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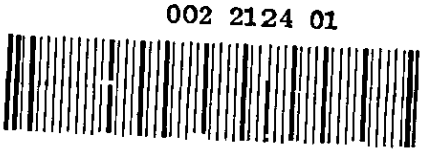
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Appendices 1 to 16 inclusive

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APPENDIX I

REDUCTION OF EXPERIMENTAL VELOCITY PROFILE DATA

A-1 Test Data

Date: 20-9-68 Configuration: $L/\Delta R_1$ = 10.0 Diffuser

Boundary Layer Traverse at X = 5.90 ins.

Barometer 30.03 ins. Hg

Room Temperature 21.0°C

Differential Pressure across Inlet Flare 4.67 ins. H_2O

Mean Wall Static Pressure at Traverse Station - 4.94 ins. H_2O

Traverses Readings

Distance from inner wall ($R-R_i$) ins	Position 1		Position 2		Position 3	
	Dynamic head Δp ins H_2O	$\frac{u}{U}$	Dynamic head Δp ins H_2O	$\frac{u}{U}$	Dynamic head Δp ins H_2O	$\frac{u}{U}$
wall (0.015)	0.41	0.37	0.38	0.36	0.38	0.36
0.025	0.50	0.41	0.47	0.40	0.47	0.40
0.035	0.595	0.45	0.57	0.44	0.56	0.44
0.05	0.67	0.475	0.66	0.475	0.65	0.47
0.06	0.717	0.49	0.71	0.49	0.68	0.485
0.075	0.79	0.515	0.78	0.515	0.77	0.515
0.085	0.82	0.525	0.81	0.525	0.79	0.52
0.10	0.88	0.545	0.88	0.545	0.86	0.545
0.125	0.976	0.57	0.95	0.57	0.93	0.565
0.15	1.08	0.60	1.07	0.605	1.065	0.605
0.175	1.19	0.63	1.18	0.635	1.17	0.635
0.20	1.31	0.66	1.28	0.66	1.27	0.66
0.25	1.50	0.71	1.50	0.715	1.47	0.71
0.30	1.70	0.755	1.70	0.76	1.67	0.755
0.35	1.94	0.805	1.92	0.81	1.91	0.81
0.40	2.175	0.855	2.15	0.855	2.13	0.855
0.45	2.32	0.88	2.33	0.89	2.29	0.885
0.50	2.53	0.92	2.49	0.92	2.48	0.92
0.55	2.69	0.95	2.65	0.95	2.64	0.95
0.60	2.82	0.975	2.76	0.97	2.75	0.97
0.65	2.91	0.99	2.84	0.985	2.86	0.99
0.70	2.96	0.996	2.89	0.992	2.87	0.992
0.75	2.98	1.0	2.93	0.999	2.91	0.999
0.80	2.98	1.0	2.94	1.0	2.92	1.0

Distance from outer wall $(R_o - R)$ ins	Position 1		Position 2		Position 3	
	Δp - ins H_2O	$\frac{u}{U}$	Δp - ins H_2O	$\frac{u}{U}$	Δp - ins H_2O	$\frac{u}{U}$
0.015	0.28	0.31	0.27	0.30	0.24	0.29
0.025	0.375	0.355	0.37	0.35	0.35	0.35
0.04	0.45	0.39	0.405	0.37	0.43	0.385
0.05	0.49	0.405	0.48	0.405	0.47	0.40
0.065	0.545	0.43	0.54	0.43	0.52	0.425
0.075	0.57	0.435	0.57	0.44	0.55	0.435
0.09	0.615	0.455	0.61	0.455	0.61	0.46
0.115	0.72	0.49	0.71	0.49	0.69	0.49
0.14	0.79	0.515	0.79	0.52	0.78	0.52
0.165	0.89	0.545	0.89	0.55	0.87	0.55
0.19	1.01	0.58	0.98	0.575	0.97	0.58
0.24	1.22	0.64	1.20	0.635	1.19	0.64
0.29	1.41	0.69	1.42	0.695	1.42	0.70
0.34	1.64	0.74	1.65	0.75	1.61	0.745
0.39	1.89	0.795	1.87	0.795	1.87	0.805
0.44	2.17	0.85	2.12	0.85	2.09	0.85
0.49	2.30	0.88	2.28	0.88	2.25	0.88
0.54	2.50	0.915	2.50	0.92	2.43	0.915
0.59	2.67	0.945	2.68	0.95	2.61	0.95
0.64	2.80	0.97	2.78	0.97	2.74	0.97
0.69	2.90	0.985	2.82	0.975	2.82	0.985
0.74	2.92	0.99	2.91	0.995	2.85	0.99
0.79	2.98	1.0	2.95	1.0	2.90	1.0

The results are plotted in Figures A1-1/2, and a mean line has been drawn through the data. The following mean values were punched on I.C.T. computer cards, and analysed using the programme detailed in Appendix 2.

Distance from wall - ins	0.005	0.020	0.035	0.050	0.065	0.080	0.095
u/U outer wall	0.265	0.346	0.390	0.410	0.430	0.450	0.469
u/U inner wall	0.290	0.385	0.435	0.470	0.498	0.518	0.536

0.110	0.125	0.140	0.155	0.170	0.185	0.200	0.215	0.230	0.245	0.260
0.486	0.505	0.525	0.545	0.563	0.581	0.600	0.616	0.635	0.650	0.667
0.552	0.570	0.586	0.605	0.625	0.645	0.660	0.676	0.693	0.709	0.722

0.275	0.290	0.305	0.320	0.335	0.350	0.365	0.380	0.395	0.410	0.425
0.683	0.699	0.715	0.731	0.747	0.764	0.778	0.793	0.807	0.821	0.835
0.738	0.753	0.767	0.781	0.796	0.810	0.823	0.836	0.850	0.865	0.876

0.440	0.455	0.470	0.485	0.500	0.515	0.530	0.545	0.560	0.575	0.590
0.848	0.860	0.871	0.882	0.893	0.903	0.914	0.924	0.932	0.942	0.950
0.887	0.896	0.905	0.914	0.923	0.932	0.940	0.947	0.957	0.965	0.970

0.605	0.620	0.635	0.650	0.665	0.680	0.695	0.710	0.725	0.740
0.960	0.966	0.972	0.977	0.981	0.985	0.988	0.991	0.993	0.996
0.976	0.981	0.985	0.988	0.992	0.995	0.996	0.998	0.999	1.000

0.755	0.770
0.998	1.000
1.000	1.000

The results obtained are quoted in Table A8-13

The boundary layer thicknesses calculated in the computer programme are;

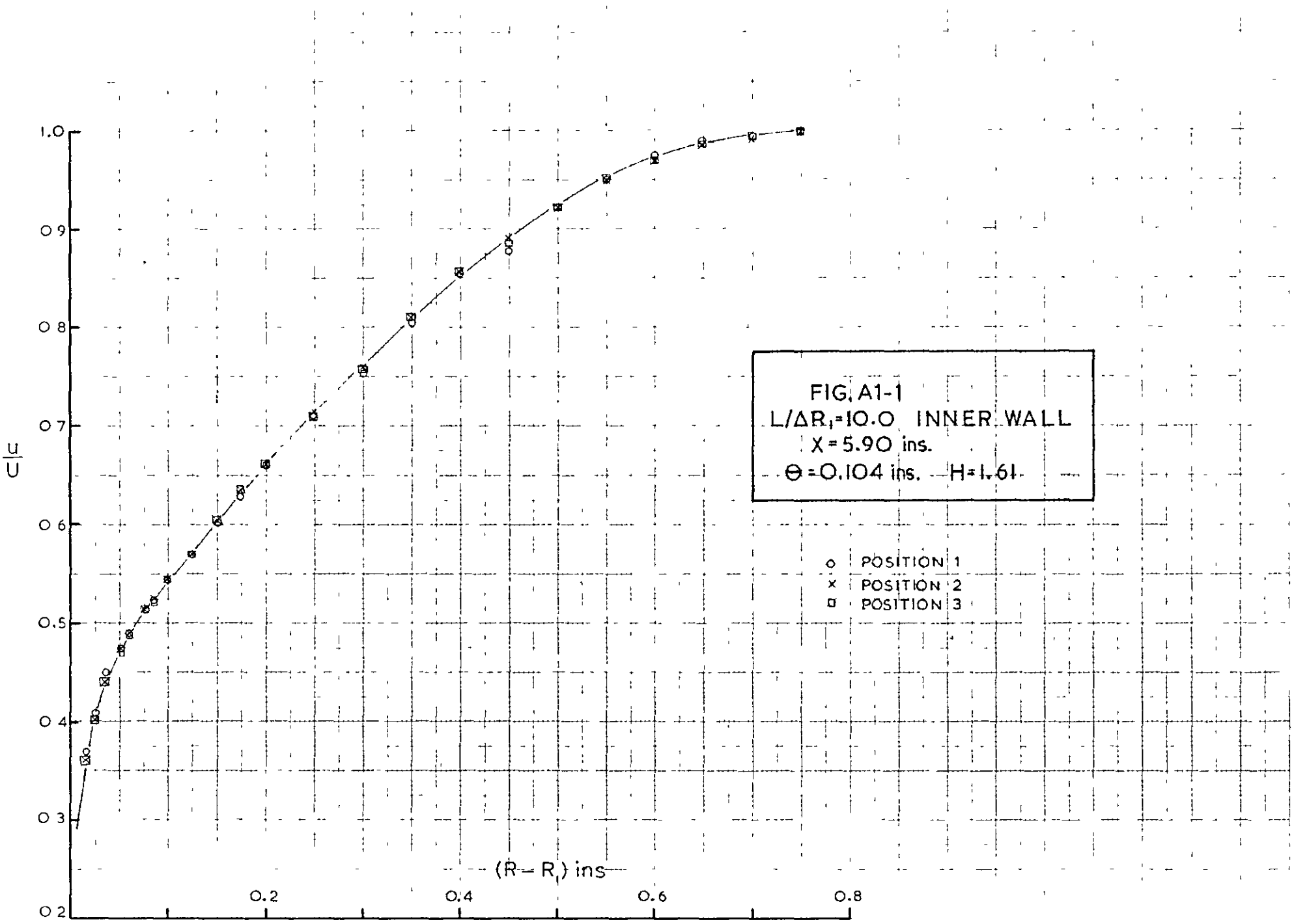
Outer wall :- 0.77 + 0.015/2 = 0.7775 ins

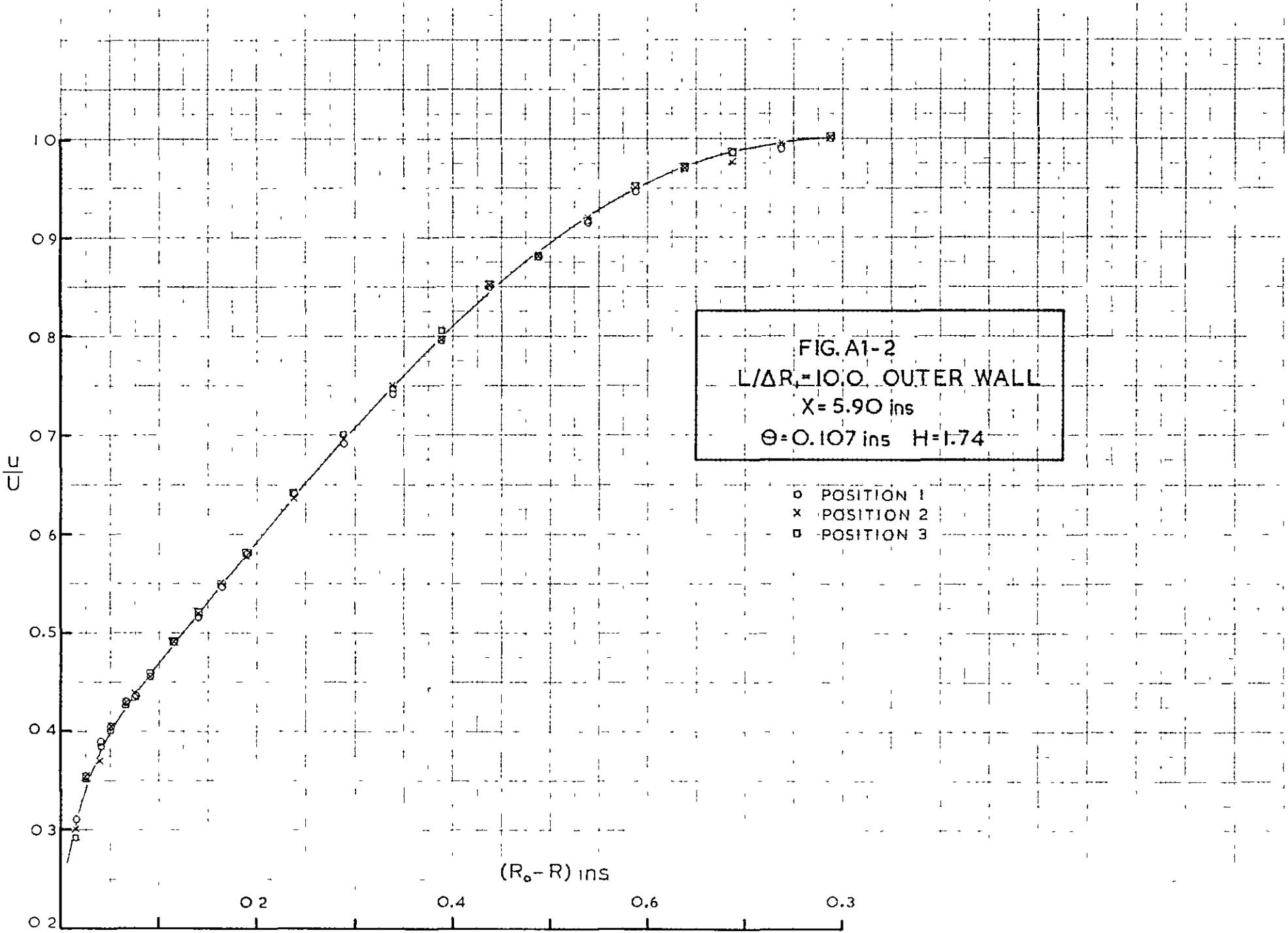
Inner wall :- 0.74 + 0.015/2 = 0.7475 ins

The total depth of the boundary layers is therefore 1.525 ins., compared with the physical distance between inner and outer walls of 1.516 ins. This difference, which is due to experimental error, is referred to as the 'OVERLAP' in the tabulated results in Appendices A4/6/8, the value is - 0.009 ins. in this case.

In a number of the Tables listed in the Appendices a colour coding has been used to identify the radial location of the traverses. This coding is used in conjunction with Fig. 2-3-1 as follows:

Position No.	Colour Coding	Symbol
1	Blue	O
2	Green	X
3	Red	□


1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
U/u
0.2
0.4
0.6
0.8
(R − R_i) ins
FIG. A1-1
L/ΔR_i = 10.0 INNER WALL
X = 5.90 ins.
Θ = 0.104 ins. H = 1.61
POSITION 1
POSITION 2
POSITION 3


FIG. A1-2
L/ΔR = 10.0 OUTER WALL
X = 5.90 ins
Θ = 0.107 ins H = 1.74
POSITION 1
POSITION 2
POSITION 3
U/U
(R₀ - R) ins
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.2
0.4
0.6
0.3

Appendix 2

Computer Programme

Analysis of Velocity Profile Data

```
C                                   APPENDIX 2

COMMENT                      ANALYSIS OF VELOCITY PROFILES
CXXXXXTHIS PROGRAM PROCESSES VELOCITY PROFILE DATA . PREVIOUS TO THIS
C      ALL VALUES OF U/UMAX HAD BEEN PLOTTED FOR EACH OF THE 3 POSITIONS,
C      AT EACH STATION , AND A MEAN LINE DRAWN THROUGH THE DATA . VALUES
C      WERE THEN TABULATED AT 0.01 INS. INTERVALS AND FED INTO THIS
C      PROGRAM
CXXXXXWARNINGXXXXDUE TO ASYMMETRY AT OUTLET OF THE L/DR=5 DIFFUSER IT
C      WAS NOT POSSIBLE TO USE THIS TECHNIQUE AND THE PROFILE AT EACH
C      POSITION WAS TREATED SEPARATELY. (THIS ONLY APPLIES TO OUTER WALL
C      BOUNDARY LAYERS)
       REAL MOM2DO,MOM3DO,MO,KO,MOM2DI,MOM3DI,MI,KI,MT,KT
       DIMENSION UNDO(96),UNDI(96)
CXXXXXINPUT DATA
C      ZZ-NUMBER OF STATIONS TO BE ANALYSED
C      COSWAL-COSINE OF ANGLE BETWEEN WALL AND HORIZONTAL CENTER LINE
C      (NOT USED IN THIS PROGRAM)
C      DIFNDL-DIFFUSER NON DIMENSIONAL LENGTH (L/DR(INLET))
C      UNDO-NON DIMENSIONAL AXIAL VELOCITY U/UMAX (OUTER WALL B.L.)
C      ROUTER-OUTER WALL RADIUS (INCHES)
C      DISP-DISTANCE FROM WALL(INS) OF FIRST VALUE OF U/UMAX
C      DR-RADIAL DISTANCE(INS) BETWEEN SUBSEQUENT VALUES OF U/UMAX
C      RINNER-INNER WALL RADIUS (INCHES)
C      UMAX-MAXIMUM VELOCITY(FT/SEC)
C      X-AXIAL DISTANCE FROM DIFFUSER INLET (INCHES)
C      UNDI-NON DIMENSIONAL AXIAL VELOCITY U/UMAX (INNER WALL B.L.)
   20  READ(1,21)ZZ
   21  FORMAT(F5.1)
  100  READ(1,101)COSWAL
  101  FORMAT(1F7.4)
       B=COSWAL
       Z=0.
  279  READ(1,289)DIFNDL
  289  FORMAT(F0.0)
   26  READ(1,27) (UNDO(I),I=1,96)
   27  FORMAT(12F6.3)
       READ(1,28)ROUTER,DISP,DR,RINNER
   28  FORMAT(4F7.3)
       READ(1,60)UMAX,X
   60  FORMAT(1F6.3,1F7.3)
       XND=X/DIFNDL
CXXXXXCALCULATION OF OUTER WALL BOUNDARY LAYER PARAMETERS
C      DEL2DO-2D DISPLACEMENT THICKNESS
C      DEL3DO-3D DISPLACEMENT THICKNESS
C      MOM2DO-2D MOMENTUM THICKNESS
C      MOM3DO-3D MOMENTUM THICKNESS
C      QO-VOLUME FLOW
C      MO-MOMENTUM
C      KO-KINETIC ENERGY (NB-IN CALCULATING QO,MO,&KO,PI AND UMAX DO NOT
C      APPEAR AS THEY CANCEL IN LATER CALCULATIONS OF UMEAN/UMAX,BETA,
C      AND ALPHA)
C      THO-3D ENERGY THICKNESS
C      H2DO-SHAPE PARAMETER BASED ON 2D DEFINITIONS
C      H3DO-SHAPE PARAMETER BASED ON 3D DEFINITIONS
CXXXXXHTHO-SHAPE PARAMETER BASED ON ENERGY AND MOMENTUM THICKNESSES
       HEIGHT=ROUTER-RINNER
       HEIGHT=(ROUTER-RINNER)/B
       SUM2O=0.
```

```
      SUM1=0.
      SUM2=0.
      RO=ROUTER-DISP
      SUM12=0.
      SUM11=0.
      SUM9=0.
      SUM7=0.
      SUM5=0.
      DO 30 I=1,96
      DEL2DO=(1.-UNDO(I))*DR
      RATIO=RO/ROUTER
      DEL3DO=(1.-UNDO(I))*DR*RATIO
      MOM2DO=(1.-UNDO(I))*UNDO(I)*DR
      MOM3DO=(1.-UNDO(I))*UNDO(I)*DR*RATIO
      QO=2.*RO*DR*UNDO(I)
      MO=2.*RO*DR*UNDO(I)*UNDO(I)
      KO=2.*RO*DR*UNDO(I)*UNDO(I)*UNDO(I)
      THO=UNDO(I)*UNDO(I)
      THO=(1.-THO)*DR*RATIO*UNDO(I)
      RO=RO-DR
      SUM20=SUM20+THO
      SUM5=SUM5+QO
      SUM7=SUM7+MO
      SUM9=SUM9+KO
      SUM11=SUM11+MOM2DO
      SUM12=SUM12+MOM3DO
      SUM1=SUM1+DEL2DO
      RU=1.-UNDO(I)
      IF (RU) 50,50,30
   30 SUM2=SUM2+DEL3DO
   50 SUM1=SUM1/B
      SUM2=SUM2/B
      SUM20=SUM20/B
      SUM5=SUM5/B
      SUM7=SUM7/B
      SUM9=SUM9/B
      SUM11=SUM11/B
      SUM12=SUM12/B
      H2DO=SUM1/SUM11
      H3DO=SUM2/SUM12
      HTHO=SUM20/SUM12
      SUM30=(SUM2*ROUTER)/HEIGHT
      SUM40=(SUM12*ROUTER)/HEIGHT
   33 READ(1,27) (UNDI(I),I=1,96)
CXXXXXCALCULATION OF INNER WALL BOUNDARY LAYER PARAMETERS
C      DEL2DI-2D DISPLACEMENT THICKNESS
C      DEL3DI-3D DISPLACEMENT THICKNESS
C      MOM2DI-2D MOMENTUM THICKNESS
C      MOM3DI-3D MOMENTUM THICKNESS
C      QI-VOLUME FLOW
C      MI-MOMENTUM
C      KI-KINETIC ENERGY (SEE COMMENTS IN OUTER WALL CALCULATIONS)
C      THI-3D ENERGY THICKNESS
C      H2DI-SHAPE PARAMETER BASED ON 2D DEFINITIONS
C      H3DI-SHAPE PARAMETER BASED ON 3D DEFINITIONS
CXXXXXHTHI-SHAPE PARAMETER BASED ON ENERGY AND MOMENTUM THICKNESSES
      SUM21=0.
      SUM16=0.
```

```
      SUM15=0.
      SUM10=0.
      SUM8=0.
      SUM6=0.
      SUM3=0.
      SUM4=0.
      RI=RINNER+DISP
      DO 34 I=1,96
      DEL2DI=(1.-UNDI(I))*DR
      RATII=RI/RINNER
      DEL3DI=(1.-UNDI(I))*RATII*DR
      MOM2DI=(1.-UNDI(I))*UNDI(I)*DR
      MOM3DI=(1.-UNDI(I))*UNDI(I)*DR*RATII
      QI=2.*RI*DR*UNDI(I)
      MI=2.*RI*DR*UNDI(I)*UNDI(I)
      KI=2.*RI*DR*UNDI(I)*UNDI(I)*UNDI(I)
      THI=UNDI(I)*UNDI(I)
      THI=(1.-THI)*DR*RATII*UNDI(I)
      RI=RI+DR
      SUM21=SUM21+THI
      SUM6=SUM6+QI
      SUM8=SUM8+MI
      SUM10=SUM10+KI
      SUM15=SUM15+MOM2DI
      SUM16=SUM16+MOM3DI
      SUM3=SUM3+DEL2DI
      RX=1.-UNDI(I)
      IF (RX) 51,51,34
   34 SUM4=SUM4+DEL3DI
   51 SUM3=SUM3/B
      SUM4=SUM4/B
      SUM21=SUM21/B
      SUM6=SUM6/B
      SUM8=SUM8/B
      SUM10=SUM10/B
      SUM15=SUM15/B
      SUM16=SUM16/B
      H2DI=SUM3/SUM15
      H3DI=SUM4/SUM16
      HTHI=SUM21/SUM16
      SUM31=(SUM4*RINNER)/HEIGHT
      SUM41=(SUM16*RINNER)/HEIGHT
CXXXXXQT-TOTAL VOLUME FLOW (SUM OF OUTER AND INNER LAYERS)
C     MT-TOTAL MOMENTUM
C     KT-TOTAL KINETIC ENERGY
C     RO-RADIUS OF POSITION OF MAX. VELOCITY (OUTER LAYER)
C     RI-RADIUS OF POSITION OF MAX. VELOCITY (INNER LAYER)
CXXXXXWARNINGXXXXTHEORETICALLY RO AND RI SHOULD COINCIDE HOWEVER DUE TO
C     EXPERIMENTAL ERRORS THERE IS USUALLY A SMALL DIFFERENCE AND THE
C     CALCULATIONS OF FLOW MOMENTUM ETC. ARE CORRECTED TO TAKE ACCOUNT
C     OF ANY ERRORS INCURRED DUE TO THE POSSIBLE UNDER OR OVER-LAPPING
C     OF THE EXPERIMENTAL PROFILES. THE OVERLAP IS QUOTED IN THE RESULTS
CXXXXXREA-MEASURE OF FLOW MOMENTUM & ENERGY IN OVERLAP REGION
      QT=SUM5+SUM6
      MT=SUM7+SUM8
      KT=SUM9+SUM10
      RO=RO+(DR*0.5)
```

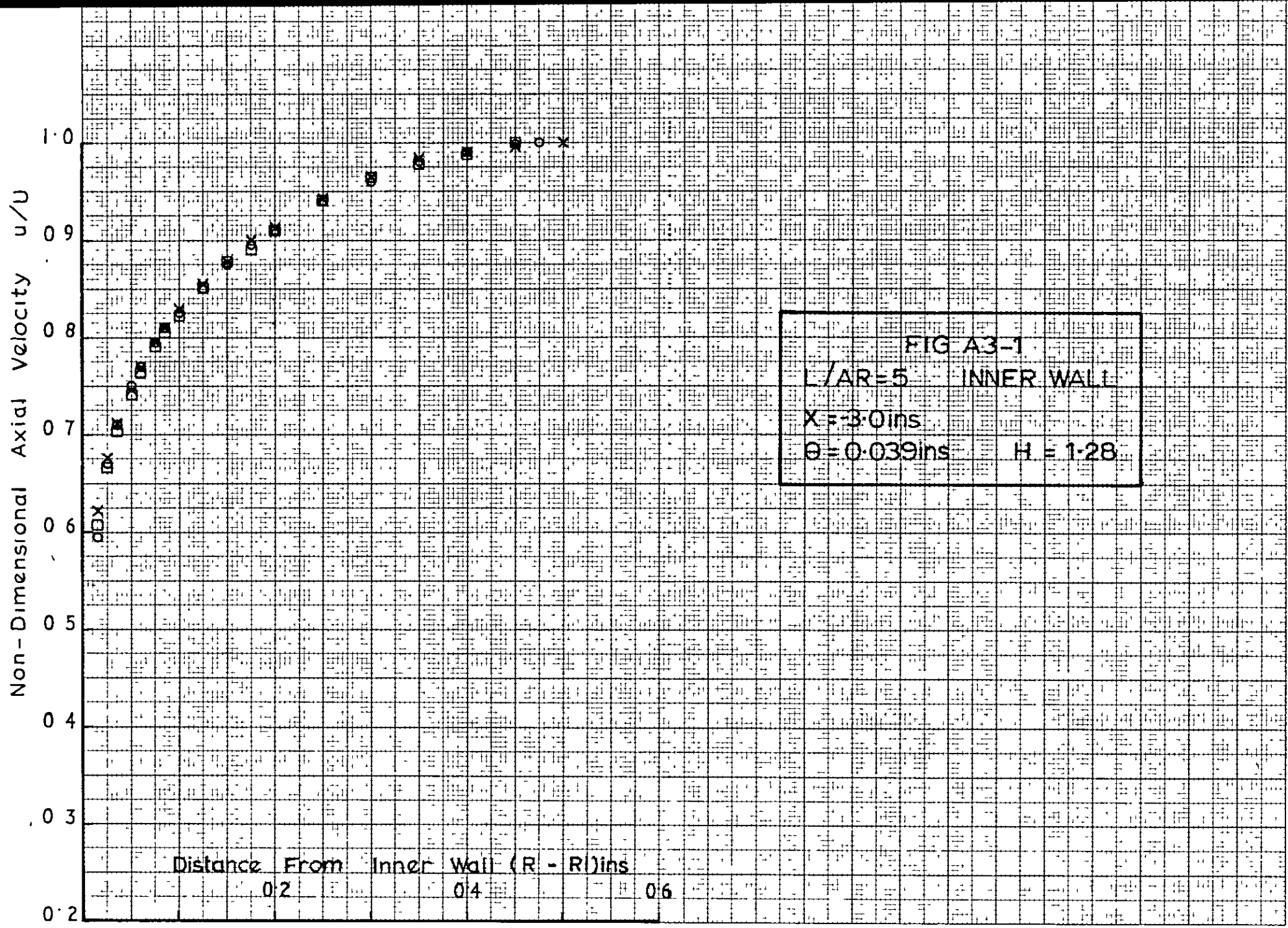
```
      RI=RI-(DR*0.5)
      REA=(RO*RO)-(RI*RI)
      REA=ABS(REA)
      REA=REA/B
      FLOWO=(SUM5*3.1416*UMAX)/144.
      FLOWI=(SUM6*3.1416*UMAX)/144.
      DQ=REA
      DM=REA
      DK=REA
      H=(RO-RI)/B
      IF (H) 37,38,39
C     TRANSFER TO 37 INDICATES AN OVERLAP
   37 QT=QT-DQ
      MT=MT-DM
      KT=KT-DK
      SUM5=SUM5-(DQ/2.)
      GO TO 40
C     TRANSFER TO 38 INDICATES RO & RI COINCIDE
   38 QT=QT
      MT=MT
      KT=KT
      GO TO 40
C     TRANSFER TO 39 INDICATES AN UNDERLAP
   39 QT=QT+DQ
      MT=MT+DM
      KT=KT+DK
      SUM5=SUM5+(DQ/2.)
      GO TO 40
   40 AREA=((ROUTER*ROUTER)-(RINNER*RINNER))
C     UMEAN-RATIO OF MEAN TO MAX. VELOCITY
C     BETA-VELOCITY PROFILE MOMENTUM COEFFICIENT
C     ALPHA-VELOCITY PROFILE ENERGY COEFFICIENT
C     QPERO-PERCENTAGE OF TOTAL FLOW IN OUTER WALL BOUNDARY LAYER
CXXXXXNOTEXXXXIN THIS CORRECTION IT IS ASSUMED THAT INNER AND OUTER
C     PROFILES ARE IN ERROR BY EQUAL AMOUNTS
      ATOTAL=(3.1416*AREA)/B
      UMEAN=(QT*B)/AREA
      BETA=(MT*B)/(AREA*UMEAN*UMEAN)
      ALPHA=(KT*B)/(AREA*UMEAN*UMEAN*UMEAN)
      FLOW=QT*3.1416*UMAX/144.
      QPERO=SUM5/QT
      WRITE(2,290)DIFNDL
  290 FORMAT(29X,33HDIFFUSER NON DIMENSIONAL LENGTH =,F5.1)
      WRITE(2,291)X,XND
  291 FORMAT(/18X,27HAXIAL DIST. FROM INLET(X) =,F6.3,1X,4HINS.,3X,15HN.
     1D.DIST.(X/L)=,F6.3)
      WRITE(2,301)
  301 FORMAT(/18X,4HB.L.,1X,9HTHICKNESS,7X,12HDISPLACEMENT,3X,8HMOMENTUM
     1,3X,15HSHAPE PARAMETER)
      WRITE(2,302)
  302 FORMAT(18X,2H2D,1X,11HDEFINITIONS,7X,11HDELTA*(INS),2X,14HH=DELTA*
     1/THETA)
      WRITE(2,303)SUM1,SUM11,H2DO
  303 FORMAT(/18X,21HOUTER WALL(REL TO RO),2X,F6.3,7X,F6.3,8X,F6.3)
      WRITE(2,304)SUM3,SUM15,H2DI
```

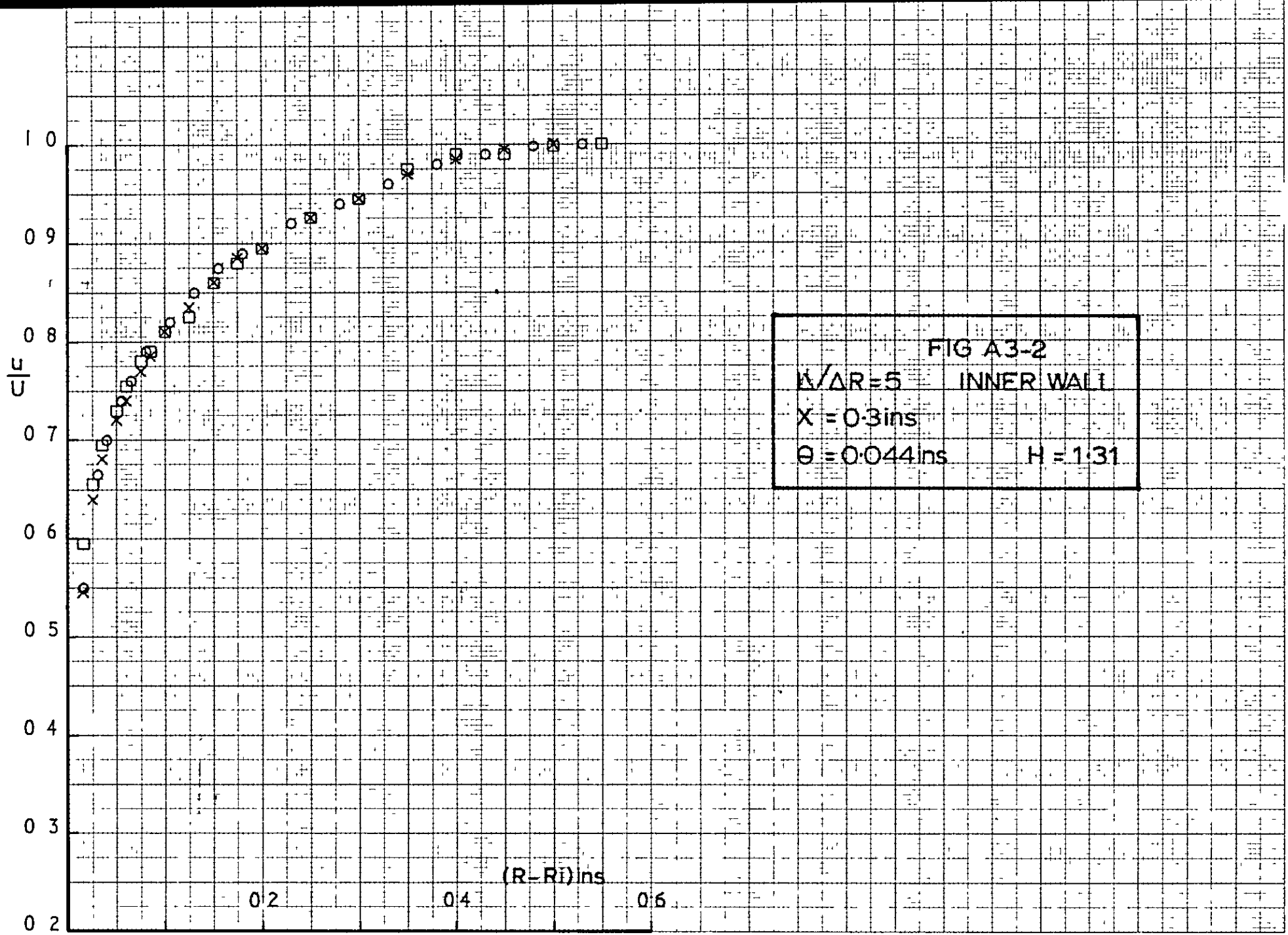
```
304 FORMAT(/18X,21HINNER WALL(REL TO RI),2X,F6.3,7X,F6.3,8X,F6.3)
    WRITE(2,305)
305 FORMAT(/18X,28H3D DEFINITIONS(AXISYMMETRIC))
    WRITE(2,306)SUM2,SUM12,H3DO
306 FORMAT(/18X,21HOUTER WALL(REL TO RO),2X,F6.3,7X,F6.3,8X,F6.3)
    WRITE(2,307)SUM30,SUM40,H3DO
307 FORMAT(25X,14H(REL TO RO-RI),2X,F6.3,7X,F6.3,8X,F6.3)
    WRITE(2,308)SUM4,SUM16,H3DI
308 FORMAT(/18X,21HINNER WALL(REL TO RI),2X,F6.3,7X,F6.3,8X,F6.3)
    WRITE(2,309)SUM31,SUM41,H3DI
309 FORMAT(25X,14H(REL TO RO-RI),2X,F6.3,7X,F6.3,8X,F6.3)
    WRITE(2,310)
310 FORMAT(/18X,14HB.L. THICKNESS,8X,6HENERGY,9X,24HENERGY  SHAPE  PAR
   1AMETER)
    WRITE(2,311)
311 FORMAT(18X,19H3D DEFINITIONS(AXI),3X,12HDELTA**(INS),8X,13HDELTA**
   1/THETA)
    WRITE(2,312)SUM20,HTHO
312 FORMAT(/18X,21HOUTER WALL(REL TO RO),2X,F6.3,14X,F6.3)
    WRITE(2,313)SUM21,HTHI
313 FORMAT(18X,21HINNER WALL(REL TO RI),2X,F6.3,14X,F6.3)
    WRITE(2,314)UMEAN,BETA,ALPHA
314 FORMAT(/18X,11HUMEAN/UMAX=,F6.3,2X,15HBETA(MOMENTUM)=,F6.3,2X,14HA
   1LPHA(ENERGY)=,F6.3)
    WRITE(2,315)FLOW,QPERO,H
315 FORMAT(/18X,5HFLOW=,F6.2,8HCUFT/SEC,1X,21H%FLOW IN OUTER LAYER=,F6
   1.3,1X,8HOVERLAP=,F6.3//)
    WRITE(2,320)
320 FORMAT(1H1)
    Z=Z+1.
    IF (Z-ZZ) 279,22,22
 22 CONTINUE
    STOP
    END
    FINISH
```

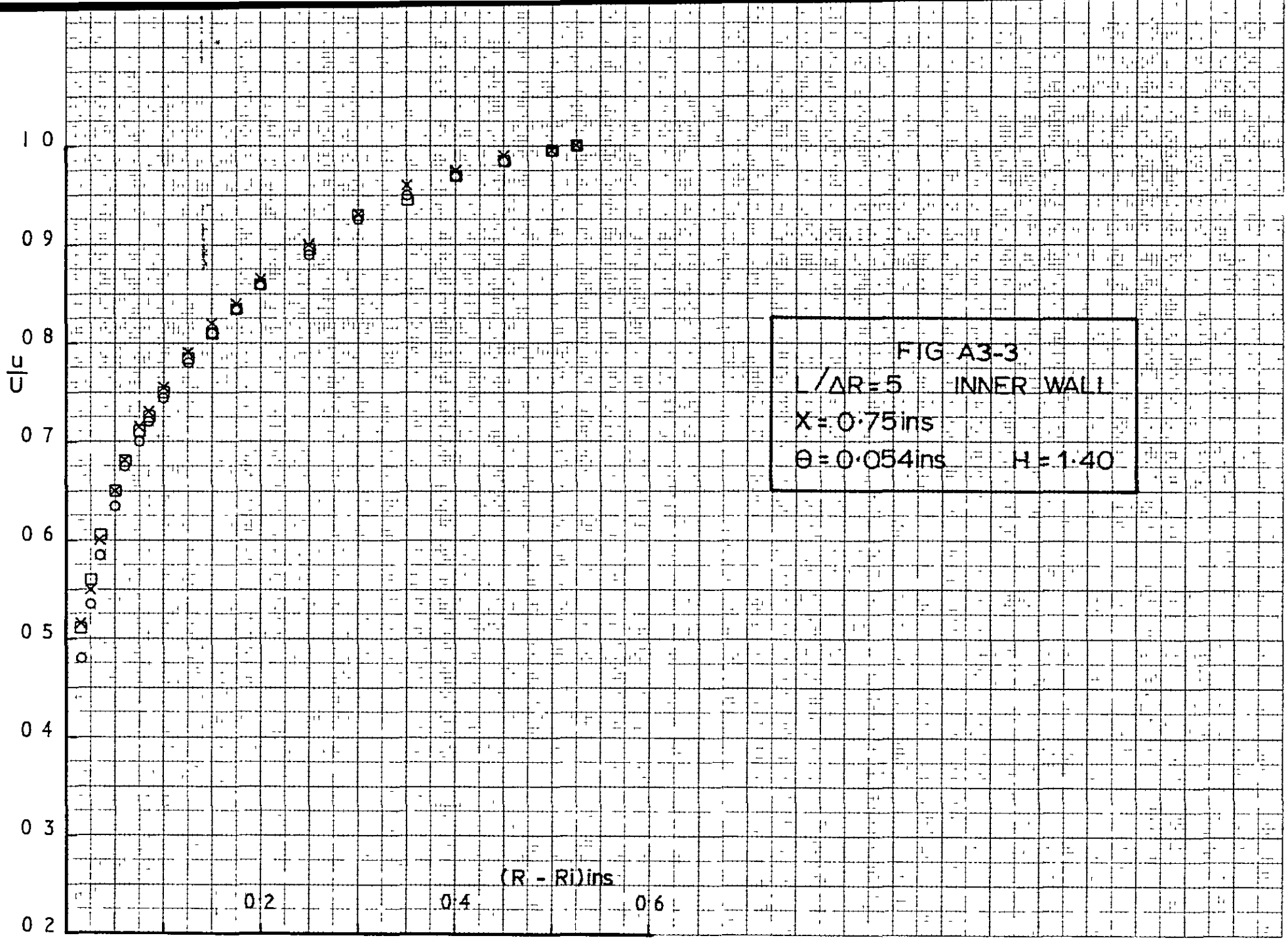
Appendix 3

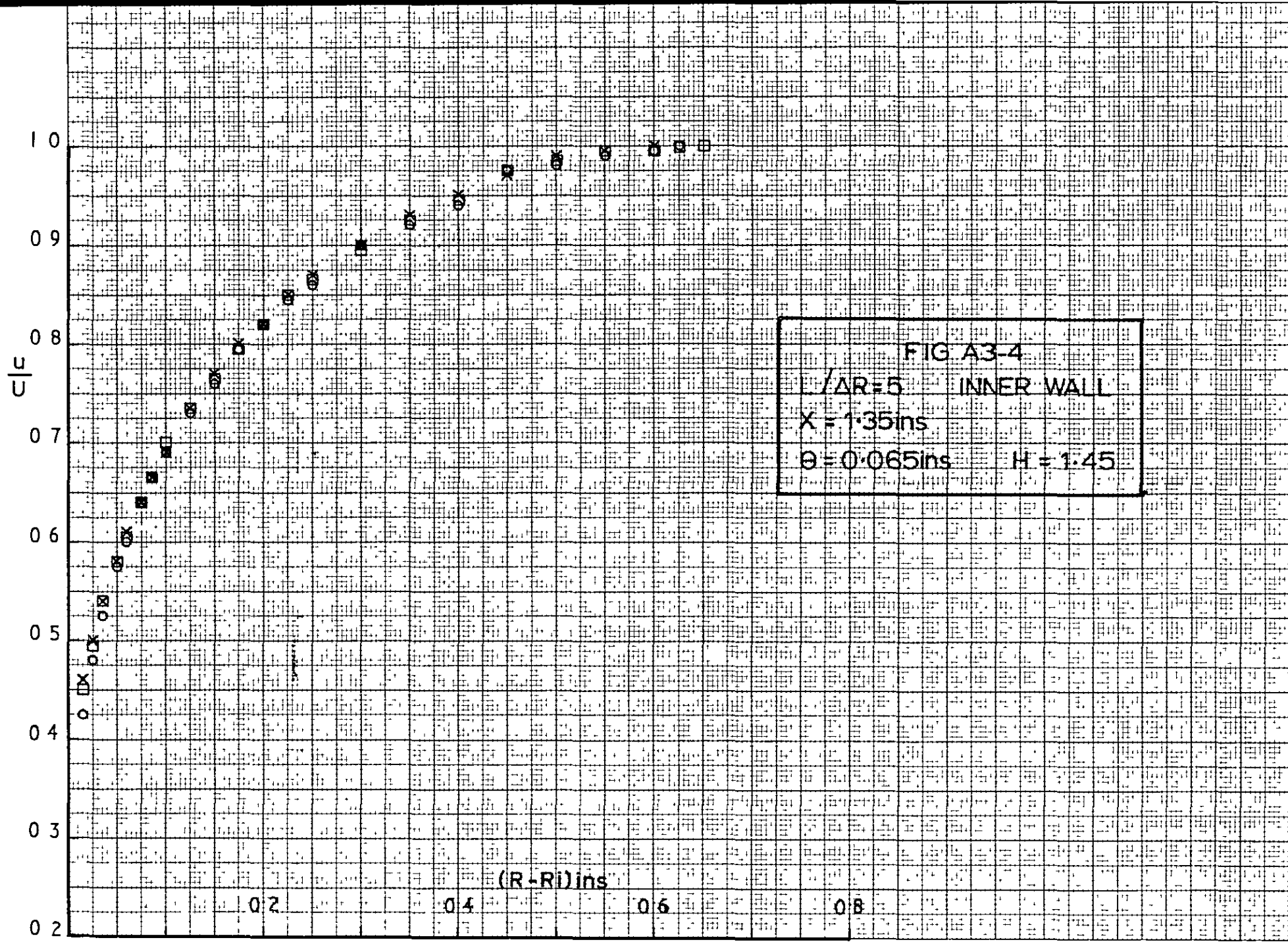
Mean Velocity Profiles

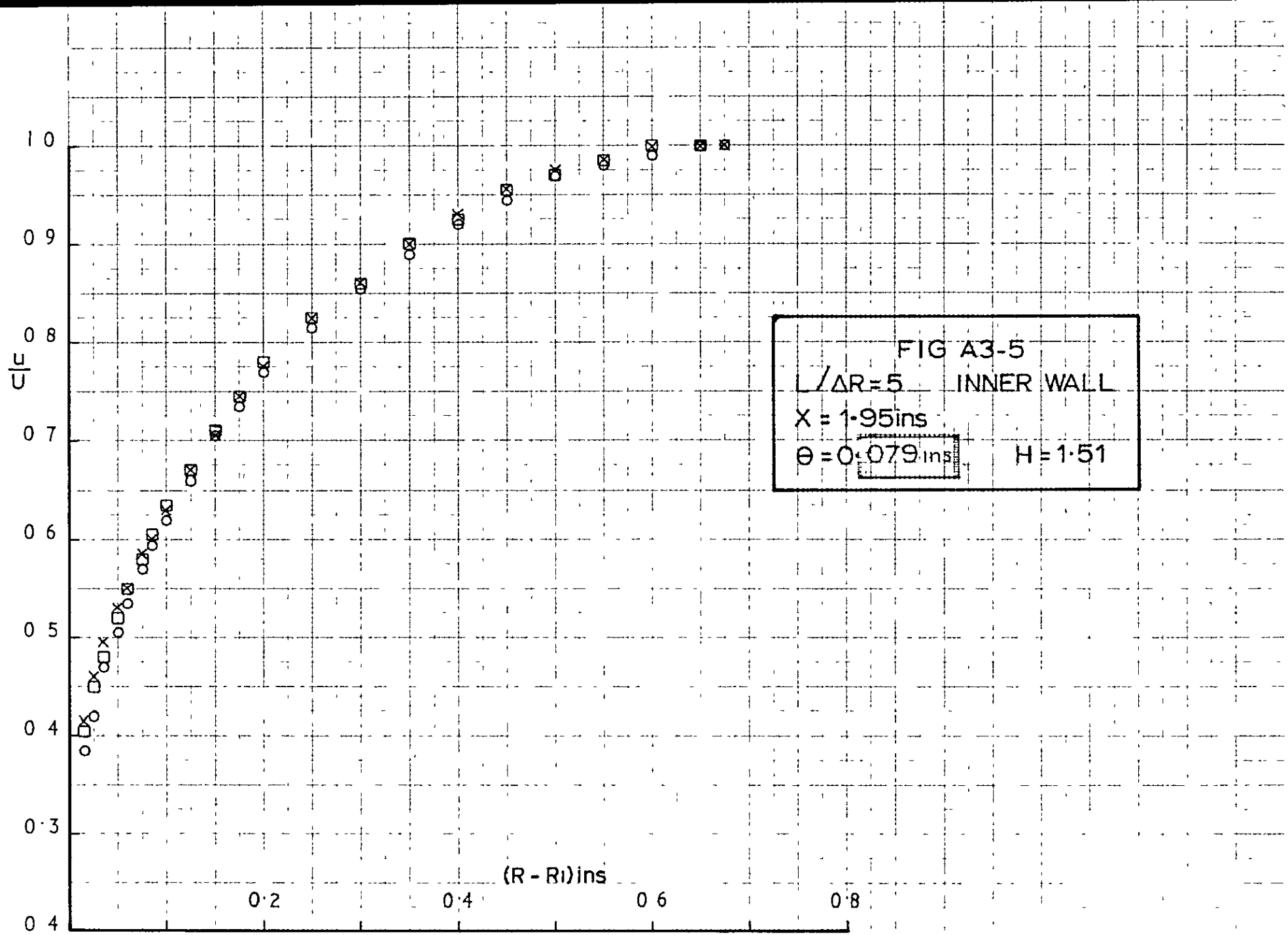
$L/\Delta R_1 = 5$ Diffuser

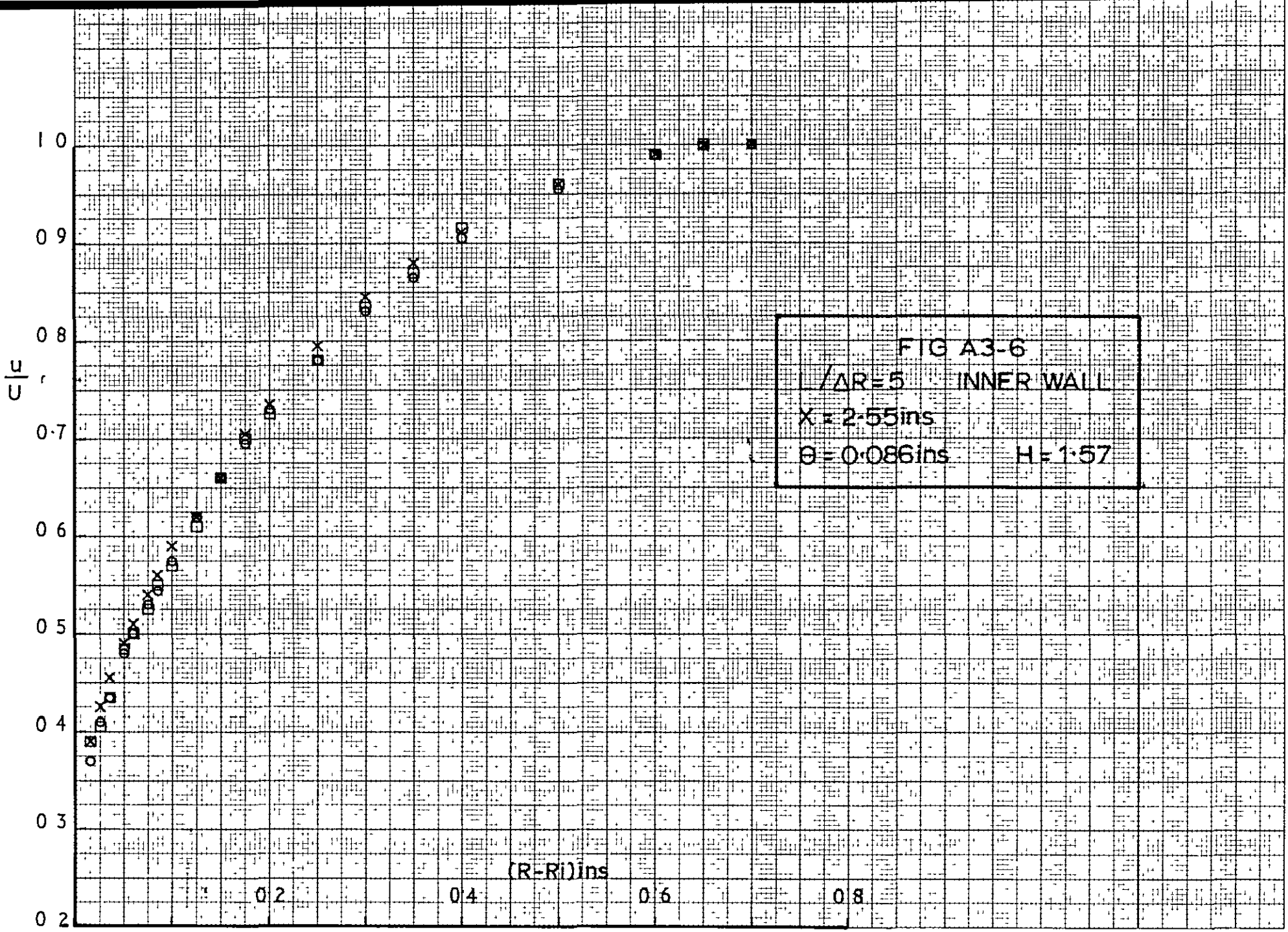

Non-Dimensional Axial Velocity u/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
Distance From Inner Wall (R - R)ins
0·2
0·4
0·6
FIG A3-1
L/AR=5 INNER WALL
X = -3·0ins
Θ = 0·039ins H = 1·28

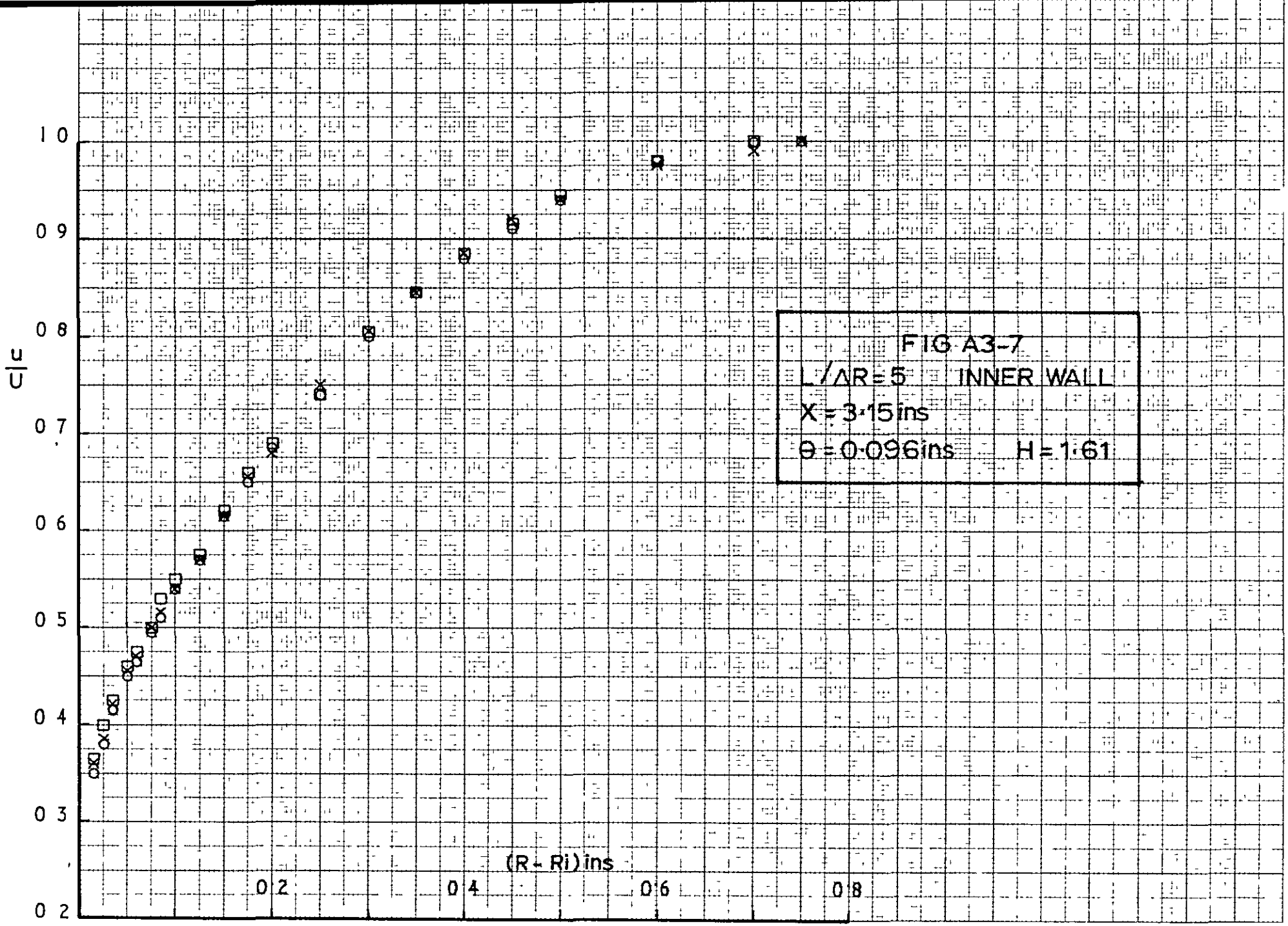

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
U/U
0 2
0 4
0 6
(R-Ri) ins
FIG A3-2
Δ/ΔR=5 INNER WALL
X = 0·3ins
θ = 0·044ins H = 1·31

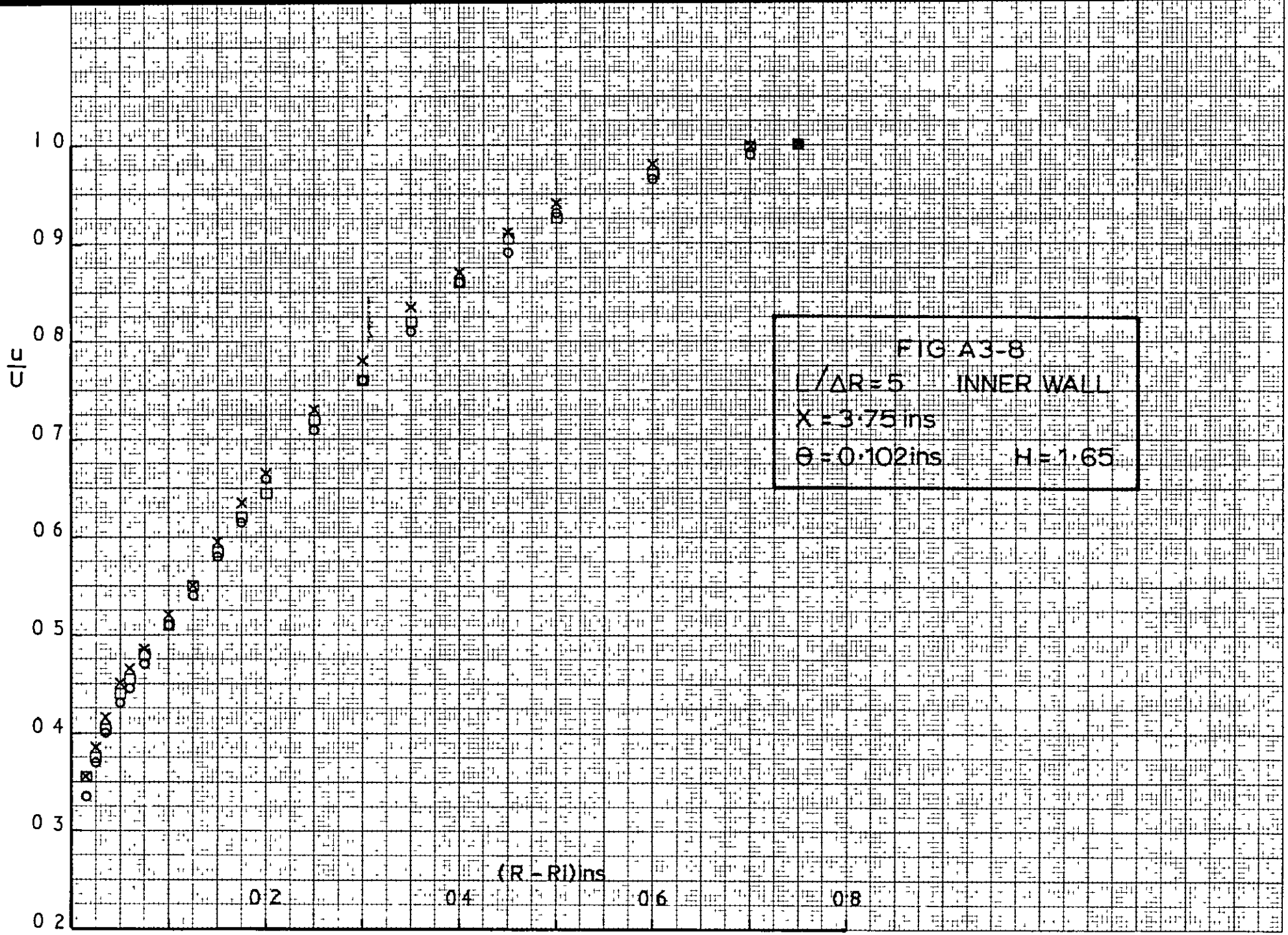

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
u/U
0·2
0·4
0·6
(R - Ri)ins
FIG A3-3
L/ΔR=5 INNER WALL
X=0·75ins
θ=0·054ins H=1·40

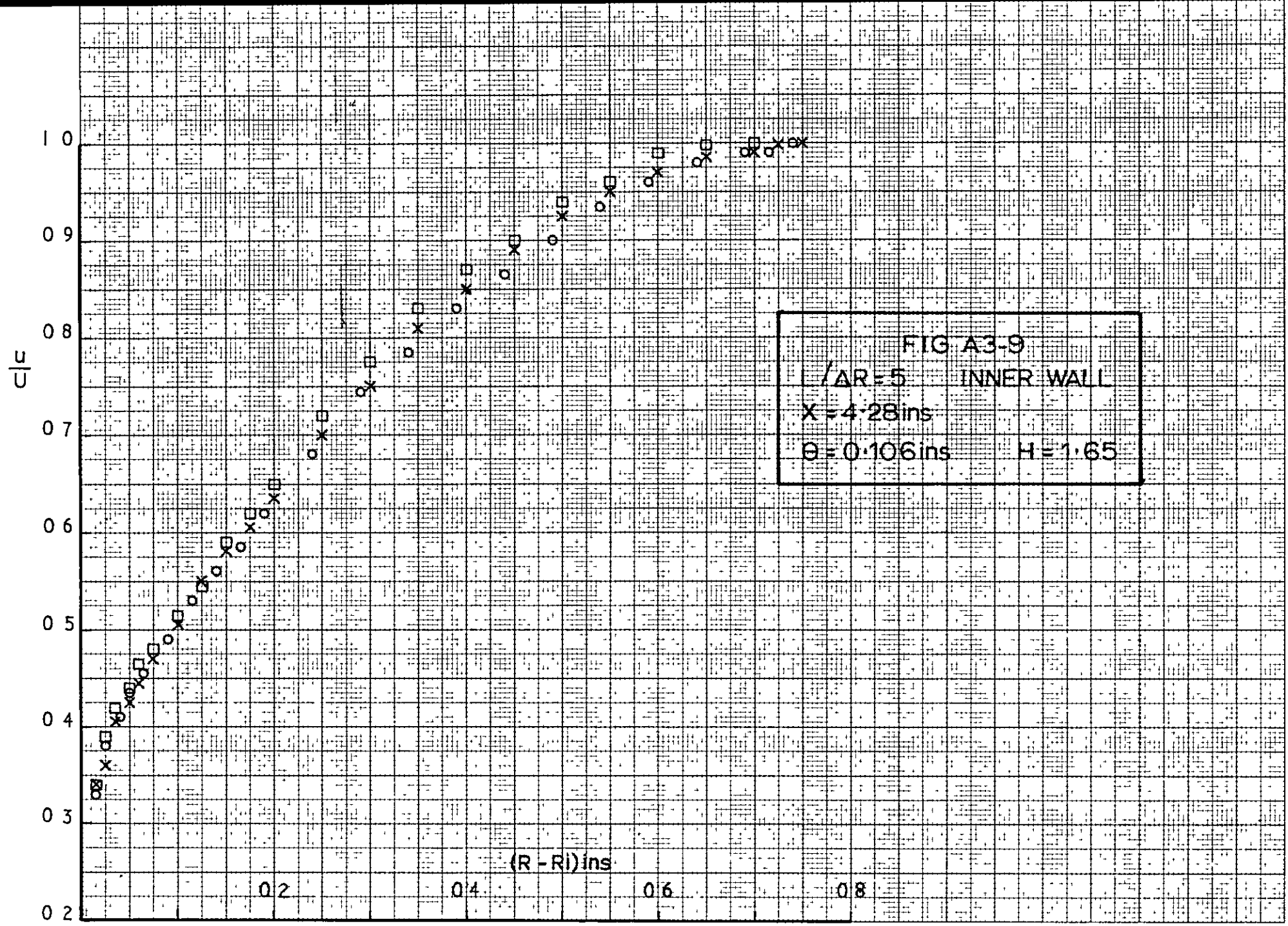

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
u/U
0 2
0 4
0 6
0 8
(R-Ri)ins
FIG A3-4
L/ΔR=5 INNER WALL
X = 1·35ins
θ = 0·065ins H = 1·45

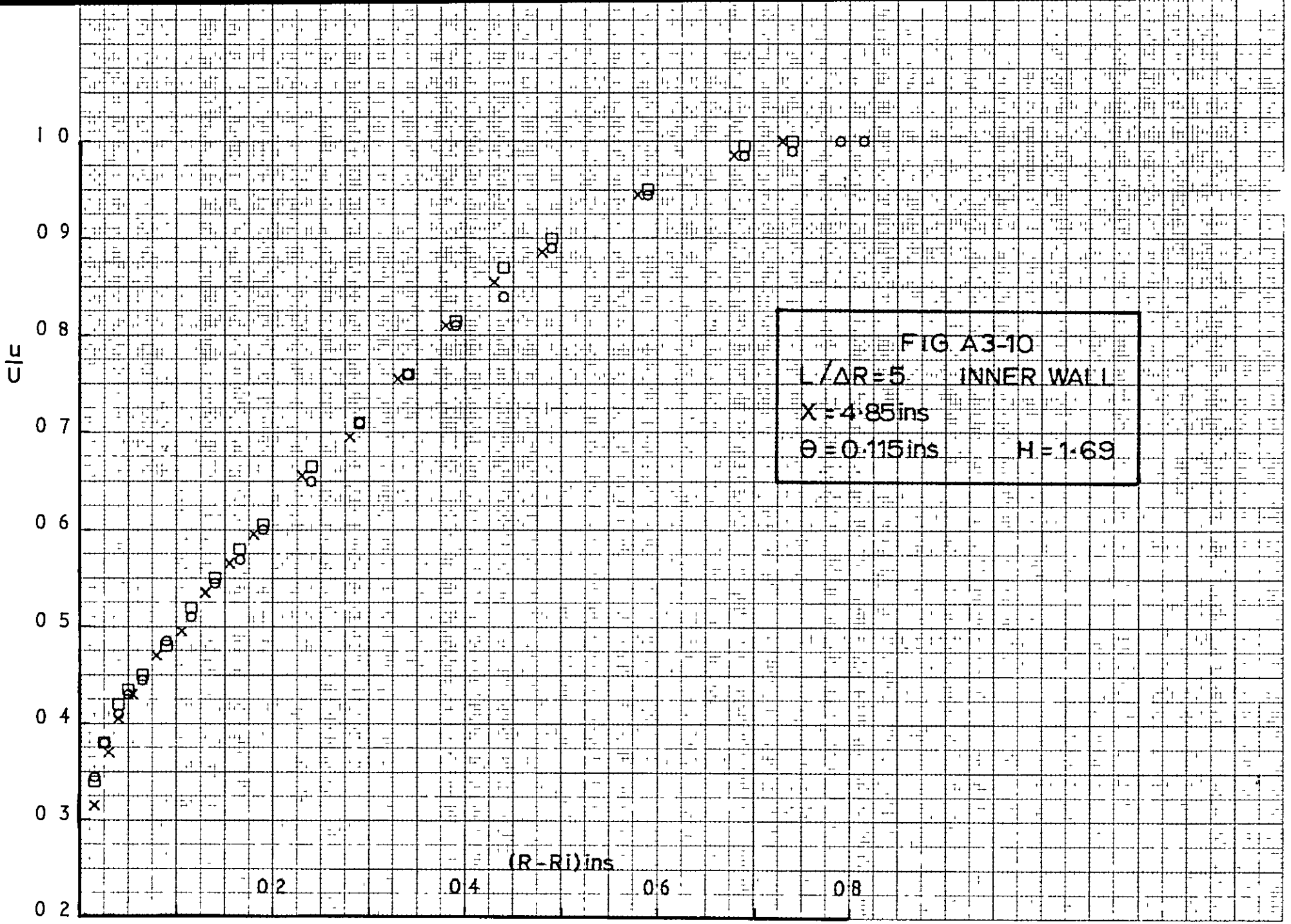

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0·3
0 4
U/u
0·2
0·4
0 6
0·8
(R - Ri) ins
FIG A3-5
L/ΔR=5 INNER WALL
X = 1·95ins
θ = 0·079 ins
H = 1·51

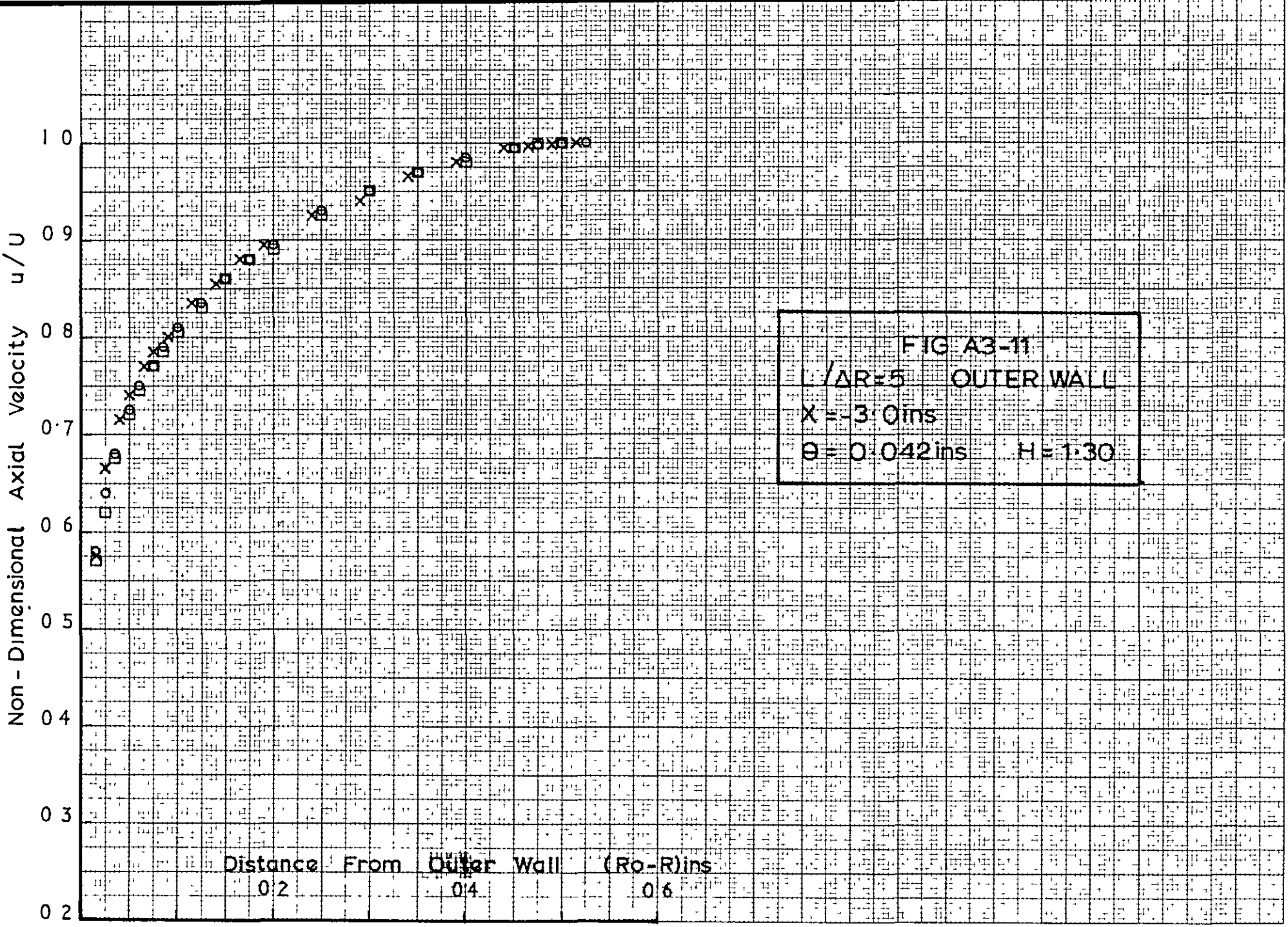

1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
u/U
0·2
0·4
0·6
0·8
(R-Ri)ins
FIG A3-6
/ΔR=5 INNER WALL
X = 2·55ins
θ = 0·086ins H = 1·57

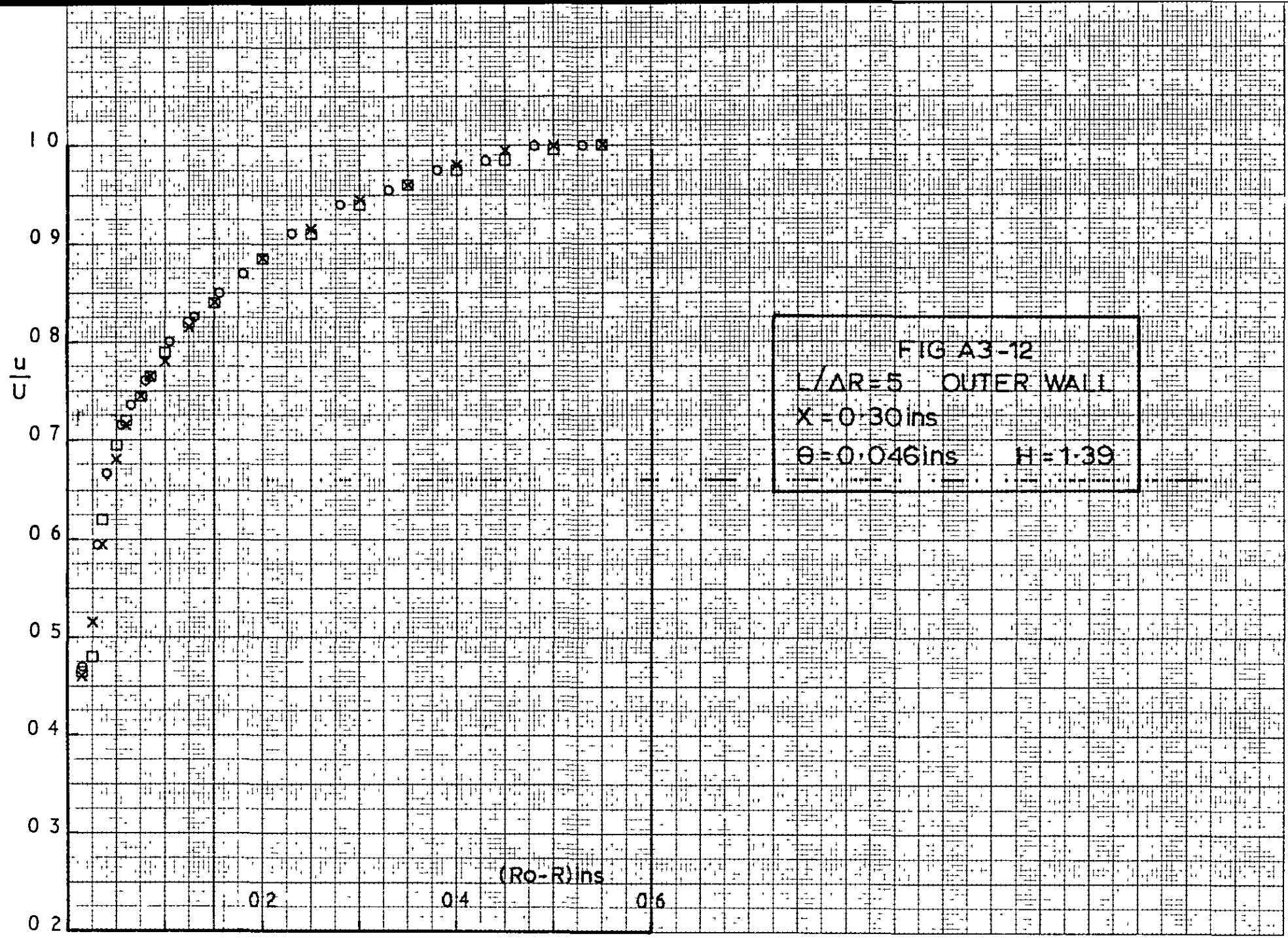

FIG A3-7
L/ΔR = 5 INNER WALL
X = 3·15 ins
θ = 0·096 ins H = 1·61
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(R - Ri) ins
0·2
0·4
0·6
0·8

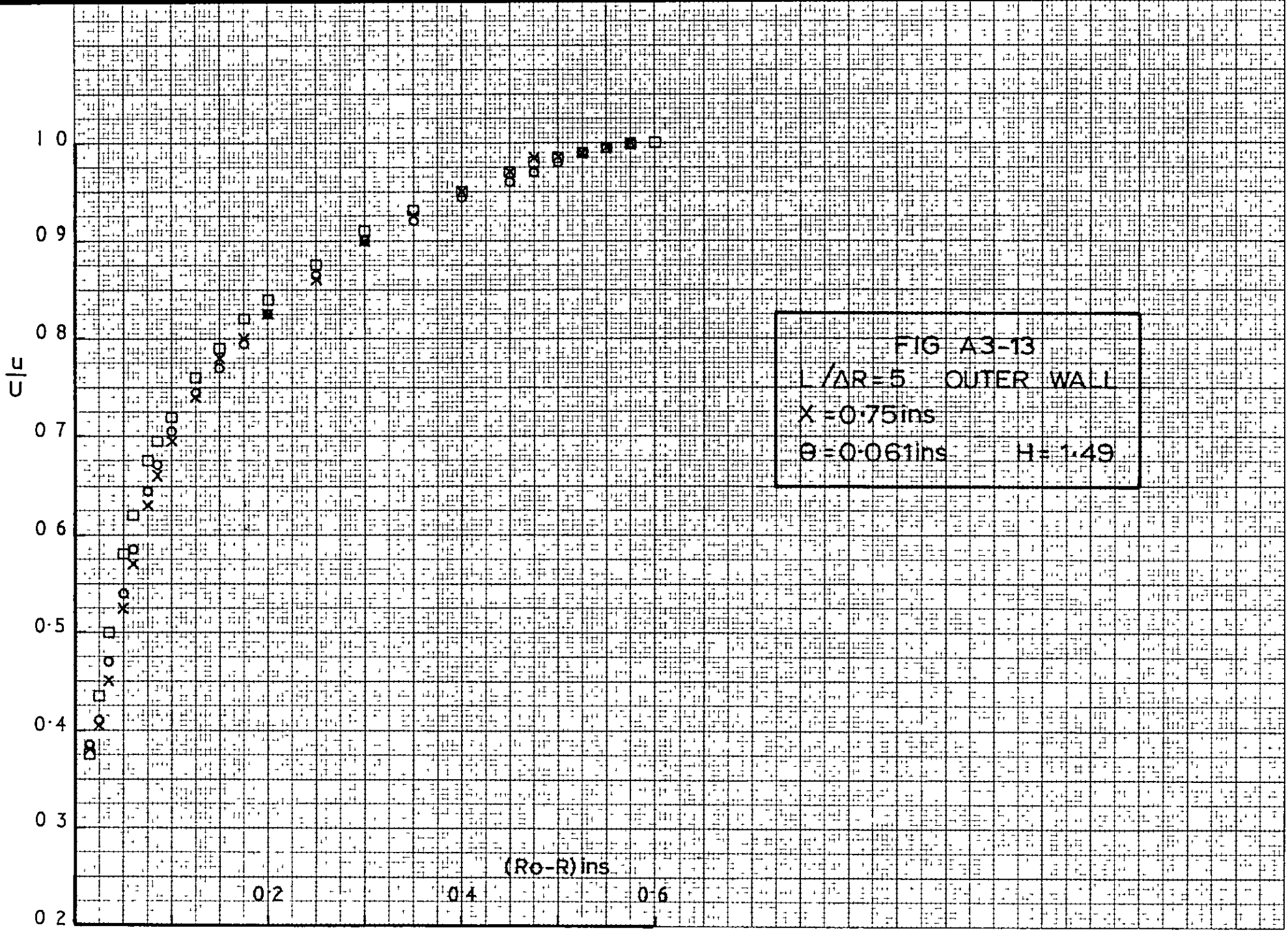

FIG A3-8
L/ΔR = 5 INNER WALL
X = 3·75 ins
θ = 0·102 ins H = 1·65
U/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(R – RI)/ins
0·2
0·4
0·6
0·8

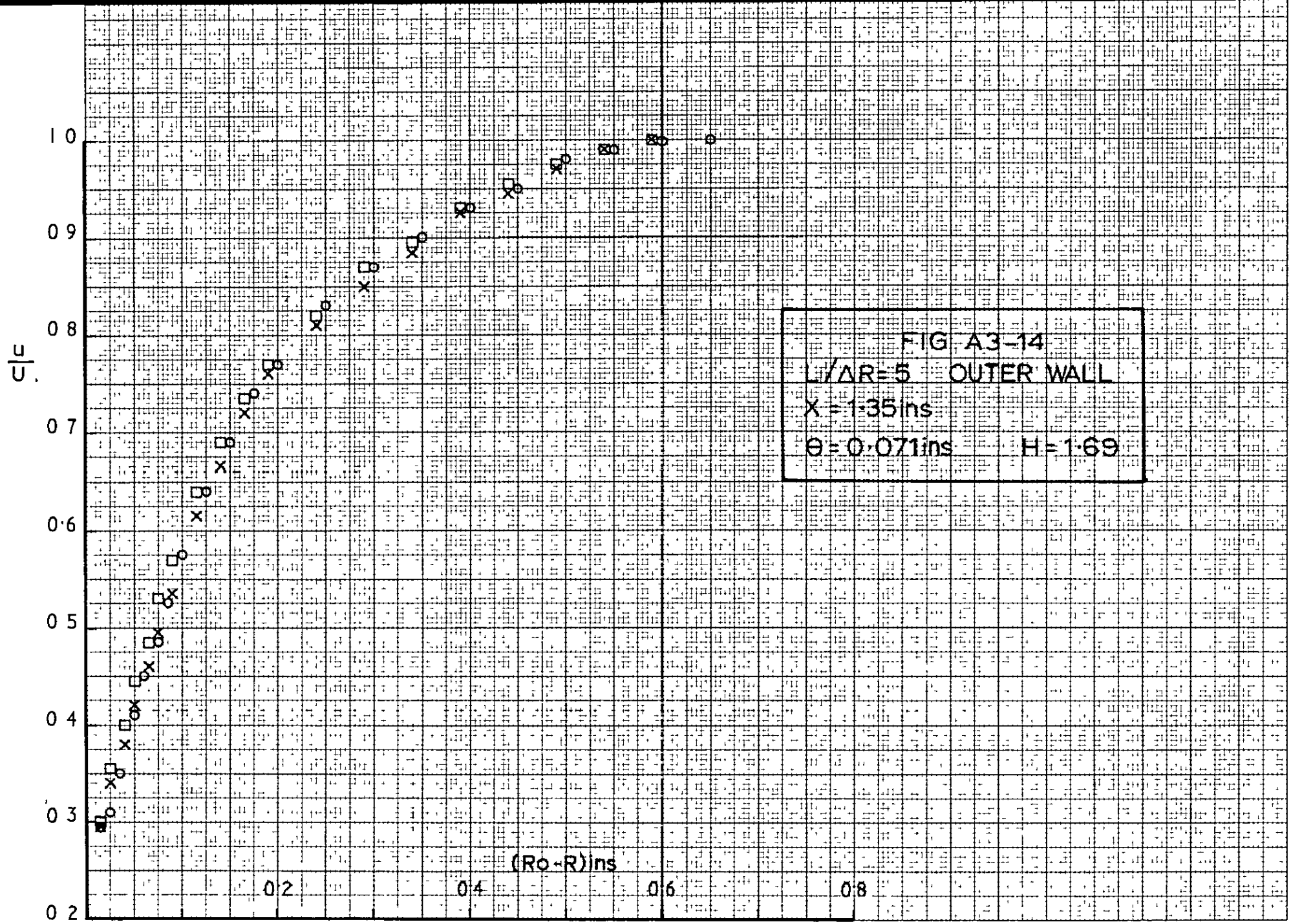

FIG A3-9
L/ΔR=5 INNER WALL
X=4·28ins
θ=0·106ins H=1·65
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(R-Ri)ins
0·2
0·4
0·6
0·8

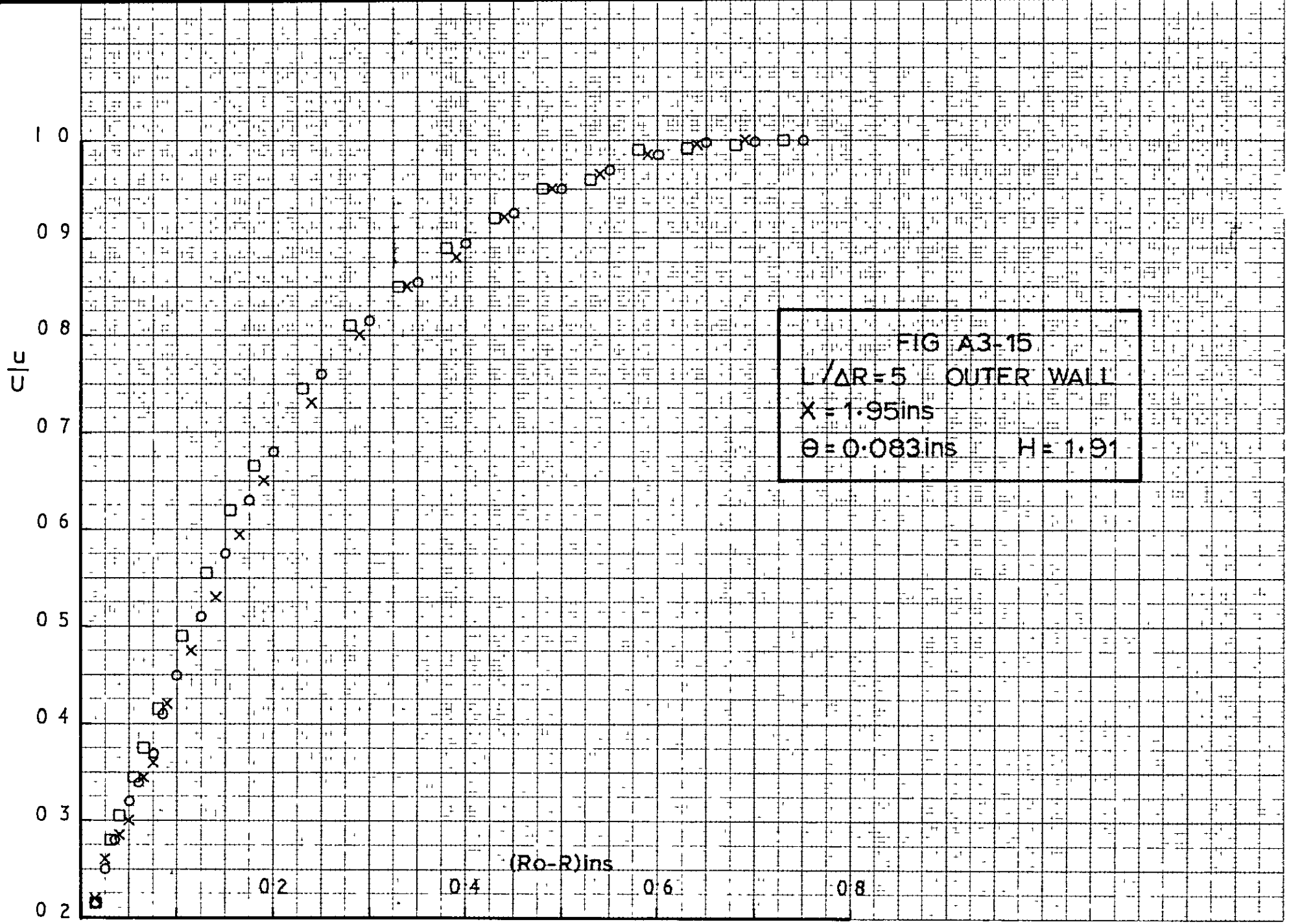

FIG A3-10
L/ΔR=5 INNER WALL
X=4·85ins
θ=0·115ins H=1·69
U/u
1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
(R-Ri)ins
0 2
0 4
0 6
0 8

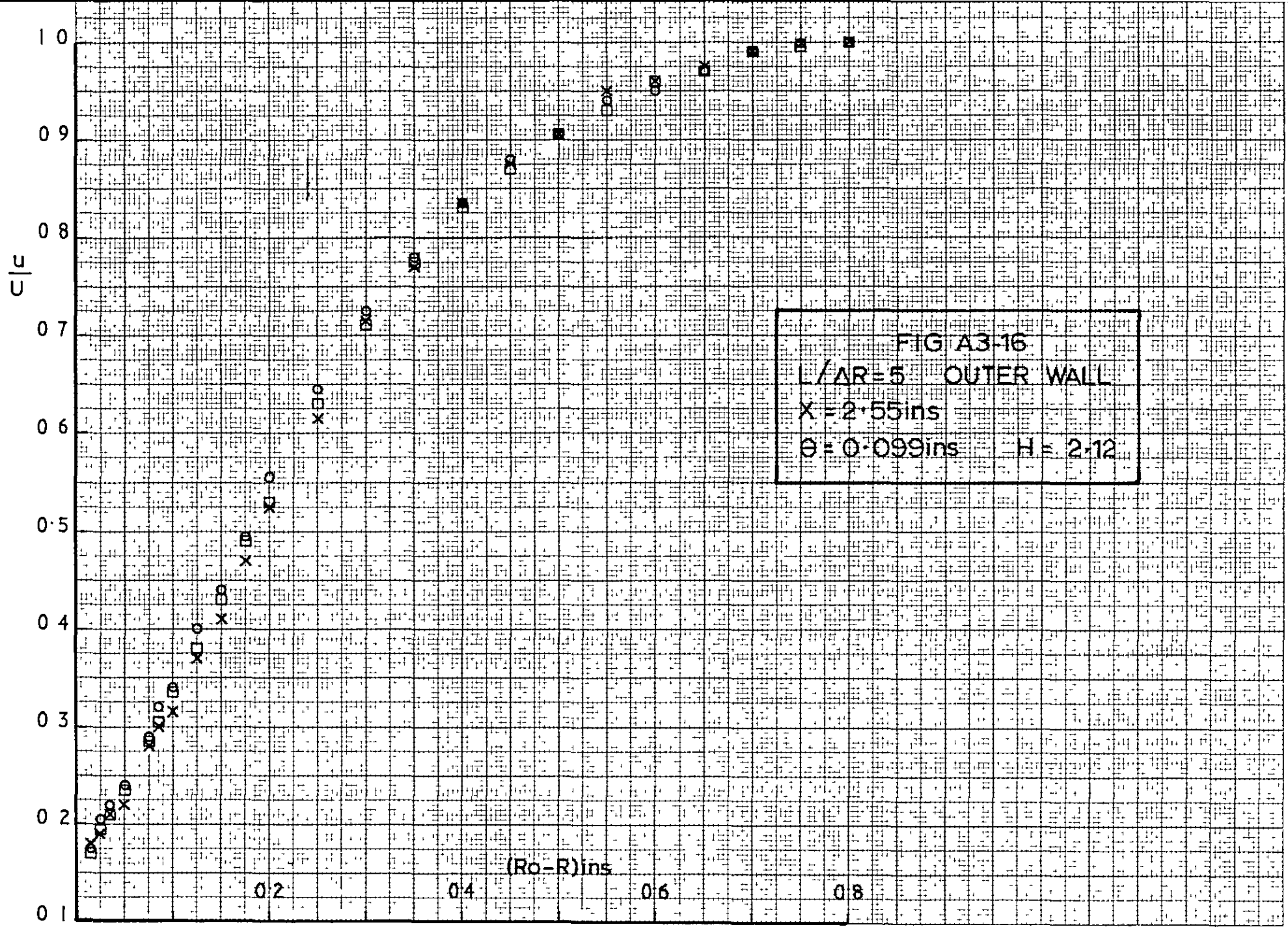

Non - Dimensional Axial Velocity u / U
1 0
0 9
0 8
0·7
0 6
0 5
0 4
0 3
0 2
Distance From Outer Wall (Ro-R)ins
0 2
0 4
0 6
FIG A3-11
L /ΔR=5 OUTER WALL
X =-3·0ins
θ = 0·042ins H = 1·30

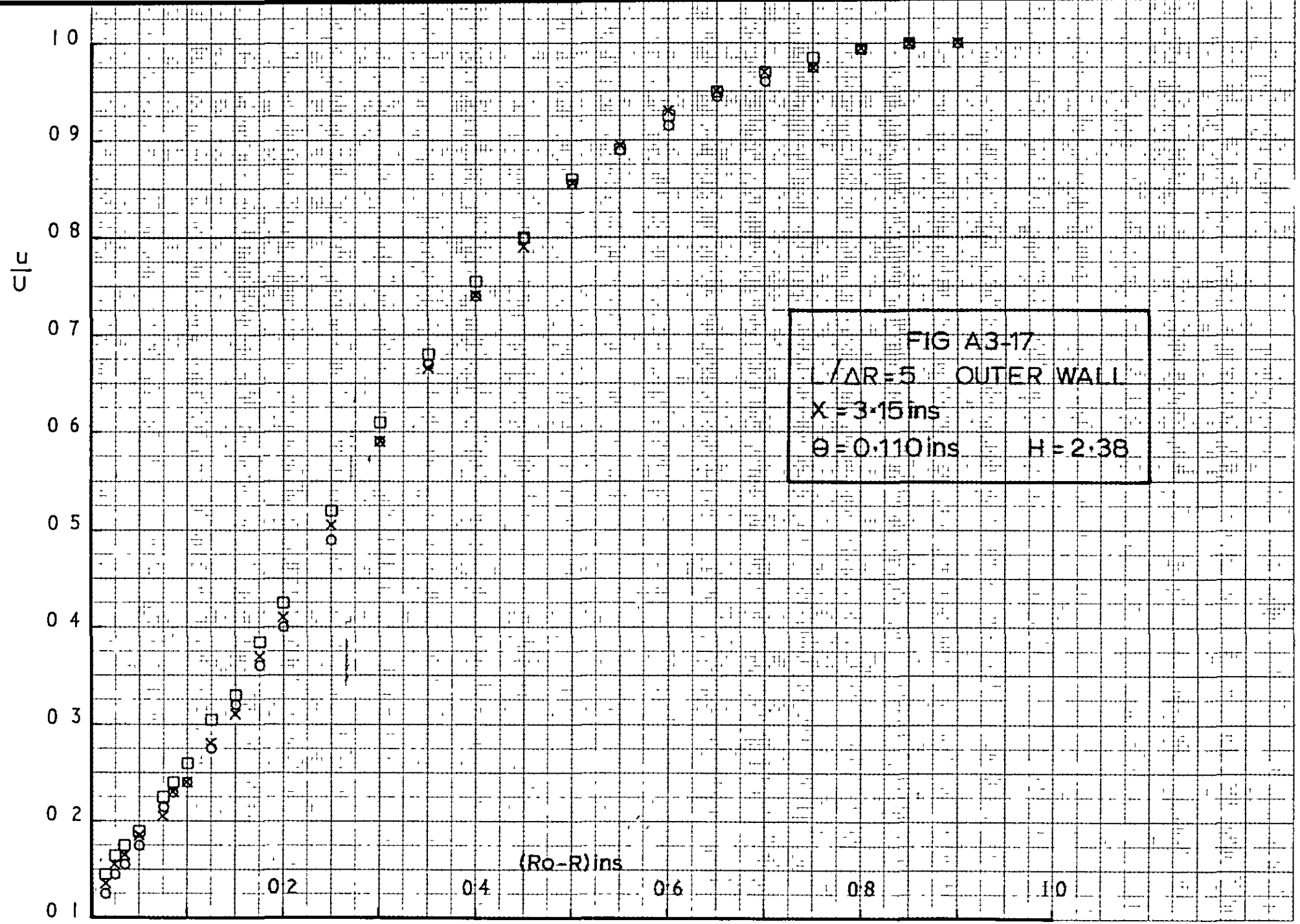

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
u/U
0 2
0 4
0 6
(Ro-R)ins
FIG A3-12
L/ΔR=5 OUTER WALL
X=0·30ins
θ=0·046ins H=1·39

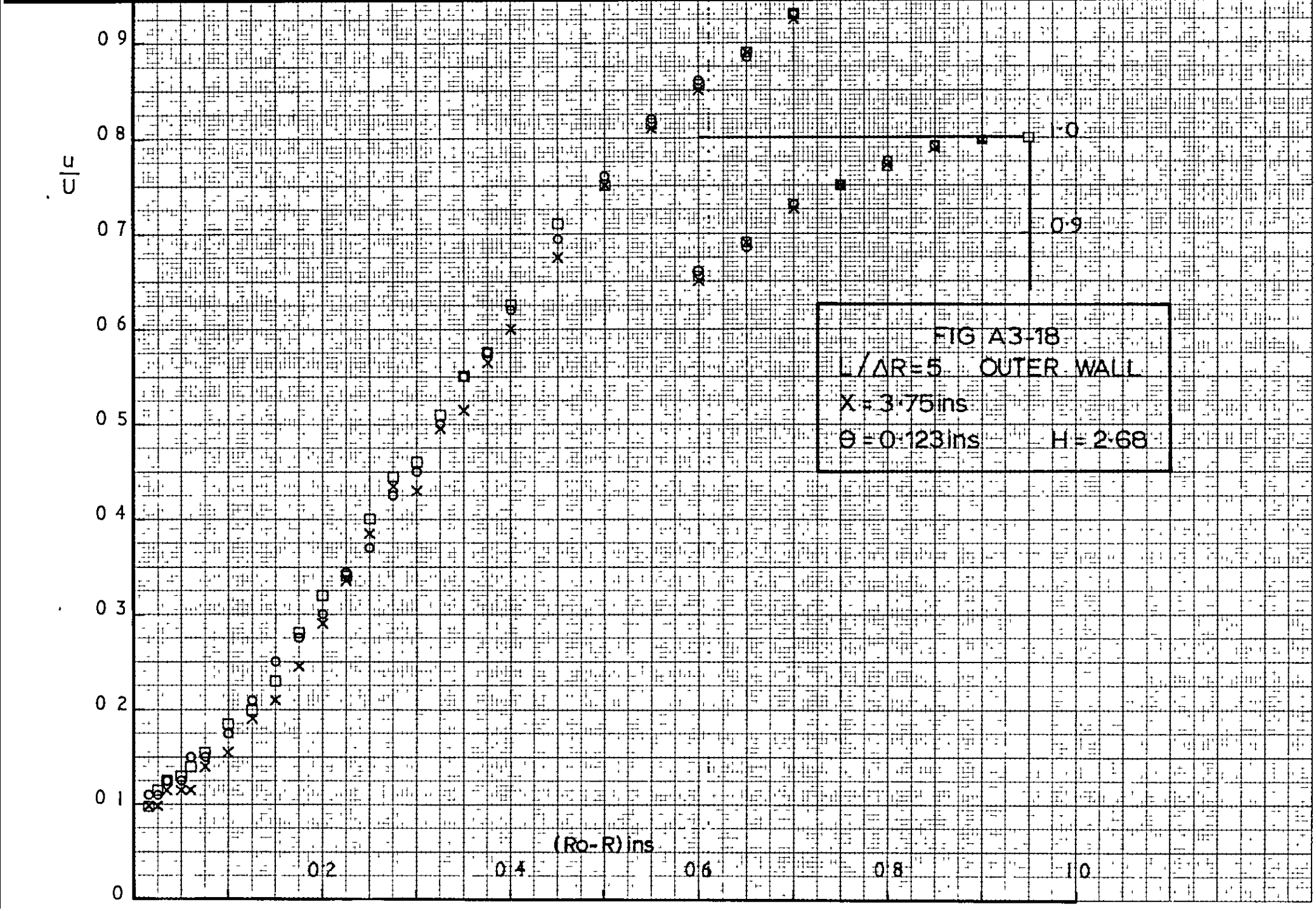

FIG A3-13
L/ΔR=5 OUTER WALL
X =0·75ins
θ =0·061ins H= 1·49
U/u
1 0
0 9
0 8
0 7
0 6
0·5
0·4
0 3
0 2
0·2
0·4
0·6
(Ro-R) ins

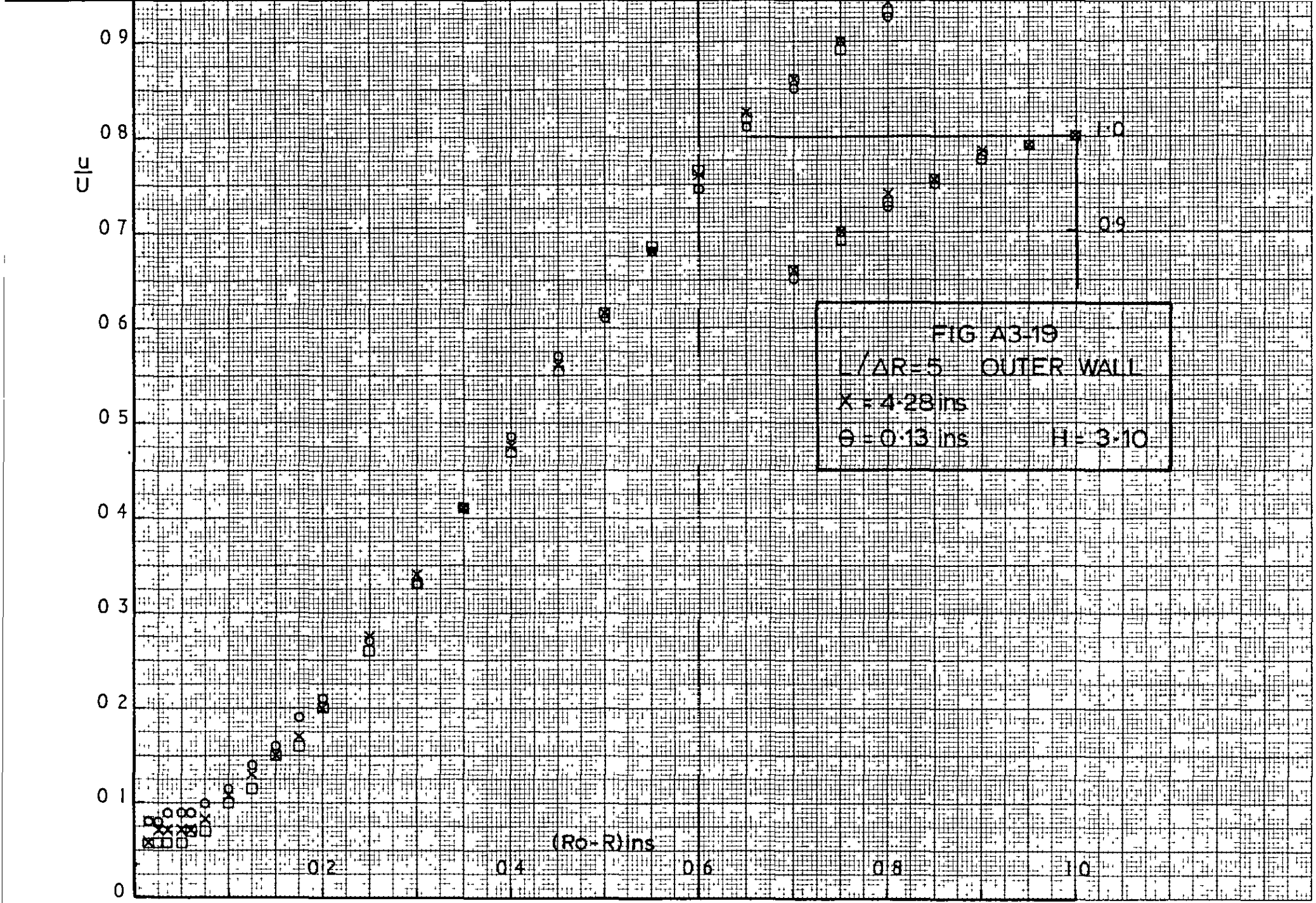

FIG A3-14
L/ΔR=5 OUTER WALL
X = 1·35ins
Θ = 0·071ins H=1·69
U/U.
1 0
0 9
0 8
0 7
0·6
0 5
0 4
0 3
0 2
(Ro-R)ins
0 2
0 4
0 6
0 8

