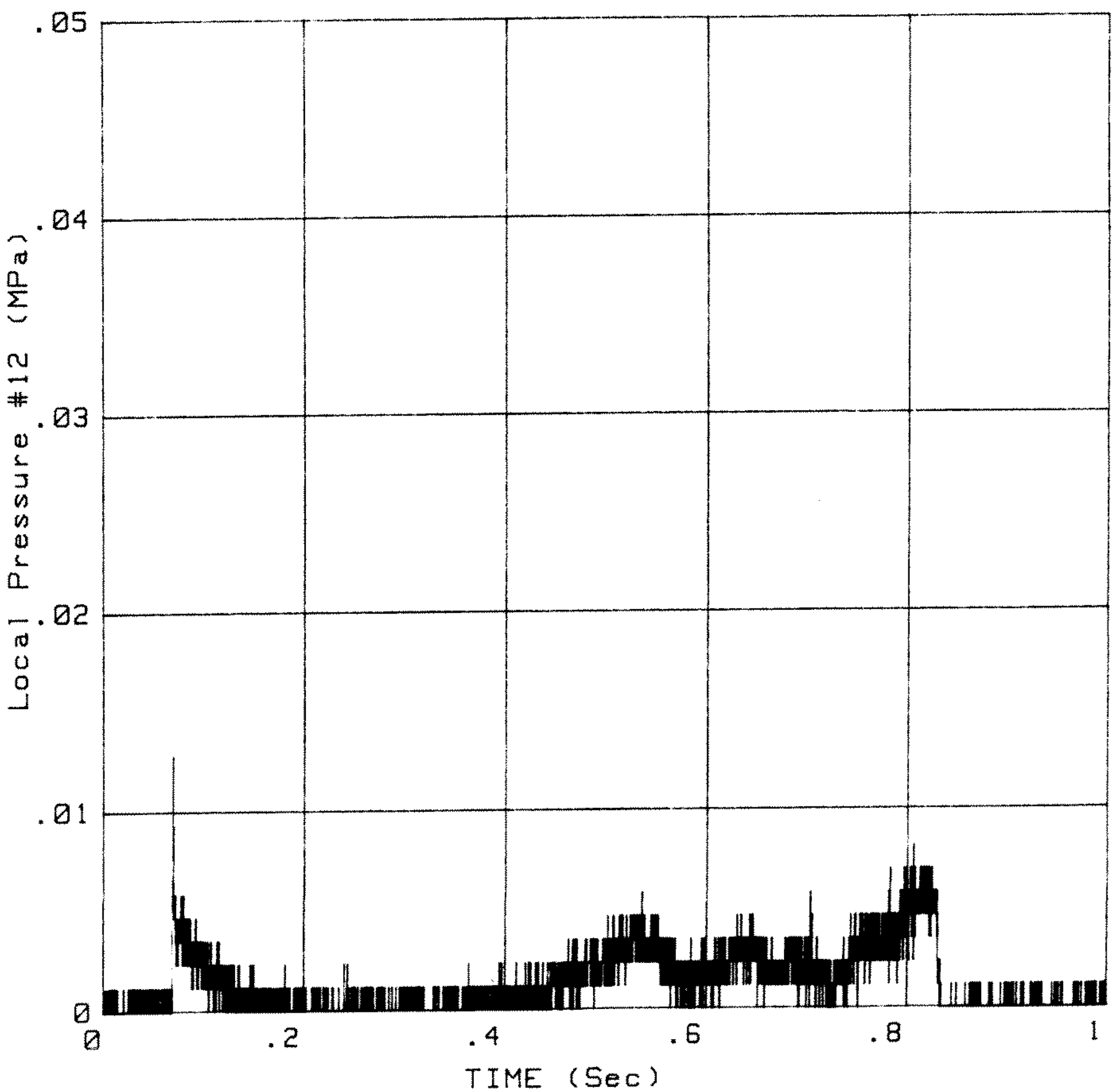
Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 3.01



Local Pressure #10
vs.
TIME

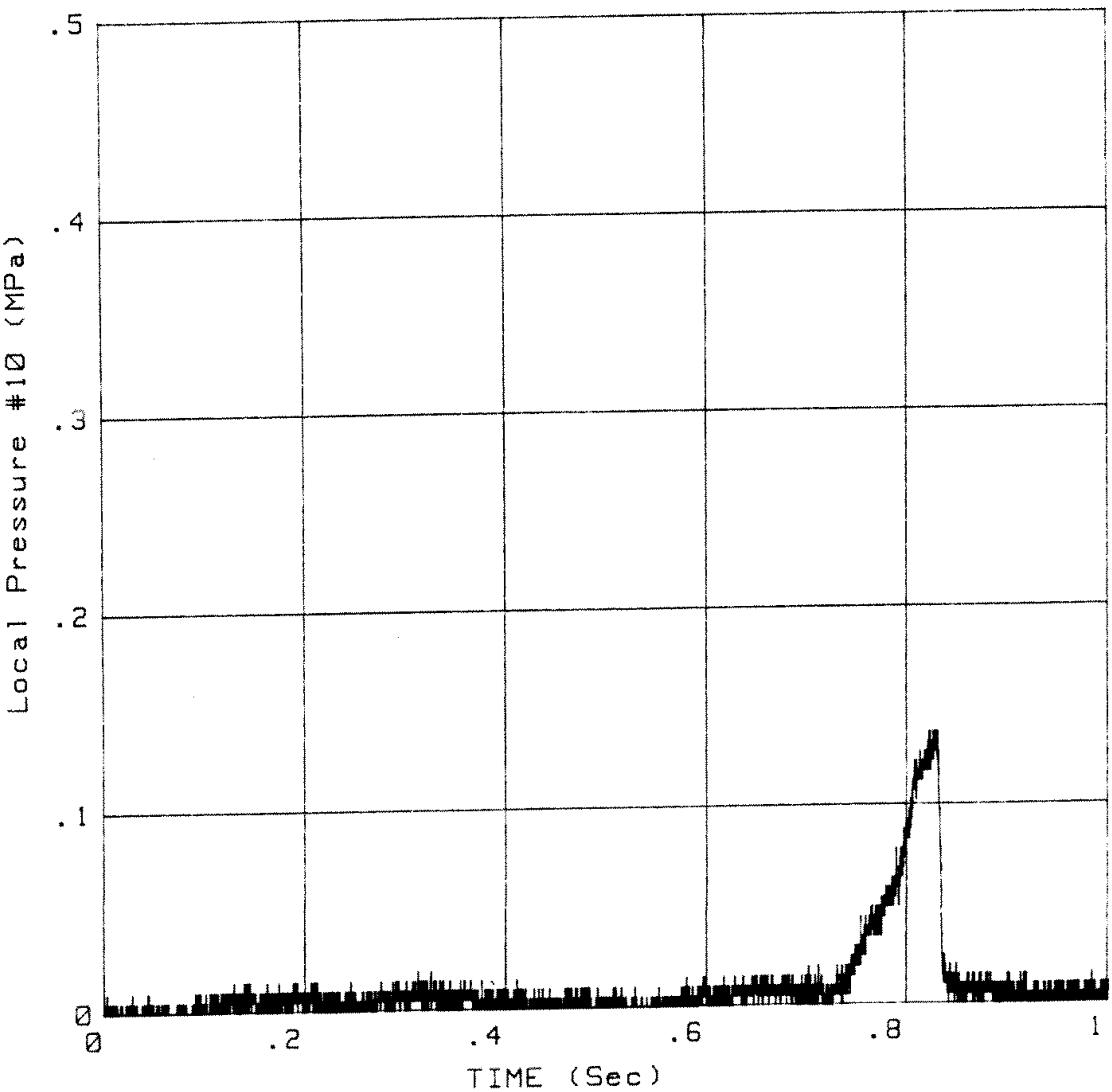
Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 3.01



Local Pressure #8
vs.
TIME

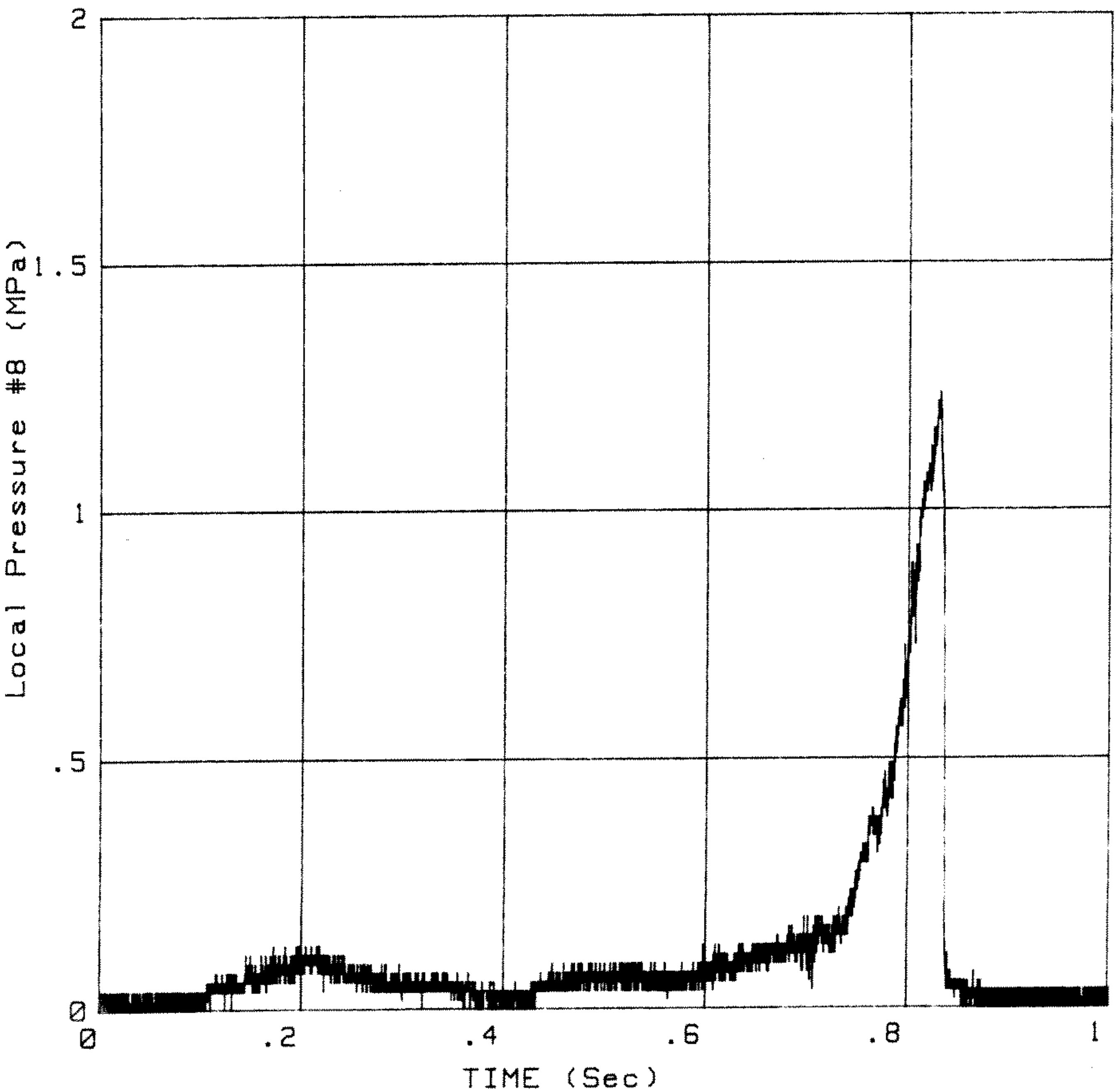
Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 3.01



Local Pressure #8
vs.
TIME

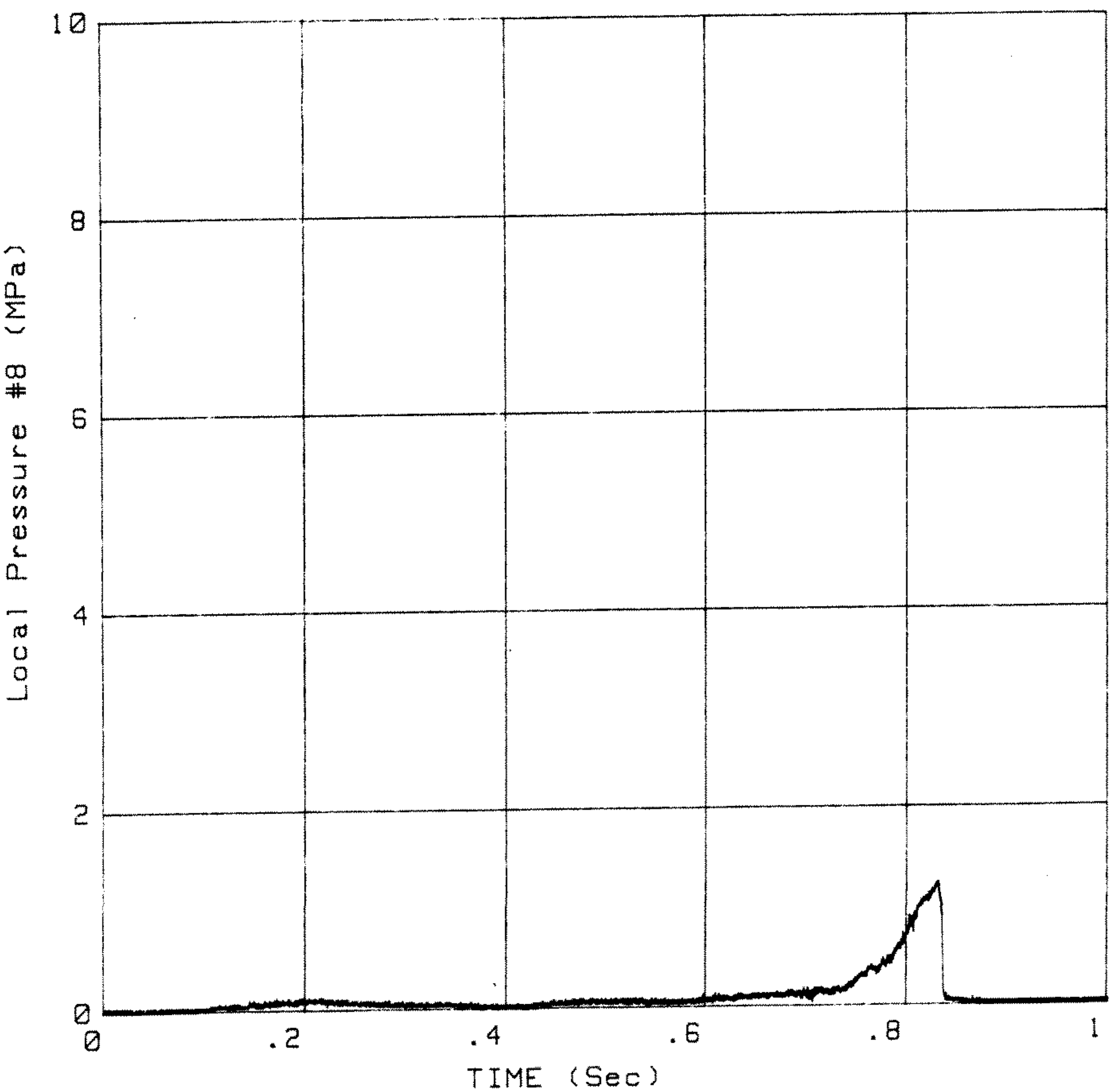
Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 3.01



Local Pressure #16
vs.
TIME

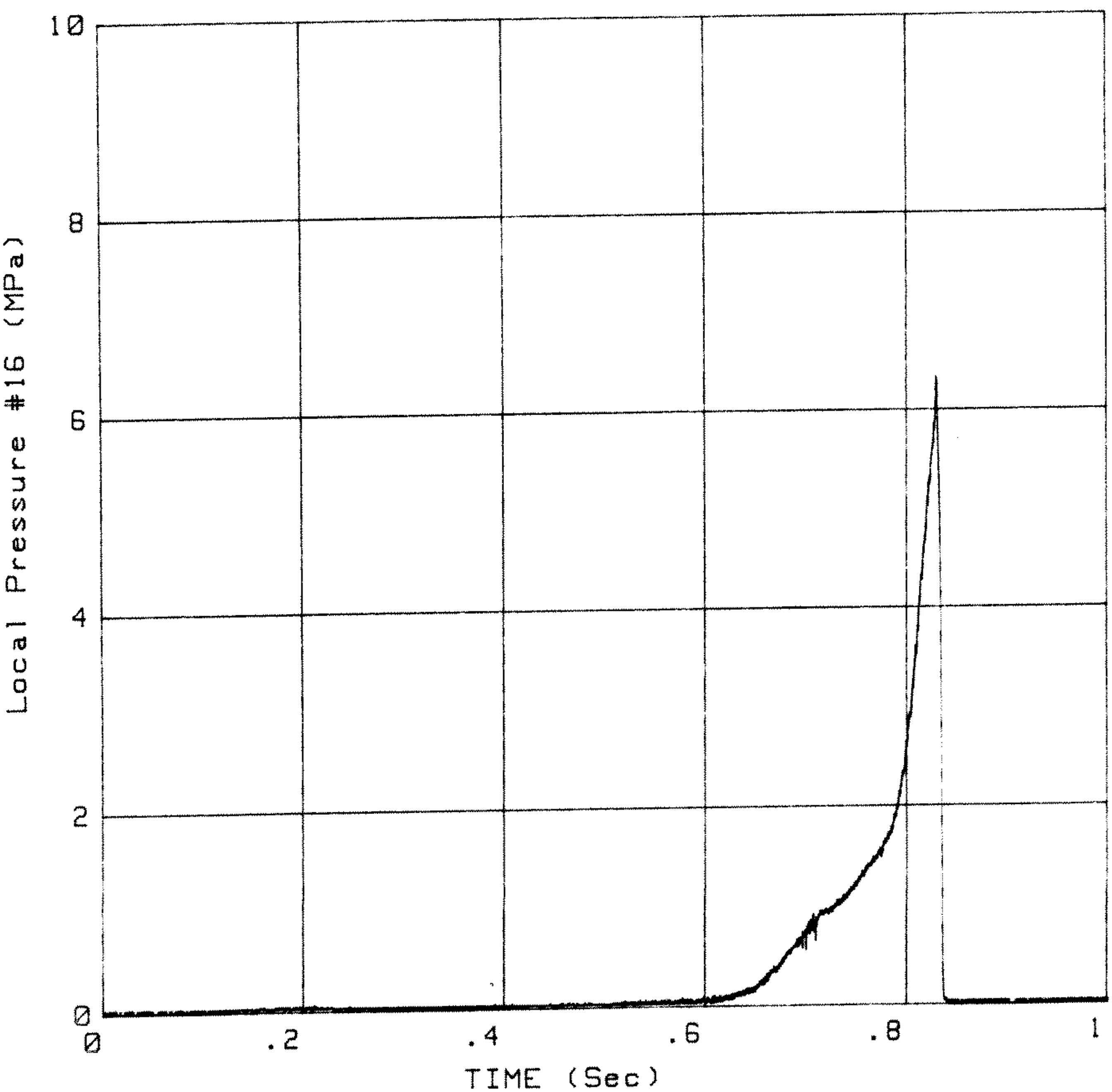
Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 3.01



Mean Plate Pressure
vs.
TIME

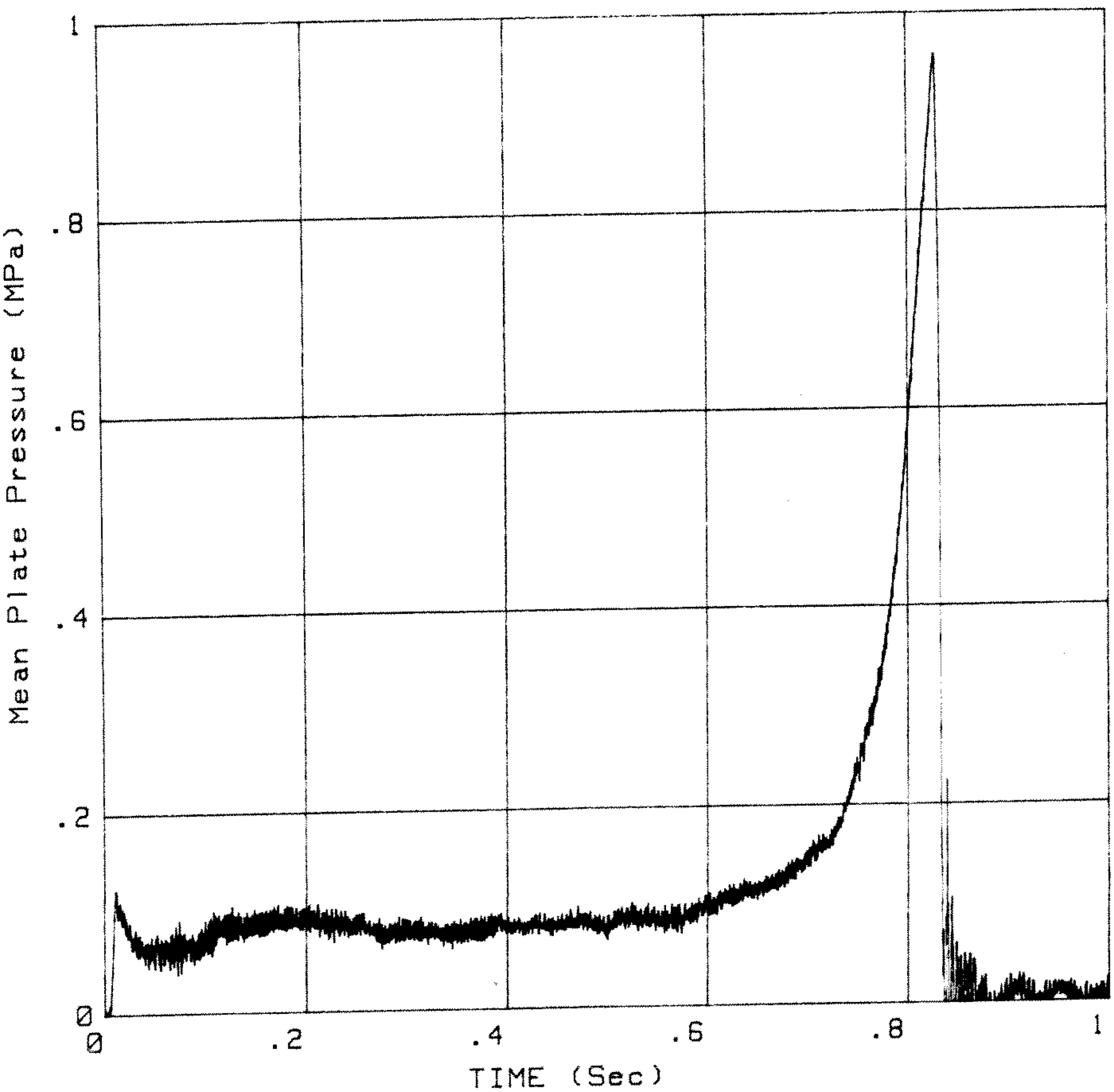
Test: X972
Type: Extrusion test
Sample: CRUSHED ICE

Date: 27 Jan 1989
Time: 11:47:26

Y Offset Removed

Temperature: -11

Average = 1
Truncation Time (s) = 1



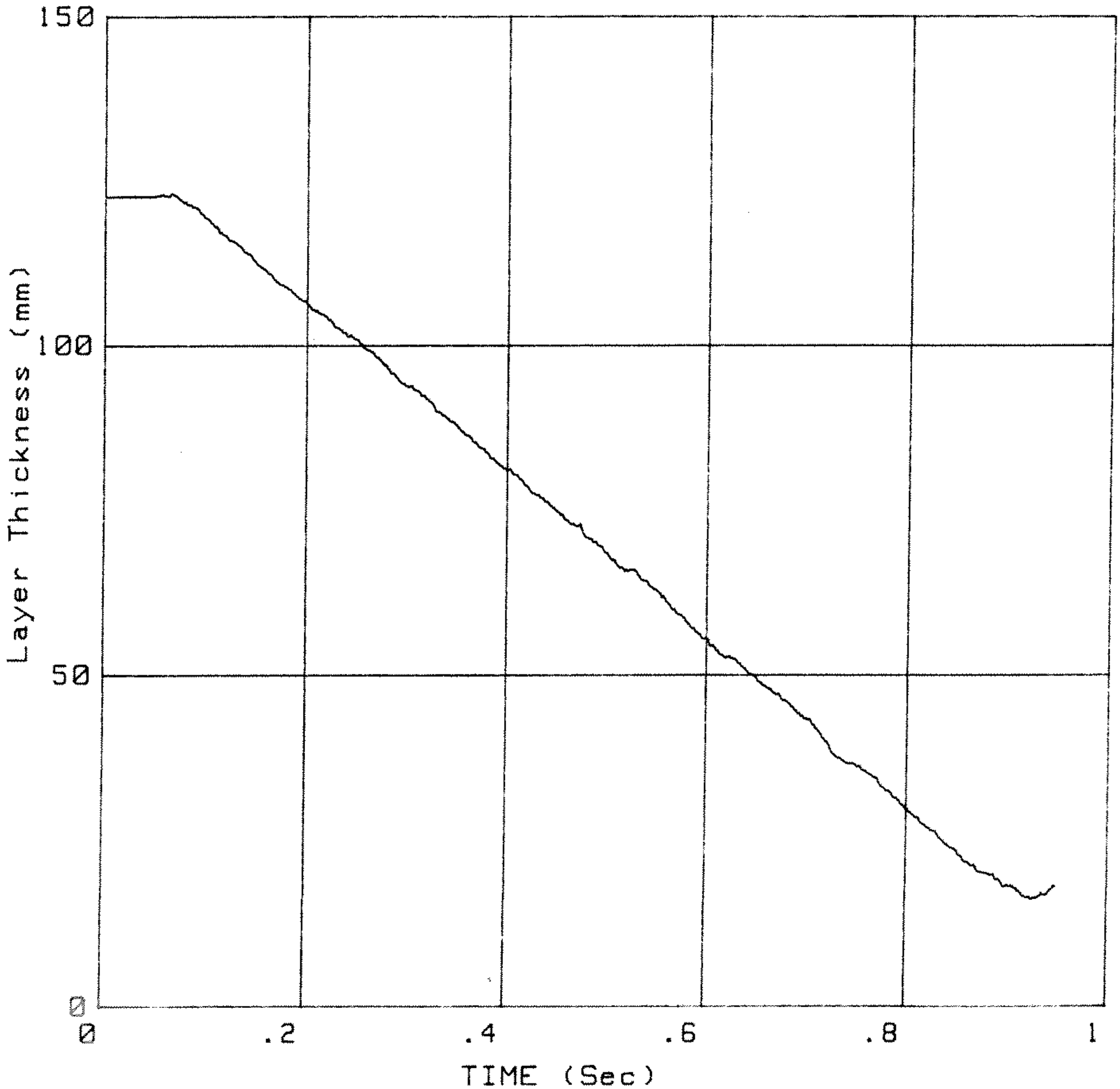
Layer Thickness
vs.
TIME

Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Temperature: -11.2

Average = 10
Truncation Time (s) = .95



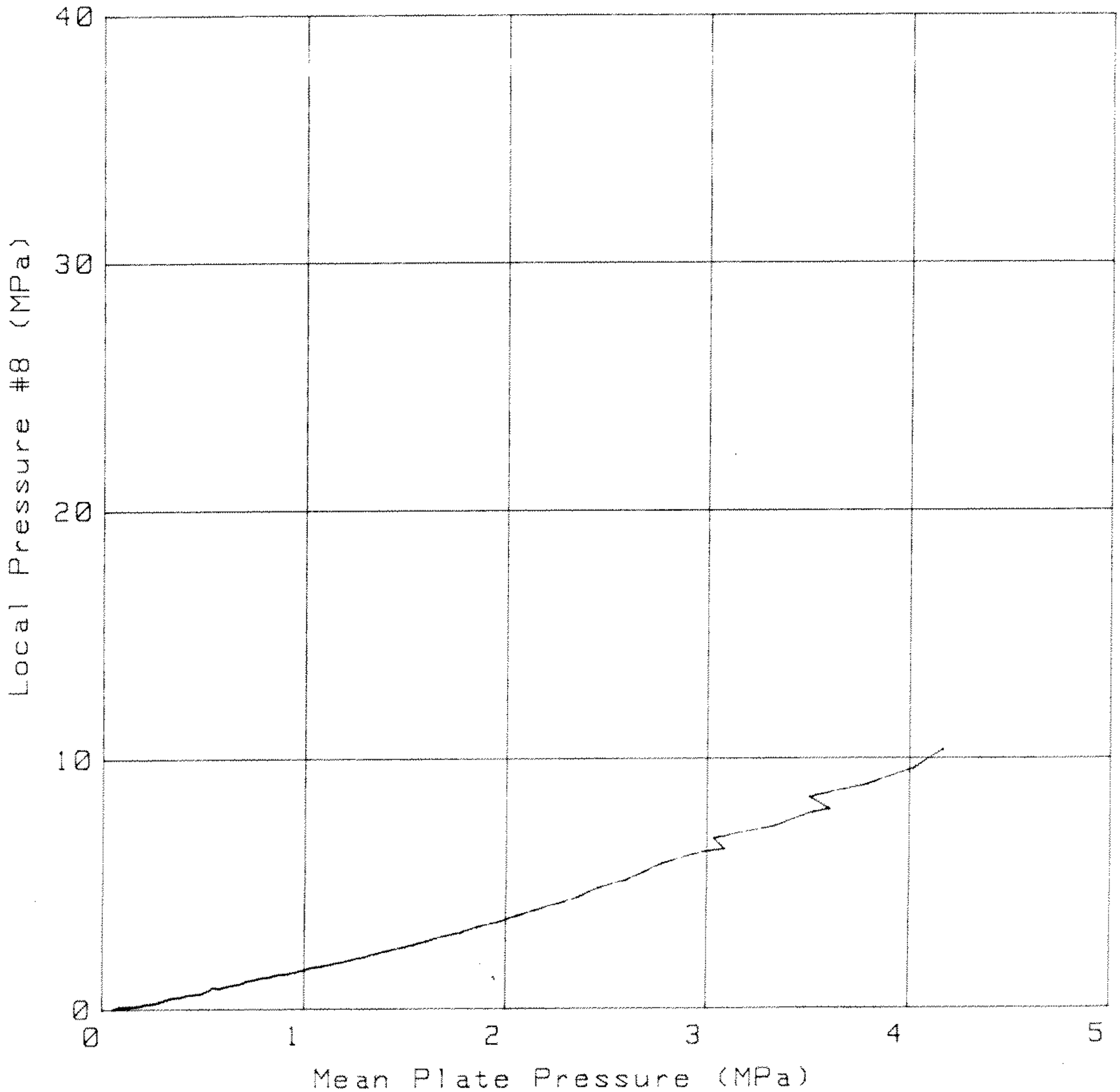
Local Pressure #8
vs.
Mean Plate Pressure

Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Temperature: -11.2

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .165
Data To (s): .923



Local Pressure #12
vs.
TIME

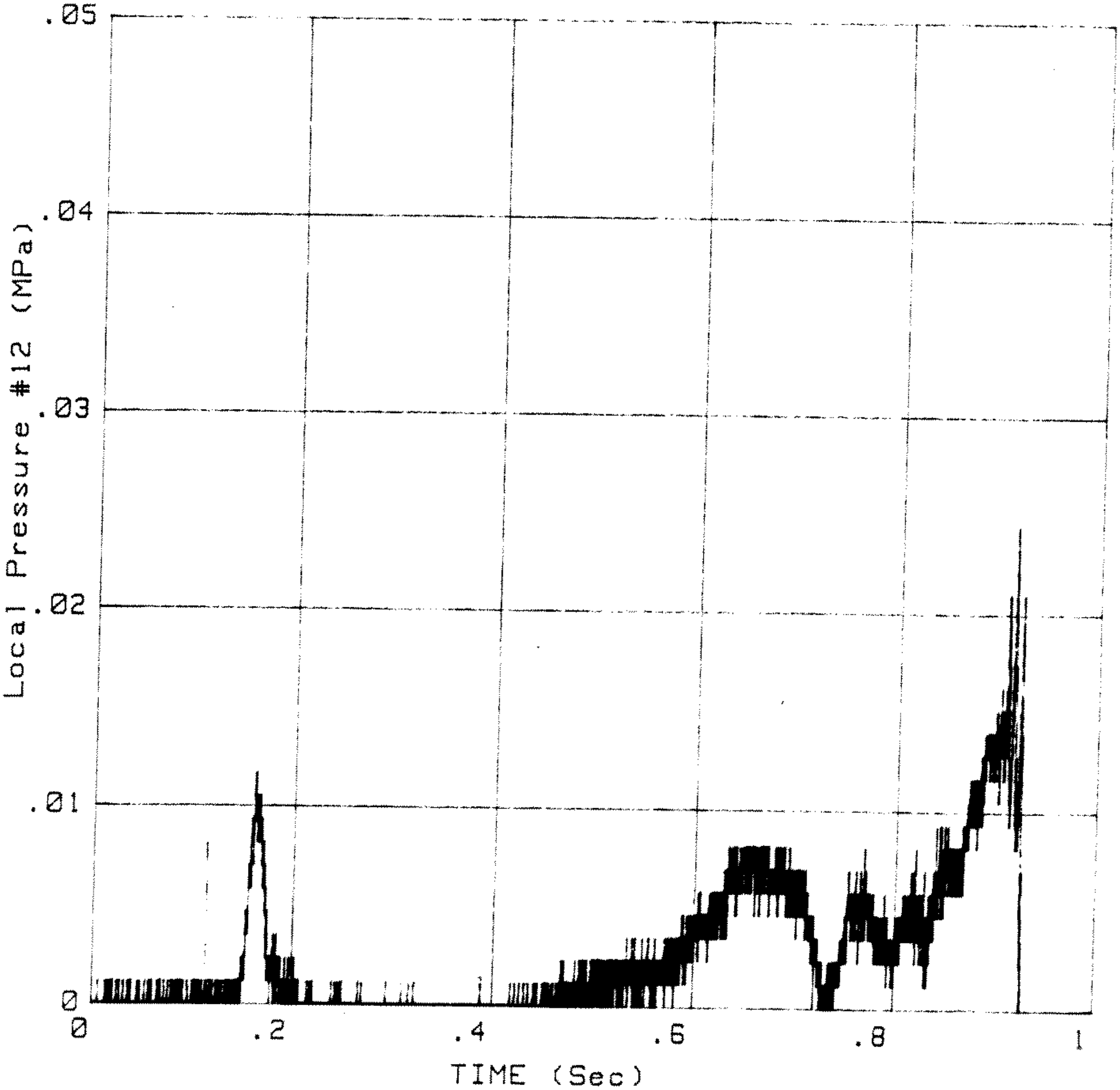
Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Y Offset Removed

Temperature: -11.2

Average = 1
Truncation Time (s) = 2.57



Local Pressure #10
vs.
TIME

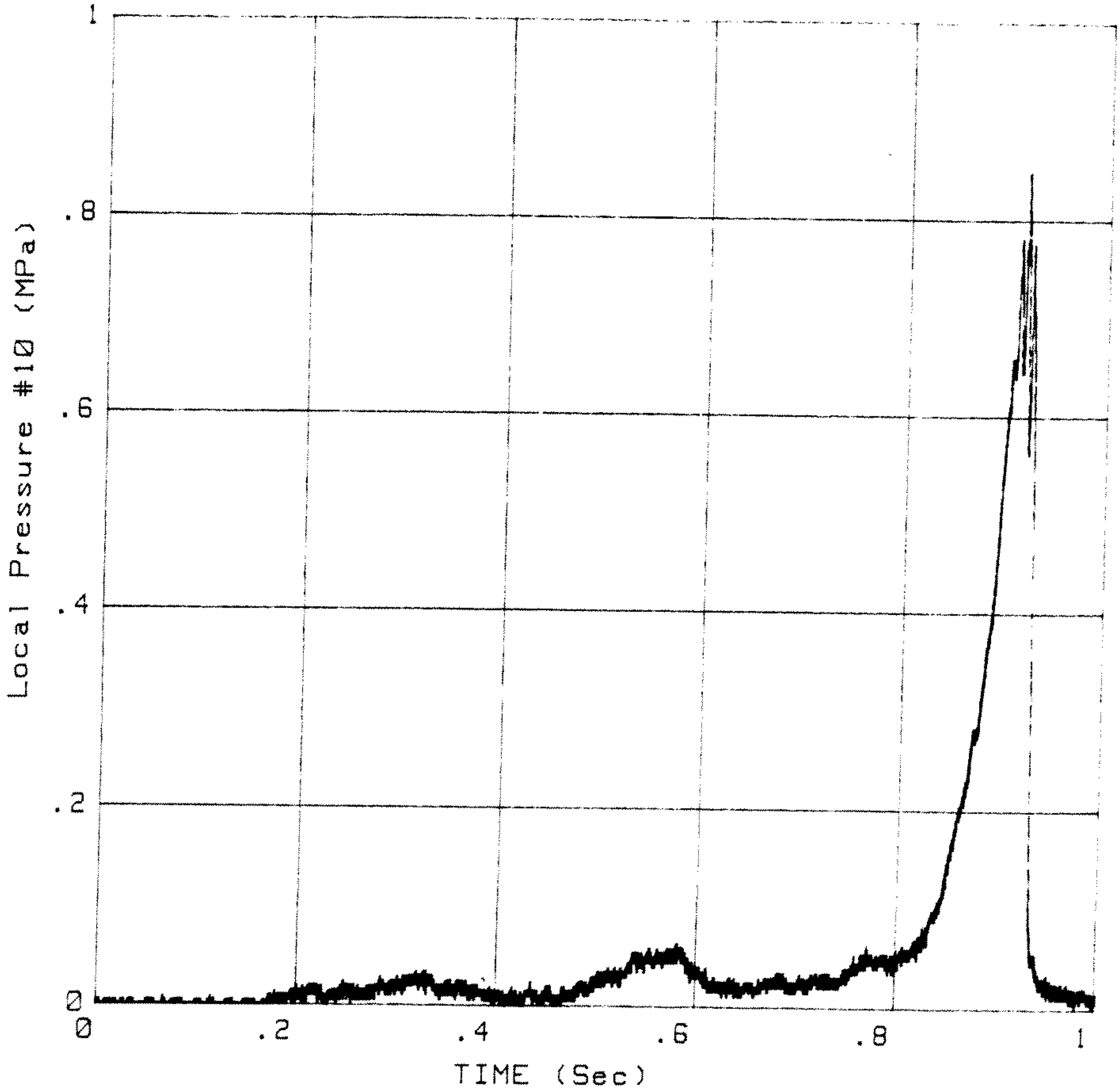
Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Y Offset Removed

Temperature: -11.2

Average = 1
Truncation Time (s) = 2.57



Local Pressure #8
vs.
TIME

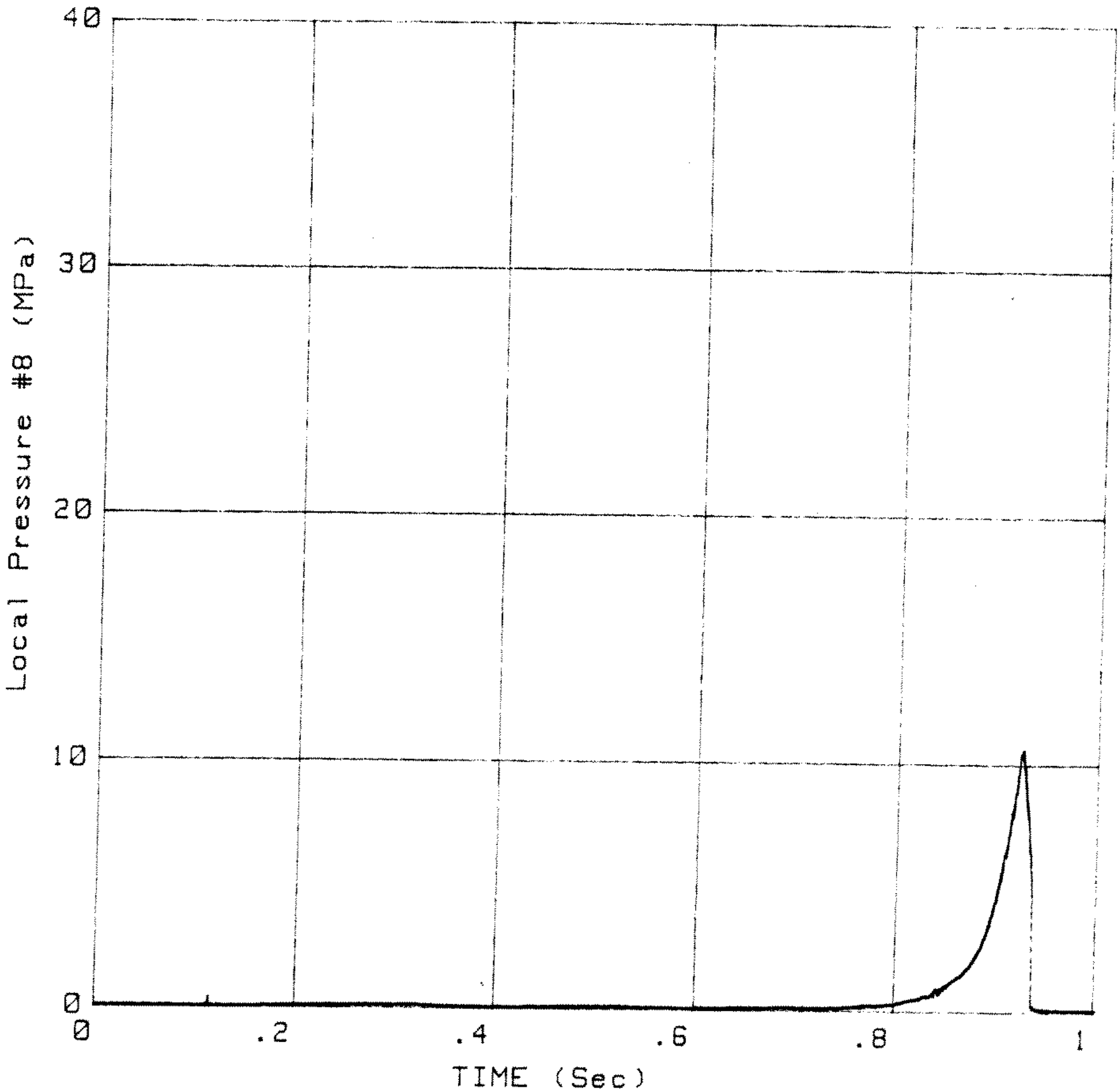
Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Y Offset Removed

Temperature: -11.2

Average = 1
Truncation Time (s) = 2.57



Local Pressure #16
vs.
TIME

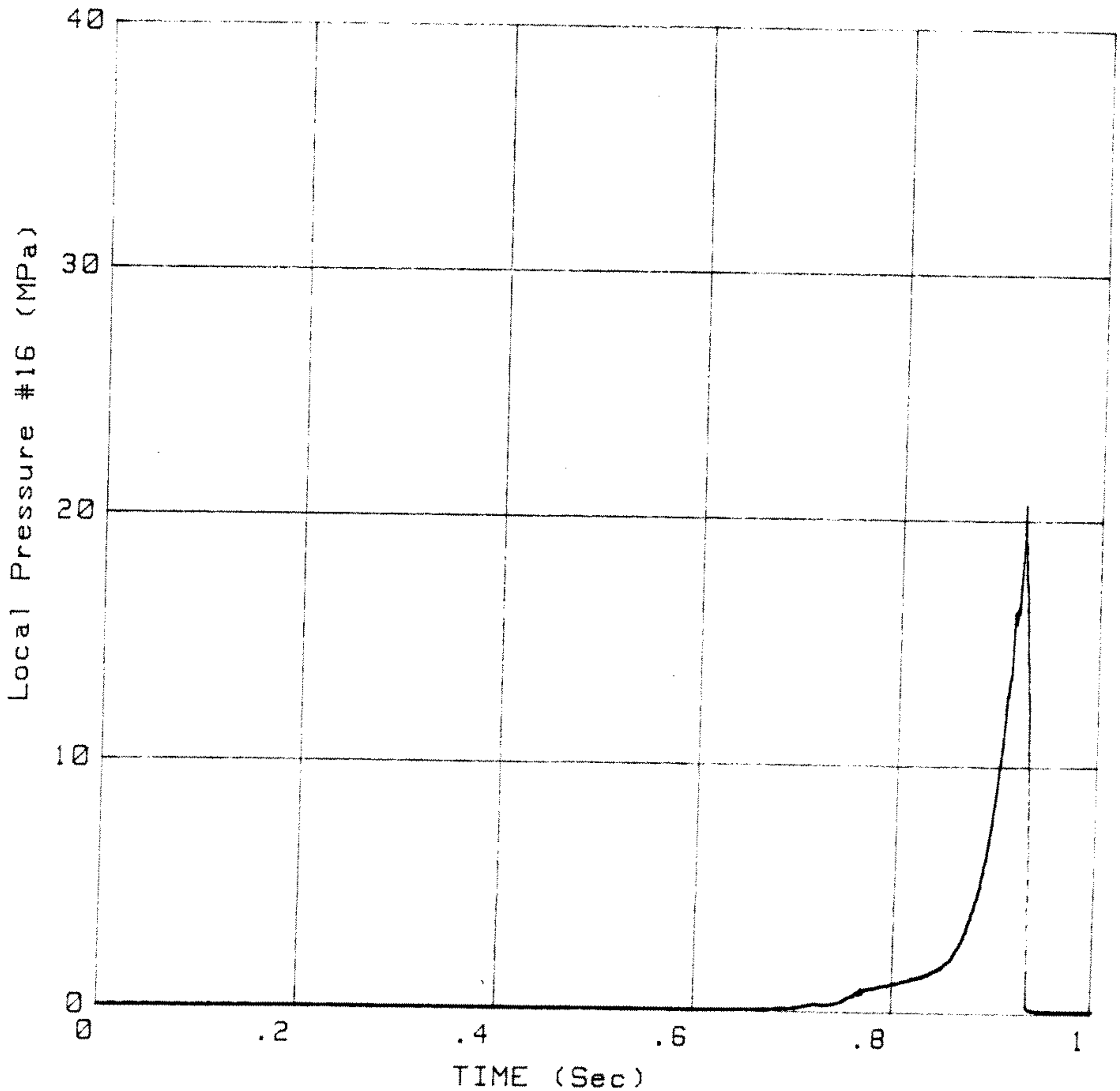
Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Y Offset Removed

Temperature: -11.2

Average = 1
Truncation Time (s) = 2.57



Mean Plate Pressure
vs.
TIME

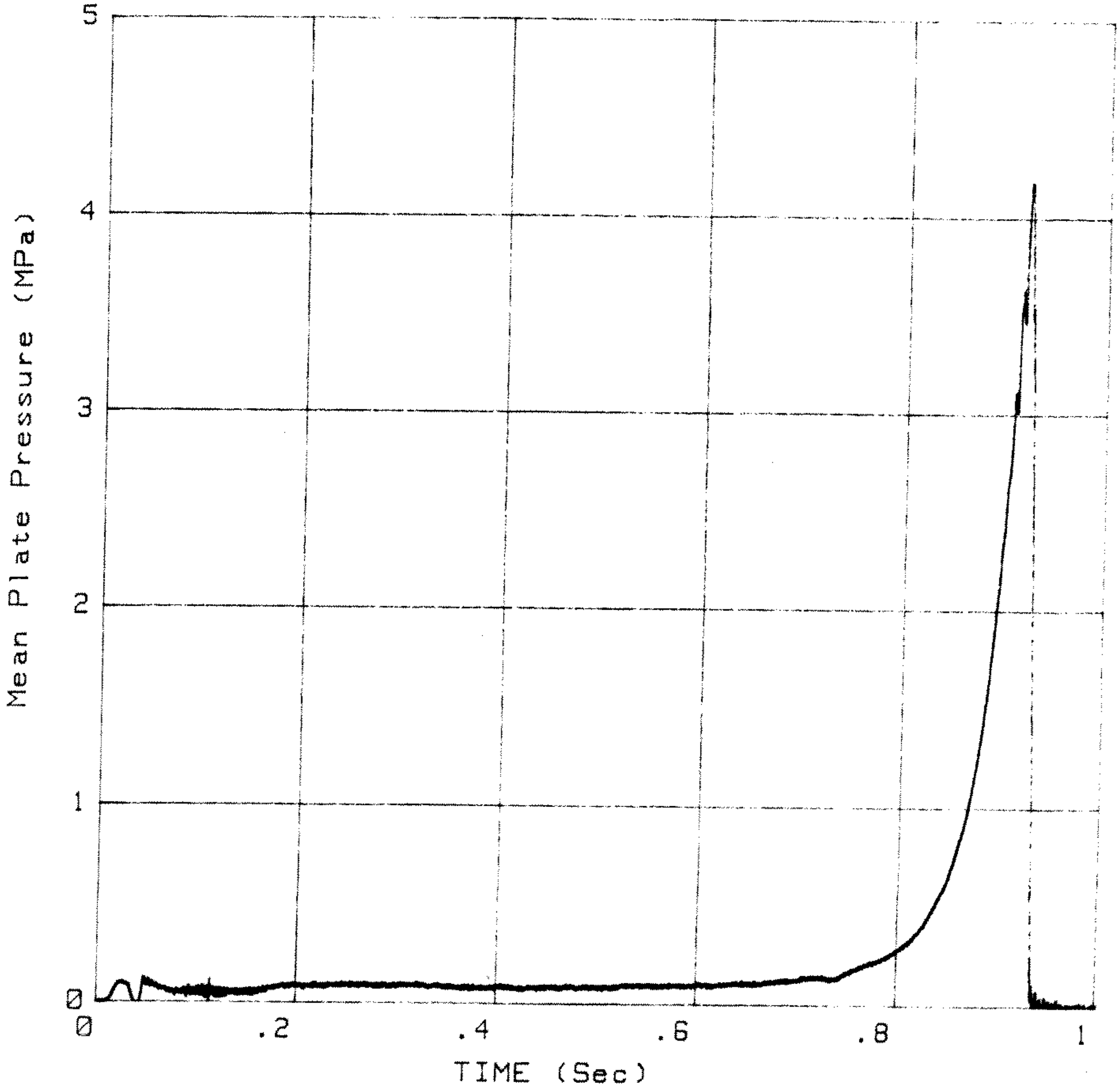
Test: X973
Type: Extrusion test
Sample: CRUSHED ICE

Date: 30 Jan 1989
Time: 08:57:31

Y Offset Removed

Temperature: -11.2

Average = 1
Truncation Time (s) = 2.57



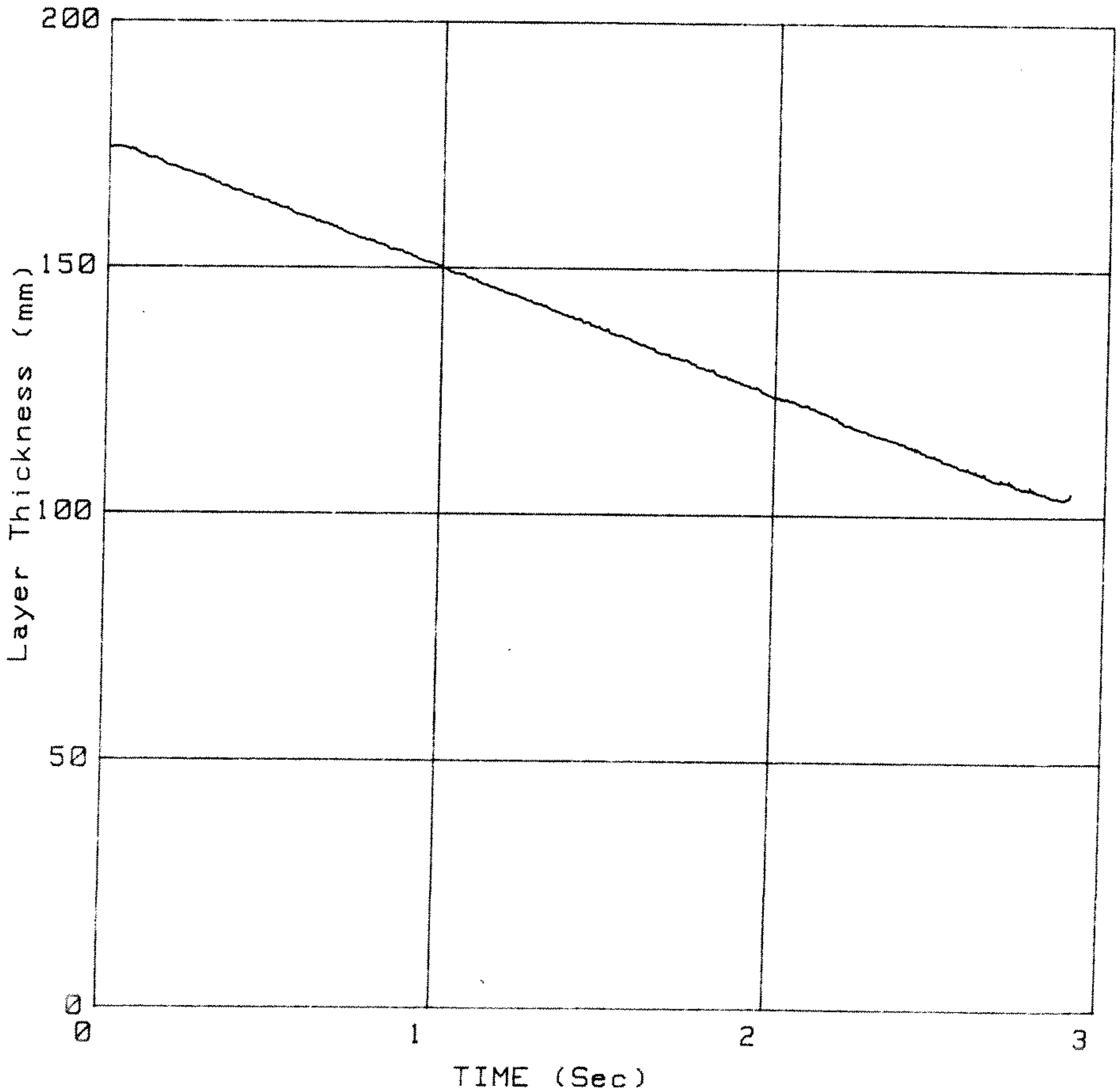
Layer Thickness
vs.
TIME

Test: X974
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 15:28:36

Temperature: -10

Average = 10
Truncation Time (s) = 2.9



LOGe(Mean Plate Pressure)
vs.
Sample Density

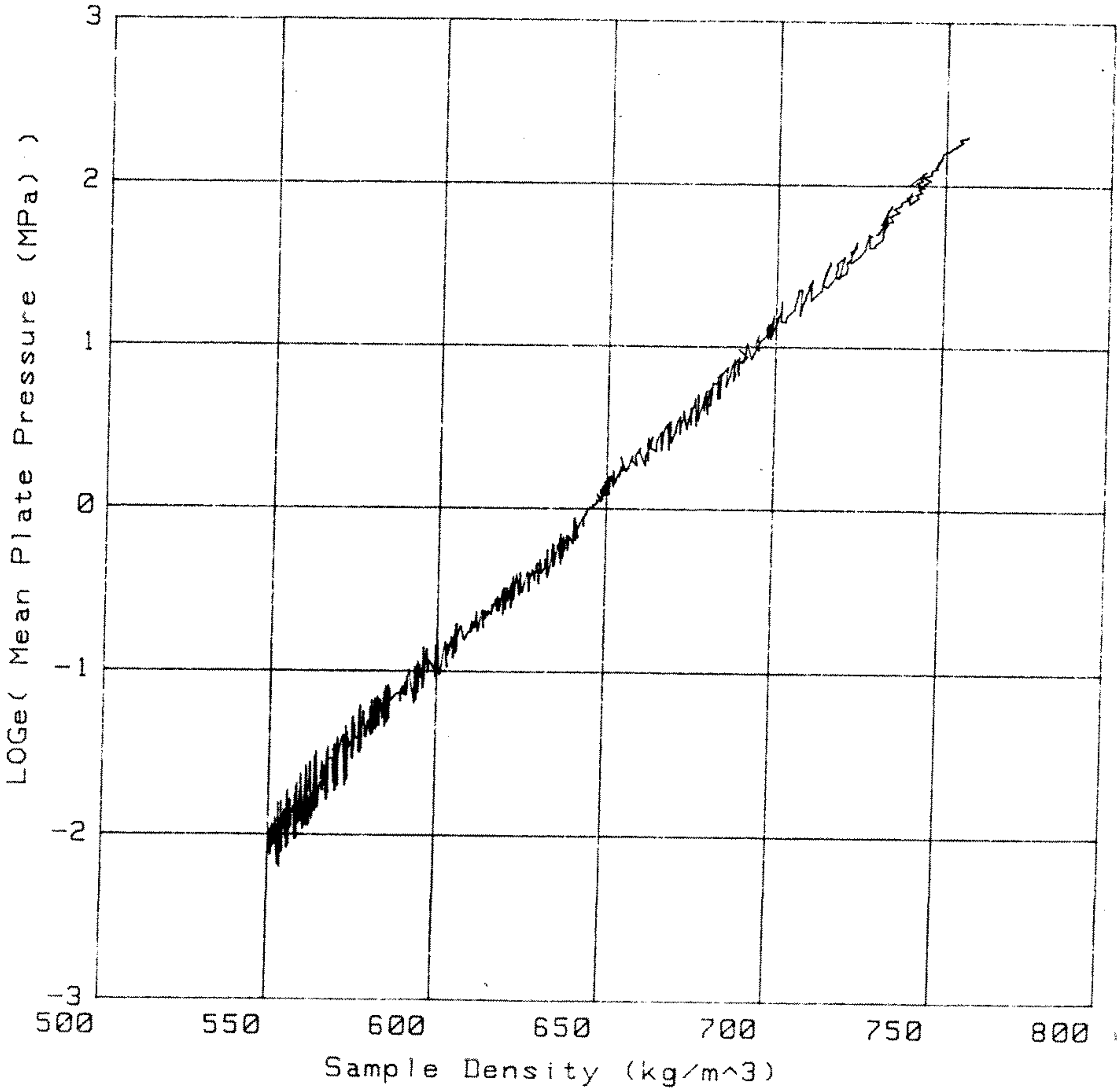
Test: X974
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 15:28:36

Y Offset Removed

Temperature: -10

Average = 10
Data From (s): 1.3
Data To (s): 2.87



Mean Plate Pressure
vs.
TIME

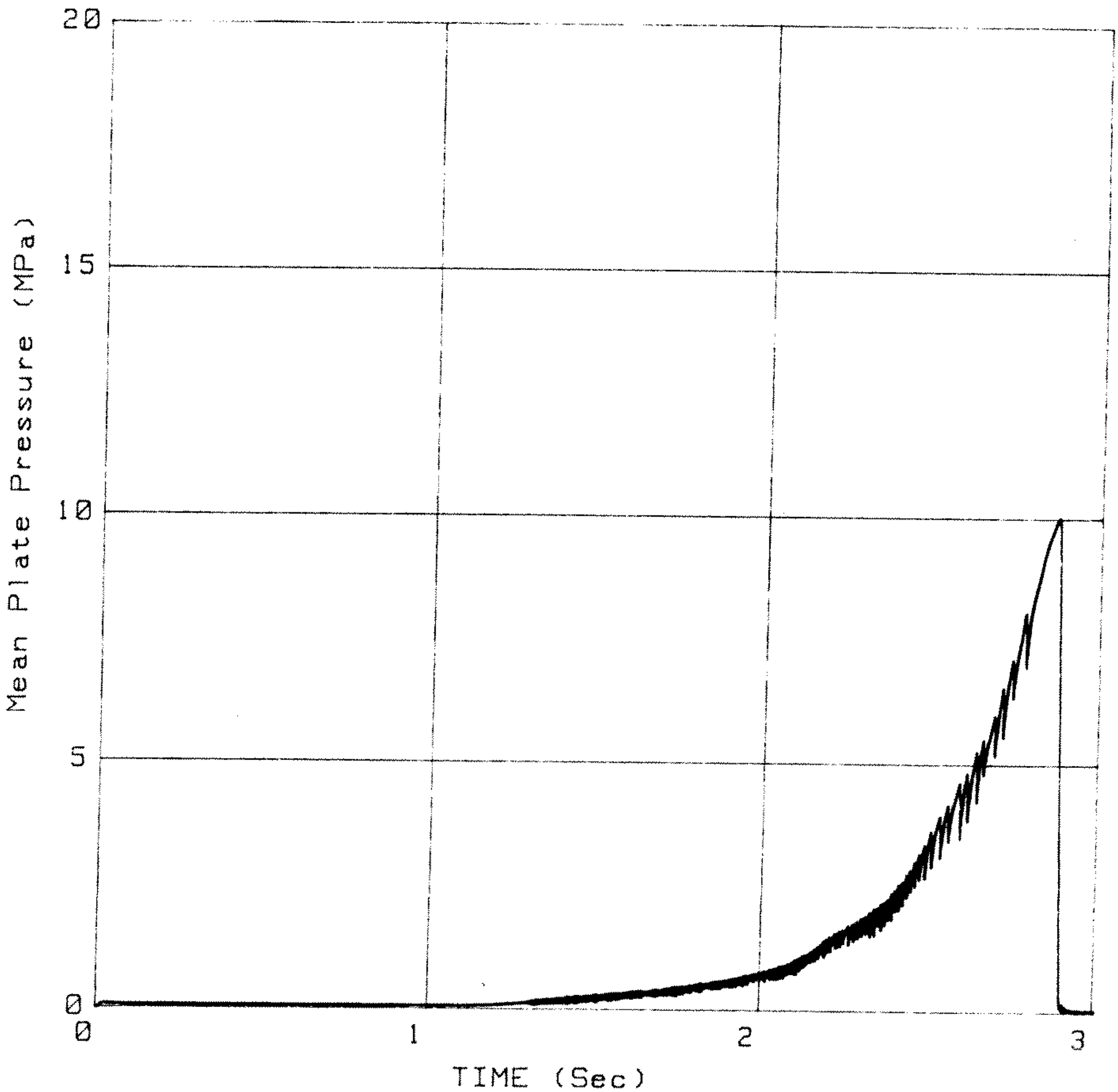
Test: X974
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 15:28:36

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 3.93



Local Pressure #16
vs.
TIME

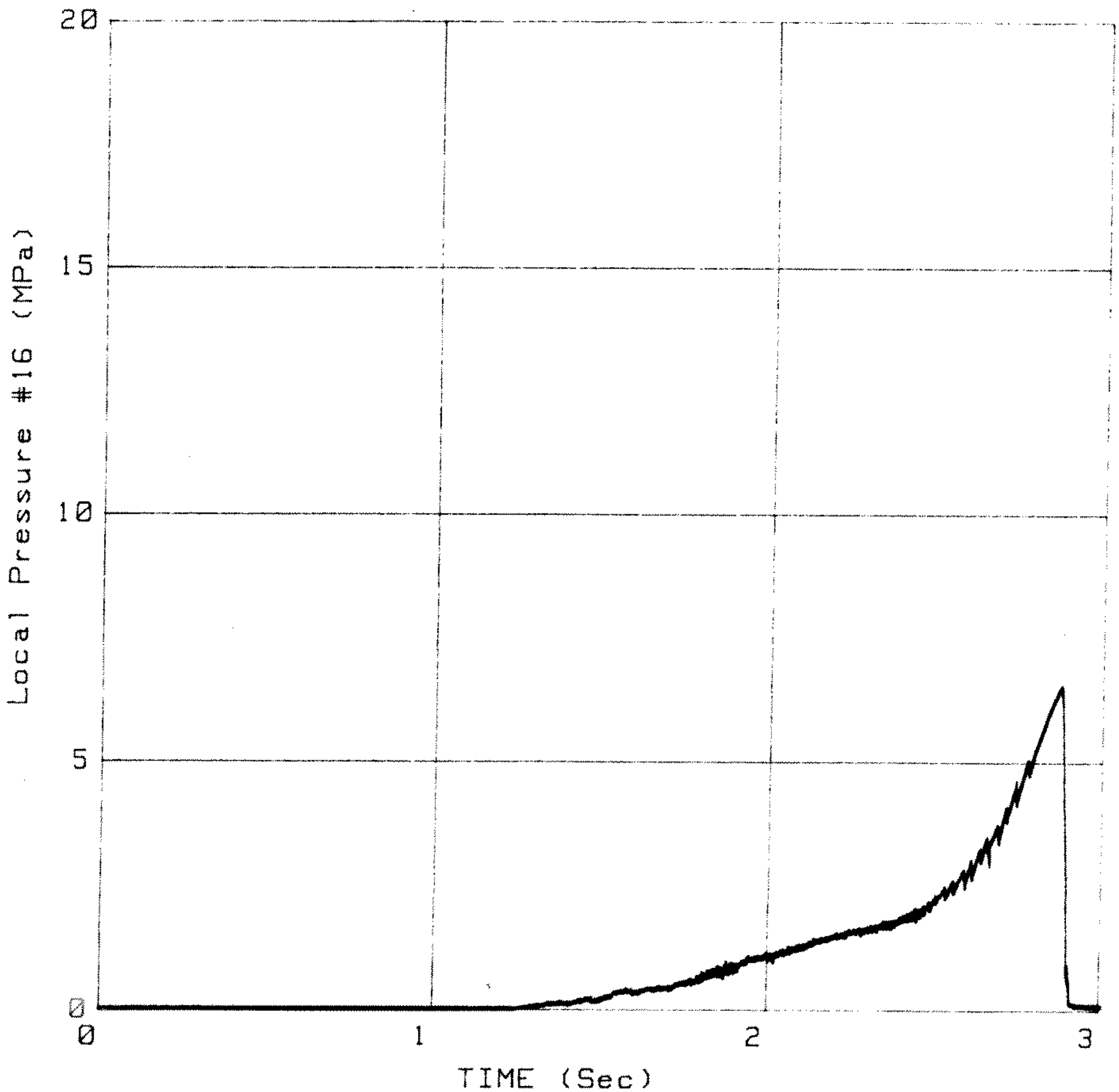
Test: X974
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 15:28:36

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 3.93



Local Pressure #10
vs.
TIME

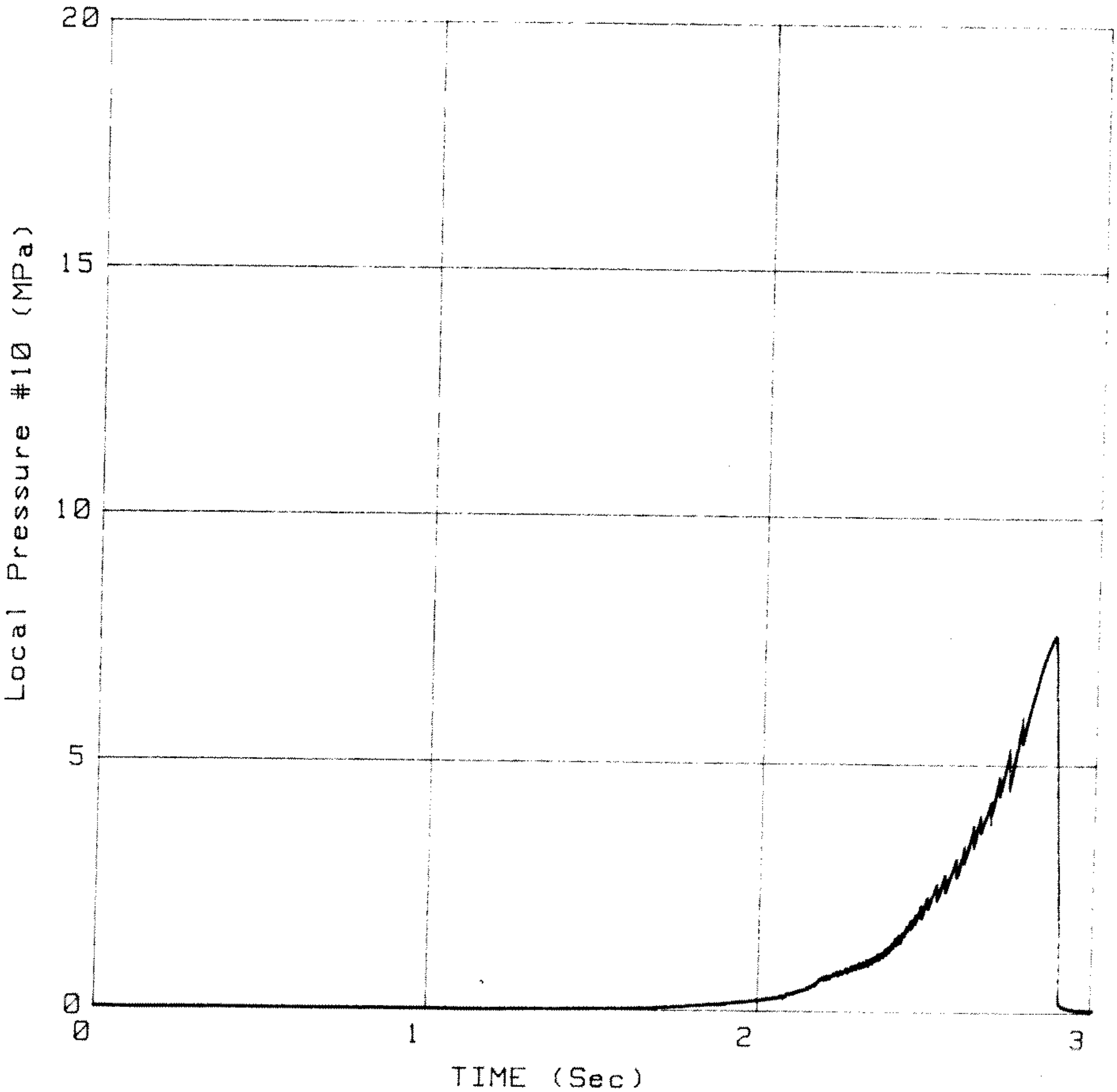
Test: X974
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 15:28:36

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 3.93



Mean Plate Pressure
vs.
TIME

Test: X974
Type: Compaction test
Sample: CRUSHED ICE

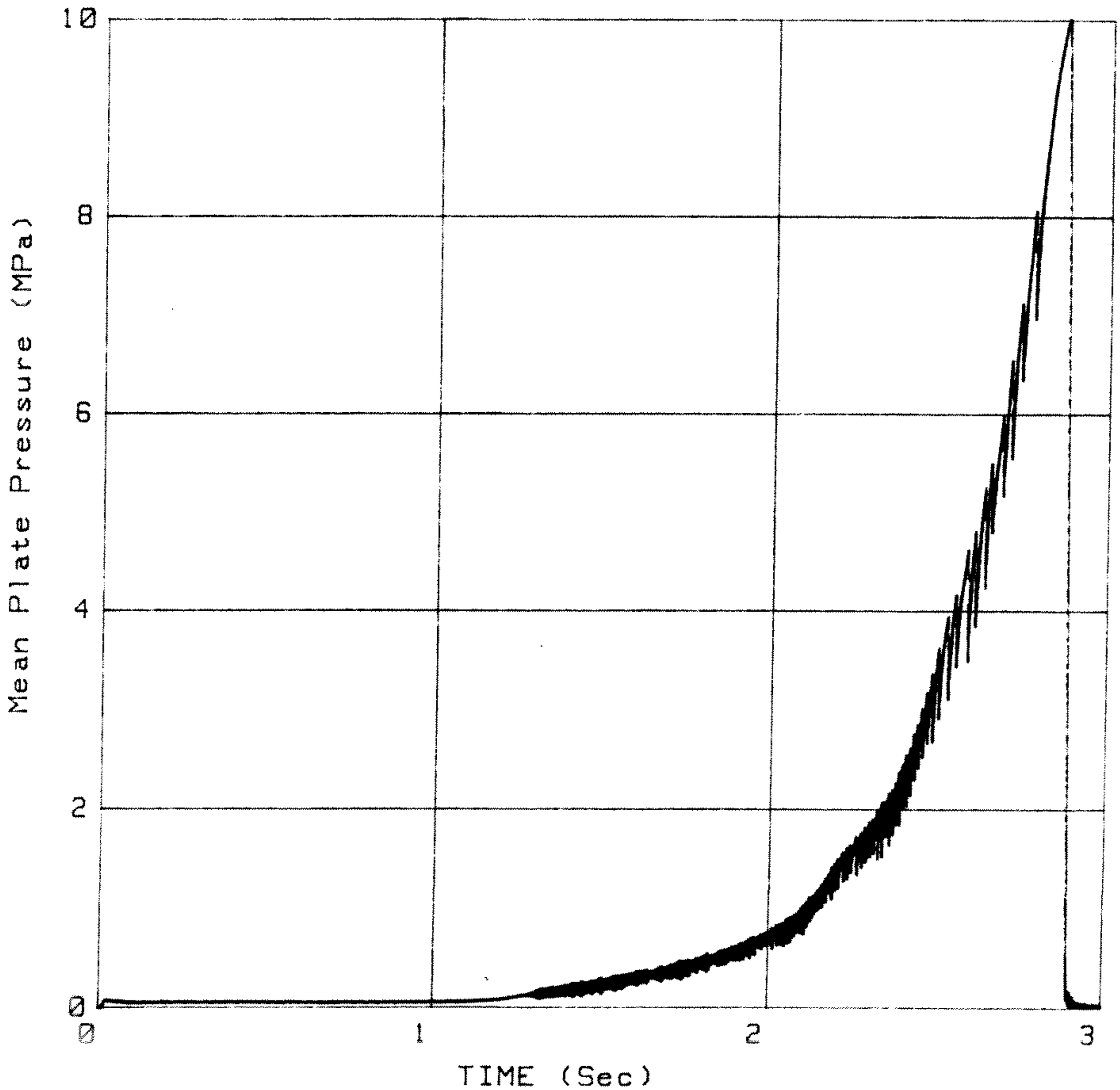
Date: 18 Jan 1989
Time: 15:28:36

Temperature: -10

Y Offset Removed

Average = 1

Truncation Time (s) = 3.93



Local Pressure #8
vs.
TIME

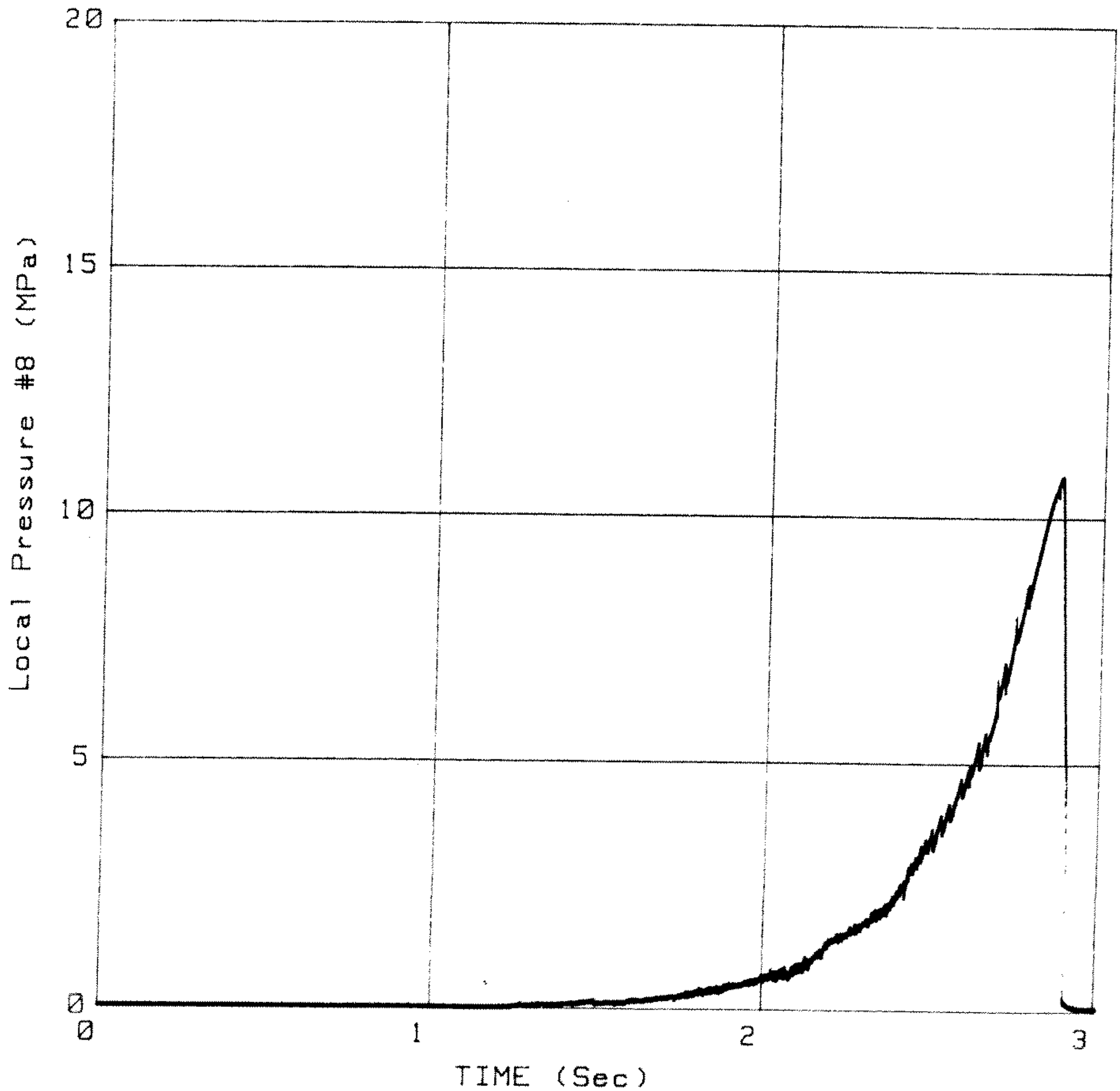
Test: X974
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 15:28:36

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 3.93



Layer Thickness
vs.
TIME

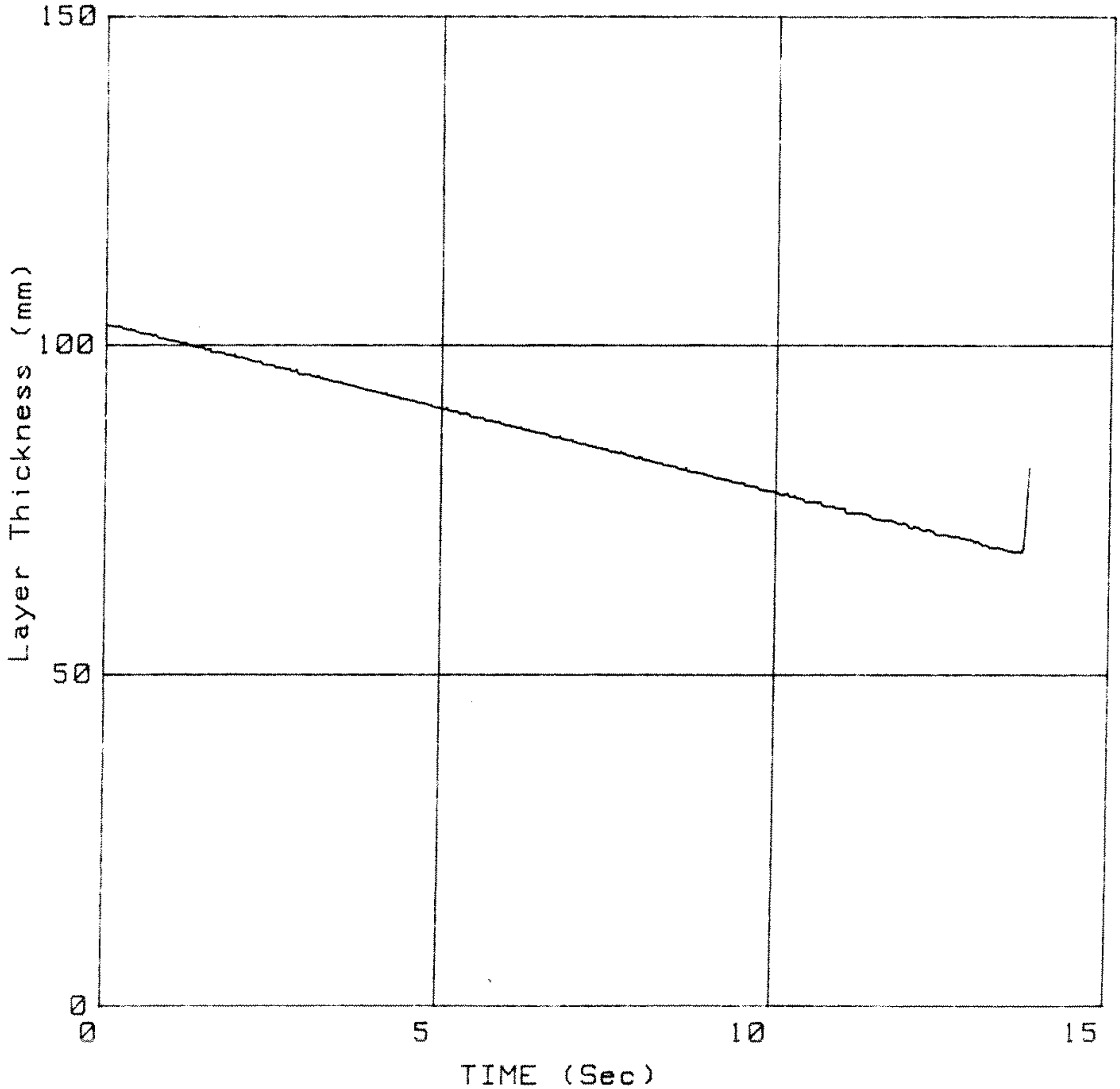
Test: X975
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 11:11:49

Temperature: -10

Average = 10

Truncation Time (s) = 13.8



LOGe(Mean Plate Pressure)
vs.
Sample Density

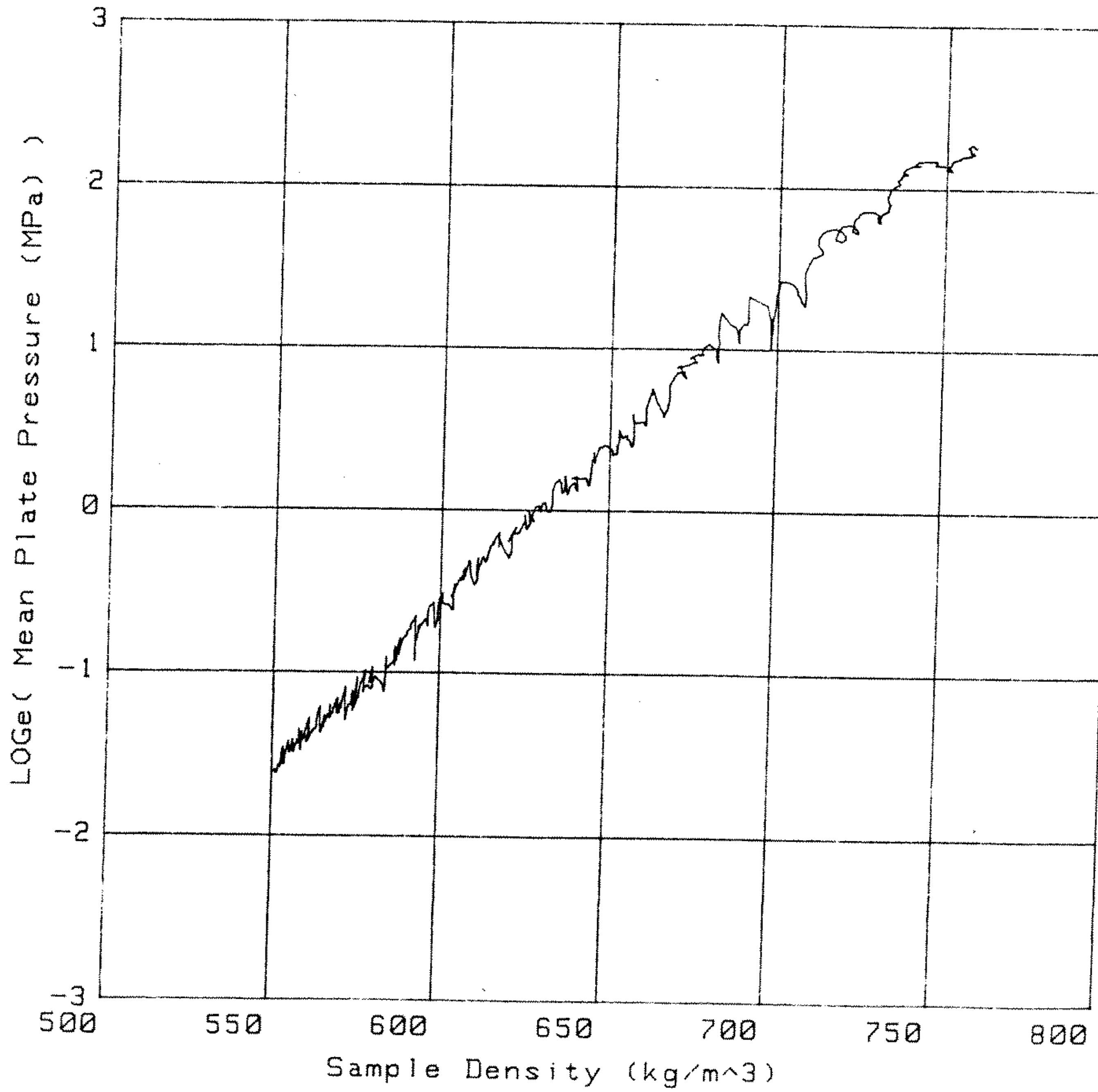
Test: X975
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 11:11:49

Y Offset Removed

Temperature: -10

Average = 10
Data From (s): 3.5
Data To (s): 13.7



Mean Plate Pressure
vs.
TIME

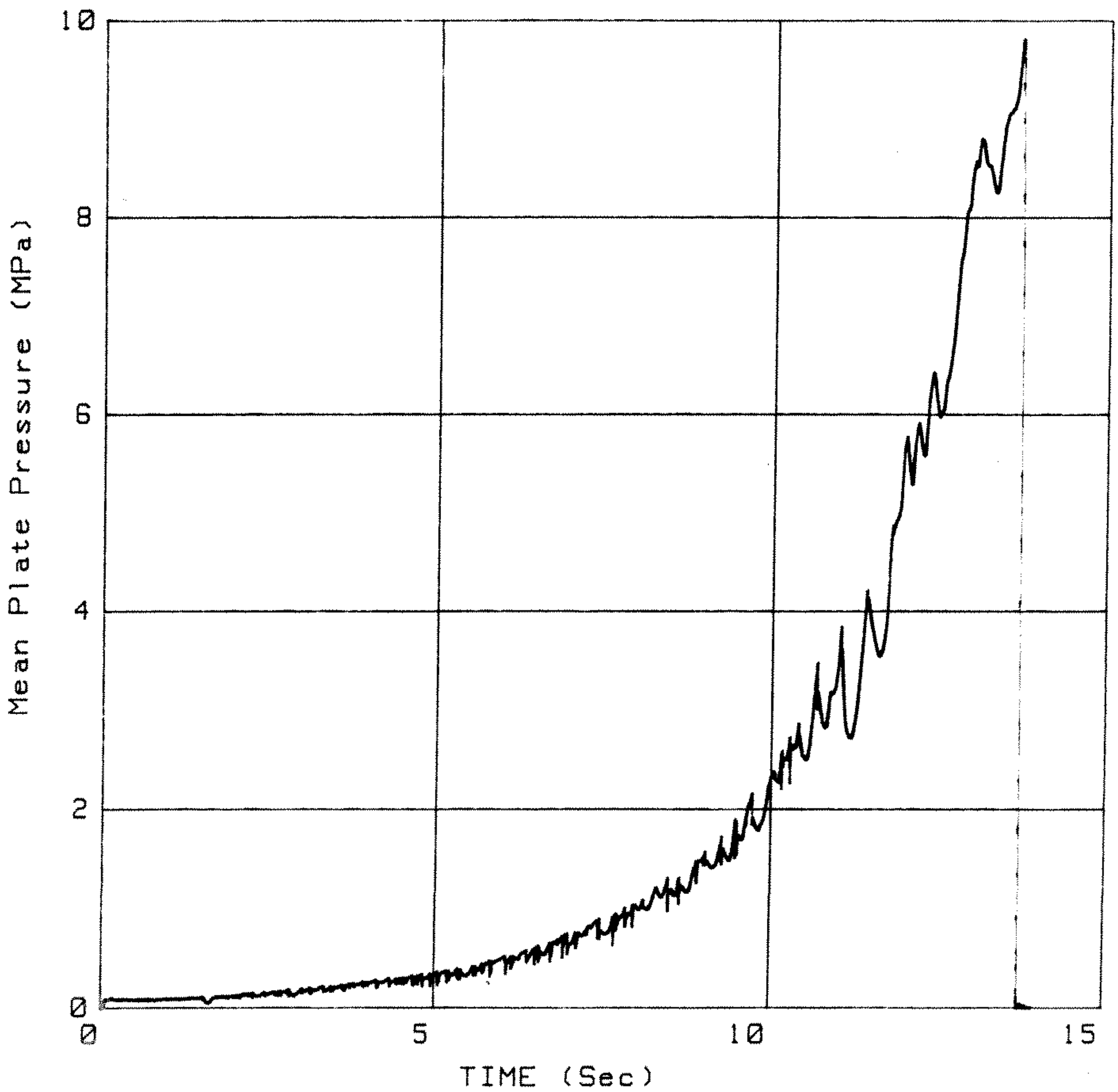
Test: X975
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 11:11:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 30



Local Pressure #16
vs.
TIME

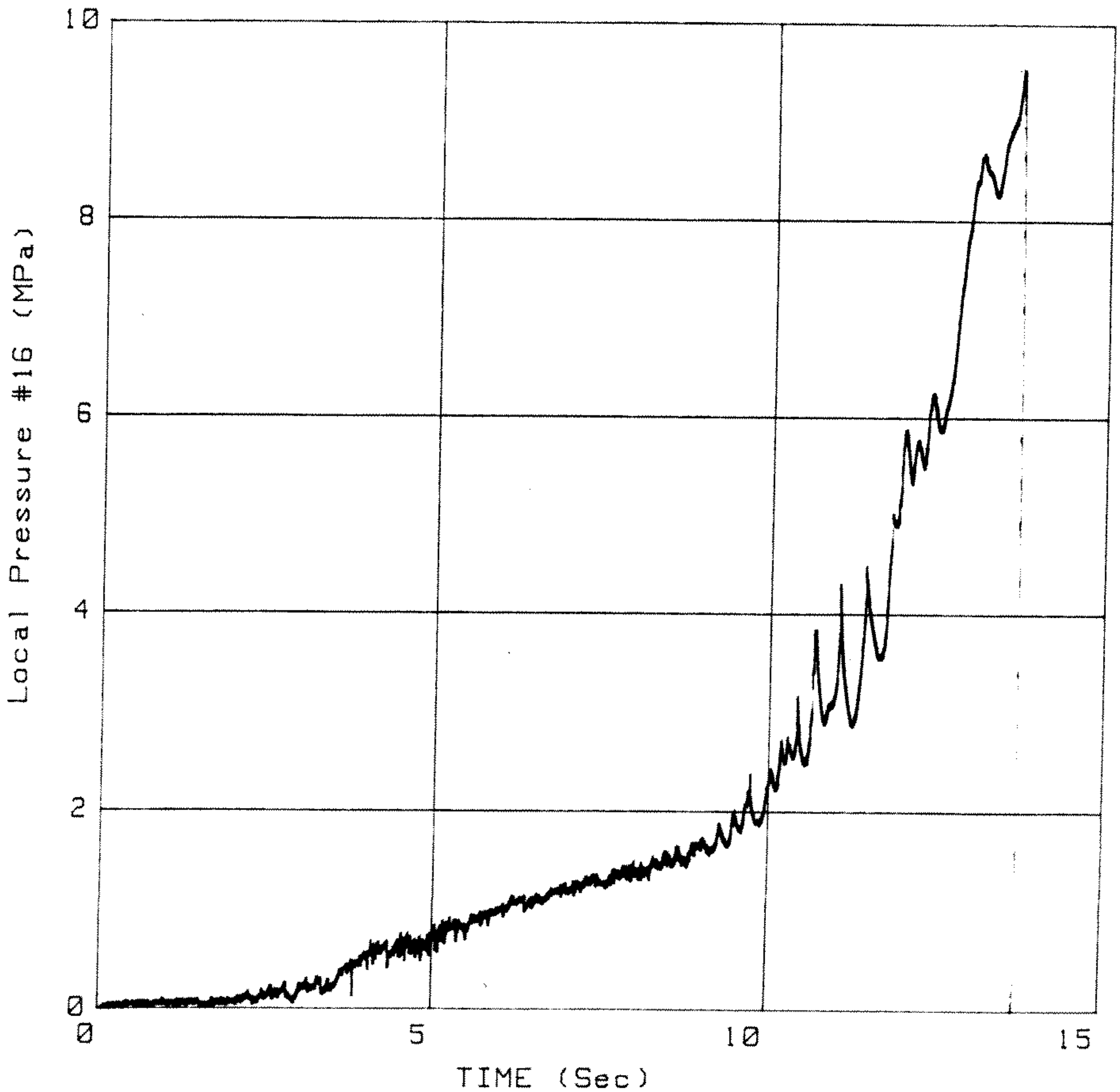
Test: X975
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 11:11:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 30



Local Pressure #10
vs.
TIME

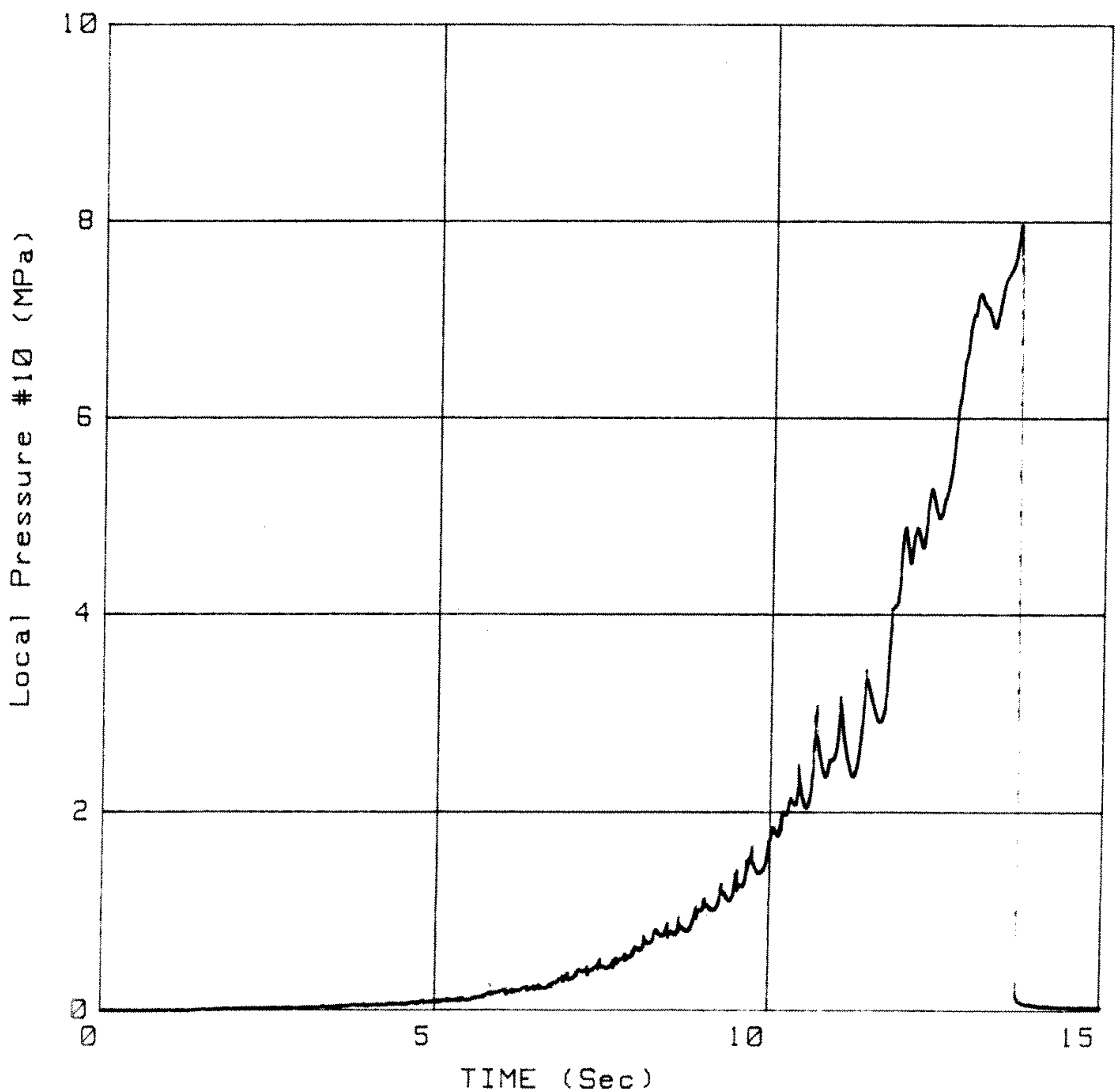
Test: X975
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 11:11:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 30



Local Pressure #8
vs.
TIME

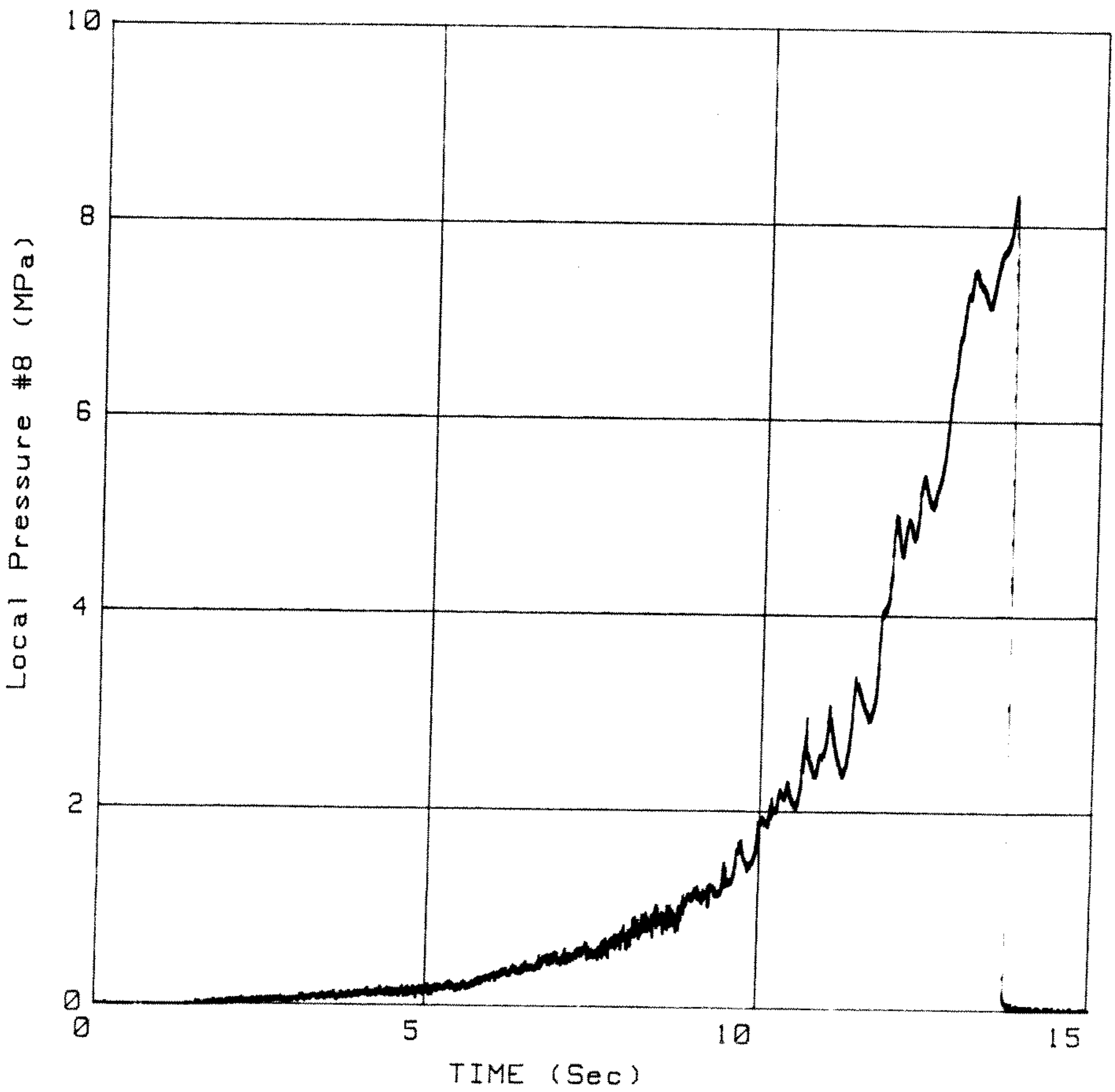
Test: X975
Type: Compaction test
Sample: CRUSHED ICE

Date: 18 Jan 1989
Time: 11:11:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 30



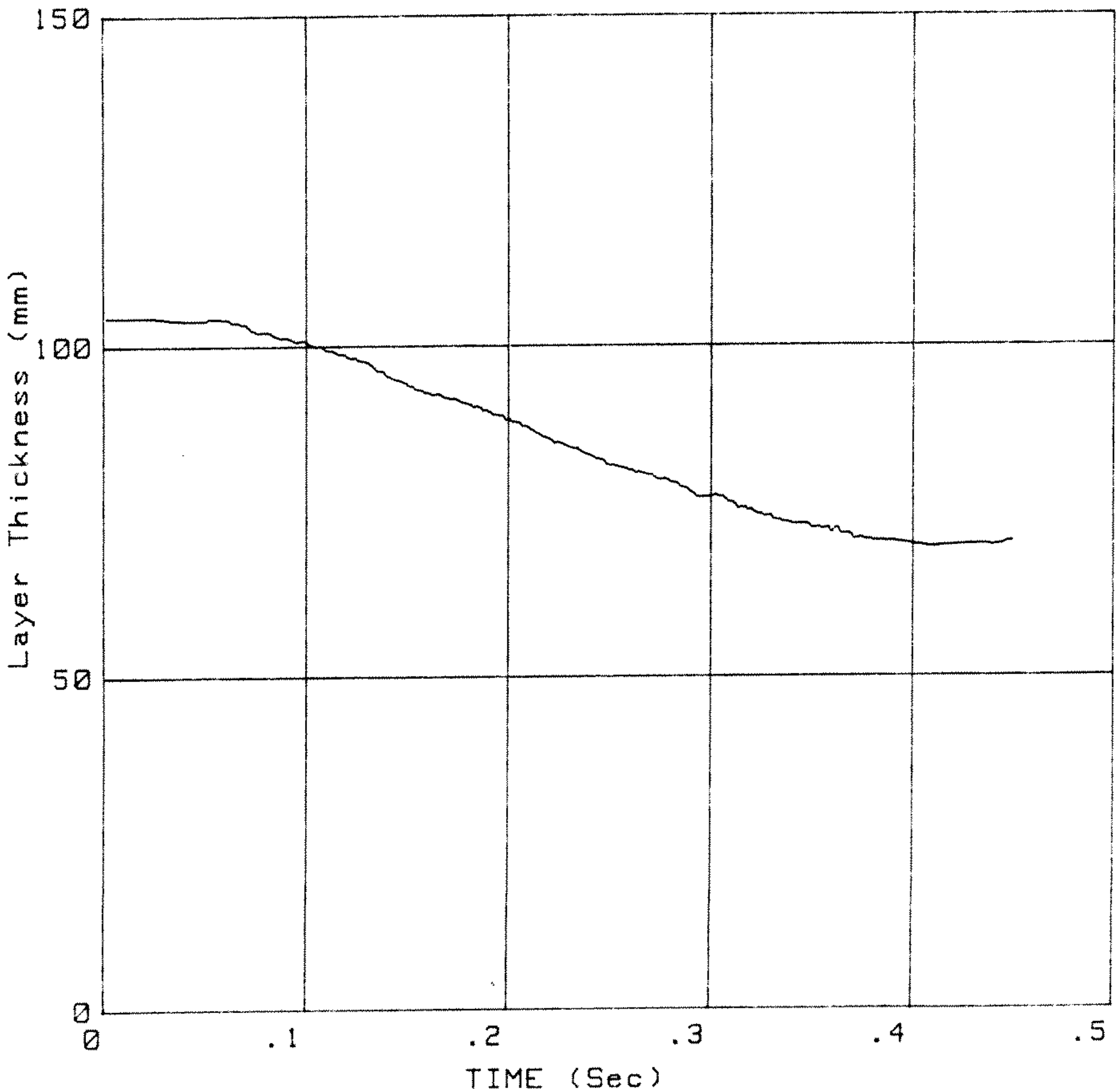
Layer Thickness
vs.
TIME

Test: X976
Type: Compaction test
Sample: CRUSHED ICE

Date: 17 Jan 1989
Time: 15:12:25

Temperature: -10

Average = 10
Truncation Time (s) = .45



Local Pressure #10
vs.
TIME

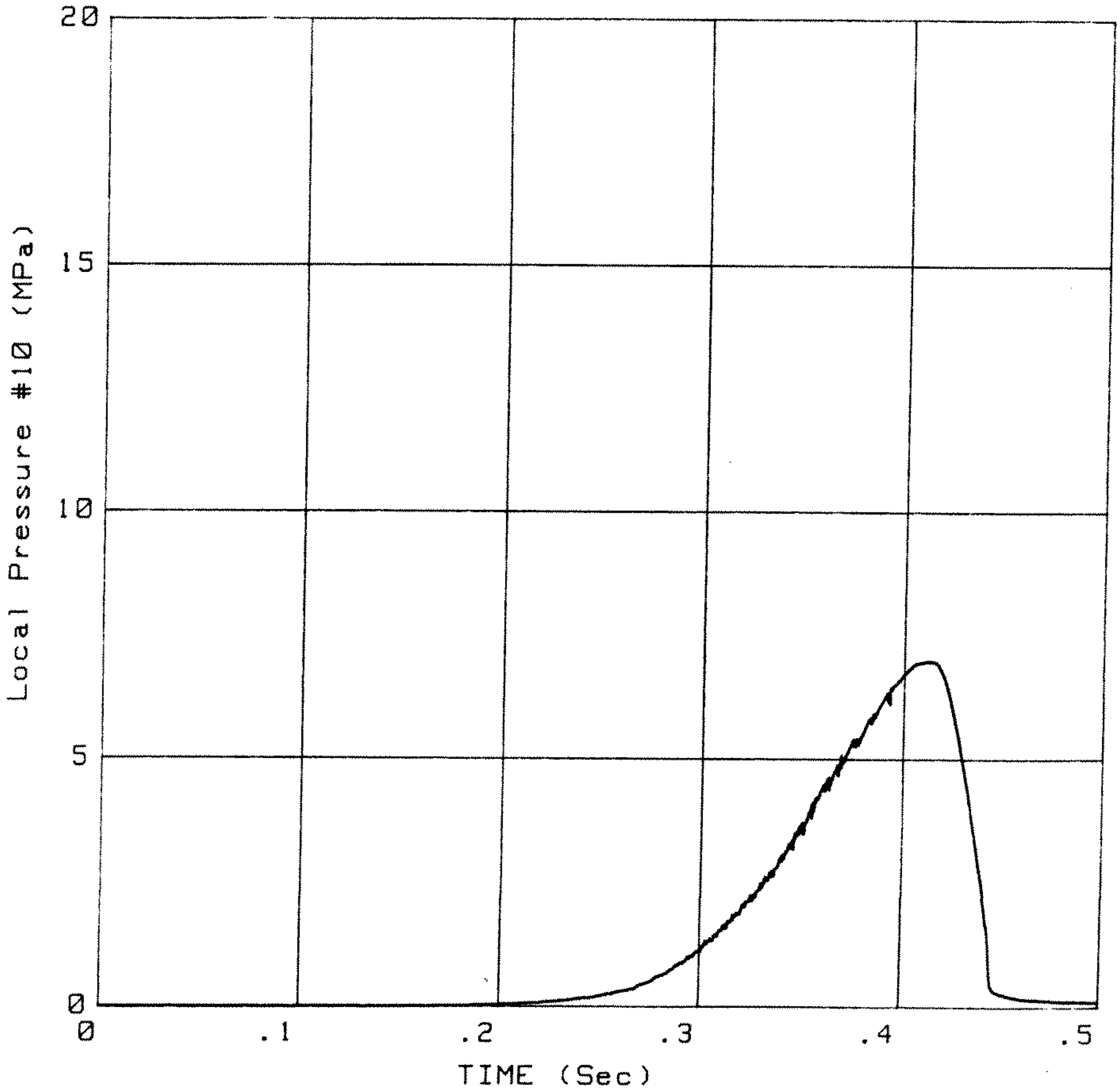
Test: X976
Type: Compaction test
Sample: CRUSHED ICE

Date: 17 Jan 1989
Time: 15:12:25

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.55



Local Pressure #8
vs.
TIME

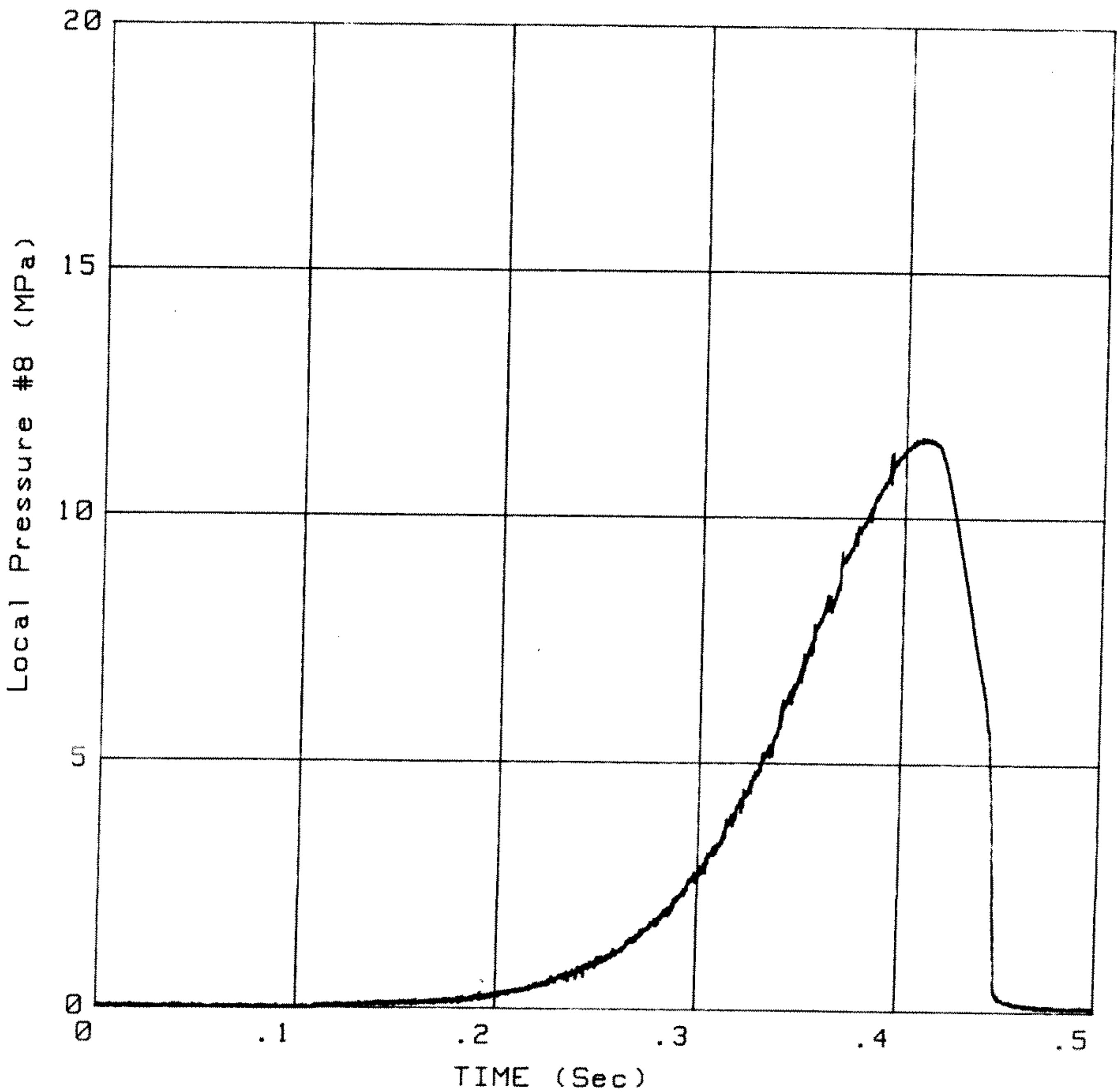
Test: X976
Type: Compaction test
Sample: CRUSHED ICE

Date: 17 Jan 1989
Time: 15:12:25

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.55



LOGe(Mean Plate Pressure)
vs.
Sample Density

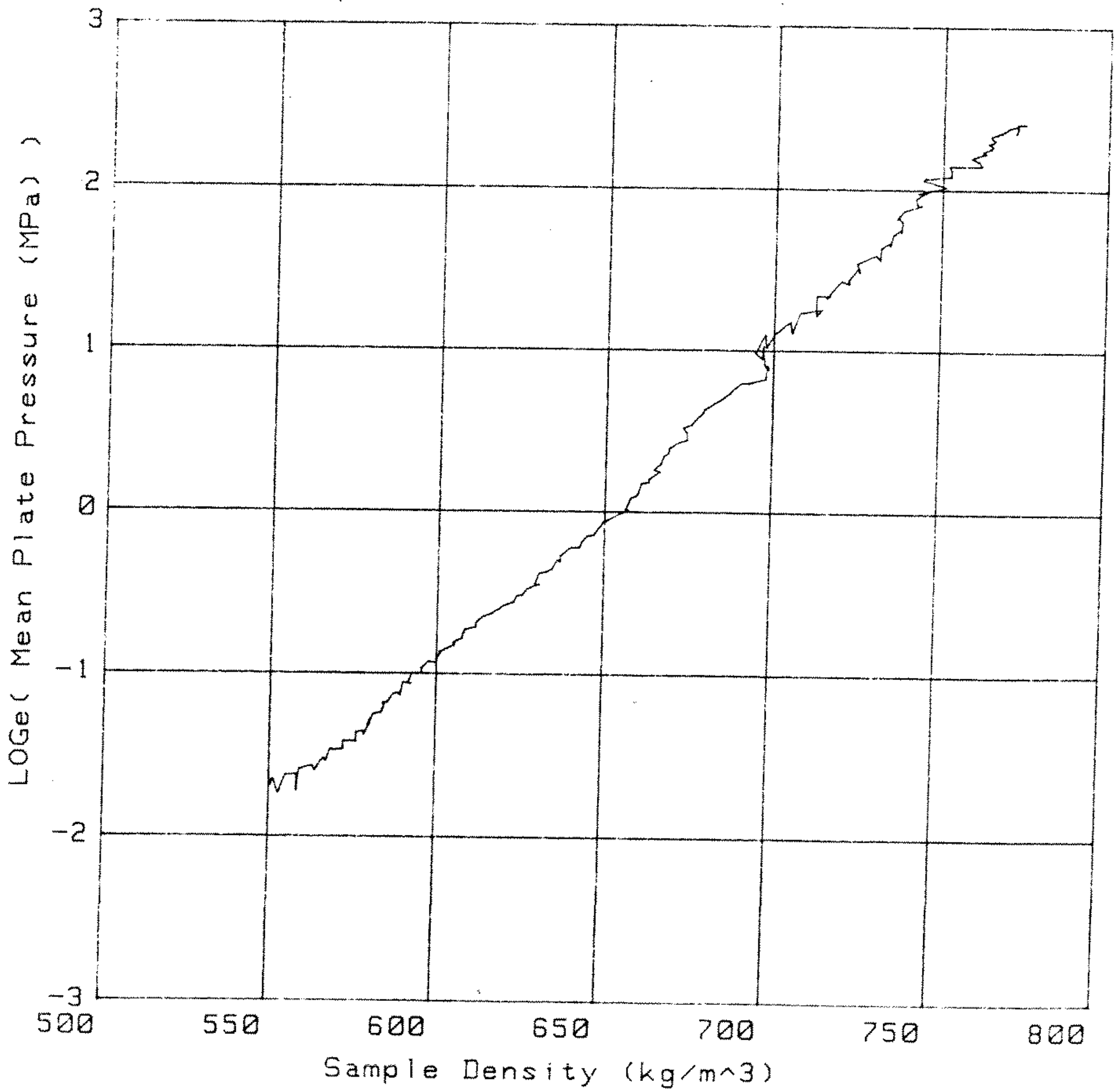
Test: X976
Type: Compaction test
Sample: CRUSHED ICE

Date: 17 Jan 1989
Time: 15:12:25

Y Offset Removed

Temperature: -10

Average = 10
Data From (s): .13
Data To (s): .42



Local Pressure #16
vs.
TIME

Test: X976
Type: Compaction test
Sample: CRUSHED ICE

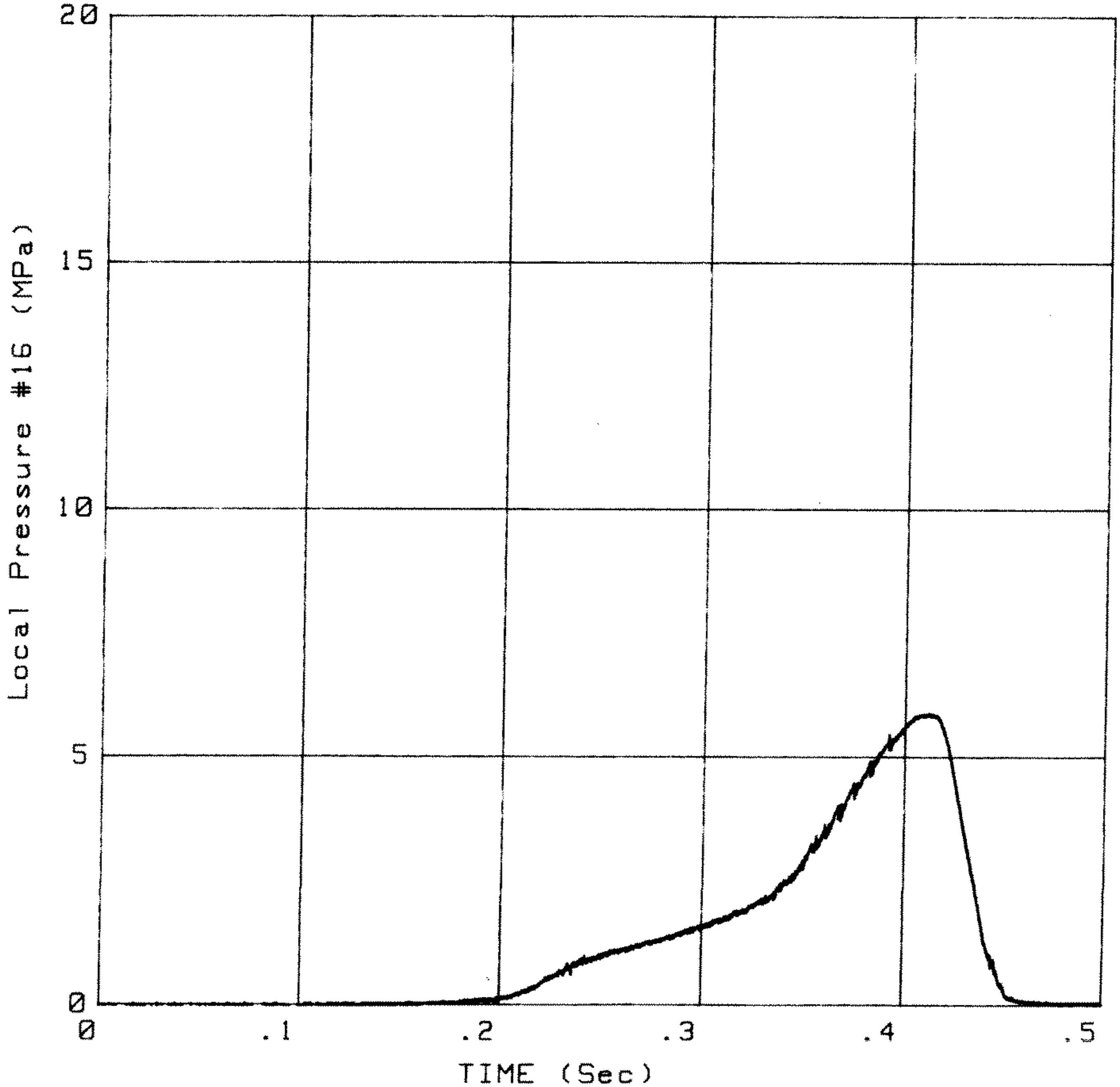
Date: 17 Jan 1989
Time: 15:12:25

Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 2.55



Mean Plate Pressure
vs.
TIME

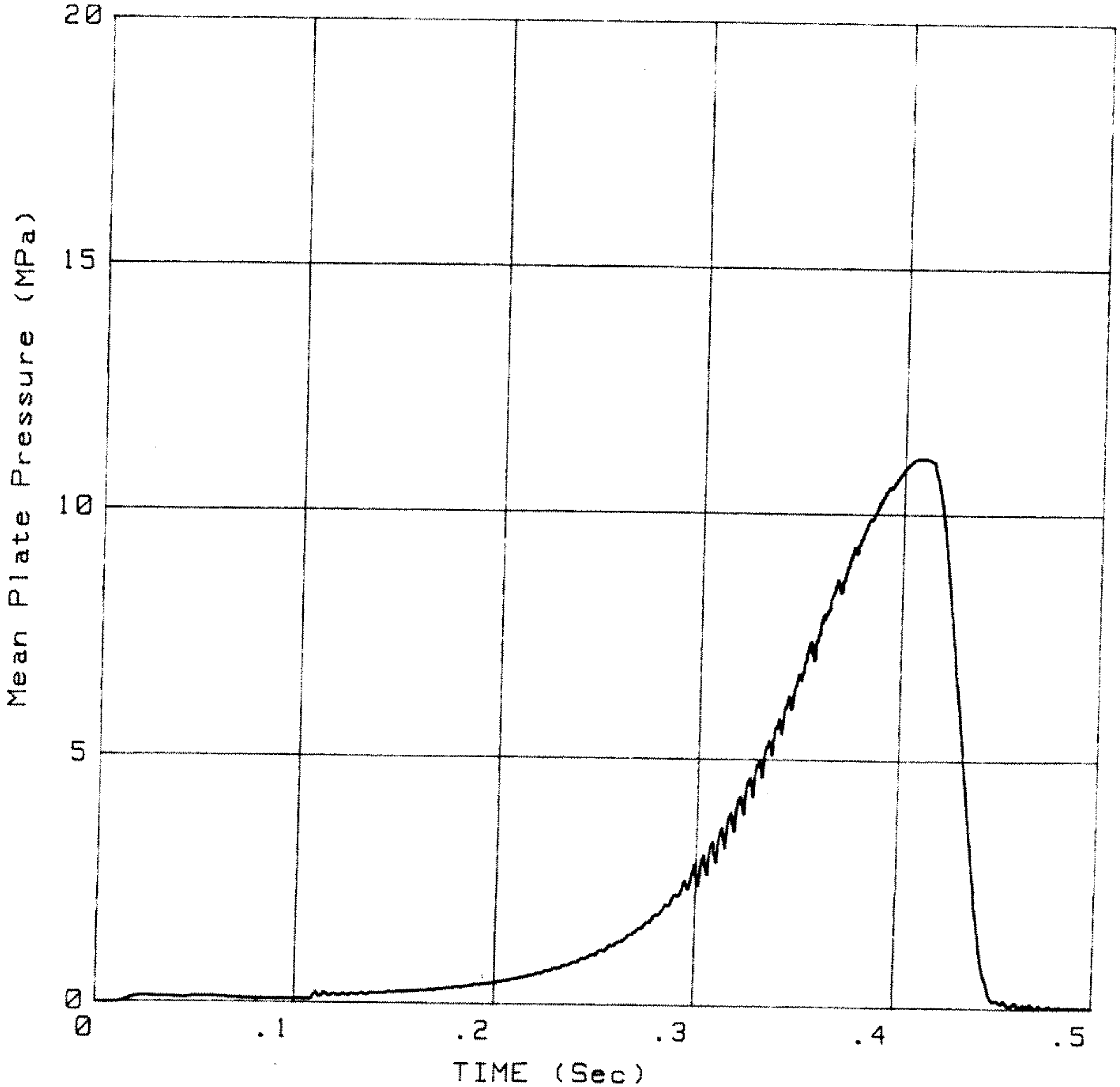
Test: X976
Type: Compaction test
Sample: CRUSHED ICE

Date: 17 Jan 1989
Time: 15:12:25

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.55



LOGė(Mean Plate Pressure)
vs.
Sample Density

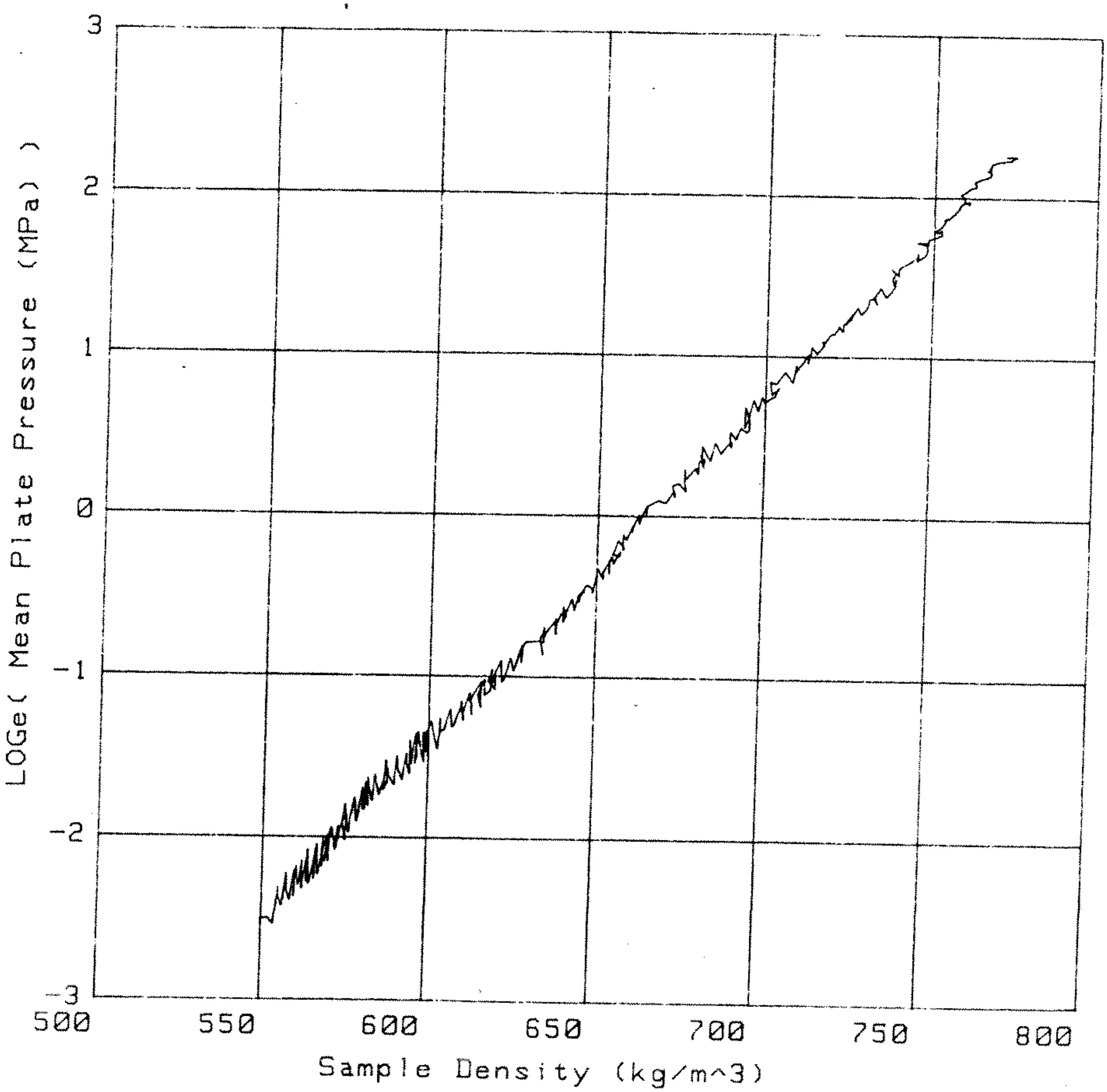
Test: X977
Type: Compaction test
Sample: CRUSHED ICE

Date: 16 Jan 1989
Time: 14:14:27

Temperature: -10

Y Offset Removed

Average = 10
Data From (s): .575
Data To (s): 1.73



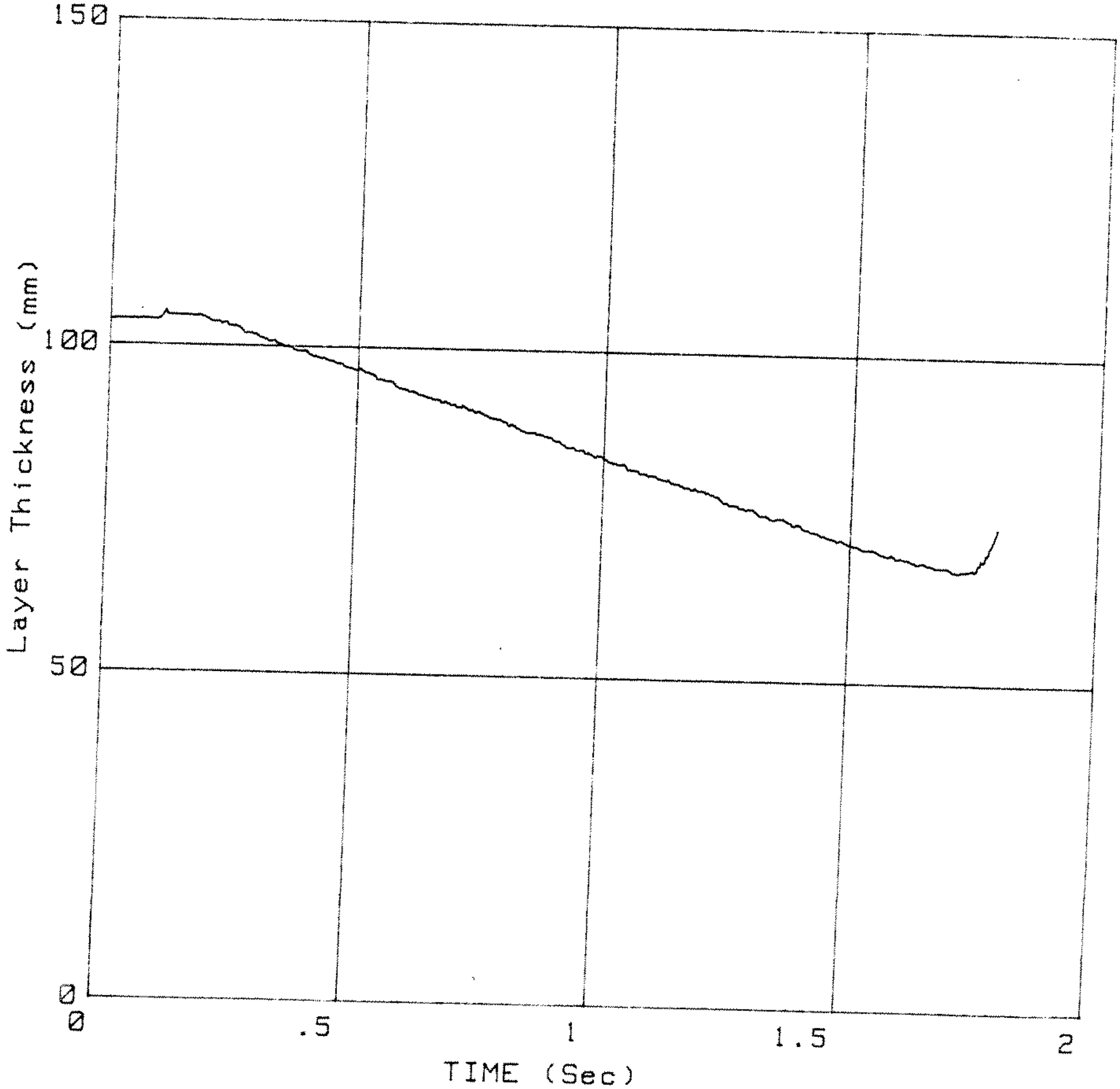
Layer Thickness
vs.
TIME

Test: X977
Type: Compaction test
Sample: CRUSHED ICE

Date: 16 Jan 1989
Time: 14:14:27

Temperature: -10

Average = 10
Truncation Time (s) = 1.8



Local Pressure #10
vs.
TIME

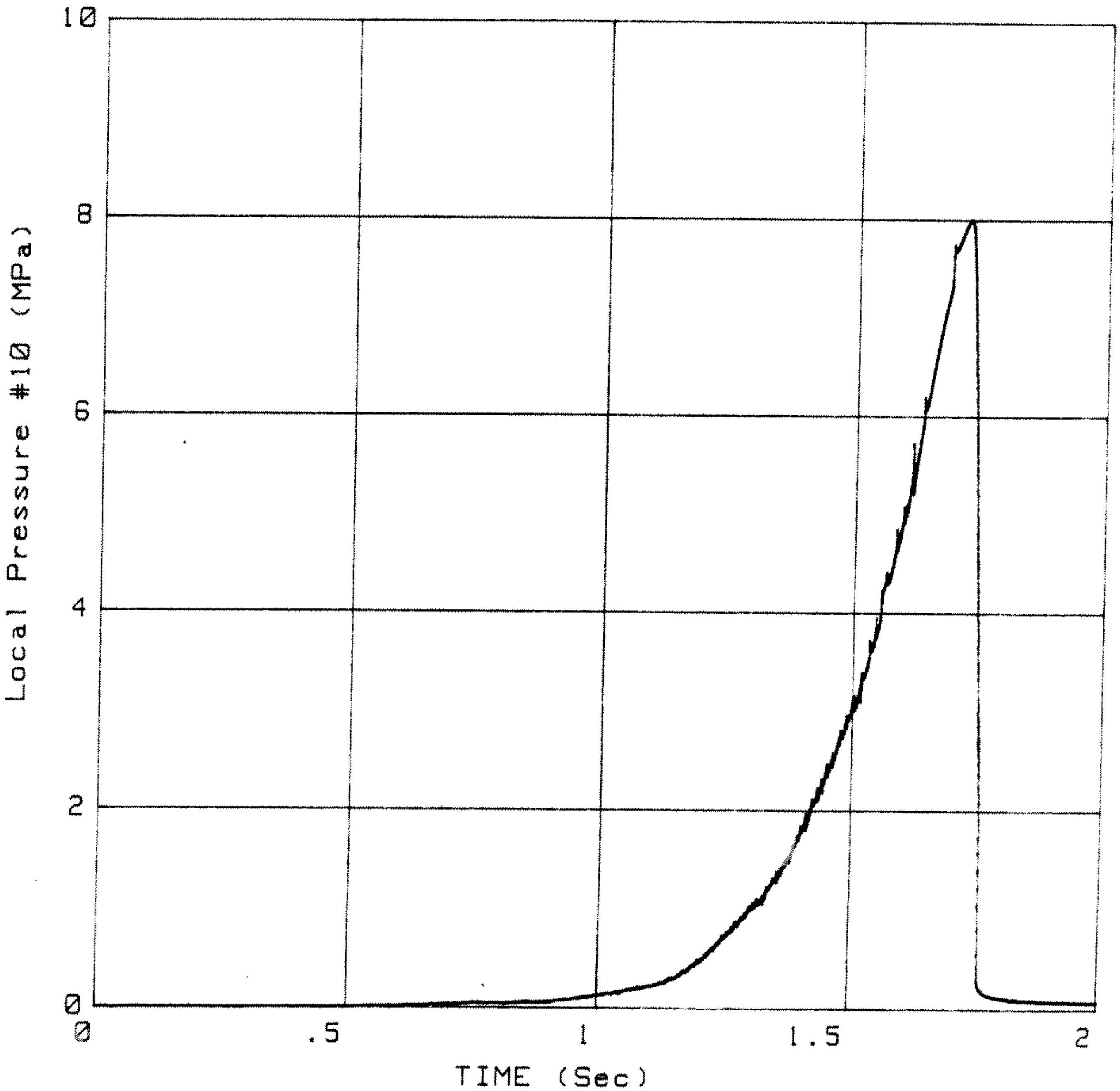
Test: X977
Type: Compaction test
Sample: CRUSHED ICE

Date: 16 Jan 1989
Time: 14:14:27

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.1



Local Pressure #8
vs.
TIME

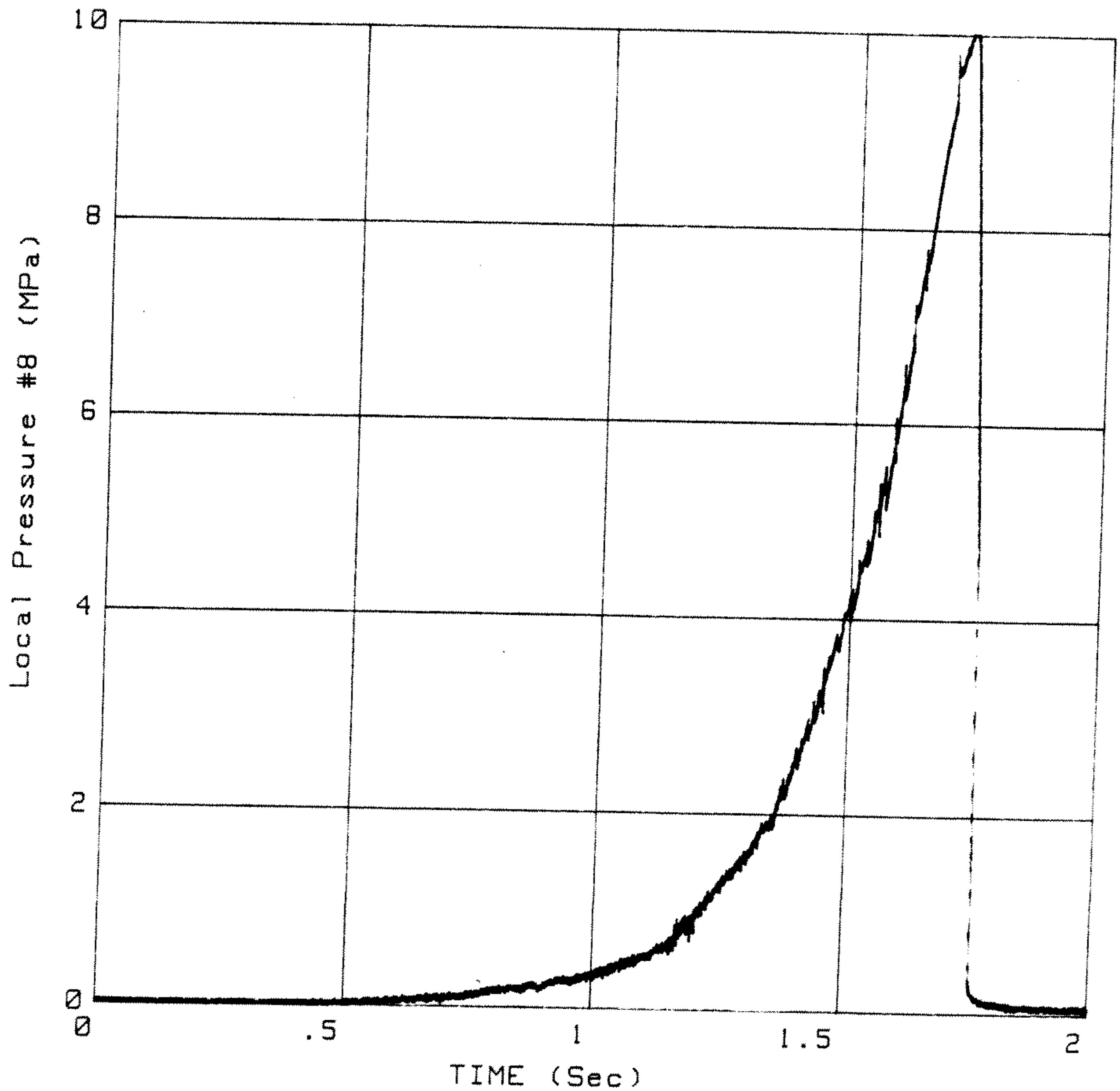
Test: X977
Type: Compaction test
Sample: CRUSHED ICE

Date: 16 Jan 1989
Time: 14:14:27

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.1



Local Pressure #16
vs.
TIME

Test: X977
Type: Compaction test
Sample: CRUSHED ICE

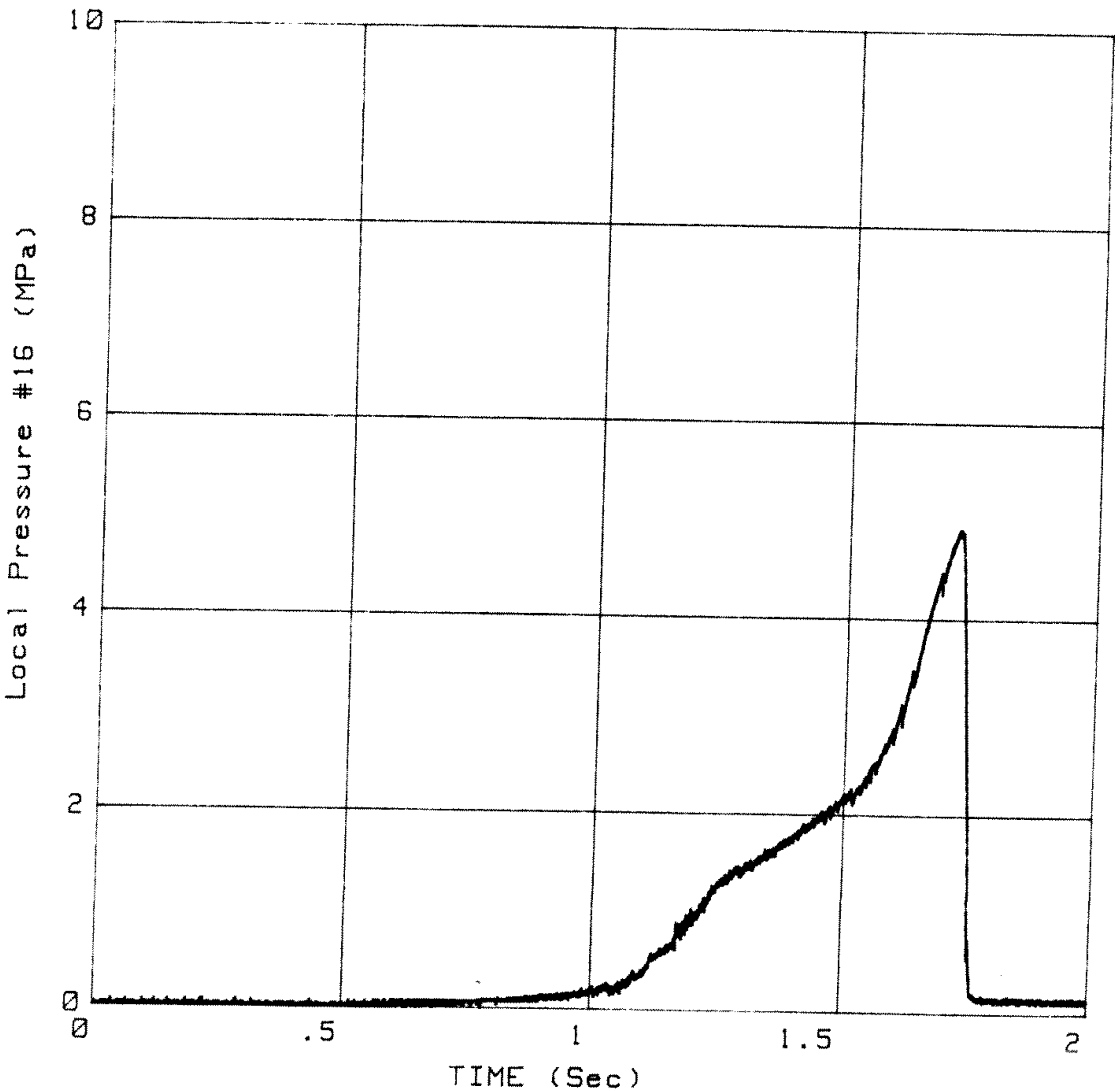
Date: 16 Jan 1989
Time: 14:14:27

Temperature: -10

Y Offset Removed

Average = 1

Truncation Time (s) = 5.1



Mean Plate Pressure
vs.
TIME

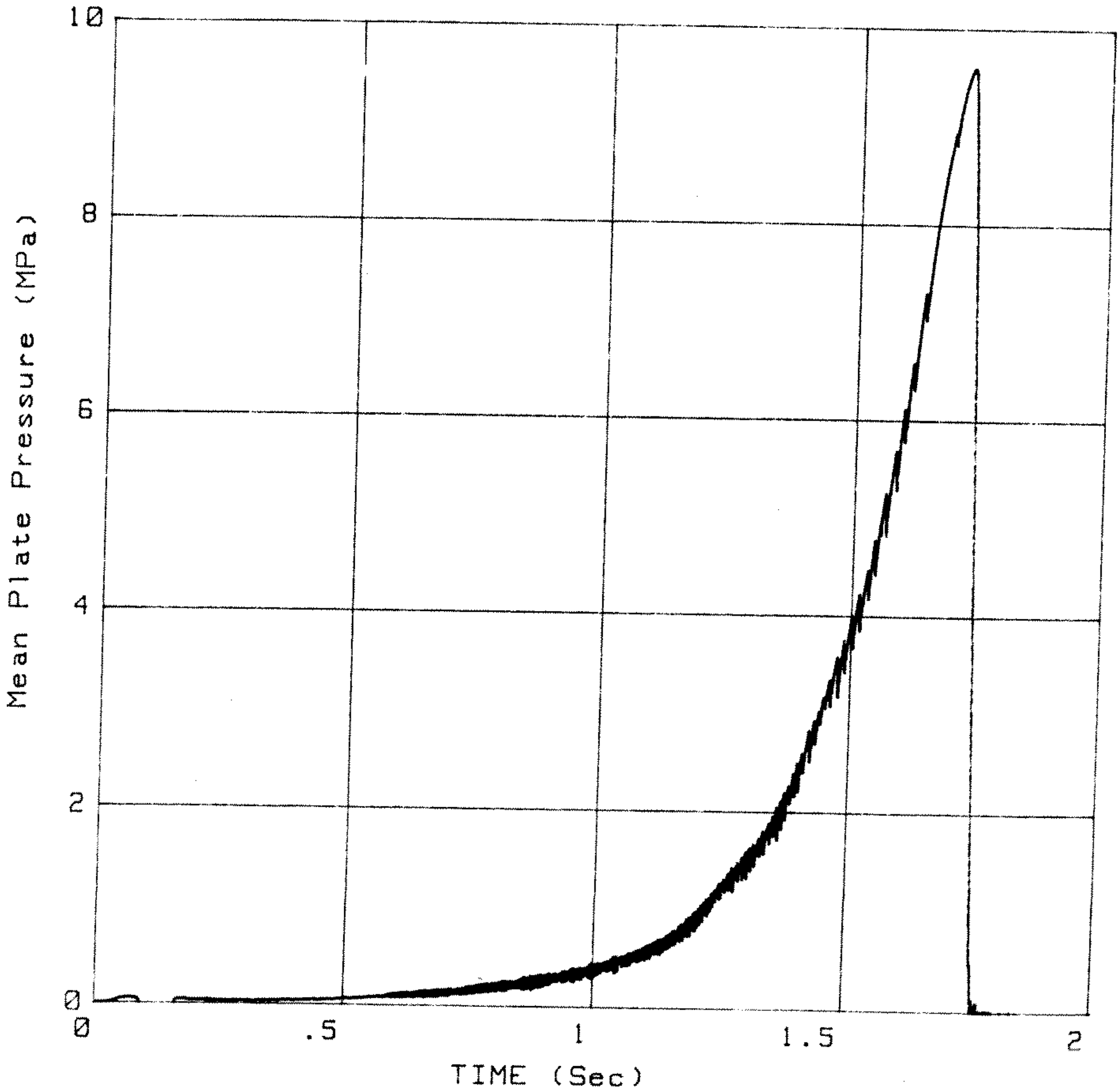
Test: X977
Type: Compaction test
Sample: CRUSHED ICE

Date: 16 Jan 1989
Time: 14:14:27

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.1



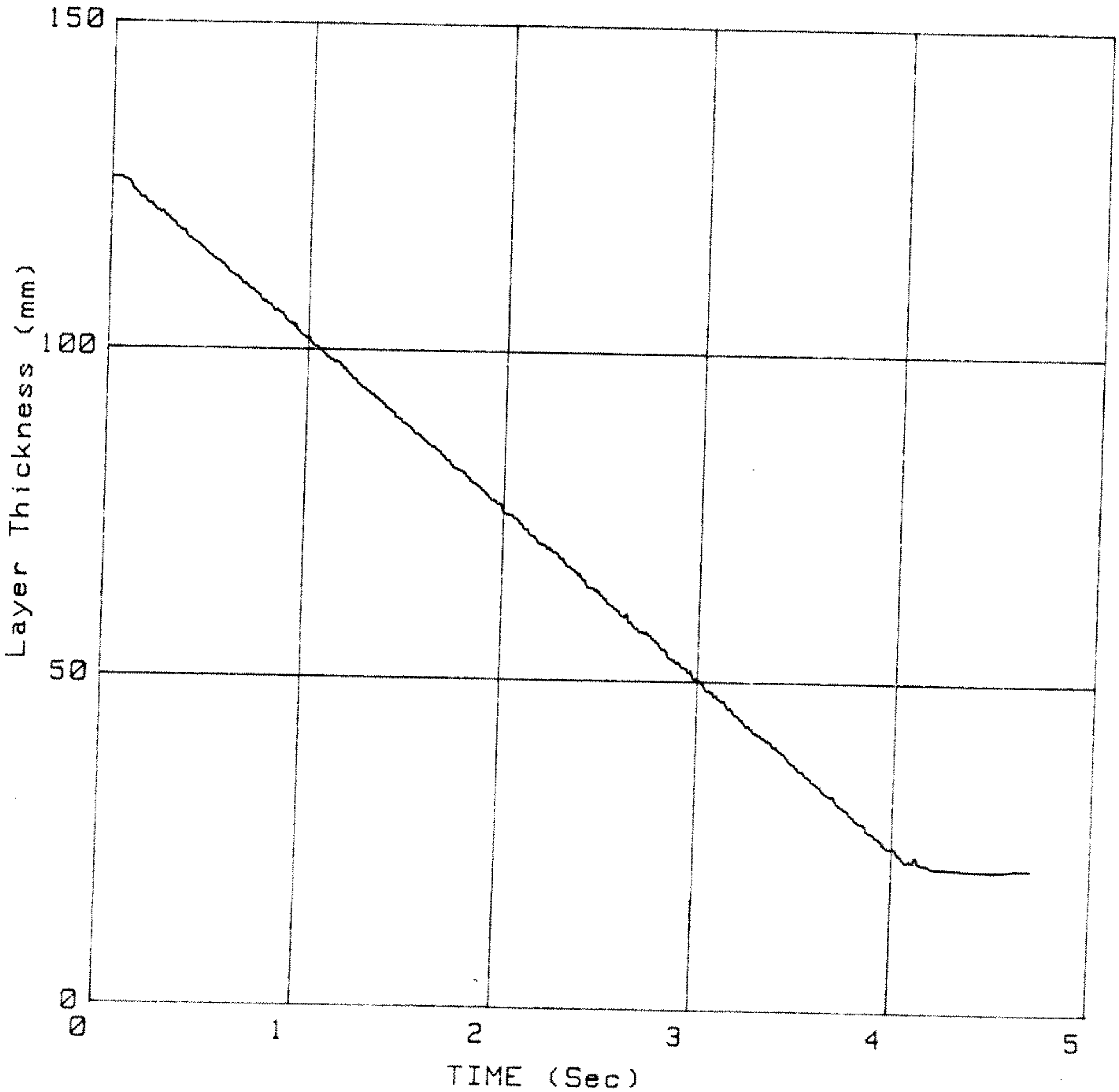
Layer Thickness vs. TIME

Test: X978
Type: Extrusion test
Sample: CRUSHED ICE

Date: 22 Dec 1988
Time: 08:41:46

Temperature: -9.8

Average = 10
Truncation Time (s) = 4.7



Local Pressure #12 vs. TIME

Test: X978
Type: Extrusion test
Sample: CRUSHED ICE

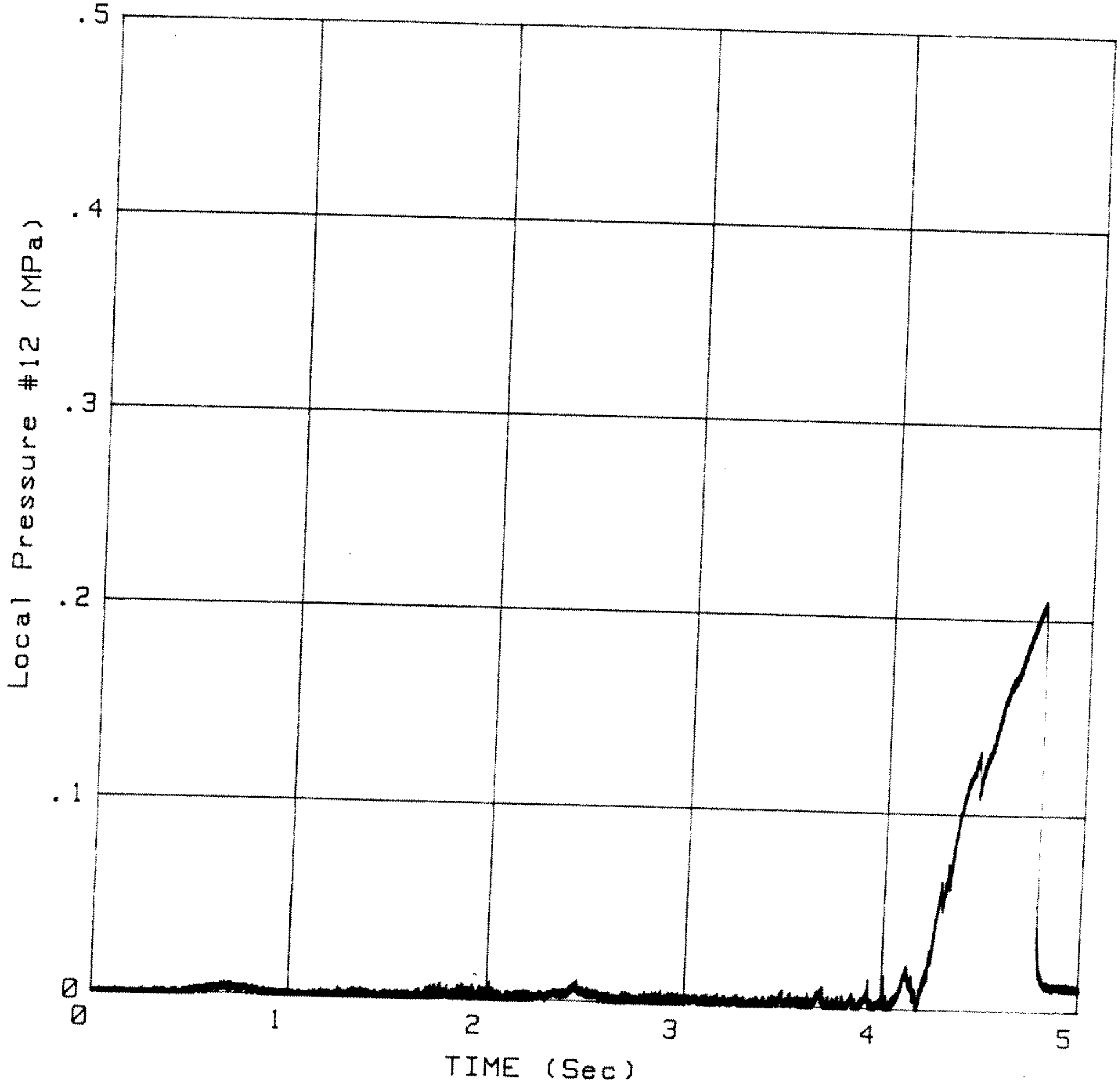
Date: 22 Dec 1988
Time: 08:41:46

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 5.67



Mean Plate Pressure vs. TIME

Test: X978

Type: Extrusion test

Sample: CRUSHED ICE

Date: 22 Dec 1988

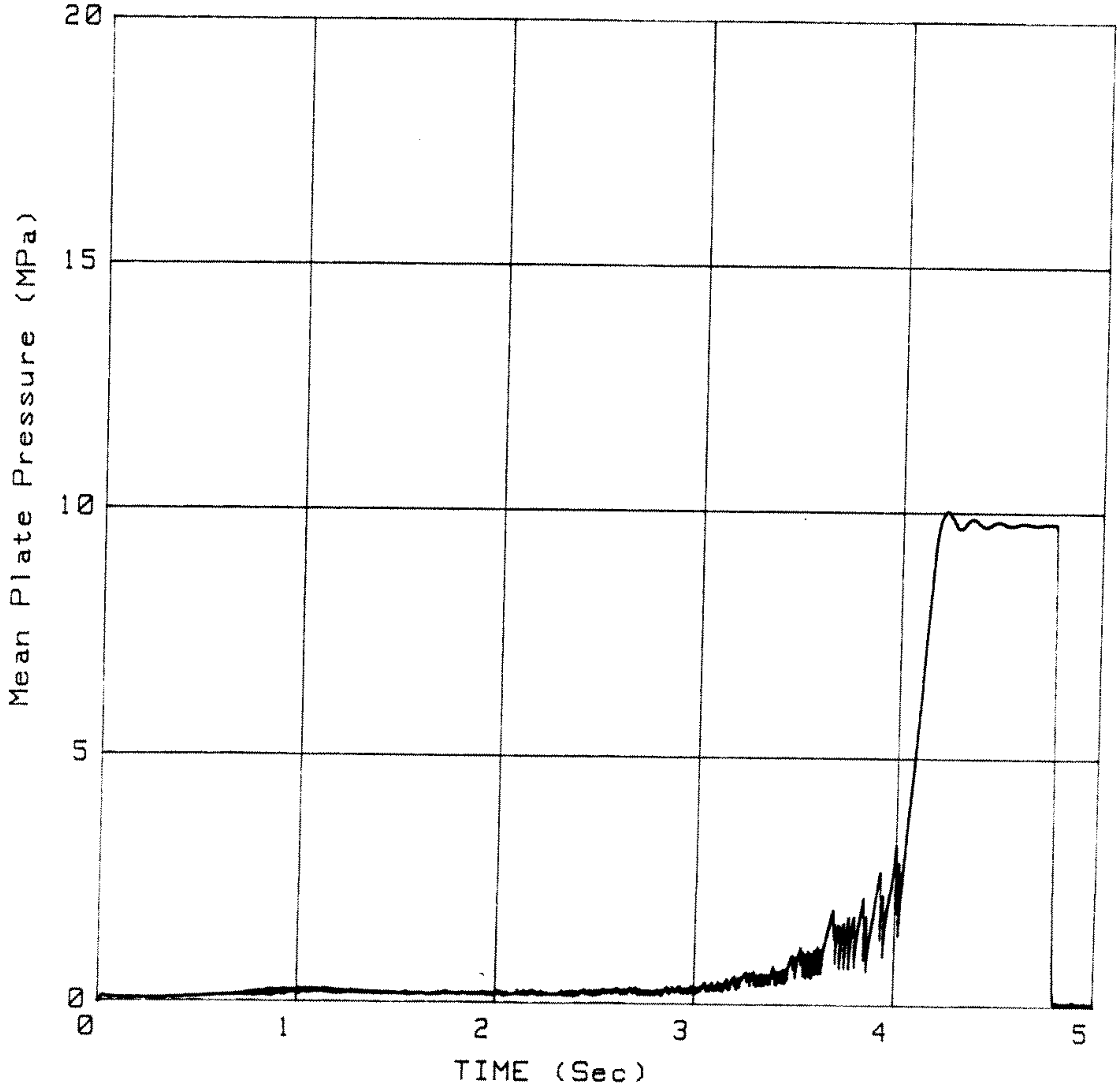
Time: 08:41:46

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 5.67



Local Pressure #10 vs. TIME

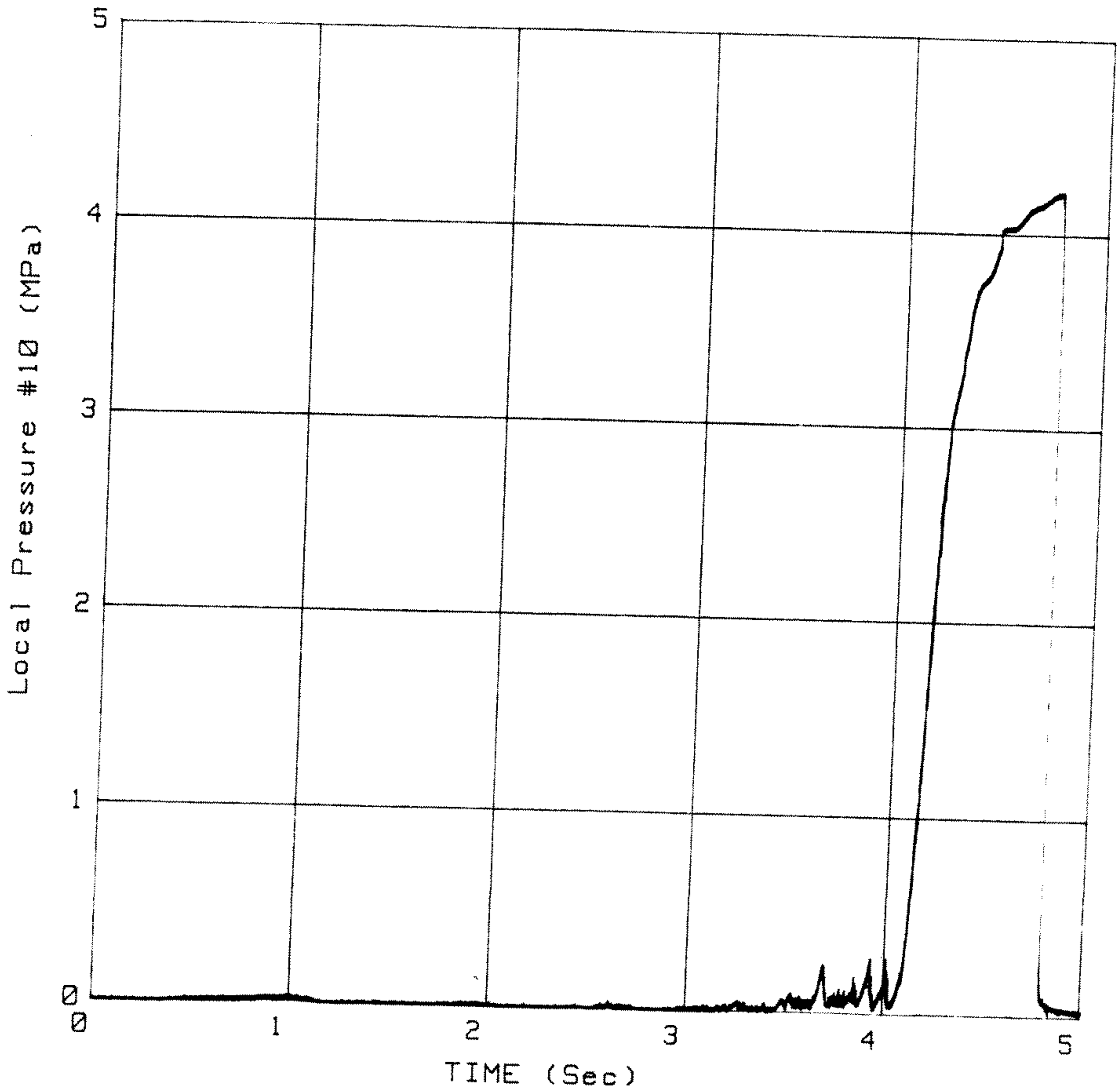
Test: X978
Type: Extrusion test
Sample: CRUSHED ICE

Date: 22 Dec 1988
Time: 08:41:46

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 5.67



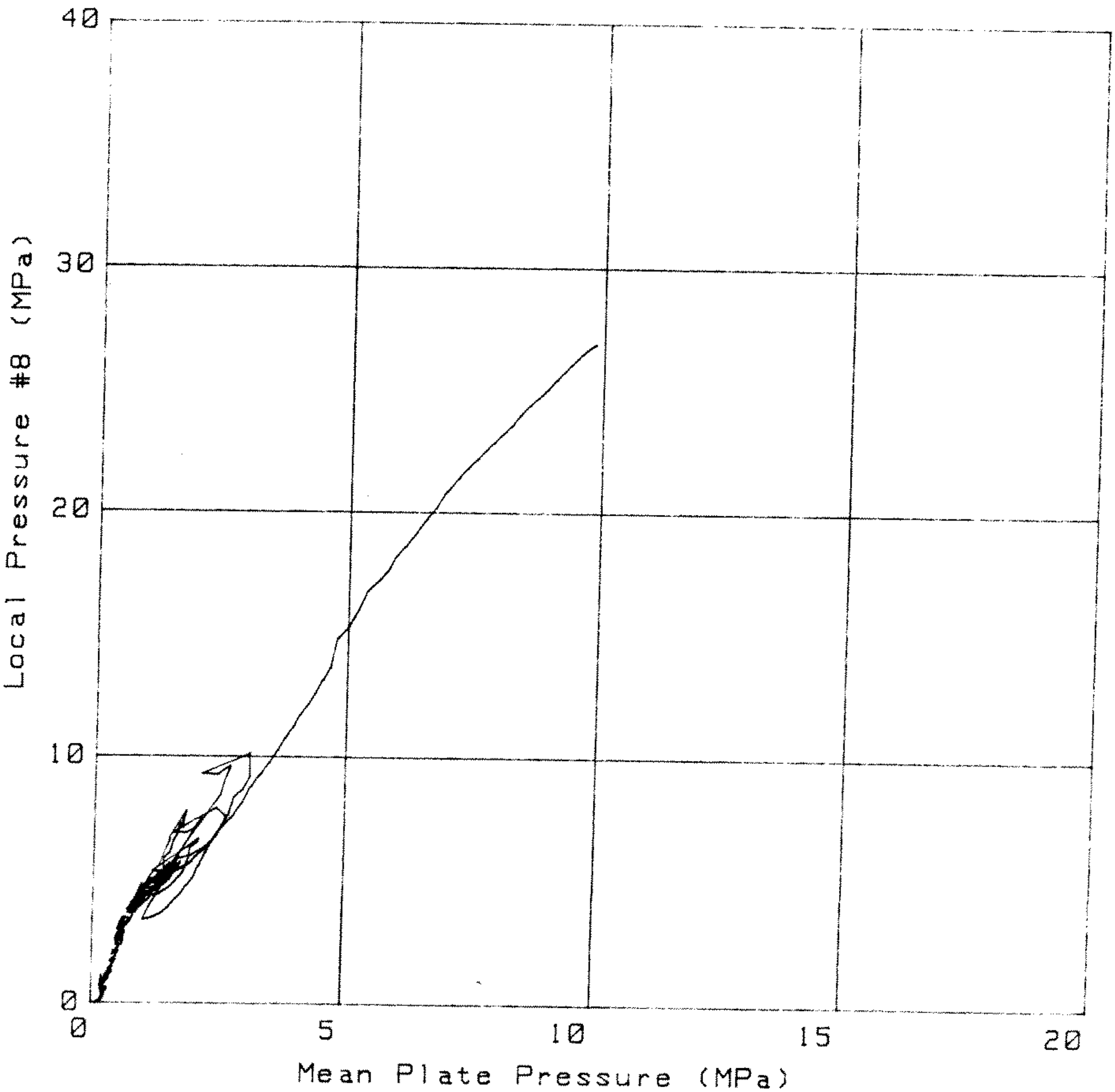
Local Pressure #8 vs. Mean Plate Pressure

Test: X978
Type: Extrusion test
Sample: CRUSHED ICE

Date: 22 Dec 1988
Time: 08:41:46

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .38
Data To (s): 4.2



Local Pressure #16
vs.
TIME

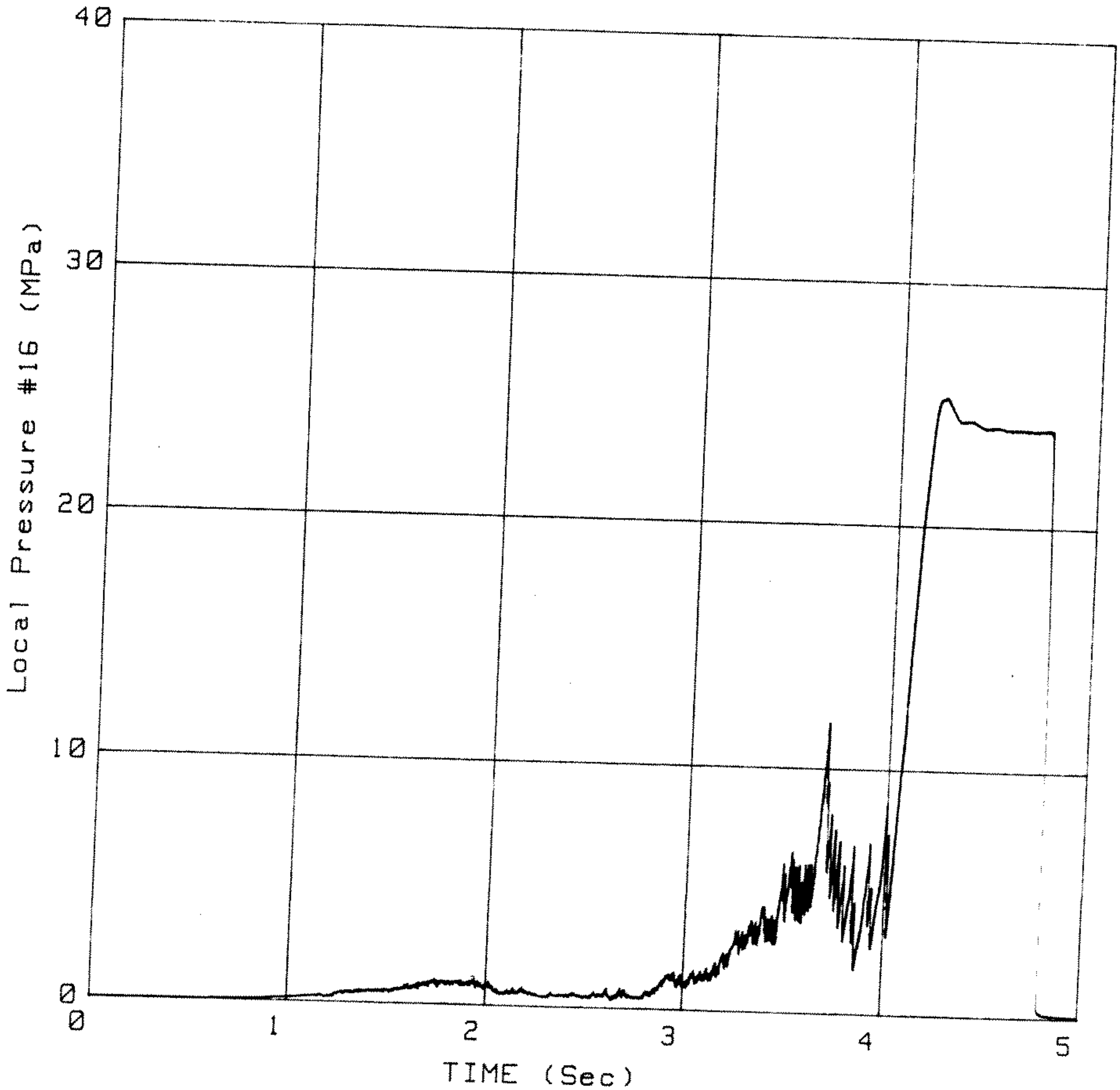
Test: X978
Type: Extrusion test
Sample: CRUSHED ICE

