

ICE FORMATION IN SALINE SOILS

VOLUME 2

Report Submitted

to

SUPPLY AND SERVICES CANADA

HULL, QUEBEC

(DSS File No. 63SS.23233-7-1080)

APPENDIX 4

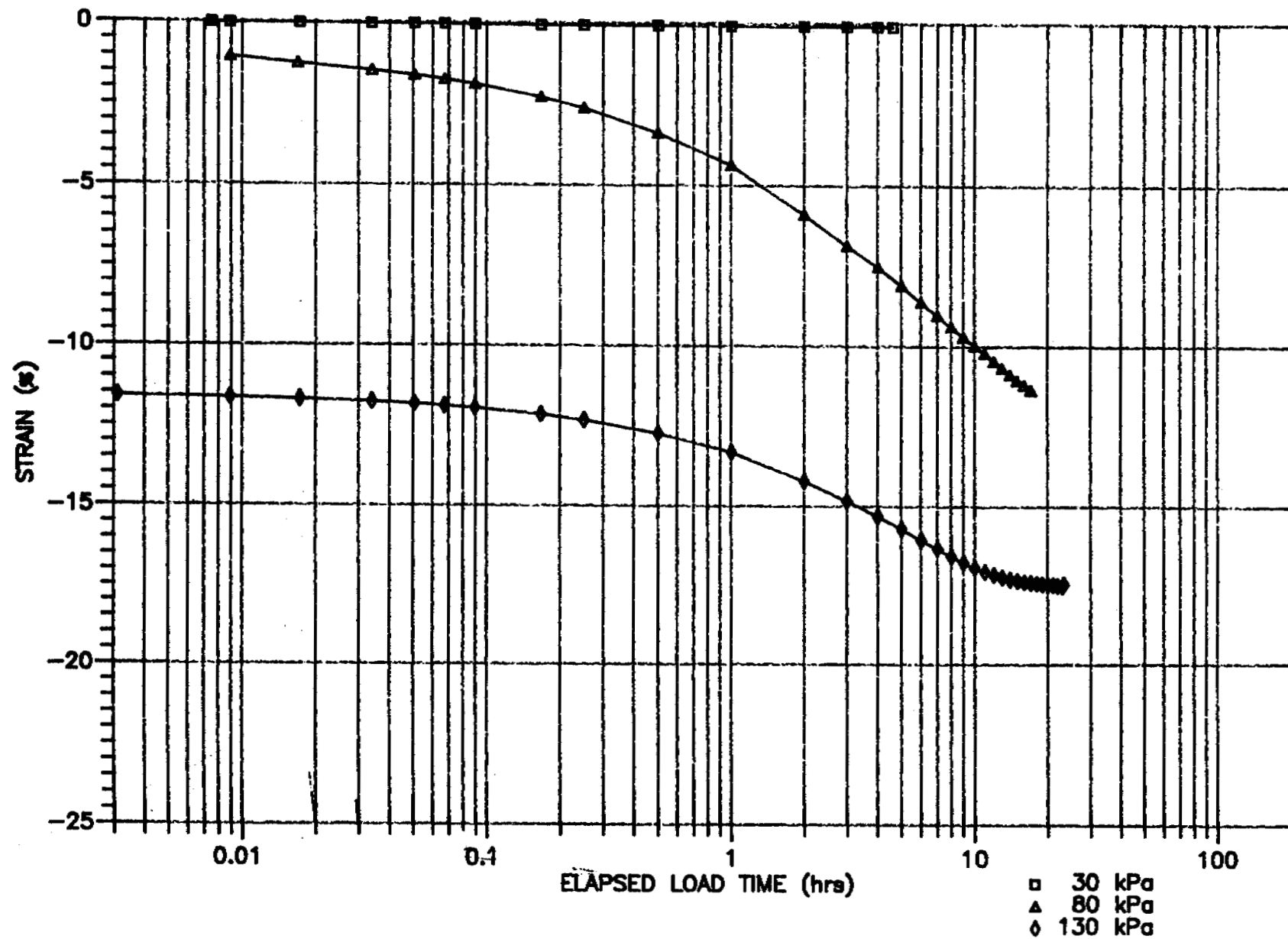
Test Results of Series 1. (No Applied Surcharge)

Prepared by

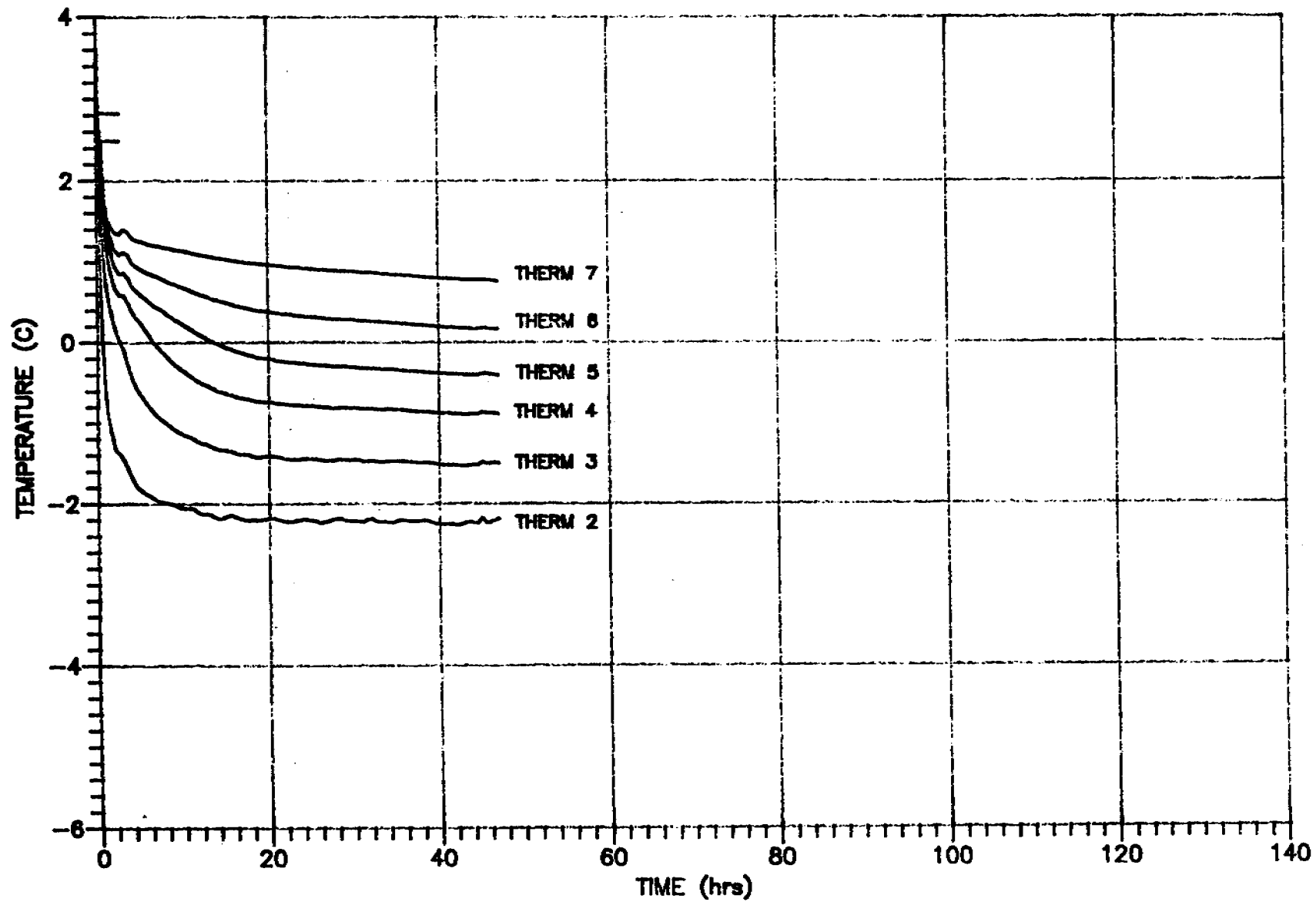
J.- M. Konrad, Ph.D., P.Eng.
Dept. of Earth Sciences
University of Waterloo
Waterloo, Ontario, N2L-3G1

March, 1989

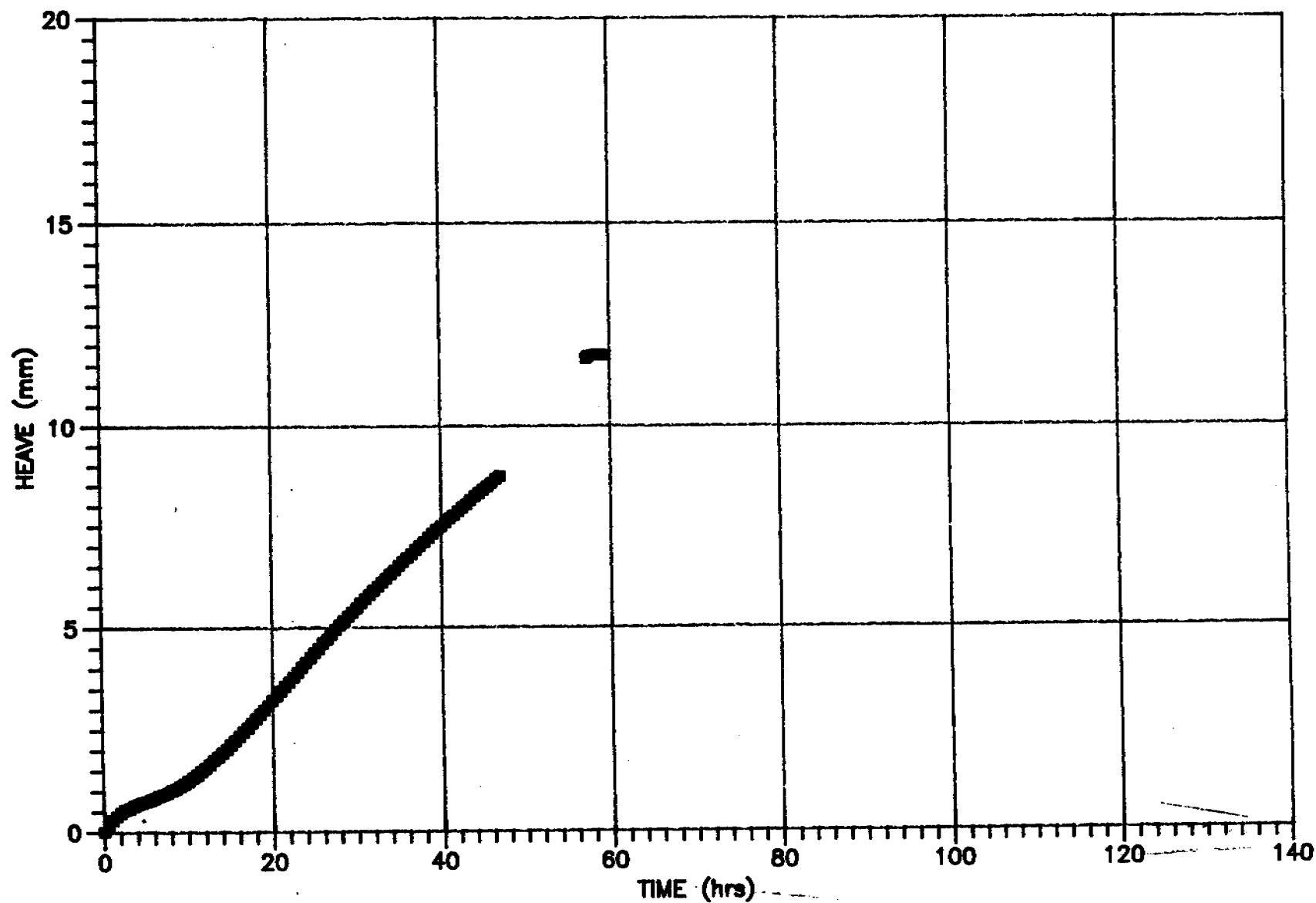
CONSOLIDATION TEST S3



FREEZING TEST S3

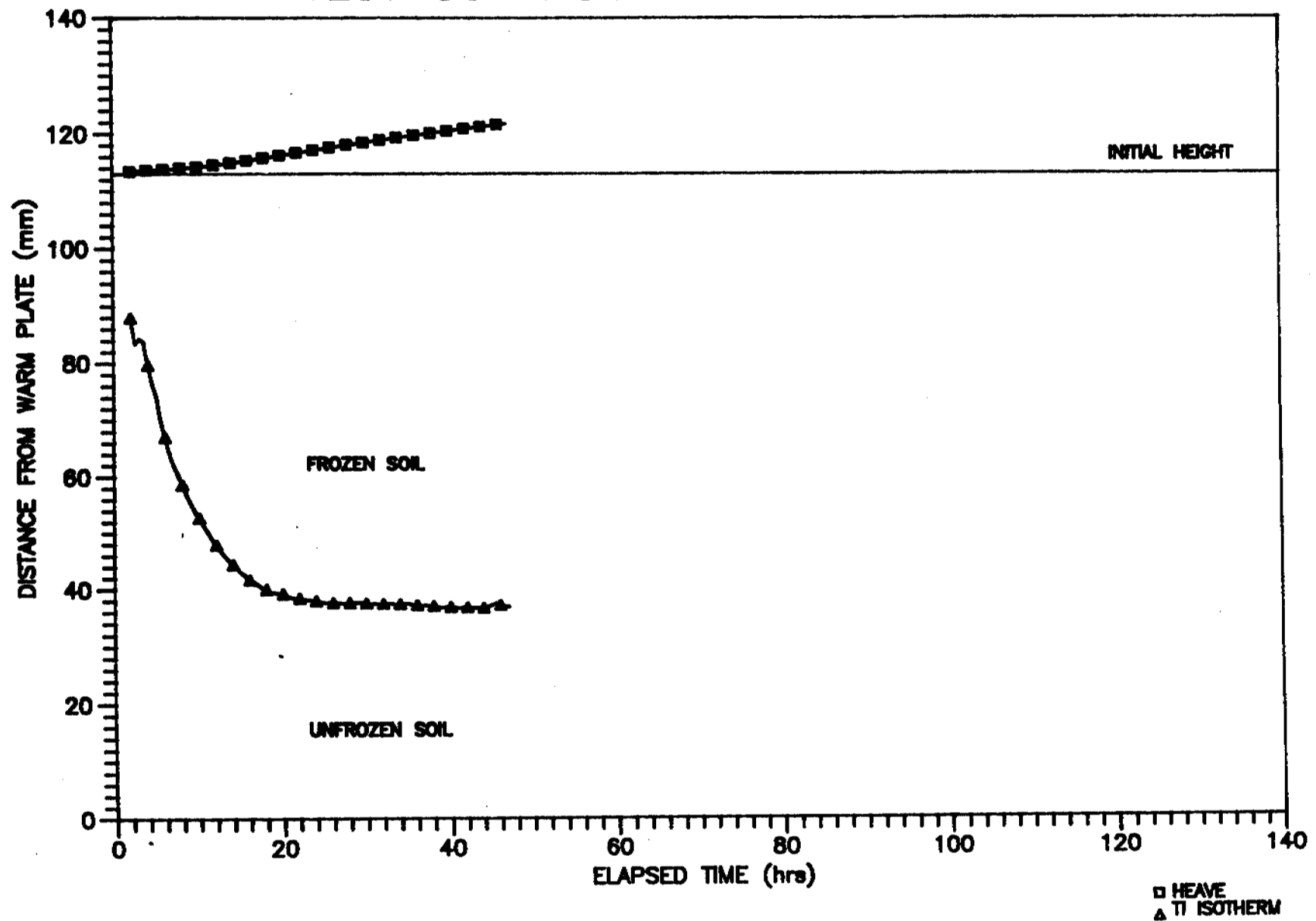


FREEZING TEST S3

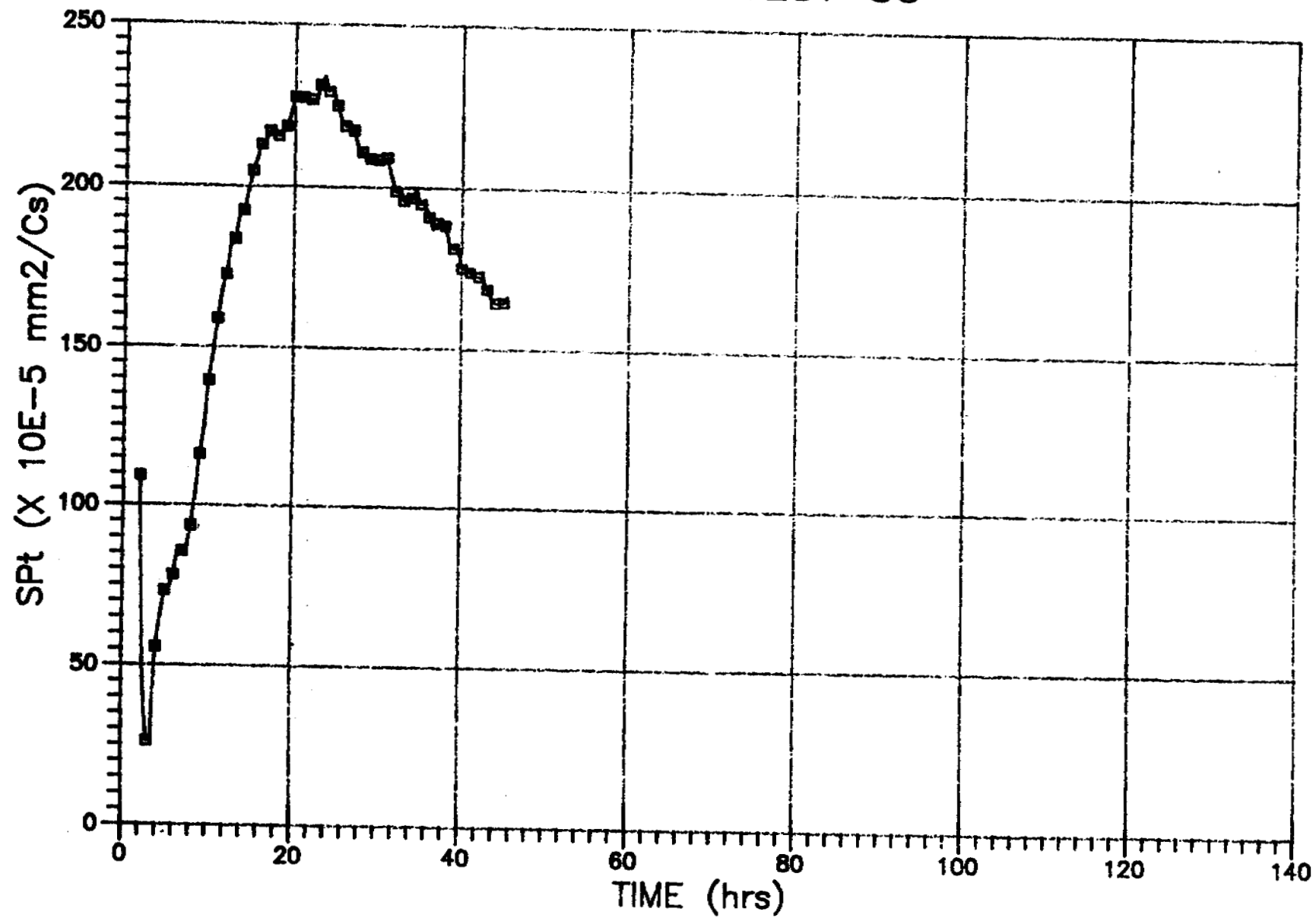


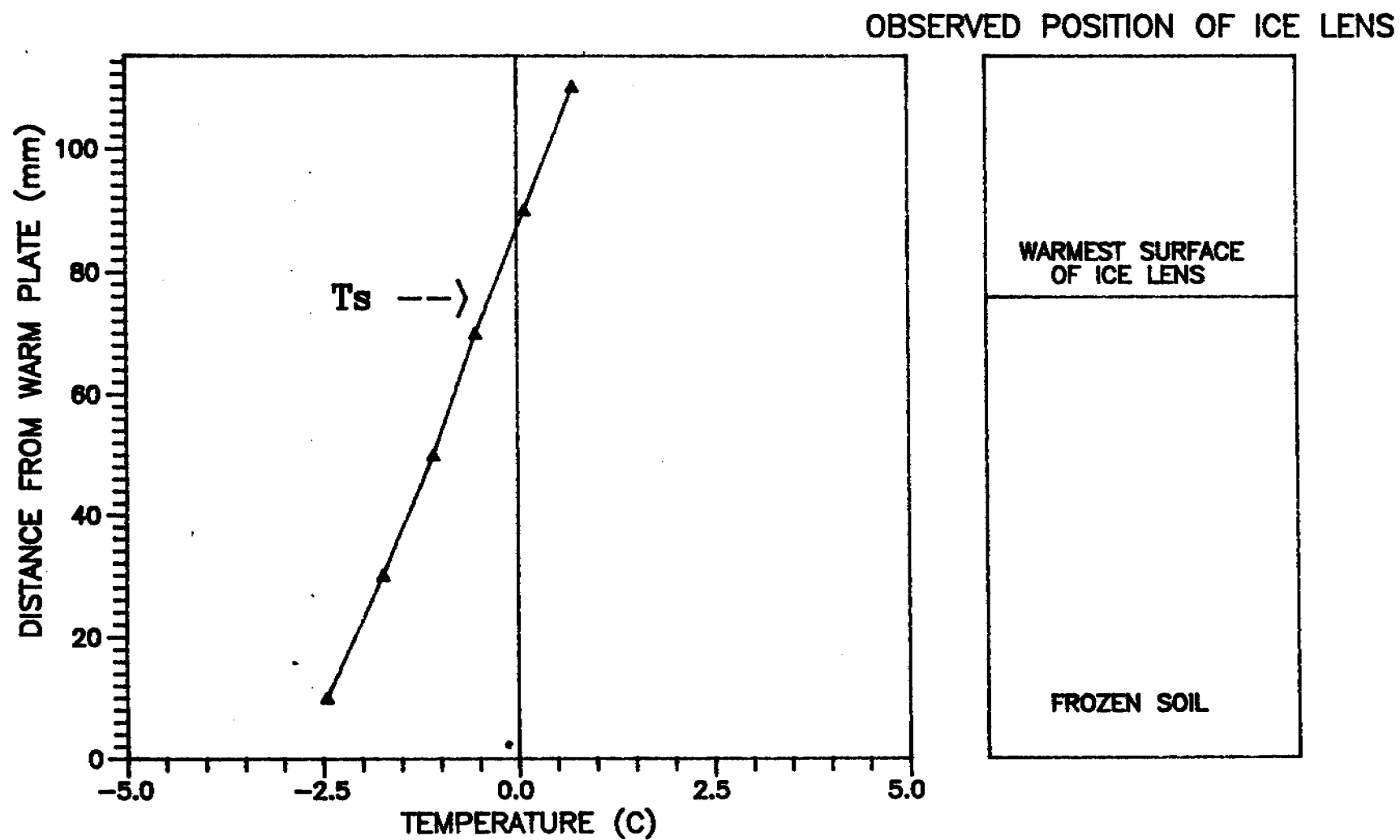
TOTAL HEAVE

TEST S3 FROST FRONT LOCATION



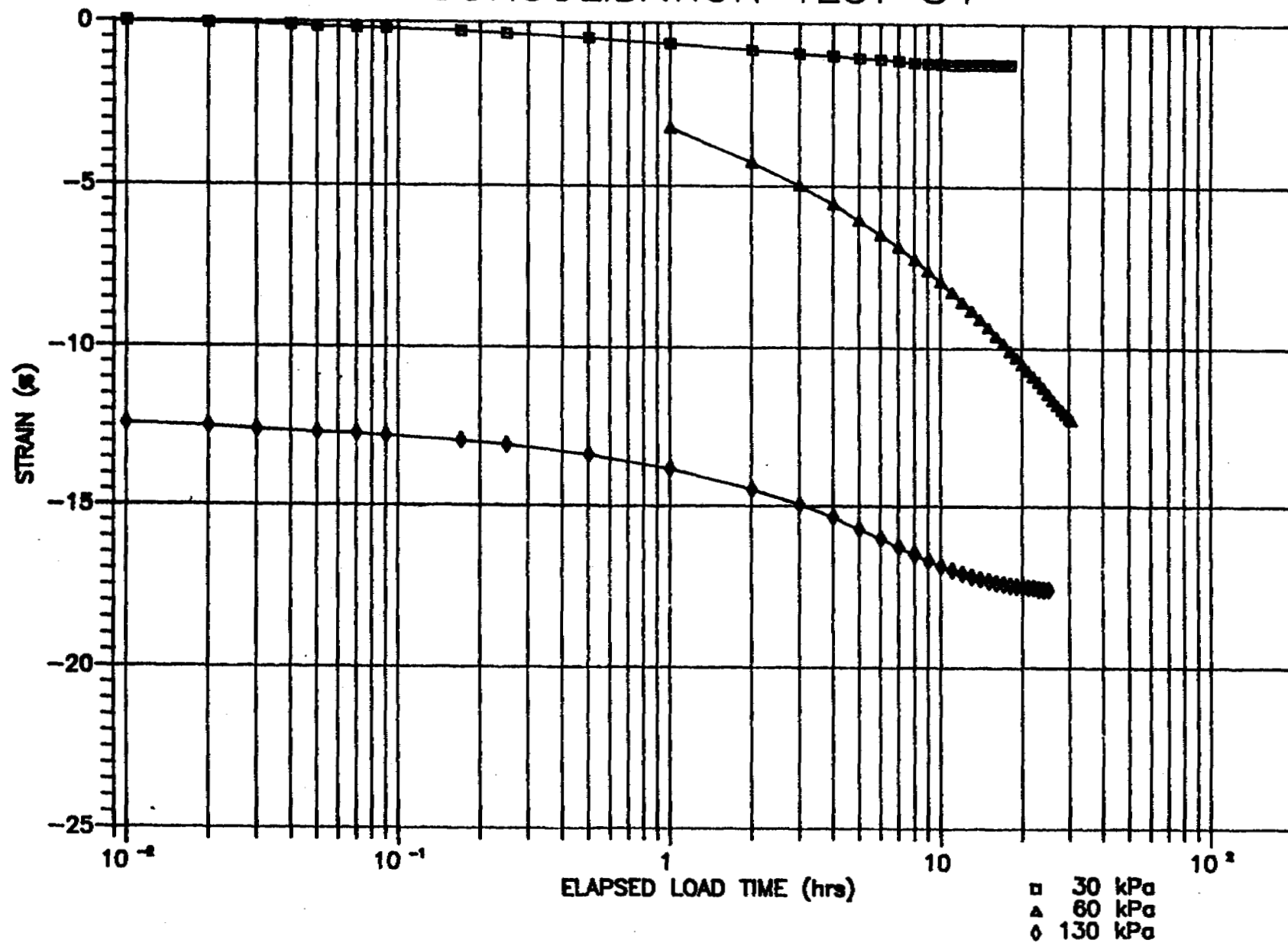
FREEZING TEST S3



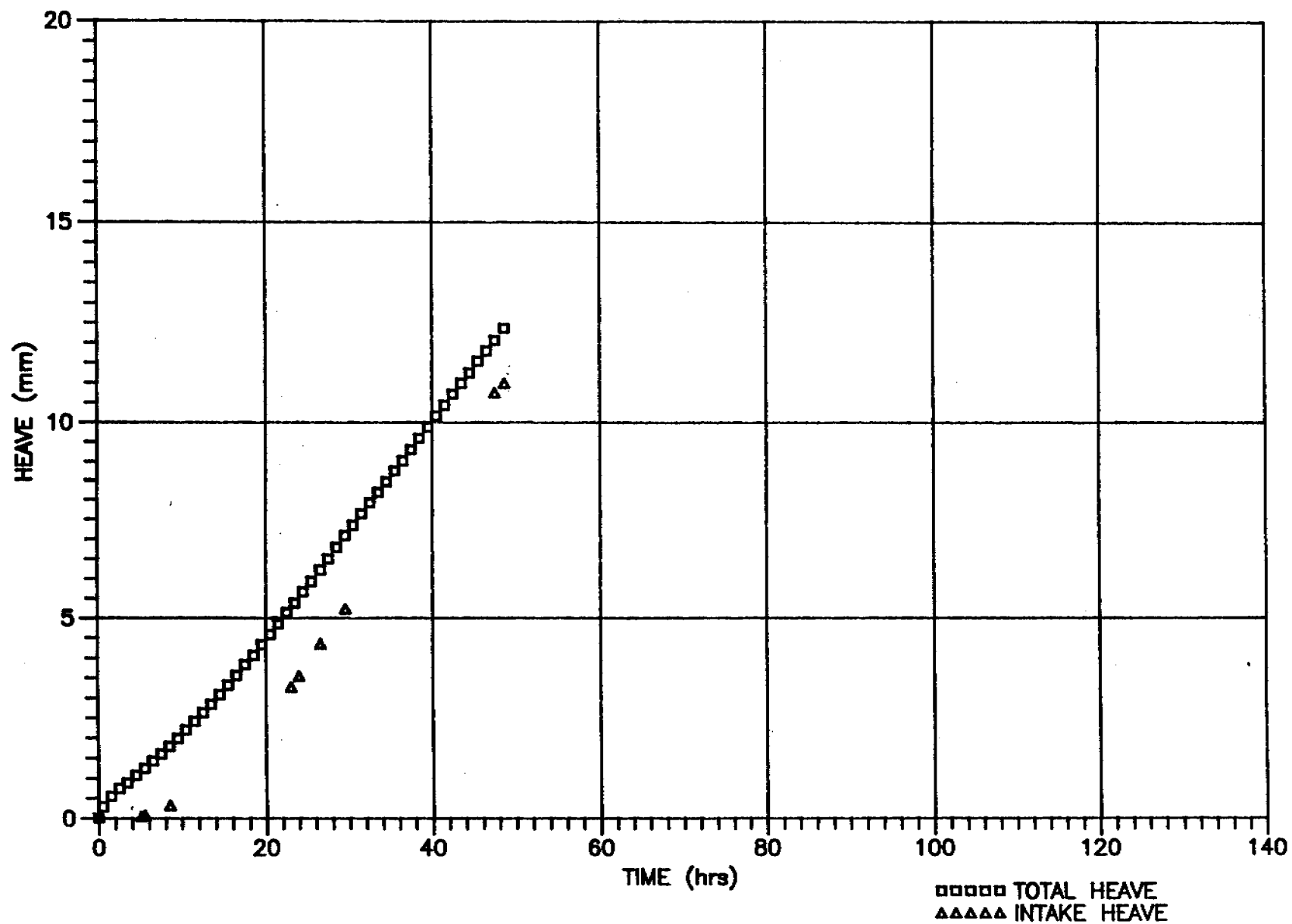


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S3

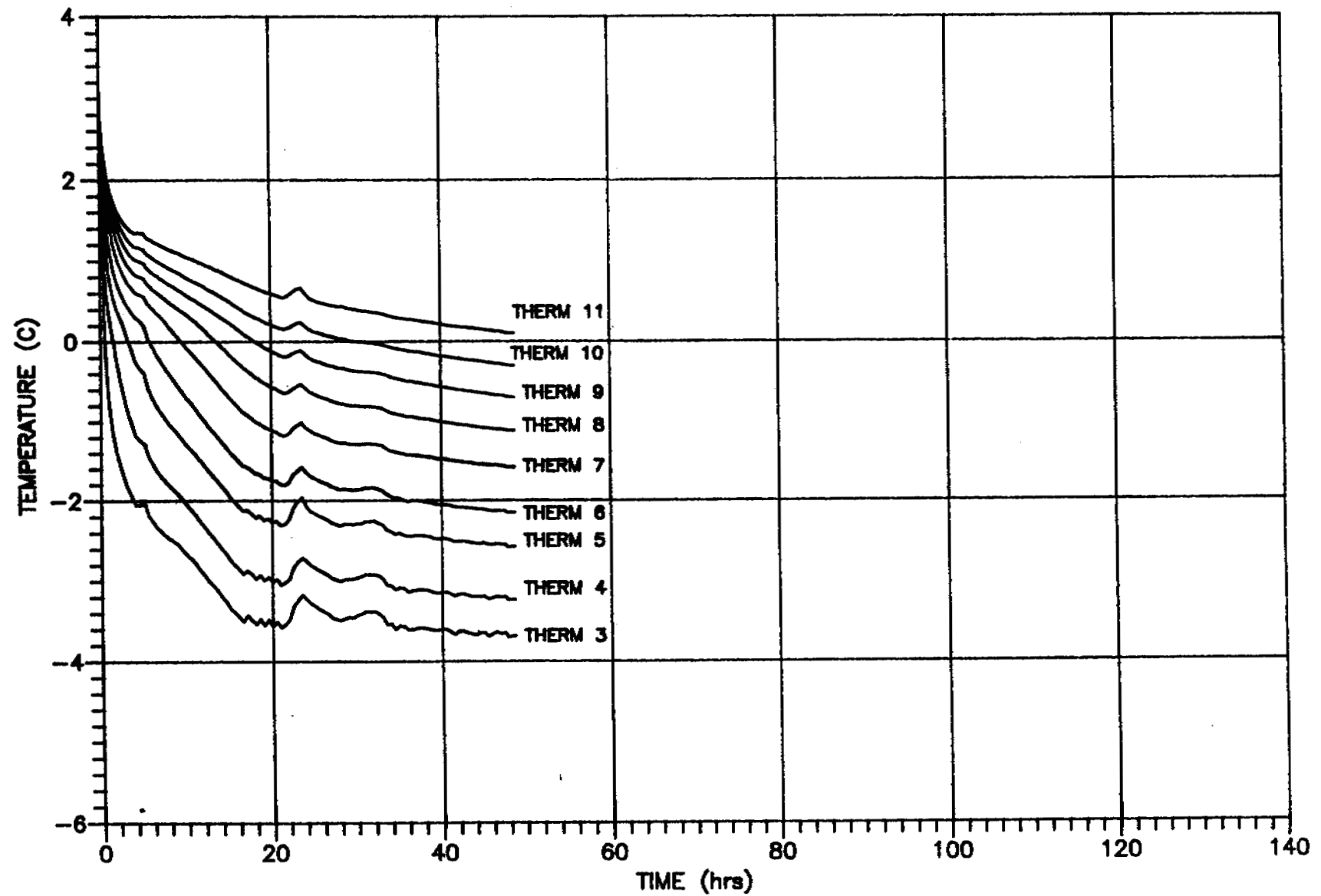
CONSOLIDATION TEST S4



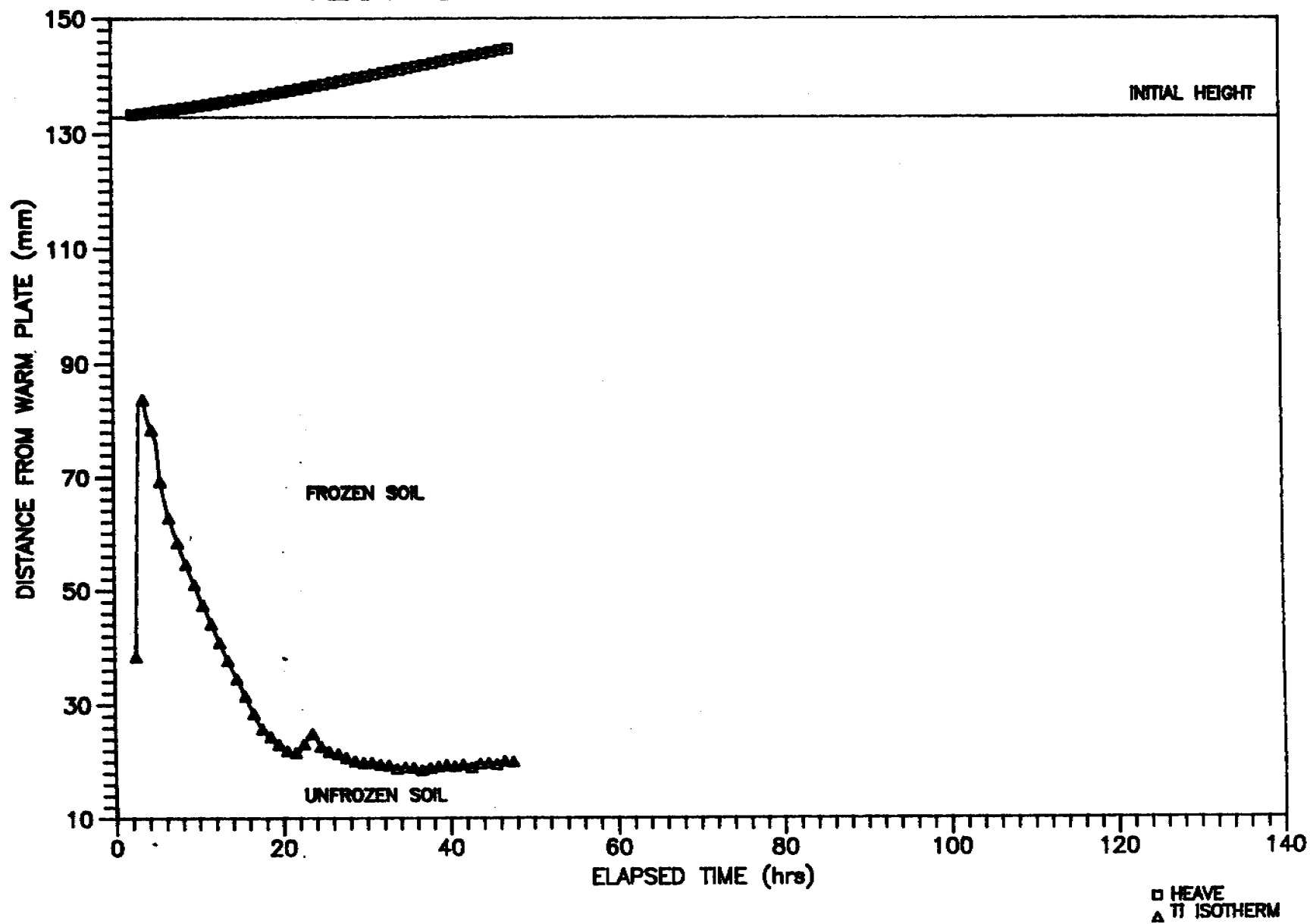
FREEZING TEST S4

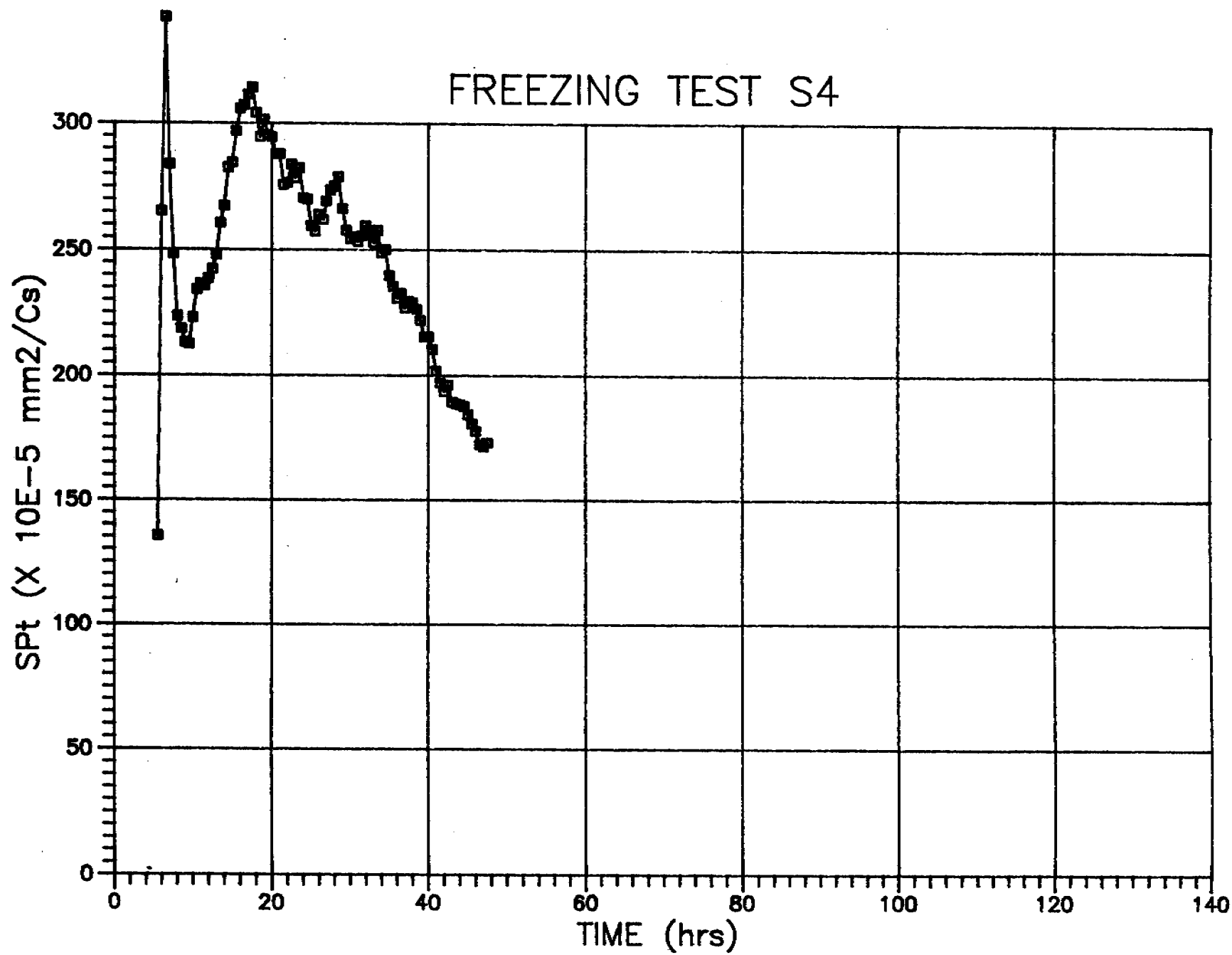


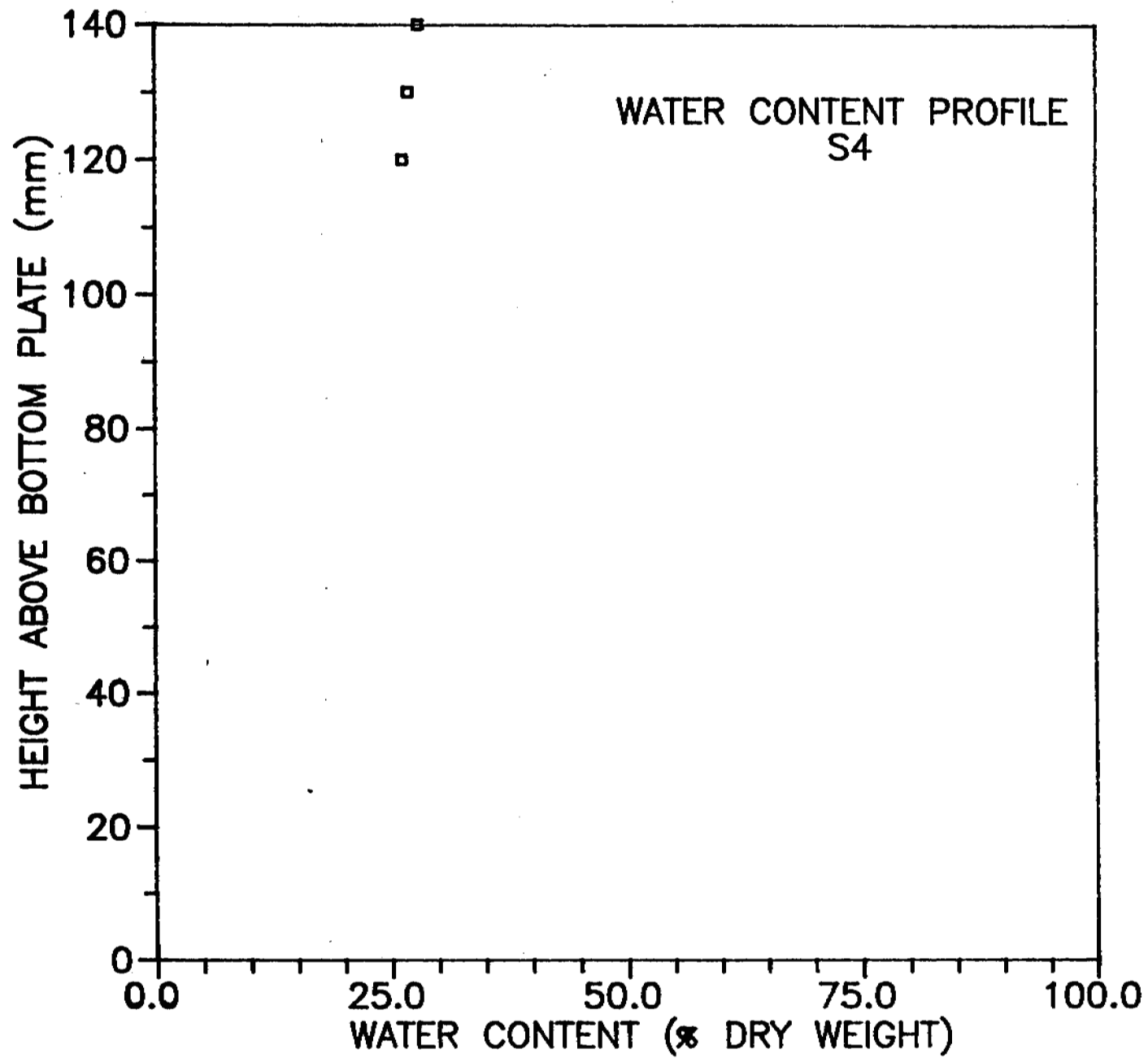
FREEZING TEST S4

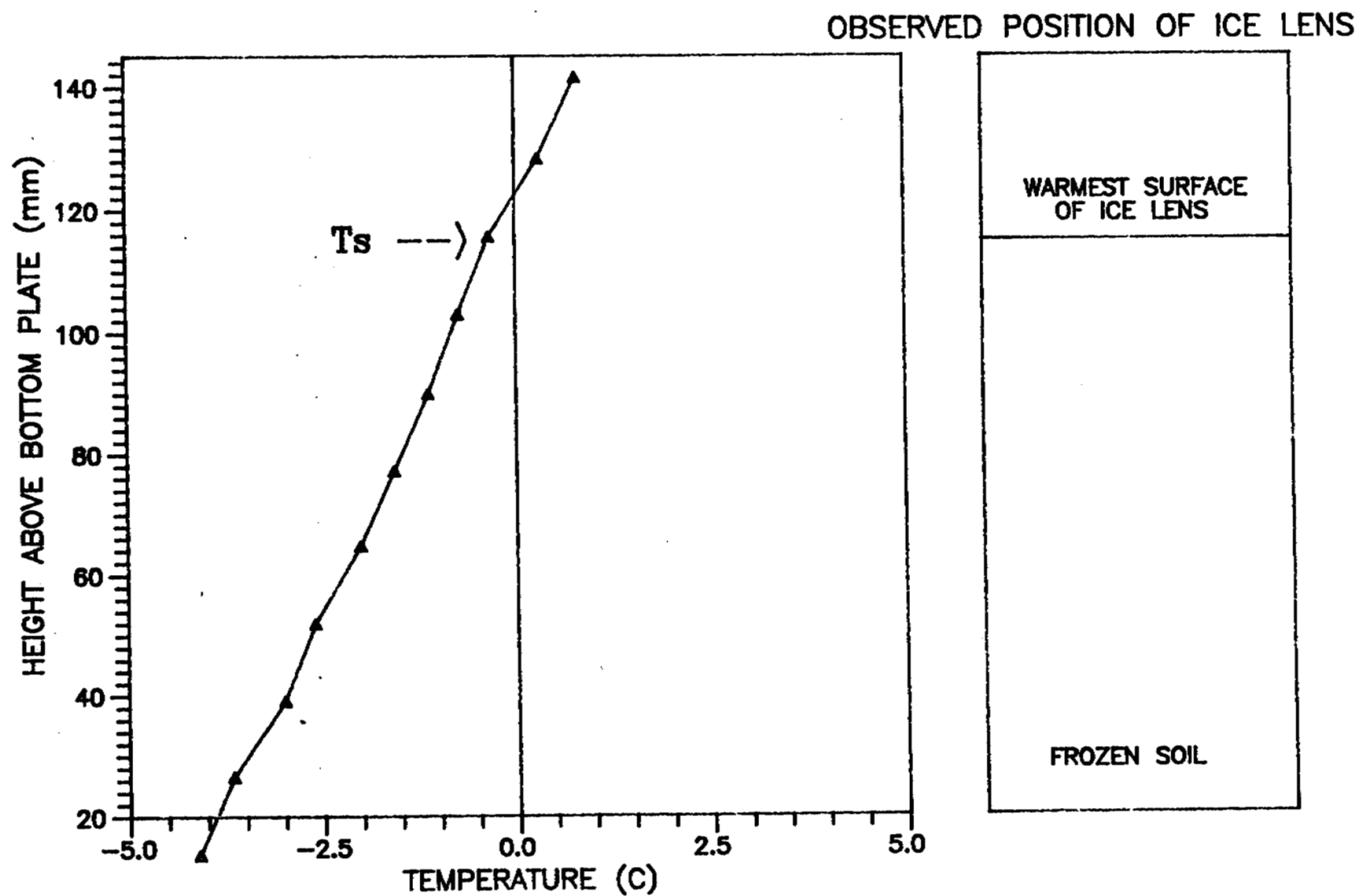


TEST S4 FROST FRONT LOCATION



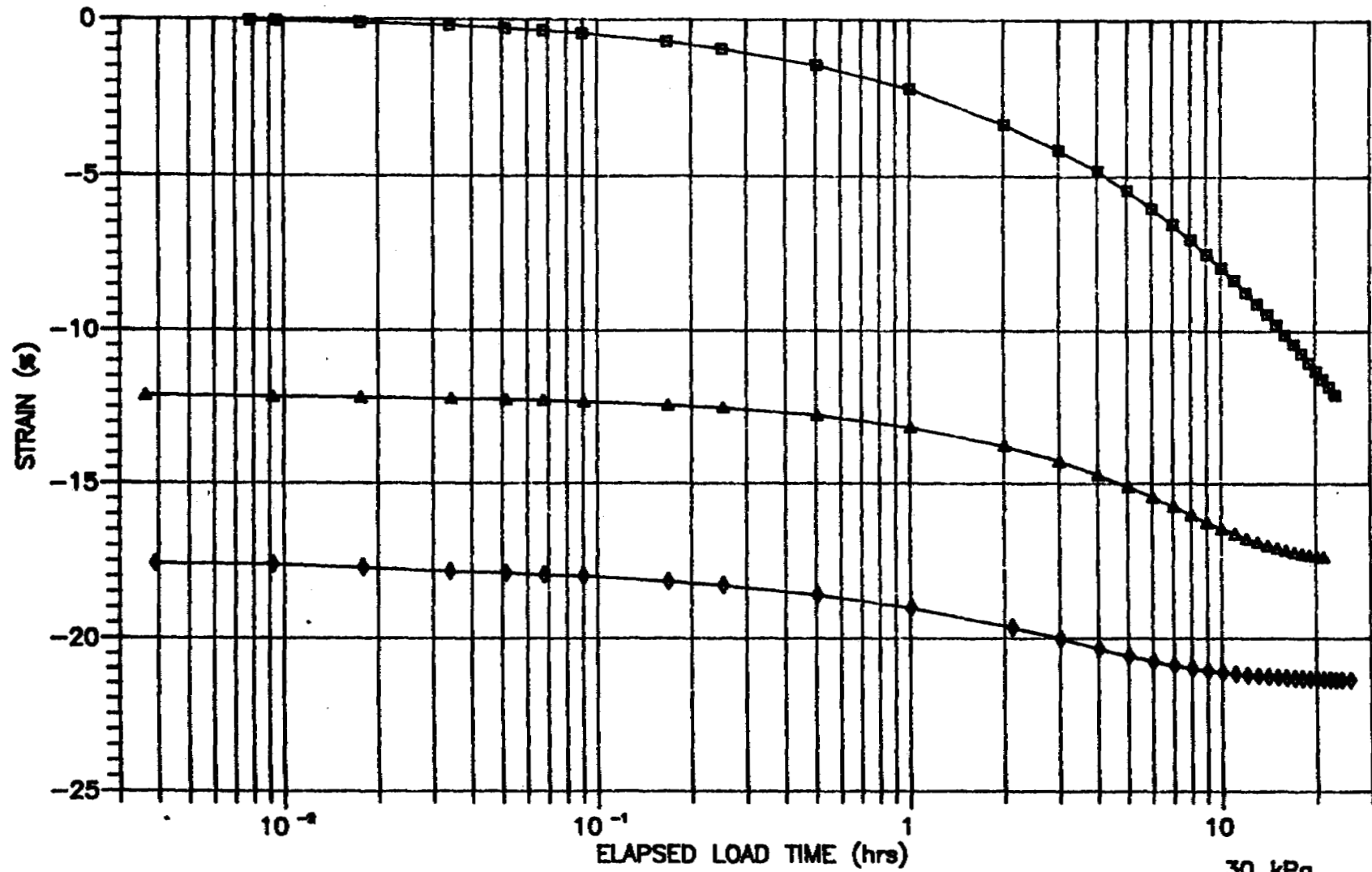






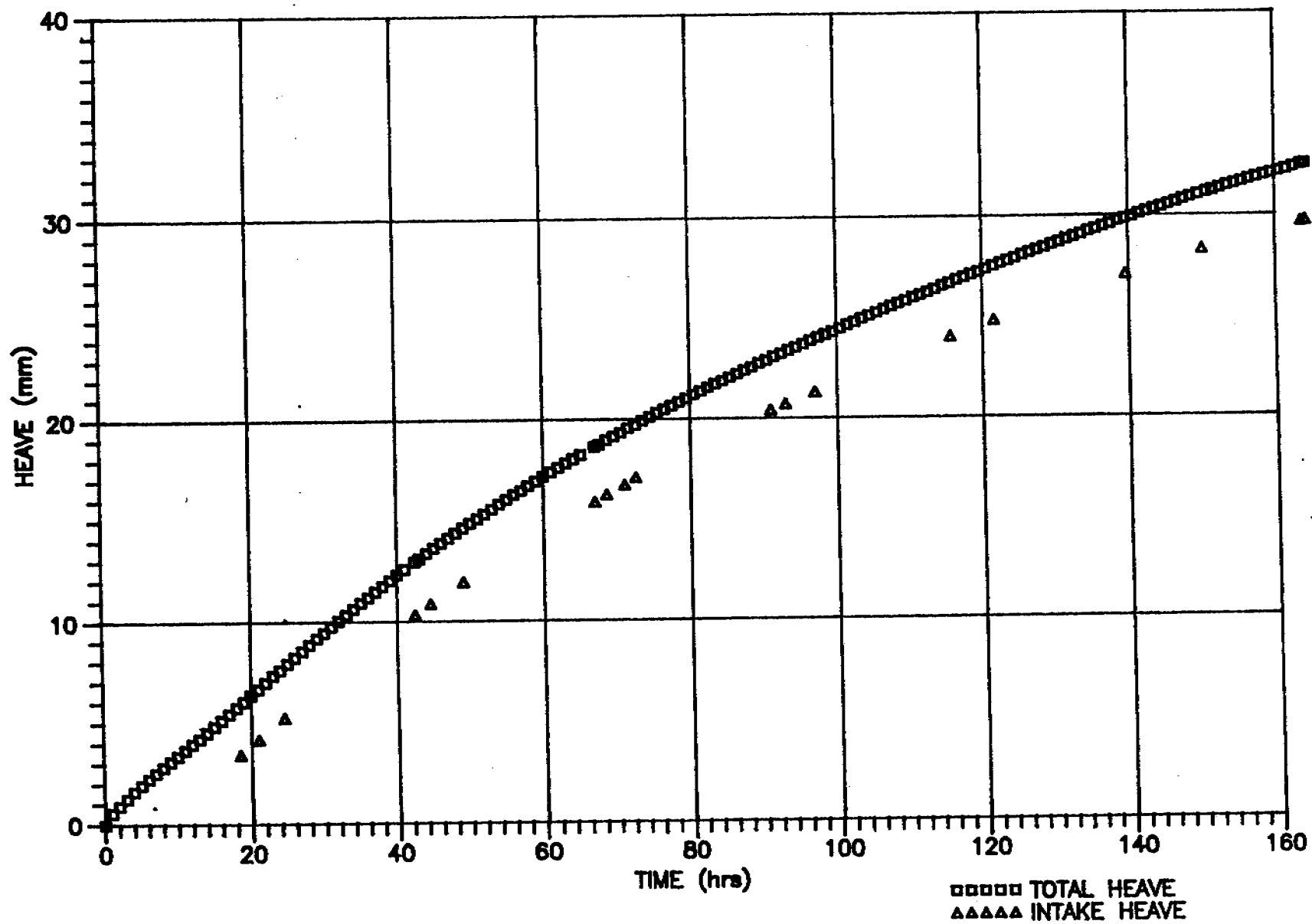
TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S4