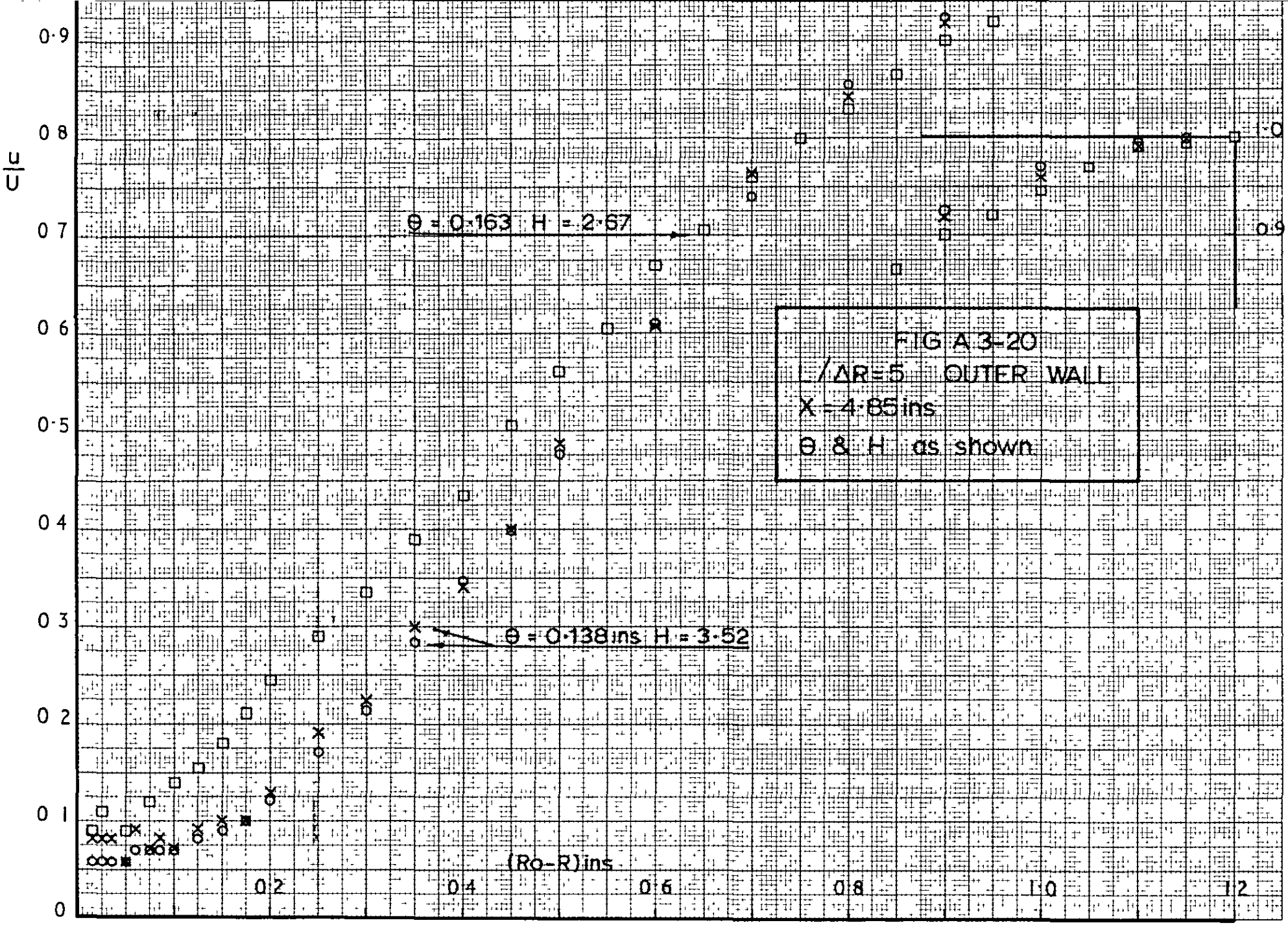

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
C/C
0 2
0 4
0 6
0 8
(Ro-R)ins
FIG A3-15
L/ΔR=5 OUTER WALL
X = 1·95ins
θ = 0·083ins H = 1·91


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
U/u
0·2
0·4
0·6
0·8
(Ro-R)ins
FIG A3-16
L/ΔR=5 OUTER WALL
X=2·55ins
θ=0·099ins H=2·12


U/u
1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
0 1
0 2
0 4
0 6
0 8
1 0
(Ro-R) ins
FIG A3-17
L/ΔR=5 OUTER WALL
X = 3·15 ins
Θ = 0·110 ins H = 2·38


0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
0 1
0
U/u
0 2
0 4
0 6
0 8
1 0
(Ro-R) ins
1·0
0·9
FIG A3-18
L/ΔR=5 OUTER WALL
X = 3·75ins
θ = 0·123ins
H = 2·68


0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
0 1
0
U/u
0 2
0 4
0 6
0 8
1 0
(Ro-R) ins
1·0
0·9
FIG A3-19
L/ΔR=5 OUTER WALL
X = 4·28 ins
Θ = 0·13 ins
H = 3·10


U/u
0·9
0 8
0 7
0 6
0·5
0 4
0 3
0 2
0 1
0
0 2
0 4
0 6
0 8
1·0
1·2
(Ro-R)ins
Θ = 0·163 H = 2·67
Θ = 0·138 ins H = 3·52
1·0
0·9
FIG A 3-20
/ΔR=5 OUTER WALL
X = 4·85 ins
Θ & H as shown

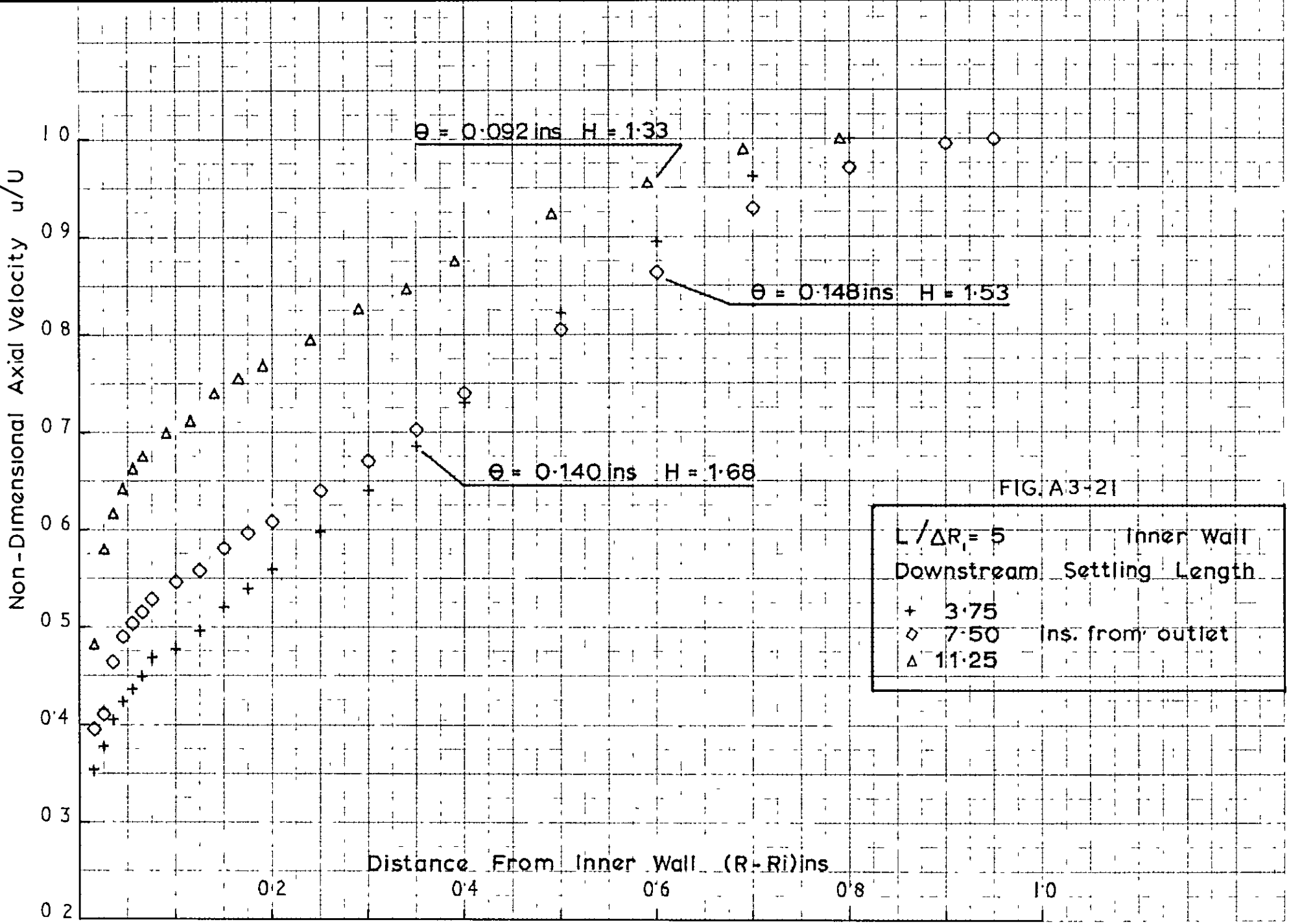

θ = 0·092 ins H = 1·33
θ = 0·148 ins H = 1·53
θ = 0·140 ins H = 1·68
L/ΔR_i = 5 Inner Wall
Downstream Settling Length
+ 3·75
◇ 7·50 ins. from outlet
△ 11·25
Non-Dimensional Axial Velocity u/U
Distance From Inner Wall (R-Ri) ins
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·2
0·4
0·6
0·8
1·0

FIG. A3-21

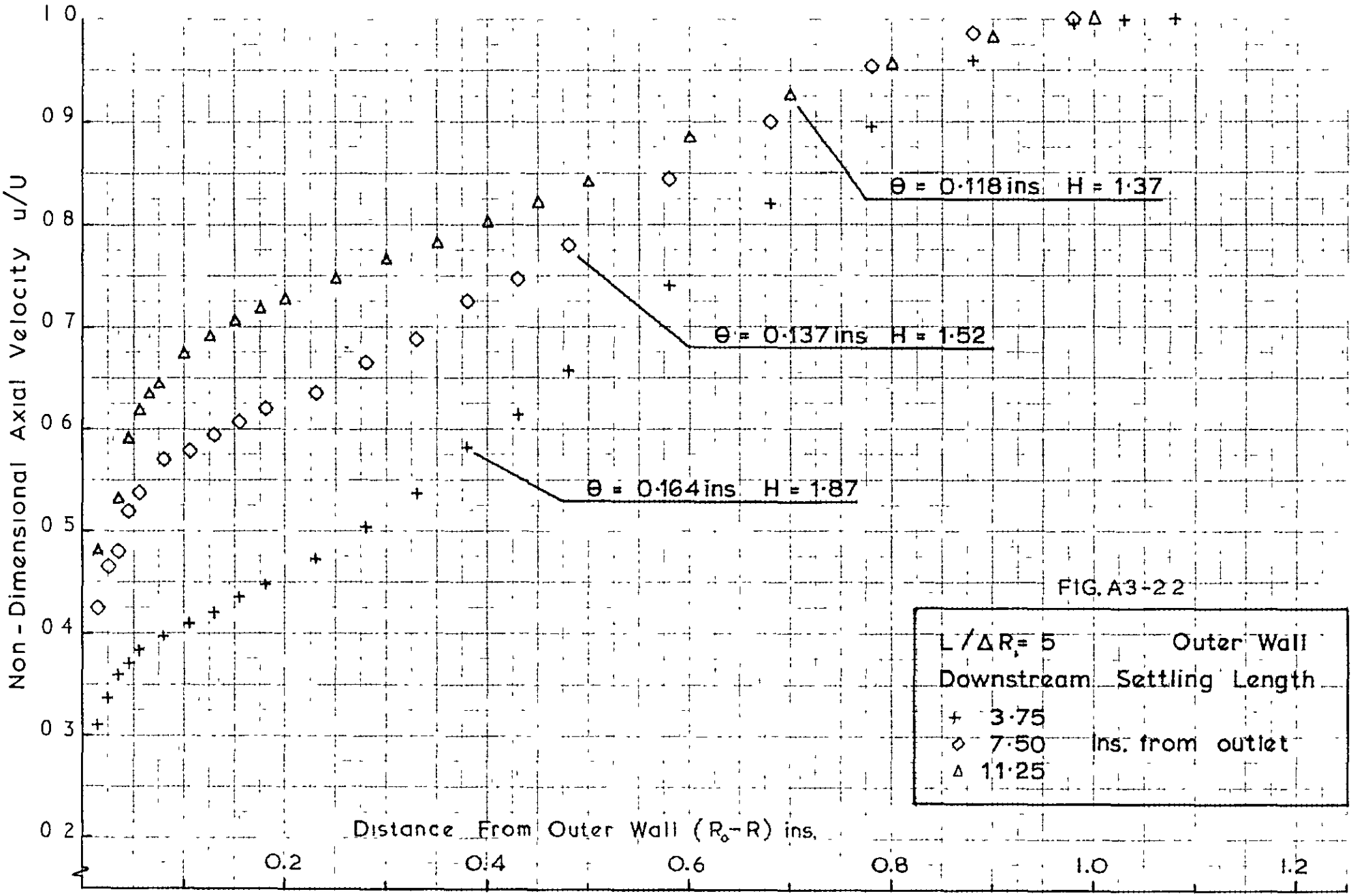

Non-Dimensional Axial Velocity u/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
Distance From Outer Wall (R₀-R) ins.
0.2
0.4
0.6
0.8
1.0
1.2
θ = 0·118 ins H = 1·37
θ = 0·137 ins H = 1·52
θ = 0·164 ins H = 1·87
L/ΔR = 5 Outer Wall
Downstream Settling Length
+ 3·75
◇ 7·50 Ins. from outlet
△ 11·25

FIG. A3-22

Appendix 4

Boundary Layer Parameters

$L/\Delta R_1 = 5$ Diffuser

TABLE A4-1

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.000 INS. N.D.DIST.(X/L)= 0.600

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.056	0.043	1.301
INNER WALL(REL TO RI)	0.049	0.038	1.287
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.055	0.042	1.304
(REL TO RO-RI)	0.327	0.251	1.304
INNER WALL(REL TO RI)	0.050	0.039	1.284
(REL TO RO-RI)	0.251	0.196	1.284

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.075	1.792
INNER WALL(REL TO RI)	0.071	1.803

UMEAN/UMAX= 0.895 BETA(MOMENTUM)= 1.016 ALPHA(ENERGY)= 1.045

FLOW= 33.86CUFT/SEC %FLOW IN OUTER LAYER= 0.540 OVERLAP=-0.000

TABLE A4-2

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 0.300 INS. N.D.DIST.(X/L)= 0.060

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.065	0.047	1.385
INNER WALL(REL TO RI)	0.056	0.042	1.314
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.064	0.046	1.391
(REL TO RO-RI)	0.366	0.264	1.391
INNER WALL(REL TO RI)	0.057	0.044	1.310
(REL TO RO-RI)	0.271	0.207	1.310

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.081	1.766
INNER WALL(REL TO RI)	0.078	1.793

UMEAN/UMAX= 0.885 BETA(MOMENTUM)= 1.022 ALPHA(ENERGY)= 1.059

FLOW= 34.73CUFT/SEC %FLOW IN OUTER LAYER= 0.528 OVERLAP=-0.007

TABLE A4-3

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 0.750 INS. N.D.DIST.(X/L)= 0.150

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.092	0.062	1.477
INNER WALL(REL TO RI)	0.073	0.052	1.404
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.090	0.061	1.485
(REL TO RO-RI)	0.480	0.323	1.485
INNER WALL(REL TO RI)	0.075	0.054	1.398
(REL TO RO-RI)	0.325	0.233	1.398

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.105	1.731
INNER WALL(REL TO RI)	0.094	1.756

UMEAN/UMAX= 0.856 BETA(MOMENTUM)= 1.033 ALPHA(ENERGY)= 1.089

FLOW= 34.69CUFT/SEC %FLOW IN OUTER LAYER= 0.549 OVERLAP= 0.002

TABLE A4-4

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.350 INS. N.D.DIST.(X/L)= 0.270

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.122	0.073	1.682
INNER WALL(REL TO RI)	0.092	0.063	1.460
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.120	0.071	1.693
(REL TO RO-RI)	0.602	0.356	1.693
INNER WALL(REL TO RI)	0.094	0.065	1.452
(REL TO RO-RI)	0.381	0.263	1.452

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.118	1.671
INNER WALL(REL TO RI)	0.113	1.735

UMEAN/UMAX= 0.825 BETA(MOMENTUM)= 1.050 ALPHA(ENERGY)= 1.137

FLOW= 33.87CUFT/SEC %FLOW IN OUTER LAYER= 0.514 OVERLAP= 0.028

TABLE A4-5

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.950 INS. N.D.DIST.(X/L)= 0.390

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.161	0.085	1.892
INNER WALL(REL TO RI)	0.115	0.076	1.514
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.157	0.083	1.909
(REL TO RO-RI)	0.743	0.389	1.909
INNER WALL(REL TO RI)	0.118	0.079	1.505
(REL TO RO-RI)	0.441	0.293	1.505

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.134	1.625
INNER WALL(REL TO RI)	0.135	1.712

UMEAN/UMAX= 0.791 BETA(MOMENTUM)= 1.072 ALPHA(ENERGY)= 1.194

FLOW= 33.41CUFT/SEC %FLOW IN OUTER LAYER= 0.513 OVERLAP= 0.004

TABLE A4-6

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 2.550 INS. N.D.DIST.(X/L)= 0.510

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.216	0.103	2.092
INNER WALL(REL TO RI)	0.131	0.083	1.581
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.209	0.099	2.117
(REL TO RO-RI)	0.931	0.440	2.117
INNER WALL(REL TO RI)	0.136	0.086	1.570
(REL TO RO-RI)	0.467	0.298	1.570

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.157	1.589
INNER WALL(REL TO RI)	0.146	1.689

UMEAN/UMAX= 0.756 BETA(MOMENTUM)= 1.098 ALPHA(ENERGY)= 1.265

FLOW= 33.78CUFT/SEC %FLOW IN OUTER LAYER= 0.525 OVERLAP=-0.010

TABLE A4-7

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.630

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.271	0.116	2.342
INNER WALL(REL TO RI)	0.149	0.092	1.620
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.262	0.110	2.376
(REL TO RO-RI)	1.104	0.465	2.376
INNER WALL(REL TO RI)	0.155	0.096	1.607
(REL TO RO-RI)	0.497	0.309	1.607

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.171	1.553
INNER WALL(REL TO RI)	0.161	1.676

UMEAN/UMAX= 0.723 BETA(MOMENTUM)= 1.127 ALPHA(ENERGY)= 1.346

FLOW= 34.11CUFT/SEC %FLOW IN OUTER LAYER= 0.527 OVERLAP=-0.005

TABLE A4-8

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.750 INS. N.D.DIST.(X/L)= 0.750

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.342	0.130	2.630
INNER WALL(REL TO RI)	0.162	0.098	1.661
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.329	0.123	2.678
(REL TO RO-RI)	1.320	0.493	2.678
INNER WALL(REL TO RI)	0.168	0.102	1.647
(REL TO RO-RI)	0.506	0.307	1.647

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.187	1.525
INNER WALL(REL TO RI)	0.170	1.661

UMEAN/UMAX= 0.687 BETA(MOMENTUM)= 1.165 ALPHA(ENERGY)= 1.452

FLOW= 34.16CUFT/SEC %FLOW IN OUTER LAYER= 0.533 OVERLAP= 0.030

TABLE A4-9

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.282 INS. N.D.DIST.(X/L)= 0.856

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.422	0.139	3.033
INNER WALL(REL TO RI)	0.169	0.101	1.664
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.404	0.130	3.103
(REL TO RO-RI)	1.557	0.502	3.103
INNER WALL(REL TO RI)	0.175	0.106	1.651
(REL TO RO-RI)	0.499	0.303	1.651

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.195	1.500
INNER WALL(REL TO RI)	0.176	1.658

UMEAN/UMAX= 0.650 BETA(MOMENTUM)= 1.214 ALPHA(ENERGY)= 1.589

FLOW= 33.95CUFT/SEC %FLOW IN OUTER LAYER= 0.523 OVERLAP= 0.074

TABLE A4-10

BLUE POSITION

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.511	0.149	3.424
INNER WALL(REL TO RI)	0.186	0.109	1.705
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.487	0.138	3.520
(REL TO RO-RI)	1.805	0.513	3.520
INNER WALL(REL TO RI)	0.194	0.115	1.689
(REL TO RO-RI)	0.524	0.310	1.689

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.204	1.474
INNER WALL(REL TO RI)	0.189	1.649

UMEAN/UMAX= 0.612 BETA(MOMENTUM)= 1.263 ALPHA(ENERGY)= 1.735

FLOW= 33.41CUFT/SEC %FLOW IN OUTER LAYER= 0.553 OVERLAP=-0.001

TABLE A4-11

GREEN POSITION

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.511	0.149	3.424
INNER WALL(REL TO RI)	0.186	0.109	1.705
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.487	0.138	3.520
(REL TO RO-RI)	1.805	0.513	3.520
INNER WALL(REL TO RI)	0.194	0.115	1.689
(REL TO RO-RI)	0.524	0.310	1.689

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.204	1.474
INNER WALL(REL TO RI)	0.189	1.649

UMEAN/UMAX= 0.612 BETA(MOMENTUM)= 1.263 ALPHA(ENERGY)= 1.735

FLOW= 33.41CUFT/SEC %FLOW IN OUTER LAYER= 0.553 OVERLAP=-0.001

TABLE A4-12

RED POSITION

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.472	0.175	2.695
INNER WALL(REL TO RI)	0.186	0.109	1.705
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.449	0.163	2.763
(REL TO RO-RI)	1.665	0.603	2.763
INNER WALL(REL TO RI)	0.194	0.115	1.689
(REL TO RO-RI)	0.524	0.310	1.689

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.247	1.519
INNER WALL(REL TO RI)	0.189	1.649

UMEAN/UMAX= 0.636 BETA(MOMENTUM)= 1.192 ALPHA(ENERGY)= 1.536

FLOW= 34.70CUFT/SEC %FLOW IN OUTER LAYER= 0.602 OVERLAP=-0.081

TABLE A4-13

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.322	0.174	1.848
INNER WALL(REL TO RI)	0.224	0.132	1.694
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.307	0.164	1.867
(REL TO RO-RI)	1.125	0.603	1.867
INNER WALL(REL TO RI)	0.235	0.140	1.679
(REL TO RO-RI)	0.625	0.372	1.679

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.260	1.582
INNER WALL(REL TO RI)	0.229	1.638

UMEAN/UMAX= 0.705 BETA(MOMENTUM)= 1.088 ALPHA(ENERGY)= 1.260

FLOW= 33.62CUFT/SEC %FLOW IN OUTER LAYER= 0.545 OVERLAP= 0.085

TABLE A4-14

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.217	0.144	1.510
INNER WALL(REL TO RI)	0.215	0.139	1.546
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.208	0.137	1.519
(REL TO RO-RI)	0.761	0.501	1.519
INNER WALL(REL TO RI)	0.227	0.148	1.533
(REL TO RO-RI)	0.606	0.395	1.533

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.230	1.685
INNER WALL(REL TO RI)	0.250	1.685

UMEAN/UMAX= 0.770 BETA(MOMENTUM)= 1.044 ALPHA(ENERGY)= 1.130

FLOW= 33.36CUFT/SEC %FLOW IN OUTER LAYER= 0.541 OVERLAP=-0.025

TABLE A4-15

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.169	0.124	1.365
INNER WALL(REL TO RI)	0.118	0.088	1.338
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.162	0.118	1.372
(REL TO RO-RI)	0.592	0.432	1.372
INNER WALL(REL TO RI)	0.123	0.092	1.331
(REL TO RO-RI)	0.327	0.246	1.331

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.206	1.751
INNER WALL(REL TO RI)	0.163	1.774

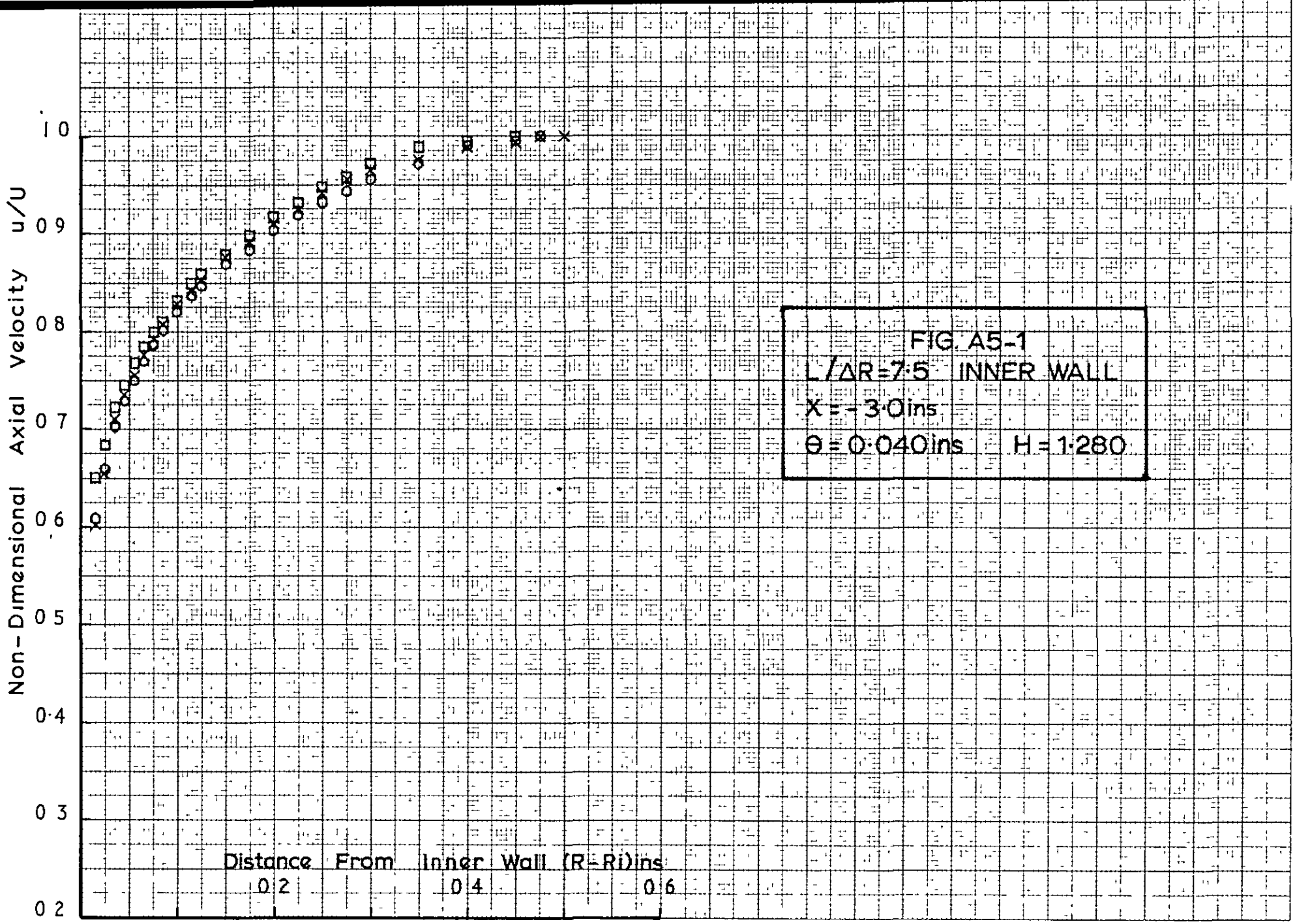
UMEAN/UMAX= 0.845 BETA(MOMENTUM)= 1.024 ALPHA(ENERGY)= 1.067

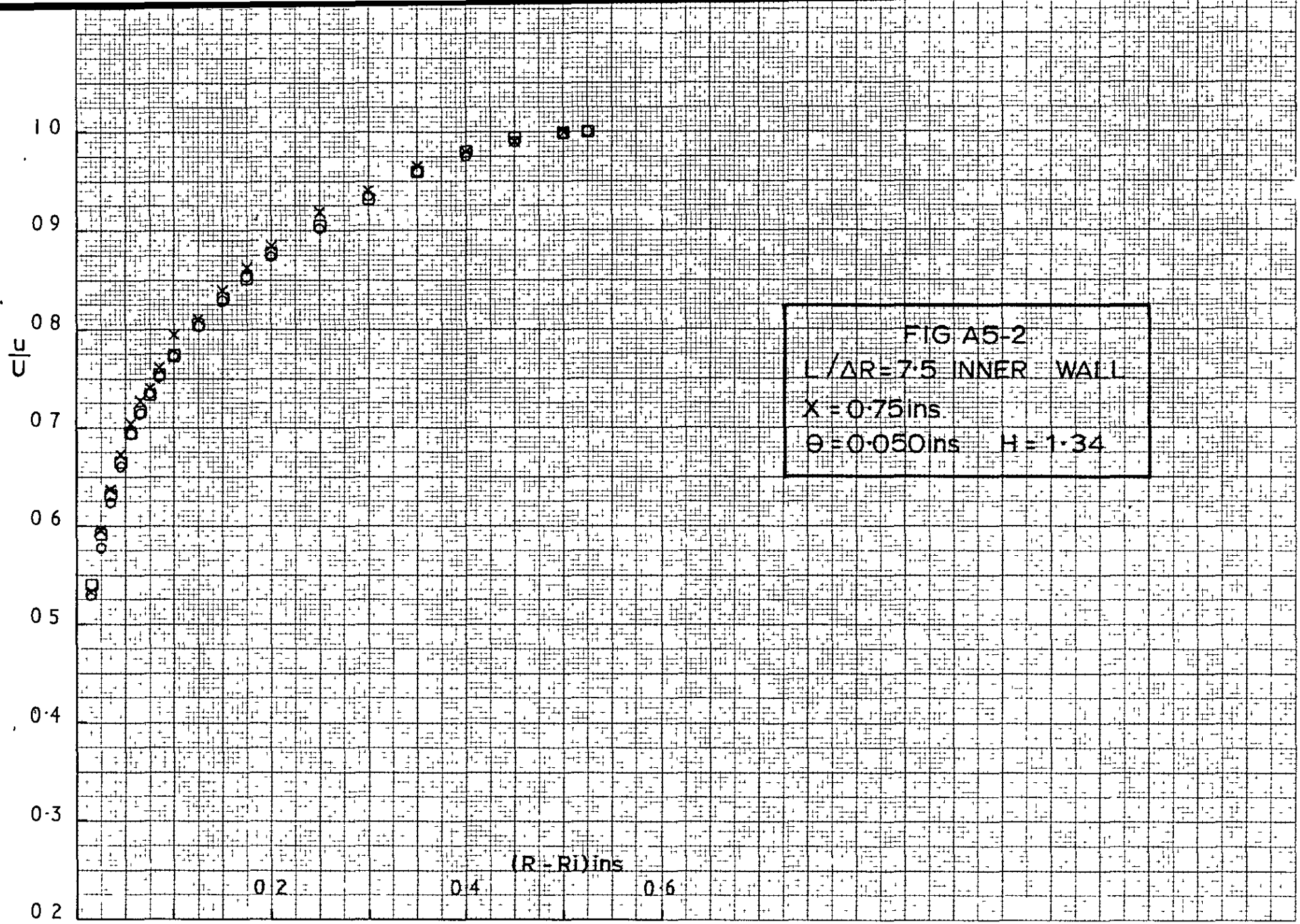
FLOW= 31.73CUFT/SEC %FLOW IN OUTER LAYER= 0.579 OVERLAP= 0.145

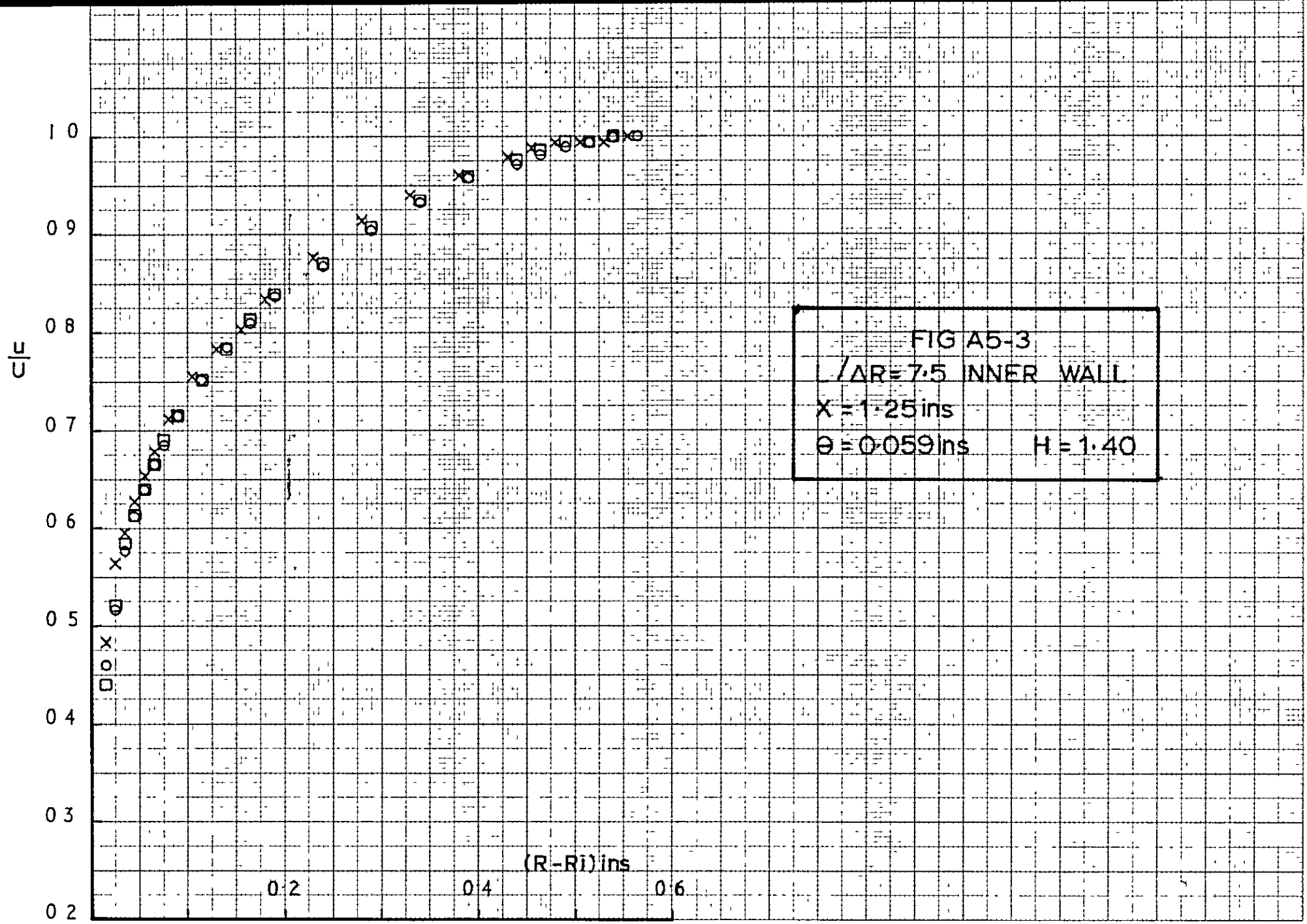
Appendix 5

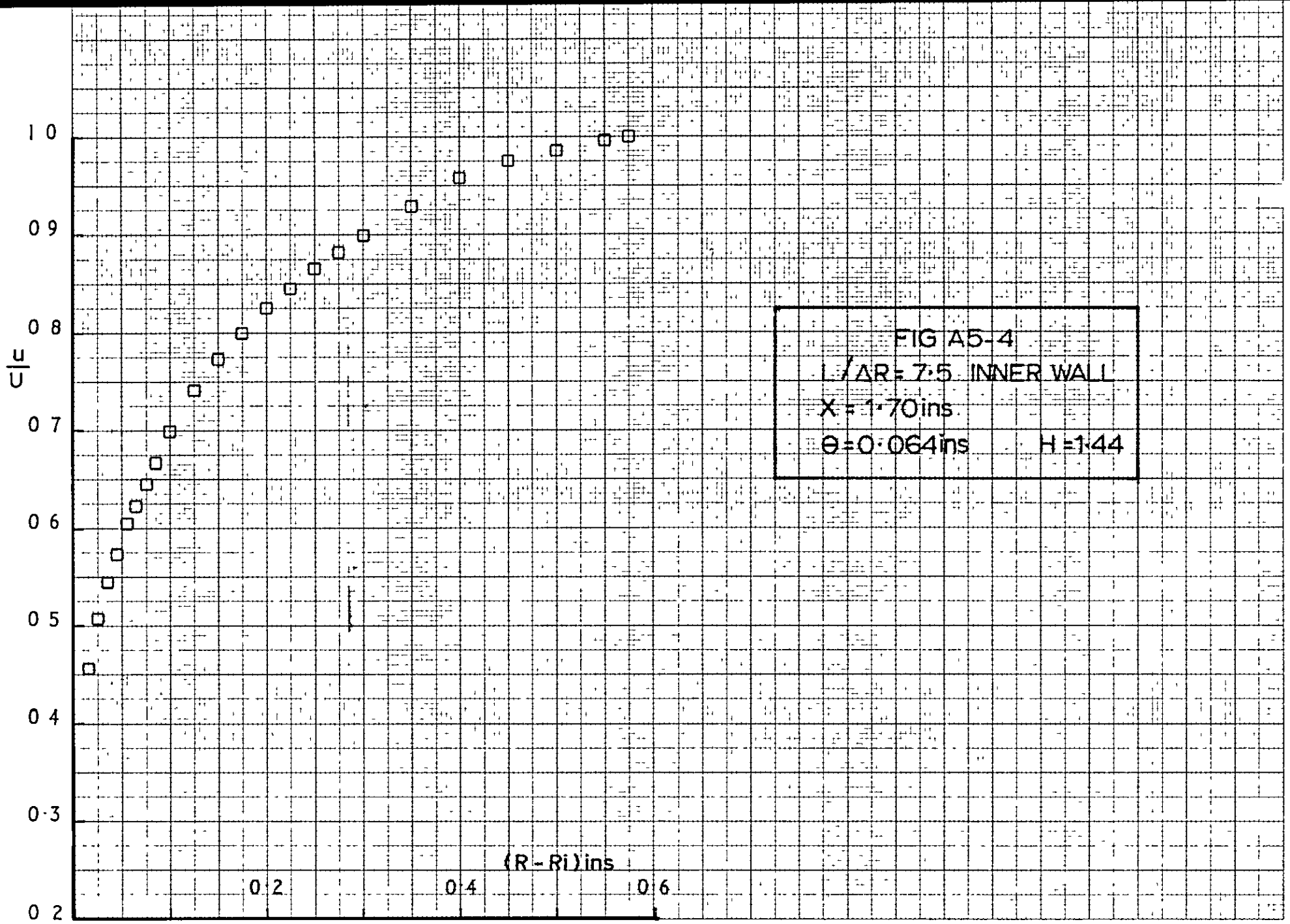
Mean Velocity Profiles

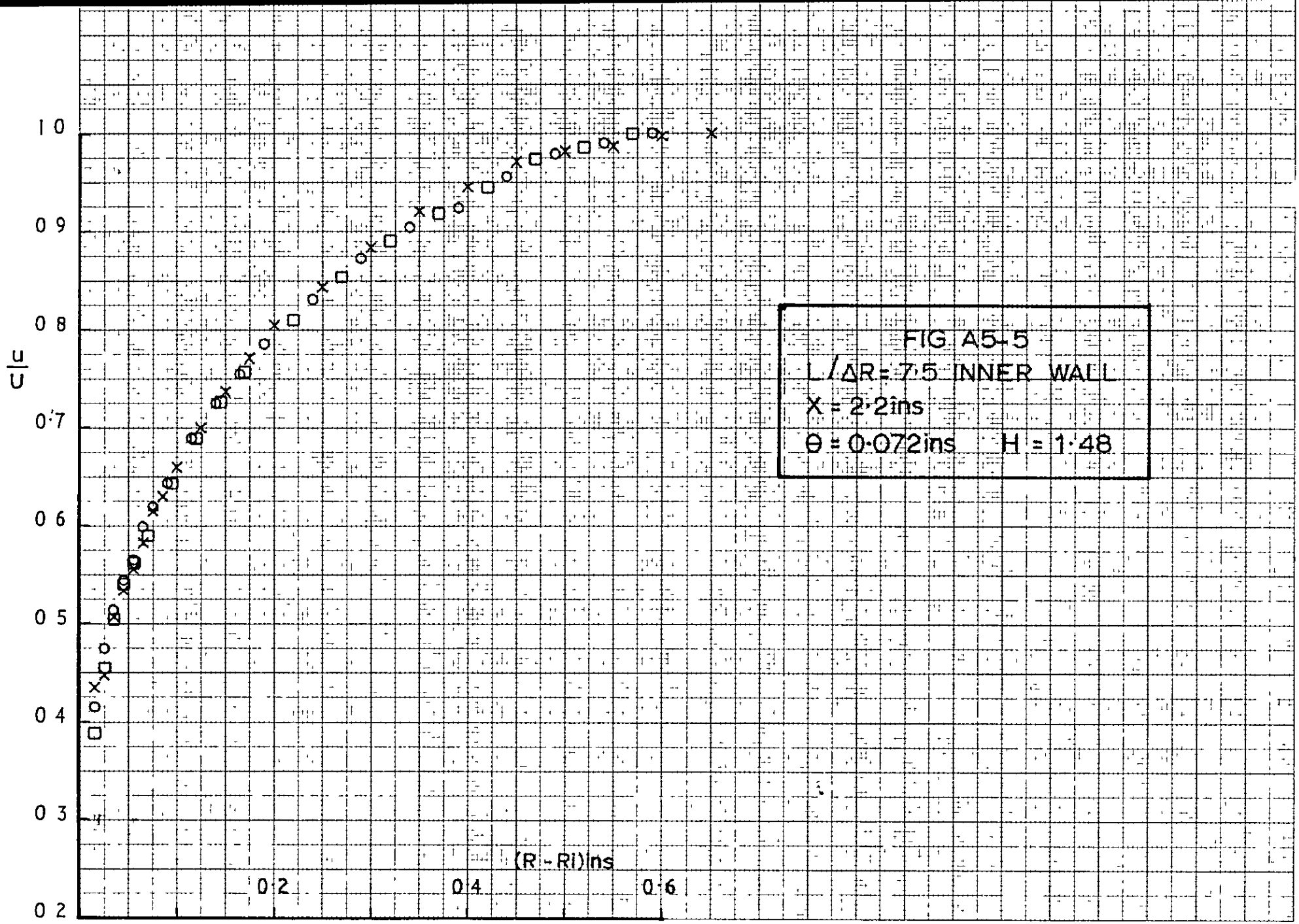
$L/\Delta R_1 = 7.5$ Diffuser

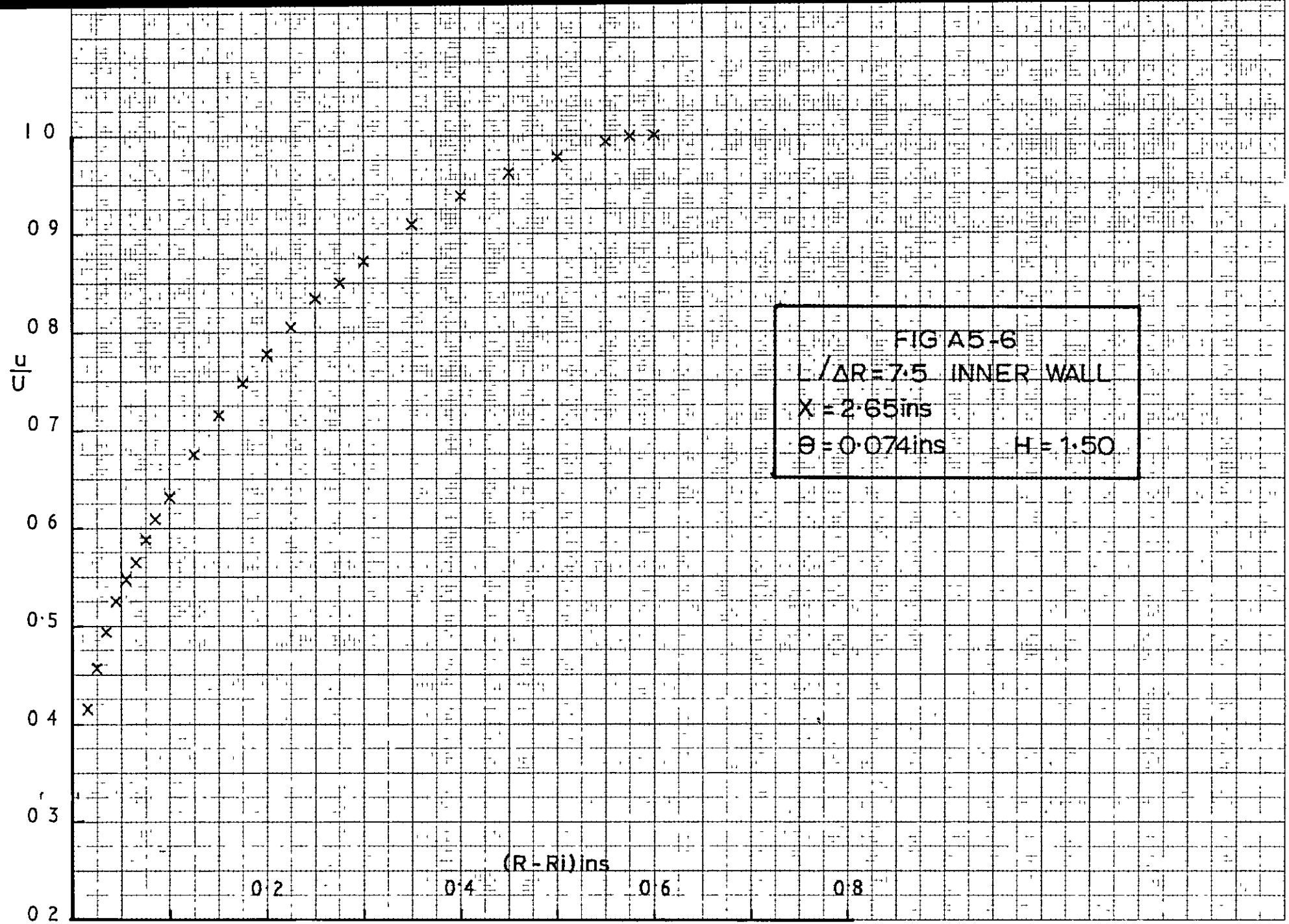

Non-Dimensional Axial Velocity u/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
Distance From Inner Wall (R-Ri)ins
0·2
0·4
0·6
FIG. A5-1
L/ΔR=7·5 INNER WALL
X = -3·0ins
θ = 0·040ins H = 1·280

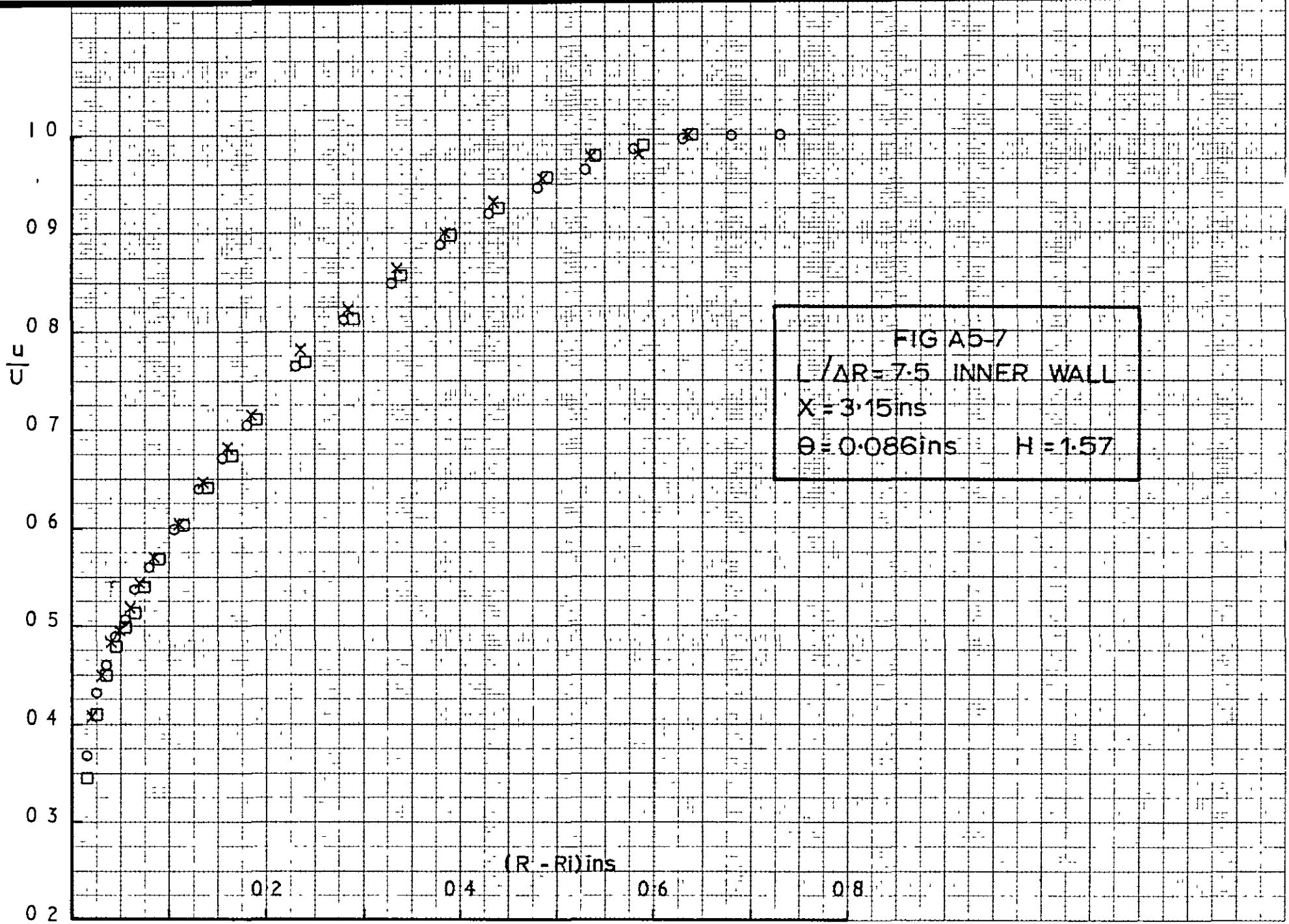

1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
(R - Ri) ins
FIG A5-2
L/ΔR = 7·5 INNER WALL
X = 0·75 ins
Θ = 0·050 ins H = 1·34

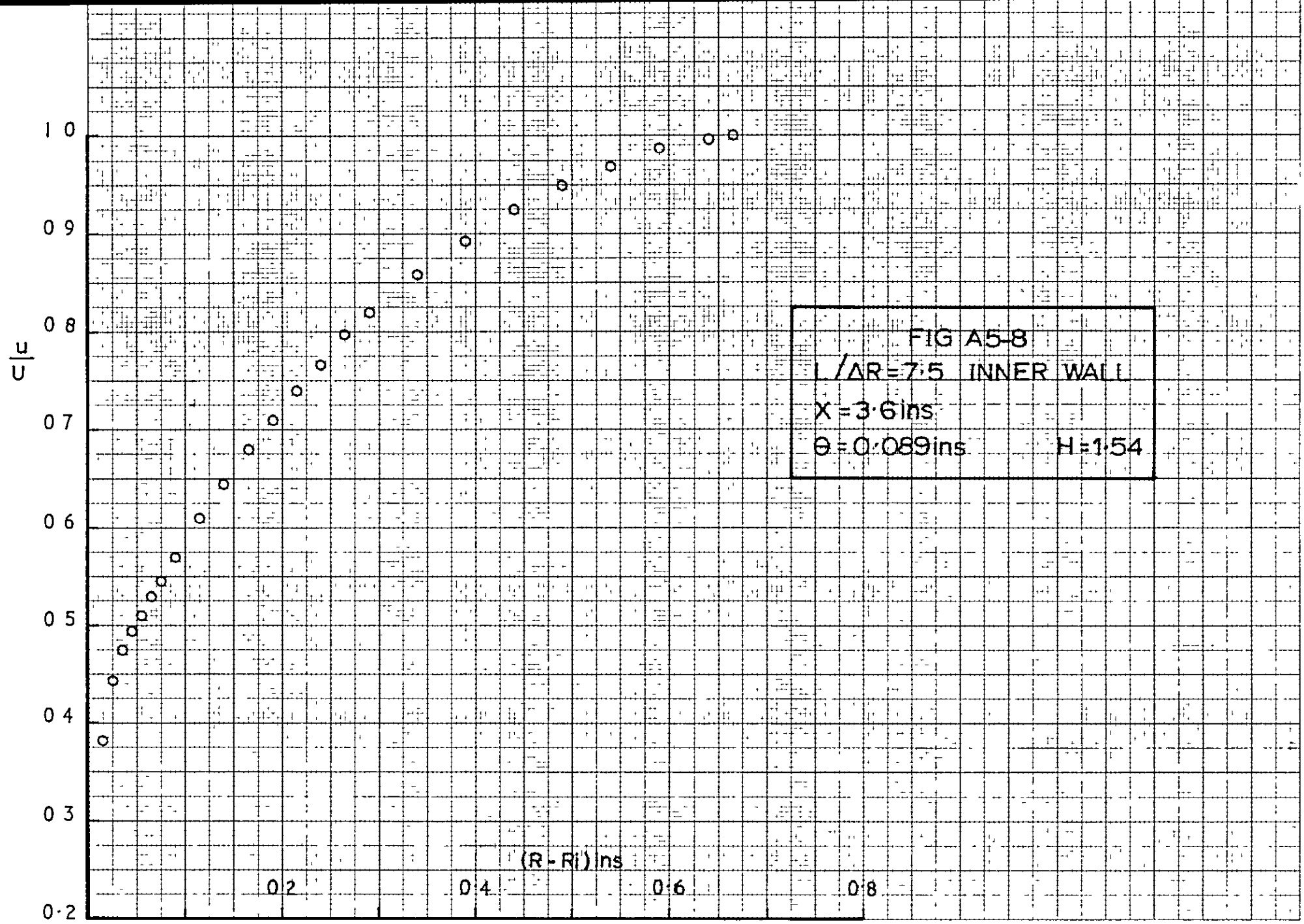

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
u/U
0·2
0·4
0·6
(R-Ri) ins
FIG A5-3
L/ΔR = 7·5 INNER WALL
X = 1·25 ins
θ = 0·059 ins
H = 1·40

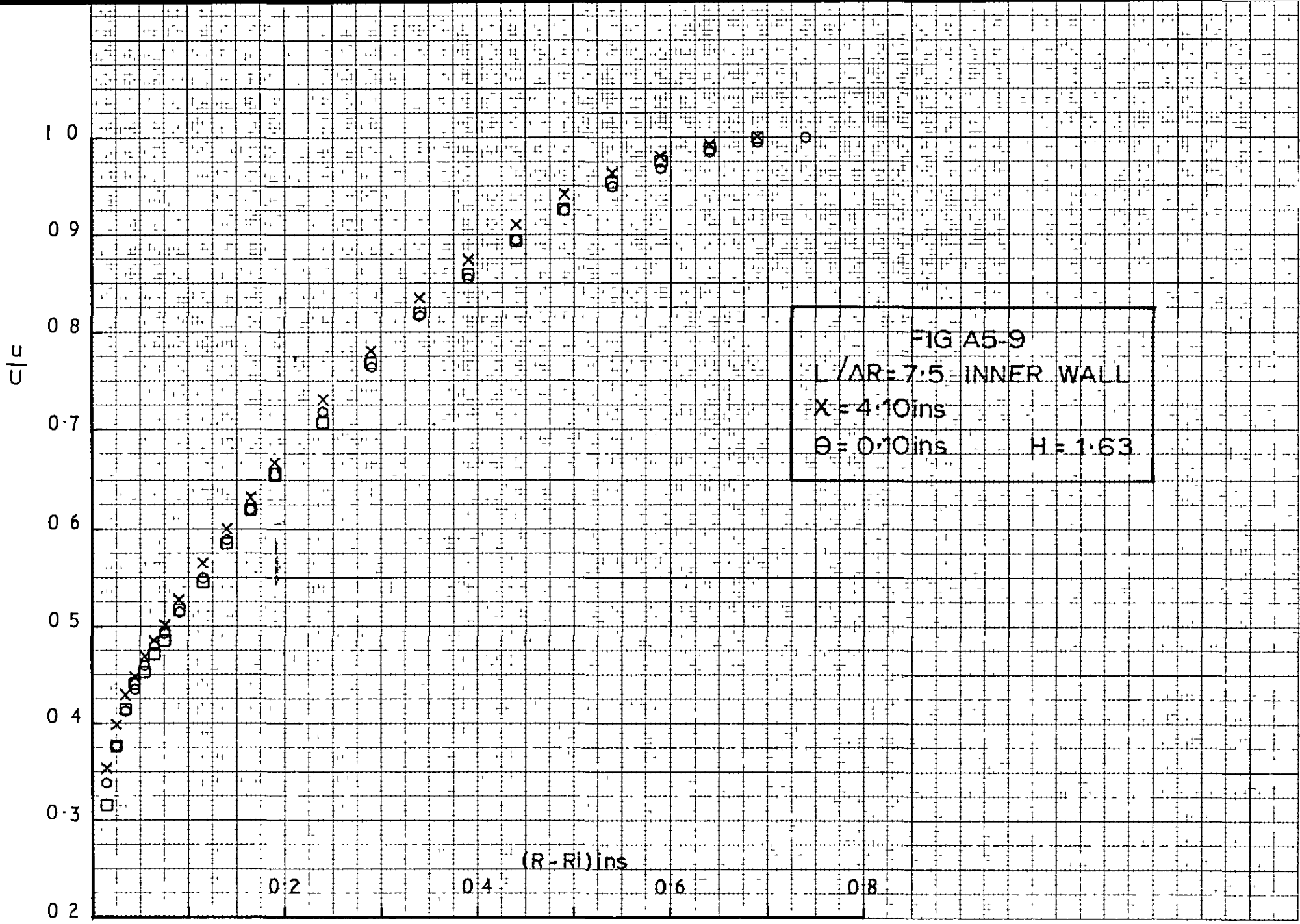

1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
(R-Ri) ins
FIG A5-4
L/ΔR = 7·5 INNER WALL
X = 1·70 ins
θ = 0·064 ins
H = 1·44

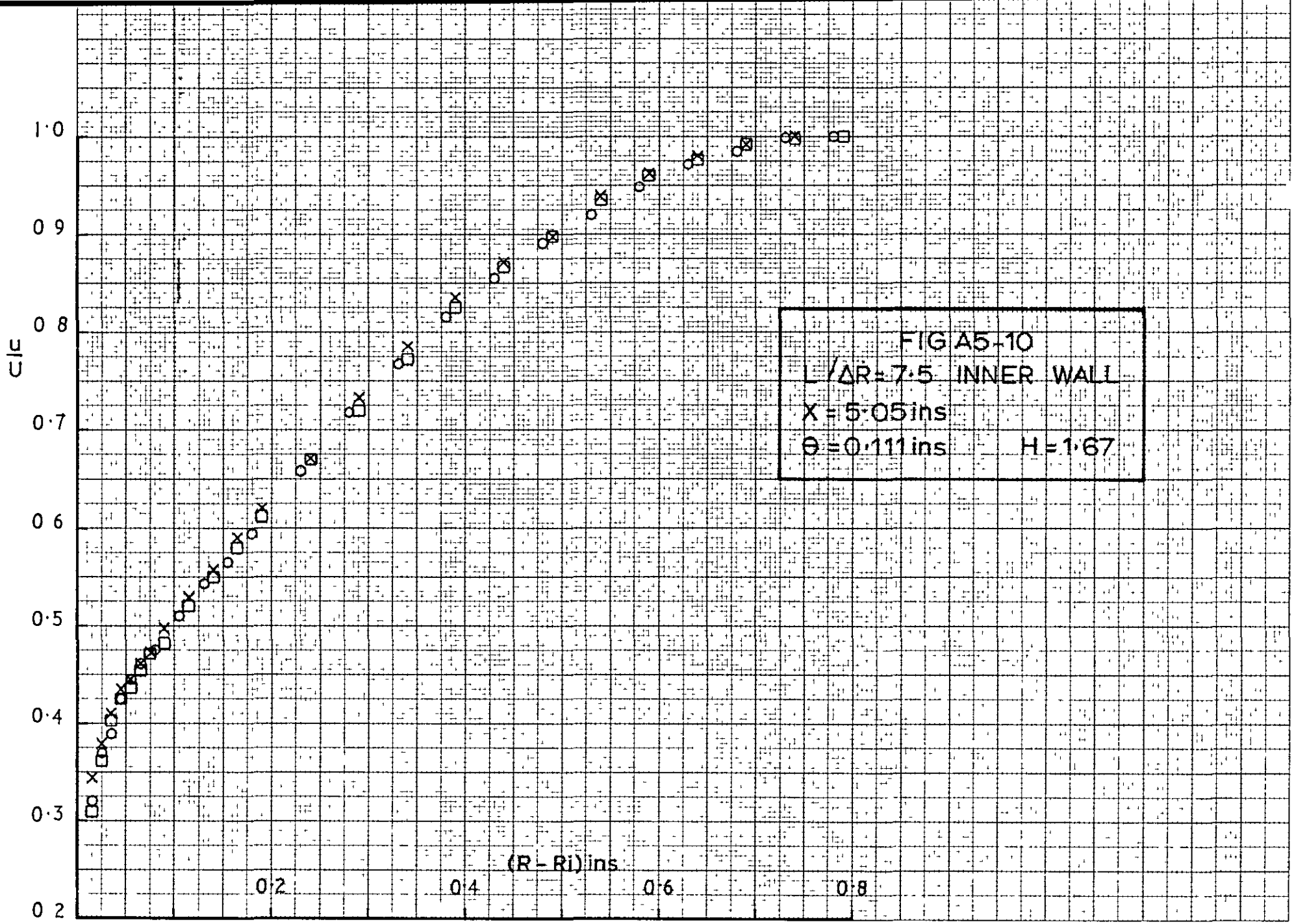

1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
(R - Ri)ins
FIG A5-5
L/ΔR = 7·5 INNER WALL
X = 2·2ins
θ = 0·072ins H = 1·48

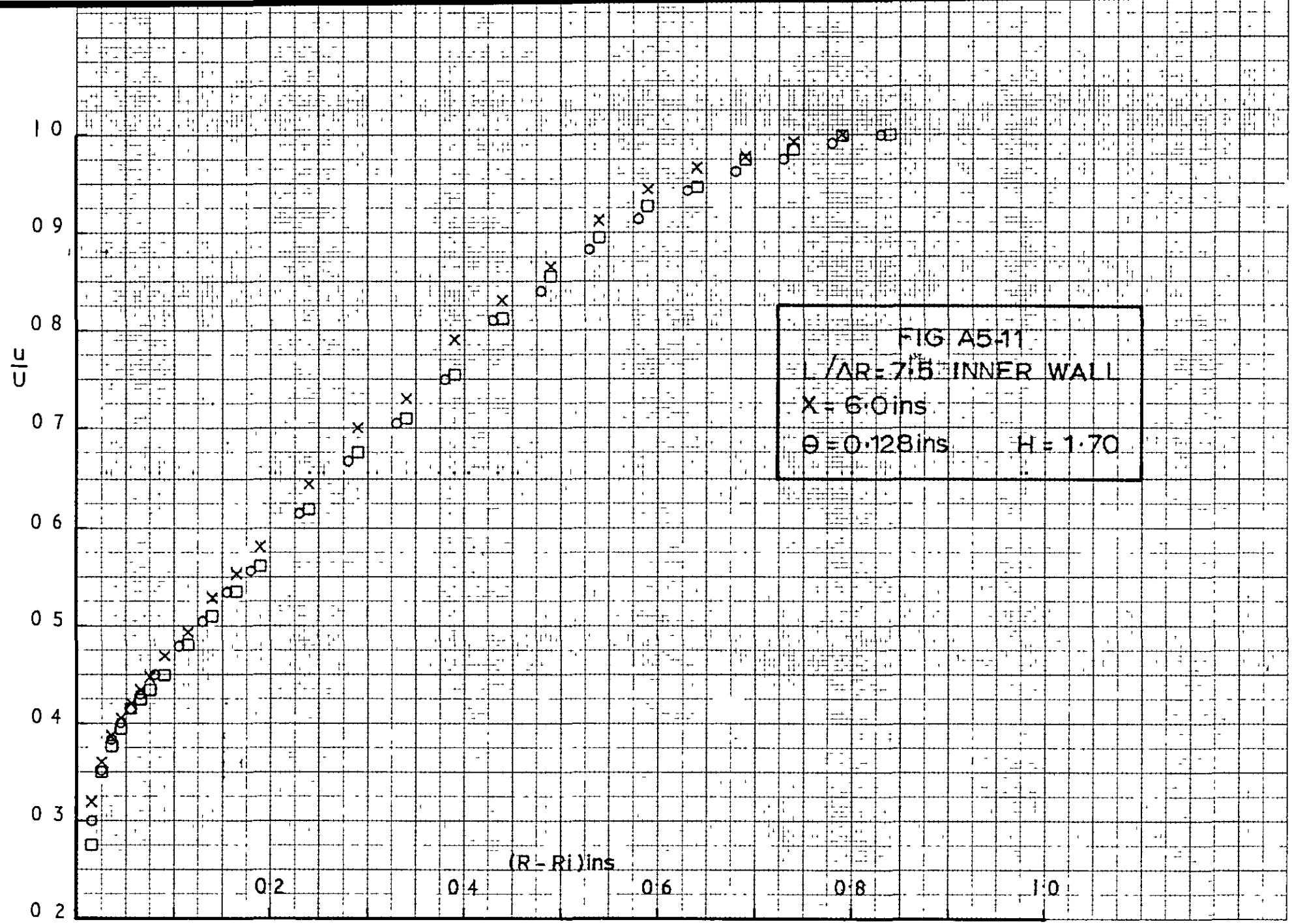

1 0
0 9
0 8
0 7
0 6
0·5
0 4
0 3
0 2
U/u
0 2
0 4
0 6
0 8
(R - Ri) ins
FIG A5-6
L/ΔR=7·5 INNER WALL
X = 2·65ins
θ = 0·074ins
H = 1·50

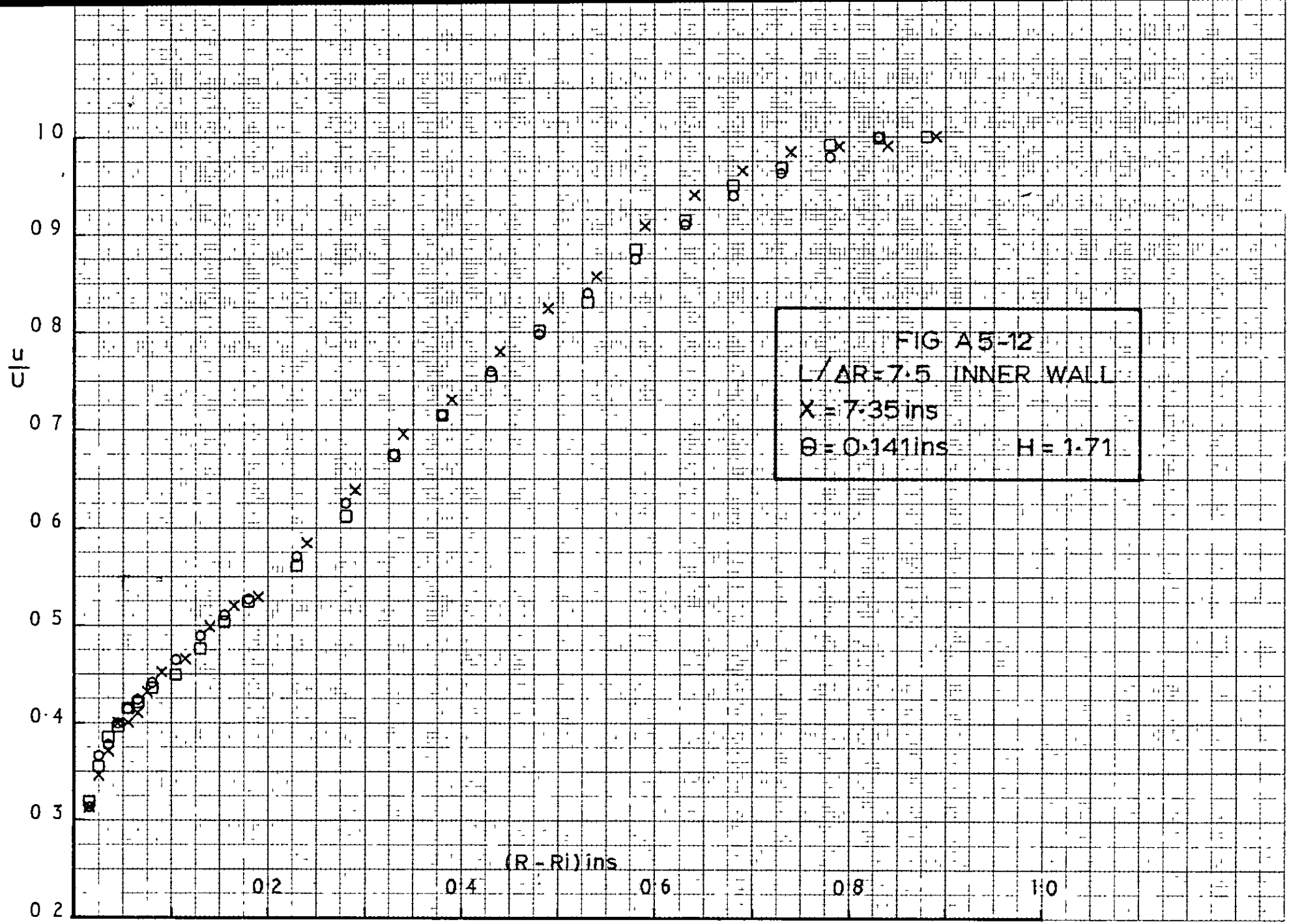

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
U/u
0 2
0 4
0 6
0 8
(R - Ri)ins
FIG A5-7
L/ΔR = 7·5 INNER WALL
X = 3·15ins
θ = 0·086ins H = 1·57

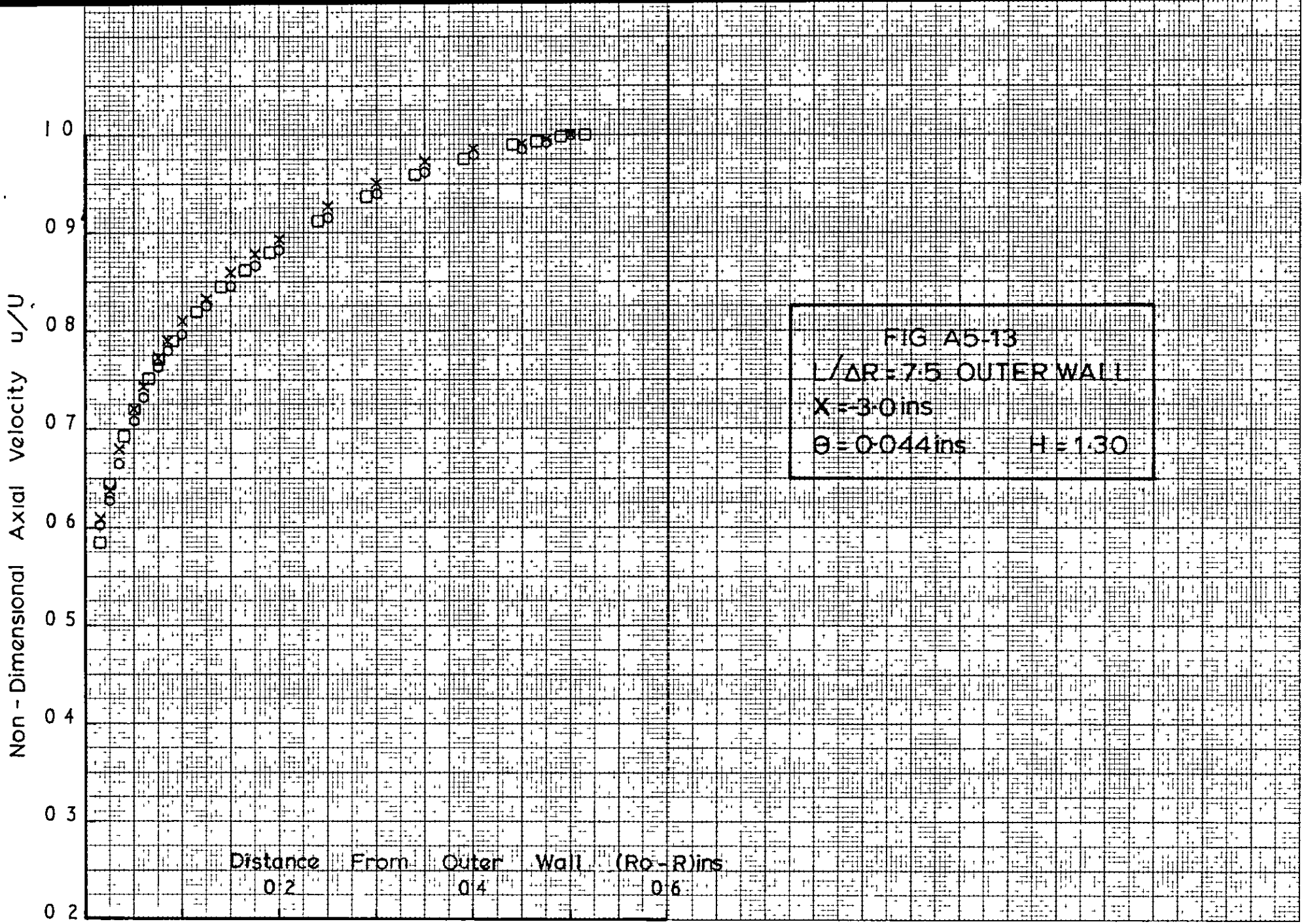

1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
0·8
(R - Ri) ins
FIG A5-8
L/ΔR = 7·5 INNER WALL
X = 3·6 ins
θ = 0·089 ins
H = 1·54


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
0·8
(R-Ri)ins
FIG A5-9
L/ΔR= 7·5 INNER WALL
X = 4·10ins
θ = 0·10ins
H = 1·63


FIG A5-10
L/ΔR = 7·5 INNER WALL
X = 5·05 ins
θ = 0·111 ins
H = 1·67
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(R – Ri) ins
0·2
0·4
0·6
0·8


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
0·8
1·0
(R - Ri) ins
FIG A5-11
L/ΔR = 7·5 INNER WALL
X = 6·0 ins
θ = 0·128 ins
H = 1·70


FIG A5-12
L/ΔR = 7·5 INNER WALL
X = 7·35 ins
θ = 0·141 ins
H = 1·71
u/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(R - Ri) ins
0·2
0·4
0·6
0·8
1·0


Non - Dimensional Axial Velocity u/U
1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
Distance From Outer Wall (Ro - R)ins
0·2
0·4
0·6
FIG A5-13
L/ΔR = 7·5 OUTER WALL
X = -3·0 ins
Θ = 0·044 ins H = 1·30

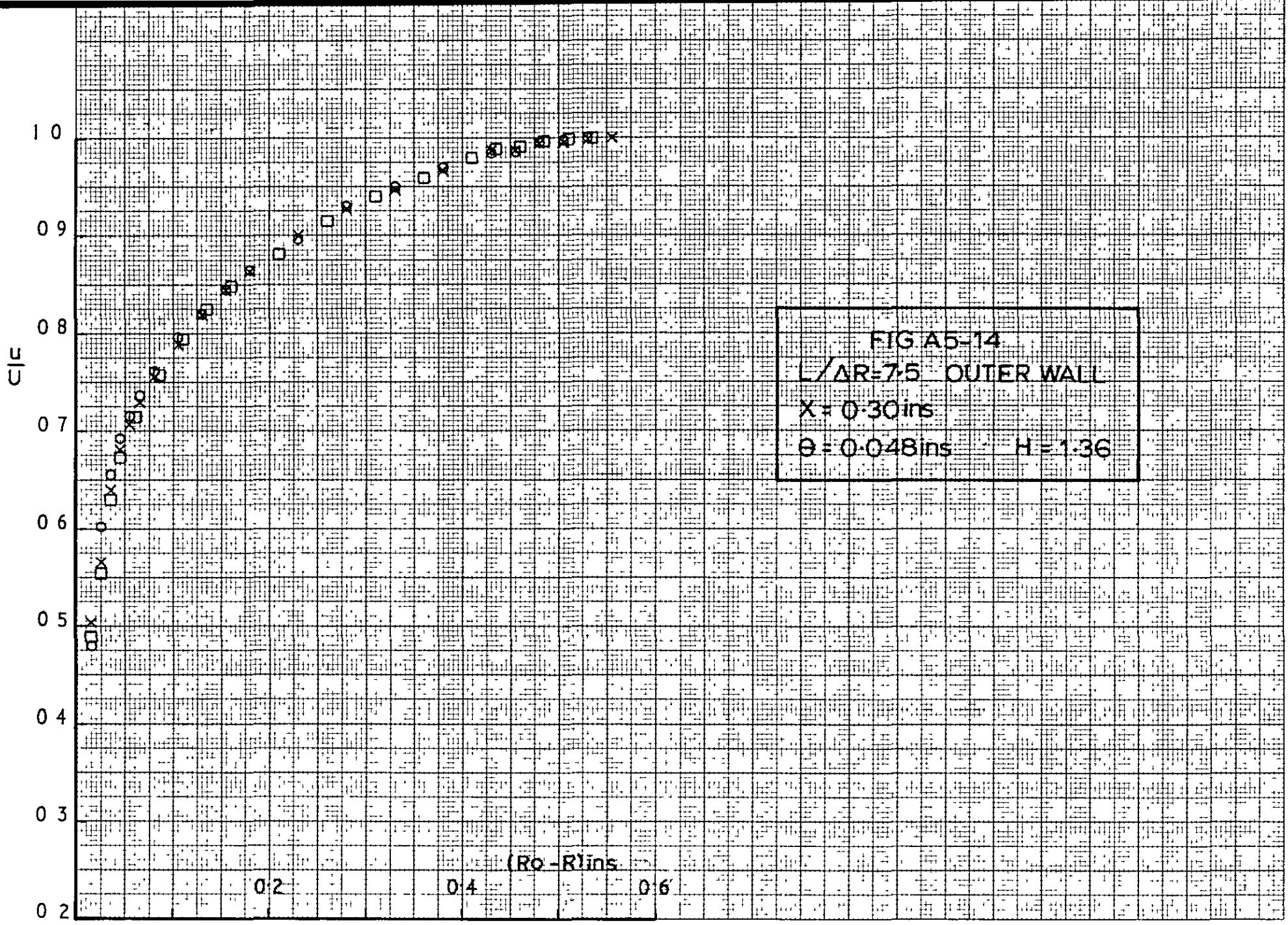
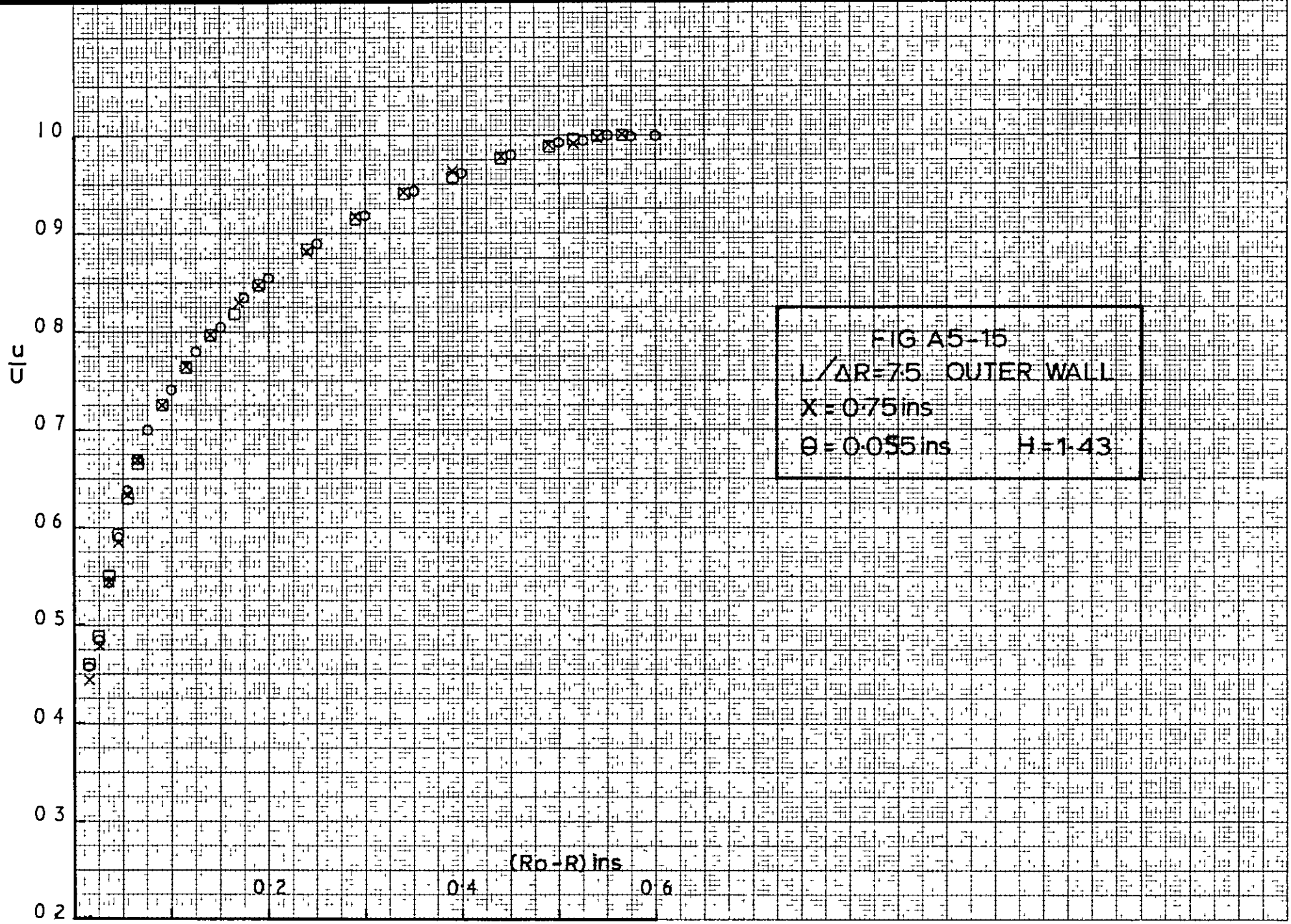
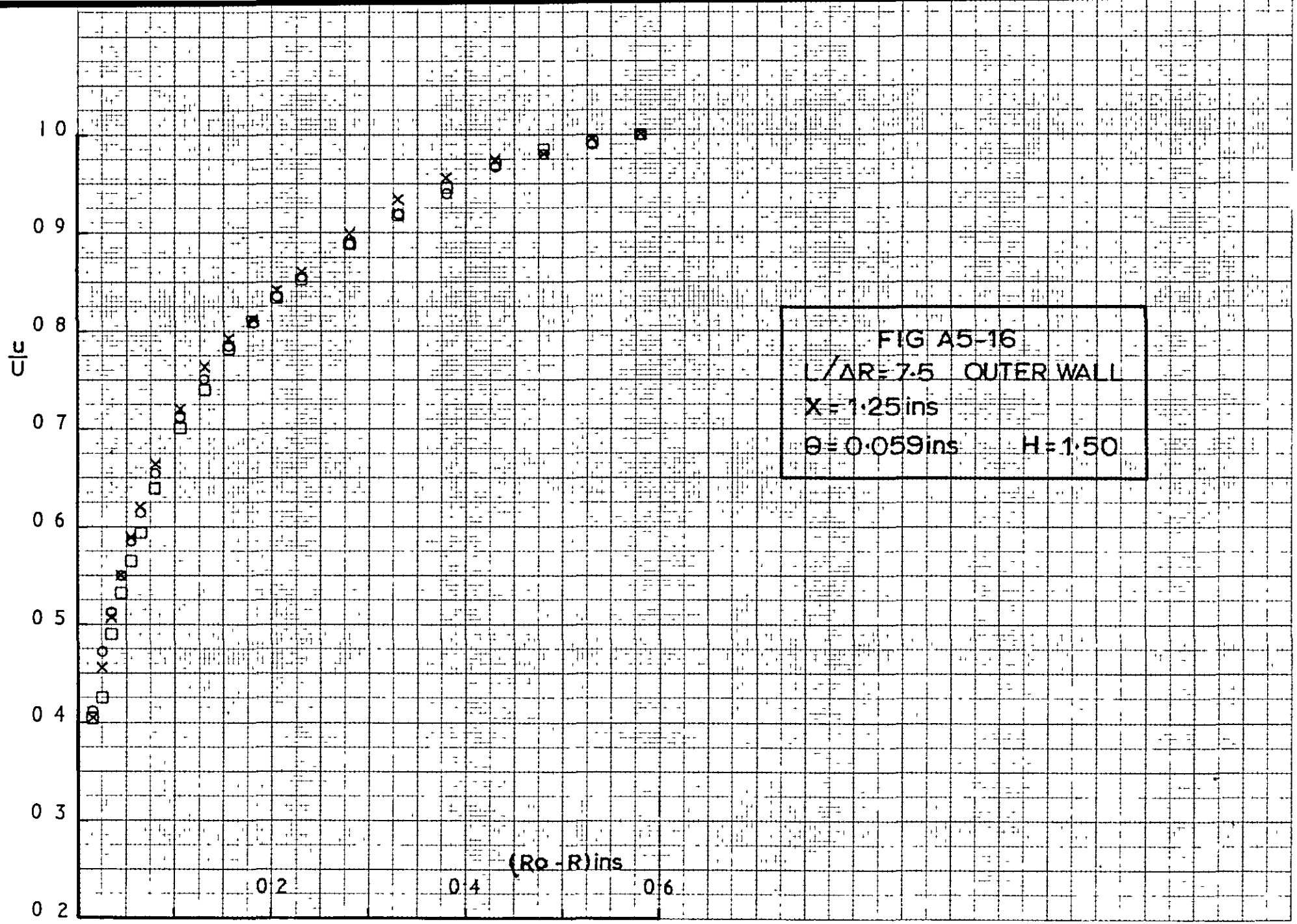
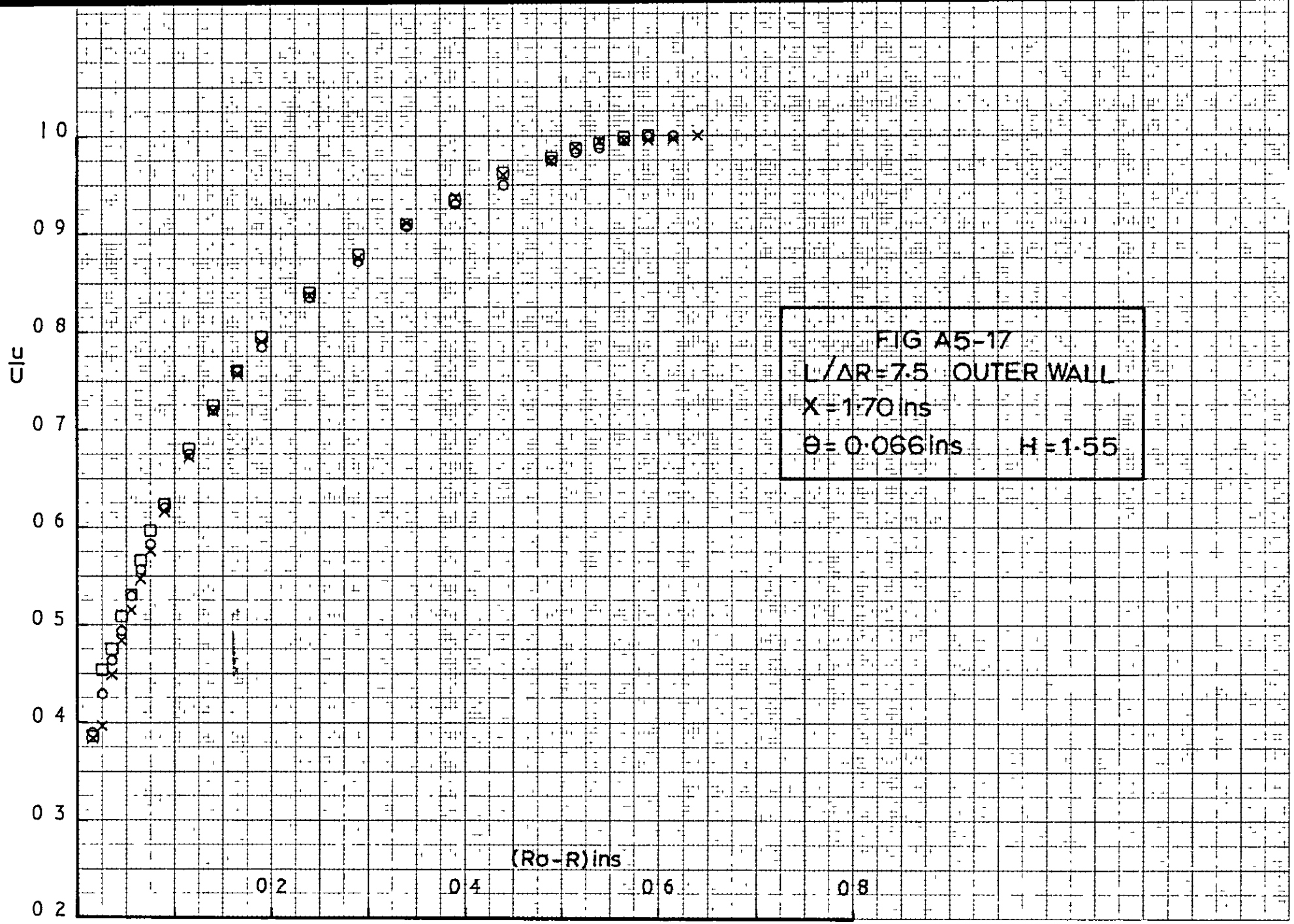
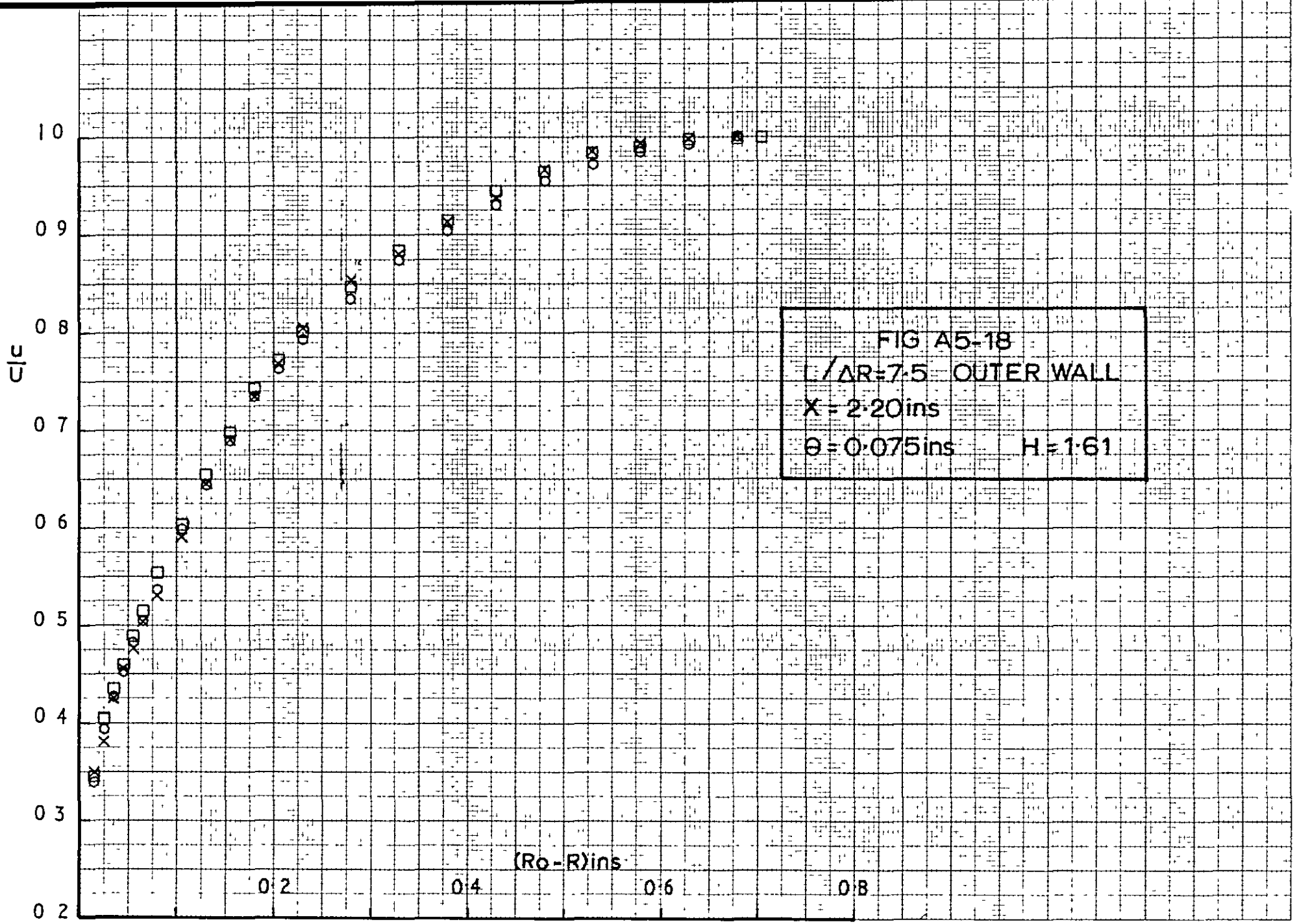


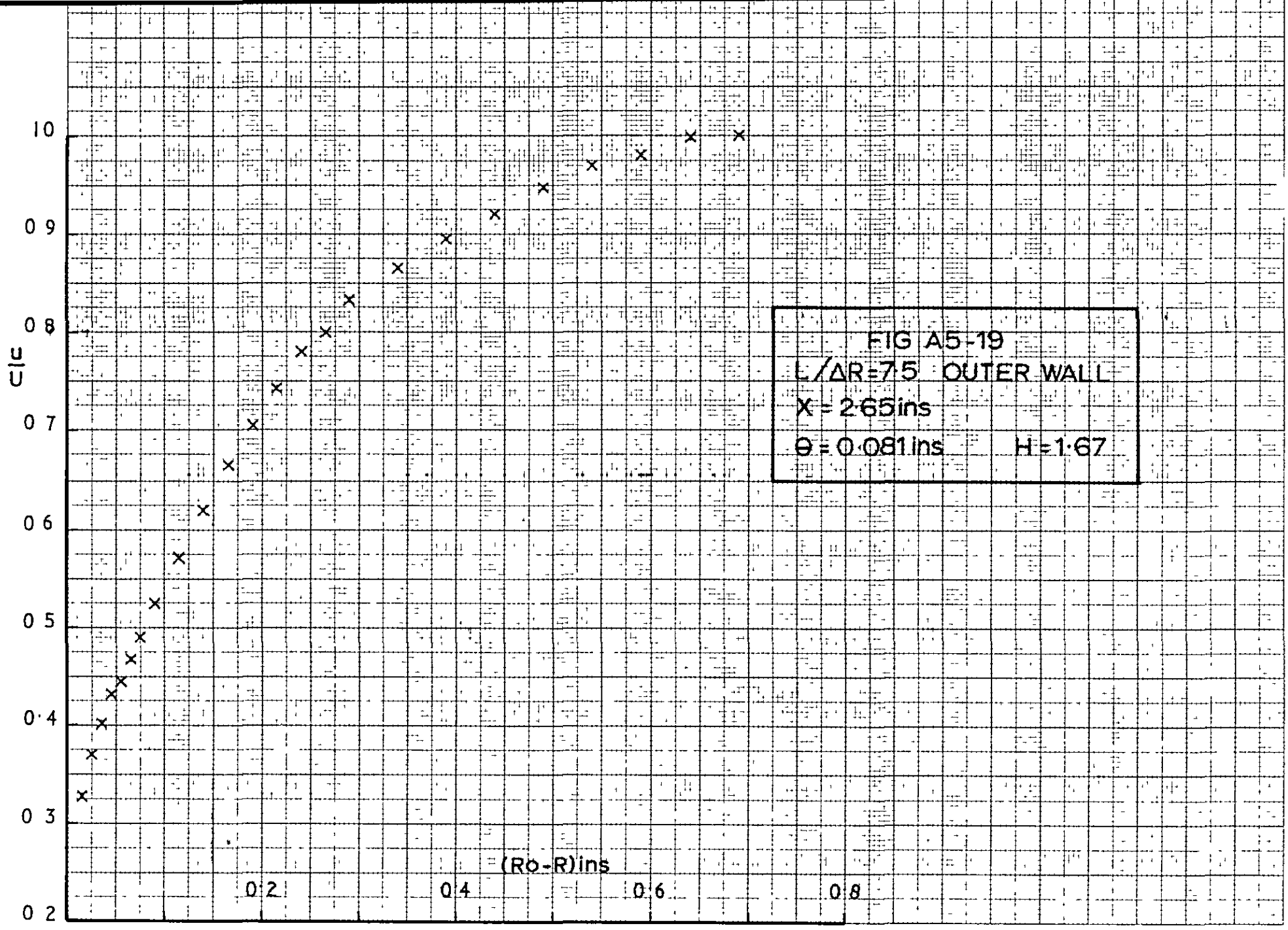
FIG A5-14
L/ΔR=7·5 OUTER WALL
X = 0·30ins
θ = 0·048ins H = 1·36

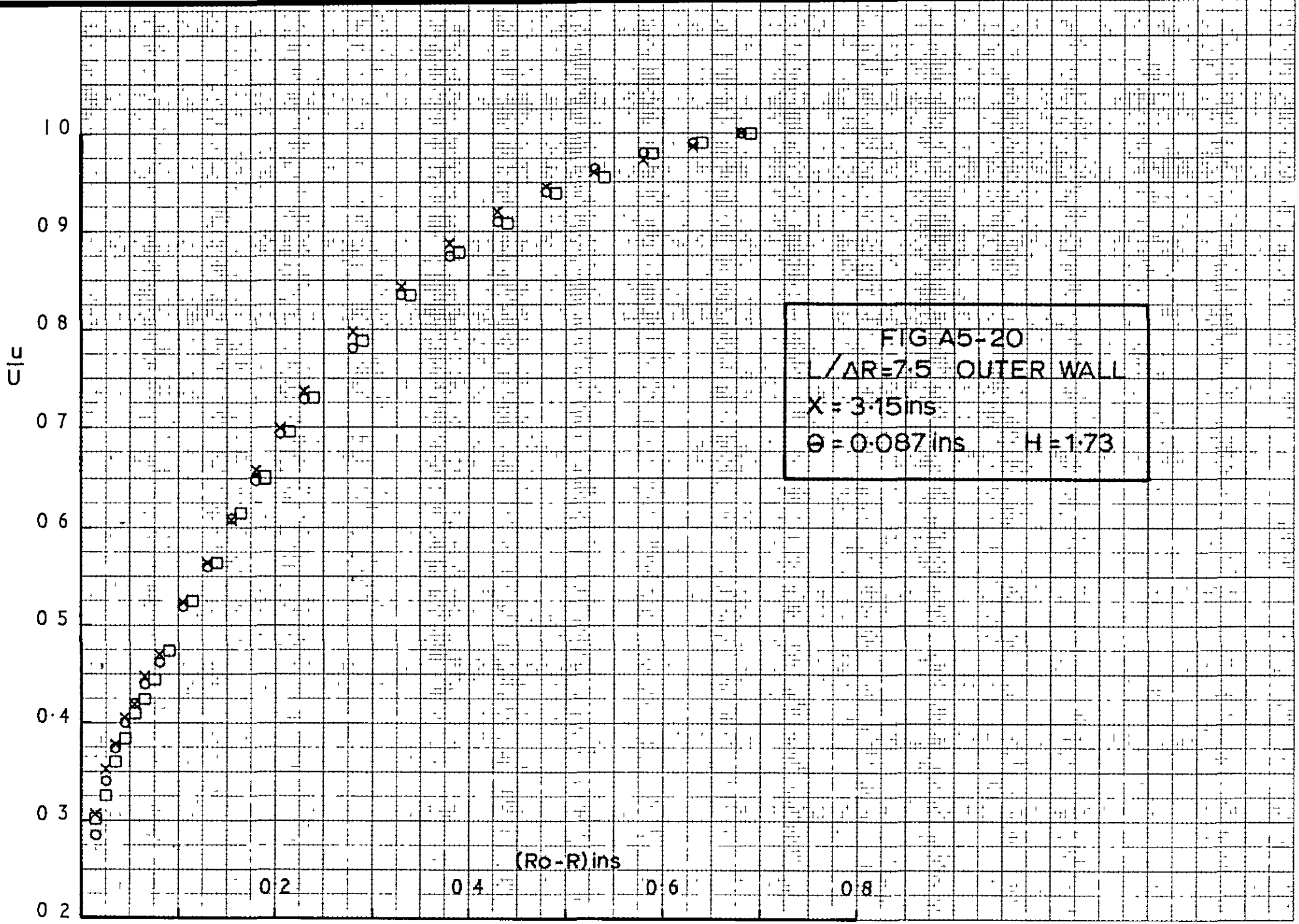

U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·2
0·4
0·6
(Ro-R) ins
FIG A5-15
L/ΔR=7·5 OUTER WALL
X=0·75 ins
θ=0·055 ins
H=1·43

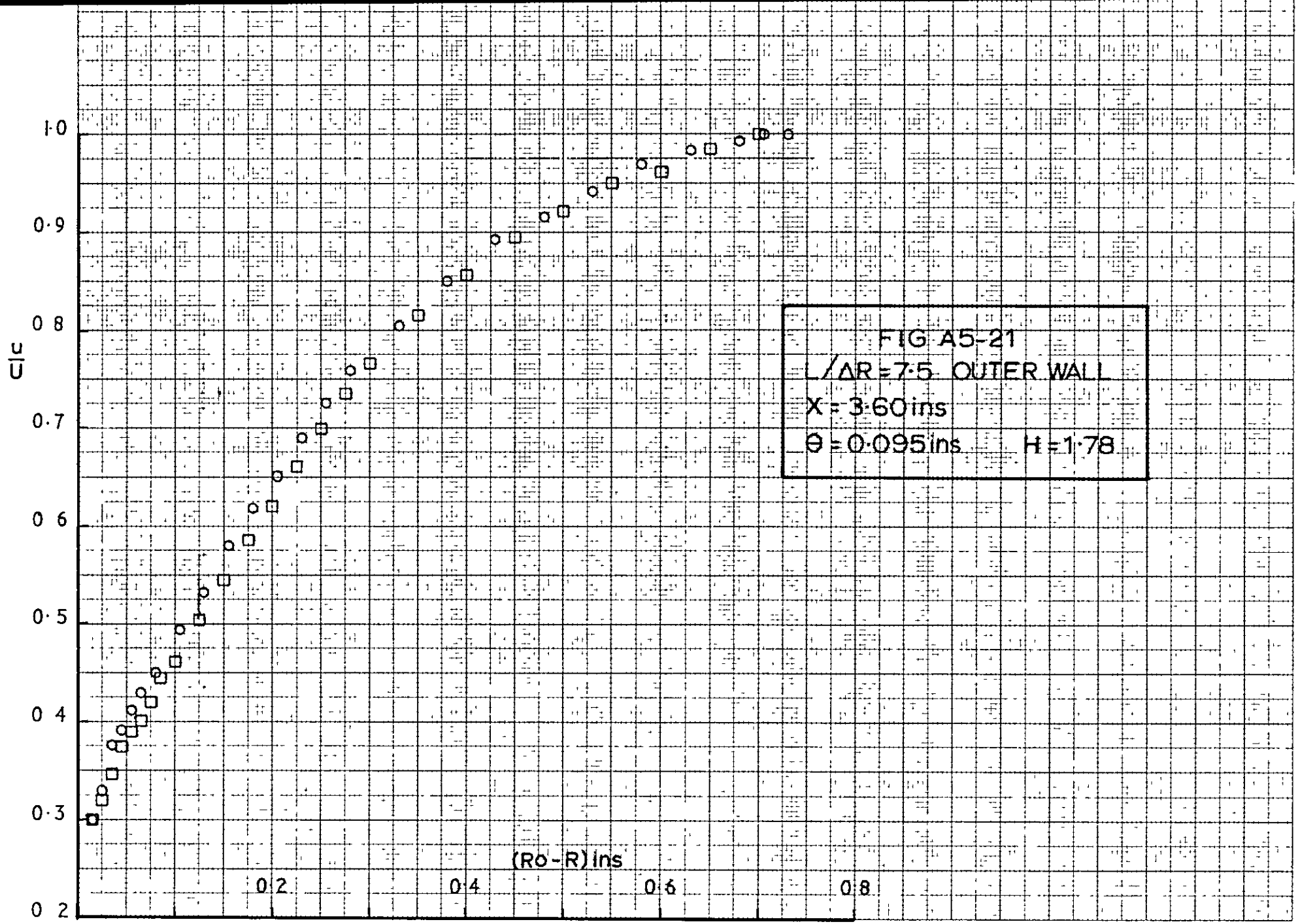

U/u
1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
0 2
0 4
0 6
(Ro - R) ins
FIG A5-16
L/ΔR = 7·5 OUTER WALL
X = 1·25 ins
Θ = 0·059 ins
H = 1·50