Date: 22 Dec 1988
Time: 08:41:46

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 5.67



Local Pressure #8
vs.
TIME

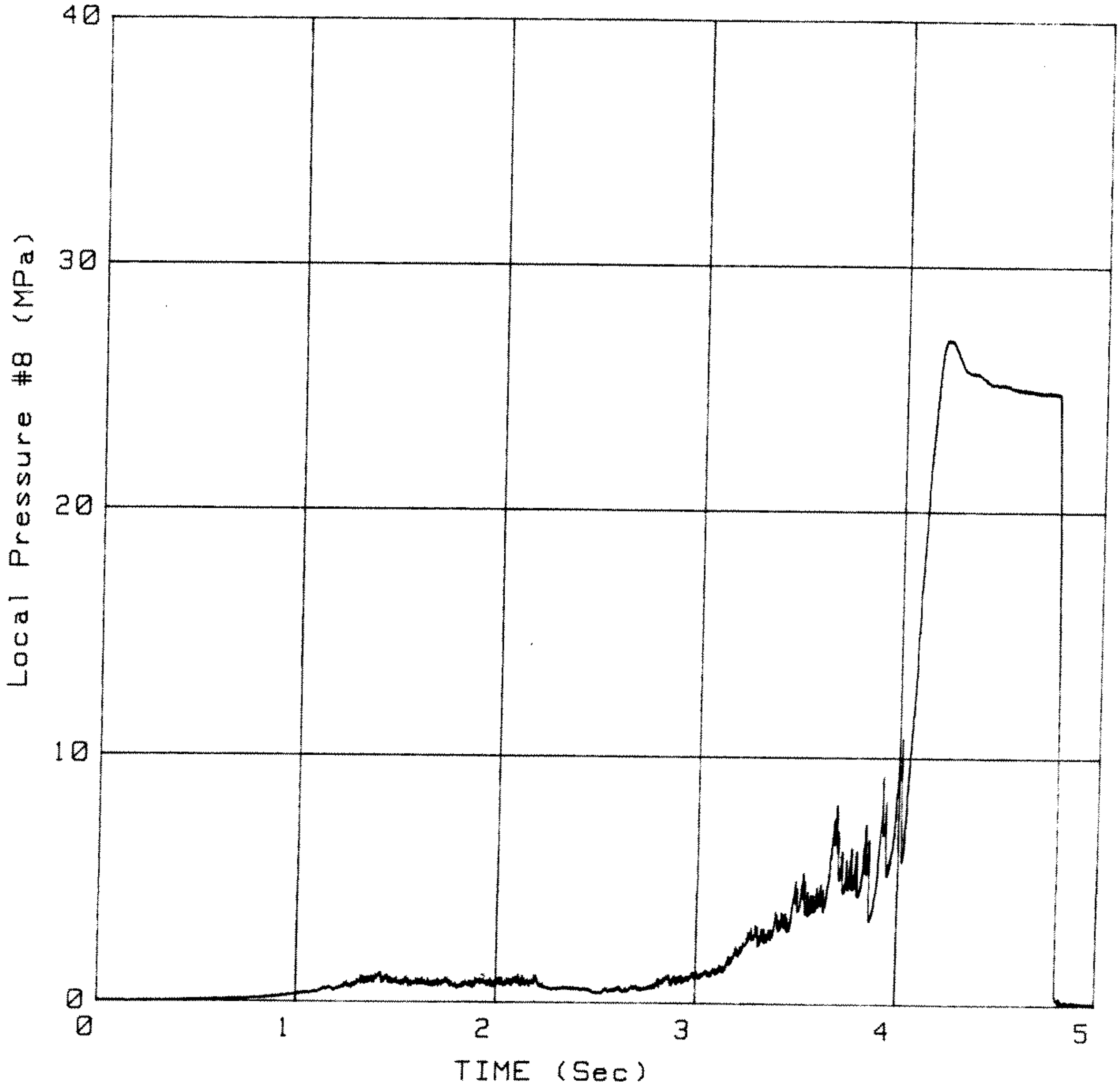
Test: X978
Type: Extrusion test
Sample: CRUSHED ICE

Date: 22 Dec 1988
Time: 08:41:46

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



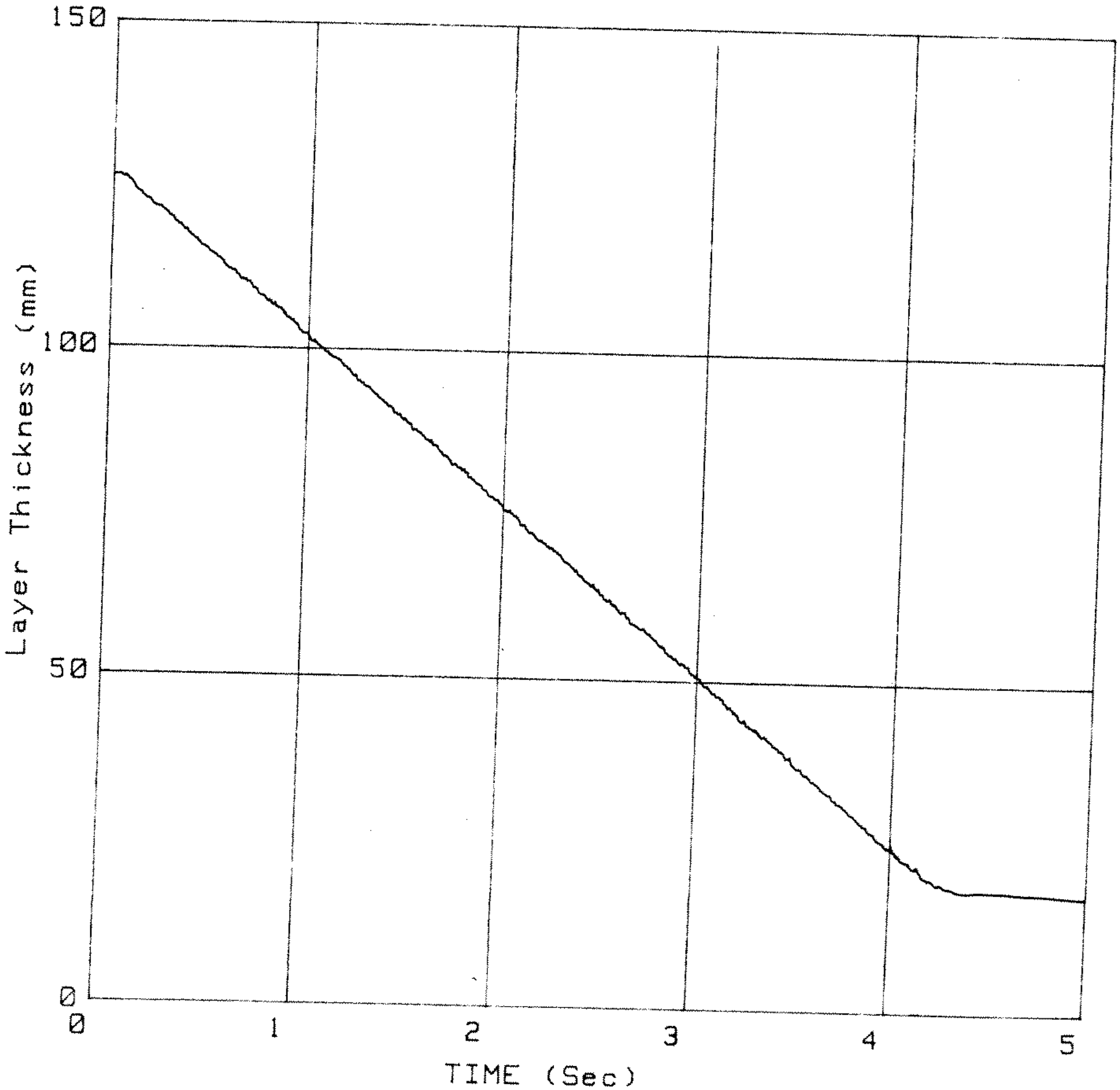
Layer Thickness
vs.
TIME

Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 14:01:49

Temperature: -9.6

Average = 10
Truncation Time (s) = 5



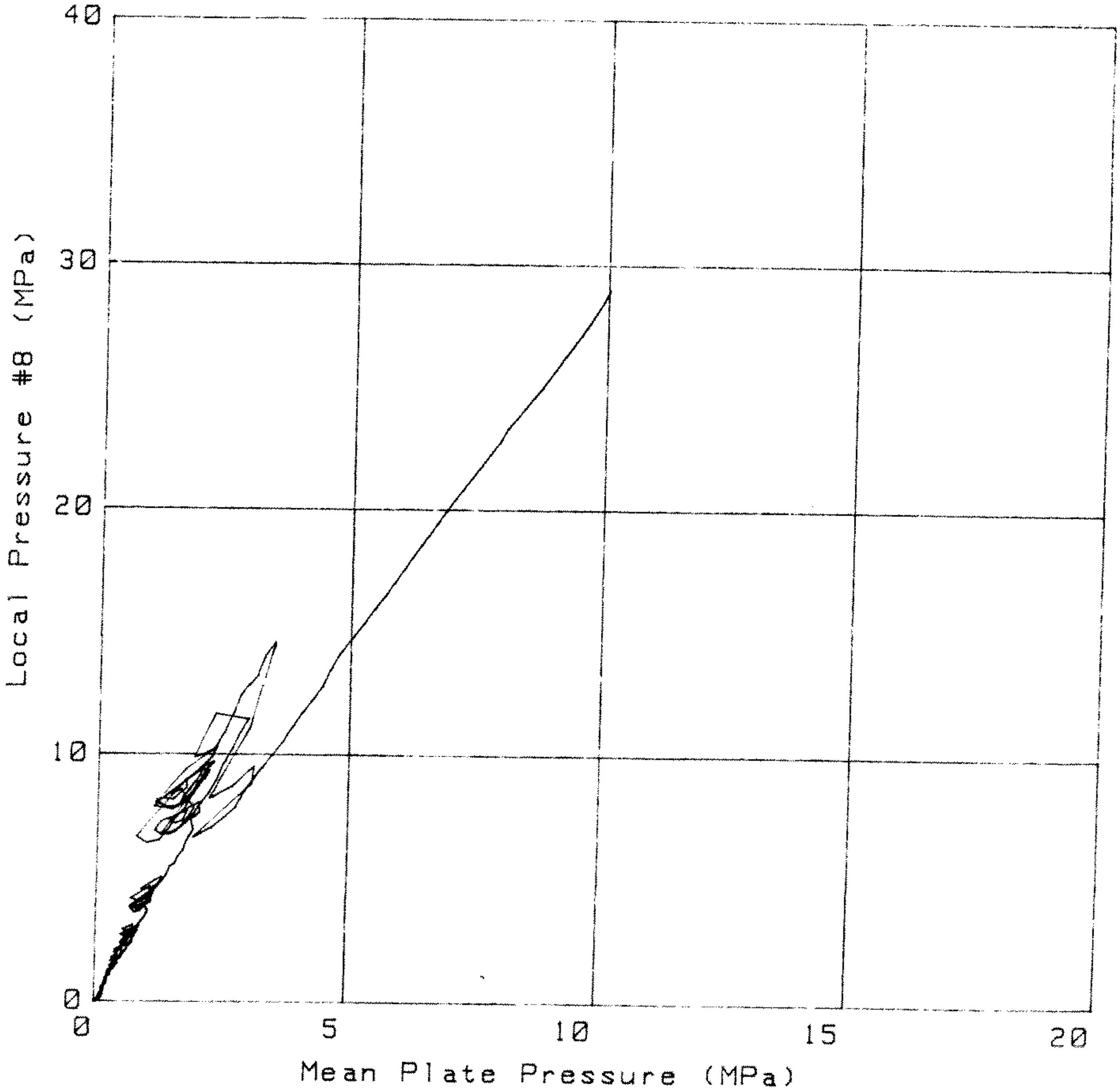
Local Pressure #8
vs.
Mean Plate Pressure

Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 14:01:49

Temperature: -9.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .5
Data To (s): 4.35



Local Pressure #16
vs.
TIME

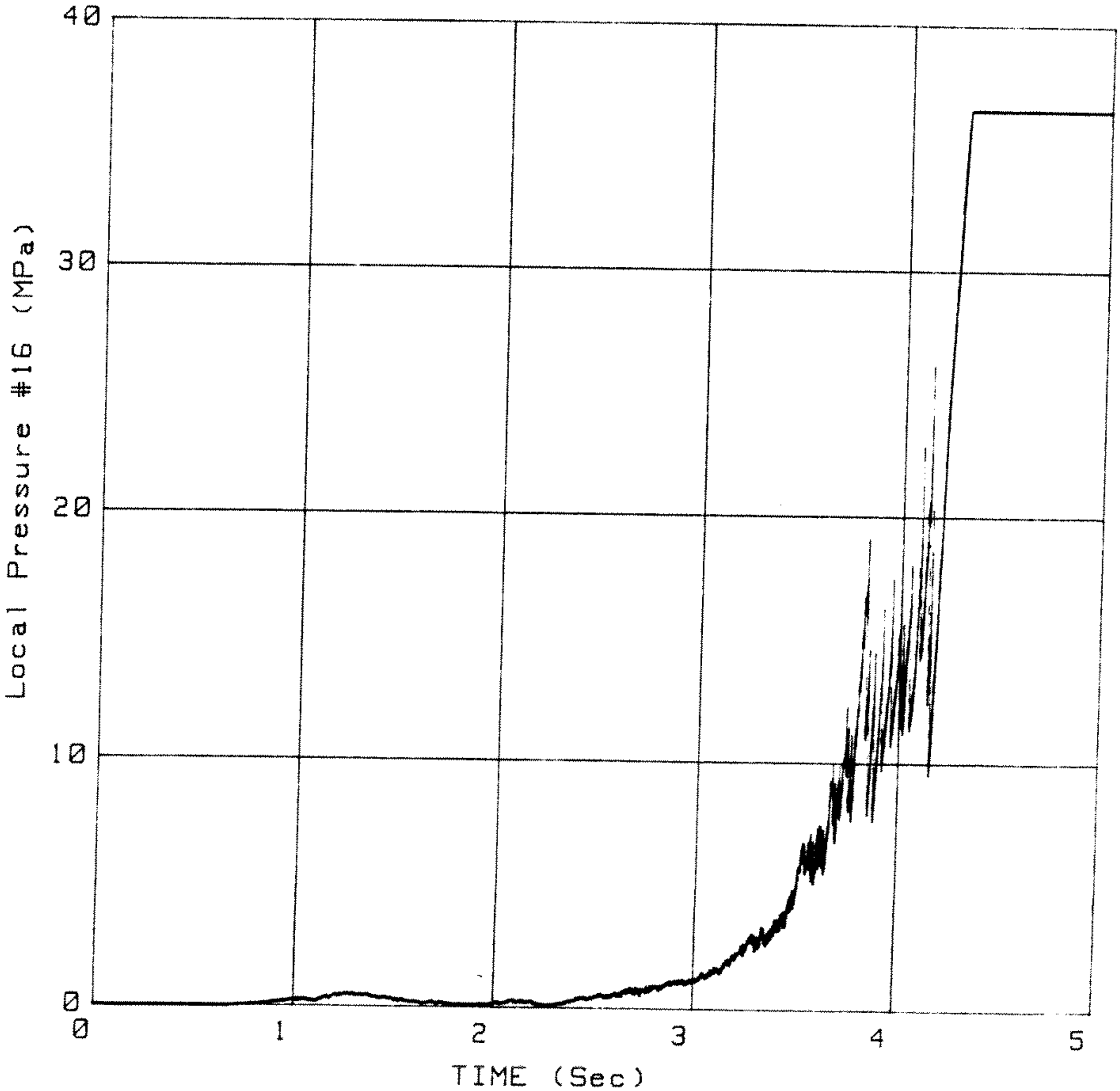
Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 14:01:49

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 5.67



Local Pressure #12
vs.
TIME

Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

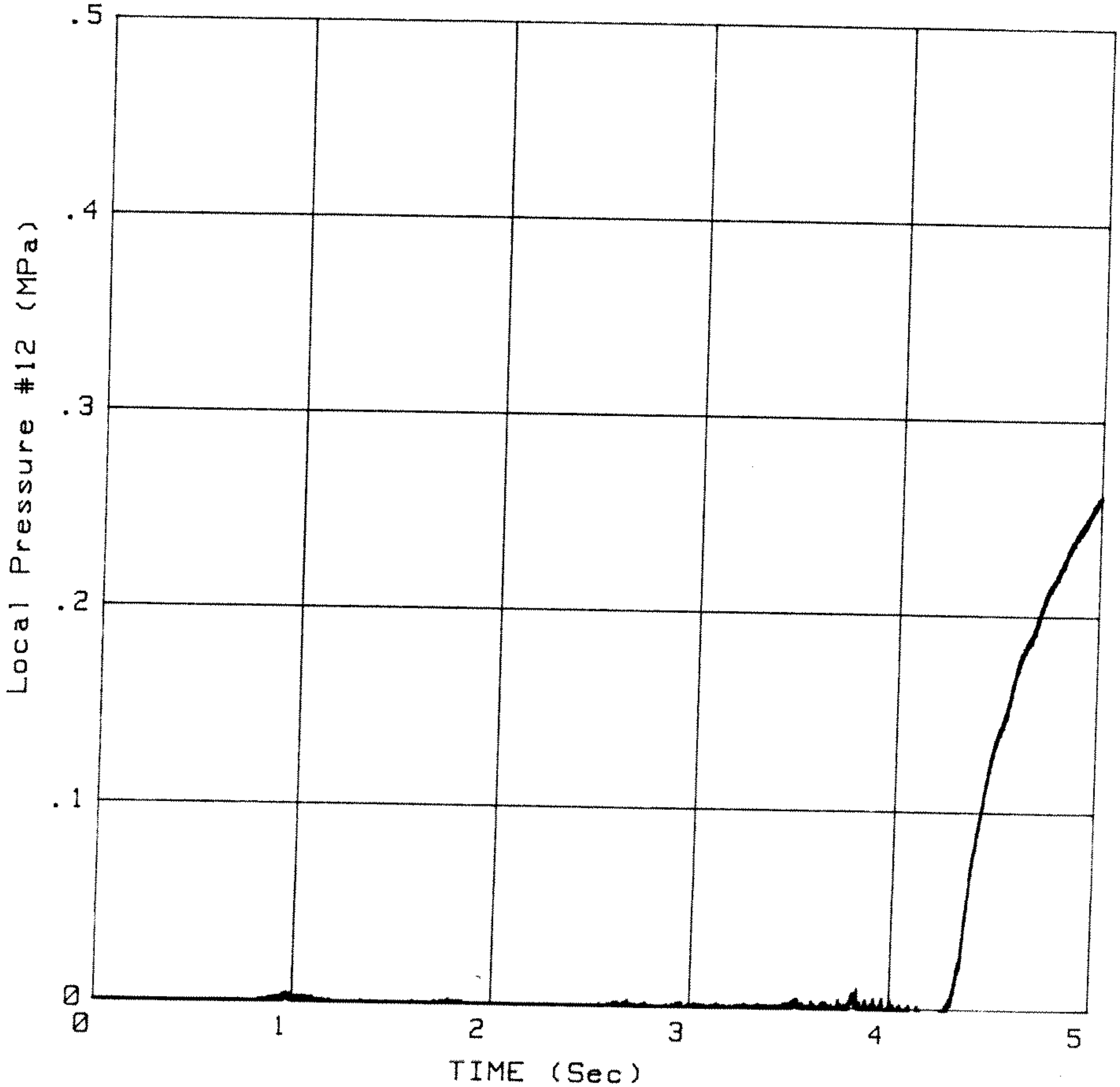
Date: 21 Dec 1988
Time: 14:01:49

Temperature: -9.6

Y Offset Removed

Average = 1

Truncation Time (s) = 5.67



Local Pressure #10 vs. TIME

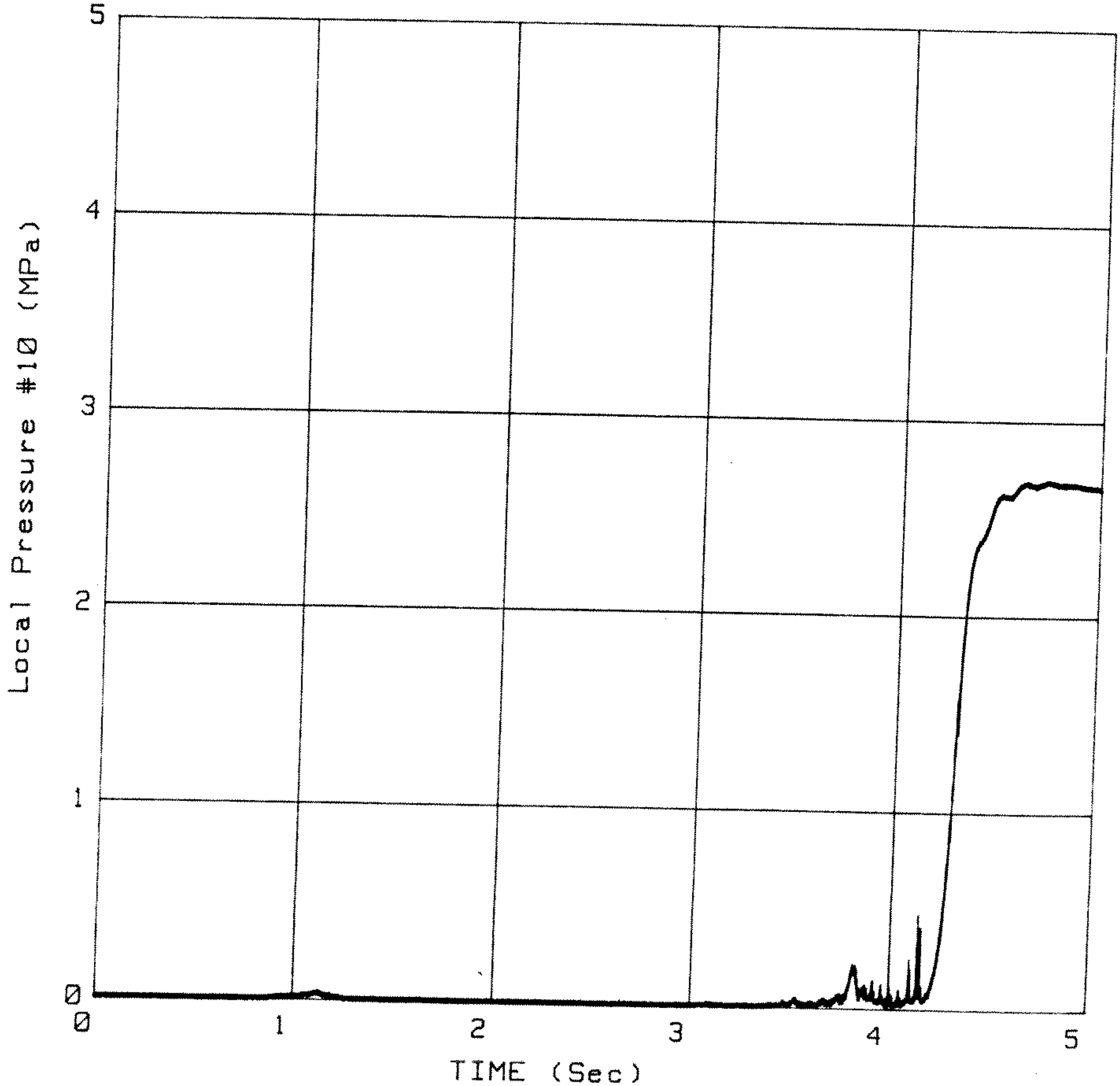
Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 14:01:49

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 5.67



Local Pressure #8
vs.
TIME

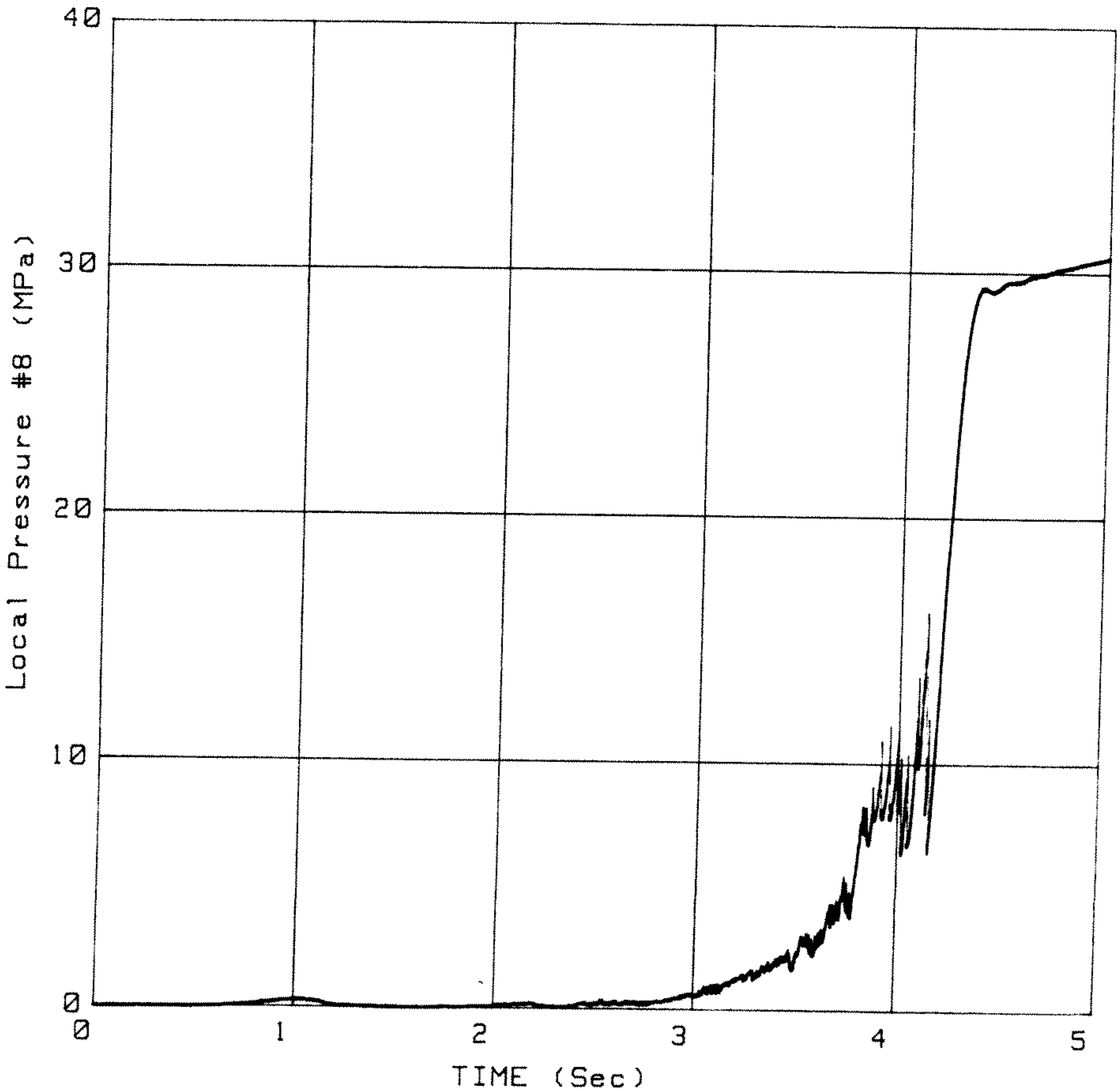
Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 14:01:49

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 5.67



Mean Plate Pressure
vs.
TIME

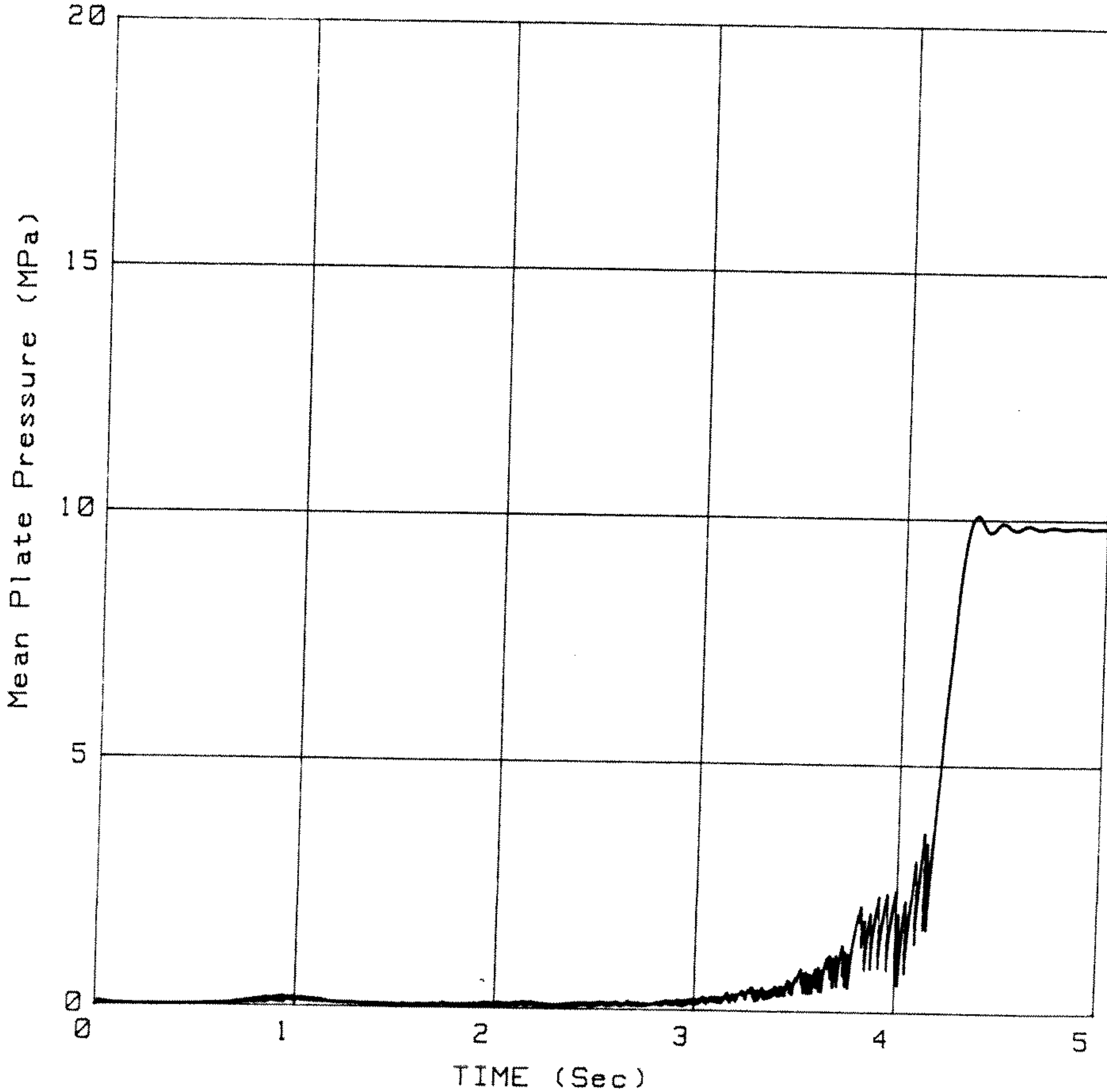
Test: X979
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 14:01:49

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 5.67



Displacement 1
vs.
TIME

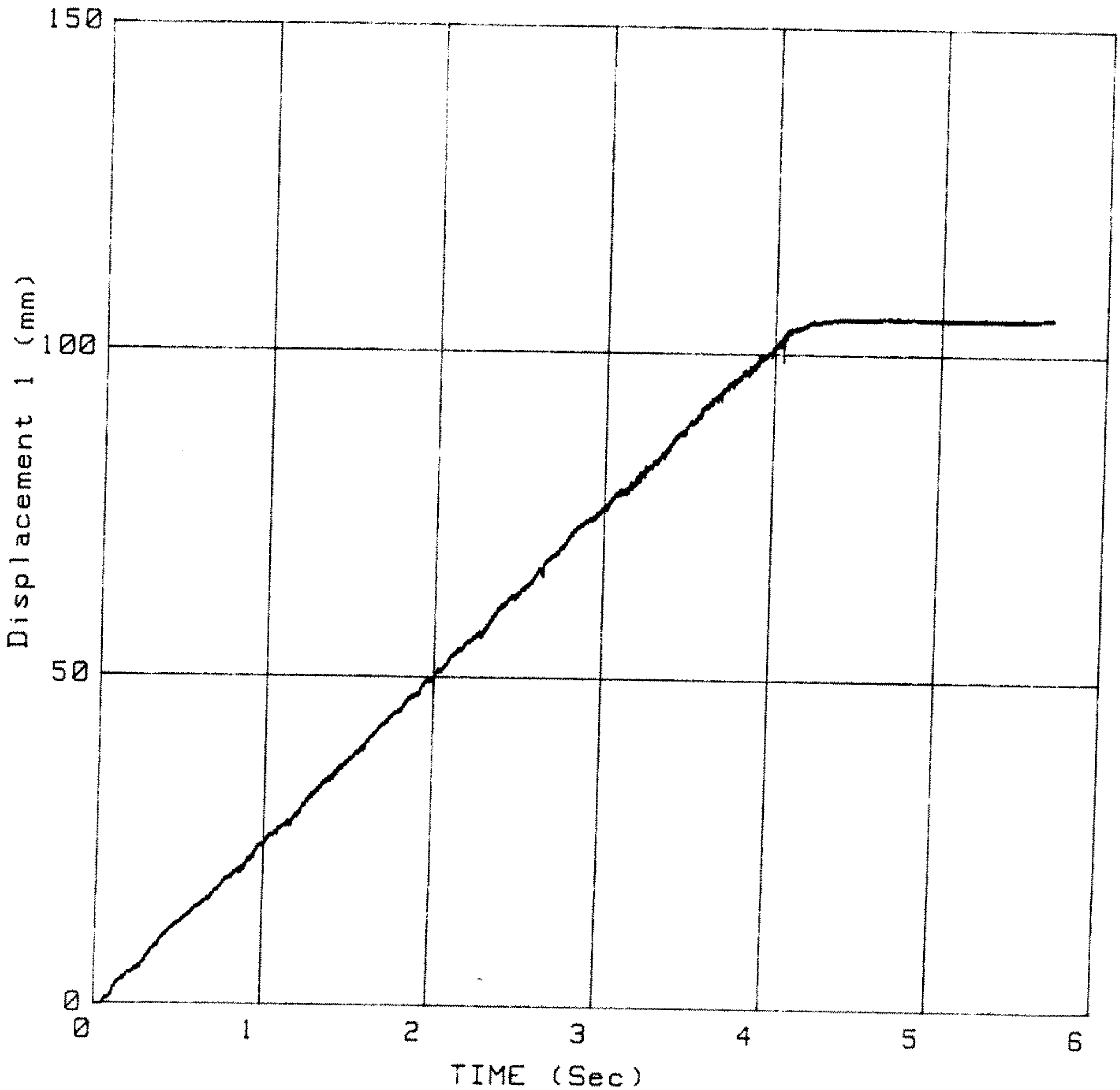
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Displacement 2 vs. TIME

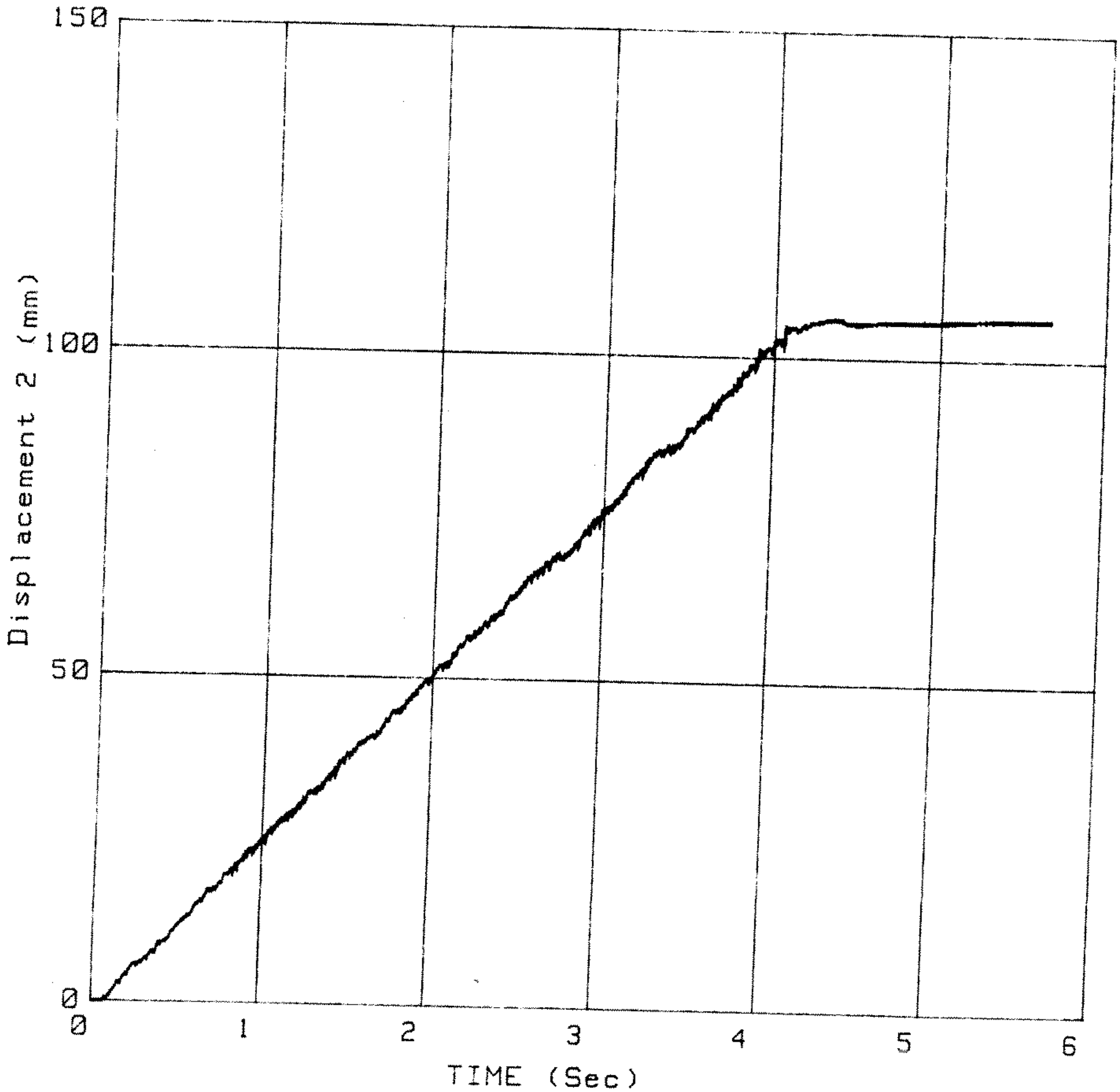
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 5.67



Mean Displacement
vs.
TIME

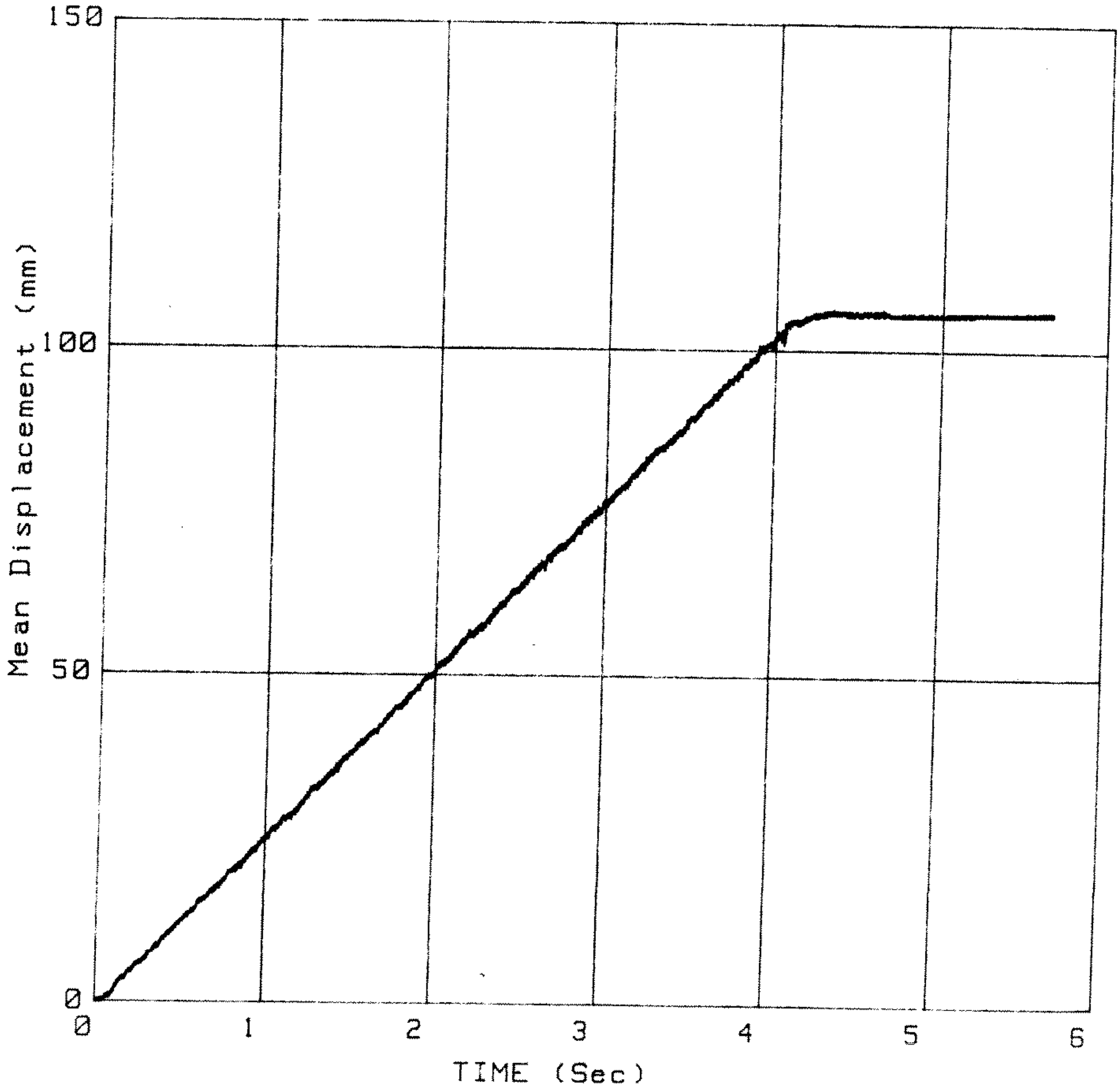
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Extend Load
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

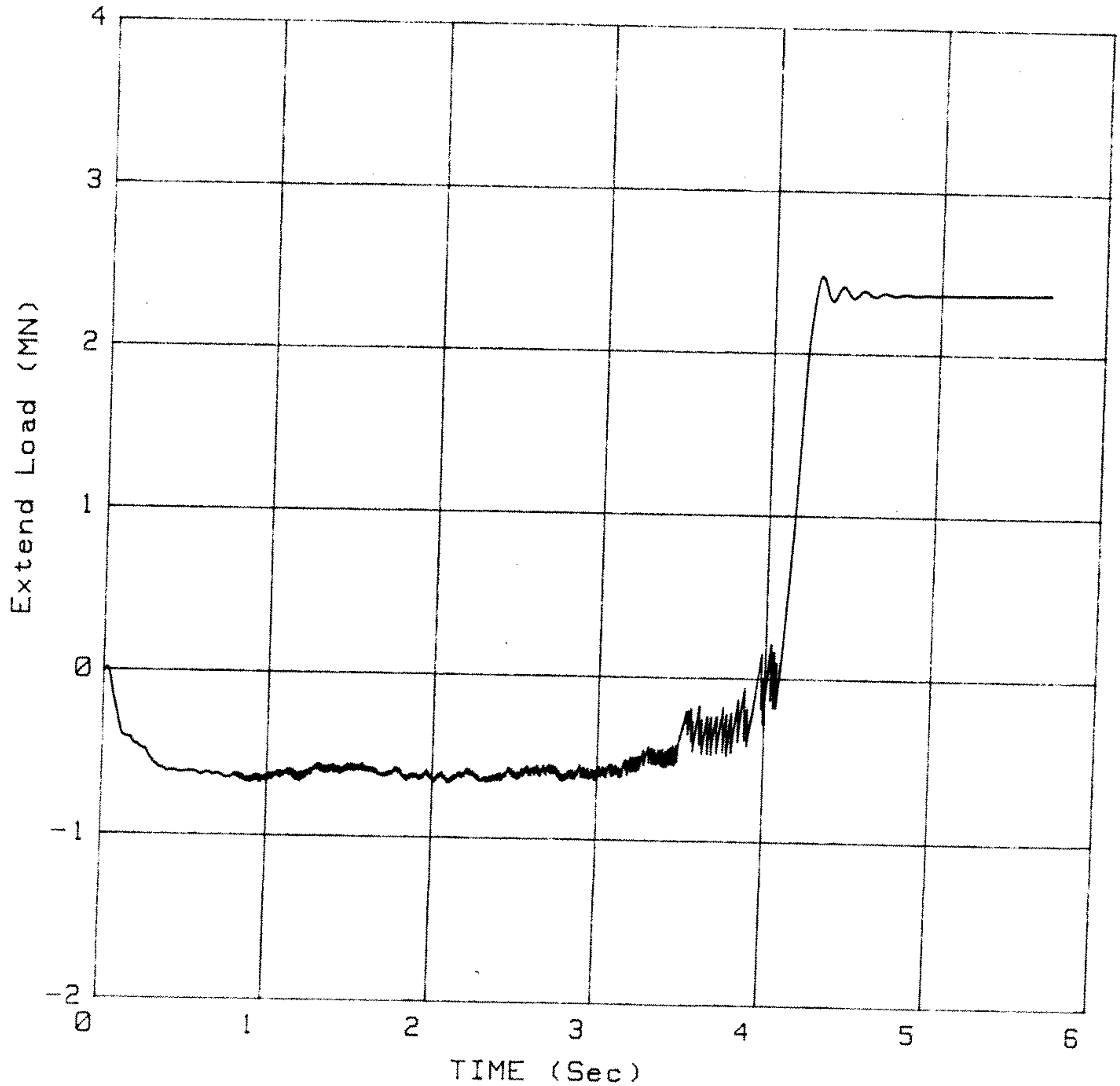
Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 5.67



Retract Load
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

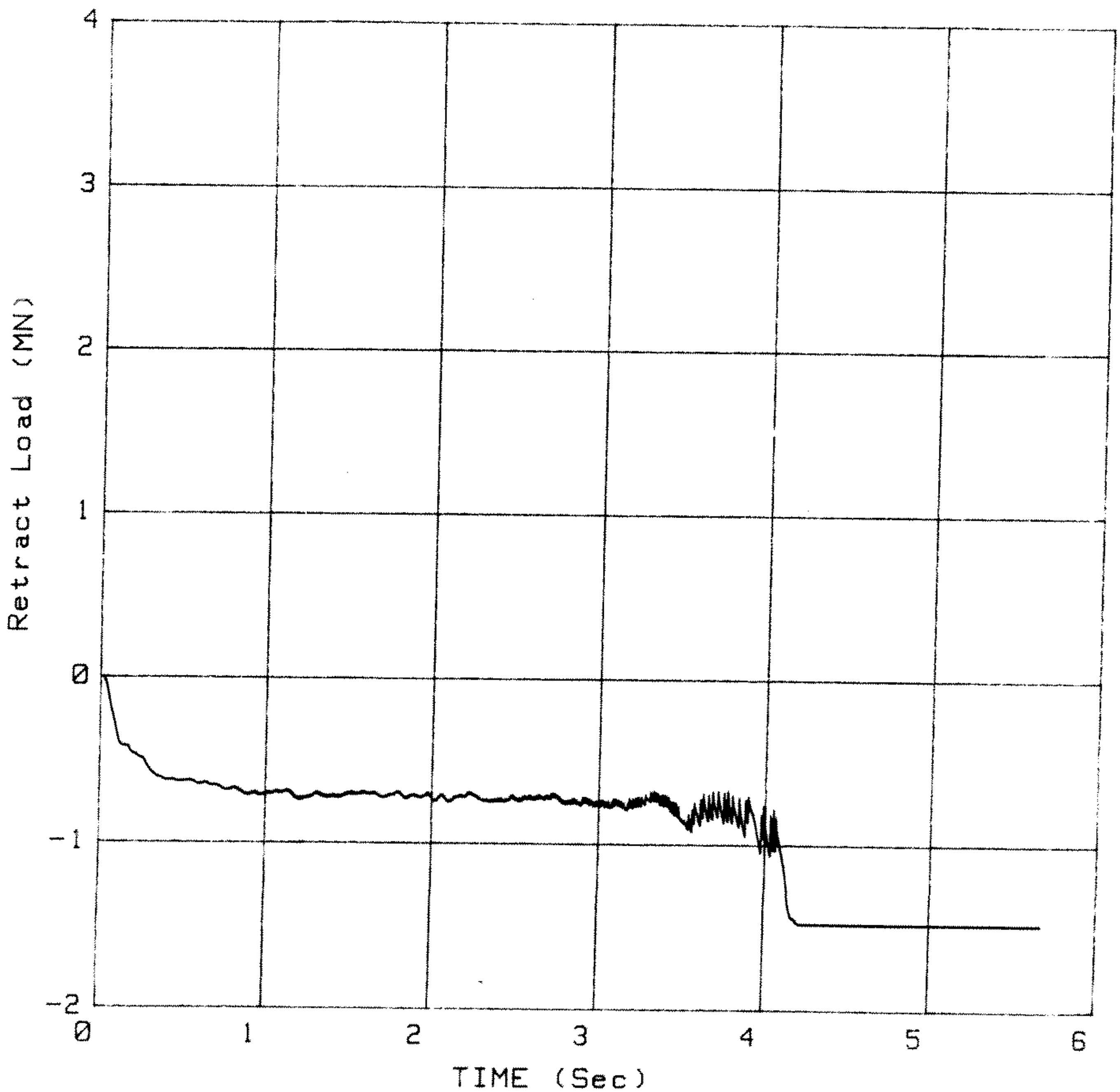
Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 5.67



Load
vs.
TIME

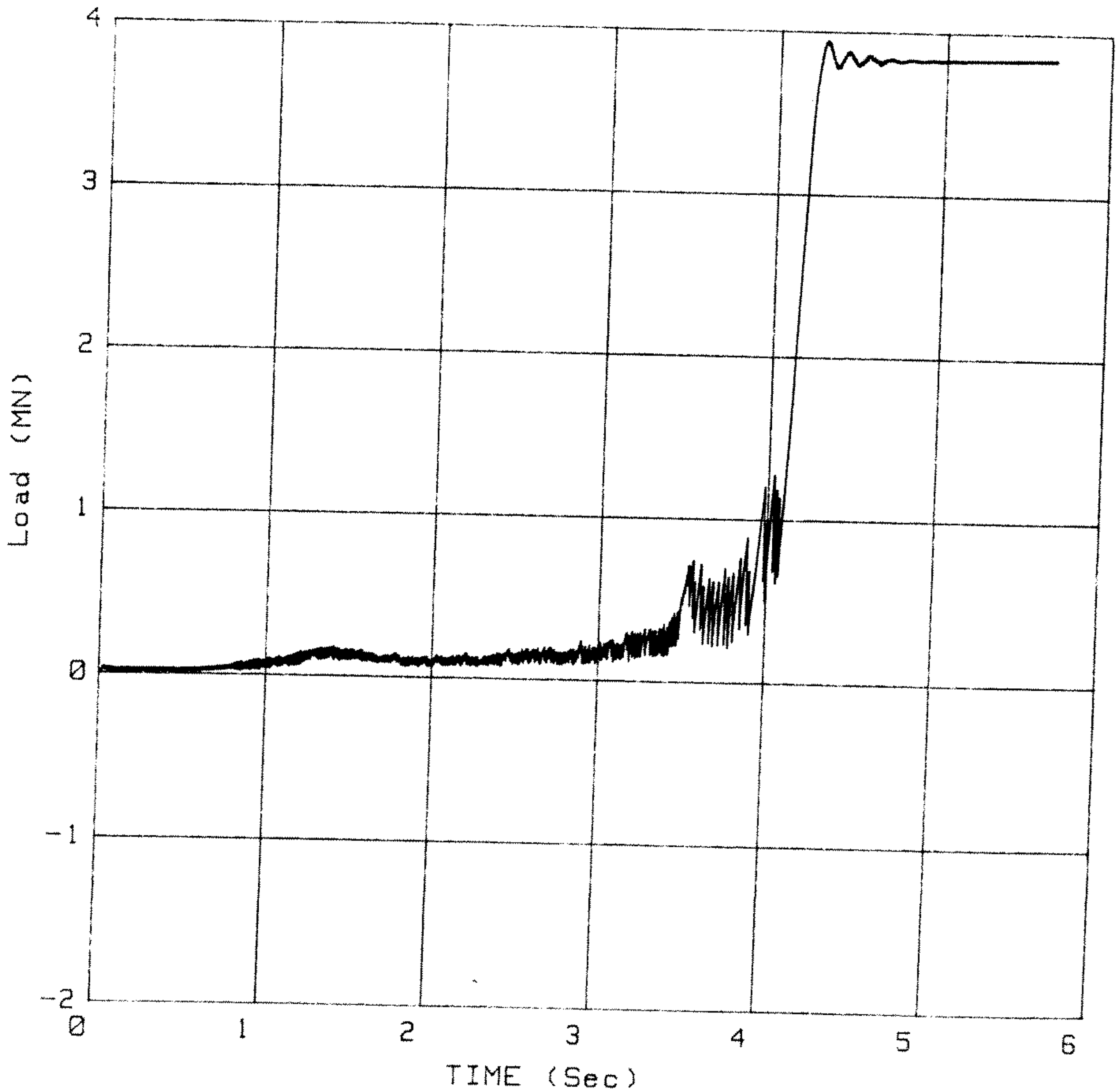
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 5.67



Command
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

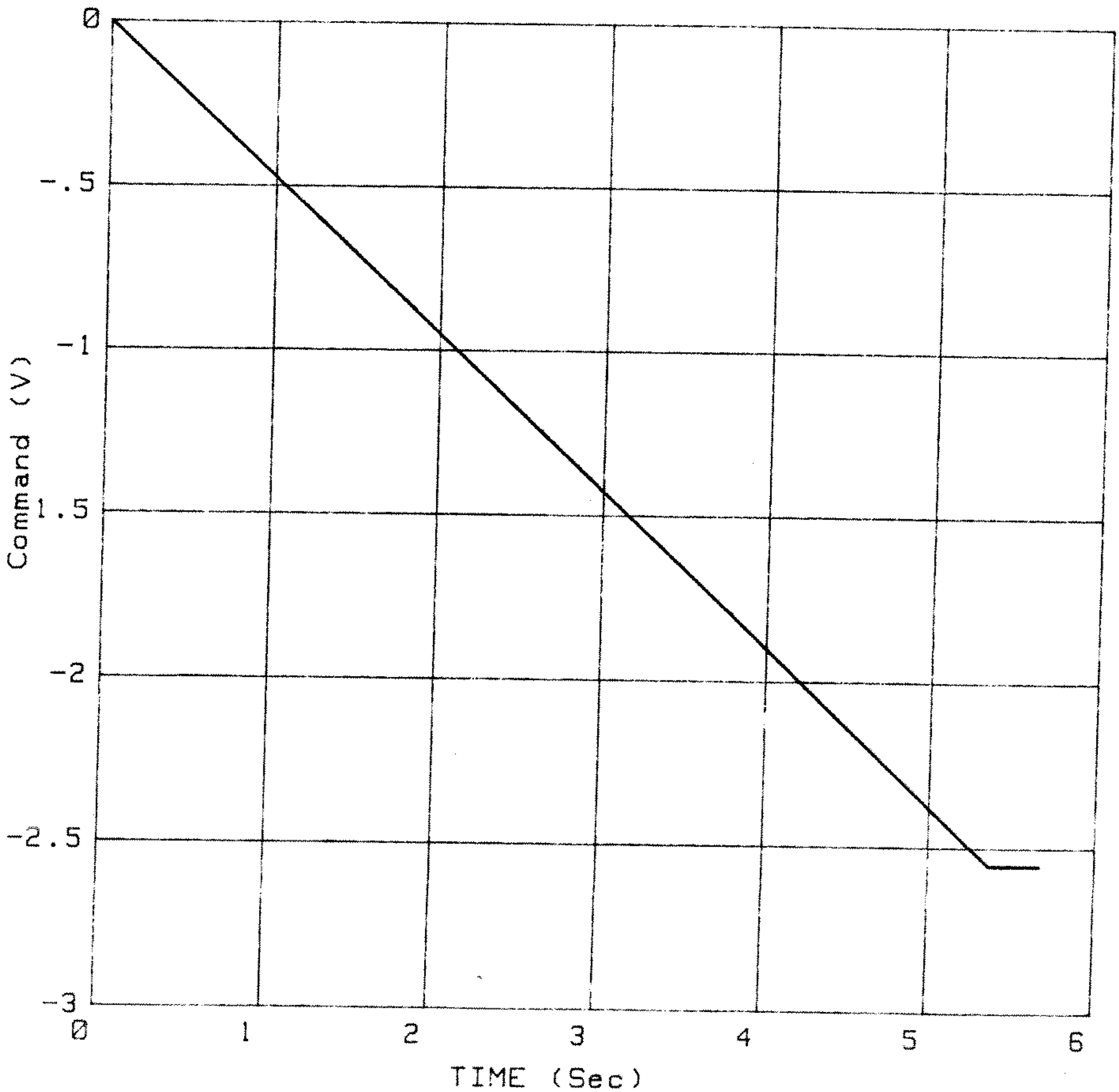
Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 5.67



Local Pressure #8
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

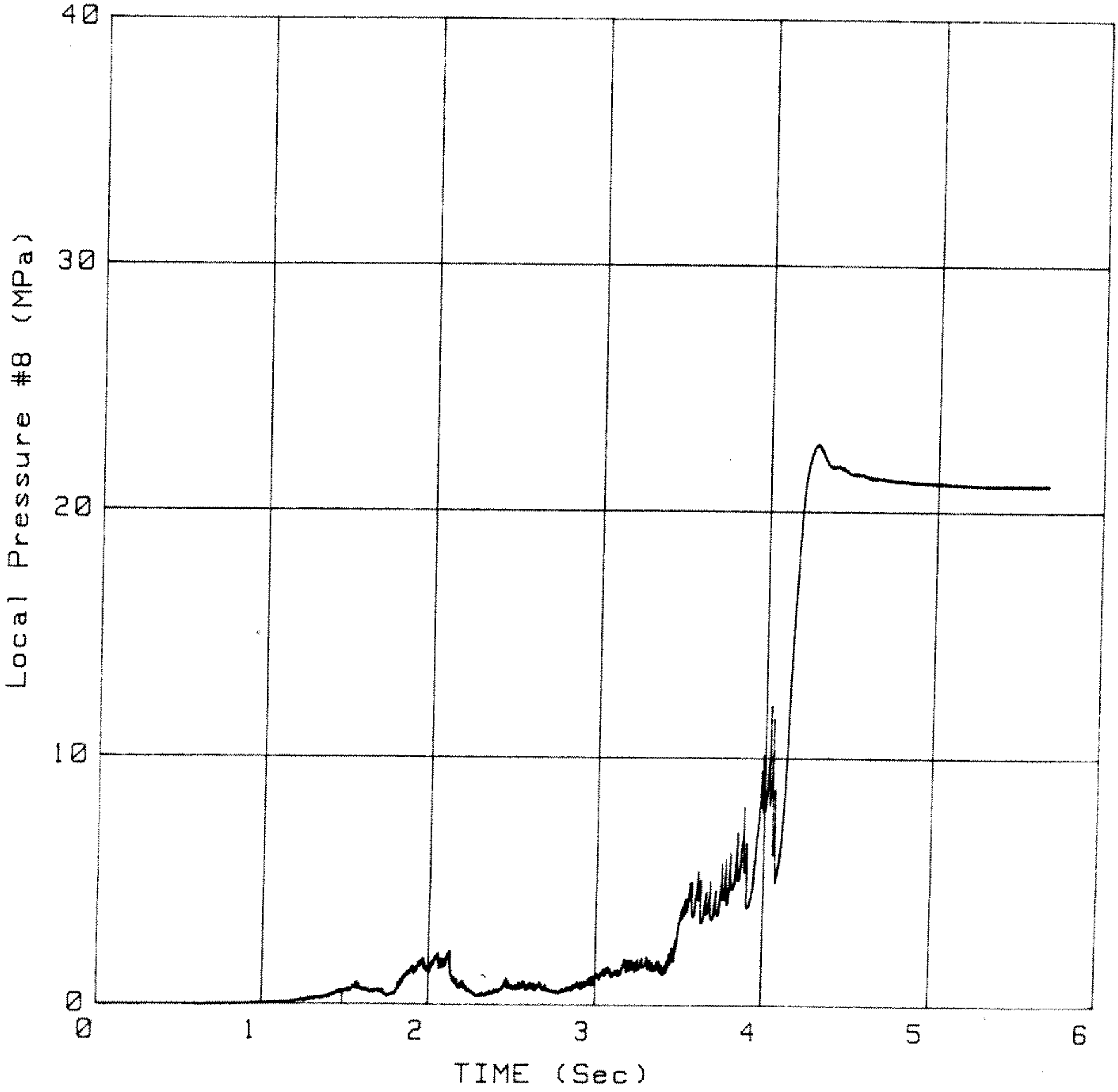
Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 5.67



Local Pressure #9
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

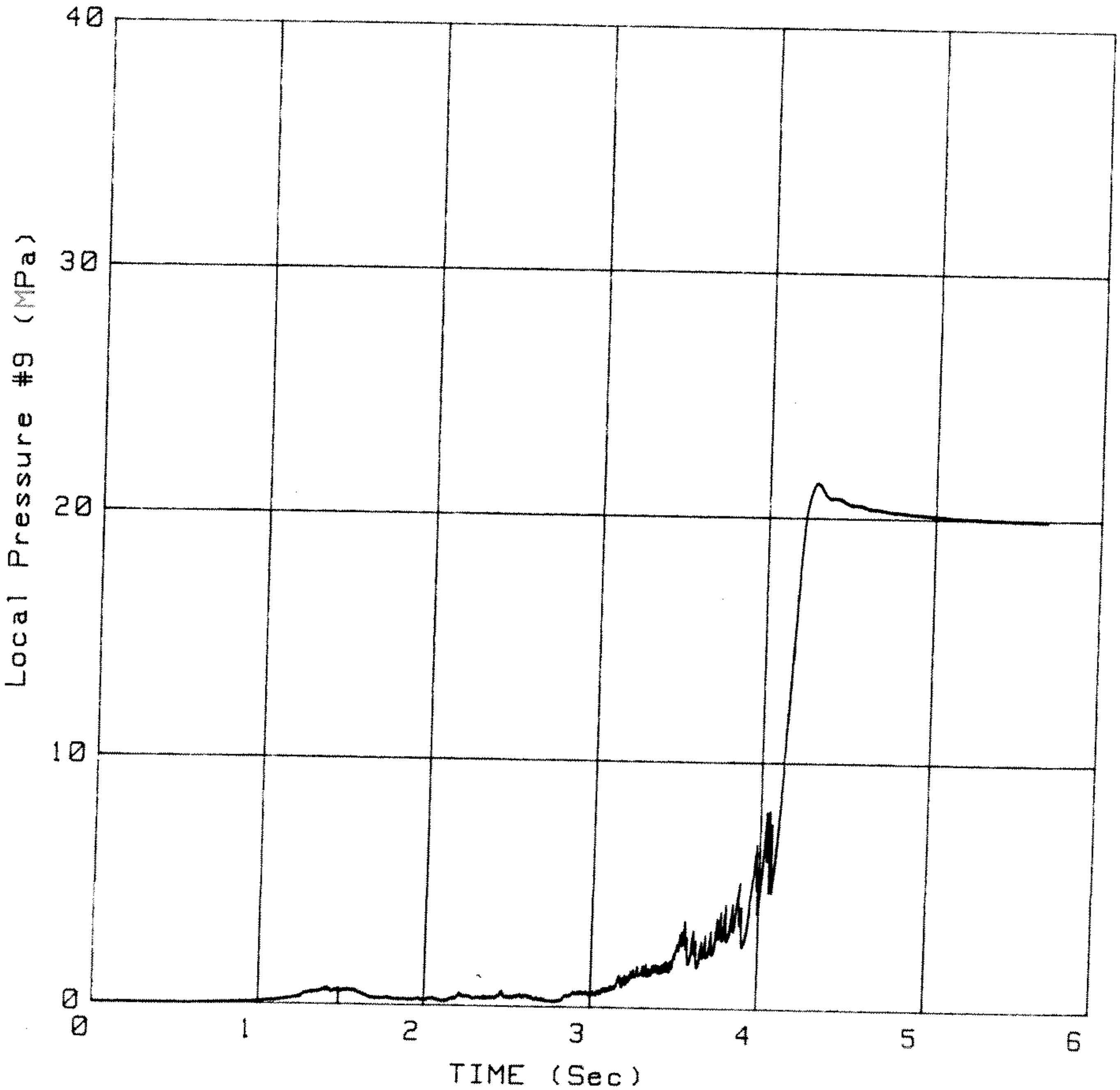
Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 5.67



Local Pressure #10
vs.
TIME

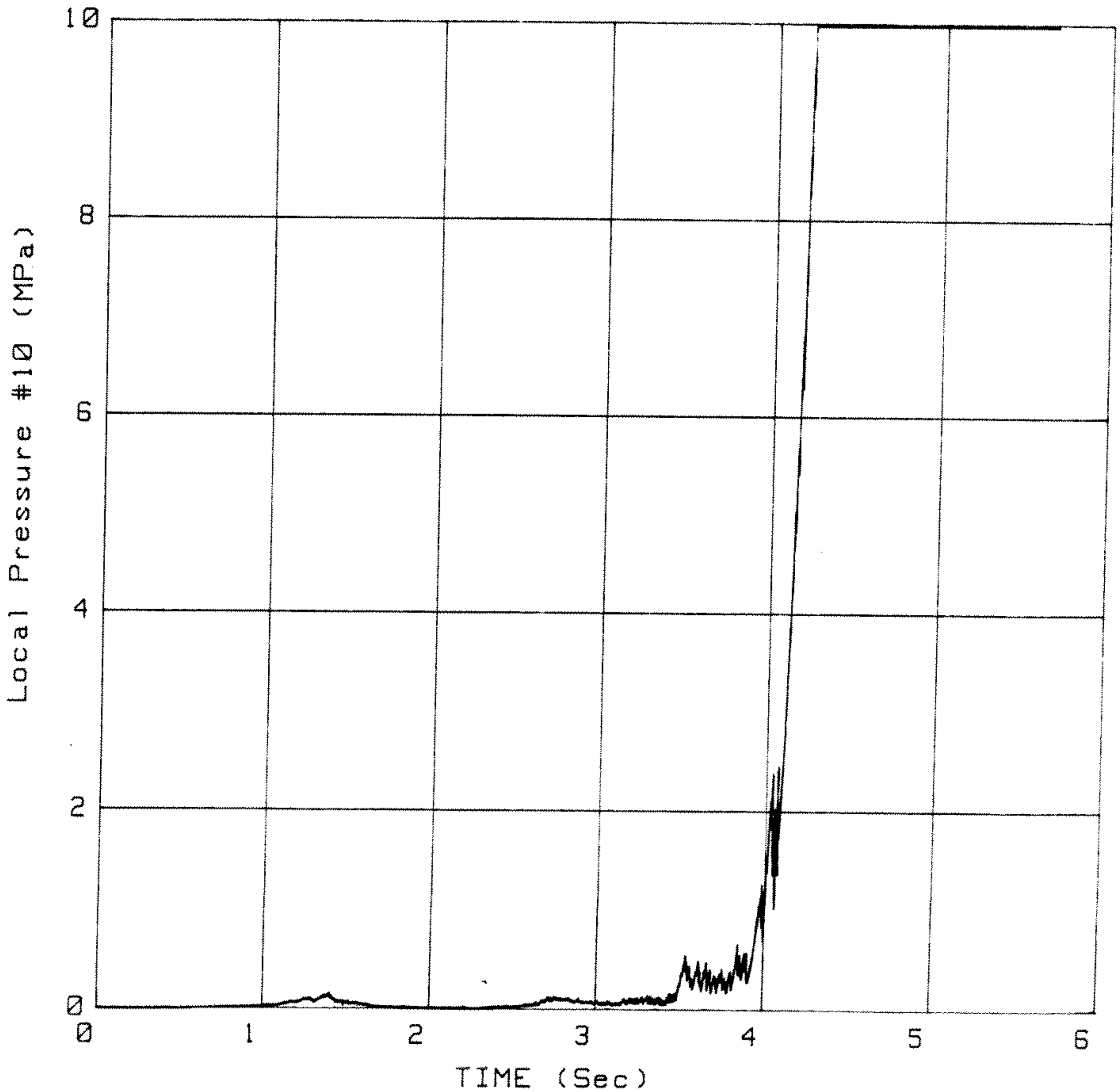
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Local Pressure #11
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

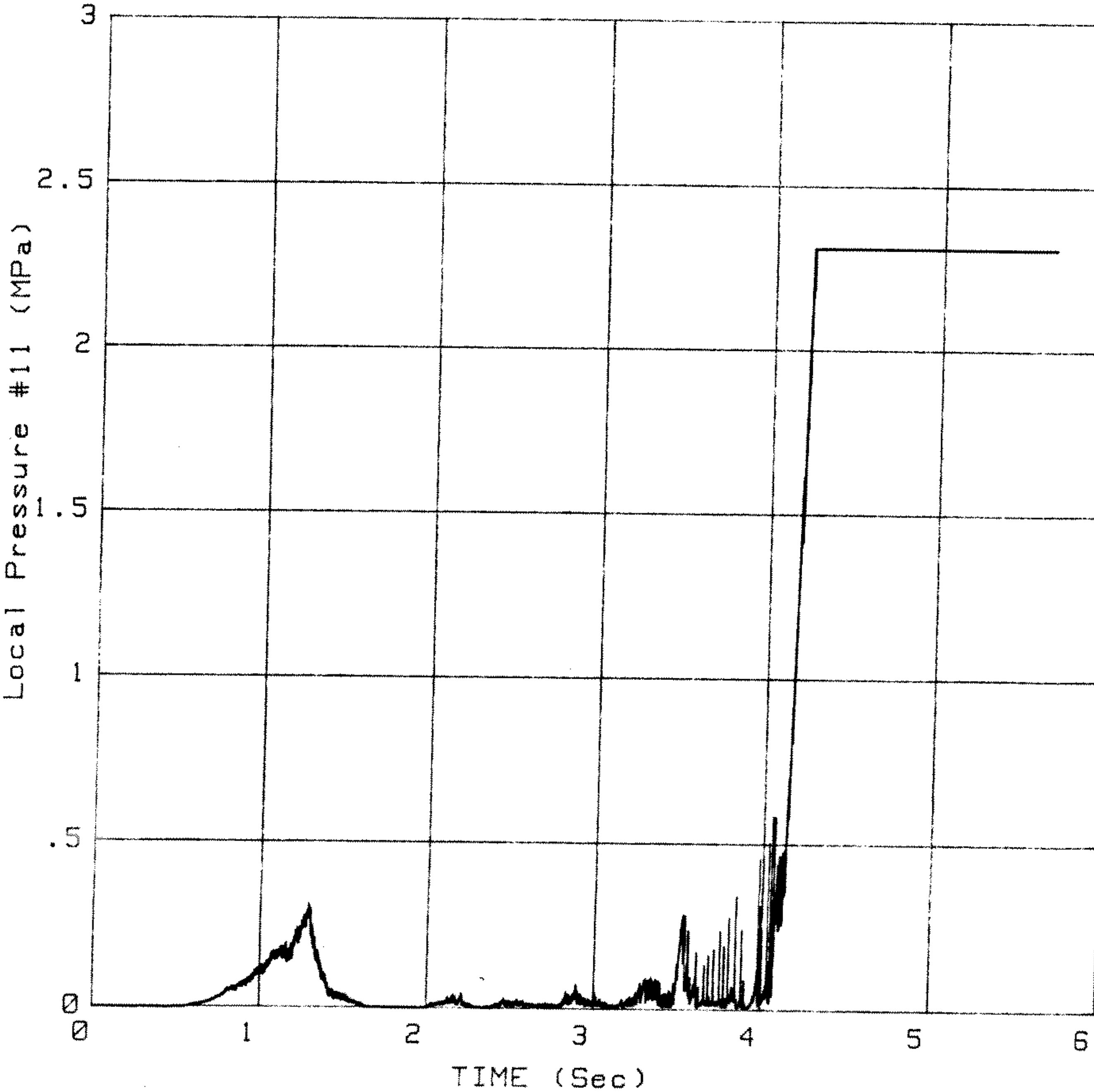
Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 5.67



Local Pressure #12
vs.
TIME

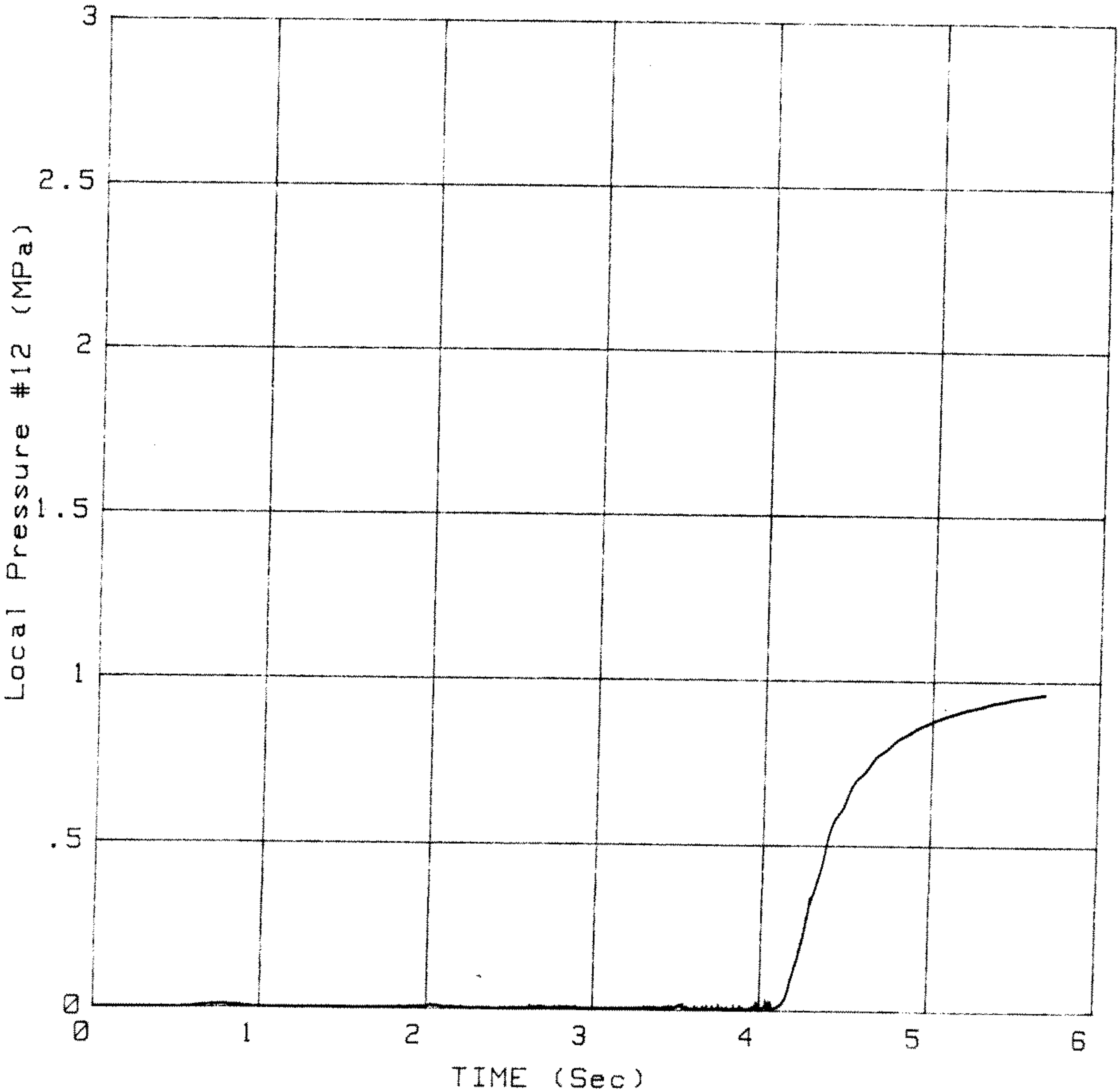
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Local Pressure #13
vs.
TIME

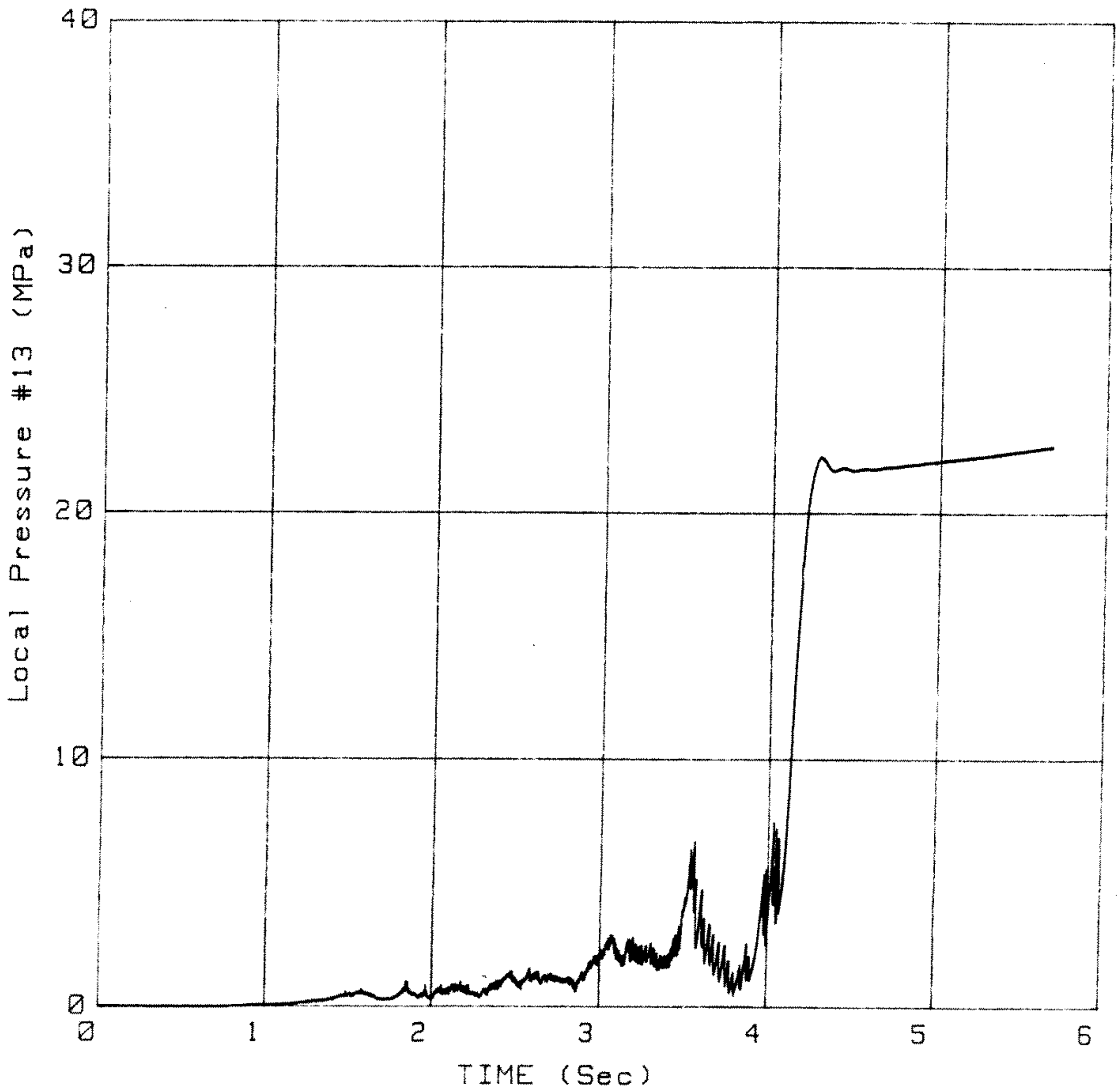
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Local Pressure #14
vs.
TIME

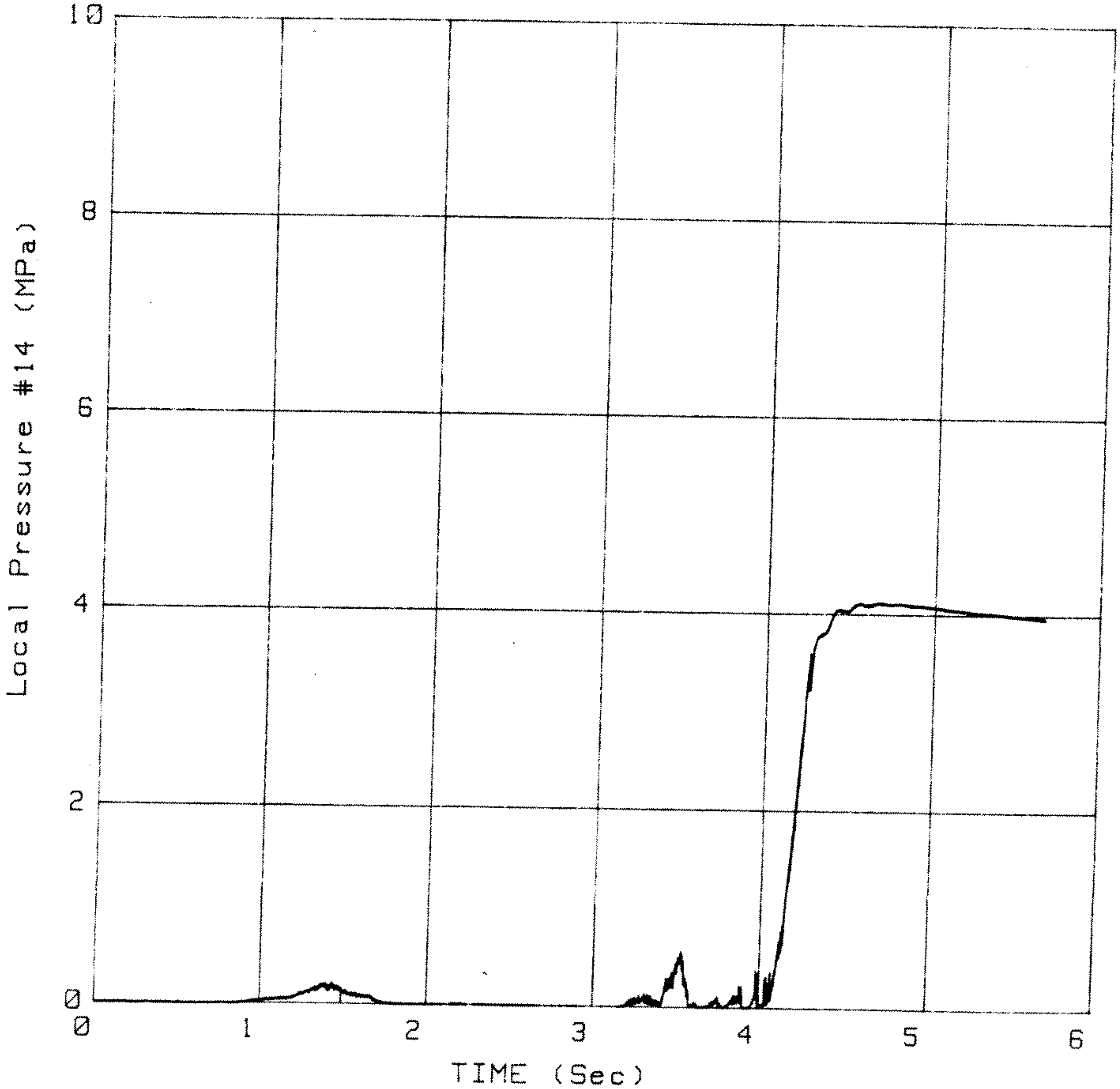
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Local Pressure #15
vs.
TIME

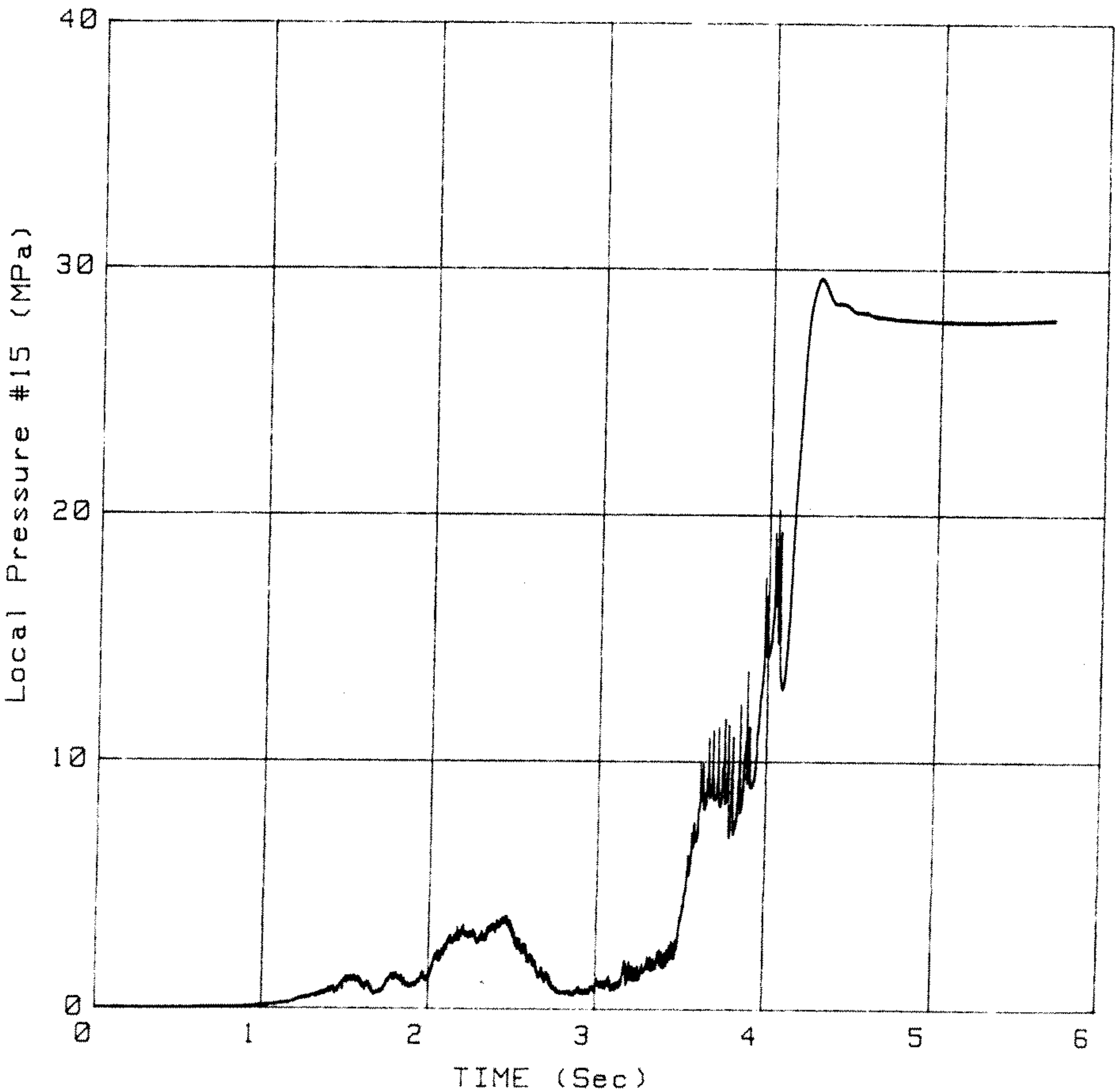
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



Local Pressure #16
vs.
TIME

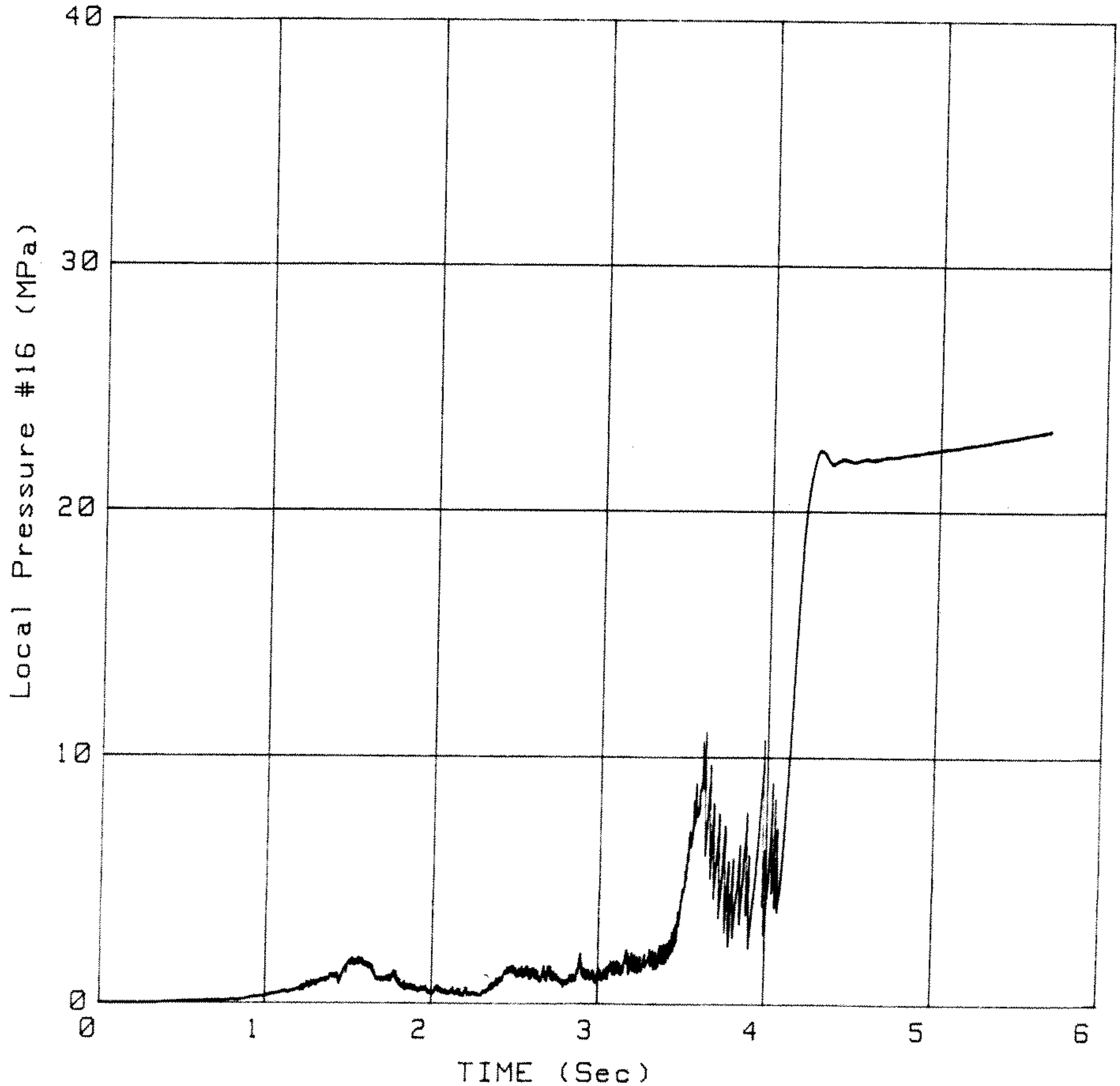
Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 5.67



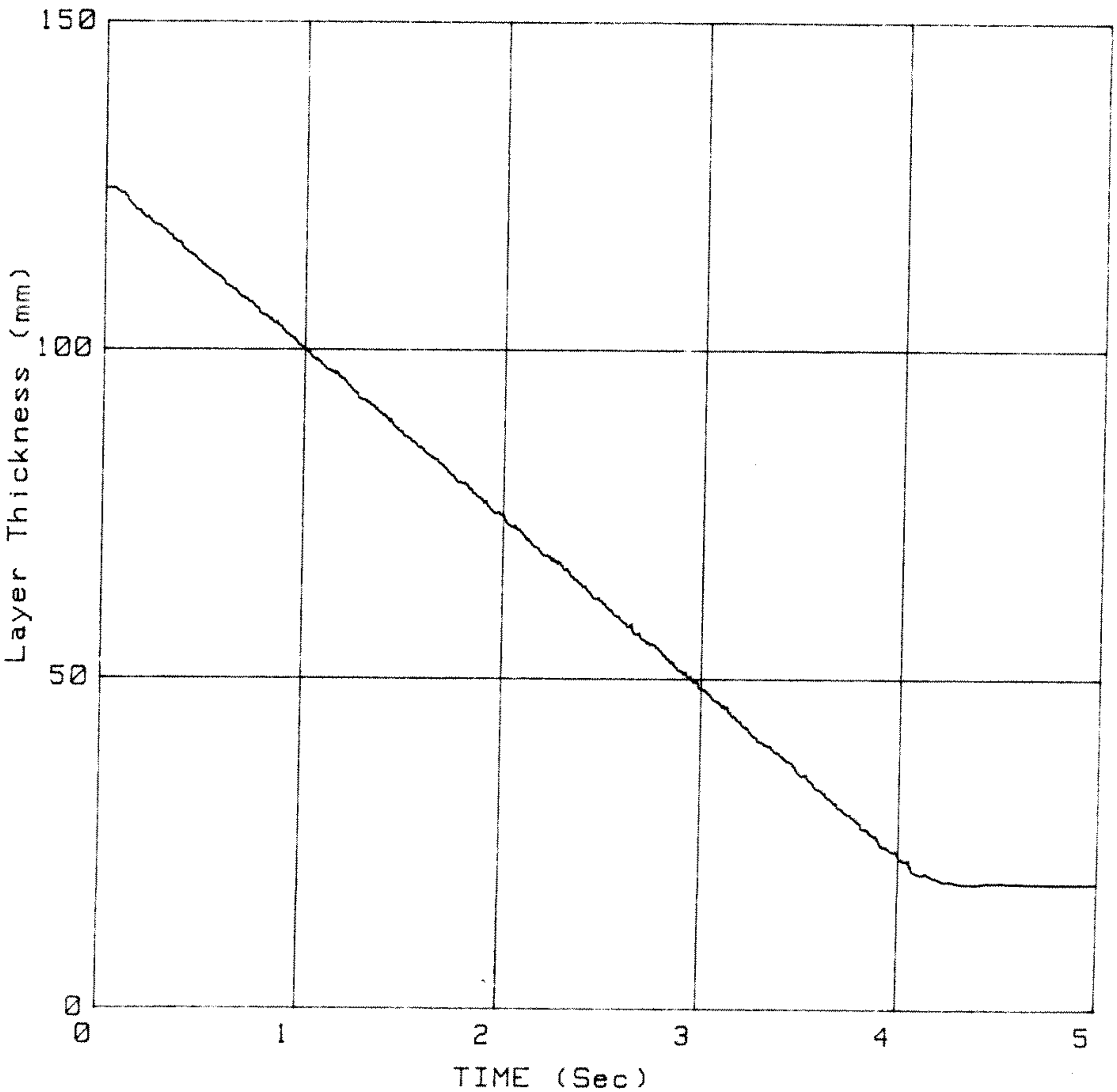
Layer Thickness vs. TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Average = 10
Truncation Time (s) = 5



Mean Plate Pressure
vs.
TIME

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

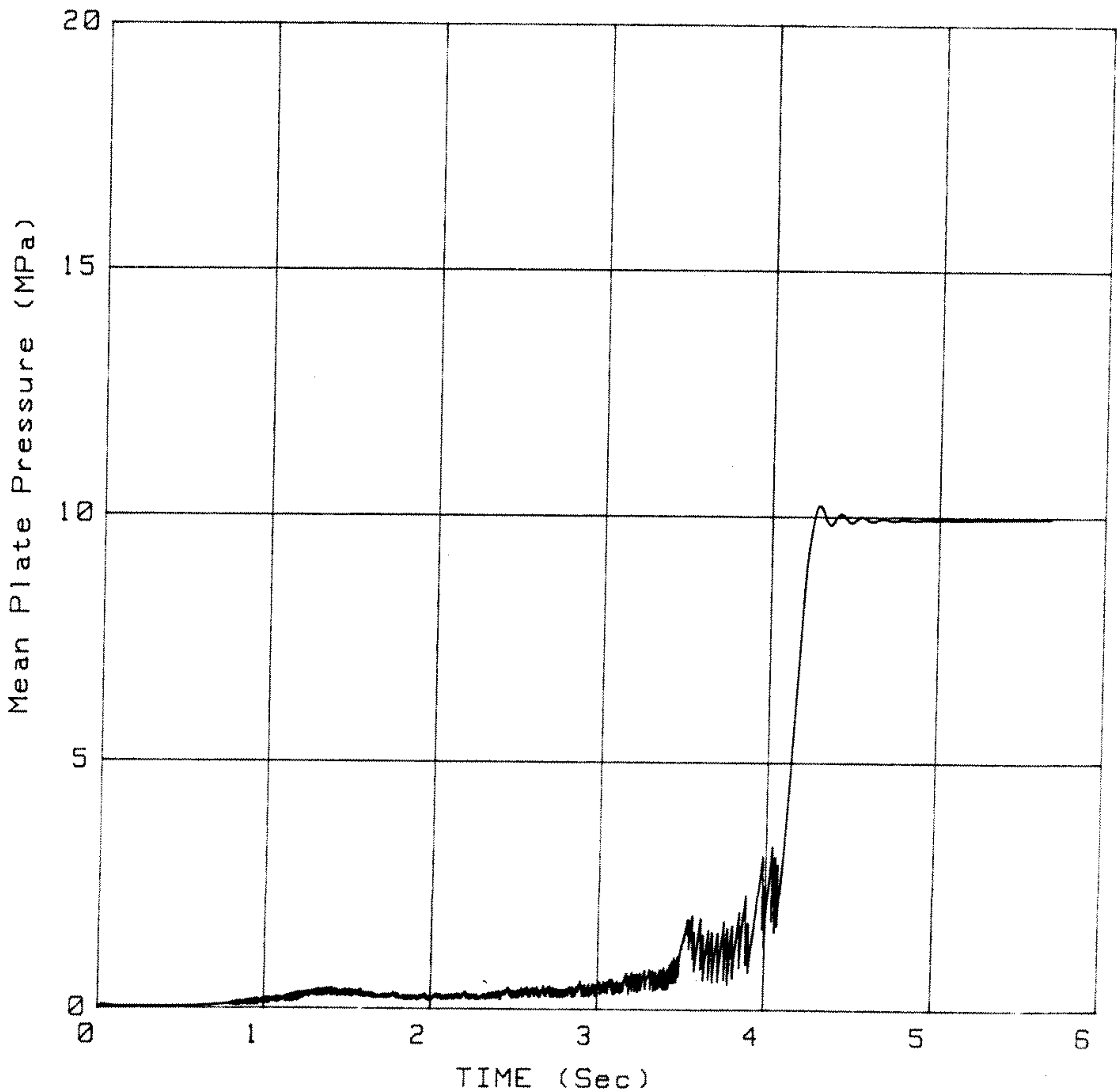
Date: 21 Dec 1988
Time: 09:56:01

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 5.67



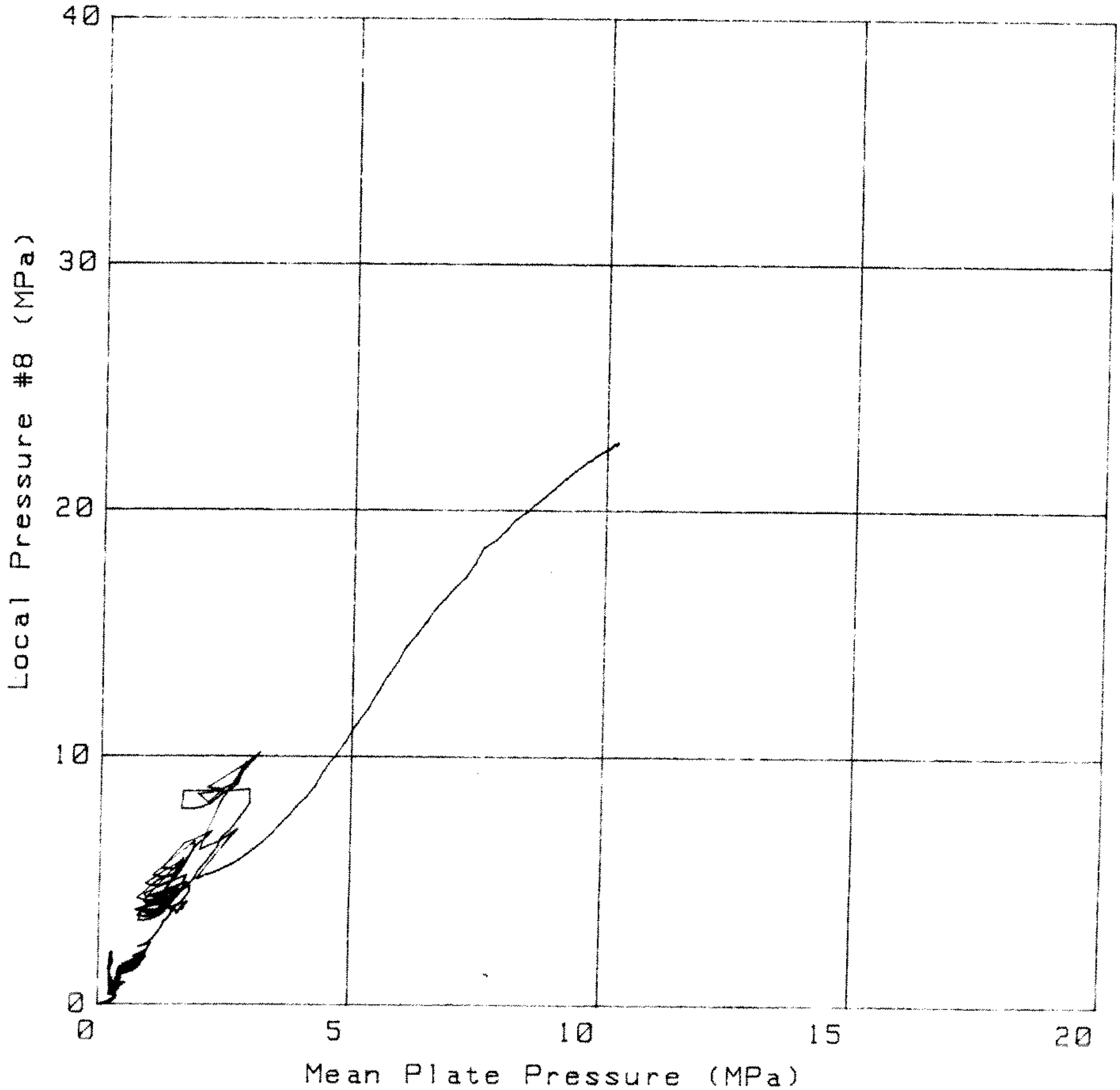
Local Pressure #8
vs.
Mean Plate Pressure

Test: X980
Type: Extrusion test
Sample: CRUSHED ICE

Date: 21 Dec 1988
Time: 09:56:01

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .65
Data To (s): 4.3



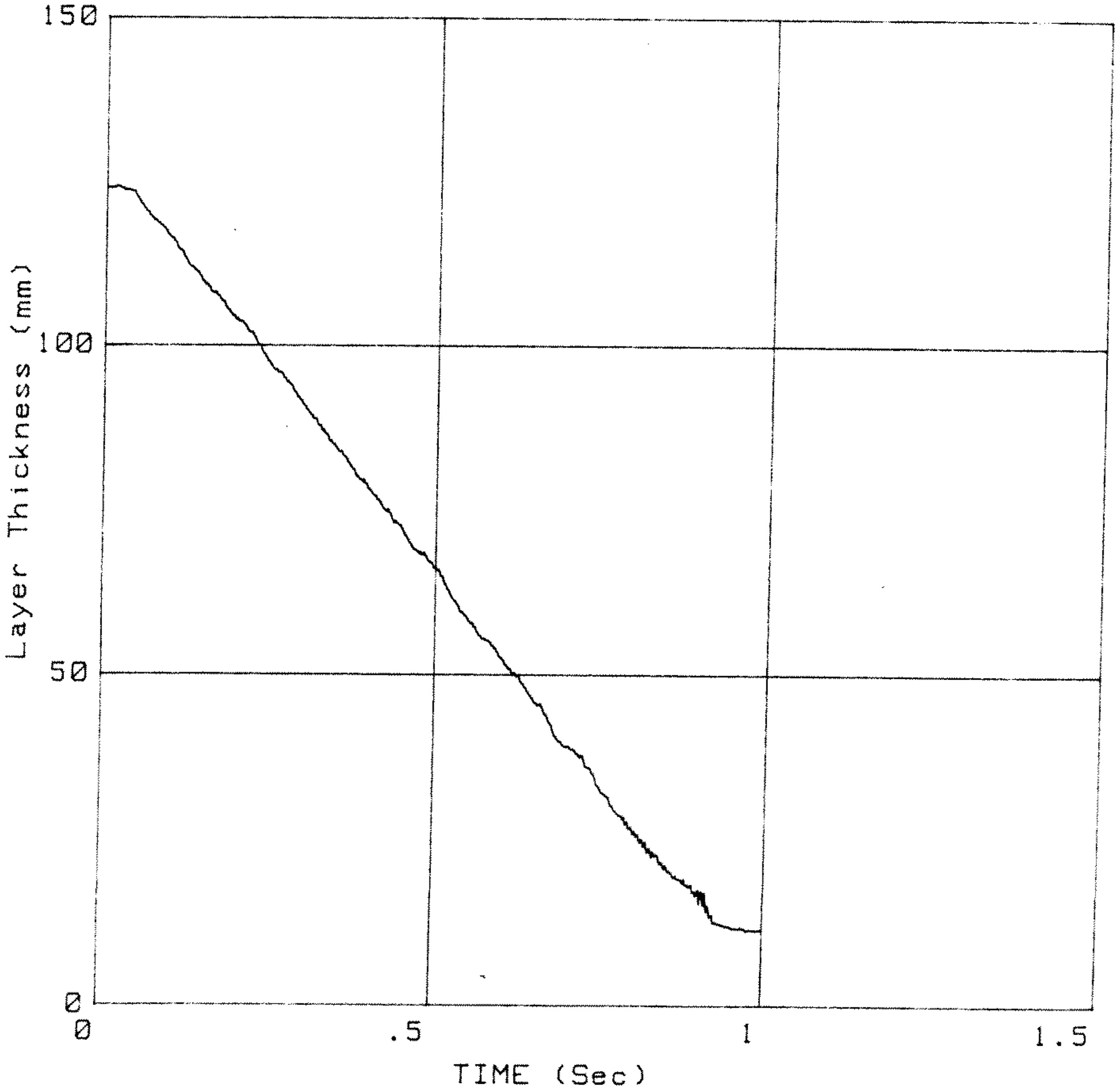
Layer Thickness
vs.
TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Temperature: -9.6

Average = 10
Truncation Time (s) = 1



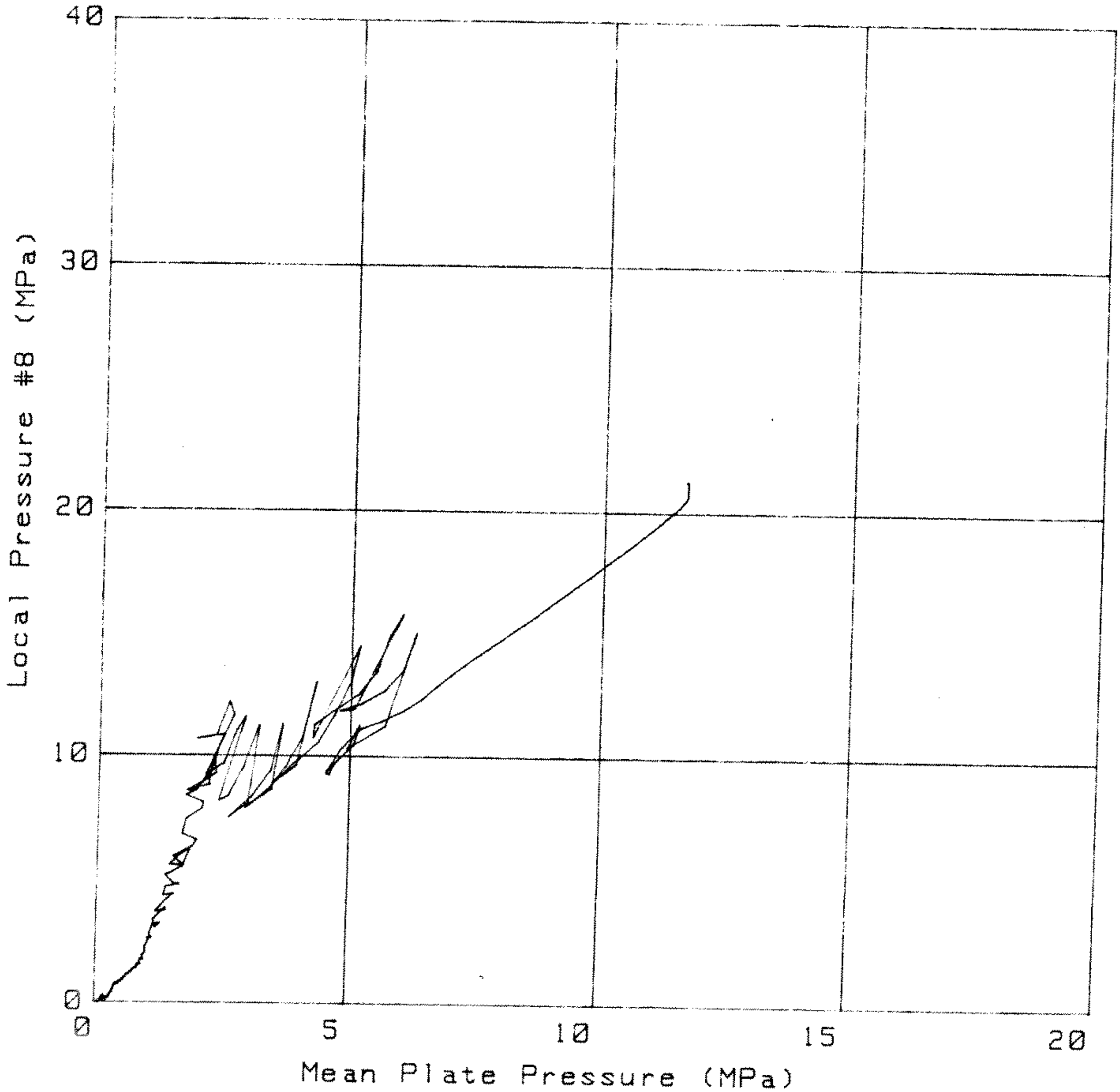
Local Pressure #8
vs.
Mean Plate Pressure

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Temperature: -9.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .13
Data To (s): .988



Local Pressure #16
vs.
TIME

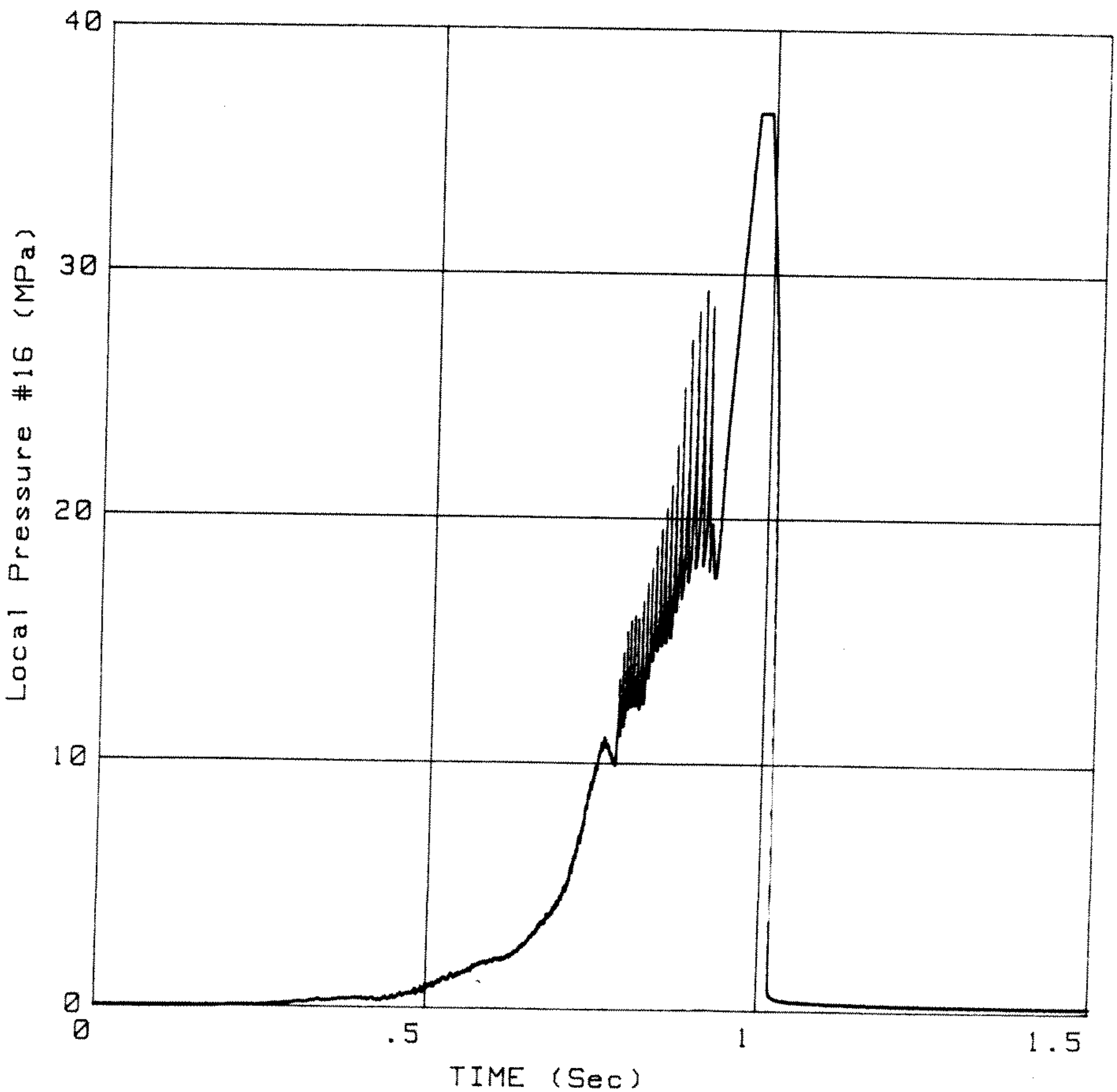
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57



Local Pressure #12
vs.
TIME

Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

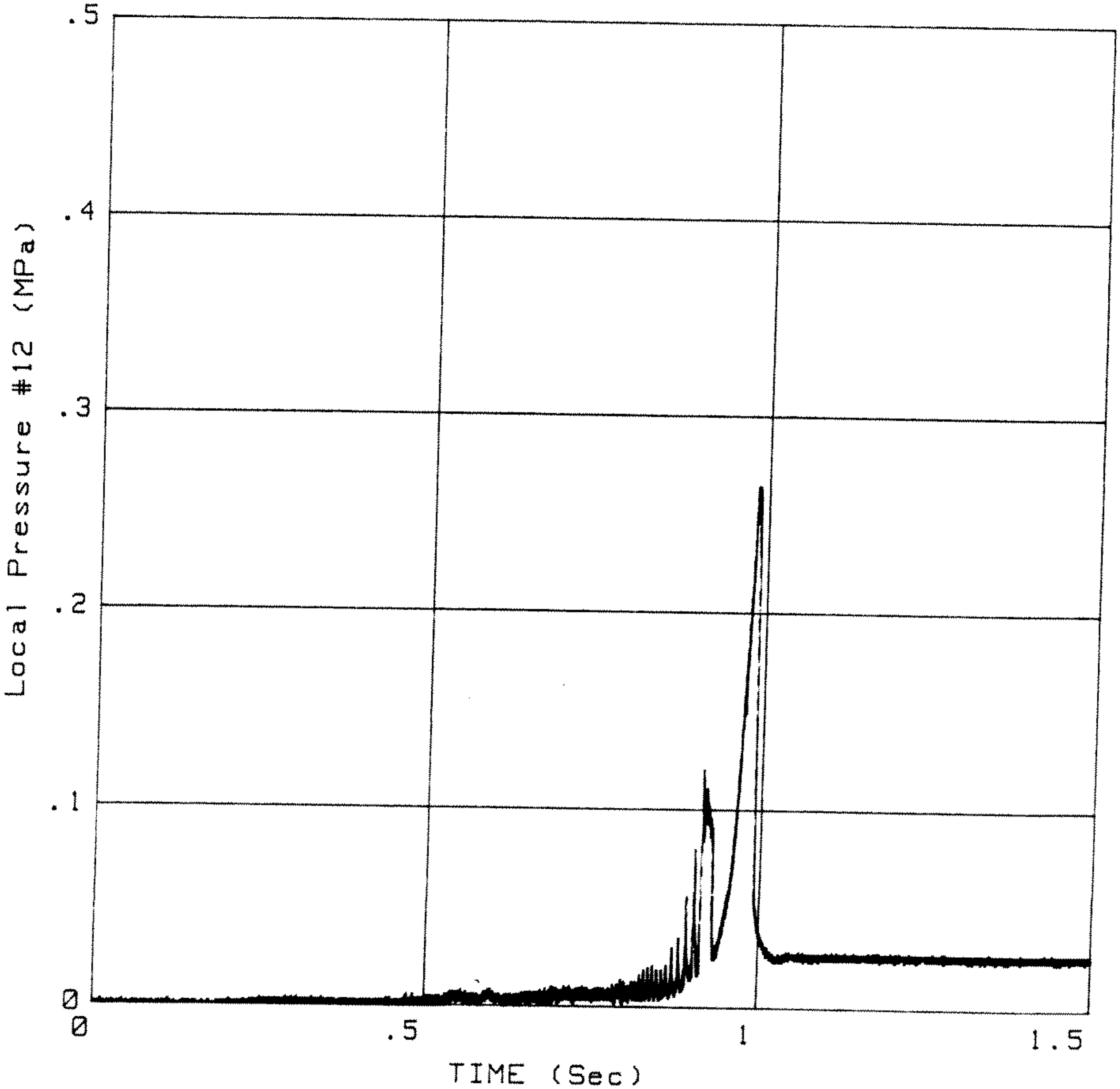
Date: 20 Dec 1988
Time: 14:23:00

Temperature: -9.6

Y Offset Removed

Average = 1

Truncation Time (s) = 2.57



Local Pressure #10
vs.
TIME

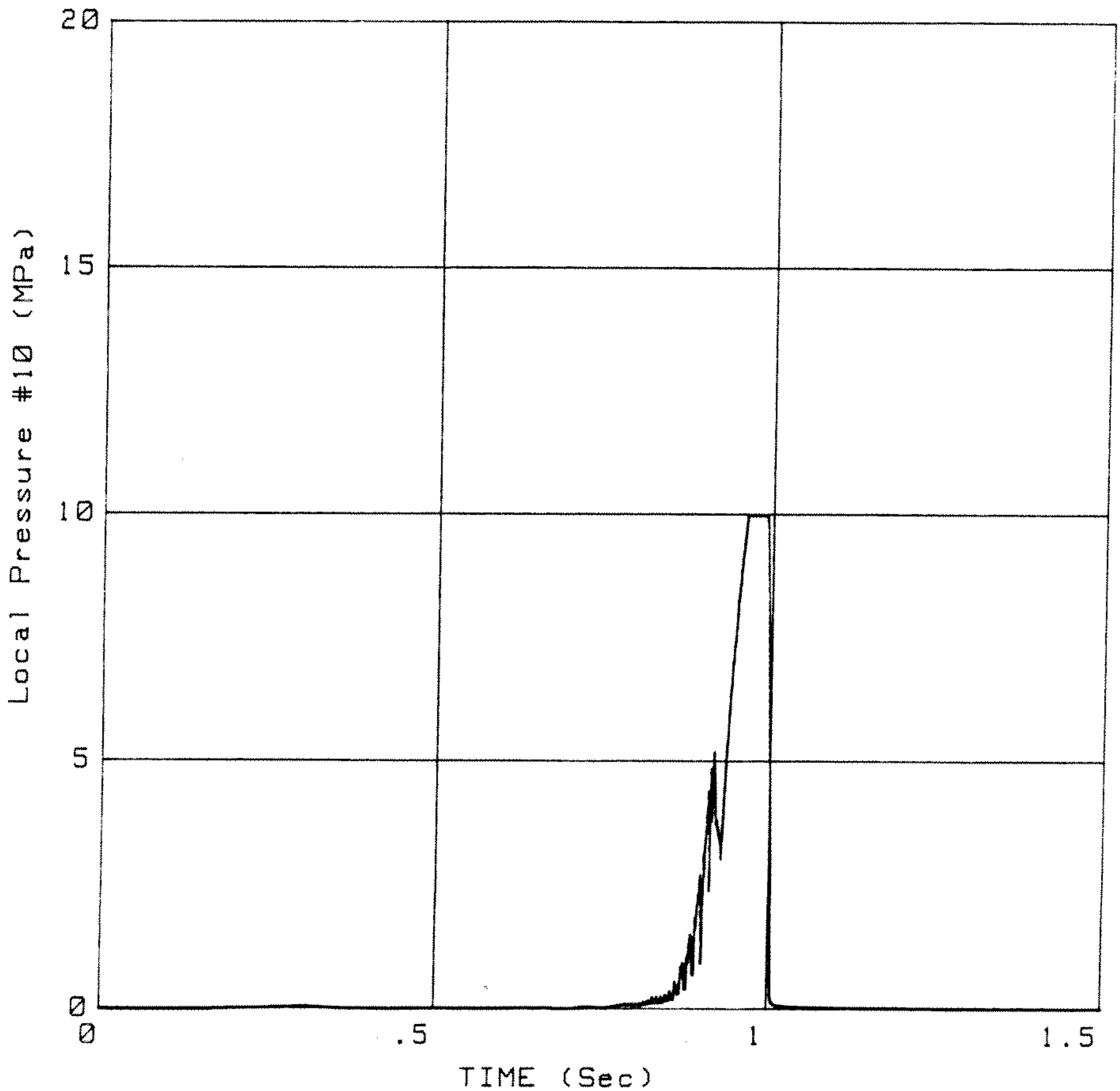
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57



Local Pressure #8
vs.
TIME

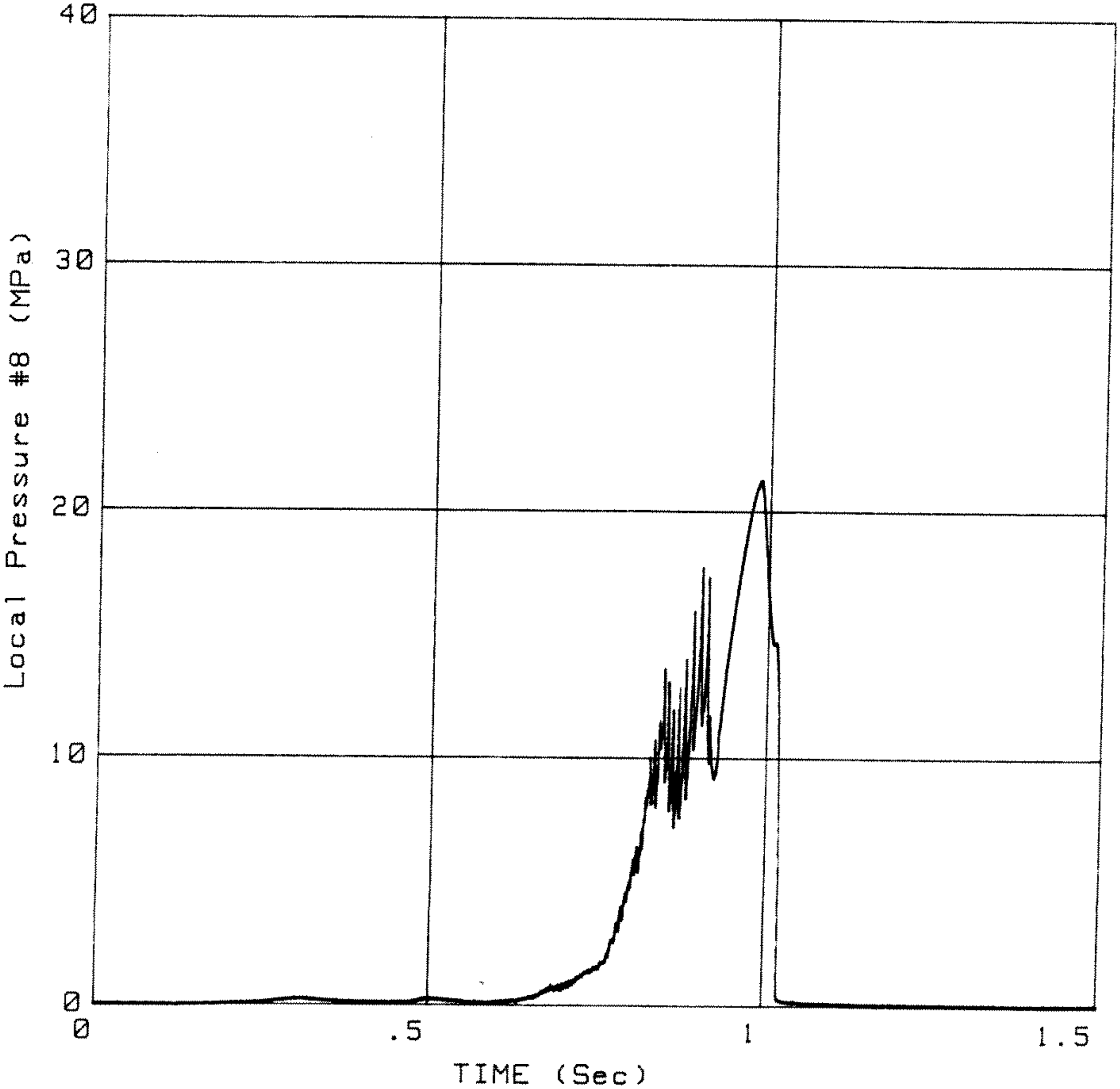
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 2.57



Mean Plate Pressure
vs.
TIME

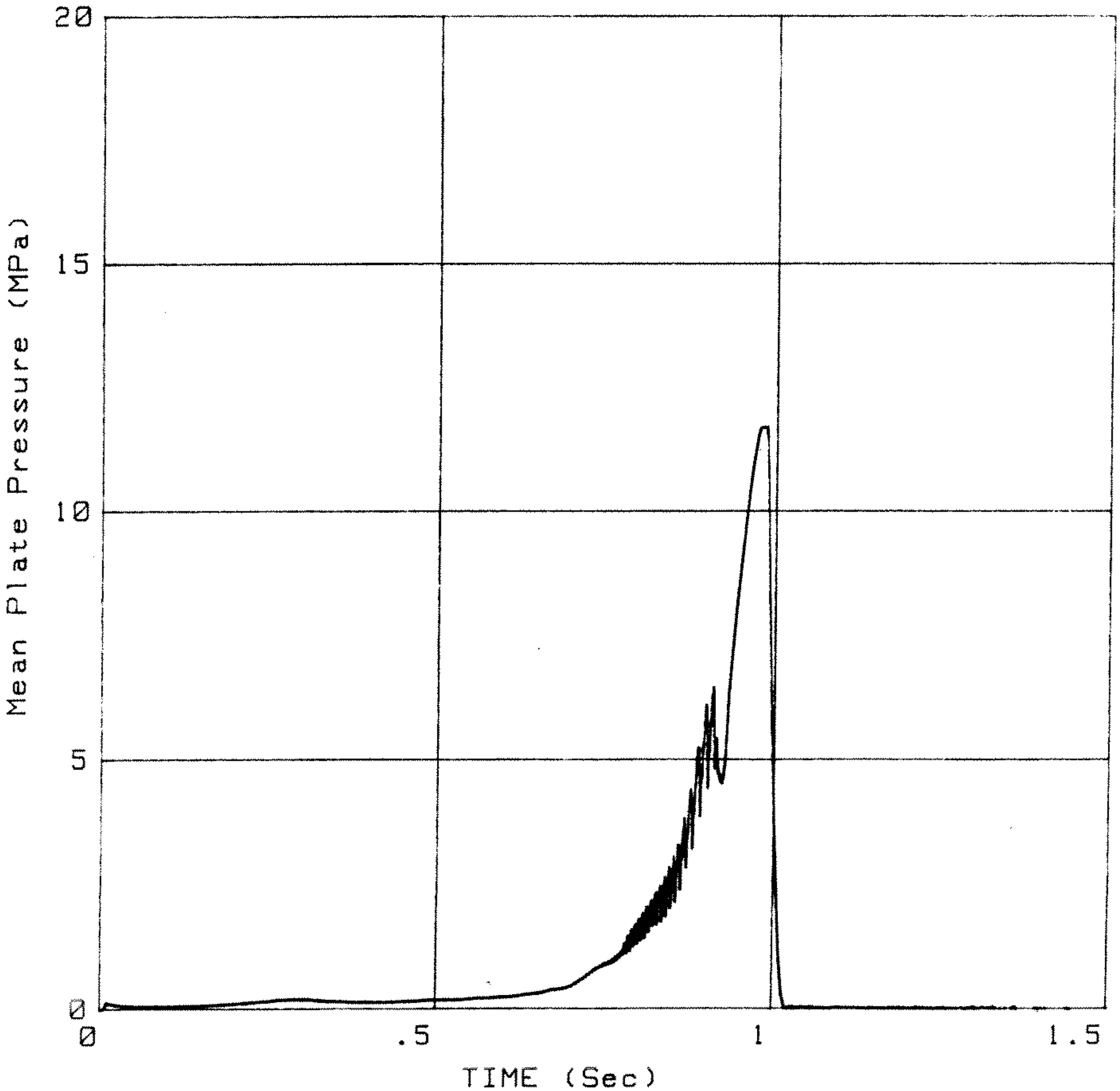
Test: X981
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 14:23:00

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57



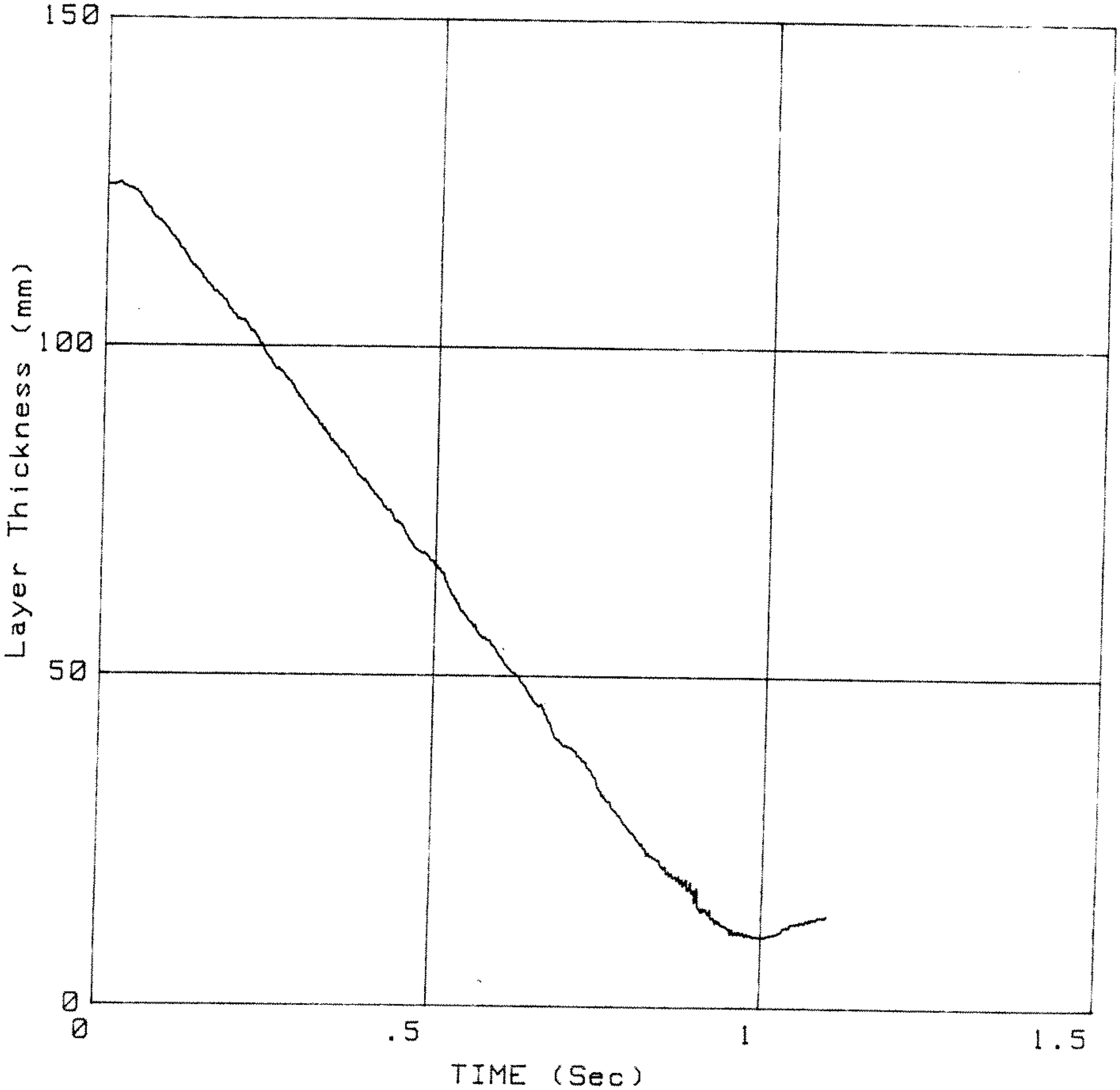
Layer Thickness
vs.
TIME

Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 10:55:44

Temperature: -10.2

Average = 10
Truncation Time (s) = 1.1



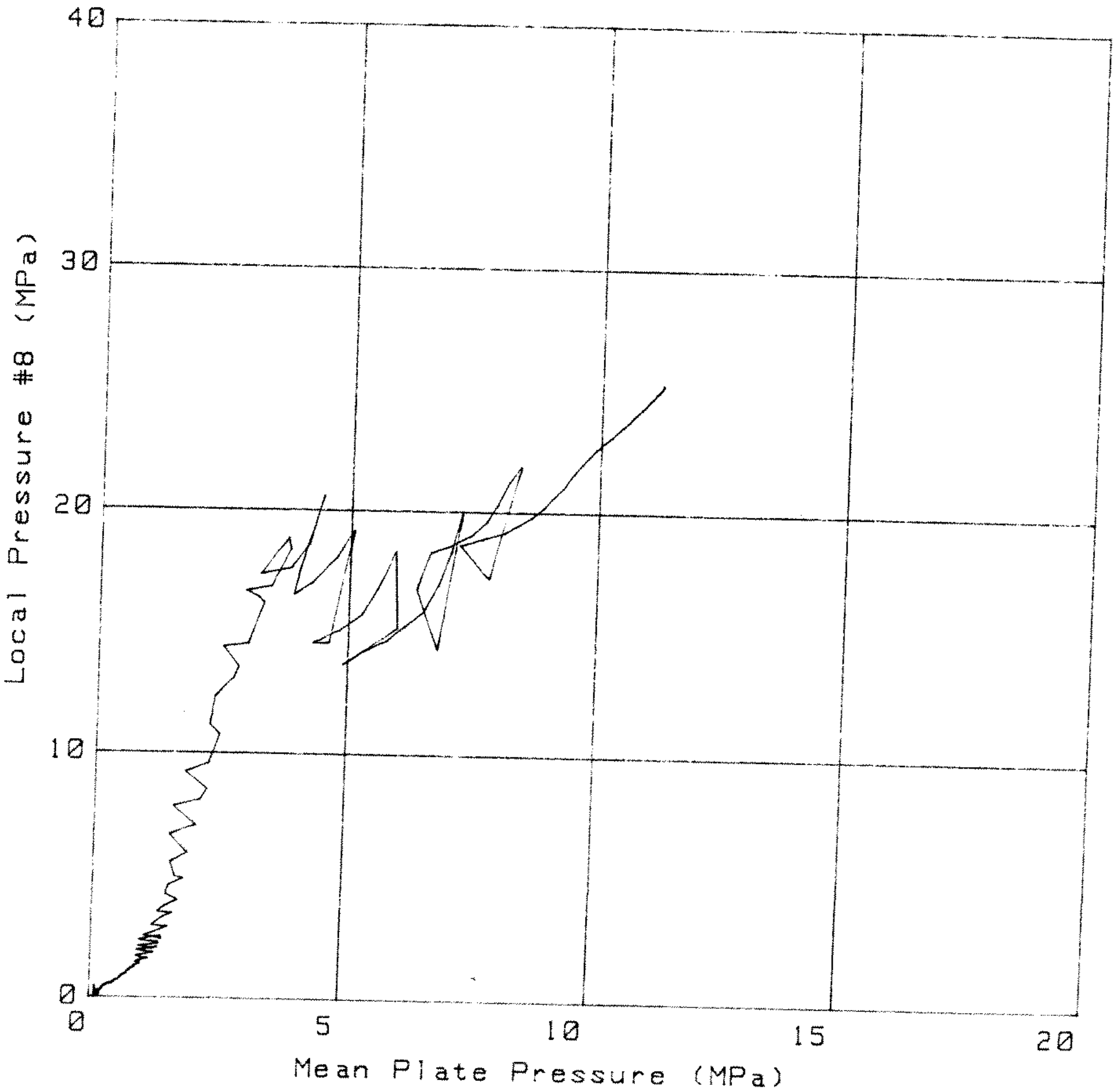
Local Pressure #8 vs. Mean Plate Pressure

Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 10:55:44

Temperature: -10.2

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .19
Data To (s): 1



Local Pressure #10 vs. TIME

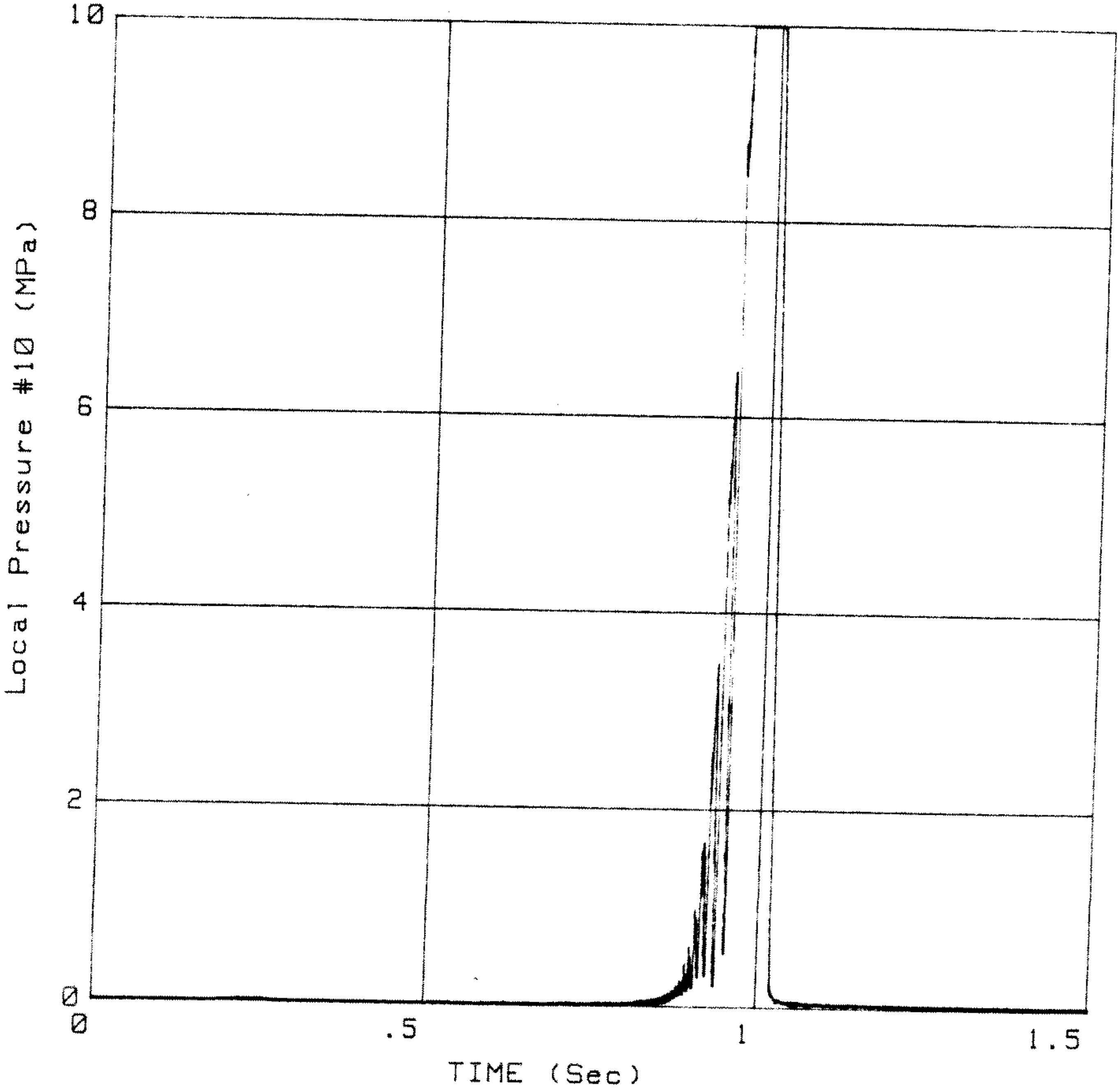
Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 10:55:44

Temperature: -10.2

Y Offset Removed

Average = 1
Truncation Time (s) = 2.57



Local Pressure #12
vs.
TIME

Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

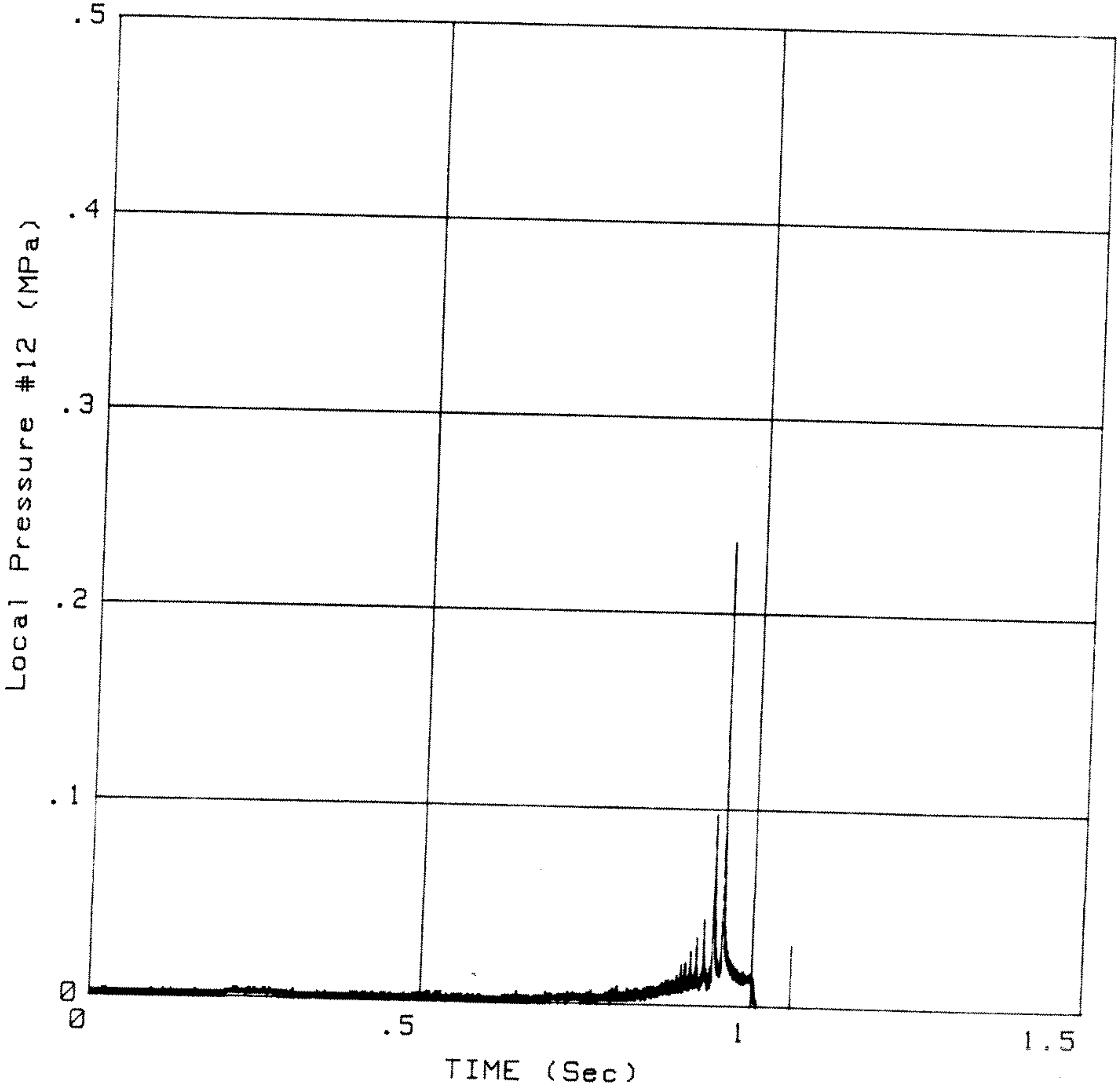
Date: 20 Dec 1988
Time: 10:55:44

Temperature: -10.2

Y Offset Removed

Average = 1

Truncation Time (s) = 2.57



Local Pressure #16
vs.
TIME

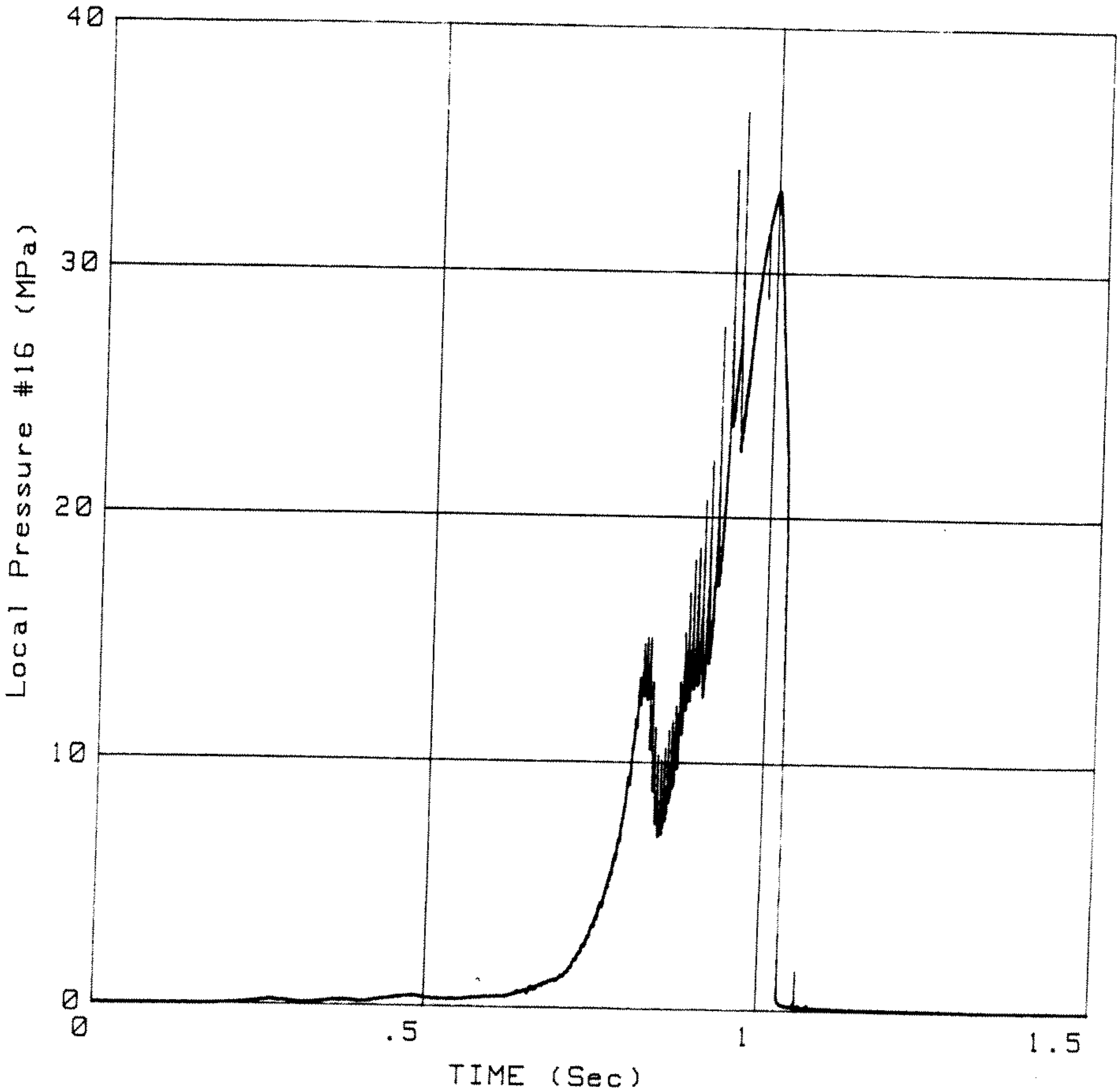
Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 10:55:44

Y Offset Removed

Temperature: -10.2

Average = 1
Truncation Time (s) = 2.57



Local Pressure #8 vs. TIME

Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

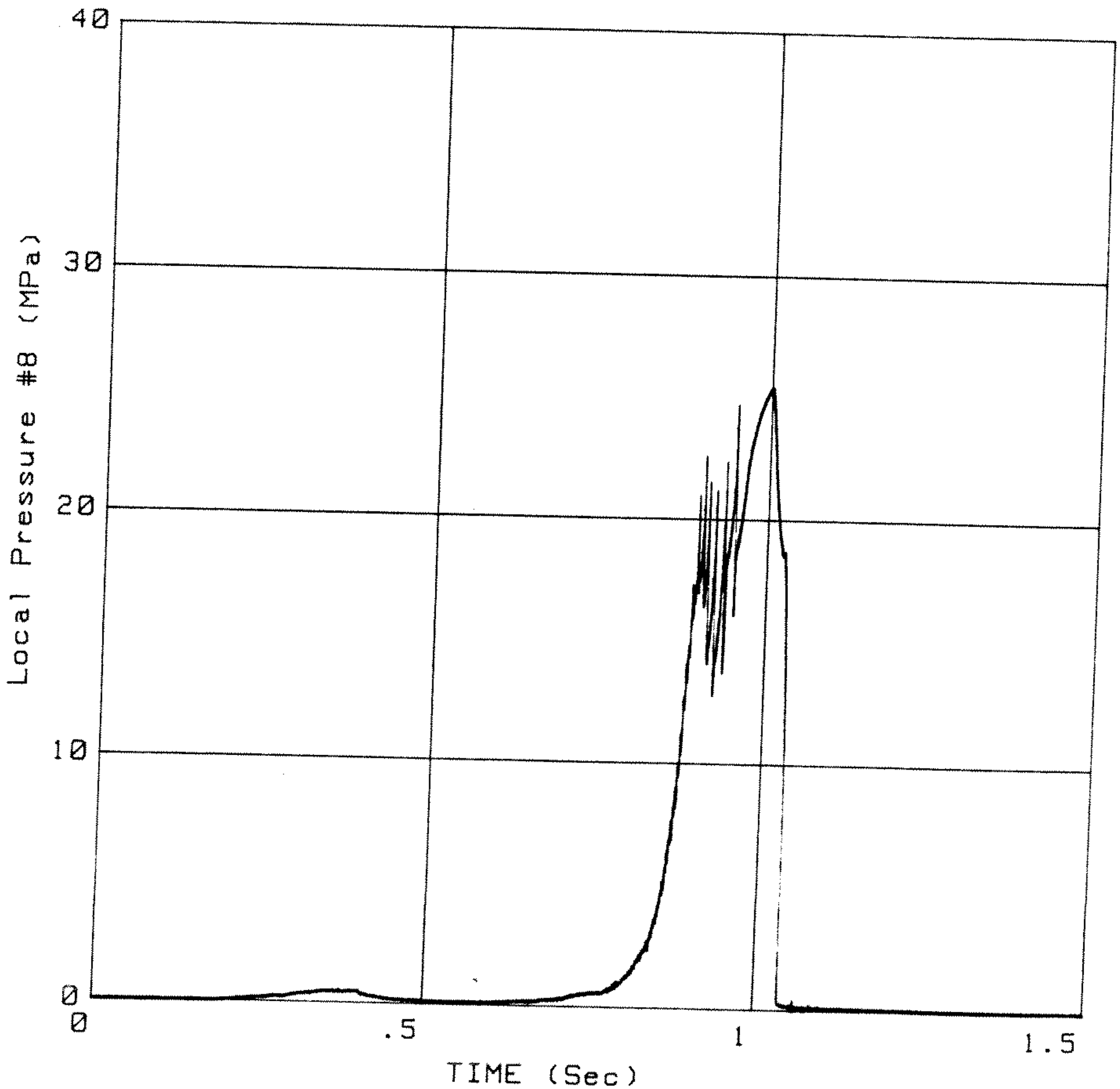
Date: 20 Dec 1988
Time: 10:55:44

Temperature: -10.2

Y Offset Removed

Average = 1

Truncation Time (s) = 2.57



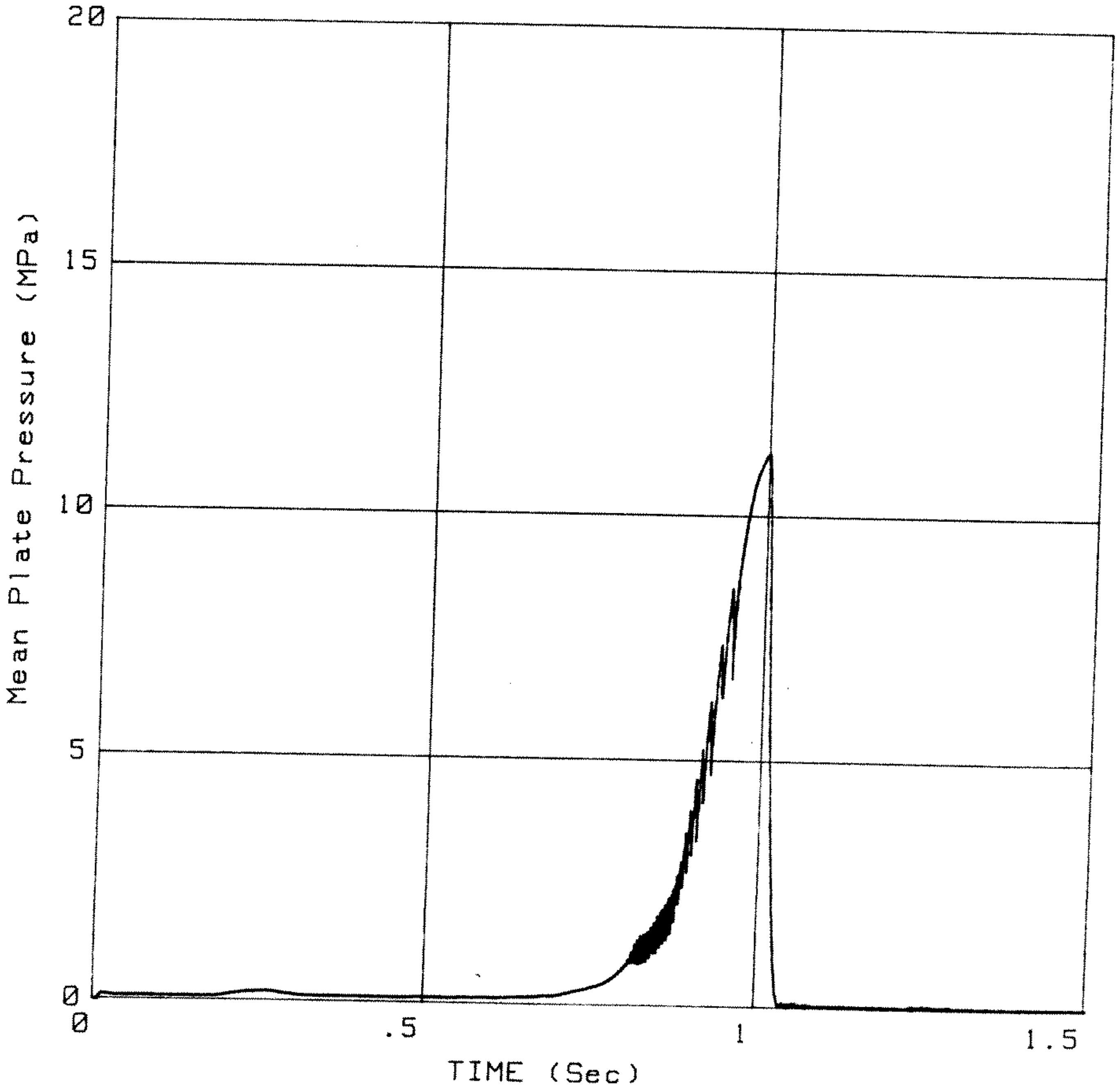
Mean Plate Pressure
vs.
TIME

Test: X982
Type: Extrusion test
Sample: CRUSHED ICE

Date: 20 Dec 1988
Time: 10:55:44

Temperature: -10.2

Average = 1
Truncation Time (s) = 2.57

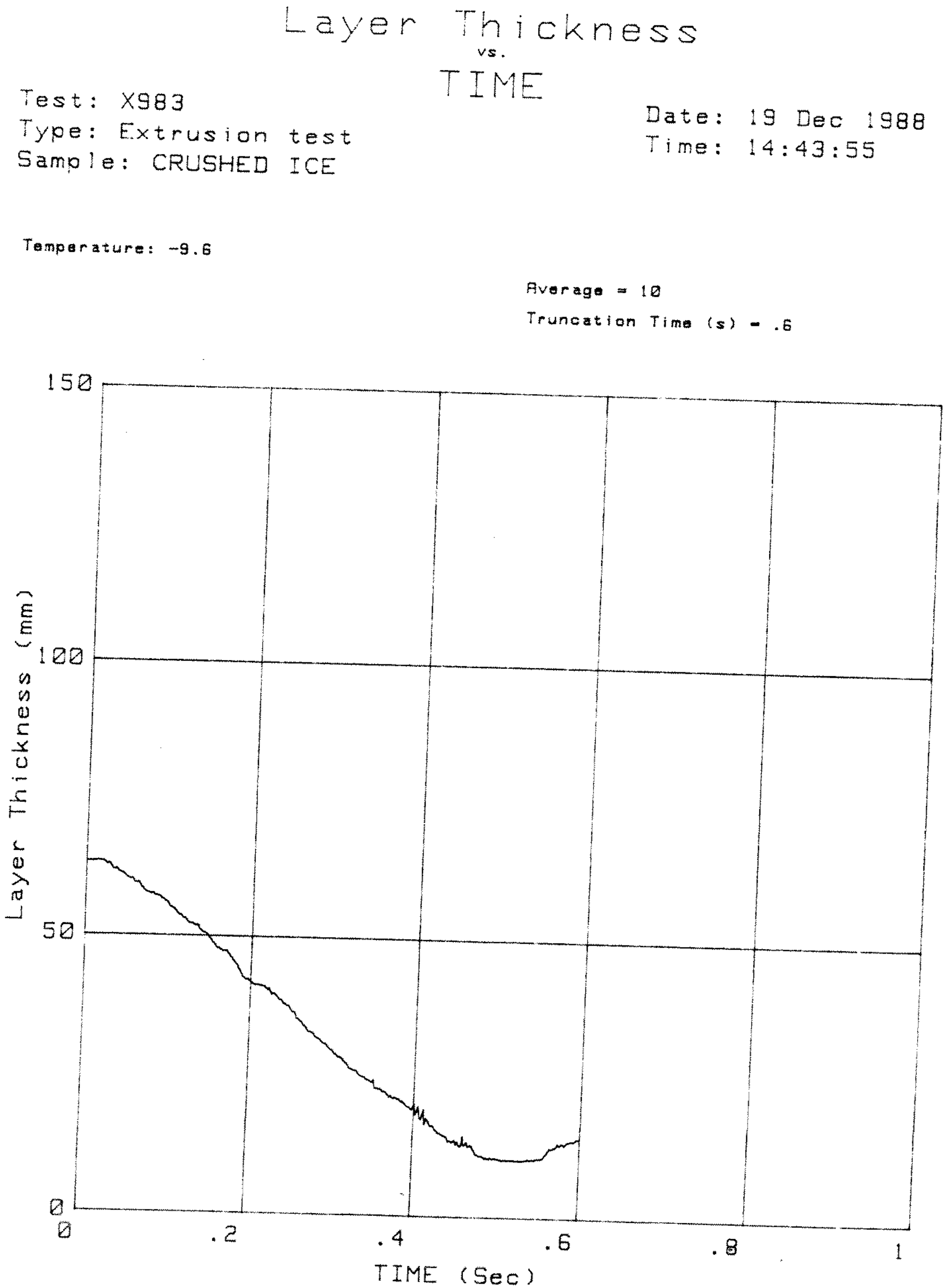


Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 14:43:55

Temperature: -9.6

Average = 10
Truncation Time (s) = .6



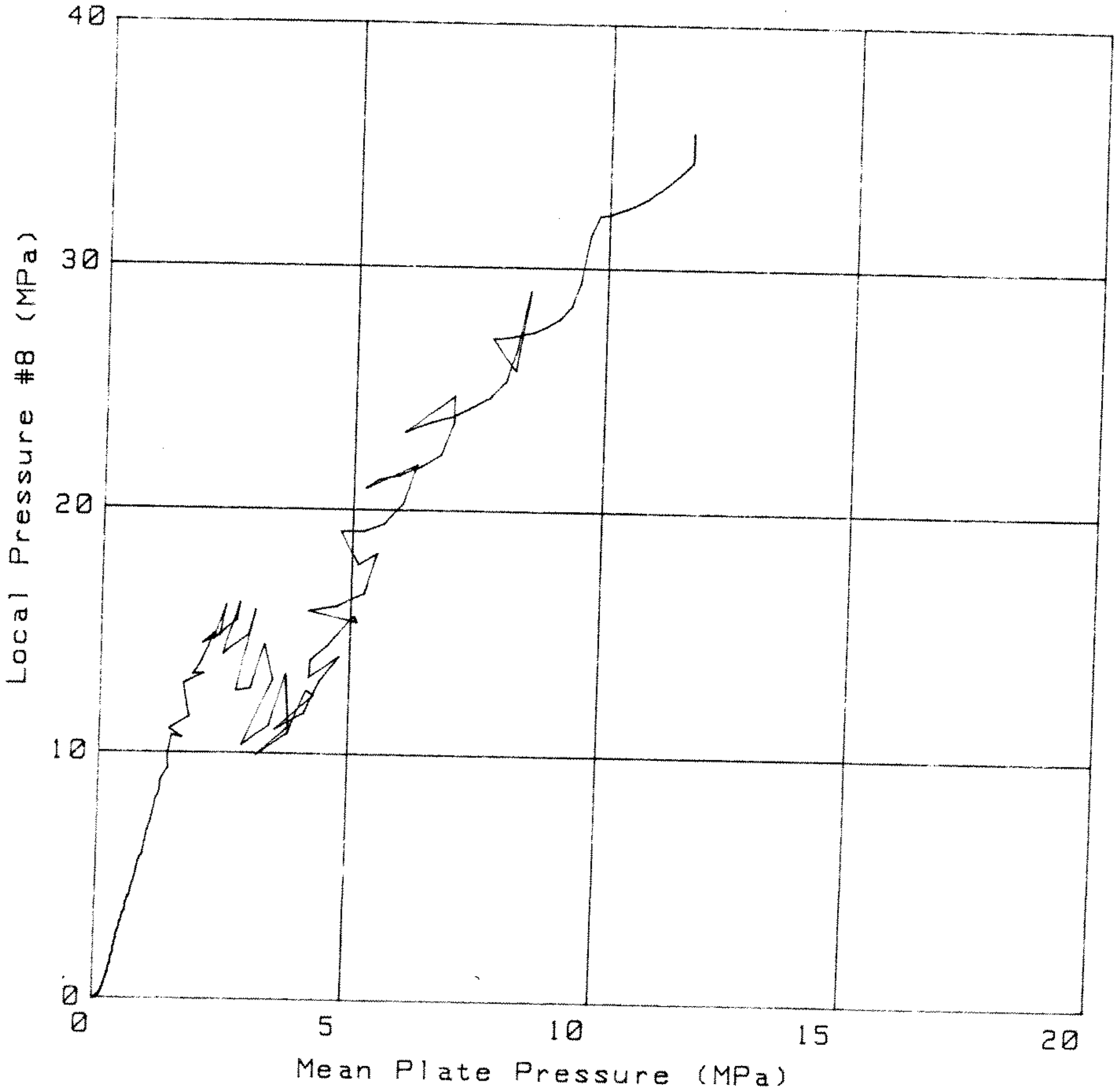
Local Pressure #8
vs.
Mean Plate Pressure

Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 14:43:55

Temperature: -9.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .09
Data To (s): .53



Local Pressure #12
vs.
TIME

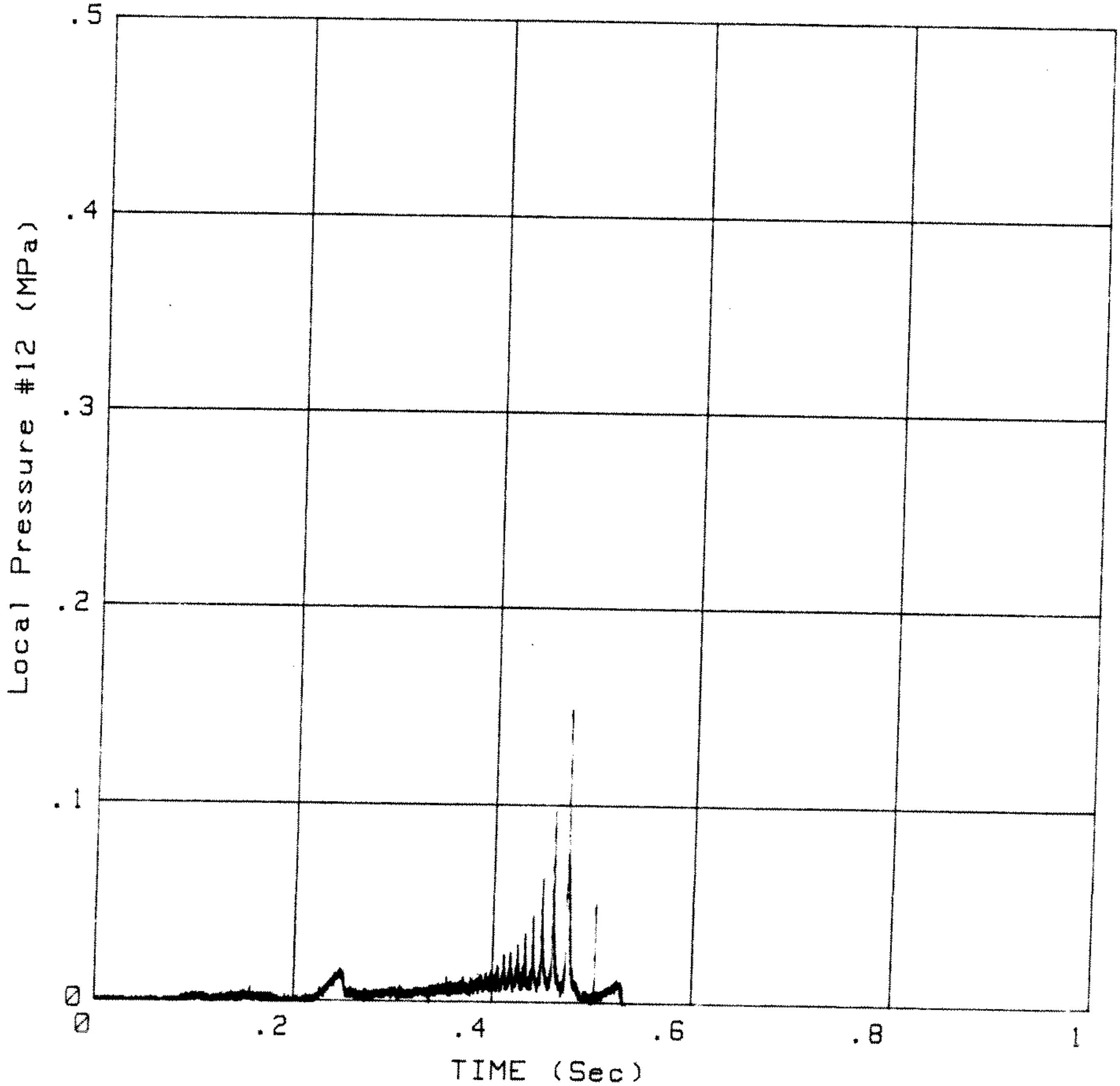
Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 14:43:55

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57



Local Pressure #10
vs.
TIME

Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

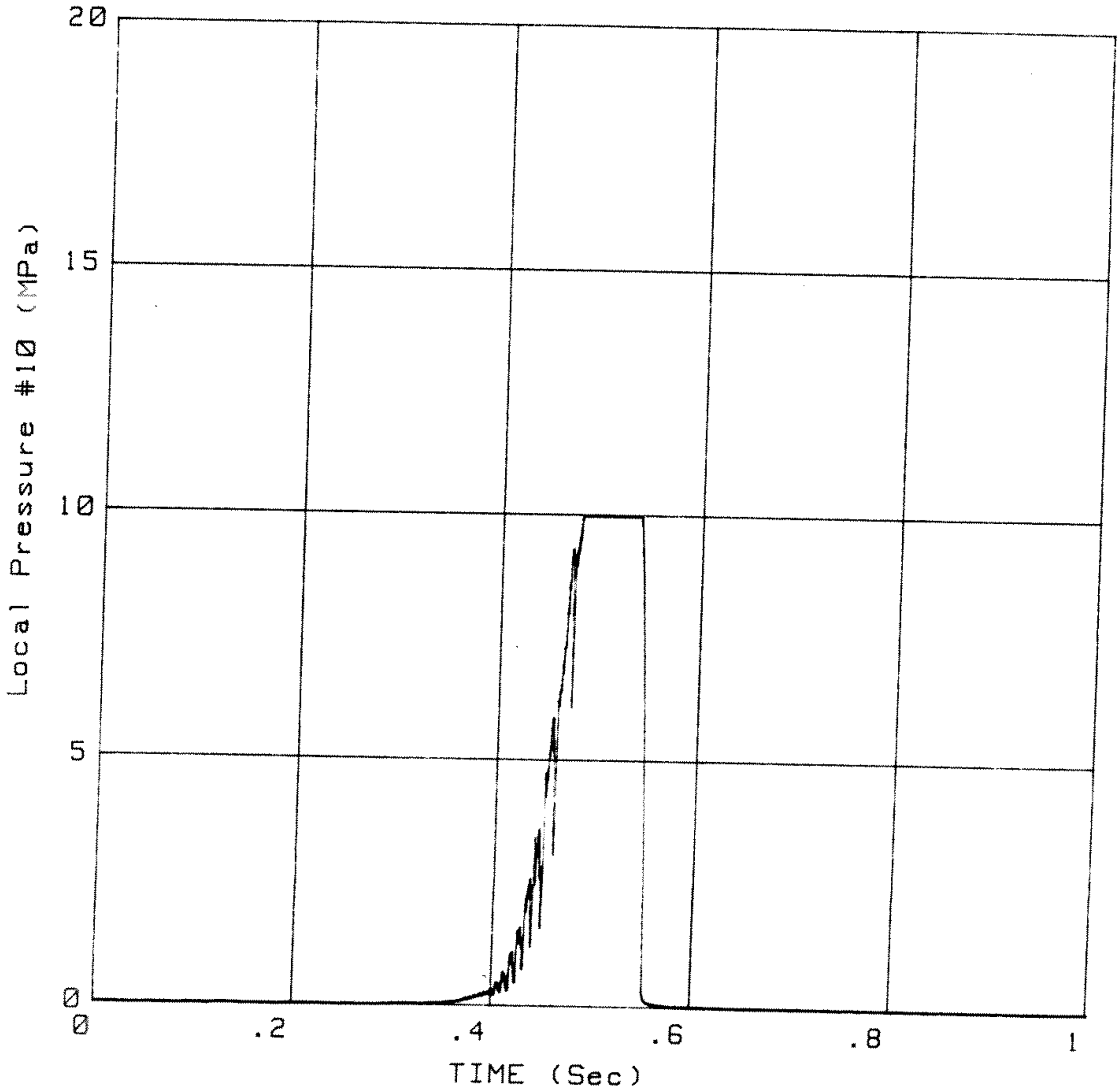
Date: 19 Dec 1988
Time: 14:43:55

Temperature: -9.6

Y Offset Removed

Average = 1

Truncation Time (s) = 2.57



Local Pressure #16
vs.
TIME

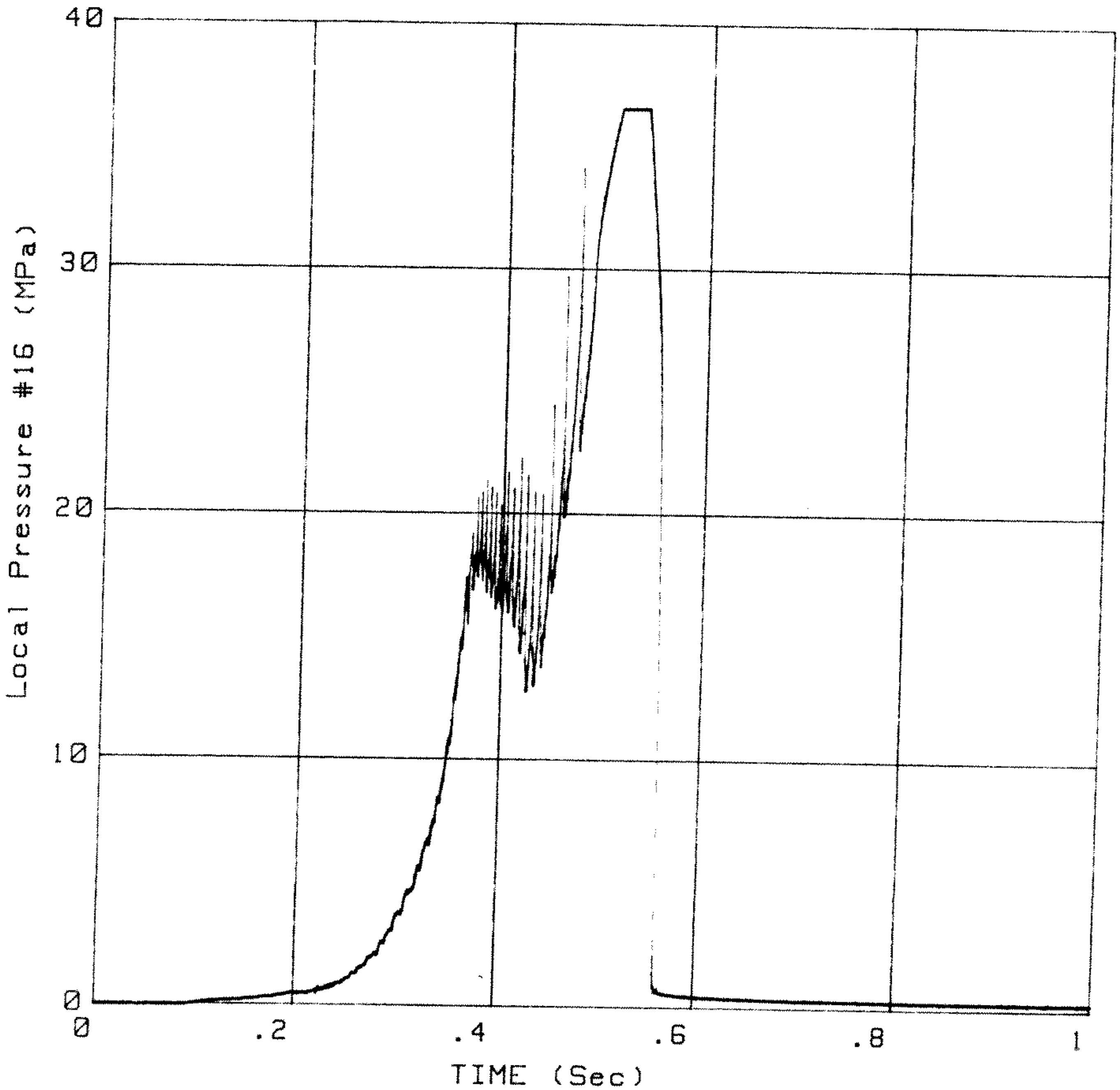
Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 14:43:55

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57



Local Pressure #8

vs.

