December 1983

MCIC-HB-01R
Volume 2



# Damage Tolerant Design Handbook

## A Compilation of Fracture and Crack-Growth Data for High Strength Alloys



Metals and Ceramics Information Center
Battelle
Columbus Laboratories

Prepared by

University of Dayton Research Institute

Materials Laboratory
Air Force Wright Aeronautical Laboratories
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This edition entirely revamps the 1975 edition. This edition is arranged by alloy rather than by property as in the previous addition. The data are presented in eight chapters and four volumes. Plane-strain fracture toughness ($K_{IC}$), critical plane stress fracture toughness, apparent fracture toughness, R-curve, fatigue crack growth rates, sustained-load crack growth rate and threshold stress intensity ($K_{ISCC}$) data are presented for stainless steels, titanium alloys, nickel-base alloys, alloy steels, 2000-, 6000- and 7000-series aluminum alloys.

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**Sponsored by**

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MCIC is publishing this revised and expanded edition of the Damage Tolerant Design Handbook to increase the availability of information to the technical community. The loose leaf format was selected to facilitate updating the handbook as new information becomes available. This edition is a completely revised and expanded version of the original handbook first published by MCIC in 1972 and revised in 1973 and 1975.

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TABLE 1.4

ABBREVIATIONS FOR MATERIAL SYSTEMS

| Abbreviation | Materials |
|---|---|
| ALUM | Aluminum Alloys |
| TITAN. | Titanium Alloys |
| NICKEL | Nickel-Base Alloys |
| STAIN. STEEL | Stainless Steel Alloys |
| ALLOY STEEL | Steel Alloys |

TABLE 1.5

ABBREVIATIONS FOR ALLOY CONDITIONING AND HEAT TREATMENTS

| Abbreviation | Condition/Heat Treatment |
|---|---|
| OQ | Oil Quenched |
| ABQ | Aus-Bay Quench |
| AC | Air Cool |
| WC | Water Quench |
| MA | Mill Anneal |
| BA | Beta Anneal |
| DA | Duplex Anneal |
| RA | Recrystallize Anneal |
| ST | Solution Treated |
| STA | Solution Treated And Aged |

TABLE 1.6

ABBREVIATIONS FOR PRODUCT FORMS

| Abbreviations | Product Form |
|---|---|
| S | Sheet |
| P | Plate |
| E | Extrusion |
| F | Forging |
| FB | Forged Bar |
| BT | Billet |
| BR | Round Bar |
| RB | Rolled Bar |
| C | Casting |
| W | Weldment |
| D | Disk |
| EB | Extruded Bar |
| B | Bar |

TABLE 1.7

ABBREVIATIONS FOR ENVIRONMENTAL SYSTEMS

| Abbreviations | Environmental System |
|---|---|
| R. T. | Room Temperature (65°F-80°F) |
| L. H. A. | Low Humidity Air ( < 10% RH) |
| Dry Air | Low Humidity Air ( < 10% RH) |
| H. H. A. | High Humidity Air (> 80% RH) |
| Lab. Air | Laboratory Air (% RH unspecified) |
| Dist. $H_2O$ | Distilled Water |
| Dist. Water | Distilled Water |
| 3.5 PCT Nacl | 3.5% Salt Water Solution |
| JP.4 | JP-4 Aircraft Fuel |
| JP.4 - Fuel | JP-4 Aircraft Fuel |
| S. T. W. | Sump Tank Water |
| S. S. W. | Simulated Sea Water |
| S. C. S. | Shop Cleaning Solvent |
| F. C. S. | Field Cleaning Solvent |
| Salt Fog | Salt Fog |
| Temp. | Temperature |

TABLE 1.8

ABBREVIATIONS FOR SPECIMEN DESIGNS

| Abbreviations | Specimen Design* |
|---|---|
| CT | Compact Tension |
| NB | 3Pt. Notched Bend |
| WOL | Wedge Open Load |
| CCP | Center Cracked Panel |
| BWOL | Bolt Loaded-Wedge Open Load |
| CANT | Cantilever Beam |
| TDCB | Tapered Double Cantilever Beam |
| CHAR | Charpy |
| PTSC | Part Through Surface Crack |
| SENT | Single Edge Notch Tension |
| $K_B$BAR | $K_B$ Bar |
| 4-NB | 4 Pt. Notched Bend |
| MCT | Modified Compact Tension |
| CNT | Center Notched Tension |
| DCB | Double Cantilever Beam |
| BDCB | Bolt Loaded Double Cantilever Beam |

*Also note that when "SG" is used in conjunction with a specimen design, the specimen is side-grooved along the path of the crack.

# Volume 2

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### CHAPTER 5 NICKEL BASE ALLOYS



### CHAPTER 6 ALLOY STEELS

# CHAPTER 5

## NICKEL BASE ALLOY SECTIONS

Table 5.0.1

**AVAILABLE DATA FOR NICKEL-BASE SUPERALLOYS**

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| ASTROLOY P/M-H | 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | | | | X | | |
| ASTROLOY P/M-W | 2025F 4HRS AC, 1600F 8HRS AC, 1800F 4HRS AC, 1200F 24HRS AC, 1400F 8HRS AC | DISK | | | | X | | |
| ASTROLOY 901 | ----- | ---- | | | | X | | |
| INCOLOY 901 | ----- | ---- | | | | X | | |
| INCONEL 600 | 1585F .75HR AC | PLATE | | | | X | | |
| | 1585F .75HR AC, 1000F, 18800HRS | PLATE | | | | X | | |
| | 1585F .75HR AC, 1200F 1450 HRS | PLATE | | | | X | | |
| INCONEL 625 | MA | PLATE | | | | X | | |
| INCONEL 718 | COLD ROLLED 30 PERCENT AND AGED | SHEET | | X | | | | |
| | ST 1850F, 1360F 9HRS F/C 1175F | FORGED BAR | | | | X | | |
| | 1325F 8 HR, FC TO 1150F, HOLD 18 HR | FORGING | X | | | | | |
| | 1325F 8HRS, FC TO 1150F | FORGING | | | | X | | |
| | 1325F 9 HR, FC TO 1150F AT 100F/HR, HOLD AT 1150F 8 HR, AC | FORGING | X | | | | | |
| | 1730F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | | | | X | | |

Table 5.0.1 (con't)

AVAILABLE DATA FOR NICKEL-BASE SUPERALLOYS

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| INCONEL 718 | 1750F, AC, 1325F, 8HRS, FC TO 1130F, HELD 18HRS, AC | SHEET | | | | X | | |
| | | PLATE | | | | X | | |
| | | FORGING | | | | X | | |
| | | FORGED BAR | | | | X | | |
| | 1750F, 1HR, AC 1325F, 8HRS, FC TO 1150F, HELD 18HRS, AC (VIM-EFR) | PLATE | | | | X | | |
| | 1750F, 1HR, AC 1325F, 8HRS, FC TO 1150F, HELD 18HRS, AC (VIM-VAR) | FORGED BAR | | | | X | | |
| | 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC | DISK | | | | X | | |
| | 1800F 1HR Q, 1325F 8HRS FC TO 1150F HOLD 8HRS AC | FORGING | | | | X | | |
| | 1850F 1.5HR OQ, 1360F 9HRS, FC TO 1175F | FORGED BAR | | | | | | X |
| | 1880F 1HR AC 1520F 8HR FC 1200F 16HR AC | SHEET | | | | | | X |
| | 1950F, AC, 1325F, 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | | | | X | | |
| IN100 | ------ | ---- | | | | X | | |
| | | FORGING | | | | X | | |
| | PRESTRAIN | FORGING | | | | X | | |
| IN100 P/M-G | 2050F 2HRS OQ, 1600F 0.67HR AC, 1200F 24HRS AC, 1400F 4HRS AC | DISK | | | | X | | |
| NASA IIB-7 P/M | 1650F 16HRS TO 2000F 1HR OQ, 1400F 16HRS AC | DISK | | | | X | | |

Table 5.0.1 (con't)

AVAILABLE DATA FOR NICKEL-BASE SUPERALLOYS

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| P/M RENE 95 | 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC | DISK | | | | X | | |
| | 2100F 1HR, SQ AT 1000F, 1600F 1HR, 1200F 24HRS, AC | DISK | | | | X | | |
| RENE 95 (H&F) | 2000F 1HR, SQ AT 1000F, 1400F 16HRS | FORGING | | | | X | | |
| WASPALOY | ----- | ---- | | | | X | | |
| | | FORGING | | | | X | | |
| | 1850F 2HRS, 1350F 6HRS, (FINE GS, SMALL PRECIPITATES) | BILLET | | | | X | | |
| | 1850F 2HRS, 1600F 24HRS (FINE GS, LARGE PRECIPITATES) | BILLET | | | | X | | |
| | 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC | DISK | | | | X | | |
| | 2010F 2HRS, 1350F 6HRS, (COARSE GS, SMALL PRECIPITATES) | BILLET | | | | X | | |
| | 2010F 2HRS, 1600F 24HRS, (COARSE GS, LARGE PRECIPITATES) | BILLET | | | | X | | |

TABLE 5.0.2

PLANE STRESS AND TRANSITIONAL FRACTURE TOUGHNESS
OF NICKEL BASE ALLOYS (WITHOUT BUCKLING CONSTRAINTS)

| Alloy | Condition/HT | Test Temp. (°F) | Specimen Orient | Specimen Width (in) | Yield Strength (KSI) | Specimen Thickness (in) = 0.027 $K_c^*$ (Ksi $\sqrt{in}$) |
|---|---|---|---|---|---|---|
| Inconel 718 | Cold Rolled 30 Percent and aged | -423 | L-T | 4.0 | 269.0 | 191.1/7.5 (15) |
| | | -320 | L-T | 4.0 | 259.0 | 200.6/13.8 (13) |
| | | R.T. | L-T | 4.0<br>18.0 | 218.0<br>218.0 | 178.5/3.6 (6)<br>224.6/11.1 (5) |

*Mean/Standard Deviation (No. of Specimens)

Table 5.0.3.1

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN ORIENTATION: Unknown

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.05-0.10

FREQUENCY: 10.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| INCONEL 718 | 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | PLATE | 0.05 | 10.00 | | | | 1.77 | 44.1 | |
| | 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGING | 0.05 | 10.00 | | | | 1.77 | 41.7 | |
| | 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-EFR) | PLATE | 0.05 | 10.00 | | | | 1.57 | | |
| WASPALOY | 1850F 2HRS, 1350F 6HRS(FINE GS, SMALL PRECIPITATES) | BILLET | 0.10 | 10.00 | | | | | 10.7 | |
| | 2010F 2HR, 1350F 6HR(COARSE GS, SMALL PRECIPITATES) | BILLET | 0.10 | 10.00 | | | | | 2.84 | |
| | 2010F 2HR, 1600F 24HR(COARSE GS, LARGE PRECIPITATES) | BILLET | 0.10 | 10.00 | | | | | 9.65 | |

Table 5.0.3.2

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.05

FREQUENCY: 8.33HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| INCONEL 718 | 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 8.33 | | | | 1.29 | 30.4 | |
| | 1950F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 8.33 | | | | 1.05 | | |

Table 5.0.3.3

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN ORIENTATION: T-L

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.05

FREQUENCY: 8.33-10.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| INCONEL 718 | 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-VAR) | FORGED BAR | 0.05 | 8.33- 10.00 | | | | 2.99 | 122. | |

Table 5.0.3.4

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN ORIENTATION: C-R

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.00-0.05

FREQUENCY: 0.33-10.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| INCONEL 718 | 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGED BAR | 0.05 | 10.00 | | | | 2.55 | 47.2 | |
| | 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC | DISK | 0.00 | .33 | | | | 2.06 | | |
| P/M RENE 95 | 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC | DISK | 0.00 | .33 | | | | .394 | 27.6 | |

TABLE 5.0.4

INDIVIDUAL STRESS CORROSION CRACKING THRESHOLD
DATA FOR NICKEL BASE ALLOYS AT ROOM TEMPERATURE

| | | | | | | $K_{Iscc}$ (Ksi$\sqrt{in}$) ENVIRONMENTS | | | |
|---|---|---|---|---|---|---|---|---|---|
| ALLOY | CONDITION | PRODUCT FORM | SPECIMEN ORIENTATION | SHOP CLEANING SOLVENT | SUMP TANK WATER | AEROZINE 50 | MARTIN-MARIETTA REFINED GRADE HYDRAZINE | MATHESON-COLEMAN-BELL 97% GRADE HYDRAZINE | PROPELLANT GRADE HYDRAZINE |
| INCONEL 718 | 1850 1.5 HR OQ, 1360F 9 HRS, FC to 1175F | FB | L-T | >166.0;>86.0 | >86.0;>180.0 | | | | |
| | | FB | T-L | | >89.0;121.0 | | | | |
| | | FB | S-L | | >87.0;>99.0 | | | | |
| | 1880F 1 HR AC, 1520F 8 HR FC, 1200F 16 HR AC | S | --- | | | 80.0 | 79.0;79.0 | 25.8 | 87.5 |

Table 5.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE ASTROLOY P/M-H

TEST CONDITIONS:

SPECIMEN ORIENTATION: C-R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 2 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM | | | | | | 173 | |
| 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 5 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM | | | | | | 181 | |
| 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 15 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM | | | | | | 514 | |
| 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 0.01 | | | | | | 275 | |
| 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 0.33 | | | | | 7.93 | 84.4 | |
| 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 20.00 | | | | | 4.53 | | |

TABLE 5.1.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.1.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE ASTROLOY P/M-H
CONDITION: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC

ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.01 | F(HZ)= 0.33 | F(HZ)= 20.00 | |
| DELTA K MIN | A: | 21.63 | 12.0 | | | |
| | B: | 14.25 | | 2.67 | | |
| | C: | 15.27 | | | 2.39 | |
| | D: | | | | | |
| | | 16.00 | | 3.95 | 2.64 | |
| | | 20.00 | | 7.93 | 4.53 | |
| | | 25.00 | 18.4 | 14.9 | 8.25 | |
| | | 30.00 | 31.2 | 24.2 | 13.6 | |
| | | 35.00 | 54.7 | 35.7 | 20.2 | |
| | | 40.00 | 103. | 49.4 | 27.8 | |
| | | 50.00 | 275. | 84.4 | | |
| | | 60.00 | 410. | 130. | | |
| | | 70.00 | 582. | | | |
| | | 80.00 | 1085. | | | |
| DELTA K MAX | A: | 80.05 | 1089. | | | |
| | B: | 62.12 | | 142. | | |
| | C: | 44.64 | | | 35.6 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 33.43 | 24.73 | 8.73 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR
YIELD STRENGTH: 135.8 KSI
ULT. STRENGTH: 202.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

ASTROLOY P/M-H

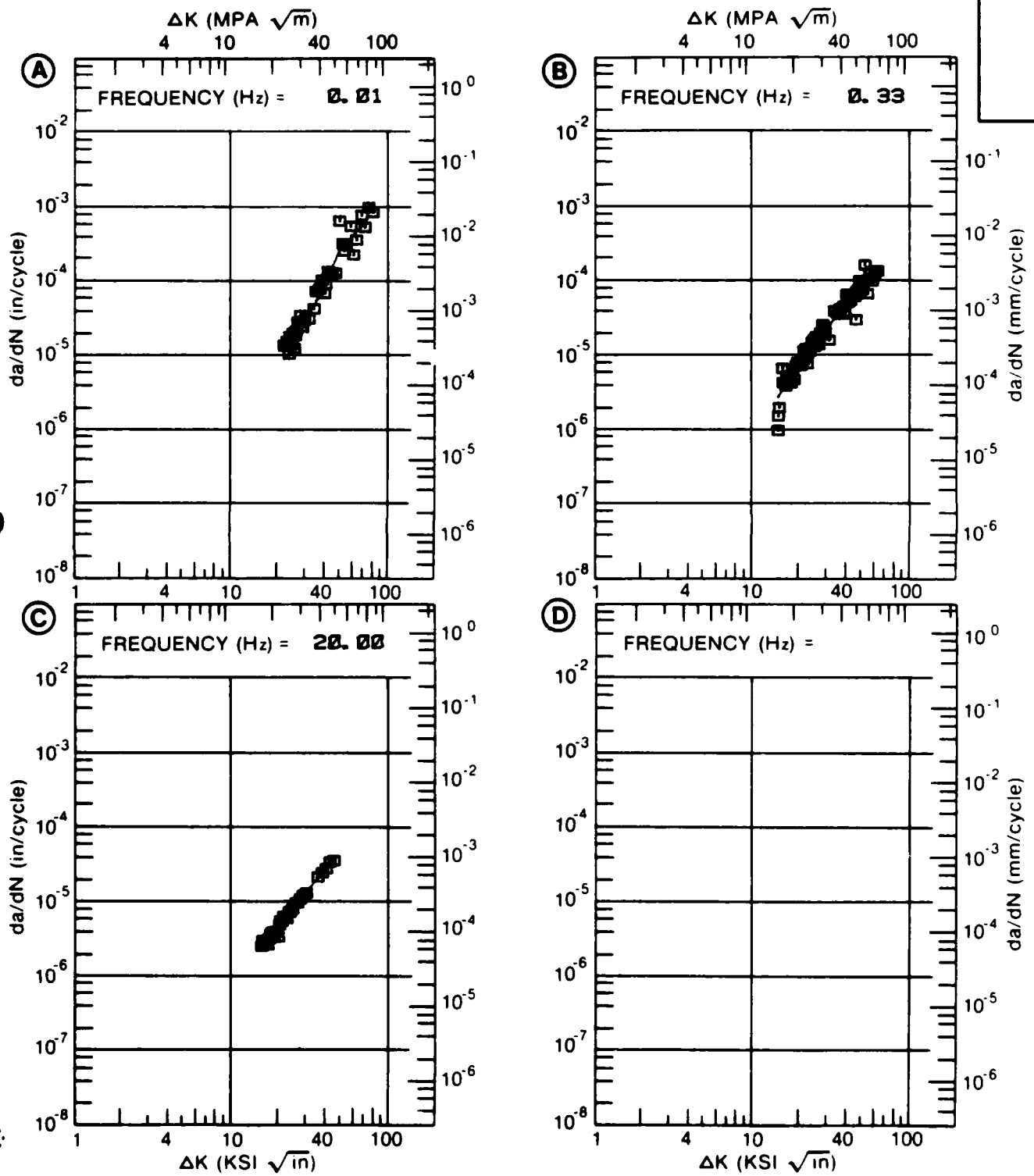



Figure 5.1.3.1

TABLE 5.1.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.1.3.2 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE ASTROLOY P/M-H
CONDITION: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC

ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=2 MIN HOLD TRAPEZOIDAL | F=5 MIN HOLD TRAPEZOIDAL | F=15 MIN HOLD TRAPEZOIDAL | |
| DELTA K MIN | A: | 29.04 | 38.9 | | | |
| | B: | 28.95 | | 90.9 | | |
| | C: | 23.79 | | | 60.7 | |
| | D: | | | | | |
| | | 25.00 | | | 64.9 | |
| | | 30.00 | 43.3 | 90.1 | 97.1 | |
| | | 35.00 | 65.5 | 95.9 | 156. | |
| | | 40.00 | 90.0 | 114. | 246. | |
| | | 50.00 | 173. | 181. | 514. | |
| | | 60.00 | 327. | 298. | 926. | |
| | | 70.00 | 559. | 472. | 1574. | |
| | | 80.00 | 842. | 708. | 2622. | |
| | | 90.00 | | 1000. | 4352. | |
| DELTA K MAX | A: | 87.40 | 1050. | | | |
| | B: | 93.51 | | 1113. | | |
| | C: | 92.44 | | | 4928. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 26.66 | 26.49 | 24.65 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 135.8 KSI
ULT. STRENGTH: 202.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

ASTROLOY P/M-H

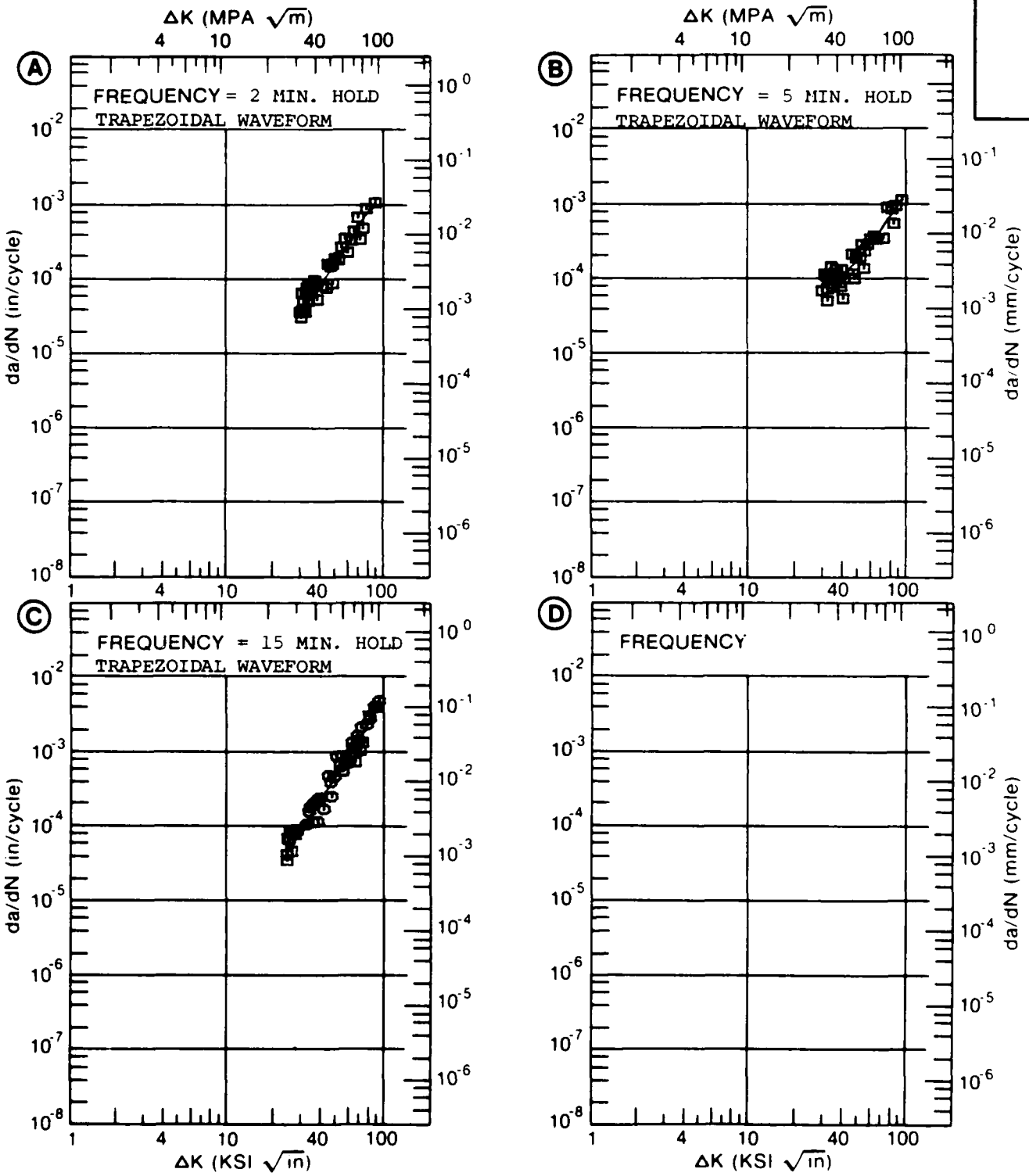



Figure 5.1.3.2

Table 5.2.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE ASTROLOY P/M-W

TEST CONDITIONS:

SPECIMEN ORIENTATION: C-R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2025F 4HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 15 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM | | | | | 50.2 | 1155 | |
| 2025F 4HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 0.33 | | | | | 10.3 | 132 | |
| 2025F 4HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC | DISK | 0.05 | 20.00 | | | | | 3.48 | | |

TABLE 5.2.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.2.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE ASTROLOY P/M-W
CONDITION: 2025F 4HR AC, 1600F 8HR AC, 1800F 4HR
1200F 24HR AC, 1400F 8HR AC

ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=15 MIN HOLD TRAPEZOIDAL | F(HZ)= 0.33 | F(HZ)= 20.00 | |
| DELTA K MIN | A: | 15.46 | 18.2 | | | |
| | B: | 12.48 | | 3.50 | | |
| | C: | 16.61 | | | 2.59 | |
| | D: | | | | | |
| | | 13.00 | | 3.61 | | |
| | | 16.00 | 21.0 | 5.26 | | |
| | | 20.00 | 50.2 | 10.3 | 3.48 | |
| | | 25.00 | 113. | 21.7 | 5.84 | |
| | | 30.00 | 218. | 37.7 | 9.22 | |
| | | 35.00 | 373. | 55.9 | 13.6 | |
| | | 40.00 | 578. | 76.5 | 18.8 | |
| | | 50.00 | 1156. | 132. | | |
| | | 60.00 | 2205. | 225. | | |
| | | 70.00 | 4714. | | | |
| | | 80.00 | 14680. | | | |
| DELTA K MAX | A: | 84.92 | 30709. | | | |
| | B: | 61.82 | | 249. | | |
| | C: | 45.34 | | | 25.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 97.51 | 14.52 | 15.84 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT. 2025F 4HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR
YIELD STRENGTH: 153.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

ASTROLOY P/M-W

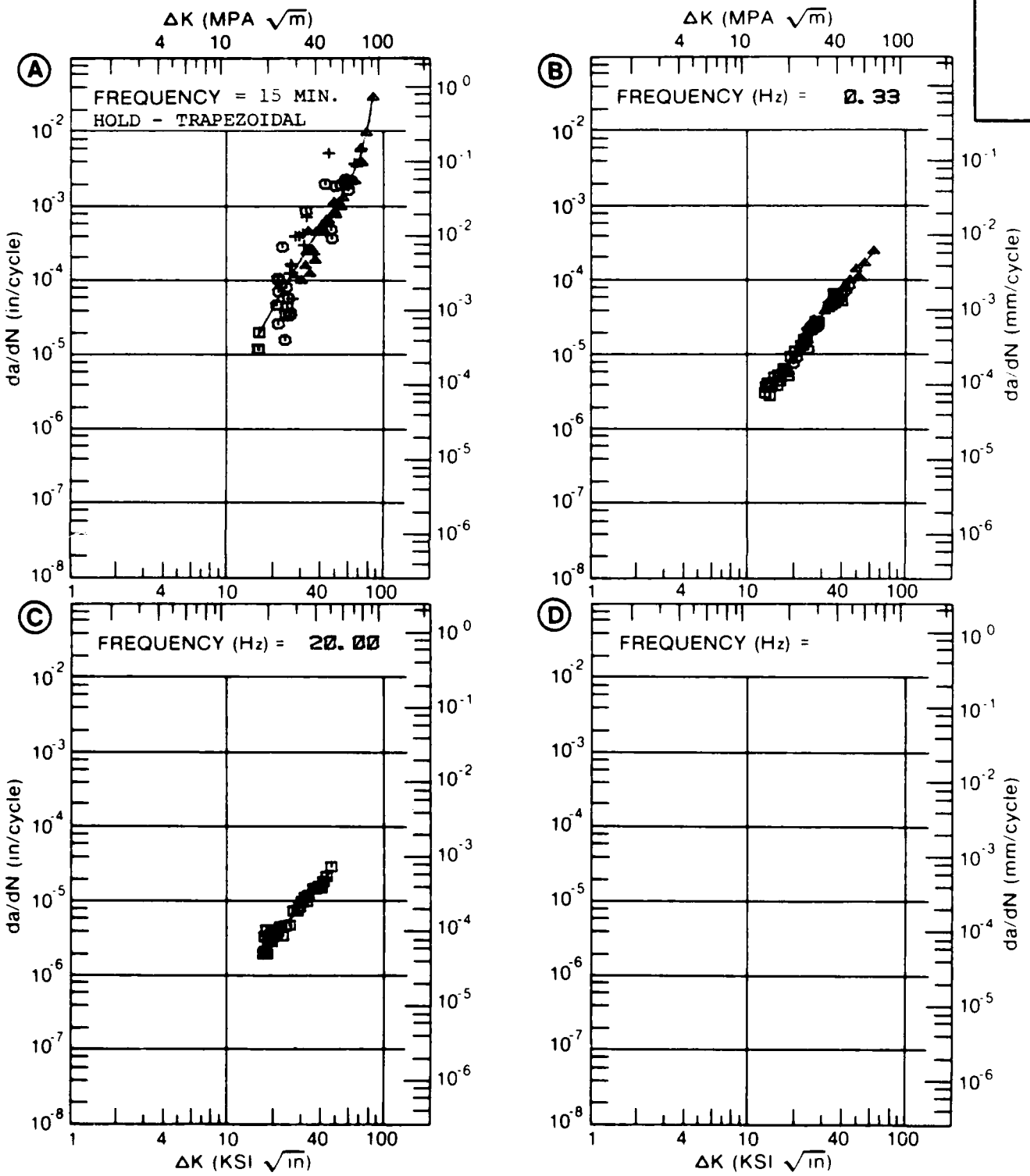



Figure 5.2.3.1

TABLE 5.3.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 18.88 | .752 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 1.12 | | | |
| | | 25.00 | 2.62 | | | |
| | | 30.00 | 4.55 | | | |
| | | 35.00 | 6.35 | | | |
| | | 40.00 | 8.55 | | | |
| | | 50.00 | 22.1 | | | |
| DELTA K MAX | A: | 59.15 | 35.1 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 11.20