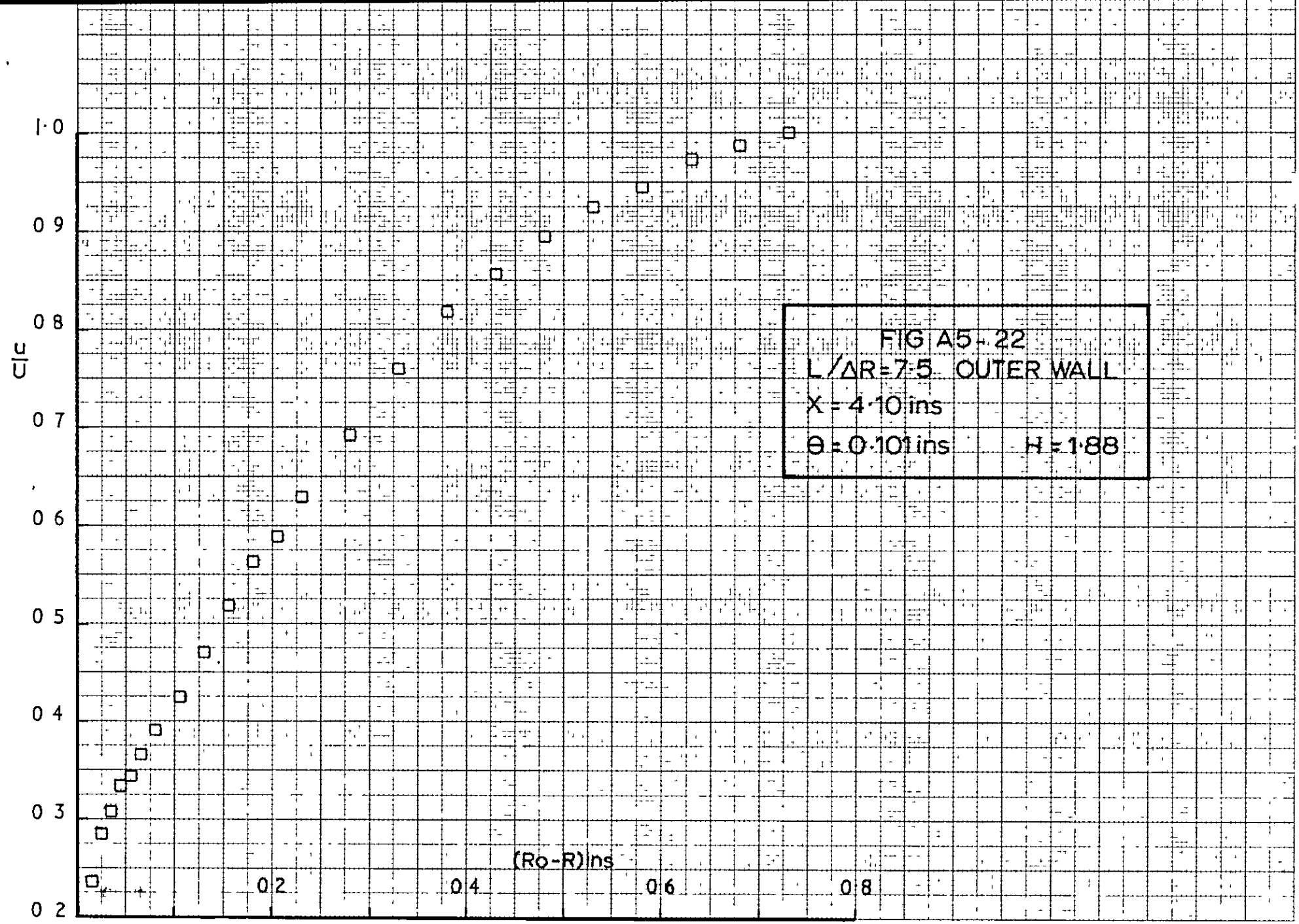

1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
U/u
0 2
0 4
0 6
0 8
(Ro-R) ins
FIG A5-17
L/ΔR=7·5 OUTER WALL
X=1·70 ins
θ=0·066 ins H=1·55

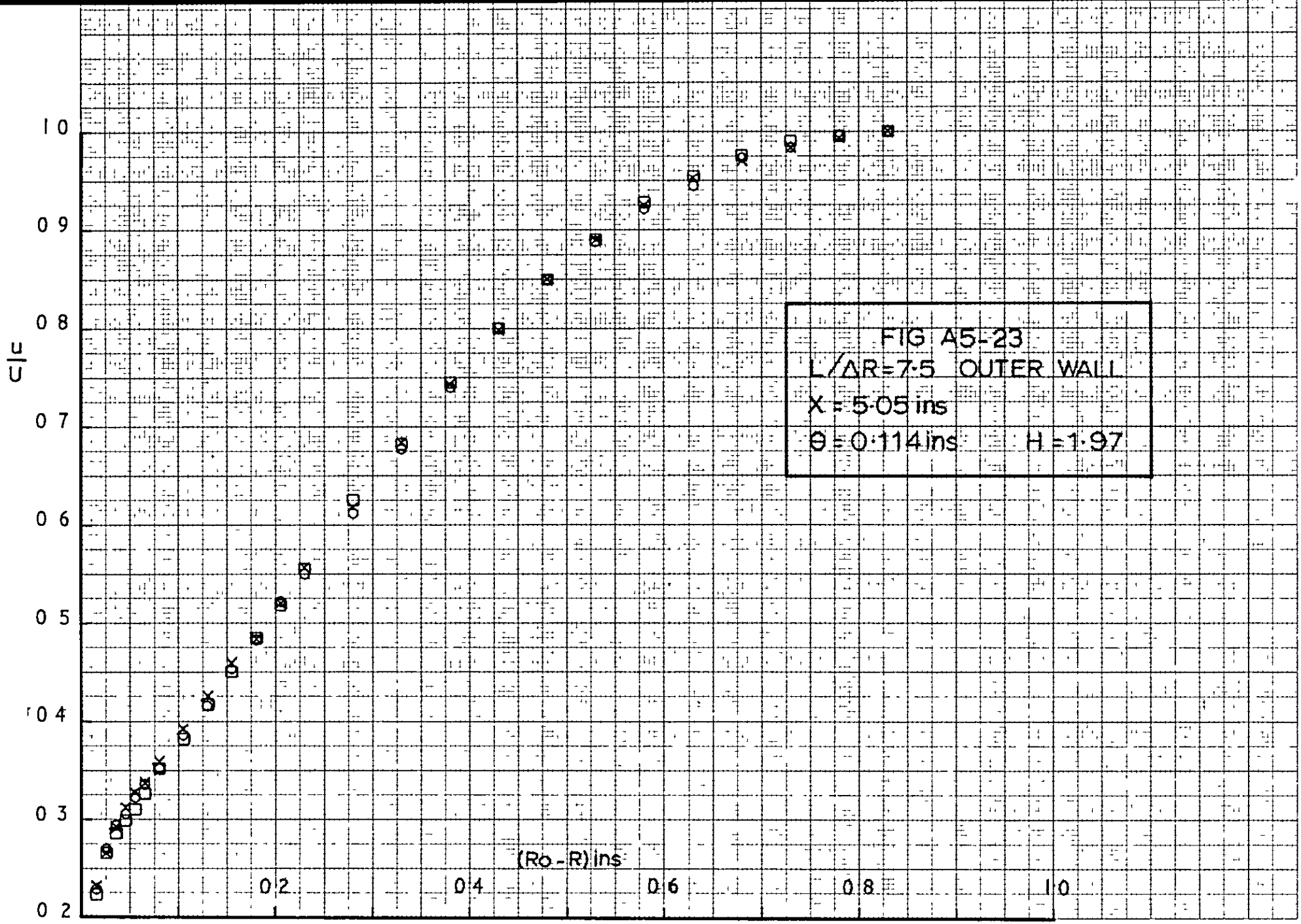

FIG A5-18
L/ΔR=7·5 OUTER WALL
X = 2·20ins
θ = 0·075ins H = 1·61
U/c
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(Ro-R)ins
0·2
0·4
0·6
0·8

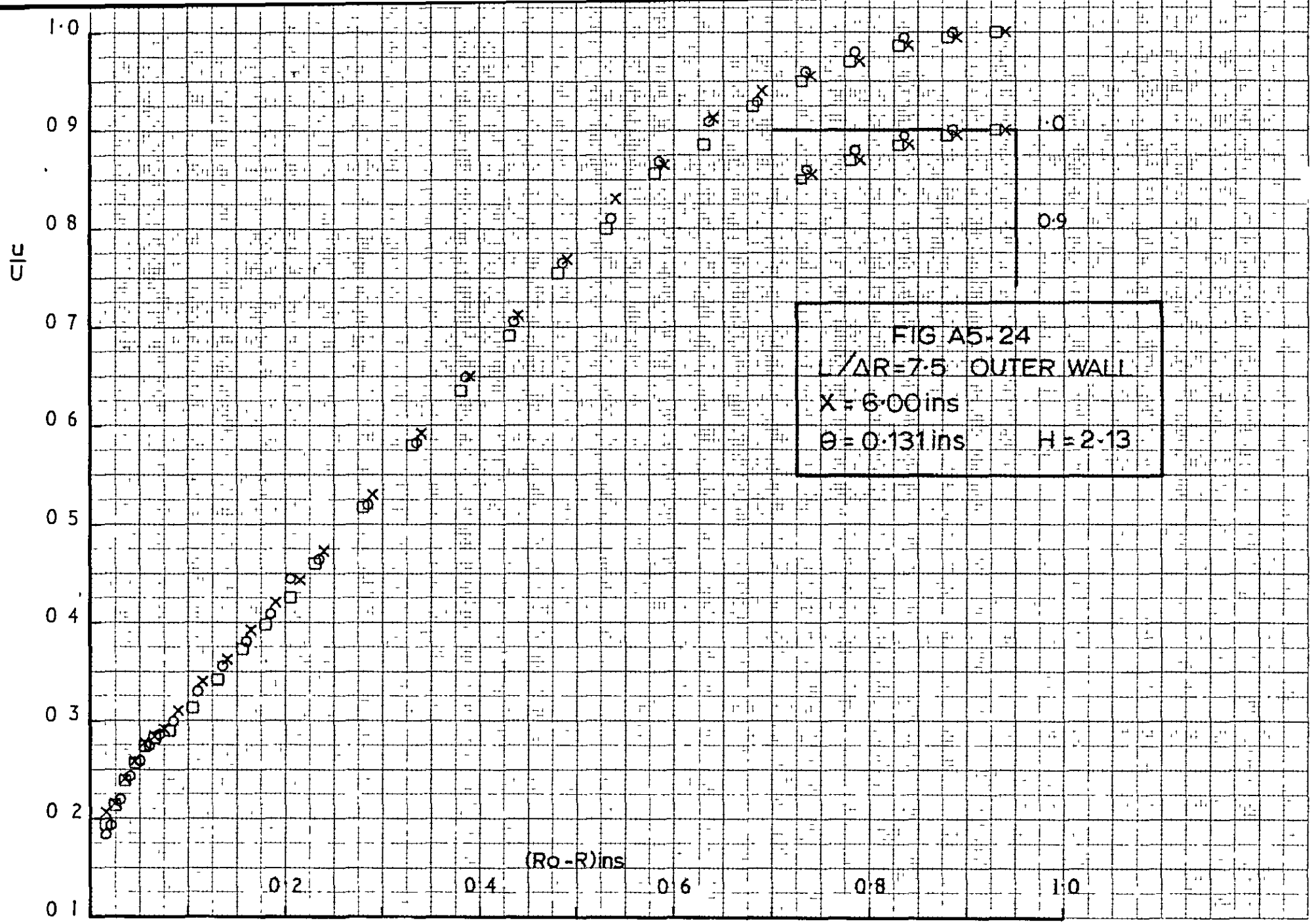

FIG A5-19
L/ΔR=7·5 OUTER WALL
X = 2·65ins
θ = 0·081ins H = 1·67
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(Ro-R)ins
0·2
0·4
0·6
0·8

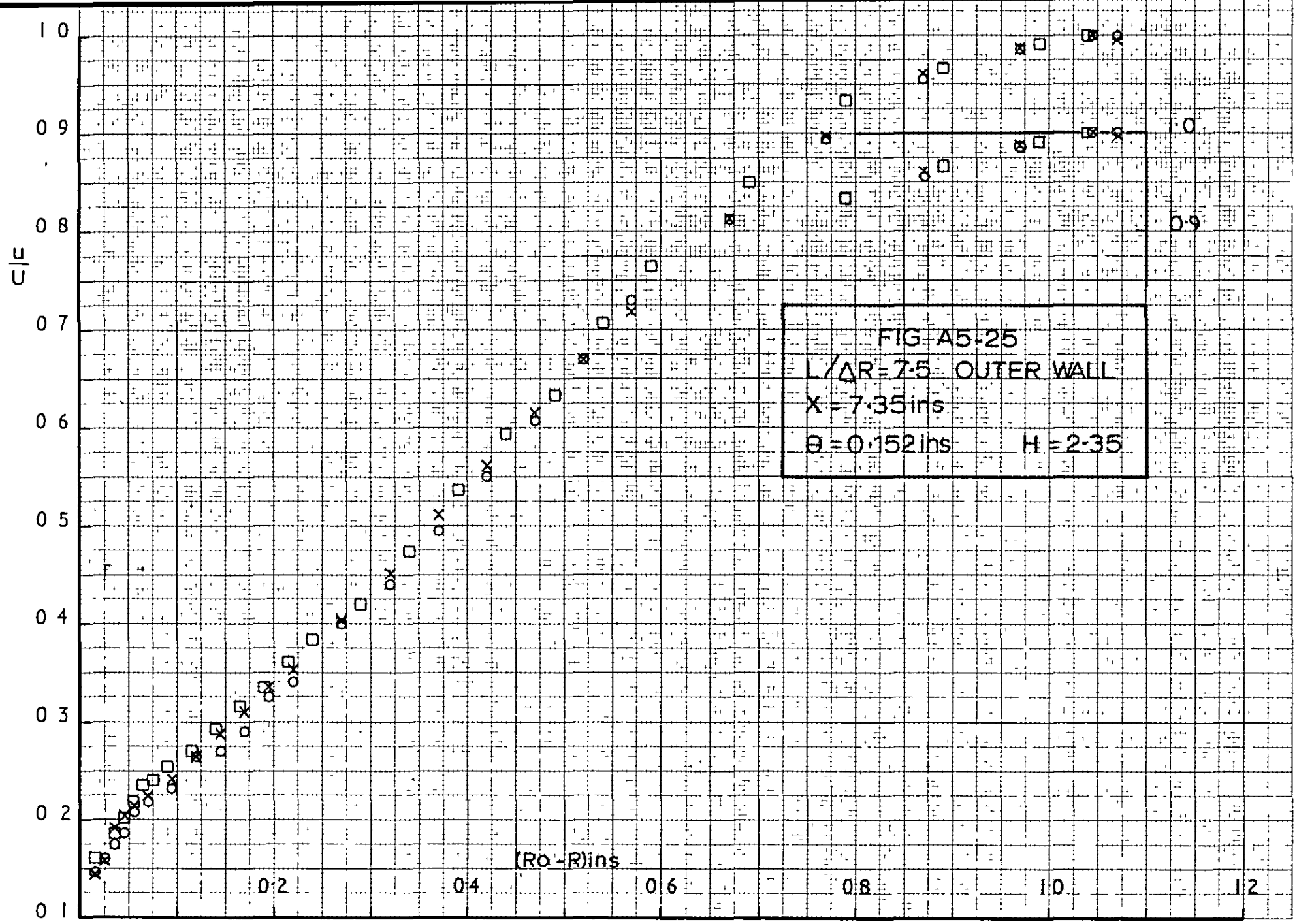

1 0
0 9
0 8
0 7
0 6
0 5
0·4
0 3
0 2
u/U
0 2
0 4
0 6
0 8
(Ro-R) ins
FIG A5-20
L/ΔR=7·5 OUTER WALL
X = 3·15ins
Θ = 0·087 ins H = 1·73


1·0
0·9
0 8
0·7
0 6
0·5
0 4
0·3
0 2
U/u
0 2
0·4
0·6
0 8
(Ro-R) ins
FIG A5-21
L/ΔR=7·5 OUTER WALL
X=3·60 ins
θ=0·095 ins
H=1·78


1·0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
U/u
0 2
0 4
0 6
0 8
(Ro-R)ins
FIG A5-22
L/ΔR=7·5 OUTER WALL
X = 4·10 ins
θ = 0·101 ins
H = 1·88


FIG A5-23
L/ΔR=7·5 OUTER WALL
X = 5·05 ins
θ = 0·114 ins H = 1·97
U/U
(Ro - R) ins
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·2
0·4
0·6
0·8
1·0


1·0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
0 1
C/c
(Ro-R)ins
0·2
0·4
0·6
0·8
1·0
1·0
0·9
FIG A5·24
L/ΔR=7·5 OUTER WALL
X = 6·00 ins
θ = 0·131 ins
H = 2·13


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
U/u
0·2
0·4
0·6
0·8
1·0
1·2
(Ro-R)ins
FIG A5·25
L/ΔR=7·5 OUTER WALL
X=7·35ins
θ=0·152ins H=2·35

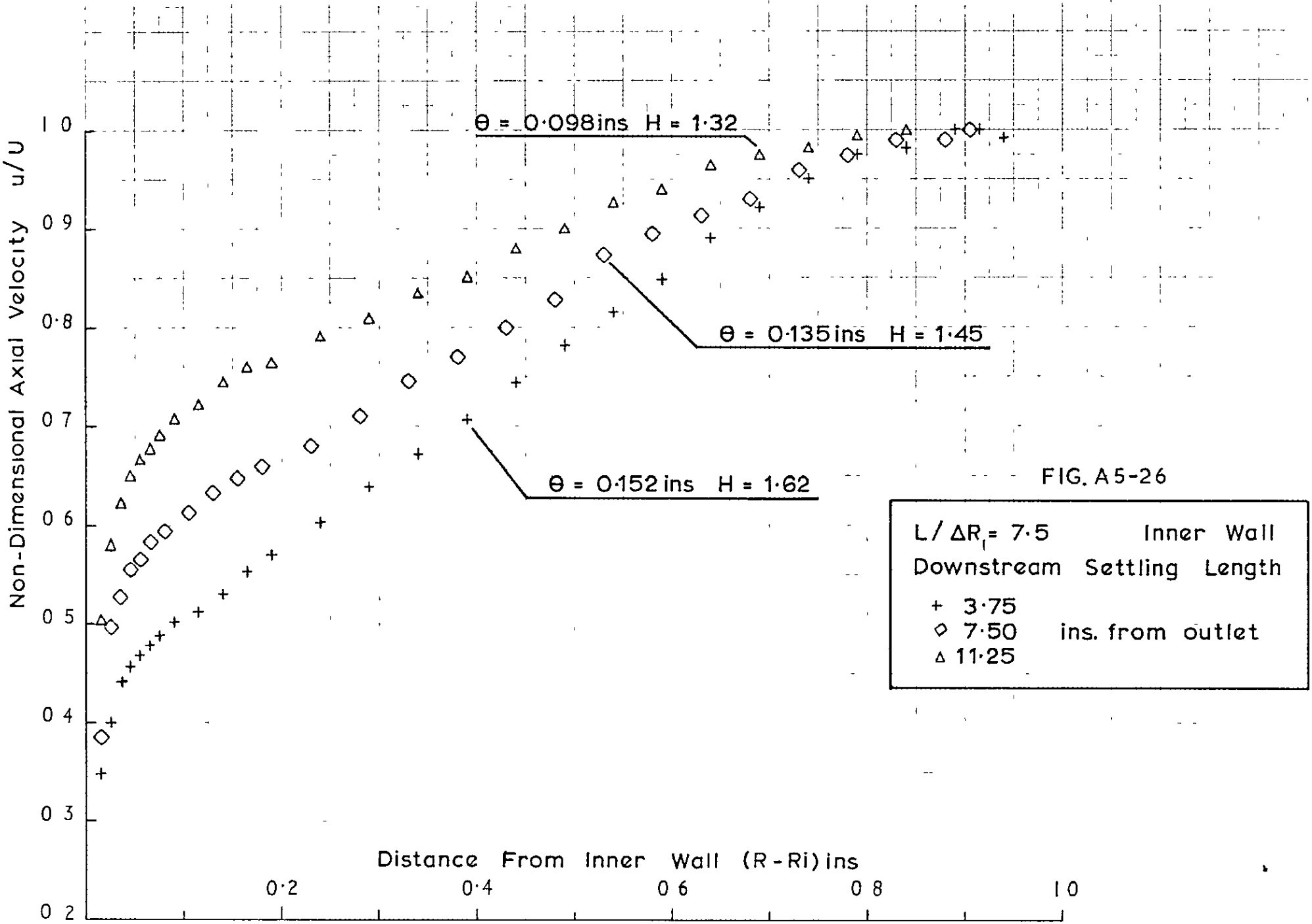

θ = 0·098ins H = 1·32
θ = 0·135ins H = 1·45
θ = 0·152ins H = 1·62
Non-Dimensional Axial Velocity u/U
1 0
0 9
0·8
0 7
0 6
0 5
0 4
0 3
0 2
Distance From Inner Wall (R-Ri) ins
0·2
0·4
0 6
0 8
1 0
L/ΔR_i = 7·5 Inner Wall
Downstream Settling Length
+ 3·75
◇ 7·50 ins. from outlet
△ 11·25

FIG. A5-26

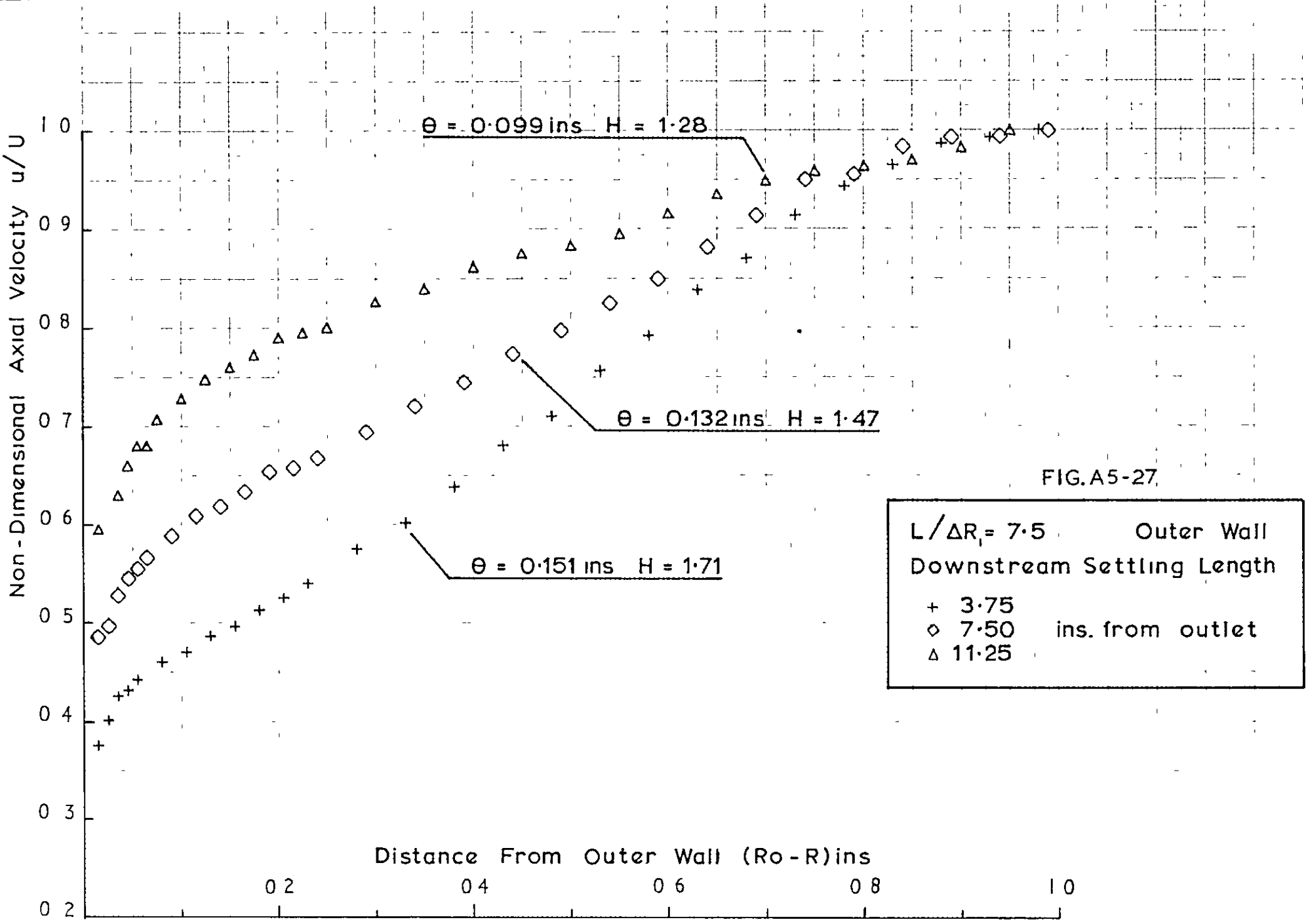

θ = 0·099 ins H = 1·28
θ = 0·132 ins H = 1·47
θ = 0·151 ins H = 1·71
L/ΔR₁ = 7·5 Outer Wall
Downstream Settling Length
+ 3·75
◇ 7·50 ins. from outlet
△ 11·25
Non-Dimensional Axial Velocity u/U
Distance From Outer Wall (Ro-R) ins
0 2
0 3
0 4
0 5
0 6
0 7
0 8
0 9
1 0
0 2
0 4
0 6
0 8
1 0

FIG. A5-27.

Appendix 6

Boundary Layer Parameters

$L/\Delta R_1 = 7.5$ Diffuser

TABLE A6-1

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.000 INS. N.D.DIST.(X/L)= 0.400

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.058	0.045	1.292
INNER WALL(REL TO RI)	0.050	0.039	1.286
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.057	0.044	1.295
(REL TO RO-RI)	0.344	0.265	1.295
INNER WALL(REL TO RI)	0.051	0.040	1.282
(REL TO RO-RI)	0.256	0.200	1.282

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.079	1.793
INNER WALL(REL TO RI)	0.072	1.803

UMEAN/UMAX= 0.891 BETA(MOMENTUM)= 1.016 ALPHA(ENERGY)= 1.045

FLOW= 32.93CUFT/SEC %FLOW IN OUTER LAYER= 0.533 OVERLAP= 0.010

TABLE A6-2

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 0.300 INS. N.D.DIST.(X/L)= 0.040

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.066	0.049	1.355
INNER WALL(REL TO RI)	0.050	0.039	1.286
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.065	0.048	1.360
(REL TO RO-RI)	0.377	0.277	1.360
INNER WALL(REL TO RI)	0.051	0.040	1.282
(REL TO RO-RI)	0.248	0.193	1.282

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.084	1.773
INNER WALL(REL TO RI)	0.072	1.803

UMEAN/UMAX= 0.887 BETA(MOMENTUM)= 1.019 ALPHA(ENERGY)= 1.053

FLOW= 33.40CUFT/SEC %FLOW IN OUTER LAYER= 0.546 OVERLAP= 0.015

TABLE A6-3

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 0.750 INS. N.D.DIST.(X/L)= 0.100

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.080	0.056	1.423
INNER WALL(REL TO RI)	0.065	0.048	1.348
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.078	0.055	1.430
(REL TO RO-RI)	0.436	0.305	1.430
INNER WALL(REL TO RI)	0.067	0.050	1.343
(REL TO RO-RI)	0.307	0.229	1.343

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.095	1.744
INNER WALL(REL TO RI)	0.088	1.774

UMEAN/UMAX= 0.866 BETA(MOMENTUM)= 1.026 ALPHA(ENERGY)= 1.073

FLOW= 32.91CUFT/SEC %FLOW IN OUTER LAYER= 0.536 OVERLAP= 0.008

TABLE A6-4

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 1.250 INS. N.D.DIST.(X/L)= 0.167

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.091	0.061	1.493
INNER WALL(REL TO RI)	0.081	0.057	1.411
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.089	0.059	1.500
(REL TO RO-RI)	0.477	0.318	1.500
INNER WALL(REL TO RI)	0.083	0.059	1.404
(REL TO RO-RI)	0.362	0.258	1.404

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.102	1.718
INNER WALL(REL TO RI)	0.103	1.752

UMEAN/UMAX= 0.850 BETA(MOMENTUM)= 1.034 ALPHA(ENERGY)= 1.094

FLOW= 32.71CUFT/SEC %FLOW IN OUTER LAYER= 0.523 OVERLAP=-0.024

TABLE A6-5

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 1.700 INS. N.D.DIST.(X/L)= 0.227

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.104	0.068	1.542
INNER WALL(REL TO RI)	0.090	0.062	1.442
3D DFFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.102	0.066	1.550
(REL TO RO-RI)	0.528	0.341	1.550
INNER WALL(REL TO RI)	0.093	0.064	1.435
(REL TO RO-RI)	0.386	0.269	1.435

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.112	1.700
INNER WALL(REL TO RI)	0.112	1.737

UMEAN/UMAX= 0.837 BETA(MOMENTUM)= 1.040 ALPHA(ENERGY)= 1.109

FLOW= 32.92CUFT/SEC %FLOW IN OUTER LAYER= 0.537 OVERLAP=-0.022

TABLE A6-6

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 2.200 INS. N.D.DIST.(X/L)= 0.293

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.124	0.077	1.603
INNER WALL(REL TO RI)	0.104	0.069	1.492
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.121	0.075	1.613
(REL TO RO-RI)	0.601	0.372	1.613
INNER WALL(REL TO RI)	0.107	0.072	1.484
(REL TO RO-RI)	0.424	0.286	1.484

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.126	1.681
INNER WALL(REL TO RI)	0.124	1.721

UMEAN/UMAX= 0.818 BETA(MOMENTUM)= 1.048 ALPHA(ENERGY)= 1.132

FLOW= 32.79CUFT/SEC %FLOW IN OUTER LAYER= 0.539 OVERLAP=-0.033

TABLE A6-7

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 2.650 INS. N.D.DIST.(X/L)= 0.353

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.139	0.084	1.654
INNER WALL(REL TO RI)	0.108	0.072	1.510
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.136	0.081	1.666
(REL TO RO-RI)	0.654	0.393	1.666
INNER WALL(REL TO RI)	0.111	0.074	1.501
(REL TO RO-RI)	0.425	0.283	1.501

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.136	1.665
INNER WALL(REL TO RI)	0.127	1.710

UMEAN/UMAX= 0.809 BETA(MOMENTUM)= 1.053 ALPHA(ENERGY)= 1.147

FLOW= 33.04CUFT/SEC %FLOW IN OUTER LAYER= 0.530 OVERLAP= 0.029

TABLE A6-8

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.154	0.090	1.718
INNER WALL(REL TO RI)	0.131	0.083	1.577
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.150	0.087	1.731
(REL TO RO-RI)	0.698	0.403	1.731
INNER WALL(REL TO RI)	0.135	0.086	1.566
(REL TO RO-RI)	0.493	0.315	1.566

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.143	1.645
INNER WALL(REL TO RI)	0.146	1.693

UMEAN/UMAX= 0.790 BETA(MOMENTUM)= 1.063 ALPHA(ENERGY)= 1.174

FLOW= 32.51CUFT/SEC %FLOW IN OUTER LAYER= 0.534 OVERLAP= 0.007

TABLE A6-9

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.600 INS. N.D.DIST.(X/L)= 0.480

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.174	0.099	1.767
INNER WALL(REL TO RI)	0.133	0.086	1.551
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.169	0.095	1.780
(RFL TO RO-RI)	0.766	0.430	1.780
INNER WALL(REL TO RI)	0.137	0.089	1.541
(RFL TO RO-RI)	0.483	0.314	1.541

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.155	1.629
INNER WALL(REL TO RI)	0.151	1.695

UMEAN/UMAX= 0.781 BETA(MOMENTUM)= 1.067 ALPHA(ENERGY)= 1.186

FLOW= 33.09CUFT/SEC %FLOW IN OUTER LAYER= 0.522 OVERLAP= 0.010

TABLE A6-10

DIFFUSER NON DIMENSIONAL LFNGTH = 7.5

AXIAL DIST. FROM INLET(X) = 4.100 INS. N.D.DIST.(X/L)= 0.547

B.L. THICKNESS 2D DFFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.196	0.105	1.861
INNER WALL(REL TO RI)	0.158	0.096	1.643
3D DFFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.191	0.101	1.879
(REL TO RO-RI)	0.835	0.444	1.879
INNER WALL(REL TO RI)	0.163	0.100	1.630
(REL TO RO-RI)	0.553	0.339	1.630

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.164	1.615
INNER WALL(REL TO RI)	0.167	1.667

UMEAN/UMAX= 0.758 BETA(MOMENTUM)= 1.081 ALPHA(ENERGY)= 1.227

FLOW= 32.48CUFT/SEC %FLOW IN OUTER LAYER= 0.528 OVERLAP=-0.012

TABLE A6-11

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 5.050 INS. N.D.DIST.(X/L)= 0.673

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.232	0.119	1.949
INNER WALL(REL TO RI)	0.178	0.106	1.680
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.224	0.114	1.969
(REL TO RO-RI)	0.930	0.472	1.969
INNER WALL(REL TO RI)	0.185	0.111	1.666
(REL TO RO-RI)	0.583	0.350	1.666

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.181	1.589
INNER WALL(REL TO RI)	0.184	1.654

UMEAN/UMAX= 0.739 BETA(MOMENTUM)= 1.093 ALPHA(ENERGY)= 1.263

FLOW= 33.04CUFT/SEC %FLOW IN OUTER LAYER= 0.527 OVERLAP=-0.021

TABLE A6-12

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 6.000 INS. N.D.DIST.(X/L)= 0.800

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.290	0.138	2.102
INNER WALL(REL TO RI)	0.209	0.121	1.719
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.279	0.131	2.128
(REL TO RO-RI)	1.100	0.517	2.128
INNER WALL(REL TO RI)	0.218	0.128	1.702
(REL TO RO-RI)	0.642	0.377	1.702

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.205	1.560
INNER WALL(REL TO RI)	0.211	1.644

UMEAN/UMAX= 0.702 BETA(MOMENTUM)= 1.114 ALPHA(ENERGY)= 1.324

FLOW= 32.76CUFT/SEC %FLOW IN OUTER LAYER= 0.525 OVERLAP=-0.090

TABLE A6-13

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.374	0.161	2.316
INNER WALL(REL TO RI)	0.230	0.133	1.731
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.358	0.152	2.352
(REL TO RO-RI)	1.318	0.560	2.352
INNER WALL(REL TO RI)	0.241	0.141	1.714
(REL TO RO-RI)	0.647	0.378	1.714

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.232	1.525
INNER WALL(REL TO RI)	0.230	1.636

UMEAN/UMAX= 0.669 BETA(MOMENTUM)= 1.142 ALPHA(ENERGY)= 1.406

FLOW= 32.65CUFT/SEC %FLOW IN OUTER LAYER= 0.514 OVERLAP= 0.042

TABLE A6-14

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.270	0.159	1.700
INNER WALL(REL TO RI)	0.232	0.143	1.630
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.258	0.151	1.714
(REL TO RO-RI)	0.947	0.553	1.714
INNER WALL(REL TO RI)	0.245	0.152	1.615
(REL TO RO-RI)	0.653	0.404	1.615

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.244	1.620
INNER WALL(REL TO RI)	0.251	1.657

UMEAN/UMAX= 0.731 BETA(MOMENTUM)= 1.067 ALPHA(ENERGY)= 1.198

FLOW= 33.35CUFT/SEC %FLOW IN OUTER LAYER= 0.535 OVERLAP=-0.005

TABLE A6-15

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.202	0.138	1.459
INNER WALL(REL TO RI)	0.182	0.124	1.459
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.193	0.132	1.467
(REL TO RO-RI)	0.708	0.483	1.467
INNER WALL(REL TO RI)	0.191	0.132	1.449
(REL TO RO-RI)	0.509	0.352	1.449

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.224	1.703
INNER WALL(REL TO RI)	0.227	1.720

UMEAN/UMAX= 0.795 BETA(MOMENTUM)= 1.056 ALPHA(ENERGY)= 1.104

FLOW= 32.72CUFT/SEC %FLOW IN OUTER LAYER= 0.545 OVERLAP= 0.045

TABLE A6-16

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.132	0.104	1.271
INNER WALL(REL TO RI)	0.124	0.093	1.325
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.126	0.099	1.276
(REL TO RO-RI)	0.462	0.362	1.276
INNER WALL(REL TO RI)	0.129	0.098	1.318
(REL TO RO-RI)	0.345	0.262	1.318

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.178	1.799
INNER WALL(REL TO RI)	0.175	1.780

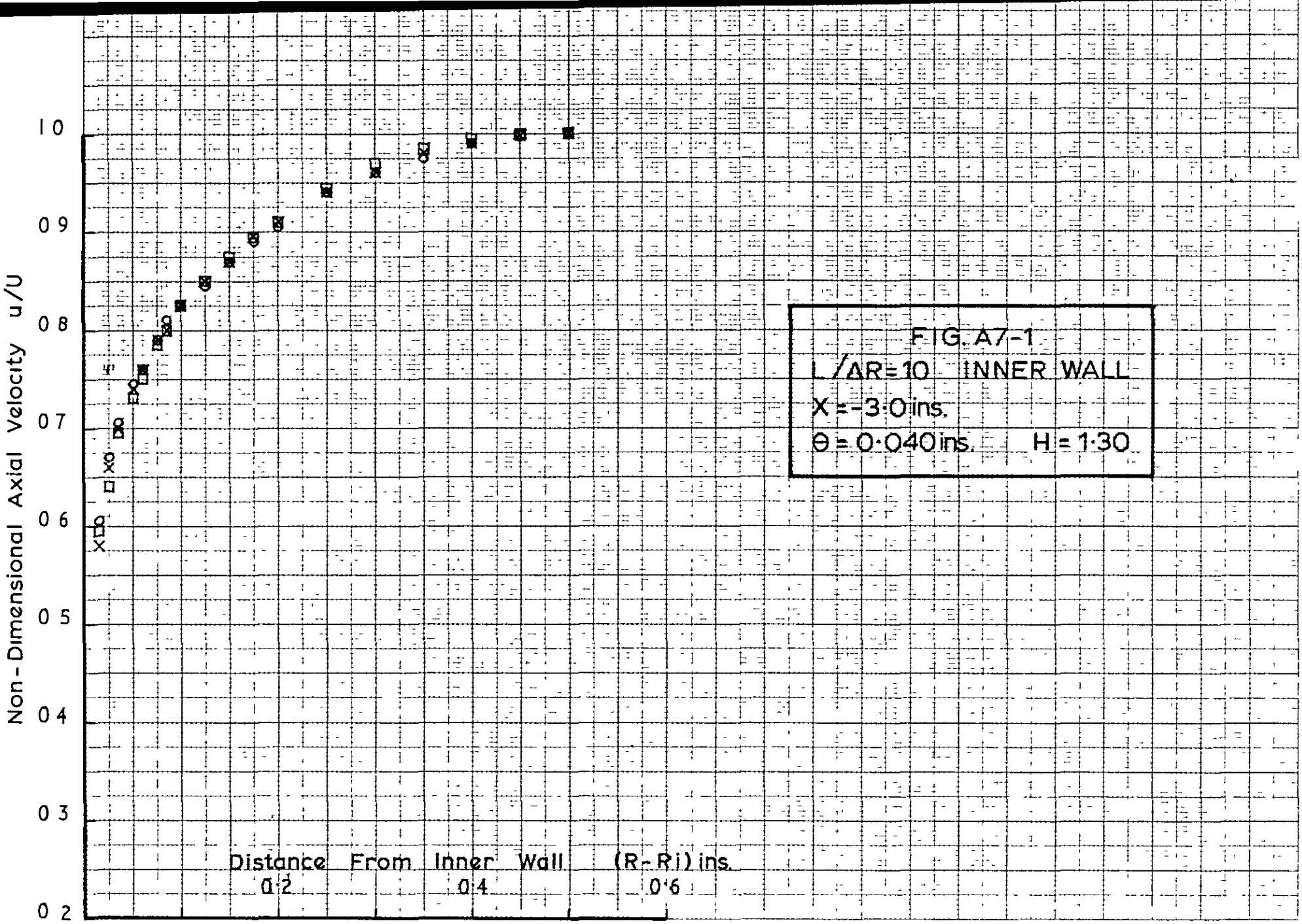
UMEAN/UMAX= 0.864 BETA(MOMENTUM)= 1.017 ALPHA(ENERGY)= 1.048

FLOW= 32.60CUFT/SEC %FLOW IN OUTER LAYER= 0.571 OVERLAP= 0.075

Appendix 7

Mean Velocity Profiles

$L/\Delta R_1 = 10$ Diffuser


Non-Dimensional Axial Velocity u/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
Distance From Inner Wall (R-Ri) ins.
0·2
0·4
0·6
FIG. A7-1
L/ΔR=10 INNER WALL
X=-3·0 ins.
Θ=0·040 ins. H=1·30

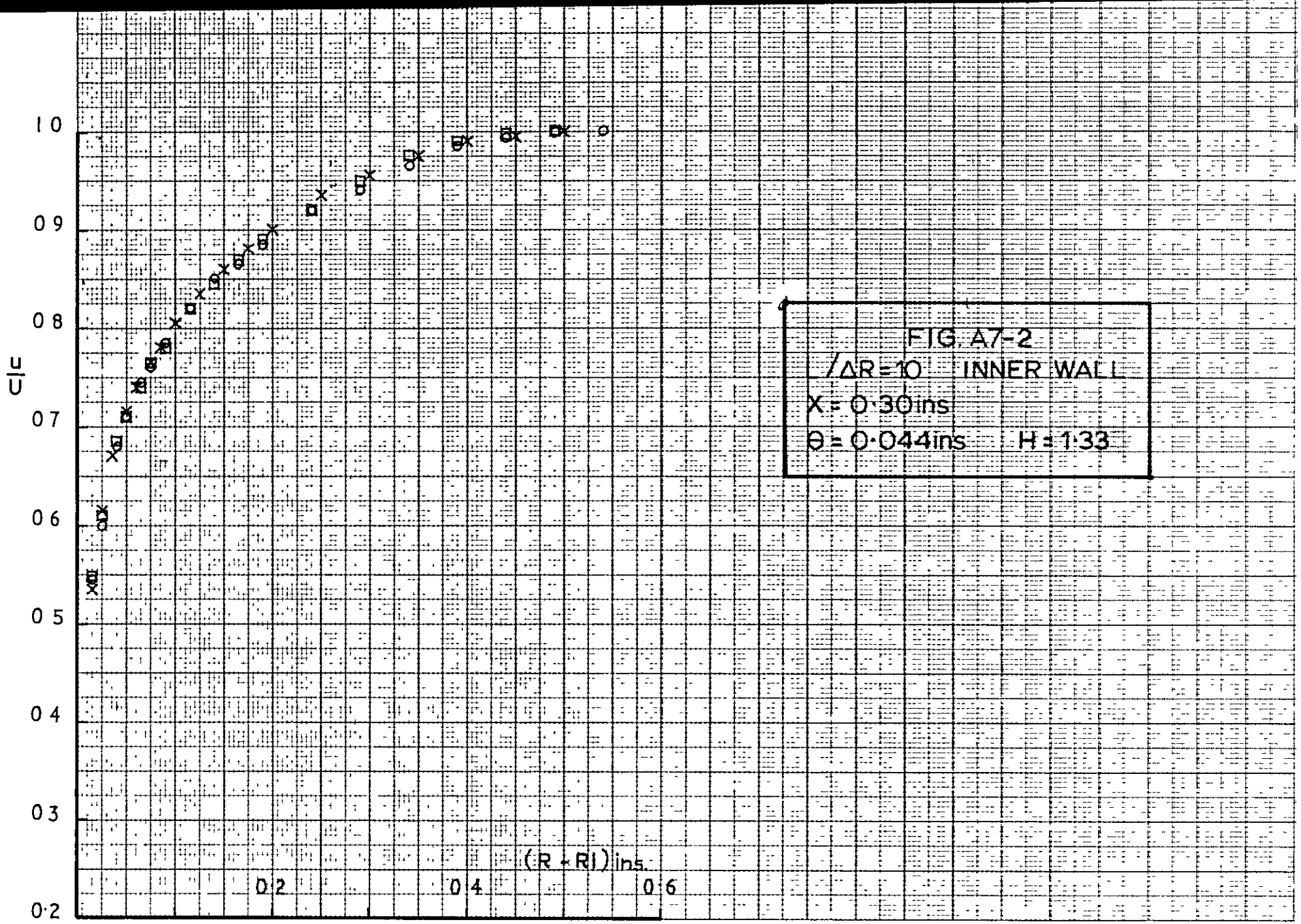


FIG. A7-2
/ΔR = 10 INNER WALL
X = 0·30ins
Θ = 0·044ins H = 1·33

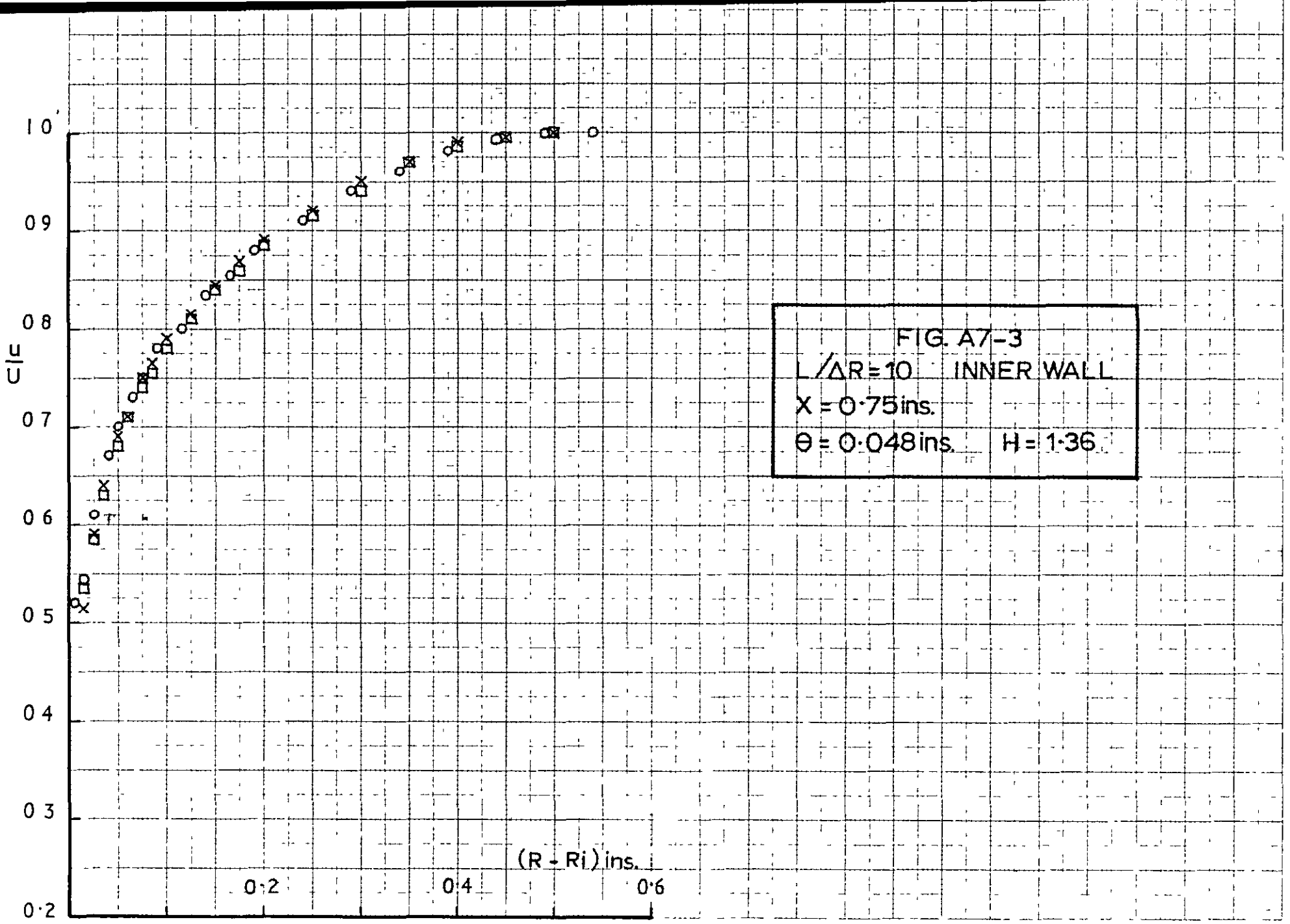


FIG. A7-3
L/ΔR = 10 INNER WALL
X = 0·75 ins.
θ = 0·048 ins. H = 1·36

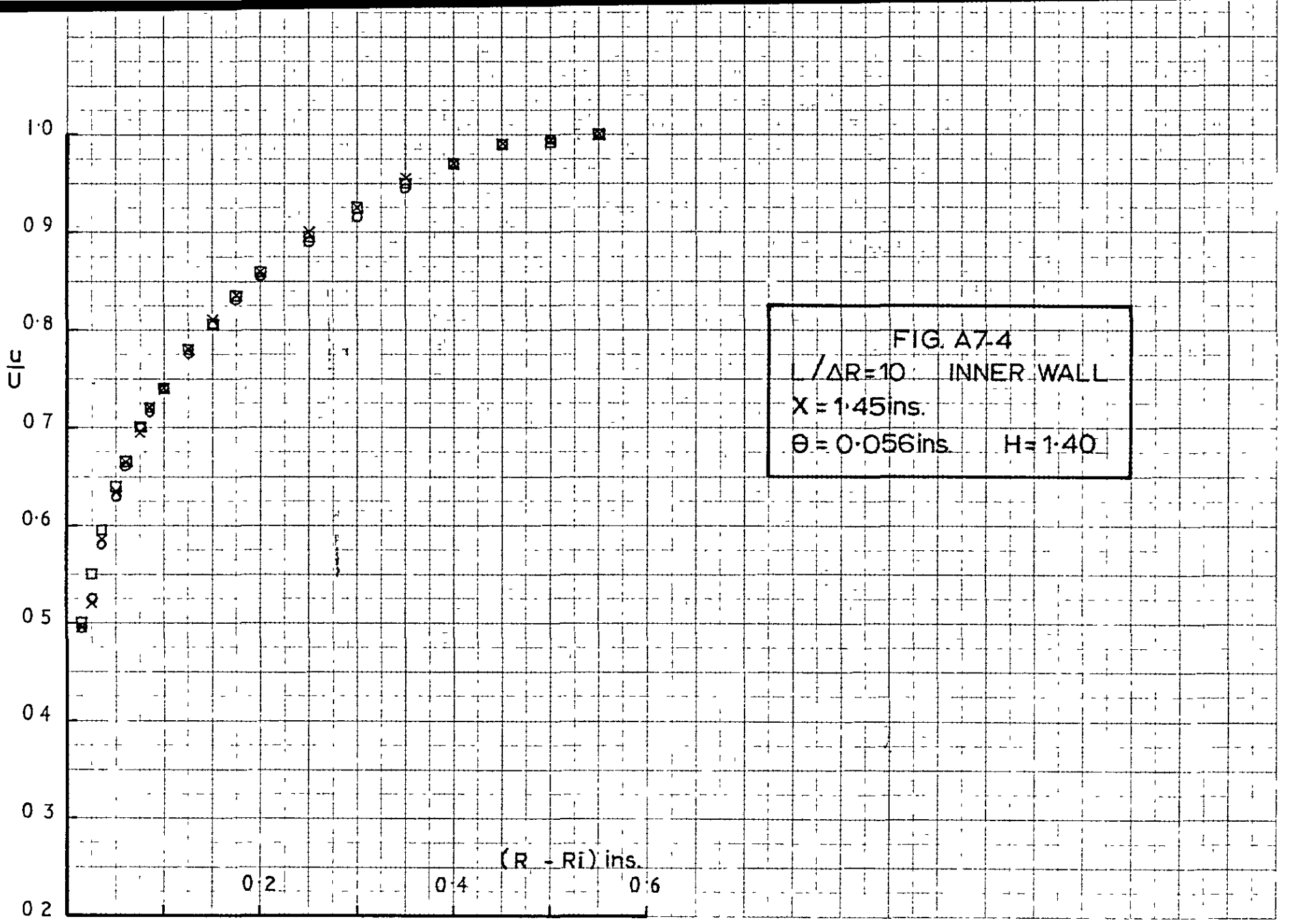
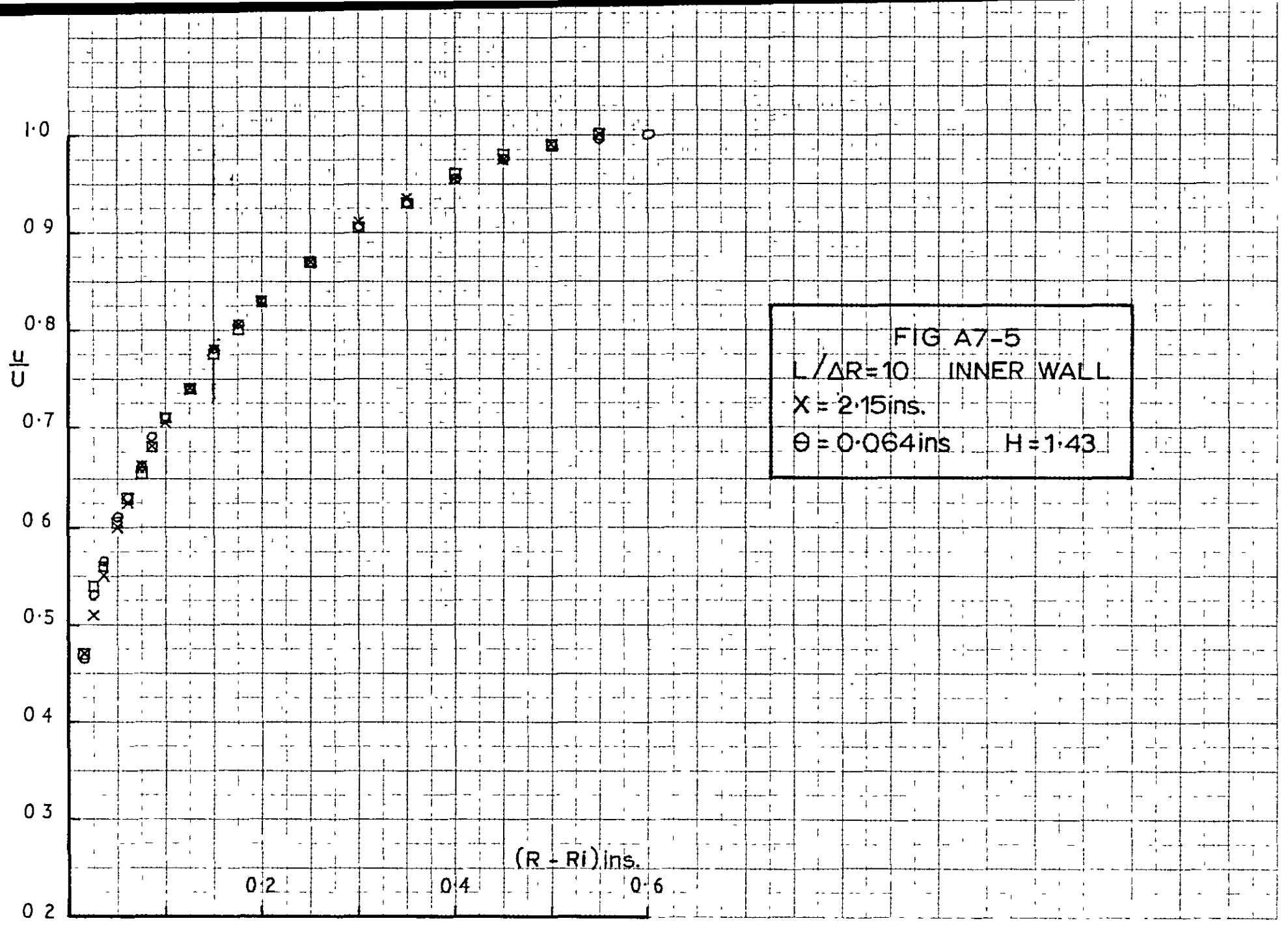


FIG. A7-4
L/ΔR=10 INNER WALL
X = 1·45ins.
θ = 0·056ins. H=1·40


1·0
0 9
0·8
0·7
0 6
0·5
0 4
0 3
0 2
u/U
0·2
0·4
0·6
(R - Ri) ins.
FIG A7-5
L/ΔR=10 INNER WALL
X = 2·15ins.
θ = 0·064ins H = 1·43

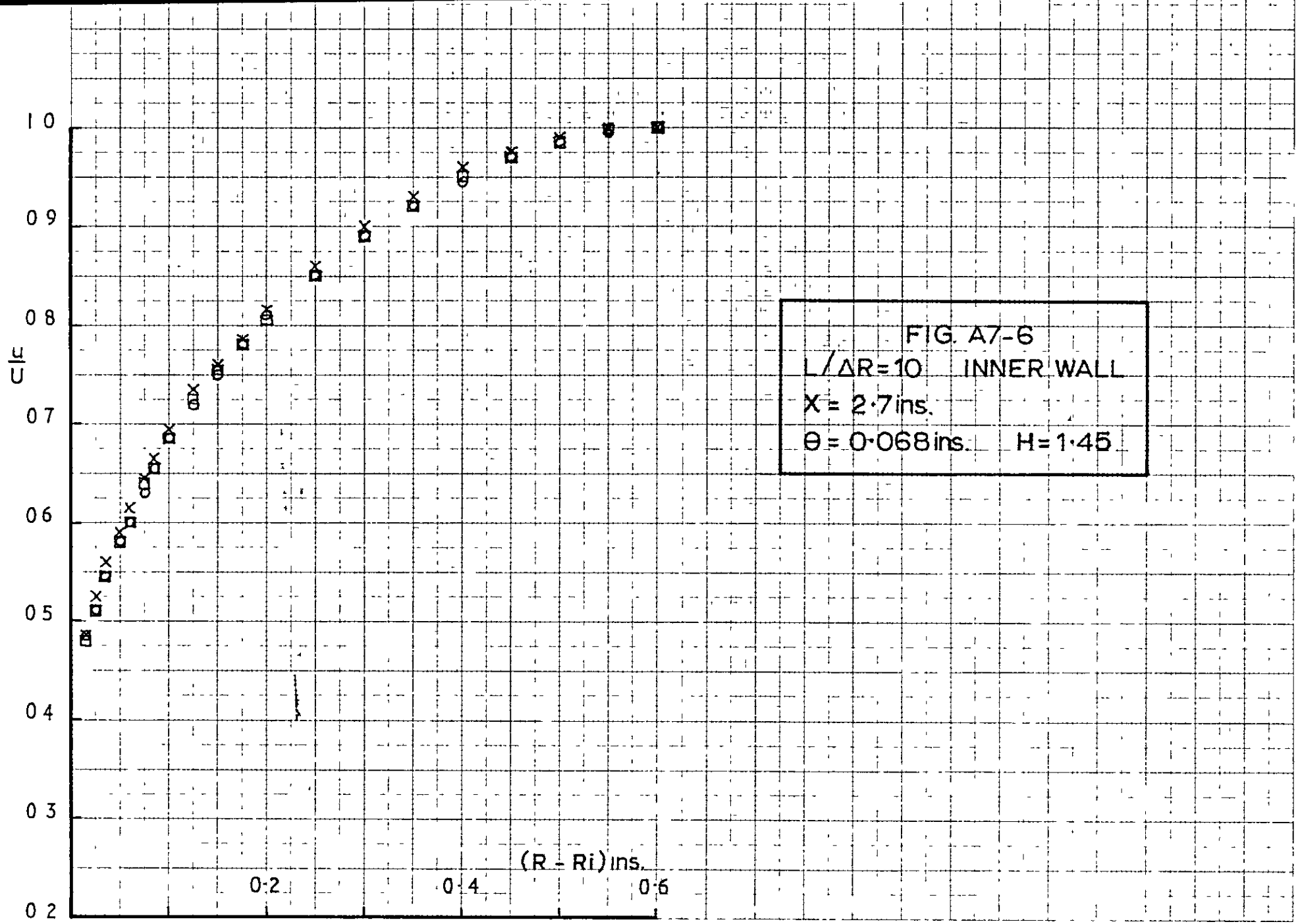
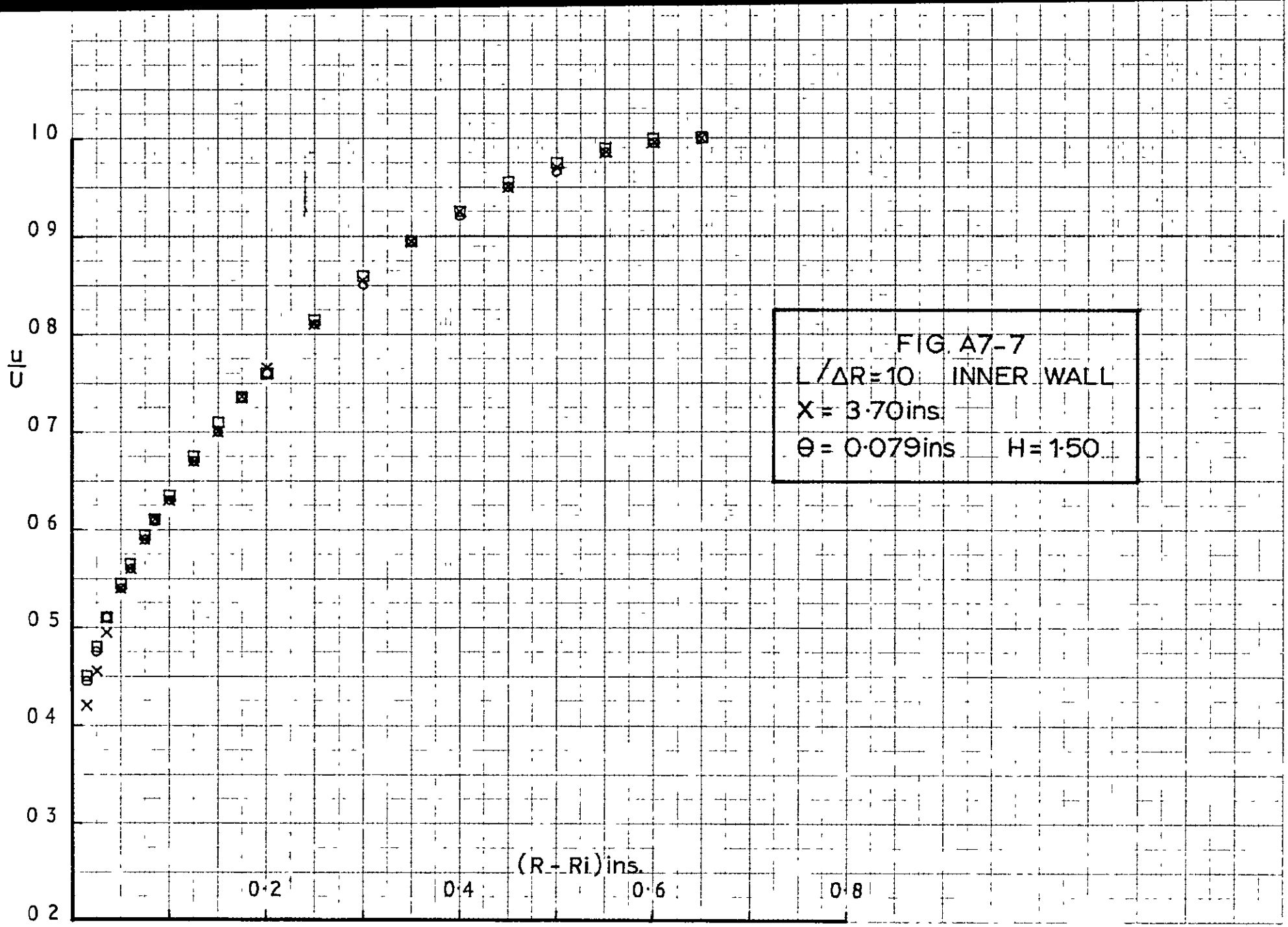
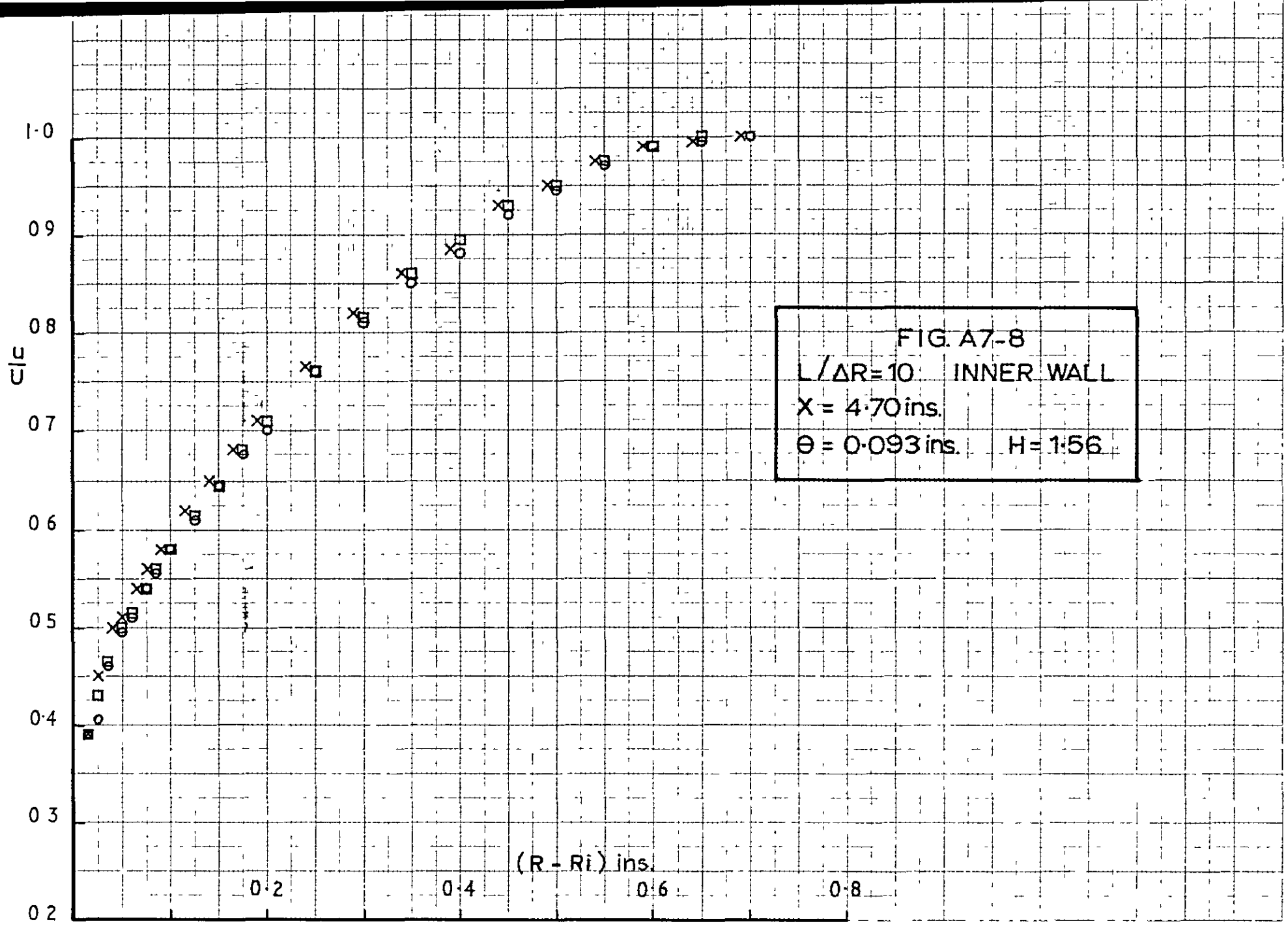
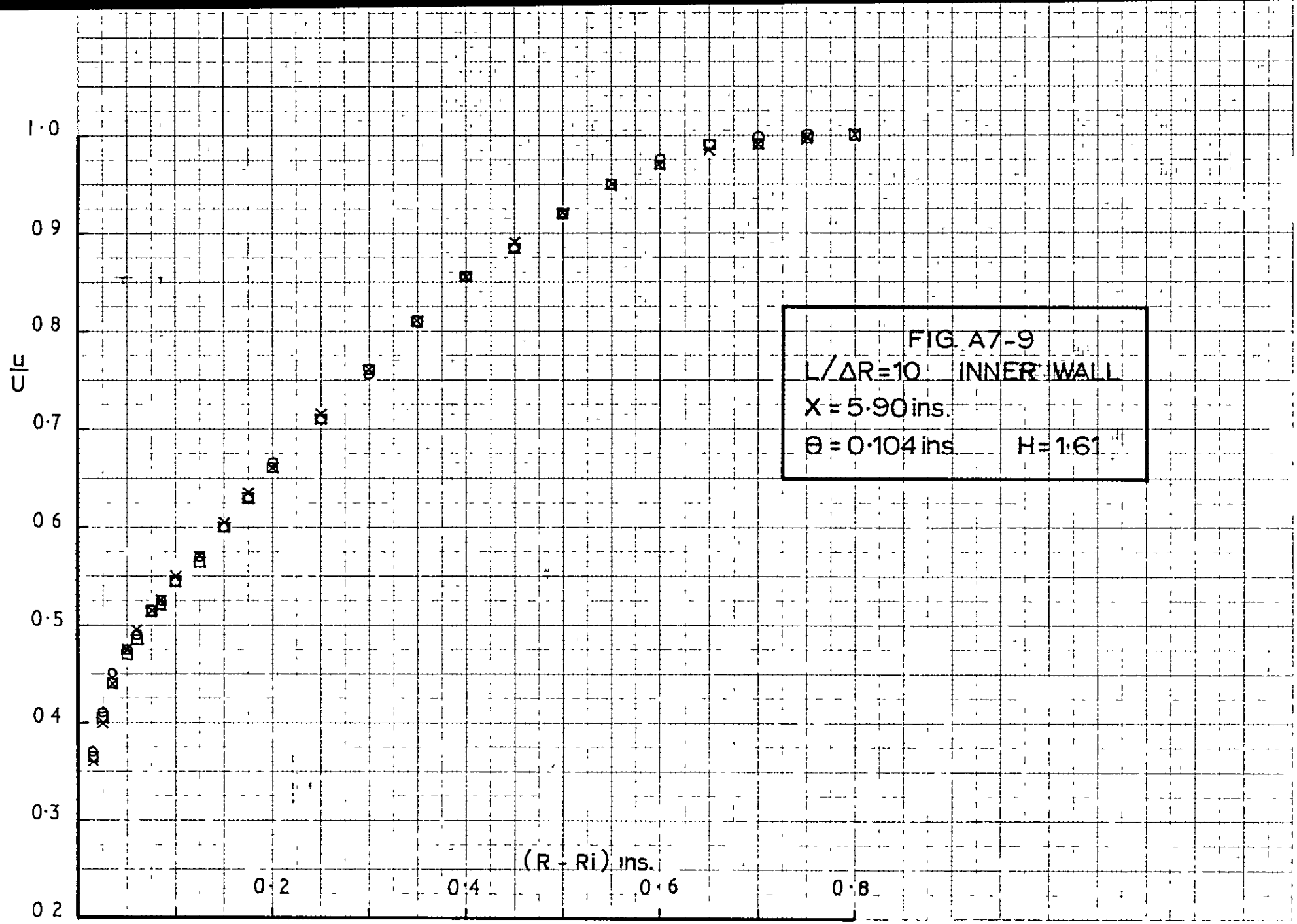
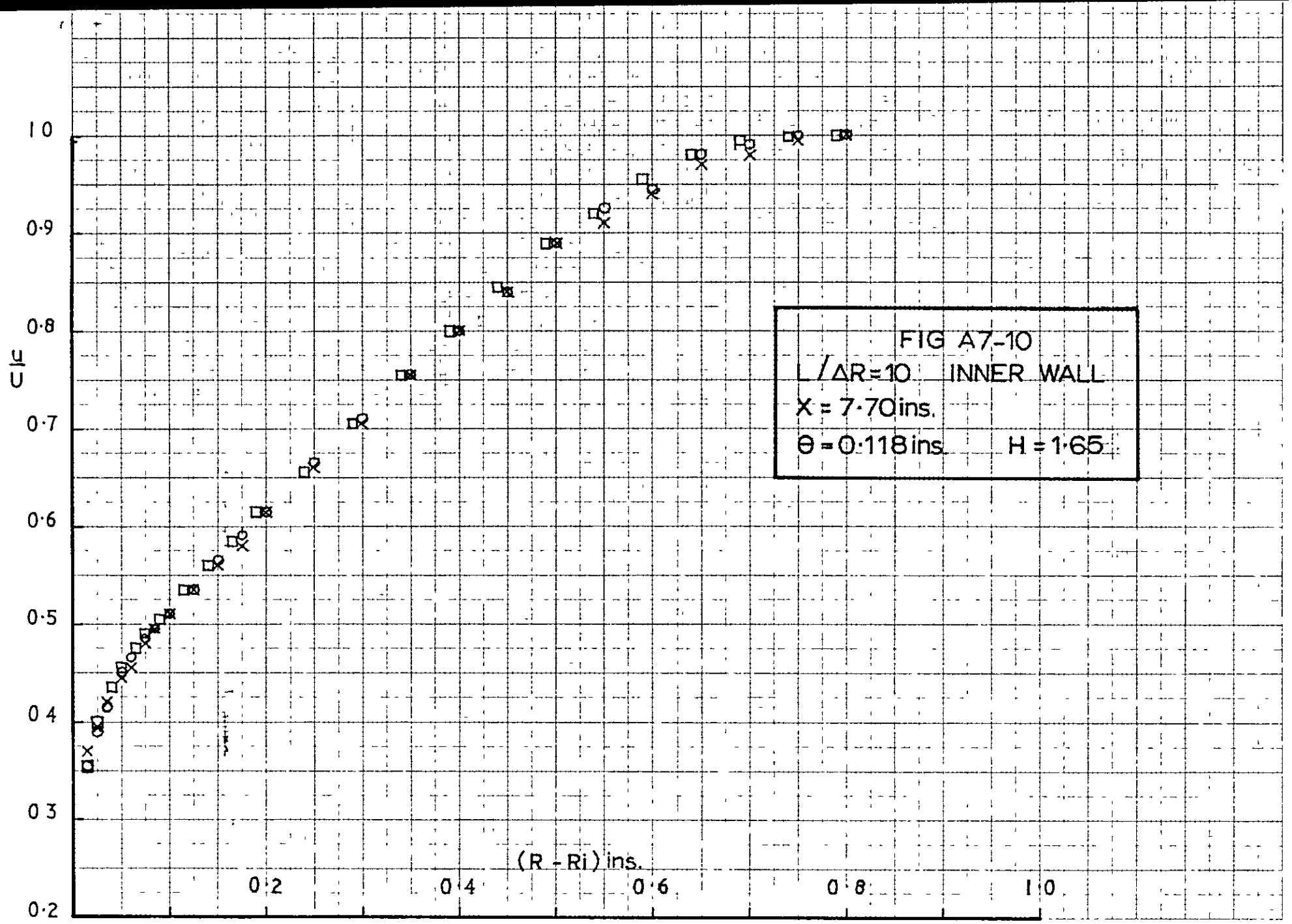


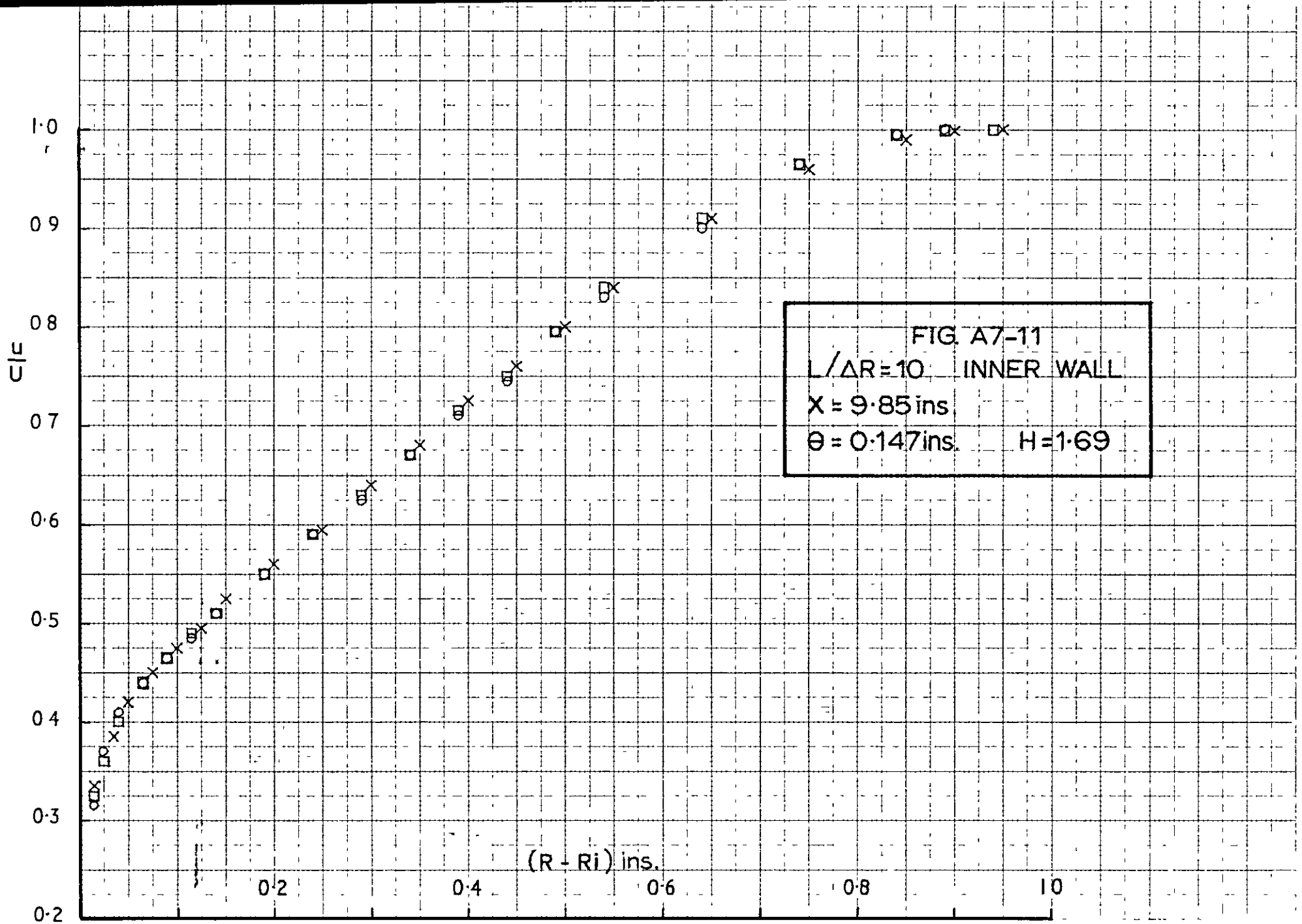
FIG. A7-6
L/ΔR = 10 INNER WALL
X = 2·7 ins.
θ = 0·068 ins. H = 1·45

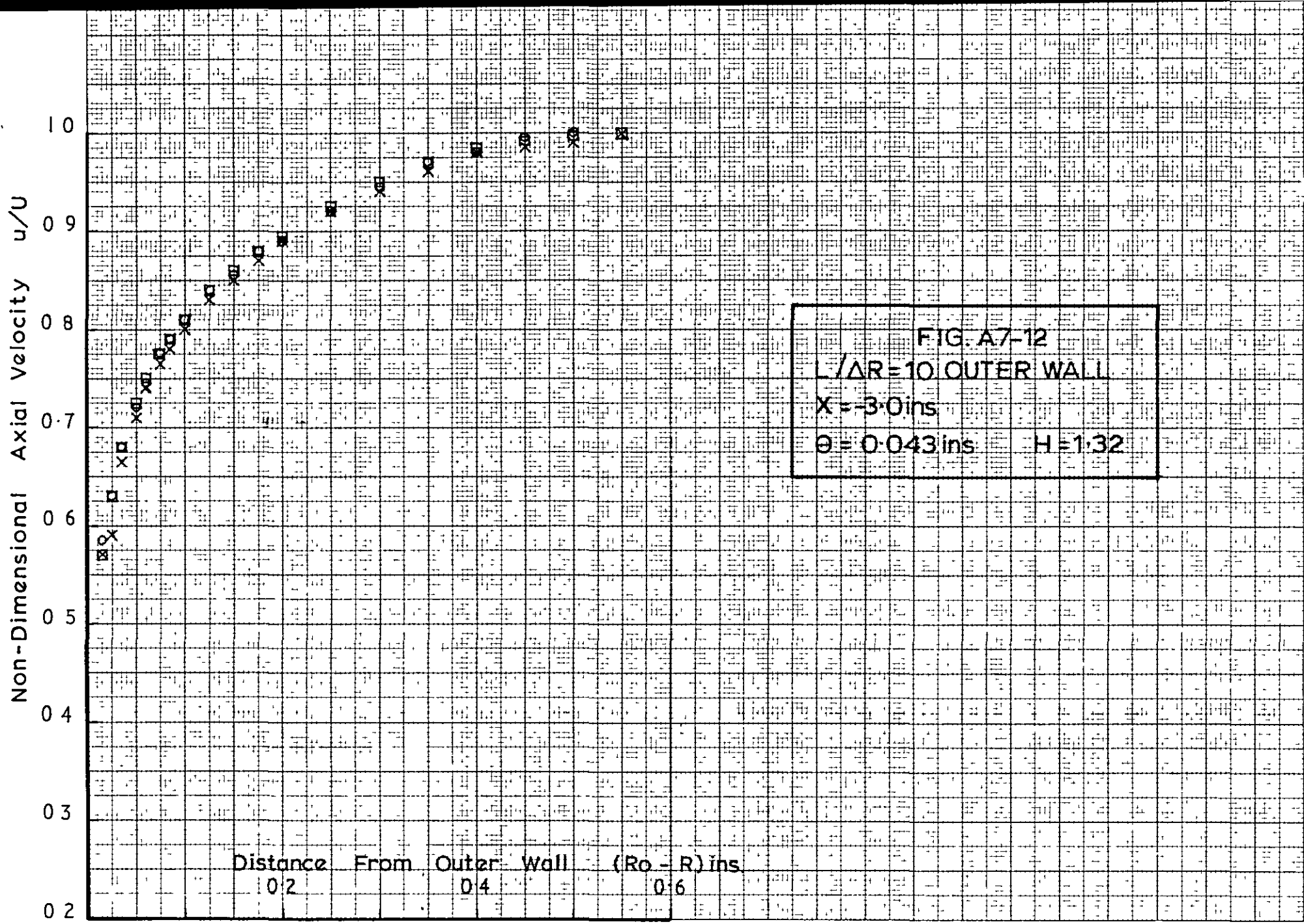

FIG. A7-7
L/ΔR=10 INNER WALL
X = 3·70ins.
θ = 0·079ins H = 1·50
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(R-Ri)ins.
0·2
0·4
0·6
0·8


1·0
0 9
0 8
0 7
0 6
0 5
0·4
0 3
0 2
U/u
0·2
0·4
0·6
0·8
(R - Ri) ins.
FIG. A7-8
L/ΔR=10 INNER WALL
X = 4·70 ins.
θ = 0·093 ins. H=1·56


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/U
(R - Ri) ins.
0·2
0·4
0·6
0·8
FIG. A7-9
L/ΔR=10 INNER WALL
X = 5·90 ins.
θ = 0·104 ins. H = 1·61


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
0·8
1·0
(R - Ri) ins.
FIG A7-10
L/ΔR=10 INNER WALL
X = 7·70ins.
θ = 0·118ins. H = 1·65


FIG. A7-11
L/ΔR = 10 INNER WALL
X = 9·85 ins.
θ = 0·147 ins. H = 1·69
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·2
0·4
0·6
0·8
1·0
(R - Ri) ins.


Non-Dimensional Axial Velocity u/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
Distance From Outer Wall (Ro - R) ins
0·2
0·4
0·6
FIG. A7-12
L/ΔR = 10 OUTER WALL
X = -3·0 ins
θ = 0·043 ins
H = 1·32

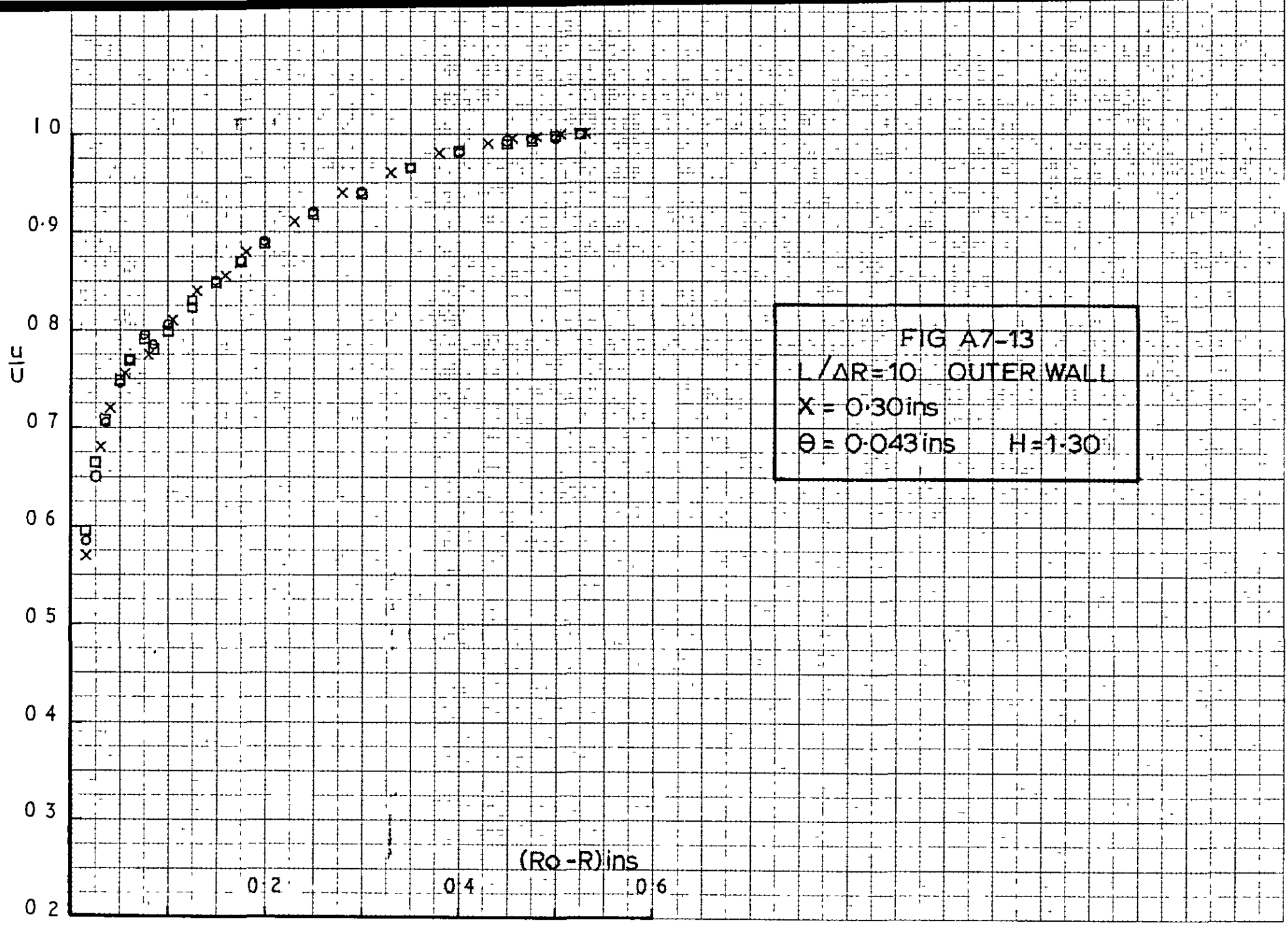


FIG A7-13
L/ΔR=10 OUTER WALL
X = 0·30 ins
θ = 0·043 ins H=1·30

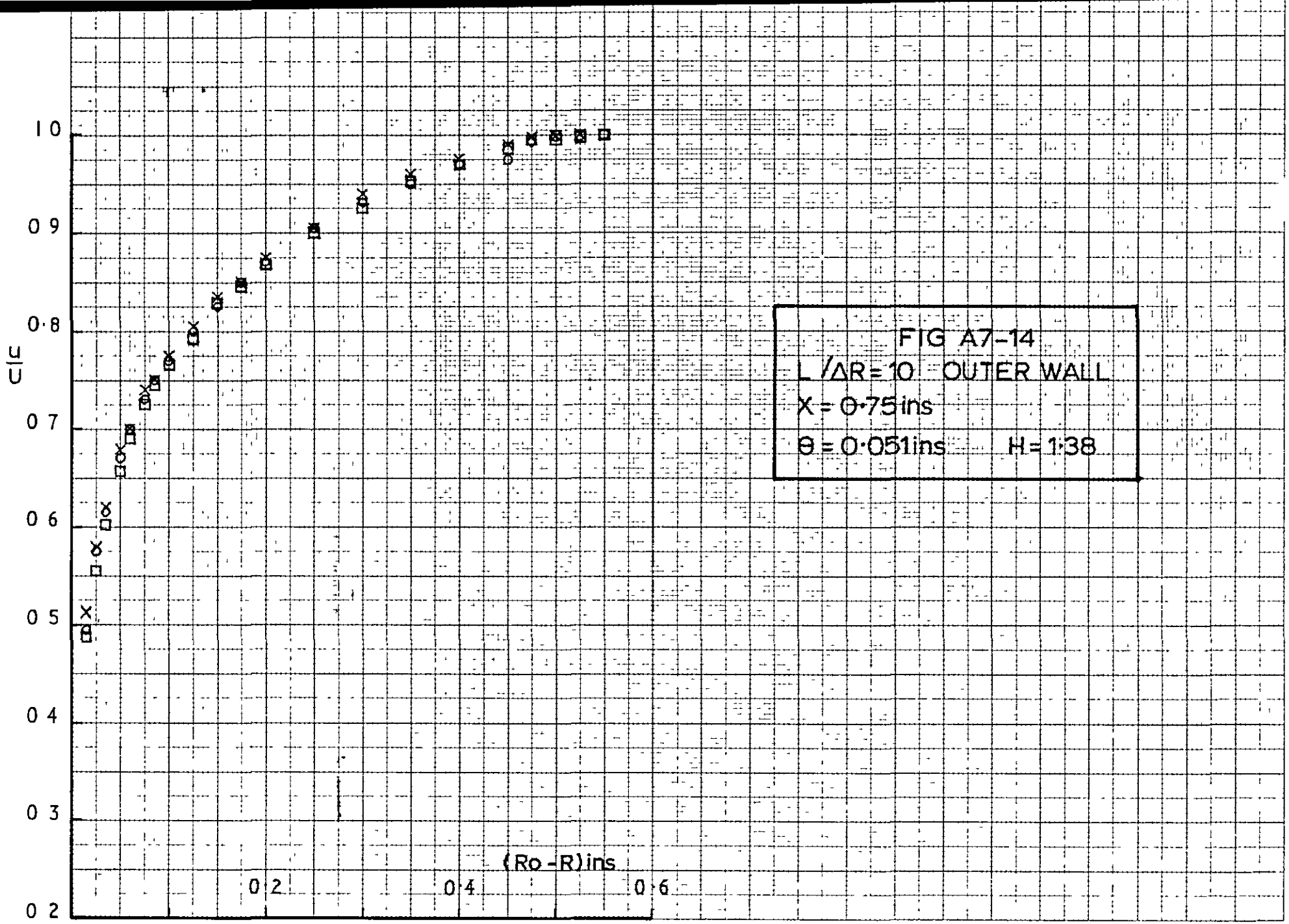
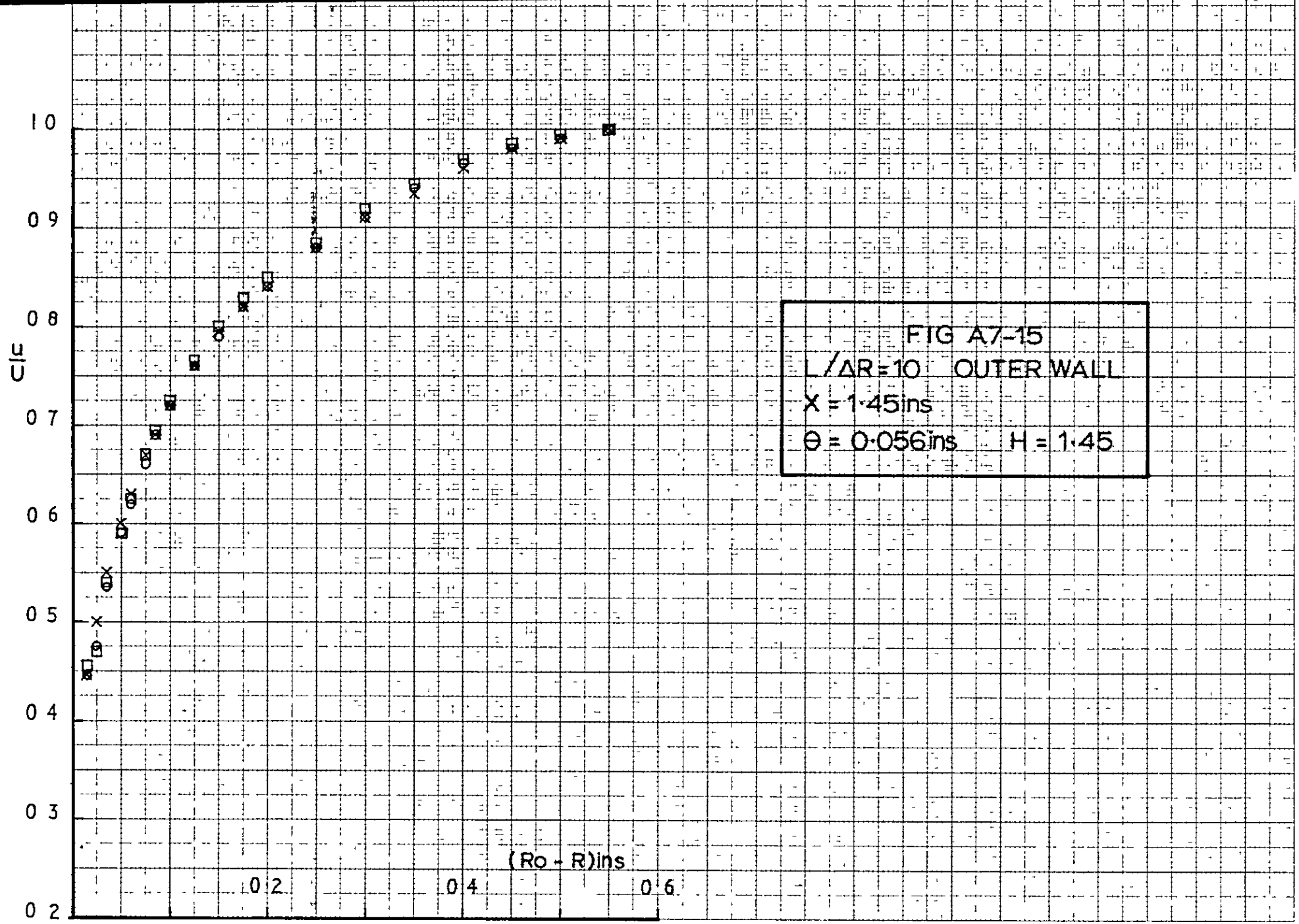
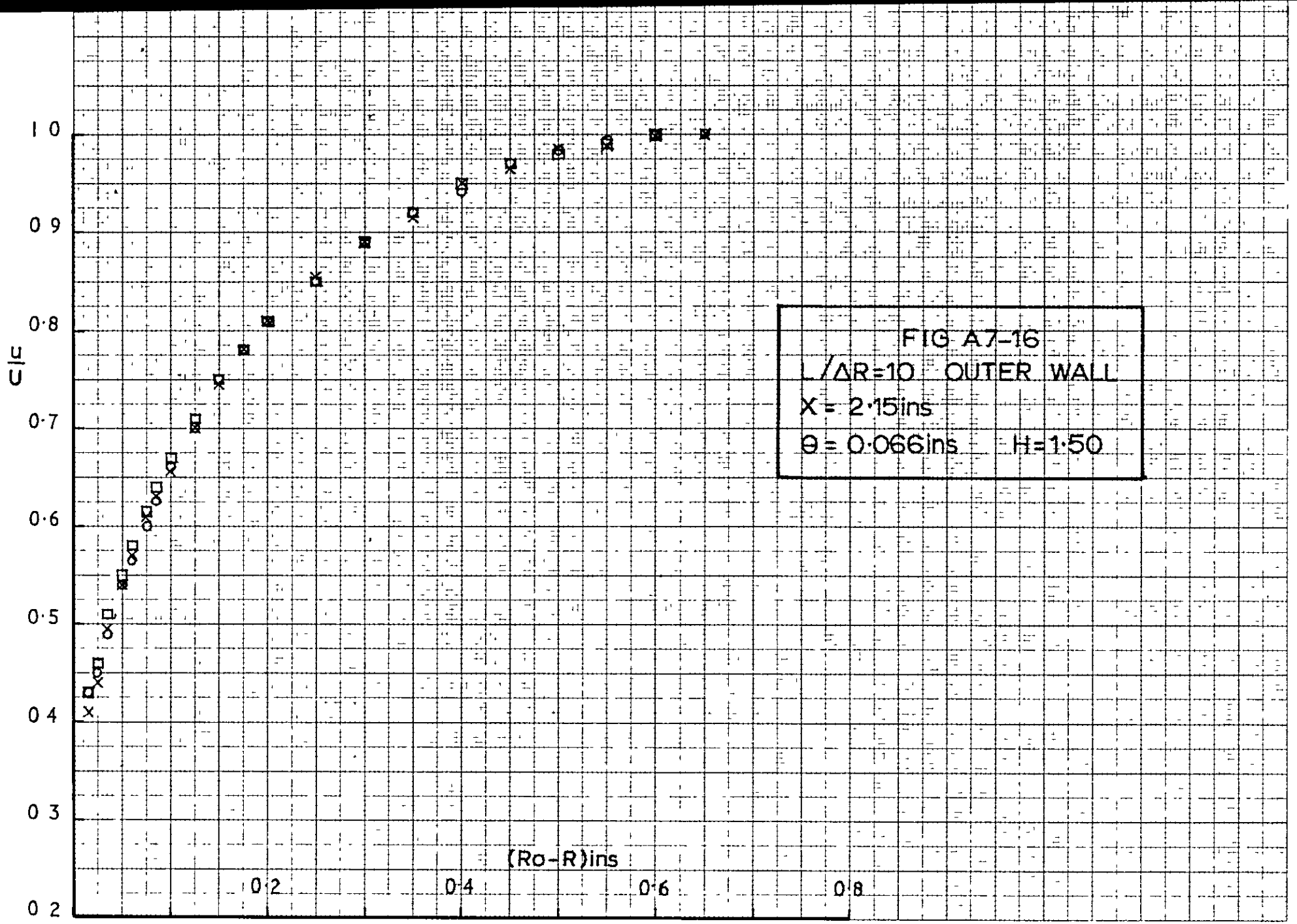
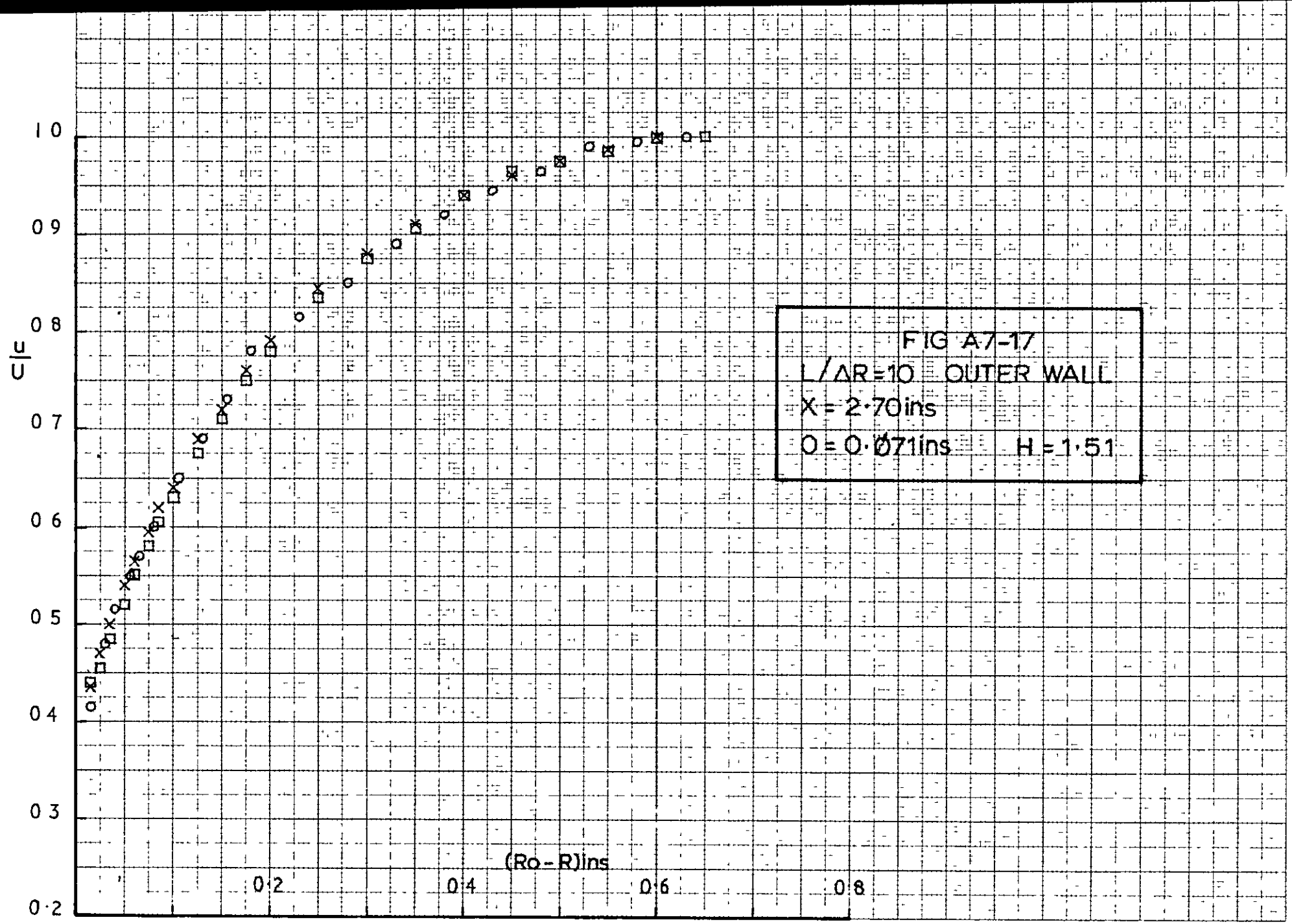
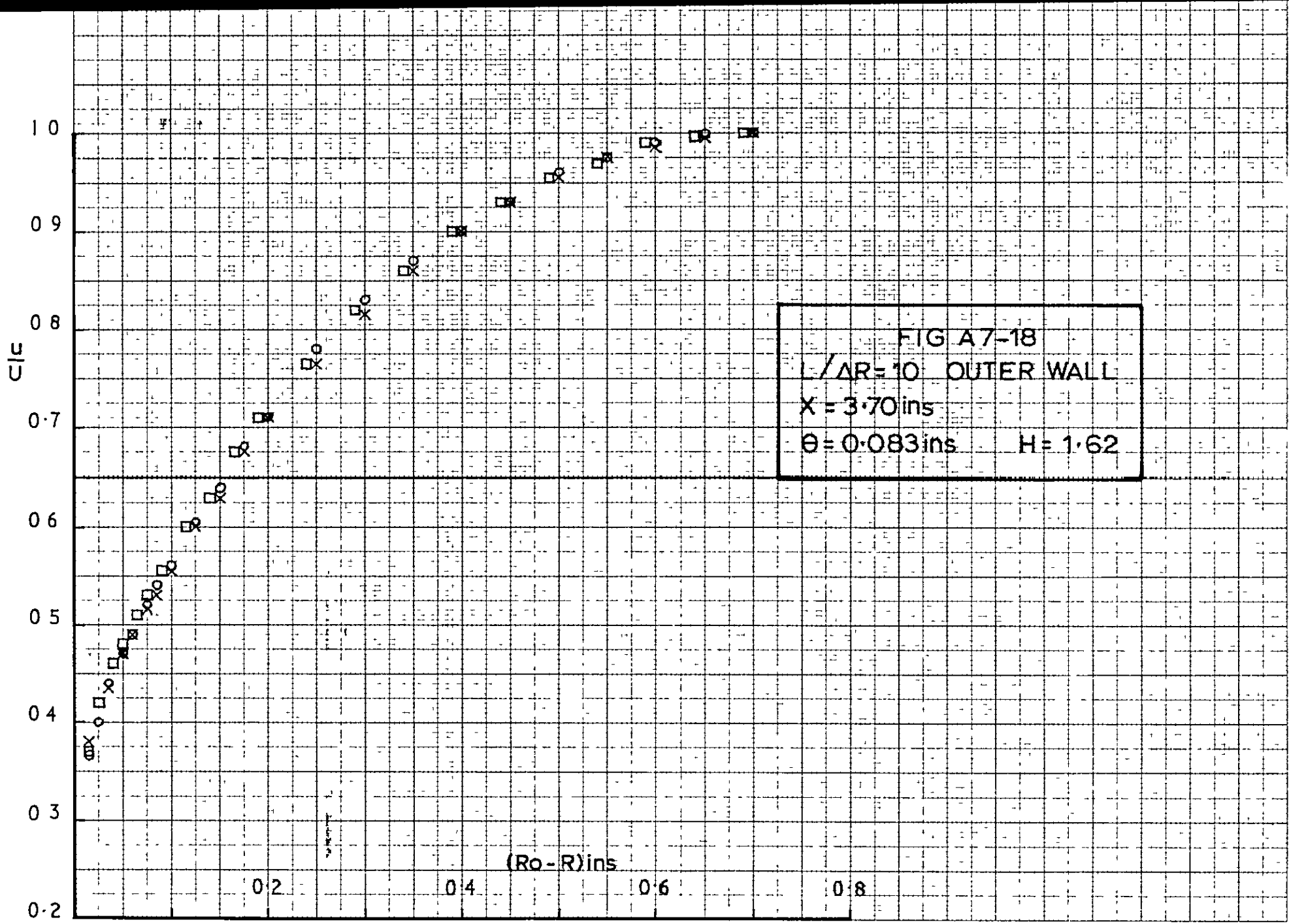