TIME

Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

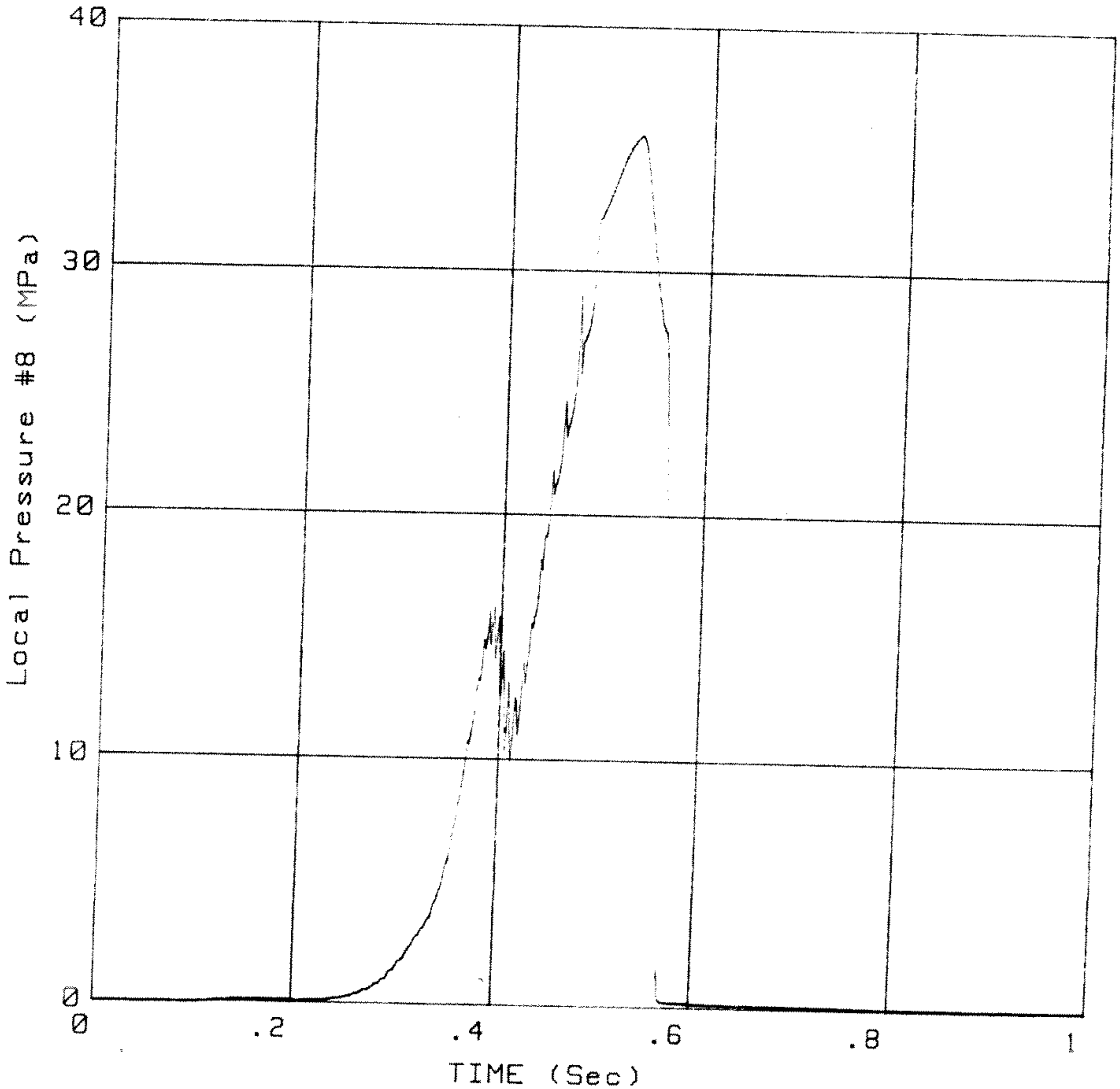
Date: 19 Dec 1988
Time: 14:43:55

Temperature: -9.6

Y Offset Removed

Average = 10

Truncation Time (s) = 2.57



Mean Plate Pressure
vs.
TIME

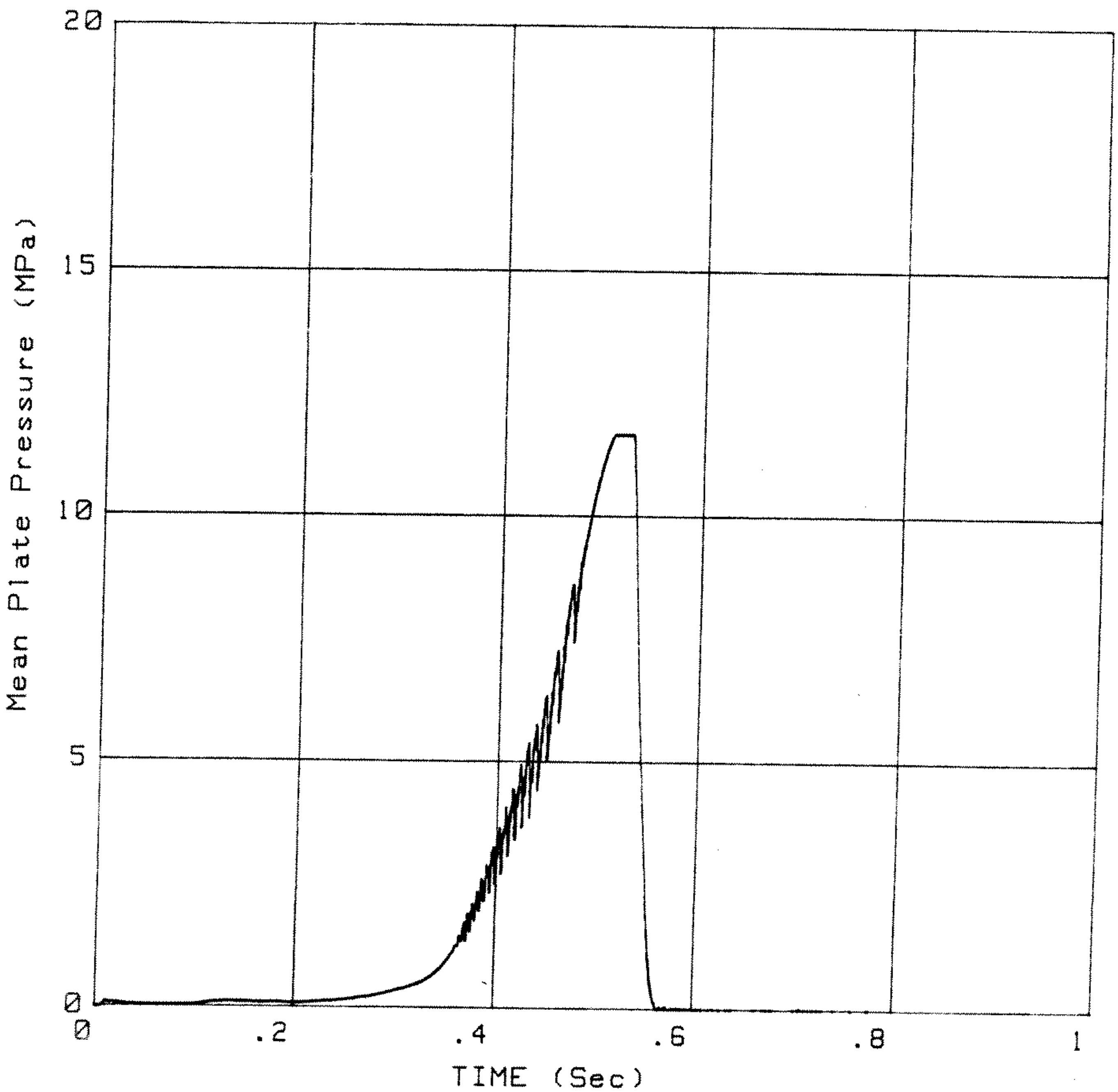
Test: X983
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 14:43:55

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.57



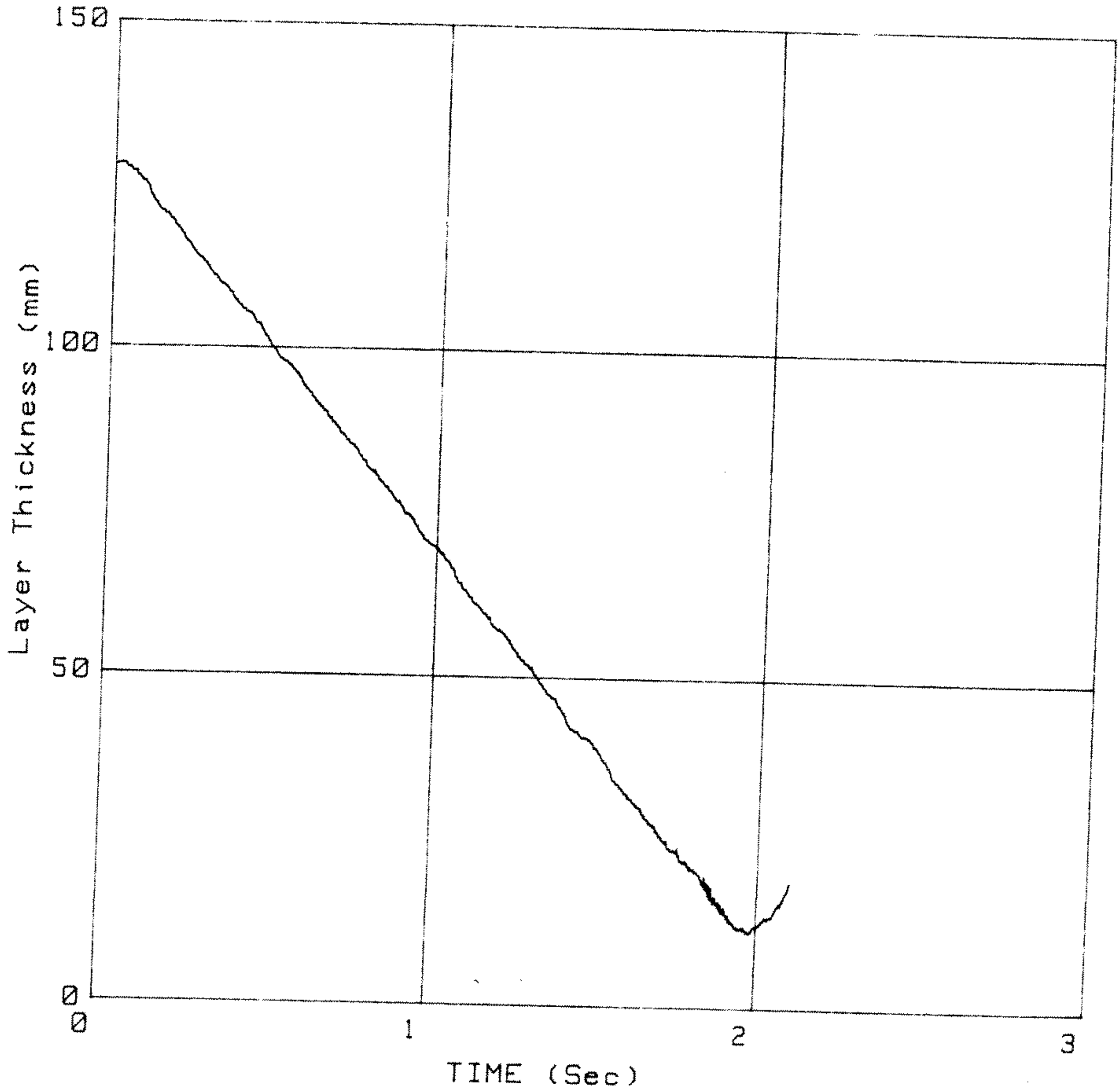
Layer Thickness
vs.
TIME

Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 10:24:25

Temperature: -9.8

Average = 10
Truncation Time (s) = 2.1



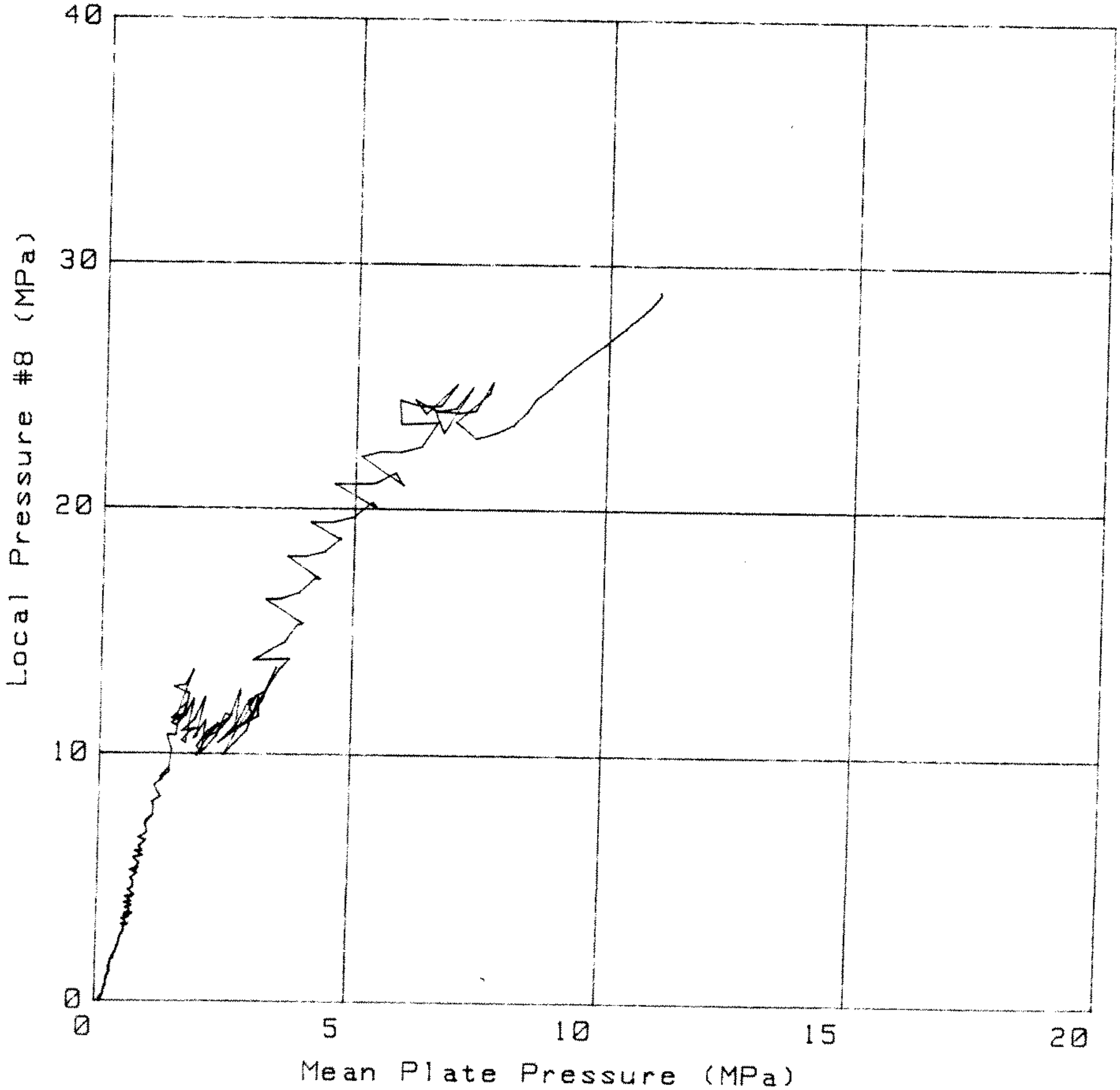
Local Pressure #8
vs.
Mean Plate Pressure

Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 10:24:25

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .4
Data To (s): 1.98



Local Pressure #12
vs.
TIME

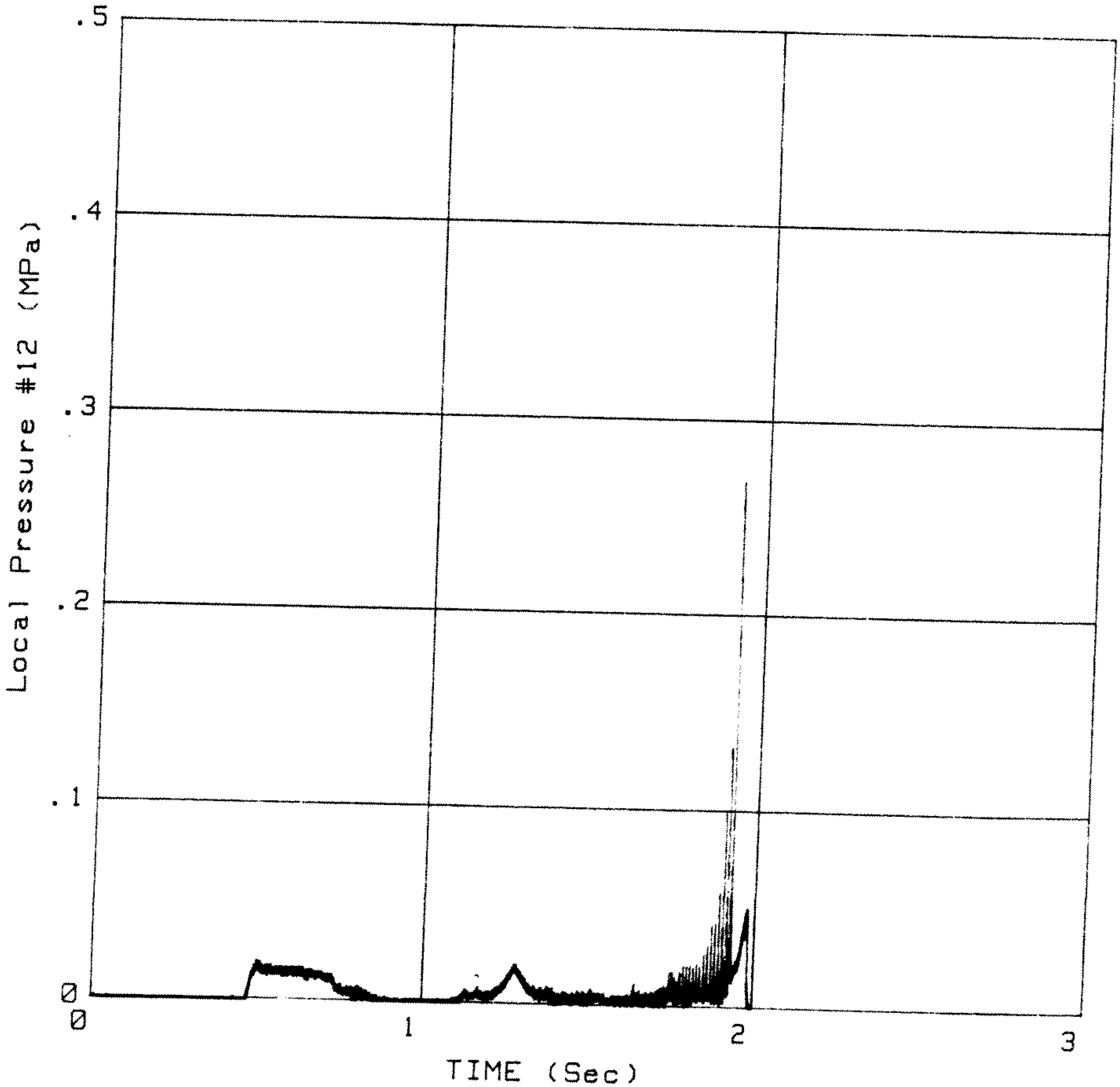
Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 10:24:25

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 3.4



Local Pressure #10
vs.
TIME

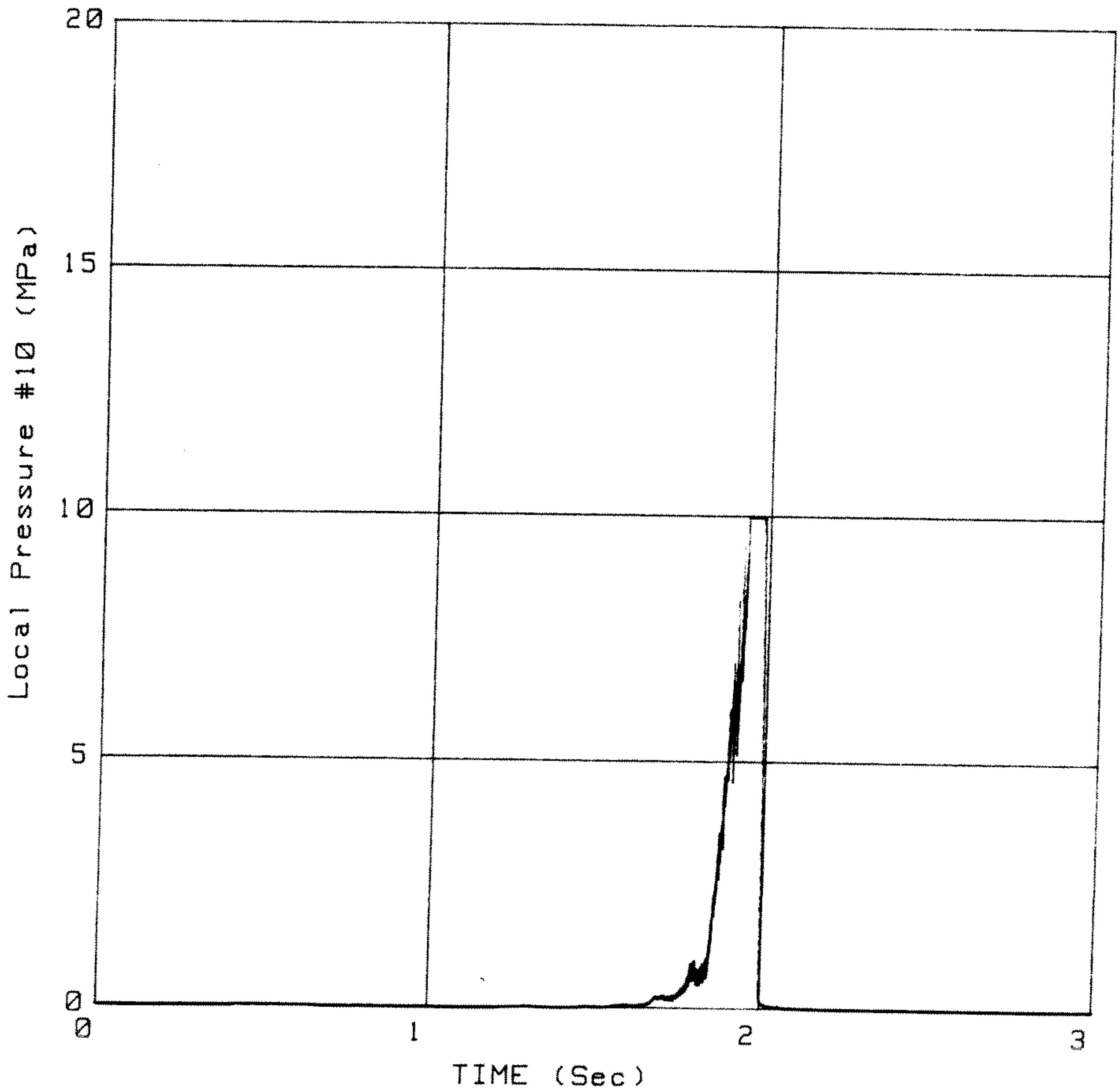
Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 10:24:25

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 3.4



Local Pressure #8
vs.
TIME

Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

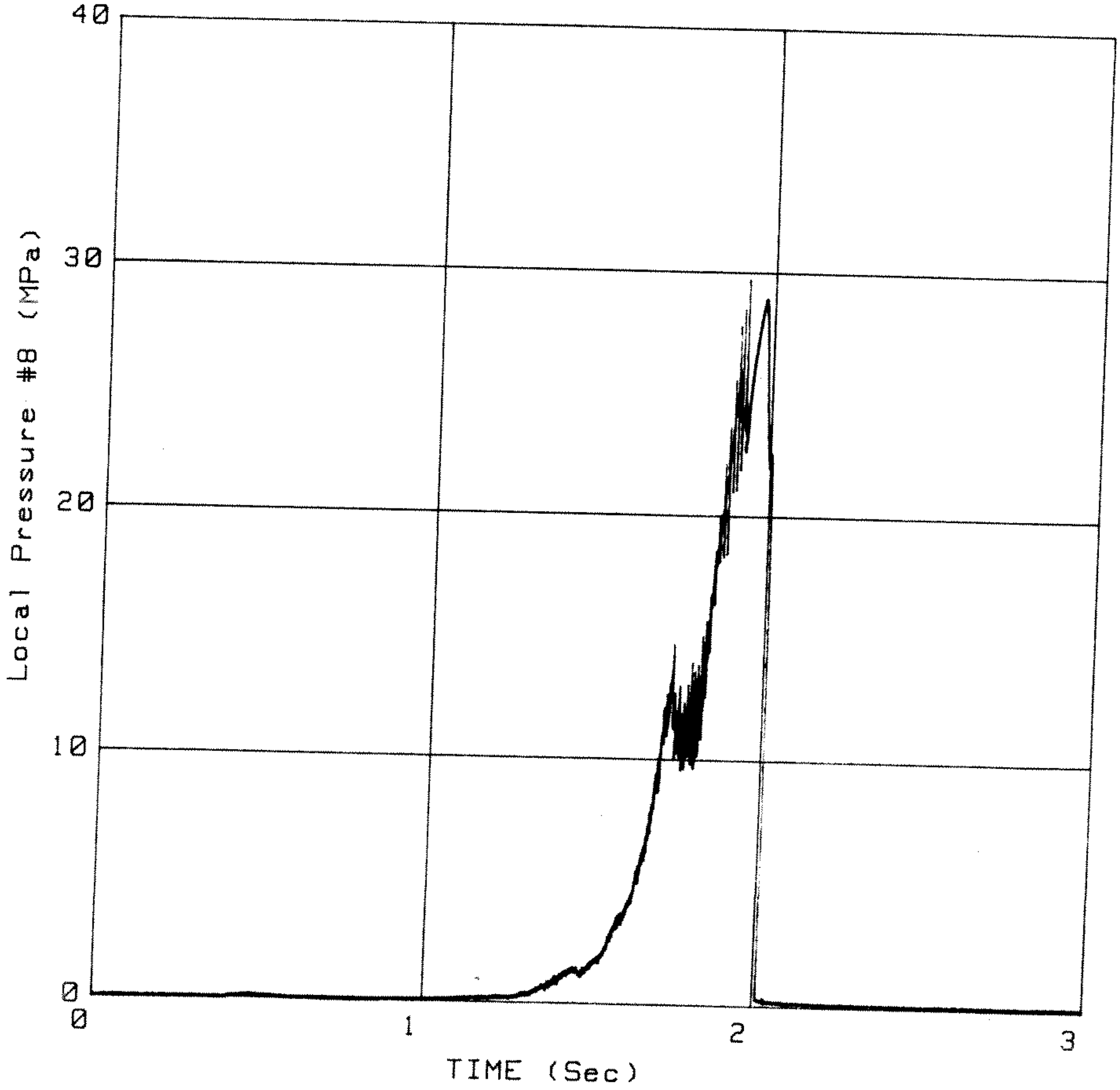
Date: 19 Dec 1988
Time: 10:24:25

Temperature: -9.8

Y Offset Removed

Average = 1

Truncation Time (s) = 3.4



Local Pressure #16
vs.
TIME

Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

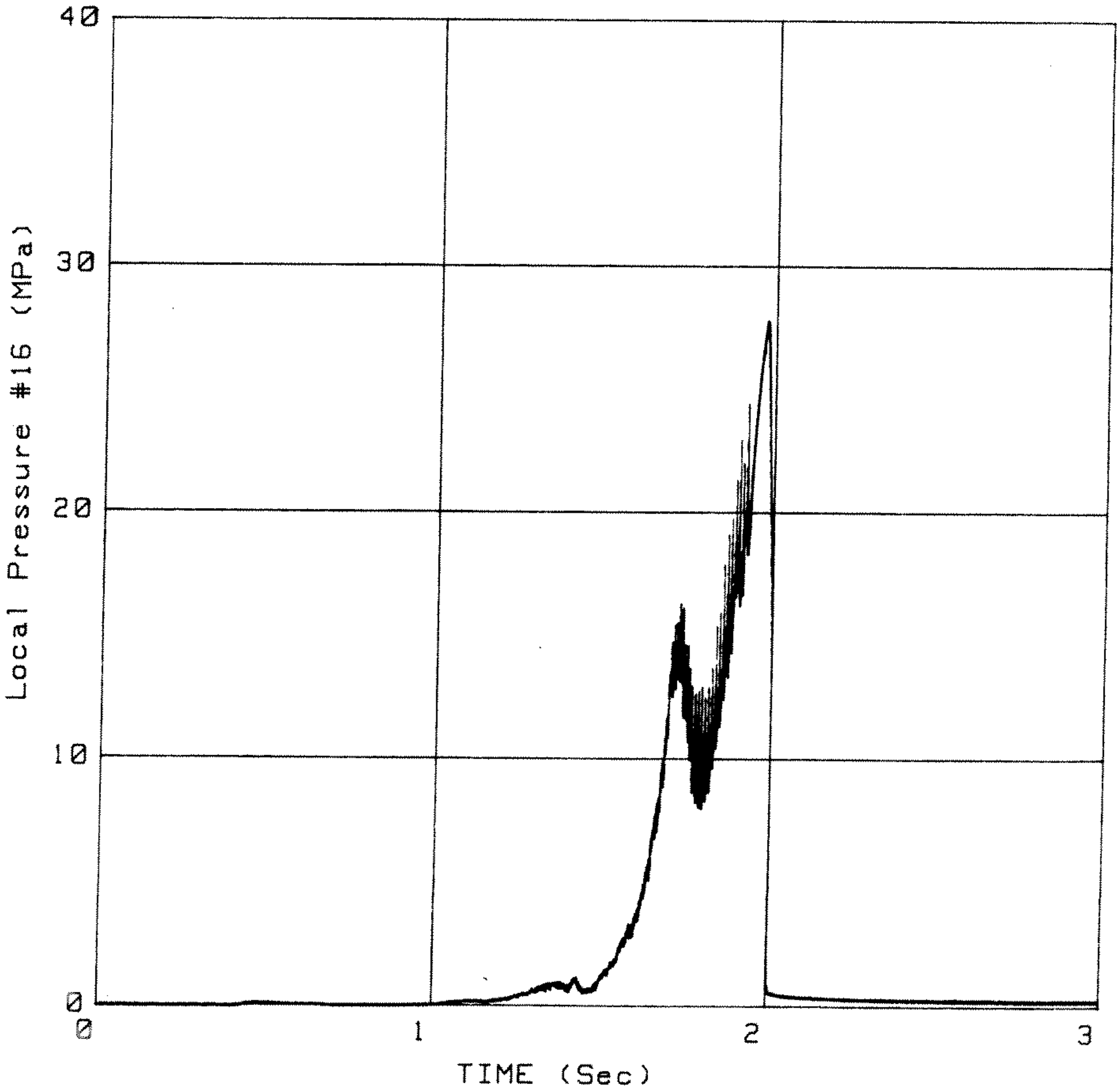
Date: 19 Dec 1988
Time: 10:24:25

Y Offset Removed

Temperature: -9.8

Average = 1

Truncation Time (s) = 3.4



Mean Plate Pressure
vs.
TIME

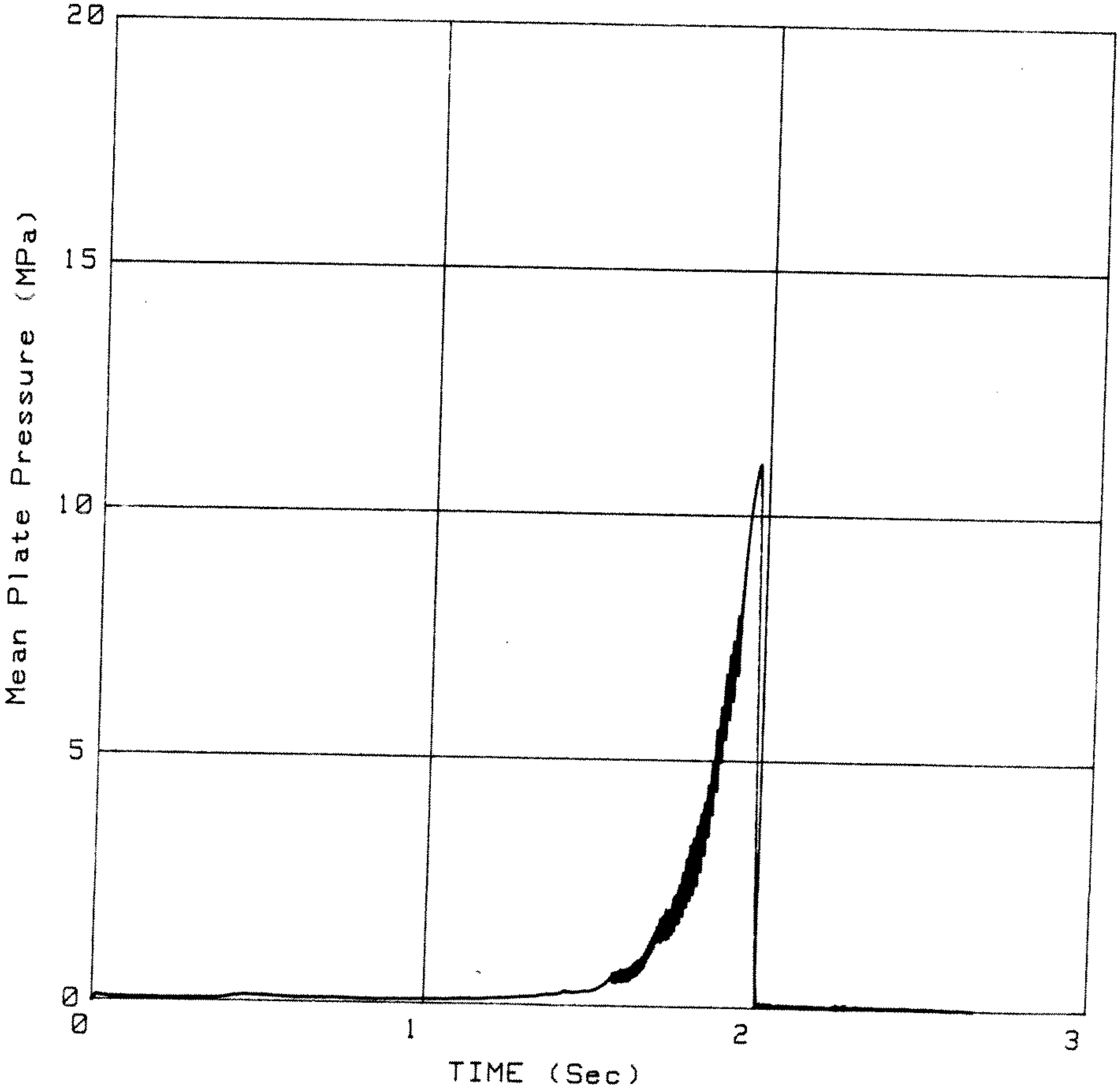
Test: X984
Type: Extrusion test
Sample: CRUSHED ICE

Date: 19 Dec 1988
Time: 10:24:25

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 3.4



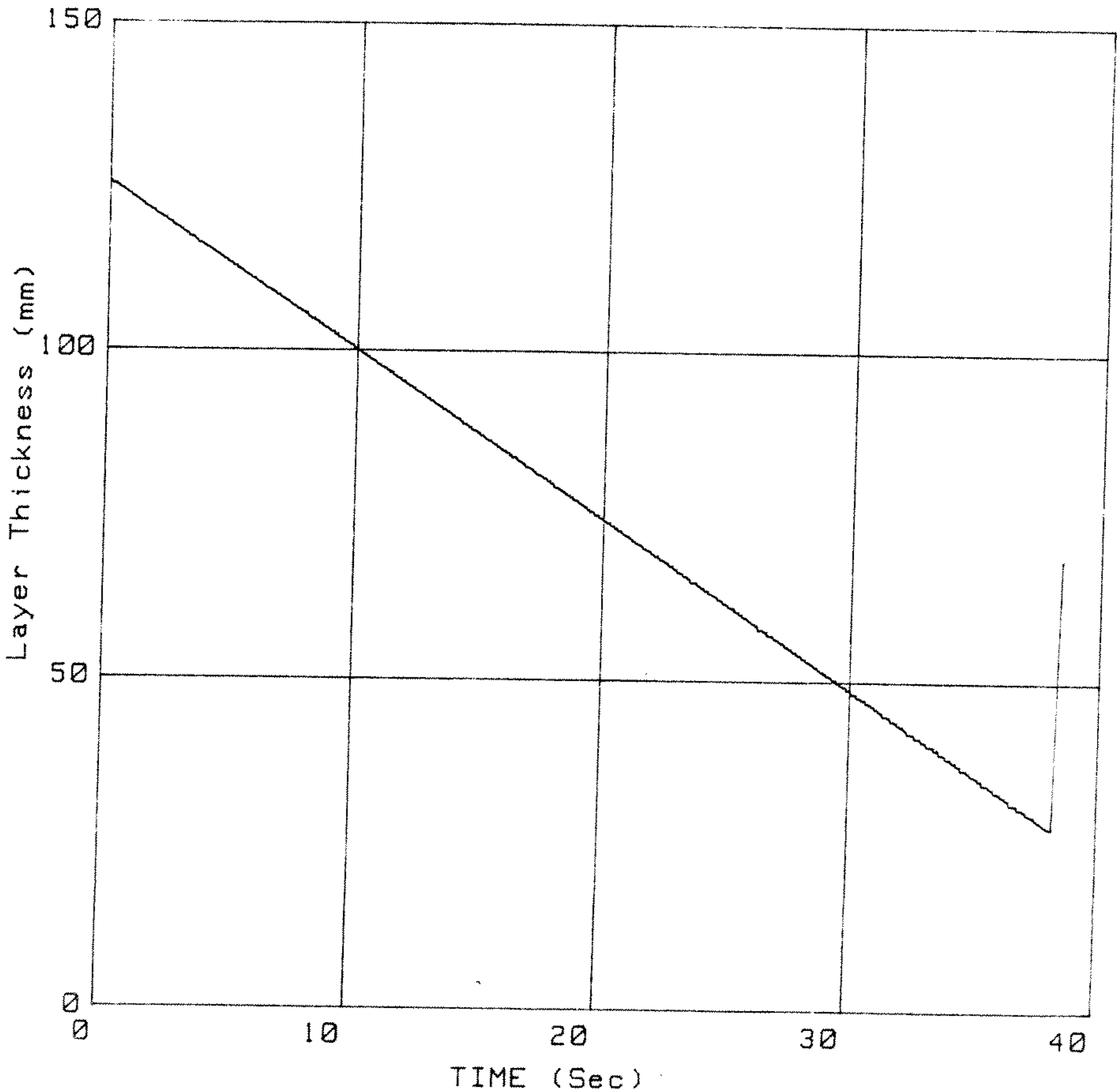
Layer Thickness
vs.
TIME

Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Temperature: -9.6

Average = 10
Truncation Time (s) = 38.5



Local Pressure #12
vs.
TIME

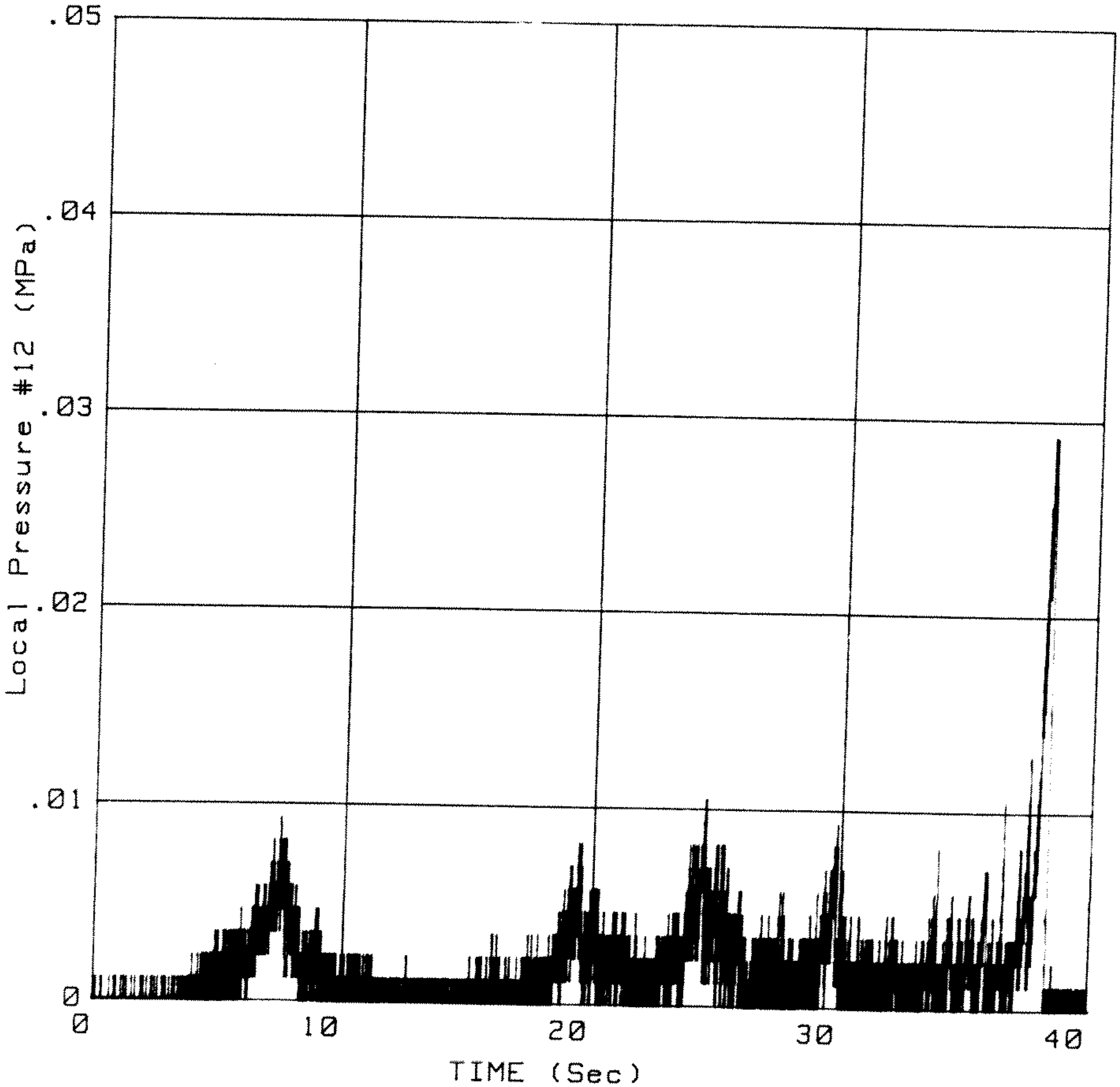
Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 48.57



Local Pressure #10
vs.
TIME

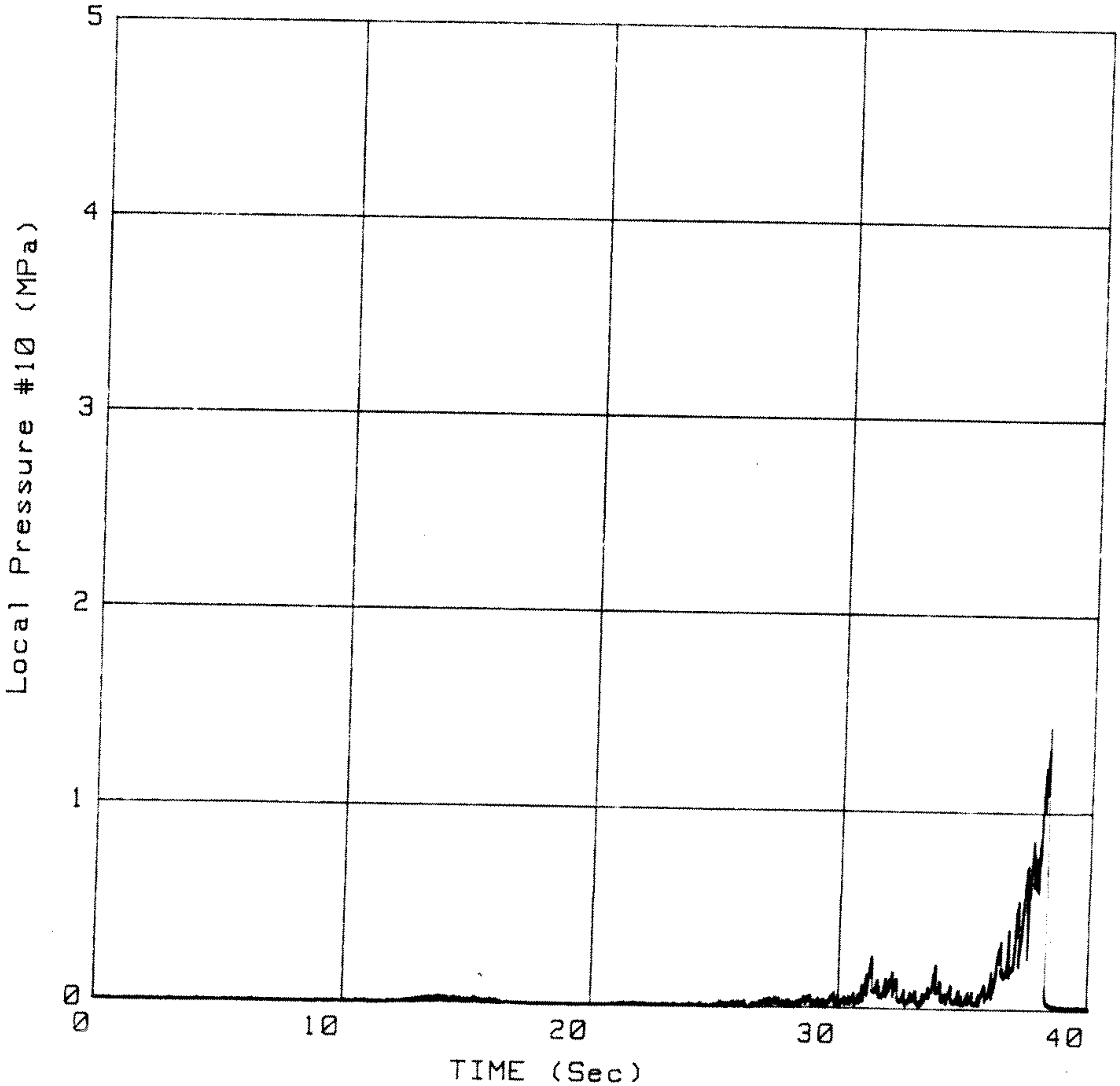
Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 48.57



Local Pressure #16
vs.
TIME

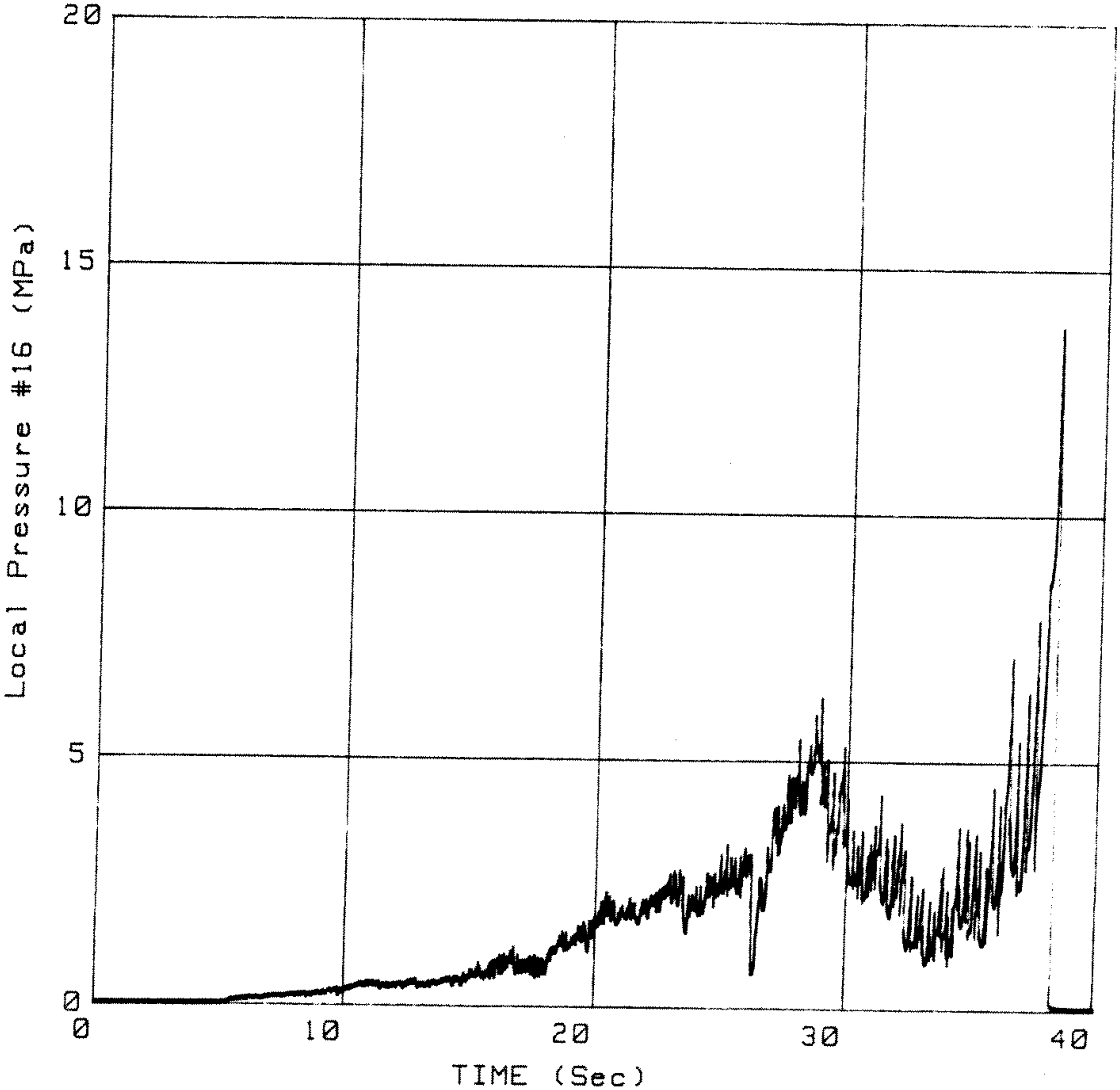
Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 48.57



Local Pressure #8
vs.
TIME

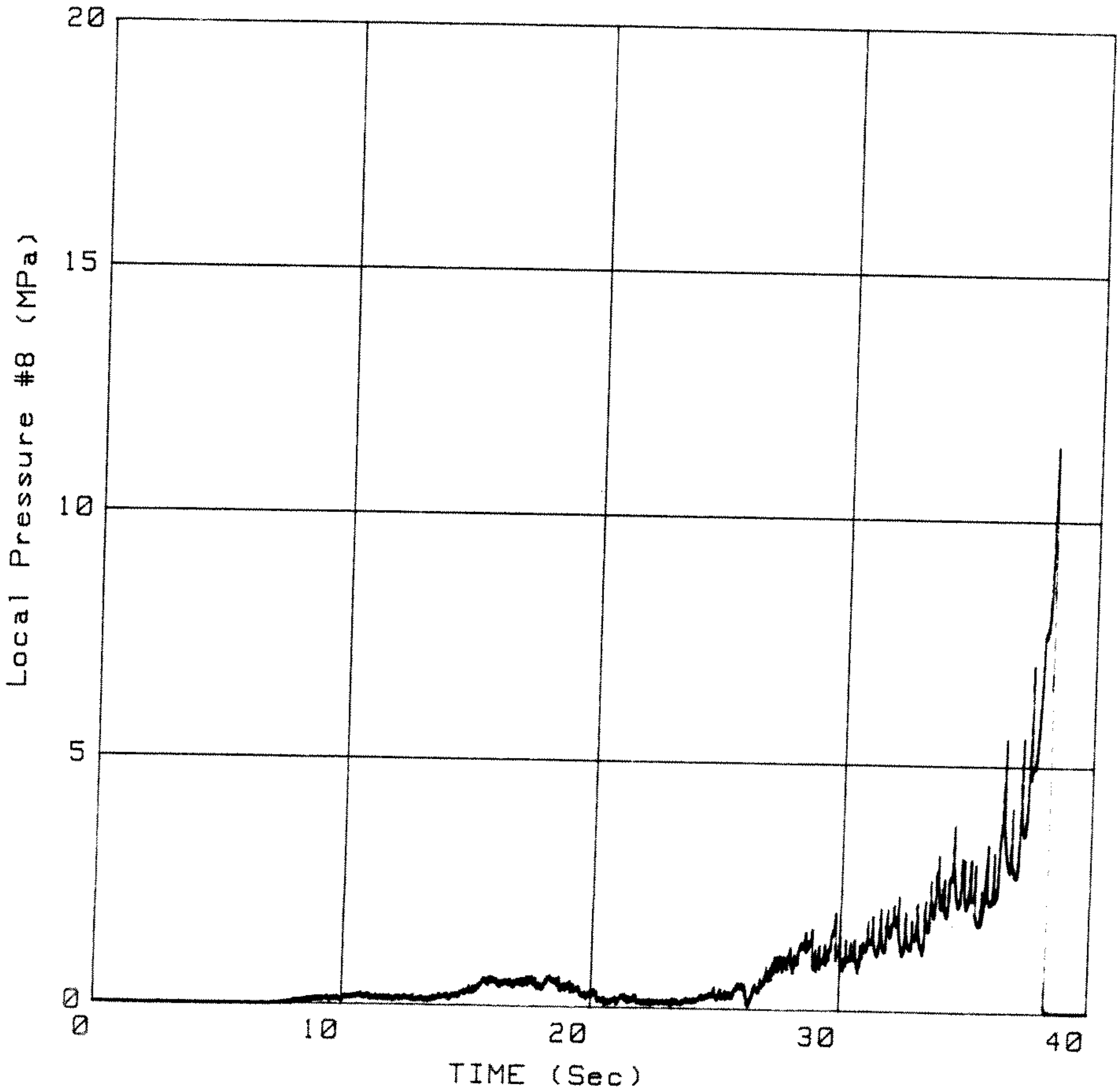
Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 48.57



Mean Plate Pressure
vs.
TIME

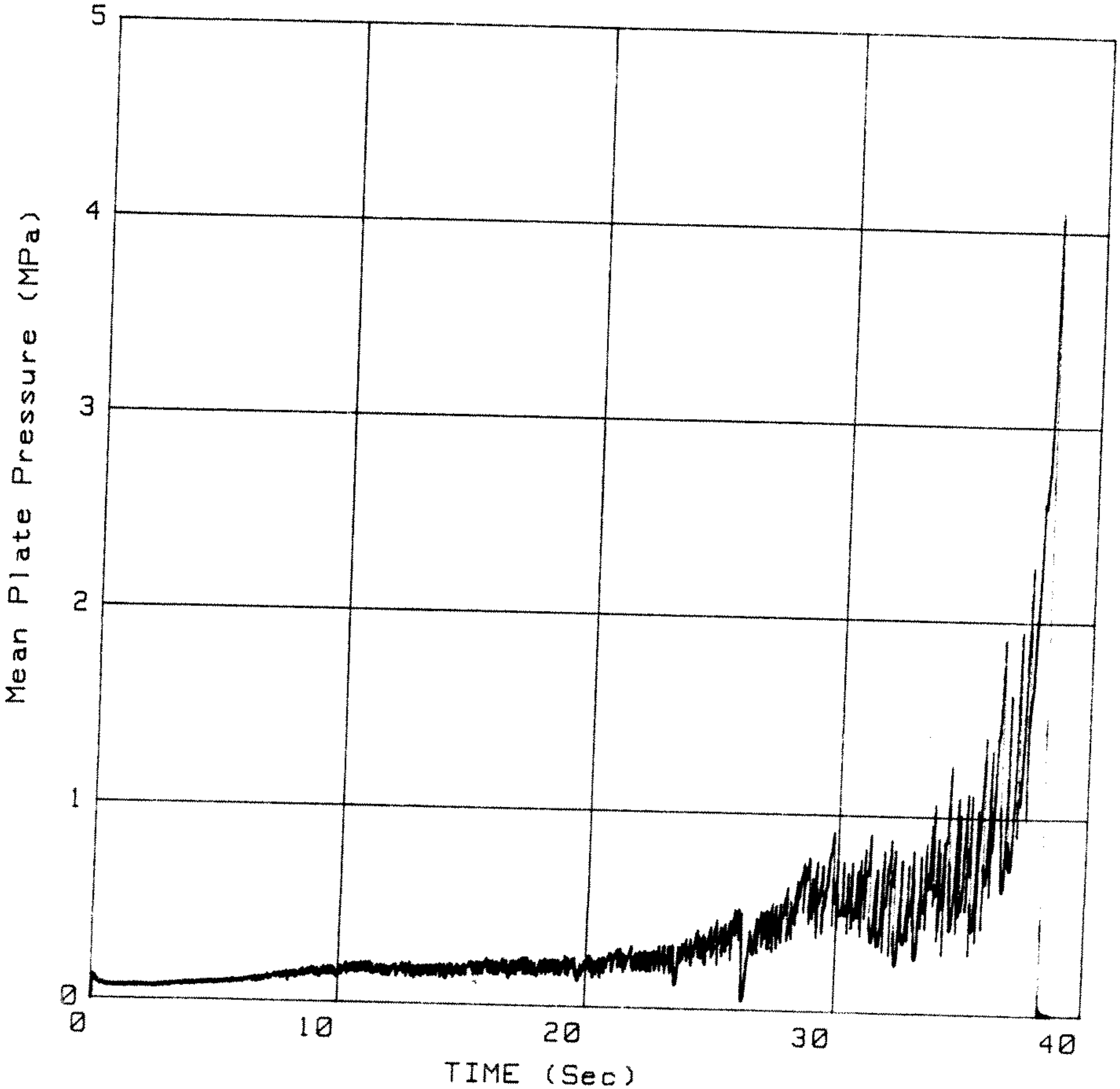
Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 48.57



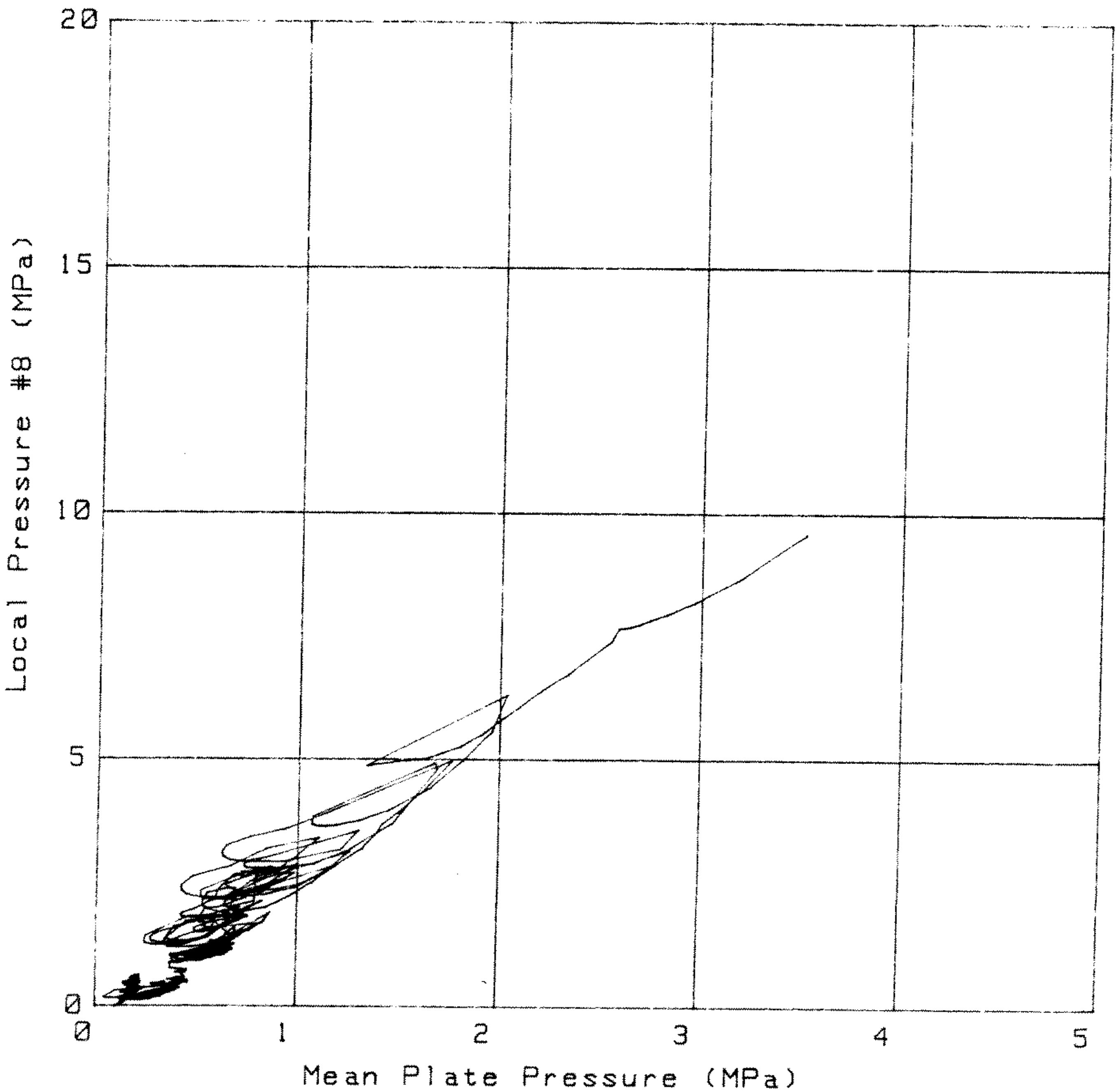
Local Pressure #8
vs.
Mean Plate Pressure

Test: X985
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 16:13:26

Temperature: -9.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 6.8
Data To (s): 38.2



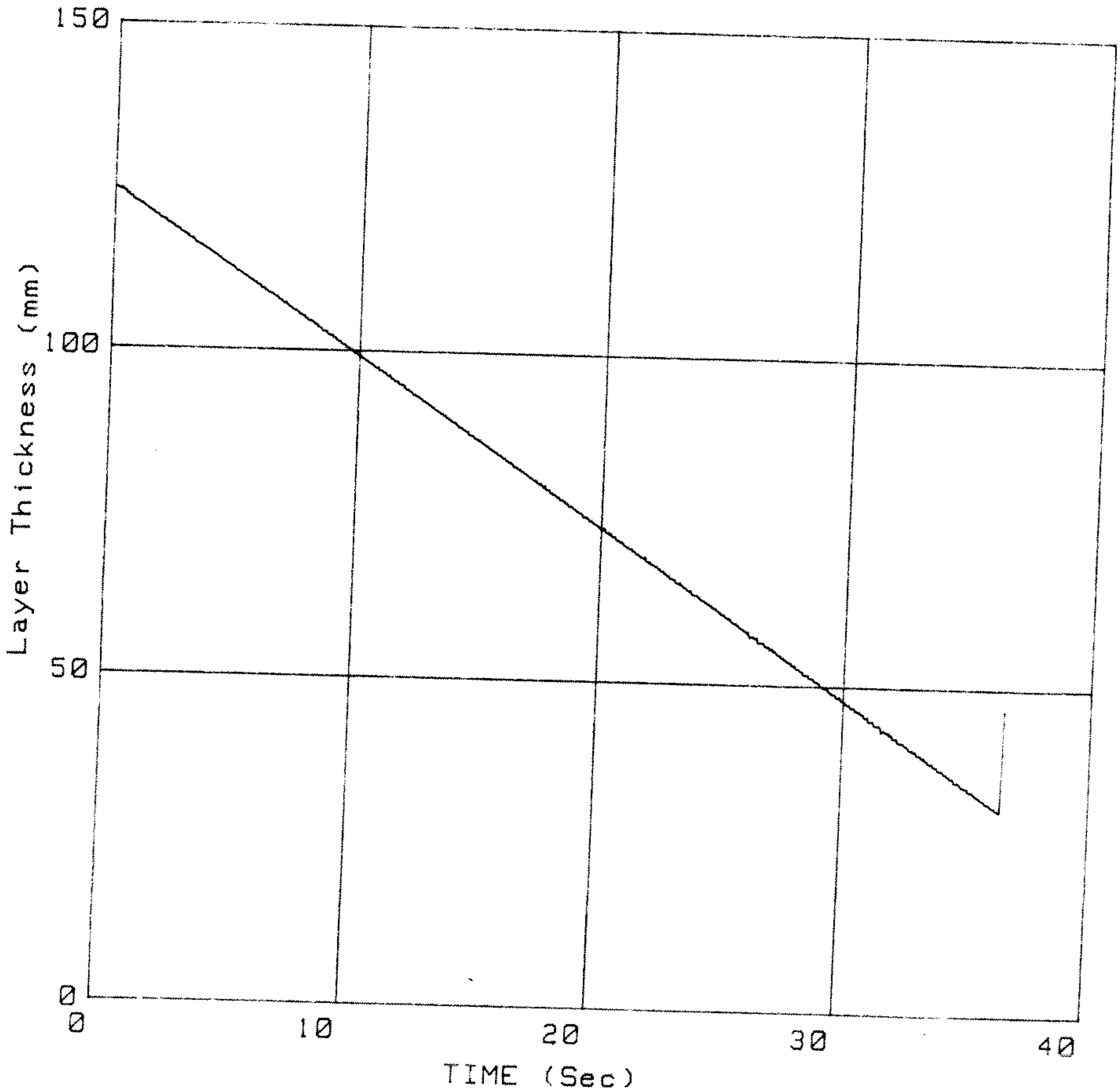
Layer Thickness
vs.
TIME

Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 14:05:31

Temperature: -9

Average = 10
Truncation Time (s) = 36.6



Local Pressure #12
vs.
TIME

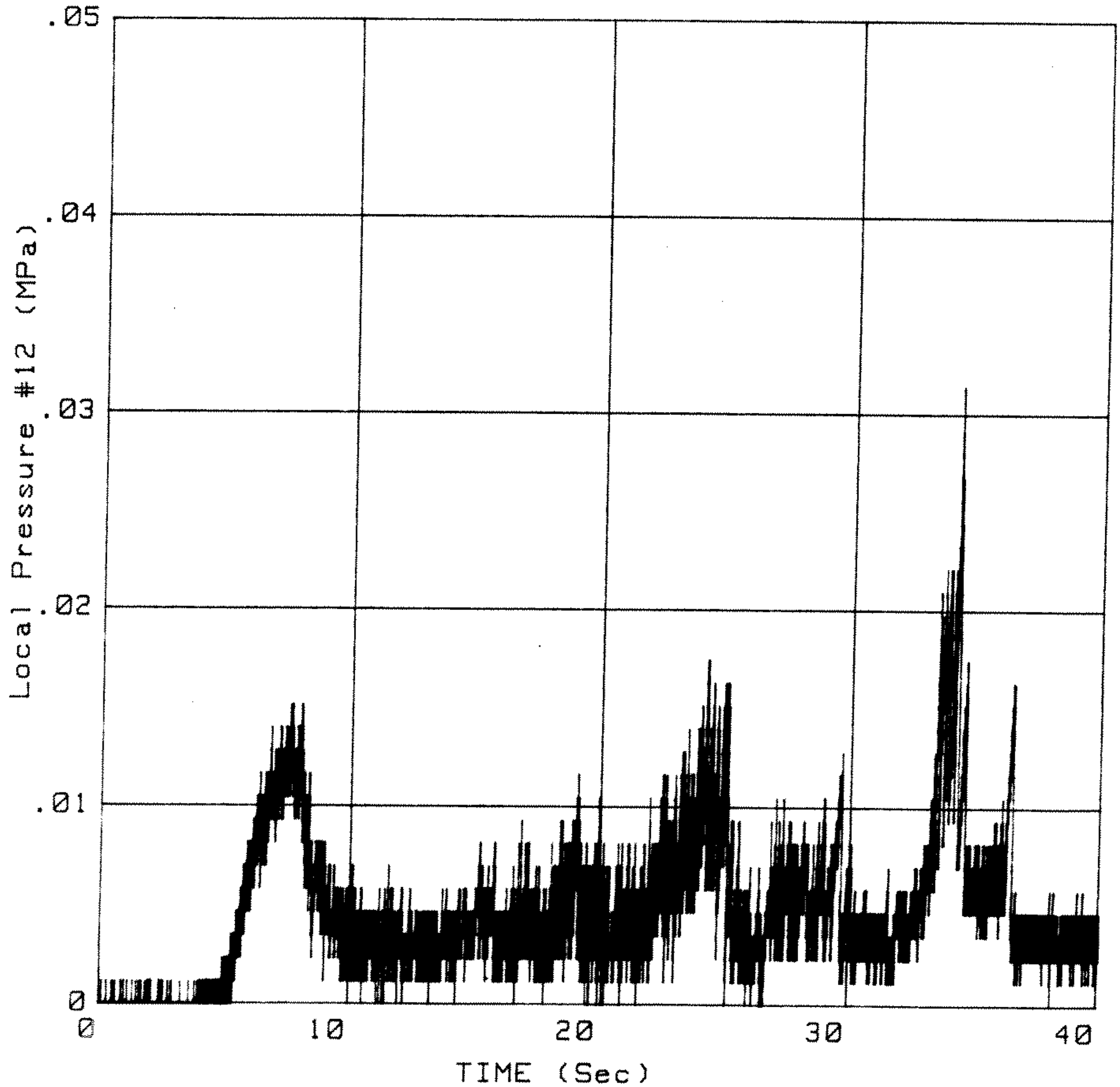
Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 14:05:31

Y Offset Removed

Temperature: -9

Average = 1
Truncation Time (s) = 48.57



Local Pressure #10
vs.
TIME

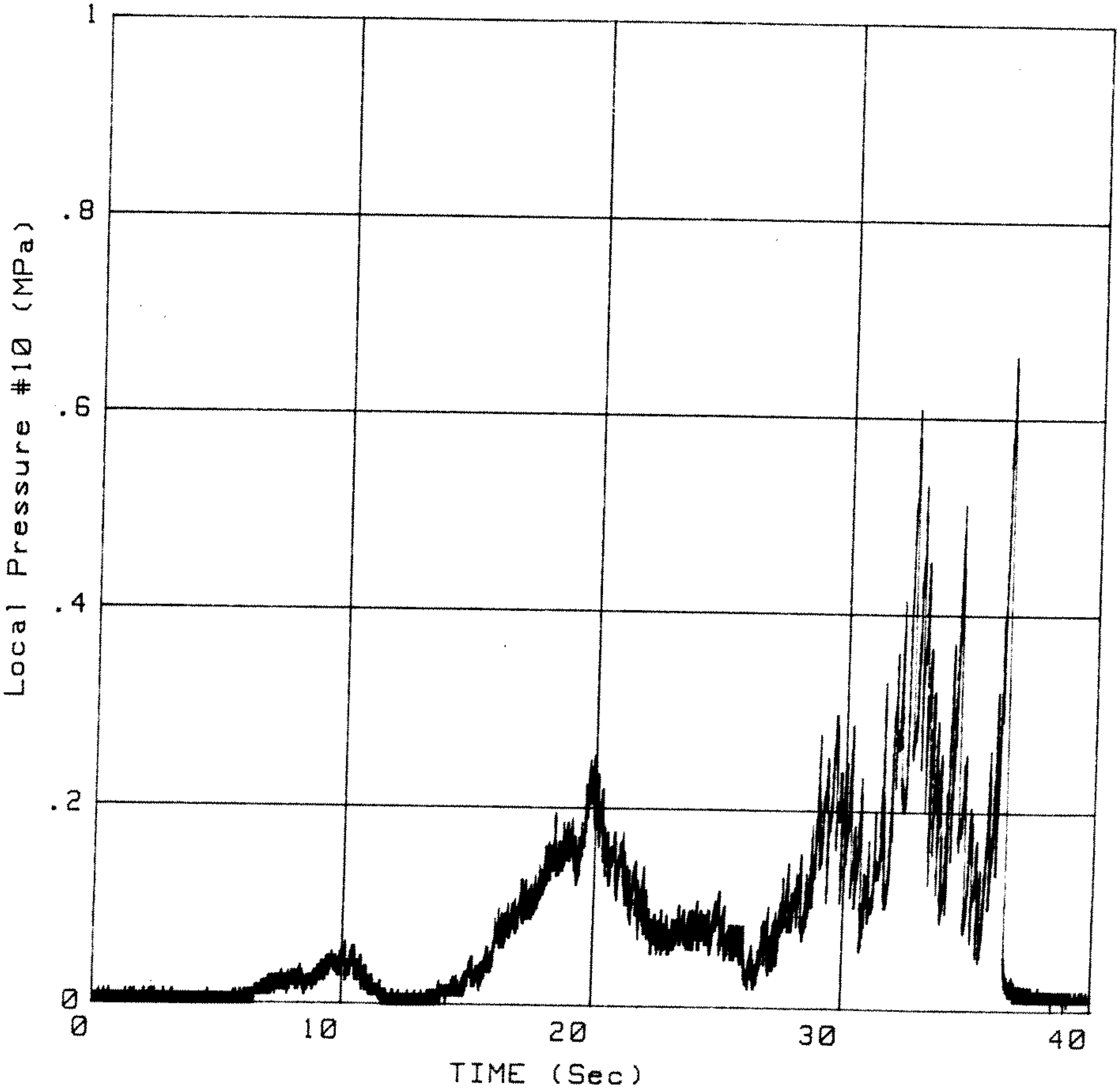
Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 14:05:31

Y Offset Removed

Temperature: -9

Average = 1
Truncation Time (s) = 48.57



Mean Plate Pressure
vs.
TIME

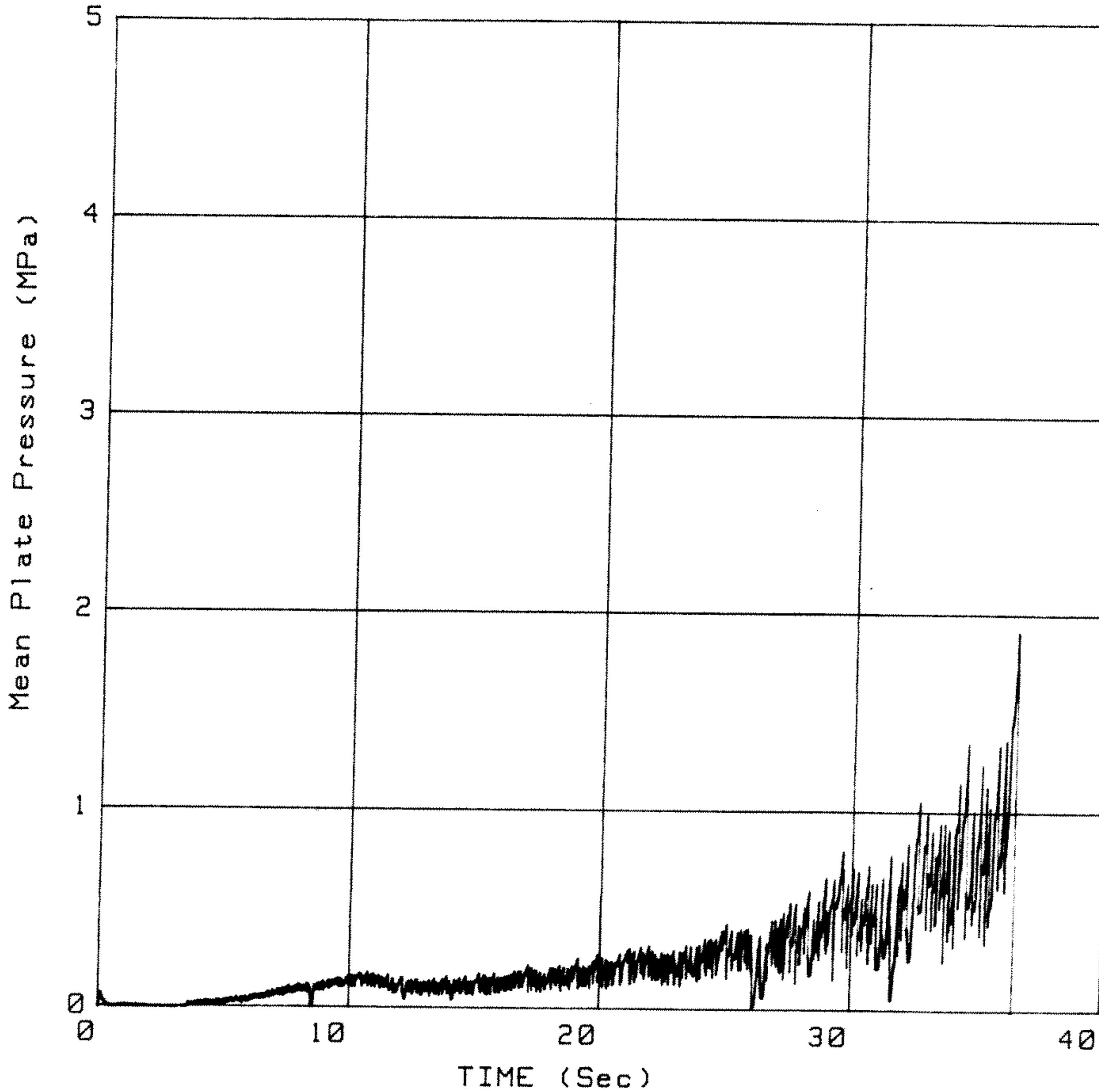
Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 14:05:31

Y Offset Removed

Temperature: -9

Average = 1
Truncation Time (s) = 48.57



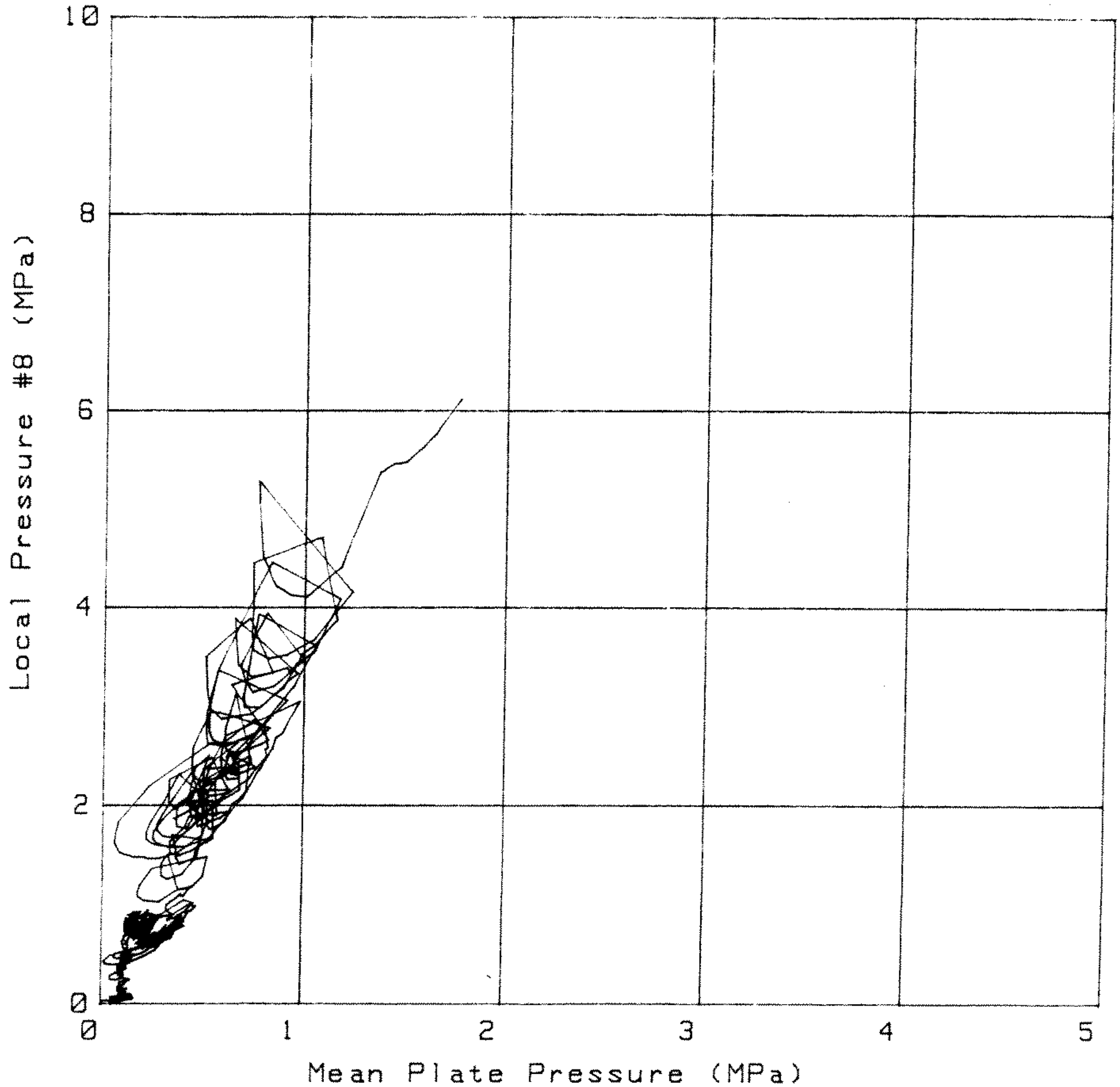
Local Pressure #8
vs.
Mean Plate Pressure

Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 14:05:31

Temperature: -9

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 6.24
Data To (s): 36.47



Local Pressure #16
vs.
TIME

Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

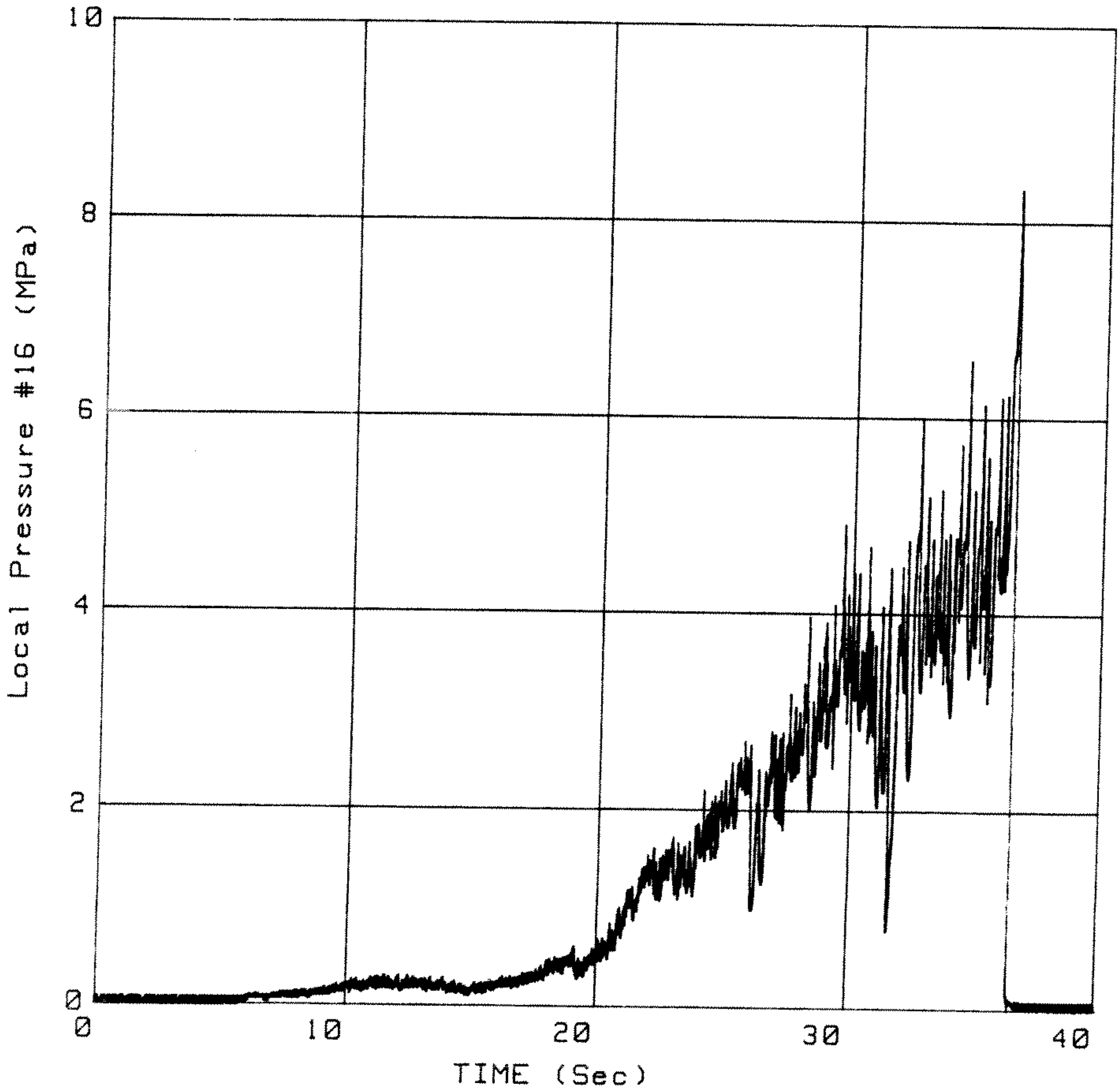
Date: 16 Dec 1988
Time: 14:05:31

Temperature: -9

Y Offset Removed

Average = 1

Truncation Time (s) = 48.57



Local Pressure #8 vs. TIME

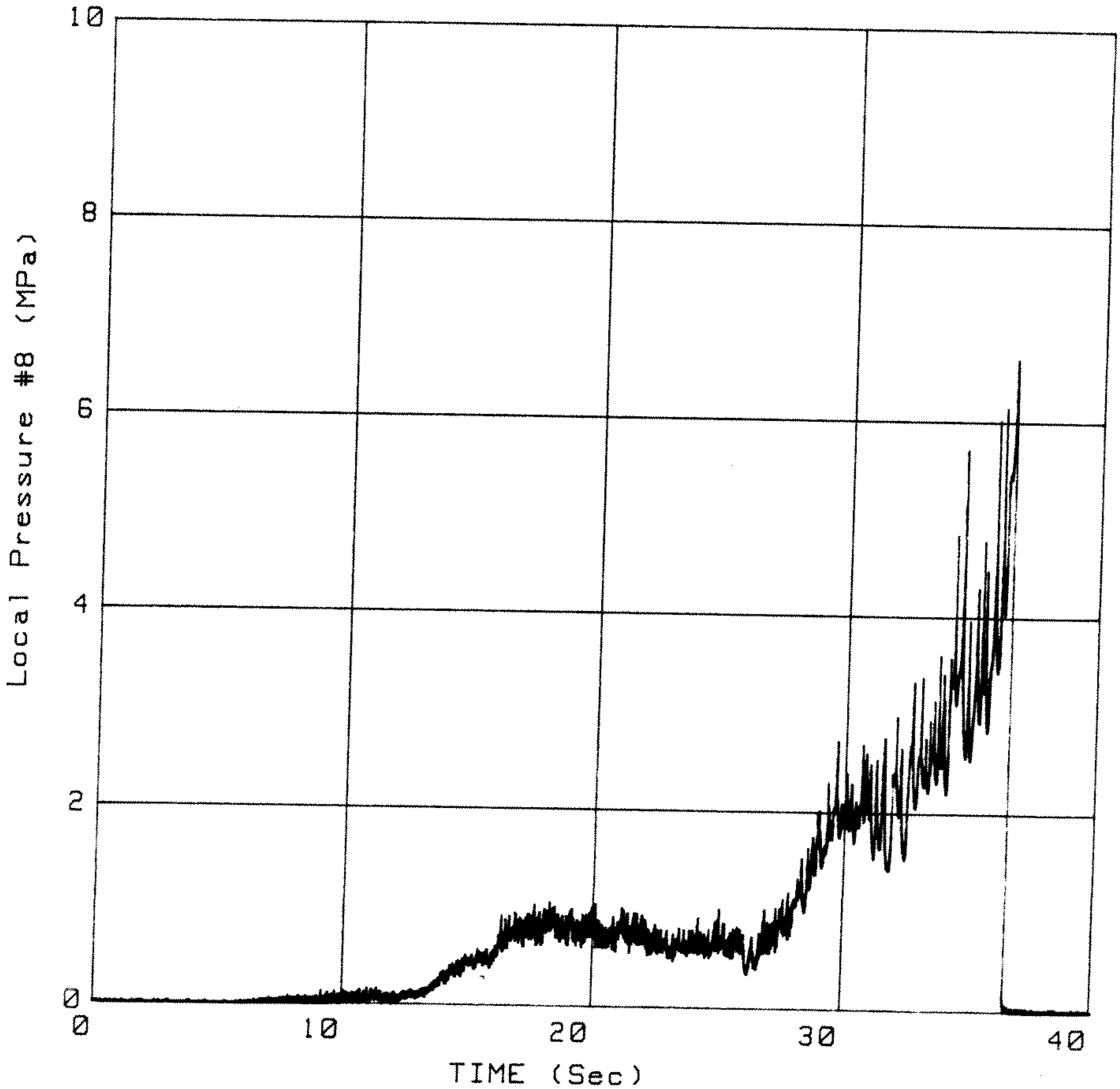
Test: X986
Type: Extrusion test
Sample: CRUSHED ICE

Date: 16 Dec 1988
Time: 14:05:31

Temperature: -9

Y Offset Removed

Average = 1
Truncation Time (s) = 48.57



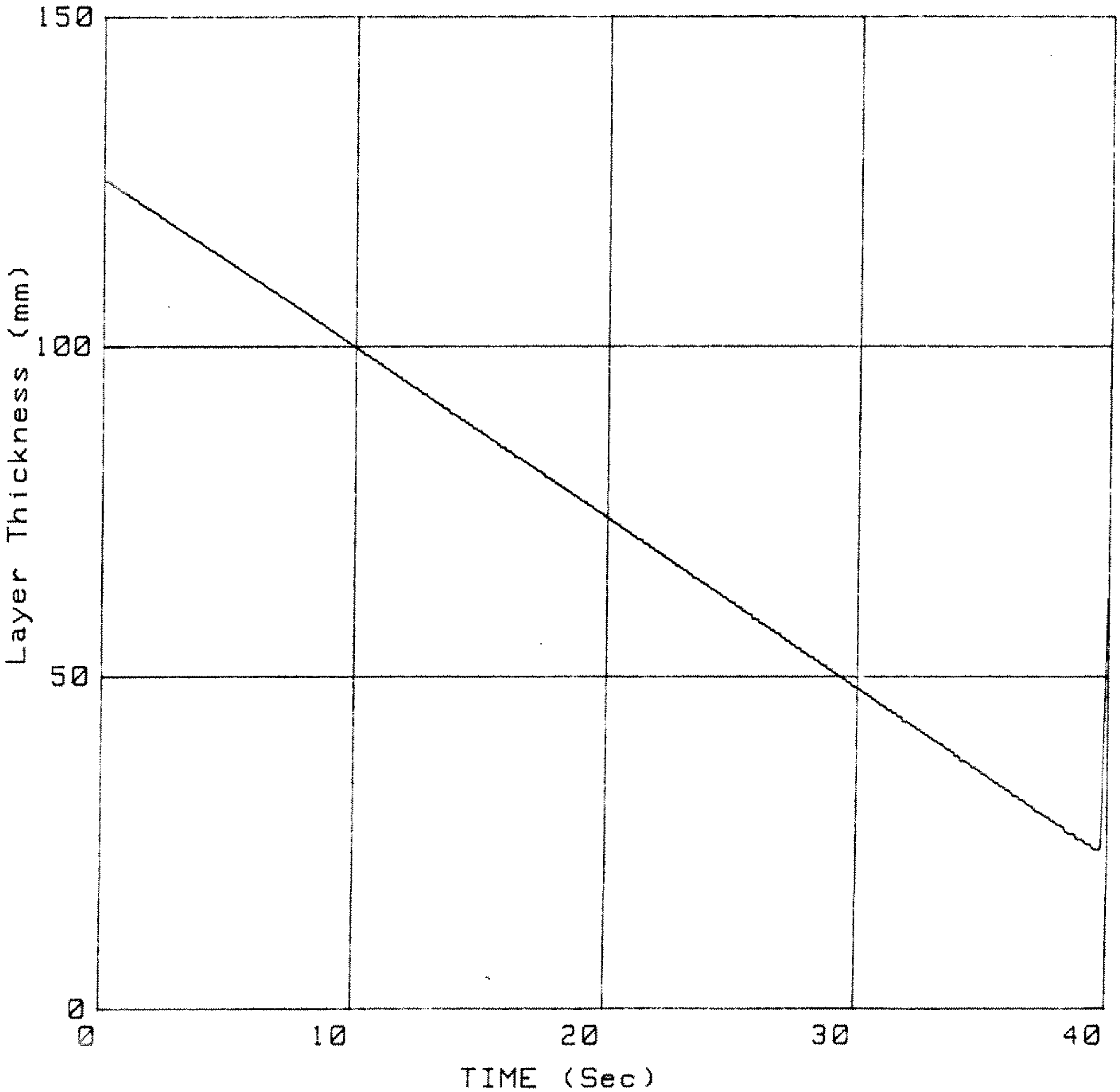
Layer Thickness
vs.
TIME

Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 15:38:49

Temperature: -8

Average = 10
Truncation Time (s) = 56.67



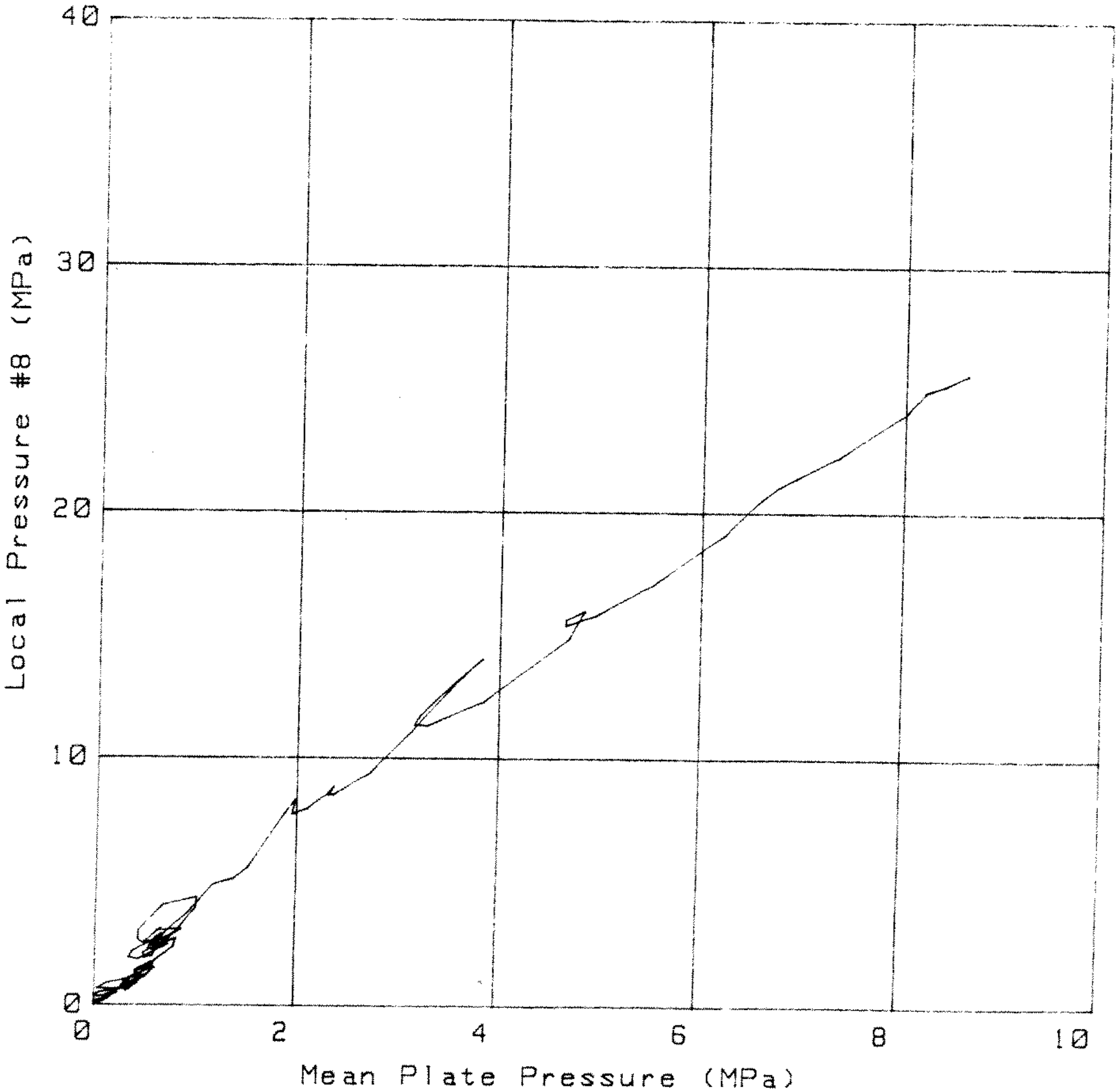
Local Pressure #8
vs.
Mean Plate Pressure

Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 15:38:49

Temperature: -8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 8.6
Data To (s): 39.7



Local Pressure #12
vs.
TIME

Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

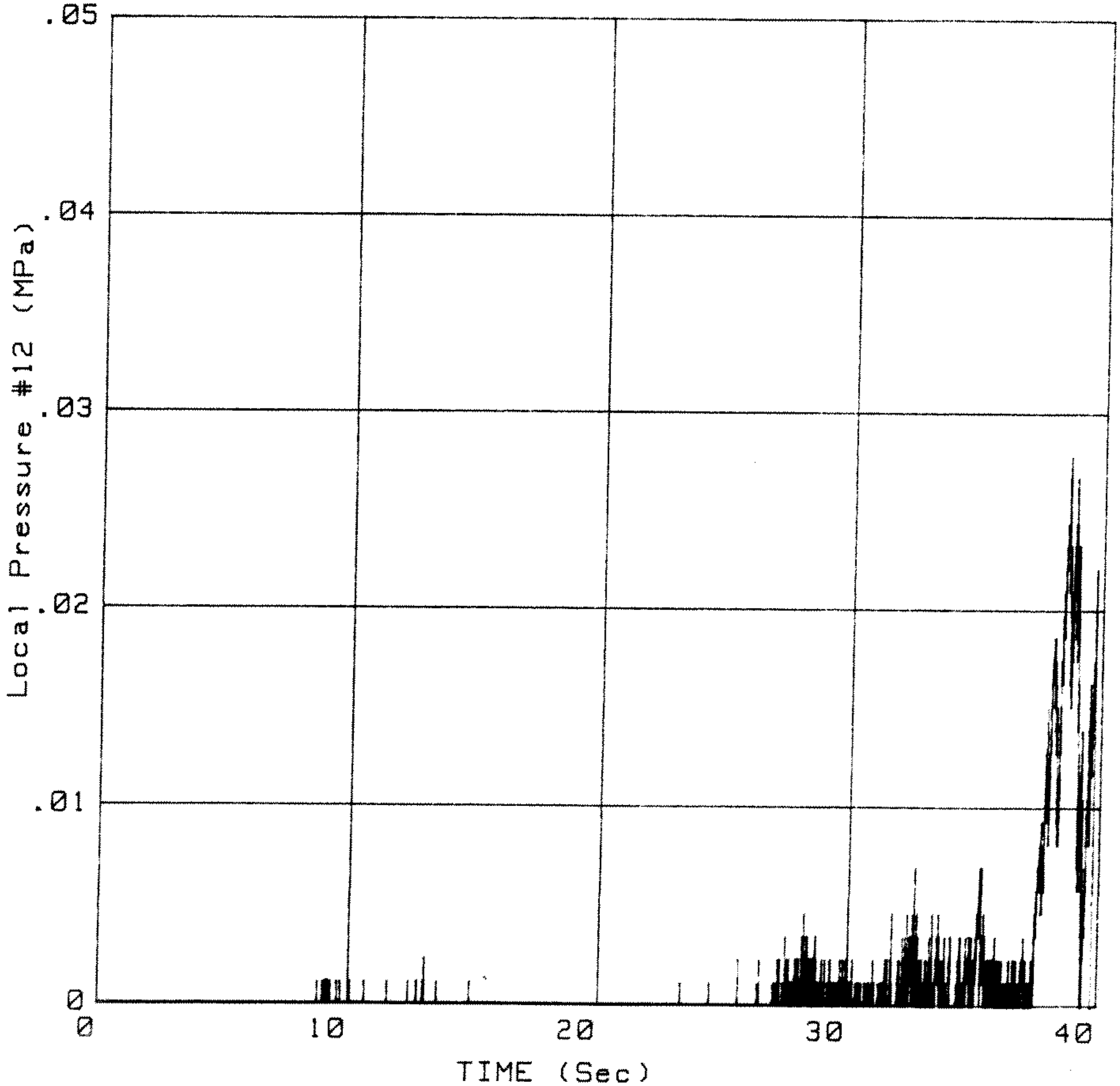
Date: 15 Dec 1988
Time: 15:38:49

Y Offset Removed

Temperature: -8

Average = 1

Truncation Time (s) = 56.67



Local Pressure #10 vs. TIME

Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

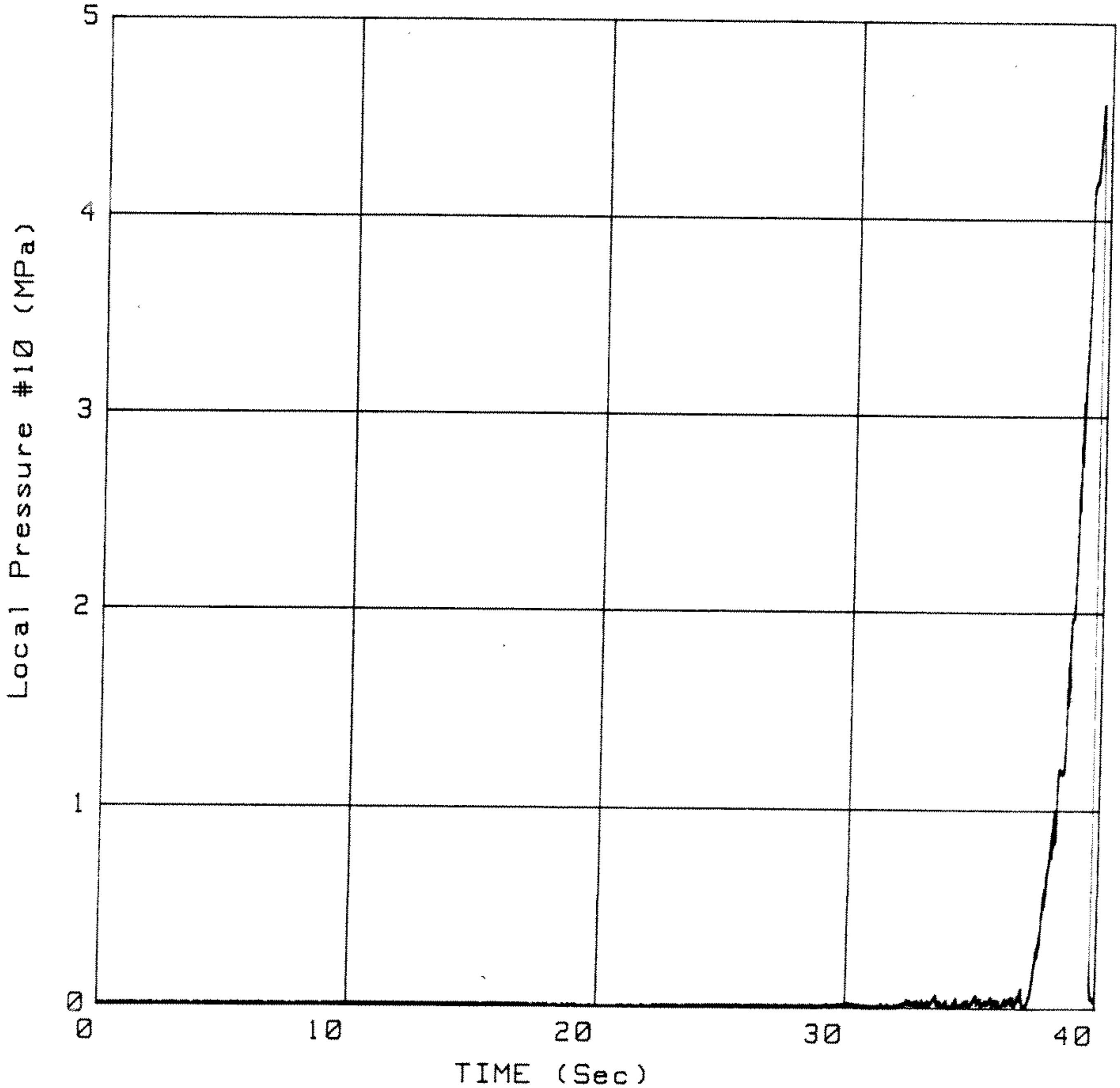
Date: 15 Dec 1988
Time: 15:38:49

Y Offset Removed

Temperature: -8

Average = 1

Truncation Time (s) = 56.67



Mean Plate Pressure
vs.
TIME

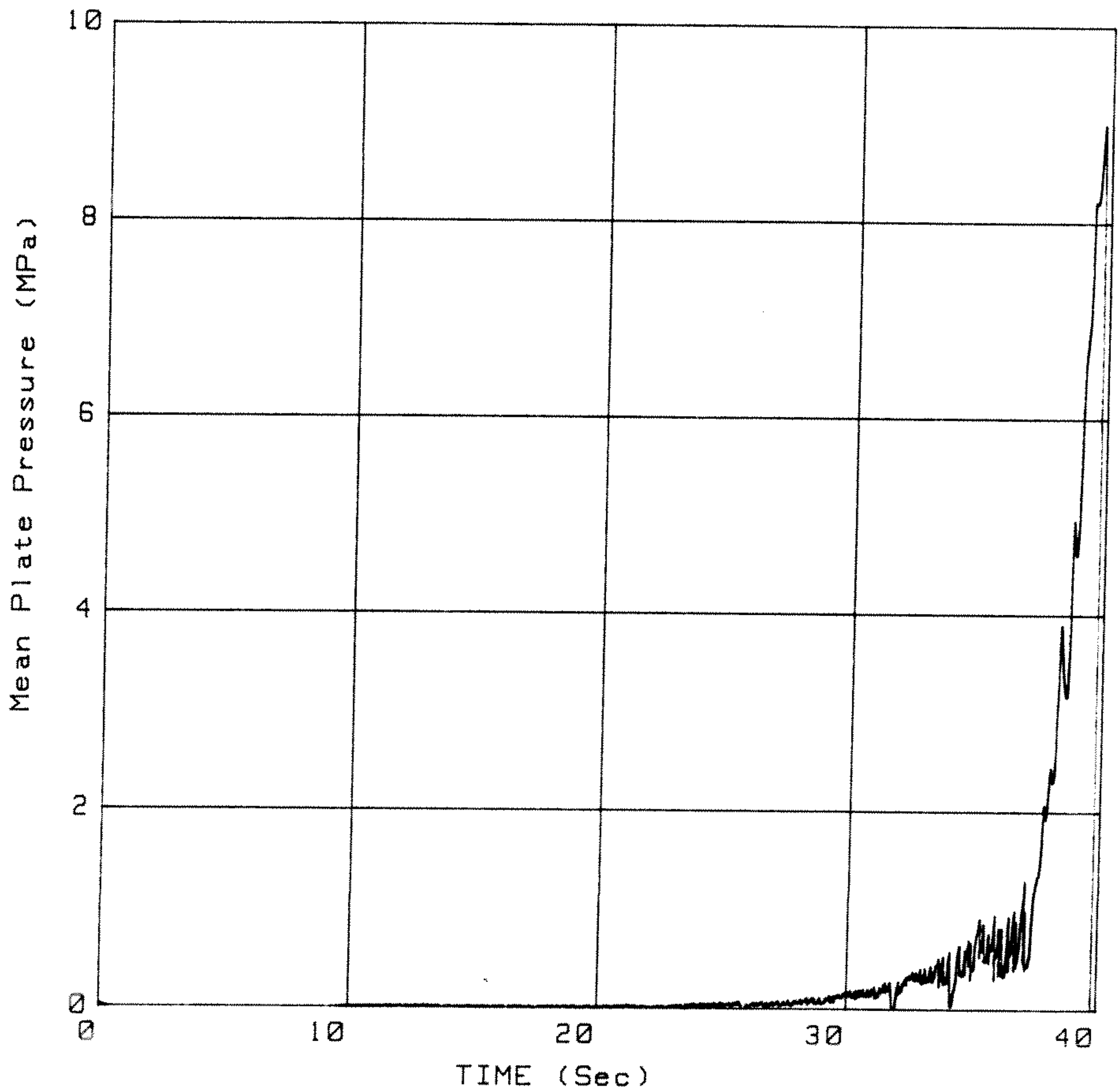
Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 15:38:49

Y Offset Removed

Temperature: -8

Average = 1
Truncation Time (s) = 56.67



Local Pressure #16
vs.
TIME

Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

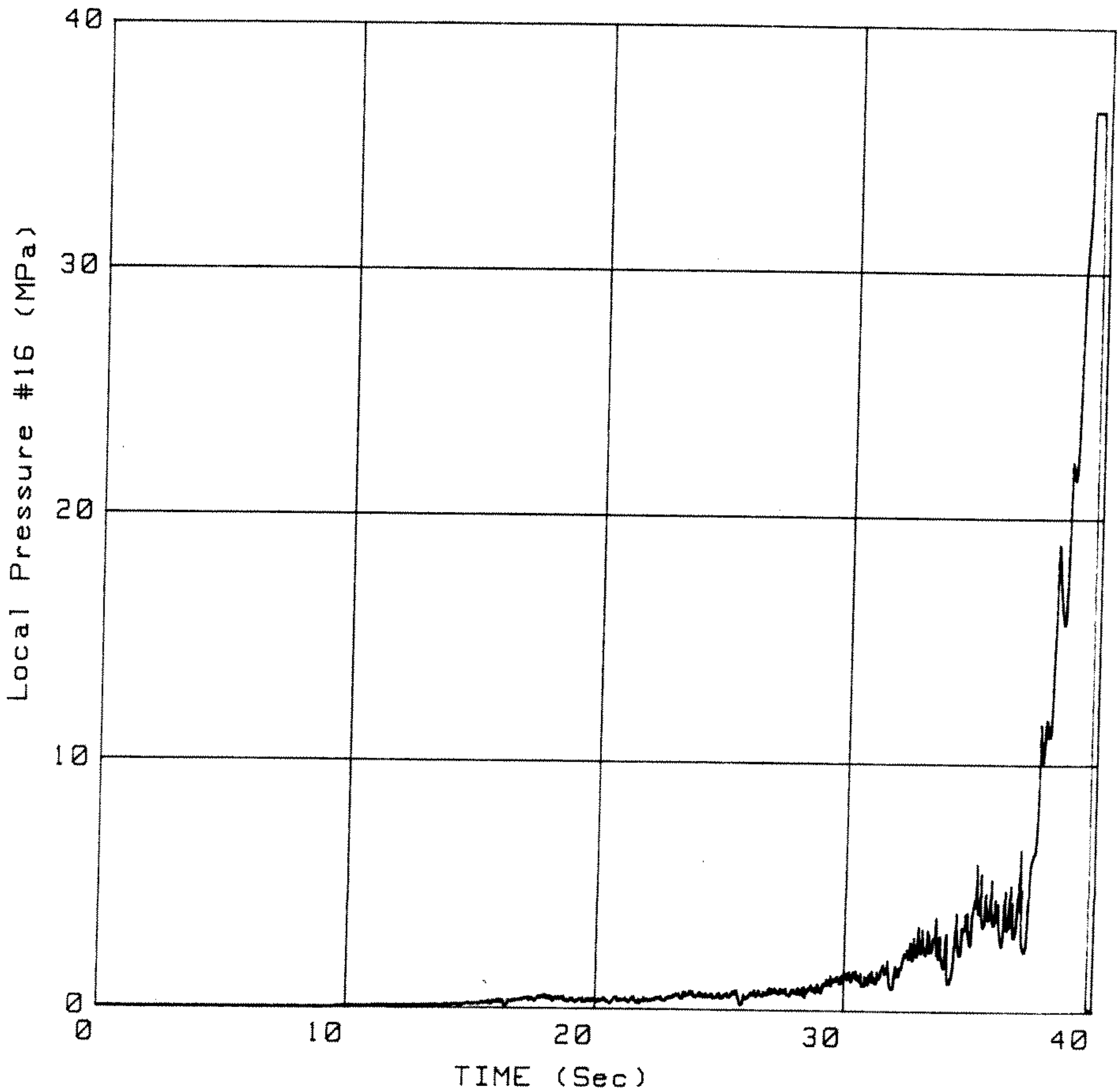
Date: 15 Dec 1988
Time: 15:38:49

Y Offset Removed

Temperature: -8

Average = 1

Truncation Time (s) = 56.67



Local Pressure #8
vs.
TIME

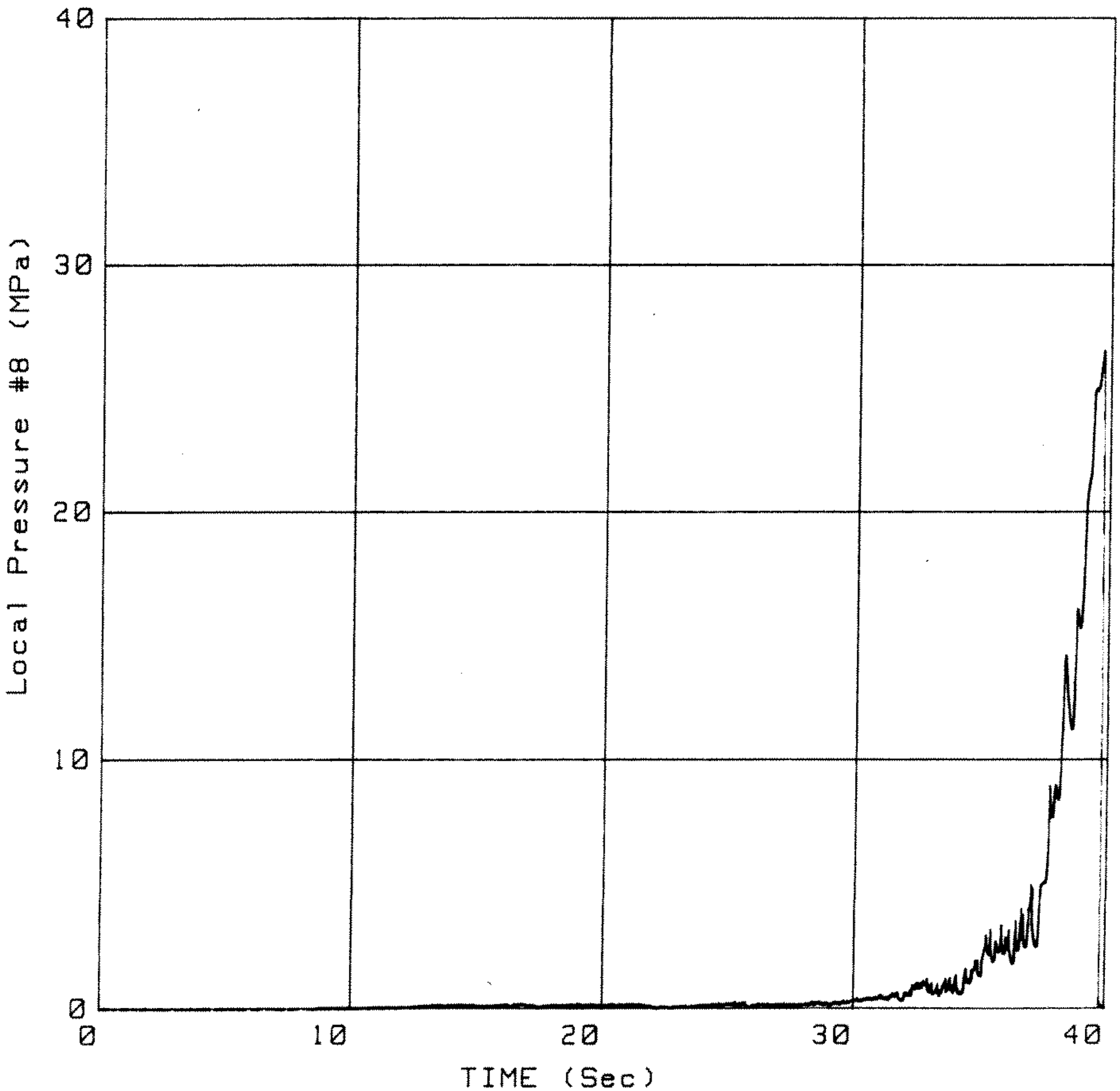
Test: X987
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 15:38:49

Y Offset Removed

Temperature: -8

Average = 1
Truncation Time (s) = 56.67



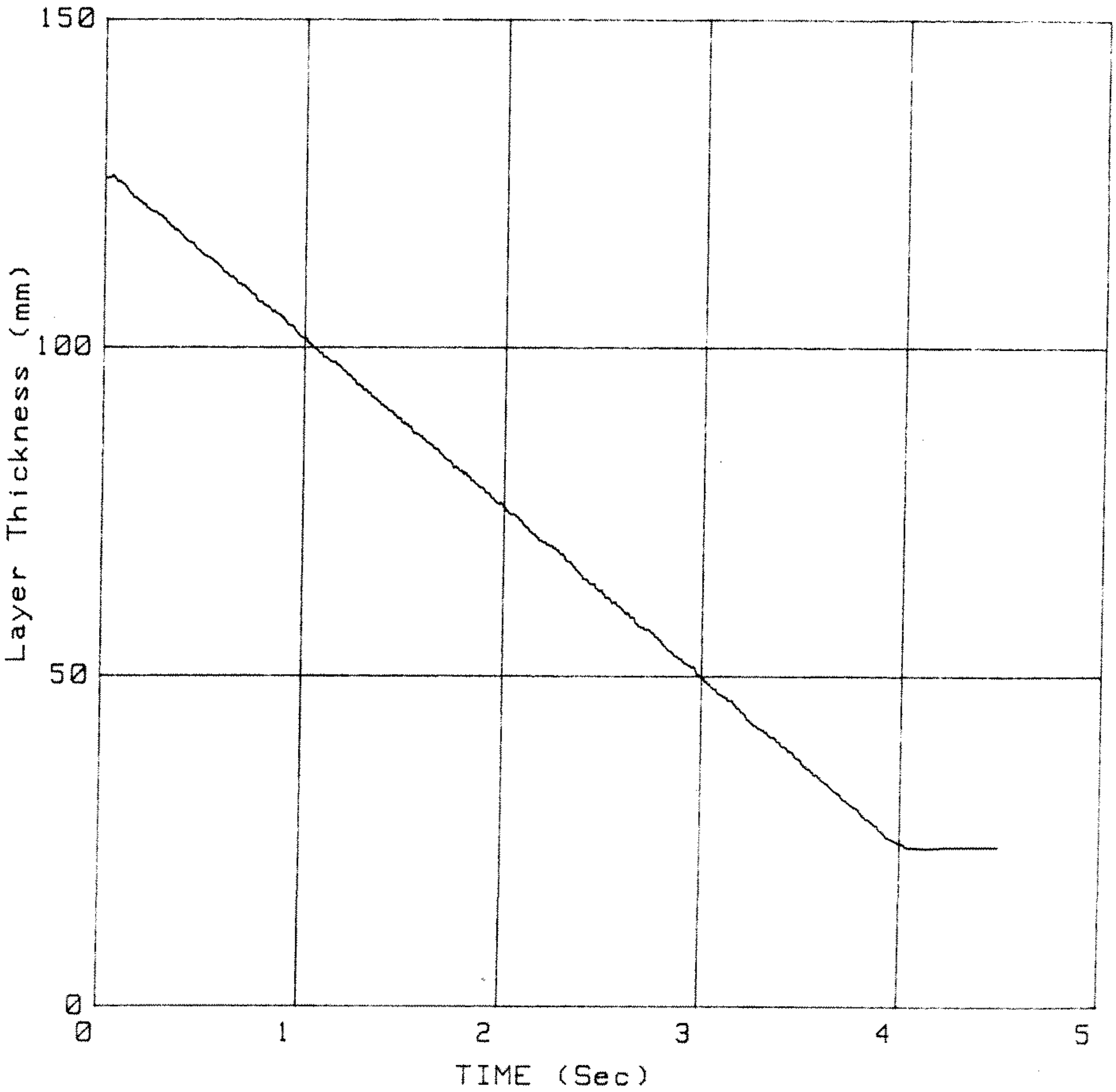
Layer Thickness
vs.
TIME

Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 13:38:40

Temperature: -8

Average = 10
Truncation Time (s) = 4.5



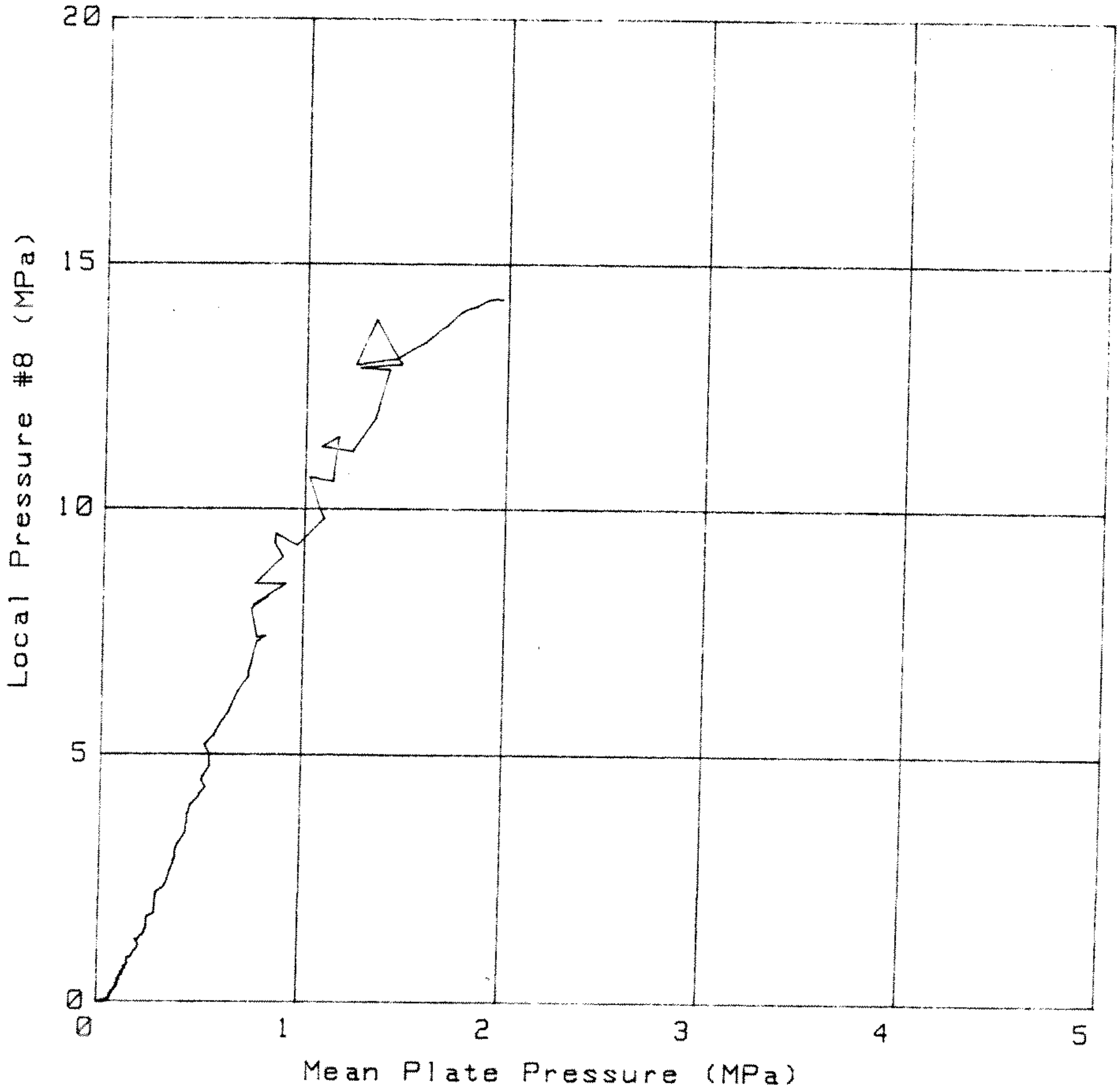
Local Pressure #8
vs.
Mean Plate Pressure

Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 13:38:40

Temperature: -8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .68
Data To (s): 4.03



Local Pressure #12
vs.
TIME

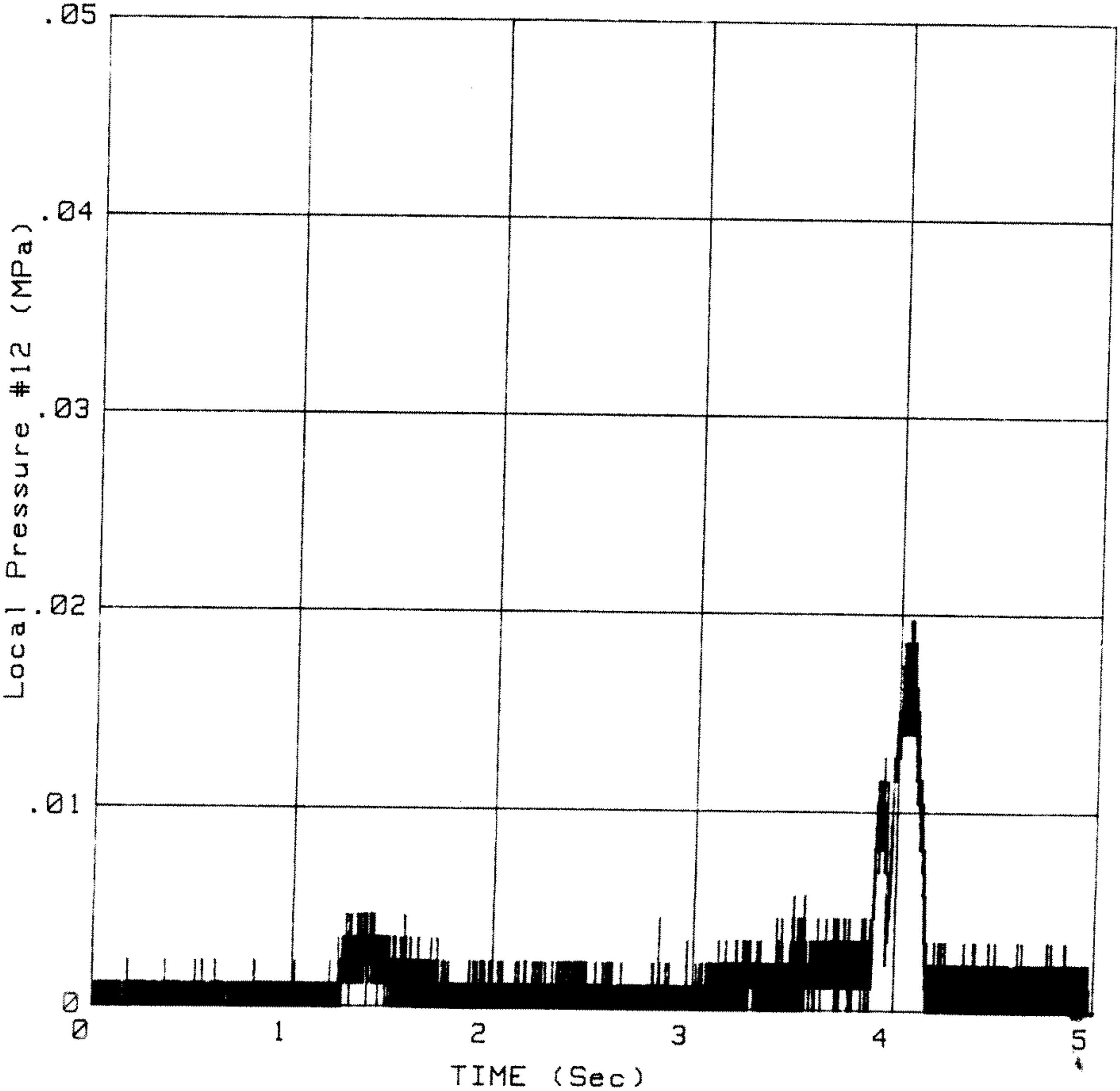
Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 13:38:40

Temperature: -8

Y Offset Removed

Average = 1
Truncation Time (s) = 6.01



Local Pressure #10
vs.
TIME

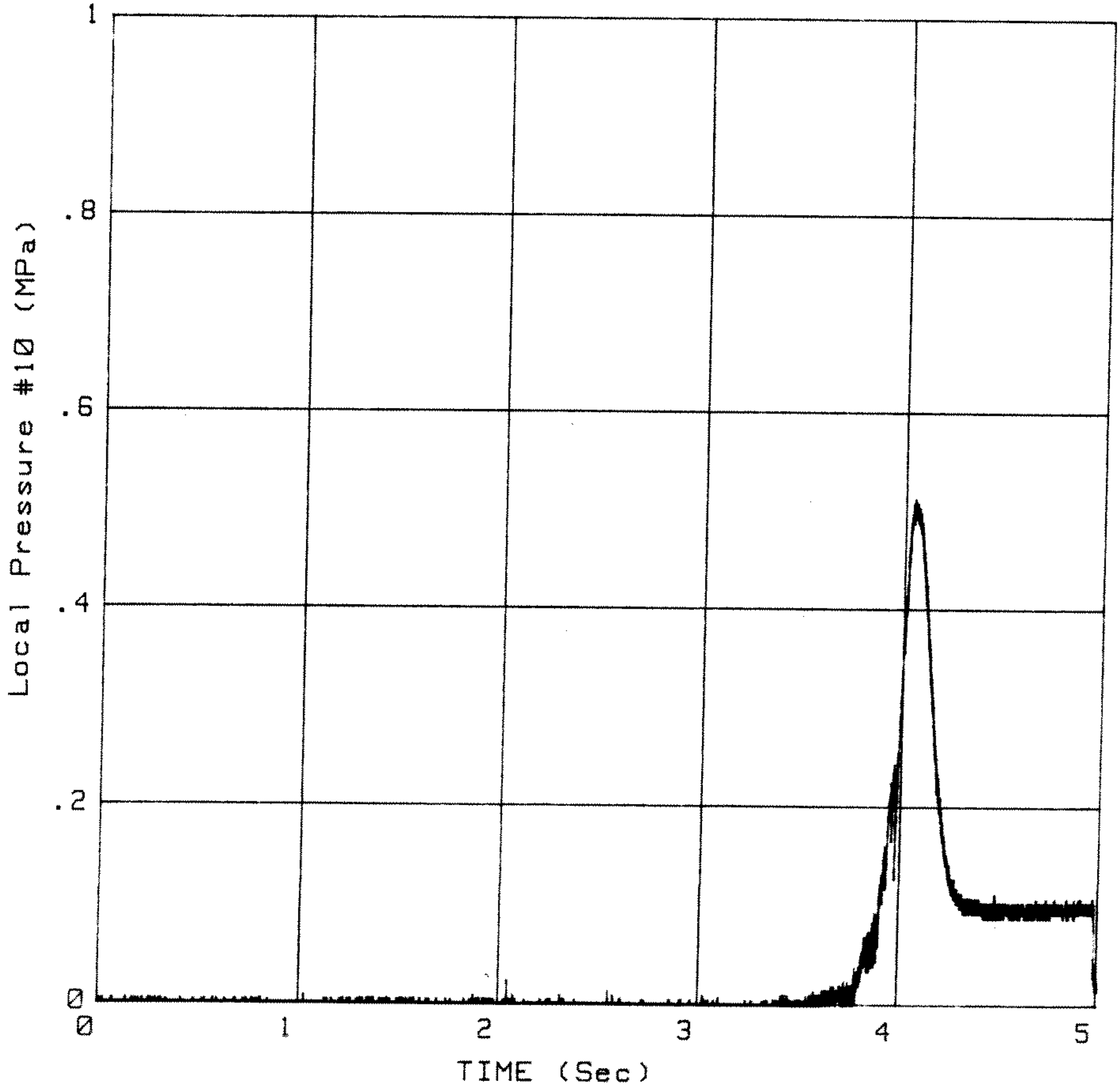
Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 13:38:40

Y Offset Removed

Temperature: -8

Average = 1
Truncation Time (s) = 6.01



Mean Plate Pressure vs. TIME

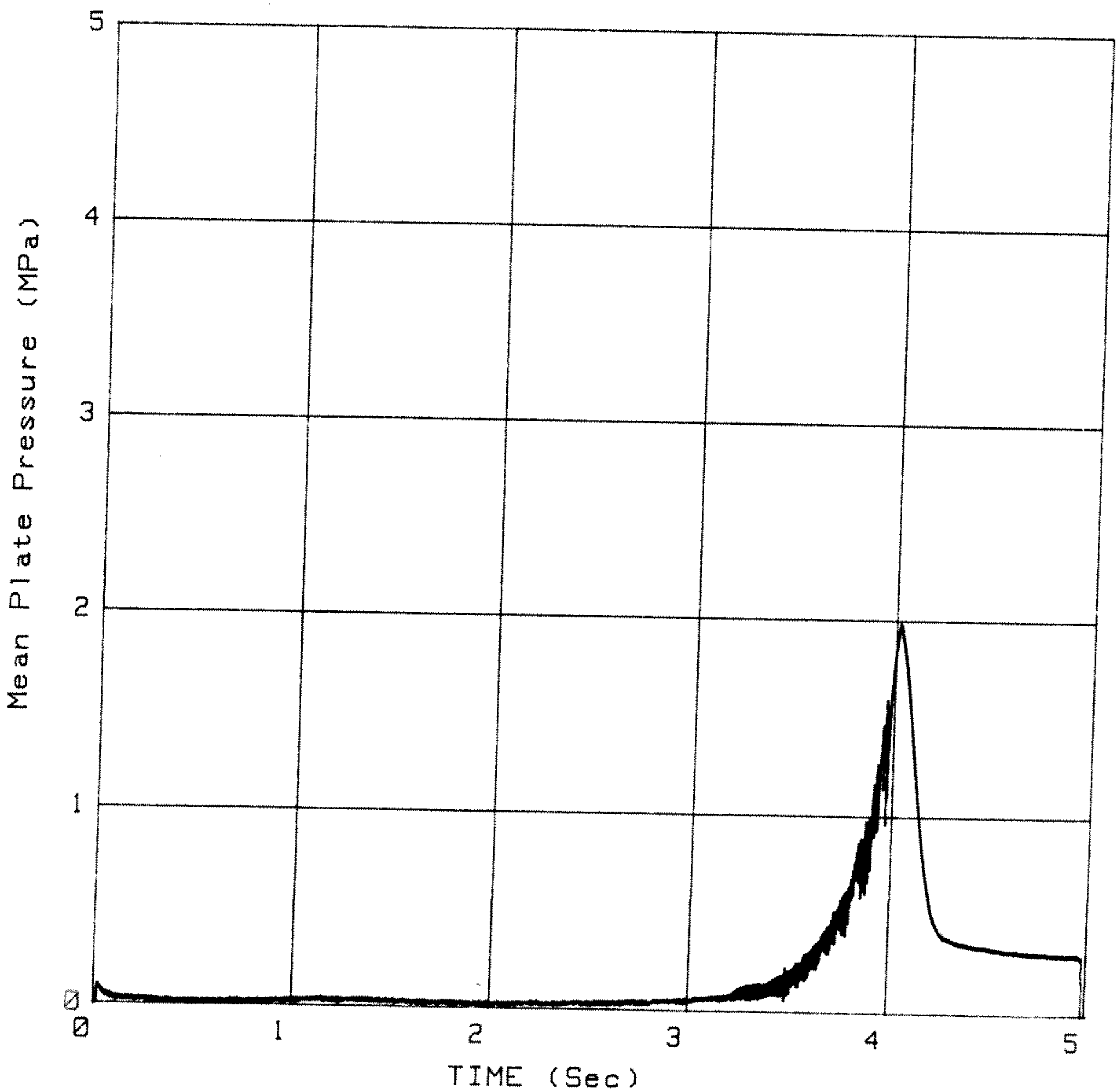
Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 13:38:40

Temperature: -8

Y Offset Removed

Average = 1
Truncation Time (s) = 6.01



Local Pressure #16
vs.
TIME

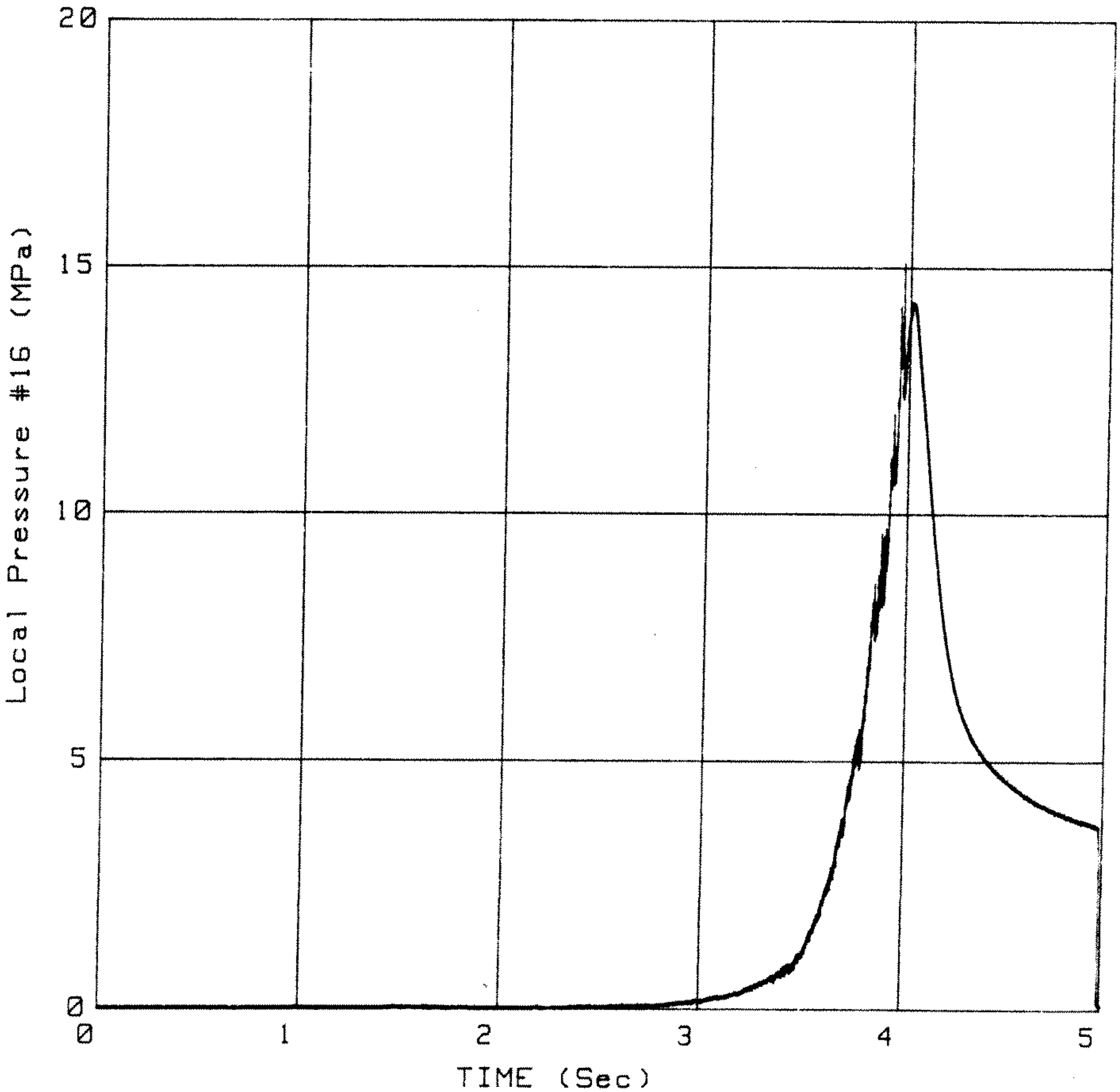
Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

Date: 15 Dec 1988
Time: 13:38:40

Y Offset Removed

Temperature: -8

Average = 1
Truncation Time (s) = 6.01



Local Pressure #8
vs.
TIME

Test: X988
Type: Extrusion test
Sample: CRUSHED ICE

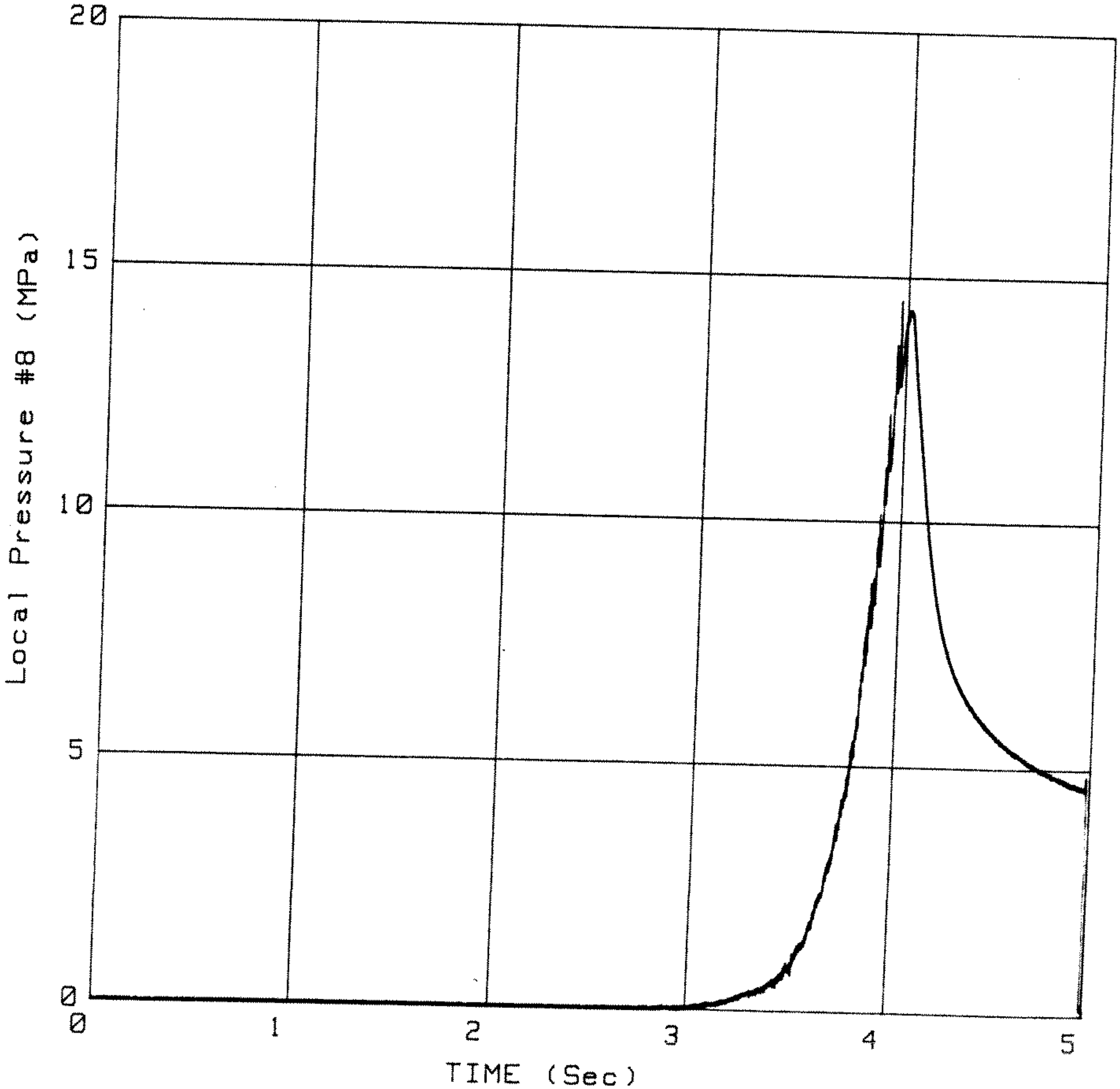
Date: 15 Dec 1988
Time: 13:38:40

Temperature: -8

Y Offset Removed

Average = 1

Truncation Time (s) = 6.01



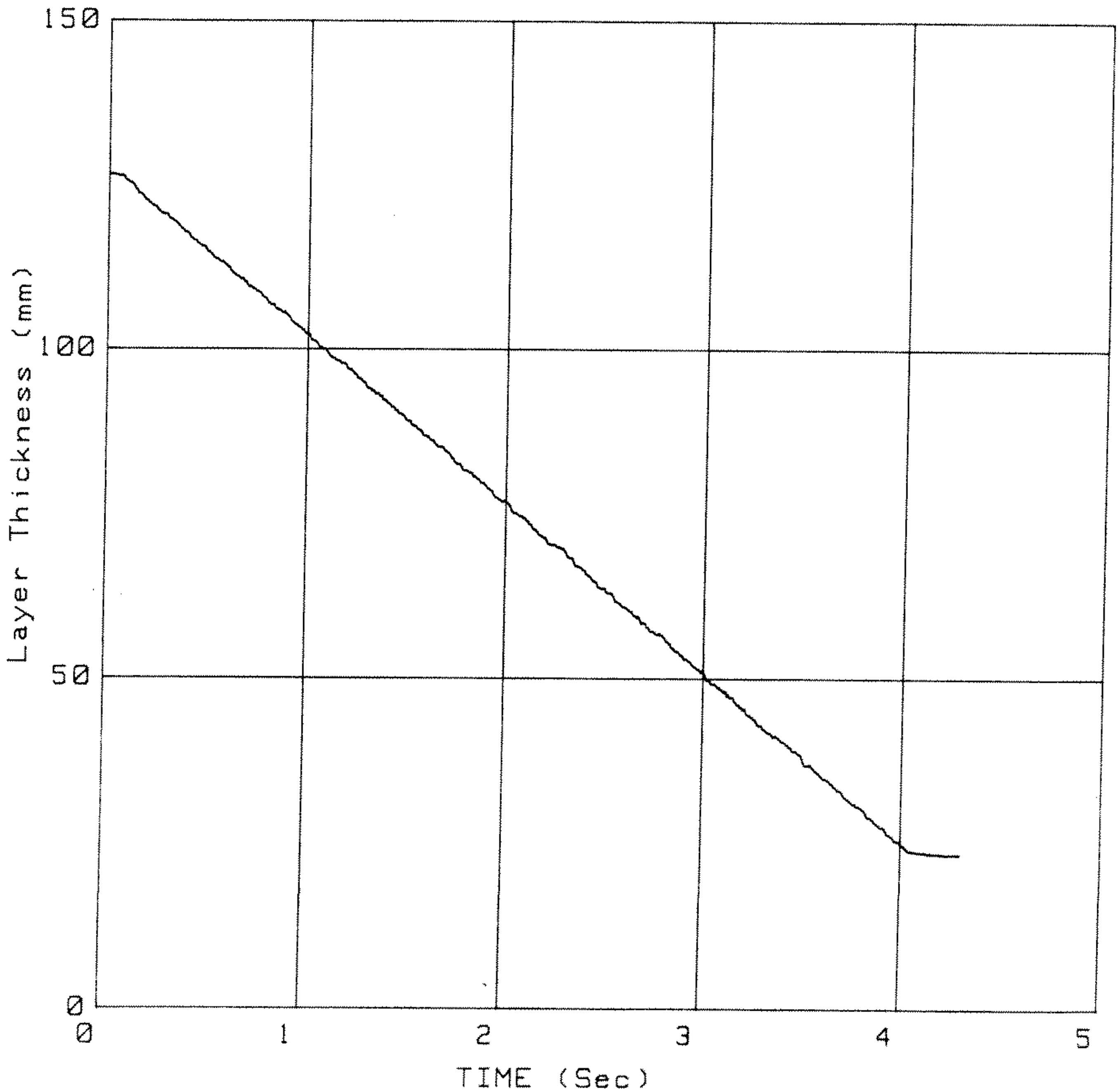
Layer Thickness
vs.
TIME

Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Temperature: -8.8

Average = 10
Truncation Time (s) = 4.3



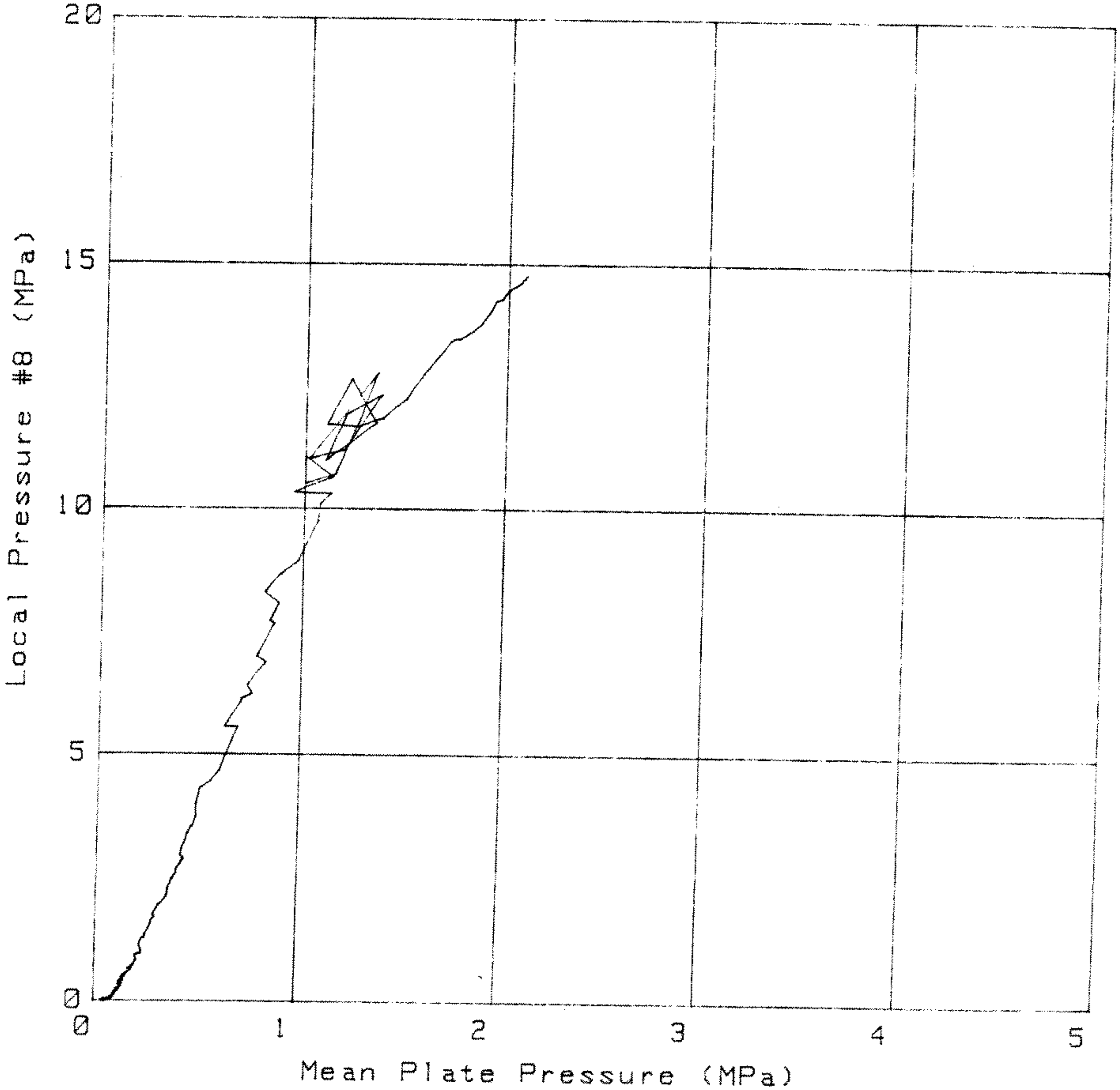
Local Pressure #8
vs.
Mean Plate Pressure

Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Temperature: -8.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 1.1
Data To (s): 4.16



Local Pressure #12
vs.
TIME

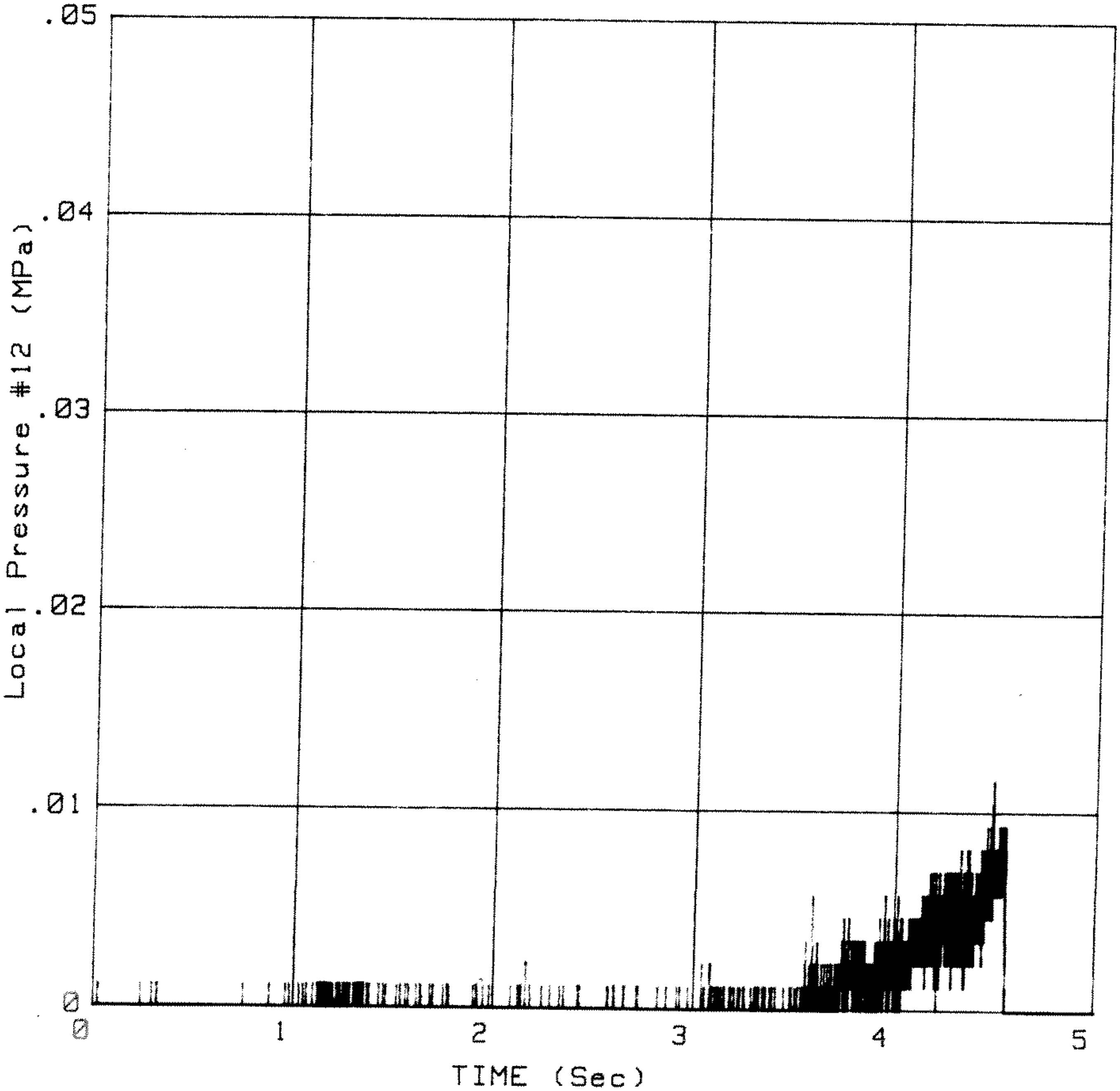
Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Y Offset Removed

Temperature: -8.8

Average = 1
Truncation Time (s) = 6.01



Local Pressure #12
vs.
TIME

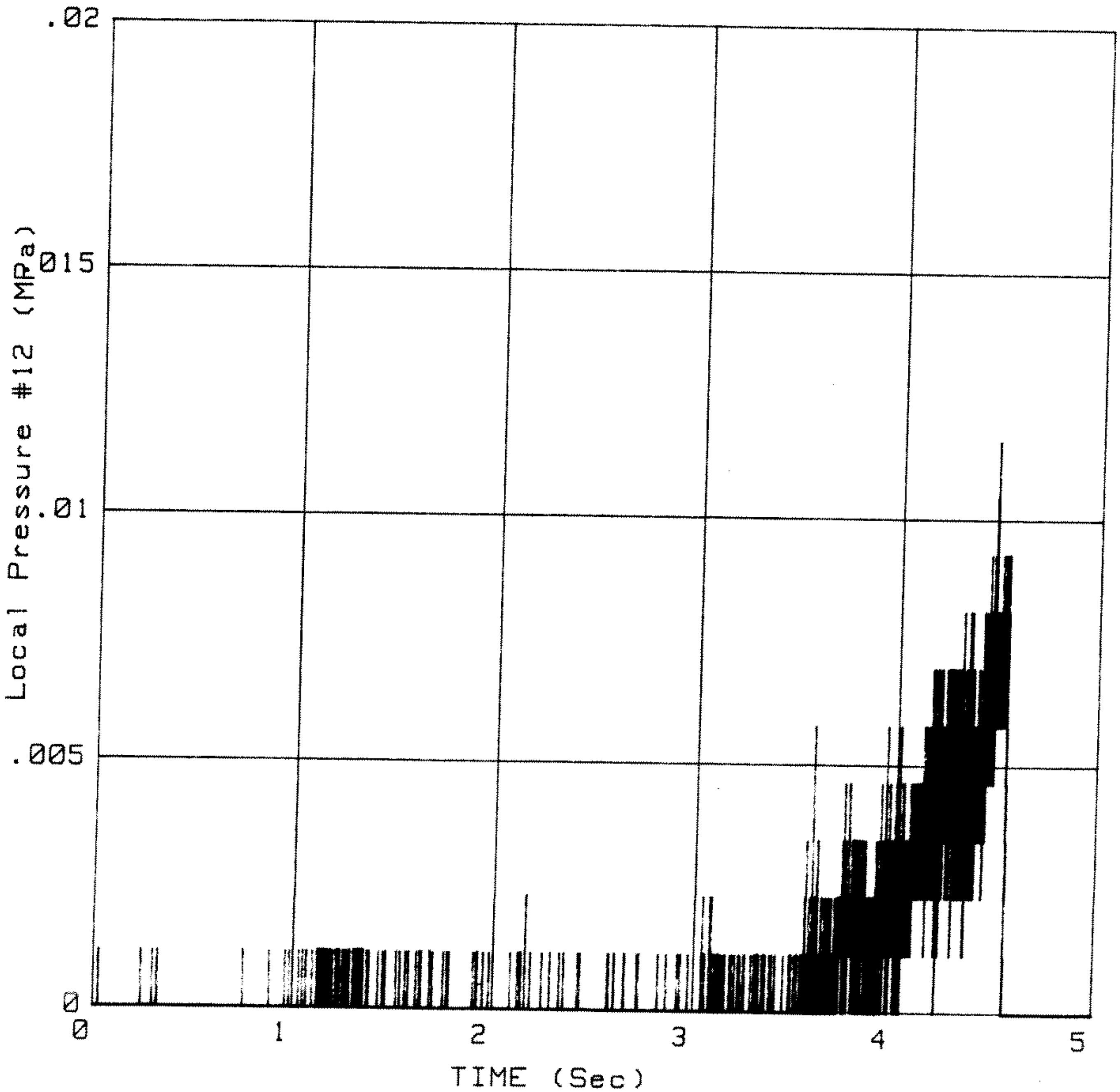
Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Temperature: -8.8

Y Offset Removed

Average = 1
Truncation Time (s) = 6.01



Local Pressure #10
vs.
TIME

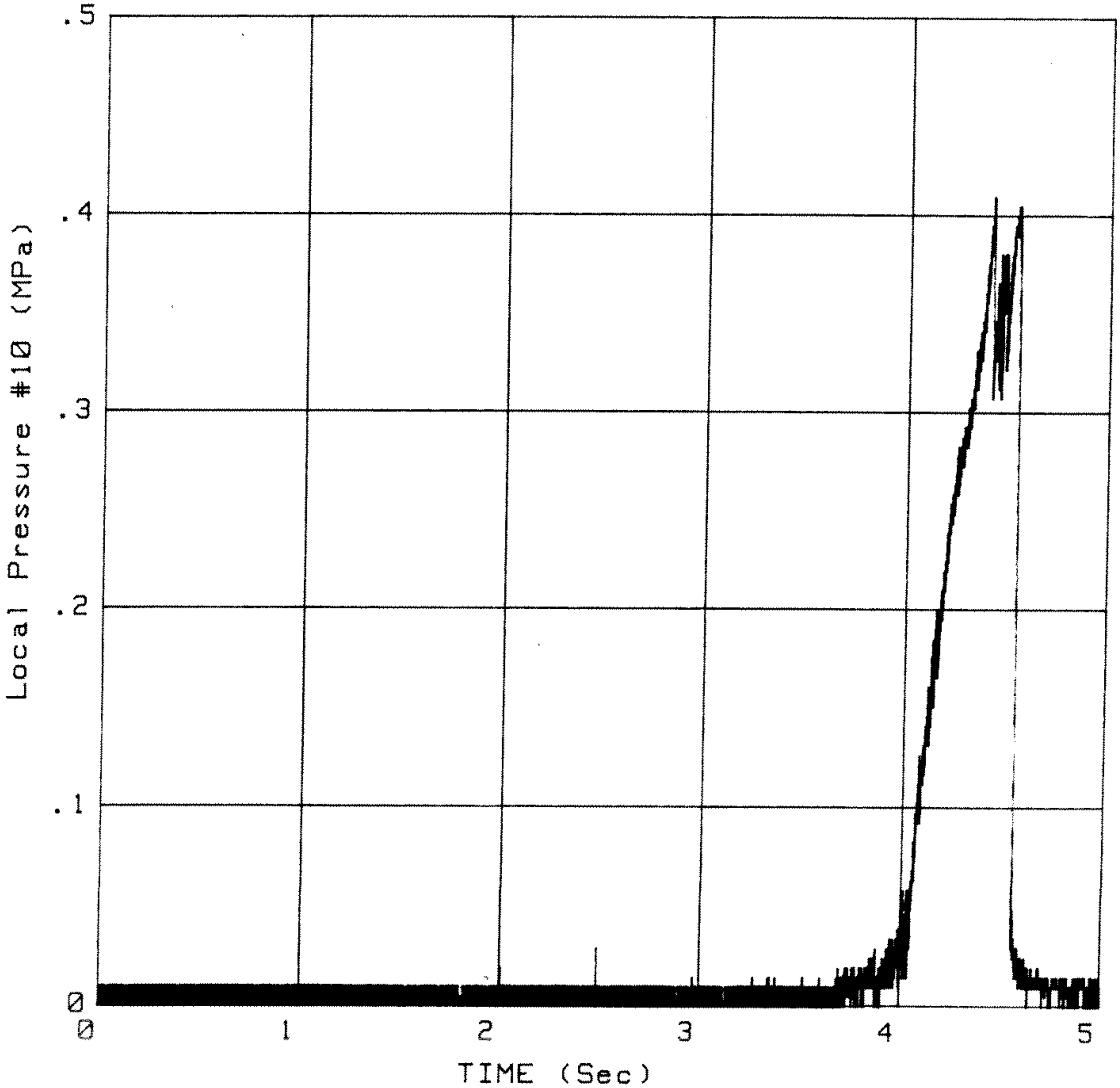
Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Y Offset Removed