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: R.T.,LAB AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.126"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL BASE

ASTROLOY 901

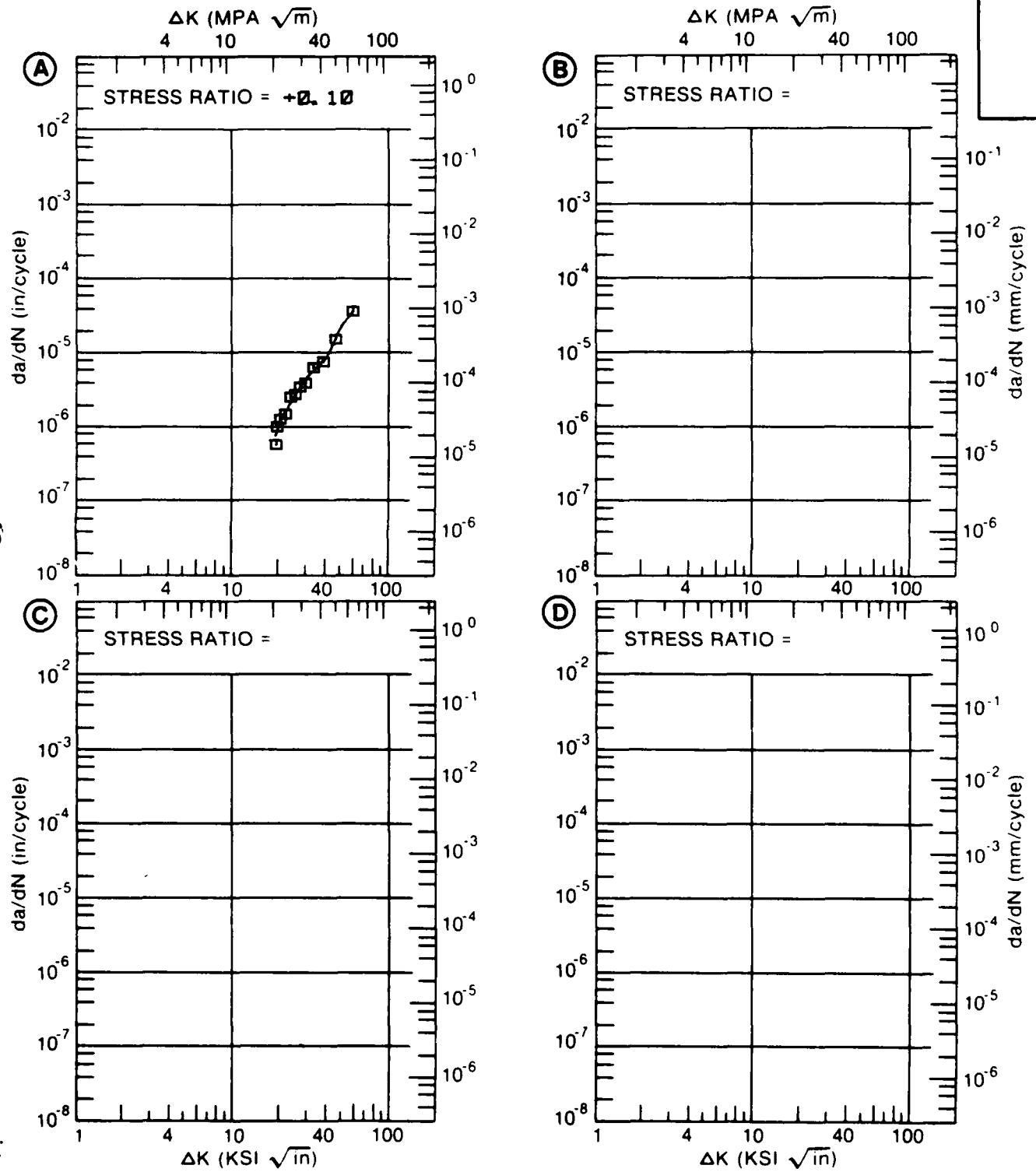



Figure 5.3.3.1

TABLE 5.3.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 16.50 | 1.99 | | | |
| | B: | 9.87 | | .867 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | | 1.21 | | |
| | | 13.00 | | 2.25 | | |
| | | 16.00 | | 3.72 | | |
| | | 20.00 | 3.58 | 5.85 | | |
| | | 25.00 | 7.14 | 9.39 | | |
| | | 30.00 | 12.0 | 15.3 | | |
| | | 35.00 | 18.9 | 23.7 | | |
| | | 40.00 | 27.7 | 34.2 | | |
| | | 50.00 | 50.0 | | | |
| | | 60.00 | 87.1 | | | |
| | | 70.00 | 172. | | | |
| | | 80.00 | 402. | | | |
| DELTA K MAX | A: | 88.23 | 918. | | | |
| | B: | 48.57 | | 54.2 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.41 | 14.70 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.121- 0.124"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL BASE

ASTROLOY 901

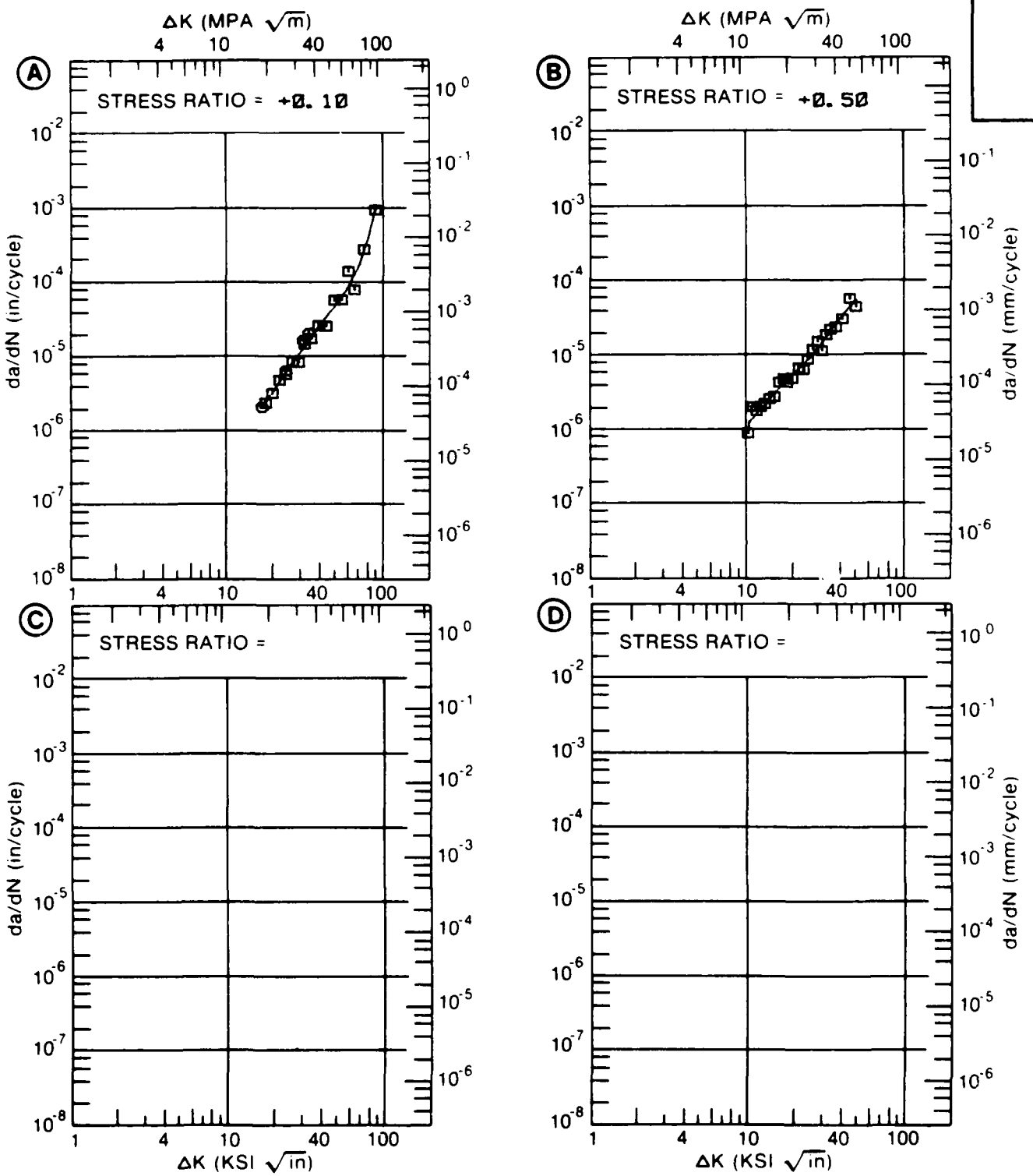



Figure 5.3.3.2

TABLE 5.3.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.70 | | | |
| DELTA K MIN A: | 8.01 | .441 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 9.00 | .428 | | | |
| | 10.00 | .601 | | | |
| | 13.00 | 1.44 | | | |
| | 16.00 | 2.26 | | | |
| | 20.00 | 3.93 | | | |
| | 25.00 | 5.98 | | | |
| DELTA K MAX A: | 26.83 | 7.68 | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 14.00

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 30.00 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH:
ULT STRENGTH:
SPECIMEN THK: 0.123"
SPECIMEN WIDTH: 2.500"
REFERENCES PW003

NICKEL BASE

ASTROLOY 901

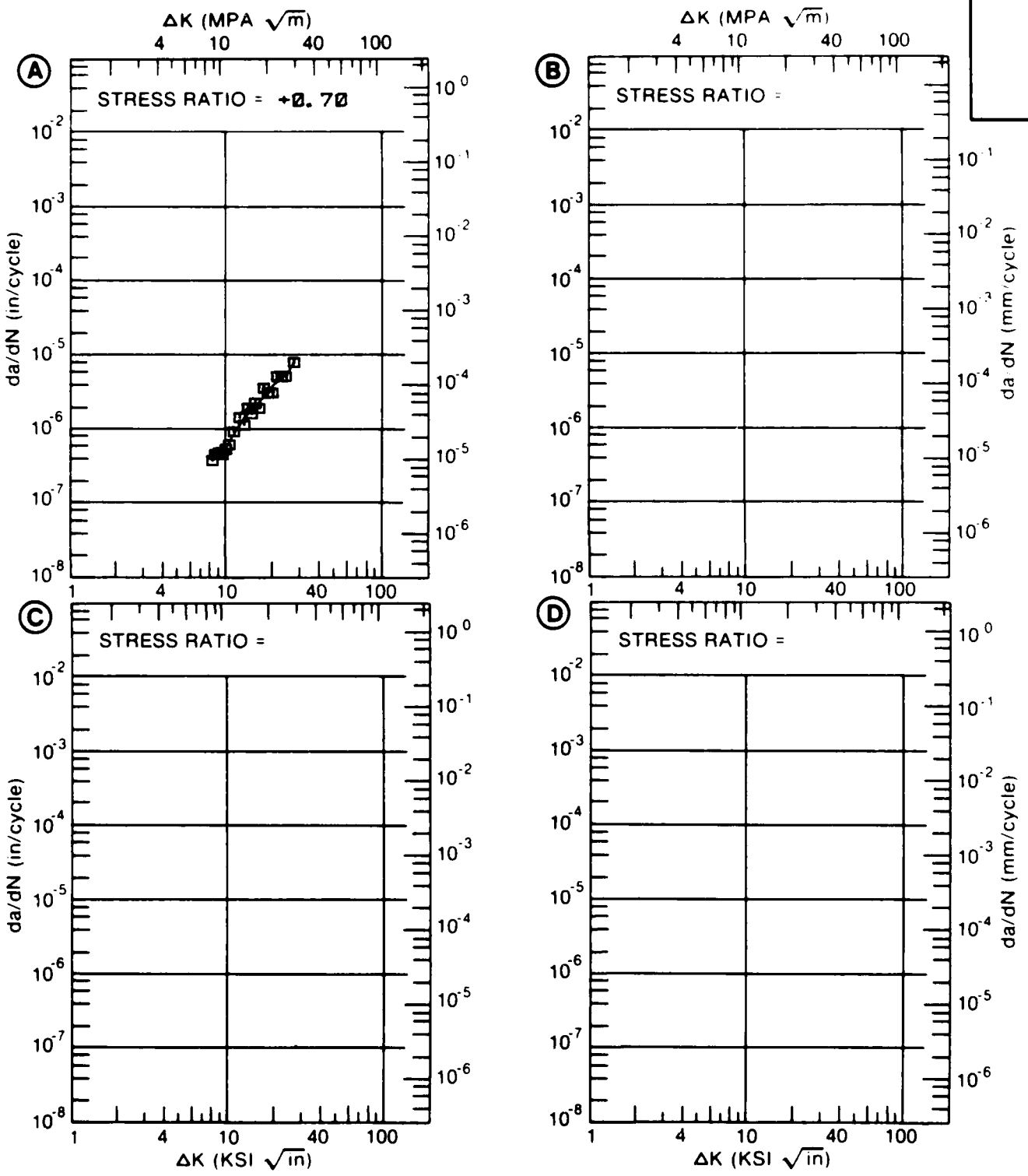



Figure 5.3.3.3

TABLE 5.3.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:
ENVIRONMENT: + 950F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | R=+0.80 | |
| DELTA K MIN | A: | 14.98 | 1.53 | | | |
| | B: | 13.38 | | 1.60 | | |
| | C: | 8.44 | | | .948 | |
| | D: | | | | | |
| | | 9.00 | | | 1.64 | |
| | | 10.00 | | | 2.08 | |
| | | 13.00 | | | 3.12 | |
| | | 16.00 | 3.15 | 4.57 | 5.03 | |
| | | 20.00 | 6.81 | 10.0 | 7.69 | |
| | | 25.00 | 10.6 | 15.6 | | |
| | | 30.00 | 15.8 | 20.7 | | |
| | | 35.00 | 22.1 | 27.7 | | |
| | | 40.00 | 30.4 | 39.7 | | |
| | | 50.00 | 65.5 | | | |
| | | 60.00 | 151. | | | |
| | | 70.00 | 191. | | | |
| DELTA K MAX | A: | 71.72 | 182. | | | |
| | B: | 42.89 | | 50.9 | | |
| | C: | 24.05 | | | 11.9 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 18.21 | 16.75 | 12.71 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 950° F. AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.117- 0.123"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL BASE

ASTROLOY 901

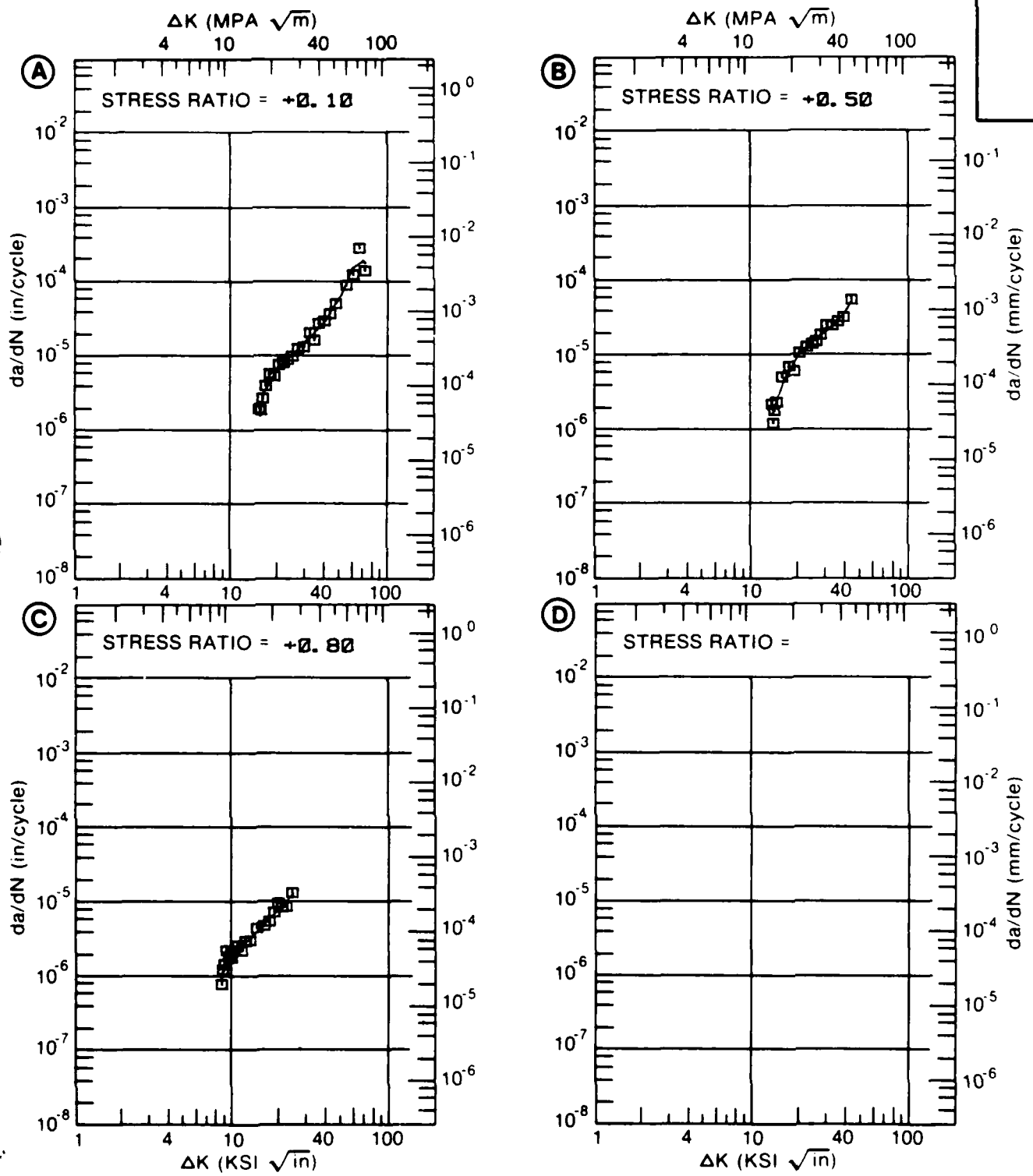



Figure 5.3.3.4

TABLE 5.3.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:
ENVIRONMENT: +1100F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 17.59 | 7.88 | | | |
| | B: | 15.58 | | 5.64 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | | 6.02 | | |
| | | 20.00 | 11.4 | 11.4 | | |
| | | 25.00 | 19.3 | 20.2 | | |
| | | 30.00 | 27.9 | 26.9 | | |
| | | 35.00 | 37.0 | 35.0 | | |
| | | 40.00 | 47.3 | 50.9 | | |
| | | 50.00 | 78.0 | | | |
| | | 60.00 | 139. | | | |
| DELTA K MAX | A: | 67.44 | 249. | | | |
| | B: | 48.57 | | 110. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 14.45 | 13.87 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1100° F, AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.122"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW003

NICKEL BASE

ASTROLOY 901

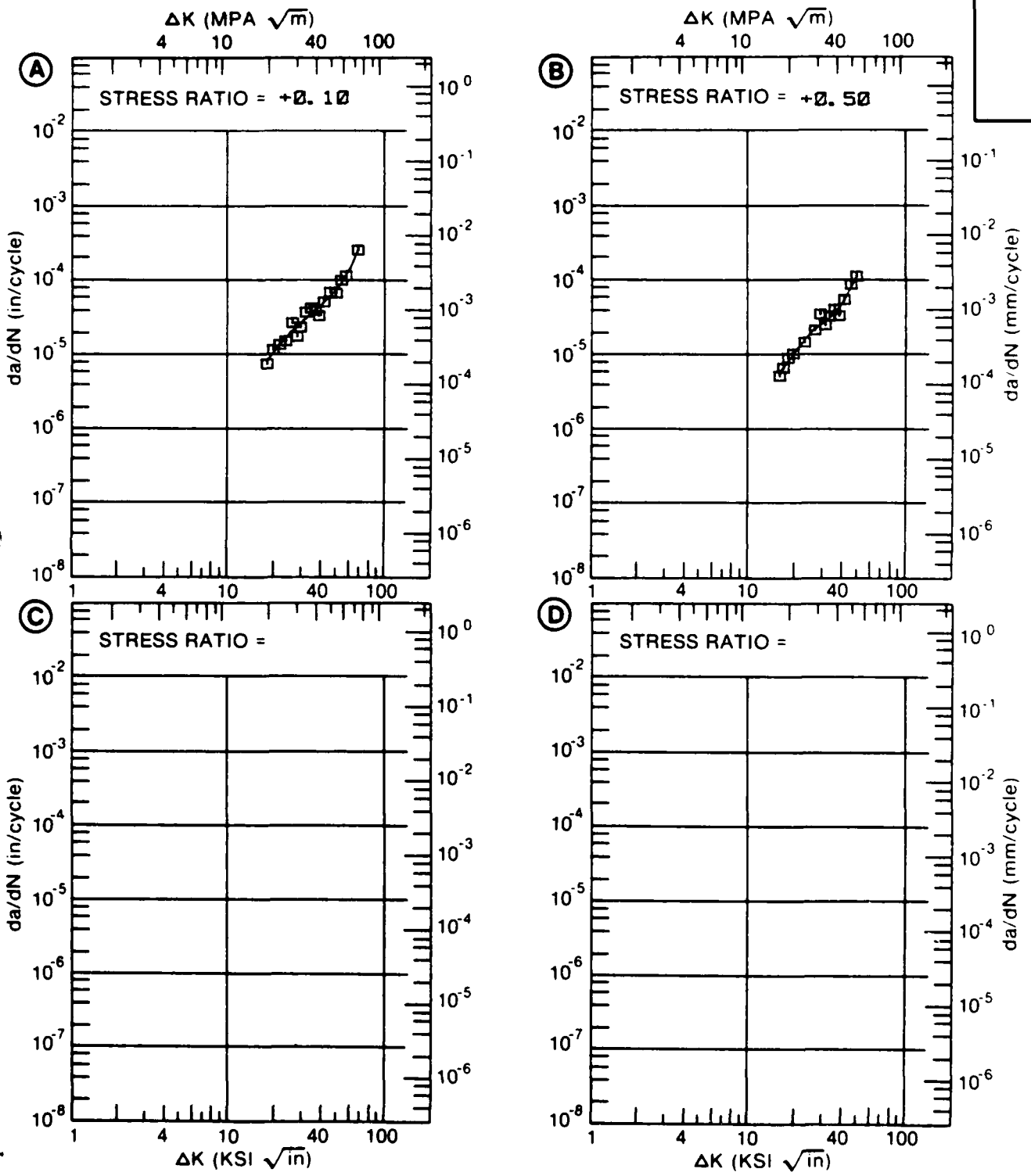



Figure 5.3.3.5

TABLE 5.3.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.6 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:
ENVIRONMENT: +1350F, AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | | | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| 200.00 | | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 0.00

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1350° F, AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL BASE

ASTROLOY 901

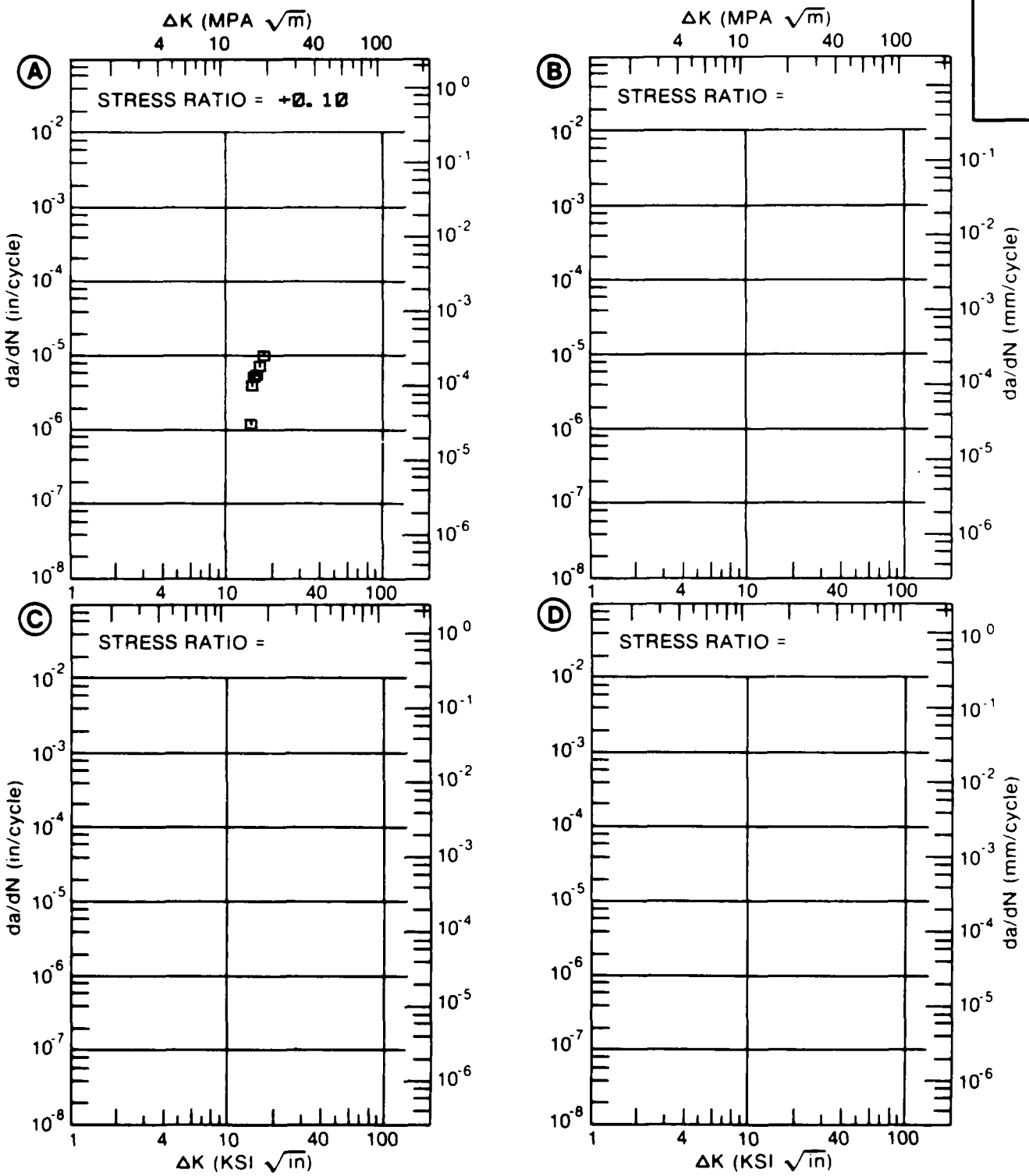



Figure 5.3.3.6

TABLE 5.3.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E=+800F AIR | E=+1100F AIR | | |
| DELTA K MIN A: | 10.86 | 1.81 | | | |
| DELTA K MIN B: | 11.04 | | 4.57 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 13.00 | 2.58 | 5.22 | | |
| | 16.00 | 3.71 | 10.9 | | |
| | 20.00 | 5.96 | 16.6 | | |
| | 25.00 | 9.97 | 24.6 | | |
| | 30.00 | 13.8 | 35.1 | | |
| | 35.00 | 19.9 | 37.8 | | |
| | 40.00 | 29.4 | | | |
| DELTA K MAX A: | 45.80 | 37.3 | | | |
| DELTA K MAX B: | 36.86 | | 35.6 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 11.65 | 15.60 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION: C-R
STRESS RATIO: +0.50
FREQUENCY: 0.17 HZ