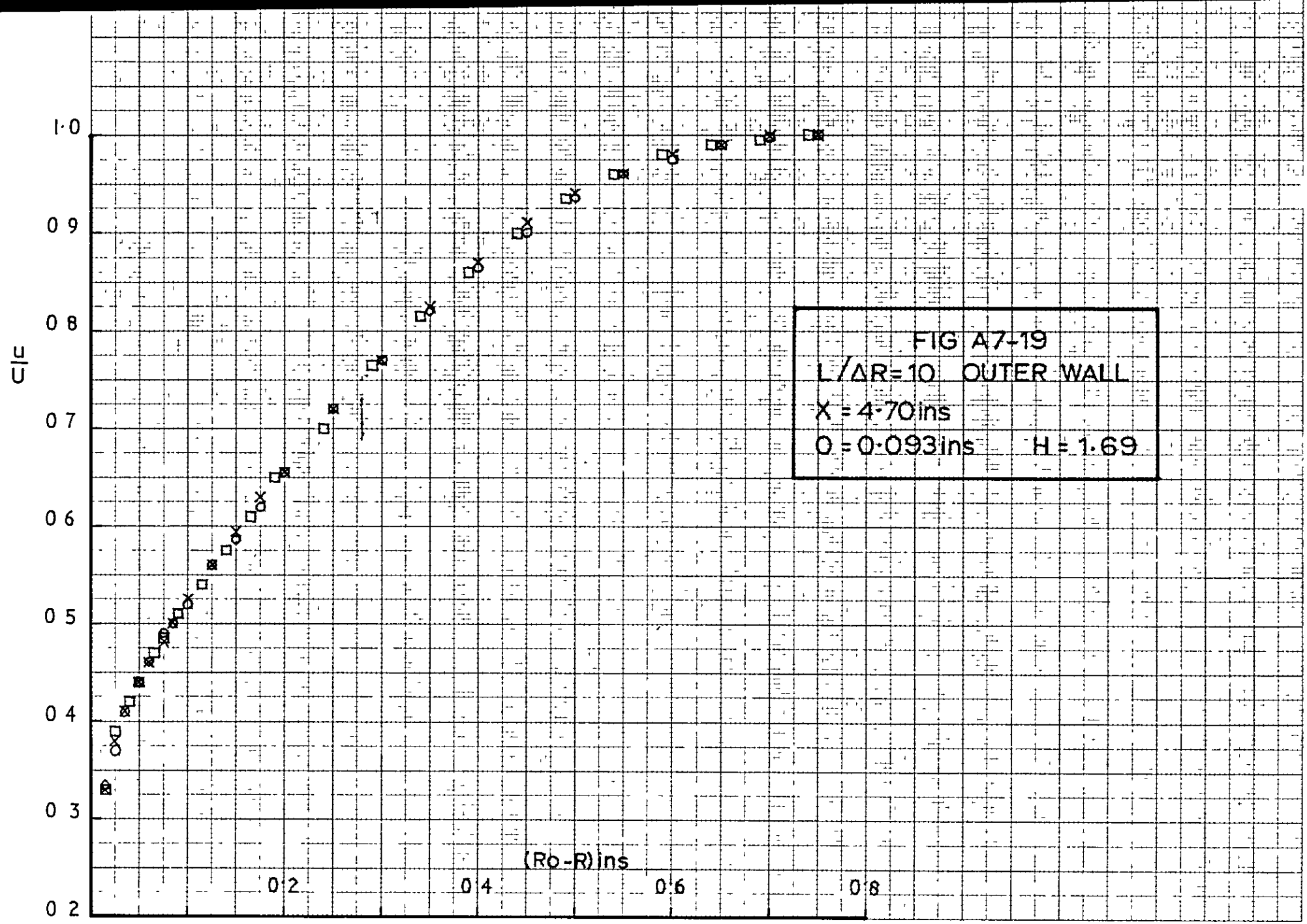
FIG A7-14
L/ΔR = 10 OUTER WALL
X = 0·75 ins
θ = 0·051 ins H = 1:38


FIG A7-15
L/ΔR=10 OUTER WALL
X = 1·45ins
θ = 0·056ins H = 1·45
u/U
1 0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
(Ro - R)ins
0 2
0 4
0 6


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
u/U
(Ro-R)ins
0·2
0·4
0·6
0·8
FIG A7-16
L/ΔR=10 OUTER WALL
X = 2·15ins
θ = 0·066ins H=1·50


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
0·8
(Ro - R)ins
FIG A7-17
L/ΔR=10 OUTER WALL
X = 2·70ins
O = 0·071ins
H = 1·51


1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
U/u
0·2
0·4
0·6
0·8
(Ro - R)ins
FIG A7-18
L/ΔR = 10 OUTER WALL
X = 3·70 ins
θ = 0·083 ins H = 1·62


1·0
0 9
0 8
0 7
0 6
0 5
0 4
0 3
0 2
U/c
0·2
0 4
0·6
0·8
(Ro-R)ins
FIG A7-19
L/ΔR=10 OUTER WALL
X = 4·70ins
O = 0·093ins H = 1·69

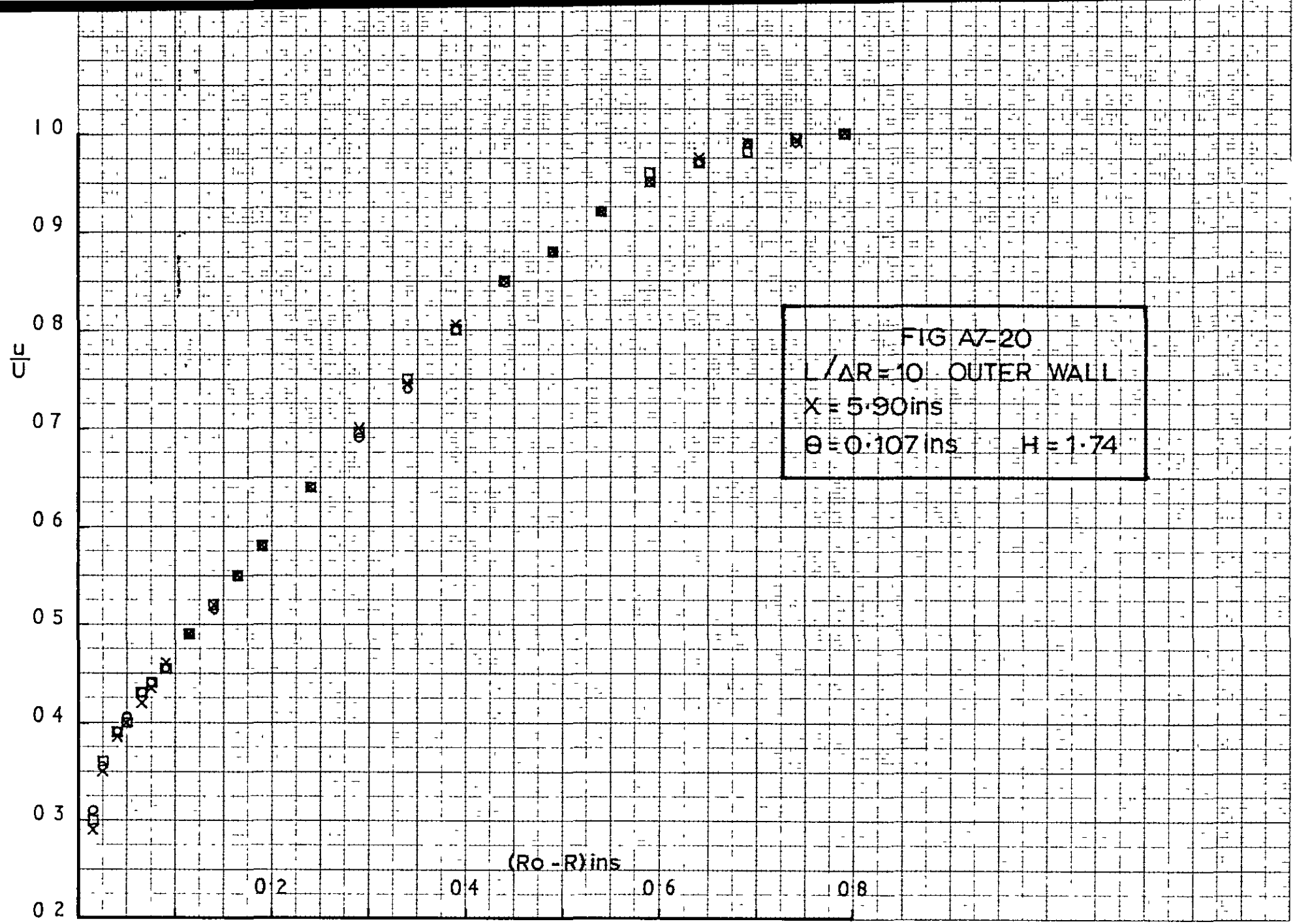
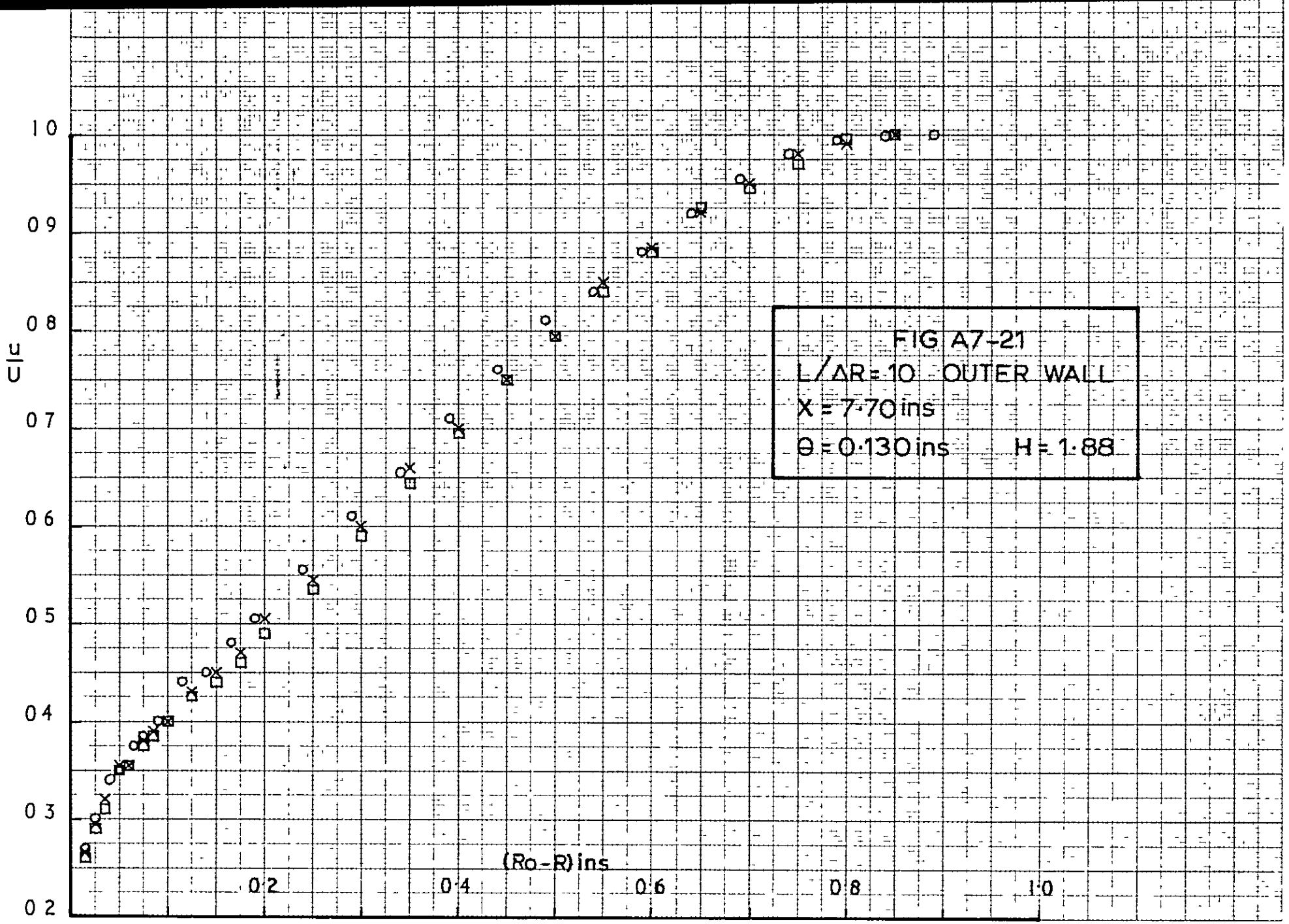
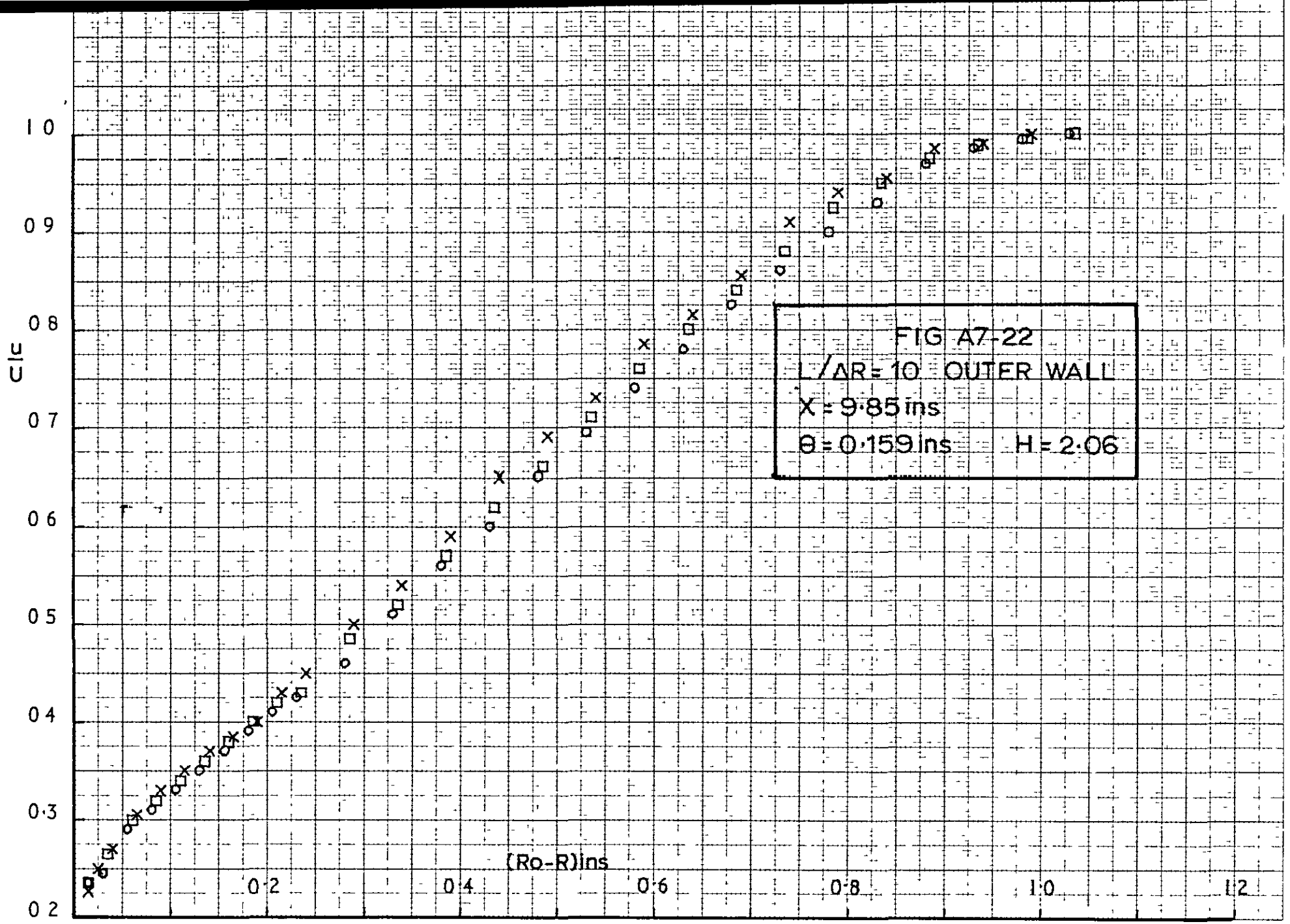


FIG A7-20
L/ΔR = 10 OUTER WALL
X = 5·90 ins
θ = 0·107 ins H = 1·74


FIG A7-21
L/ΔR = 10 OUTER WALL
X = 7·70 ins
θ = 0·130 ins H = 1·88
U/u
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(Ro-R) ins
0·2
0·4
0·6
0·8
1·0


FIG A7-22
L/ΔR = 10 OUTER WALL
X = 9·85 ins
θ = 0·159 ins H = 2·06
U/U
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
(Ro-R) ins
0·2
0·4
0·6
0·8
1·0
1·2

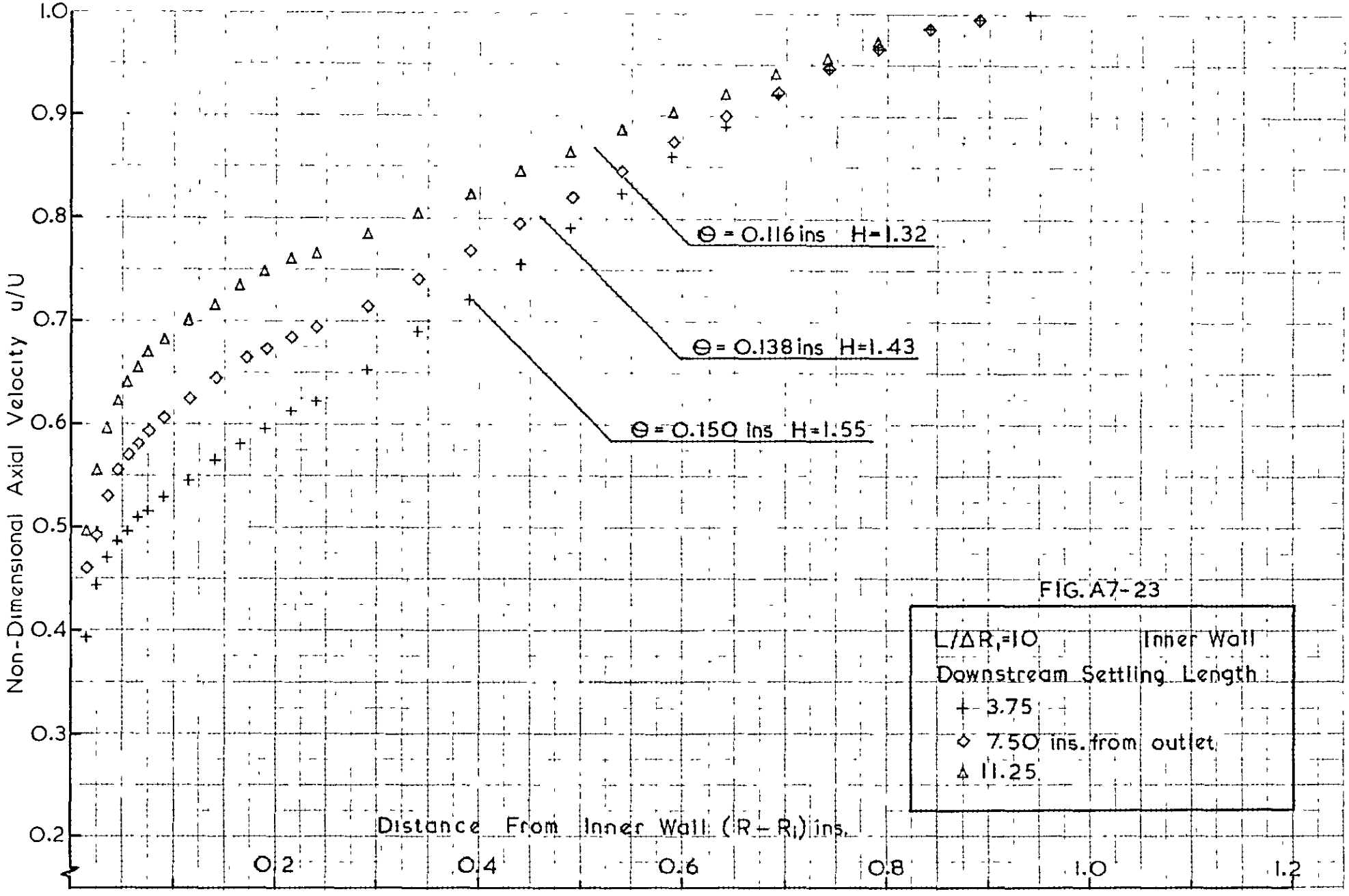

Non-Dimensional Axial Velocity u/U
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Θ = 0.116 ins H=1.32
Θ = 0.138 ins H=1.43
Θ = 0.150 ins H=1.55
L/ΔR_i=10 Inner Wall
Downstream Settling Length
+ 3.75
◇ 7.50 ins. from outlet
△ 11.25
Distance From Inner Wall (R − R_i) ins.
0.2
0.4
0.6
0.8
1.0
1.2

FIG. A7-23

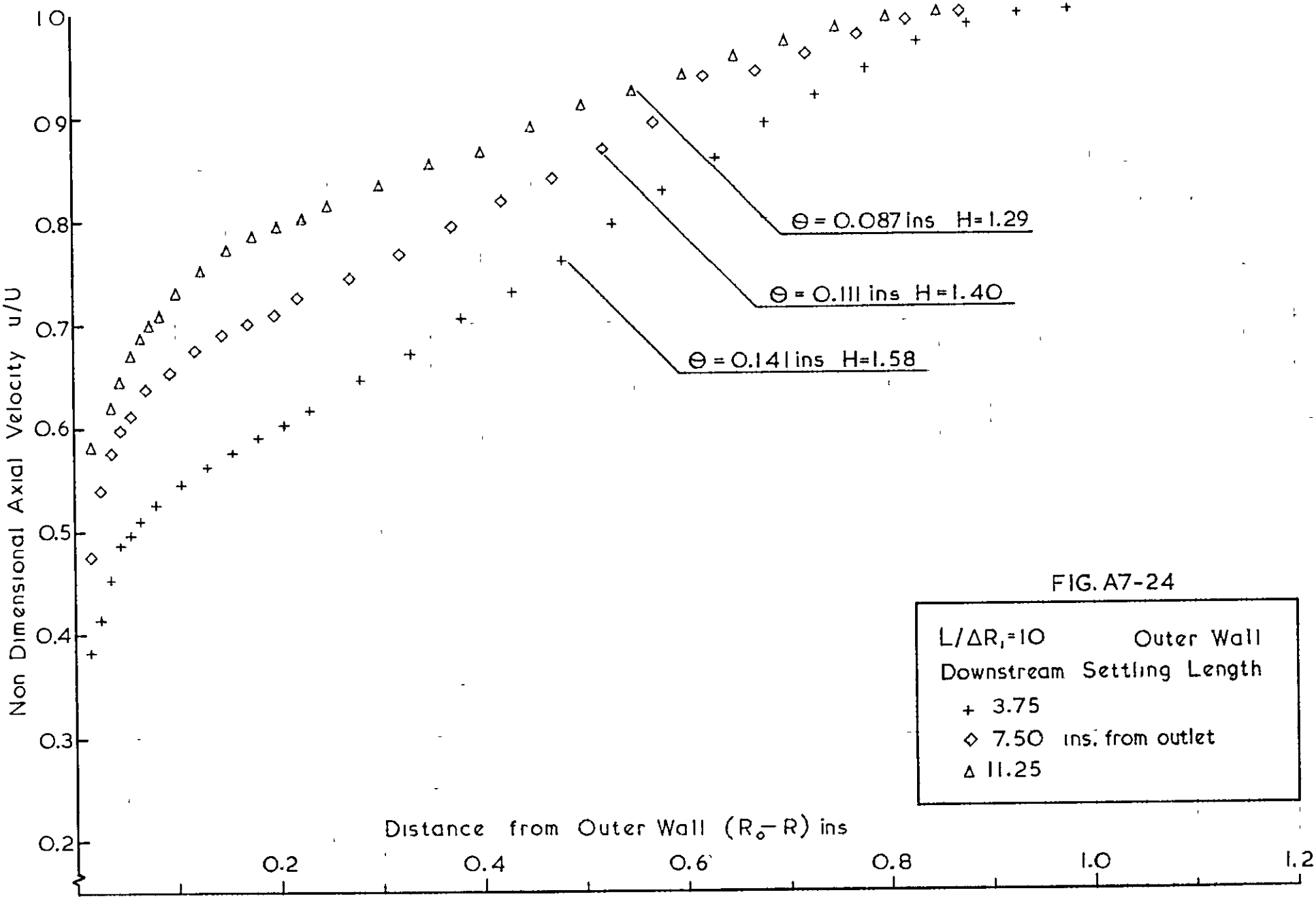

Non Dimensional Axial Velocity u/U
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Distance from Outer Wall (R₀ − R) ins
0.2
0.4
0.6
0.8
1.0
1.2
Θ = 0.087 ins H = 1.29
Θ = 0.111 ins H = 1.40
Θ = 0.141 ins H = 1.58
L/ΔR₁ = 10 Outer Wall
Downstream Settling Length
+ 3.75
◇ 7.50 ins. from outlet
△ 11.25

FIG. A7-24

Appendix 8

Boundary Layer Parameters

$L/\Delta R_1$ = 10 Diffuser

TABLE A8-1

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) =-3.000 INS. N.D.DIST.(X/L)=-0.300

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.058	0.044	1.317
INNER WALL(REL TO RI)	0.050	0.039	1.303
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.057	0.043	1.321
(REL TO RO-RI)	0.340	0.258	1.321
INNER WALL(REL TO RI)	0.051	0.040	1.299
(REL TO RO-RI)	0.257	0.198	1.299

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.077	1.787
INNER WALL(REL TO RI)	0.071	1.796

UMEAN/UMAX= 0.891 BETA(MOMENTUM)= 1.018 ALPHA(ENERGY)= 1.049

FLOW= 33.31CUFT/SEC %FLOW IN OUTER LAYER= 0.551 OVERLAP= 0.040

TABLE A8-2

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 0.300 INS. N.D.DIST.(X/L)=-0.030

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.058	0.044	1.297
INNER WALL(REL TO RI)	0.057	0.043	1.330
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.056	0.043	1.301
(REL TO RO-RI)	0.332	0.255	1.301
INNER WALL(REL TO RI)	0.059	0.044	1.325
(REL TO RO-RI)	0.286	0.216	1.325

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.078	1.796
INNER WALL(REL TO RI)	0.079	1.784

UMEAN/UMAX= 0.888 BETA(MOMENTUM)= 1.018 ALPHA(ENERGY)= 1.050

FLOW= 33.31CUFT/SEC %FLOW IN OUTER LAYER= 0.538 OVERLAP= 0.0[illegible]

TABLE A8-3

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 0.750 INS. N.D.DIST.(X/L)=-0.075

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.071	0.052	1.370
INNER WALL(REL TO RI)	0.063	0.047	1.362
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.070	0.051	1.375
(REL TO RO-RI)	0.396	0.288	1.375
INNER WALL(REL TO RI)	0.065	0.048	1.357
(REL TO RO-RI)	0.304	0.224	1.357

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.089	1.764
INNER WALL(REL TO RI)	0.085	1.773

UMEAN/UMAX= 0.874 BETA(MOMENTUM)= 1.024 ALPHA(ENERGY)= 1.065

FLOW= 32.59CUFT/SEC %FLOW IN OUTER LAYER= 0.540 OVERLAP= 0.006

TABLE A8-4

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 1.000 INS. N.D.DIST.(X/L)=-0.100

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.068	0.050	1.371
INNER WALL(REL TO RI)	0.071	0.054	1.327
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.067	0.049	1.376
(REL TO RO-RI)	0.374	0.272	1.376
INNER WALL(REL TO RI)	0.073	0.055	1.322
(REL TO RO-RI)	0.337	0.255	1.322

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.086	1.759
INNER WALL(REL TO RI)	0.099	1.760

UMEAN/UMAX= 0.872 BETA(MOMENTUM)= 1.022 ALPHA(ENERGY)= 1.062

FLOW= 32.41CUFT/SEC %FLOW IN OUTER LAYER= 0.522 OVERLAP= 0.008

TABLE A8-5

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 1.450 INS. N.D.DIST.(X/L)=-0.145

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.083	0.057	1.444
INNER WALL(REL TO RI)	0.076	0.054	1.405
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.081	0.056	1.450
(REL TO RO-RI)	0.441	0.304	1.450
INNER WALL(REL TO RI)	0.078	0.056	1.399
(REL TO RO-RI)	0.345	0.247	1.399

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.097	1.733
INNER WALL(REL TO RI)	0.097	1.754

UMEAN/UMAX= 0.859 BETA(MOMENTUM)= 1.030 ALPHA(ENERGY)= 1.084

FLOW= 32.94CUFT/SEC %FLOW IN OUTER LAYER= 0.509 OVERLAP= 0.027

TABLE A8-6

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 2.150 INS. N.D.DIST.(X/L)=-0.215

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.102	0.068	1.494
INNER WALL(REL TO RI)	0.090	0.062	1.440
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.099	0.066	1.502
(REL TO RO-RI)	0.517	0.345	1.502
INNER WALL(REL TO RI)	0.092	0.064	1.432
(REL TO RO-RI)	0.387	0.270	1.432

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.113	1.712
INNER WALL(REL TO RI)	0.112	1.739

UMEAN/UMAX= 0.842 BETA(MOMENTUM)= 1.032 ALPHA(ENERGY)= 1.092

FLOW= 32.89CUFT/SEC %FLOW IN OUTER LAYER= 0.540 OVERLAP=-0.052

TABLE A8-7

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 2.700 INS. N.D.DIST.(X/L)=-0.270

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.110	0.073	1.503
INNER WALL(REL TO RI)	0.096	0.066	1.453
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.107	0.071	1.511
(REL TO RO-RI)	0.540	0.358	1.511
INNER WALL(REL TO RI)	0.099	0.068	1.446
(REL TO RO-RI)	0.401	0.277	1.446

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.121	1.708
INNER WALL(REL TO RI)	0.118	1.730

UMEAN/UMAX= 0.837 BETA(MOMENTUM)= 1.034 ALPHA(ENERGY)= 1.097

FLOW= 33.37CUFT/SEC %FLOW IN OUTER LAYER= 0.547 OVERLAP=-0.019

TABLE A8-8

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 3.250 INS. N.D.DIST.(X/L)=-0.325

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.117	0.075	1.557
INNER WALL(REL TO RI)	0.106	0.072	1.471
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.114	0.073	1.565
(REL TO RO-RI)	0.559	0.357	1.565
INNER WALL(REL TO RI)	0.109	0.075	1.464
(REL TO RO-RI)	0.426	0.291	1.464

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.123	1.684
INNER WALL(REL TO RI)	0.128	1.720

UMEAN/UMAX= 0.826 BETA(MOMENTUM)= 1.043 ALPHA(ENERGY)= 1.120

FLOW= 31.65CUFT/SEC %FLOW IN OUTER LAYER= 0.520 OVERLAP= 0.064

TABLE A8-9

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 3.700 INS. N.D.DIST.(X/L)=-0.37(

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETEF H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.139	0.086	1.614
INNER WALL(REL TO RI)	0.115	0.076	1.511
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.135	0.083	1.624
(REL TO RO-RI)	0.647	0.399	1.624
INNER WALL(REL TO RI)	0.119	0.079	1.502
(REL TO RO-RI)	0.448	0.298	1.502

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.139	1.669
INNER WALL(REL TO RI)	0.135	1.707

UMEAN/UMAX= 0.810 BETA(MOMENTUM)= 1.047 ALPHA(ENERGY)= 1.133

FLOW= 32.86CUFT/SEC %FLOW IN OUTER LAYER= 0.531 OVERLAP= 0.024

TABLE A8-10

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)=-0.425

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.136	0.085	1.613
INNER WALL(REL TO RI)	0.128	0.084	1.526
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.133	0.082	1.621
(REL TO RO-RI)	0.617	0.381	1.621
INNER WALL(REL TO RI)	0.132	0.087	1.516
(REL TO RO-RI)	0.482	0.318	1.516

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.136	1.663
INNER WALL(REL TO RI)	0.148	1.701

UMEAN/UMAX= 0.807 BETA(MOMENTUM)= 1.051 ALPHA(ENERGY)= 1.143

FLOW= 32.76CUFT/SEC %FLOW IN OUTER LAYER= 0.514 OVERLAP= 0.0[illegible]

TABLE A8-11

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.700 INS. N.D.DIST.(X/L)=-0.470

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.162	0.097	1.675
INNER WALL(REL TO RI)	0.140	0.089	1.567
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.157	0.093	1.687
(RFL TO RO-RI)	0.715	0.424	1.687
INNER WALL(REL TO RI)	0.145	0.093	1.556
(RFL TO RO-RI)	0.514	0.330	1.556

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.154	1.649
INNER WALL(RFL TO RI)	0.158	1.690

UMEAN/UMAX= 0.788 BETA(MOMENTUM)= 1.056 ALPHA(ENERGY)= 1.160

FLOW= 32.97CUFT/SEC %FLOW IN OUTER LAYER= 0.517 OVERLAP=-0.024

TABLE A8-12

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 5.450 INS. N.D.DIST.(X/L)=-0.545

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.179	0.107	1.674
INNER WALL(RFL TO RI)	0.153	0.096	1.586
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.173	0.103	1.687
(RFL TO RO-RI)	0.760	0.450	1.687
INNER WALL(REL TO RI)	0.158	0.101	1.576
(REL TO RO-RI)	0.536	0.340	1.576

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(RFL TO RO)	0.169	1.650
INNER WALL(REL TO RI)	0.169	1.676

UMEAN/UMAX= 0.774 BETA(MOMENTUM)= 1.062 ALPHA(ENERGY)= 1.175

FLOW= 32.65CUFT/SEC %FLOW IN OUTER LAYER= 0.535 OVERLAP=-0.053

TABLE A8-13

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 5.900 INS. N.D.DIST.(X/L)=-0.590

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.192	0.111	1.723
INNER WALL(REL TO RI)	0.162	0.100	1.619
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.186	0.107	1.736
(REL TO RO-RI)	0.798	0.460	1.736
INNER WALL(REL TO RI)	0.168	0.104	1.607
(REL TO RO-RI)	0.554	0.345	1.607

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.174	1.631
INNER WALL(REL TO RI)	0.175	1.671

UMEAN/UMAX= 0.769 BETA(MOMENTUM)= 1.065 ALPHA(ENERGY)= 1.186

FLOW= 33.16CUFT/SEC %FLOW IN OUTER LAYER= 0.528 OVERLAP=-0.009

TABLE A8-14

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 7.250 INS. N.D.DIST.(X/L)=-0.725

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.226	0.128	1.757
INNER WALL(REL TO RI)	0.179	0.109	1.636
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.218	0.123	1.772
(REL TO RO-RI)	0.884	0.498	1.772
INNER WALL(REL TO RI)	0.186	0.115	1.623
(REL TO RO-RI)	0.568	0.350	1.623

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.199	1.622
INNER WALL(REL TO RI)	0.190	1.661

UMEAN/UMAX= 0.750 BETA(MOMENTUM)= 1.074 ALPHA(ENERGY)= 1.210

FLOW= 32.83CUFT/SEC %FLOW IN OUTER LAYER= 0.524 OVERLAP=-0.025

TABLE A8-15

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 7.700 INS. N.D.DIST.(X/L)=-0.770

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.254	0.136	1.867
INNER WALL(REL TO RI)	0.187	0.112	1.659
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.245	0.130	1.884
(REL TO RO-RI)	0.976	0.518	1.884
INNER WALL(REL TO RI)	0.194	0.118	1.645
(REL TO RO-RI)	0.581	0.353	1.645

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.207	1.591
INNER WALL(REL TO RI)	0.196	1.655

UMEAN/UMAX= 0.736 BETA(MOMENTUM)= 1.083 ALPHA(ENERGY)= 1.240

FLOW= 33.17CUFT/SEC %FLOW IN OUTER LAYER= 0.533 OVERLAP= 0.044

TABLE A8-16

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)=-0.985

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.342	0.168	2.038
INNER WALL(REL TO RI)	0.237	0.139	1.709
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.327	0.159	2.064
(REL TO RO-RI)	1.206	0.585	2.064
INNER WALL(REL TO RI)	0.249	0.147	1.692
(REL TO RO-RI)	0.668	0.395	1.692

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.246	1.554
INNER WALL(REL TO RI)	0.241	1.640

UMEAN/UMAX= 0.687 BETA(MOMENTUM)= 1.106 ALPHA(ENERGY)= 1.311

FLOW= 32.69CUFT/SEC %FLOW IN OUTER LAYER= 0.544 OVERLAP=-0.050

TABLE A8-17

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.233	0.149	1.565
INNER WALL(REL TO RI)	0.221	0.141	1.567
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.223	0.141	1.576
(REL TO RO-RI)	0.818	0.519	1.576
INNER WALL(REL TO RI)	0.233	0.150	1.554
(REL TO RO-RI)	0.621	0.400	1.554

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.236	1.666
INNER WALL(REL TO RI)	0.251	1.676

UMEAN/UMAX= 0.758 BETA(MOMENTUM)= 1.050 ALPHA(ENERGY)= 1.148

FLOW= 32.64CUFT/SEC %FLOW IN OUTER LAYER= 0.541 OVERLAP=-0.015

TABLE A8-18

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.161	0.115	1.391
INNER WALL(REL TO RI)	0.187	0.130	1.440
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.155	0.111	1.398
(REL TO RO-RI)	0.567	0.405	1.398
INNER WALL(REL TO RI)	0.198	0.138	1.430
(REL TO RO-RI)	0.527	0.369	1.430

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.192	1.740
INNER WALL(REL TO RI)	0.238	1.724

UMEAN/UMAX= 0.816 BETA(MOMENTUM)= 1.030 ALPHA(ENERGY)= 1.087

FLOW= 32.87CUFT/SEC %FLOW IN OUTER LAYER= 0.534 OVERLAP= 0.045

TABLE A8-19

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

B.L. THICKNESS 2D DEFINITIONS	DISPLACEMENT DELTA*(INS)	MOMENTUM THETA(INS)	SHAPE PARAMETER H=DELTA*/THETA
OUTER WALL(REL TO RO)	0.116	0.091	1.282
INNER WALL(REL TO RI)	0.145	0.110	1.323
3D DEFINITIONS(AXISYMMETRIC)			
OUTER WALL(REL TO RO)	0.112	0.087	1.286
(REL TO RO-RI)	0.411	0.320	1.286
INNER WALL(REL TO RI)	0.153	0.116	1.315
(REL TO RO-RI)	0.408	0.310	1.315

B.L. THICKNESS 3D DEFINITIONS(AXI)	ENERGY DELTA**(INS)	ENERGY SHAPE PARAMETER DELTA**/THETA
OUTER WALL(REL TO RO)	0.156	1.793
INNER WALL(REL TO RI)	0.207	1.780

UMEAN/UMAX= 0.862 BETA(MOMENTUM)= 1.017 ALPHA(ENERGY)= 1.050

FLOW= 34.11CUFT/SEC %FLOW IN OUTER LAYER= 0.521 OVERLAP= 0.055

APPENDIX 9

STATIC PRESSURE DISTRIBUTIONS

The experimental observations are tabulated below.

DIFFUSER $L/\Delta R_1 = 5.0$

Inlet Conditions: $\frac{1}{2}\rho U_1^2 = 4.22$ ins. H_2O, $\frac{1}{2}\rho \bar{u}_1^2 = 3.38$ ins. H_2O

AXIAL LOCATION X - ins.	$(P_x - P_1)_o$ mean ins H_2O	$\frac{\Delta P_o}{\frac{1}{2}\rho \bar{u}_1^2}$	$(P_x - P_1)_1$ mean ins H_2O	$\frac{\Delta P_1}{\frac{1}{2}\rho \bar{u}_1^2}$
- 3.0	0	0	0	0
- 2.55	- 0.02	- 0.006	0	0
- 2.15	- 0.01	- 0.003	0	0
- 1.75	- 0.02	- 0.006	- 0.01	- 0.003
- 1.35	- 0.04	- 0.012	- 0.01	- 0.003
- 0.95	- 0.08	- 0.024	- 0.02	- 0.006
- 0.55	- 0.11	- 0.033	- 0.02	- 0.006
- 0.15	- 0.14	- 0.041	- 0.02	- 0.006
0.30	0.14	0.041	-	-
0.75	0.60	0.178	0.59	0.175
1.35	1.01	0.300	0.95	0.281
1.95	1.30	0.384	1.30	0.384
2.55	1.48	0.438	1.44	0.425
3.15	1.61	0.475	1.575	0.465
3.75	1.71	0.506	1.65	0.488
4.28	1.78	0.526	1.73	0.511
4.85	1.85	0.547	1.81	0.535
Distance from Diffuser Exit ins.				
3.75	2.11	0.624	-	-
7.50	2.21	0.653	-	-
11.25	2.25	0.665	-	-
15.00	2.25	0.665	-	-
18.75	2.23	0.660	-	-
22.50	2.21	0.654	-	-

DIFFUSER $L/\Delta R_1 = 7.5$

Inlet Conditions: $\frac{1}{2}\rho U_1^2 = 4.98$ ins. H_2O, $\frac{1}{2}\rho \bar{u}_1^2 = 3.98$ ins. H_2O

Axial Location X - ins.	$(P_x - P_1)_o$ mean ins H_2O	$\frac{\Delta P_o}{\frac{1}{2}\rho \bar{u}_1^2}$	$(P_x - P_1)_i$ mean ins. H_2O	$\frac{\Delta P_i}{\frac{1}{2}\rho \bar{u}_1^2}$
- 3.0	0	0	0	0
- 2.55	- 0.01	- 0.003	0	0
- 2.15	- 0.03	- 0.008	0	0
- 1.75	- 0.07	- 0.018	- 0.01	- 0.003
- 1.35	- 0.11	- 0.028	- 0.01	- 0.003
- 0.95	- 0.08	- 0.020	- 0.02	- 0.005
- 0.55	- 0.13	- 0.033	0	0
- 0.15	- 0.15	- 0.038	- 0.01	- 0.003
0.3	0.03	0.008	-	-
0.75	0.47	0.118	0.42	0.106
1.25	0.80	0.201	0.76	0.191
1.70	1.05	0.264	1.04	0.261
2.20	1.28	0.322	1.27	0.319
2.65	1.46	0.367	1.45	0.364
3.15	1.64	0.412	1.64	0.412
3.60	1.78	0.447	1.78	0.447
4.10	1.91	0.490	1.92	0.482
5.05	2.12	0.533	2.10	0.527
6.0	2.34	0.588	2.29	0.575
7.35	2.54	0.638	2.47	0.620
Distance from Diffuser Exit ins				
3.75	2.57	0.645	-	-
7.50	2.64	0.663	-	-
11.25	2.66	0.668	-	-
15.00	2.66	0.668	-	-
18.75	2.64	0.663	-	-
22.50	2.65	0.665	-	-

DIFFUSER $L/\Delta R_1 = 10.0$

Inlet Conditions : $\frac{1}{2}\rho U_1^2 = 4.34$ ins. H_2O, $\frac{1}{2}\rho \overline{u}_1^2 = 3.47$ ins. H_2O

Axial Location X ins.	$(P_x - P_1)_0$ mean ins H_2O	$\frac{\Delta P_0}{\frac{1}{2}\rho \overline{u}_1^2}$	$(P_x - P_1)_1$ mean ins H_2O	$\frac{\Delta P_1}{\frac{1}{2}\rho \overline{u}_1^2}$
- 3.000	0	0	0	0
- 2.55	0	0	0	0
- 2.15	0	0	-0.03	-0.086
- 1.75	-0.02	-0.006	-0.06	-0.017
- 1.35	-0.04	-0.011	-0.04	-0.011
- 0.95	-0.07	-0.020	-0.04	-0.011
-.0.55	-0.09	-0.026	-0.04	-0.011
- 0.15	-0.10	-0.029	-	-
0.30	0.145	0.042	-	-
0.75	0.385	0.111	0.380	0.110
1.10	0.54	0.156	0.500	0.144
1.45	0.685	0.198	0.640	0.184
1.80	0.80	0.231	0.750	0.216
2.15	0.912	0.263	0.905	0.261
2.70	1.09	0.314	1.045	0.301
3.70	1.345	0.388	1.380	0.398
4.70	1.565	0.451	1.60	0.460
5.90	1.78	0.513	1.79	0.515
7.70	2.02	0.582	2.01	0.579
9.85	2.23	0.641	2.19	0.632
Distance from Diffuser Exit ins.				
3.75	2.37	0.682	-	-
7.50	2.40	0.690	-	-
11.25	2.40	0.690	-	-
15.00	2.39	0.690	-	-
18.75	2.36	0.680	-	-
22.50	2.32	0.670	-	-

APPENDIX 10

ESTIMATION OF TOTAL PRESSURE LOSSES

A 10-1 Overall Loss Coefficient

Writing the Energy Equation for the total flow through the diffuser as:-

$$\alpha_1 \tfrac{1}{2}\rho \bar{u}_1^2 + P_1 = \alpha_2 \tfrac{1}{2}\rho \bar{u}_2^2 + P_2 + \Delta P_{T_{1-2}} \qquad \text{A10-1}$$

where mass-averaged total pressure loss $\Delta P_{T_{1-2}} = \lambda_{1-2} \tfrac{1}{2}\rho \bar{u}_1^2$

also from the Continuity Equation, for incompressible flow,

$$A_1 \bar{u}_1 = A_2 \bar{u}_2$$

Substitution in Eqn. A10-1 yields;

$$\bar{C}_{P_{1-2}} = \left[\alpha_1 - \frac{\alpha_2}{(A_2/A_1)^2} \right] - \lambda_{1-2} \qquad \text{A10-2}$$

or at any station x

$$\bar{C}_{P_{1-x}} = \left[\alpha_1 - \frac{\alpha_x}{(A_x/A_1)^2} \right] - \lambda_{1-x} \qquad \text{A10-3}$$

The variation of α_x with distance X from diffuser inlet is shown in Fig. A10-1. The values of α_x are given in Appendices A4/6/8. The computed values of λ_{1-x} from Equation A10-3 are tabulated below, and shown graphically in Fig. A10-2.

$L/\Delta R_1 = 5$ DIFFUSER

X ins	0.3	0.75	1.35	1.95	2.55	3.15	3.75	4.28	4.85
α_x	1.059	1.089	1.137	1.194	1.265	1.355	1.465	1.589	1.69*
A_x/A_1	1.057	1.148	1.263	1.385	1.51	1.63	1.76	1.87	1.99
α_1	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045
$\alpha_x/(A_x/A_1)^2$	0.950	0.826	0.713	0.623	0.555	0.510	0.473	0.455	0.427
$\bar{C}_P' = \left[\alpha_1 - \frac{\alpha_x}{(A_x/A_1)^2}\right]$	0.095	0.219	0.332	0.422	0.490	0.535	0.572	0.590	0.618
$\bar{C}_P$	0.05	0.175	0.290	0.375	0.433	0.470	0.500	0.518	0.540
λ_{1-x}	0.045	0.044	0.042	0.047	0.057	0.065	0.072	0.072	0.078

* arithmetic mean value

$L/\Delta R_1$ = 7.5 DIFFUSER

X ins.	0.75	1.25	1.70	2.20	2.65	3.15	3.60	4.10	5.05	6.00	7.35
α_x	1.073	1.094	1.109	1.132	1.147	1.174	1.19	1.22	1.27	1.32	1.41
A_x/A_1	1.097	1.162	1.22	1.285	1.346	1.413	1.473	1.542	1.674	1.81	1.99
α_1	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045
$\alpha_x/(A_x/A_1)^2$	0.891	0.810	0.745	0.685	0.634	0.588	0.550	0.513	0.453	0.403	0.356
$\bar{C}_p' = \left[\alpha_1 - \frac{\alpha_x}{(A_x/A_1)^2}\right]$	0.154	0.235	0.300	0.360	0.411	0.457	0.495	0.532	0.592	0.642	0.689
$\bar{C}_p$	0.112	0.200	0.260	0.320	0.365	0.410	0.445	0.483	0.537	0.580	0.624
λ_{1-x}	0.042	0.035	0.040	0.040	0.046	0.047	0.050	0.049	0.055	0.062	0.065

$L/\Delta R_1$ = 10.0 DIFFUSER

X ins.	0.75	1.00	1.45	2.15	2.70	3.25	3.70	4.25	4.70	5.45	5.90	7.25	7.70	9.85
α_x	1.061	1.065	1.075	1.092	1.105	1.118	1.128	1.143	1.155	1.175	1.186	1.225	1.240	1.311
A_x/A_1	1.072	1.096	1.139	1.22	1.264	1.319	1.363	1.42	1.465	1.54	1.585	1.73	1.766	2.00
α_1	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045	1.045
$\alpha_x/(A_x/A_1)^2$	0.925	0.888	0.830	0.735	0.691	0.644	0.608	0.568	0.538	0.495	0.472	0.410	0.394	0.328
$\bar{C}_p' = \left[\alpha_1 - \frac{\alpha_x}{(A_x/A_1)^2}\right]$	0.120	0.157	0.215	0.310	0.354	0.401	0.437	0.477	0.507	0.550	0.573	0.635	0.651	0.717
$\bar{C}_p$	0.105	0.135	0.190	0.260	0.310	0.355	0.385	0.422	0.450	0.487	0.508	0.560	0.576	0.640
λ_{1-x}	0.015	0.022	0.025	0.050	0.044	0.046	0.052	0.055	0.057	0.063	0.065	0.075	0.075	0.077

A 10-2 Estimation of Total Pressure Loss Along the Streamline of Maximum Velocity

The total pressure loss along the streamline of maximum velocity has been calculated from the pressure rise and boundary layer data, rather than by direct measurement. Although direct measurement is feasible in conical diffusers, such an approach is not practical in annular diffusers due to the difficulty in accurately locating the position of maximum velocity.

If the static pressure is uniform across all sections of the diffuser, the pressure rise along the streamline of maximum velocity will be the same as that of the diffuser. This can be evaluated in the following manner.

$$P_1 + \tfrac{1}{2}\rho U_1^2 = P_2 + \tfrac{1}{2}\rho U_2^2 + (\Delta P_T)_m \qquad \text{A10-4}$$

where $(\Delta P_T)_m$ is the total pressure loss along the streamline of maximum velocity

$$\therefore \quad P_2 - P_1 = \tfrac{1}{2}\rho(U_1^2 - U_2^2) - (\Delta P_T)_m$$

$$\text{or} \quad \bar{C}_P = \frac{P_2 - P_1}{\frac{1}{2}\rho \bar{u}_1^2} = \frac{U_1^2 - U_2^2}{\bar{u}_1^2} - \frac{(\Delta P_T)_m}{\frac{1}{2}\rho \bar{u}_1^2} \qquad \text{A10-5}$$

$$\text{at any station X} \quad \bar{C}_{P_{1-X}} = \frac{U_1^2 - U_X^2}{\bar{u}_1^2} - \frac{(\Delta P_{T\,1-X})_m}{\frac{1}{2}\rho \bar{u}_1^2} \qquad \text{A10-6}$$

$$\text{Now} \quad \bar{C}_{P_{1-X}} = \left(\frac{U_1}{\bar{u}_1}\right)^2 \left[1 - \left(\frac{U_X}{U_1}\right)^2\right] - \frac{(\Delta P_{T\,1-X})_m}{\frac{1}{2}\rho \bar{u}_1^2} \qquad \text{A10-7}$$

$$\therefore \quad \bar{C}_{P_{1-X}} = \bar{C}'_{P_{1-X}} - \frac{(\Delta P_{T\,1-X})_m}{\frac{1}{2}\rho \bar{u}_1^2} \quad \text{, where } \bar{C}'_P = \left(\frac{U_1}{\bar{u}_1}\right)^2 \left[1 - \left(\frac{U_X}{U_1}\right)^2\right]$$

$$\text{and} \quad \left(\frac{U_X}{U_1}\right) = \left(\frac{U}{\bar{u}}\right)_X \left(\frac{\bar{u}_X}{\bar{u}_1}\right)\left(\frac{\bar{u}}{U}\right)_1 = \left(\frac{U}{\bar{u}}\right)_X \left(\frac{A_1}{A_X}\right)\left(\frac{\bar{u}}{U}\right)_1$$

Values of $\left(\frac{\bar{u}}{U}\right)x$ are tabulated in Appendices in A4/6/8, and using the pressure rise characteristics, the values of $(\Delta P_{Tm})\Big/\frac{1}{2}\rho\bar{u}_1^2$ can be determined from Eqn. A10-7. The results are tabulated below and shown in Fig. A10-3.

$L/\Delta R_1 = 5$ DIFFUSER

X ins	0.3	0.75	1.35	1.95	2.55	3.15	3.75	4.28	4.85
A_x/A_1	1.057	1.148	1.263	1.385	1.51	1.63	1.76	1.87	1.99
$(\bar{u}/U)_x$	0.885	0.856	0.825	0.791	0.756	0.723	0.687	0.650	0.612
$(\bar{u}/U)_1$	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895
U_x/U_1	0.957	0.911	0.859	0.817	0.784	0.759	0.741	0.737	0.736
$(U_x/U_1)^2$	0.9155	0.831	0.738	0.668	0.615	0.576	0.550	0.543	0.541
$\bar{C}_p'$	0.1055	0.2115	0.327	0.414	0.481	0.530	0.562	0.570	0.575
$\bar{C}_p$	0.0500	0.1750	0.290	0.375	0.433	0.475	0.500	0.518	0.540
$\Delta P_{Tm}/\frac{1}{2}\rho\bar{u}_i^2$	0.0555	0.0365	0.037	0.039	0.048	0.055	0.062	0.052	0.035*

* not plotted in view of asymmetry

P.T.O. for results on the $L/\Delta R_1 = 7.5$ & 10.0 Diffuser

$L/\Delta R_1 = 7.5$ DIFFUSER

X ins	0.75	1.25	1.70	2.20	2.65	3.15	3.60	4.10	5.05	6.0	7.35
A_x/A_1	1.097	1.162	1.220	1.285	1.346	1.413	1.473	1.542	1.674	1.81	1.99
$(\bar{u}/U)_x$	0.866	0.850	0.837	0.818	0.804	0.790	0.775	0.758	0.730	0.702	0.669
$(\bar{u}/U)_1$	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895
U_x/U_1	0.942	0.906	0.8765	0.851	0.827	0.802	0.784	0.766	0.732	0.704	0.672
$(U_x/U_1)^2$	0.888	0.821	0.768	0.725	0.685	0.643	0.615	0.587	0.535	0.496	0.452
$\overline{C_P}'$	0.140	0.223	0.289	0.343	0.393	0.446	0.481	0.516	0.580	0.630	0.684
$\overline{C_P}$	0.112	0.200	0.260	0.320	0.365	0.410	0.445	0.483	0.537	0.580	0.624
$\Delta P_{Tm}/\frac{1}{2}\rho\bar{u}_1^2$	0.028	0.023	0.029	0.023	0.028	0.036	0.036	0.033	0.043	0.050	0.060

$L/R_1 = 10.0$ Diffuser

X ins	0.75	1.00	1.45	2.15	2.70	3.25	3.70	4.25	4.70	5.45	5.90	7.25	7.7	9.85
A_x/A_1	1.072	1.096	1.139	1.220	1.264	1.319	1.363	1.420	1.465	1.54	1.585	1.73	1.776	2.0
$(\bar{u}/U)_x$	0.874	0.872	0.859	0.846	0.837	0.826	0.815	0.807	0.795	0.780	0.769	0.743	0.736	0.687
$(\bar{u}/U)_1$	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895
U_x/U_1	0.955	0.937	0.915	0.867	0.846	0.821	0.806	0.781	0.769	0.745	0.734	0.696	0.685	0.651
$(U_x/U_1)^2$	0.912	0.877	0.837	0.752	0.716	0.675	0.649	0.610	0.519	0.555	0.539	0.485	0.469	0.424
$\overline{C_P}'$	0.109	0.153	0.204	0.310	0.355	0.406	0.438	0.487	0.511	0.555	0.576	0.643	0.663	0.719
$\overline{C_P}$	0.105	0.135	0.190	0.260	0.310	0.355	0.385	0.422	0.450	0.487	0.508	0.560	0.576	0.635
$\Delta P_{Tm}/\frac{1}{2}\rho\bar{u}_1^2$	0.004	0.018	0.014	0.050	0.045	0.051	0.053	0.065	0.061	0.068	0.068	0.083	0.087	0.084

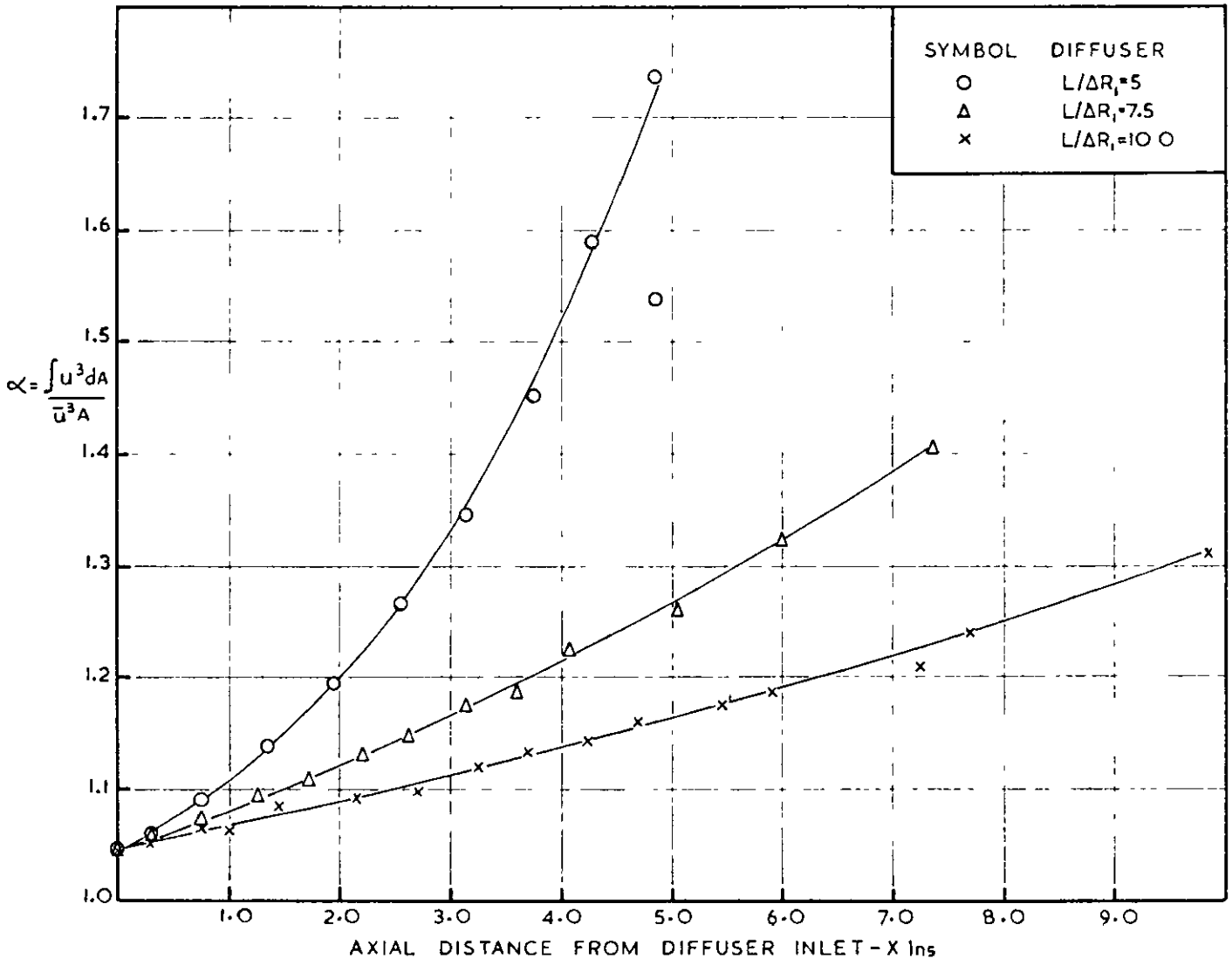


FIG A10-1 VARIATION OF VELOCITY PROFILE ENERGY COEFFICIENTS

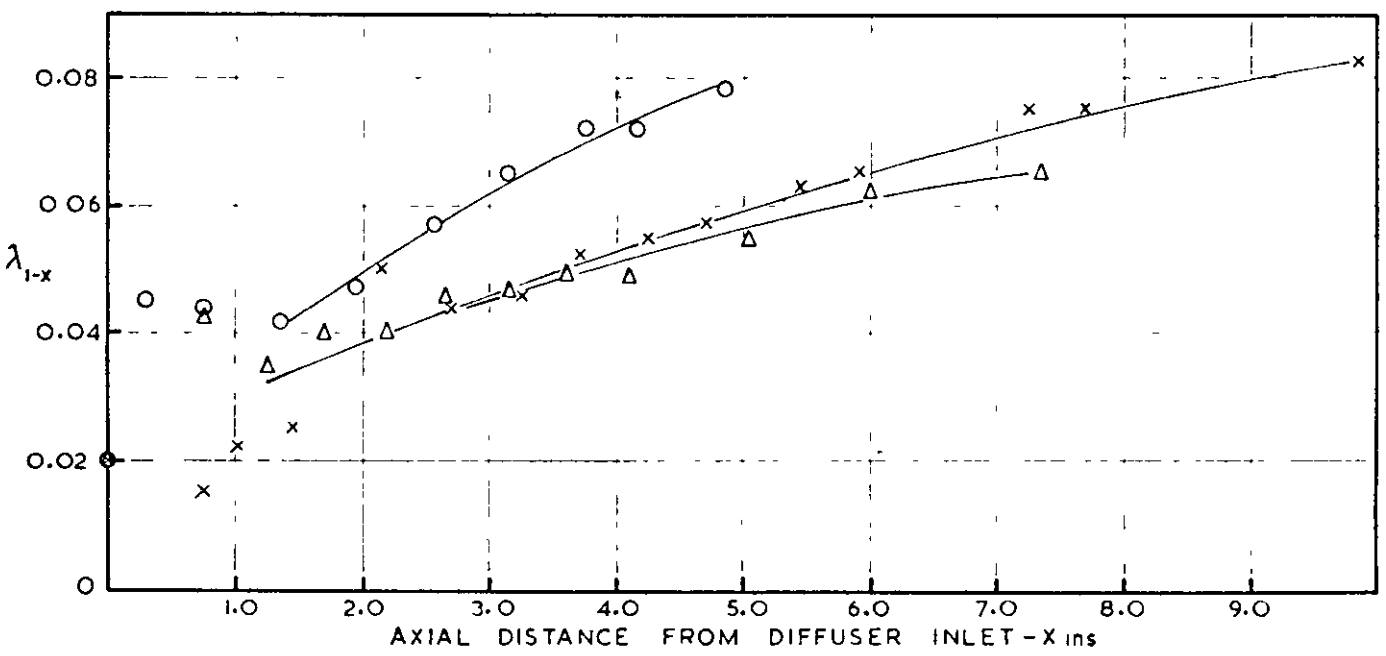


FIG.A10-2 VARIATION OF LOSS COEFFICIENTS

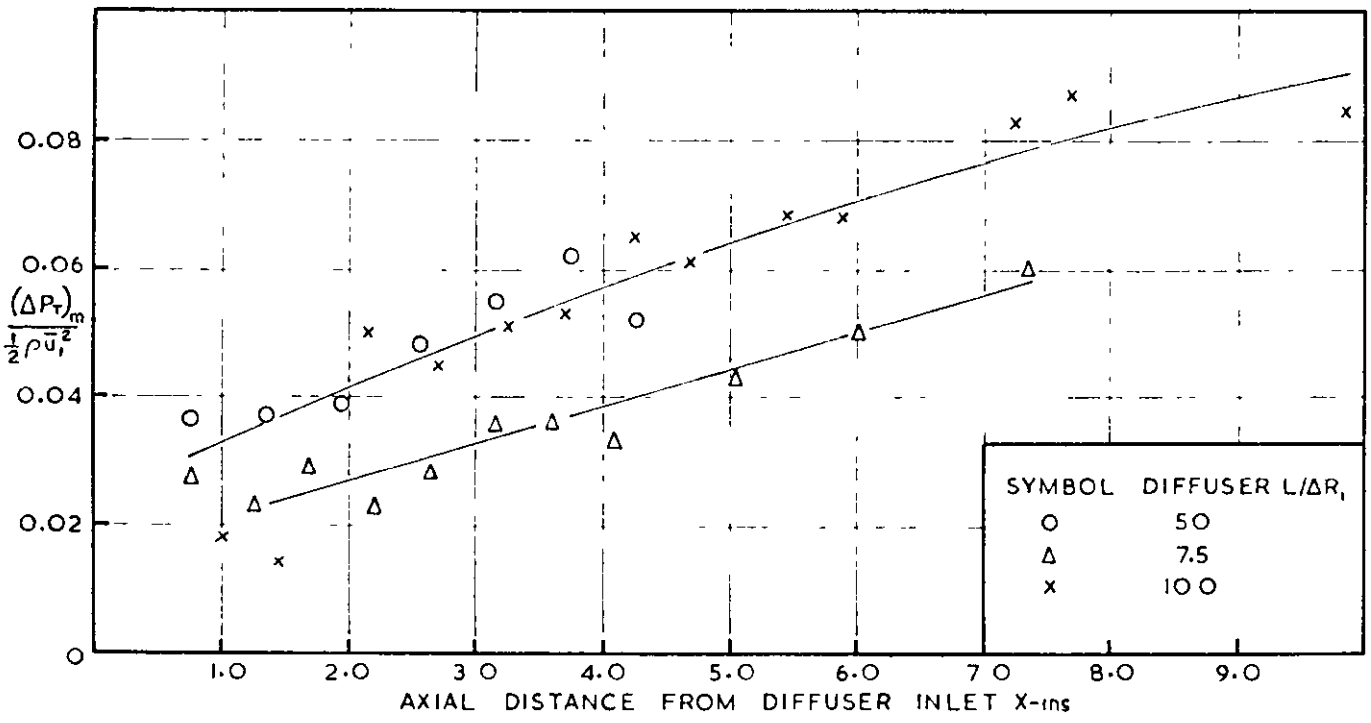


FIG. A10-3 VARIATION OF TOTAL PRESSURE LOSS ALONG THE STREAMLINE OF MAXIMUM VELOCITY

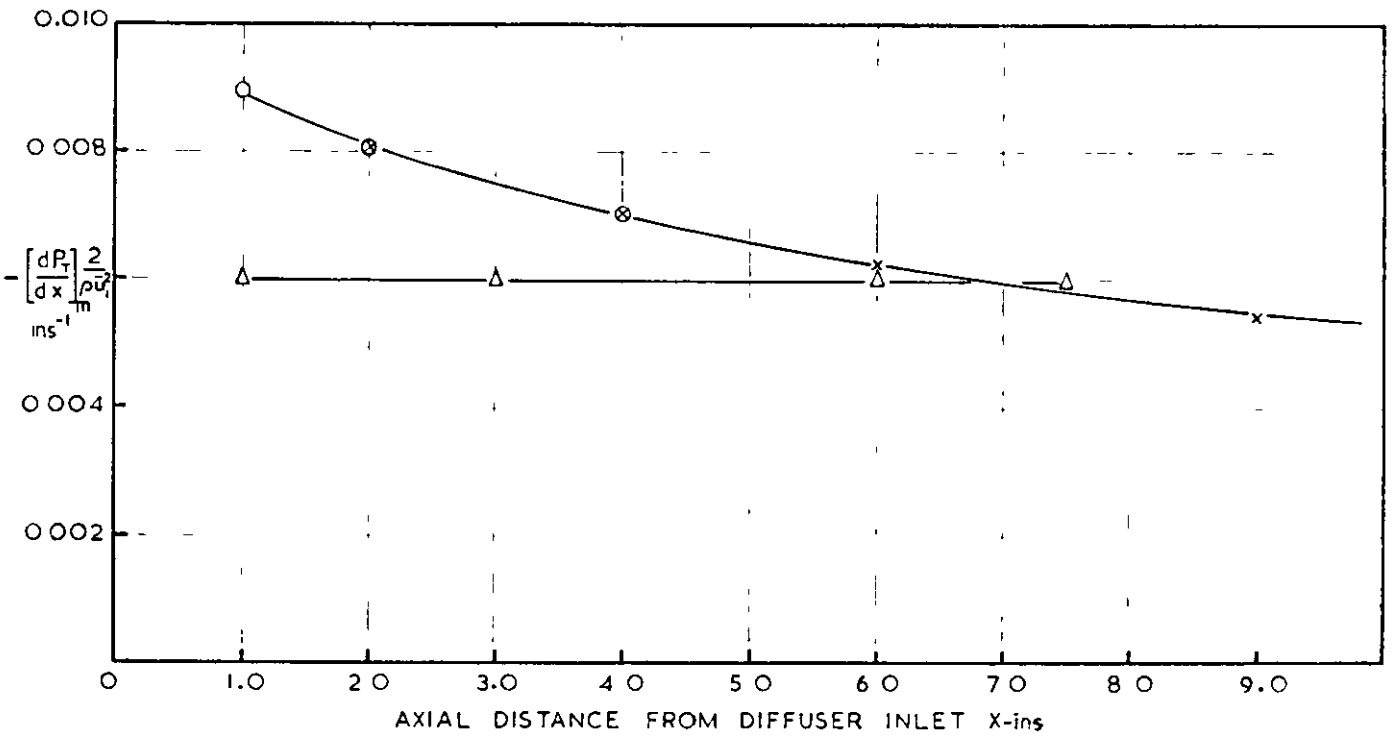


FIG. A10-4 GRADIENT OF TOTAL PRESSURE $-\frac{2}{\rho \bar{u}_1^2}\left[\frac{dP_T}{dx}\right]_m$ ALONG THE STREAMLINE OF MAXIMUM VELOCITY

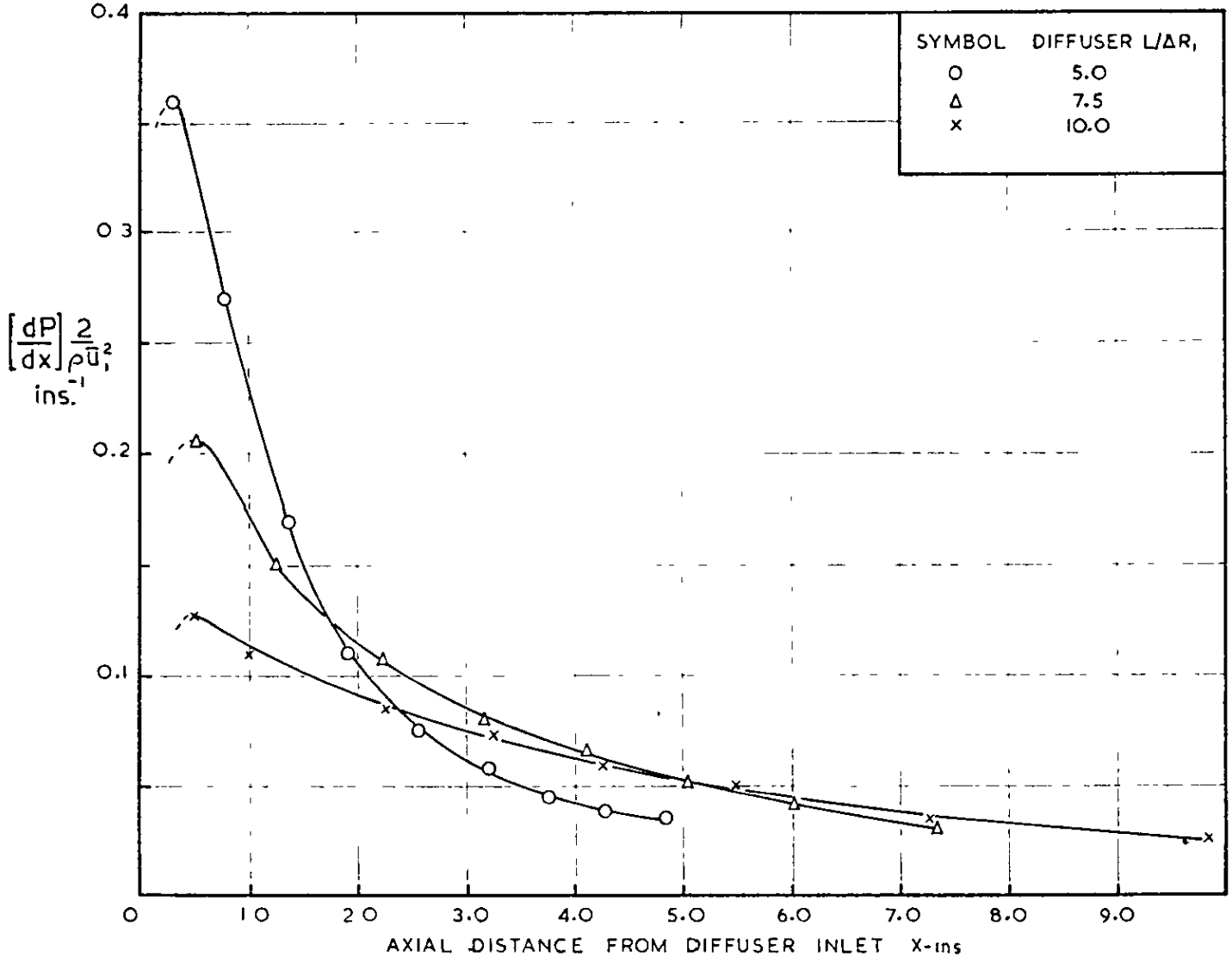


FIG. A10-5 AXIAL PRESSURE GRADIENT

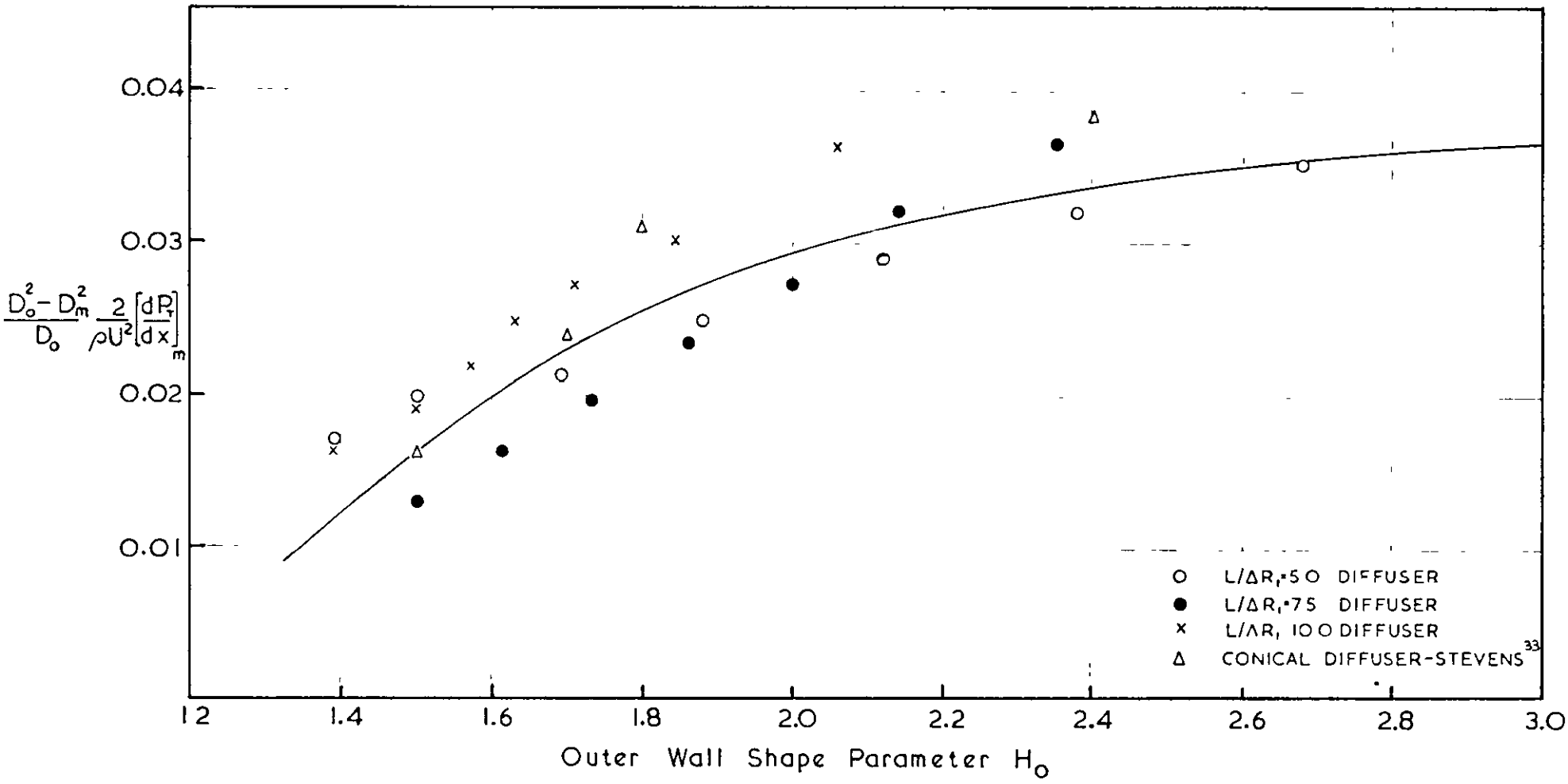


FIG. A10-6 CORRELATION OF THE TOTAL PRESSURE GRADIENT ALONG THE STREAMLINE OF MAXIMUM VELOCITY

APPENDIX 11

TURBULENCE MEASUREMENTS

All-1 Experimental Technique

The probe carrier was set on the inner wall and then traversed across the annulus to the outer wall. Traverses were also carried out from the outer wall past the point of maximum velocity. The initial run was carried out with a straight wire probe and the following readings taken:

R - Distance from inner wall (ins.),

E_c - R.M.S. voltage

V_c - Bridge D.C. voltage (recorded on a Weir D.V.M.)

V_{oc} - Bridge D.C. voltage (Zero Velocity ~ "Wind off",) (at the beginning and end of run)

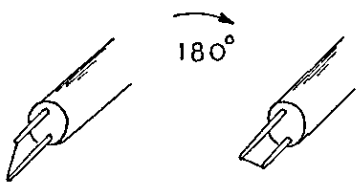
The probe element carrier was then removed and replaced by a 45° slant wire element. Prior to assembly the output terminal of the carrier was cleaned with Kistler contact cleaner, and when dry the "wind-off" voltage V_{oa} was measured. The probe was then traversed across the annulus and the following readings taken:

R - distance from wall (ins.)

Ea - R.M.S. voltage

Va_1 - Bridge D.C. voltage

At the completion of the traverse the carrier was removed and rotated through 180°, as illustrated:



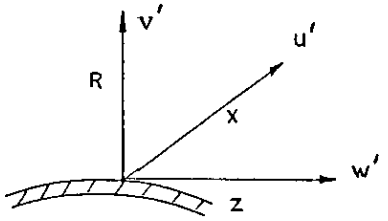
The contacts were cleaned again and the "wind-off" voltage Voa measured, if the value did not agree with that previously measured the contacts were re-cleaned. The traverse was then repeated and the following readings taken:

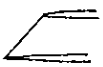
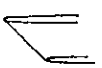
R - distance from wall (ins.)

Eb - R.M.S. Voltage

Va_2 - Bridge D.C. Voltage

At the end of this run the probe was rotated through 90°, and a further 180°, and the readings repeated. The readings taken and the symbols used in the subsequent analysis are summarised below:



Plane of wire	u'-v'	u'-v'	u'-v'	u'-w'	u'-w'
Position relative to mean flow					
R.M.S. Voltage	E_a	E_b	E_c	E_e	E_d
Bridge D.C. Voltage	Va_1	Va_2	Vc	Vd_1	Vd_2
'Wind-off' Voltage	Voa	Voa	Voc	Vod	Vod

A11-2 Reduction of Experimental Data

Prior to punching the data on I.C.T. cards, the following graphs were plotted for all traverses.

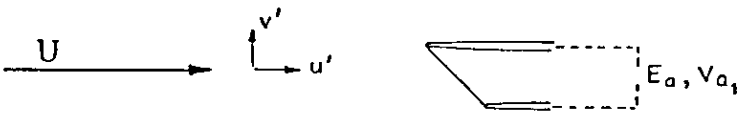
(i) E_a, E_b, E_c, E_d, E_e, v. R

(ii) V_a^2, V_c^2, V_d^2, v. R.

The purpose of plotting the initial set of data was firstly, to determine the position of zero shear stress and secondly, to check for any spurious points. However, in (ii) the object was to check for any evidence of inaccurate positioning of the probe. (see Section A13-4) A sample calculation is included in Section A11-4.

A11-3 Basic Equations

We assume a uniform velocity U with turbulence components u', v', and w'. It is further assumed that the turbulent fluctuations are small ($< 15\%$) compared with U, so that the simplified linear relations for heat loss from the wire are valid.



If the signals obtained in the various positions are led to a thermocouple we obtain:

$$(E_c)^2 = S_c^2 \overline{u'^2} \qquad \text{A11-1}$$

$$(E_a)^2 = S_a^2 (\overline{u' + v'})^2 = S_a^2 (\overline{u'^2 + 2u'v' + v'^2}) \qquad \text{A11-2}$$

$$(E_b)^2 = S_b^2 (\overline{u' - v'})^2 = S_b^2 (\overline{u'^2 - 2u'v' + v'^2}) \qquad \text{A11-3}$$

If we use the same wire for measurements in positions A and B inclined at 45°, then we may say that the wire sensitivity Sa = Sb. The sensitivity is a function of the wire itself, and its operating conditions, as well as its orientation.

$$(E_a)^2 - (E_b)^2 = S_a^2 \, 4\overline{u'v'} \qquad \text{A11-4}$$

$$(E_a)^2 + (E_b)^2 = S_a^2 \, 2(\overline{u'^2} + \overline{v'^2}) \qquad \text{A11-5}$$

in the above expression, 's', the wire sensitivity is defined as $\frac{dv}{du}$ where V = Bridge D.C. voltage, and u = mean flow velocity.

Now King's Law states:

$$\frac{V^2}{R} = \alpha + \beta\sqrt{u} \qquad \text{A11-6}$$

where R = probe operating resistance; α and β are constants.

Also we may write;

$$\frac{V^2}{R} = \frac{V_o^2}{R} + \beta\sqrt{u} \cdot \qquad \text{A11-7}$$

where V_o = bridge voltage at zero velocity.

From A11-6

$$\frac{2V\,dV}{R\,dR} = \frac{1}{2}\frac{\beta}{\sqrt{u}}\,du \qquad \therefore \frac{dv}{du} = A = \frac{\beta R}{4V\sqrt{u}}$$

$$\text{but} \quad \sqrt{u} = \frac{V^2 - V_o^2}{R\beta} \qquad uA = \frac{\beta R\sqrt{u}}{4V}$$

$$\therefore \quad u\frac{dv}{du} = \frac{\beta R}{4V}\left(\frac{V^2 - V_o^2}{\beta R}\right) = \frac{V^2 - V_o^2}{4V}$$

$$\therefore \quad S = \frac{V^2 - V_o^2}{4Vu} \qquad \text{A11-9}$$

$$\text{and} \quad \sqrt{\overline{u'^2}} = \frac{E_c}{S_c} = E_c\frac{4V_c u}{V^2 - V_o^2}$$

or non-dimensionalising w.r.t. U

$$\frac{\sqrt{\overline{u'}^2}}{U} = E_c \frac{4V_c(u/U)}{V_c^2 - V_o^2} \qquad \text{A 11-10}$$

Similarly $$S_a = \frac{V_a^2 - V_o^2}{4 V_a u}$$

$$\therefore \quad \overline{u'v'} = \left(E_a^2 - E_b^2\right) \frac{16 V_a^2 u^2}{4\left(V_a^2 - V_o^2\right)^2}$$

or $$\frac{\overline{u'v'}}{U^2} = \left(E_a^2 - E_b^2\right) \times \frac{4 V_a^2 \left(u/U\right)^2}{\left(V_a^2 - V_o^2\right)^2} \qquad \text{A 11-11}$$

and $$\frac{E_a^2 + E_b^2}{2 S_a^2} - \frac{E_c^2}{S_c^2} = \overline{v'}^2 \qquad \text{A 11-12}$$

A similar set of equations can be written for the probe in the u-'w' plane.

A11-4 Sample Calculation

Consider the reduction of the inner wall data for the traverses carried out in the $L/\Delta R_1 = 10.0$ diffuser at the station X = 3.25 ins. - Position 1 (Blue)

Test with Straight Wire Probe

Test Observations

Vo_c = 8.86 volts

Distance from inner wall ins.	E_c	V_c
0.02	0.210	10.73
0.05	0.182	10.91
0.10	0.171	11.04
0.15	0.155	11.16
0.20	0.138	11.26
0.25	0.125	11.31
0.30	0.111	11.39
0.35	0.096	11.43
0.40	0.084	11.47
0.45	0.074	11.50
0.50	0.066	11.52
0.55	0.058	11.53
0.60	0.053	11.54
0.65	0.052	11.55
0.70	0.057	11.55
0.75	0.061	11.53
0.80	0.067	11.50
0.85	0.075	11.47
0.90	0.085	11.44
0.95	0.092	11.43
1.00	0.106	11.38
1.05	0.120	11.33
1.10	0.138	11.23
1.15	0.160	11.14
1.20	0.178	11.00
1.225	0.186	10.91
1.25	0.195	10.80

Vo_c = 8.86 volts

At each point a value of (u/U) was obtained from the mean profile data (Figs. All - 5/6) and the following data derived.

Distance from wall ins.	$\frac{u}{U}$	$\sqrt{\frac{u}{U}}$	V_c^2
0.02	0.440	0.663	115.1
0.05	0.527	0.726	119.0
0.10	0.619	0.787	121.9
0.15	0.690	0.831	124.5
0.20	0.750	0.866	126.8
0.25	0.797	0.893	127.8
0.30	0.840	0.917	129.8
0.35	0.884	0.940	130.7
0.40	0.907	0.952	131.6
0.45	0.933	0.966	132.3
0.50	0.956	0.978	132.8
0.55	0.987	0.994	133.0
0.60	0.990	0.995	133.2
0.65	0.995	0.998	133.3
0.70	1.000	1.000	133.3
0.75	0.992	0.996	133.0
0.80	0.975	0.987	132.3
0.85	0.953	0.976	131.6
0.90	0.924	0.961	130.9
0.95	0.889	0.943	130.7
1.00	0.845	0.919	129.5
1.05	0.792	0.890	128.4
1.10	0.733	0.856	126.1
1.15	0.659	0.812	124.1
1.20	0.570	0.755	121.0
1.225	0.524	0.724	119.0
1.25	0.450	0.671	116.6

The experimental observations are shown in Figures All - 1/2, and mean lines have been drawn through the data. At each point the appropriate values were read off, and the following data was punched on cards.

P.T.O.

Inner Wall Data (Ref. Table A.16-4)

Dist. from Wall ins.	E_c	V_c^2
0.025	0.206	116.1
0.05	0.194	118.8
0.10	0.171	122.0
0.15	0.155	124.4
0.20	0.138	126.2
0.25	0.125	127.7
0.30	0.111	129.0
0.35	0.096	130.2
0.40	0.084	131.0
0.45	0.074	131.6
0.50	0.066	132.2
0.55	0.058	133.0
0.60	0.053	133.1
0.65	0.052	133.3
0.70	0.055	133.3

Vo_c = 8.86 volts

The same technique was employed to reduce the data obtained from the slant wire tests, the experimental observations are shown in Figs. A11-3/4, and the values fed to the computer are listed in Table A16-4. The computer programme is detailed in Appendix 12, and the data and results for the three diffusers are given in Appendices 14/15/16. The symbols used in listing the data are shown in Section A11-1, and the following notation is used in the results "print-out".

R - RI Ro-RI	R-RI RM-RI	UTURB N.D	VTURB N D.	WTURB N. D.	TURBKE N. D.	2(U*V) N. D.	2(U*W) N. D.
$\frac{R-R_i}{R_o-R_i}$	$\frac{R-R_i}{R_o-R_i}$	$\frac{\sqrt{\overline{u'^2}}}{U}$	$\frac{\sqrt{\overline{v'^2}}}{U}$	$\frac{\sqrt{\overline{w'^2}}}{U}$	$\frac{1}{2U}\left(\sqrt{\overline{u'^2}}+\sqrt{\overline{v'^2}}+\sqrt{\overline{w'^2}}\right)$	$2\frac{\overline{u'v'}}{U^2}$	$2\frac{\overline{u'w'}}{U^2}$

Values of the non-dimensional turbulence energy $\frac{1}{2U^2}\left(\overline{u'^2}+\overline{v'^2}+\overline{w'^2}\right)$ are listed at the end of Appendices 14/15/16.