CONSOLIDATION TEST S5

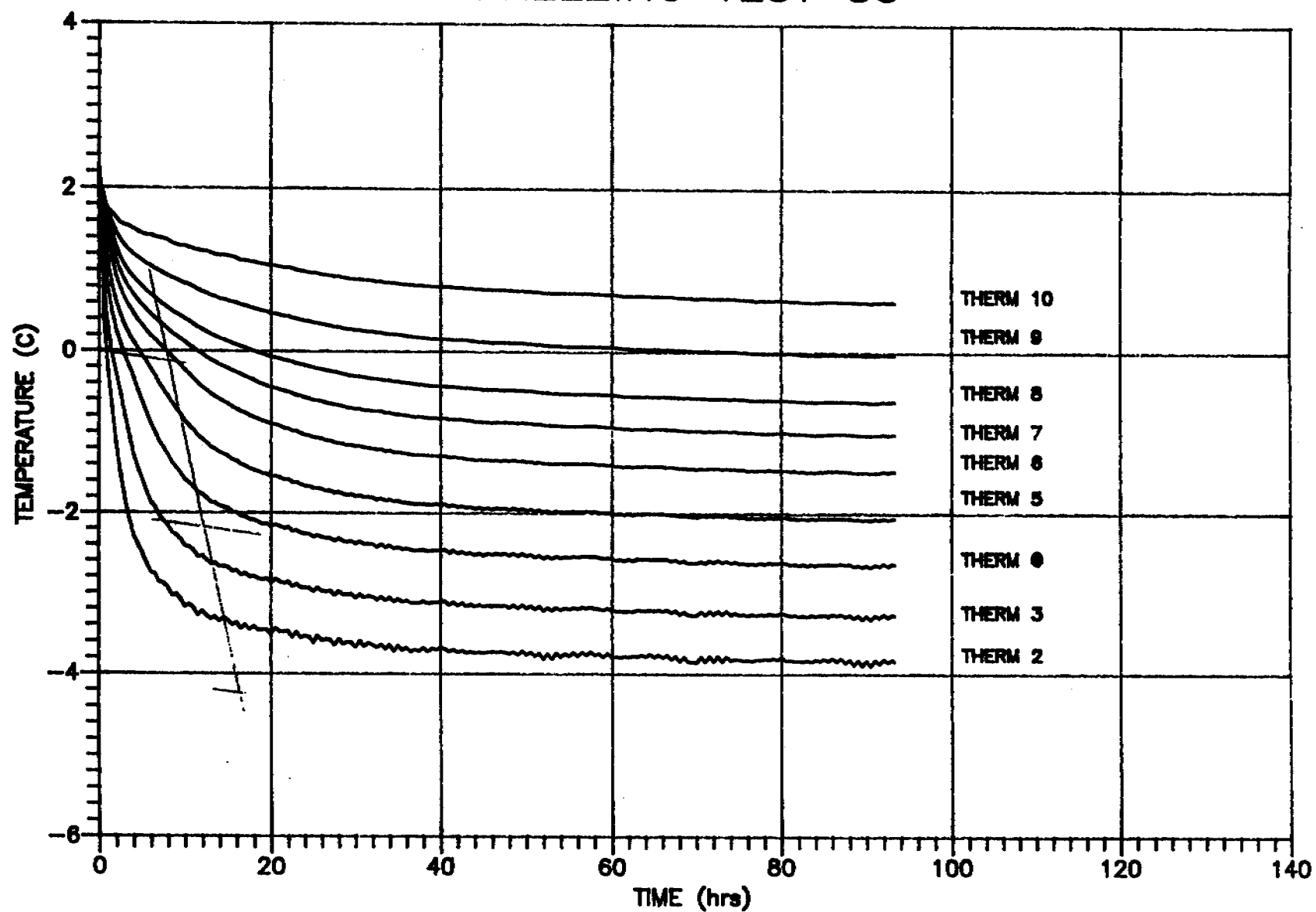


30 kPa
60 kPa
30 kPa

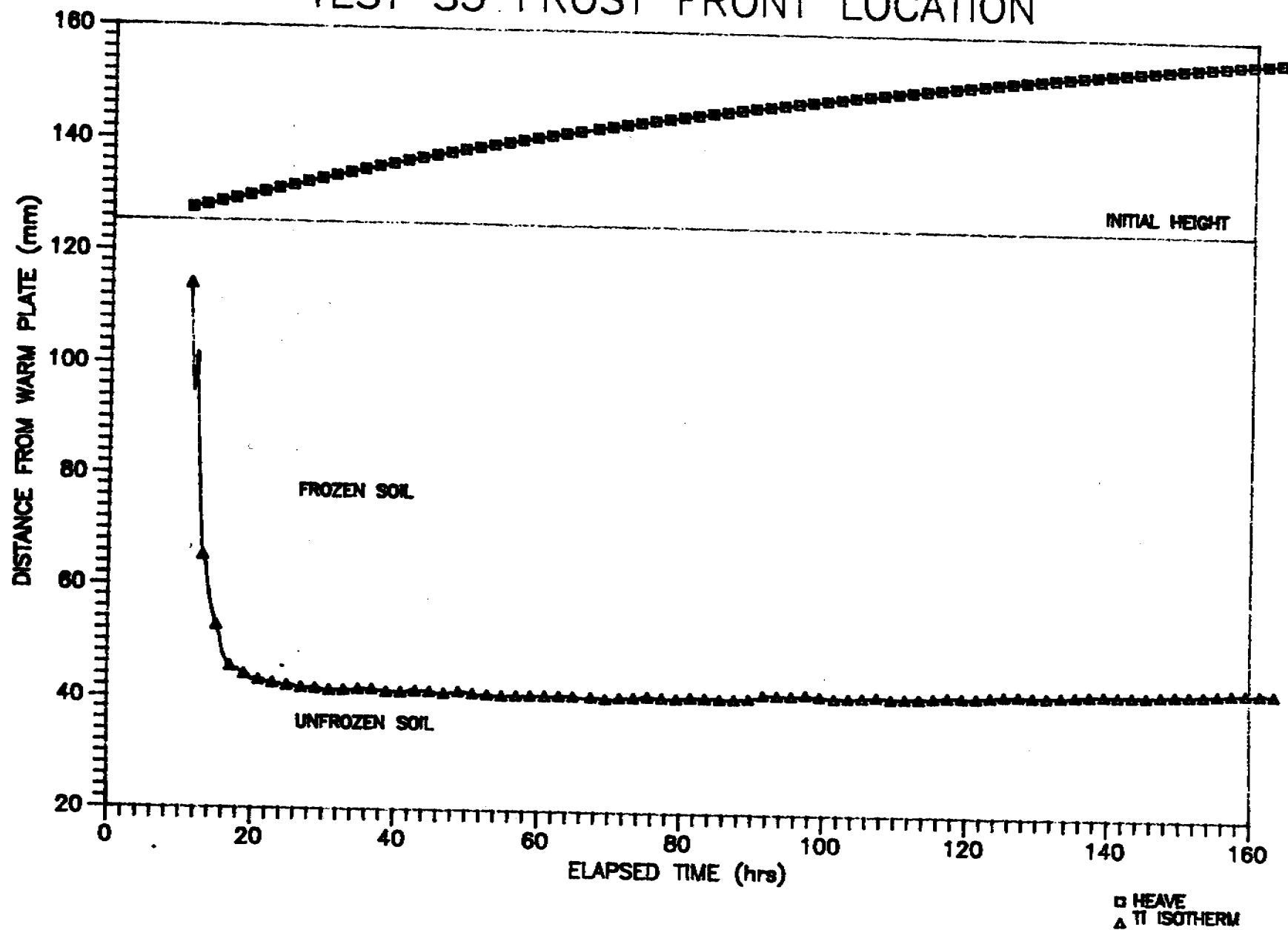
FREEZING TEST S5



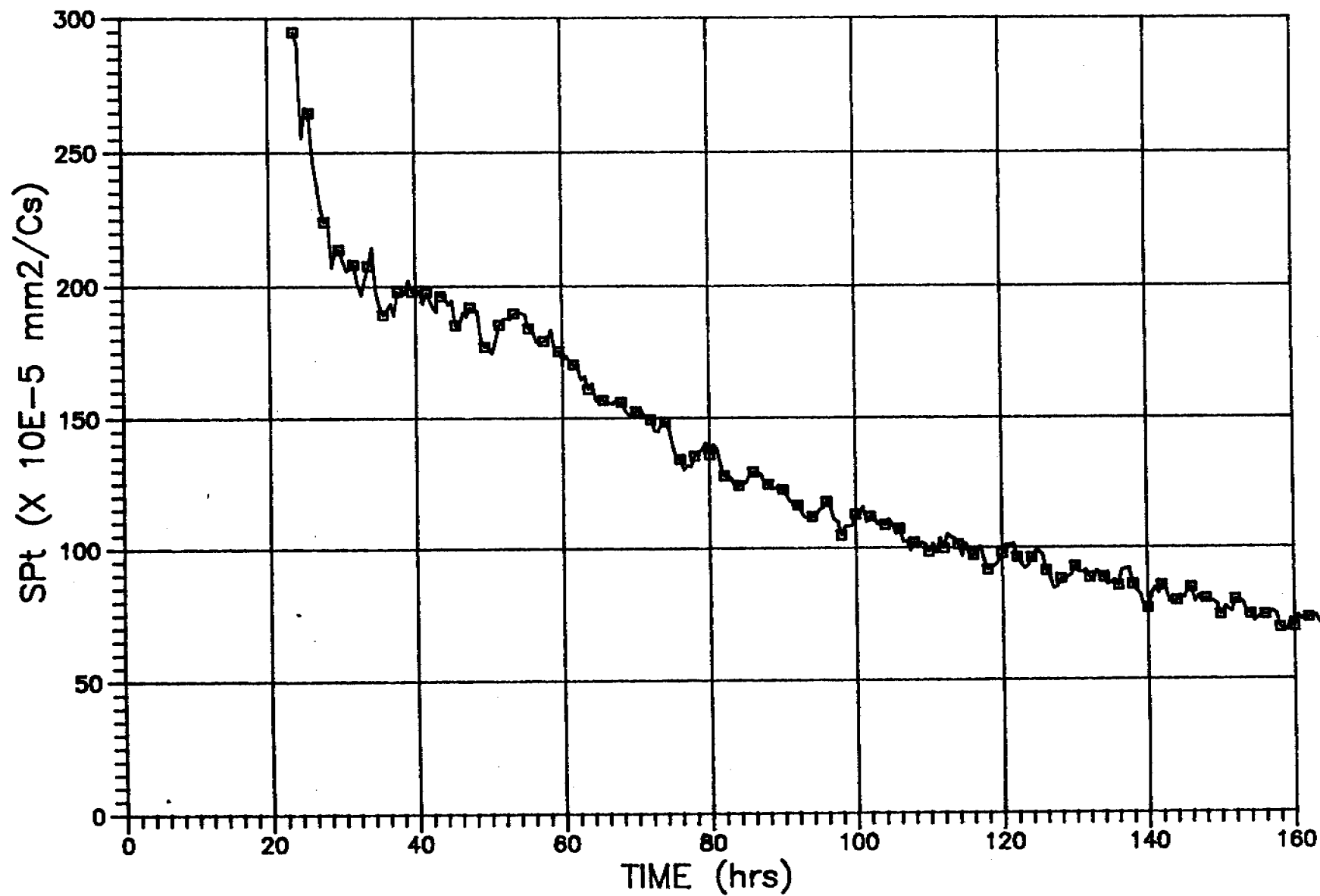
FREEZING TEST S5

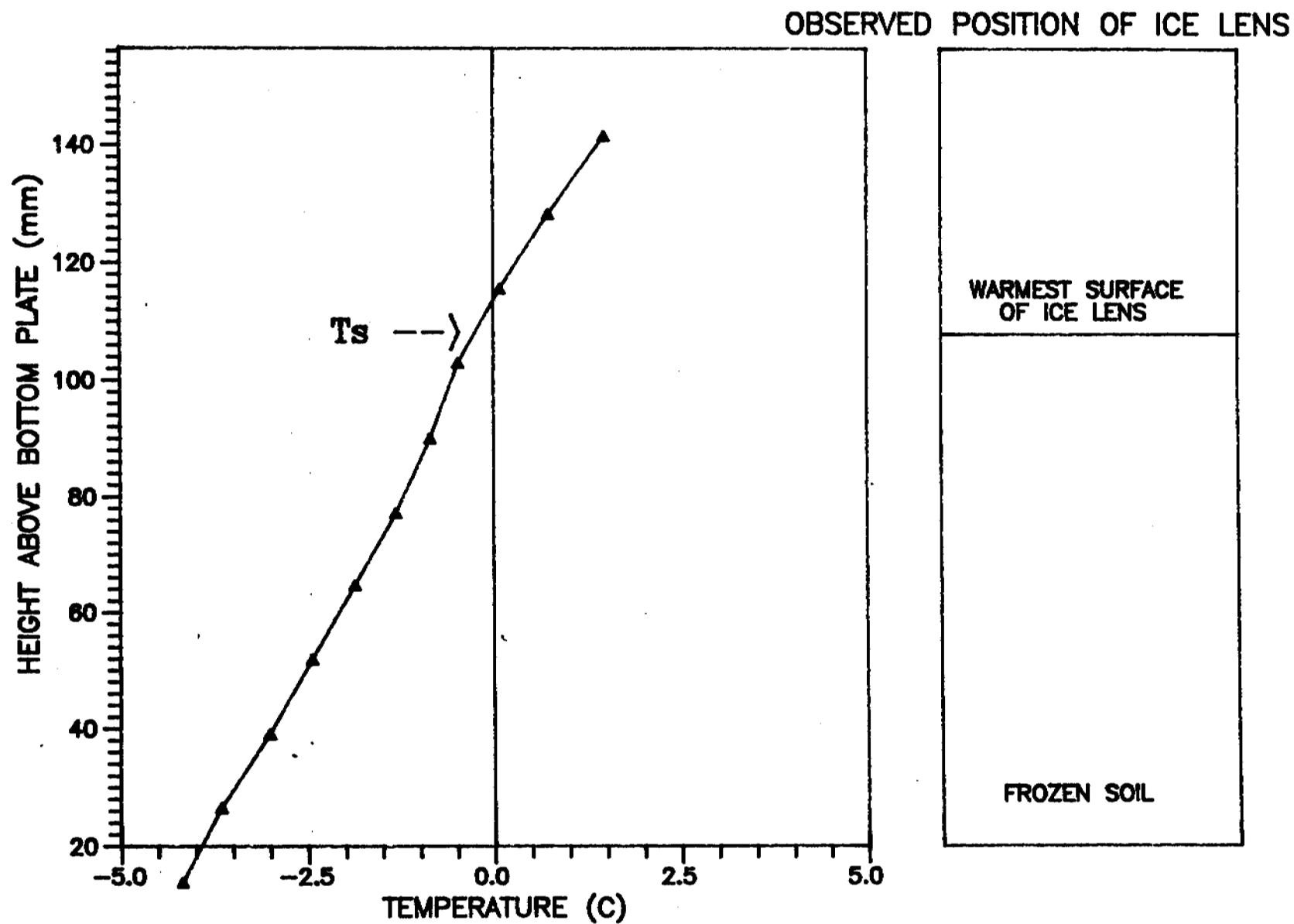


TEST S5 FROST FRONT LOCATION



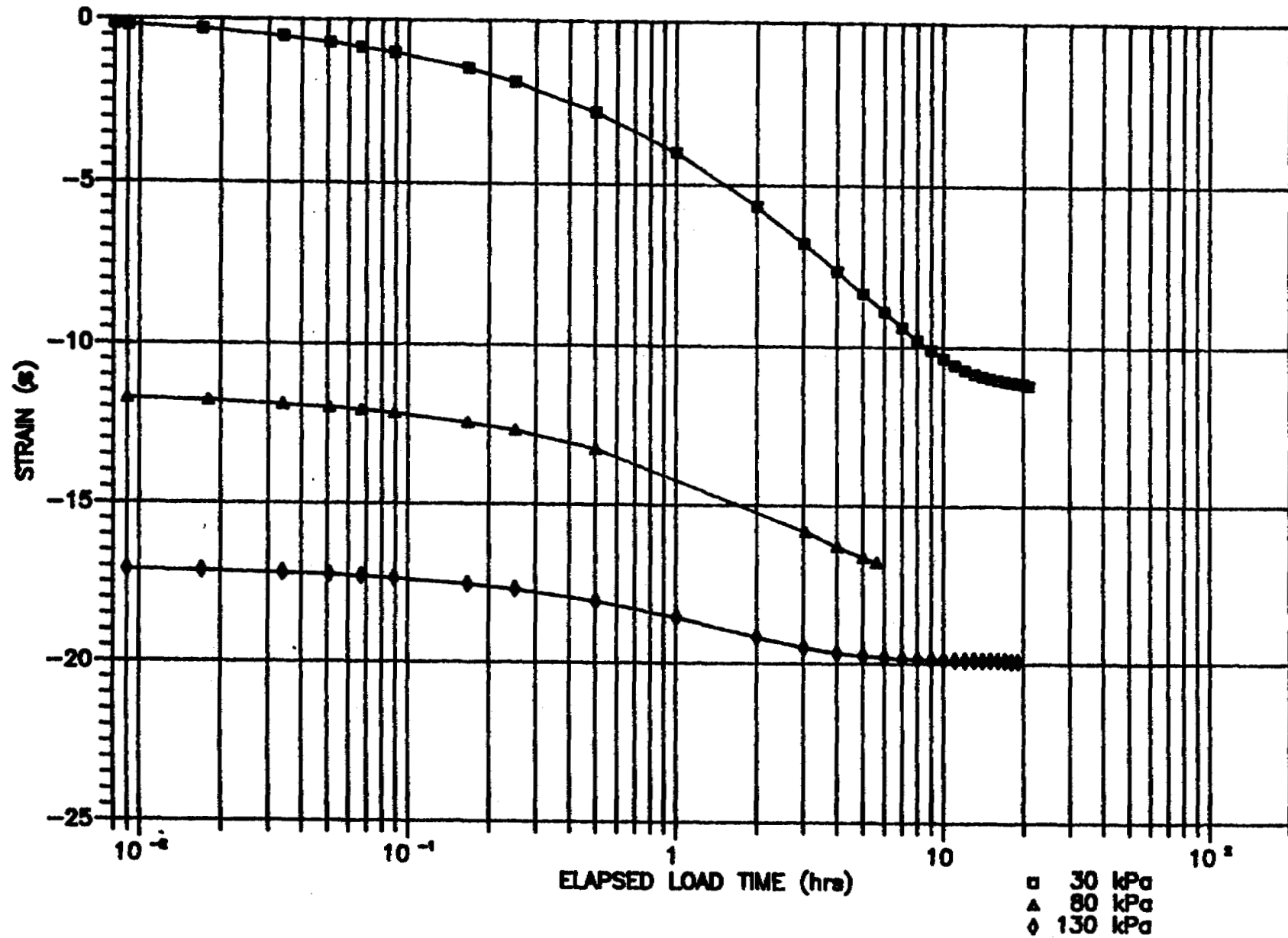
FREEZING TEST S5



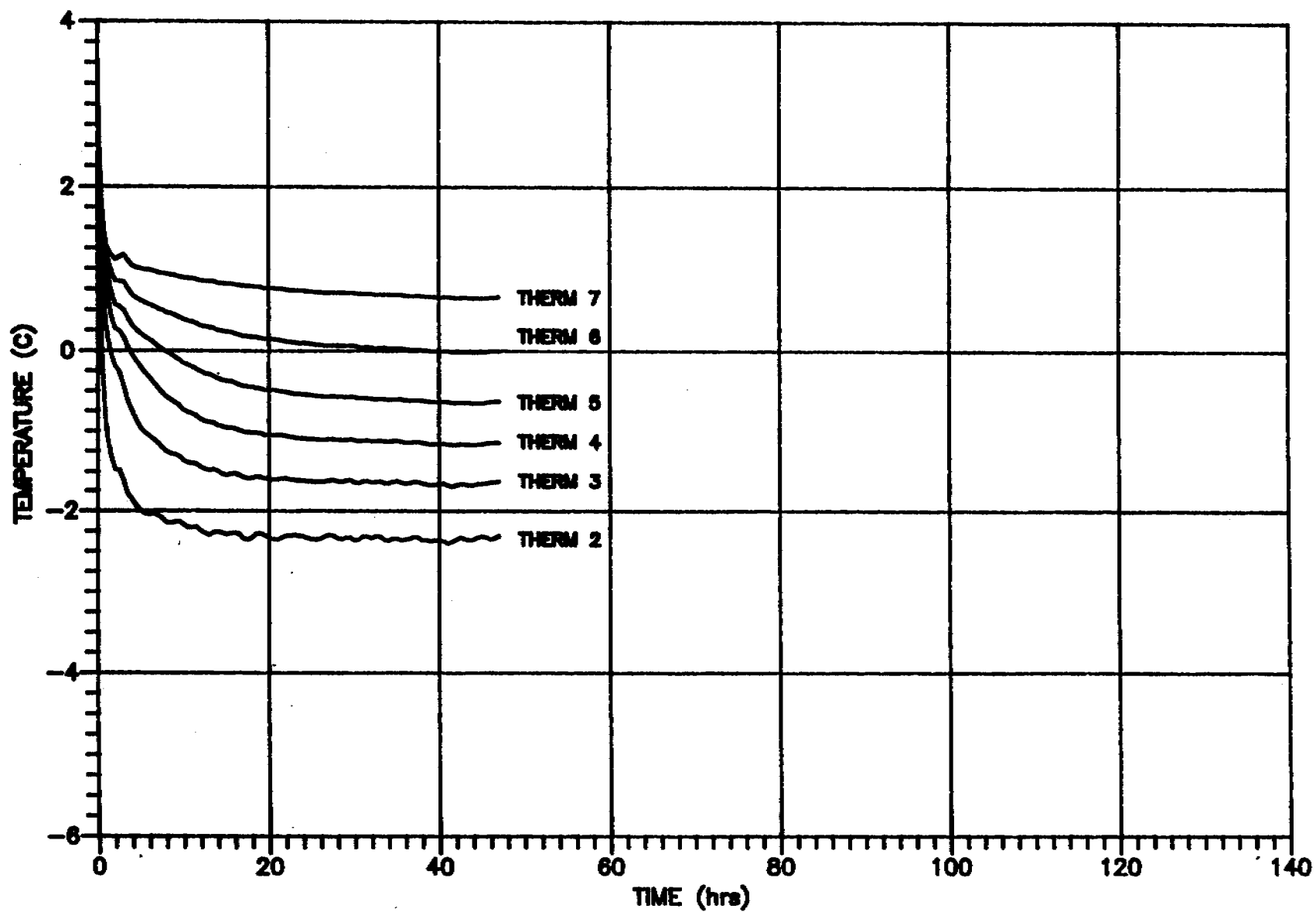


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S5

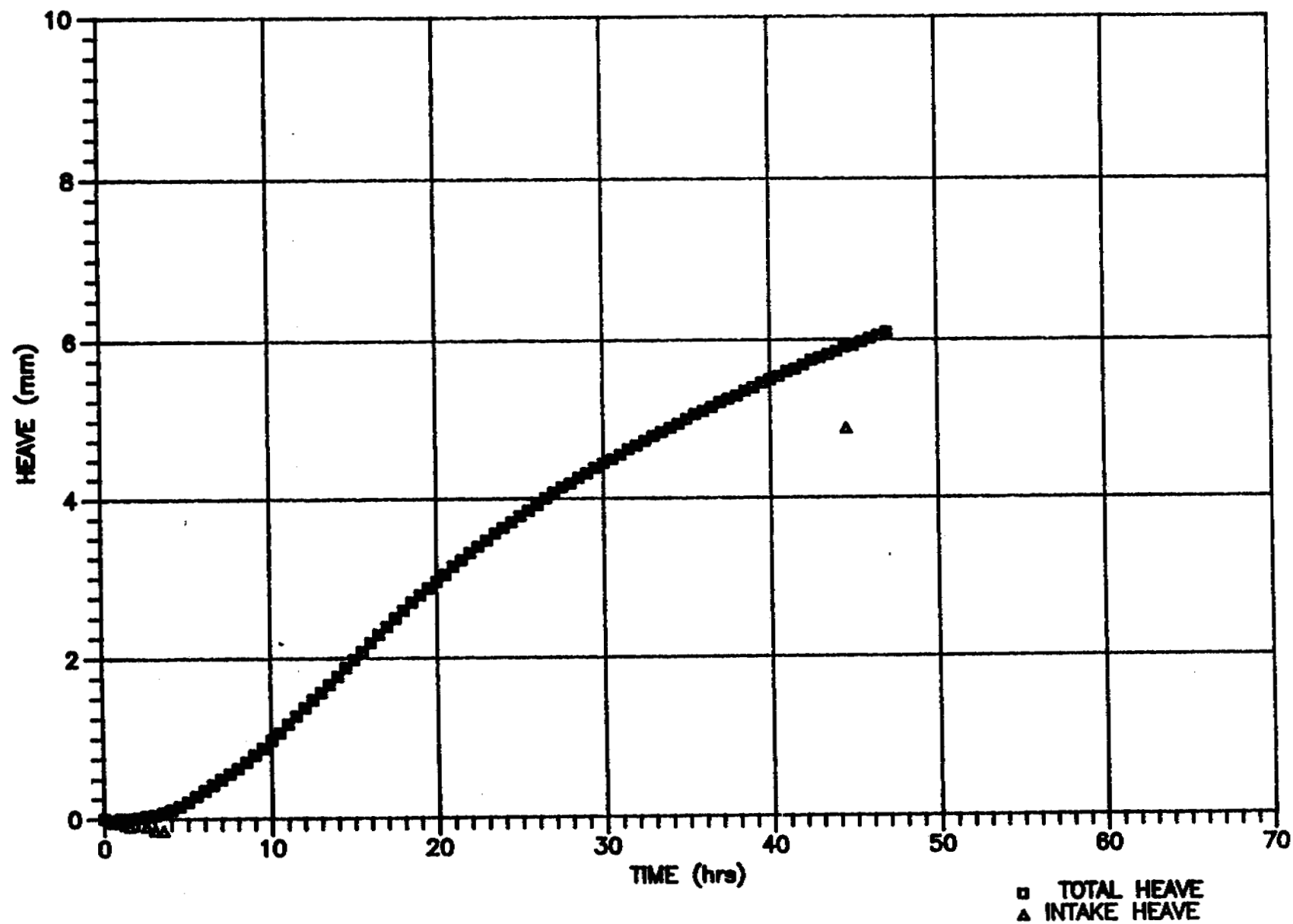
CONSOLIDATION TEST S10



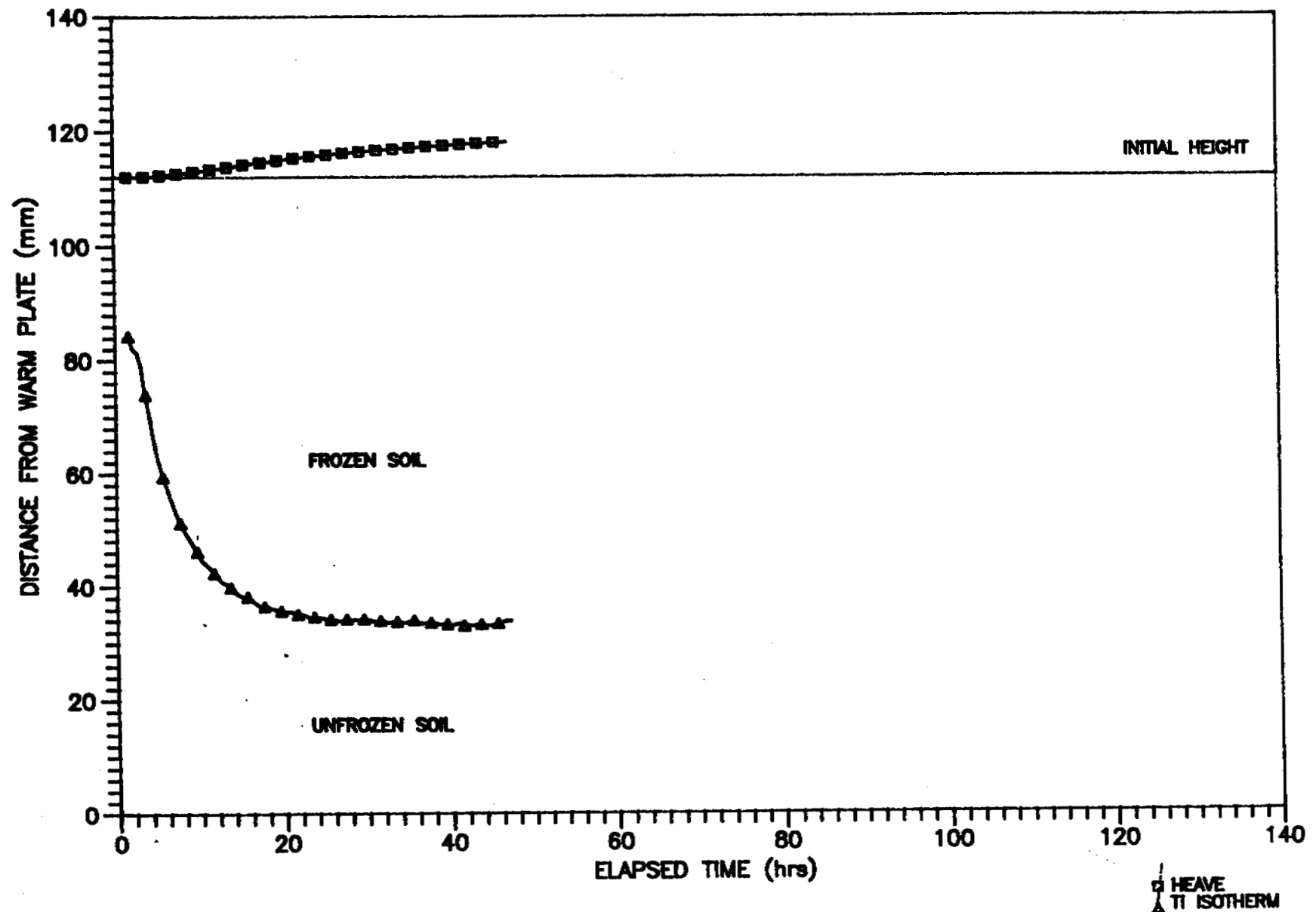
FREEZING TEST S10



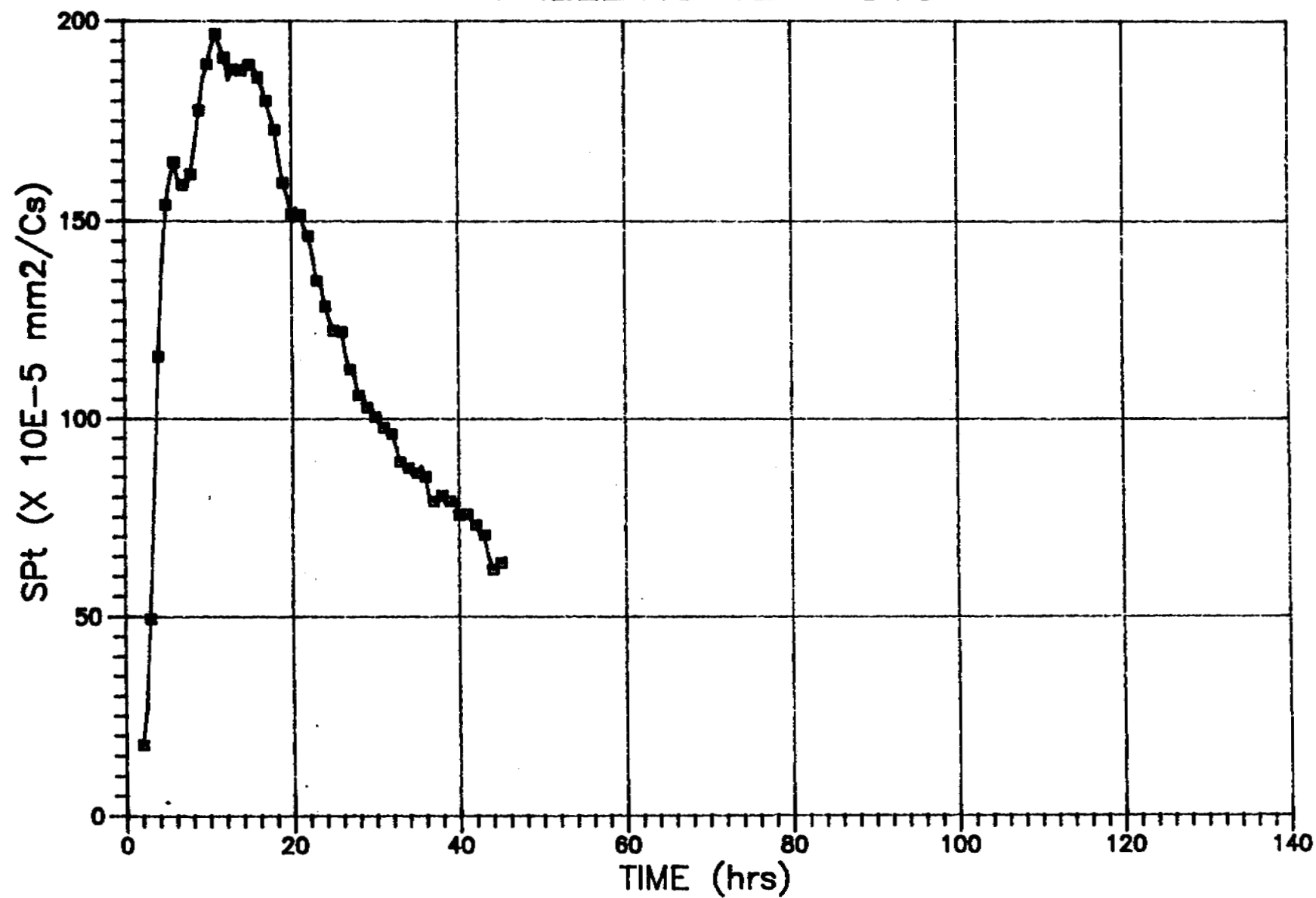
FREEZING TEST S10

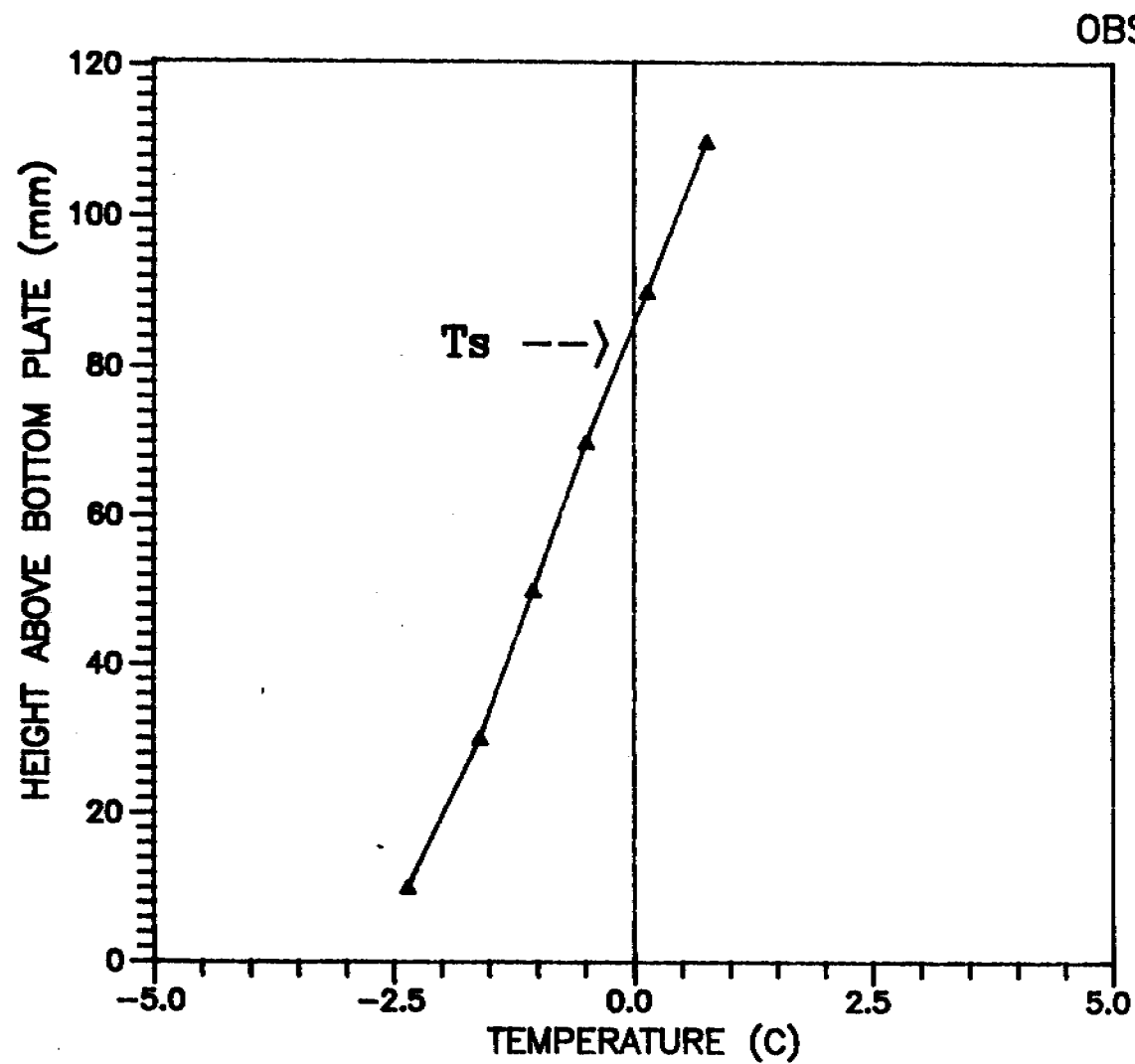


TEST S10 FROST FRONT LOCATION

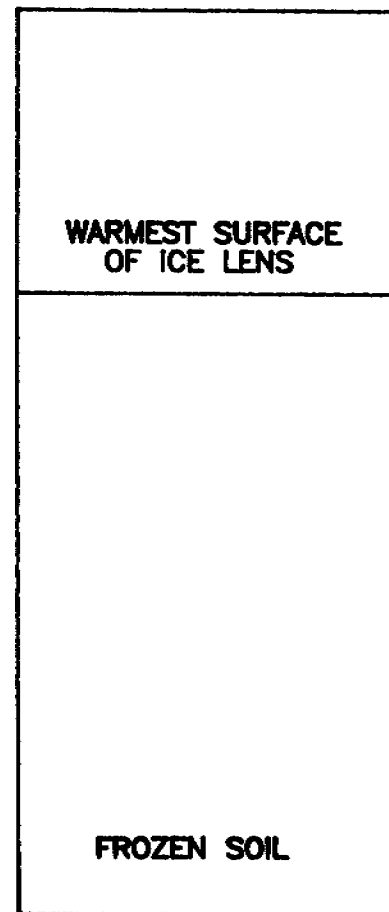


FREEZING TEST S10



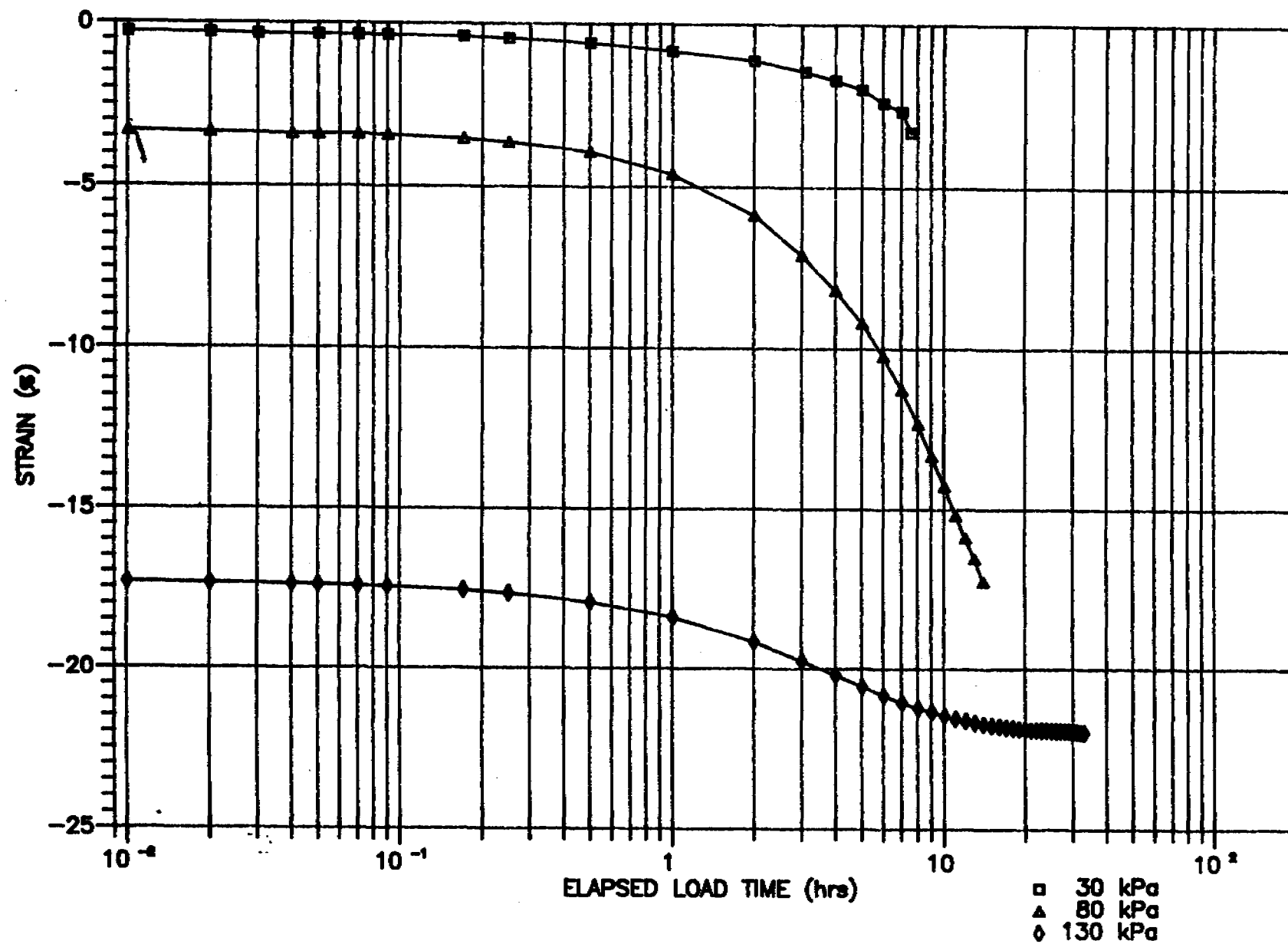


OBSERVED POSITION OF ICE LENS

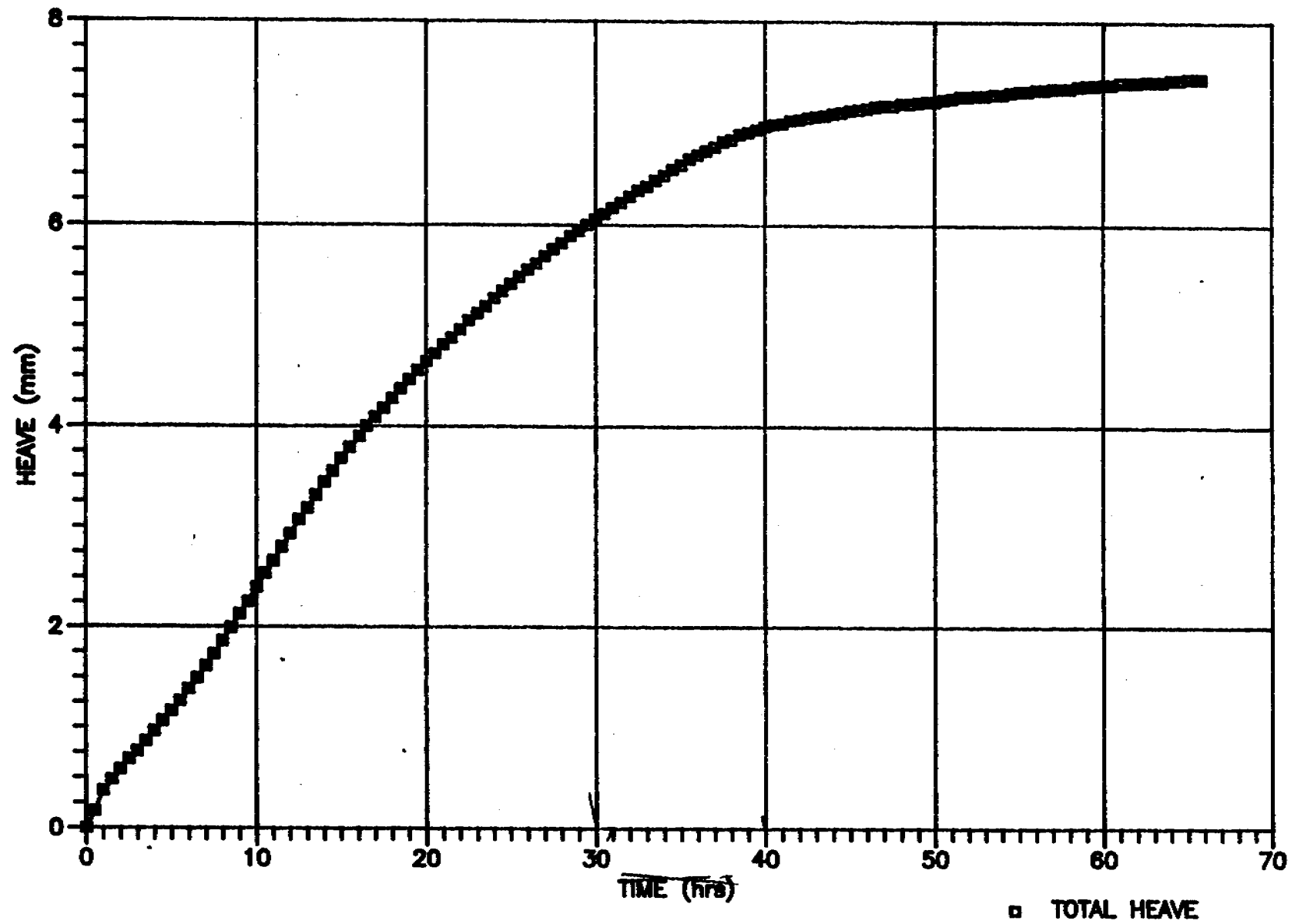


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS — S10

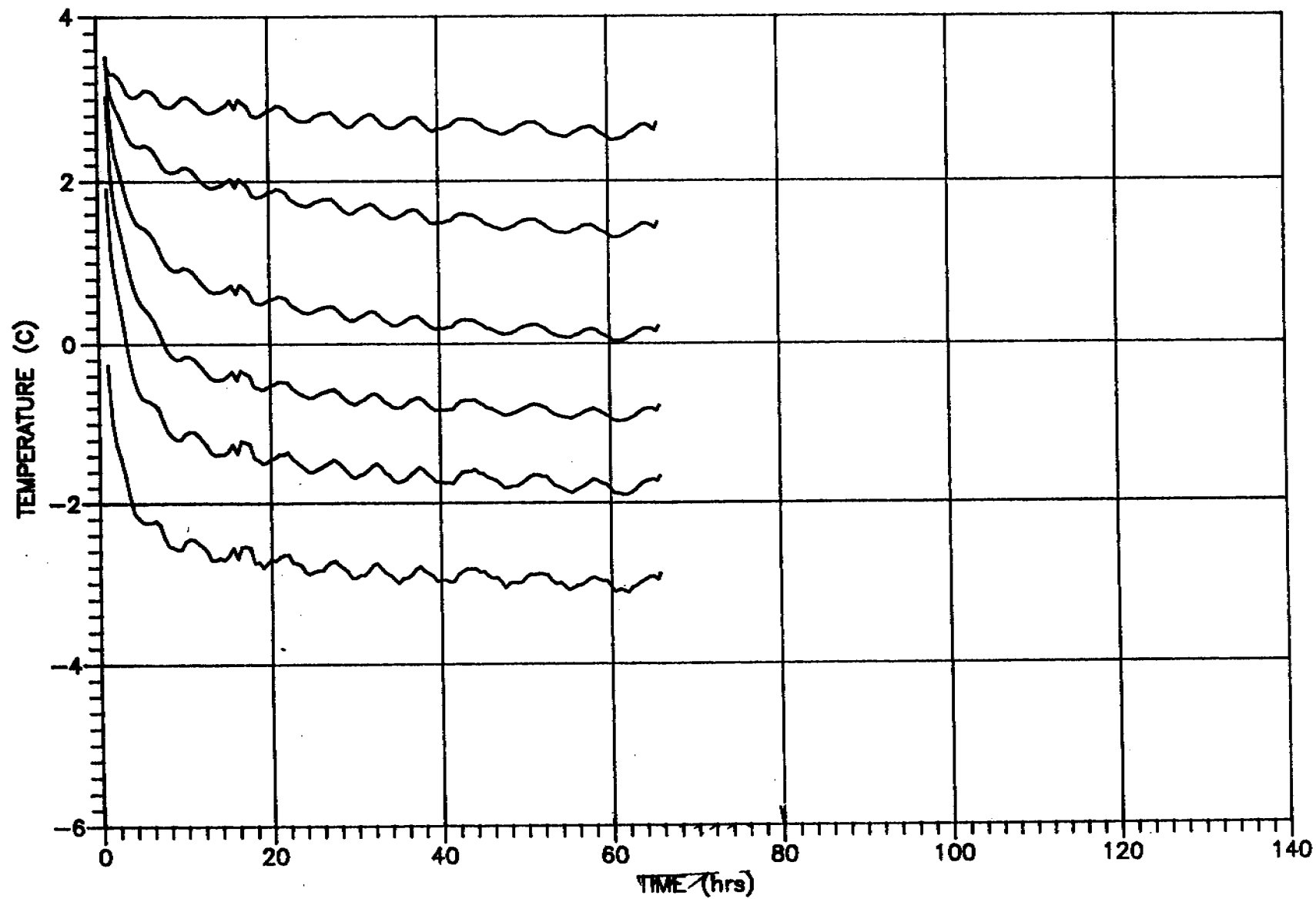
CONSOLIDATION TEST S11



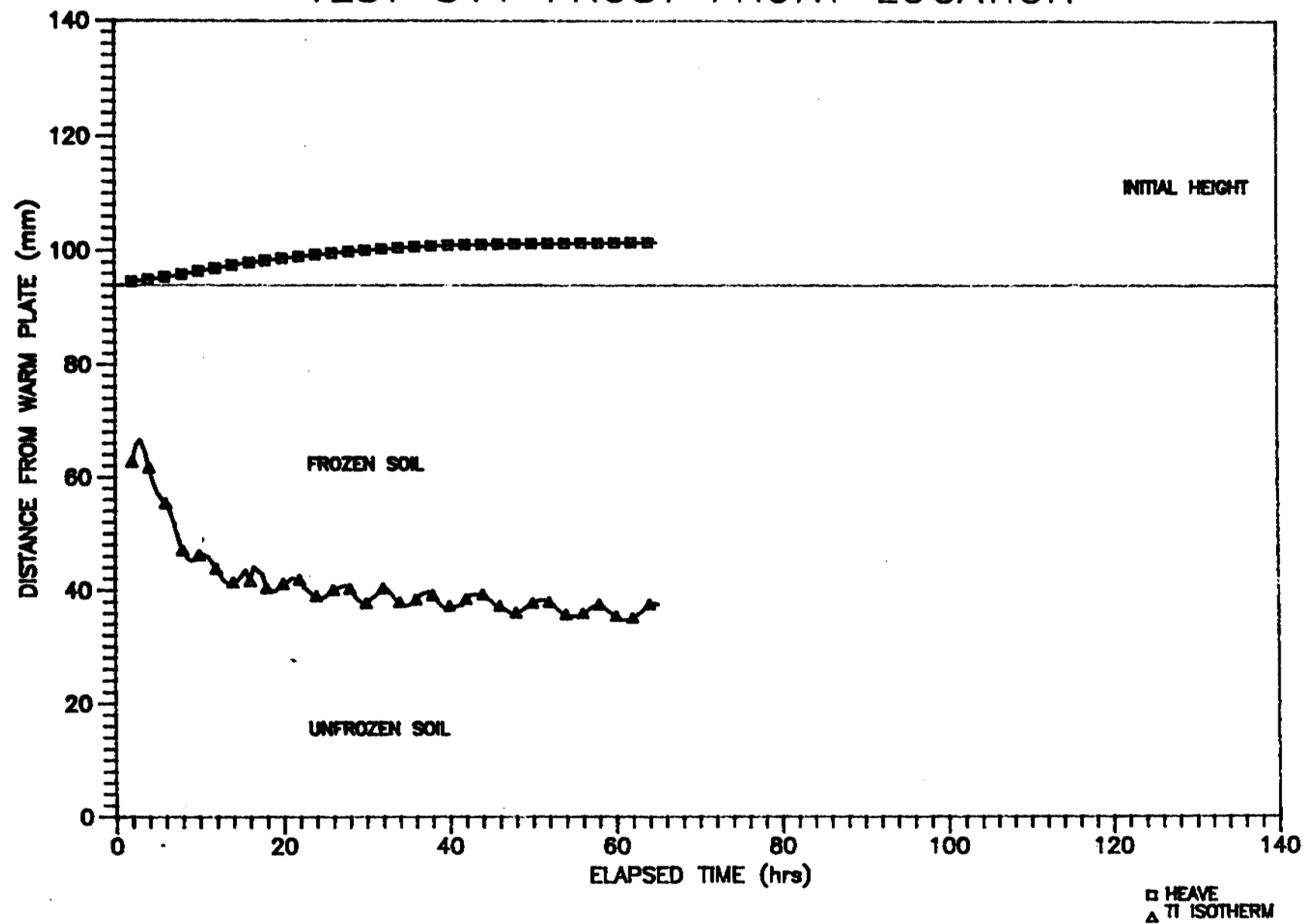
FREEZING TEST S11



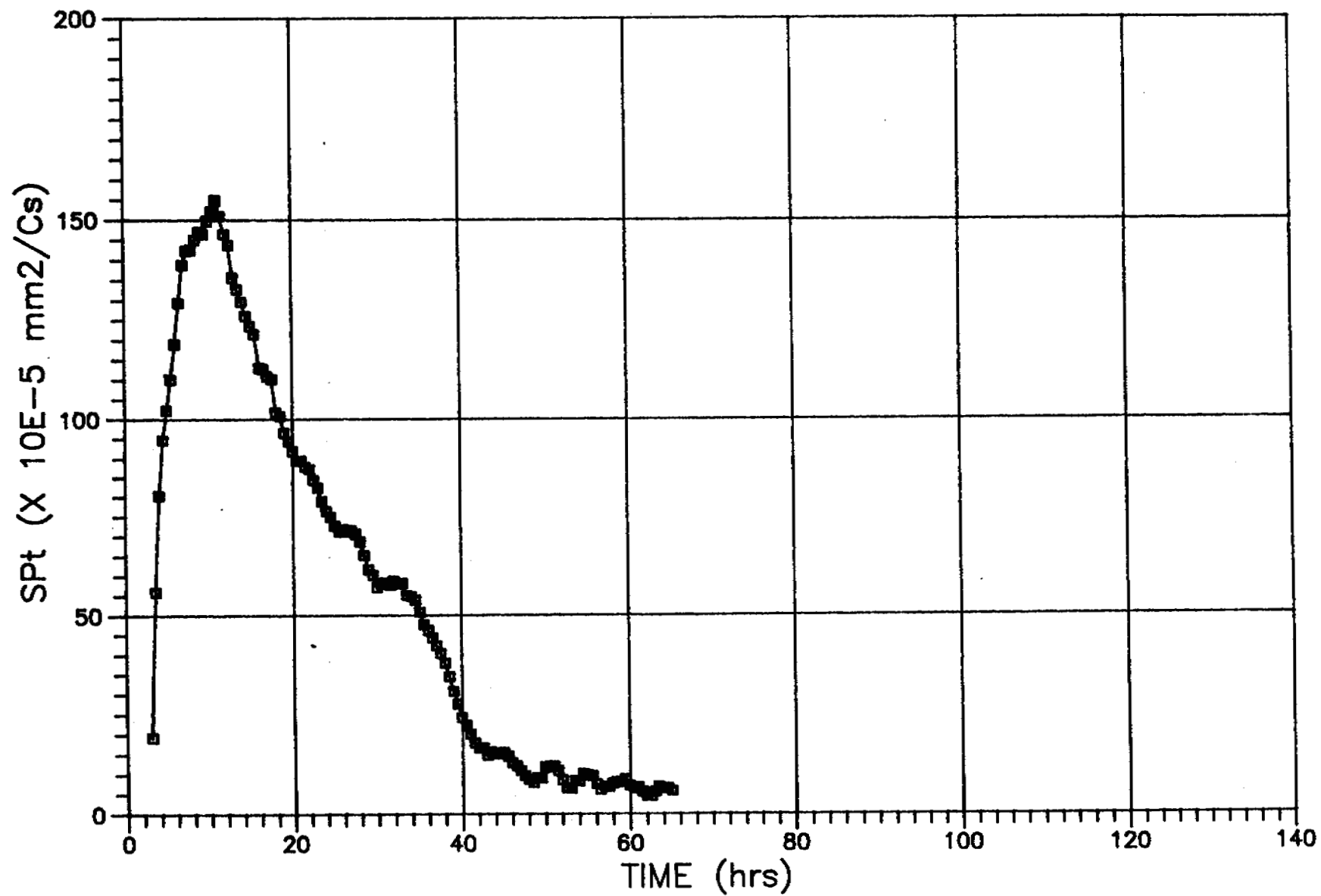
FREEZING TEST S11

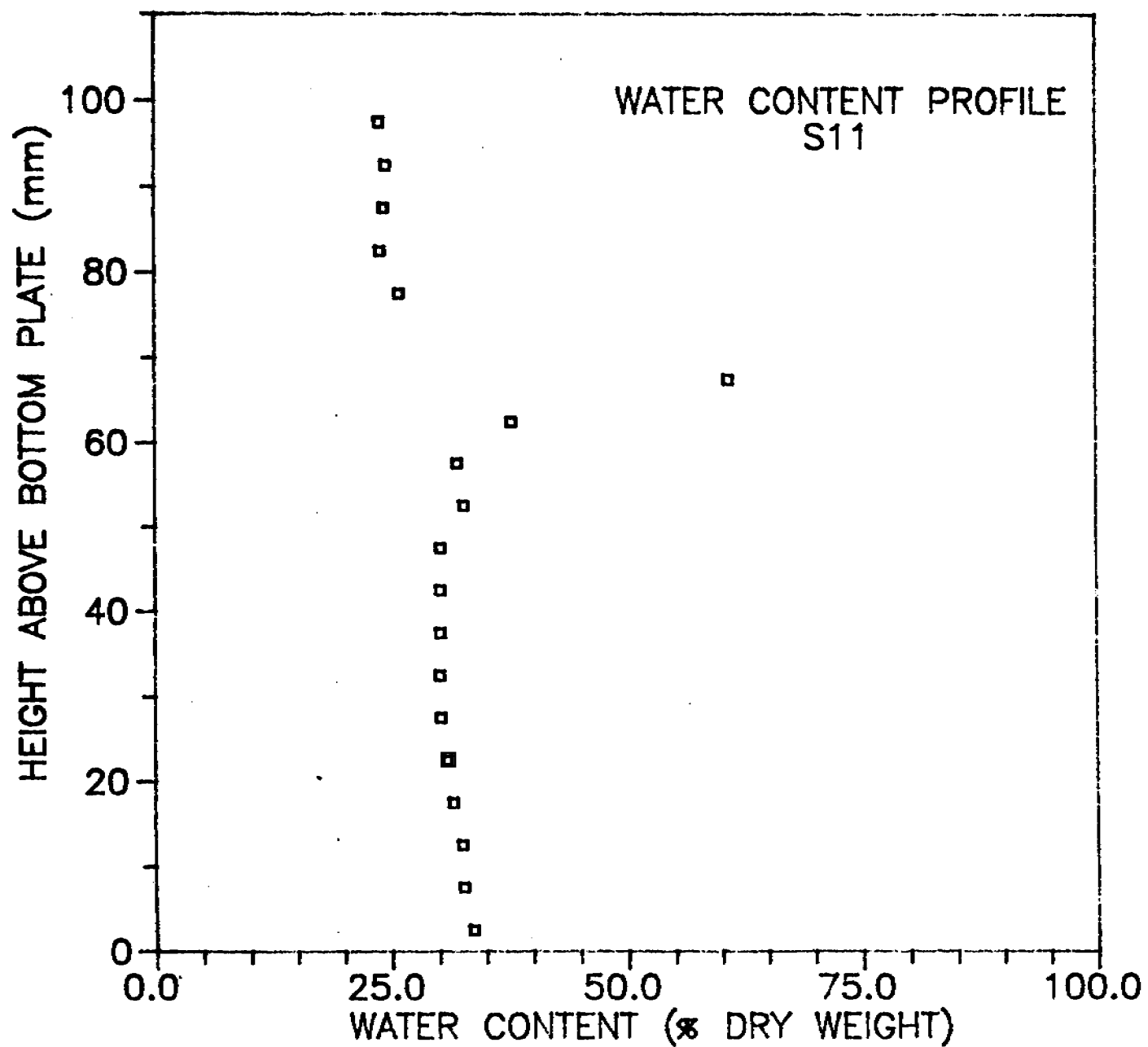


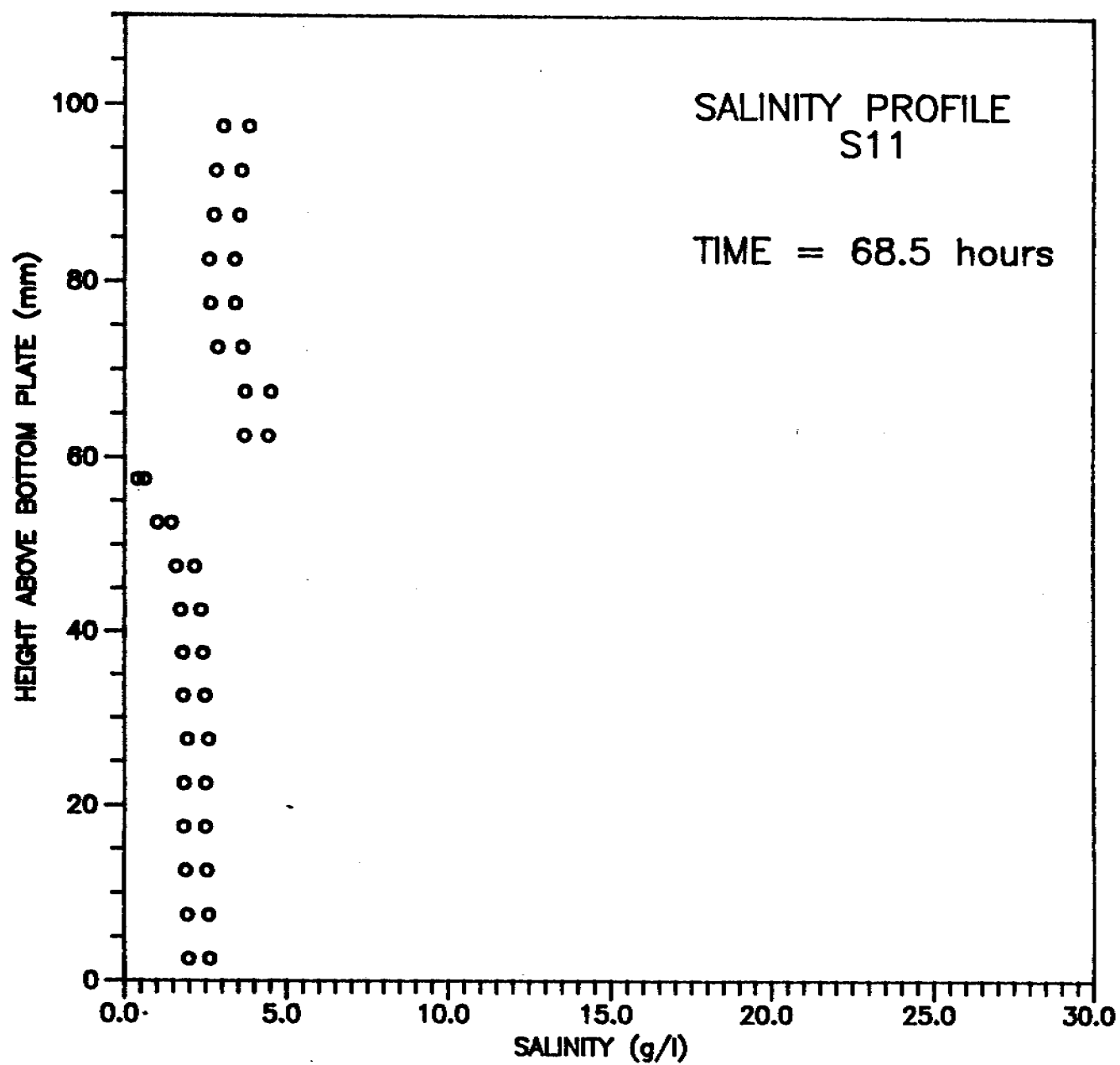
TEST S11. FROST FRONT LOCATION

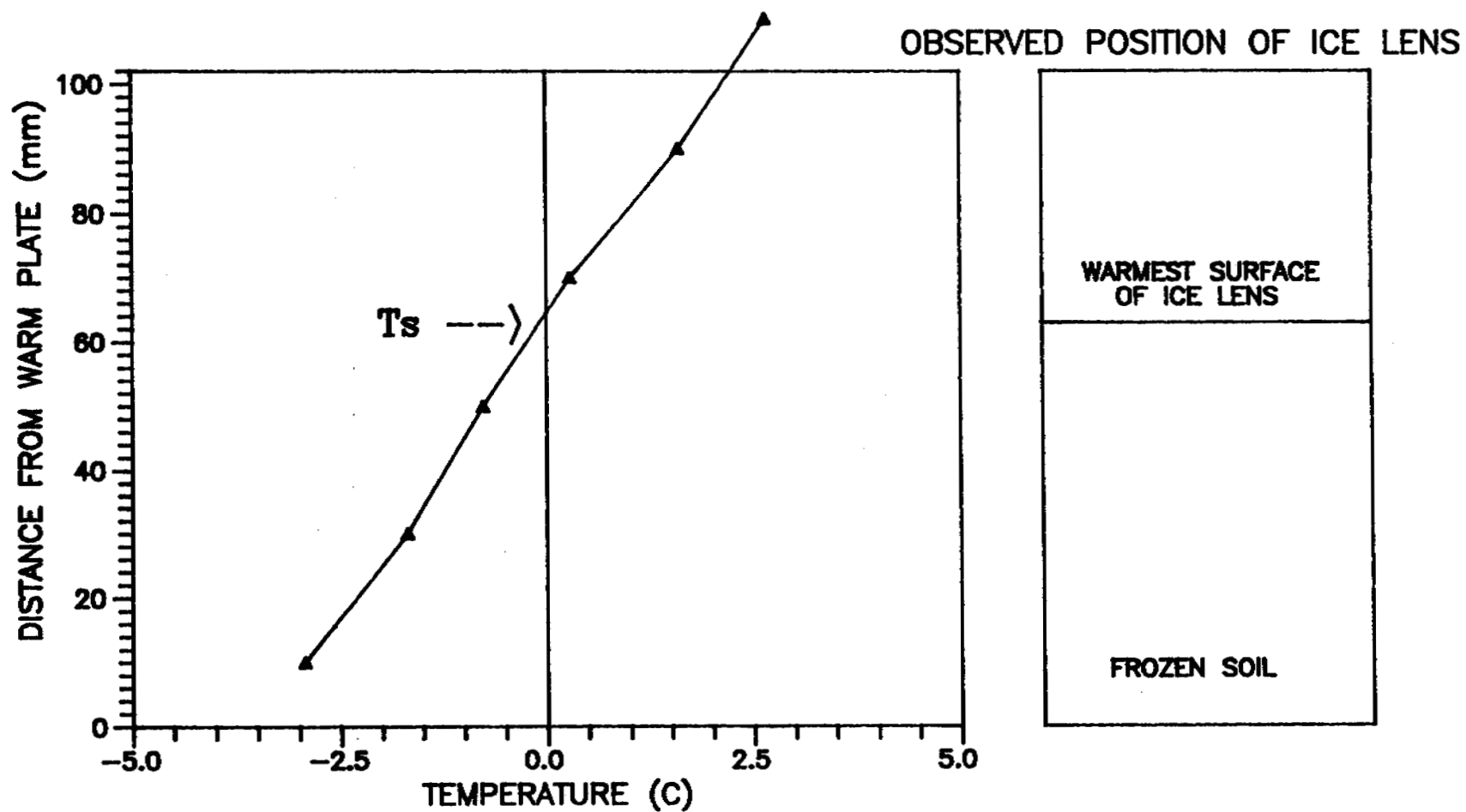


FREEZING TEST S11



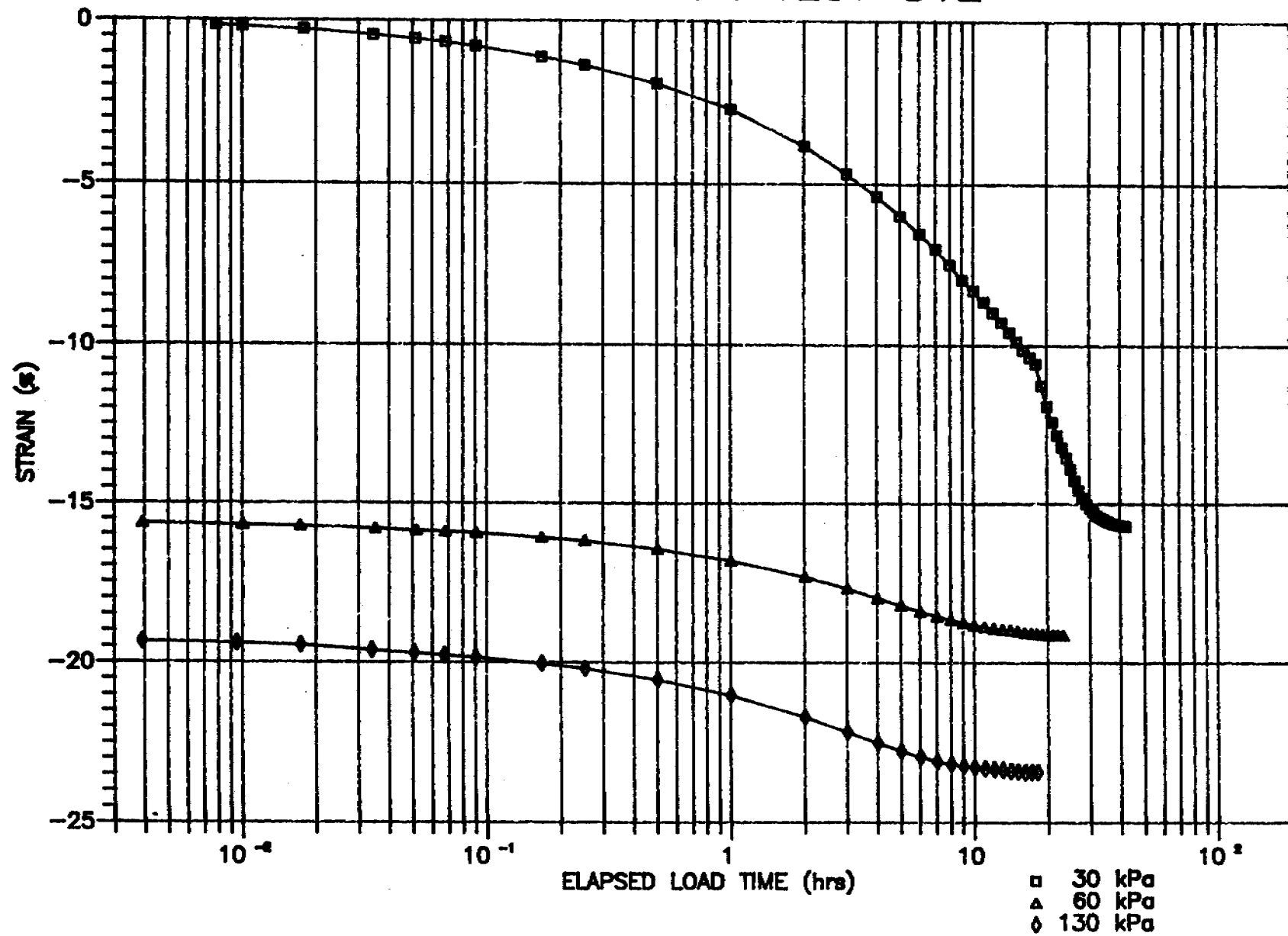




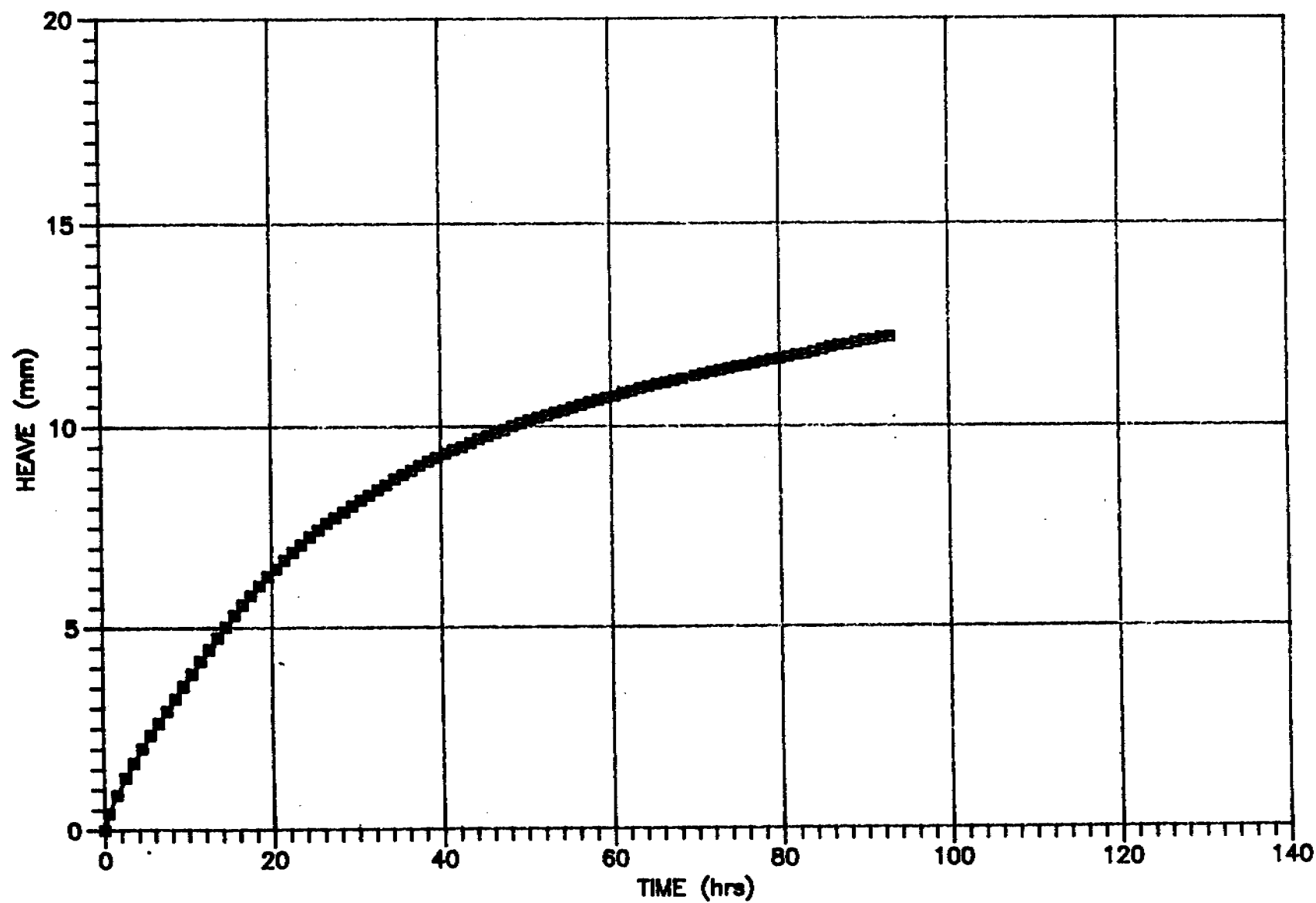


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S11

CONSOLIDATION TEST S12

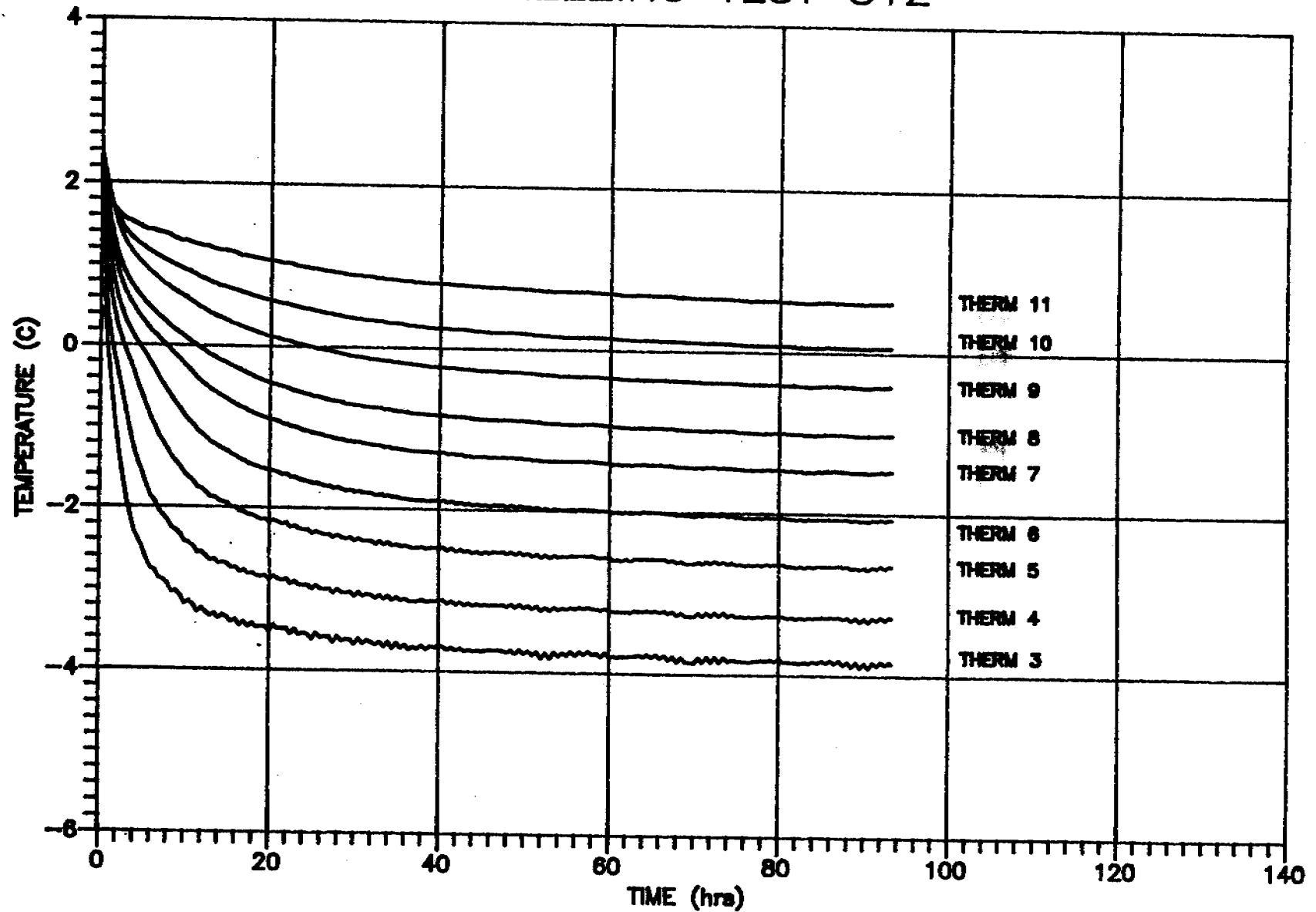


FREEZING TEST S12

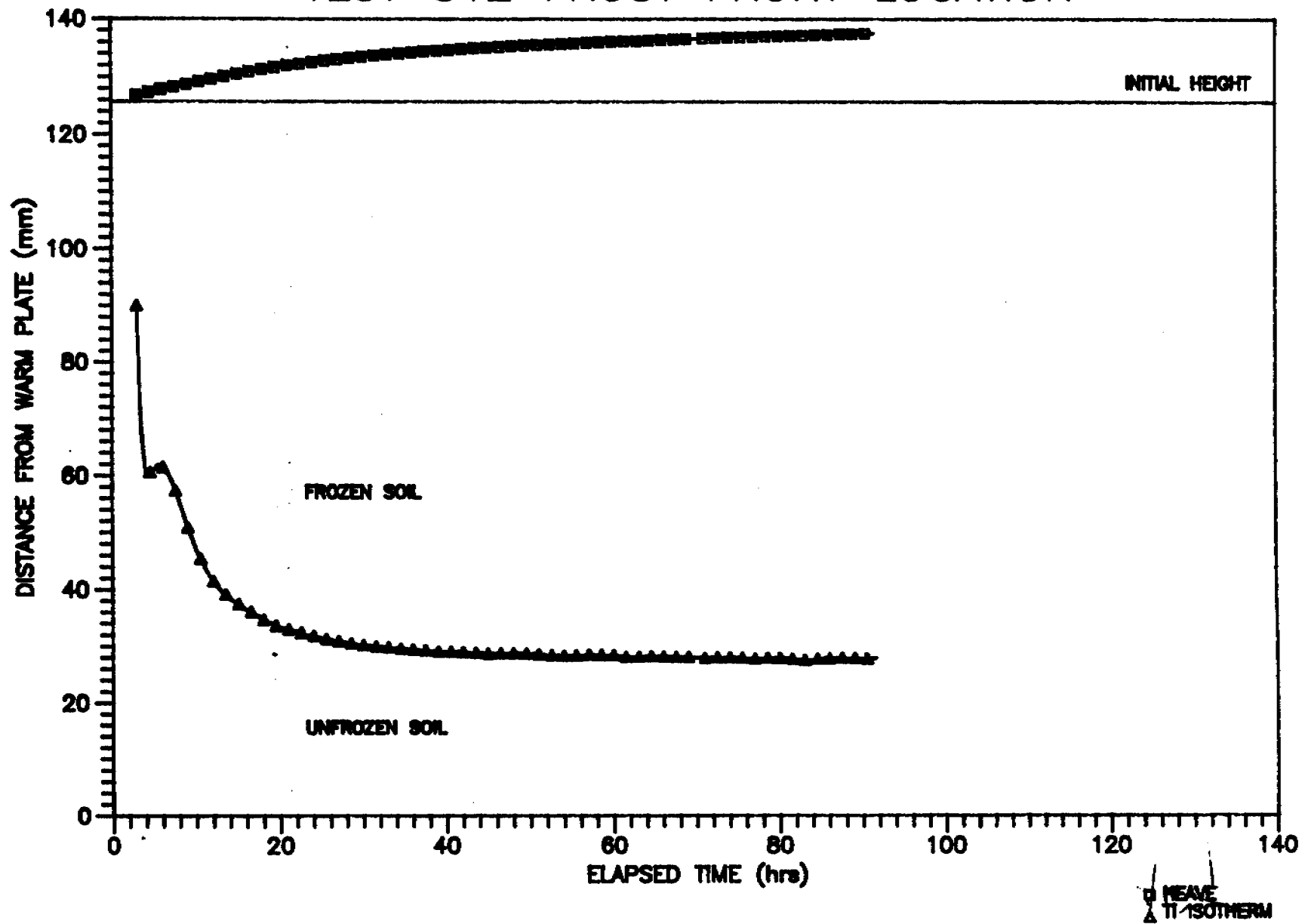


□ TOTAL HEAVE

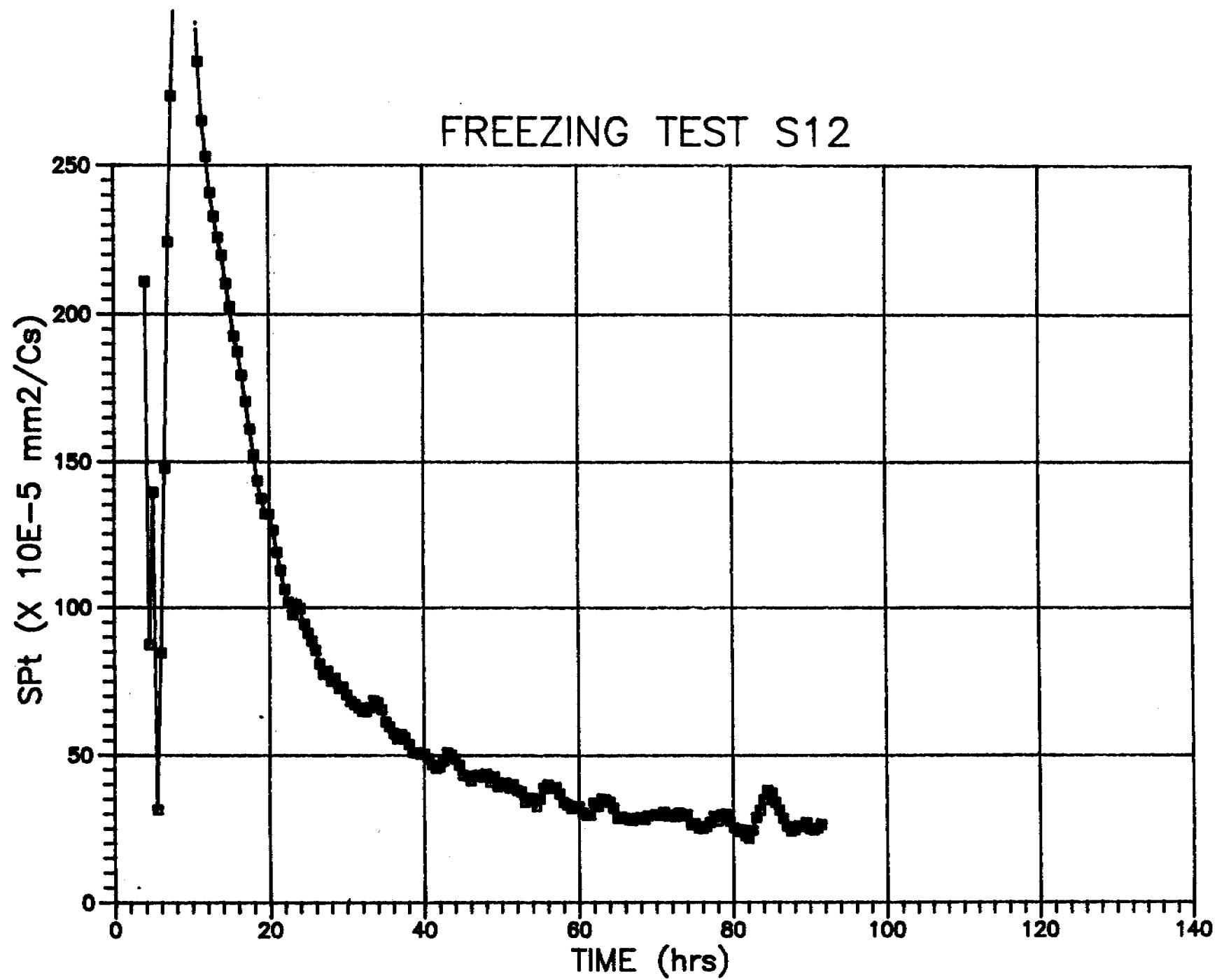
FREEZING TEST S12

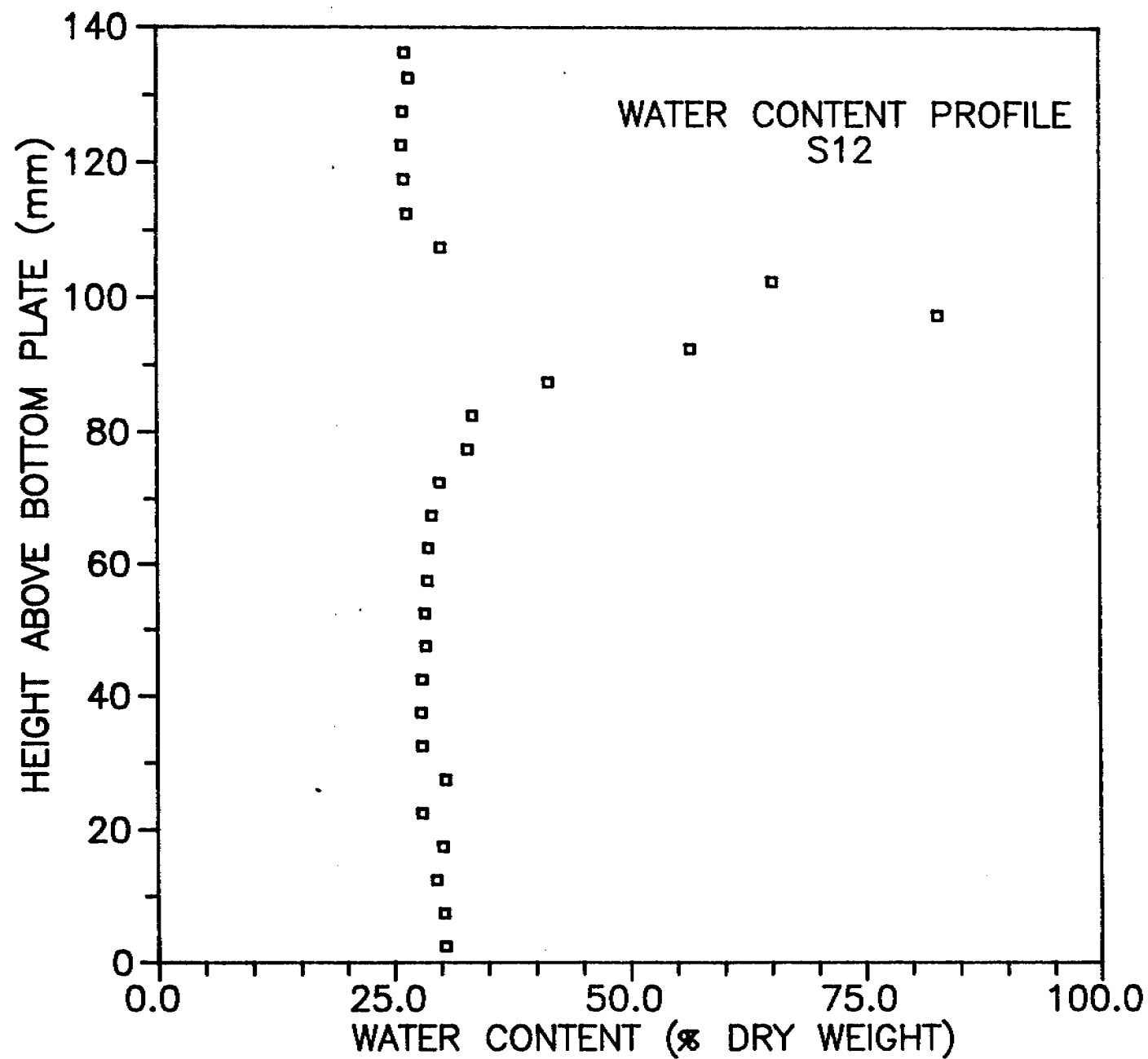


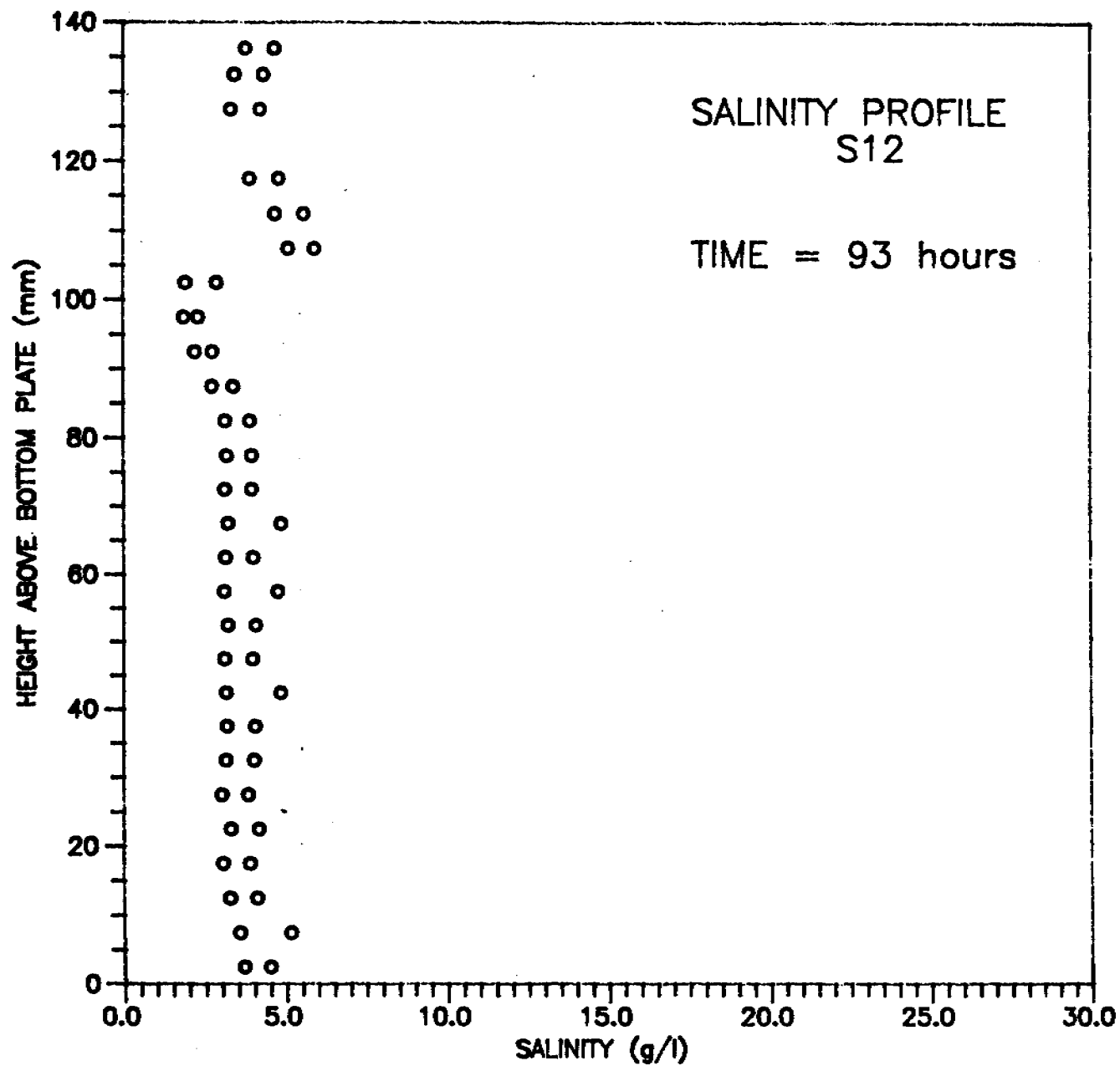
TEST S12 FROST FRONT LOCATION

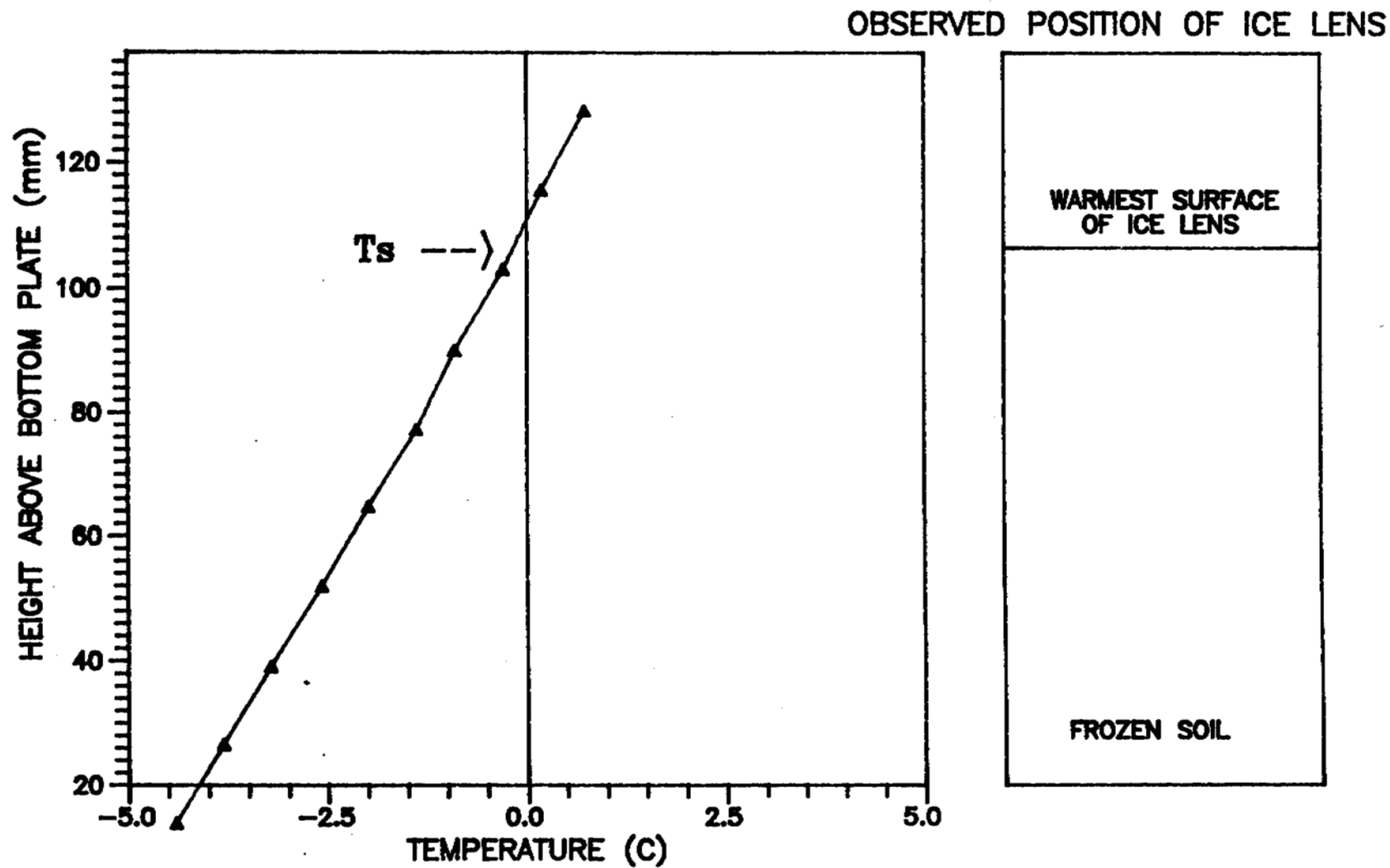


FREEZING TEST S12



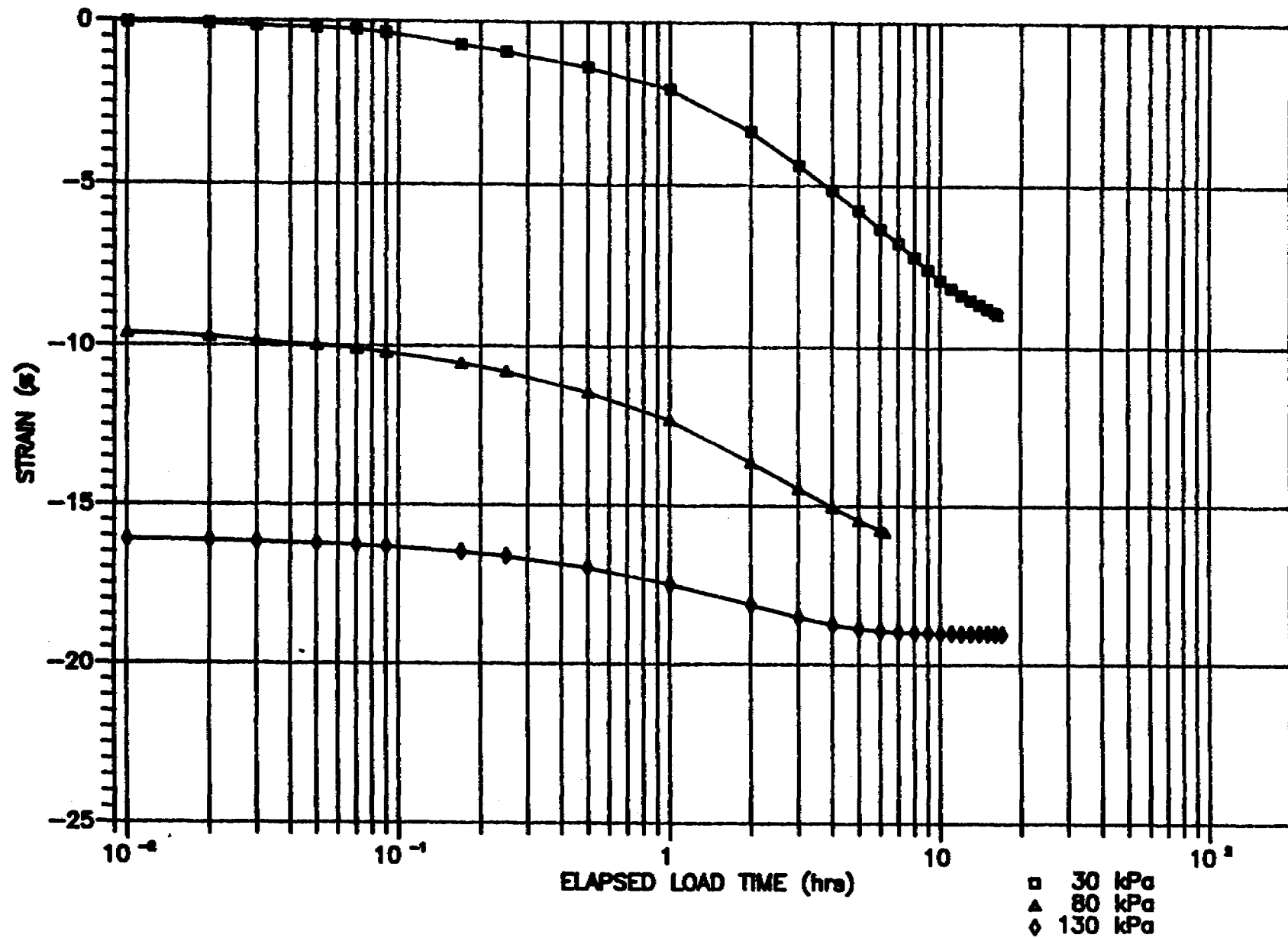




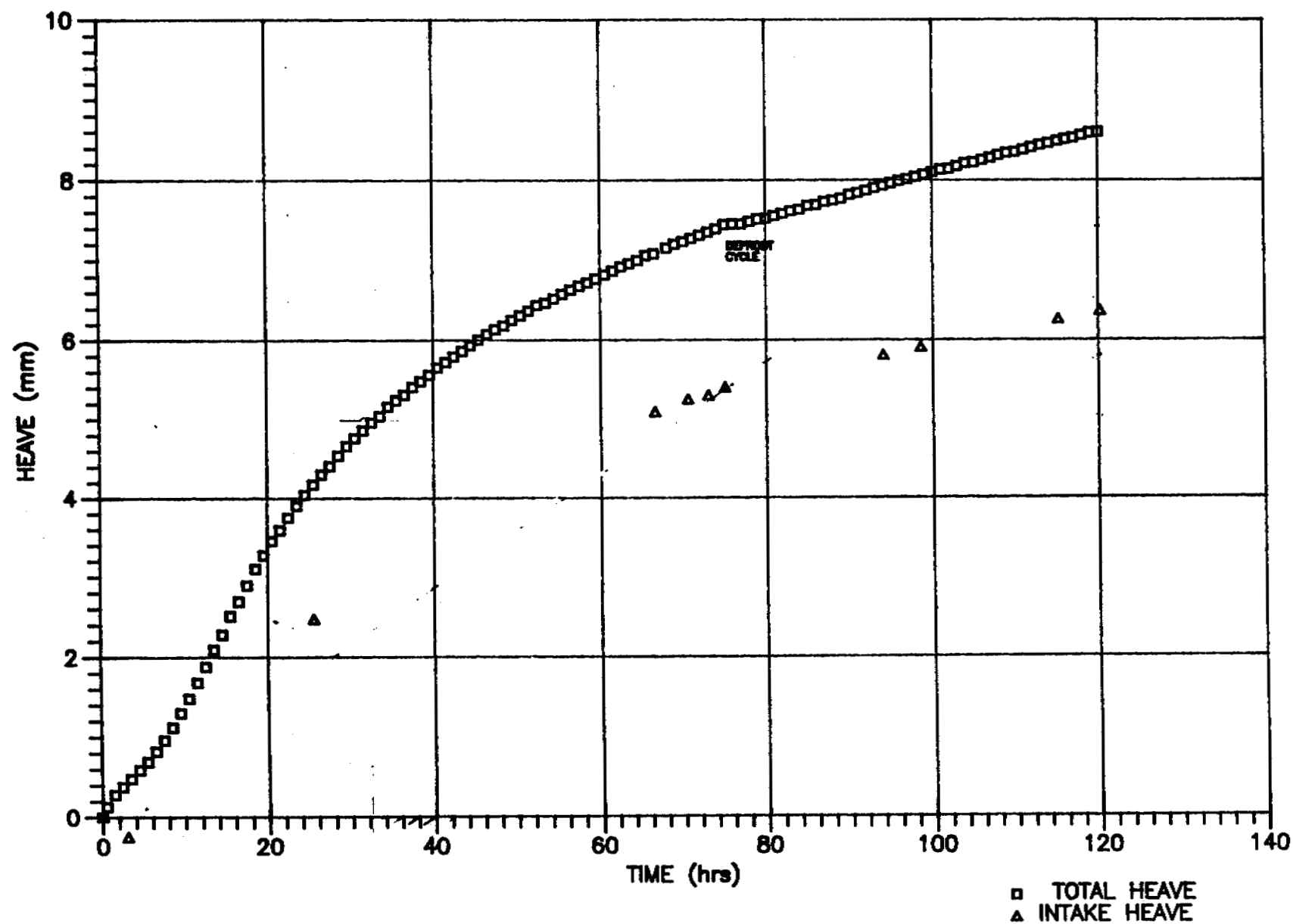


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S12

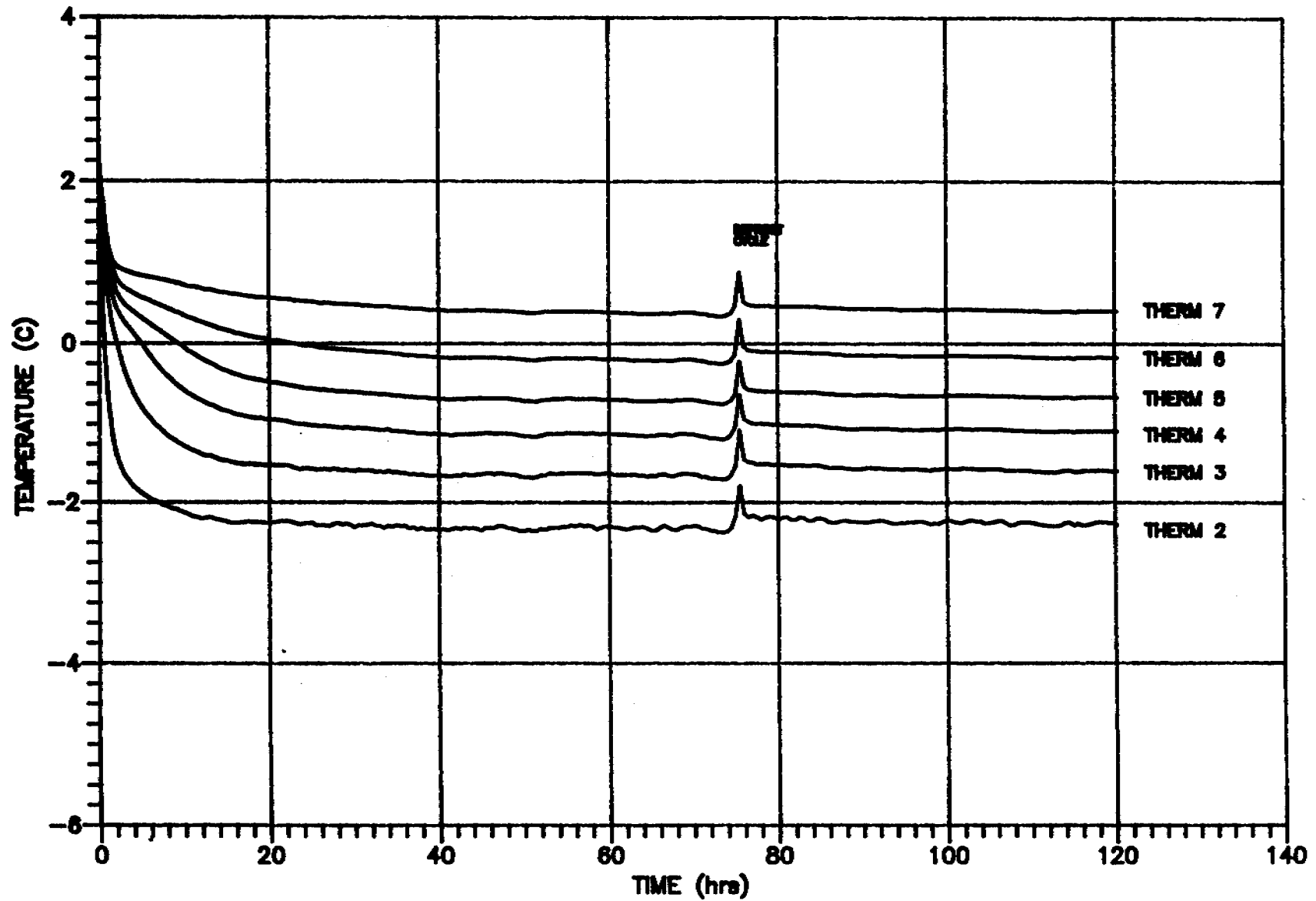
CONSOLIDATION TEST S20



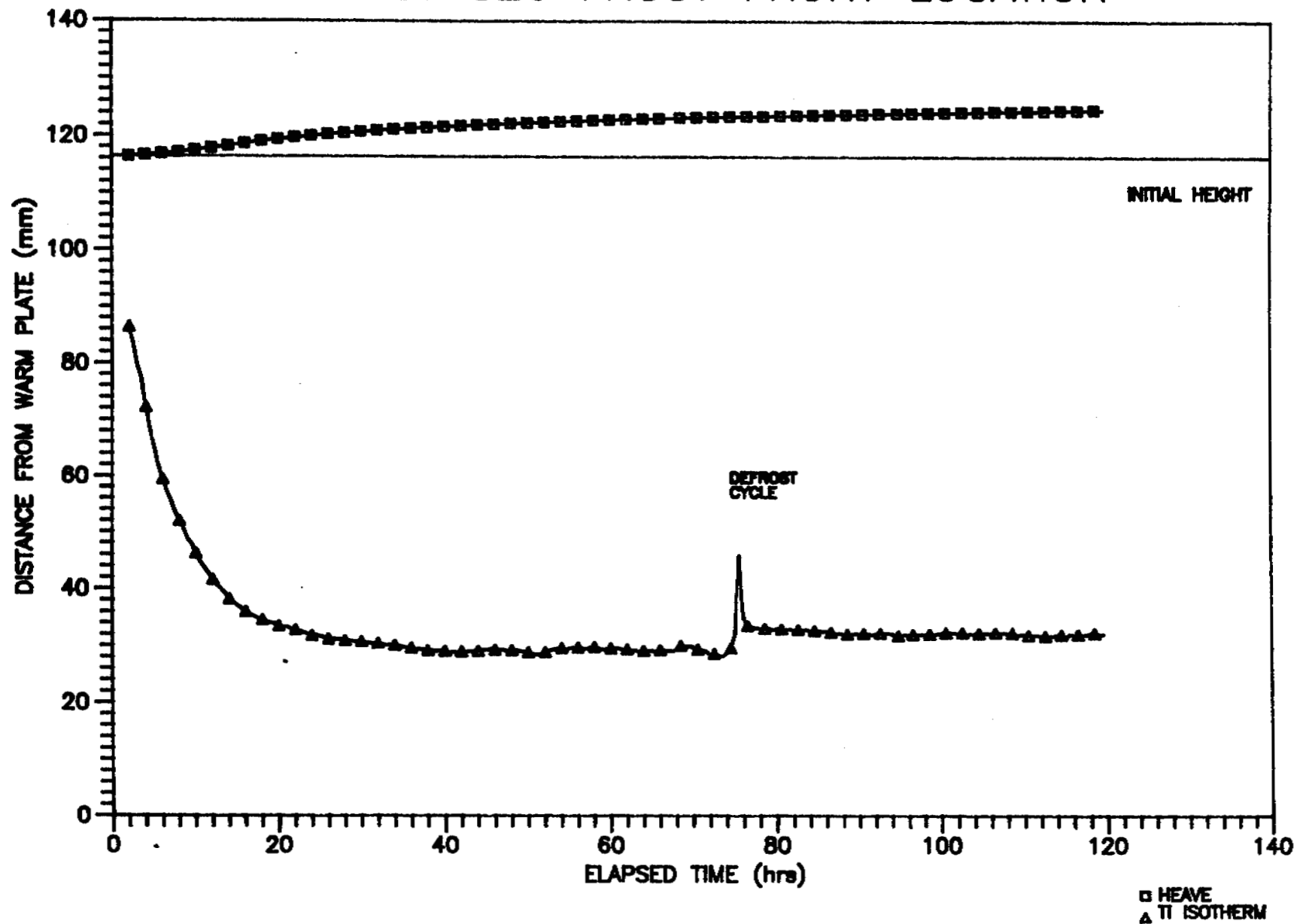
FREEZING TEST S20



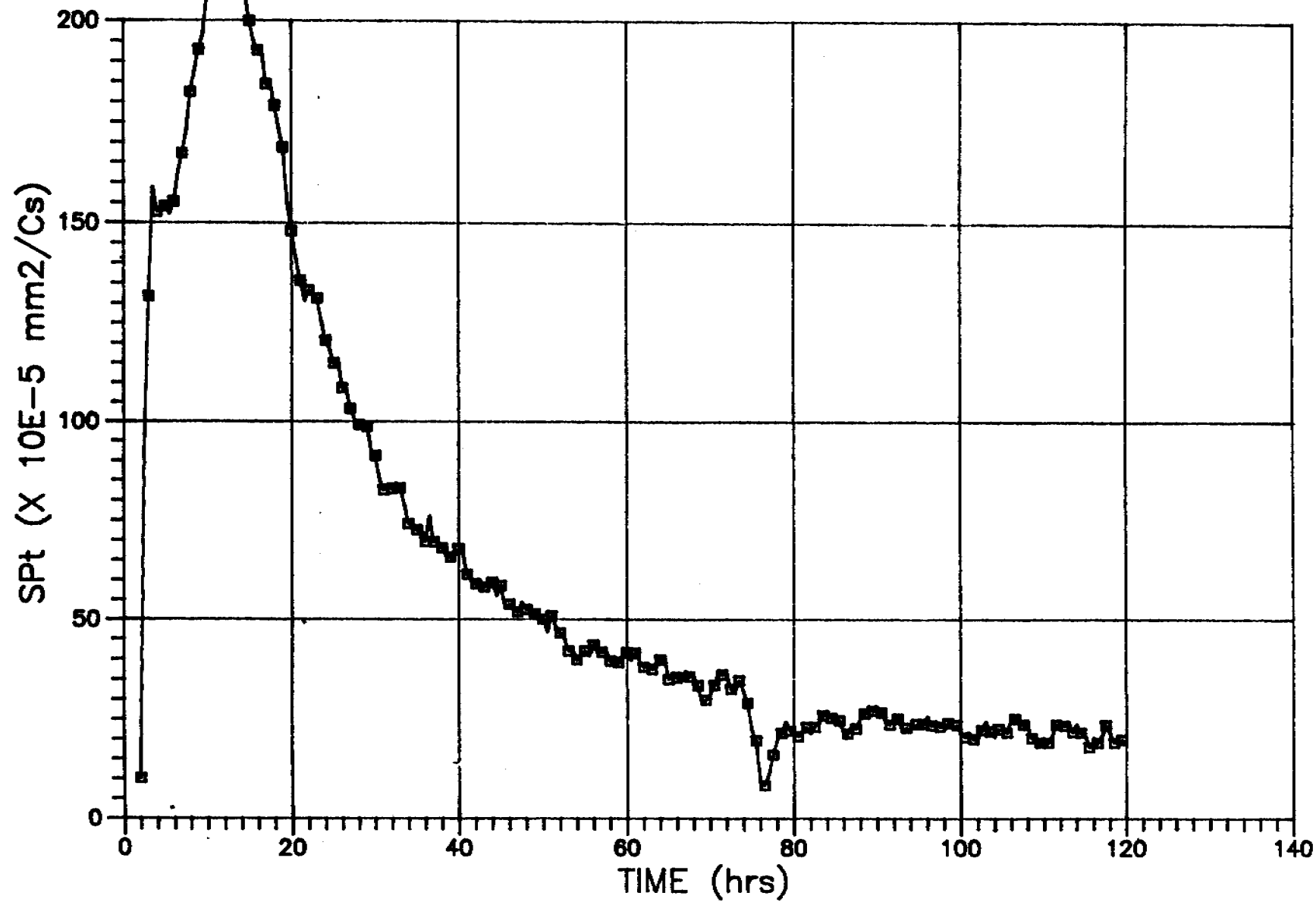
FREEZING TEST S20

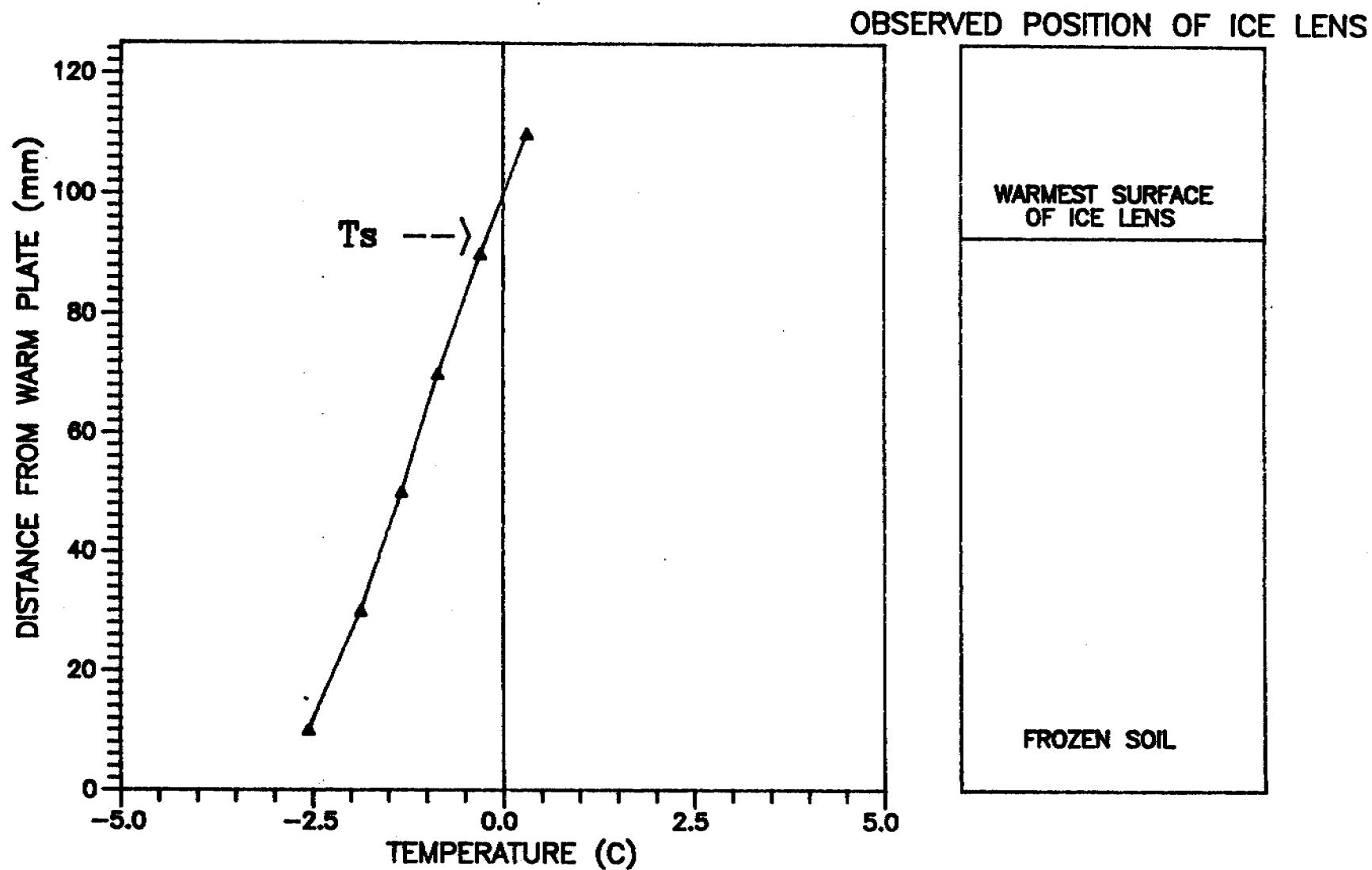


TEST S20 FROST FRONT LOCATION

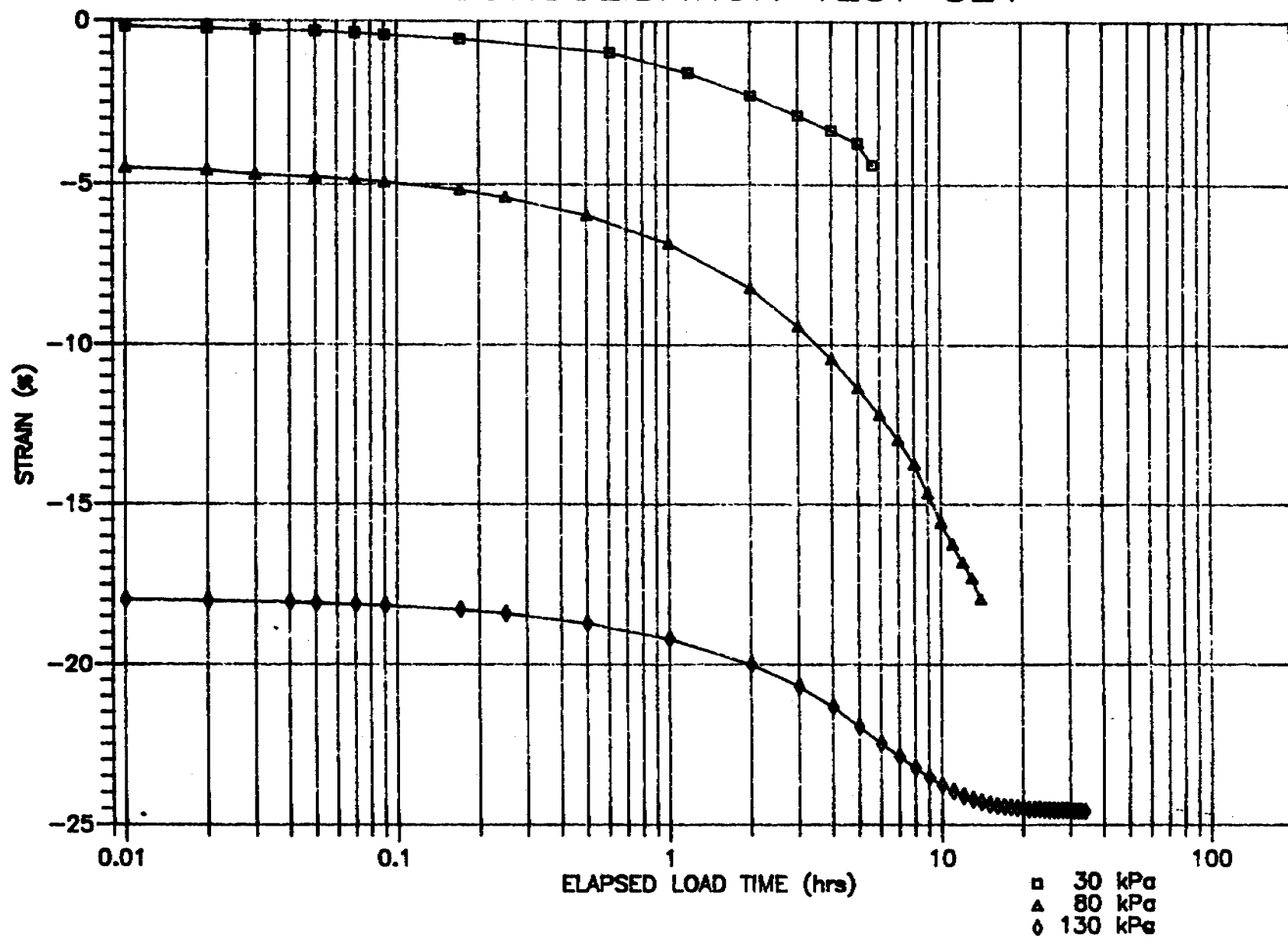


FREEZING TEST S20

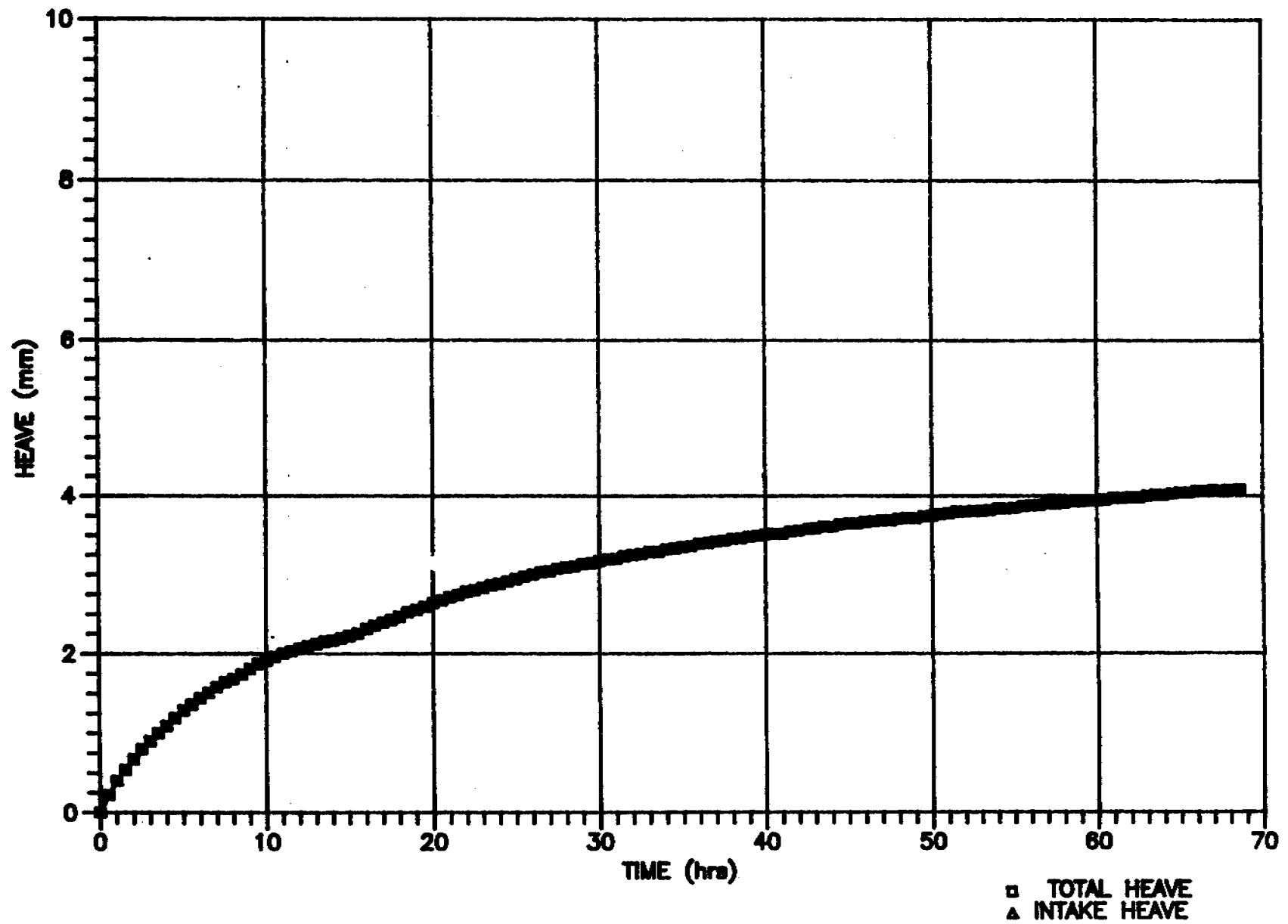




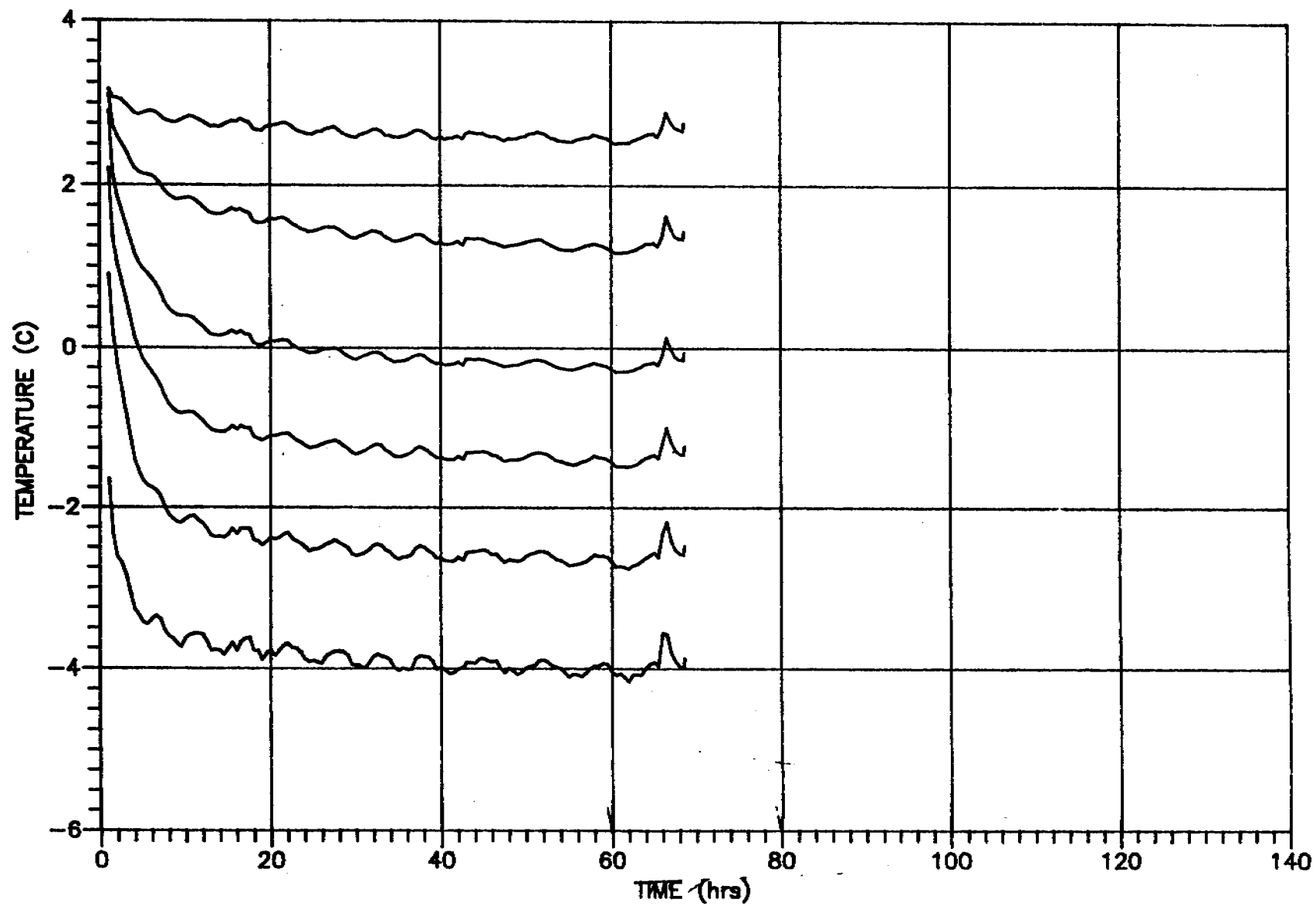
CONSOLIDATION TEST S21



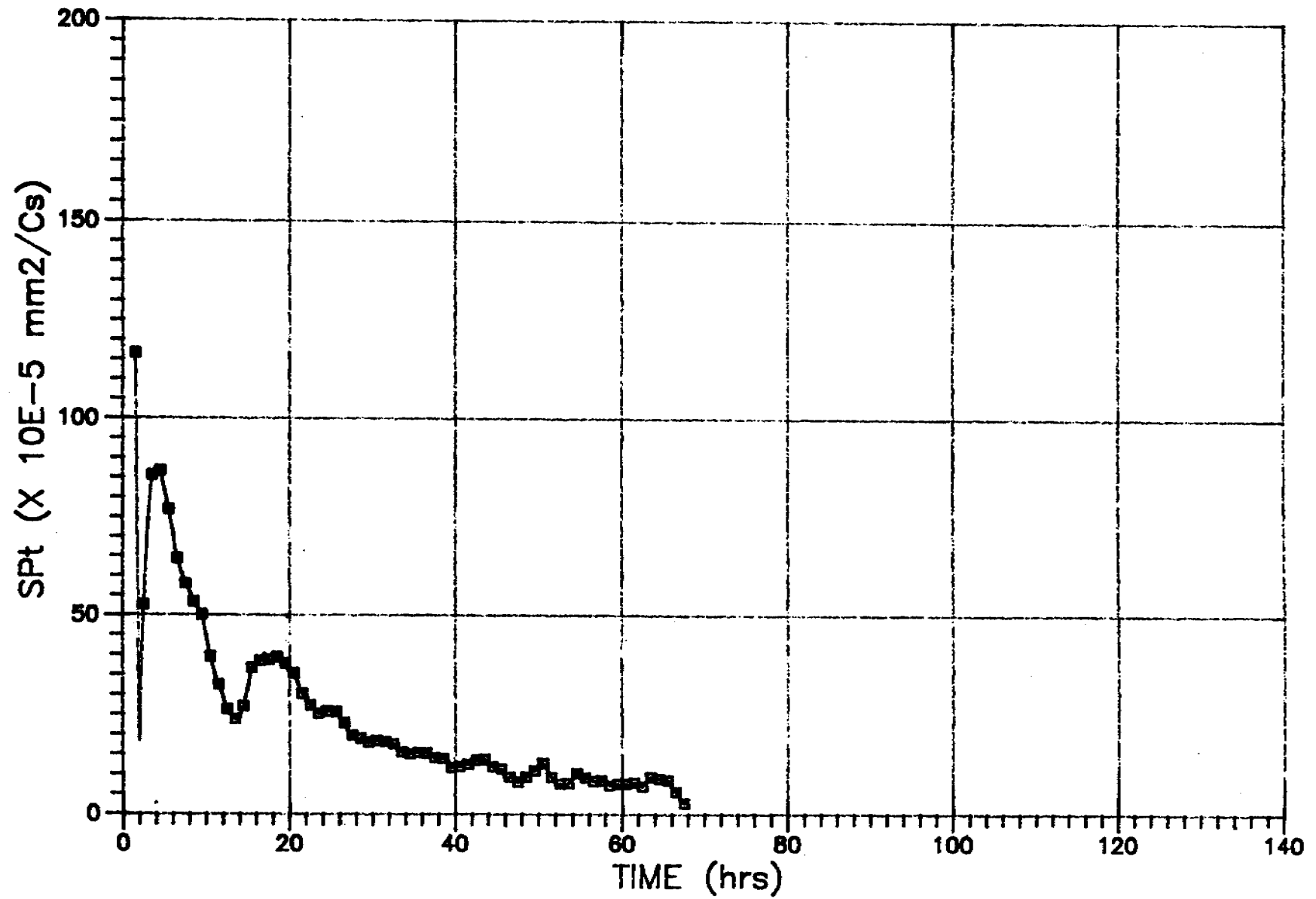
FREEZING TEST S21



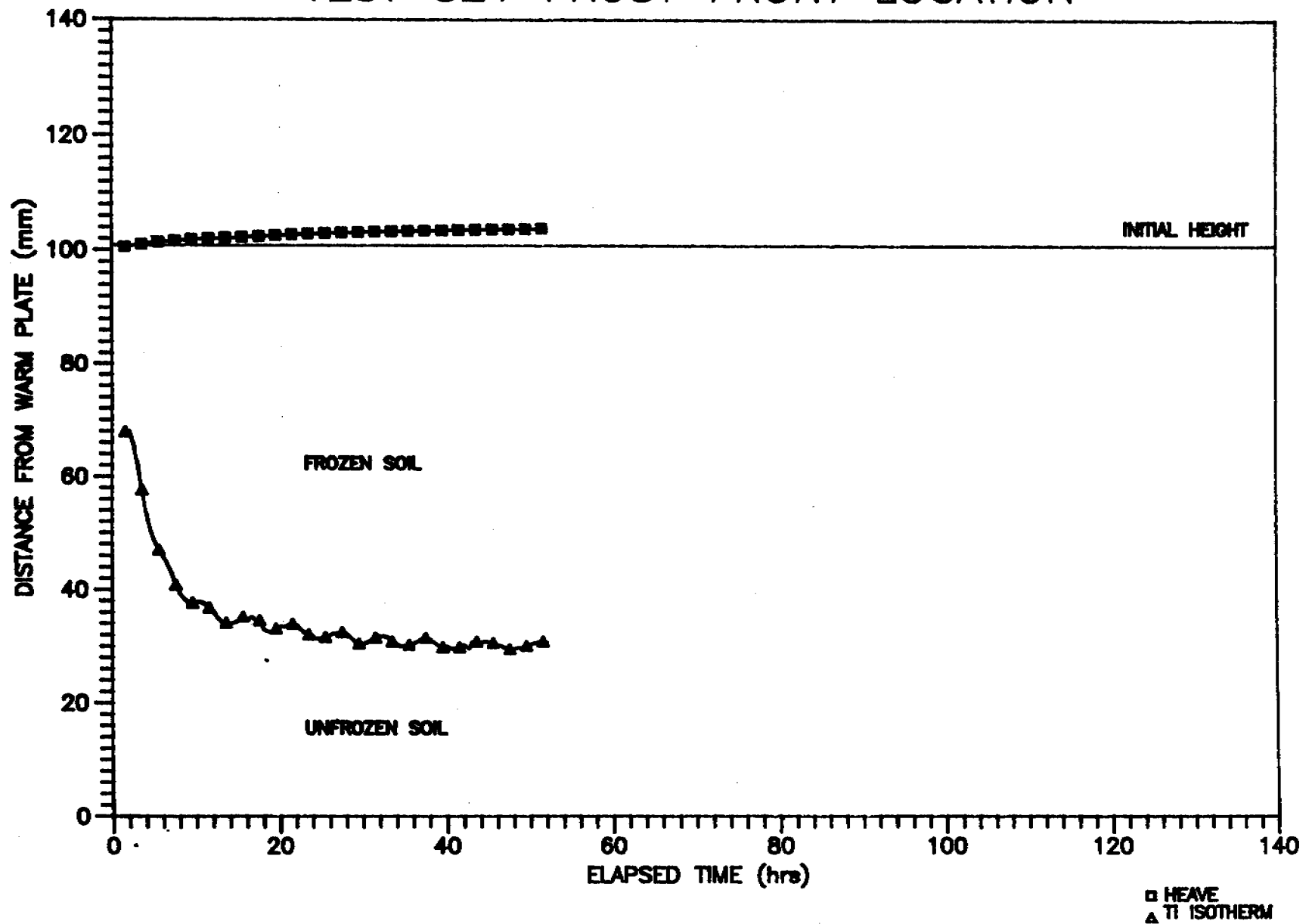