YIELD STRENGTH:
ULT STRENGTH:
SPECIMEN THK: 0.122"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW003

NICKEL BASE

ASTROLOY 901

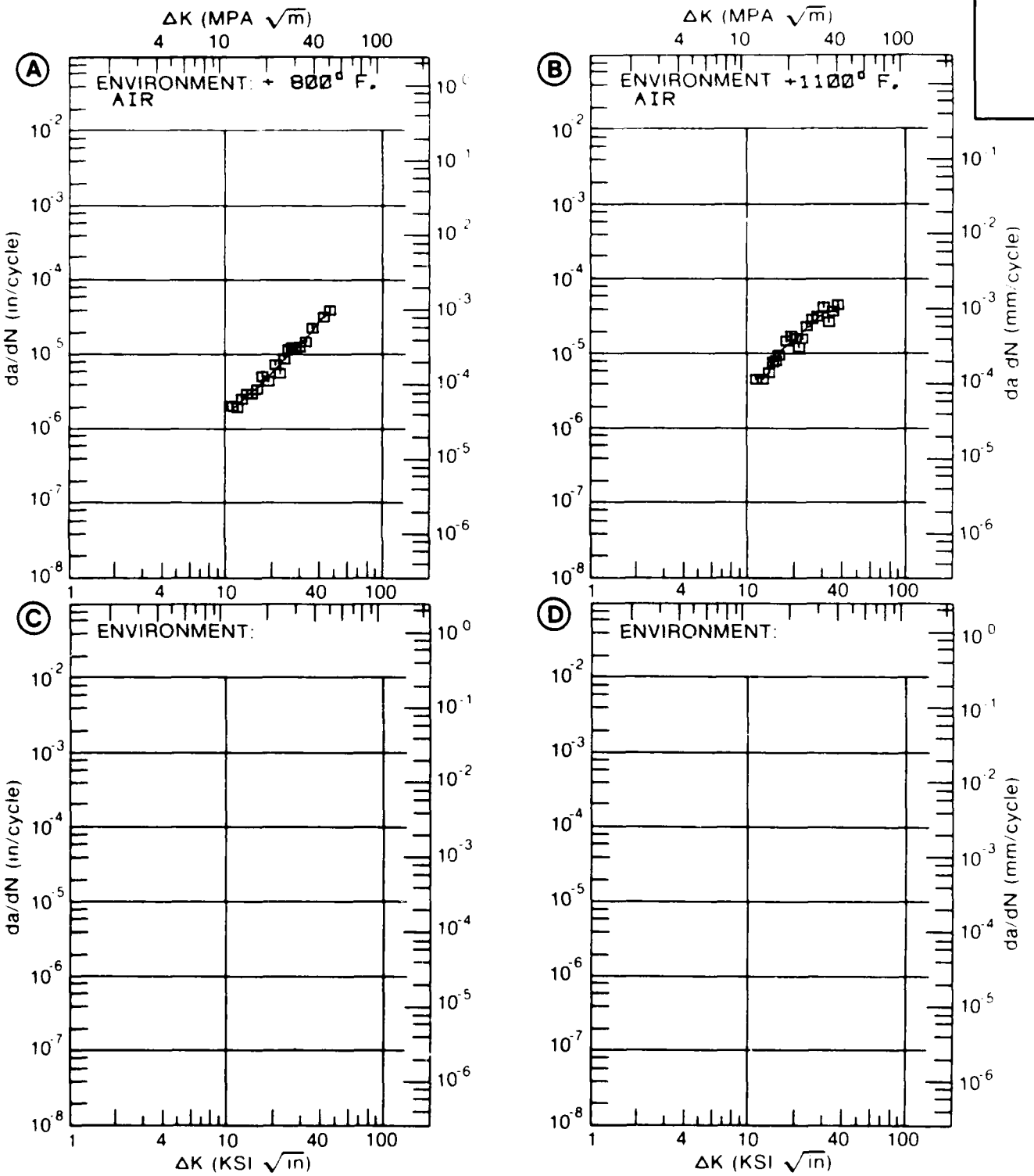



Figure 5.3.3.7

TABLE 5.3.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 800F AIR | E=+1100F AIR | | |
| DELTA K MIN | A: | 8.97 | .504 | | | |
| | B: | 7.57 | | .560 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | | .661 | | |
| | | 9.00 | .504 | .894 | | |
| | | 10.00 | .567 | 1.12 | | |
| | | 13.00 | 1.23 | 1.82 | | |
| | | 16.00 | | 2.78 | | |
| | | 20.00 | | 5.32 | | |
| | | 25.00 | | 14.3 | | |
| DELTA K MAX | A: | 15.69 | 1.88 | | | |
| | B: | 25.23 | | 15.0 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 9.84 | 17.19 | | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
STRESS RATIO: +0.70
FREQUENCY: 30.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.119- 0.123"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW003

NICKEL BASE

ASTROLOY 901

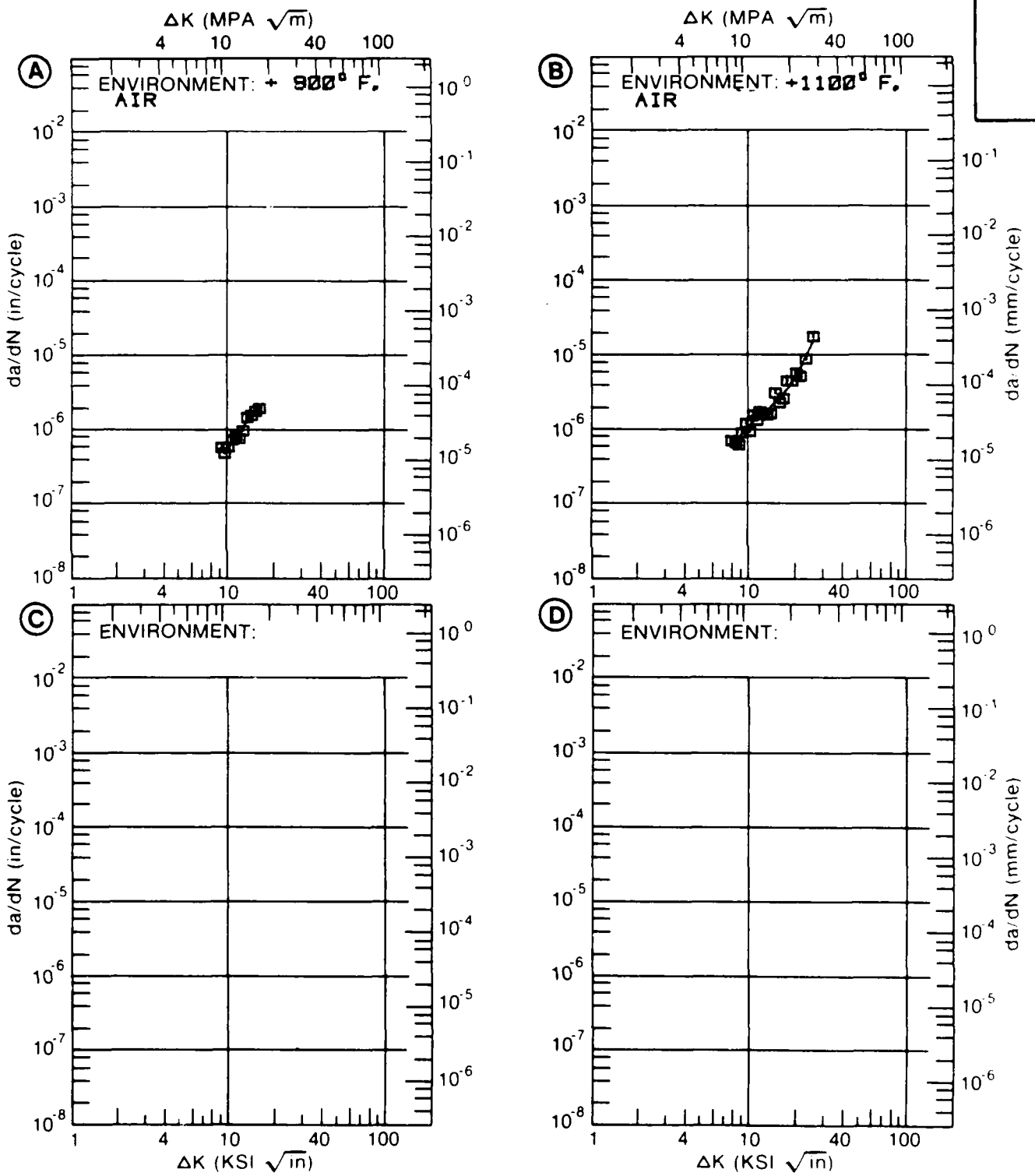



Figure 5.3.3.8

TABLE 5.4.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.4.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCOLOY 901
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E=+ 900F AIR | | | |
| DELTA K MIN A: | 14.89 | .779 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 16.00 | 1.00 | | | |
| | 20.00 | 2.20 | | | |
| | 25.00 | 4.87 | | | |
| | 30.00 | 9.23 | | | |
| | 35.00 | 15.6 | | | |
| | 40.00 | 24.3 | | | |
| | 50.00 | 48.7 | | | |
| DELTA K MAX A: | 56.30 | 68.7 | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 23.65

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 20.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL BASE

INCOLOY 901

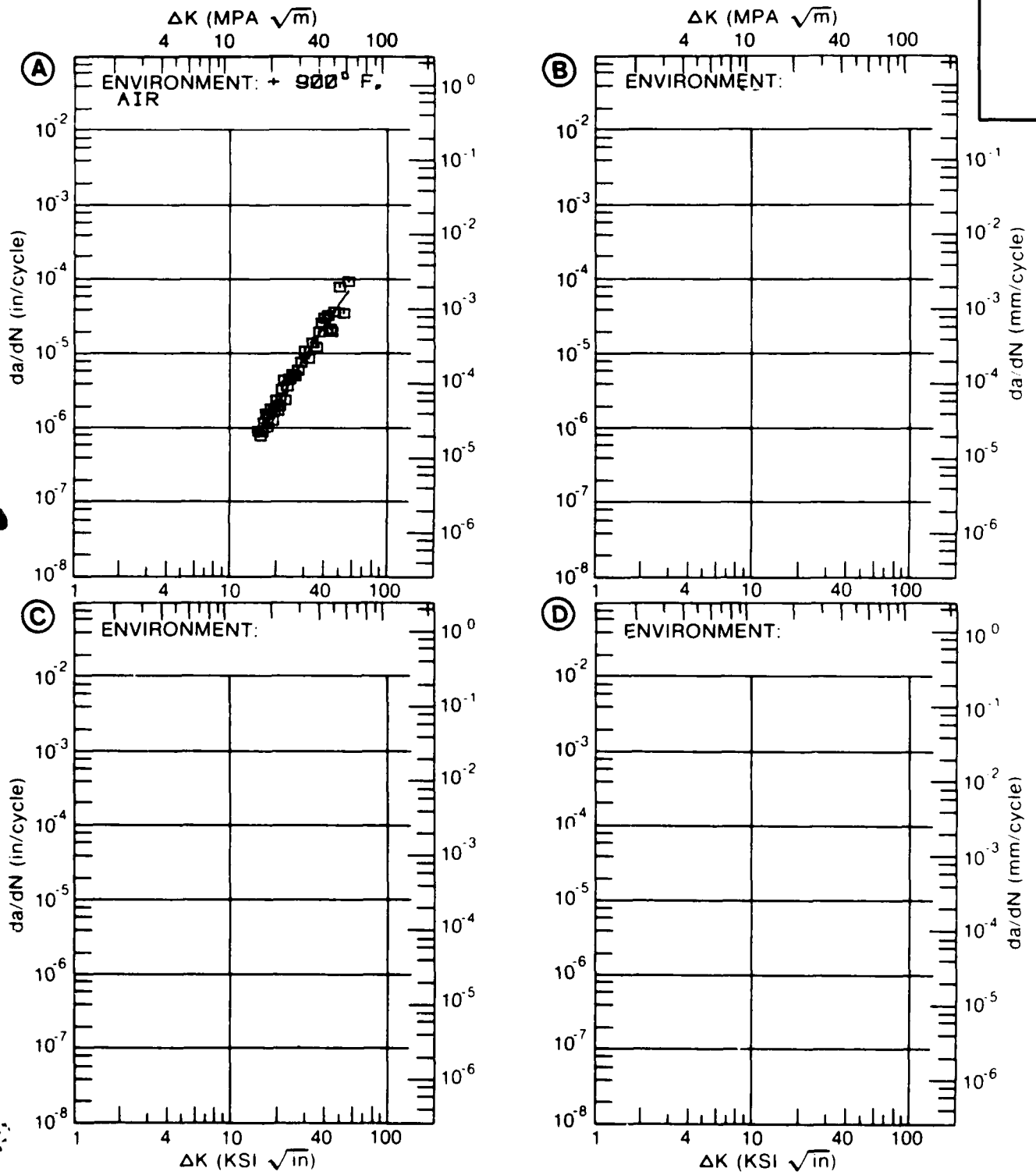



Figure 5.4.3.1

Table 5.5.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 600

TEST CONDITIONS:

SPECIMEN ORIENTATION: Unknown

ENVIRONMENT: AIR AT 800 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1585F 75HR AC | PLATE | 0.05 | 6.67 | | | | | 1.71 | | |
| 1585F 75HR AC | PLATE | 0.33 | 6.67 | | | | | 3.91 | | |
| 1585F 75HR AC | PLATE | 0.60 | 6.67 | | | | 0.54 | | | |

Table 5.5.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 600

TEST CONDITIONS:

SPECIMEN ORIENTATION: Unknown

ENVIRONMENT: AIR AT 1000 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1585F 75HR AC | PLATE | 0.05 | 6.67 | | | | | 3.85 | | |
| 1585F 75HR AC | PLATE | 0.05 | 0.67 | | | | | 4.60 | | |
| 1585F 75HR AC | PLATE | 0.33 | 6.67 | | | | | 6.55 | | |
| 1585F 75HR AC | PLATE | 0.50 | 6.67 | | | | 0.86 | | | |
| 1585F 75HR AC | PLATE | 0.66 | 6.67 | | | | 0.68 | | | |
| 1585F 75HR AC, 1000F 18000 HRS | PLATE | 0.05 | 0.67 | | | | | 4.81 | | |

TABLE 5.5.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F .75HR AC
ENVIRONMENT: R.T. ,AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | | | |
| DELTA K MIN | A: | 25.33 | 2.73 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 30.00 | 5.03 | | | |
| | | 35.00 | 10.3 | | | |
| | | 40.00 | 18.7 | | | |
| DELTA K MAX | A: | 40.56 | 19.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 5.08

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 5.00 HZ
ENVIRONMENT: R.T., AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.390"
SPECIMEN WIDTH: 2.000"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

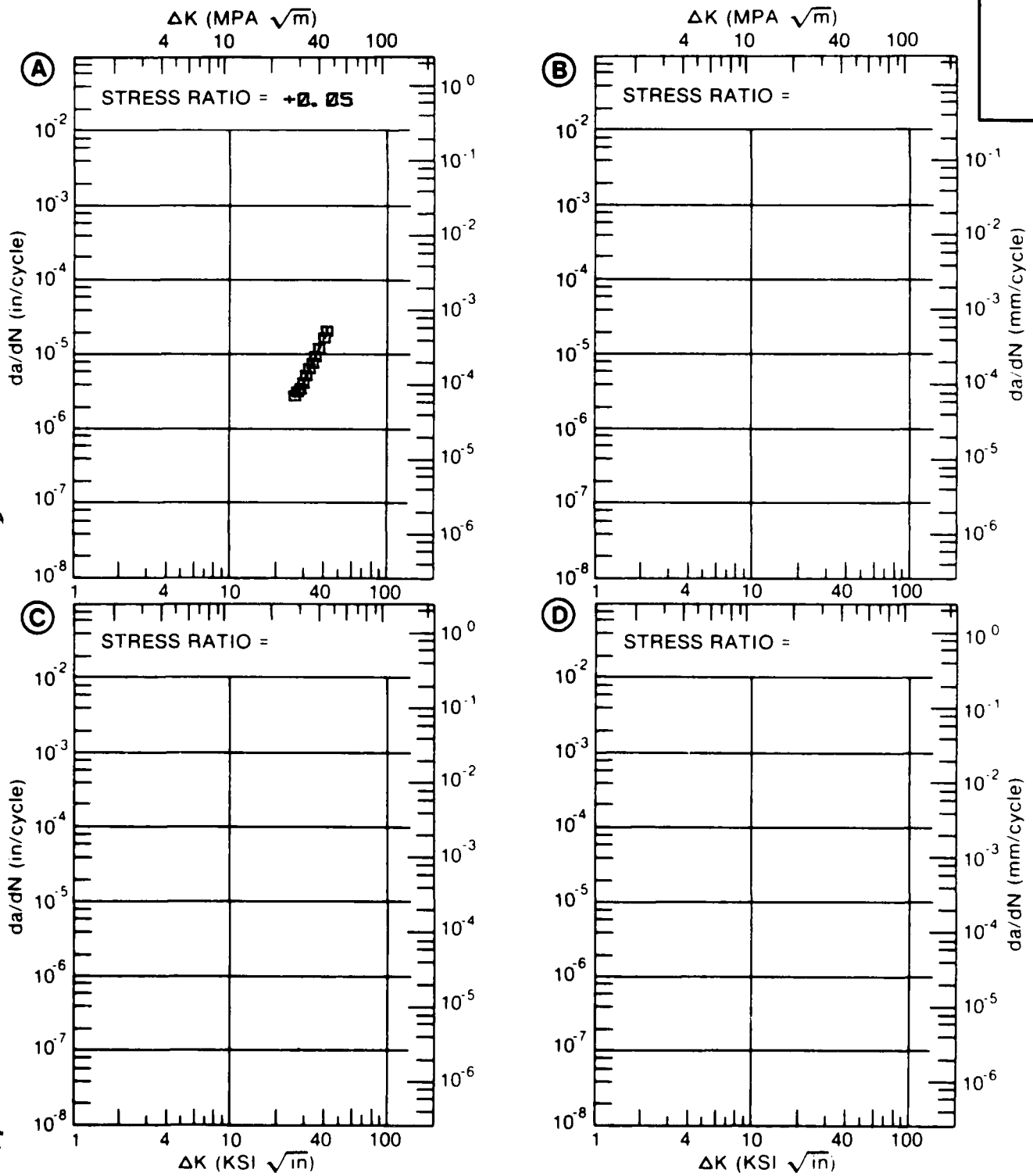



Figure 5.5.3.1

TABLE 5.5.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F .75HR AC
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | R=+0.33 | R=+0.60 | |
| DELTA K MIN | A: | 16.89 | .630 | | | |
| | B: | 12.17 | | .490 | | |
| | C: | 6.90 | | | .172 | |
| | D: | | | | | |
| | | 7.00 | | | .176 | |
| | | 8.00 | | | .250 | |
| | | 9.00 | | | .379 | |
| | | 10.00 | | | .547 | |
| | | 13.00 | | .623 | | |
| | | 16.00 | | 1.35 | | |
| | | 20.00 | 1.71 | 3.91 | | |
| | | 25.00 | 5.41 | | | |
| DELTA K MAX | A: | 27.20 | 9.04 | | | |
| | B: | 20.75 | | 4.85 | | |
| | C: | 12.06 | | | .818 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.02 | 8.23 | 7.41 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 6.67 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.412- 0.413"
SPECIMEN WIDTH: 2.002- 2.003"
REFERENCES:HD003

NICKEL BASE

INCONEL 600

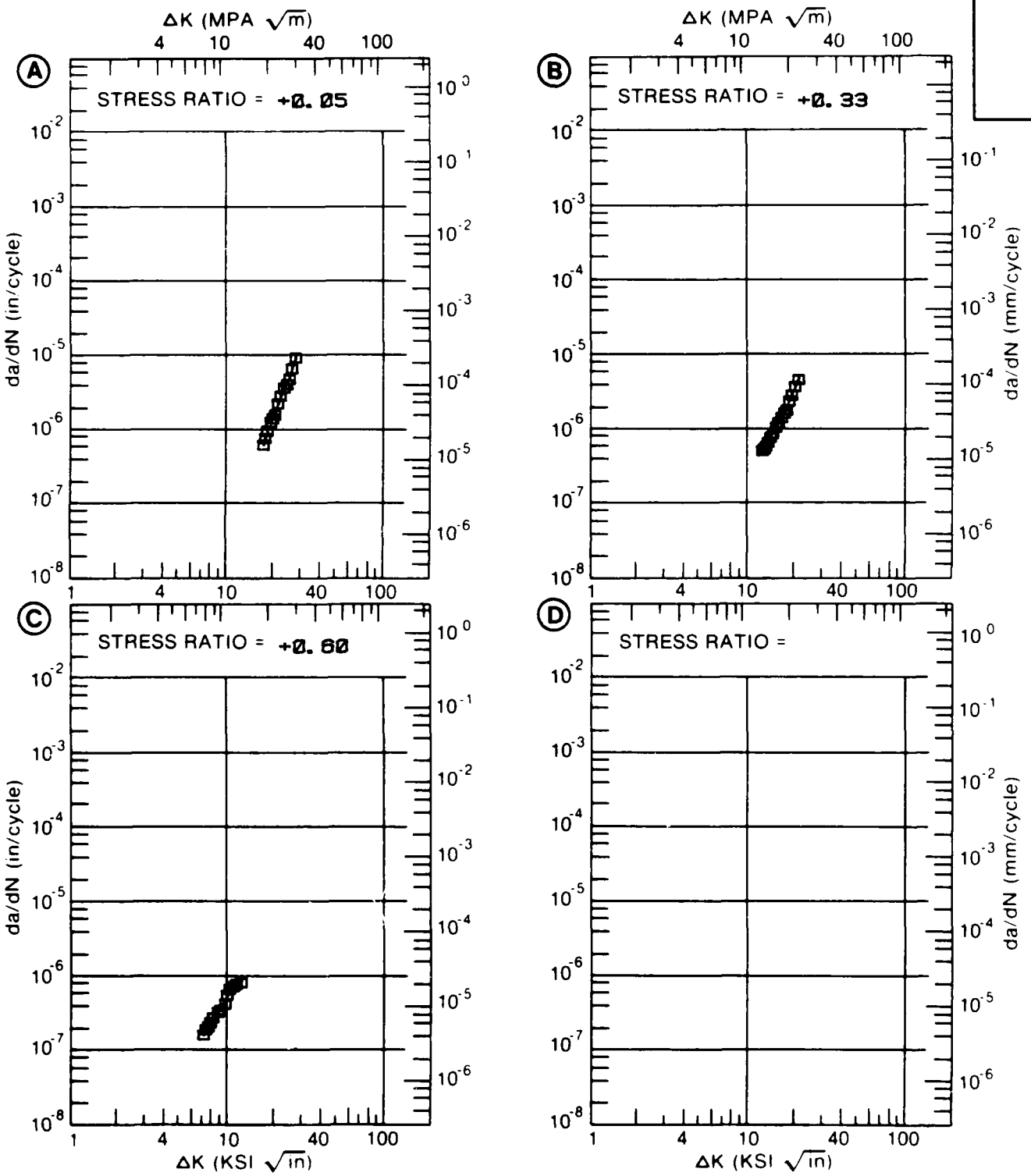



Figure 5.5.3.2

TABLE 5.5.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F .75HR AC
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.33 | R=+0.50 | R=+0.66 | |
| DELTA K MIN | A: | 11.70 | 1.02 | | | |
| | B: | 9.14 | | .688 | | |
| | C: | 6.43 | | | .208 | |
| | D: | | | | | |
| | | 7.00 | | | .255 | |
| | | 8.00 | | | .366 | |
| | | 9.00 | | | .512 | |
| | | 10.00 | | .861 | .684 | |
| | | 13.00 | 1.32 | 1.73 | | |
| | | 16.00 | 2.79 | 3.53 | | |
| | | 20.00 | 6.55 | | | |
| DELTA K MAX | A: | 22.90 | 9.57 | | | |
| | B: | 16.53 | | 4.03 | | |
| | C: | 11.40 | | | .941 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.59 | 4.43 | 2.38 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 6.67 HZ
ENVIRONMENT: +1000° F, AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.410- 0.413"
SPECIMEN WIDTH: 2.002- 2.004"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

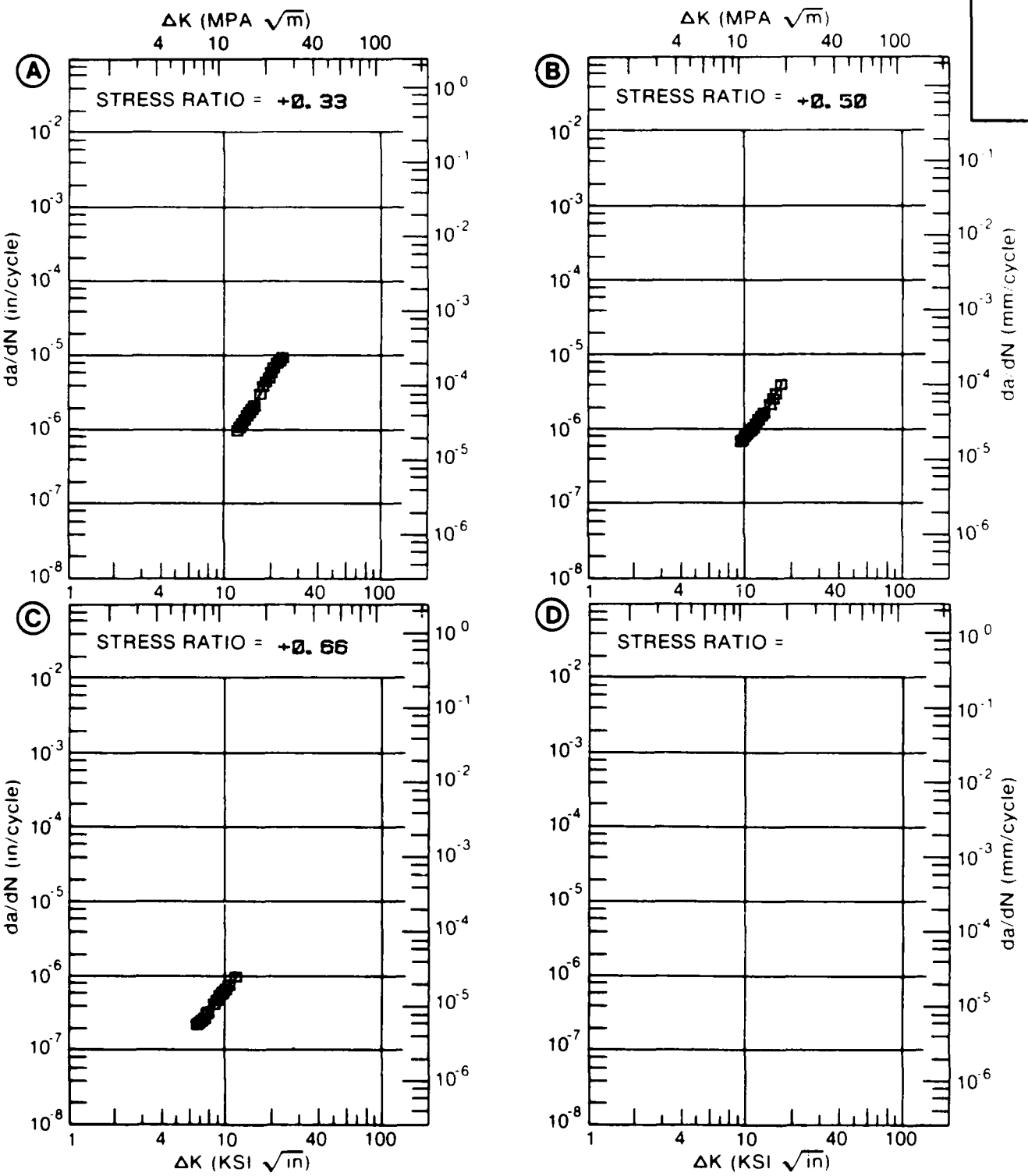



Figure 5.5.3.3

TABLE 5.5.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F 75HR AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR | E=+1200F AIR |
| DELTA K MIN | A: | 25.08 | 4.25 | | | |
| | B: | 22.56 | | 4.60 | | |
| | C: | 19.93 | | | 4.54 | |
| | D: | | | | | |
| | | 20.00 | | | 4.60 | |
| | | 25.00 | | 6.72 | 11.1 | |
| | | 30.00 | 11.5 | 15.2 | 20.9 | |
| DELTA K MAX | A: | 31.85 | 17.2 | | | |
| | B: | 32.19 | | 20.8 | | |
| | C: | 32.64 | | | 27.5 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 15.37 | 5.28 | 4.51 | 0.00 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 1 | 2 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.396- 0.402"
SPECIMEN WIDTH: 1.997- 2.001"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