Temperature: -8.8

Average = 1
Truncation Time (s) = 6.01



Mean Plate Pressure
vs.
TIME

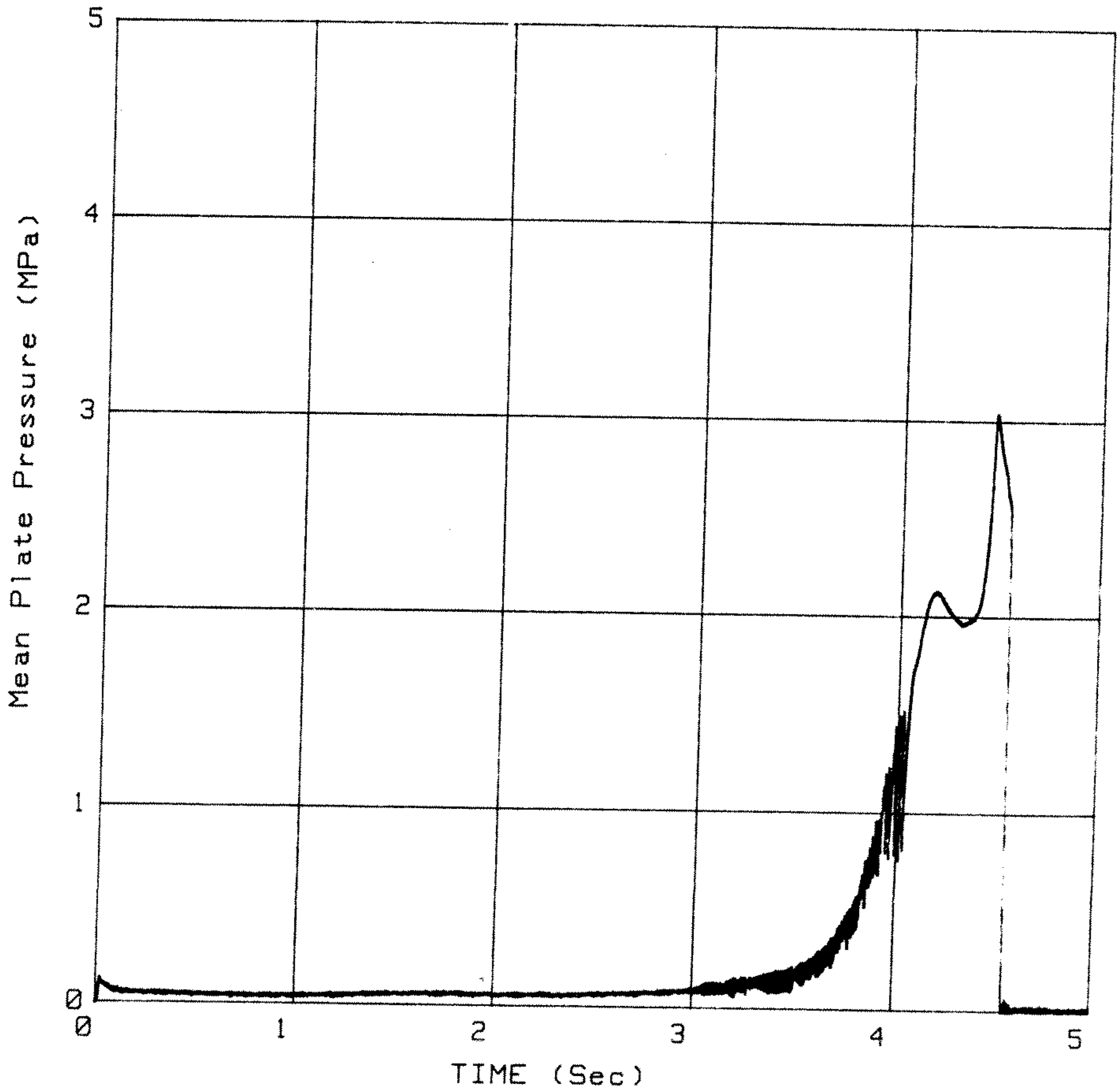
Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Y Offset Removed

Temperature: -8.8

Average = 1
Truncation Time (s) = 6.01



Local Pressure #16
vs.
TIME

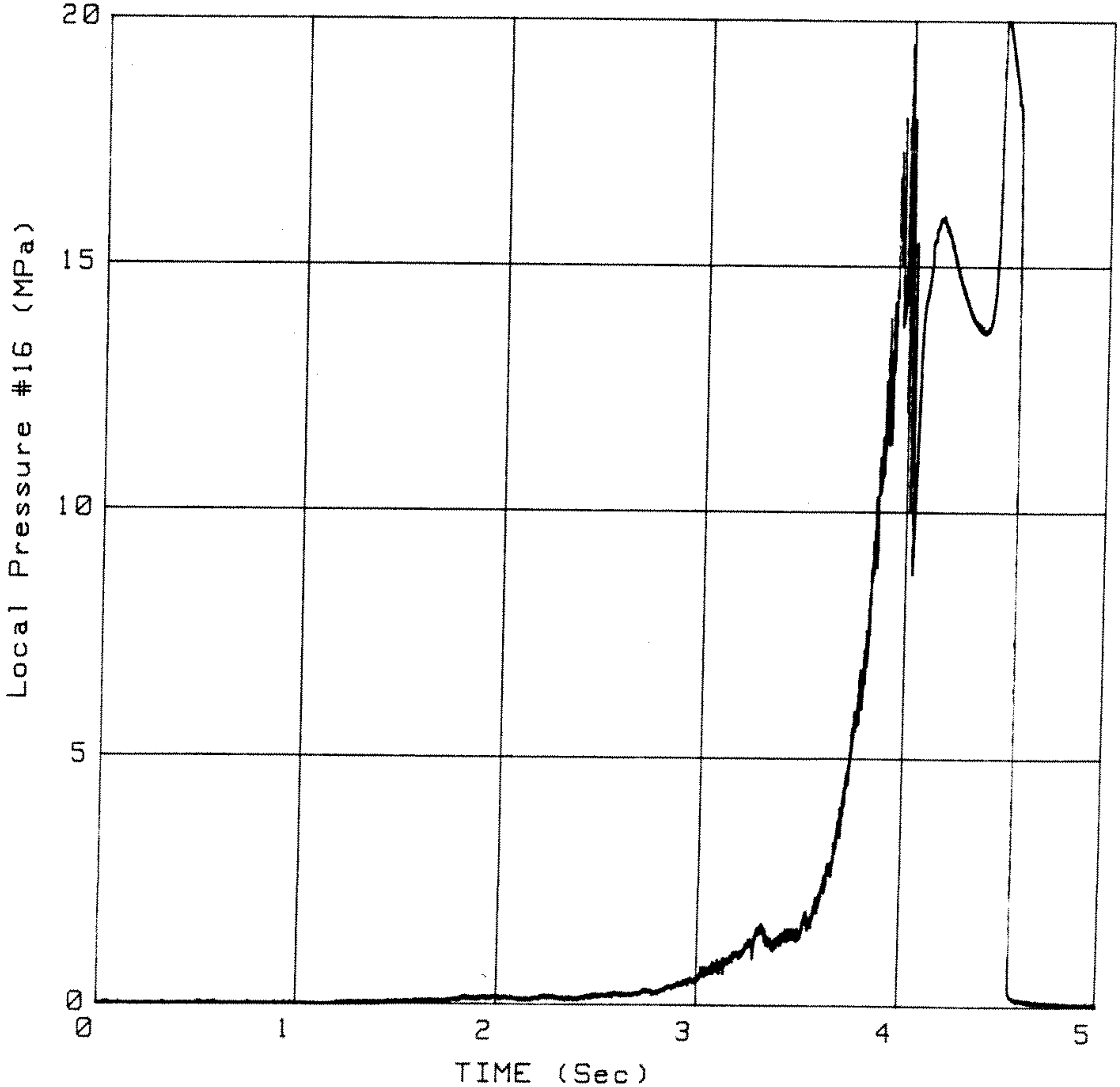
Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Temperature: -8.8

Y Offset Removed

Average = 1
Truncation Time (s) = 6.01



Local Pressure #8
vs.
TIME

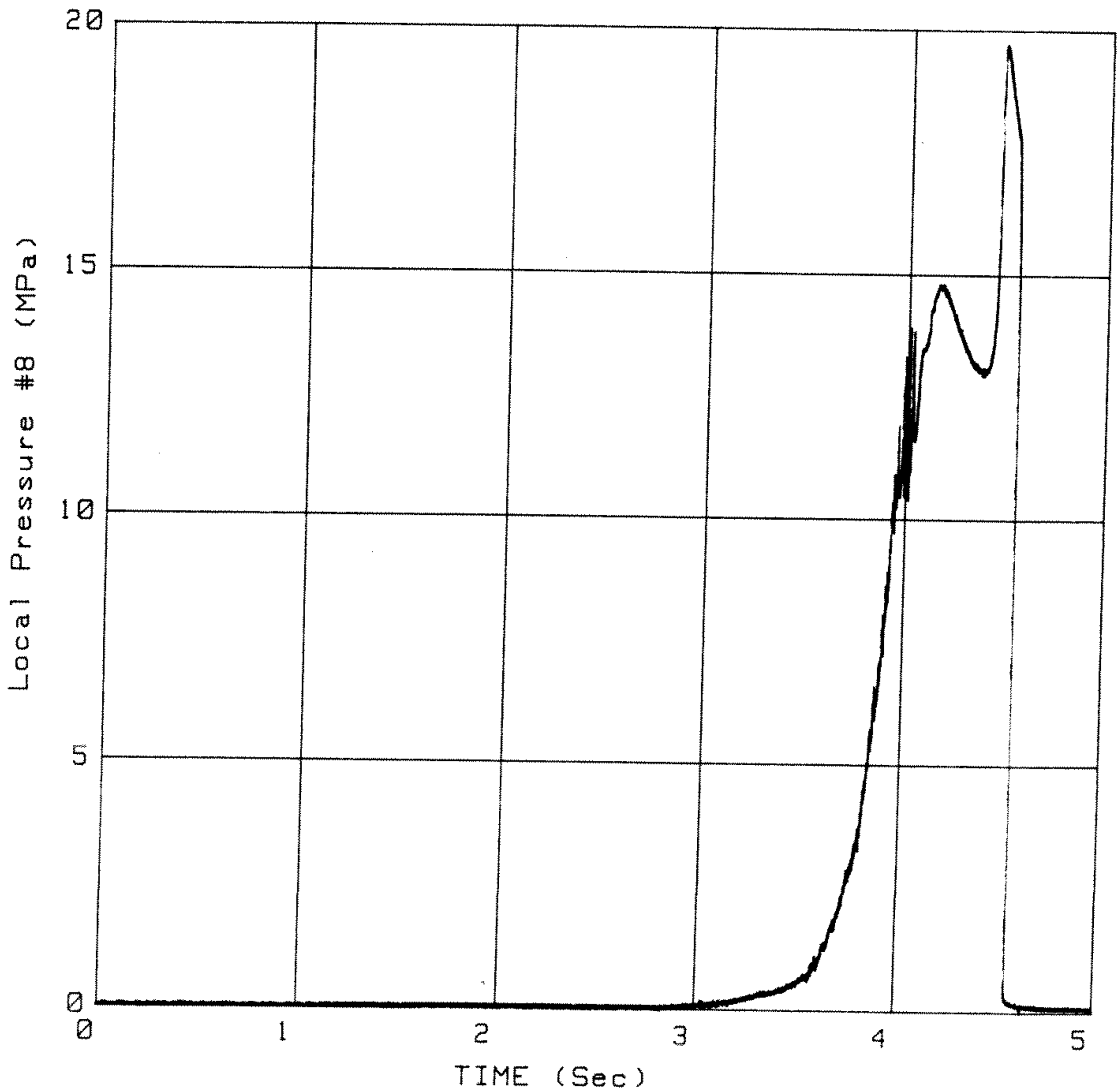
Test: X989
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 15:56:44

Y Offset Removed

Temperature: -8.8

Average = 1
Truncation Time (s) = 6.01



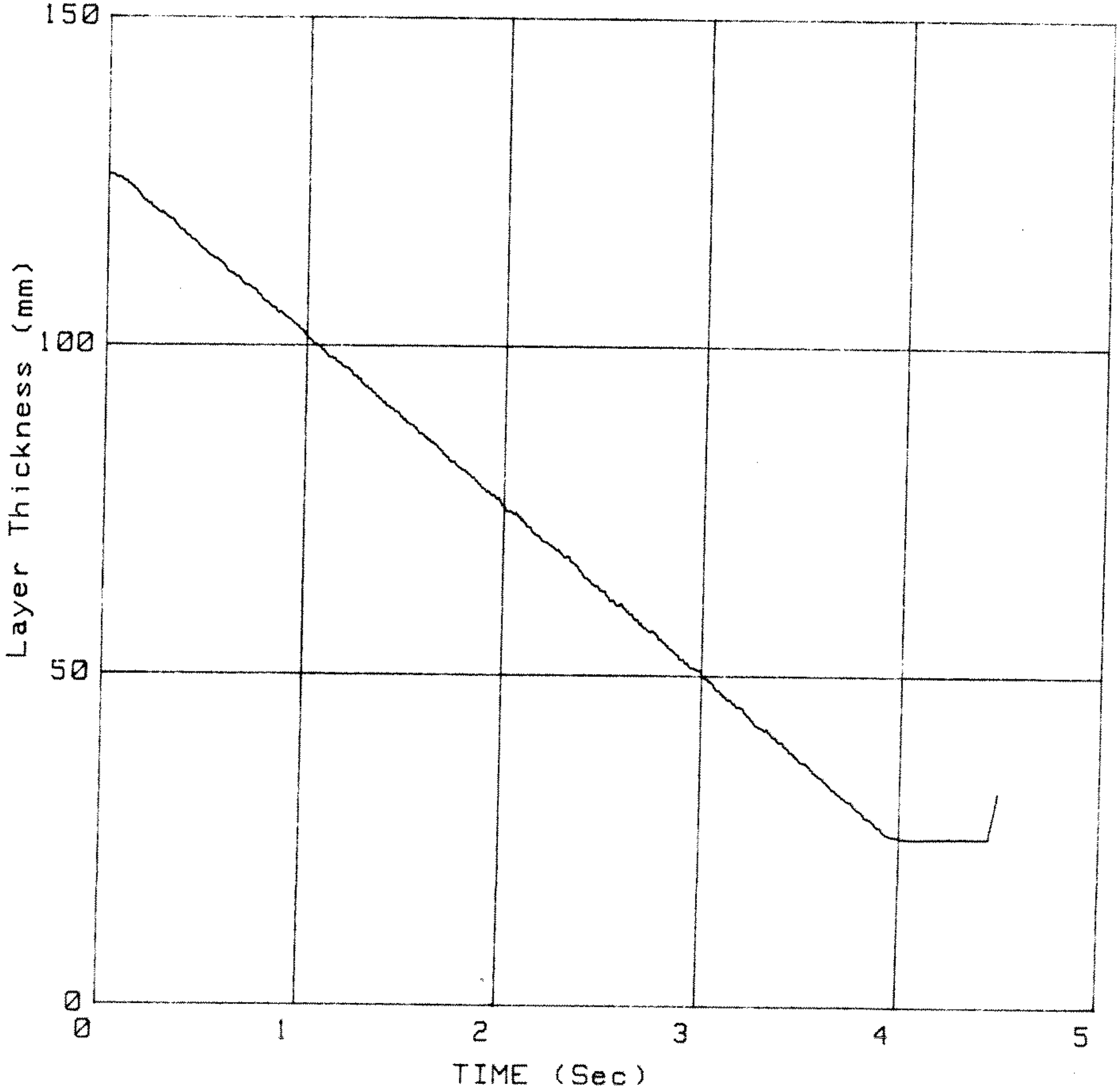
Layer Thickness
vs.
TIME

Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 13:30:37

Temperature: -9

Average = 10
Truncation Time (s) = 4.5



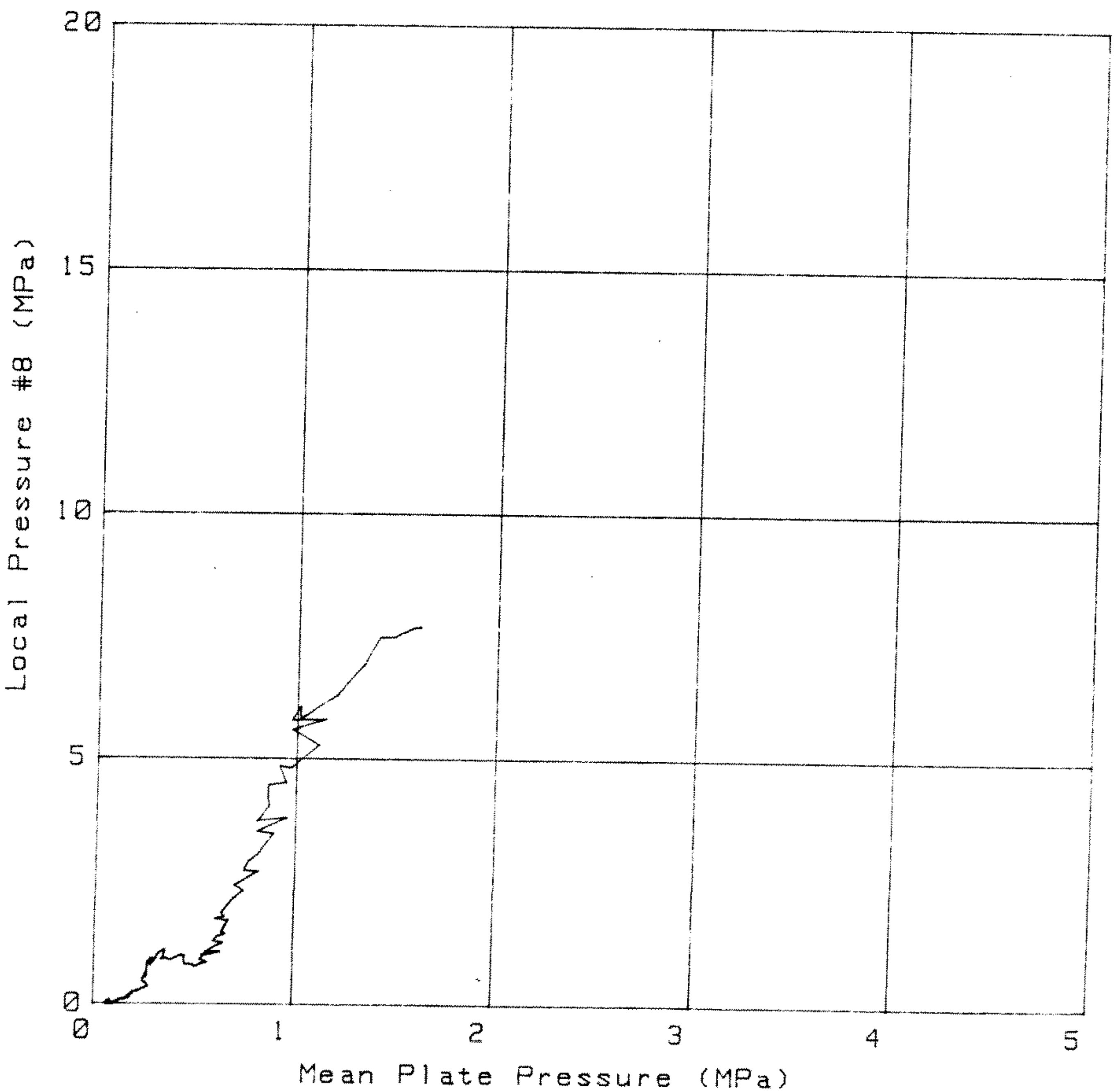
Local Pressure #8
vs.
Mean Plate Pressure

Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 13:30:37

Temperature: -9

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 1.13
Data To (s): 3.97



Local Pressure #12
vs.
TIME

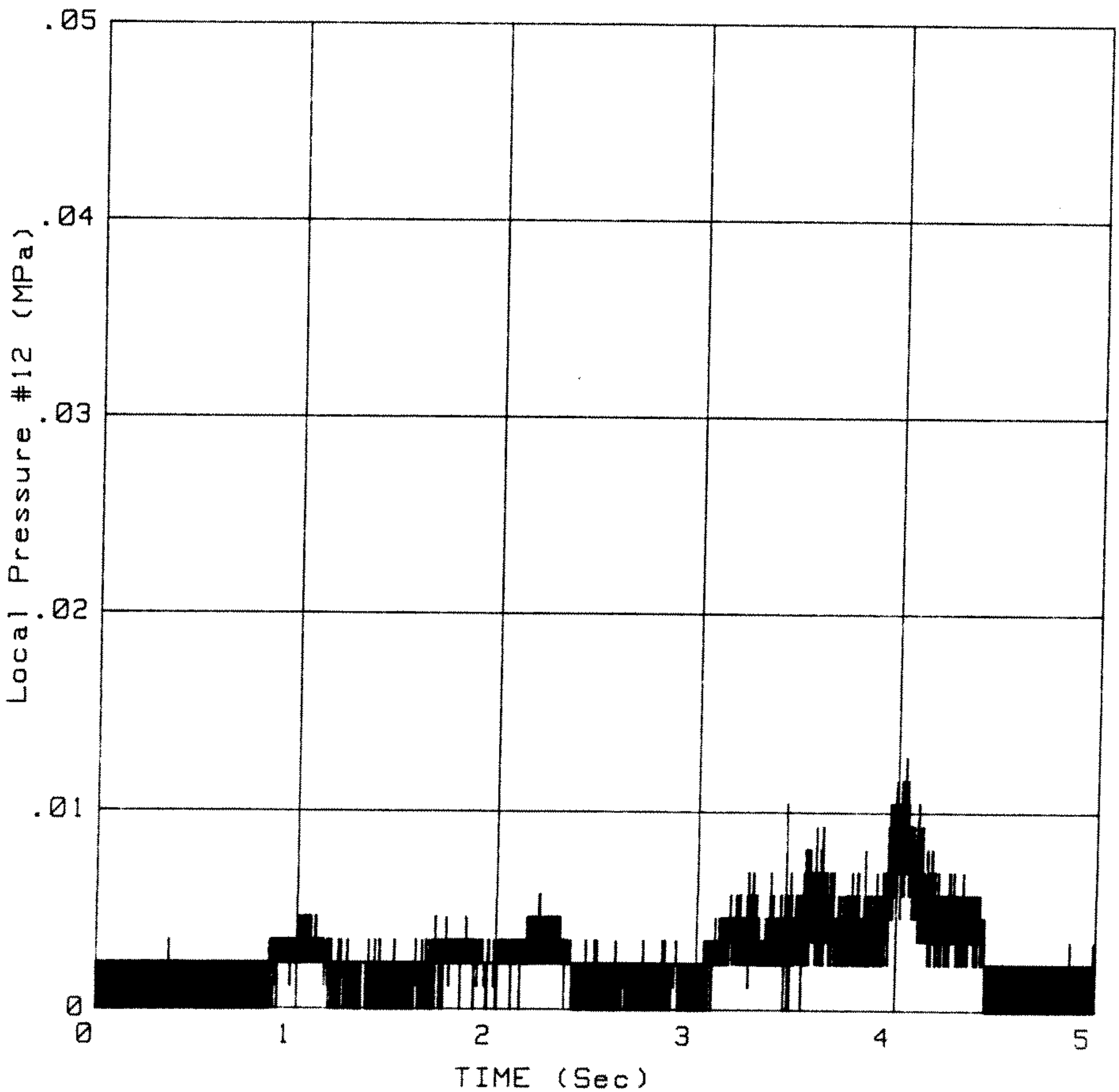
Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 13:30:37

Y Offset Removed

Temperature: -9

Average = 1
Truncation Time (s) = 6.01



Local Pressure #10
vs.
TIME

Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

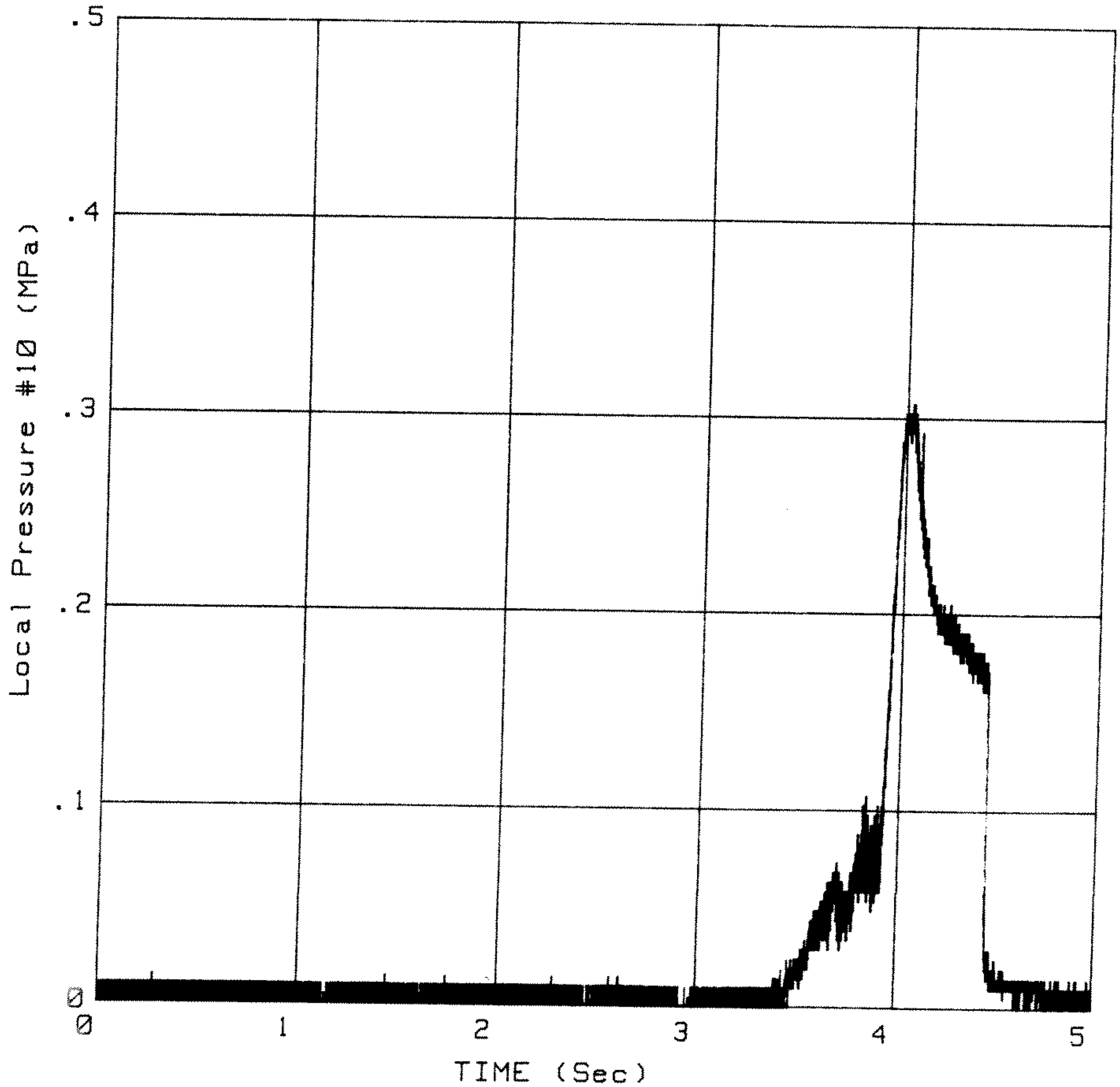
Date: 14 Dec 1988
Time: 13:30:37

Y Offset Removed

Temperature: -9

Average = 1

Truncation Time (s) = 6.01



Local Pressure #8
vs.
TIME

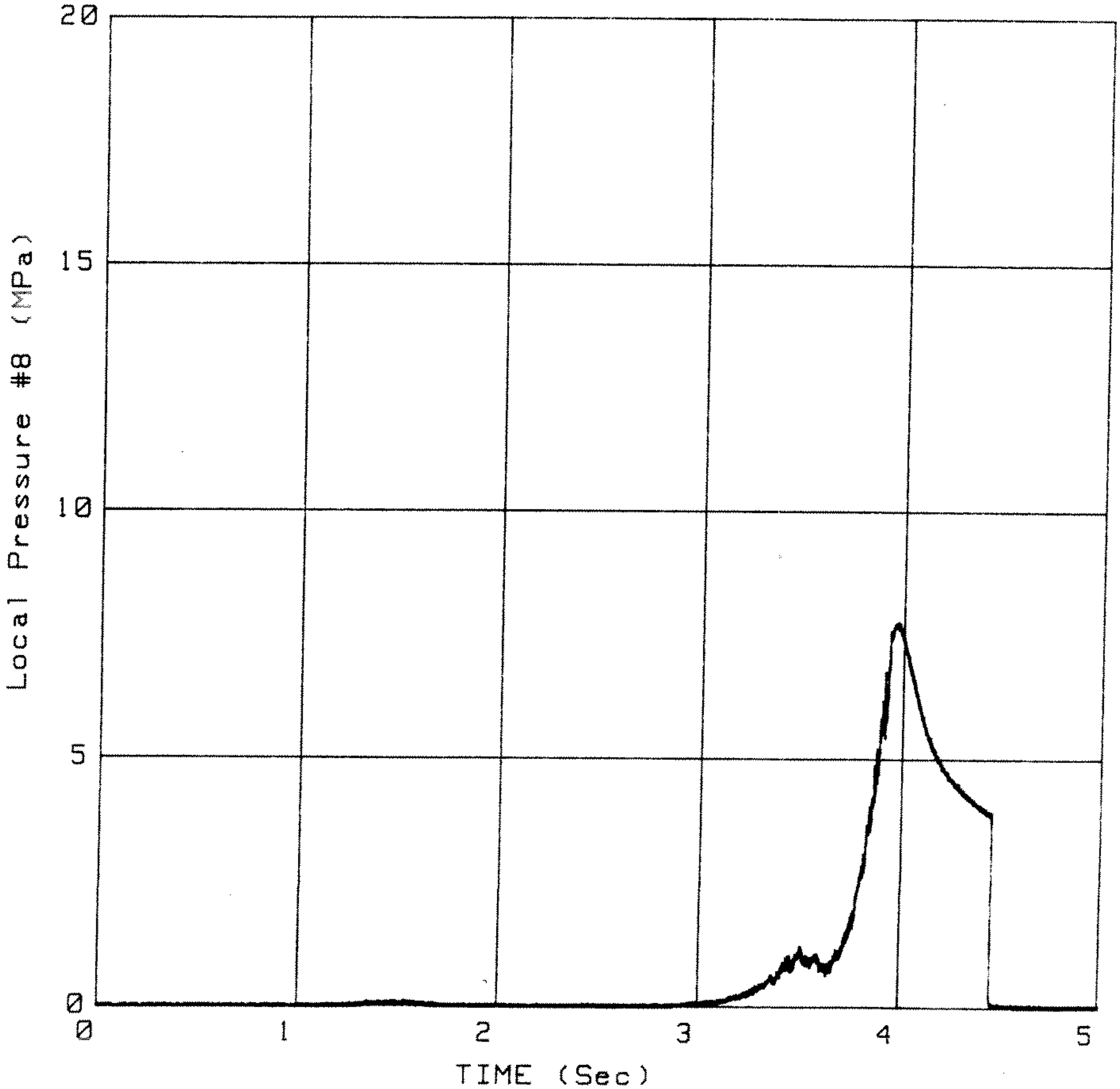
Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 13:30:37

Temperature: -9

Y Offset Removed

Average = 1
Truncation Time (s) = 6.01



Local Pressure #16
vs.
TIME

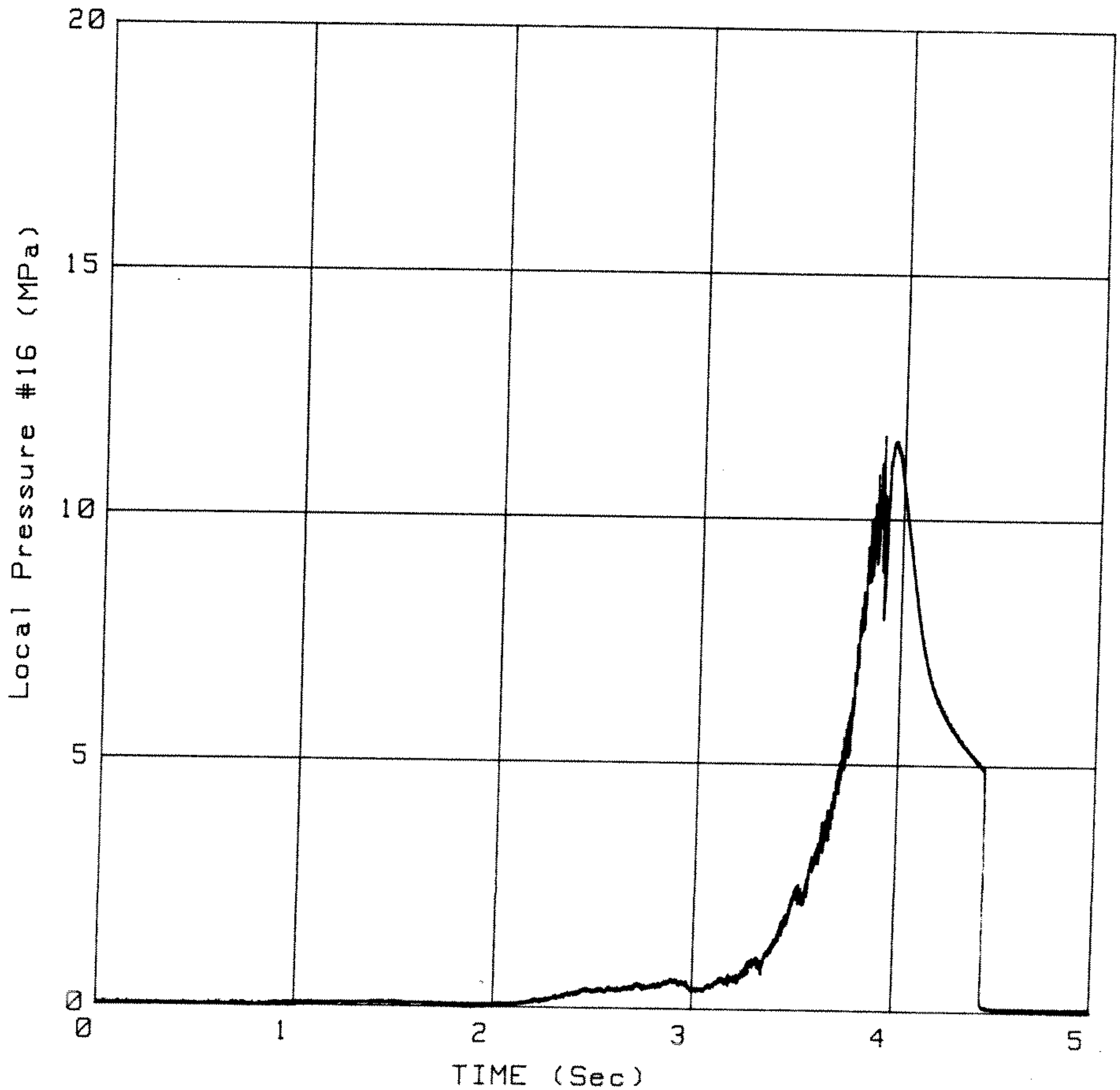
Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 13:30:37

Y Offset Removed

Temperature: -9

Average = 1
Truncation Time (s) = 6.01



Mean Plate Pressure
vs.
TIME

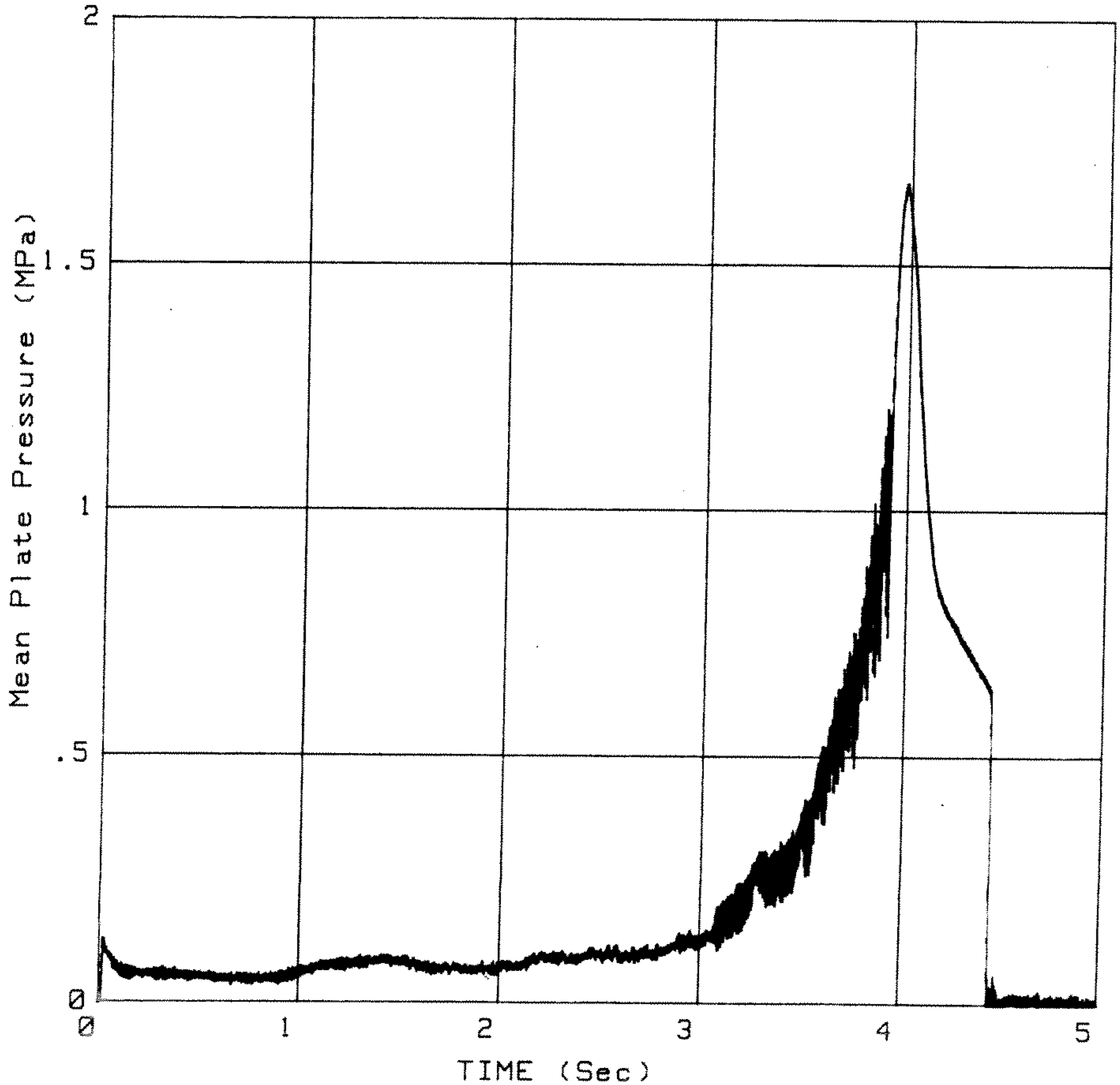
Test: X990
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 13:30:37

Temperature: -9

Y Offset Removed

Average = 1
Truncation Time (s) = 6.01



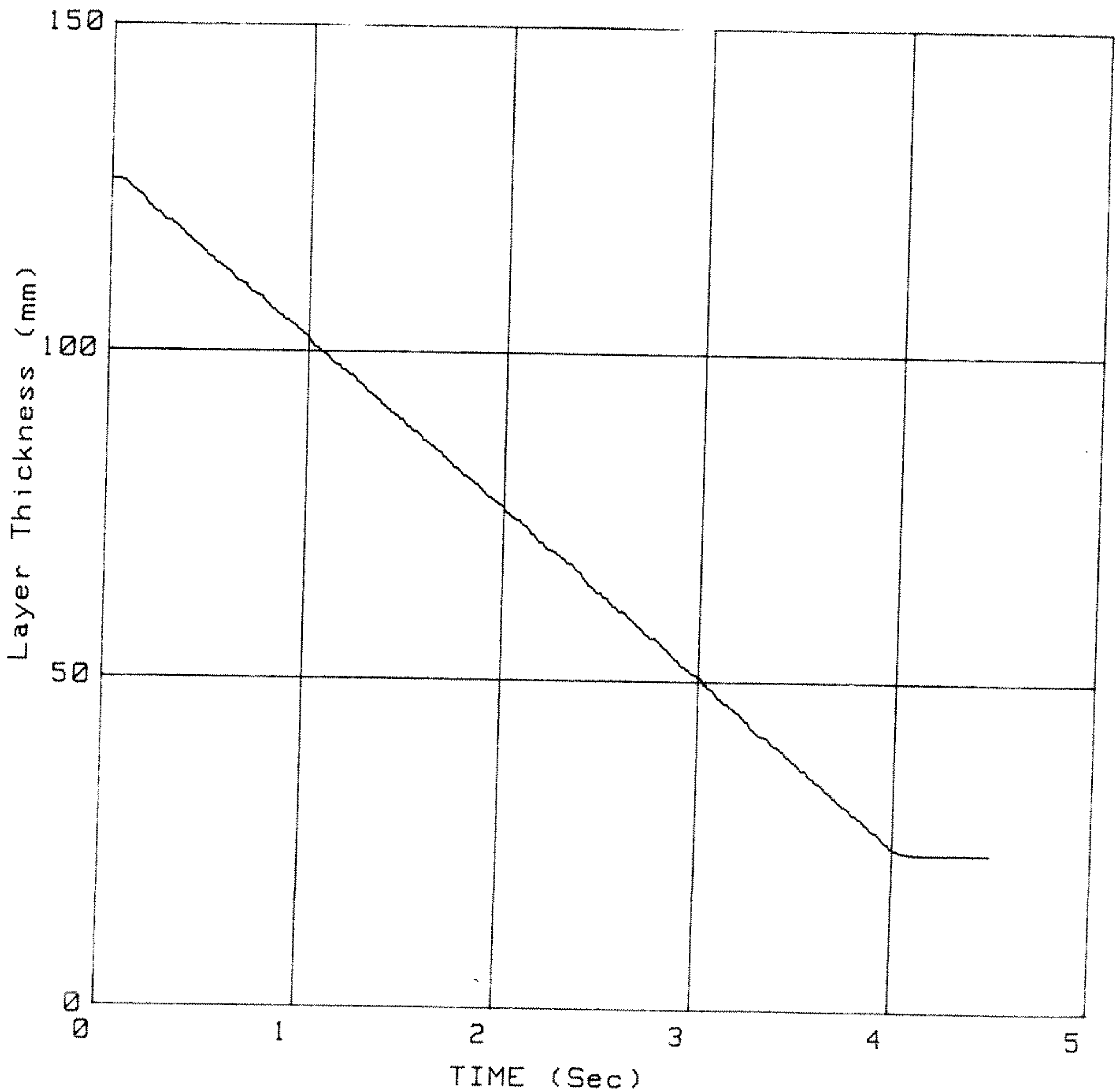
Layer Thickness
vs.
TIME

Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Temperature: -9.8

Average = 10
Truncation Time (s) = 4.5



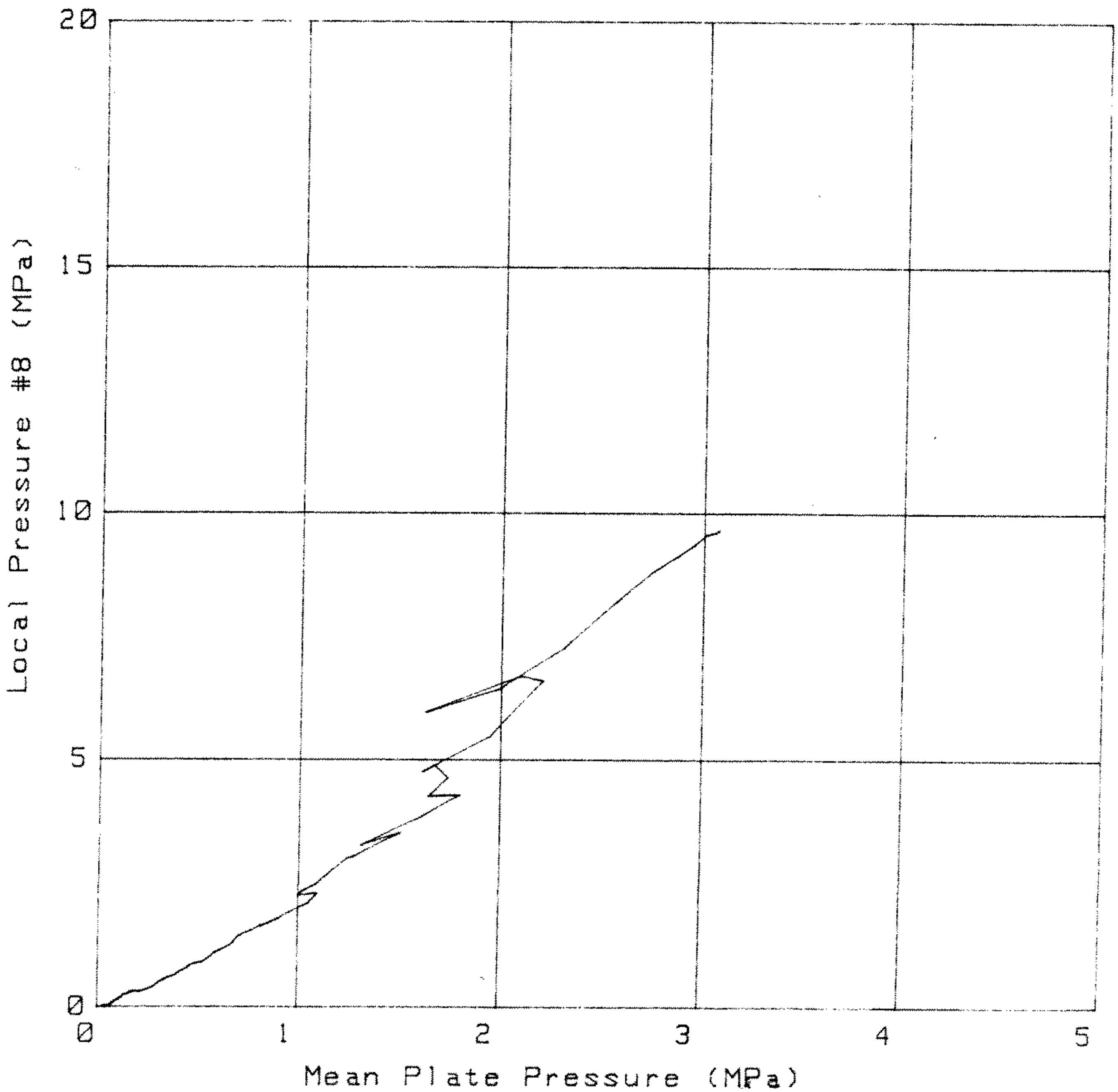
Local Pressure #8
vs.
Mean Plate Pressure

Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Temperature: -9.8

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .83
Data To (s): 4.09



Local Pressure #12
vs.
TIME

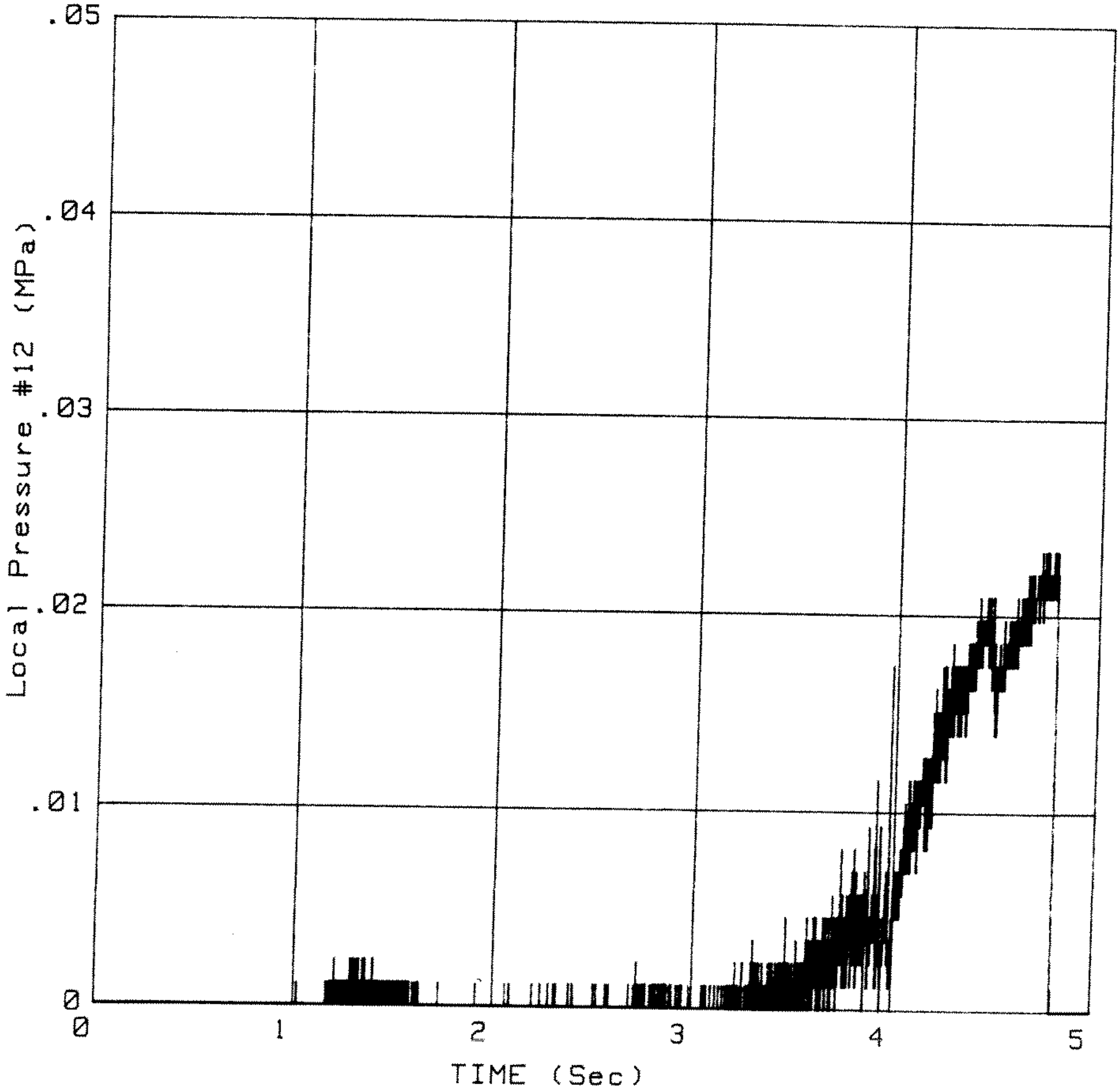
Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 10.21



Local Pressure #10
vs.
TIME

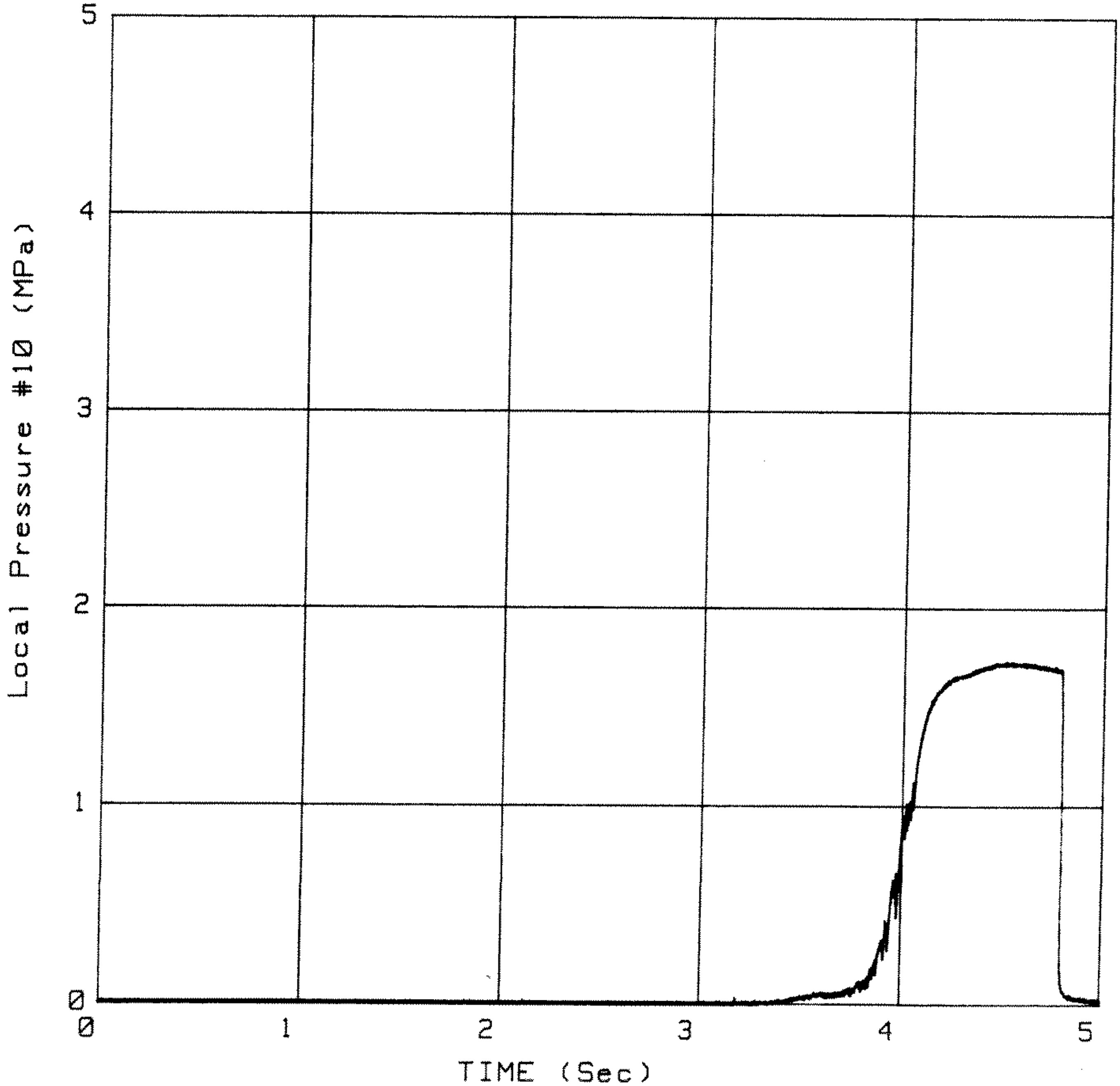
Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 10.21



Local Pressure #8
vs.
TIME

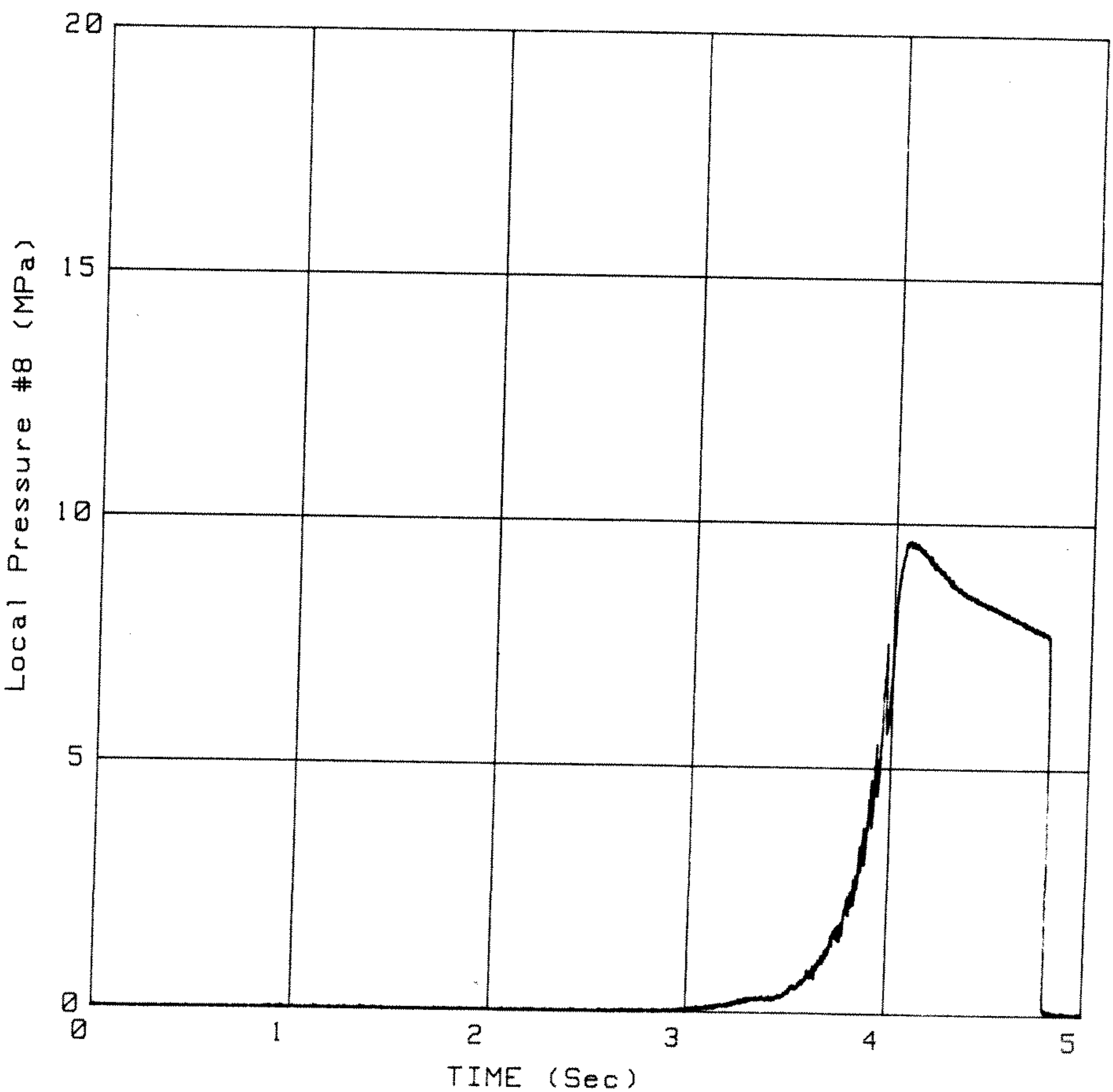
Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Temperature: -9.8

Y Offset Removed

Average = 1
Truncation Time (s) = 10.21



Local Pressure #16
vs.
TIME

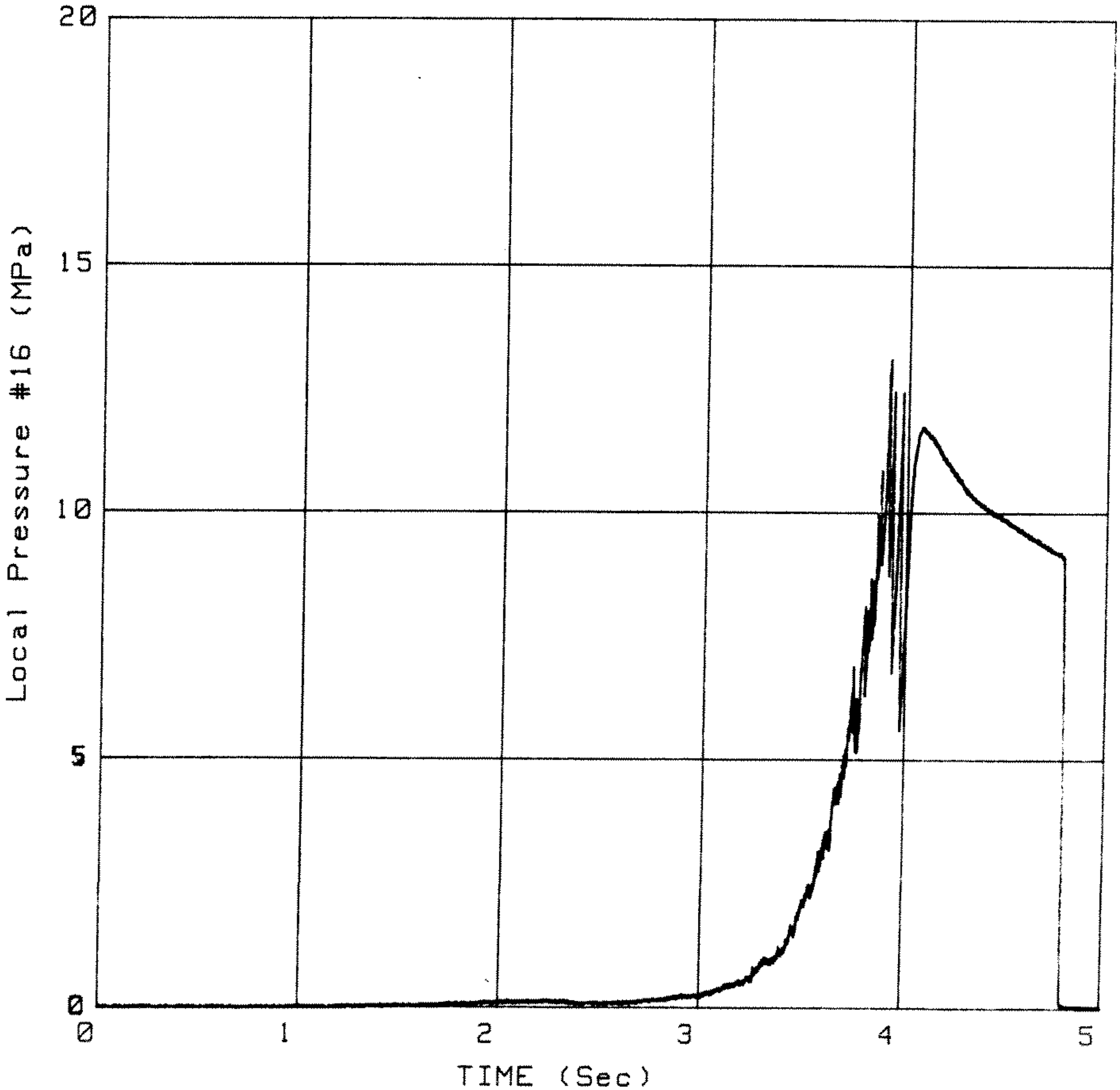
Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 10.21



Mean Plate Pressure vs. TIME

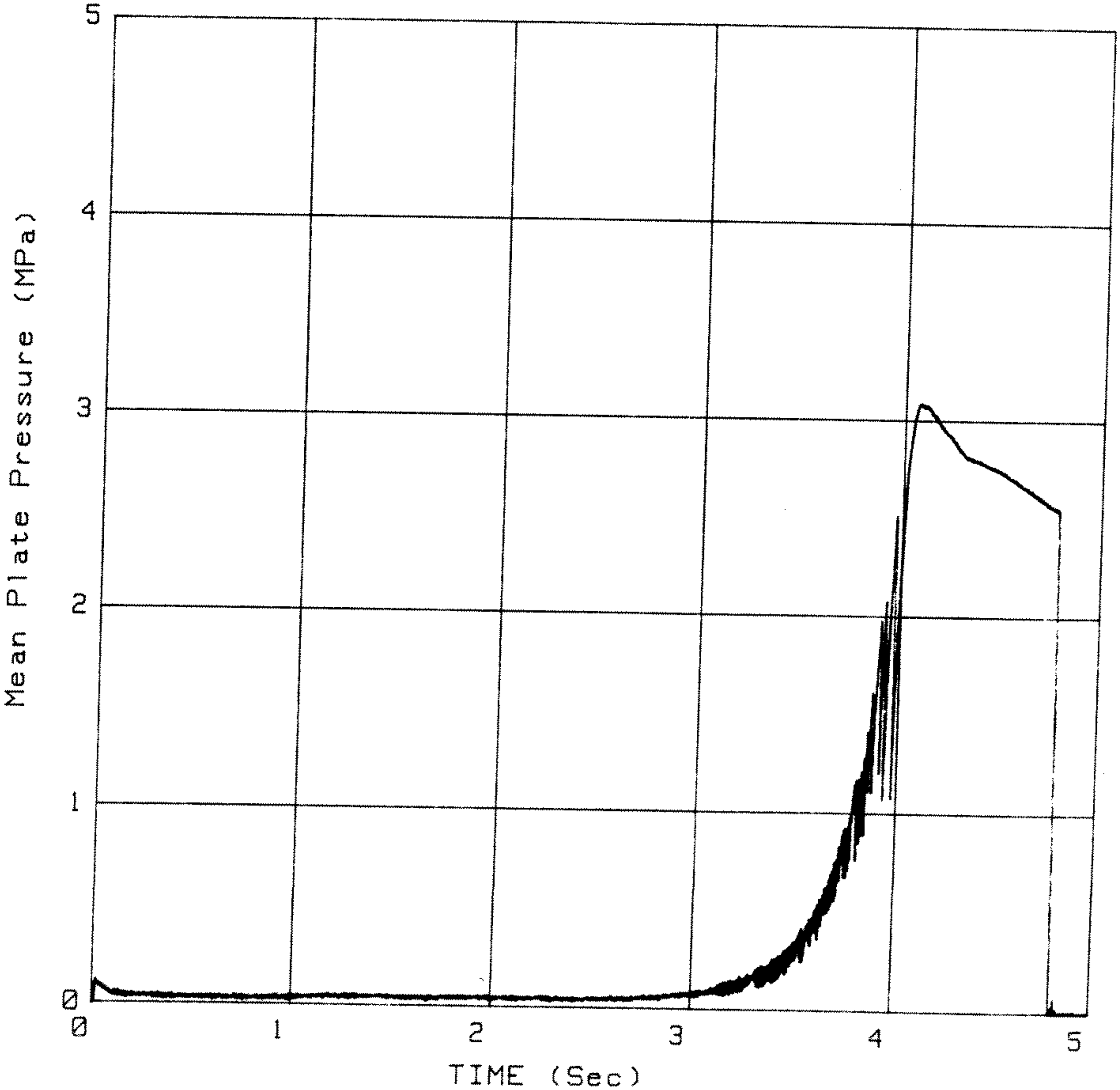
Test: X991
Type: Extrusion test
Sample: CRUSHED ICE

Date: 14 Dec 1988
Time: 09:43:24

Y Offset Removed

Temperature: -9.8

Average = 1
Truncation Time (s) = 10.21



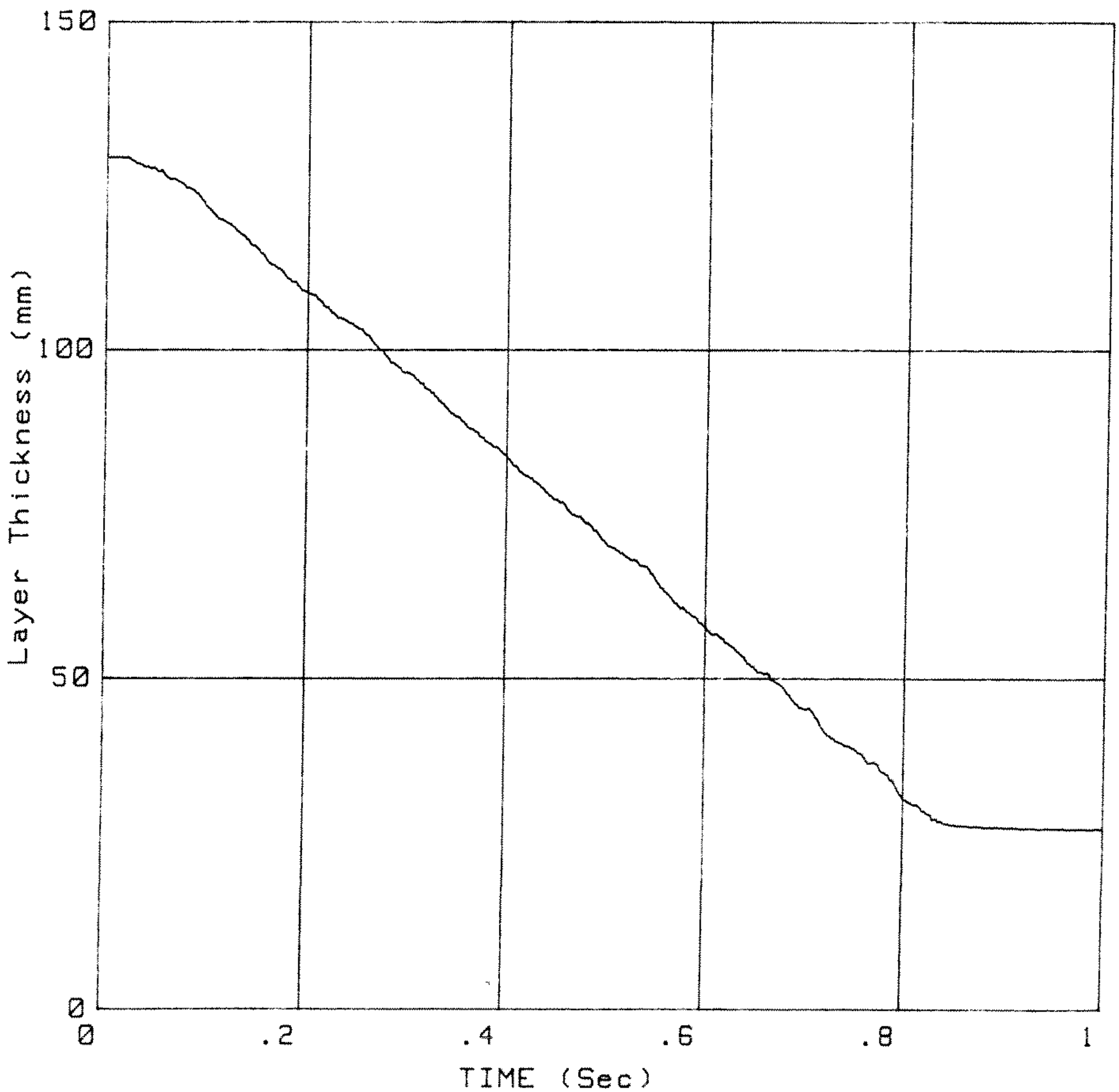
Layer Thickness vs. TIME

Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 15:42:47

Temperature: -9.6

Average = 10
Truncation Time (s) = 1



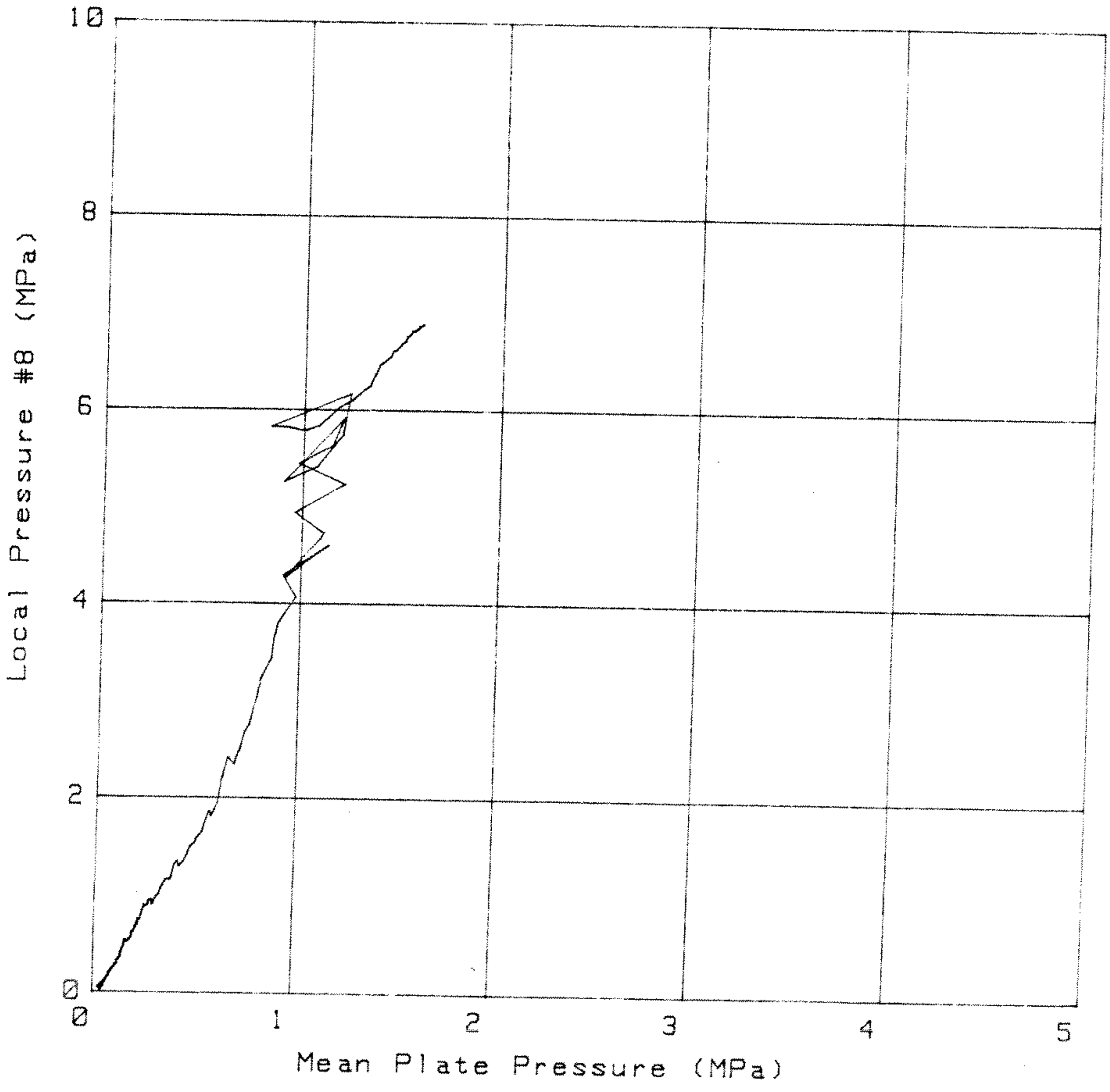
Local Pressure #8
vs.
Mean Plate Pressure

Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 15:42:47

Temperature: -9.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .26
Data To (s): .91



Local Pressure #12
vs.
TIME

Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

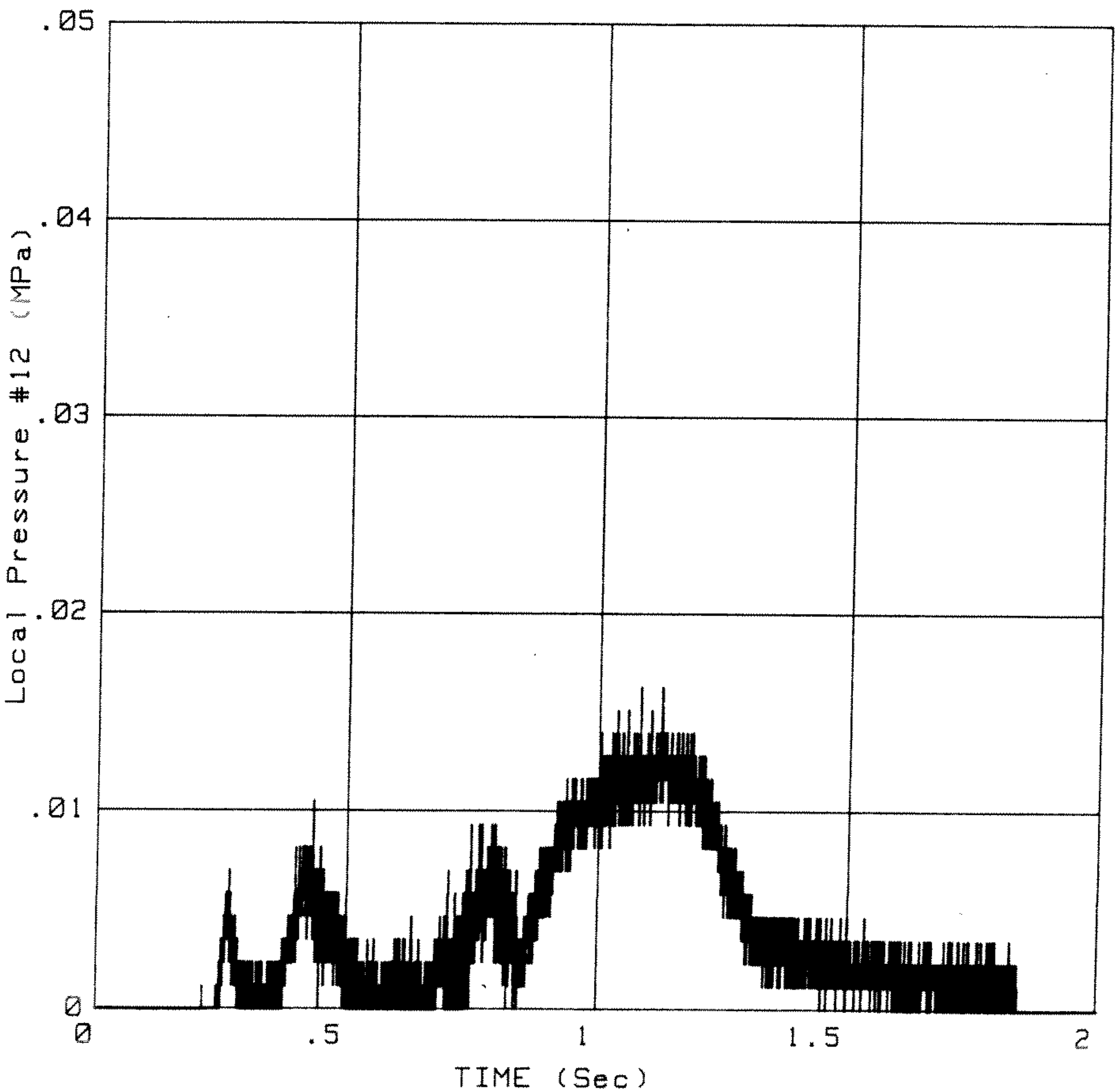
Date: 13 Dec 1988
Time: 15:42:47

Temperature: -9.6

Y Offset Removed

Average = 1

Truncation Time (s) = 2.03



Local Pressure #10
vs.
TIME

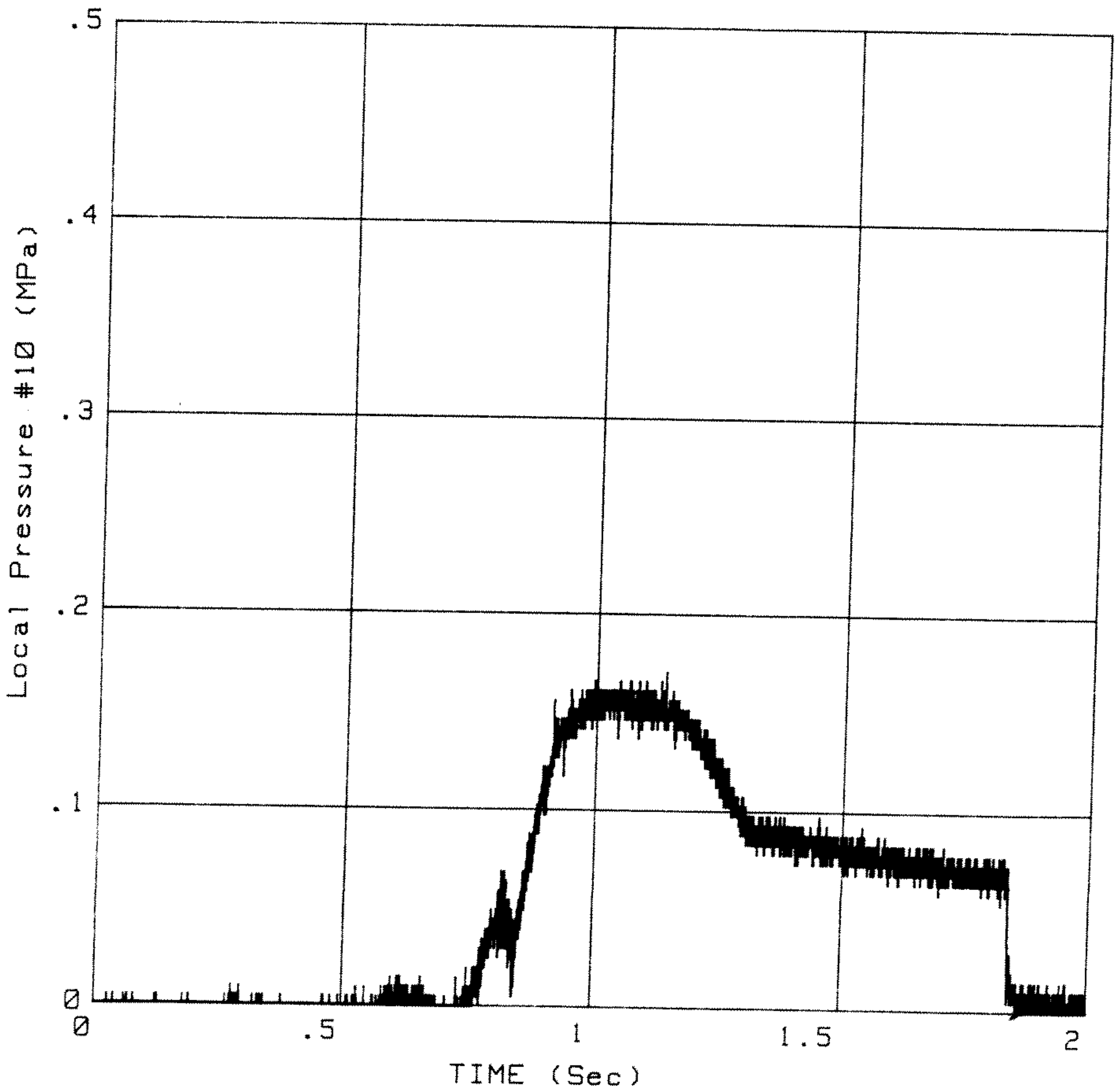
Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 15:42:47

Temperature: -9.6

Y Offset Removed

Average = 1
Truncation Time (s) = 2.03



Local Pressure #8
vs.
TIME

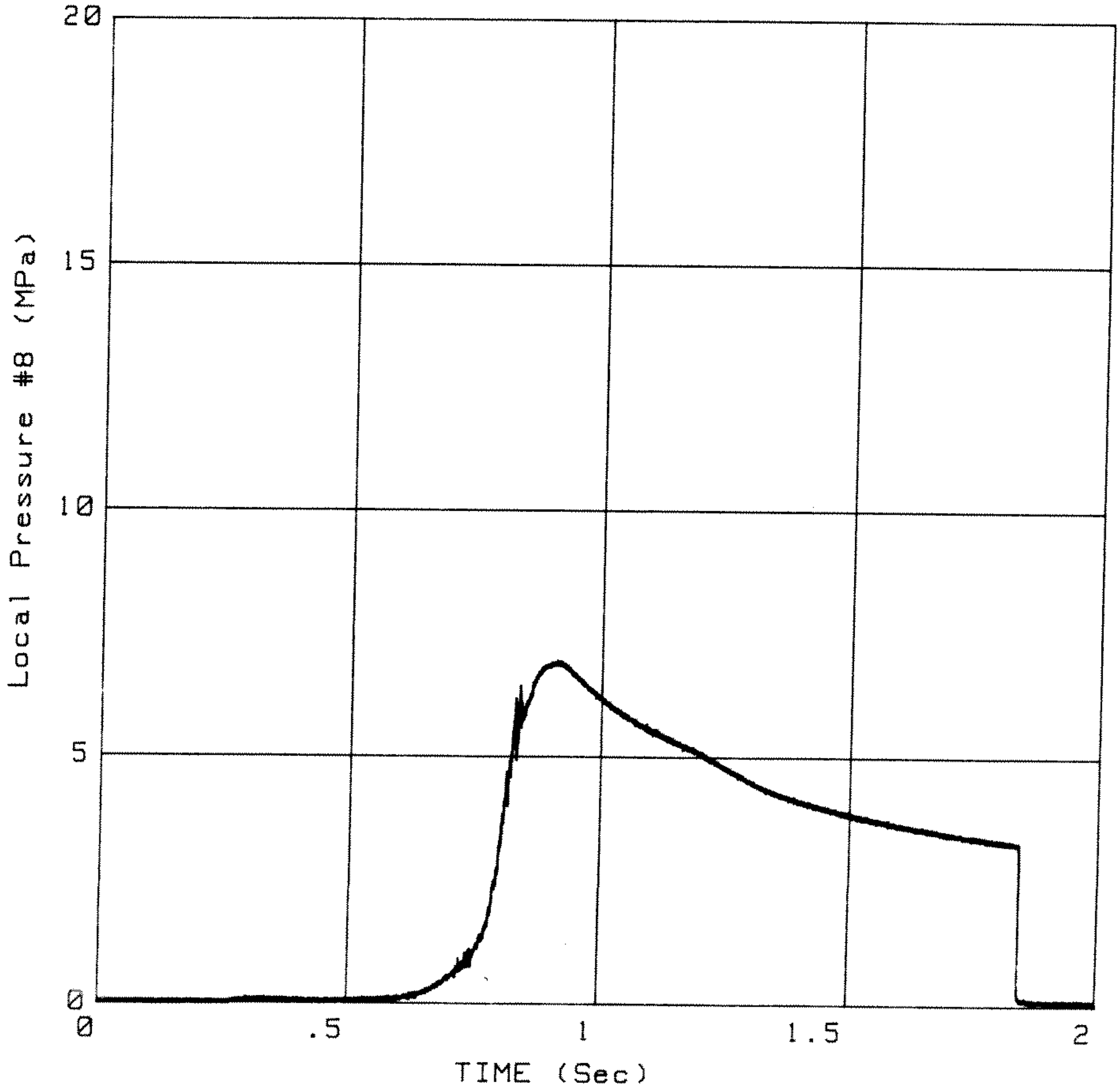
Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 15:42:47

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



Local Pressure #16
vs.
TIME

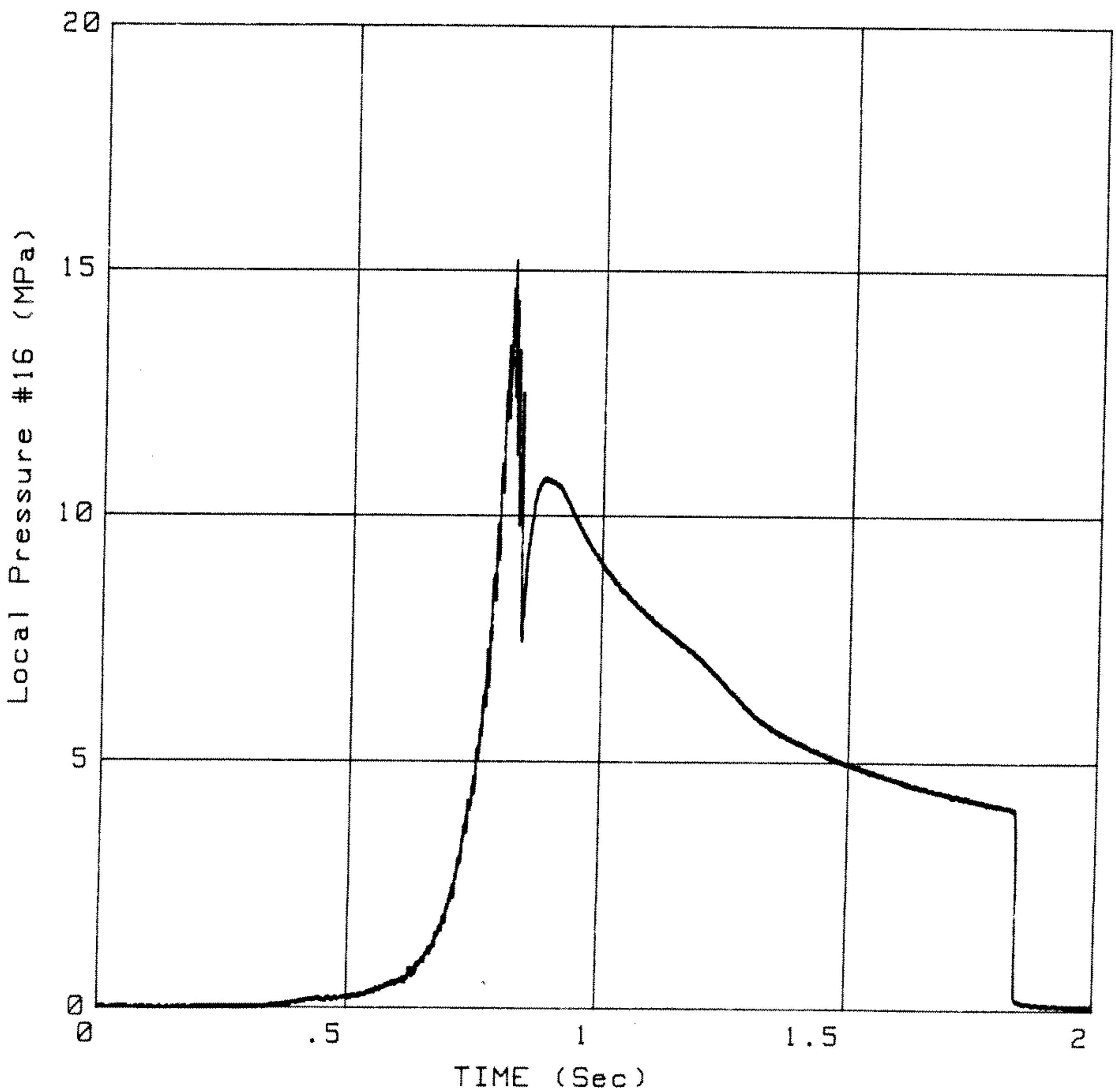
Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 15:42:47

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



Mean Plate Pressure
vs.
TIME

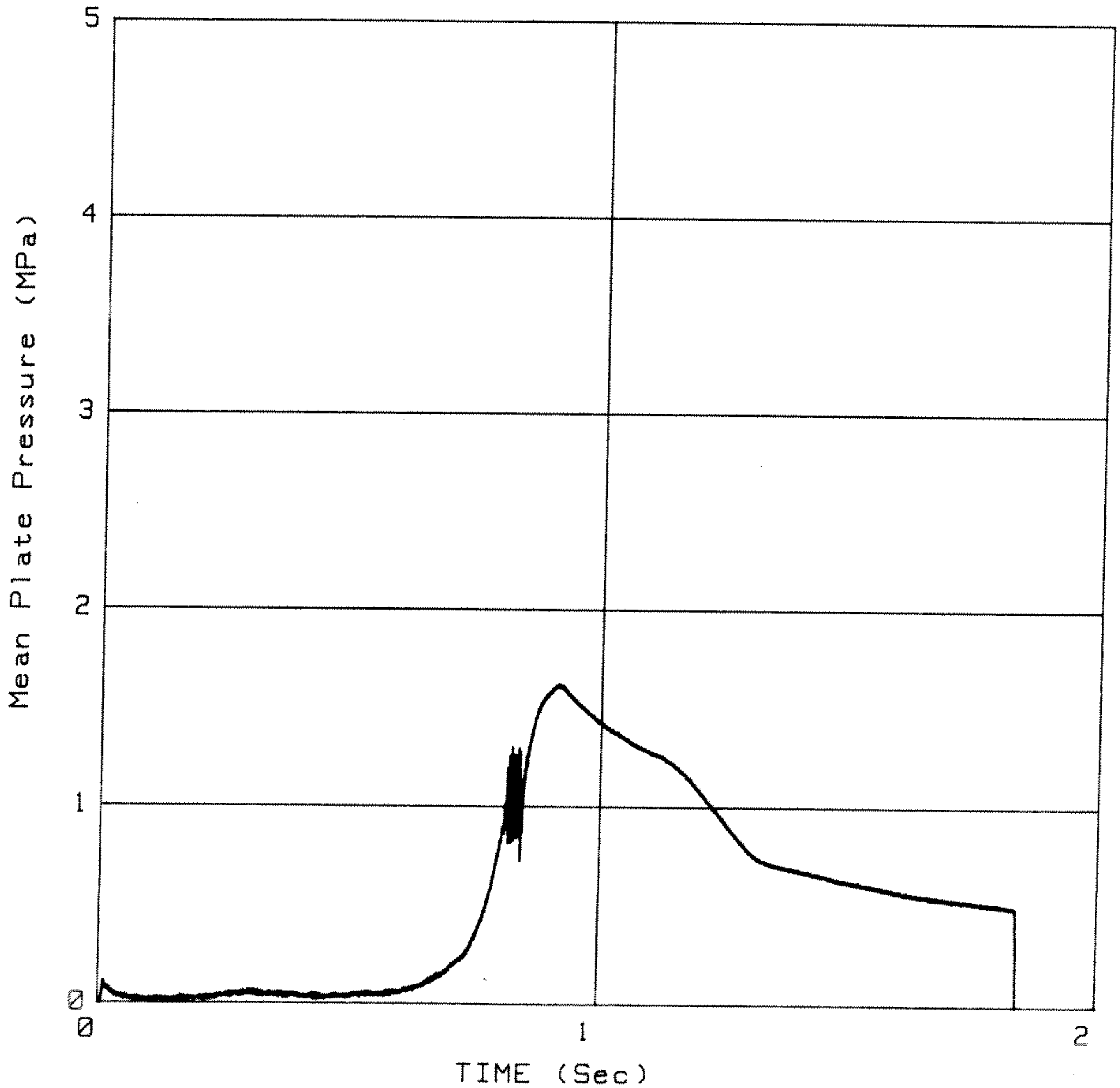
Test: X992
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 15:42:47

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



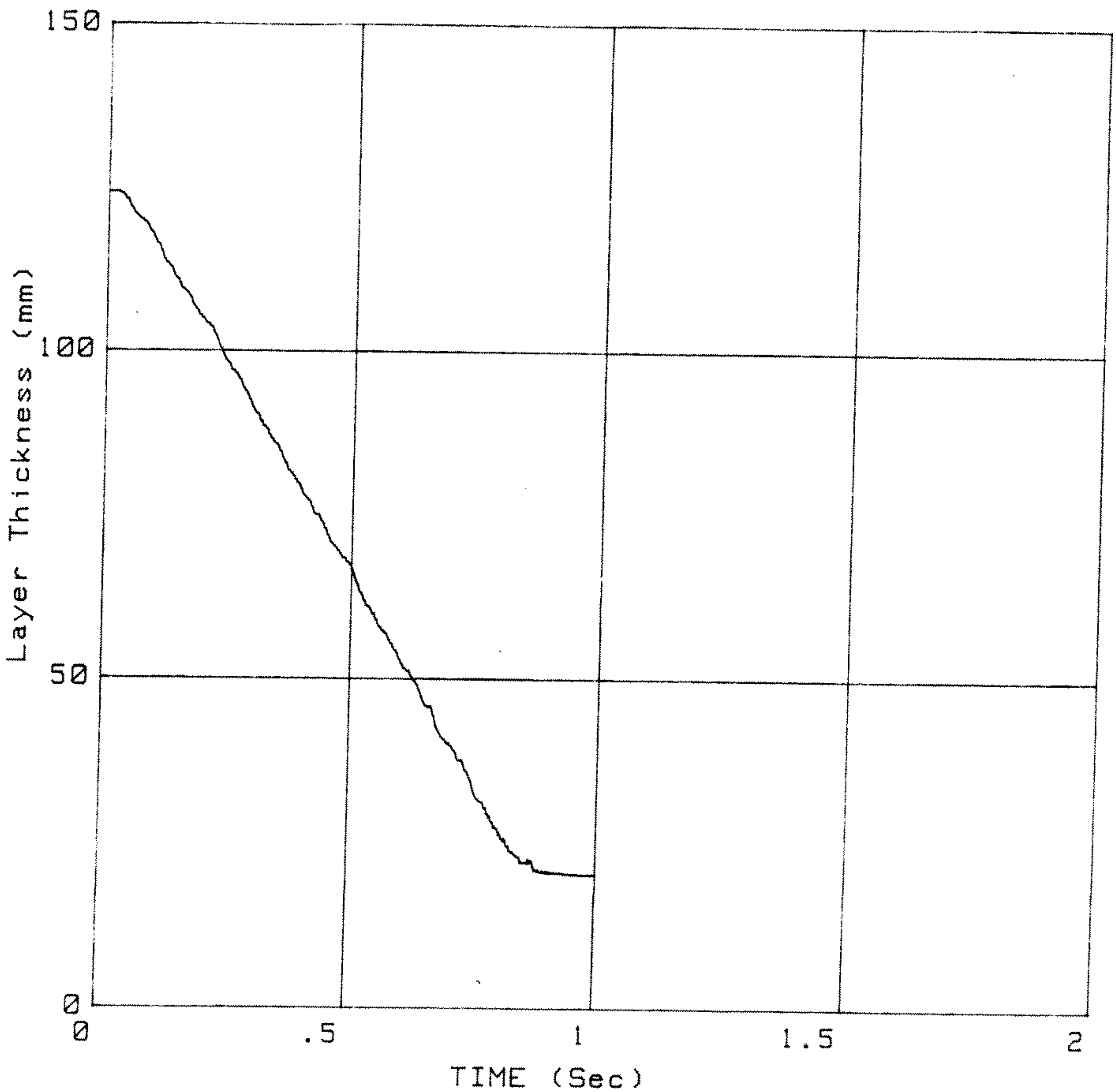
Layer Thickness
vs.
TIME

Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 09:33:27

Temperature: -9.4

Average = 10
Truncation Time (s) = 1



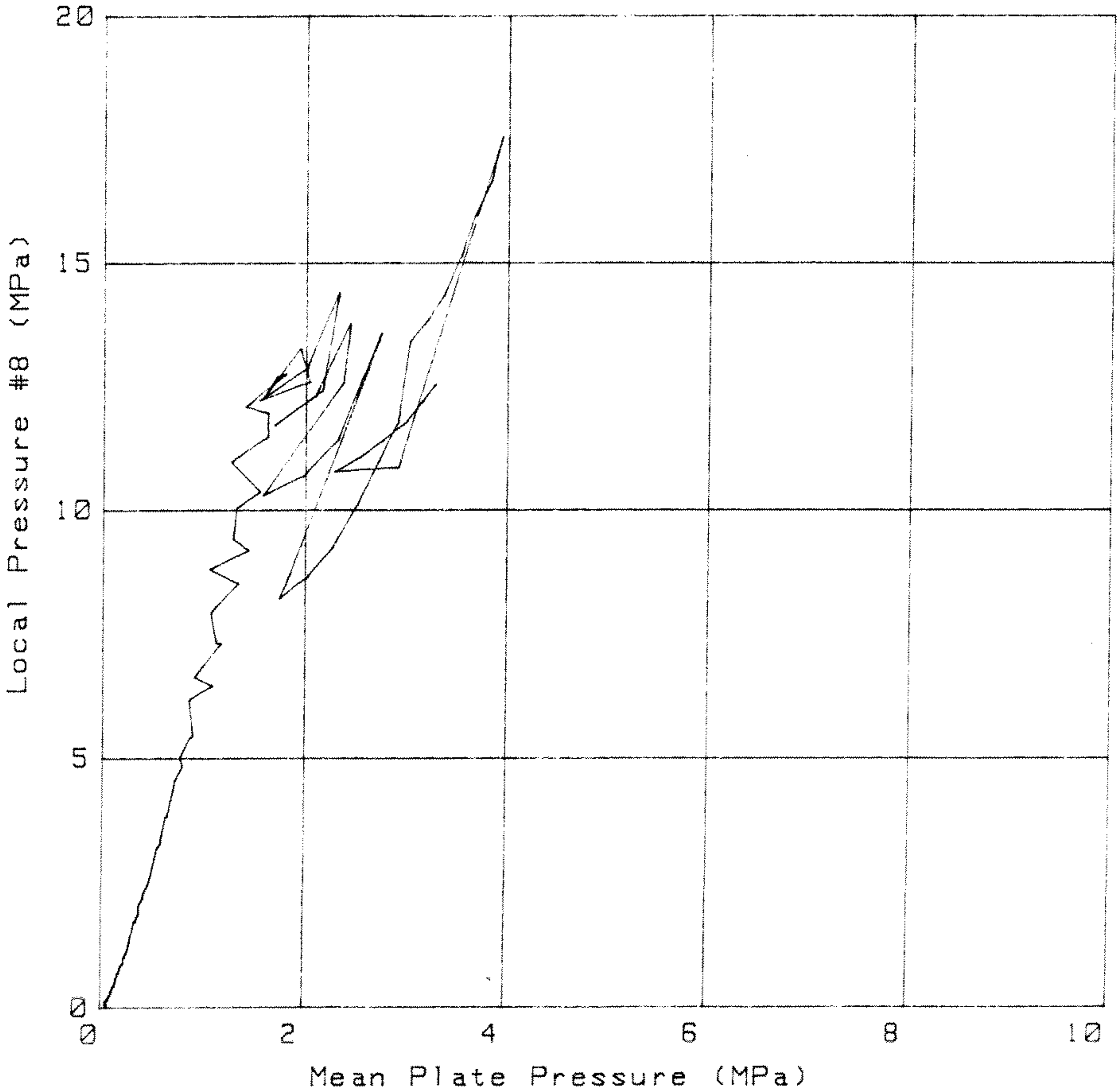
Local Pressure #8
vs.
Mean Plate Pressure

Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 09:33:27

Temperature: -9.4

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .19
Data To (s): .89



Local Pressure #12
vs.
TIME

Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

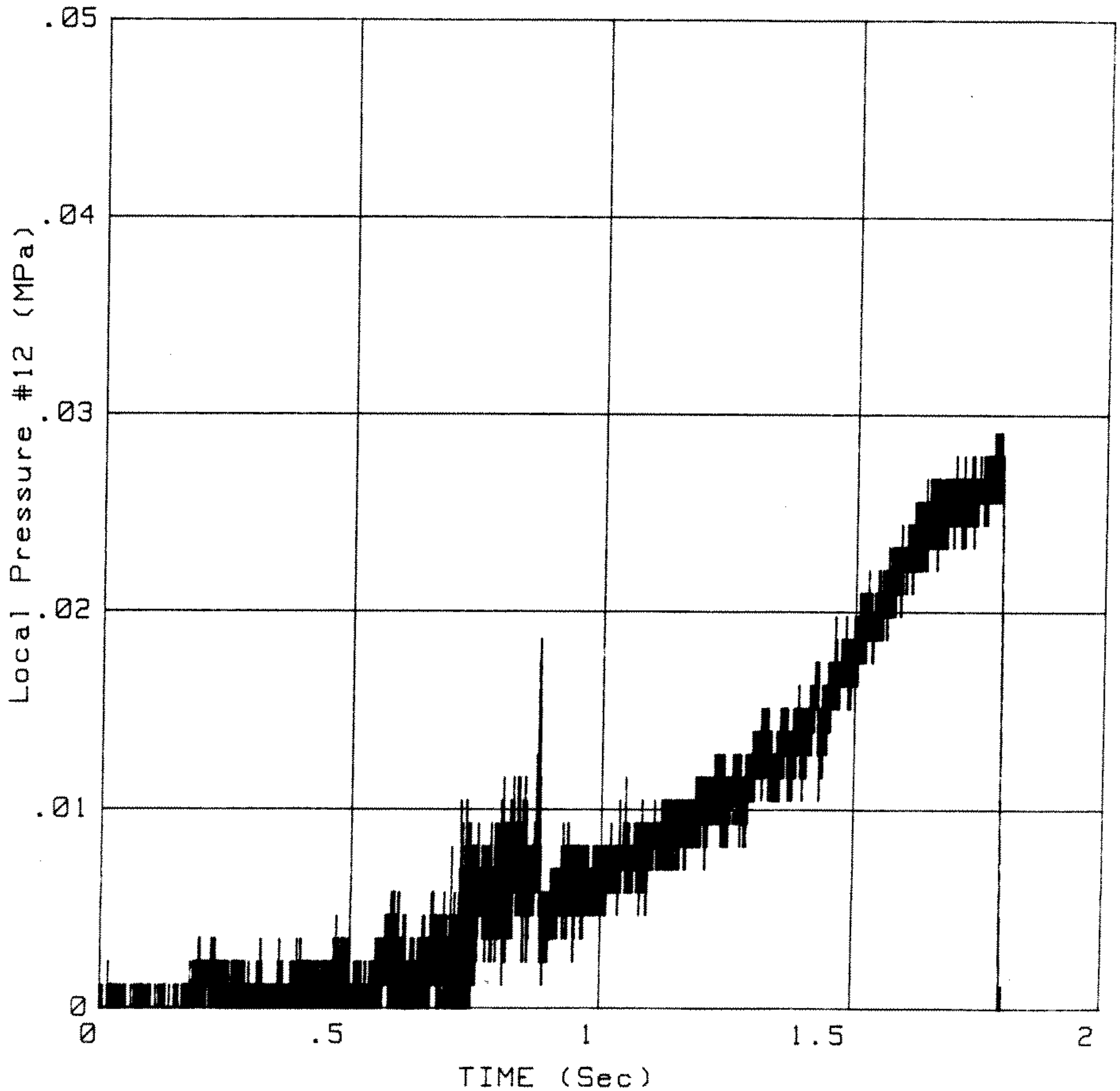
Date: 13 Dec 1988
Time: 09:33:27

Y Offset Removed

Temperature: -9.4

Average = 1

Truncation Time (s) = 2.03



Local Pressure #10
vs.
TIME

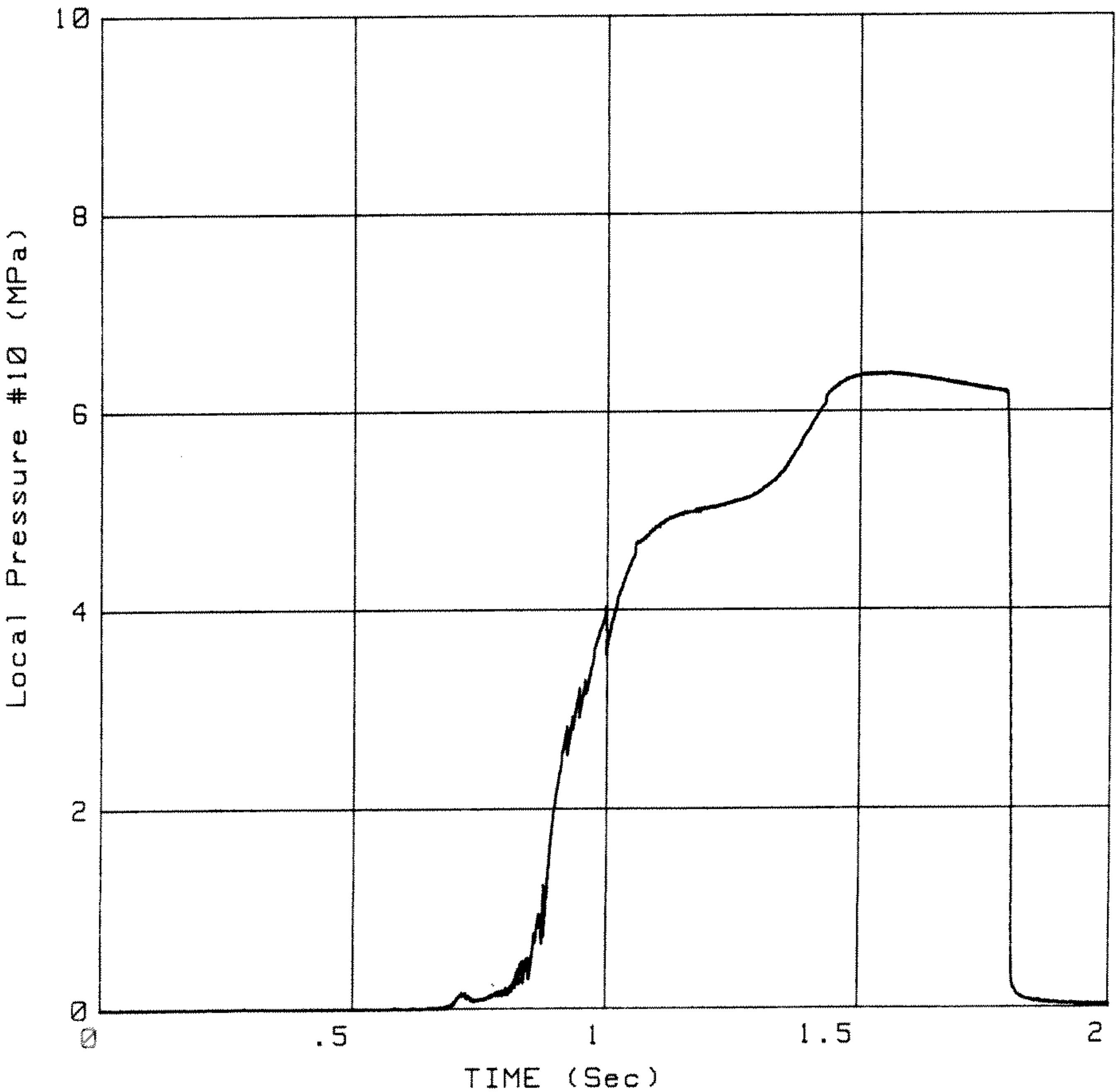
Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 09:33:27

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



Local Pressure #8
vs.
TIME

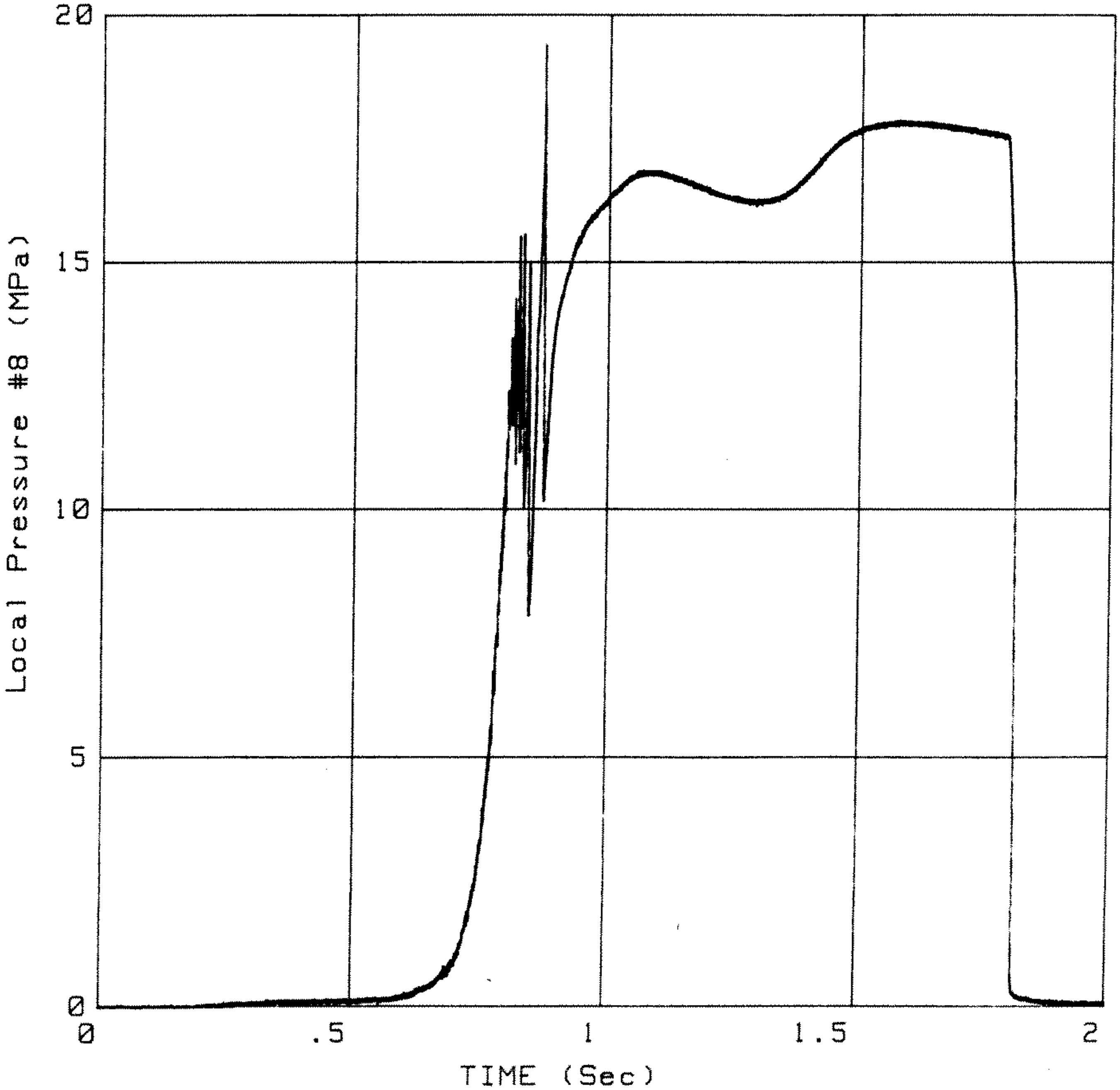
Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 09:33:27

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



Local Pressure #16
vs.
TIME

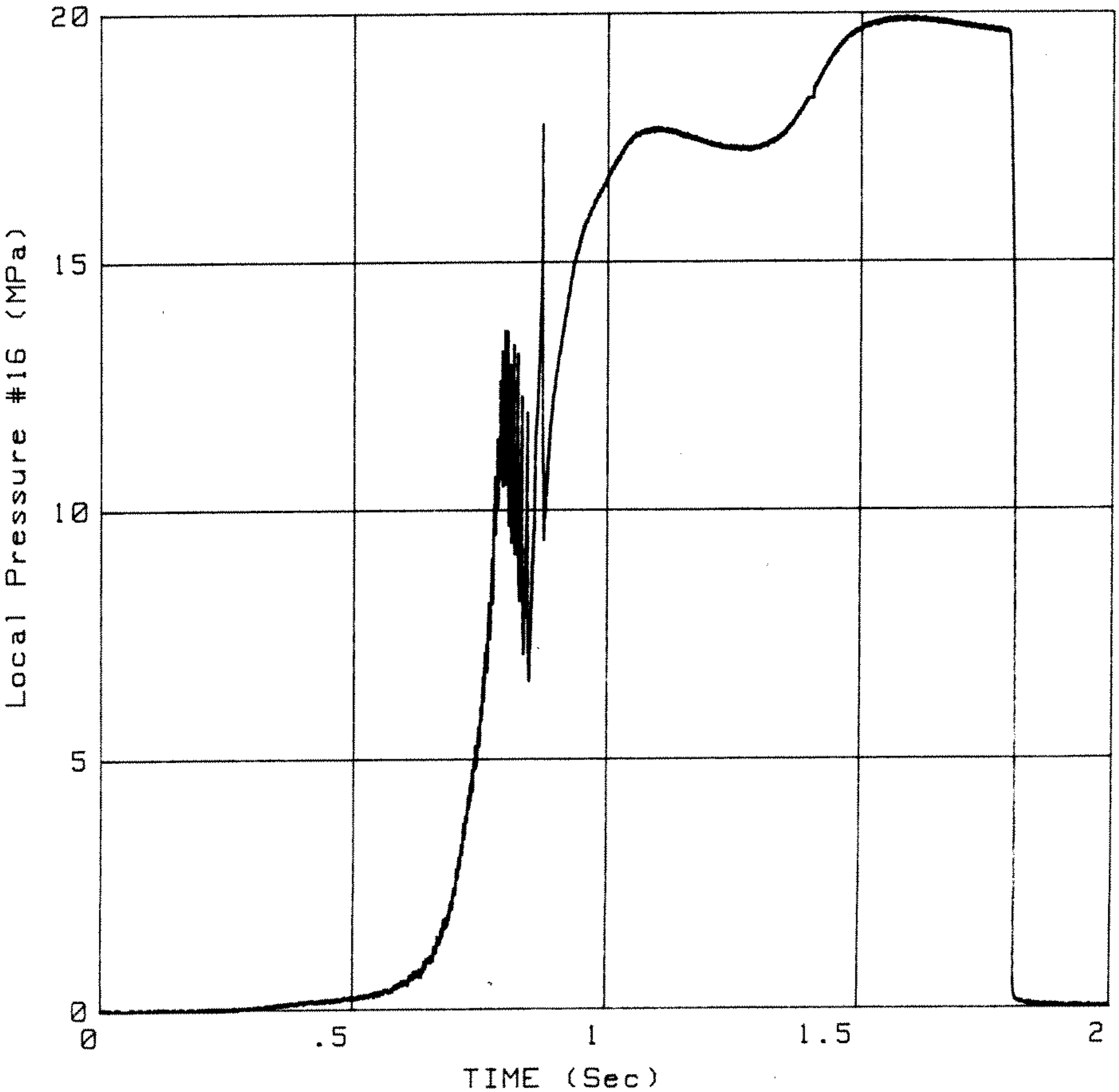
Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 09:33:27

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



Mean Plate Pressure
vs.
TIME

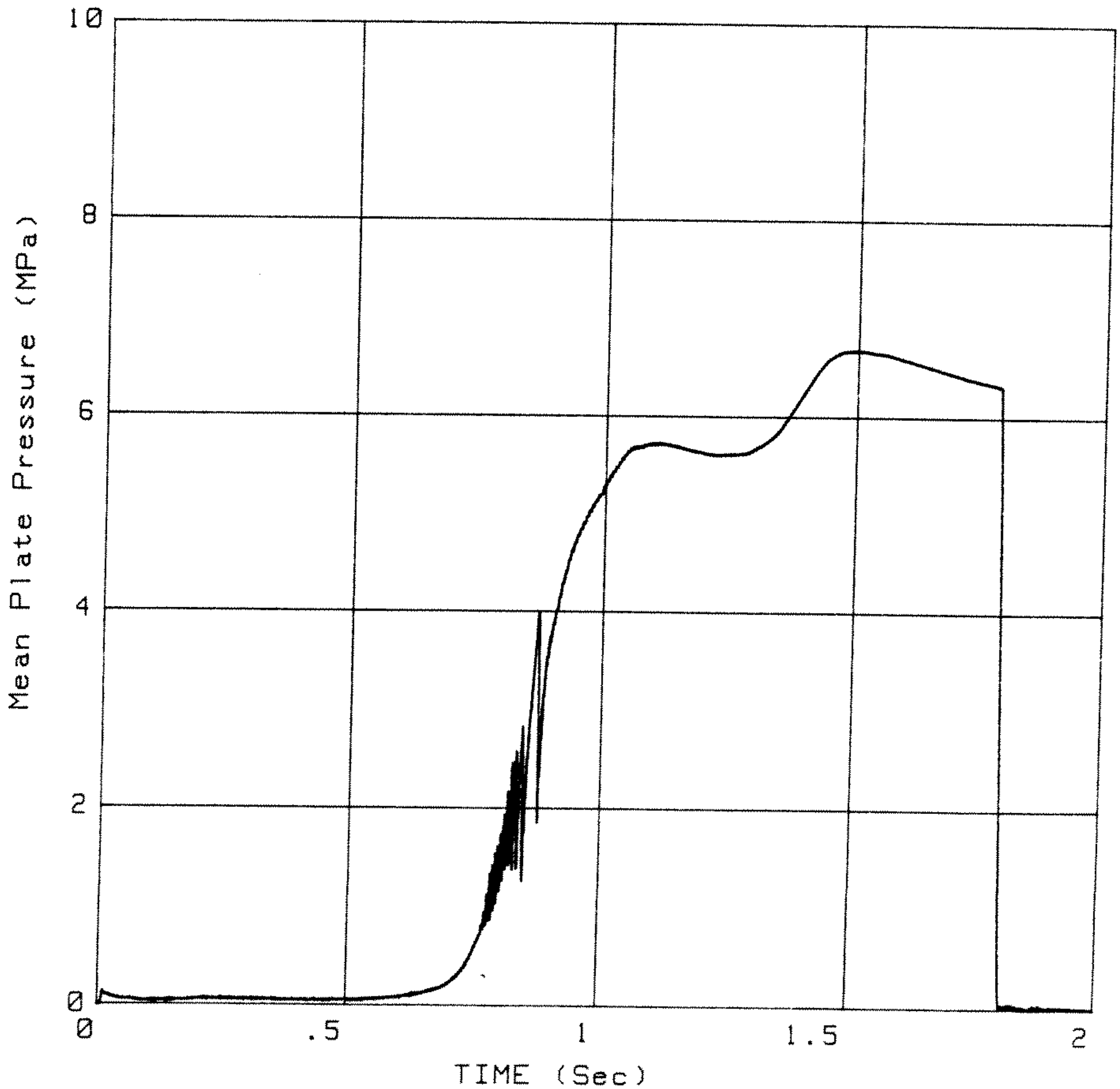
Test: X993
Type: Extrusion test
Sample: CRUSHED ICE

Date: 13 Dec 1988
Time: 09:33:27

Temperature: -9.4

Y Offset Removed

Average = 1
Truncation Time (s) = 2.03



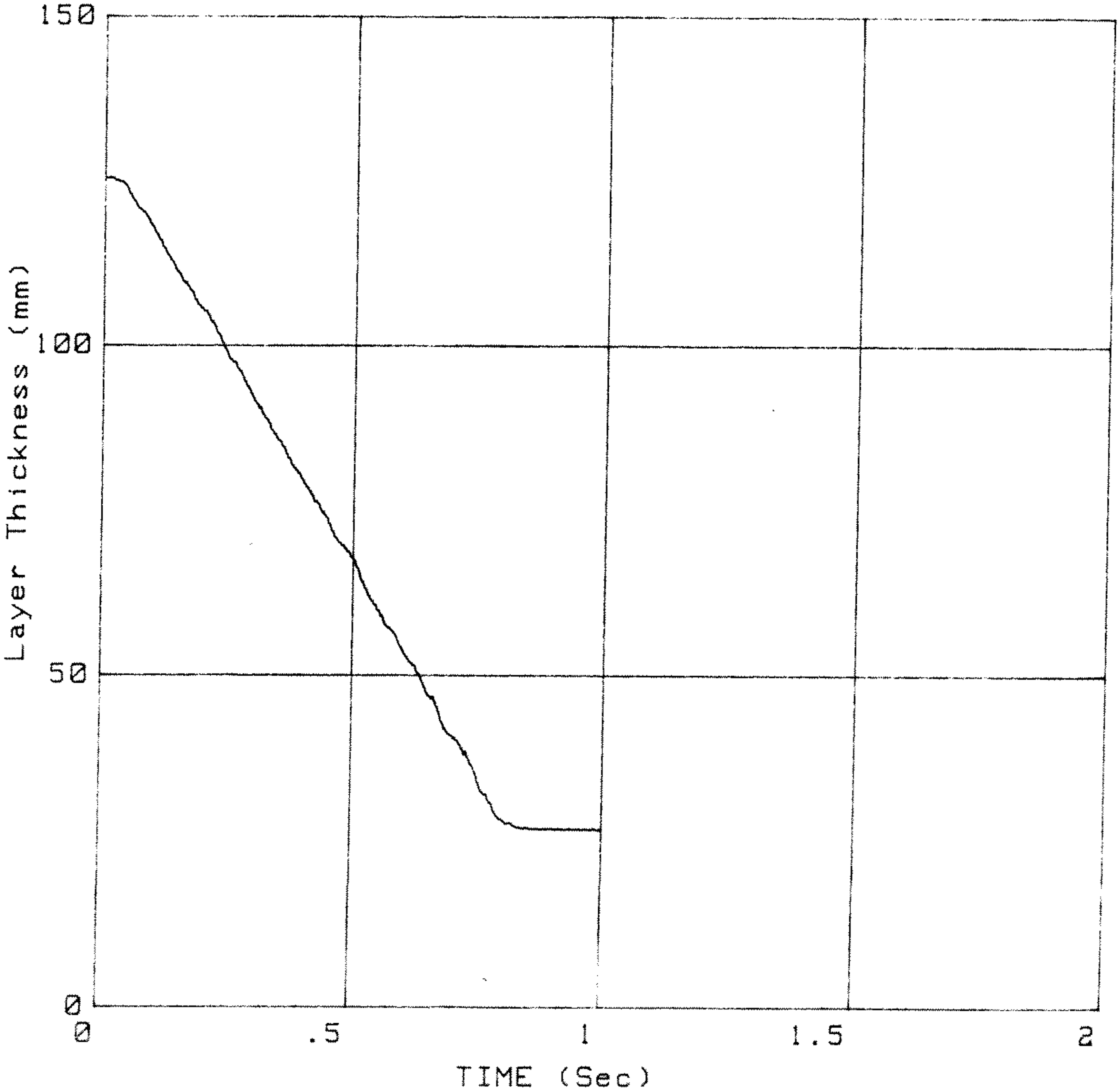
Layer Thickness
vs.
TIME

Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

Date: 12 Dec 1988
Time: 14:10:19

Temperature: -9.6

Average = 10
Truncation Time (s) = 1



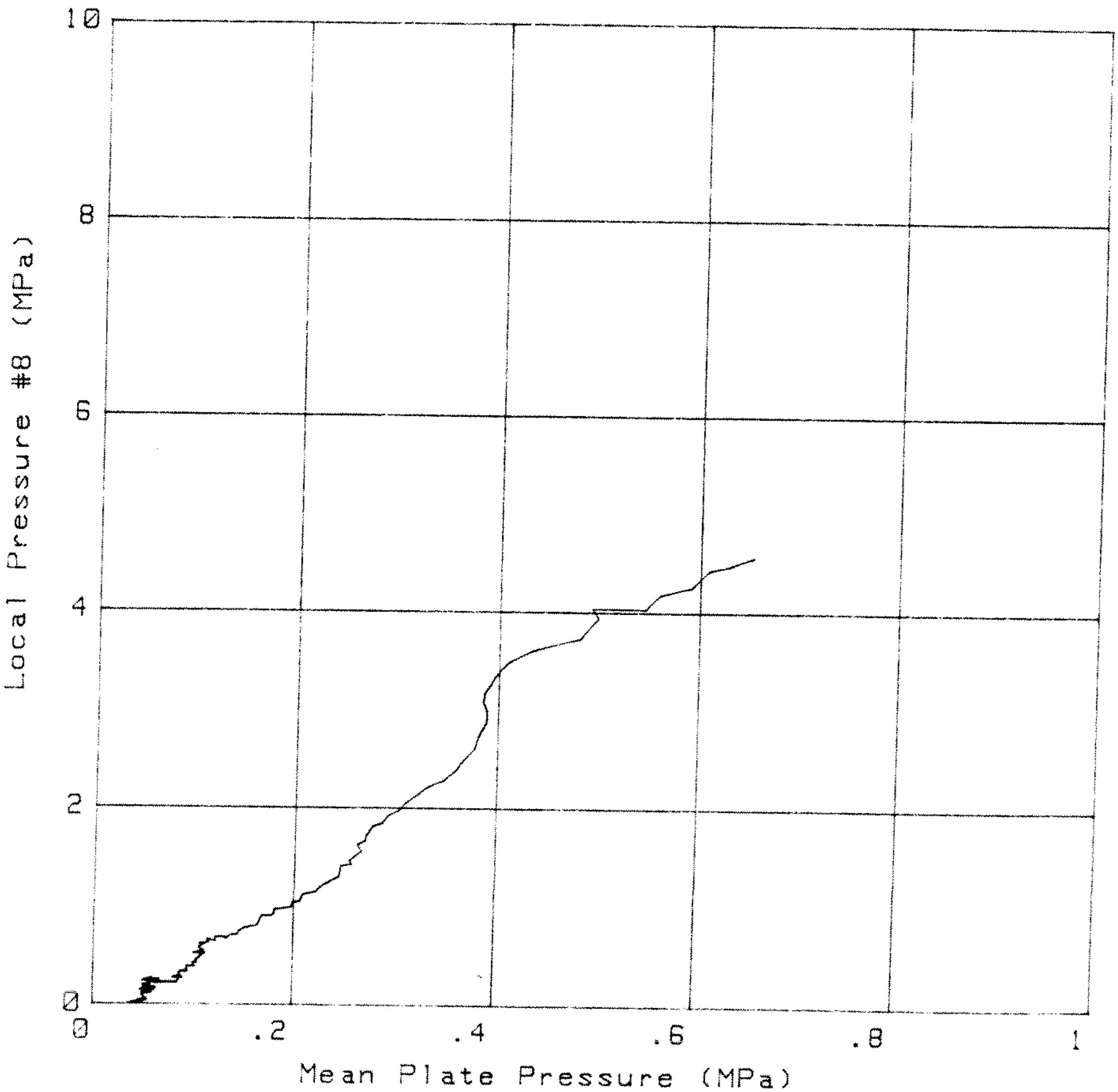
Local Pressure #8 vs. Mean Plate Pressure

Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

Date: 12 Dec 1988
Time: 14:10:19

Temperature: -9.6

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .29
Data To (s): .83



Local Pressure #16
vs.
TIME

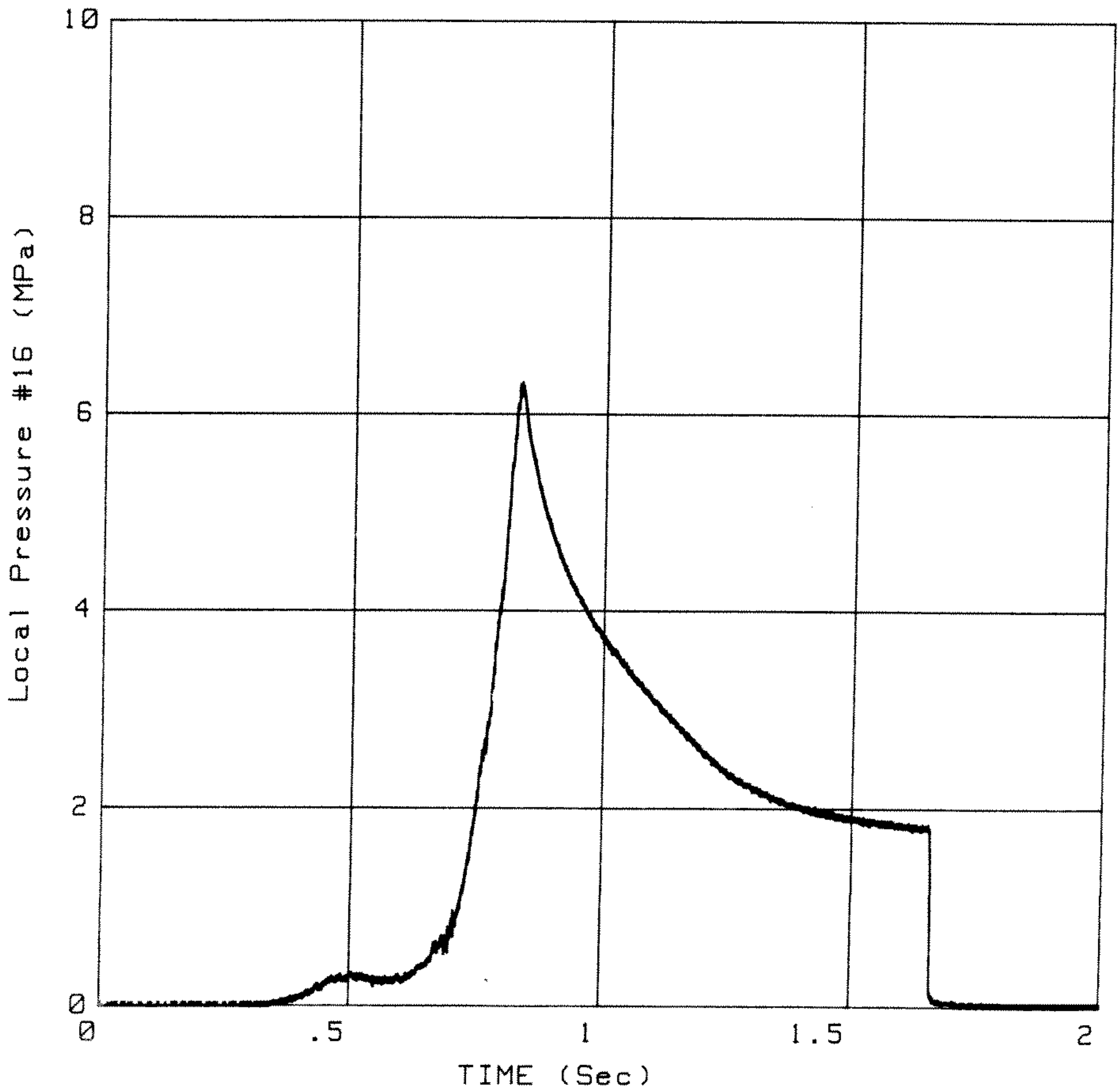
Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

Date: 12 Dec 1988
Time: 14:10:19

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



Local Pressure #12
vs.
TIME

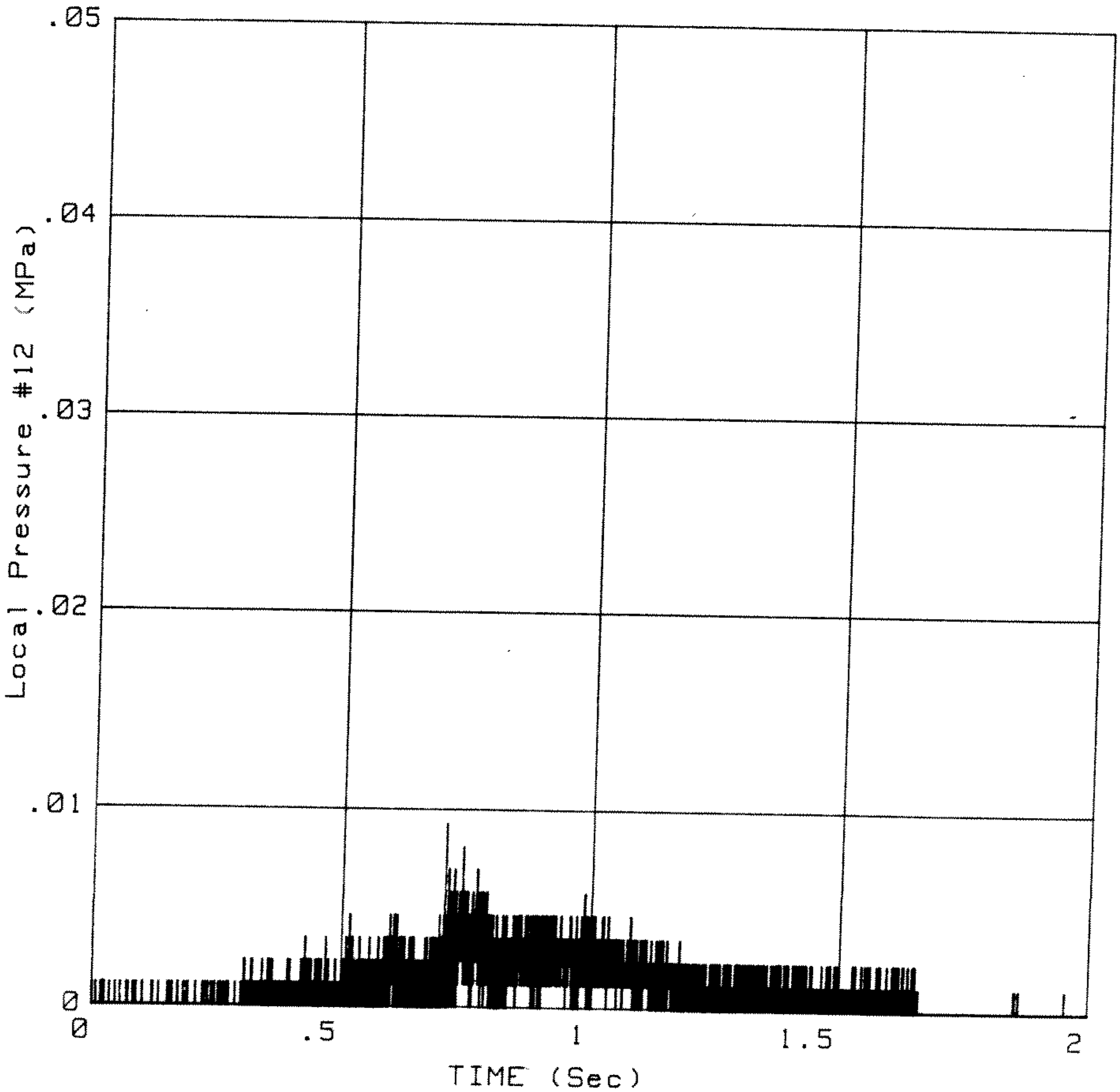
Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

Date: 12 Dec 1988
Time: 14:10:19

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



Local Pressure #10
vs.
TIME

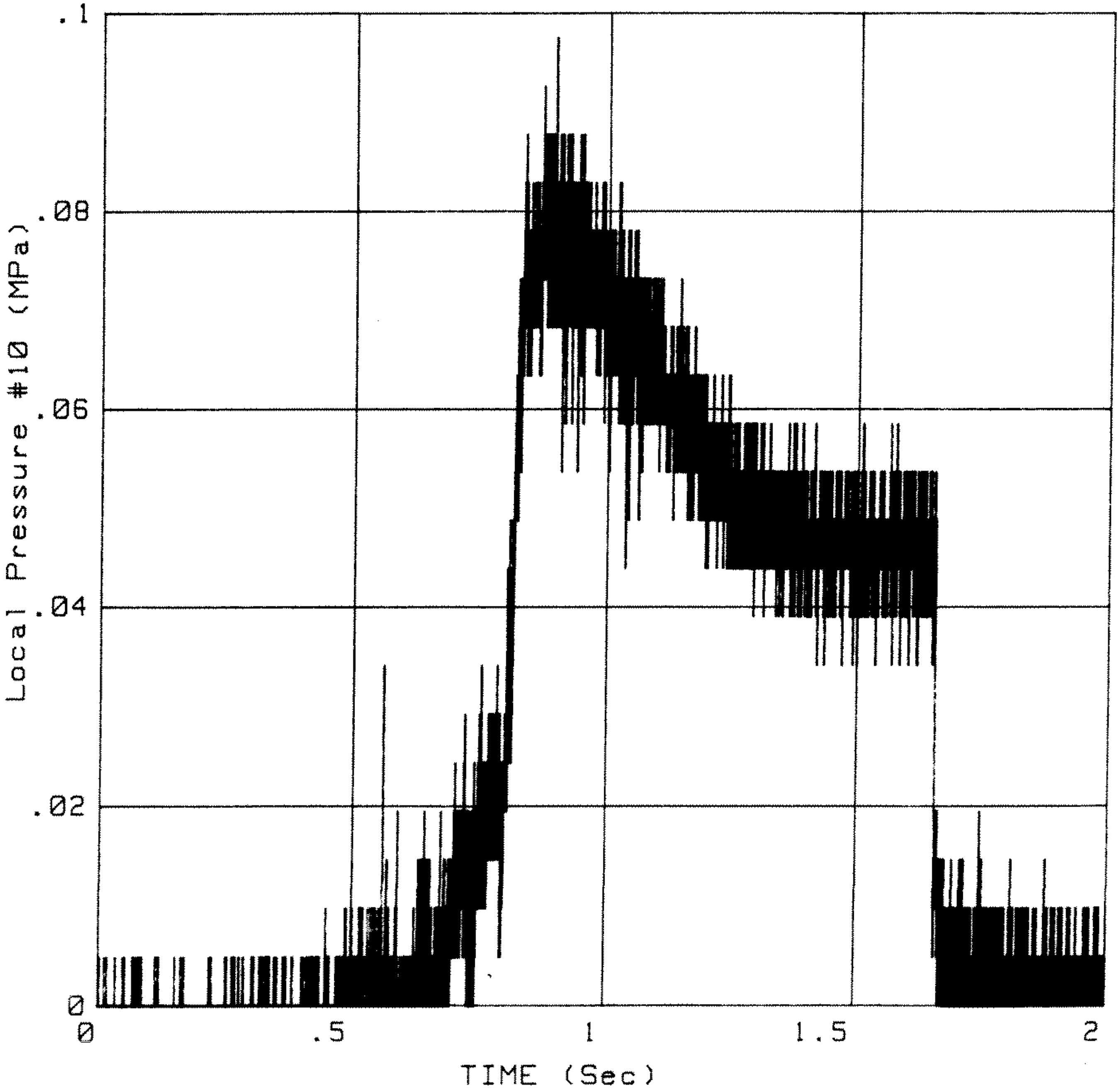
Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

Date: 12 Dec 1988
Time: 14:10:19

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



Local Pressure #8
vs.
TIME

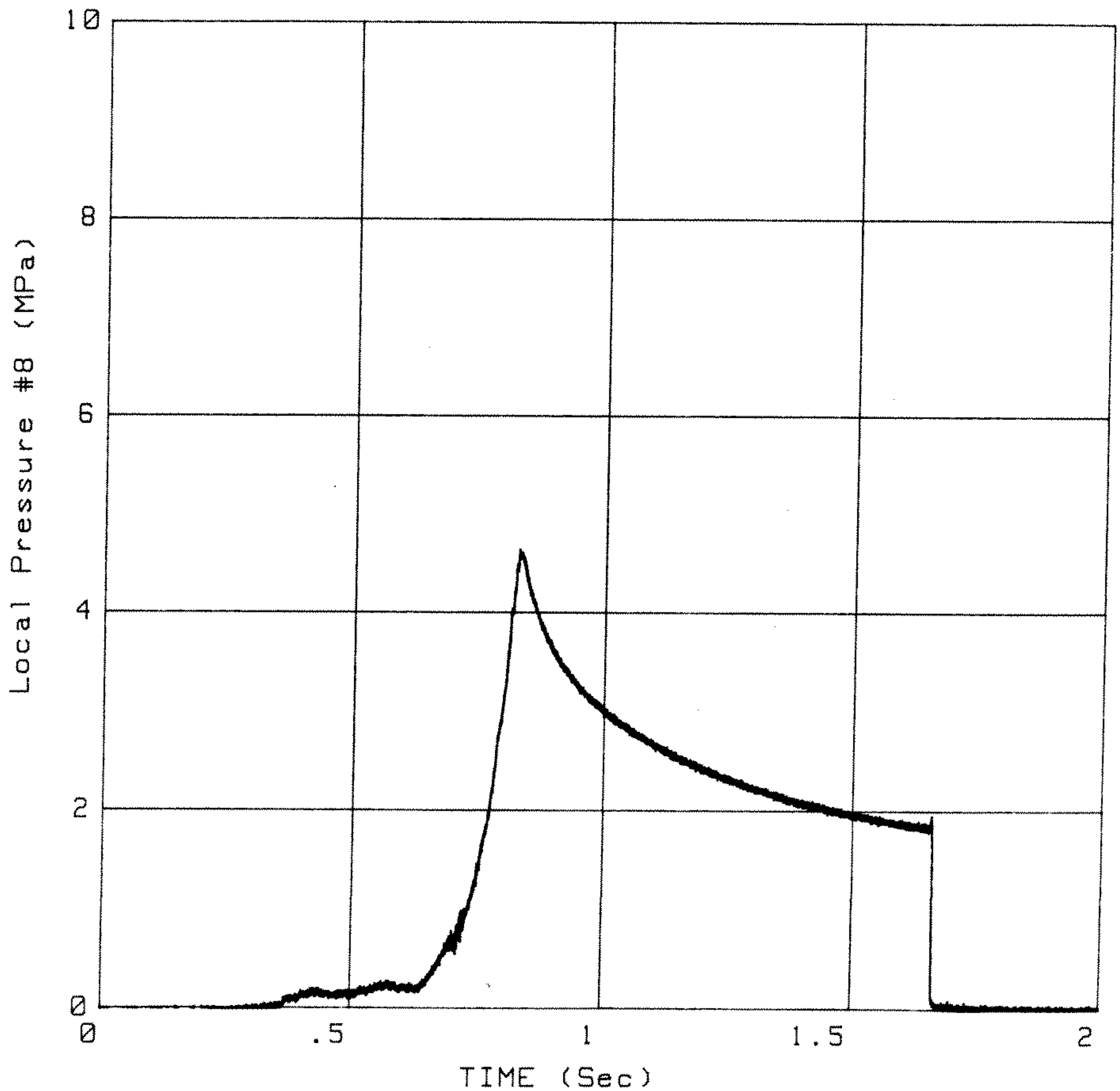
Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

Date: 12 Dec 1988
Time: 14:10:19

Y Offset Removed

Temperature: -9.6

Average = 1
Truncation Time (s) = 2.03



Mean Plate Pressure
vs.
TIME

Test: X994
Type: Extrusion test
Sample: CRUSHED ICE

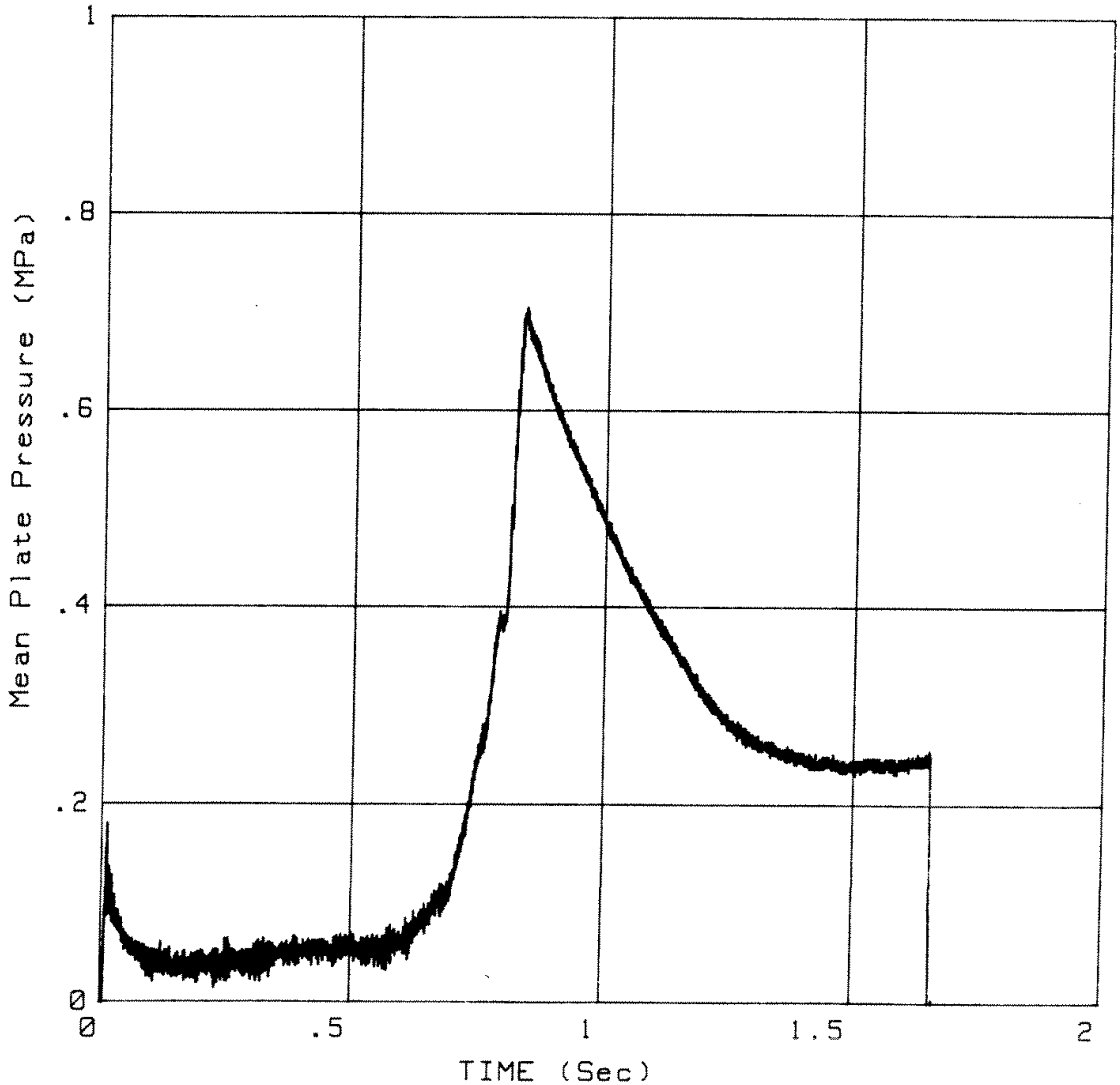
Date: 12 Dec 1988
Time: 14:10:19

Temperature: -9.6

Y Offset Removed

Average = 1

Truncation Time (s) = 2.03



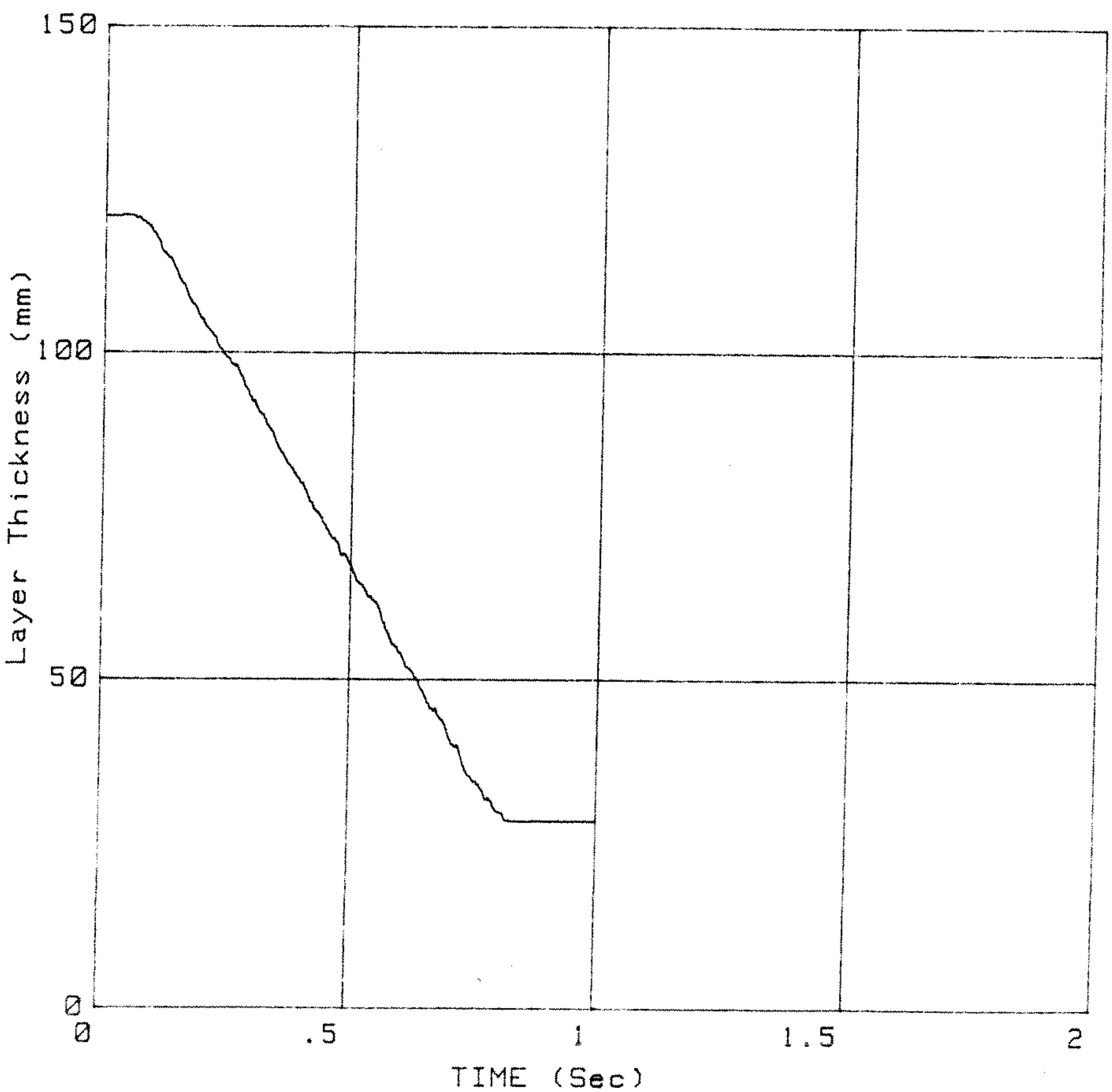
Layer Thickness
vs.
TIME

Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Temperature: -9.4

Average = 10
Truncation Time (s) = 1



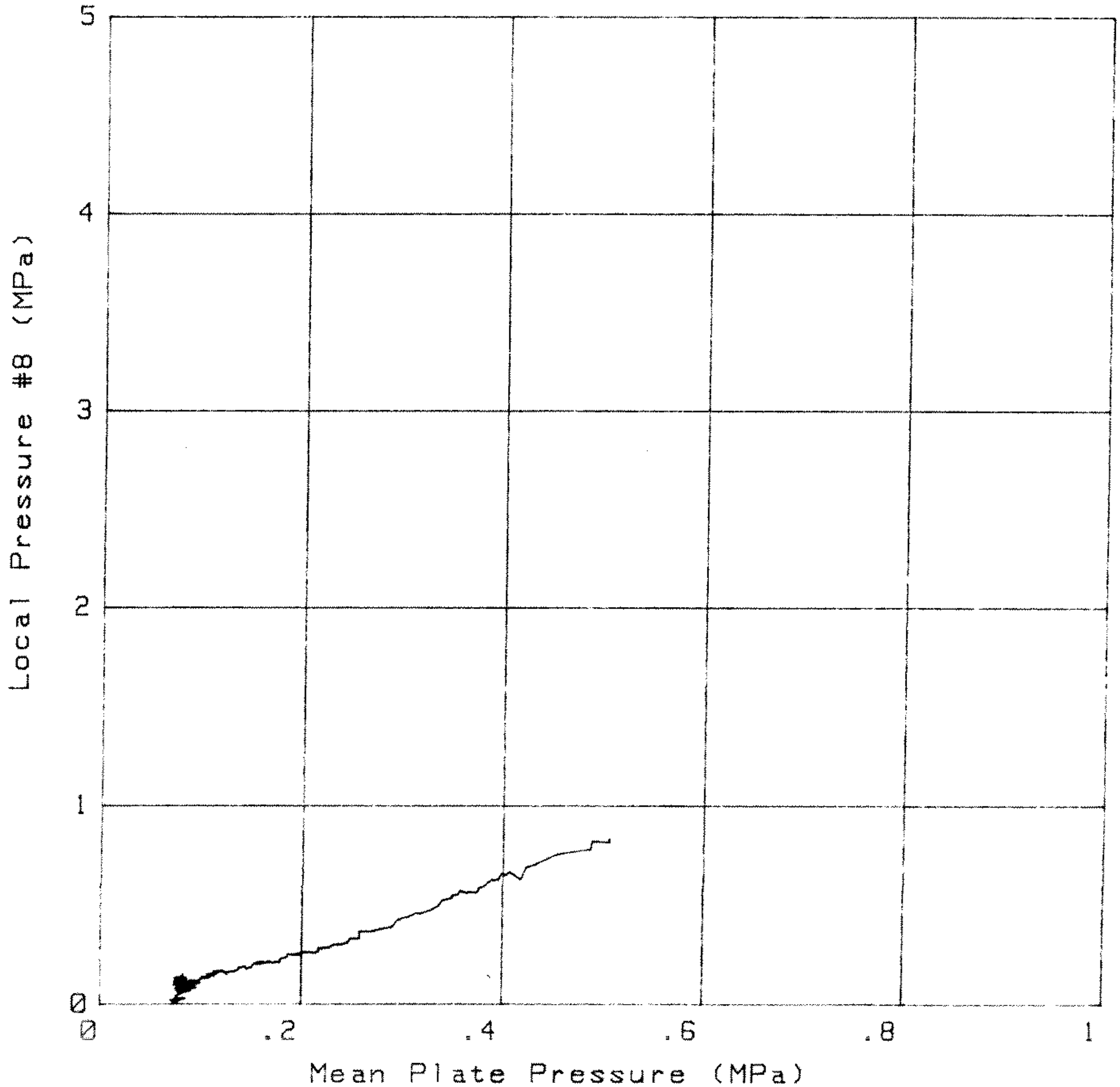
Local Pressure #8
vs.
Mean Plate Pressure

Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Temperature: -9.4

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .21
Data To (s): .83



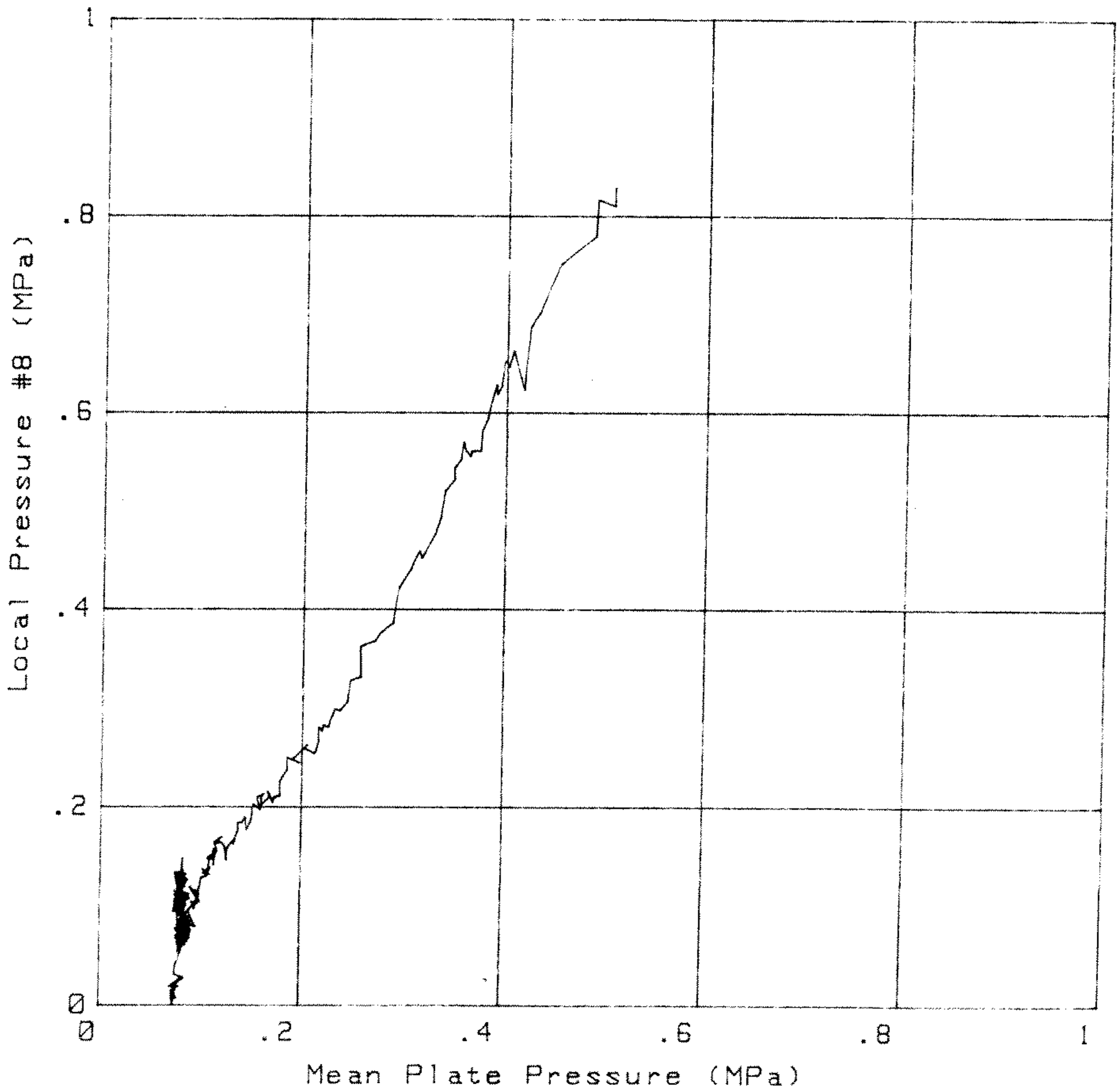
Local Pressure #8
vs.
Mean Plate Pressure

Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Temperature: -9.4

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .21
Data To (s): .83



Local Pressure #12
vs.
TIME

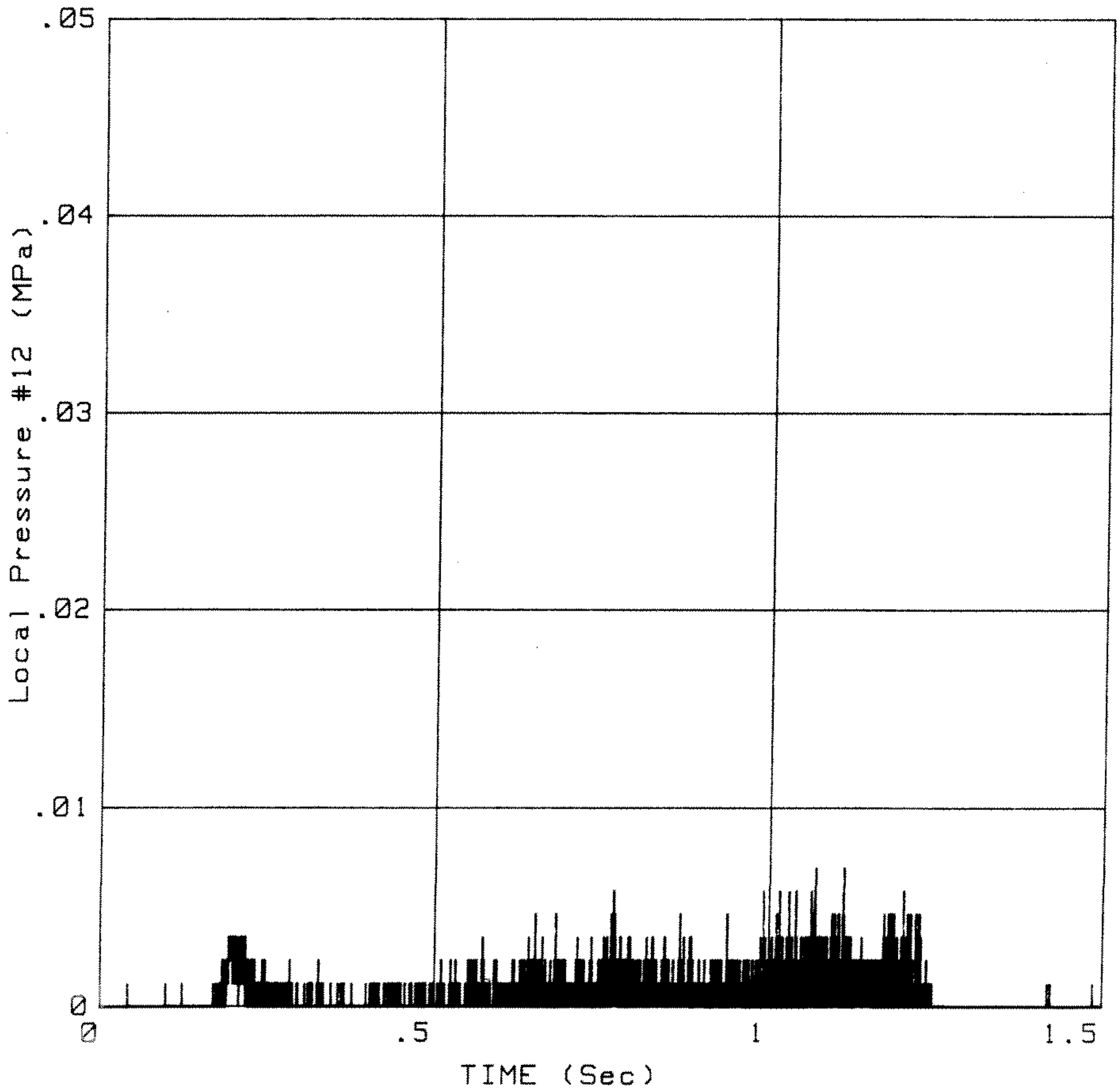
Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Temperature: -9.4

Y Offset Removed

Average = 1
Truncation Time (s) = 2.03



Local Pressure #10
vs.
TIME

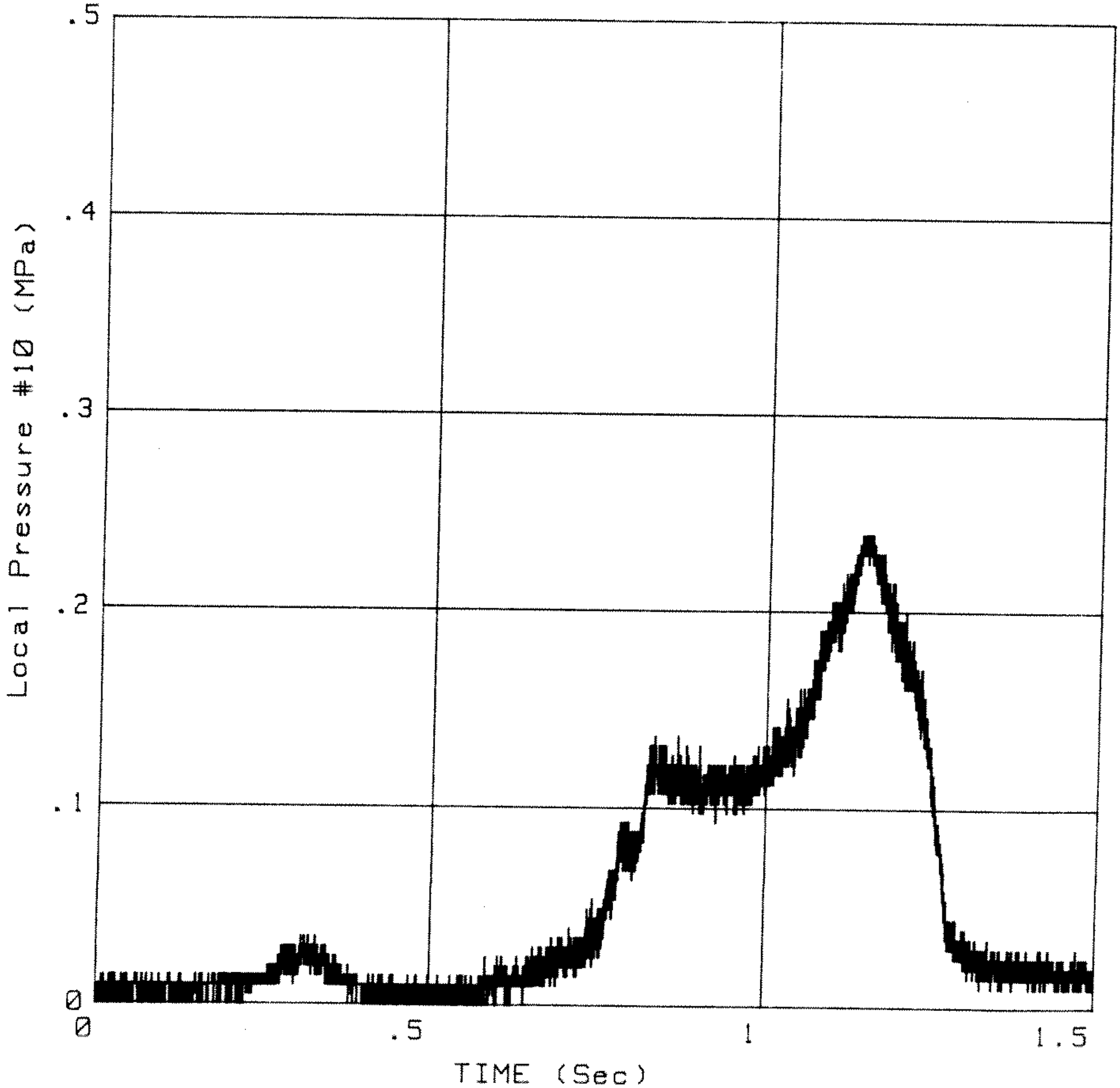
Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



Local Pressure #8
vs.
TIME

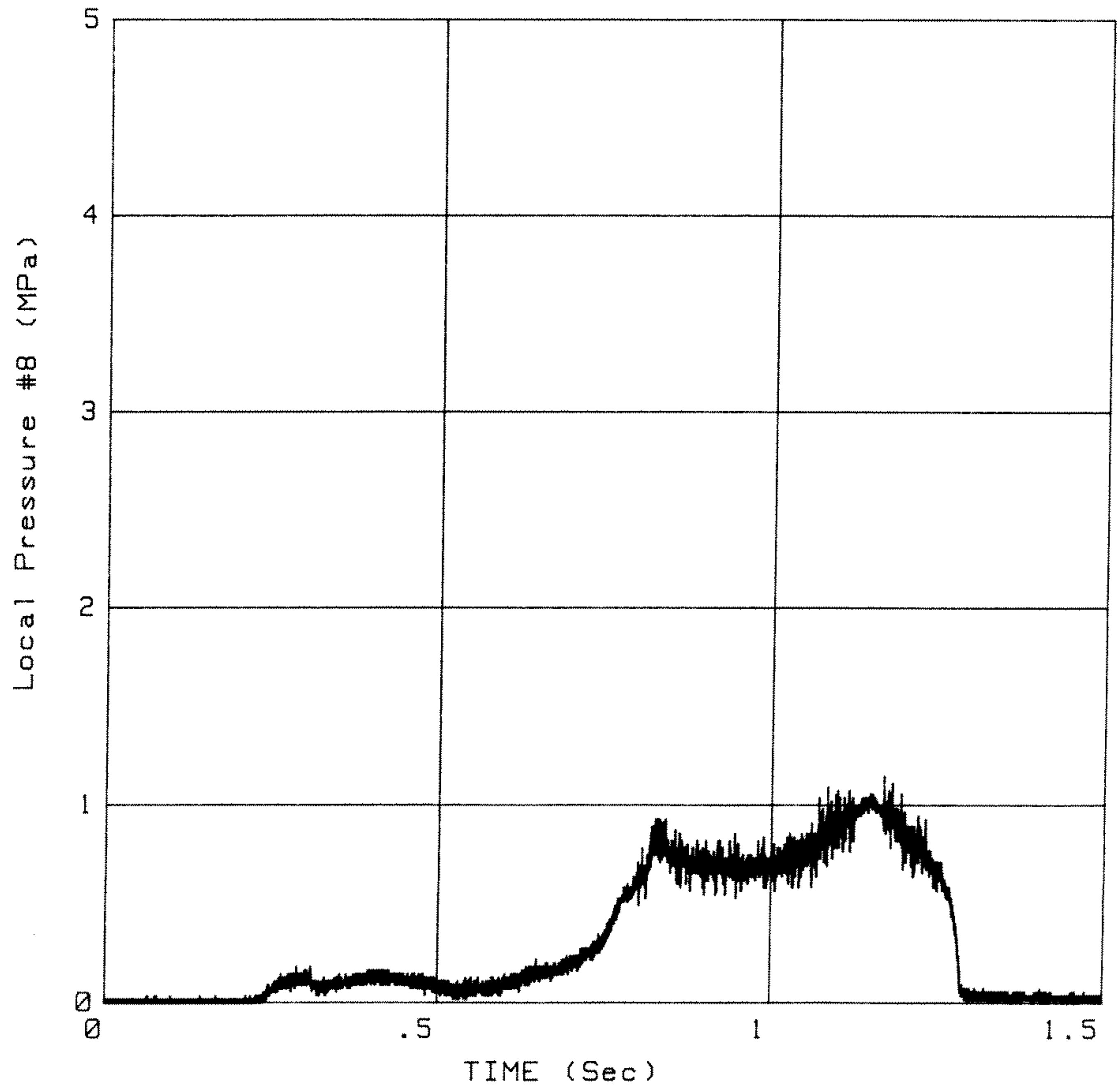
Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



Local Pressure #16
vs.
TIME

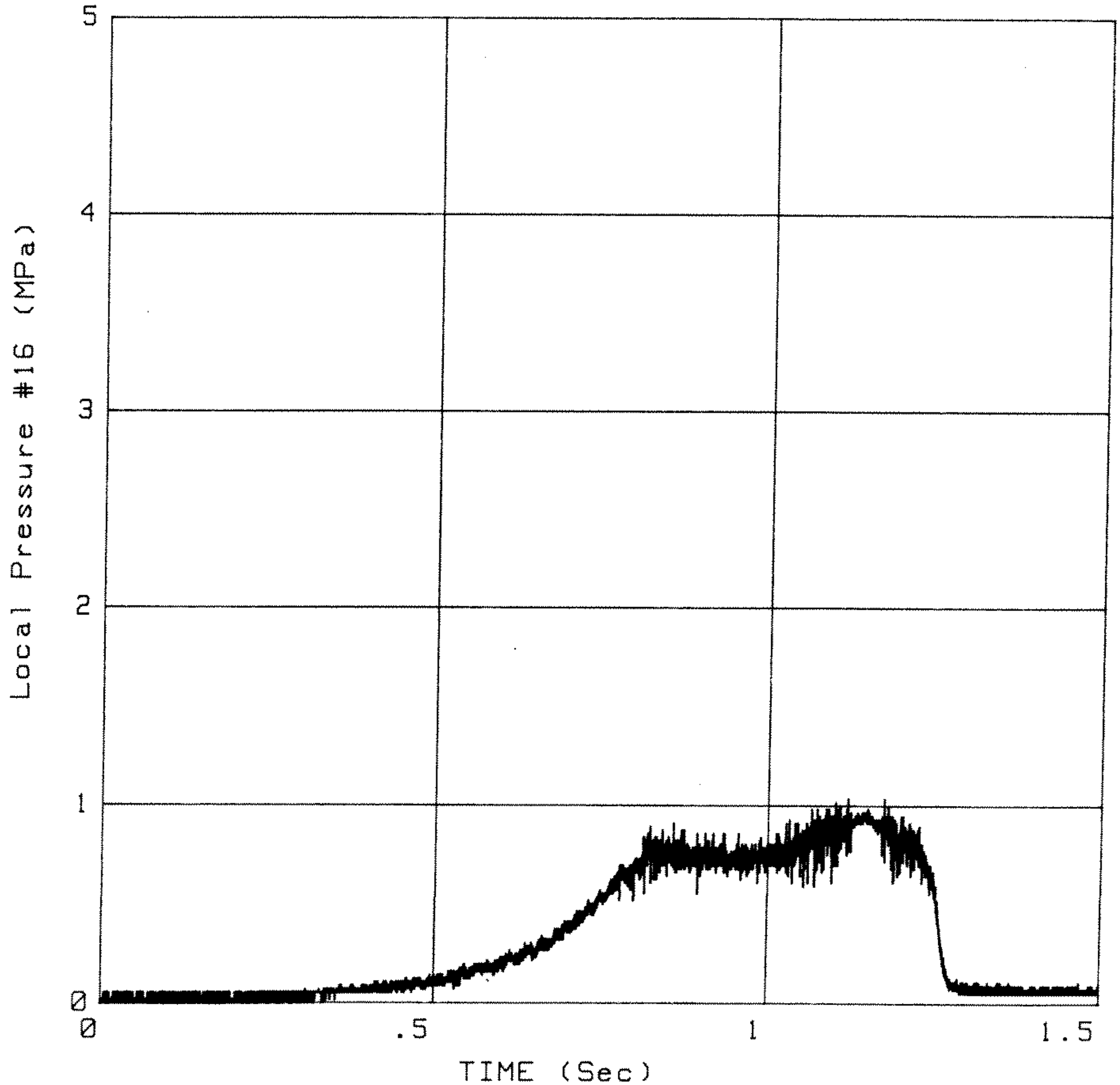
Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