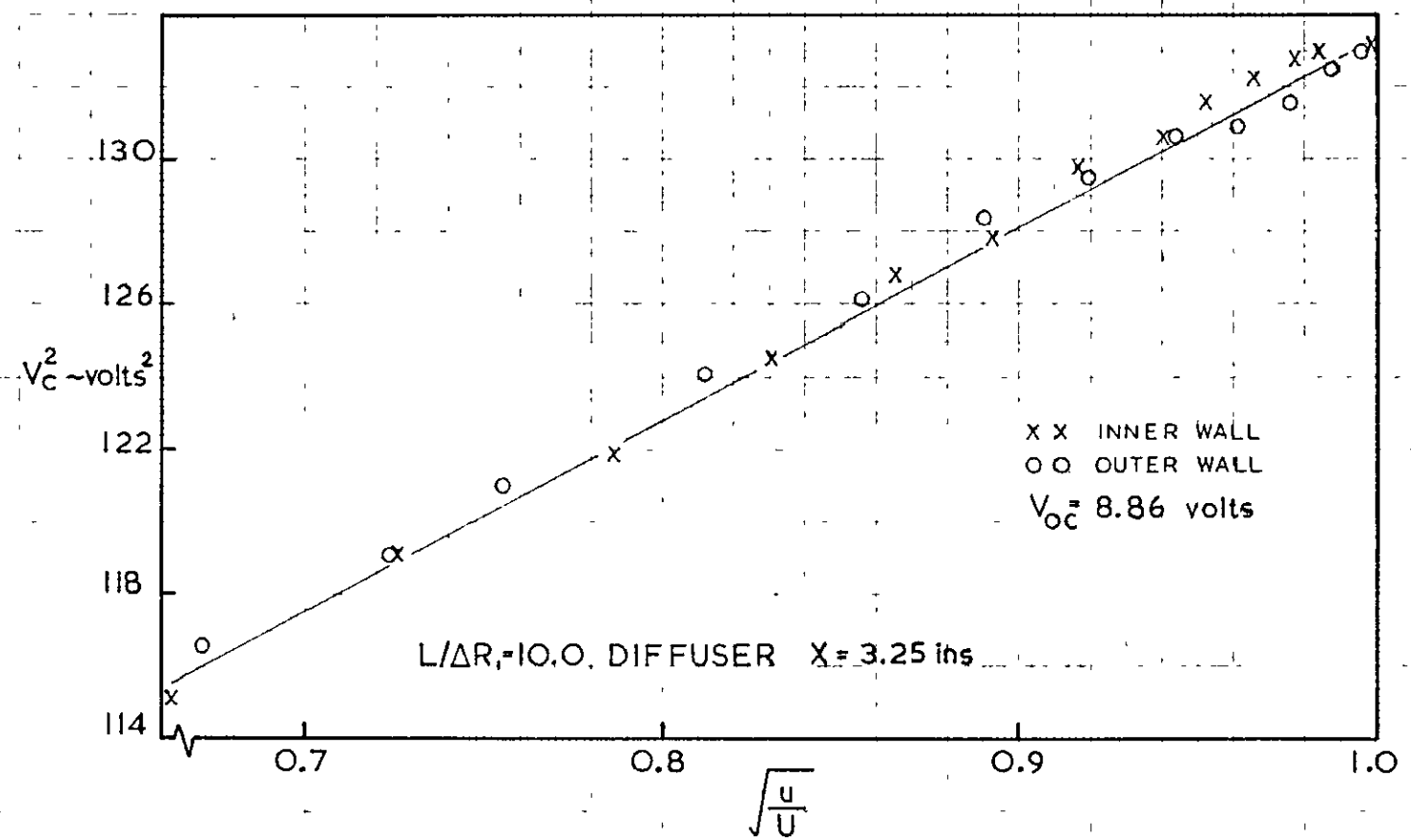


FIG. AII-1 CALIBRATION OF STRAIGHT WIRE PPOBE

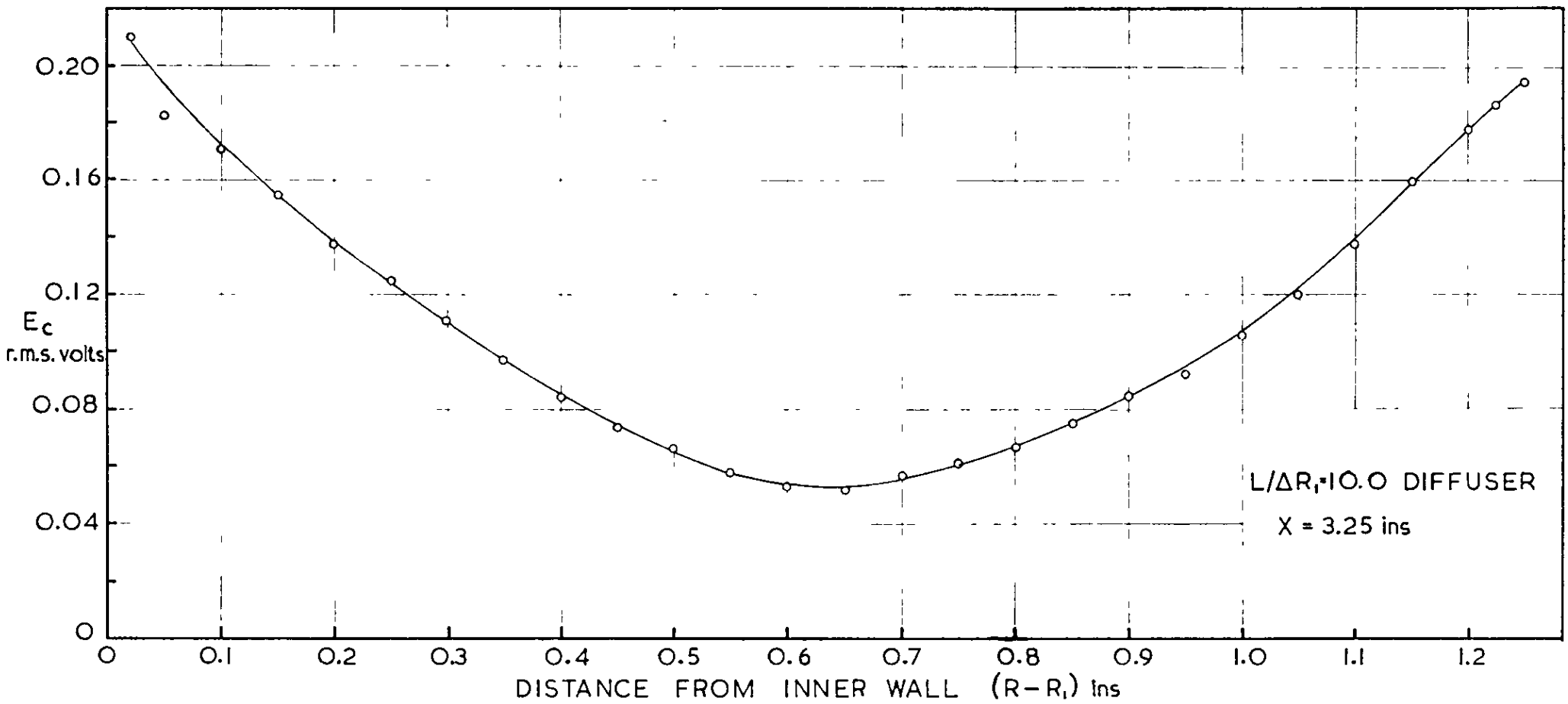


FIG. AII-2 DISTRIBUTION OF R.M.S. VOLTAGE - STRAIGHT WIRE PROBE

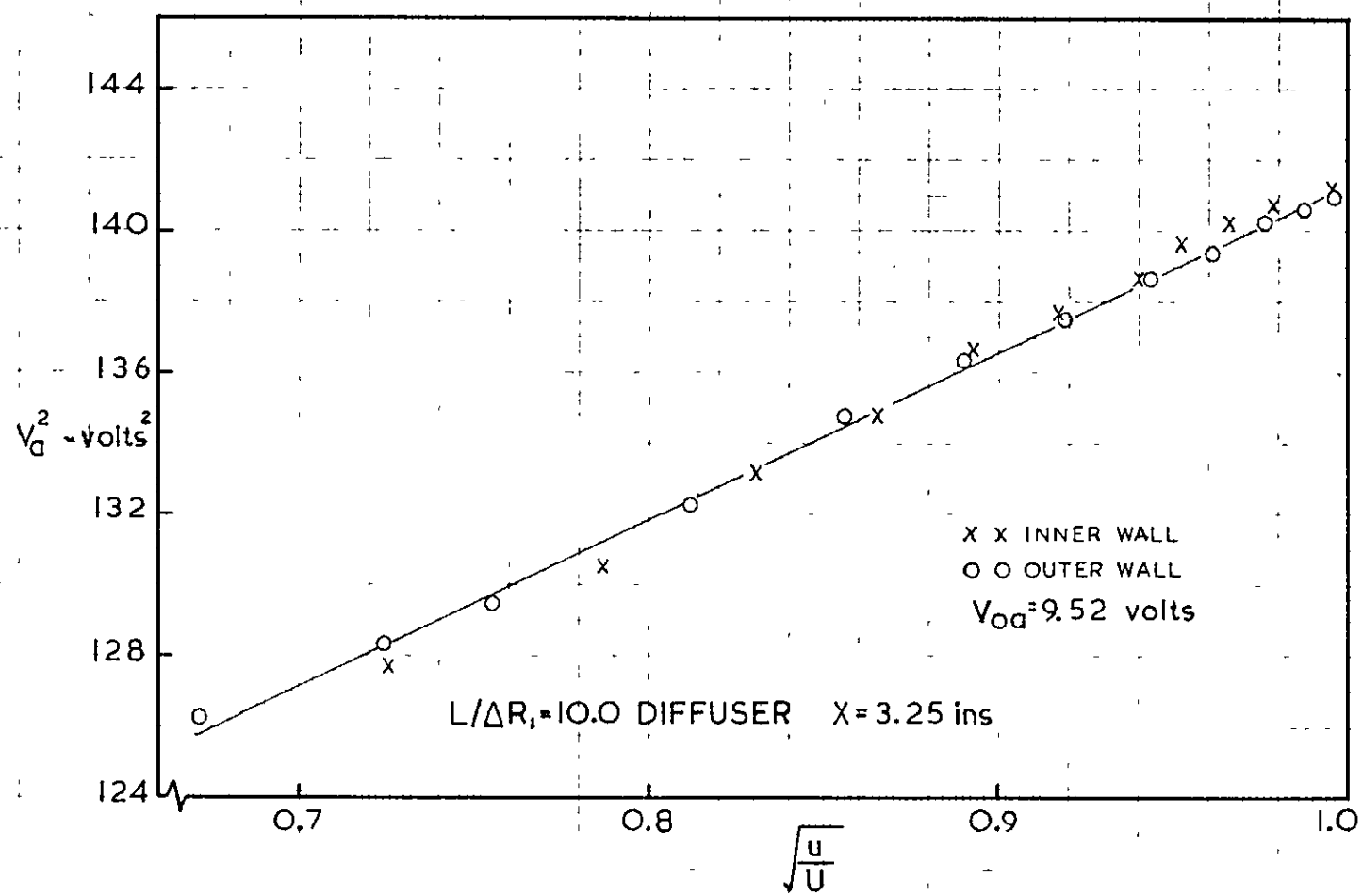


FIG. A II-3 CALIBRATION OF 45° SLANT WIRE PROBE

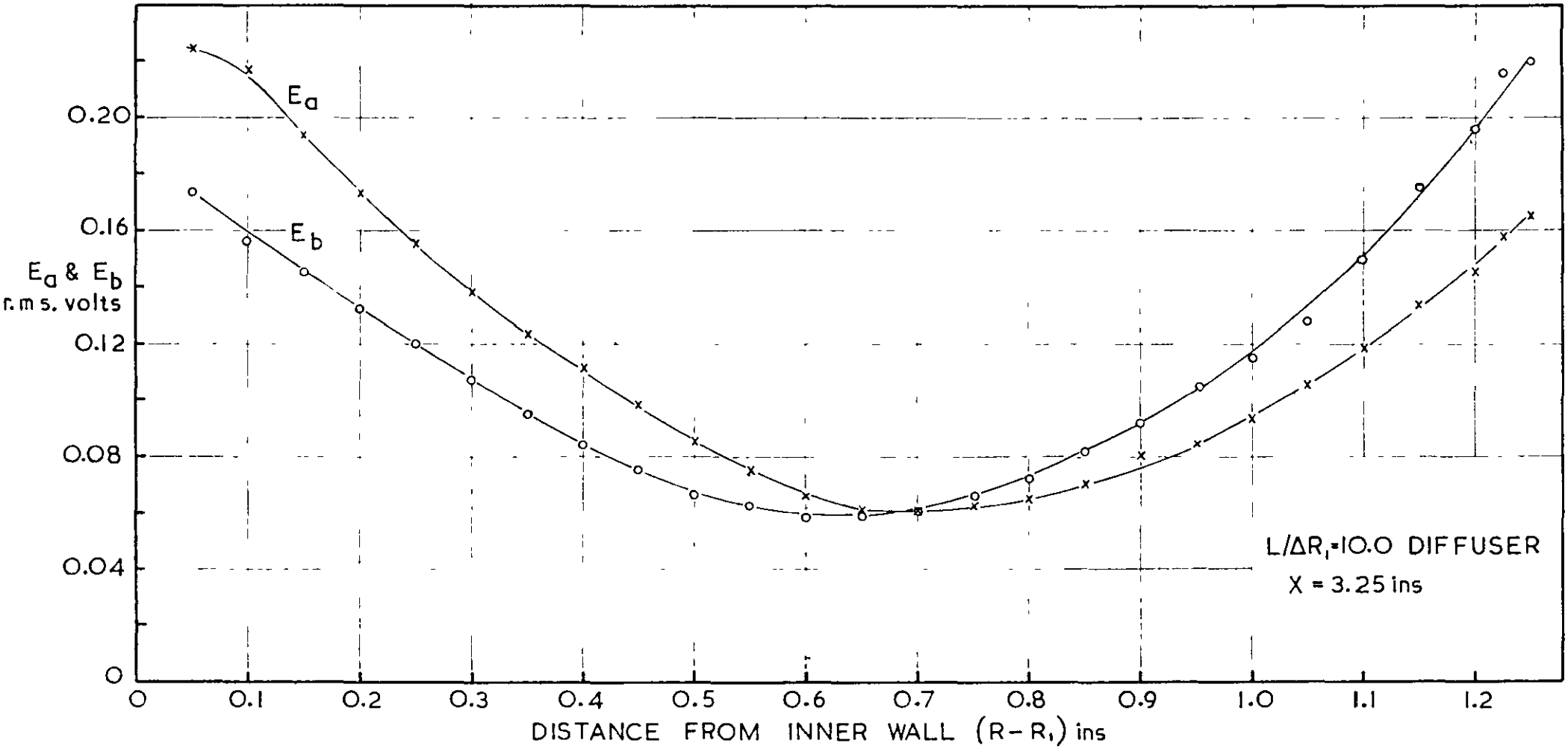


FIG. A11-4 DISTRIBUTION OF R.M.S. VOLTAGES – 45° SLANT WIRE PROBES

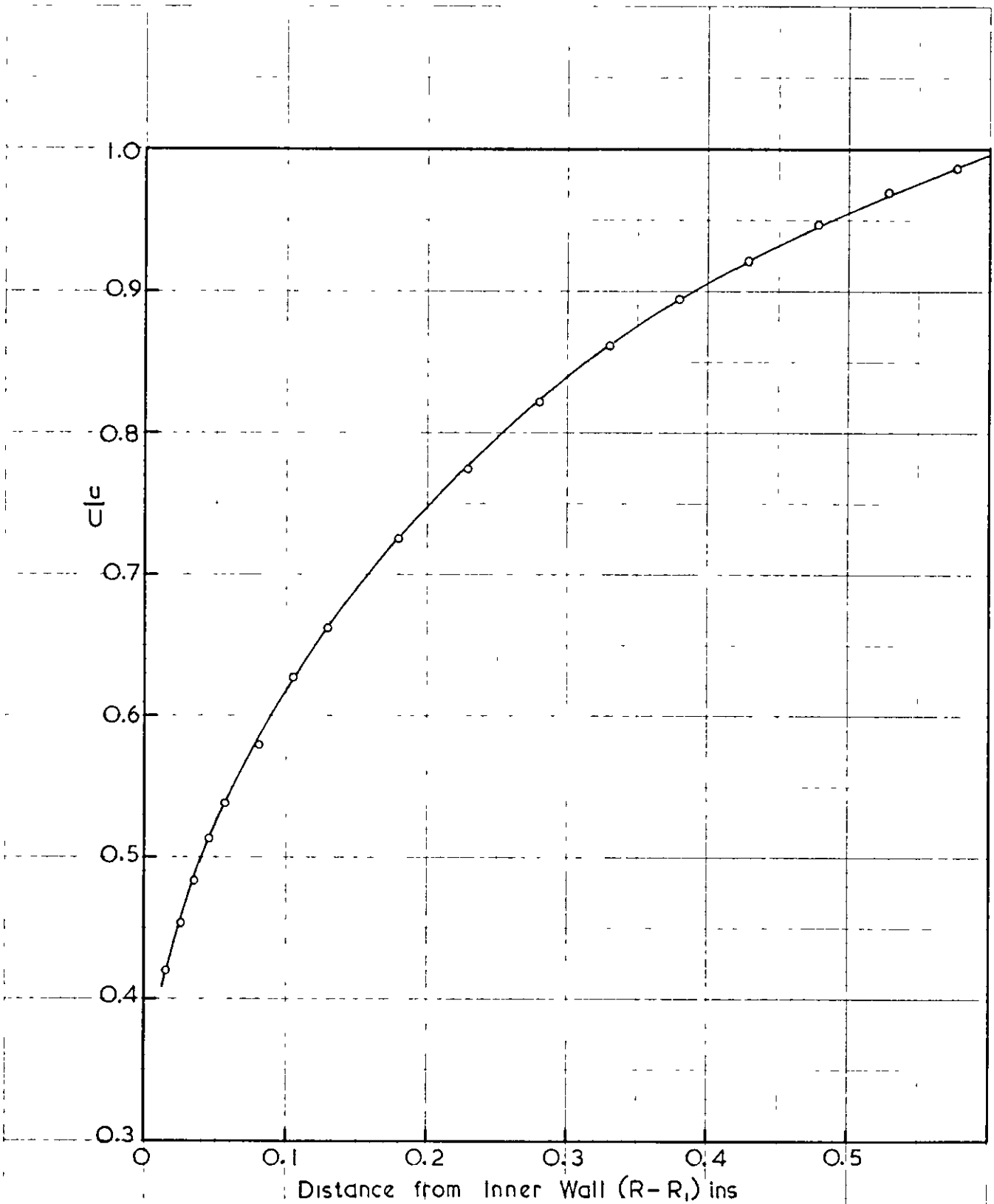


FIG. A11-5 INNER WALL VELOCITY PROFILE X=3.25 ins
L/ΔR1=10.0 DIFFUSER

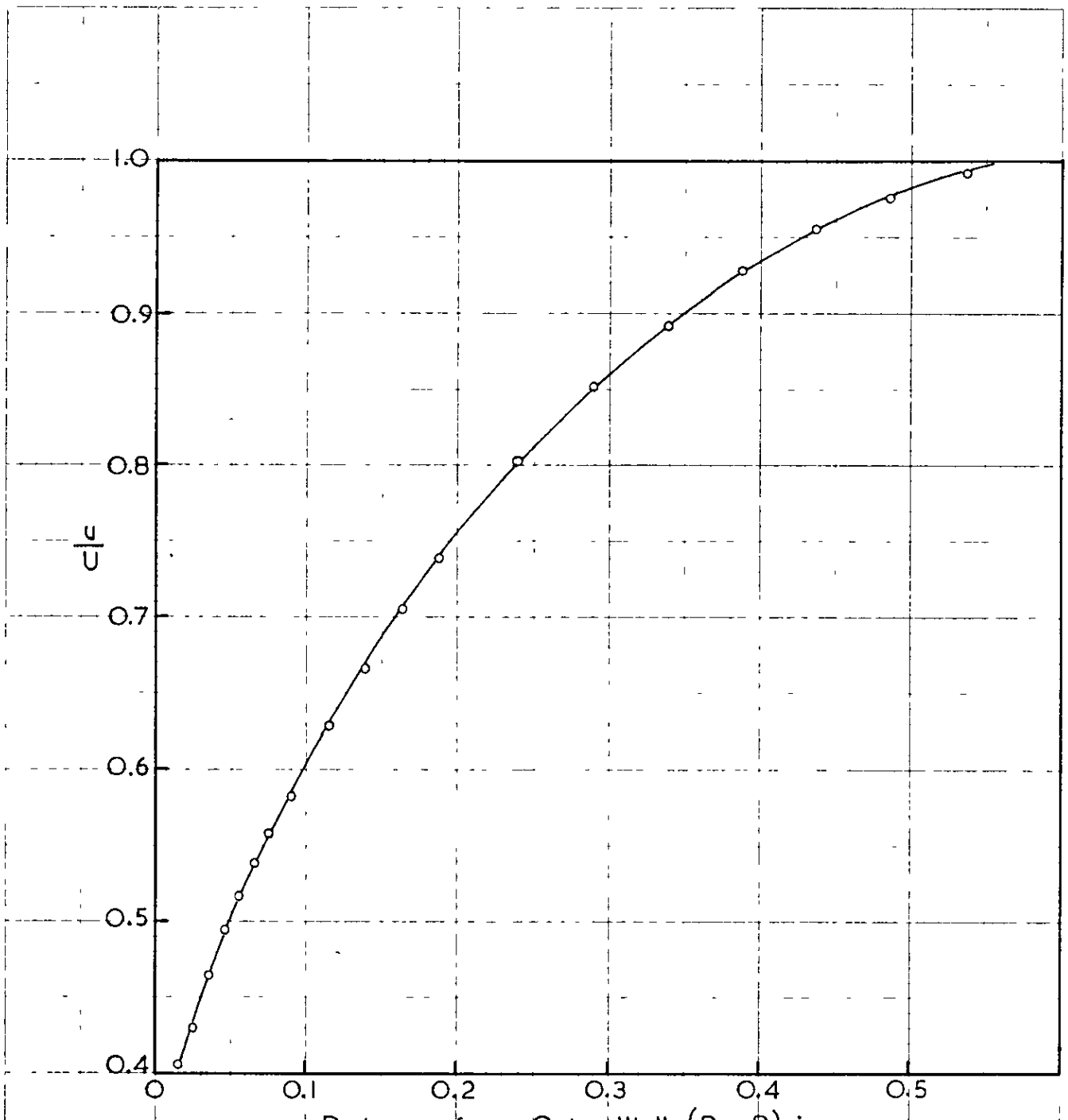


FIG. A11-6 OUTER WALL VELOCITY PROFILE X = 3.25 ins.
L/ΔR_i = 10.0 DIFFUSER

Appendix 12

Computer Programme

Reduction of Turbulence Data

```
C                                APPENDIX 12

COMMENT              TURBULENCE DATA REDUCTION PROGRAM
C*****THIS PROGRAM PROCESSES EXPERIMENTAL TURBULENCE DATA , PREVIOUS TO
C      THIS THE VALUES OF BRIDGE VOLTS AND RMS VOLTS HAVE BEEN PLOTTED
C      OUT TO CHECK FOR ANY SPURIOUS DATA  OR EVIDENCE OF INACCURATE
C      POSITIONING OF PROBE
C*****ARRAY FOR STORING INPUT DATA
       DIMENSION R(60),EC(60),VCSQ(60),UND(60)
       DIMENSION EA(60),EB(60),VASQ(60)
       DIMENSION ED(60),EE(60),VD(60)
C*****THE INPUT IS,RO-OUTER WALL RAD.(INS), ROI-ANNULUS HT.(INS),
C      ROM-APPROX. DIST. FROM OUTER WALL TO UMAX,X=AXIAL DIST FROM INLET
C      XND-NON-DIMENSIONAL DIST FROM INLET, VOC-WIND OFF VOLTS PROBE IN
C      *U*PLANE,VOA-WIND OFF VOLTS*UV*PLANE,VOD-WIND OFF VOLTS*UW*PLANE
C      M-NO. OF DATA PTS.
C      UMAX-MAX. VELOCITY(FT/SEC)
 C      DELST-B.L. DISPLACEMENT THICKNESS(INS)
 C      THETA-B.L. MOMENTUM THICKNESS(INS)
C      HB-B.L. SHAPE PARAMETER
C      DIFNDL-DIFFUSER NON DIMENSIONAL LENGTH
C      DESGN1-CODE NO. TO INDICATE INNER OR OUTER WALL
C      DESGN2-CODE NO. TO INDICATE POSITION
 4000  READ(1,3003)UMAX
 3003  FORMAT(F0.0)
  122  READ(1,123)DELST,THETA,HB
  123  FORMAT(3F0.0)
       READ(1,303)DIFNDL,DESGN1,DESGN2
  303  FORMAT(3F0.0)
    1  READ(1,2)RO,ROI,ROM,X,XND,VOC,VOA,VOD,M
    2  FORMAT(8F0.0,I2)
C      R-RAD. DIST. FROM WALL(INS),EC-RMS VOLTAGE PROBE IN*U*PLANE
C      VCSQ-BRIDGE VOLTS SQUARED*U*PLANE,UND-NON.DIM. VELOCITY(U/UMAX)
C      EA-RMS VOLTS*UV*PLANE ,EB-RMS VOLTS*UV*PLANE (180 DEGREES FROM
C      EA RDG.),VASQ-BRIDGE VOLTS SQUARED*UV*PLANE,ED-RMS VOLTS*UW*PLANE,
C      EE-RMS VOLTS*UW*PLANE(180 DEGREES FROM ED RDG),VD-BRIDGE VOLTS*UW*
C      PLANE
    3  READ(1,4) (R(I),I=1,M)
    4  FORMAT(60F0.0)
    5  READ(1,6) (EC(I),I=1,M)
    6  FORMAT(60F0.0)
    7  READ(1,8) (VCSQ(I),I=1,M)
    8  FORMAT(60F0.0)
    9  READ(1,10) (UND(I),I=1,M)
   10  FORMAT(60F0.0)
   16  READ(1,17) (EA(I),I=1,M)
   17  FORMAT(60F0.0)
   18  READ(1,19) (EB(I),I=1,M)
   19  FORMAT(60F0.0)
   20  READ(1,21) (VASQ(I),I=1,M)
   21  FORMAT(60F0.0)
   26  READ(1,27) (ED(I),I=1,M)
   27  FORMAT(60F0.0)
```

```
   30 READ(1,31) (VD(I),I=1,M)
   31 FORMAT(60F0.0)
C*****TABULATION OF EXPERIMENTAL INPUT DATA
      WRITE(2,328)DIFNDL
  328 FORMAT(18X,33HDIFFUSER NON DIMENSIONAL LENGTH =,F5.1)
      WRITE(2,329)X,XND
  329 FORMAT(/18X,27HAXIAL DIST. FROM INLET(X) =,F7.3,5H INS.,2X,15HN.D.
     1DIST.(X/L)=,F6.3,/)
      IF(DESGN1-1.)304,304,305
  304 IF(DESGN2-1.)306,306,307
  306 WRITE(2,317)
  317 FORMAT(18X,5HOUTER,1X,4HWALL,2X,4HBLUE,1X,8HPOSITION)
      GO TO 316
  307 IF(DESGN2-2.)308,308,309
  308 WRITE(2,318)
  318 FORMAT(18X,5HOUTER,1X,4HWALL,2X,5HGREEN,1X,8HPOSITION)
      GO TO 316
  309 WRITE(2,319)
  319 FORMAT(18X,5HOUTER,1X,4HWALL,2X,3HRED,1X,8HPOSITION)
      GO TO 316
  305 IF(DESGN2-1.)310,310,311
  310 WRITE(2,320)
  320 FORMAT(18X,5HINNER,1X,4HWALL,2X,4HBLUE,1X,8HPOSITION)
      GO TO 316
  311 IF(DESGN2-2.)312,312,314
  312 WRITE(2,321)
  321 FORMAT(18X,5HINNER,1X,4HWALL,2X,5HGREEN,1X,8HPOSITION)
      GO TO 316
  314 WRITE(2,322)
  322 FORMAT(18X,5HINNER,1X,4HWALL,2X,3HRED,1X,8HPOSITION)
      GO TO 316
  316 CONTINUE
      WRITE(2,2004)
 2004 FORMAT(/18X,17HEXPERIMENTAL DATA)
      WRITE(2,2005)
 2005 FORMAT(/12X,4HPO-R,4X,2HEA,5X,2HEB,5X,2HVA,5X,2HEC,5X,2HVC,5X,2HED
     1,5X,2HEE,5X,2HVD,6X,1HU)
      WRITE(2,2006)
 2006 FORMAT(12X,5H(INS),25X,7H(VOLTS),27X,4HUMAX)
      DO 11 I=1,M
      VC=VCSQ(I)**0.5
      VA=VASQ(I)**0.5
C*****PRINT OUT OF INPUT DATA
   11 WRITE(2,12)R(I),EA(I),EB(I),VA,EC(I),VC,ED(I),EE(I),VD(I),UND(I)
   12 FORMAT(10X,3F7.3,F7.2,F7.3,F7.2,F7.2,2F7.3,F7.2,F7.3)
C*****ANALYSIS
      WRITE(2,2010)VOA,VOC,VOD
 2010 FORMAT(/12X,5HVOA =,F6.2,6H VOLTS,8X,5HVOC =,F6.2,6H VOLTS,9X,5HVO
     1D =,F6.2,6H VOLTS)
      WRITE(2,3000)
 3000 FORMAT(/)
      WRITE(2,78)
   78 FORMAT(40X,7HRESULTS/)
      WRITE(2,2011)
 2011 FORMAT(12X,4HRO-R,3X,4HRO-R,3X,4HRO-R,4X,5HUTURB,3X,5HVTURB,3X,5HW
     1TURB,2X,6HTURBKE,2X,6H2(U*V),2X,6H2(U*W))
      WRITE(2,2012)
```

```
 2012 FORMAT(12X,5H(INS),2X,5HRO-RI,2X,5HRO-RM,4X,2HND,6X,2HND,6X,2HND,6
     1X,2HND,6X,2HND,6X,2HND)
      DO 14 I=1,M
C     RO-DIST. FROM OUTER WALL,RONDH-RO RELATIVE TO ANNULUS HT.,
C     ROND-RO RELATIVE TO POSITION OF UMAX,VC-BRIDGE VOLTS*U*PLANE
C     SENSC-SENSITIVITY*U*PLANE,UTURB-NON-DIMENSONAL AXIAL TURBULENCE
C     INTENSITY
      RO=RO-R(I)
      RONDH=R(I)/ROI
      ROND=R(I)/ROM
      VC=VCSQ(I)**0.5
      SENSC=(VCSQ(I)-(VOC*VOC))/(4.*VC*UND(I))
      UTURB=EC(I)/SENSC
C*****VA-BRIDGE VOLTS*UV*PLANE,SENSA-SENSITIVITY*UV*PLANE
C     UVREY-COEFF. OF TURBULENT SHEARING STRESS*UV*PLANE
C     VTURB-NON-NSIONAL RADIAL TURBULENCE INTENSITY
      VA=VASQ(I)**0.5
      SENSA=(VASQ(I)-(VOA*VOA))/(4.*VA*UND(I))
      UVREY=((EA(I)*EA(I))-(EB(I)*EB(I)))/(4.*SENSA*SENSA)
      VTUR=(((EA(I)*EA(I))+(EB(I)*EB(I)))/(2.*SENSA*SENSA))-(UTURB*UTURB
     1)
      VTURB=VTUR**0.5
C*****SENSD-SENSITIVITY*UW*PLANE
C     UWREY-COEFF. OF TURBULENT SHEARING STRESS*UW*PLANE
C     WTURB-NON-DIMENSIONAL CIRCUMFERENTIAL TURBULENCE INTENSITY
C     TURBKE-NON-DIMENSIONAL TURBULENT KINETIC ENERGY
  102 SENSD=((VD(I)*VD(I))-(VOD*VOD))/(4.*VD(I)*UND(I))
      WTURB=(((ED(I)*ED(I))+(EE(I)*EE(I)))/(2.*SENSD*SENSD))-(UTURB*UTUR
     1R)
      WTURB=WTURB**0.5
  202 UWREY=((ED(I)*ED(I))-(EE(I)*EE(I)))/(4.*SENSD*SENSD)
      UWREY=2*UWREY
      UVREY=2*UVREY
      TURBKE=0.5*(VTURB+UTURB+WTURB)
C*****PRINT OUT OF RESULTS
   14 WRITE(2,15)R(I),RONDH,ROND,UTURB,VTURB,WTURB,TURBKE,UVREY,UWREY
   15 FORMAT(10X,3F7.3,1X,6F8.4)
  900 RENOLN=(UMAX*THETA)/(0.000156*12.)
      UVREL=0.246/((10.**(0.678*HB))*(RENOLN**0.268))
      WRITE(2,3002)UVREL
 3002 FORMAT(/12X,54HSKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLM
     1N =,F8.5)
      GO TO 4000
      CONTINUE
      STOP
      END
      FINISH
```

APPENDIX 13

Accuracy of Turbulence Data

A13-1 Introduction

Errors may arise due to;

(i) Drift

(ii) Probe positioning errors

(iii) Misalignment of the wire

(iv) High Turbulence Level and Large Vertical component of Mean Velocity

A13-2 Drift

This can arise due to accumulation of dust particles on the wires, and drift, on such components as the D.C. amplifier, during the time of the traverse.

The drift due to dust was minimised by the provision of a large fine mesh cloth filter around the entry flare, and frequent cleaning of the wires. To assess the problem due to accumulation of dirt and the effectiveness of the cleaning agent, a controlled test was carried out in unfiltered air. The results are tabulated below

DIRT ACCUMULATION TEST

PROBE POSITION - MID ANNULUS AIR VELOCITY≈140 FT/SEC.

Duration of test mins.	Ea R.M.S. volts	Va D.C. volts	$\frac{1}{2}\rho U_1^2$ ins. H_2O
0	0.056	11.21	4.28
30	0.049	11.15	4.23
75	0.044	11.13	4.25
120	0.043	11.08	4.25
150	0.043	11.07	4.26
wire removed and cleaned			
150	0.058	11.24	4.25

Inspection of the probe under a microscope revealed that a layer of dirt approximately four times the thickness of the wire had been built up on the leading edge. The table indicates the problem due to dirt, and in order to minimise its effect a fine mesh Vokes filter was placed around the entry flare, and at the end of each run the wires were inspected and cleaned if necessary. In view of these precautions dirt can be said to have had neglibible effect on the results.

Electrical drift on the D.C. amplifier was found to be less than 1% over a period of 20 minutes.

A13-3 Probe Positioning Errors

The effect is particularly important in the initial stages of diffusion where the velocity gradient($\frac{du}{dR}$) near the wall is quite large. As an example consider the traverse taken from the outer wall at diffuser inlet (Table A16-13). If the probe position is correct then at 0.045 ins. from the wall;

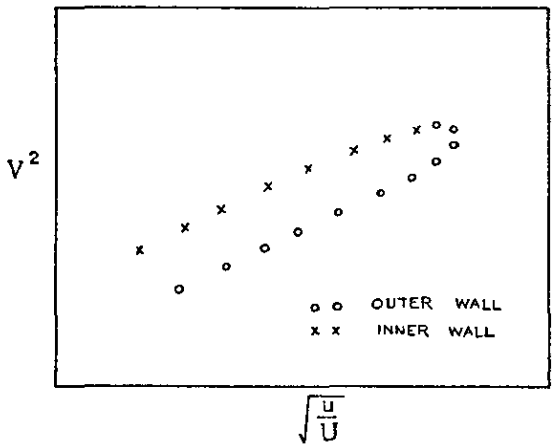
$$S_a = \frac{10.78^2 - 8.24^2}{4 \times 10.78 \times 0.70} = 1.6 \qquad \& \qquad \frac{2\overline{u'v'}}{U^2} = \frac{0.158^2 - 0.112^2}{2 \times 1.6^2} = 0.00244$$

However, if the probe had in fact been positioned 0.060 ins. from the wall (an error of 0.015 ins.) then;

$$S_a = \frac{10.78^2 - 8.24^2}{4 \times 10.78 \times 0.74} = 1.516 \qquad \& \qquad \frac{2\overline{u'v'}}{U^2} = \frac{0.158^2 - 0.112^2}{2 \times 1.516^2} = 0.00272$$

i.e. an error of 11%.

Frequently a probe positioning error could be detected when the raw data was plotted in form V^2 v. $\sqrt{\frac{u}{U}}$. If an error was present this would show itself as a failure of the points to fall onto a unique line as illustrated on next page.



In addition errors arose in attempts to determine the position of zero shear stress. This occurs at the point where $E_a = E_b$, and in Fig. A11-4 it can be seen that the point of intersection of the E_a and E_b lines is not clearly defined. In this case $R_m - R_1 = 0.70 \pm 0.25$ ins., although this is probably the upper limit of the error involved.

A13-4 Misalignment of the Wire

Goldberg (29) considered the errors due to misalignment, and showed that a 1^o misalignment produces an error of approximately 6% in the measured value of shear stress.

With a single wire probe, the axis must be aligned with the local mean flow direction, so that the angle between the wire and the local velocity will change in sign only when the probe carrier is rotated through 180^o. To have fulfilled this requirement would have necessitated the use of a variable angle probe support, and a knowledge of the flow direction to an accuracy of $\pm \frac{1}{2}^o$ across every traverse station in the diffusers. Such a technique would have required a prohibitive amount of time, and in view of this the traverses were taken normal to the walls. Thus in the regions of high shear stress good alignment was maintained, however in the outer region of the layers where the shear stress is tending

towards zero, an error of 10 to 30% was accepted.

A13-5 Uncertainty due to High Turbulence Level and Large Vertical Component of Mean Velocity

One of the major uncertainties is the effect of the normal velocity component, V, on the hot wire output. In near separating regions close to the surface the mean velocity is almost zero, and the total velocity is approximately

$$U_{TOTAL} = \left(u^2 + v^2 \right)^{1/2}$$

Thus, the heat loss is equally affected by both the u and v fluctuations. This problem has been considered by Sandborn and Liu [45] who suggest an error of approximately 30% in, $\sqrt{\overline{u'^2}}$ and $\overline{u'v'}$, near the wall.

In writing down the linearised response equation of a hot wire anemometer it is assumed that the turbulence intensity is small ($<$ 10-15%). The question arises, at what level of intensity does this assumption produce unacceptable errors? Sandborn and Liu conclude that the non-linearity produces at the most an error of 10% in $\sqrt{\overline{u'^2}}$ near to separation where the local intensity may be as high at 30 - 50%. This is considerably less than the error of up to 50% suggested by Parthasarathy and Tritton [83]. Thus under these conditions the results can at best be taken as first-order approximations.

Numerous other influences, such as, end effects, wall proximity, and ambient temperature fluctuations, can give rise to errors. However, the effects discussed above are considered to be the major sources of error, and as a guide, the following accuracies are suggested:

Early stages of diffusion	5%	in $\sqrt{\overline{u'^2}}$
	10 - 15%	in $\overline{u'v'}$
Latter stages of diffusion	20%	in $\sqrt{\overline{u'^2}}$
	20 - 40%	in $\overline{u'v'}$

Appendix 14

Turbulence Data

$L/\Delta R_1 = 5$ Diffuser

TABLE A14- 1

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.600

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.030	0.104	0.146	11.58	0.120	10.23	0.130	0.127	11.52	0.685
0.050	0.096	0.139	11.65	0.112	10.32	0.123	0.120	11.61	0.745
0.075	0.089	0.131	11.71	0.104	10.39	0.115	0.108	11.66	0.795
0.100	0.083	0.123	11.75	0.096	10.44	0.108	0.103	11.70	0.827
0.125	0.078	0.116	11.78	0.090	10.48	0.102	0.098	11.73	0.855
0.150	0.073	0.110	11.81	0.084	10.51	0.096	0.089	11.77	0.877
0.175	0.069	0.104	11.83	0.079	10.54	0.090	0.087	11.79	0.897
0.200	0.065	0.097	11.85	0.073	10.56	0.085	0.080	11.81	0.915
0.250	0.059	0.086	11.88	0.065	10.59	0.075	0.071	11.84	0.942
0.300	0.053	0.075	11.90	0.058	10.62	0.066	0.062	11.86	0.962
0.350	0.049	0.065	11.92	0.050	10.64	0.059	0.056	11.88	0.978
0.400	0.046	0.056	11.93	0.044	10.65	0.050	0.047	11.90	0.990
0.450	0.046	0.050	11.94	0.038	10.66	0.043	0.043	11.90	0.996
0.500	0.050	0.047	11.94	0.037	10.67	0.040	0.043	11.90	1.000

VOA = 9.51 VOLTS VOC = 7.95 VOLTS VOD = 9.55 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.030	0.063	0.0812	0.0438	0.0543	0.0897	-0.0028	0.0002
0.050	0.050	0.105	0.0797	0.0452	0.0543	0.0896	-0.0030	0.0002
0.075	0.075	0.158	0.0767	0.0458	0.0515	0.0870	-0.0029	0.0005
0.100	0.100	0.211	0.0725	0.0457	0.0523	0.0853	-0.0028	0.0004
0.125	0.125	0.263	0.0692	0.0446	0.0519	0.0829	-0.0026	0.0003
0.150	0.150	0.316	0.0656	0.0440	0.0471	0.0783	-0.0024	0.0005
0.175	0.175	0.368	0.0625	0.0428	0.0472	0.0763	-0.0022	0.0002
0.200	0.200	0.421	0.0584	0.0415	0.0455	0.0726	-0.0020	0.0003
0.250	0.250	0.526	0.0529	0.0380	0.0403	0.0656	-0.0015	0.0002
0.300	0.300	0.632	0.0478	0.0331	0.0347	0.0578	-0.0011	0.0002
0.350	0.350	0.737	0.0416	0.0312	0.0337	0.0533	-0.0007	0.0001
0.400	0.400	0.842	0.0369	0.0286	0.0264	0.0459	-0.0004	0.0001
0.450	0.450	0.947	0.0320	0.0301	0.0248	0.0434	-0.0002	0.0000
0.500	0.500	1.053	0.0312	0.0316	0.0238	0.0433	0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00377

TABLE A14- 2

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.600

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.030	0.110	0.149	11.65	0.122	10.23	0.140	0.142	11.60	0.685
0.050	0.103	0.141	11.73	0.115	10.33	0.132	0.130	11.69	0.745
0.075	0.095	0.132	11.80	0.106	10.41	0.123	0.126	11.76	0.795
0.100	0.089	0.125	11.84	0.099	10.45	0.115	0.116	11.80	0.827
0.125	0.082	0.118	11.87	0.092	10.49	0.107	0.107	11.83	0.855
0.150	0.077	0.112	11.90	0.086	10.53	0.100	0.102	11.87	0.877
0.175	0.072	0.105	11.92	0.080	10.55	0.094	0.096	11.89	0.897
0.200	0.069	0.098	11.95	0.076	10.58	0.088	0.090	11.91	0.915
0.250	0.062	0.087	11.98	0.066	10.62	0.078	0.080	11.94	0.942
0.300	0.056	0.075	12.00	0.058	10.64	0.069	0.072	11.97	0.962
0.350	0.052	0.064	12.02	0.049	10.66	0.061	0.062	11.99	0.978
0.400	0.049	0.057	12.04	0.043	10.68	0.056	0.056	12.00	0.990
0.450	0.049	0.051	12.04	0.040	10.69	0.052	0.050	12.01	0.996
0.500	0.055	0.048	12.05	0.042	10.69	0.054	0.051	12.00	1.000

VOA = 9.63 VOLTS VOC = 7.93 VOLTS VOD = 9.57 VOLTS

RESULTS

R-RI (INS)	R-RI RO-PI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.030	0.063	0.0818	0.0527	0.0647	0.0996	-0.0028	-0.0002
0.050	0.050	0.105	0.0808	0.0519	0.0610	0.0969	-0.0028	0.0002
0.075	0.075	0.158	0.0772	0.0515	0.0630	0.0959	-0.0027	-0.0002
0.100	0.100	0.211	0.0739	0.0506	0.0591	0.0918	-0.0026	-0.0001
0.125	0.125	0.263	0.0699	0.0492	0.0559	0.0875	-0.0025	0.0000
0.150	0.150	0.316	0.0663	0.0482	0.0537	0.0841	-0.0024	-0.0001
0.175	0.175	0.368	0.0625	0.0464	0.0521	0.0805	-0.0022	-0.0001
0.200	0.200	0.421	0.0600	0.0433	0.0485	0.0759	-0.0018	-0.0001
0.250	0.250	0.526	0.0530	0.0411	0.0453	0.0697	-0.0015	-0.0001
0.300	0.300	0.632	0.0472	0.0363	0.0415	0.0625	-0.0010	-0.0002
0.350	0.350	0.737	0.0402	0.0345	0.0379	0.0563	-0.0006	-0.0000
0.400	0.400	0.842	0.0355	0.0331	0.0363	0.0525	-0.0004	0.0000
0.450	0.450	0.947	0.0332	0.0317	0.0324	0.0486	-0.0001	0.0001
0.500	0.500	1.053	0.0350	0.0321	0.0330	0.0501	0.0003	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00377

TABLE A14- 3

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.600

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.030	0.120	0.146	11.56	0.122	10.22	0.140	0.145	11.53	0.685
0.050	0.107	0.140	11.65	0.115	10.32	0.134	0.139	11.65	0.745
0.075	0.098	0.132	11.73	0.109	10.39	0.127	0.135	11.72	0.795
0.100	0.092	0.126	11.76	0.102	10.44	0.121	0.127	11.78	0.827
0.125	0.086	0.120	11.81	0.096	10.48	0.115	0.120	11.82	0.855
0.150	0.082	0.113	11.84	0.089	10.52	0.109	0.115	11.85	0.877
0.175	0.078	0.108	11.86	0.084	10.54	0.102	0.108	11.87	0.897
0.200	0.074	0.102	11.88	0.078	10.57	0.097	0.105	11.90	0.915
0.250	0.067	0.092	11.92	0.070	10.61	0.086	0.094	11.95	0.942
0.300	0.061	0.083	11.94	0.062	10.63	0.076	0.084	11.97	0.962
0.350	0.056	0.073	11.96	0.054	10.65	0.067	0.076	11.99	0.978
0.400	0.051	0.064	11.97	0.048	10.67	0.061	0.066	12.01	0.990
0.450	0.049	0.056	11.98	0.043	10.68	0.055	0.060	12.02	0.996
0.500	0.049	0.049	11.99	0.040	10.68	0.052	0.054	12.02	1.000

VOA = 9.51 VOLTS VOC = 7.96 VOLTS VOD = 9.51 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.030	0.063	0.0832	0.0515	0.0655	0.1001	-0.0019	-0.0004
0.050	0.050	0.105	0.0821	0.0485	0.0649	0.0978	-0.0024	-0.0004
0.075	0.075	0.158	0.0807	0.0444	0.0658	0.0954	-0.0025	-0.0007
0.100	0.100	0.211	0.0772	0.0453	0.0636	0.0931	-0.0024	-0.0005
0.125	0.125	0.263	0.0740	0.0441	0.0619	0.0900	-0.0024	-0.0004
0.150	0.150	0.316	0.0695	0.0445	0.0621	0.0880	-0.0021	-0.0005
0.175	0.175	0.368	0.0665	0.0440	0.0586	0.0846	-0.0020	-0.0004
0.200	0.200	0.421	0.0624	0.0440	0.0592	0.0828	-0.0018	-0.0006
0.250	0.250	0.526	0.0569	0.0409	0.0525	0.0752	-0.0015	-0.0005
0.300	0.300	0.632	0.0511	0.0388	0.0476	0.0687	-0.0012	-0.0005
0.350	0.350	0.737	0.0449	0.0364	0.0442	0.0628	-0.0009	-0.0005
0.400	0.400	0.842	0.0401	0.0328	0.0393	0.0561	-0.0006	-0.0002
0.450	0.450	0.947	0.0361	0.0305	0.0360	0.0513	-0.0003	-0.0002
0.500	0.500	1.053	0.0337	0.0285	0.0330	0.0476	0.0000	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00377

TABLE A14- 4

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 0.300 INS. N.D.DIST.(X/L)= 0.060

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.132	0.182	11.53	0.124	10.44	0.160	0.156	11.61	0.720
0.075	0.120	0.166	11.65	0.116	10.54	0.148	0.141	11.71	0.777
0.100	0.110	0.153	11.72	0.108	10.59	0.138	0.131	11.77	0.810
0.125	0.102	0.143	11.78	0.102	10.63	0.128	0.122	11.81	0.838
0.150	0.094	0.135	11.82	0.094	10.67	0.122	0.116	11.84	0.860
0.175	0.089	0.127	11.87	0.088	10.71	0.114	0.111	11.87	0.880
0.200	0.084	0.122	11.90	0.080	10.74	0.110	0.103	11.91	0.900
0.250	0.073	0.110	11.96	0.070	10.78	0.095	0.089	11.96	0.930
0.300	0.065	0.096	12.01	0.058	10.82	0.084	0.078	11.99	0.953
0.350	0.058	0.085	12.04	0.050	10.84	0.072	0.068	12.02	0.971
0.400	0.052	0.074	12.07	0.044	10.86	0.062	0.060	12.04	0.985
0.450	0.049	0.065	12.09	0.040	10.88	0.055	0.056	12.05	0.995
0.500	0.050	0.058	12.10	0.040	10.89	0.050	0.055	12.06	0.998
0.550	0.053	0.055	12.10	0.041	10.89	0.052	0.059	12.06	1.000

VOA = 9.54 VOLTS VOC = 8.02 VOLTS VOD = 9.51 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.047	0.091	0.0834	0.0941	0.0850	0.1313	-0.0049	0.0004
0.075	0.071	0.136	0.0812	0.0847	0.0781	0.1220	-0.0043	0.0006
0.100	0.095	0.182	0.0774	0.0771	0.0734	0.1140	-0.0038	0.0006
0.125	0.119	0.227	0.0745	0.0708	0.0681	0.1067	-0.0034	0.0005
0.150	0.142	0.273	0.0696	0.0675	0.0682	0.1027	-0.0033	0.0005
0.175	0.166	0.318	0.0660	0.0641	0.0658	0.0979	-0.0029	0.0002
0.200	0.190	0.364	0.0607	0.0645	0.0650	0.0951	-0.0028	0.0005
0.250	0.237	0.455	0.0541	0.0586	0.0560	0.0843	-0.0025	0.0004
0.300	0.285	0.545	0.0454	0.0540	0.0526	0.0760	-0.0018	0.0004
0.350	0.332	0.636	0.0396	0.0491	0.0458	0.0672	-0.0014	0.0002
0.400	0.380	0.727	0.0351	0.0432	0.0398	0.0590	-0.0010	0.0001
0.450	0.427	0.818	0.0320	0.0387	0.0366	0.0537	-0.0007	-0.0000
0.500	0.475	0.909	0.0321	0.0346	0.0330	0.0498	-0.0003	-0.0002
0.550	0.522	1.000	0.0330	0.0339	0.0360	0.0514	-0.0001	-0.0003

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00356

TABLE A14- 5

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 0.750 INS. N.D.DIST.(X/L)= 0.150

INNER WALL BLUR POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.138	0.202	11.05	0.141	10.24	0.181	0.175	11.02	0.645
0.075	0.125	0.177	11.17	0.130	10.33	0.163	0.155	11.12	0.710
0.100	0.115	0.164	11.24	0.120	10.39	0.150	0.142	11.19	0.750
0.125	0.106	0.152	11.30	0.111	10.44	0.140	0.131	11.24	0.785
0.150	0.097	0.143	11.35	0.105	10.48	0.130	0.125	11.28	0.813
0.175	0.091	0.135	11.39	0.095	10.51	0.123	0.118	11.31	0.840
0.200	0.085	0.128	11.43	0.090	10.54	0.116	0.113	11.35	0.863
0.250	0.075	0.116	11.49	0.080	10.58	0.105	0.100	11.40	0.900
0.300	0.066	0.103	11.54	0.070	10.62	0.090	0.086	11.44	0.931
0.350	0.060	0.091	11.58	0.062	10.65	0.080	0.076	11.47	0.956
0.400	0.055	0.079	11.60	0.054	10.67	0.068	0.066	11.50	0.975
0.450	0.050	0.068	11.62	0.045	10.68	0.060	0.060	11.51	0.988
0.500	0.050	0.061	11.64	0.041	10.69	0.054	0.056	11.52	0.996
0.550	0.053	0.056	11.64	0.039	10.70	0.052	0.054	11.52	1.000

VOA = 9.26 VOLTS VOC = 8.14 VOLTS VOD = 9.12 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.044	0.089	0.0964	0.0954	0.0905	0.1412	-0.0067	0.0006
0.075	0.066	0.134	0.0943	0.0813	0.0806	0.1281	-0.0052	0.0008
0.100	0.088	0.179	0.0896	0.0760	0.0746	0.1201	-0.0047	0.0007
0.125	0.110	0.223	0.0851	0.0706	0.0710	0.1134	-0.0042	0.0008
0.150	0.133	0.268	0.0822	0.0646	0.0672	0.1070	-0.0040	0.0004
0.175	0.155	0.313	0.0760	0.0651	0.0686	0.1048	-0.0038	0.0004
0.200	0.177	0.357	0.0730	0.0614	0.0658	0.1001	-0.0035	0.0003
0.250	0.221	0.446	0.0668	0.0563	0.0603	0.0917	-0.0031	0.0004
0.300	0.265	0.536	0.0595	0.0512	0.0514	0.0810	-0.0026	0.0003
0.350	0.309	0.625	0.0536	0.0462	0.0462	0.0730	-0.0020	0.0003
0.400	0.353	0.714	0.0473	0.0417	0.0389	0.0640	-0.0014	0.0001
0.450	0.398	0.804	0.0397	0.0390	0.0386	0.0586	-0.0009	0.0000
0.500	0.442	0.893	0.0364	0.0373	0.0357	0.0547	-0.0005	-0.0001
0.550	0.486	0.982	0.0346	0.0375	0.0351	0.0536	-0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00296

TABLE A14- 6

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.350 INS. N.D.DIST.(X/L)= 0.270

INNER WALL BLUE POSITION
EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.164	0.222	11.00	0.154	10.07	0.220	0.220	10.79	0.763
0.075	0.152	0.210	11.10	0.153	10.18	0.205	0.205	10.91	0.803
0.100	0.140	0.195	11.18	0.147	10.26	0.184	0.181	11.03	0.834
0.125	0.130	0.185	11.24	0.138	10.32	0.167	0.169	11.10	0.857
0.150	0.122	0.171	11.28	0.127	10.36	0.153	0.157	11.16	0.876
0.175	0.114	0.160	11.33	0.120	10.40	0.143	0.144	11.20	0.892
0.200	0.105	0.150	11.37	0.110	10.44	0.133	0.135	11.25	0.907
0.250	0.092	0.132	11.42	0.096	10.49	0.119	0.122	11.32	0.931
0.300	0.081	0.120	11.46	0.083	10.52	0.106	0.110	11.35	0.945
0.350	0.072	0.108	11.50	0.073	10.57	0.093	0.094	11.41	0.964
0.400	0.064	0.094	11.53	0.064	10.60	0.082	0.083	11.43	0.977
0.450	0.058	0.081	11.55	0.056	10.62	0.072	0.071	11.46	0.986
0.500	0.054	0.070	11.55	0.048	10.63	0.064	0.063	11.49	0.993
0.550	0.053	0.065	11.56	0.044	10.64	0.061	0.058	11.50	0.998
0.600	0.056	0.061	11.56	0.044	10.65	0.061	0.057	11.51	1.000
0.650	0.061	0.062	11.56	0.048	10.65	0.063	0.061	11.51	1.000

VOA = 9.14 VOLTS VOC = 8.12 VOLTS VOD = 9.05 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.040	0.077	0.1334	0.1137	0.1620	0.2045	-0.0090	0.0000
0.075	0.061	0.115	0.1328	0.0976	0.1407	0.1855	-0.0085	0.0000
0.100	0.081	0.154	0.1278	0.0835	0.1104	0.1609	-0.0075	0.0005
0.125	0.101	0.192	0.1203	0.0792	0.0973	0.1484	-0.0070	-0.0003
0.150	0.121	0.231	0.1114	0.0748	0.0883	0.1372	-0.0059	-0.0005
0.175	0.141	0.269	0.1056	0.0677	0.0788	0.1260	-0.0051	-0.0001
0.200	0.162	0.308	0.0967	0.0657	0.0751	0.1188	-0.0047	-0.0002
0.250	0.202	0.385	0.0851	0.0585	0.0695	0.1065	-0.0037	-0.0003
0.300	0.242	0.462	0.0737	0.0564	0.0657	0.0979	-0.0032	-0.0004
0.350	0.283	0.538	0.0650	0.0524	0.0551	0.0862	-0.0027	-0.0001
0.400	0.323	0.615	0.0571	0.0462	0.0496	0.0764	-0.0020	-0.0001
0.450	0.363	0.692	0.0501	0.0405	0.0421	0.0663	-0.0013	0.0001
0.500	0.404	0.769	0.0431	0.0380	0.0386	0.0598	-0.0008	0.0001
0.550	0.444	0.846	0.0395	0.0377	0.0372	0.0572	-0.0006	0.0001
0.600	0.485	0.923	0.0395	0.0370	0.0365	0.0564	-0.0002	0.0002
0.650	0.525	1.000	0.0431	0.0370	0.0365	0.0583	-0.0001	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIFG AND TILLMAN = 0.00264

TABLE A14- 7

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.950 INS. N.D.DIST.(X/L)= 0.390

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.180	0.254	10.79	0.202	9.96	0.230	0.240	10.66	0.523
0.075	0.172	0.246	10.91	0.190	10.06	0.220	0.227	10.78	0.580
0.100	0.165	0.238	11.00	0.179	10.14	0.210	0.215	10.87	0.628
0.125	0.156	0.228	11.08	0.168	10.21	0.203	0.210	10.96	0.670
0.150	0.147	0.214	11.14	0.156	10.26	0.180	0.190	11.01	0.706
0.200	0.130	0.184	11.26	0.136	10.36	0.157	0.163	11.12	0.772
0.250	0.111	0.150	11.34	0.120	10.43	0.135	0.143	11.19	0.820
0.300	0.098	0.134	11.40	0.105	10.49	0.122	0.130	11.26	0.860
0.350	0.086	0.118	11.46	0.090	10.53	0.108	0.114	11.30	0.898
0.400	0.076	0.106	11.51	0.080	10.57	0.094	0.100	11.34	0.928
0.450	0.067	0.093	11.55	0.068	10.59	0.083	0.088	11.36	0.950
0.500	0.062	0.080	11.57	0.060	10.62	0.074	0.078	11.39	0.967
0.550	0.058	0.070	11.58	0.053	10.63	0.066	0.068	11.41	0.980
0.600	0.058	0.066	11.60	0.049	10.63	0.062	0.061	11.42	0.992
0.650	0.060	0.066	11.61	0.049	10.63	0.063	0.060	11.42	0.999
0.700	0.066	0.070	11.61	0.052	10.63	0.067	0.062	11.42	1.000

VOA = 9.21 VOLTS VOC = 8.14 VOLTS VOD = 9.08 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.037	0.074	0.1278	0.0918	0.1092	0.1644	-0.0082	-0.0012
0.075	0.056	0.110	0.1269	0.0927	0.1063	0.1630	-0.0085	-0.0009
0.100	0.074	0.147	0.1248	0.0943	0.1041	0.1616	-0.0086	-0.0006
0.125	0.093	0.184	0.1211	0.0931	0.1061	0.1601	-0.0085	-0.0009
0.150	0.112	0.221	0.1160	0.0898	0.0925	0.1492	-0.0077	-0.0012
0.200	0.149	0.294	0.1060	0.0786	0.0809	0.1328	-0.0058	-0.0007
0.250	0.186	0.368	0.0965	0.0571	0.0702	0.1119	-0.0037	-0.0008
0.300	0.223	0.441	0.0866	0.0537	0.0680	0.1042	-0.0031	-0.0008
0.350	0.260	0.515	0.0763	0.0501	0.0641	0.0953	-0.0026	-0.0005
0.400	0.298	0.588	0.0691	0.0457	0.0554	0.0850	-0.0022	-0.0005
0.450	0.335	0.662	0.0597	0.0426	0.0521	0.0772	-0.0017	-0.0004
0.500	0.372	0.735	0.0530	0.0383	0.0470	0.0692	-0.0011	-0.0003
0.550	0.409	0.809	0.0473	0.0355	0.0413	0.0621	-0.0006	-0.0001
0.600	0.446	0.882	0.0442	0.0367	0.0377	0.0593	-0.0004	0.0001
0.650	0.484	0.956	0.0445	0.0379	0.0380	0.0602	-0.0003	0.0002
0.700	0.521	1.029	0.0473	0.0418	0.0392	0.0642	-0.0002	0.0003

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00234

TABLE A14- 8

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 2.550 INS. N.D.DIST.(X/L)= 0.510

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC (VOLTS)	VC	ED	EE	VD	U UMAX
0.050	0.186	0.258	10.80	0.218	9.81	0.240	0.235	10.58	0.480
0.075	0.180	0.254	10.91	0.210	9.92	0.235	0.229	10.69	0.533
0.100	0.173	0.250	10.99	0.200	10.01	0.230	0.224	10.77	0.579
0.125	0.166	0.241	11.05	0.190	10.08	0.223	0.218	10.85	0.620
0.150	0.160	0.232	11.12	0.180	10.15	0.215	0.210	10.91	0.660
0.200	0.142	0.208	11.22	0.158	10.25	0.185	0.179	11.04	0.730
0.250	0.127	0.178	11.30	0.140	10.33	0.164	0.158	11.13	0.785
0.300	0.113	0.157	11.37	0.122	10.39	0.142	0.138	11.18	0.833
0.350	0.098	0.137	11.42	0.106	10.44	0.126	0.122	11.26	0.873
0.400	0.086	0.122	11.47	0.093	10.49	0.112	0.109	11.29	0.910
0.450	0.076	0.110	11.51	0.081	10.52	0.098	0.098	11.34	0.940
0.500	0.069	0.096	11.53	0.071	10.54	0.087	0.085	11.37	0.960
0.550	0.064	0.083	11.55	0.062	10.56	0.076	0.075	11.39	0.976
0.600	0.060	0.074	11.56	0.056	10.58	0.066	0.068	11.41	0.988
0.650	0.061	0.067	11.58	0.052	10.58	0.061	0.065	11.42	0.996
0.700	0.066	0.065	11.58	0.052	10.59	0.061	0.064	11.42	1.000

VOA = 9.25 VOLTS VOC = 8.13 VOLTS VOD = 9.04 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.034	0.072	0.1364	0.0620	0.0831	0.1407	-0.0071	0.0005
0.075	0.052	0.109	0.1375	0.0674	0.0865	0.1457	-0.0078	0.0007
0.100	0.069	0.145	0.1360	0.0750	0.0939	0.1524	-0.0085	0.0007
0.125	0.086	0.181	0.1338	0.0780	0.0963	0.1540	-0.0085	0.0006
0.150	0.103	0.217	0.1307	0.0810	0.0992	0.1555	-0.0084	0.0006
0.200	0.138	0.290	0.1213	0.0783	0.0815	0.1405	-0.0076	0.0007
0.250	0.172	0.362	0.1116	0.0665	0.0732	0.1257	-0.0055	0.0007
0.300	0.207	0.435	0.1008	0.0627	0.0661	0.1148	-0.0045	0.0004
0.350	0.241	0.507	0.0901	0.0557	0.0600	0.1029	-0.0036	0.0004
0.400	0.276	0.580	0.0809	0.0516	0.0576	0.0950	-0.0031	0.0003
0.450	0.310	0.652	0.0720	0.0492	0.0526	0.0869	-0.0027	0.0000
0.500	0.345	0.725	0.0639	0.0449	0.0464	0.0776	-0.0019	0.0001
0.550	0.379	0.797	0.0563	0.0414	0.0415	0.0696	-0.0012	0.0001
0.600	0.414	0.870	0.0511	0.0384	0.0357	0.0626	-0.0008	-0.0001
0.650	0.448	0.942	0.0478	0.0378	0.0343	0.0600	-0.0003	-0.0002
0.700	0.483	1.014	0.0479	0.0404	0.0339	0.0611	0.0001	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00208

TABLE A14- 9

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.630

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.030	0.185	0.236	10.57	0.218	9.63	0.248	0.248	10.46	0.400
0.050	0.180	0.236	10.64	0.216	9.72	0.235	0.241	10.57	0.450
0.100	0.170	0.234	10.80	0.205	9.89	0.228	0.232	10.74	0.540
0.150	0.159	0.226	10.92	0.190	10.02	0.215	0.221	10.85	0.618
0.200	0.145	0.212	11.02	0.170	10.13	0.200	0.205	10.98	0.686
0.250	0.130	0.192	11.10	0.150	10.22	0.170	0.177	11.05	0.748
0.300	0.118	0.166	11.16	0.132	10.30	0.153	0.160	11.13	0.802
0.350	0.105	0.147	11.22	0.118	10.36	0.137	0.140	11.18	0.845
0.400	0.091	0.130	11.27	0.104	10.41	0.121	0.125	11.24	0.885
0.450	0.082	0.118	11.30	0.090	10.44	0.109	0.113	11.28	0.916
0.500	0.072	0.105	11.33	0.078	10.47	0.097	0.097	11.32	0.943
0.550	0.066	0.090	11.35	0.069	10.49	0.086	0.086	11.35	0.963
0.600	0.060	0.078	11.36	0.061	10.51	0.076	0.072	11.37	0.977
0.650	0.057	0.068	11.36	0.055	10.53	0.070	0.066	11.38	0.988
0.700	0.058	0.064	11.37	0.052	10.53	0.068	0.064	11.38	0.996
0.750	0.061	0.062	11.37	0.053	10.53	0.070	0.065	11.38	1.000

VOA = 9.26 VOLTS VOC = 8.14 VOLTS VOD = 9.06 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.019	0.041	0.1266	0.0553	0.0839	0.1329	-0.0046	0.0000
0.050	0.032	0.068	0.1338	0.0582	0.0737	0.1329	-0.0056	-0.0006
0.100	0.064	0.137	0.1388	0.0680	0.0803	0.1436	-0.0074	-0.0004
0.150	0.096	0.205	0.1378	0.0765	0.0890	0.1517	-0.0084	-0.0007
0.200	0.129	0.274	0.1300	0.0826	0.0908	0.1517	-0.0086	-0.0006
0.250	0.161	0.342	0.1202	0.0817	0.0781	0.1400	-0.0078	-0.0008
0.300	0.193	0.411	0.1097	0.0747	0.0765	0.1305	-0.0058	-0.0008
0.350	0.225	0.479	0.1007	0.0665	0.0689	0.1180	-0.0047	-0.0003
0.400	0.257	0.548	0.0910	0.0592	0.0629	0.1065	-0.0040	-0.0004
0.450	0.289	0.616	0.0806	0.0597	0.0619	0.1011	-0.0035	-0.0004
0.500	0.322	0.685	0.0711	0.0556	0.0551	0.0909	-0.0029	0.0000
0.550	0.354	0.753	0.0637	0.0486	0.0491	0.0807	-0.0019	0.0000
0.600	0.386	0.822	0.0566	0.0433	0.0406	0.0703	-0.0013	0.0003
0.650	0.418	0.890	0.0514	0.0398	0.0390	0.0651	-0.0007	0.0002
0.700	0.450	0.959	0.0489	0.0406	0.0400	0.0647	-0.0004	0.0002
0.750	0.482	1.027	0.0500	0.0403	0.0413	0.0658	-0.0001	0.0003

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00192

TABLE A14-10

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.630

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.030	0.184	0.240	10.89	0.210	9.45	0.236	0.240	10.04	0.400
0.050	0.180	0.240	10.97	0.206	9.55	0.230	0.230	10.11	0.450
0.100	0.172	0.239	11.11	0.195	9.71	0.222	0.222	10.28	0.540
0.150	0.159	0.230	11.22	0.183	9.85	0.210	0.210	10.44	0.618
0.200	0.148	0.212	11.31	0.166	9.95	0.187	0.184	10.53	0.686
0.250	0.133	0.185	11.39	0.149	10.05	0.167	0.166	10.63	0.748
0.300	0.122	0.167	11.46	0.132	10.13	0.145	0.145	10.70	0.802
0.350	0.108	0.147	11.52	0.115	10.19	0.130	0.130	10.75	0.845
0.400	0.094	0.129	11.56	0.104	10.24	0.116	0.116	10.80	0.885
0.450	0.084	0.114	11.59	0.089	10.29	0.104	0.100	10.83	0.916
0.500	0.075	0.100	11.62	0.077	10.31	0.092	0.088	10.85	0.943
0.550	0.068	0.087	11.64	0.068	10.33	0.081	0.076	10.88	0.963
0.600	0.064	0.077	11.66	0.060	10.34	0.072	0.067	10.89	0.977
0.650	0.064	0.068	11.67	0.056	10.34	0.070	0.062	10.89	0.988
0.700	0.065	0.064	11.68	0.055	10.35	0.071	0.062	10.89	0.996
0.750	0.072	0.065	11.68	0.058	10.35	0.078	0.066	10.89	1.000

VOA = 9.48 VOLTS VOC = 7.93 VOLTS VOD = 9.02 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.019	0.041	0.1202	0.0498	0.1557	0.1628	-0.0044	-0.0006
0.050	0.032	0.068	0.1251	0.0565	0.1570	0.1693	-0.0053	0.0000
0.100	0.064	0.137	0.1302	0.0717	0.1554	0.1786	-0.0070	0.0000
0.150	0.096	0.205	0.1306	0.0775	0.1463	0.1772	-0.0081	0.0000
0.200	0.129	0.274	0.1252	0.0805	0.1315	0.1686	-0.0076	0.0005
0.250	0.161	0.342	0.1175	0.0714	0.1192	0.1541	-0.0060	0.0002
0.300	0.193	0.411	0.1080	0.0714	0.1044	0.1419	-0.0051	0.0000
0.350	0.225	0.479	0.0968	0.0666	0.0985	0.1310	-0.0041	0.0000
0.400	0.257	0.548	0.0897	0.0557	0.0880	0.1167	-0.0034	0.0000
0.450	0.289	0.616	0.0780	0.0551	0.0813	0.1072	-0.0027	0.0005
0.500	0.322	0.685	0.0690	0.0508	0.0742	0.0970	-0.0021	0.0005
0.550	0.354	0.753	0.0618	0.0453	0.0640	0.0855	-0.0014	0.0005
0.600	0.386	0.822	0.0551	0.0433	0.0573	0.0779	-0.0009	0.0005
0.650	0.418	0.890	0.0520	0.0402	0.0560	0.0741	-0.0003	0.0007
0.700	0.450	0.959	0.0513	0.0391	0.0583	0.0744	0.0001	0.0008
0.750	0.482	1.027	0.0543	0.0422	0.0648	0.0806	0.0005	0.0012

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00192

TABLE A14-11

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L) = 0.630

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.030	0.212	0.250	10.72	0.225	9.41	0.250	0.240	10.84	0.400
0.050	0.208	0.250	10.83	0.220	9.51	0.250	0.235	10.90	0.450
0.100	0.194	0.246	10.99	0.208	9.68	0.248	0.230	11.07	0.540
0.150	0.178	0.236	11.13	0.195	9.81	0.238	0.220	11.18	0.618
0.200	0.164	0.222	11.23	0.177	9.91	0.220	0.204	11.29	0.686
0.250	0.152	0.202	11.34	0.159	10.01	0.208	0.188	11.37	0.748
0.300	0.139	0.181	11.42	0.145	10.09	0.181	0.169	11.43	0.802
0.350	0.125	0.164	11.48	0.126	10.15	0.165	0.150	11.51	0.845
0.400	0.113	0.146	11.53	0.116	10.20	0.145	0.138	11.55	0.885
0.450	0.103	0.132	11.58	0.105	10.24	0.135	0.124	11.62	0.916
0.500	0.091	0.120	11.61	0.092	10.28	0.120	0.112	11.64	0.943
0.550	0.084	0.107	11.64	0.083	10.30	0.109	0.100	11.66	0.963
0.600	0.075	0.098	11.65	0.071	10.32	0.098	0.090	11.69	0.977
0.650	0.069	0.084	11.67	0.064	10.33	0.085	0.078	11.71	0.988
0.700	0.064	0.074	11.68	0.058	10.34	0.076	0.068	11.72	0.996
0.750	0.062	0.068	11.69	0.054	10.35	0.069	0.066	11.72	1.000

VOA = 9.51 VOLTS VOC = 7.90 VOLTS VOD = 9.58 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.019	0.041	0.1298	0.0968	0.1022	0.1644	-0.0043	0.0011
0.050	0.032	0.068	0.1345	0.0997	0.1136	0.1739	-0.0051	0.0019
0.100	0.064	0.137	0.1390	0.1034	0.1234	0.1829	-0.0070	0.0026
0.150	0.096	0.205	0.1399	0.1006	0.1295	0.1850	-0.0082	0.0029
0.200	0.129	0.274	0.1345	0.1011	0.1258	0.1807	-0.0083	0.0026
0.250	0.161	0.342	0.1260	0.0974	0.1283	0.1759	-0.0070	0.0033
0.300	0.193	0.411	0.1191	0.0877	0.1144	0.1606	-0.0056	0.0019
0.350	0.225	0.479	0.1065	0.0859	0.1066	0.1495	-0.0050	0.0022
0.400	0.257	0.548	0.1007	0.0745	0.0959	0.1355	-0.0039	0.0010
0.450	0.289	0.616	0.0929	0.0682	0.0875	0.1243	-0.0032	0.0014
0.500	0.322	0.685	0.0826	0.0648	0.0823	0.1148	-0.0030	0.0009
0.550	0.354	0.753	0.0754	0.0593	0.0750	0.1048	-0.0022	0.0010
0.600	0.386	0.822	0.0651	0.0587	0.0703	0.0970	-0.0020	0.0008
0.650	0.418	0.890	0.0589	0.0503	0.0588	0.0840	-0.0012	0.0006
0.700	0.450	0.959	0.0536	0.0449	0.0508	0.0747	-0.0007	0.0006
0.750	0.482	1.027	0.0500	0.0429	0.0482	0.0705	-0.0004	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00192

TABLE A14-12

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.750 INS. N.D.DIST.(X/L)= 0.750

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.184	0.246	10.51	0.196	9.95	0.222	0.224	10.40	0.430
0.100	0.174	0.248	10.64	0.186	10.07	0.210	0.212	10.54	0.510
0.150	0.164	0.242	10.75	0.176	10.17	0.194	0.200	10.65	0.583
0.200	0.152	0.229	10.84	0.164	10.26	0.177	0.184	10.75	0.655
0.250	0.142	0.206	10.93	0.153	10.33	0.158	0.167	10.84	0.720
0.300	0.130	0.186	10.99	0.140	10.39	0.140	0.147	10.90	0.770
0.350	0.118	0.167	11.05	0.127	10.44	0.123	0.131	10.96	0.818
0.400	0.106	0.149	11.10	0.114	10.48	0.108	0.116	11.01	0.860
0.450	0.095	0.131	11.14	0.100	10.51	0.095	0.103	11.06	0.900
0.500	0.085	0.115	11.18	0.086	10.54	0.085	0.092	11.09	0.930
0.550	0.076	0.101	11.20	0.076	10.56	0.075	0.081	11.12	0.955
0.600	0.069	0.086	11.22	0.066	10.57	0.068	0.073	11.14	0.974
0.650	0.065	0.076	11.23	0.059	10.58	0.063	0.067	11.16	0.987
0.700	0.063	0.070	11.25	0.052	10.59	0.063	0.065	11.17	0.995
0.750	0.066	0.067	11.25	0.052	10.59	0.064	0.065	11.17	1.000

VOA = 9.08 VOLTS VOC = 8.41 VOLTS VOD = 9.02 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.030	0.066	0.1186	0.0743	0.0899	0.1414	-0.0055	-0.0002
0.100	0.060	0.132	0.1246	0.0857	0.0881	0.1492	-0.0078	-0.0002
0.150	0.090	0.197	0.1274	0.0913	0.0840	0.1514	-0.0091	-0.0007
0.200	0.120	0.263	0.1278	0.0913	0.0759	0.1475	-0.0096	-0.0009
0.250	0.151	0.329	0.1262	0.0822	0.0615	0.1350	-0.0081	-0.0011
0.300	0.181	0.395	0.1205	0.0744	0.0452	0.1200	-0.0069	-0.0008
0.350	0.211	0.461	0.1134	0.0679	0.0311	0.1062	-0.0058	-0.0009
0.400	0.241	0.526	0.1052	0.0606	0.0167	0.0912	-0.0048	-0.0008
0.450	0.271	0.592	0.0951	0.0560	0.0149	0.0830	-0.0038	-0.0007
0.500	0.301	0.658	0.0837	0.0529	0.0265	0.0815	-0.0029	-0.0006
0.550	0.331	0.724	0.0752	0.0473	0.0222	0.0724	-0.0022	-0.0005
0.600	0.361	0.789	0.0662	0.0421	0.0274	0.0678	-0.0013	-0.0004
0.650	0.392	0.855	0.0597	0.0396	0.0289	0.0641	-0.0008	-0.0003
0.700	0.422	0.921	0.0529	0.0422	0.0388	0.0669	-0.0005	-0.0001
0.750	0.452	0.987	0.0531	0.0423	0.0398	0.0676	-0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00179

TABLE A14-13

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EF	VD	U UMAX
0.050	0.175	0.230	10.76	0.190	9.48	0.232	0.228	10.52	0.424
0.100	0.170	0.237	10.86	0.189	9.60	0.230	0.220	10.63	0.495
0.150	0.164	0.240	10.95	0.186	9.70	0.230	0.220	10.72	0.556
0.200	0.158	0.232	11.02	0.179	9.79	0.222	0.215	10.91	0.616
0.250	0.150	0.222	11.09	0.170	9.87	0.215	0.208	10.87	0.670
0.300	0.140	0.210	11.15	0.160	9.95	0.195	0.187	10.95	0.725
0.350	0.130	0.193	11.21	0.143	10.01	0.176	0.168	11.00	0.775
0.400	0.122	0.170	11.26	0.132	10.07	0.161	0.156	11.06	0.825
0.450	0.110	0.150	11.30	0.120	10.12	0.145	0.139	11.10	0.865
0.500	0.100	0.132	11.34	0.105	10.16	0.130	0.125	11.14	0.900
0.550	0.090	0.115	11.37	0.092	10.20	0.115	0.112	11.18	0.930
0.600	0.080	0.105	11.39	0.080	10.23	0.102	0.100	11.19	0.955
0.650	0.074	0.090	11.41	0.070	10.25	0.090	0.090	11.21	0.975
0.700	0.068	0.080	11.43	0.062	10.27	0.078	0.080	11.22	0.990
0.750	0.066	0.072	11.43	0.058	10.28	0.070	0.072	11.23	0.995
0.800	0.068	0.068	11.43	0.058	10.28	0.066	0.068	11.23	1.000

VOA = 9.34 VOLTS VOC = 7.91 VOLTS VOD = 9.05 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.063	0.1121	0.0669	0.0882	0.1336	-0.0045	0.0004
0.100	0.054	0.125	0.1213	0.0780	0.0922	0.1457	-0.0067	0.0010
0.150	0.081	0.187	0.1273	0.0861	0.1011	0.1572	-0.0086	0.0012
0.200	0.108	0.250	0.1296	0.0892	0.0908	0.1548	-0.0091	0.0008
0.250	0.135	0.313	0.1291	0.0908	0.1106	0.1652	-0.0093	0.0010
0.300	0.162	0.375	0.1267	0.0898	0.0971	0.1568	-0.0093	0.0011
0.350	0.189	0.437	0.1179	0.0911	0.0928	0.1509	-0.0083	0.0010
0.400	0.216	0.500	0.1130	0.0815	0.0879	0.1412	-0.0062	0.0006
0.450	0.243	0.563	0.1053	0.0712	0.0797	0.1281	-0.0049	0.0007
0.500	0.270	0.625	0.0943	0.0672	0.0761	0.1188	-0.0036	0.0006
0.550	0.297	0.688	0.0842	0.0611	0.0700	0.1077	-0.0026	0.0003
0.600	0.324	0.750	0.0744	0.0598	0.0664	0.1003	-0.0024	0.0002
0.650	0.352	0.813	0.0659	0.0544	0.0611	0.0908	-0.0014	0.0000
0.700	0.379	0.875	0.0588	0.0504	0.0539	0.0816	-0.0010	-0.0002
0.750	0.406	0.938	0.0551	0.0468	0.0460	0.0739	-0.0005	-0.0001
0.800	0.433	1.000	0.0554	0.0453	0.0396	0.0701	0.0000	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00164

TABLE A14-14

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.179	0.240	10.68	0.188	9.50	0.220	0.216	10.46	0.424
0.100	0.173	0.240	10.77	0.185	9.62	0.217	0.217	10.60	0.495
0.150	0.168	0.239	10.87	0.181	9.72	0.212	0.212	10.71	0.556
0.200	0.160	0.232	10.95	0.174	9.80	0.205	0.206	10.79	0.616
0.250	0.151	0.223	11.02	0.166	9.87	0.192	0.190	10.87	0.670
0.300	0.142	0.210	11.09	0.153	9.95	0.178	0.177	10.95	0.725
0.350	0.132	0.192	11.15	0.139	10.01	0.162	0.162	11.02	0.775
0.400	0.121	0.170	11.22	0.125	10.07	0.147	0.144	11.09	0.825
0.450	0.111	0.149	11.26	0.112	10.12	0.132	0.130	11.14	0.865
0.500	0.100	0.131	11.30	0.100	10.16	0.120	0.116	11.18	0.900
0.550	0.090	0.114	11.33	0.088	10.19	0.106	0.102	11.22	0.930
0.600	0.082	0.100	11.36	0.078	10.22	0.094	0.091	11.25	0.955
0.650	0.076	0.088	11.38	0.068	10.25	0.084	0.080	11.27	0.975
0.700	0.074	0.077	11.40	0.060	10.26	0.076	0.071	11.29	0.990
0.750	0.076	0.071	11.41	0.058	10.27	0.074	0.068	11.29	0.995
0.800	0.081	0.070	11.41	0.060	10.27	0.080	0.072	11.29	1.000

VOA = 9.26 VOLTS VOC = 8.01 VOLTS VOD = 9.12 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.063	0.1163	0.0699	0.0906	0.1384	-0.0053	0.0004
0.100	0.054	0.125	0.1239	0.0791	0.0948	0.1489	-0.0068	0.0000
0.150	0.081	0.187	0.1293	0.0834	0.0945	0.1536	-0.0080	0.0000
0.200	0.108	0.250	0.1319	0.0852	0.0980	0.1575	-0.0088	-0.0001
0.250	0.135	0.313	0.1318	0.0860	0.0891	0.1534	-0.0092	0.0003
0.300	0.162	0.375	0.1267	0.0889	0.0866	0.1511	-0.0089	0.0001
0.350	0.189	0.437	0.1197	0.0860	0.0812	0.1434	-0.0078	0.0000
0.400	0.216	0.500	0.1115	0.0779	0.0738	0.1316	-0.0061	0.0004
0.450	0.243	0.563	0.1025	0.0709	0.0686	0.1210	-0.0044	0.0002
0.500	0.270	0.625	0.0937	0.0632	0.0642	0.1106	-0.0034	0.0004
0.550	0.297	0.688	0.0840	0.0570	0.0573	0.0991	-0.0024	0.0004
0.600	0.324	0.750	0.0755	0.0518	0.0519	0.0896	-0.0016	0.0003
0.650	0.352	0.813	0.0665	0.0500	0.0483	0.0824	-0.0010	0.0003
0.700	0.379	0.875	0.0593	0.0492	0.0447	0.0766	-0.0002	0.0004
0.750	0.406	0.938	0.0575	0.0484	0.0435	0.0747	0.0004	0.0004
0.800	0.433	1.000	0.0597	0.0497	0.0495	0.0795	0.0009	0.0006

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00163

TABLE A14-15

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

INNER WALL REF POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U/UMAX
				(VOLTS)					
0.050	0.190	0.232	10.53	0.195	9.42	0.238	0.230	10.65	0.424
0.100	0.185	0.240	10.65	0.190	9.54	0.237	0.230	10.78	0.495
0.150	0.178	0.244	10.74	0.184	9.64	0.233	0.226	10.88	0.556
0.200	0.172	0.240	10.84	0.177	9.74	0.227	0.220	10.98	0.616
0.250	0.164	0.230	10.91	0.168	9.81	0.220	0.210	11.06	0.670
0.300	0.156	0.217	10.99	0.159	9.89	0.208	0.200	11.12	0.725
0.350	0.146	0.201	11.05	0.148	9.95	0.193	0.186	11.19	0.775
0.400	0.137	0.185	11.11	0.136	10.02	0.176	0.170	11.24	0.825
0.450	0.127	0.166	11.16	0.124	10.07	0.158	0.152	11.29	0.865
0.500	0.117	0.149	11.20	0.112	10.11	0.142	0.138	11.33	0.900
0.550	0.106	0.133	11.24	0.100	10.15	0.128	0.122	11.38	0.930
0.600	0.099	0.119	11.27	0.090	10.18	0.114	0.110	11.42	0.955
0.650	0.094	0.106	11.29	0.079	10.20	0.102	0.100	11.42	0.975
0.700	0.092	0.095	11.31	0.070	10.22	0.094	0.094	11.42	0.990
0.750	0.096	0.088	11.32	0.067	10.23	0.094	0.096	11.41	0.995
0.800	0.106	0.087	11.32	0.069	10.24	0.099	0.099	11.41	1.000

VOA = 9.21 VOLTS VOC = 8.02 VOLTS VOD = 9.24 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB/U ND	VTURB/U ND	WTURB/U ND	TURBKE/U**2 ND	2(U*V)/U**2 ND	2(U*W)/U**2 ND
0.050	0.027	0.063	0.1273	0.0709	0.0807	0.1395	-0.0042	0.0008
0.100	0.054	0.125	0.1345	0.0831	0.0897	0.1536	-0.0064	0.0008
0.150	0.081	0.187	0.1376	0.0944	0.0969	0.1645	-0.0085	0.0009
0.200	0.108	0.250	0.1393	0.0993	0.1007	0.1697	-0.0094	0.0009
0.250	0.135	0.313	0.1385	0.0993	0.1029	0.1703	-0.0095	0.0014
0.300	0.162	0.375	0.1362	0.0974	0.1049	0.1692	-0.0089	0.0012
0.350	0.189	0.437	0.1316	0.0928	0.0995	0.1620	-0.0080	0.0010
0.400	0.216	0.500	0.1246	0.0910	0.0950	0.1553	-0.0069	0.0009
0.450	0.243	0.563	0.1165	0.0838	0.0844	0.1424	-0.0054	0.0008
0.500	0.270	0.625	0.1074	0.0782	0.0782	0.1319	-0.0042	0.0005
0.550	0.297	0.688	0.0976	0.0715	0.0697	0.1194	-0.0033	0.0007
0.600	0.324	0.750	0.0891	0.0674	0.0619	0.1092	-0.0023	0.0004
0.650	0.352	0.813	0.0790	0.0666	0.0611	0.1034	-0.0013	0.0002
0.700	0.379	0.875	0.0705	0.0666	0.0627	0.0999	-0.0003	0.0000
0.750	0.406	0.938	0.0677	0.0678	0.0685	0.1020	0.0008	-0.0002
0.800	0.433	1.000	0.0698	0.0736	0.0728	0.1081	0.0020	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00164

TABLE A14-16

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.600

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.096	0.137	11.50	0.107	10.16	0.101	0.099	11.45	0.635
0.050	0.092	0.131	11.62	0.103	10.31	0.097	0.094	11.58	0.725
0.075	0.087	0.125	11.68	0.098	10.37	0.092	0.090	11.64	0.775
0.100	0.083	0.118	11.73	0.093	10.42	0.088	0.086	11.68	0.808
0.125	0.080	0.111	11.76	0.088	10.46	0.084	0.082	11.71	0.836
0.150	0.073	0.106	11.79	0.083	10.49	0.800	0.077	11.75	0.860
0.200	0.067	0.096	11.83	0.073	10.54	0.072	0.068	11.79	0.898
0.250	0.062	0.086	11.86	0.066	10.58	0.065	0.061	11.83	0.928
0.300	0.057	0.077	11.89	0.060	10.61	0.058	0.056	11.85	0.952
0.350	0.053	0.068	11.90	0.054	10.63	0.052	0.048	11.87	0.969
0.400	0.049	0.060	11.92	0.046	10.65	0.047	0.044	11.89	0.984
0.450	0.047	0.052	11.93	0.040	10.66	0.042	0.040	11.90	0.993
0.500	0.047	0.048	11.96	0.037	10.67	0.041	0.040	11.91	1.000
0.550	0.053	0.045	11.96	0.038	10.67	0.043	0.043	11.91	1.000

VOA = 9.51 VOLTS VOC = 7.95 VOLTS VOD = 9.55 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.025	0.048	0.0689	0.0455	0.0238	0.0691	-0.0023	0.0001
0.050	0.050	0.095	0.0716	0.0466	0.0216	0.0699	-0.0025	0.0002
0.075	0.075	0.143	0.0710	0.0462	0.0214	0.0693	-0.0025	0.0001
0.100	0.100	0.190	0.0690	0.0446	0.0227	0.0681	-0.0023	0.0001
0.125	0.125	0.238	0.0666	0.0436	0.0239	0.0671	-0.0020	0.0001
0.150	0.150	0.286	0.0640	0.0413	0.4860	0.2956	-0.0021	0.2359
0.200	0.200	0.381	0.0577	0.0413	0.0228	0.0609	-0.0017	0.0002
0.250	0.250	0.476	0.0532	0.0385	0.0198	0.0558	-0.0014	0.0002
0.300	0.300	0.571	0.0492	0.0347	0.0178	0.0508	-0.0011	0.0001
0.350	0.350	0.667	0.0447	0.0319	0.0122	0.0444	-0.0007	0.0002
0.400	0.400	0.762	0.0384	0.0316	0.0181	0.0441	-0.0005	0.0001
0.450	0.450	0.857	0.0336	0.0303	0.0187	0.0413	-0.0002	0.0001
0.500	0.500	0.952	0.0312	0.0299	0.0219	0.0415	-0.0000	0.0000
0.550	0.550	1.048	0.0320	0.0312	0.0247	0.0440	0.0003	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIFG AND TILLMAN = 0.00358

TABLE A14-17

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.600

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.105	0.141	11.58	0.113	10.15	0.130	0.137	11.53	0.635
0.050	0.100	0.136	11.70	0.108	10.30	0.125	0.131	11.66	0.725
0.075	0.096	0.130	11.77	0.103	10.37	0.120	0.127	11.72	0.775
0.100	0.091	0.125	11.82	0.098	10.43	0.115	0.122	11.77	0.808
0.125	0.087	0.120	11.85	0.094	10.46	0.111	0.117	11.80	0.836
0.150	0.083	0.114	11.88	0.090	10.50	0.106	0.113	11.83	0.860
0.200	0.075	0.104	11.93	0.081	10.55	0.097	0.104	11.88	0.898
0.250	0.068	0.094	11.96	0.073	10.59	0.089	0.095	11.92	0.928
0.300	0.063	0.084	11.99	0.066	10.63	0.081	0.086	11.95	0.952
0.350	0.057	0.075	12.01	0.059	10.65	0.073	0.078	11.97	0.969
0.400	0.053	0.066	12.03	0.052	10.67	0.066	0.070	11.99	0.984
0.450	0.049	0.057	12.04	0.046	10.68	0.060	0.061	12.00	0.993
0.500	0.049	0.052	12.05	0.041	10.69	0.054	0.056	12.00	1.000
0.550	0.051	0.049	12.05	0.040	10.69	0.052	0.052	12.00	0.998

VOA = 9.63 VOLTS VOC = 7.93 VOLTS VOD = 9.57 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.025	0.048	0.0726	0.0507	0.0606	0.0920	-0.0022	-0.0005
0.050	0.050	0.095	0.0748	0.0528	0.0627	0.0951	-0.0025	-0.0004
0.075	0.075	0.143	0.0741	0.0527	0.0643	0.0955	-0.0024	-0.0005
0.100	0.100	0.190	0.0721	0.0524	0.0635	0.0940	-0.0024	-0.0005
0.125	0.125	0.238	0.0706	0.0511	0.0627	0.0922	-0.0024	-0.0005
0.150	0.150	0.286	0.0687	0.0488	0.0615	0.0895	-0.0022	-0.0005
0.200	0.200	0.381	0.0633	0.0462	0.0591	0.0843	-0.0019	-0.0005
0.250	0.250	0.476	0.0582	0.0429	0.0558	0.0785	-0.0016	-0.0004
0.300	0.300	0.571	0.0533	0.0396	0.0516	0.0723	-0.0012	-0.0003
0.350	0.350	0.667	0.0482	0.0360	0.0477	0.0659	-0.0010	-0.0003
0.400	0.400	0.762	0.0429	0.0337	0.0441	0.0604	-0.0006	-0.0002
0.450	0.450	0.857	0.0381	0.0302	0.0397	0.0540	-0.0004	-0.0001
0.500	0.500	0.952	0.0342	0.0315	0.0370	0.0514	-0.0001	-0.0001
0.550	0.550	1.048	0.0333	0.0317	0.0340	0.0494	0.0001	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00358

TABLE A14-18

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.600

OUTER WALL RFD POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.101	0.137	11.49	0.113	10.15	0.126	0.120	11.46	0.635
0.050	0.096	0.133	11.63	0.106	10.29	0.120	0.114	11.62	0.725
0.075	0.092	0.128	11.70	0.101	10.36	0.115	0.108	11.69	0.775
0.100	0.087	0.123	11.74	0.095	10.41	0.109	0.103	11.75	0.808
0.125	0.083	0.118	11.78	0.090	10.45	0.104	0.097	11.79	0.836
0.150	0.078	0.112	11.81	0.084	10.49	0.098	0.092	11.83	0.860
0.200	0.071	0.101	11.86	0.075	10.55	0.088	0.083	11.88	0.898
0.250	0.063	0.089	11.90	0.066	10.58	0.079	0.074	11.92	0.928
0.300	0.057	0.079	11.93	0.058	10.62	0.070	0.066	11.96	0.952
0.350	0.052	0.069	11.95	0.051	10.64	0.062	0.059	11.98	0.969
0.400	0.048	0.061	11.97	0.044	10.66	0.055	0.053	12.00	0.984
0.450	0.046	0.053	11.98	0.039	10.68	0.051	0.050	12.01	0.993
0.500	0.049	0.049	11.99	0.039	10.68	0.052	0.053	12.02	1.000
0.550	0.055	0.049	11.99	0.043	10.68	0.055	0.059	12.02	0.998

VOA = 9.51 VOLTS VOC = 7.96 VOLTS VOD = 9.51 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.025	0.048	0.0735	0.0417	0.0476	0.0814	-0.0021	0.0004
0.050	0.050	0.095	0.0745	0.0456	0.0477	0.0839	-0.0024	0.0004
0.075	0.075	0.143	0.0738	0.0464	0.0469	0.0836	-0.0024	0.0005
0.100	0.100	0.190	0.0710	0.0471	0.0460	0.0820	-0.0024	0.0004
0.125	0.125	0.238	0.0685	0.0473	0.0444	0.0801	-0.0023	0.0005
0.150	0.150	0.286	0.0650	0.0465	0.0434	0.0774	-0.0022	0.0004
0.200	0.200	0.381	0.0594	0.0442	0.0407	0.0721	-0.0019	0.0003
0.250	0.250	0.476	0.0533	0.0399	0.0382	0.0657	-0.0015	0.0003
0.300	0.300	0.571	0.0474	0.0373	0.0349	0.0598	-0.0011	0.0002
0.350	0.350	0.667	0.0422	0.0338	0.0320	0.0540	-0.0008	0.0001
0.400	0.400	0.762	0.0367	0.0323	0.0303	0.0497	-0.0006	0.0001
0.450	0.450	0.857	0.0327	0.0301	0.0306	0.0467	-0.0003	0.0000
0.500	0.500	0.952	0.0328	0.0295	0.0332	0.0478	0.0000	-0.0000
0.550	0.550	1.048	0.0361	0.0297	0.0355	0.0507	0.0003	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00358

TABLE A14-19

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 0.750 INS. N.D.DIST.(X/L)= 0.150

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.163	0.240	10.94	0.174	10.10	0.195	0.207	10.95	0.576
0.075	0.143	0.210	11.10	0.136	10.24	0.155	0.162	11.09	0.660
0.100	0.123	0.158	11.22	0.120	10.34	0.132	0.140	11.19	0.716
0.125	0.115	0.139	11.28	0.115	10.39	0.123	0.131	11.24	0.750
0.150	0.110	0.131	11.32	0.107	10.44	0.117	0.121	11.30	0.780
0.200	0.100	0.120	11.38	0.096	10.51	0.105	0.108	11.37	0.830
0.250	0.092	0.109	11.43	0.085	10.55	0.095	0.102	11.42	0.870
0.300	0.083	0.100	11.46	0.078	10.59	0.085	0.089	11.48	0.902
0.350	0.077	0.092	11.48	0.070	10.62	0.076	0.079	11.50	0.928
0.400	0.070	0.083	11.50	0.062	10.64	0.067	0.072	11.53	0.950
0.450	0.064	0.075	11.52	0.056	10.66	0.062	0.064	11.56	0.970
0.500	0.060	0.067	11.52	0.050	10.68	0.056	0.058	11.58	0.983
0.550	0.056	0.061	11.53	0.044	10.68	0.052	0.056	11.59	0.993
0.600	0.055	0.055	11.53	0.042	10.69	0.052	0.054	11.61	0.100

VOA = 9.25 VOLTS VOC = 8.02 VOLTS VOD = 9.05 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.044	0.086	0.1075	0.1068	0.0792	0.1467	-0.0085	-0.0011
0.075	0.066	0.129	0.0908	0.1064	0.0672	0.1322	-0.0072	-0.0006
0.100	0.086	0.172	0.0833	0.0761	0.0565	0.1079	-0.0031	-0.0006
0.125	0.111	0.216	0.0821	0.0633	0.0506	0.0980	-0.0020	-0.0006
0.150	0.133	0.259	0.0780	0.0632	0.0481	0.0947	-0.0017	-0.0003
0.200	0.177	0.345	0.0727	0.0611	0.0438	0.0888	-0.0016	-0.0002
0.250	0.221	0.431	0.0663	0.0595	0.0461	0.0859	-0.0013	-0.0005
0.300	0.265	0.517	0.0623	0.0550	0.0367	0.0770	-0.0013	-0.0002
0.350	0.310	0.603	0.0569	0.0536	0.0328	0.0717	-0.0011	-0.0002
0.400	0.354	0.690	0.0513	0.0503	0.0306	0.0661	-0.0009	-0.0003
0.450	0.398	0.776	0.0469	0.0467	0.0280	0.0608	-0.0007	-0.0001
0.500	0.442	0.862	0.0423	0.0441	0.0262	0.0563	-0.0004	-0.0001
0.550	0.487	0.948	0.0375	0.0424	0.0291	0.0545	-0.0003	-0.0002
0.600	0.531	1.034	0.0036	0.0040	0.0030	0.0053	0.0000	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00250

TABLE A14-20

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.350 INS. N.D.DIST.(X/L)= 0.270

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.210	0.282	10.59	0.195	9.47	0.251	0.255	10.67	0.415
0.075	0.188	0.265	10.78	0.185	9.69	0.230	0.235	10.83	0.500
0.100	0.172	0.245	10.93	0.170	9.89	0.207	0.210	10.95	0.585
0.125	0.152	0.219	11.04	0.157	10.03	0.170	0.175	11.04	0.650
0.150	0.135	0.180	11.14	0.144	10.14	0.150	0.156	11.09	0.700
0.200	0.115	0.145	11.25	0.124	10.27	0.125	0.130	11.20	0.773
0.250	0.105	0.130	11.34	0.106	10.34	0.111	0.115	11.25	0.825
0.300	0.095	0.118	11.38	0.094	10.40	0.100	0.107	11.28	0.866
0.350	0.088	0.109	11.43	0.085	10.43	0.093	0.095	11.32	0.900
0.400	0.080	0.098	11.47	0.076	10.47	0.082	0.084	11.36	0.931
0.450	0.075	0.089	11.50	0.070	10.50	0.074	0.077	11.39	0.955
0.500	0.068	0.081	11.53	0.062	10.51	0.066	0.069	11.41	0.978
0.550	0.063	0.072	11.55	0.056	10.53	0.060	0.064	11.42	0.991
0.600	0.060	0.065	10.67	0.050	10.54	0.056	0.058	11.44	0.998
0.650	0.058	0.059	11.58	0.046	10.54	0.055	0.056	11.44	1.000

VOA = 9.24 VOLTS VOC = 8.03 VOLTS VOD = 9.04 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.040	0.076	0.1220	0.1081	0.0677	0.1489	-0.0076	-0.0003
0.075	0.060	0.114	0.1219	0.1047	0.0721	0.1494	-0.0085	-0.0004
0.100	0.081	0.152	0.1181	0.1060	0.0751	0.1496	-0.0086	-0.0003
0.125	0.101	0.189	0.1134	0.0954	0.0485	0.1286	-0.0077	-0.0004
0.150	0.121	0.227	0.1067	0.0710	0.0433	0.1105	-0.0046	-0.0005
0.200	0.161	0.303	0.0962	0.0543	0.0308	0.0906	-0.0028	-0.0004
0.250	0.202	0.379	0.0851	0.0568	0.0389	0.0904	-0.0022	-0.0003
0.300	0.242	0.455	0.0775	0.0562	0.0436	0.0886	-0.0020	-0.0005
0.350	0.282	0.530	0.0720	0.0542	0.0403	0.0832	-0.0017	-0.0001
0.400	0.323	0.606	0.0656	0.0504	0.0348	0.0753	-0.0014	-0.0001
0.450	0.363	0.682	0.0614	0.0466	0.0302	0.0691	-0.0010	-0.0002
0.500	0.403	0.758	0.0554	0.0444	0.0282	0.0640	-0.0009	-0.0002
0.550	0.444	0.833	0.0504	0.0403	0.0281	0.0594	-0.0006	-0.0002
0.600	0.484	0.909	0.0452	0.0818	0.0276	0.0773	-0.0007	-0.0001
0.650	0.524	0.985	0.0417	0.0370	0.0306	0.0546	-0.0001	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00177

TABLE A14-21

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.950 INS. N.D.DIST.(X/L)= 0.390

OUTER WALL BLUF POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.232	0.300	10.53	0.278	9.59	0.273	0.272	10.31	0.316
0.100	0.217	0.292	10.75	0.250	9.88	0.245	0.250	10.60	0.450
0.125	0.194	0.280	10.85	0.228	9.98	0.226	0.232	10.69	0.506
0.150	0.178	0.260	10.95	0.210	10.08	0.207	0.215	10.80	0.566
0.175	0.163	0.235	11.05	0.175	10.18	0.177	0.184	10.89	0.623
0.200	0.145	0.214	11.11	0.155	10.25	0.160	0.167	10.98	0.677
0.250	0.123	0.167	11.21	0.130	10.36	0.133	0.137	11.09	0.760
0.300	0.108	0.140	11.23	0.109	10.44	0.120	0.119	11.15	0.818
0.350	0.099	0.127	11.32	0.100	10.50	0.110	0.105	11.20	0.862
0.400	0.090	0.116	11.36	0.089	10.54	0.100	0.094	11.24	0.896
0.450	0.082	0.106	11.38	0.080	10.57	0.090	0.087	11.28	0.926
0.500	0.076	0.096	11.41	0.074	10.60	0.082	0.078	11.31	0.952
0.550	0.069	0.086	11.43	0.065	10.62	0.073	0.068	11.33	0.970
0.600	0.064	0.078	11.45	0.059	10.64	0.066	0.063	11.35	0.990
0.650	0.060	0.068	11.45	0.054	10.65	0.062	0.060	11.36	0.996
0.700	0.060	0.062	11.45	0.050	10.65	0.061	0.058	11.37	1.000

VOA = 9.27 VOLTS VOC = 8.14 VOLTS VOD = 9.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.037	0.070	0.1309	0.0587	0.0534	0.1215	-0.0052	0.0001
0.100	0.074	0.141	0.1419	0.0897	0.0531	0.1423	-0.0081	-0.0005
0.125	0.093	0.176	0.1381	0.0921	0.0578	0.1440	-0.0097	-0.0006
0.150	0.112	0.211	0.1353	0.0895	0.0536	0.1392	-0.0095	-0.0008
0.175	0.130	0.246	0.1189	0.0984	0.0549	0.1361	-0.0083	-0.0007
0.200	0.149	0.282	0.1108	0.0957	0.0545	0.1305	-0.0079	-0.0007
0.250	0.186	0.352	0.0996	0.0772	0.0441	0.1104	-0.0047	-0.0004
0.300	0.223	0.423	0.0871	0.0737	0.0512	0.1060	-0.0033	0.0001
0.350	0.260	0.493	0.0824	0.0654	0.0449	0.0963	-0.0027	0.0004
0.400	0.298	0.563	0.0751	0.0631	0.0430	0.0906	-0.0024	0.0005
0.450	0.335	0.634	0.0688	0.0603	0.0414	0.0853	-0.0021	0.0002
0.500	0.372	0.704	0.0647	0.0550	0.0353	0.0775	-0.0017	0.0003
0.550	0.409	0.775	0.0576	0.0517	0.0317	0.0705	-0.0013	0.0003
0.600	0.446	0.845	0.0529	0.0485	0.0302	0.0658	-0.0010	0.0002
0.650	0.484	0.915	0.0486	0.0426	0.0311	0.0611	-0.0005	0.0001
0.700	0.521	0.986	0.0452	0.0421	0.0336	0.0604	-0.0001	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00123

TABLE A14-22

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.950 INS. N.D.DIST.(X/L)= 0.390

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EF	VD	U UMAX
0.050	0.264	0.310	10.64	0.278	9.59	0.273	0.272	10.31	0.316
0.100	0.242	0.308	10.91	0.250	9.88	0.245	0.250	10.60	0.450
0.125	0.228	0.296	11.01	0.228	9.98	0.226	0.232	10.69	0.506
0.150	0.210	0.278	11.11	0.210	10.08	0.207	0.215	10.80	0.566
0.175	0.192	0.256	11.21	0.175	10.18	0.177	0.184	10.89	0.623
0.200	0.172	0.232	11.29	0.155	10.25	0.160	0.167	10.98	0.677
0.250	0.136	0.180	11.41	0.130	10.36	0.133	0.137	11.09	0.760
0.300	0.116	0.150	11.49	0.109	10.44	0.120	0.119	11.15	0.818
0.350	0.104	0.132	11.54	0.100	10.50	0.110	0.105	11.20	0.862
0.400	0.093	0.120	11.58	0.089	10.54	0.100	0.094	11.24	0.896
0.450	0.084	0.110	11.62	0.080	10.57	0.090	0.087	11.28	0.926
0.500	0.078	0.100	11.65	0.074	10.60	0.082	0.078	11.31	0.952
0.550	0.070	0.090	11.68	0.065	10.62	0.073	0.068	11.33	0.970
0.600	0.066	0.081	11.70	0.059	10.64	0.066	0.063	11.35	0.990
0.650	0.062	0.072	11.70	0.054	10.65	0.062	0.060	11.36	0.996
0.700	0.061	0.064	11.71	0.050	10.65	0.061	0.058	11.37	1.000

VOA = 9.48 VOLTS VOC = 8.14 VOLTS VOD = 9.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.037	0.070	0.1309	0.1020	0.0534	0.1431	-0.0044	0.0001
0.100	0.074	0.141	0.1419	0.1205	0.0531	0.1577	-0.0082	-0.0005
0.125	0.093	0.176	0.1381	0.1274	0.0578	0.1616	-0.0090	-0.0006
0.150	0.112	0.211	0.1353	0.1252	0.0536	0.1570	-0.0093	-0.0008
0.175	0.130	0.246	0.1189	0.1310	0.0549	0.1524	-0.0088	-0.0007
0.200	0.149	0.282	0.1108	0.1241	0.0545	0.1447	-0.0080	-0.0007
0.250	0.186	0.352	0.0996	0.0944	0.0441	0.1190	-0.0051	-0.0004
0.300	0.223	0.423	0.0871	0.0820	0.0512	0.1102	-0.0036	0.0001
0.350	0.260	0.493	0.0824	0.0716	0.0449	0.0994	-0.0028	0.0004
0.400	0.298	0.563	0.0751	0.0668	0.0430	0.0925	-0.0025	0.0005
0.450	0.335	0.634	0.0688	0.0631	0.0414	0.0866	-0.0023	0.0002
0.500	0.372	0.704	0.0647	0.0576	0.0353	0.0788	-0.0018	0.0003
0.550	0.409	0.775	0.0576	0.0534	0.0317	0.0713	-0.0015	0.0003
0.600	0.446	0.845	0.0529	0.0500	0.0302	0.0665	-0.0011	0.0002
0.650	0.484	0.915	0.0486	0.0454	0.0311	0.0625	-0.0007	0.0001
0.700	0.521	0.986	0.0452	0.0425	0.0336	0.0606	-0.0002	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00123

TABLE A14-23

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 1.950 INS. N.D.DIST.(X/L)= 0.390

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	FC (VOLTS)	VC	ED	EE	VD	U UMAX
0.050	0.221	0.290	10.82	0.278	9.59	0.273	0.272	10.31	0.316
0.100	0.188	0.277	11.09	0.250	9.88	0.245	0.250	10.60	0.450
0.125	0.172	0.264	11.18	0.228	9.98	0.226	0.232	10.69	0.506
0.150	0.158	0.244	11.28	0.210	10.08	0.207	0.215	10.80	0.566
0.175	0.145	0.218	11.37	0.175	10.18	0.177	0.184	10.89	0.623
0.200	0.132	0.191	11.45	0.155	10.25	0.160	0.167	10.98	0.677
0.250	0.112	0.160	11.57	0.130	10.36	0.133	0.137	11.09	0.760
0.300	0.096	0.136	11.64	0.109	10.44	0.120	0.119	11.15	0.818
0.350	0.086	0.119	11.70	0.100	10.50	0.110	0.105	11.20	0.862
0.400	0.078	0.105	11.74	0.089	10.54	0.100	0.094	11.24	0.896
0.450	0.070	0.094	11.78	0.080	10.57	0.090	0.087	11.28	0.926
0.500	0.064	0.084	11.81	0.074	10.60	0.082	0.078	11.31	0.952
0.550	0.061	0.074	11.83	0.065	10.62	0.073	0.068	11.33	0.970
0.600	0.059	0.067	11.85	0.059	10.64	0.066	0.063	11.35	0.990
0.650	0.060	0.060	11.86	0.054	10.65	0.062	0.060	11.36	0.996
0.700	0.064	0.058	11.86	0.050	10.65	0.061	0.058	11.37	1.000

VOA = 9.50 VOLTS VOC = 8.14 VOLTS VOD = 9.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.037	0.070	0.1309	0.0102	0.0534	0.0973	-0.0046	0.0001
0.100	0.074	0.141	0.1419	0.0285	0.0531	0.1117	-0.0077	-0.0005
0.125	0.093	0.176	0.1381	0.0444	0.0578	0.1201	-0.0085	-0.0006
0.150	0.112	0.211	0.1353	0.0433	0.0536	0.1161	-0.0083	-0.0008
0.175	0.130	0.246	0.1189	0.0626	0.0549	0.1182	-0.0070	-0.0007
0.200	0.149	0.282	0.1108	0.0565	0.0545	0.1109	-0.0055	-0.0007
0.250	0.186	0.352	0.0996	0.0502	0.0441	0.0969	-0.0043	-0.0004
0.300	0.223	0.423	0.0871	0.0472	0.0512	0.0928	-0.0033	0.0001
0.350	0.260	0.493	0.0824	0.0361	0.0449	0.0817	-0.0025	0.0004
0.400	0.298	0.563	0.0751	0.0321	0.0430	0.0751	-0.0019	0.0005
0.450	0.335	0.634	0.0688	0.0289	0.0414	0.0695	-0.0016	0.0002
0.500	0.372	0.704	0.0647	0.0218	0.0353	0.0609	-0.0012	0.0003
0.550	0.409	0.775	0.0576	0.0246	0.0317	0.0569	-0.0007	0.0003
0.600	0.446	0.845	0.0529	0.0263	0.0302	0.0547	-0.0004	0.0002
0.650	0.484	0.915	0.0486	0.0284	0.0311	0.0540	0.0000	0.0001
0.700	0.521	0.986	0.0452	0.0355	0.0336	0.0571	0.0003	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00123

TABLE A14-24

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 2.550 INS. N.D.DIST.(X/L)= 0.510

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.260	0.304	10.27	0.280	9.16	0.312	0.302	10.06	0.238
0.100	0.252	0.310	10.49	0.282	9.46	0.310	0.305	10.28	0.333
0.150	0.236	0.310	10.70	0.280	9.71	0.296	0.290	10.51	0.433
0.200	0.210	0.290	10.87	0.245	9.93	0.262	0.254	10.68	0.533
0.250	0.172	0.252	11.03	0.203	10.09	0.220	0.212	10.85	0.629
0.300	0.145	0.211	11.15	0.158	10.21	0.184	0.180	10.96	0.710
0.350	0.123	0.170	11.24	0.129	10.31	0.152	0.144	11.03	0.776
0.400	0.108	0.142	11.30	0.108	10.37	0.132	0.126	11.09	0.828
0.450	0.096	0.127	11.36	0.094	10.42	0.120	0.110	11.13	0.870
0.500	0.086	0.115	11.40	0.085	10.45	0.109	0.101	11.19	0.903
0.550	0.080	0.103	11.43	0.077	10.49	0.098	0.089	11.23	0.934
0.600	0.074	0.093	11.46	0.068	10.51	0.088	0.082	11.26	0.955
0.650	0.069	0.084	11.48	0.063	10.52	0.080	0.076	11.28	0.973
0.700	0.064	0.075	11.50	0.057	10.54	0.072	0.068	11.30	0.988
0.750	0.062	0.067	11.51	0.052	10.55	0.067	0.064	11.31	0.998
0.800	0.063	0.062	11.52	0.050	10.56	0.064	0.060	11.33	1.000

VOA = 9.20 VOLTS VOC = 8.07 VOLTS VOD = 9.05 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.033	0.065	0.1300	0.0259	0.0794	0.1176	-0.0027	0.0008
0.100	0.067	0.129	0.1463	0.0530	0.0998	0.1496	-0.0049	0.0005
0.150	0.100	0.194	0.1619	0.0566	0.0932	0.1558	-0.0078	0.0007
0.200	0.133	0.258	0.1549	0.0811	0.0968	0.1664	-0.0095	0.0010
0.250	0.167	0.323	0.1405	0.0805	0.0858	0.1534	-0.0096	0.0010
0.300	0.200	0.387	0.1172	0.0845	0.0907	0.1462	-0.0075	0.0005
0.350	0.233	0.452	0.1005	0.0731	0.0785	0.1260	-0.0048	0.0009
0.400	0.267	0.516	0.0875	0.0657	0.0751	0.1142	-0.0032	0.0006
0.450	0.300	0.581	0.0786	0.0624	0.0715	0.1062	-0.0027	0.0010
0.500	0.333	0.645	0.0727	0.0567	0.0658	0.0976	-0.0024	0.0007
0.550	0.367	0.710	0.0672	0.0531	0.0581	0.0892	-0.0018	0.0008
0.600	0.400	0.774	0.0602	0.0509	0.0550	0.0830	-0.0014	0.0005
0.650	0.433	0.839	0.0566	0.0458	0.0500	0.0762	-0.0010	0.0003
0.700	0.467	0.903	0.0516	0.0419	0.0447	0.0691	-0.0007	0.0003
0.750	0.500	0.968	0.0474	0.0399	0.0434	0.0654	-0.0003	0.0002
0.800	0.533	1.032	0.0455	0.0391	0.0398	0.0622	0.0001	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00085

TABLE A14-25

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.630

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.273	0.312	10.25	0.267	8.89	0.285	0.300	9.85	0.180
0.100	0.273	0.320	10.45	0.295	9.12	0.293	0.307	10.07	0.247
0.150	0.266	0.320	10.61	0.300	9.34	0.292	0.306	10.25	0.325
0.200	0.254	0.314	10.75	0.286	9.55	0.275	0.290	10.45	0.410
0.250	0.235	0.300	10.89	0.265	9.75	0.259	0.266	10.59	0.500
0.300	0.210	0.272	11.00	0.232	9.92	0.229	0.236	10.75	0.590
0.350	0.172	0.232	11.10	0.190	10.05	0.190	0.200	10.87	0.670
0.400	0.144	0.192	11.16	0.158	10.16	0.157	0.168	10.97	0.740
0.450	0.123	0.160	11.22	0.127	10.24	0.131	0.142	11.04	0.800
0.500	0.108	0.137	11.26	0.108	10.30	0.115	0.120	11.09	0.855
0.550	0.095	0.122	11.30	0.095	10.38	0.100	0.106	11.14	0.892
0.600	0.087	0.108	11.32	0.082	10.39	0.088	0.095	11.18	0.923
0.650	0.080	0.098	11.35	0.075	10.41	0.080	0.086	11.20	0.948
0.700	0.071	0.087	11.36	0.066	10.44	0.073	0.078	11.23	0.969
0.750	0.067	0.078	11.37	0.059	10.45	0.068	0.070	11.24	0.983
0.800	0.064	0.070	11.37	0.054	10.47	0.062	0.065	11.26	0.993
0.850	0.063	0.065	11.37	0.051	10.47	0.062	0.064	11.27	1.000

VOA = 9.40 VOLTS VOC = 8.07 VOLTS VOD = 9.07 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.031	0.058	0.1231	0.0393	0.0679	0.1152	-0.0022	-0.0010
0.100	0.063	0.116	0.1471	0.0089	0.0519	0.1040	-0.0034	-0.0011
0.150	0.094	0.174	0.1650	0.0321	0.0578	0.1274	-0.0052	-0.0014
0.200	0.125	0.233	0.1718	0.0683	0.0531	0.1466	-0.0071	-0.0017
0.250	0.156	0.291	0.1729	0.0882	0.0687	0.1649	-0.0090	-0.0009
0.300	0.187	0.349	0.1632	0.1025	0.0689	0.1673	-0.0094	-0.0009
0.350	0.219	0.407	0.1426	0.1003	0.0687	0.1558	-0.0088	-0.0013
0.400	0.250	0.465	0.1248	0.0915	0.0605	0.1384	-0.0067	-0.0013
0.450	0.281	0.523	0.1046	0.0876	0.0624	0.1273	-0.0048	-0.0012
0.500	0.313	0.581	0.0929	0.0816	0.0580	0.1162	-0.0036	-0.0005
0.550	0.344	0.640	0.0826	0.0757	0.0525	0.1054	-0.0031	-0.0006
0.600	0.375	0.698	0.0735	0.0723	0.0492	0.0975	-0.0023	-0.0006
0.650	0.406	0.756	0.0684	0.0662	0.0446	0.0896	-0.0018	-0.0005
0.700	0.437	0.814	0.0609	0.0605	0.0438	0.0826	-0.0015	-0.0004
0.750	0.469	0.872	0.0549	0.0576	0.0421	0.0773	-0.0010	-0.0001
0.800	0.500	0.930	0.0505	0.0541	0.0390	0.0718	-0.0005	-0.0002
0.850	0.531	0.988	0.0480	0.0525	0.0415	0.0710	-0.0002	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00056