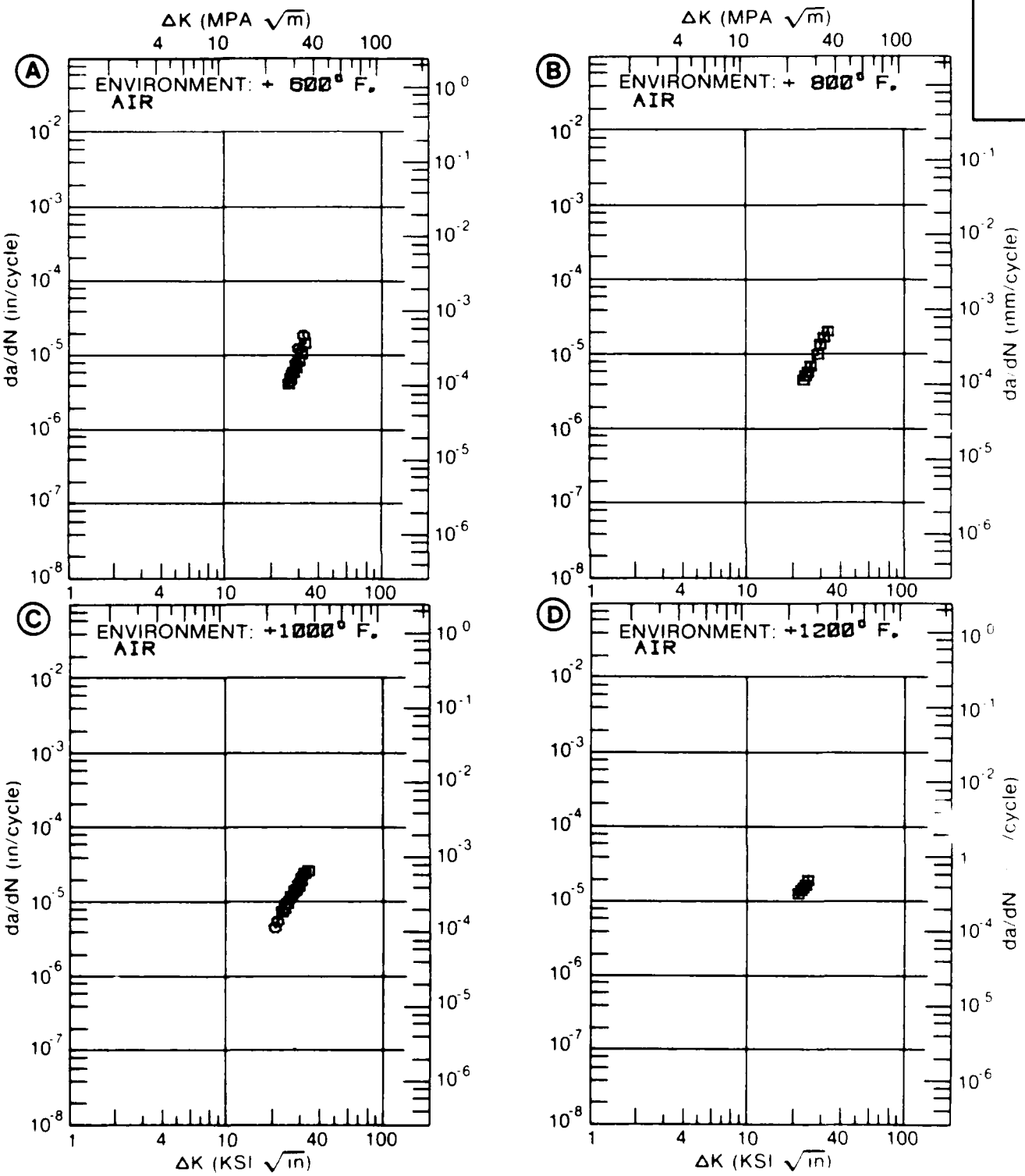



Figure 5.5.3.4

TABLE 5.5.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.5 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F .75HR AC
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.001 | F(HZ)= 0.07 | F(HZ)= 6.67 | |
| DELTA K MIN | A: | | | | | |
| | B: | 20.04 | | 6.75 | | |
| | C: | 16.50 | | | 1.55 | |
| | D: | | | | | |
| | | 20.00 | | | 3.85 | |
| | | 25.00 | | 12.8 | 11.8 | |
| | | 30.00 | | 24.1 | 22.9 | |
| DELTA K MAX | A: | | | | | |
| | B: | 32.54 | | 30.6 | | |
| | C: | 30.56 | | | 23.9 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 0.00 | 3.86 | 7.59 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
ENVIRONMENT: +1000° F, AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.412- 0.420"
SPECIMEN WIDTH: 2.002- 2.004"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

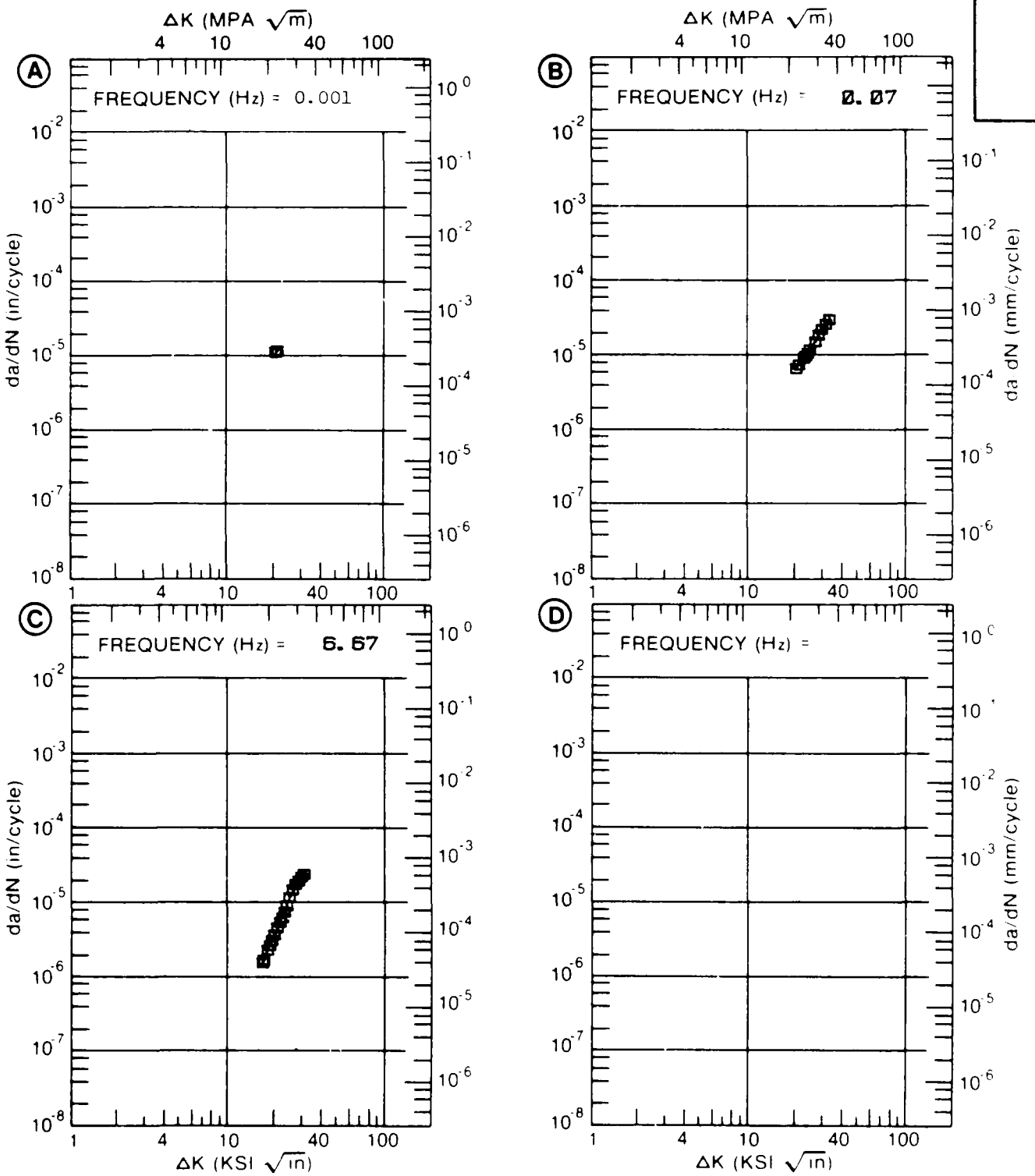



Figure 5.5.3.5

TABLE 5.5.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F 75HR AC, 1000F 18,800HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1000F AIR | | | |
| DELTA K MIN | A: | 18.57 | 4.68 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 4.81 | | | |
| | | 25.00 | 13.2 | | | |
| | | 30.00 | 24.3 | | | |
| DELTA K MAX | A: | 30.70 | 30.5 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 12.33

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 2 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1585F .75HR AC, 1000F 18,800HRS
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.398"
SPECIMEN WIDTH: 2.001"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

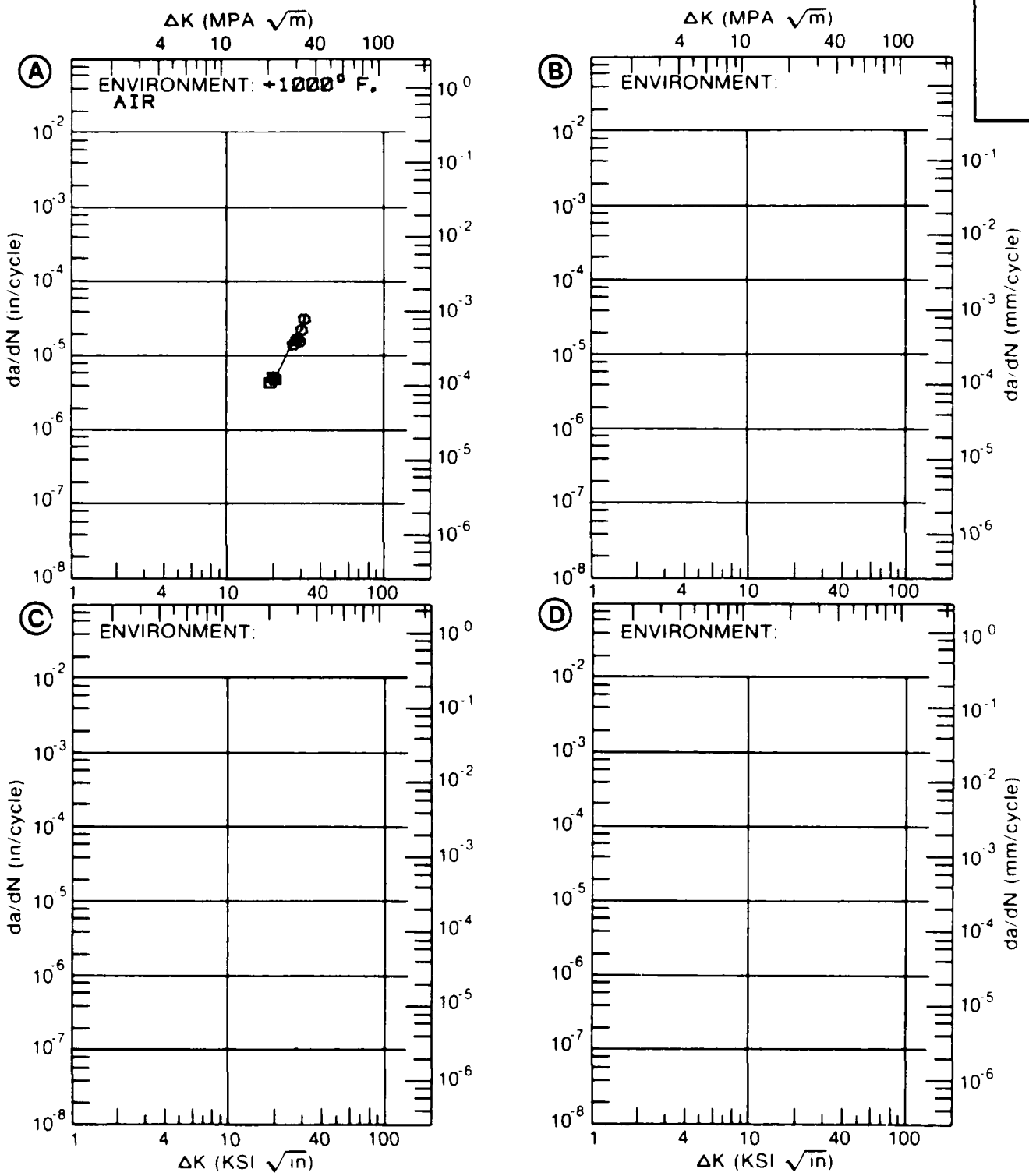



Figure 5.5.3.6

TABLE 5.5.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 600
CONDITION: 1585F 75HR AC, 1200F 14,500HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F | | | |
| | | AIR | | | | |
| DELTA K MIN | A: | 14.24 | 4.17 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 7.87 | | | |
| | | 20.00 | 18.3 | | | |
| DELTA K MAX | A: | 23.73 | 37.6 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 5.92

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1585F .75HR AC. 1200F 14.500HRS
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.482"
SPECIMEN WIDTH: 2.005"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

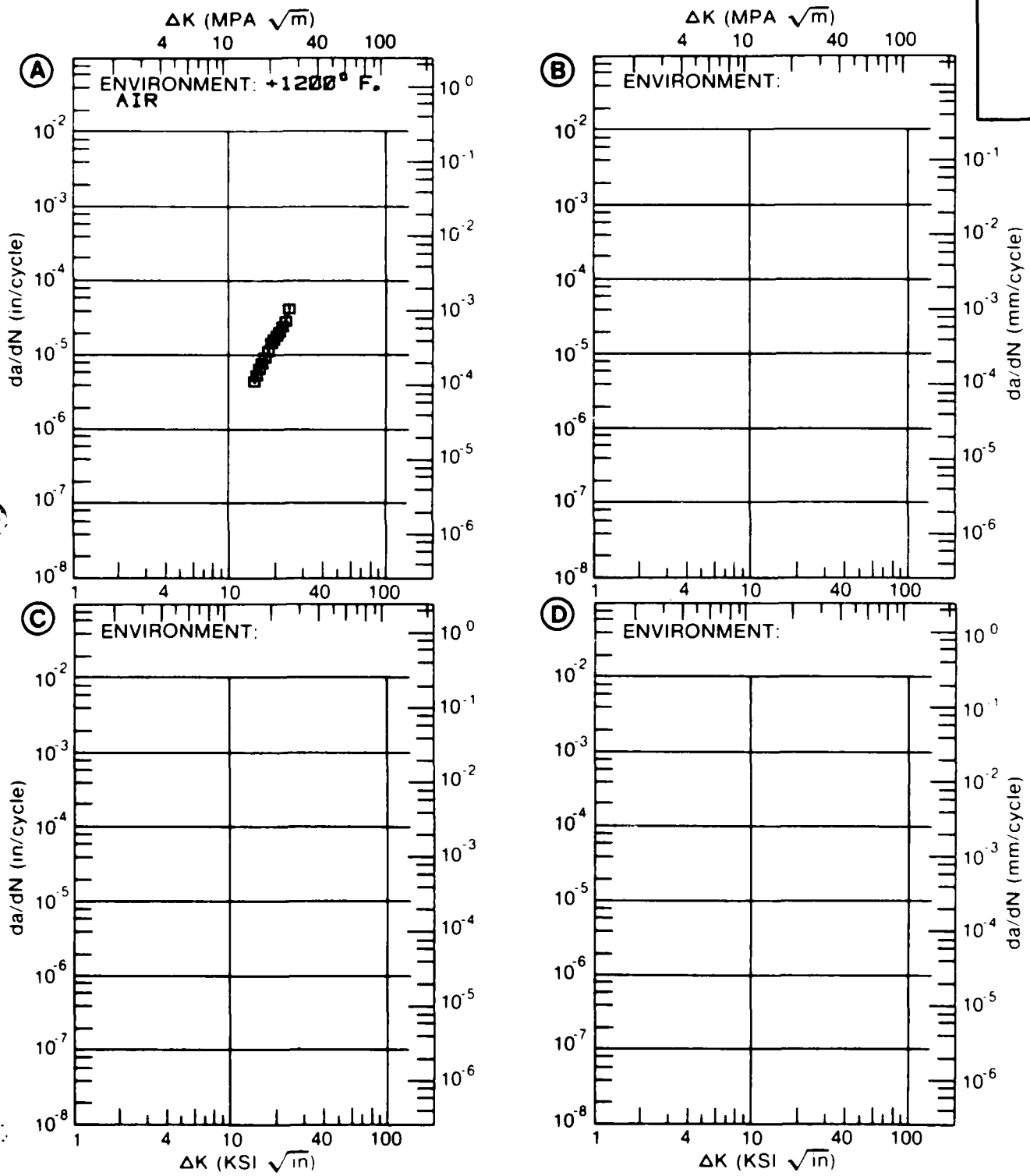



Figure 5.5.3.7

TABLE 5.6.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 625
CONDITION: MA
ENVIRONMENT: R.T., AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.05 | | | |
| DELTA K MIN A: | 18.93 | 1.71 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |
| | 20.00 | 2.07 | | | |
| | 25.00 | 4.35 | | | |
| | 30.00 | 8.25 | | | |
| | 35.00 | 15.4 | | | |
| DELTA K MAX A: | 37.87 | 22.2 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 3.21

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., AIR

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.295"
SPECIMEN WIDTH: 1.153"
REFERENCES:HD005

NICKEL BASE

INCONEL 625

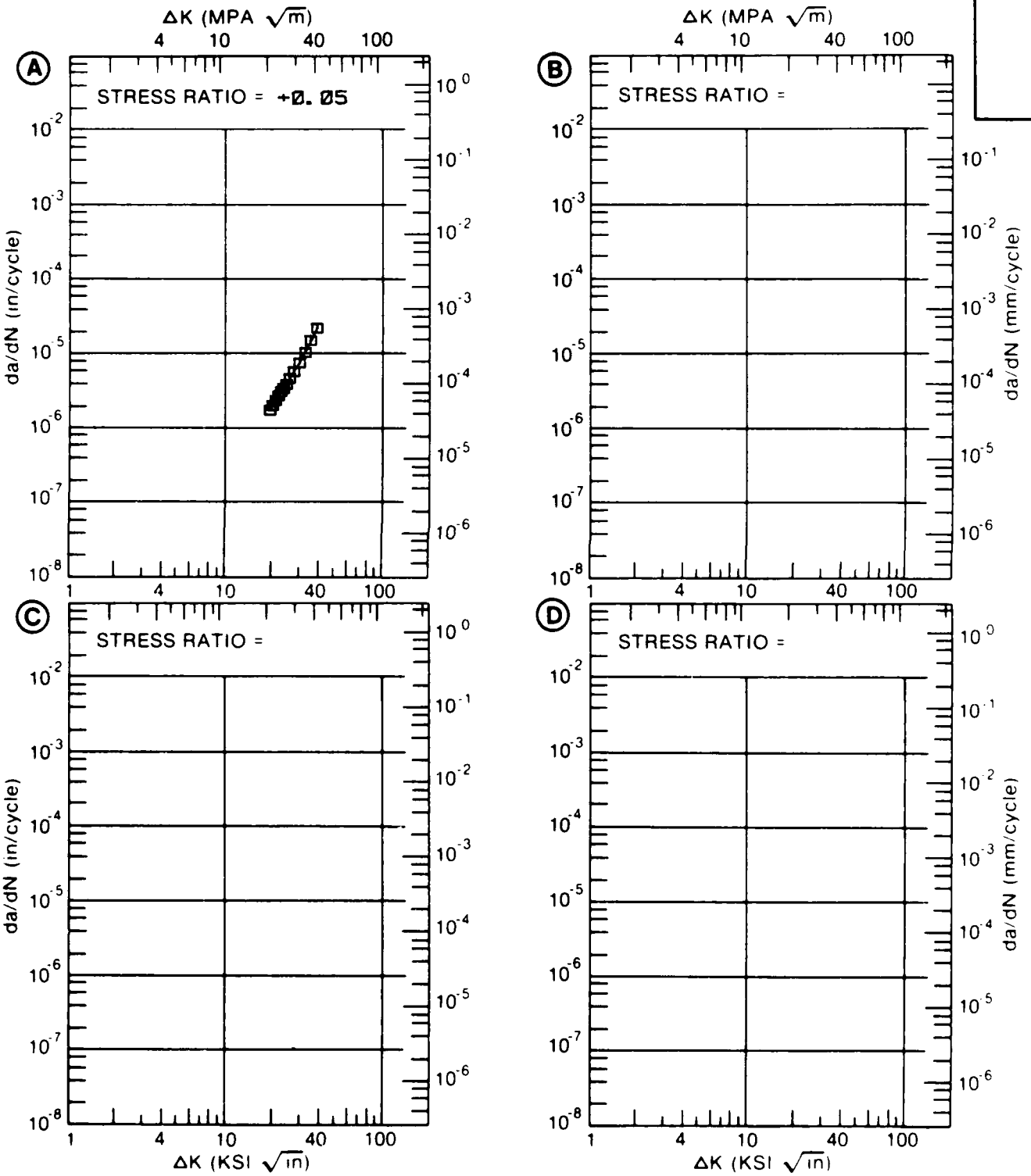



Figure 5.6.3.1

TABLE 5.6.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 625
CONDITION: MA

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR-10HZ | | | |
| DELTA K MIN | A: | 20.25 | 3.01 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 25.00 | 7.20 | | | |
| | | 30.00 | 14.3 | | | |
| | | 35.00 | 25.1 | | | |
| | | 40.00 | 40.8 | | | |
| DELTA K MAX | A: | 49.76 | 94.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 5.17

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.443"
SPECIMEN WIDTH: 2.002"
REFERENCES: HD005

NICKEL BASE

INCONEL 625

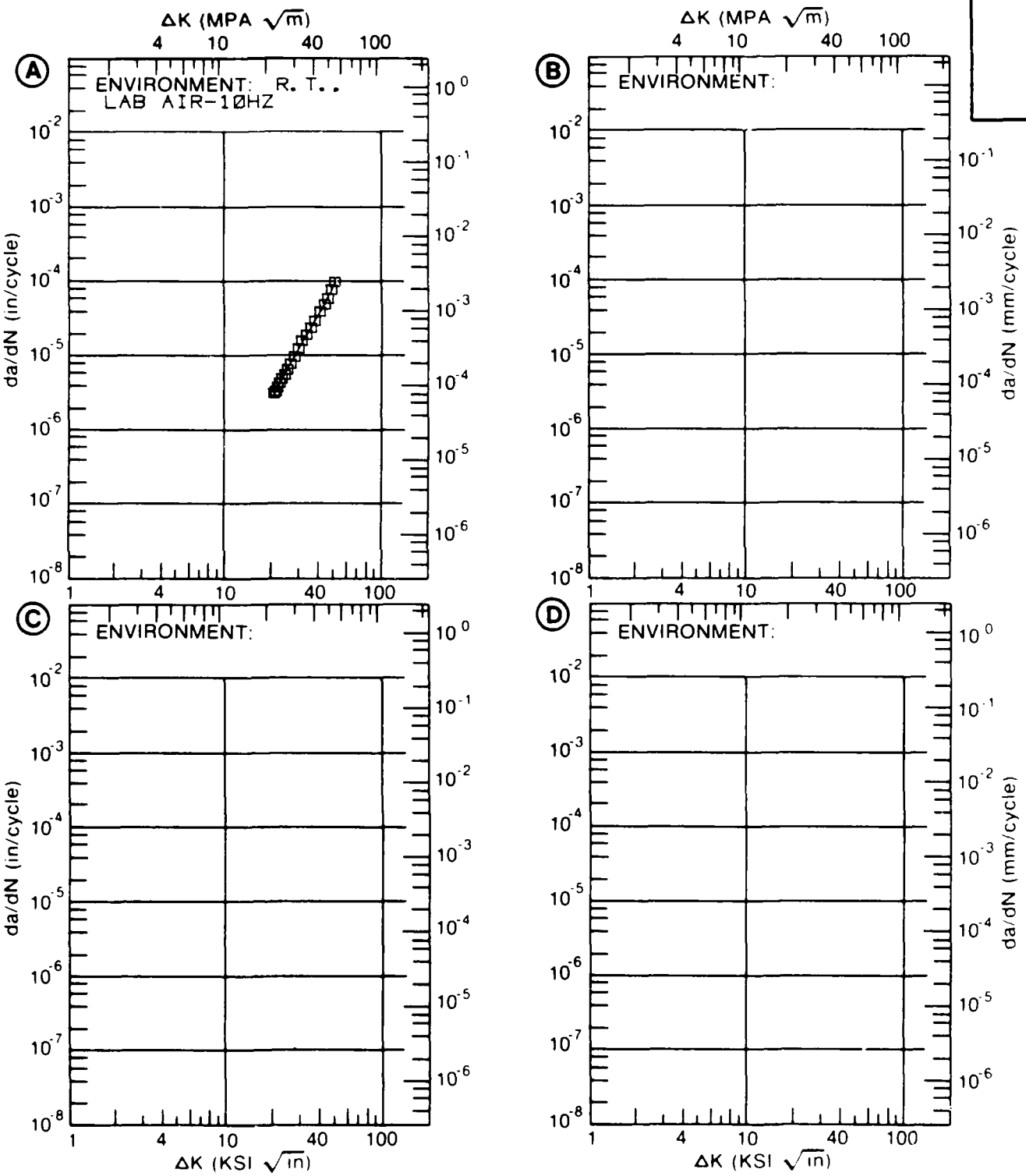



Figure 5.6.3.2

TABLE 5.6.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 625
CONDITION: MA

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E=+ 600F | E=+ 800F | E=+1000F | E=+1200F |
| | | AIR | | AIR | AIR | AIR |
| DELTA K MIN | A: | 20.70 | 6.81 | | | |
| | B: | 16.88 | | 4.19 | | |
| | C: | 15.46 | | | 5.59 | |
| | D: | 13.75 | | | | 4.52 |
| | | 16.00 | | | 5.87 | 7.50 |
| | | 20.00 | | 7.00 | 9.68 | 18.0 |
| | | 25.00 | 12.5 | 18.3 | 20.0 | 40.3 |
| | | 30.00 | 26.5 | 30.3 | 38.1 | |
| | | 35.00 | 56.2 | | 62.6 | |
| DELTA K MAX | A: | 35.47 | 60.3 | | | |
| | B: | 34.08 | | 55.2 | | |
| | C: | 35.43 | | | 64.8 | |
| | D: | 26.80 | | | | 49.1 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.72 | 7.54 | 5.17 | 4.35 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.299"
SPECIMEN WIDTH: 1.153- 1.154"
REFERENCES:HD005

NICKEL BASE

INCONEL 625

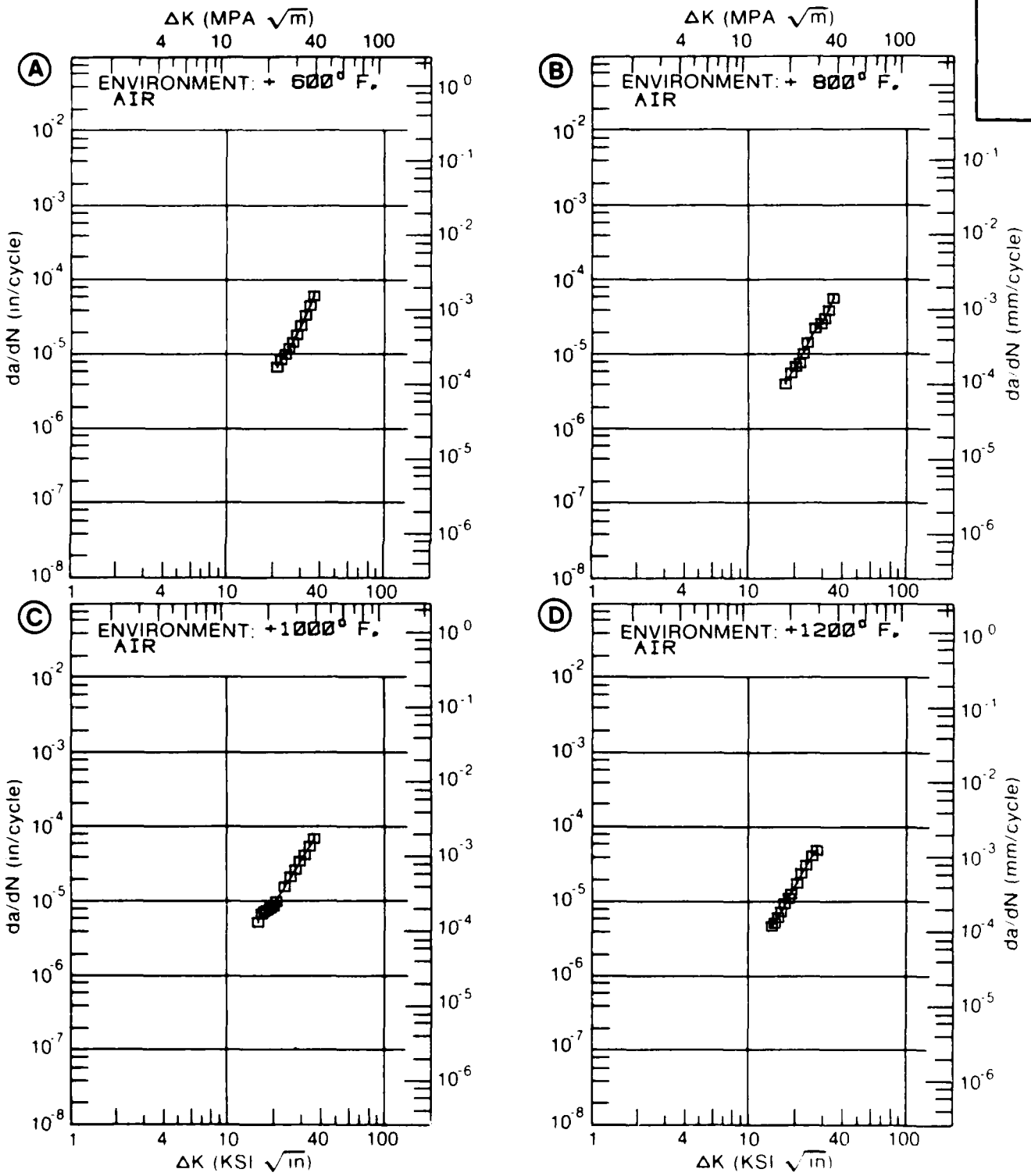



Figure 5.6.3.3

TABLE 5.6.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 625
CONDITION: MA