FREEZING TEST S21

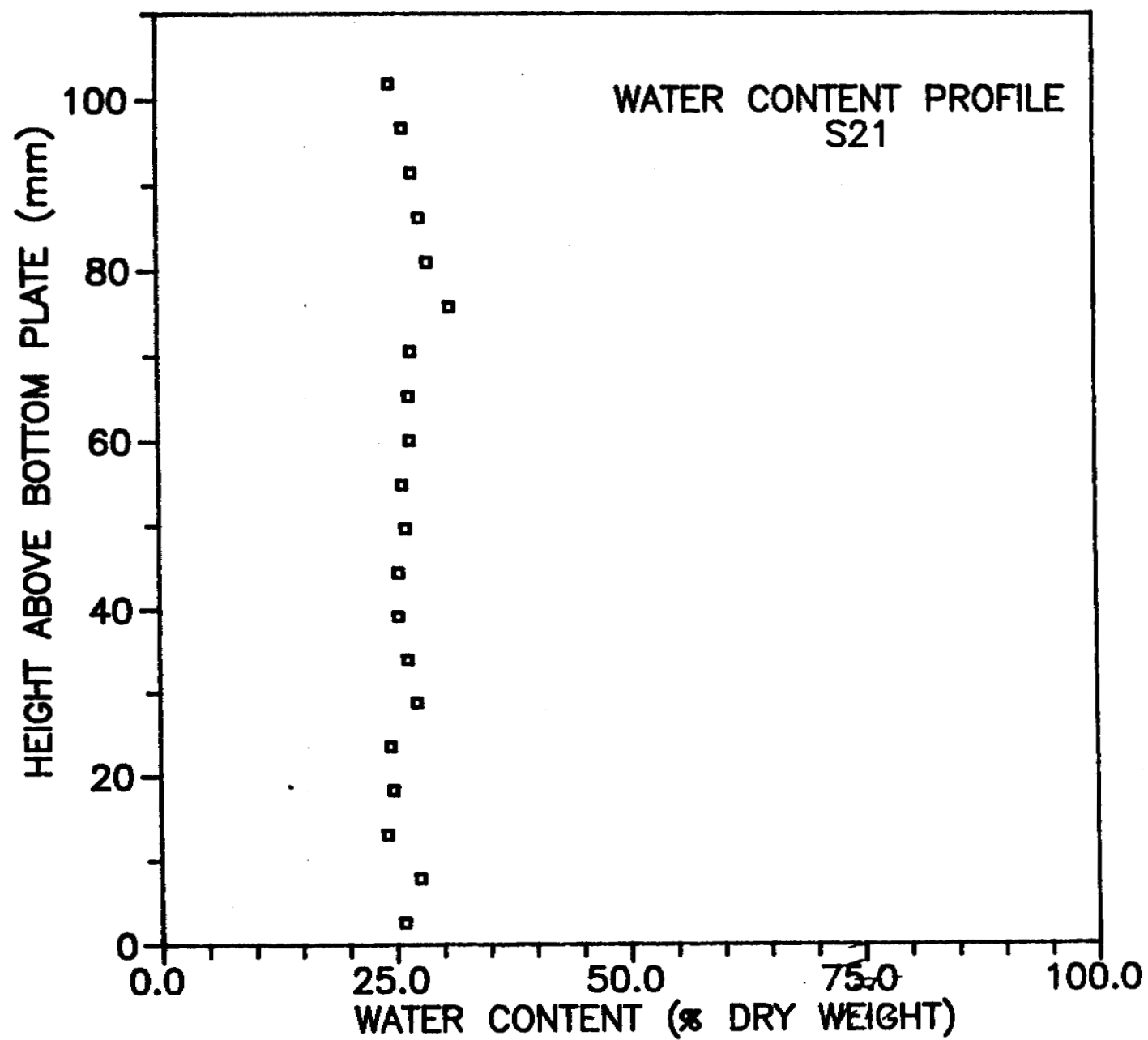


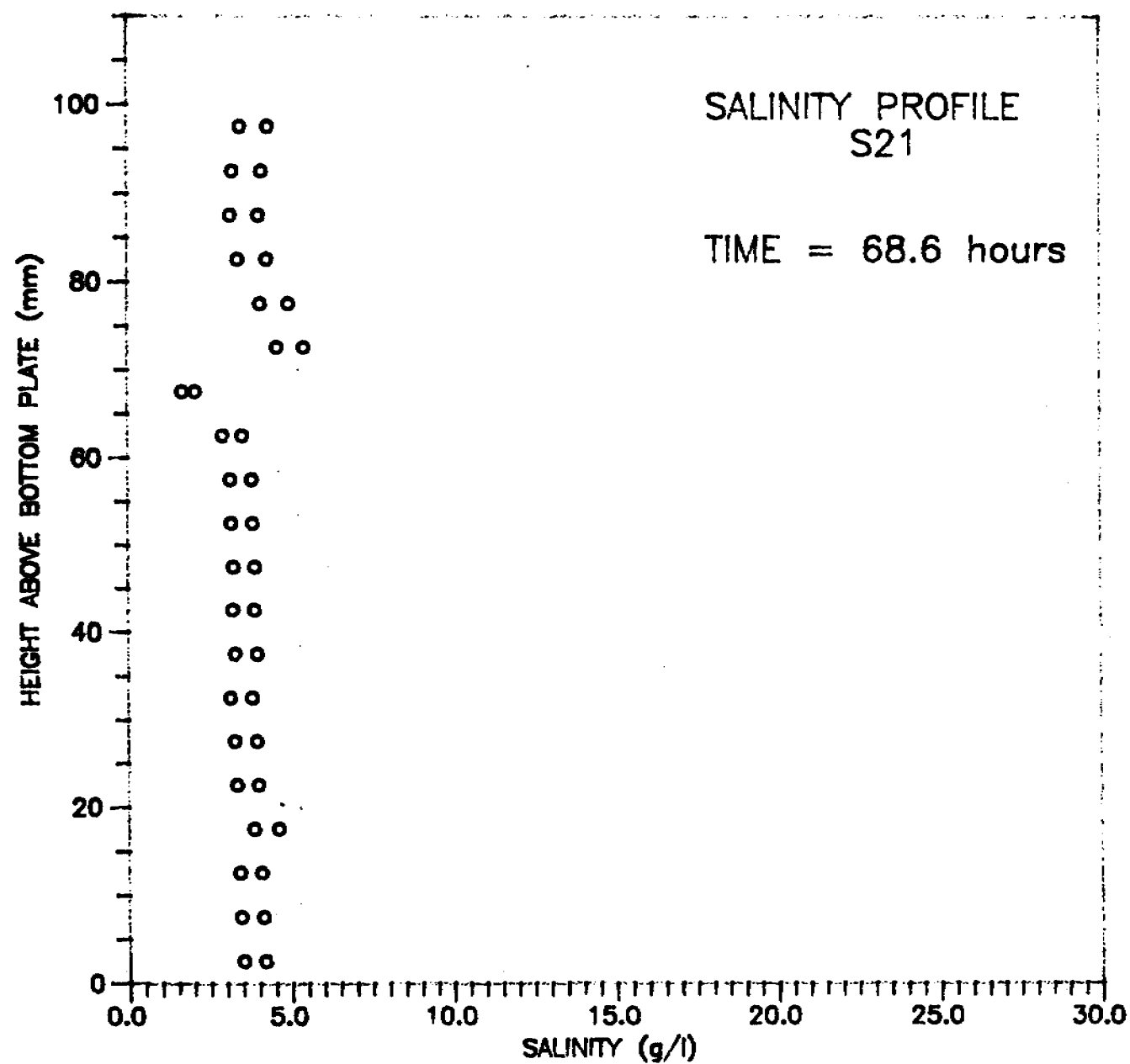
FREEZING TEST S21

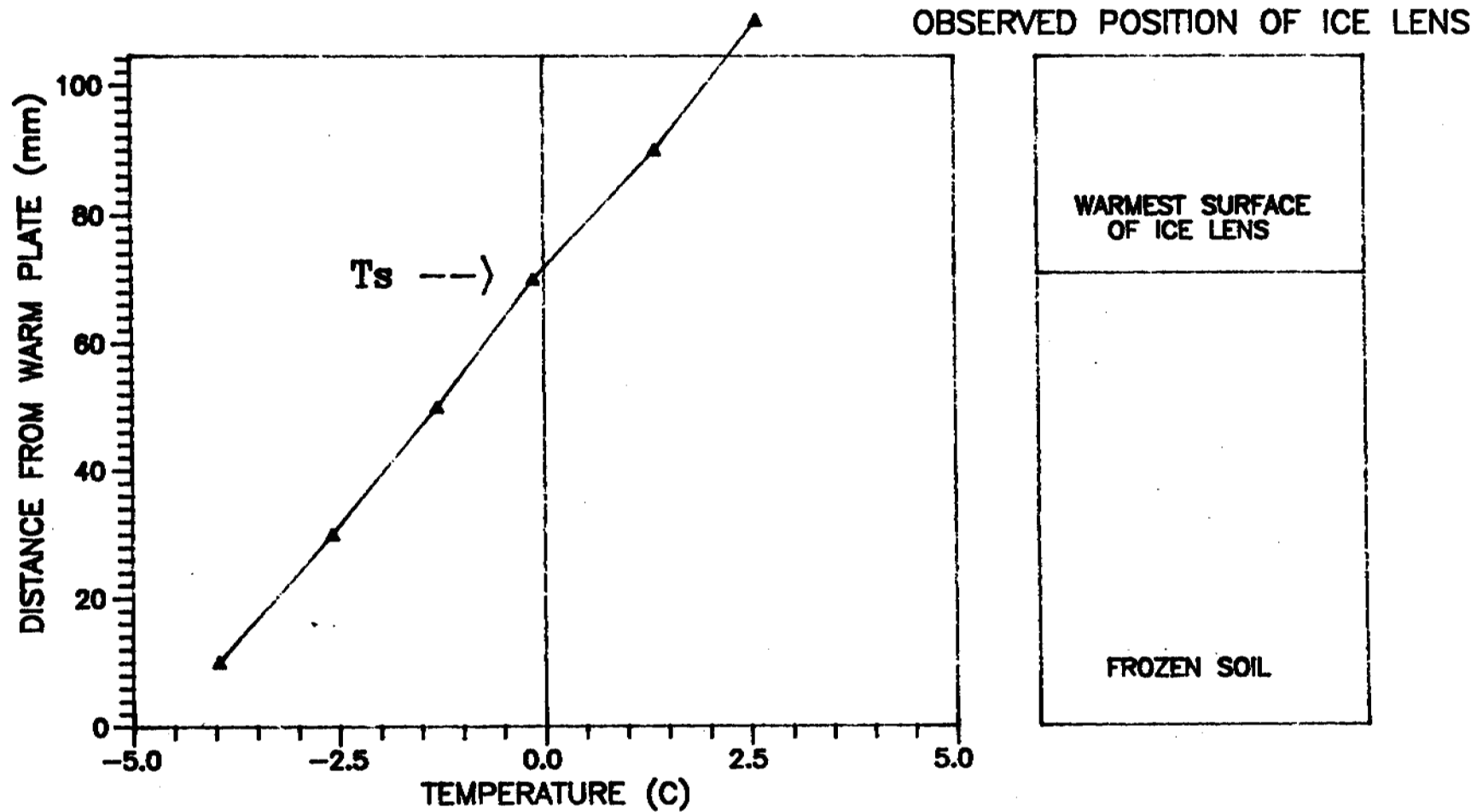


TEST S21 FROST FRONT LOCATION

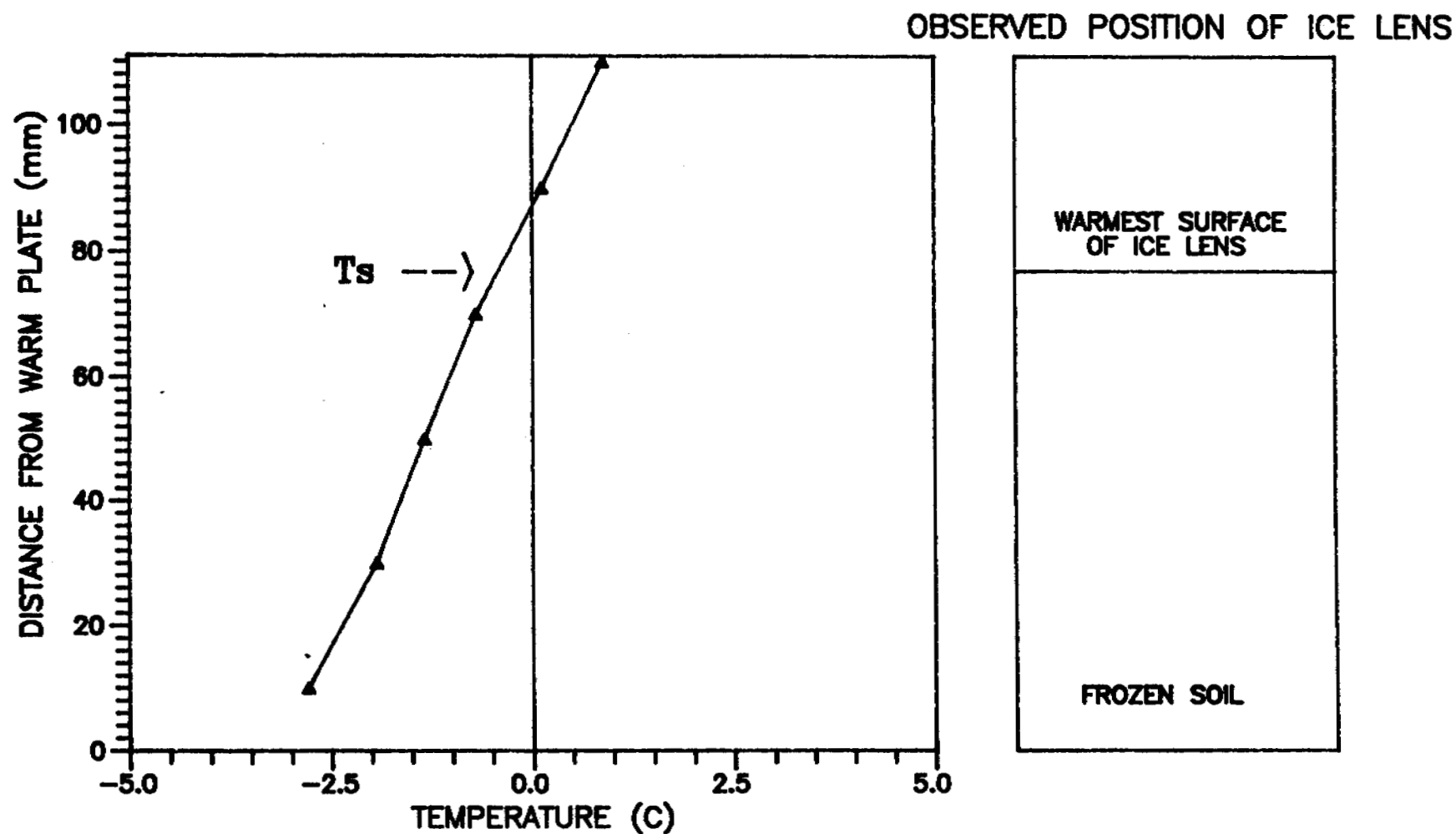






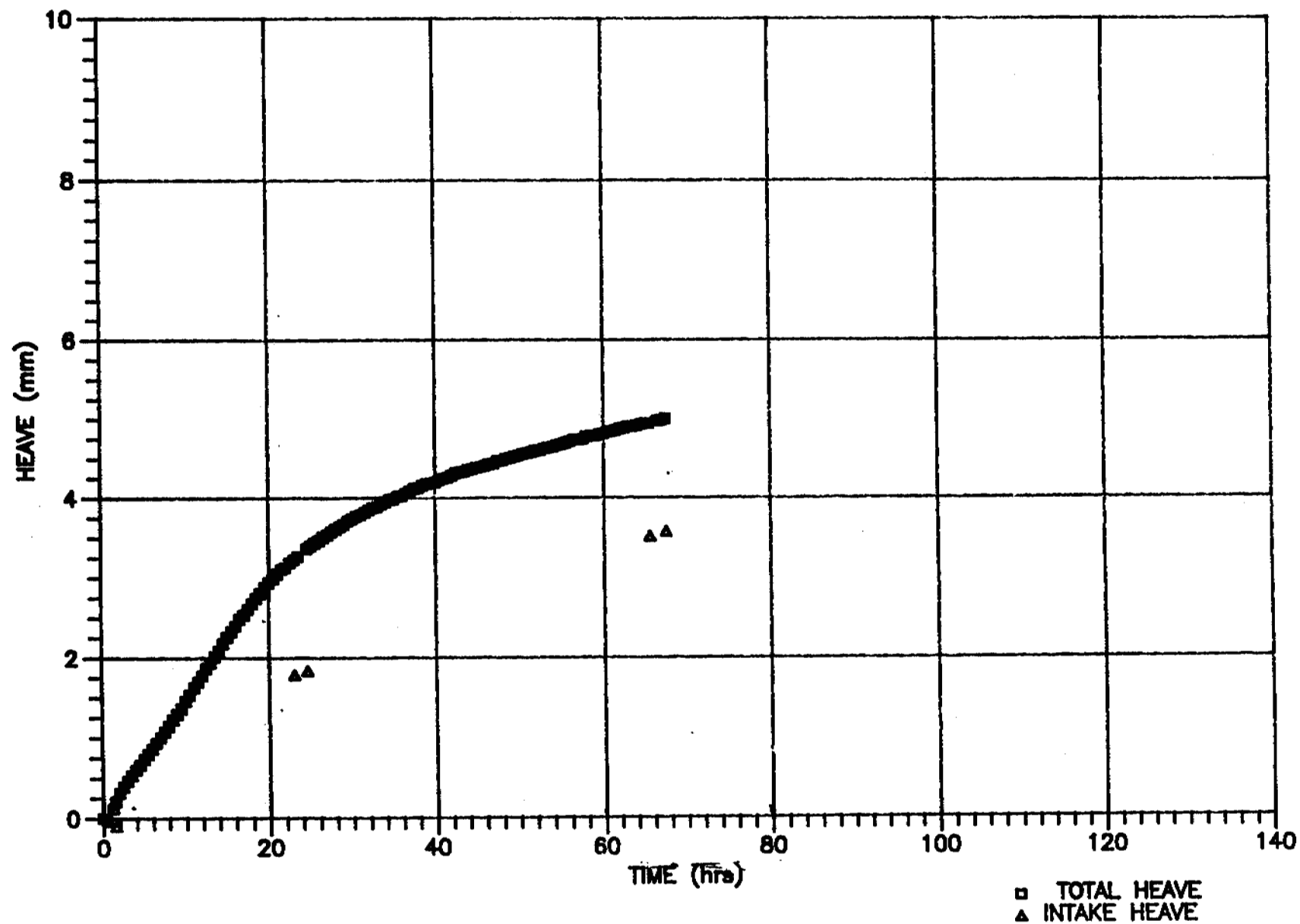


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S21

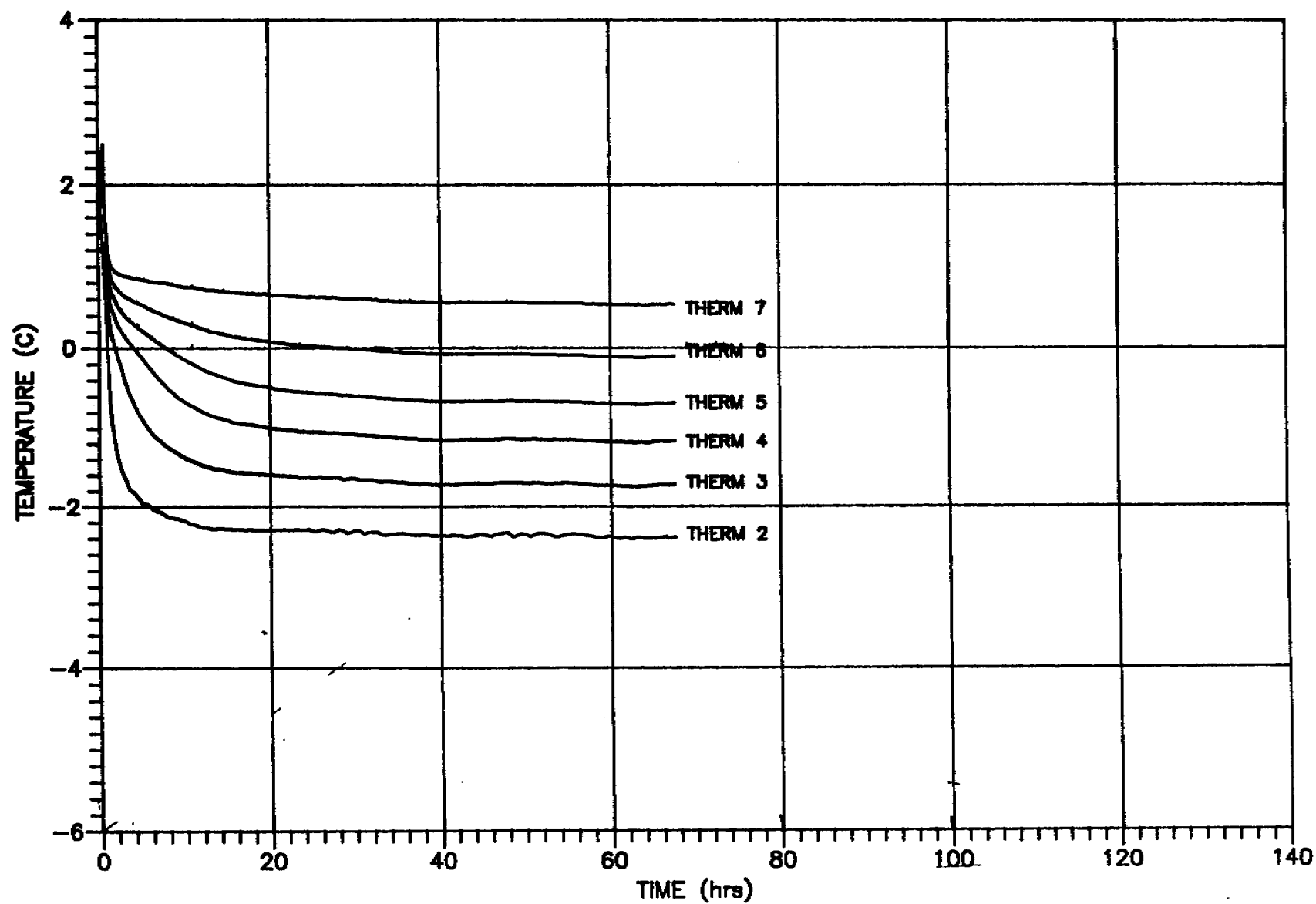


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S31

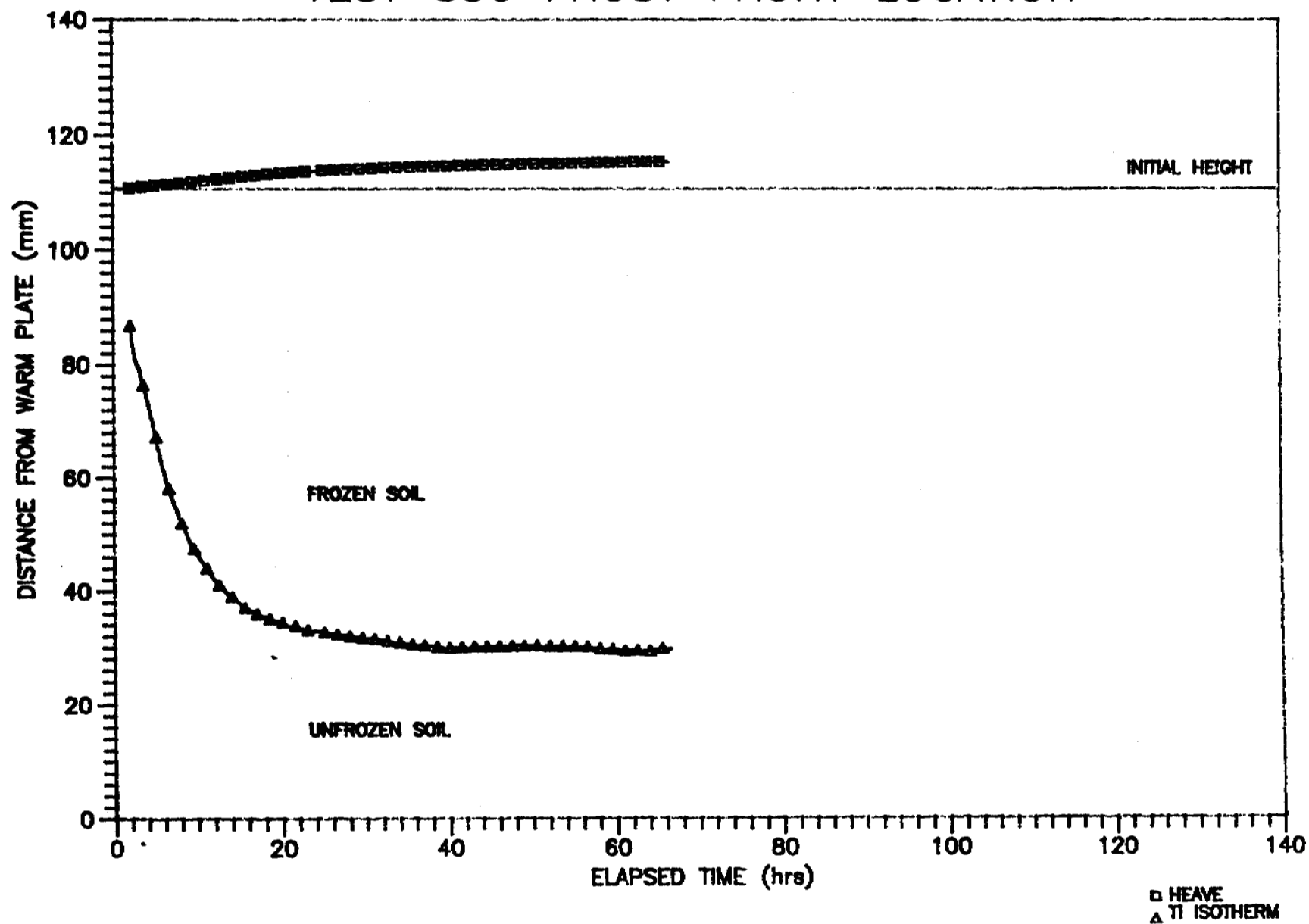
FREEZING TEST S30



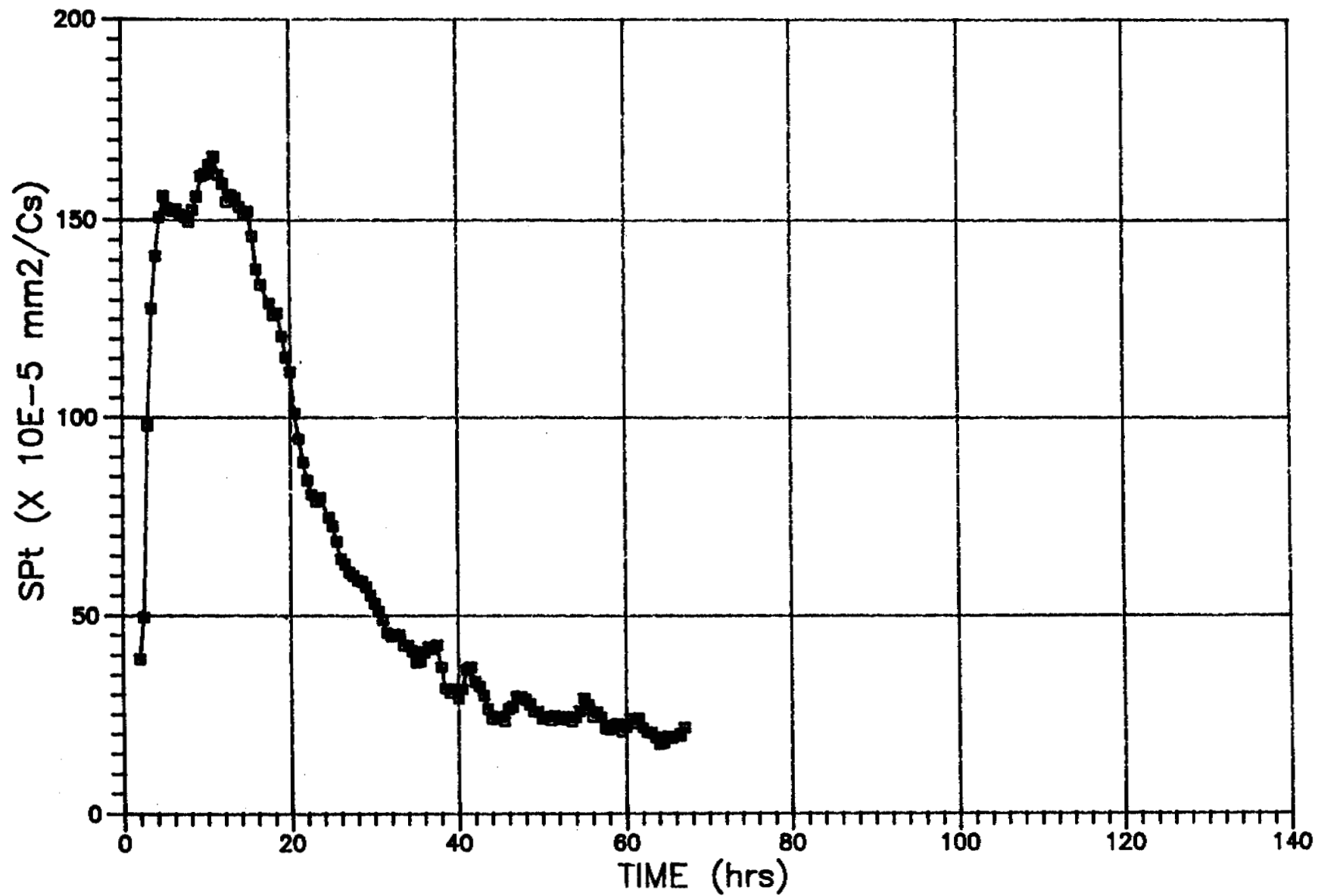
FREEZING TEST S30

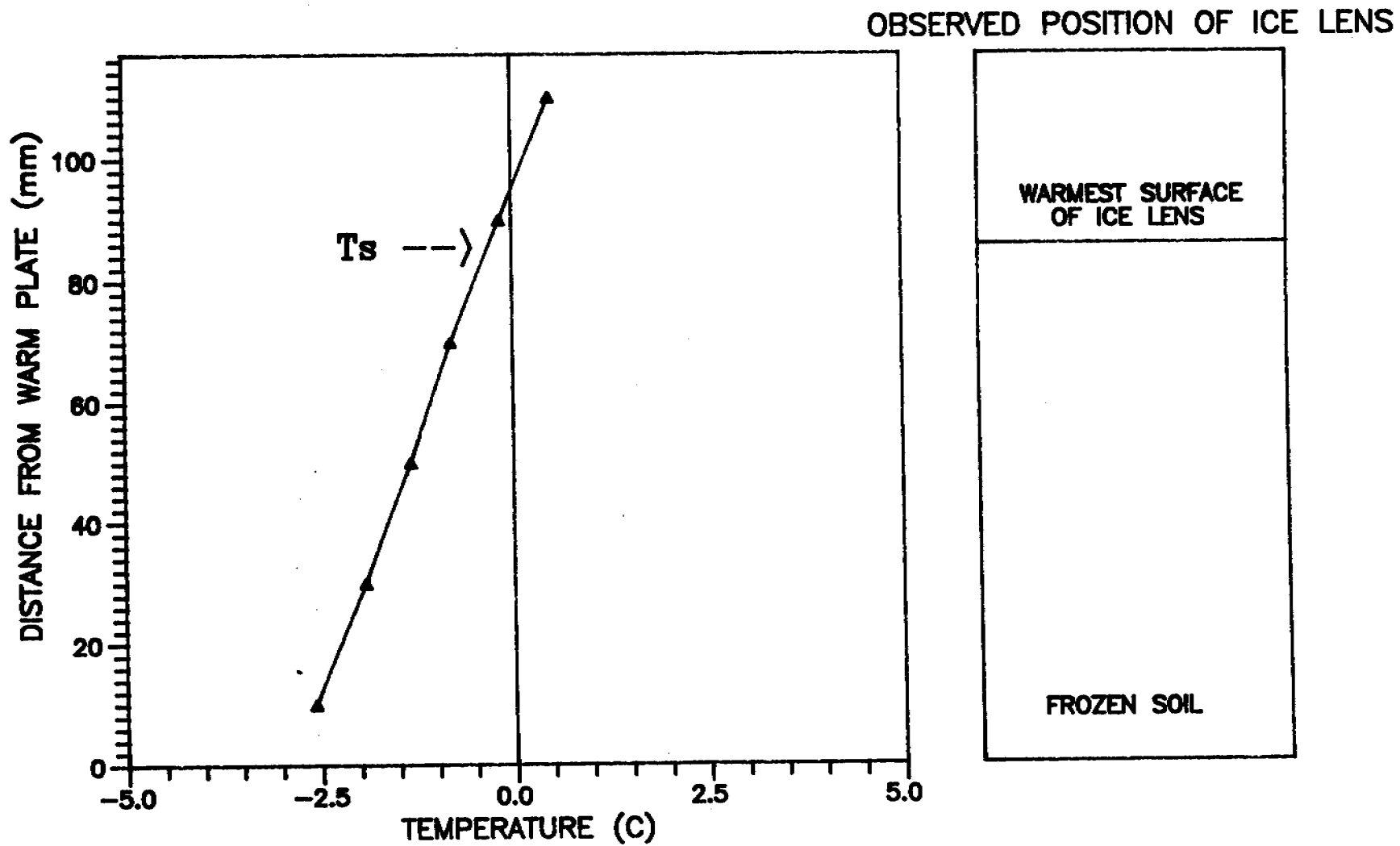


TEST S30 FROST FRONT LOCATION



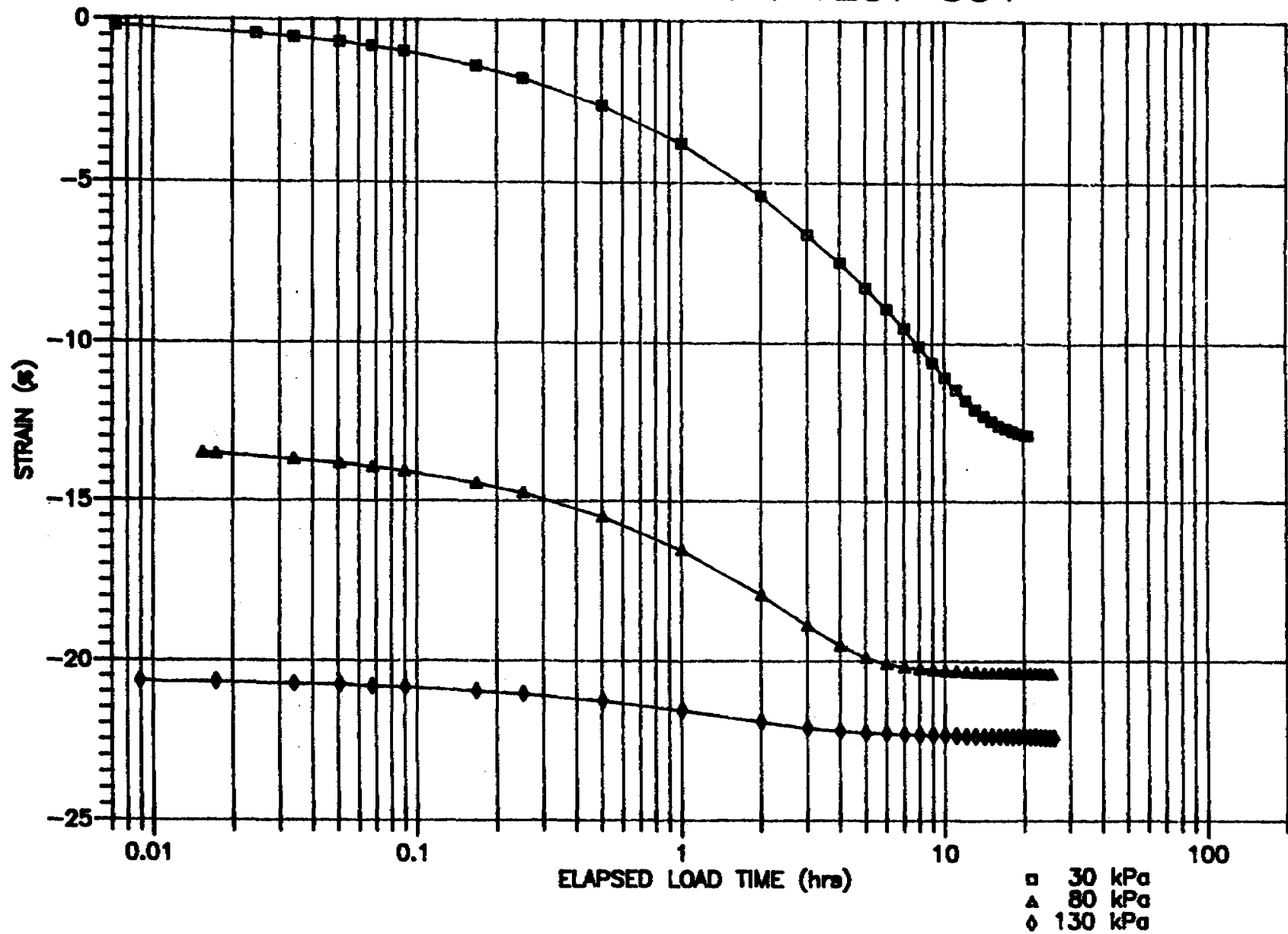
FREEZING TEST S30



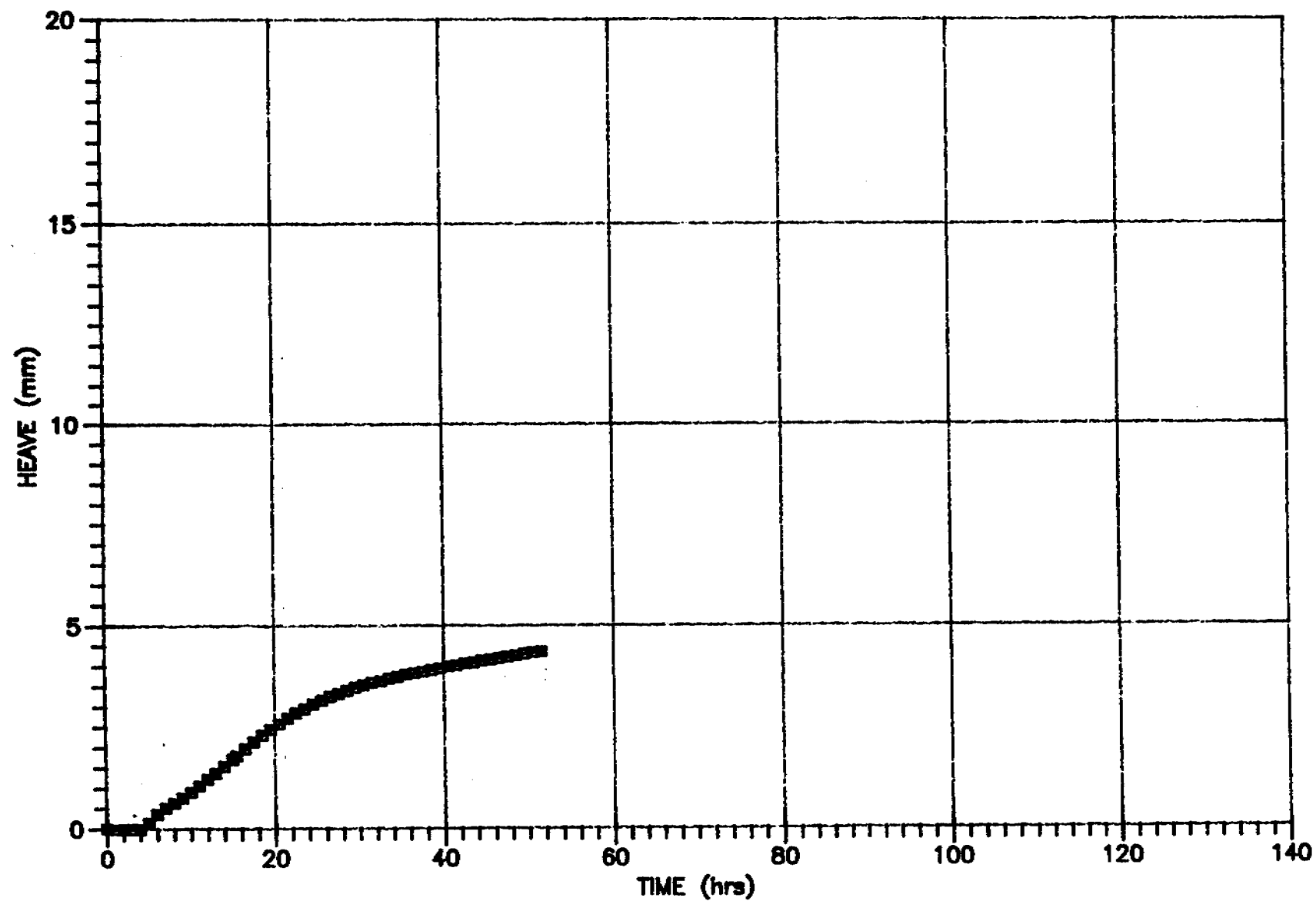


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- S30

CONSOLIDATION TEST S31

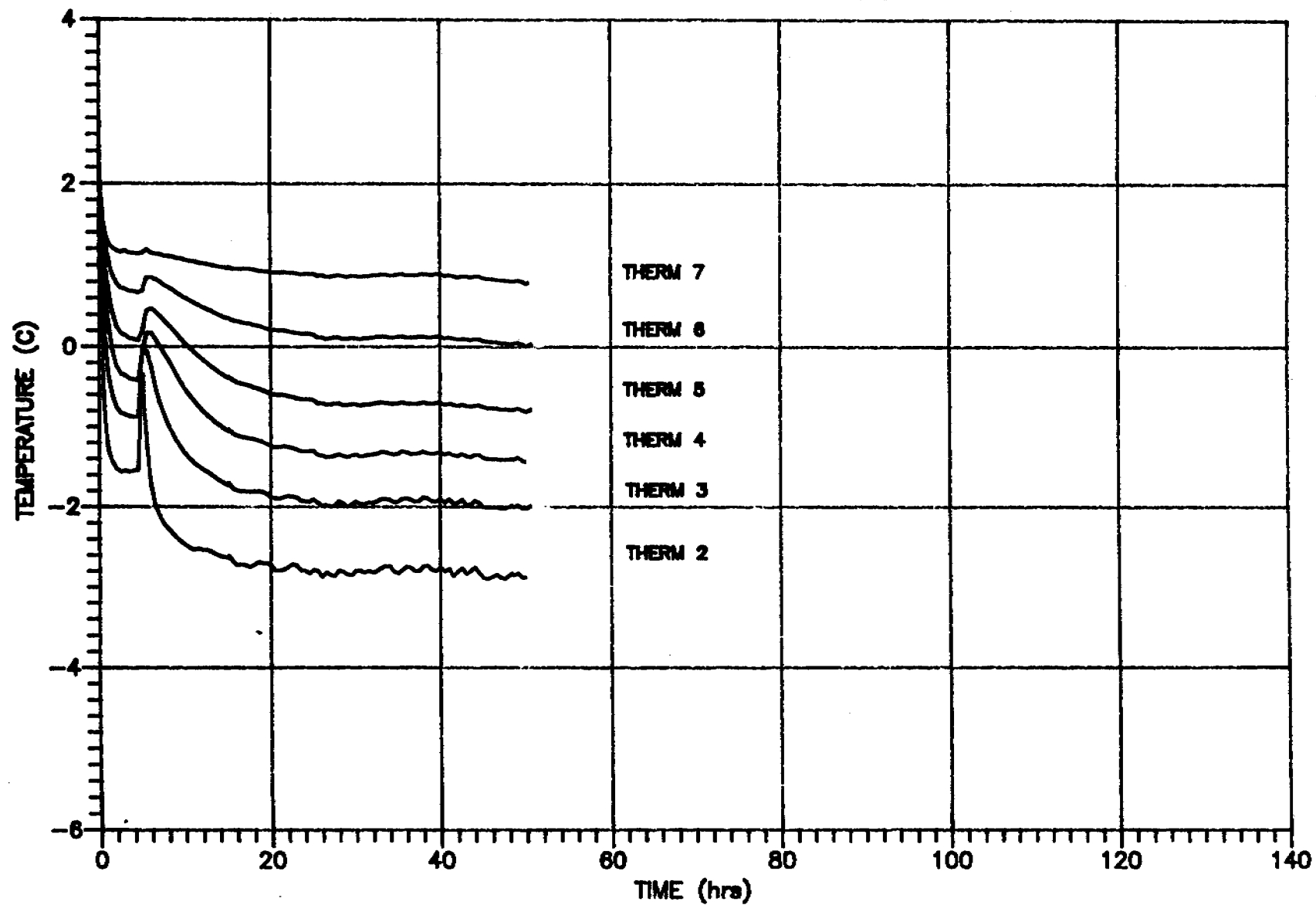


FREEZING TEST S31

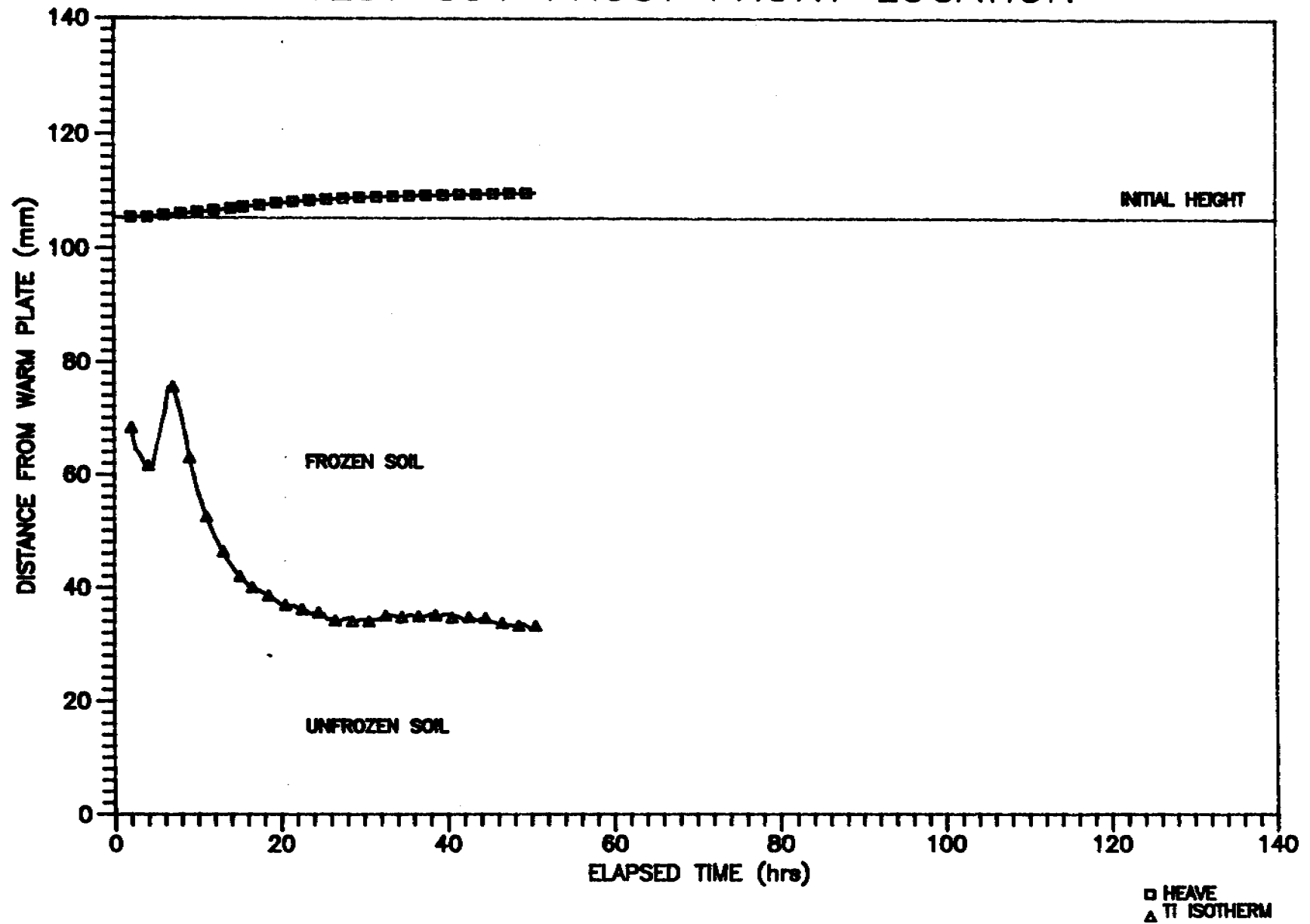


□ TOTAL HEAVE

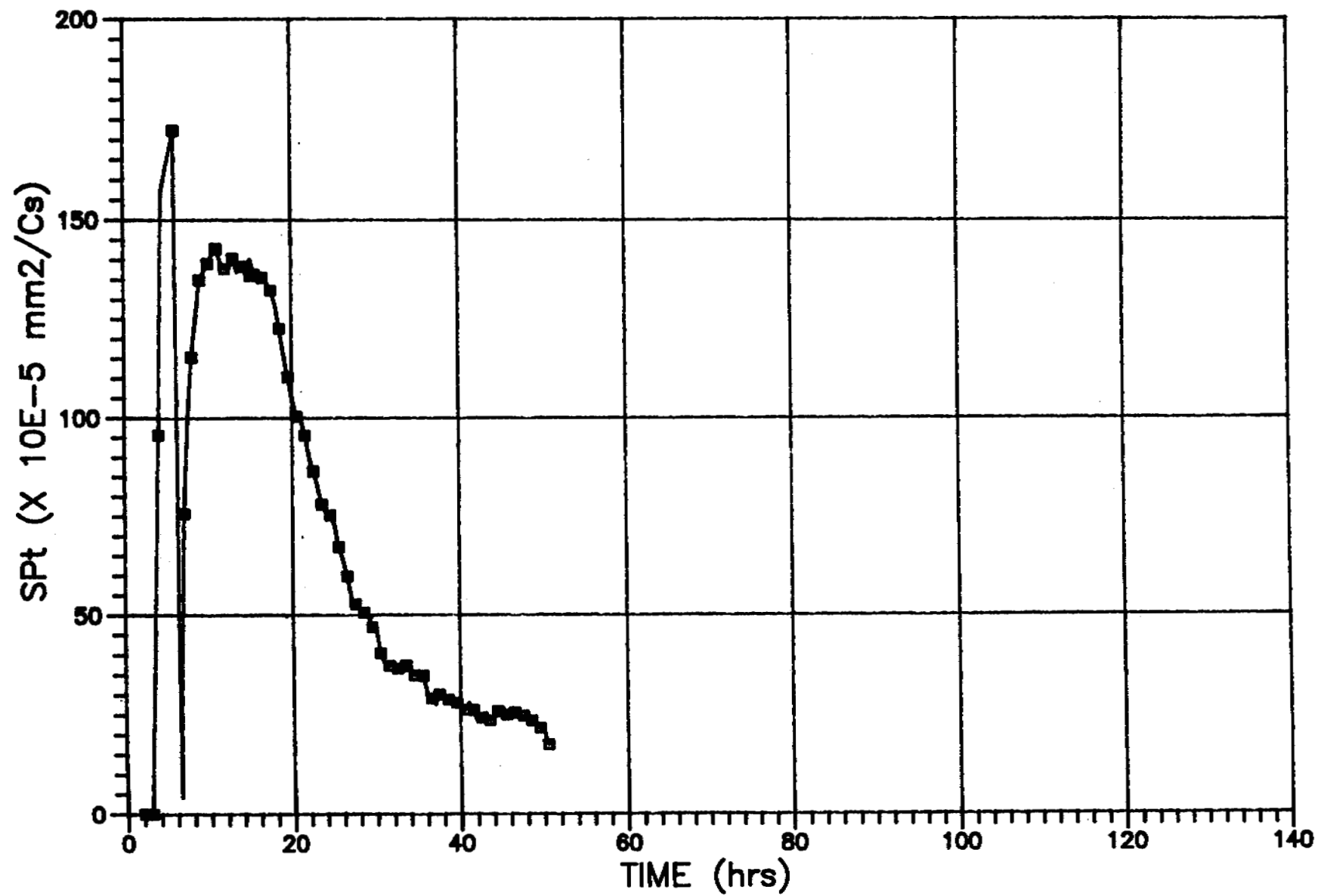
FREEZING TEST S31

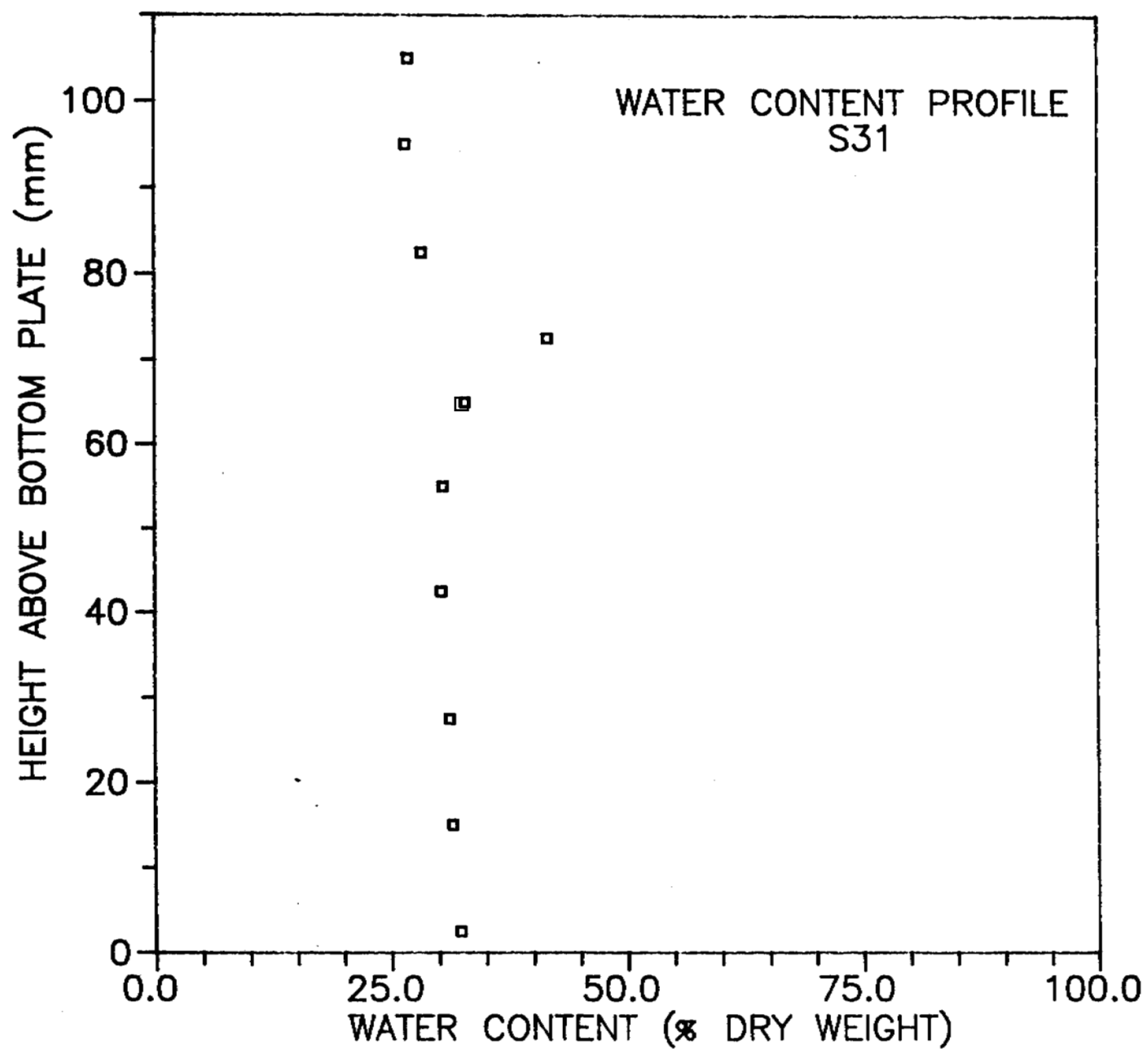


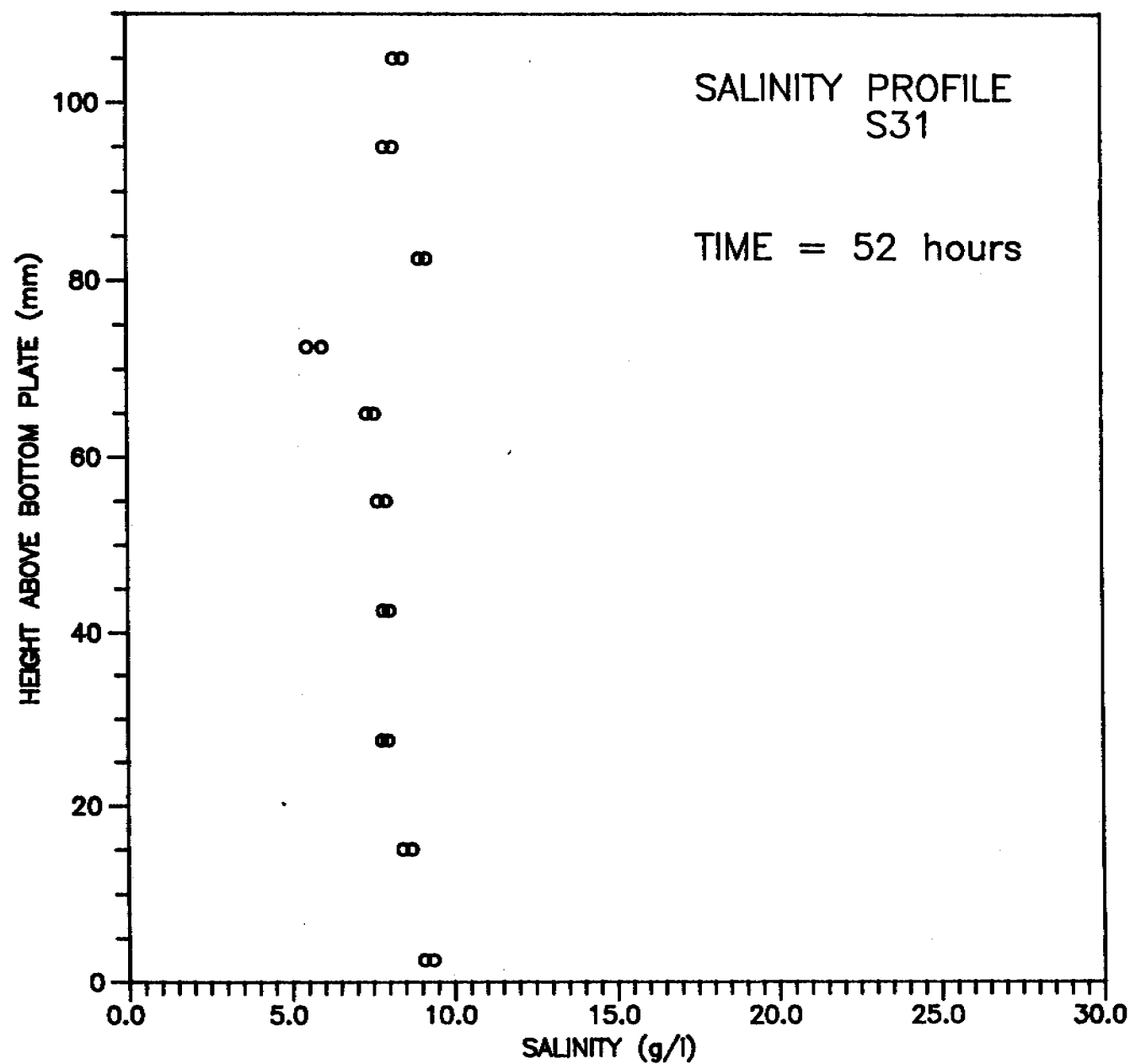
TEST S31 FROST FRONT LOCATION



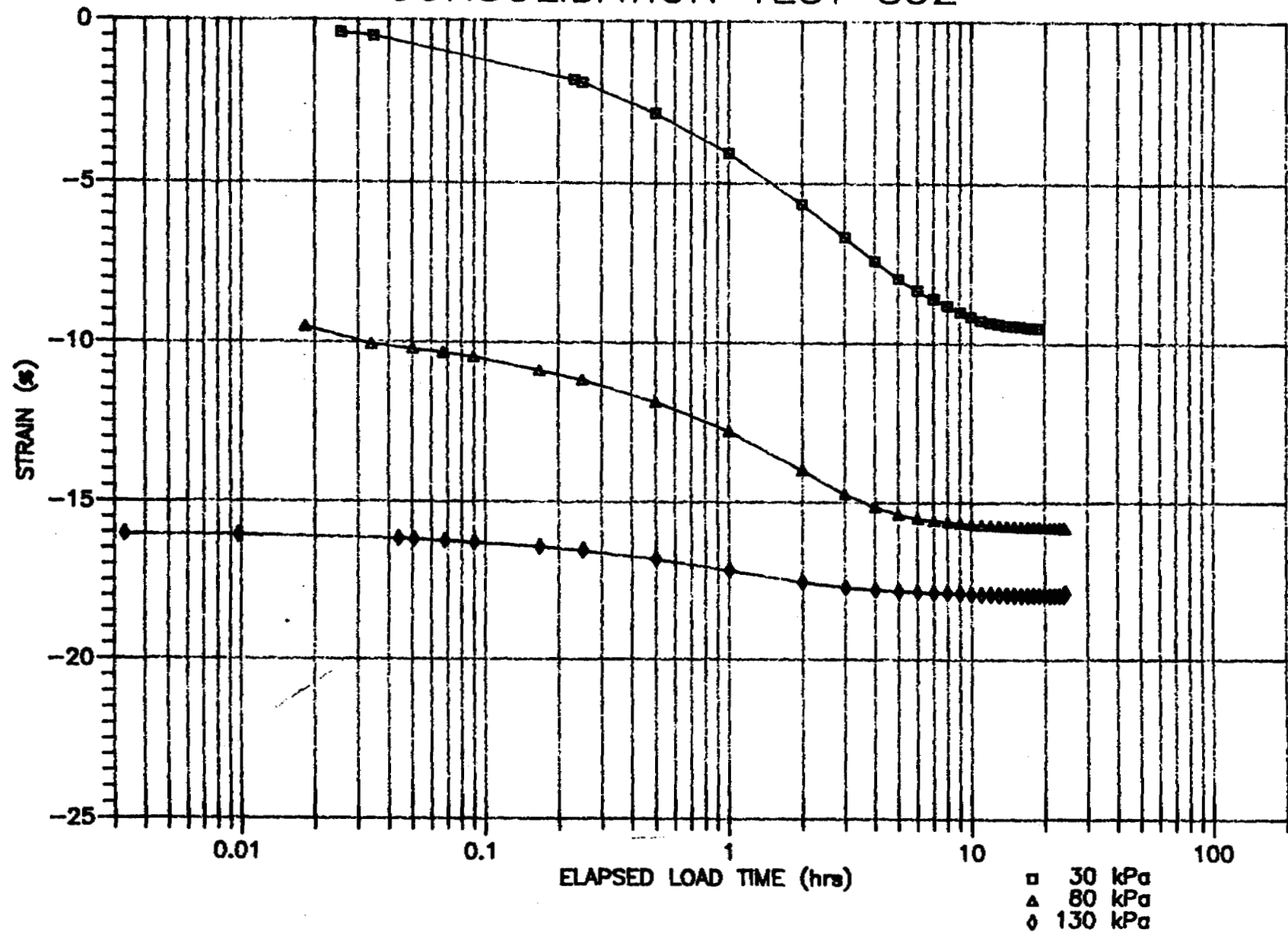
FREEZING TEST S31



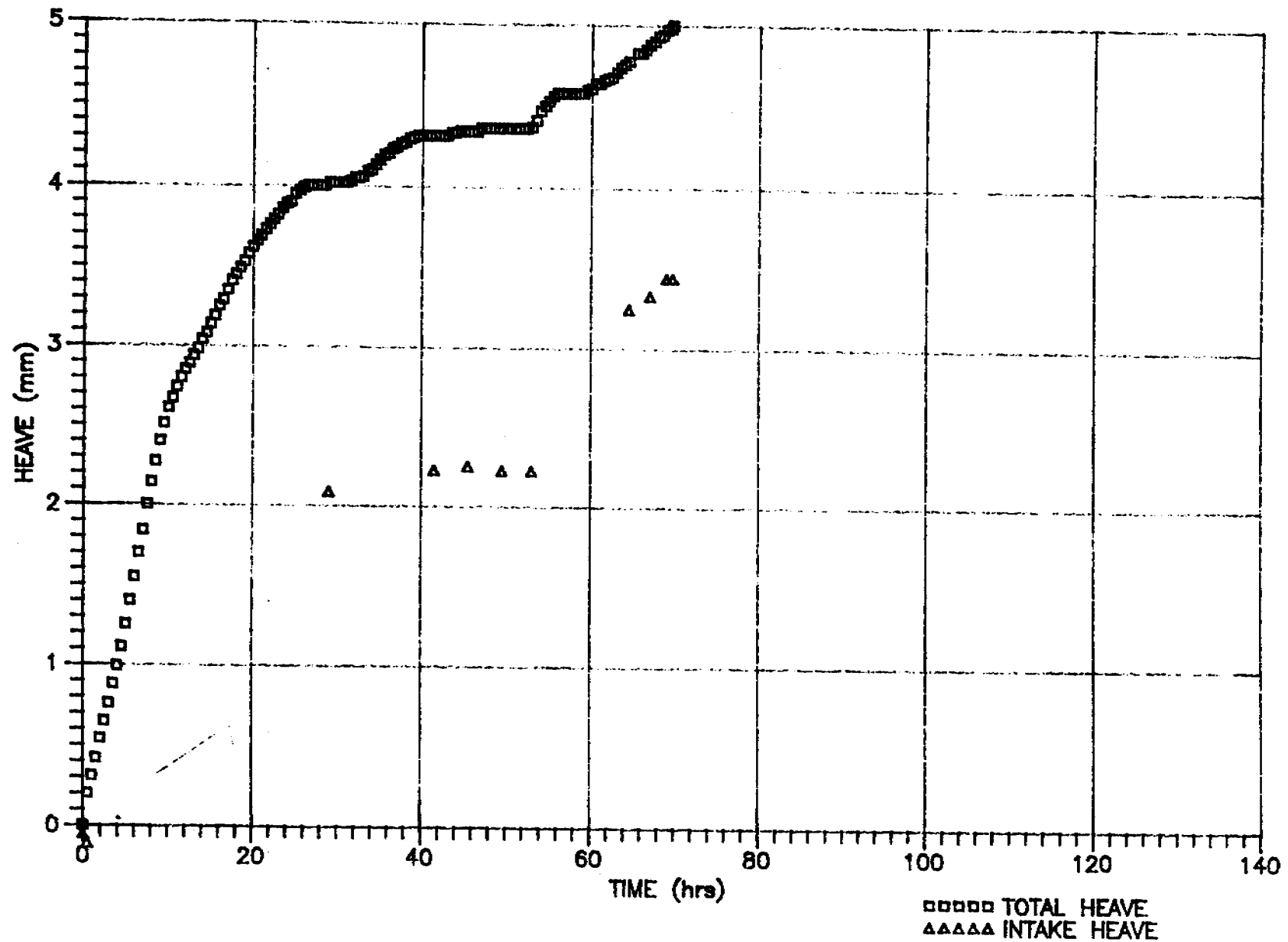




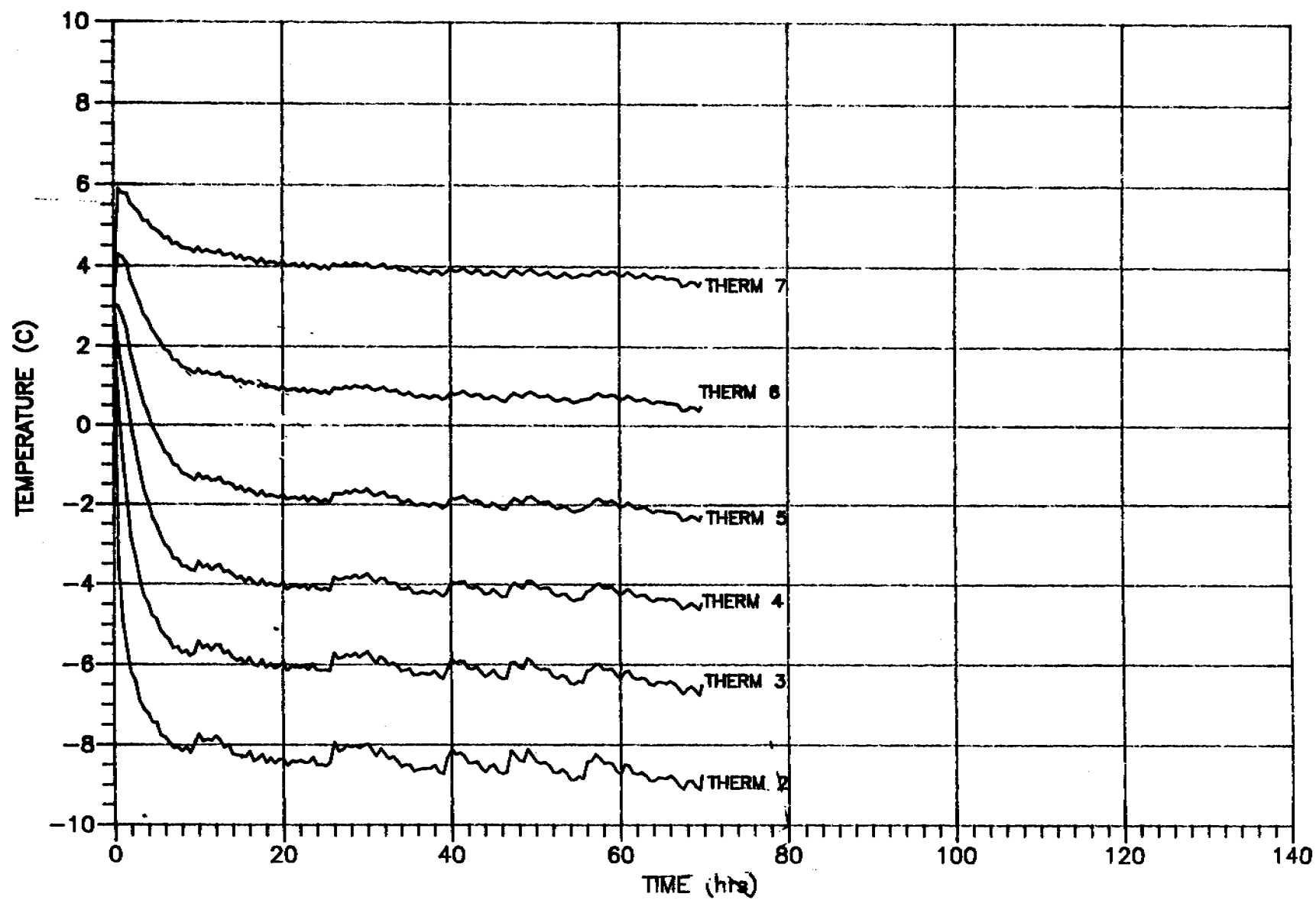
CONSOLIDATION TEST S32



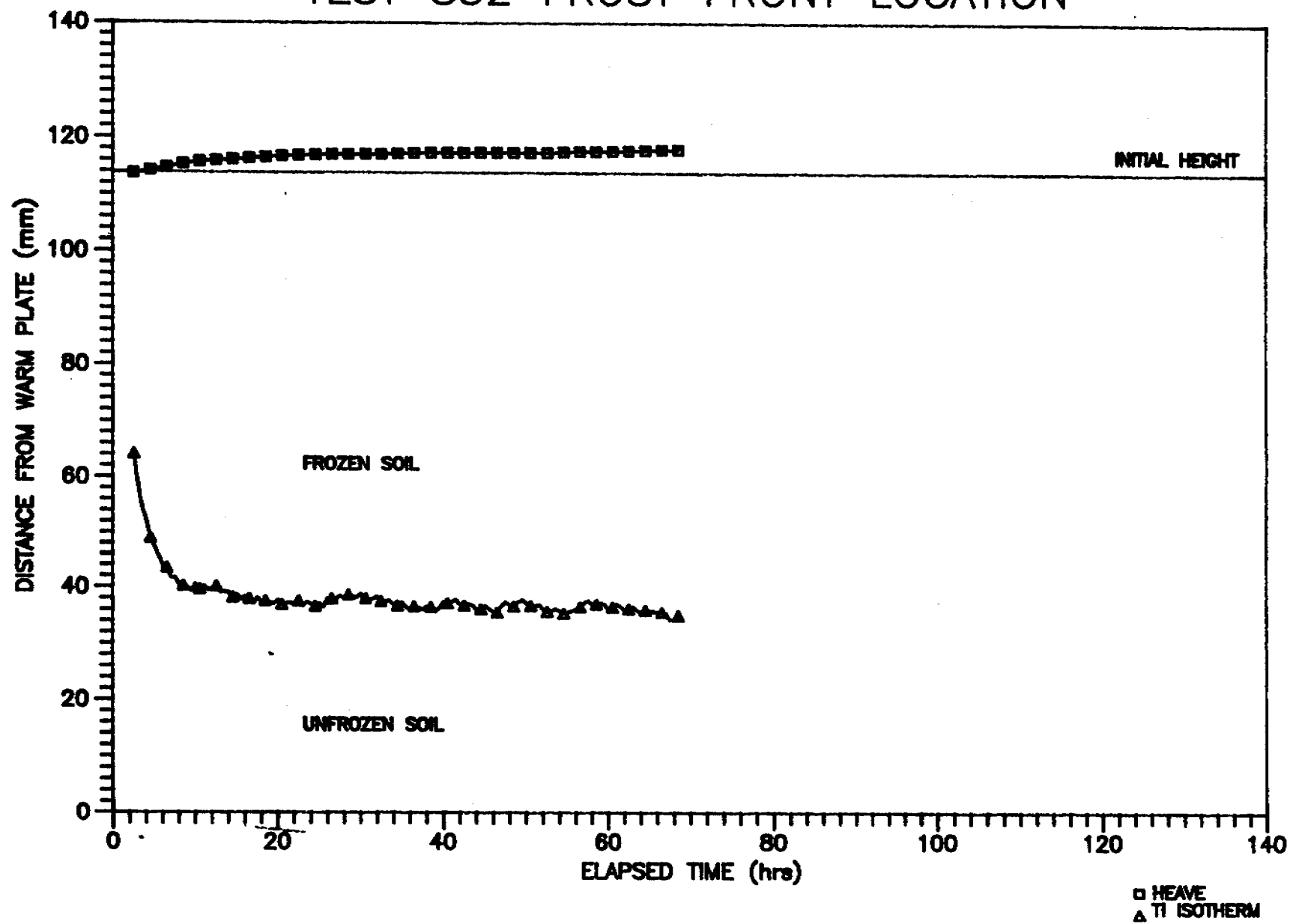
FREEZING TEST S32

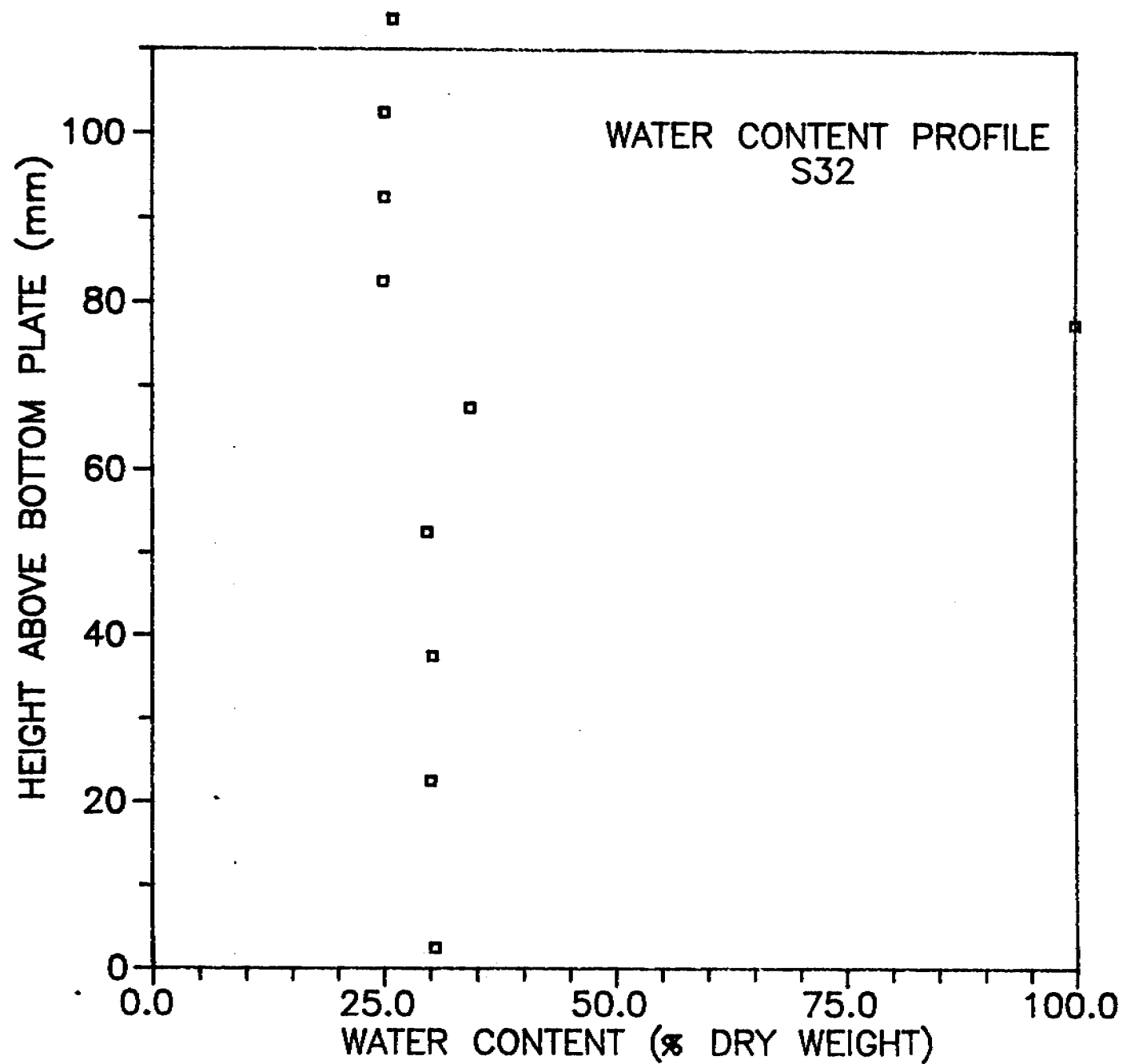


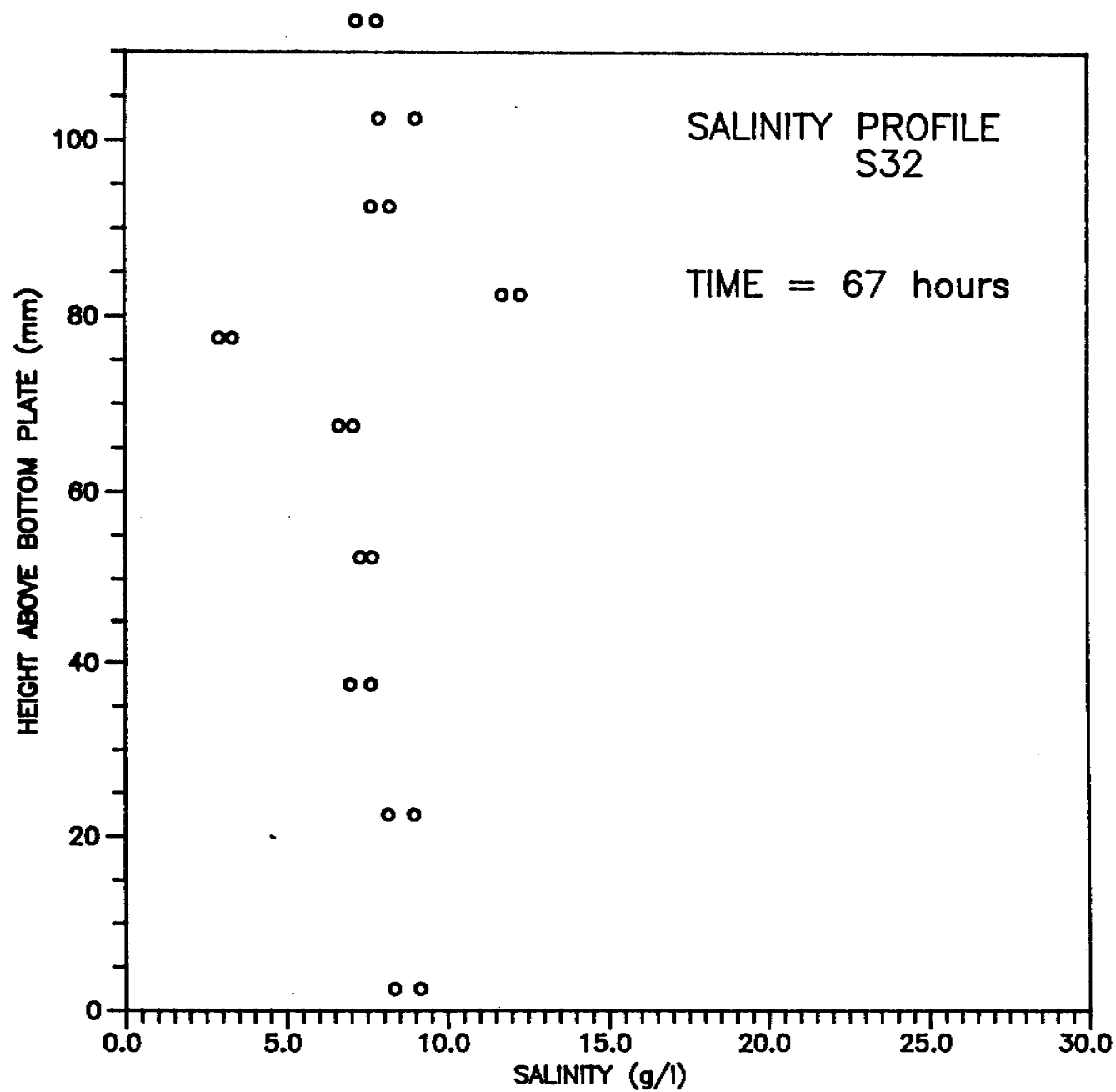
FREEZING TEST S32

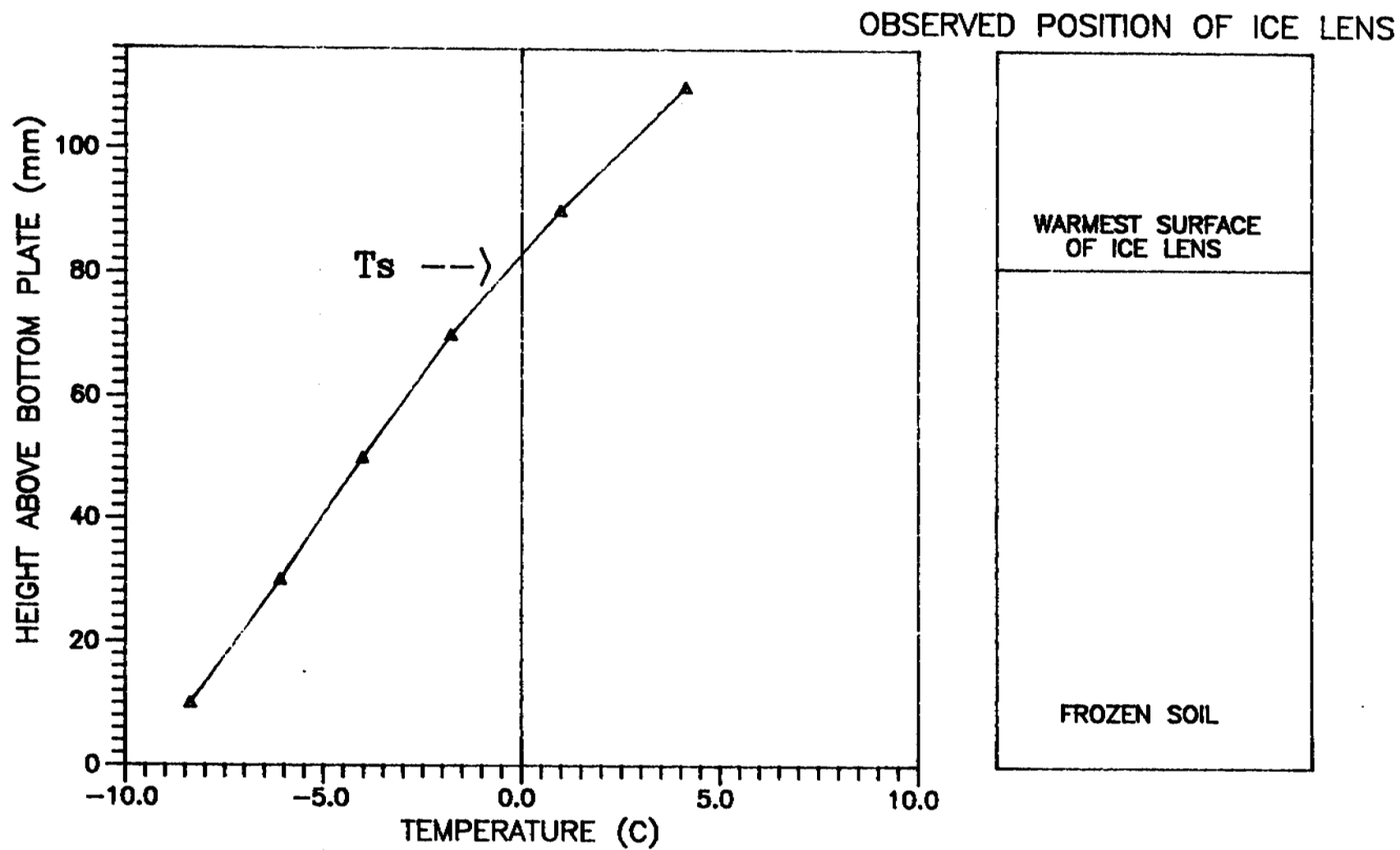


TEST S32 FROST FRONT LOCATION



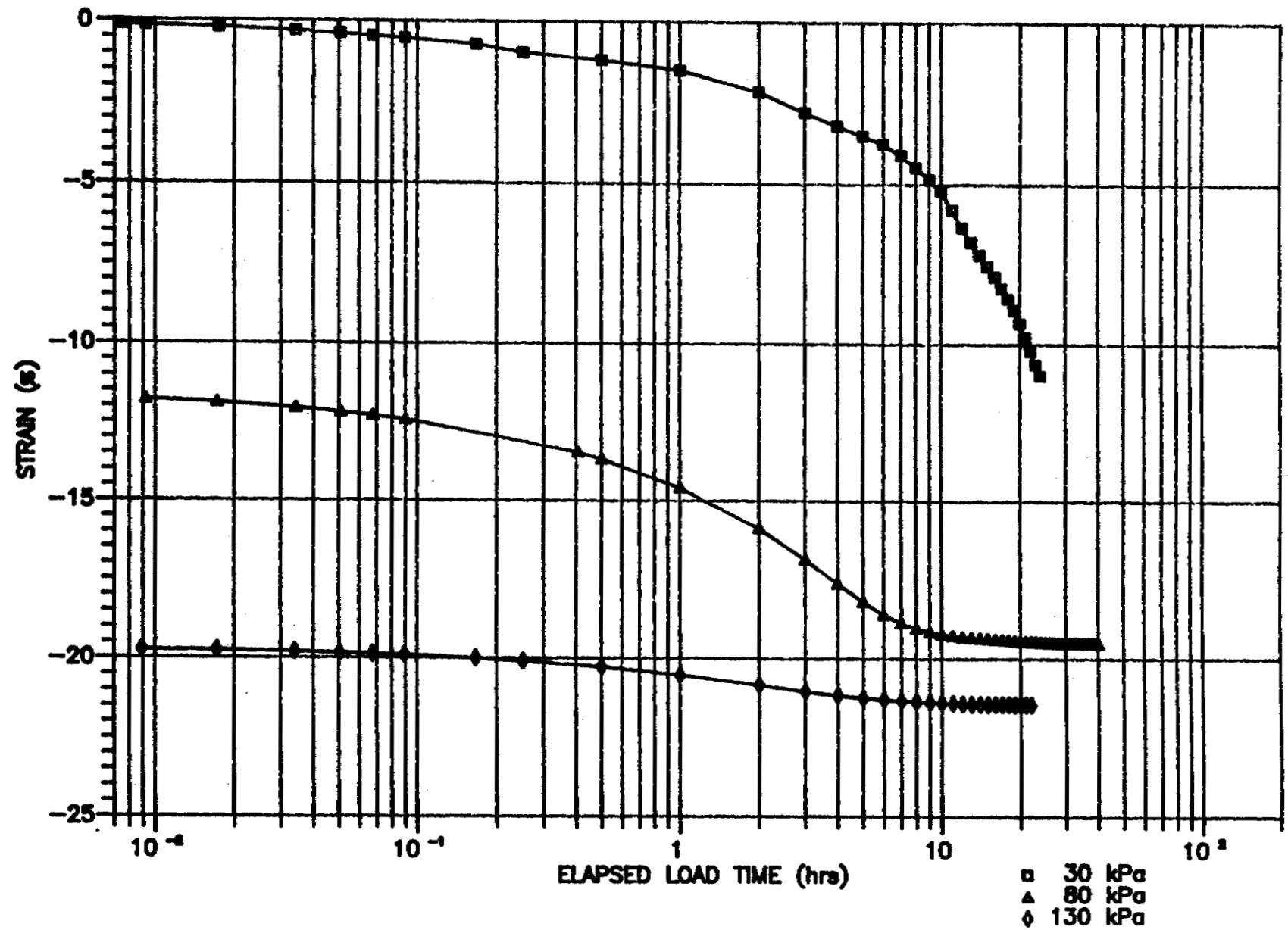




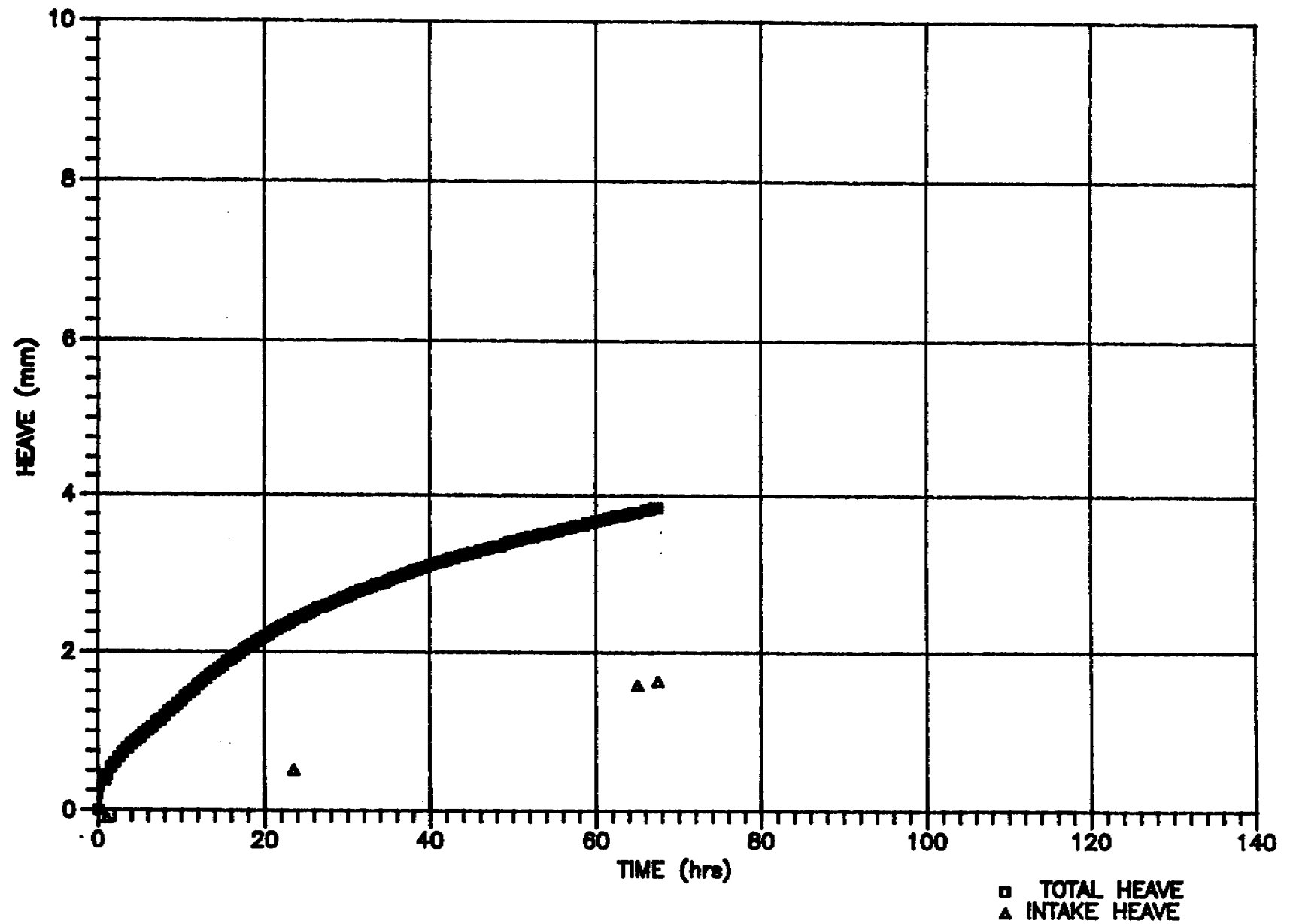


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S32

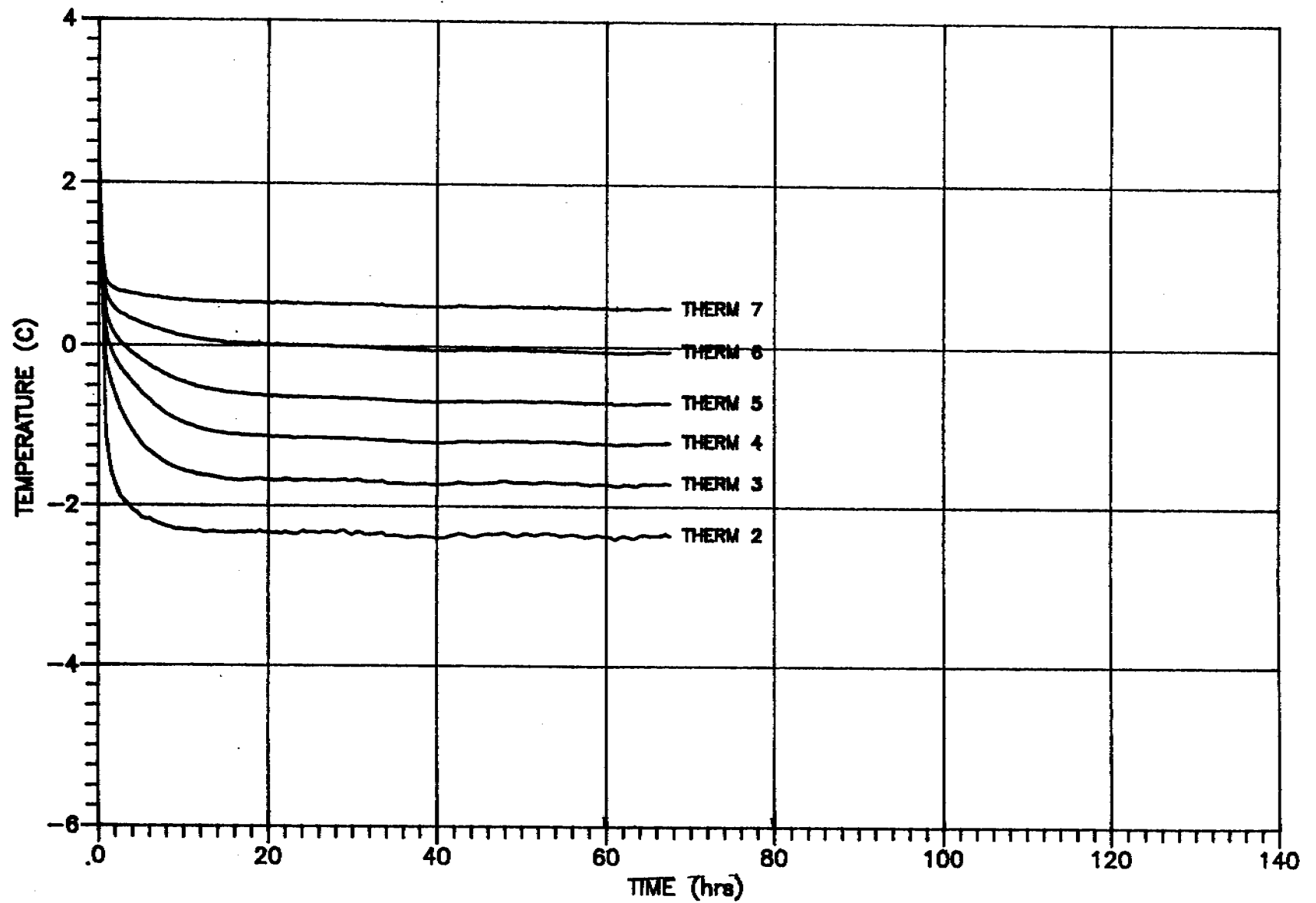
CONSOLIDATION TEST S40



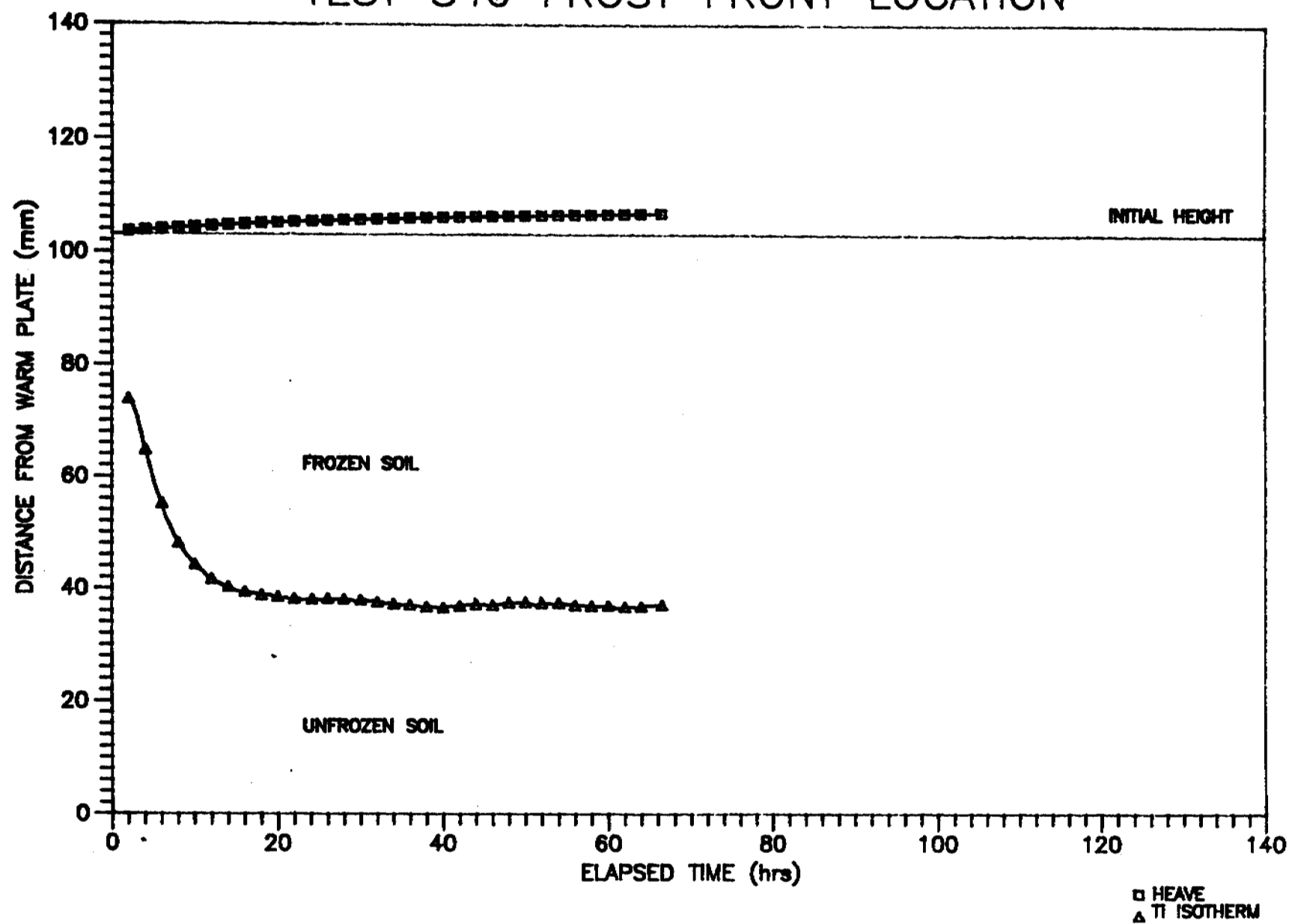
FREEZING TEST S40



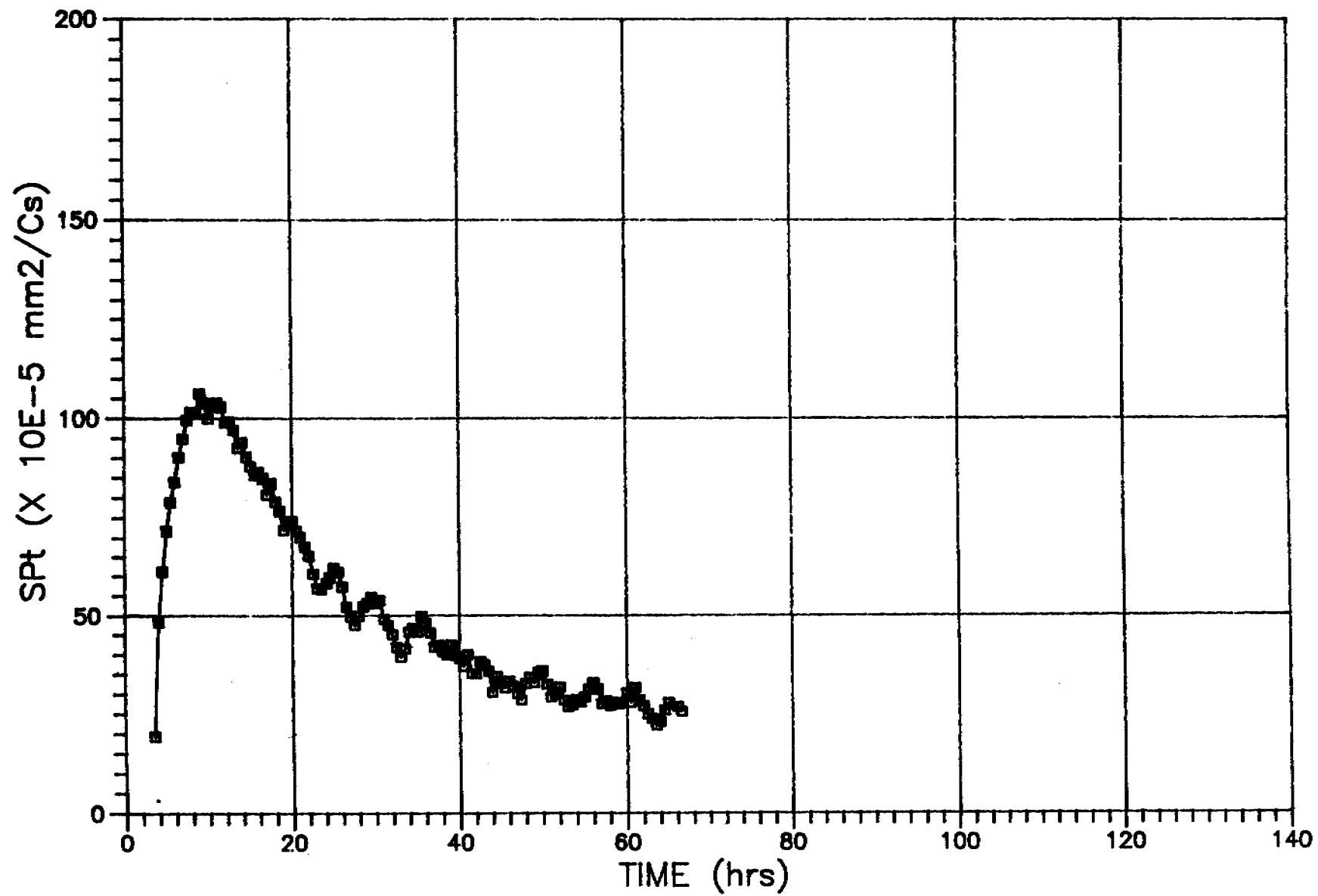
FREEZING TEST S40

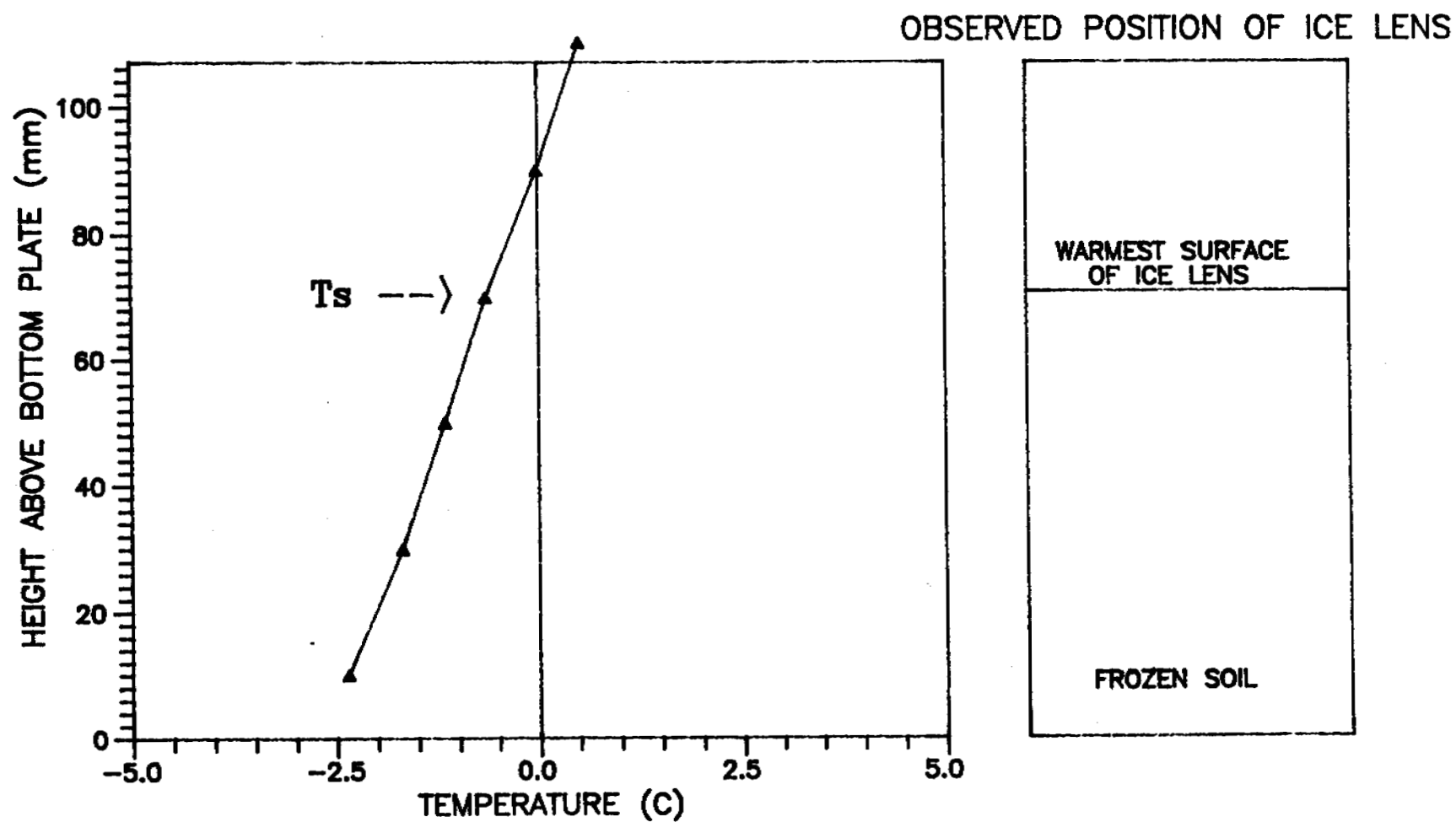


TEST S40 FROST FRONT LOCATION



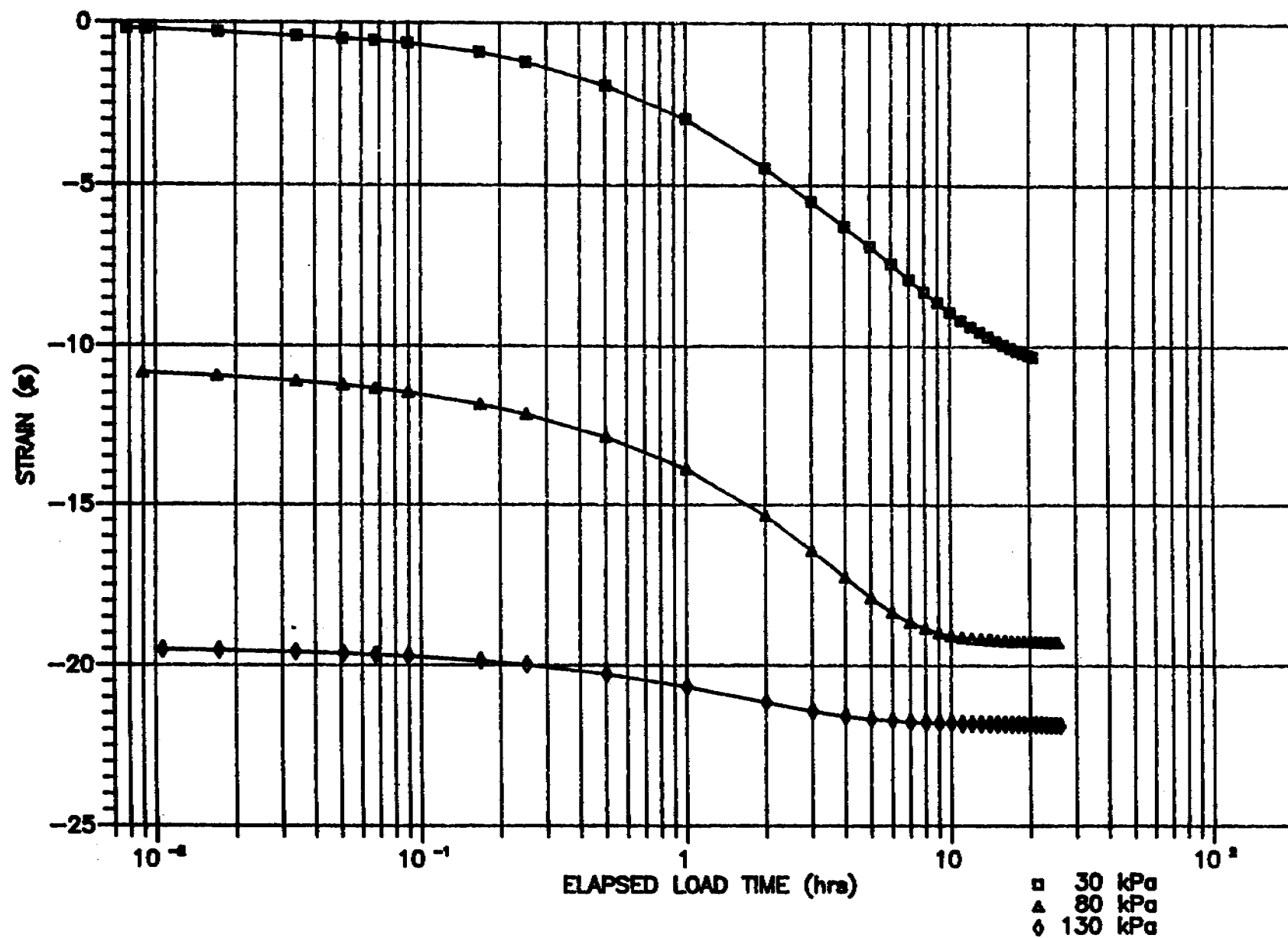
FREEZING TEST S40



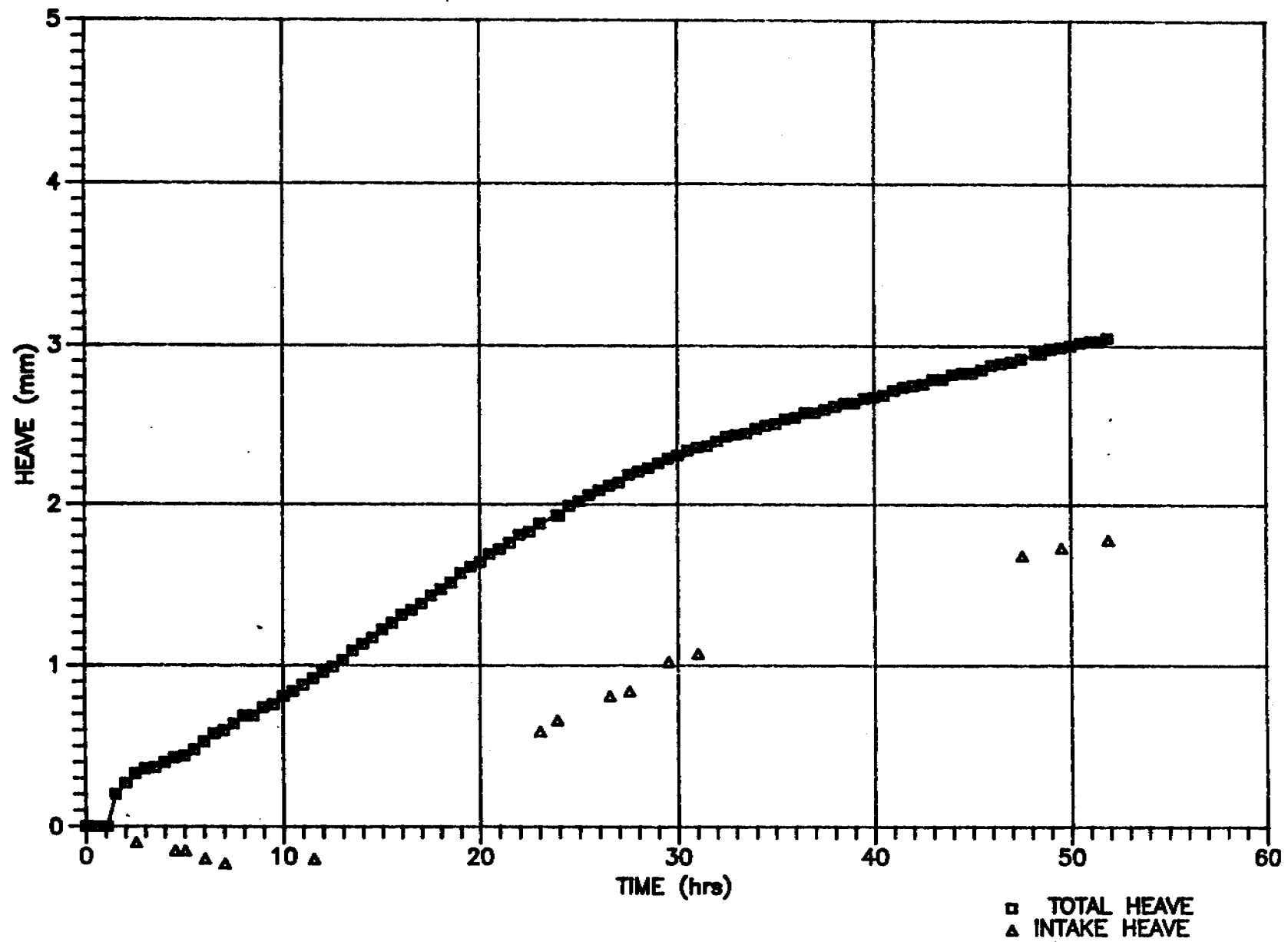


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S40

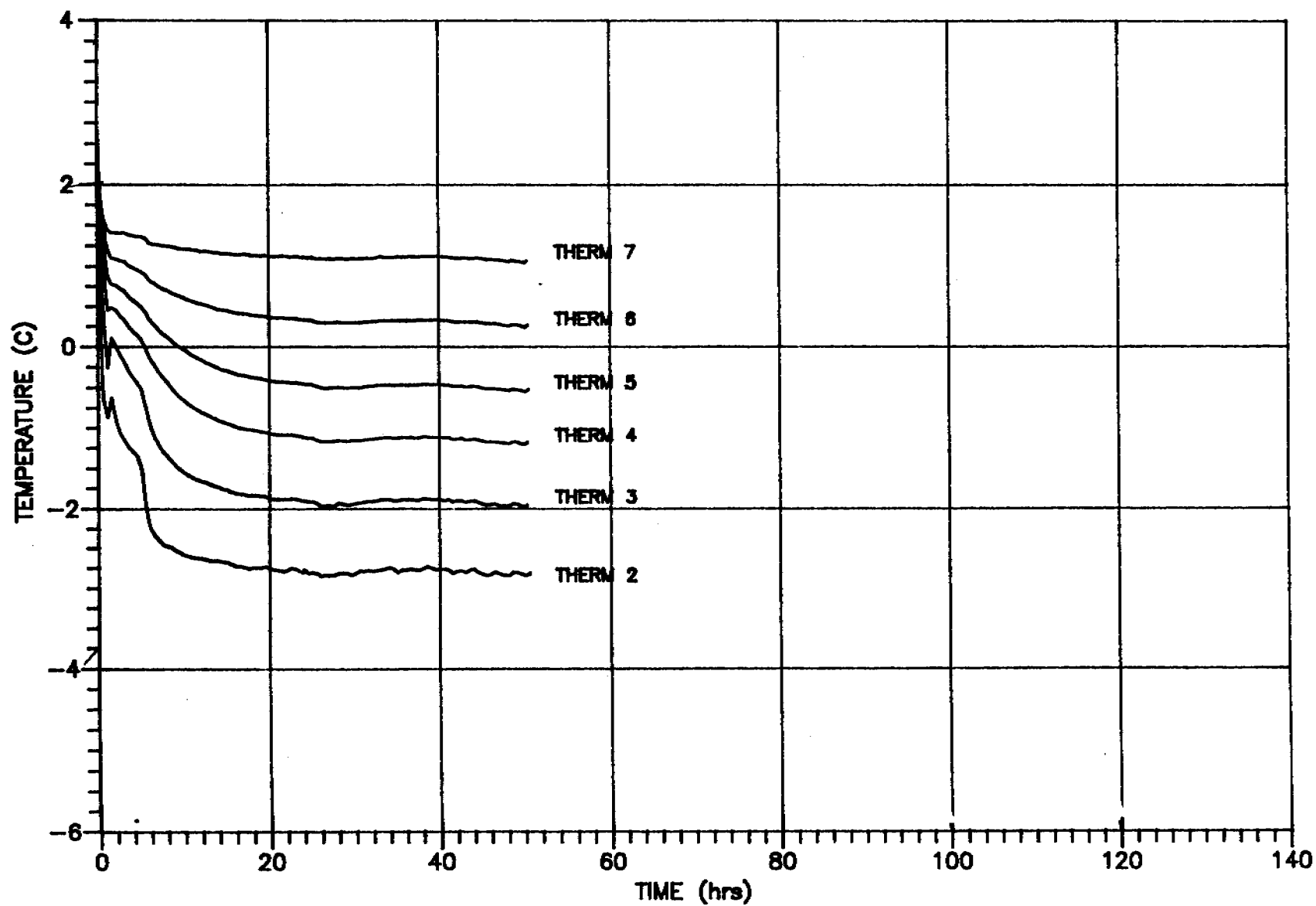
CONSOLIDATION TEST S41



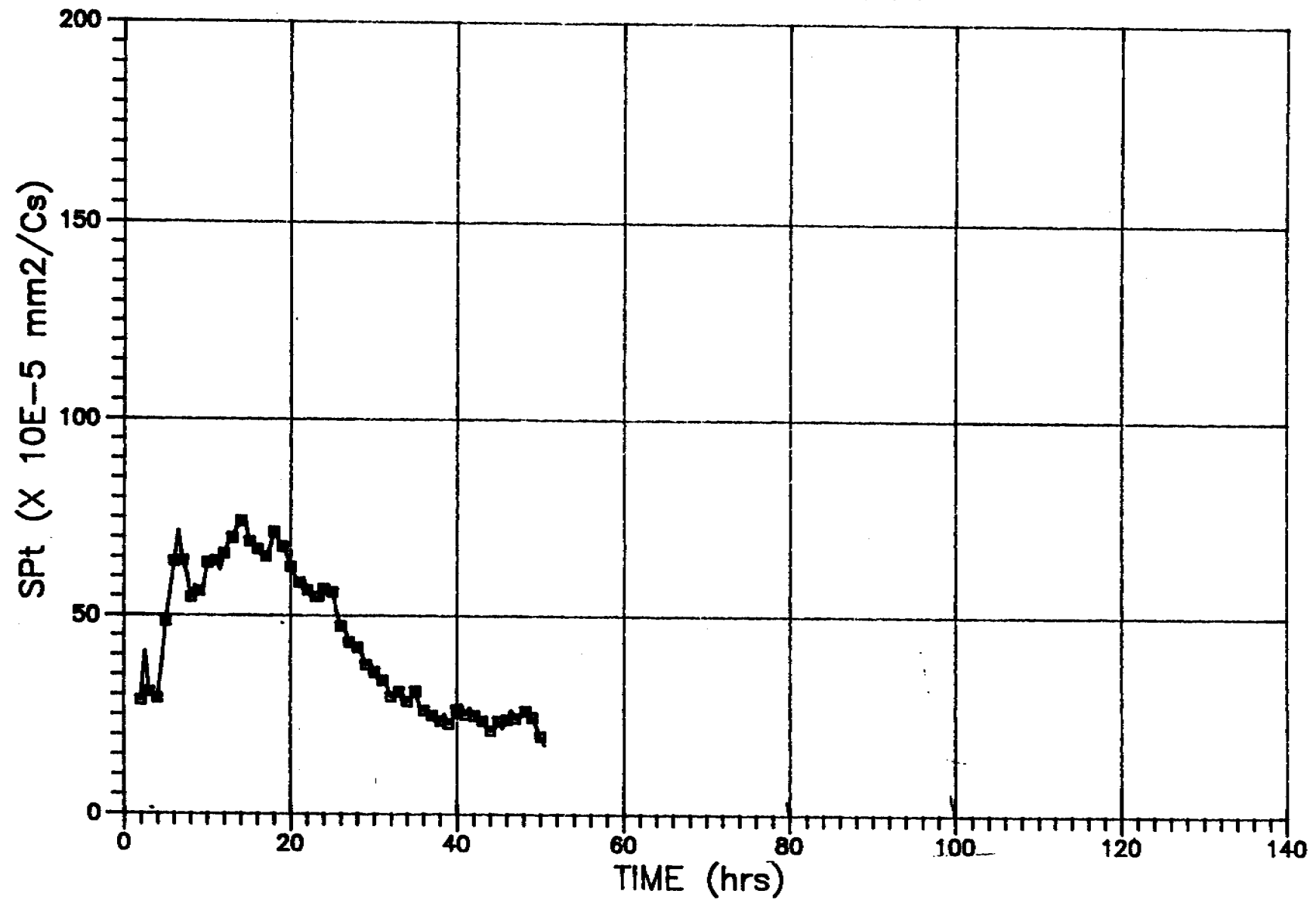
FREEZING TEST S41



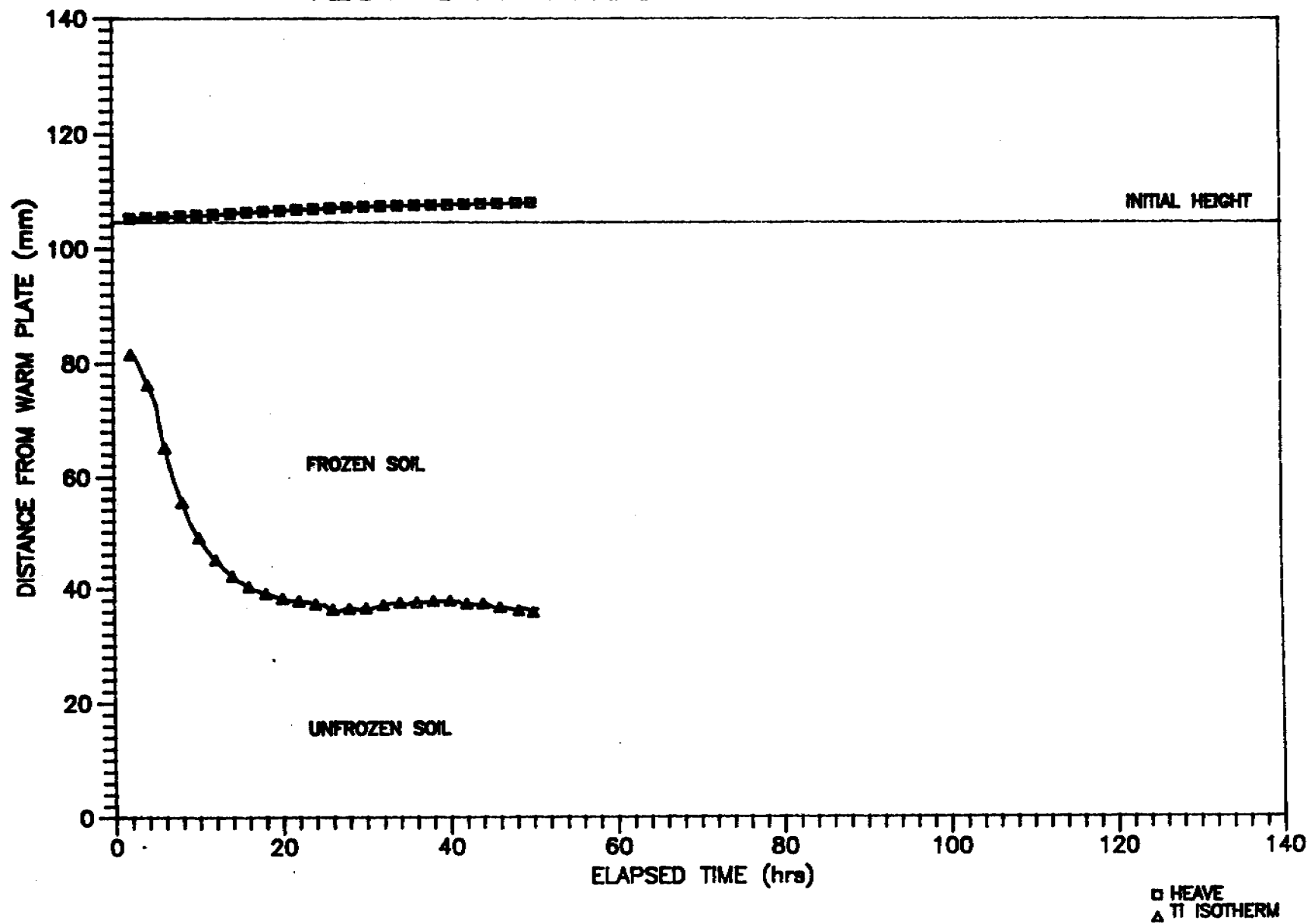
FREEZING TEST S41

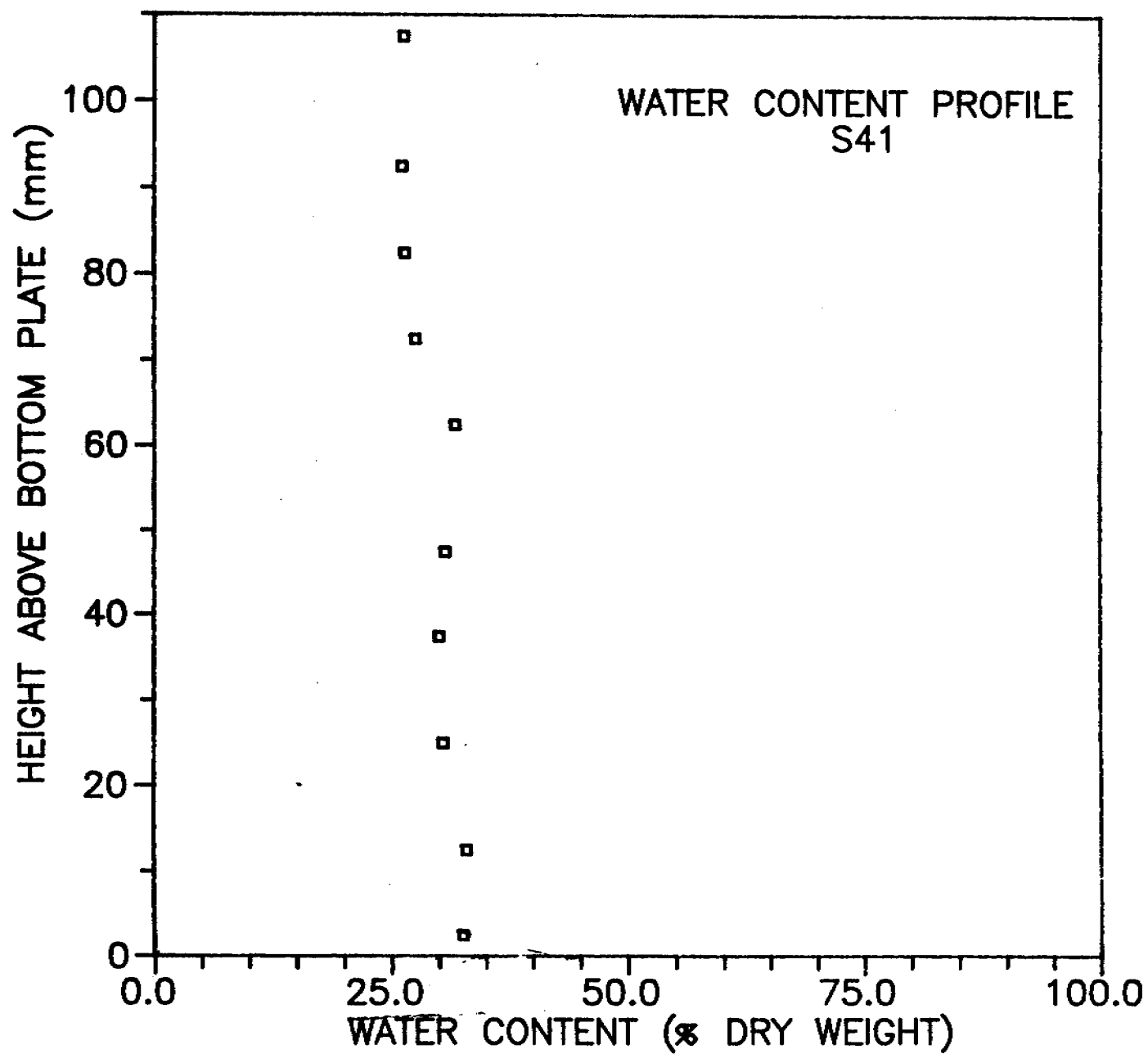


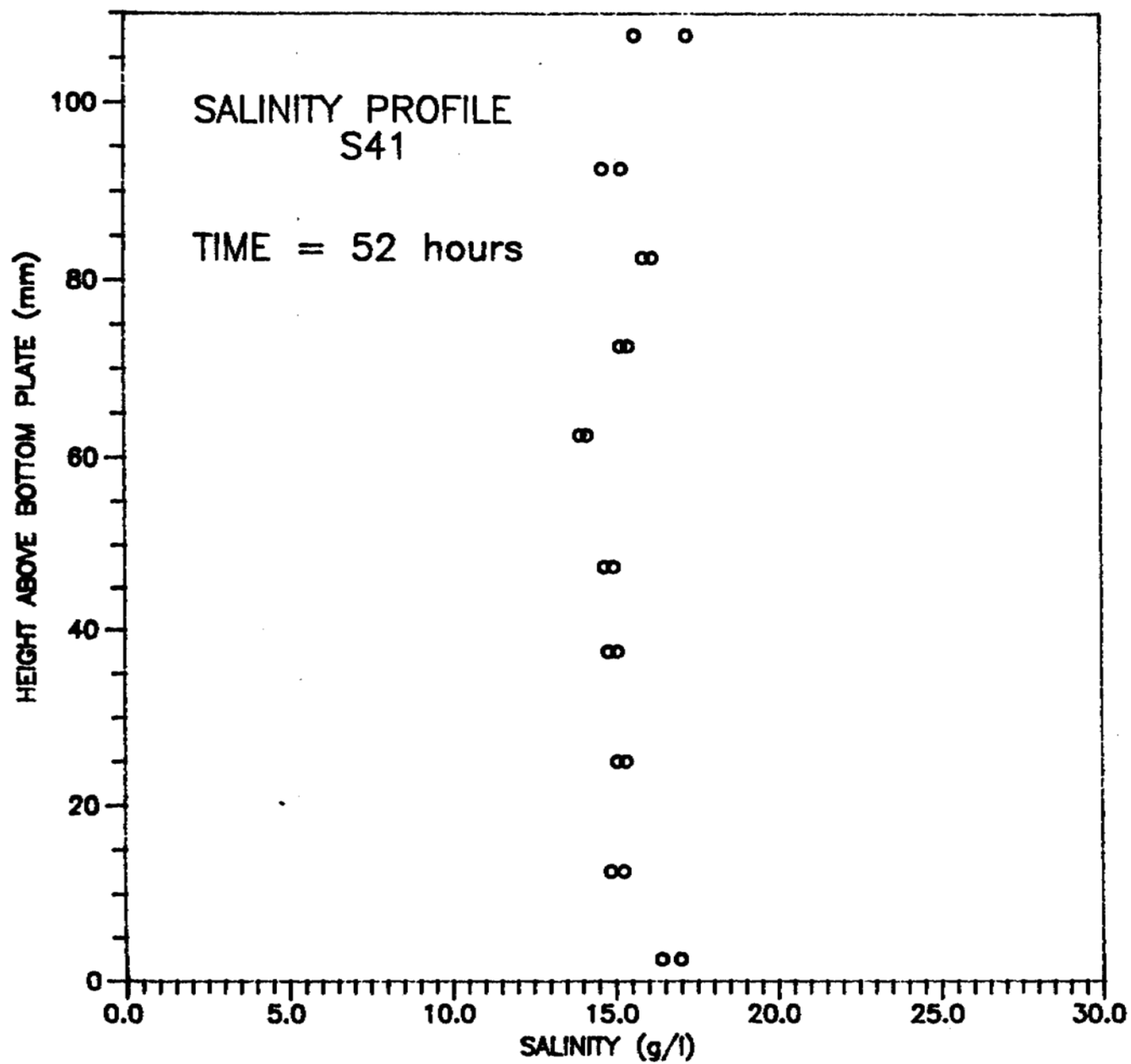
FREEZING TEST S41

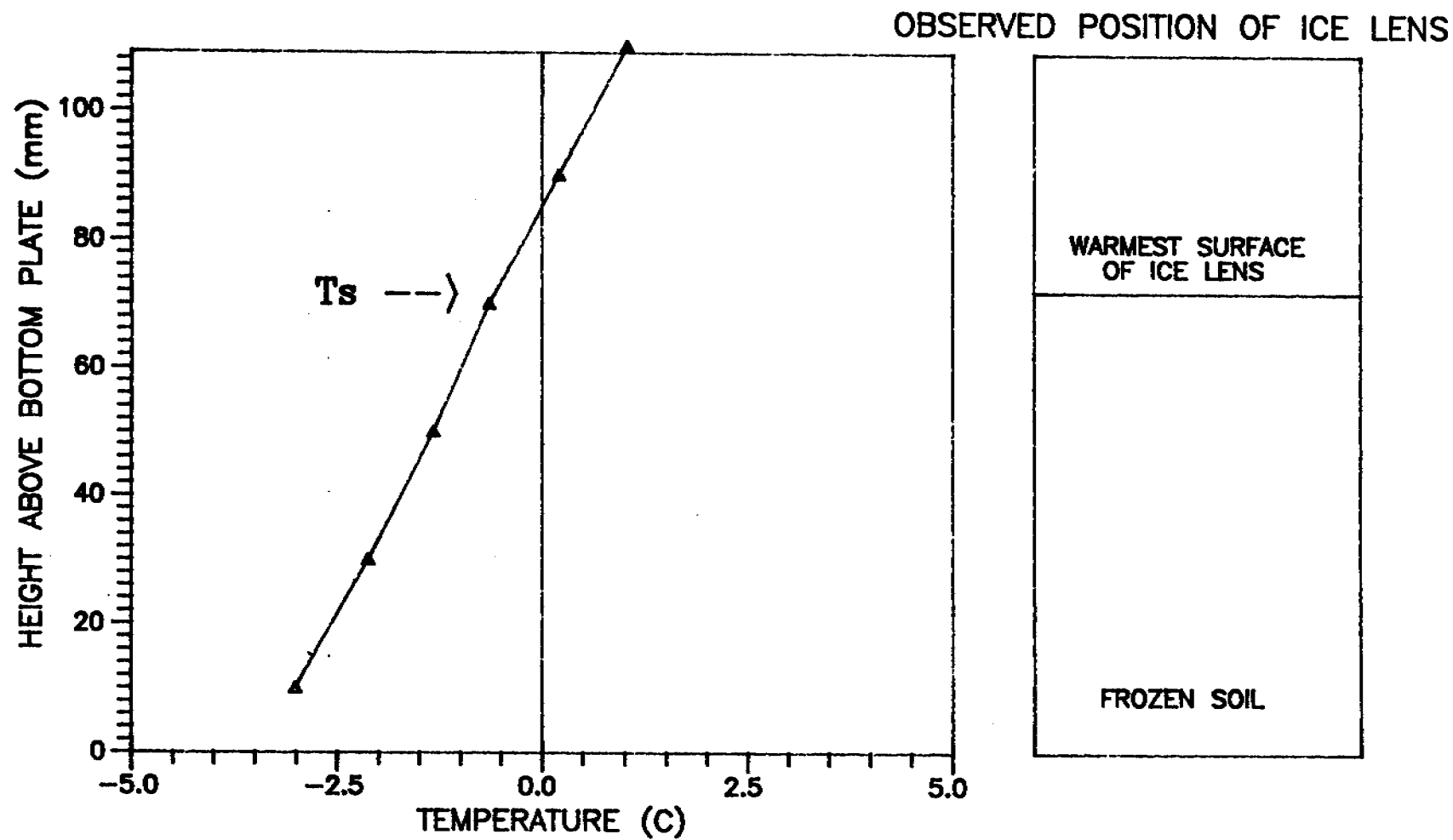


TEST S41 FROST FRONT LOCATION