TABLE A14-26

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.630

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.275	0.307	10.02	0.306	9.01	0.300	0.290	9.91	0.180
0.100	0.290	0.332	10.20	0.320	9.11	0.325	0.316	10.12	0.247
0.150	0.290	0.343	10.37	0.322	9.35	0.330	0.322	10.32	0.325
0.200	0.280	0.337	10.54	0.302	9.57	0.330	0.318	10.52	0.410
0.250	0.260	0.318	10.69	0.272	9.76	0.310	0.300	10.68	0.500
0.300	0.235	0.290	10.83	0.240	9.92	0.287	0.272	10.83	0.590
0.350	0.210	0.256	10.94	0.202	10.07	0.255	0.240	10.96	0.670
0.400	0.173	0.215	11.03	0.166	10.17	0.220	0.205	11.09	0.740
0.450	0.142	0.180	11.10	0.132	10.23	0.177	0.165	11.16	0.800
0.500	0.120	0.152	11.17	0.110	10.31	0.147	0.137	11.25	0.855
0.550	0.104	0.130	11.22	0.090	10.39	0.126	0.120	11.27	0.892
0.600	0.091	0.113	11.25	0.080	10.39	0.112	0.105	11.33	0.923
0.650	0.082	0.100	11.28	0.070	10.40	0.100	0.096	11.37	0.948
0.700	0.076	0.090	11.30	0.062	10.44	0.090	0.085	11.41	0.969
0.750	0.070	0.080	11.32	0.057	10.45	0.080	0.078	11.43	0.983
0.800	0.066	0.073	11.32	0.052	10.46	0.070	0.070	11.44	0.993
0.850	0.064	0.068	11.33	0.050	10.47	0.067	0.068	11.45	1.000

VOA = 9.22 VOLTS VOC = 8.06 VOLTS VOD = 9.18 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.031	0.058	0.1223	0.0591	0.0887	0.1350	-0.0020	0.0008
0.100	0.063	0.116	0.1597	0.0429	0.0755	0.1391	-0.0037	0.0009
0.150	0.094	0.174	0.1744	0.0743	0.0911	0.1699	-0.0060	0.0009
0.200	0.125	0.233	0.1785	0.1027	0.1139	0.1976	-0.0078	0.0017
0.250	0.156	0.291	0.1755	0.1200	0.1305	0.2130	-0.0090	0.0016
0.300	0.187	0.349	0.1680	0.1251	0.1364	0.2148	-0.0091	0.0025
0.350	0.219	0.407	0.1493	0.1307	0.1374	0.2087	-0.0077	0.0025
0.400	0.250	0.465	0.1300	0.1158	0.1249	0.1853	-0.0065	0.0023
0.450	0.281	0.523	0.1090	0.1042	0.1056	0.1594	-0.0053	0.0016
0.500	0.313	0.581	0.0940	0.0919	0.0887	0.1373	-0.0040	0.0012
0.550	0.344	0.640	0.0777	0.0855	0.0858	0.1245	-0.0029	0.0007
0.600	0.375	0.698	0.0713	0.0736	0.0743	0.1096	-0.0022	0.0007
0.650	0.406	0.756	0.0639	0.0672	0.0688	0.0999	-0.0017	0.0004
0.700	0.437	0.814	0.0570	0.0637	0.0621	0.0914	-0.0012	0.0004
0.750	0.469	0.872	0.0529	0.0568	0.0553	0.0825	-0.0008	0.0001
0.800	0.500	0.930	0.0485	0.0538	0.0480	0.0752	-0.0005	0.0000
0.850	0.531	0.988	0.0469	0.0506	0.0465	0.0720	-0.0003	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00056

TABLE A14-27

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 3.750 INS. N.D.DIST.(X/L)= 0.750

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.265	0.290	9.83	0.283	9.22	0.292	0.260	9.71	0.127
0.100	0.275	0.315	9.96	0.304	9.32	0.313	0.290	9.85	0.175
0.150	0.278	0.332	10.12	0.310	9.51	0.330	0.310	10.01	0.234
0.200	0.270	0.337	10.28	0.314	9.70	0.323	0.310	10.17	0.304
0.250	0.256	0.328	10.40	0.306	9.85	0.315	0.306	10.31	0.376
0.300	0.235	0.314	10.54	0.280	9.98	0.305	0.290	10.44	0.453
0.350	0.212	0.292	10.68	0.248	10.10	0.280	0.264	10.58	0.533
0.400	0.182	0.265	10.78	0.220	10.21	0.250	0.238	10.69	0.610
0.450	0.157	0.230	10.88	0.184	10.30	0.220	0.206	10.79	0.682
0.500	0.135	0.188	10.97	0.150	10.36	0.177	0.170	10.87	0.746
0.550	0.119	0.156	11.02	0.124	10.43	0.150	0.144	10.95	0.806
0.600	0.104	0.134	11.09	0.104	10.47	0.130	0.123	11.00	0.850
0.650	0.092	0.118	11.12	0.090	10.51	0.116	0.108	11.05	0.890
0.700	0.083	0.106	11.15	0.080	10.54	0.107	0.096	11.08	0.925
0.750	0.076	0.095	11.19	0.070	10.55	0.095	0.086	11.11	0.951
0.800	0.070	0.085	11.21	0.062	10.57	0.085	0.077	11.14	0.974
0.850	0.067	0.076	11.22	0.054	10.58	0.076	0.070	11.15	0.990
0.900	0.065	0.069	11.24	0.052	10.59	0.069	0.064	11.16	1.000

VOA = 9.08 VOLTS VOC = 8.41 VOLTS VOD = 9.02 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.029	0.056	0.0929	0.0313	0.0501	0.0871	-0.0009	0.0013
0.100	0.059	0.111	0.1227	0.0097	0.0510	0.0916	-0.0020	0.0013
0.150	0.088	0.167	0.1402	0.0382	0.0754	0.1269	-0.0037	0.0016
0.200	0.118	0.222	0.1591	0.0430	0.0785	0.1403	-0.0059	0.0013
0.250	0.147	0.278	0.1725	0.0466	0.0867	0.1530	-0.0078	0.0011
0.300	0.176	0.333	0.1749	0.0600	0.1045	0.1697	-0.0096	0.0021
0.350	0.206	0.389	0.1708	0.0687	0.1055	0.1725	-0.0105	0.0024
0.400	0.235	0.444	0.1637	0.0665	0.1030	0.1666	-0.0112	0.0018
0.450	0.265	0.500	0.1465	0.0705	0.1027	0.1598	-0.0096	0.0021
0.500	0.294	0.556	0.1265	0.0634	0.0860	0.1380	-0.0064	0.0009
0.550	0.324	0.611	0.1098	0.0629	0.0780	0.1254	-0.0042	0.0007
0.600	0.353	0.667	0.0952	0.0580	0.0720	0.1126	-0.0031	0.0008
0.650	0.382	0.722	0.0849	0.0558	0.0671	0.1039	-0.0025	0.0008
0.700	0.412	0.778	0.0774	0.0530	0.0643	0.0974	-0.0021	0.0011
0.750	0.441	0.833	0.0691	0.0506	0.0592	0.0895	-0.0016	0.0008
0.800	0.471	0.889	0.0622	0.0481	0.0540	0.0822	-0.0012	0.0007
0.850	0.500	0.944	0.0548	0.0484	0.0513	0.0773	-0.0007	0.0005
0.900	0.529	1.000	0.0531	0.0436	0.0437	0.0702	-0.0003	0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00034

TABLE A14-28

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.251	0.264	9.93	0.190	8.49	0.288	0.273	9.60	0.065
0.100	0.270	0.282	9.98	0.234	8.54	0.310	0.290	9.64	0.075
0.150	0.280	0.312	10.06	0.255	8.65	0.328	0.304	9.77	0.100
0.200	0.284	0.329	10.18	0.280	8.79	0.335	0.316	9.90	0.137
0.250	0.281	0.340	10.31	0.300	8.94	0.335	0.320	10.03	0.185
0.300	0.272	0.346	10.42	0.312	9.08	0.331	0.316	10.15	0.235
0.350	0.262	0.346	10.54	0.316	9.21	0.326	0.309	10.28	0.290
0.400	0.250	0.338	10.63	0.313	9.33	0.314	0.296	10.36	0.345
0.450	0.234	0.324	10.75	0.296	9.46	0.300	0.282	10.49	0.410
0.500	0.216	0.306	10.84	0.276	9.57	0.283	0.264	10.59	0.475
0.550	0.194	0.286	10.93	0.252	9.69	0.262	0.242	10.71	0.545
0.600	0.172	0.262	11.01	0.225	9.78	0.235	0.214	10.80	0.610
0.650	0.150	0.238	11.09	0.194	9.88	0.204	0.188	10.88	0.675
0.700	0.132	0.212	11.17	0.166	9.96	0.176	0.164	10.95	0.740
0.750	0.116	0.184	11.22	0.140	10.03	0.150	0.144	11.02	0.790
0.800	0.102	0.156	11.27	0.118	10.09	0.130	0.124	11.09	0.840
0.850	0.090	0.132	11.32	0.100	10.15	0.113	0.106	11.13	0.890
0.900	0.080	0.114	11.37	0.084	10.20	0.099	0.092	11.18	0.930
0.950	0.072	0.098	11.40	0.072	10.24	0.087	0.080	11.20	0.960
1.000	0.068	0.086	11.42	0.062	10.26	0.078	0.072	11.22	0.983
1.050	0.068	0.076	11.43	0.058	10.28	0.072	0.071	11.22	1.000

VOA = 9.33 VOLTS VOC = 7.91 VOLTS VOD = 9.04 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.048	0.0444	0.0359	0.0503	0.0653	-0.0002	0.0002
0.100	0.054	0.095	0.0575	0.0321	0.0519	0.0707	-0.0002	0.0004
0.150	0.081	0.143	0.0716	0.0445	0.0546	0.0853	-0.0008	0.0006
0.200	0.108	0.190	0.0921	0.0473	0.0572	0.0983	-0.0016	0.0007
0.250	0.135	0.238	0.1139	0.0495	0.0601	0.1117	-0.0029	0.0008
0.300	0.162	0.286	0.1342	0.0446	0.0547	0.1167	-0.0047	0.0010
0.350	0.189	0.333	0.1518	0.0383	0.0441	0.1171	-0.0066	0.0013
0.400	0.216	0.381	0.1649	0.0323	0.0428	0.1200	-0.0083	0.0017
0.450	0.243	0.429	0.1711	0.0373	0.0449	0.1266	-0.0096	0.0019
0.500	0.270	0.476	0.1729	0.0488	0.0535	0.1376	-0.0108	0.0023
0.550	0.297	0.524	0.1704	0.0564	0.0534	0.1401	-0.0119	0.0025
0.600	0.324	0.571	0.1621	0.0629	0.0499	0.1375	-0.0120	0.0027
0.650	0.352	0.619	0.1477	0.0751	0.0538	0.1383	-0.0118	0.0020
0.700	0.379	0.667	0.1336	0.0780	0.0548	0.1332	-0.0106	0.0015
0.750	0.406	0.714	0.1167	0.0775	0.0548	0.1245	-0.0085	0.0007
0.800	0.433	0.762	0.1018	0.0720	0.0530	0.1134	-0.0062	0.0006
0.850	0.460	0.810	0.0894	0.0653	0.0512	0.1029	-0.0045	0.0007
0.900	0.487	0.857	0.0769	0.0620	0.0502	0.0946	-0.0033	0.0006
0.950	0.514	0.905	0.0670	0.0565	0.0476	0.0856	-0.0023	0.0006
1.000	0.541	0.952	0.0587	0.0548	0.0467	0.0801	-0.0015	0.0004
1.050	0.568	1.000	0.0554	0.0516	0.0470	0.0770	-0.0006	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00009

TABLE A14-29

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.249	0.272	9.97	0.191	8.54	0.240	0.230	9.76	0.065
0.100	0.266	0.300	10.00	0.212	8.60	0.273	0.260	9.80	0.075
0.150	0.280	0.322	10.07	0.250	8.69	0.298	0.280	9.87	0.100
0.200	0.292	0.342	10.16	0.293	8.83	0.320	0.296	9.97	0.137
0.250	0.298	0.357	10.27	0.308	8.98	0.338	0.308	10.09	0.185
0.300	0.296	0.366	10.36	0.317	9.11	0.342	0.314	10.20	0.235
0.350	0.291	0.368	10.47	0.320	9.24	0.341	0.313	10.32	0.290
0.400	0.284	0.365	10.55	0.316	9.35	0.335	0.309	10.42	0.345
0.450	0.272	0.353	10.66	0.302	9.48	0.327	0.302	10.54	0.410
0.500	0.257	0.339	10.75	0.285	9.59	0.316	0.290	10.64	0.475
0.550	0.240	0.320	10.85	0.266	9.70	0.303	0.274	10.74	0.545
0.600	0.220	0.300	10.94	0.246	9.79	0.286	0.256	10.84	0.610
0.650	0.199	0.278	11.03	0.224	9.88	0.264	0.232	10.92	0.675
0.700	0.173	0.252	11.11	0.200	9.97	0.236	0.205	11.00	0.740
0.750	0.152	0.225	11.18	0.172	10.03	0.204	0.176	11.07	0.790
0.800	0.132	0.192	11.23	0.144	10.09	0.170	0.152	11.13	0.840
0.850	0.115	0.163	11.29	0.120	10.15	0.144	0.130	11.18	0.890
0.900	0.099	0.136	11.33	0.098	10.19	0.122	0.110	11.22	0.930
0.950	0.086	0.114	11.37	0.068	10.23	0.106	0.094	11.25	0.960
1.000	0.075	0.097	11.39	0.062	10.25	0.092	0.080	11.28	0.983
1.050	0.070	0.083	11.41	0.058	10.27	0.082	0.070	11.30	1.000

VOA = 9.26 VOLTS VOC = 8.00 VOLTS VOD = 9.12 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.048	0.0471	0.0151	0.0146	0.0385	-0.0002	0.0001
0.100	0.054	0.095	0.0552	0.0226	0.0257	0.0518	-0.0004	0.0002
0.150	0.081	0.143	0.0750	0.0203	0.0284	0.0618	-0.0008	0.0004
0.200	0.108	0.190	0.1013	0.0053	0.0226	0.0646	-0.0016	0.0008
0.250	0.135	0.238	0.1233	0.0311	0.0399	0.0971	-0.0029	0.0016
0.300	0.162	0.286	0.1429	0.0448	0.0484	0.1181	-0.0047	0.0019
0.350	0.189	0.333	0.1603	0.0532	0.0502	0.1318	-0.0066	0.0024
0.400	0.216	0.381	0.1736	0.0659	0.0561	0.1478	-0.0085	0.0027
0.450	0.243	0.429	0.1819	0.0776	0.0699	0.1647	-0.0100	0.0030
0.500	0.270	0.476	0.1861	0.0881	0.0840	0.1790	-0.0114	0.0036
0.550	0.297	0.524	0.1874	0.0933	0.0952	0.1880	-0.0123	0.0044
0.600	0.324	0.571	0.1843	0.0939	0.0988	0.1885	-0.0129	0.0048
0.650	0.352	0.619	0.1774	0.0940	0.0990	0.1852	-0.0130	0.0053
0.700	0.379	0.667	0.1667	0.0885	0.0917	0.1734	-0.0128	0.0051
0.750	0.406	0.714	0.1489	0.0884	0.0804	0.1589	-0.0112	0.0042
0.800	0.433	0.762	0.1291	0.0834	0.0726	0.1426	-0.0085	0.0024
0.850	0.460	0.810	0.1112	0.0780	0.0685	0.1288	-0.0062	0.0017
0.900	0.487	0.857	0.0931	0.0717	0.0649	0.1149	-0.0042	0.0013
0.950	0.514	0.905	0.0658	0.0772	0.0750	0.1090	-0.0028	0.0012
1.000	0.541	0.952	0.0608	0.0638	0.0619	0.0933	-0.0020	0.0010
1.050	0.568	1.000	0.0574	0.0540	0.0519	0.0817	-0.0010	0.0009

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00009

TABLE A14-30

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DIST. FROM INLET(X) = 4.850 INS. N.D.DIST.(X/L)= 0.970

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.250	0.286	9.70	0.248	8.55	0.265	0.265	9.78	0.096
0.100	0.275	0.310	9.82	0.274	8.71	0.300	0.305	9.94	0.135
0.150	0.280	0.328	9.94	0.291	8.82	0.310	0.315	10.05	0.170
0.200	0.282	0.340	10.12	0.300	9.00	0.311	0.320	10.24	0.235
0.250	0.280	0.345	10.23	0.304	9.12	0.310	0.320	10.34	0.283
0.300	0.274	0.346	10.35	0.302	9.24	0.310	0.320	10.46	0.335
0.350	0.264	0.343	10.45	0.288	9.34	0.305	0.310	10.58	0.387
0.400	0.253	0.336	10.55	0.271	9.91	0.296	0.308	10.68	0.442
0.450	0.240	0.322	10.66	0.254	9.54	0.286	0.301	10.77	0.497
0.500	0.224	0.308	10.74	0.232	9.64	0.274	0.292	10.86	0.555
0.550	0.206	0.290	10.83	0.210	9.73	0.260	0.280	10.95	0.610
0.600	0.188	0.273	10.90	0.190	9.80	0.244	0.266	11.02	0.660
0.650	0.172	0.254	10.97	0.172	9.87	0.225	0.250	11.09	0.710
0.700	0.156	0.234	11.04	0.156	9.93	0.205	0.230	11.16	0.760
0.750	0.142	0.214	11.09	0.140	9.99	0.184	0.206	11.21	0.800
0.800	0.130	0.192	11.13	0.126	10.03	0.164	0.184	11.25	0.835
0.850	0.118	0.172	11.17	0.112	10.07	0.148	0.164	11.30	0.870
0.900	0.108	0.154	11.21	0.100	10.11	0.134	0.148	11.34	0.900
0.950	0.100	0.138	11.23	0.090	10.14	0.120	0.132	11.37	0.925
1.000	0.092	0.122	11.26	0.080	10.17	0.110	0.118	11.39	0.947
1.050	0.088	0.110	11.28	0.070	10.19	0.100	0.106	11.41	0.965
1.100	0.087	0.097	11.30	0.067	10.21	0.094	0.098	11.43	0.985

VOA = 9.21 VOLTS VOC = 8.02 VOLTS VOD = 9.23 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.043	0.0927	0.0572	0.0214	0.0857	-0.0016	0.0000
0.100	0.054	0.087	0.1122	0.0716	0.0405	0.1122	-0.0021	-0.0002
0.150	0.081	0.130	0.1295	0.0706	0.0385	0.1193	-0.0034	-0.0003
0.200	0.108	0.174	0.1522	0.0736	0.0265	0.1261	-0.0053	-0.0007
0.250	0.135	0.217	0.1663	0.0767	0.0343	0.1386	-0.0069	-0.0009
0.300	0.162	0.261	0.1782	0.0775	0.0388	0.1472	-0.0087	-0.0011
0.350	0.189	0.304	0.1813	0.0900	0.0510	0.1611	-0.0105	-0.0006
0.400	0.216	0.348	0.1401	0.1548	0.1393	0.2171	-0.0121	-0.0016
0.450	0.243	0.391	0.1805	0.1055	0.0952	0.1906	-0.0125	-0.0021
0.500	0.270	0.435	0.1737	0.1181	0.1153	0.2035	-0.0136	-0.0028
0.550	0.297	0.478	0.1646	0.1217	0.1271	0.2067	-0.0138	-0.0032
0.600	0.324	0.522	0.1551	0.1238	0.1338	0.2064	-0.0141	-0.0036
0.650	0.352	0.565	0.1457	0.1226	0.1343	0.2013	-0.0135	-0.0041
0.700	0.379	0.609	0.1370	0.1174	0.1284	0.1914	-0.0125	-0.0040
0.750	0.406	0.652	0.1261	0.1128	0.1186	0.1787	-0.0111	-0.0034
0.800	0.433	0.696	0.1163	0.1044	0.1073	0.1641	-0.0091	-0.0029
0.850	0.460	0.739	0.1056	0.0971	0.0987	0.1507	-0.0074	-0.0021
0.900	0.487	0.783	0.0961	0.0899	0.0917	0.1388	-0.0059	-0.0017
0.950	0.514	0.826	0.0876	0.0836	0.0826	0.1269	-0.0046	-0.0014
1.000	0.541	0.870	0.0789	0.0764	0.0774	0.1163	-0.0033	-0.0009
1.050	0.568	0.913	0.0697	0.0749	0.0729	0.1088	-0.0023	-0.0006
1.100	0.595	0.957	0.0674	0.0676	0.0671	0.1011	-0.0010	-0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00078

TABLE A14-31

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.040	0.165	0.204	10.36	0.166	9.92	0.202	0.189	10.28	0.410
0.100	0.151	0.210	10.47	0.166	10.06	0.200	0.188	10.42	0.475
0.150	0.148	0.218	10.54	0.166	10.14	0.198	0.188	10.49	0.517
0.200	0.147	0.220	10.60	0.166	10.20	0.196	0.186	10.56	0.558
0.250	0.142	0.220	10.66	0.165	10.27	0.192	0.180	10.62	0.600
0.300	0.139	0.220	10.71	0.162	10.32	0.188	0.178	10.68	0.640
0.350	0.134	0.210	10.77	0.155	10.38	0.181	0.172	10.73	0.687
0.400	0.129	0.197	10.83	0.147	10.44	0.174	0.164	10.79	0.730
0.450	0.123	0.184	10.89	0.139	10.50	0.165	0.155	10.85	0.778
0.500	0.117	0.170	10.94	0.130	10.55	0.156	0.147	10.92	0.820
0.550	0.110	0.158	10.98	0.121	10.59	0.144	0.136	10.94	0.860
0.600	0.105	0.146	11.03	0.113	10.64	0.132	0.126	10.98	0.900
0.650	0.099	0.134	11.05	0.101	10.67	0.120	0.116	11.03	0.930
0.700	0.094	0.122	11.09	0.091	10.71	0.107	0.107	11.05	0.960
0.750	0.090	0.110	11.11	0.081	10.73	0.094	0.096	11.07	0.982
0.800	0.092	0.100	11.13	0.075	10.75	0.087	0.090	11.08	0.995

VIA = 9.05 VOLTS VOC = 8.47 VOLTS VOD = 9.00 VOLTS

RESULTS

R-RI (INS)	R-RI RU-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.040	0.021	0.048	0.1010	0.0721	0.0875	0.1303	-0.0032	0.0012
0.100	0.053	0.120	0.1074	0.0756	0.0888	0.1359	-0.0055	0.0012
0.150	0.080	0.181	0.1121	0.0831	0.0908	0.1430	-0.0072	0.0011
0.200	0.107	0.241	0.1168	0.0869	0.0902	0.1469	-0.0081	0.0011
0.250	0.133	0.301	0.1208	0.0880	0.0876	0.1482	-0.0092	0.0014
0.300	0.160	0.361	0.1231	0.0922	0.0881	0.1517	-0.0102	0.0013
0.350	0.187	0.422	0.1226	0.0913	0.0907	0.1523	-0.0098	0.0012
0.400	0.213	0.482	0.1203	0.0882	0.0903	0.1493	-0.0089	0.0013
0.450	0.240	0.542	0.1181	0.0839	0.0879	0.1449	-0.0080	0.0014
0.500	0.267	0.602	0.1135	0.0800	0.0853	0.1394	-0.0069	0.0012
0.550	0.293	0.663	0.1090	0.0761	0.0818	0.1334	-0.0061	0.0011
0.600	0.320	0.723	0.1044	0.0726	0.0757	0.1263	-0.0051	0.0008
0.650	0.347	0.783	0.0951	0.0735	0.0717	0.1202	-0.0042	0.0005
0.700	0.373	0.843	0.0871	0.0717	0.0679	0.1134	-0.0032	0.0000
0.750	0.400	0.904	0.0787	0.0705	0.0607	0.1050	-0.0022	-0.0002
0.800	0.427	0.964	0.0733	0.0703	0.0586	0.1008	-0.0009	-0.0003

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00166

TABLE A14-32

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLFT= 7.50 INS (2 HYDRAULIC DIAMETERS)

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.131	0.169	10.16	0.146	9.98	0.172	0.174	10.19	0.500
0.100	0.129	0.167	10.23	0.140	10.06	0.155	0.164	10.26	0.550
0.150	0.126	0.166	10.27	0.140	10.11	0.155	0.165	10.33	0.583
0.200	0.125	0.169	10.31	0.138	10.15	0.156	0.165	10.35	0.614
0.250	0.125	0.172	10.34	0.138	10.19	0.156	0.165	10.39	0.643
0.300	0.125	0.172	10.38	0.137	10.23	0.155	0.163	10.42	0.673
0.350	0.122	0.171	10.42	0.136	10.27	0.153	0.161	10.47	0.705
0.400	0.120	0.170	10.46	0.133	10.32	0.150	0.158	10.51	0.740
0.450	0.119	0.167	10.50	0.130	10.35	0.146	0.154	10.55	0.773
0.500	0.117	0.162	10.54	0.125	10.39	0.142	0.148	10.59	0.810
0.550	0.117	0.156	10.56	0.120	10.43	0.138	0.143	10.63	0.840
0.600	0.117	0.149	10.60	0.116	10.47	0.134	0.138	10.66	0.870
0.650	0.118	0.142	10.63	0.110	10.48	0.130	0.132	10.70	0.898
0.700	0.120	0.135	10.65	0.105	10.51	0.127	0.127	10.72	0.925
0.750	0.125	0.129	10.77	0.100	10.53	0.125	0.125	10.74	0.948
0.800	0.130	0.124	10.71	0.094	10.55	0.123	0.123	10.77	0.970

VOA = 9.02 VOLTS VOC = 8.45 VOLTS VOD = 9.04 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.065	0.1033	0.0946	0.1214	0.1597	-0.0049	-0.0003
0.100	0.053	0.130	0.1040	0.1003	0.1122	0.1582	-0.0053	-0.0013
0.150	0.080	0.195	0.1072	0.0995	0.1110	0.1588	-0.0057	-0.0015
0.200	0.107	0.260	0.1089	0.1045	0.1182	0.1658	-0.0067	-0.0014
0.250	0.133	0.325	0.1116	0.1090	0.1196	0.1701	-0.0075	-0.0015
0.300	0.160	0.390	0.1136	0.1111	0.1212	0.1730	-0.0078	-0.0014
0.350	0.187	0.455	0.1155	0.1111	0.1195	0.1730	-0.0084	-0.0011
0.400	0.213	0.519	0.1155	0.1143	0.1203	0.1750	-0.0088	-0.0011
0.450	0.240	0.584	0.1163	0.1145	0.1177	0.1743	-0.0087	-0.0015
0.500	0.267	0.649	0.1150	0.1151	0.1163	0.1732	-0.0083	-0.0011
0.550	0.293	0.714	0.1125	0.1164	0.1145	0.1717	-0.0077	-0.0009
0.600	0.320	0.779	0.1104	0.1154	0.1132	0.1695	-0.0060	-0.0007
0.650	0.347	0.844	0.1076	0.1157	0.1097	0.1665	-0.0046	-0.0004
0.700	0.373	0.909	0.1045	0.1173	0.1101	0.1659	-0.0029	0.0000
0.750	0.400	0.974	0.1011	0.1110	0.1127	0.1624	-0.0007	0.0000
0.800	0.427	1.039	0.0964	0.1251	0.1149	0.1682	0.0012	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.0210

TABLE A14-33

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.134	0.170	11.01	0.123	10.05	0.169	0.174	10.46	0.650
0.100	0.130	0.167	11.08	0.122	10.12	0.155	0.165	10.56	0.705
0.150	0.129	0.170	11.13	0.120	10.17	0.152	0.161	10.60	0.744
0.200	0.128	0.172	11.16	0.118	10.20	0.149	0.160	10.64	0.775
0.250	0.127	0.173	11.19	0.116	10.23	0.147	0.158	10.68	0.803
0.300	0.125	0.174	11.22	0.114	10.25	0.145	0.154	10.71	0.828
0.350	0.125	0.172	11.24	0.111	10.27	0.142	0.150	10.72	0.850
0.400	0.124	0.170	11.27	0.108	10.30	0.140	0.147	10.76	0.875
0.450	0.124	0.166	11.30	0.106	10.32	0.137	0.143	10.78	0.900
0.500	0.125	0.162	11.32	0.104	10.33	0.135	0.141	10.81	0.922
0.550	0.126	0.157	11.34	0.102	10.35	0.132	0.138	10.83	0.940
0.600	0.127	0.151	11.36	0.100	10.36	0.129	0.134	10.84	0.960
0.650	0.130	0.146	11.37	0.099	10.37	0.126	0.130	10.86	0.975
0.700	0.134	0.142	11.39	0.098	10.38	0.125	0.127	10.86	0.985
0.750	0.139	0.139	11.39	0.099	10.39	0.126	0.128	10.87	0.995

VOA = 9.53 VOLTS VOC = 8.46 VOLTS VOD = 9.06 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.067	0.1092	0.0936	0.1312	0.1670	-0.0048	-0.0008
0.100	0.053	0.133	0.1129	0.0929	0.1161	0.1610	-0.0052	-0.0016
0.150	0.080	0.200	0.1141	0.0997	0.1166	0.1652	-0.0062	-0.0015
0.200	0.107	0.267	0.1150	0.1043	0.1166	0.1680	-0.0069	-0.0019
0.250	0.133	0.333	0.1154	0.1083	0.1161	0.1699	-0.0075	-0.0019
0.300	0.160	0.400	0.1154	0.1115	0.1146	0.1707	-0.0082	-0.0016
0.350	0.187	0.467	0.1143	0.1142	0.1150	0.1717	-0.0081	-0.0014
0.400	0.213	0.533	0.1130	0.1163	0.1139	0.1716	-0.0080	-0.0013
0.450	0.240	0.600	0.1127	0.1163	0.1125	0.1708	-0.0074	-0.0011
0.500	0.267	0.667	0.1125	0.1166	0.1113	0.1702	-0.0067	-0.0011
0.550	0.293	0.733	0.1117	0.1155	0.1092	0.1682	-0.0056	-0.0011
0.600	0.320	0.800	0.1111	0.1143	0.1075	0.1664	-0.0044	-0.0009
0.650	0.347	0.867	0.1112	0.1141	0.1025	0.1639	-0.0029	-0.0007
0.700	0.373	0.933	0.1107	0.1146	0.1018	0.1636	-0.0015	-0.0004
0.750	0.400	1.000	0.1127	0.1160	0.1025	0.1656	0.0000	-0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00338

TABLE A14-34

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.222	0.260	10.30	0.226	9.84	0.266	0.250	10.18	0.373
0.100	0.222	0.272	10.35	0.230	9.91	0.269	0.253	10.26	0.405
0.150	0.222	0.283	10.39	0.232	9.97	0.271	0.254	10.33	0.430
0.200	0.221	0.292	10.44	0.234	10.03	0.272	0.255	10.38	0.457
0.250	0.200	0.298	10.49	0.235	10.08	0.272	0.255	10.43	0.485
0.300	0.218	0.298	10.54	0.234	10.14	0.270	0.253	10.50	0.520
0.350	0.210	0.275	10.59	0.232	10.20	0.268	0.249	10.56	0.555
0.400	0.202	0.287	10.65	0.227	10.25	0.263	0.243	10.61	0.593
0.450	0.193	0.278	10.70	0.221	10.31	0.254	0.235	10.66	0.632
0.500	0.183	0.268	10.75	0.212	10.36	0.246	0.224	10.72	0.674
0.550	0.173	0.255	10.81	0.199	10.42	0.233	0.214	10.77	0.717
0.600	0.162	0.242	10.86	0.185	10.48	0.220	0.200	10.83	0.760
0.650	0.150	0.222	10.91	0.170	10.53	0.204	0.187	10.87	0.800
0.700	0.140	0.206	10.95	0.156	10.57	0.187	0.172	10.91	0.835
0.750	0.130	0.187	10.99	0.142	10.61	0.168	0.154	10.95	0.870
0.800	0.120	0.168	11.03	0.130	10.65	0.150	0.138	10.99	0.905
0.850	0.110	0.145	11.07	0.116	10.69	0.133	0.121	11.03	0.940
0.900	0.102	0.128	11.10	0.104	10.72	0.117	0.107	11.07	0.971
0.950	0.094	0.114	11.12	0.091	10.74	0.105	0.097	11.09	0.990
1.000	0.090	0.103	11.13	0.078	10.75	0.097	0.090	11.09	0.998
1.050	0.096	0.094	11.13	0.074	10.75	0.092	0.087	11.09	1.000

VOA = 9.05 VOLTS VOC = 8.46 VOLTS VOD = 9.00 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.048	0.1315	0.0803	0.1128	0.1623	-0.0037	0.0019
0.100	0.053	0.095	0.1387	0.0898	0.1130	0.1707	-0.0055	0.0020
0.150	0.080	0.143	0.1430	0.0995	0.1118	0.1772	-0.0072	0.0021
0.200	0.107	0.190	0.1478	0.1068	0.1146	0.1846	-0.0090	0.0023
0.250	0.133	0.238	0.1530	0.1007	0.1159	0.1848	-0.0127	0.0024
0.300	0.160	0.286	0.1576	0.1166	0.1154	0.1948	-0.0116	0.0025
0.350	0.187	0.333	0.1620	0.0991	0.1152	0.1881	-0.0095	0.0026
0.400	0.213	0.381	0.1646	0.1118	0.1167	0.1966	-0.0134	0.0032
0.450	0.240	0.429	0.1663	0.1086	0.1148	0.1948	-0.0138	0.0032
0.500	0.267	0.476	0.1653	0.1079	0.1134	0.1933	-0.0142	0.0038
0.550	0.293	0.524	0.1606	0.1071	0.1149	0.1913	-0.0138	0.0033
0.600	0.320	0.571	0.1542	0.1083	0.1123	0.1874	-0.0135	0.0035
0.650	0.347	0.619	0.1460	0.1023	0.1107	0.1795	-0.0119	0.0029
0.700	0.373	0.667	0.1372	0.0989	0.1039	0.1700	-0.0105	0.0025
0.750	0.400	0.714	0.1278	0.0935	0.0926	0.1570	-0.0087	0.0022
0.800	0.427	0.762	0.1198	0.0848	0.0801	0.1424	-0.0070	0.0017
0.850	0.453	0.810	0.1093	0.0738	0.0697	0.1264	-0.0047	0.0016
0.900	0.480	0.857	0.0999	0.0679	0.0590	0.1154	-0.0033	0.0012
0.950	0.507	0.905	0.0883	0.0661	0.0581	0.1063	-0.0023	0.0009
1.000	0.533	0.952	0.0760	0.0685	0.0629	0.1037	-0.0014	0.0007
1.050	0.560	1.000	0.0723	0.0701	0.0610	0.1017	0.0002	0.0005

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00118

TABLE A14-35

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EF	VD	U UMAX
				(VOLTS)					
0.050	0.162	0.204	10.20	0.150	10.02	0.210	0.206	10.23	0.527
0.100	0.162	0.211	10.26	0.151	10.09	0.211	0.204	10.30	0.575
0.150	0.161	0.218	10.30	0.152	10.13	0.212	0.204	10.34	0.600
0.200	0.160	0.225	10.32	0.152	10.16	0.214	0.205	10.36	0.625
0.250	0.159	0.230	10.35	0.152	10.19	0.216	0.206	10.39	0.648
0.300	0.158	0.234	10.38	0.152	10.23	0.217	0.208	10.42	0.673
0.350	0.156	0.238	10.41	0.151	10.26	0.218	0.208	10.46	0.700
0.400	0.154	0.240	10.45	0.149	10.30	0.218	0.208	10.50	0.730
0.450	0.152	0.240	10.48	0.146	10.33	0.218	0.207	10.54	0.760
0.500	0.150	0.239	10.51	0.142	10.37	0.216	0.203	10.58	0.792
0.550	0.147	0.236	10.55	0.138	10.41	0.210	0.196	10.61	0.824
0.600	0.144	0.230	10.58	0.133	10.44	0.202	0.190	10.64	0.855
0.650	0.141	0.222	10.62	0.126	10.47	0.193	0.182	10.67	0.882
0.700	0.137	0.214	10.63	0.120	10.50	0.184	0.175	10.71	0.910
0.750	0.134	0.204	10.66	0.114	10.52	0.175	0.168	10.73	0.936
0.800	0.131	0.192	10.69	0.106	10.54	0.166	0.160	10.75	0.960
0.850	0.129	0.180	10.71	0.098	10.56	0.156	0.152	10.78	0.980
0.900	0.126	0.168	10.71	0.092	10.56	0.147	0.143	10.79	0.990
0.950	0.124	0.157	10.71	0.088	10.57	0.139	0.134	10.79	0.995
1.000	0.122	0.146	10.71	0.088	10.57	0.132	0.128	10.80	1.000
1.050	0.122	0.135	10.71	0.090	10.56	0.125	0.123	10.78	0.980
1.100	0.126	0.127	10.69	0.096	10.54	0.123	0.123	10.76	0.960

VOA = 9.02 VOLTS VOC = 8.45 VOLTS VOD = 9.04 VOLTS

RESULTS

RO-R (INS)	RO-P RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	Σ(U*V) ND	Σ(U*W) ND
0.050	0.027	0.045	0.1089	0.1368	0.1625	0.2041	-0.0069	0.0007
0.100	0.053	0.091	0.1150	0.1455	0.1658	0.2131	-0.0089	0.0014
0.150	0.080	0.136	0.1181	0.1516	0.1674	0.2186	-0.0109	0.0017
0.200	0.107	0.182	0.1211	0.1587	0.1739	0.2269	-0.0131	0.0019
0.250	0.133	0.227	0.1236	0.1640	0.1780	0.2328	-0.0149	0.0022
0.300	0.160	0.273	0.1261	0.1693	0.1828	0.2390	-0.0166	0.0021
0.350	0.187	0.318	0.1280	0.1752	0.1855	0.2443	-0.0188	0.0024
0.400	0.213	0.364	0.1292	0.1802	0.1891	0.2492	-0.0205	0.0025
0.450	0.240	0.409	0.1296	0.1839	0.1923	0.2529	-0.0216	0.0028
0.500	0.267	0.455	0.1289	0.1881	0.1935	0.2553	-0.0226	0.0034
0.550	0.293	0.500	0.1280	0.1899	0.1914	0.2546	-0.0231	0.0037
0.600	0.320	0.545	0.1263	0.1882	0.1881	0.2513	-0.0224	0.0031
0.650	0.347	0.591	0.1218	0.1859	0.1829	0.2453	-0.0210	0.0028
0.700	0.373	0.636	0.1182	0.1845	0.1763	0.2395	-0.0201	0.0023
0.750	0.400	0.682	0.1143	0.1798	0.1717	0.2329	-0.0180	0.0017
0.800	0.427	0.727	0.1081	0.1746	0.1669	0.2248	-0.0154	0.0015
0.850	0.453	0.773	0.1012	0.1698	0.1593	0.2152	-0.0126	0.0009
0.900	0.480	0.818	0.0957	0.1628	0.1507	0.2046	-0.0100	0.0009
0.950	0.507	0.864	0.0919	0.1553	0.1418	0.1945	-0.0075	0.0010
1.000	0.533	0.909	0.0921	0.1458	0.1319	0.1849	-0.0053	0.0008
1.050	0.560	0.955	0.0929	0.1332	0.1202	0.1732	-0.0027	0.0004
1.100	0.587	1.000	0.0979	0.1241	0.1126	0.1673	-0.0062	0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00219

TABLE A14-36

DIFFUSER NON DIMENSIONAL LENGTH = 5.0

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.158	0.178	10.95	0.136	9.97	0.180	0.180	10.39	0.605
0.100	0.152	0.189	11.04	0.133	10.07	0.180	0.178	10.50	0.670
0.150	0.150	0.198	11.08	0.131	10.12	0.180	0.176	10.56	0.705
0.200	0.150	0.206	11.11	0.131	10.15	0.180	0.175	10.58	0.728
0.250	0.150	0.212	11.13	0.131	10.17	0.180	0.174	10.60	0.746
0.300	0.150	0.218	11.15	0.131	10.19	0.180	0.174	10.63	0.765
0.350	0.150	0.221	11.17	0.131	10.21	0.179	0.173	10.65	0.780
0.400	0.150	0.224	11.19	0.131	10.23	0.179	0.171	10.67	0.800
0.450	0.148	0.225	11.21	0.130	10.25	0.178	0.170	10.70	0.820
0.500	0.147	0.224	11.23	0.130	10.27	0.177	0.169	10.72	0.840
0.550	0.146	0.223	11.26	0.128	10.29	0.176	0.167	10.74	0.863
0.600	0.144	0.220	11.28	0.127	10.31	0.174	0.164	10.77	0.885
0.650	0.143	0.218	11.30	0.125	10.32	0.172	0.161	10.79	0.905
0.700	0.141	0.213	11.32	0.122	10.34	0.168	0.158	10.81	0.925
0.750	0.140	0.206	11.34	0.120	10.35	0.164	0.153	10.83	0.945
0.800	0.138	0.198	11.36	0.117	10.36	0.158	0.148	10.85	0.960
0.850	0.137	0.186	11.37	0.114	10.37	0.152	0.143	10.86	0.975
0.900	0.136	0.175	11.39	0.112	10.38	0.146	0.139	10.86	0.988
0.950	0.136	0.165	11.39	0.109	10.39	0.138	0.134	10.87	0.995
1.000	0.136	0.156	11.40	0.106	10.39	0.133	0.131	10.87	1.000
1.050	0.136	0.148	11.40	0.103	10.39	0.130	0.130	10.87	1.000
1.100	0.138	0.142	11.40	0.100	10.39	0.127	0.129	10.87	1.000

VOA = 9.52 VOLTS VOC = 8.46 VOLTS VOD = 9.05 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.049	0.1175	0.0962	0.1279	0.1709	-0.0027	0.0000
0.100	0.053	0.098	0.1200	0.1093	0.1311	0.1802	-0.0056	0.0004
0.150	0.080	0.146	0.1213	0.1200	0.1317	0.1865	-0.0079	0.0007
0.200	0.107	0.195	0.1232	0.1283	0.1341	0.1928	-0.0097	0.0009
0.250	0.133	0.244	0.1249	0.1342	0.1349	0.1970	-0.0112	0.0011
0.300	0.160	0.293	0.1267	0.1410	0.1350	0.2014	-0.0128	0.0012
0.350	0.187	0.341	0.1279	0.1448	0.1345	0.2035	-0.0138	0.0012
0.400	0.213	0.390	0.1298	0.1488	0.1347	0.2067	-0.0148	0.0016
0.450	0.240	0.439	0.1307	0.1510	0.1344	0.2080	-0.0154	0.0016
0.500	0.267	0.488	0.1326	0.1511	0.1344	0.2091	-0.0161	0.0016
0.550	0.293	0.537	0.1328	0.1536	0.1361	0.2113	-0.0165	0.0019
0.600	0.320	0.585	0.1338	0.1520	0.1336	0.2097	-0.0164	0.0021
0.650	0.347	0.634	0.1337	0.1533	0.1329	0.2100	-0.0165	0.0023
0.700	0.373	0.683	0.1321	0.1520	0.1318	0.2080	-0.0158	0.0021
0.750	0.400	0.732	0.1318	0.1489	0.1276	0.2041	-0.0146	0.0020
0.800	0.427	0.780	0.1300	0.1440	0.1217	0.1978	-0.0130	0.0021
0.850	0.453	0.829	0.1280	0.1368	0.1170	0.1909	-0.0104	0.0016
0.900	0.480	0.878	0.1269	0.1285	0.1128	0.1841	-0.0080	0.0014
0.950	0.507	0.927	0.1240	0.1235	0.1047	0.1761	-0.0056	0.0008
1.000	0.533	0.976	0.1210	0.1188	0.1021	0.1709	-0.0039	0.0004
1.050	0.560	1.024	0.1175	0.1153	0.1024	0.1676	-0.0023	0.0000
1.100	0.587	1.073	0.1141	0.1153	0.1027	0.1660	-0.0003	-0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00297

TABLE A14-37 VALUES OF $\frac{1}{2U^2}(\overline{u'^2} + \overline{v'^2} + \overline{w'^2})$, $L/\Delta R_1 = 5$ DIFFUSER, INNER WALL LAYER

ins X / R-Ri	-3.0	0.3	0.75	1.35	1.95	2.55	3.15	3.75	4.85
0.030	0 0057						0 0131		
0.050	0 0057	0 0115	0.0133	0 0285	0 0183	0.0147	0 0134	0.0138	0.0124
0 075	0 0053	0.0099	0 0110	0 0235	0 0180	0 0155	″	″	″
0.100	0 0050	0.0087	0.0097	0 0178	0 0177	0.0165	0.0152	0.0153	0 0146
0.125	0 0047	0 0076	0 0086	0 0151	0 0173	0 0166	″	″	″
0 150	0 0042	0 0070	0 0077	0 0129	0.0150	0.0167	0 0164	0.0158	0.0169
0.175	0 0040	0 0064	0 0074	0.0110	″	″	″	″	″
0.20	0 0036	0 0060	0 0067	0 0097	0.0120	0 0137	0.0160	0 0152	0.0165
0 25	0 0029	0 0047	0 0056	0 0077	0.0087	0.0111	0.0136	0 0132	0 0186
0 30	0 0023	0 0039	0 0044	0.0065	0.0075	0 0092	0 0117	0.0110	0 0168
0 35	0.0019	0 0030	0 0036	0 0050	0.0062	0 0074	0 0097	0.0092	0.0154
0 40	0 0014	0 0023	0.0027	0.0039	0.0050	0.0063	0.0079	0.0075	0 0136
0 45	0 0013	0.0019	0 0023	0 0030	0 0040	0 0052	0.0069	0.0062	0 0113
0 50	0 0013	0.0017	0 0020	0 0024	0.0032	0.0041	0 0056	0 0053	0.0096
0 55		0.0018	0 0019	0 0022	0.0026	0.0033	0 0044	0.0042	0.0079
0.60				0 0021	0 0024	0.0027	0 0034	0.0035	0 0068
0.65				0 0023	0 0024	0 0025	0.0029	0.0030	0 0055
0.70					0.0028	0 0025	0 0028	0.0030	0 0045
0.75							0.0029	0.0031	0 0037
0 80									0 0033

TABLE A14-38 VALUES OF $\frac{1}{2U^2}(\overline{u'^2}+\overline{v'^2}+\overline{w'^2})$, $L/\Delta R_1 = 5$ DIFFUSER, OUTER WALL LAYER

ins X / R_o-R	-3.0	0.75	1 35	1.95	2.55	3.15	3.75	4.85 BLUE	4.85 RED
0 025	0.0037	–	–	–	–	–	–	–	–
0.05	0.0039	0.0146	0. 0156	0.0117	0.0119	0. 0107	0. 0061	0. 0029	0. 0062
0.075	0.0038	0. 0120	0. 0155	–	–	–	–	–	–
0.10	0.0036	0.0080	0.0154	0.0155	0. 0171	0. 0122	0 0089	0.0035	0.0097
0.125	0.0035	0 0067	0 0122	0.0155	–	–	–	–	–
0.15	0 0030	0.0062	0.0092	0 0146	0.0190	0.0158	0.0134	0. 0050	0.0116
0.175	–	–	–	0 0134	–	–	–	–	–
0.20	0. 0028	0. 0055	0.0066	0 0122	0.0200	0.0185	0.0167	0. 0070	0.0146
0 25	0.0024	0.0050	0.0060	0.0089	0.0168	0. 0212	0. 0197	0.0095	0.0173
0.30	0.0020	0 0041	0.0055	0 0078	0 0146	0.0209	0.0226	0.0115	0 0196
0.35	0 0016	0.0036	0.0049	0.0065	0. 0108	0. 0176	0 0225	0.0132	0.0218
0.40	0.0014	0.0030	0.0040	0.0057	0.0088	0.0138	0.0209	0.0150	0 0315
0 45	0.0012	0.0026	0 0034	0.0050	0.0076	0.0113	0.0185	0.0163	0 0264
0.50	0.0012	0.0022	0.0029	0 0042	0.0064	0.0093	0.0137	0.0176	0.0287
0 55	0.0013	0.0020	0 0025	0.0035	0 0054	0.0077	0.0110	0.0175	0 0290
0.60			0.0023	0 0030	0.0046	0.0065	0.0088	0.0164	0.0287
0.65			0.0020	0.0026	0. 0039	0.0055	0.0074	0.0152	0.0272
0.70				0. 0025	0 0032	0.0046	0.0065	0.0135	0.0245
0.75					0 0029	0 0041	0.0054	0.0113	0 0213
0 80					0.0026	0.0035	0.0045	0.0092	0.0180
0.85						0.0034	0.0040	0 0074	0.0152
0.90							0 0033	0 0061	0.0129
0.95								0 0050	0.0107
1.00								0.0043	0.0090
1.05								0.0040	0.0079

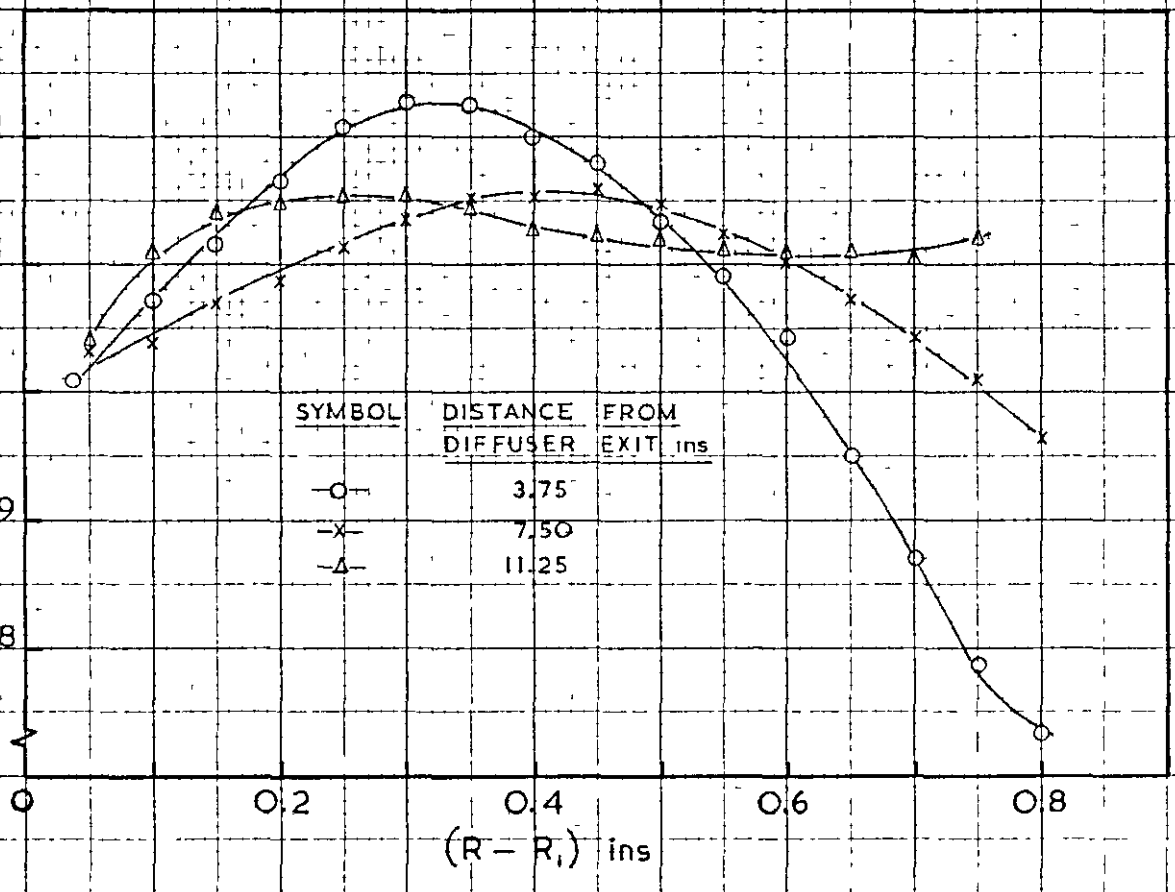


FIG.A14-1 LONGITUDINAL TURBULENCE INTENSITY DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_i = 5.0$ INNER WALL

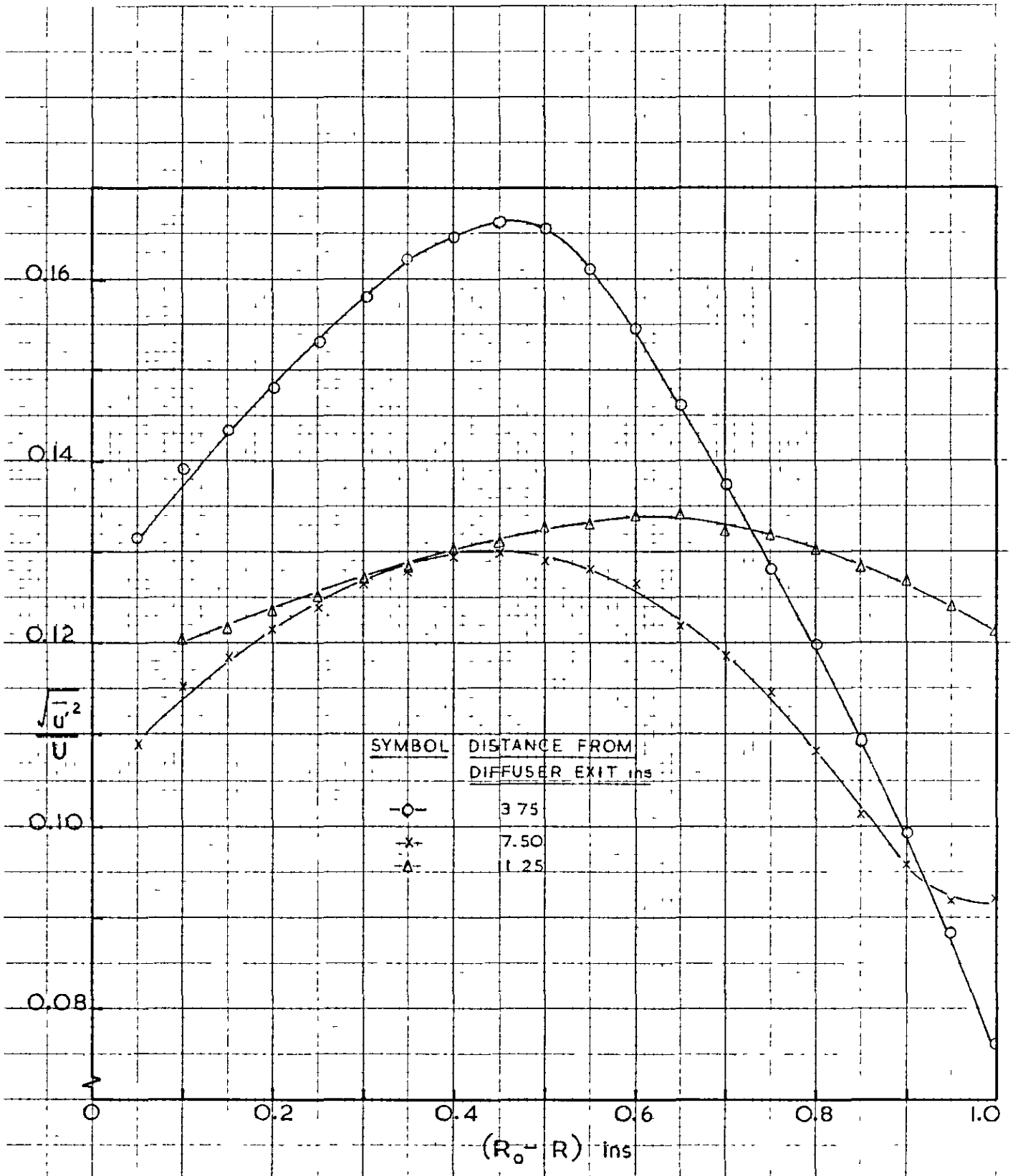


FIG. A14-2 LONGITUDINAL TURBULENCE INTENSITY DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_i = 5.0$

OUTER WALL

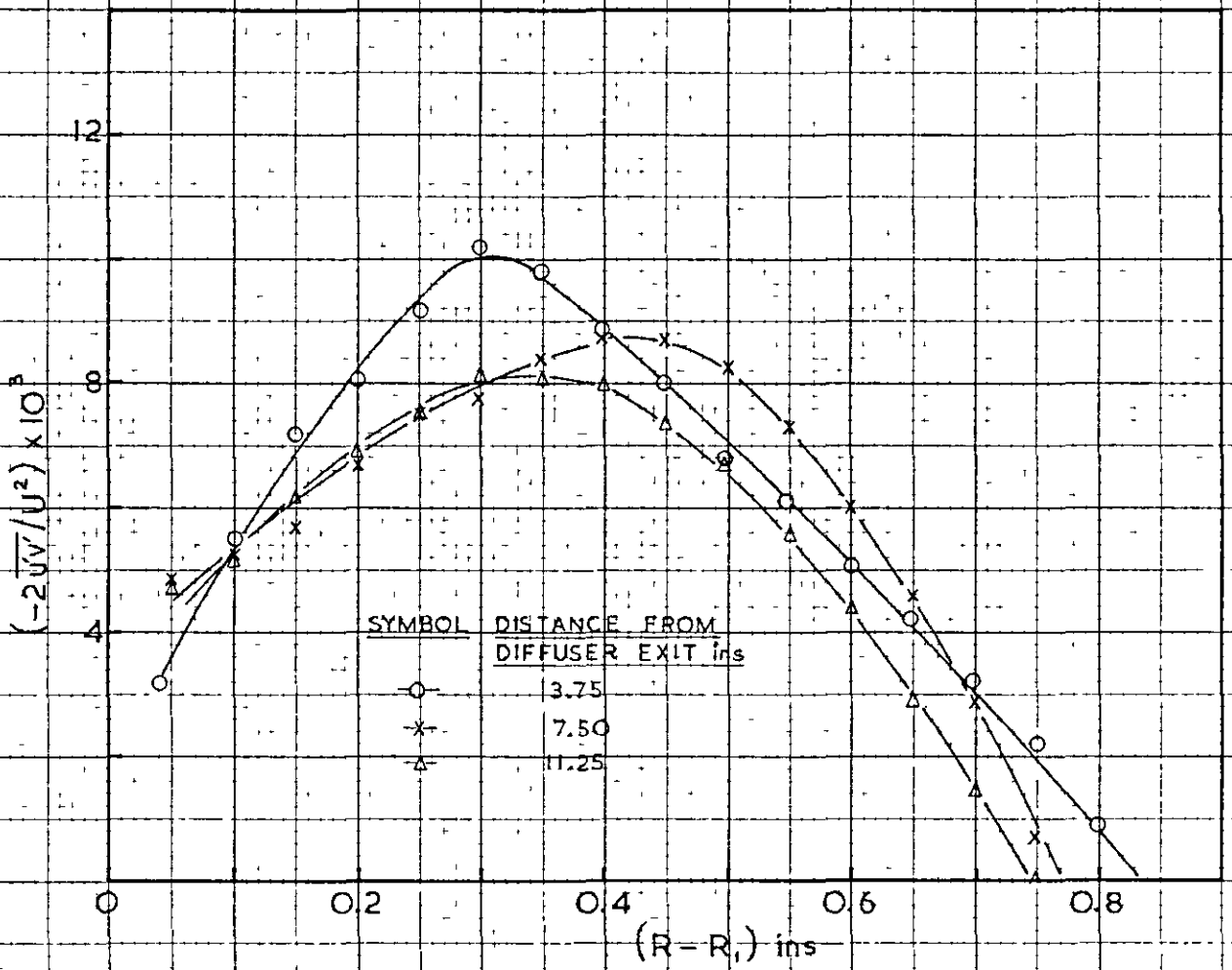


FIG.A14-3 EXPERIMENTAL SHEAR STRESS DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_1 = 5.0$ INNER WALL

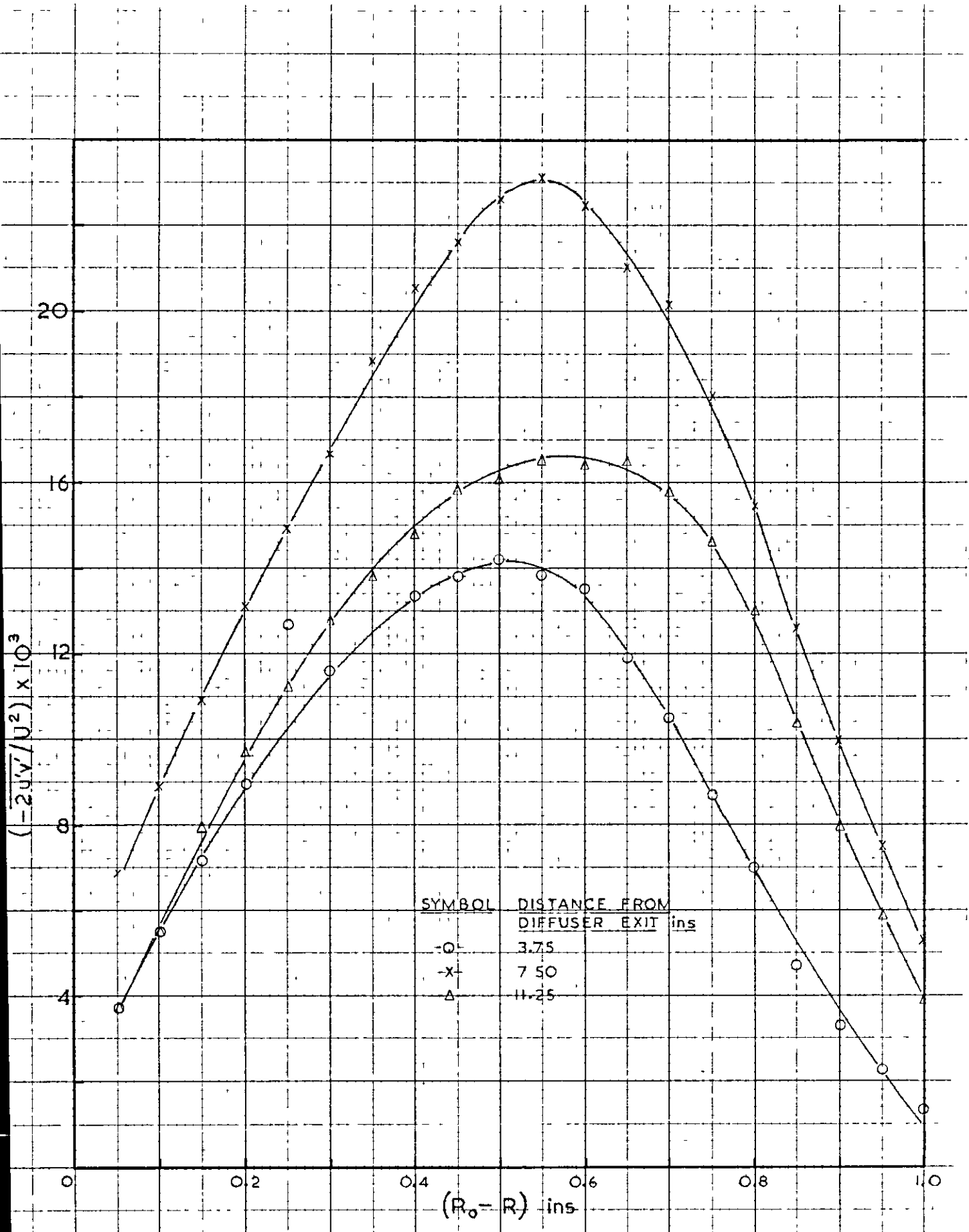


FIG.A14-4 EXPERIMENTAL SHEAR STRESS DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_1 = 5.0$

OUTER WALL

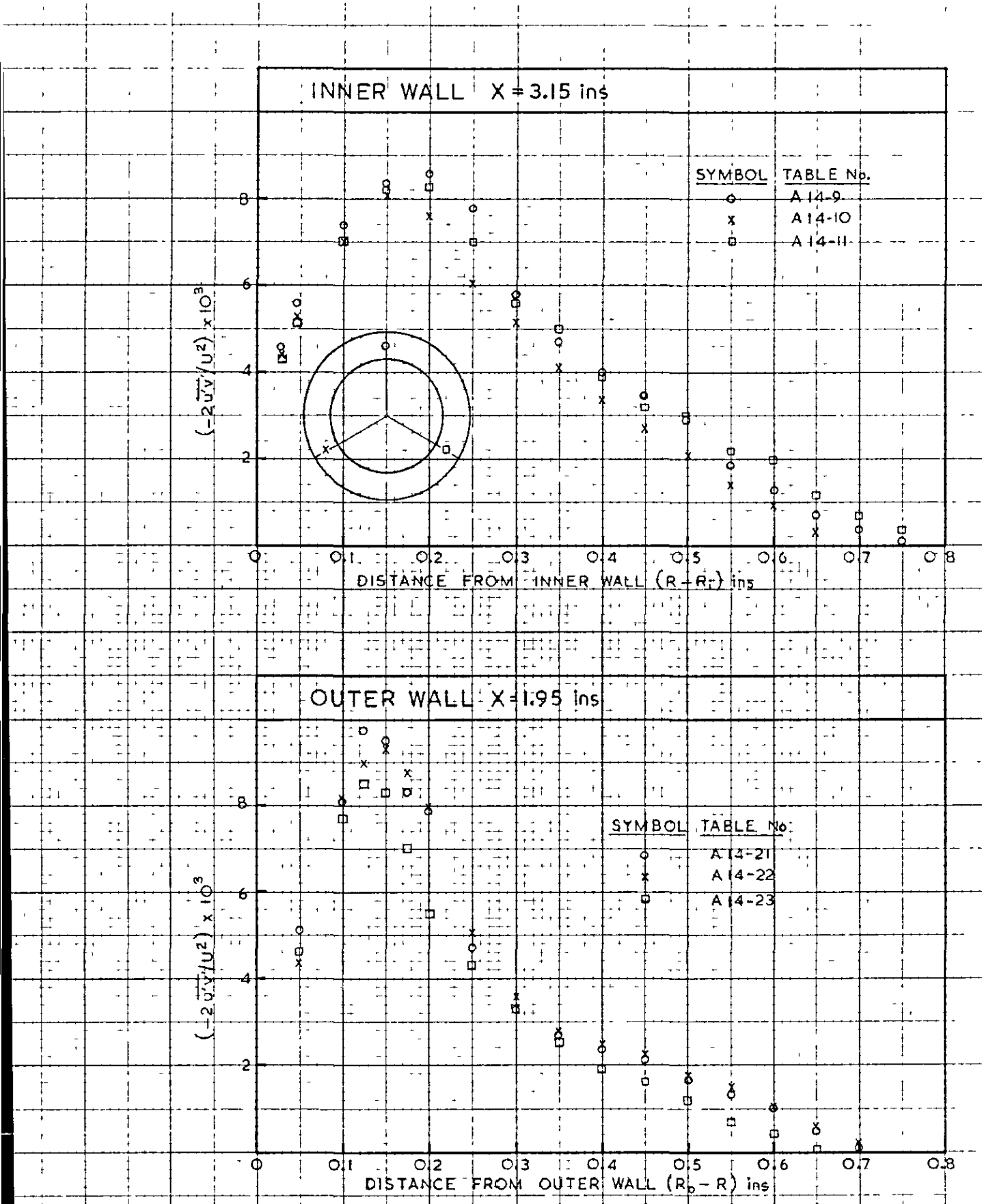


FIG. A14-5 DISTRIBUTION OF TURBULENT SHEAR STRESS ALONG THREE EQUALLY SPACED RADII IN THE $L/\Delta R_i = 5.0$ DIFFUSER

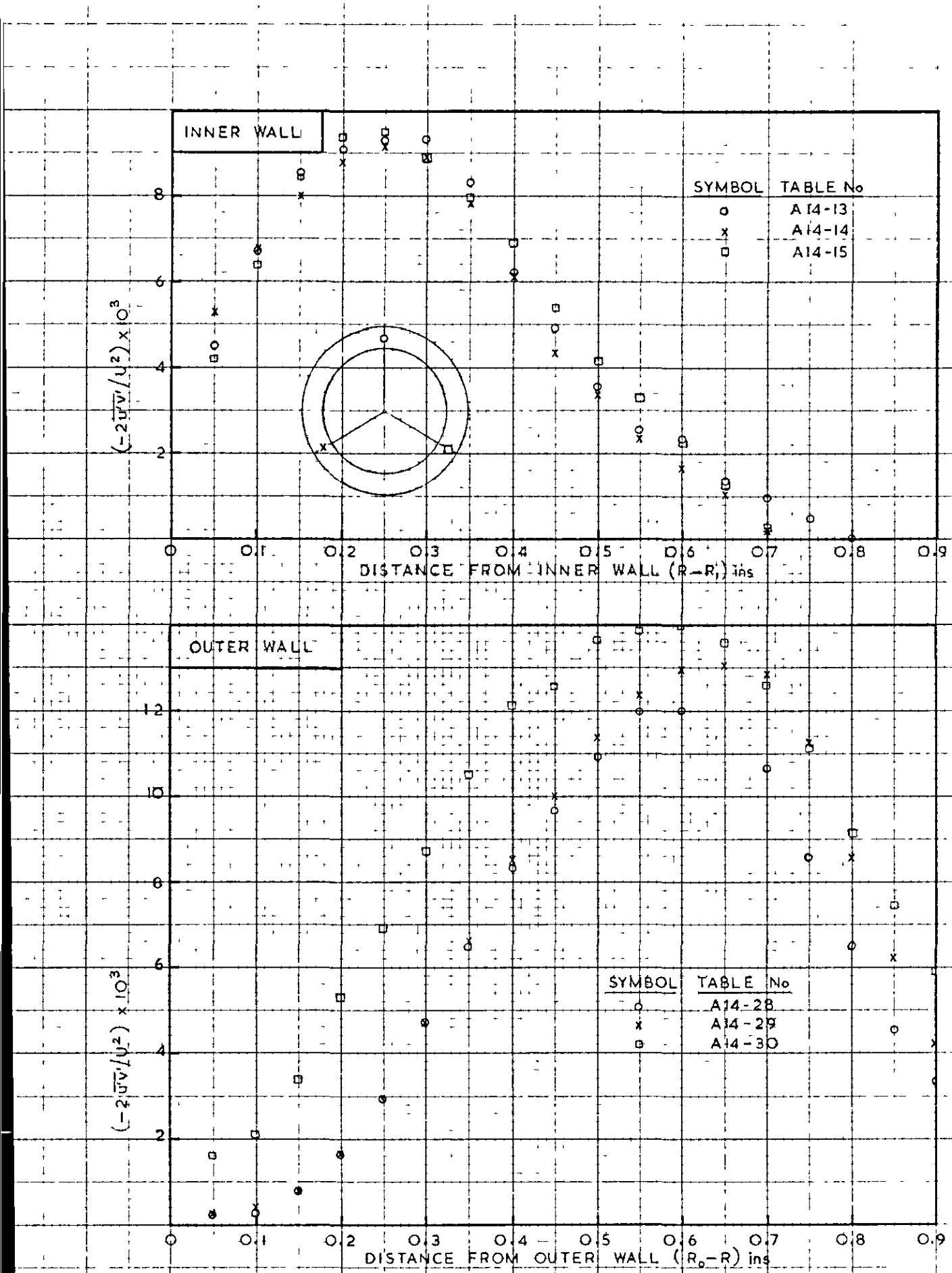


FIG. A14-6 DISTRIBUTION OF TURBULENT SHEAR STRESS ALONG THREE EQUALLY SPACED RADII AT OUTLET OF THE $L/\Delta R_i = 5.0$ DIFFUSER

Appendix 15

Turbulence Data

$L/\Delta R_1 = 7.5$ Diffuser

TABLE A15- 1

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.400

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EF	VD	U UMAX
0.050	0.122	0.162	10.42	0.125	11.57	0.148	0.146	10.68	0.746
0.100	0.103	0.141	10.53	0.109	11.67	0.127	0.127	10.78	0.822
0.150	0.091	0.126	10.60	0.096	11.75	0.115	0.115	10.86	0.875
0.200	0.082	0.112	10.65	0.085	11.79	0.103	0.103	10.90	0.910
0.250	0.070	0.103	10.68	0.076	11.84	0.093	0.092	10.94	0.940
0.300	0.064	0.090	10.71	0.068	11.87	0.082	0.081	10.97	0.962
0.350	0.058	0.080	10.75	0.060	11.90	0.076	0.075	11.00	0.978
0.400	0.055	0.065	10.76	0.053	11.91	0.065	0.064	11.01	0.988
0.450	0.053	0.060	10.77	0.047	11.92	0.058	0.059	11.03	0.997
0.500	0.055	0.053	10.77	0.045	11.93	0.056	0.058	11.04	1.000

VOA = 7.98 VOLTS VOC = 8.96 VOLTS VOD = 8.03 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.050	0.105	0.0806	0.0579	0.0493	0.0939	-0.0027	0.0001
0.100	0.100	0.211	0.0747	0.0512	0.0447	0.0853	-0.0025	0.0000
0.150	0.150	0.316	0.0684	0.0483	0.0448	0.0807	-0.0022	0.0000
0.200	0.200	0.421	0.0620	0.0448	0.0425	0.0747	-0.0018	0.0000
0.250	0.250	0.526	0.0565	0.0416	0.0395	0.0688	-0.0018	0.0001
0.300	0.300	0.632	0.0512	0.0369	0.0343	0.0612	-0.0013	0.0000
0.350	0.350	0.737	0.0456	0.0337	0.0350	0.0571	-0.0010	0.0000
0.400	0.400	0.842	0.0405	0.0279	0.0283	0.0484	-0.0004	0.0000
0.450	0.450	0.947	0.0361	0.0294	0.0269	0.0462	-0.0003	-0.0000
0.500	0.500	1.053	0.0346	0.0279	0.0269	0.0447	0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00378

TABLE A15- 2

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 1.250 INS, N.D.DIST.(X/L)= 0.167

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.180	0.220	10.25	0.185	11.10	0.217	0.214	10.28	0.626
0.100	0.158	0.190	10.42	0.158	11.34	0.182	0.180	10.45	0.731
0.150	0.135	0.163	10.51	0.132	11.46	0.159	0.156	10.56	0.800
0.200	0.117	0.141	10.57	0.119	11.54	0.140	0.138	10.63	0.845
0.250	0.105	0.126	10.62	0.105	11.60	0.127	0.125	10.69	0.883
0.300	0.093	0.112	10.66	0.092	11.64	0.113	0.109	10.73	0.913
0.350	0.083	0.101	10.69	0.083	11.68	0.101	0.100	10.77	0.940
0.400	0.074	0.089	10.72	0.072	11.71	0.090	0.088	10.80	0.965
0.450	0.066	0.080	10.74	0.064	11.74	0.080	0.078	10.83	0.982
0.500	0.062	0.069	10.75	0.056	11.75	0.070	0.068	10.84	0.992
0.550	0.059	0.058	10.76	0.050	11.75	0.065	0.064	10.85	0.998
0.600	0.060	0.053	10.76	0.049	11.76	0.066	0.064	10.85	1.000

VOA = 8.08 VOLTS VOC = 9.02 VOLTS VOD = 8.03 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.044	0.089	0.1231	0.0412	0.0545	0.1094	-0.0033	0.0003
0.100	0.087	0.179	0.1109	0.0535	0.0547	0.1096	-0.0028	0.0002
0.150	0.131	0.268	0.0968	0.0551	0.0587	0.1053	-0.0023	0.0002
0.200	0.175	0.357	0.0895	0.0435	0.0508	0.0919	-0.0018	0.0002
0.250	0.218	0.446	0.0808	0.0430	0.0510	0.0874	-0.0015	0.0001
0.300	0.262	0.536	0.0722	0.0407	0.0465	0.0797	-0.0013	0.0003
0.350	0.305	0.625	0.0662	0.0369	0.0431	0.0731	-0.0011	0.0001
0.400	0.349	0.714	0.0584	0.0352	0.0406	0.0671	-0.0008	0.0001
0.450	0.393	0.804	0.0523	0.0330	0.0363	0.0608	-0.0007	0.0001
0.500	0.436	0.893	0.0461	0.0311	0.0318	0.0545	-0.0003	0.0001
0.550	0.480	0.982	0.0413	0.0277	0.0323	0.0507	0.0000	0.0000
0.600	0.524	1.071	0.0405	0.0262	0.0342	0.0505	0.0003	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00290

TABLE A15- 3

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 2.200 INS. N.D.DIST.(X/L)= 0.294

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.193	0.248	11.89	0.205	11.01	0.250	0.240	10.10	0.552
0.100	0.171	0.230	12.05	0.185	11.21	0.230	0.220	10.33	0.660
0.150	0.155	0.205	12.17	0.165	11.34	0.198	0.190	10.45	0.737
0.200	0.137	0.184	12.25	0.142	11.43	0.173	0.168	10.57	0.794
0.250	0.120	0.165	12.30	0.126	11.50	0.152	0.153	10.65	0.839
0.300	0.108	0.145	12.35	0.111	11.56	0.134	0.132	10.70	0.877
0.350	0.096	0.131	12.39	0.100	11.61	0.120	0.118	10.74	0.910
0.400	0.087	0.115	12.43	0.088	11.65	0.107	0.107	10.78	0.940
0.450	0.077	0.102	12.46	0.078	11.68	0.096	0.096	10.81	0.964
0.500	0.070	0.088	12.49	0.068	11.71	0.082	0.083	10.85	0.981
0.550	0.064	0.079	12.49	0.061	11.72	0.072	0.074	10.86	0.993
0.600	0.060	0.070	12.50	0.056	11.73	0.067	0.068	10.87	1.000
0.650	0.061	0.061	12.50	0.056	11.73	0.066	0.070	10.87	0.998

VOA = 10.03 VOLTS VOC = 8.98 VOLTS VOD = 8.01 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.040	0.077	0.1229	0.0738	0.0758	0.1362	-0.0050	0.0009
0.100	0.080	0.154	0.1217	0.0779	0.0774	0.1385	-0.0060	0.0009
0.150	0.119	0.231	0.1150	0.0754	0.0662	0.1283	-0.0052	0.0007
0.200	0.159	0.308	0.1030	0.0755	0.0623	0.1204	-0.0047	0.0004
0.250	0.199	0.385	0.0942	0.0699	0.0581	0.1111	-0.0042	-0.0001
0.300	0.239	0.462	0.0850	0.0643	0.0512	0.1002	-0.0033	0.0001
0.350	0.278	0.538	0.0780	0.0589	0.0466	0.0918	-0.0029	0.0001
0.400	0.318	0.615	0.0700	0.0538	0.0452	0.0845	-0.0021	0.0000
0.450	0.358	0.692	0.0629	0.0484	0.0425	0.0769	-0.0017	0.0000
0.500	0.398	0.769	0.0553	0.0434	0.0352	0.0670	-0.0011	-0.0001
0.550	0.438	0.846	0.0500	0.0404	0.0304	0.0604	-0.0009	-0.0001
0.600	0.477	0.923	0.0461	0.0360	0.0287	0.0555	-0.0005	-0.0000
0.650	0.517	1.000	0.0460	0.0295	0.0295	0.0525	0.0000	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00246

TABLE A15- 4

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.208	0.260	11.59	0.240	10.67	0.284	0.280	9.73	0.420
0.050	0.200	0.255	11.74	0.225	10.82	0.272	0.269	9.87	0.490
0.100	0.184	0.242	11.91	0.210	11.01	0.255	0.250	10.05	0.590
0.150	0.168	0.226	12.03	0.200	11.14	0.238	0.232	10.23	0.665
0.200	0.152	0.210	12.13	0.176	11.25	0.218	0.210	10.32	0.730
0.250	0.138	0.190	12.21	0.156	11.34	0.200	0.195	10.42	0.785
0.300	0.124	0.168	12.27	0.136	11.41	0.176	0.174	10.49	0.830
0.350	0.110	0.150	12.33	0.122	11.47	0.156	0.154	10.54	0.872
0.400	0.098	0.132	12.37	0.110	11.52	0.136	0.132	10.60	0.906
0.450	0.088	0.116	12.41	0.098	11.56	0.120	0.122	10.64	0.935
0.500	0.078	0.102	12.44	0.082	11.60	0.104	0.100	10.66	0.960
0.550	0.070	0.088	12.47	0.075	11.61	0.090	0.088	10.68	0.978
0.600	0.064	0.078	12.49	0.066	11.62	0.080	0.078	10.72	0.993
0.650	0.062	0.070	12.49	0.060	11.64	0.072	0.073	10.73	0.999
0.700	0.066	0.066	12.49	0.058	11.64	0.072	0.073	10.73	1.000

VOA = 9.97 VOLTS VOC = 8.99 VOLTS VOD = 8.02 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.018	0.036	0.1304	0.0125	0.0778	0.1104	-0.0038	0.0003
0.050	0.037	0.071	0.1318	0.0372	0.0873	0.1282	-0.0045	0.0003
0.100	0.073	0.143	0.1351	0.0443	0.0917	0.1355	-0.0054	0.0005
0.150	0.110	0.214	0.1367	0.0321	0.0804	0.1246	-0.0057	0.0006
0.200	0.146	0.286	0.1263	0.0500	0.0862	0.1313	-0.0058	0.0009
0.250	0.183	0.357	0.1165	0.0534	0.0881	0.1290	-0.0051	0.0005
0.300	0.219	0.429	0.1043	0.0540	0.0830	0.1207	-0.0041	0.0002
0.350	0.256	0.500	0.0961	0.0482	0.0749	0.1096	-0.0035	0.0002
0.400	0.293	0.571	0.0884	0.0402	0.0606	0.0946	-0.0027	0.0003
0.450	0.329	0.643	0.0801	0.0352	0.0572	0.0863	-0.0021	-0.0002
0.500	0.366	0.714	0.0679	0.0390	0.0506	0.0787	-0.0016	0.0003
0.550	0.402	0.786	0.0631	0.0282	0.0401	0.0657	-0.0011	0.0001
0.600	0.439	0.857	0.0561	0.0278	0.0356	0.0598	-0.0008	0.0001
0.650	0.475	0.929	0.0510	0.0282	0.0337	0.0565	-0.0004	-0.0001
0.700	0.512	1.000	0.0494	0.0307	0.0362	0.0582	0.0000	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00211

TABLE A15- 5

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC (VOLTS)	VC	ED	EE	VD	U UMAX
0.025	0.210	0.273	9.59	0.240	10.67	0.284	0.280	9.73	0.420
0.050	0.205	0.272	9.72	0.225	10.82	0.272	0.269	9.87	0.490
0.100	0.189	0.261	9.95	0.210	11.01	0.255	0.250	10.05	0.590
0.150	0.177	0.238	10.10	0.200	11.14	0.238	0.232	10.23	0.665
0.200	0.160	0.217	10.20	0.176	11.25	0.218	0.210	10.32	0.730
0.250	0.141	0.190	10.31	0.156	11.34	0.200	0.195	10.42	0.785
0.300	0.126	0.170	10.39	0.136	11.41	0.176	0.174	10.49	0.830
0.350	0.112	0.145	10.44	0.122	11.47	0.156	0.154	10.54	0.872
0.400	0.100	0.129	10.48	0.110	11.52	0.136	0.132	10.60	0.906
0.450	0.090	0.115	10.53	0.098	11.56	0.120	0.122	10.64	0.935
0.500	0.080	0.103	10.57	0.082	11.60	0.104	0.100	10.66	0.960
0.550	0.072	0.089	10.59	0.075	11.61	0.090	0.088	10.68	0.978
0.600	0.068	0.078	10.62	0.066	11.62	0.080	0.078	10.72	0.993
0.650	0.067	0.072	10.62	0.060	11.64	0.072	0.073	10.73	0.999
0.700	0.070	0.068	10.63	0.058	11.64	0.072	0.073	10.73	1.000

VOA = 7.95 VOLTS VOC = 8.99 VOLTS VOD = 8.02 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.018	0.036	0.1304	0.0395	0.0778	0.1239	-0.0048	0.0003
0.050	0.037	0.071	0.1318	0.0643	0.0873	0.1417	-0.0059	0.0003
0.100	0.073	0.143	0.1351	0.0639	0.0917	0.1453	-0.0070	0.0005
0.150	0.110	0.214	0.1367	0.0491	0.0804	0.1331	-0.0061	0.0006
0.200	0.146	0.286	0.1263	0.0584	0.0862	0.1354	-0.0057	0.0009
0.250	0.183	0.357	0.1165	0.0472	0.0881	0.1259	-0.0046	0.0005
0.300	0.219	0.429	0.1043	0.0489	0.0830	0.1181	-0.0039	0.0002
0.350	0.256	0.500	0.0961	0.0370	0.0749	0.1040	-0.0027	0.0002
0.400	0.293	0.571	0.0884	0.0317	0.0606	0.0904	-0.0022	0.0003
0.450	0.329	0.643	0.0801	0.0291	0.0572	0.0832	-0.0017	-0.0002
0.500	0.366	0.714	0.0679	0.0364	0.0506	0.0774	-0.0015	0.0003
0.550	0.402	0.786	0.0631	0.0265	0.0401	0.0649	-0.0010	0.0001
0.600	0.439	0.857	0.0561	0.0269	0.0356	0.0593	-0.0005	0.0001
0.650	0.475	0.929	0.0510	0.0306	0.0337	0.0577	-0.0003	-0.0001
0.700	0.512	1.000	0.0494	0.0321	0.0362	0.0589	0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00211

TABLE A15- 6

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 4.100 INS. N.D.DIST.(X/L)= 0.546

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.220	0.258	11.49	0.237	10.75	0.275	0.280	9.78	0.445
0.100	0.208	0.260	11.63	0.230	10.92	0.265	0.270	9.95	0.530
0.150	0.193	0.253	11.75	0.215	11.06	0.250	0.257	10.06	0.600
0.200	0.180	0.242	11.86	0.203	11.17	0.230	0.240	10.17	0.665
0.250	0.166	0.228	11.95	0.185	11.26	0.212	0.220	10.26	0.723
0.300	0.154	0.208	12.03	0.170	11.34	0.190	0.196	10.34	0.776
0.350	0.136	0.186	12.10	0.151	11.41	0.171	0.176	10.41	0.826
0.400	0.125	0.165	12.15	0.135	11.47	0.153	0.158	10.46	0.867
0.450	0.113	0.148	12.20	0.120	11.52	0.135	0.138	10.52	0.903
0.500	0.102	0.130	12.26	0.104	11.56	0.120	0.123	10.56	0.934
0.550	0.091	0.118	12.27	0.092	11.58	0.106	0.107	10.58	0.958
0.600	0.082	0.104	12.30	0.084	11.61	0.096	0.096	10.62	0.978
0.650	0.074	0.090	12.31	0.070	11.63	0.086	0.085	10.63	0.992
0.700	0.068	0.080	12.32	0.063	11.64	0.080	0.079	10.64	0.998
0.750	0.068	0.069	12.32	0.061	11.64	0.080	0.079	10.64	1.000

VOA = 9.98 VOLTS VOC = 8.98 VOLTS VOD = 7.98 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.034	0.067	0.1301	0.0774	0.0770	0.1422	-0.0036	-0.0004
0.100	0.068	0.133	0.1381	0.0860	0.0804	0.1522	-0.0058	-0.0005
0.150	0.101	0.200	0.1367	0.0928	0.0890	0.1592	-0.0072	-0.0007
0.200	0.135	0.267	0.1366	0.0909	0.0833	0.1554	-0.0077	-0.0011
0.250	0.169	0.333	0.1307	0.0920	0.0816	0.1522	-0.0078	-0.0009
0.300	0.203	0.400	0.1250	0.0856	0.0701	0.1404	-0.0067	-0.0006
0.350	0.237	0.467	0.1149	0.0786	0.0681	0.1308	-0.0059	-0.0005
0.400	0.271	0.533	0.1056	0.0732	0.0638	0.1213	-0.0045	-0.0005
0.450	0.304	0.600	0.0961	0.0684	0.0544	0.1094	-0.0037	-0.0003
0.500	0.338	0.667	0.0848	0.0629	0.0534	0.1005	-0.0027	-0.0002
0.550	0.372	0.733	0.0763	0.0605	0.0468	0.0918	-0.0024	-0.0001
0.600	0.406	0.800	0.0704	0.0513	0.0404	0.0811	-0.0018	0.0000
0.650	0.440	0.867	0.0592	0.0499	0.0429	0.0760	-0.0012	0.0001
0.700	0.474	0.933	0.0534	0.0451	0.0423	0.0705	-0.0008	0.0001
0.750	0.507	1.000	0.0518	0.0387	0.0445	0.0675	-0.0001	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00185

TABLE A15- 7

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 5.050 INS. N.D.DIST.(X/L)= 0.673

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.220	0.263	11.29	0.248	10.49	0.294	0.282	9.50	0.370
0.050	0.216	0.268	11.42	0.240	10.63	0.289	0.279	9.64	0.430
0.100	0.207	0.267	11.56	0.232	10.77	0.284	0.273	9.81	0.500
0.150	0.197	0.260	11.68	0.224	10.90	0.278	0.266	9.95	0.563
0.200	0.188	0.251	11.82	0.213	11.00	0.266	0.258	10.06	0.620
0.250	0.177	0.236	11.88	0.202	11.09	0.252	0.248	10.16	0.680
0.300	0.164	0.221	11.97	0.185	11.17	0.237	0.230	10.23	0.733
0.350	0.151	0.204	12.04	0.168	11.24	0.216	0.210	10.32	0.782
0.400	0.138	0.185	12.11	0.156	11.31	0.195	0.190	10.39	0.830
0.450	0.126	0.168	12.17	0.140	11.37	0.173	0.168	10.45	0.872
0.500	0.115	0.148	12.22	0.120	11.41	0.155	0.149	10.50	0.907
0.550	0.103	0.130	12.26	0.108	11.46	0.136	0.130	10.54	0.938
0.600	0.093	0.115	12.29	0.097	11.49	0.118	0.117	10.59	0.963
0.650	0.084	0.100	12.31	0.084	11.51	0.103	0.103	10.60	0.980
0.700	0.075	0.088	12.32	0.072	11.52	0.092	0.092	10.62	0.990
0.750	0.071	0.078	12.33	0.066	11.54	0.084	0.083	10.64	0.996
0.800	0.072	0.070	12.34	0.063	11.54	0.082	0.082	10.64	1.000

VOA = 10.00 VOLTS VOC = 8.96 VOLTS VOD = 8.00 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.016	0.031	0.1292	0.0719	0.0844	0.1427	-0.0039	0.0010
0.050	0.031	0.063	0.1341	0.0821	0.0923	0.1543	-0.0053	0.0009
0.100	0.063	0.125	0.1399	0.0854	0.0957	0.1605	-0.0067	0.0011
0.150	0.094	0.187	0.1427	0.0853	0.0998	0.1639	-0.0075	0.0013
0.200	0.126	0.250	0.1427	0.0810	0.1025	0.1631	-0.0076	0.0009
0.250	0.157	0.313	0.1426	0.0802	0.1033	0.1631	-0.0075	0.0005
0.300	0.189	0.375	0.1364	0.0799	0.1053	0.1608	-0.0072	0.0009
0.350	0.220	0.437	0.1283	0.0781	0.0985	0.1525	-0.0066	0.0007
0.400	0.252	0.500	0.1230	0.0680	0.0877	0.1393	-0.0056	0.0006
0.450	0.283	0.563	0.1133	0.0659	0.0779	0.1285	-0.0048	0.0006
0.500	0.315	0.625	0.0995	0.0656	0.0760	0.1205	-0.0035	0.0006
0.550	0.346	0.688	0.0909	0.0570	0.0650	0.1064	-0.0026	0.0006
0.600	0.378	0.750	0.0829	0.0505	0.0552	0.0943	-0.0020	0.0001
0.650	0.409	0.813	0.0726	0.0468	0.0506	0.0850	-0.0013	0.0000
0.700	0.441	0.875	0.0626	0.0447	0.0487	0.0780	-0.0009	0.0000
0.750	0.472	0.938	0.0573	0.0409	0.0434	0.0708	-0.0005	0.0001
0.800	0.503	1.000	0.0550	0.0384	0.0448	0.0691	0.0001	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00172

TABLE A15- 8

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 6.000 INS. N.D.DIST.(X/L)= 0.800

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.240	0.300	9.75	0.246	10.52	0.294	0.282	9.49	0.405
0.100	0.232	0.302	9.90	0.236	10.68	0.288	0.277	9.62	0.470
0.150	0.224	0.300	10.02	0.228	10.78	0.278	0.272	9.72	0.525
0.200	0.215	0.295	10.13	0.222	10.88	0.266	0.261	9.82	0.580
0.250	0.205	0.284	10.23	0.208	10.97	0.253	0.250	9.91	0.631
0.300	0.194	0.265	10.32	0.200	11.05	0.237	0.235	9.99	0.680
0.350	0.180	0.245	10.40	0.186	11.13	0.220	0.219	10.06	0.729
0.400	0.168	0.225	10.47	0.174	11.20	0.205	0.202	10.12	0.775
0.450	0.154	0.204	10.55	0.161	11.26	0.186	0.185	10.20	0.823
0.500	0.142	0.183	10.62	0.147	11.32	0.169	0.167	10.25	0.867
0.550	0.150	0.165	10.68	0.132	11.37	0.150	0.149	10.30	0.903
0.600	0.118	0.147	10.72	0.117	11.41	0.133	0.132	10.34	0.934
0.650	0.108	0.130	10.74	0.103	11.43	0.117	0.116	10.35	0.955
0.700	0.098	0.115	10.77	0.090	11.45	0.104	0.105	10.40	0.973
0.750	0.089	0.100	10.79	0.077	11.46	0.093	0.094	10.41	0.985
0.800	0.083	0.089	10.81	0.069	11.48	0.086	0.084	10.41	0.996
0.850	0.084	0.082	10.81	0.065	11.48	0.083	0.084	10.41	1.000

VOA = 8.17 VOLTS VOC = 8.96 VOLTS VOD = 7.96 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.029	0.058	0.1382	0.0628	0.0917	0.1464	-0.0051	0.0011
0.100	0.059	0.116	0.1401	0.0780	0.1050	0.1616	-0.0066	0.0012
0.150	0.088	0.174	0.1437	0.0822	0.1091	0.1675	-0.0078	0.0007
0.200	0.118	0.233	0.1473	0.0832	0.1060	0.1683	-0.0088	0.0006
0.250	0.147	0.291	0.1439	0.0885	0.1090	0.1707	-0.0090	0.0004
0.300	0.176	0.349	0.1437	0.0796	0.1015	0.1625	-0.0082	0.0003
0.350	0.206	0.407	0.1387	0.0743	0.0986	0.1558	-0.0074	0.0001
0.400	0.235	0.465	0.1336	0.0683	0.0942	0.1481	-0.0064	0.0004
0.450	0.265	0.523	0.1283	0.0576	0.0836	0.1348	-0.0054	0.0001
0.500	0.294	0.581	0.1205	0.0515	0.0775	0.1247	-0.0043	0.0002
0.550	0.324	0.640	0.1106	0.0658	0.0686	0.1225	-0.0016	0.0001
0.600	0.353	0.698	0.1001	0.0477	0.0616	0.1047	-0.0027	0.0001
0.650	0.382	0.756	0.0892	0.0473	0.0558	0.0962	-0.0019	0.0001
0.700	0.412	0.814	0.0789	0.0452	0.0518	0.0880	-0.0013	-0.0001
0.750	0.441	0.872	0.0680	0.0438	0.0513	0.0816	-0.0008	-0.0001
0.800	0.471	0.930	0.0614	0.0414	0.0487	0.0757	-0.0004	0.0001
0.850	0.500	0.988	0.0579	0.0422	0.0511	0.0756	0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00158

TABLE A15- 9

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.220	0.271	9.58	0.228	10.51	0.265	0.270	9.43	0.400
0.100	0.216	0.278	9.70	0.225	10.62	0.260	0.260	9.54	0.455
0.150	0.210	0.280	9.78	0.222	10.71	0.258	0.256	9.60	0.502
0.200	0.204	0.278	9.86	0.217	10.79	0.255	0.253	9.70	0.550
0.250	0.197	0.270	9.95	0.211	10.88	0.246	0.244	9.78	0.600
0.300	0.190	0.258	10.02	0.205	10.95	0.237	0.238	9.85	0.645
0.350	0.182	0.245	10.10	0.196	11.02	0.226	0.225	9.93	0.690
0.400	0.173	0.230	10.16	0.185	11.09	0.214	0.213	9.98	0.735
0.450	0.164	0.216	10.23	0.175	11.15	0.200	0.204	10.05	0.777
0.500	0.154	0.200	10.28	0.163	11.21	0.186	0.184	10.10	0.819
0.550	0.144	0.185	10.33	0.150	11.26	0.169	0.170	10.15	0.855
0.600	0.133	0.168	10.38	0.137	11.30	0.150	0.152	10.20	0.892
0.650	0.122	0.151	10.42	0.122	11.35	0.133	0.130	10.24	0.925
0.700	0.111	0.135	10.45	0.109	11.38	0.120	0.118	10.28	0.950
0.750	0.101	0.118	10.48	0.096	11.41	0.114	0.114	10.31	0.973
0.800	0.093	0.104	10.50	0.084	11.43	0.112	0.113	10.32	0.990
0.850	0.089	0.094	10.52	0.076	11.44	0.118	0.118	10.32	1.000
0.900	0.091	0.085	10.51	0.072	11.44	0.125	0.127	10.32	0.990

VOA = 8.01 VOLTS VOC = 8.97 VOLTS VOD = 7.96 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.058	0.1280	0.0496	0.0924	0.1350	-0.0039	-0.0005
0.100	0.054	0.116	0.1345	0.0599	0.0926	0.1435	-0.0054	0.0000
0.150	0.081	0.174	0.1398	0.0650	0.1003	0.1525	-0.0067	0.0002
0.200	0.108	0.233	0.1430	0.0711	0.1033	0.1587	-0.0076	0.0002
0.250	0.135	0.291	0.1452	0.0717	0.1031	0.1600	-0.0080	0.0003
0.300	0.161	0.349	0.1472	0.0659	0.1024	0.1578	-0.0077	-0.0001
0.350	0.188	0.407	0.1456	0.0638	0.0977	0.1536	-0.0073	0.0001
0.400	0.215	0.465	0.1418	0.0643	0.0989	0.1525	-0.0067	0.0001
0.450	0.242	0.523	0.1383	0.0599	0.0947	0.1465	-0.0061	-0.0006
0.500	0.269	0.581	0.1326	0.0580	0.0867	0.1386	-0.0054	0.0003
0.550	0.296	0.640	0.1249	0.0579	0.0801	0.1315	-0.0047	-0.0001
0.600	0.323	0.698	0.1169	0.0536	0.0677	0.1191	-0.0038	-0.0002
0.650	0.350	0.756	0.1060	0.0543	0.0564	0.1084	-0.0030	0.0003
0.700	0.377	0.814	0.0961	0.0509	0.0532	0.1001	-0.0023	0.0002
0.750	0.404	0.872	0.0859	0.0475	0.0631	0.0982	-0.0015	0.0000
0.800	0.431	0.930	0.0758	0.0465	0.0749	0.0986	-0.0009	-0.0001
0.850	0.457	0.988	0.0690	0.0458	0.0894	0.1021	-0.0004	0.0000
0.900	0.484	1.047	0.0648	0.0456	0.1003	0.1053	0.0004	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00154

TABLE A15-10

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.215	0.254	9.57	0.228	10.51	0.265	0.270	9.43	0.400
0.100	0.208	0.262	9.67	0.225	10.62	0.260	0.260	9.54	0.455
0.150	0.200	0.264	9.76	0.222	10.71	0.258	0.256	9.60	0.502
0.200	0.193	0.264	9.84	0.217	10.79	0.255	0.253	9.70	0.550
0.250	0.185	0.257	9.91	0.211	10.88	0.246	0.244	9.78	0.600
0.300	0.177	0.248	9.98	0.205	10.95	0.237	0.238	9.85	0.645
0.350	0.169	0.236	10.05	0.196	11.02	0.226	0.225	9.93	0.690
0.400	0.160	0.224	10.11	0.185	11.09	0.214	0.213	9.98	0.735
0.450	0.152	0.211	10.17	0.175	11.15	0.200	0.204	10.05	0.777
0.500	0.143	0.197	10.22	0.163	11.21	0.186	0.184	10.10	0.819
0.550	0.134	0.182	10.27	0.150	11.26	0.169	0.170	10.15	0.855
0.600	0.124	0.167	10.32	0.137	11.30	0.150	0.152	10.20	0.892
0.650	0.116	0.152	10.35	0.122	11.35	0.133	0.130	10.24	0.925
0.700	0.107	0.136	10.39	0.109	11.38	0.120	0.118	10.28	0.950
0.750	0.098	0.120	10.41	0.096	11.41	0.114	0.114	10.31	0.973
0.800	0.090	0.104	10.43	0.084	11.43	0.112	0.113	10.32	0.990
0.850	0.087	0.093	10.44	0.076	11.44	0.118	0.118	10.32	1.000
0.900	0.088	0.086	10.43	0.072	11.44	0.125	0.127	10.32	0.990

VOA = 8.08 VOLTS VOC = 8.97 VOLTS VOD = 7.96 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.058	0.1280	0.0498	0.0924	0.1351	-0.0031	-0.0005
0.100	0.054	0.116	0.1345	0.0607	0.0926	0.1439	-0.0049	0.0000
0.150	0.081	0.174	0.1398	0.0632	0.1003	0.1516	-0.0064	0.0002
0.200	0.108	0.233	0.1430	0.0692	0.1033	0.1577	-0.0077	0.0002
0.250	0.135	0.291	0.1452	0.0704	0.1031	0.1594	-0.0083	0.0003
0.300	0.161	0.349	0.1472	0.0669	0.1024	0.1583	-0.0085	-0.0001
0.350	0.188	0.407	0.1456	0.0649	0.0977	0.1541	-0.0082	0.0001
0.400	0.215	0.465	0.1418	0.0667	0.0989	0.1537	-0.0080	0.0001
0.450	0.242	0.523	0.1383	0.0642	0.0947	0.1486	-0.0074	-0.0006
0.500	0.269	0.581	0.1326	0.0635	0.0867	0.1414	-0.0067	0.0003
0.550	0.296	0.640	0.1249	0.0624	0.0801	0.1337	-0.0058	-0.0001
0.600	0.323	0.698	0.1169	0.0605	0.0677	0.1226	-0.0050	-0.0002
0.650	0.350	0.756	0.1060	0.0636	0.0564	0.1130	-0.0040	0.0003
0.700	0.377	0.814	0.0961	0.0601	0.0532	0.1047	-0.0030	0.0002
0.750	0.404	0.872	0.0859	0.0568	0.0631	0.1029	-0.0021	0.0000
0.800	0.431	0.930	0.0758	0.0527	0.0749	0.1017	-0.0012	-0.0001
0.850	0.457	0.988	0.0690	0.0514	0.0894	0.1049	-0.0005	0.0000
0.900	0.484	1.047	0.0648	0.0512	0.1003	0.1081	0.0002	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00154

TABLE A15-11

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.210	0.260	9.44	0.228	10.51	0.265	0.270	9.43	0.400
0.100	0.205	0.263	9.55	0.225	10.62	0.260	0.260	9.54	0.455
0.150	0.200	0.263	9.63	0.222	10.71	0.258	0.256	9.60	0.502
0.200	0.193	0.262	9.72	0.217	10.79	0.255	0.253	9.70	0.550
0.250	0.187	0.257	9.80	0.211	10.88	0.246	0.244	9.78	0.600
0.300	0.180	0.250	9.86	0.205	10.95	0.237	0.238	9.85	0.645
0.350	0.173	0.238	9.93	0.196	11.02	0.226	0.225	9.93	0.690
0.400	0.164	0.225	9.99	0.185	11.09	0.214	0.213	9.98	0.735
0.450	0.156	0.210	10.05	0.175	11.15	0.200	0.204	10.05	0.777
0.500	0.148	0.194	10.10	0.163	11.21	0.186	0.184	10.10	0.819
0.550	0.138	0.178	10.15	0.150	11.26	0.169	0.170	10.15	0.855
0.600	0.129	0.162	10.20	0.137	11.30	0.150	0.152	10.20	0.892
0.650	0.120	0.149	10.24	0.122	11.35	0.133	0.130	10.24	0.925
0.700	0.112	0.135	10.27	0.109	11.38	0.120	0.118	10.28	0.950
0.750	0.108	0.123	10.30	0.096	11.41	0.114	0.114	10.31	0.973
0.800	0.104	0.113	10.32	0.084	11.43	0.112	0.113	10.32	0.990
0.850	0.106	0.104	10.32	0.076	11.44	0.118	0.118	10.32	1.000
0.900	0.111	0.100	10.32	0.072	11.44	0.125	0.127	10.32	0.990