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A E=+ 600F AIR | B E=+ 800F AIR | C E=+1000F AIR | D E=+1200F AIR |
|---|---|---|---|---|---|
| DELTA K MIN A: | 17.31 | 1.69 | | | |
| DELTA K MIN B: | 19.54 | | 4.13 | | |
| DELTA K MIN C: | 17.98 | | | 7.23 | |
| DELTA K MIN D: | 14.04 | | | | 6.78 |
| | 16.00 | | | | 9.17 |
| | 20.00 | 2.98 | 4.55 | 9.05 | 16.5 |
| | 25.00 | 7.55 | 10.7 | 15.6 | 30.7 |
| | 30.00 | 15.9 | 21.0 | 26.9 | 50.4 |
| | 35.00 | 33.6 | 38.3 | 46.6 | 74.1 |
| | 40.00 | 63.7 | 67.0 | 80.8 | |
| DELTA K MAX A: | 46.44 | 113. | | | |
| DELTA K MAX B: | 44.02 | | 103. | | |
| DELTA K MAX C: | 43.39 | | | 117. | |
| DELTA K MAX D: | 38.90 | | | | 93.8 |
| ROOT MEAN SQUARE PERCENT ERROR | | 6.43 | 3.83 | 3.21 | 2.39 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 2 | 1 | 1 | 1 |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.443- 0.445"
SPECIMEN WIDTH: 2.000- 2.002"
REFERENCES:HD005

NICKEL BASE

INCONEL 625

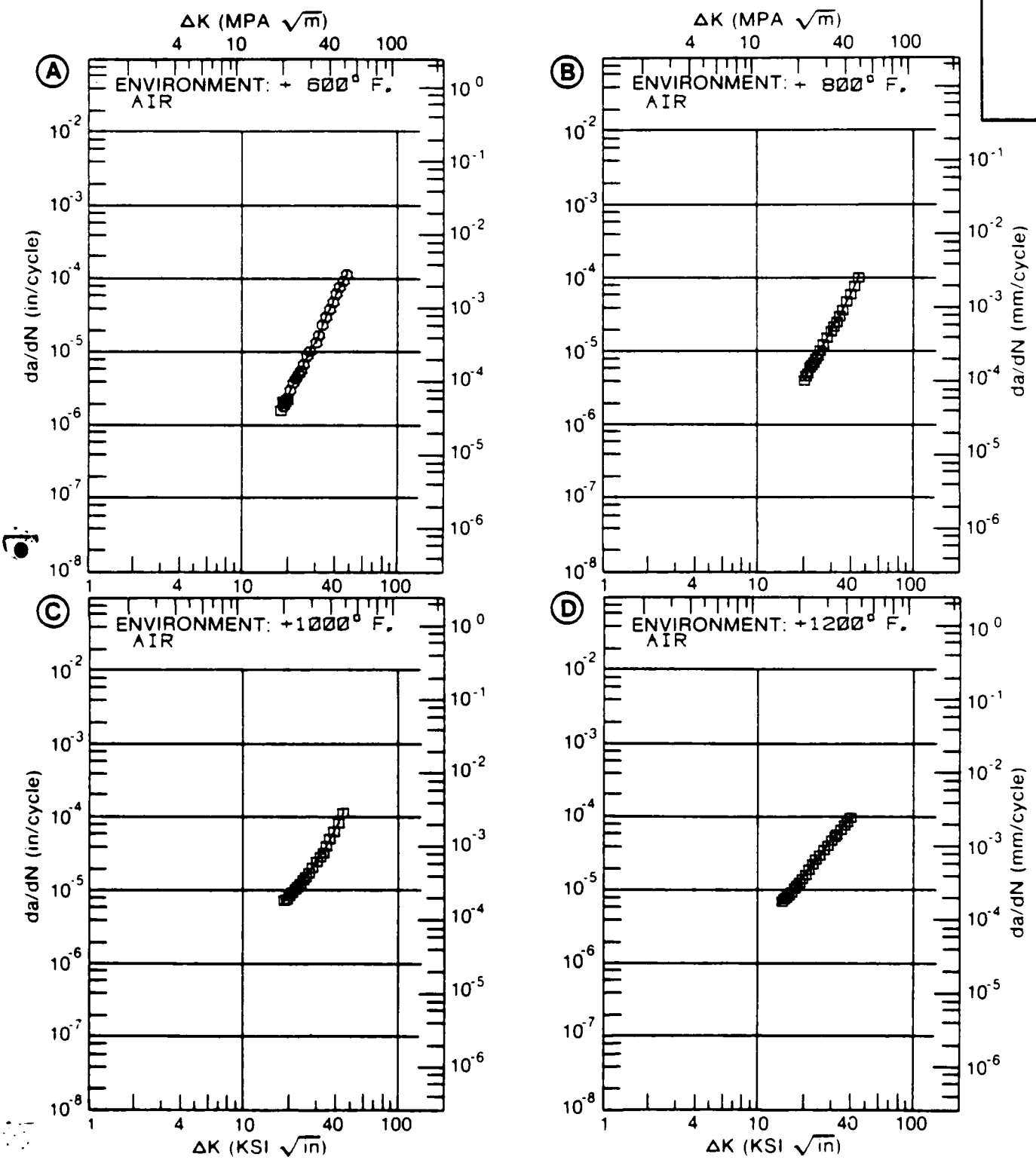



Figure 5.6.3.4

Table 5.7.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION Unknown

ENVIRONMENT: LAB AIR AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F HELD 18HR AC | PLATE | 0.05 | 10.00 | | | | | 1.77 | 44.1 | |
| 1750F AC, 1325F 8HR FC TO 1150F HELD 18HR AC | FORGING | 0.05 | 10.00 | | | | | 1.77 | 41.7 | |
| 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-EFR) | PLATE | 0.05 | 10.00 | | | | | 1.57 | | |

Table 5.7.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION Unknown

ENVIRONMENT: AIR AT 600 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | SHEET | 0.05 | 0.67 | | | | | 1.91 | 28.4 | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.05 | 0.67 | | | | | 2.33 | 58.8 | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | FORGING | 0.05 | 0.67 | | | | | 1.44 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.05 | 0.67 | | | | | 1.23 | | |

Table 5.7.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: Unknown

ENVIRONMENT: AIR AT 800 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | SHEET | 0.05 | 0.67 | | | | | 2.24 | 30.6 | |
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | PLATE | 0.05 | 0.67 | | | | | 3.29 | | |
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGING | 0.05 | 0.67 | | | | | 2.05 | 48.6 | |

Table 5.7.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION Unknown

ENVIRONMENT: AIR AT 1000 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.05 | 0.06 | | | | | 4.90 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.05 | 0.67 | | | | | 5.01 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.05 | 6.67 | | | | | 3.23 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.33 | 6.67 | | | | | 4.06 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | PLATE | 0.50 | 6.67 | | | | 0.77 | 6.48 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC | FORGING | 0.05 | 0.67 | | | | | 5.93 | | |

Table 5.7.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: ---

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | PLATE | 0.05 | 0.67 | | | | | 17.5 | | |
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGING | 0.05 | 0.67 | | | | | 9.30 | | |

Table 5.7.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: L. H. A. AT R. T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ST 1850F, 1360F 9HRS, F/C 1175F | FORGED BAR | 0.08 | 6.00 | | | | | | 10.0 | |
| ST 1850F, 1360F 9HRS, F/C 1175F | FORGED BAR | 0.50 | 6.00 | | | | | 0.77 | 30.2 | |
| 1325F 8HRS, FC TO 1150F | FORGING | 0.08 | 6.00 | | | | | 1.13 | 19.0 | |
| 1325F 8HRS, FC TO 1150F | FORGING | 0.50 | 6.00 | | | | | 2.17 | 34.0 | |

Table 5.7.1.7

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: L. H. A. AT 400 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ST 1850F, 1360F 9HRS, F/C 1175F | FORGED BAR | 0.08 | 6.00 | | | | | | 13.3 | |
| ST 1850F, 1360F 9HRS, F/C 1175F | FORGED BAR | 0.50 | 6.00 | | | | | 1.66 | | |

Table 5.7.1.8

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS:

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: LAB AIR AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 8.33 | | | | | 1.29 | 30.4 | |
| 1950F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 8.33 | | | | | 1.05 | | |

Table 5.7.1.9

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: AIR AT 800 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 0.67 | | | | | 2.93 | 69.4 | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 6.67 | | | | | 1.98 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.33 | 6.67 | | | | | 4.40 | | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.50 | 6.67 | | | | 0.54 | 5.14 | | |

Table 5.7.1.10

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: AIR AT 1000 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.05 | 0.67 | | | | | 3.78 | 63.9 | |
| 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC | PLATE | 0.67 | 6.67 | | | | 1.18 | | | |

Table 5.7.1.11

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: T-L

ENVIRONMENT: L. H. A. AT R. T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ST 1850F, 1360F 9HRS, F/C 1175F | FORGED BAR | 0.08 | 6.00 | | | | | | 16.1 | |
| 1325F 8HRS, FC TO 1150F | FORGING | 0.08 | 6.00 | | | | | | 32.3 | |

Table 5.7.1.12

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: C-R

ENVIRONMENT: LAB AIR AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGED BAR | 0.05 | 10.00 | | | | | 2.55 | 47.2 | |
| 1760F 1HR WQ, 1325F 8HRS, FC 1150F 8HRS, AC | DISK | 0.00 | 0.33 | | | | | 2.86 | | |

Table 5.7.1.13

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION C-R

ENVIRONMENT: AIR AT 300 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F /HR HOLD 8HR, AC | DISK | -0.33 | 0.33 | | | | | 0.77 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F /HR HOLD 8HR, AC | DISK | 0.00 | 0.33 | | | | | 1.45 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F /HR HOLD 8HR, AC | DISK | 0.03 | 0.33 | | | | | 1.86 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F /HR HOLD 8HR, AC | DISK | 0.25 | 0.33 | | | | | 1.09 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F /HR HOLD 8HR, AC | DISK | 0.54 | 0.33 | | | | | 3.25 | | |

Table 5.7.1.14

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION C-R

ENVIRONMENT: AIR AT 600 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGED BAR | 0.05 | 0.67 | | | | | 2.32 | 50.1 | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | -0.33 | 0.33 | | | | | 2.12 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.00 | 0.33 | | | | | 1.66 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.25 | 0.33 | | | | | 2.71 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.54 | 0.33 | | | | | 3.74 | | |

Table 5.7.1.15

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION C R

ENVIRONMENT: AIR AT 800 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGED BAR | 0.05 | 0.67 | | | | | 2.88 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | -0.33 | 0.33 | | | | | 2.42 | 64.2 | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.03 | 0.33 | | | | 0.34 | 2.67 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.25 | 0.33 | | | | | 2.91 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.54 | 0.33 | | | | | 5.86 | | |

Table 5.7.1.16

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION C-R

ENVIRONMENT: AIR AT 1000 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC | FORGED BAR | 0.05 | 0.67 | | | | | 7.13 | 101 | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | -0.33 | 0.33 | | | | | 3.70 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.00 | 0.33 | | | | | 3.36 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.03 | 0.33 | | | | | 2.59 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.03 | 0.33 | | | | | 4.80 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.25 | 0.33 | | | | | 6.62 | | |
| 1750F 1HR G, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.54 | 0.33 | | | | 0.85 | 8.45 | | |

Table 5.7.1.17

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION C R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) (COMMENTS) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1750F AC, 1325F 8HR FC TO 1150F, HELD 16HR AC | FORGED BAR | 0.05 | 0.67 | | | | | 21.0 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | -0.33 | 0.33 | | | | | 9.75 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.03 | 0.33 | | | | | 9.92 | | |
| 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC | DISK | 0.54 | 0.33 | | | | 2.12 | 16.0 | | |
| 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC | DISK | 0.00 | 0.02 | | | | | 8.02 | 294 | |
| 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC | DISK | 0.00 | 0.33 | SPEC. THK = 0.08" | | | | 3.20 | 60.7 | |
| 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC | DISK | 0.00 | 0.33 | SPEC. THK = 0.25" | | | | 11.7 | 110 | |

Table 5.7.2.1

NICKEL BASE INCONEL 718 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1325F 8 HR, FC TO 1150F, HOLD 18 HR | F | 3.00 | R.T. | T-L | 160.0 | 4.022 | 1.120 | CT | 1.987 | 0.53 | 74.00 | | | 1973 | 88187 |
| 1325F 9 HR, FC TO 1150F AT 100F/HR, HOLD AT 1150F 8 HR, AC | F | 3.30 | R.T. | T-L | 151.0 | 2.002 | 0.746 | CT | 1.049 | 0.68 | 78.80 | | | 1973 | 88187 |
| 1325F 9 HR, FC TO 1150F AT 100F/HR, HOLD AT 1150F 8 HR, AC | F | 3.30 | R.T. | S-L | 143.0 | 2.002 | 0.749 | CT | 1.060 | 0.53 | 65.60 | | | 1973 | 88187 |

Table 5.7.2.2

NICKEL BASE INCONEL 718 K(C)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | CRACK LENGTH INIT (IN) 2A(O) | CRACK LENGTH FINAL (IN) 2A(F) | GROSS STRESS ONSET (KSI) S(O) | GROSS STRESS MAX (KSI) S(MAX) | K(APP) (KSI*SQRT IN) | K(APP) MEAN | K(APP) STAN DEV | K(C) (KSI*SQRT IN) | K(C) MEAN | K(C) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUCKLING OF CRACK EDGES NOT RESTRAINED | | | | | | | | | | | | | | | | | | | |
| COLD ROLLED 30 S | | 0 03 | - 423 | L-T | 269.0 | 4.000 | 0.028 | 1.370 | 1.480 | --- | 112.00 | 177.30 | | | 186.79 | | | 1964 | 60578 |
| PERCENT AND | | 0 03 | | | 269.0 | 4.000 | 0.028 | 1.280 | 1.420 | --- | 117.00 | 177.22 | | | 189.70 | | | 1964 | 60578 |
| AGED | | 0 03 | | | 269.0 | 4.000 | 0.028 | 1.740 | 2.000 | --- | 90.50 | 169.90 | | | 190.76 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.000 | 0.028 | 1.310 | 1.340 | --- | 116.00 | 178.34 | | | 180.98 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.027 | 1.270 | 1.450 | --- | 116.00 | 174.77 | | | 190.67 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 1.740 | 2.000 | --- | 87.50 | 164.15 | | | 184.25 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 1.770 | 2.050 | --- | 91.50 | 173.97 | | | 197.02 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 1.240 | 1.500 | --- | 119.00 | 176.61 | | | 200.22 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 1.730 | 1.920 | --- | 89.00 | 166.22 | | | 180.87 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.027 | 1.240 | 1.370 | --- | 117.00 | 173.64 | | | 185.14 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.027 | 1.250 | 1.400 | --- | 120.00 | 178.99 | | | 192.64 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 0.750 | 0.890 | --- | 168.00 | 186.38 | | | 204.90* | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 1.250 | 1.400 | --- | 118.00 | 176.01 | | | 189.43 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 0.740 | 0.950 | --- | 169.00 | 186.13 | | | 213.90* | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.027 | 1.270 | 1.400 | --- | 119.00 | 179.29 | | | 191.03 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.010 | 0.028 | 0.750 | 1.020 | --- | 158.00 | 175.29 | | | 208.37 | | | 1964 | 60578 |
| | | 0 03 | | | 269.0 | 4.020 | 0.027 | 1.750 | 2.050 | --- | 92.50 | 174.19 | 175.8/ | 5.7 | 198.97 | 191.1/ | 7.5 | 1964 | 60578 |
| COLD ROLLED 30 S | | 0 03 | - 320 | L-T | 259.0 | 3.980 | 0.028 | 1.330 | 1.550 | --- | 119.00 | 184.90 | | | 205.22 | | | 1964 | 60578 |
| PERCENT AND | | 0 03 | | | 259.0 | 4.000 | 0.028 | 0.730 | 0.830 | --- | 171.00 | 186.97* | | | 200.60* | | | 1964 | 60578 |
| AGED | | 0 03 | | | 259.0 | 4.000 | 0.028 | 1.290 | 1.650 | --- | 118.00 | 179.63 | | | 212.75 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.000 | 0.028 | 0.730 | 0.930 | --- | 169.00 | 184.78 | | | 211.35* | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.000 | 0.028 | 1.270 | 1.650 | --- | 121.00 | 182.37 | | | 218.16 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.000 | 0.027 | 1.310 | 1.620 | --- | 123.00 | 189.10 | | | 218.77 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.027 | 1.250 | 1.400 | --- | 126.00 | 187.94 | | | 202.27 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.730 | 1.920 | --- | 92.00 | 171.83 | | | 186.97 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.300 | 1.750 | --- | 125.00 | 191.16 | | | 235.55* | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.250 | 1.450 | --- | 119.00 | 177.50 | | | 195.61 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.730 | 1.790 | --- | 89.10 | 166.41 | | | 170.92 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.720 | 2.000 | --- | 90.30 | 167.90 | | | 190.15 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.730 | 2.090 | --- | 91.90 | 171.64 | | | 201.46 | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 0.740 | 0.950 | --- | 177.00 | 194.94* | | | 224.02* | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 0.730 | 0.850 | --- | 170.00 | 185.85* | | | 202.06* | | | 1964 | 60578 |
| | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.230 | 1.400 | --- | 127.00 | 187.53 | | | 203.87 | | | 1964 | 60578 |

*NOTE- NET SECTION STRESS EXCEEDS 80% OF YIELD STRENGTH. VALUE NOT INCLUDED IN MEAN OR STD. DEV

Table 5.7.2.2 (con't)

NICKEL BASE INCONEL 718 K(C)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | CRACK LENGTH INIT (IN) 2A(O) | CRACK LENGTH FINAL (IN) 2A(F) | GROSS STRESS ONSET (KSI) S(O) | GROSS STRESS MAX (KSI) S(MAX) | K(APP) (KSI*SQRT IN) | K(APP) STAN MEAN DEV | K(C) (KSI*SQRT IN) | K(C) STAN MEAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUCKLING OF CRACK EDGES NOT RESTRAINED | | | | | | | | | | | | | | | | | |
| COLD ROLLED 30 S | | 0 03 | - 320 | L-T | 259.0 | 4.010 | 0.028 | 1.250 | 1.450 | --- | 129.00 | 192.42 | | 212.04 | | 1964 | 60578 |
| PERCENT AND | | 0 03 | | | 259.0 | 4.010 | 0.028 | 1.720 | 1.950 | --- | 91.90 | 170.88 | | 189.27 | | 1964 | 60578 |
| AGED | | | | | | | | | | | | | 180.4/ 8.8 | | 200.6/13.8 | | |
| COLD ROLLED 30 S | | 0 03 | R T | L-T | 218.0 | 4.000 | 0.028 | 1.250 | 1.550 | --- | 112.00 | 167.12 | | 192.94* | | 1964 | 60578 |
| PERCENT AND | | 0 03 | | | 218.0 | 4.000 | 0.028 | 1.730 | 1.980 | --- | 83.00 | 155.12 | | 173.40 | | 1964 | 60578 |
| AGED | | 0 03 | | | 218.0 | 4.000 | 0.028 | 1.230 | 1.480 | --- | 116.00 | 171.34 | | 193.46* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.000 | 0.028 | 1.250 | 1.450 | --- | 111.00 | 165.62 | | 182.54 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.000 | 0.028 | 0.730 | 1.050 | --- | 138.00 | 150.89 | | 185.16* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.000 | 0.028 | 1.720 | 2.100 | --- | 81.80 | 152.20 | | 180.32 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 0.720 | 0.890 | --- | 143.00 | 155.17 | | 174.41* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 1.720 | 2.150 | --- | 85.50 | 158.98 | | 192.56* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 0.720 | 0.940 | --- | 145.00 | 157.34* | | 182.41* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 0.740 | 0.880 | --- | 138.00 | 151.99 | | 167.24* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 1.730 | 2.100 | --- | 80.10 | 149.60 | | 176.38 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 1.240 | 1.460 | --- | 110.00 | 163.25 | | 181.66 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 0.730 | 1.000 | --- | 148.00 | 161.80* | | 192.94* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 1.720 | 1.950 | --- | 85.80 | 159.53 | | 176.70 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.027 | 1.280 | 1.500 | --- | 118.00 | 178.68 | | 198.54* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 1.320 | 1.650 | --- | 104.00 | 160.62 | | 187.39* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.010 | 0.028 | 1.240 | 1.550 | --- | 112.00 | 166.22 | | 192.84* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.020 | 0.028 | 1.270 | 1.730 | --- | 108.00 | 162.67 | | 201.57* | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 4.020 | 0.026 | 1.310 | 1.700 | --- | 114.00 | 175.14 | 161.4/ 8.6 | 209.94* | 178.5/ 3.6 | 1964 | 60578 |
| COLD ROLLED 30 S | | 0 03 | R.T. | L-T | 218.0 | 17.930 | 0.026 | 5.480 | 5.880 | --- | 64.40 | 200.63 | | 233.26 | | 1964 | 60578 |
| PERCENT AND | | 0 03 | | | 218.0 | 17.930 | 0.026 | 5.480 | 5.880 | --- | 64.30 | 200.31 | | 209.48 | | 1964 | 60578 |
| AGED | | 0 03 | | | 218.0 | 17.940 | 0.026 | 5.470 | 6.820 | --- | 65.50 | 203.81 | | 235.75 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 18.080 | 0.026 | 5.480 | 6.680 | --- | 61.30 | 190.77 | | 217.14 | | 1964 | 60578 |
| | | 0 03 | | | 218.0 | 18.080 | 0.026 | 5.470 | 7.200 | --- | 60.90 | 189.31 | 197.0/ 6.5 | 227.47 | 224.6/11.1 | 1964 | 60578 |

*NOTE- NET SECTION STRESS EXCEEDS 80% OF YIELD STRENGTH. VALUE NOT INCLUDED IN MEAN OR STD. DEV

TABLE 5.7.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1325F 8HRS, FC TO 1150F
ENVIRONMENT: R.T. , L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | R=+0.50 | | |
| DELTA K MIN | A: | 15.35 | .300 | | | |
| | B: | 17.63 | | 1.40 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | .462 | | | |
| | | 20.00 | 1.13 | 2.17 | | |
| | | 25.00 | 2.31 | 4.27 | | |
| | | 30.00 | 4.22 | 7.07 | | |
| | | 35.00 | 6.76 | 10.9 | | |
| | | 40.00 | 9.68 | 16.1 | | |
| | | 50.00 | 19.0 | 34.0 | | |
| | | 60.00 | | 71.4 | | |
| | | 70.00 | | 152. | | |
| | | 80.00 | | 329. | | |
| DELTA K MAX | A: | 54.42 | 27.2 | | | |
| | B: | 89.46 | | 689. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.41 | 11.84 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1325F 8HRS. FC TO 1150F
FORM: 4.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 168.0 KSI
ULT. STRENGTH: 199.0 KSI
SPECIMEN THK: 0.540- 0.550"
SPECIMEN WIDTH: 7.400"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

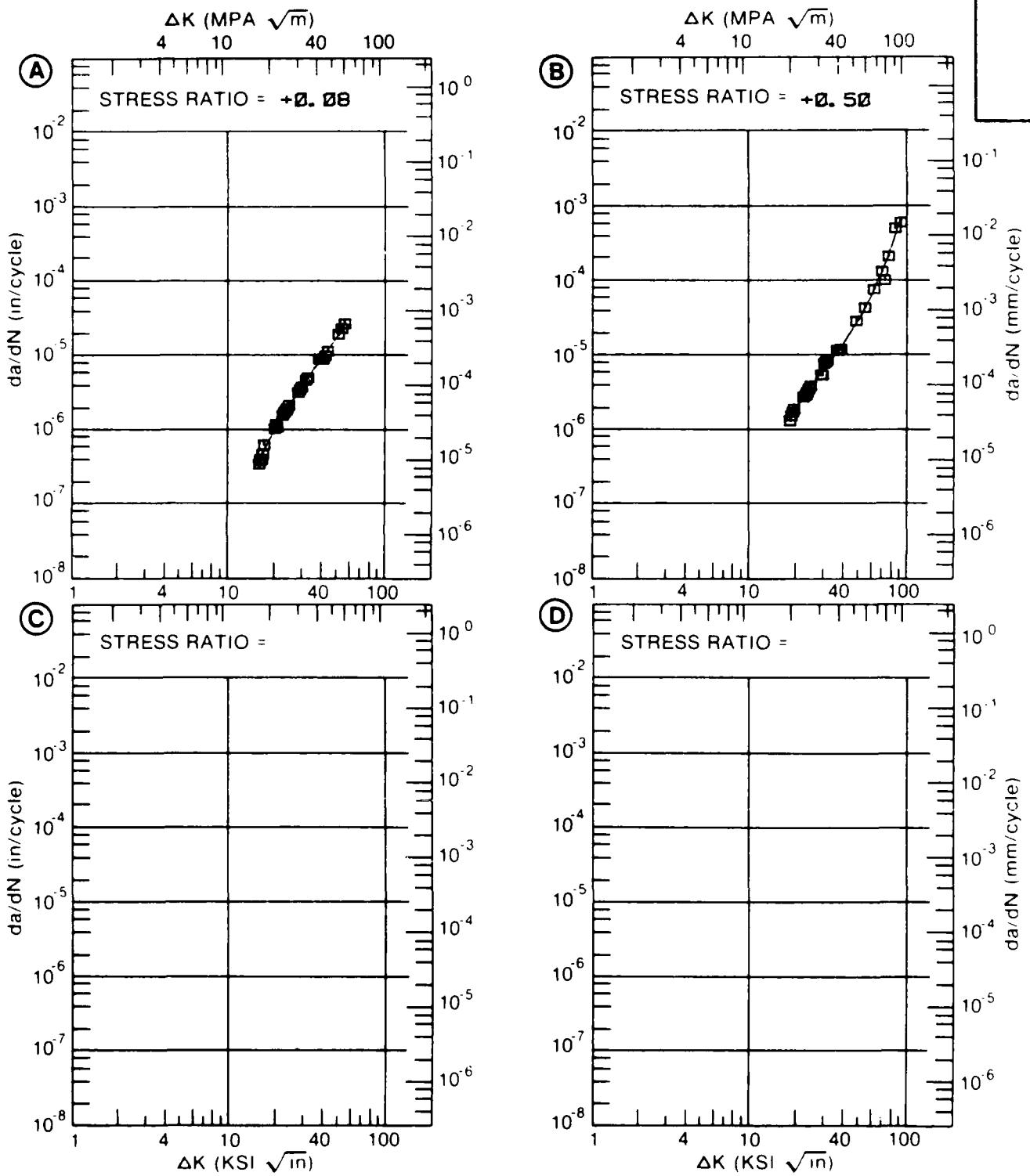



Figure 5.7.3.1

TABLE 5.7.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1325F 8HRS, FC TO 1150F
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.08 | | | |
| DELTA K MIN A: | 21.31 | 1.56 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 25.00 | 2.77 | | | |
| | 30.00 | 5.09 | | | |
| | 35.00 | 8.68 | | | |
| | 40.00 | 14.3 | | | |
| | 50.00 | 32.3 | | | |
| | 60.00 | 59.0 | | | |
| | 70.00 | 107. | | | |
| | 80.00 | 284. | | | |
| DELTA K MAX A: | 86.24 | 790. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 8.94