Mean Plate Pressure
vs.
TIME

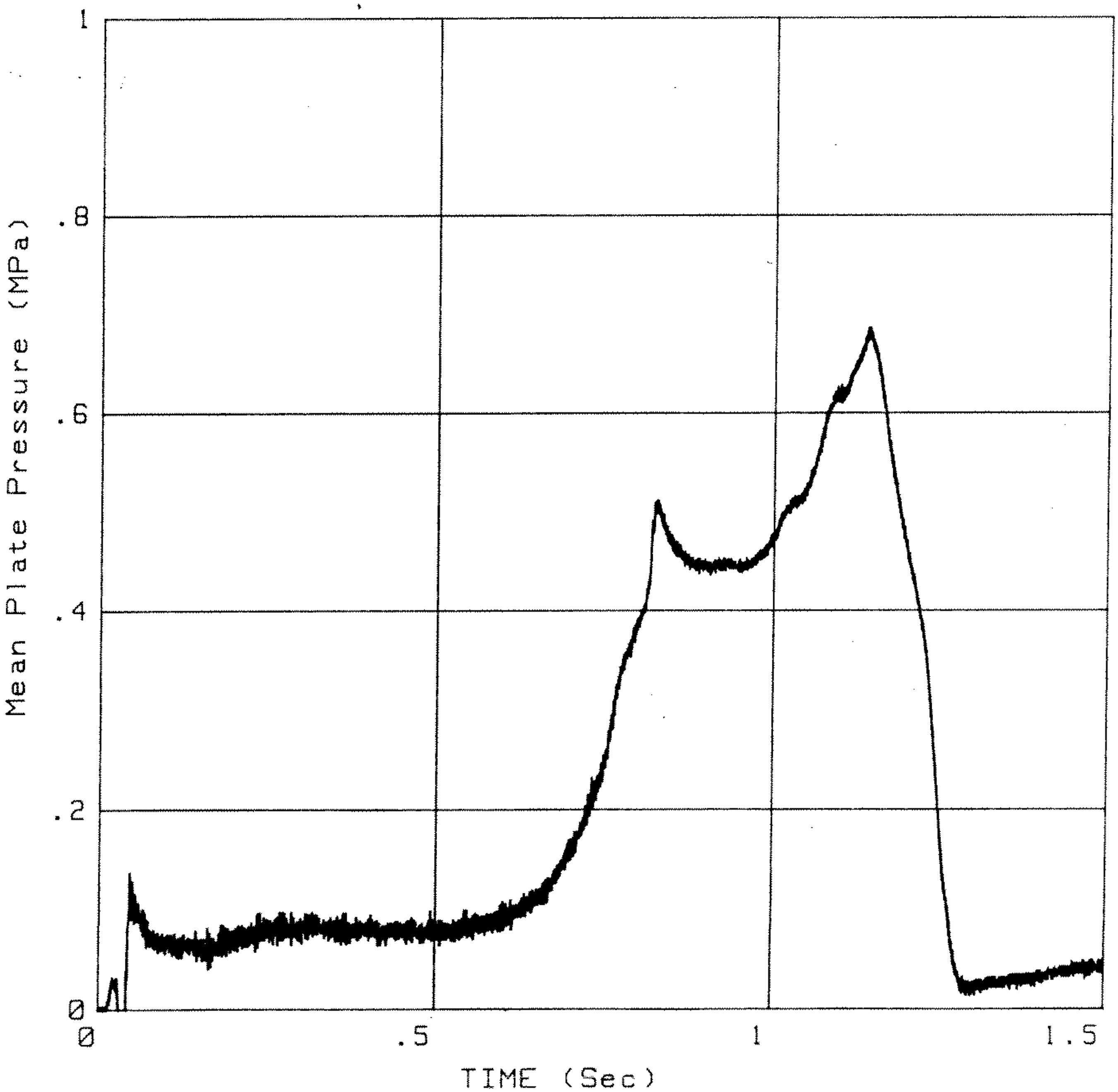
Test: X995
Type: Extrusion test
Sample: CRUSHED ICE

Date: 9 Dec 1988
Time: 10:42:32

Y Offset Removed

Temperature: -9.4

Average = 1
Truncation Time (s) = 2.03



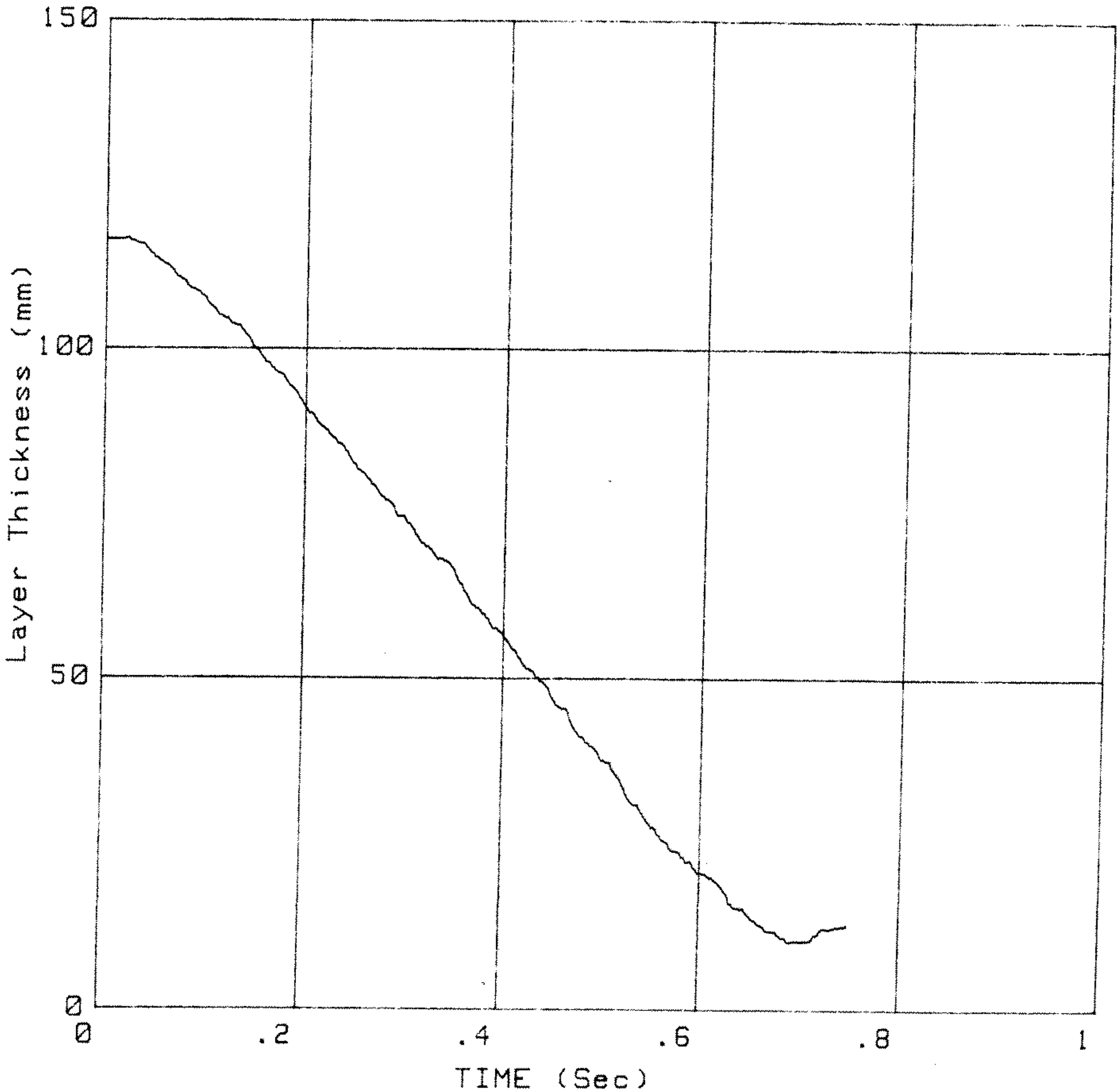
Layer Thickness vs. TIME

Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

Date: 7 Dec 1988
Time: 16:26:01

Temperature: -10

Average = 10
Truncation Time (s) = .75



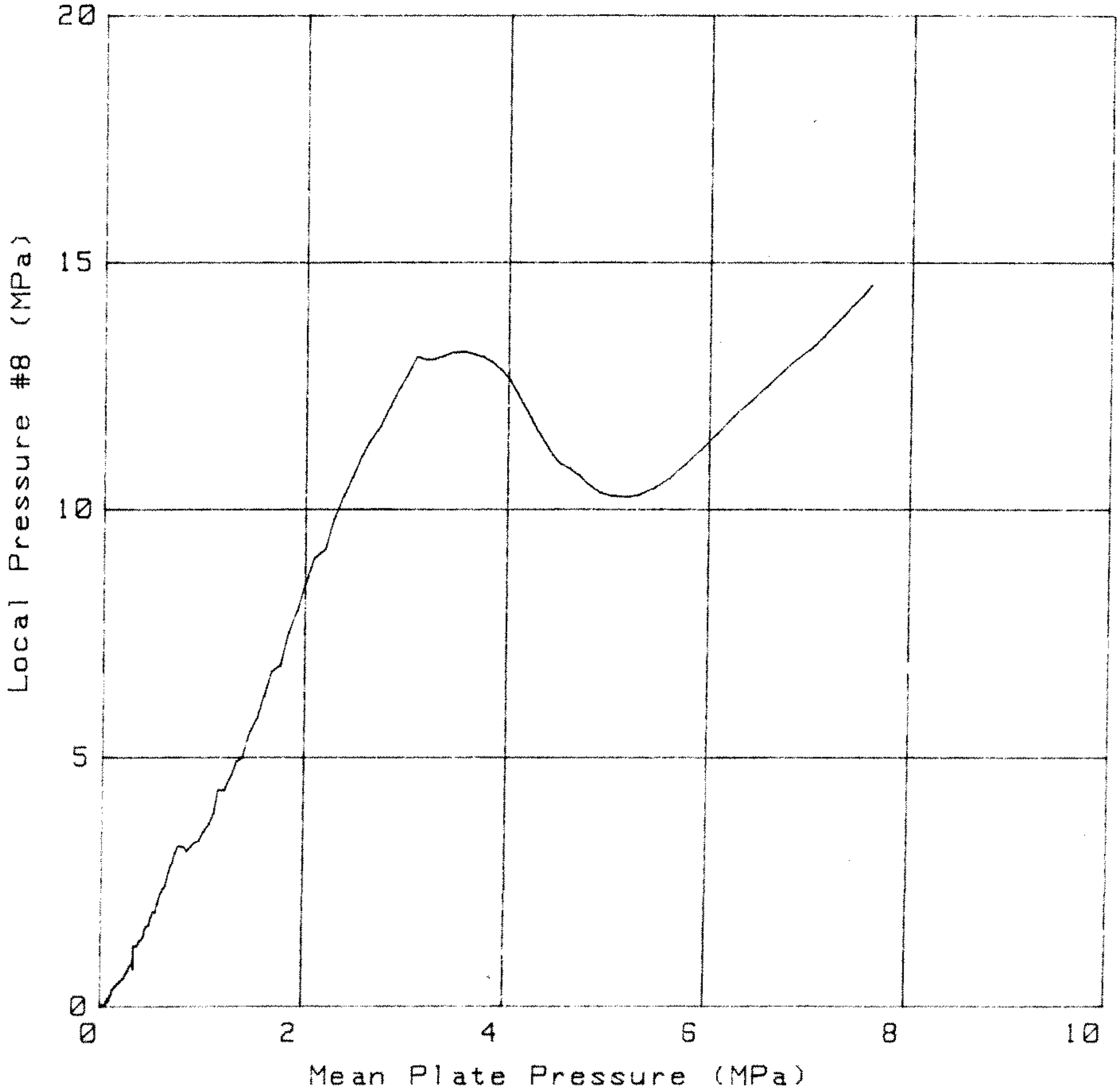
Local Pressure #8
vs.
Mean Plate Pressure

Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

Date: 7 Dec 1988
Time: 16:26:01

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .06
Data To (s): .69



Local Pressure #12
vs.
TIME

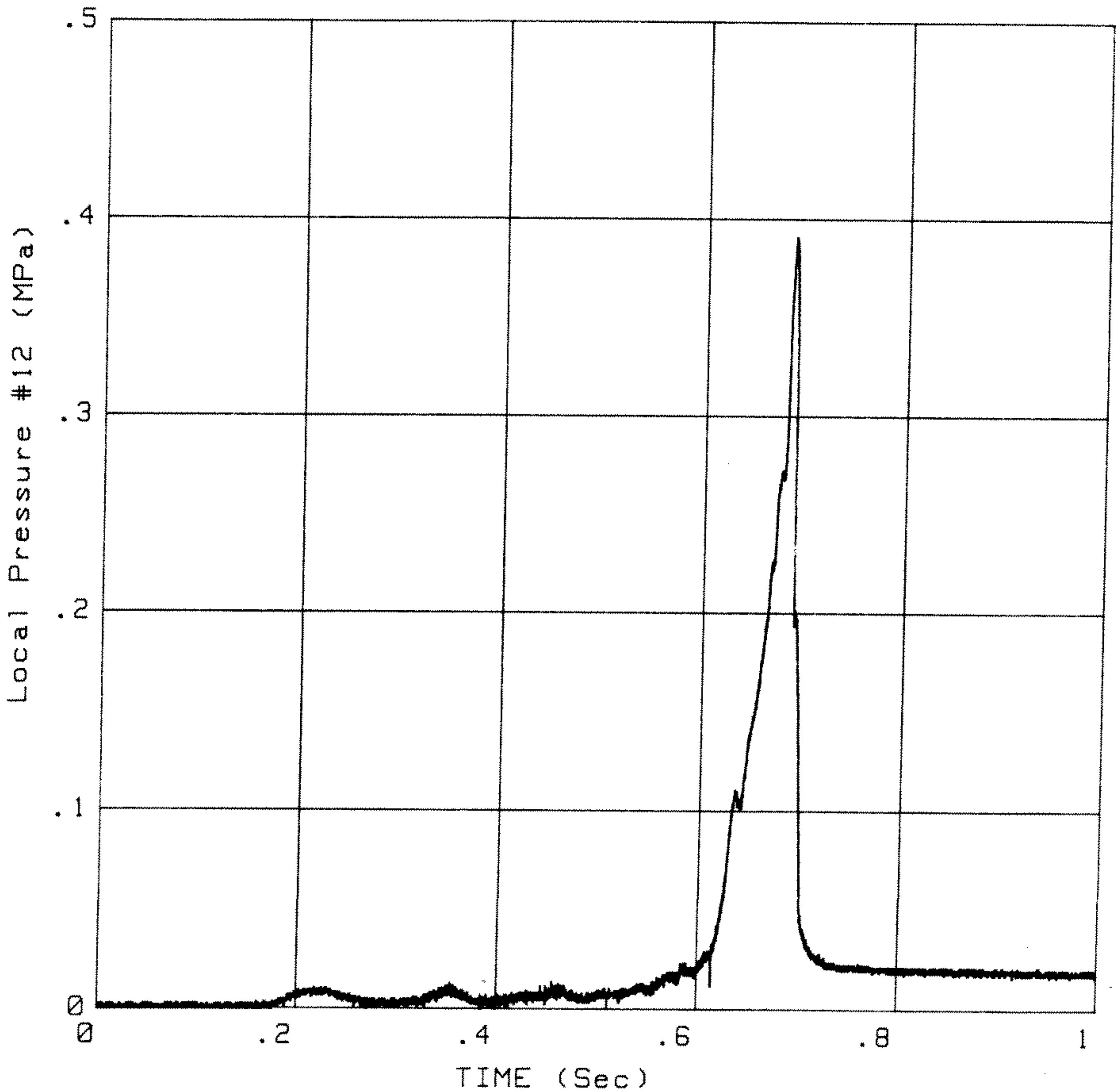
Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

Date: 7 Dec 1988
Time: 16:26:01

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.03



Local Pressure #10
vs.
TIME

Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

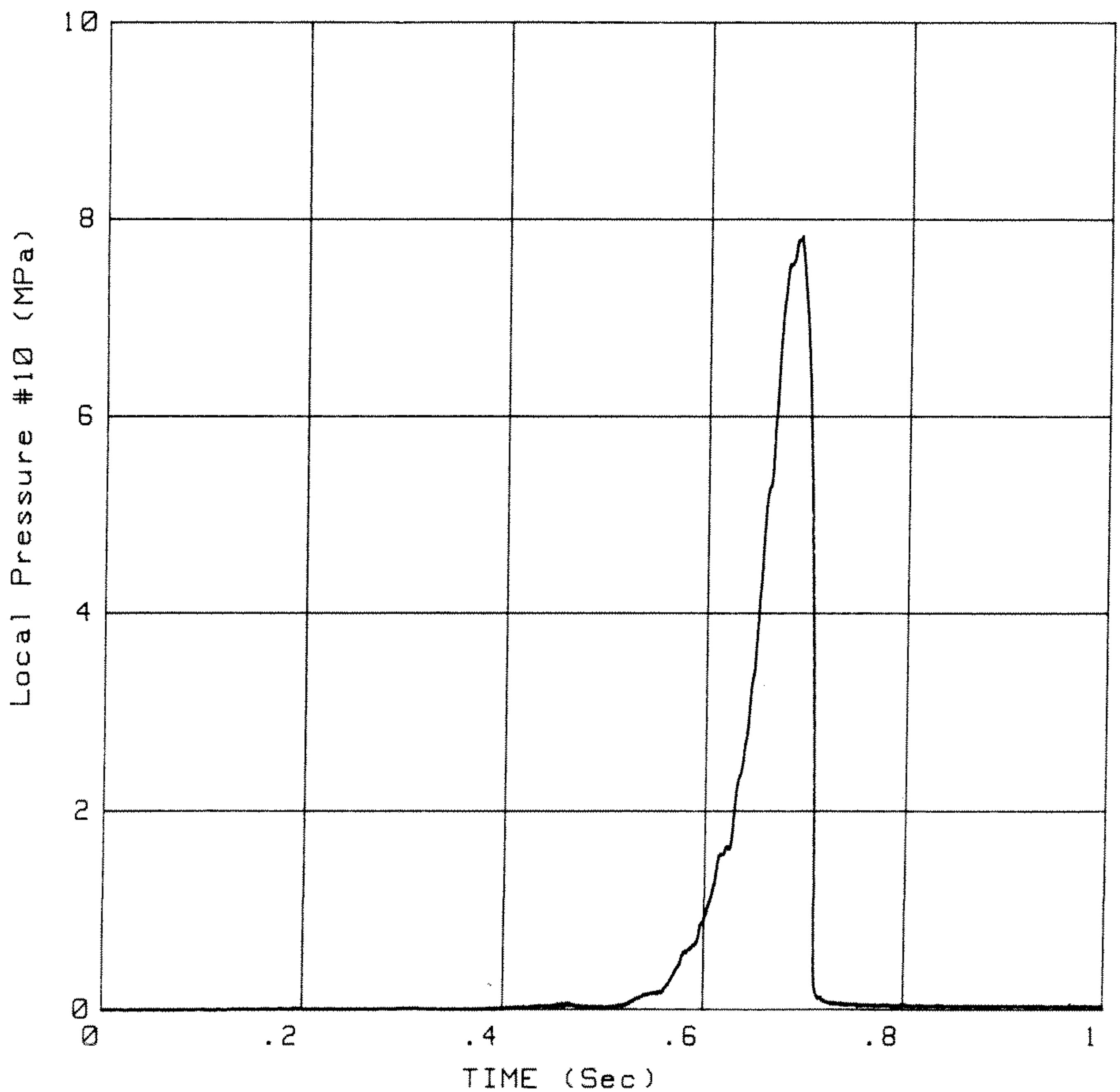
Date: 7 Dec 1988
Time: 16:26:01

Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 2.03



Local Pressure #8
vs.
TIME

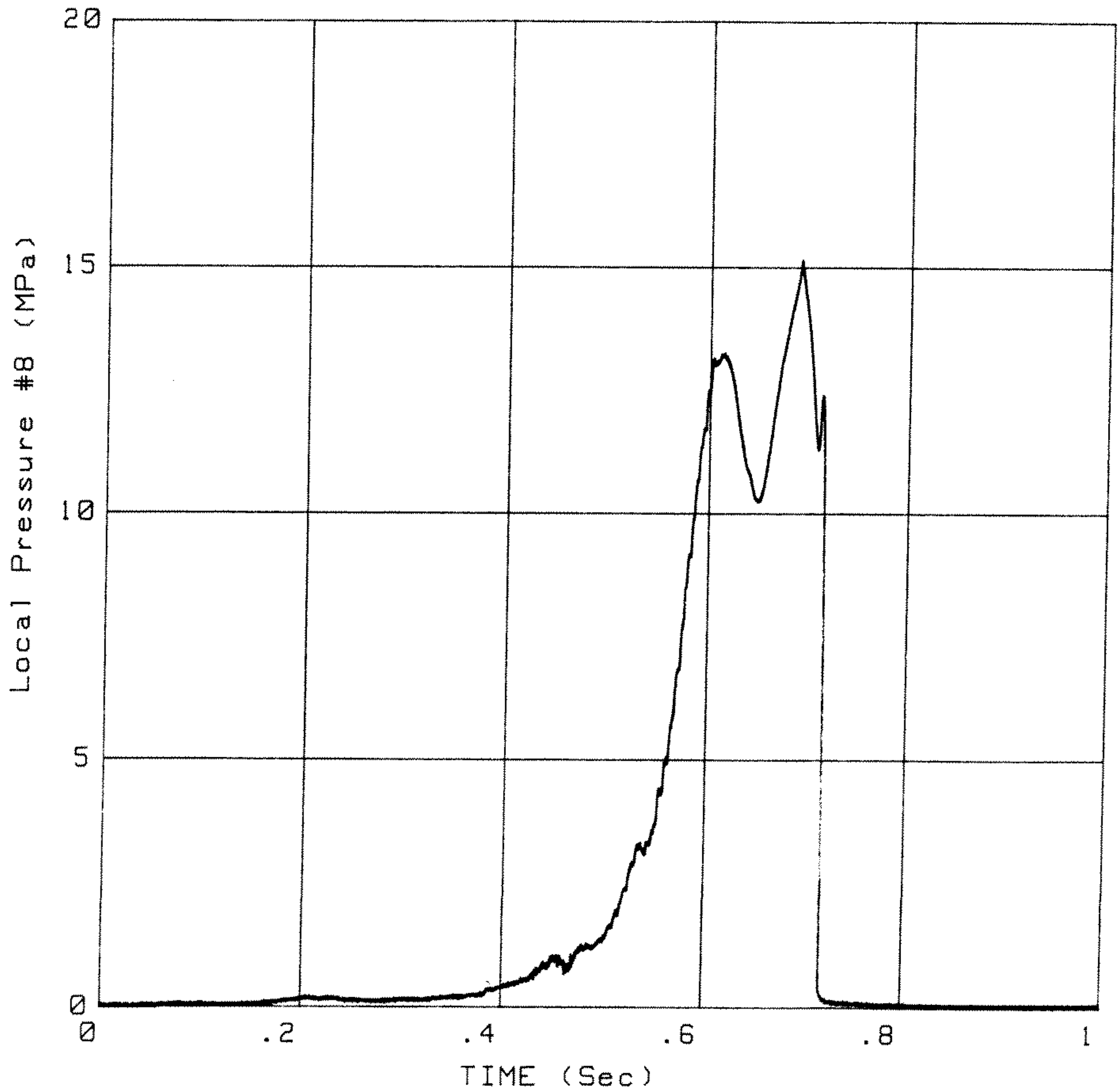
Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

Date: 7 Dec 1988
Time: 16:26:01

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.03



Local Pressure #16
vs.
TIME

Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

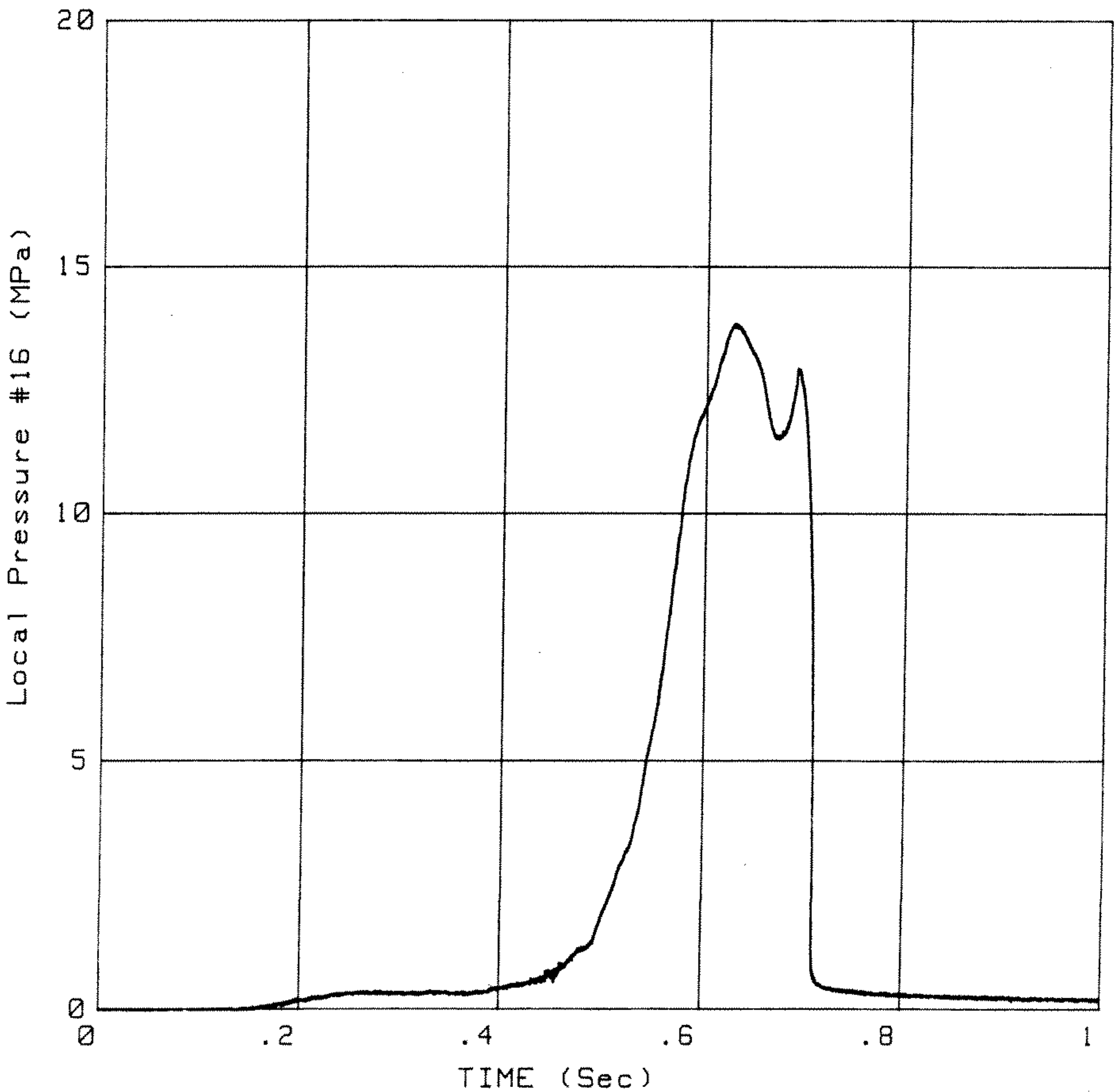
Date: 7 Dec 1988
Time: 16:26:01

Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 2.03



Mean Plate Pressure
vs.
TIME

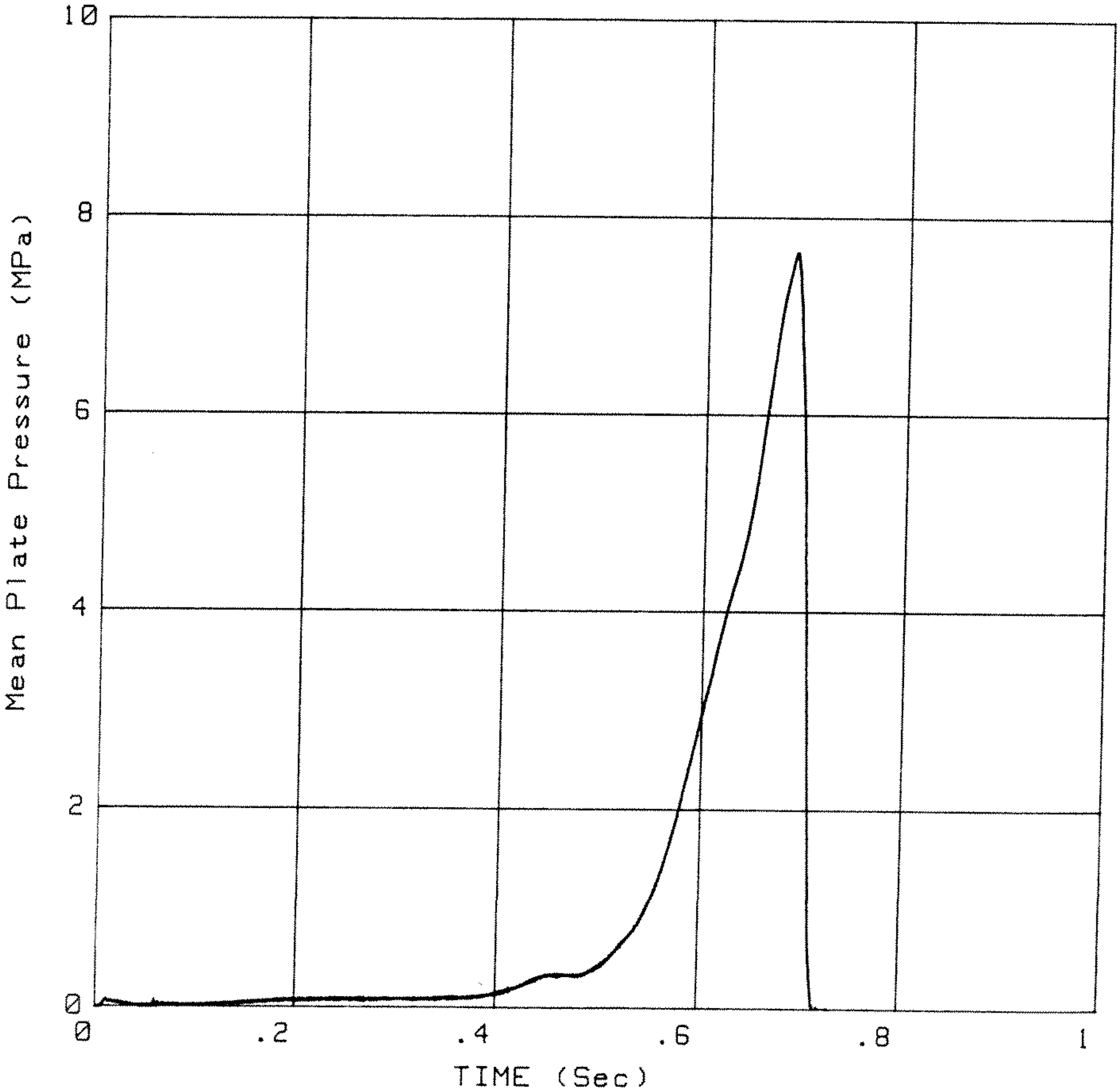
Test: X996
Type: Extrusion test
Sample: CRUSHED ICE

Date: 7 Dec 1988
Time: 16:26:01

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.03



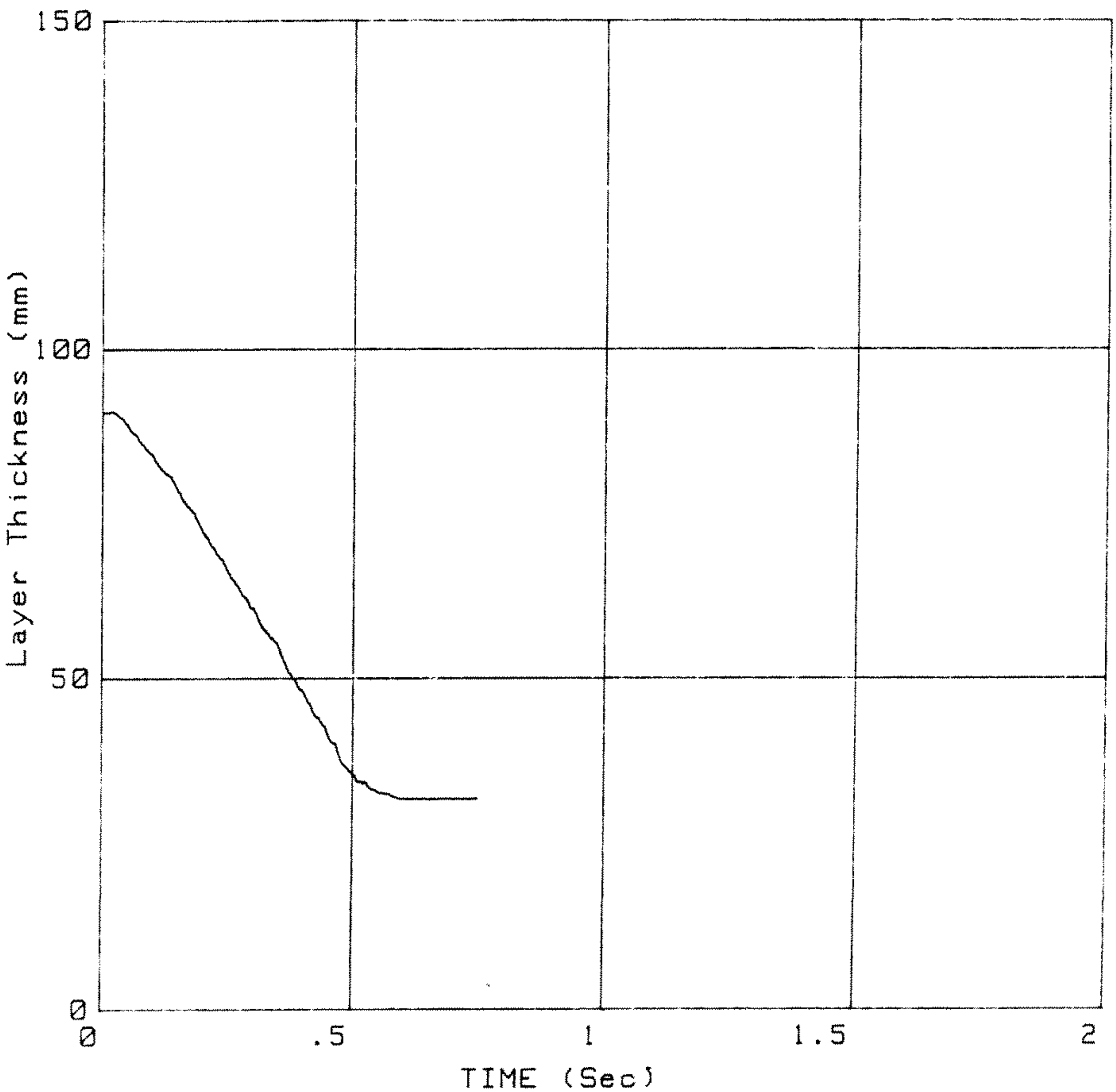
Layer Thickness
vs.
TIME

Test: X997
Type: Extrusion
Sample: CRUSHED ICE

Date: 5 Dec 1988
Time: 15:57:54

Temperature: -10

Average = 10
Truncation Time (s) = .75



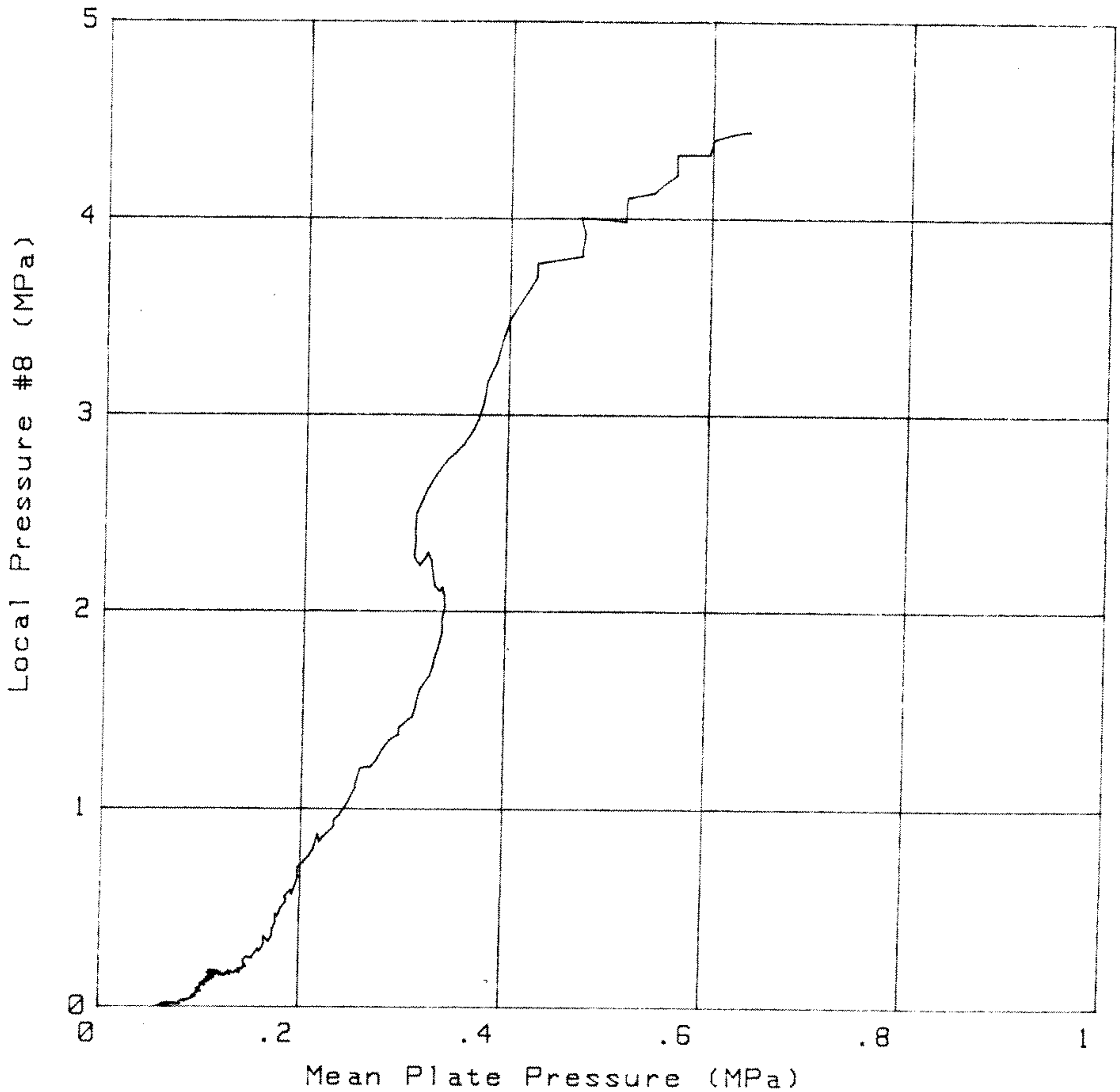
Local Pressure #8
vs.
Mean Plate Pressure

Test: X997
Type: Extrusion
Sample: CRUSHED ICE

Date: 5 Dec 1988
Time: 15:57:54

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): .11
Data To (s): .58



Local Pressure #16
vs.
TIME

Test: X997
Type: Extrusion
Sample: CRUSHED ICE

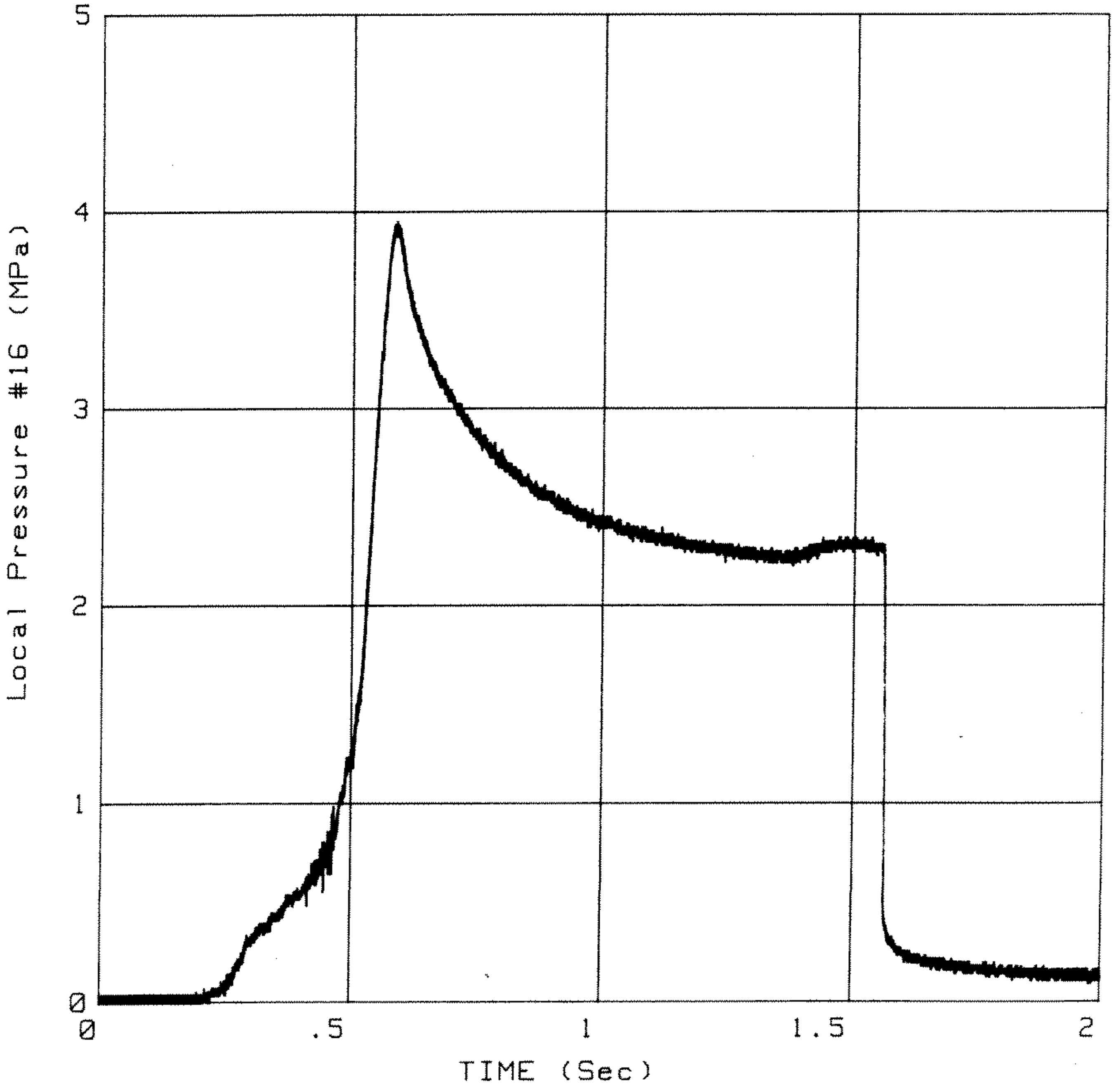
Date: 5 Dec 1988
Time: 15:57:54

Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 2.03



Local Pressure #12
vs.
TIME

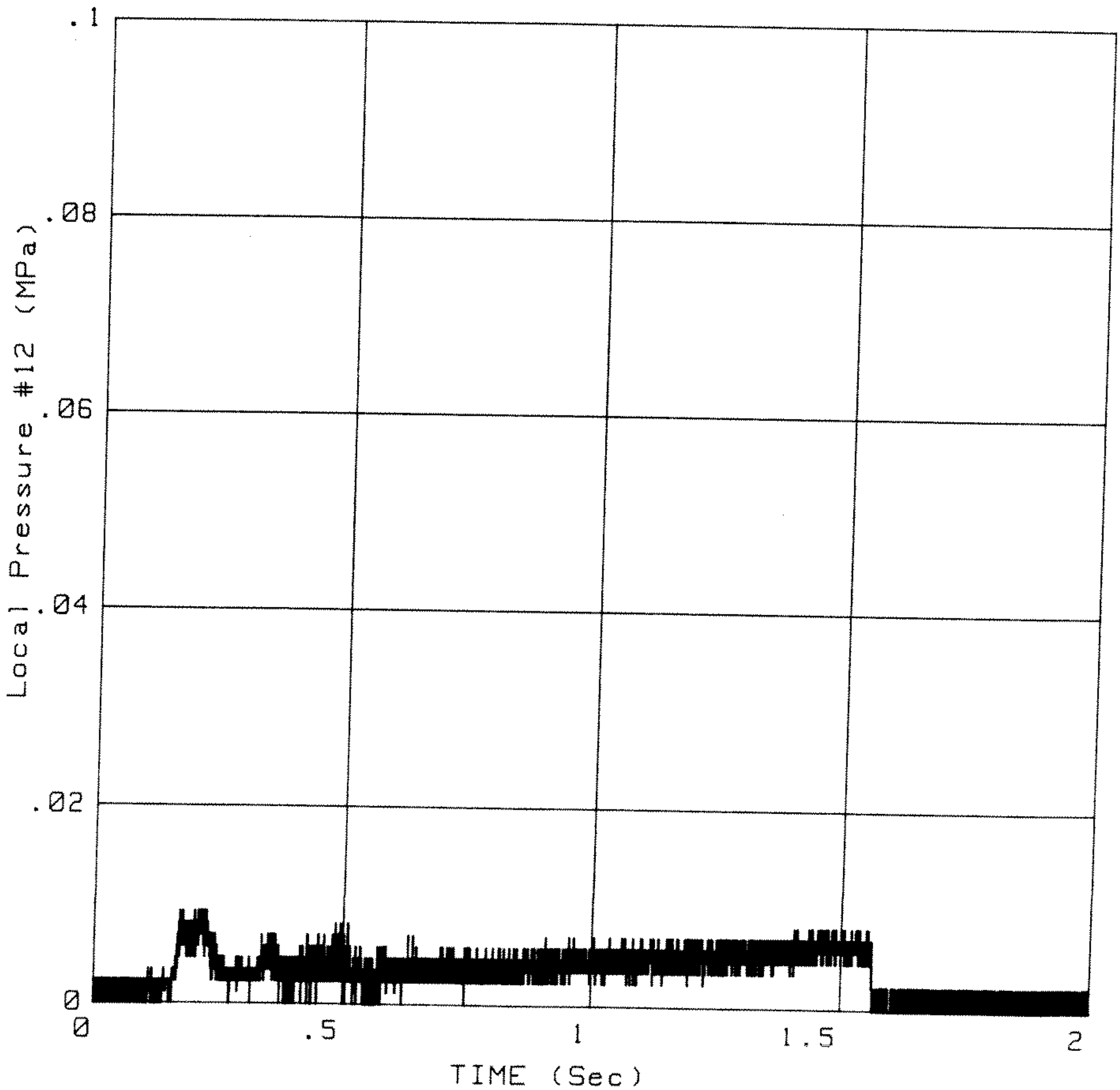
Test: X997
Type: Extrusion
Sample: CRUSHED ICE

Date: 5 Dec 1988
Time: 15:57:54

Temperature: -10

Y Offset Removed

Average = 1
Truncation Time (s) = 2.03



Local Pressure #10
vs.
TIME

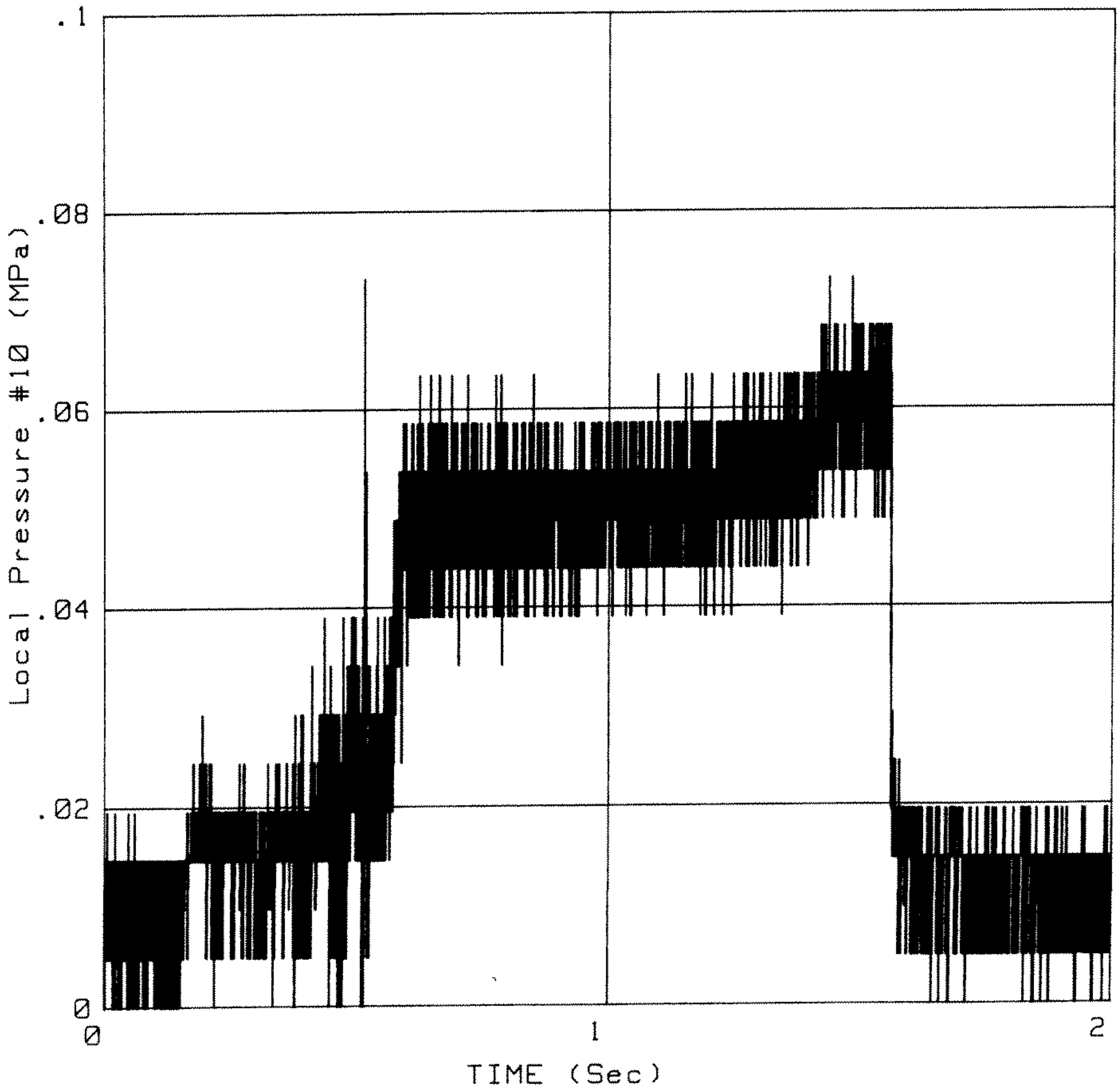
Test: X997
Type: Extrusion
Sample: CRUSHED ICE

Date: 5 Dec 1988
Time: 15:57:54

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.03



Local Pressure #8
vs.
TIME

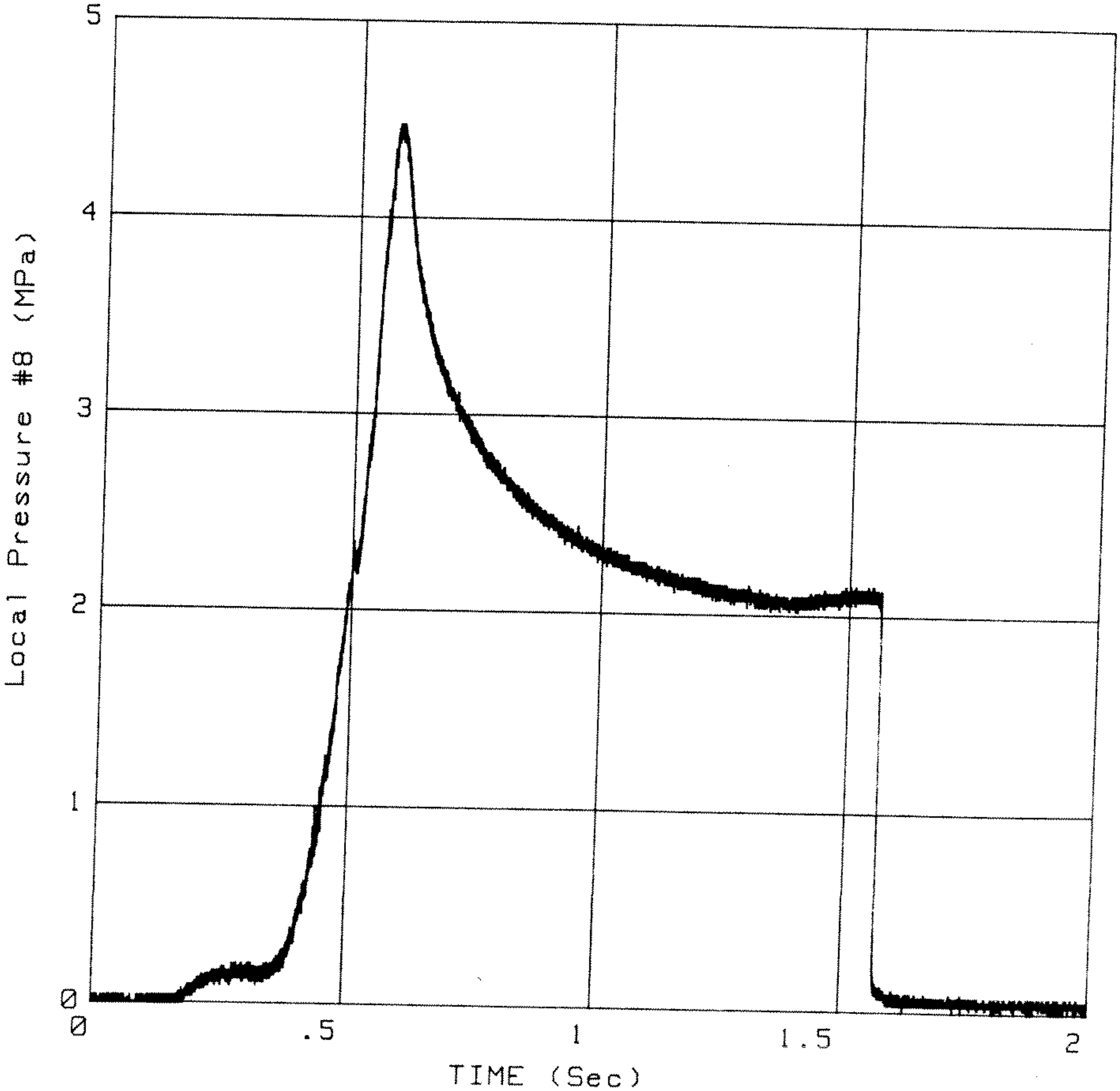
Test: X997
Type: Extrusion
Sample: CRUSHED ICE

Date: 5 Dec 1988
Time: 15:57:54

Temperature: -10

Y Offset Removed

Average = 1
Truncation Time (s) = 2.03



Mean Plate Pressure
vs.
TIME

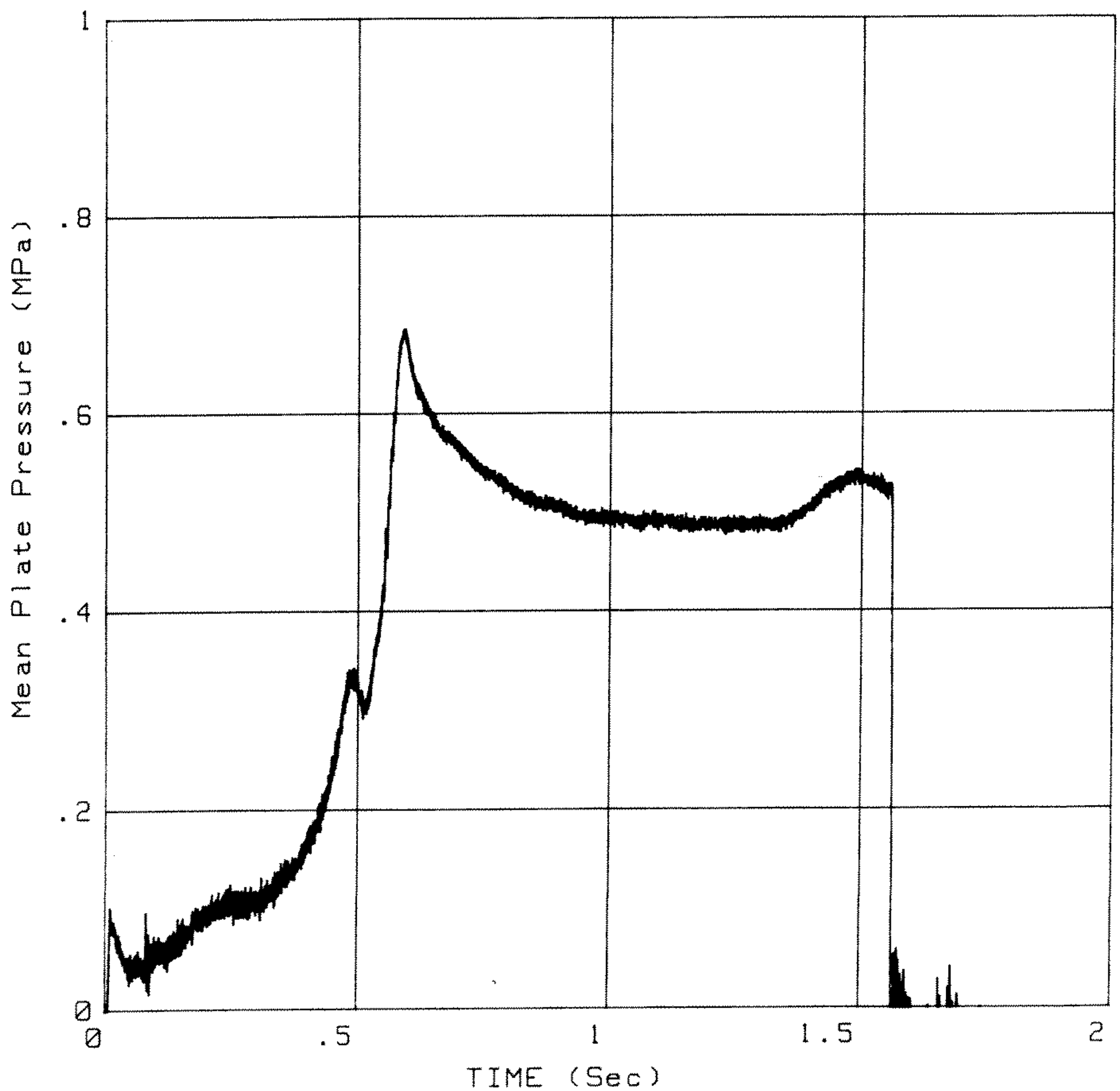
Test: X997
Type: Extrusion
Sample: CRUSHED ICE

Date: 5 Dec 1988
Time: 15:57:54

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 2.03



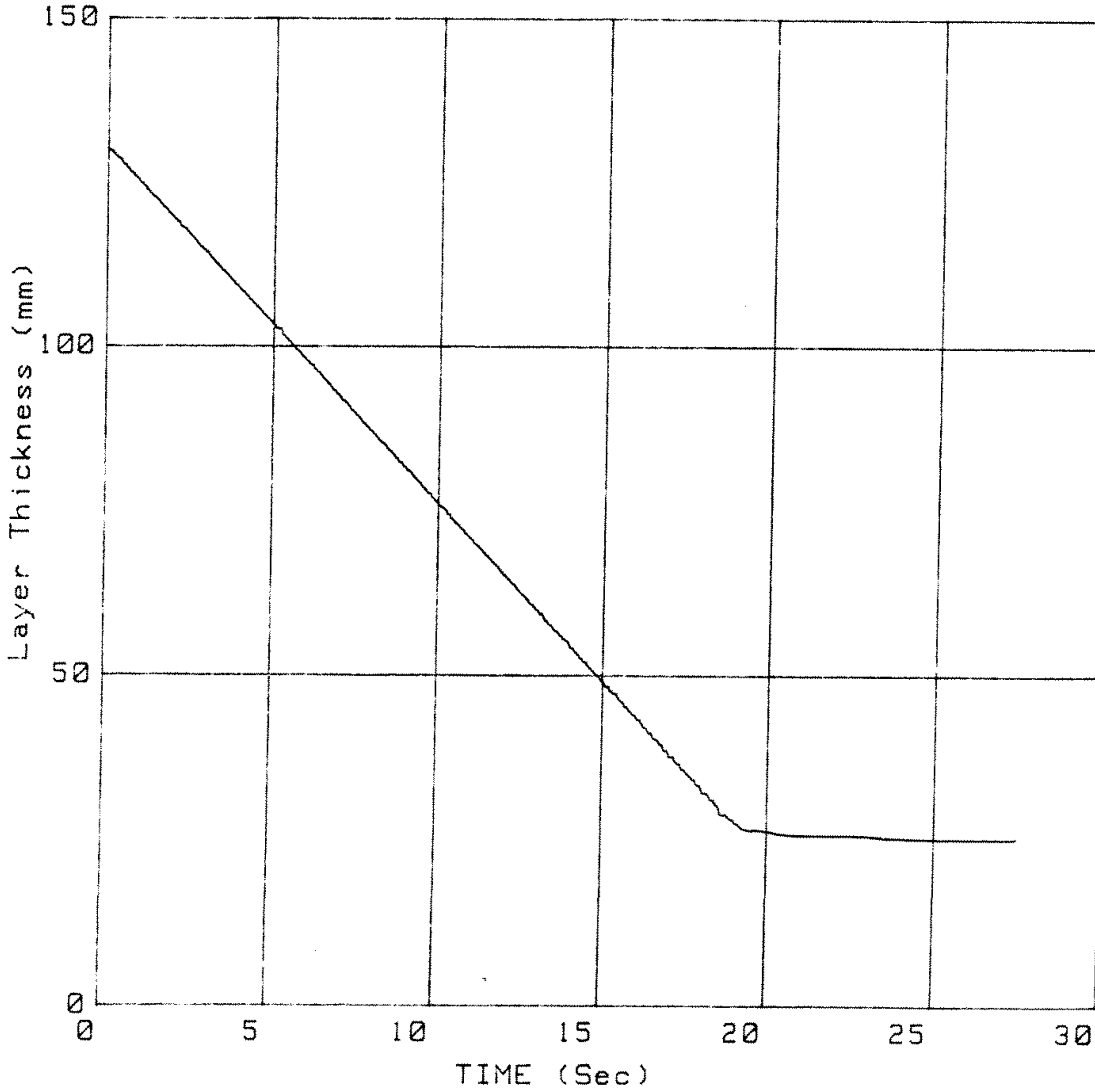
Layer Thickness
vs.
TIME

Test: X998
Type: System test
Sample: CRUSHED ICE

Date: 1 Dec 1988
Time: 09:25:53

Temperature: -10

Average = 10
Truncation Time (s) = 27.5



Local Pressure 12
vs.
TIME

Test: X998
Type: System test
Sample: CRUSHED ICE

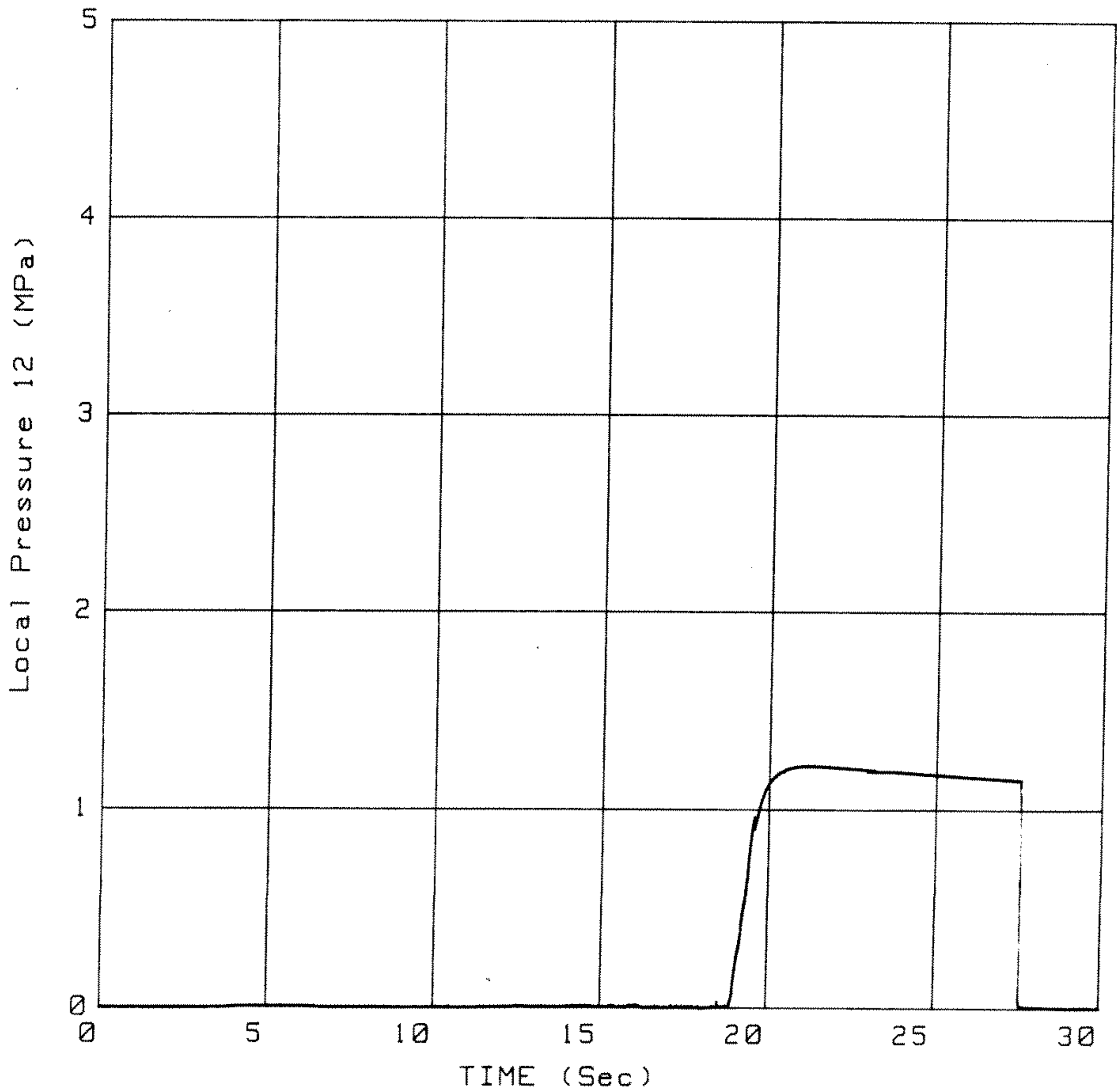
Date: 1 Dec 1988
Time: 09:25:53

Temperature: -10

Y Offset Removed

Average = 1

Truncation Time (s) = 34.01



Local Pressure 12
vs.
TIME

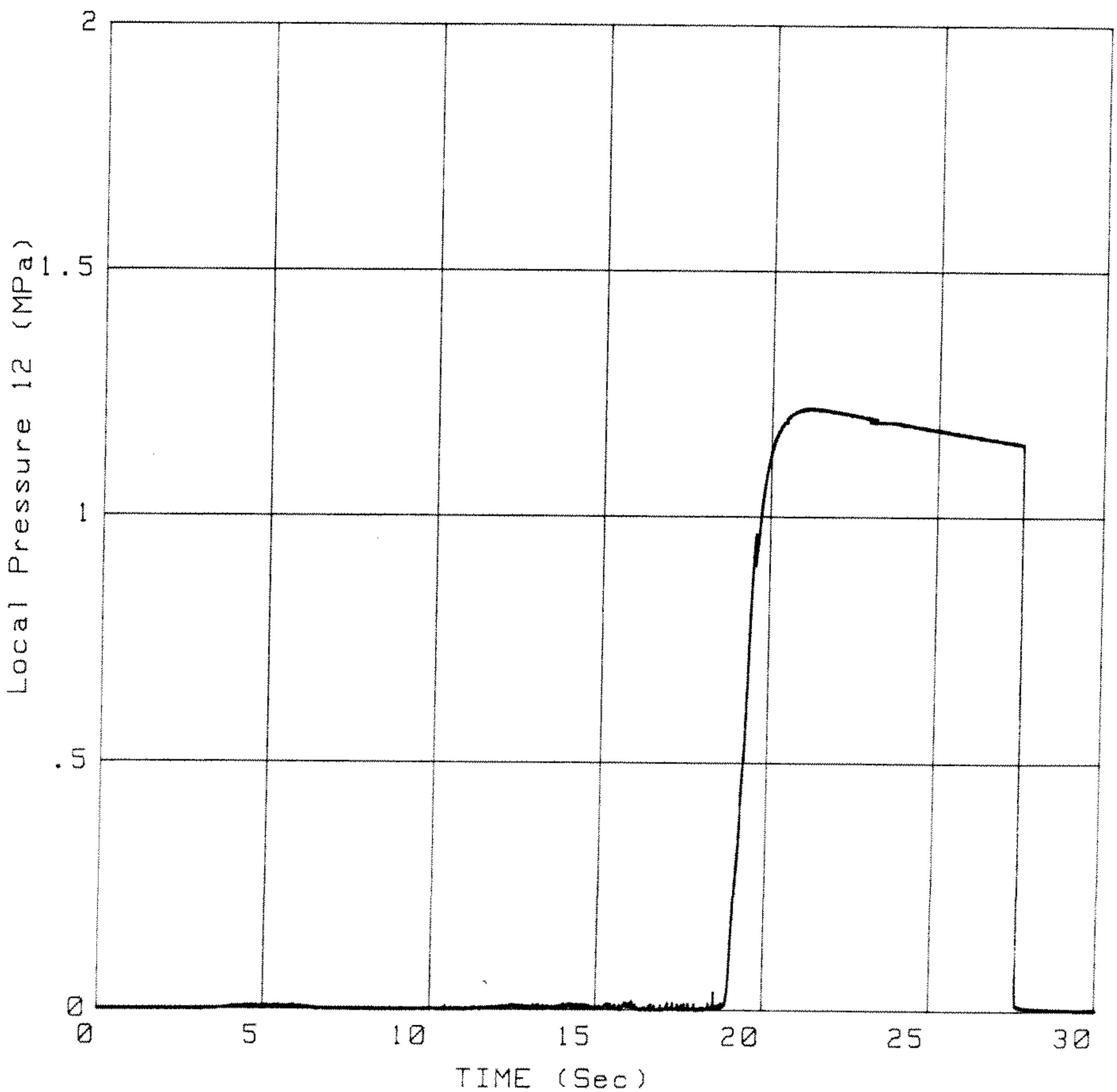
Test: X998
Type: System test
Sample: CRUSHED ICE

Date: 1 Dec 1988
Time: 09:25:53

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 34.01



Local Pressure 10
vs.
TIME

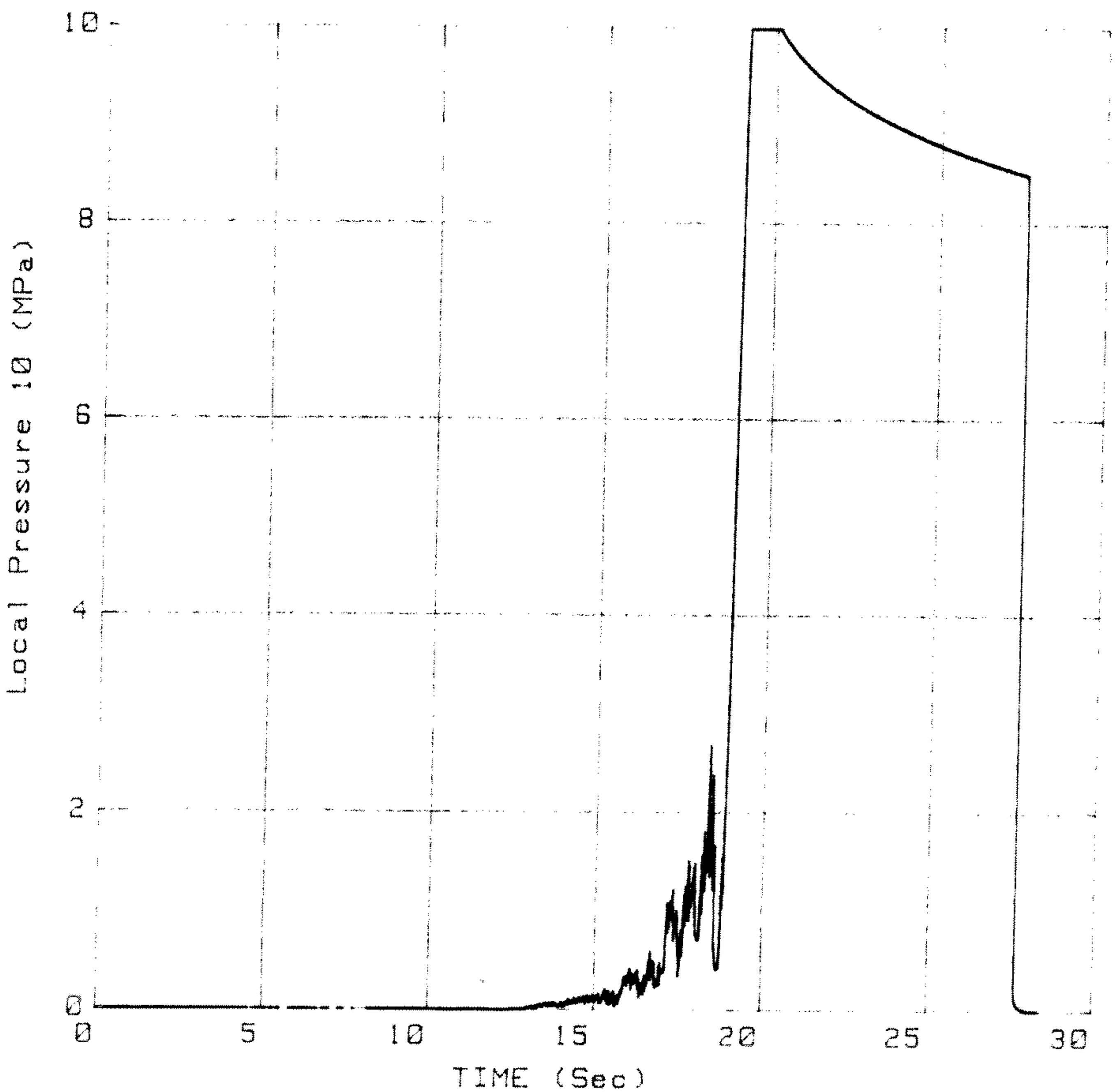
Test: X998
Type: System test
Sample: CRUSHED ICE

Date: 1 Dec 1988
Time: 09:25:53

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 34.01



Mean Plate Pressure
vs.
TIME

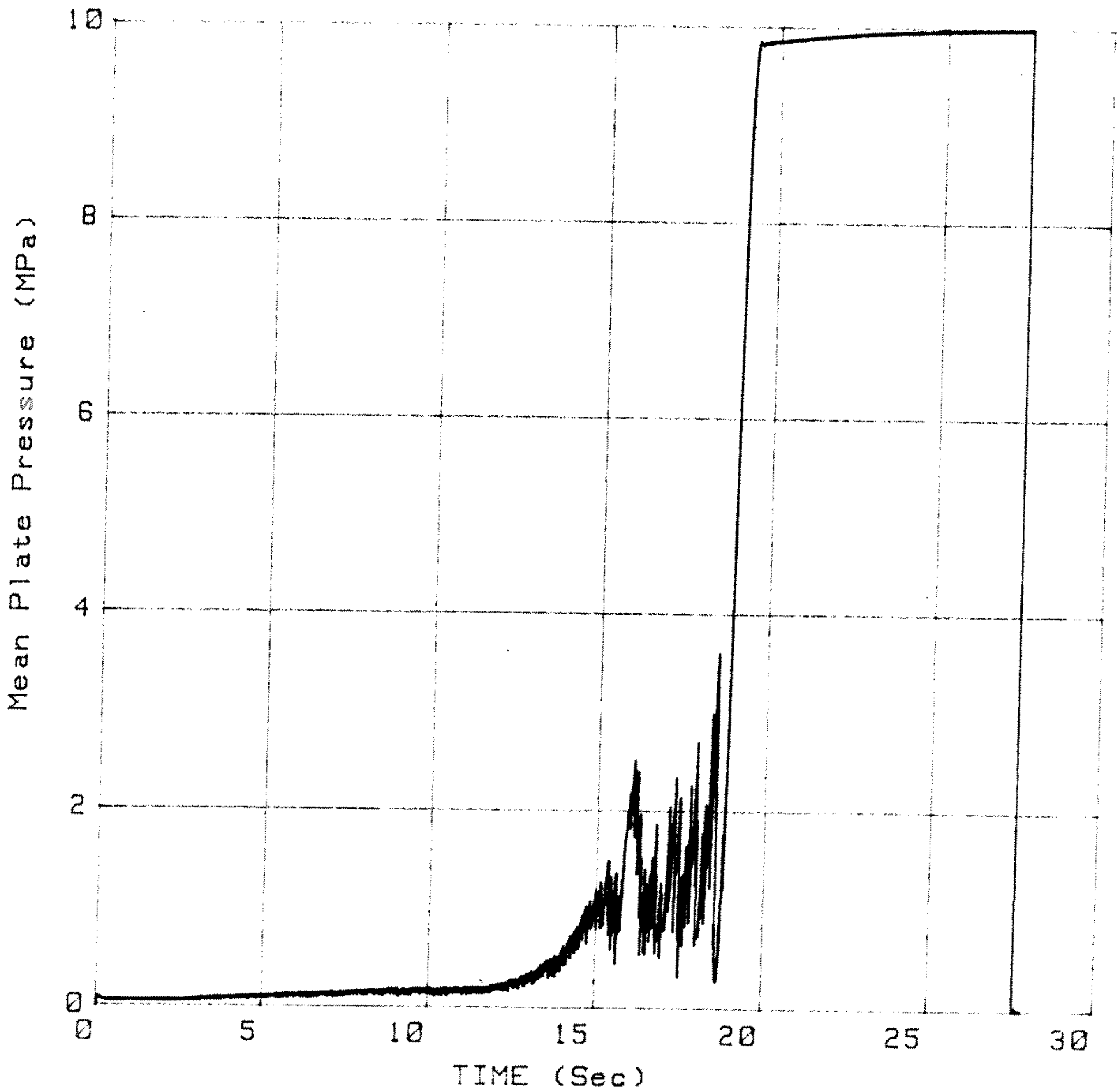
Test: X998
Type: System test
Sample: CRUSHED ICE

Date: 1 Dec 1988
Time: 09:25:53

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 34.01



Local Pressure 16
vs.
TIME

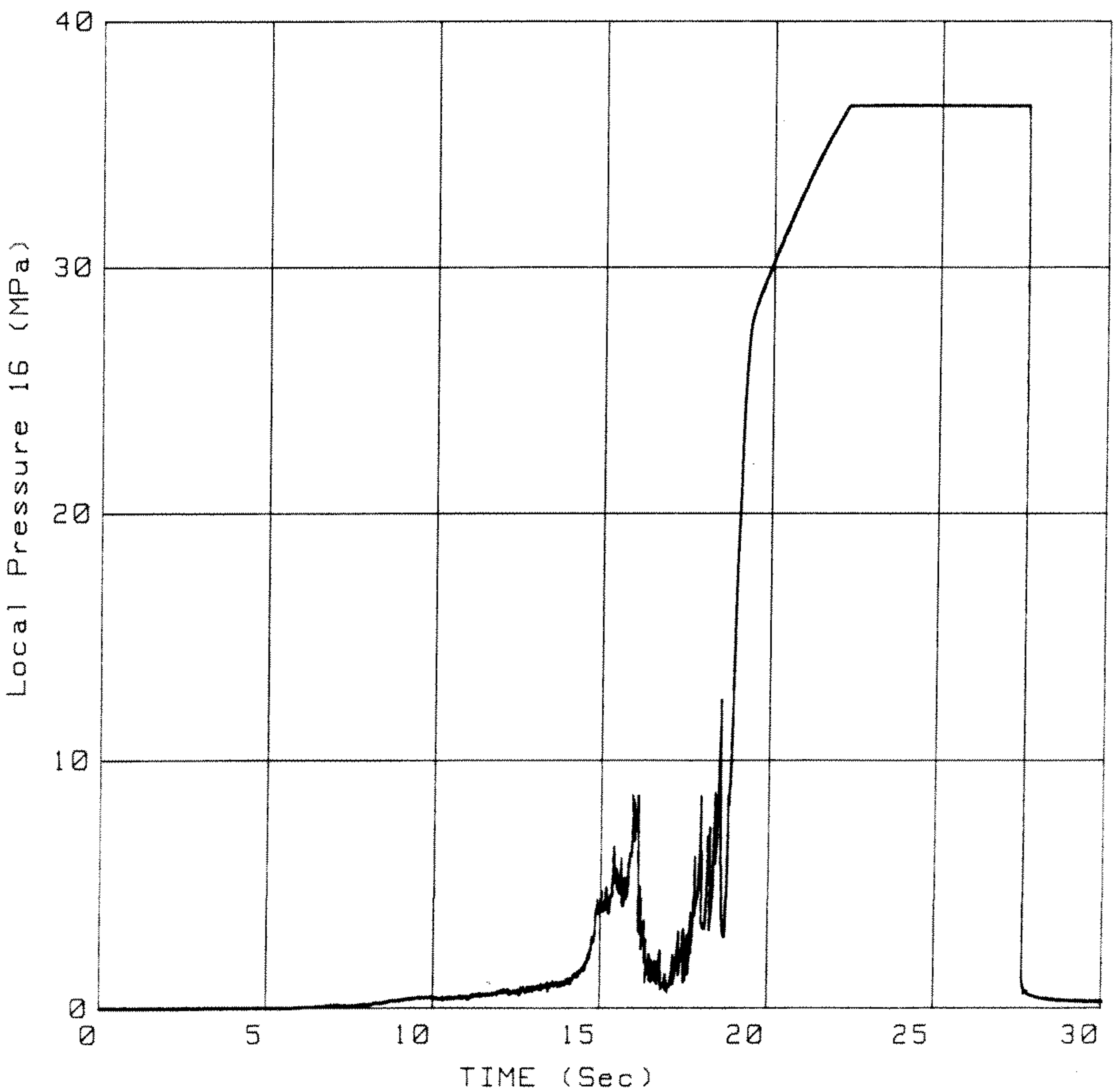
Test: X998
Type: System test
Sample: CRUSHED ICE

Date: 1 Dec 1988
Time: 09:25:53

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 34.01



Local Pressure 8
vs.
TIME

Test: X998
Type: System test
Sample: CRUSHED ICE

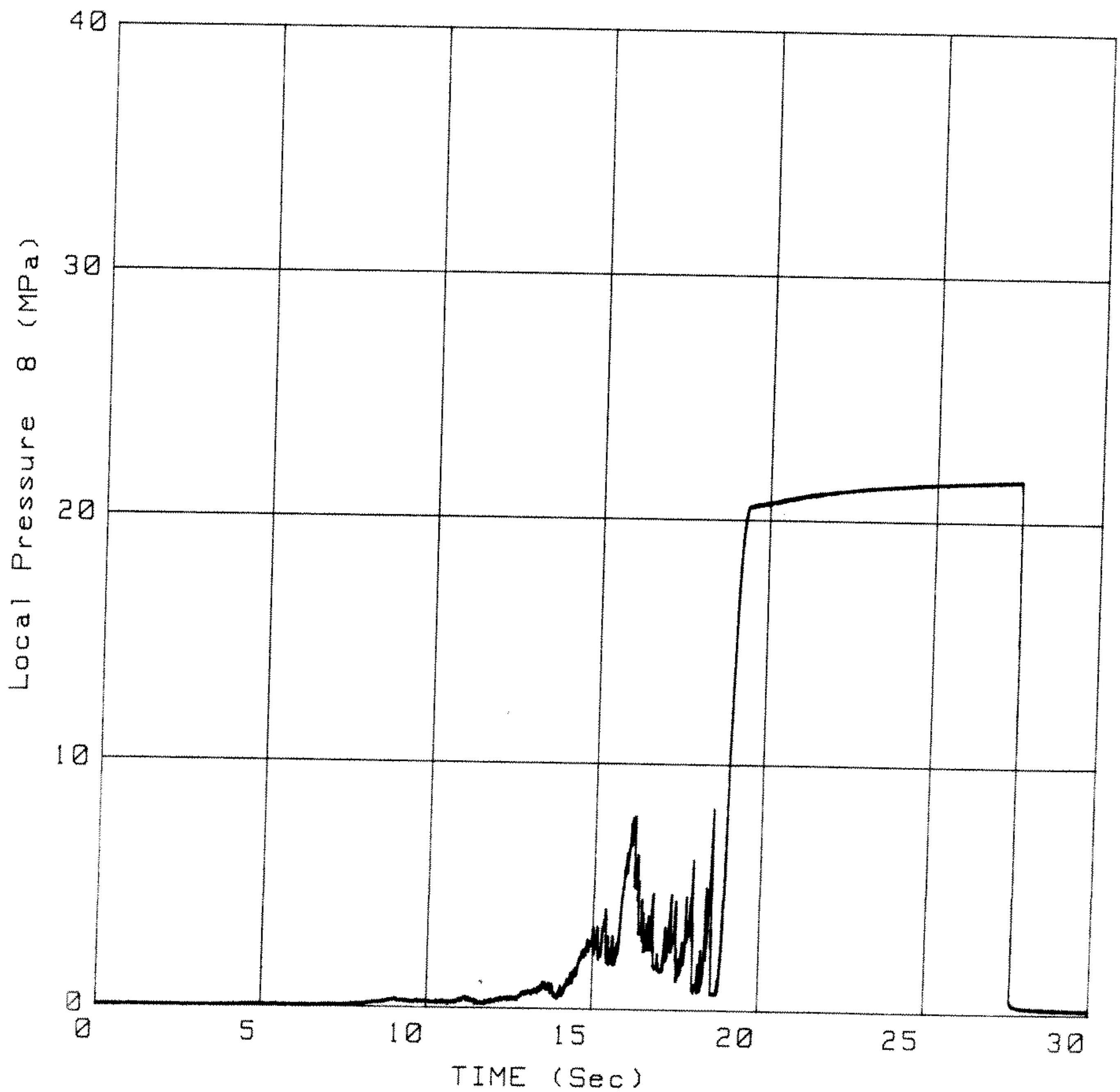
Date: 1 Dec 1988
Time: 09:25:53

Temperature: -10

Y Offset Removed

Average = 1

Truncation Time (s) = 30



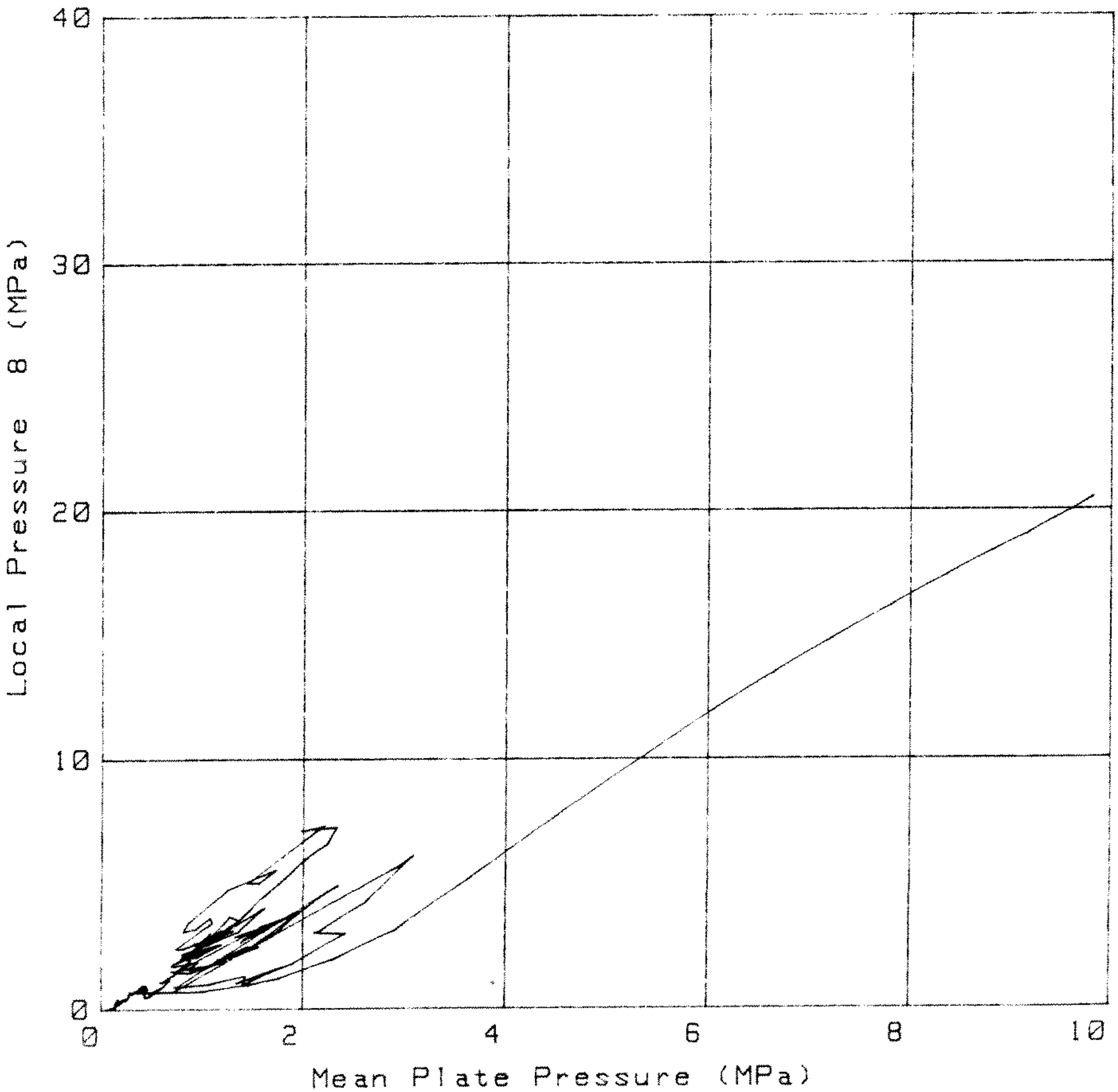
Local Pressure 8
vs.
Mean Plate Pressure

Test: X998
Type: System test
Sample: CRUSHED ICE

Date: 1 Dec 1988
Time: 09:25:53

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 2
Data To (s): 19.4



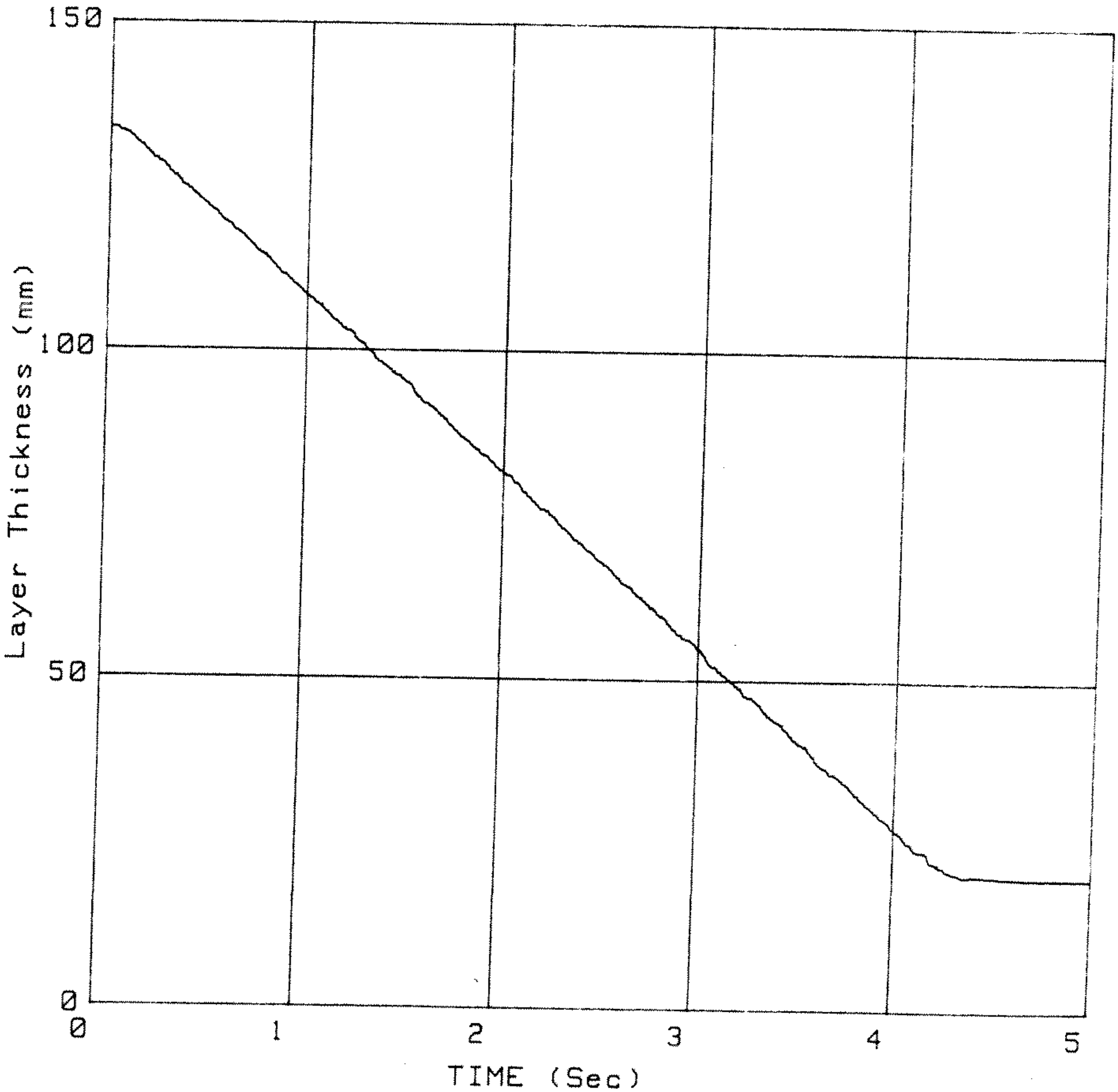
Layer Thickness
vs.
TIME

Test: X999
Type: Sys test
Sample:

Date: 29 Nov 1988
Time: 16:45:49

Temperature: -10

Average = 10
Truncation Time (s) = 5.01



Local Pressure 12
vs.
TIME

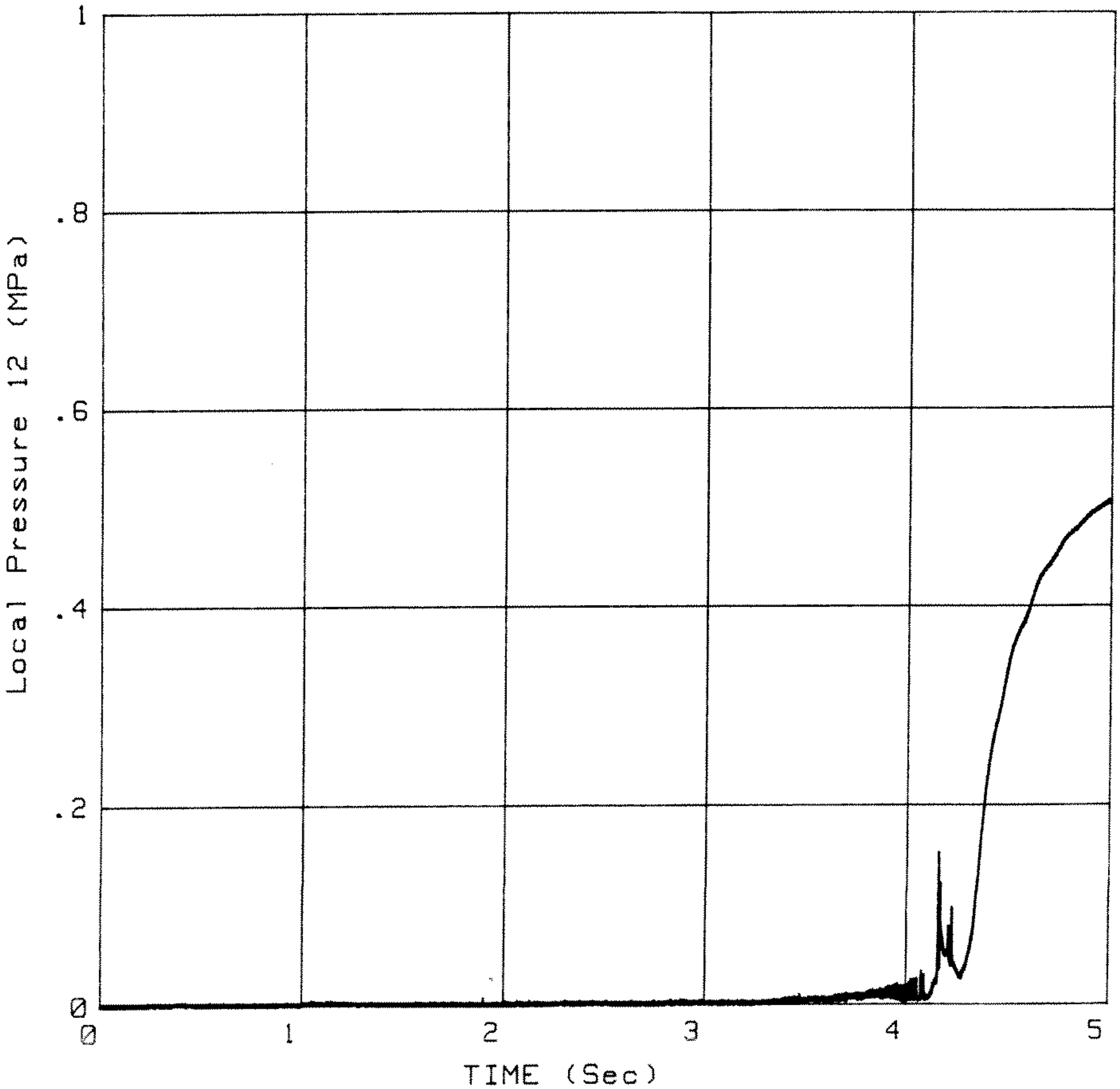
Test: X999
Type: Sys test
Sample:

Date: 29 Nov 1988
Time: 16:45:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.01



Local Pressure 10
vs.
TIME

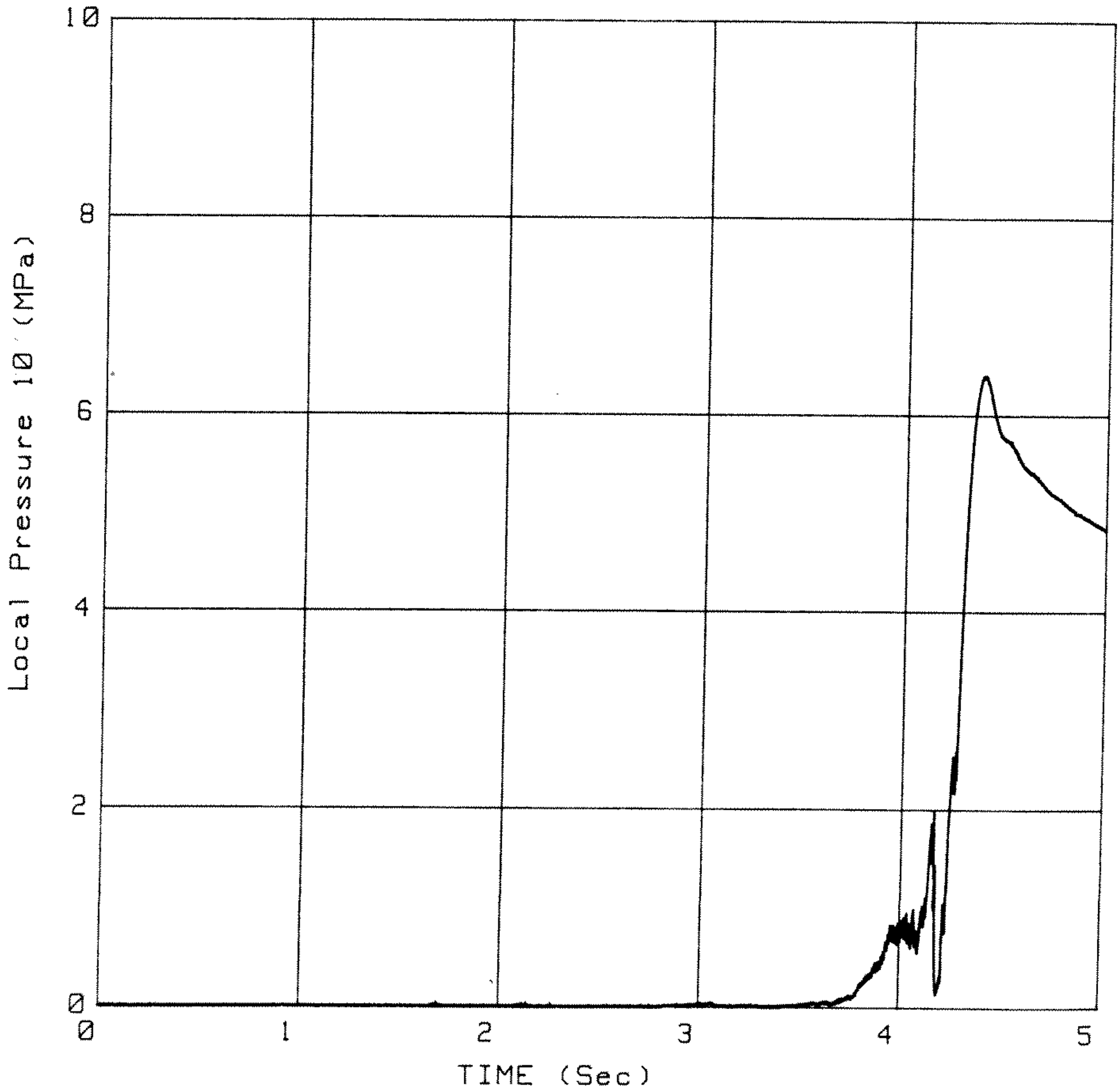
Test: X999
Type: Sys test
Sample:

Date: 29 Nov 1988
Time: 16:45:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.01



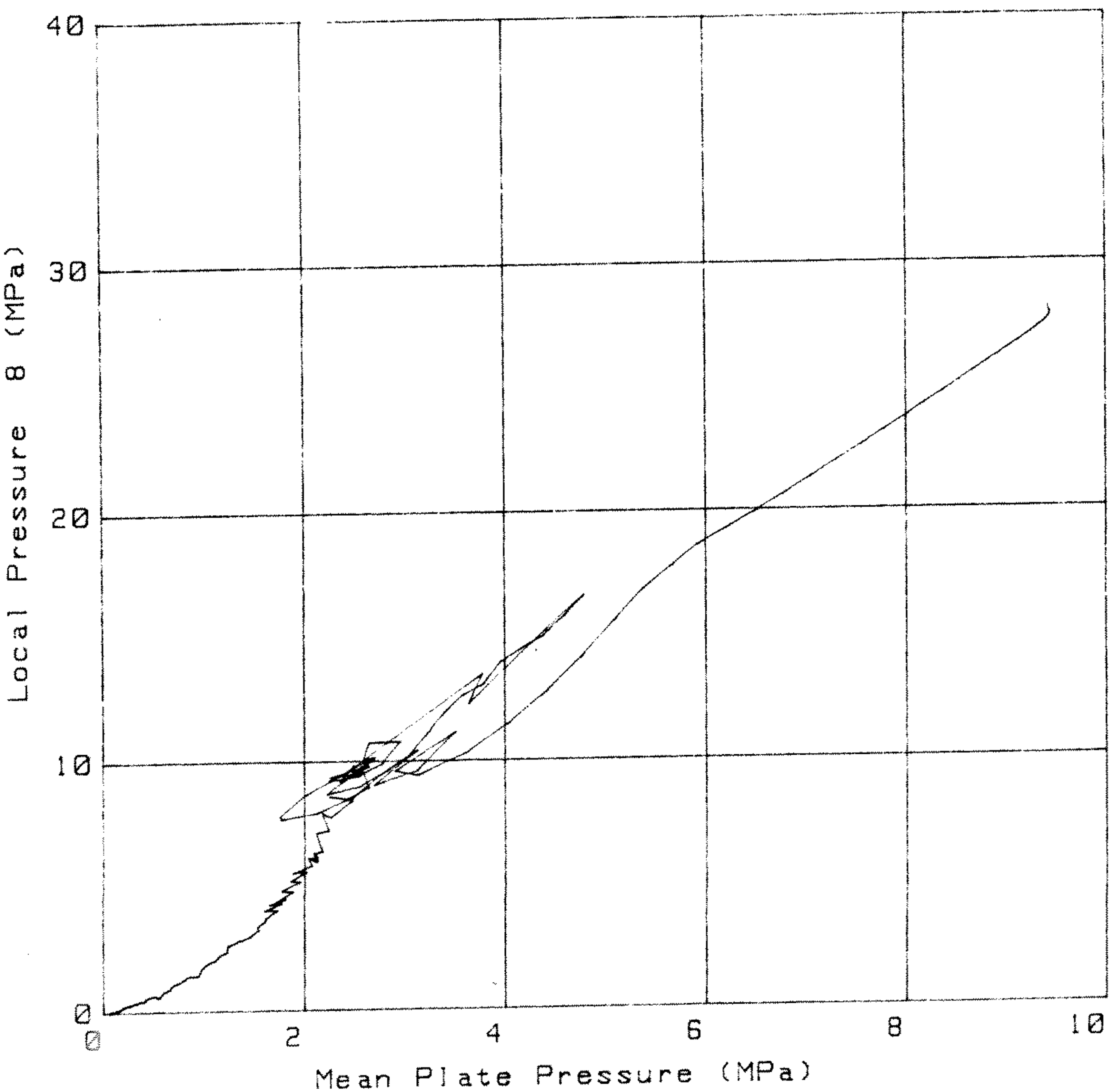
Local Pressure 8
vs.
Mean Plate Pressure

Test: X999
Type: Sys test
Sample:

Date: 29 Nov 1988
Time: 16:45:49

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 2.1
Data To (s): 4.4



Local Pressure 8
vs.
TIME

Test: X999
Type: Sys test
Sample:

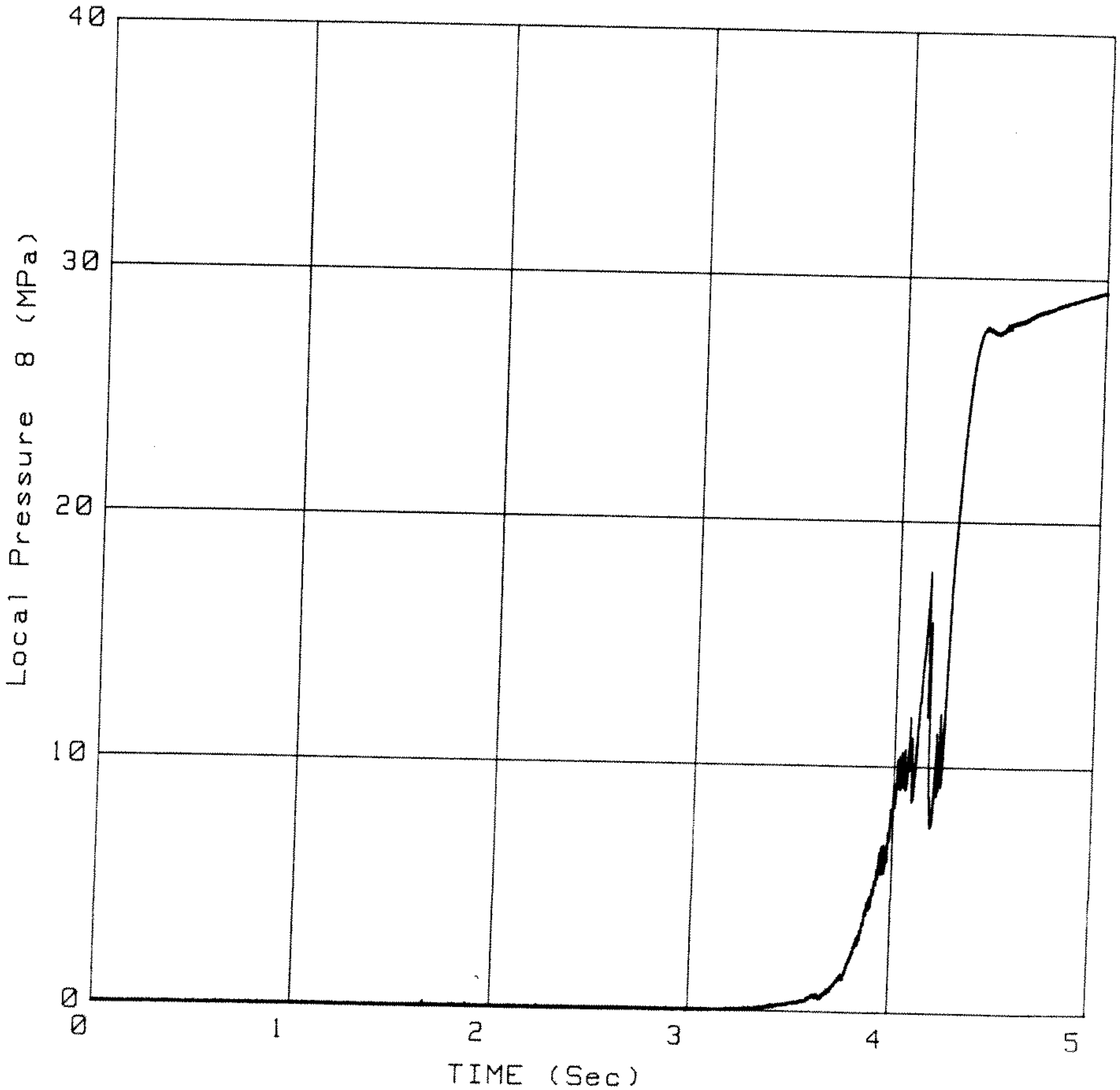
Date: 29 Nov 1988
Time: 16:45:49

Temperature: -10

Y Offset Removed

Average = 1

Truncation Time (s) = 5.01



Local Pressure 16
vs.
TIME

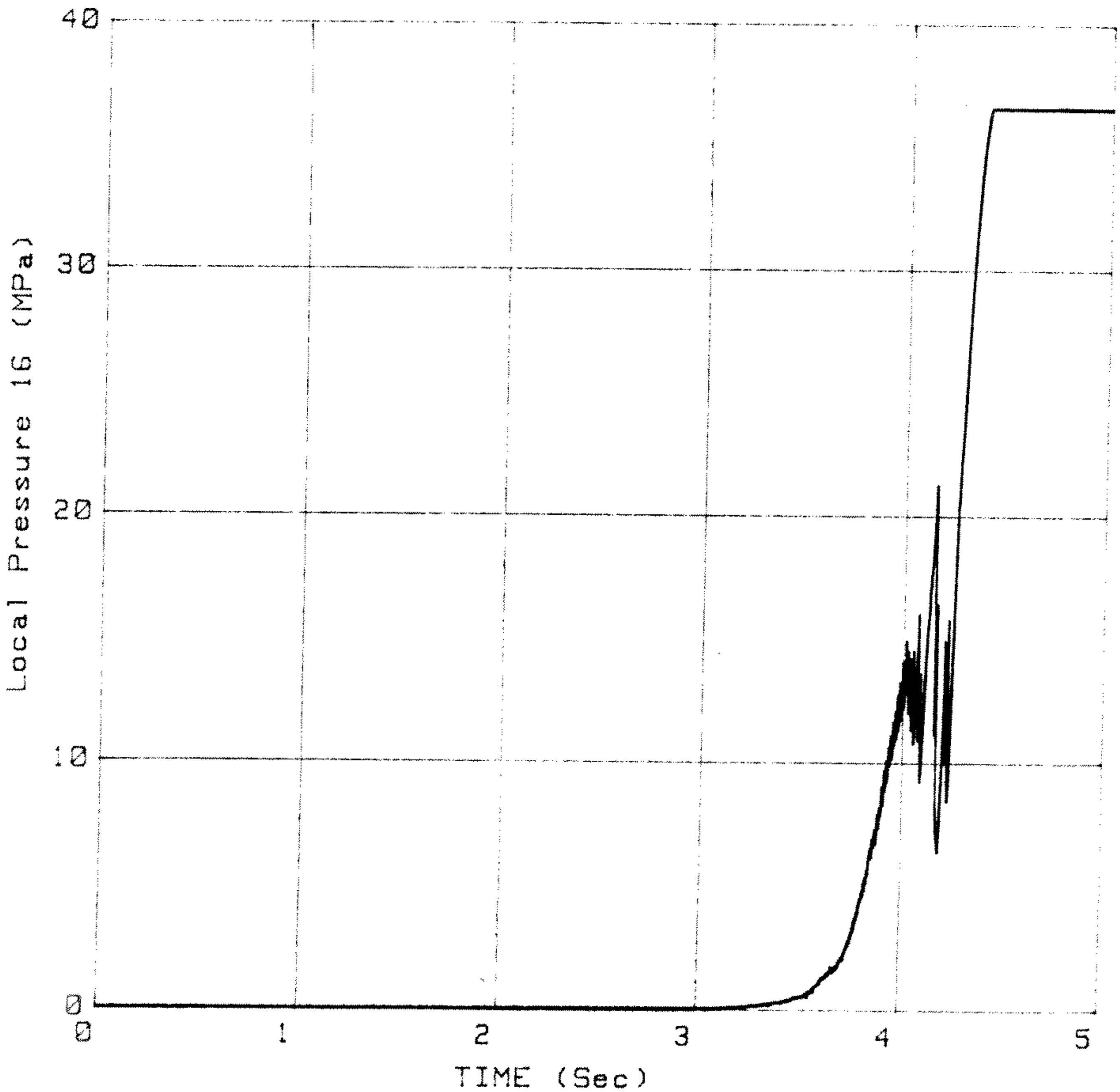
Test: X999
Type: Sys test
Sample:

Date: 29 Nov 1988
Time: 16:45:49

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.01



Mean Plate Pressure
vs.
TIME

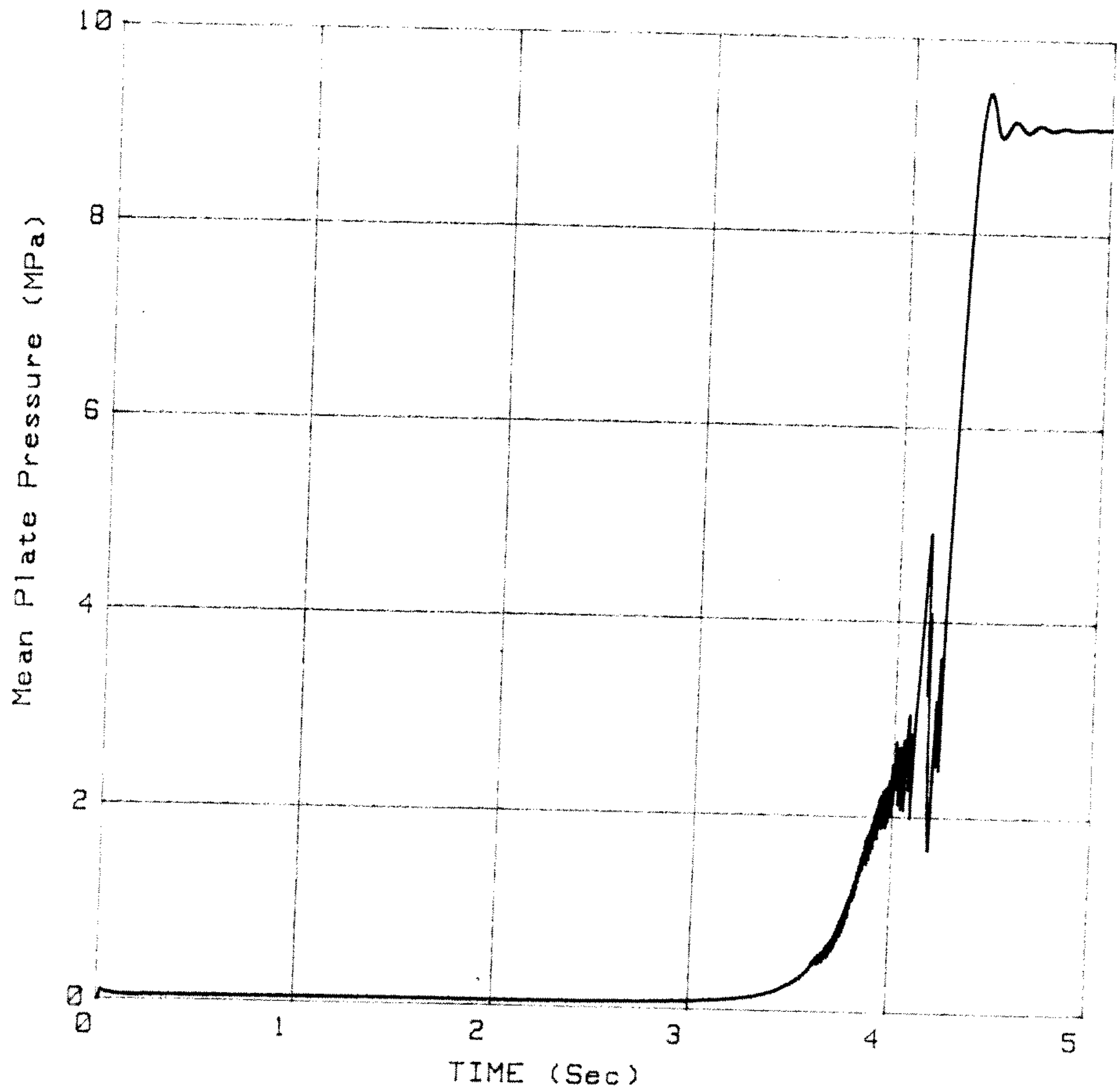
Test: X999
Type: Sys test
Sample:

Date: 29 Nov 1988
Time: 16:45:49

Temperature: -10

Y Offset Removed

Average = 1
Truncation Time (s) = 5.01



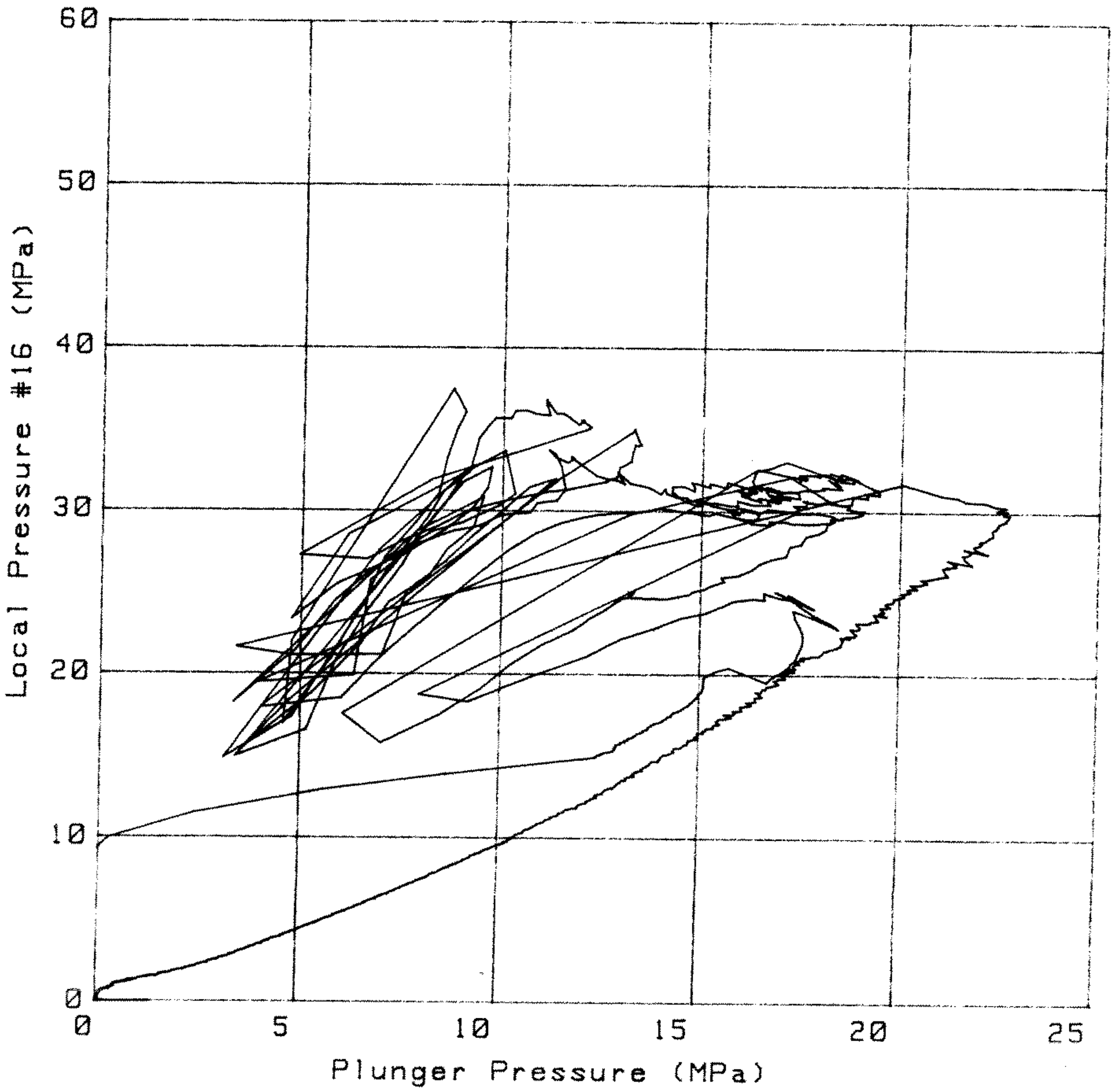
Local Pressure #16
vs.
Plunger Pressure

Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 0
Data To (s): 29.1499938965



Mean Displacement
vs.
TIME

Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

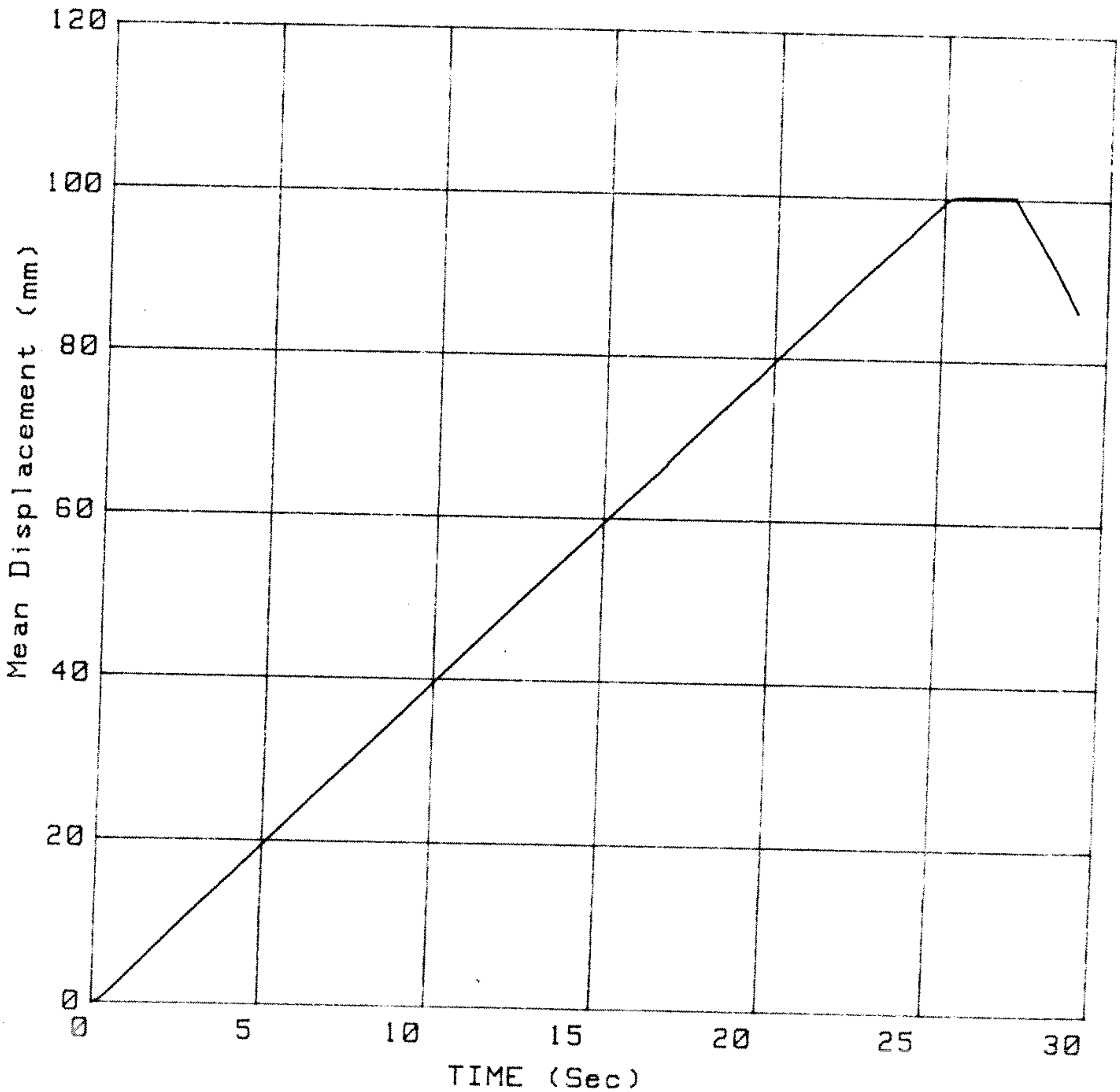
Date: 3 Jan 1989
Time: 11:48:09

Temperature: -10

Y Offset Removed

Average = 10

Truncation Time (s) = 29.15



Local Pressure #16
vs.
TIME

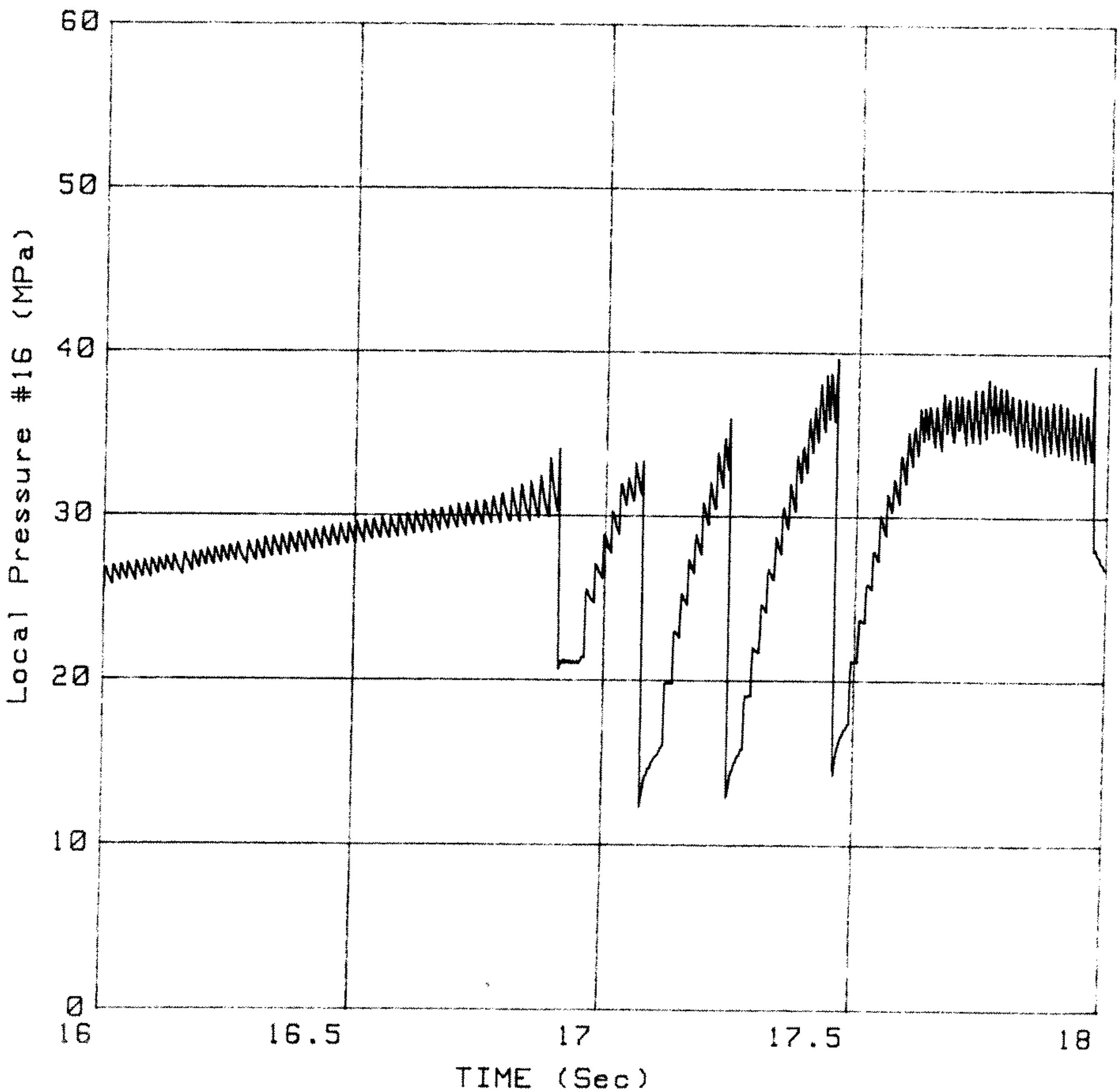
Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 29.15



Plunger Pressure
vs.
TIME

Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

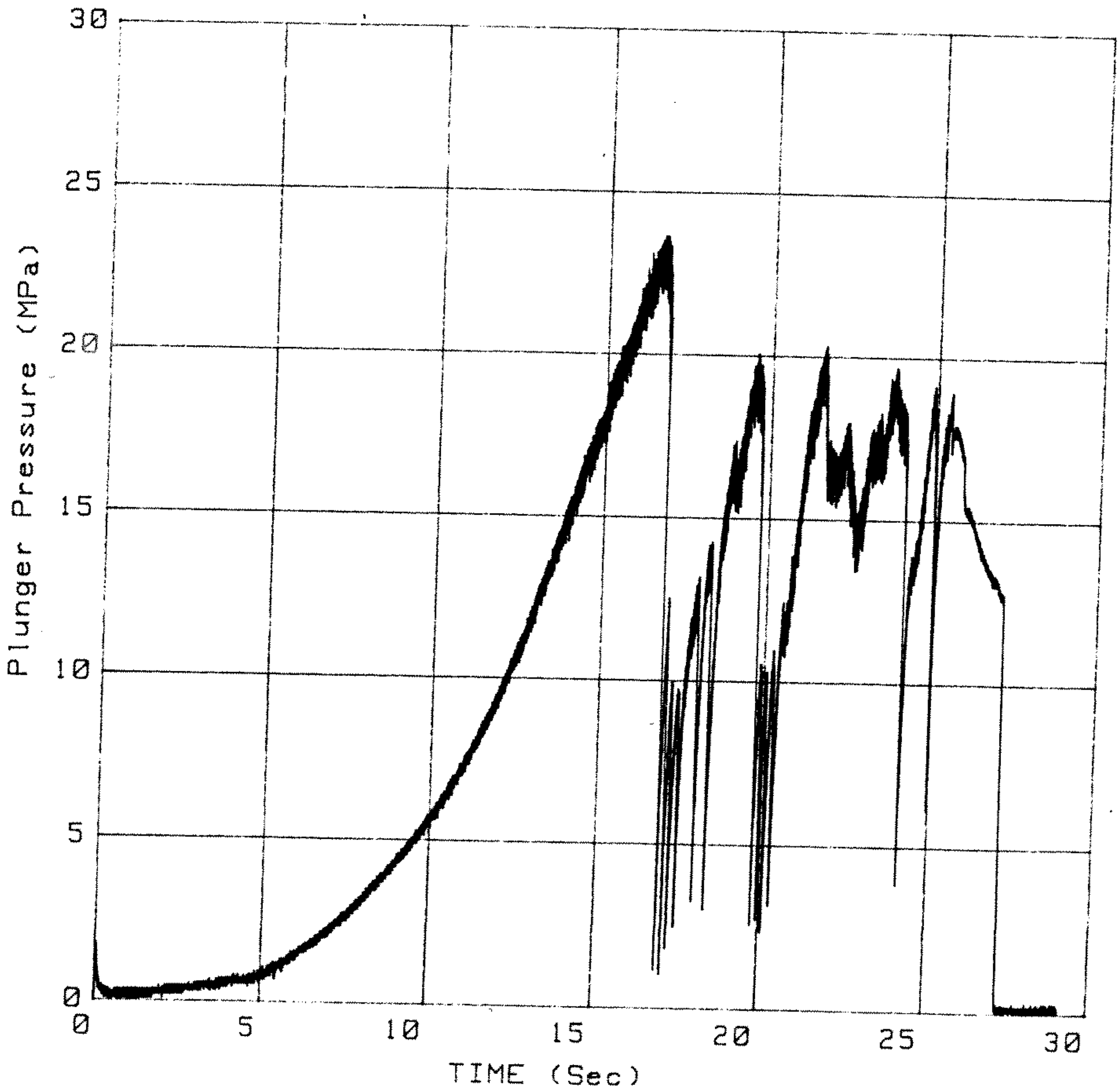
Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 29.15



Plunger Pressure
vs.
TIME

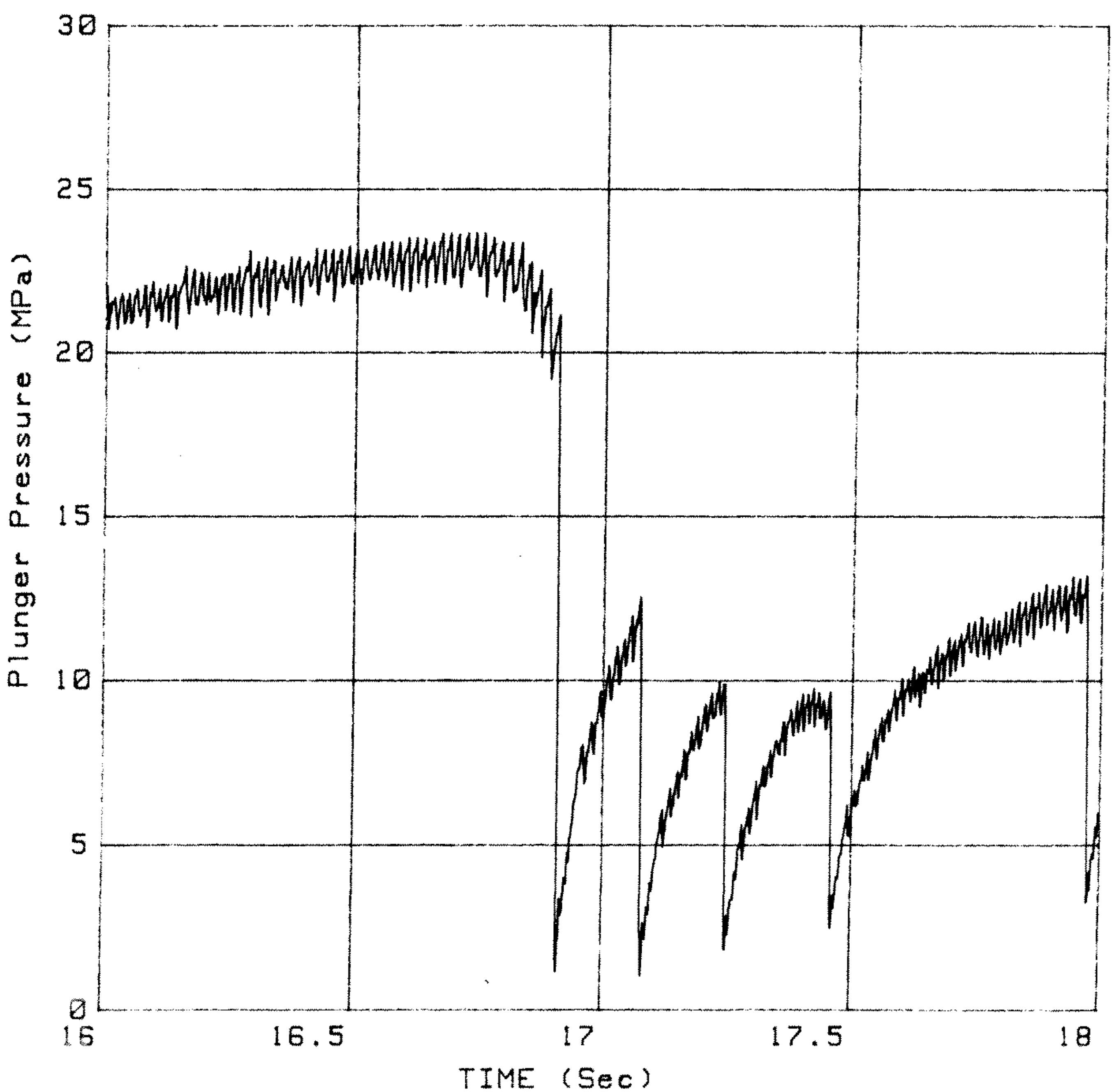
Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 29.15



Plunger Pressure
vs.
TIME

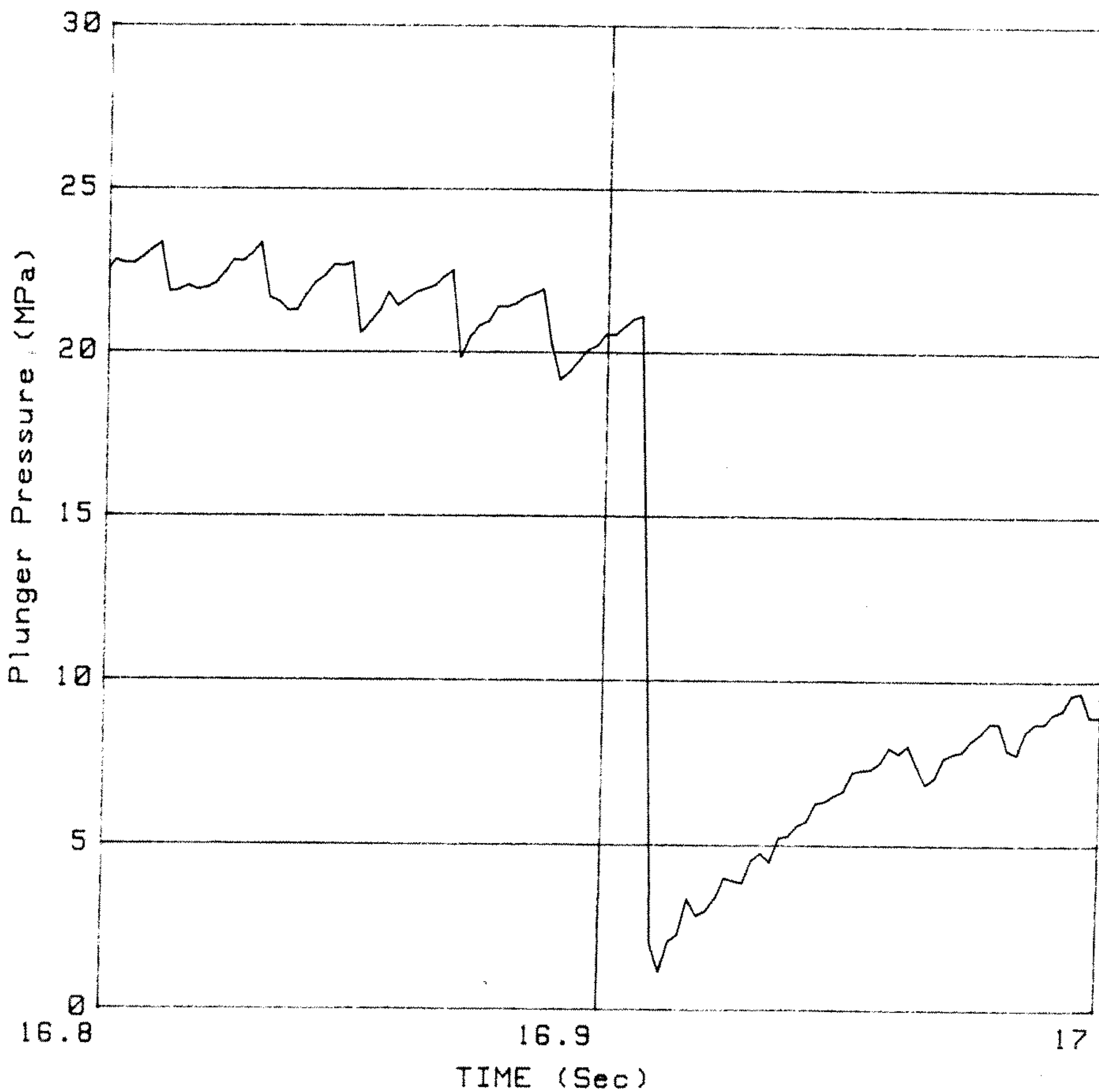
Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 29.15



Local Pressure #16
vs.
TIME

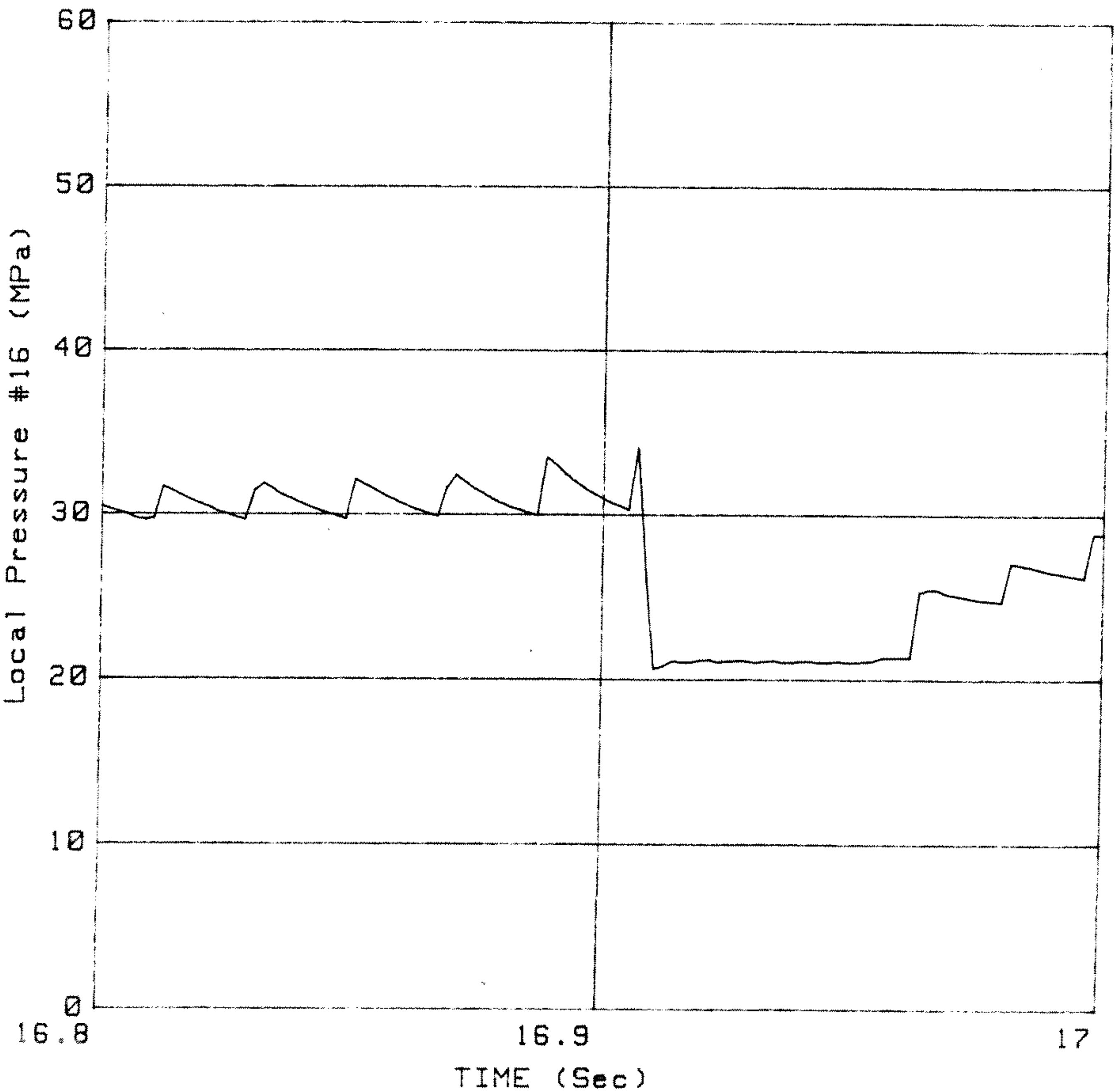
Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 29.15



Local Pressure #16
vs.
TIME

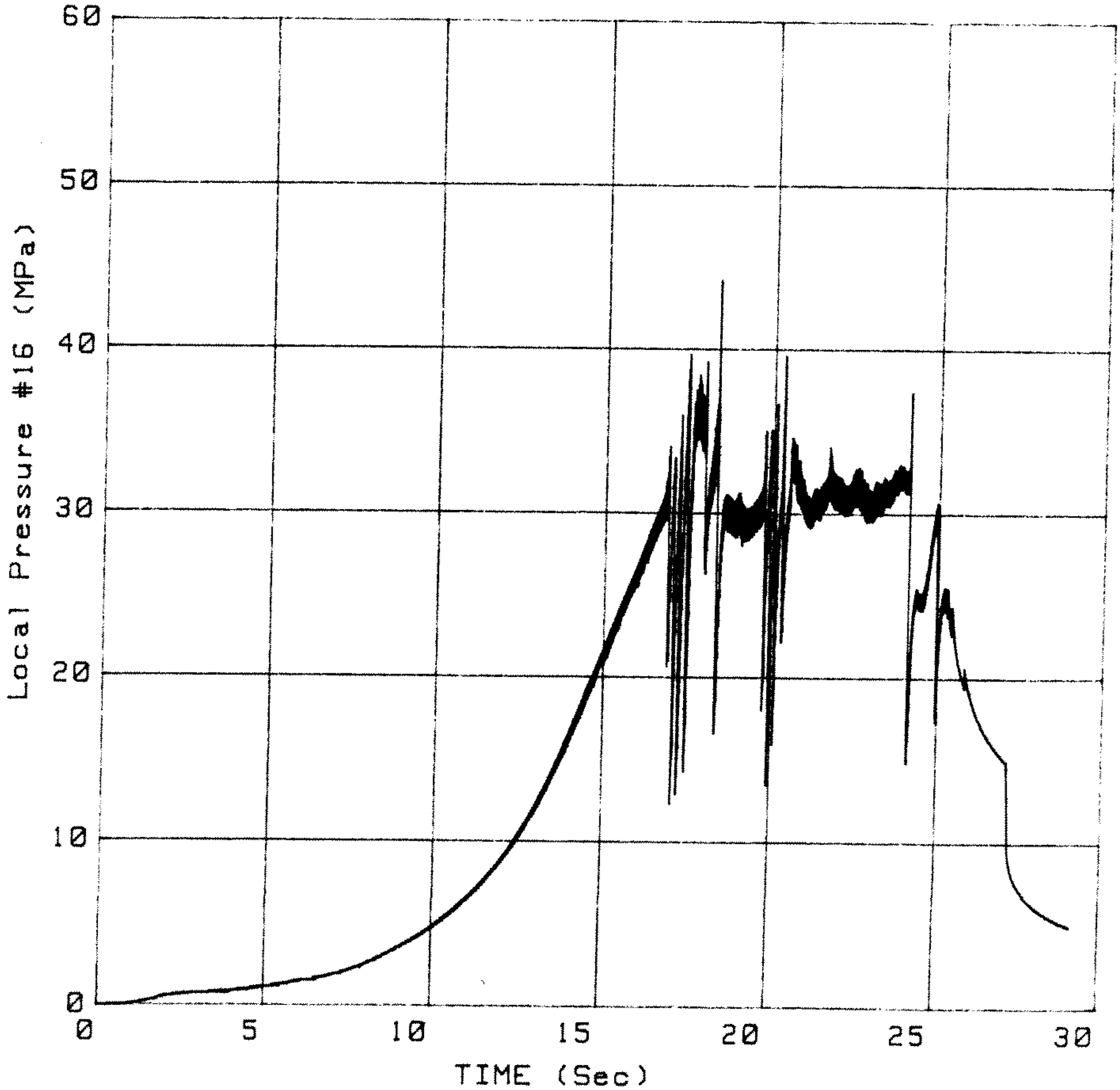
Test: Y001
Type: Crush extrusion test
Sample: CRUSHED ICE

Date: 3 Jan 1989
Time: 11:48:09

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 29.15



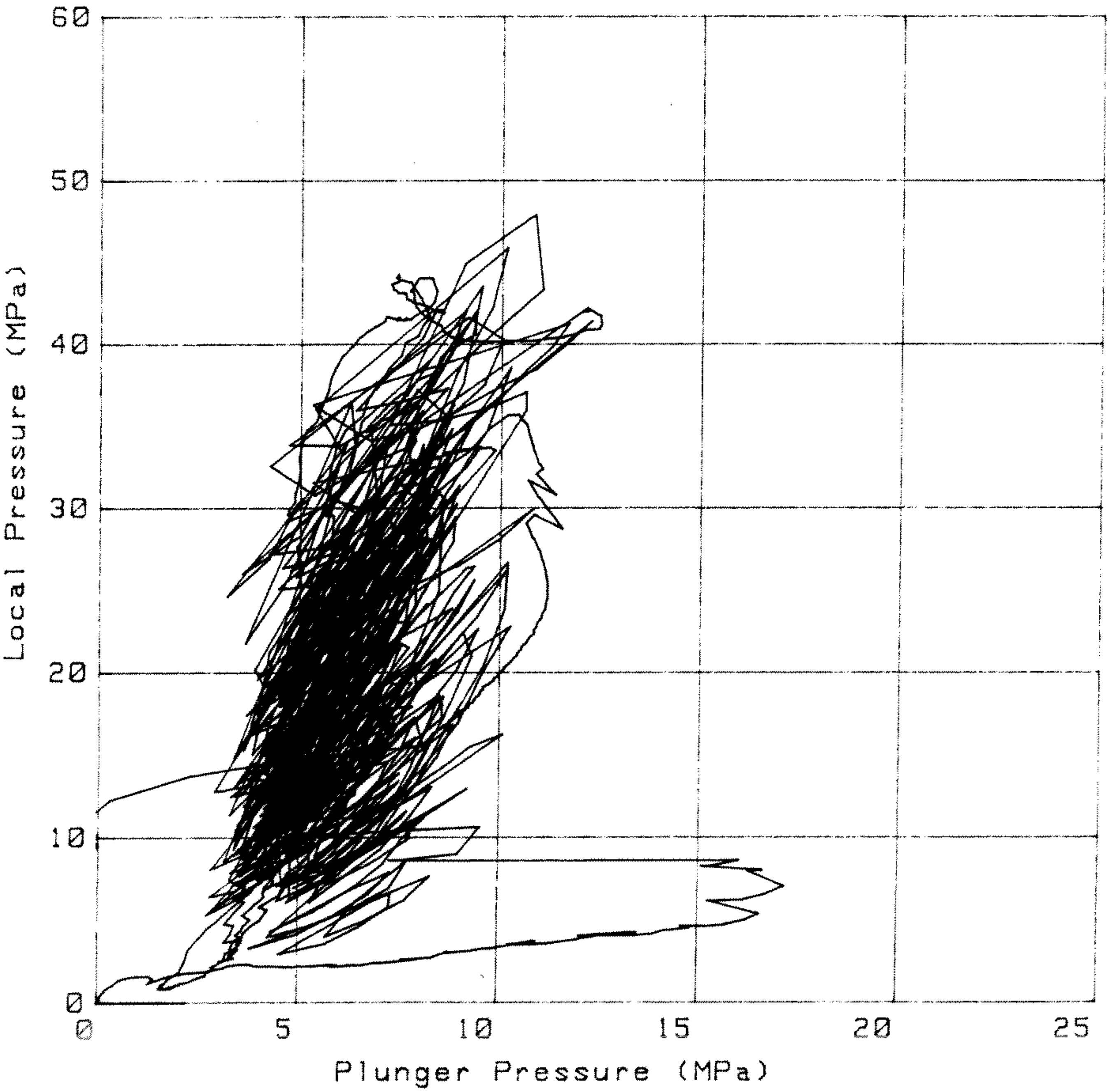
Local Pressure
vs.
Plunger Pressure

Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

Date: 4 Jan 1989
Time: 13:38:13

Temperature: -10.2

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 0
Data To (s): 29.15



Displacement
vs.
TIME

Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

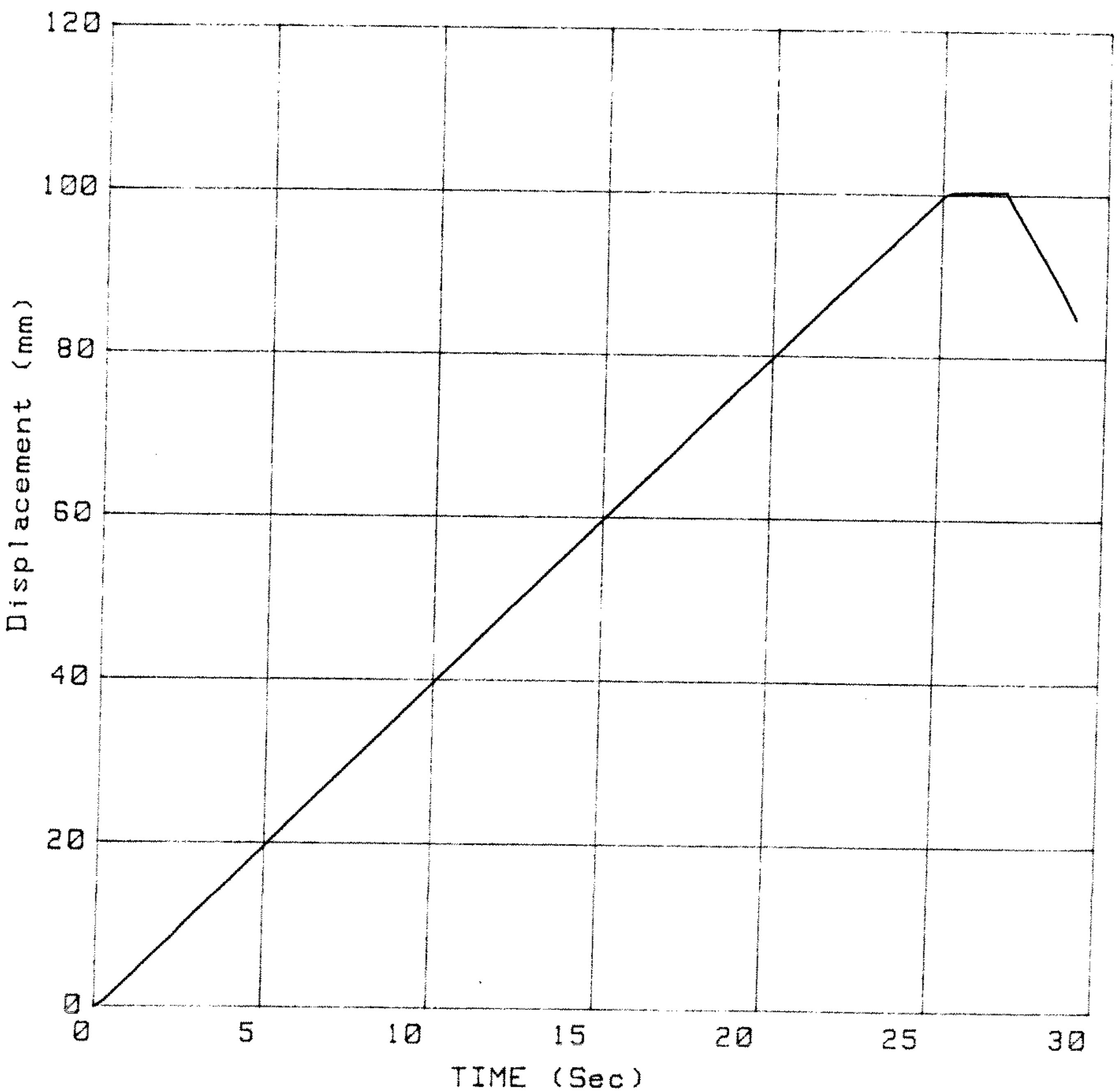
Date: 4 Jan 1989
Time: 13:38:13

Temperature: -10.2

Y Offset Removed

Average = 10

Truncation Time (s) = 29.15



Local Pressure
vs.
TIME

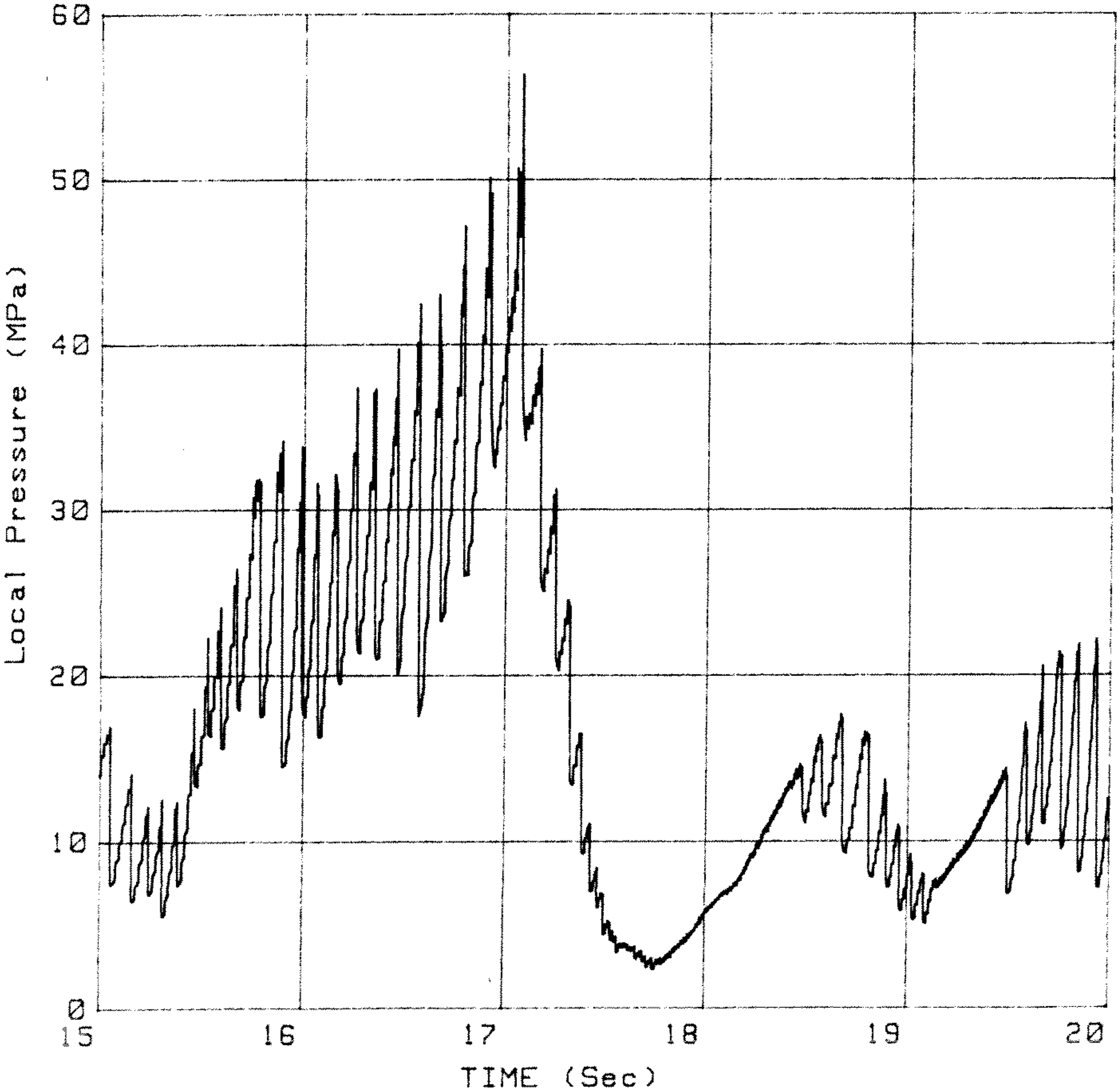
Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

Date: 4 Jan 1989
Time: 13:38:13

Y Offset Removed

Temperature: -10.2

Average = 1
Truncation Time (s) = 29.15



Local Pressure
vs.
TIME

Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

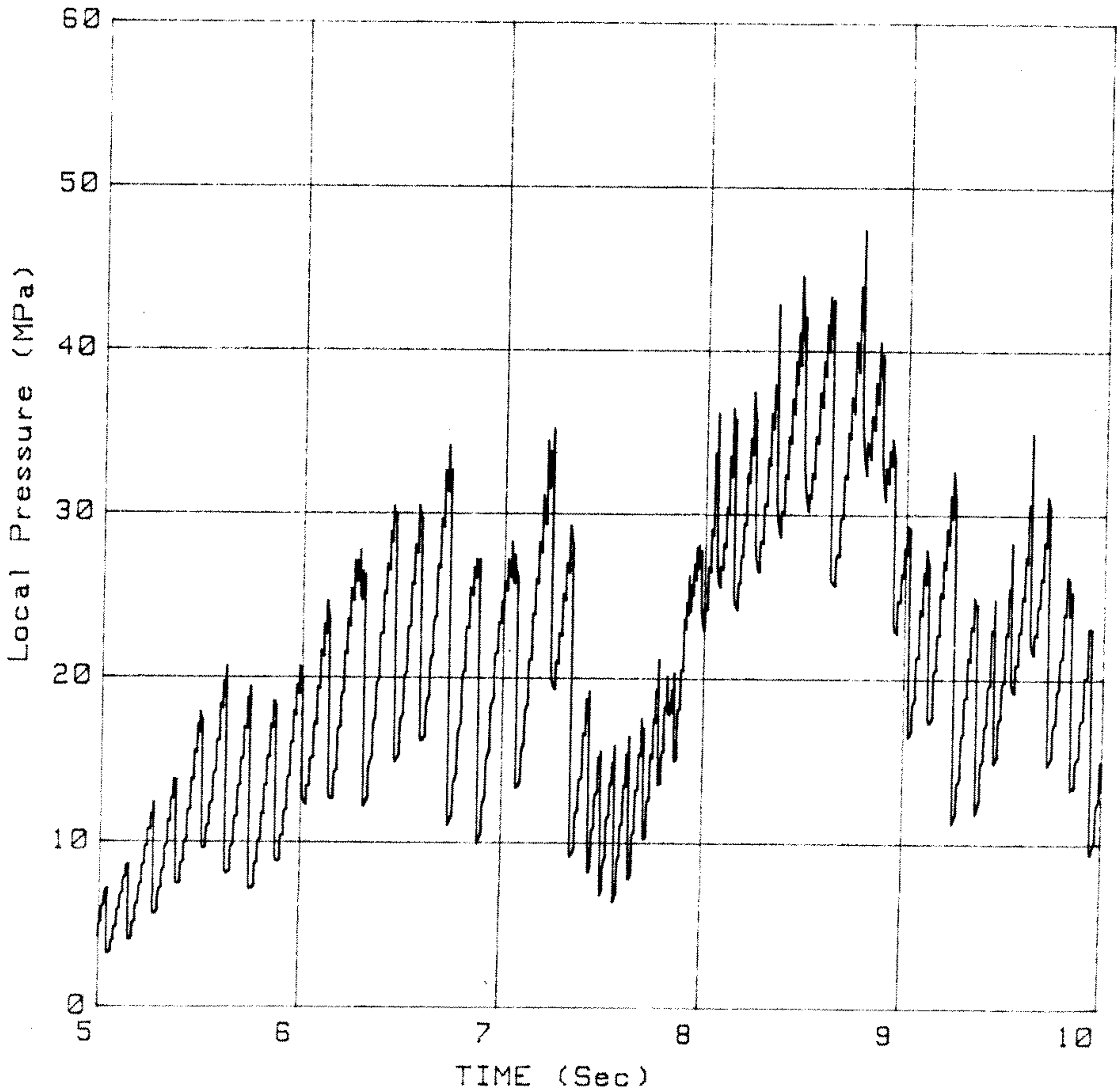
Date: 4 Jan 1989
Time: 13:38:13

Y Offset Removed

Temperature: -10.2

Average = 1

Truncation Time (s) = 29.15



Local Pressure
vs.
TIME

Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

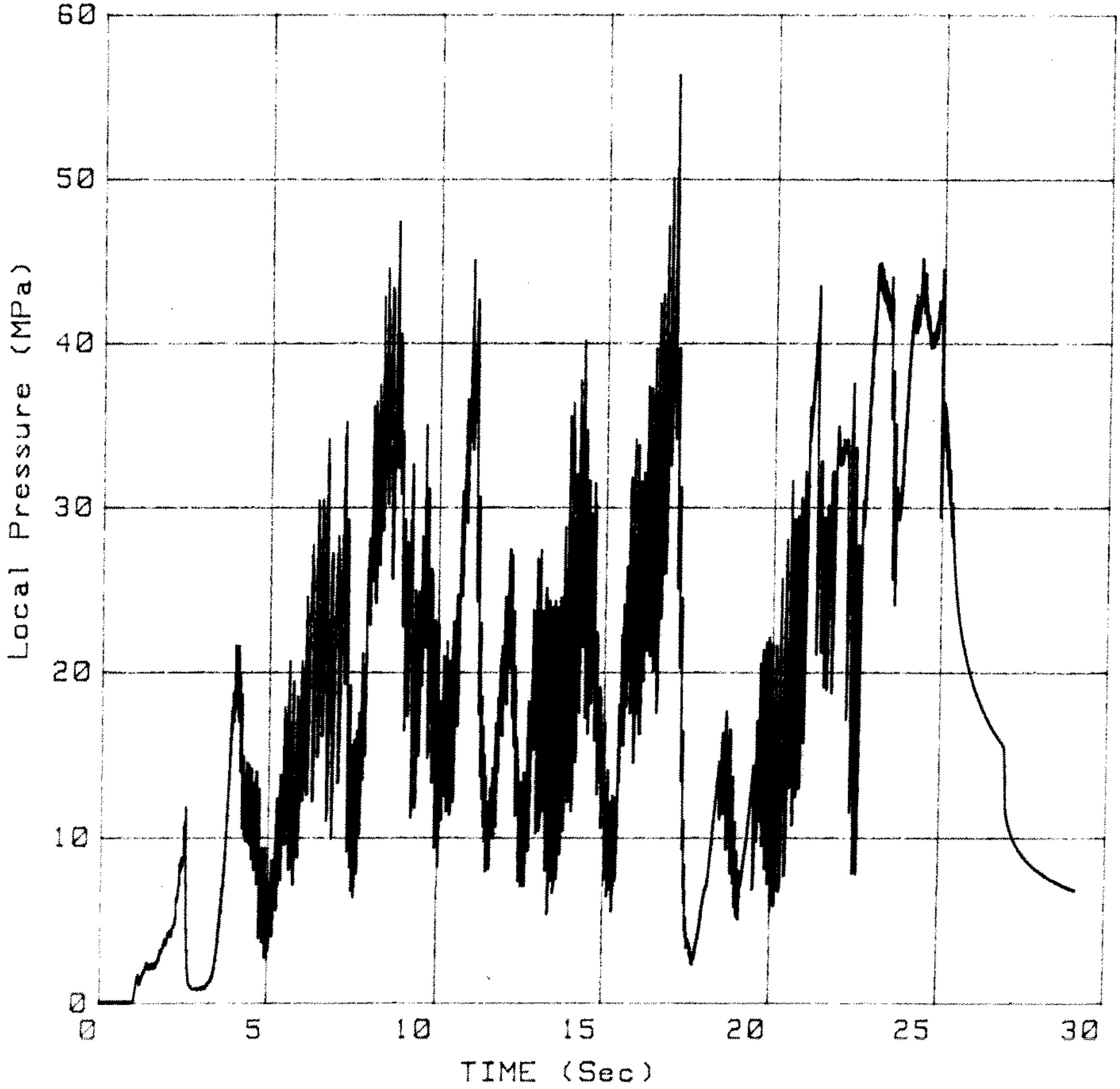
Date: 4 Jan 1989
Time: 13:38:13

Temperature: -10.2

Y Offset Removed

Average = 1

Truncation Time (s) = 29.15



Plunger Pressure
vs.
TIME

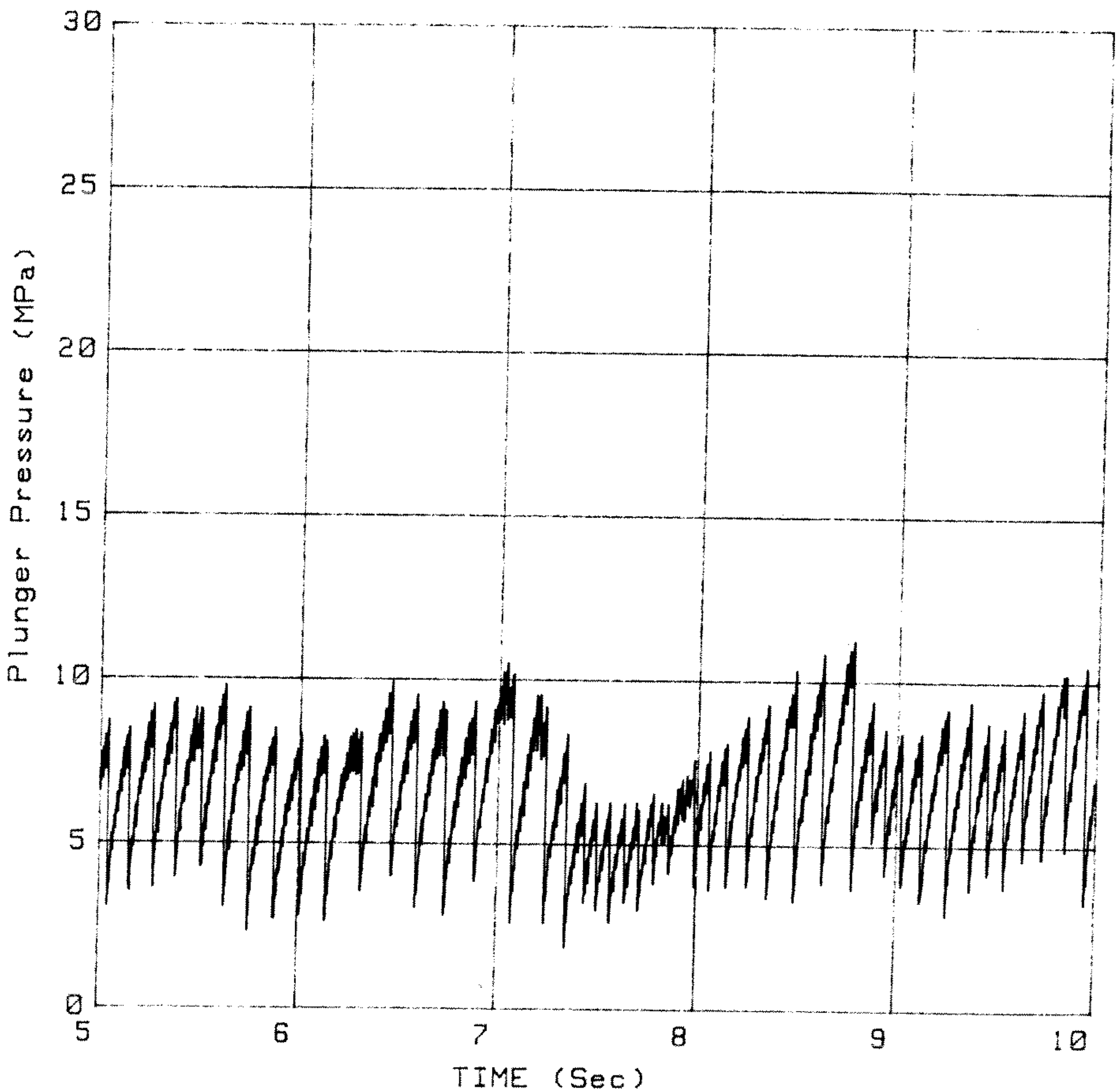
Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