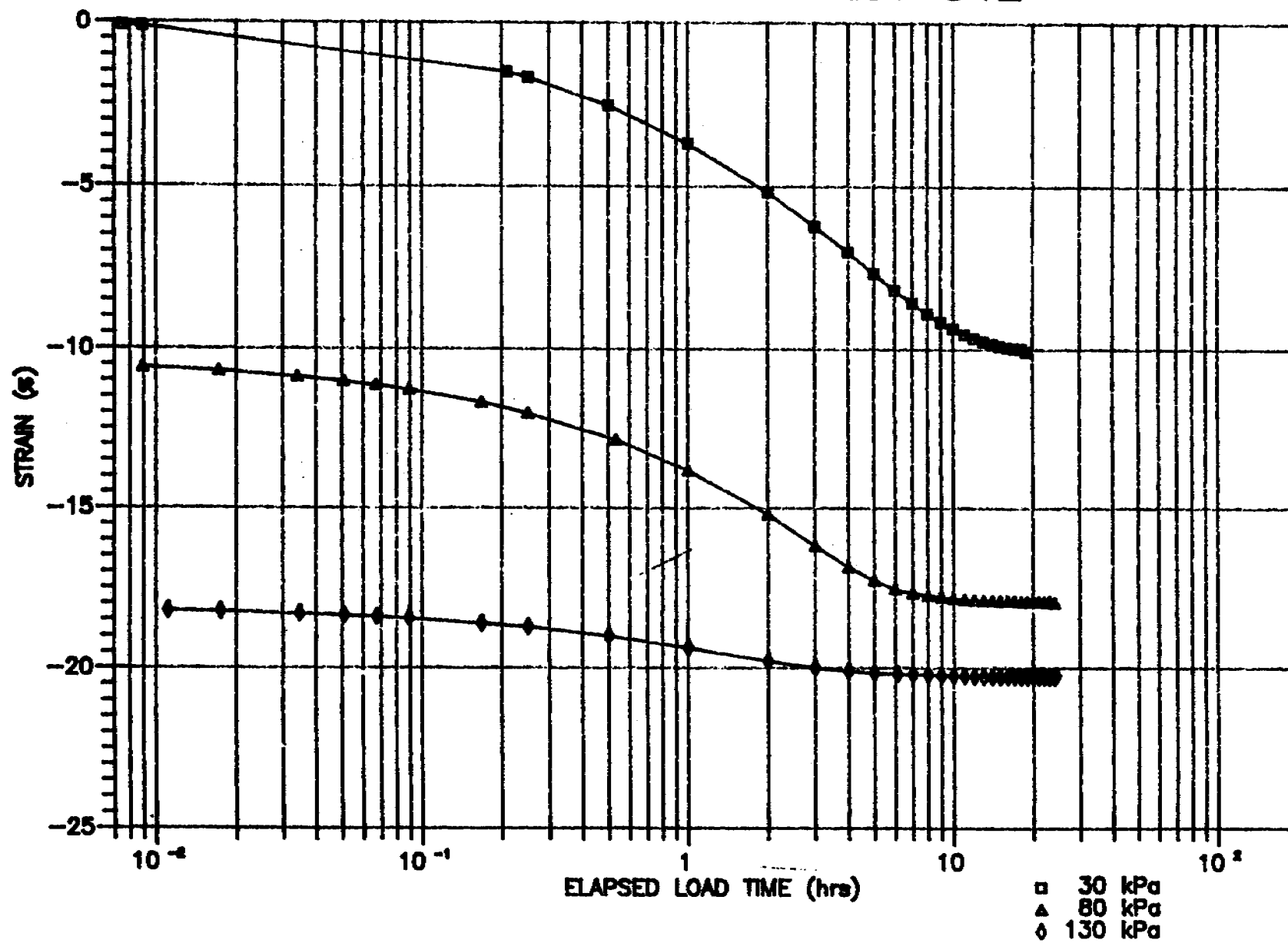




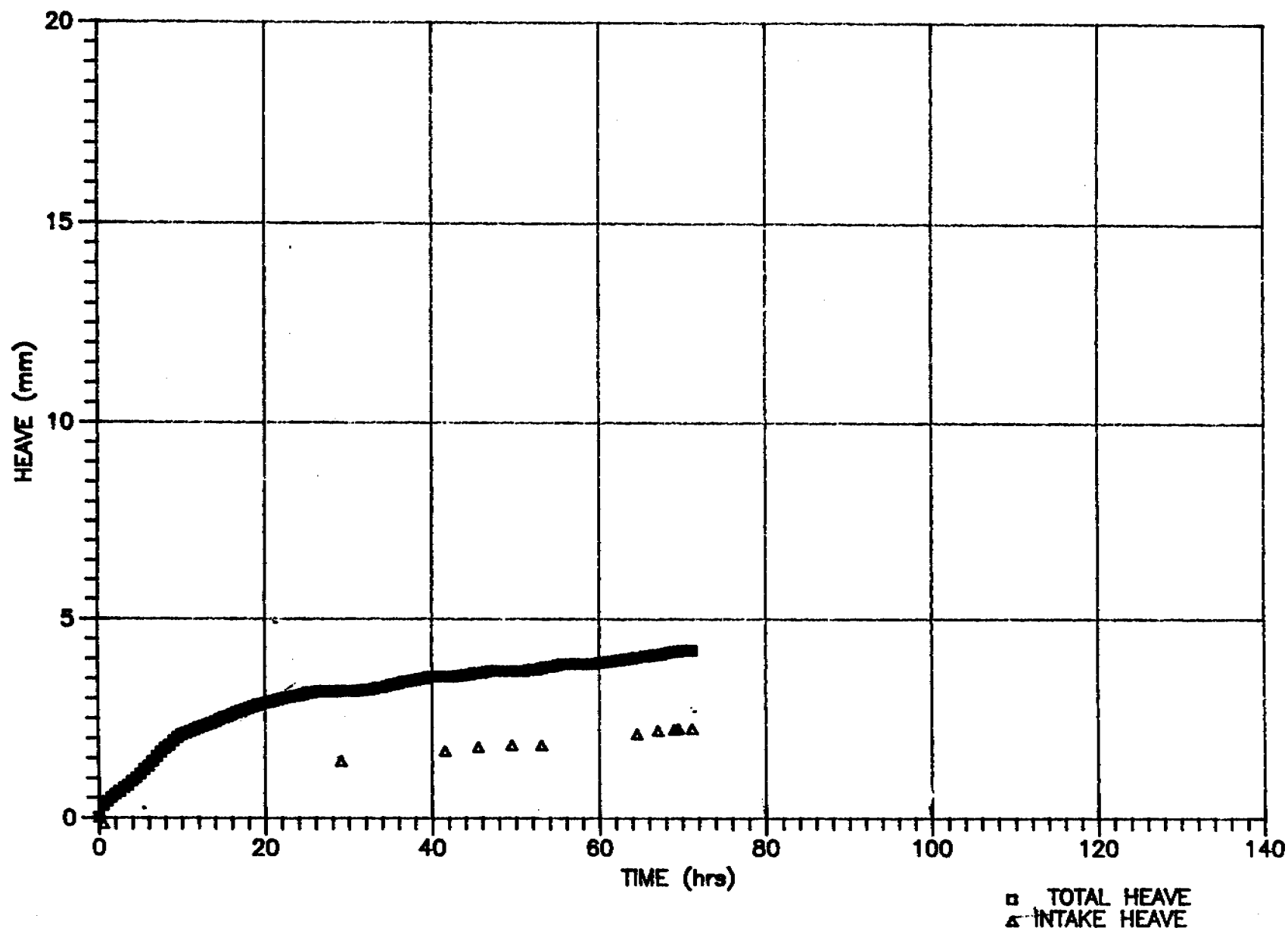


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S41

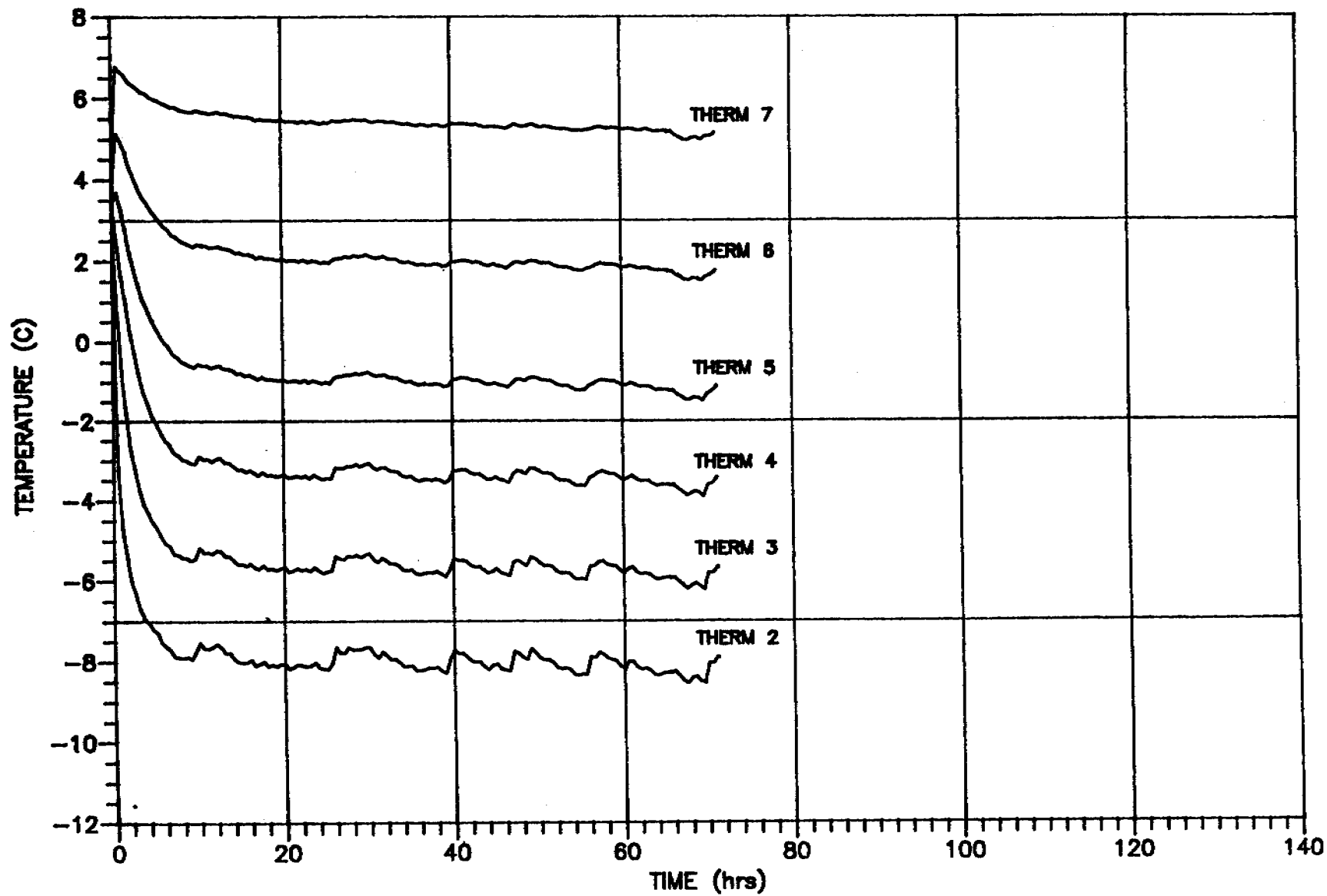
CONSOLIDATION TEST S42



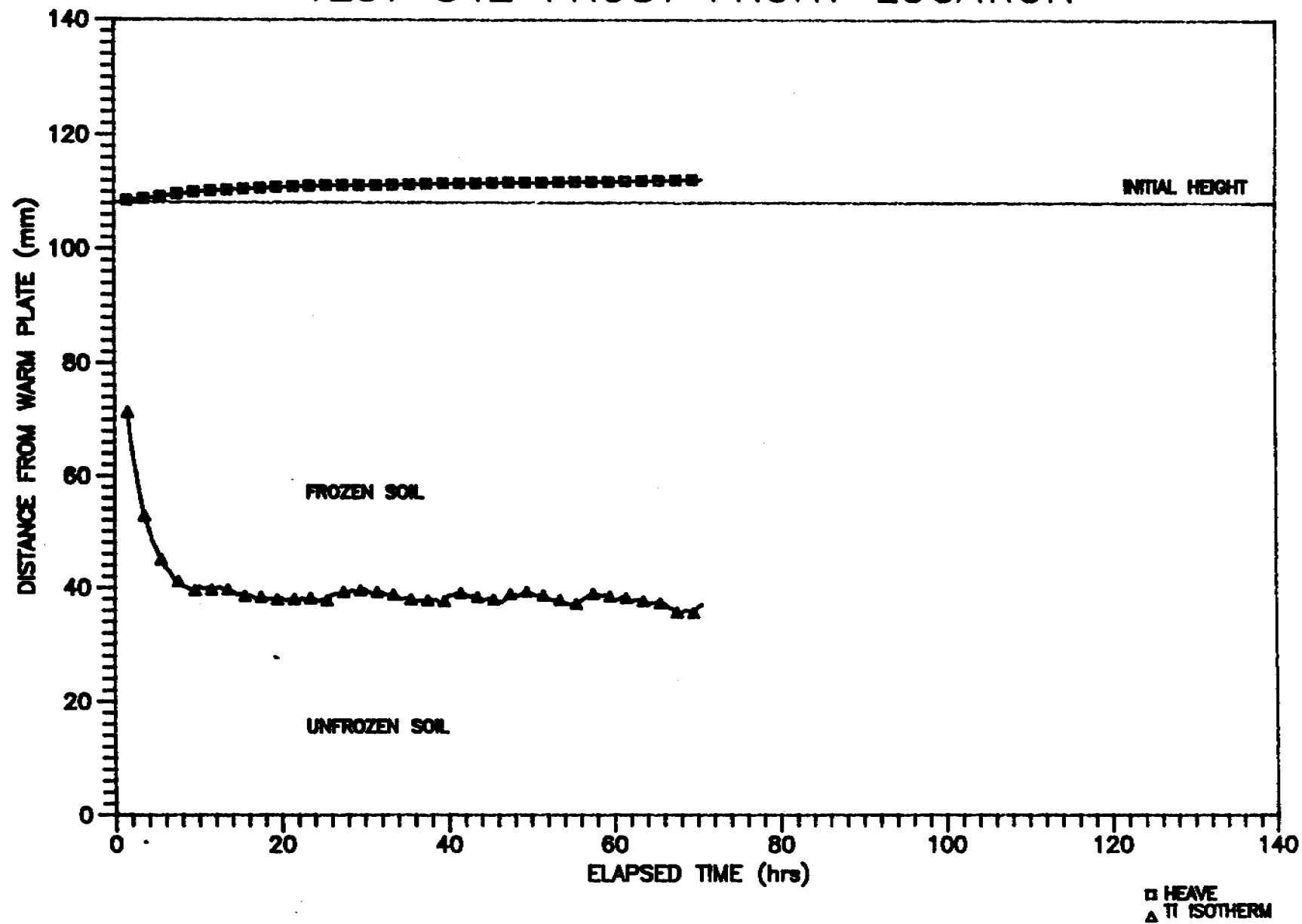
FREEZING TEST S42



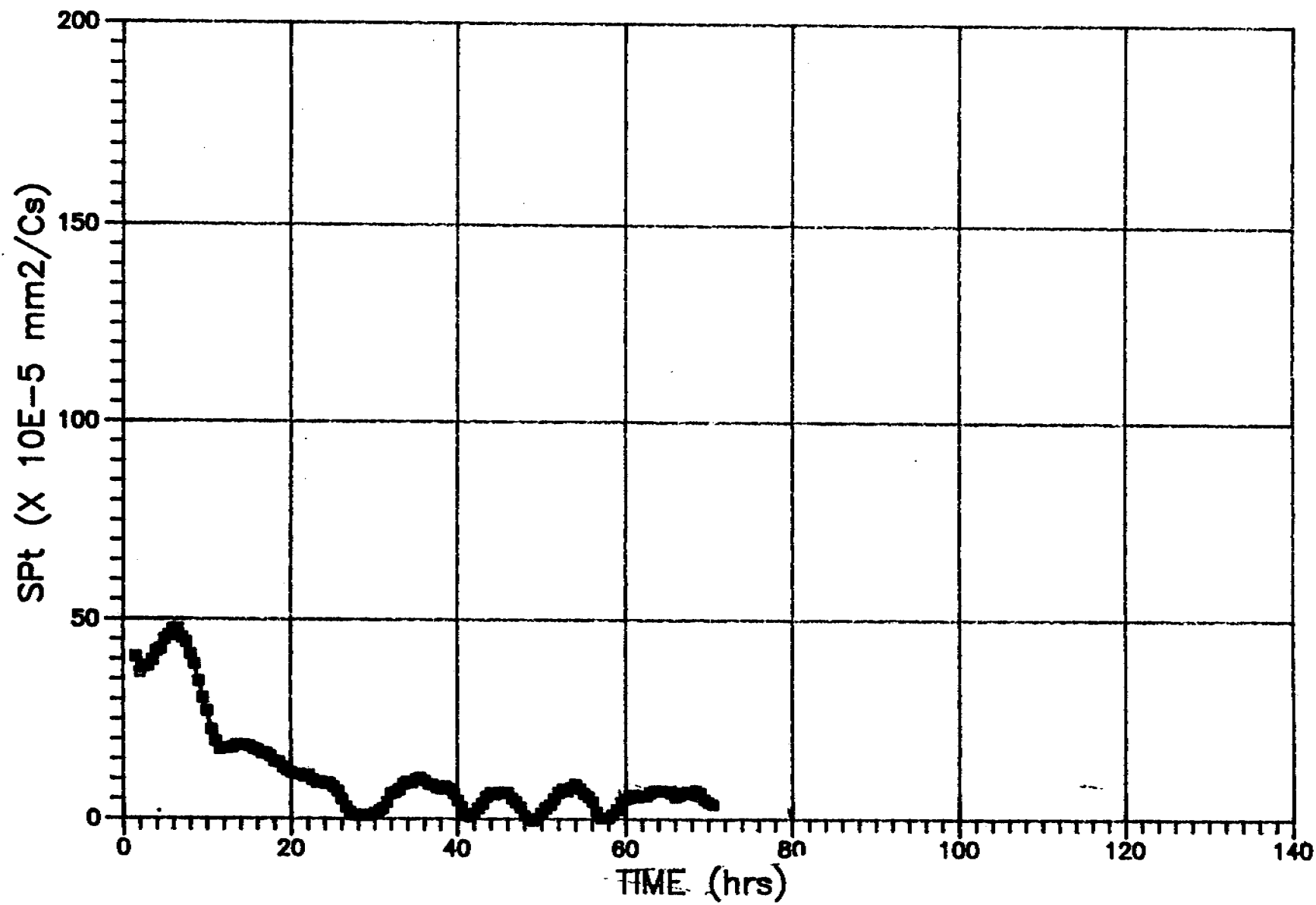
FREEZING TEST S42



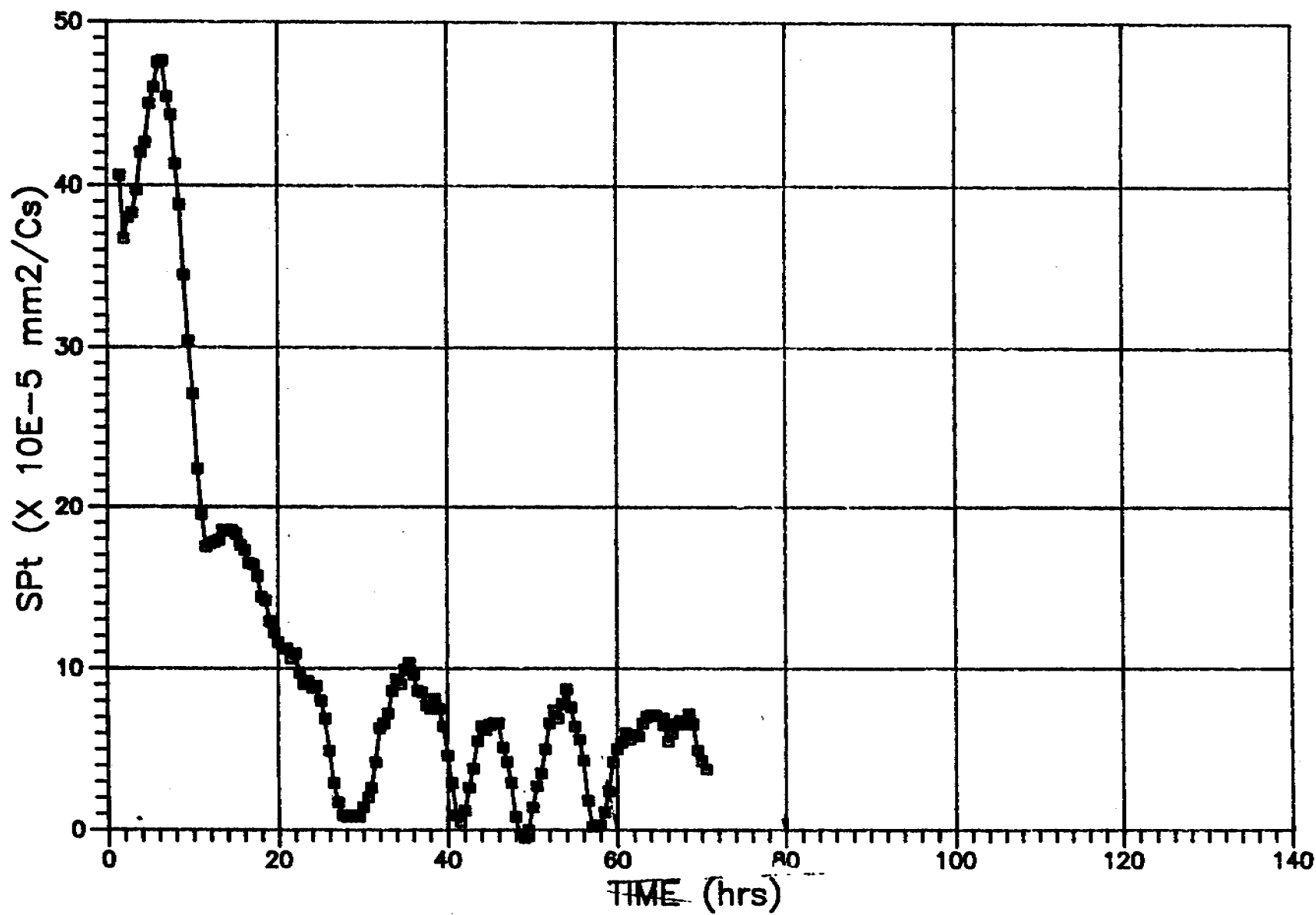
TEST S42 FROST FRONT LOCATION

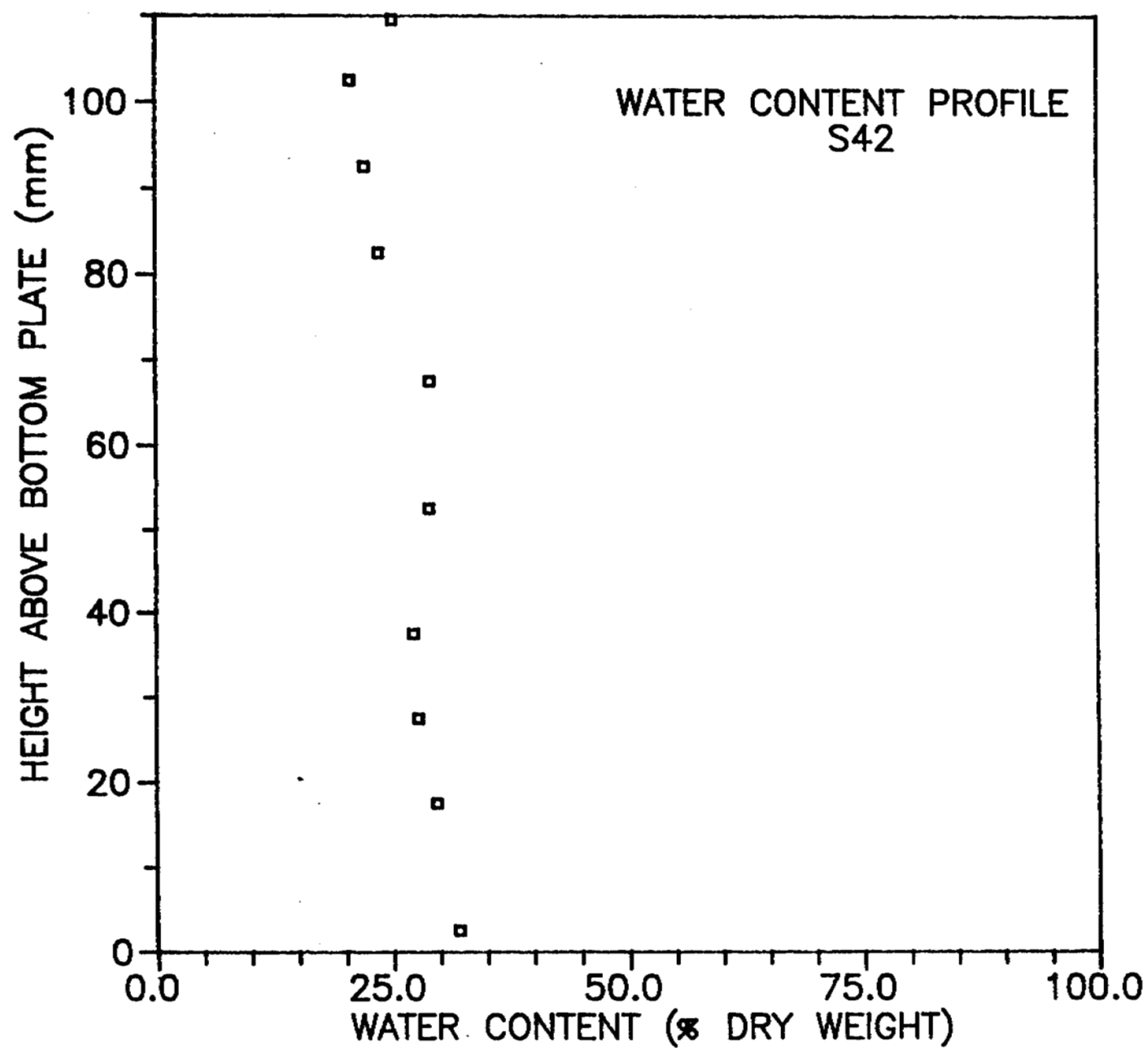


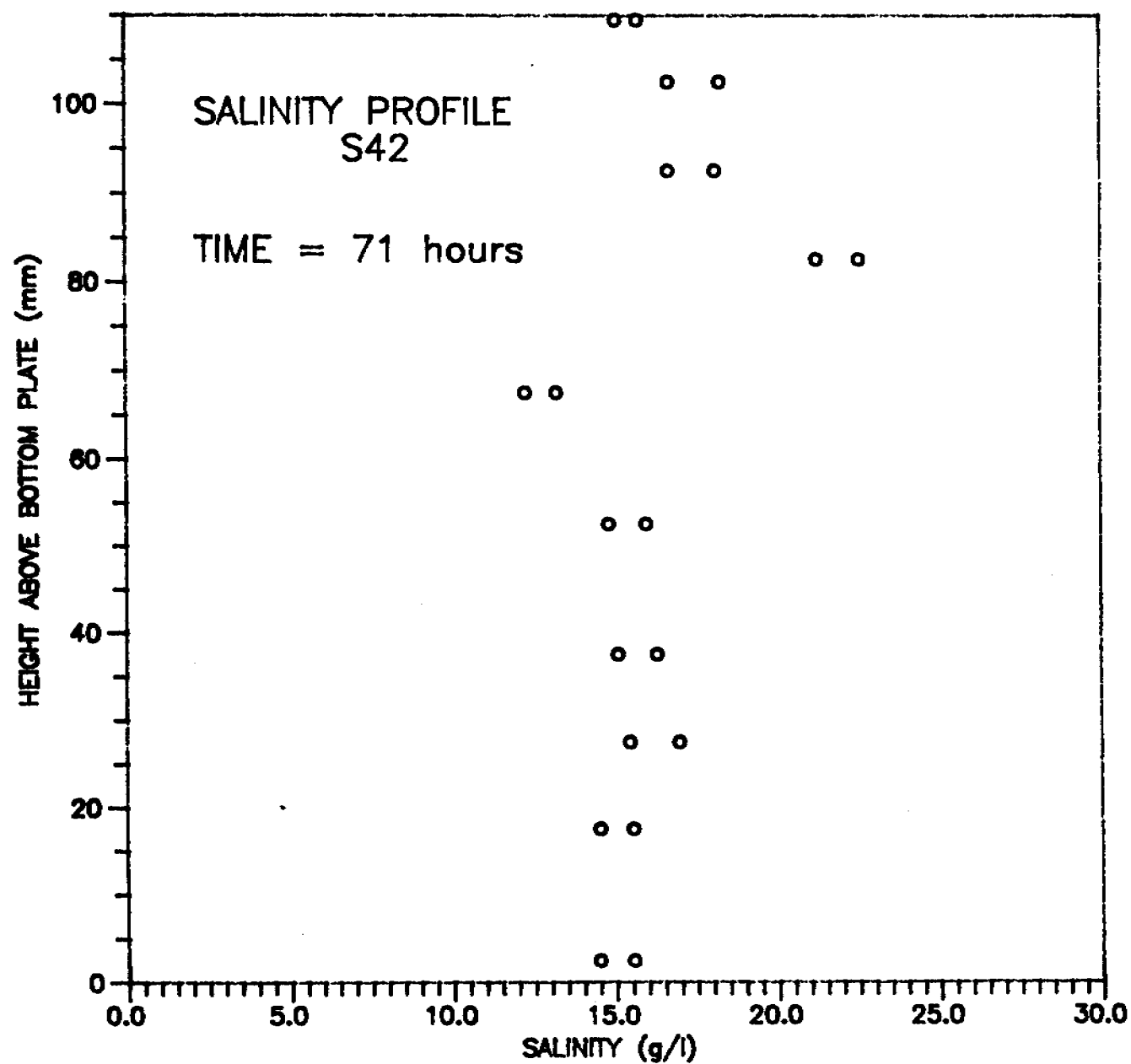
FREEZING TEST S42

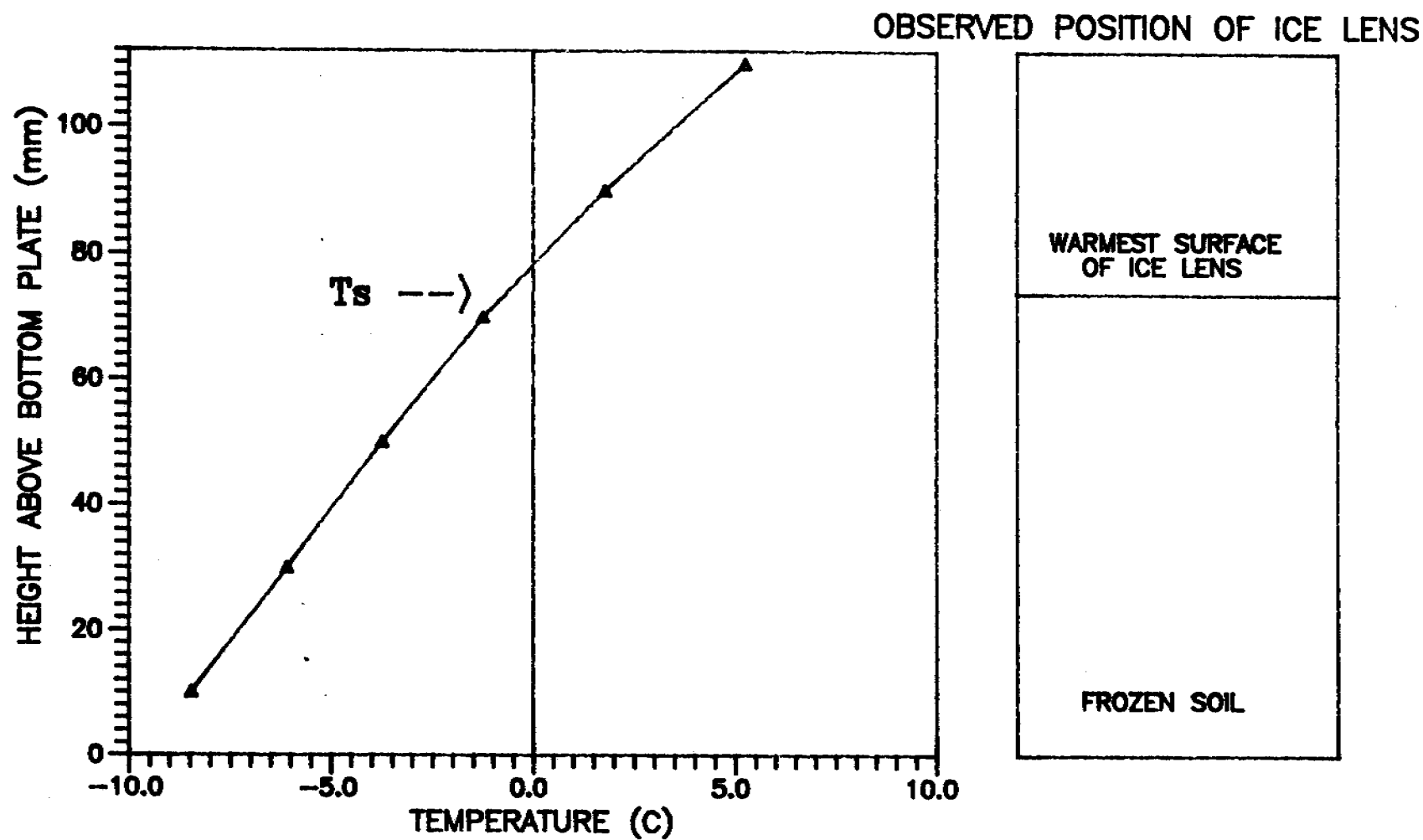


FREEZING TEST S42



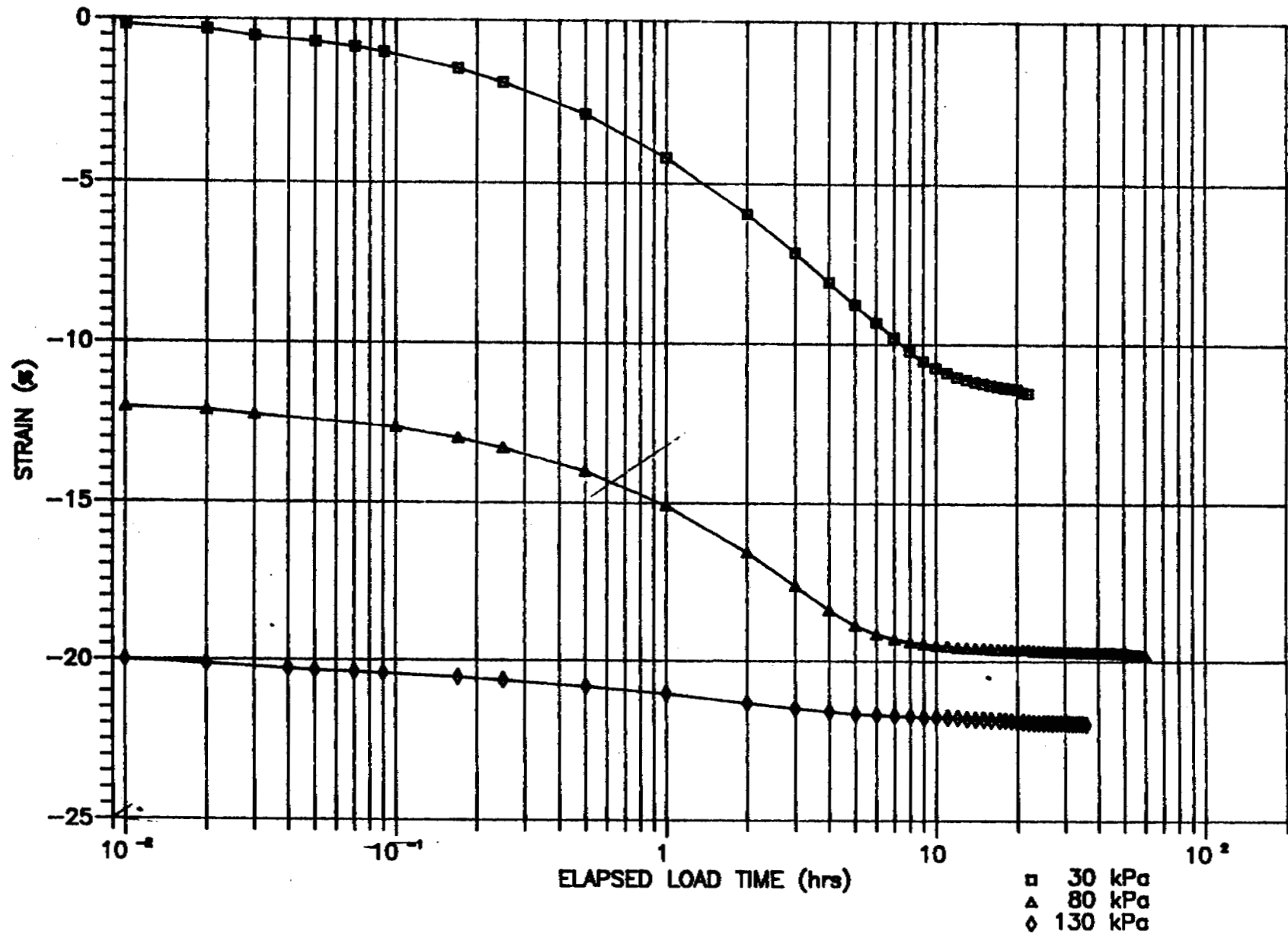




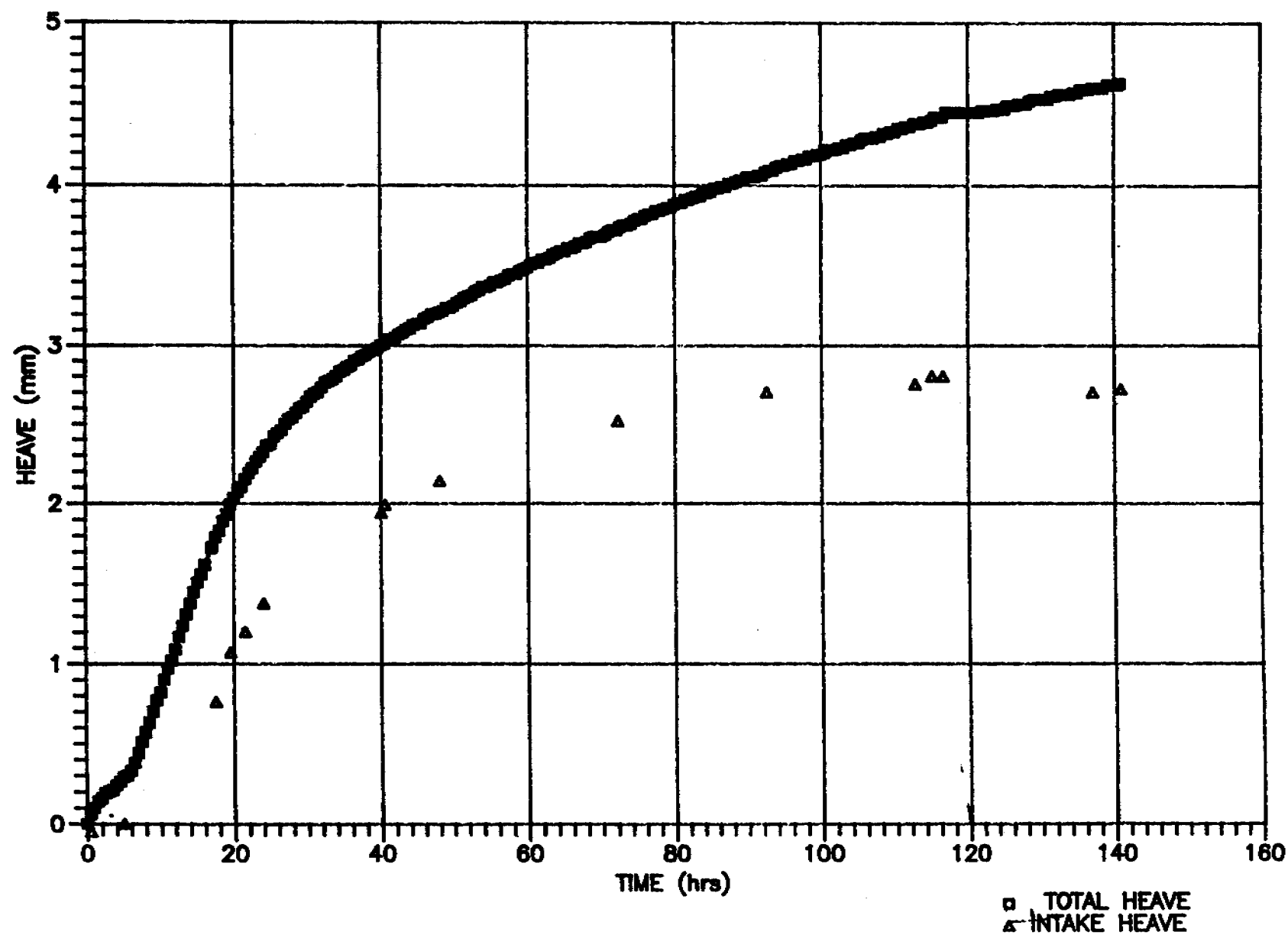


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S42

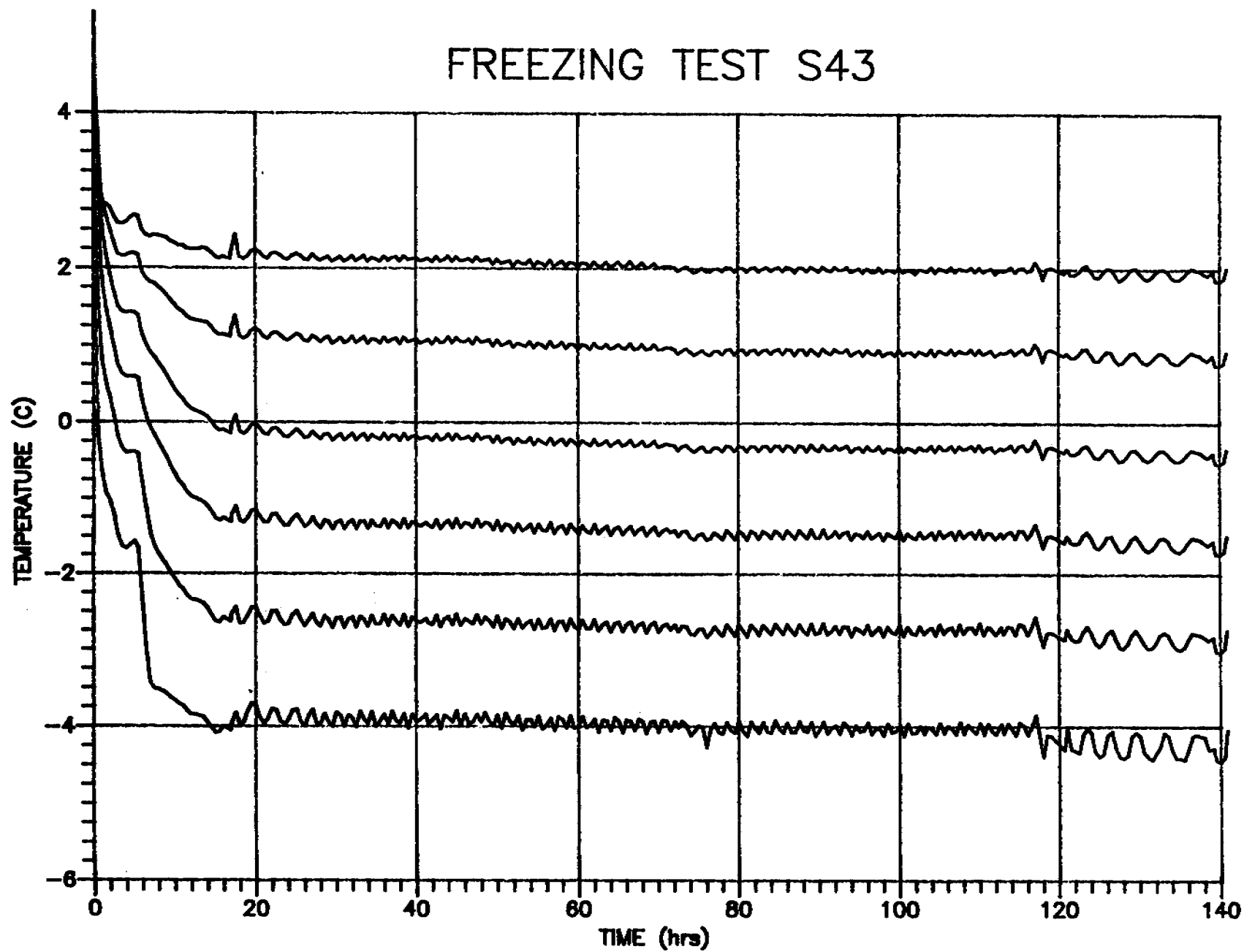
CONSOLIDATION TEST S43



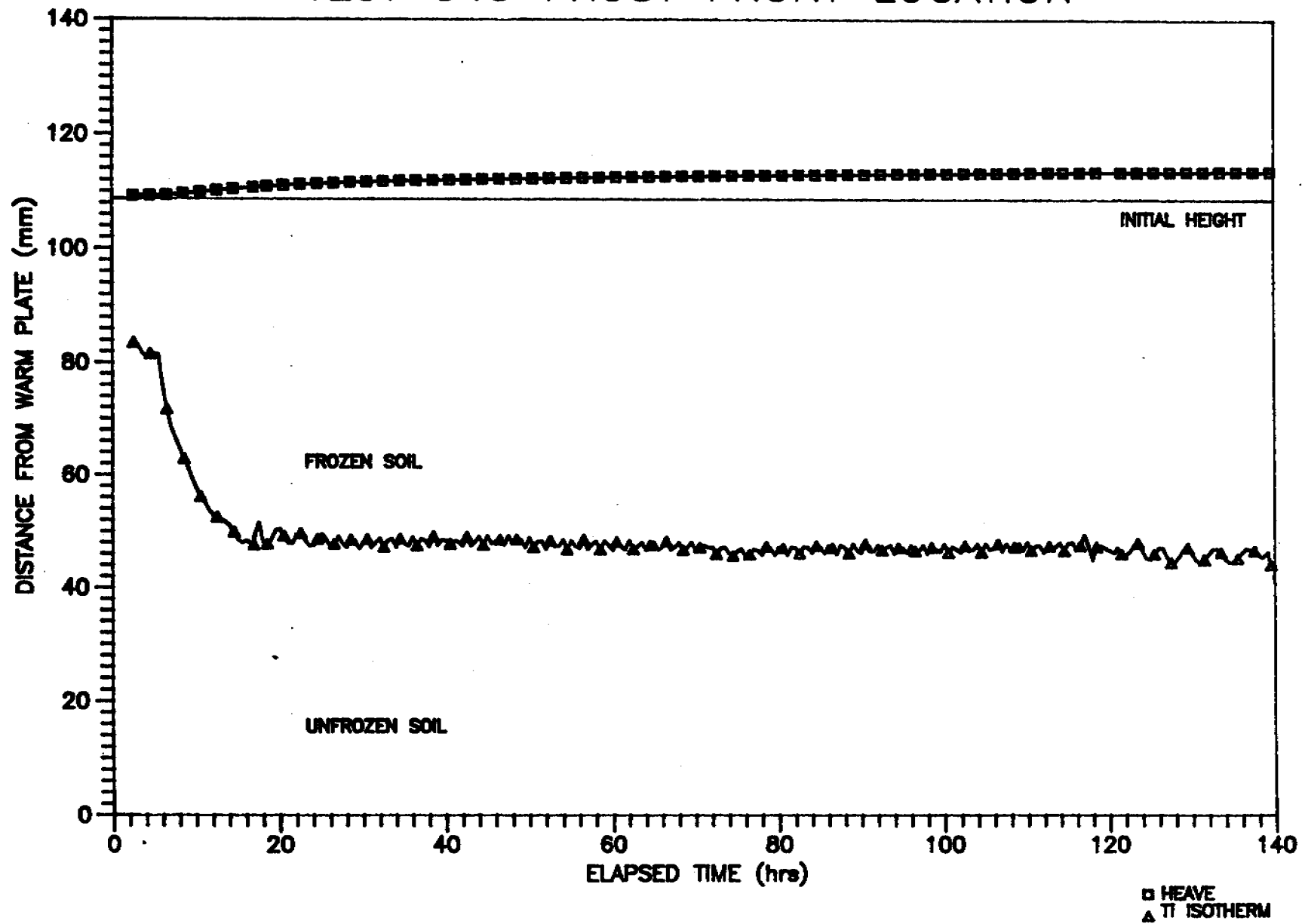
FREEZING TEST S43



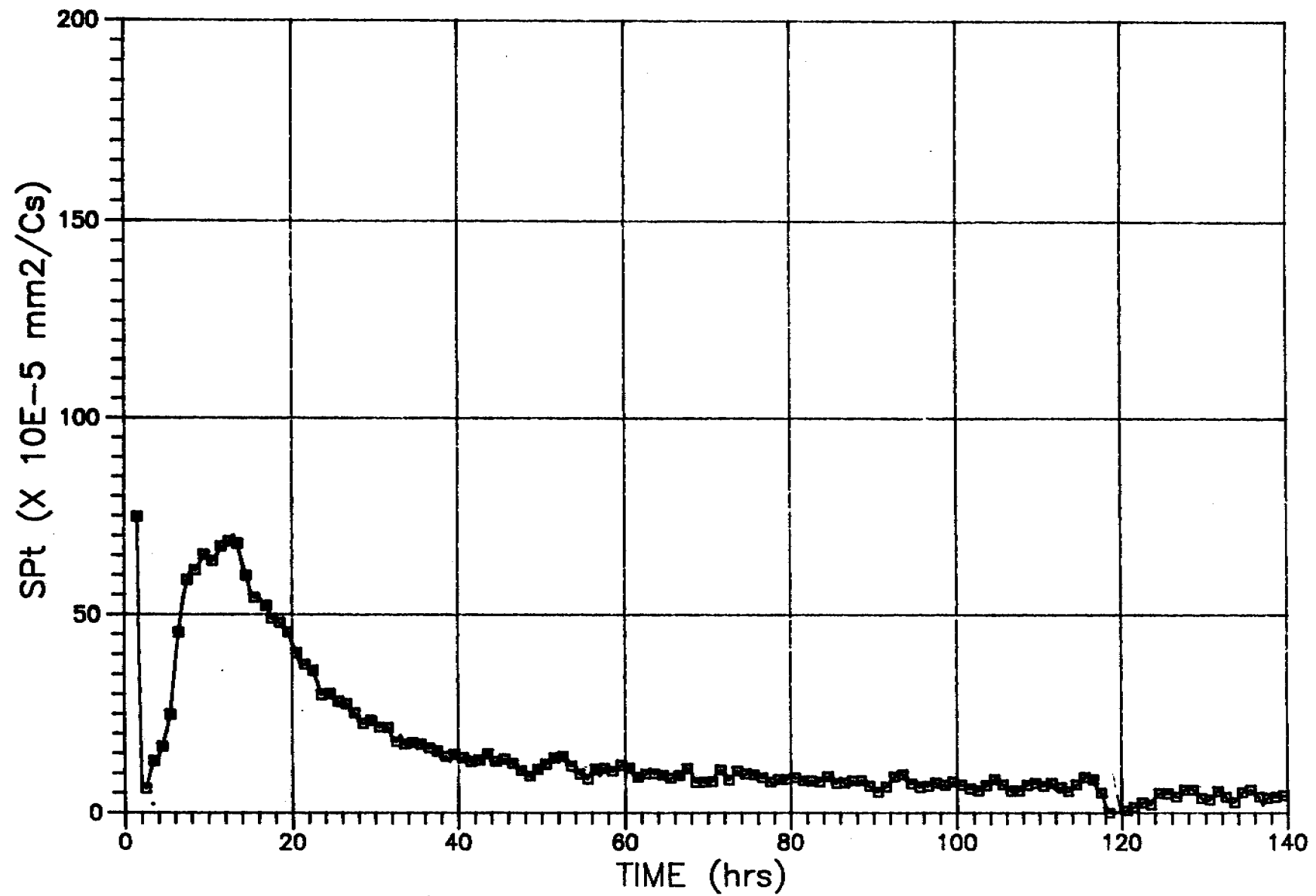
FREEZING TEST S43

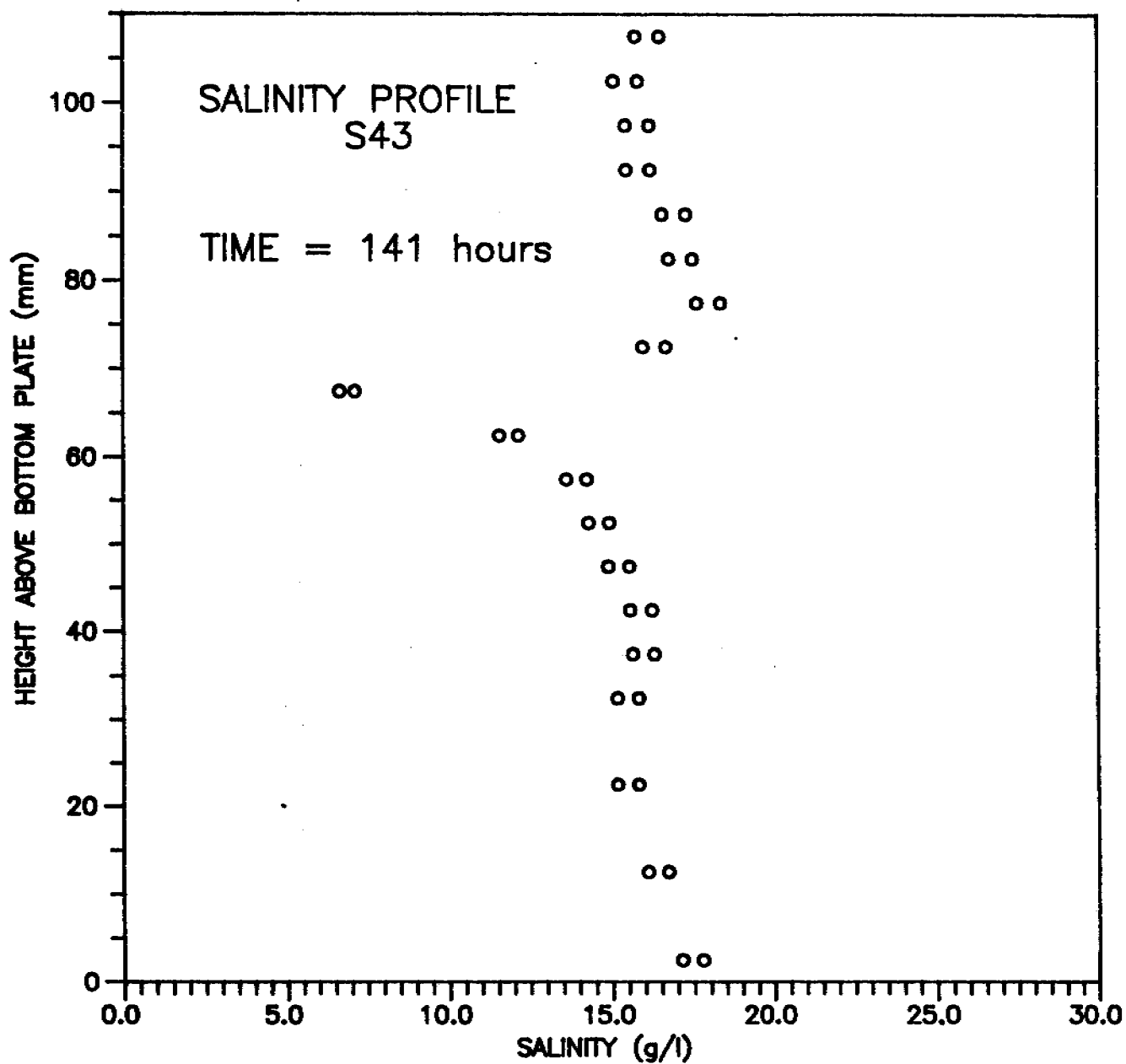


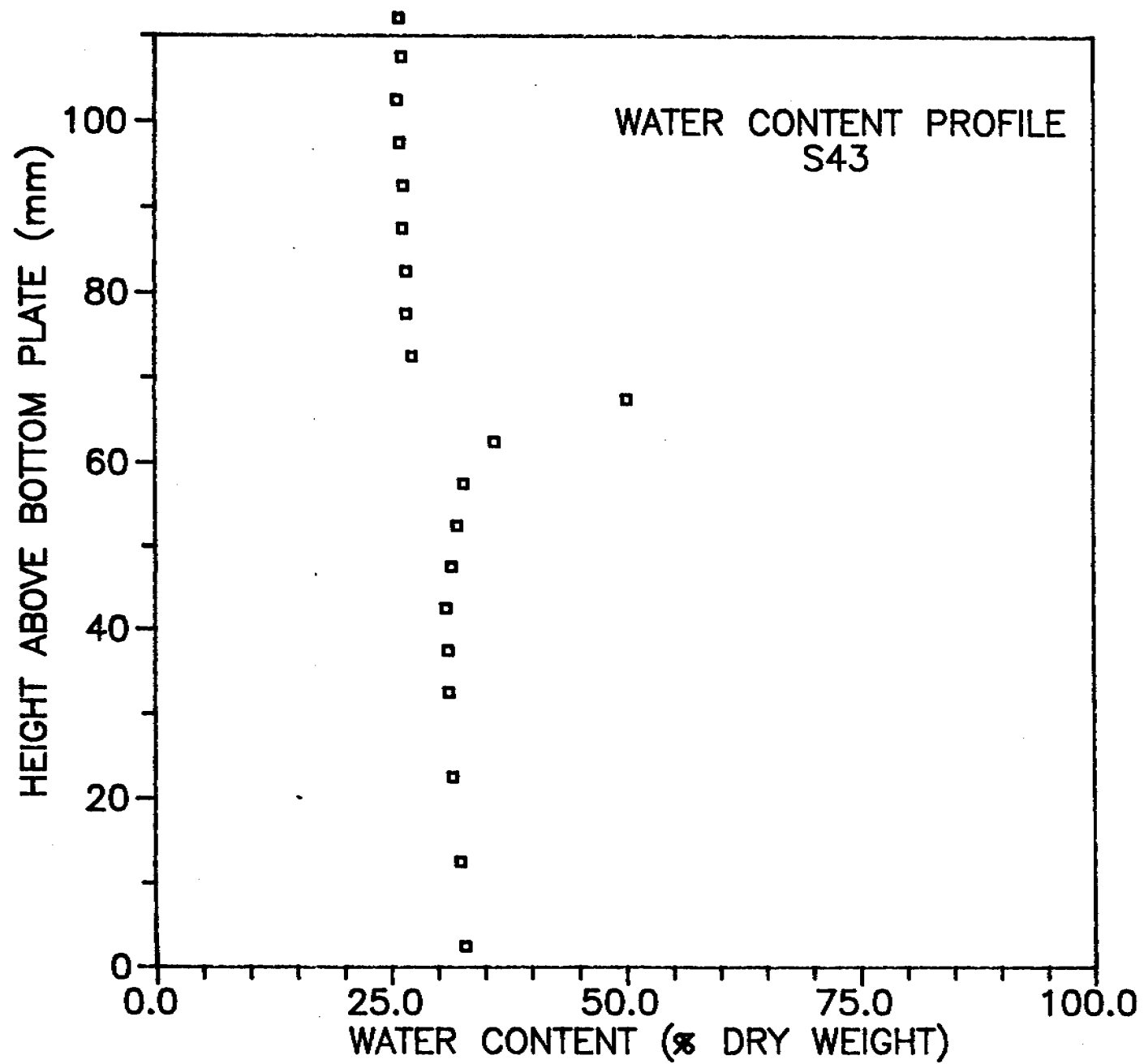
TEST S43 FROST FRONT LOCATION

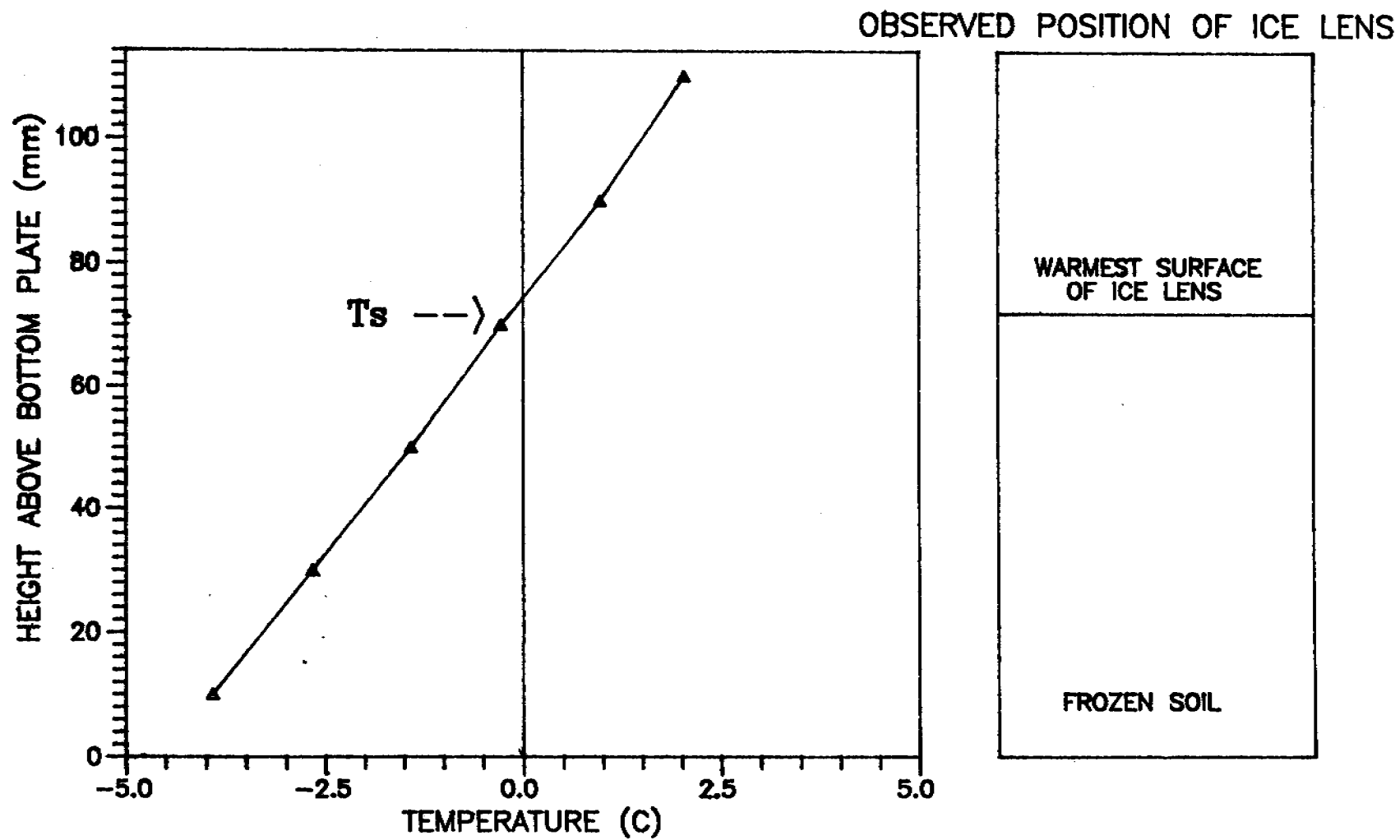


FREEZING TEST S43



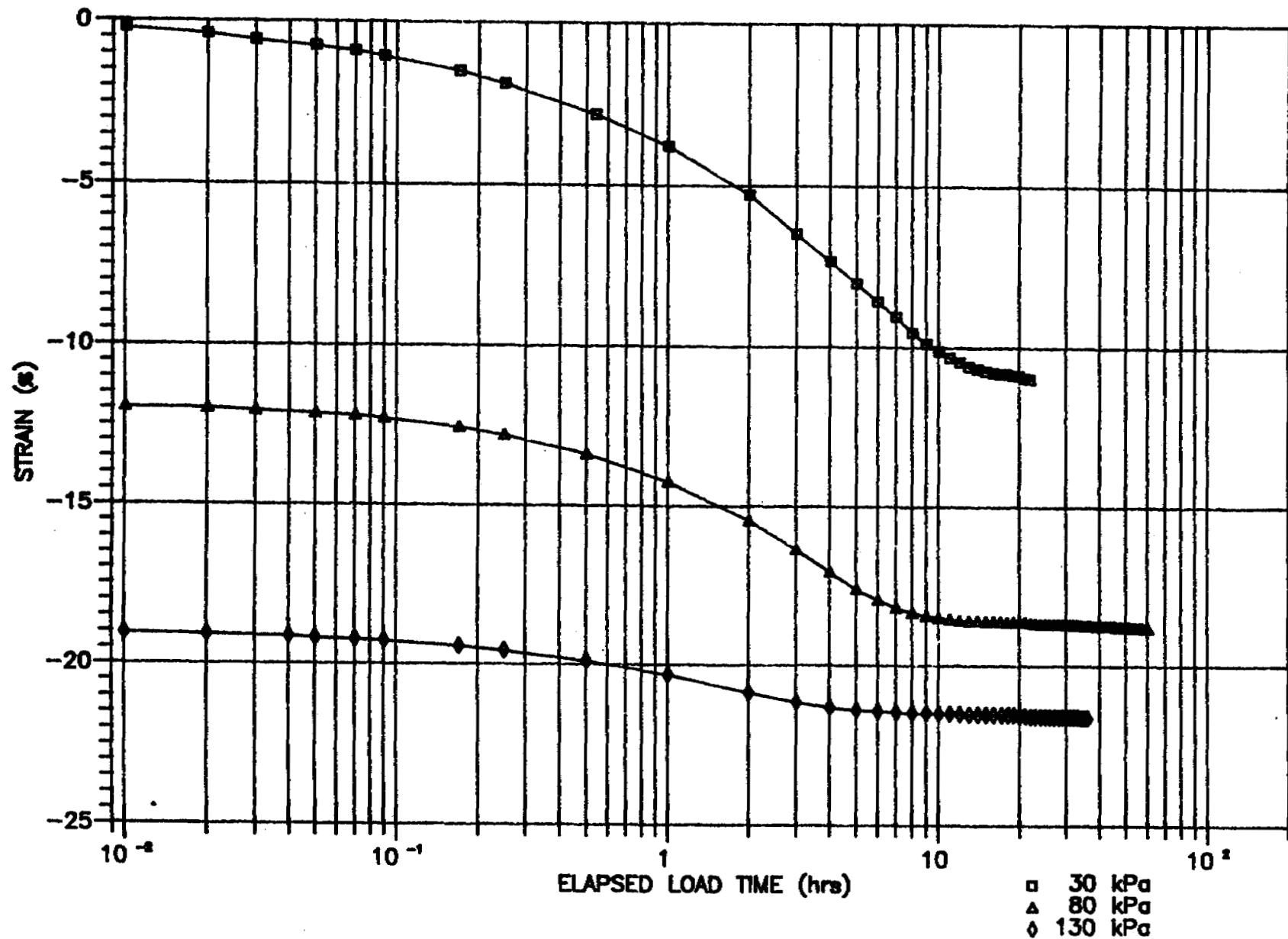




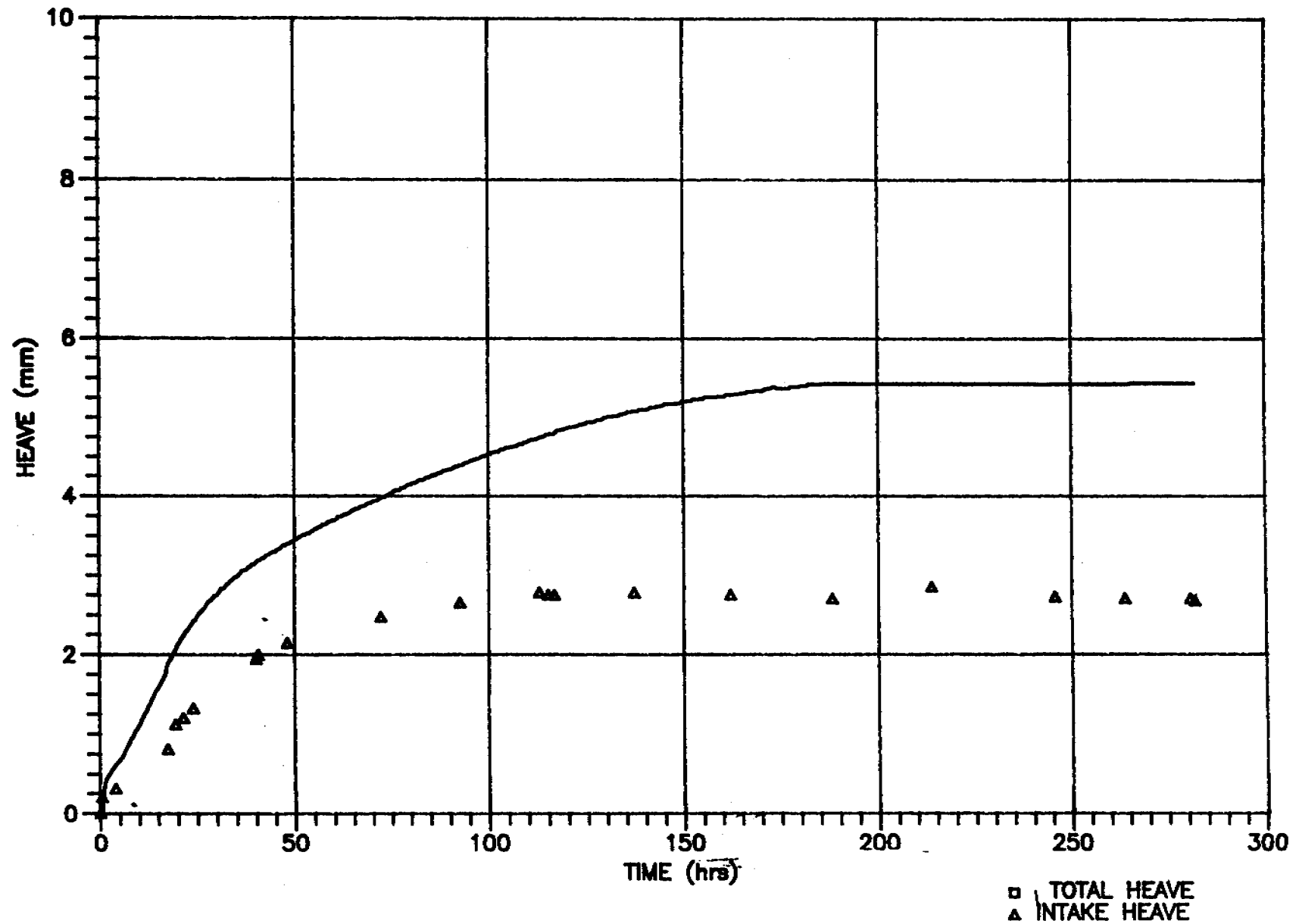


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S43

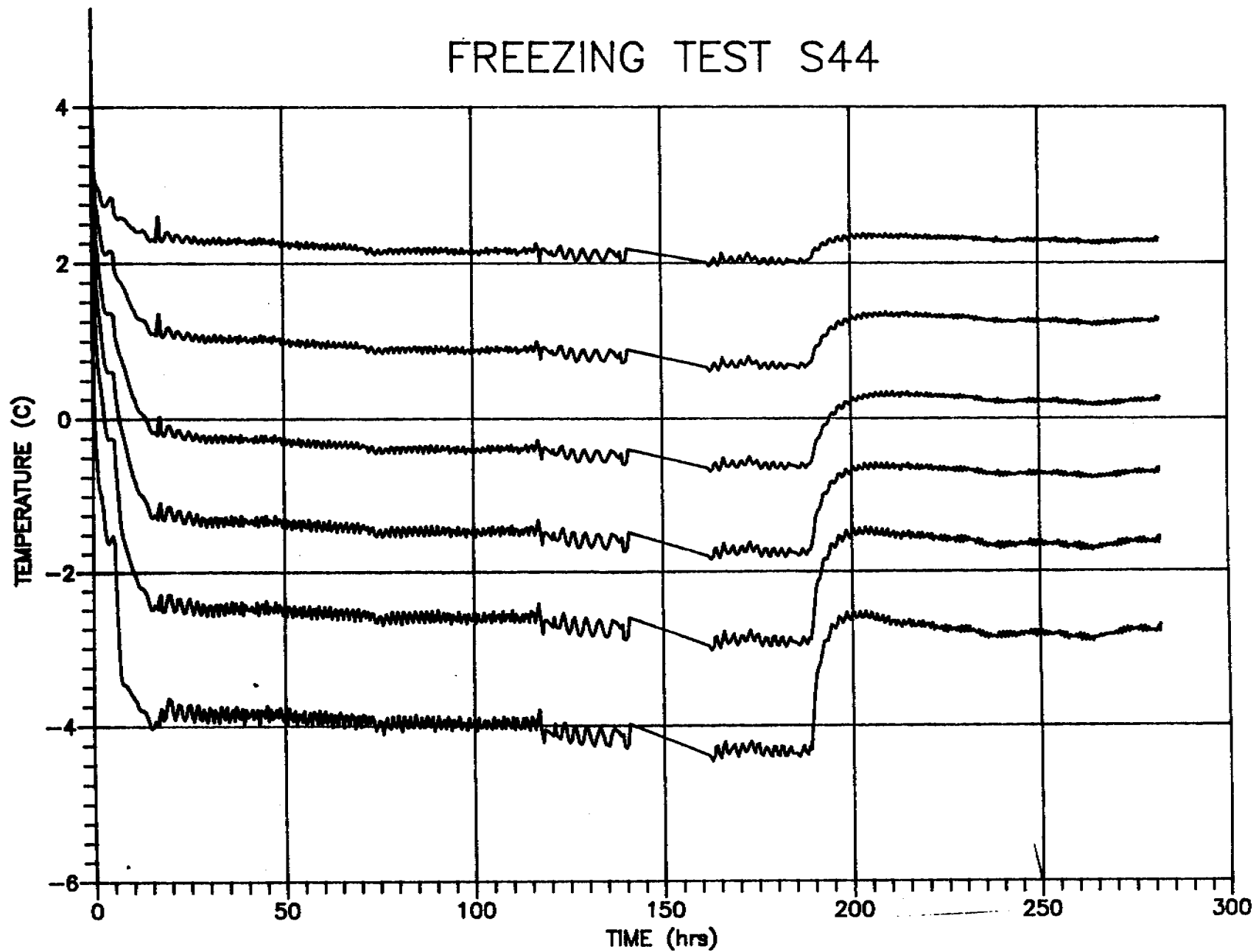
CONSOLIDATION TEST S44



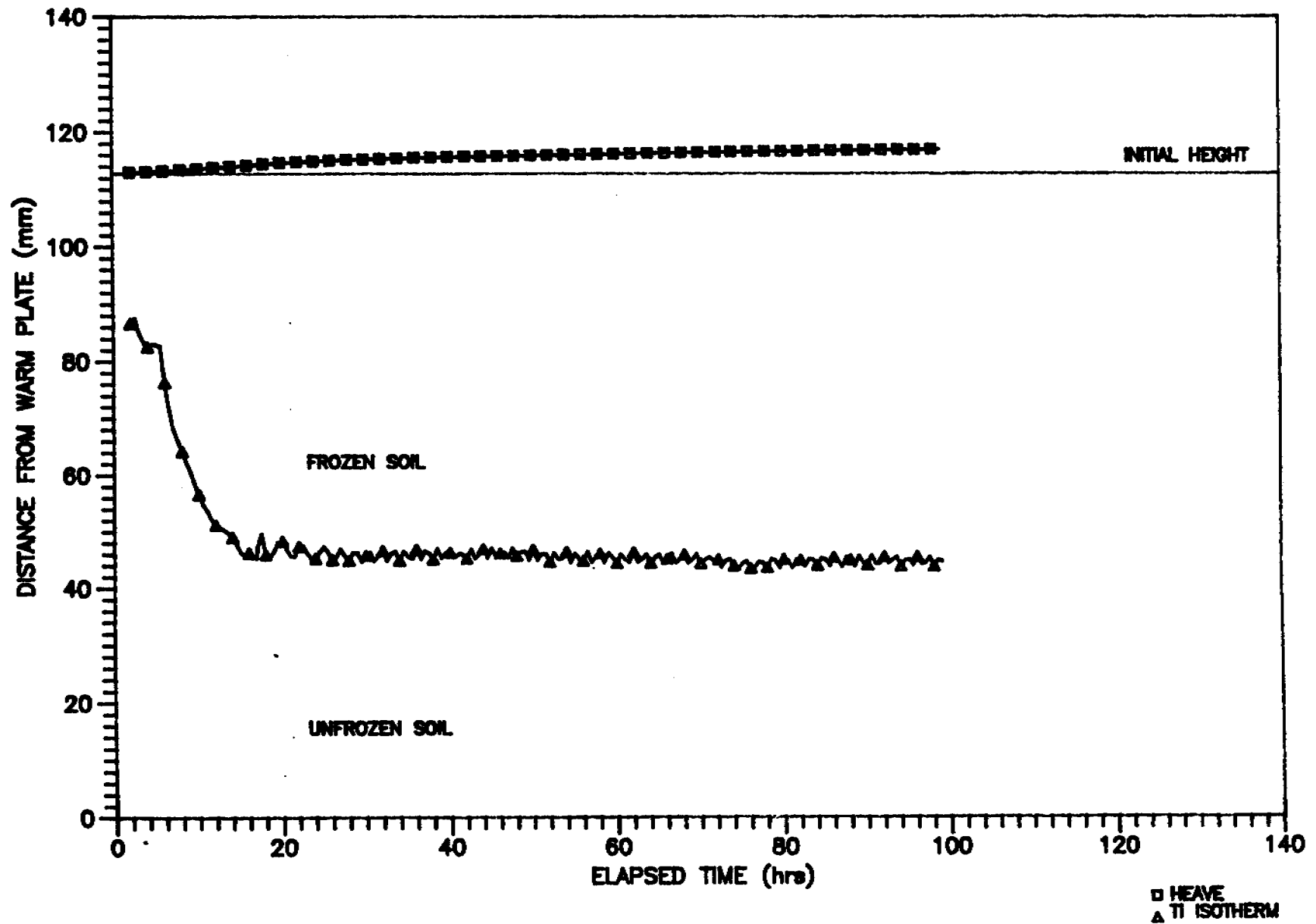
FREEZING TEST S44



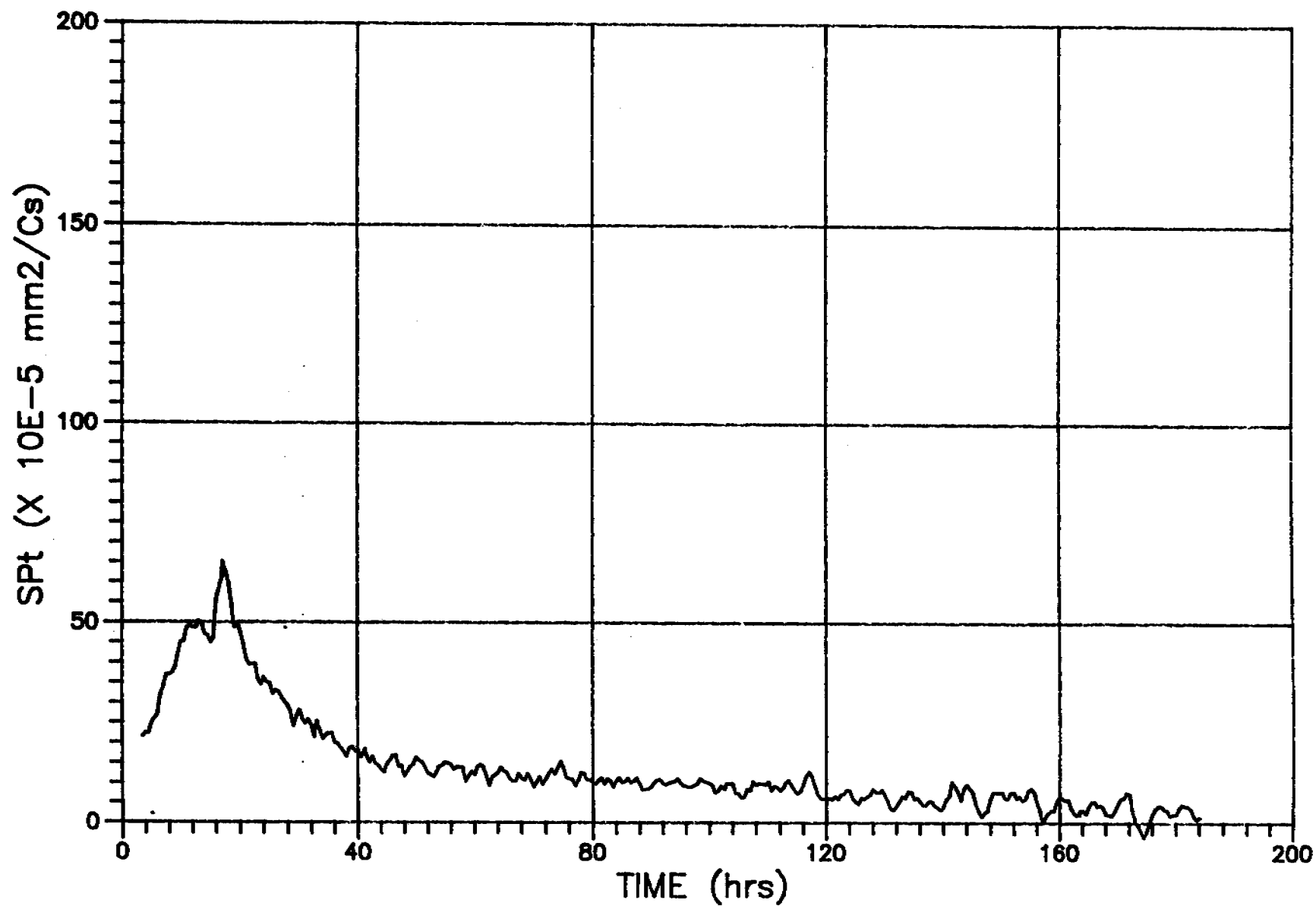
FREEZING TEST S44

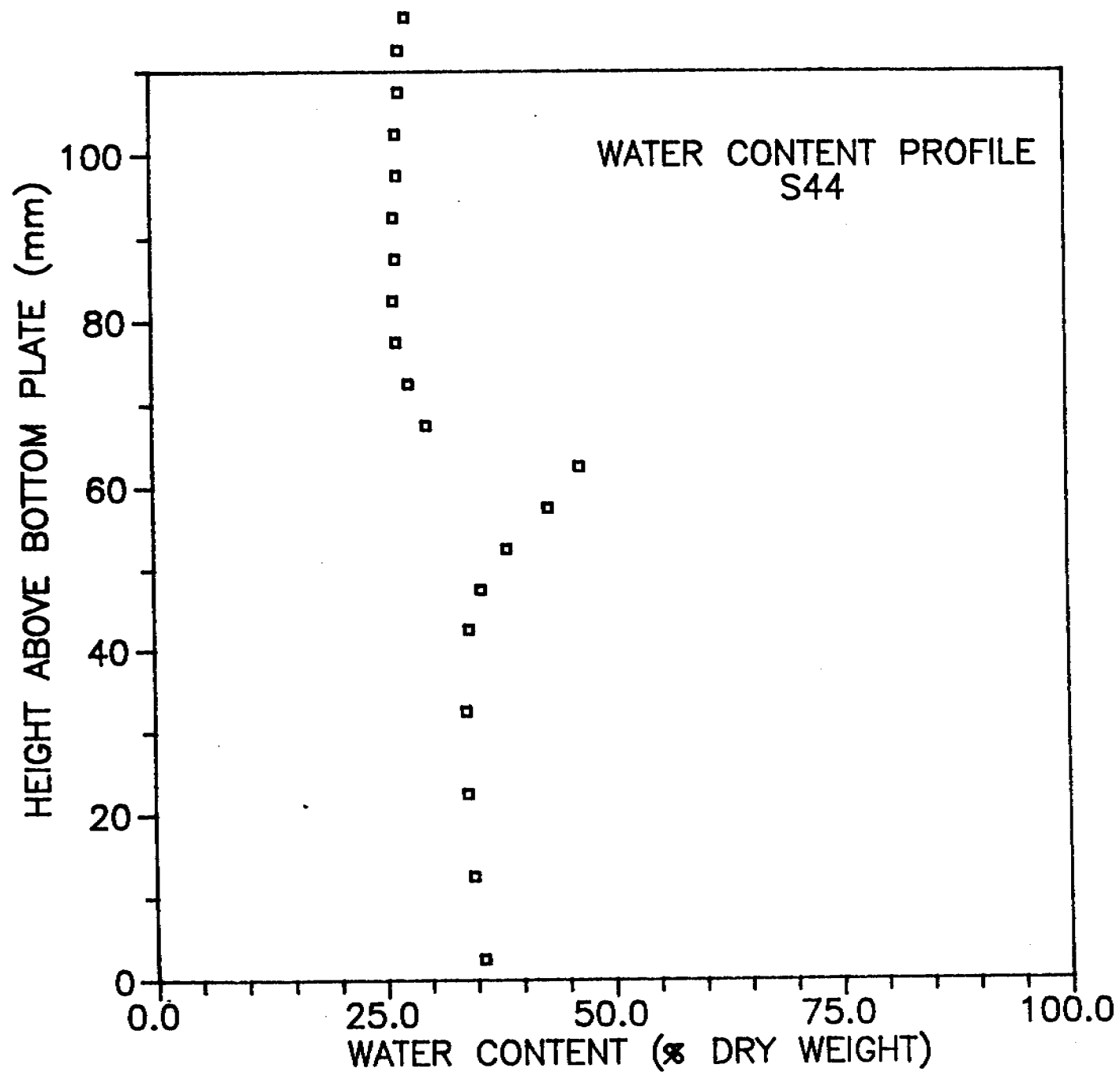


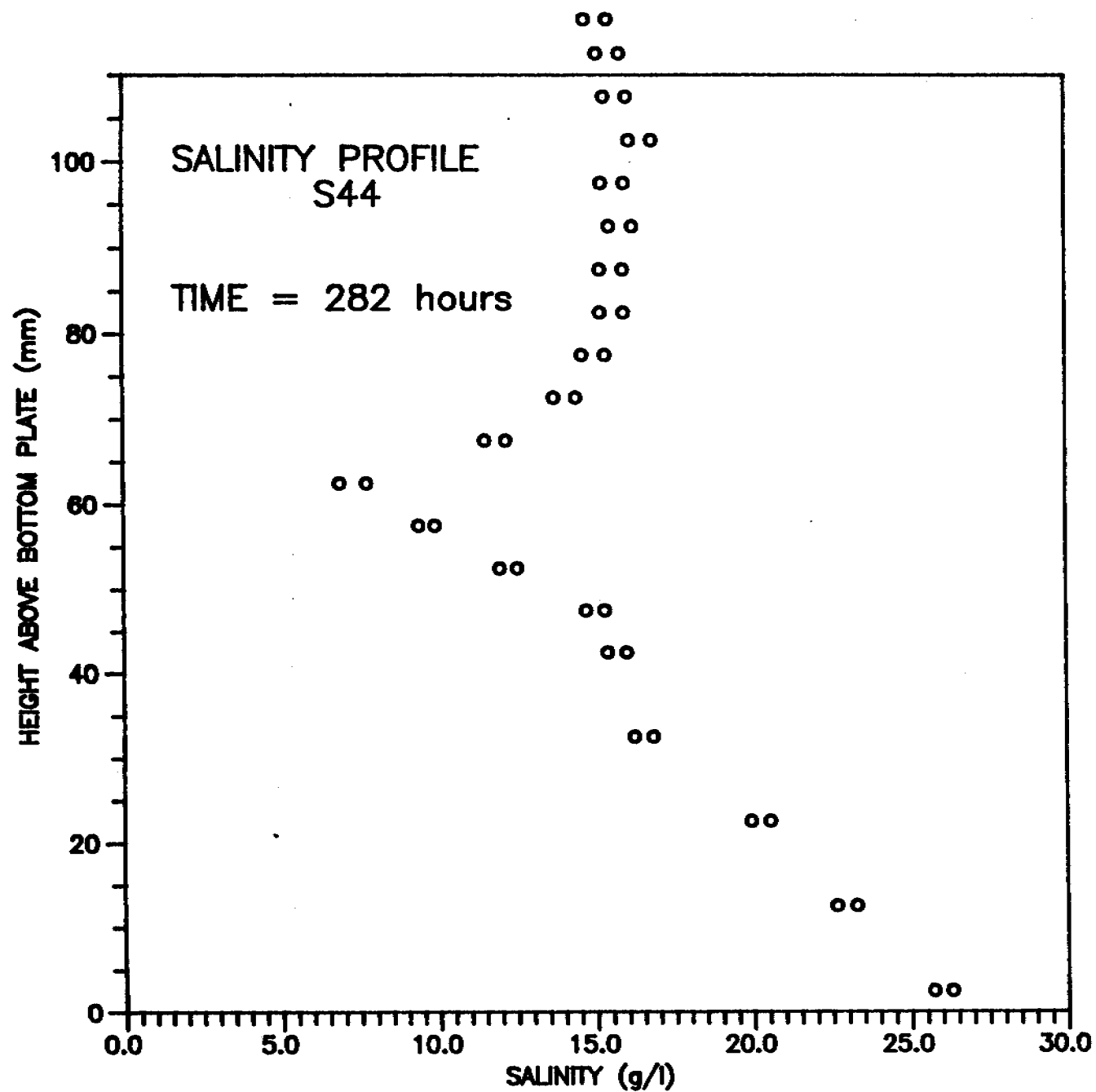
TEST S44 FROST FRONT LOCATION

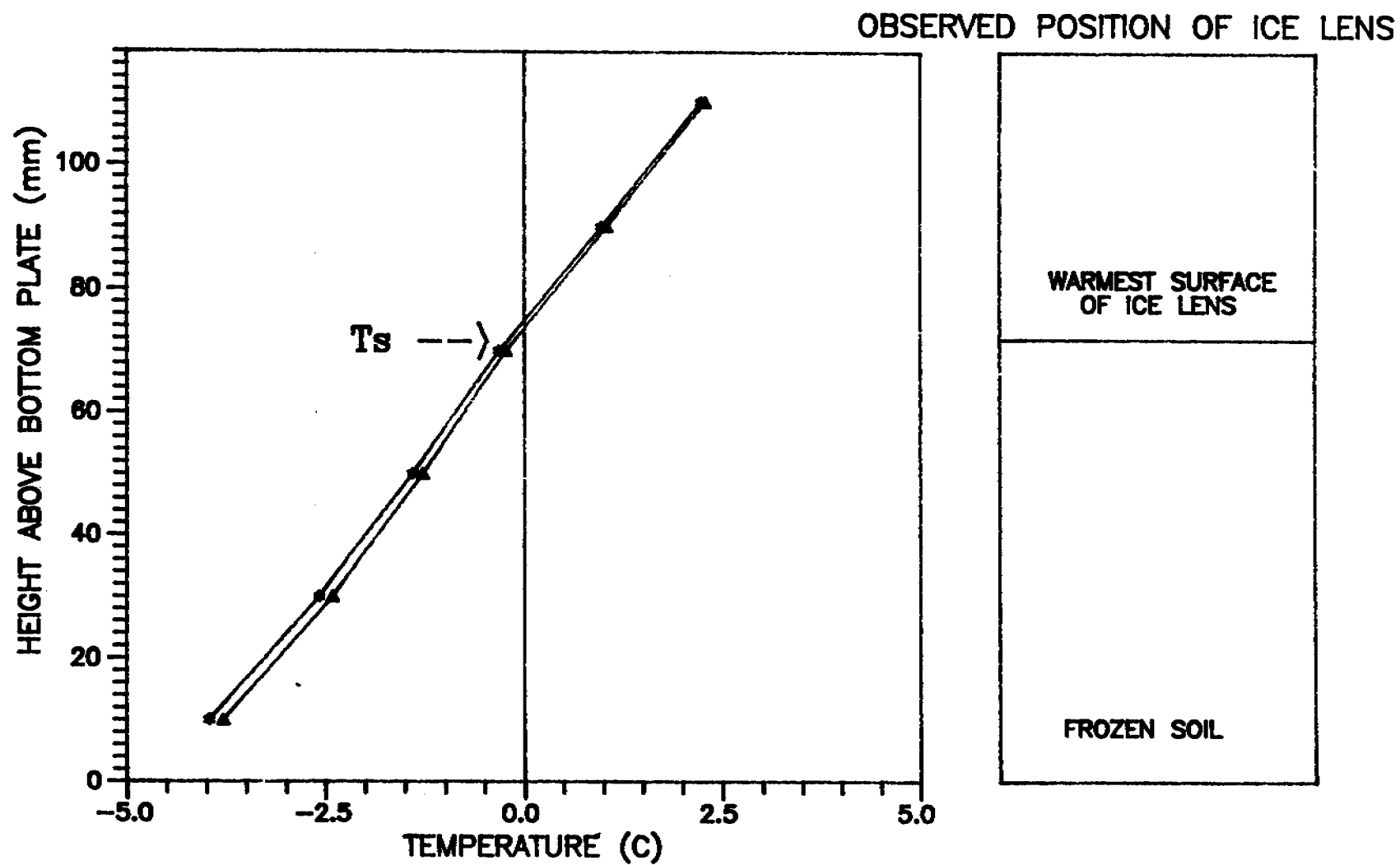


FREEZING TEST S44



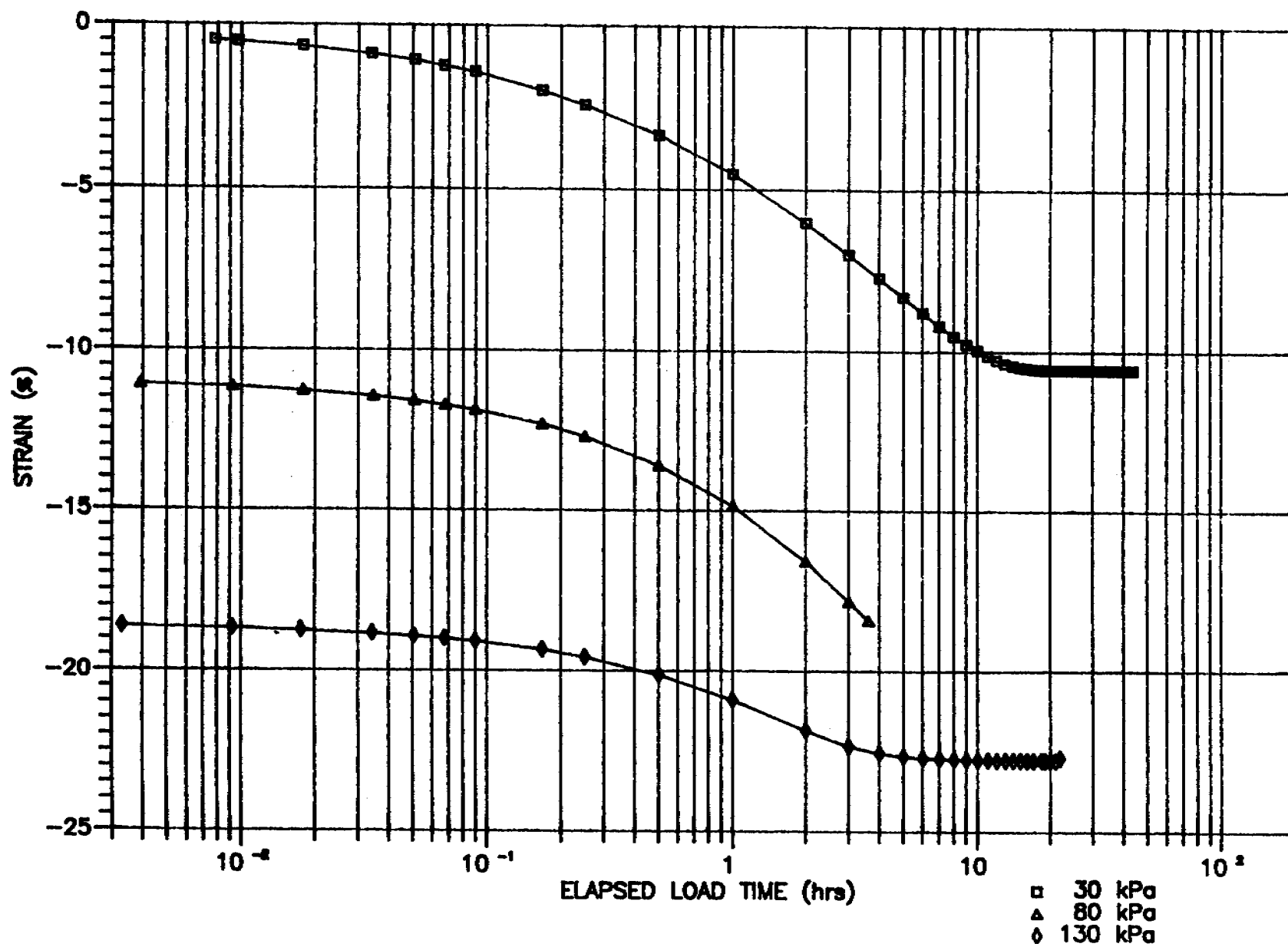




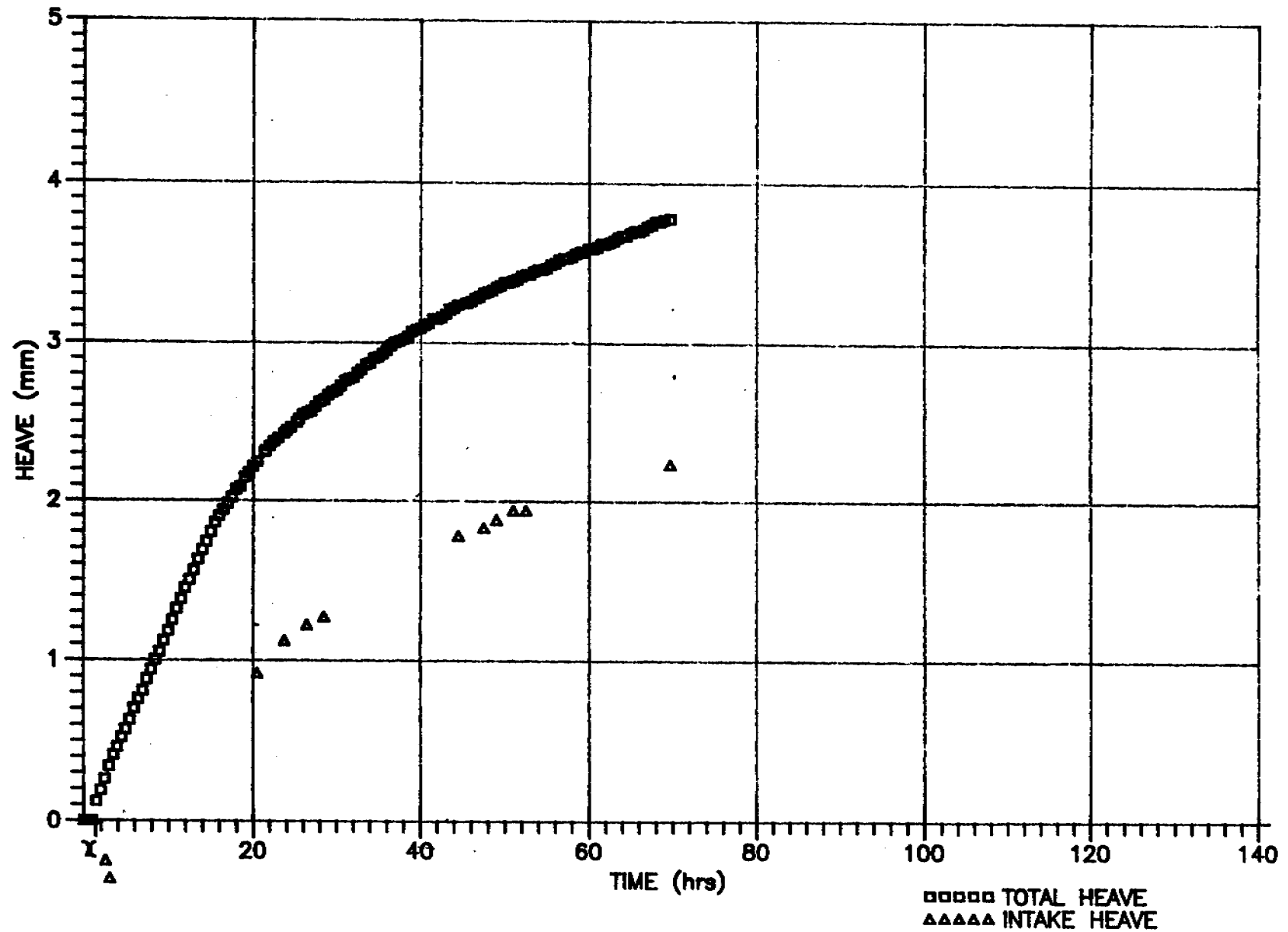


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S44

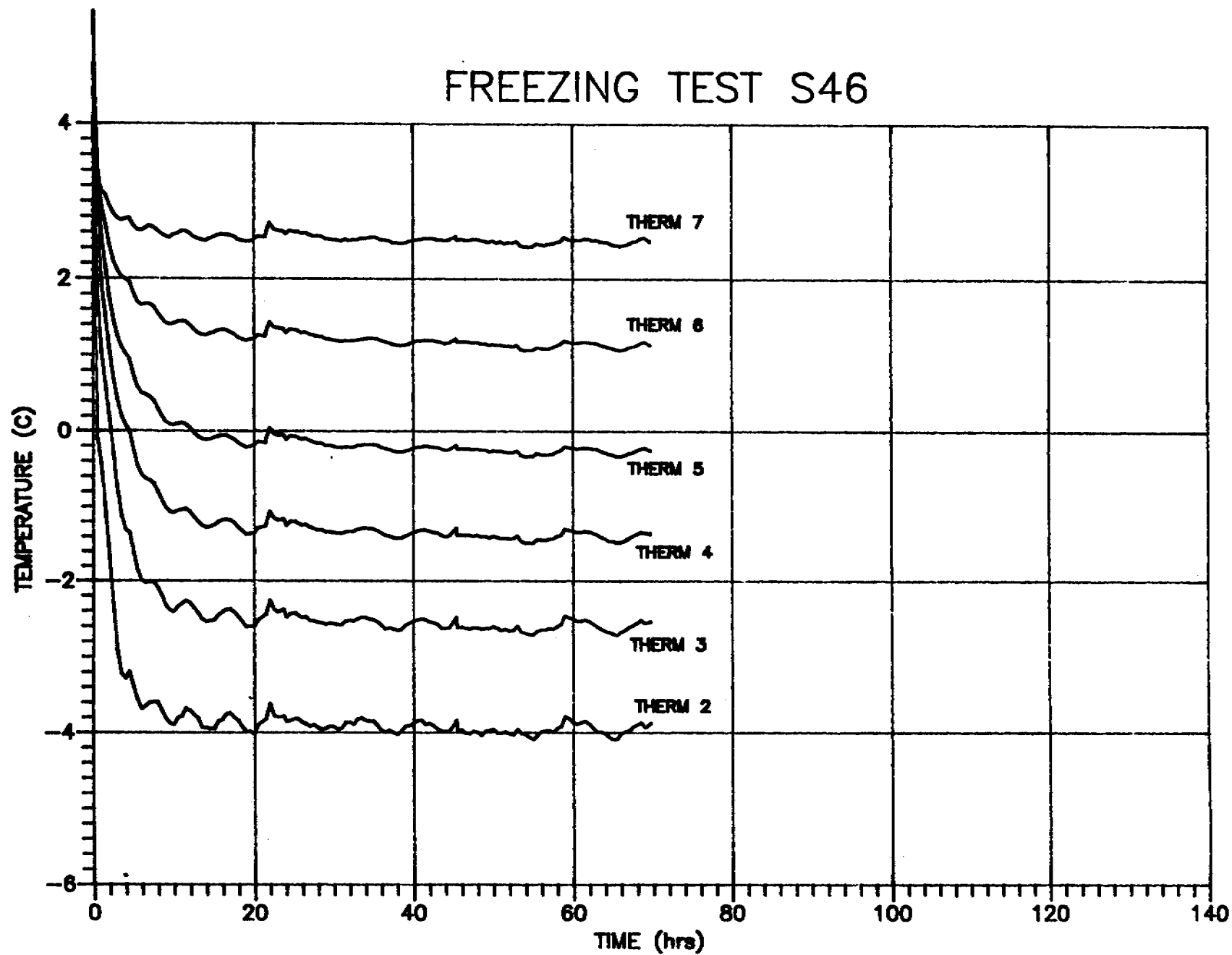
CONSOLIDATION TEST S46



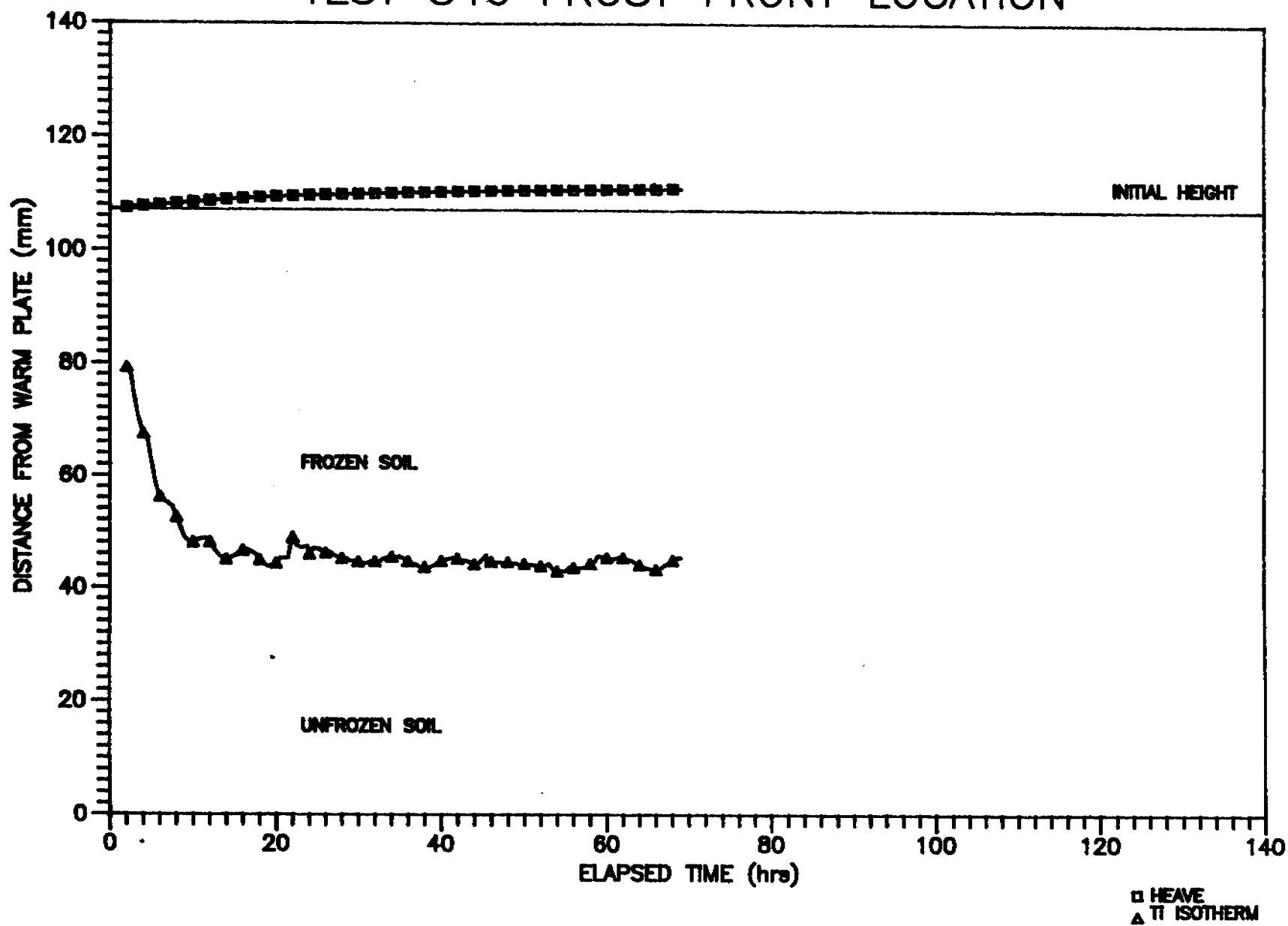
FREEZING TEST S46



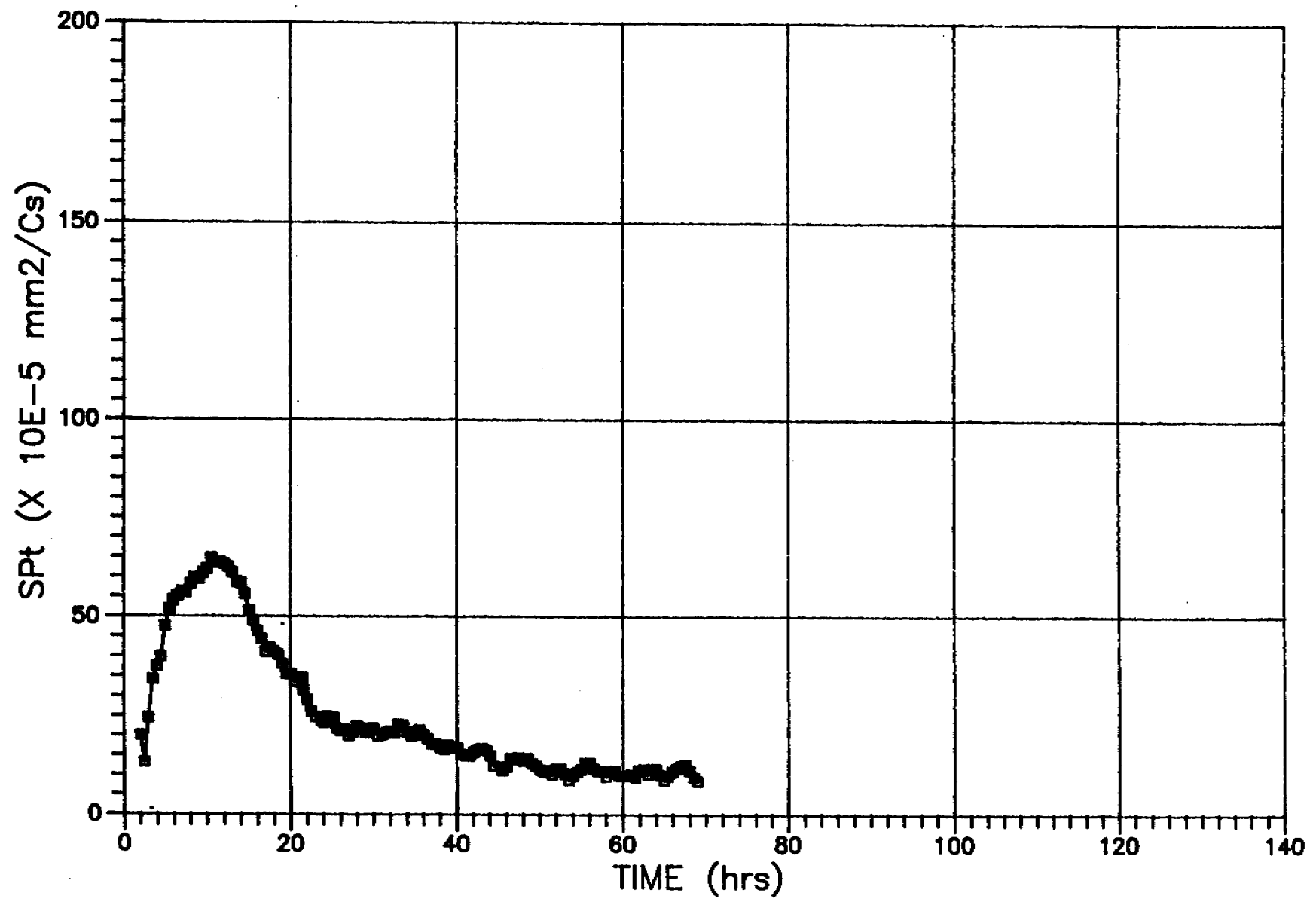
FREEZING TEST S46

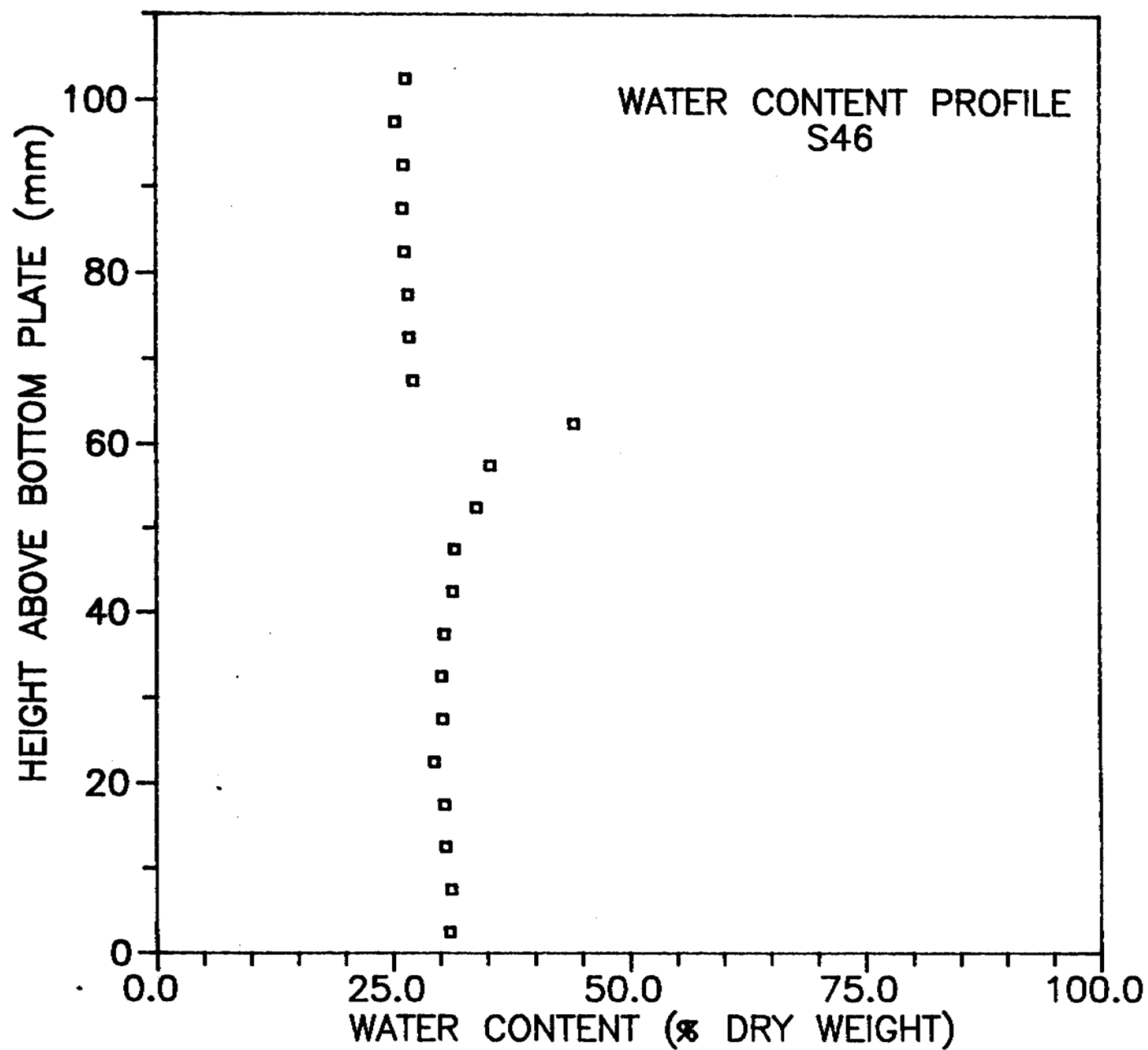


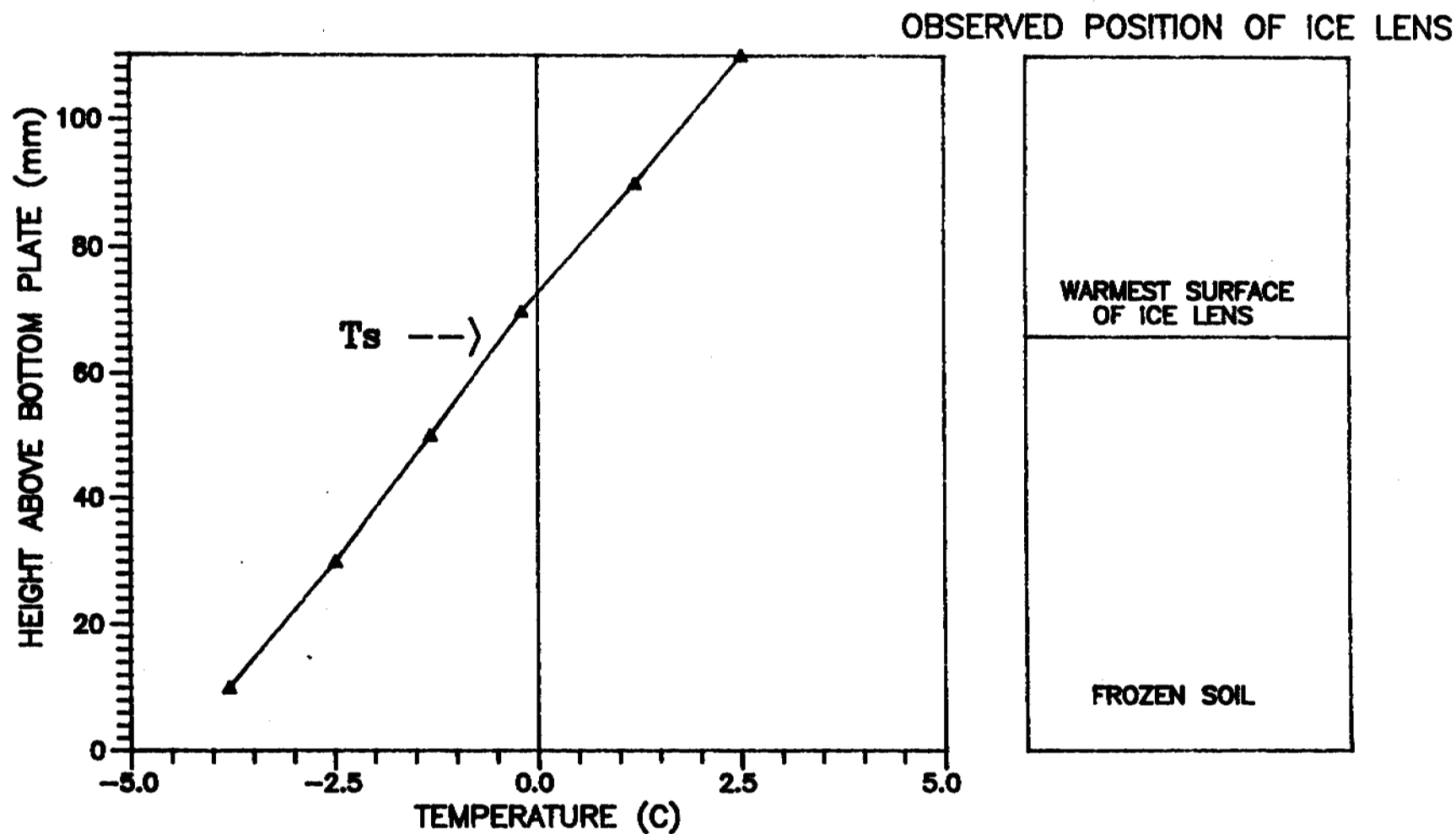
TEST S46 FROST FRONT LOCATION



FREEZING TEST S46

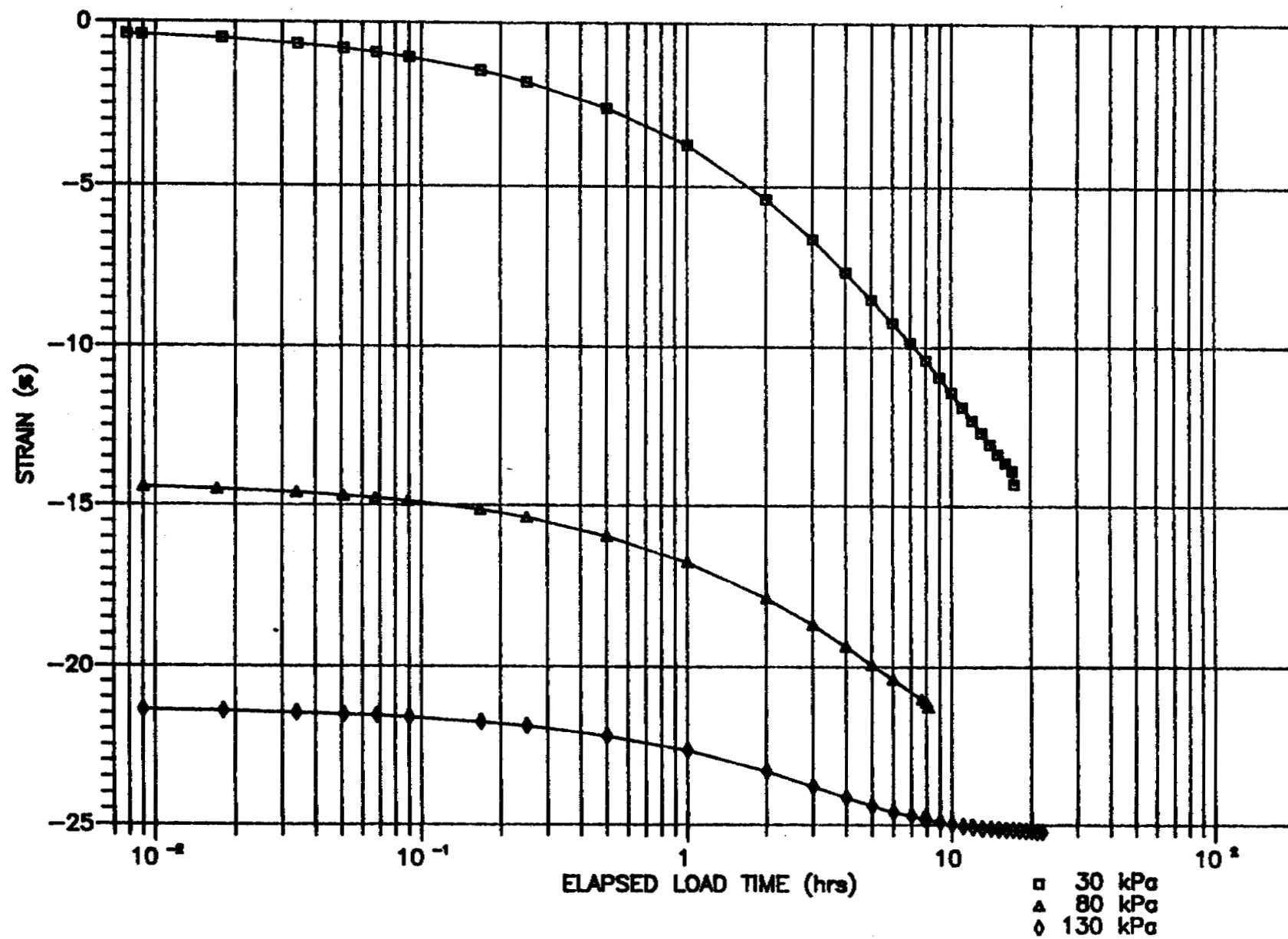




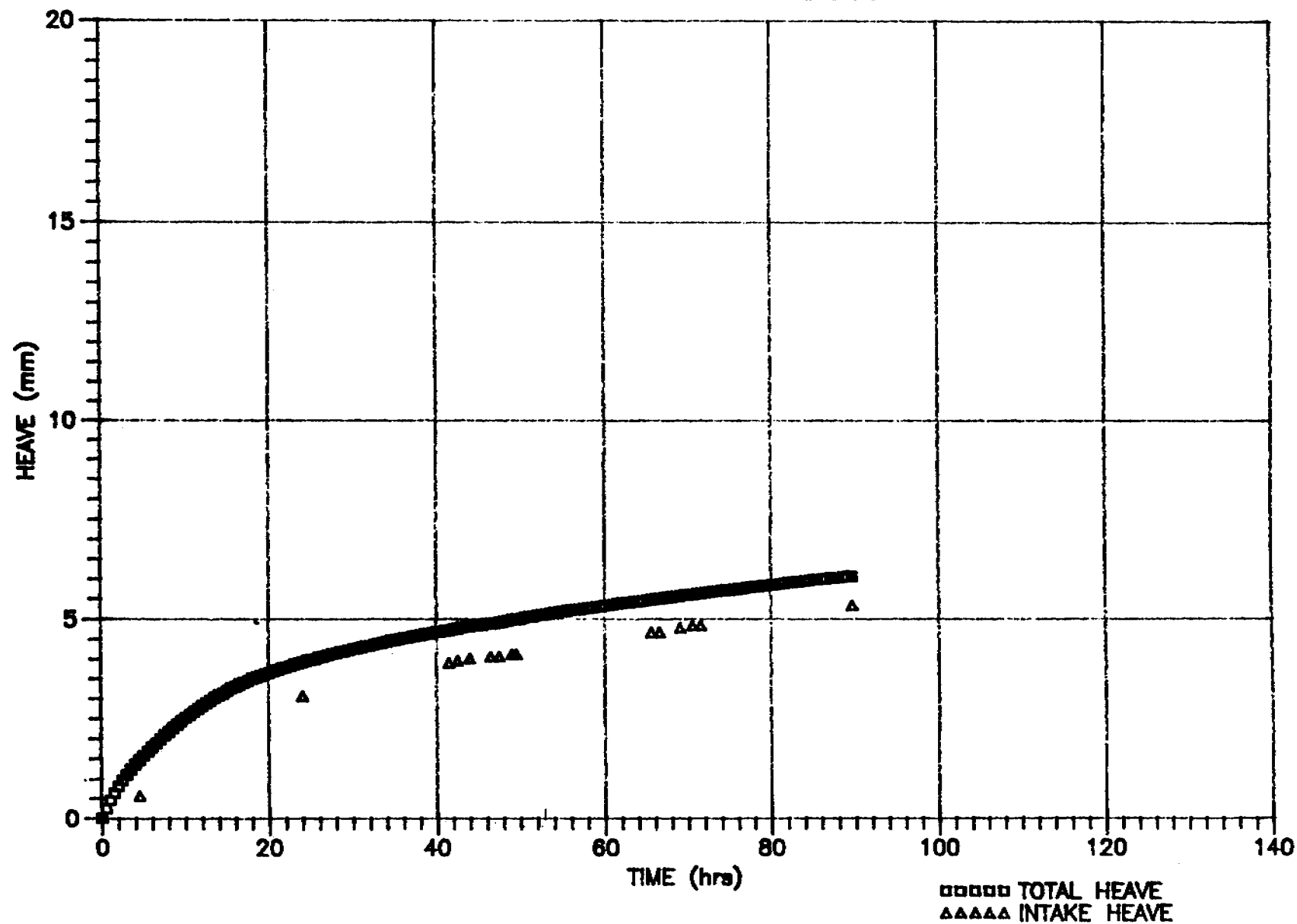


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S46

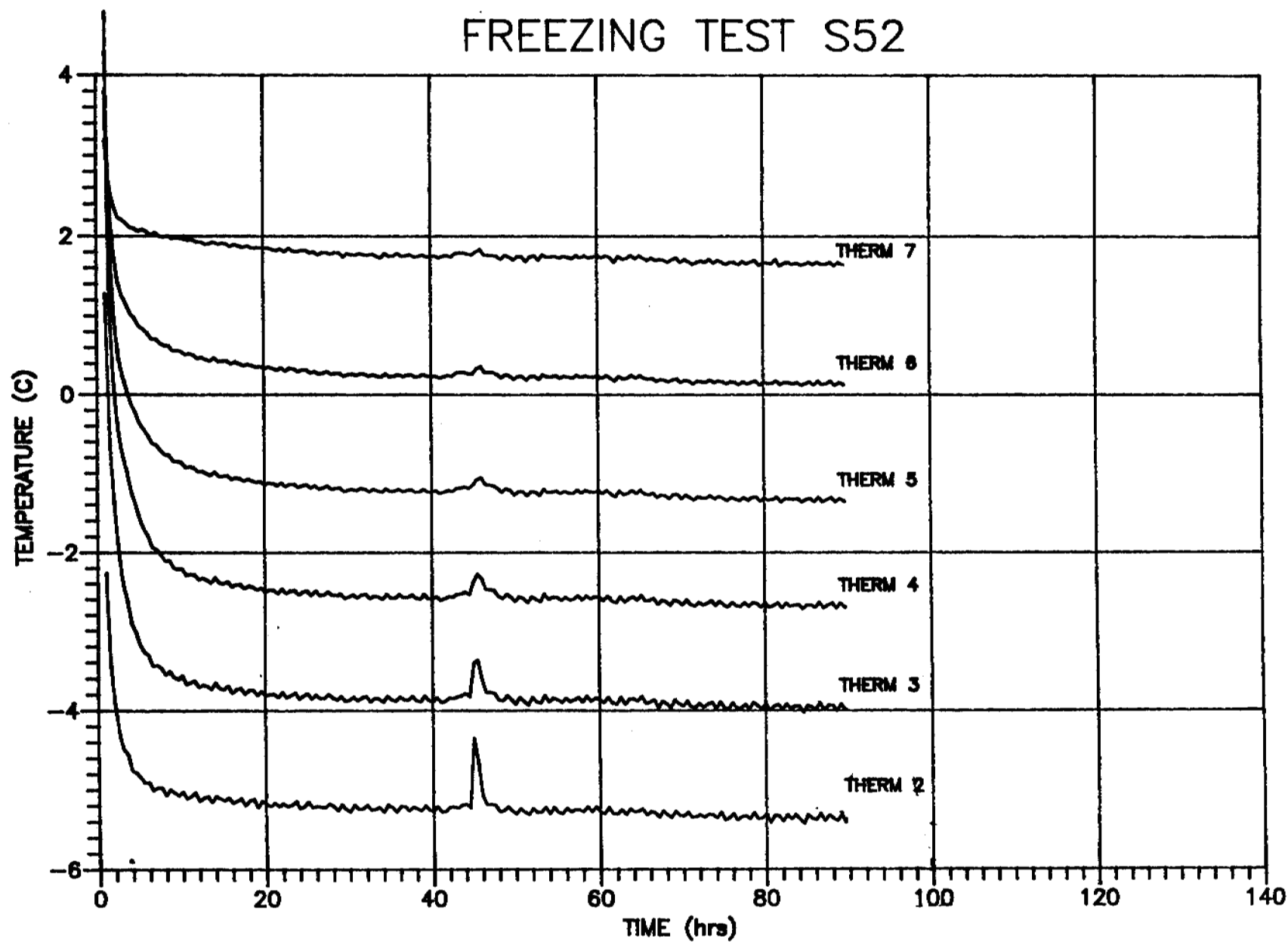
CONSOLIDATION TEST S52



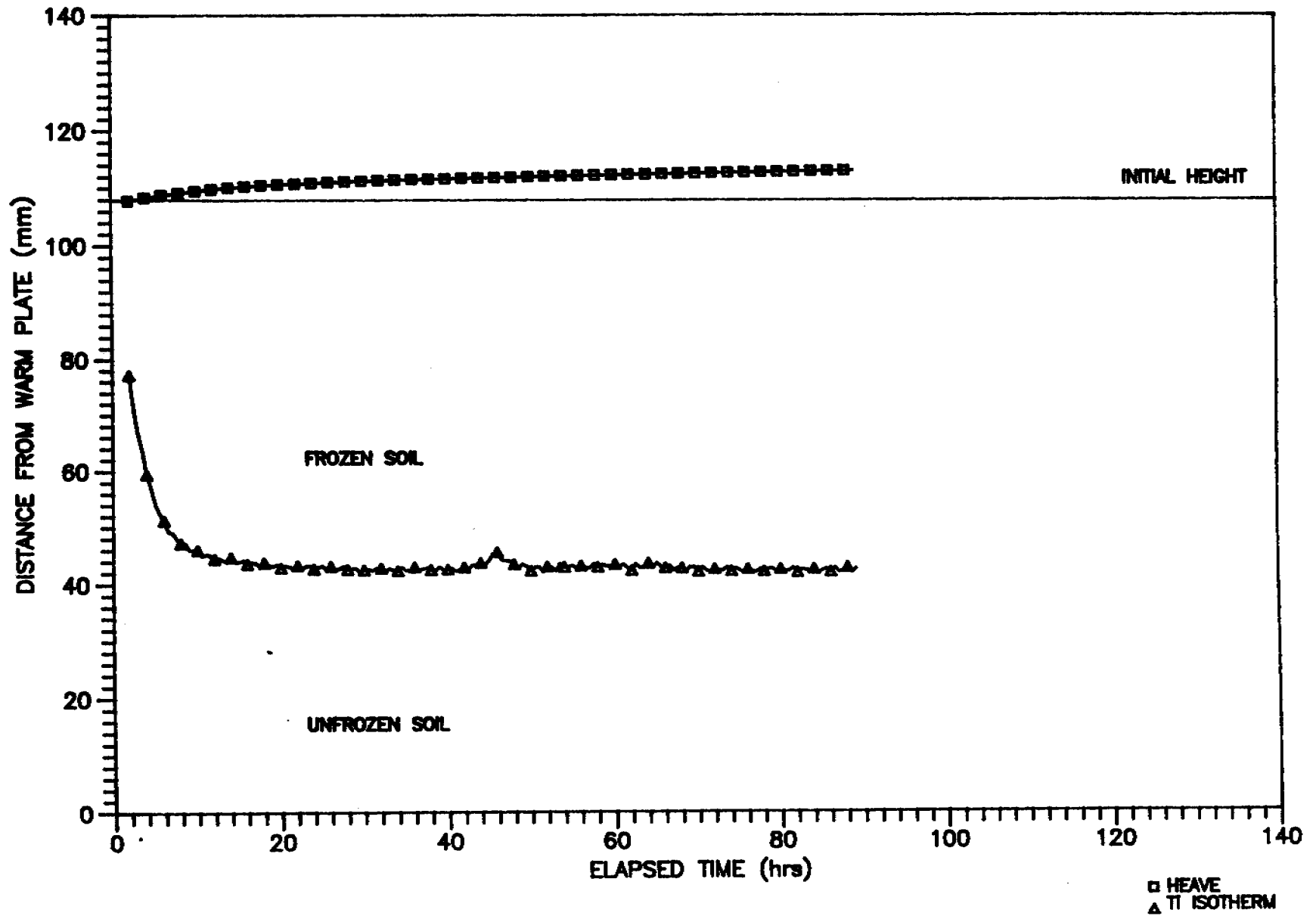
FREEZING TEST S52



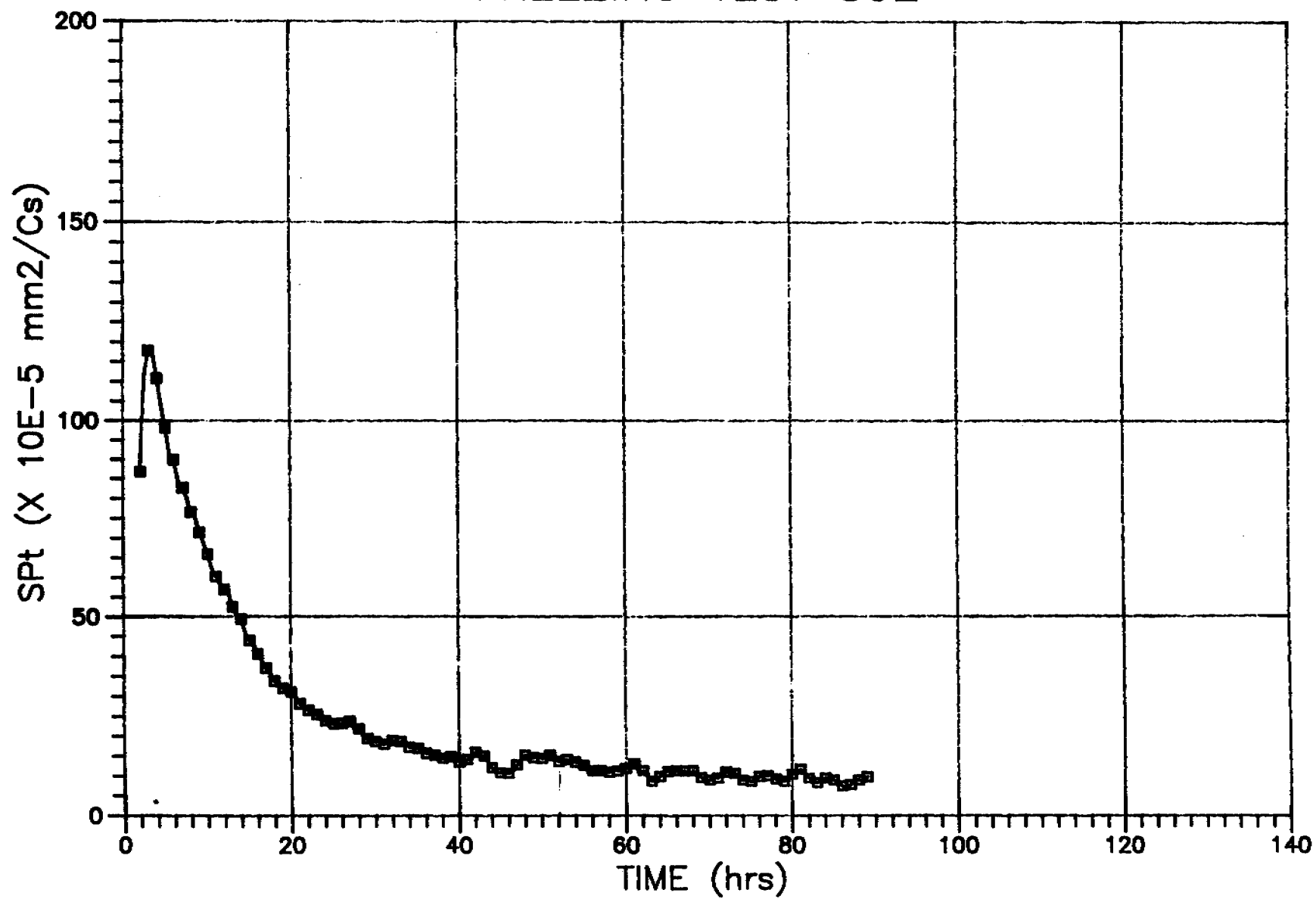
FREEZING TEST S52

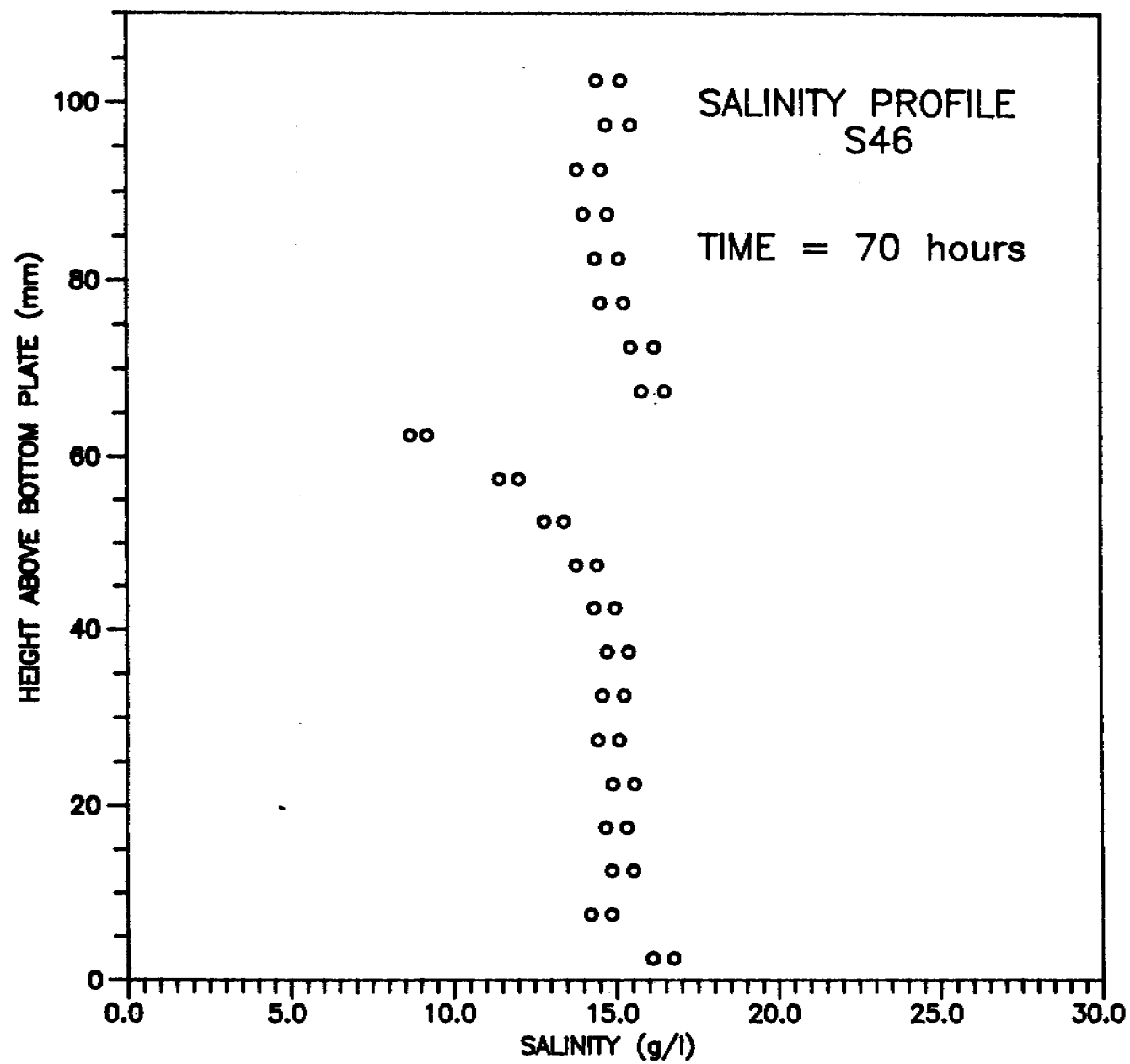


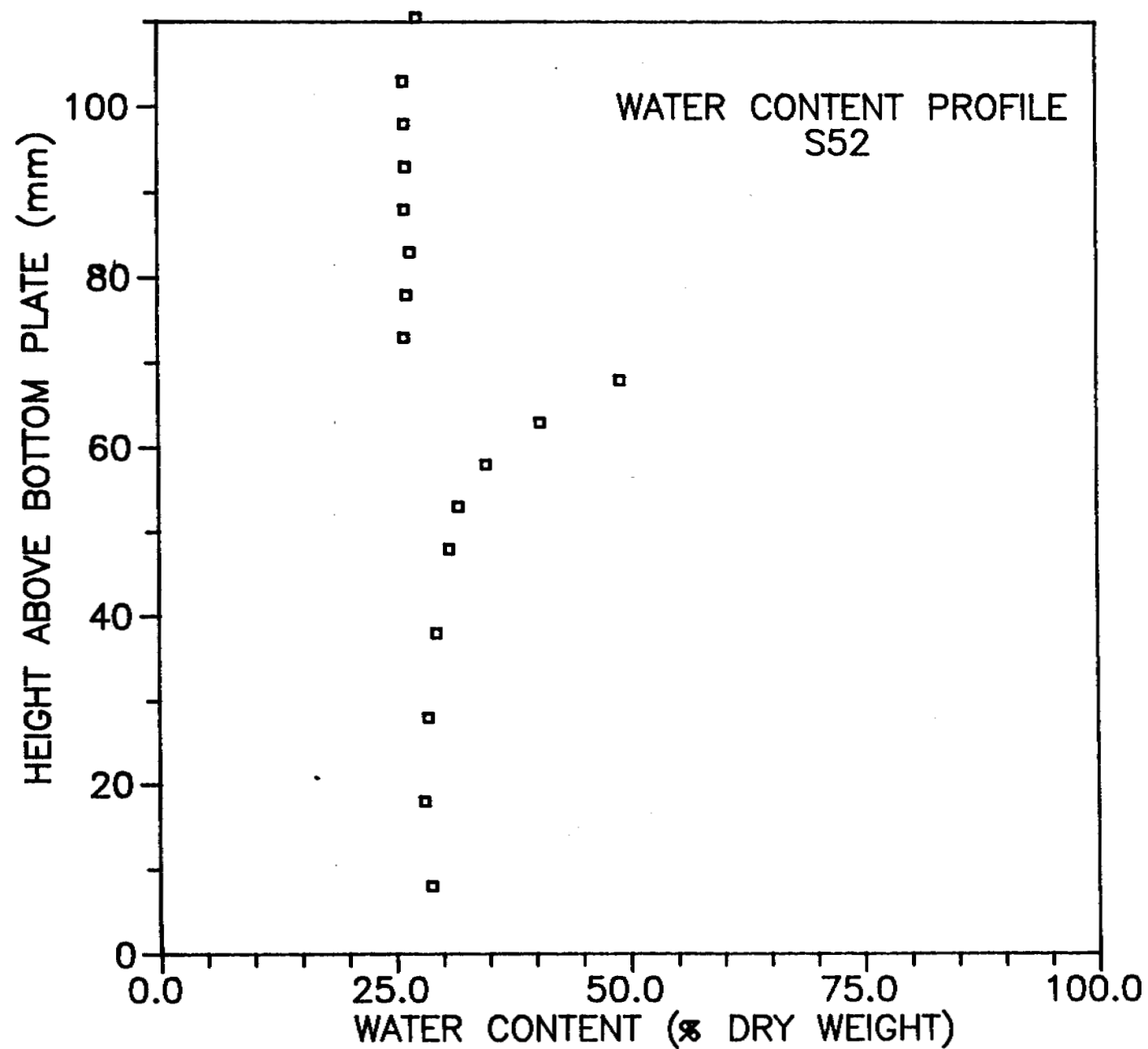
TEST S52 FROST FRONT LOCATION