VOA = 8.01 VOLTS VOC = 8.97 VOLTS VOD = 7.96 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.058	0.1280	0.0628	0.0924	0.1416	-0.0043	-0.0005
0.100	0.054	0.116	0.1345	0.0699	0.0926	0.1485	-0.0056	0.0000
0.150	0.081	0.174	0.1398	0.0732	0.1003	0.1566	-0.0067	0.0002
0.200	0.108	0.233	0.1430	0.0775	0.1033	0.1619	-0.0078	0.0002
0.250	0.135	0.291	0.1452	0.0803	0.1031	0.1643	-0.0085	0.0003
0.300	0.161	0.349	0.1472	0.0795	0.1024	0.1646	-0.0089	-0.0001
0.350	0.188	0.407	0.1456	0.0788	0.0977	0.1611	-0.0085	0.0001
0.400	0.215	0.465	0.1418	0.0788	0.0989	0.1598	-0.0081	0.0001
0.450	0.242	0.523	0.1383	0.0739	0.0947	0.1535	-0.0071	-0.0006
0.500	0.269	0.581	0.1326	0.0713	0.0867	0.1453	-0.0060	0.0003
0.550	0.296	0.640	0.1249	0.0683	0.0801	0.1366	-0.0050	-0.0001
0.600	0.323	0.698	0.1169	0.0649	0.0677	0.1248	-0.0040	-0.0002
0.650	0.350	0.756	0.1060	0.0683	0.0564	0.1154	-0.0034	0.0003
0.700	0.377	0.814	0.0961	0.0673	0.0532	0.1083	-0.0025	0.0002
0.750	0.404	0.872	0.0859	0.0701	0.0631	0.1095	-0.0016	0.0000
0.800	0.431	0.930	0.0758	0.0727	0.0749	0.1117	-0.0009	-0.0001
0.850	0.457	0.988	0.0690	0.0754	0.0894	0.1169	0.0002	0.0000
0.900	0.484	1.047	0.0648	0.0790	0.1003	0.1220	0.0011	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00154

TABLE A15-12

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.210	0.255	9.47	0.228	10.51	0.265	0.270	9.43	0.400
0.100	0.210	0.261	9.57	0.225	10.62	0.260	0.260	9.54	0.455
0.150	0.205	0.262	9.66	0.222	10.71	0.258	0.256	9.60	0.502
0.200	0.198	0.260	9.75	0.217	10.79	0.255	0.253	9.70	0.550
0.250	0.190	0.257	9.83	0.211	10.88	0.246	0.244	9.78	0.600
0.300	0.180	0.250	9.90	0.205	10.95	0.237	0.238	9.85	0.645
0.350	0.171	0.242	9.98	0.196	11.02	0.226	0.225	9.93	0.690
0.400	0.161	0.230	10.04	0.185	11.09	0.214	0.213	9.98	0.735
0.450	0.150	0.215	10.10	0.175	11.15	0.200	0.204	10.05	0.777
0.500	0.140	0.197	10.16	0.163	11.21	0.186	0.184	10.10	0.819
0.550	0.130	0.180	10.21	0.150	11.26	0.169	0.170	10.15	0.855
0.600	0.120	0.163	10.26	0.137	11.30	0.150	0.152	10.20	0.892
0.650	0.111	0.147	10.30	0.122	11.35	0.133	0.130	10.24	0.925
0.700	0.103	0.131	10.33	0.109	11.38	0.120	0.118	10.28	0.950
0.750	0.095	0.117	10.36	0.096	11.41	0.114	0.114	10.31	0.973
0.800	0.090	0.103	10.38	0.084	11.43	0.112	0.113	10.32	0.990
0.850	0.088	0.091	10.39	0.076	11.44	0.118	0.118	10.32	1.000
0.900	0.090	0.086	10.38	0.072	11.44	0.125	0.127	10.32	0.990

VOA = 8.01 VOLTS VOC = 8.97 VOLTS VOD = 7.96 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.058	0.1280	0.0543	0.0924	0.1374	-0.0037	-0.0005
0.100	0.054	0.116	0.1345	0.0673	0.0926	0.1472	-0.0048	0.0000
0.150	0.081	0.174	0.1398	0.0695	0.1003	0.1548	-0.0059	0.0002
0.200	0.108	0.233	0.1430	0.0723	0.1033	0.1593	-0.0068	0.0002
0.250	0.135	0.291	0.1452	0.0760	0.1031	0.1622	-0.0079	0.0003
0.300	0.161	0.349	0.1472	0.0724	0.1024	0.1610	-0.0085	-0.0001
0.350	0.188	0.407	0.1456	0.0730	0.0977	0.1581	-0.0089	0.0001
0.400	0.215	0.465	0.1418	0.0740	0.0989	0.1573	-0.0088	0.0001
0.450	0.242	0.523	0.1383	0.0672	0.0947	0.1501	-0.0082	-0.0006
0.500	0.269	0.581	0.1326	0.0604	0.0867	0.1398	-0.0070	0.0003
0.550	0.296	0.640	0.1249	0.0554	0.0801	0.1302	-0.0059	-0.0001
0.600	0.323	0.698	0.1169	0.0511	0.0677	0.1179	-0.0048	-0.0002
0.650	0.350	0.756	0.1060	0.0532	0.0564	0.1078	-0.0038	0.0003
0.700	0.377	0.814	0.0961	0.0508	0.0532	0.1001	-0.0028	0.0002
0.750	0.404	0.872	0.0859	0.0505	0.0631	0.0997	-0.0020	0.0000
0.800	0.431	0.930	0.0758	0.0505	0.0749	0.1006	-0.0011	-0.0001
0.850	0.457	0.988	0.0690	0.0495	0.0894	0.1039	-0.0002	0.0000
0.900	0.484	1.047	0.0648	0.0518	0.1003	0.1084	0.0003	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00154

TABLE A15-13

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.400

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	E'D,	EE	VD	U UMAX
				(VOLTS)					
0.065	0.113	0.156	10.64	0.122	11.56	0.143	0.144	10.67	0.748
0.075	0.110	0.153	10.68	0.121	11.58	0.139	0.137	10.72	0.767
0.125	0.100	0.138	10.75	0.107	11.70	0.127	0.125	10.80	0.828
0.175	0.090	0.125	10.83	0.096	11.75	0.115	0.115	10.86	0.870
0.225	0.080	0.114	10.88	0.085	11.78	0.103	0.104	10.90	0.903
0.275	0.072	0.103	10.91	0.076	11.82	0.092	0.090	10.95	0.933
0.325	0.064	0.091	10.94	0.068	11.86	0.081	0.081	10.98	0.953
0.375	0.058	0.079	10.97	0.060	11.89	0.071	0.070	11.00	0.973
0.425	0.054	0.068	10.99	0.051	11.91	0.063	0.063	11.03	0.987
0.475	0.053	0.060	10.99	0.047	11.93	0.058	0.058	11.04	0.996
0.525	0.054	0.054	11.00	0.045	11.93	0.057	0.057	11.04	1.000

VOA = 8.03 VOLTS VOC = 8.97 VOLTS VOD = 8.03 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.065	0.065	0.124	0.0793	0.0404	0.0482	0.0840	-0.0025	-0.0001
0.075	0.075	0.143	0.0801	0.0364	0.0409	0.0787	-0.0025	0.0001
0.125	0.125	0.238	0.0735	0.0409	0.0455	0.0799	-0.0022	0.0001
0.175	0.175	0.333	0.0681	0.0377	0.0444	0.0751	-0.0019	0.0000
0.225	0.225	0.429	0.0621	0.0362	0.0421	0.0702	-0.0018	-0.0001
0.275	0.275	0.524	0.0566	0.0347	0.0361	0.0637	-0.0015	0.0001
0.325	0.325	0.619	0.0511	0.0305	0.0323	0.0569	-0.0012	0.0000
0.375	0.375	0.714	0.0456	0.0270	0.0278	0.0502	-0.0008	0.0000
0.425	0.425	0.810	0.0391	0.0268	0.0278	0.0468	-0.0005	0.0000
0.475	0.475	0.905	0.0361	0.0251	0.0259	0.0436	-0.0002	0.0000
0.525	0.525	1.000	0.0347	0.0237	0.0268	0.0426	0.0000	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00361

TABLE A15-14

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 1.250 INS. N.D.DIST.(X/L)= 0.167

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.210	0.255	9.80	0.195	10.95	0.270	0.280	9.95	0.458
0.050	0.178	0.244	10.04	0.170	11.14	0.250	0.263	10.15	0.560
0.075	0.164	0.217	10.20	0.151	11.26	0.215	0.210	10.30	0.633
0.100	0.145	0.190	10.35	0.137	11.35	0.190	0.188	10.38	0.690
0.125	0.131	0.168	10.42	0.126	11.41	0.172	0.168	10.46	0.736
0.150	0.123	0.154	10.47	0.118	11.47	0.158	0.154	10.53	0.776
0.175	0.116	0.148	10.53	0.111	11.52	0.148	0.143	10.58	0.806
0.200	0.110	0.135	10.58	0.105	11.55	0.139	0.139	10.61	0.832
0.250	0.100	0.125	10.64	0.094	11.61	0.125	0.120	10.67	0.873
0.300	0.092	0.114	10.69	0.084	11.65	0.113	0.120	10.72	0.910
0.350	0.081	0.100	10.72	0.075	11.69	0.102	0.100	10.76	0.938
0.400	0.074	0.090	10.76	0.066	11.72	0.092	0.088	10.80	0.960
0.450	0.067	0.079	10.78	0.058	11.74	0.082	0.080	10.82	0.978
0.500	0.063	0.070	10.81	0.052	11.75	0.073	0.077	10.84	0.990
0	0.062	0.064	10.83	0.049	11.76	0.066	0.064	10.85	0.998
0.600	0.062	0.059	10.84	0.051	11.76	0.065	0.067	10.85	1.000

VOA = 7.94 VOLTS VOC = 9.02 VOLTS VOD = 8.05 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.022	0.043	0.1013	0.0768	0.1060	0.1420	-0.0031	-0.0008
0.050	0.044	0.085	0.0993	0.0796	0.1160	0.1474	-0.0049	-0.0012
0.075	0.065	0.128	0.0947	0.0757	0.0951	0.1328	-0.0040	0.0004
0.100	0.087	0.171	0.0905	0.0618	0.0878	0.1201	-0.0032	0.0002
0.125	0.109	0.213	0.0865	0.0530	0.0793	0.1094	-0.0025	0.0003
0.150	0.131	0.256	0.0836	0.0494	0.0725	0.1027	-0.0021	0.0003
0.175	0.153	0.299	0.0804	0.0493	0.0680	0.0989	-0.0021	0.0004
0.200	0.175	0.341	0.0776	0.0428	0.0674	0.0939	-0.0016	0.0000
0.250	0.218	0.427	0.0714	0.0439	0.0597	0.0875	-0.0015	0.0004
0.300	0.262	0.512	0.0655	0.0436	0.0629	0.0860	-0.0013	-0.0005
0.350	0.305	0.597	0.0595	0.0379	0.0534	0.0754	-0.0010	0.0001
0.400	0.349	0.683	0.0531	0.0367	0.0487	0.0692	-0.0008	0.0002
0.450	0.393	0.768	0.0472	0.0339	0.0456	0.0633	-0.0006	0.0001
0.500	0.436	0.853	0.0426	0.0315	0.0438	0.0590	-0.0003	-0.0002
0.550	0.480	0.939	0.0404	0.0299	0.0346	0.0525	-0.0001	0.0001
0.600	0.524	1.024	0.0421	0.0235	0.0340	0.0498	0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00250

TABLE A15-15

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 2.200 INS. N.D.DIST.(X/L)= 0.294

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.210	0.280	9.75	0.228	10.68	0.284	0.272	9.70	0.370
0.050	0.202	0.275	9.89	0.221	10.86	0.271	0.266	9.93	0.465
0.075	0.193	0.268	10.00	0.214	10.96	0.257	0.243	10.07	0.530
0.100	0.180	0.250	10.10	0.205	11.07	0.242	0.239	10.18	0.583
0.125	0.164	0.232	10.19	0.192	11.16	0.224	0.221	10.28	0.634
0.150	0.152	0.212	10.27	0.176	11.25	0.202	0.200	10.36	0.682
0.175	0.143	0.192	10.33	0.158	11.32	0.185	0.190	10.44	0.725
0.200	0.128	0.175	10.37	0.145	11.38	0.172	0.176	10.50	0.760
0.250	0.114	0.145	10.45	0.123	11.47	0.146	0.140	10.59	0.815
0.300	0.103	0.130	10.51	0.108	11.52	0.129	0.135	10.65	0.856
0.350	0.091	0.119	10.56	0.096	11.58	0.115	0.112	10.72	0.892
0.400	0.083	0.109	10.58	0.085	11.63	0.103	0.100	10.76	0.924
0.450	0.076	0.094	10.62	0.075	11.66	0.092	0.090	10.79	0.949
0.500	0.070	0.084	10.64	0.068	11.69	0.082	0.078	10.83	0.970
0.550	0.064	0.074	10.65	0.061	11.71	0.073	0.072	10.85	0.984
0.600	0.062	0.064	10.66	0.057	11.72	0.067	0.065	10.85	0.993
0.650	0.064	0.061	10.66	0.056	11.73	0.067	0.065	10.86	1.000

VOA = 7.95 VOLTS VOC = 8.98 VOLTS VOD = 8.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.020	0.040	0.1080	0.0307	0.0783	0.1085	-0.0035	0.0008
0.050	0.040	0.079	0.1195	0.0465	0.0803	0.1232	-0.0049	0.0004
0.075	0.060	0.119	0.1257	0.0479	0.0689	0.1212	-0.0057	0.0011
0.100	0.080	0.159	0.1264	0.0388	0.0703	0.1178	-0.0055	0.0003
0.125	0.099	0.198	0.1239	0.0306	0.0646	0.1096	-0.0054	0.0003
0.150	0.119	0.238	0.1178	0.0326	0.0587	0.1046	-0.0048	0.0002
0.175	0.139	0.278	0.1093	0.0406	0.0640	0.1069	-0.0039	-0.0004
0.200	0.159	0.317	0.1028	0.0358	0.0628	0.1007	-0.0036	-0.0003
0.250	0.199	0.397	0.0904	0.0340	0.0491	0.0868	-0.0022	0.0004
0.300	0.239	0.476	0.0817	0.0359	0.0536	0.0856	-0.0018	-0.0004
0.350	0.278	0.556	0.0742	0.0361	0.0426	0.0764	-0.0018	0.0002
0.400	0.318	0.635	0.0670	0.0393	0.0404	0.0734	-0.0016	0.0002
0.450	0.358	0.714	0.0600	0.0351	0.0386	0.0668	-0.0010	0.0001
0.500	0.398	0.794	0.0550	0.0324	0.0313	0.0593	-0.0007	0.0002
0.550	0.438	0.873	0.0497	0.0294	0.0295	0.0543	-0.0005	0.0000
0.600	0.477	0.952	0.0468	0.0245	0.0251	0.0482	-0.0001	0.0001
0.650	0.517	1.032	0.0462	0.0256	0.0266	0.0492	0.0001	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00199

TABLE A15-16

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.241	0.290	9.45	0.258	10.46	0.296	0.300	9.55	0.335
0.050	0.233	0.288	9.59	0.249	10.62	0.290	0.300	9.72	0.405
0.075	0.221	0.290	9.74	0.238	10.74	0.283	0.288	9.82	0.455
0.100	0.215	0.280	9.84	0.228	10.83	0.276	0.281	9.92	0.500
0.125	0.207	0.272	9.90	0.217	10.92	0.266	0.271	10.00	0.545
0.150	0.198	0.260	10.00	0.207	11.00	0.252	0.257	10.09	0.590
0.175	0.182	0.244	10.08	0.195	11.10	0.237	0.242	10.17	0.635
0.200	0.166	0.228	10.17	0.184	11.16	0.222	0.247	10.25	0.675
0.250	0.144	0.192	10.28	0.160	11.28	0.195	0.200	10.36	0.747
0.300	0.126	0.162	10.37	0.136	11.37	0.169	0.171	10.45	0.805
0.350	0.107	0.140	10.44	0.116	11.45	0.147	0.149	10.53	0.855
0.400	0.097	0.125	10.50	0.101	11.50	0.127	0.129	10.58	0.893
0.450	0.088	0.112	10.55	0.088	11.54	0.110	0.112	10.63	0.924
0.500	0.078	0.100	10.58	0.078	11.58	0.096	0.098	10.66	0.947
0.550	0.074	0.088	10.60	0.070	11.60	0.085	0.087	10.69	0.967
0.600	0.067	0.079	10.63	0.064	11.63	0.078	0.079	10.72	0.984
0.650	0.067	0.071	10.65	0.060	11.64	0.063	0.064	10.72	0.995
0.700	0.071	0.065	10.65	0.060	11.65	0.063	0.064	10.72	1.000

VOA = 7.95 VOLTS VOC = 8.99 VOLTS VOD = 8.01 VOLTS

RESULTS

RO-R)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.018	0.037	0.1261	0.0287	0.0631	0.1090	-0.0031	-0.0003
0.050	0.037	0.074	0.1340	0.0455	0.0744	0.1269	-0.0042	-0.0008
0.075	0.055	0.111	0.1349	0.0513	0.0825	0.1343	-0.0055	-0.0004
0.100	0.073	0.148	0.1354	0.0549	0.0878	0.1390	-0.0055	-0.0005
0.125	0.091	0.185	0.1346	0.0659	0.0926	0.1465	-0.0060	-0.0005
0.150	0.110	0.222	0.1335	0.0644	0.0900	0.1440	-0.0058	-0.0005
0.175	0.128	0.259	0.1300	0.0601	0.0891	0.1396	-0.0058	-0.0005
0.200	0.146	0.296	0.1269	0.0487	0.0956	0.1356	-0.0057	-0.0027
0.250	0.183	0.370	0.1163	0.0392	0.0809	0.1182	-0.0042	-0.0005
0.300	0.219	0.444	0.1029	0.0365	0.0745	0.1069	-0.0029	-0.0002
0.350	0.256	0.519	0.0905	0.0353	0.0695	0.0976	-0.0025	-0.0002
0.400	0.293	0.593	0.0807	0.0377	0.0611	0.0898	-0.0020	-0.0002
0.450	0.329	0.667	0.0717	0.0391	0.0533	0.0820	-0.0016	-0.0001
0.500	0.366	0.741	0.0643	0.0359	0.0462	0.0732	-0.0013	-0.0001
0.550	0.402	0.815	0.0584	0.0344	0.0403	0.0665	-0.0008	-0.0001
0.600	0.439	0.889	0.0539	0.0298	0.0368	0.0602	-0.0006	-0.0001
0.650	0.475	0.963	0.0508	0.0286	0.0165	0.0480	-0.0002	-0.0000
0.700	0.512	1.037	0.0509	0.0272	0.0168	0.0475	0.0003	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00162

TABLE A15-17

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.216	0.278	11.41	0.258	10.46	0.296	0.300	9.55	0.335
0.050	0.210	0.277	11.56	0.249	10.62	0.290	0.300	9.72	0.405
0.075	0.202	0.273	11.66	0.238	10.74	0.283	0.288	9.82	0.455
0.100	0.186	0.266	11.75	0.228	10.83	0.276	0.281	9.92	0.500
0.125	0.195	0.258	11.83	0.217	10.92	0.266	0.271	10.00	0.545
0.150	0.178	0.247	11.91	0.207	11.00	0.252	0.257	10.09	0.590
0.175	0.168	0.235	11.98	0.195	11.10	0.237	0.242	10.17	0.635
0.200	0.158	0.220	12.05	0.184	11.16	0.222	0.247	10.25	0.675
0	0.138	0.187	12.16	0.160	11.28	0.195	0.200	10.36	0.747
0.300	0.120	0.160	12.24	0.136	11.37	0.169	0.171	10.45	0.805
0.350	0.106	0.138	12.31	0.116	11.45	0.147	0.149	10.53	0.855
0.400	0.094	0.120	12.36	0.101	11.50	0.127	0.129	10.58	0.893
0.450	0.085	0.107	12.40	0.088	11.54	0.110	0.112	10.63	0.924
0.500	0.078	0.095	12.43	0.078	11.58	0.096	0.098	10.66	0.947
0.550	0.071	0.084	12.45	0.070	11.60	0.085	0.087	10.69	0.967
0.600	0.067	0.075	12.47	0.064	11.63	0.078	0.079	10.72	0.984
0.650	0.065	0.067	12.49	0.060	11.64	0.063	0.064	10.72	0.995
0.700	0.068	0.064	12.49	0.060	11.65	0.063	0.064	10.72	1.000

VOA = 10.09 VOLTS VOC = 8.99 VOLTS VOD = 8.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.018	0.037	0.1261	0.0454	0.0631	0.1173	-0.0044	-0.0003
0.050	0.037	0.074	0.1340	0.0538	0.0744	0.1311	-0.0056	-0.0008
0.075	0.055	0.111	0.1349	0.0634	0.0825	0.1404	-0.0065	-0.0004
0.100	0.073	0.148	0.1354	0.0614	0.0878	0.1423	-0.0076	-0.0005
0.125	0.091	0.185	0.1346	0.0758	0.0926	0.1515	-0.0065	-0.0005
0.150	0.110	0.222	0.1335	0.0712	0.0900	0.1474	-0.0072	-0.0005
0.175	0.128	0.259	0.1300	0.0724	0.0891	0.1457	-0.0072	-0.0005
0.200	0.146	0.296	0.1269	0.0672	0.0956	0.1449	-0.0066	-0.0027
0.250	0.183	0.370	0.1163	0.0577	0.0809	0.1274	-0.0050	-0.0005
0.300	0.219	0.444	0.1029	0.0539	0.0745	0.1156	-0.0038	-0.0002
0.350	0.256	0.519	0.0905	0.0517	0.0695	0.1058	-0.0028	-0.0002
0.400	0.293	0.593	0.0807	0.0468	0.0611	0.0943	-0.0021	-0.0002
0.450	0.329	0.667	0.0717	0.0463	0.0533	0.0856	-0.0016	-0.0001
0.500	0.366	0.741	0.0643	0.0435	0.0462	0.0770	-0.0012	-0.0001
0.550	0.402	0.815	0.0584	0.0391	0.0403	0.0689	-0.0008	-0.0001
0.600	0.439	0.889	0.0539	0.0362	0.0368	0.0635	-0.0005	-0.0001
0.650	0.475	0.963	0.0508	0.0330	0.0165	0.0501	-0.0001	-0.0000
0.700	0.512	1.037	0.0509	0.0332	0.0168	0.0505	0.0002	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00162

TABLE A15-18

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.236	0.295	9.38	0.258	10.46	0.296	0.300	9.55	0.335
0.050	0.228	0.294	9.63	0.249	10.62	0.290	0.300	9.72	0.405
0.075	0.220	0.293	9.74	0.238	10.74	0.283	0.288	9.82	0.455
0.100	0.210	0.290	9.83	0.228	10.83	0.276	0.281	9.92	0.500
0.125	0.201	0.283	9.92	0.217	10.92	0.266	0.271	10.00	0.545
0.150	0.192	0.270	10.00	0.207	11.00	0.252	0.257	10.09	0.590
0.175	0.182	0.254	10.08	0.195	11.10	0.237	0.242	10.17	0.635
0.200	0.172	0.236	10.15	0.184	11.16	0.222	0.247	10.25	0.675
0.250	0.152	0.202	10.27	0.160	11.28	0.195	0.200	10.36	0.747
0.300	0.133	0.172	10.36	0.136	11.37	0.169	0.171	10.45	0.805
0.350	0.116	0.147	10.43	0.116	11.45	0.147	0.149	10.53	0.855
0.400	0.103	0.128	10.49	0.101	11.50	0.127	0.129	10.58	0.893
0.450	0.093	0.114	10.53	0.088	11.54	0.110	0.112	10.63	0.924
0.500	0.085	0.102	10.56	0.078	11.58	0.096	0.098	10.66	0.947
0.550	0.079	0.091	10.58	0.070	11.60	0.085	0.087	10.69	0.967
0.600	0.074	0.081	10.61	0.064	11.63	0.078	0.079	10.72	0.984
0.650	0.071	0.072	10.62	0.060	11.64	0.063	0.064	10.72	0.995
0.700	0.070	0.070	10.63	0.060	11.65	0.063	0.064	10.72	1.000

VOA = 7.95 VOLTS VOC = 8.99 VOLTS VOD = 8.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.018	0.037	0.1261	0.0493	0.0631	0.1192	-0.0040	-0.0003
0.050	0.037	0.074	0.1340	0.0360	0.0744	0.1222	-0.0048	-0.0008
0.075	0.055	0.111	0.1349	0.0540	0.0825	0.1357	-0.0059	-0.0004
0.100	0.073	0.148	0.1354	0.0614	0.0878	0.1423	-0.0069	-0.0005
0.125	0.091	0.185	0.1346	0.0681	0.0926	0.1476	-0.0075	-0.0005
0.150	0.110	0.222	0.1335	0.0690	0.0900	0.1462	-0.0074	-0.0005
0.175	0.128	0.259	0.1300	0.0687	0.0891	0.1439	-0.0069	-0.0005
0.200	0.146	0.296	0.1269	0.0635	0.0956	0.1430	-0.0062	-0.0027
0.250	0.183	0.370	0.1163	0.0581	0.0809	0.1276	-0.0047	-0.0005
0.300	0.219	0.444	0.1029	0.0542	0.0745	0.1158	-0.0034	-0.0002
0.350	0.256	0.519	0.0905	0.0504	0.0695	0.1052	-0.0025	-0.0002
0.400	0.293	0.593	0.0807	0.0462	0.0611	0.0940	-0.0019	-0.0002
0.450	0.329	0.667	0.0717	0.0458	0.0533	0.0854	-0.0015	-0.0001
0.500	0.366	0.741	0.0643	0.0437	0.0462	0.0771	-0.0011	-0.0001
0.550	0.402	0.815	0.0584	0.0412	0.0403	0.0700	-0.0007	-0.0001
0.600	0.439	0.889	0.0539	0.0374	0.0368	0.0641	-0.0004	-0.0001
0.650	0.475	0.963	0.0508	0.0337	0.0165	0.0505	-0.0001	-0.0000
0.700	0.512	1.037	0.0509	0.0313	0.0168	0.0495	0.0000	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00162

TABLE A15-19

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 3.150 INS. N.D.DIST.(X/L)= 0.420

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.260	0.311	9.39	0.258	10.46	0.296	0.300	9.55	0.335
0.050	0.250	0.310	9.56	0.249	10.62	0.290	0.300	9.72	0.405
0.075	0.242	0.307	9.68	0.238	10.74	0.283	0.288	9.82	0.455
0.100	0.234	0.304	9.77	0.228	10.83	0.276	0.281	9.92	0.500
0.125	0.225	0.296	9.86	0.217	10.92	0.266	0.271	10.00	0.545
0.150	0.216	0.288	9.95	0.207	11.00	0.252	0.257	10.09	0.590
0.175	0.206	0.276	10.03	0.195	11.10	0.237	0.242	10.17	0.635
0.200	0.196	0.262	10.10	0.184	11.16	0.222	0.247	10.25	0.675
0.250	0.172	0.225	10.22	0.160	11.28	0.195	0.200	10.36	0.747
0.300	0.150	0.188	10.31	0.136	11.37	0.169	0.171	10.45	0.805
0.350	0.132	0.163	10.39	0.116	11.45	0.147	0.149	10.53	0.855
0.400	0.116	0.144	10.44	0.101	11.50	0.127	0.129	10.58	0.893
0.450	0.104	0.130	10.49	0.088	11.54	0.110	0.112	10.63	0.924
0.500	0.096	0.118	10.52	0.078	11.58	0.096	0.098	10.66	0.947
0.550	0.089	0.106	10.55	0.070	11.60	0.085	0.087	10.69	0.967
0.600	0.083	0.097	10.57	0.064	11.63	0.078	0.079	10.72	0.984
0.650	0.078	0.088	10.59	0.060	11.64	0.063	0.064	10.72	0.995
0.700	0.074	0.076	10.59	0.060	11.65	0.063	0.064	10.72	1.000

VOA = 7.94 VOLTS VOC = 8.99 VOLTS VOD = 8.01 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.018	0.034	0.1261	0.0682	0.0631	0.1287	-0.0036	-0.0003
0.050	0.037	0.069	0.1340	0.0756	0.0744	0.1420	-0.0050	-0.0008
0.075	0.055	0.103	0.1349	0.0839	0.0825	0.1506	-0.0059	-0.0004
0.100	0.073	0.138	0.1354	0.0914	0.0878	0.1573	-0.0068	-0.0005
0.125	0.091	0.172	0.1346	0.0962	0.0926	0.1617	-0.0073	-0.0005
0.150	0.110	0.207	0.1335	0.0991	0.0900	0.1613	-0.0077	-0.0005
0.175	0.128	0.241	0.1300	0.1020	0.0891	0.1605	-0.0078	-0.0005
0.200	0.146	0.276	0.1269	0.1006	0.0956	0.1616	-0.0074	-0.0027
0.250	0.183	0.345	0.1163	0.0913	0.0809	0.1442	-0.0057	-0.0005
0.300	0.219	0.414	0.1029	0.0803	0.0745	0.1288	-0.0038	-0.0002
0.350	0.256	0.483	0.0905	0.0746	0.0695	0.1173	-0.0029	-0.0002
0.400	0.293	0.552	0.0807	0.0688	0.0611	0.1053	-0.0024	-0.0002
0.450	0.329	0.621	0.0717	0.0656	0.0533	0.0953	-0.0021	-0.0001
0.500	0.366	0.690	0.0643	0.0629	0.0462	0.0867	-0.0016	-0.0001
0.550	0.402	0.759	0.0584	0.0586	0.0403	0.0787	-0.0012	-0.0001
0.600	0.439	0.828	0.0539	0.0551	0.0368	0.0729	-0.0009	-0.0001
0.650	0.475	0.897	0.0508	0.0502	0.0165	0.0588	-0.0006	-0.0000
0.700	0.512	0.966	0.0509	0.0398	0.0168	0.0538	-0.0001	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00162

TABLE A15-20

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 4.100 INS. N.D.DIST.(X/L)= 0.546

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC (VOLTS)	VC	ED	EE	VD	U UMAX
0.025	0.260	0.322	9.50	0.254	10.31	0.310	0.303	9.38	0.275
0.050	0.252	0.318	9.59	0.258	10.49	0.311	0.301	9.54	0.337
0.075	0.245	0.312	9.70	0.252	10.59	0.312	0.302	9.63	0.379
0.100	0.238	0.311	9.78	0.246	10.68	0.311	0.301	9.72	0.420
0.150	0.220	0.300	9.93	0.232	10.86	0.305	0.295	9.88	0.504
0.200	0.204	0.277	10.09	0.217	11.01	0.283	0.277	10.03	0.584
0.250	0.182	0.250	10.19	0.198	11.14	0.256	0.250	10.12	0.657
0.300	0.160	0.220	10.32	0.176	11.24	0.228	0.220	10.26	0.723
0.350	0.140	0.190	10.38	0.149	11.34	0.199	0.194	10.34	0.782
0.400	0.124	0.164	10.44	0.126	11.41	0.174	0.169	10.41	0.830
0.450	0.107	0.142	10.49	0.109	11.47	0.151	0.146	10.47	0.873
0.500	0.095	0.125	10.52	0.095	11.52	0.131	0.126	10.52	0.904
0.550	0.087	0.109	10.55	0.082	11.56	0.113	0.108	10.56	0.935
0.600	0.077	0.097	10.57	0.073	11.59	0.100	0.095	10.59	0.960
0.650	0.072	0.087	10.58	0.067	11.61	0.089	0.085	10.61	0.978
0.700	0.070	0.079	10.59	0.062	11.63	0.083	0.080	10.63	0.991
0.750	0.069	0.072	10.59	0.062	11.64	0.080	0.079	10.63	1.000

VOA = 7.97 VOLTS VOC = 8.99 VOLTS VOD = 7.99 VOLTS

RESULTS

RO-R (INS)	RO-R RO-KI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.017	0.033	0.1131	0.0176	0.0662	0.0984	-0.0028	0.0004
0.050	0.034	0.067	0.1250	0.0370	0.0732	0.1176	-0.0039	0.0007
0.075	0.051	0.100	0.1290	0.0397	0.0862	0.1274	-0.0043	0.0008
0.100	0.068	0.133	0.1330	0.0487	0.0944	0.1380	-0.0052	0.0009
0.150	0.101	0.200	0.1367	0.0621	0.1124	0.1556	-0.0068	0.0010
0.200	0.135	0.267	0.1382	0.0569	0.1129	0.1540	-0.0066	0.0007
0.250	0.169	0.333	0.1342	0.0551	0.1115	0.1504	-0.0065	0.0007
0.300	0.203	0.400	0.1255	0.0456	0.0999	0.1355	-0.0055	0.0009
0.350	0.237	0.467	0.1106	0.0524	0.0977	0.1303	-0.0044	0.0006
0.400	0.271	0.533	0.0965	0.0544	0.0917	0.1213	-0.0033	0.0005
0.450	0.304	0.600	0.0860	0.0489	0.0817	0.1083	-0.0027	0.0005
0.500	0.338	0.667	0.0764	0.0467	0.0712	0.0971	-0.0021	0.0004
0	0.372	0.733	0.0672	0.0461	0.0622	0.0877	-0.0015	0.0004
0.600	0.406	0.800	0.0607	0.0418	0.0553	0.0789	-0.0012	0.0003
0.650	0.440	0.867	0.0564	0.0384	0.0481	0.0714	-0.0009	0.0003
0.700	0.474	0.933	0.0526	0.0372	0.0461	0.0679	-0.0005	0.0002
0.750	0.507	1.000	0.0529	0.0312	0.0440	0.0640	-0.0002	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00125

TABLE A15-21

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 5.050 INS. N.D.DIST.(X/L)= 0.673

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EF	VD	U UMAX
				(VOLTS)					
0.025	0.276	0.318	9.33	0.267	10.20	0.329	0.327	9.25	0.265
0.050	0.270	0.320	9.40	0.277	10.32	0.326	0.324	9.38	0.310
0.075	0.265	0.323	9.49	0.273	10.41	0.321	0.320	9.49	0.346
0.100	0.257	0.324	9.57	0.268	10.50	0.316	0.318	9.56	0.380
0.150	0.247	0.320	9.73	0.257	10.65	0.307	0.307	9.71	0.447
0.200	0.232	0.312	9.85	0.244	10.78	0.295	0.295	9.85	0.513
0.250	0.215	0.293	9.97	0.228	10.90	0.278	0.274	9.98	0.578
0.300	0.196	0.270	10.10	0.208	11.01	0.256	0.255	10.09	0.640
0.350	0.177	0.242	10.21	0.184	11.11	0.233	0.231	10.20	0.700
0.400	0.158	0.210	10.29	0.161	11.20	0.206	0.204	10.30	0.760
0.450	0.137	0.182	10.39	0.140	11.29	0.180	0.182	10.38	0.816
0.500	0.119	0.160	10.45	0.121	11.36	0.152	0.150	10.46	0.865
0.550	0.105	0.140	10.51	0.104	11.41	0.127	0.126	10.52	0.903
0.600	0.094	0.120	10.54	0.090	11.46	0.107	0.107	10.56	0.935
0.650	0.084	0.106	10.58	0.079	11.49	0.095	0.094	10.59	0.960
0.700	0.080	0.090	10.59	0.070	11.51	0.086	0.084	10.61	0.977
0.750	0.078	0.082	10.60	0.064	11.53	0.082	0.082	10.63	0.990
0.800	0.078	0.084	10.60	0.064	11.54	0.082	0.081	10.64	1.000

VOA = 7.96 VOLTS VOC = 8.96 VOLTS VOD = 8.00 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.016	0.031	0.1212	0.0275	0.0869	0.1178	-0.0022	0.0001
0.050	0.031	0.063	0.1352	0.0279	0.0810	0.1220	-0.0032	0.0002
0.075	0.047	0.094	0.1399	0.0394	0.0807	0.1300	-0.0041	0.0001
0.100	0.063	0.125	0.1429	0.0479	0.0886	0.1397	-0.0052	-0.0002
0.150	0.094	0.188	0.1478	0.0583	0.0956	0.1508	-0.0064	0.0000
0	0.126	0.250	0.1503	0.0684	0.1001	0.1594	-0.0078	0.0000
0.250	0.157	0.313	0.1492	0.0690	0.0988	0.1585	-0.0081	0.0005
0.300	0.189	0.375	0.1433	0.0663	0.0997	0.1547	-0.0077	0.0001
0.350	0.220	0.438	0.1327	0.0663	0.0988	0.1489	-0.0067	0.0002
0.400	0.252	0.501	0.1213	0.0630	0.0925	0.1384	-0.0052	0.0002
0.450	0.283	0.563	0.1095	0.0548	0.0876	0.1259	-0.0041	-0.0002
0.500	0.315	0.626	0.0976	0.0533	0.0704	0.1107	-0.0036	0.0002
0.550	0.346	0.688	0.0857	0.0508	0.0571	0.0968	-0.0028	0.0001
0.600	0.378	0.751	0.0756	0.0470	0.0469	0.0847	-0.0019	0.0000
0.650	0.409	0.814	0.0674	0.0429	0.0428	0.0765	-0.0015	0.0001
0.700	0.441	0.876	0.0603	0.0397	0.0404	0.0702	-0.0006	0.0001
0.750	0.472	0.939	0.0554	0.0403	0.0435	0.0696	-0.0002	0.0000
0.800	0.503	1.001	0.0558	0.0424	0.0430	0.0706	-0.0004	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00107

TABLE A15-22

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 6.000 INS. N.D.DIST.(X/L)= 0.800

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.300	0.340	9.19	0.267	10.00	0.322	0.320	8.99	0.215
0.050	0.298	0.340	9.33	0.272	10.15	0.320	0.320	9.13	0.260
0.100	0.280	0.342	9.47	0.277	10.32	0.317	0.318	9.27	0.316
0.150	0.268	0.345	9.60	0.275	10.45	0.312	0.310	9.40	0.370
0.200	0.252	0.340	9.73	0.263	10.58	0.305	0.304	9.52	0.425
0.250	0.240	0.325	9.83	0.250	10.70	0.293	0.295	9.64	0.483
0.300	0.220	0.310	9.98	0.236	10.81	0.278	0.281	9.75	0.540
0.350	0.204	0.290	10.09	0.221	10.92	0.258	0.252	9.86	0.602
0.400	0.187	0.274	10.19	0.202	11.02	0.238	0.237	9.96	0.662
0.450	0.169	0.246	10.27	0.182	11.11	0.218	0.216	10.04	0.718
0.500	0.150	0.220	10.34	0.159	11.19	0.192	0.191	10.12	0.773
0.550	0.133	0.195	10.45	0.138	11.27	0.168	0.167	10.20	0.828
0.600	0.120	0.160	10.49	0.119	11.33	0.144	0.145	10.26	0.872
0.650	0.103	0.130	10.54	0.102	11.38	0.122	0.122	10.31	0.908
0.700	0.090	0.110	10.58	0.087	11.41	0.107	0.102	10.34	0.938
0.750	0.082	0.097	10.63	0.075	11.44	0.097	0.097	10.37	0.963
0.800	0.077	0.087	10.64	0.067	11.45	0.089	0.089	10.39	0.977
0.850	0.076	0.081	10.66	0.065	11.47	0.083	0.084	10.40	0.990
0.900	0.080	0.074	10.67	0.069	11.48	0.084	0.084	10.41	1.000

VOA = 7.94 VOLTS VOC = 8.96 VOLTS VOD = 7.97 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.015	0.029	0.1164	0.0199	0.0838	0.1101	-0.0017	0.0001
0.050	0.029	0.058	0.1264	0.0270	0.0866	0.1200	-0.0022	0.0000
0.100	0.059	0.116	0.1383	0.0246	0.0918	0.1274	-0.0039	-0.0001
0.150	0.088	0.174	0.1471	0.0330	0.0933	0.1367	-0.0056	0.0002
0.200	0.118	0.233	0.1496	0.0461	0.1033	0.1495	-0.0071	0.0001
0.250	0.147	0.291	0.1514	0.0563	0.1084	0.1580	-0.0077	-0.0002
0.300	0.176	0.349	0.1509	0.0486	0.1099	0.1547	-0.0083	-0.0004
0.350	0.206	0.407	0.1493	0.0481	0.1000	0.1487	-0.0083	0.0008
0.400	0.235	0.465	0.1430	0.0596	0.1018	0.1522	-0.0088	0.0001
0.450	0.265	0.523	0.1344	0.0586	0.1005	0.1468	-0.0077	0.0003
0.500	0.294	0.581	0.1222	0.0624	0.0938	0.1392	-0.0069	0.0001
0.550	0.324	0.640	0.1101	0.0596	0.0860	0.1278	-0.0057	0.0001
0	0.353	0.698	0.0977	0.0504	0.0761	0.1121	-0.0034	-0.0001
0.650	0.382	0.756	0.0858	0.0370	0.0636	0.0932	-0.0020	0.0000
0.700	0.412	0.814	0.0745	0.0331	0.0564	0.0820	-0.0013	0.0004
0.750	0.441	0.872	0.0653	0.0340	0.0590	0.0792	-0.0009	0.0000
0.800	0.471	0.930	0.0589	0.0342	0.0561	0.0746	-0.0006	0.0000
0.850	0.500	0.988	0.0575	0.0312	0.0512	0.0700	-0.0003	-0.0001
0.900	0.529	1.047	0.0615	0.0200	0.0480	0.0647	0.0003	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00081

TABLE A15-23

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	FC (VOLTS)	VC	ED	EE	VD	U UMAX
0.050	0.288	0.340	9.14	0.277	10.01	0.300	0.312	8.93	0.205
0.100	0.282	0.350	9.25	0.300	10.14	0.308	0.320	9.06	0.250
0.150	0.277	0.360	9.34	0.300	10.25	0.314	0.323	9.15	0.291
0.200	0.270	0.367	9.46	0.298	10.36	0.310	0.320	9.26	0.336
0.250	0.263	0.360	9.58	0.292	10.47	0.305	0.315	9.37	0.385
0.300	0.250	0.350	9.67	0.282	10.57	0.298	0.307	9.47	0.433
0.400	0.230	0.325	9.88	0.255	10.77	0.281	0.291	9.55	0.540
0.500	0.200	0.290	10.06	0.220	10.96	0.258	0.268	9.83	0.650
0.600	0.172	0.240	10.20	0.184	11.12	0.231	0.237	9.98	0.755
0.700	0.143	0.195	10.32	0.145	11.25	0.201	0.206	10.11	0.850
0.800	0.108	0.141	10.42	0.107	11.35	0.172	0.175	10.20	0.925
0.900	0.086	0.102	10.46	0.081	11.41	0.143	0.146	10.26	0.970
1.000	0.088	0.088	10.47	0.074	11.44	0.120	0.120	10.29	1.000

VOA = 8.02 VOLTS VOC = 8.97 VOLTS VOD = 7.92 VOLTS

RESULTS

RO-P (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.050	0.1152	0.0434	0.0638	0.1112	-0.0025	-0.0007
0.100	0.054	0.100	0.1362	0.0249	0.0554	0.1082	-0.0041	-0.0008
0.150	0.081	0.150	0.1458	0.0442	0.0696	0.1298	-0.0059	-0.0007
0.200	0.108	0.200	0.1546	0.0509	0.0715	0.1385	-0.0079	-0.0009
0.250	0.135	0.250	0.1616	0.0509	0.0758	0.1441	-0.0087	-0.0010
0.300	0.161	0.300	0.1652	0.0561	0.0811	0.1513	-0.0099	-0.0010
0.400	0.215	0.400	0.1665	0.0696	0.1233	0.1797	-0.0108	-0.0015
0.500	0.269	0.500	0.1581	0.0788	0.1196	0.1783	-0.0111	-0.0015
0.600	0.323	0.600	0.1432	0.0759	0.1268	0.1729	-0.0084	-0.0009
0.700	0.377	0.700	0.1204	0.0757	0.1299	0.1630	-0.0061	-0.0008
0.800	0.431	0.800	0.0929	0.0576	0.1284	0.1395	-0.0031	-0.0004
0.900	0.484	0.900	0.0722	0.0444	0.1143	0.1155	-0.0012	-0.0004
1.000	0.538	1.000	0.0671	0.0457	0.0927	0.1028	0.0000	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00056

TABLE A15-24

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.278	0.326	9.08	0.277	10.01	0.300	0.312	8.93	0.205
0.100	0.275	0.342	9.22	0.300	10.14	0.308	0.320	9.06	0.250
0.150	0.271	0.348	9.33	0.300	10.25	0.314	0.323	9.15	0.291
0.200	0.265	0.346	9.43	0.298	10.36	0.310	0.320	9.26	0.336
0.250	0.257	0.342	9.53	0.292	10.47	0.305	0.315	9.37	0.385
0.300	0.245	0.333	9.63	0.282	10.57	0.298	0.307	9.47	0.433
0.400	0.217	0.305	9.82	0.255	10.77	0.281	0.291	9.55	0.540
0.500	0.188	0.268	9.99	0.220	10.96	0.258	0.268	9.83	0.650
0.600	0.158	0.228	10.14	0.184	11.12	0.231	0.237	9.98	0.755
0.700	0.128	0.185	10.26	0.145	11.25	0.201	0.206	10.11	0.850
0.800	0.105	0.140	10.35	0.107	11.35	0.172	0.175	10.20	0.925
0.900	0.087	0.101	10.41	0.081	11.41	0.143	0.146	10.26	0.970
1.000	0.090	0.087	10.45	0.074	11.44	0.120	0.120	10.29	1.000

VOA = 8.08 VOLTS VOC = 8.97 VOLTS VOD = 7.92 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.050	0.1152	0.0626	0.0638	0.1208	-0.0027	-0.0007
0.100	0.054	0.100	0.1362	0.0483	0.0554	0.1199	-0.0045	-0.0008
0.150	0.081	0.150	0.1458	0.0553	0.0696	0.1354	-0.0060	-0.0007
0.200	0.108	0.200	0.1546	0.0571	0.0715	0.1416	-0.0071	-0.0009
0.250	0.135	0.250	0.1616	0.0630	0.0758	0.1502	-0.0084	-0.0010
0.300	0.161	0.300	0.1652	0.0657	0.0811	0.1560	-0.0094	-0.0010
0.400	0.215	0.400	0.1665	0.0694	0.1233	0.1796	-0.0107	-0.0015
0.500	0.269	0.500	0.1581	0.0731	0.1196	0.1754	-0.0103	-0.0015
0.600	0.323	0.600	0.1432	0.0716	0.1268	0.1708	-0.0090	-0.0009
0.700	0.377	0.700	0.1204	0.0688	0.1299	0.1596	-0.0068	-0.0008
0.800	0.431	0.800	0.0929	0.0644	0.1284	0.1429	-0.0036	-0.0004
0.900	0.484	0.900	0.0722	0.0508	0.1143	0.1187	-0.0012	-0.0004
1.000	0.538	1.000	0.0671	0.0511	0.0927	0.1055	0.0002	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00056

TABLE A15-25

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.278	0.320	8.98	0.277	10.01	0.300	0.312	8.93	0.205
0.100	0.284	0.332	9.12	0.300	10.14	0.308	0.320	9.06	0.250
0.150	0.284	0.342	9.21	0.300	10.25	0.314	0.323	9.15	0.291
0.200	0.279	0.349	9.32	0.298	10.36	0.310	0.320	9.26	0.336
0.250	0.269	0.350	9.42	0.292	10.47	0.305	0.315	9.37	0.385
0.300	0.258	0.345	9.51	0.282	10.57	0.298	0.307	9.47	0.433
0.400	0.234	0.323	9.70	0.255	10.77	0.281	0.291	9.55	0.540
0.500	0.209	0.287	9.87	0.220	10.96	0.258	0.268	9.83	0.650
0.600	0.181	0.244	10.02	0.184	11.12	0.231	0.237	9.98	0.755
0.700	0.152	0.200	10.15	0.145	11.25	0.201	0.206	10.11	0.850
0.800	0.121	0.152	10.24	0.107	11.35	0.172	0.175	10.20	0.925
0.900	0.100	0.121	10.29	0.081	11.41	0.143	0.146	10.26	0.970
1.000	0.103	0.105	10.33	0.074	11.44	0.120	0.120	10.29	1.000

VOA = 8.01 VOLTS VOC = 8.97 VOLTS VOD = 7.92 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.050	0.1152	0.0675	0.0638	0.1232	-0.0025	-0.0007
0.100	0.054	0.100	0.1362	0.0597	0.0554	0.1256	-0.0034	-0.0008
0.150	0.081	0.150	0.1458	0.0734	0.0696	0.1444	-0.0049	-0.0007
0.200	0.108	0.200	0.1546	0.0815	0.0715	0.1538	-0.0067	-0.0009
0.250	0.135	0.250	0.1616	0.0891	0.0758	0.1632	-0.0088	-0.0010
0.300	0.161	0.300	0.1652	0.0961	0.0811	0.1713	-0.0103	-0.0010
0.400	0.215	0.400	0.1665	0.1060	0.1233	0.1979	-0.0121	-0.0015
0.500	0.269	0.500	0.1581	0.1120	0.1196	0.1949	-0.0115	-0.0015
0.600	0.323	0.600	0.1432	0.1080	0.1268	0.1890	-0.0093	-0.0009
0.700	0.377	0.700	0.1204	0.1020	0.1299	0.1762	-0.0067	-0.0008
0.800	0.431	0.800	0.0929	0.0877	0.1284	0.1545	-0.0037	-0.0004
0.900	0.484	0.900	0.0722	0.0778	0.1143	0.1322	-0.0021	-0.0004
1.000	0.538	1.000	0.0671	0.0755	0.0927	0.1176	-0.0002	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00056

TABLE A15-26

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DIST. FROM INLET(X) = 7.350 INS. N.D.DIST.(X/L)= 0.980

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.282	0.326	8.98	0.277	10.01	0.300	0.312	8.93	0.205
0.100	0.277	0.340	9.10	0.300	10.14	0.308	0.320	9.06	0.250
0.150	0.272	0.348	9.21	0.300	10.25	0.314	0.323	9.15	0.291
0.200	0.264	0.348	9.32	0.298	10.36	0.310	0.320	9.26	0.336
0.250	0.256	0.344	9.43	0.292	10.47	0.305	0.315	9.37	0.385
0.300	0.246	0.327	9.53	0.282	10.57	0.298	0.307	9.47	0.433
0.400	0.224	0.312	9.73	0.255	10.77	0.281	0.291	9.55	0.540
0.500	0.198	0.275	9.91	0.220	10.96	0.258	0.268	9.83	0.650
0.600	0.168	0.235	10.07	0.184	11.12	0.231	0.237	9.98	0.755
0.700	0.137	0.194	10.20	0.145	11.25	0.201	0.206	10.11	0.850
0.800	0.110	0.147	10.30	0.107	11.35	0.172	0.175	10.20	0.925
0.900	0.090	0.101	10.36	0.081	11.41	0.143	0.146	10.26	0.970
1.000	0.089	0.088	10.39	0.074	11.44	0.120	0.120	10.29	1.000

VOA = 8.01 VOLTS VOC = 8.97 VOLTS VOD = 7.92 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.050	0.1152	0.0718	0.0638	0.1254	-0.0027	-0.0007
0.100	0.054	0.100	0.1362	0.0662	0.0554	0.1289	-0.0046	-0.0008
0.150	0.081	0.150	0.1458	0.0710	0.0696	0.1432	-0.0064	-0.0007
0.200	0.108	0.200	0.1546	0.0727	0.0715	0.1494	-0.0079	-0.0009
0.250	0.135	0.250	0.1616	0.0731	0.0758	0.1552	-0.0090	-0.0010
0.300	0.161	0.300	0.1652	0.0695	0.0811	0.1579	-0.0089	-0.0010
0.400	0.215	0.400	0.1665	0.0849	0.1233	0.1874	-0.0112	-0.0015
0.500	0.269	0.500	0.1581	0.0879	0.1196	0.1828	-0.0104	-0.0015
0.600	0.323	0.600	0.1432	0.0855	0.1268	0.1778	-0.0090	-0.0009
0.700	0.377	0.700	0.1204	0.0823	0.1299	0.1663	-0.0071	-0.0008
0.800	0.431	0.800	0.0929	0.0727	0.1284	0.1470	-0.0039	-0.0004
0.900	0.484	0.900	0.0722	0.0522	0.1143	0.1194	-0.0009	-0.0004
1.000	0.538	1.000	0.0671	0.0503	0.0927	0.1051	0.0001	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00056

TABLE A15-27

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

INNER WALL BLUF POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC (VOLTS)	VC	FD	EE	VD	U UMAX
0.025	0.168	0.214	9.49	0.180	10.45	0.232	0.230	9.38	0.410
0.050	0.168	0.216	9.58	0.176	10.54	0.228	0.227	9.47	0.460
0.100	0.166	0.222	9.65	0.176	10.65	0.225	0.220	9.56	0.504
0.200	0.163	0.232	9.77	0.176	10.76	0.229	0.221	9.67	0.575
0.300	0.158	0.231	9.87	0.176	10.88	0.224	0.218	9.79	0.645
0.400	0.151	0.222	9.97	0.168	10.99	0.215	0.210	9.91	0.715
0.500	0.142	0.208	10.07	0.155	11.08	0.198	0.192	9.99	0.785
0.600	0.132	0.187	10.16	0.140	11.17	0.176	0.175	10.09	0.857
0.700	0.120	0.158	10.25	0.123	11.25	0.154	0.150	10.17	0.928
0.800	0.109	0.130	10.30	0.104	11.32	0.128	0.125	10.24	0.975
0.850	0.108	0.120	10.32	0.097	11.34	0.120	0.118	10.26	0.990
0.900	0.114	0.112	10.33	0.094	11.35	0.118	0.116	10.26	1.000

VOA = 7.98 VOLTS VOC = 8.97 VOLTS VOD = 7.94 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.013	0.028	0.1070	0.0385	0.0941	0.1198	-0.0031	0.0002
0.050	0.027	0.056	0.1117	0.0473	0.0983	0.1287	-0.0036	0.0001
0.100	0.053	0.111	0.1147	0.0595	0.0986	0.1364	-0.0047	0.0005
0.200	0.107	0.222	0.1233	0.0705	0.1086	0.1512	-0.0068	0.0010
0.300	0.160	0.333	0.1305	0.0720	0.1092	0.1559	-0.0081	0.0008
0.400	0.213	0.444	0.1312	0.0752	0.1101	0.1583	-0.0084	0.0007
0.500	0.267	0.556	0.1274	0.0778	0.1071	0.1562	-0.0081	0.0009
0.600	0.320	0.667	0.1209	0.0756	0.0995	0.1480	-0.0068	0.0001
0.700	0.373	0.778	0.1115	0.0651	0.0880	0.1323	-0.0045	0.0005
0.800	0.427	0.889	0.0962	0.0608	0.0731	0.1151	-0.0023	0.0003
0.850	0.453	0.944	0.0905	0.0610	0.0702	0.1109	-0.0013	0.0002
0.900	0.480	1.000	0.0883	0.0631	0.0717	0.1116	0.0002	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00179

TABLE A15-28

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	FB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.025	0.151	0.188	9.51	0.146	10.65	0.208	0.210	9.59	0.500
0.050	0.150	0.190	9.67	0.146	10.73	0.203	0.200	9.69	0.558
0.100	0.147	0.192	9.78	0.147	10.79	0.195	0.196	9.77	0.610
0.150	0.145	0.195	9.84	0.148	10.84	0.190	0.189	9.81	0.643
0.200	0.144	0.198	9.88	0.148	10.89	0.185	0.186	9.85	0.670
0.250	0.142	0.200	9.92	0.145	10.91	0.182	0.182	9.89	0.696
0.300	0.141	0.196	9.96	0.142	10.95	0.178	0.180	9.93	0.726
0.350	0.140	0.191	9.99	0.138	10.98	0.174	0.172	9.97	0.756
0.400	0.140	0.185	10.02	0.136	11.02	0.170	0.169	10.00	0.788
0.450	0.140	0.180	10.05	0.130	11.05	0.166	0.164	10.02	0.816
0.500	0.142	0.174	10.07	0.126	11.08	0.162	0.160	10.04	0.843
0.550	0.147	0.167	10.09	0.125	11.10	0.158	0.160	10.06	0.870
0.600	0.155	0.161	10.10	0.124	11.11	0.158	0.160	10.08	0.895
0.700	0.182	0.154	10.12	0.129	11.11	0.162	0.161	10.09	0.943
0.800	0.208	0.156	10.10	0.144	11.10	0.176	0.175	10.07	0.982
0.900	0.232	0.160	10.06	0.157	11.07	0.193	0.194	10.05	1.000

VOA = 7.97 VOLTS VOC = 8.97 VOLTS VOD = 7.95 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.013	0.038	0.0944	0.0745	0.1025	0.1357	-0.0031	-0.0002
0.050	0.027	0.077	0.1007	0.0705	0.1001	0.1356	-0.0035	0.0003
0.100	0.053	0.154	0.1077	0.0676	0.0964	0.1359	-0.0042	-0.0001
0.150	0.080	0.231	0.1111	0.0681	0.0927	0.1360	-0.0049	0.0001
0.200	0.107	0.308	0.1135	0.0715	0.0899	0.1375	-0.0055	-0.0001
0.250	0.133	0.385	0.1143	0.0756	0.0889	0.1394	-0.0062	0.0000
0.300	0.160	0.462	0.1147	0.0774	0.0900	0.1411	-0.0061	-0.0002
0.350	0.187	0.538	0.1142	0.0795	0.0879	0.1408	-0.0058	0.0002
0.400	0.213	0.615	0.1151	0.0800	0.0885	0.1418	-0.0053	0.0001
0.450	0.240	0.692	0.1128	0.0848	0.0912	0.1444	-0.0049	0.0003
0.500	0.267	0.769	0.1112	0.0884	0.0930	0.1463	-0.0040	0.0003
0.550	0.293	0.846	0.1130	0.0893	0.0932	0.1478	-0.0026	-0.0003
0.600	0.320	0.923	0.1148	0.0936	0.0956	0.1520	-0.0008	-0.0003
0.700	0.373	1.077	0.1259	0.1075	0.0975	0.1654	0.0045	0.0002
0.800	0.427	1.231	0.1469	0.1198	0.1070	0.1868	0.0101	0.0002
0.900	0.480	1.385	0.1653	0.1340	0.1225	0.2109	0.0161	-0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00241

TABLE A15-29

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.147	0.167	9.55	0.147	10.68	0.200	0.197	9.60	0.590
0.050	0.143	0.167	9.65	0.140	10.72	0.181	0.177	9.67	0.654
0.100	0.136	0.167	9.72	0.130	10.81	0.176	0.170	9.73	0.713
0.200	0.126	0.168	9.80	0.125	10.91	0.169	0.160	9.82	0.772
0.300	0.122	0.167	9.86	0.123	10.95	0.164	0.158	9.88	0.818
0.400	0.121	0.164	9.91	0.117	11.01	0.155	0.148	9.92	0.860
0.500	0.120	0.158	9.96	0.113	11.05	0.147	0.143	9.95	0.904
0.600	0.121	0.151	10.00	0.109	11.07	0.139	0.141	9.97	0.945
0.700	0.127	0.143	10.04	0.109	11.08	0.135	0.140	10.00	0.978
0.800	0.138	0.138	10.06	0.116	11.10	0.137	0.143	9.99	1.000

VOA = 7.96 VOLTS VOC = 8.96 VOLTS VOD = 7.95 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.013	0.031	0.1099	0.0644	0.1098	0.1420	-0.0021	0.0004
0.050	0.027	0.062	0.1131	0.0679	0.0976	0.1393	-0.0027	0.0005
0.100	0.053	0.123	0.1097	0.0797	0.1060	0.1477	-0.0037	0.0008
0.200	0.107	0.247	0.1088	0.0838	0.1036	0.1481	-0.0053	0.0012
0.300	0.160	0.370	0.1115	0.0837	0.1023	0.1487	-0.0059	0.0009
0.400	0.213	0.494	0.1083	0.0903	0.0993	0.1489	-0.0059	0.0010
0.500	0.267	0.617	0.1080	0.0907	0.0979	0.1483	-0.0053	0.0006
0.600	0.320	0.741	0.1078	0.0906	0.0981	0.1483	-0.0043	-0.0003
0.700	0.373	0.864	0.1111	0.0877	0.0950	0.1469	-0.0024	-0.0008
0.800	0.427	0.988	0.1202	0.0836	0.0945	0.1491	0.0000	-0.0010

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00337

TABLE A15-50

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.198	0.247	9.53	0.192	10.50	0.260	0.262	9.40	0.436
0.100	0.196	0.259	9.61	0.199	10.56	0.264	0.266	9.47	0.471
0.150	0.194	0.272	9.64	0.204	10.61	0.266	0.270	9.52	0.495
0.200	0.194	0.281	9.69	0.208	10.66	0.268	0.270	9.57	0.525
0.250	0.194	0.287	9.74	0.211	10.71	0.270	0.274	9.62	0.555
0.300	0.194	0.287	9.80	0.213	10.77	0.270	0.272	9.68	0.586
0.400	0.186	0.285	9.91	0.212	10.88	0.264	0.266	9.79	0.657
0.500	0.174	0.268	10.02	0.202	10.98	0.252	0.260	9.90	0.730
0.600	0.160	0.242	10.12	0.184	11.10	0.231	0.235	10.02	0.812
0.700	0.141	0.210	10.22	0.160	11.19	0.200	0.206	10.12	0.887
0.800	0.122	0.169	10.29	0.131	11.27	0.160	0.164	10.20	0.953
0.900	0.108	0.130	10.33	0.104	11.33	0.126	0.130	10.26	0.999
1.000	0.115	0.110	10.32	0.094	11.33	0.118	0.121	10.25	1.000

VOA = 8.00 VOLTS VOC = 8.97 VOLTS VOD = 7.94 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.051	0.1182	0.0726	0.1208	0.1558	-0.0042	-0.0002
0.100	0.053	0.102	0.1272	0.0730	0.1238	0.1620	-0.0058	-0.0002
0.150	0.080	0.153	0.1337	0.0801	0.1251	0.1695	-0.0079	-0.0005
0.200	0.107	0.204	0.1401	0.0858	0.1274	0.1767	-0.0096	-0.0003
0.250	0.133	0.255	0.1462	0.0899	0.1320	0.1840	-0.0110	-0.0006
0.300	0.160	0.306	0.1517	0.0885	0.1312	0.1857	-0.0115	-0.0003
0.400	0.213	0.408	0.1601	0.0890	0.1325	0.1908	-0.0135	-0.0003
0.500	0.267	0.510	0.1614	0.0833	0.1370	0.1908	-0.0134	-0.0014
0.600	0.320	0.612	0.1555	0.0815	0.1305	0.1838	-0.0121	-0.0007
0.700	0.373	0.714	0.1417	0.0753	0.1192	0.1681	-0.0098	-0.0010
0.800	0.427	0.816	0.1207	0.0669	0.0951	0.1413	-0.0060	-0.0006
0.900	0.480	0.918	0.0982	0.0608	0.0762	0.1176	-0.0024	-0.0005
1.000	0.533	1.020	0.0889	0.0636	0.0755	0.1140	0.0005	-0.0007

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00154

TABLE A15-31

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.179	0.220	9.51	0.175	10.51	0.218	0.211	9.35	0.506
0.100	0.177	0.225	9.54	0.171	10.53	0.218	0.216	9.43	0.576
0.150	0.177	0.233	9.61	0.168	10.55	0.219	0.215	9.49	0.613
0.200	0.175	0.240	9.61	0.168	10.57	0.220	0.221	9.53	0.642
0.300	0.177	0.250	9.68	0.172	10.63	0.222	0.222	9.63	0.687
0.400	0.175	0.265	9.72	0.178	10.69	0.226	0.224	9.67	0.736
0.500	0.176	0.270	9.77	0.181	10.75	0.228	0.230	9.72	0.790
0.600	0.174	0.280	9.84	0.183	10.80	0.229	0.227	9.80	0.845
0.700	0.170	0.270	9.89	0.182	10.87	0.226	0.222	9.88	0.904
0.800	0.167	0.263	9.95	0.177	10.93	0.220	0.216	9.98	0.953
0.900	0.165	0.250	10.02	0.168	11.00	0.208	0.206	10.01	0.983
1.000	0.160	0.230	10.05	0.154	11.06	0.189	0.188	10.03	1.000
1.100	0.155	0.200	10.09	0.139	11.10	0.173	0.171	10.06	0.982
1.200	0.155	0.172	10.12	0.127	11.13	0.160	0.158	10.09	0.943
1.300	0.165	0.150	10.09	0.124	11.11	0.158	0.158	10.08	0.895

VOA = 7.97 VOLTS VOC = 8.97 VOLTS VOD = 7.94 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.040	0.1239	0.0721	0.1112	0.1536	-0.0042	0.0009
0.100	0.053	0.079	0.1363	0.0873	0.1209	0.1722	-0.0062	0.0003
0.150	0.080	0.119	0.1409	0.0935	0.1228	0.1786	-0.0077	0.0006
0.200	0.107	0.159	0.1456	0.1055	0.1287	0.1899	-0.0099	-0.0002
0.300	0.160	0.238	0.1544	0.1123	0.1237	0.1952	-0.0121	0.0000
0.400	0.213	0.317	0.1660	0.1246	0.1291	0.2098	-0.0169	0.0006
0.500	0.267	0.397	0.1754	0.1334	0.1389	0.2238	-0.0196	-0.0014
0.600	0.320	0.476	0.1848	0.1415	0.1350	0.2307	-0.0240	-0.0015
0.700	0.373	0.556	0.1900	0.1388	0.1322	0.2305	-0.0239	0.0010
0.800	0.427	0.635	0.1889	0.1406	0.1256	0.2276	-0.0236	0.0009
0.900	0.480	0.714	0.1792	0.1381	0.1263	0.2218	-0.0201	0.0005
1.000	0.533	0.794	0.1625	0.1369	0.1189	0.2092	-0.0157	0.0002
1.100	0.587	0.873	0.1421	0.1183	0.1074	0.1839	-0.0085	0.0004
1.200	0.640	0.952	0.1230	0.1035	0.0962	0.1613	-0.0027	0.0003
1.300	0.693	1.032	0.1148	0.0941	0.0931	0.1510	0.0021	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00241

TABLE A15-32

DIFFUSER NON DIMENSIONAL LENGTH = 7.5

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.161	0.190	9.65	0.151	10.63	0.188	0.201	9.54	0.660
0.100	0.158	0.191	9.75	0.151	10.71	0.182	0.200	9.60	0.727
0.150	0.156	0.195	9.79	0.151	10.75	0.180	0.200	9.64	0.760
0.200	0.154	0.199	9.81	0.151	10.79	0.179	0.200	9.67	0.785
0.300	0.154	0.206	9.86	0.150	10.84	0.177	0.200	9.72	0.825
0.400	0.151	0.210	9.89	0.149	10.89	0.175	0.198	9.78	0.858
0.500	0.147	0.207	9.91	0.147	10.92	0.172	0.195	9.82	0.890
0.600	0.146	0.200	9.96	0.144	10.95	0.168	0.190	9.87	0.916
0.700	0.144	0.195	9.98	0.141	10.99	0.164	0.184	9.90	0.941
0.800	0.140	0.180	10.01	0.135	11.02	0.157	0.176	9.93	0.963
0.900	0.139	0.165	10.04	0.129	11.05	0.148	0.166	9.96	0.982
1.000	0.137	0.150	10.06	0.121	11.09	0.141	0.156	9.98	1.000
1.100	0.138	0.135	10.06	0.113	11.09	0.136	0.147	9.99	0.993

VOA = 7.96 VOLTS VOC = 8.96 VOLTS VOD = 7.95 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.047	0.1295	0.0765	0.1195	0.1628	-0.0037	-0.0021
0.100	0.053	0.093	0.1366	0.0769	0.1237	0.1686	-0.0046	-0.0032
0.150	0.080	0.140	0.1397	0.0816	0.1251	0.1732	-0.0057	-0.0037
0.200	0.107	0.187	0.1416	0.0879	0.1269	0.1782	-0.0070	-0.0040
0.300	0.160	0.280	0.1442	0.0988	0.1293	0.1862	-0.0086	-0.0046
0.400	0.213	0.374	0.1453	0.1059	0.1274	0.1893	-0.0103	-0.0046
0.500	0.267	0.467	0.1465	0.1076	0.1263	0.1902	-0.0109	-0.0047
0.600	0.320	0.561	0.1455	0.1030	0.1215	0.1850	-0.0097	-0.0044
0.700	0.373	0.654	0.1440	0.1041	0.1187	0.1834	-0.0093	-0.0040
0.800	0.427	0.748	0.1391	0.0956	0.1146	0.1746	-0.0070	-0.0037
0.900	0.480	0.841	0.1339	0.0889	0.1062	0.1645	-0.0044	-0.0033
1.000	0.533	0.935	0.1257	0.0863	0.1039	0.1579	-0.0021	-0.0027
1.100	0.587	1.028	0.1165	0.0843	0.1000	0.1504	0.0005	-0.0018

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00359

TABLE A15-33 VALUES OF $\frac{1}{2U^2}(\overline{u'^2}+\overline{v'^2}+\overline{w'^2})$, $L/\Delta R_1 = 7.5$ DIFFUSER, INNER WALL LAYER

ins. X / R−Ri	−3.0	1.25	2.20	3.15	4.1	5.05	6 00	7.35
0 025	/	/	/	0 0116	/	0.0145	/	/ .
0 05	0 0061	0.0099	0 0131	0 0132	0.0144	0 0166	0 0157	0.0137
0.10	0.0051	0 0091	0 0134	0.0143	0.0165	0.0180	0 0184	0.0152
0.15	0 0045	0 0079	0.0116	0.0131	0.0176	0.0188	0 0197	0.0168
0.20	0.0038	0.0062	0.0101	0.0129	0.0169	0.0187	0.0199	0.0179
0.25	0.0032	0 0055	0.0086	0.0121	0.0161	0.0187	0.0202	0 0183
0.30	0.0026	0.0045	0.0070	0.0103	0.0139	0 0180	0.0187	0.0183
0.35	0.0022	0.0038	0.0059	0.0086	0.0120	0.0161	0 0172	0.0175
0.40	0.0016	0.0031	0.0049	0.0065	0.0103	0.0137	0.0157	0.0172
0 45	0.0014	0.0026	0.0041	0 0055	0.0084	0.0116	0.0134	0.0161
0.50	0.0014	0.0021	0.0031	0.0043	0.0070	0.0100	0.0116	0.0146
0 55		0.0018	0.0025	0.0032	0.0058	0.0079	0.0106	0.0130
0 60		0.0017	0.0021	0 0026	0.0046	0.0062	0 0080	0.0110
0.65			0.0019	0.0023	0.0039	0.0050	0.0067	0.0092
0.70				0.0023	0.0033	0.0041	0 0055	0.0078
0.75					0.0031	0.0034	0.0046	0 0073
0.80						0.0033	0 0039	0.0071
0.85							0.0039	0.0077
0.90								0.0084

TABLE A15-34 VALUES OF $\frac{1}{2U^2}(\overline{u'^2}+\overline{v'^2}+\overline{w'^2})$, $L/\Delta R_1 = 7.5$ DIFFUSER, OUTER WALL LAYER

ins. X / $R_o - R$	-3.0	1.25	2.20	3.15	4.1	5 05	6 00	7.35
0.025	/	0.0137	0 0094	0 0104	0.0087	0.0115	0. 0105	/
0 050	/	0 0148	0. 0114	0 0128	0.0112	0 0128	0 0121	0.0096
0 065	0 0051	/	/	/	/	/	/	/
0.075	0 0047	0 0119	0 0114	0. 0138	0.0128	0 0138	/	/
0.10	/	0 0099	0 0112	0.0145	0.0145	0.0153	0.0141	0.0111
0 125	0.0046	0.0083	0.0102	0.0155	/	/	/	/
0 150	/	0.0073	0.0092	0.0150	0.0176	0 0172	0.0157	0 0140
0.175	0 0040	0 0068	0.0088	0.0142	/	/	/	/
0 20	0.0038	0 0062	0 0079	0 0138	0.0175	0 0186	0.0176	0.0158
0.25	0 0033	0 0053	0 0059	0.0108	0.0167	0 0184	0 0189	0 0172
0.30	0 0026	0.0051	0.0054	0 0087	0 0139	0 0174	0.0186	0.0185
0.35	0.0020	0.0039	0 0043	0.0071	0.0123	0 0159	0 0173	/
0.40	0 0017	0 0033	0.0038	0.0058	0 0103	0 0136	0 0172	0 0239
045	0 0014	0 0027	0.0032	0 0048	0.0082	0 0113	0.0158	/
0 50	0 0013	0 0024	0.0025	0.0038	0 0065	0.0087	0.0138	0.0228
0 55		0 0019	0.0021	0.0031	0 0053	0 0066	0.0115	/
0.60		0 0017	0.0017	0.0026	0.0042	0.0051	0.0089	0.0212
0.65			0 0017	0 0018	0.0035	0.0041	0.0064	/
0 70				0.0018	0.0031	0 0034	0 0049	0.0186
0 75					0.0029	0.0033	0.0045	/
0.80						0.0034	0.0039	0.0142
0 85							0.0035	/
0.90							0 0032	0.0101
1.00								0.0076

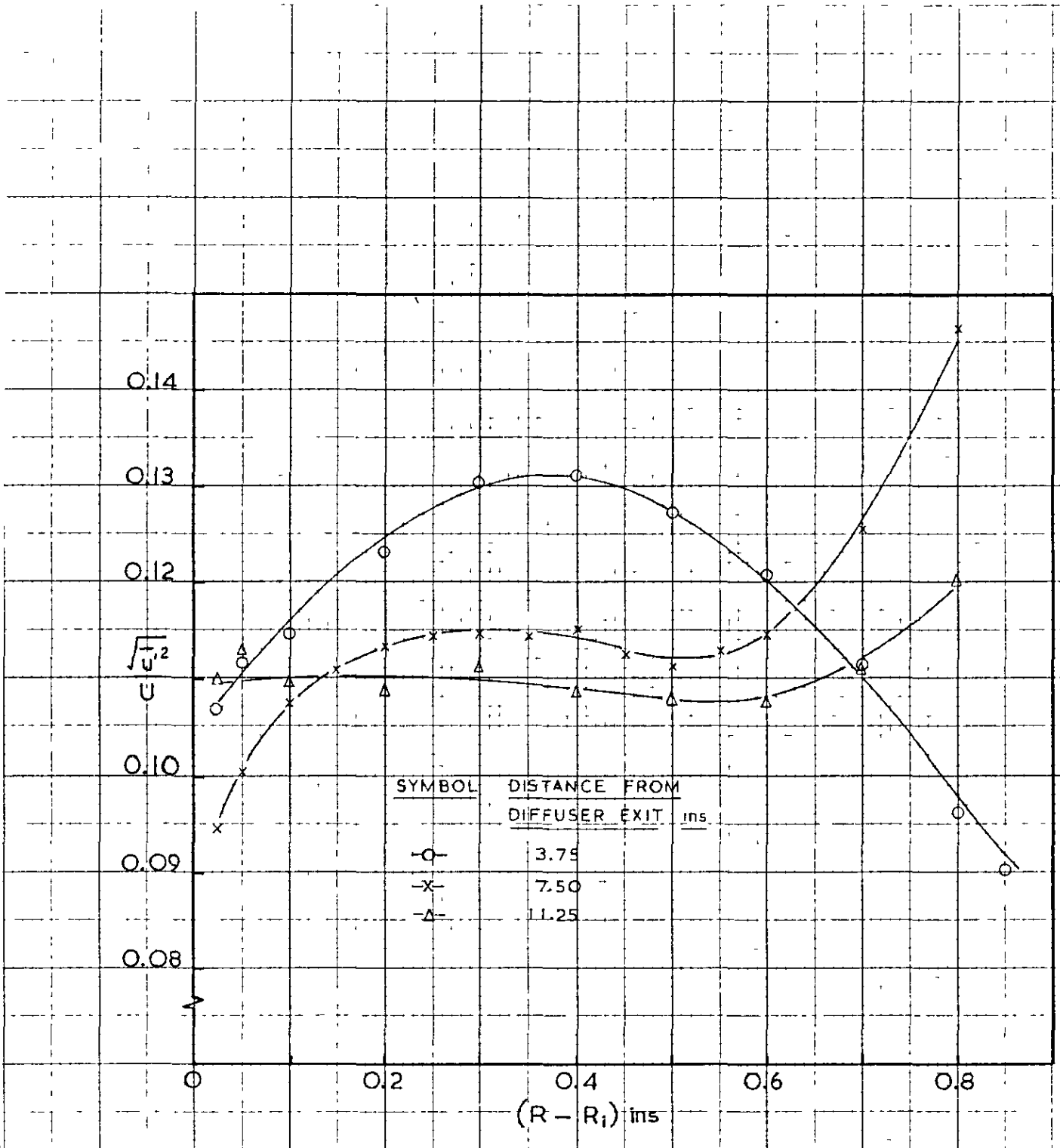


FIG.A15-1 LONGITUDINAL TURBULENCE INTENSITY DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_i = 7.5$ INNER WALL

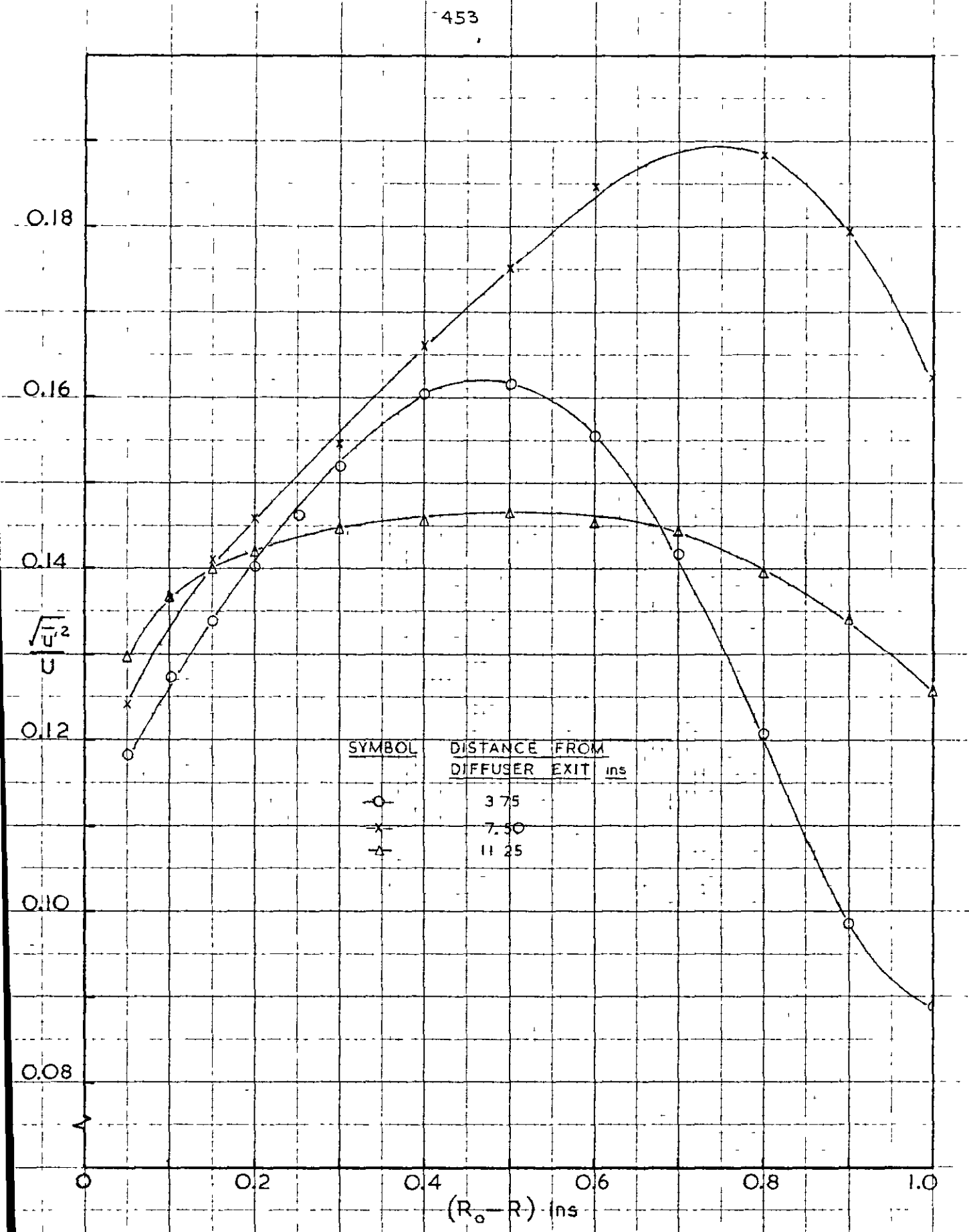


FIG. A15-2 LONGITUDINAL TURBULENCE INTENSITY DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_1 = 7.5$ OUTER WALL

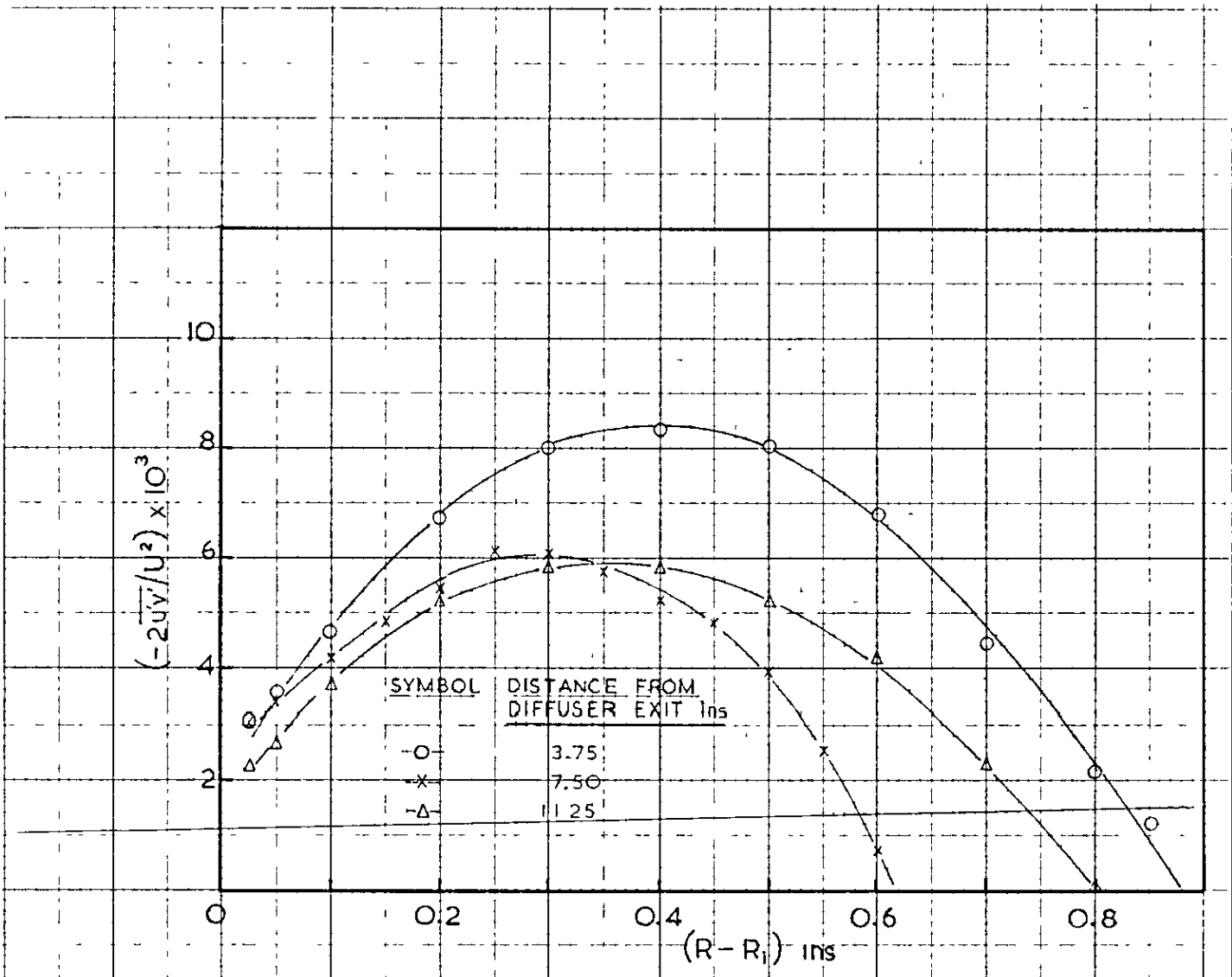


FIG. A15-3 EXPERIMENTAL SHEAR STRESS DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_1 = 7.5$ INNER WALL

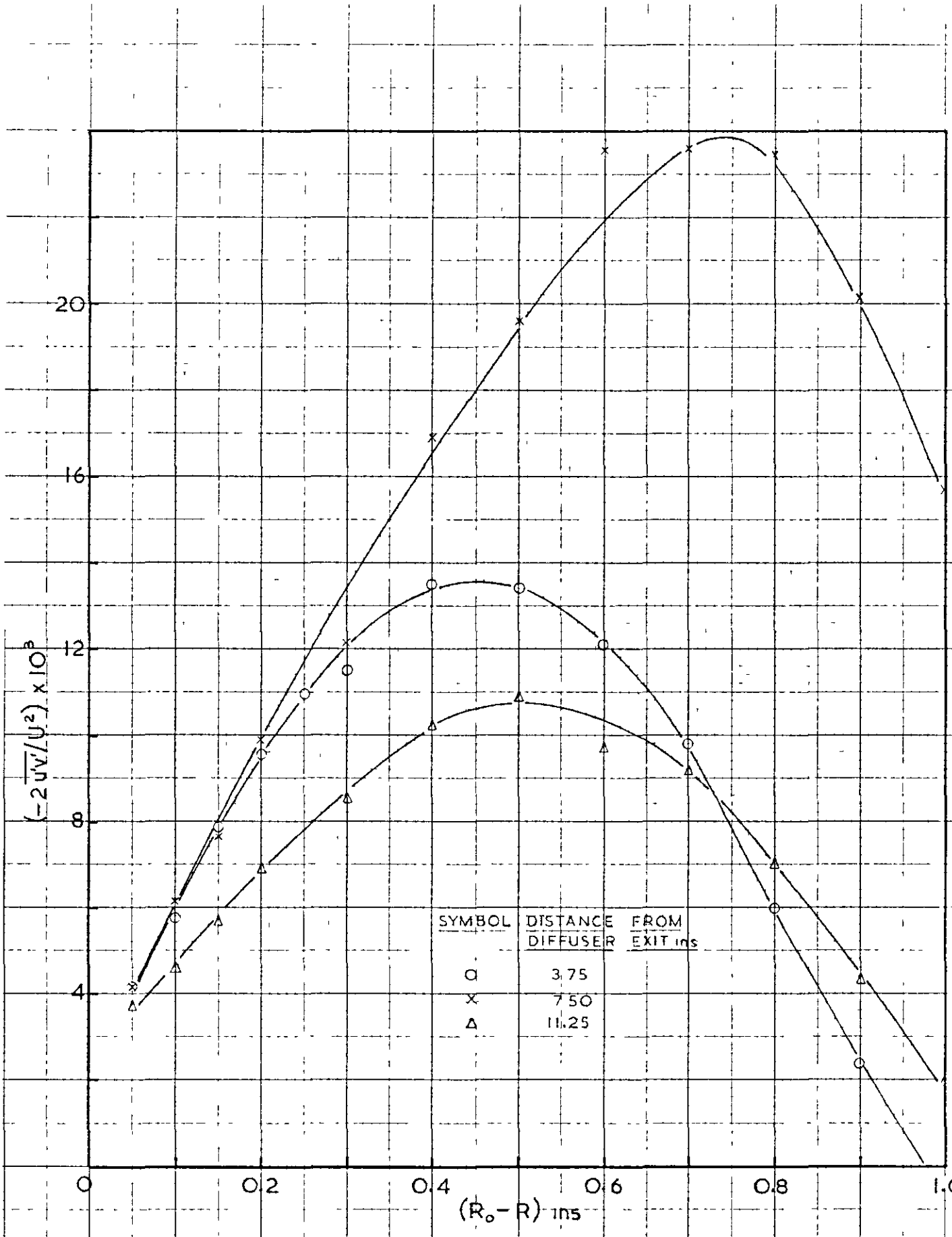


FIG.A15-4 EXPERIMENTAL SHEAR STRESS DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_i = 7.5$ OUTER WALL

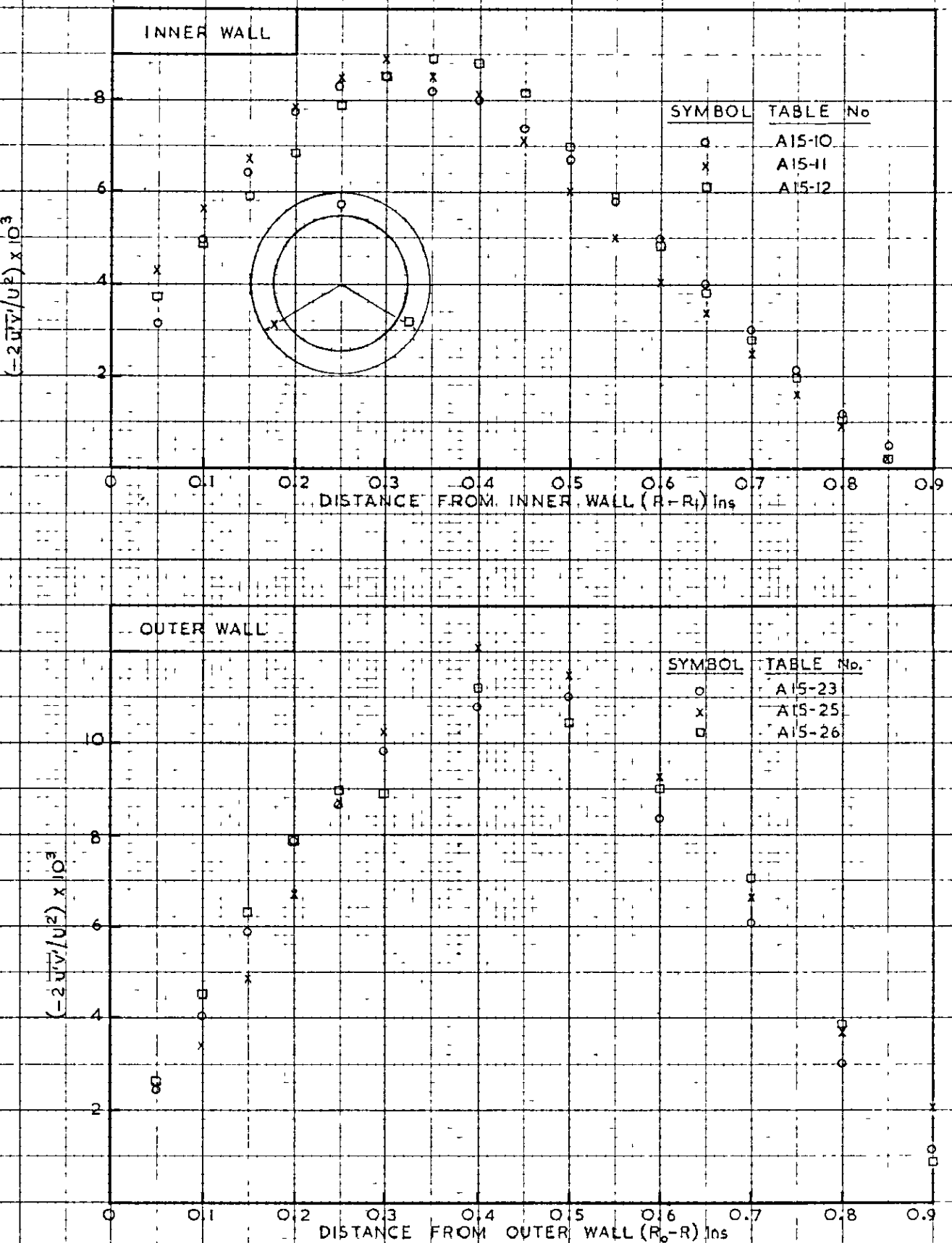


FIG. A15-5 DISTRIBUTION OF TURBULENT SHEAR STRESS ALONG THREE EQUALLY SPACED RADII AT OUTLET OF THE $L/\Delta R_i = 7.5$ DIFFUSER

Appendix 16

Turbulence Data

$L/\Delta R_1 = 10$ Diffuser

TABLE A16- 1

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.300

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.030	0.125	0.168	10.74	0.124	11.43	0.145	0.147	12.66	0.670
0.040	0.121	0.164	10.79	0.118	11.48	0.140	0.142	12.72	0.705
0.090	0.107	0.149	10.95	0.105	11.62	0.123	0.125	12.87	0.810
0.140	0.094	0.133	11.02	0.092	11.68	0.108	0.110	12.93	0.865
0.190	0.084	0.119	11.07	0.081	11.73	0.096	0.096	12.99	0.904
0.240	0.074	0.105	11.11	0.070	11.77	0.085	0.086	13.03	0.935
0.290	0.066	0.093	11.14	0.060	11.80	0.075	0.076	13.06	0.958
0.340	0.060	0.081	11.16	0.053	11.82	0.066	0.067	13.08	0.977
0.390	0.057	0.070	11.18	0.047	11.84	0.058	0.059	13.10	0.990
0.440	0.055	0.061	11.20	0.042	11.84	0.051	0.052	13.11	0.998
0.490	0.056	0.057	11.20	0.040	11.84	0.050	0.048	13.11	1.000

VOA = 8.24 VOLTS VOC = 8.95 VOLTS VOD = 10.34 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.030	0.030	0.063	0.0752	0.0490	0.0544	0.0893	-0.0023	-0.0001
0.040	0.040	0.084	0.0740	0.0517	0.0549	0.0903	-0.0024	-0.0001
0.090	0.090	0.189	0.0720	0.0517	0.0507	0.0872	-0.0025	-0.0001
0.140	0.140	0.295	0.0659	0.0488	0.0469	0.0808	-0.0022	-0.0001
0.190	0.190	0.400	0.0597	0.0461	0.0419	0.0738	-0.0019	0.0000
0.240	0.240	0.505	0.0528	0.0427	0.0401	0.0678	-0.0016	-0.0001
0.290	0.290	0.611	0.0459	0.0406	0.0376	0.0621	-0.0012	-0.0000
0.340	0.340	0.716	0.0411	0.0363	0.0334	0.0554	-0.0009	-0.0000
0.390	0.390	0.821	0.0367	0.0332	0.0292	0.0495	-0.0005	-0.0000
0.440	0.440	0.926	0.0330	0.0308	0.0252	0.0445	-0.0002	-0.0000
0.490	0.490	1.032	0.0315	0.0308	0.0240	0.0431	-0.0000	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00379

TABLE A16- 2

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 1.000 INS. N.D.DIST.(X/L)= 0.100

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.122	0.169	10.20	0.155	11.11	0.160	0.162	10.19	0.595
0.050	0.114	0.153	10.31	0.139	11.22	0.149	0.150	10.30	0.670
0.100	0.100	0.135	10.44	0.120	11.35	0.128	0.126	10.40	0.765
0.150	0.088	0.120	10.51	0.105	11.42	0.112	0.110	10.48	0.820
0.200	0.068	0.105	10.56	0.092	11.47	0.100	0.100	10.52	0.860
0.250	0.069	0.093	10.60	0.082	11.51	0.087	0.086	10.55	0.893
0.300	0.061	0.082	10.63	0.071	11.55	0.079	0.075	10.59	0.922
0.350	0.054	0.072	10.65	0.062	11.57	0.069	0.066	10.62	0.945
0.400	0.049	0.063	10.68	0.054	11.59	0.060	0.059	10.63	0.965
0.450	0.045	0.055	10.70	0.047	11.61	0.053	0.052	10.66	0.983
0.500	0.045	0.048	10.71	0.042	11.63	0.048	0.047	10.67	0.993
0.550	0.049	0.044	10.71	0.042	11.63	0.048	0.047	10.66	1.000

VOA = 8.43 VOLTS VOC = 8.86 VOLTS VOD = 8.51 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.023	0.048	0.0913	0.0589	0.0844	0.1173	-0.0037	-0.0002
0.050	0.046	0.095	0.0880	0.0587	0.0853	0.1160	-0.0032	-0.0001
0.100	0.092	0.190	0.0828	0.0561	0.0770	0.1080	-0.0029	0.0002
0.150	0.138	0.286	0.0757	0.0527	0.0684	0.0984	-0.0026	0.0002
0.200	0.184	0.381	0.0684	0.0405	0.0654	0.0871	-0.0026	0.0000
0.250	0.230	0.476	0.0624	0.0419	0.0559	0.0801	-0.0016	0.0001
0.300	0.276	0.571	0.0552	0.0390	0.0519	0.0730	-0.0013	0.0003
0.350	0.322	0.667	0.0490	0.0354	0.0460	0.0651	-0.0010	0.0002
0.400	0.368	0.762	0.0432	0.0327	0.0419	0.0589	-0.0007	0.0001
0.450	0.414	0.857	0.0381	0.0303	0.0375	0.0529	-0.0005	0.0001
0.500	0.460	0.952	0.0342	0.0298	0.0346	0.0493	-0.0001	0.0000
0.550	0.506	1.048	0.0344	0.0302	0.0351	0.0499	0.0002	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00342

TABLE A16- 3

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 2.250 INS. N.D.DIST.(X/L)= 0.225

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EF	VD	U UMAX
				(VOLTS)					
0.025	0.150	0.200	10.25	0.180	10.90	0.177	0.177	10.08	0.510
0.050	0.144	0.180	10.40	0.168	11.07	0.165	0.167	10.24	0.610
0.100	0.130	0.165	10.50	0.150	11.18	0.148	0.150	10.34	0.680
0.150	0.116	0.145	10.61	0.132	11.28	0.130	0.132	10.42	0.750
0.200	0.102	0.129	10.68	0.117	11.35	0.115	0.119	10.49	0.800
0.250	0.089	0.117	10.72	0.105	11.41	0.102	0.106	10.54	0.842
0.300	0.079	0.102	10.76	0.091	11.45	0.090	0.092	10.57	0.870
0.350	0.069	0.090	10.80	0.080	11.48	0.080	0.082	10.60	0.908
0.400	0.062	0.080	10.83	0.070	11.51	0.069	0.070	10.63	0.935
0.450	0.056	0.069	10.85	0.062	11.53	0.061	0.063	10.65	0.957
0.500	0.050	0.060	10.86	0.056	11.55	0.054	0.057	10.66	0.975
0.550	0.048	0.054	10.88	0.049	11.56	0.051	0.052	10.68	0.990
0.600	0.050	0.050	10.89	0.048	11.57	0.050	0.052	10.68	1.000

VOA = 8.60 VOLTS VOC = 8.86 VOLTS VOD = 8.56 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.021	0.042	0.0993	0.0657	0.0815	0.1232	-0.0040	0.0000
0.050	0.042	0.083	0.1029	0.0633	0.0816	0.1239	-0.0032	-0.0002
0.100	0.084	0.167	0.0983	0.0631	0.0766	0.1189	-0.0032	-0.0002
0.150	0.125	0.250	0.0916	0.0580	0.0712	0.1104	-0.0026	-0.0002
0.200	0.167	0.333	0.0843	0.0523	0.0656	0.1011	-0.0023	-0.0004
0.250	0.209	0.417	0.0781	0.0477	0.0587	0.0922	-0.0022	-0.0004
0.300	0.251	0.500	0.0690	0.0436	0.0530	0.0828	-0.0017	-0.0002
0.350	0.292	0.583	0.0626	0.0388	0.0495	0.0754	-0.0014	-0.0002
0.400	0.334	0.667	0.0558	0.0369	0.0415	0.0671	-0.0011	-0.0001
0.450	0.376	0.750	0.0502	0.0322	0.0380	0.0602	-0.0007	-0.0001
0.500	0.418	0.833	0.0459	0.0267	0.0340	0.0533	-0.0005	-0.0002
0.550	0.459	0.917	0.0406	0.0285	0.0346	0.0519	-0.0003	-0.0001
0.600	0.501	1.000	0.0401	0.0279	0.0353	0.0517	0.0000	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00273

TABLE A16- 4

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 3.250 INS. N.D.DIST.(X/L)= 0.325

INNER WALL BLUF POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.180	0.225	11.19	0.206	10.77	0.187	0.191	10.37	0.460
0.050	0.173	0.225	11.30	0.194	10.90	0.176	0.178	10.50	0.527
0.100	0.158	0.214	11.43	0.171	11.05	0.165	0.168	10.61	0.619
0.150	0.145	0.193	11.53	0.155	11.15	0.150	0.154	10.71	0.690
0.200	0.132	0.173	11.61	0.138	11.23	0.136	0.139	10.79	0.750
0.250	0.120	0.156	11.66	0.125	11.30	0.121	0.124	10.85	0.797
0.300	0.107	0.138	11.72	0.111	11.36	0.109	0.111	10.90	0.840
0.350	0.095	0.123	11.76	0.096	11.41	0.094	0.096	10.94	0.884
0.400	0.084	0.111	11.79	0.084	11.45	0.084	0.086	10.97	0.907
0.450	0.075	0.098	11.82	0.074	11.47	0.072	0.076	10.99	0.933
0.500	0.066	0.086	11.84	0.066	11.50	0.065	0.067	11.00	0.956
0.550	0.062	0.075	11.88	0.058	11.53	0.058	0.060	11.01	0.987
0.600	0.058	0.066	11.88	0.053	11.54	0.055	0.055	11.02	0.990
0.650	0.058	0.061	11.89	0.052	11.55	0.055	0.055	11.02	0.995
0.700	0.060	0.061	11.89	0.055	11.55	0.059	0.059	11.02	1.000

VOA = 9.54 VOLTS VOC = 8.86 VOLTS VOD = 9.00 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.019	0.036	0.1086	0.0564	0.0817	0.1233	-0.0033	-0.0004
0.050	0.039	0.072	0.1106	0.0689	0.0755	0.1275	-0.0044	-0.0002
0.200	0.156	0.290	0.0975	0.0740	0.0793	0.1254	-0.0040	-0.0003
0.100	0.078	0.145	0.1075	0.0802	0.0874	0.1376	-0.0053	-0.0003
0.150	0.117	0.217	0.1040	0.0771	0.0835	0.1322	-0.0047	-0.0005
0.250	0.195	0.362	0.0915	0.0696	0.0703	0.1157	-0.0034	-0.0003
0.300	0.234	0.435	0.0839	0.0632	0.0657	0.1064	-0.0027	-0.0002
0.350	0.273	0.507	0.0749	0.0608	0.0584	0.0971	-0.0024	-0.0002
0.400	0.312	0.580	0.0664	0.0573	0.0546	0.0892	-0.0021	-0.0002
0.450	0.350	0.652	0.0597	0.0519	0.0476	0.0796	-0.0016	-0.0003
0.500	0.389	0.725	0.0540	0.0452	0.0436	0.0714	-0.0013	-0.0001
0.550	0.428	0.797	0.0485	0.0425	0.0415	0.0662	-0.0008	-0.0001
0.600	0.467	0.870	0.0443	0.0378	0.0394	0.0608	-0.0004	0.0000
0.650	0.506	0.942	0.0436	0.0351	0.0407	0.0597	-0.0002	0.0000
0.700	0.545	1.014	0.0464	0.0335	0.0446	0.0622	-0.0001	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00262

TABLE A16- 5

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)= 0.425

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.172	0.229	11.27	0.185	10.75	0.213	0.220	10.95	0.510
0.100	0.162	0.224	11.44	0.176	10.90	0.206	0.210	11.10	0.600
0.150	0.152	0.211	11.53	0.165	11.01	0.185	0.190	11.20	0.670
0.200	0.141	0.193	11.63	0.150	11.09	0.172	0.176	11.28	0.728
0.250	0.130	0.172	11.71	0.138	11.17	0.155	0.160	11.35	0.780
0.300	0.118	0.155	11.77	0.122	11.22	0.138	0.141	11.41	0.827
0.350	0.105	0.140	11.81	0.108	11.28	0.125	0.127	11.47	0.870
0.400	0.094	0.125	11.86	0.096	11.33	0.110	0.114	11.51	0.902
0.450	0.084	0.111	11.89	0.084	11.36	0.098	0.100	11.54	0.935
0.500	0.076	0.097	11.93	0.074	11.39	0.085	0.088	11.58	0.958
0.550	0.069	0.085	11.95	0.064	11.41	0.074	0.076	11.60	0.977
0.600	0.062	0.074	11.96	0.058	11.43	0.067	0.067	11.61	0.990
0.650	0.060	0.066	11.97	0.054	11.44	0.062	0.062	11.62	0.998
0.700	0.061	0.063	11.97	0.058	11.45	0.062	0.062	11.62	1.000
0.750	0.067	0.063	11.96	0.058	11.45	0.067	0.065	11.62	0.999