Date: 4 Jan 1989
Time: 13:38:13

Y Offset Removed

Temperature: -10.2

Average = 1
Truncation Time (s) = 29.15



Plunger Pressure
vs.
TIME

Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

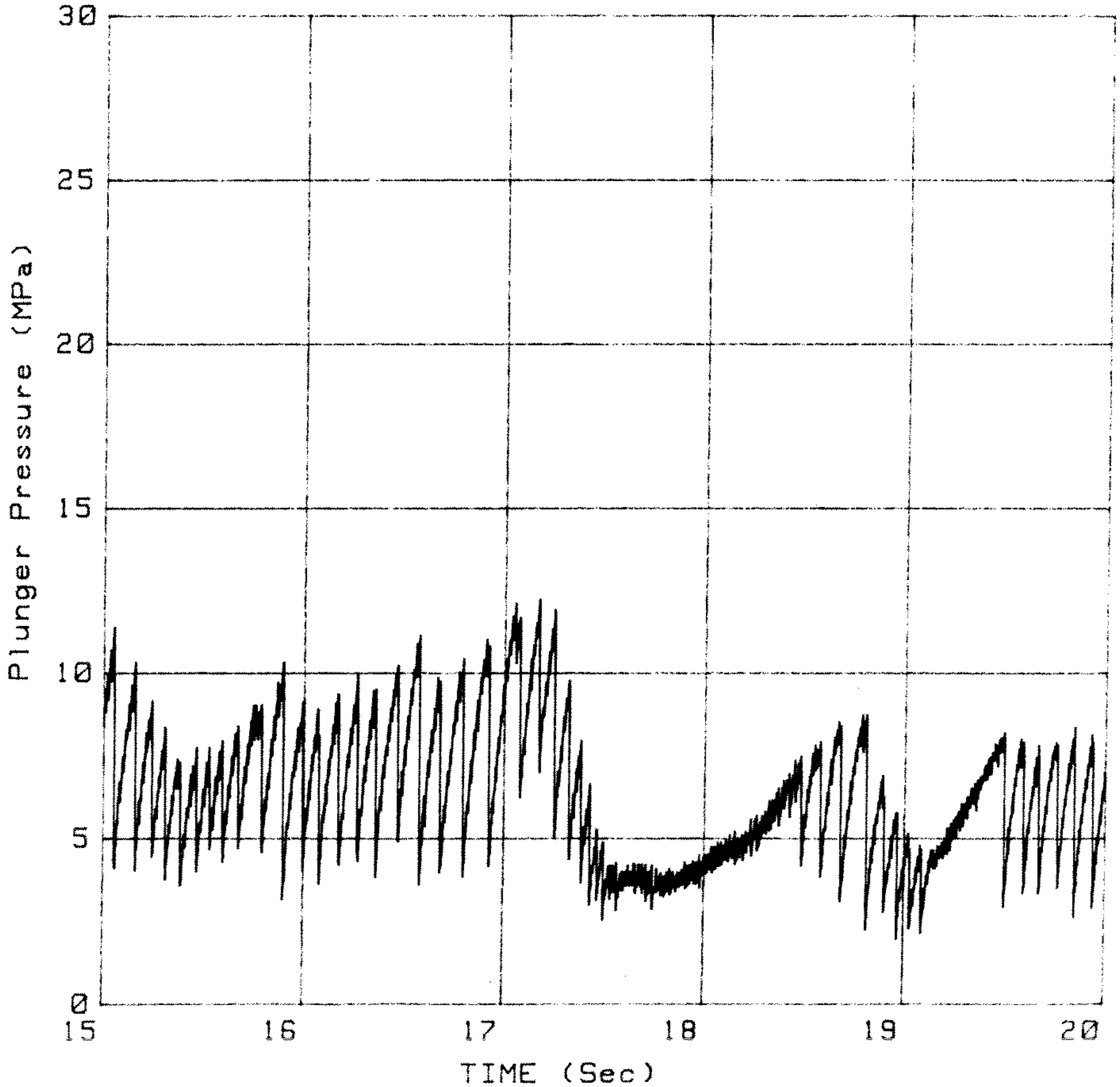
Date: 4 Jan 1989
Time: 13:38:13

Y Offset Removed

Temperature: -10.2

Average = 1

Truncation Time (s) = 29.15



Plunger Pressure
vs.
TIME

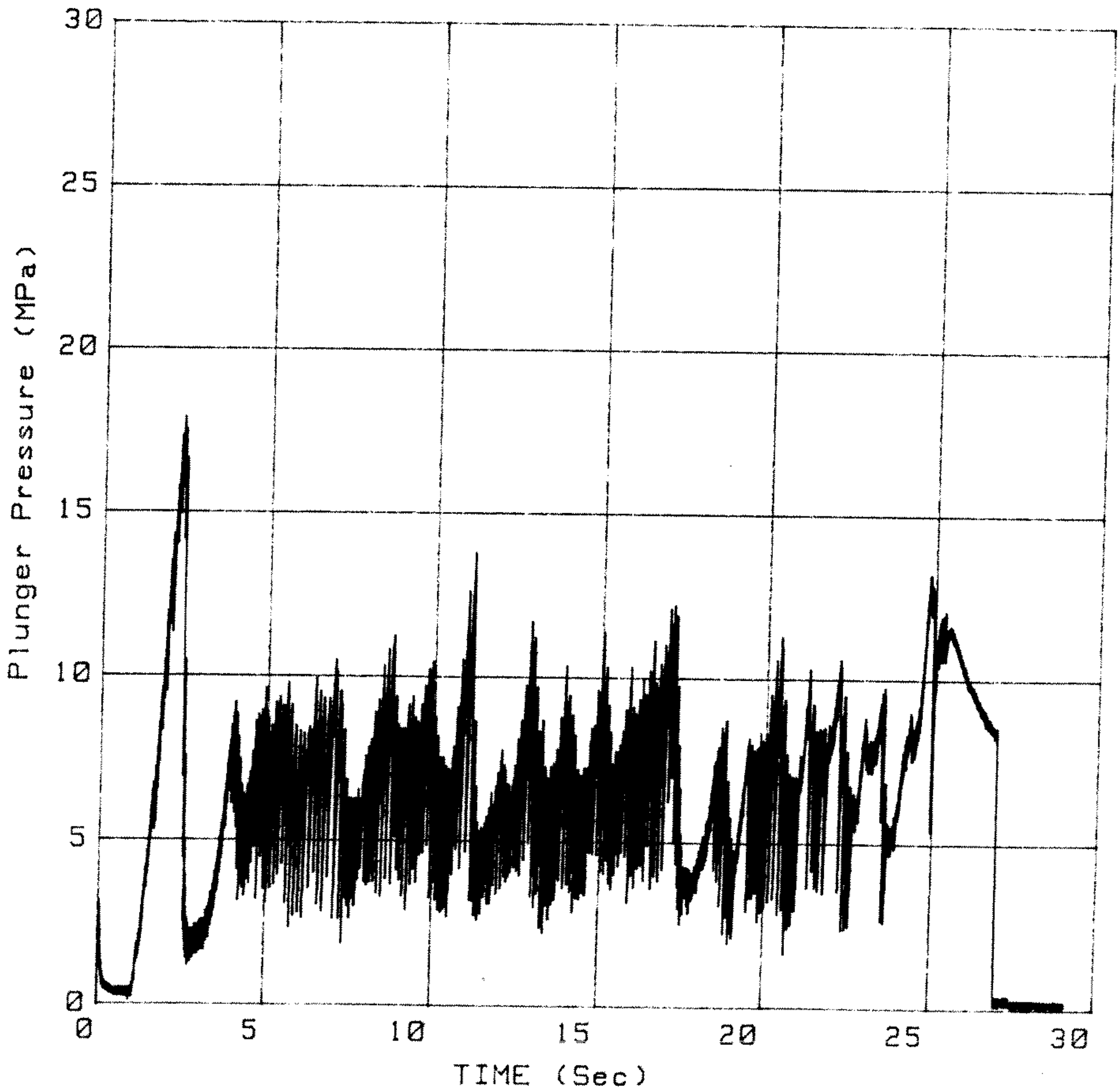
Test: Y002
Type: Crush extrusion test
Sample: SOLID ICE

Date: 4 Jan 1989
Time: 13:38:13

Y Offset Removed

Temperature: -10.2

Average = 1
Truncation Time (s) = 29.15

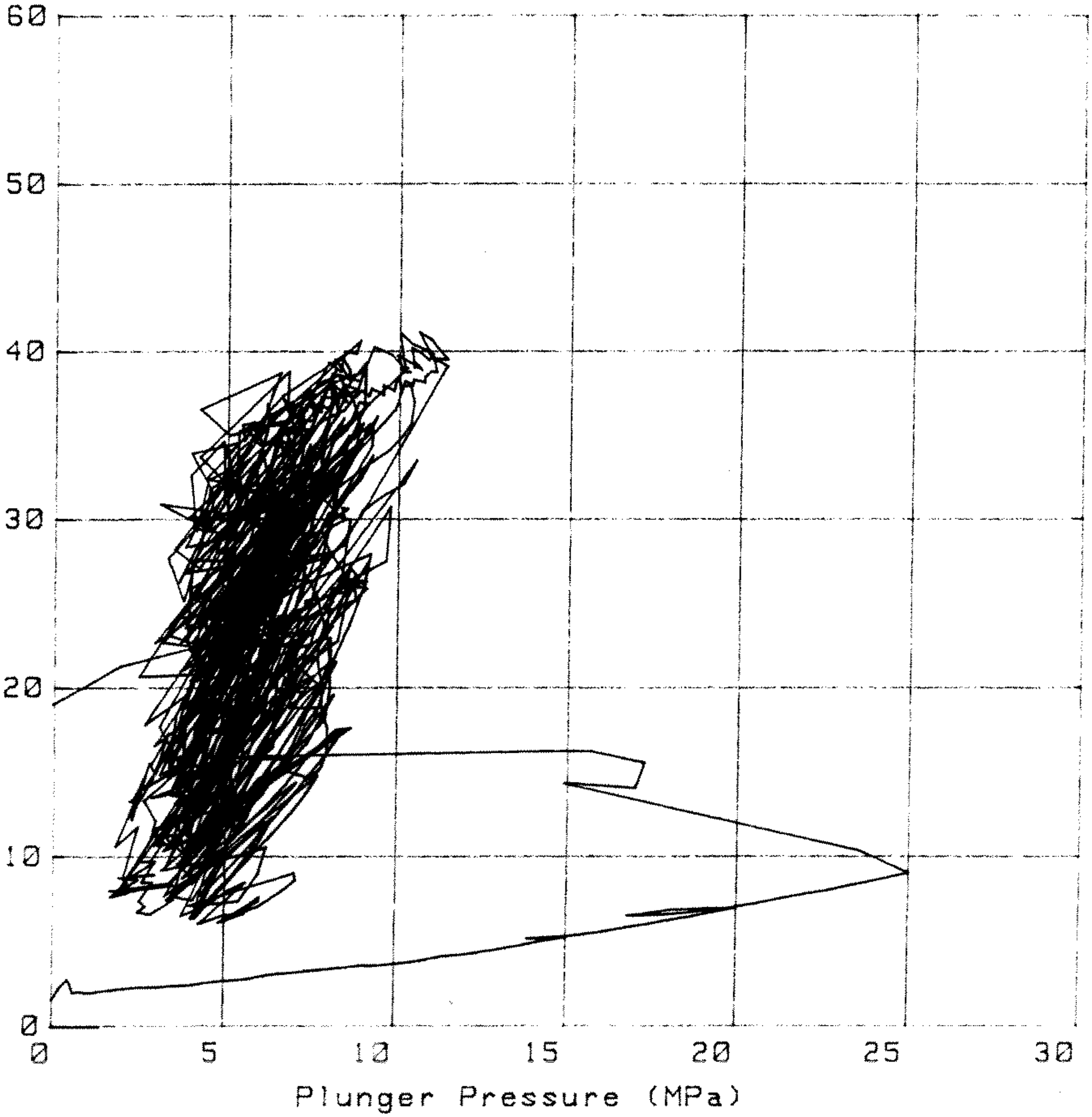


Local Pressure
vs.
Plunger Pressure

Test: Y003
Date: 5 Jan 1989
Type: Crush extrusion test
Time: 14:51:20
Sample: SOLID ICE

Temperature: -10

Y Offset Removed
X Offset Removed
Average = 10
Data From (s): 0
Data To (s): 60.009979248



Displacement
vs.
TIME

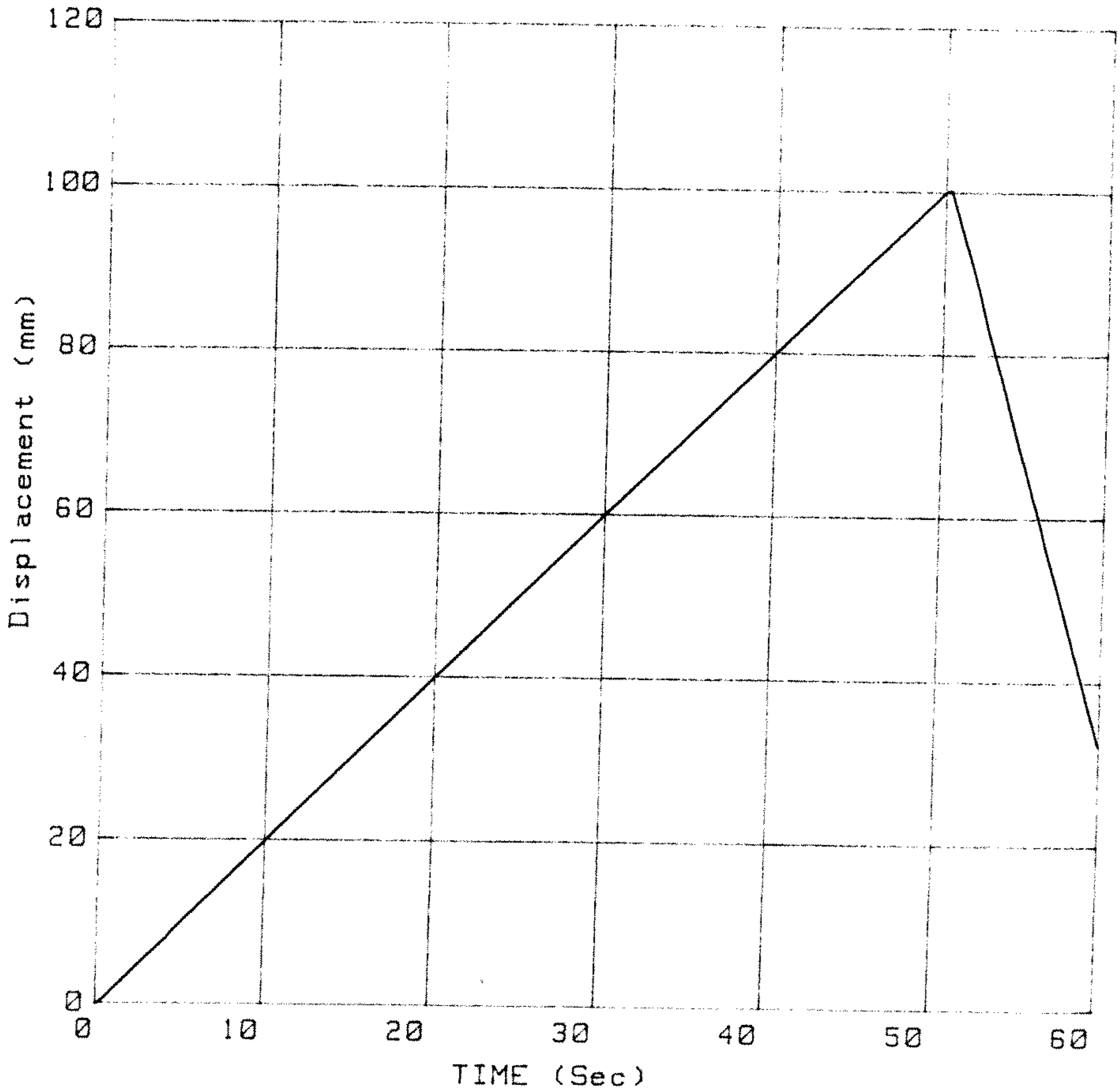
Test: Y003
Type: Crush extrusion test
Sample: SOLID ICE

Date: 5 Jan 1989
Time: 14:51:20

Temperature: -10

Y Offset Removed

Average = 10
Truncation Time (s) = 60.01



Local Pressure
vs.
TIME

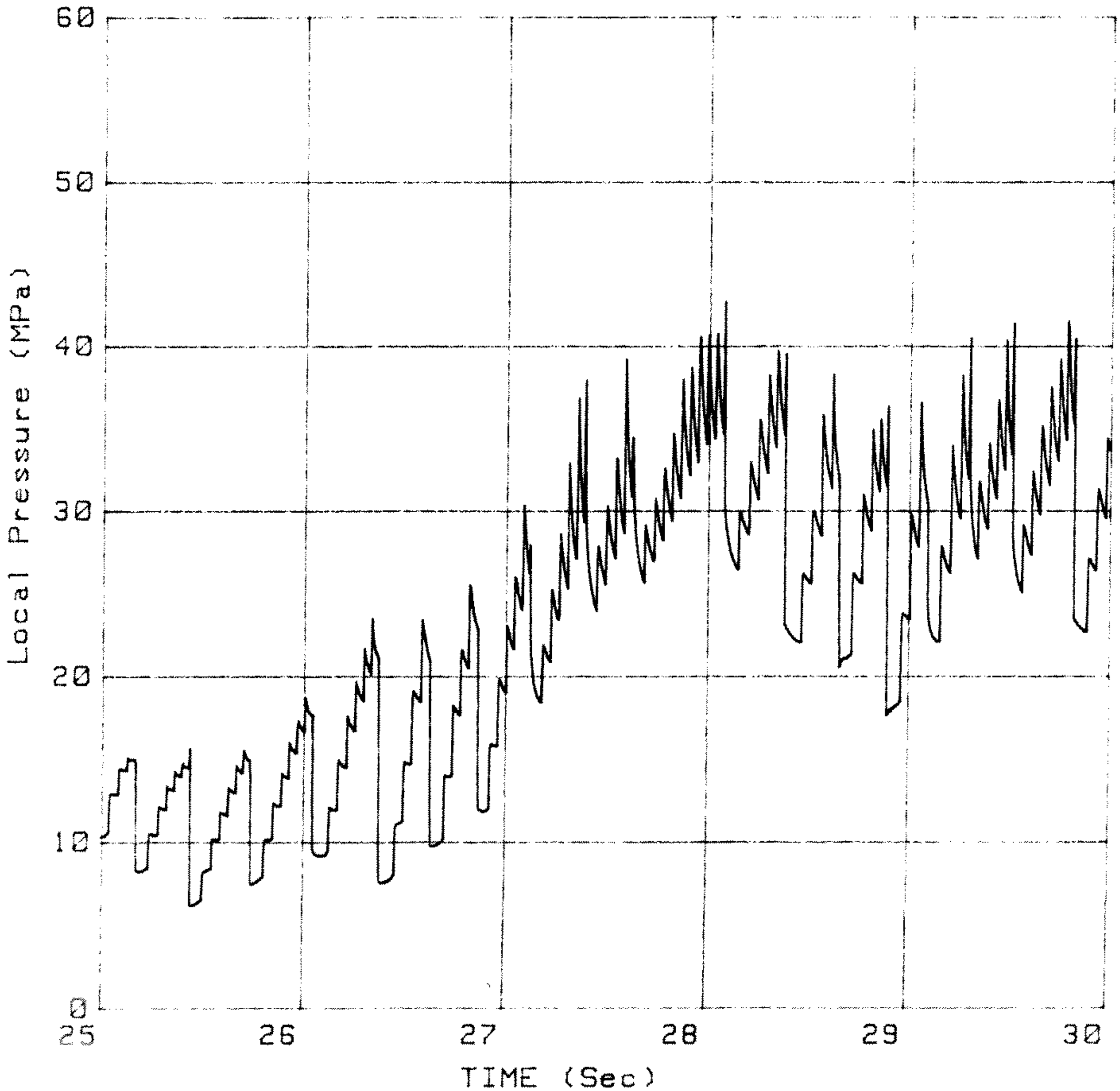
Test: Y003
Type: Crush extrusion test
Sample: SOLID ICE

Date: 5 Jan 1989
Time: 14:51:20

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 60.01



Local Pressure
vs.
TIME

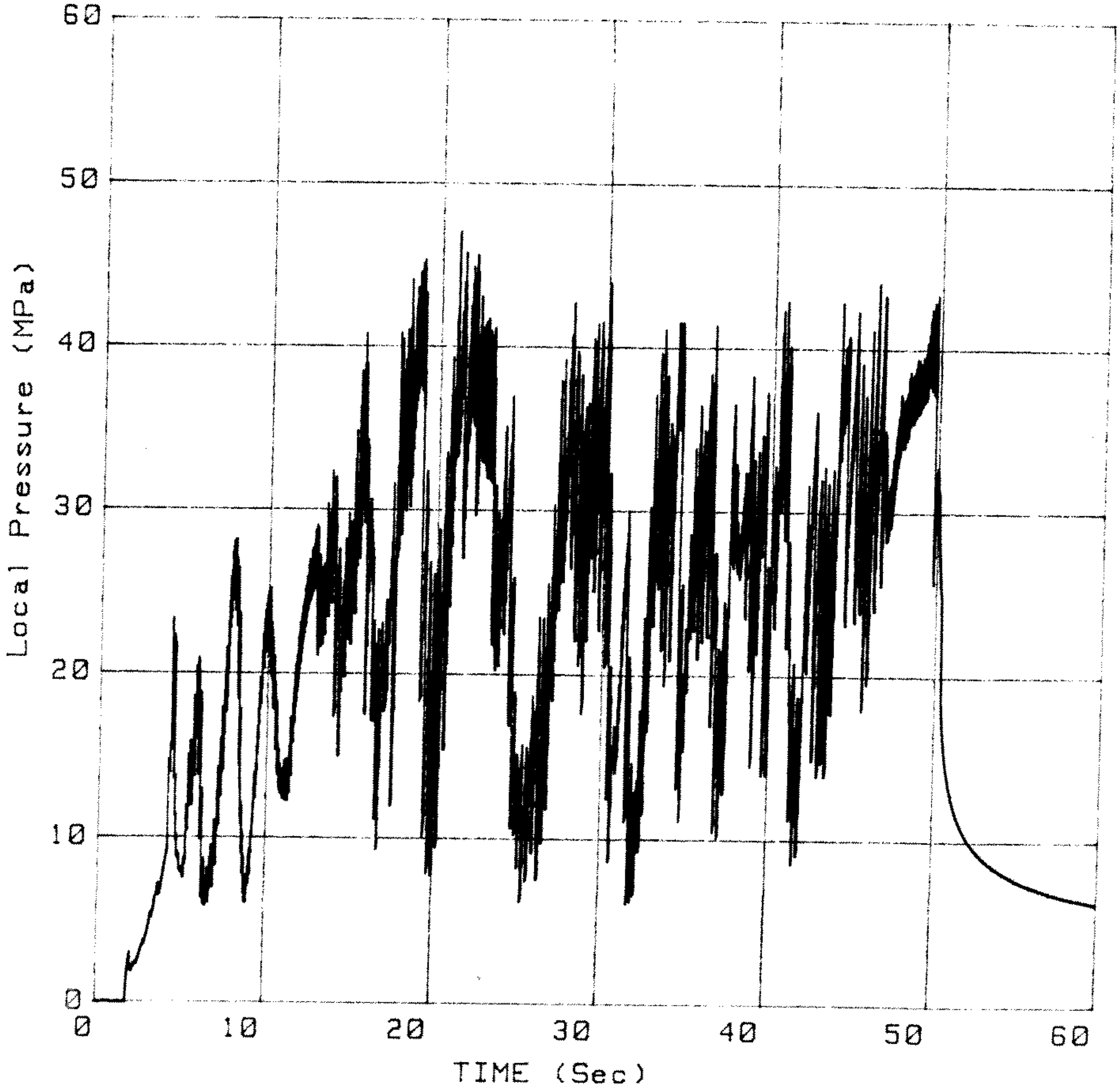
Test: Y003
Type: Crush extrusion test
Sample: SOLID ICE

Date: 5 Jan 1989
Time: 14:51:20

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 60.01



Plunger Pressure
vs.
TIME

Test: Y003
Type: Crush extrusion test
Sample: SOLID ICE

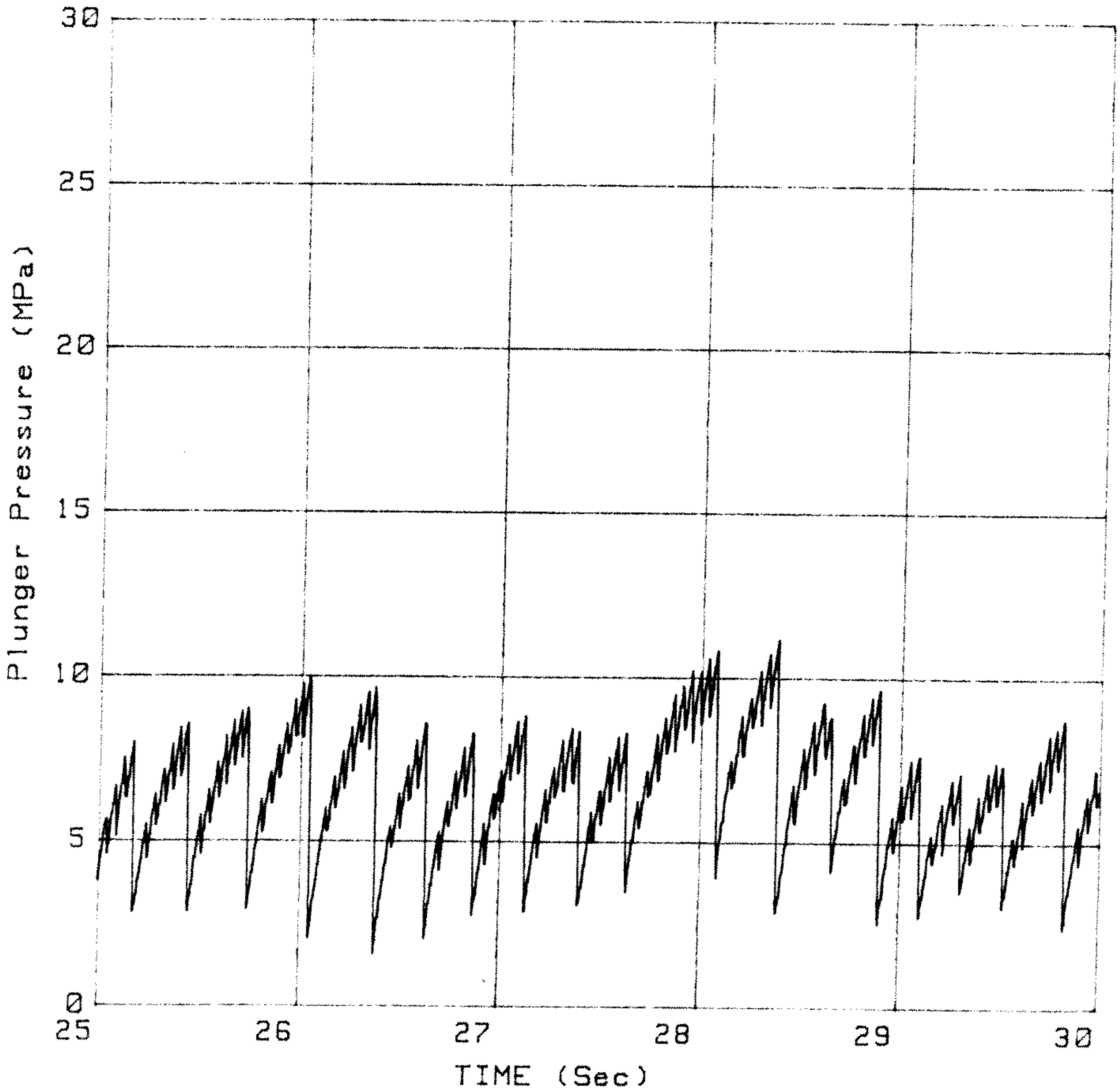
Date: 5 Jan 1989
Time: 14:51:20

Y Offset Removed

Temperature: -10

Average = 1

Truncation Time (s) = 60.01



Plunger Pressure
vs.
TIME

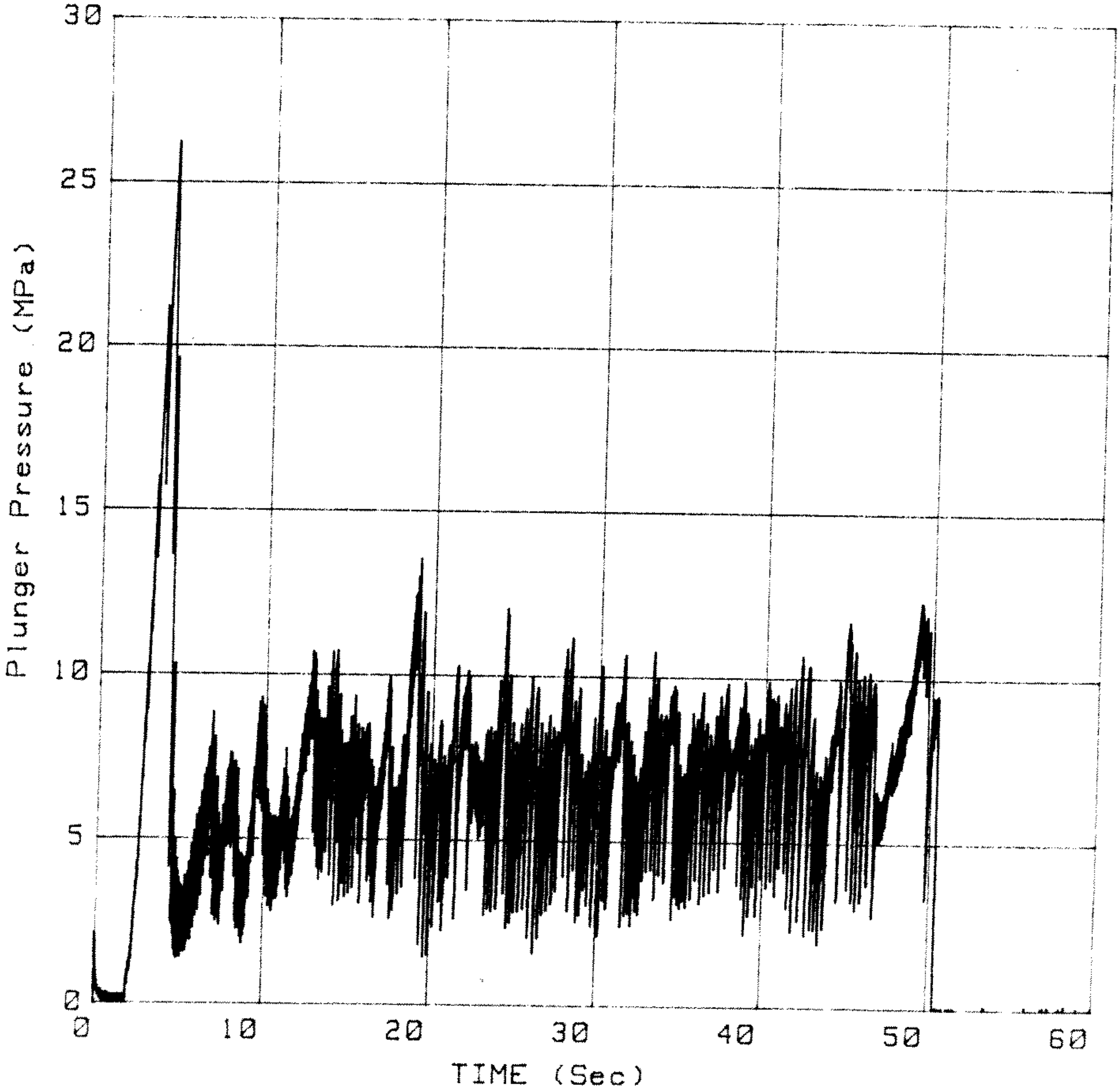
Test: Y003
Type: Crush extrusion test
Sample: SOLID ICE

Date: 5 Jan 1989
Time: 14:51:20

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 60.01



Displacement vs. TIME

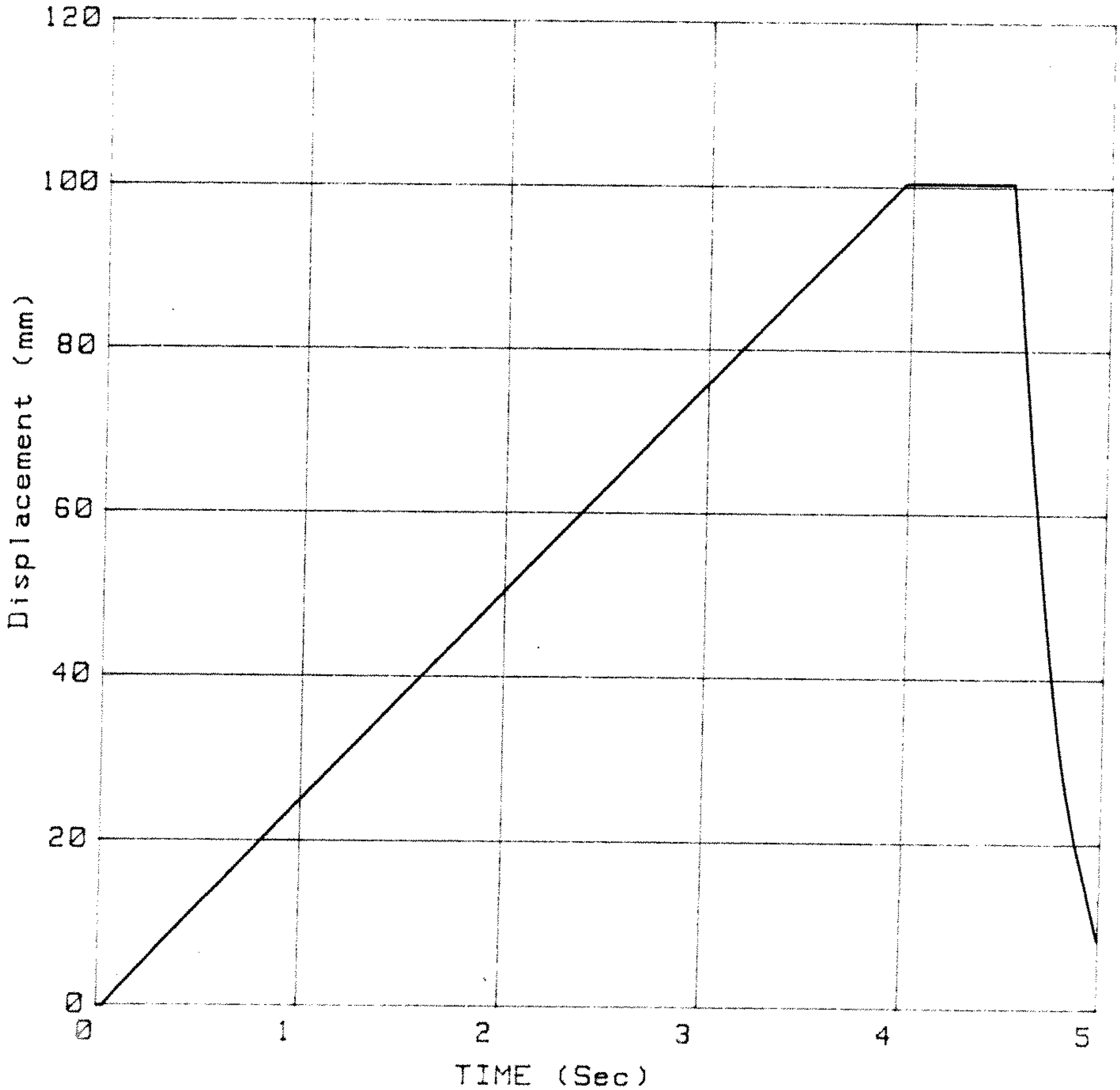
Test: Y005
Type: Crush extrusion test
Sample: SOLID ICE

Date: 9 Jan 1989
Time: 11:43:24

Y Offset Removed

Temperature: -10

Average = 10
Truncation Time (s) = 5.11



Local Pressure
vs.
TIME

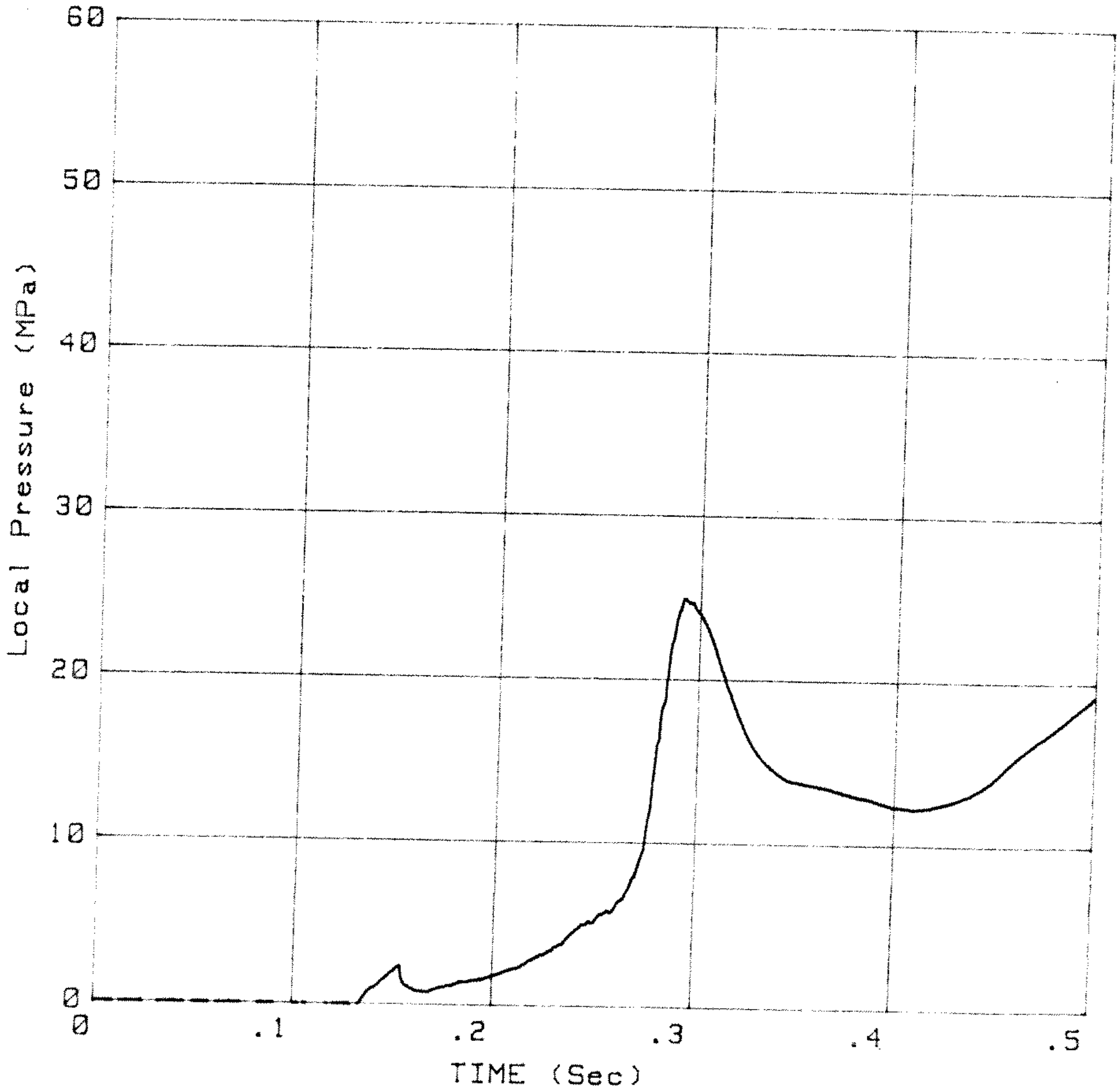
Test: Y005
Type: Crush extrusion test
Sample: SOLID ICE

Date: 9 Jan 1989
Time: 11:43:24

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.11



Local Pressure
vs.
TIME

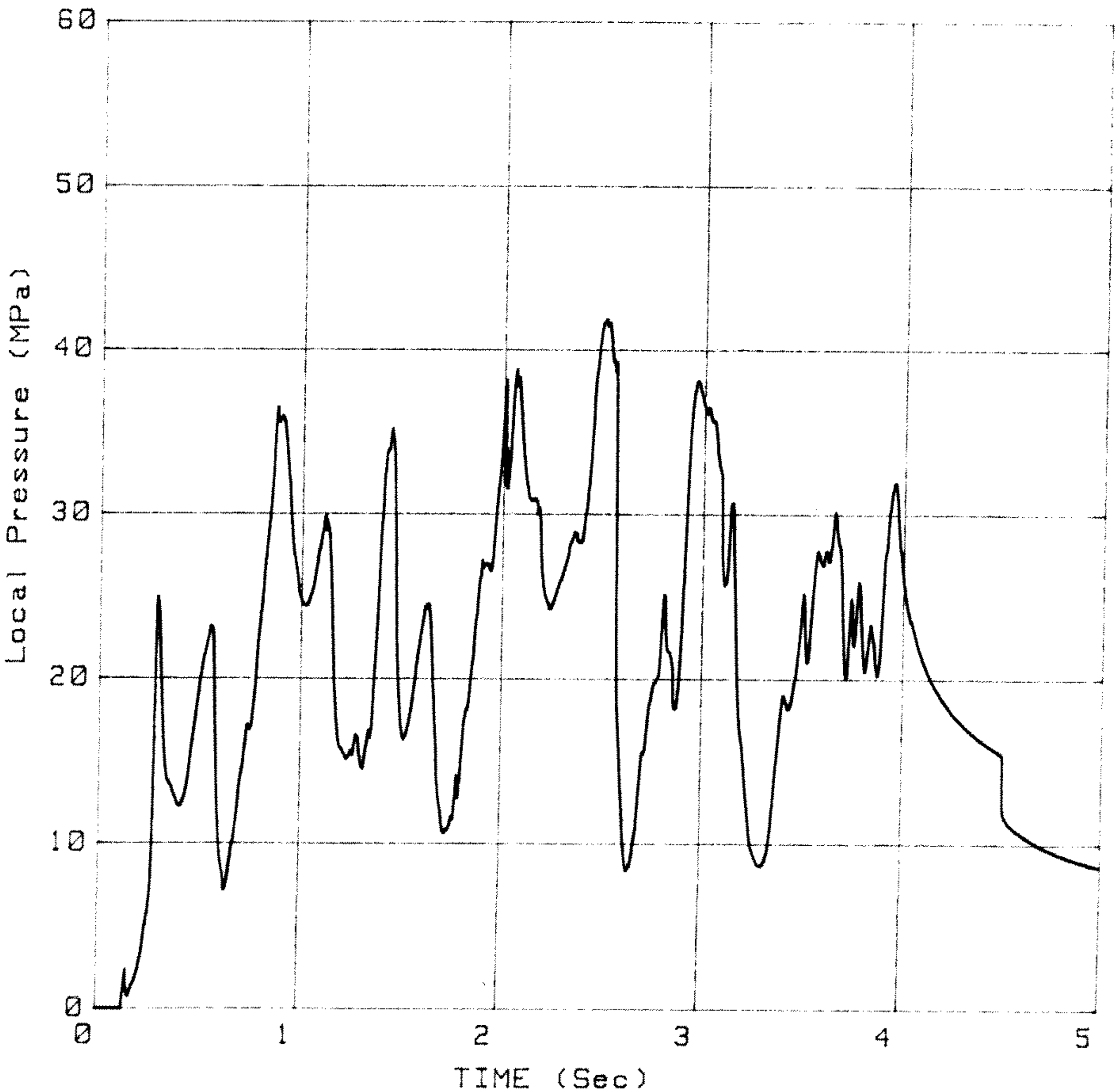
Test: Y005
Type: Crush extrusion test
Sample: SOLID ICE

Date: 9 Jan 1989
Time: 11:43:24

Y Offset Removed

Temperature: -10

Average = 1
Truncation Time (s) = 5.11



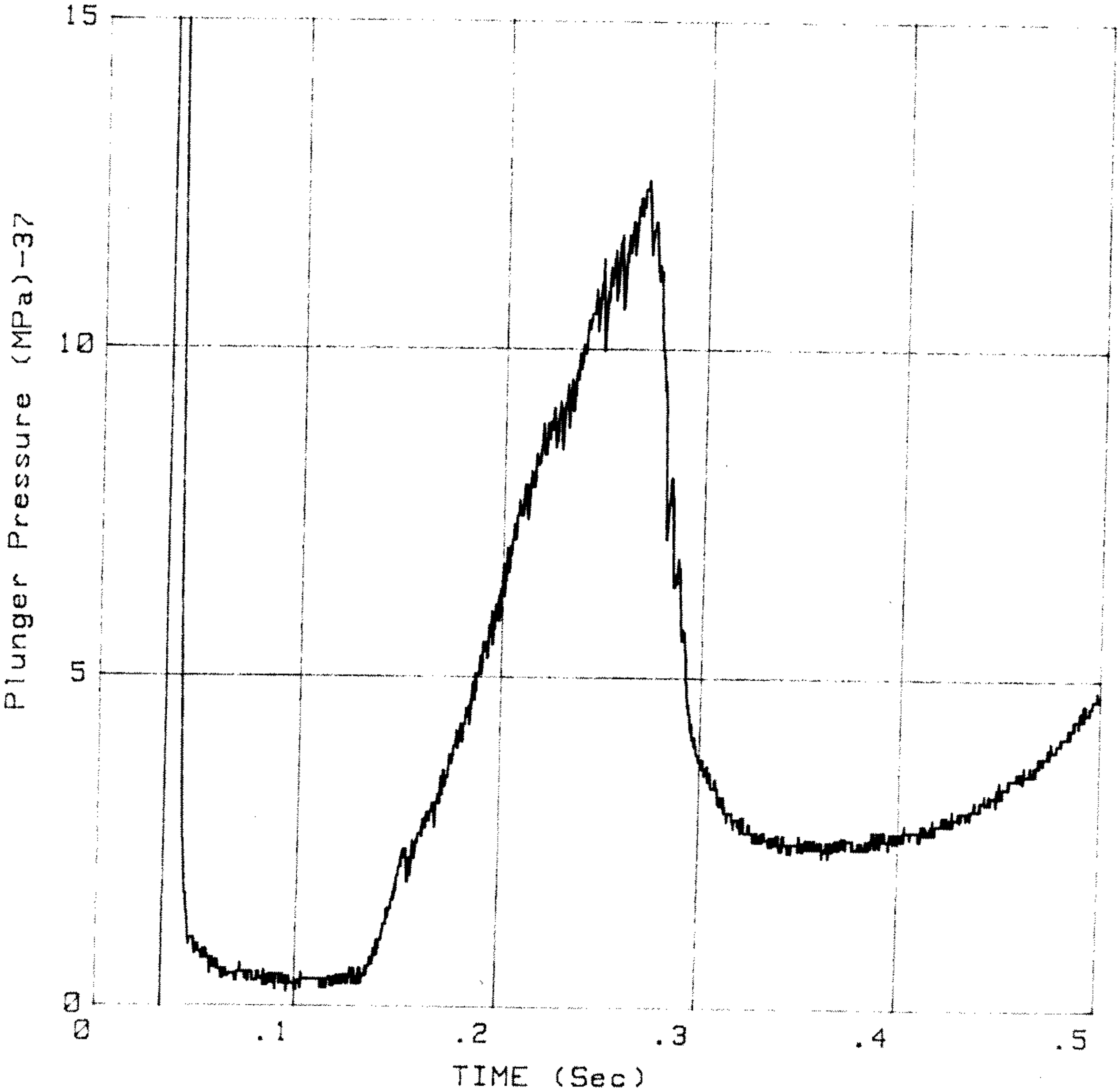
Plunger Pressure-37
vs.
TIME

Test: Y005
Type: Crush extrusion test
Sample: SOLID ICE

Date: 9 Jan 1989
Time: 11:43:24

Temperature: -10

Average = 1
Truncation Time (s) = 5.11



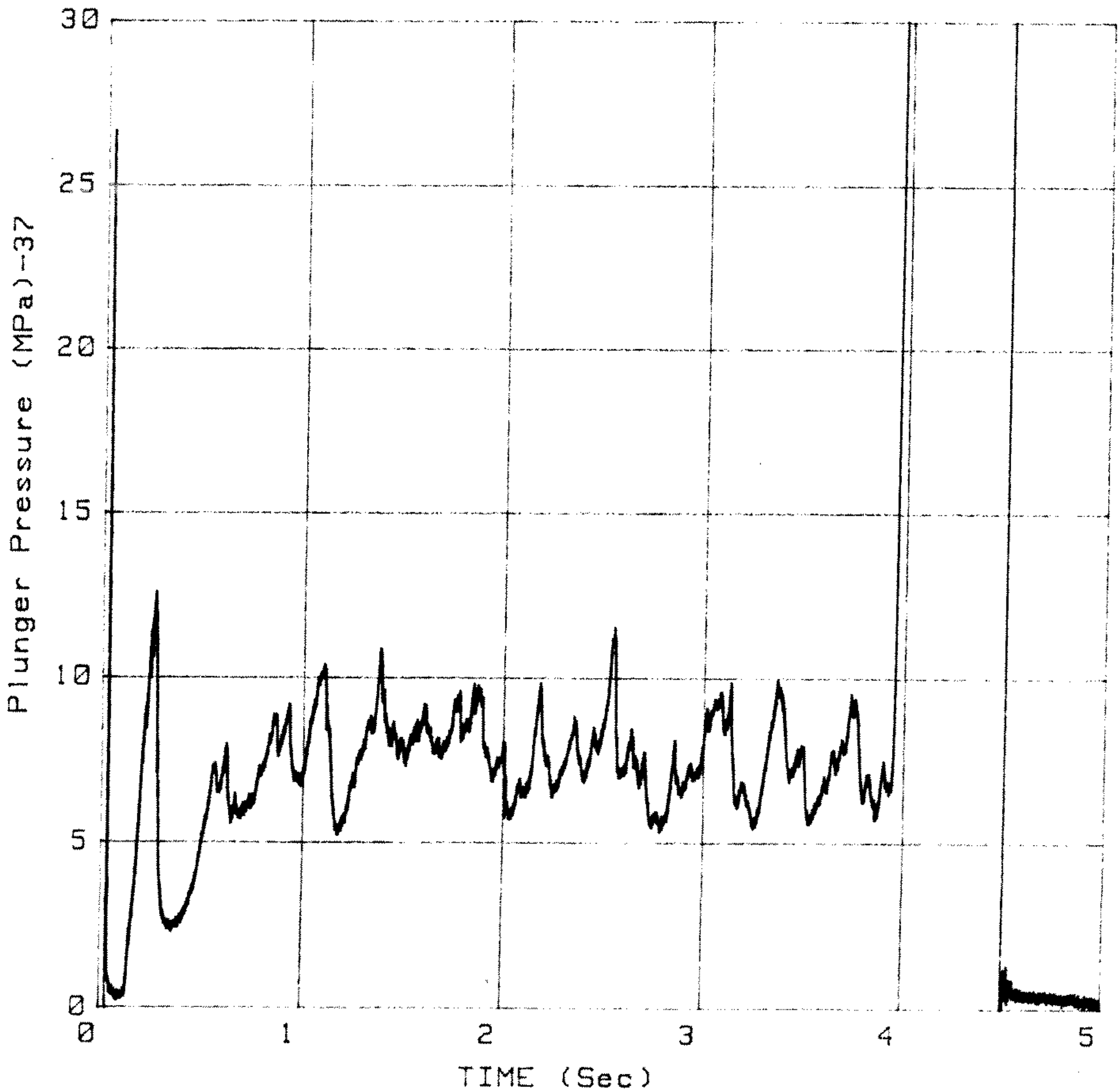
Plunger Pressure-37
vs.
TIME

Test: Y005
Type: Crush extrusion test
Sample: SOLID ICE

Date: 9 Jan 1989
Time: 11:43:24

Temperature: -10

Average = 1
Truncation Time (s) = 5.11



Displacement vs. TIME

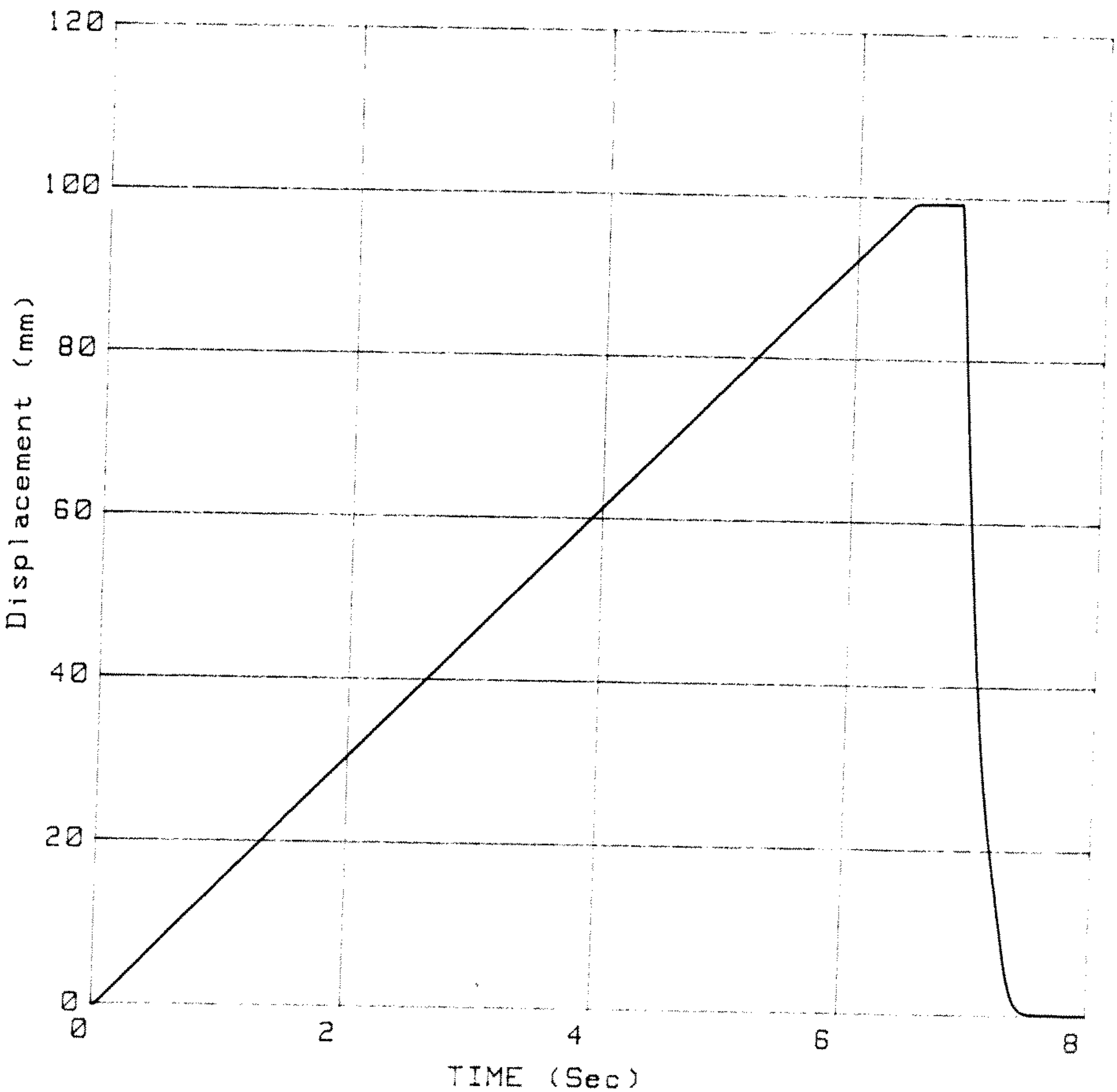
Test: Y006
Type: Crush extrusion test
Sample: SOLID ICE

Date: 11 Jan 1989
Time: 14:22:07

Y Offset Removed

Temperature: -10.3

Average = 10
Truncation Time (s) = 7.98



Local Pressure
vs.
TIME

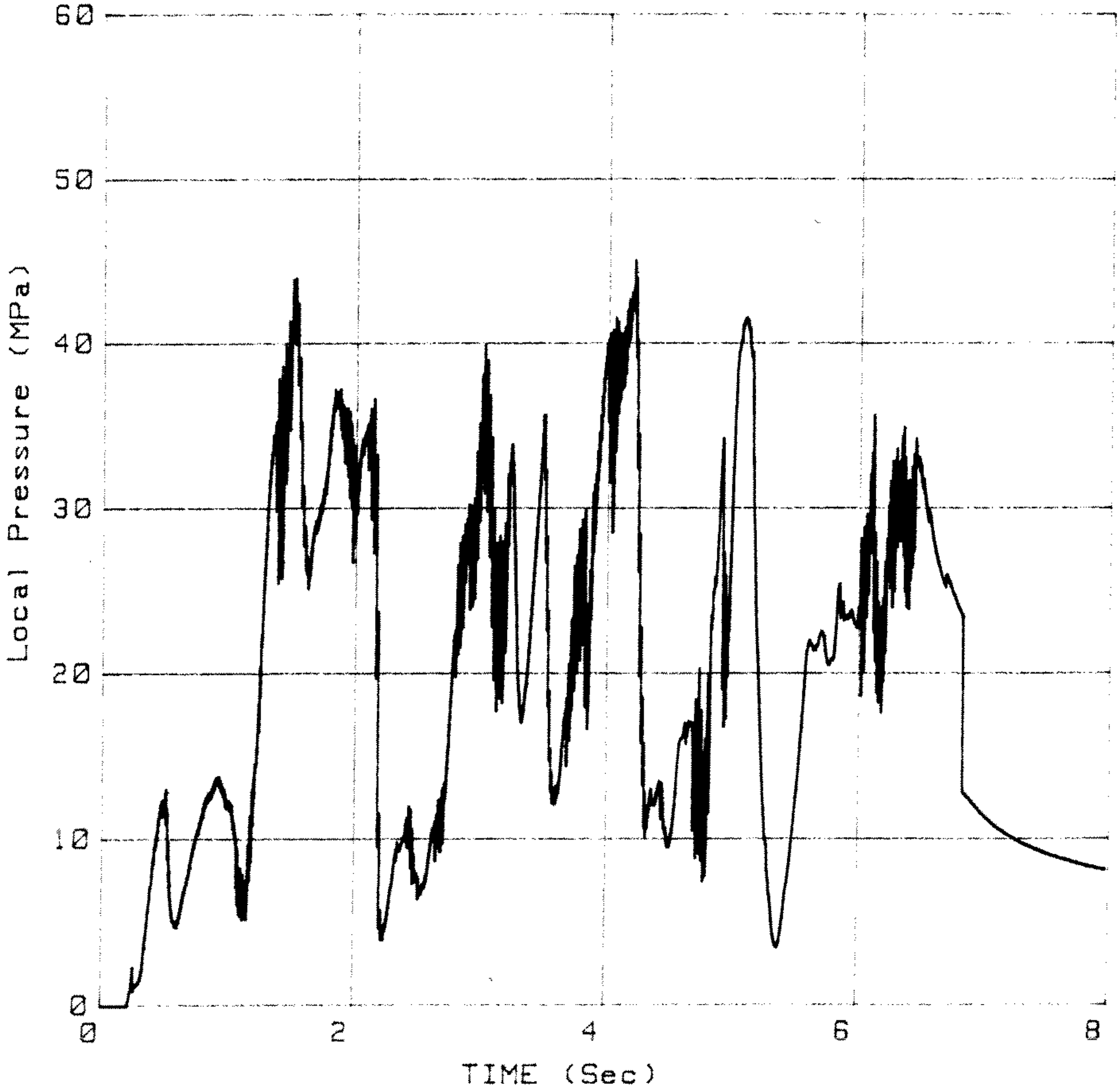
Test: Y006
Type: Crush extrusion test
Sample: SOLID ICE

Date: 11 Jan 1989
Time: 14:22:07

Y Offset Removed

Temperature: -10.3

Average = 1
Truncation Time (s) = 7.98



Local Pressure
vs.
TIME

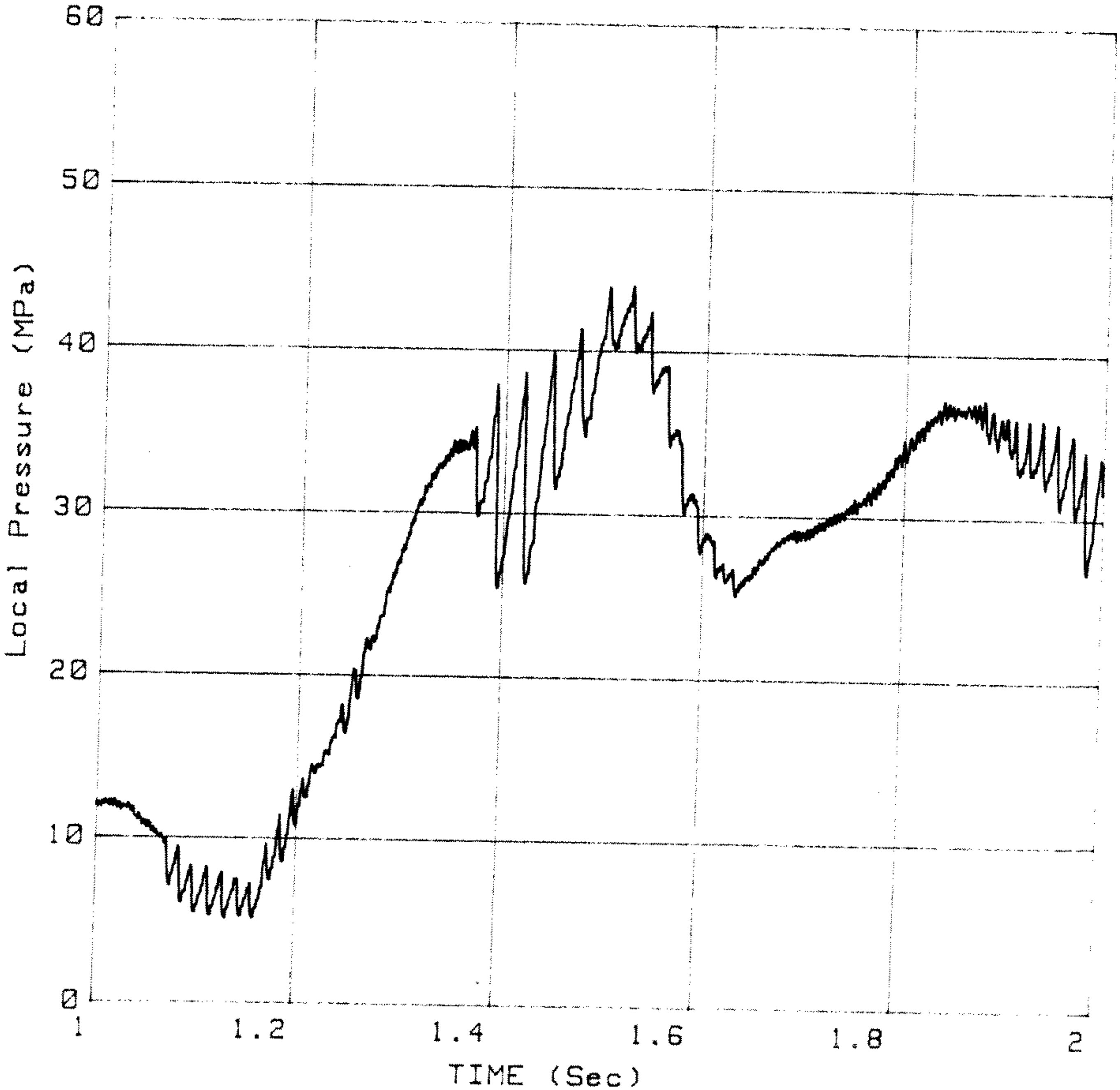
Test: Y006
Type: Crush extrusion test
Sample: SOLID ICE

Date: 11 Jan 1989
Time: 14:22:07

Y Offset Removed

Temperature: -10.3

Average = 1
Truncation Time (s) = 7.98



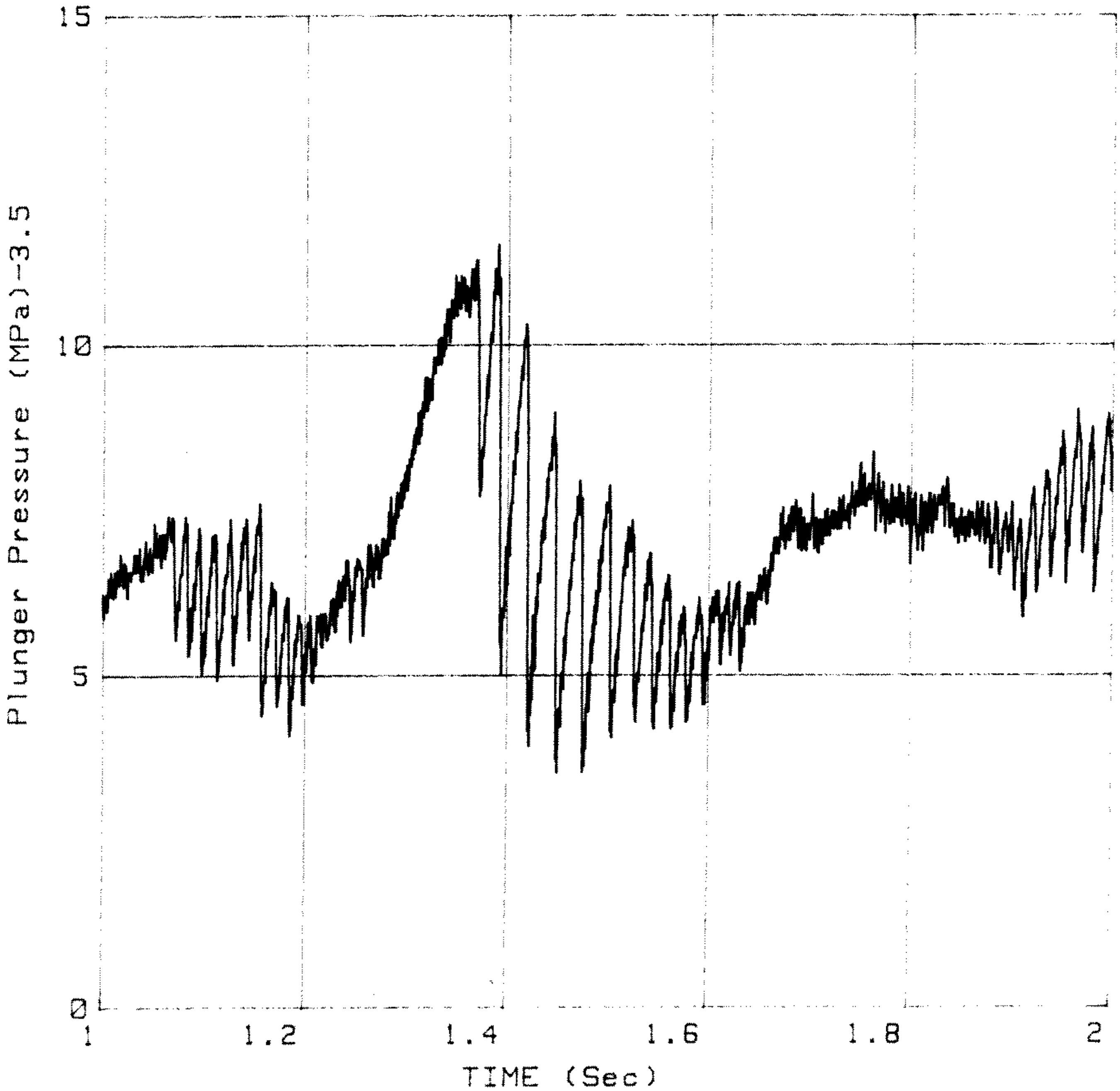
Plunger Pressure-3.5
vs.
TIME

Test: Y006
Type: Crush extrusion test
Sample: SOLID ICE

Date: 11 Jan 1989
Time: 14:22:07

Temperature: -10.3

Average = 1
Truncation Time (s) = 7.98



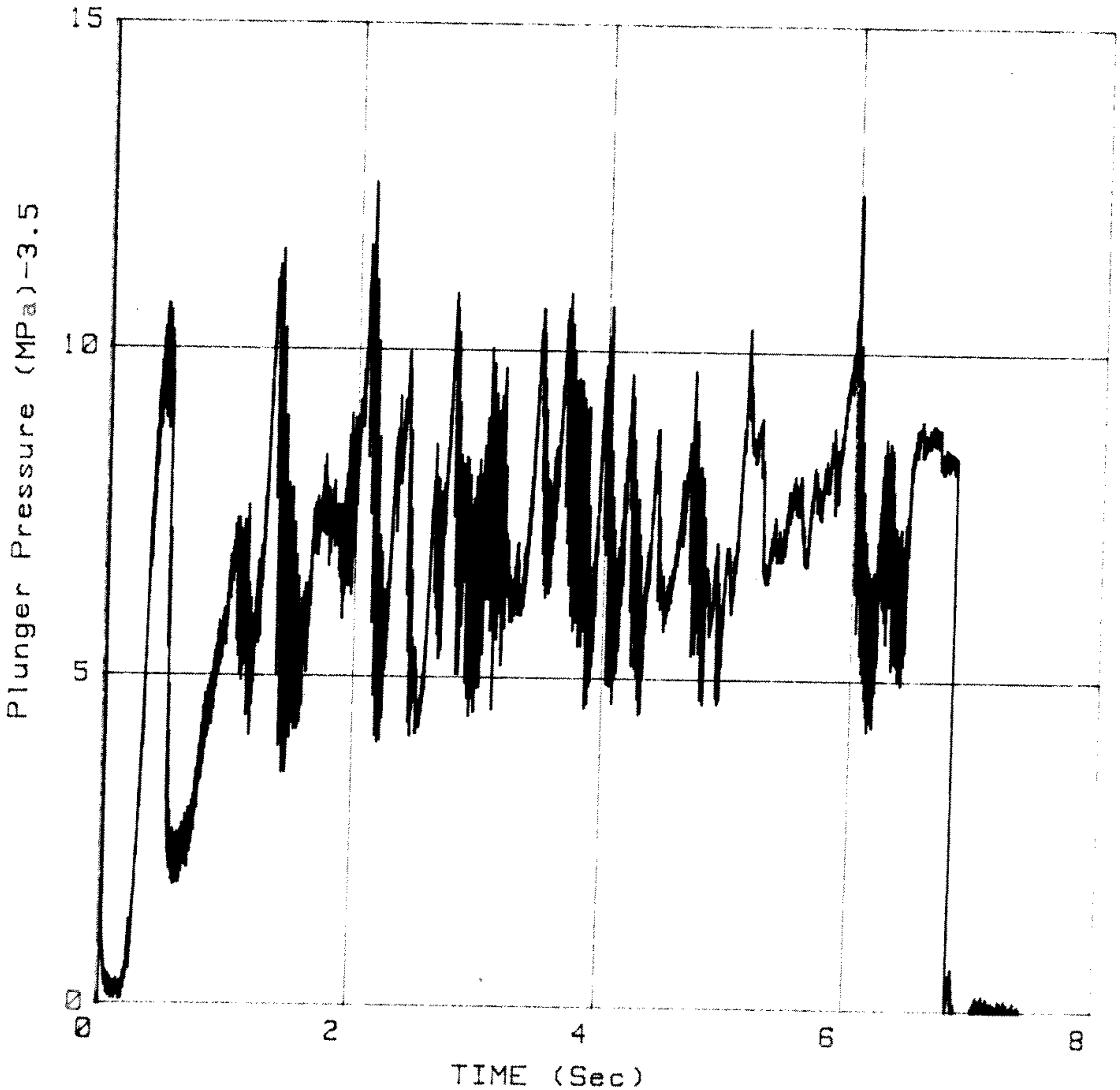
Plunger Pressure-3.5
vs.
TIME

Test: Y006
Type: Crush extrusion test
Sample: SOLID ICE

Date: 11 Jan 1989
Time: 14:22:07

Temperature: -10.3

Average = 1
Truncation Time (s) = 7.98



Displacement
vs.
TIME

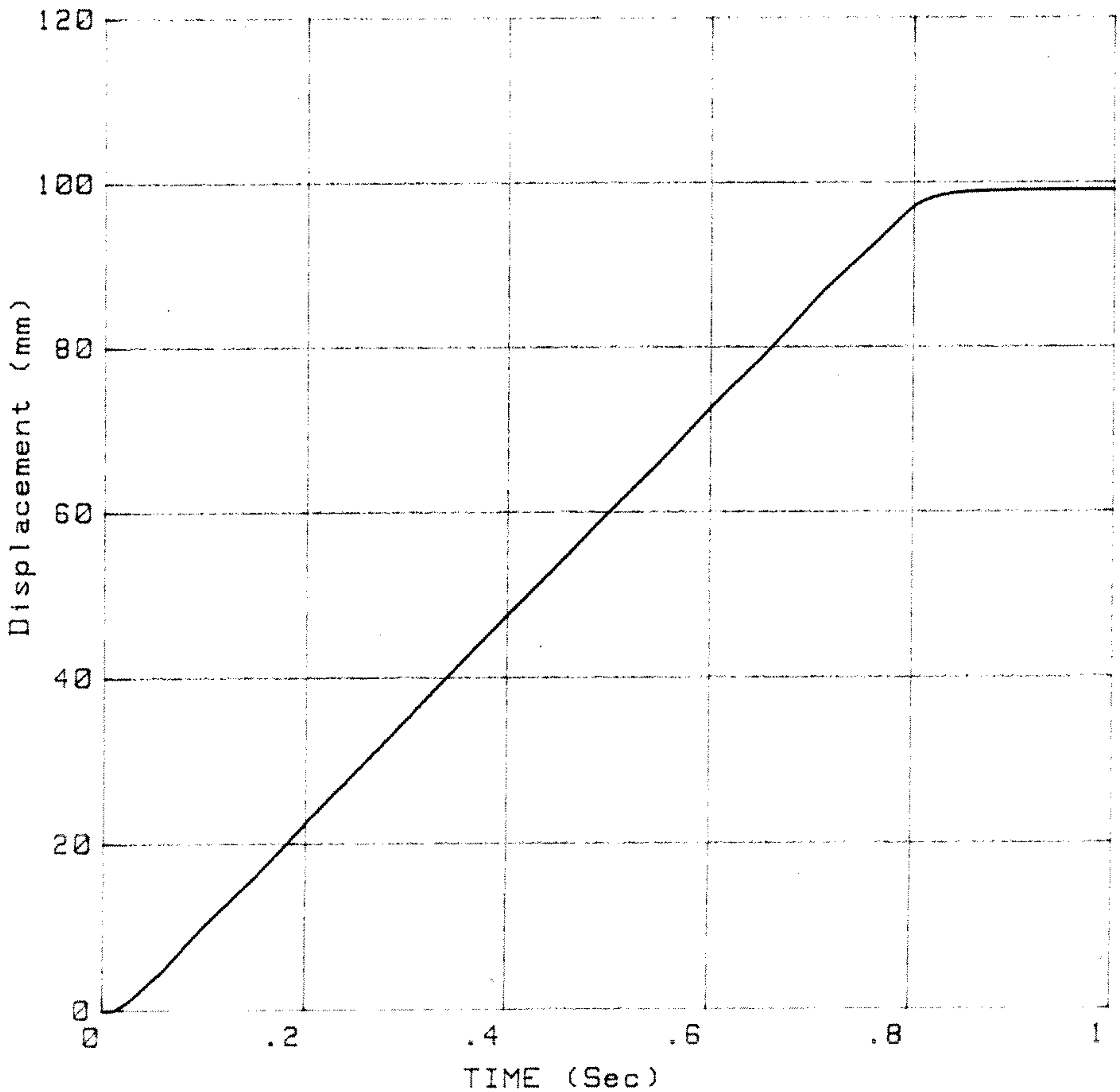
Test: Y007
Type: Crush extrusion test
Sample: SOLID ICE

Date: 12 Jan 1989
Time: 10:09:58

Y Offset Removed

Temperature: -10.2

Average = 10
Truncation Time (s) = 1.71



Local Pressure
vs.
TIME

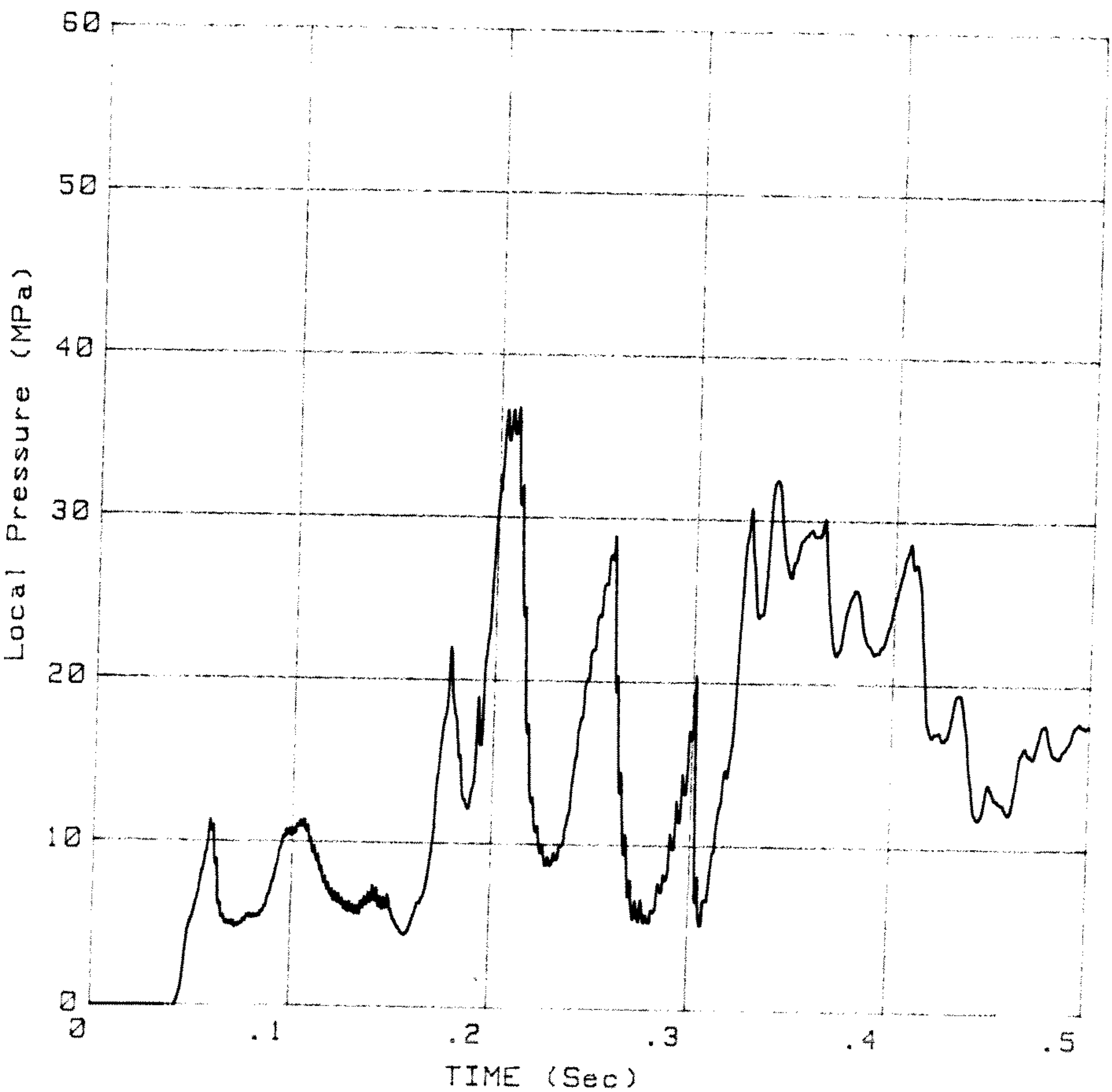
Test: Y007
Type: Crush extrusion test
Sample: SOLID ICE

Date: 12 Jan 1989
Time: 10:09:58

Y Offset Removed

Temperature: -10.2

Average = 1
Truncation Time (s) = 1.71



Local Pressure
vs.
TIME

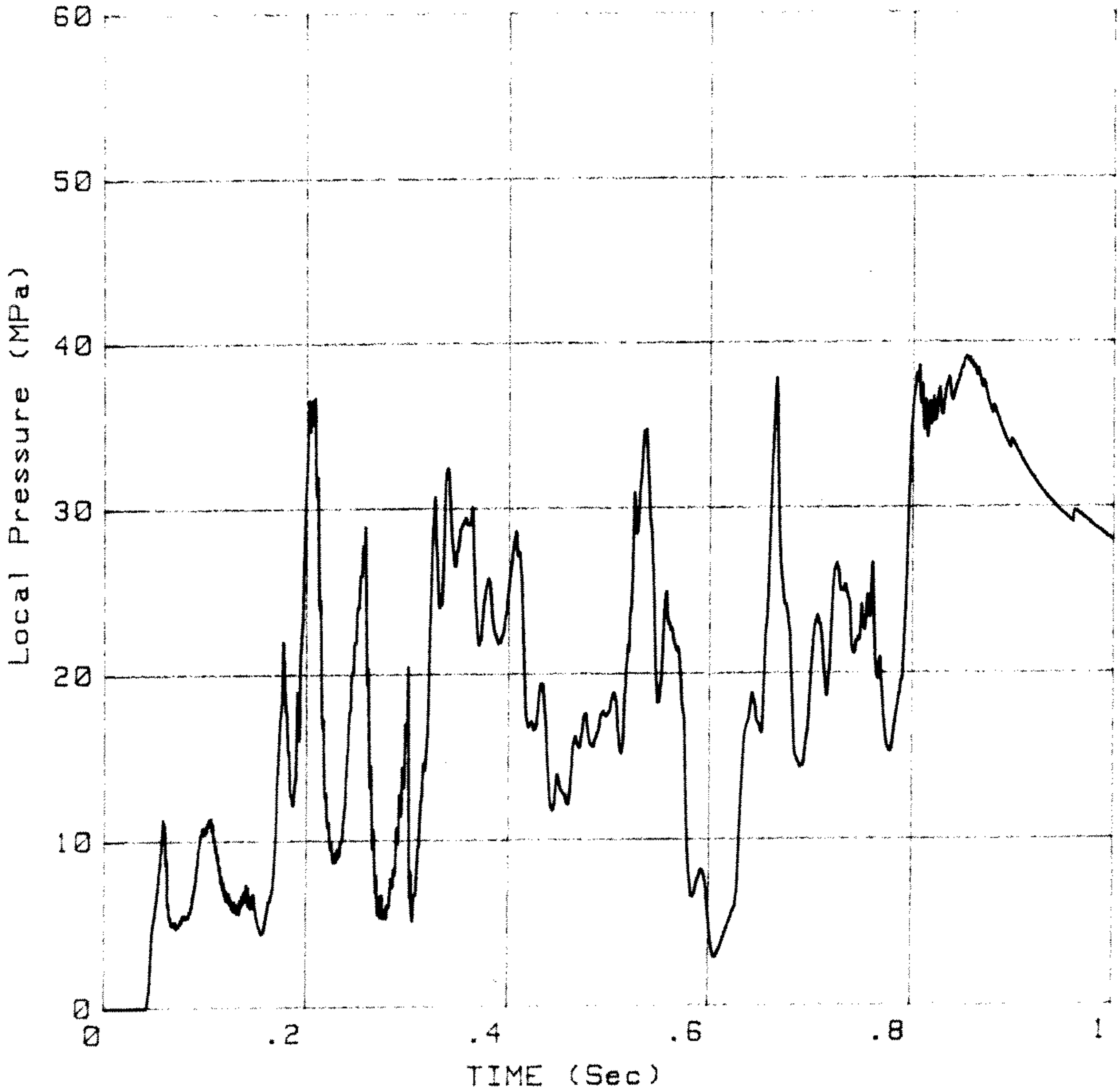
Test: Y007
Type: Crush extrusion test
Sample: SOLID ICE

Date: 12 Jan 1989
Time: 10:09:58

Y Offset Removed

Temperature: -10.2

Average = 1
Truncation Time (s) = 1.71



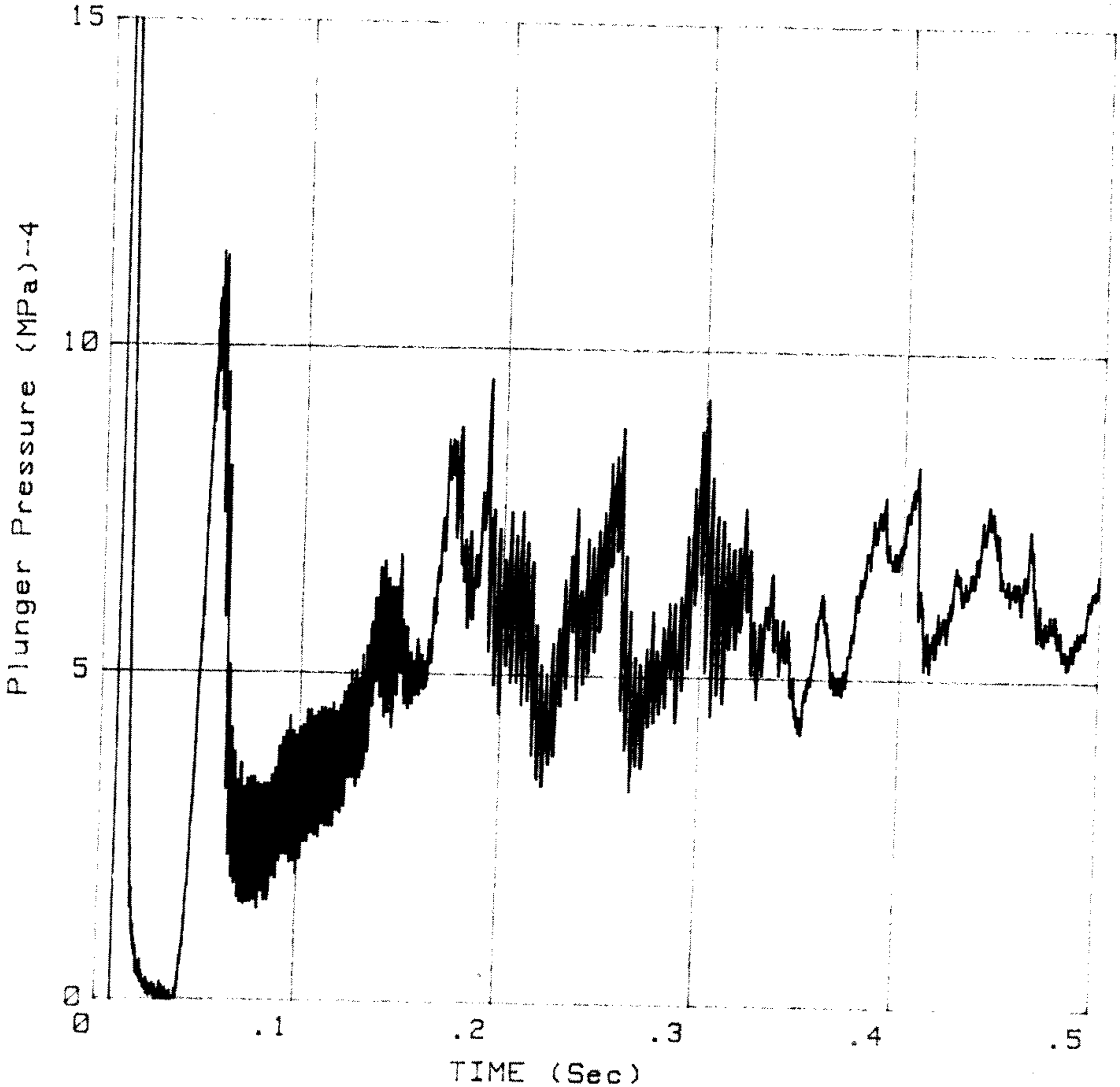
Plunger Pressure-4
vs.
TIME

Test: Y007
Type: Crush extrusion test
Sample: SOLID ICE

Date: 12 Jan 1989
Time: 10:09:58

Temperature: -10.2

Average = 1
Truncation Time (s) = 1.71



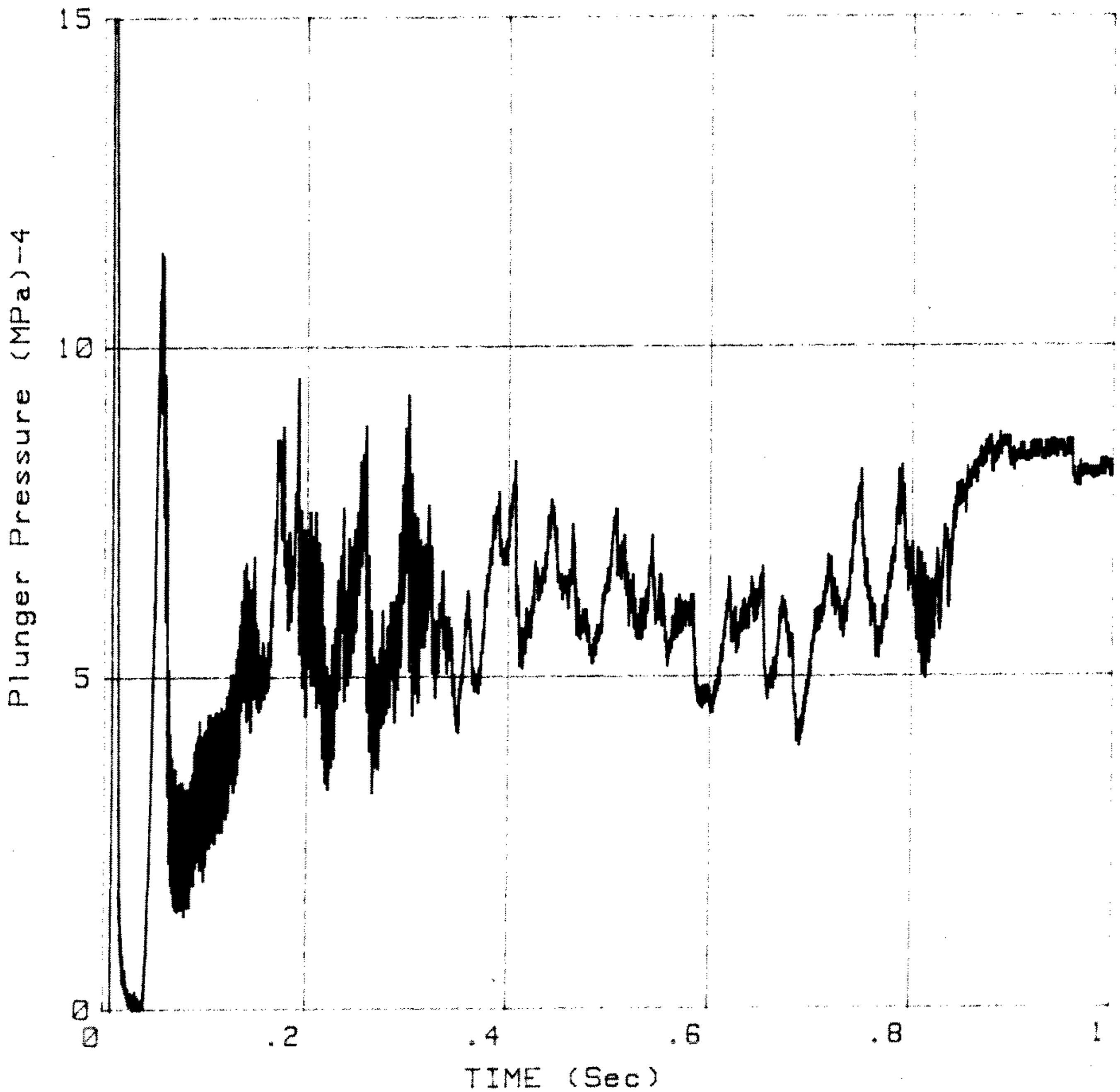
Plunger Pressure-4
vs.
TIME

Test: Y007
Type: Crush extrusion test
Sample: SOLID ICE

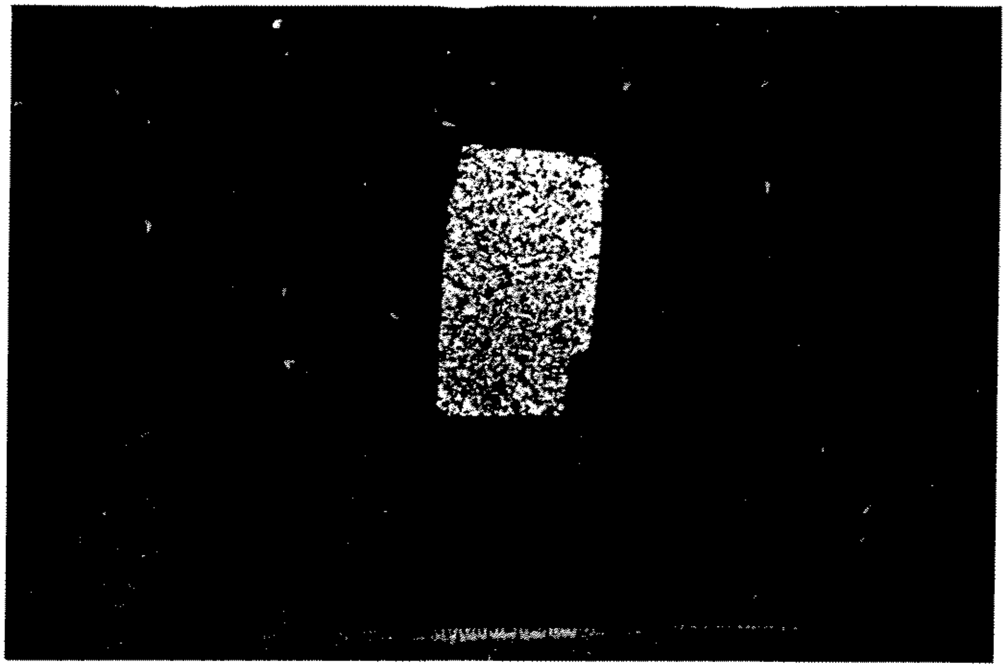
Date: 12 Jan 1989
Time: 10:09:58

Temperature: -10.2

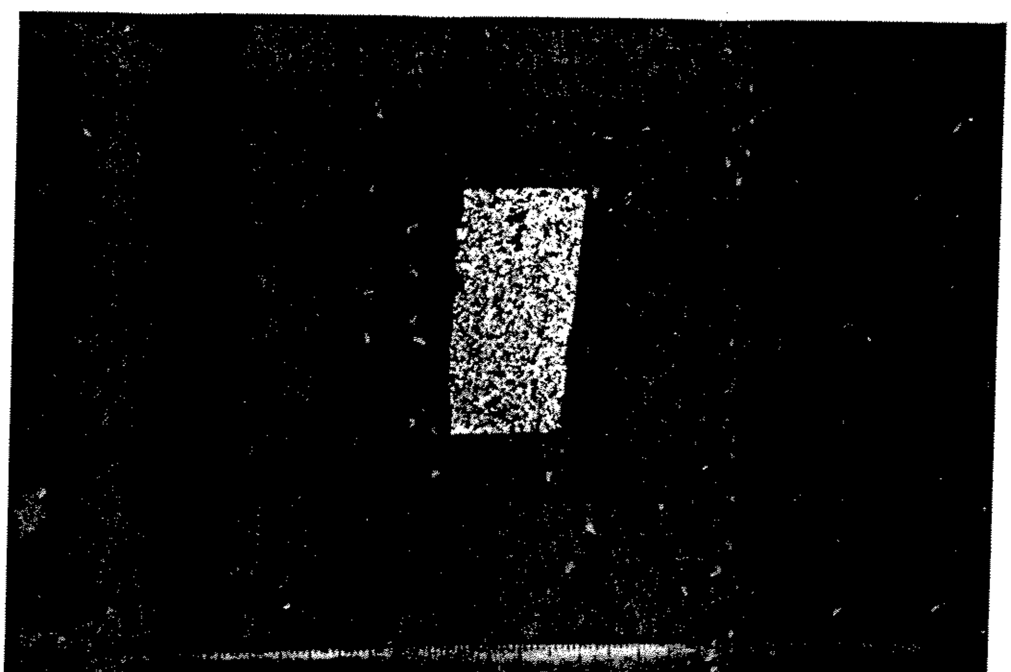
Average = 1
Truncation Time (s) = 1.71



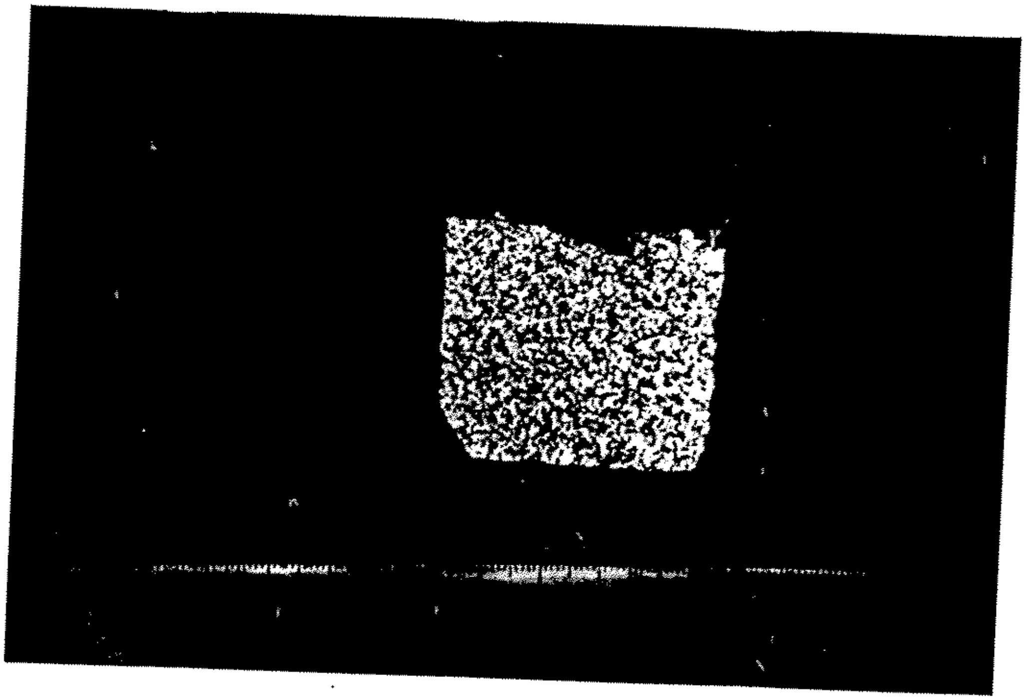
9.5 Thin Section Photography



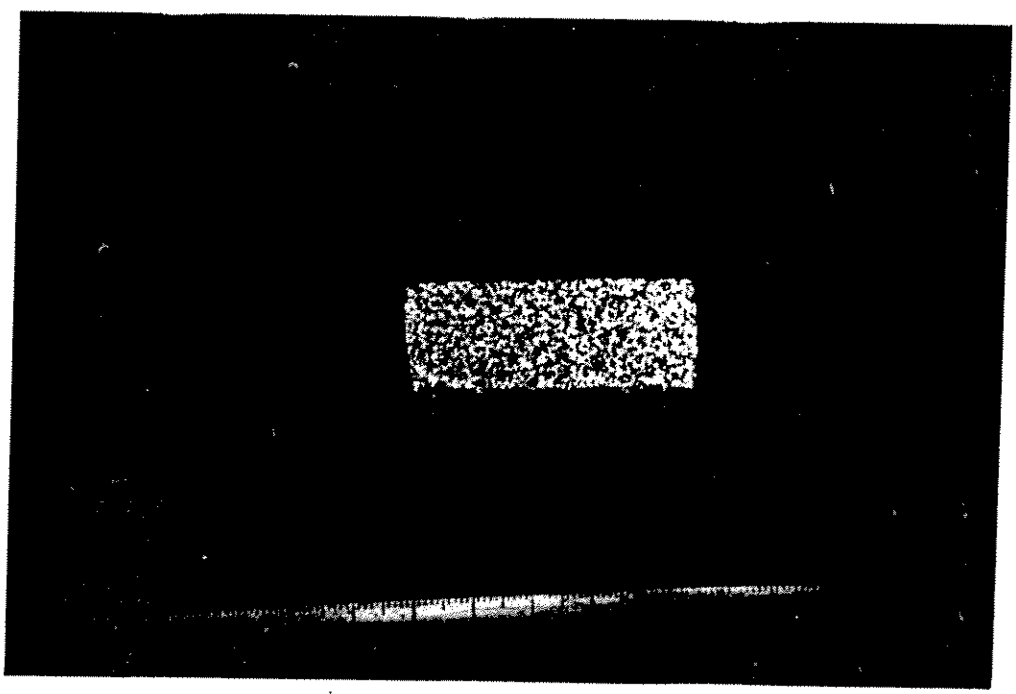
Test x990 sample 36



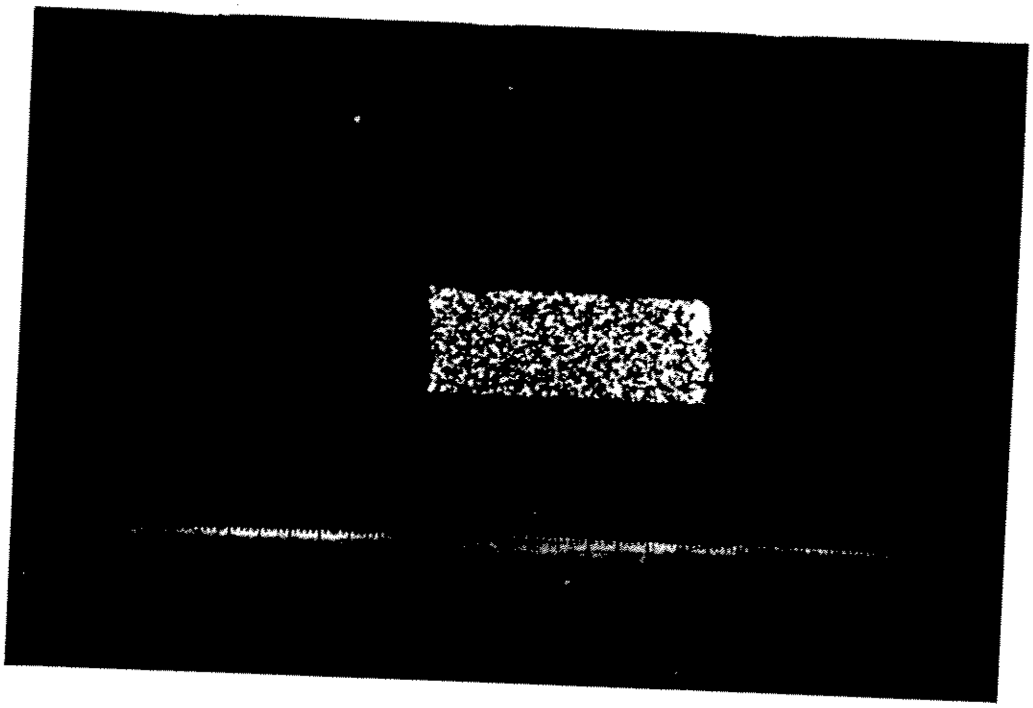
Test x990 sample 49



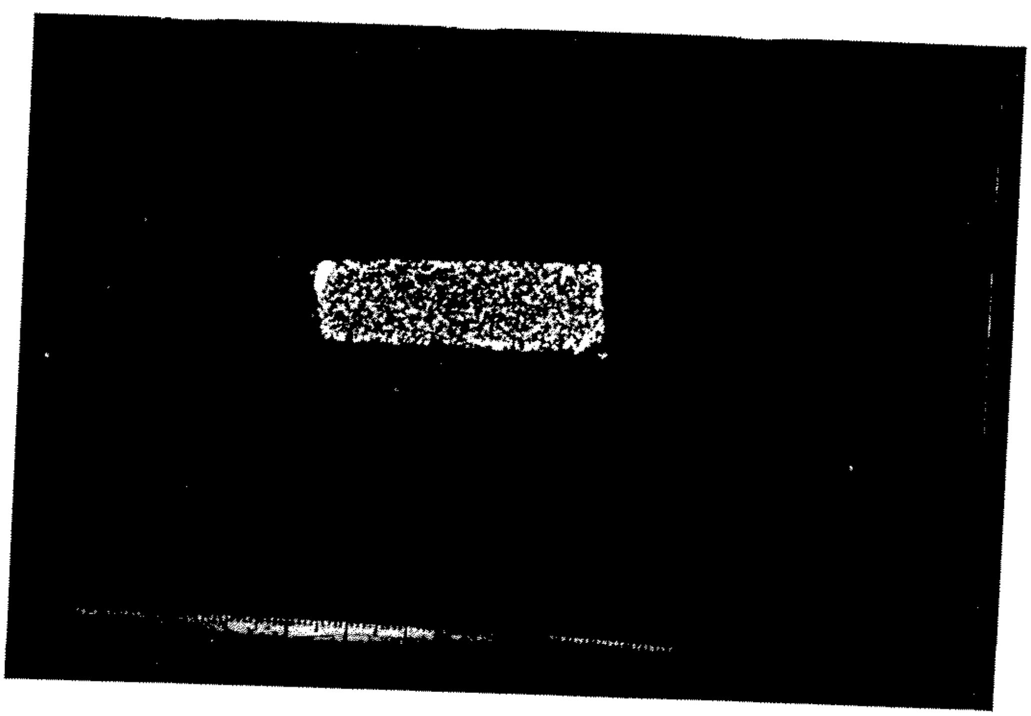
Test x963A sample 40



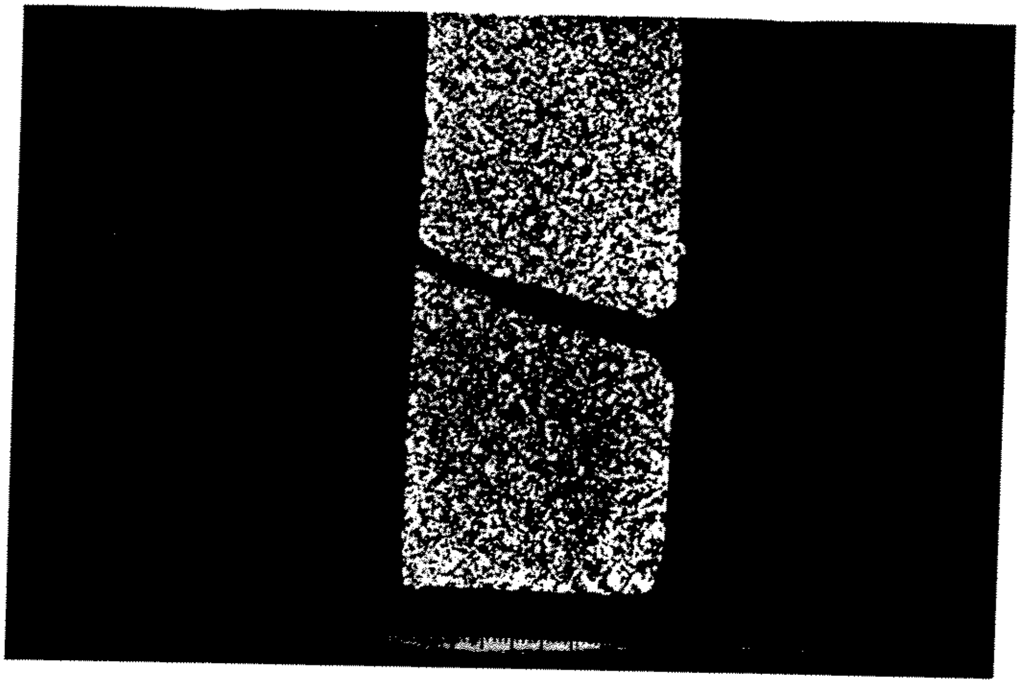
Test x971 sample 15



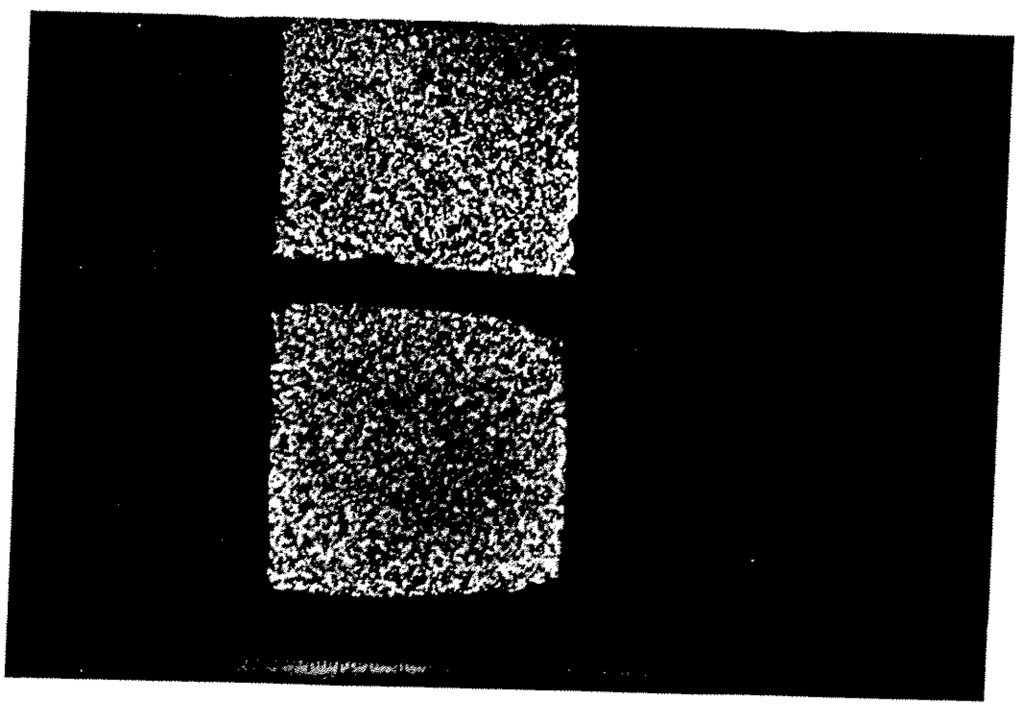
Test x971 sample 39



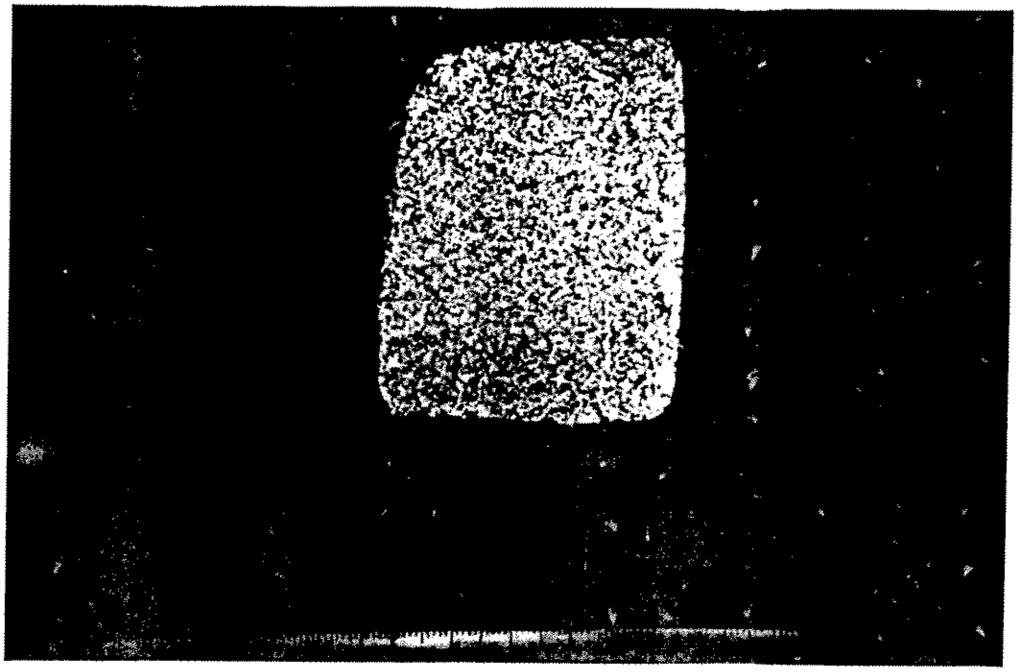
Test x973 sample 15



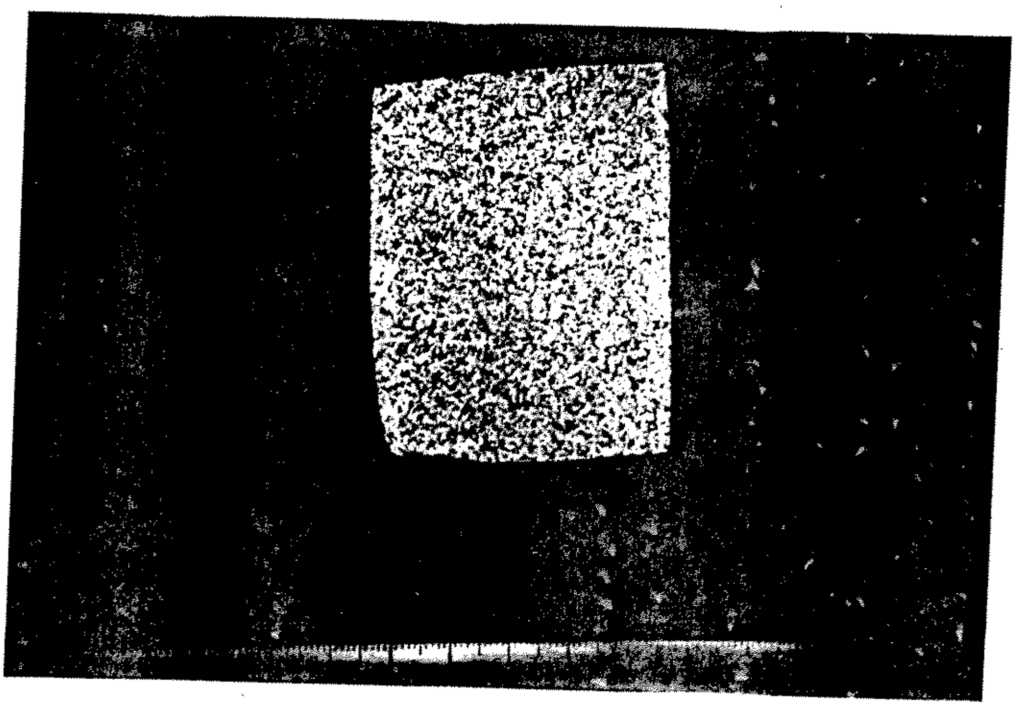
Test x974 sample 15



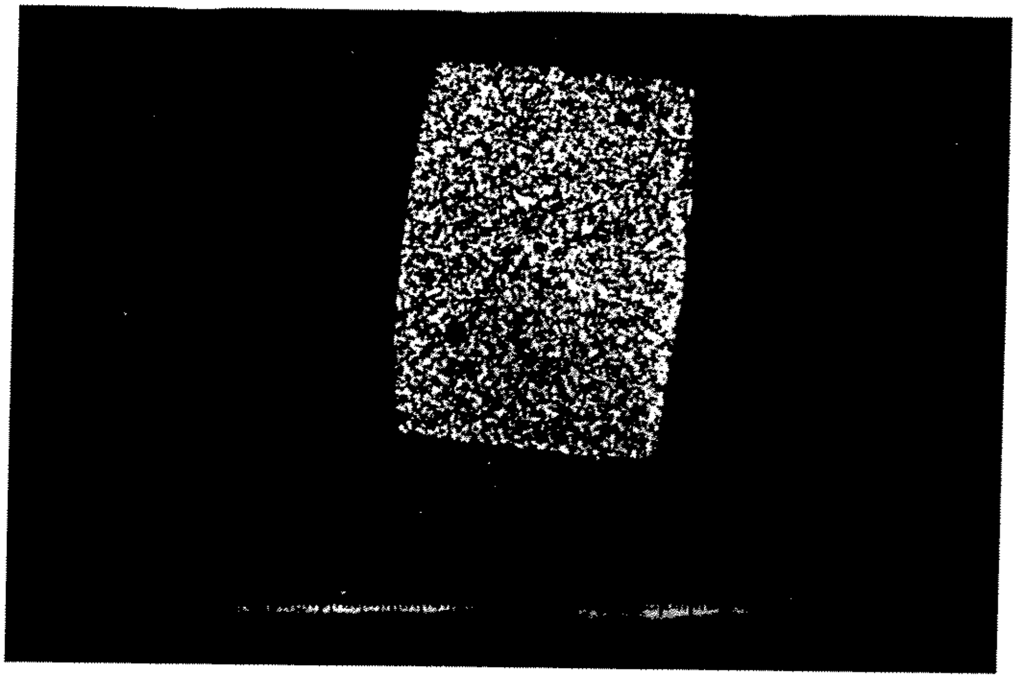
Test x974 sample 42



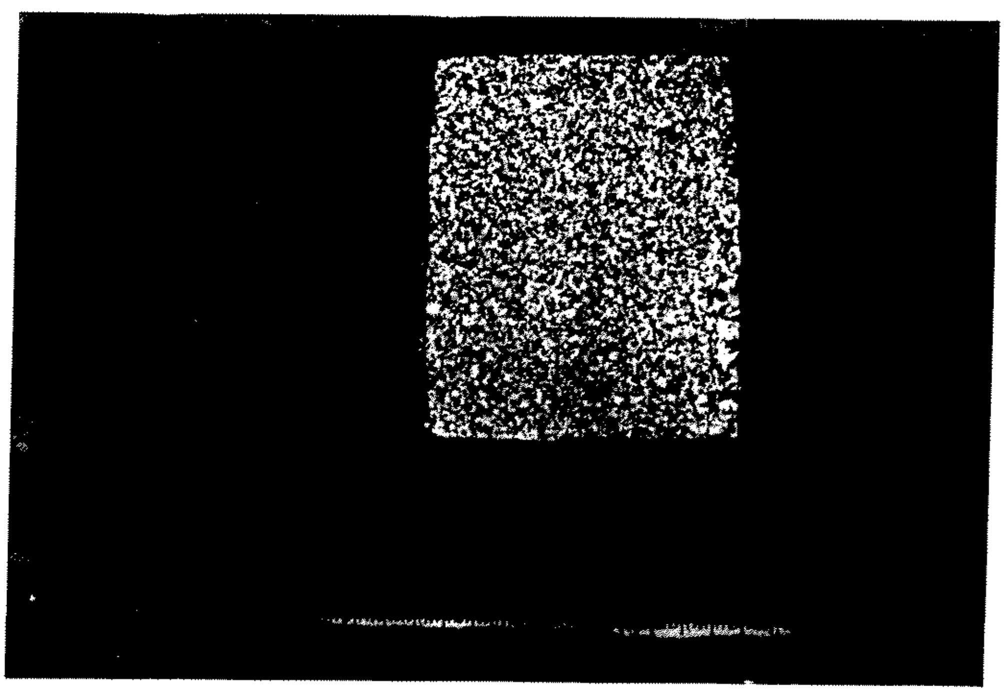
Test x975 sample 15



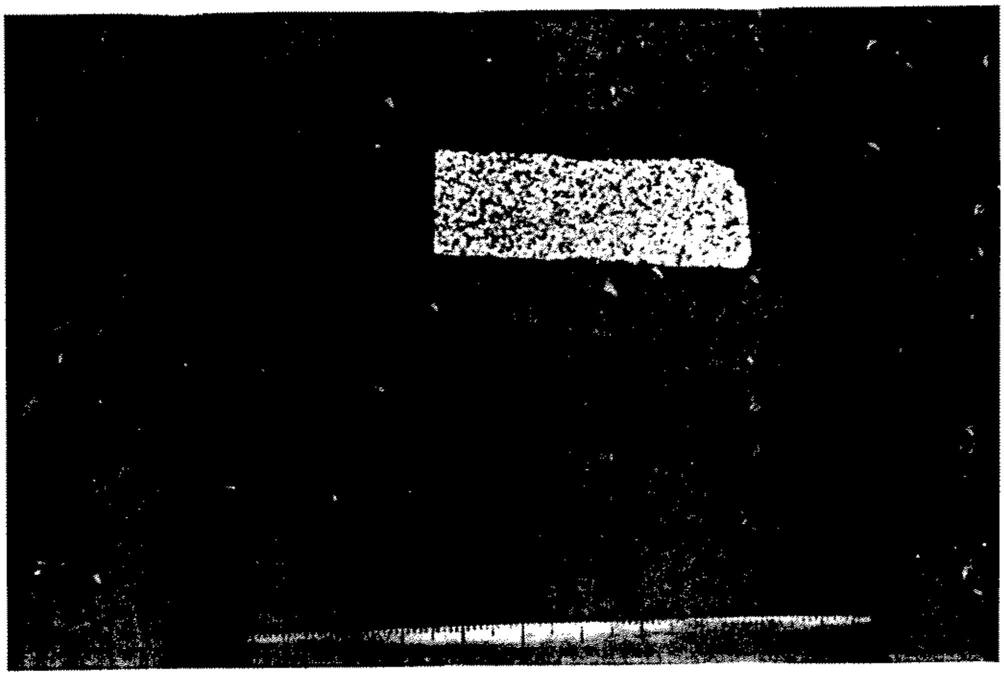
Test x976 sample 42



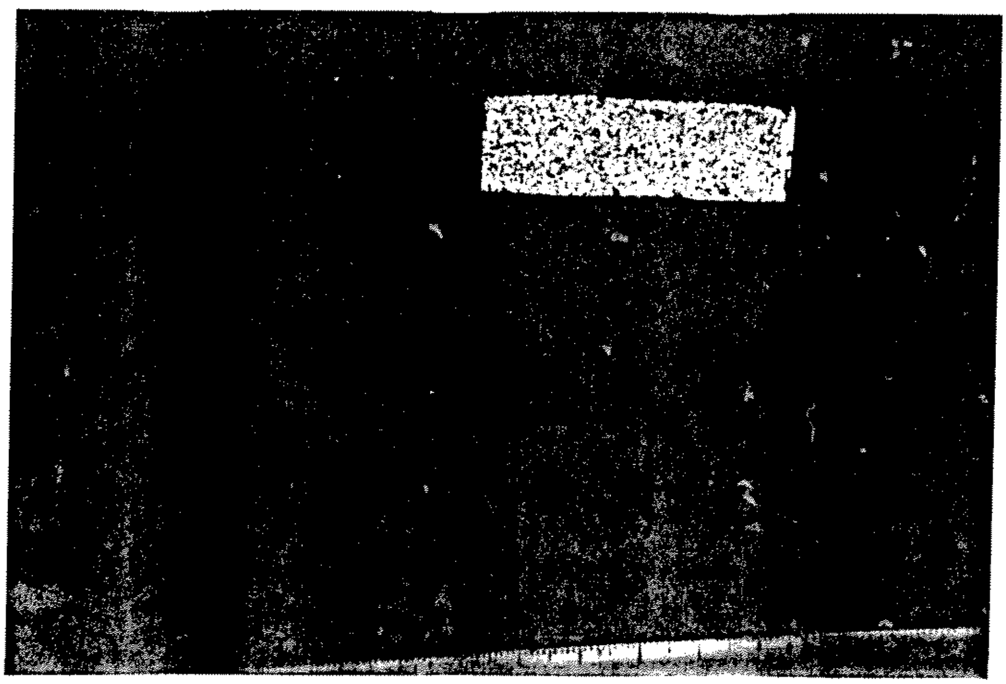
Test x977 sample 15



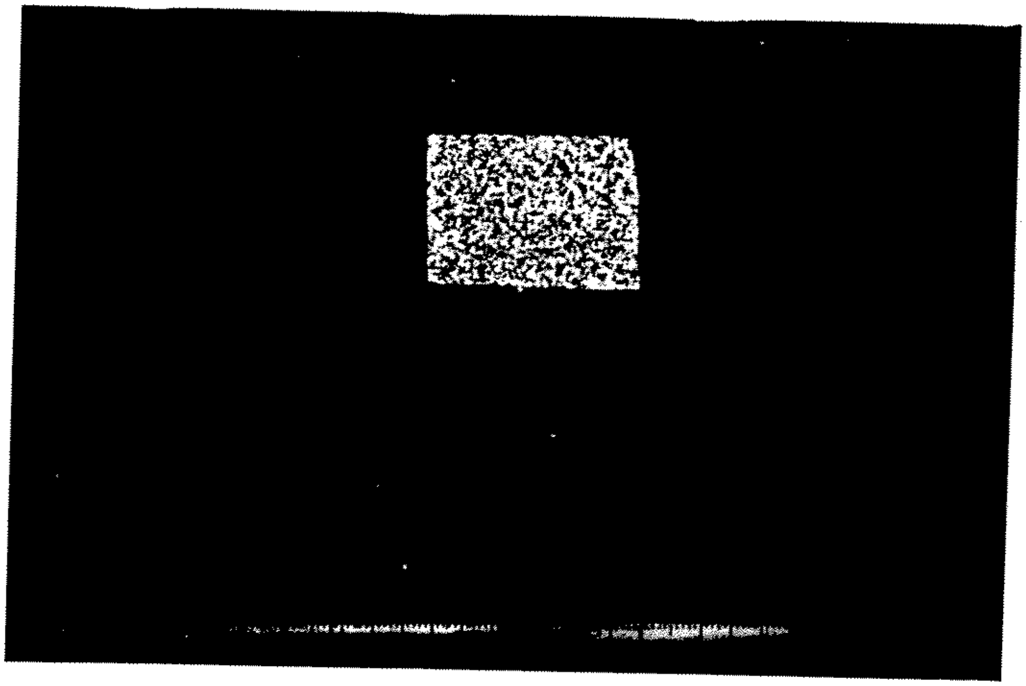
Test x977 sample 42



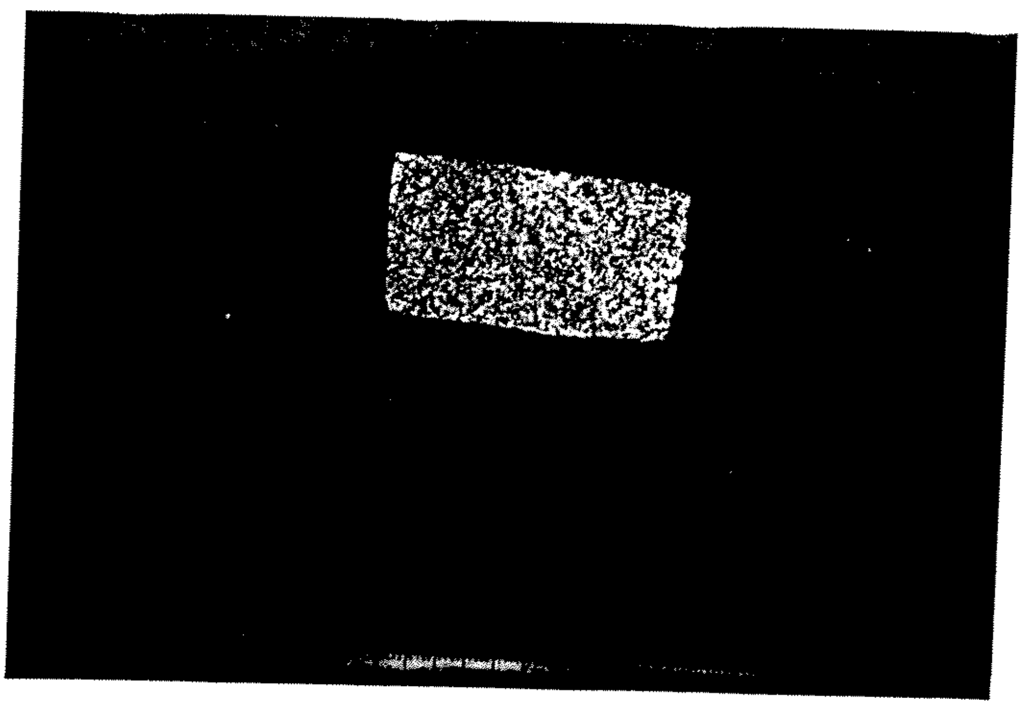
Test x978 sample 15



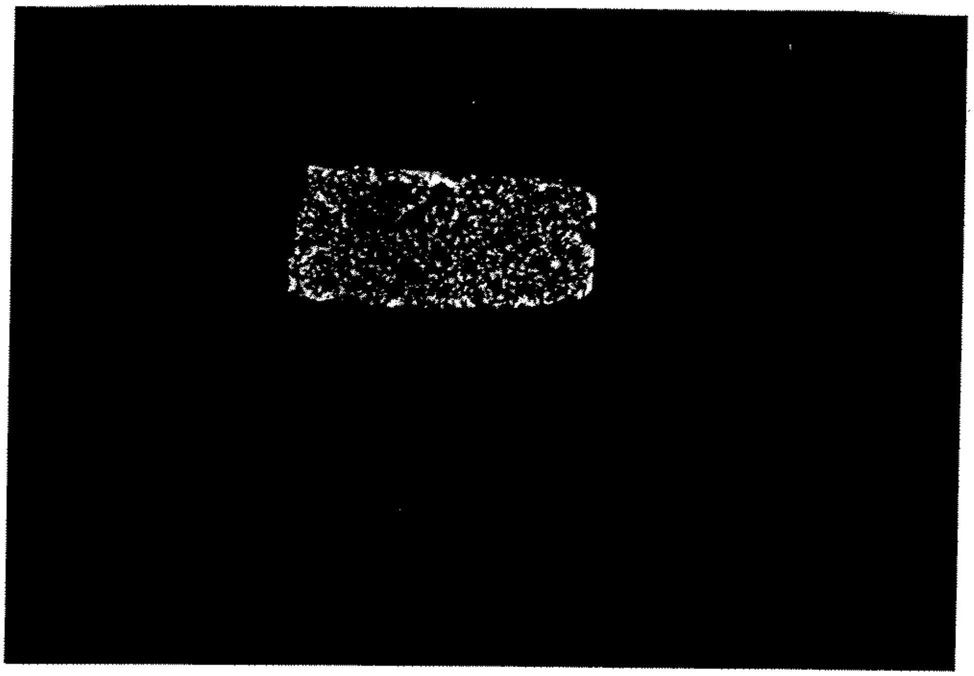
Test x980 sample 39



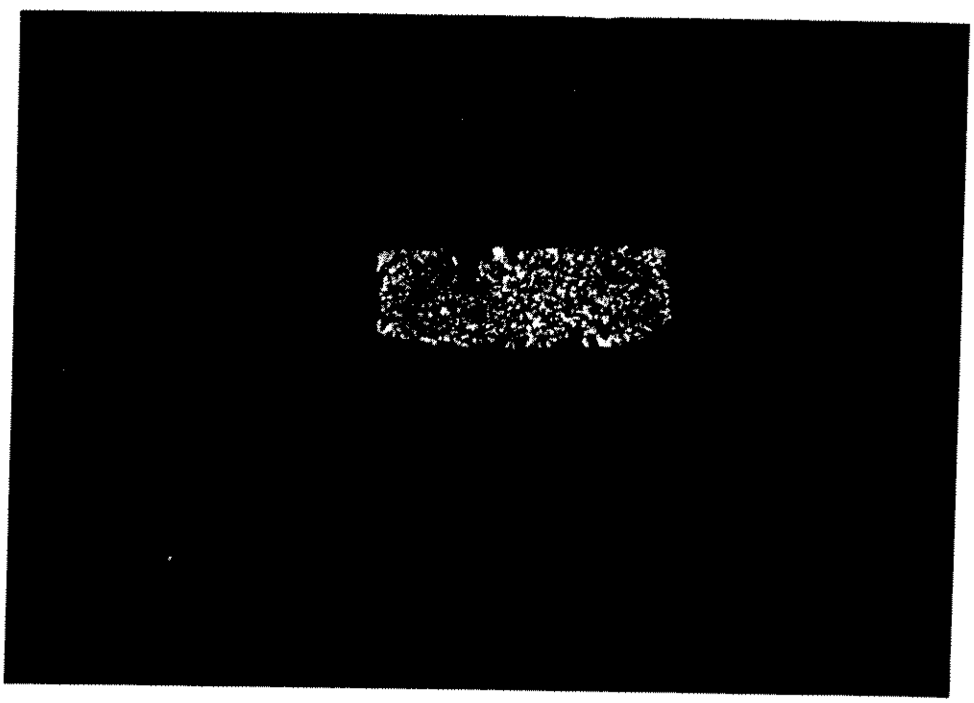
Test x985 sample 14



Test x985 sample 39

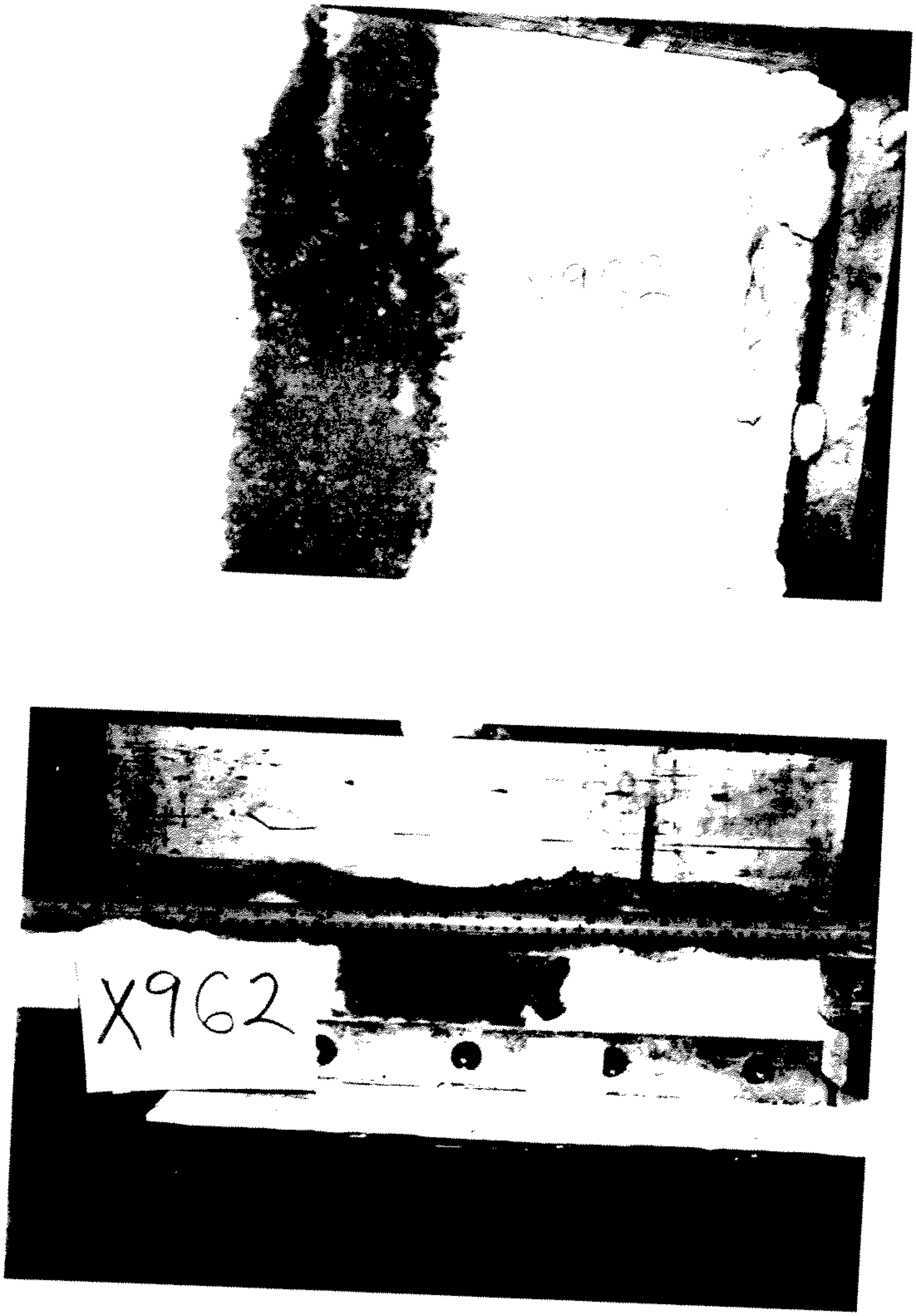


Test x986 sample 14

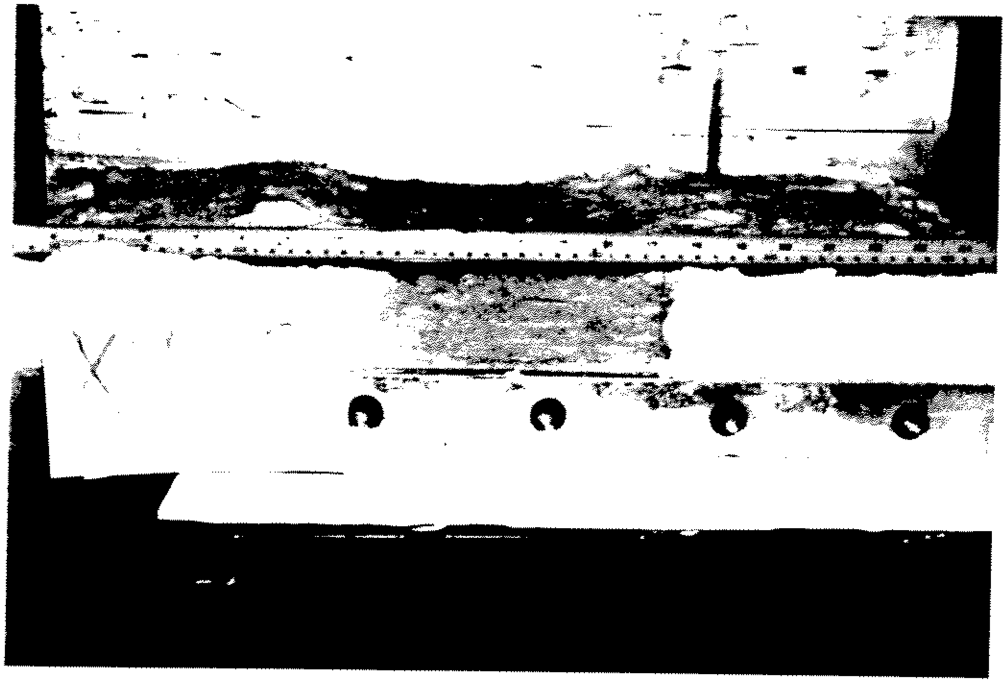


Test x986 sample 39

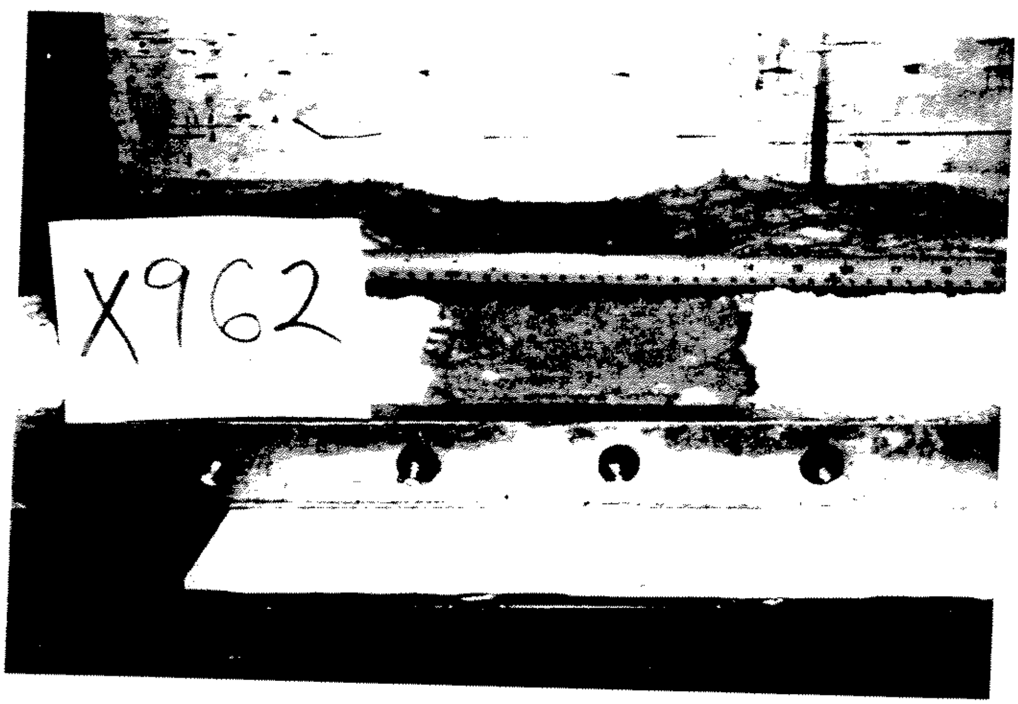
9.6 Flow Visualization Photography



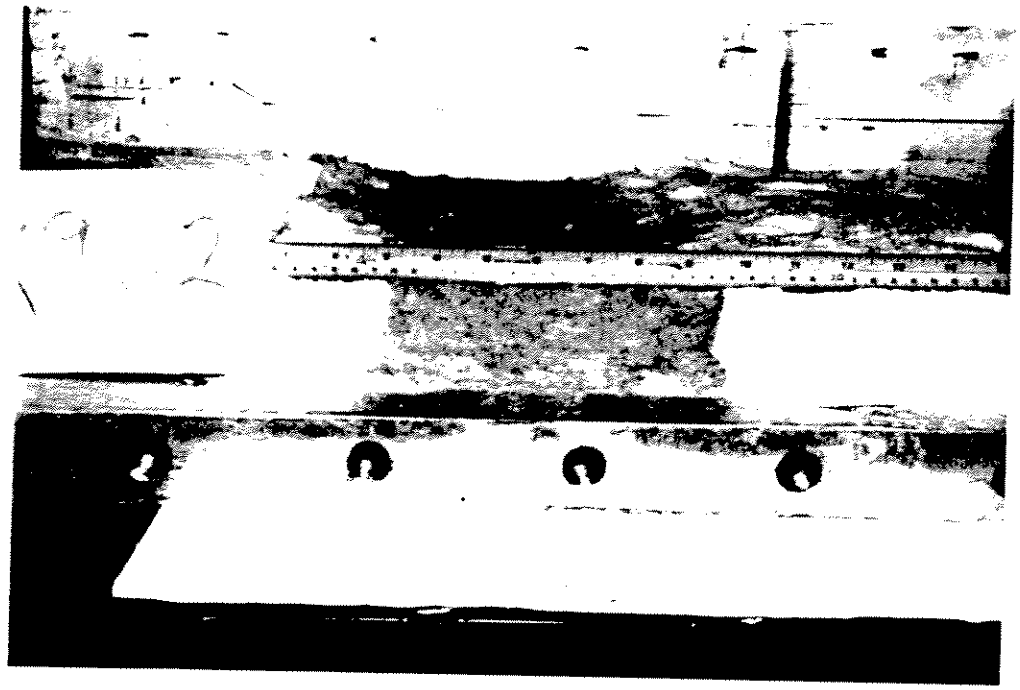
Test x962 at 0 mm.



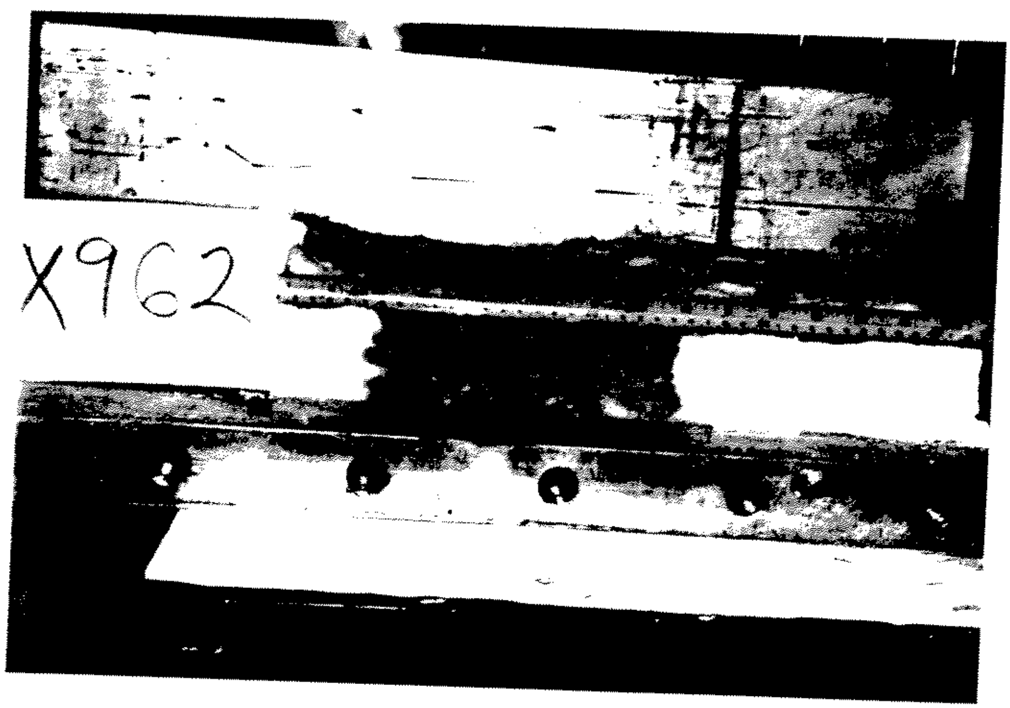
Test x962 at +20 mm.



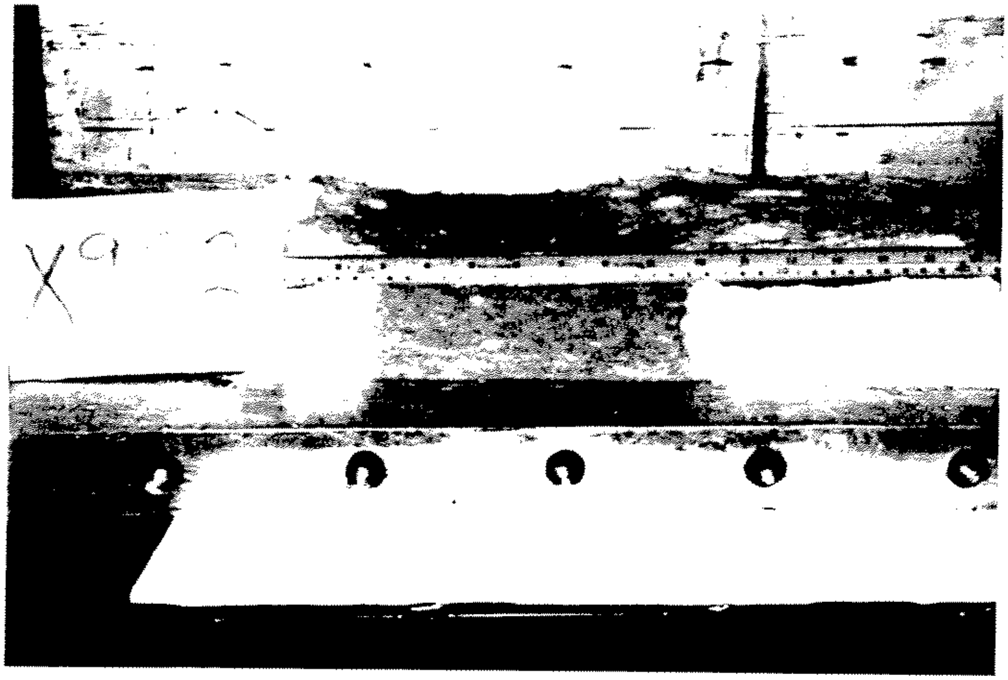
Test x962 at +40 mm.



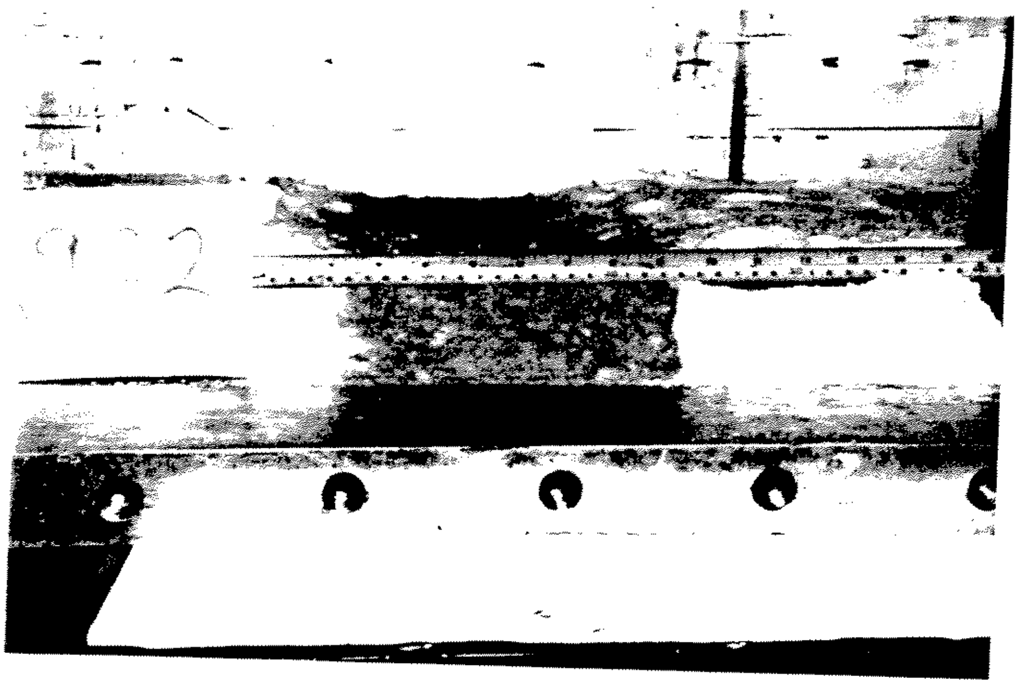
Test x962 at +60 mm.



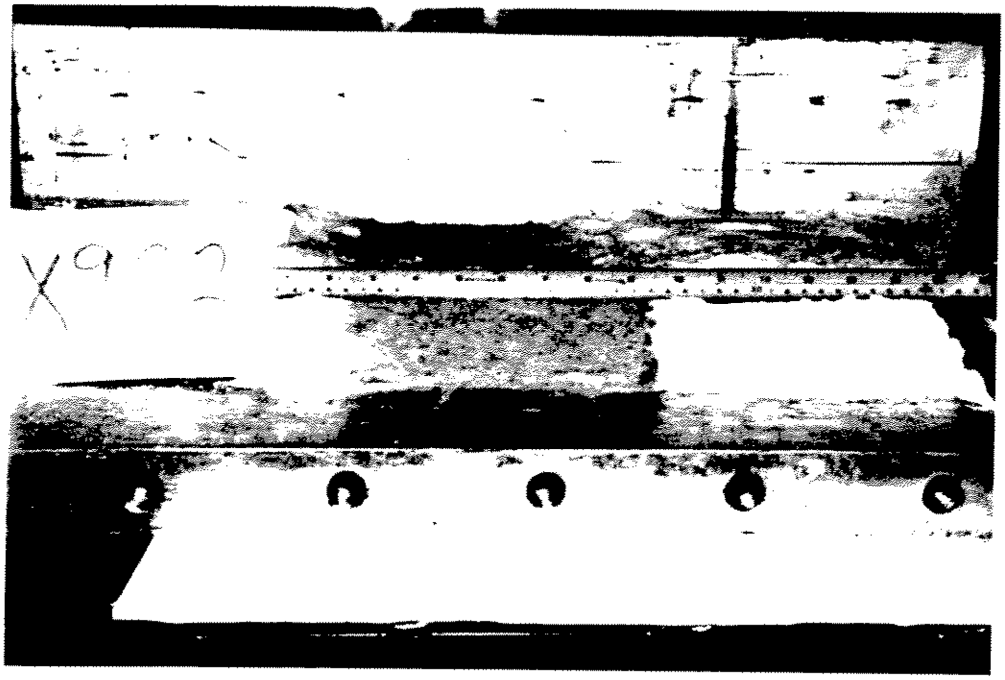
Test x962 at +80 mm.



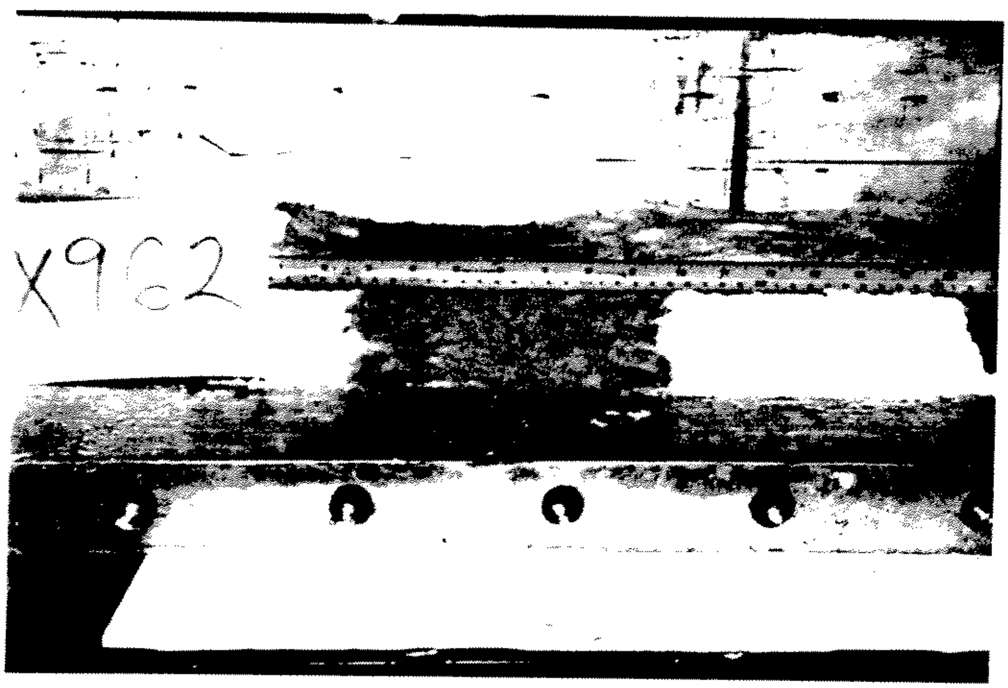
Test x962 at +100 mm.



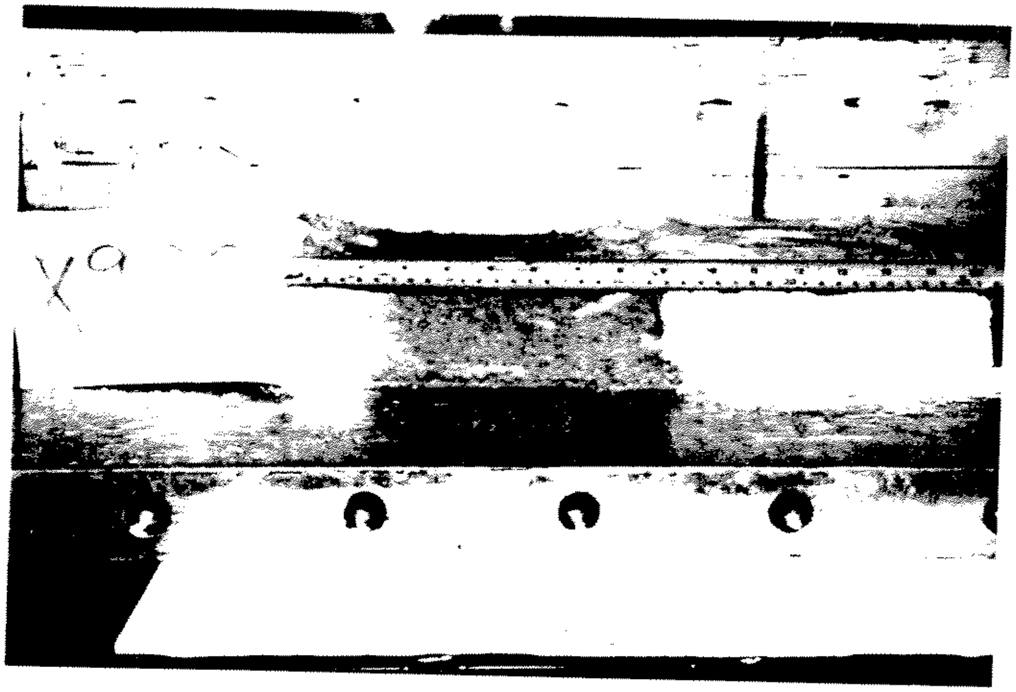
Test x962 at +120 mm.



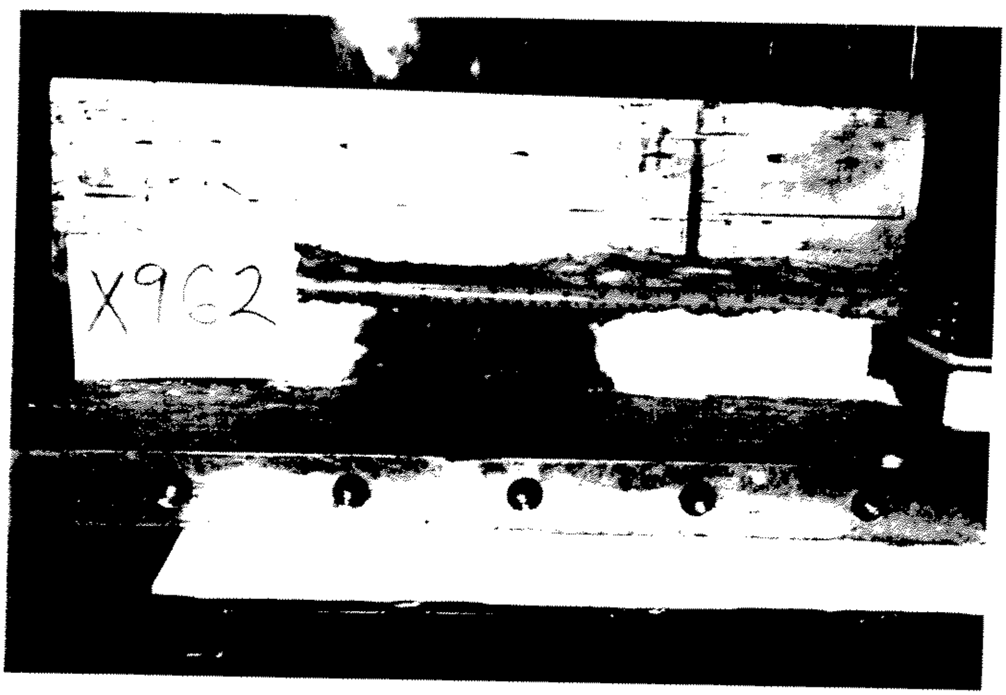
Test x962 at +140 mm.



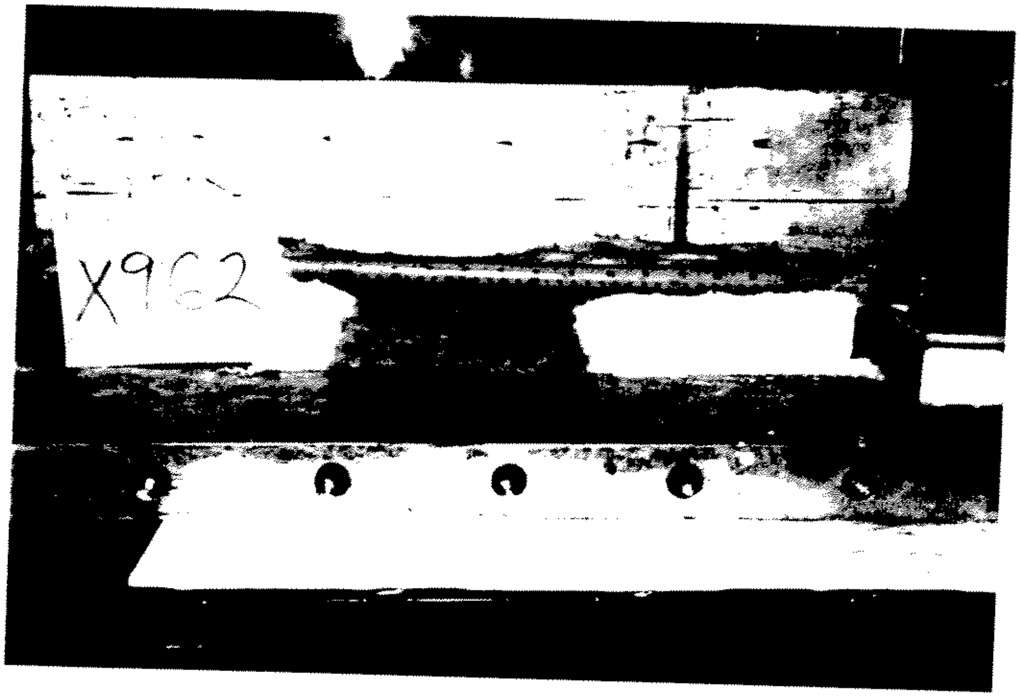
Test x962 at +160 mm.



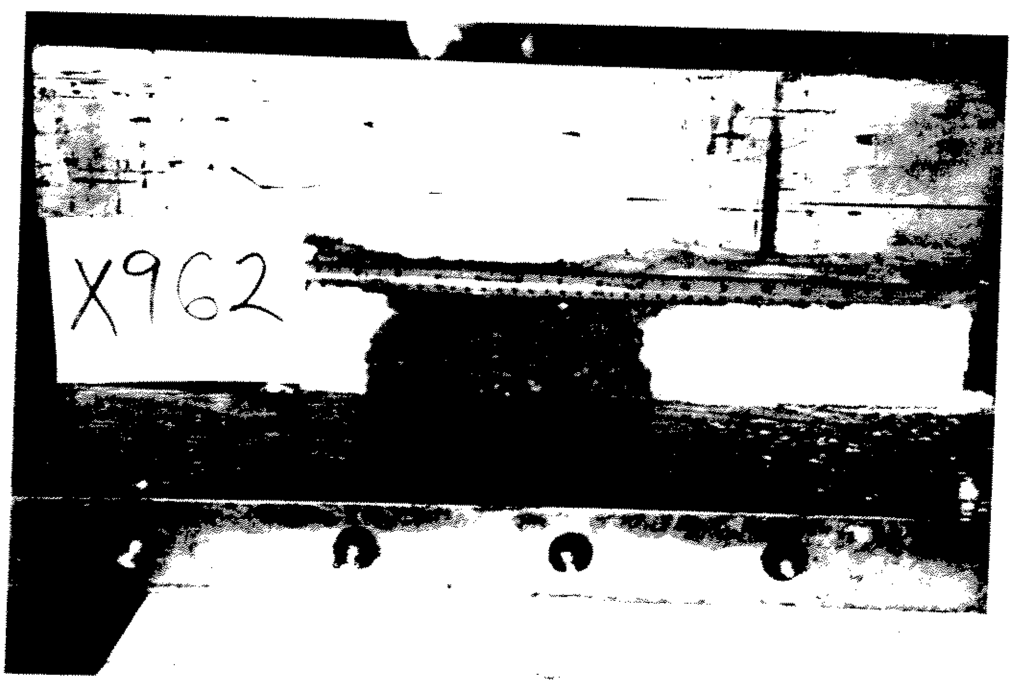
Test x962 at +180 mm.



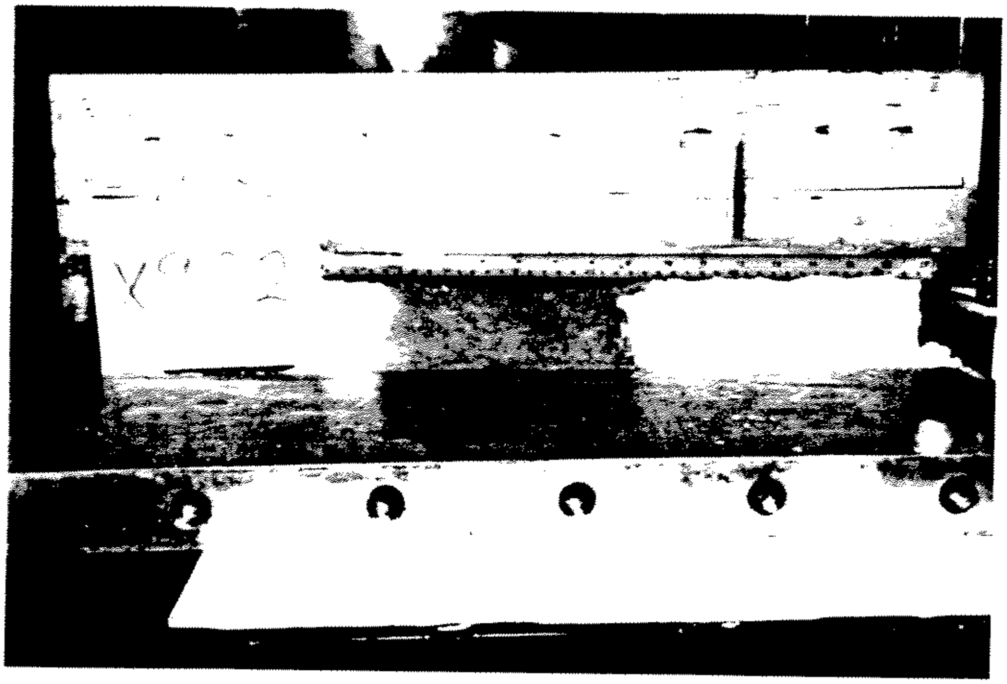
Test x962 at +200 mm.



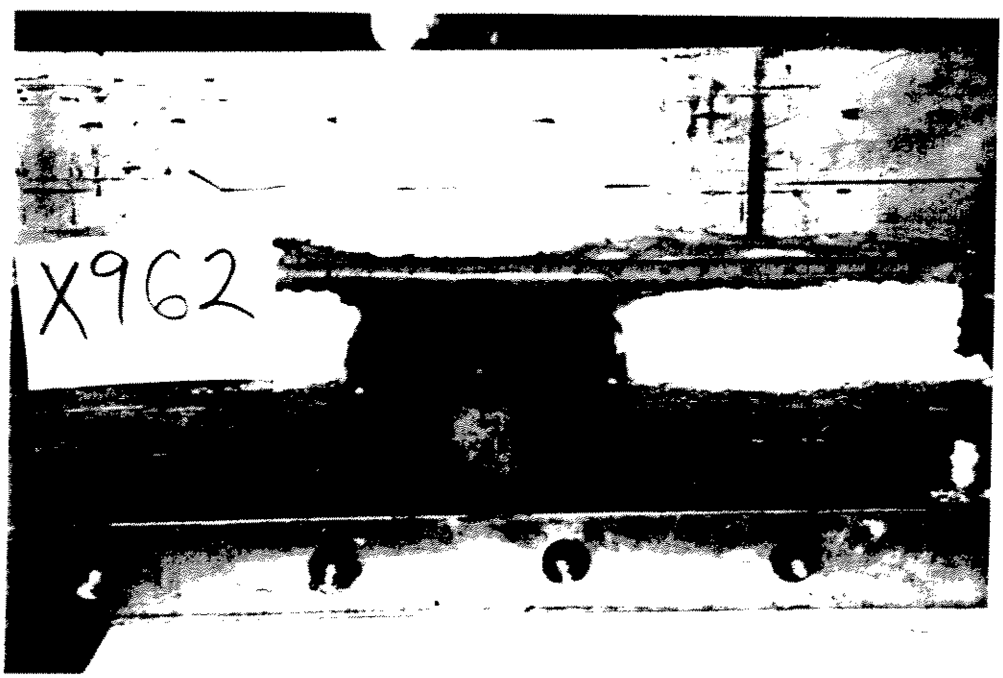
Test x962 at +220 mm.