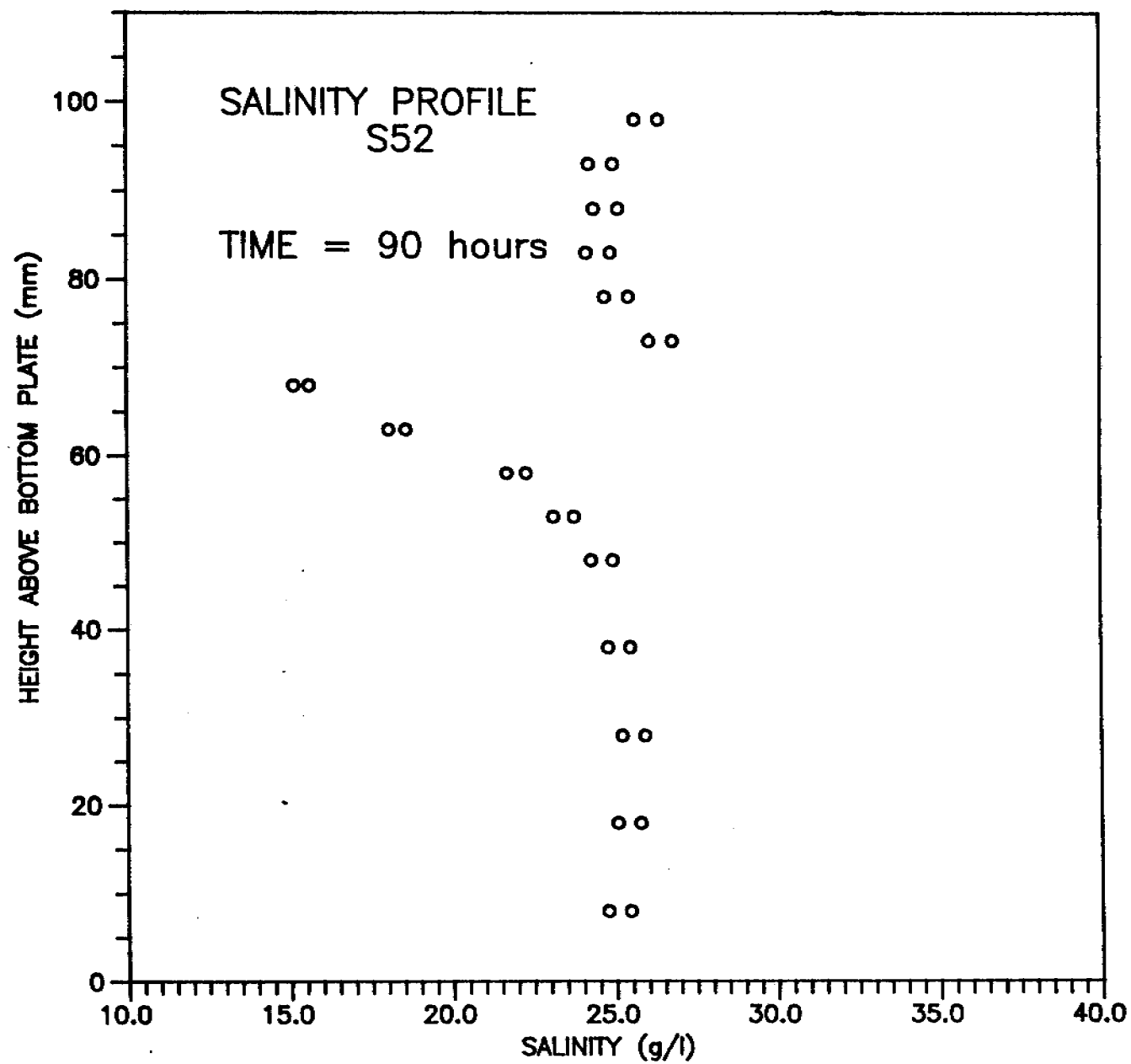


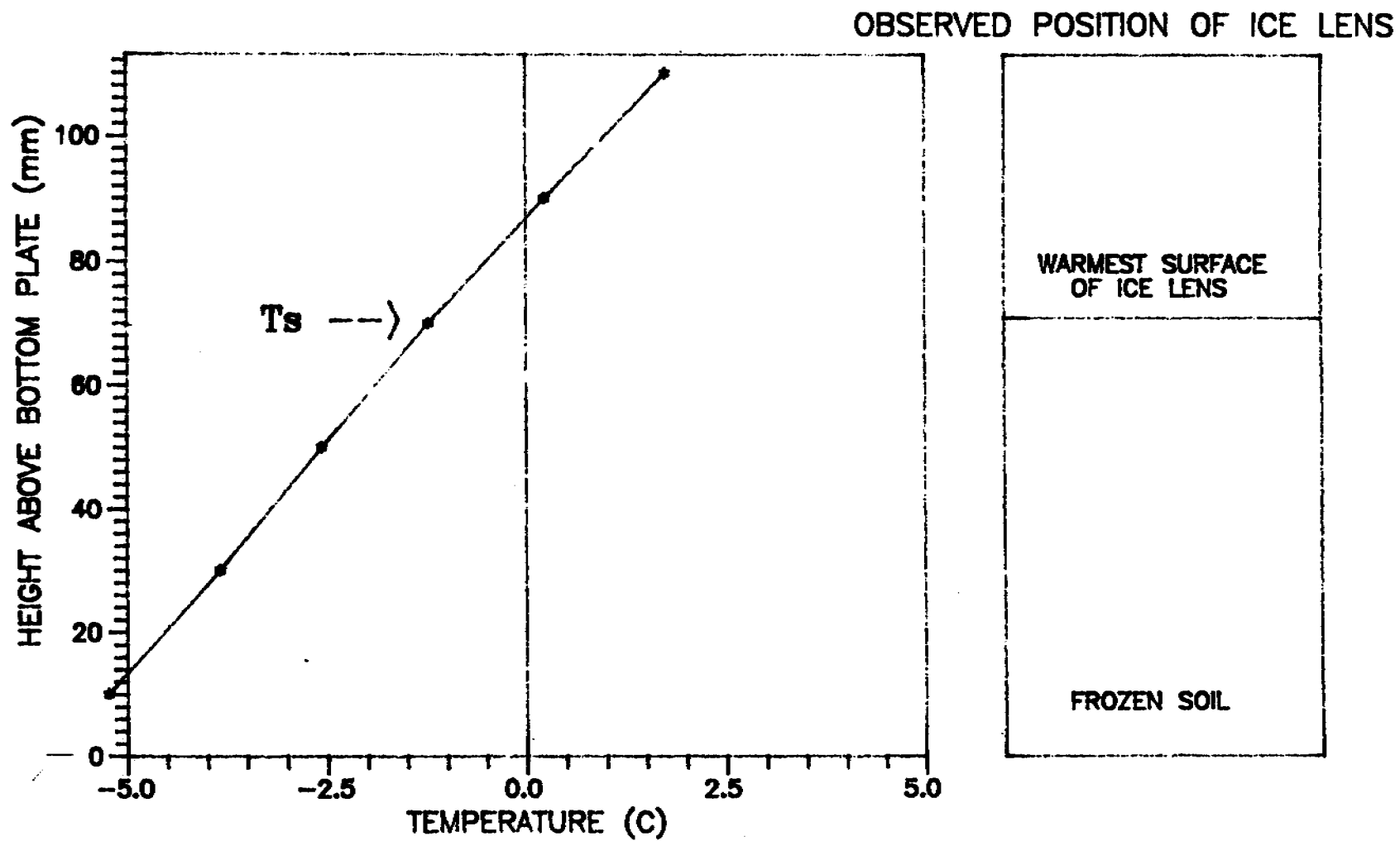
FREEZING TEST S52





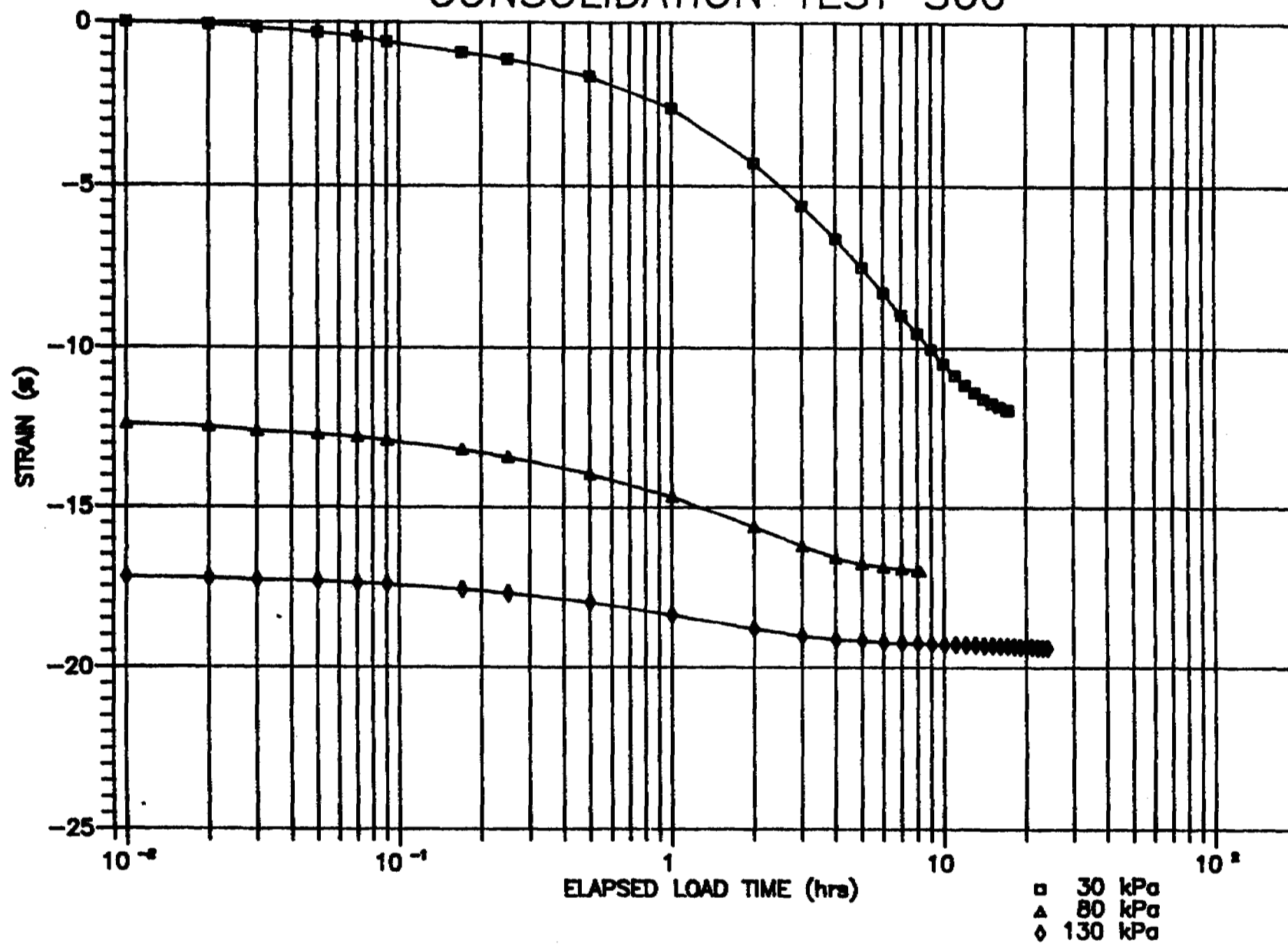




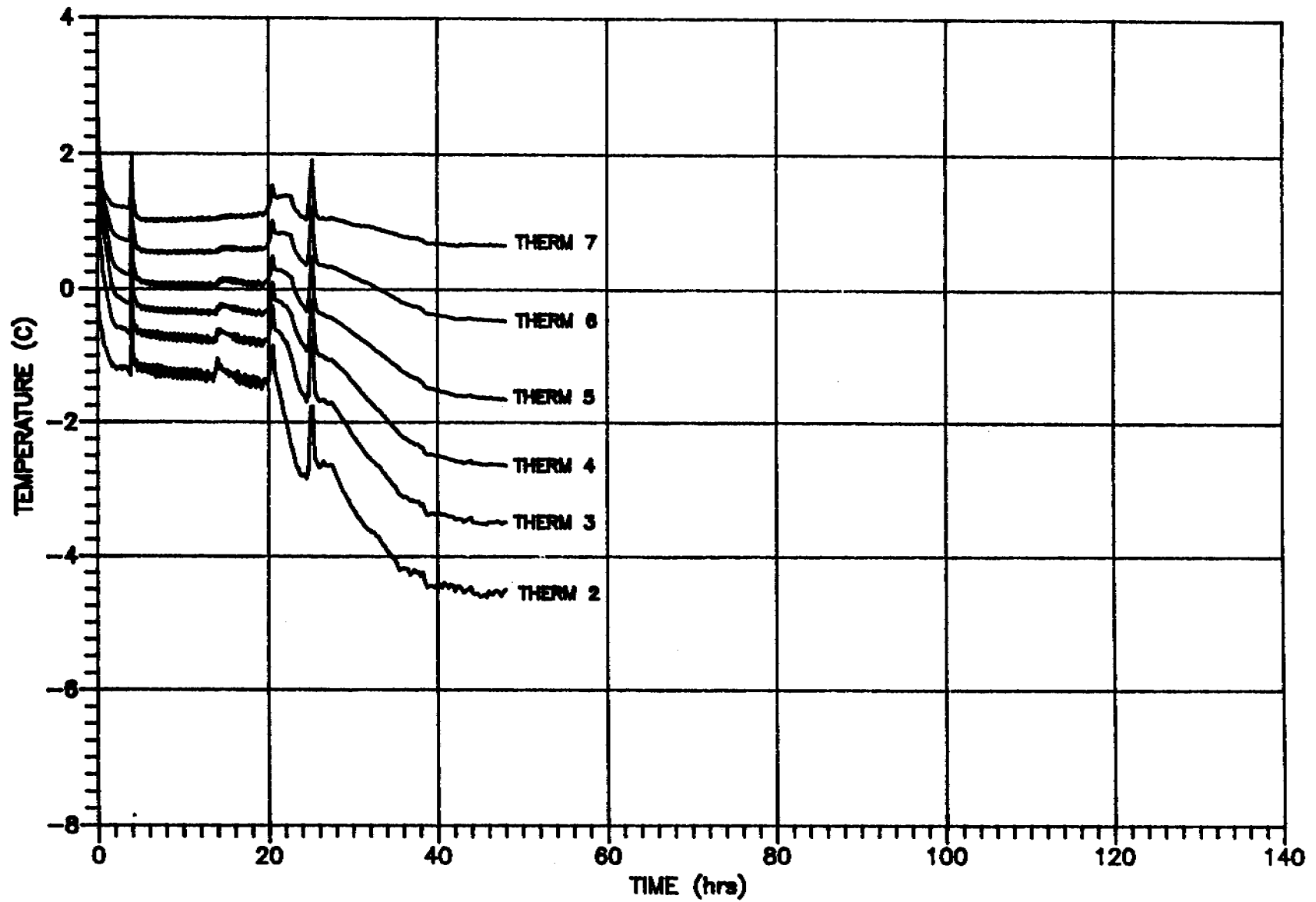


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- S52

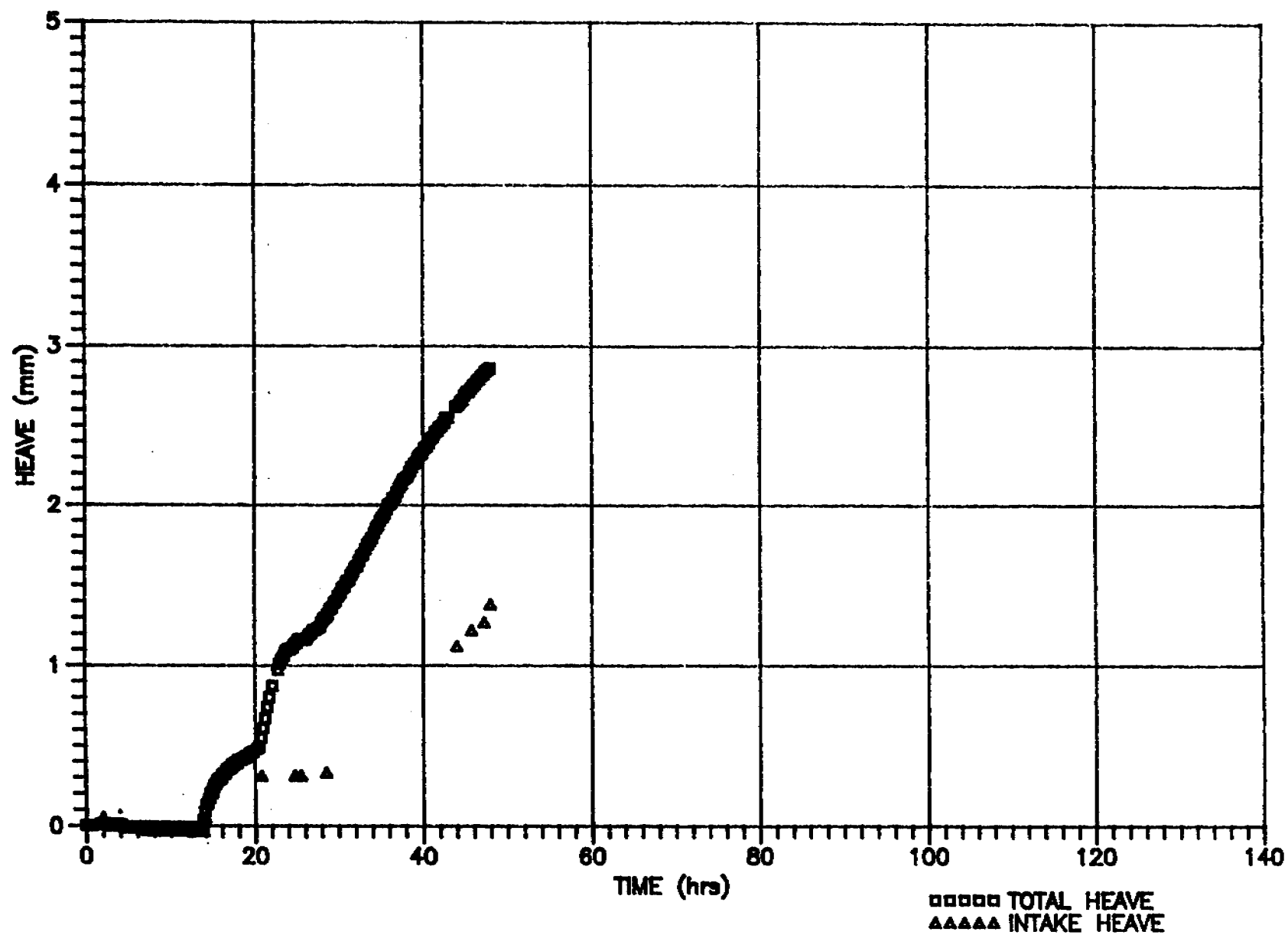
CONSOLIDATION TEST S60

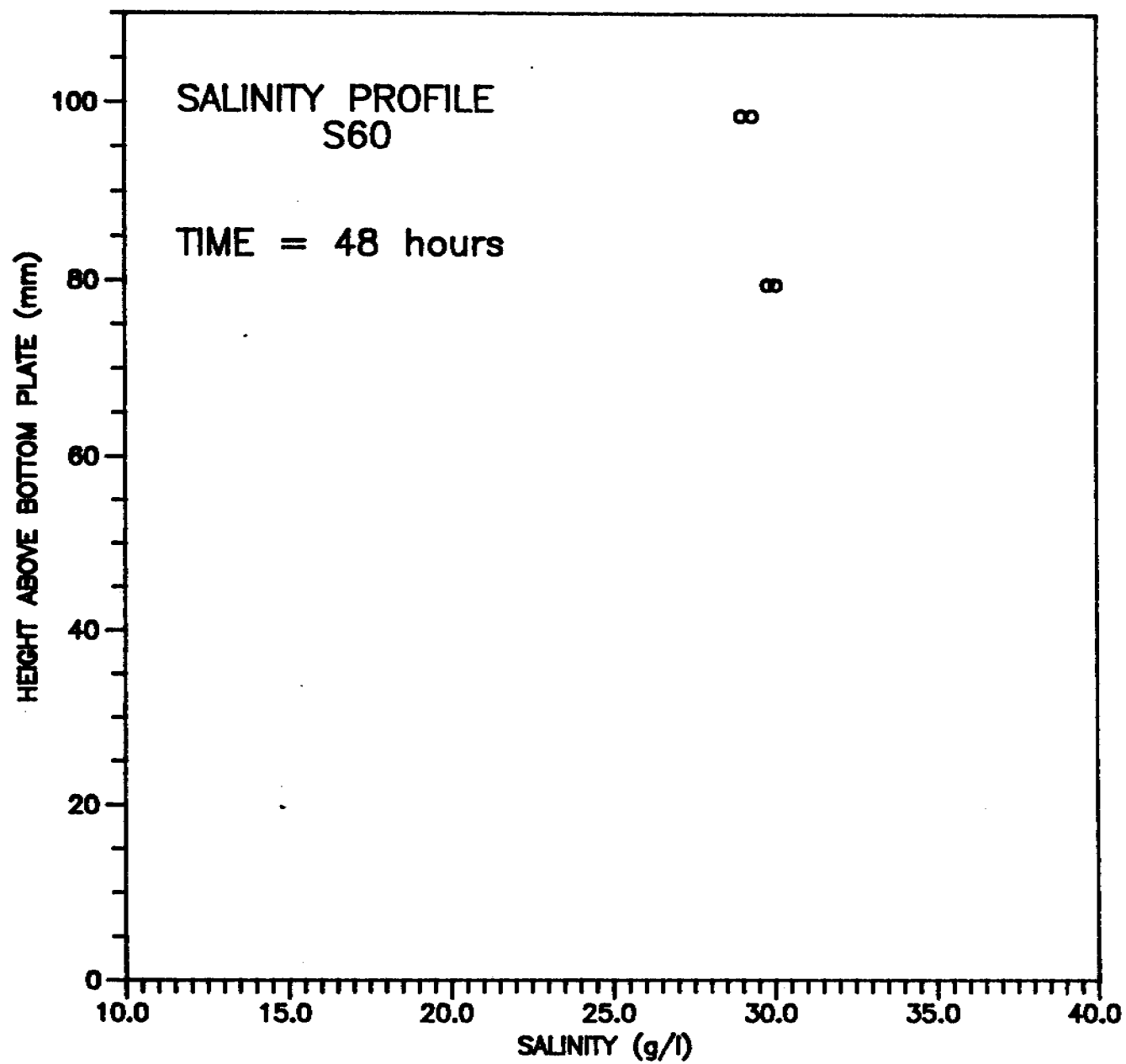


FREEZING TEST S60

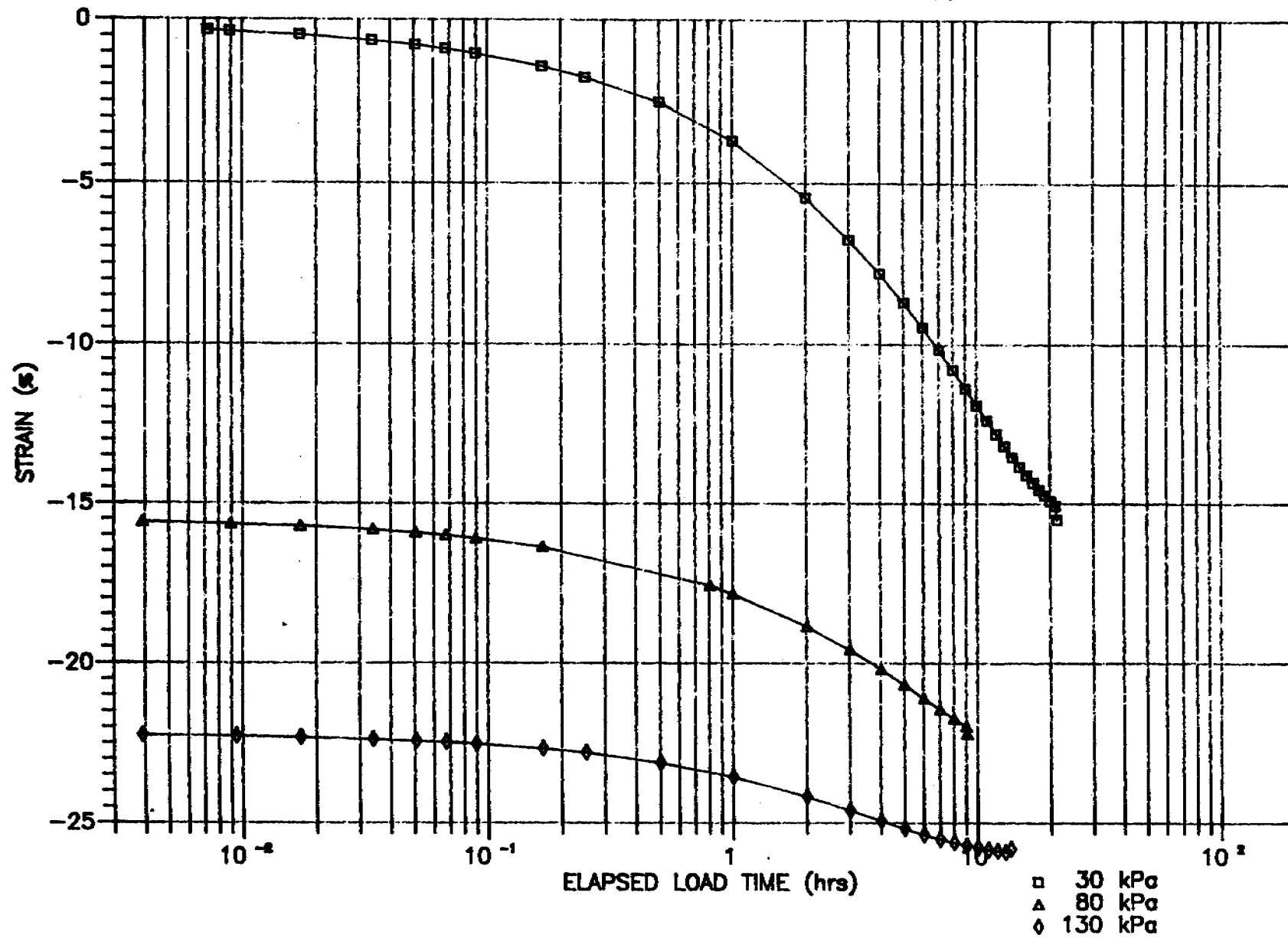


FREEZING TEST S60

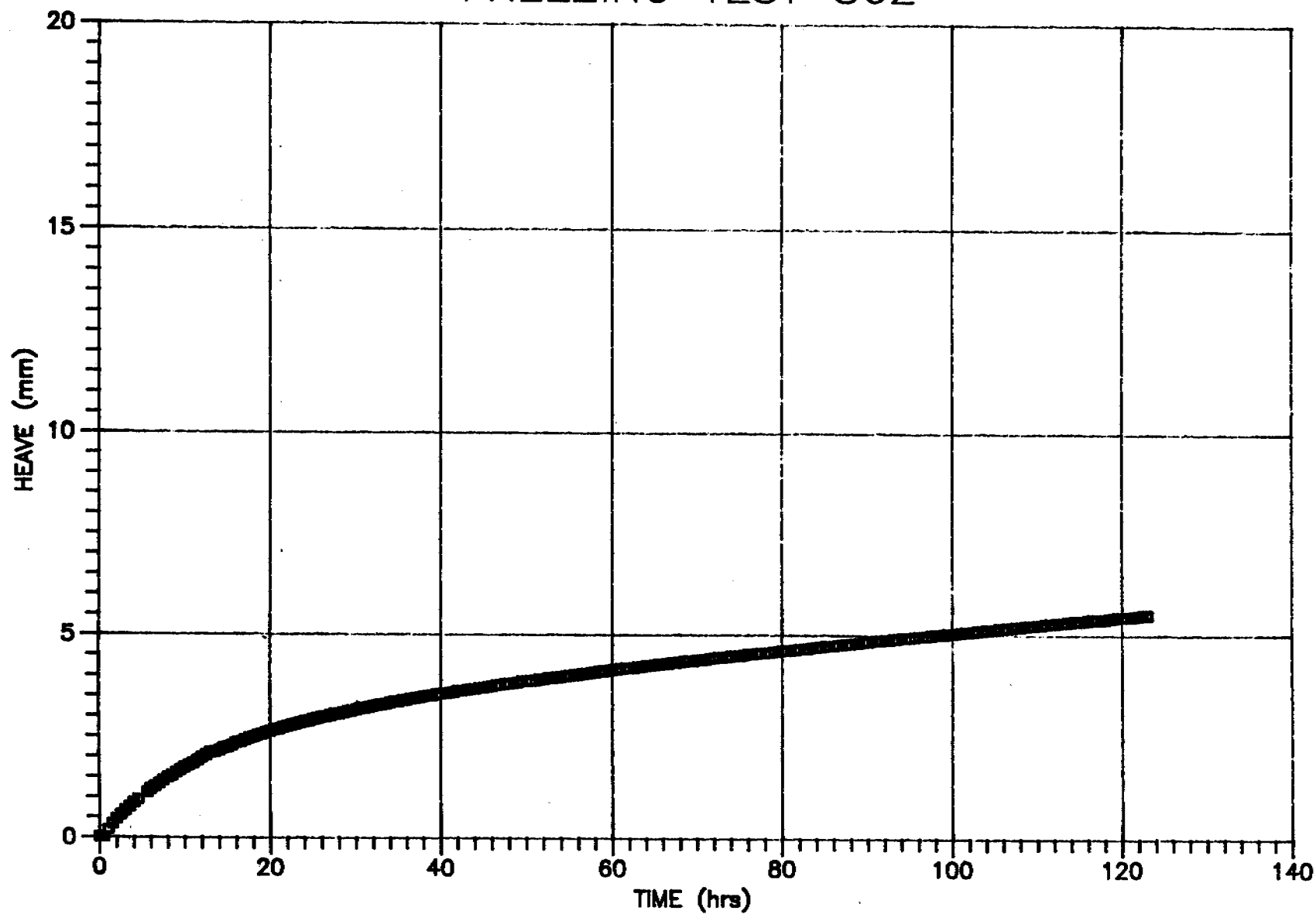




CONSOLIDATION TEST S62

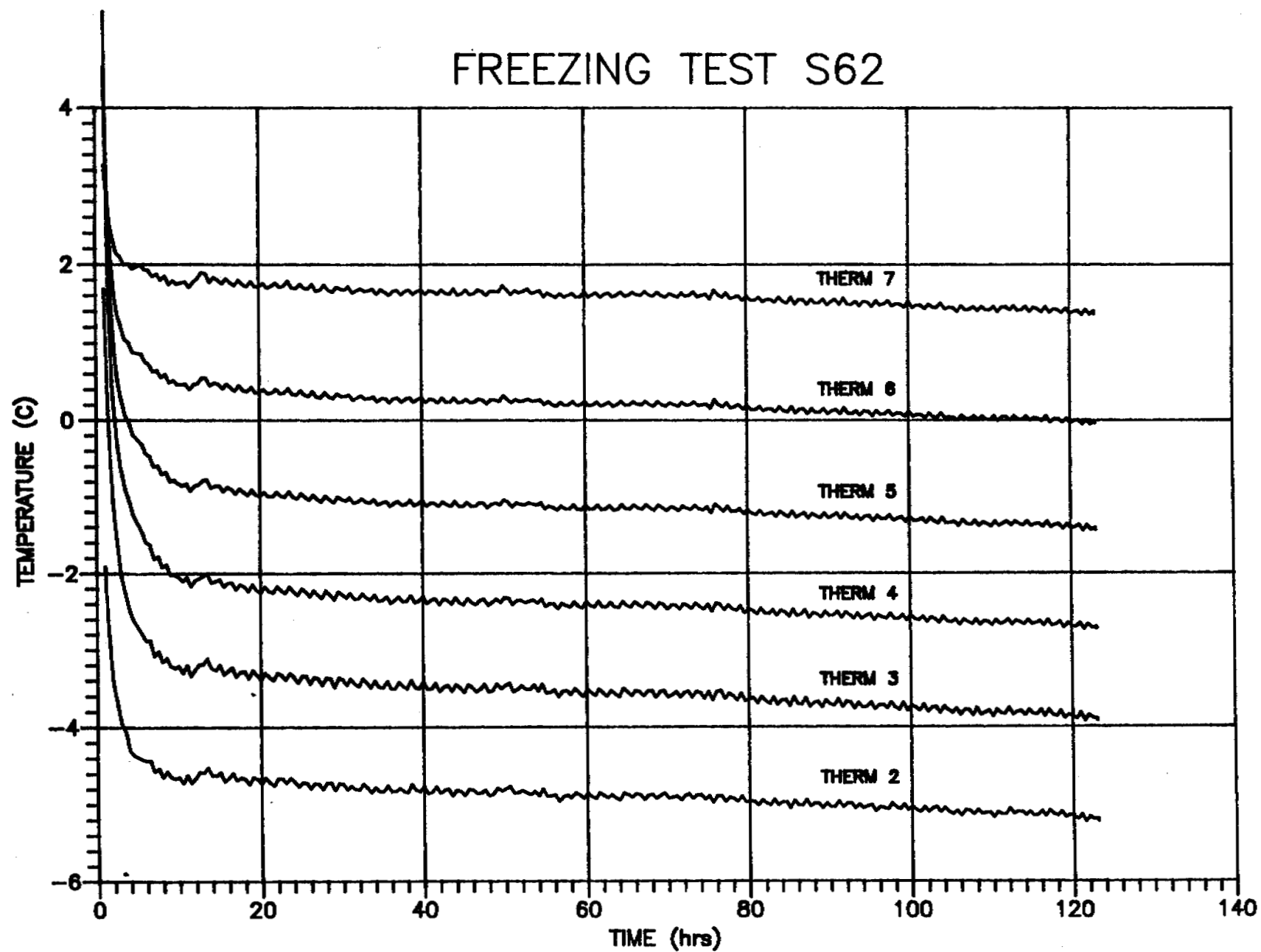


FREEZING TEST S62

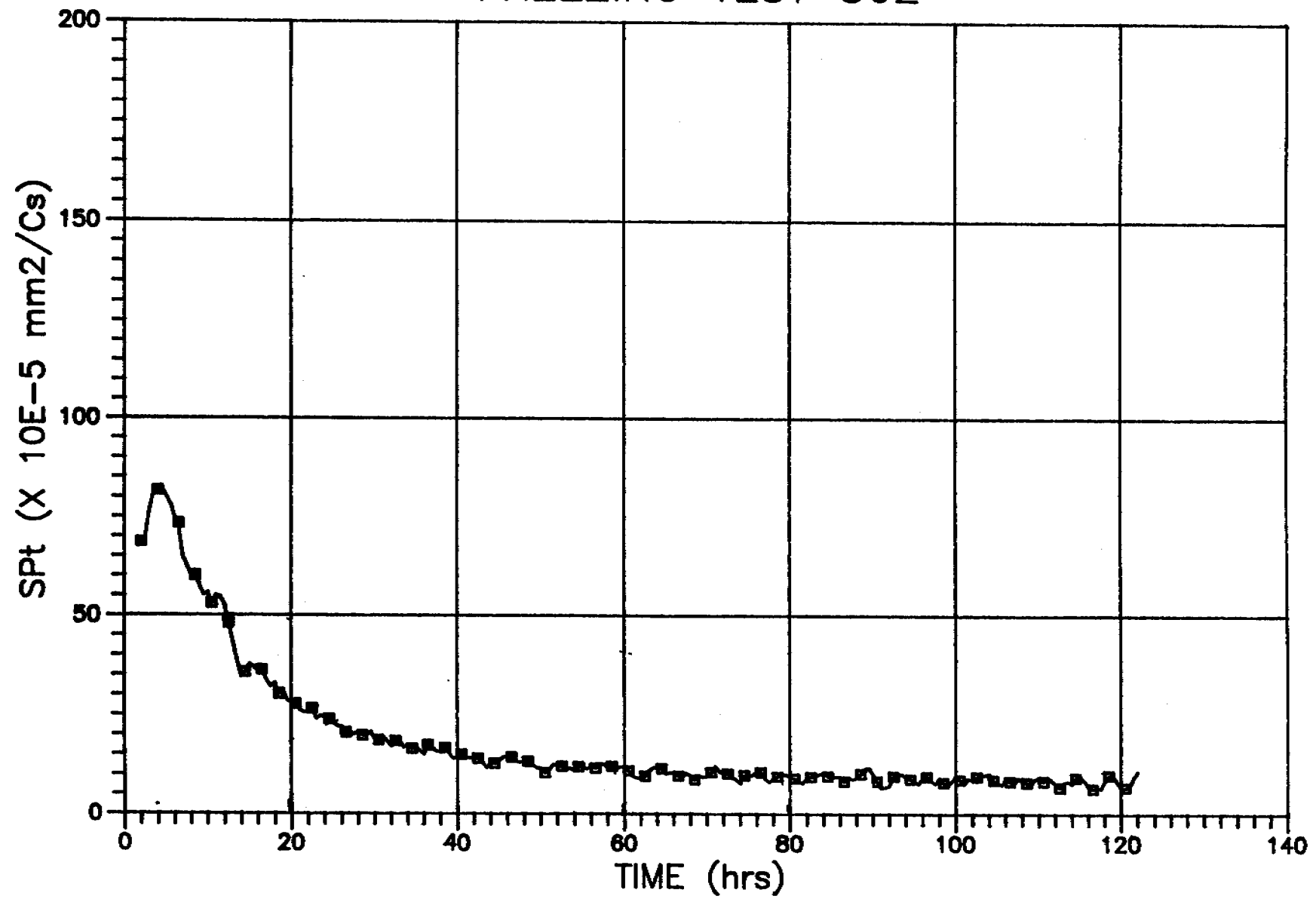


□□□□ TOTAL HEAVE

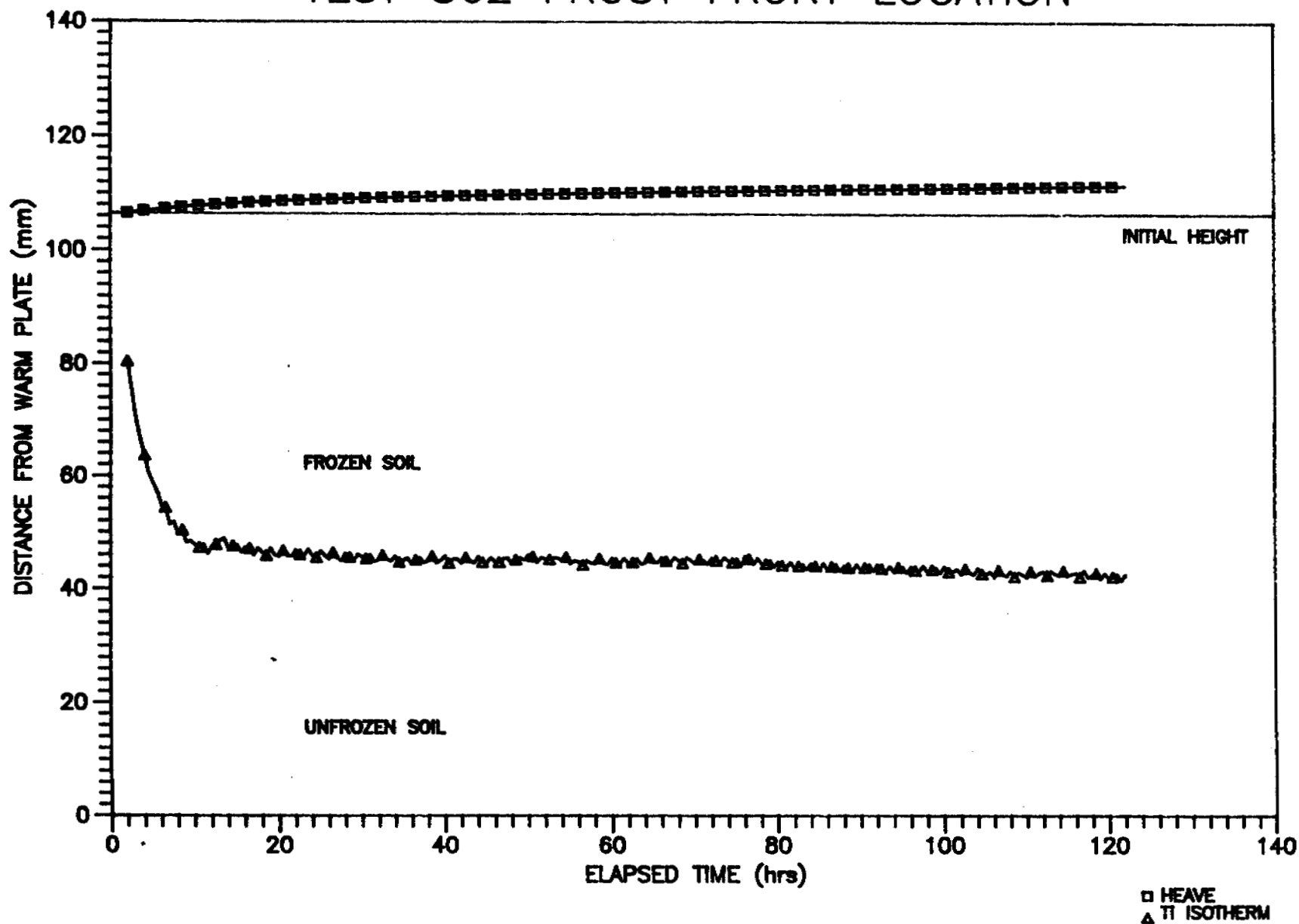
FREEZING TEST S62

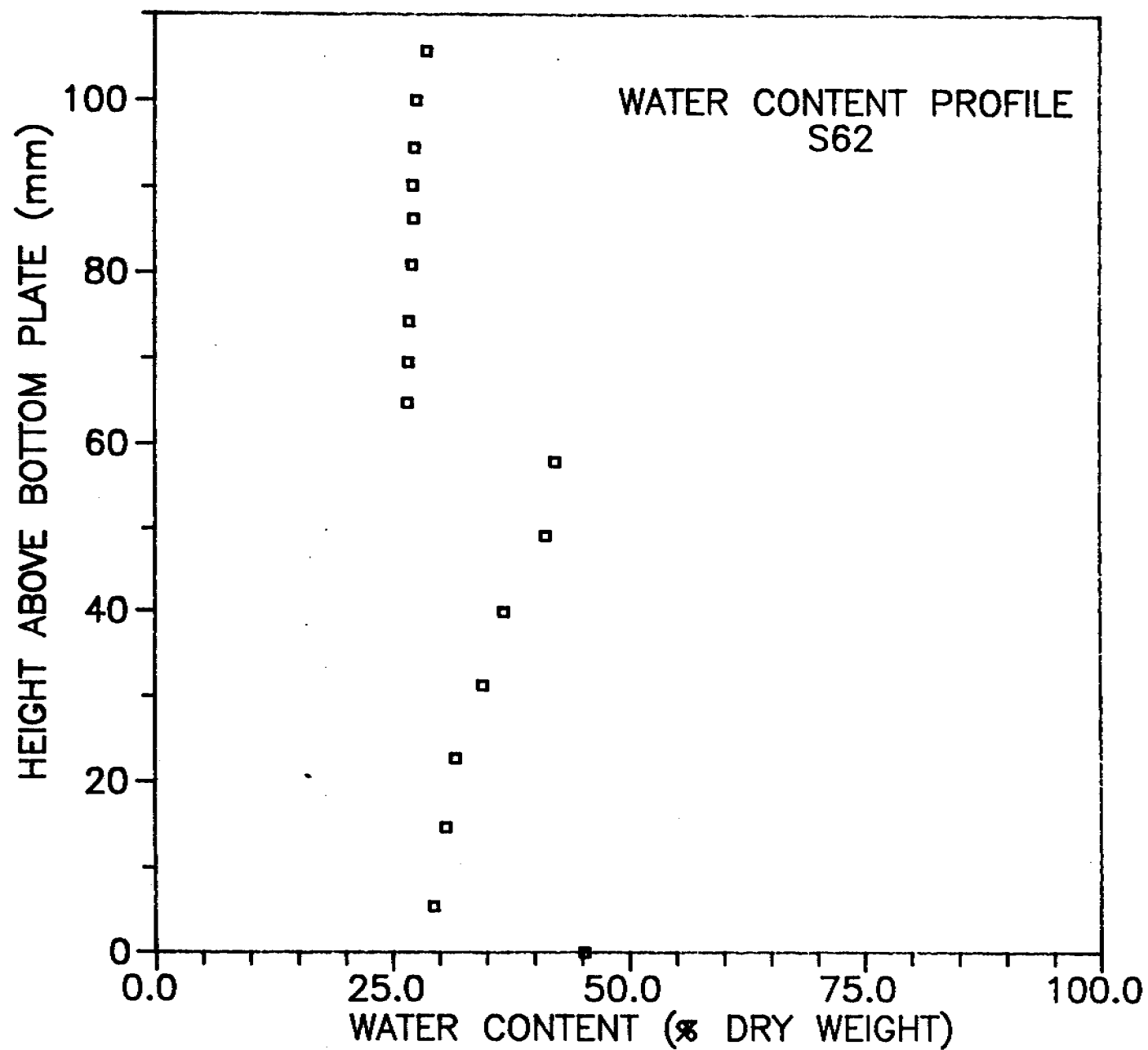


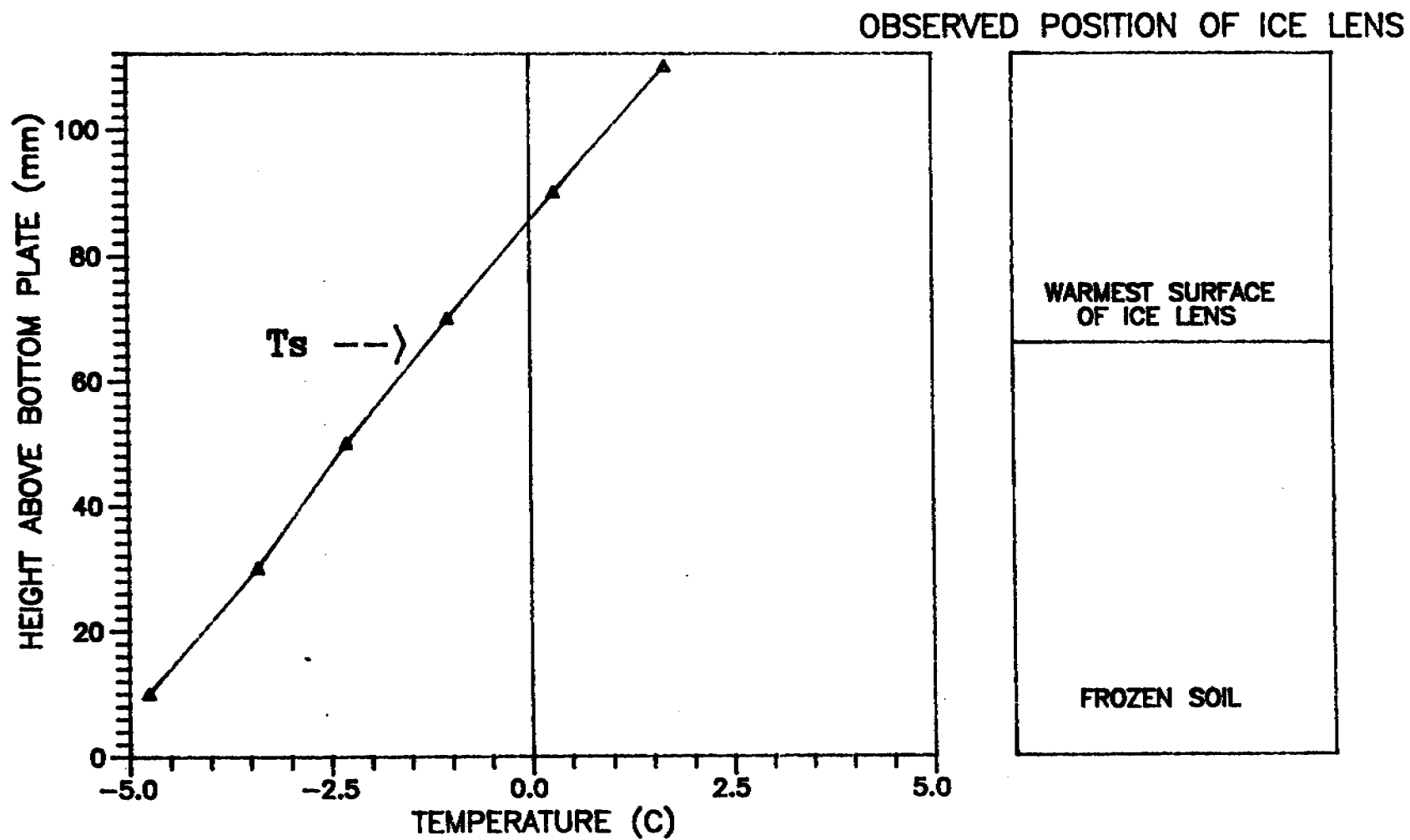
FREEZING TEST S62



TEST S62 FROST FRONT LOCATION

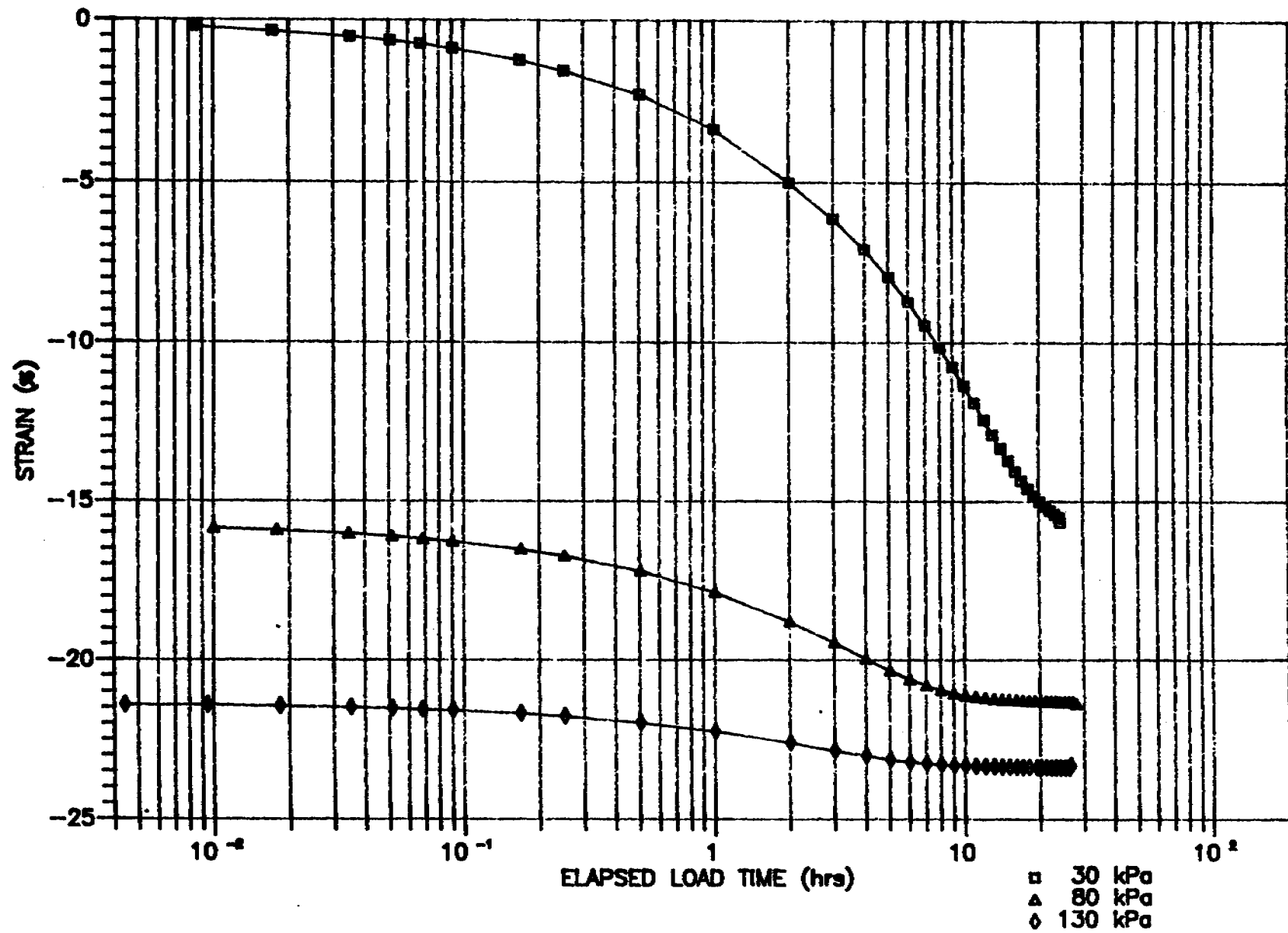




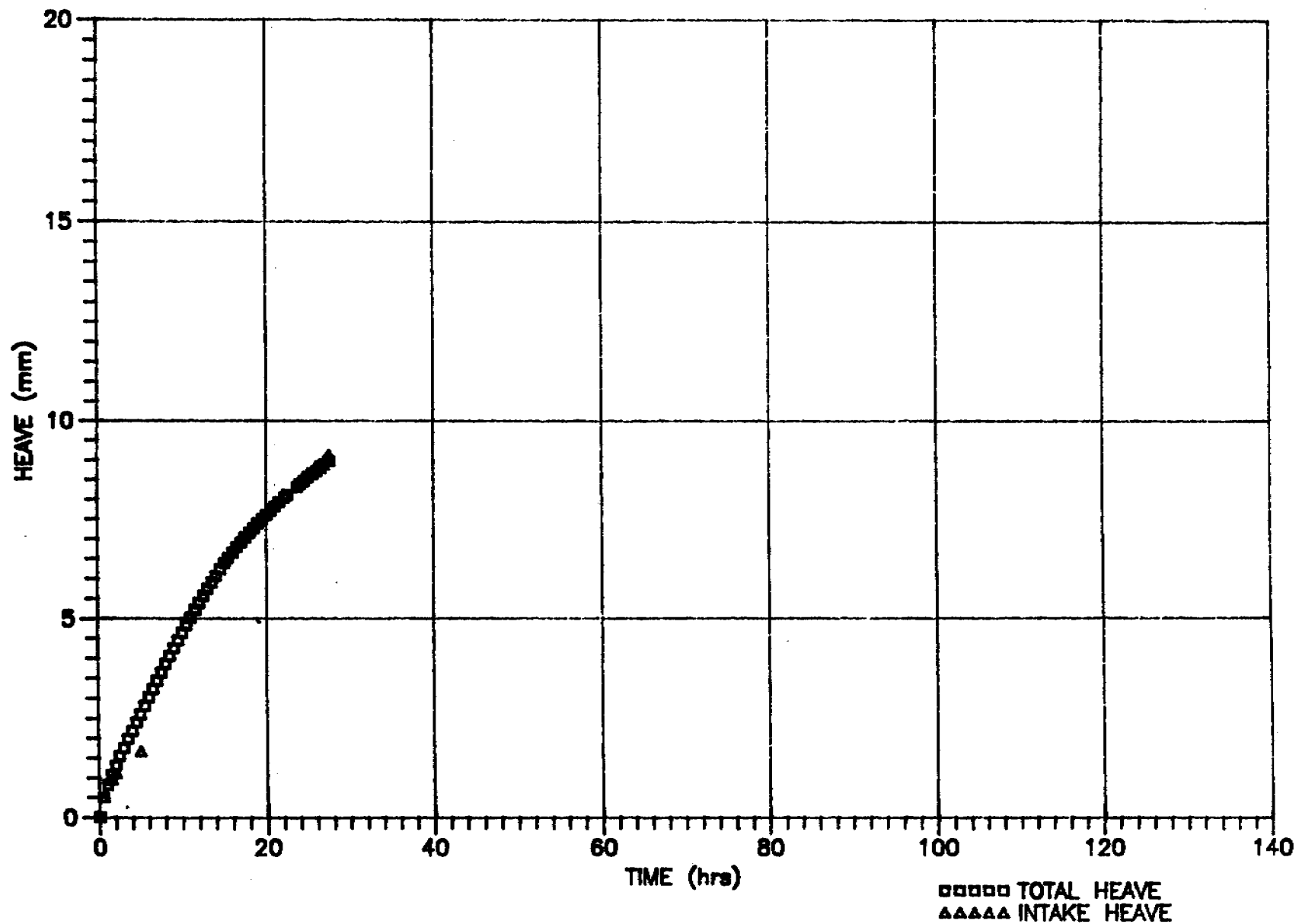


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- S62

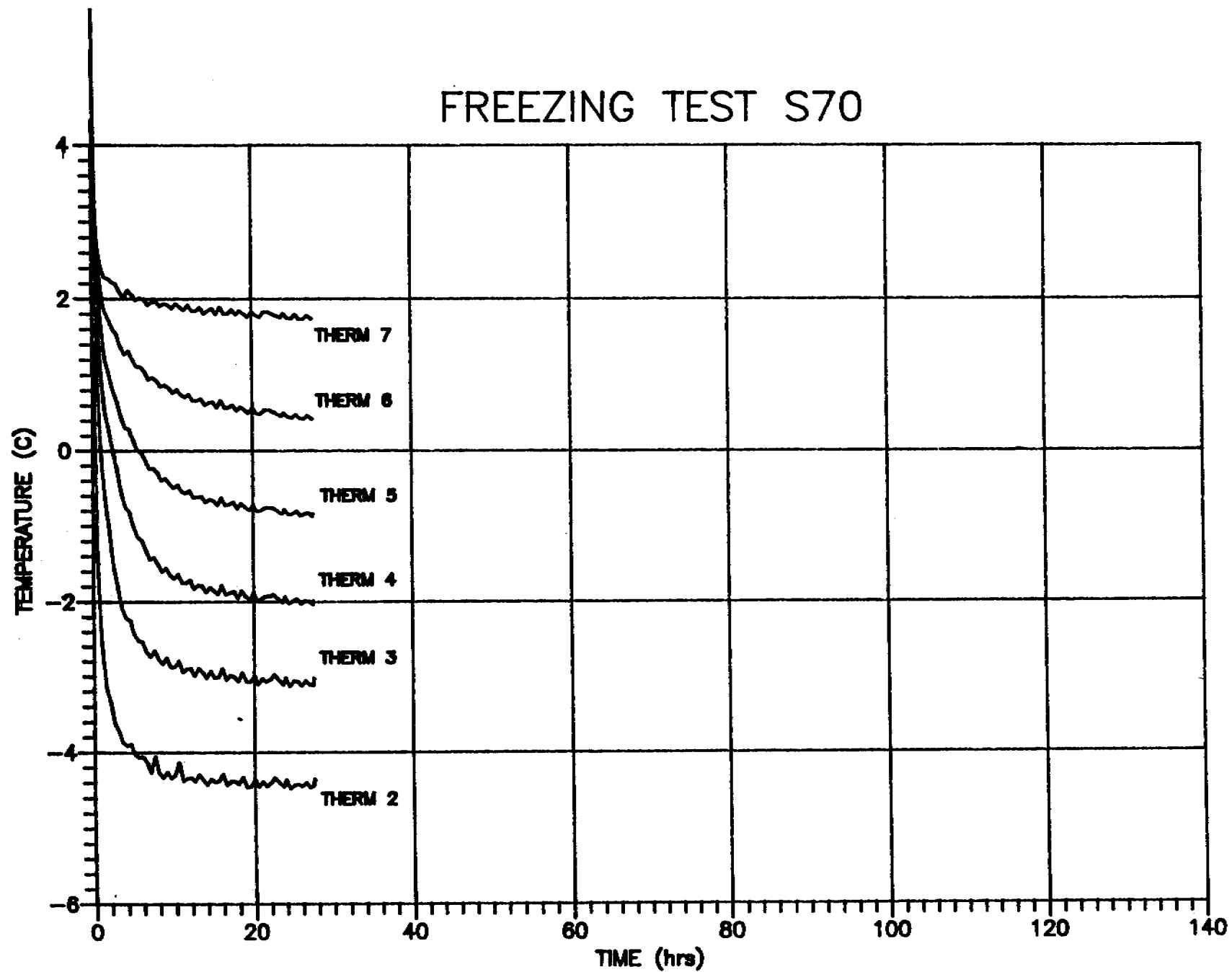
CONSOLIDATION TEST S70



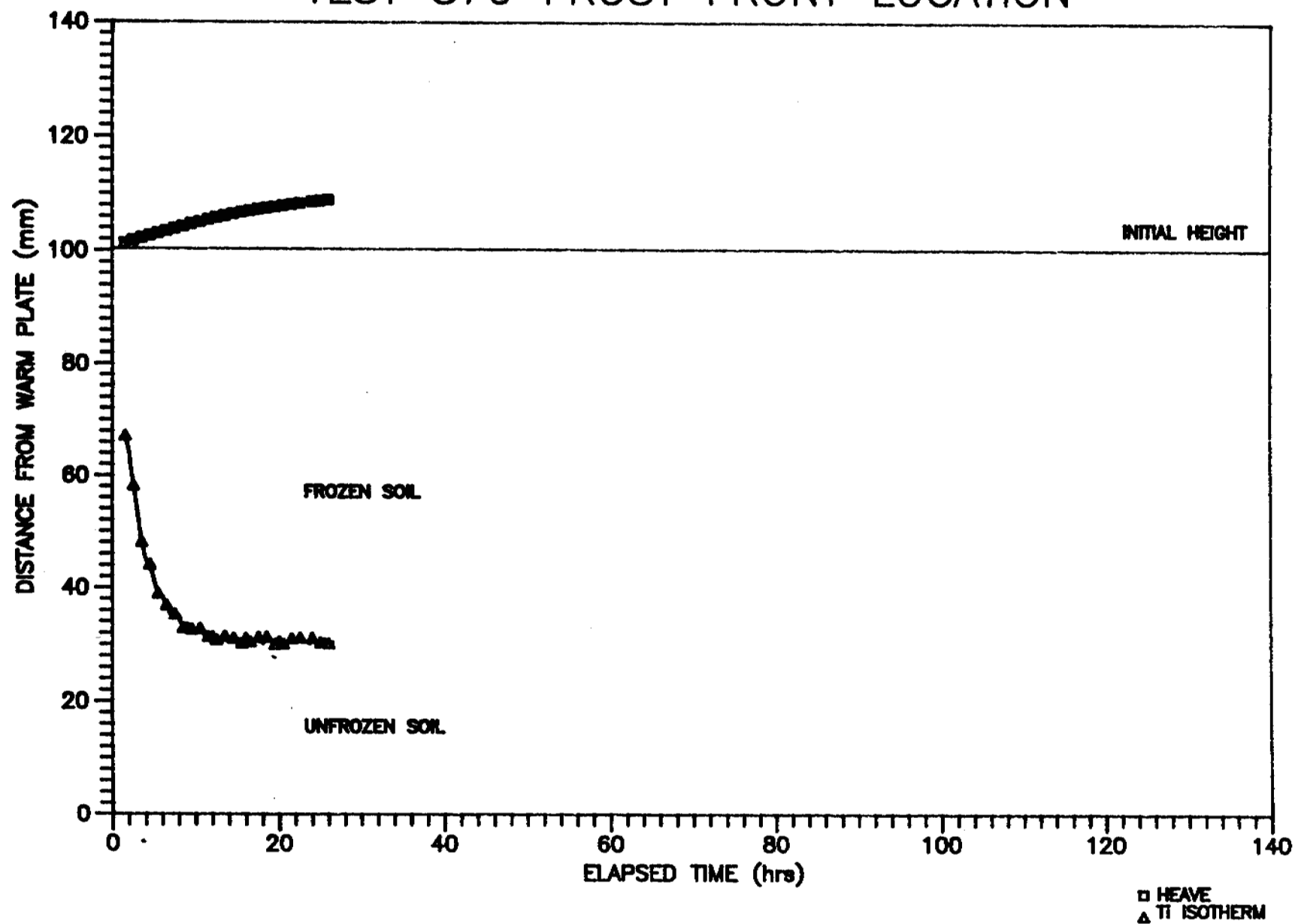
FREEZING TEST S70

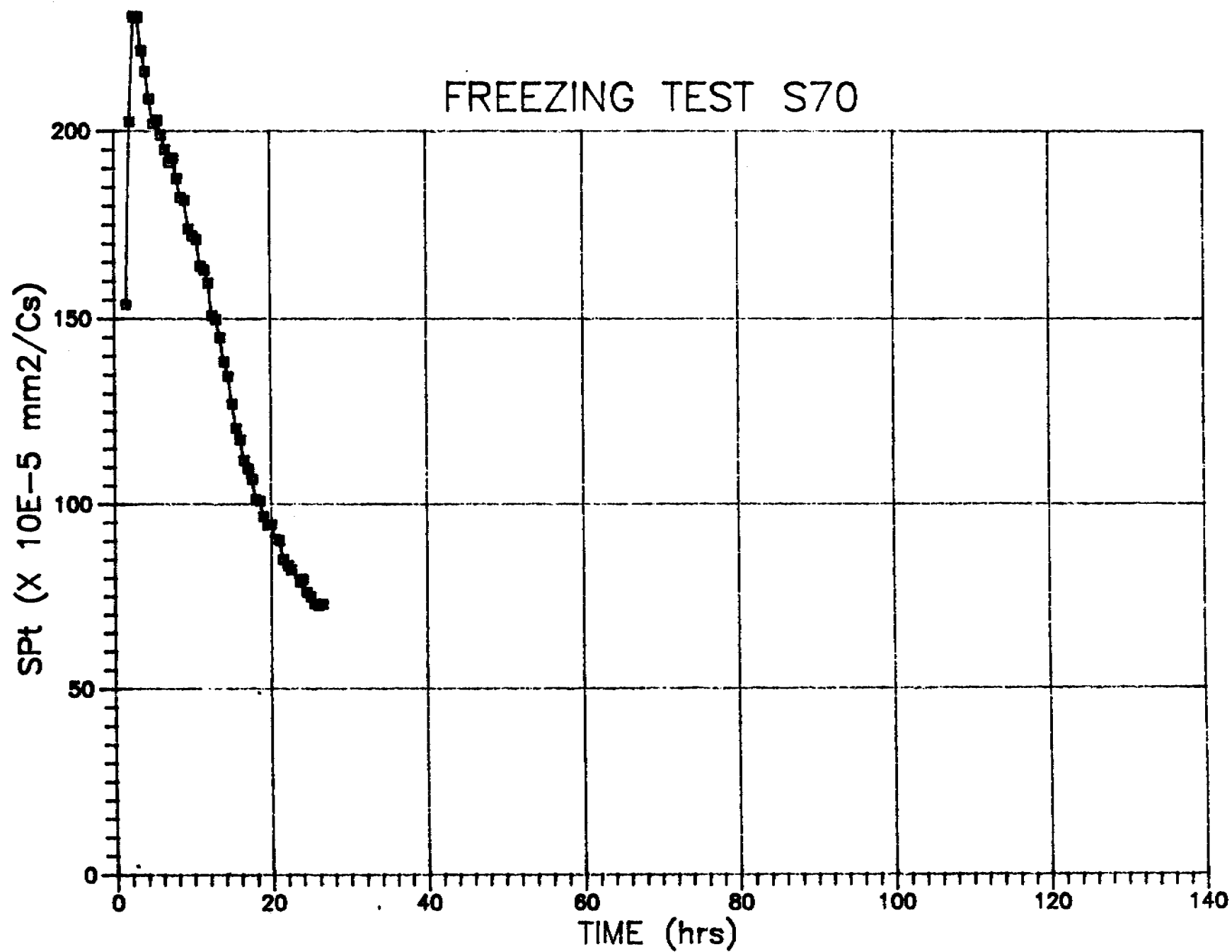


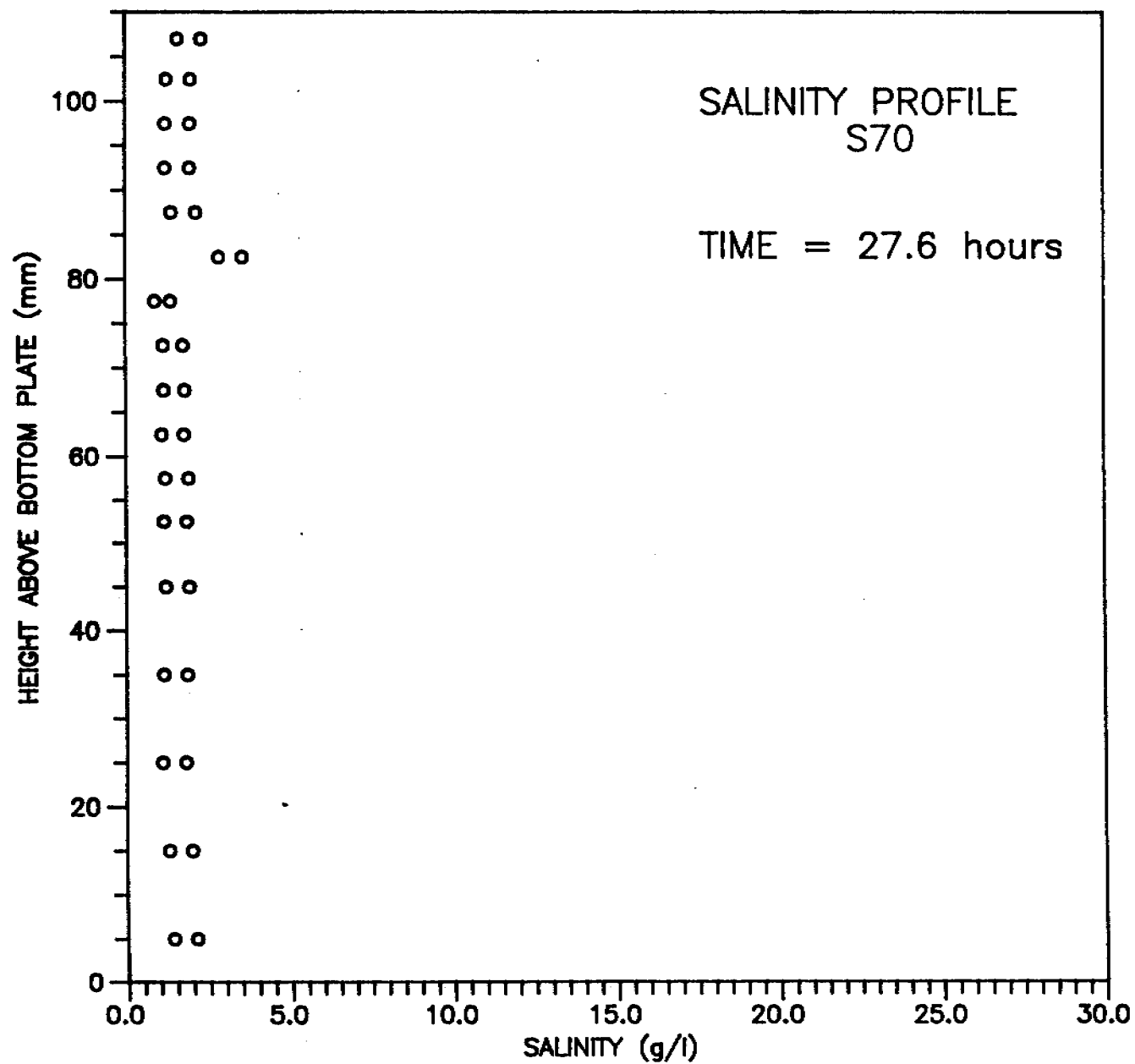
FREEZING TEST S70

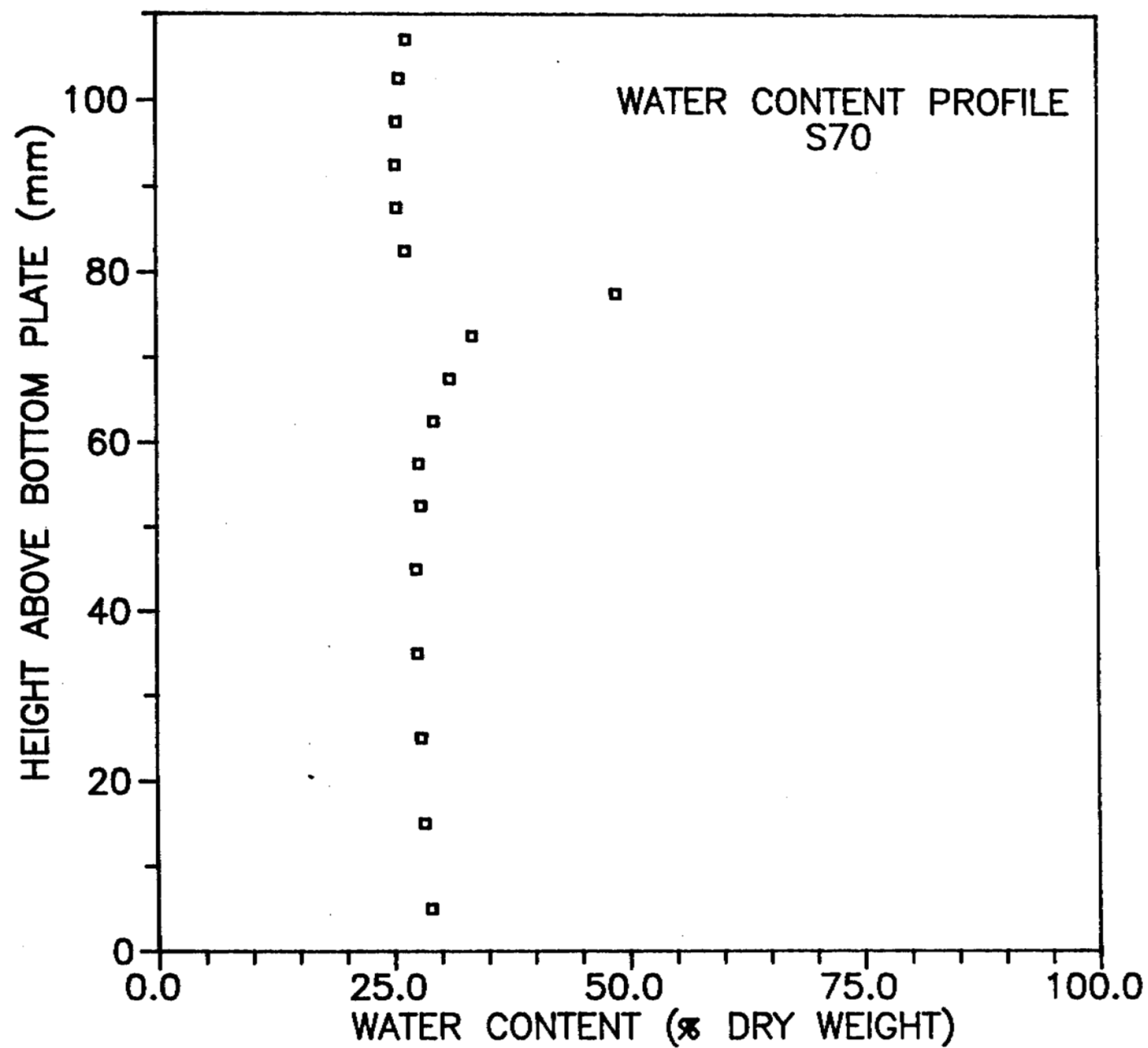


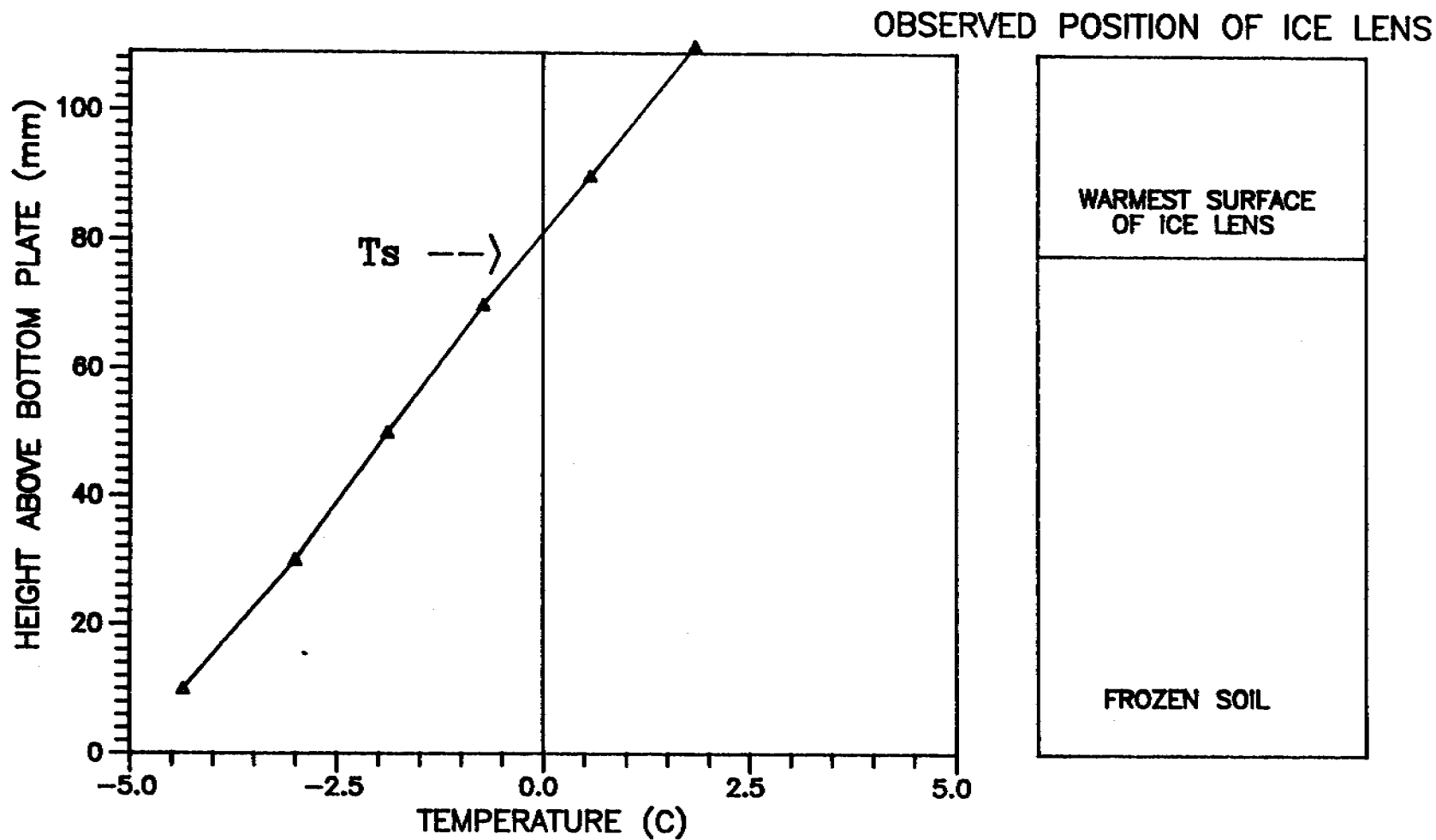
TEST S70 FROST FRONT LOCATION





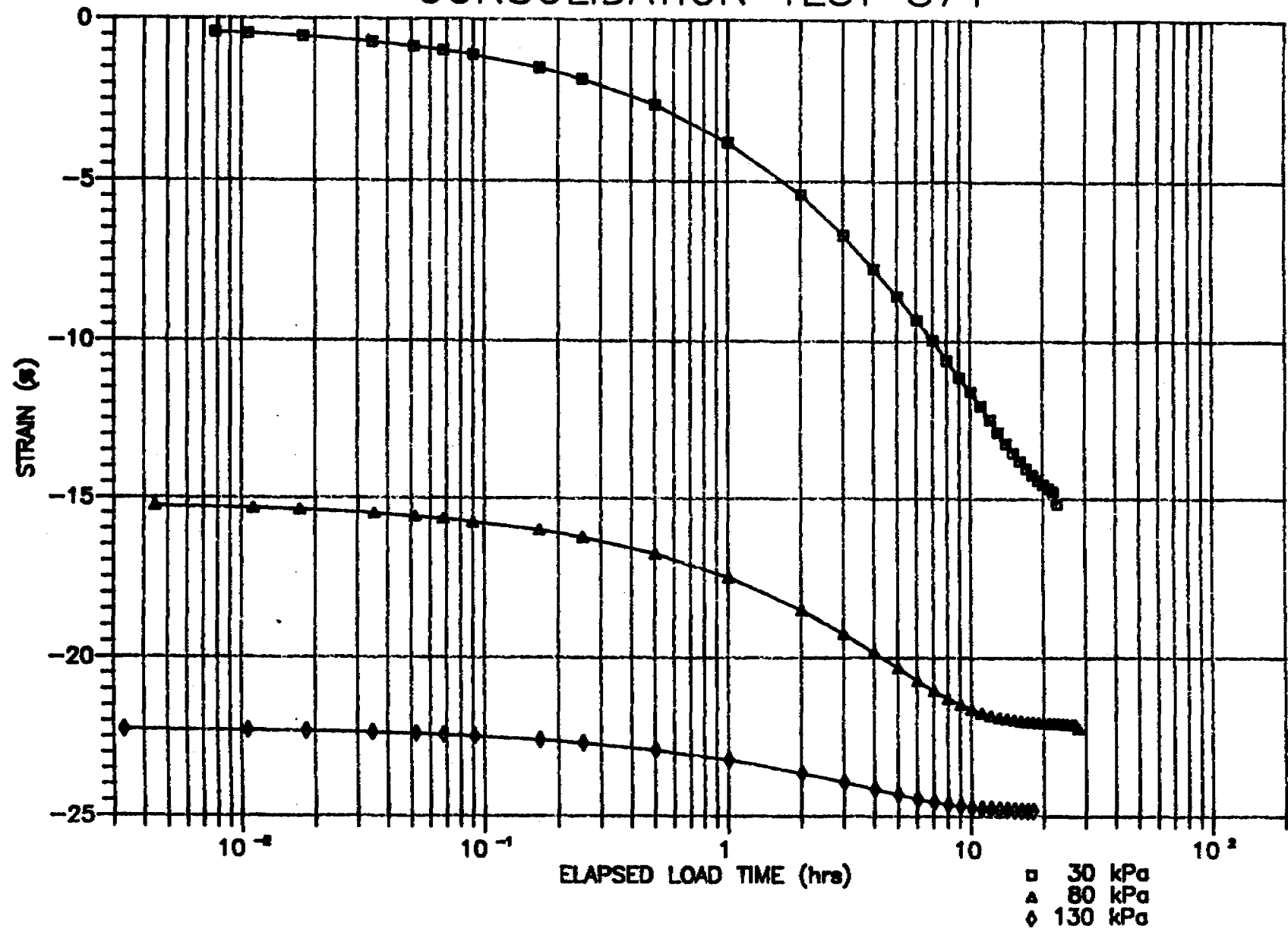




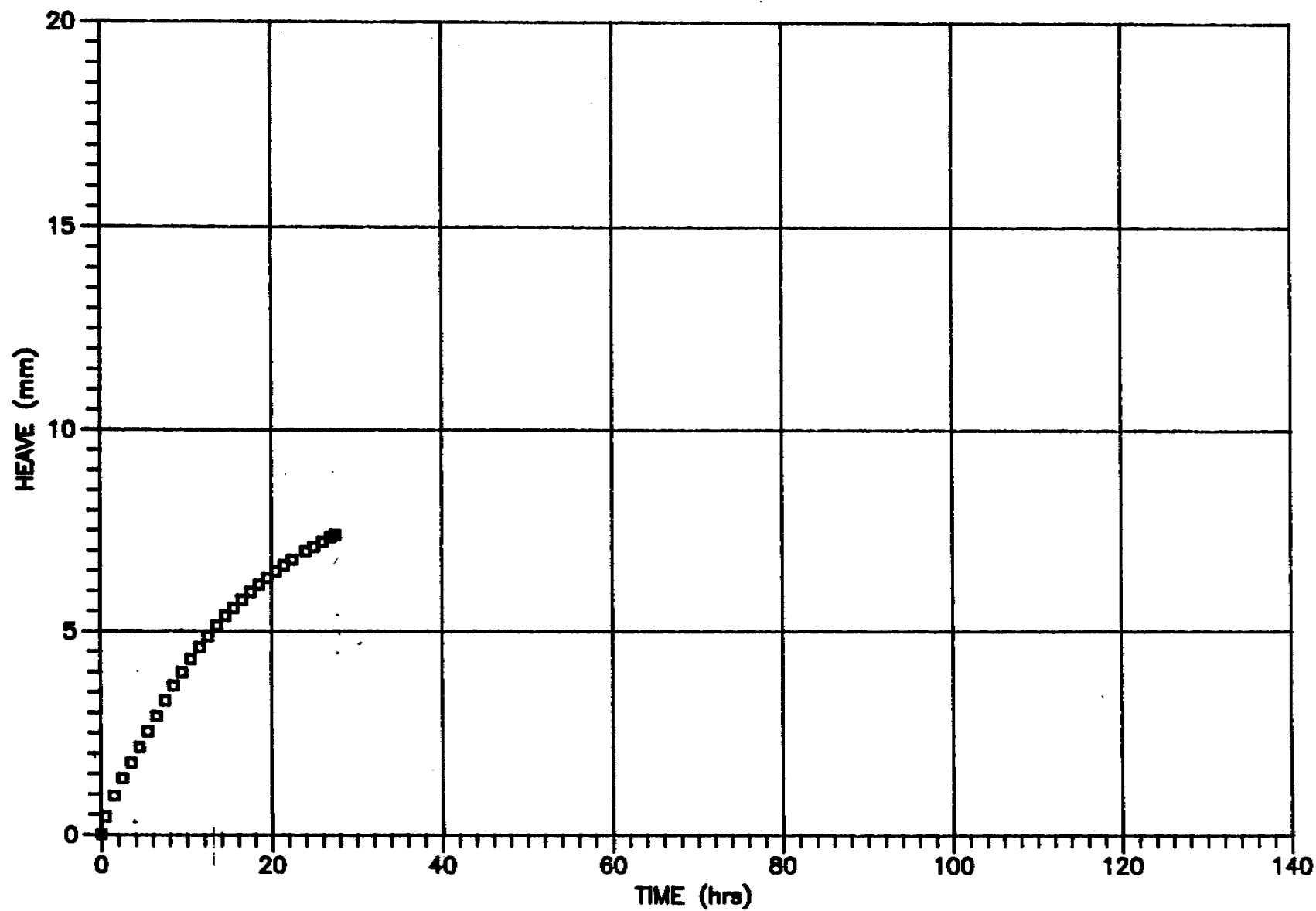


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S70

CONSOLIDATION TEST S71

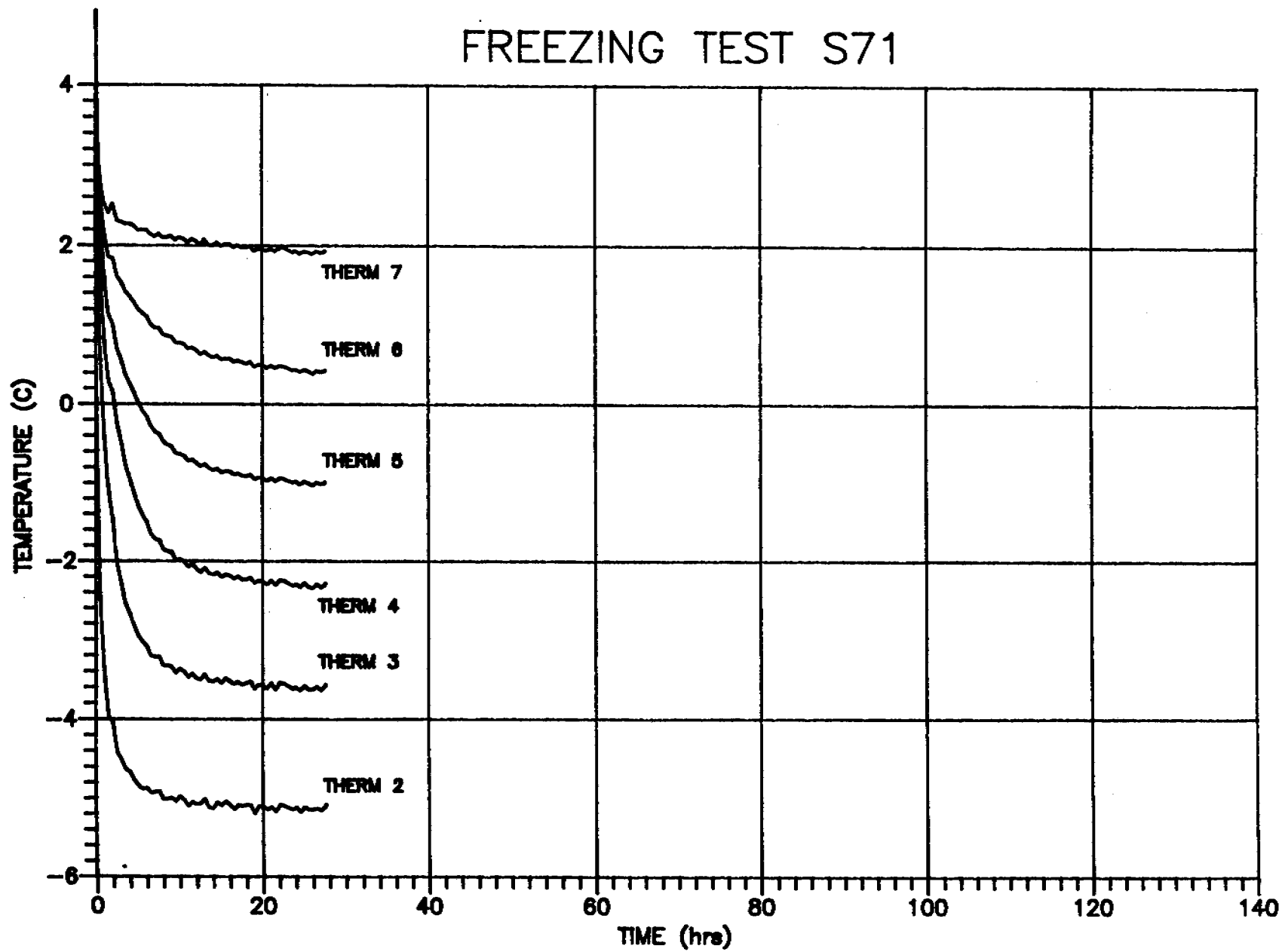


FREEZING TEST S71

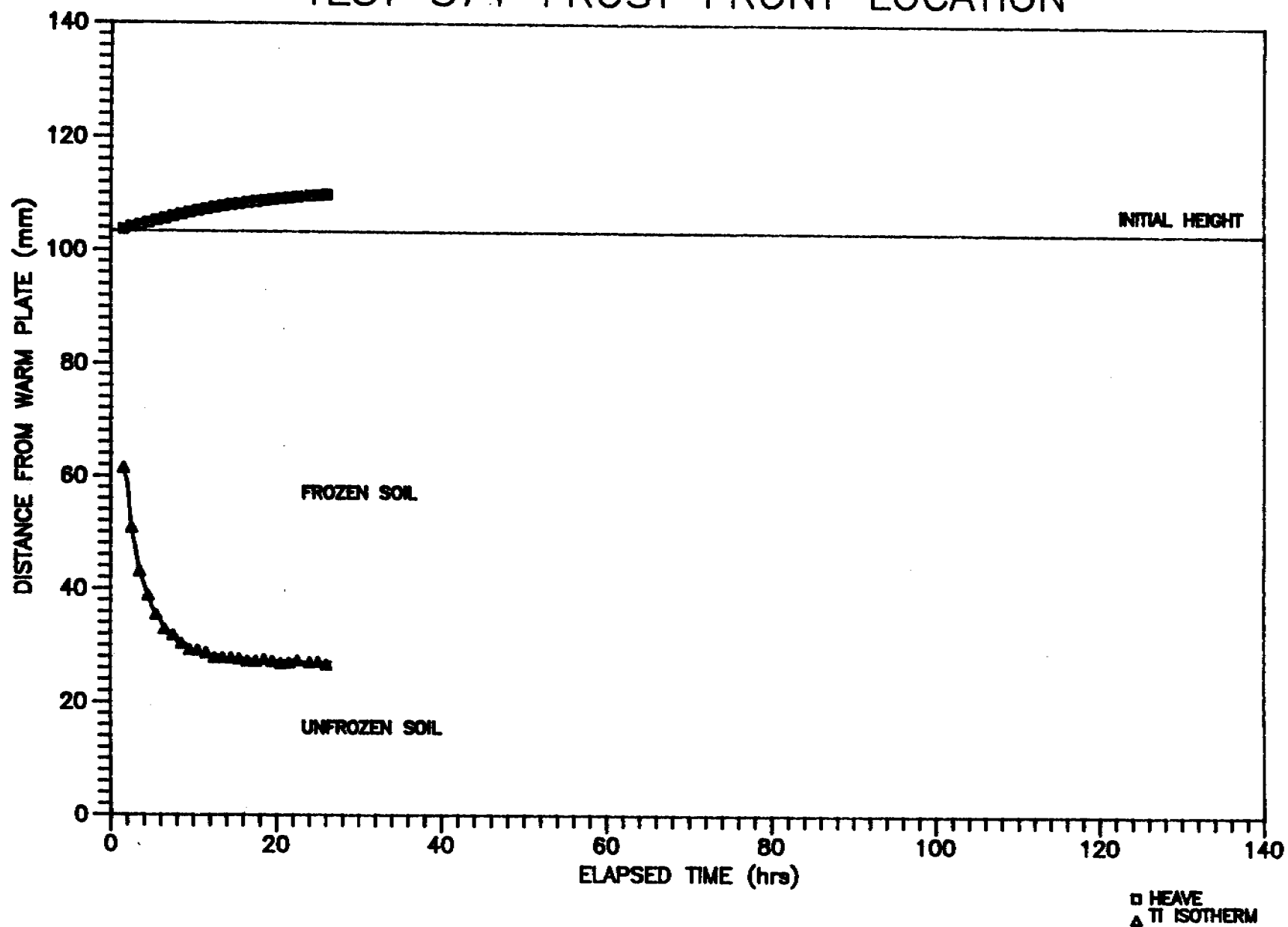


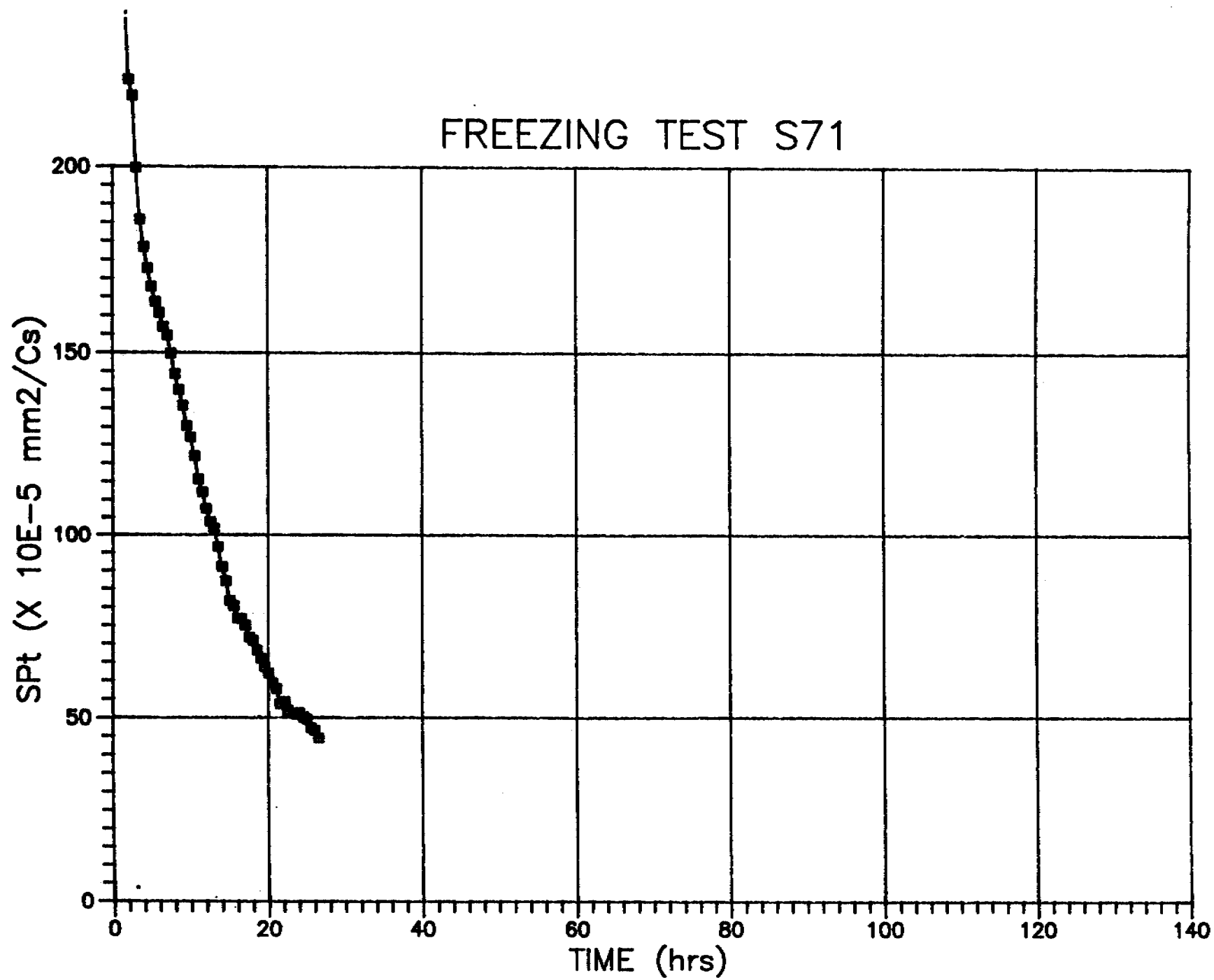
□□□□ TOTAL HEAVE

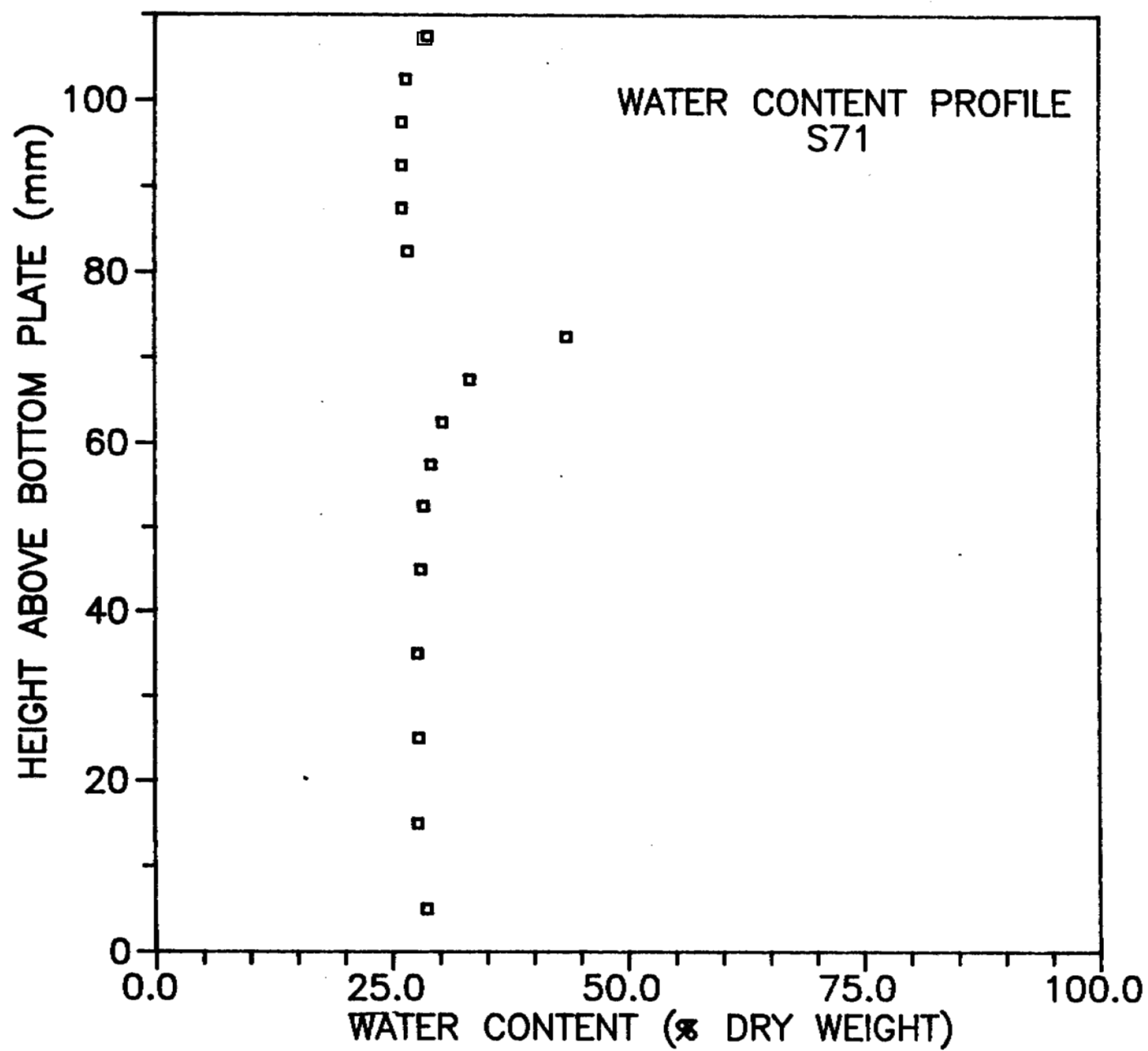
FREEZING TEST S71

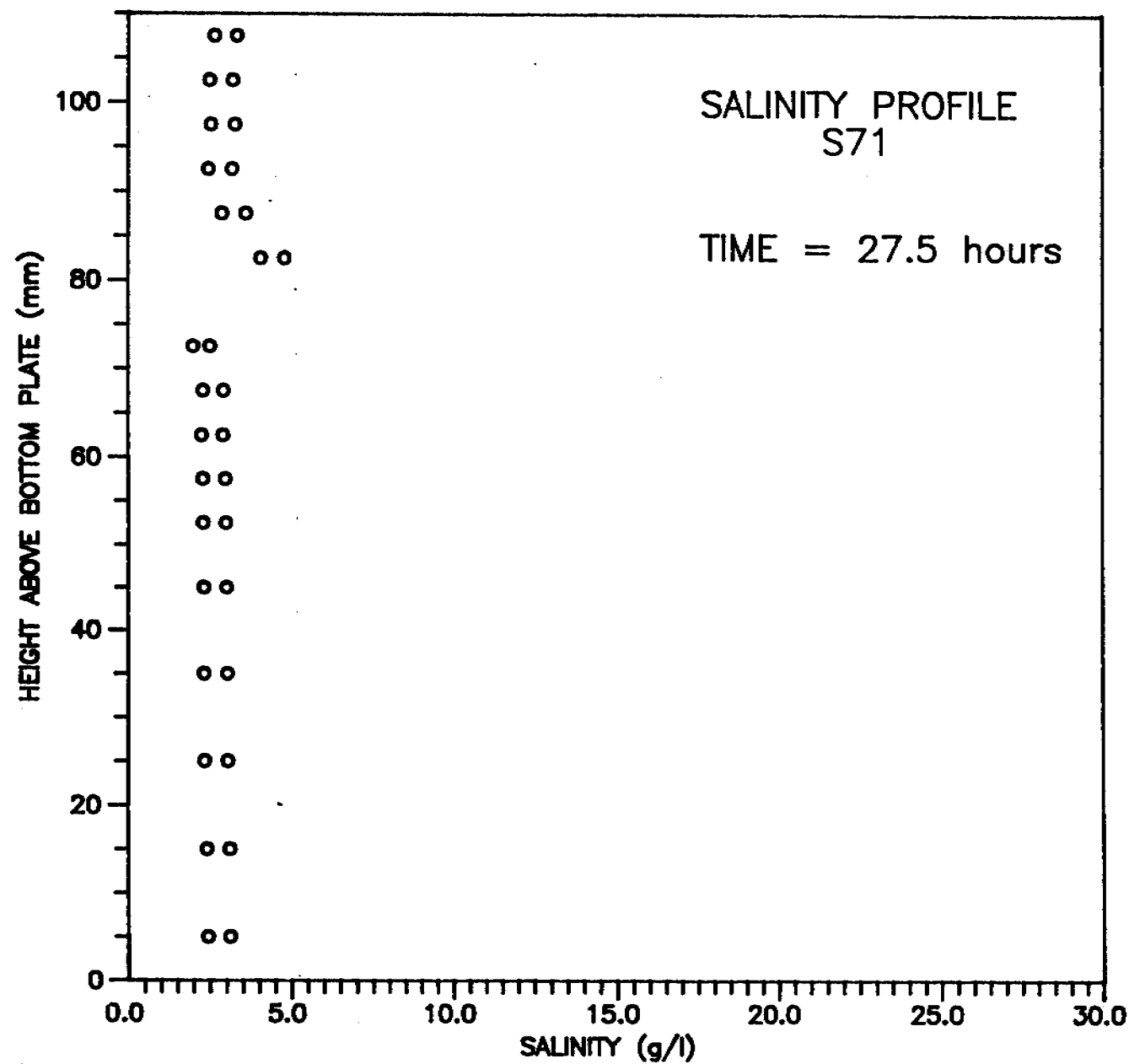


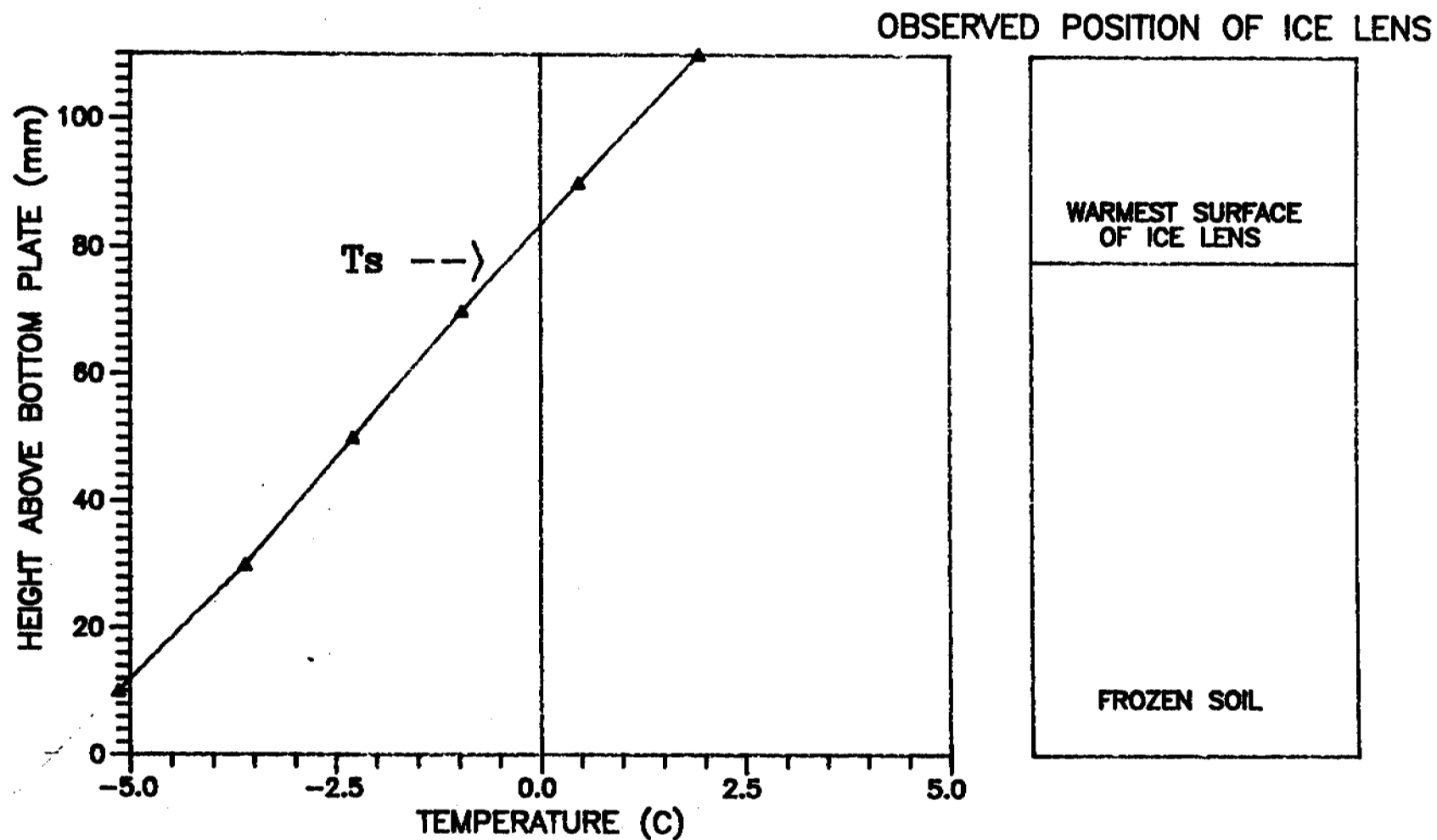
TEST S71 FROST FRONT LOCATION





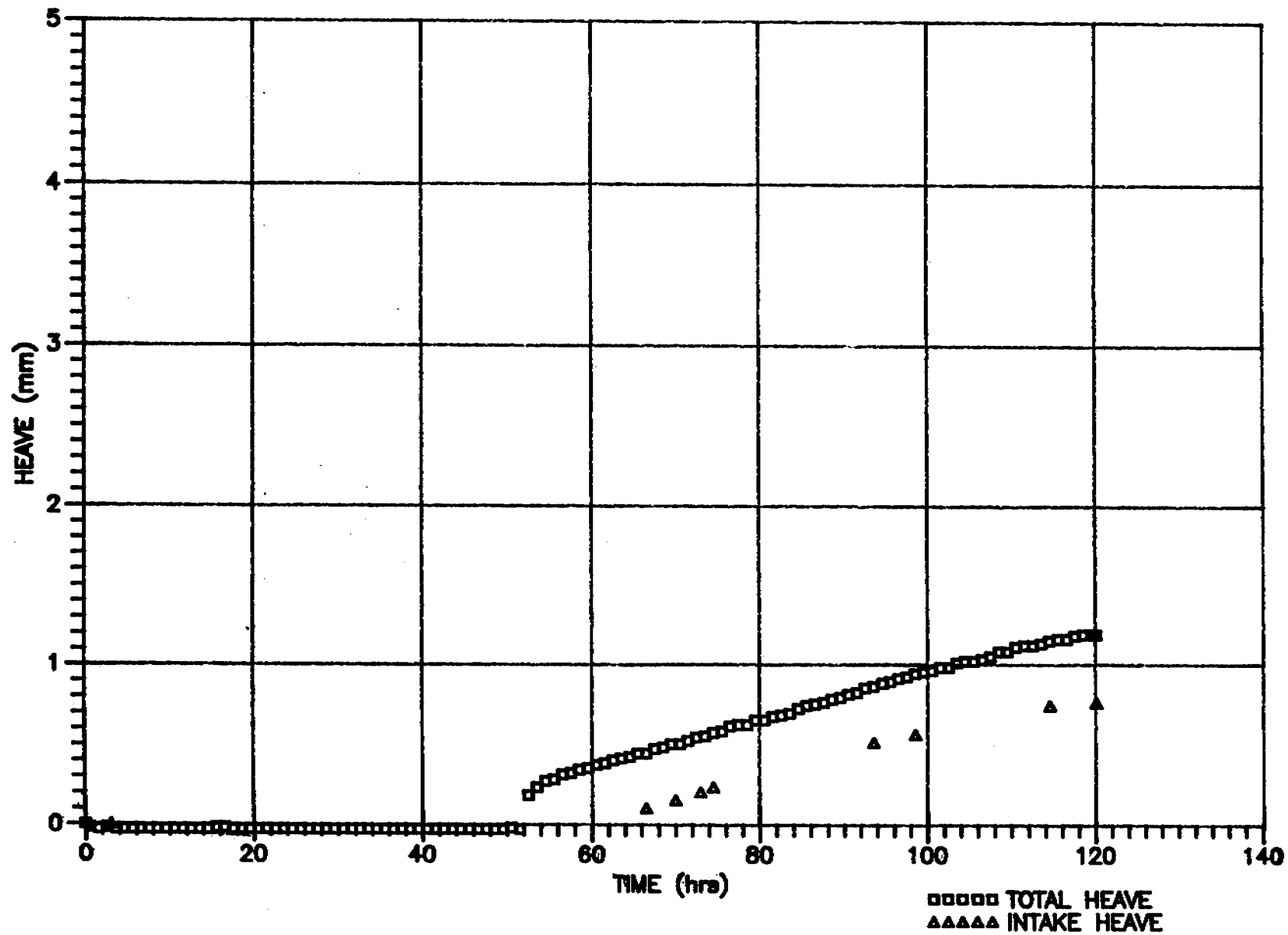




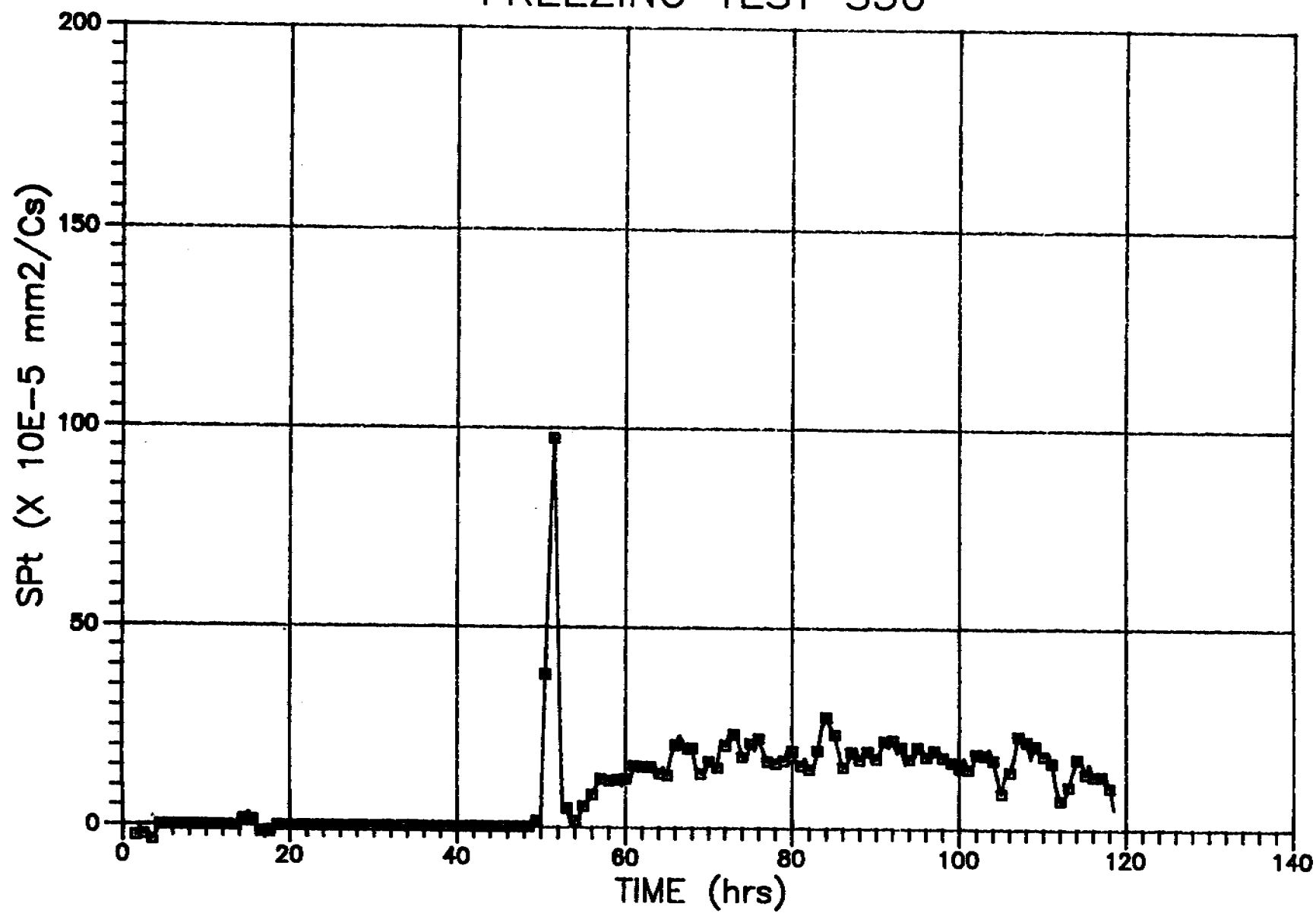


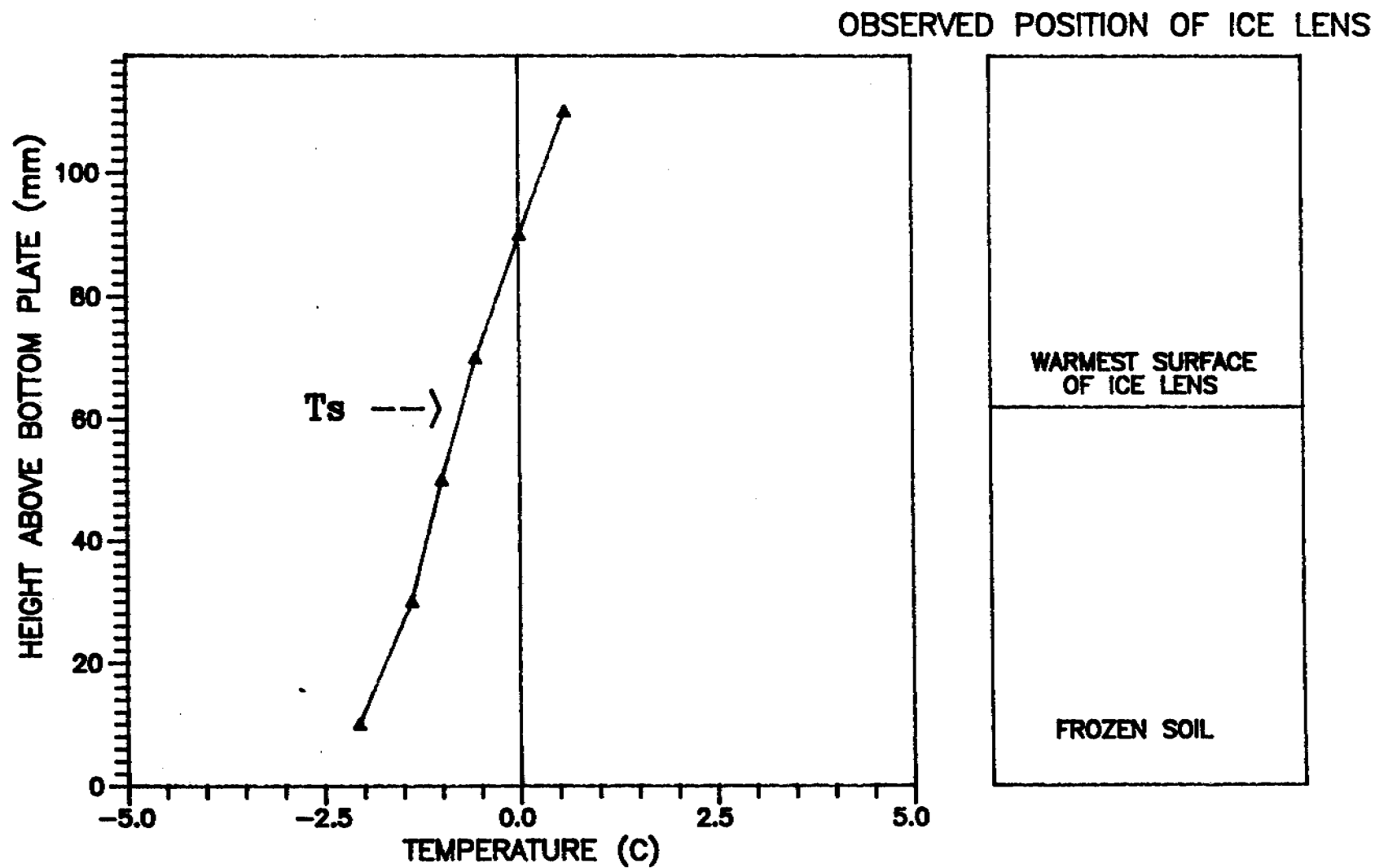
TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- S71

FREEZING TEST S50



FREEZING TEST S50





TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- S50

ICE FORMATION IN SALINE SOILS

VOLUME 3

Report Submitted

to

SUPPLY AND SERVICES CANADA

HULL, QUEBEC

(DSS File No. 63SS.23233-7-1080)

APPENDIX 5

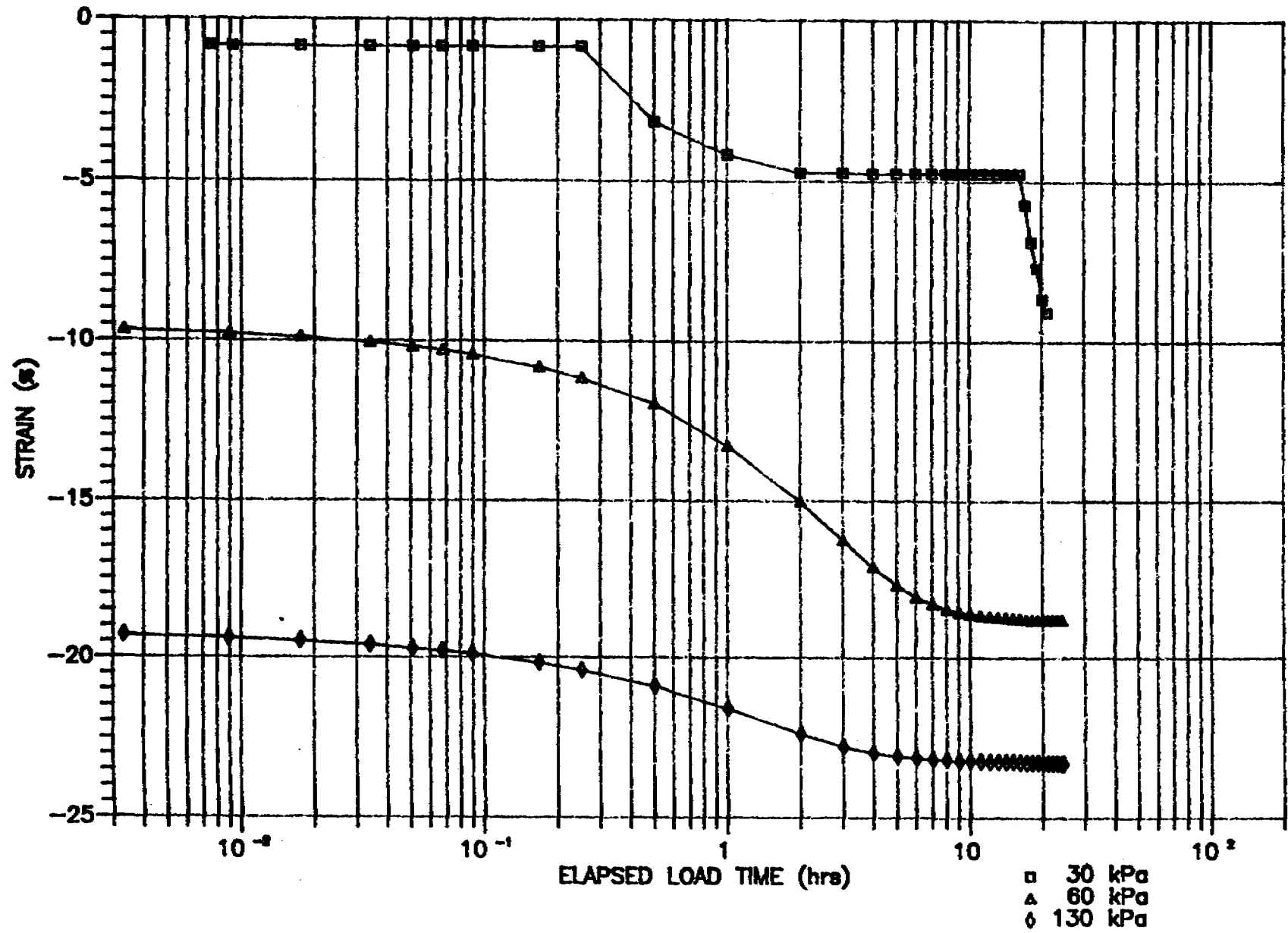
Test Results of Series 2. (Applied Surcharge)

Prepared by

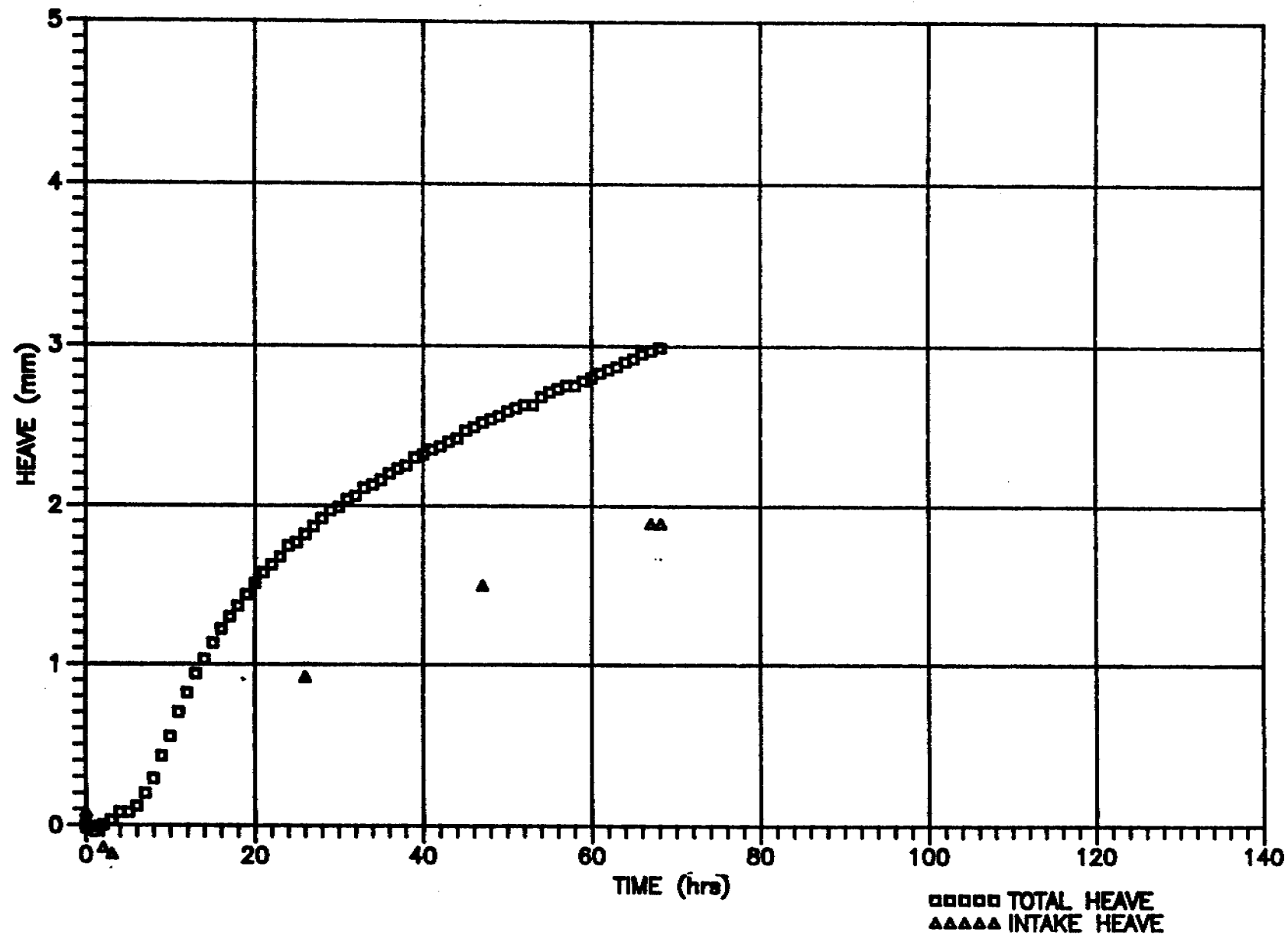
J.- M. Konrad, Ph.D., P.Eng.
Dept. of Earth Sciences
University of Waterloo
Waterloo, Ontario, N2L-3G1