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1325F 8HRS. FC TO 1150F
FORM: 4.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH: 166.0 KSI
ULT. STRENGTH: 197.0 KSI
SPECIMEN THK: 0.510"
SPECIMEN WIDTH: 6.010"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

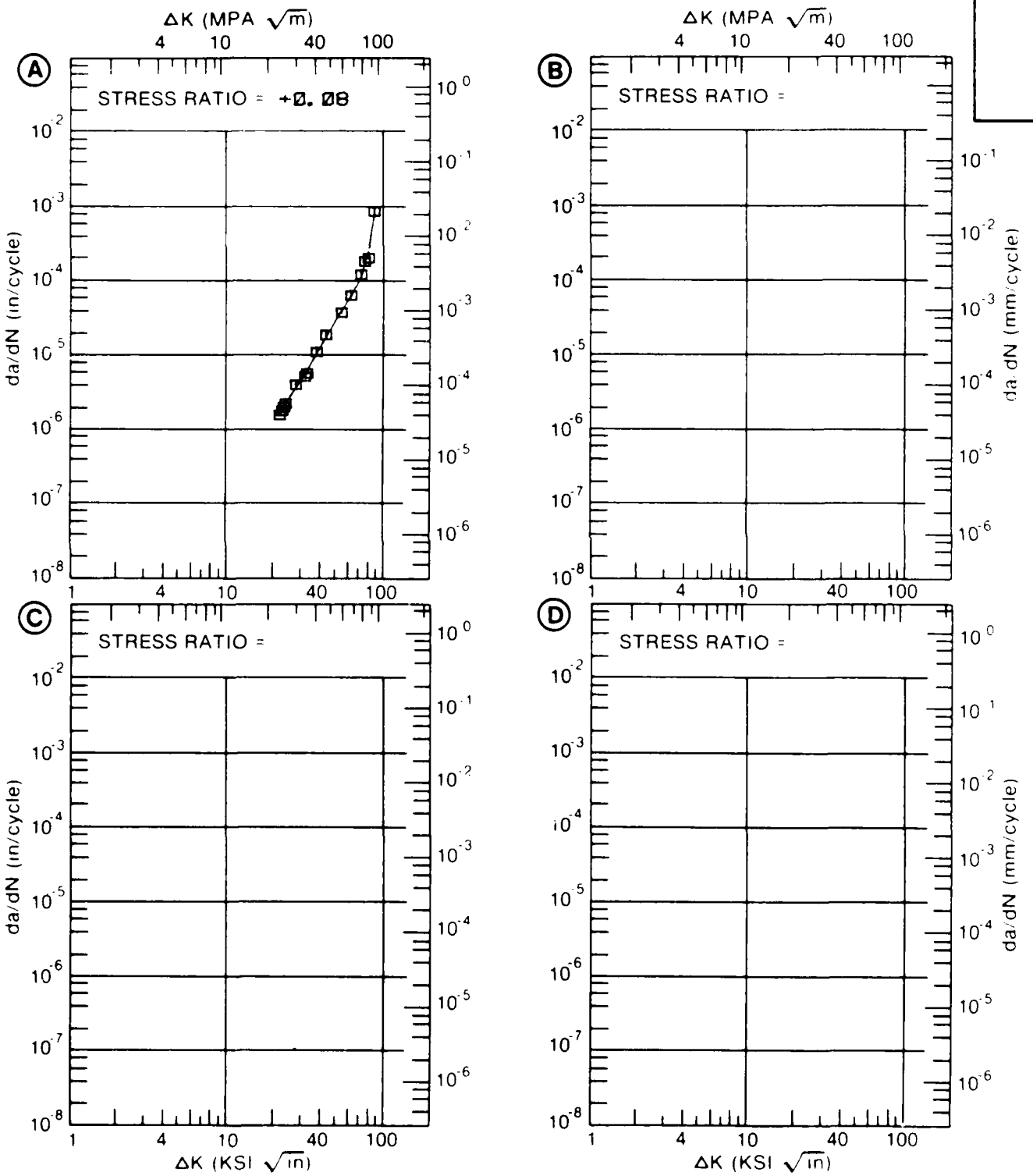



Figure 5.7.3.2

TABLE 5.7.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. AIR | | | |
| DELTA K MIN A: | 14.22 | .612 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |
| | 16.00 | .975 | | | |
| | 20.00 | 1.96 | | | |
| | 25.00 | 3.39 | | | |
| | 30.00 | 5.13 | | | |
| | 35.00 | 7.46 | | | |
| | 40.00 | 10.8 | | | |
| DELTA K MAX A: | 47.95 | 20.1 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 3.66

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.06"TH SHEET
SPECIMEN TYPE: CCP
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 5.00 HZ

YIELD STRENGTH: 174.0 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.061"
SPECIMEN WIDTH: 1.994"
REFERENCES: HD017

NICKEL BASE

INCONEL 718

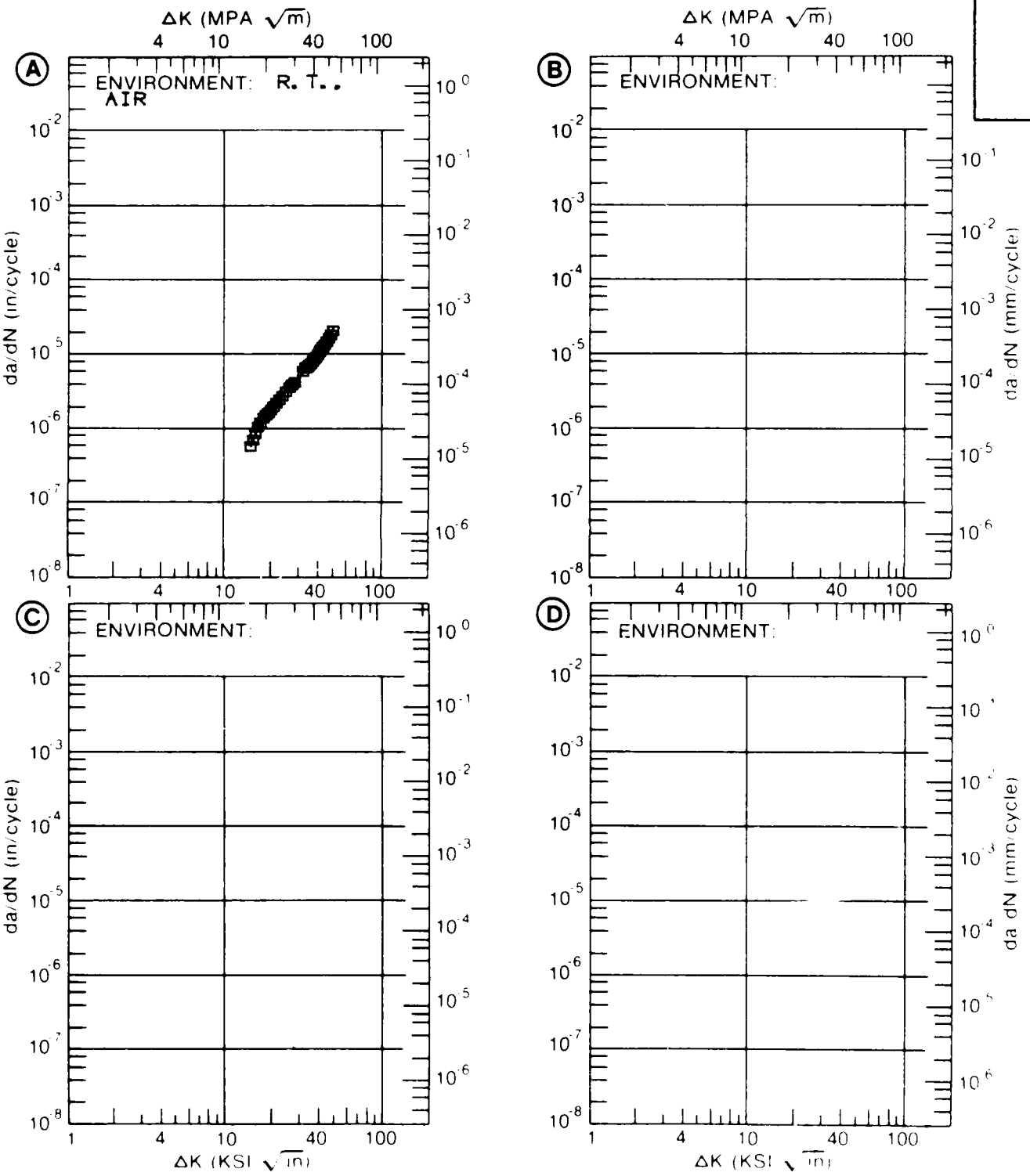



Figure 5.7.3.3

TABLE 5.7.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR | |
| DELTA K MIN | A: | 18.40 | 1.51 | | | |
| | B: | 19.39 | | 2.06 | | |
| | C: | 23.42 | | | 10.8 | |
| | D: | | | | | |
| | | 20.00 | 1.91 | 2.24 | | |
| | | 25.00 | 3.50 | 3.95 | 12.3 | |
| | | 30.00 | 5.72 | 6.35 | 17.9 | |
| | | 35.00 | 8.86 | 9.71 | 23.7 | |
| | | 40.00 | 13.3 | 14.4 | 28.4 | |
| | | 50.00 | 28.4 | 30.6 | | |
| DELTA K MAX | A: | 57.54 | 49.4 | | | |
| | B: | 57.84 | | 53.8 | | |
| | C: | 40.06 | | | 28.5 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 3.58 | 4.18 | 3.30 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.06"TH SHEET
SPECIMEN TYPE: CCP
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 174.0 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.061"
SPECIMEN WIDTH: 1.995- 2.000"
REFERENCES: HD017

NICKEL BASE

INCONEL 718

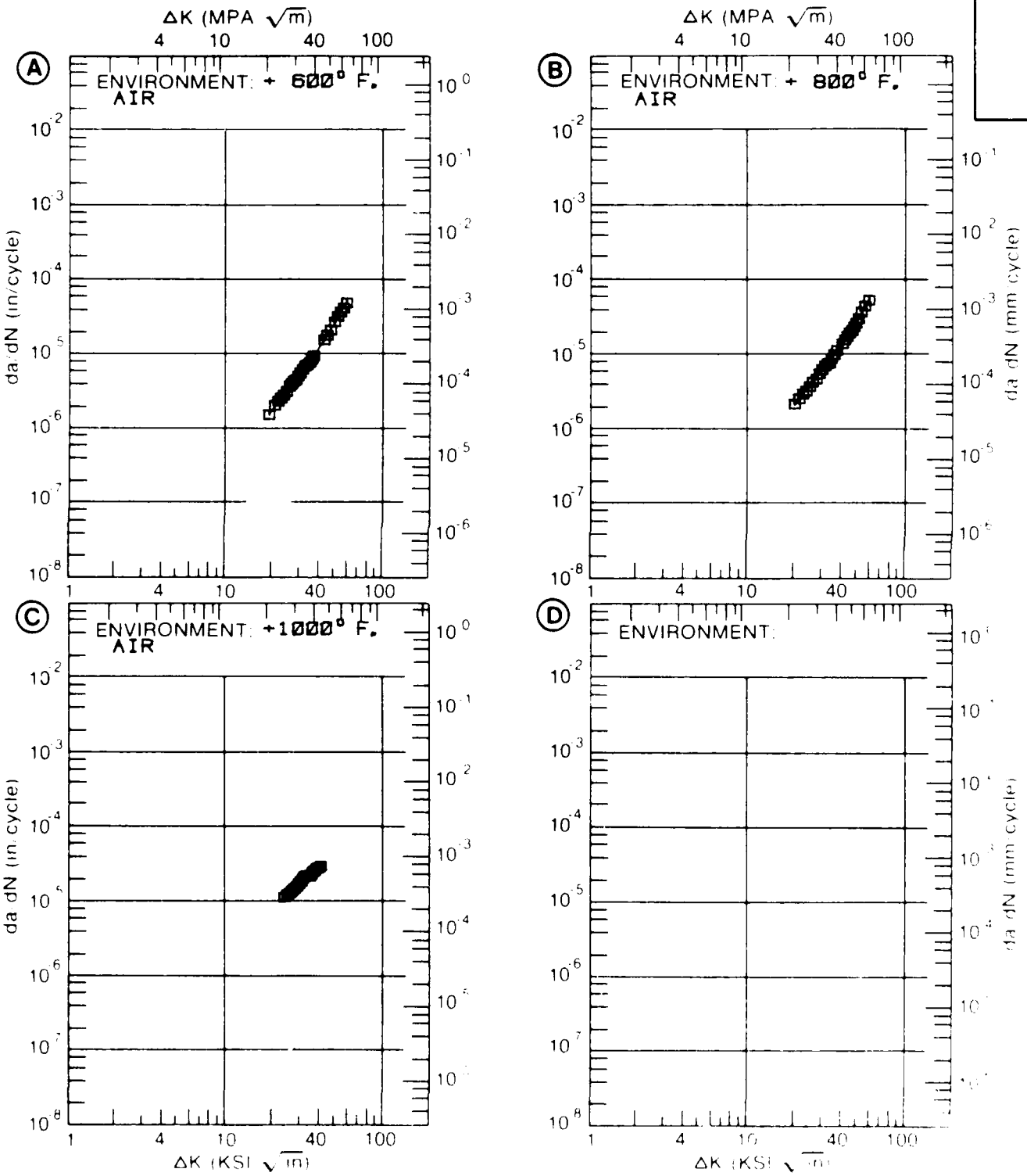


TABLE 5.7.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

ENVIRONMENT: R.T., LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | | | |
| DELTA K MIN | A: | 14.19 | .438 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | .754 | | | |
| | | 20.00 | 1.77 | | | |
| | | 25.00 | 3.72 | | | |
| | | 30.00 | 6.69 | | | |
| | | 35.00 | 11.2 | | | |
| | | 40.00 | 18.0 | | | |
| | | 50.00 | 44.1 | | | |
| DELTA K MAX | A: | 58.21 | 89.9 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 4.88

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 156.4 KSI
ULT. STRENGTH: 200.7 KSI
SPECIMEN THK: 0.495"
SPECIMEN WIDTH: 1.998"
REFERENCES: HD017

NICKEL BASE

INCONEL 718

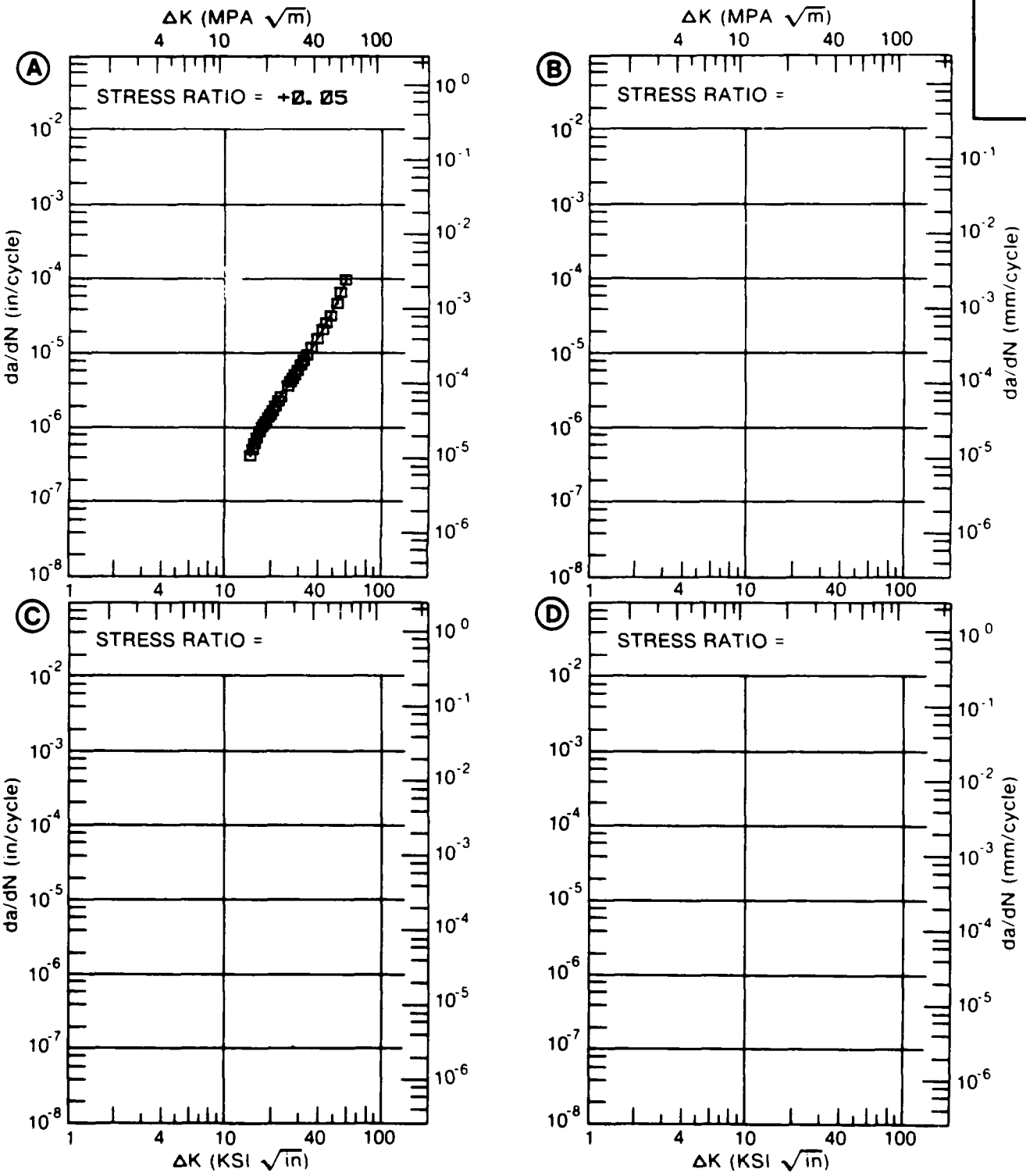



Figure 5.7.3.5

TABLE 5.7.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.6 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | R=+0.33 | R=+0.50 | |
| DELTA K MIN | A: | 12.91 | .693 | | | |
| | B: | 10.17 | | .471 | | |
| | C: | 9.19 | | | .615 | |
| | D: | | | | | |
| | | 10.00 | | | .770 | |
| | | 13.00 | .717 | 1.16 | 1.72 | |
| | | 16.00 | 1.77 | 2.17 | 3.38 | |
| | | 20.00 | 3.23 | 4.06 | 6.48 | |
| | | 25.00 | 5.55 | 7.91 | 10.9 | |
| | | 30.00 | 10.6 | 14.9 | | |
| | | 35.00 | 20.1 | | | |
| | | 40.00 | 32.9 | | | |
| DELTA K MAX | A: | 44.45 | 43.3 | | | |
| | B: | 31.81 | | 18.8 | | |
| | C: | 25.68 | | | 11.7 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.84 | 6.03 | 4.04 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC. 1325F 8HRS. FC TO 1150F. HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 6.67 HZ
ENVIRONMENT: +1000° F. AIR

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.298- 0.299"
SPECIMEN WIDTH: 1.151- 1.152"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

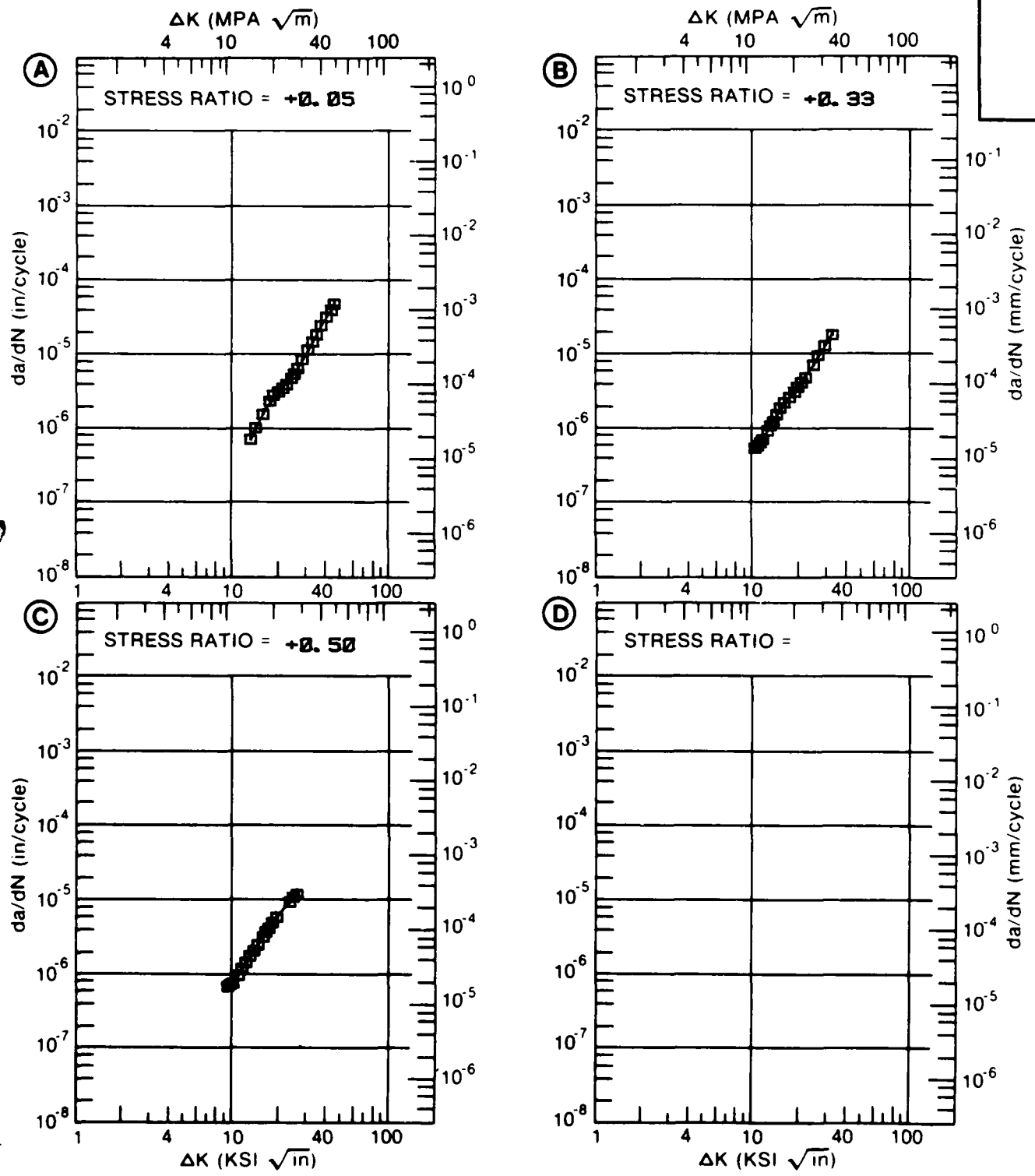



Figure 5.7.3.6

TABLE 5.7.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 600F AIR, .67HZ | E=+1000F AIR, .001HZ | E=+1000F AIR, .06HZ | |
| DELTA K MIN | A: | 14.29 | .386 | | | |
| | B: | | | | | |
| | C: | 15.63 | | | 2.11 | |
| | D: | | | | | |
| | | 16.00 | .549 | | 2.27 | |
| | | 20.00 | 1.23 | | 4.90 | |
| | | 25.00 | 3.03 | | 10.3 | |
| | | 30.00 | 6.43 | | 17.2 | |
| | | 35.00 | 11.9 | | | |
| DELTA K MAX | A: | 39.08 | 18.0 | | | |
| | B: | | | | | |
| | C: | 34.70 | | | 23.2 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.47 | 0.00 | 3.25 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.299- 0.300"
SPECIMEN WIDTH: 1.151- 1.152"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

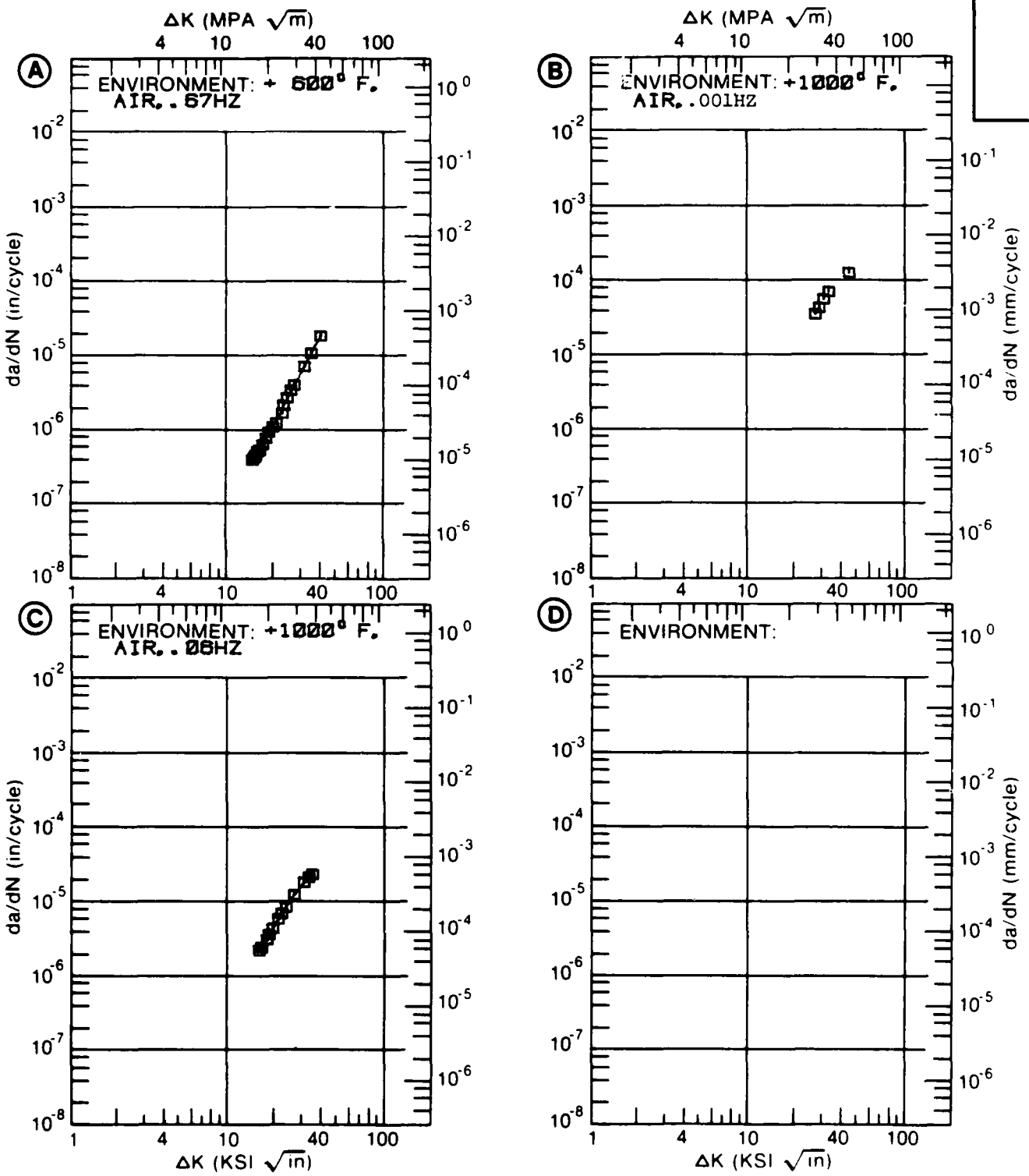



Figure 5.7.3.7

TABLE 5.7.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD
18HR AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR | E=+1200F AIR |
| DELTA K MIN | A: | 14.43 | .743 | | | |
| | B: | 16.56 | | 1.49 | | |
| | C: | 13.60 | | | 1.44 | |
| | D: | 16.93 | | | | 11.1 |
| | | 16.00 | 1.06 | | 2.33 | |
| | | 20.00 | 2.33 | 3.29 | 5.01 | 17.5 |
| | | 25.00 | 5.18 | 7.87 | 11.2 | 32.8 |
| | | 30.00 | 9.97 | 15.0 | 20.9 | 52.4 |
| | | 35.00 | 17.3 | 24.2 | 33.5 | 73.1 |
| | | 40.00 | 27.6 | 34.7 | 47.0 | |
| | | 50.00 | 58.8 | | | |
| DELTA K MAX | A: | 57.98 | 95.2 | | | |
| | B: | 44.06 | | 43.5 | | |
| | C: | 41.58 | | | 51.1 | |
| | D: | 35.62 | | | | 75.6 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.71 | 7.22 | 2.95 | 4.81 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.87 HZ