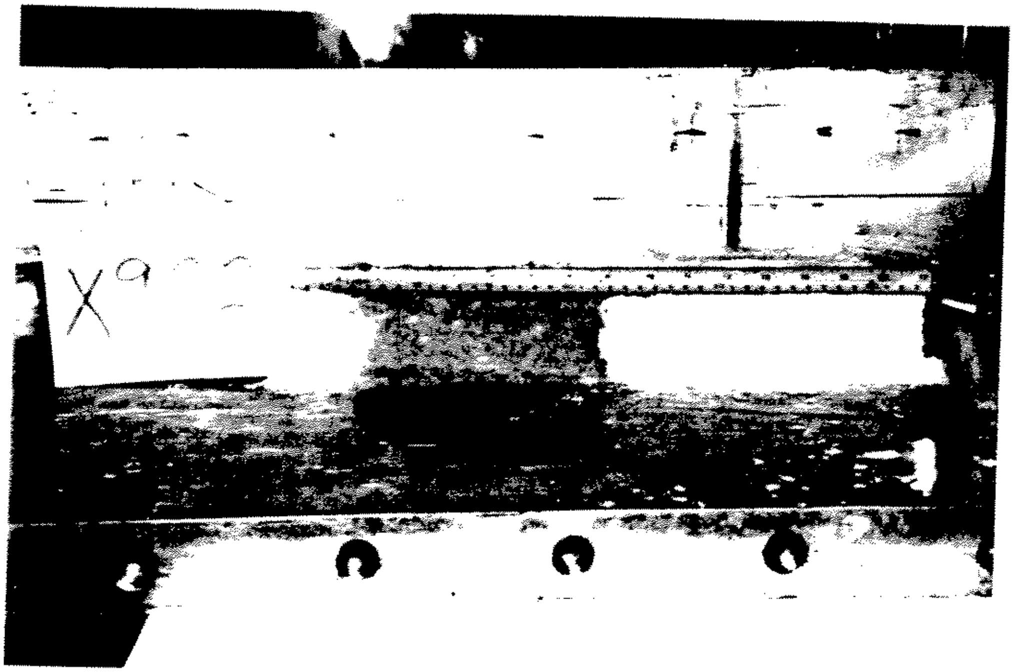
Test x962 at +240 mm.



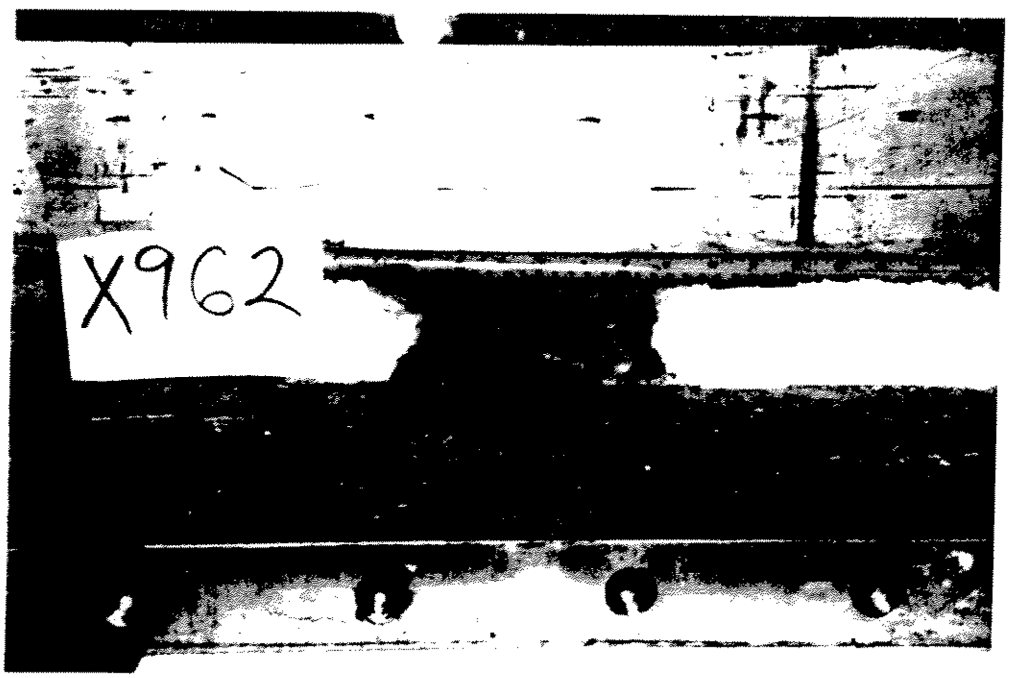
Test x962 at +260 mm.



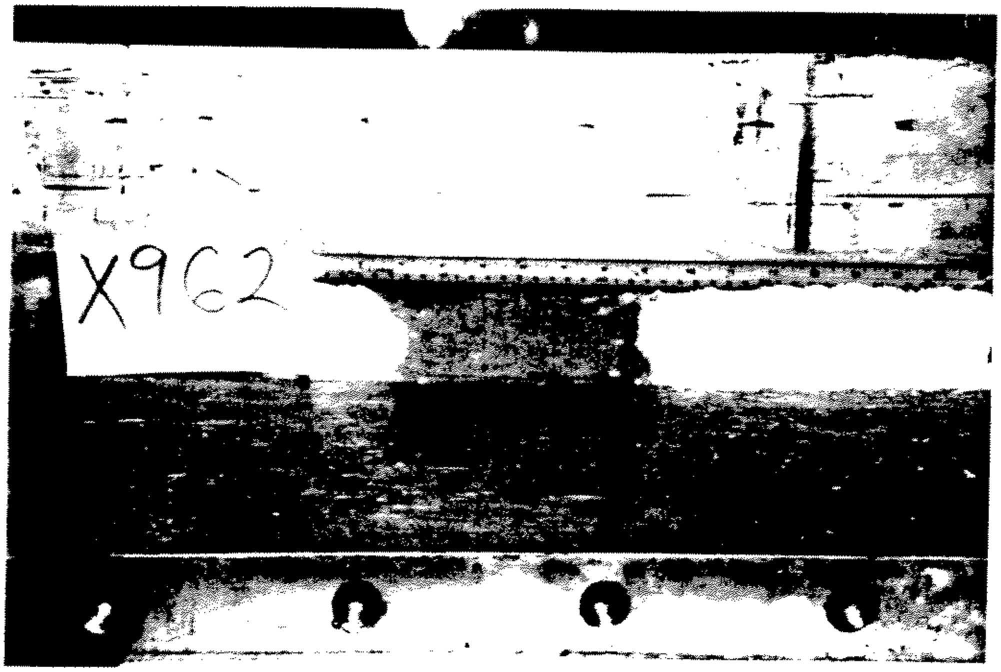
Test x962 at +280 mm.



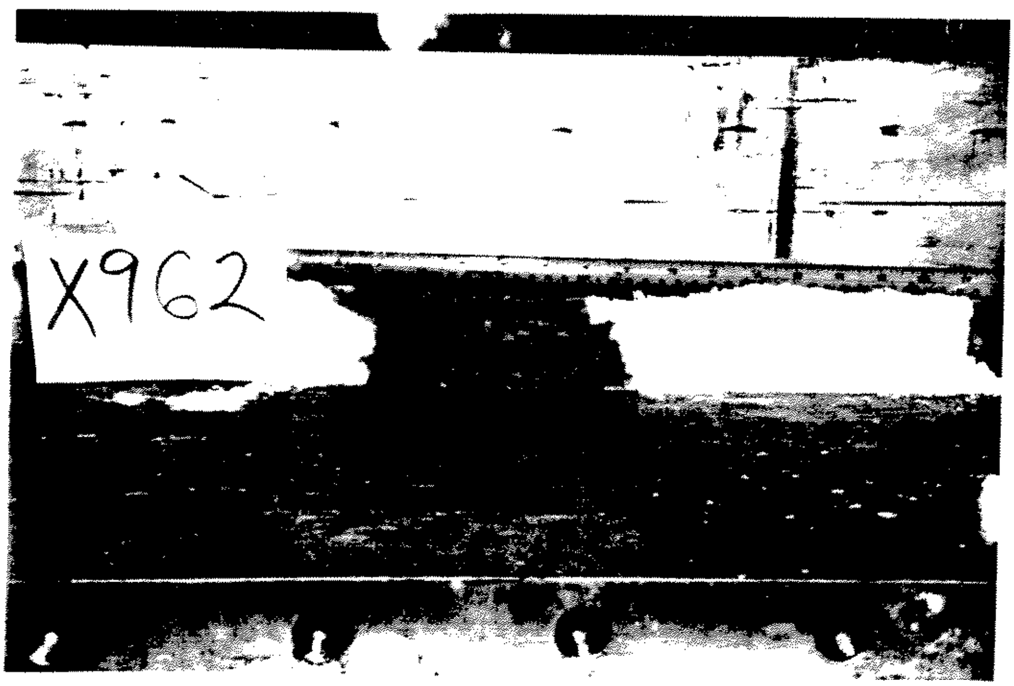
Test x962 at +300 mm.



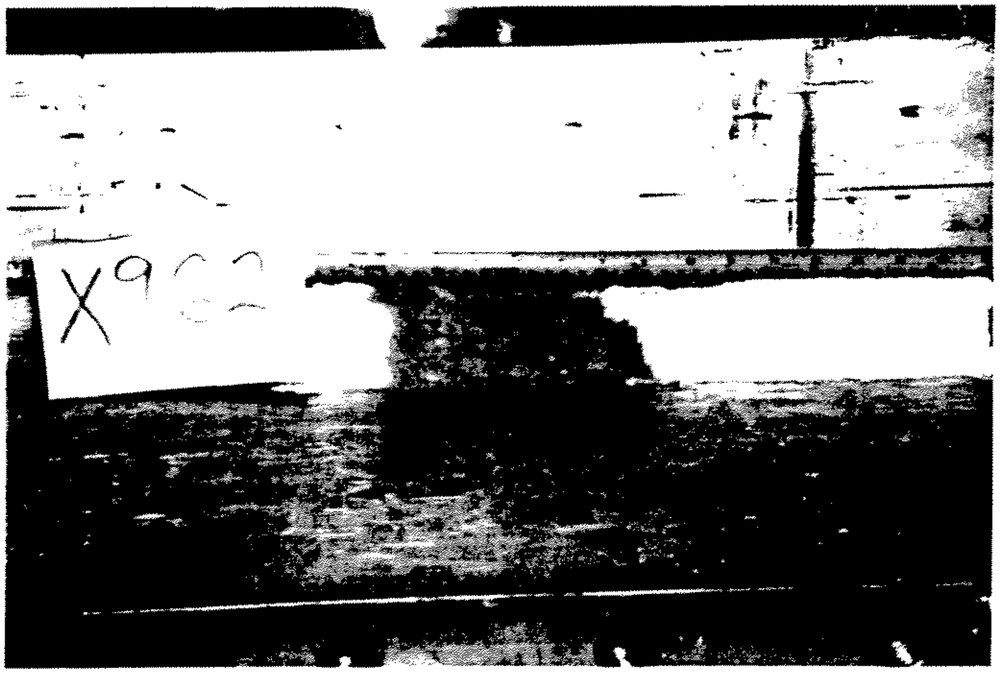
Test x962 at +320 mm.



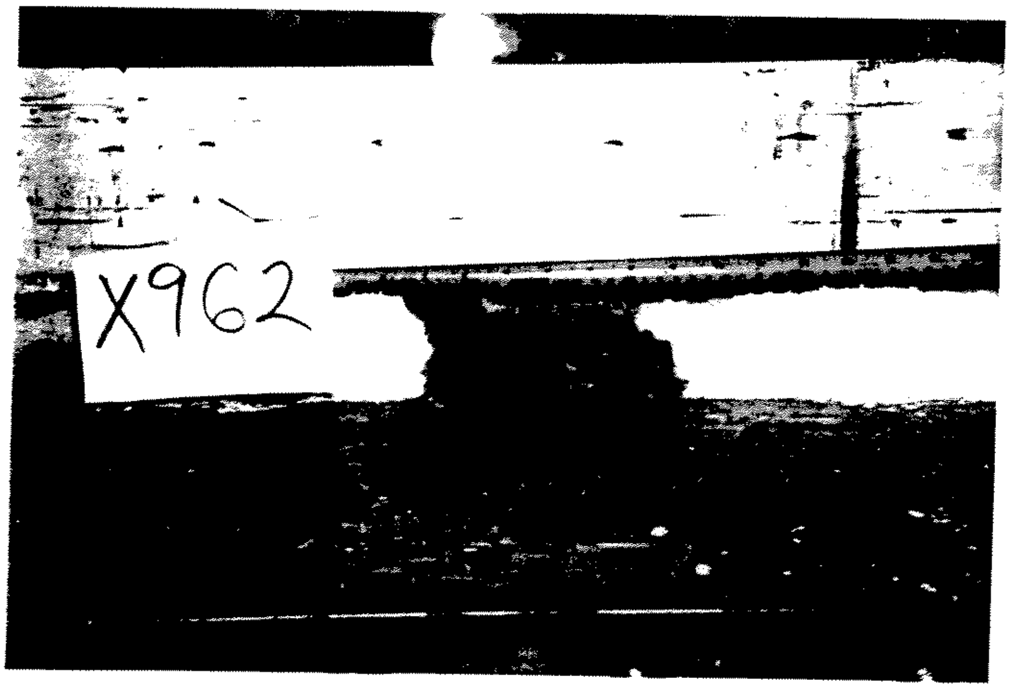
Test x962 at +340 mm.



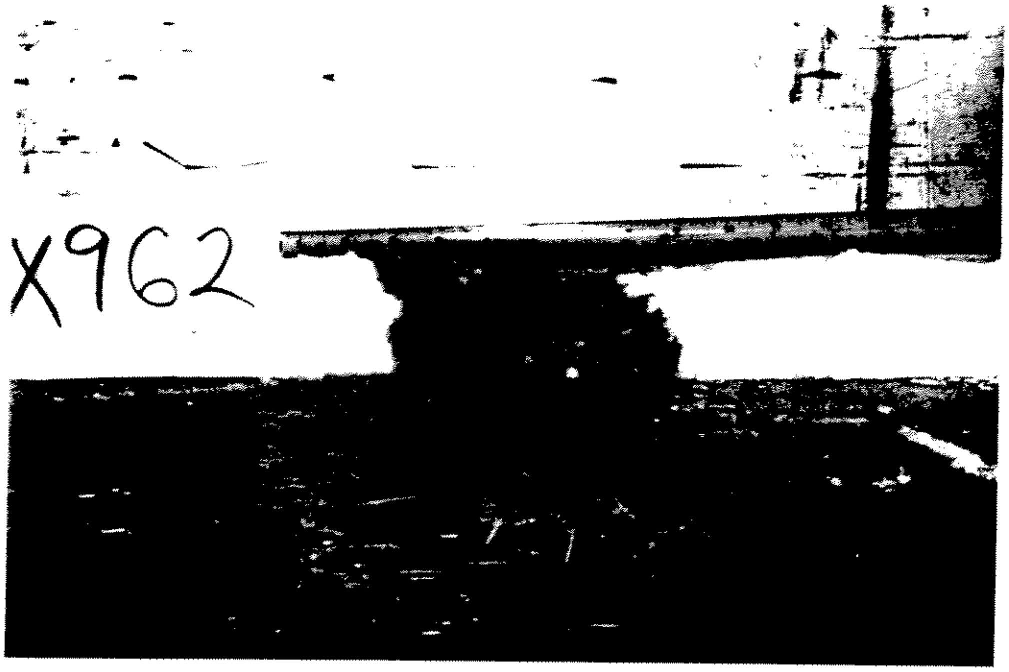
Test x962 at +360 mm.



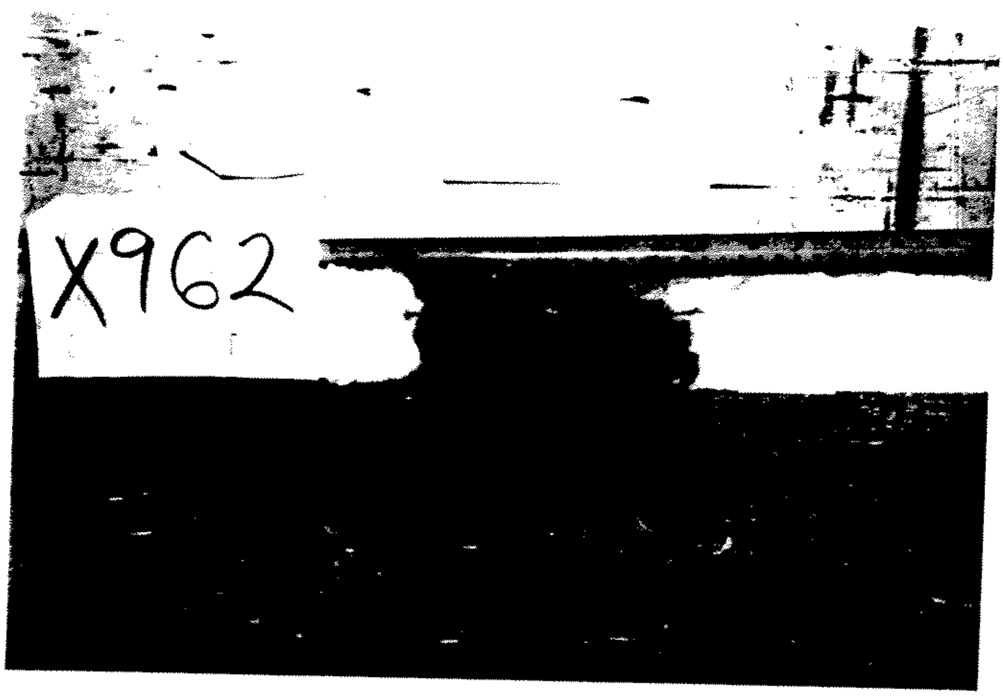
Test x962 at +380 mm.



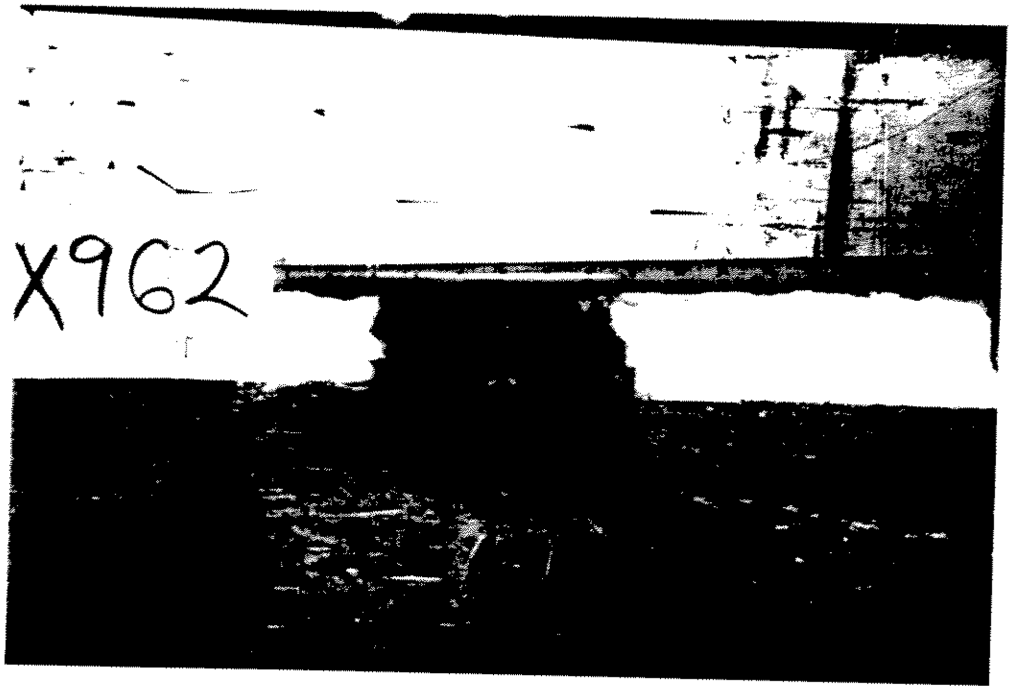
Test x962 at +400 mm.



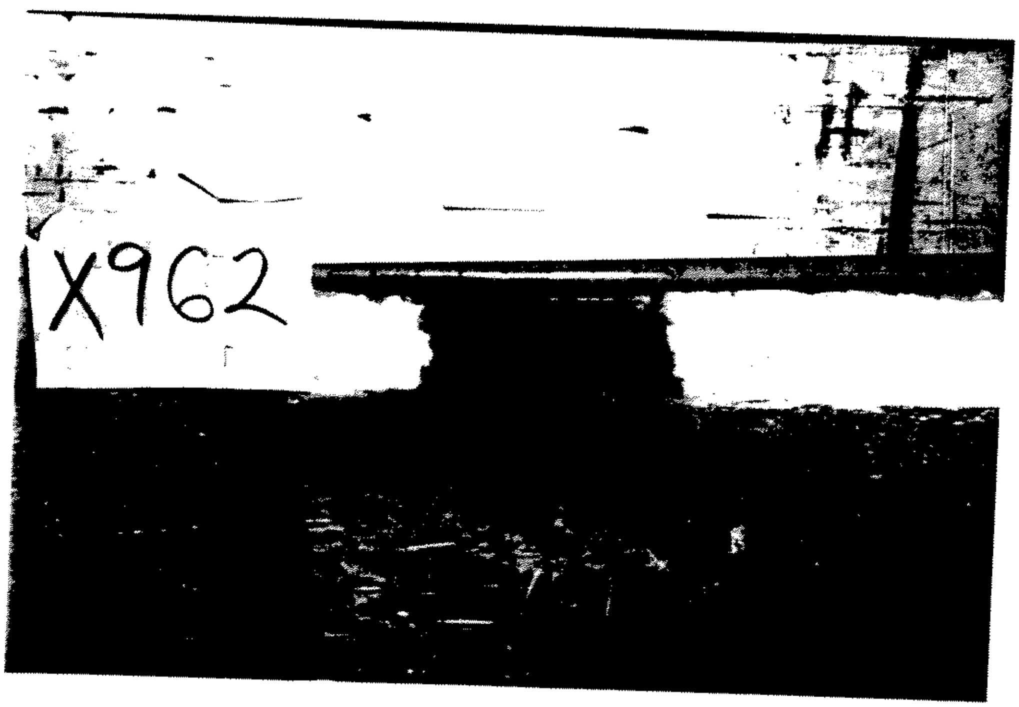
Test x962 at +420 mm.



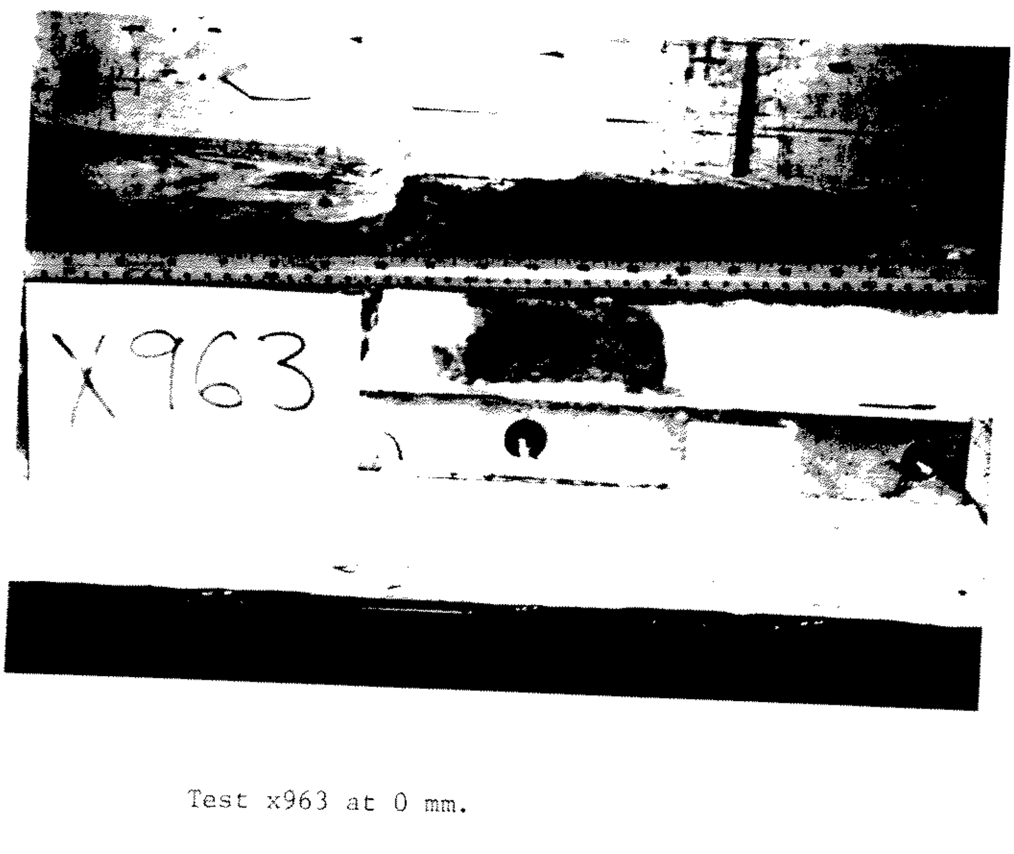
Test x962 at +440 mm.



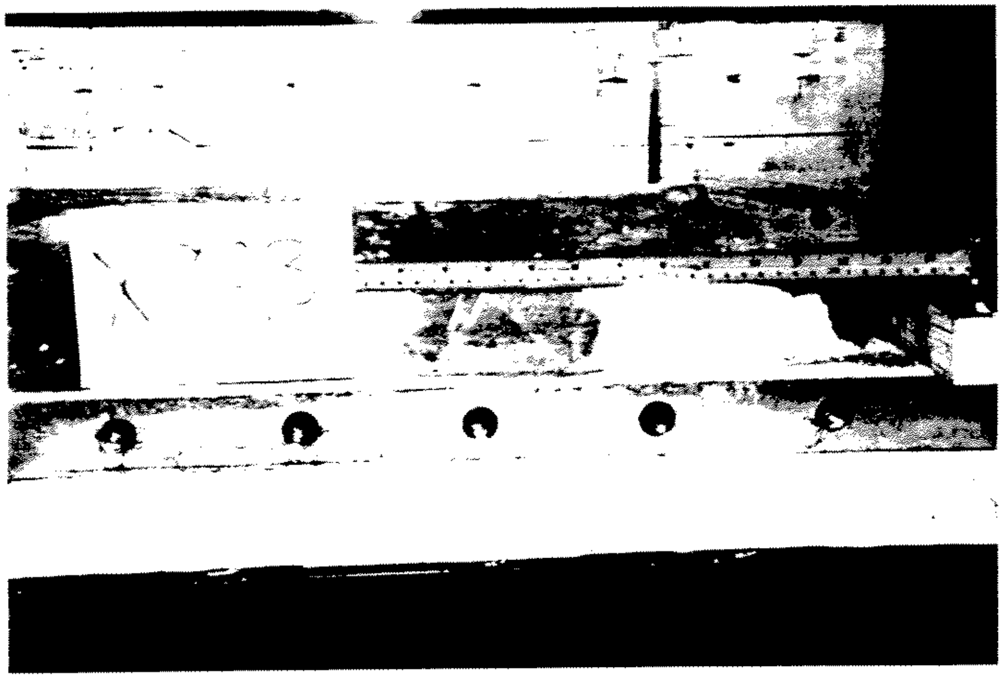
Test x962 at +460 mm.



Test x962 at +480 mm.

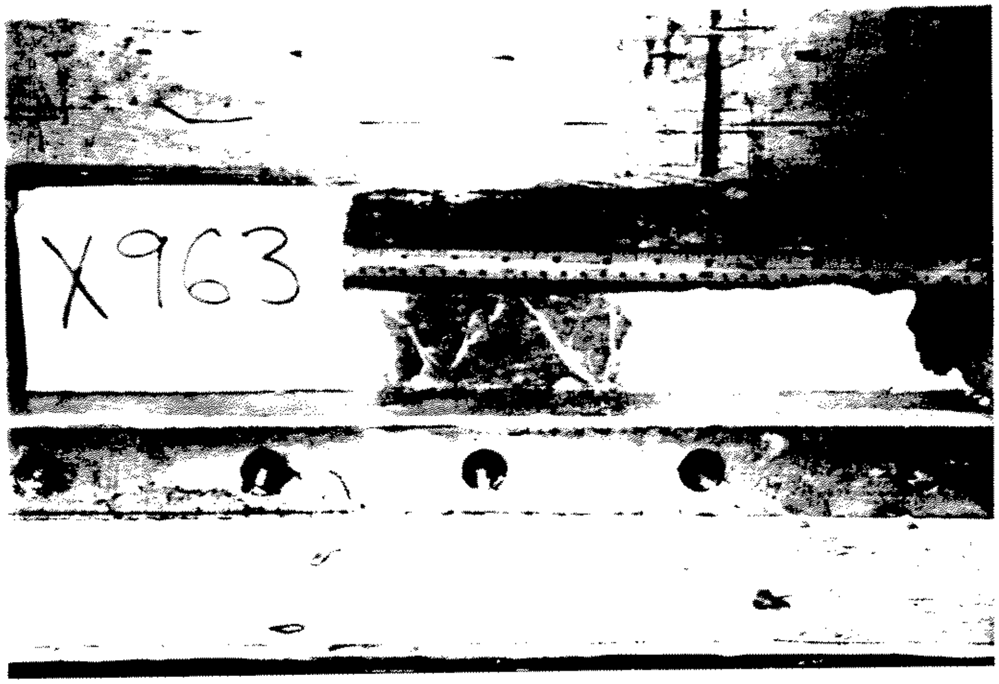


Test x963 at 0 mm.

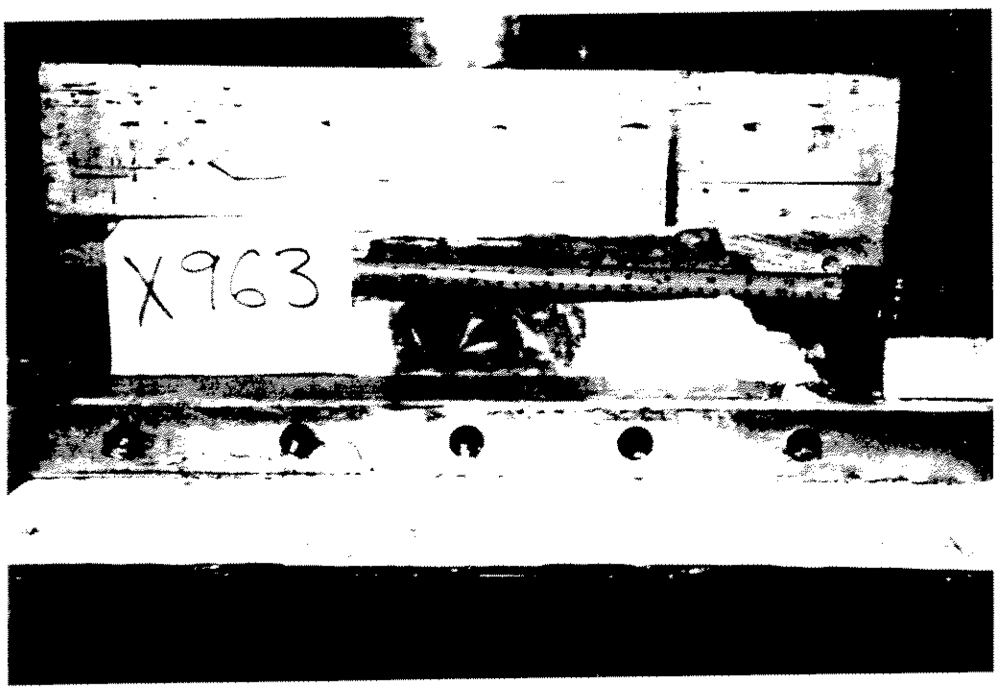


Test x963 at +20 mm.

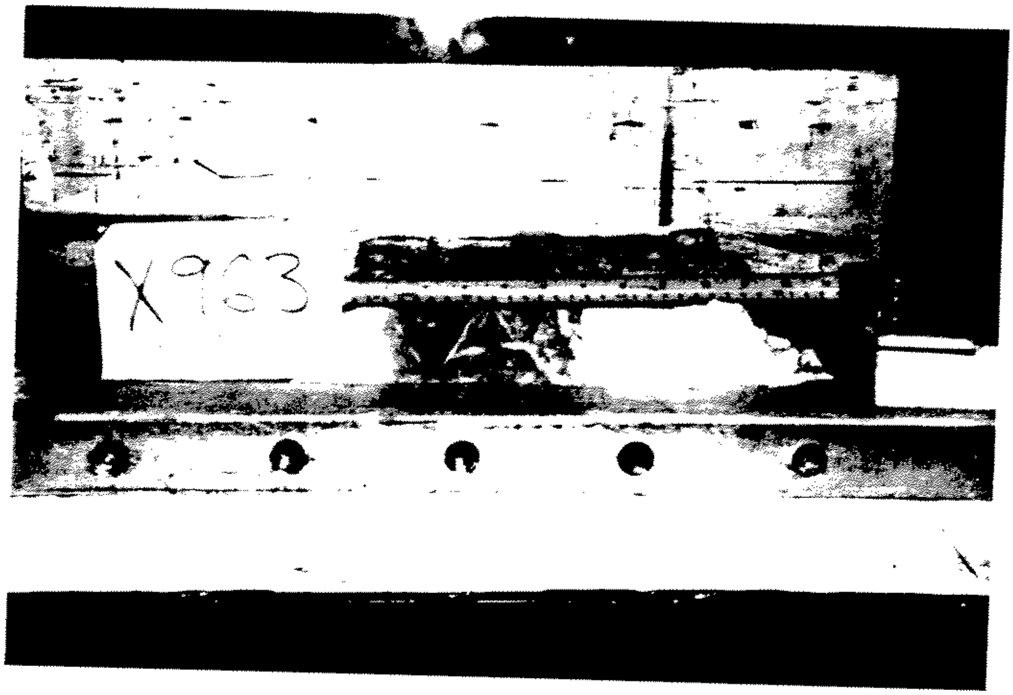
Test x963 at +40 mm.



Test x963 at +60 mm.

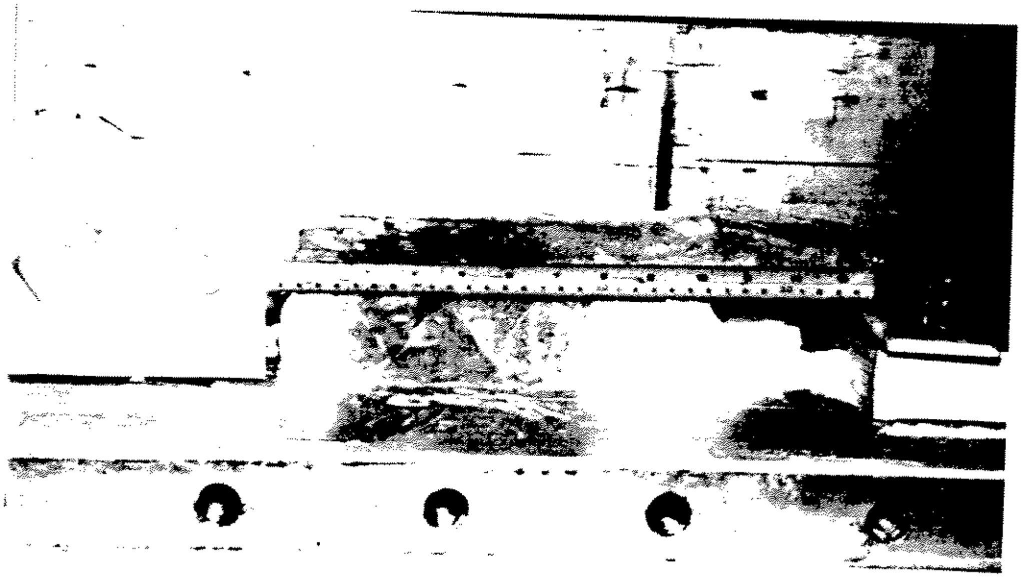


Test x963 at +80 mm.



Test x963 at +100 mm.

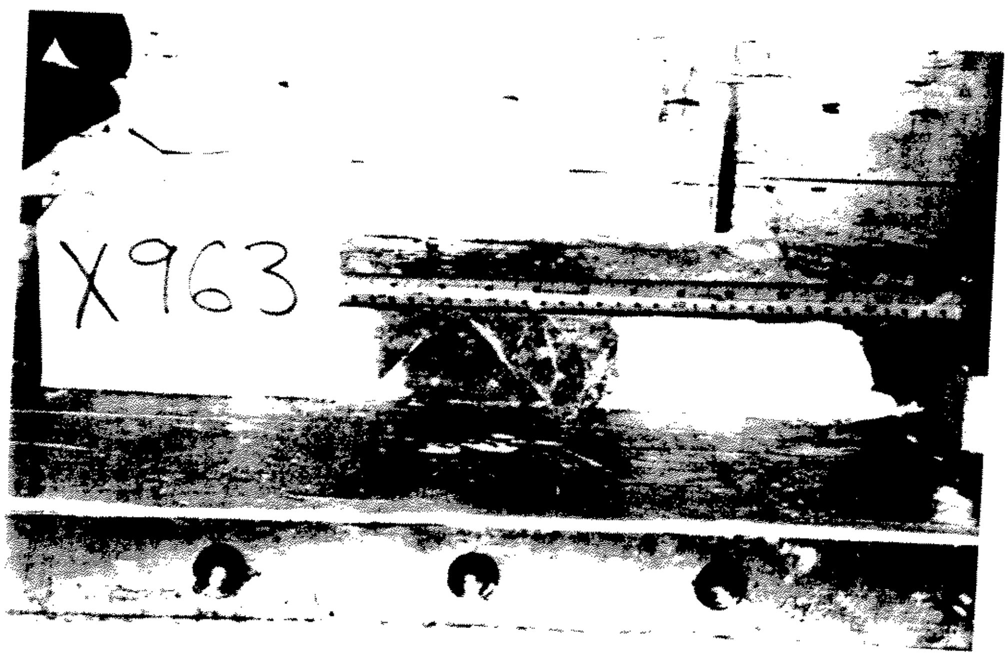
Test x963 at +120 mm.



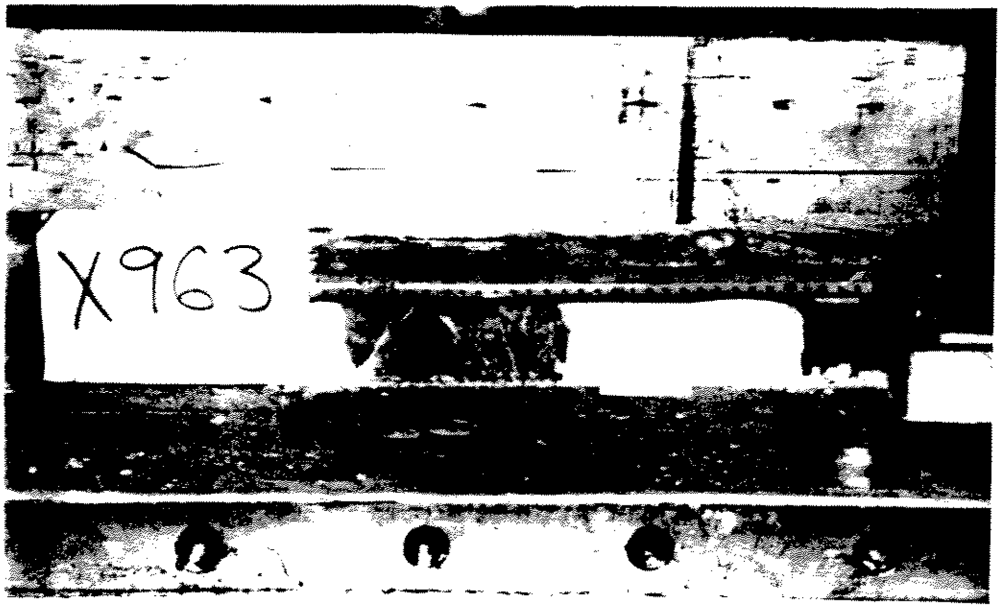
Test x963 at +140 mm.

Test x963 at +160 mm.

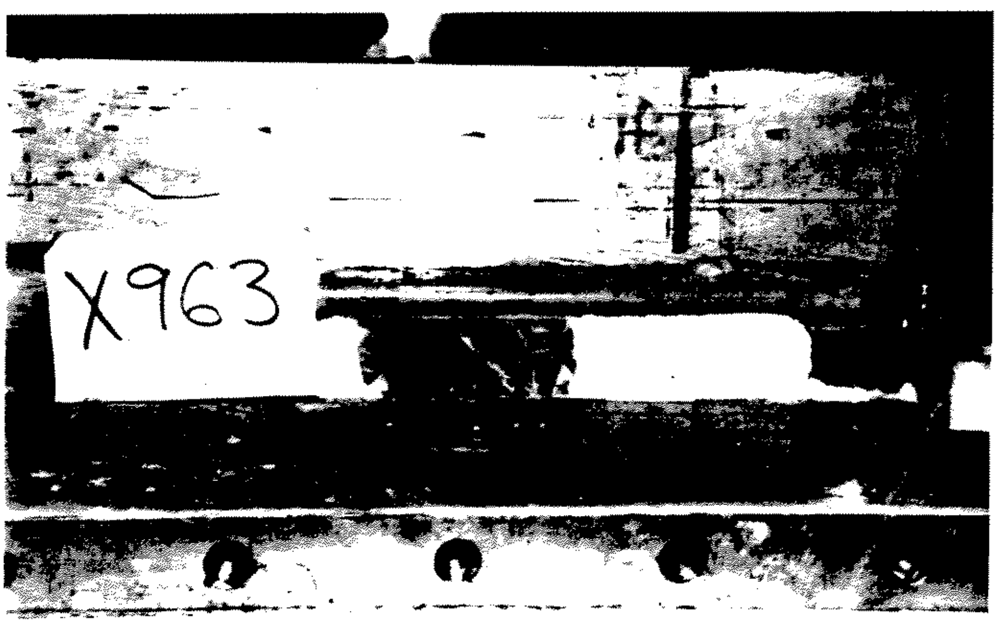
Test x963 at +180 mm.



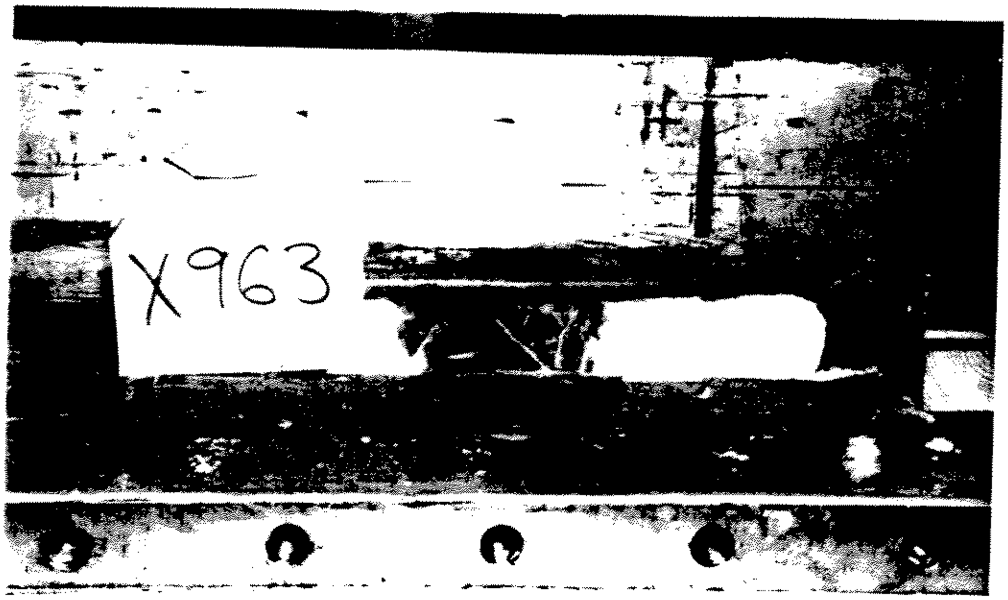
Test x963 at +200 mm.



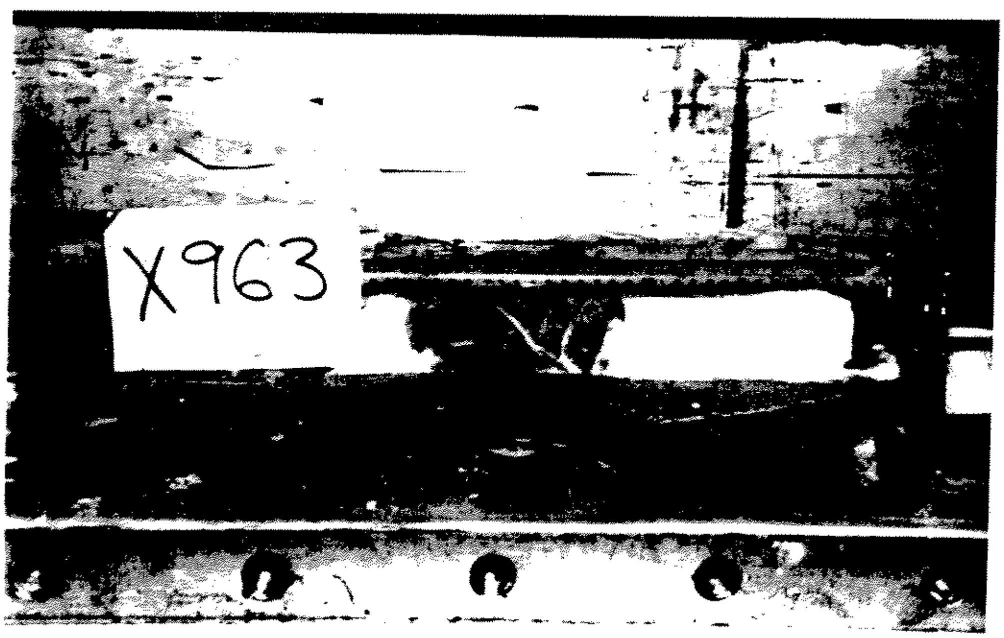
Test x963 at +220 mm.



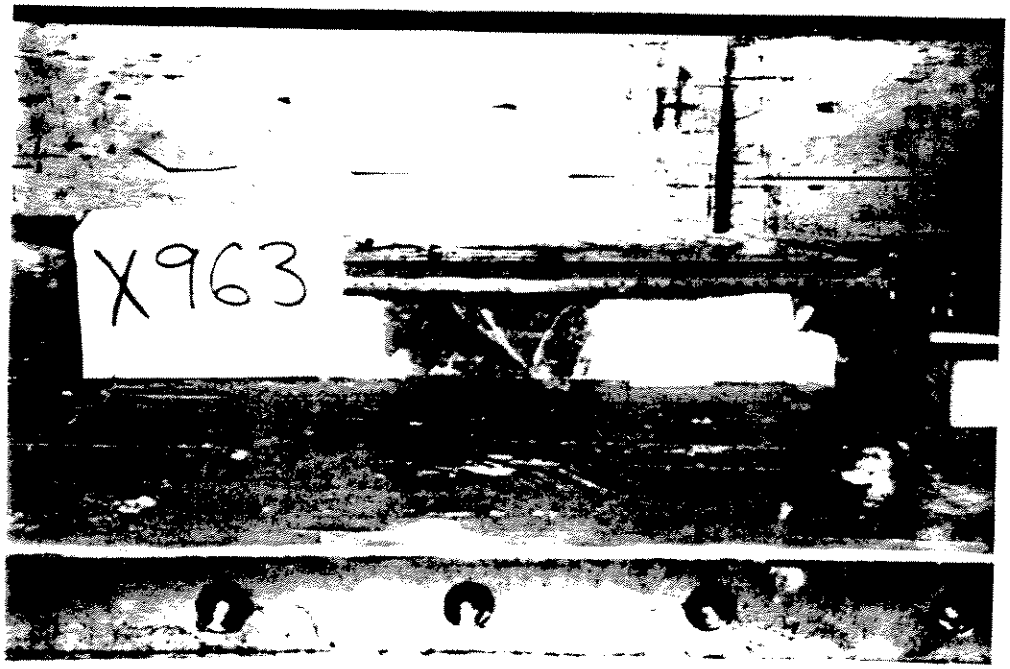
Test x963 at +240 mm.



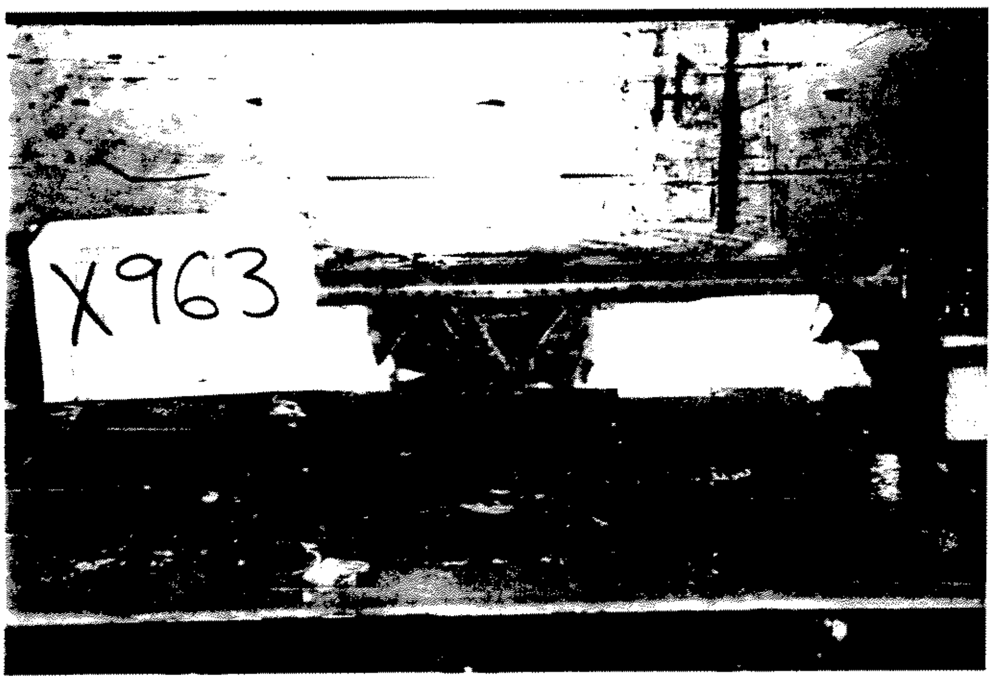
Test x963 at +260 mm.



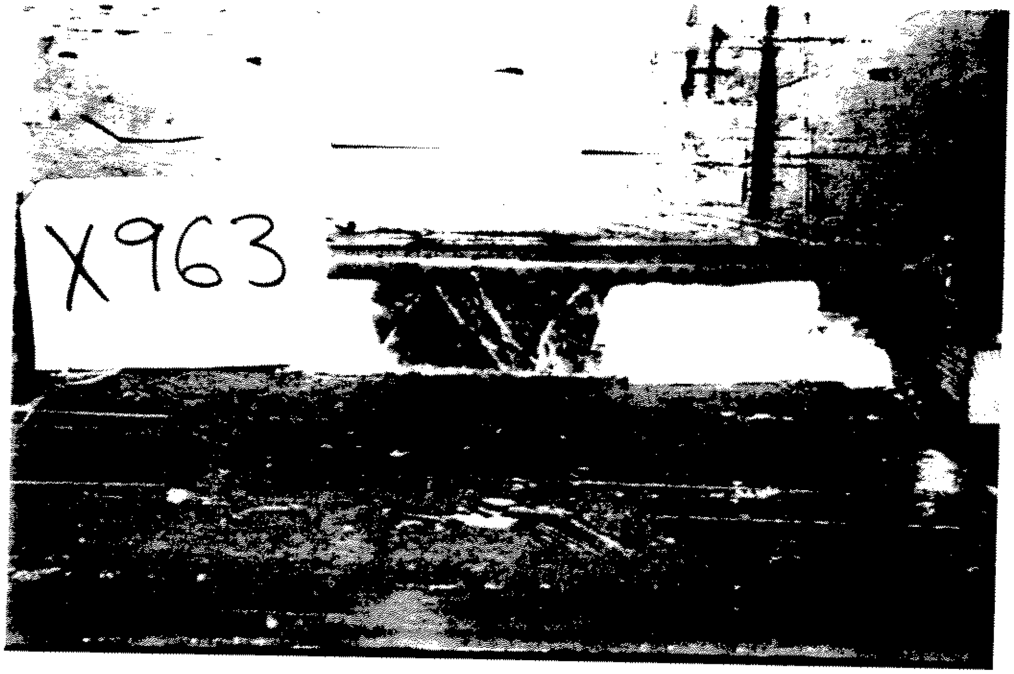
Test x963 at +280 mm.



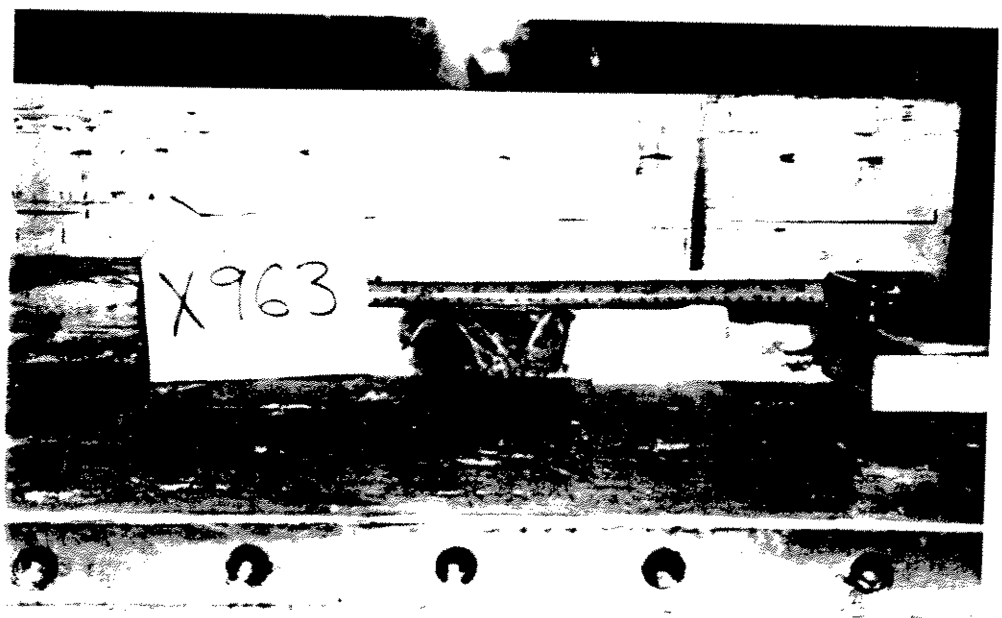
Test x963 at +300 mm.



Test x963 at +320 mm.



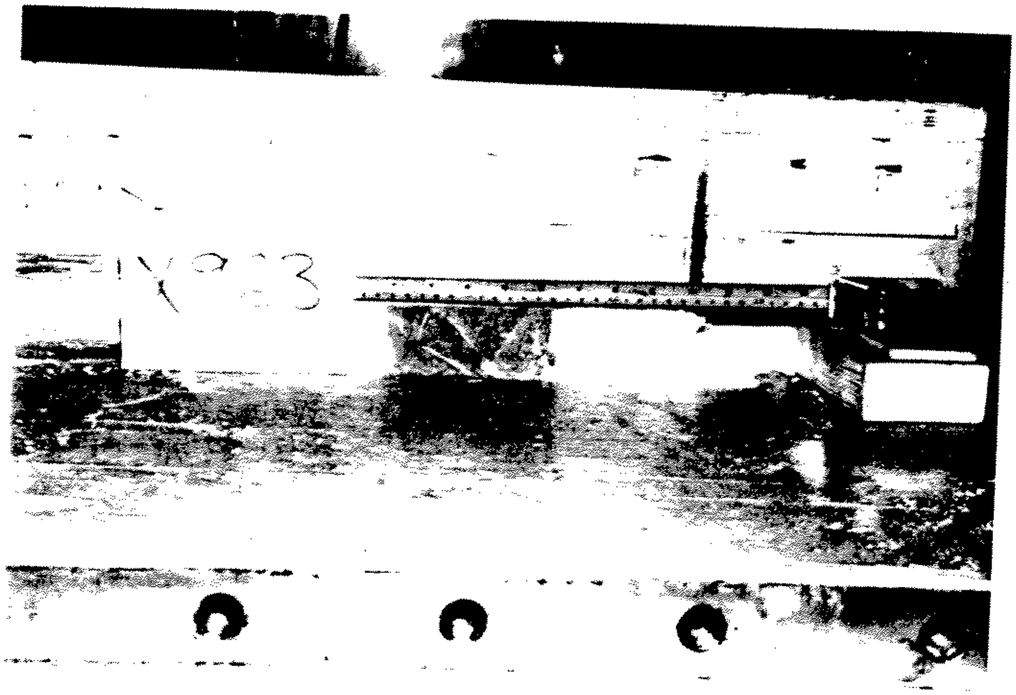
Test x963 at +340 mm.



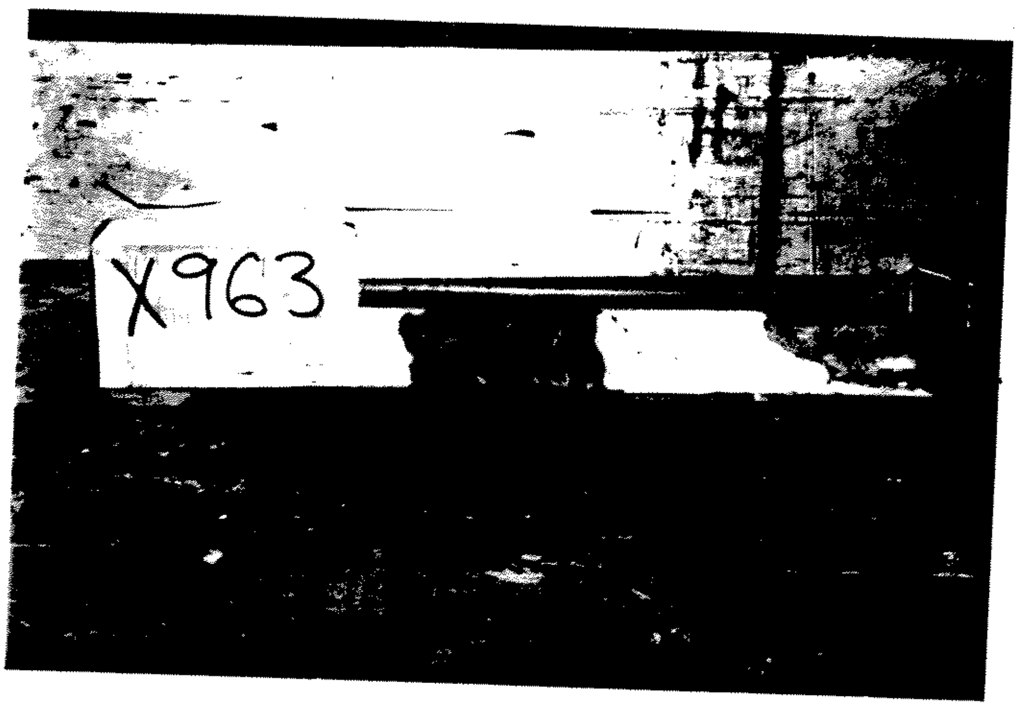
Test x963 at +360 mm.

Test x963 at +380 mm.

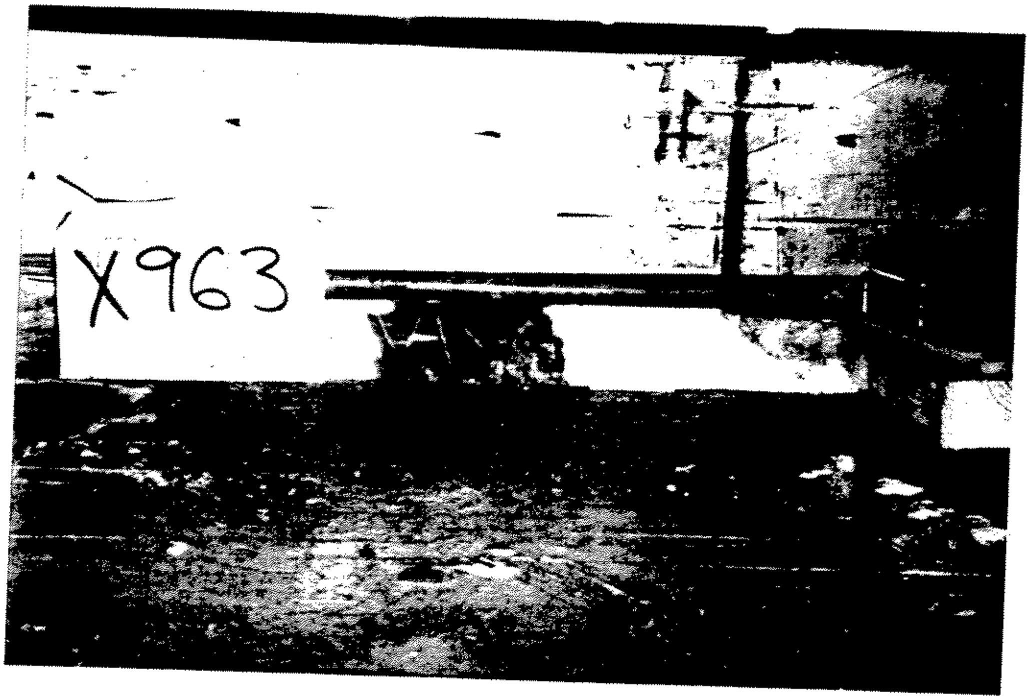
Test x963 at +400 mm.



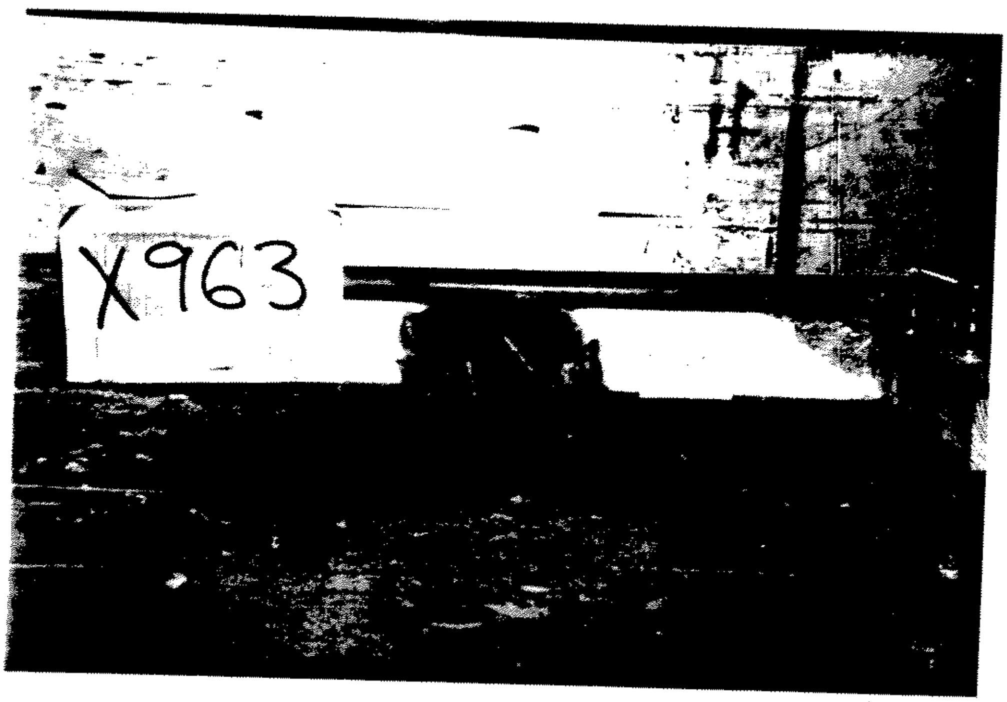
Test x963 at +420 mm.



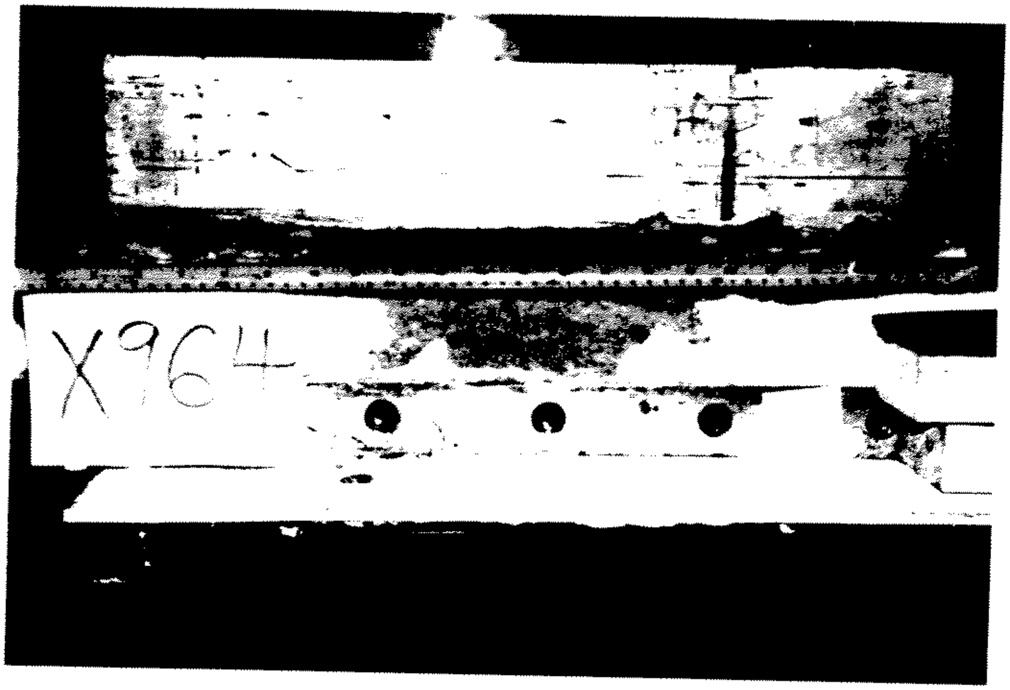
Test x963 at +440 mm.



Test x963 at +460 mm.

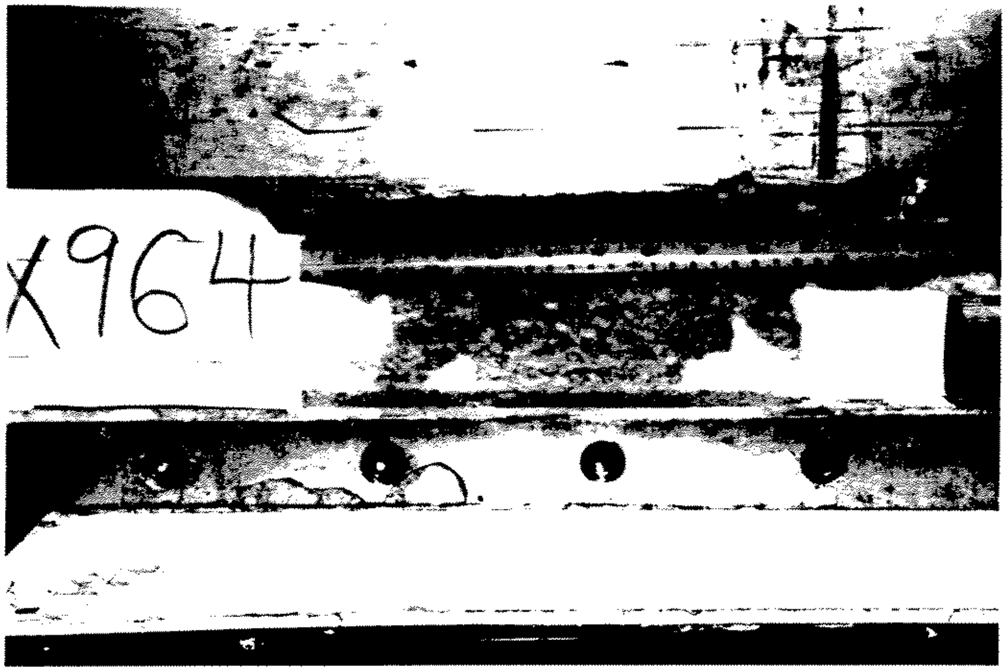


Test x963 at +480 mm.

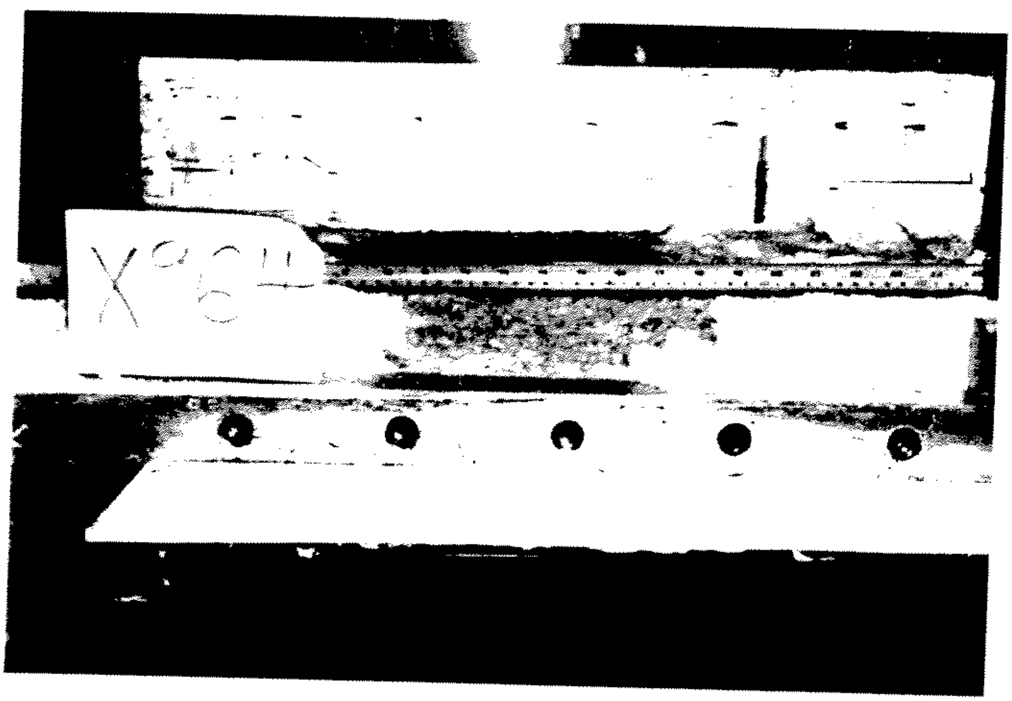


Test x964 at 0 mm.

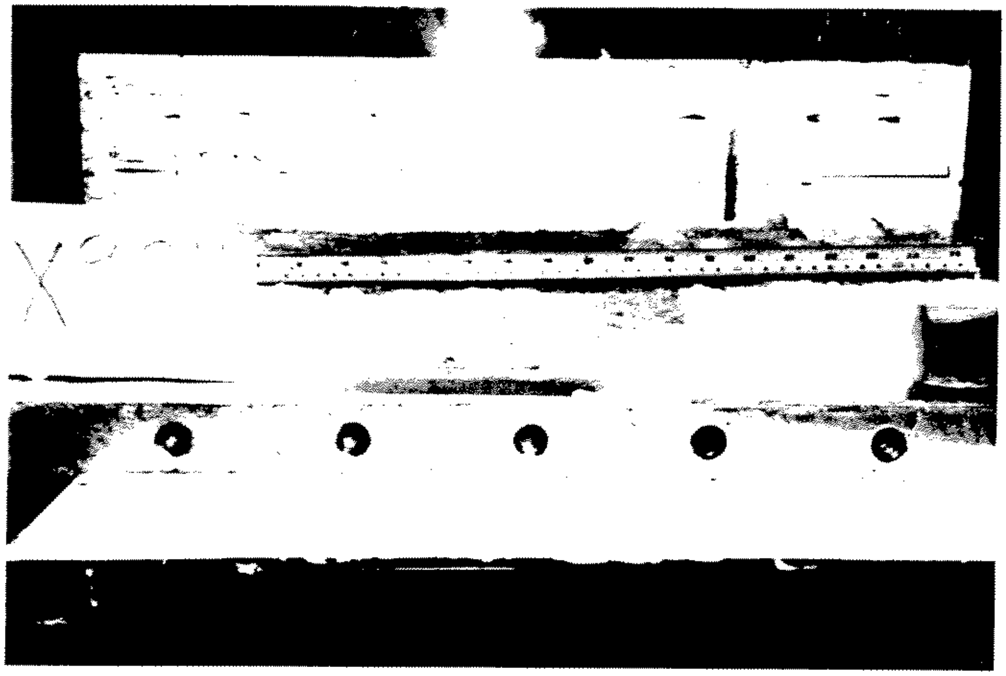
Test x964 at +20 mm.



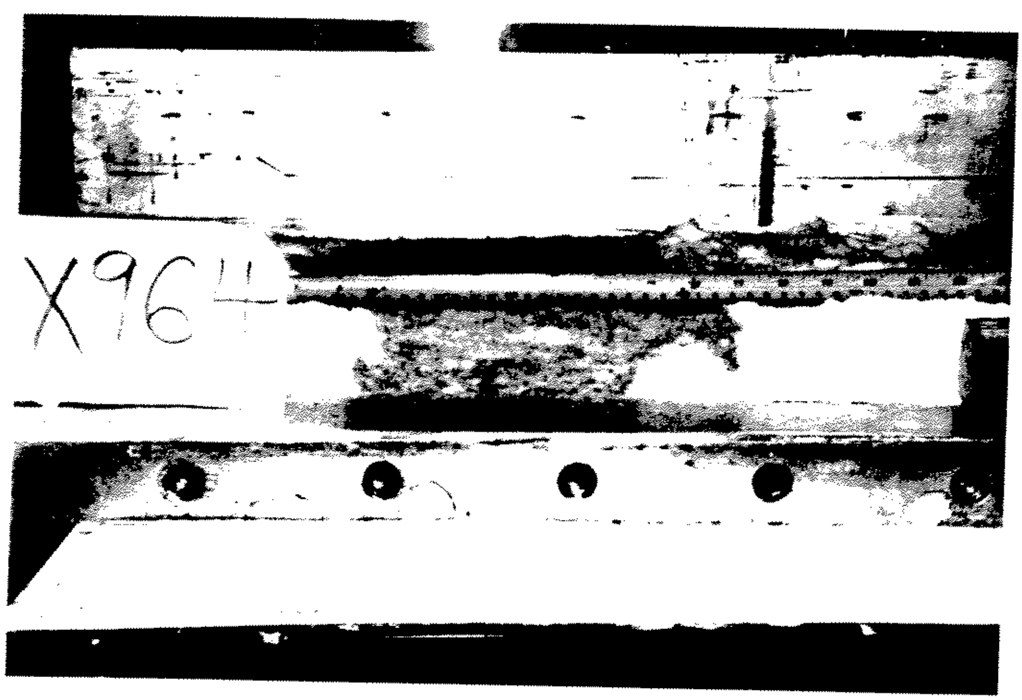
Test x964 at +40 mm.



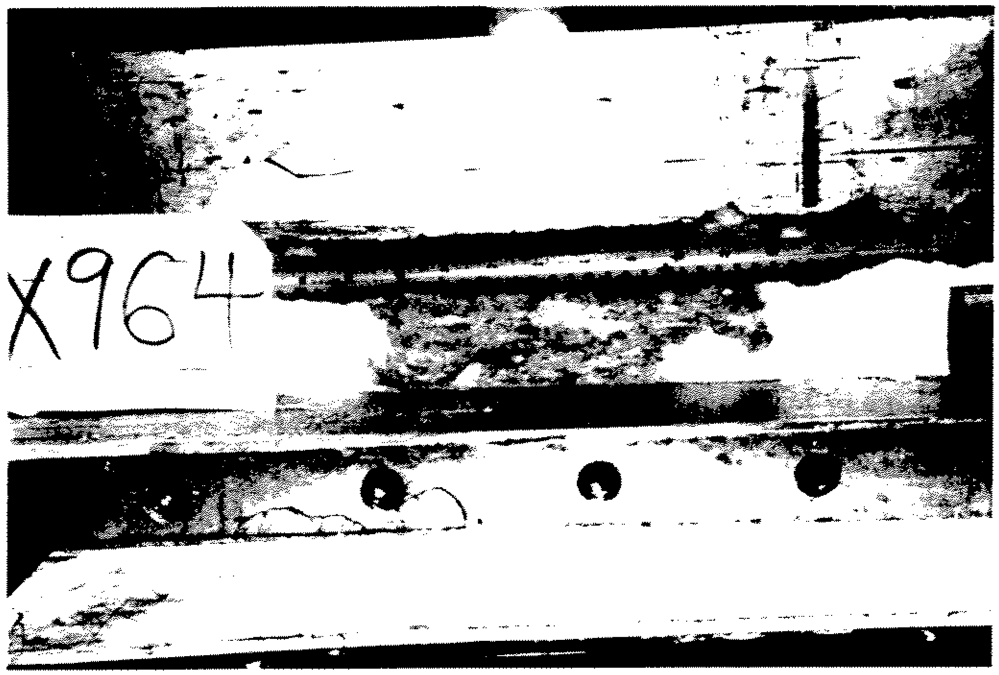
Test x 964 at +60 mm.



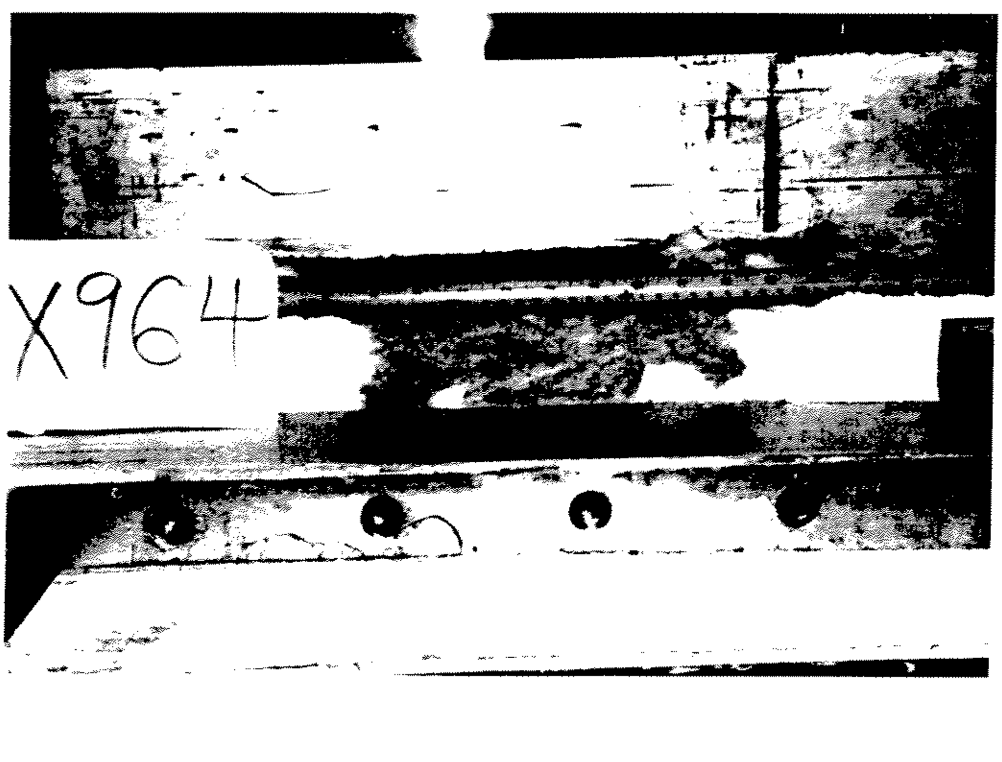
Test x964 at +80 mm.



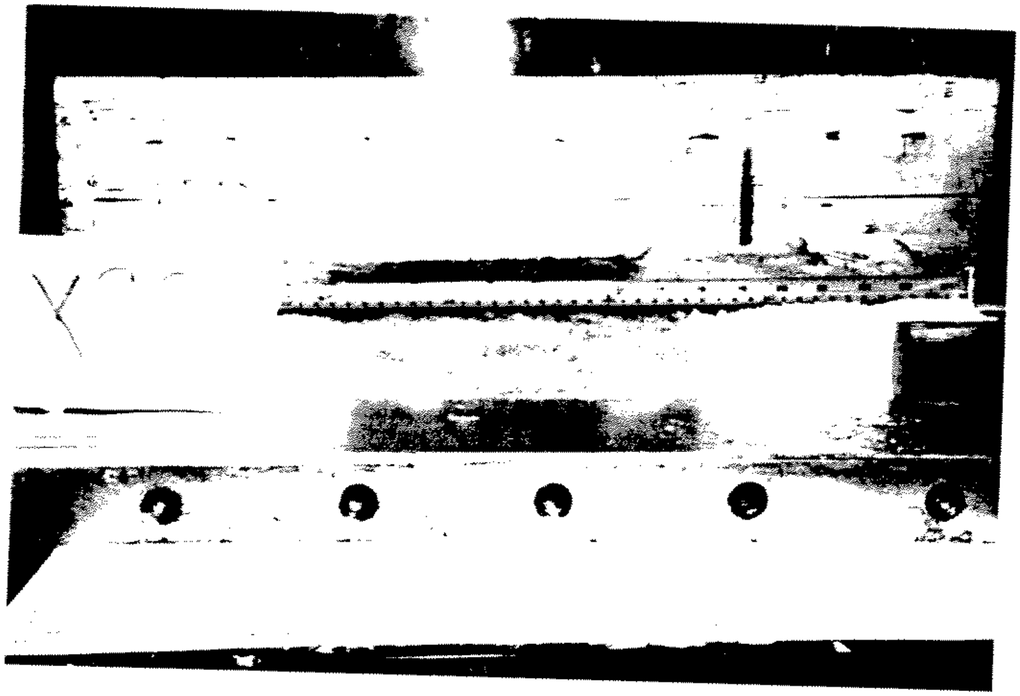
Test x964 at +100 mm.



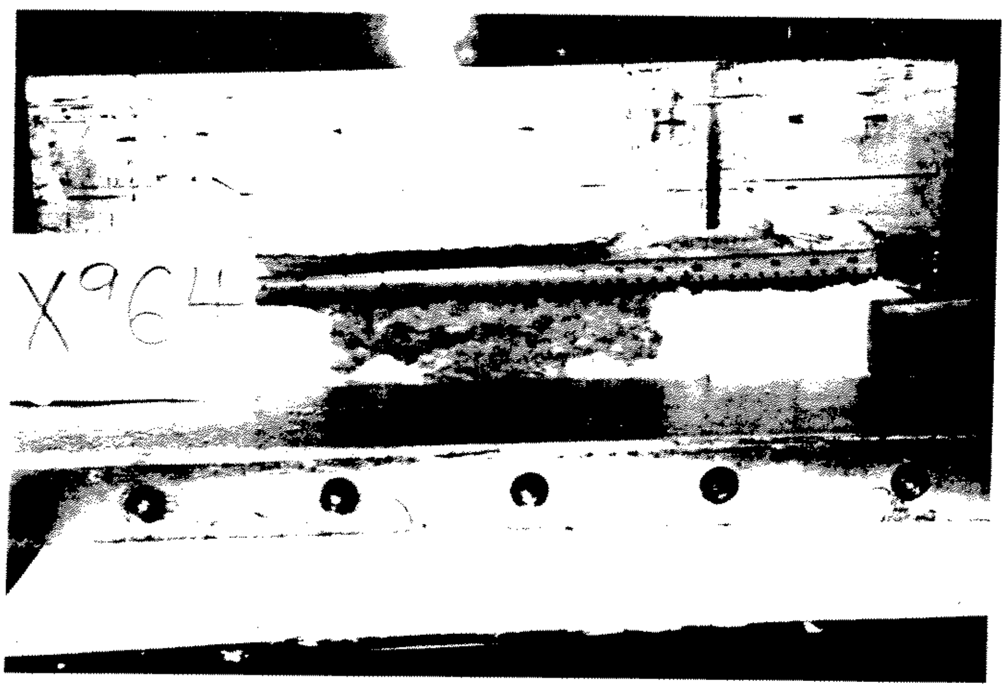
Test x964 at +120 mm.



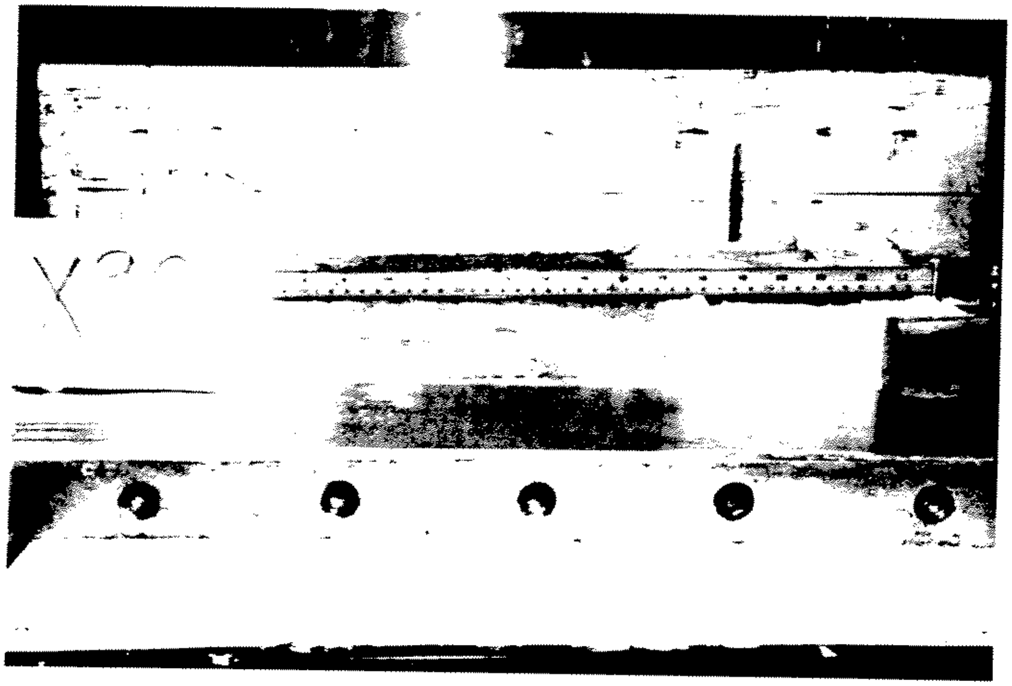
Test x964 at +140 mm.



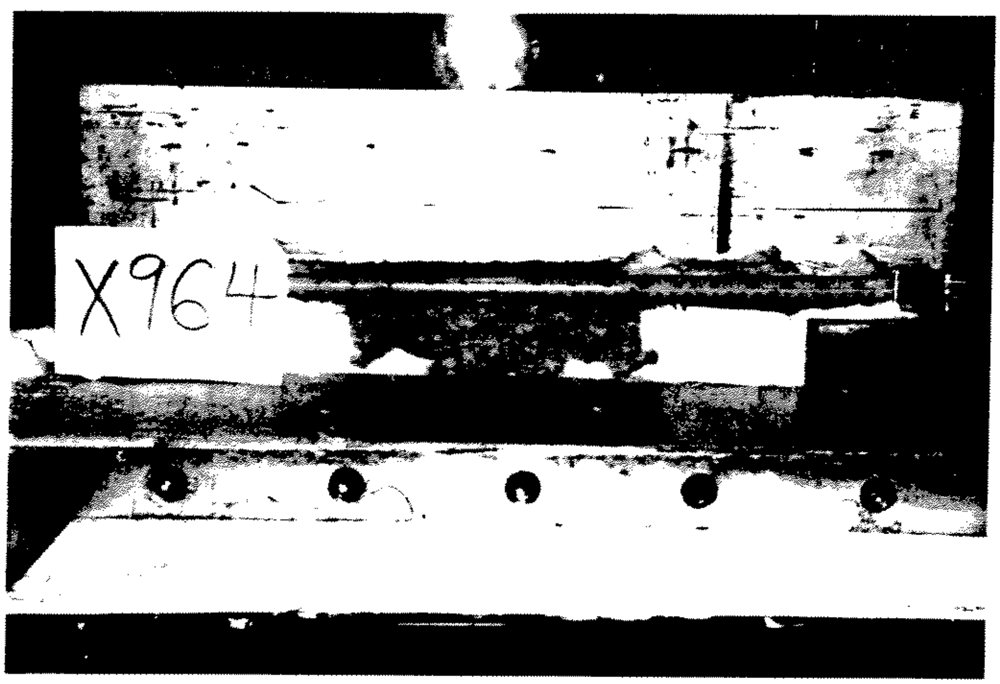
Test x964 at +160 mm.



Test x964 at +180 mm.

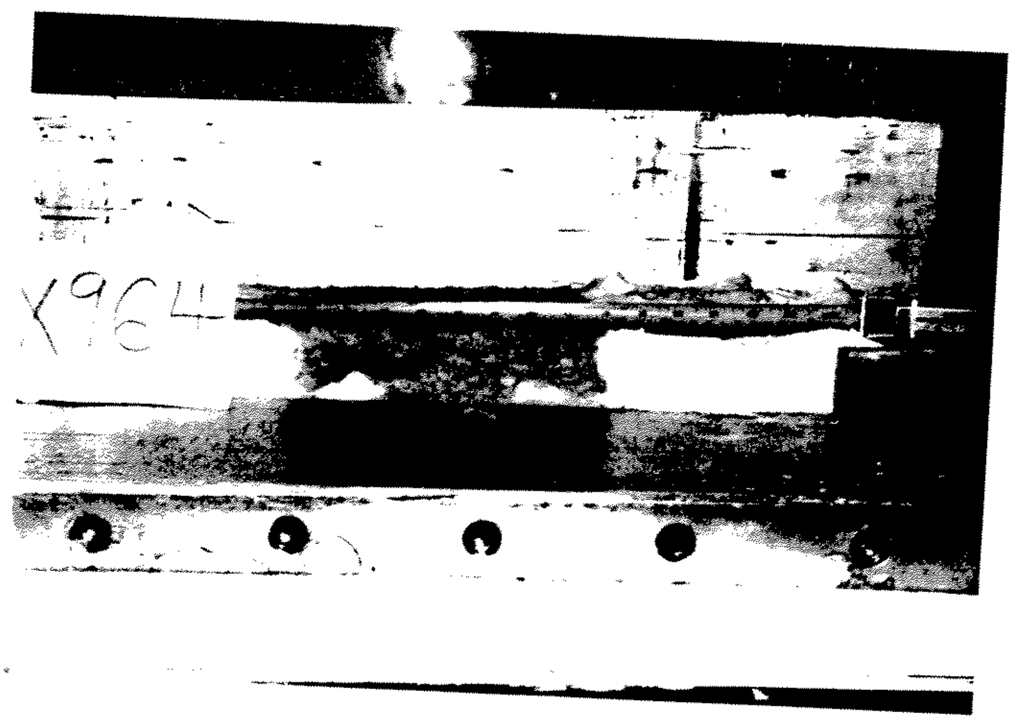


Test x964 at +200 mm.

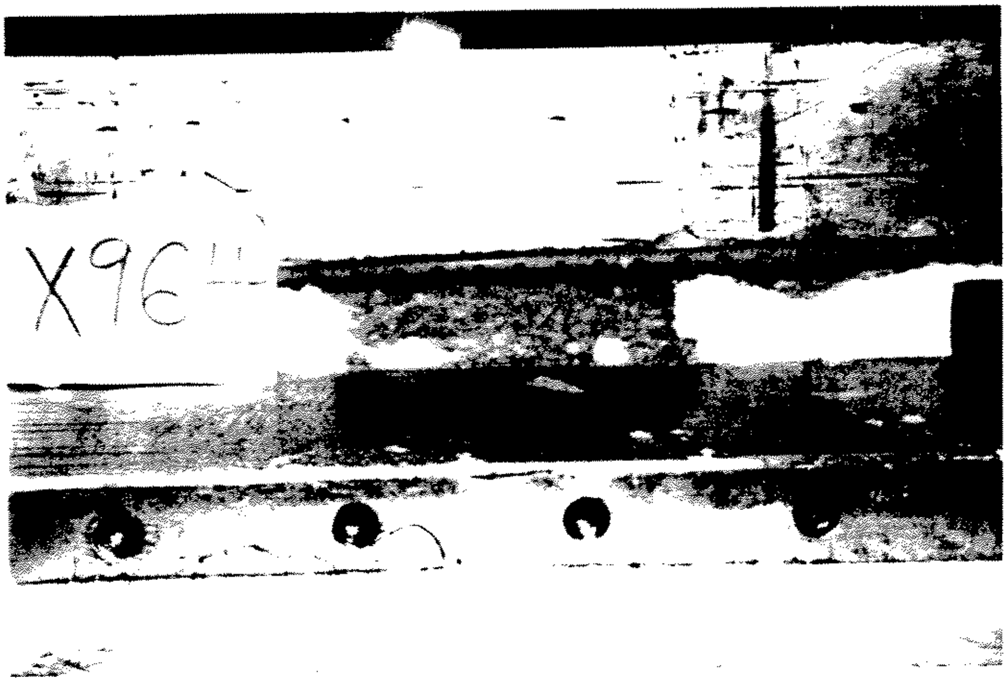


Test x964 at +220 mm.

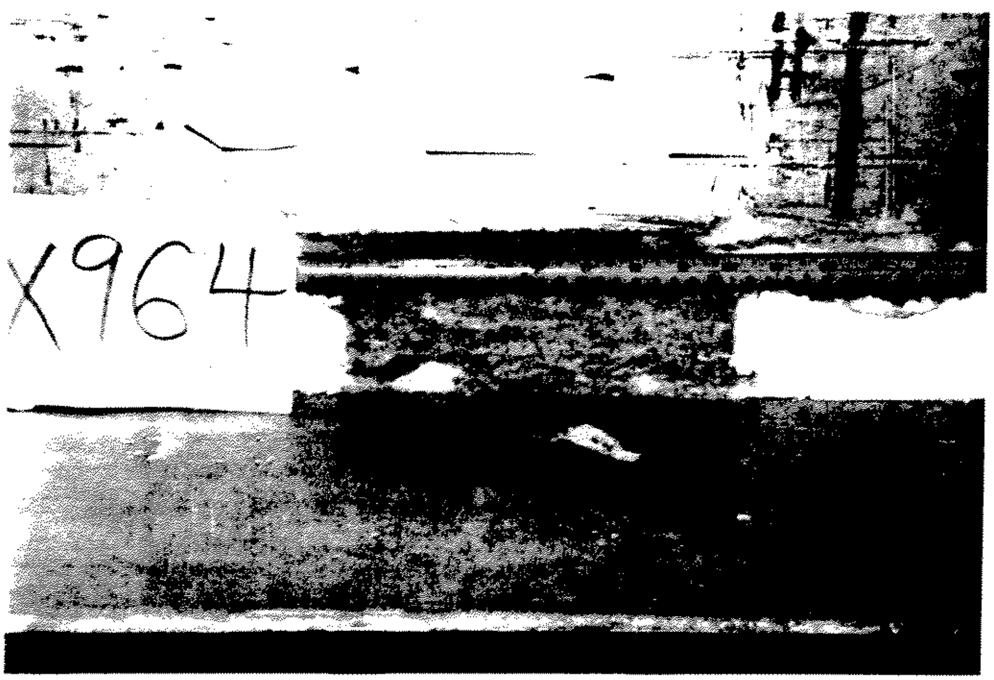
Test x964 at +240 mm.



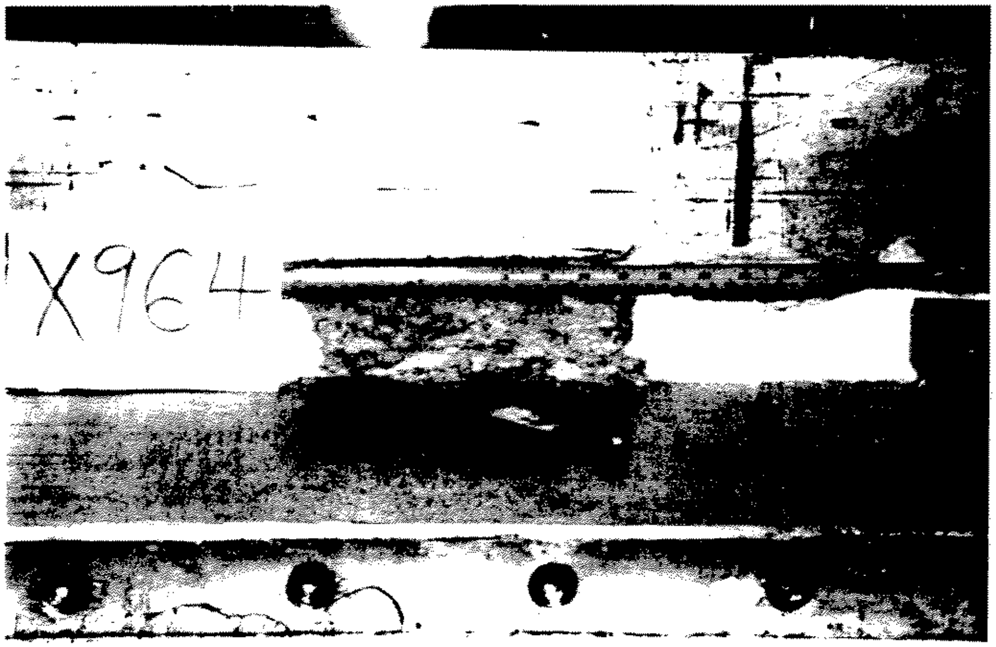
Test x964 at +260 mm.



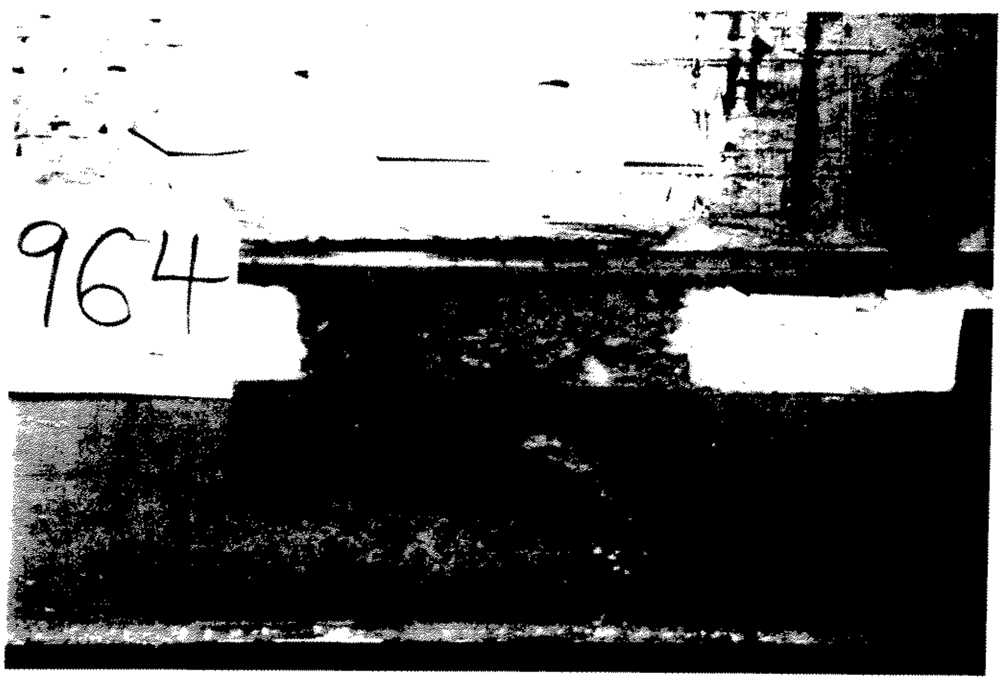
Test x964 at +280 mm.



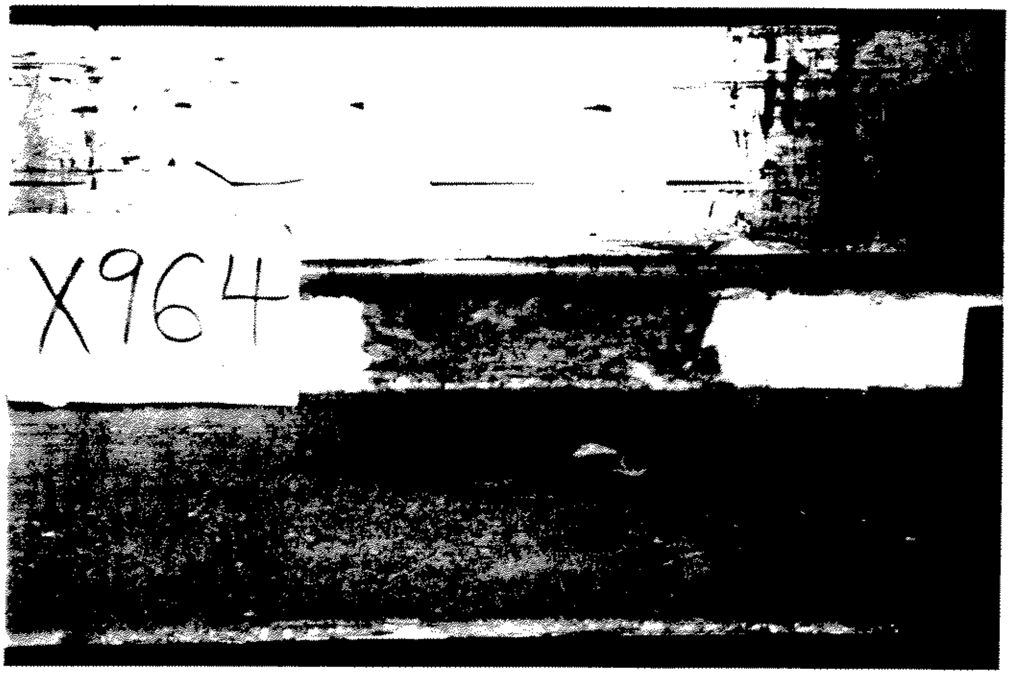
Test x964 at +300 mm.



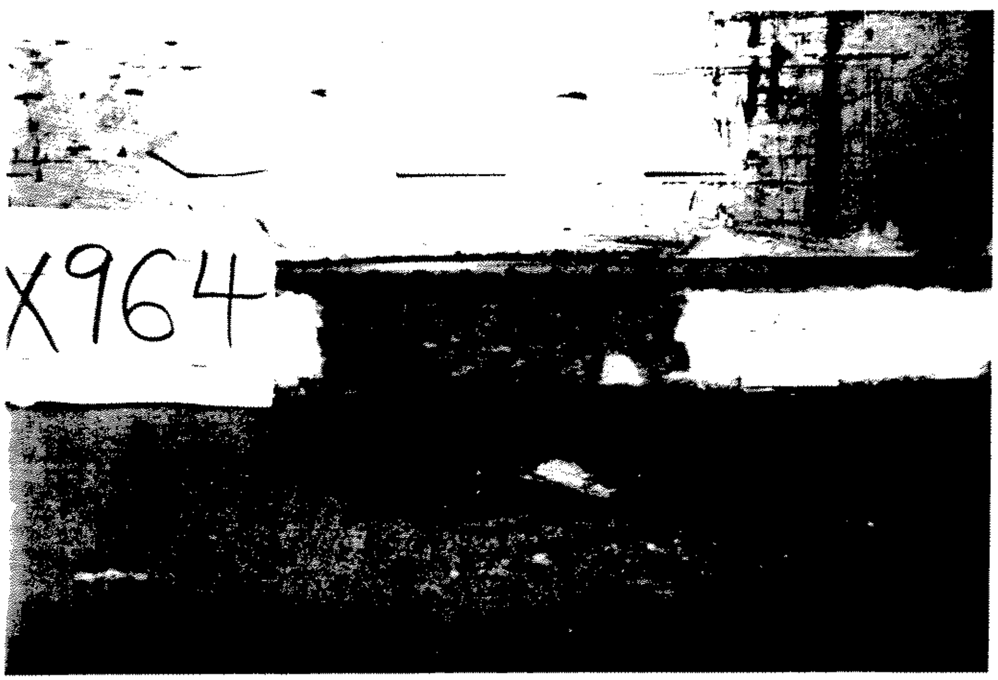
Test x964 at +320 mm.



Test x964 at +340 mm.

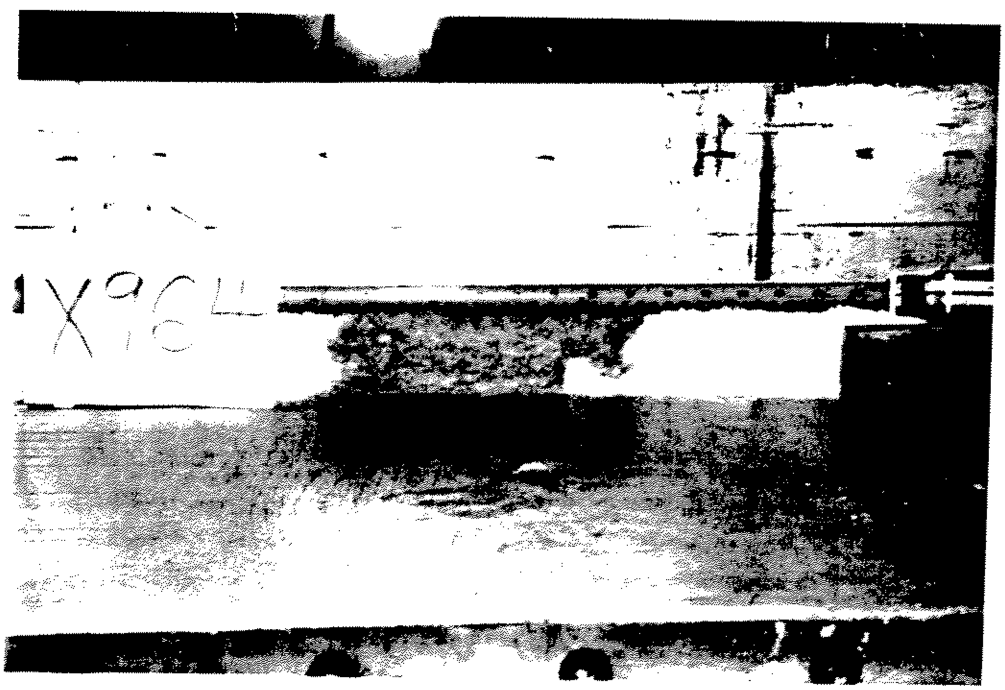


Test x964 at +360 mm.

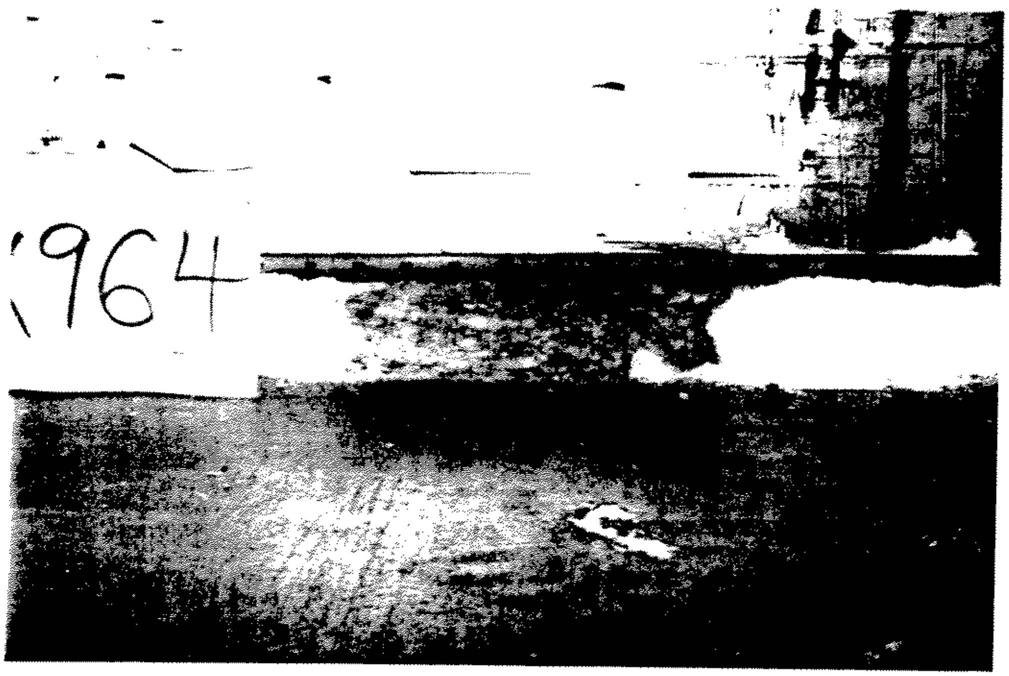


Test x964 at +380 mm.

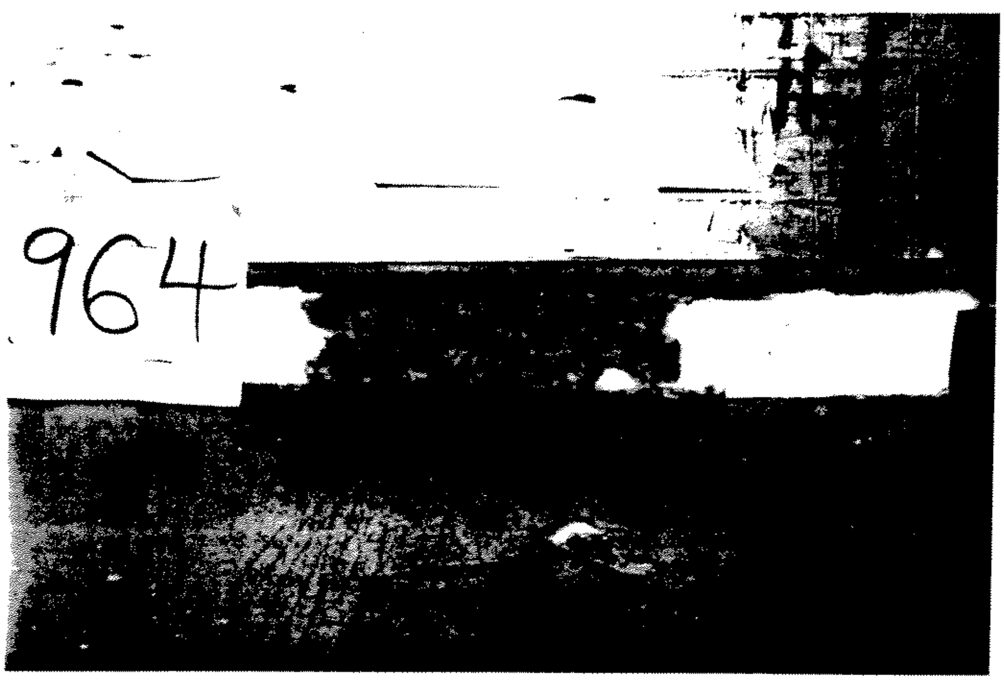
Test x964 at +400 mm.



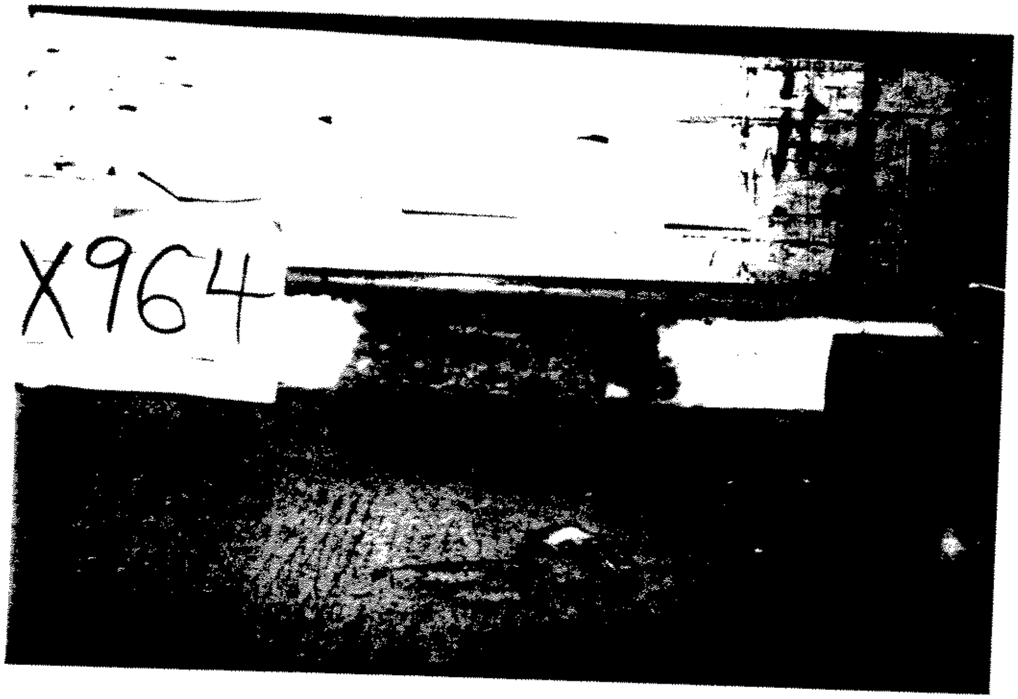
Test x964 at +420 mm.



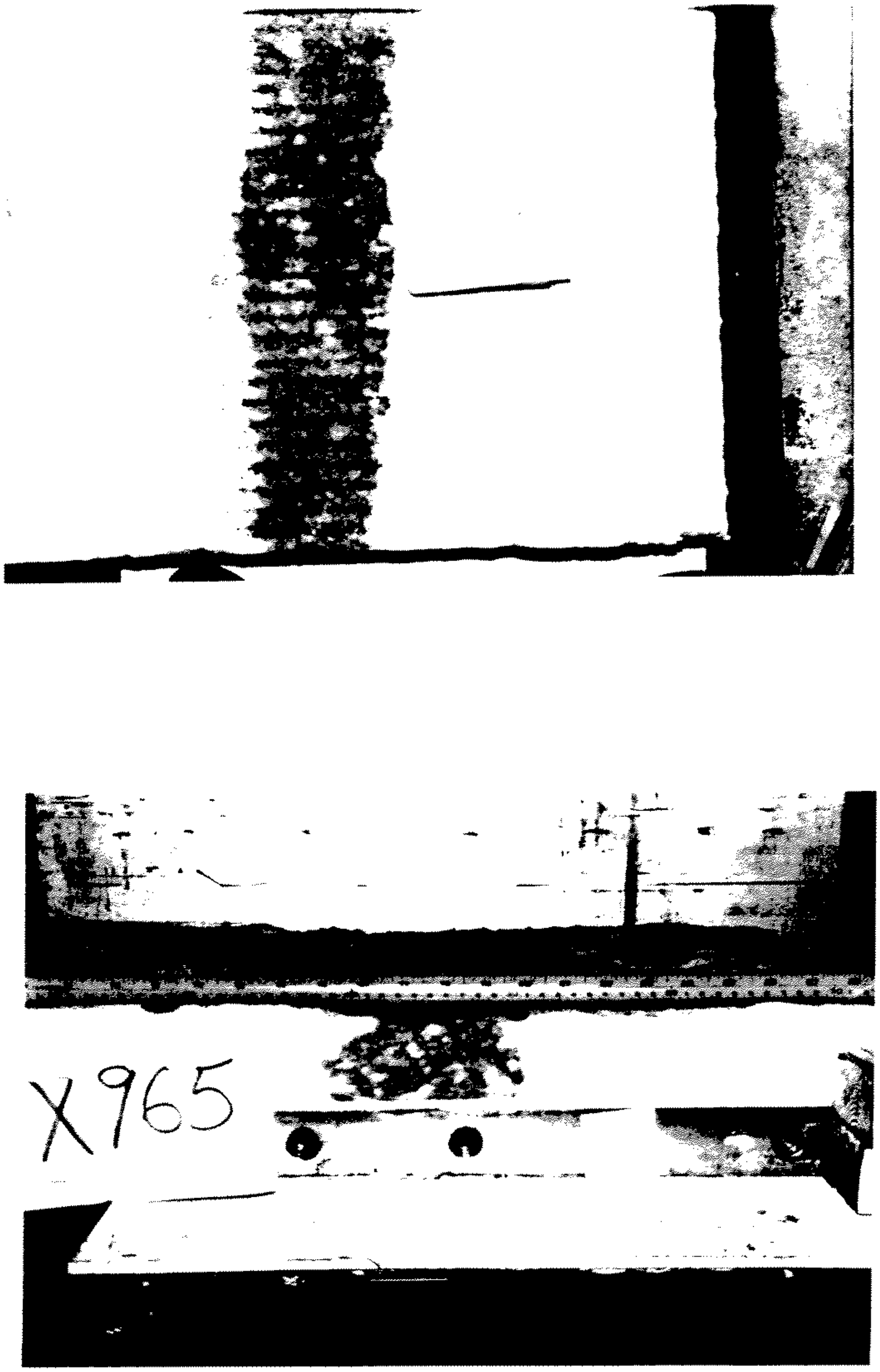
Test x964 at +440 mm.



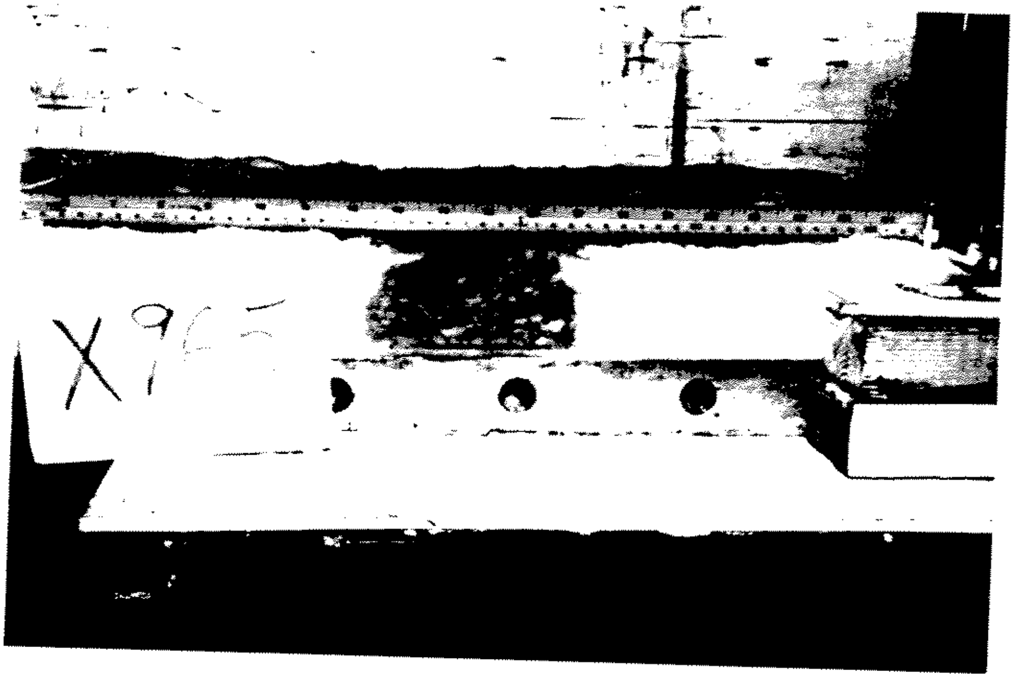
Test x964 at +460 mm.



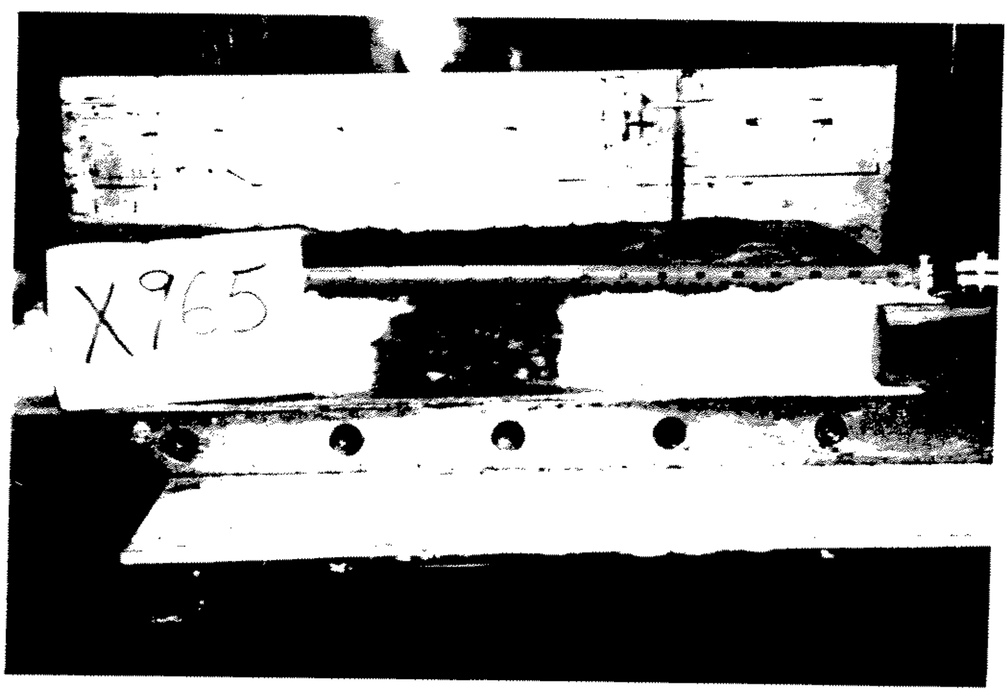
Test x964 at +480 mm.



Test x965 at 0 mm.



Test x965 at +20 mm.



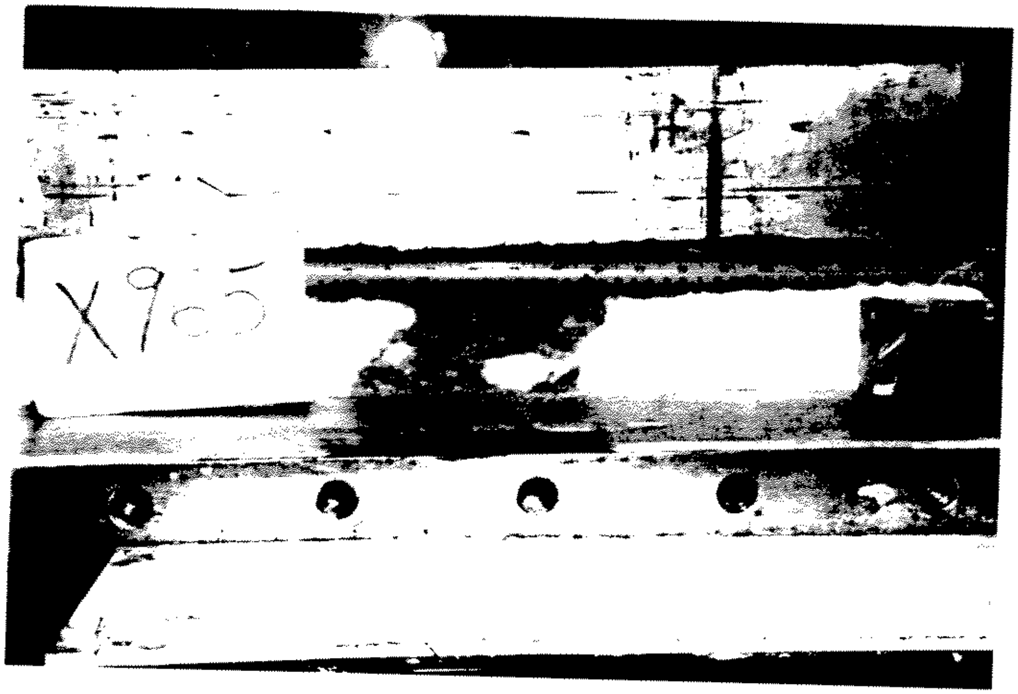
Test x965 at +40 mm.

Test x965 at +80 mm.

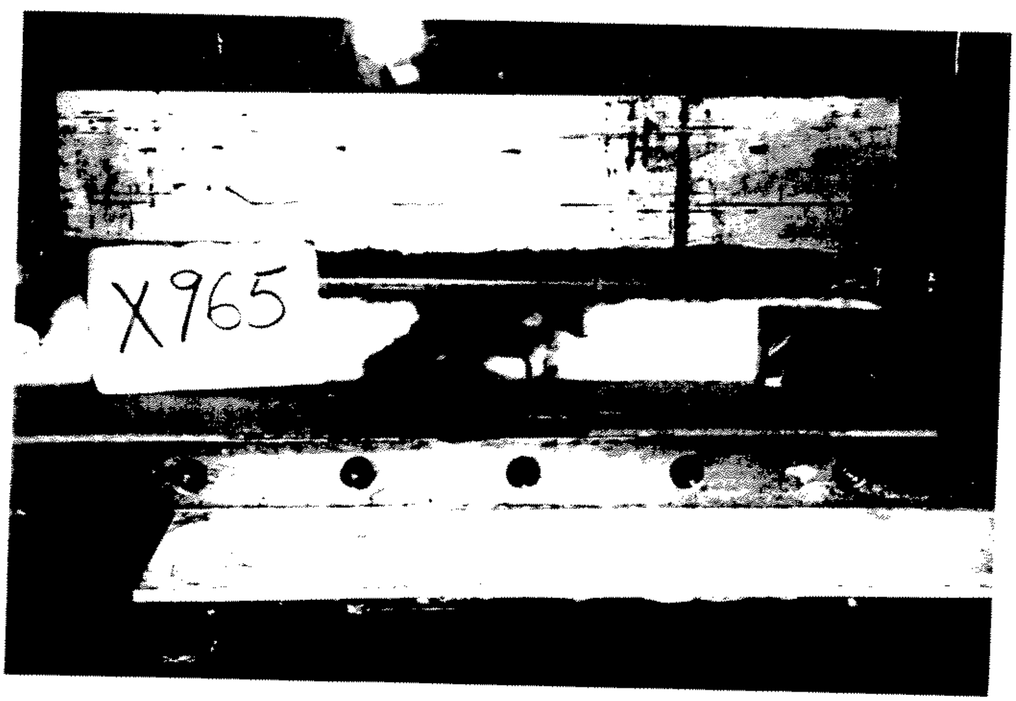
Test x965 at +100 mm.

Test x965 at +120 mm.

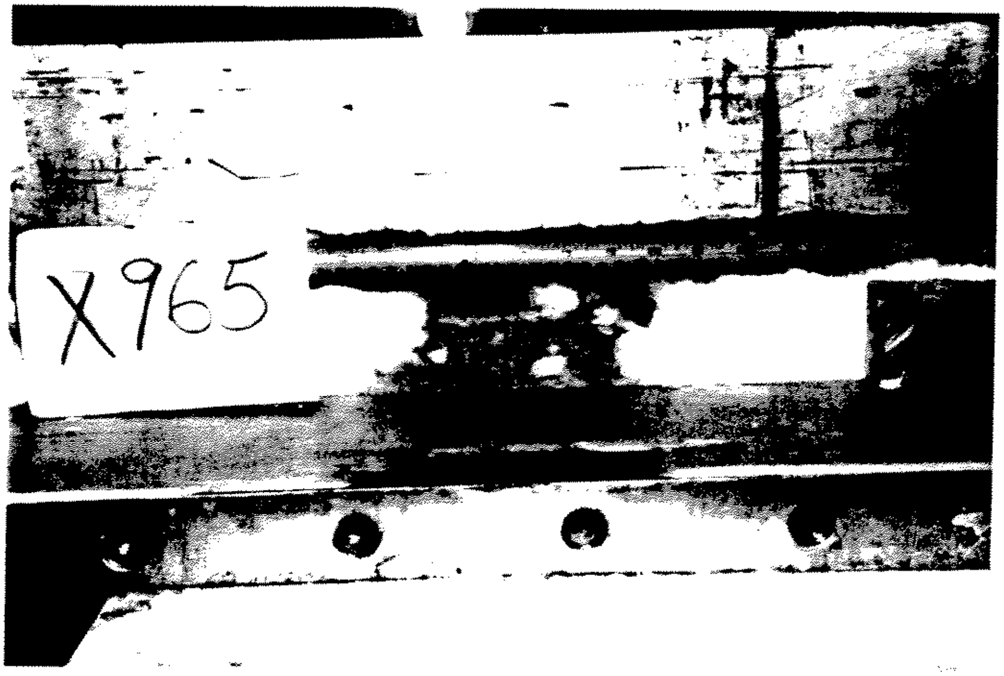
Test x965 at +140 mm.



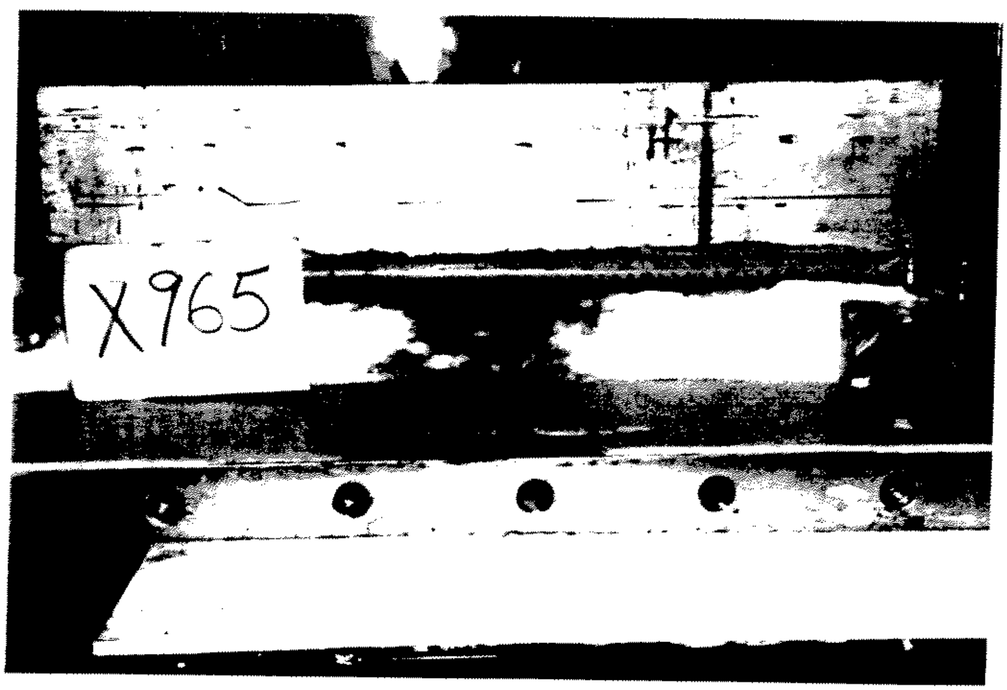
Test x965 at +160 mm.



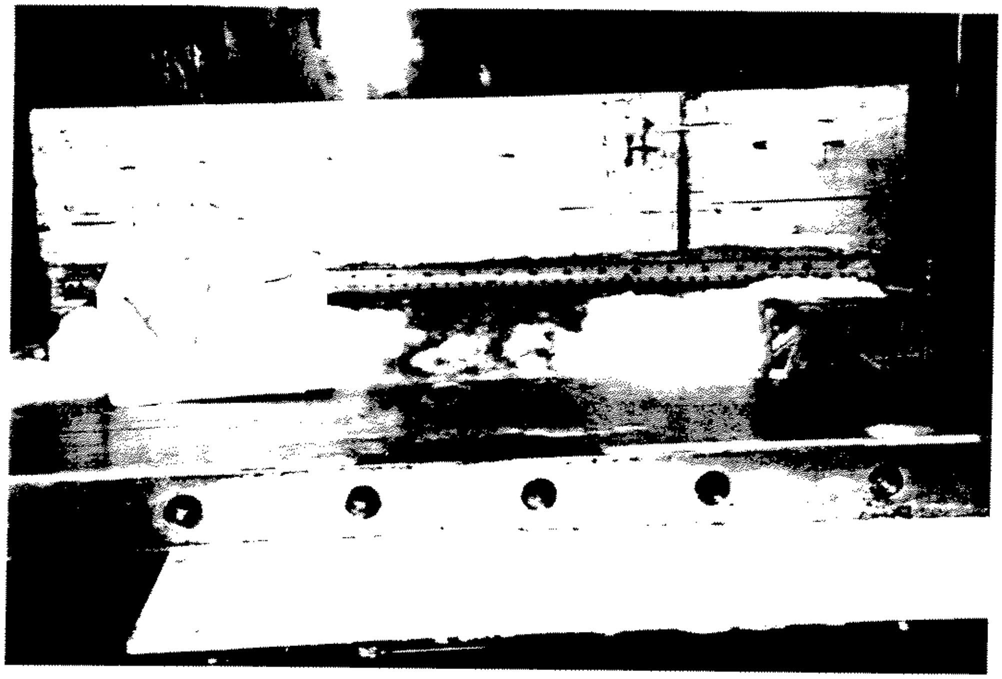
Test x965 at +180 mm.



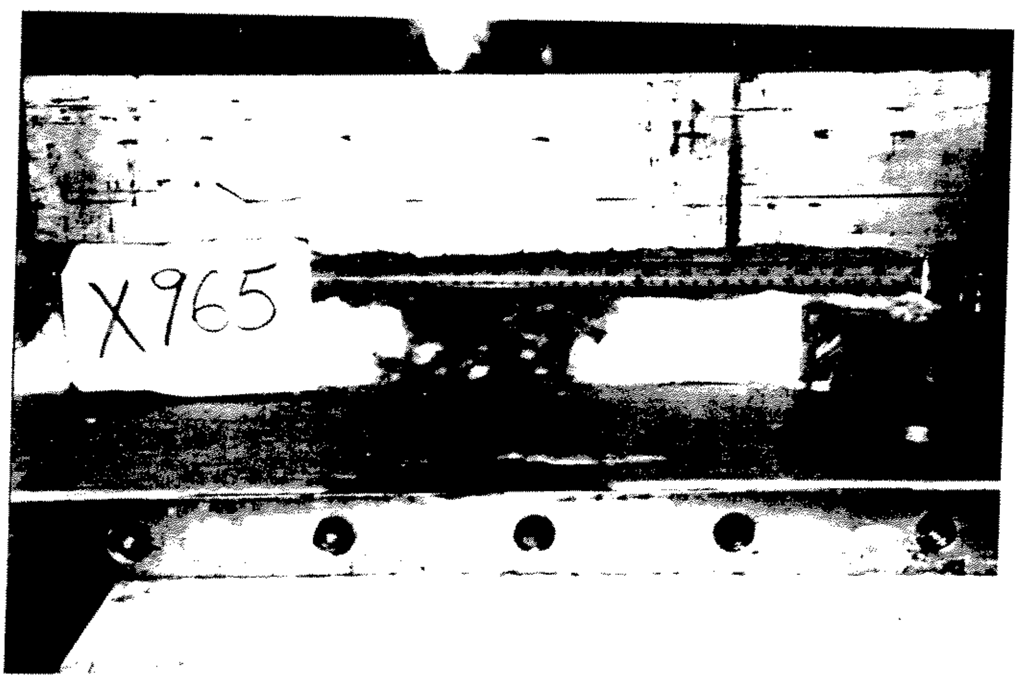
Test x965 at +200 mm.



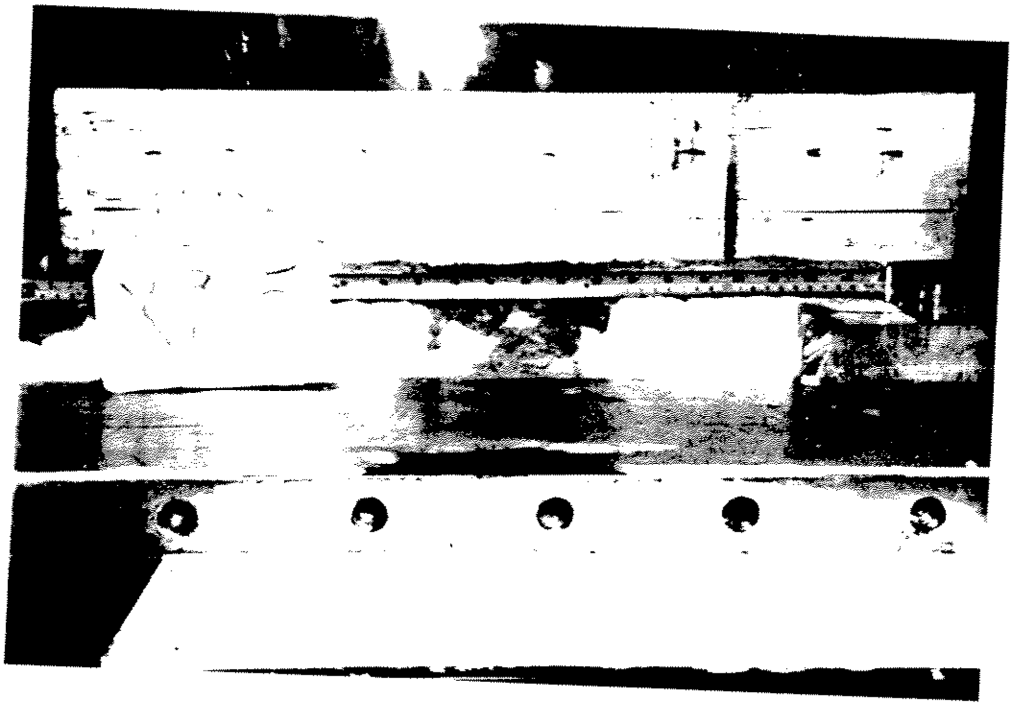
Test x965 at +220 mm.



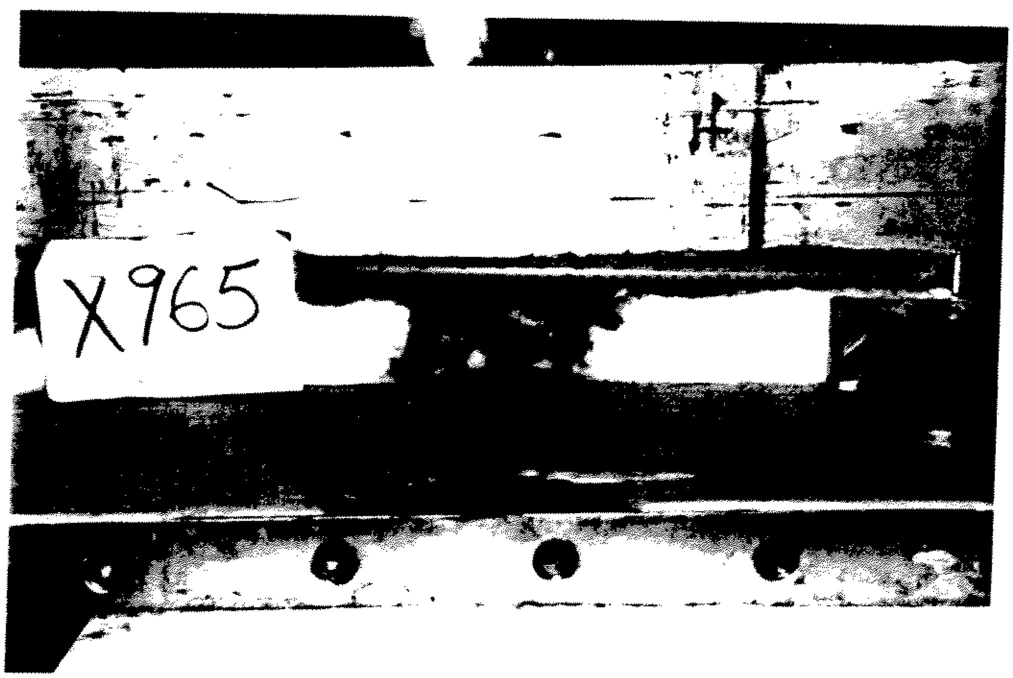
Test x965 at +240 mm.



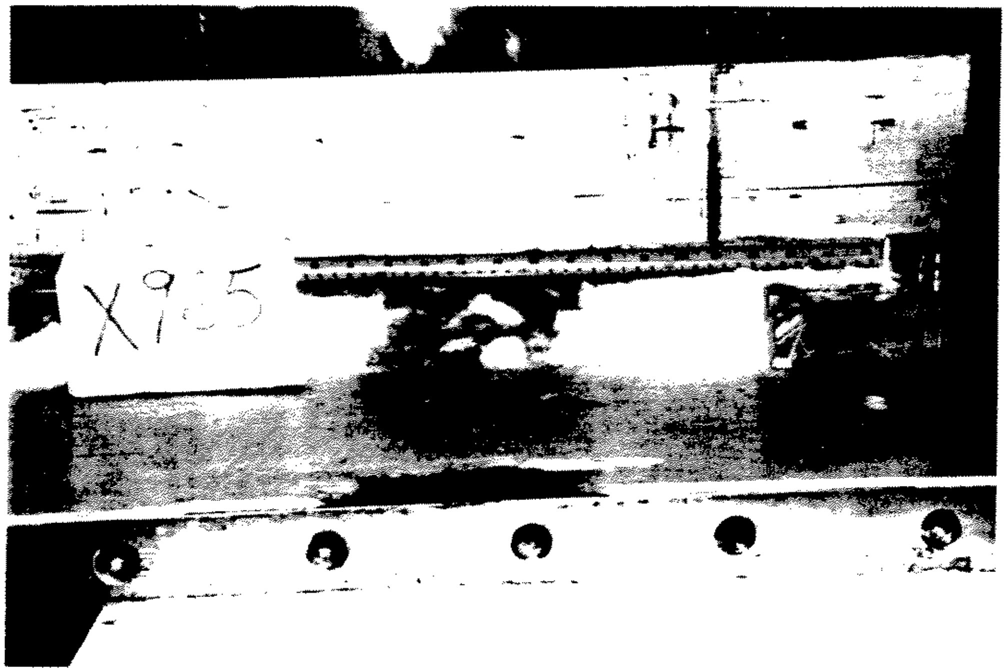
Test x965 at +260 mm.



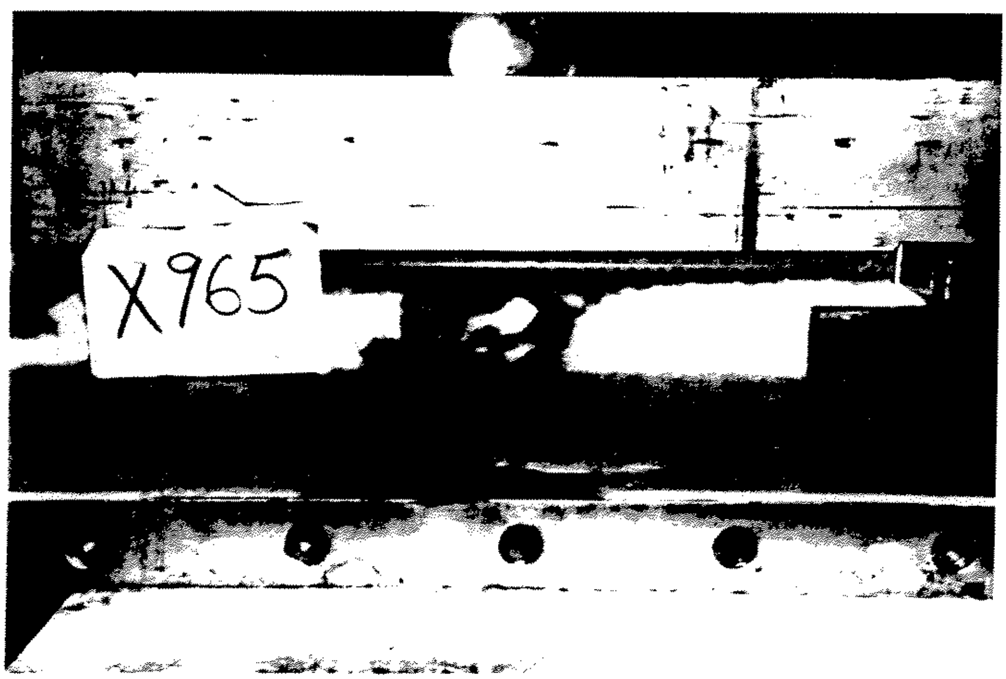
Test x965 at +280 mm.



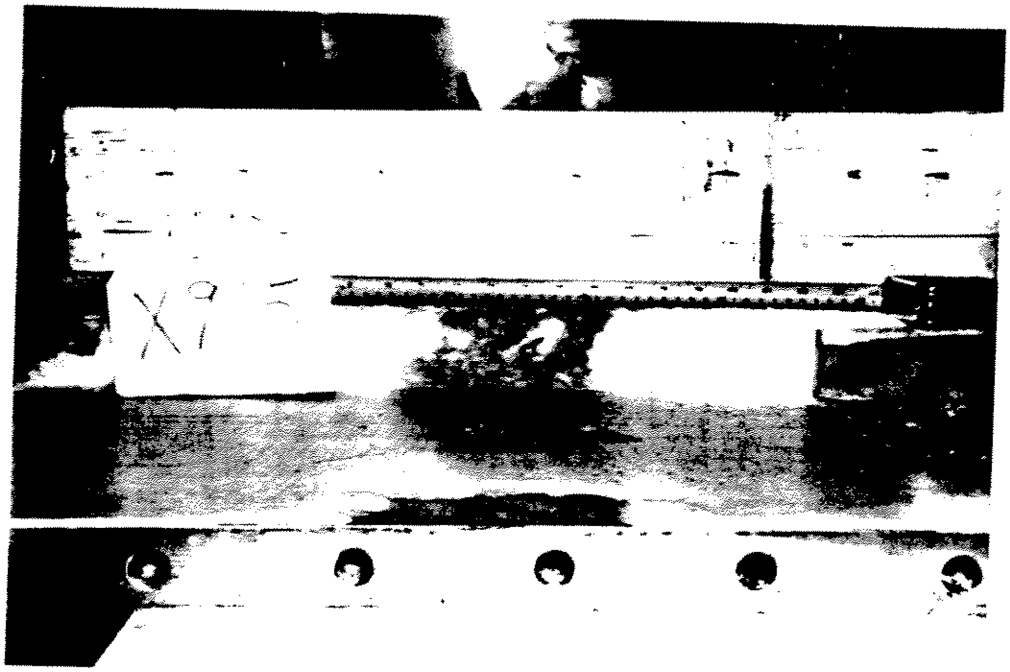
Test x965 at +300 mm.



Test x965 at +320 mm.

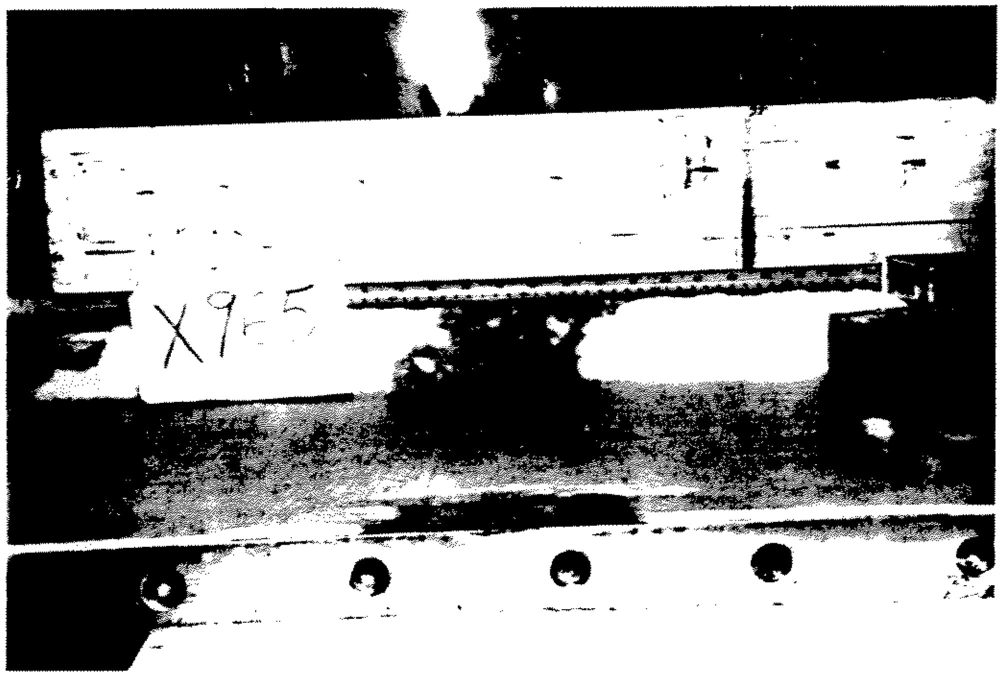


Test x965 at +340 mm.

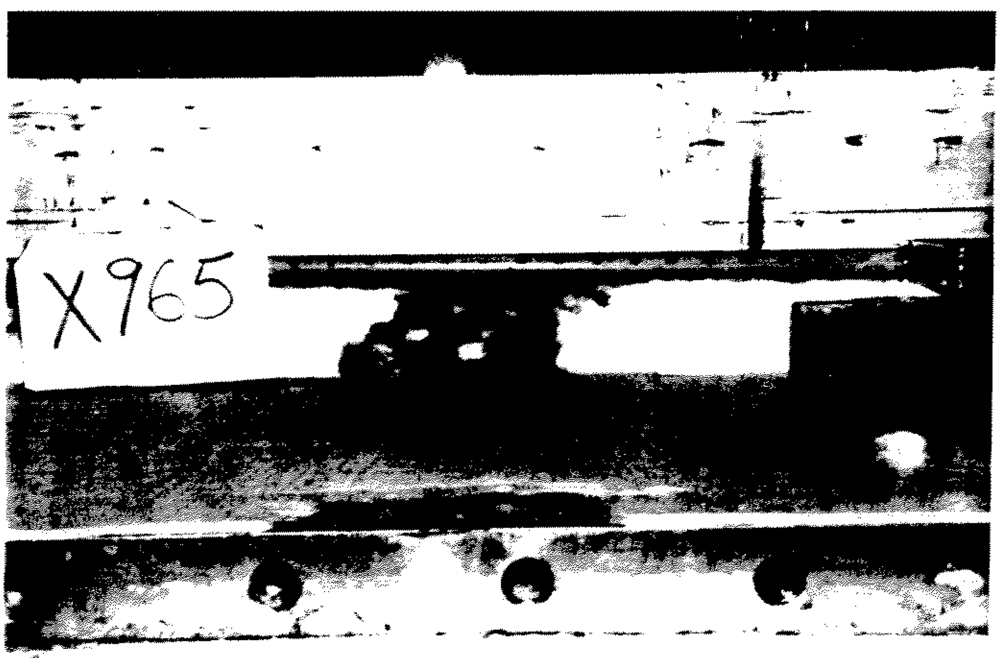


Test x965 at +360 mm.

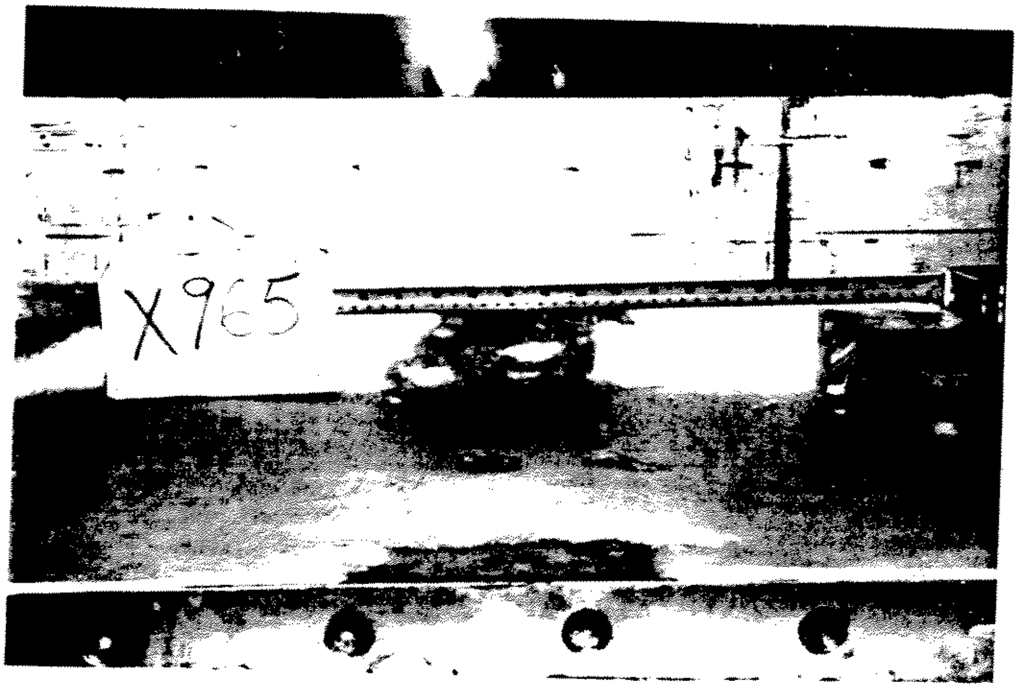
Test x965 at +380 mm.



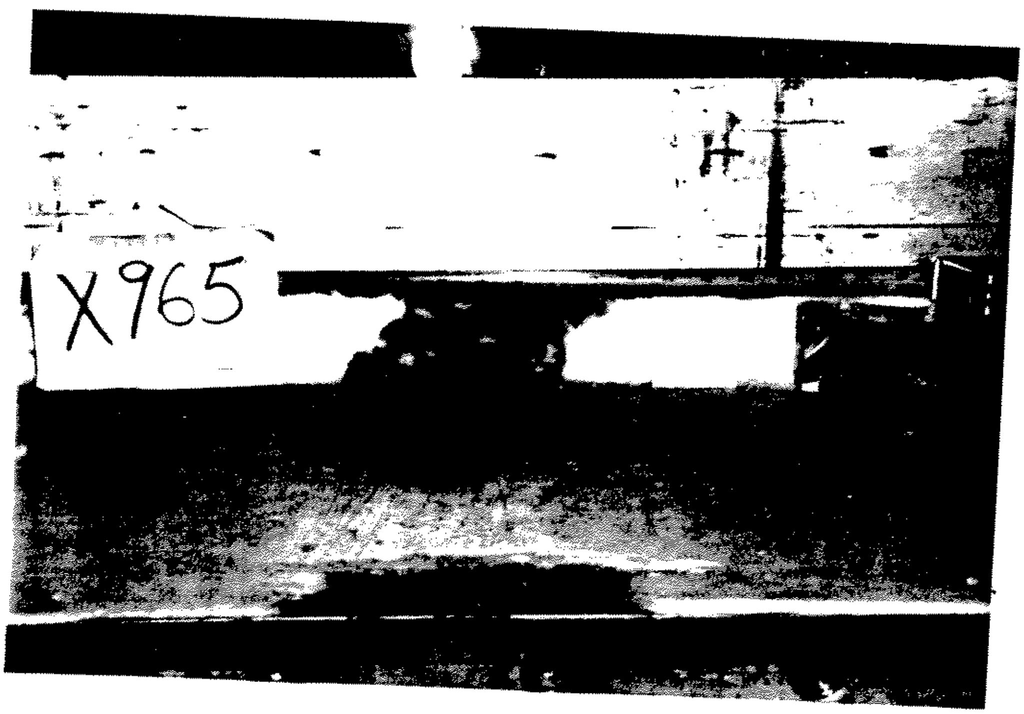
Test x965 at +400 mm.



Test x965 at +420 mm.

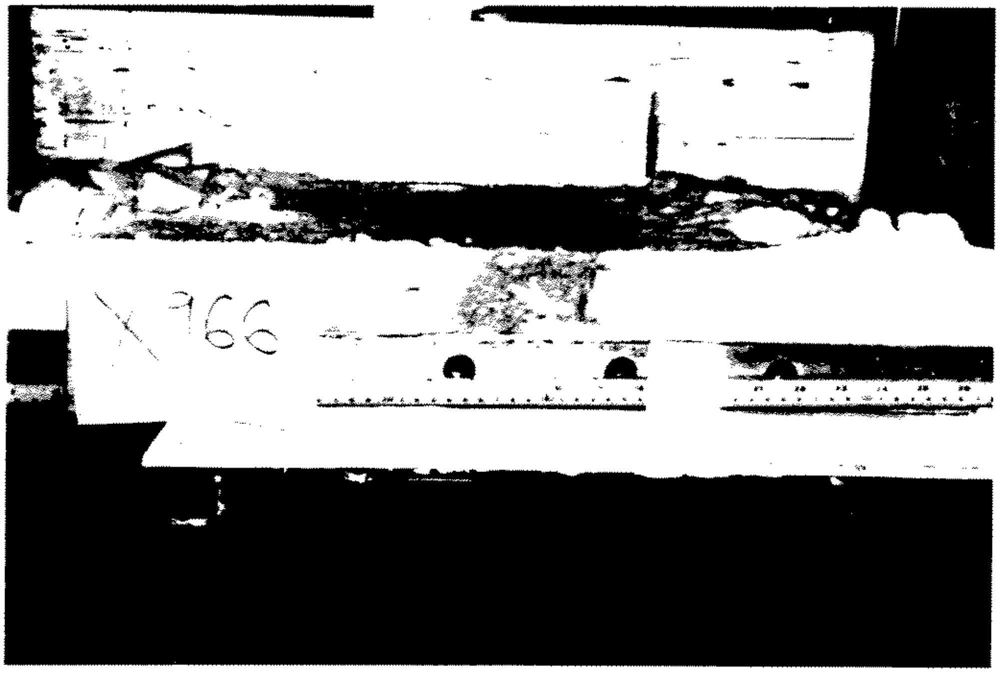


Test x965 at +440 mm.

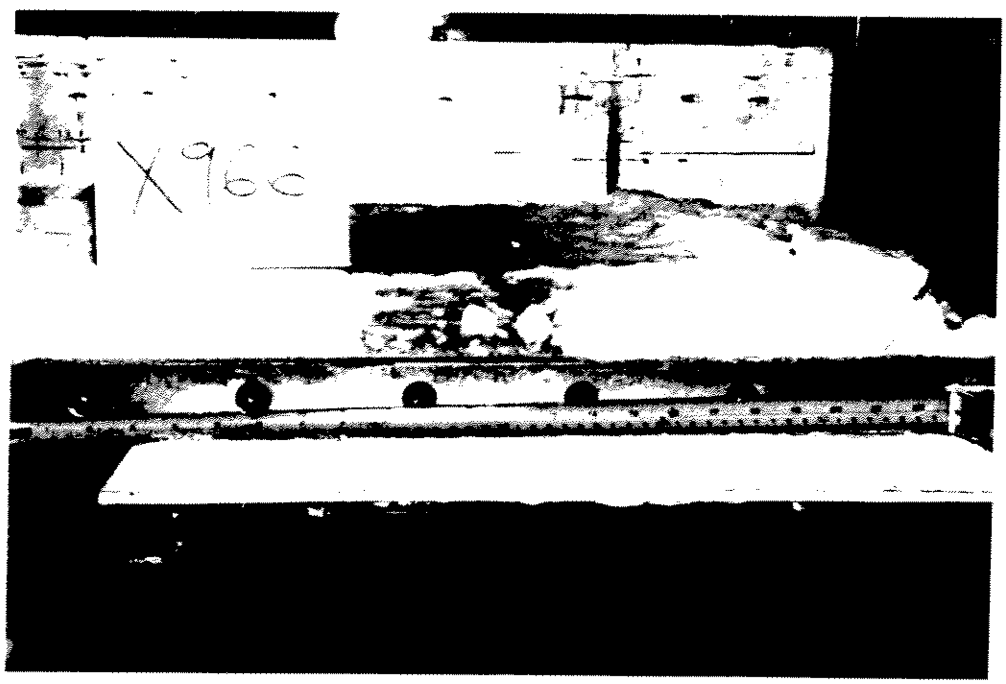


Test x965 at +460 mm.

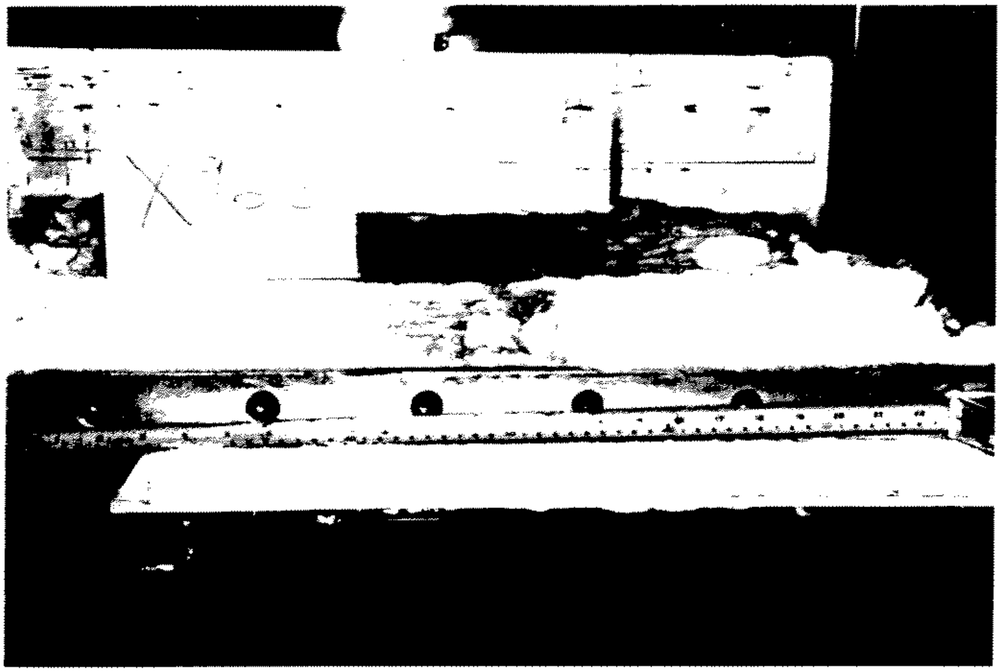
Test x965 at +480 mm.

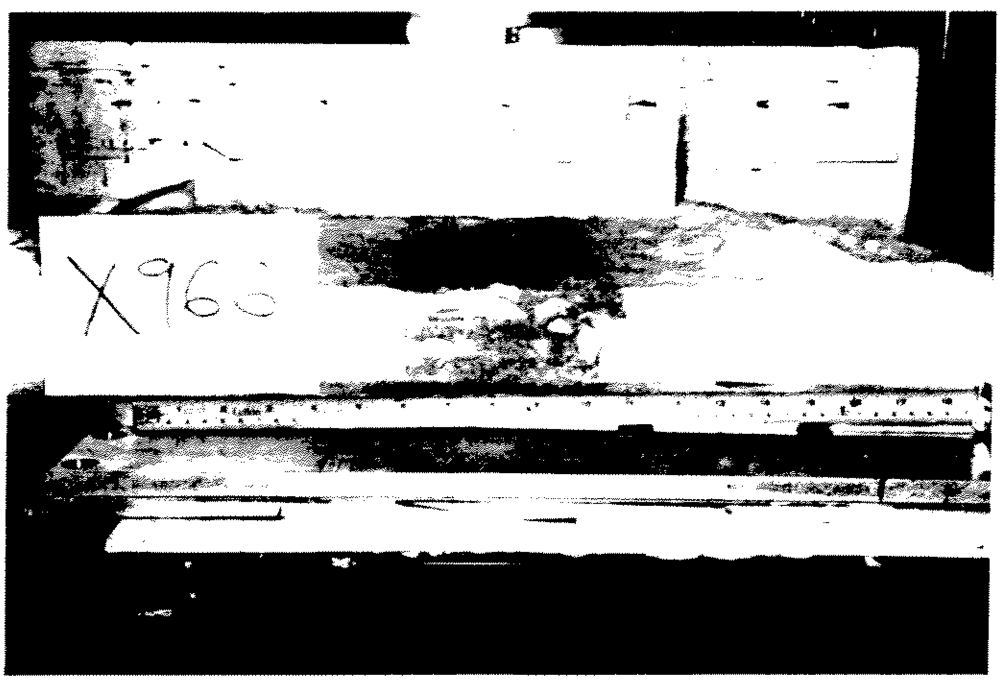


Test x966 at 0 mm.

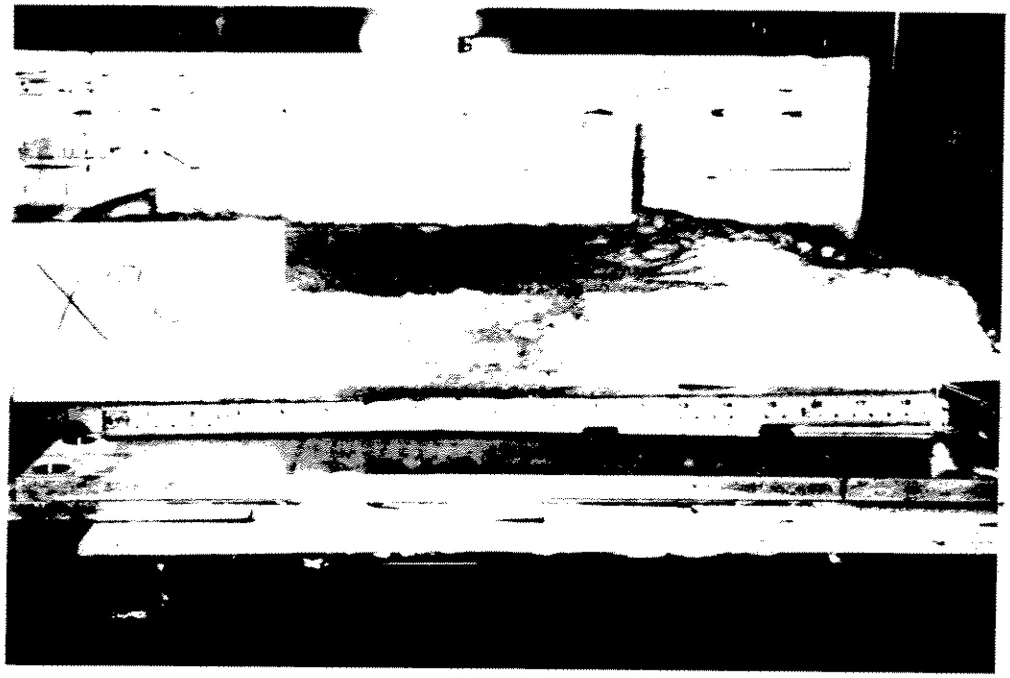


Test x966 at +20 mm.

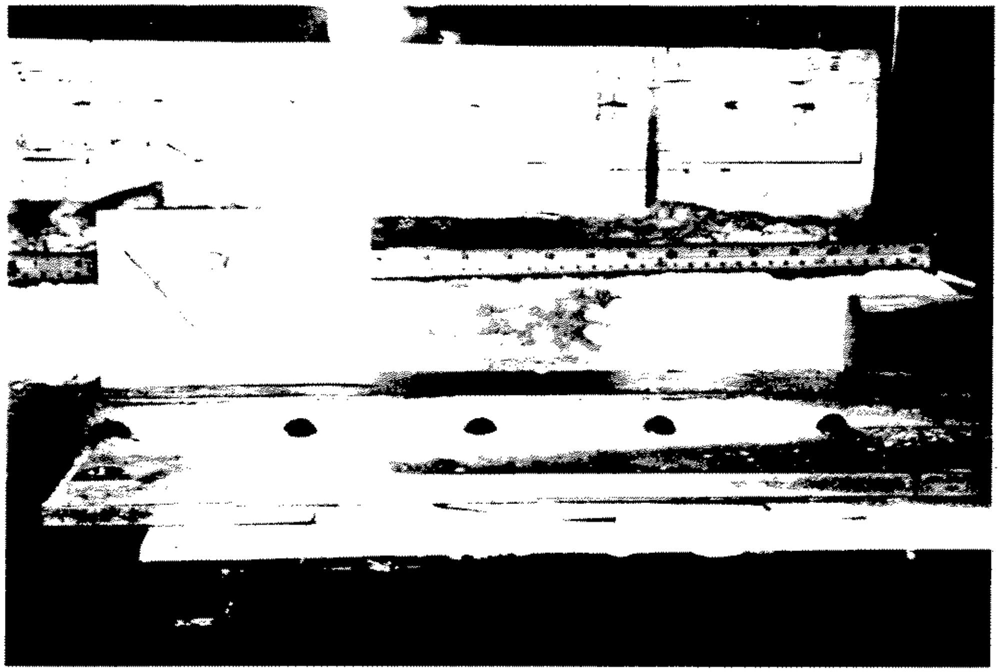




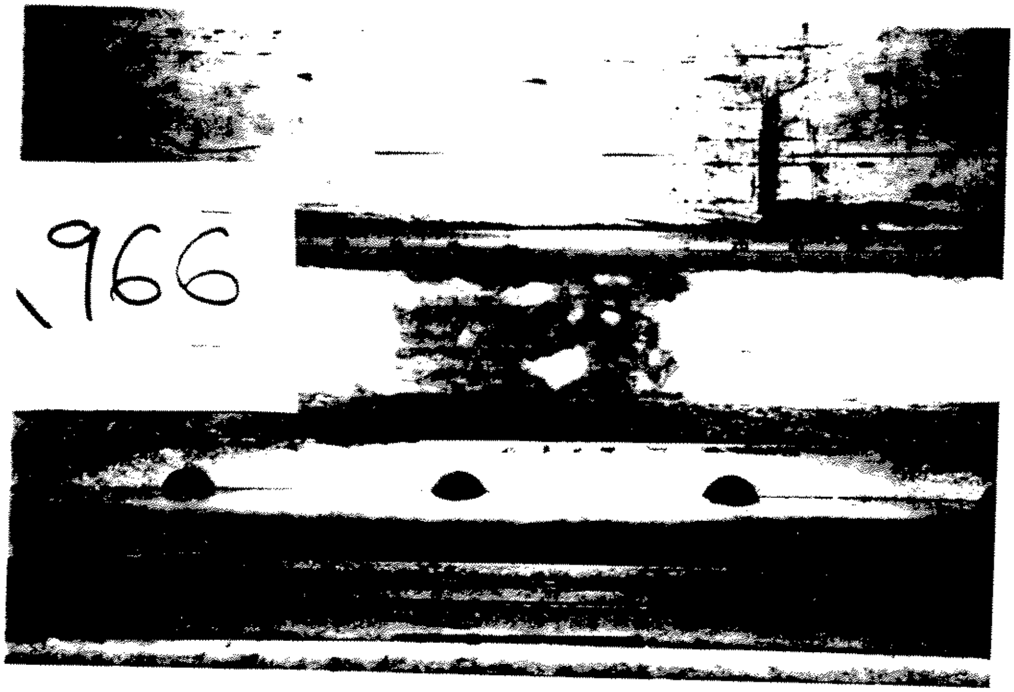
Test x966 at +40 mm.



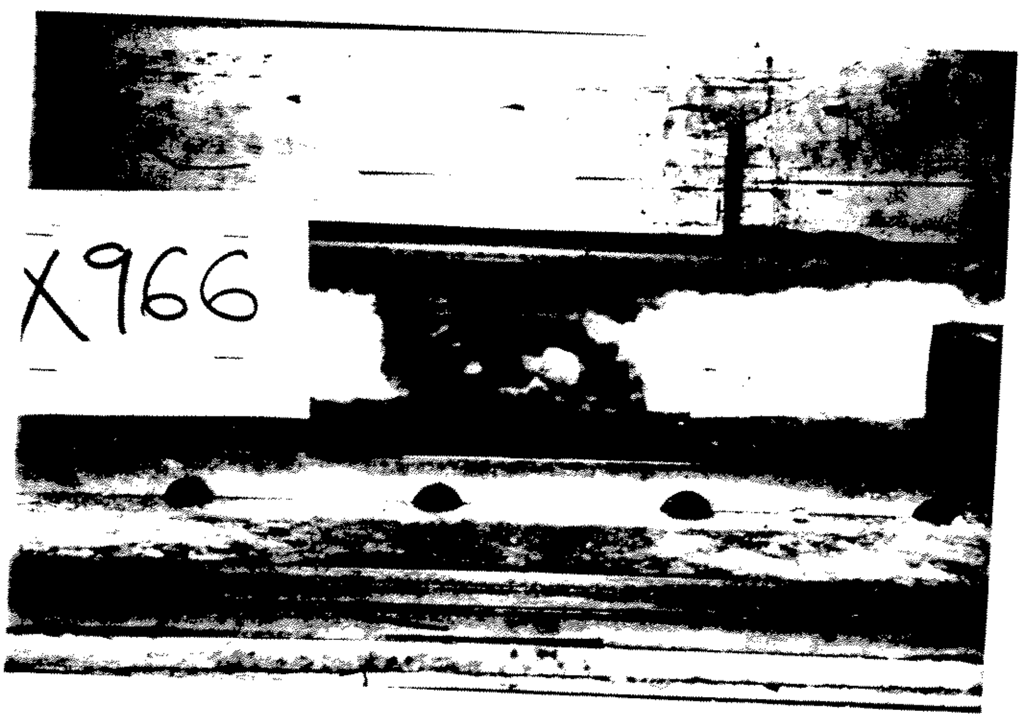
Test x966 at +60 mm.