March, 1989

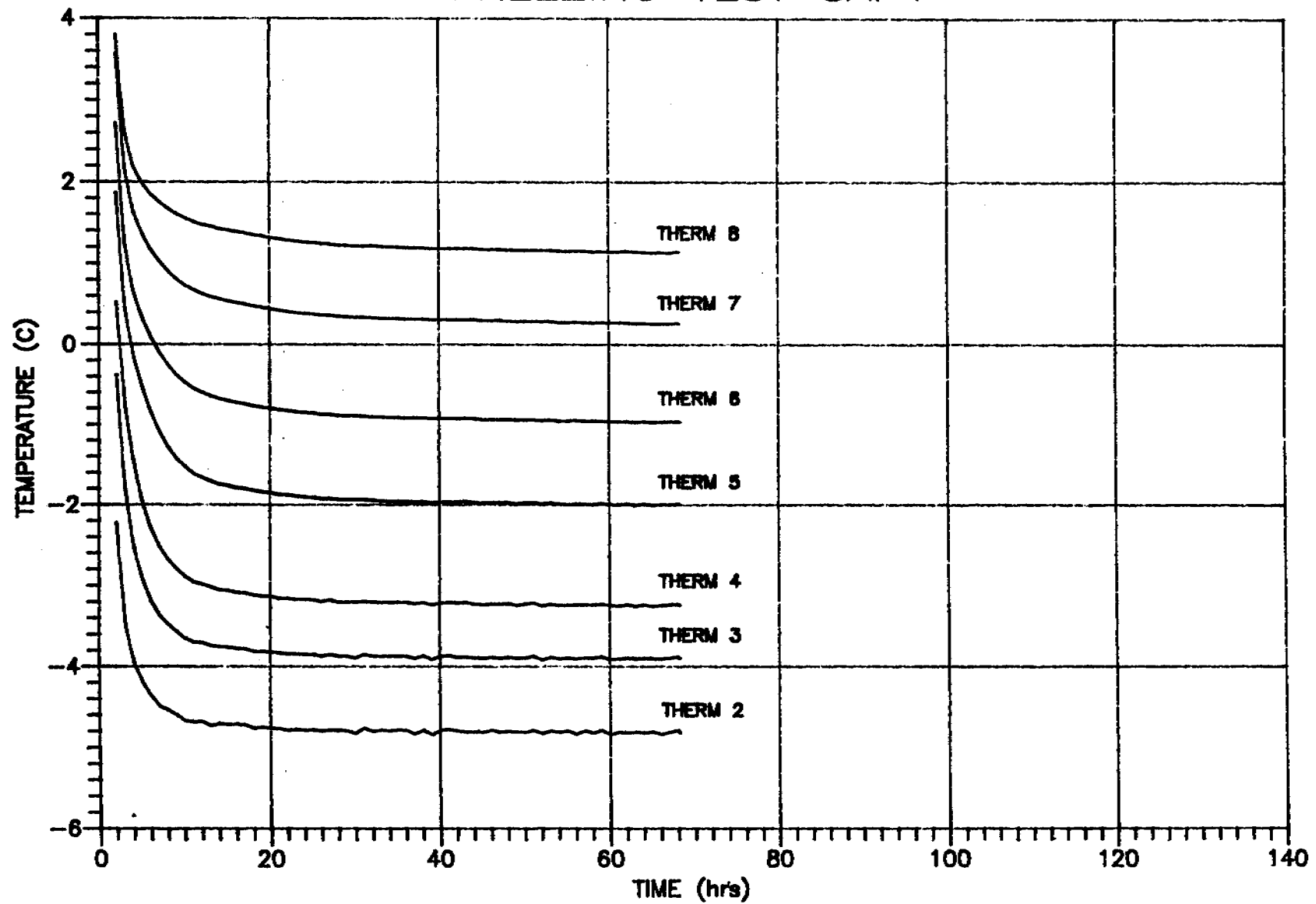
CONSOLIDATION TEST SAP1



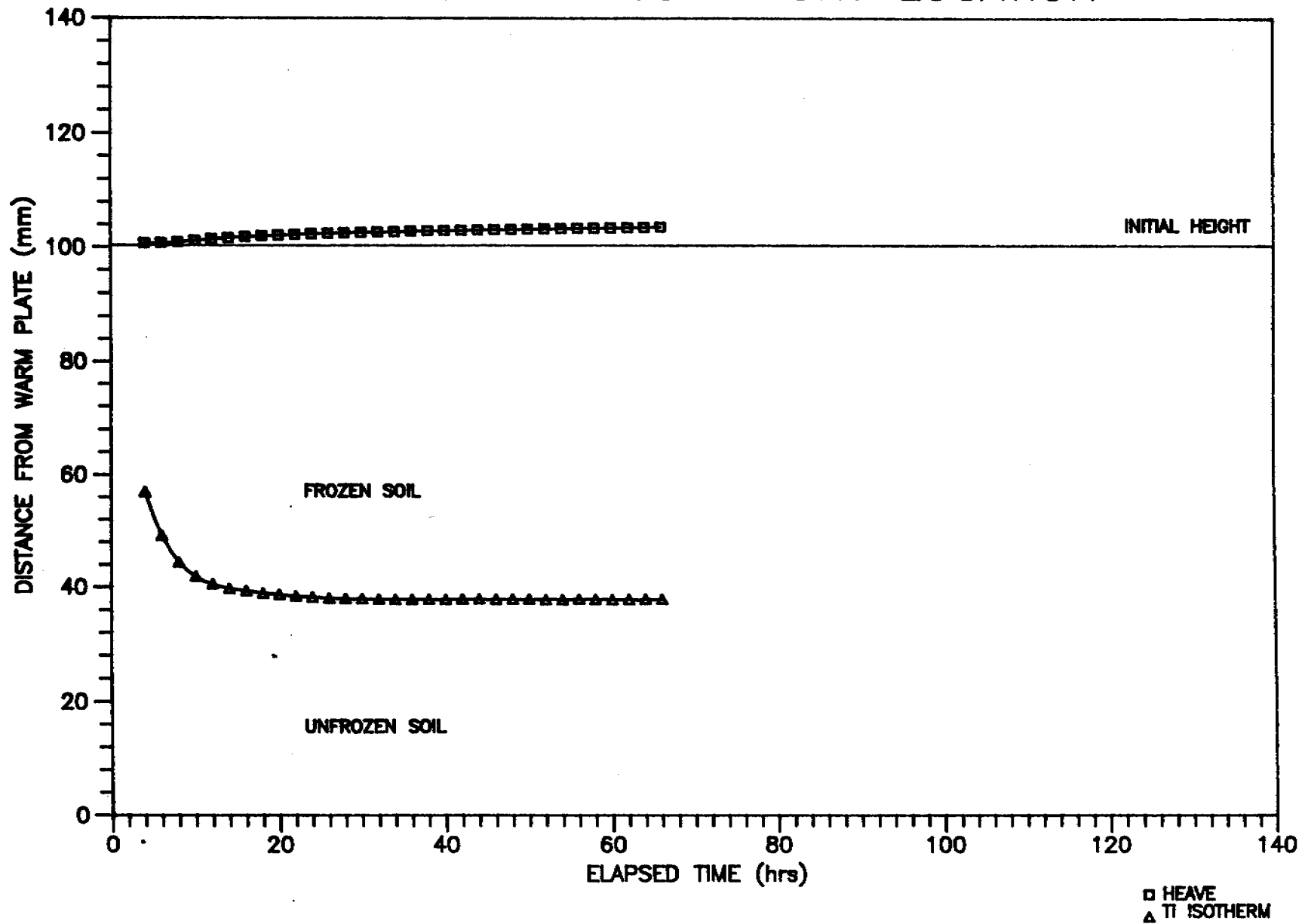
FREEZING TEST SAP1



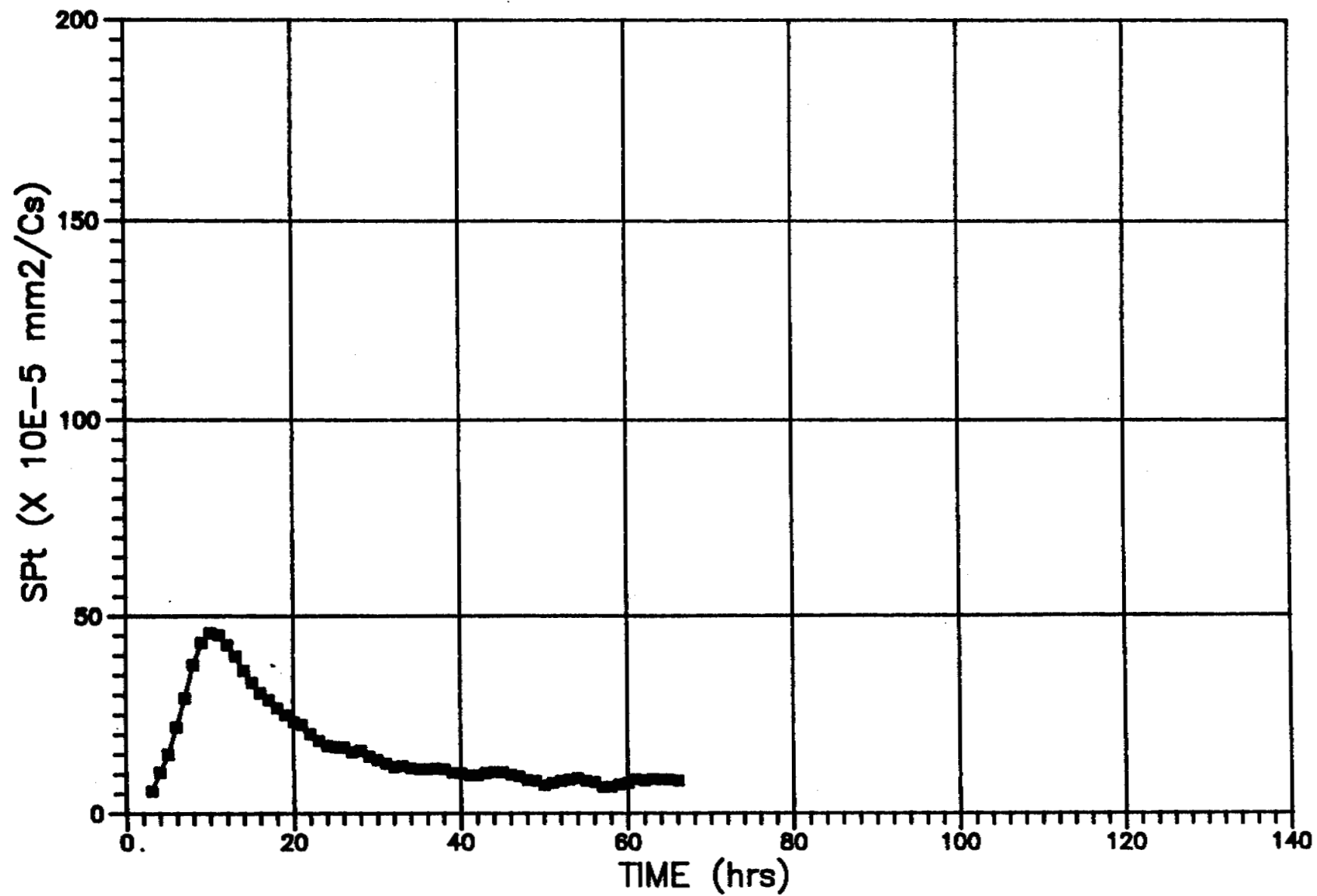
FREEZING TEST SAP1



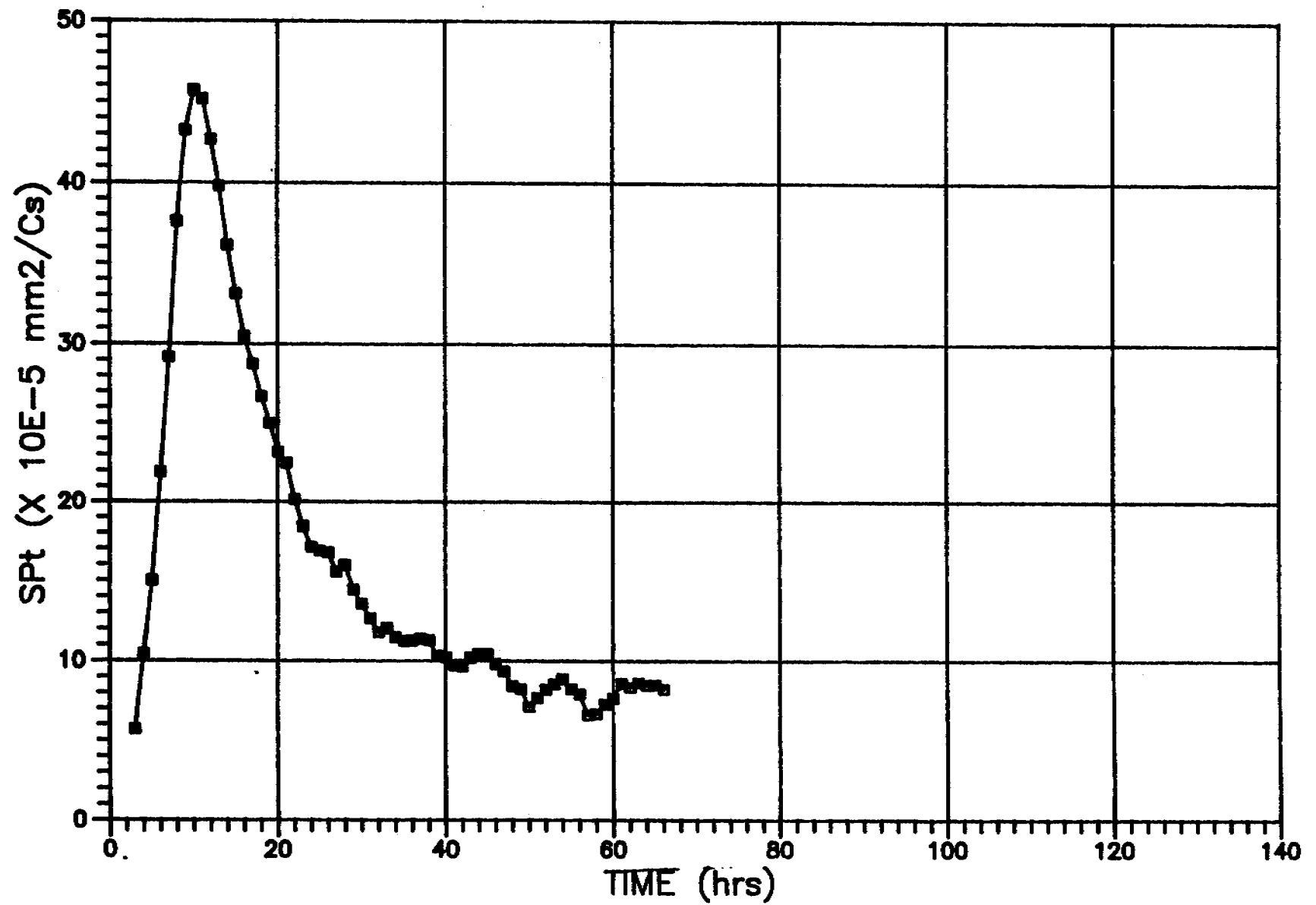
TEST SAP1 FROST FRONT LOCATION

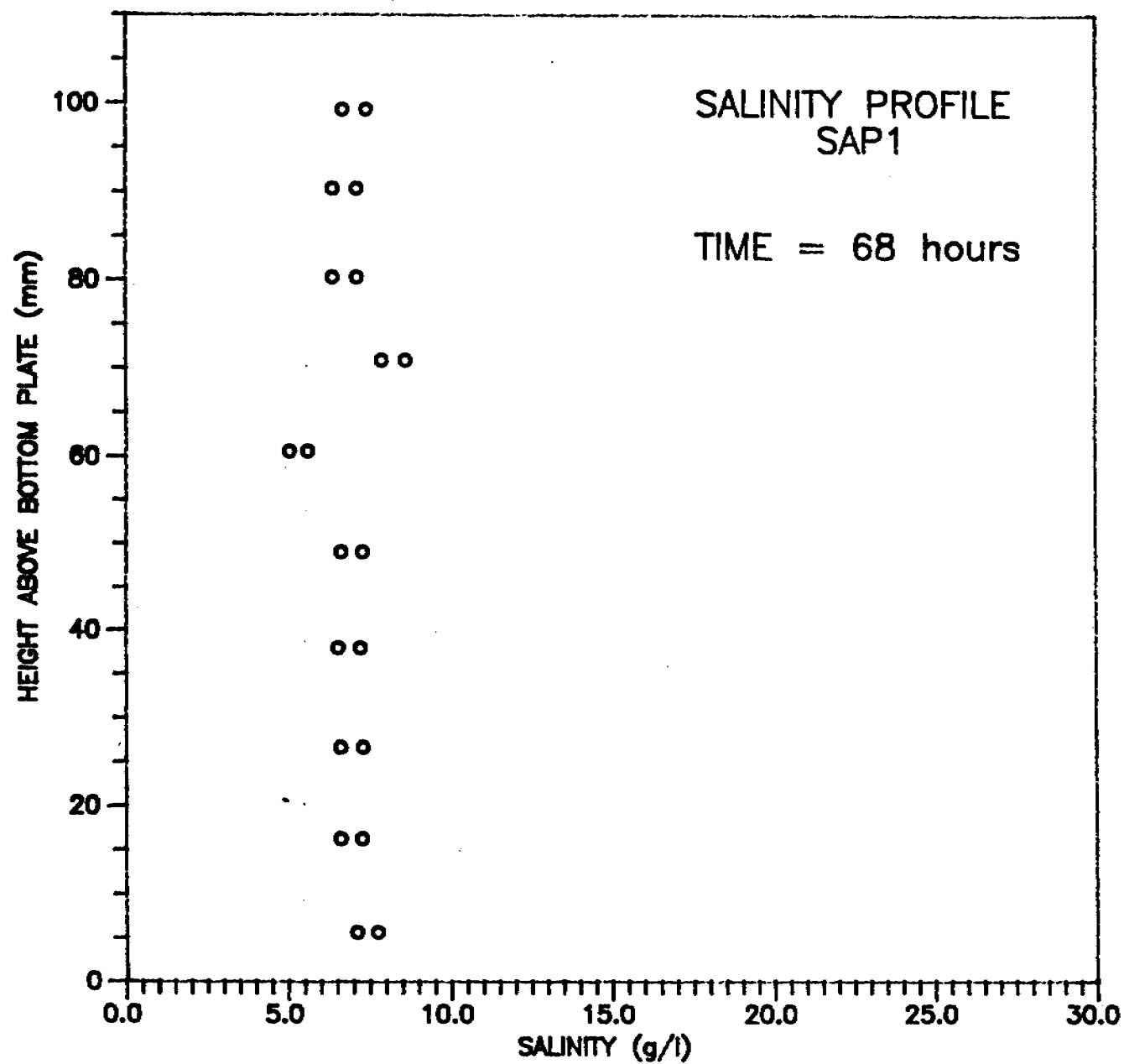


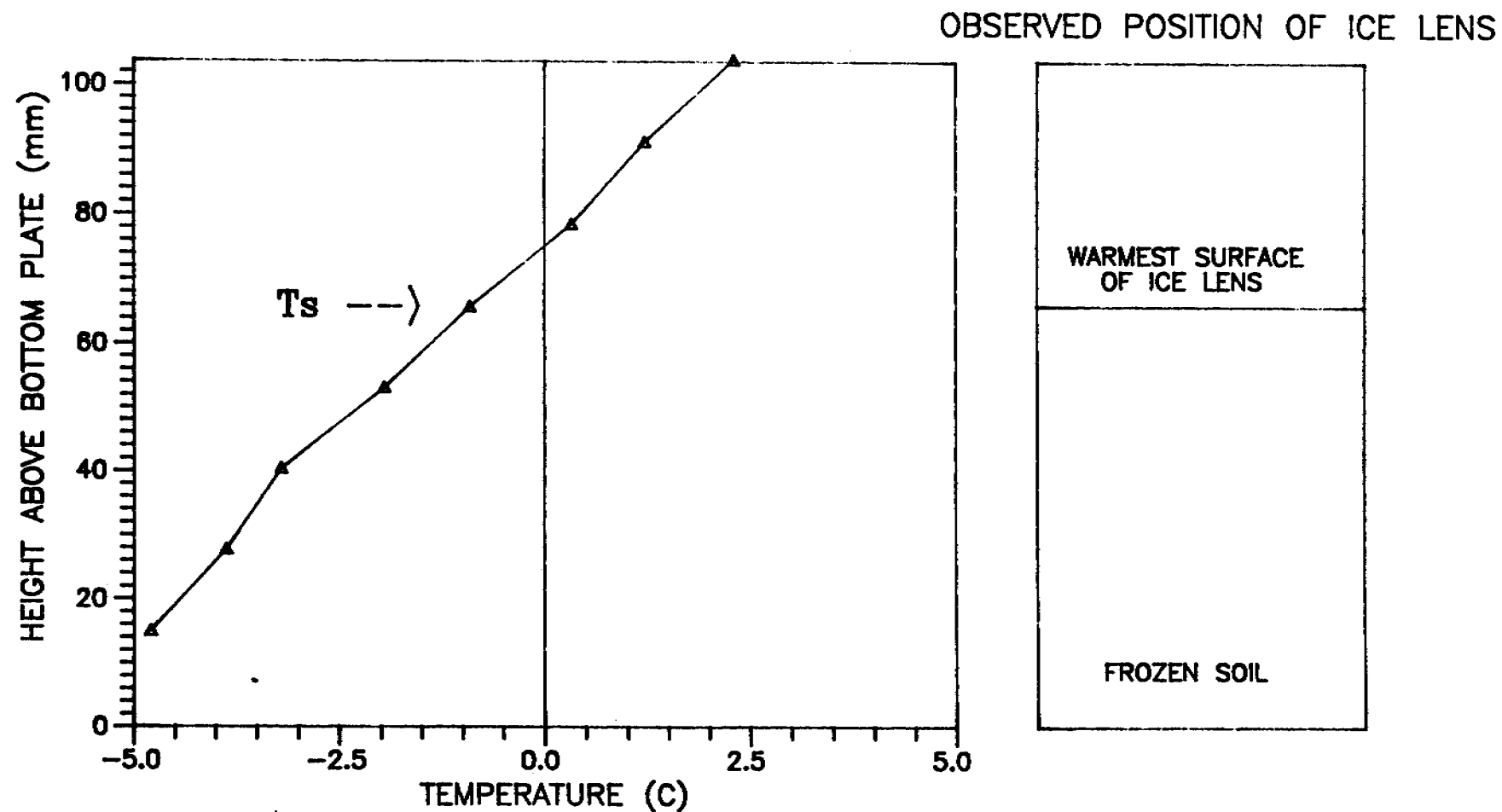
FREEZING TEST SAP1



FREEZING TEST SAP1

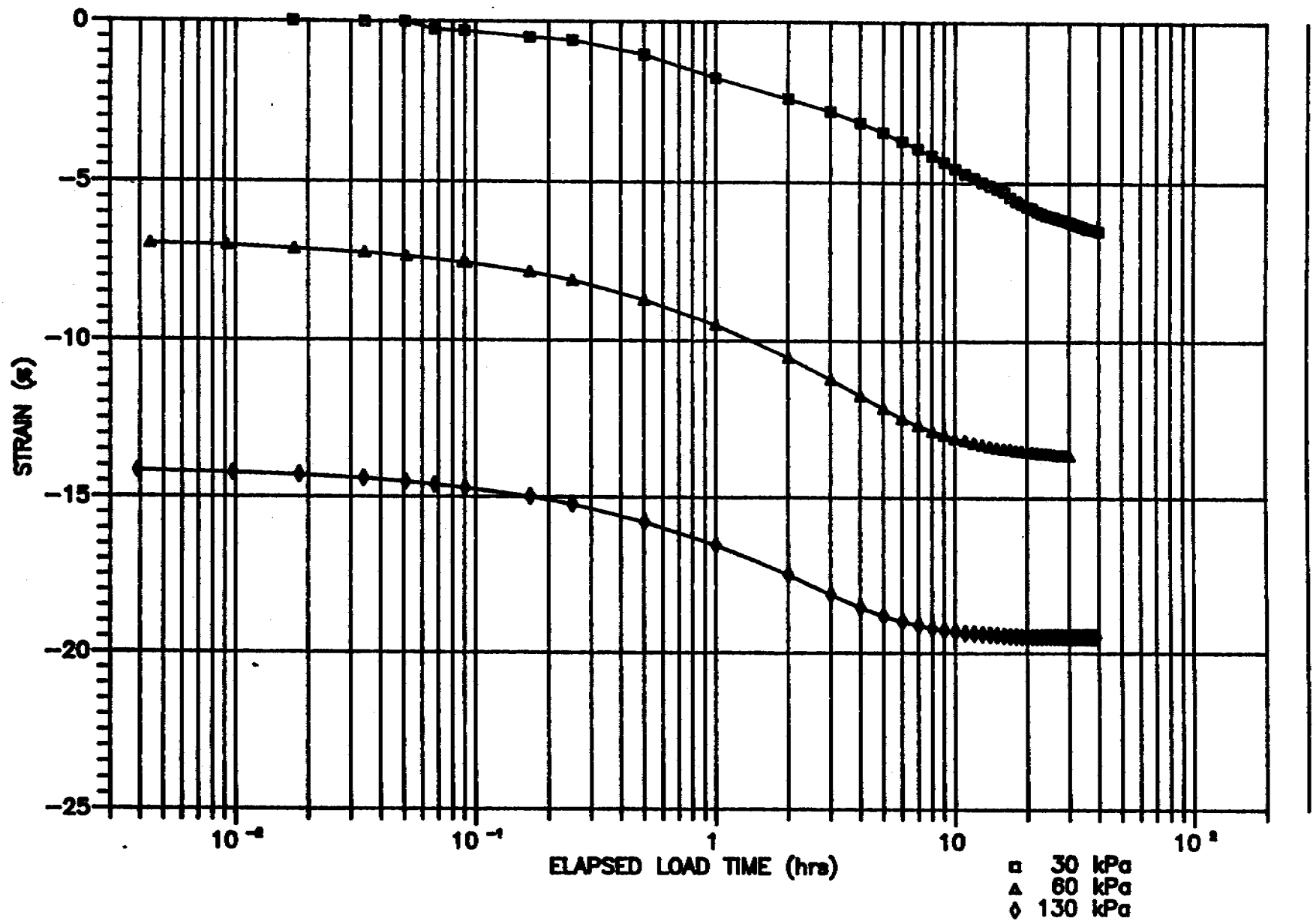




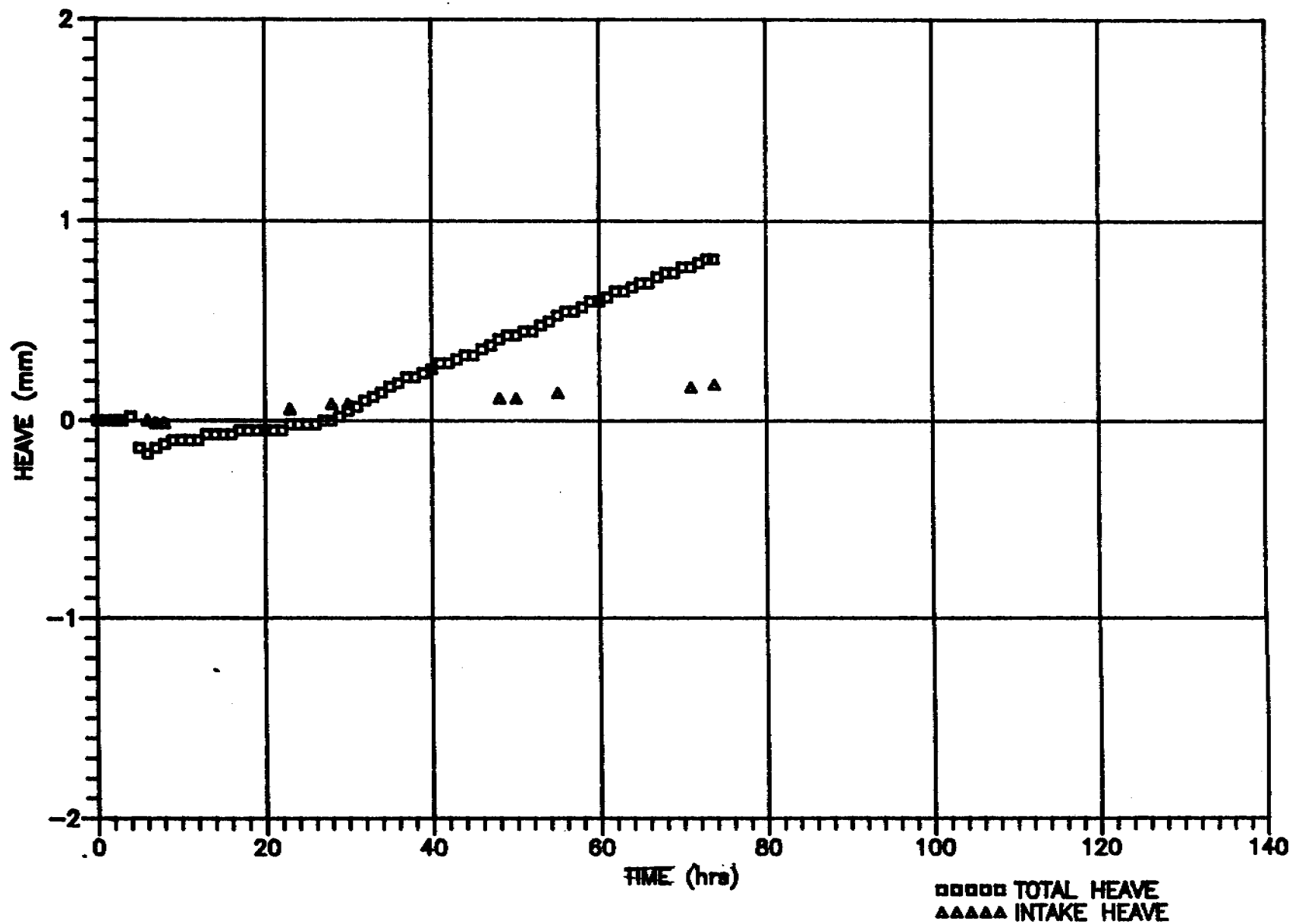


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP1

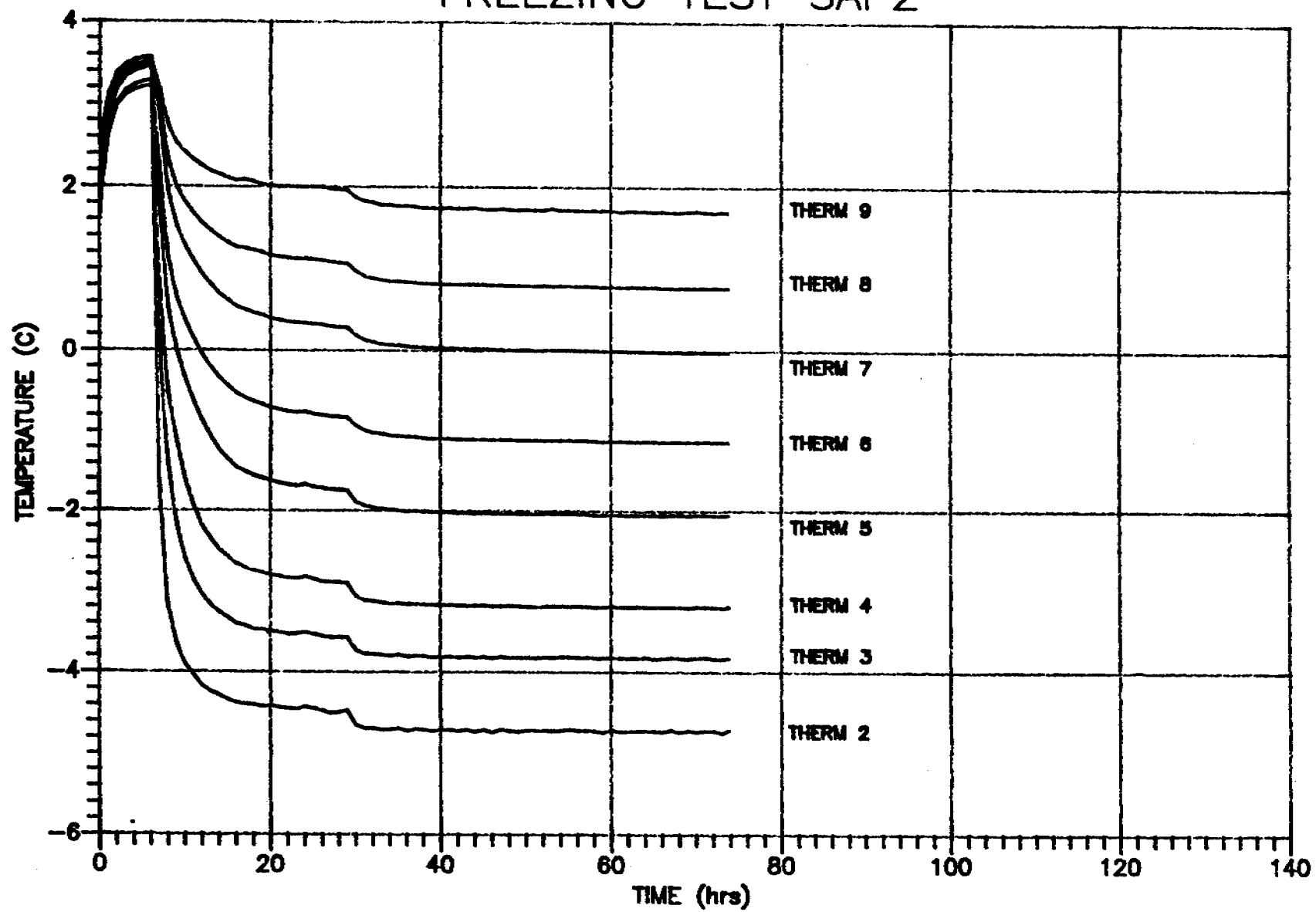
CONSOLIDATION TEST SAP2



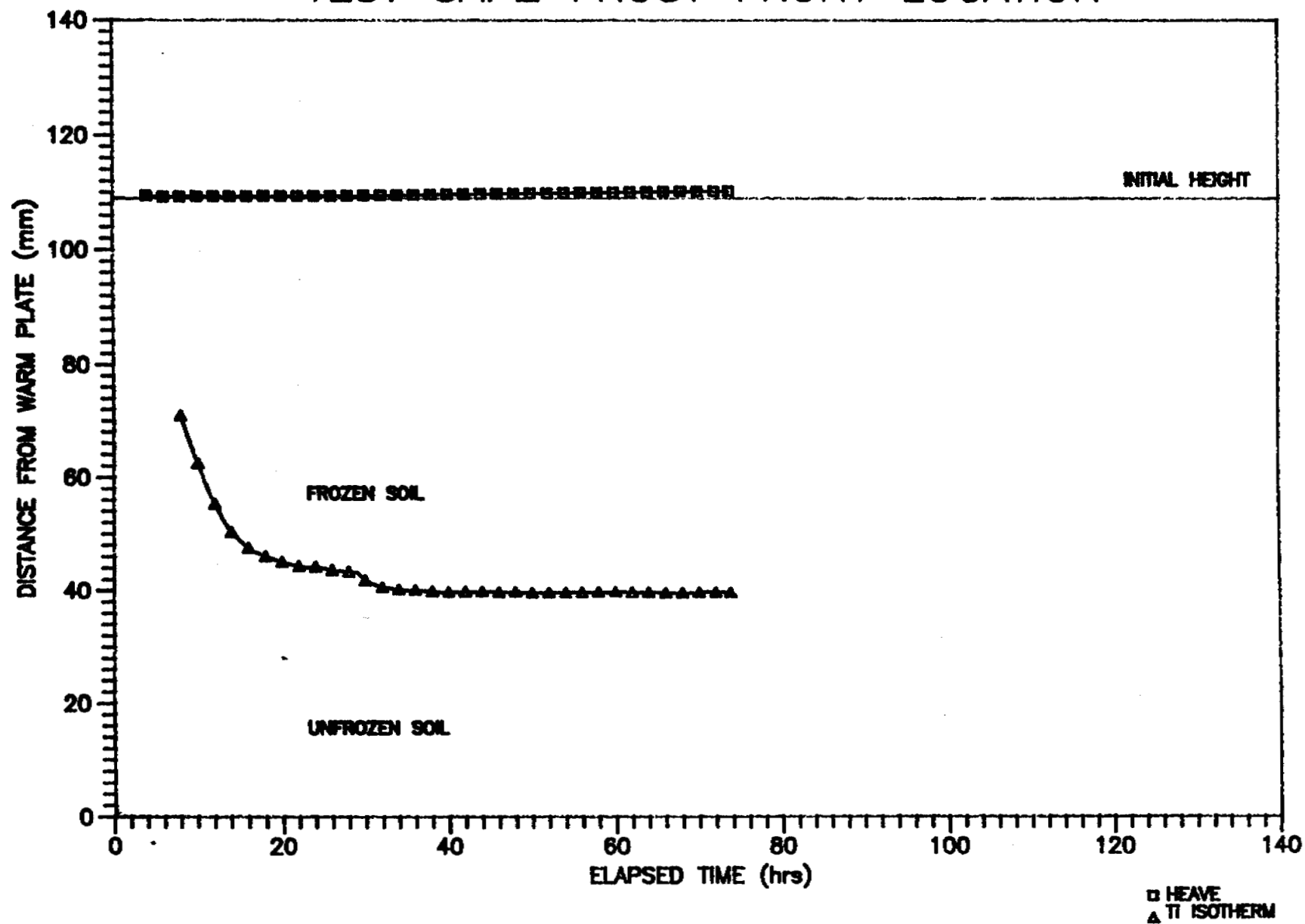
FREEZING TEST SAP2



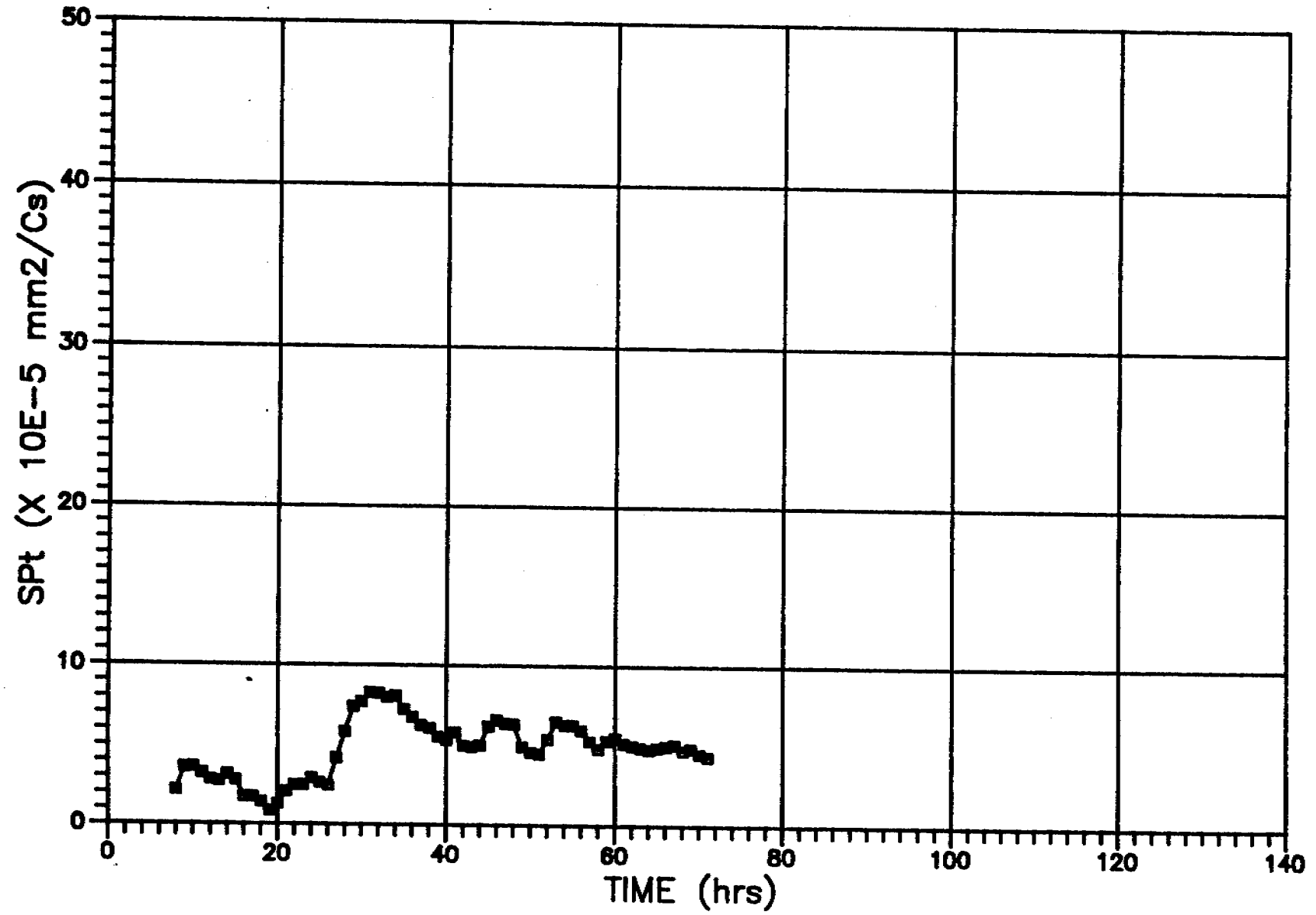
FREEZING TEST SAP2



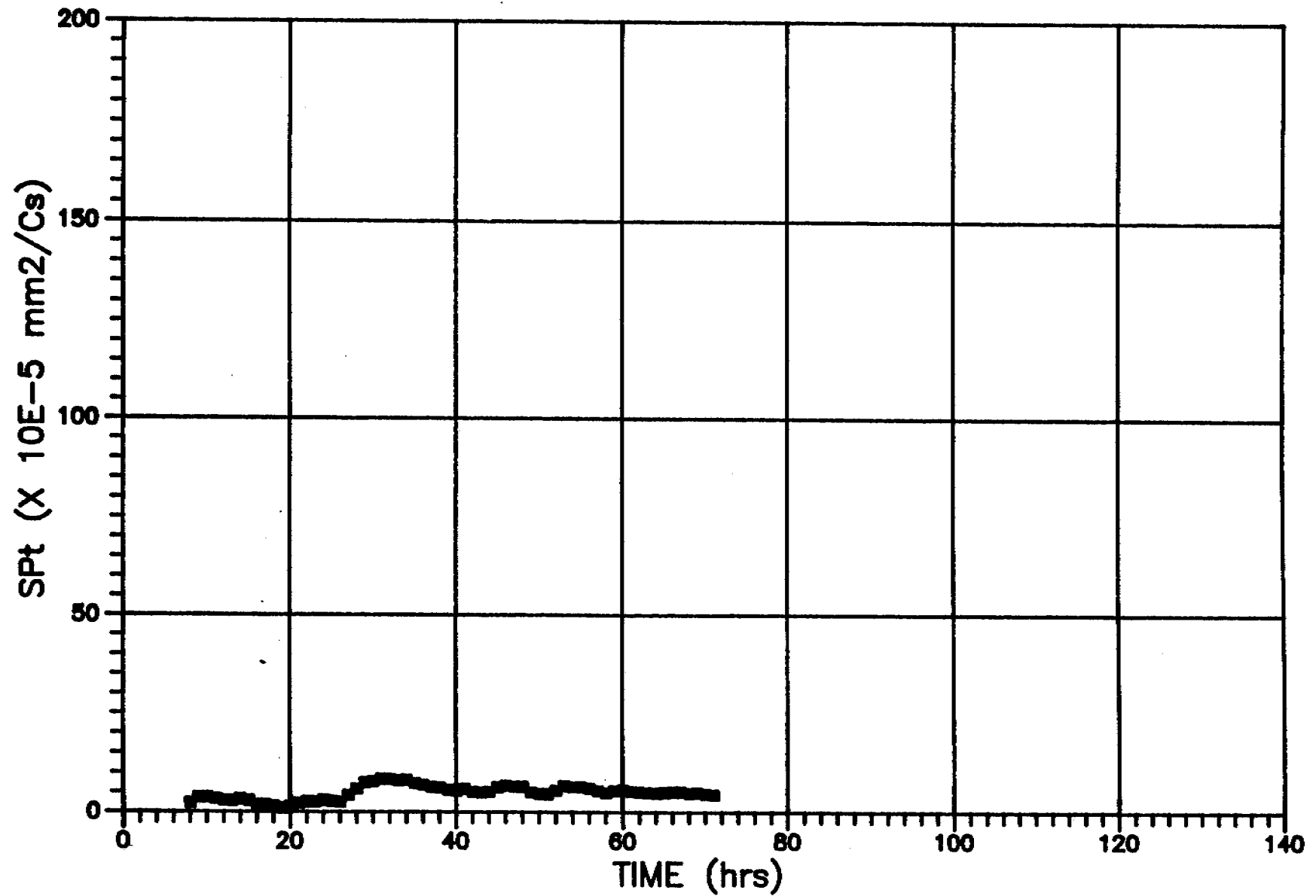
TEST SAP2 FROST FRONT LOCATION

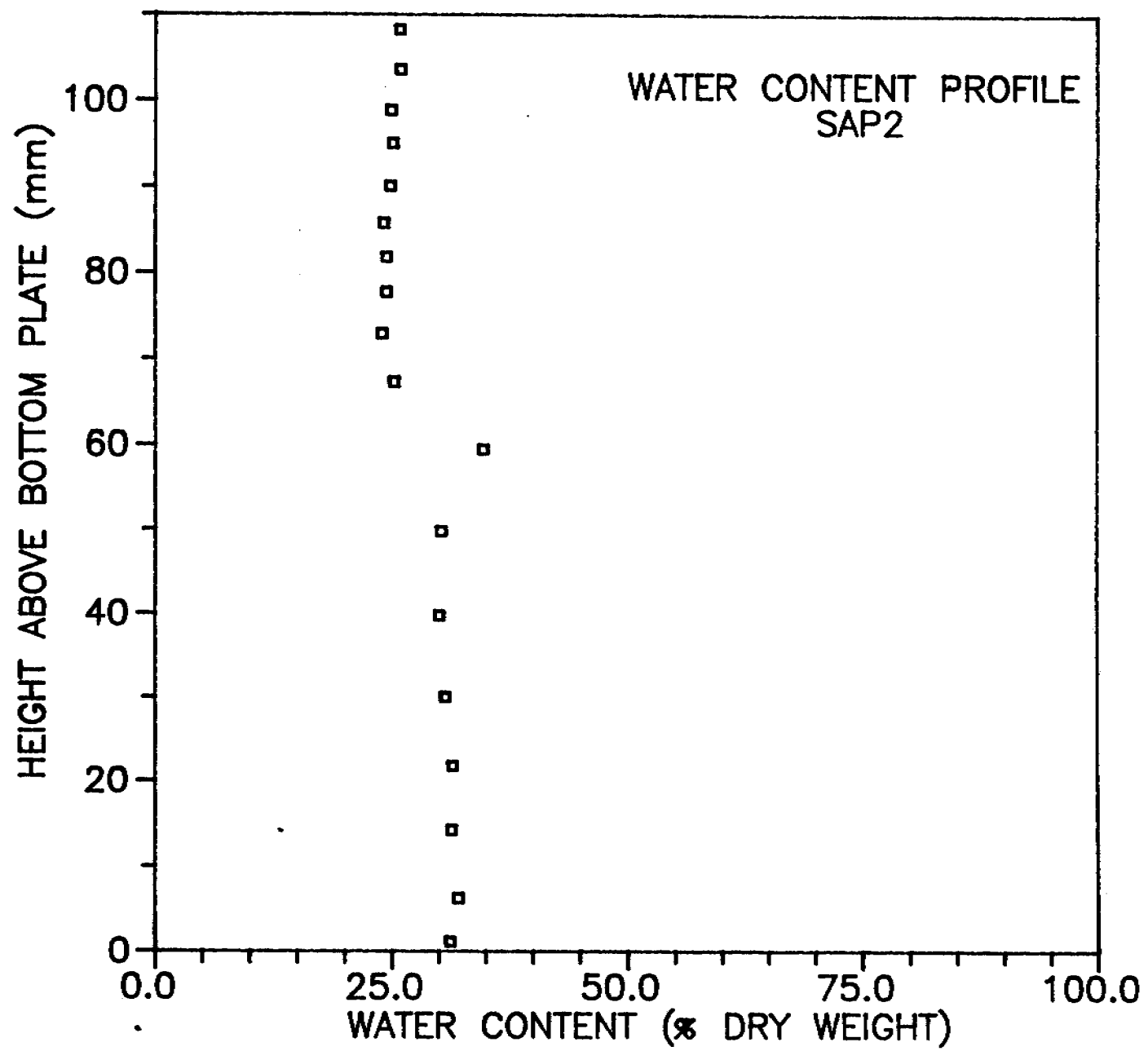


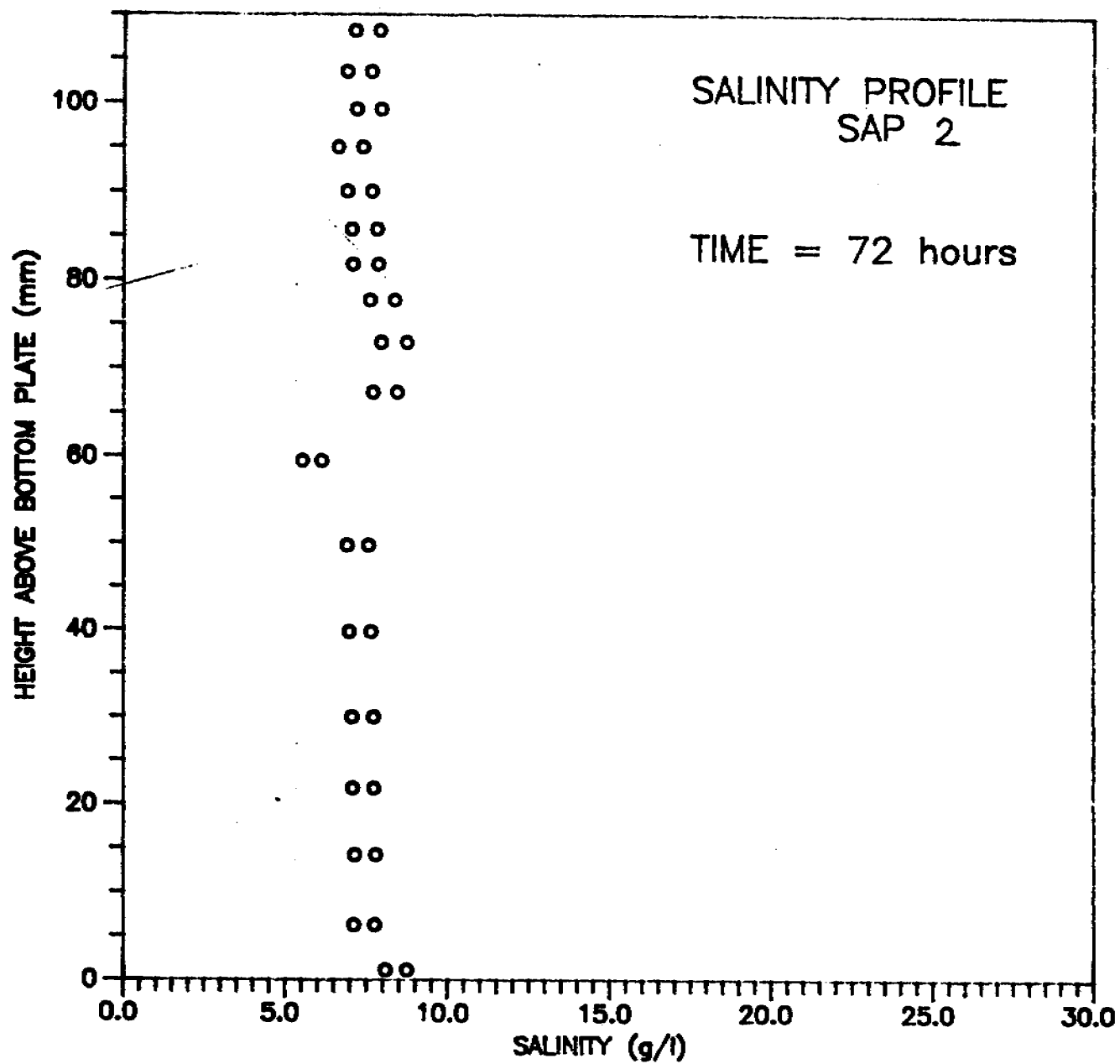
FREEZING TEST SAP2

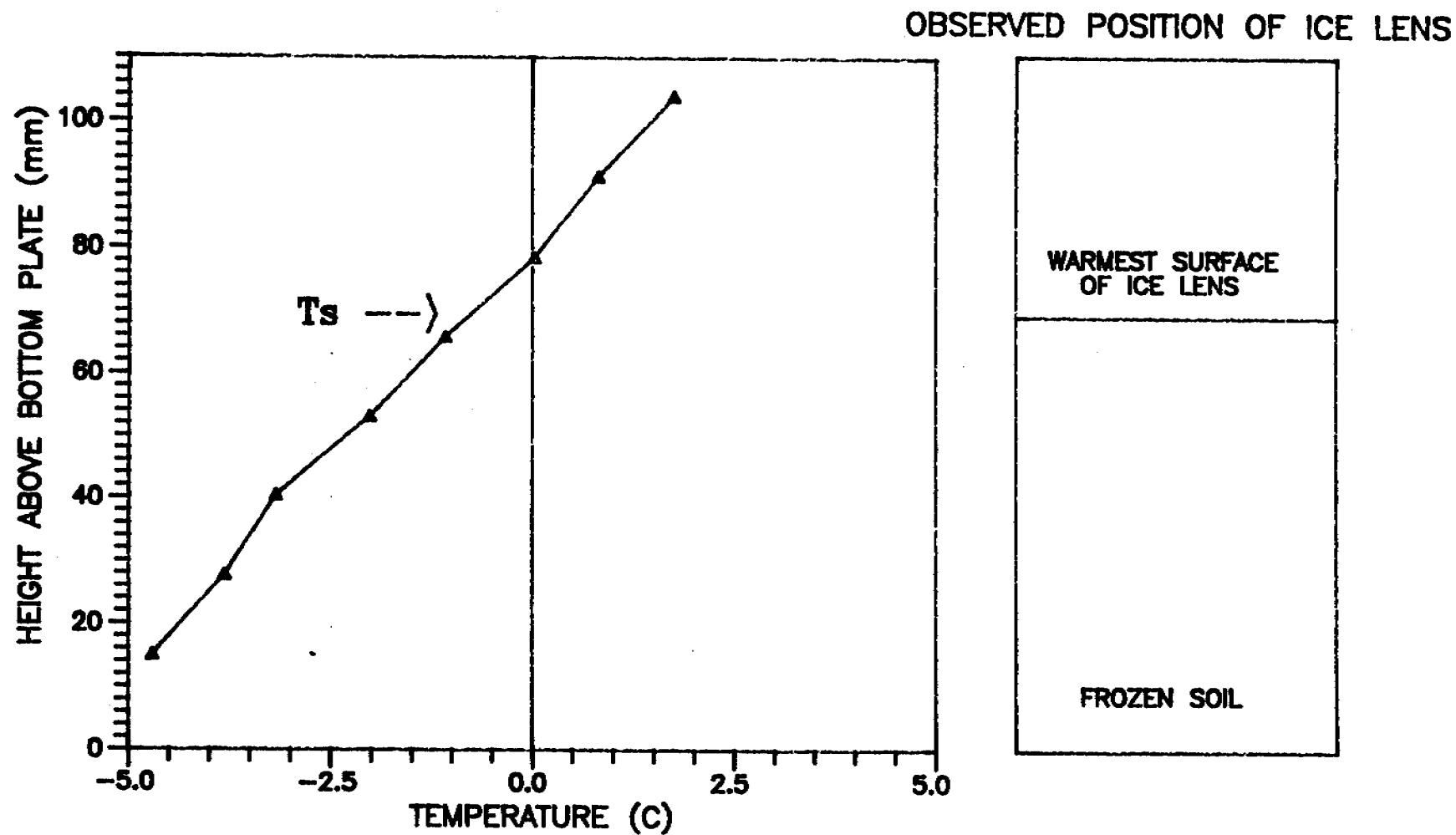


FREEZING TEST SAP2



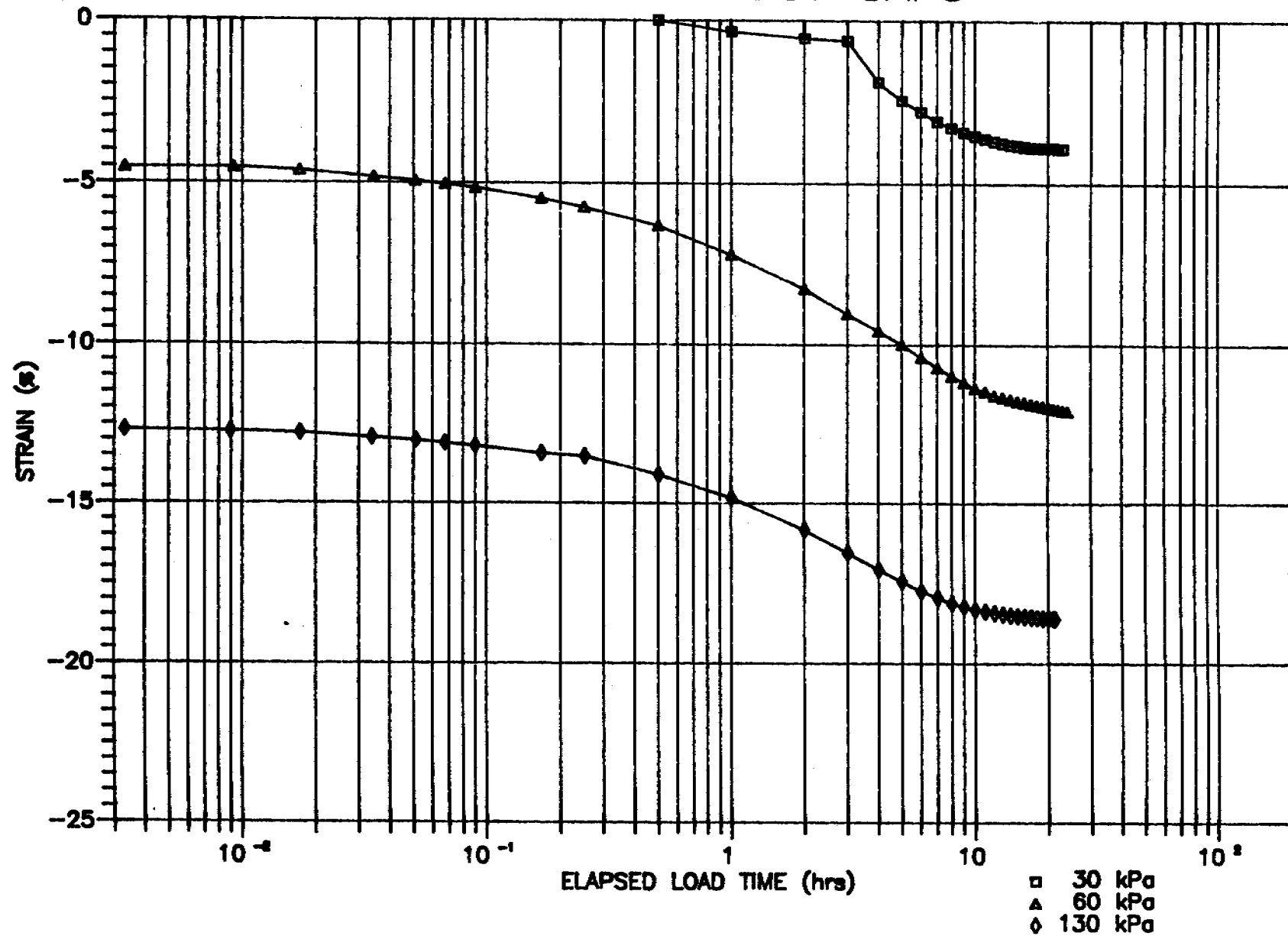




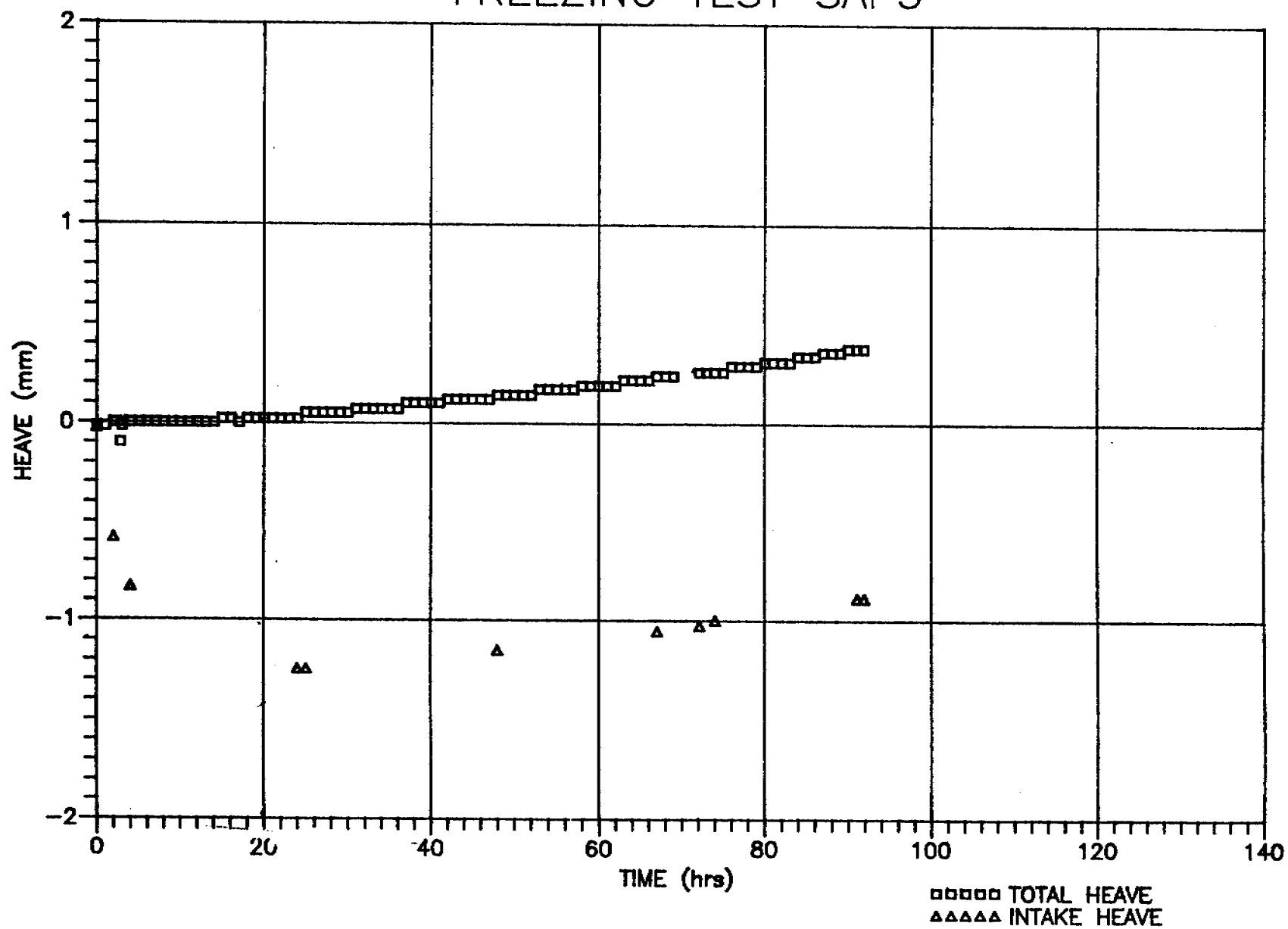


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP2

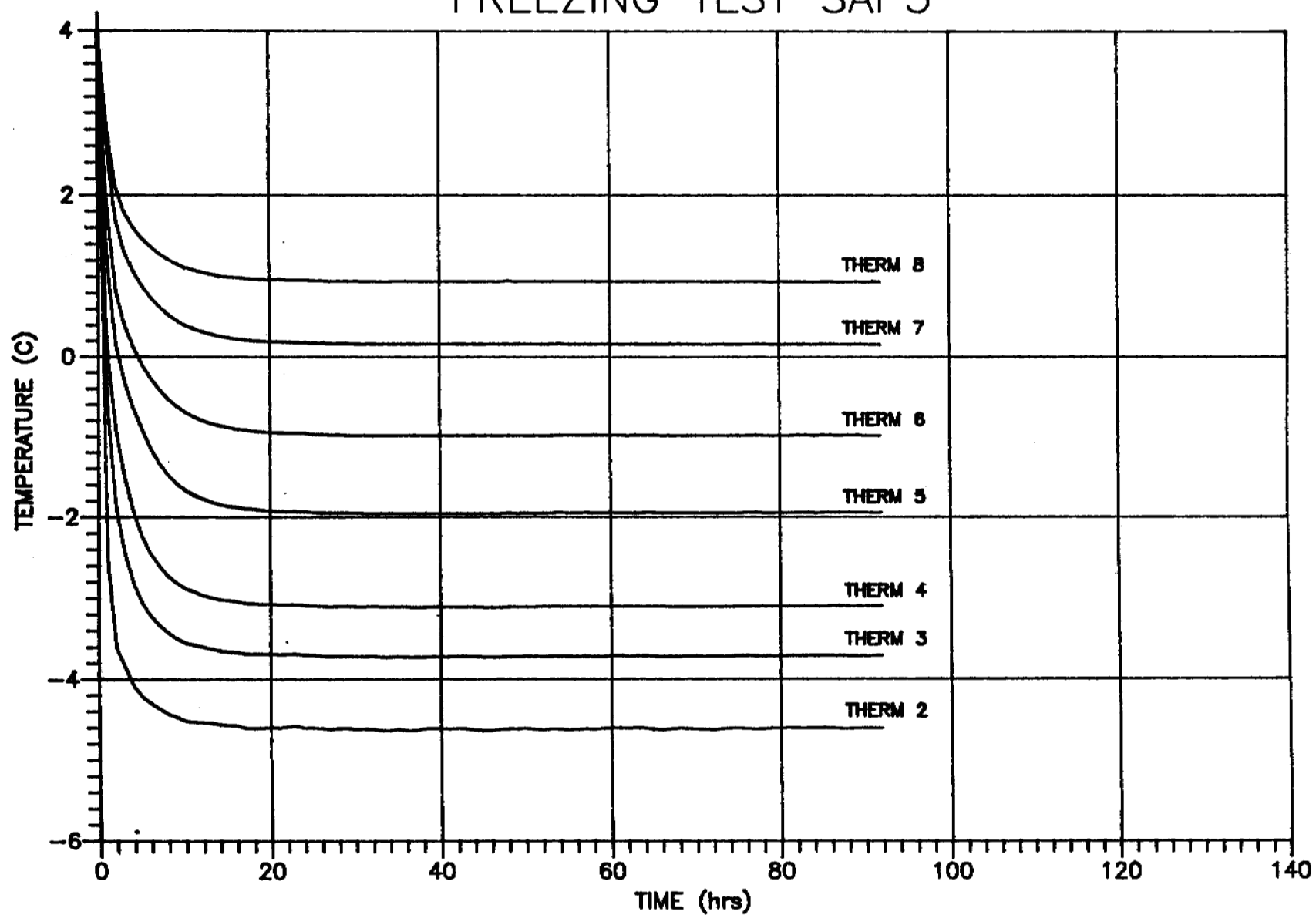
CONSOLIDATION TEST SAP3



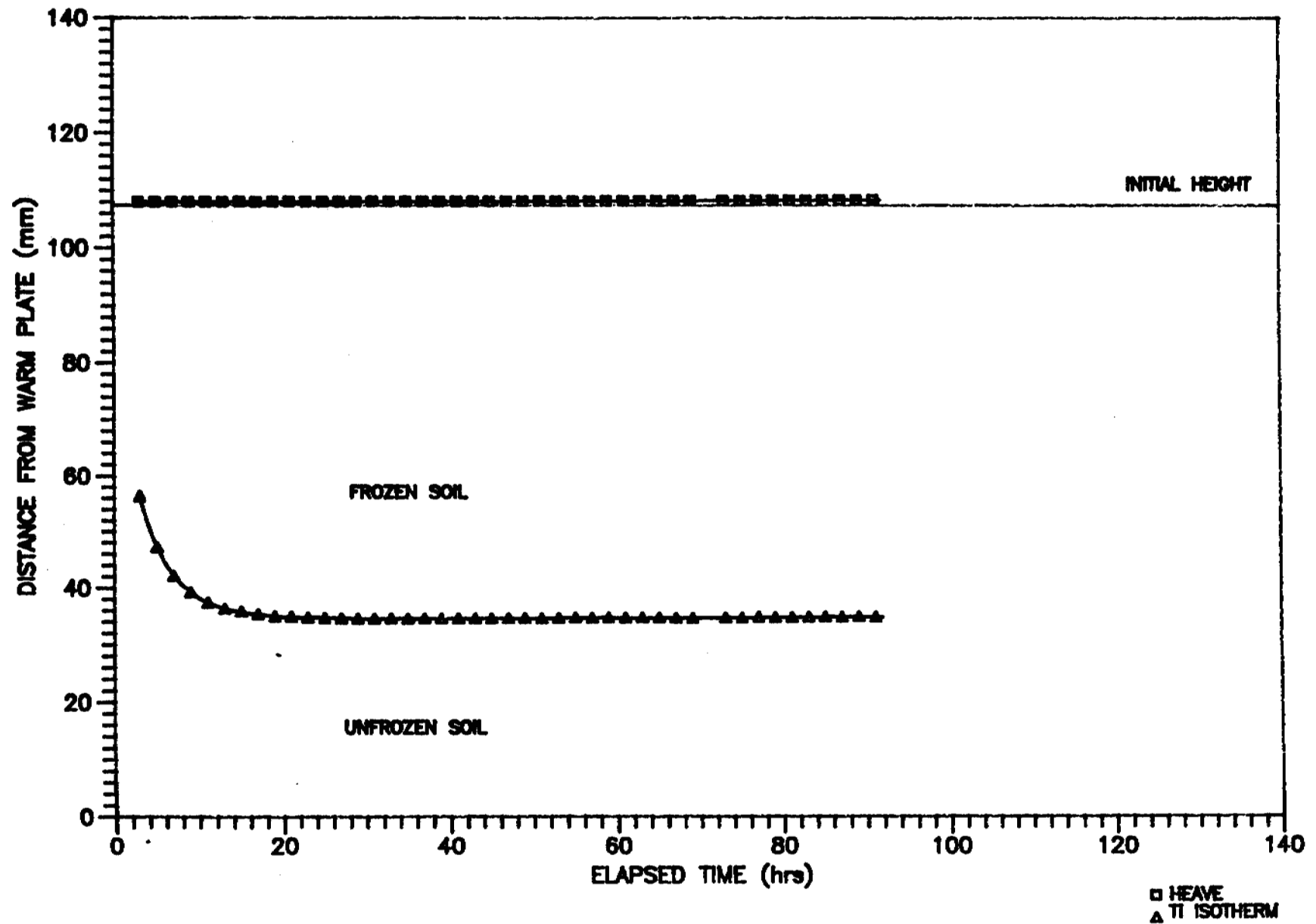
FREEZING TEST SAP3



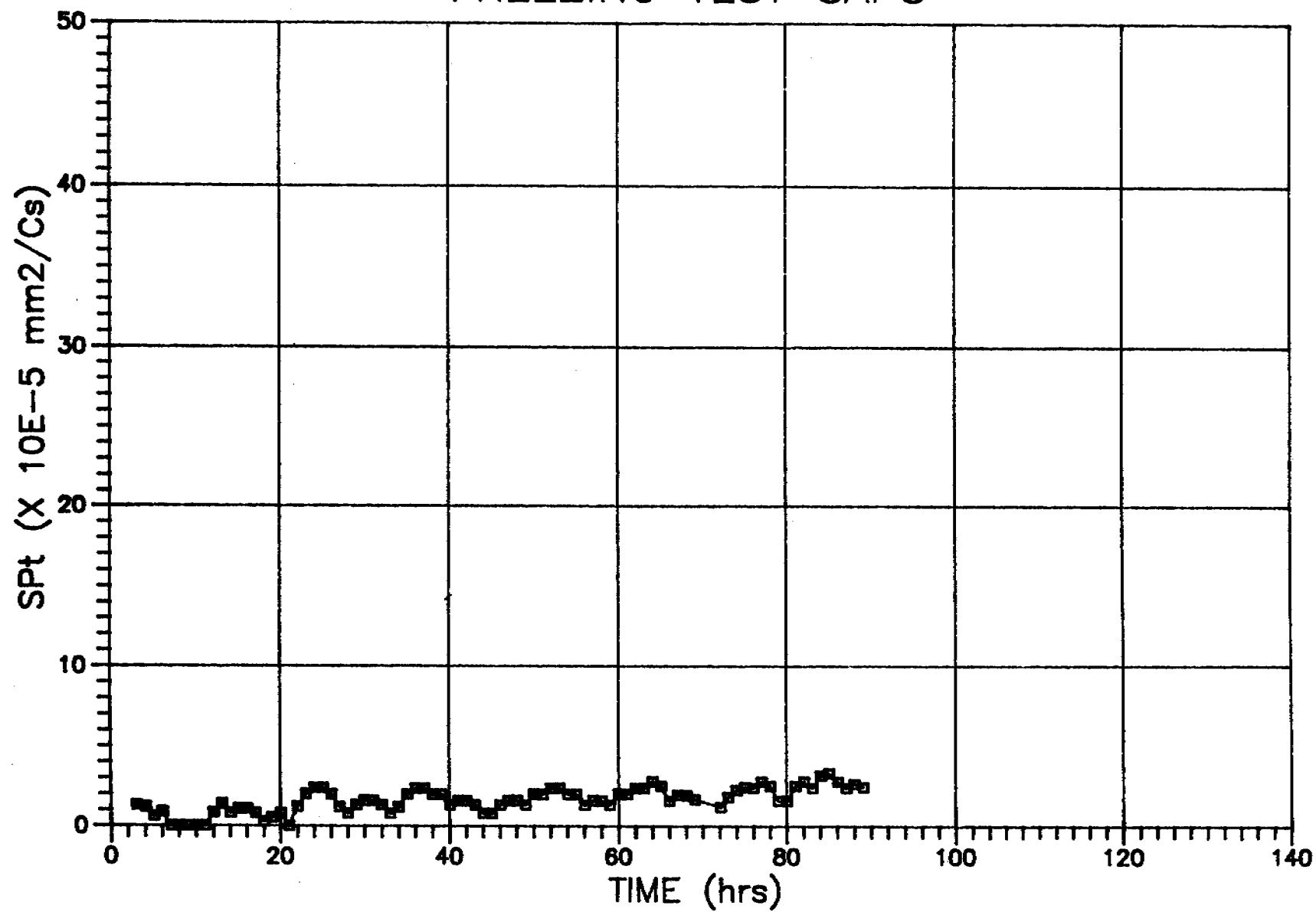
FREEZING TEST SAP3

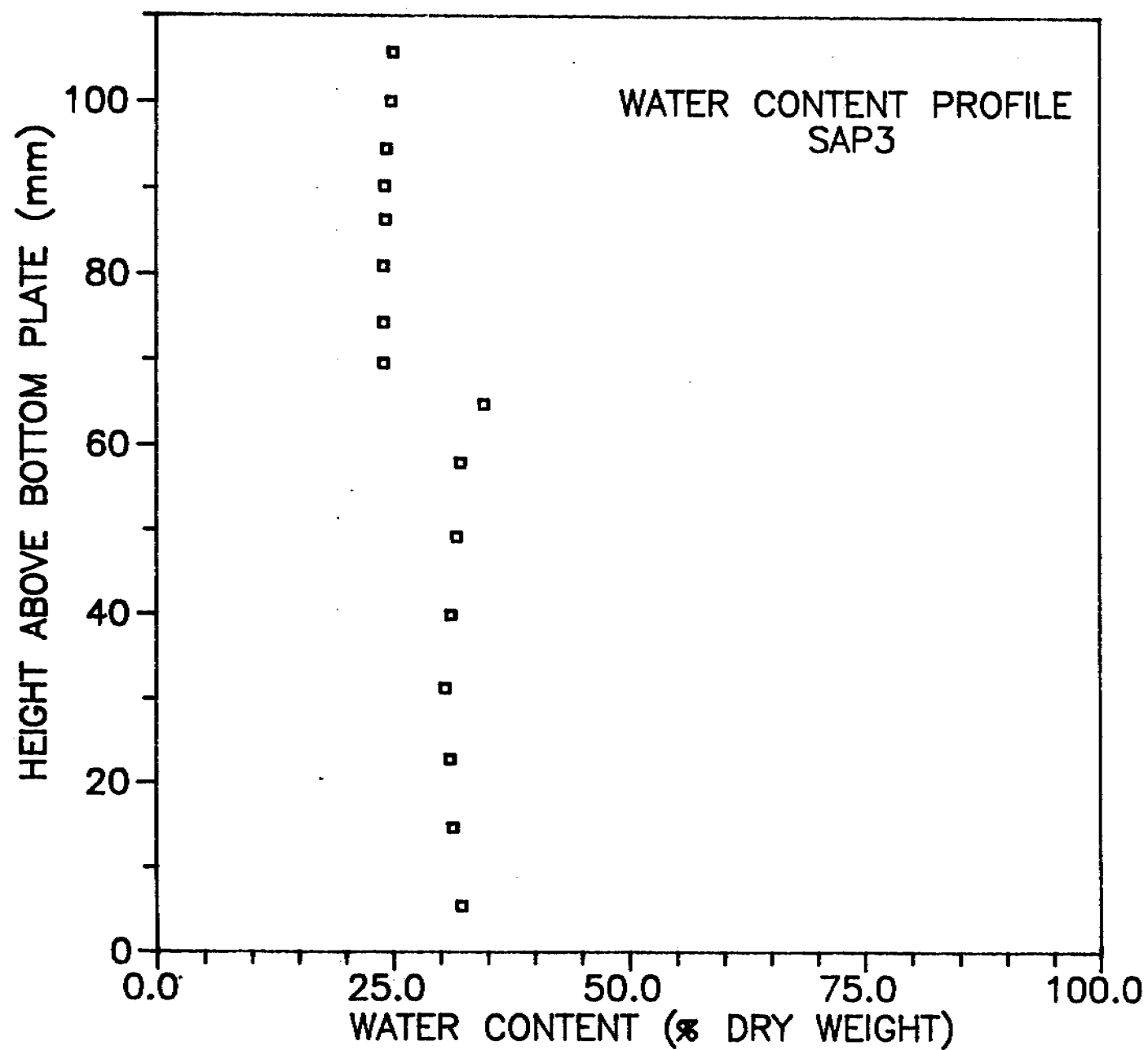


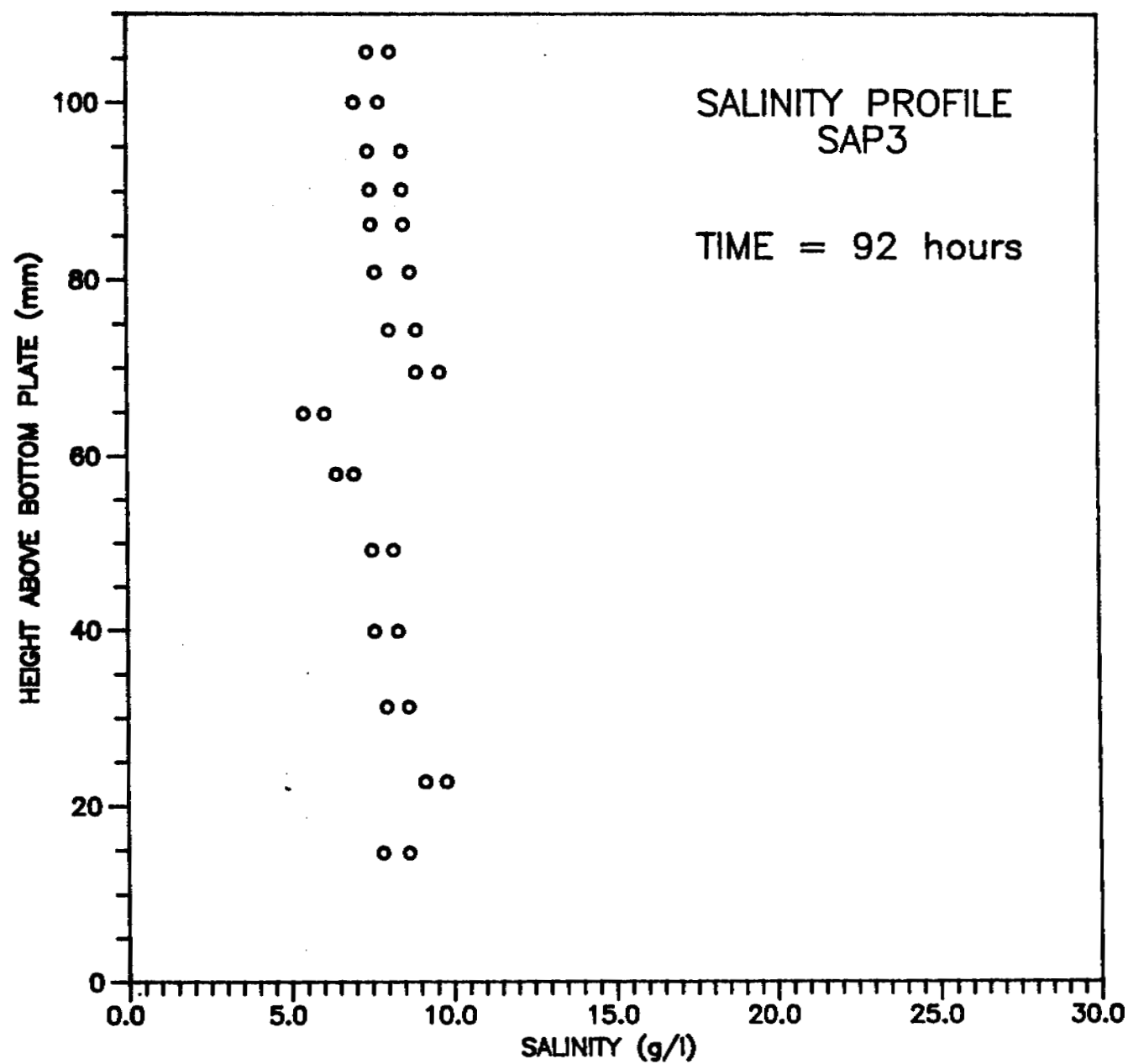
TEST SAP3 FROST FRONT LOCATION

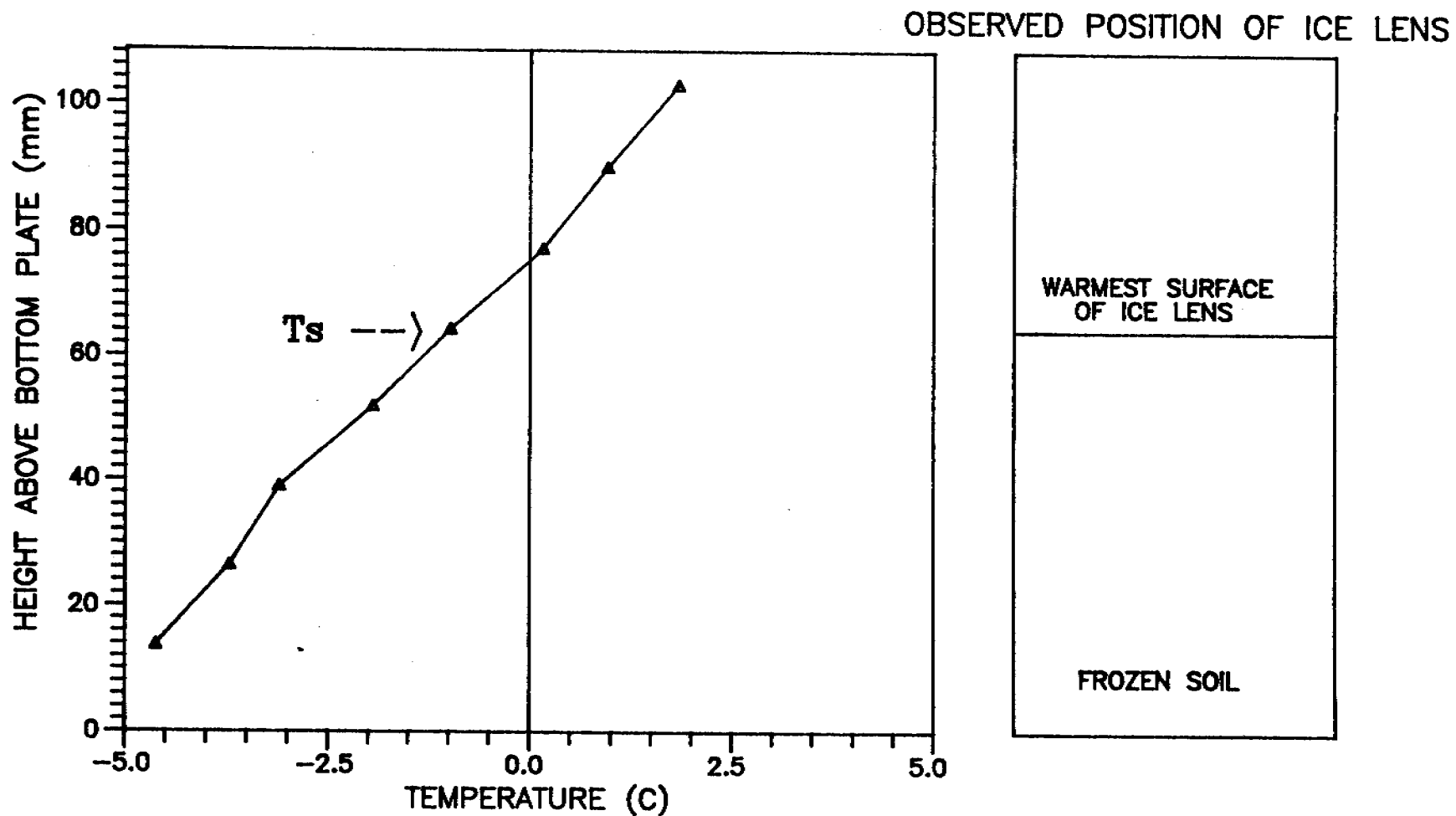


FREEZING TEST SAP3



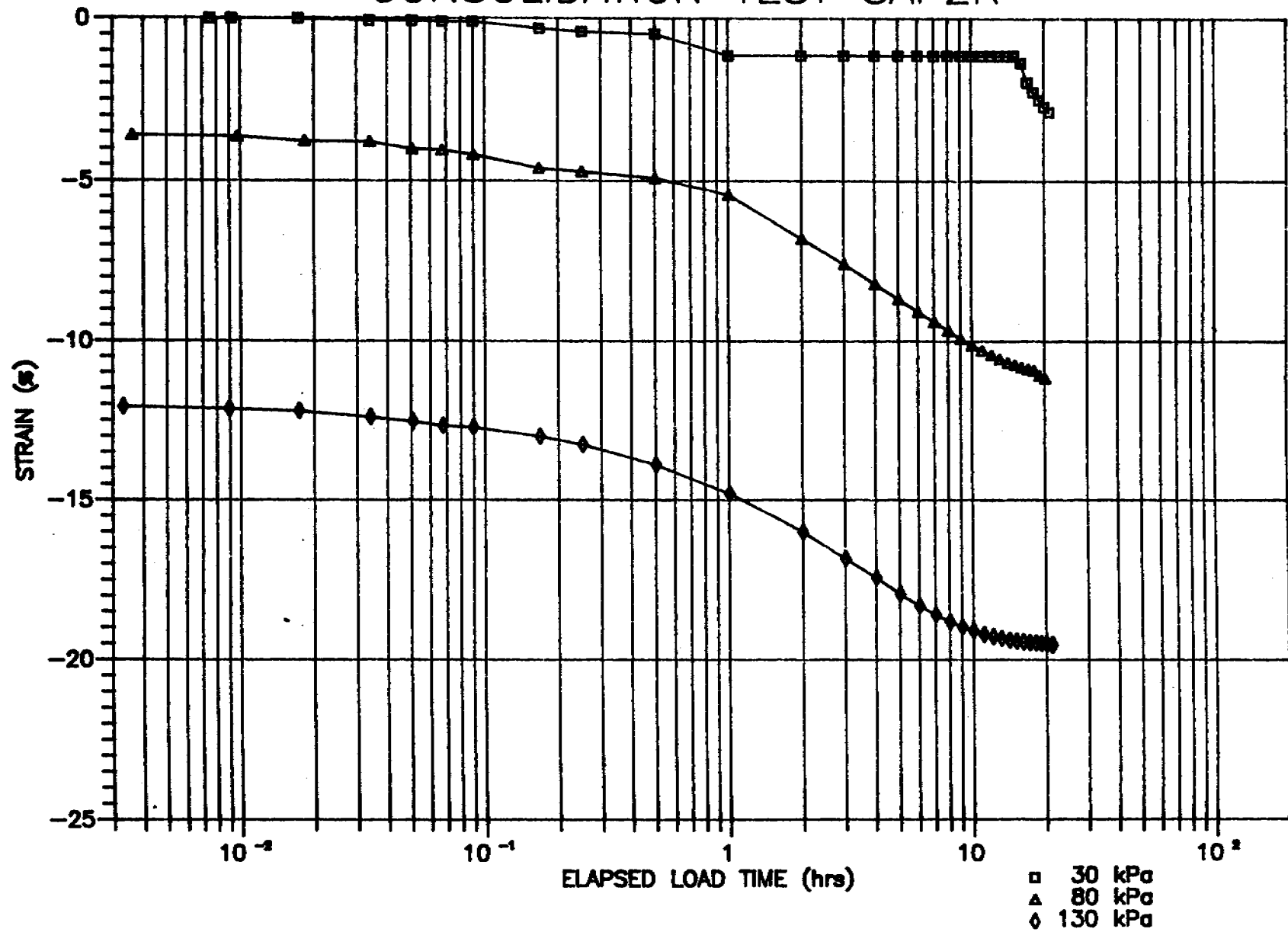




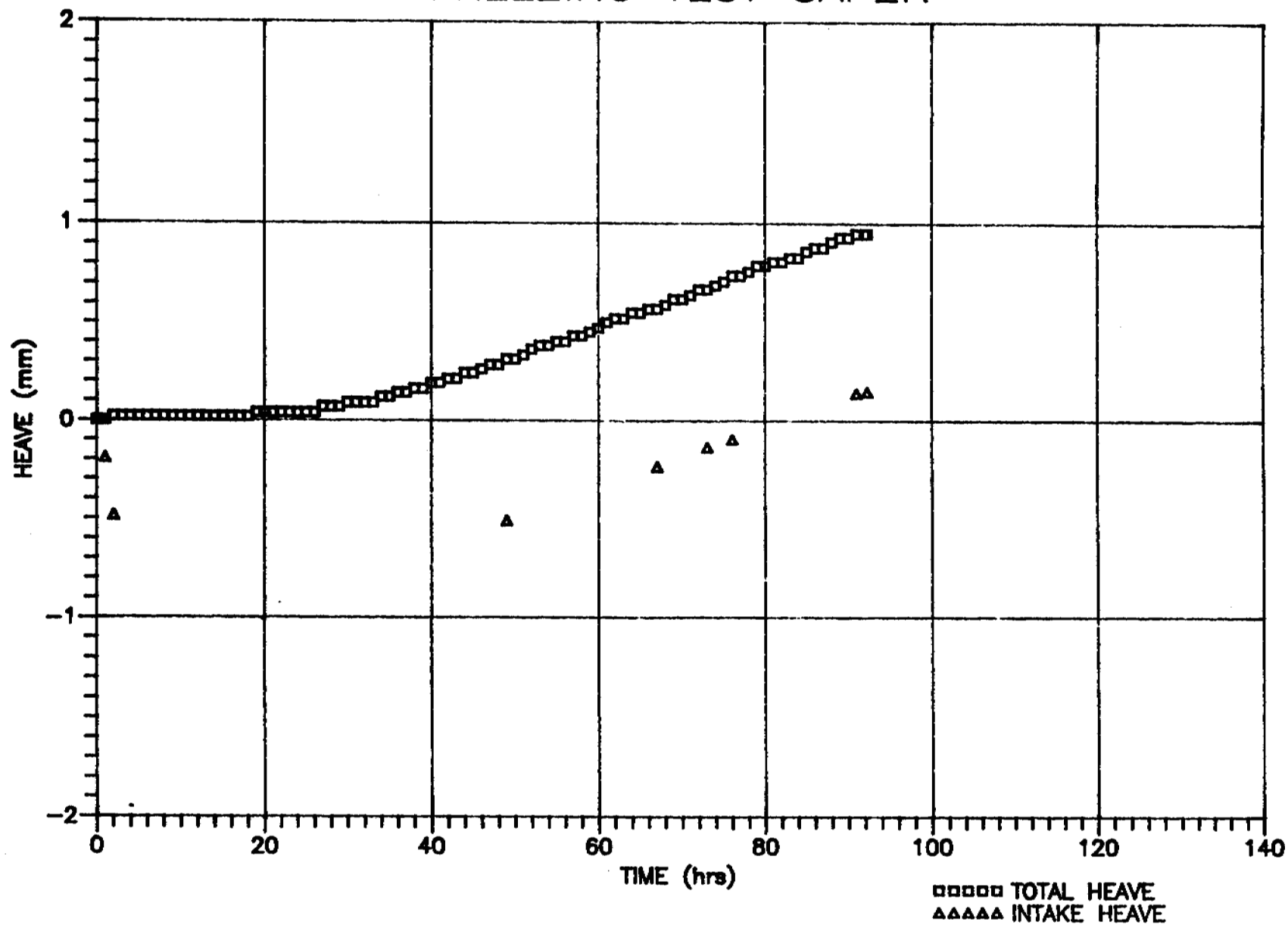


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- SAP3

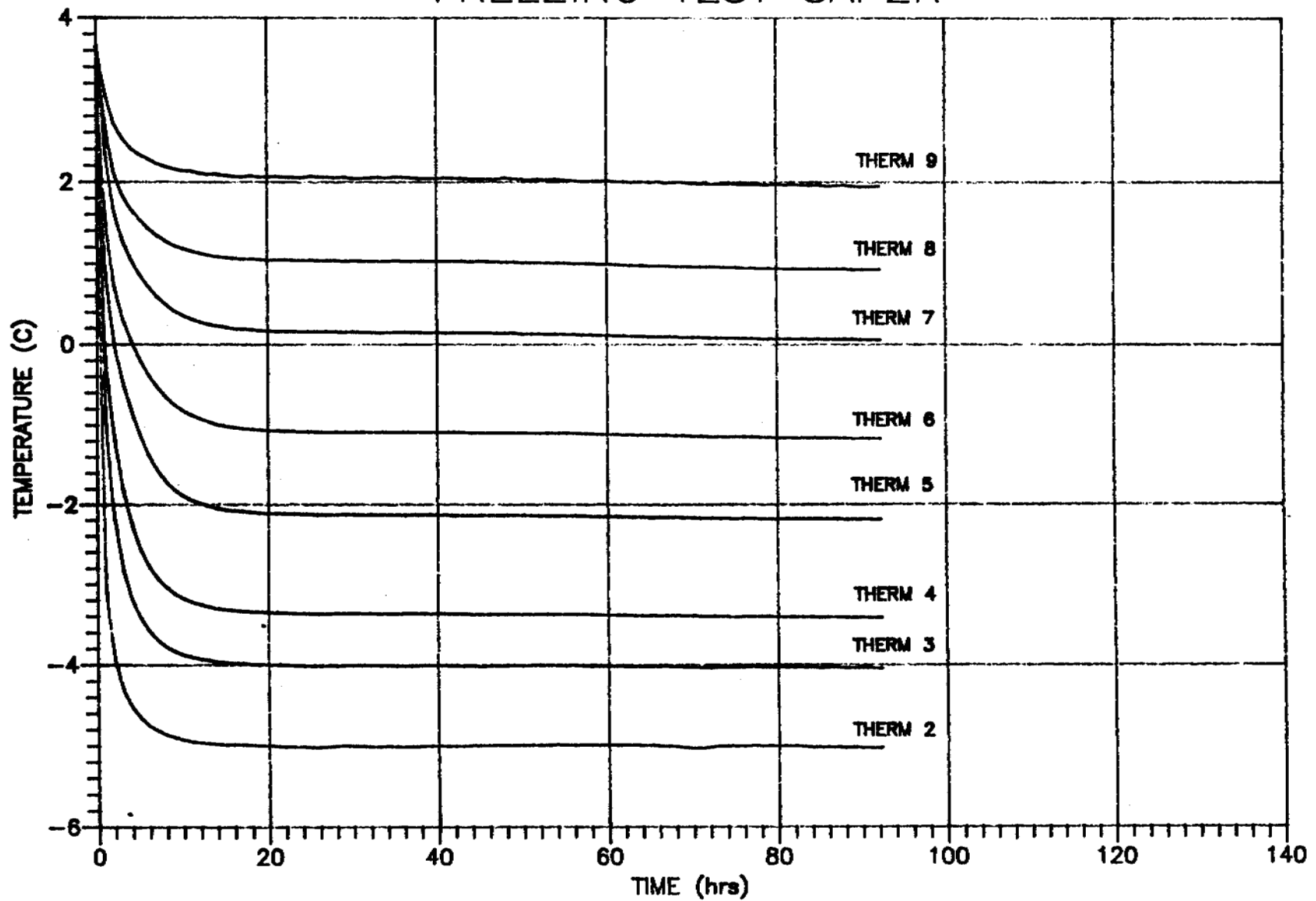
CONSOLIDATION TEST SAP2R



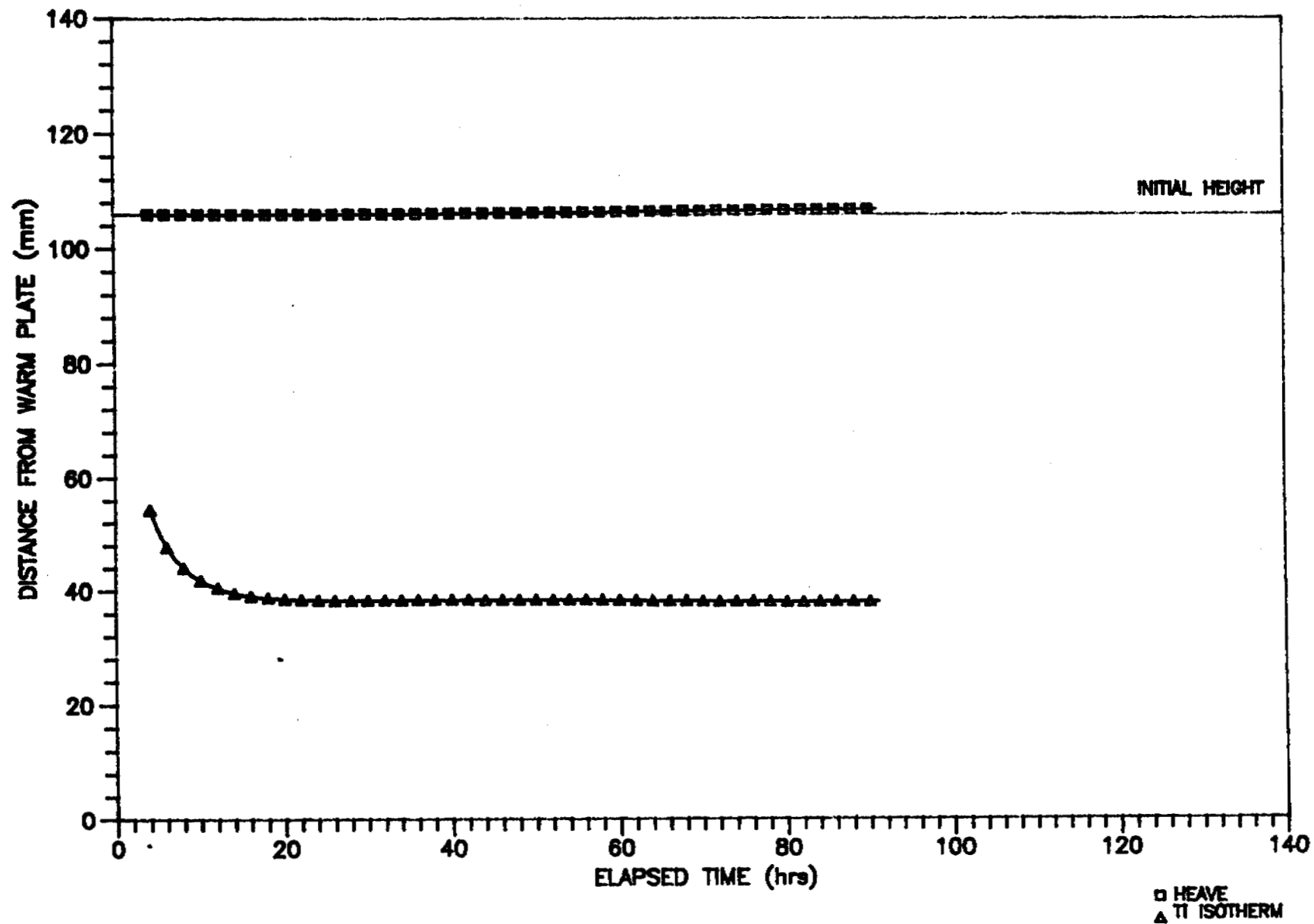
FREEZING TEST SAP2R



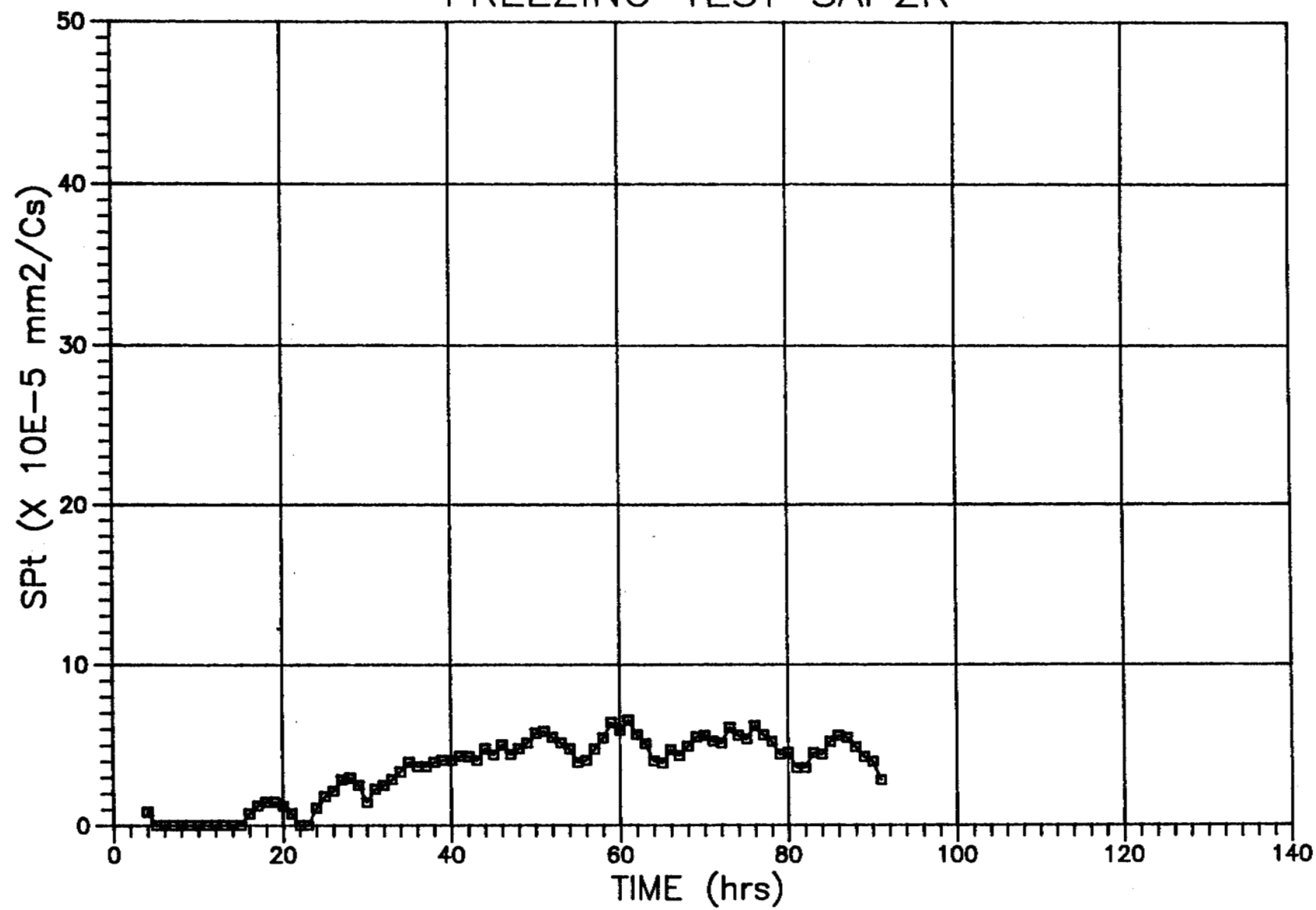
FREEZING TEST SAP2R



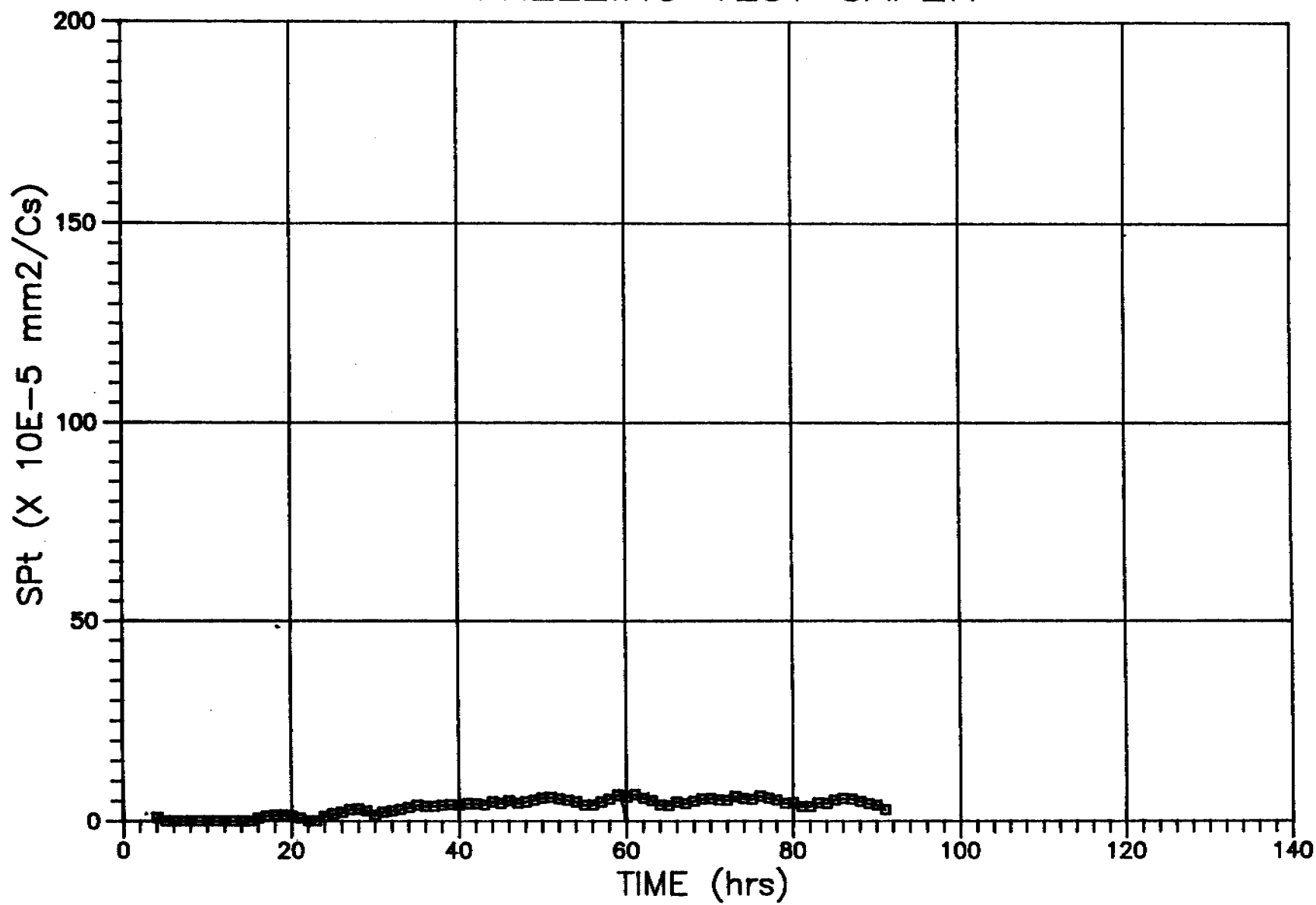
TEST SAP2R FROST FRONT LOCATION

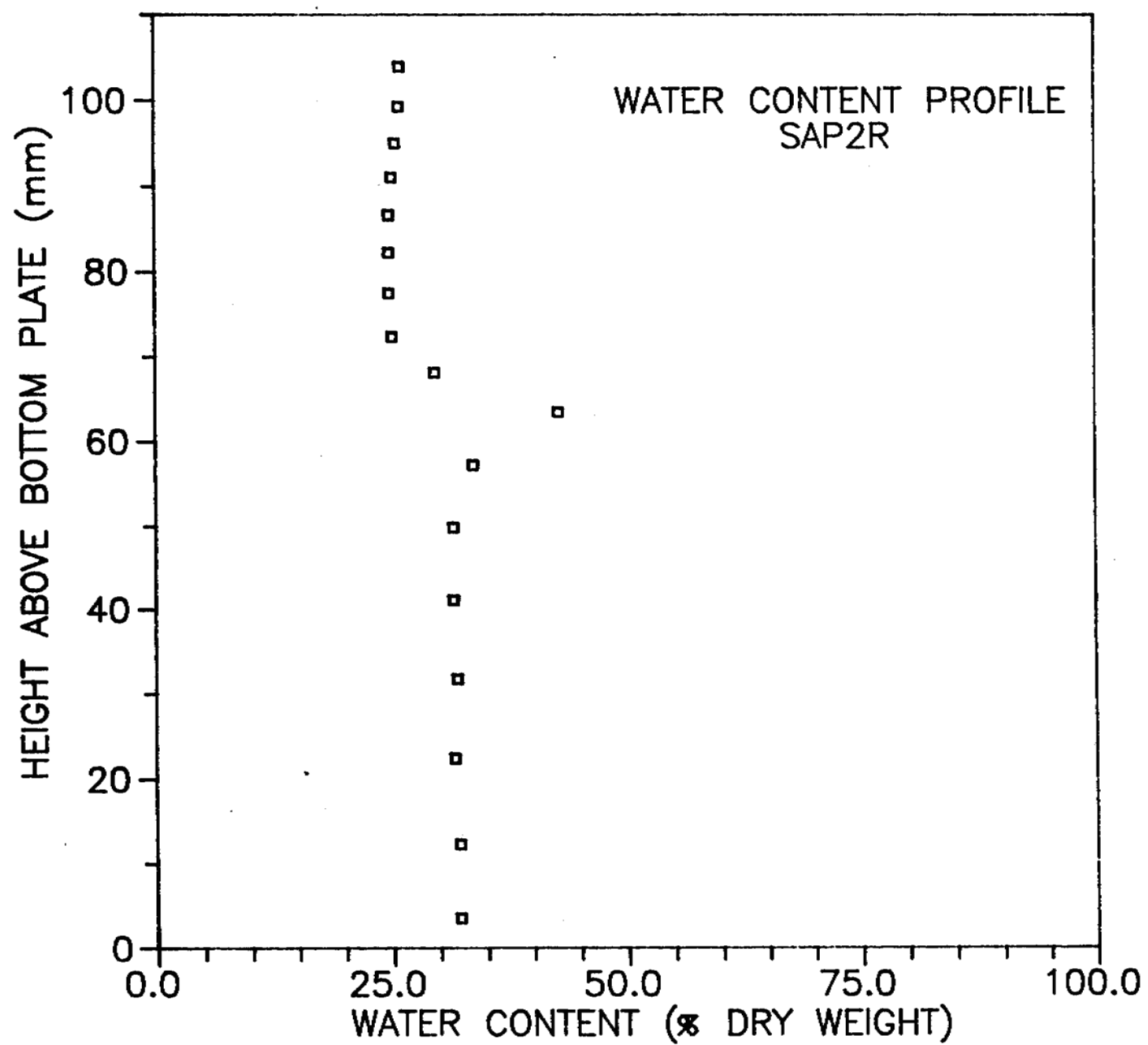


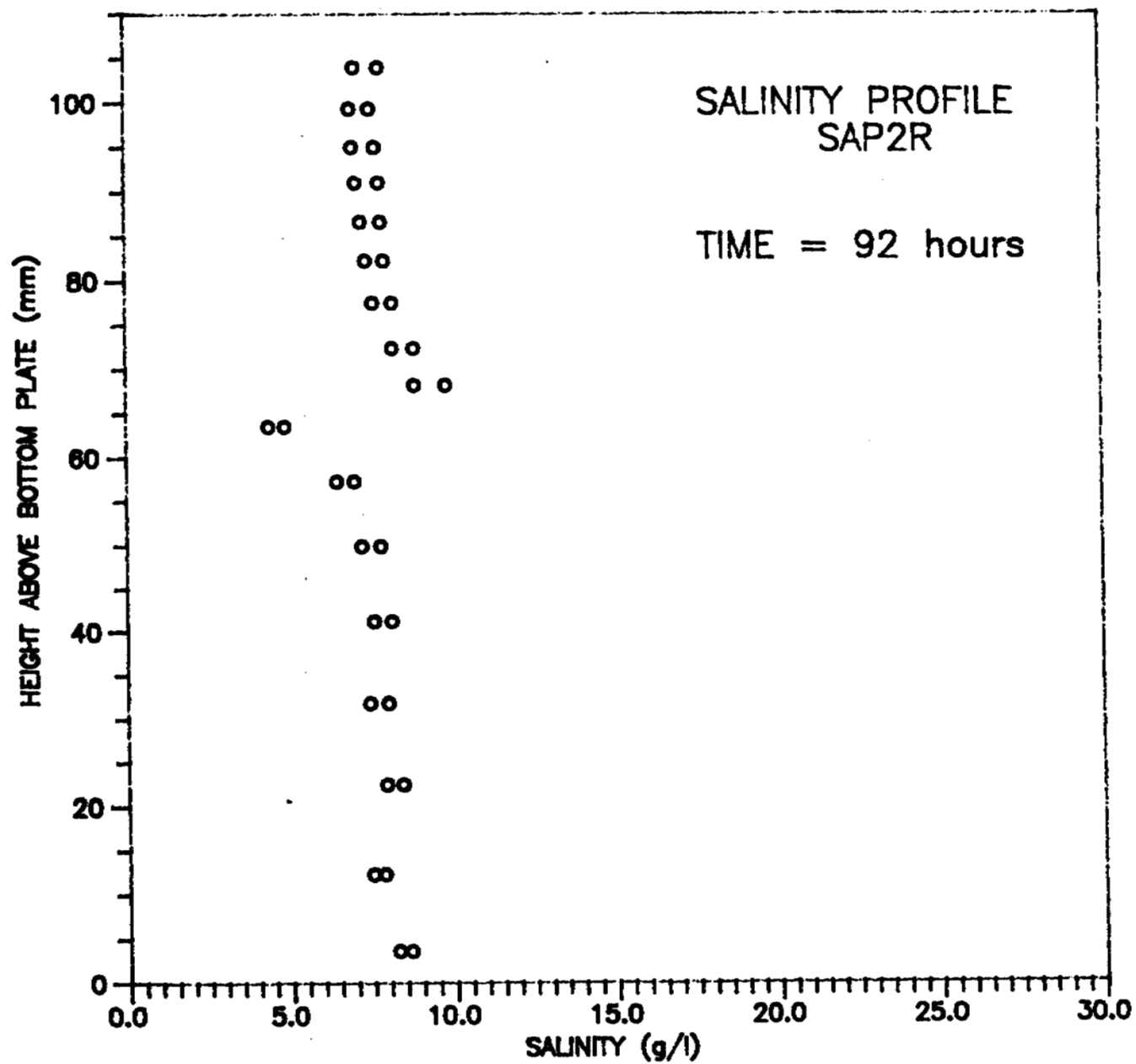
FREEZING TEST SAP2R

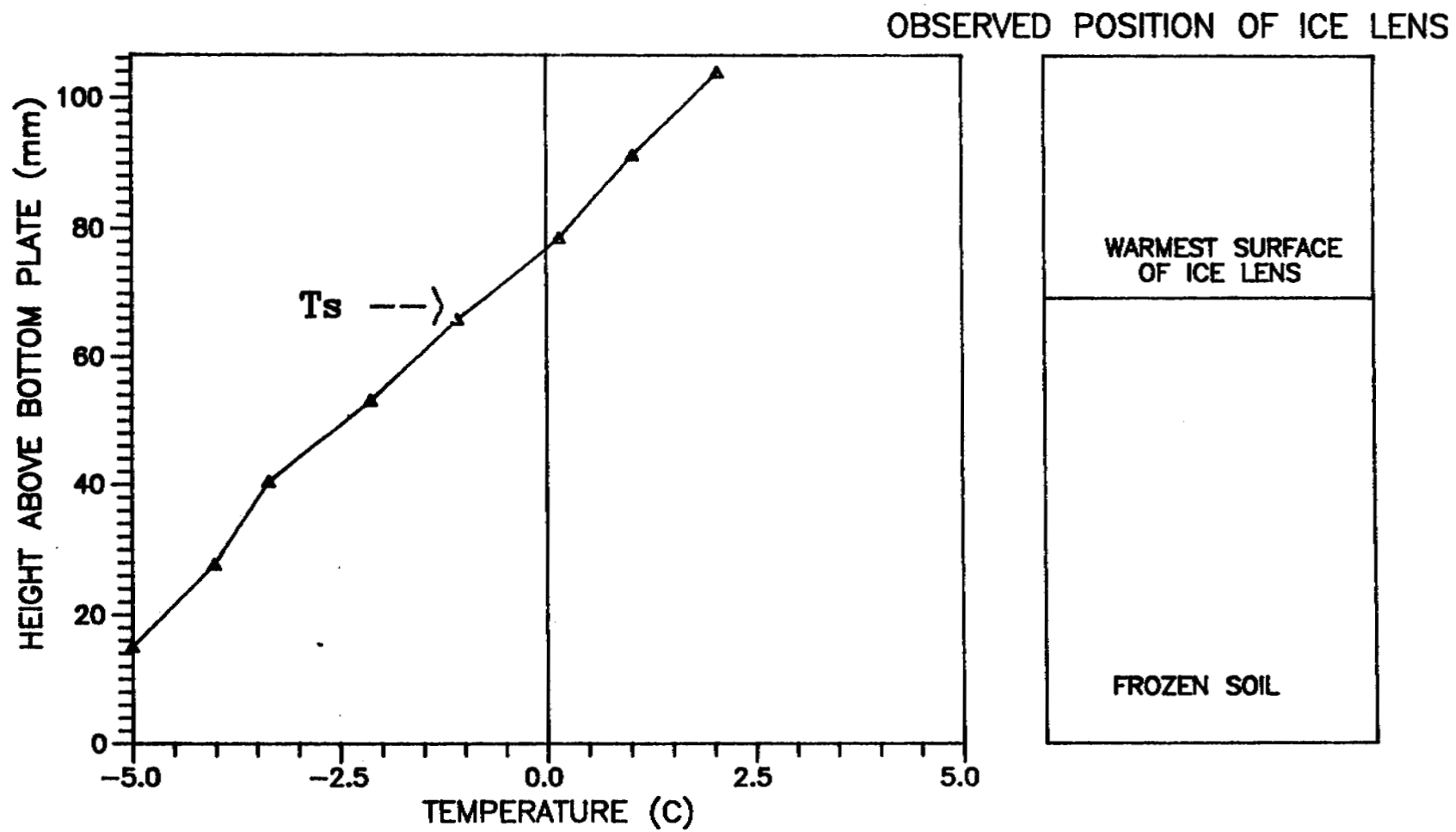


FREEZING TEST SAP2R



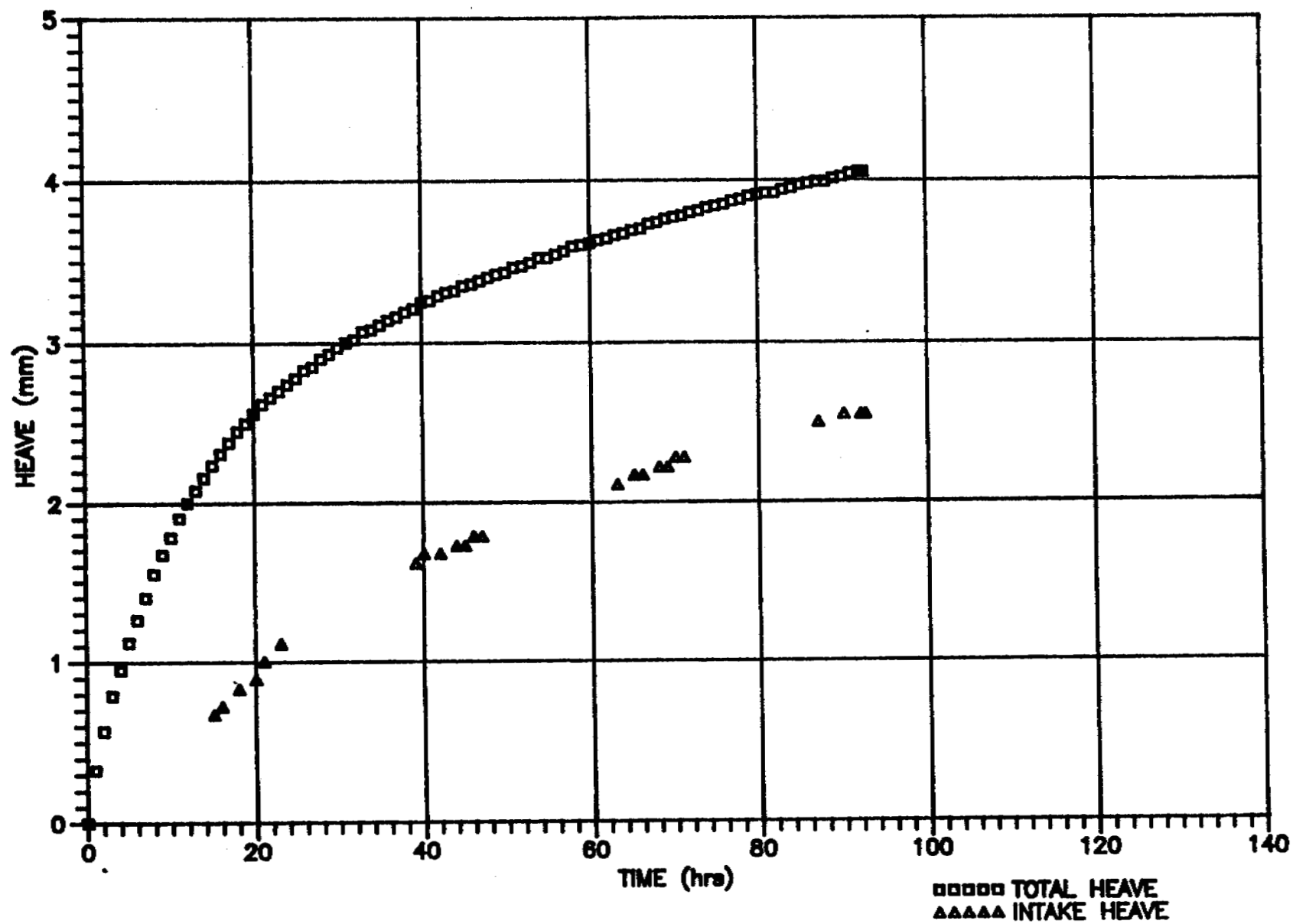




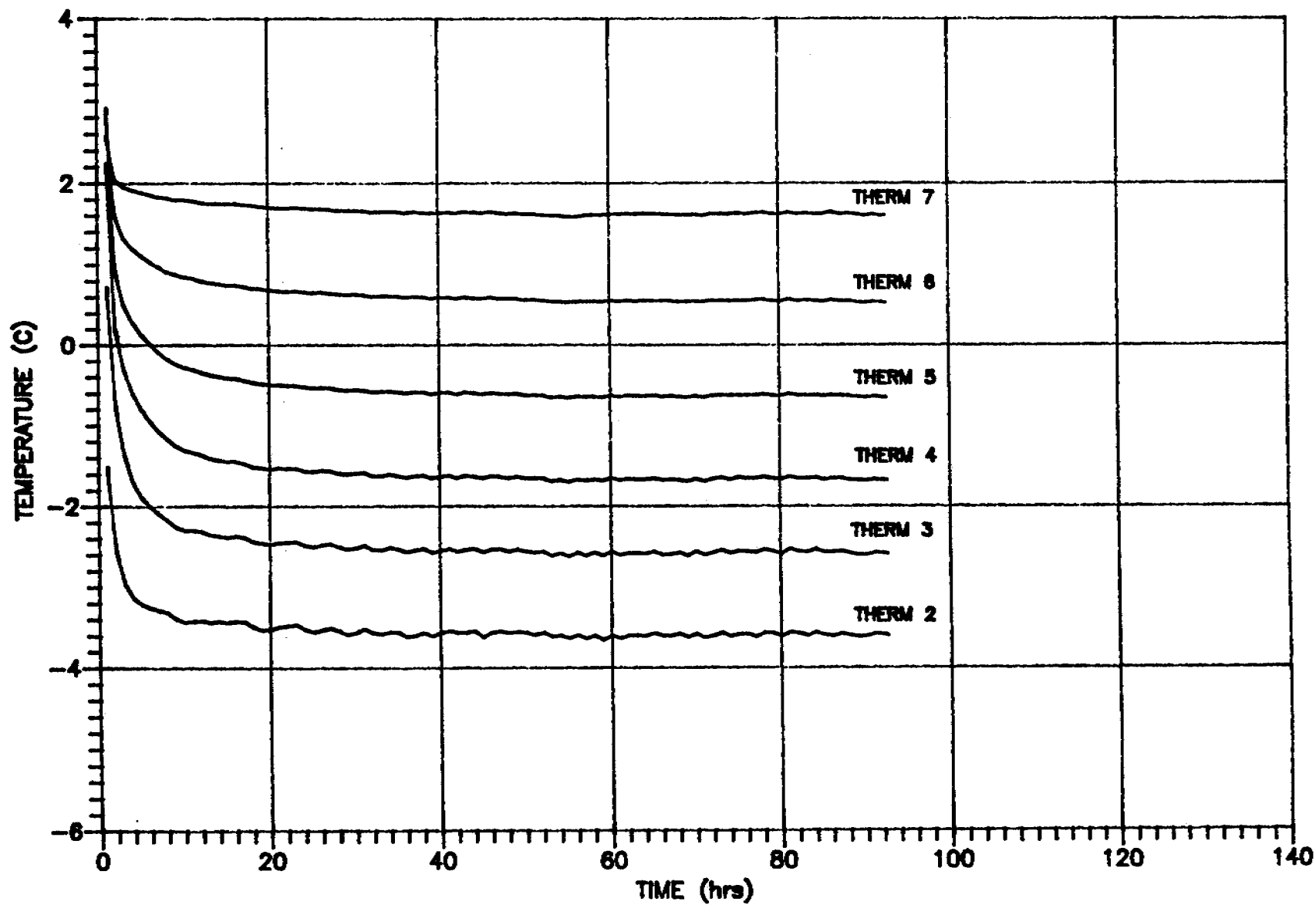


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- SAP2R

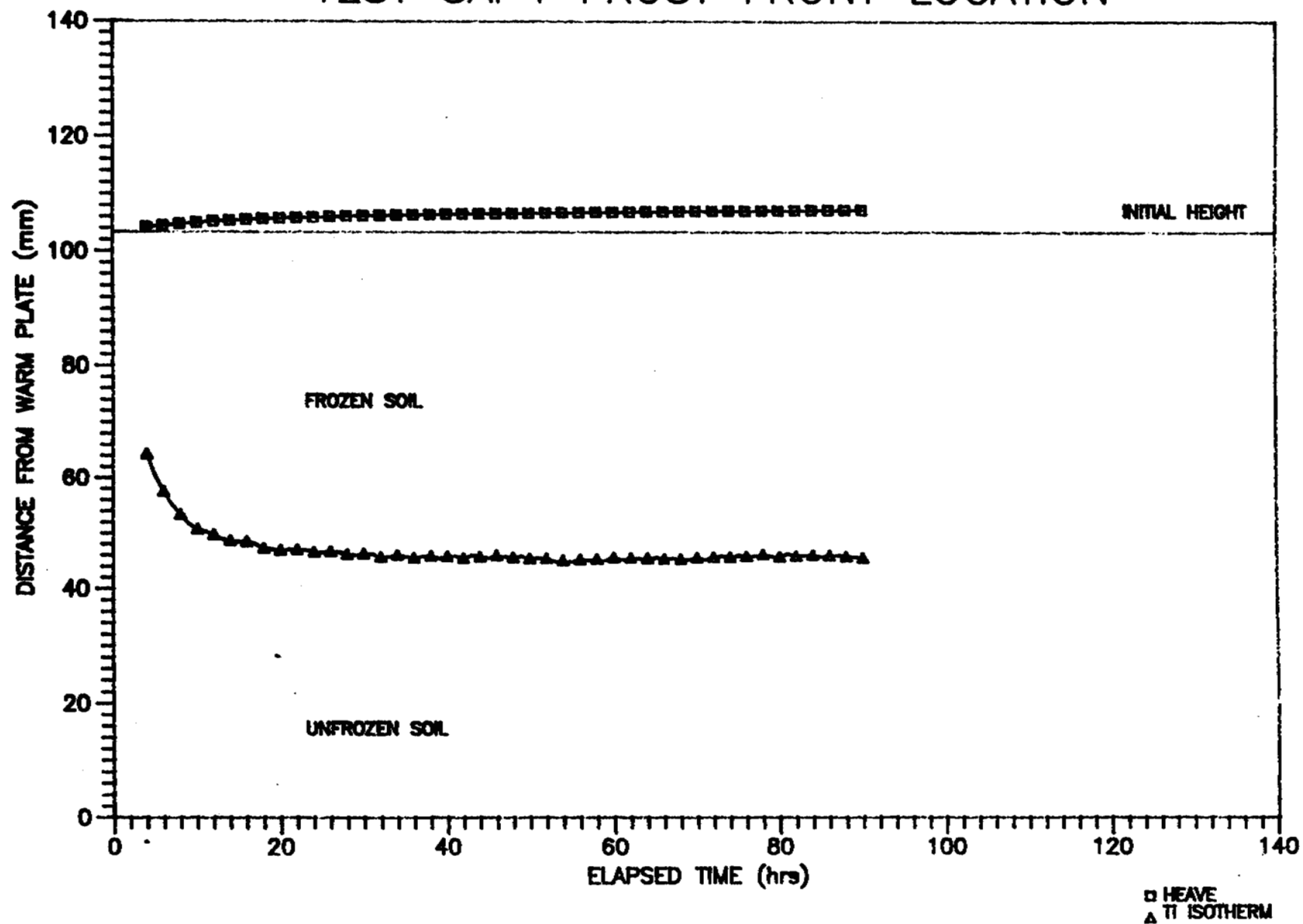
FREEZING TEST SAP4