YIELD STRENGTH: 156.4 KSI
ULT. STRENGTH: 200.7 KSI
SPECIMEN THK: 0.495- 0.497"
SPECIMEN WIDTH: 1.997- 1.999"
REFERENCES: HD017

NICKEL BASE

INCONEL 718

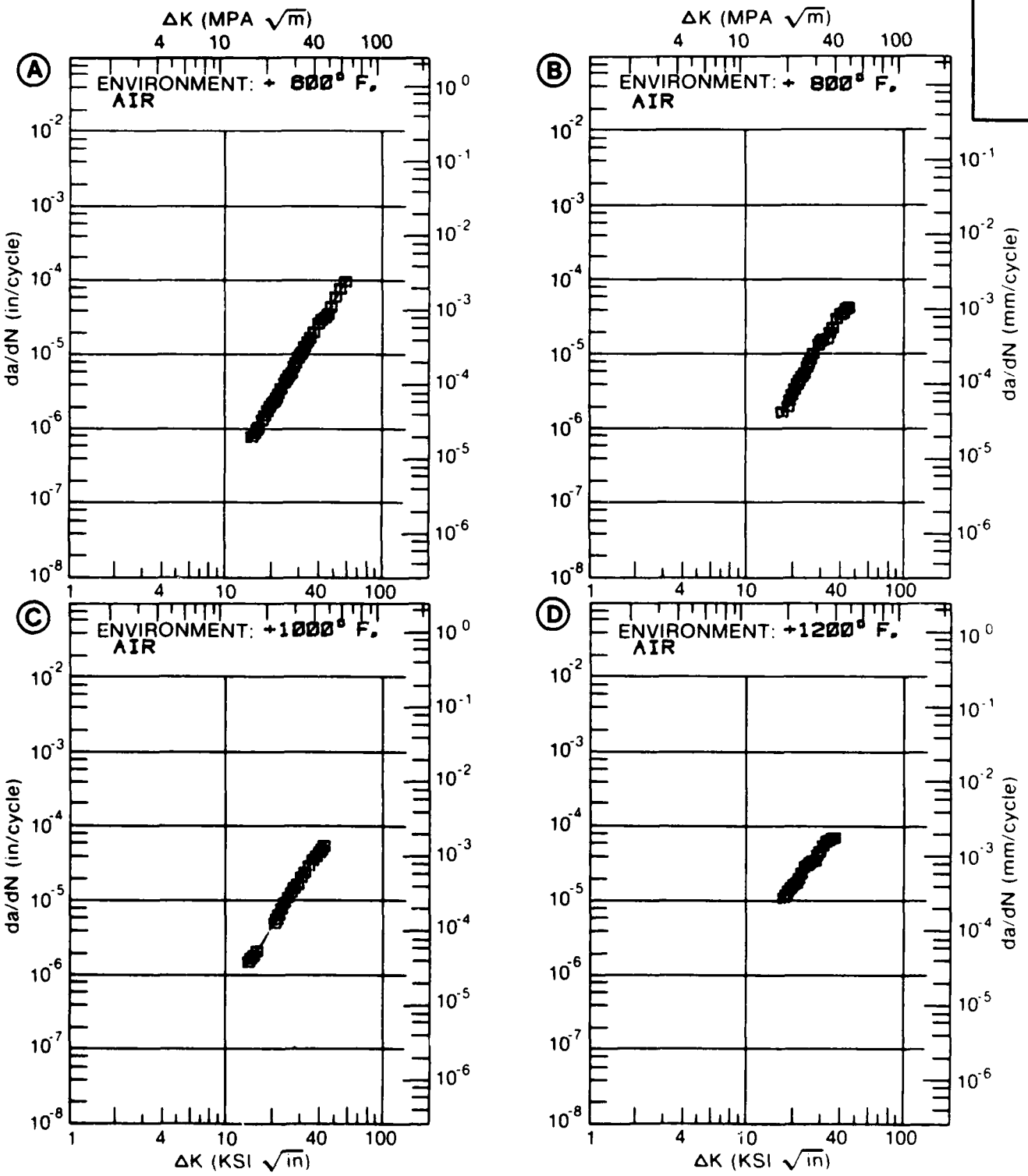



Figure 5.7.3.8

TABLE 5.7.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.9 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.33 | R=+0.50 | | |
| DELTA K MIN | A: | 10.68 | .499 | | | |
| | B: | 7.32 | | .147 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | | .220 | | |
| | | 9.00 | | .362 | | |
| | | 10.00 | | .548 | | |
| | | 13.00 | 1.00 | 1.39 | | |
| | | 16.00 | 2.08 | 2.68 | | |
| | | 20.00 | 4.40 | 5.14 | | |
| | | 25.00 | 8.86 | | | |
| DELTA K MAX | A: | 29.34 | 14.1 | | | |
| | B: | 23.56 | | 8.10 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 3.82 | 5.67 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.67 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK. 0.477- 0.478"
SPECIMEN WIDTH: 1.996"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

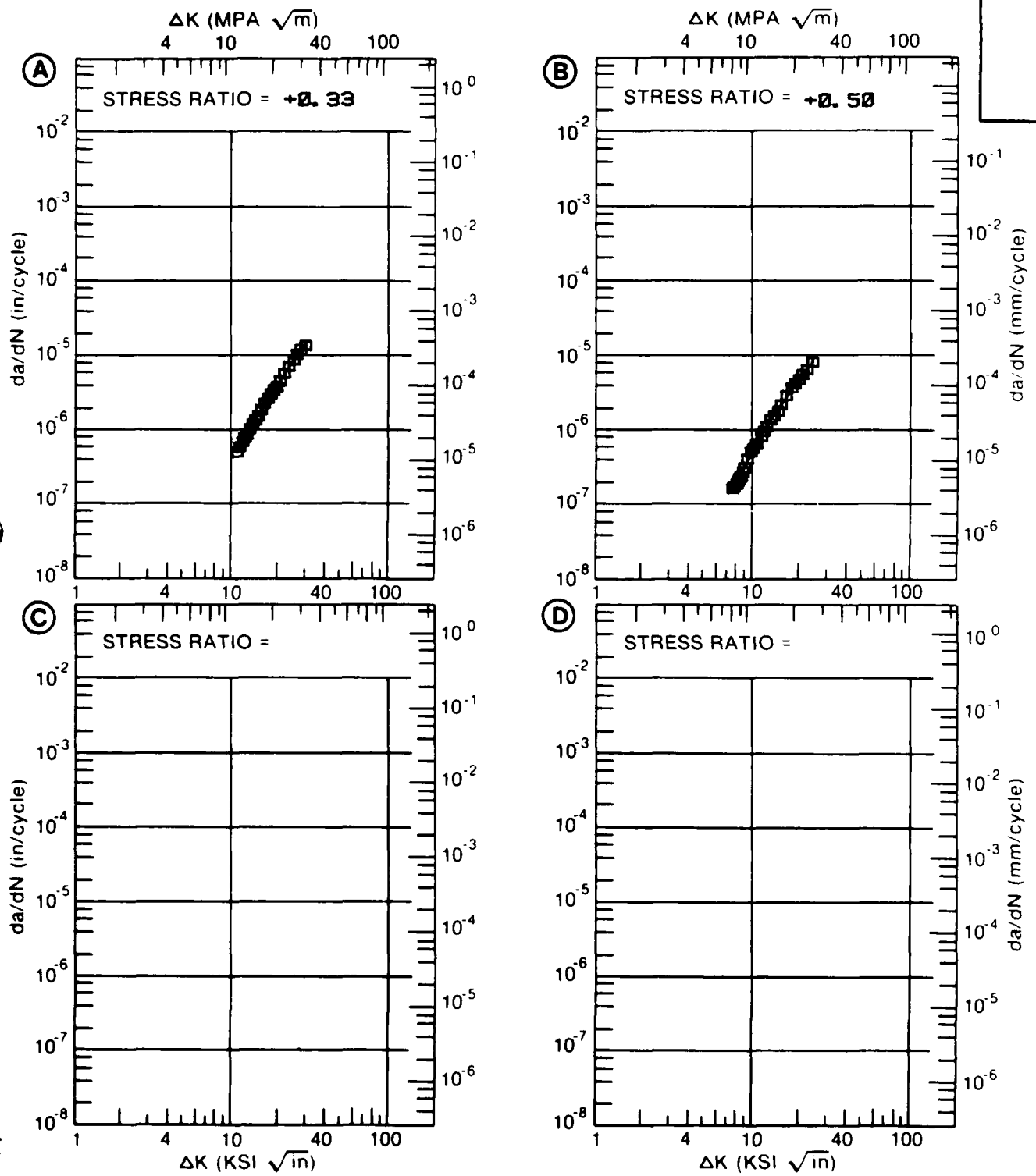



Figure 5.7.3.9

TABLE 5.7.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.10 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.67 | | | |
| DELTA K MIN | A: | 7.74 | .523 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | .585 | | | |
| | | 9.00 | .855 | | | |
| | | 10.00 | 1.18 | | | |
| | | 13.00 | 2.42 | | | |
| | | 16.00 | 4.08 | | | |
| DELTA K MAX | A: | 18.84 | 6.03 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 2.72

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.67 HZ
ENVIRONMENT: +1000° F, AIR

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.479"
SPECIMEN WIDTH: 1.993"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

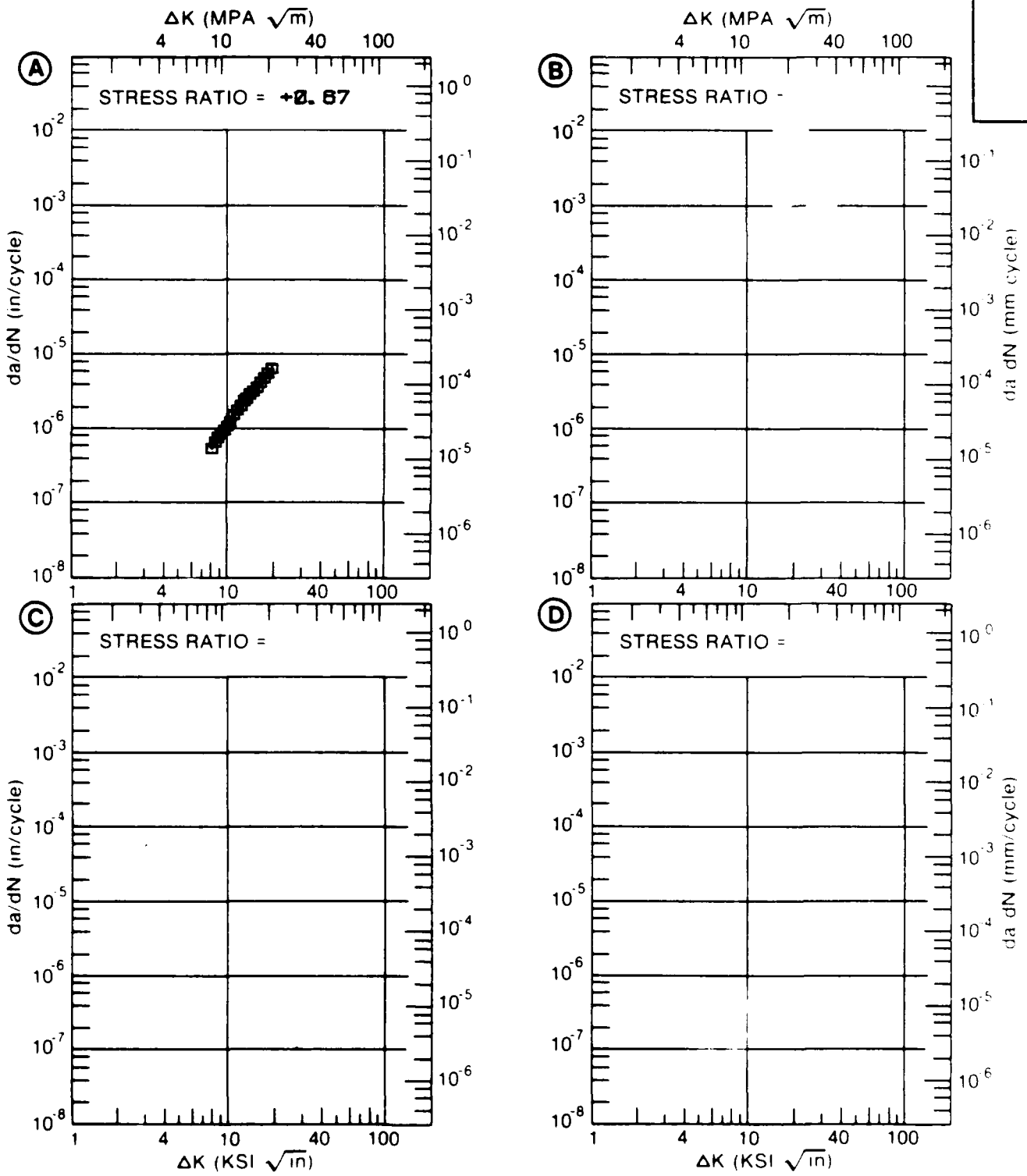



Figure 5.7.3.10

TABLE 5.7.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E=+1200F AIR | | | |
| DELTA K MIN A: | 20.23 | 9.05 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 25.00 | 17.8 | | | |
| | 30.00 | 31.1 | | | |
| | 35.00 | 48.8 | | | |
| | 40.00 | 70.7 | | | |
| | 50.00 | 125. | | | |
| DELTA K MAX A: | 55.76 | 160. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 2.88

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.03
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.477"
SPECIMEN WIDTH: 1.997"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

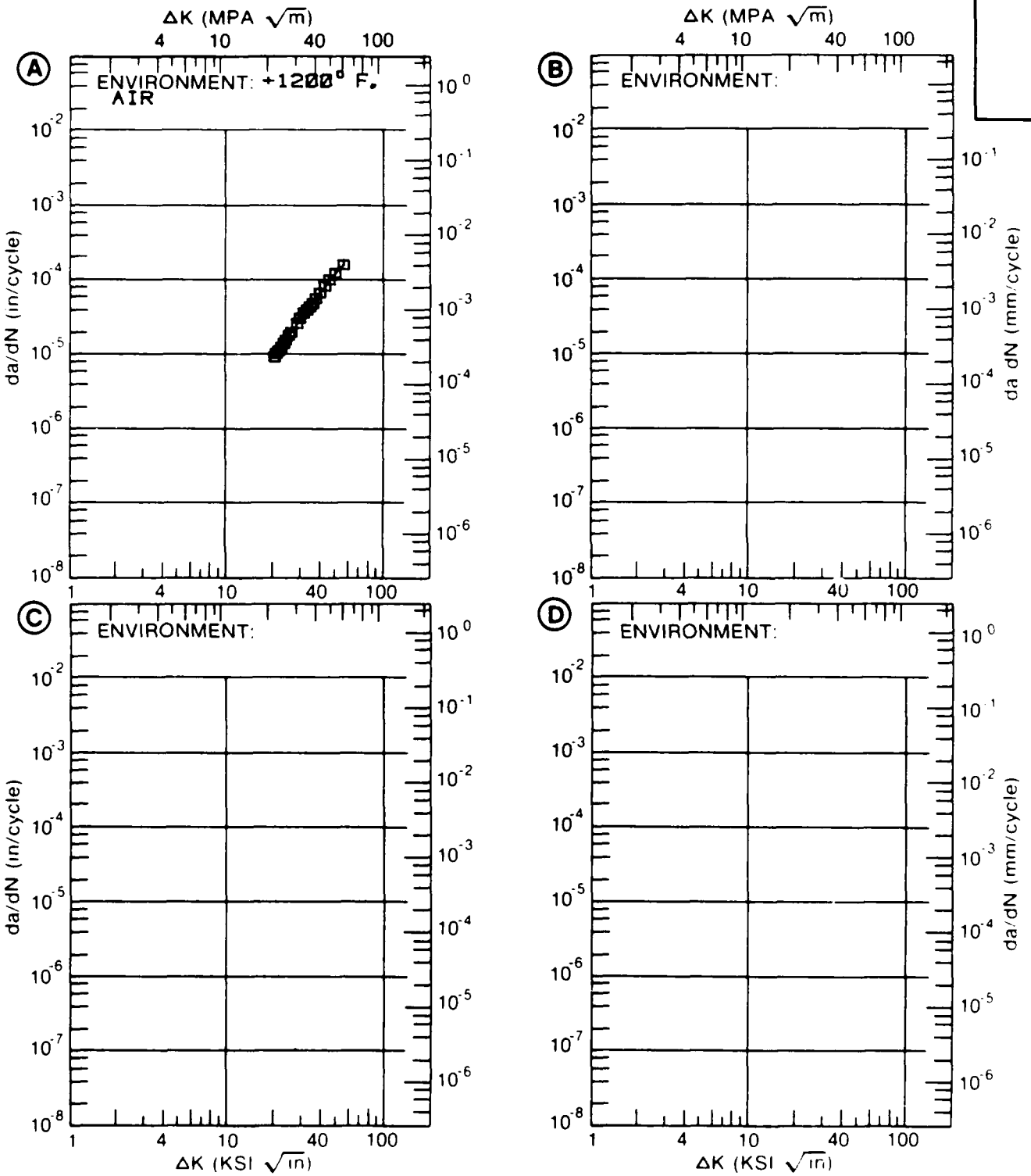



Figure 5.7.3.11

TABLE 5.7.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.12 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR, 8.33HZ | E=+ 800F AIR, 6.67HZ | | |
| DELTA K MIN | A: | 18.26 | 1.01 | | | |
| | B: | 15.64 | | .749 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | | .820 | | |
| | | 20.00 | 1.29 | 1.98 | | |
| | | 25.00 | 2.73 | 4.69 | | |
| | | 30.00 | 5.50 | 9.30 | | |
| | | 35.00 | 9.95 | 16.3 | | |
| | | 40.00 | 16.0 | 25.9 | | |
| | | 50.00 | 30.4 | | | |
| DELTA K MAX | A: | 54.46 | 35.9 | | | |
| | B: | 42.78 | | 32.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.56 | 4.55 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.477"
SPECIMEN WIDTH: 1.997- 1.998"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

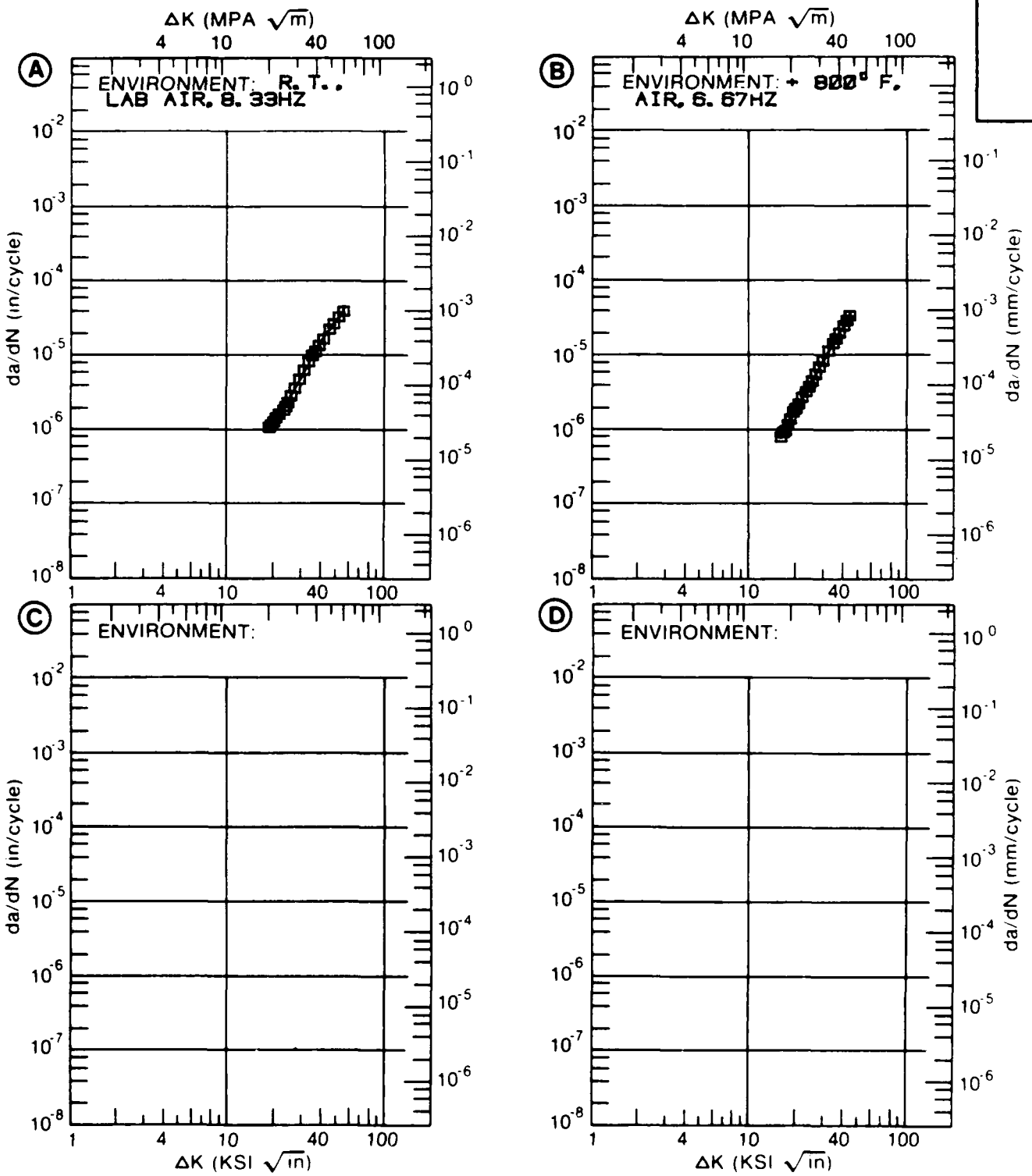



Figure 5.7.3.12

TABLE 5.7.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.13 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 800F AIR | E=+1000F AIR | | |
| DELTA K MIN | A: | 16.57 | 1.25 | | | |
| | B: | 15.20 | | 1.43 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | | 1.73 | | |
| | | 20.00 | 2.93 | 3.78 | | |
| | | 25.00 | 6.96 | 7.63 | | |
| | | 30.00 | 13.1 | 13.2 | | |
| | | 35.00 | 21.6 | 20.8 | | |
| | | 40.00 | 33.1 | 31.1 | | |
| | | 50.00 | 69.4 | 63.9 | | |
| | | 60.00 | | 122. | | |
| DELTA K MAX | A: | 56.07 | 104. | | | |
| | B: | 66.35 | | 181. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.56 | 12.07 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 5 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 129.0- 150.5 KSI
ULT. STRENGTH: 160.1- 191.3 KSI
SPECIMEN THK: 0.476- 0.478"
SPECIMEN WIDTH: 1.996- 1.998"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

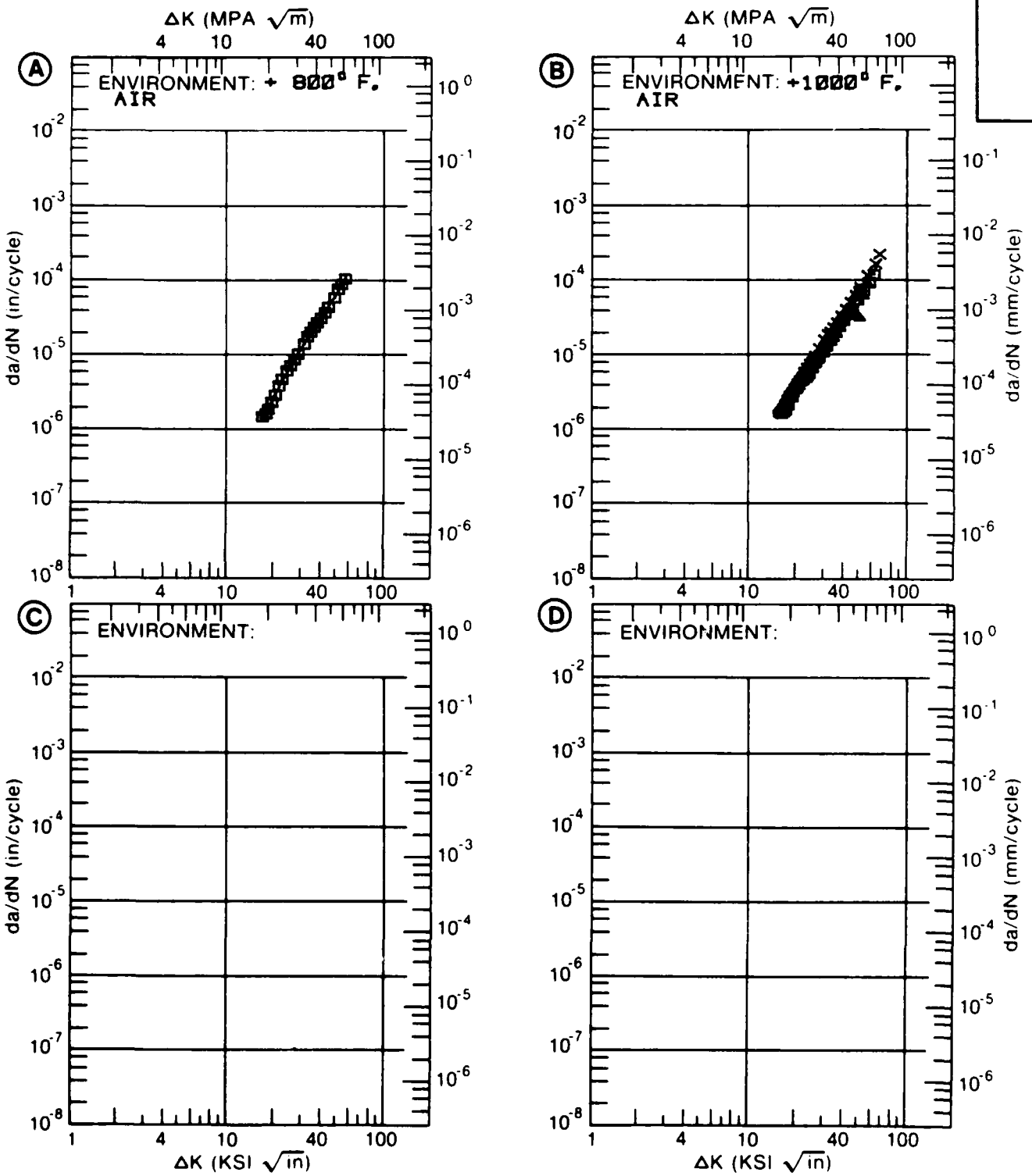



Figure 5.7.3.13

TABLE 5.7.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.14 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

ENVIRONMENT: R.T., LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.05 | | | |
| DELTA K MIN A: | 13.06 | .190 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 16.00 | .871 | | | |
| | 20.00 | 1.77 | | | |
| | 25.00 | 3.70 | | | |
| | 30.00 | 6.86 | | | |
| | 35.00 | 11.7 | | | |
| | 40.00 | 18.7 | | | |
| | 50.00 | 41.7 | | | |
| DELTA K MAX A: | 59.94 | 80.8 | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.07

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: FORGING
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 168.4 KSI
ULT. STRENGTH: 195.7 KSI
SPECIMEN THK: 0.402"
SPECIMEN WIDTH: 1.998"
REFERENCES:HD017