VOA = 9.60 VOLTS VOC = 8.90 VOLTS VOD = 9.54 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.036	0.069	0.1115	0.0736	0.1249	0.1550	-0.0050	-0.0009
0.100	0.073	0.138	0.1163	0.0753	0.1269	0.1592	-0.0060	-0.0006
0.150	0.109	0.207	0.1159	0.0770	0.1153	0.1541	-0.0061	-0.0007
0.200	0.146	0.276	0.1106	0.0733	0.1125	0.1482	-0.0054	-0.0006
0.250	0.182	0.345	0.1057	0.0647	0.1029	0.1367	-0.0042	-0.0007
0.300	0.219	0.414	0.0968	0.0634	0.0932	0.1267	-0.0036	-0.0004
0.350	0.255	0.483	0.0882	0.0617	0.0872	0.1186	-0.0032	-0.0002
0.400	0.292	0.552	0.0799	0.0562	0.0787	0.1074	-0.0026	-0.0004
0.450	0.328	0.621	0.0715	0.0530	0.0718	0.0982	-0.0022	-0.0002
0.500	0.364	0.690	0.0639	0.0472	0.0621	0.0866	-0.0015	-0.0003
0.550	0.401	0.759	0.0559	0.0446	0.0545	0.0775	-0.0011	-0.0002
0.600	0.437	0.828	0.0510	0.0380	0.0485	0.0687	-0.0007	0.0000
0.650	0.474	0.897	0.0477	0.0348	0.0446	0.0636	-0.0003	0.0000
0.700	0.510	0.966	0.0513	0.0274	0.0407	0.0597	-0.0001	0.0000
0.750	0.547	1.034	0.0512	0.0332	0.0472	0.0658	0.0002	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00236

TABLE A16- 6

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)= 0.425

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.176	0.228	10.84	0.185	10.75	0.213	0.220	10.95	0.510
0.100	0.164	0.222	10.99	0.176	10.90	0.206	0.210	11.10	0.600
0.150	0.154	0.212	11.10	0.165	11.01	0.185	0.190	11.20	0.670
0.200	0.143	0.197	11.19	0.150	11.09	0.172	0.176	11.28	0.728
0.250	0.132	0.180	11.26	0.138	11.17	0.155	0.160	11.35	0.780
0.300	0.121	0.163	11.32	0.122	11.22	0.138	0.141	11.41	0.827
0.350	0.110	0.147	11.38	0.108	11.28	0.125	0.127	11.47	0.870
0.400	0.101	0.132	11.41	0.096	11.33	0.110	0.114	11.51	0.902
0.450	0.092	0.120	11.43	0.084	11.36	0.098	0.100	11.54	0.935
0.500	0.083	0.108	11.46	0.074	11.39	0.085	0.088	11.58	0.958
0.550	0.075	0.097	11.48	0.064	11.41	0.074	0.076	11.60	0.977
0.600	0.069	0.087	11.50	0.058	11.43	0.067	0.067	11.61	0.990
0.650	0.064	0.077	11.51	0.054	11.44	0.062	0.062	11.62	0.998
0.700	0.062	0.069	11.51	0.058	11.45	0.062	0.062	11.62	1.000
0.750	0.063	0.063	11.51	0.058	11.45	0.067	0.065	11.62	0.999

VOA = 9.29 VOLTS VOC = 8.90 VOLTS VOD = 9.54 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.036	0.069	0.1115	0.0917	0.1249	0.1640	-0.0053	-0.0009
0.100	0.073	0.138	0.1163	0.0935	0.1269	0.1683	-0.0065	-0.0006
0.150	0.109	0.207	0.1159	0.0937	0.1153	0.1624	-0.0069	-0.0007
0.200	0.146	0.276	0.1106	0.0925	0.1125	0.1578	-0.0064	-0.0006
0.250	0.182	0.345	0.1057	0.0871	0.1029	0.1478	-0.0056	-0.0007
0.300	0.219	0.414	0.0968	0.0842	0.0932	0.1371	-0.0048	-0.0004
0.350	0.255	0.483	0.0882	0.0796	0.0872	0.1275	-0.0040	-0.0002
0.400	0.292	0.552	0.0799	0.0756	0.0787	0.1171	-0.0032	-0.0004
0.450	0.328	0.621	0.0715	0.0741	0.0718	0.1087	-0.0028	-0.0002
0.500	0.364	0.690	0.0639	0.0687	0.0621	0.0974	-0.0023	-0.0003
0.550	0.401	0.759	0.0559	0.0647	0.0545	0.0876	-0.0018	-0.0002
0.600	0.437	0.828	0.0510	0.0587	0.0485	0.0791	-0.0014	0.0000
0.650	0.474	0.897	0.0477	0.0518	0.0446	0.0721	-0.0009	0.0000
0.700	0.510	0.966	0.0513	0.0406	0.0407	0.0663	-0.0005	0.0000
0.750	0.547	1.034	0.0512	0.0362	0.0472	0.0673	0.0000	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00236

TABLE A16- 7

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)= 0.425

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.190	0.250	9.02	0.185	10.75	0.213	0.220	10.95	0.510
0.100	0.178	0.244	9.18	0.176	10.90	0.206	0.210	11.10	0.600
0.150	0.170	0.233	9.31	0.165	11.01	0.185	0.190	11.20	0.670
0.200	0.157	0.218	9.41	0.150	11.09	0.172	0.176	11.28	0.728
0.250	0.148	0.200	9.47	0.138	11.17	0.155	0.160	11.35	0.780
0.300	0.135	0.180	9.55	0.122	11.22	0.138	0.141	11.41	0.827
0.350	0.122	0.163	9.60	0.108	11.28	0.125	0.127	11.47	0.870
0.400	0.111	0.147	9.65	0.096	11.33	0.110	0.114	11.51	0.902
0.450	0.102	0.132	9.67	0.084	11.36	0.098	0.100	11.54	0.935
0.500	0.094	0.118	9.71	0.074	11.39	0.085	0.088	11.58	0.958
0.550	0.085	0.105	9.72	0.064	11.41	0.074	0.076	11.60	0.977
0.600	0.076	0.094	9.75	0.058	11.43	0.067	0.067	11.61	0.990
0.650	0.071	0.083	9.76	0.054	11.44	0.062	0.062	11.62	0.998
0.700	0.066	0.075	9.77	0.058	11.45	0.062	0.062	11.62	1.000
0.750	0.067	0.070	9.78	0.058	11.45	0.067	0.065	11.62	0.999

VOA = 7.31 VOLTS VOC = 8.90 VOLTS VOD = 9.54 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.036	0.069	0.1115	0.0947	0.1249	0.1656	-0.0057	-0.0009
0.100	0.073	0.138	0.1163	0.0988	0.1269	0.1710	-0.0071	-0.0006
0.150	0.109	0.207	0.1159	0.0999	0.1153	0.1656	-0.0072	-0.0007
0.200	0.146	0.276	0.1106	0.0987	0.1125	0.1609	-0.0070	-0.0006
0.250	0.182	0.345	0.1057	0.0969	0.1029	0.1528	-0.0060	-0.0007
0.300	0.219	0.414	0.0968	0.0913	0.0932	0.1407	-0.0050	-0.0004
0.350	0.255	0.483	0.0882	0.0875	0.0872	0.1314	-0.0043	-0.0002
0.400	0.292	0.552	0.0799	0.0817	0.0787	0.1202	-0.0036	-0.0004
0.450	0.328	0.621	0.0715	0.0788	0.0718	0.1111	-0.0029	-0.0002
0.500	0.364	0.690	0.0639	0.0733	0.0621	0.0996	-0.0021	-0.0003
0.550	0.401	0.759	0.0559	0.0685	0.0545	0.0895	-0.0016	-0.0002
0.600	0.437	0.828	0.0510	0.0607	0.0485	0.0801	-0.0013	0.0000
0.650	0.474	0.897	0.0477	0.0539	0.0446	0.0731	-0.0008	0.0000
0.700	0.510	0.966	0.0513	0.0411	0.0407	0.0665	-0.0005	0.0000
0.750	0.547	1.034	0.0512	0.0374	0.0472	0.0679	-0.0002	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00236

TABLE A16- 8

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 5.450 INS. N.D.DIST.(X/L)= 0.545

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	FB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.167	0.220	11.22	0.209	10.73	0.220	0.215	11.55	0.475
0.100	0.159	0.220	11.33	0.195	10.87	0.212	0.205	11.67	0.550
0.150	0.150	0.213	11.42	0.181	10.97	0.201	0.193	11.77	0.615
0.200	0.140	0.200	11.50	0.168	11.06	0.190	0.182	11.85	0.670
0.250	0.130	0.185	11.57	0.156	11.14	0.175	0.170	11.92	0.723
0.300	0.120	0.170	11.63	0.144	11.22	0.160	0.158	11.99	0.775
0.350	0.111	0.153	11.69	0.132	11.28	0.144	0.142	12.04	0.822
0.400	0.100	0.137	11.74	0.119	11.34	0.130	0.128	12.10	0.865
0.450	0.091	0.121	11.78	0.106	11.38	0.115	0.115	12.14	0.902
0.500	0.081	0.107	11.82	0.092	11.42	0.100	0.102	12.18	0.934
0.550	0.073	0.093	11.84	0.082	11.45	0.089	0.088	12.21	0.960
0.600	0.065	0.082	11.86	0.070	11.48	0.079	0.078	12.23	0.980
0.650	0.060	0.072	11.87	0.064	11.49	0.071	0.070	12.24	0.994
0.700	0.062	0.065	11.89	0.059	11.50	0.067	0.066	12.25	1.000
0.750	0.062	0.062	11.89	0.058	11.50	0.066	0.066	12.25	0.996

VOA = 9.62 VOLTS VOC = 8.95 VOLTS VOD = 10.08 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.034	0.067	0.1214	0.0303	0.0883	0.1200	-0.0042	0.0005
0.100	0.068	0.133	0.1224	0.0531	0.0948	0.1351	-0.0056	0.0008
0.150	0.102	0.200	0.1212	0.0625	0.0958	0.1397	-0.0063	0.0010
0.200	0.135	0.267	0.1178	0.0642	0.0964	0.1392	-0.0062	0.0010
0.250	0.169	0.333	0.1142	0.0613	0.0924	0.1340	-0.0057	0.0006
0.300	0.203	0.400	0.1096	0.0583	0.0875	0.1277	-0.0052	0.0002
0.350	0.237	0.467	0.1039	0.0528	0.0790	0.1179	-0.0042	0.0002
0.400	0.271	0.533	0.0964	0.0478	0.0723	0.1083	-0.0035	0.0002
0.450	0.305	0.600	0.0880	0.0441	0.0661	0.0991	-0.0027	0.0000
0.500	0.339	0.667	0.0779	0.0431	0.0600	0.0905	-0.0022	-0.0002
0.550	0.372	0.733	0.0706	0.0371	0.0515	0.0796	-0.0015	0.0001
0.600	0.406	0.800	0.0609	0.0373	0.0494	0.0738	-0.0012	0.0001
0.650	0.440	0.867	0.0562	0.0317	0.0436	0.0658	-0.0008	0.0001
0.700	0.474	0.933	0.0520	0.0337	0.0426	0.0641	-0.0002	0.0001
0.750	0.508	1.000	0.0509	0.0322	0.0427	0.0629	0.0000	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00206

TABLE A16- 9

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 7.250 INS. N.D.DIST.(X/L)= 0.725

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.178	0.228	10.90	0.220	10.58	0.215	0.225	11.47	0.448
0.100	0.170	0.227	11.05	0.210	10.72	0.205	0.220	11.58	0.518
0.150	0.166	0.228	11.14	0.200	10.82	0.195	0.215	11.67	0.570
0.200	0.159	0.222	11.22	0.188	10.92	0.189	0.200	11.75	0.625
0.250	0.150	0.216	11.31	0.177	11.01	0.176	0.189	11.83	0.678
0.300	0.143	0.210	11.39	0.167	11.09	0.165	0.178	11.89	0.725
0.350	0.135	0.196	11.46	0.156	11.16	0.155	0.167	11.96	0.775
0.400	0.126	0.180	11.52	0.145	11.22	0.144	0.158	12.02	0.816
0.450	0.117	0.165	11.58	0.134	11.29	0.133	0.147	12.08	0.860
0.500	0.108	0.150	11.63	0.122	11.34	0.122	0.136	12.13	0.895
0.550	0.098	0.135	11.67	0.110	11.39	0.111	0.122	12.19	0.930
0.600	0.090	0.121	11.70	0.098	11.42	0.100	0.110	12.22	0.955
0.650	0.080	0.107	11.74	0.087	11.45	0.090	0.096	12.25	0.978
0.700	0.072	0.094	11.76	0.076	11.47	0.080	0.084	12.28	0.992
0.750	0.067	0.081	11.76	0.067	11.48	0.071	0.074	12.29	0.998
0.800	0.064	0.070	11.76	0.064	11.48	0.068	0.070	12.29	1.000
0.850	0.070	0.067	11.76	0.065	11.48	0.069	0.069	12.29	1.000

VOA = 9.62 VOLTS VOC = 8.95 VOLTS VOD = 10.08 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.031	0.061	0.1308	0.0777	0.0754	0.1420	-0.0056	-0.0010
0.100	0.061	0.121	0.1337	0.0800	0.0823	0.1480	-0.0068	-0.0017
0.150	0.092	0.182	0.1337	0.0897	0.0841	0.1537	-0.0080	-0.0024
0.200	0.122	0.242	0.1312	0.0949	0.0858	0.1560	-0.0084	-0.0014
0.250	0.153	0.303	0.1286	0.0967	0.0825	0.1539	-0.0090	-0.0017
0.300	0.183	0.364	0.1255	0.0988	0.0801	0.1522	-0.0093	-0.0017
0.350	0.214	0.424	0.1213	0.0953	0.0779	0.1472	-0.0085	-0.0015
0.400	0.245	0.485	0.1157	0.0876	0.0757	0.1396	-0.0072	-0.0018
0.450	0.275	0.545	0.1100	0.0823	0.0719	0.1321	-0.0062	-0.0017
0.500	0.306	0.606	0.1021	0.0764	0.0689	0.1237	-0.0052	-0.0016
0.550	0.336	0.667	0.0940	0.0699	0.0620	0.1129	-0.0042	-0.0012
0.600	0.367	0.727	0.0850	0.0654	0.0579	0.1041	-0.0033	-0.0010
0.650	0.398	0.788	0.0763	0.0580	0.0515	0.0929	-0.0026	-0.0005
0.700	0.428	0.848	0.0672	0.0530	0.0457	0.0829	-0.0019	-0.0003
0.750	0.459	0.909	0.0594	0.0478	0.0406	0.0739	-0.0011	-0.0002
0.800	0.489	0.970	0.0568	0.0388	0.0384	0.0670	-0.0004	-0.0001
0.850	0.520	1.030	0.0577	0.0401	0.0371	0.0675	0.0002	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00189

TABLE A16-10

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)= 0.985

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.164	0.212	12.32	0.200	10.28	0.230	0.225	8.54	0.415
0.100	0.162	0.217	12.41	0.183	10.38	0.222	0.220	8.56	0.475
0.150	0.160	0.221	12.46	0.178	10.44	0.222	0.218	8.72	0.515
0.200	0.157	0.223	12.51	0.175	10.50	0.222	0.215	8.79	0.556
0.250	0.153	0.223	12.57	0.168	10.57	0.218	0.210	8.87	0.600
0.300	0.149	0.220	12.62	0.162	10.63	0.213	0.205	8.92	0.640
0.350	0.144	0.216	12.66	0.150	10.68	0.205	0.196	8.98	0.680
0.400	0.140	0.208	12.70	0.140	10.72	0.195	0.187	9.03	0.718
0.450	0.132	0.195	12.75	0.130	10.78	0.183	0.176	9.09	0.760
0.500	0.126	0.181	12.79	0.120	10.82	0.172	0.165	9.14	0.796
0.550	0.120	0.167	12.83	0.112	10.87	0.160	0.153	9.19	0.835
0.600	0.114	0.153	12.87	0.105	10.91	0.147	0.142	9.24	0.873
0.650	0.106	0.140	12.91	0.100	10.95	0.135	0.130	9.28	0.910
0.700	0.100	0.128	12.94	0.092	10.99	0.120	0.118	9.32	0.940
0.750	0.092	0.116	12.96	0.089	11.02	0.108	0.105	9.34	0.965
0.800	0.088	0.105	12.98	0.084	11.04	0.096	0.093	9.37	0.987
0.850	0.084	0.094	13.00	0.080	11.00	0.088	0.084	9.38	0.977
0.900	0.086	0.085	13.00	0.080	11.00	0.082	0.081	9.38	1.000

VOA = 11.02 VOLTS VOC = 8.78 VOLTS VOD = 7.06 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.056	0.1197	0.0456	0.0754	0.1203	-0.0041	0.0004
0.100	0.054	0.111	0.1179	0.0730	0.1011	0.1460	-0.0055	0.0002
0.150	0.081	0.167	0.1200	0.0844	0.0942	0.1493	-0.0067	0.0004
0.200	0.107	0.222	0.1231	0.0903	0.0981	0.1558	-0.0079	0.0008
0.250	0.134	0.278	0.1231	0.0987	0.1015	0.1617	-0.0090	0.0010
0.300	0.161	0.333	0.1230	0.1034	0.1056	0.1660	-0.0096	0.0010
0.350	0.188	0.389	0.1180	0.1114	0.1088	0.1691	-0.0101	0.0012
0.400	0.215	0.444	0.1137	0.1152	0.1093	0.1691	-0.0099	0.0010
0.450	0.242	0.500	0.1089	0.1128	0.1069	0.1643	-0.0091	0.0009
0.500	0.269	0.556	0.1035	0.1094	0.1040	0.1585	-0.0079	0.0009
0.550	0.295	0.611	0.0989	0.1048	0.0990	0.1513	-0.0066	0.0009
0.600	0.322	0.667	0.0954	0.0987	0.0916	0.1429	-0.0054	0.0006
0.650	0.349	0.722	0.0929	0.0897	0.0827	0.1327	-0.0045	0.0006
0.700	0.376	0.778	0.0870	0.0849	0.0729	0.1224	-0.0036	0.0002
0.750	0.403	0.833	0.0854	0.0732	0.0584	0.1085	-0.0029	0.0003
0.800	0.430	0.889	0.0817	0.0667	0.0440	0.0962	-0.0019	0.0003
0.850	0.456	0.944	0.0783	0.0542	0.0284	0.0804	-0.0010	0.0003
0.900	0.483	1.000	0.0802	0.0481	0.0099	0.0691	0.0001	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00159

TABLE A16-11

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)= 0.985

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.172	0.223	12.29	0.200	10.28	0.181	0.174	9.10	0.415
0.100	0.171	0.229	12.37	0.183	10.38	0.181	0.174	9.23	0.475
0.150	0.169	0.234	12.43	0.178	10.44	0.180	0.173	9.28	0.515
0.200	0.166	0.237	12.48	0.175	10.50	0.180	0.172	9.34	0.556
0.250	0.162	0.236	12.53	0.168	10.57	0.178	0.171	9.40	0.600
0.300	0.159	0.233	12.58	0.162	10.63	0.175	0.167	9.46	0.640
0.350	0.155	0.229	12.63	0.150	10.68	0.172	0.164	9.51	0.680
0.400	0.150	0.223	12.67	0.140	10.72	0.167	0.159	9.54	0.718
0.450	0.144	0.212	12.72	0.130	10.78	0.162	0.153	9.61	0.760
0.500	0.138	0.202	12.76	0.120	10.82	0.156	0.147	9.68	0.796
0.550	0.132	0.188	12.80	0.112	10.87	0.149	0.140	9.71	0.835
0.600	0.126	0.175	12.84	0.105	10.91	0.141	0.132	9.73	0.873
0.650	0.121	0.161	12.88	0.100	10.95	0.132	0.124	9.76	0.910
0.700	0.115	0.149	12.91	0.092	10.99	0.122	0.116	9.79	0.940
0.750	0.110	0.137	12.93	0.089	11.02	0.112	0.106	9.82	0.965
0.800	0.106	0.125	12.95	0.084	11.04	0.102	0.096	9.85	0.987
0.850	0.102	0.114	12.96	0.080	11.00	0.090	0.086	9.87	0.997
0.900	0.102	0.104	12.96	0.080	11.00	0.080	0.077	9.88	1.000

VOA = 10.88 VOLTS VOC = 8.78 VOLTS VOD = 8.12 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.056	0.1197	0.0344	0.1046	0.1293	-0.0039	0.0010
0.100	0.054	0.111	0.1179	0.0701	0.1106	0.1493	-0.0053	0.0010
0.150	0.081	0.167	0.1200	0.0815	0.1165	0.1590	-0.0066	0.0011
0.200	0.107	0.222	0.1231	0.0888	0.1197	0.1658	-0.0079	0.0013
0.250	0.134	0.278	0.1231	0.0978	0.1252	0.1730	-0.0089	0.0012
0.300	0.161	0.333	0.1230	0.1037	0.1256	0.1762	-0.0094	0.0014
0.350	0.188	0.389	0.1180	0.1129	0.1324	0.1817	-0.0099	0.0015
0.400	0.215	0.444	0.1137	0.1179	0.1371	0.1844	-0.0101	0.0016
0.450	0.242	0.500	0.1089	0.1186	0.1360	0.1818	-0.0096	0.0017
0.500	0.269	0.556	0.1035	0.1196	0.1326	0.1779	-0.0091	0.0017
0.550	0.295	0.611	0.0989	0.1161	0.1325	0.1738	-0.0079	0.0017
0.600	0.322	0.667	0.0954	0.1121	0.1302	0.1689	-0.0069	0.0017
0.650	0.349	0.722	0.0929	0.1057	0.1243	0.1614	-0.0055	0.0015
0.700	0.376	0.778	0.0870	0.1018	0.1179	0.1534	-0.0045	0.0011
0.750	0.403	0.833	0.0854	0.0943	0.1052	0.1425	-0.0035	0.0010
0.800	0.430	0.889	0.0817	0.0883	0.0931	0.1316	-0.0024	0.0009
0.850	0.456	0.944	0.0799	0.0797	0.0757	0.1176	-0.0014	0.0006
0.900	0.483	1.000	0.0802	0.0721	0.0563	0.1043	-0.0002	0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00159

TABLE A16-12

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)= 0.985

INNER WALL RED POSITION

FXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.182	0.224	12.13	0.200	10.28	0.190	0.185	9.10	0.415
0.100	0.175	0.229	12.25	0.183	10.38	0.180	0.172	9.23	0.475
0.150	0.172	0.234	12.32	0.178	10.44	0.180	0.172	9.28	0.515
0.200	0.169	0.236	12.39	0.175	10.50	0.178	0.171	9.34	0.556
0.250	0.165	0.235	12.45	0.168	10.57	0.176	0.169	9.40	0.600
0.300	0.162	0.230	12.51	0.162	10.63	0.173	0.167	9.46	0.640
0.350	0.156	0.224	12.56	0.150	10.68	0.170	0.163	9.50	0.680
0.400	0.151	0.216	12.61	0.140	10.72	0.165	0.158	9.54	0.718
0.450	0.145	0.207	12.66	0.130	10.78	0.159	0.152	9.62	0.760
0.500	0.140	0.196	12.70	0.120	10.82	0.152	0.145	9.68	0.796
0.550	0.133	0.185	12.74	0.112	10.87	0.145	0.139	9.71	0.835
0.600	0.127	0.172	12.77	0.105	10.91	0.138	0.130	9.73	0.873
0.650	0.120	0.158	12.81	0.100	10.95	0.129	0.123	9.76	0.910
0.700	0.115	0.145	12.83	0.092	10.99	0.120	0.114	9.79	0.940
0.750	0.111	0.131	12.85	0.089	11.02	0.111	0.106	9.82	0.965
0.800	0.108	0.120	12.87	0.084	11.04	0.103	0.096	9.85	0.987
0.850	0.102	0.108	12.88	0.080	11.00	0.092	0.088	9.86	0.997
0.900	0.100	0.098	12.88	0.080	11.00	0.082	0.079	9.88	1.000

VOA = 10.90 VOLTS VOC = 8.78 VOLTS VOD = 8.12 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.056	0.1197	0.0815	0.1177	0.1594	-0.0043	0.0008
0.100	0.054	0.111	0.1179	0.0960	0.1086	0.1613	-0.0061	0.0012
0.150	0.081	0.167	0.1200	0.1035	0.1158	0.1696	-0.0075	0.0013
0.200	0.107	0.222	0.1231	0.1076	0.1176	0.1741	-0.0086	0.0012
0.250	0.134	0.278	0.1231	0.1138	0.1223	0.1796	-0.0095	0.0012
0.300	0.161	0.333	0.1230	0.1159	0.1241	0.1815	-0.0096	0.0011
0.350	0.188	0.389	0.1180	0.1212	0.1319	0.1855	-0.0099	0.0013
0.400	0.215	0.444	0.1137	0.1235	0.1350	0.1861	-0.0097	0.0013
0.450	0.242	0.500	0.1089	0.1250	0.1317	0.1828	-0.0094	0.0013
0.500	0.269	0.556	0.1035	0.1247	0.1283	0.1783	-0.0085	0.0013
0.550	0.295	0.611	0.0989	0.1227	0.1289	0.1753	-0.0079	0.0011
0.600	0.322	0.667	0.0954	0.1182	0.1265	0.1701	-0.0068	0.0015
0.650	0.349	0.722	0.0929	0.1109	0.1212	0.1625	-0.0056	0.0011
0.700	0.376	0.778	0.0870	0.1066	0.1148	0.1542	-0.0043	0.0011
0.750	0.403	0.833	0.0854	0.0978	0.1044	0.1438	-0.0028	0.0008
0.800	0.430	0.889	0.0817	0.0932	0.0940	0.1345	-0.0016	0.0011
0.850	0.456	0.944	0.0799	0.0824	0.0801	0.1212	-0.0008	0.0006
0.900	0.483	1.000	0.0802	0.0731	0.0605	0.1069	0.0002	0.0004

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00159

TABLE A16-13

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = -3.000 INS. N.D.DIST.(X/L)=-0.300

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.045	0.112	0.158	10.78	0.124	11.47	0.125	0.124	12.71	0.700
0.060	0.108	0.153	10.84	0.119	11.52	0.122	0.119	12.77	0.740
0.110	0.095	0.138	10.96	0.105	11.63	0.109	0.107	12.89	0.822
0.160	0.084	0.124	11.02	0.093	11.69	0.097	0.093	12.94	0.866
0.210	0.075	0.111	11.07	0.083	11.73	0.086	0.083	12.99	0.902
0.260	0.068	0.098	11.10	0.073	11.76	0.078	0.076	13.02	0.930
0.310	0.063	0.086	11.13	0.065	11.79	0.069	0.067	13.05	0.951
0.360	0.058	0.075	11.16	0.057	11.82	0.062	0.060	13.07	0.970
0.410	0.055	0.067	11.18	0.051	11.83	0.058	0.055	13.09	0.985
0.460	0.054	0.060	11.20	0.045	11.84	0.052	0.050	13.11	0.995
0.510	0.056	0.056	11.20	0.042	11.84	0.050	0.048	13.11	1.000

VOA = 8.24 VOLTS VOC = 8.95 VOLTS VOD = 10.34 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.045	0.045	0.086	0.0775	0.0360	0.0240	0.0688	-0.0024	0.0001
0.060	0.060	0.114	0.0770	0.0372	0.0254	0.0698	-0.0024	0.0002
0.110	0.110	0.210	0.0728	0.0371	0.0260	0.0679	-0.0024	0.0001
0.160	0.160	0.305	0.0666	0.0354	0.0226	0.0623	-0.0021	0.0002
0.210	0.210	0.400	0.0611	0.0327	0.0193	0.0565	-0.0018	0.0001
0.260	0.260	0.495	0.0548	0.0308	0.0234	0.0545	-0.0014	0.0001
0.310	0.310	0.590	0.0495	0.0283	0.0197	0.0487	-0.0010	0.0001
0.360	0.360	0.686	0.0439	0.0265	0.0204	0.0454	-0.0007	0.0001
0.410	0.410	0.781	0.0397	0.0258	0.0217	0.0436	-0.0004	0.0001
0.460	0.460	0.876	0.0352	0.0267	0.0209	0.0414	-0.0002	0.0001
0.510	0.510	0.971	0.0331	0.0285	0.0217	0.0416	0.0000	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00360

TABLE A16-14

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 1.000 INS. N.D.DIST.(X/L)= 0.100

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.115	0.150	10.16	0.139	11.07	0.135	0.136	10.15	0.570
0.050	0.108	0.143	10.30	0.128	11.21	0.128	0.131	10.29	0.662
0.100	0.095	0.128	10.44	0.109	11.35	0.113	0.113	10.41	0.768
0.150	0.085	0.115	10.51	0.097	11.42	0.100	0.100	10.48	0.824
0.200	0.077	0.103	10.56	0.087	11.48	0.089	0.090	10.53	0.867
0.250	0.070	0.092	10.61	0.078	11.52	0.080	0.081	10.57	0.905
0.300	0.064	0.083	10.65	0.069	11.56	0.072	0.074	10.60	0.938
0.350	0.058	0.075	10.67	0.061	11.59	0.064	0.064	10.63	0.963
0.400	0.052	0.066	10.70	0.056	11.61	0.058	0.059	10.65	0.982
0	0.047	0.059	10.71	0.049	11.63	0.054	0.054	10.66	0.994
0.500	0.044	0.053	10.71	0.044	11.63	0.050	0.050	10.67	1.000
0.550	0.044	0.047	10.71	0.042	11.63	0.048	0.049	10.67	1.000
0.600	0.049	0.045	10.71	0.043	11.63	0.049	0.049	10.66	0.998

VOA = 8.43 VOLTS VOC = 8.86 VOLTS VOD = 8.51 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.023	0.044	0.0797	0.0536	0.0644	0.0989	-0.0024	-0.0001
0.050	0.046	0.089	0.0805	0.0570	0.0681	0.1028	-0.0027	-0.0003
0.100	0.092	0.178	0.0754	0.0582	0.0665	0.1001	-0.0026	0.0000
0.150	0.138	0.266	0.0702	0.0544	0.0599	0.0923	-0.0023	0.0000
0.200	0.184	0.355	0.0650	0.0503	0.0548	0.0850	-0.0019	-0.0001
0.250	0.230	0.444	0.0599	0.0463	0.0505	0.0784	-0.0015	-0.0001
0.300	0.276	0.533	0.0542	0.0442	0.0484	0.0734	-0.0012	-0.0001
0.350	0.322	0.622	0.0488	0.0419	0.0423	0.0665	-0.0010	0.0000
0.400	0.368	0.710	0.0453	0.0356	0.0389	0.0599	-0.0008	-0.0001
0.450	0.414	0.799	0.0400	0.0334	0.0386	0.0559	-0.0006	0.0000
0.500	0.460	0.888	0.0360	0.0313	0.0368	0.0521	-0.0004	0.0000
0.550	0.506	0.977	0.0344	0.0284	0.0362	0.0495	-0.0001	-0.0001
0.600	0.551	1.066	0.0352	0.0298	0.0363	0.0506	0.0002	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00324

TABLE A16-15

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 2.250 INS. N.D.DIST.(X/L)= 0.225

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.153	0.204	10.14	0.180	10.78	0.194	0.195	10.00	0.455
0.050	0.144	0.190	10.30	0.168	10.96	0.178	0.178	10.14	0.545
0.100	0.127	0.163	10.49	0.148	11.16	0.148	0.149	10.32	0.665
0.150	0.112	0.142	10.60	0.129	11.27	0.127	0.129	10.42	0.745
0.200	0.097	0.123	10.67	0.112	11.35	0.112	0.111	10.49	0.800
0.250	0.086	0.108	10.73	0.098	11.41	0.100	0.100	10.55	0.845
0.300	0.078	0.095	10.78	0.088	11.46	0.090	0.092	10.58	0.890
0.350	0.070	0.084	10.82	0.078	11.50	0.080	0.082	10.62	0.923
0.400	0.063	0.075	10.84	0.069	11.52	0.072	0.070	10.64	0.950
0.450	0.057	0.067	10.86	0.062	11.55	0.065	0.066	10.66	0.972
0.500	0.053	0.060	10.87	0.056	11.56	0.059	0.059	10.67	0.985
0.550	0.050	0.055	10.88	0.051	11.57	0.054	0.054	10.68	0.995
0.600	0.050	0.050	10.88	0.048	11.57	0.050	0.050	10.68	1.000

VOA = 8.60 VOLTS VOC = 8.86 VOLTS VOD = 8.56 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.021	0.042	0.0935	0.0671	0.0938	0.1272	-0.0037	-0.0001
0.050	0.042	0.084	0.0963	0.0678	0.0920	0.1281	-0.0037	0.0000
0.100	0.084	0.168	0.0953	0.0609	0.0772	0.1167	-0.0031	-0.0001
0.150	0.125	0.251	0.0892	0.0561	0.0687	0.1070	-0.0026	-0.0002
0.200	0.167	0.335	0.0807	0.0495	0.0620	0.0961	-0.0021	0.0001
0.250	0.209	0.419	0.0731	0.0454	0.0587	0.0886	-0.0017	0.0000
0.300	0.251	0.503	0.0679	0.0403	0.0570	0.0826	-0.0012	-0.0002
0.350	0.292	0.586	0.0617	0.0367	0.0516	0.0750	-0.0009	-0.0002
0.400	0.334	0.670	0.0556	0.0346	0.0455	0.0679	-0.0007	0.0001
0.450	0.376	0.754	0.0508	0.0313	0.0441	0.0631	-0.0006	-0.0001
0.500	0.418	0.838	0.0463	0.0294	0.0399	0.0578	-0.0004	0.0000
0.550	0.459	0.921	0.0425	0.0288	0.0369	0.0541	-0.0003	0.0000
0.600	0.501	1.005	0.0402	0.0282	0.0336	0.0510	0.0000	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00243

TABLE A16-16

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 3.250 INS. N.D.DIST.(X/L)= 0.325

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.025	0.169	0.230	11.15	0.198	10.73	0.198	0.199	10.29	0.433
0.050	0.160	0.215	11.26	0.188	10.85	0.188	0.189	10.39	0.500
0.100	0.143	0.190	11.41	0.170	11.02	0.170	0.172	10.54	0.600
0.150	0.127	0.165	11.52	0.152	11.14	0.152	0.152	10.66	0.685
0.200	0.113	0.144	11.61	0.135	11.24	0.135	0.137	10.74	0.752
0.250	0.101	0.126	11.68	0.120	11.31	0.120	0.122	10.81	0.810
0.300	0.092	0.111	11.74	0.105	11.38	0.107	0.110	10.86	0.860
0.350	0.083	0.098	11.78	0.092	11.43	0.095	0.096	10.91	0.900
0.400	0.076	0.088	11.82	0.081	11.47	0.084	0.085	10.95	0.932
0.450	0.068	0.078	11.85	0.072	11.51	0.075	0.076	10.97	0.960
0.500	0.064	0.070	11.87	0.064	11.53	0.068	0.068	11.00	0.980
0.550	0.061	0.063	11.89	0.058	11.55	0.061	0.061	11.02	0.995
0.600	0.060	0.060	11.89	0.056	11.55	0.056	0.055	11.02	1.000

VOA = 9.54 VOLTS VOC = 8.86 VOLTS VOD = 9.00 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.025	0.019	0.042	0.1003	0.0604	0.1008	0.1307	-0.0041	-0.0001
0.050	0.039	0.084	0.1038	0.0592	0.1017	0.1324	-0.0041	-0.0001
0.100	0.078	0.168	0.1048	0.0537	0.0984	0.1285	-0.0038	-0.0002
0.150	0.117	0.253	0.1016	0.0454	0.0905	0.1187	-0.0032	0.0000
0.200	0.156	0.337	0.0955	0.0398	0.0851	0.1102	-0.0025	-0.0002
0	0.195	0.421	0.0889	0.0341	0.0779	0.1005	-0.0020	-0.0002
0.300	0.234	0.505	0.0805	0.0356	0.0746	0.0953	-0.0014	-0.0003
0.350	0.273	0.589	0.0725	0.0351	0.0668	0.0873	-0.0011	-0.0001
0.400	0.312	0.673	0.0652	0.0361	0.0601	0.0807	-0.0008	-0.0001
0.450	0.350	0.758	0.0590	0.0326	0.0552	0.0734	-0.0006	-0.0001
0.500	0.389	0.842	0.0532	0.0330	0.0505	0.0683	-0.0003	0.0000
0.550	0.428	0.926	0.0486	0.0320	0.0448	0.0628	-0.0001	0.0000
0.600	0.467	1.010	0.0472	0.0313	0.0379	0.0582	0.0000	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00225

TABLE A16-17

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)= 0.425

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.174	0.235	11.22	0.192	10.69	0.226	0.224	10.88	0.475
0.100	0.163	0.226	11.36	0.182	10.83	0.208	0.205	11.03	0.555
0.150	0.151	0.212	11.48	0.168	10.95	0.190	0.188	11.15	0.630
0.200	0.138	0.191	11.58	0.150	11.05	0.170	0.170	11.24	0.700
0.250	0.125	0.168	11.67	0.135	11.14	0.152	0.150	11.32	0.760
0.300	0.111	0.148	11.75	0.120	11.22	0.136	0.135	11.40	0.820
0.350	0.099	0.128	11.80	0.106	11.28	0.122	0.122	11.47	0.865
0.400	0.088	0.113	11.85	0.093	11.33	0.109	0.107	11.51	0.905
0.450	0.078	0.100	11.90	0.082	11.38	0.097	0.095	11.55	0.940
0.500	0.072	0.088	11.92	0.072	11.40	0.086	0.086	11.59	0.967
0.550	0.067	0.078	11.95	0.065	11.43	0.077	0.078	11.61	0.986
0.600	0.064	0.070	11.96	0.059	11.45	0.070	0.072	11.62	0.995
0.650	0.063	0.065	11.97	0.056	11.45	0.064	0.064	11.62	1.000

VOA = 9.60 VOLTS VOC = 8.90 VOLTS VOD = 9.54 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.036	0.077	0.1114	0.0676	0.1284	0.1537	-0.0050	0.0003
0.100	0.073	0.155	0.1151	0.0696	0.1182	0.1515	-0.0057	0.0004
0.150	0.109	0.232	0.1139	0.0712	0.1115	0.1483	-0.0059	0.0003
0.200	0.146	0.309	0.1080	0.0702	0.1062	0.1422	-0.0052	0.0000
0.250	0.182	0.386	0.1018	0.0625	0.0960	0.1302	-0.0041	0.0003
0.300	0.219	0.464	0.0946	0.0561	0.0893	0.1200	-0.0034	0.0001
0.350	0.255	0.541	0.0862	0.0489	0.0826	0.1089	-0.0025	0.0000
0.400	0.292	0.618	0.0777	0.0452	0.0758	0.0994	-0.0020	0.0002
0.450	0.328	0.696	0.0699	0.0415	0.0692	0.0903	-0.0016	0.0002
0.500	0.364	0.773	0.0625	0.0398	0.0634	0.0828	-0.0011	0.0000
0.550	0.401	0.850	0.0570	0.0365	0.0576	0.0755	-0.0007	-0.0001
0.600	0.437	0.927	0.0519	0.0353	0.0536	0.0704	-0.0004	-0.0002
0.650	0.474	1.005	0.0495	0.0340	0.0460	0.0647	-0.0001	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00203

TABLE A16-18

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)= 0.425

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.176	0.244	8.97	0.192	10.69	0.226	0.224	10.88	0.475
0.100	0.167	0.239	9.11	0.182	10.83	0.208	0.205	11.03	0.555
0.150	0.155	0.227	9.24	0.168	10.95	0.190	0.188	11.15	0.630
0.200	0.142	0.206	9.35	0.150	11.05	0.170	0.170	11.24	0.700
0.250	0.127	0.179	9.44	0.135	11.14	0.152	0.150	11.32	0.760
0.300	0.113	0.154	9.53	0.120	11.22	0.136	0.135	11.40	0.820
0.350	0.100	0.133	9.59	0.106	11.28	0.122	0.122	11.47	0.865
0.400	0.088	0.114	9.64	0.093	11.33	0.109	0.107	11.51	0.905
0.450	0.079	0.097	9.69	0.082	11.38	0.097	0.095	11.55	0.940
0.500	0.072	0.085	9.73	0.072	11.40	0.086	0.086	11.59	0.967
0.550	0.068	0.076	9.75	0.065	11.43	0.077	0.078	11.61	0.986
0.600	0.069	0.069	9.76	0.059	11.45	0.070	0.072	11.62	0.995
0 5074	0.068		9.76	0.056	11.45	0.064	0.064	11.62	1.000

VOA = 7.31 VOLTS VOC = 8.90 VOLTS VOD = 9.54 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.036	0.077	0.1114	0.0752	0.1284	0.1575	-0.0057	0.0003
0.100	0.073	0.155	0.1151	0.0815	0.1182	0.1574	-0.0068	0.0004
0.150	0.109	0.232	0.1139	0.0841	0.1115	0.1548	-0.0073	0.0003
0.200	0.146	0.309	0.1080	0.0832	0.1062	0.1487	-0.0066	0.0000
0.250	0.182	0.386	0.1018	0.0722	0.0960	0.1350	-0.0052	0.0003
0.300	0.219	0.464	0.0946	0.0618	0.0893	0.1228	-0.0038	0.0001
0.350	0.255	0.541	0.0862	0.0531	0.0826	0.1110	-0.0028	0.0000
0.400	0.292	0.618	0.0777	0.0452	0.0758	0.0993	-0.0020	0.0002
0.450	0.328	0.696	0.0699	0.0382	0.0692	0.0887	-0.0013	0.0002
0.500	0.364	0.773	0.0625	0.0357	0.0634	0.0808	-0.0009	0.0000
0.550	0.401	0.850	0.0570	0.0346	0.0576	0.0746	-0.0005	-0.0001
0.600	0.437	0.927	0.0519	0.0375	0.0536	0.0715	0.0000	-0.0002
0.650	0.474	1.005	0.0495	0.0440	0.0460	0.0698	0.0004	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00203

TABLE A16-19

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 4.250 INS. N.D.DIST.(X/L)= 0.425

OUTER WALL RED POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.156	0.230	10.79	0.192	10.69	0.226	0.224	10.88	0.475
0.100	0.149	0.220	10.92	0.182	10.83	0.208	0.205	11.03	0.555
0.150	0.140	0.205	11.05	0.168	10.95	0.190	0.188	11.15	0.630
0.200	0.129	0.186	11.15	0.150	11.05	0.170	0.170	11.24	0.700
0.250	0.116	0.163	11.23	0.135	11.14	0.152	0.150	11.32	0.760
0.300	0.103	0.142	11.31	0.120	11.22	0.136	0.135	11.40	0.820
0.350	0.091	0.123	11.37	0.106	11.28	0.122	0.122	11.47	0.865
0.400	0.080	0.107	11.41	0.093	11.33	0.109	0.107	11.51	0.905
0.450	0.071	0.091	11.45	0.082	11.38	0.097	0.095	11.55	0.940
0.500	0.065	0.080	11.47	0.072	11.40	0.086	0.086	11.59	0.967
0.550	0.062	0.071	11.49	0.065	11.43	0.077	0.078	11.61	0.986
0.600	0.062	0.065	11.50	0.059	11.45	0.070	0.072	11.62	0.995
0.650	0.066	0.066	11.50	0.056	11.45	0.064	0.064	11.62	1.000

VOA = 9.29 VOLTS VOC = 8.90 VOLTS VOD = 9.54 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.036	0.077	0.1114	0.0735	0.1284	0.1566	-0.0066	0.0003
0.100	0.073	0.155	0.1151	0.0769	0.1182	0.1551	-0.0071	0.0004
0.150	0.109	0.232	0.1139	0.0759	0.1115	0.1507	-0.0068	0.0003
0.200	0.146	0.309	0.1080	0.0750	0.1062	0.1446	-0.0061	0.0000
0.250	0.182	0.386	0.1018	0.0655	0.0960	0.1317	-0.0048	0.0003
0.300	0.219	0.464	0.0946	0.0569	0.0893	0.1204	-0.0038	0.0001
0.350	0.255	0.541	0.0862	0.0487	0.0826	0.1088	-0.0029	0.0000
0.400	0.292	0.618	0.0777	0.0429	0.0758	0.0982	-0.0022	0.0002
0.450	0.328	0.696	0.0699	0.0359	0.0692	0.0875	-0.0015	0.0002
0.500	0.364	0.773	0.0625	0.0345	0.0634	0.0802	-0.0010	0.0000
0.550	0.401	0.850	0.0570	0.0334	0.0576	0.0740	-0.0006	-0.0001
0.600	0.437	0.927	0.0519	0.0363	0.0536	0.0709	-0.0002	-0.0002
0.650	0.474	1.005	0.0495	0.0437	0.0460	0.0696	0.0000	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00203

TABLE A16-20

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 5.450 INS. N.D.DIST.(X/L)= 0.545

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.171	0.231	11.13	0.220	10.63	0.241	0.235	11.46	0.420
0.100	0.162	0.230	11.26	0.215	10.78	0.227	0.221	11.60	0.500
0.150	0.153	0.225	11.36	0.200	10.89	0.212	0.207	11.69	0.565
0.200	0.143	0.211	11.44	0.184	10.99	0.195	0.191	11.79	0.625
0.250	0.133	0.190	11.52	0.167	11.08	0.177	0.172	11.87	0.686
0.300	0.122	0.169	11.59	0.150	11.17	0.160	0.162	11.95	0.743
0.350	0.110	0.150	11.66	0.133	11.24	0.141	0.136	12.01	0.795
0.400	0.100	0.132	11.70	0.118	11.30	0.126	0.130	12.06	0.836
0.450	0.090	0.117	11.75	0.104	11.34	0.112	0.117	12.11	0.872
0.500	0.080	0.103	11.78	0.093	11.38	0.100	0.105	12.14	0.904
0.550	0.073	0.091	11.82	0.082	11.42	0.089	0.092	12.18	0.933
0.600	0.067	0.081	11.84	0.073	11.45	0.080	0.078	12.21	0.955
0.650	0.063	0.072	11.85	0.065	11.47	0.074	0.076	12.22	0.973
0.700	0.071	0.064	11.87	0.060	11.48	0.068	0.067	12.24	0.986
0.750	0.073	0.072	11.88	0.059	11.50	0.066	0.064	12.25	0.995

VOA = 9.62 VOLTS VOC = 8.95 VOLTS VOD = 10.08 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.034	0.069	0.1194	0.0207	0.0975	0.1188	-0.0043	0.0006
0.100	0.068	0.139	0.1284	0.0265	0.0916	0.1232	-0.0058	0.0007
0.150	0.102	0.208	0.1279	0.0448	0.0927	0.1327	-0.0067	0.0006
0.200	0.135	0.277	0.1242	0.0513	0.0878	0.1317	-0.0067	0.0005
0.250	0.169	0.346	0.1189	0.0502	0.0824	0.1258	-0.0057	0.0006
0.300	0.203	0.416	0.1114	0.0480	0.0828	0.1211	-0.0046	-0.0002
0.350	0.237	0.485	0.1027	0.0458	0.0696	0.1091	-0.0038	0.0006
0.400	0.271	0.554	0.0938	0.0427	0.0712	0.1038	-0.0029	-0.0004
0.450	0.305	0.623	0.0847	0.0410	0.0660	0.0959	-0.0023	-0.0005
0.500	0.339	0.693	0.0773	0.0351	0.0607	0.0866	-0.0018	-0.0005
0.550	0.372	0.762	0.0695	0.0339	0.0540	0.0787	-0.0013	-0.0003
0.600	0.406	0.831	0.0627	0.0326	0.0457	0.0705	-0.0009	0.0002
0.650	0.440	0.900	0.0564	0.0324	0.0490	0.0689	-0.0006	-0.0001
0.700	0.474	0.970	0.0525	0.0391	0.0426	0.0671	0.0004	0.0001
0.750	0.508	1.039	0.0518	0.0478	0.0399	0.0697	0.0001	0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00155

TABLE A16-21

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 7.250 INS. N.D.DIST.(X/L)= 0.725

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.184	0.249	10.77	0.237	10.45	0.235	0.240	11.33	0.385
0.100	0.181	0.251	10.90	0.232	10.57	0.232	0.241	11.46	0.445
0.150	0.175	0.247	11.00	0.225	10.69	0.227	0.238	11.55	0.500
0.200	0.168	0.236	11.10	0.217	10.79	0.220	0.232	11.64	0.552
0.250	0.159	0.222	11.19	0.204	10.88	0.207	0.217	11.72	0.603
0.300	0.148	0.206	11.27	0.189	10.97	0.191	0.200	11.80	0.655
0.350	0.138	0.189	11.35	0.173	11.05	0.176	0.184	11.86	0.703
0.400	0.127	0.172	11.42	0.158	11.12	0.161	0.168	11.93	0.750
0.450	0.114	0.156	11.49	0.145	11.19	0.146	0.152	12.00	0.795
0.500	0.104	0.140	11.55	0.130	11.25	0.133	0.137	12.05	0.836
0.550	0.094	0.124	11.60	0.117	11.31	0.119	0.122	12.11	0.876
0.600	0.084	0.110	11.65	0.103	11.36	0.105	0.108	12.15	0.910
0.650	0.077	0.095	11.68	0.091	11.39	0.093	0.096	12.20	0.935
0.700	0.070	0.083	11.71	0.079	11.42	0.082	0.085	12.23	0.957
0.750	0.066	0.075	11.73	0.071	11.45	0.074	0.076	12.25	0.976
0.800	0.068	0.069	11.75	0.067	11.47	0.068	0.069	12.28	0.990

VOA = 9.62 VOLTS VOC = 8.95 VOLTS VOD = 10.08 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.031	0.062	0.1315	0.0829	0.0818	0.1481	-0.0071	-0.0005
0.100	0.061	0.123	0.1378	0.0847	0.0859	0.1541	-0.0083	-0.0010
0.150	0.092	0.185	0.1410	0.0856	0.0930	0.1598	-0.0090	-0.0013
0.200	0.122	0.247	0.1424	0.0808	0.0955	0.1594	-0.0088	-0.0016
0.250	0.153	0.309	0.1398	0.0769	0.0926	0.1547	-0.0082	-0.0013
0.300	0.183	0.370	0.1351	0.0725	0.0869	0.1472	-0.0075	-0.0012
0.350	0.214	0.432	0.1280	0.0688	0.0852	0.1410	-0.0064	-0.0011
0.400	0.245	0.494	0.1209	0.0633	0.0793	0.1318	-0.0055	-0.0009
0.450	0.275	0.556	0.1142	0.0544	0.0704	0.1195	-0.0049	-0.0007
0.500	0.306	0.617	0.1052	0.0503	0.0671	0.1113	-0.0039	-0.0005
0.550	0.336	0.679	0.0968	0.0440	0.0592	0.1000	-0.0031	-0.0003
0.600	0.367	0.741	0.0871	0.0408	0.0538	0.0908	-0.0024	-0.0003
0.650	0.398	0.802	0.0780	0.0361	0.0474	0.0808	-0.0015	-0.0003
0.700	0.428	0.864	0.0685	0.0356	0.0441	0.0741	-0.0010	-0.0002
0.750	0.459	0.926	0.0622	0.0355	0.0401	0.0689	-0.0007	-0.0001
0.800	0.489	0.988	0.0592	0.0373	0.0329	0.0647	-0.0001	-0.0001

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00146

TABLE A16-22

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)= 0.985

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.196	0.262	12.09	0.239	10.01	0.278	0.276	8.26	0.280
0.100	0.192	0.272	12.18	0.234	10.11	0.278	0.278	8.37	0.330
0.150	0.187	0.276	12.25	0.230	10.20	0.278	0.278	8.46	0.373
0.200	0.182	0.274	12.31	0.225	10.27	0.276	0.274	8.53	0.410
0	0.176	0.270	12.37	0.220	10.33	0.272	0.268	8.60	0.448
0.300	0.170	0.264	12.43	0.215	10.40	0.266	0.263	8.68	0.490
0.350	0.163	0.255	12.48	0.209	10.46	0.256	0.253	8.75	0.530
0.400	0.155	0.243	12.54	0.203	10.53	0.244	0.242	8.82	0.575
0.450	0.147	0.230	12.59	0.196	10.59	0.230	0.226	8.90	0.620
0.500	0.140	0.215	12.65	0.189	10.66	0.215	0.208	8.96	0.668
0.550	0.131	0.200	12.70	0.177	10.72	0.200	0.196	9.03	0.715
0.600	0.122	0.184	12.76	0.165	10.78	0.184	0.179	9.09	0.760
0.650	0.113	0.168	12.80	0.152	10.83	0.167	0.161	9.15	0.805
0.700	0.104	0.151	12.85	0.140	10.89	0.150	0.146	9.21	0.850
0.750	0.096	0.134	12.88	0.127	10.93	0.135	0.129	9.25	0.890
0.800	0.088	0.120	12.92	0.113	10.97	0.120	0.116	9.30	0.925
0.850	0.082	0.107	12.95	0.101	11.00	0.103	0.105	9.33	0.953
0.900	0.080	0.096	12.97	0.089	11.03	0.093	0.092	9.35	0.975
0.950	0.083	0.087	12.98	0.077	11.05	0.088	0.086	9.37	0.990

VOA = 11.02 VOLTS VOC = 8.78 VOLTS VOD = 7.08 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.052	0.1159	0.0519	0.0812	0.1245	-0.0046	0.0001
0.100	0.054	0.104	0.1239	0.0671	0.0916	0.1413	-0.0066	0.0000
0.150	0.081	0.156	0.1300	0.0764	0.0993	0.1529	-0.0064	0.0000
0.200	0.107	0.208	0.1338	0.0806	0.1048	0.1596	-0.0095	0.0002
0.250	0.134	0.260	0.1371	0.0834	0.1081	0.1643	-0.0104	0.0005
0.300	0.161	0.312	0.1409	0.0841	0.1095	0.1672	-0.0111	0.0004
0.350	0.188	0.364	0.1431	0.0827	0.1069	0.1663	-0.0115	0.0004
0.400	0.215	0.416	0.1454	0.0766	0.1030	0.1625	-0.0114	0.0003
0.450	0.242	0.468	0.1466	0.0694	0.0919	0.1539	-0.0111	0.0005
0.500	0.269	0.520	0.1474	0.0596	0.0804	0.1437	-0.0102	0.0009
0.550	0.295	0.572	0.1432	0.0559	0.0774	0.1383	-0.0094	0.0005
0.600	0.322	0.624	0.1382	0.0491	0.0686	0.1280	-0.0084	0.0007
0.650	0.349	0.676	0.1318	0.0450	0.0576	0.1172	-0.0073	0.0008
0.700	0.376	0.728	0.1251	0.0352	0.0468	0.1036	-0.0060	0.0005
0.750	0.403	0.780	0.1165	0.0285	0.0384	0.0917	-0.0046	0.0007
0.800	0.430	0.832	0.1059	0.0312	0.0354	0.0863	-0.0037	0.0004
0.850	0.456	0.884	0.0964	0.0323	0.0271	0.0779	-0.0027	-0.0002
0.900	0.483	0.936	0.0860	0.0417	0.0280	0.0779	-0.0016	0.0001
0.950	0.510	0.988	0.0750	0.0548	0.0415	0.0856	-0.0004	0.0002

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00087

TABLE A16-23

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)= 0.985

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	FC	VC	ED	EF	VD	U UMAX
				(VOLTS)					
0.050	0.198	0.248	12.06	0.239	10.01	0.210	0.212	8.97	0.280
0.100	0.194	0.260	12.14	0.234	10.11	0.210	0.212	9.06	0.330
0.150	0.189	0.268	12.21	0.230	10.20	0.211	0.210	9.13	0.373
0.200	0.184	0.270	12.27	0.225	10.27	0.210	0.210	9.19	0.410
0.250	0.173	0.266	12.33	0.220	10.33	0.205	0.208	9.24	0.448
0.300	0.170	0.260	12.39	0.215	10.40	0.198	0.200	9.31	0.490
0.350	0.161	0.252	12.44	0.209	10.46	0.191	0.192	9.36	0.530
0.400	0.153	0.240	12.50	0.203	10.53	0.182	0.180	9.42	0.575
0.450	0.144	0.226	12.56	0.196	10.59	0.172	0.170	9.48	0.620
0.500	0.135	0.210	12.61	0.189	10.66	0.161	0.160	9.54	0.668
0.550	0.127	0.194	12.67	0.175	10.72	0.150	0.150	9.59	0.715
0.600	0.119	0.175	12.72	0.159	10.78	0.138	0.141	9.64	0.760
0.650	0.112	0.158	12.77	0.145	10.83	0.125	0.127	9.70	0.805
0.700	0.105	0.143	12.81	0.133	10.89	0.112	0.111	9.74	0.850
0.750	0.100	0.131	12.86	0.121	10.93	0.098	0.100	9.78	0.890
0.800	0.097	0.120	12.89	0.110	10.97	0.094	0.095	9.82	0.925
0.850	0.098	0.110	12.92	0.100	11.00	0.092	0.091	9.85	0.953
0.900	0.102	0.104	12.93	0.089	11.03	0.087	0.088	9.87	0.975
0.950	0.110	0.102	12.95	0.077	11.05	0.082	0.082	9.88	0.990

VOA = 10.93 VOLTS VOC = 8.78 VOLTS VOD = 8.12 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.055	0.1159	0.0146	0.0886	0.1096	-0.0030	-0.0002
0.100	0.054	0.110	0.1239	0.0430	0.0952	0.1311	-0.0049	-0.0002
0.150	0.081	0.165	0.1300	0.0573	0.1009	0.1441	-0.0068	0.0001
0.200	0.107	0.220	0.1338	0.0663	0.1063	0.1532	-0.0082	0.0000
0.250	0.134	0.275	0.1371	0.0664	0.1101	0.1568	-0.0094	-0.0004
0.300	0.161	0.330	0.1409	0.0686	0.1039	0.1567	-0.0099	-0.0003
0.350	0.188	0.385	0.1431	0.0667	0.1014	0.1556	-0.0105	-0.0002
0.400	0.215	0.440	0.1454	0.0595	0.0918	0.1484	-0.0104	0.0003
0.450	0.242	0.495	0.1466	0.0482	0.0819	0.1383	-0.0101	0.0003
0.500	0.269	0.549	0.1474	0.0283	0.0699	0.1228	-0.0094	0.0002
0.550	0.295	0.604	0.1416	0.0303	0.0702	0.1210	-0.0084	0.0000
0.600	0.322	0.659	0.1332	0.0306	0.0720	0.1179	-0.0069	-0.0005
0.650	0.349	0.714	0.1258	0.0301	0.0610	0.1085	-0.0055	-0.0003
0.700	0.376	0.769	0.1189	0.0282	0.0464	0.0968	-0.0045	0.0001
0.750	0.403	0.824	0.1110	0.0349	0.0336	0.0898	-0.0036	-0.0003
0.800	0.430	0.879	0.1031	0.0421	0.0452	0.0952	-0.0026	-0.0001
0.850	0.456	0.934	0.0955	0.0512	0.0556	0.1012	-0.0014	0.0001
0.900	0.483	0.989	0.0860	0.0664	0.0637	0.1080	-0.0002	-0.0001
0.950	0.510	1.044	0.0750	0.0842	0.0681	0.1136	0.0010	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00087

TABLE A16-24

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DIST. FROM INLET(X) = 9.850 INS. N.D.DIST.(X/L)= 0.985

OUTER WALL RED POSITION

(INS)				(VOLTS)					UMAX
0.050	0.213	0.268	11.84	0.239	10.01	0.208	0.210	9.11	0.280
0.100	0.208	0.274	11.96	0.234	10.11	0.206	0.208	9.22	0.330
0.150	0.204	0.279	12.05	0.230	10.20	0.203	0.204	9.30	0.373
0.200	0.198	0.281	12.12	0.225	10.27	0.200	0.202	9.35	0.410
0.250	0.191	0.278	12.19	0.220	10.33	0.197	0.198	9.42	0.448
0	0.184	0.273	12.27	0.215	10.40	0.193	0.195	9.49	0.490
0.350	0.176	0.265	12.34	0.209	10.46	0.189	0.190	9.54	0.530
0.400	0.168	0.254	12.41	0.203	10.53	0.183	0.185	9.60	0.575
0.450	0.160	0.241	12.48	0.196	10.59	0.177	0.179	9.67	0.620
0.500	0.152	0.226	12.55	0.189	10.66	0.169	0.171	9.73	0.668
0.550	0.143	0.210	12.61	0.177	10.72	0.160	0.160	9.79	0.715
0.600	0.134	0.191	12.66	0.165	10.78	0.150	0.151	9.84	0.760
0.650	0.125	0.173	12.71	0.152	10.83	0.140	0.142	9.89	0.805
0.700	0.116	0.156	12.75	0.140	10.89	0.126	0.128	9.94	0.850
0.750	0.106	0.140	12.79	0.127	10.93	0.116	0.118	9.99	0.890
0.800	0.098	0.125	12.82	0.113	10.97	0.105	0.104	10.02	0.925
0.850	0.092	0.110	12.85	0.101	11.00	0.094	0.096	10.05	0.953
0.900	0.093	0.102	12.86	0.089	11.03	0.086	0.088	10.07	0.975
0.950	0.101	0.098	12.87	0.077	11.05	0.080	0.080	10.10	0.990

VOA = 10.90 VOLTS VOC = 8.78 VOLTS VOD = 8.08 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.053	0.1159	0.0953	0.0326	0.1219	-0.0051	-0.0001
0.100	0.054	0.106	0.1239	0.0992	0.0310	0.1271	-0.0068	-0.0002
0.150	0.081	0.160	0.1300	0.1040	0.0287	0.1314	-0.0084	-0.0001
0.200	0.107	0.213	0.1338	0.1072	0.0385	0.1398	-0.0099	-0.0002
0.250	0.134	0.266	0.1371	0.1077	0.0375	0.1412	-0.0109	-0.0001
0.300	0.161	0.319	0.1409	0.1057	0.0370	0.1418	-0.0116	-0.0002
0.350	0.188	0.372	0.1431	0.1021	0.0416	0.1434	-0.0120	-0.0001
0.400	0.215	0.426	0.1454	0.0967	0.0413	0.1417	-0.0119	-0.0002
0.450	0.242	0.479	0.1466	0.0891	0.0371	0.1364	-0.0114	-0.0003
0.500	0.269	0.532	0.1474	0.0791	0.0298	0.1282	-0.0106	-0.0003
0.550	0.295	0.585	0.1432	0.0740	0.0315	0.1243	-0.0095	0.0000
0.600	0.322	0.638	0.1382	0.0657	0.0355	0.1197	-0.0080	-0.0001
0.650	0.349	0.691	0.1318	0.0596	0.0410	0.1162	-0.0066	-0.0003
0.700	0.376	0.745	0.1251	0.0535	0.0273	0.1030	-0.0053	-0.0003
0.750	0.403	0.798	0.1165	0.0485	0.0309	0.0980	-0.0043	-0.0002
0.800	0.430	0.851	0.1059	0.0494	0.0309	0.0931	-0.0033	0.0001
0.850	0.456	0.904	0.0964	0.0475	0.0329	0.0884	-0.0020	-0.0002
0.900	0.483	0.957	0.0860	0.0607	0.0394	0.0931	-0.0010	-0.0002
0.950	0.510	1.011	0.0750	0.0782	0.0444	0.0988	0.0004	0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00087

TABLE A16-25

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

INNER WALL BLUE POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	FB	VA	EC	VC (VOLTS)	ED	EE	VD	U UMAX
0.050	0.150	0.180	12.12	0.163	10.45	0.172	0.170	11.80	0.490
0.100	0.137	0.184	12.21	0.154	10.52	0.167	0.167	11.87	0.536
0.150	0.135	0.192	12.26	0.152	10.57	0.168	0.162	11.92	0.570
0.200	0.136	0.195	12.30	0.152	10.63	0.170	0.163	11.97	0.604
0.250	0.136	0.199	12.35	0.151	10.67	0.168	0.163	12.01	0.633
0.300	0.134	0.199	12.38	0.150	10.71	0.168	0.163	12.05	0.665
0.400	0.130	0.196	12.46	0.140	10.80	0.160	0.158	12.13	0.730
0.500	0.125	0.185	12.54	0.130	10.89	0.148	0.148	12.22	0.800
0.600	0.117	0.169	12.62	0.115	10.97	0.131	0.133	12.29	0.865
0.700	0.110	0.149	12.69	0.107	11.04	0.115	0.120	12.36	0.924
0.800	0.103	0.125	12.73	0.112	11.09	0.108	0.108	12.41	0.970
0.900	0.106	0.107	12.76	0.120	11.12	0.119	0.113	12.44	0.998

VOA = 10.85 VOLTS VOC = 8.87 VOLTS VOD = 10.40 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.056	0.1094	0.0782	0.0650	0.1263	-0.0033	0.0002
0.100	0.053	0.111	0.1085	0.0816	0.0713	0.1307	-0.0053	0.0000
0.150	0.080	0.167	0.1106	0.0897	0.0724	0.1363	-0.0069	0.0006
0.200	0.107	0.222	0.1137	0.0959	0.0766	0.1431	-0.0076	0.0008
0.250	0.133	0.278	0.1161	0.1000	0.0773	0.1467	-0.0085	0.0006
0.300	0.160	0.333	0.1186	0.1029	0.0803	0.1509	-0.0093	0.0006
0.400	0.213	0.444	0.1164	0.1113	0.0856	0.1567	-0.0101	0.0003
0.500	0.267	0.556	0.1137	0.1127	0.0827	0.1545	-0.0096	0.0000
0.600	0.320	0.667	0.1049	0.1110	0.0784	0.1471	-0.0082	-0.0003
0.700	0.373	0.778	0.1012	0.0995	0.0651	0.1329	-0.0059	-0.0006
0.800	0.427	0.889	0.1087	0.0670	0.0323	0.1040	-0.0031	0.0000
0.900	0.480	1.000	0.1186	0.0207	0.0352	0.0872	-0.0001	0.0008

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00202

TABLE A16-26

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 7.50 INS (2 HYDRAULIC DIAMETERS)

INNER WALL GREEN POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	FB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.140	0.170	11.32	0.152	10.49	0.162	0.169	11.66	0.558
0.100	0.129	0.165	11.40	0.137	10.57	0.150	0.148	11.73	0.616
0.150	0.127	0.165	11.44	0.135	10.63	0.150	0.147	11.79	0.652
0.200	0.126	0.171	11.47	0.134	10.67	0.147	0.145	11.82	0.677
0.250	0.125	0.171	11.50	0.134	10.70	0.147	0.145	11.84	0.700
0.300	0.125	0.175	11.52	0.134	10.73	0.147	0.144	11.87	0.724
0.400	0.123	0.170	11.58	0.134	10.79	0.145	0.141	11.93	0.773
0.500	0.121	0.166	11.64	0.130	10.86	0.137	0.136	11.99	0.826
0.600	0.123	0.156	11.69	0.125	10.92	0.129	0.130	12.04	0.880
0.700	0.129	0.141	11.73	0.117	10.98	0.125	0.124	12.09	0.927
0.800	0.144	0.133	11.78	0.110	11.02	0.123	0.122	12.13	0.970
0.900	0.166	0.130	11.80	0.100	11.05	0.129	0.126	12.16	0.997
1.000	0.180	0.128	11.79	0.100	11.05	0.138	0.135	12.17	0.998

VOA = 9.95 VOLTS VOC = 8.87 VOLTS VOD = 10.29 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.066	0.1136	0.0725	0.0873	0.1367	-0.0035	-0.0009
0.100	0.053	0.132	0.1078	0.0800	0.0827	0.1352	-0.0043	0.0002
0.150	0.080	0.197	0.1090	0.0848	0.0844	0.1391	-0.0049	0.0004
0.200	0.107	0.263	0.1102	0.0913	0.0833	0.1424	-0.0061	0.0003
0.250	0.133	0.329	0.1121	0.0924	0.0857	0.1451	-0.0064	0.0003
0.300	0.160	0.395	0.1140	0.0977	0.0860	0.1489	-0.0073	0.0004
0.400	0.213	0.526	0.1182	0.0951	0.0835	0.1484	-0.0072	0.0006
0.500	0.267	0.658	0.1187	0.0973	0.0794	0.1477	-0.0072	0.0001
0.600	0.320	0.789	0.1185	0.0978	0.0753	0.1459	-0.0055	-0.0002
0.700	0.373	0.921	0.1139	0.1006	0.0789	0.1467	-0.0020	0.0002
0.800	0.427	1.053	0.1099	0.1157	0.0864	0.1560	0.0020	0.0002
0.900	0.480	1.184	0.1015	0.1420	0.1067	0.1751	0.0073	0.0005
1.000	0.533	1.316	0.1016	0.1531	0.1198	0.1873	0.0111	0.0005

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00258

TABLE A16-27

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

INNER WALL RED POSITION

EXPERIMENTAL DATA

R-RI (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.128	0.165	11.18	0.140	10.62	0.143	0.147	11.81	0.624
0.100	0.116	0.149	11.23	0.124	10.65	0.130	0.137	11.84	0.690
0.150	0.114	0.148	11.28	0.119	10.70	0.125	0.132	11.88	0.725
0.200	0.111	0.146	11.31	0.117	10.73	0.123	0.132	11.92	0.750
0.250	0.110	0.147	11.35	0.115	10.76	0.122	0.131	11.95	0.770
0.300	0.108	0.150	11.38	0.114	10.77	0.120	0.130	11.96	0.790
0.400	0.106	0.147	11.42	0.110	10.83	0.118	0.127	12.01	0.830
0.500	0.105	0.145	11.46	0.106	10.86	0.115	0.121	12.05	0.870
0.600	0.103	0.140	11.50	0.102	10.89	0.112	0.116	12.09	0.905
0.700	0.101	0.132	11.53	0.096	10.92	0.109	0.110	12.12	0.940
0.800	0.102	0.123	11.56	0.092	10.94	0.107	0.104	12.16	0.970
0.900	0.105	0.112	11,57	0.092	10.95	0.110	0.105	12.20	1.000
1.000	0.114	0.106	11.58	0.096	10.95	0.116	0.107	12.20	1.000

VOA = 9.73 VOLTS VOC = 8.87 VOLTS VOD = 10.28 VOLTS

RESULTS

R-RI (INS)	R-RI RO-RI	R-RI RM-RI	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.053	0.1088	0.0821	0.0646	0.1277	-0.0046	-0.0[illegible]4
0.100	0.053	0.105	0.1047	0.0799	0.0709	0.1277	-0.0043	-0.[illegible]
0.150	0.080	0.158	0.1031	0.0838	0.0705	0.1287	-0.0045	-0.[illegible]
0.200	0.107	0.211	0.1034	0.0827	0.0708	0.1285	-0.0047	-0.0[illegible]
0.250	0.133	0.263	0.1029	0.0842	0.0718	0.1295	-0.0050	-0.0[illegible]
0.300	0.160	0.316	0.1037	0.0863	0.0725	0.1313	-0.0058	-0.[illegible]
0.400	0.213	0.421	0.1026	0.0887	0.0744	0.1329	-0.0058	-[illegible]
0.500	0.267	0.526	0.1019	0.0923	0.0728	0.1335	-0.0059	-[illegible]
0.600	0.320	0.632	0.1007	0.0914	0.0710	0.1316	-0.0055	[illegible]
0.700	0.373	0.737	0.0973	0.0907	0.0721	0.1300	-0.0046	-[illegible]
0.800	0.427	0.842	0.0954	0.0882	0.0695	0.1265	-0.0031	[illegible]
0.900	0.480	0.947	0.0976	0.0830	0.0707	0.1256	-0.0011	0.0010
1.000	0.533	1.053	0.1018	0.0798	0.0745	0.1280	0.0012	0.0013

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = [illegible]0327

TABLE A16-28

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 3.75 INS. (1 HYDRAULIC DIAMETER)

OUTER WALL BLUE POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC	ED	EE	VD	U UMAX
				(VOLTS)					
0.050	0.155	0.213	12.17	0.157	10.45	0.182	0.183	11.81	0.490
0.100	0.156	0.221	12.23	0.155	10.53	0.190	0.186	11.87	0.540
0.150	0.157	0.228	12.28	0.155	10.58	0.197	0.193	11.93	0.573
0.200	0.156	0.233	12.31	0.156	10.62	0.203	0.200	11.96	0.600
0.250	0.155	0.237	12.35	0.158	10.66	0.208	0.207	12.00	0.630
0.300	0.153	0.238	12.39	0.160	10.70	0.210	0.208	12.04	0.656
0.350	0.150	0.235	12.42	0.162	10.73	0.211	0.210	12.07	0.684
0.400	0.147	0.230	12.45	0.163	10.77	0.210	0.206	12.11	0.713
0.500	0.138	0.215	12.53	0.164	10.85	0.205	0.200	12.20	0.775
0.600	0.128	0.192	12.60	0.161	10.94	0.190	0.190	12.27	0.840
0.700	0.117	0.164	12.67	0.155	11.01	0.172	0.173	12.33	0.902
0.800	0.108	0.138	12.72	0.138	11.07	0.153	0.154	12.40	0.955
0.900	0.104	0.117	12.76	0.124	11.11	0.134	0.134	12.43	0.990
1.000	0.110	0.104	12.77	0.120	11.12	0.114	0.116	12.44	1.000

VOA = 10.85 VOLTS VOC = 8.87 VOLTS VOD = 10.40 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.051	0.1054	0.1021	0.0843	0.1458	-0.0066	-0.0001
0.100	0.053	0.103	0.1097	0.1144	0.0982	0.1612	-0.0084	0.0005
0.150	0.080	0.154	0.1131	0.1229	0.1075	0.1718	-0.0099	0.0005
0.200	0.107	0.205	0.1168	0.1275	0.1177	0.1810	-0.0114	0.0004
0.250	0.133	0.256	0.1212	0.1313	0.1263	0.1894	-0.0128	0.0001
0.300	0.160	0.308	0.1257	0.1320	0.1280	0.1928	-0.0138	0.0003
0.350	0.187	0.359	0.1303	0.1294	0.1317	0.1957	-0.0142	0.0002
0.400	0.213	0.410	0.1341	0.1257	0.1298	0.1948	-0.0142	0.0007
0.500	0.267	0.513	0.1410	0.1097	0.1247	0.1877	-0.0133	0.0005
0.600	0.320	0.615	0.1446	0.0860	0.1151	0.1728	-0.0109	0.0000
0.700	0.373	0.718	0.1448	0.0470	0.0982	0.1450	-0.0075	0.0002
0.800	0.427	0.821	0.1331	0.0293	0.0877	0.1251	-0.0045	-0.0000
0.900	0.480	0.923	0.1220	0.0228	0.0733	0.1090	-0.0018	0.0000
1.000	0.533	1.026	0.1188	0.0216	0.0312	0.0858	0.0008	-0.0000

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00199

TABLE A16-29

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 7.50 INS. (2 HYDRAULIC DIAMETERS)

OUTER WALL GREEN POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	EB	VA	EC	VC (VOLTS)	ED	EF	VD	U UMAX
0.050	0.132	0.170	11.38	0.145	10.56	0.158	0.173	11.72	0.605
0.100	0.132	0.170	11.45	0.141	10.64	0.155	0.172	11.79	0.660
0.150	0.131	0.171	11.49	0.140	10.69	0.154	0.172	11.83	0.690
0.200	0.131	0.172	11.51	0.141	10.72	0.155	0.170	11.85	0.714
0.250	0.130	0.174	11.54	0.142	10.75	0.155	0.170	11.88	0.738
0.300	0.130	0.176	11.56	0.142	10.77	0.156	0.170	11.92	0.760
0.350	0.130	0.178	11.59	0.141	10.81	0.157	0.168	11.94	0.784
0.400	0.129	0.182	11.61	0.140	10.84	0.159	0.167	11.96	0.807
0.500	0.129	0.191	11.66	0.135	10.89	0.160	0.163	12.02	0.857
0.600	0.128	0.200	11.71	0.127	10.95	0.158	0.159	12.07	0.906
0.700	0.128	0.198	11.76	0.118	11.00	0.151	0.151	12.11	0.950
0.800	0.128	0.190	11.79	0.106	11.04	0.144	0.142	12.15	0.985
0.900	0.129	0.177	11.80	0.100	11.05	0.135	0.132	12.17	1.000

VOA = 9.95 VOLTS VOC = 8.87 VOLTS VOD = 10.29 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.056	0.1126	0.0781	0.0980	0.1444	-0.0047	-0.0020
0.100	0.053	0.111	0.1144	0.0869	0.1028	0.1521	-0.0051	-0.0025
0.150	0.080	0.167	0.1162	0.0890	0.1047	0.1550	-0.0056	-0.0027
0.200	0.107	0.222	0.1192	0.0912	0.1059	0.1581	-0.0060	-0.0023
0.250	0.133	0.278	0.1223	0.0919	0.1059	0.1601	-0.0066	-0.0024
0.300	0.160	0.333	0.1243	0.0955	0.1059	0.1629	-0.0072	-0.0023
0.350	0.187	0.389	0.1254	0.1002	0.1088	0.1672	-0.0078	-0.00[illegible]
0.400	0.213	0.444	0.1265	0.1056	0.1127	0.1724	-0.0090	-0.00[illegible]4
0.500	0.267	0.556	0.1260	0.1230	0.1177	0.1834	-0.0116	-0.0[illegible]
0.600	0.320	0.667	0.1220	0.1412	0.1243	0.1938	-0.0146	-0.0[illegible]
0.700	0.373	0.778	0.1165	0.1501	0.1244	0.1955	-0.0148	[illegible]
0.800	0.427	0.889	0.1067	0.1550	0.1246	0.1931	-0.0133	[illegible]
0.900	0.480	1.000	0.1016	0.1508	0.1156	0.1840	-0.0101	[illegible]

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.002[illegible]

TABLE A16-30

DIFFUSER NON DIMENSIONAL LENGTH = 10.0

AXIAL DISTANCE FROM OUTLET= 11.25 INS (3 HYDRAULIC DIAMETERS)

OUTER WALL RFD POSITION

EXPERIMENTAL DATA

RO-R (INS)	EA	FB	VA	FC	VC	ED	FE	VD	U UMAX
				(VOLTS)					
0.050	0.122	0.147	11.19	0.124	10.63	0.144	0.156	11.82	0.670
0.100	0.120	0.150	11.28	0.123	10.70	0.138	0.148	11.89	0.730
0.150	0.118	0.152	11.34	0.122	10.75	0.134	0.144	11.94	0.767
0.200	0.116	0.153	11.37	0.121	10.78	0.132	0.142	11.97	0.795
0.250	0.114	0.154	11.39	0.120	10.81	0.131	0.142	11.99	0.815
0.300	0.113	0.154	11.42	0.119	10.83	0.131	0.142	12.01	0.835
0.350	0.111	0.154	11.44	0.118	10.84	0.130	0.141	12.03	0.852
0.400	0.110	0.153	11.45	0.116	10.86	0.130	0.140	12.05	0.870
0.500	0.108	0.150	11.49	0.113	10.89	0.127	0.138	12.09	0.905
0.600	0.105	0.141	11.53	0.110	10.92	0.122	0.134	12.12	0.940
0.700	0.103	0.132	11.55	0.106	10.94	0.117	0.128	12.16	0.970
0.800	0.104	0.121	11.57	0.101	10.95	0.112	0.120	12.19	0.992
0.900	0.108	0.111	11.58	0.095	10.95	0.106	0.113	12.19	1.000

VOA = 9.73 VOLTS VOC = 8.87 VOLTS VOD = 10.28 VOLTS

RESULTS

RO-R (INS)	RO-R RO-RI	RO-R RO-RM	UTURB ND	VTURB ND	WTURB ND	TURBKE ND	2(U*V) ND	2(U*W) ND
0.050	0.027	0.054	0.1029	0.0837	0.0945	0.1406	-0.0032	-0.0016
0.100	0.053	0.108	0.1073	0.0860	0.0887	0.1410	-0.0042	-0.0014
0.150	0.080	0.162	0.1092	0.0874	0.0845	0.1406	-0.0049	-0.0014
0.200	0.107	0.216	0.1103	0.0891	0.0842	0.1418	-0.0054	-0.0014
0.250	0.133	0.270	0.1109	0.0907	0.0858	0.1437	-0.0060	-0.0016
0.300	0.160	0.324	0.1115	0.0915	0.0882	0.1455	-0.0062	-0.0016
0.350	0.187	0.378	0.1120	0.0918	0.0879	0.1458	-0.0066	-0.0016
0.400	0.213	0.432	0.1115	0.0933	0.0900	0.1474	-0.0067	-0.0015
0.500	0.267	0.541	0.1116	0.0936	0.0900	0.1476	-0.0067	-0.0017
0.600	0.320	0.649	0.1114	0.0863	0.0875	0.1426	-0.0057	-0.0019
0.700	0.373	0.757	0.1097	0.0816	0.0823	0.1368	-0.0045	-0.0017
0.800	0.427	0.865	0.1062	0.0784	0.0763	0.1305	-0.0026	-0.0012
0.900	0.480	0.973	0.1007	0.0805	0.0731	0.1272	-0.0005	-0.0010

SKIN FRICTION COEFFICIENT DUE TO LUDWIEG AND TILLMAN = 0.00370

TABLE A16-31 VALUES OF $\frac{1}{2U^2}(\overline{u'^2}+\overline{v'^2}+\overline{w'^2})$, $L/\Delta R_1 = 10$ DIFFUSER, INNER WALL LAYER

ins X / R−Ri	−3.0	1.0	2.25	3.25	4.25	5.45	7.25	9 85
0 025	0 0050	0 0095	0 0104	0.0108	/	/	/	/
0 05	0 0057	0 0092	0 0106	0.0113	0 0167	0.0117	0.0144	0.0132
0.10	0 0052	0 0080	0 0097	0 0128	0 0176	0 0134	0.0155	0 0155
0 15	0 0044	0 0066	0 0084	0 0119	0 0163	0 0139	0 0165	0 0173
0 20	0 0036	0 0053	0 0071	0 0106	0 0151	0 0136	0 0168	0 0187
0.25	0 0030	0 0044	0.0059	0 0091	0.0130	0 0127	0 0164	0 0202
0 30	0 0025	0 0036	0 0047	0 0077	0 0110	0 0115	0 0160	0 0208
0 35	0 0020	0 0029	0 0039	0 0064	0 0096	0.0099	0.0149	0 0221
0 40	0 0017	0 0023	0.0031	0 0053	0 0079	0 0084	0 0134	0 0228
0 45	0 0013	0.0019	0 0025	0.0043	0 0065	0 0070	0 0120	0 0222
0 50	0 0013	0.0016	0 0020	0 0034	0 0051	0 0058	0 0105	0.0213
0 55		0.0017	0.0018	0 0029	0.0040	0 0045	0 0088	0 0204
0.60			0 0018	0 0025	0 0032	0 0038	0 0074	0 0193
0.65				0 0024	0 0027	0 0030	0 0059	0.0176
0.70				0.0026	0 0025	0 0028	0.0047	0 0159
0.75					0.0030	0.0027	0 0037	0.0136
0 80							0 0031	0.0116
0.85							0 0032	0 0092
0.90								0 0074

TABLE A16-32 VALUES OF $\frac{1}{2U^2}(\overline{u'^2}+\overline{v'^2}+\overline{w'^2})$, $L/\Delta R_1 = 10$ DIFFUSER, OUTER WALL LAYER

ins X / $R_o - R$	-3 0	1 0	2.25	3 25	4.25	5.45	7.25	9 85
0 025	/	0 0067	0 0110	0.0119	/	/	/	/
0 05	0 0039	0 0072	0 0112	0.0123	0.0167	0 0121	0 0154	0 0114
0.10	0 0038	0 0067	0 0094	0 0118	0 0160	0 0128	0 0168	0.0141
0 15	0 0031	0 0057	0.0079	0 0103	0 0152	0 0135	0 0179	0.0163
0.20	0 0026	0 0049	0 0064	0.0090	0 0139	0 0129	0 0180	0 0177
0 25	0 0023	0.0041	0 0054	0 0076	0 0117	0 0117	0 0170	0 0187
0 30	0 0018	0 0036	0.0047	0 0067	0.0100	0 0108	0 0155	0 0195
0.35	0.0015	0 0030	0 0039	0 0055	0 0083	0.0087	0 0142	0 0194
0 40	0 0014	0 0024	0.0032	0 0046	0 0069	0.0078	0 0125	0 0188
0.45	0 0012	0 0021	0 0028	0 0038	0 0057	0 0066	0 0105	0 0174
0 50	0 0012	0 0018	0 0023	0 0032	0 0048	0 0055	0 0090	0 0159
0.55		0 0017	0 0020	0 0027	0 0039	0 0044	0 0074	0 0148
0.60		0 0017	0 0018	0 0023	0 0034	0 0035	0 0061	0.0131
0.65					0 0029	0 0033	0 0048	0 0114
0 70						0 0030	0 0040	0 0095
0 75						0 0033	0 0034	0 0079
0.80							0 0030	0 0067
0 85								0.0055
0 90								0.0050
0 95								0 0052

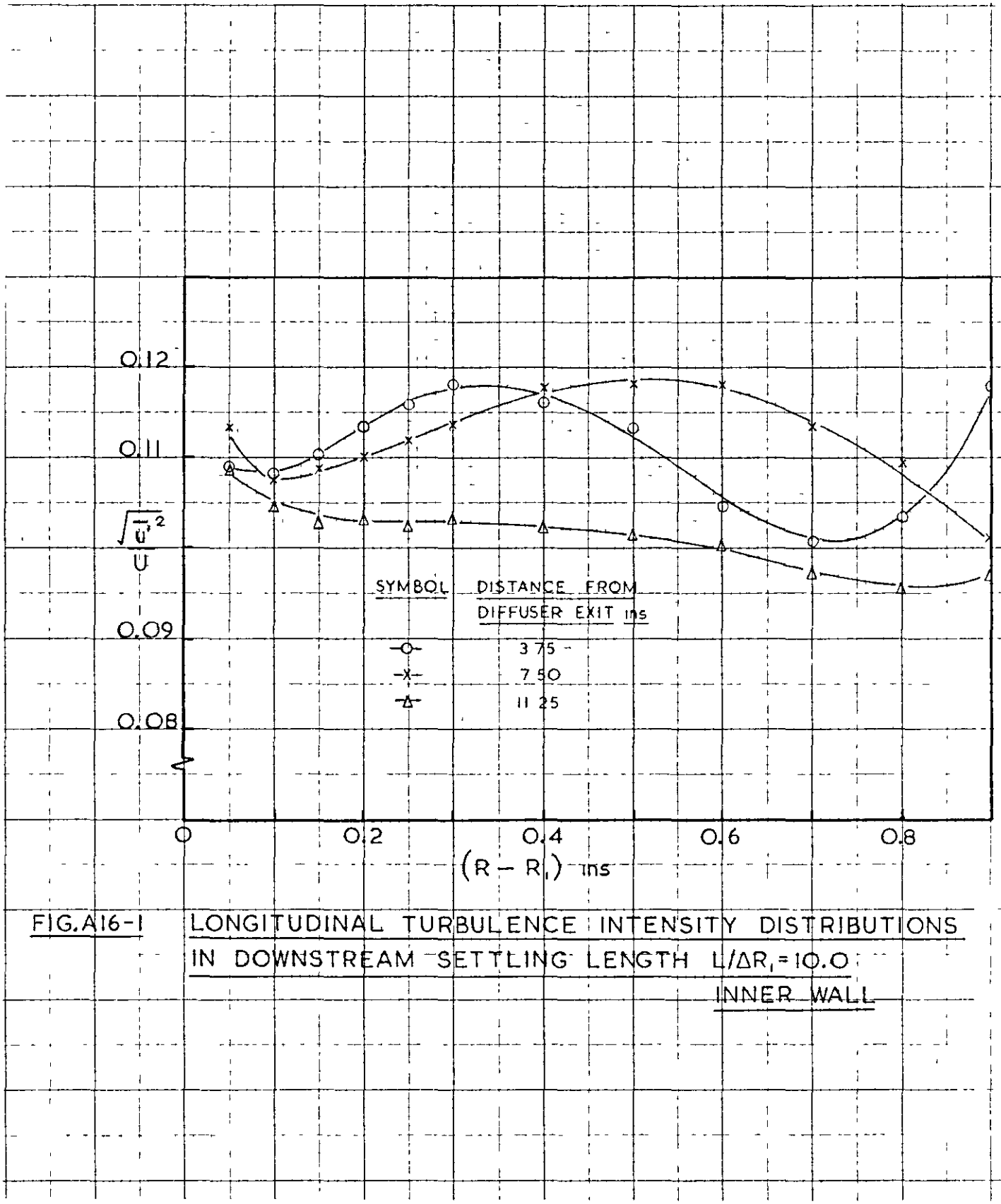


FIG.A16-1 LONGITUDINAL TURBULENCE INTENSITY DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_1 = 10.0$

INNER WALL

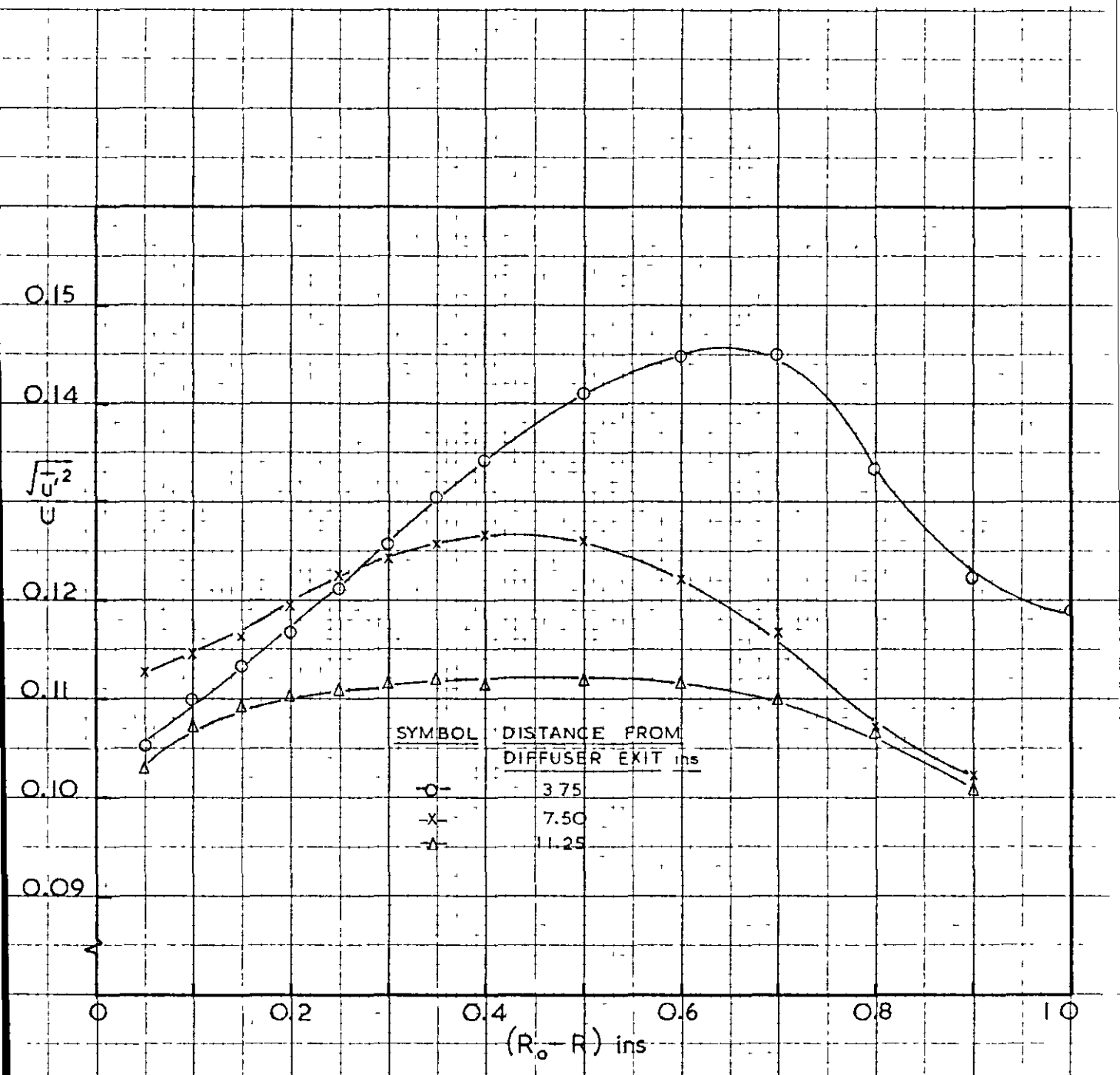


FIG. A16-2 LONGITUDINAL TURBULENCE INTENSITY DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_i = 10.0$ OUTER WALL

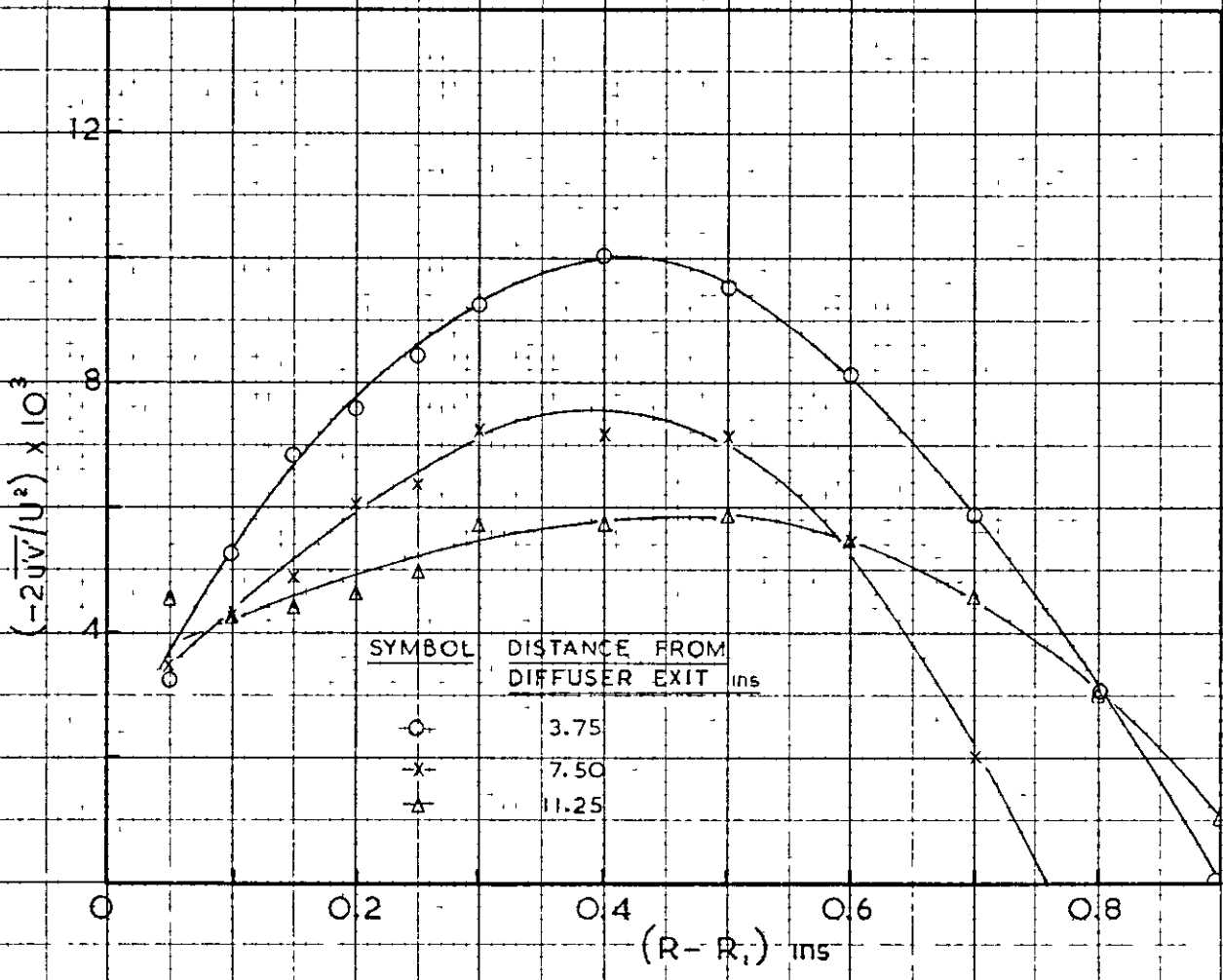


FIG.A16-3 EXPERIMENTAL SHEAR STRESS DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_i = 10.0$ INNER WALL

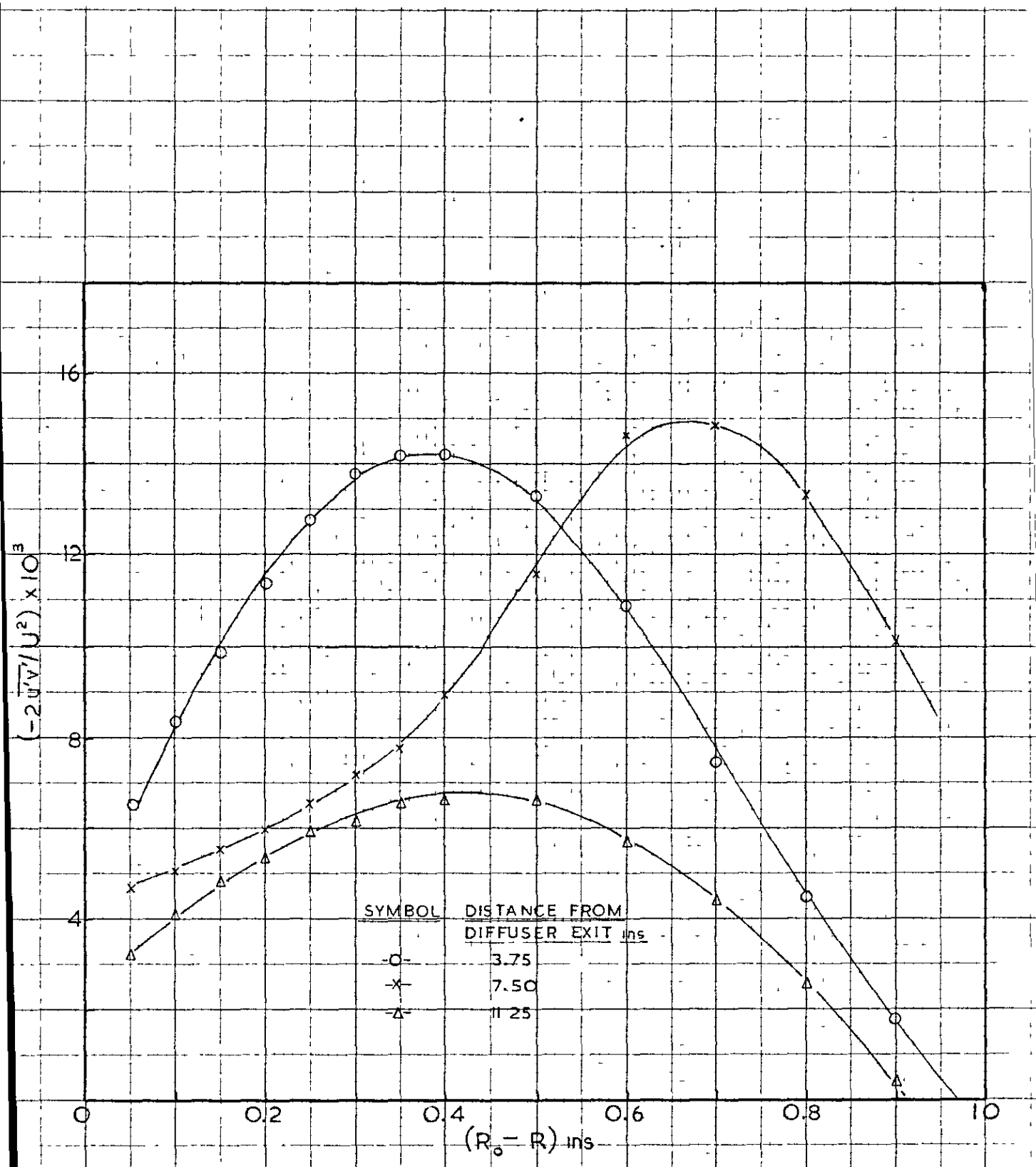


FIG.A16-4 EXPERIMENTAL SHEAR STRESS DISTRIBUTIONS IN DOWNSTREAM SETTLING LENGTH $L/\Delta R_1 = 10.0$

OUTER WALL

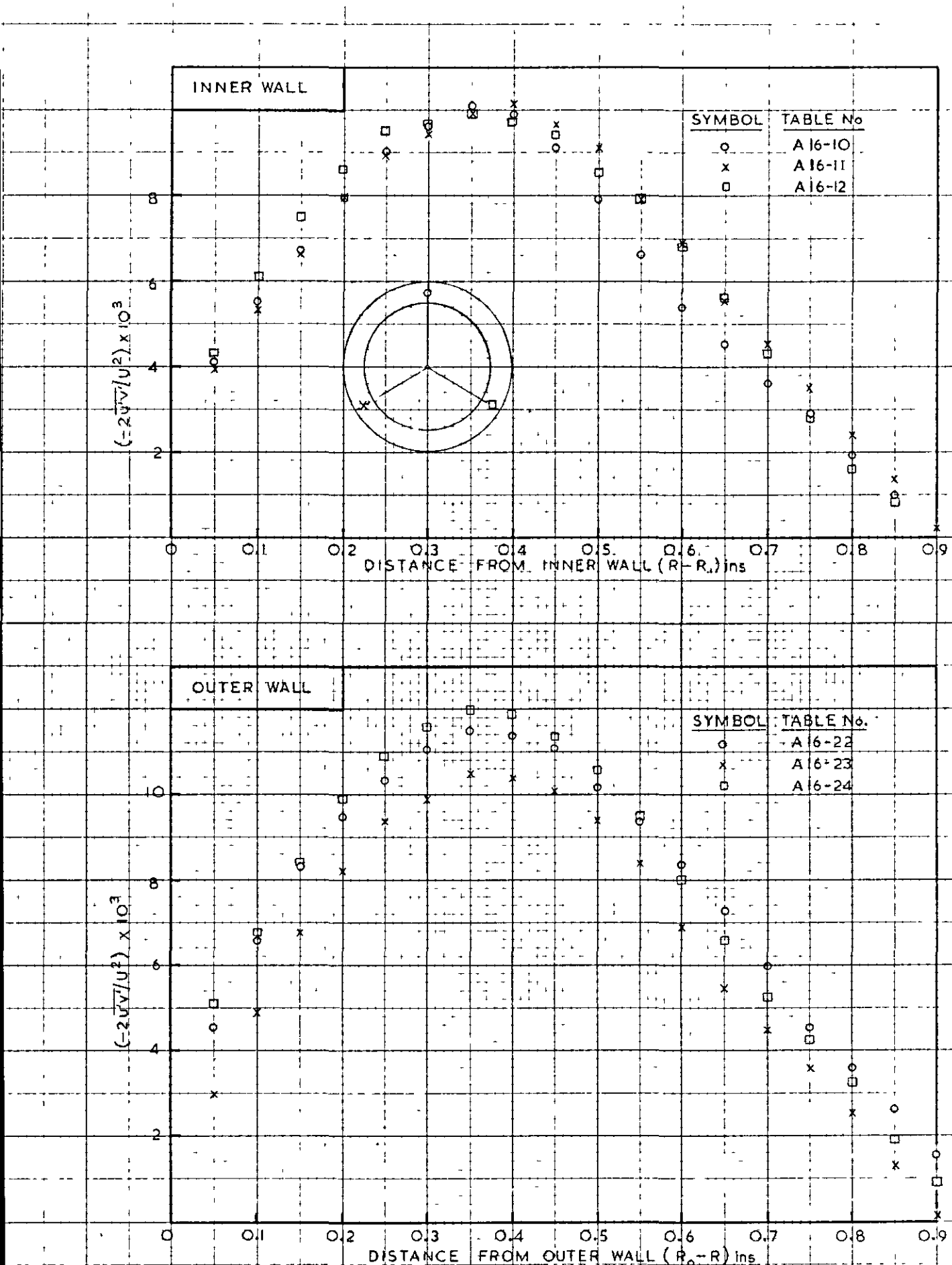


FIG.A16-6 DISTRIBUTION OF TURBULENT SHEAR STRESS ALONG THREE EQUALLY SPACED RADII AT OUTLET OF THE $L/\Delta R_i$=10.0 DIFFUSER