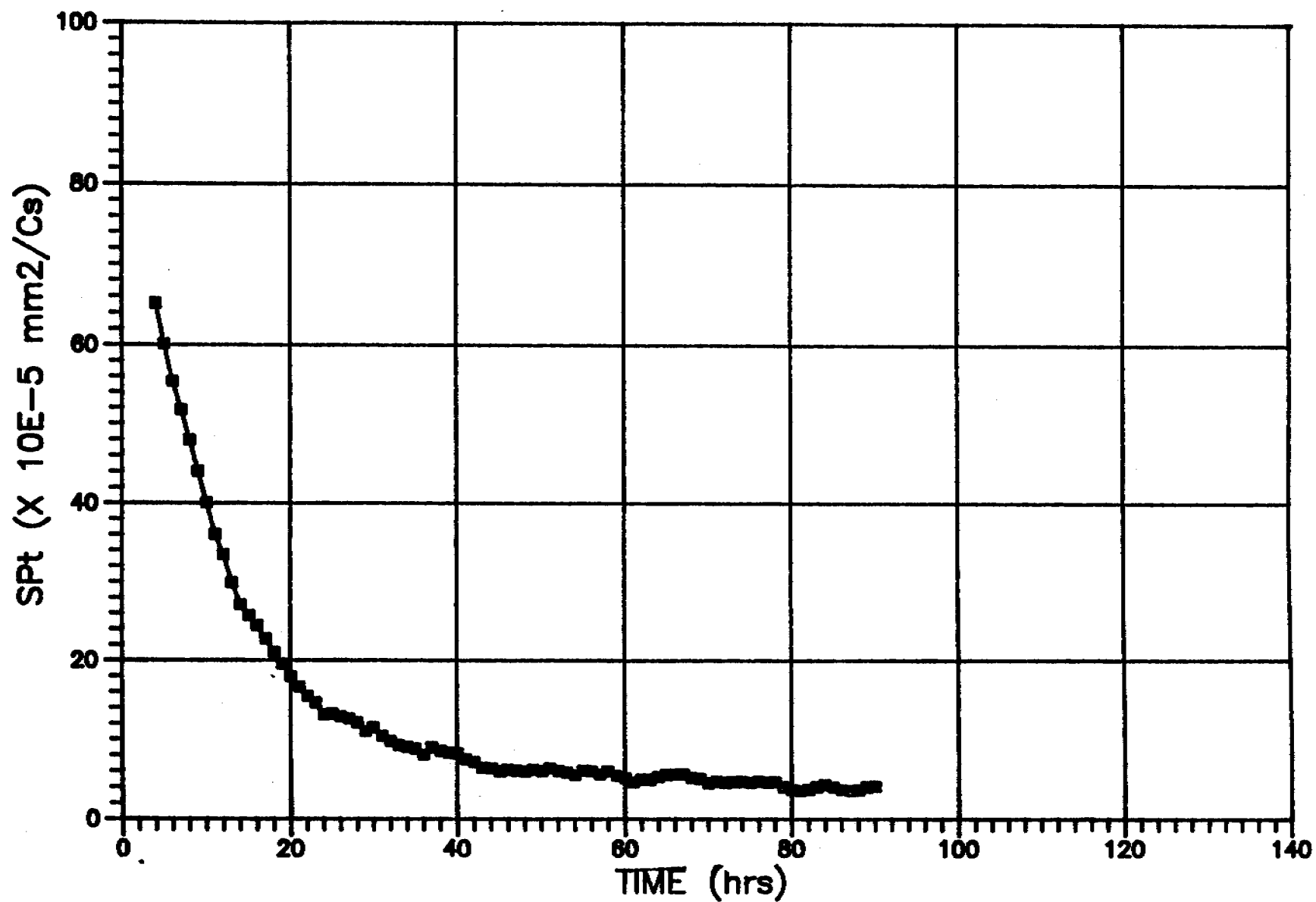
FREEZING TEST SAP4



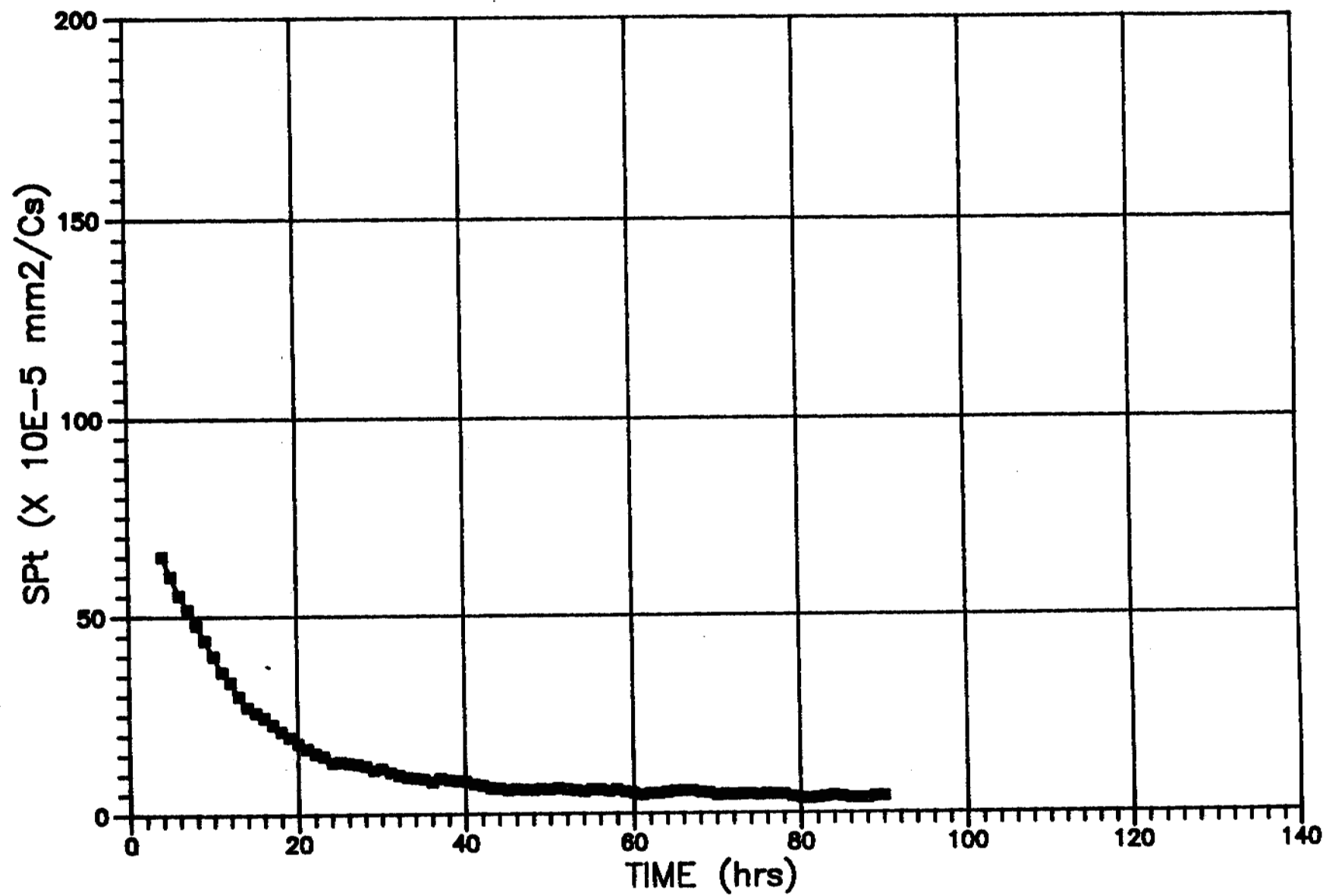
TEST SAP4 FROST FRONT LOCATION

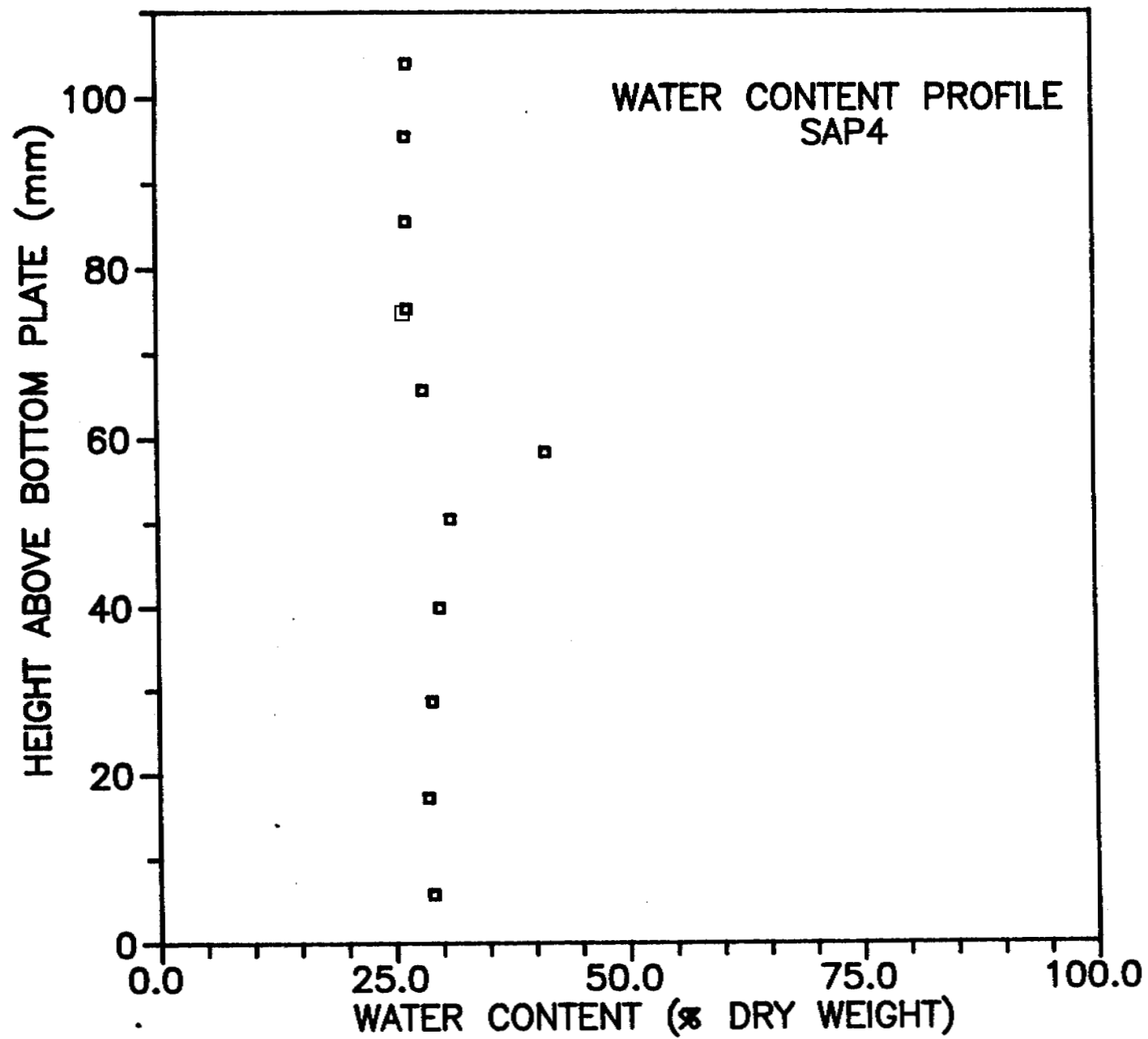


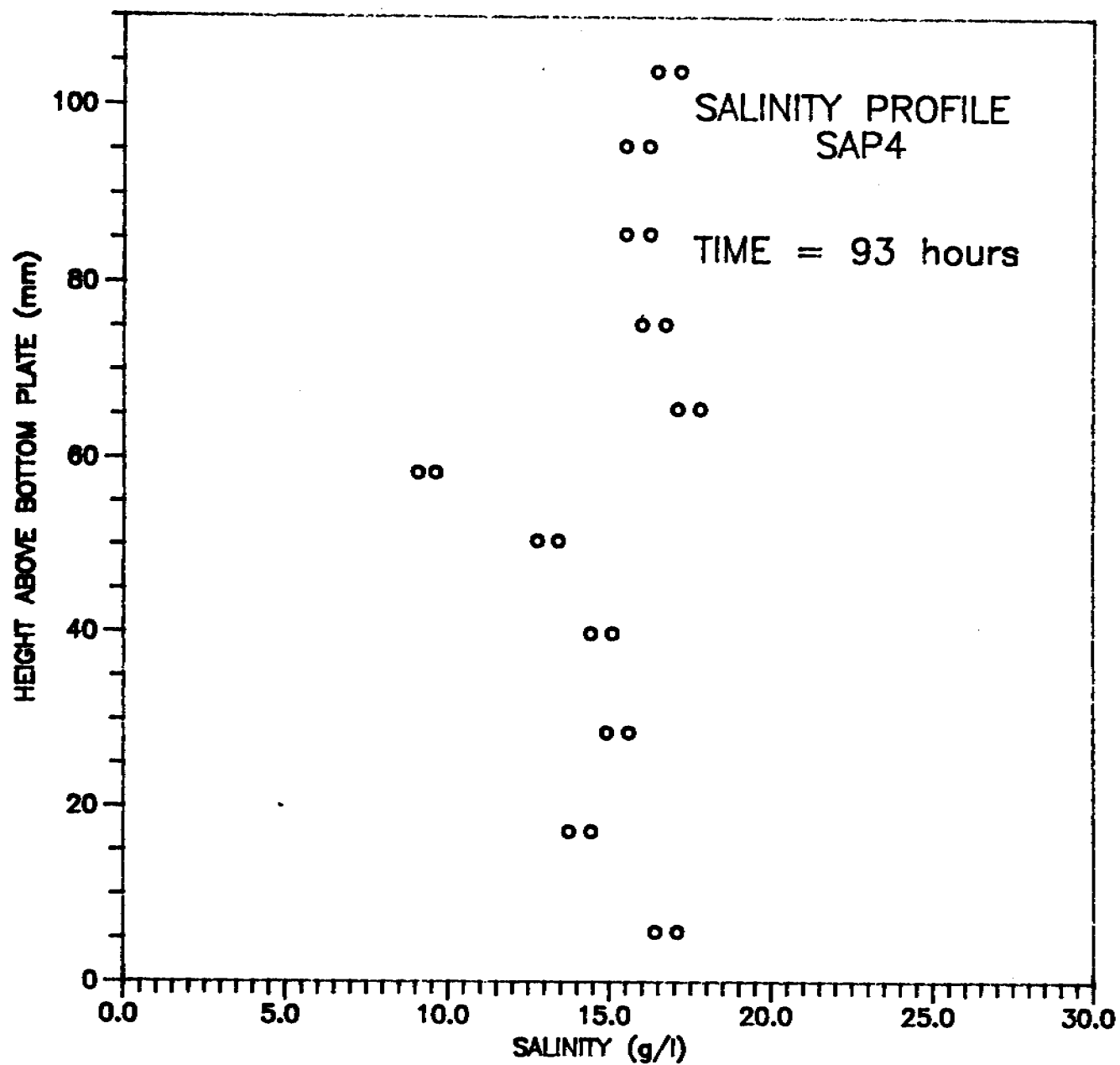
FREEZING TEST SAP4

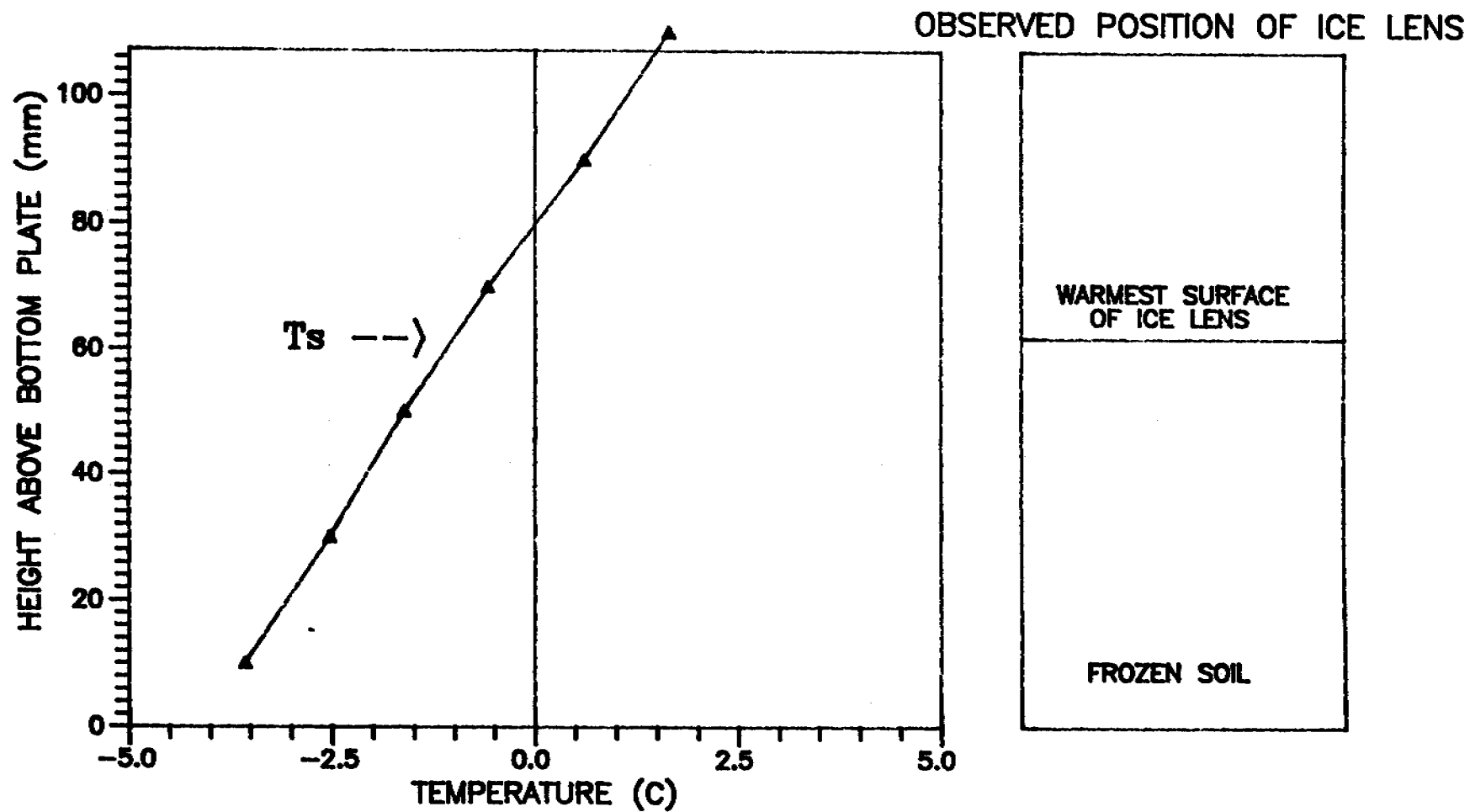


FREEZING TEST SAP4



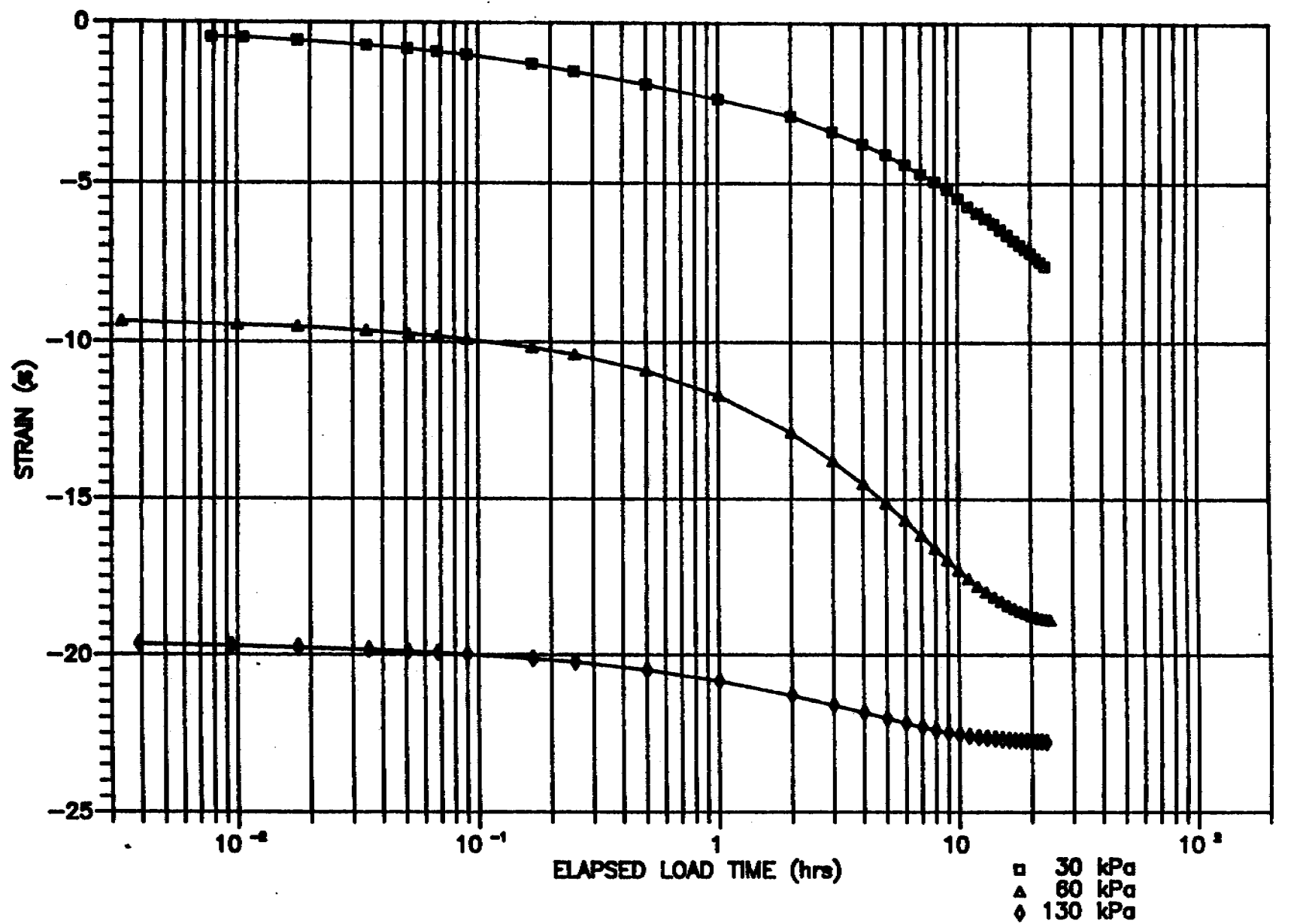




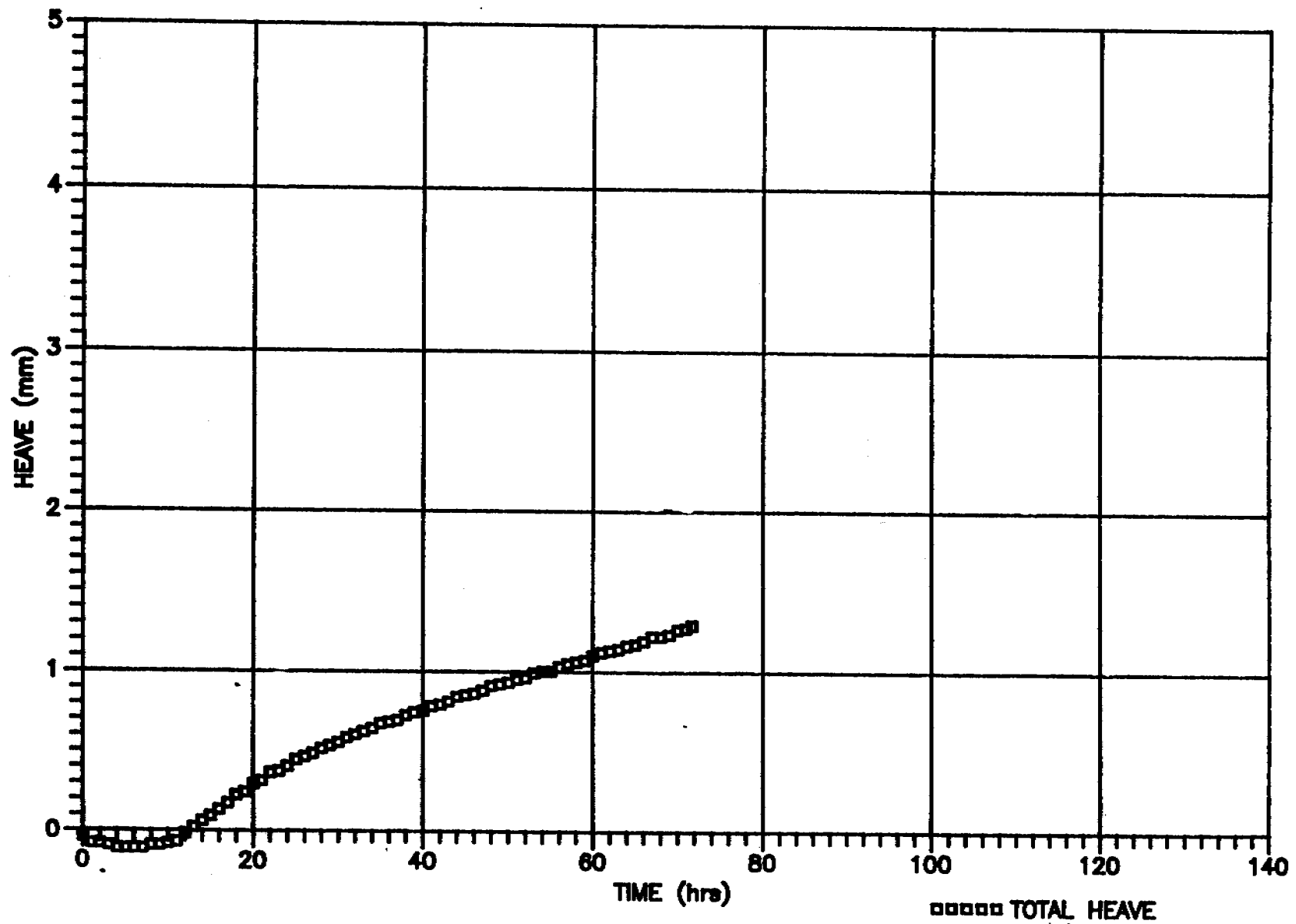


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP4

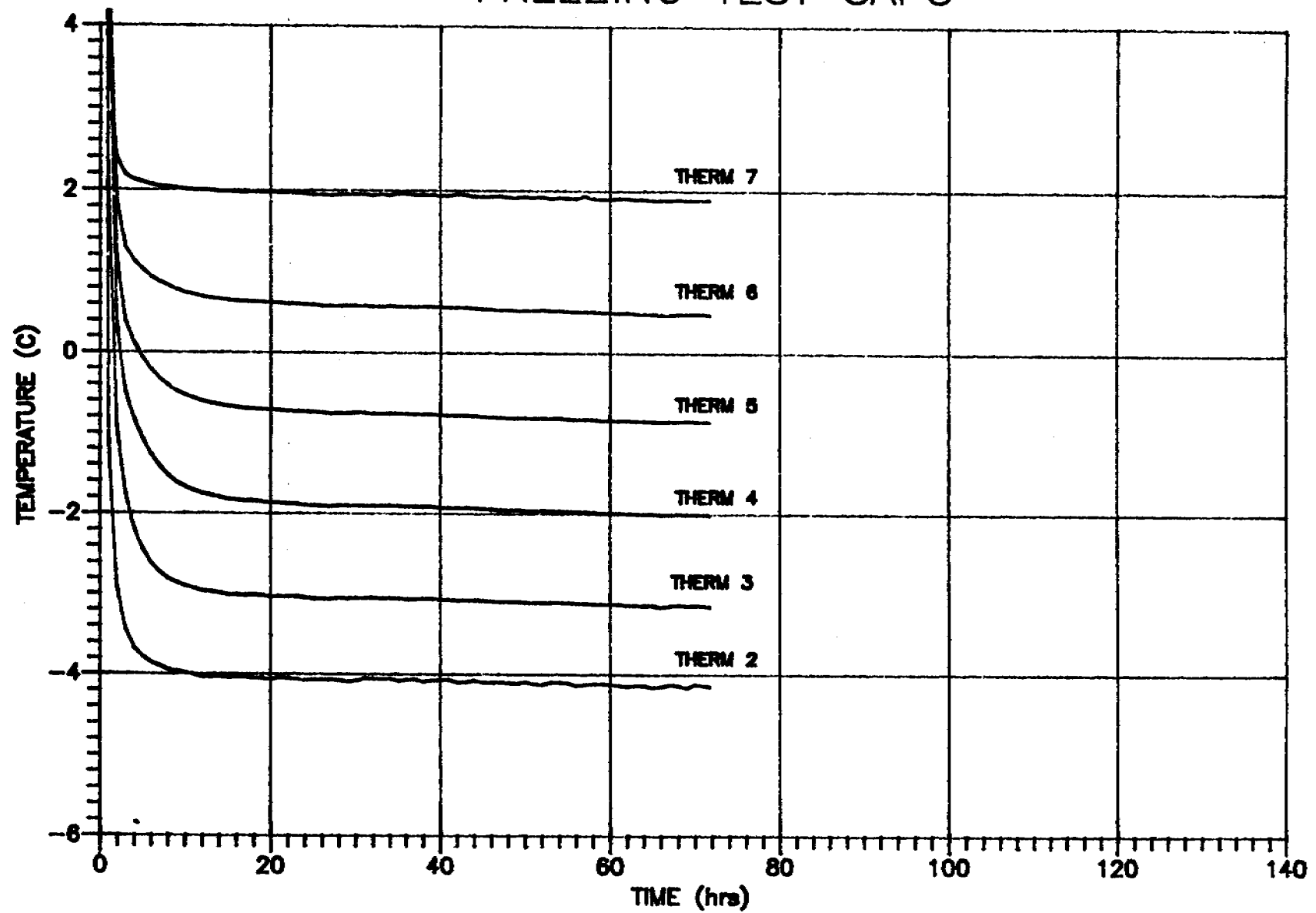
CONSOLIDATION TEST SAP5



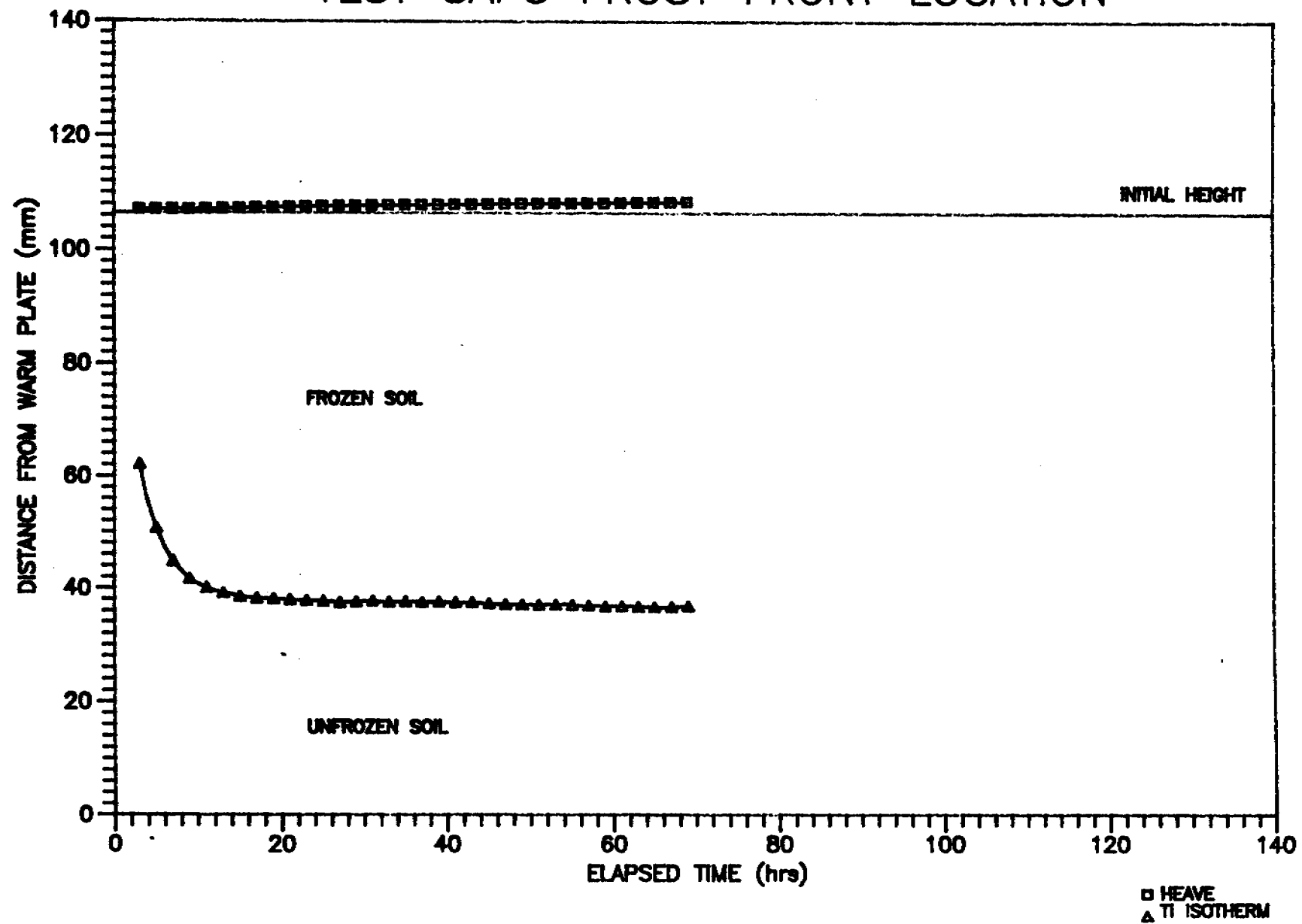
FREEZING TEST SAP5



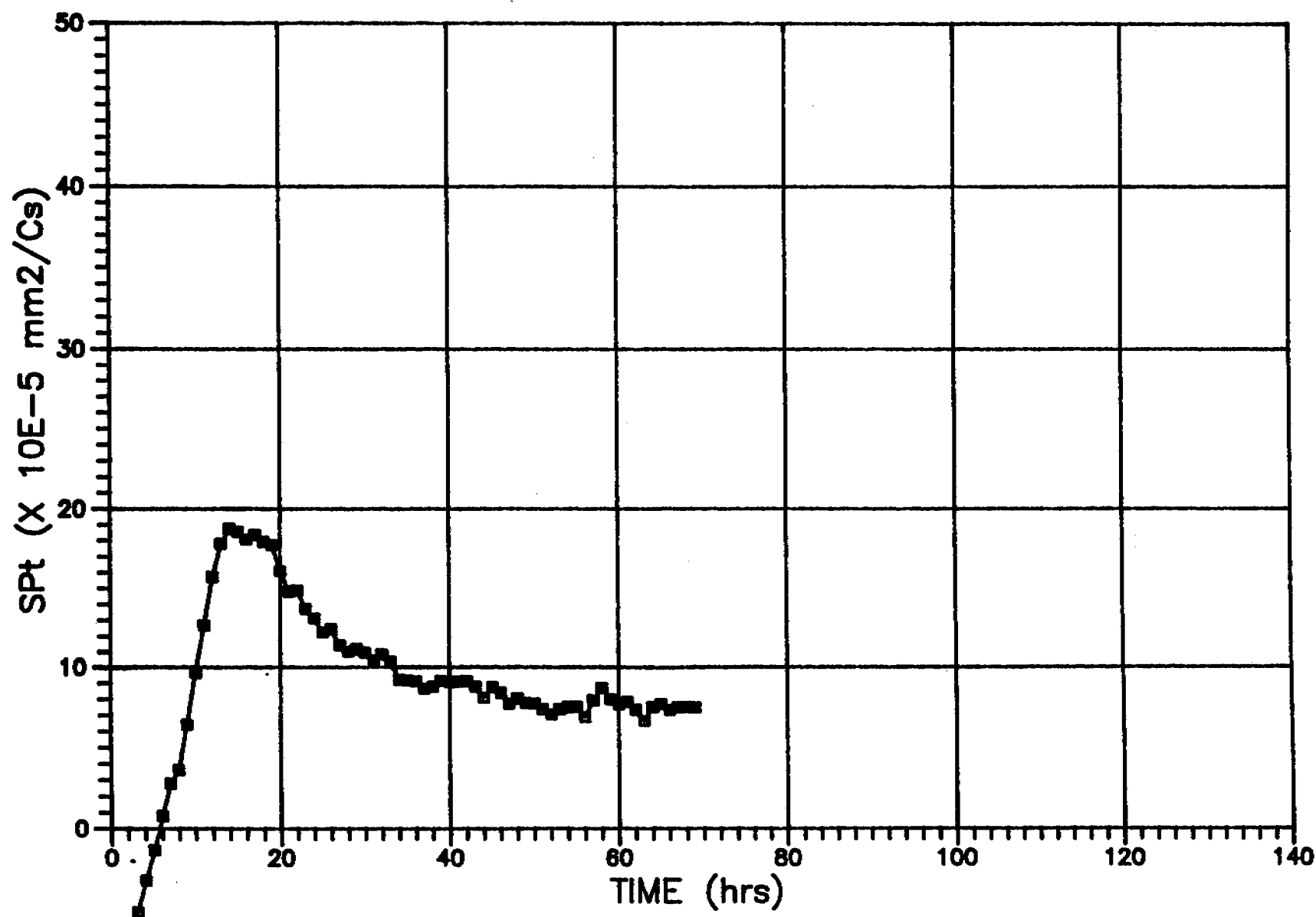
FREEZING TEST SAP5



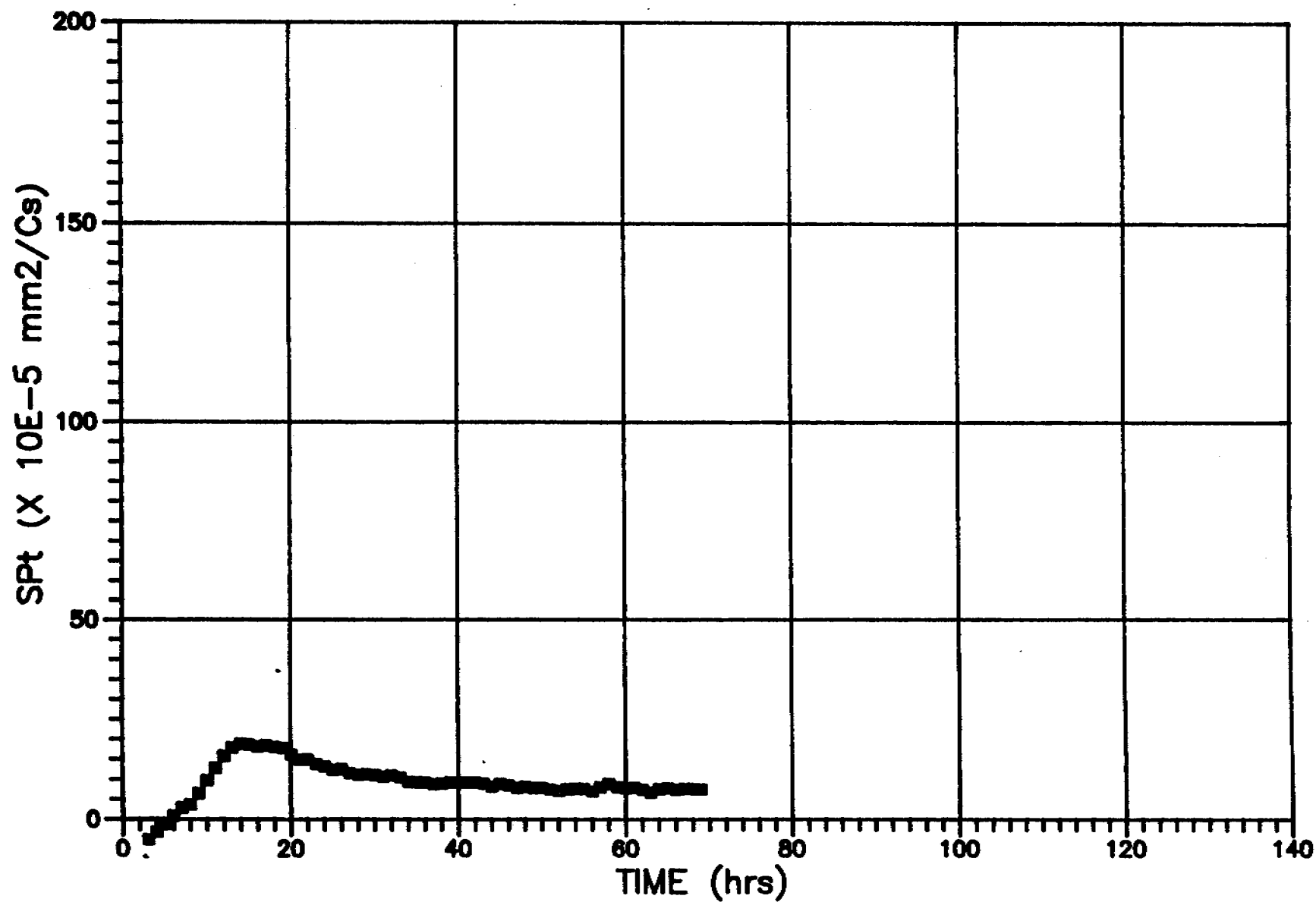
TEST SAP5 FROST FRONT LOCATION

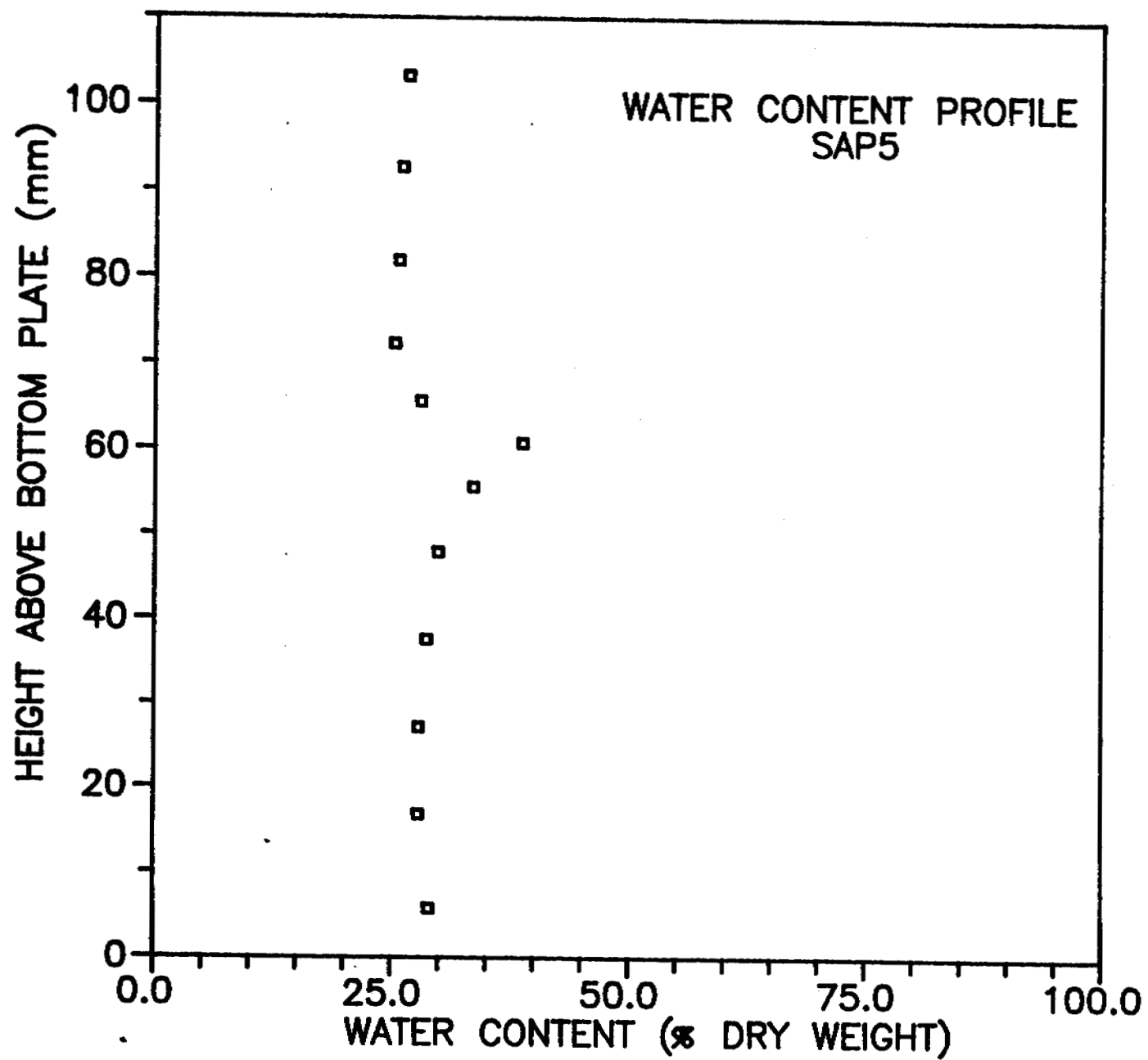


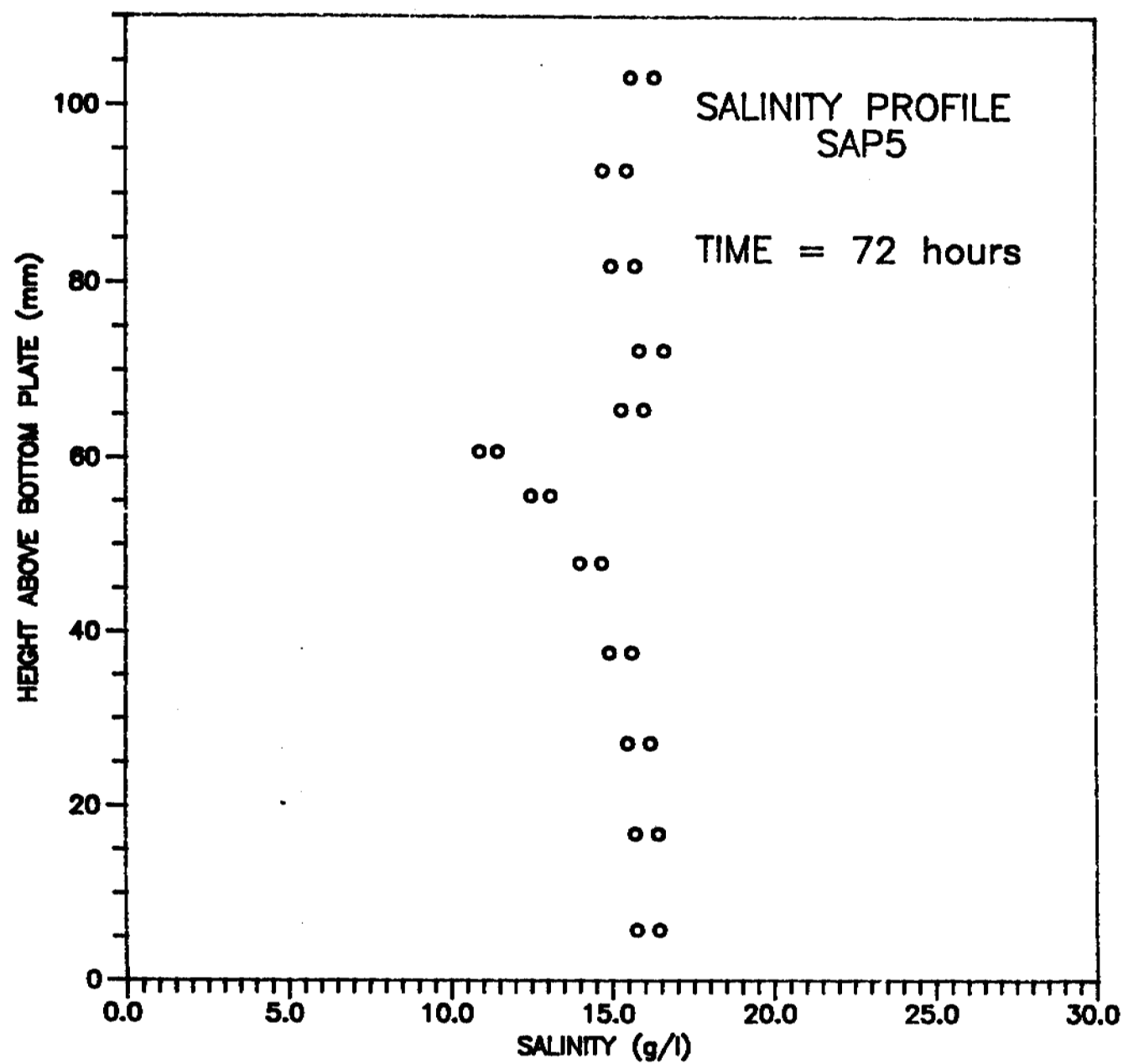
FREEZING TEST SAP5

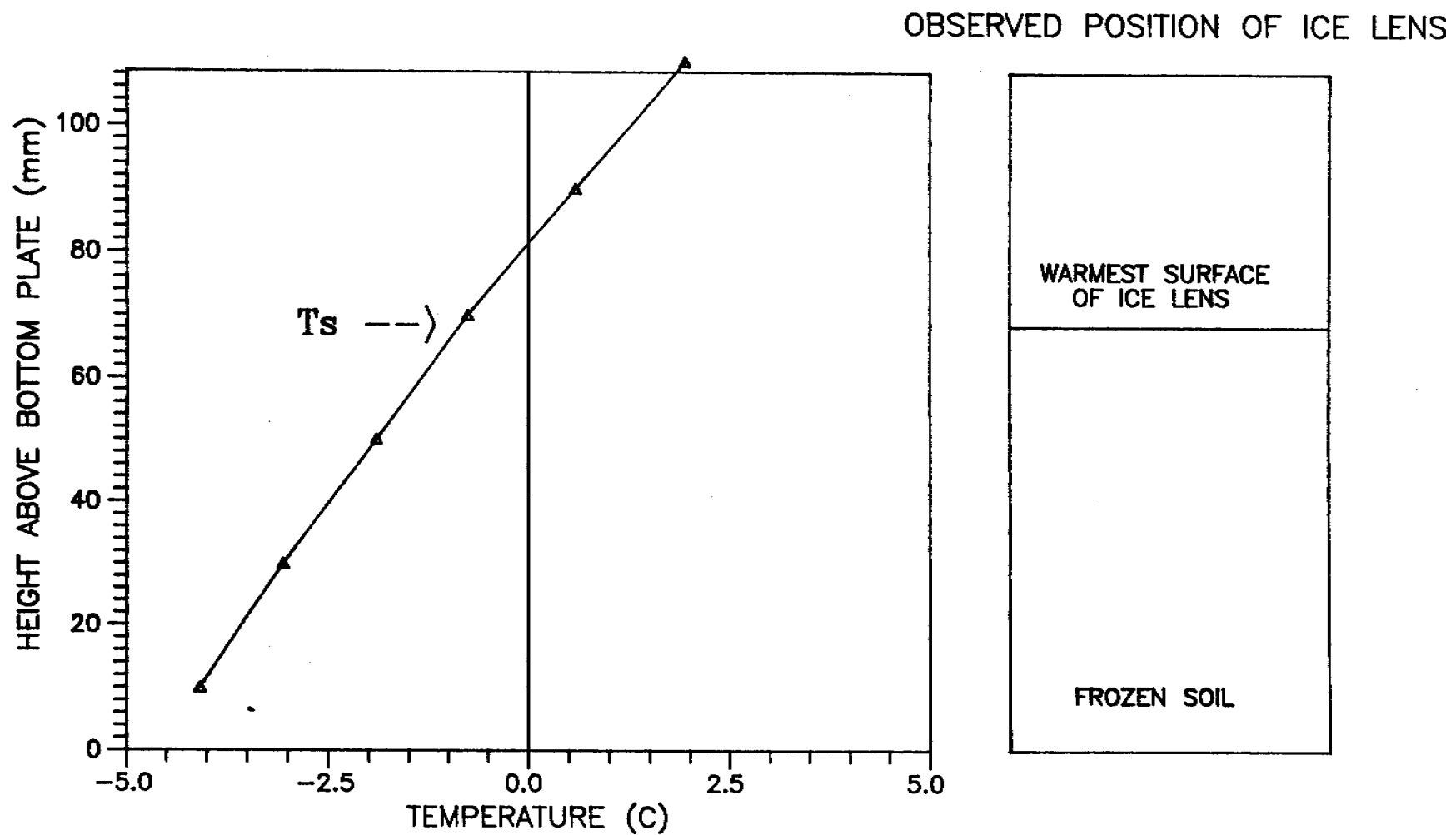


FREEZING TEST SAP5



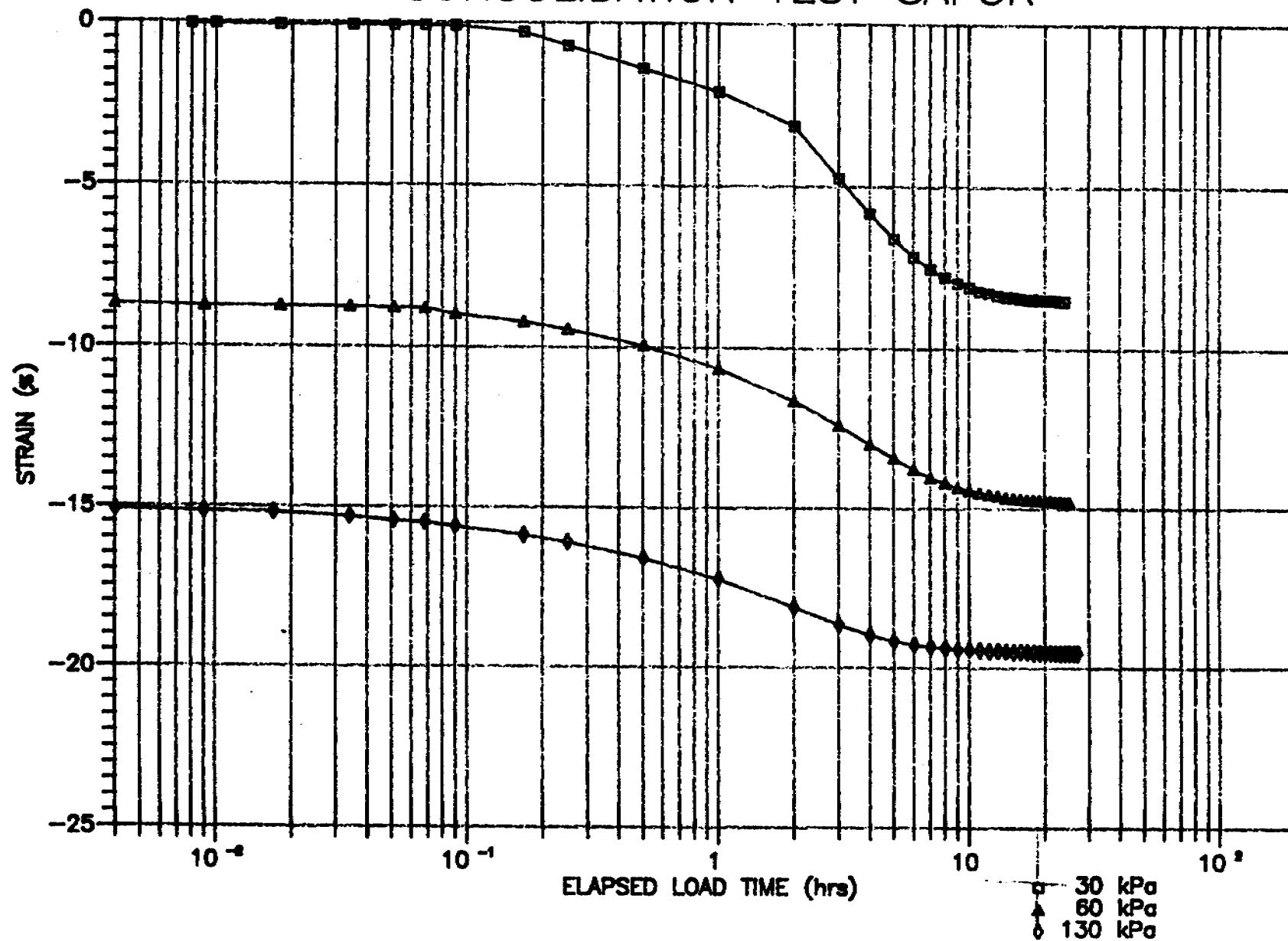




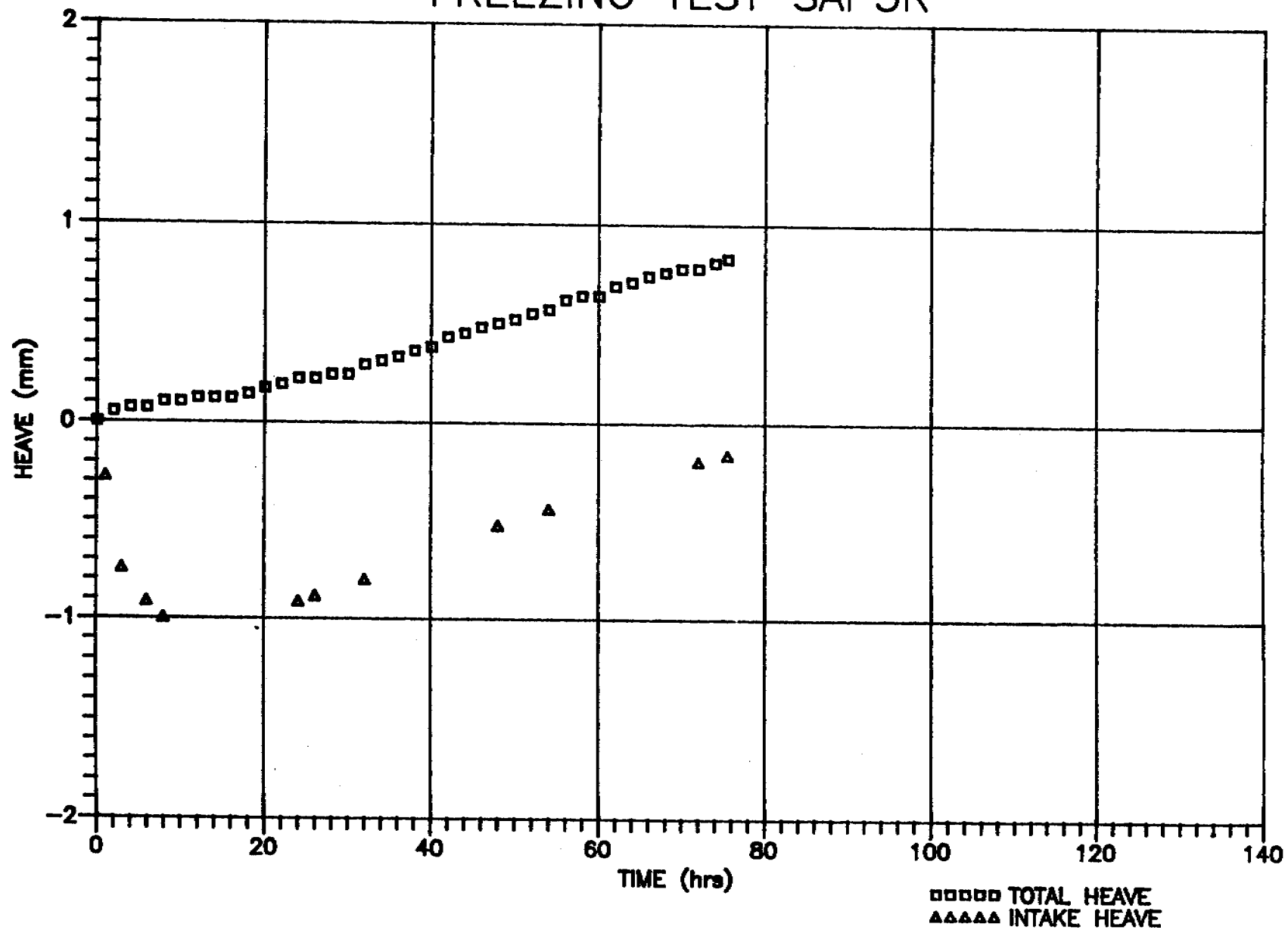


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP5

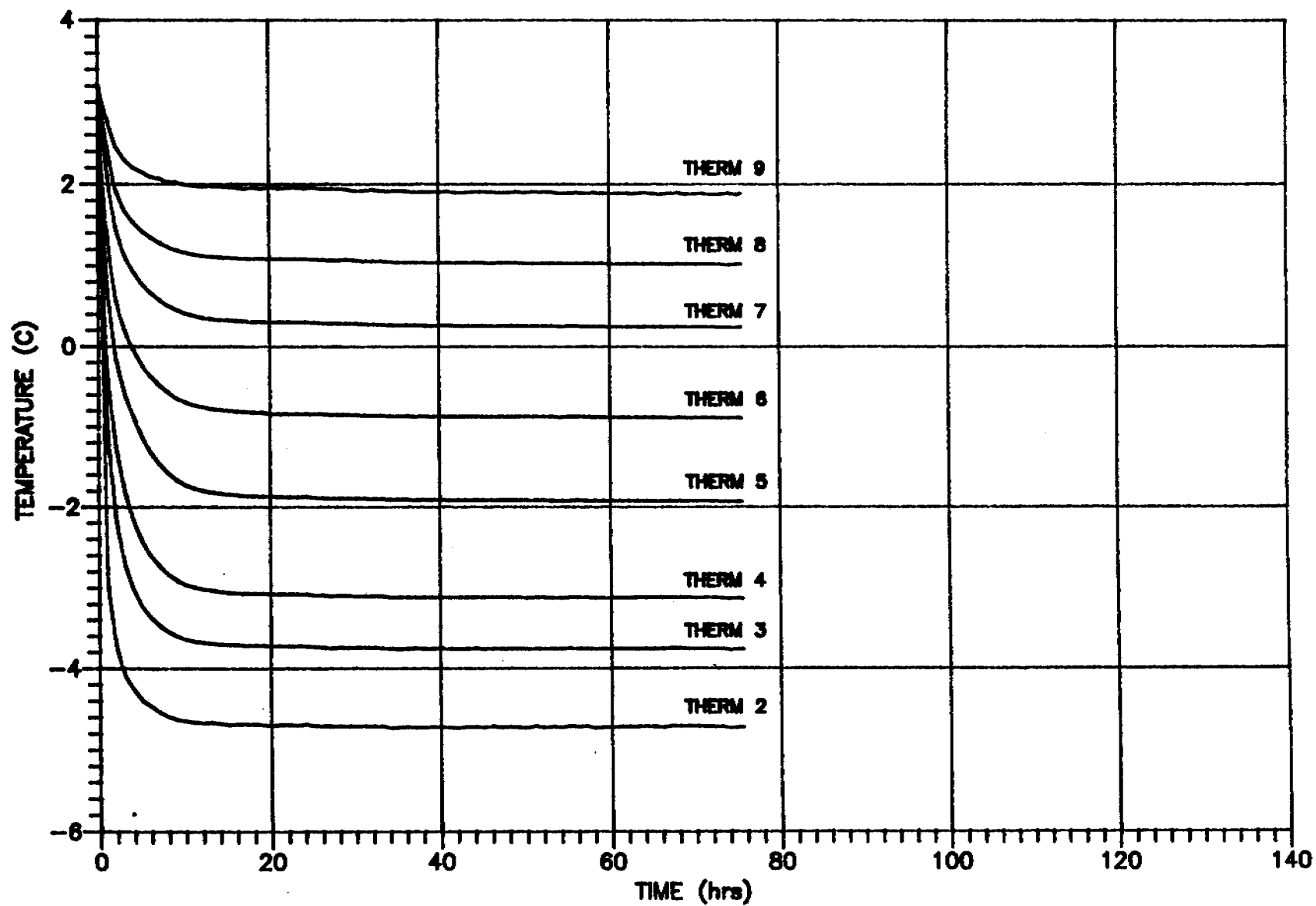
CONSOLIDATION TEST SAP5R



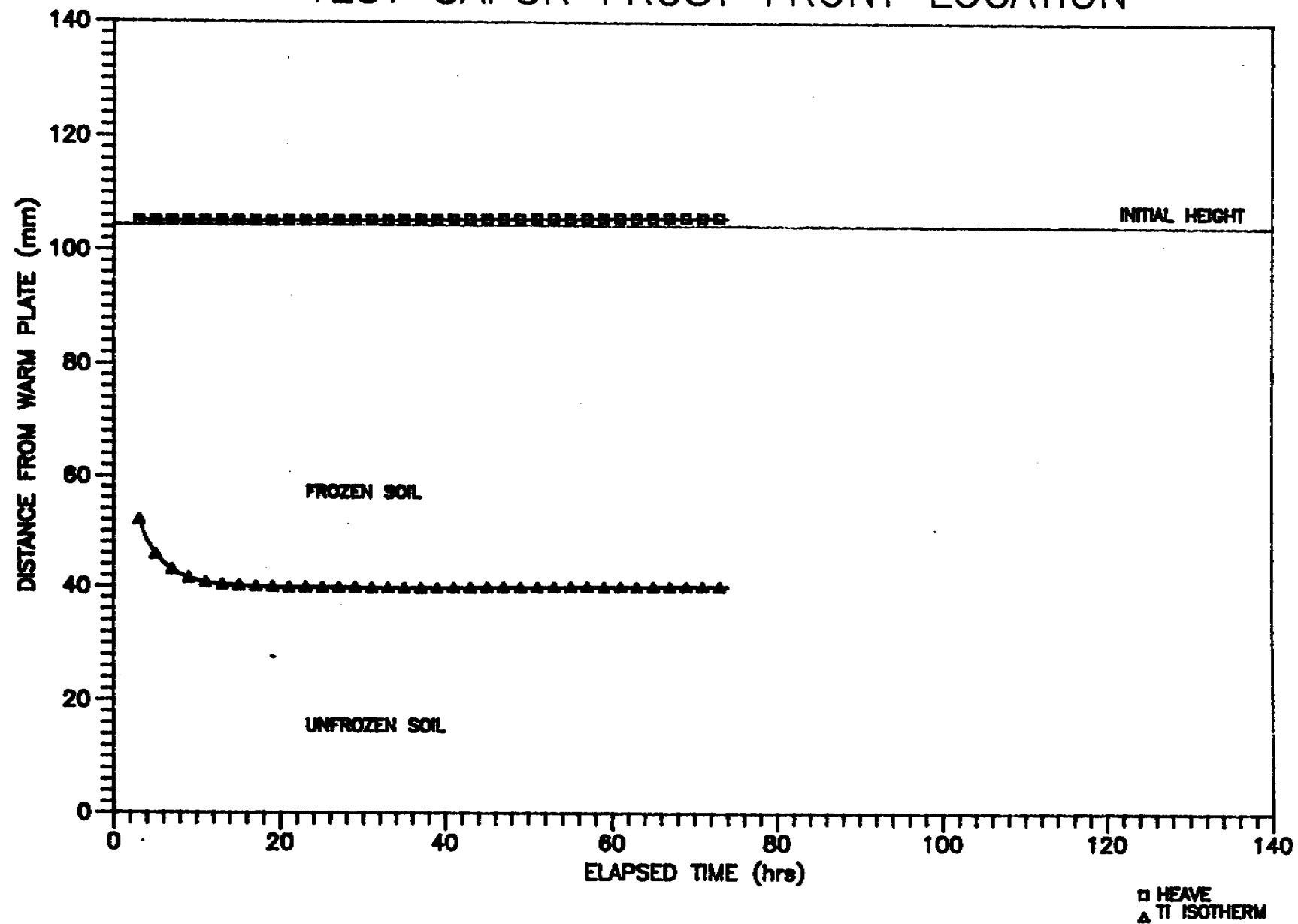
FREEZING TEST SAP5R



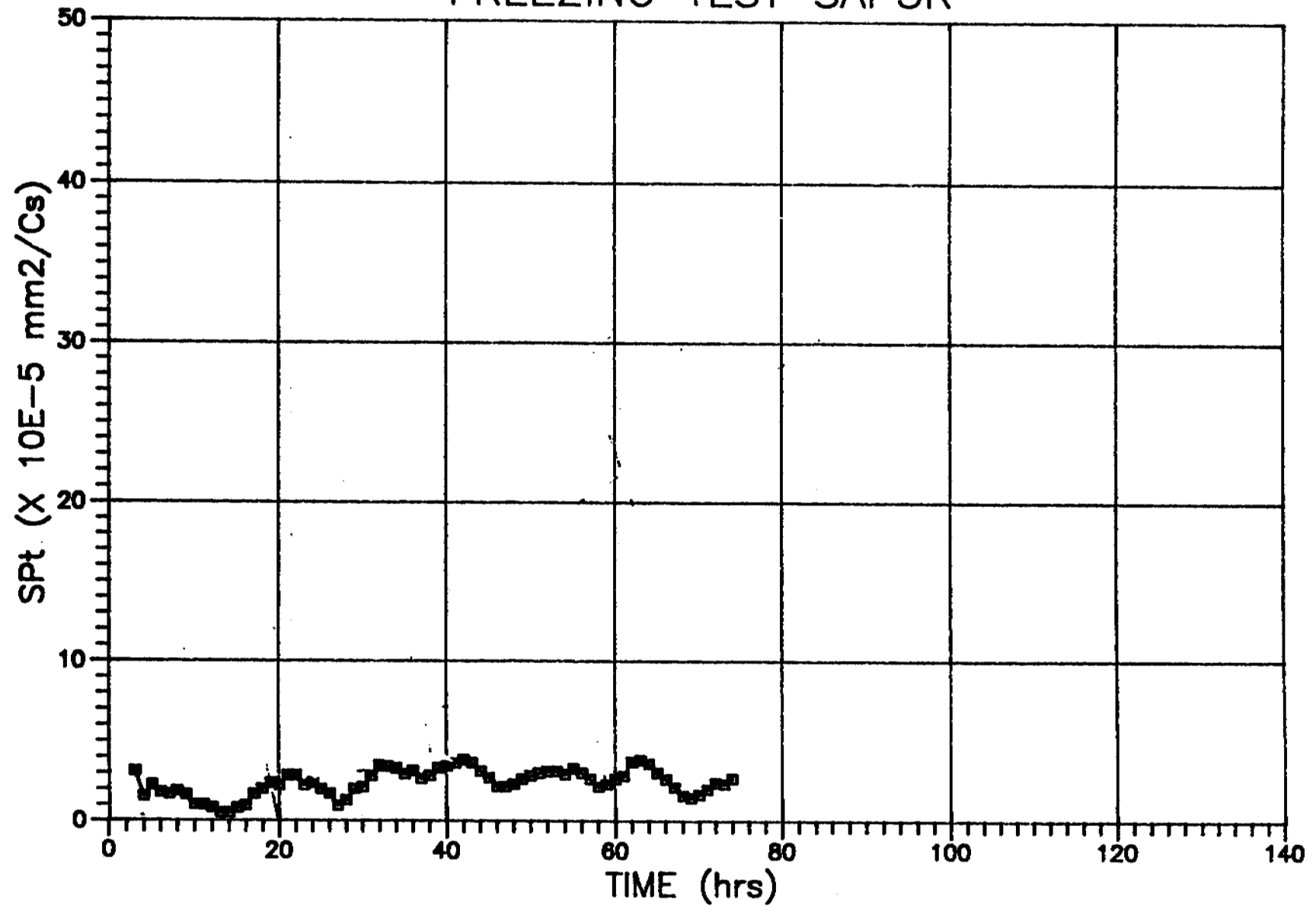
FREEZING TEST SAP5R

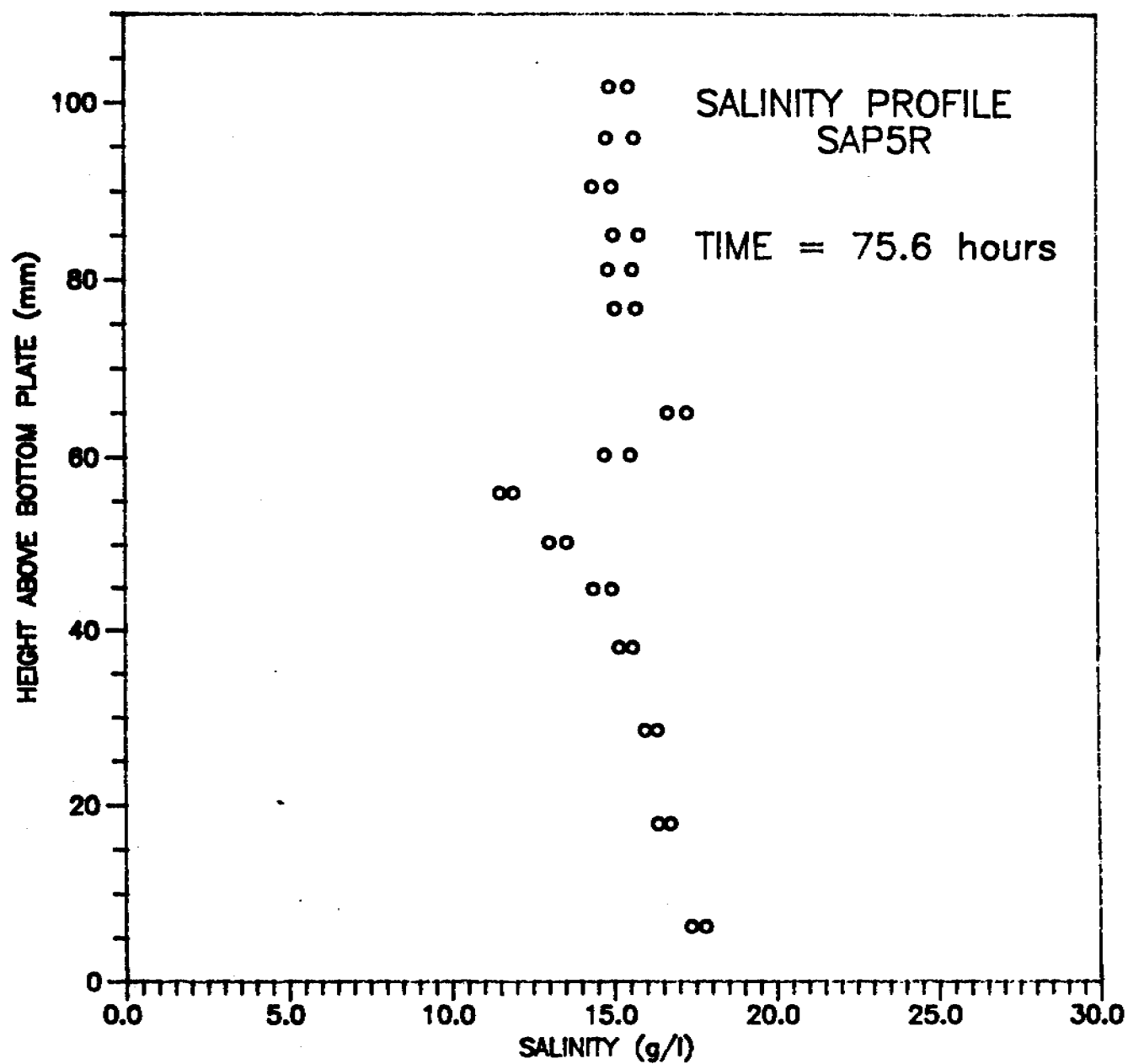


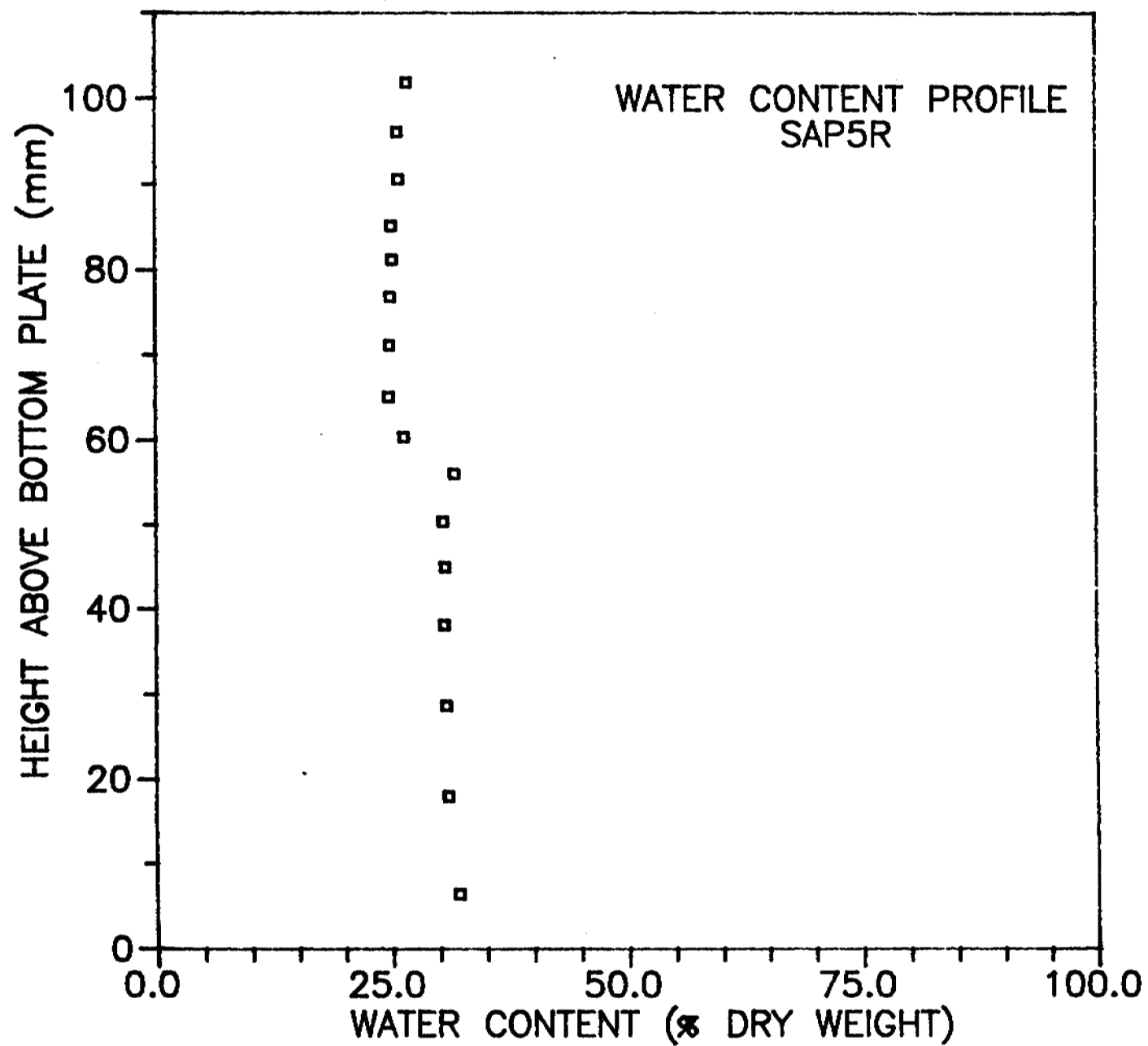
TEST SAP5R FROST FRONT LOCATION

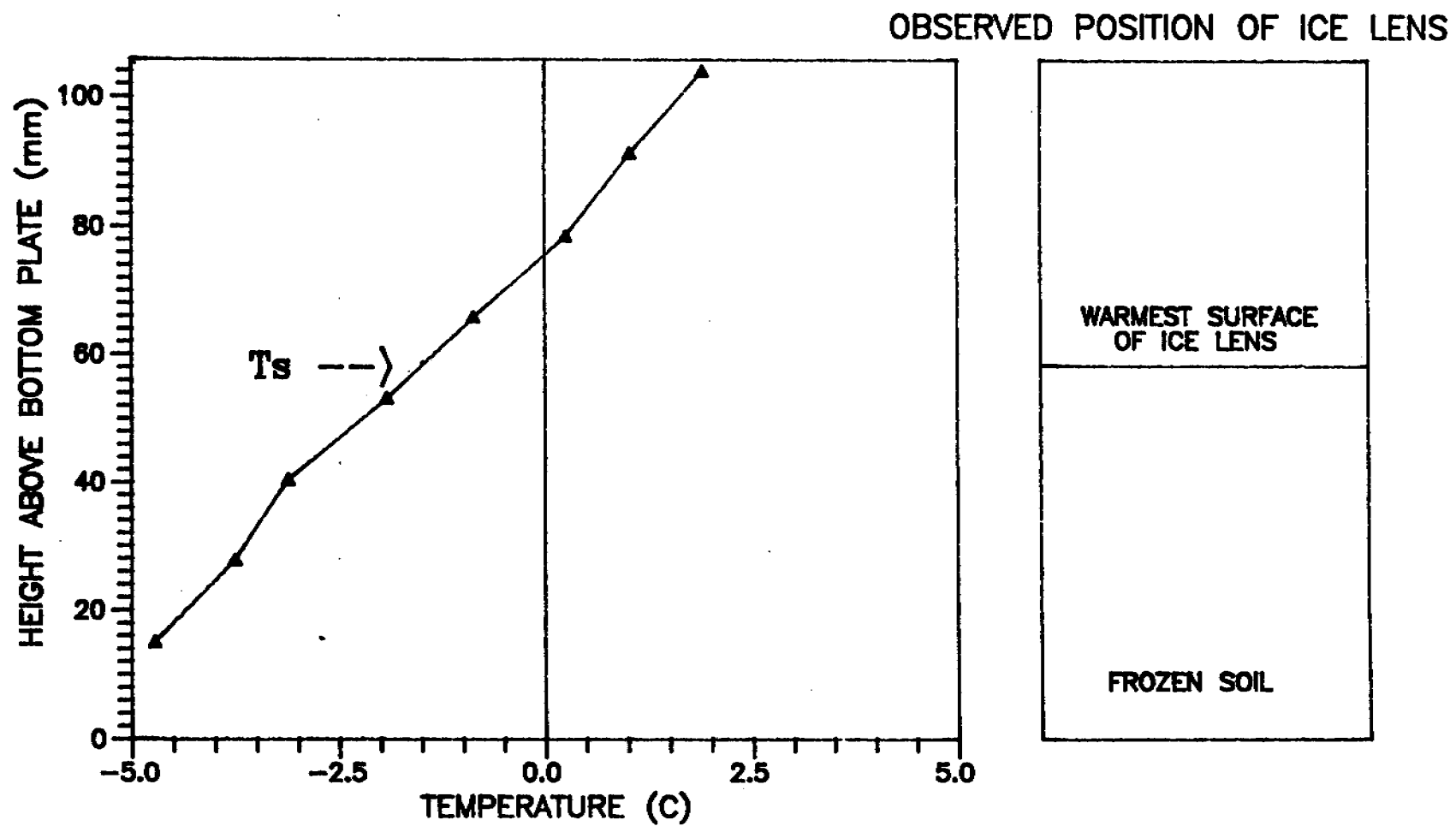


FREEZING TEST SAP5R



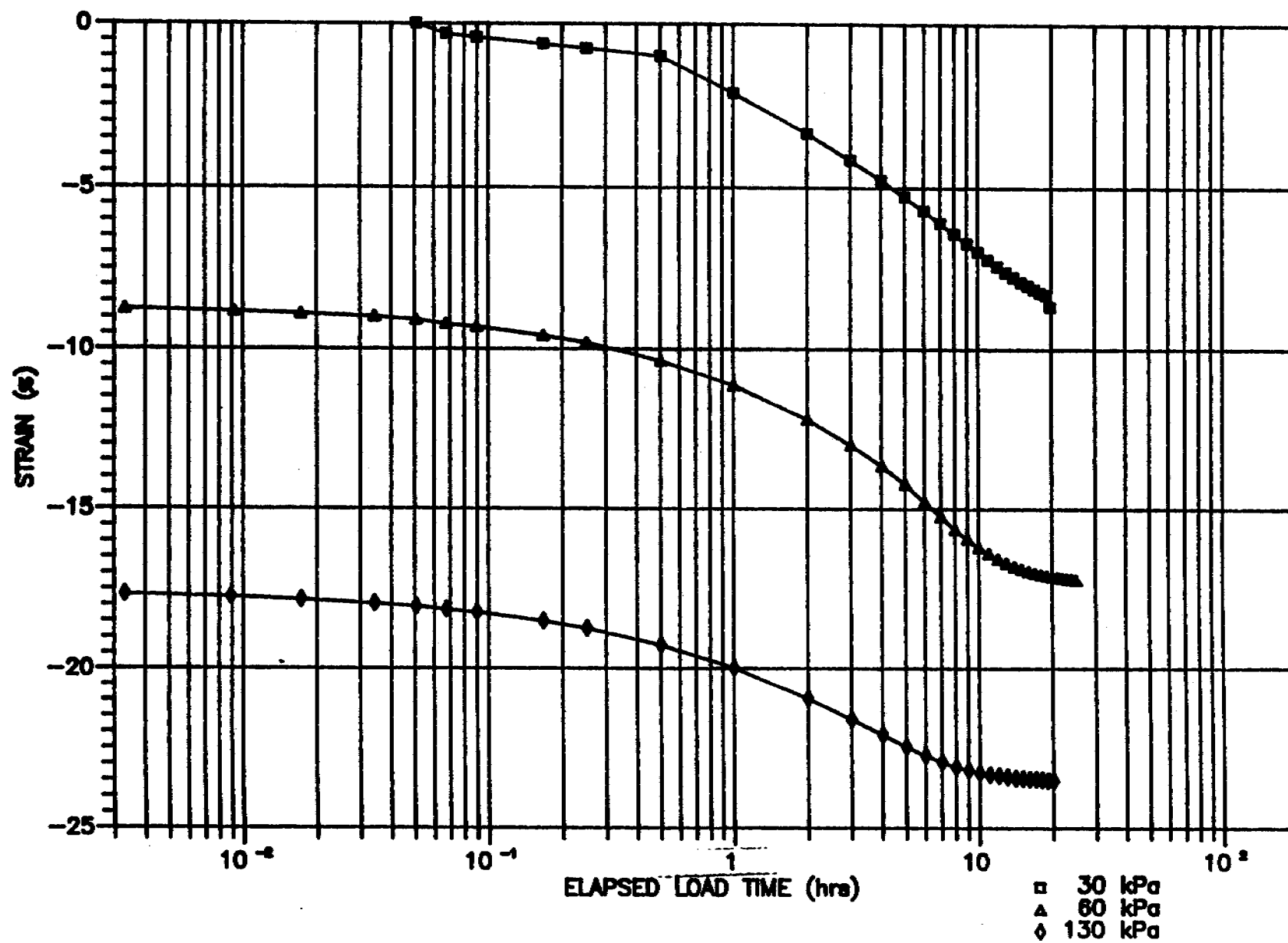




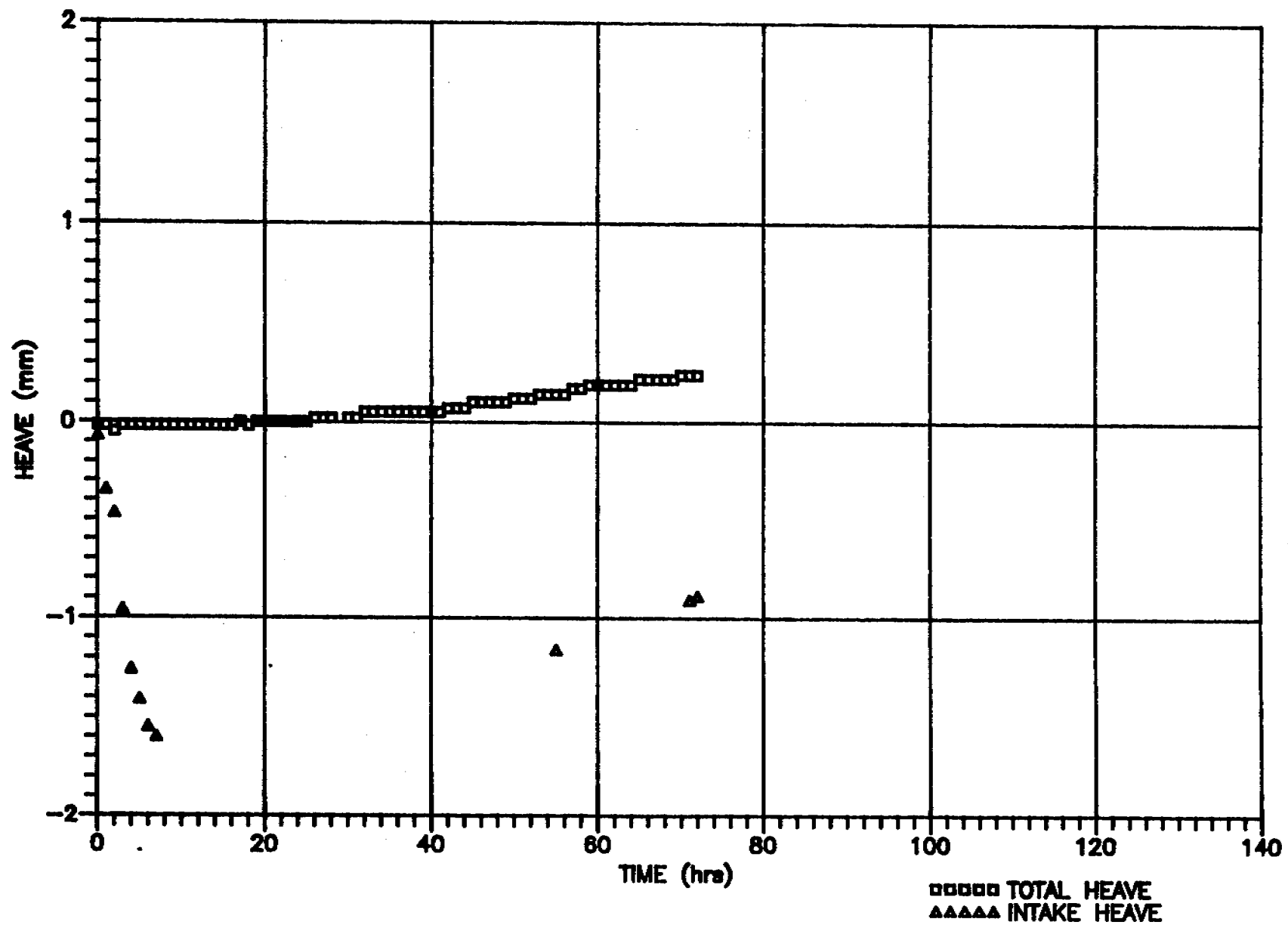


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP5R

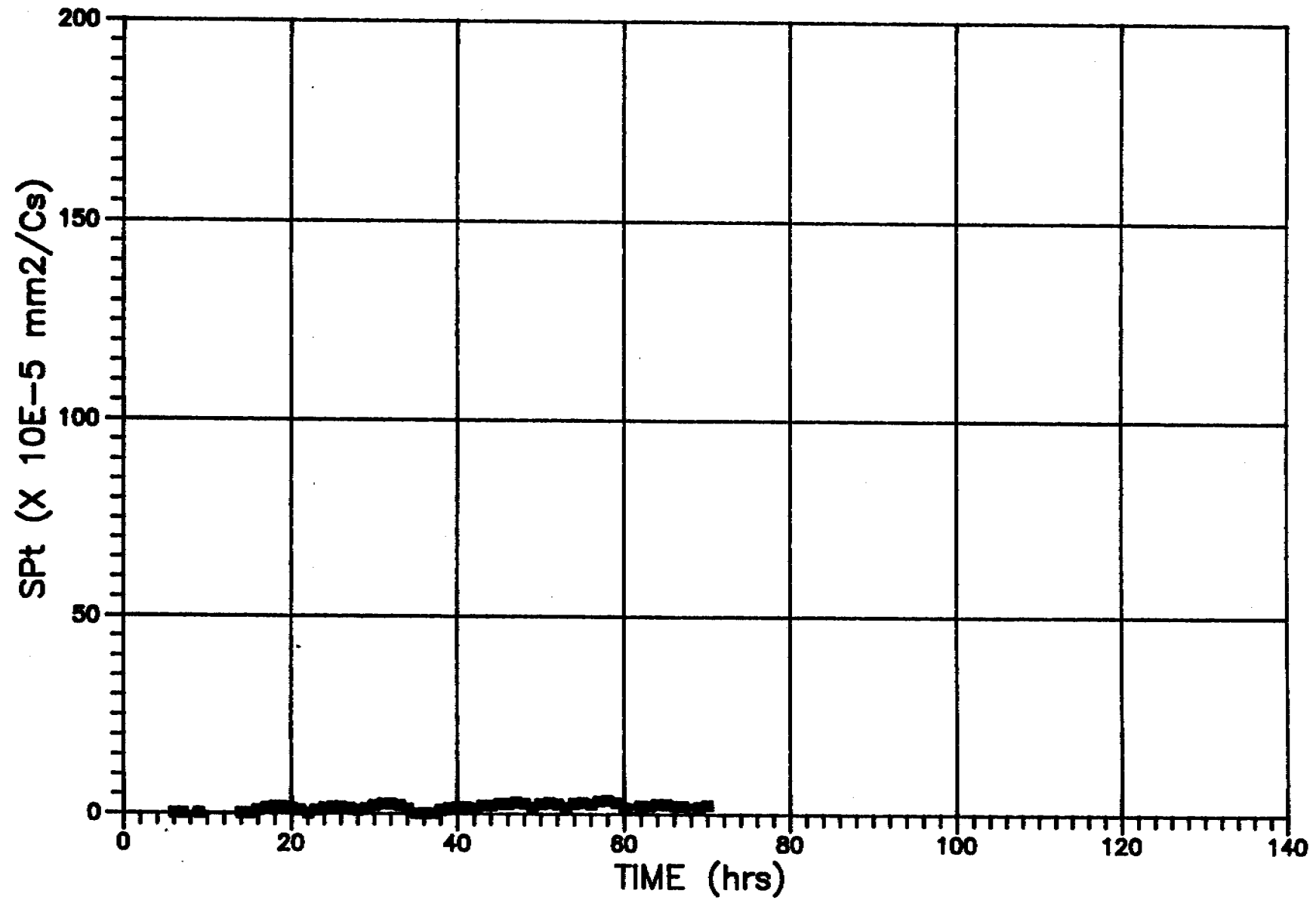
CONSOLIDATION TEST SAP6



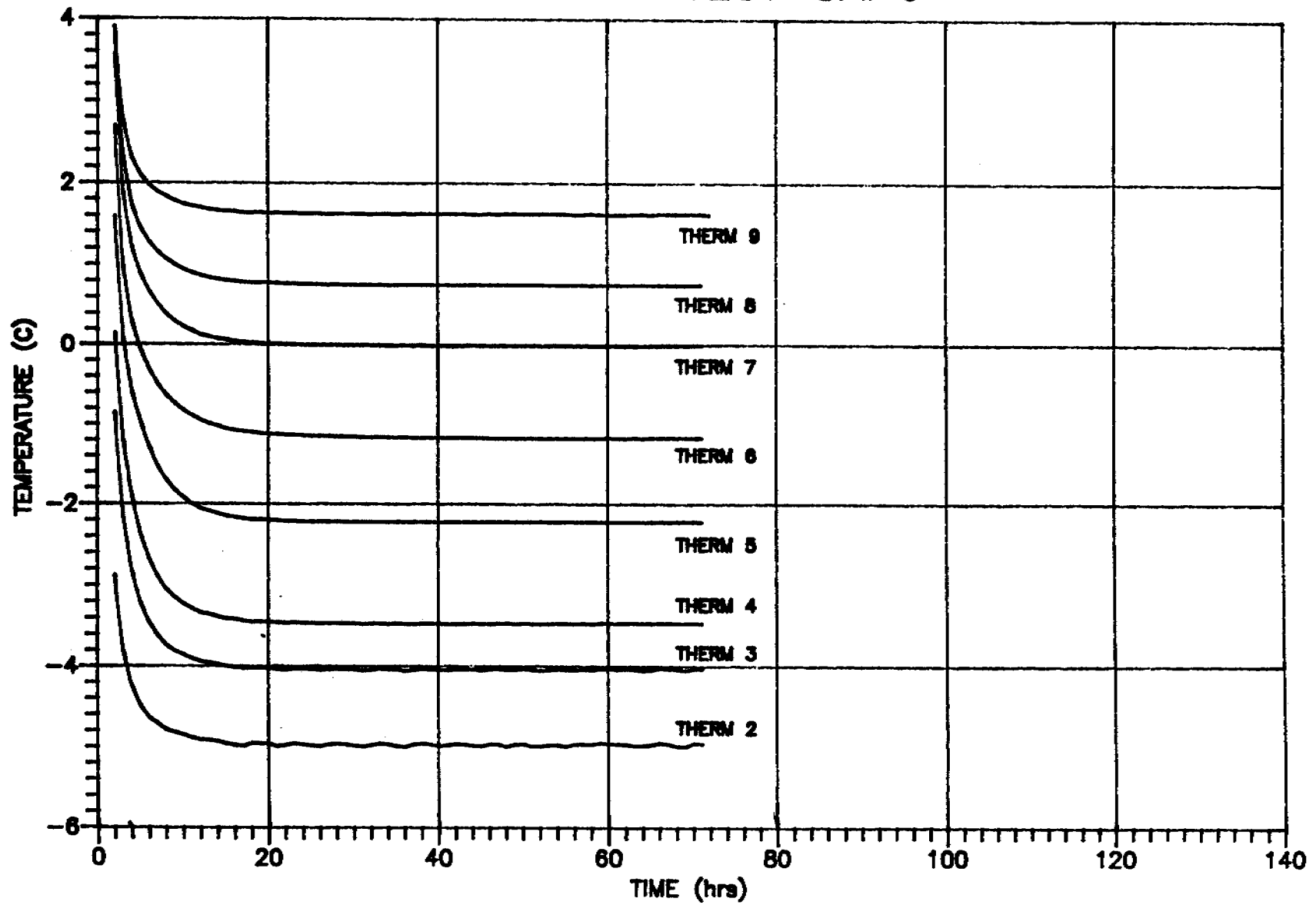
FREEZING TEST SAP6



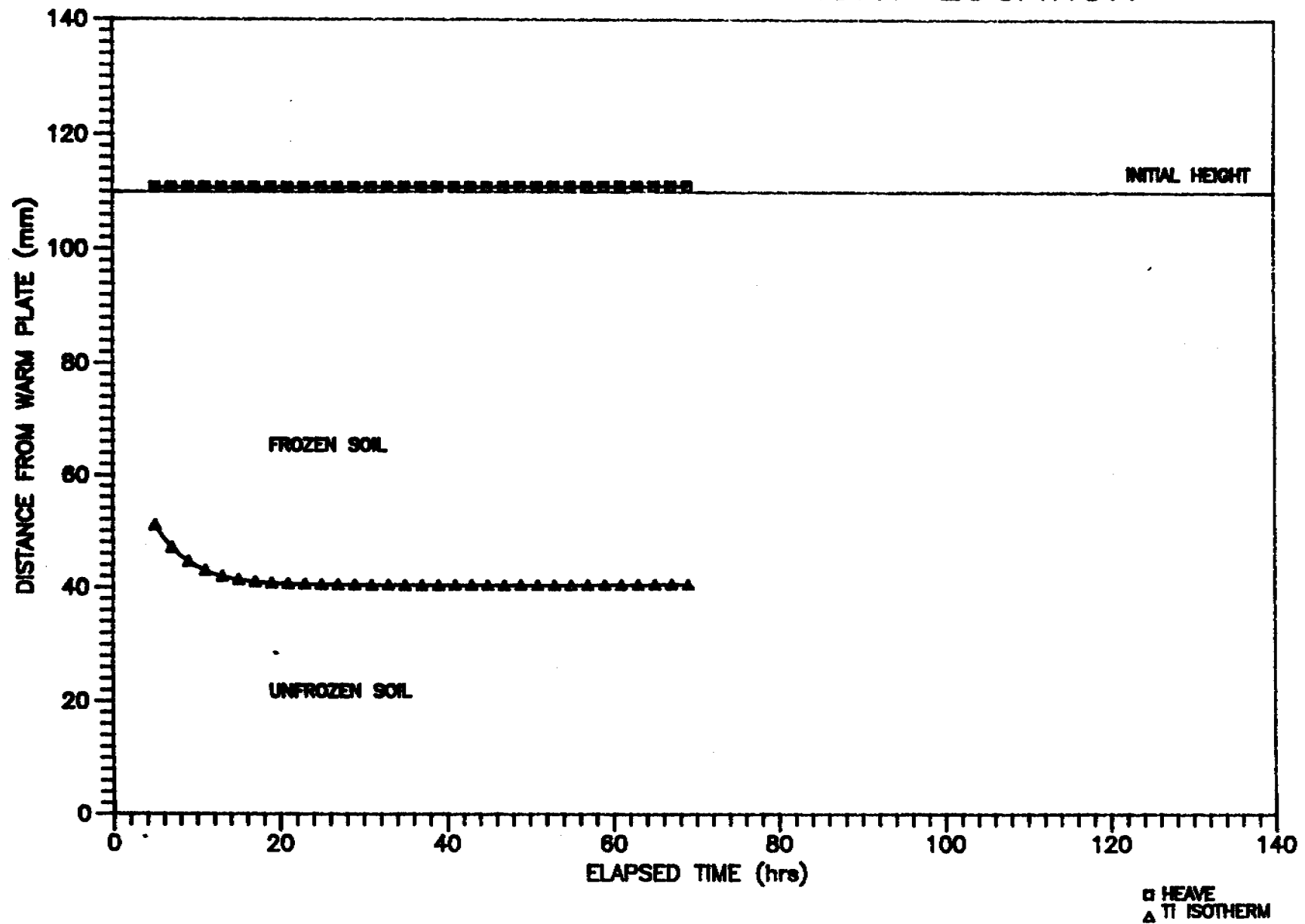
FREEZING TEST SAP6



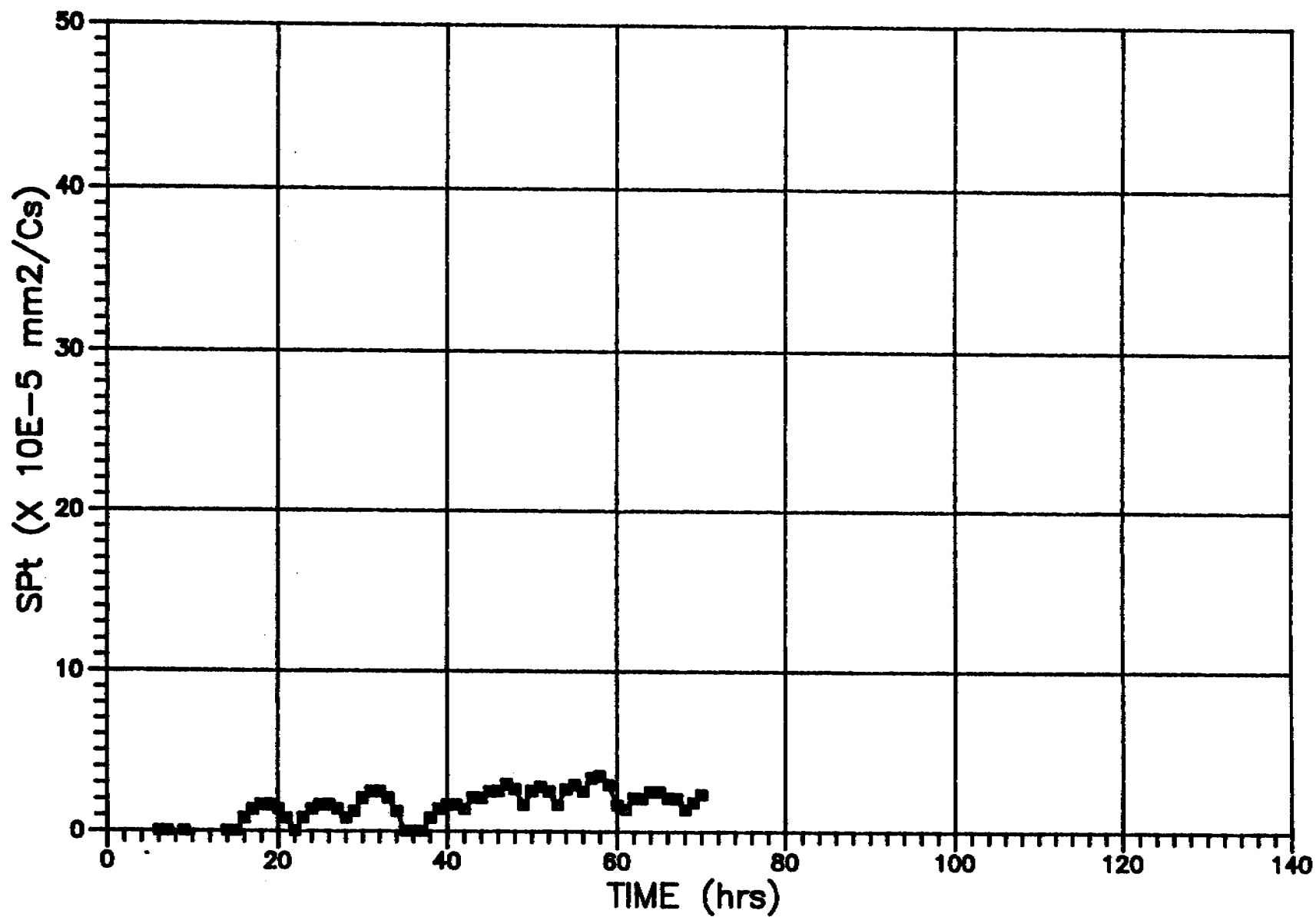
FREEZING TEST SAP6

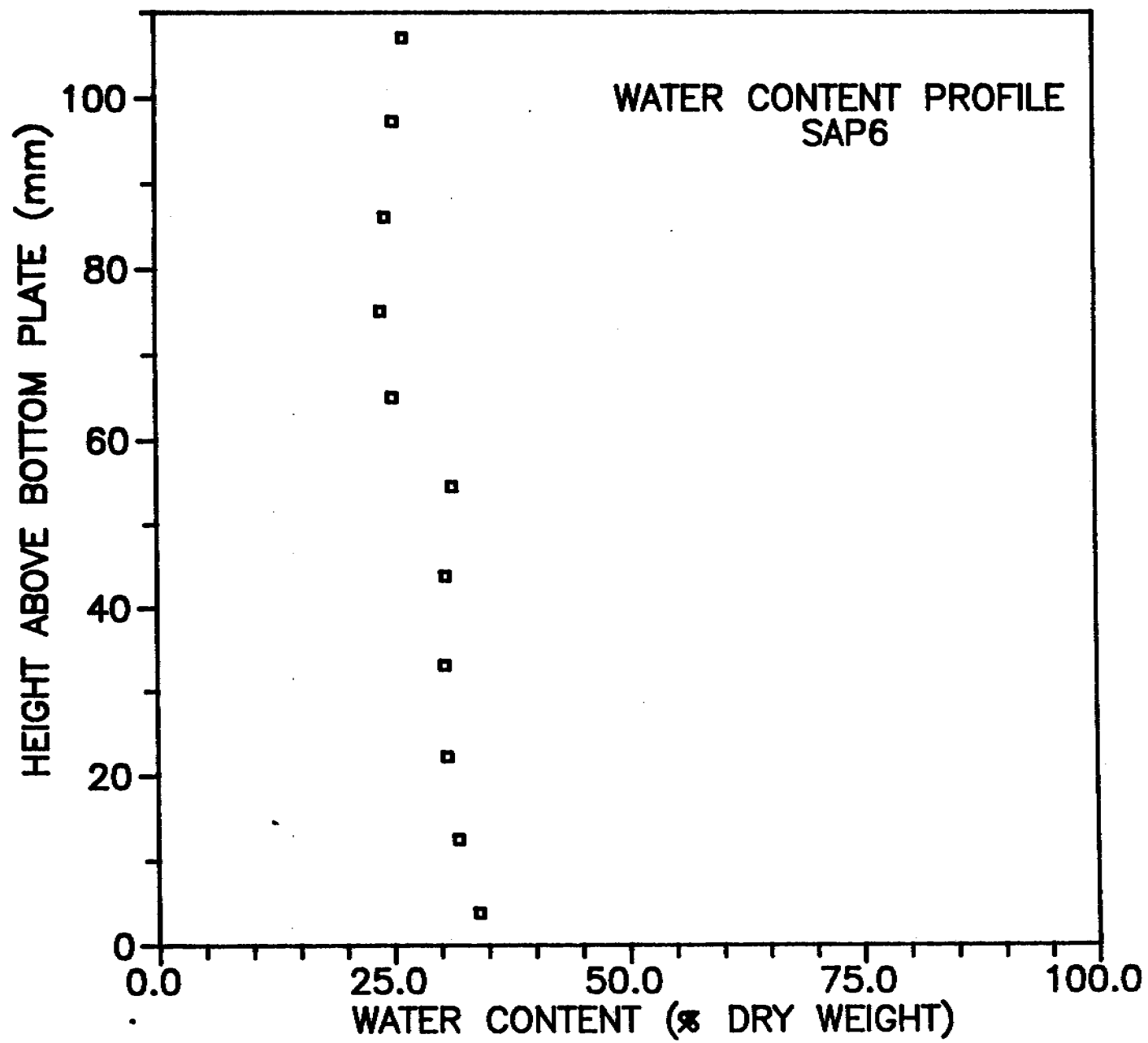


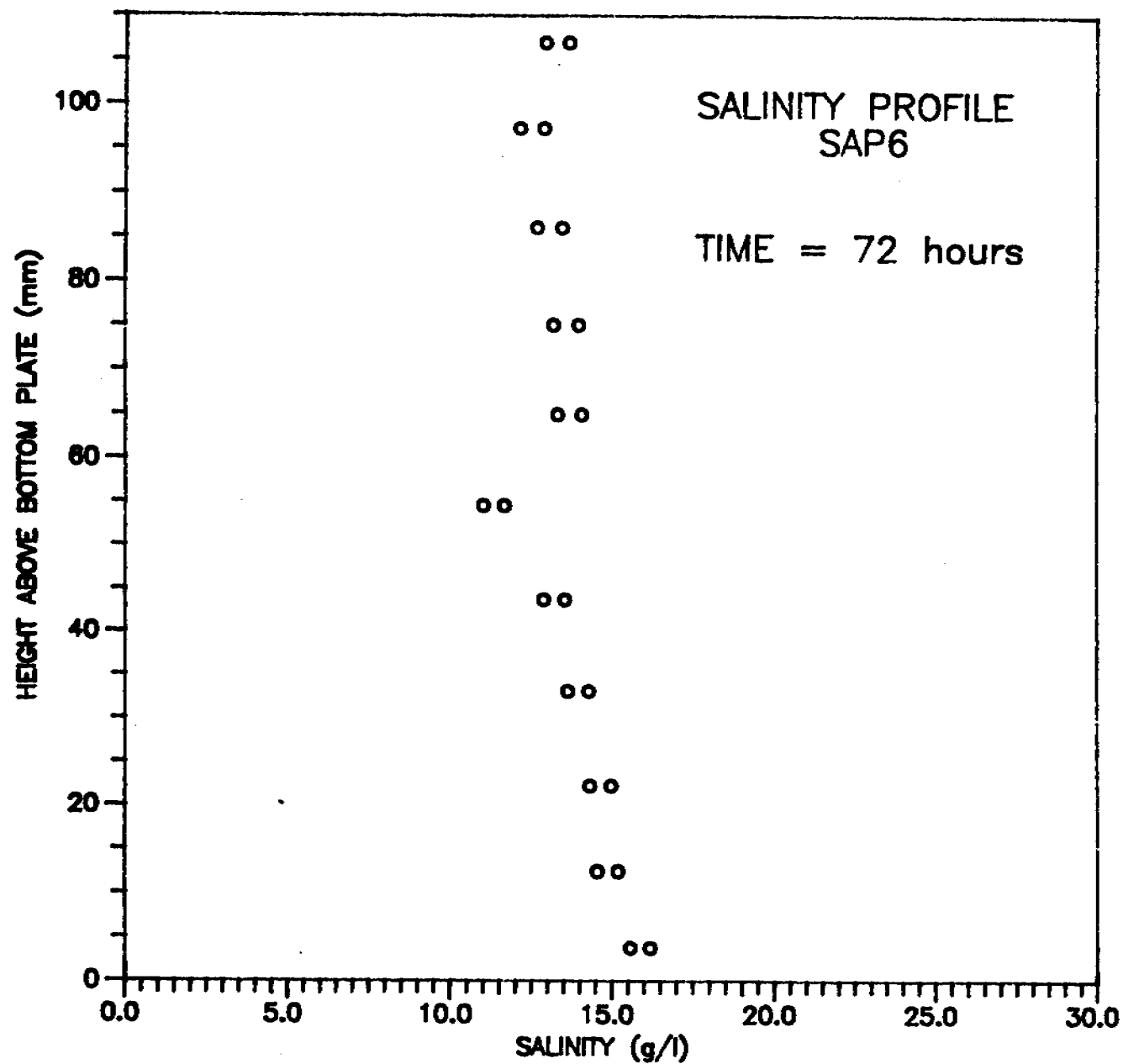
TEST SAP6 FROST FRONT LOCATION

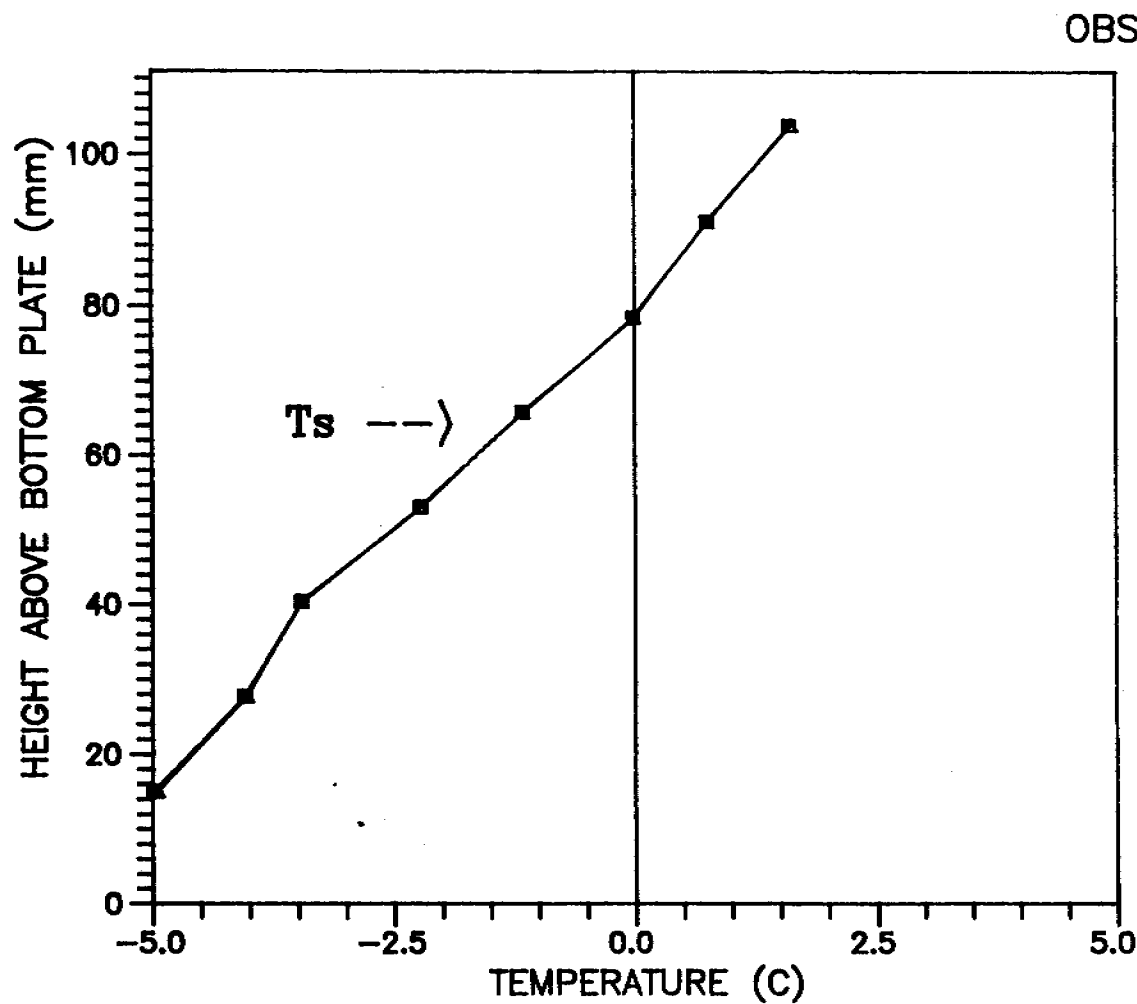


FREEZING TEST SAP6

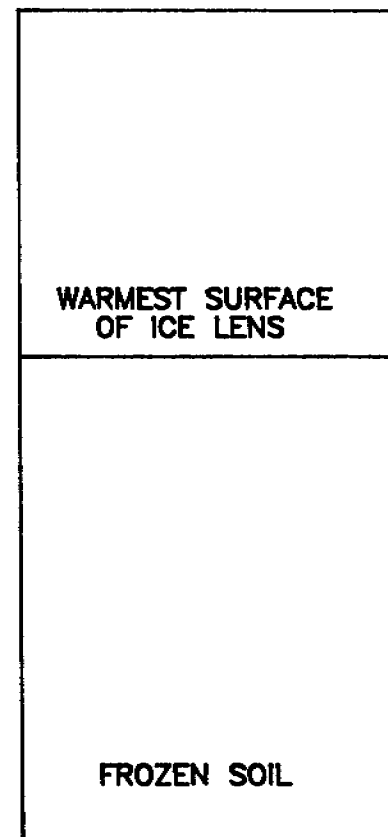






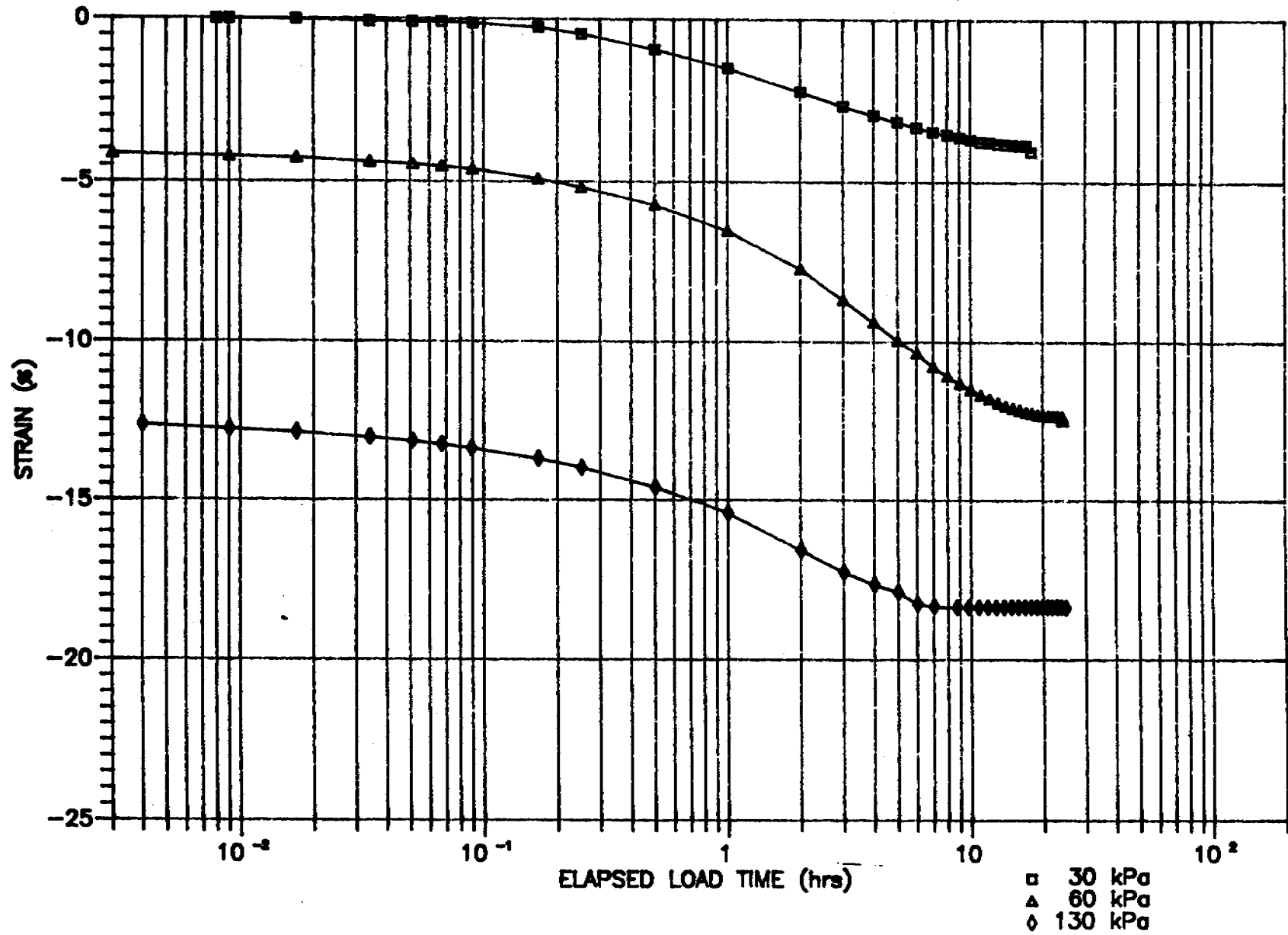


OBSERVED POSITION OF ICE LENS

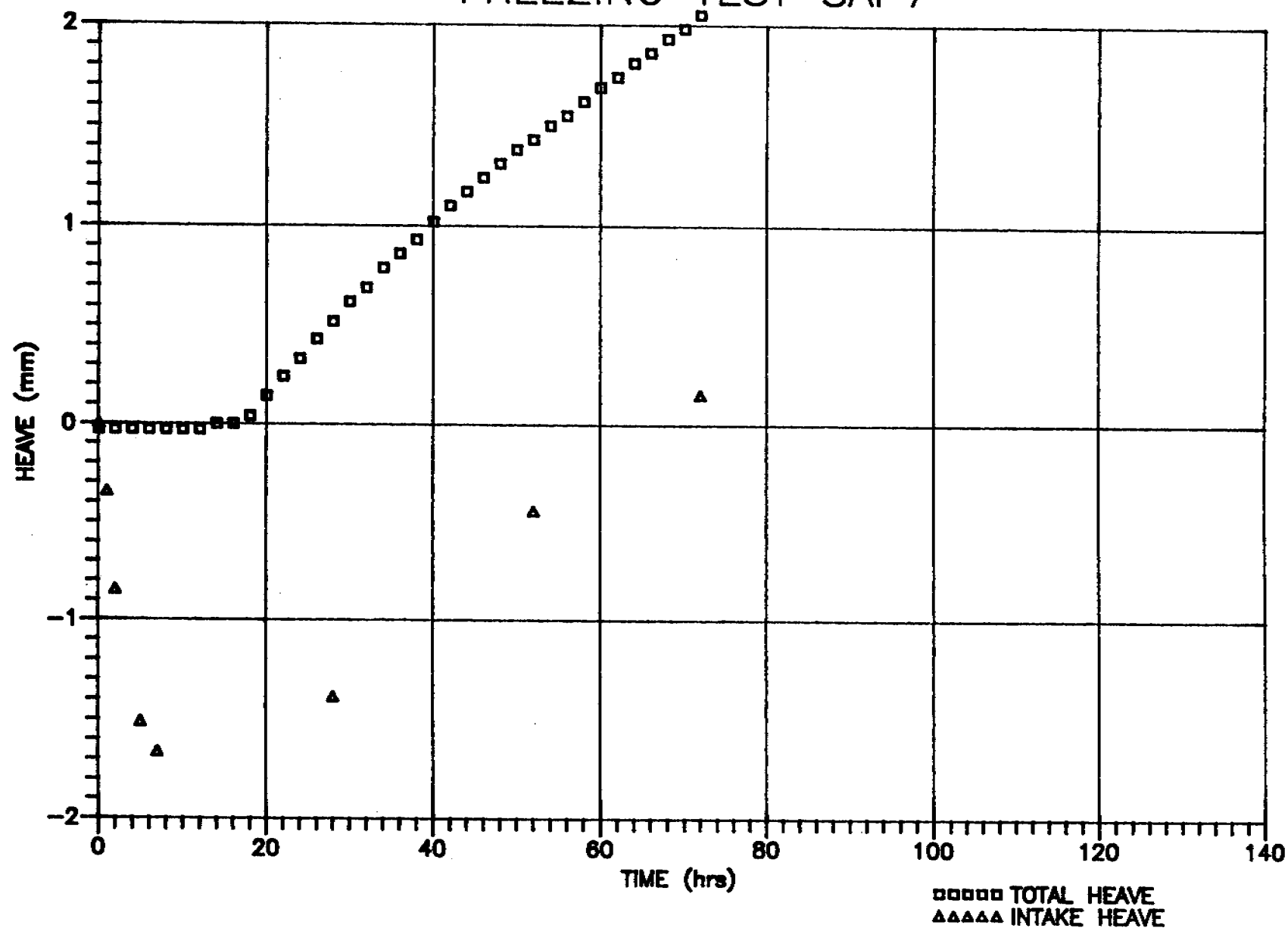


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP6

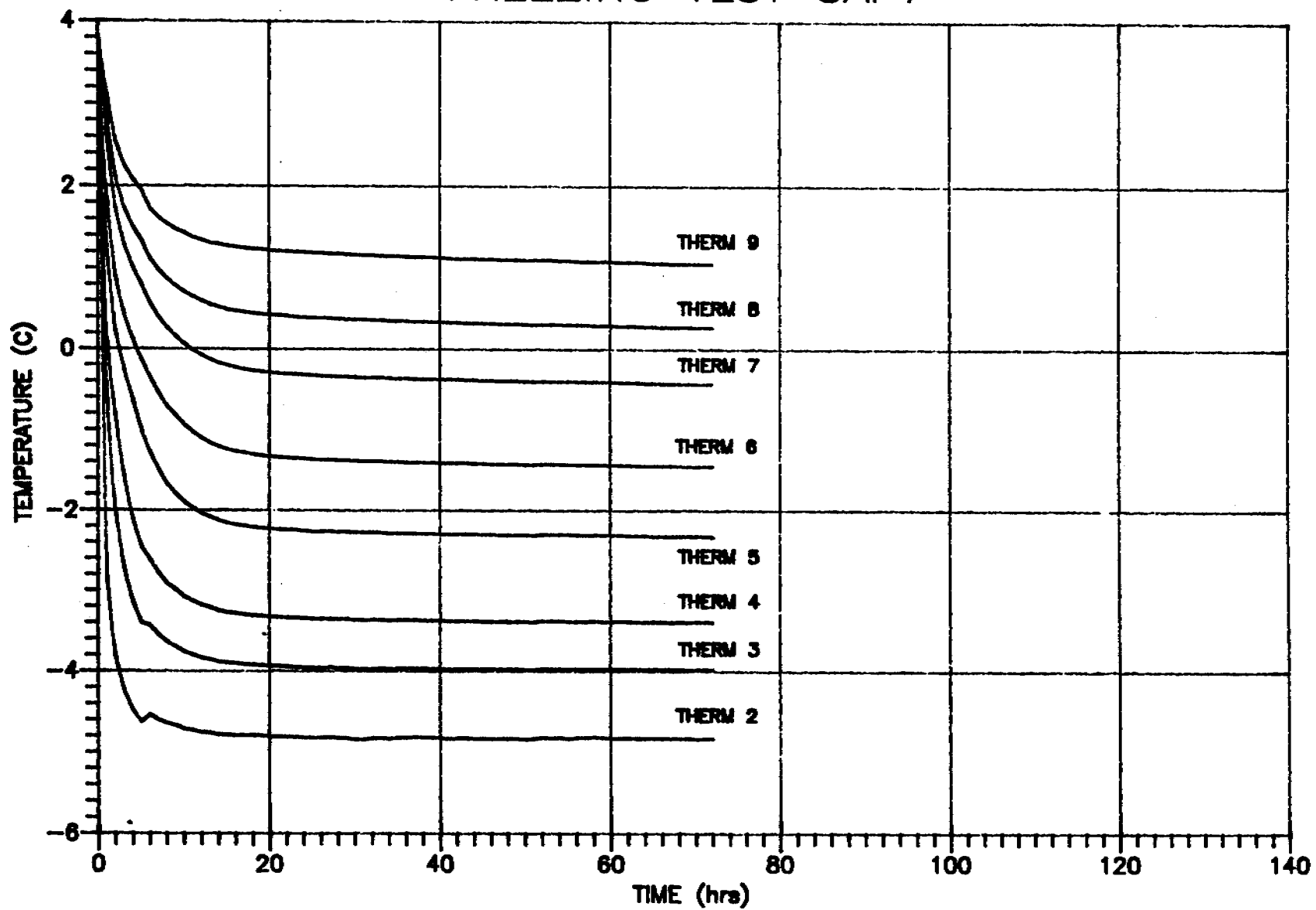
CONSOLIDATION TEST SAP7



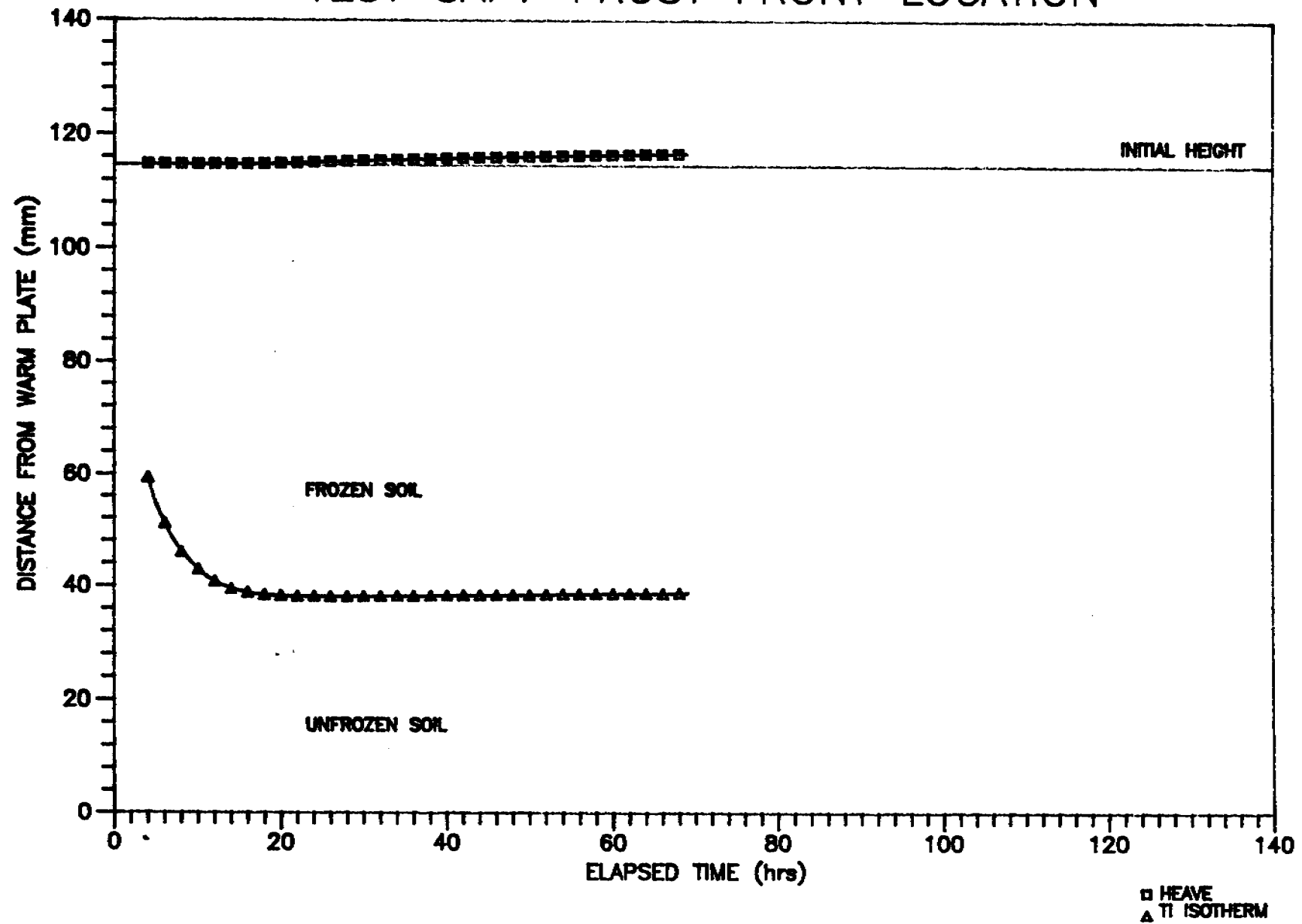