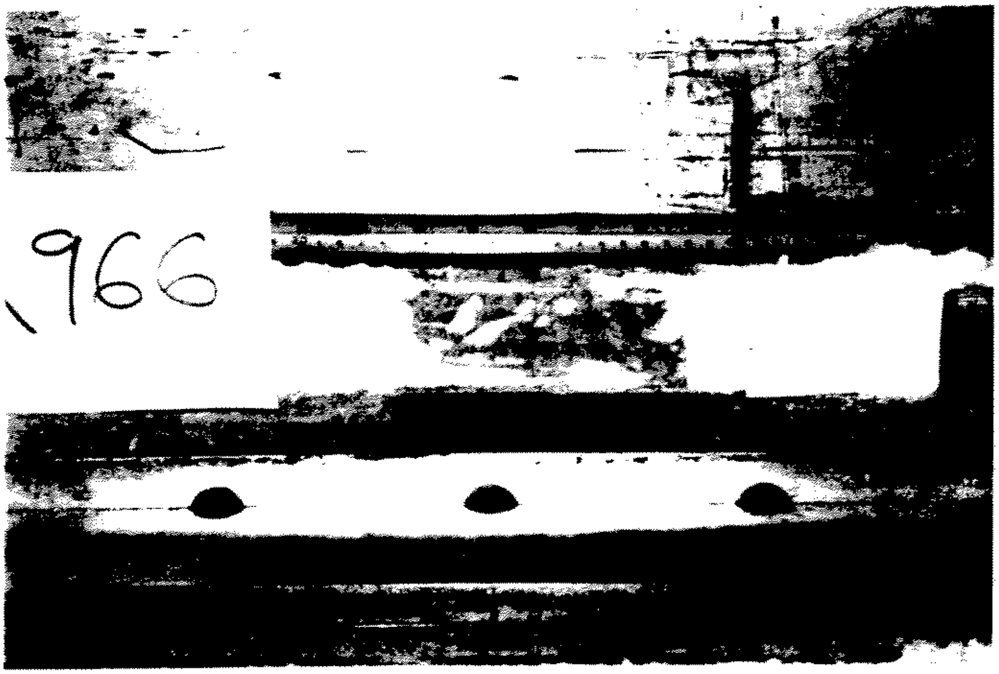
Test x966 at +80 mm.



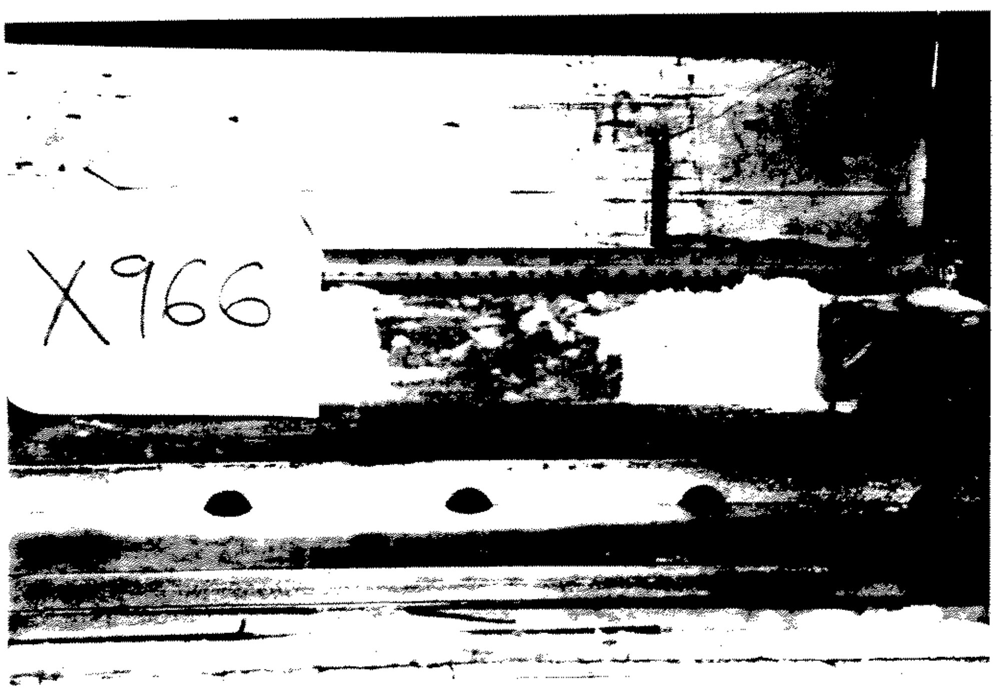
Test x966 at +100 mm.



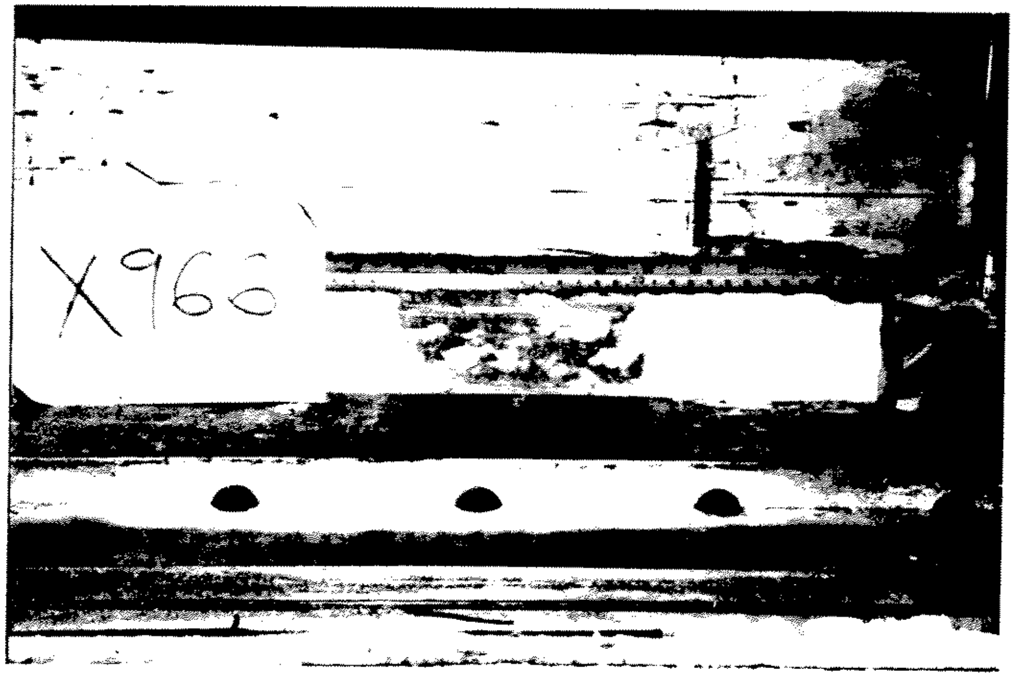
Test x966 at +120 mm.



Test x966 at +140 mm.

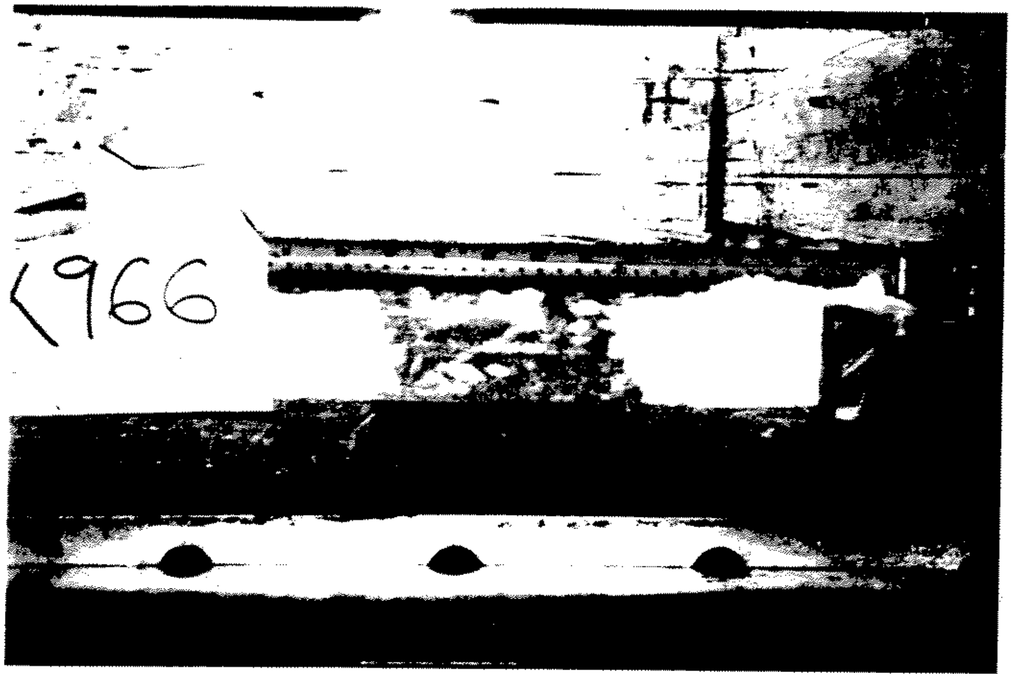


Test x966 at +160 mm.

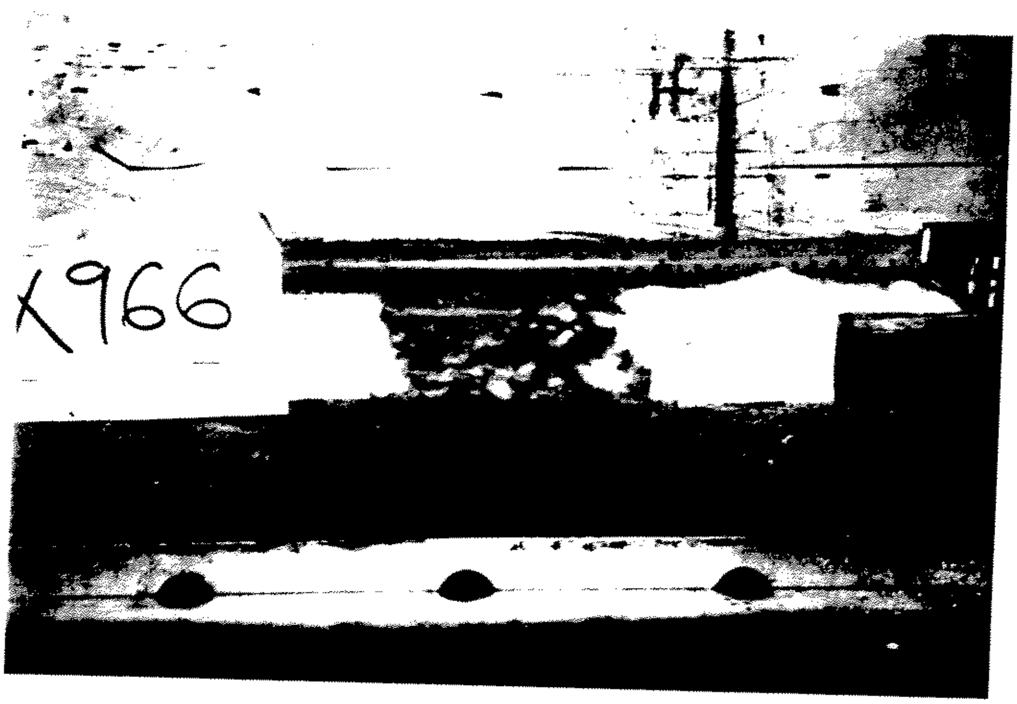


Test x966 at +180 mm.

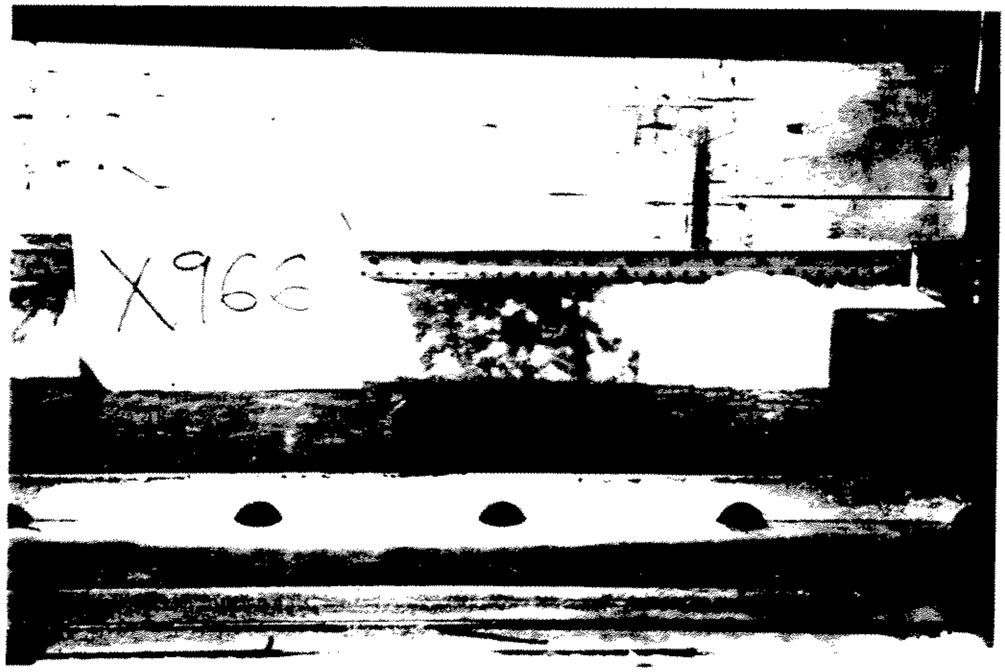
Test x966 at +200 mm.



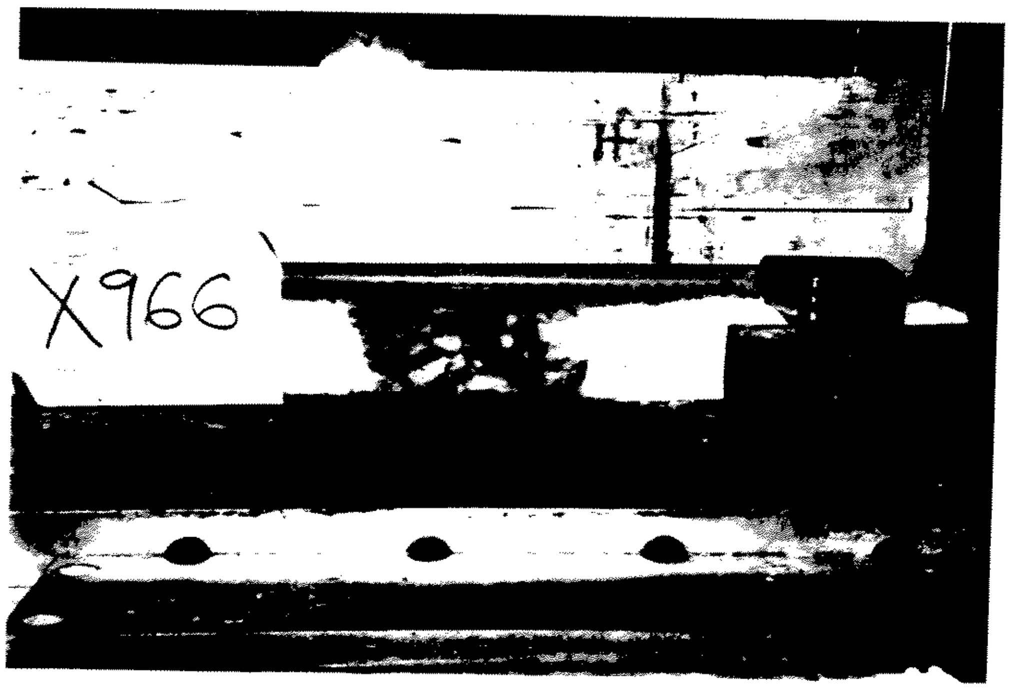
Test x966 at +220 mm.



Test x966 at +240 mm.



Test x966 at +260 mm.



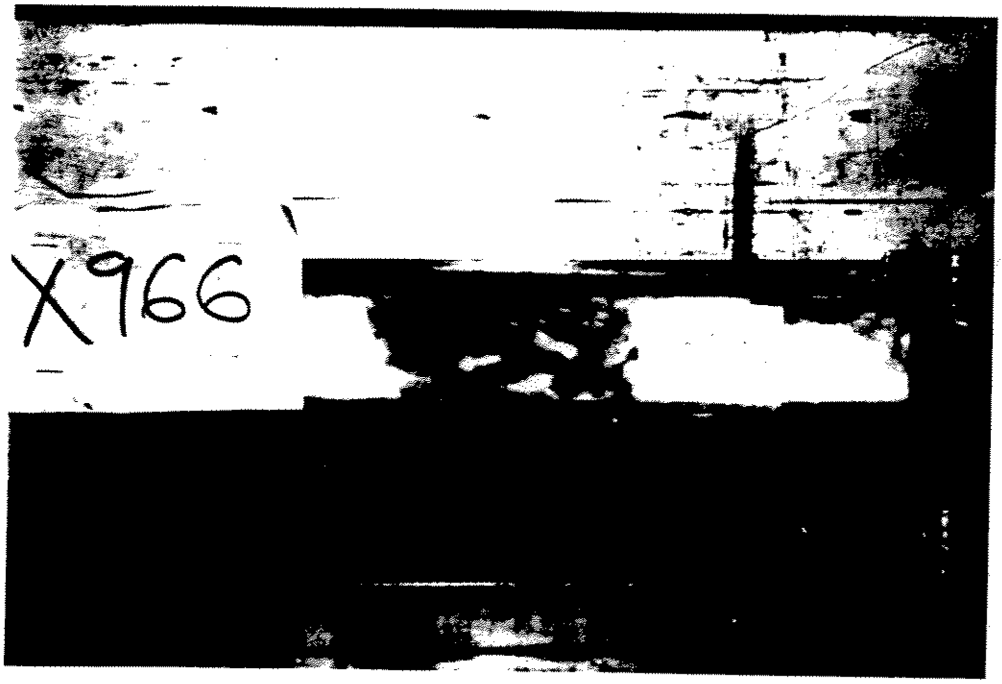
Test x966 at +280 mm.

Test x966 at +300 mm.

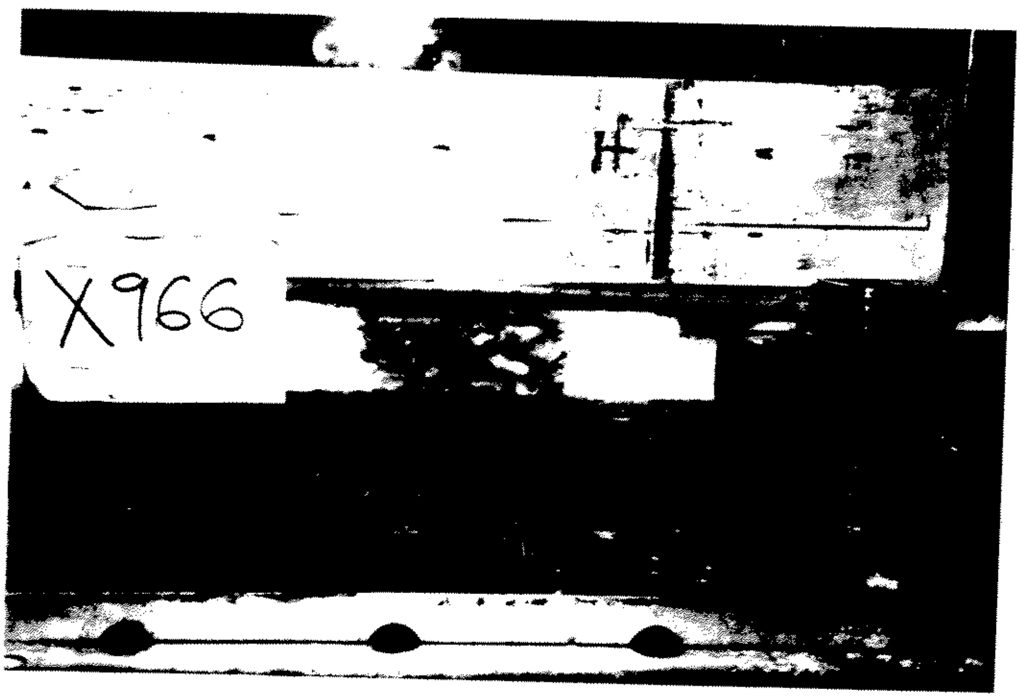
Test x966 at +320 mm.

Test x966 at +340 mm.

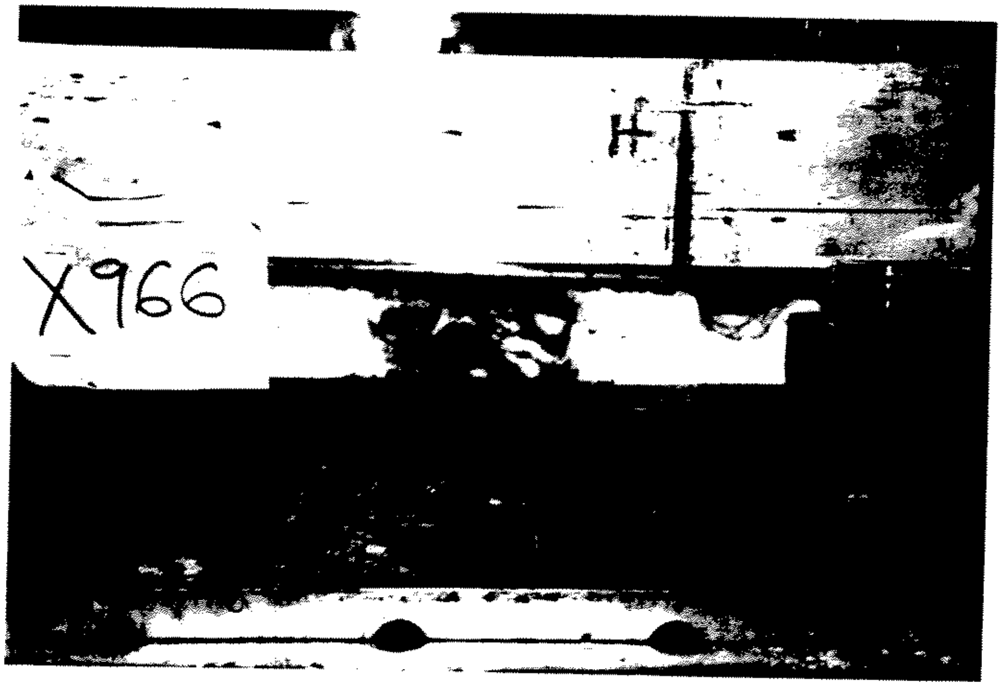
Test x966 at +360 mm.



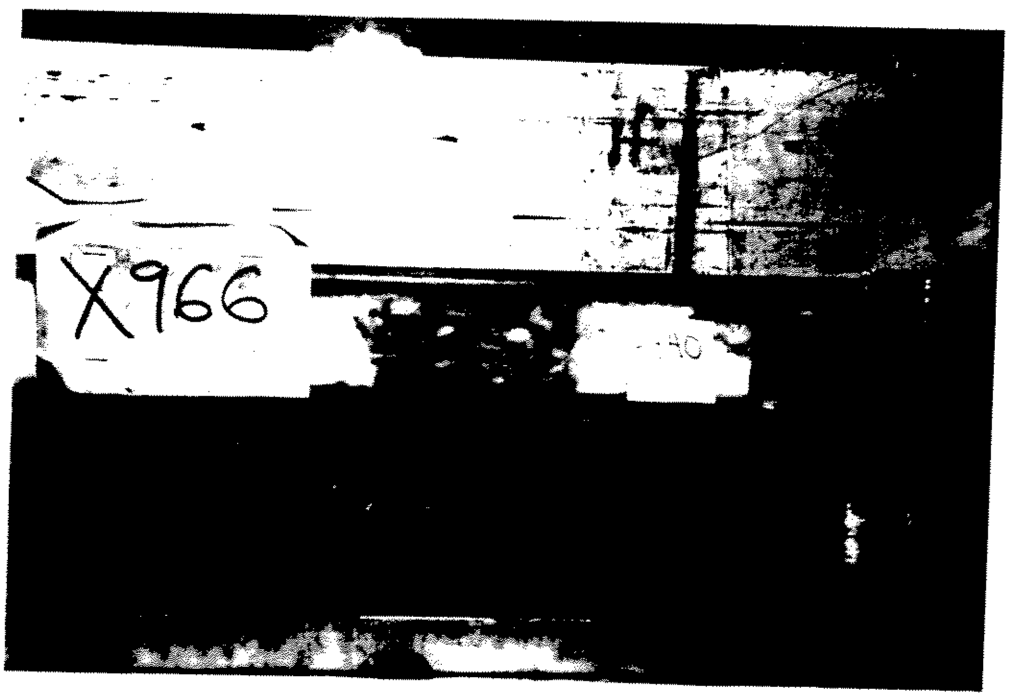
Test x966 at +380 mm.



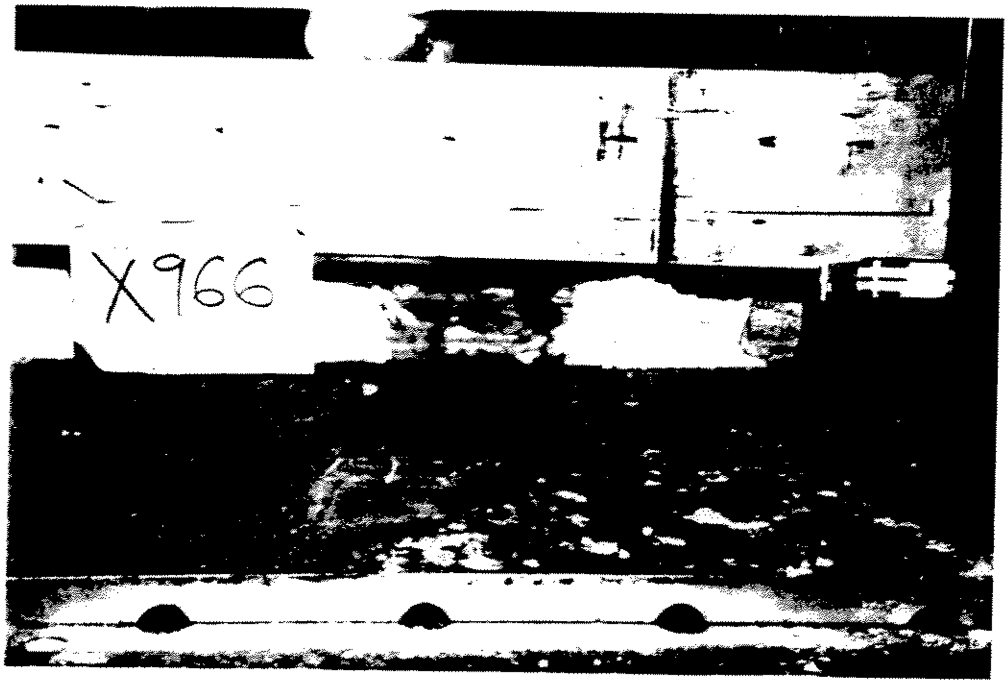
Test x966 at +400 mm.



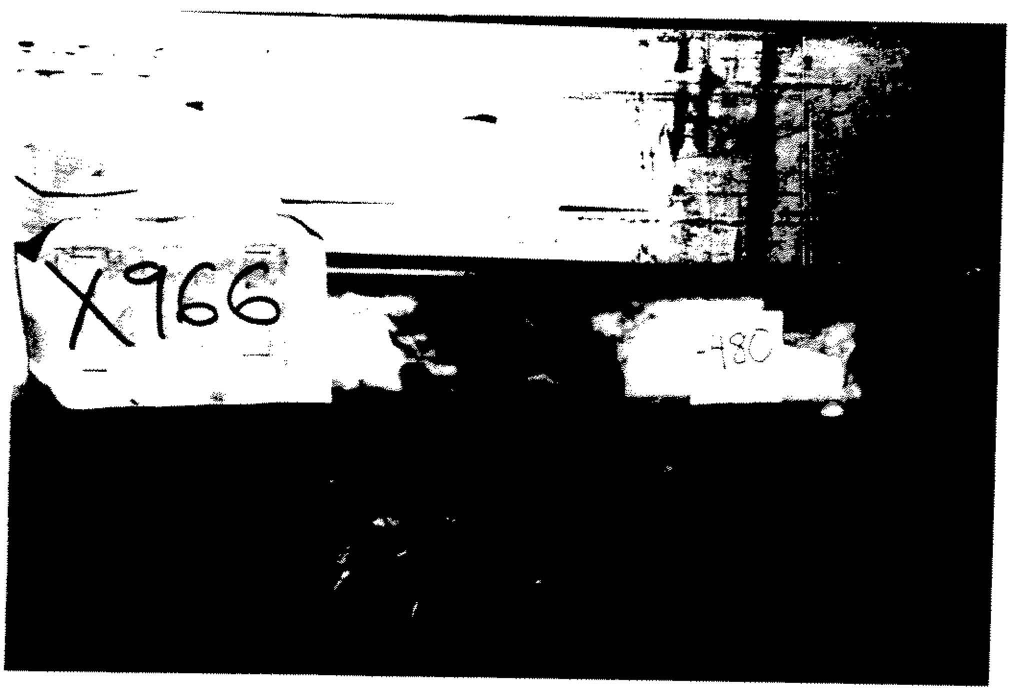
Test x966 at +420 mm.



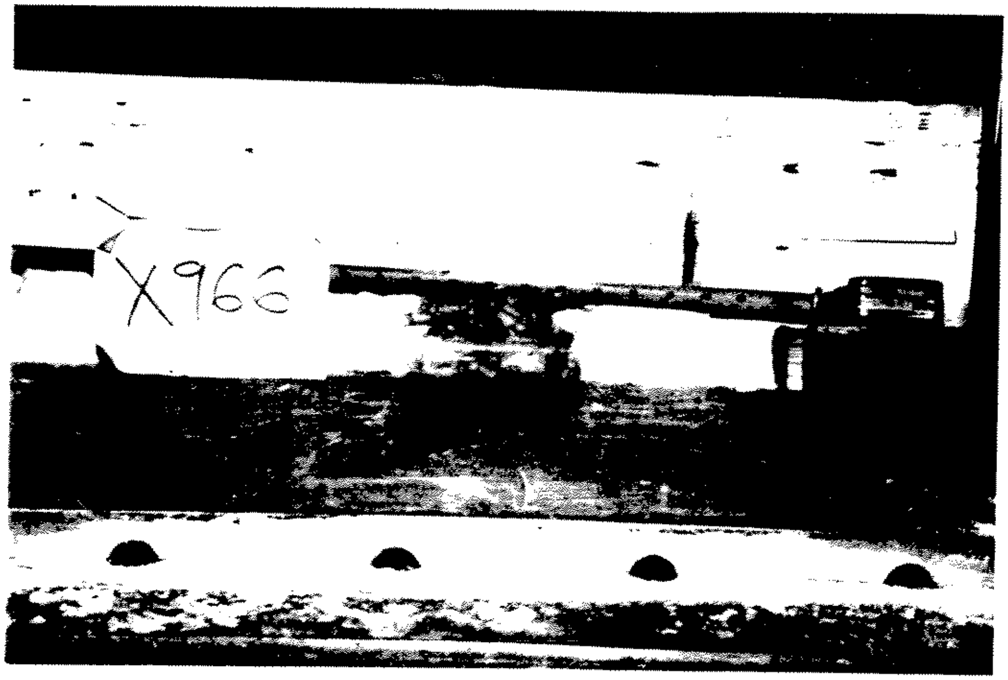
Test x966 at +440 mm.



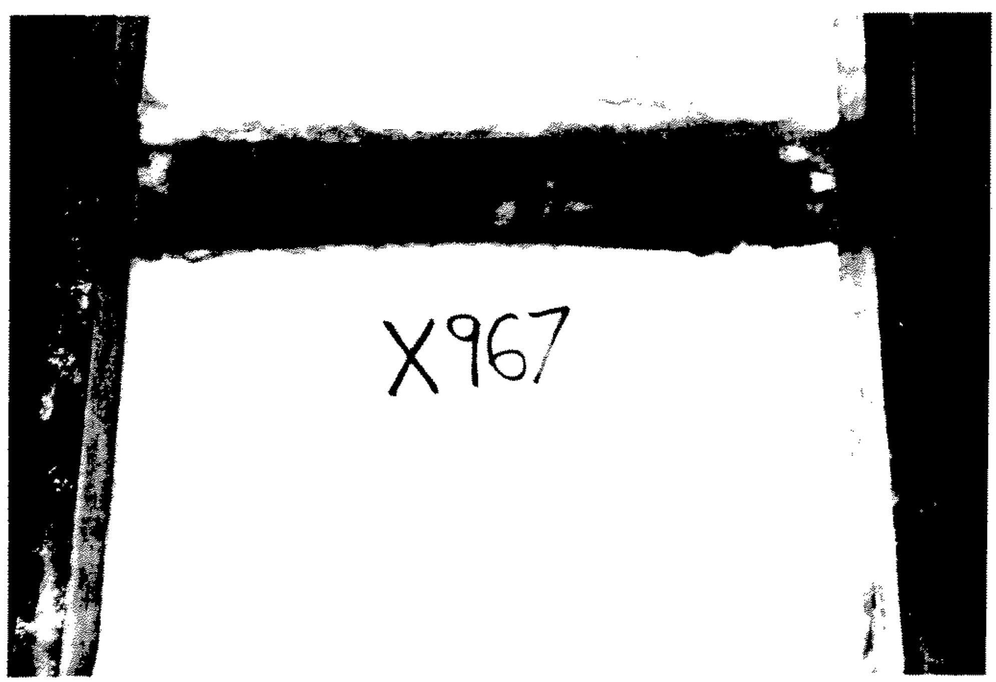
Test x966 at +460 mm.

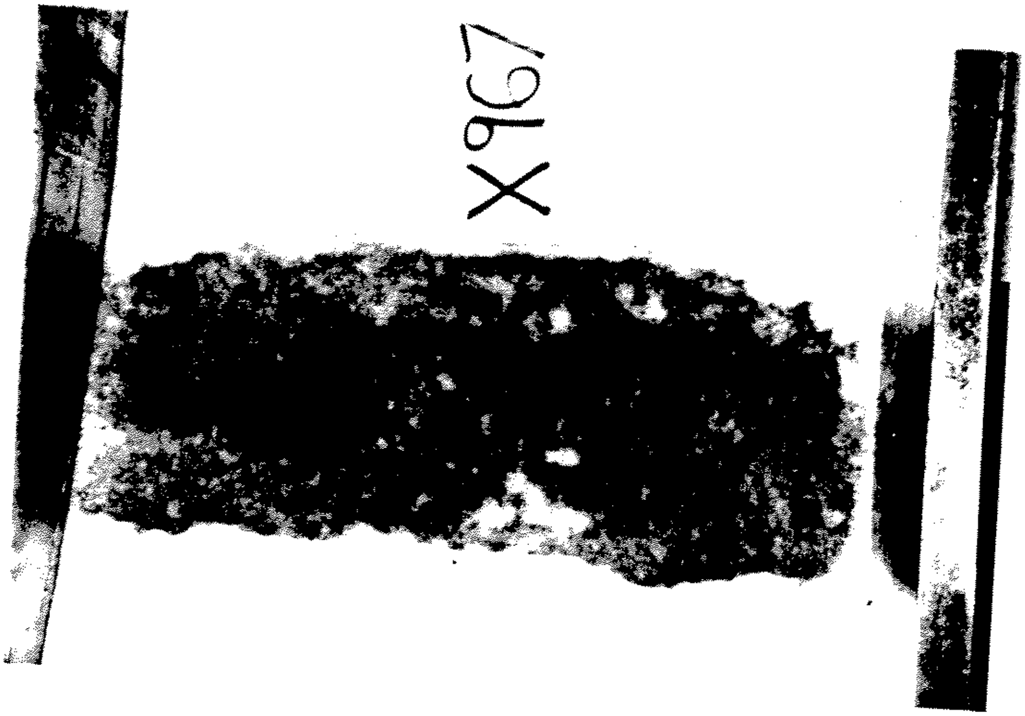


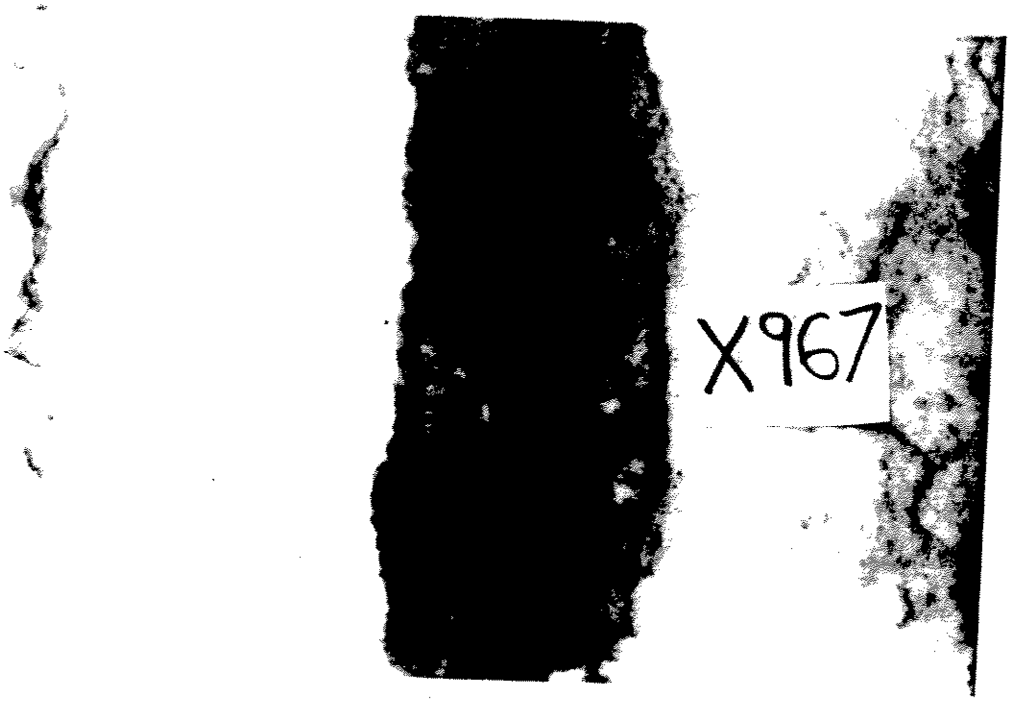
Test x966 at +480 mm.

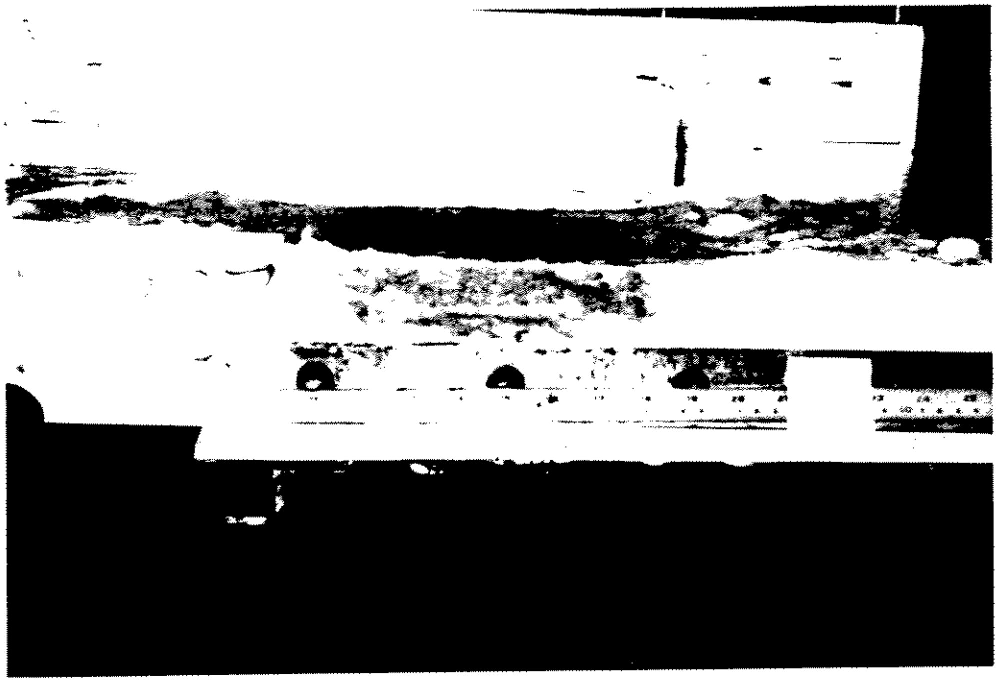

X966


X967


X967

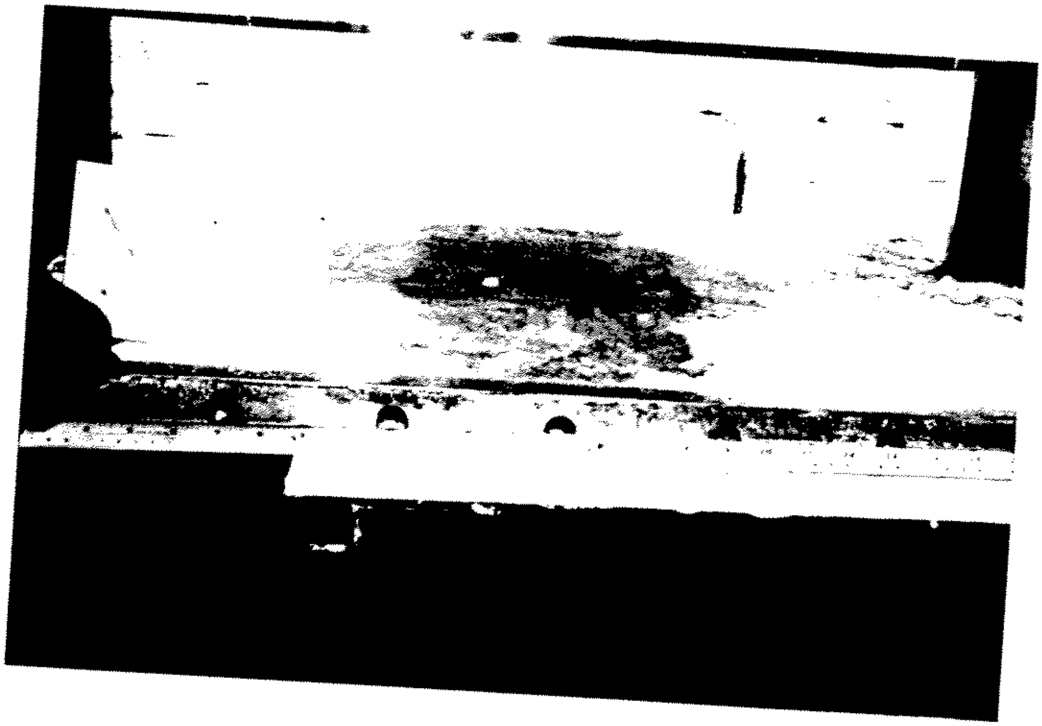

X967


X967

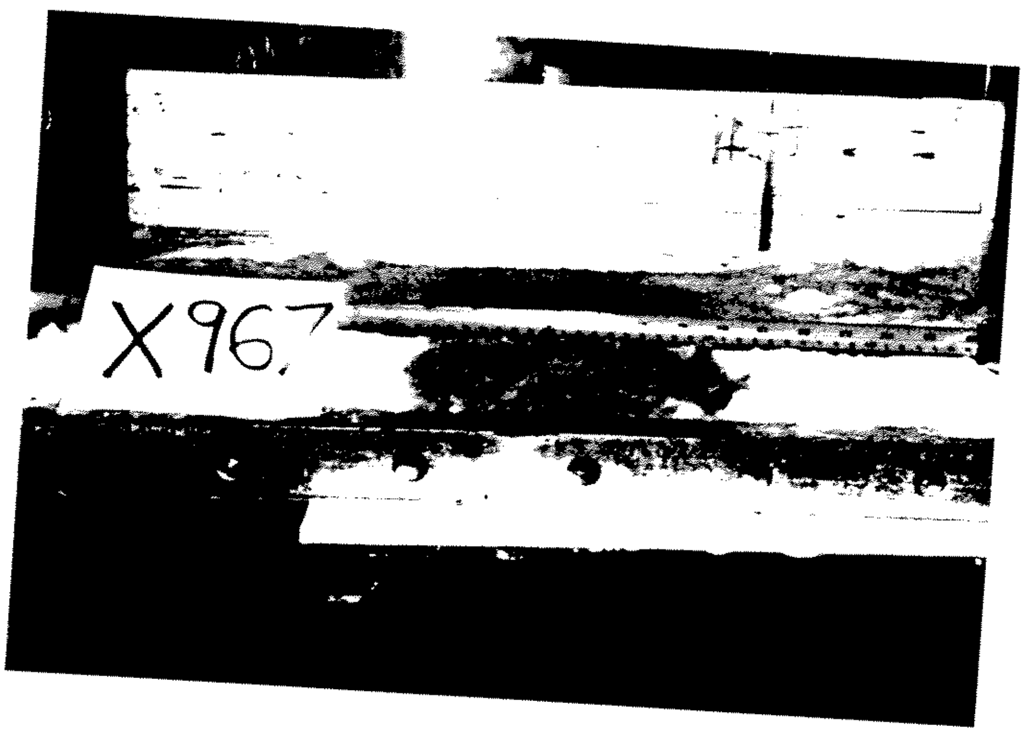


Test x967 at 0 mm.

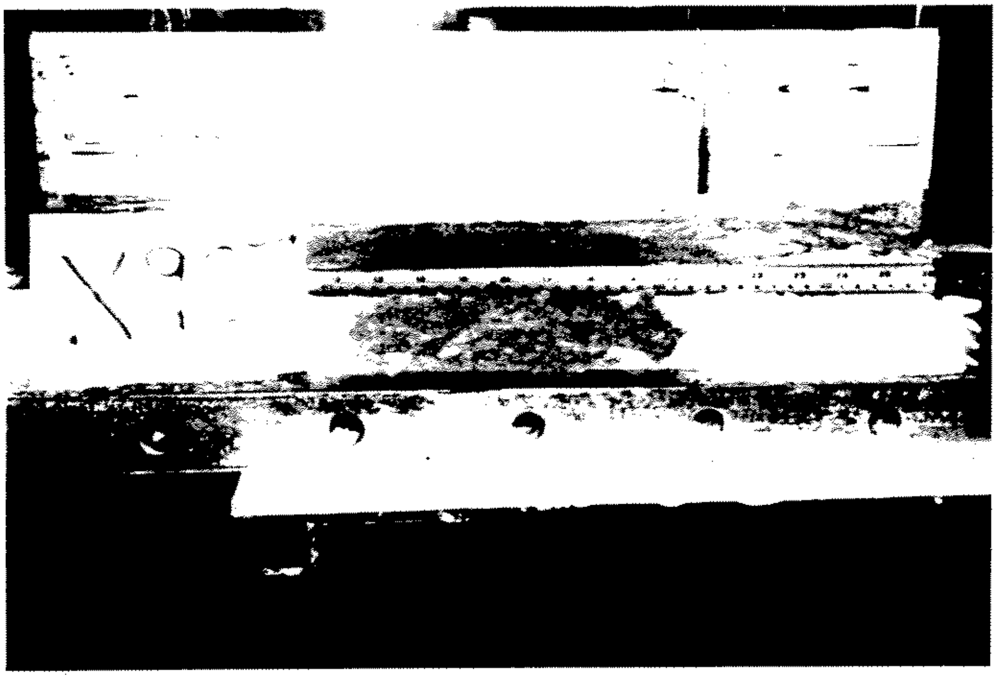
Test x967 at +20 mm.



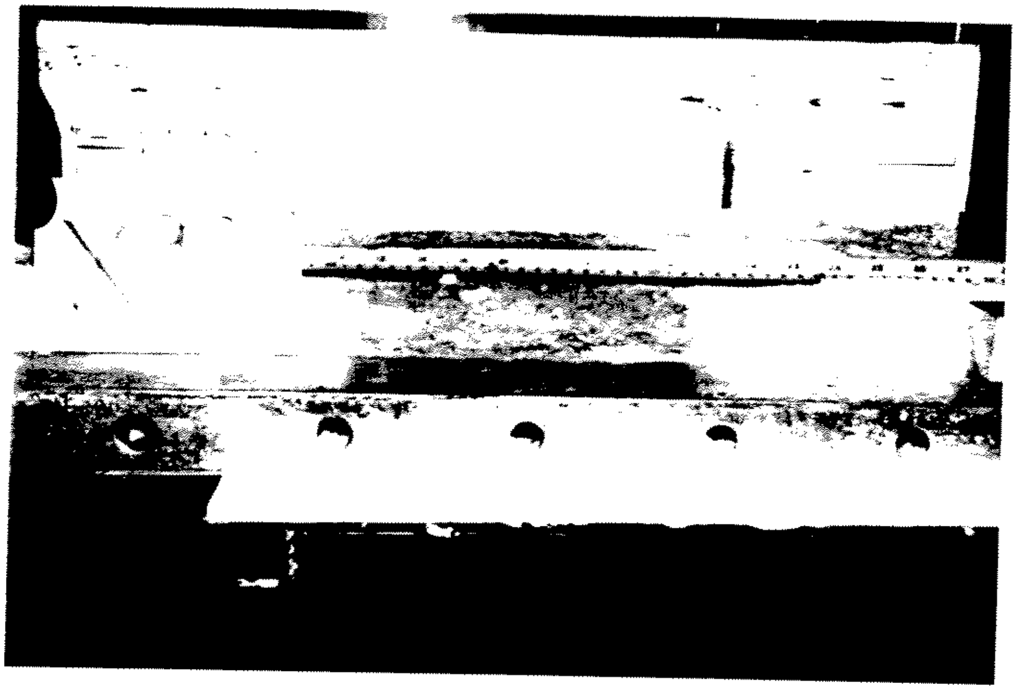
Test x967 at +40 mm.



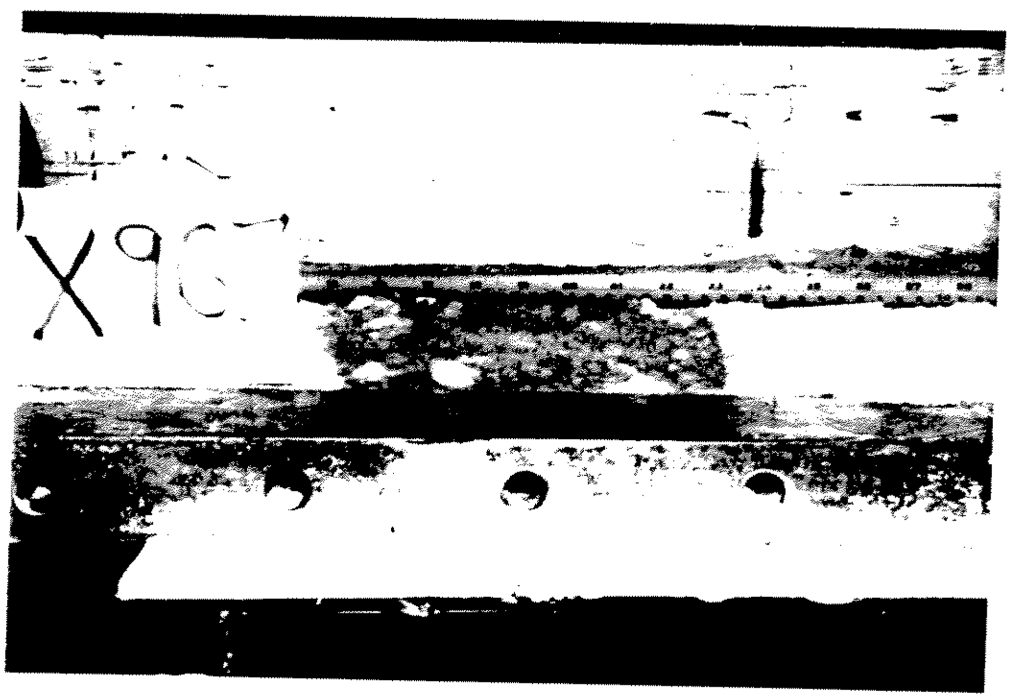
Test x967 at +60 mm.



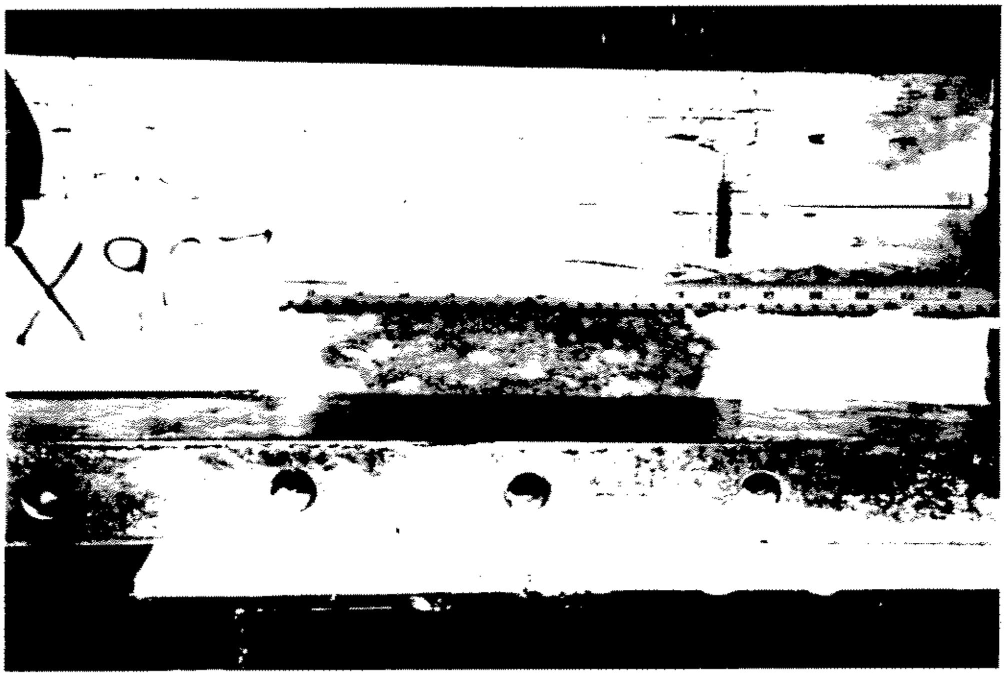
Test x967 at +80 mm.



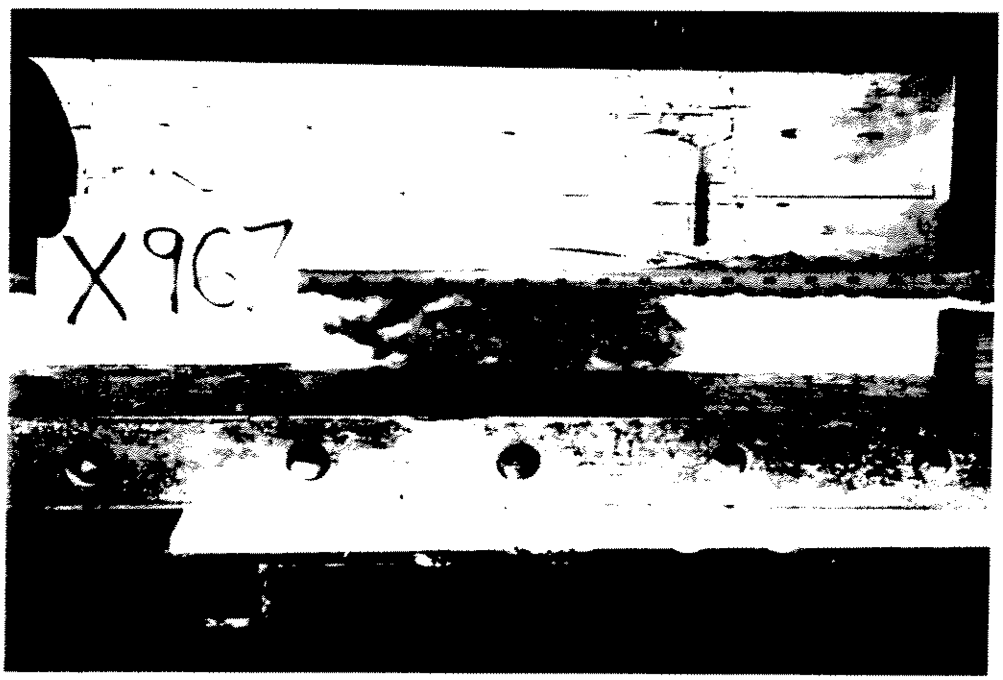
Test x967 at +120 mm.



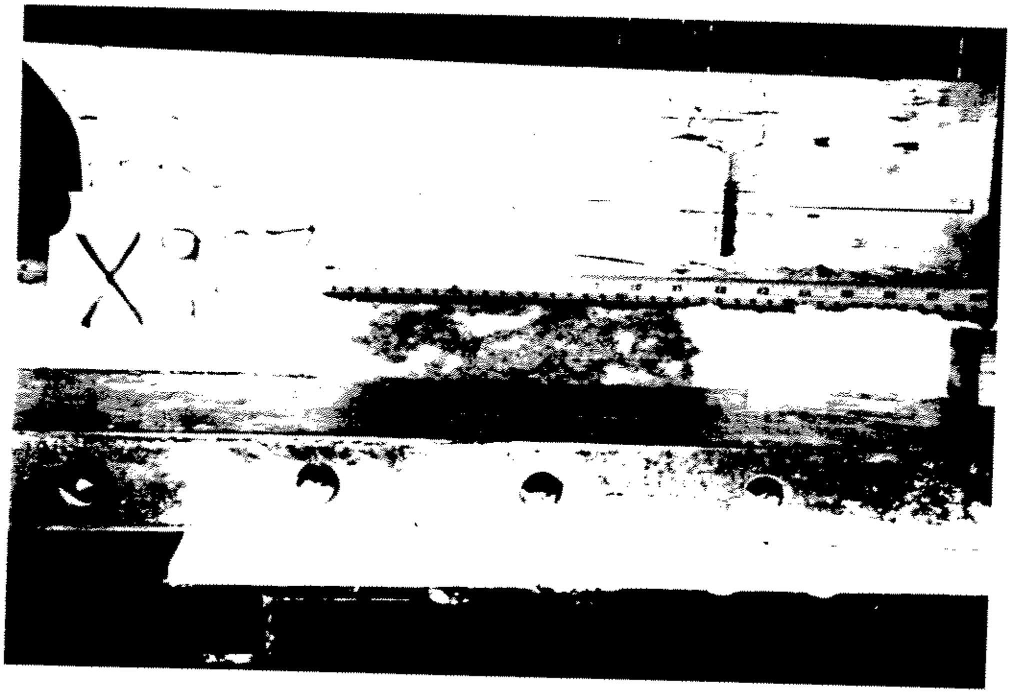
Test x967 at +140 mm.



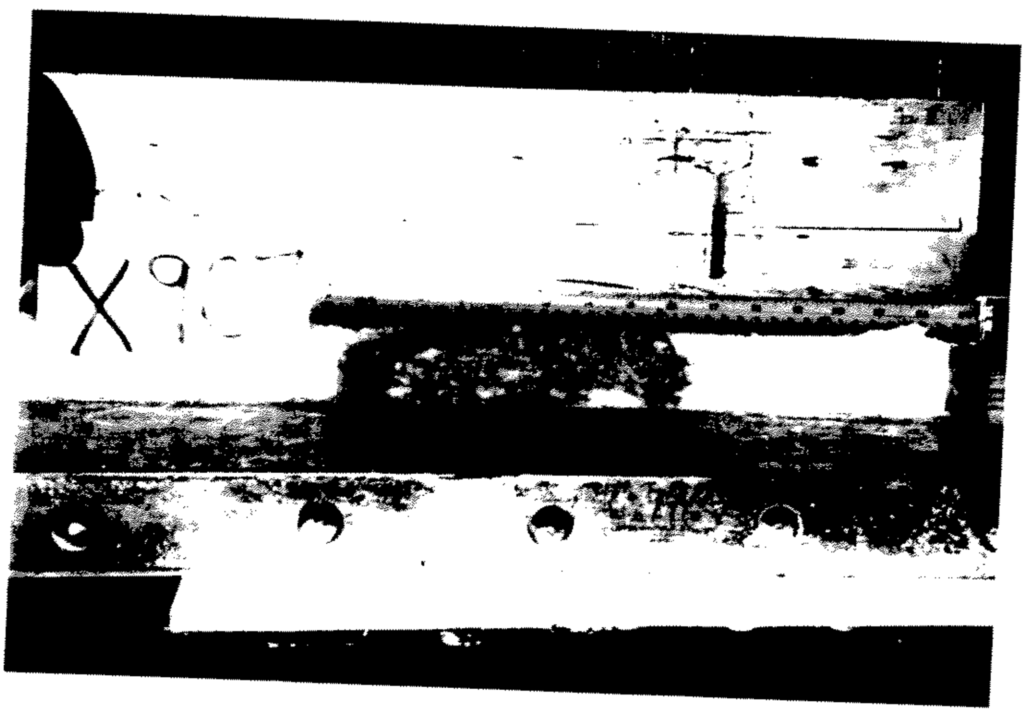
Test x967 at +160 mm.



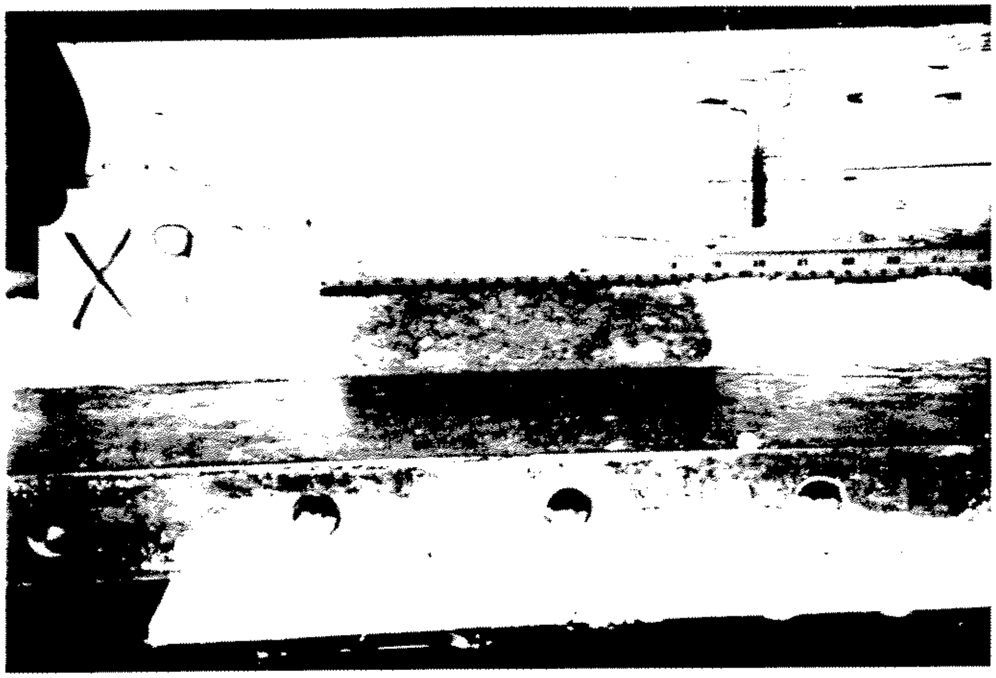
Test x967 at +180 mm.



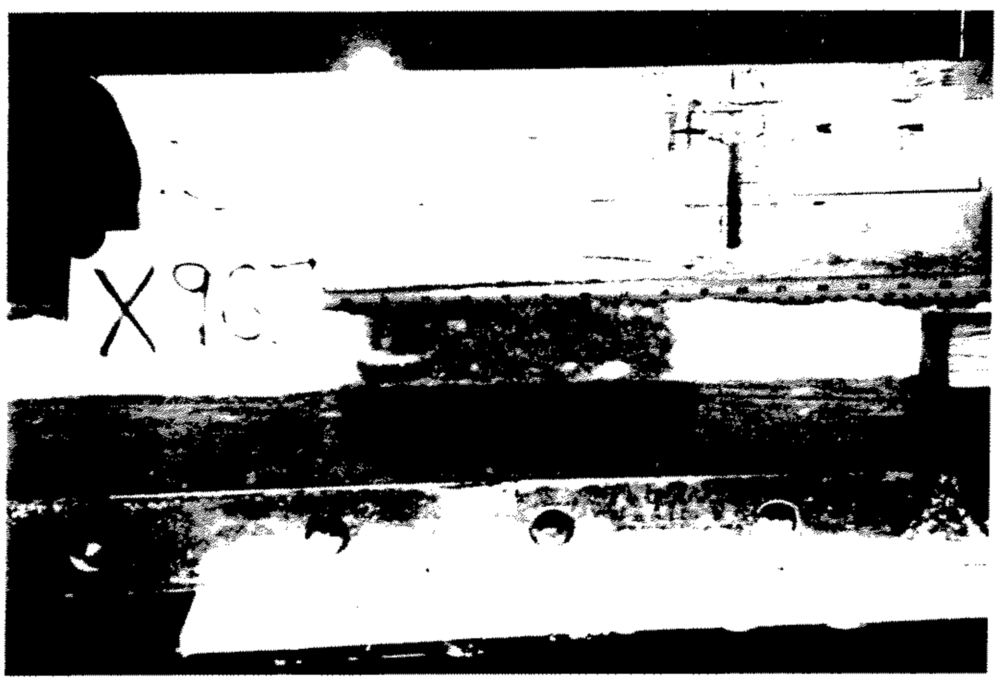
Test x967 at +200 mm.



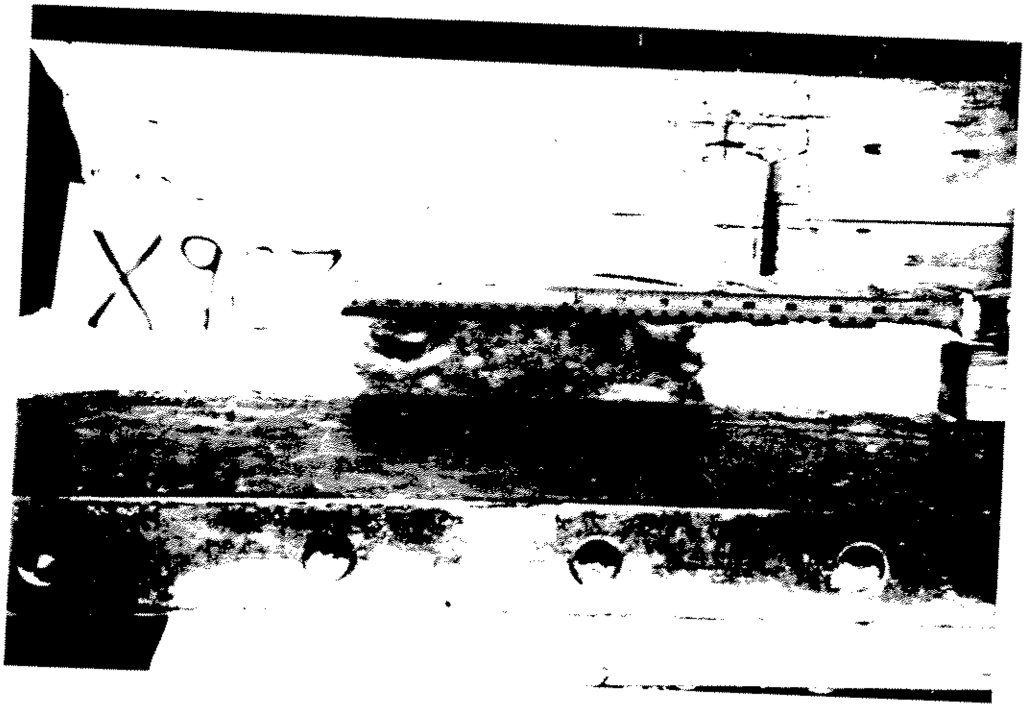
Test x967 at +220 mm.



Test x967 at +240 mm.

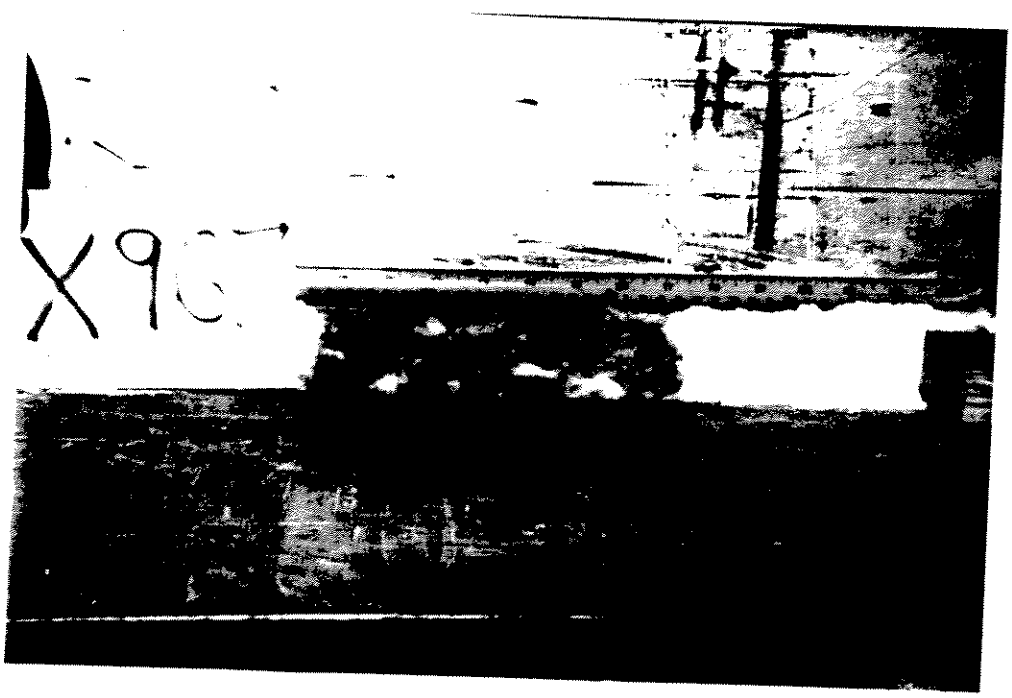


Test x967 at +260 mm.

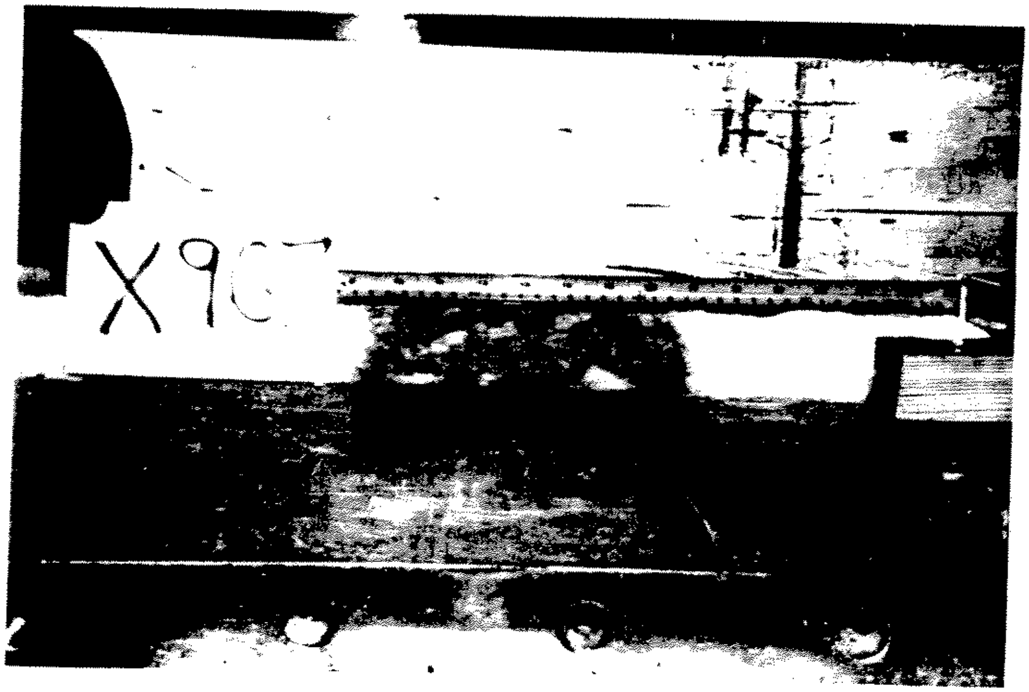


Test x967 at +280 mm.

Test x967 at +320 mm.



Test x967 at +340 mm.

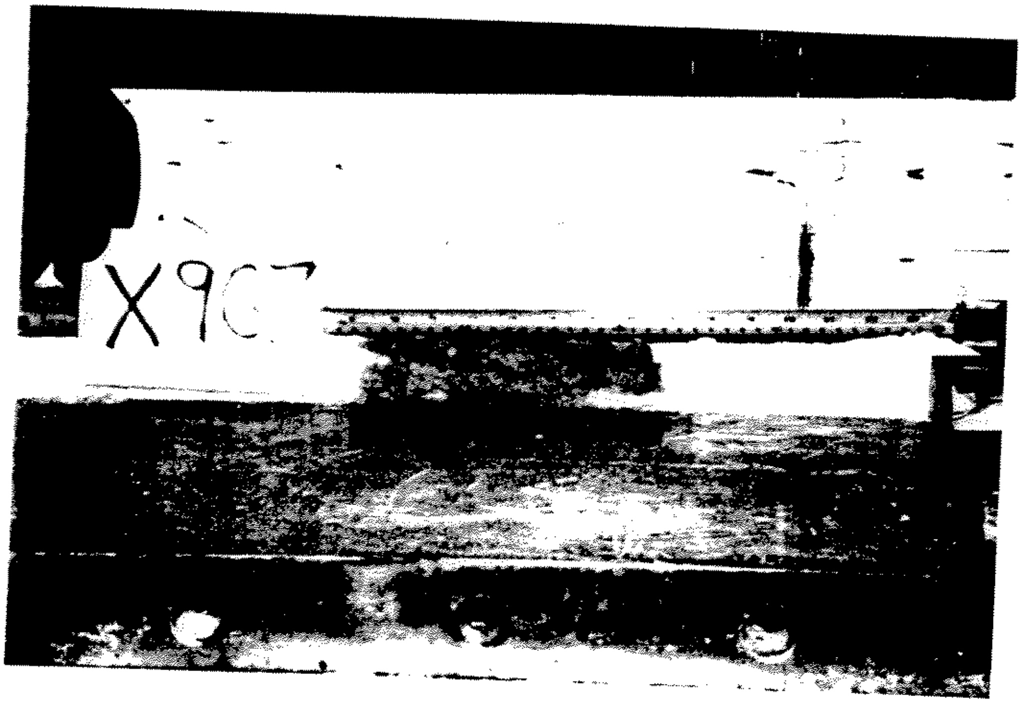


Test x967 at +360 mm.

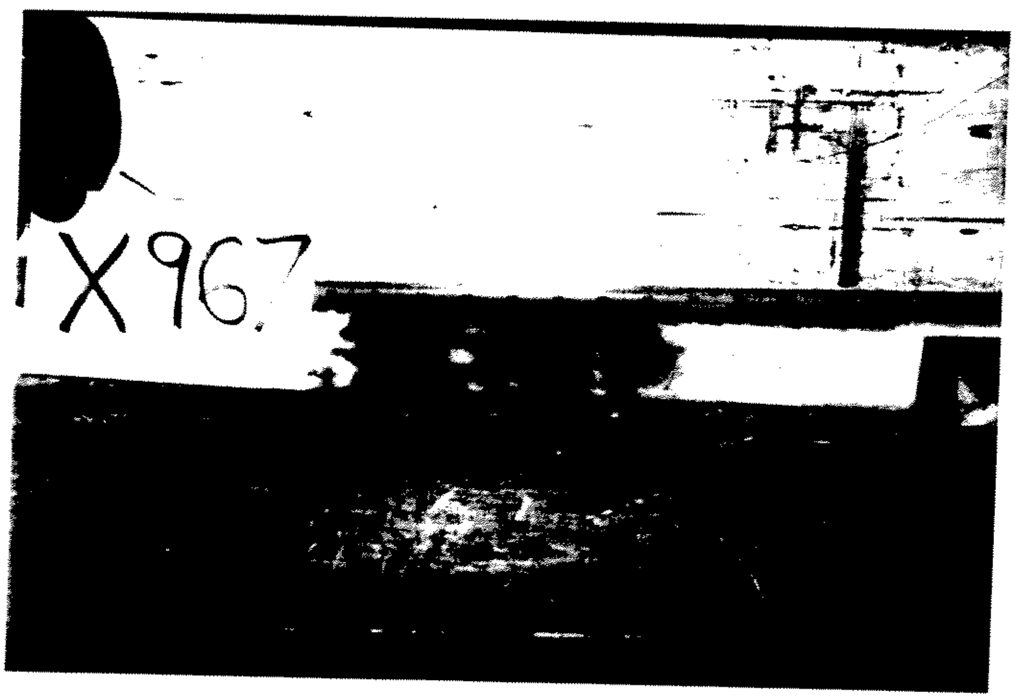
Test x967 at +380 mm.

Test x967 at +400 mm.

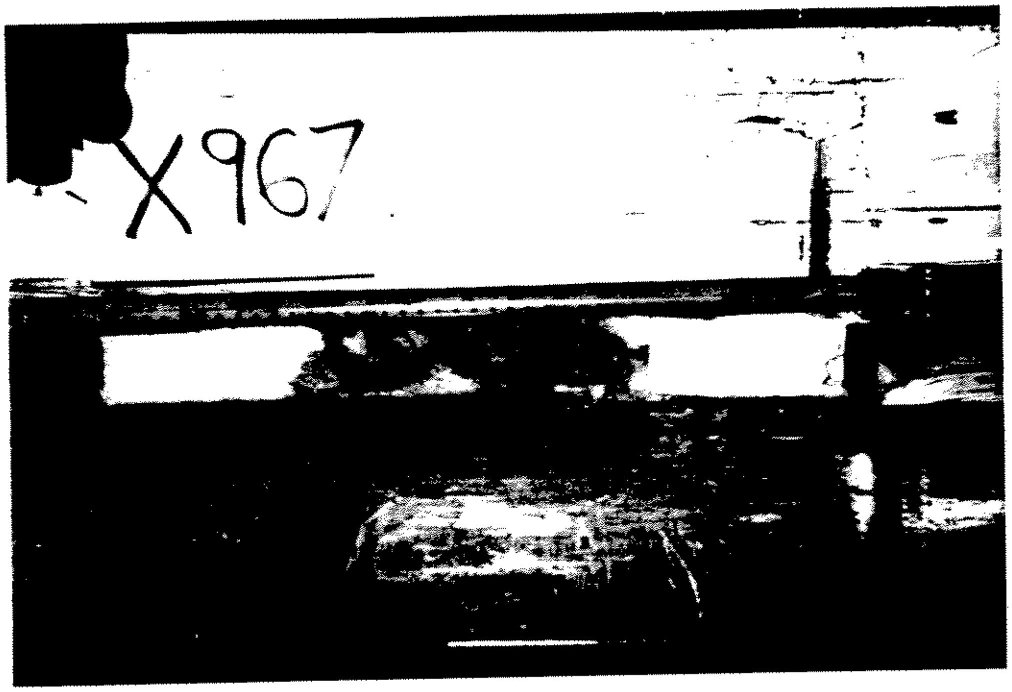
Test x967 at +420 mm.



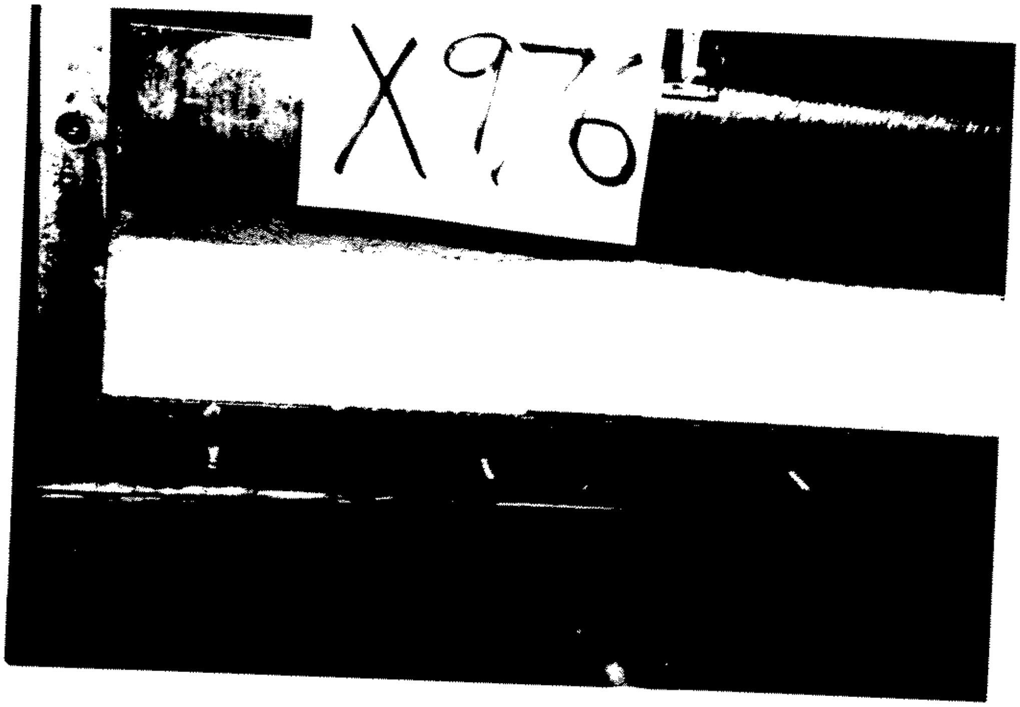
Test x967 at +440 mm.



Test x967 at +460 mm.



Test x967 at +480 mm.


X97.6

9.7 Notes on Nine Track Tape Data

Notes on recorded channels

ch #1	Potentiometer across upper and lower platten.
ch #2	Second potentiometer across upper and lower platten.
ch #3	The approximate average of channel 1 and channel 2 calculated electronically, this channel used as the feedback element in the servo control system.
ch #4	Output of the pressure transducer recording the oil pressure on the ch actuator.
ch #5	Output of the pressure transducer recording the oil pressure on the actuator.
ch #6	Data from ch 4 and ch 5 used to produce a signal approximately proportional to the applied load. Used internally within the servo controller unit to limit the applied load.

	Command signal.
ch #7	Local pressure cells on platten.
ch #8 to #16	

- To calculate the displacement use the average of channel 1 and channel 2.
- To calculate the mean platten pressure use the difference of channels 4 and 5 rather than channel 6. For the X series of tests the platten area is 0.387 m^2. For the Y series of tests the plunger area is 0.0127 m^2.
- The following conversion factors are required to get the data recorded on the 9 track tape into correct engineering units.

ch 1	multiply by	0.5
ch 2	multiply by	0.5
ch 3	multiply by	0.5
ch 4	multiply by	0.5
ch 5	multiply by	0.5
ch 6	multiply by	0.5
ch 7	multiply by	0.5
ch 8	multiply by	0.4141
ch 9	multiply by	0.4126
ch 10	multiply by	0.4441
ch 11	multiply by	0.4027
ch 12	multiply by	0.4153
ch 13	multiply by	0.4161
ch 14	multiply by	0.4250
ch 15	multiply by	0.4057
ch 16	multiply by	0.4057

Tests x999 to x987 have 10,000 words per channel.

Tests x986 to x962 have 16,000 words per channel.

Tests x969 and x968 do not exist.

Tests Y001 to Y007 have 16,000 words per channel.

The tapes are written in ASCII, unlabelled, at 1600 BPI. There are 120 characters per record, and 10 records to a block.

Each test's data file is divided (demultiplexed) into individual channels. There are a variable number of channels for each test. The data for each test appears as follows:

```
(Channel 1 ID)  (No. of samples in Channel 1)
(Sample 1) (Sample 2) (Sample 3) ... (Sample 10)
etc.

(Channel 2 ID) (No. of samples in Channel 2)
(Sample 1) ... etc
```

Each data sample is in "e10.3" format (e.g. -1.234e-03). Two blanks (ASCII 32) appear between each sample. An end-of-file marker appears at the end of each test.

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X962	Test duration 2.56	Sec.
Test date ..... 25 Jan 1989	Strain rate 2.5E-2	1/Sec
Test time 14:37:52	Sample rate 6250	Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-4.4	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X962_ch1	Displacement 1	107.2635	0	mm/V
X962_ch2	Displacement 2	107.2635	0	mm/V
X962_ch3	Mean Displacement	107.2635	0	mm/V
X962_ch4	Extend Load	.9265	0	MN/V
X962_ch5	Retract Load	.5217	0	MN/V
X962_ch6	Load	1	0	MN/V
X962_ch7	Command	2	0	V/V
X962_ch8	Local Pressure #8	8.99	0	MPa/V
X962_ch9	Local Pressure #9	8.99	0	MPa/V
X962_ch10	Local Pressure #10	2.248	0	MPa/V
X962_ch11	Local Pressure #11	.5735	0	MPa/V
X962_ch12	Local Pressure #12	.5735	0	MPa/V
X962_ch13	Local Pressure #13	8.99	0	MPa/V
X962_ch14	Local Pressure #14	2.248	0	MPa/V
X962_ch15	Local Pressure #15	8.99	0	MPa/V
X962_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X963	Test duration 29.99	Sec.
Test date ..... 24 Jan 1989	Strain rate 1.7E-3	1/Sec
Test time 16:16:59	Sample rate 533.333333333	Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-9.8	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X963_ch1	Displacement 1	107.2635	0	mm/V
X963_ch2	Displacement 2	107.2635	0	mm/V
X963_ch3	Mean Displacement	107.2635	0	mm/V
X963_ch4	Extend Load	.9265	0	MN/V
X963_ch5	Retract Load	.5217	0	MN/V
X963_ch6	Load	1	0	MN/V
X963_ch7	Command	2	0	V/V
X963_ch8	Local Pressure #8	8.99	0	MPa/V
X963_ch9	Local Pressure #9	8.99	0	MPa/V
X963_ch10	Local Pressure #10	2.248	0	MPa/V
X963_ch11	Local Pressure #11	.5735	0	MPa/V
X963_ch12	Local Pressure #12	.5735	0	MPa/V
X963_ch13	Local Pressure #13	8.99	0	MPa/V
X963_ch14	Local Pressure #14	2.248	0	MPa/V
X963_ch15	Local Pressure #15	8.99	0	MPa/V
X963_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X964	Test duration 29.99		Sec.
Test date ..... 24 Jan 1989	Strain rate 1.7E-3		1/Sec
Test time 11:39:57	Sample rate 533.333333333		Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100		mm
Sample name ... CRUSHED ICE	Temperature ......-9.8		C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X964_ch1	Displacement 1	107.2635	0	mm/V
X964_ch2	Displacement 2	107.2635	0	mm/V
X964_ch3	Mean Displacement	107.2635	0	mm/V
X964_ch4	Extend Load	.9265	0	MN/V
X964_ch5	Retract Load	.5217	0	MN/V
X964_ch6	Load	1	0	MN/V
X964_ch7	Command	2	0	V/V
X964_ch8	Local Pressure #8	8.99	0	MPa/V
X964_ch9	Local Pressure #9	8.99	0	MPa/V
X964_ch10	Local Pressure #10	2.248	0	MPa/V
X964_ch11	Local Pressure #11	.5735	0	MPa/V
X964_ch12	Local Pressure #12	.5735	0	MPa/V
X964_ch13	Local Pressure #13	8.99	0	MPa/V
X964_ch14	Local Pressure #14	2.248	0	MPa/V
X964_ch15	Local Prassure #15	8.99	0	MPa/V
X964_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name	X965	Test duration	2.56	Sec.
Test date	23 Jan 1989	Strain rate	2.5E-2	1/Sec
Test time	16:12:24	Sample rate	6250	Hz
Test type	Extrusion test	Sample size (wdh).	750 x 500 x 100	mm
Sample name ...	CRUSHED ICE	Temperature	-9.8	C.
Sample shape ..	Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X965_ch1	Displacement 1	107.2635	0	mm/V
X965_ch2	Displacement 2	107.2635	0	mm/V
X965_ch3	Mean Displacement	107.2635	0	mm/V
X965_ch4	Extend Load	.9265	0	MN/V
X965_ch5	Retract Load	.5217	0	MN/V
X965_ch6	Load	1	0	MN/V
X965_ch7	Command	2	0	V/V
X965_ch8	Local Pressure #8	8.99	0	MPa/V
X965_ch9	Local Pressure #9	8.99	0	MPa/V
X965_ch10	Local Pressure #10	2.248	0	MPa/V
X965_ch11	Local Pressure #11	.5735	0	MPa/V
X965_ch12	Local Pressure #12	.5735	0	MPa/V
X965_ch13	Local Pressure #13	8.99	0	MPa/V
X965_ch14	Local Pressure #14	2.248	0	MPa/V
X965_ch15	Local Pressure #15	8.99	0	MPa/V
X965_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X966	Test duration 29.99	Sec.
Test date ..... 23 Jan 1989	Strain rate 1.7E-3	1/Sec
Test time 13:13:35	Sample rate 533.333333333	Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-10	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X966_ch1	Displacement 1	107.2635	0	mm/V
X966_ch2	Displacement 2	107.2635	0	mm/V
X966_ch3	Mean Displacement	107.2635	0	mm/V
X966_ch4	Extend Load	.9265	0	MN/V
X966_ch5	Retract Load	.5217	0	MN/V
X966_ch6	Load	1	0	MN/V
X966_ch7	Command	2	0	V/V
X966_ch8	Local Pressure #8	8.99	0	MPa/V
X966_ch9	Local Pressure #9	8.99	0	MPa/V
X966_ch10	Local Pressure #10	2.248	0	MPa/V
X966_ch11	Local Pressure #11	.5735	0	MPa/V
X966_ch12	Local Pressure #12	.5735	0	MPa/V
X966_ch13	Local Pressure #13	8.99	0	MPa/V
X966_ch14	Local Pressure #14	2.248	0	MPa/V
X966_ch15	Local Pressure #15	8.99	0	MPa/V
X966_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X967	Test duration	2.56	Sec.
Test date ..... 19 Jan 1989	Strain rate	2.5E-2	1/Sec
Test time 15:31:17	Sample rate	6250	Hz
Test type ..... Extrusion test	Sample size (wdh).	500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature	-10	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X967_ch1	Displacement 1	107.2635	0	mm/V
X967_ch2	Displacement 2	107.2635	0	mm/V
X967_ch3	Mean Displacement	107.2635	0	mm/V
X967_ch4	Extend Load	.9265	0	MN/V
X967_ch5	Retract Load	.5217	0	MN/V
X967_ch6	Load	1	0	MN/V
X967_ch7	Command	2	0	V/V
X967_ch8	Local Pressure #8	8.99	0	MPa/V
X967_ch9	Local Pressure #9	8.99	0	MPa/V
X967_ch10	Local Pressure #10	2.248	0	MPa/V
X967_ch11	Local Pressure #11	.5735	0	MPa/V
X967_ch12	Local Pressure #12	.5735	0	MPa/V
X967_ch13	Local Pressure #13	8.99	0	MPa/V
X967_ch14	Local Pressure #14	2.248	0	MPa/V
X967_ch15	Local Pressure #15	8.99	0	MPa/V
X967_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X970		Test duration	5.094	Sec.
Test date ..... 26 Jan 1989		Strain rate	1E-2	1/Sec
Test time 13:40:07		Sample rate	3137.25490196	Hz
Test type ..... Extrusion test		Sample size (wdh).	750 x 500 x 100	mm
Sample name ... CRUSHED ICE		Temperature	-10.6	C.
Sample shape .. Rectangular				

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X970_ch1	Displacement 1	107.2635	0	mm/V
X970_ch2	Displacement 2	107.2635	0	mm/V
X970_ch3	Mean Displacement	107.2635	0	mm/V
X970_ch4	Extend Load	.9265	0	MN/V
X970_ch5	Retract Load	.5217	0	MN/V
X970_ch6	Load	1	0	MN/V
X970_ch7	Command	2	0	V/V
X970_ch8	Local Pressure #8	8.99	0	MPa/V
X970_ch9	Local Pressure #9	8.99	0	MPa/V
X970_ch10	Local Pressure #10	2.248	0	MPa/V
X970_ch11	Local Pressure #11	.5735	0	MPa/V
X970_ch12	Local Pressure #12	.5735	0	MPa/V
X970_ch13	Local Pressure #13	8.99	0	MPa/V
X970_ch14	Local Pressure #14	2.248	0	MPa/V
X970_ch15	Local Pressure #15	8.99	0	MPa/V
X970_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X971	Test duration 5.094	Sec.
Test date ..... 27 Jan 1989	Strain rate 1E-2	1/Sec
Test time 09:36:05	Sample rate 3137.25490196	Hz
Test type ..... Extusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-11	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X971_ch1	Displacement 1	107.2635	0	mm/V
X971_ch2	Displacement 2	107.2635	0	mm/V
X971_ch3	Mean Displacement	107.2635	0	mm/V
X971_ch4	Extend Load	.9265	0	MN/V
X971_ch5	Retract Load	.5217	0	MN/V
X971_ch6	Load	1	0	MN/V
X971_ch7	Command	2	0	V/V
X971_ch8	Local Pressure #8	8.99	0	MPa/V
X971_ch9	Local Pressure #9	8.99	0	MPa/V
X971_ch10	Local Pressure #10	2.248	0	MPa/V
X971_ch11	Local Pressure #11	.5735	0	MPa/V
X971_ch12	Local Pressure #12	.5735	0	MPa/V
X971_ch13	Local Pressure #13	8.99	0	MPa/V
X971_ch14	Local Pressure #14	2.248	0	MPa/V
X971_ch15	Local Pressure #15	8.99	0	MPa/V
X971_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X972	Test duration 2.995	Sec.
Test date ..... 27 Jan 1989	Strain rate 1.7E-2	1/Sec
Test time 11:47:26	Sample rate 5333.33333333	Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-11	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X972_ch1	Displacement 1	107.2635	0	mm/V
X972_ch2	Displacement 2	107.2635	0	mm/V
X972_ch3	Mean Displacement	107.2635	0	mm/V
X972_ch4	Extend Load	.9265	0	MN/V
X972_ch5	Retract Load	.5217	0	MN/V
X972_ch6	Load	1	0	MN/V
X972_ch7	Command	2	0	V/V
X972_ch8	Local Pressure #8	8.99	0	MPa/V
X972_ch9	Local Pressure #9	8.99	0	MPa/V
X972_ch10	Local Pressure #10	2.248	0	MPa/V
X972_ch11	Local Pressure #11	.5735	0	MPa/V
X972_ch12	Local Pressure #12	.5735	0	MPa/V
X972_ch13	Local Pressure #13	8.99	0	MPa/V
X972_ch14	Local Pressure #14	2.248	0	MPa/V
X972_ch15	Local Pressure #15	8.99	0	MPa/V
X972_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X973	Test duration	2.56	Sec.
Test date ..... 30 Jan 1989	Strain rate	2.5E-2	1/Sec
Test time 08:57:31	Sample rate	6250	Hz
Test type ..... Extrusion test	Sample size (wdh).	750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature	-11.2	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X973_ch1	Displacement 1	107.2635	0	mm/V
X973_ch2	Displacement 2	107.2635	0	mm/V
X973_ch3	Mean Displacement	107.2635	0	mm/V
X973_ch4	Extend Load	.9265	0	MN/V
X973_ch5	Retract Load	.5217	0	MN/V
X973_ch6	Load	1	0	MN/V
X973_ch7	Command	2	0	V/V
X973_ch8	Local Pressure #8	8.99	0	MPa/V
X973_ch9	Local Pressure #9	8.99	0	MPa/V
X973_ch10	Local Pressure #10	2.248	0	MPa/V
X973_ch11	Local Pressure #11	.5735	0	MPa/V
X973_ch12	Local Pressure #12	.5735	0	MPa/V
X973_ch13	Local Pressure #13	8.99	0	MPa/V
X973_ch14	Local Pressure #14	2.248	0	MPa/V
X973_ch15	Local Pressure #15	8.99	0	MPa/V
X973_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X974	Test duration 3.92		Sec.
Test date ..... 18 Jan 1989	Strain rate 1.3E-2		1/Sec
Test time 15:28:36	Sample rate 4078.43137255		Hz
Test type ..... Compaction test	Sample size (wdh). 500 x 750 x 150		mm
Sample name ... CRUSHED ICE	Temperature ......-10		C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X974_ch1	Displacement 1	107.2635	0	mm/V
X974_ch2	Displacement 2	107.2635	0	mm/V
X974_ch3	Mean Displacement	107.2635	0	mm/V
X974_ch4	Extend Load	.9265	0	MN/V
X974_ch5	Retract Load	.5217	0	MN/V
X974_ch6	Load	1	0	MN/V
X974_ch7	Command	2	0	V/V
X974_ch8	Local Pressure #8	8.99	0	MPa/V
X974_ch9	Local Pressure #9	8.99	0	MPa/V
X974_ch10	Local Pressure #10	2.248	0	MPa/V
X974_ch13	Local Pressure #13	8.99	0	MPa/V
X974_ch14	Local Pressure #14	2.248	0	MPa/V
X974_ch15	Local Pressure #15	8.99	0	MPa/V
X974_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X975	Test duration	29.993	Sec.
Test date ..... 18 Jan 1989	Strain rate	1.7E-3	1/Sec
Test time 11:11:49	Sample rate	533.333333333	Hz
Test type ..... Compaction test	Sample size (wdh).	500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature	-10	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X975_ch1	Displacement 1	107.2635	0	mm/V
X975_ch2	Displacement 2	107.2635	0	mm/V
X975_ch3	Mean Displacement	107.2635	0	mm/V
X975_ch4	Extend Load	.9265	0	MN/V
X975_ch5	Retract Load	.5217	0	MN/V
X975_ch6	Load	1	0	MN/V
X975_ch7	Command	2	0	V/V
X975_ch8	Local Pressure #8	8.99	0	MPa/V
X975_ch9	Local Pressure #9	8.99	0	MPa/V
X975_ch10	Local Pressure #10	2.248	0	MPa/V
X975_ch13	Local Pressure #13	8.99	0	MPa/V
X975_ch14	Local Pressure #14	2.248	0	MPa/V
X975_ch15	Local Pressure #15	8.99	0	MPa/V
X975_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X976	Test duration 2.542	Sec.
Test date ..... 17 Jan 1989	Strain rate 2E-2	1/Sec
Test time 15:12:25	Sample rate 6274.50980392	Hz
Test type ..... Compaction test	Sample size (wdh). 500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-10	°C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X976_ch1	Displacement 1	107.2635	0	mm/V
X976_ch2	Displacement 2	107.2635	0	mm/V
X976_ch3	Mean Displacement	107.2635	0	mm/V
X976_ch4	Extend Load	.9265	0	MN/V
X976_ch5	Retract Load	.5217	0	MN/V
X976_ch6	Load	1	0	MN/V
X976_ch7	Command	2	0	V/V
X976_ch8	Local Pressure #8	8.99	0	MPa/V
X976_ch9	Local Pressure #9	8.99	0	MPa/V
X976_ch10	Local Pressure #10	2.248	0	MPa/V
X976_ch13	Local Pressure #13	8.99	0	MPa/V
X976_ch14	Local Pressure #14	2.248	0	MPa/V
X976_ch15	Local Pressure #15	8.99	0	MPa/V
X976_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name	X977	Test duration	5.094	Sec.
Test date	16 Jan 1989	Strain rate	1E-2	1/Sec
Test time	14:14:27	Sample rate	3137.25490196	Hz
Test type	Compaction test	Sample size (wdh).	500 x 750 x 100	mm
Sample name ...	CRUSHED ICE	Temperature	-10	C.
Sample shape ..	Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X977_ch1	Displacement 1	107.2635	0	mm/V
X977_ch2	Displacement 2	107.2635	0	mm/V
X977_ch3	Mean Displacement	107.2635	0	mm/V
X977_ch4	Extend Load	.9265	0	MN/V
X977_ch5	Retract Load	.5217	0	MN/V
X977_ch6	Load	1	0	MN/V
X977_ch7	Command	2	0	V/V
X977_ch8	Local Pressure #8	8.99	0	MPa/V
X977_ch9	Local Pressure #9	8.99	0	MPa/V
X977_ch10	Local Pressure #10	2.248	0	MPa/V
X977_ch11	Local Pressure #11	.5735	0	MPa/V
X977_ch12	Local Pressure #12	.5735	0	MPa/V
X977_ch13	Local Pressure #13	8.99	0	MPa/V
X977_ch14	Local Pressure #14	2.248	0	MPa/V
X977_ch15	Local Pressure #15	8.99	0	MPa/V
X977_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X978
Test date ..... 22 Dec 1988
Test time 08:41:46
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 5.657 Sec.
Strain rate 9E-3 1/Sec
Sample rate ...... 2823.52941176 Hz
Sample size (wdh). 750 x 500 x 100 mm
Temperature ......-9.8 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X978_ch1	Displacement 1	107.2635	0	mm/V
X978_ch2	Displacement 2	107.2635	0	mm/V
X978_ch3	Mean Displacement	107.2635	0	mm/V
X978_ch4	Extend Load	.9265	0	MN/V
X978_ch5	Retract Load	.5217	0	MN/V
X978_ch6	Load	1	0	MN/V
X978_ch7	Command	1	0	V/V
X978_ch8	Local Pressure #8	8.99	0	MPa/V
X978_ch9	Local Pressure #9	8.99	0	MPa/V
X978_ch10	Local Pressure #10	2.248	0	MPa/V
X978_ch11	Local Pressure #11	.5735	0	MPa/V
X978_ch12	Local Pressure #12	.5735	0	MPa/V
X978_ch13	Local Pressure #13	8.99	0	MPa/V
X978_ch14	Local Pressure #14	2.248	0	MPa/V
X978_ch15	Local Pressure #15	8.99	0	MPa/V
X978_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X979		Test duration 5.657		Sec.
Test date ..... 21 Dec 1988		Strain rate 9E-3		1/Sec
Test time 14:01:49		Sample rate 2823.52941176		Hz
Test type ..... Extrusion test		Sample size (wdh). 750 x 500 x 100		mm
Sample name ... CRUSHED ICE		Temperature ......-9.6		C.
Sample shape .. Rectangular				

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X979_ch1	Displacement 1	107.2635	0	mm/V
X979_ch2	Displacement 2	107.2635	0	mm/V
X979_ch3	Mean Displacement	107.2635	0	mm/V
X979_ch4	Extend Load	.9265	0	MN/V
X979_ch5	Retract Load	.5217	0	MN/V
X979_ch6	Load	1	0	MN/V
X979_ch7	Command	1	0	V/V
X979_ch8	Local Pressure #8	8.99	0	MPa/V
X979_ch9	Local Pressure #9	8.99	0	MPa/V
X979_ch10	Local Pressure #10	2.248	0	MPa/V
X979_ch11	Local Pressure #11	.5735	0	MPa/V
X979_ch12	Local Pressure #12	.5735	0	MPa/V
X979_ch13	Local Pressure #13	8.99	0	MPa/V
X979_ch14	Local Pressure #14	2.248	0	MPa/V
X979_ch15	Local Pressure #15	8.99	0	MPa/V
X979_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X980	Test duration 5.657	Sec.
Test date ..... 21 Dec 1988	Strain rate 9E-3	1/Sec
Test time 09:56:01	Sample rate 2823.52941176	Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-9.8	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X980_ch1	Displacement 1	107.2635	0	mm/V
X980_ch2	Displacement 2	107.2635	0	mm/V
X980_ch3	Mean Displacement	107.2635	0	mm/V
X980_ch4	Extend Load	.9265	0	MN/V
X980_ch5	Retract Load	.5217	0	MN/V
X980_ch6	Load	1	0	MN/V
X980_ch7	Command	1	0	V/V
X980_ch8	Local Pressure #8	8.99	0	MPa/V
X980_ch9	Local Pressure #9	8.99	0	MPa/V
X980_ch10	Local Pressure #10	2.248	0	MPa/V
X980_ch11	Local Pressure #11	.5735	0	MPa/V
X980_ch12	Local Pressure #12	.5735	0	MPa/V
X980_ch13	Local Pressure #13	8.99	0	MPa/V
X980_ch14	Local Pressure #14	2.248	0	MPa/V
X980_ch15	Local Pressure #15	8.99	0	MPa/V
X980_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X981	Test duration	2.56	Sec.
Test date ..... 20 Dec 1988	Strain rate	2.5E-2	1/Sec
Test time 14:23:00	Sample rate	6250	Hz
Test type ..... Extrusion test	Sample size (wdh).	500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature	-9.6	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X981_ch1	Displacement 1	107.2635	0	mm/V
X981_ch2	Displacement 2	107.2635	0	mm/V
X981_ch3	Mean Displacement	107.2635	0	mm/V
X981_ch4	Extend Load	.9265	0	MN/V
X981_ch5	Retract Load	.5217	0	MN/V
X981_ch6	Load	1	0	MN/V
X981_ch7	Command	1	0	V/V
X981_ch8	Local Pressure #8	8.99	0	MPa/V
X981_ch9	Local Pressure #9	8.99	0	MPa/V
X981_ch10	Local Pressure #10	2.248	0	MPa/V
X981_ch11	Local Pressure #11	.5735	0	MPa/V
X981_ch12	Local Pressure #12	.5735	0	MPa/V
X981_ch13	Local Pressure #13	8.99	0	MPa/V
X981_ch14	Local Pressure #14	2.248	0	MPa/V
X981_ch15	Local Pressure #15	8.99	0	MPa/V
X981_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X982	Test duration 2.56	Sec.
Test date ..... 20 Dec 1988	Strain rate 2.5E-2	1/Sec
Test time 10:55:44	Sample rate 6250	Hz
Test type ..... Extrusion test	Sample size (wdh). 500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-10.2	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X982_ch1	Displacement 1	107.2635	0	mm/V
X982_ch2	Displacement 2	107.2635	0	mm/V
X982_ch3	Mean Displacement	107.2635	0	mm/V
X982_ch4	Extend Load	.9265	0	MN/V
X982_ch5	Retract Load	.5217	0	MN/V
X982_ch6	Load	1	0	MN/V
X982_ch7	Command	1	0	V/V
X982_ch8	Local Pressure #8	8.99	0	MPa/V
X982_ch9	Local Pressure #9	8.99	0	MPa/V
X982_ch10	Local Pressure #10	2.248	0	MPa/V
X982_ch11	Local Pressure #11	.5735	0	MPa/V
X982_ch12	Local Pressure #12	.5735	0	MPa/V
X982_ch13	Local Pressure #13	8.99	0	MPa/V
X982_ch14	Local Pressure #14	2.248	0	MPa/V
X982_ch15	Local Pressure #15	8.99	0	MPa/V
X982_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X983	Test duration	2.56		Sec.
Test date ..... 19 Dec 1988	Strain rate	2.5E-2		1/Sec
Test time 14:43:55	Sample rate	6250		Hz
Test type ..... Extrusion test	Sample size (wdh).	500 x 750 x 50		mm
Sample name ... CRUSHED ICE	Temperature	-9.6		C.
Sample shape .. Rectangular				

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X983_ch1	Displacement 1	107.2635	0	mm/V
X983_ch2	Displacement 2	107.2635	0	mm/V
X983_ch3	Mean Displacement	107.2635	0	mm/V
X983_ch4	Extend Load	.9265	0	MN/V
X983_ch5	Retract Load	.5217	0	MN/V
X983_ch6	Load	1	0	MN/V
X983_ch7	Command	1	0	V/V
X983_ch8	Local Pressure #8	8.99	0	MPa/V
X983_ch9	Local Pressure #9	8.99	0	MPa/V
X983_ch10	Local Pressure #10	2.248	0	MPa/V
X983_ch11	Local Pressure #11	.5735	0	MPa/V
X983_ch12	Local Pressure #12	.5735	0	MPa/V
X983_ch13	Local Pressure #13	8.99	0	MPa/V
X983_ch14	Local Pressure #14	2.248	0	MPa/V
X983_ch15	Local Pressure #15	8.99	0	MPa/V
X983_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X984	Test duration	3.392	Sec.
Test date ..... 19 Dec 1988	Strain rate	1.5E-2	1/Sec
Test time 10:24:25	Sample rate	4705.88235294	Hz
Test type ..... Extrusion test	Sample size (wdh).	750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature	-9.8	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X984_ch1	Displacement 1	107.2635	0	mm/V
X984_ch2	Displacement 2	107.2635	0	mm/V
X984_ch3	Mean Displacement	107.2635	0	mm/V
X984_ch4	Extend Load	.9265	0	MN/V
X984_ch5	Retract Load	.5217	0	MN/V
X984_ch6	Load	1	0	MN/V
X984_ch7	Command	1	0	V/V
X984_ch8	Local Pressure #8	8.99	0	MPa/V
X984_ch9	Local Pressure #9	8.99	0	MPa/V
X984_ch10	Local Pressure #10	2.248	0	MPa/V
X984_ch11	Local Pressure #11	.5735	0	MPa/V
X984_ch12	Local Pressure #12	.5735	0	MPa/V
X984_ch13	Local Pressure #13	8.99	0	MPa/V
X984_ch14	Local Pressure #14	2.248	0	MPa/V
X984_ch15	Local Pressure #15	8.99	0	MPa/V
X984_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X985	Test duration	48.563	Sec.
Test date ..... 16 Dec 1988	Strain rate	1.05E-3	1/Sec
Test time 16:13:26	Sample rate	329.411764706	Hz
Test type ..... Extrusion test	Sample size (wdh).	500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature	-9.6	C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X985_ch1	Displacement 1	107.2635	0	mm/V
X985_ch2	Displacement 2	107.2635	0	mm/V
X985_ch3	Mean Displacement	107.2635	0	mm/V
X985_ch4	Extend Load	.9265	0	MN/V
X985_ch5	Retract Load	.5217	0	MN/V
X985_ch6	Load	1	0	MN/V
X985_ch7	Command	1	0	V/V
X985_ch8	Local Pressure #8	8.99	0	MPa/V
X985_ch9	Local Pressure #9	8.99	0	MPa/V
X985_ch10	Local Pressure #10	2.248	0	MPa/V
X985_ch11	Local Pressure #11	.5735	0	MPa/V
X985_ch12	Local Pressure #12	.5735	0	MPa/V
X985_ch13	Local Pressure #13	8.99	0	MPa/V
X985_ch14	Local Pressure #14	2.248	0	MPa/V
X985_ch15	Local Pressure #15	8.99	0	MPa/V
X985_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X986
Test date ..... 16 Dec 1988
Test time 14:05:31
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 48.563 Sec.
Strain rate 1.05E-3 1/Sec
Sample rate ...... 329.411764706 Hz
Sample size (wdh). 500 x 750 x 100 mm
Temperature ......-9 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X986_ch1	Displacement 1	107.2635	0	mm/V
X986_ch2	Displacement 2	107.2635	0	mm/V
X986_ch3	Mean Displacement	107.2635	0	mm/V
X986_ch4	Extend Load	.9265	0	MN/V
X986_ch5	Retract Load	.5217	0	MN/V
X986_ch6	Load	1	0	MN/V
X986_ch7	Command	1	0	V/V
X986_ch8	Local Pressure #8	8.99	0	MPa/V
X986_ch9	Local Pressure #9	8.99	0	MPa/V
X986_ch10	Local Pressure #10	2.248	0	MPa/V
X986_ch11	Local Pressure #11	.5735	0	MPa/V
X986_ch12	Local Pressure #12	.5735	0	MPa/V
X986_ch13	Local Pressure #13	8.99	0	MPa/V
X986_ch14	Local Pressure #14	2.248	0	MPa/V
X986_ch15	Local Pressure #15	8.99	0	MPa/V
X986_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X987
Test date ..... 15 Dec 1988
Test time 15:38:49
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 56.664 Sec.
Strain rate 9E-4 1/Sec
Sample rate ...... 176.470588235 Hz
Sample size (wdh). 750 x 500 x 100 mm
Temperature ......-8 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X987_ch1	Displacement 1	107.2635	0	mm/V
X987_ch2	Displacement 2	107.2635	0	mm/V
X987_ch3	Mean Displacement	107.2635	0	mm/V
X987_ch4	Extend Load	.9265	0	MN/V
X987_ch5	Retract Load	.5217	0	MN/V
X987_ch6	Load	1	0	MN/V
X987_ch7	Command	1	0	V/V
X987_ch8	Local Pressure #8	8.99	0	MPa/V
X987_ch9	Local Pressure #9	8.99	0	MPa/V
X987_ch10	Local Pressure #10	2.248	0	MPa/V
X987_ch11	Local Pressure #11	.5735	0	MPa/V
X987_ch12	Local Pressure #12	.5735	0	MPa/V
X987_ch13	Local Pressure #13	8.99	0	MPa/V
X987_ch14	Local Pressure #14	2.248	0	MPa/V
X987_ch15	Local Pressure #15	8.99	0	MPa/V
X987_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X986	Test duration 48.563	Sec.
Test date ..... 16 Dec 1988	Strain rate 1.05E-3	1/Sec
Test time 14:05:31	Sample rate 329.411764706	Hz
Test type ..... Extrusion test	Sample size (wdh). 500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-9	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X986_ch1	Displacement 1	107.2635	0	mm/V
X986_ch2	Displacement 2	107.2635	0	mm/V
X986_ch3	Mean Displacement	107.2635	0	mm/V
X986_ch4	Extend Load	.9265	0	MN/V
X986_ch5	Retract Load	.5217	0	MN/V
X986_ch6	Load	1	0	MN/V
X986_ch7	Command	1	0	V/V
X986_ch8	Local Pressure #8	8.99	0	MPa/V
X986_ch9	Local Pressure #9	8.99	0	MPa/V
X986_ch10	Local Pressure #10	2.248	0	MPa/V
X986_ch11	Local Pressure #11	.5735	0	MPa/V
X986_ch12	Local Pressure #12	.5735	0	MPa/V
X986_ch13	Local Pressure #13	8.99	0	MPa/V
X986_ch14	Local Pressure #14	2.248	0	MPa/V
X986_ch15	Local Pressure #15	8.99	0	MPa/V
X986_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X987	Test duration 56.664	Sec.
Test date ..... 15 Dec 1988	Strain rate 9E-4	1/Sec
Test time 15:38:49	Sample rate 176.470588235	Hz
Test type ..... Extrusion test	Sample size (wdh). 750 x 500 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-8	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X987_ch1	Displacement 1	107.2635	0	mm/V
X987_ch2	Displacement 2	107.2635	0	mm/V
X987_ch3	Mean Displacement	107.2635	0	mm/V
X987_ch4	Extend Load	.9265	0	MN/V
X987_ch5	Retract Load	.5217	0	MN/V
X987_ch6	Load	1	0	MN/V
X987_ch7	Command	1	0	V/V
X987_ch8	Local Pressure #8	8.99	0	MPa/V
X987_ch9	Local Pressure #9	8.99	0	MPa/V
X987_ch10	Local Pressure #10	2.248	0	MPa/V
X987_ch11	Local Pressure #11	.5735	0	MPa/V
X987_ch12	Local Pressure #12	.5735	0	MPa/V
X987_ch13	Local Pressure #13	8.99	0	MPa/V
X987_ch14	Local Pressure #14	2.248	0	MPa/V
X987_ch15	Local Pressure #15	8.99	0	MPa/V
X987_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X988
Test date ..... 15 Dec 1988
Test time 13:38:40
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 6 Sec.
Strain rate 8.5E-3 1/Sec
Sample rate ...... 1666.66666667 Hz
Sample size (wdh). 750 x 500 x 100 mm
Temperature ......-8 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X988_ch1	Displacement 1	107.2635	0	mm/V
X988_ch2	Displacement 2	107.2635	0	mm/V
X988_ch3	Mean Displacement	107.2635	0	mm/V
X988_ch4	Extend Load	.9265	0	MN/V
X988_ch5	Retract Load	.5217	0	MN/V
X988_ch6	Load	1	0	MN/V
X988_ch7	Command	1	0	V/V
X988_ch8	Local Pressure #8	8.99	0	MPa/V
X988_ch9	Local Pressure #9	8.99	0	MPa/V
X988_ch10	Local Pressure #10	2.248	0	MPa/V
X988_ch11	Local Pressure #11	.5735	0	MPa/V
X988_ch12	Local Pressure #12	.5735	0	MPa/V
X988_ch13	Local Pressure #13	8.99	0	MPa/V
X988_ch14	Local Pressure #14	2.248	0	MPa/V
X988_ch15	Local Pressure #15	8.99	0	MPa/V
X988_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name	X989	Test duration	6	Sec.
Test date	14 Dec 1988	Strain rate	8.5E-3	1/Sec
Test time	15:56:44	Sample rate	1666.66666667	Hz
Test type	Extrusion test	Sample size (wdh).	500 x 750 x 100	mm
Sample name ...	CRUSHED ICE	Temperature	-8.8	C.
Sample shape ..	Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X989_ch1	Displacement 1	107.2635	0	mm/V
X989_ch2	Displacement 2	107.2635	0	mm/V
X989_ch3	Mean Displacement	107.2635	0	mm/V
X989_ch4	Extend Load	.9265	0	MN/V
X989_ch5	Retract Load	.5217	0	MN/V
X989_ch6	Load	1	0	MN/V
X989_ch7	Command	1	0	V/V
X989_ch8	Local Pressure #8	8.99	0	MPa/V
X989_ch9	Local Pressure #9	8.99	0	MPa/V
X989_ch10	Local Pressure #10	2.248	0	MPa/V
X989_ch11	Local Pressure #11	.5735	0	MPa/V
X989_ch12	Local Pressure #12	.5735	0	MPa/V
X989_ch13	Local Pressure #13	8.99	0	MPa/V
X989_ch14	Local Pressure #14	2.248	0	MPa/V
X989_ch15	Local Pressure #15	8.99	0	MPa/V
X989_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X990	Test duration 6		Sec.
Test date ..... 14 Dec 1988	Strain rate 8.5E-3		1/Sec
Test time 13:30:37	Sample rate 1666.66666667		Hz
Test type ..... Extrusion test	Sample size (wdh). 500 x 750 x 100		mm
Sample name ... CRUSHED ICE	Temperature ......-9		C.
Sample shape .. Rectangular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X990_ch1	Displacement 1	107.2635	0	mm/V
X990_ch2	Displacement 2	107.2635	0	mm/V
X990_ch3	Mean Displacement	107.2635	0	mm/V
X990_ch4	Extend Load	.9265	0	MN/V
X990_ch5	Retract Load	.5217	0	MN/V
X990_ch6	Load	1	0	MN/V
X990_ch7	Command	1	0	V/V
X990_ch8	Local Pressure #8	8.99	0	MPa/V
X990_ch9	Local Pressure #9	8.99	0	MPa/V
X990_ch10	Local Pressure #10	2.248	0	MPa/V
X990_ch11	Local Pressure #11	.5735	0	MPa/V
X990_ch12	Local Pressure #12	.5735	0	MPa/V
X990_ch13	Local Pressure #13	8.99	0	MPa/V
X990_ch14	Local Pressure #14	2.248	0	MPa/V
X990_ch15	Local Pressure #15	8.99	0	MPa/V
X990_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X991
Test date ..... 14 Dec 1988
Test time 09:43:24
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 10.2 Sec.
Strain rate 5E-3 1/Sec
Sample rate ...... 980.392156863 Hz
Sample size (wdh). 500 x 750 x 100 mm
Temperature ......-9.8 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X991_ch1	Displacement 1	107.2635	0	mm/V
X991_ch2	Displacement 2	107.2635	0	mm/V
X991_ch3	Mean Displacement	107.2635	0	mm/V
X991_ch4	Extend Load	.9265	0	MN/V
X991_ch5	Retract Load	.5217	0	MN/V
X991_ch6	Load	1	0	MN/V
X991_ch7	Command	1	0	V/V
X991_ch8	Local Pressure #8	8.99	0	MPa/V
X991_ch9	Local Pressure #9	8.99	0	MPa/V
X991_ch10	Local Pressure #10	2.248	0	MPa/V
X991_ch11	Local Pressure #11	.5735	0	MPa/V
X991_ch12	Local Pressure #12	.5735	0	MPa/V
X991_ch13	Local Pressure #13	8.99	0	MPa/V
X991_ch14	Local Pressure #14	2.248	0	MPa/V
X991_ch15	Local Pressure #15	8.99	0	MPa/V
X991_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X992	Test duration 2.016	Sec.
Test date ..... 13 Dec 1988	Strain rate 2.5E-2	1/Sec
Test time 15:42:47	Sample rate 4901.96078431	Hz
Test type ..... Extrusion test	Sample size (wdh). 500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-9.6	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X992_ch1	Displacement 1	107.2635	0	mm/V
X992_ch2	Displacement 2	107.2635	0	mm/V
X992_ch3	Mean Displacement	107.2635	0	mm/V
X992_ch4	Extend Load	.9265	0	MN/V
X992_ch5	Retract Load	.5217	0	MN/V
X992_ch6	Load	1	0	MN/V
X992_ch7	Command	1	0	V/V
X992_ch8	Local Pressure #8	8.99	0	MPa/V
X992_ch9	Local Pressure #9	8.99	0	MPa/V
X992_ch10	Local Pressure #10	2.248	0	MPa/V
X992_ch11	Local Pressure #11	.5735	0	MPa/V
X992_ch12	Local Pressure #12	.5735	0	MPa/V
X992_ch13	Local Pressure #13	8.99	0	MPa/V
X992_ch14	Local Pressure #14	2.248	0	MPa/V
X992_ch15	Local Pressure #15	8.99	0	MPa/V
X992_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X993
Test date ..... 13 Dec 1988
Test time 09:33:27
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 2.016 Sec.
Strain rate 2.5E-2 1/Sec
Sample rate ...... 4901.96078431 Hz
Sample size (wdh). 500 x 750 x 100 mm
Temperature ......-9.4 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X993_ch1	Displacement 1	107.2635	0	mm/V
X993_ch2	Displacement 2	107.2635	0	mm/V
X993_ch3	Mean Displacement	107.2635	0	mm/V
X993_ch4	Extend Load	.9265	0	MN/V
X993_ch5	Retract Load	.5217	0	MN/V
X993_ch6	Load	1	0	MN/V
X993_ch7	Command	1	0	V/V
X993_ch8	Local Pressure #8	8.99	0	MPa/V
X993_ch9	Local Pressure #9	8.99	0	MPa/V
X993_ch10	Local Pressure #10	2.248	0	MPa/V
X993_ch11	Local Pressure #11	.5735	0	MPa/V
X993_ch12	Local Pressure #12	.5735	0	MPa/V
X993_ch13	Local Pressure #13	8.99	0	MPa/V
X993_ch14	Local Pressure #14	2.248	0	MPa/V
X993_ch15	Local Pressure #15	8.99	0	MPa/V
X993_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X994
Test date ..... 12 Dec 1988
Test time 14:10:19
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 2.016 Sec.
Strain rate 2.5E-2 1/Sec
Sample rate ...... 4901.96078431 Hz
Sample size (wdh). 500 x 750 x 100 mm
Temperature ......-9.6 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X994_ch1	Displacement 1	107.2635	0	mm/V
X994_ch2	Displacement 2	107.2635	0	mm/V
X994_ch3	Mean Displacement	107.2635	0	mm/V
X994_ch4	Extend Load	.9265	0	MN/V
X994_ch5	Retract Load	.5217	0	MN/V
X994_ch6	Load	1	0	MN/V
X994_ch7	Command	1	0	V/V
X994_ch8	Local Pressure #8	8.99	0	MPa/V
X994_ch9	Local Pressure #9	8.99	0	MPa/V
X994_ch10	Local Pressure #10	2.248	0	MPa/V
X994_ch11	Local Pressure #11	.5735	0	MPa/V
X994_ch12	Local Pressure #12	.5735	0	MPa/V
X994_ch13	Local Pressure #13	8.99	0	MPa/V
X994_ch14	Local Pressure #14	2.248	0	MPa/V
X994_ch15	Local Pressure #15	8.99	0	MPa/V
X994_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X995	Test duration 2.016	Sec.
Test date ..... 9 Dec 1988	Strain rate 2.5E-2	1/Sec
Test time 10:42:32	Sample rate 4901.96078431	Hz
Test type ..... Extrusion test	Sample size (wdh). 500 x 750 x 100	mm
Sample name ... CRUSHED ICE	Temperature ......-9.4	C.
Sample shape .. Rectangular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X995_ch1	Displacement 1	107.2635	0	mm/V
X995_ch2	Displacement 2	107.2635	0	mm/V
X995_ch3	Mean Displacement	107.2635	0	mm/V
X995_ch4	Extend Load	.9265	0	MN/V
X995_ch5	Retract Load	.5217	0	MN/V
X995_ch6	Load	1	0	MN/V
X995_ch7	Command	1	0	V/V
X995_ch8	Local Pressure #8	8.99	0	MPa/V
X995_ch9	Local Pressure #9	8.99	0	MPa/V
X995_ch10	Local Pressure #10	2.248	0	MPa/V
X995_ch11	Local Pressure #11	.5735	0	MPa/V
X995_ch12	Local Pressure #12	.5735	0	MPa/V
X995_ch13	Local Pressure #13	8.99	0	MPa/V
X995_ch14	Local Pressure #14	2.248	0	MPa/V
X995_ch15	Local Pressure #15	8.99	0	MPa/V
X995_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X996
Test date ..... 7 Dec 1988
Test time 16:26:01
Test type ..... Extrusion test
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 2.016 Sec.
Strain rate 2.5E-2 1/Sec
Sample rate ...... 4901.96078431 Hz
Sample size (wdh). 500 x 750 x 100 mm
Temperature ......-10 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X996_ch1	Displacement 1	107.2635	0	mm/V
X996_ch2	Displacement 2	107.2635	0	mm/V
X996_ch3	Mean Displacement	107.2635	0	mm/V
X996_ch4	Extend Load	.9265	0	MN/V
X996_ch5	Retract Load	.5217	0	MN/V
X996_ch6	Load	1	0	MN/V
X996_ch7	Command	1	0	V/V
X996_ch8	Local Pressure #8	8.99	0	MPa/V
X996_ch9	Local Pressure #9	8.99	0	MPa/V
X996_ch10	Local Pressure #10	2.248	0	MPa/V
X996_ch11	Local Pressure #11	.5735	0	MPa/V
X996_ch12	Local Pressure #12	.5735	0	MPa/V
X996_ch13	Local Pressure #13	8.99	0	MPa/V
X996_ch14	Local Pressure #14	2.248	0	MPa/V
X996_ch15	Local Pressure #15	8.99	0	MPa/V
X996_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X997
Test date ..... 5 Dec 1988
Test time 15:57:54
Test type ..... Extrusion
Sample name ... CRUSHED ICE
Sample shape .. Rectangular

Test duration .... 2.016 Sec.
Strain rate 2.5E-2 1/Sec
Sample rate ...... 4901.96078431 Hz
Sample size (wdh). 500 x 750 x 100 mm
Temperature ......-10 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X997_ch1	Displacement 1	107.2635	0	mm/V
X997_ch2	Displacement 2	107.2635	0	mm/V
X997_ch3	Mean Displacement	107.2635	0	mm/V
X997_ch4	Extend Load	.9265	0	MN/V
X997_ch5	Retract Load	.5217	0	MN/V
X997_ch6	Load	1	0	MN/V
X997_ch7	Command	1	0	V/V
X997_ch8	Local Pressure #8	8.99	0	MPa/V
X997_ch9	Local Pressure #9	8.99	0	MPa/V
X997_ch10	Local Pressure #10	2.248	0	MPa/V
X997_ch11	Local Pressure #11	.5735	0	MPa/V
X997_ch12	Local Pressure #12	.5735	0	MPa/V
X997_ch13	Local Pressure #13	8.99	0	MPa/V
X997_ch14	Local Pressure #14	2.248	0	MPa/V
X997_ch15	Local Pressure #15	8.99	0	MPa/V
X997_ch16	Local Pressure #16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X998
Test date ..... 1 Dec 1988
Test time 09:25:53
Test type ..... System test
Sample name ... CRUSHED ICE
Sample shape .. Circular

Test duration .... 34 Sec.
Strain rate 1.5E-3 1/Sec
Sample rate ...... 294.117647059 Hz
Sample size (dh).. 100 x 250 mm
Temperature ......-10 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X998_ch1	Displacement 1	107.2635	0	mm/V
X998_ch2	Displacement 2	107.2635	0	mm/V
X998_ch3	Mean Displacement	107.2635	0	mm/V
X998_ch4	Extend Load	.9265	0	MN/V
X998_ch5	Retract Load	.5217	0	MN/V
X998_ch6	Load	1	0	MN/V
X998_ch7	Command	1	0	V/V
X998_ch8	Local Pressure 8	8.99	0	MPa/V
X998_ch9	Local Pressure 9	8.99	0	MPa/V
X998_ch10	Local Pressure 10	2.248	0	MPa/V
X998_ch11	Local Pressure 11	.5735	0	MPa/V
X998_ch12	Local Pressure 12	.5735	0	MPa/V
X998_ch13	Local Pressure 13	8.99	0	MPa/V
X998_ch14	Local Pressure 14	2.248	0	MPa/V
X998_ch15	Local Pressure 15	8.99	0	MPa/V
X998_ch16	Local Pressure 16	8.99	0	MPa/V

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MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name X999	Test duration	5	Sec.
Test date ..... 29 Nov 1988	Strain rate	1.0E-2	1/Sec
Test time 16:45:49	Sample rate	2000	Hz
Test type ..... Sys test	Sample size (dh)..	100 x 250	mm
Sample name ...	Temperature	-10	C.
Sample shape .. Circular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
X999_ch1	Displacement 1	107.2635	0	mm/V
X999_ch2	Displacement 2	107.2635	0	mm/V
X999_ch3	Mean Displacement	107.2635	0	mm/V
X999_ch4	Extend Load	.9265	0	MN/V
X999_ch5	Retract Load	.5217	0	MN/V
X999_ch6	Load	1	0	MN/V
X999_ch7	Command	1	0	V/V
X999_ch8	Local Pressure 8	8.99	0	MPa/V
X999_ch9	Local Pressure 9	8.99	0	MPa/V
X999_ch10	Local Pressure 10	2.248	0	MPa/V
X999_ch11	Local Pressure 11	.5735	0	MPa/V
X999_ch12	Local Pressure 12	.5735	0	MPa/V
X999_ch13	Local Pressure 13	8.99	0	MPa/V
X999_ch14	Local Pressure 14	2.248	0	MPa/V
X999_ch15	Local Pressure 15	8.99	0	MPa/V
X999_ch16	Local Pressure 16	8.99	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y001		Test duration 29.14		Sec.
Test date ..... 3 Jan 1989		Strain rate 1.75E-3		1/Sec
Test time 11:48:09		Sample rate 549.019607843		Hz
Test type ..... Crush extrusion test				
		Sample size (dh).. 127 x 187		mm
Sample name ... CRUSHED ICE		Temperature ......-10		C.
Sample shape .. Circular				

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y001_ch3	Mean Displacement	20.19	0	mm/V
Y001_ch4	Extend Load	1.382	0	MN/V
Y001_ch5	Retract Load	1.056	0	MN/V
Y001_ch7	Command	2	0	V/V
Y001_ch16	Local Pressure #16	49.94	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y002
Test date ..... 4 Jan 1989
Test time 13:38:13
Test type ..... Crush extrusion test

Sample name ... SOLID ICE
Sample shape .. Circular

Test duration .... 29.14 Sec.
Strain rate 1.75E-3 1/Sec
Sample rate ...... 549.019607843 Hz

Sample size (dh).. 126.37 x 164 mm
Temperature ......-10.2 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y002_ch3	Displacement	20.19	0	mm/V
Y002_ch4	Extend Load	1.3834	0	MN/V
Y002_ch5	Retract Load	1.0476	0	MN/V
Y002_ch7	Command	2	0	V/V
Y002_ch16	Local Pressure	49.94	0	MPa/V

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MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y003
Test date ..... 5 Jan 1989
Test time 14:51:20
Test type ..... Crush extrusion test

Sample name ... SOLID ICE
Sample shape .. Circular

Test duration .... 60 Sec.
Strain rate ...... .85E-3 1/Sec
Sample rate ...... 266.666666667 Hz
Sample size (dh).. 126.28 x 164 mm
Temperature ......-10 C.

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y003_ch3	Displacement	20.19	0	mm/V
Y003_ch4	Extend Load	1.3834	0	MN/V
Y003_ch5	Retract Load	1.0476	0	MN/V
Y003_ch7	Command	2	0	V/V
Y003_ch16	Local Pressure	49.94	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y004	Test duration 8	Sec.
Test date ..... 6 Jan 1989	Strain rate 1.0E-2	1/Sec
Test time 13:14:17	Sample rate 2000	Hz
Test type ..... Sys test	Sample size (dh).. 100 x 250	mm
Sample name ... NONE	Temperature 0	C.
Sample shape .. Circular		

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y004_ch3	Displacement	20.19	0	mm/V
Y004_ch4	Extend Load	1.3834	0	MN/V
Y004_ch5	Retract Load	1.0476	0	MN/V
Y004_ch7	Command	2	0	V/V
Y004_ch16	Local Pressure	49.94	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y005
Test date ..... 9 Jan 1989
Test time 11:43:24
Test type ..... Crush extrusion test

Test duration .... 5.1 Sec.
Strain rate 1E-2 1/Sec
Sample rate ...... 3137.25490196 Hz

Sample size (dh).. 126.5 x 163.5 mm
Temperature ......-10 C.

Sample name ... SOLID ICE
Sample shape .. Circular

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y005_ch3	Displacement	20.19	0	mm/V
Y005_ch4	Extend Load	1.3834	0	MN/V
Y005_ch5	Retract Load	1.0476	0	MN/V
Y005_ch7	Command	2	0	V/V
Y005_ch16	Local Pressure	49.94	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y006	Test duration	7.968	Sec.
Test date ..... 11 Jan 1989	Strain rate	6.4E-3	1/Sec
Test time 14:22:07	Sample rate	2007.84313725	Hz
Test type ..... Crush extrusion test			
	Sample size (dh)..	126 x 163.5	mm
Sample name ... SOLID ICE	Temperature	-10.3	C.
Sample shape .. Circular			

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y006_ch3	Displacement	20.19	0	mm/V
Y006_ch4	Extend Load	1.3834	0	MN/V
Y006_ch5	Retract Load	1.0476	0	MN/V
Y006_ch7	Command	2	0	V/V
Y006_ch16	Local Pressure	49.94	0	MPa/V

MATERIALS TEST ANALYSIS PROGRAM

--TEST PARAMETERS AND INFORMATION--

Test name Y007
Test date ..... 12 Jan 1989
Test time 10:09:58
Test type ..... Crush extrusion test

Test duration .... 1.7 Sec.
Strain rate 3E-2 1/Sec
Sample rate ...... 9411.76470588 Hz

Sample size (dh).. 126.56 x 164 mm
Temperature ......-10.2 C.

Sample name ... SOLID ICE
Sample shape .. Circular

FILE	DESCRIPTION	TX GAIN	TX OFFSET	UNITS
Y007_ch3	Displacement	20.19	0	mm/V
Y007_ch4	Extend Load	1.3834	0	MN/V
Y007_ch5	Retract Load	1.0476	0	MN/V
Y007_ch7	Command	2	0	V/V
Y007_ch16	Local Pressure	49.94	0	MPa/V

9.8 Component Specifications

2100 SYSTEM

Strain Gage Conditioner and Amplifier System

– Instruction Manual –

MEASUREMENTS GROUP

INSTRUMENTS DIVISION

INTERTECHNOLOGY LIMITED

SECTION 1
DESCRIPTION

GENERAL

1.1 The Series 2100 modules comprise a multichannel system for generating conditioned high-level signals from strain gage inputs for display or recording on external equipment. A system would be comprised of:

a) One or more 2-channel 2120 Strain Gage Conditioners;

b) One or more 2110 Power Supplies (each Power Supply will handle up to 10 channels; i.e., five 2120 Conditioner/Amplifiers); and,

c) One or more rack adapters or cabinets, complete with wiring, to accept the above modules.

1.2 The principal features of the system include:

... Independently variable and regulated excitation for each channel (1 to 12 Vdc).

... Independently continuously variable gain (100 to 2100) for each channel.

... Bridge-completion components to accept quarter- (120Ω and 350Ω), half- and full-bridge inputs to each channel as standard.

... LED null indicators on each channel – always active.

... 100 mA output as standard.

... All supplies and outputs short-circuit proof with current limiting.

... Compact packaging – 10 channels in 5-¼ in x 19 in rack space.

SPECIFICATIONS

All specifications nominal or typical at 23°C unless noted.

1.3 2120 STRAIN GAGE CONDITIONER

Note: These specifications apply for each of two independent channels per module.

INPUTS	Quarter (120Ω and 350Ω), half and full bridge. Quarter-bridge dummy resistors provided.
BRIDGE EXCITATION	1 to 12 Vdc (adjustable for each channel) with 120Ω full bridge load. Short-circuit current: less than 40 mA. Ripple, noise, and 10% line change: 2 mV max. Load regulation: ±0.2% no-load to 120Ω load.
BRIDGE BALANCE	±2000 $\mu\epsilon$ (quarter, half, or 350Ω full bridge); range can be changed by internal resistance change.
CALIBRATION	Two-position (center off) toggle switch. As delivered: ±1000 $\mu\epsilon$ ±1% at GF = 2 (see also Section 3).
AMP GAIN	100 to 2100 continuously adjustable. Gain equal to twice dial reading (±2%).
BANDPASS	dc to 5 kHz (min): ±0.5 dB (±5%) dc to 15 kHz: ±3 dB
AMP INPUT	Temperature coefficient: ±2 μV RTI/°C (max). Warm-up: 25 μV RTI over 30 minutes. Noise and drift (pk-pk): dc – 10 μV RTI/day; 0.01 to 100 Hz – 3 μV RTI (max); 1 Hz up – 10 μV RTI (max). Input impedance: >25 MΩ differential or common mode (balance limit resistor removed). CMR: dc – 120 dB (min); 0 to 500 Hz – 100 dB Input bias: +0.1 μA each input.
OUTPUT	±10 V (min) at 30 mA; ±50 mA (min) into 150Ω load; ±100mA (min) into 15Ω load. Current limit: 120 mA. Linearity: ±0.05% at dc.
SIZE & WEIGHT	5.25 in H x 2.94 in W x 10.97 in D (133 mm x 75 mm x 279 mm) 2.2 lb (1.0 kg)

1.4 2110 POWER SUPPLY

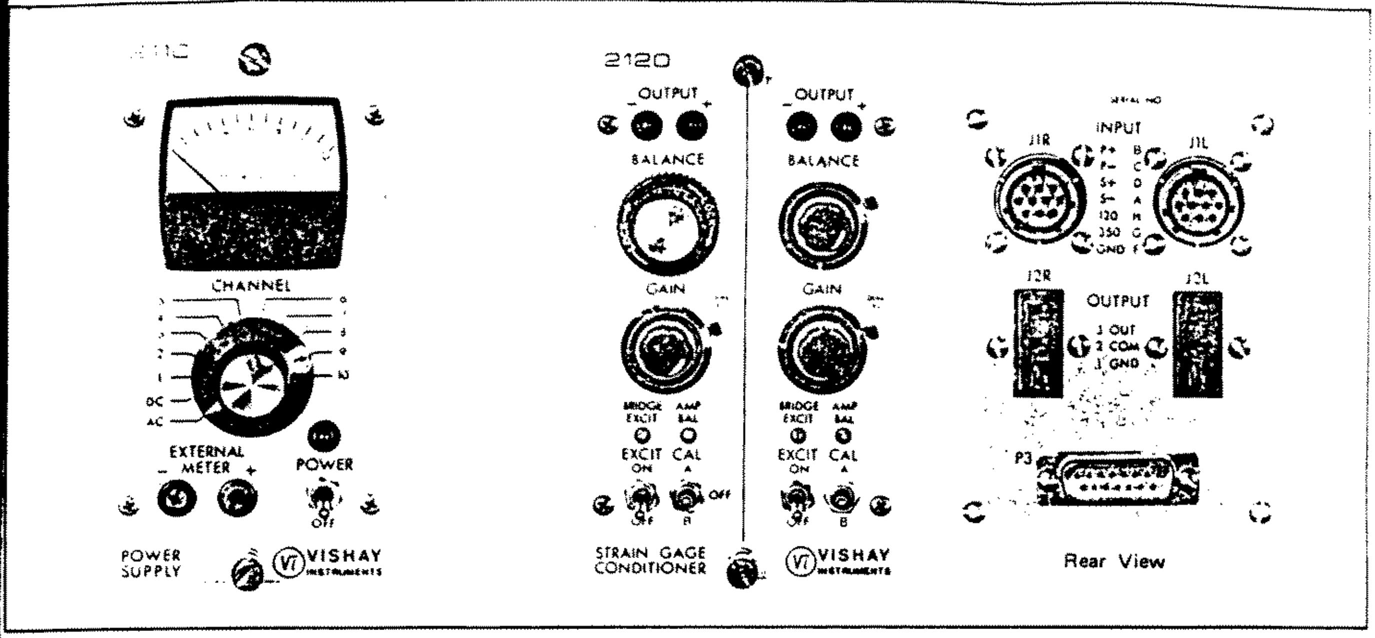
OUTPUTS	±15 V at 1.2 A and +17.5 V at 1.1 A; all regulators current-limited against overload.
INPUT	107, 115, 214, 230 Vac ±10% (selected internally); 50-60 Hz. Power: 40 W typical, 100 W max.
METER	0 to 12 Vdc (with switch) to read bridge excitation. Also ac input and dc output to/no-go monitor.
SIZE & WEIGHT	5.25 in H x 2.44 in W x 12.34 in D (133 mm x 62 mm x 313 mm) 6.7 lb (3.1 kg)

1.5 2150 RACK ADAPTER

APPLICATION	Fits standard 19-in (483-mm) electronic equipment rack. Accepts one 2110 Power Supply and one to five 2120 Strain Gage Conditioners. Completely wired.
POWER	2-ft (0.6-m) 3-wire line cord; 10-ft (3-m) extension available. Fuse: 1 A size 3 AG (32 mm x 6.4 mm dia.). Receptacle to accept line cord from adjacent 2150 Rack Adapter.
SIZE & WEIGHT	5.25 in H x 19 in W x 12.82 in D overall (133 mm x 483 mm x 325 mm) 6.6 lb (3.0 kg)

1.6 2160 PORTABLE ENCLOSURE

DESCRIPTION	Completely self-contained adapter and cabinet with all wiring for two or four channels. Accepts one 2110 Power Supply and one or two 2120 Strain Gage Conditioners.
POWER	8-ft (2.4-m) detachable 3-wire cord. Fuse: 1 A size 3 AG (32 mm x 6.4 mm dia.).
SIZE & WEIGHT	5.50 in H x 8.75 in W x 13.13 in D (140 mm x 222 mm x 333 mm) 5.2 lb (2.4 kg).



CONTROLS

1.7 2110 POWER SUPPLY

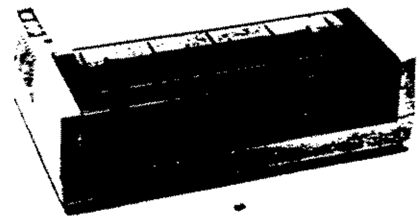
BRIDGE VOLTS Meter	Displays the voltage on each input bridge (as selected by CHANNEL selector). Also used to monitor ac line and dc outputs of Power Supply (see below).
CHANNEL Selector	Positions 1 to 10 select channel to display bridge excitation on Meter ("1" is channel farthest to left in cabinet, etc). The DC position monitors a mixed output from the +15, −15, and +17.5 V power supplies and should always read on the "DC" line at "10" on the Meter. The AC position monitors the peak-to-peak ac line input (at a fixed transformer tap). A reading anywhere in the band from 9 to 11 on the Meter indicates that the input voltage is proper for the selected transformer tap (see paragraph 2.5). No reading indicates the equipment is ungrounded; noticeable needle vibration indicates reversal of the ac input line.
EXTERNAL METER Jacks	Supplies Meter voltage to an external meter if desired for precise adjustment of bridge supply voltages.
POWER Switch	The main power switch for this supply and all Conditioners connected to it. (The pilot lamp may take several seconds to extinguish when the power is turned off.)

1.8 2120 STRAIN GAGE CONDITIONER (one channel described; both identical and independent).

OUTPUT Lamps	LED indicators always monitoring amplifier output. Primarily used to adjust AMP BAL and Bridge BALANCE. (Fully lit with 0.07 V output.)
BALANCE Control	A 10-turn potentiometer to adjust bridge balance. Normal range ±2000 $\mu\epsilon$. (See paragraph 2.26 to extend range.) EXCIT must be ON to set bridge balance.
GAIN Control	A 10-turn potentiometer to adjust amplifier gain. The nominal gain equals twice the dial reading (e.g., with the dial set at 500 the gain is approximately 1000). Gain is adjustable from 100 to 2100 (050 to 1050 on GAIN dial).
GAGE EXCIT	A 22-turn trimmer to adjust bridge excitation from 1 to 12 Vdc. The actual setting is monitored on the Meter and the EXTERNAL METER jacks on the 2110 Power Supply (the proper channel must be selected).
AMP BAL	A 22-turn trimmer to adjust the amplifier balance. (EXCIT should be OFF when this is done.) Thermal EMF's in the bridge may also affect this balance.
EXCIT switch	A toggle switch controlling the excitation to the input bridge. (Any amplifier output with EXCIT at OFF is dc amplifier offset, thermal EMF from the bridge or ac pickup in the wiring.)
CAL Switch	A 2-position (with center off) toggle switch to shunt-calibrate the input bridge. As delivered, "A" simulates +1000 $\mu\epsilon$, and "B" simulates −1000 $\mu\epsilon$ by shunting the internal 350Ω half bridge. Many other arrangements possible by internal-resistor and jumper changes (see Section 3).
INPUT receptacle (rear panel)	A 10-pin quarter-turn connector to connect input gage(s). (Quarter, half and full bridges can be accepted simply by using the appropriate pins. See paragraph 2.11 for details.) Mating connector supplied.
OUTPUT receptacle (rear panel)	A 3-pin connector delivers the amplifier output (±10 V or ±100 mA). Mating connector supplied.

HP 2225 Family ThinkJet Printers

HEWLETT PACKARD



The low-cost HP 2225 family of personal printers provides fast, quiet printing for office, factory, home, or on-the-go. For permanent copies and portable printing, for high-quality, professional-looking text, the HP 2225 Family offers an exceptional solution via an all-new approach to ink-jet printing.

Simplicity of Design for User Convenience

The HP 2225 Family features a new and unique high-technology ink-jet print head system that is encased in a single disposable cartridge. There are no reservoirs to fill and virtually no mess. When the print head is empty, after about 500 pages of normal printing, you simply open the front window of the printer, pull a tab down, lift the old cartridge out, and insert the new one in place. Push the tab back up, close the print window; and you're off again.

Printing Flexibility

For highlighting and print variation, you can choose from four different print pitches. And you can print your text in boldface or underline in just one pass without sacrificing throughput. In addition, you get clear, distinct graphics with up to 192 x 96 dots per inch resolution.

Since the printer utilizes both friction feed and pin feed, you can use either single sheets or continuous fanfold paper depending on your application needs. The adjustable paper-feed mechanism allows you to use either 8½ x 11-inch or 21.0 x 29.7-centimeter (A-4 size) paper.

Features:	Benefits and Advantages:
• 150-cps ink-jet printing	Delivers high throughput and permanent copies of your memos, graphics, reports, and spreadsheets.
• 11 x 12 dot-matrix character cell	Your printed text is easy to read and professional looking.
• Quiet 50 dBA printing	Suitable for any environment because noise is not a factor.
• Comprehensive print features –four print pitches –underline and bold –Roman8 –printable control codes	Allows you to highlight and vary your output to meet your different pri[illegible]
• Disposable print head	Qu acc get wi
• Compact and lightweight	It r of on
• Portable operation (HP2225B)	Ut tha no
• Variety of interfaces	Yo of Pa In fe
• Pin or friction feed	Allows you to use continuous fanfold paper or cut sheets.
• Graphics	Produces permanent copies of your graphics displays.

Print Sample

Print quality is enhanced over common dot matrix printers by an 11 x 12 character cell which provides high resolution characters in boldface or underline modes and four print pitches as shown here.

Compressed (142 characters/line)

Normal (80 characters/line)

Expanded compressed (71 characters/line)

Expanded(40 characters/line)

INFOTEK AD-200

2 SPECIFICATIONS

2.1 GENERAL

12 BIT Resolution

16 Single ended / 8 differential inputs

0 to 55 Degrees Celcius

Common mode rejection @ 120 Hz

> 75 db @ hardware gain = 1
> 80 db @ hardware gain = 4
> 85 db @ hardware gain = 10

2.2 INPUT (ANALOG)

Range (+/- Volts DC) See table below

	hardware gain		
Programmed gain	1	4	10
1	5.000	1.250	0.500
2	2.500	0.625	0.250
5	1.000	0.250	0.100
10	0.500	0.125	0.050

Common mode range +/- 5.0 Volts

Resistance > 10E10 Ohms

Capacitance < 150 Pf

Overvoltage +/- 20.0 Volts

Current < 10 Nanoamps

2.3 THROUGHPUT

Maximum settling times to within 1 LSB (See table below) time is in microseconds (equivalent sample rate in 1000 samples/second in brackets)

Condition	Hardware gain 1	4	10
Step response (single)	3.3	4.0	5.0
Step response (burst)	4.8 (208)	5.0 (200)	5.0 (200)
Channel-to-Channel	5.0 (200)	5.0 (200)	7.5 (133)
Channel/gain to Channel/gain	6.0 (166)	7.5 (133)	12.5 (80)

Bandwidth > 300 KHz

2.4 ACCURACY

Absolute error (Hardware gain = Programmed gain = 1)
(see note 1)

0.15% of reading + 3 LSB's

Gain Drift < 0.15%

Relative gain error (gain non-linearity) < 0.05%

Offset drift error (in LSB's) See table below
(see note 1)

	Hardware gain		
Programmed gain	1	4	10
1	3	5	7
2	3	5	9
5	4	7	13
10	5	10	20

Relative offset error (relative to hardware gain = 1)
(see notes 1 and 2)

< 12 LSB's @ hardware gain = 4

< 29 LSB's @ hardware gain = 10

Linearity < 1 LSB

Noise (RMS in LSB's) (See table below)
These figures may be significantly higher for the 9816

	Hardware gain		
Programmed gain	1	4	10
1	0.6	0.7	1.0
2	0.8	1.2	1.5
5	0.8	2.0	3.0
10	1.0	3.0	5.0

2.5 DIGITAL

Timebase	Delay	100 nanoseconds to 0.500 seconds in 50 nanosecond steps.
	Period	3000 nanoseconds to 0.500 seconds in 50 nanosecond steps.
	Clock	0.005% stability and accuracy

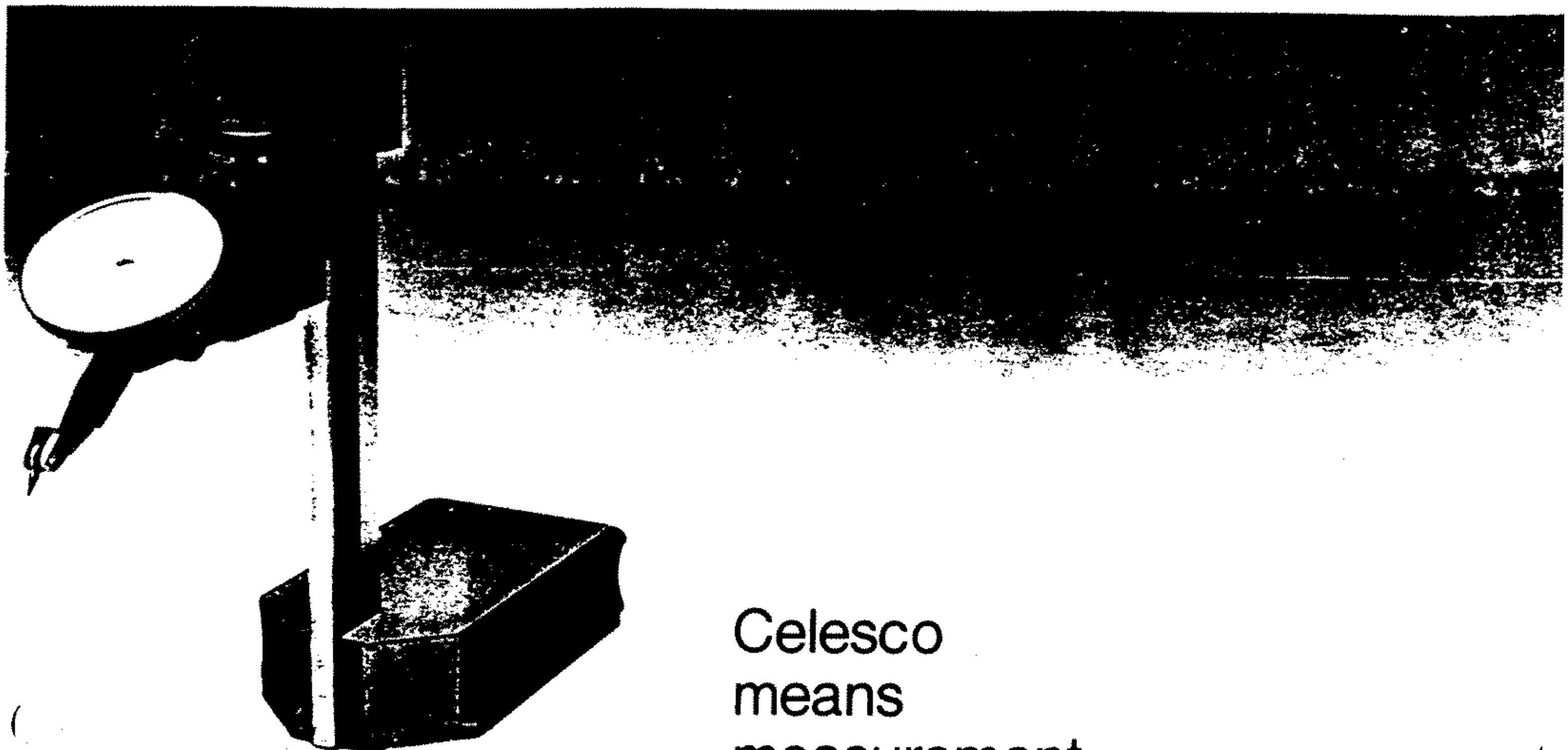
2.6 POWER REQUIREMENTS

+5 Volts	1.0 Amps
+12 Volts	40 Milliamps
-12 Volts	58 Milliamps

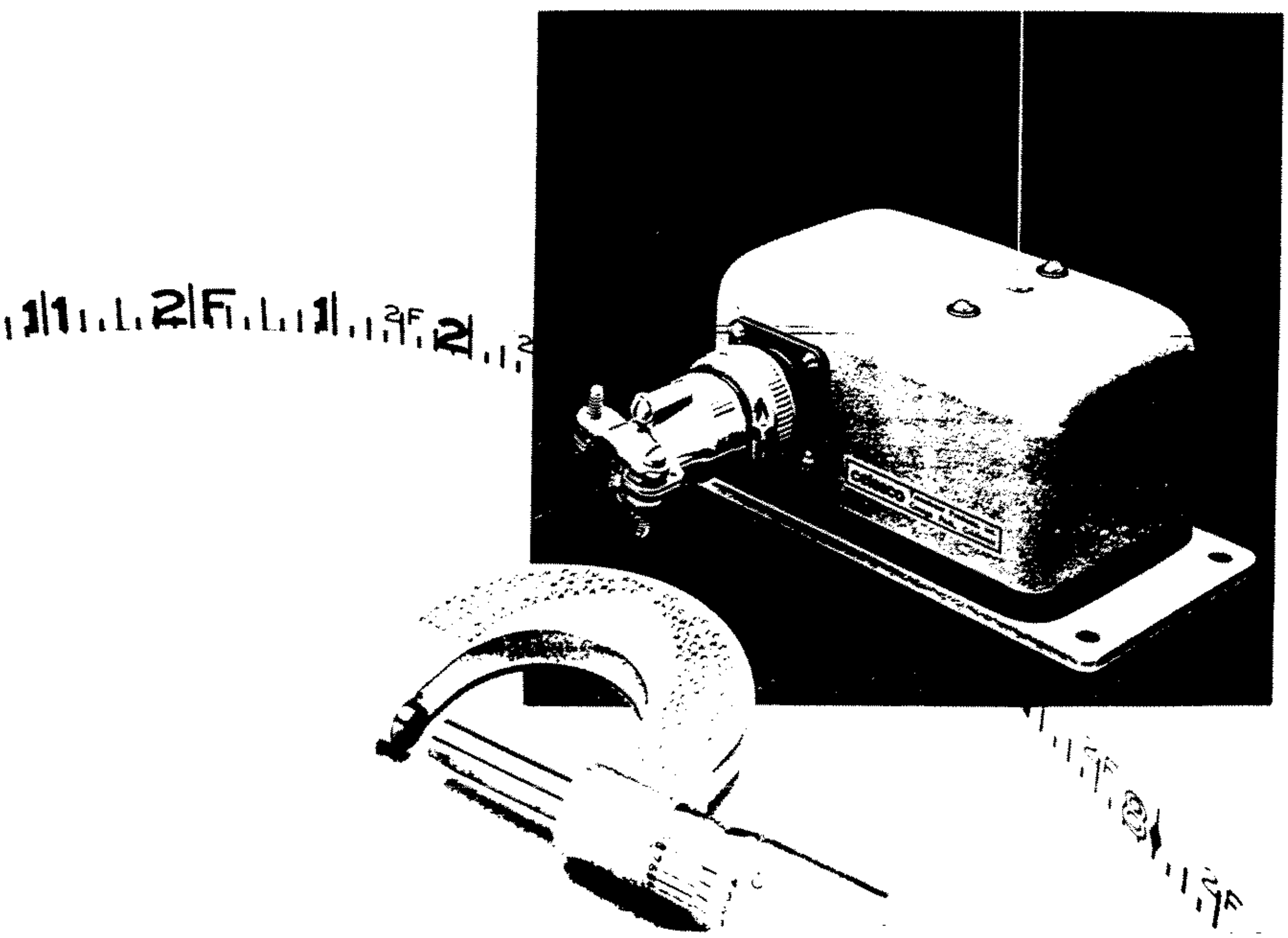
NOTE 1: Offsets can be eliminated through software by measuring a grounded input and adjusting readings accordingly.

NOTE 2: Offset error can be adjusted to zero for any Hardware gain. Factory calibration zeros the offset for hardware gain = 1.

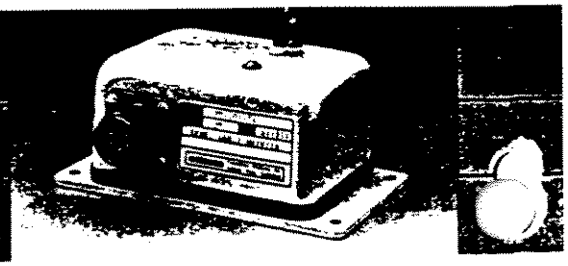
Celesco Transducer Products, Inc.



Celesco
means
measurement.



PT101 Position/Displacement Transducer



The position measurement workhorse.

The PT101 is our most widely used transducer. Such diverse applications as positioning shutter dampers for draft control, testing automotive suspension systems and monitoring lateral drift in space shuttle launching operations are common. Designed for linear measurements up to 500 inches, it provides a voltage output by means of a precision potentiometer. A more rugged version is available for use in extreme environments. This instrument will endure shock of 2,000 G's for six milliseconds and vibration of 10 G's from 10 to 2000 Hz without damage or changes in calibration.

FEATURES:

- 0.1% accuracy standard (most ranges)
- Resolution of 0.001 inch (most ranges)
- Ranges from 0–2 to 0–500 inches full scale
- "A" circuit full scale output approximates input
- "B" circuit simulates wheatstone bridge with zero at midpoint for use with stain gauge signal conditioners

Measurement Range	Position "A" Circuit	Transducer "B" Circuit	Approx. Cable Tension	Max. Cable Acceleration	
Inches	MV/V/Inch	MV/V/Inch	Ounces	Ext. G's	Ret.
2	468.49	1.0536	27	37	25
5	188.51	0.4240	11	7	5
10	94.754	0.2131	27	37	25
15	62.547	0.1407	18	15	10
20	47.377	0.1065	27	37	25
25	38.182	.08587	11	7	5
30	31.317	.07043	18	15	10
40	24.641	.05542	14	12	8
50	19.091	.04294	11	7	5
60	16.342	.03676	9	6	4
75	13.190	.02967	8	5	3
80	12.446	.02799	14	5	3
100	9.8870	.02224	25	7	5
150	6.1763	.01389	16	6	4
200	4.9638	.01116	12	5	3
250	3.8818	.008731	10	5	3
300	3.3107	N.A.	12	5	3
350	2.8162	N.A.	10	5	3
500	1.9777	N.A.	15	5	3

$652
HI-TEMP OPT. $100

Specifications:

GENERAL

- **Range**[1] .... 0–2 to 0–500 inches
- **Weight** .... 20 ounces (to 50 inch range)
- **Case Material** .... Aluminum
- **Sensing System** .... Precision Potentiometer
- **Electrical Connector** .... MS3102E-14S-6P (Other connectors optional)

ELECTRICAL

- **Input Impedance**
  - **"A" Circuit** .... 500 ohms std. Other options available
  - **"B" Circuit** .... 1100 ohms std. Other options available
- **Output Impedance**
  - **"A" Circuit** .... 138 ohms max. std. Other options available
  - **"B" Circuit** .... 240 ohms std. Other options available
- **Excitation Voltage** .... 25 volts max., AC or DC
- **Insulation Resistance** .... 100 meg ohms min. at 100 VDC

PERFORMANCE

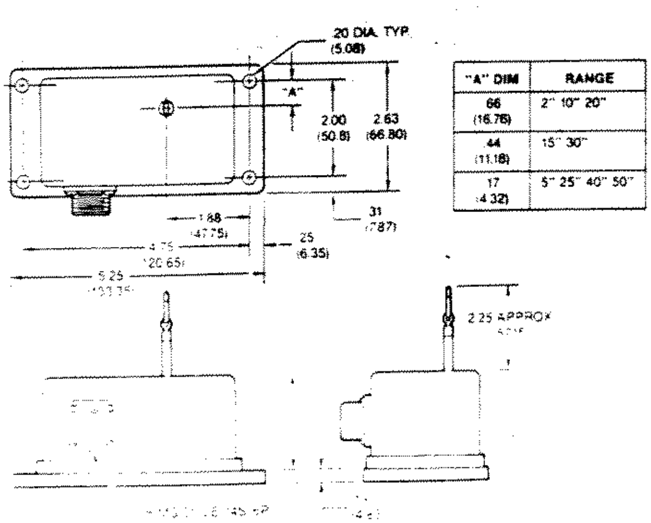
- **Accuracy:**[2]
  - **2 and 5 inch ranges** .... 0.25% F.S. max.
  - **10 and 15 inch ranges** .... 0.15% F.S. max.
  - **20 inch and greater** .... 0.10% F.S. max.
- **Resolution:**
  - **2 and 5 inch ranges** .... 0.08% F.S. max.
  - **10 inch and greater** .... Effectively Infinite
- **Thermal Effects:**[3]
  - **Zero** .... 0.002%/°F
  - **Span** .... 0.002%/°F
- **Sensitivity** .... See Specification Table

ENVIRONMENTAL

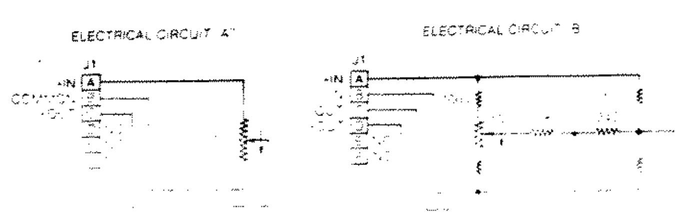
- **Temperature Range** .... 0°F to +200°F (-65°F to +250°F available)
- **Humidity** .... up to 90% RH
- **Shock** .... up to 50 G's, 6 m.s.
- **Vibration** .... up to 10 G's to 2000 Hz.

NOTES:

1. See Table for standard ranges. Longer ranges available, consult factory.
2. Repeatability and non-linearity errors included.
3. Over temperature range from 0°F to 200°F.



"A" DIM	RANGE
.66 (16.76)	2" 10" 20"
.44 (11.18)	15" 30"
.17 (4.32)	5" 25" 40" 50"

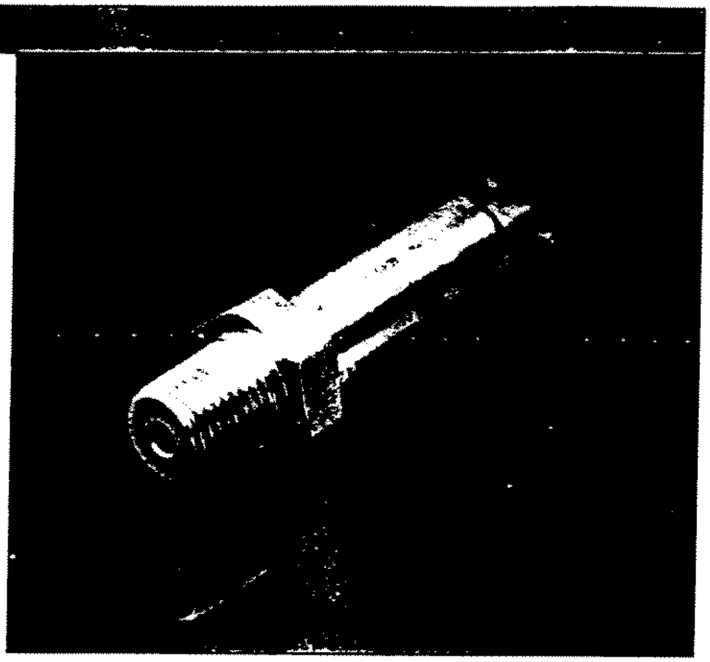


ORDER INFORMATION

MODEL NO.	RANGE (IN.)	CIRCUIT
PT101	50	A

Ψ PSI-TRONIX PSI-5000

High Level Output Pressure Transducer



Highly Accurate Pressure Transducer for Minute Pressure Ranges

Features

- Low Cost
- Accuracy (Linearity, Hysteresis, Repeatability): ±.25% F.S. (B.F.S.L.)
- Hybrid Electronics

Description

Strain Gage Transducer Accepts Unregulated Input.

The PSI-5000 offers pressure ranges of 0-15 to 0-10,000 psi, gage or absolute, all stainless steel construction, high burst pressure, and high accuracy of ±.25% F.S. (B.F.S.L.).

The sensor consists of silicon piezoresistive strain gages, mounted on a flat diaphragm, and arranged in a wheatstone bridge configuration. The output is conditioned for 5.0 volts output for all units.

The highly accurate sensor, with hybrid electronics is packaged in a stainless steel housing for use in most environments.

Basic Applications

PSI-5000 is the economical answer for all applications requiring high accuracy over a wide range of pressures. The unit's small size (2 oz.), integrated hybrid electronics, wide operating temperature range (-65° F to +200° F), extreme reliability, durability, and long life, make the PSI-5000 the perfect instrument for most static and dynamic pressure measurement where a high level output signal is desired.

SEE REVERSE SIDE FOR SPECIFICATIONS AND OPTIONS

4509 Runway St., Simi Valley, California 93063 • (805) 584-6617 • (818) 993-9790

PSI-TRONIX

PSI-5000

High Level Output Pressure Transducer

Specifications

PERFORMANCE

Pressure Ranges: (gage or absolute) .... 0 to 15, 25, 50, 100, 250, 500, 1000, 3000, 5000, and 10,000 psi

Overpressure: .... 2x Range

Burst Pressure: .... 10x full scale or 20,000 psi, whichever is less

Pressure Cavity Volume: .... 0.025 in³

Output .... 5.050 Vdc ±.050 Vdc

Accuracy (linearity, hysteresis, and repeatability): .... ±.25% of full scale (B.F.S.L.)

Zero Balance: .... ±1.0% of full scale

Temperature Range: .... 0-130° F

Thermal Zero Shift: ±0.01% F.S./° F

Thermal Sensitivity Shift: ±0.01% F.S./° F

Resolution: .... Infinite

Life: .... Millions of cycles

ELECTRICAL

Excitation: .... 16 to 32 Vdc

Input Impedance: .... 2800Ω min.

Output/Input .... non-isolated, 3-wire

ENVIRONMENTAL

Maximum Temperature Operating Range: .... -65° F to +200° F

Compensated Range: .... 0° F to 130° F

PHYSICAL

Weight .... 2 ounces

Construction Materials: .... Stainless Steel 17-4P.H. and 316 S.S.T. (no O-rings)

Media: .... Compatible with 17-4P.H. and 316 S.S.T.

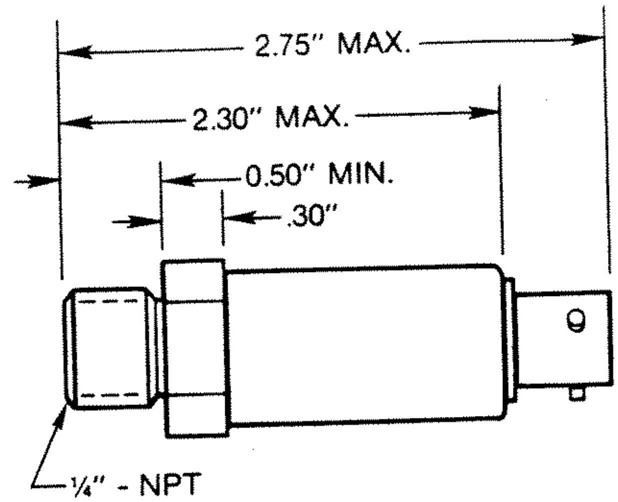
Connectors:

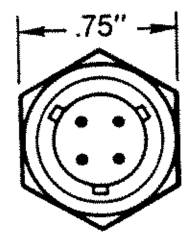
Electrical Recptl.: Bendix PT1H-8-4 PN or equivalent

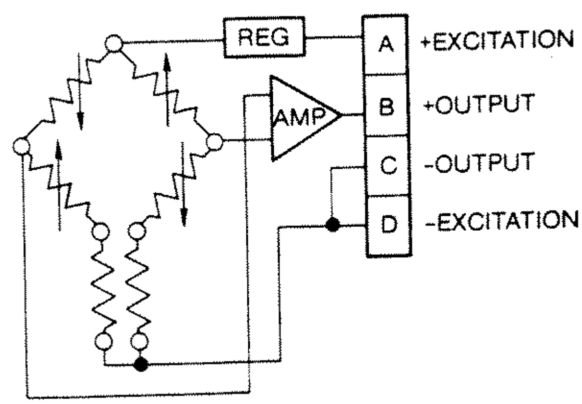
Mating Connector: Bendix PT06A-8-45 (SR) or equivalent

(mating connector not supplied)

Installation Diagrams







Options:

- Special Fittings and excitation on Request
- Consult Factory for Custom Designs for Special Applications

Ordering Information

PSI-5000 — 1000 — G

PSI-5000	1000	G
Model No.	Pressure Range(psi)	G=gage A=absolute

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