FREEZING TEST SAP7



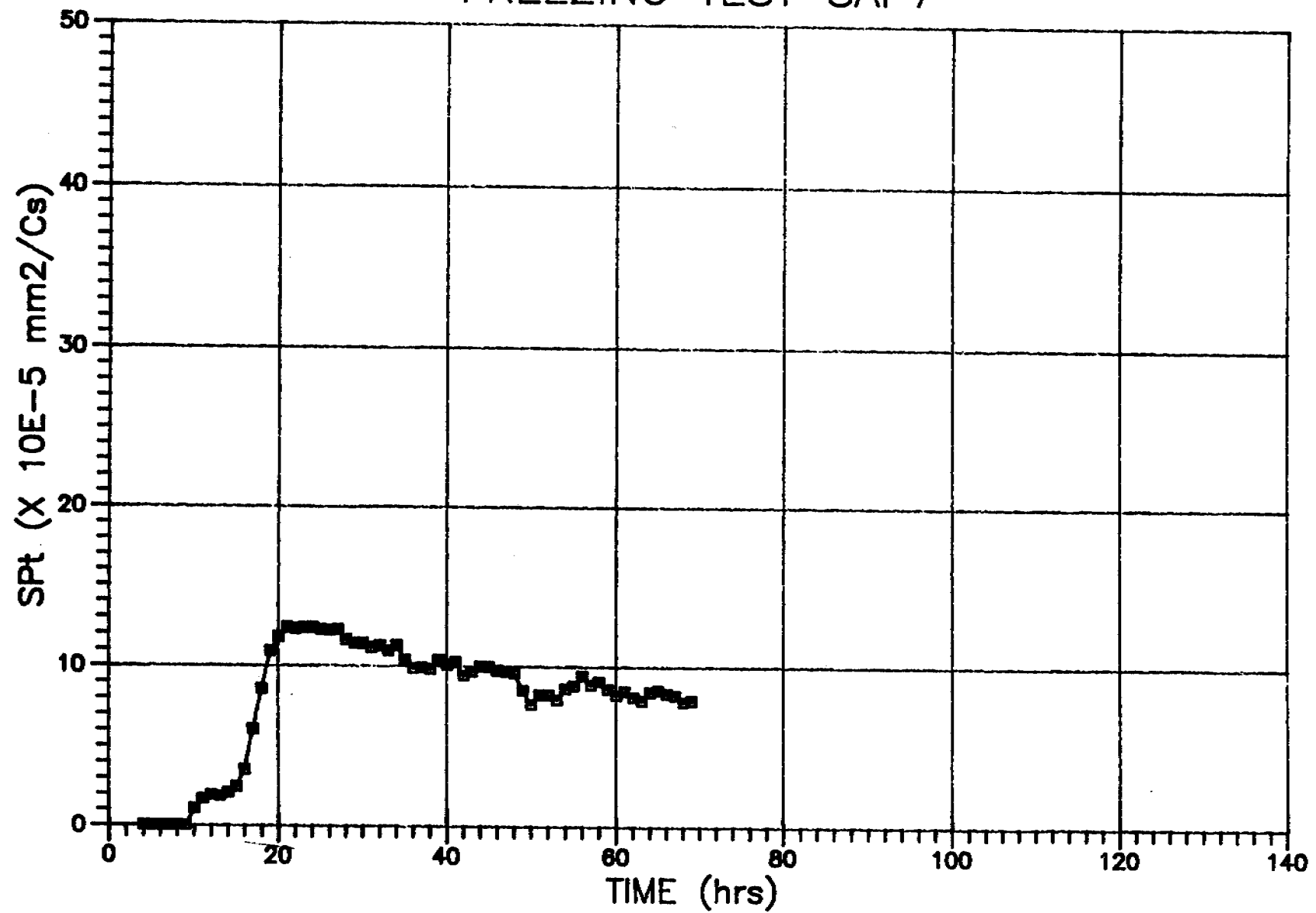
FREEZING TEST SAP7

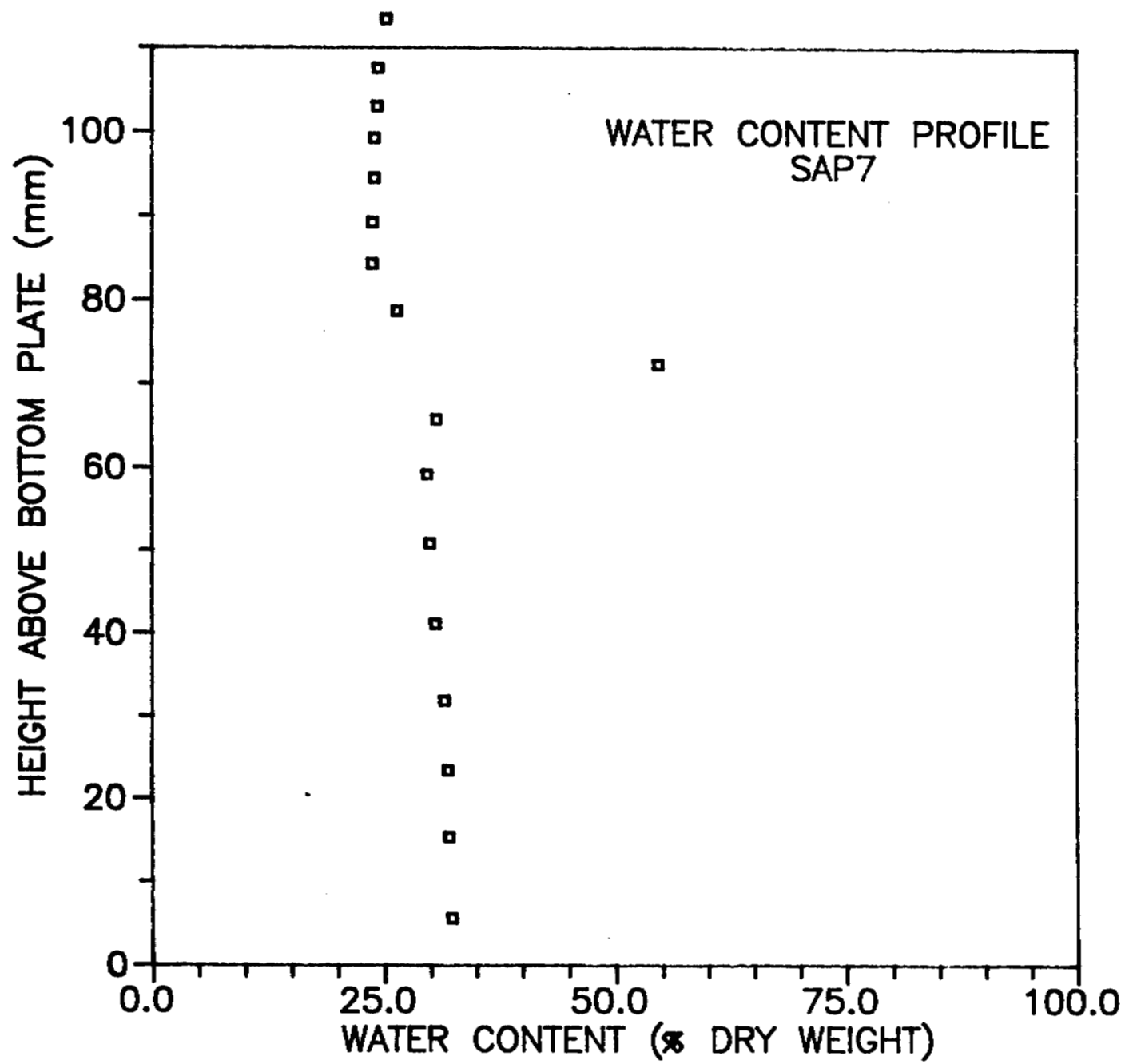


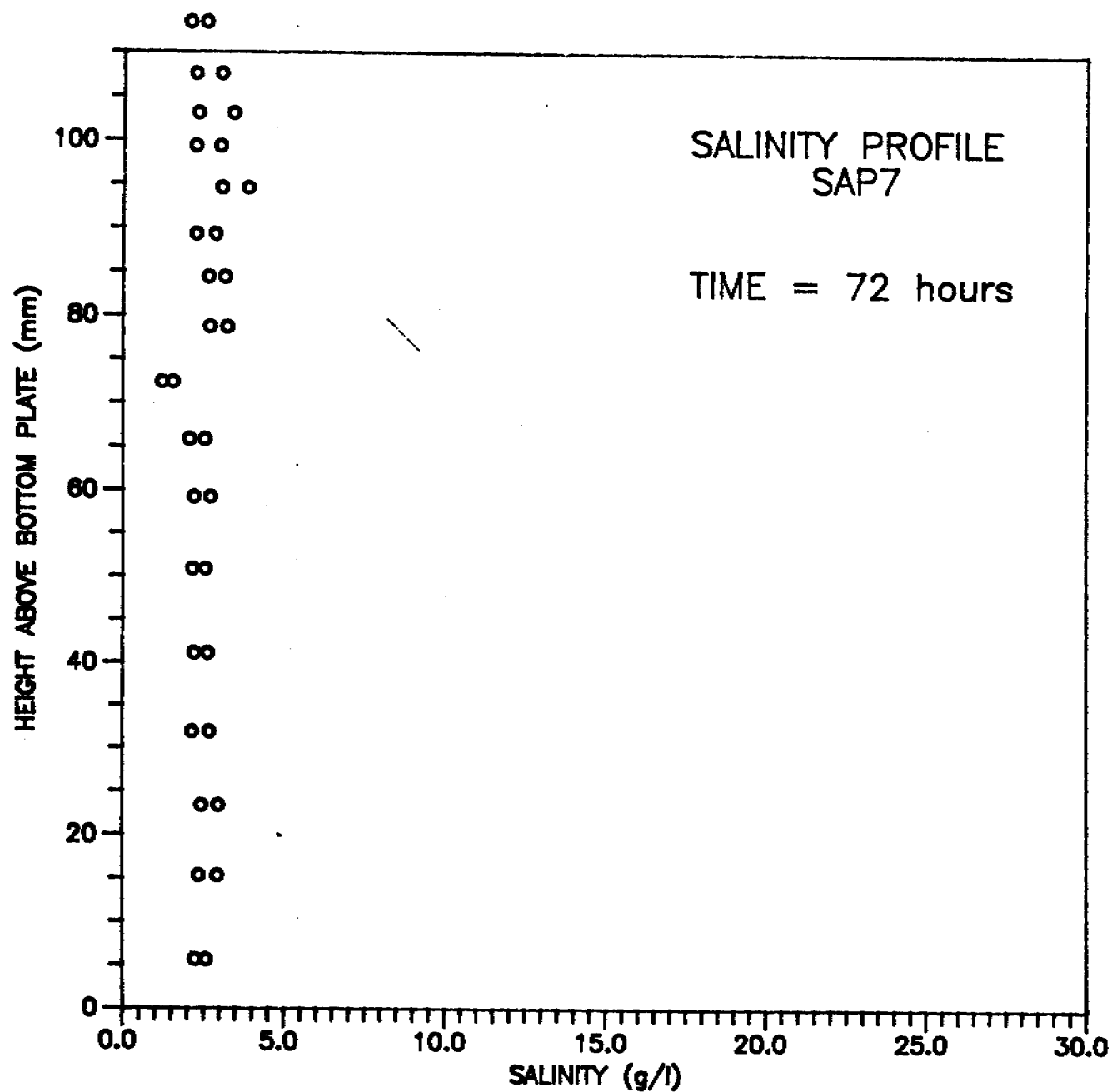
TEST SAP7 FROST FRONT LOCATION

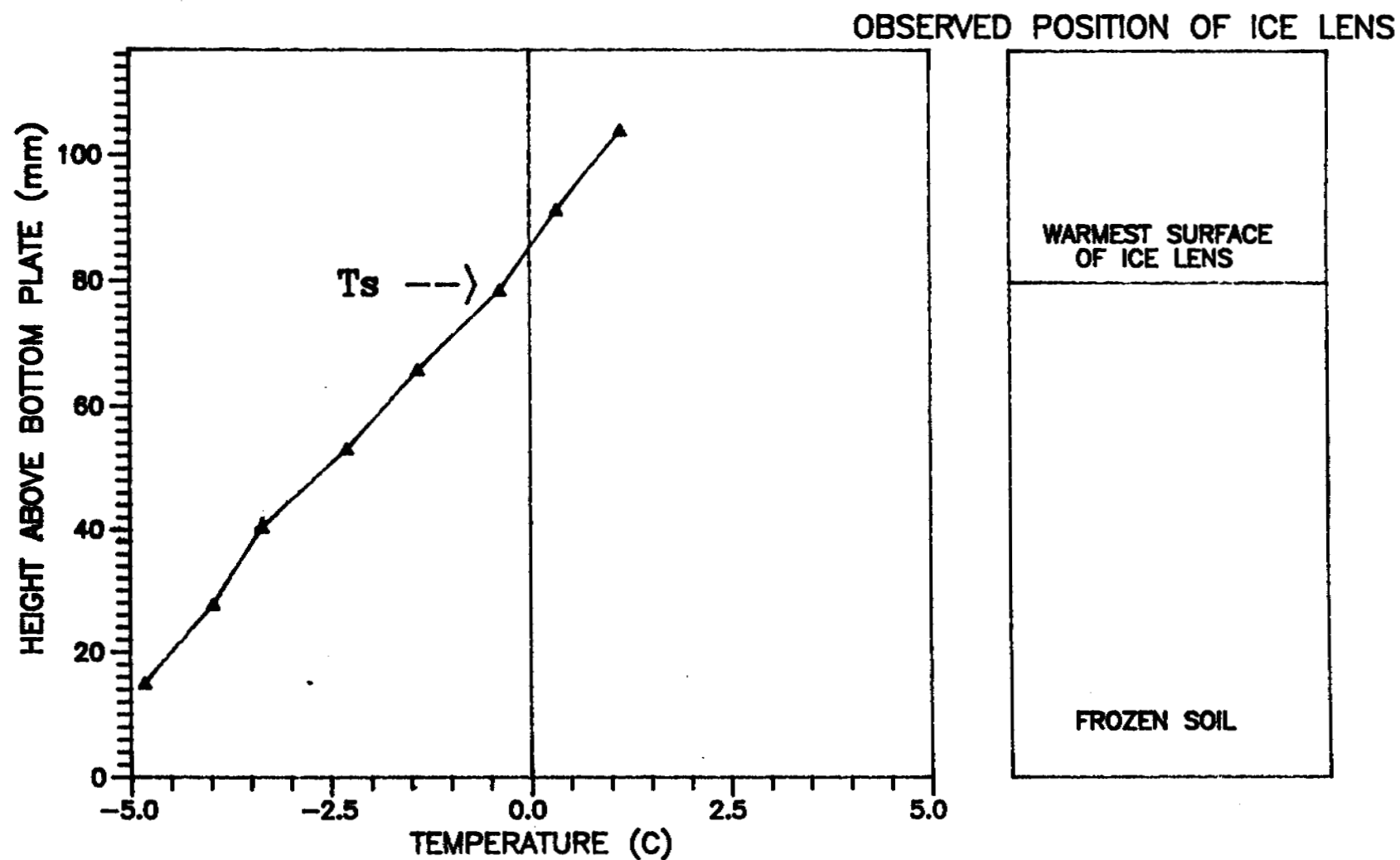


FREEZING TEST SAP7



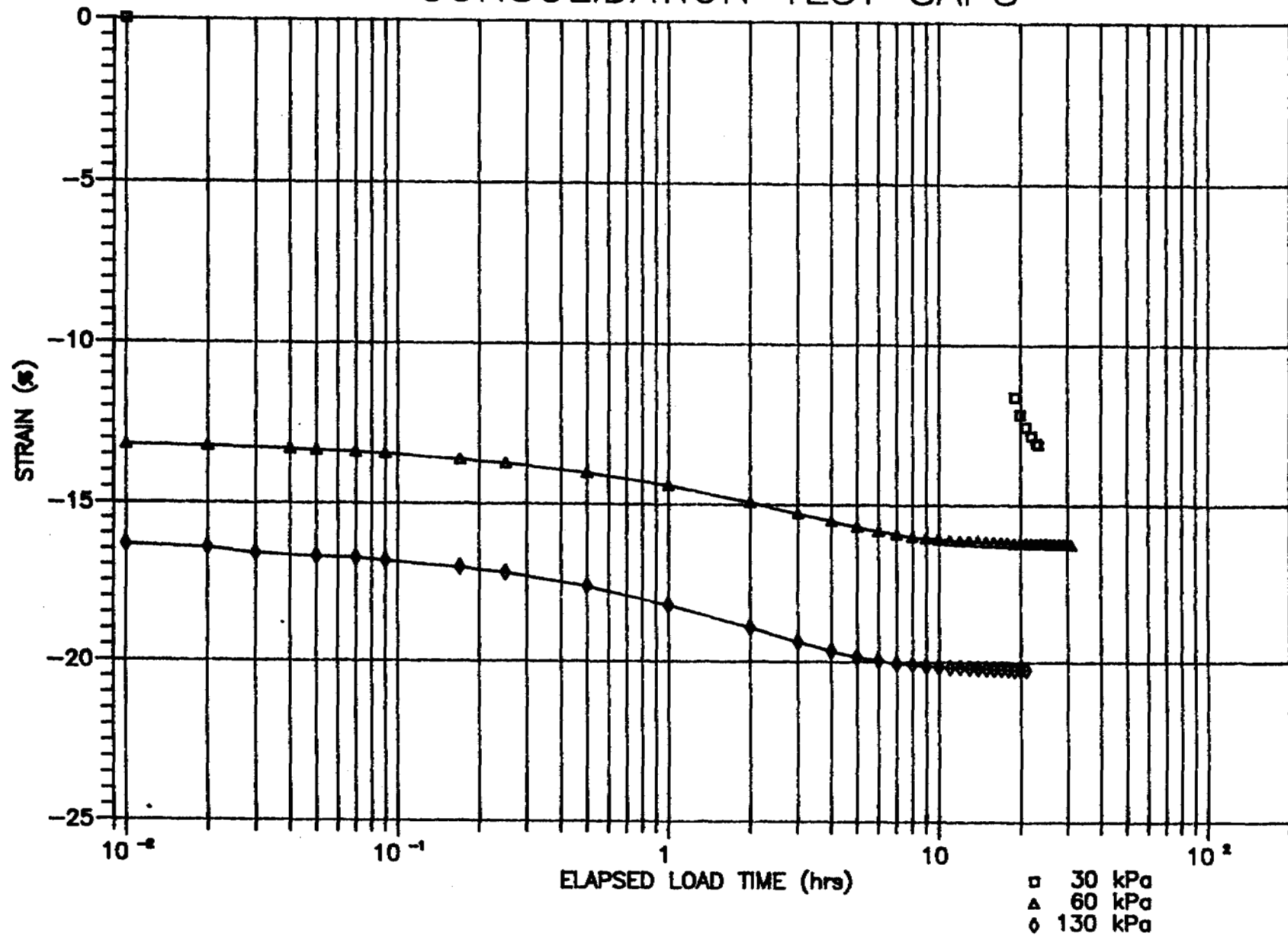




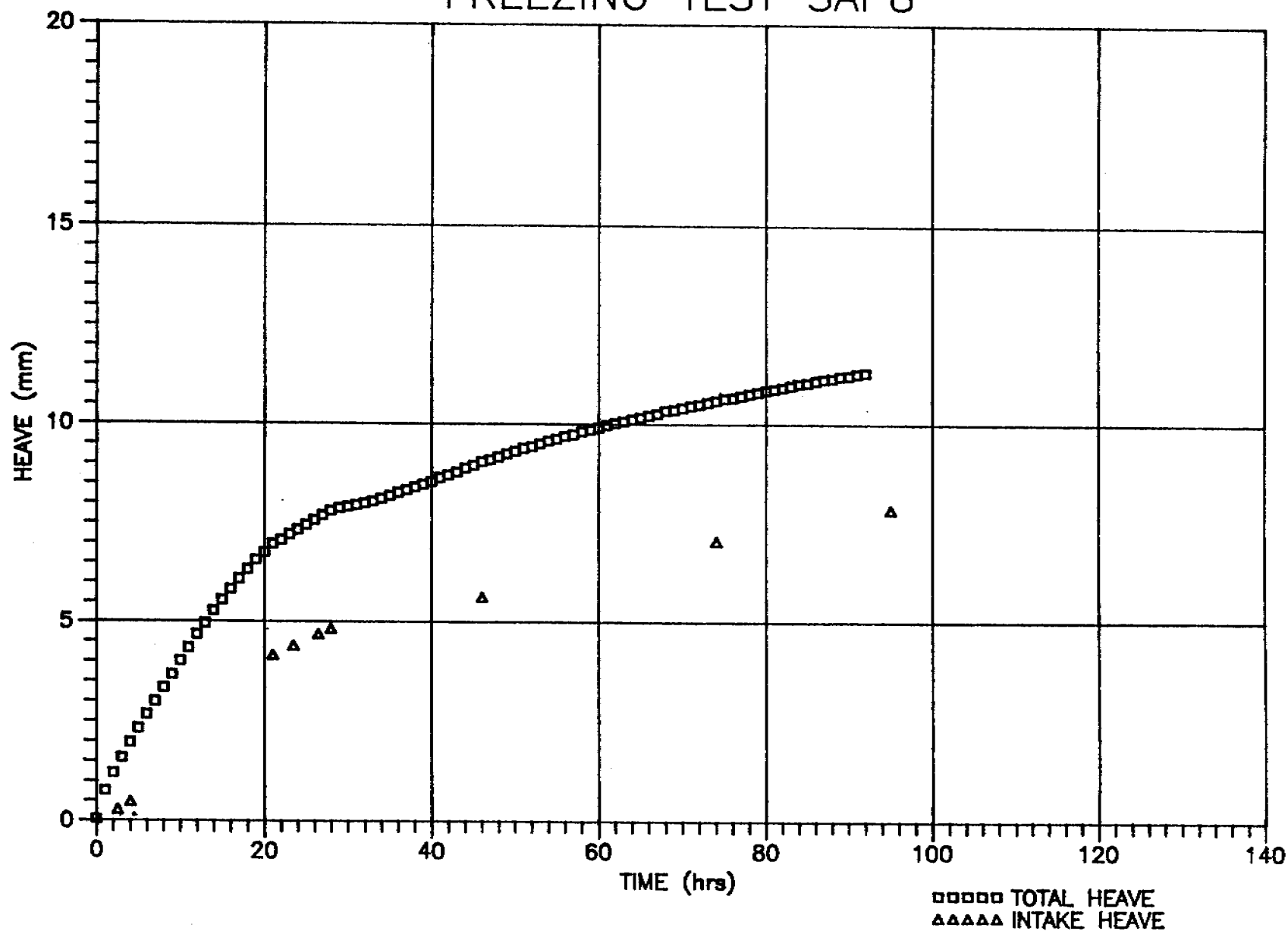


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP7

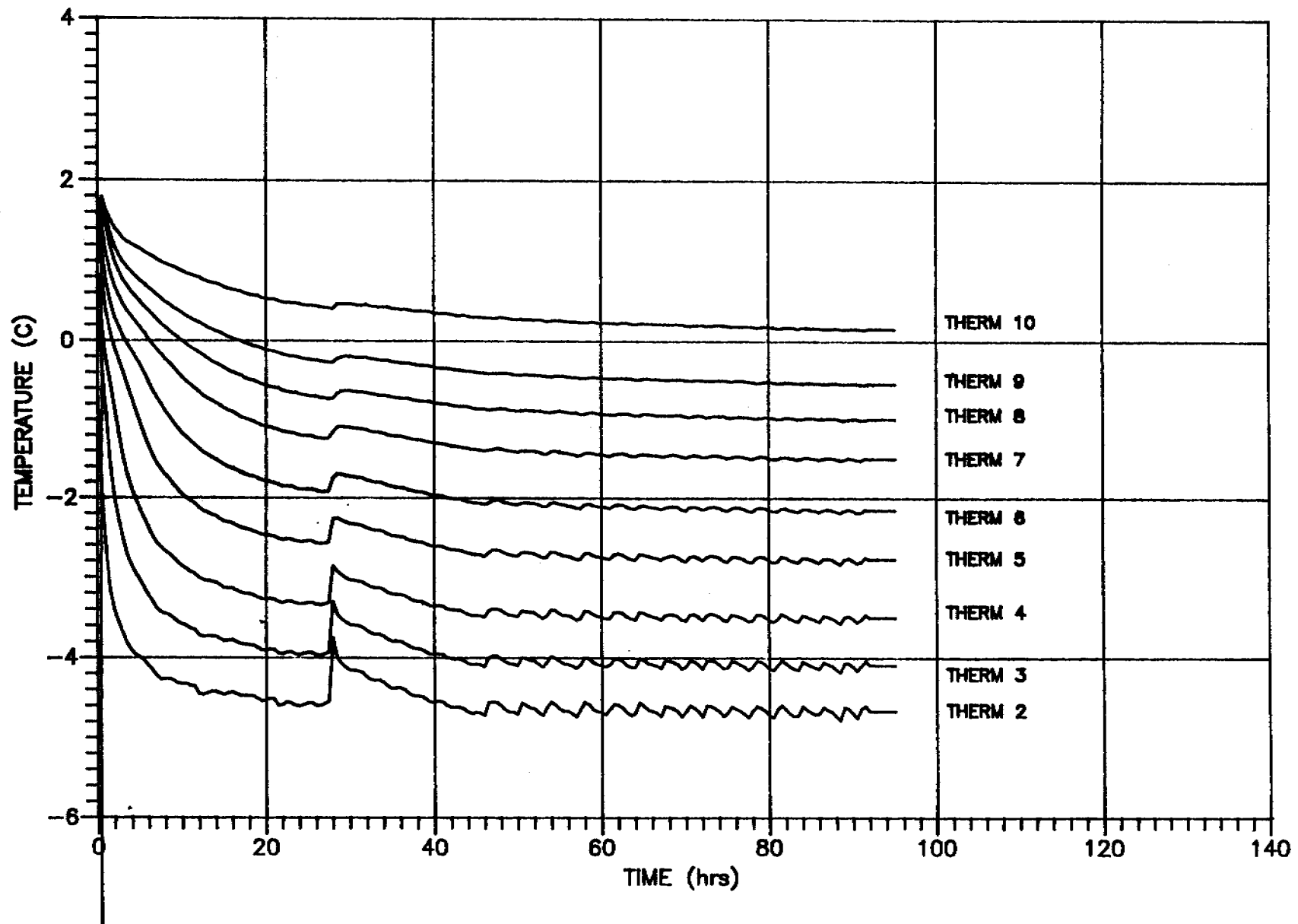
CONSOLIDATION TEST SAP8



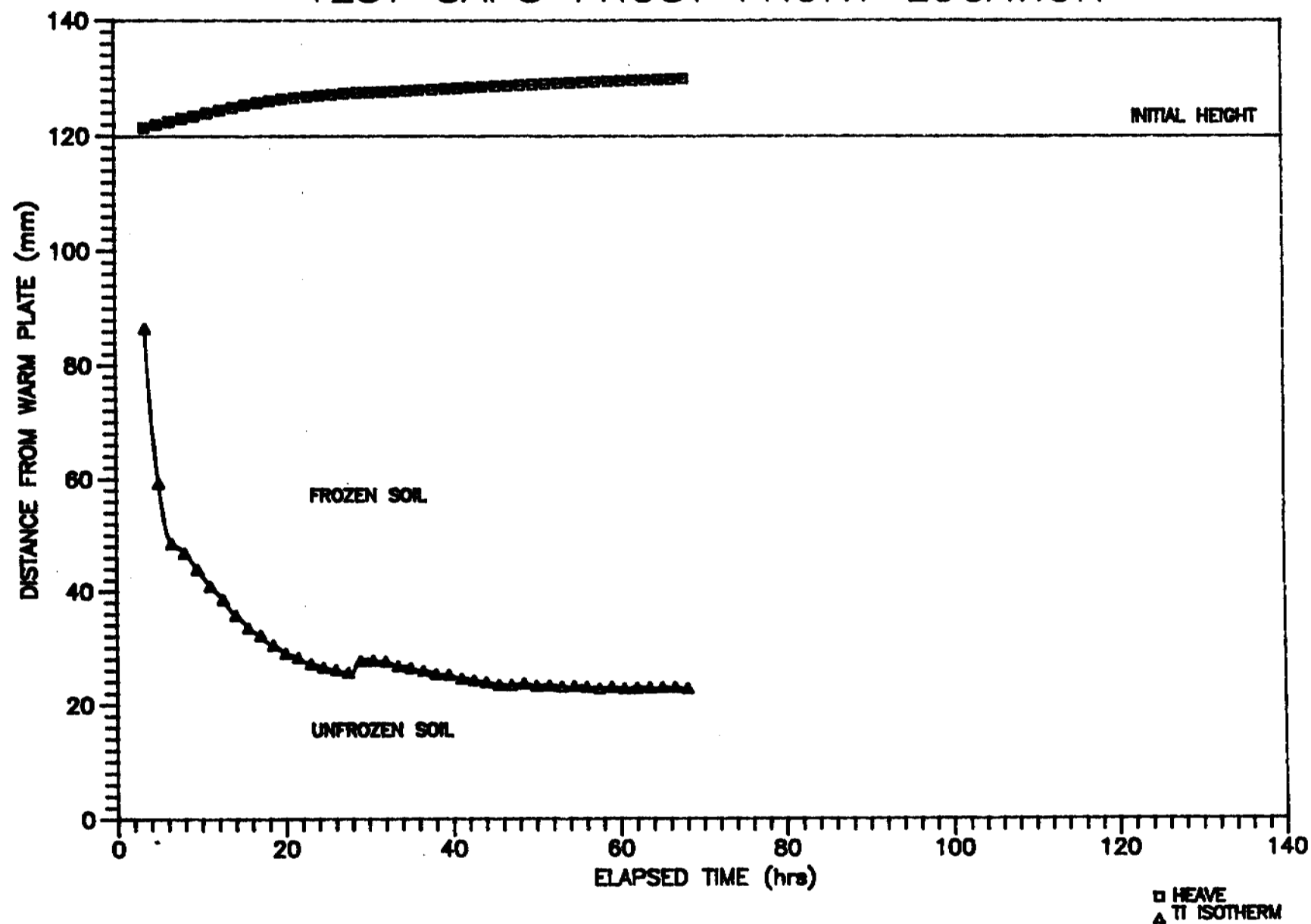
FREEZING TEST SAP8



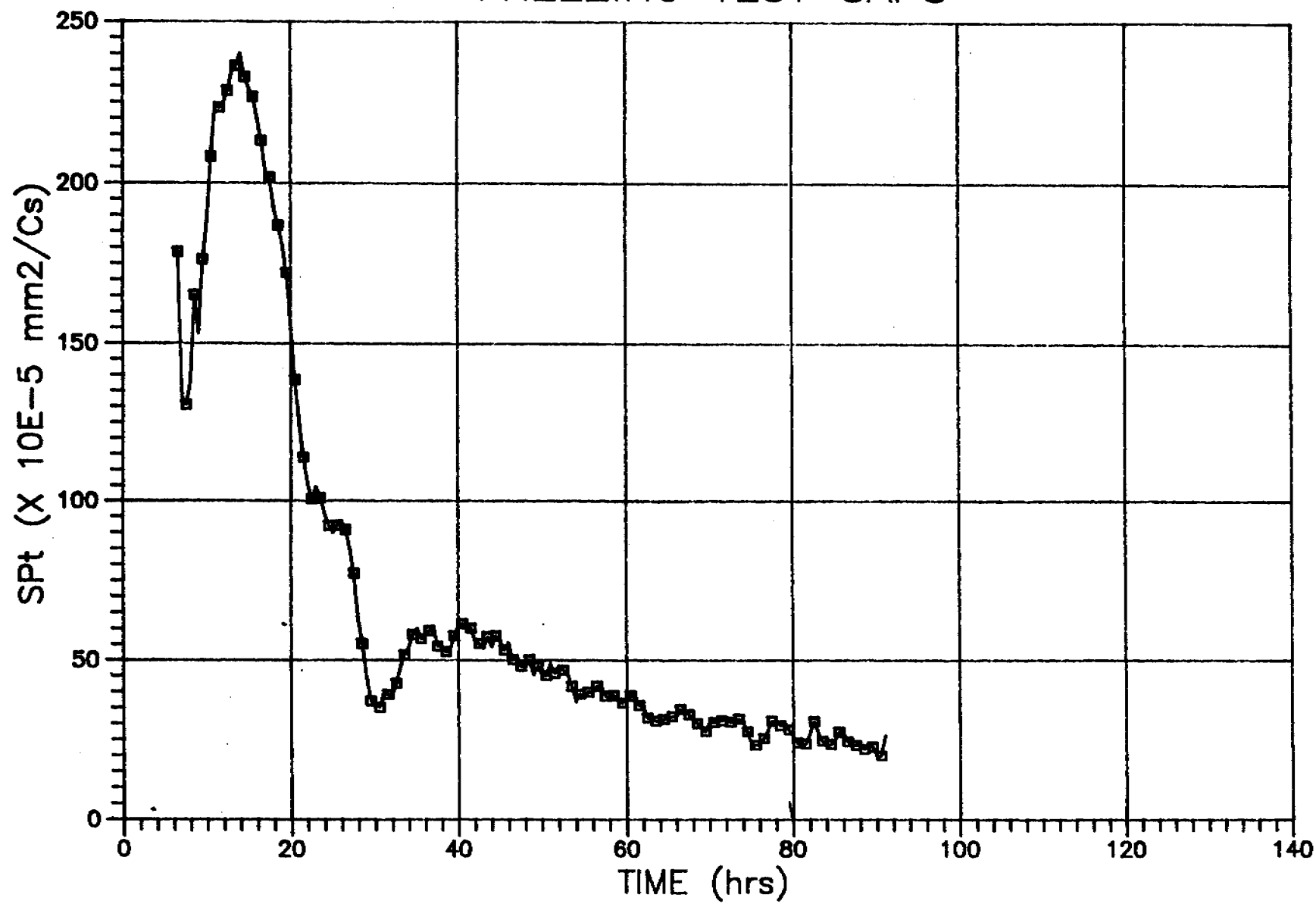
FREEZING TEST SAP8

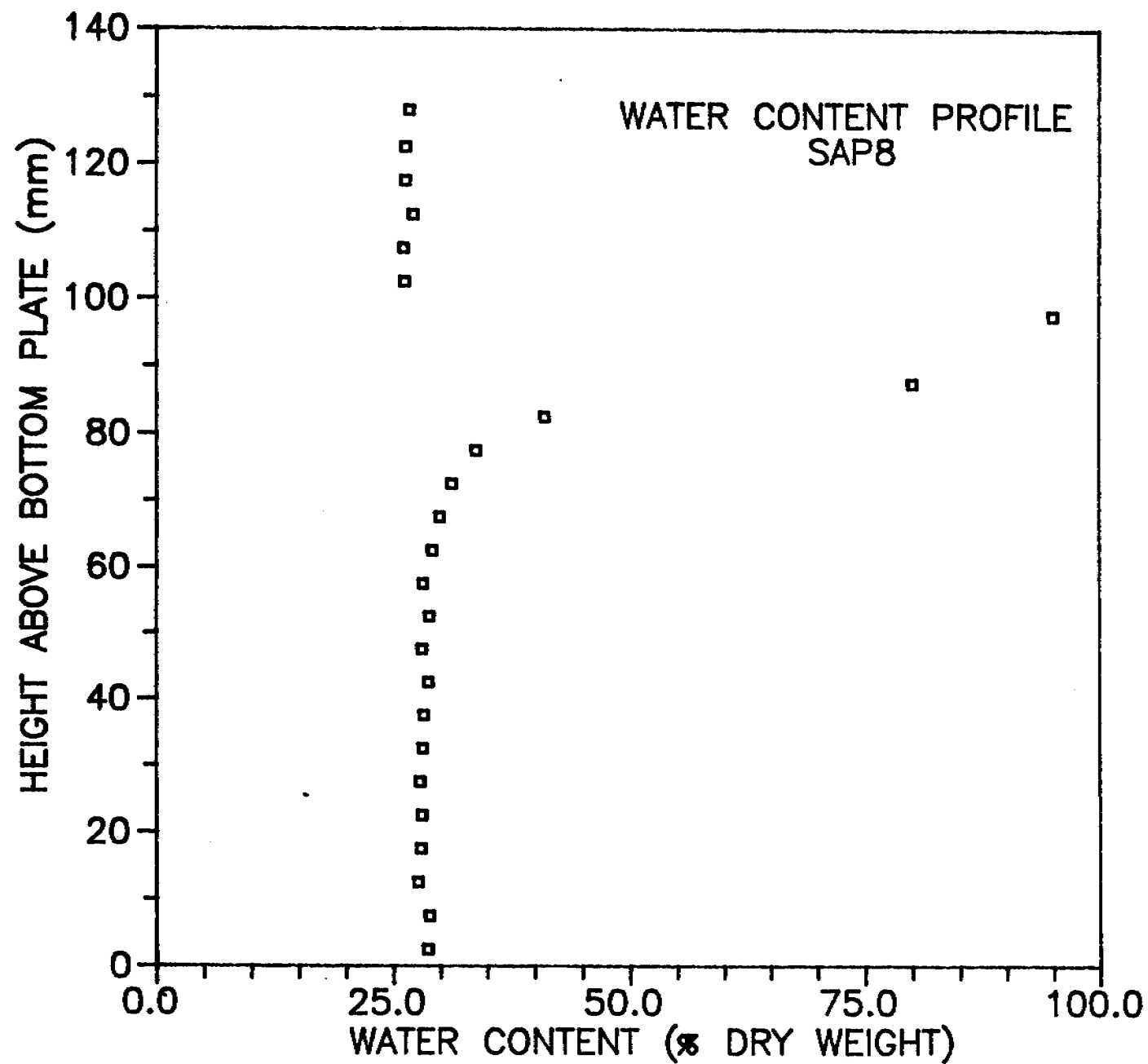


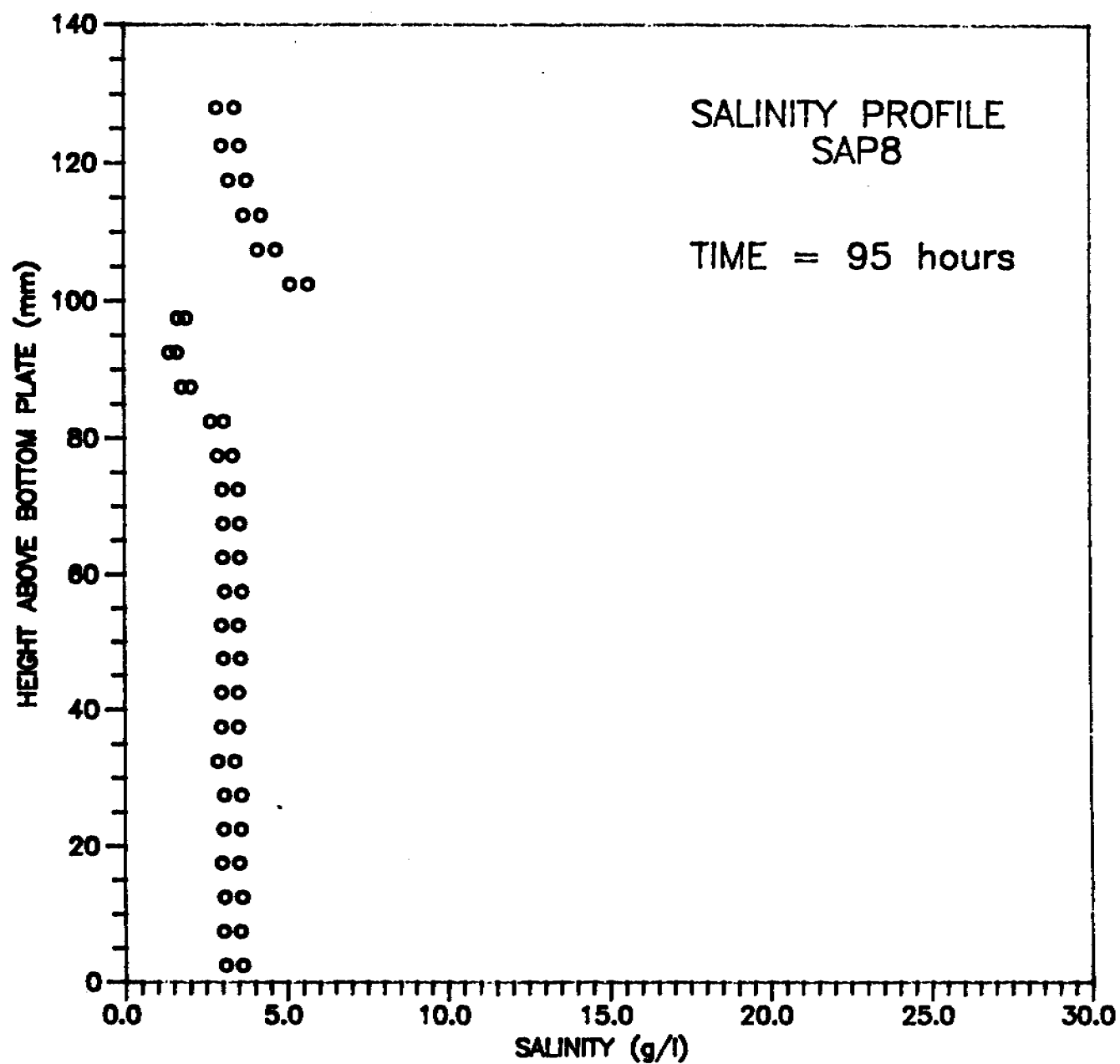
TEST SAP8 FROST FRONT LOCATION

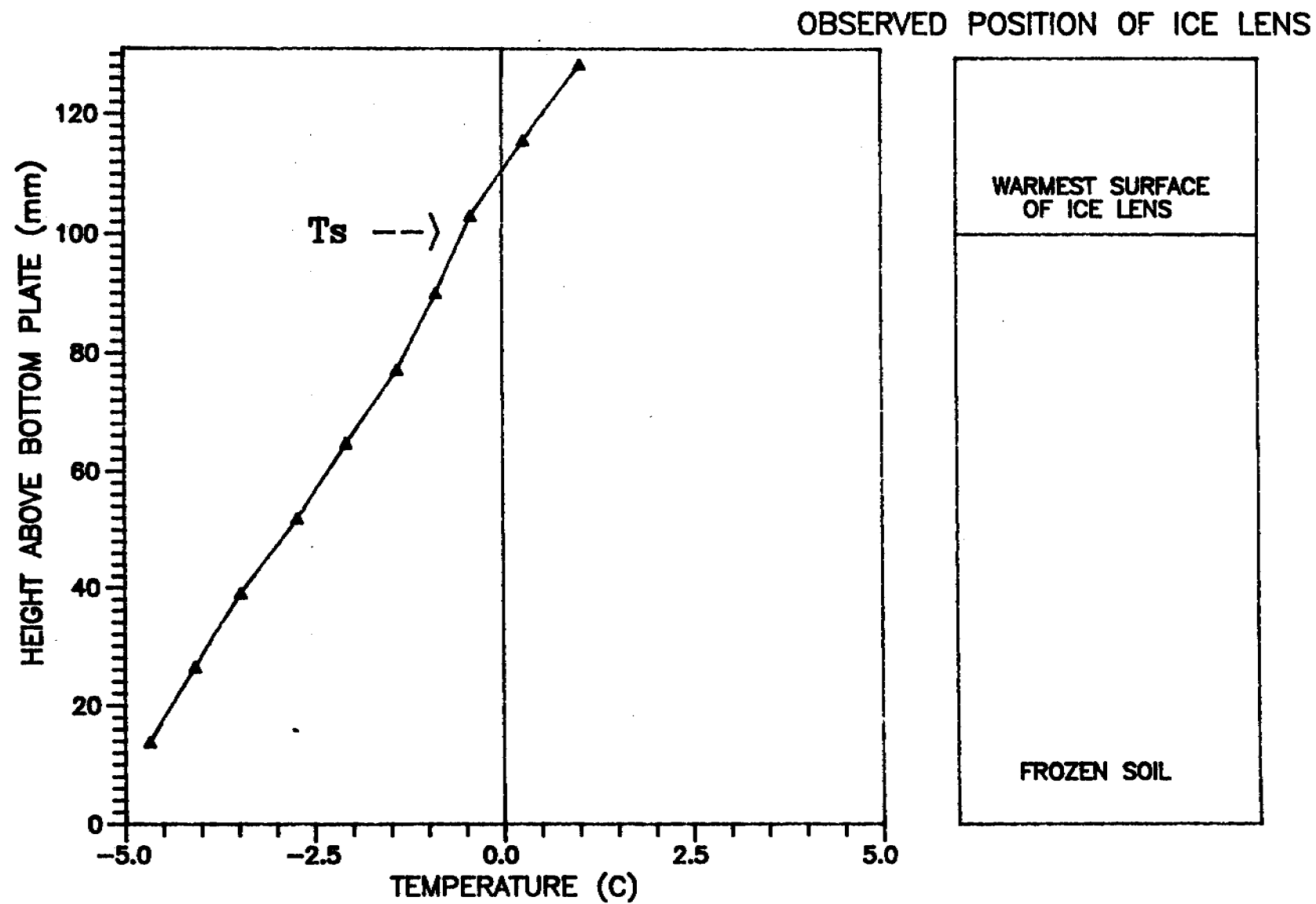


FREEZING TEST SAP8



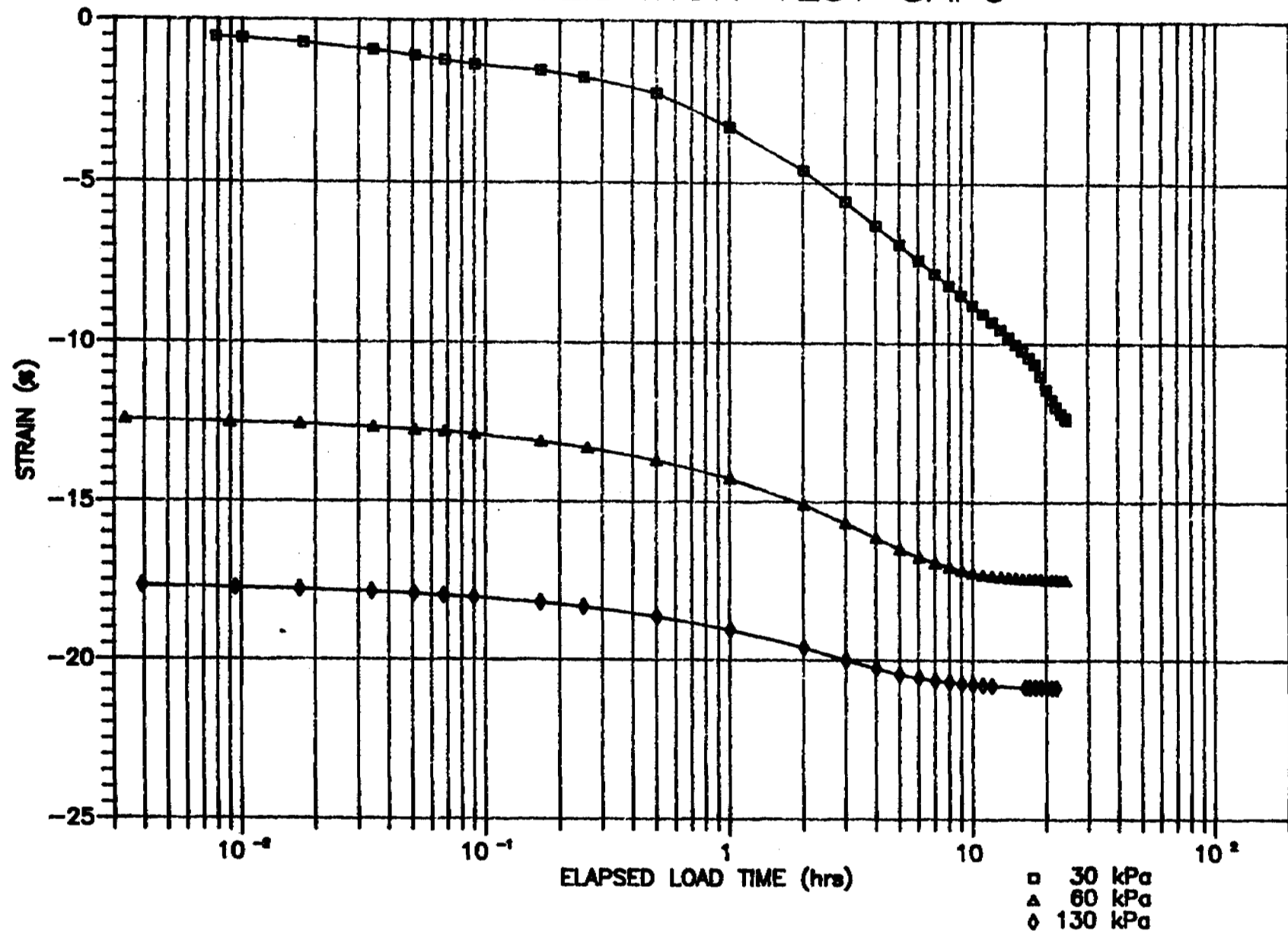




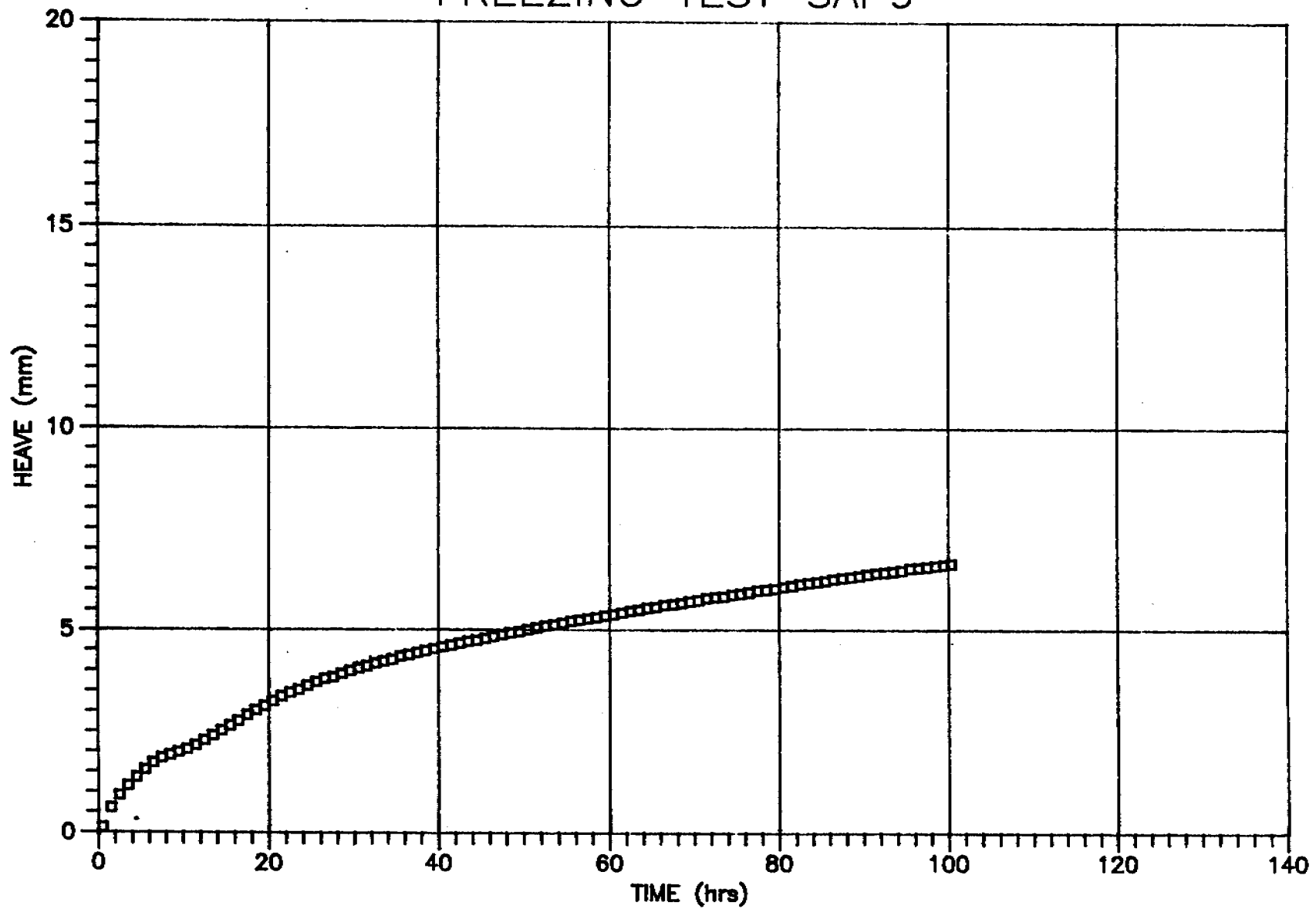


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP8

CONSOLIDATION TEST SAP9

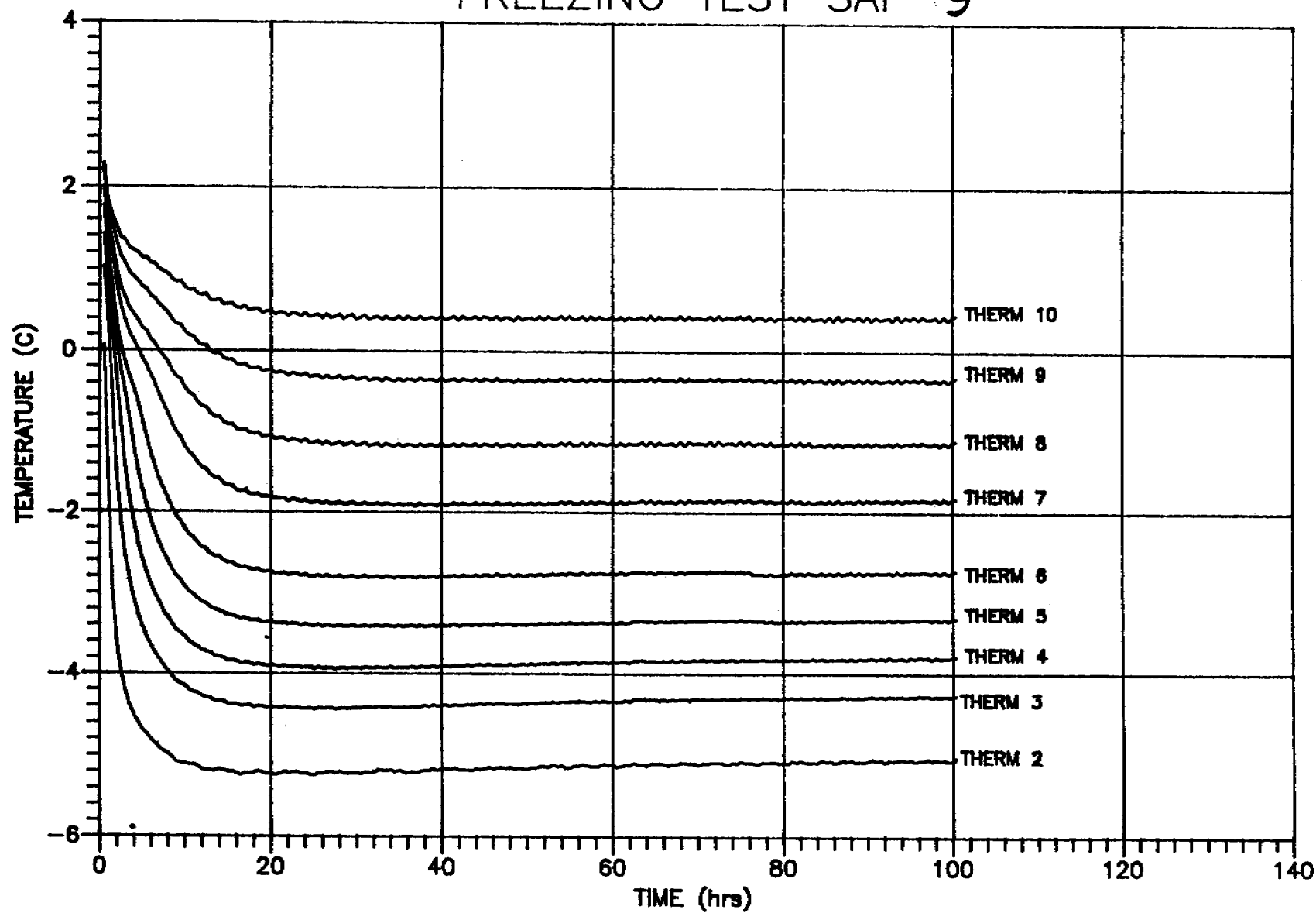


FREEZING TEST SAP9

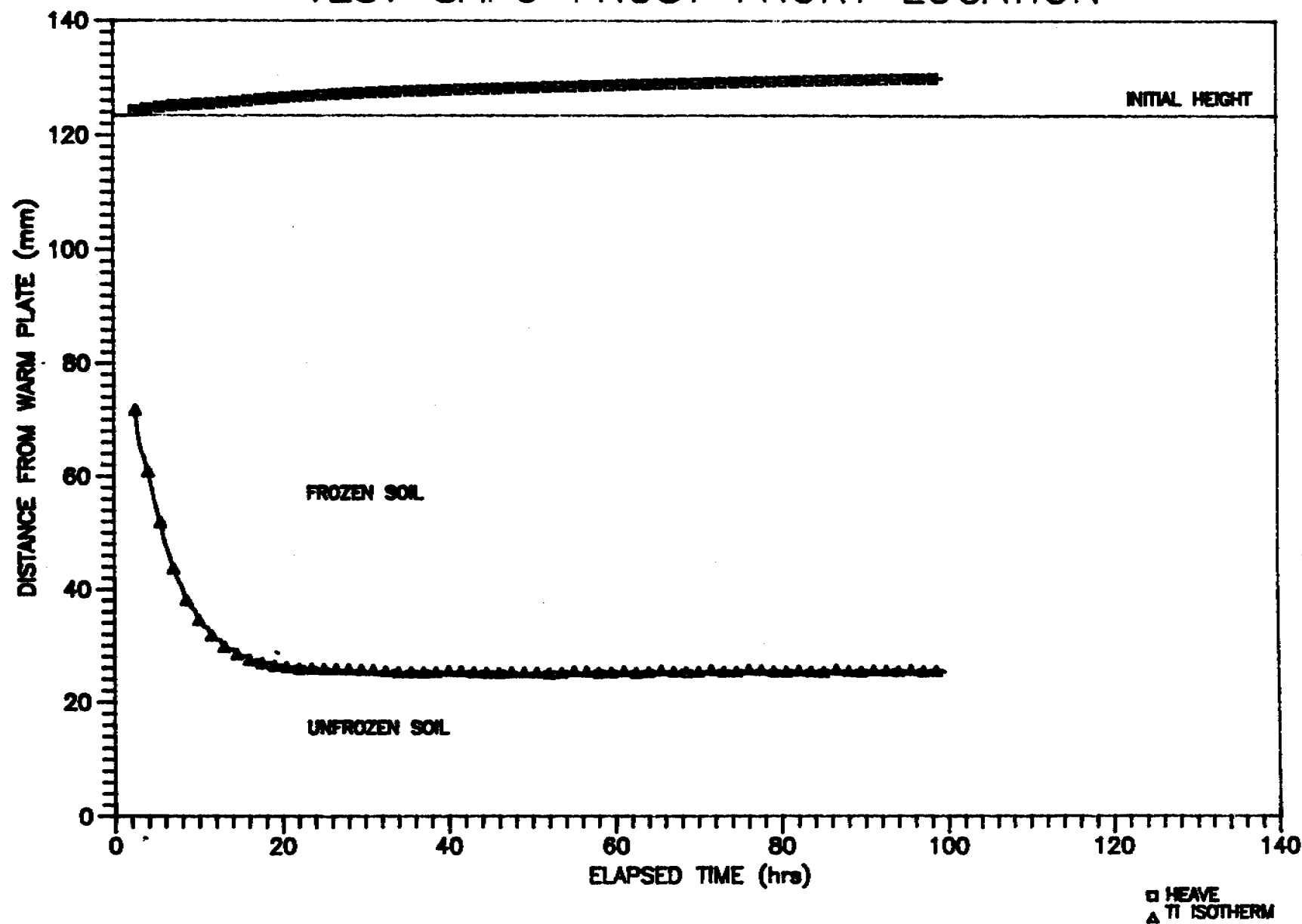


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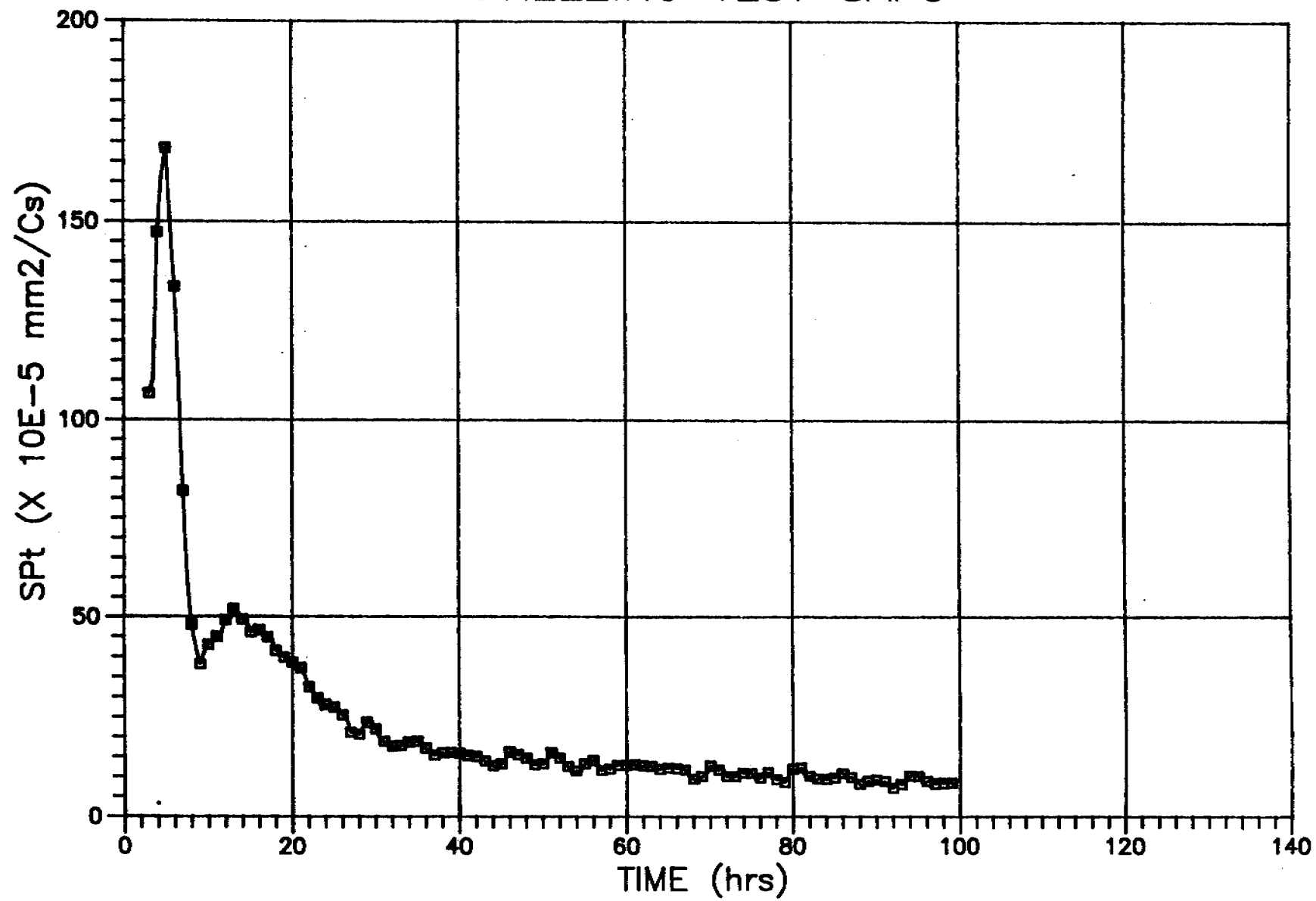
FREEZING TEST SAP 9

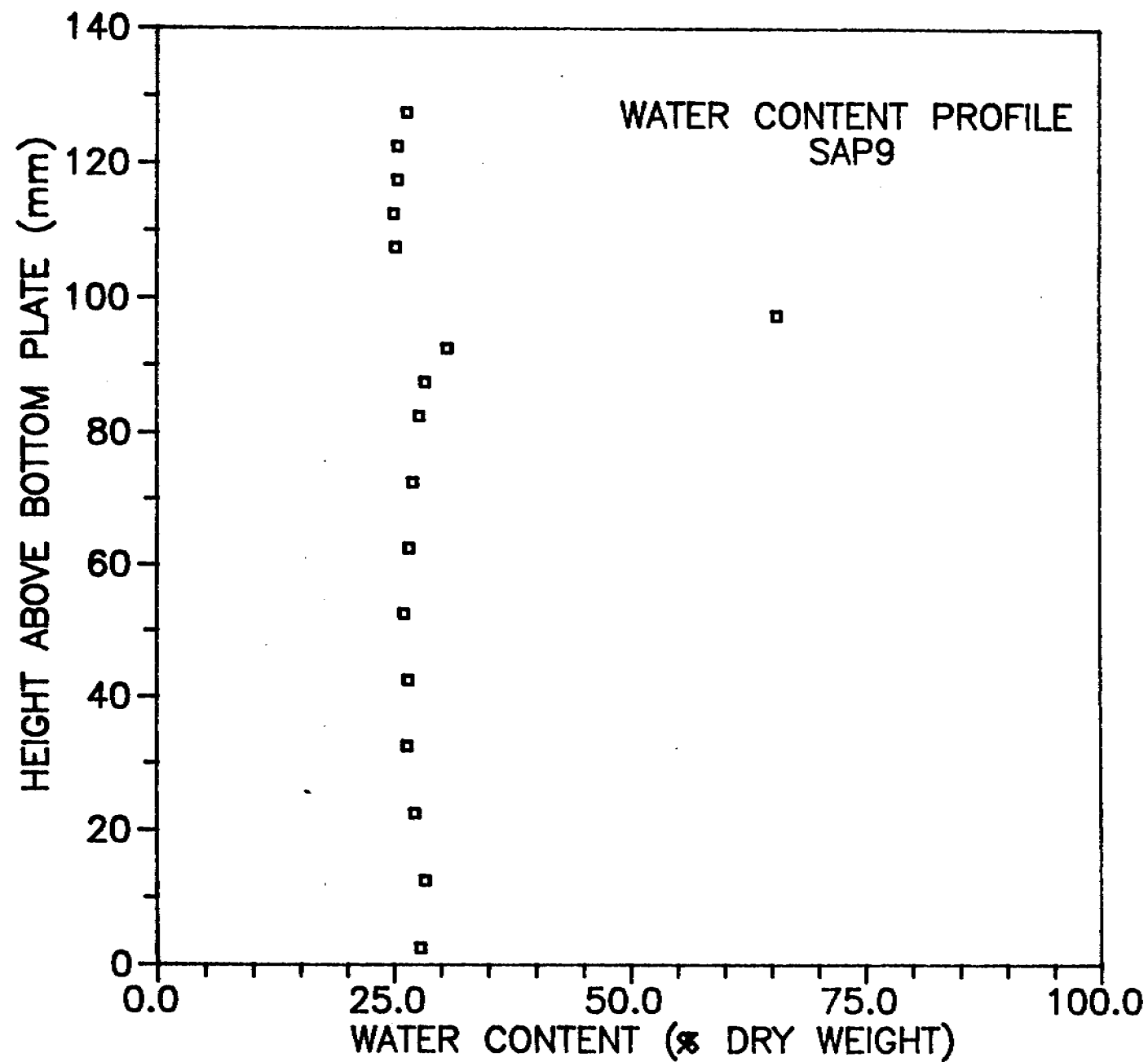


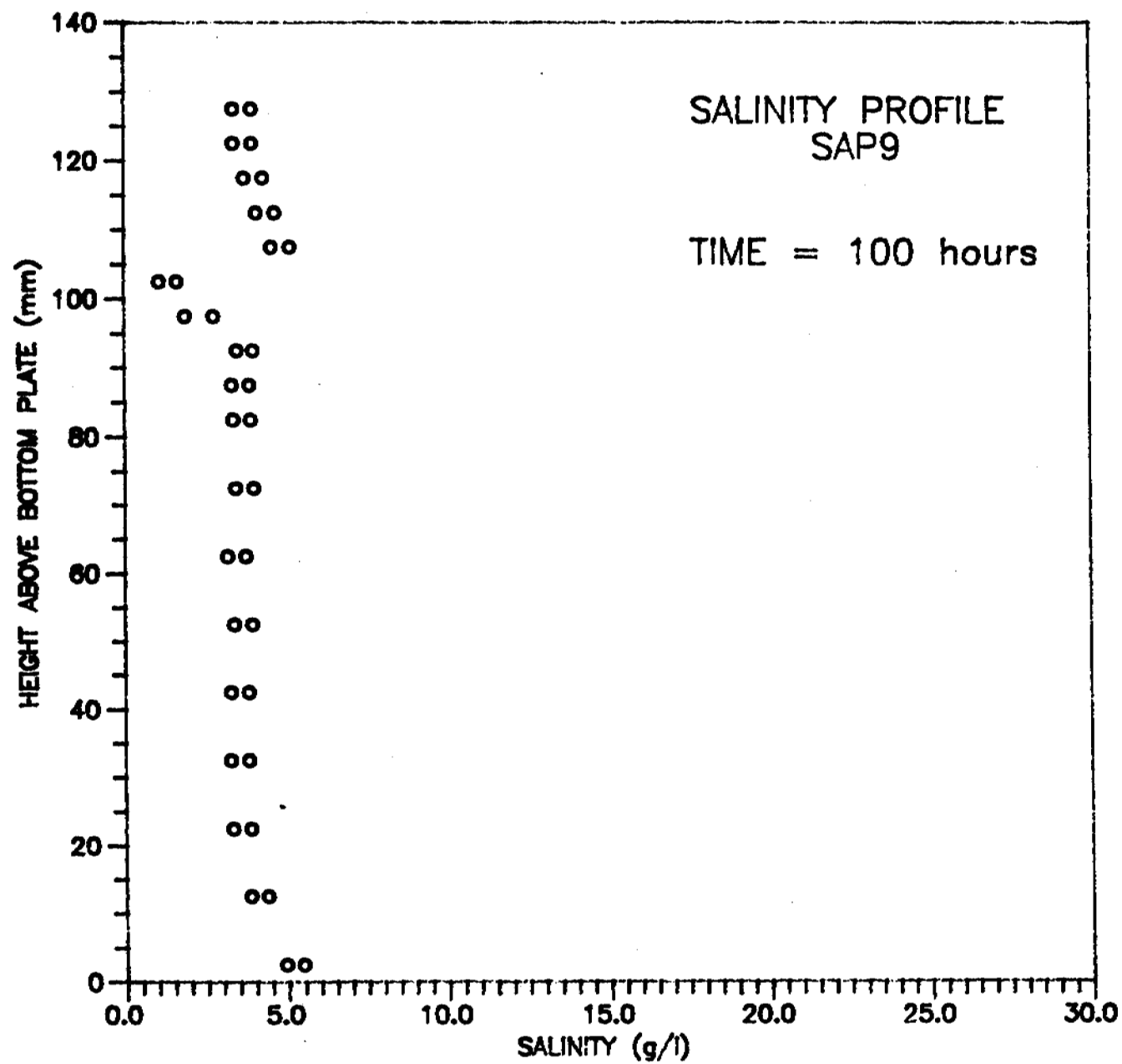
TEST SAP9 FROST FRONT LOCATION

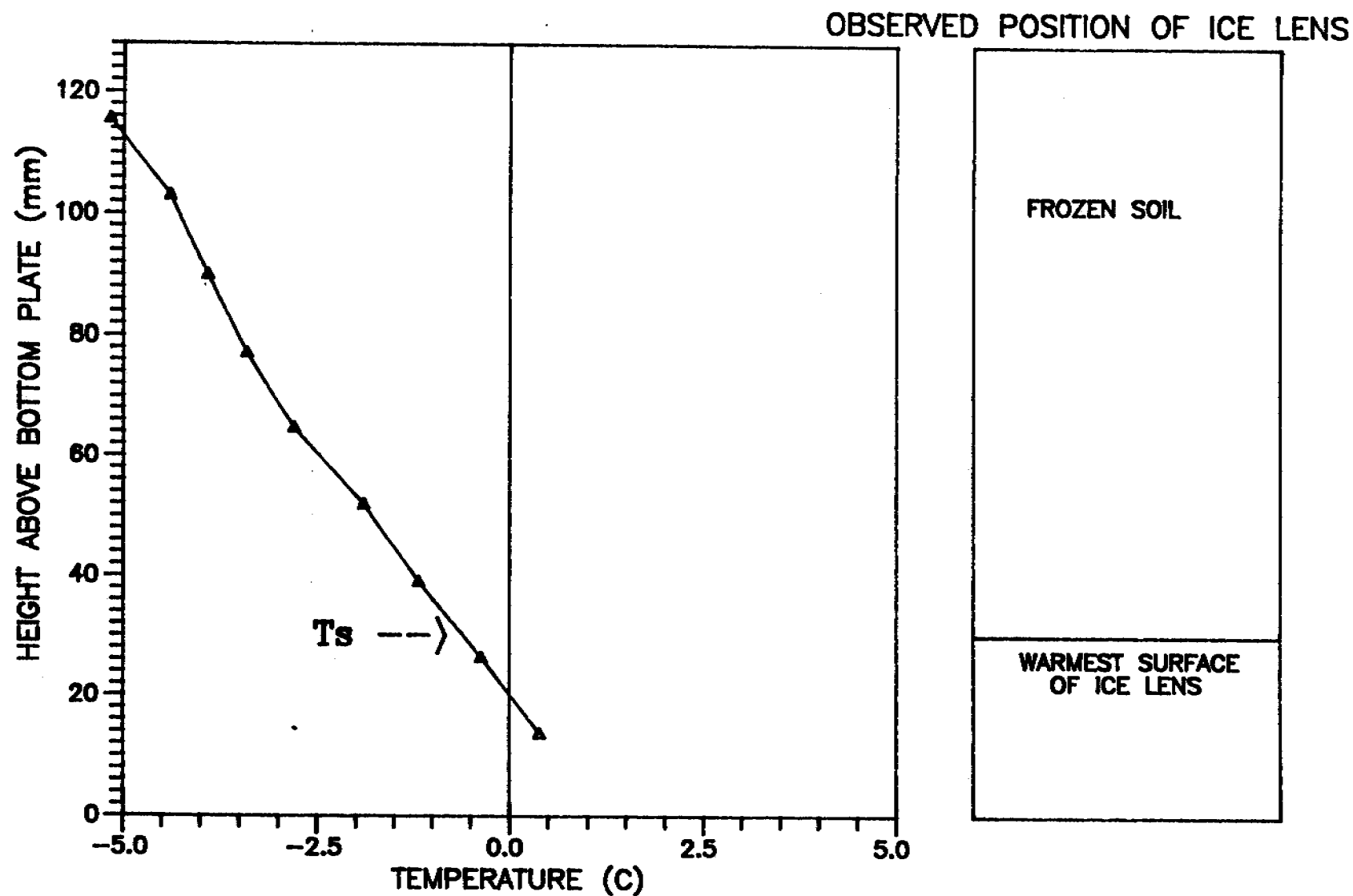


FREEZING TEST SAP9



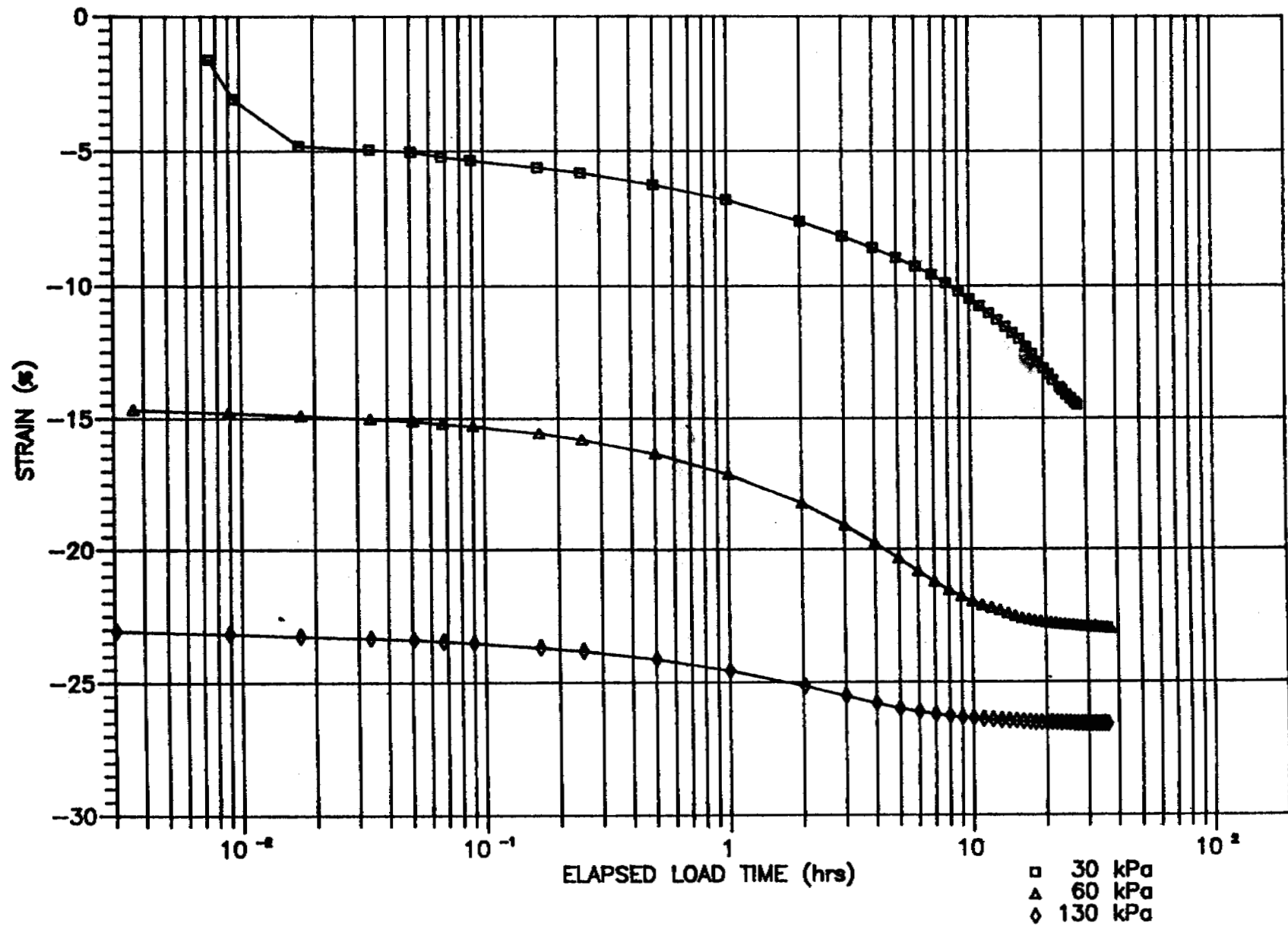




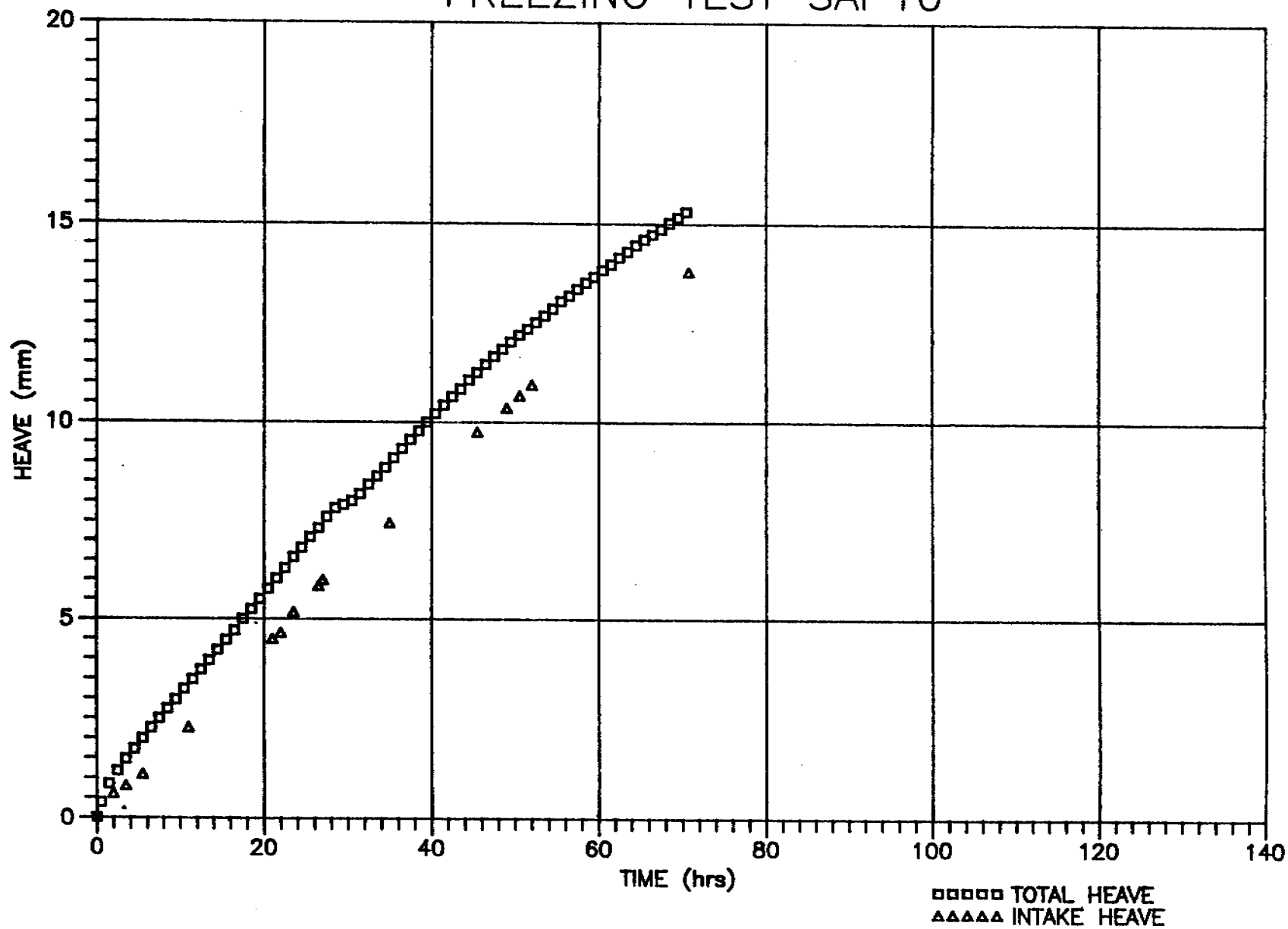


TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS --- SAP9

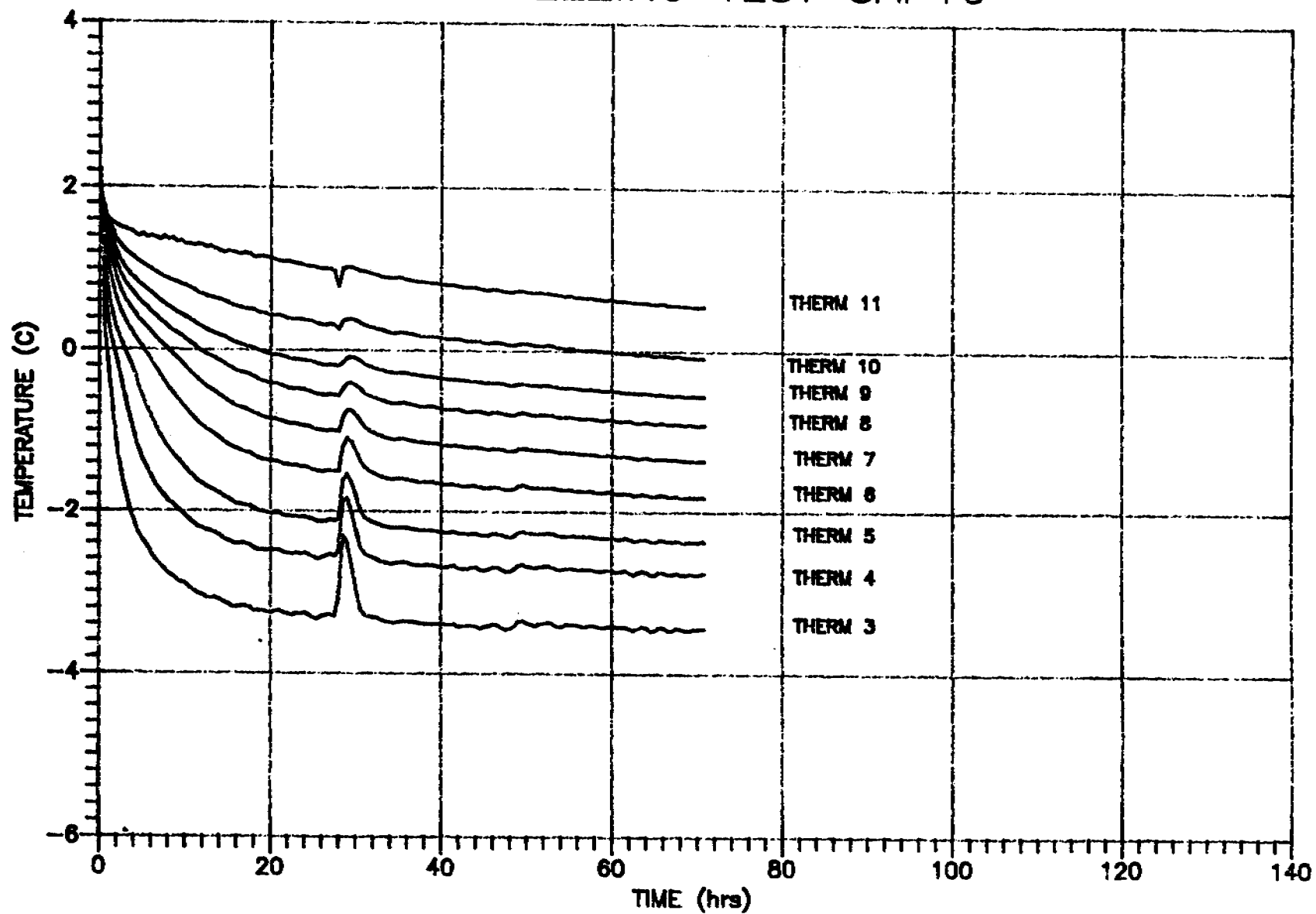
CONSOLIDATION TEST SAP10



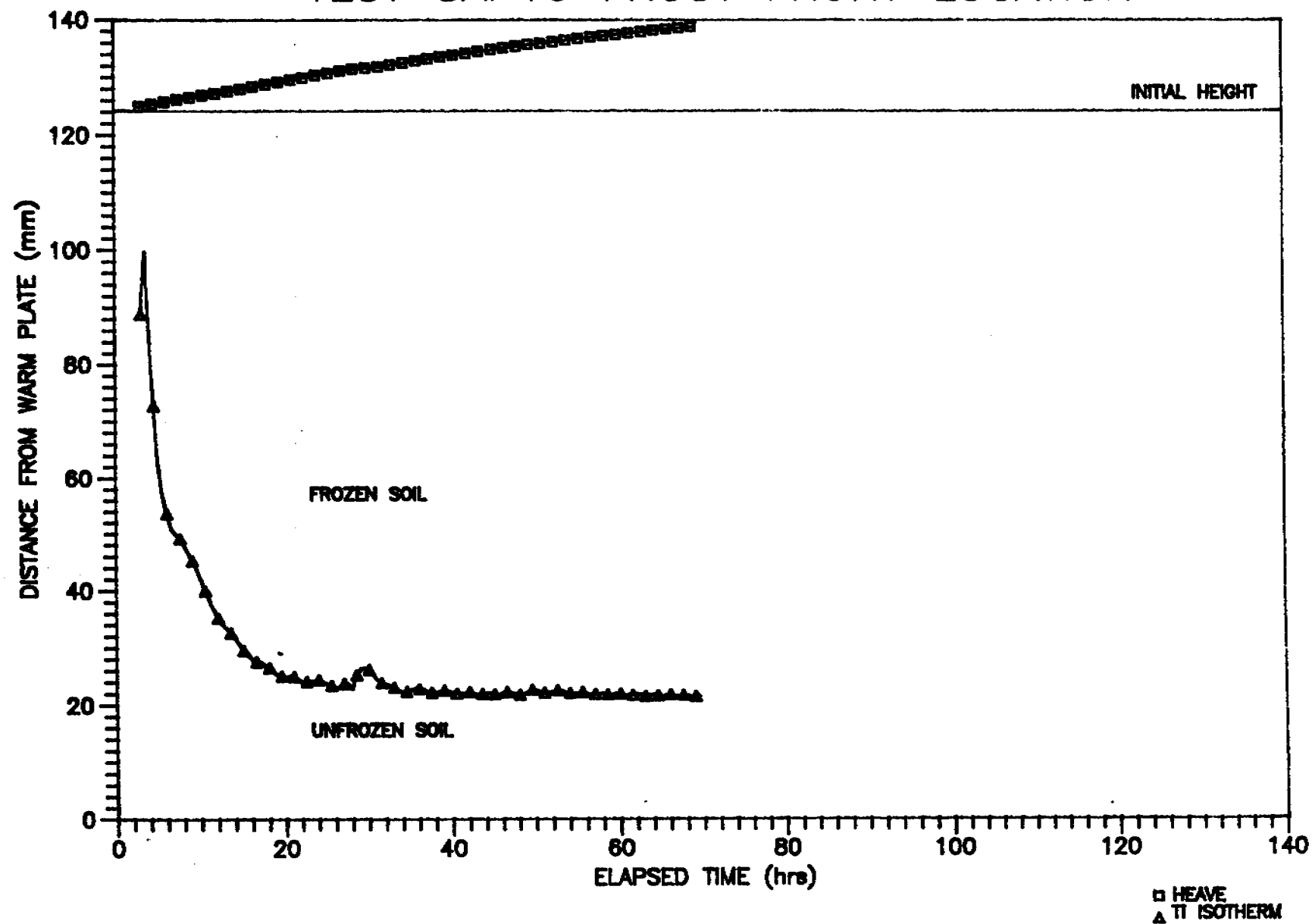
FREEZING TEST SAP10

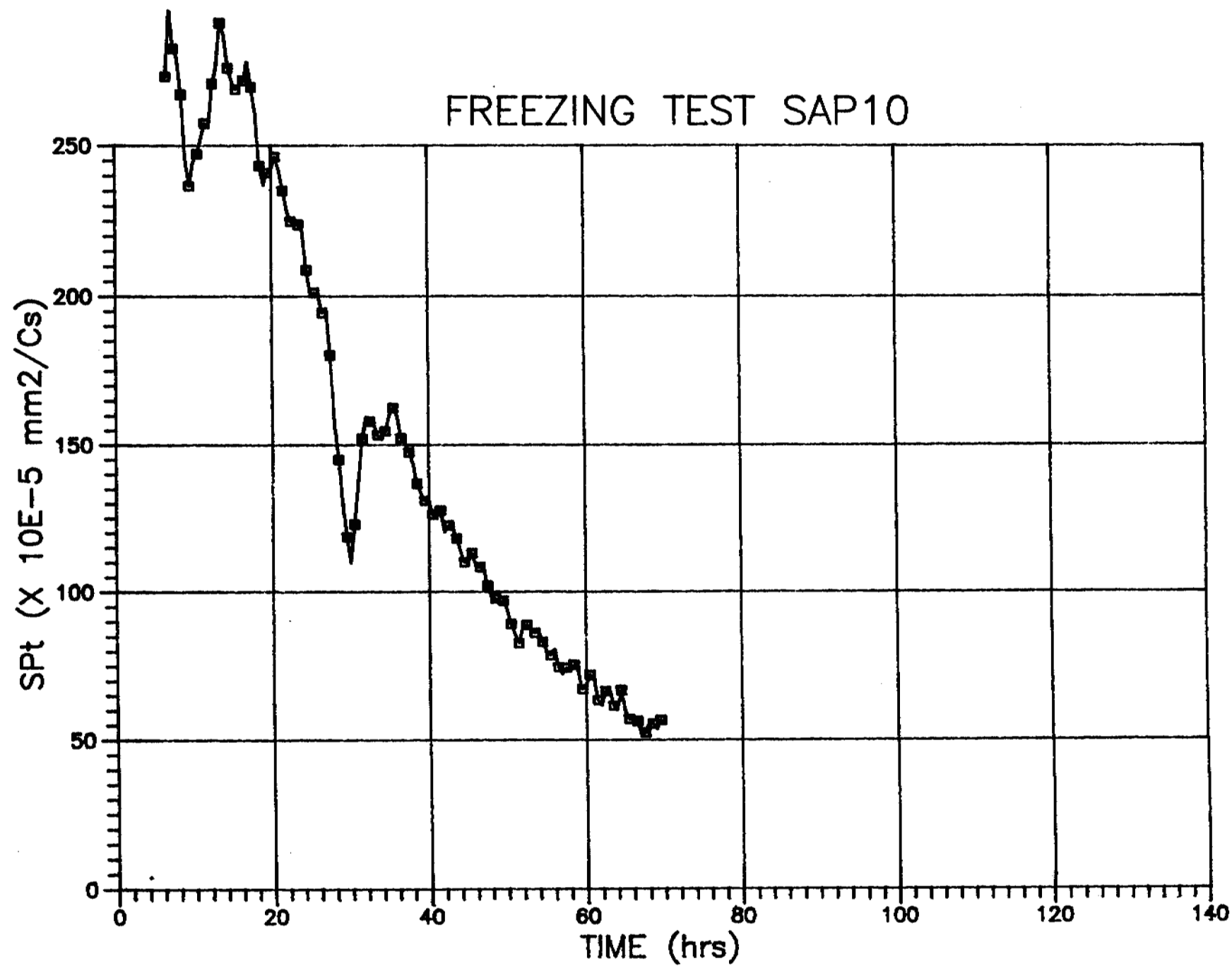


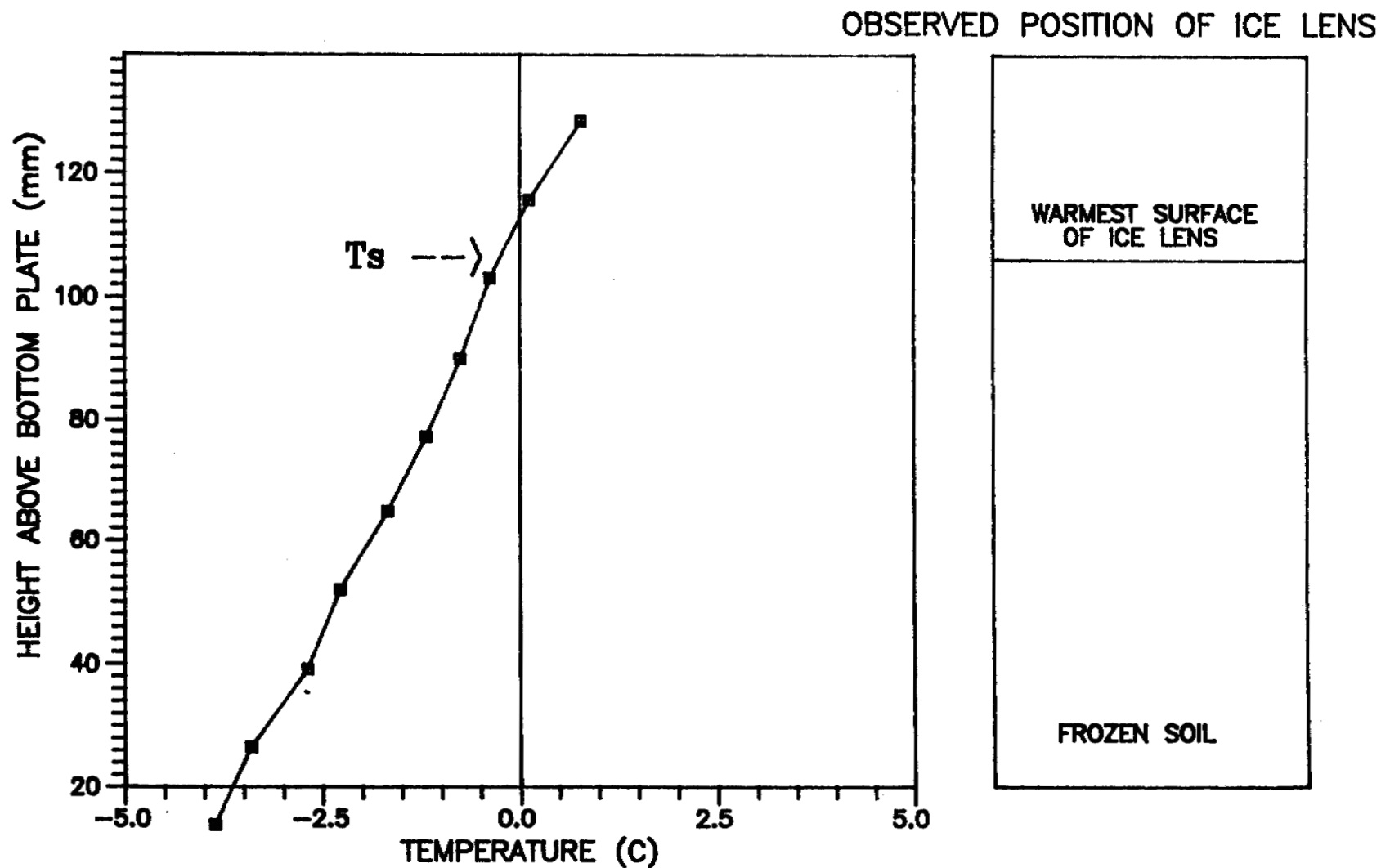
FREEZING TEST SAP10



TEST SAP10 FROST FRONT LOCATION

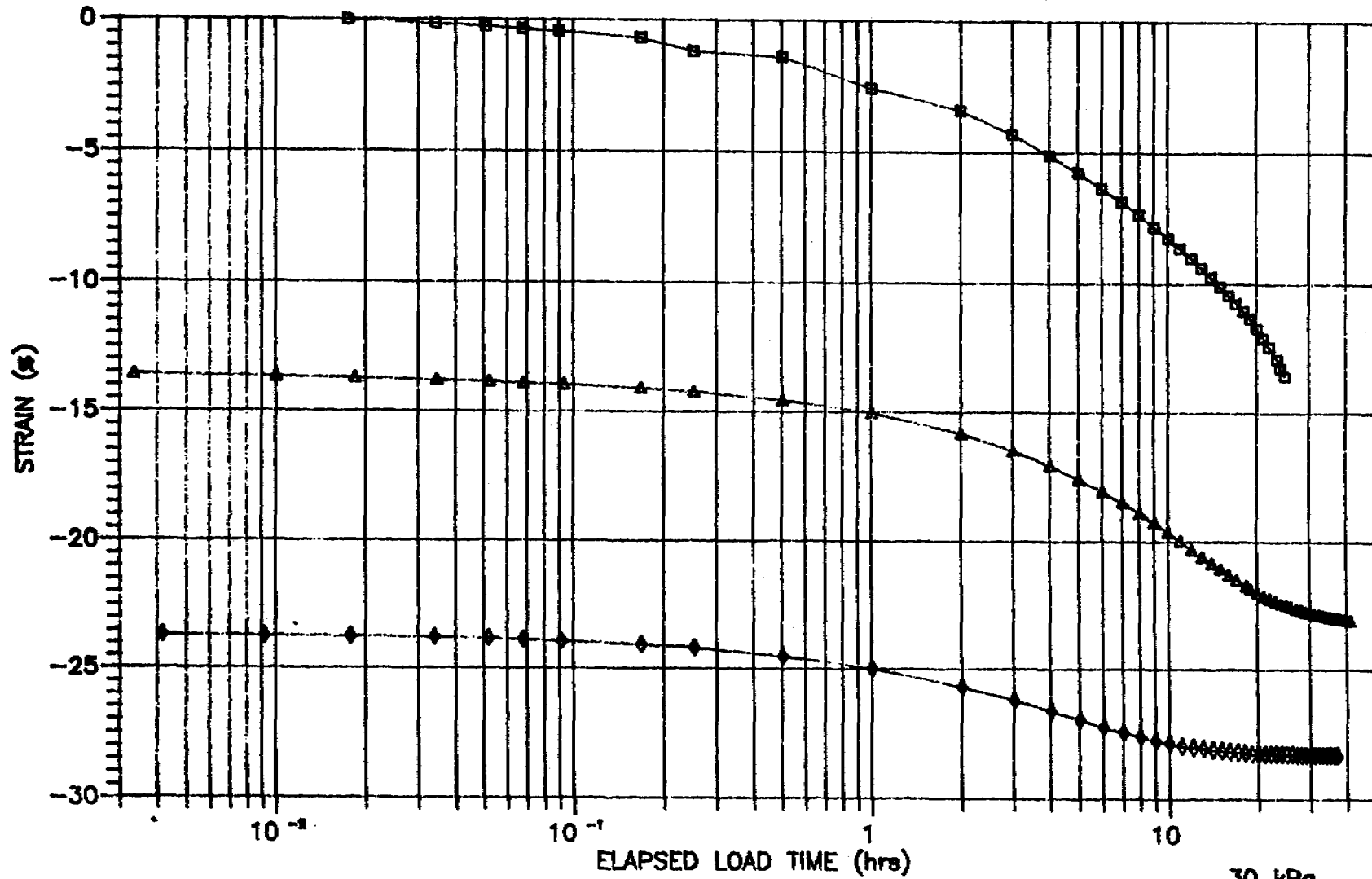






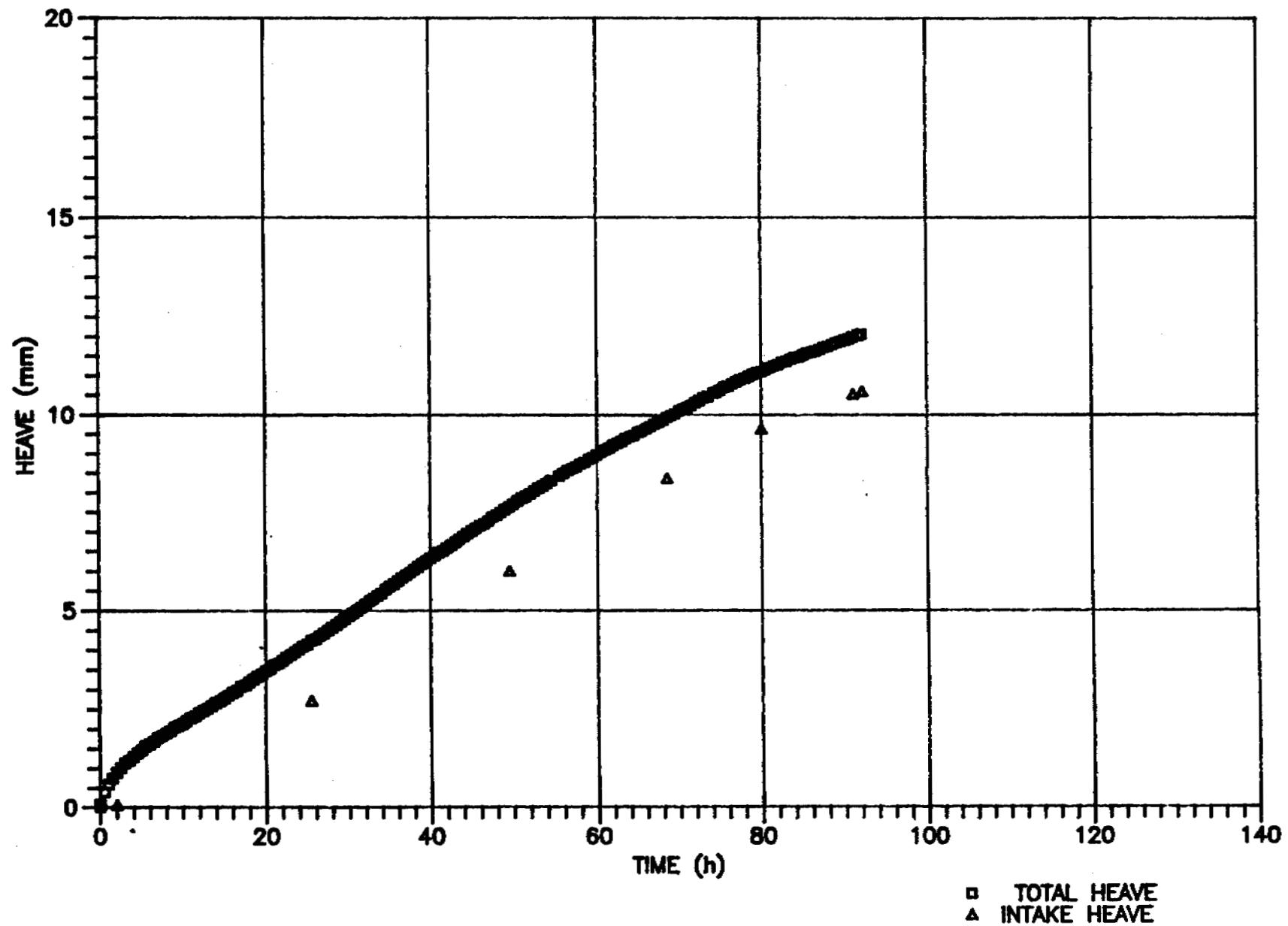
TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP10

CONSOLIDATION TEST SAP11

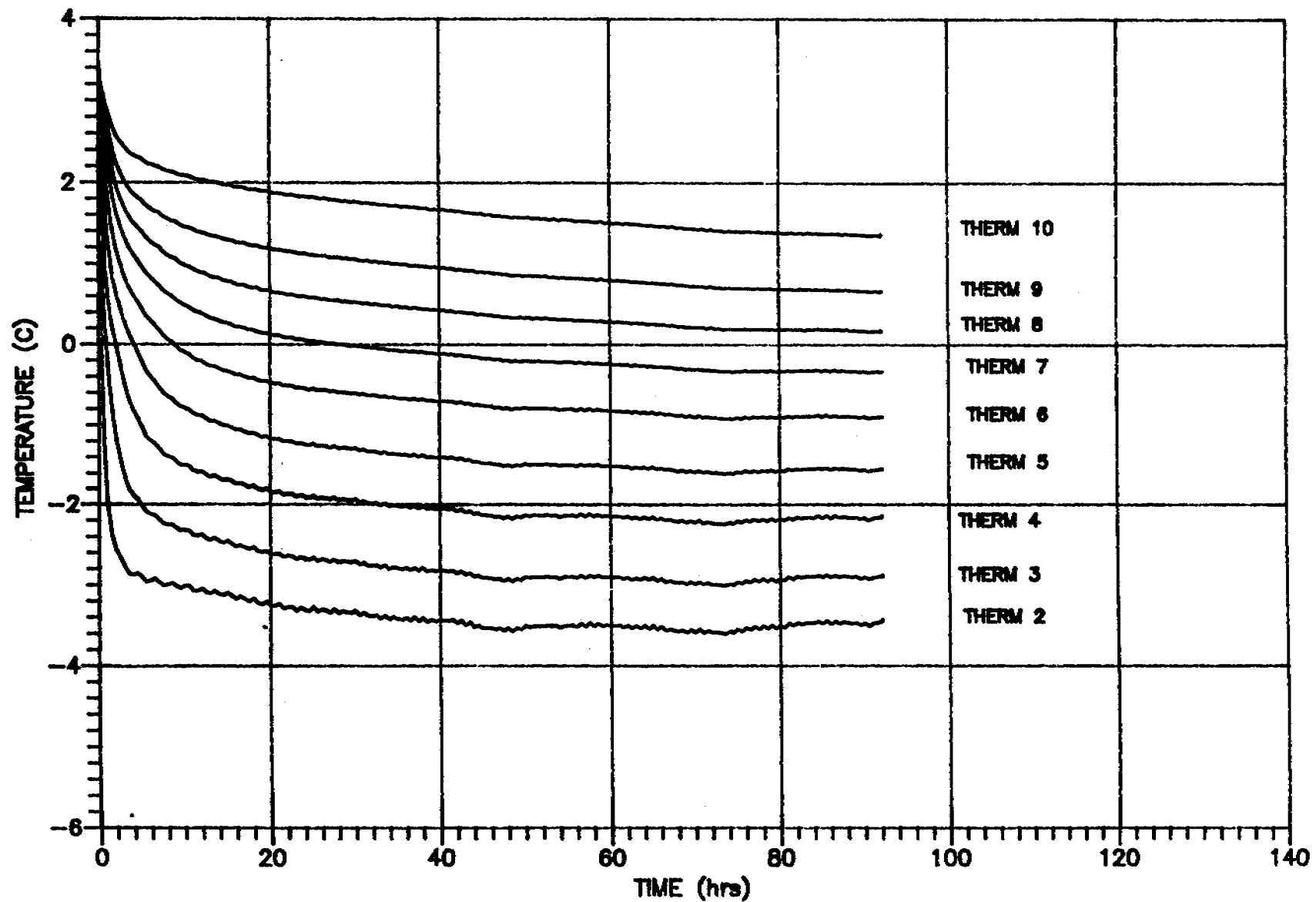


30 kPa
60 kPa
90 kPa

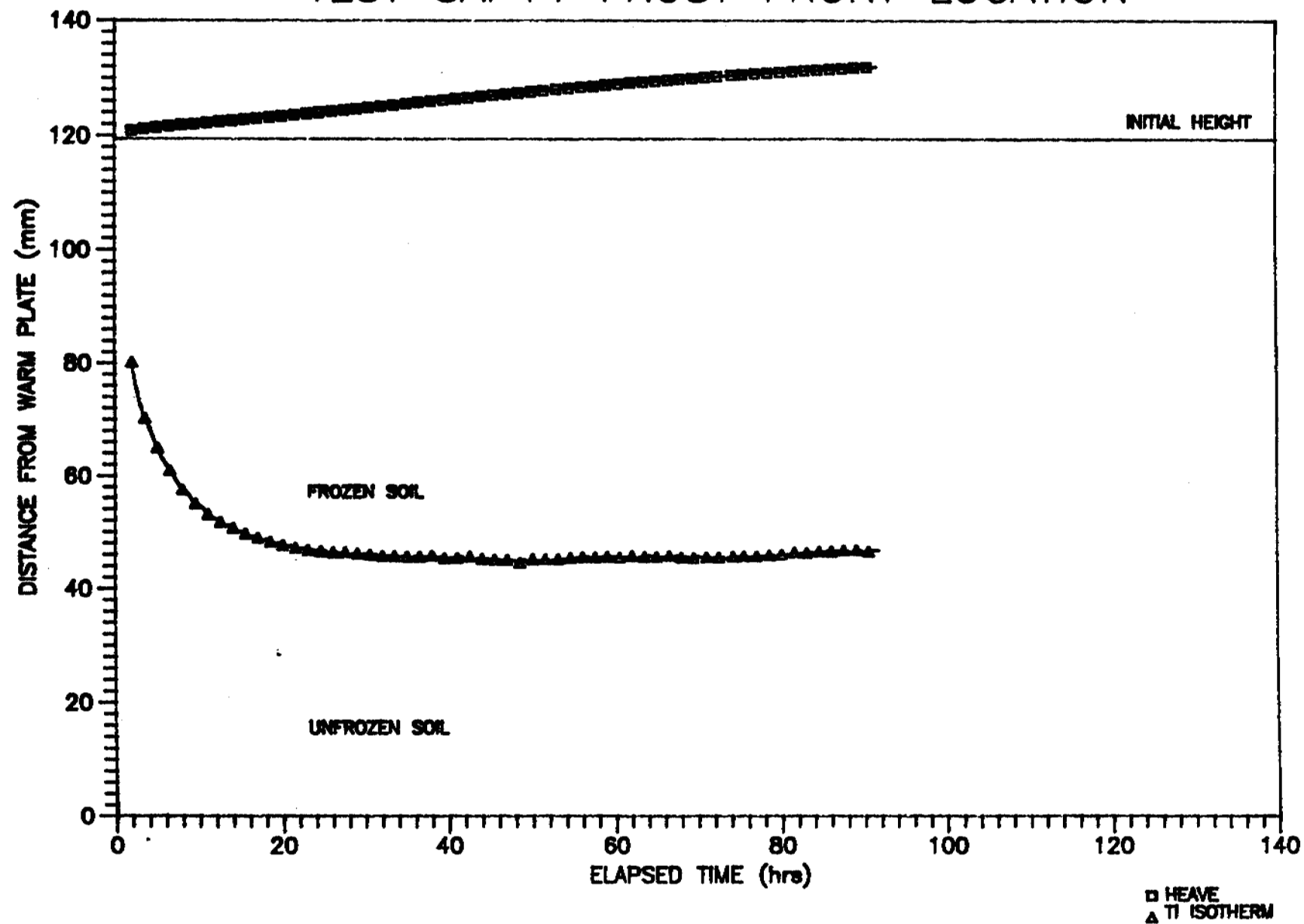
FREEZING TEST SAP11



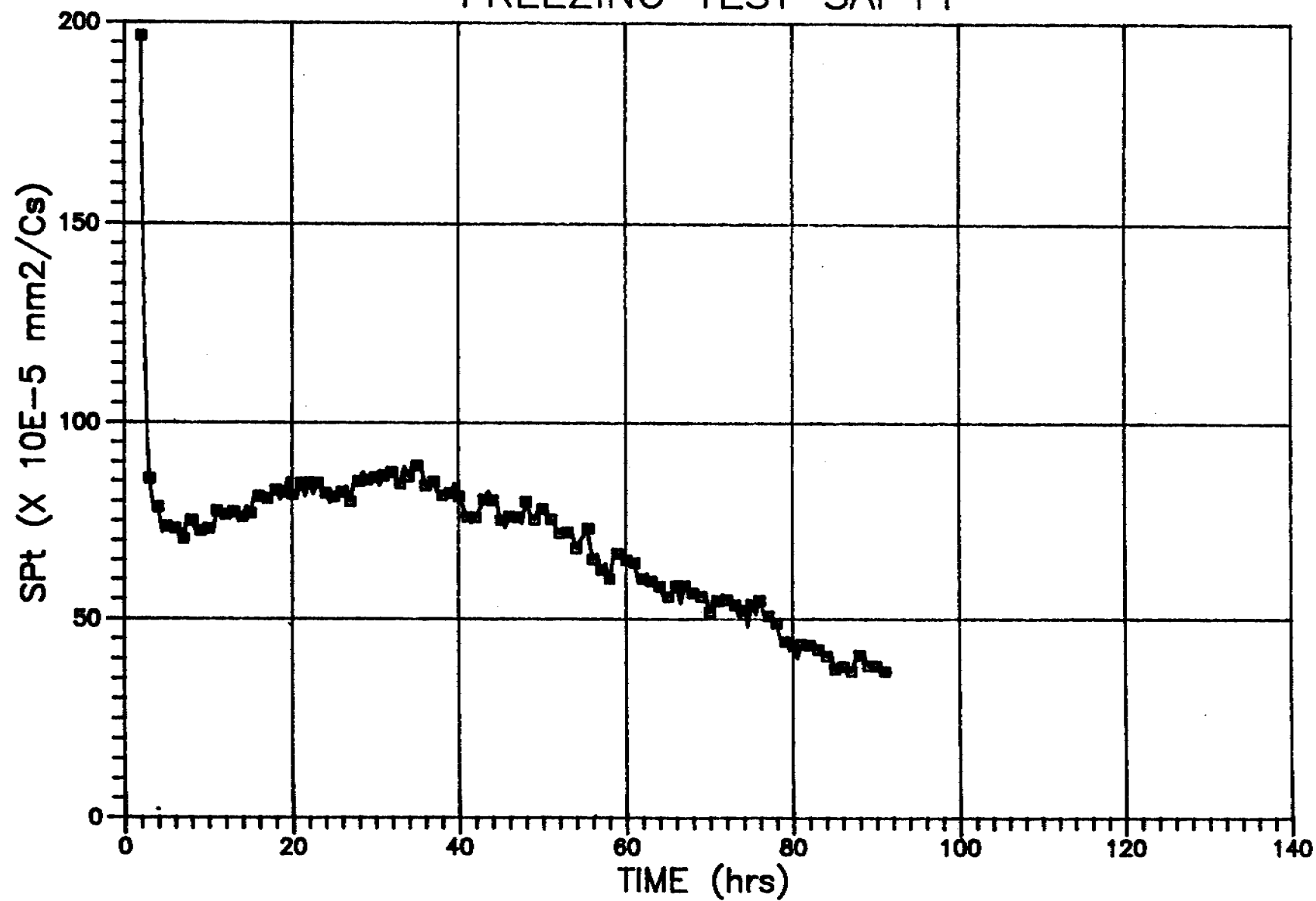
FREEZING TEST SAP11

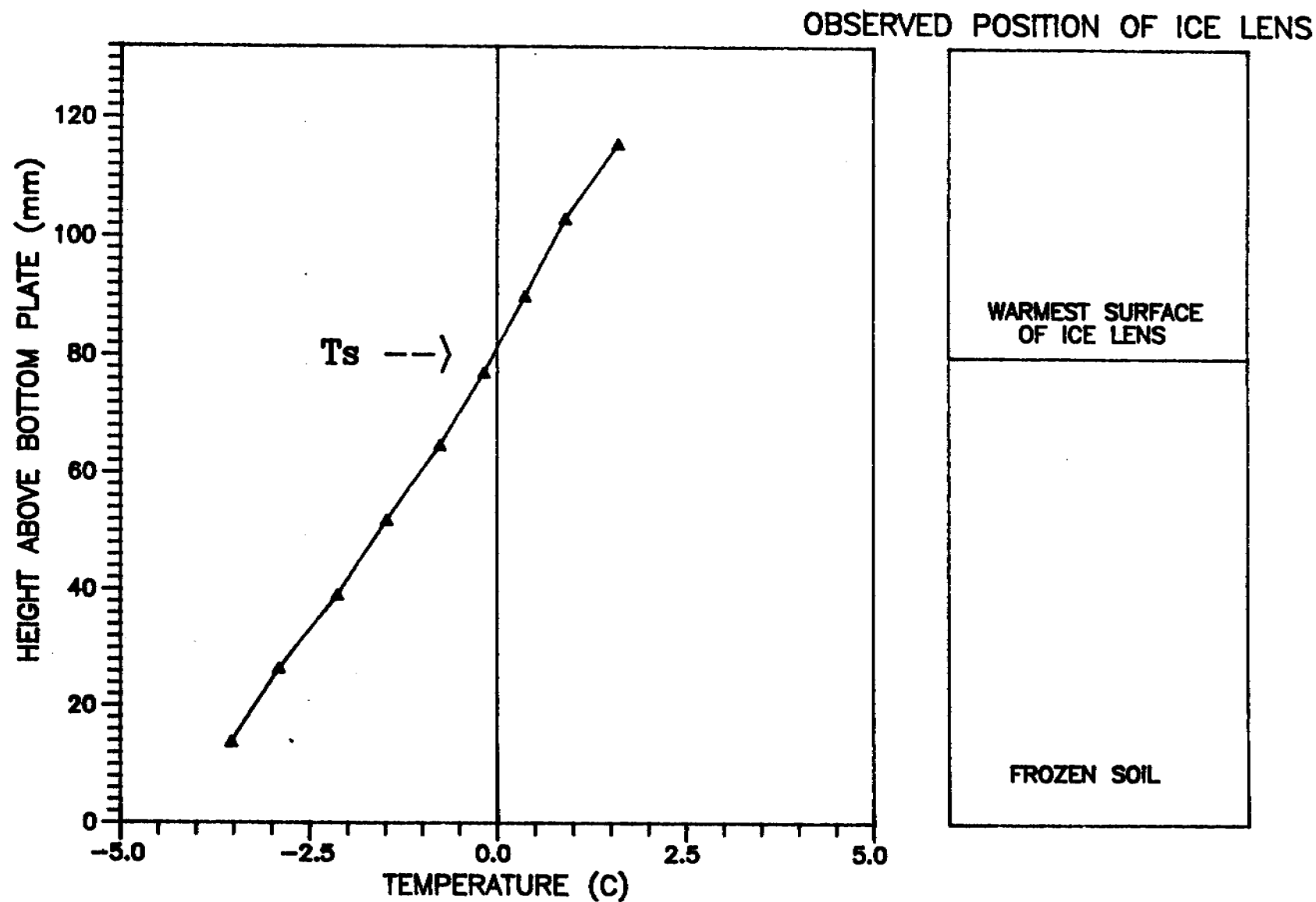


TEST SAP11 FROST FRONT LOCATION



FREEZING TEST SAP11





TEMPERATURE PROFILE AT ONSET OF WARMEST ICE LENS -- SAP11