NICKEL BASE

INCONEL 718

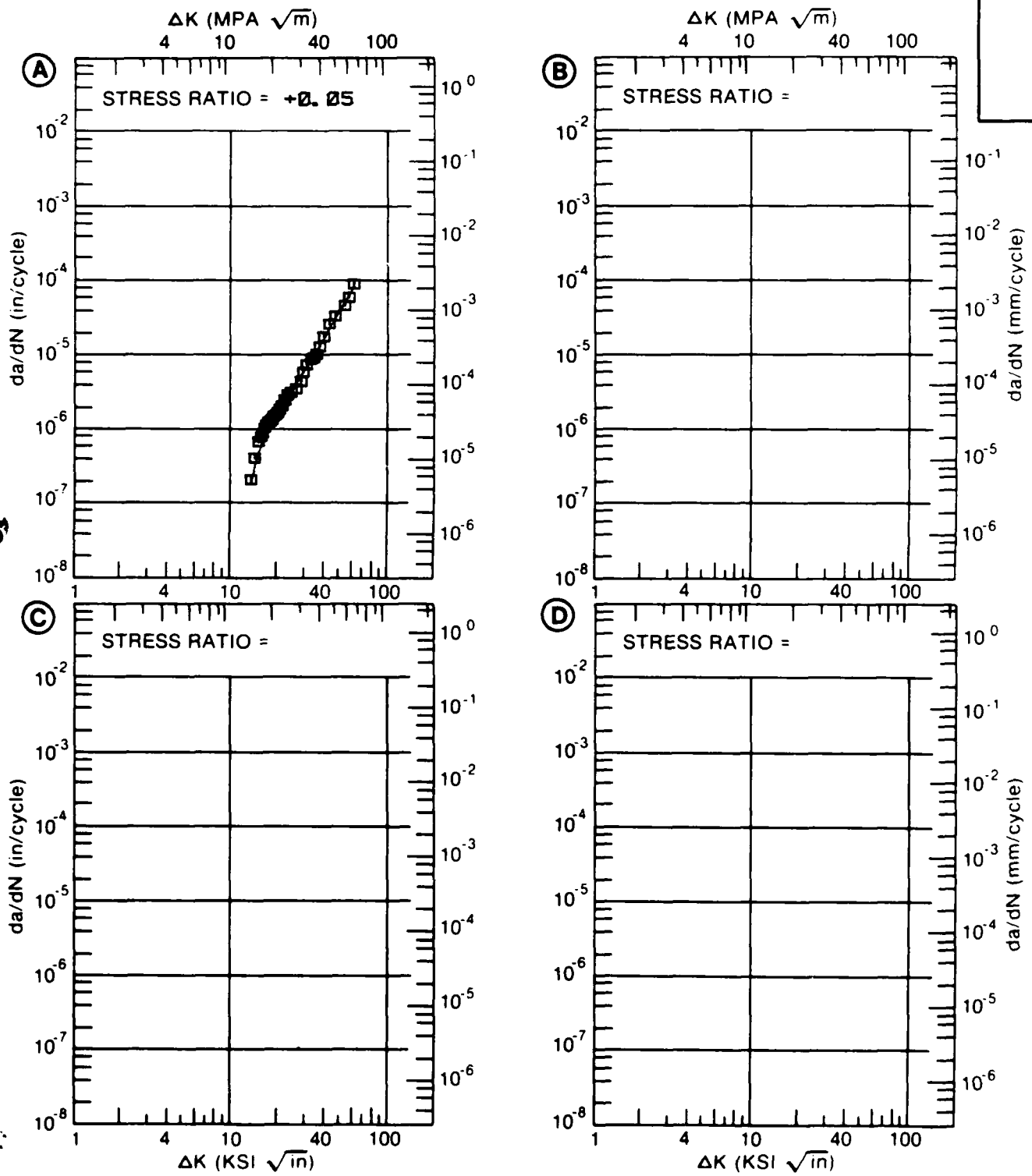



Figure 5.7.3.14

TABLE 5.7.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.15 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR | E=+1200F AIR |
| DELTA K MIN | A: | 16.43 | .786 | | | |
| | B: | 15.22 | | .849 | | |
| | C: | 12.64 | | | 1.22 | |
| | D: | 14.06 | | | | 3.09 |
| | | 13.00 | | | 1.38 | |
| | | 16.00 | | .993 | 3.06 | 4.71 |
| | | 20.00 | 1.44 | 2.05 | 5.93 | 9.30 |
| | | 25.00 | 3.28 | 4.40 | 10.7 | 17.4 |
| | | 30.00 | 6.61 | 8.32 | 17.9 | 28.2 |
| | | 35.00 | 11.5 | 14.3 | | 41.7 |
| | | 40.00 | 17.4 | 22.7 | | |
| | | 50.00 | | 48.6 | | |
| DELTA K MAX | A: | 41.28 | 19.0 | | | |
| | B: | 51.90 | | 54.9 | | |
| | C: | 31.19 | | | 20.2 | |
| | D: | 38.42 | | | | 52.5 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.75 | 5.36 | 3.25 | 4.14 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: FORGING
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 188.4 KSI
ULT. STRENGTH: 196.7 KSI
SPECIMEN THK: 0.402- 0.403"
SPECIMEN WIDTH: 1.996- 1.998"
REFERENCES: HD017

NICKEL BASE

INCONEL 718

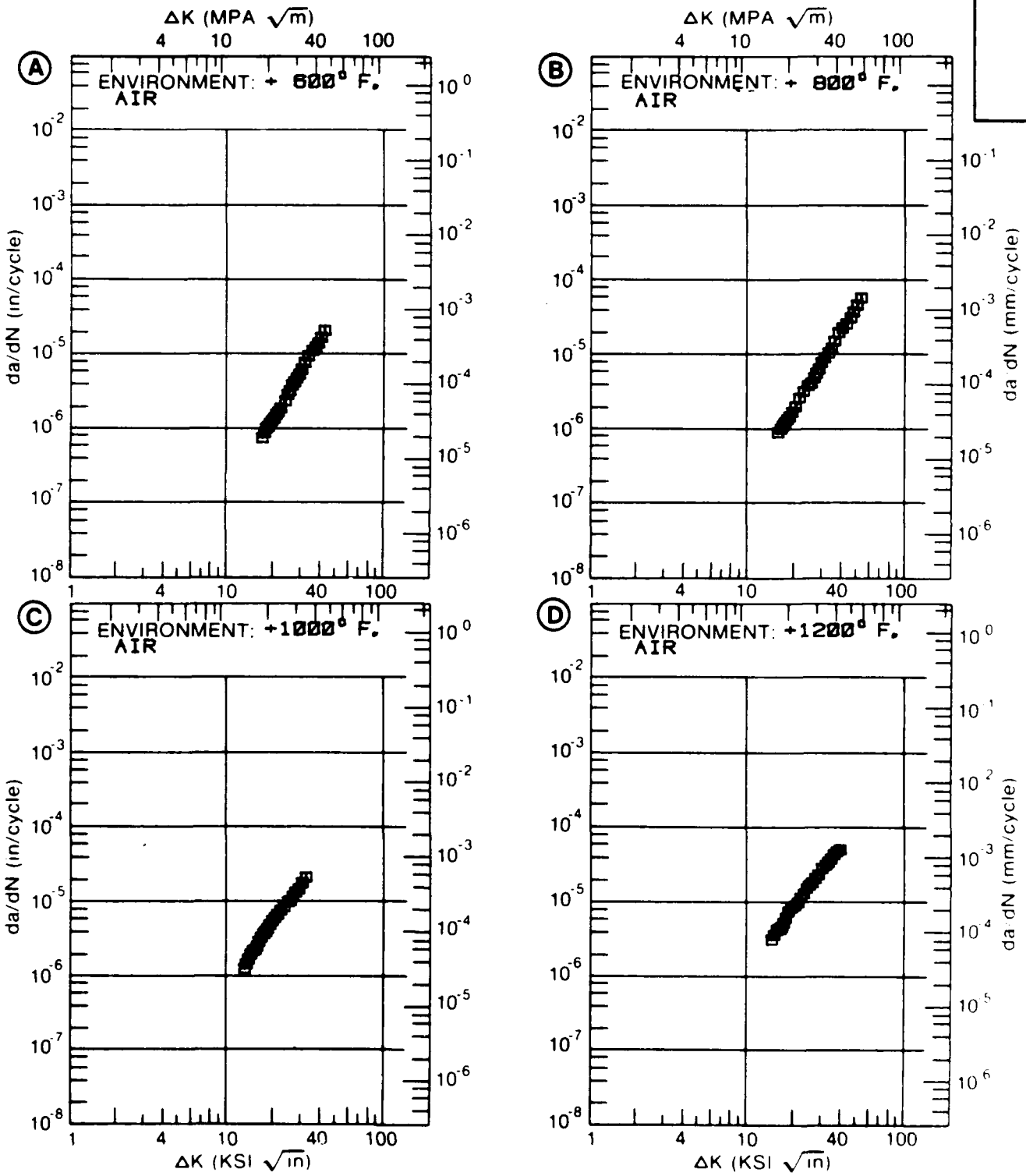



Figure 5.7.3.15

TABLE 5.7.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. LAB AIR | | | |
| DELTA K MIN A: | 16.57 | 1.36 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 20.00 | 2.55 | | | |
| | 25.00 | 5.07 | | | |
| | 30.00 | 8.74 | | | |
| | 35.00 | 14.0 | | | |
| | 40.00 | 21.5 | | | |
| | 50.00 | 47.2 | | | |
| | 60.00 | 98.4 | | | |
| DELTA K MAX A: | 63.69 | 128. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 7.64

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 2.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 10.00 HZ

YIELD STRENGTH: 152.1 KSI
ULT. STRENGTH: 194.4 KSI
SPECIMEN THK: 0.304"
SPECIMEN WIDTH: 1.480"
REFERENCES:HD017

NICKEL BASE

INCONEL 718

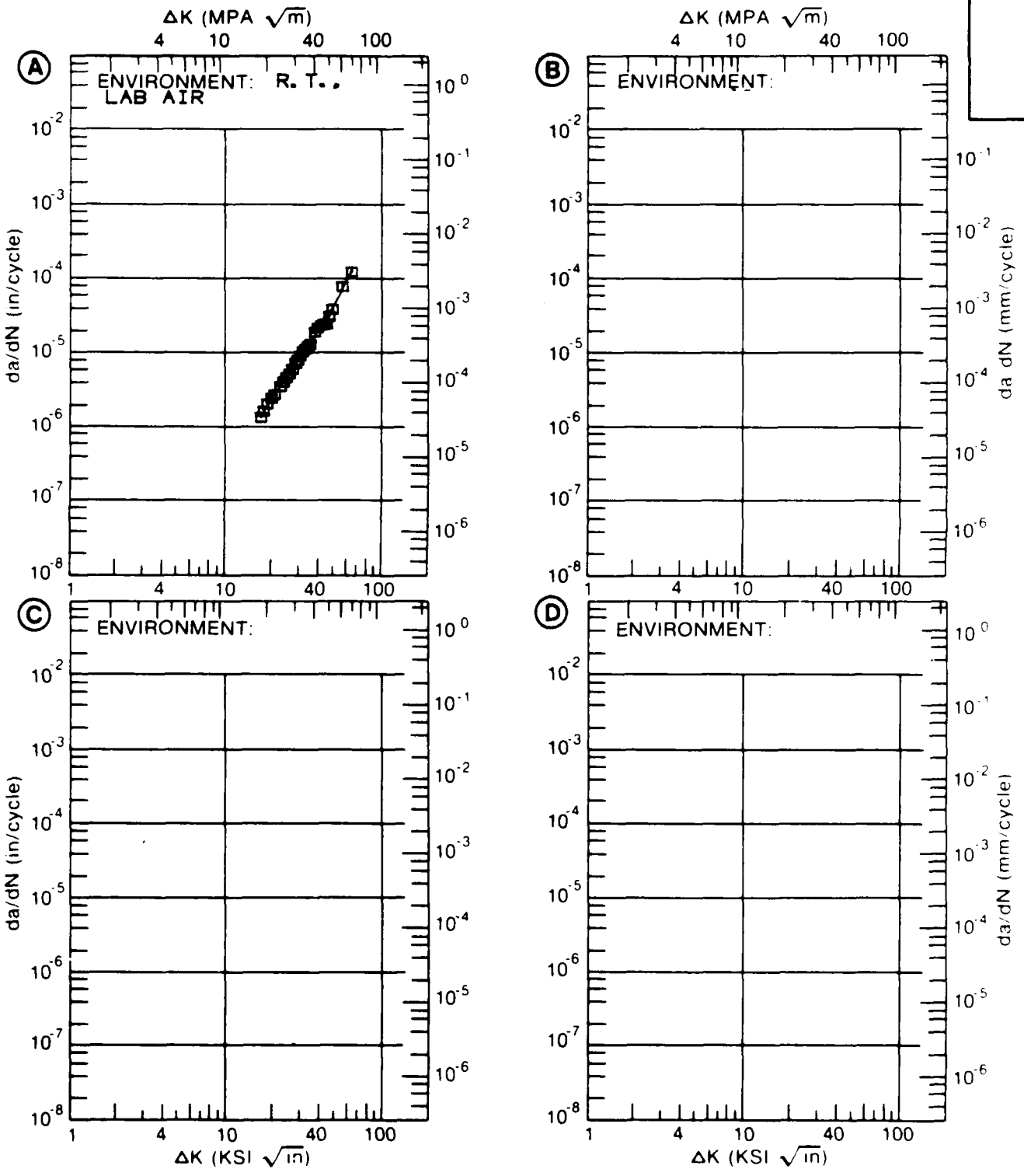



Figure 5.7.3.16

TABLE 5.7.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.17INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR | E=+1200F AIR |
| DELTA K MIN A: | 17.61 | 1.38 | | | |
| DELTA K MIN B: | 17.80 | | 1.72 | | |
| DELTA K MIN C: | 16.17 | | | 3.68 | |
| DELTA K MIN D: | 16.10 | | | | 12.5 |
| | 20.00 | 2.32 | 2.88 | 7.13 | 21.0 |
| | 25.00 | 5.29 | 6.91 | 12.9 | 36.4 |
| | 30.00 | 9.77 | 12.9 | 20.5 | 55.6 |
| | 35.00 | 16.0 | 21.0 | 31.0 | 76.1 |
| | 40.00 | 24.4 | 31.2 | 45.9 | 95.3 |
| | 50.00 | 50.1 | | 101. | |
| DELTA K MAX A: | 56.32 | 74.9 | | | |
| DELTA K MAX B: | 42.93 | | 38.3 | | |
| DELTA K MAX C: | 55.00 | | | 150. | |
| DELTA K MAX D: | 44.50 | | | | 110. |
| ROOT MEAN SQUARE PERCENT ERROR | | 4.54 | 5.17 | 4.81 | 4.86 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 2.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 152.1 KSI
ULT. STRENGTH: 194.4 KSI
SPECIMEN THK: 0.303- 0.304"
SPECIMEN WIDTH: 1.478- 1.481"
REFERENCES: HD017

NICKEL BASE

INCONEL 718

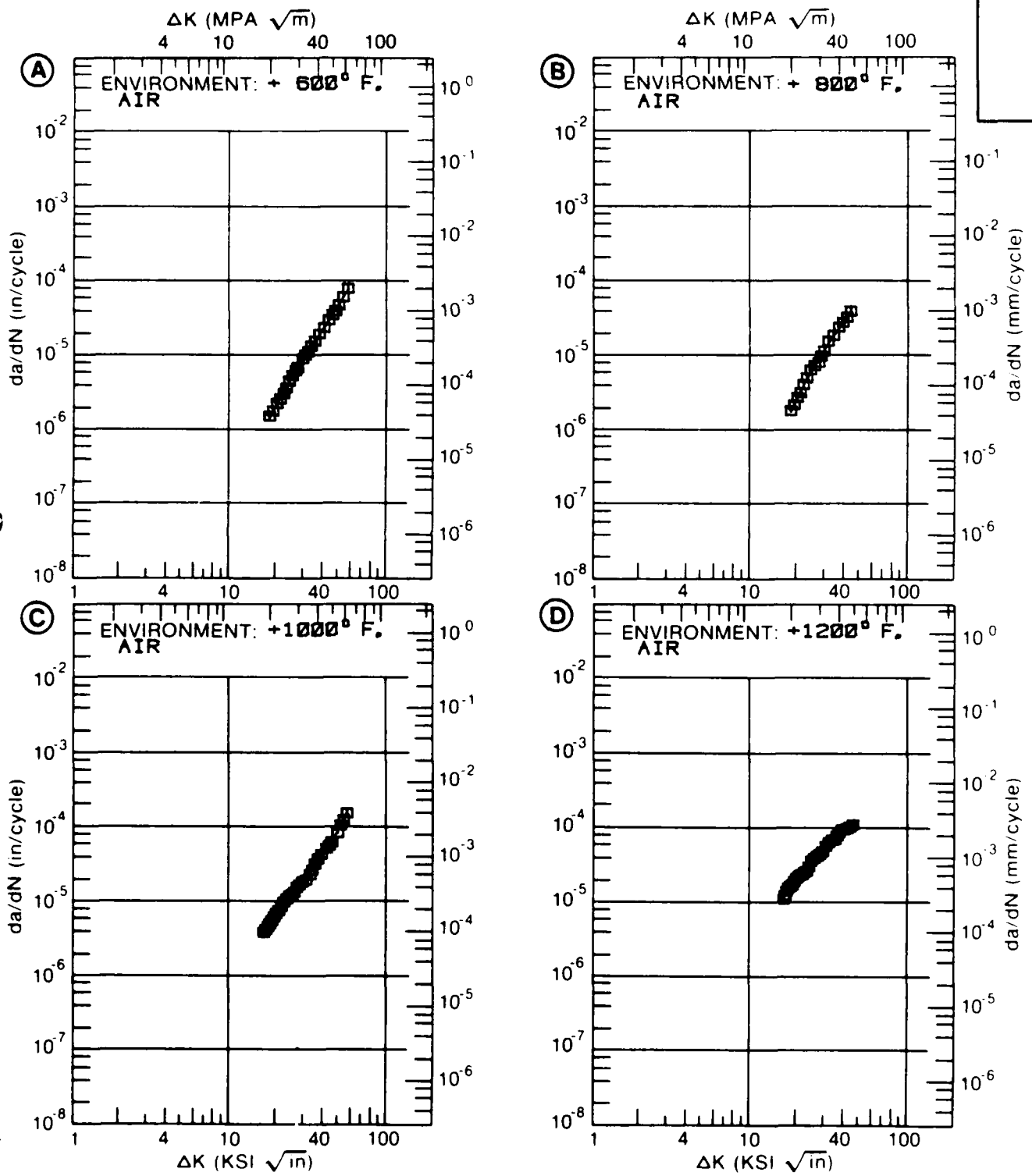



Figure 5.7.3.17

TABLE 5.7.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.18 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR AC, 1325F 8HR FC TO 1150F,
HELD 18HR AC(VIM-EFR)

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR,10HZ | E=+1200F AIR,.67HZ | | |
| DELTA K MIN | A: | 12.11 | .0962 | | | |
| | B: | 28.72 | | 21.7 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | .218 | | | |
| | | 16.00 | .632 | | | |
| | | 20.00 | 1.57 | | | |
| | | 25.00 | 3.83 | | | |
| | | 30.00 | 7.06 | 25.1 | | |
| | | 35.00 | 11.7 | 37.7 | | |
| | | 40.00 | 19.5 | 49.0 | | |
| DELTA K MAX | A: | 45.38 | 35.7 | | | |
| | B: | 45.46 | | 60.6 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.97 | 3.70 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION HT 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-EFR)
FORM 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 147.9 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.298- 0.490"
SPECIMEN WIDTH: 1.153- 1.998"
REFERENCES: HD016

NICKEL BASE

INCONEL 718

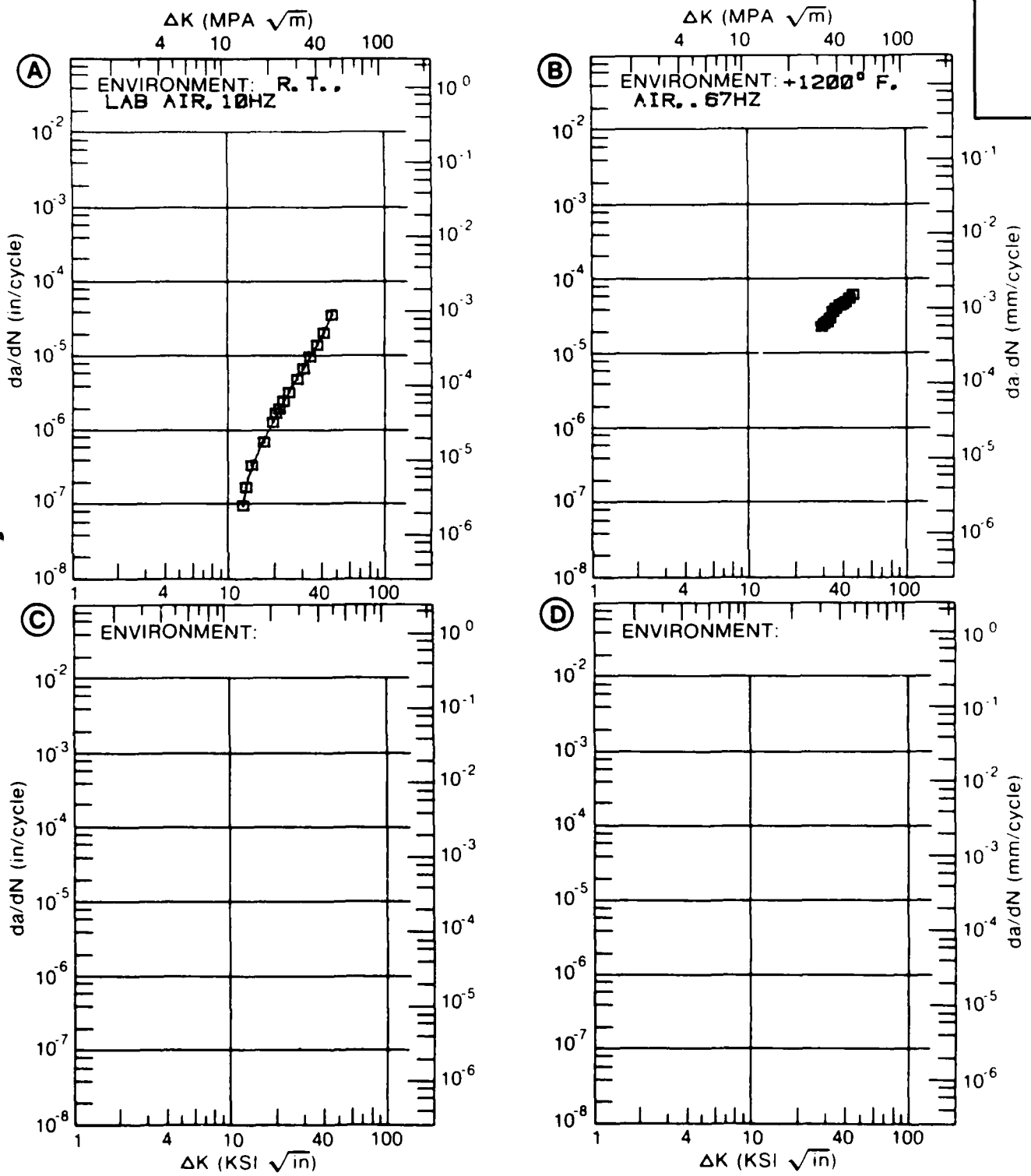



Figure 5.7.3.18

TABLE 5.7.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.19 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
(VIM-VAR)

ENVIRONMENT: R.T., LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | | | |
| DELTA K MIN | A: | 16.56 | 1.63 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 2.99 | | | |
| | | 25.00 | 6.28 | | | |
| | | 30.00 | 12.1 | | | |
| | | 35.00 | 22.4 | | | |
| | | 40.00 | 40.0 | | | |
| | | 50.00 | 122. | | | |
| DELTA K MAX | A: | 56.03 | 232. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 5.04

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-VAR)
FORM: 0.63"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 8.33- 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 164.9 KSI
ULT. STRENGTH: 208.1 KSI
SPECIMEN THK: 0.301"
SPECIMEN WIDTH: 1.151"
REFERENCES: HD016

NICKEL BASE

INCONEL 718

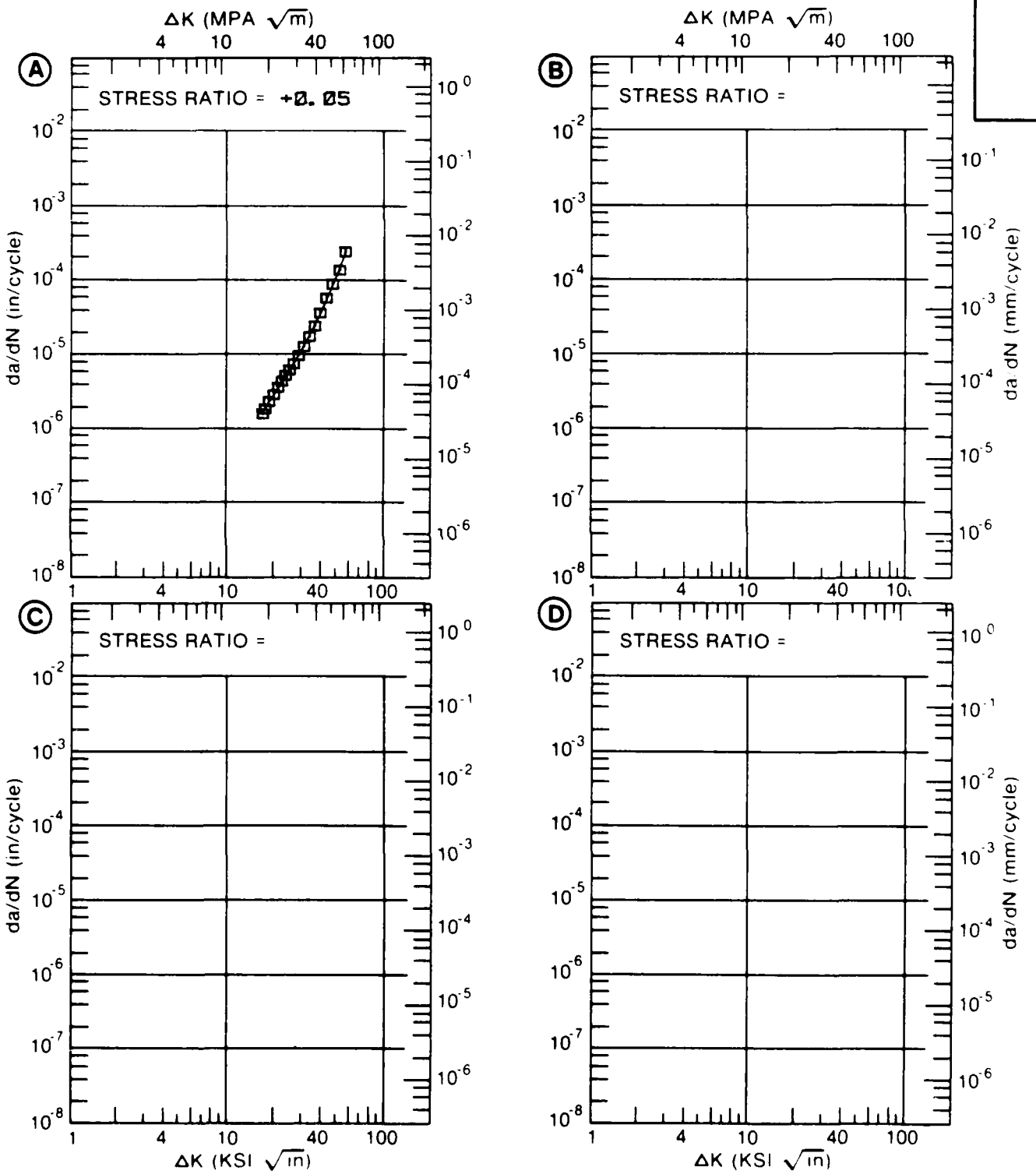



Figure 5.7.3.19

TABLE 5.7.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.20 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
(VIM-VAR)

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR | E=+1200F AIR |
| DELTA K MIN | A: | 13.90 | 1.13 | | | |
| | B: | 13.42 | | 1.37 | | |
| | C: | 12.74 | | | 1.93 | |
| | D: | 16.46 | | | | 20.1 |
| | | 13.00 | | | 2.06 | |
| | | 16.00 | 2.01 | 2.70 | 3.88 | |
| | | 20.00 | 4.34 | 5.66 | 7.07 | 34.6 |
| | | 25.00 | 8.72 | 11.1 | 11.9 | 59.4 |
| | | 30.00 | 16.0 | 19.4 | 17.2 | 83.4 |
| | | 35.00 | 28.9 | 32.3 | 22.5 | |
| | | 40.00 | | 52.9 | | |
| DELTA K MAX | A: | 37.80 | 40.5 | | | |
| | B: | 41.21 | | 59.6 | | |
| | C: | 39.66 | | | 27.2 | |
| | D: | 31.33 | | | | 88.9 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.62 | 3.55 | 7.73 | 2.35 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

1750F 1HR AC. 1325F 8HR FC TO 1150F.
CONDITION/HT: HELD 18HR AC(VIM-VAR)
FORM: 0.63"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 164.9 KSI
ULT. STRENGTH: 208.1 KSI
SPECIMEN THK: 0.300- 0.302"
SPECIMEN WIDTH: 1.152- 1.153"
REFERENCES:HD016

NICKEL BASE

INCONEL 718

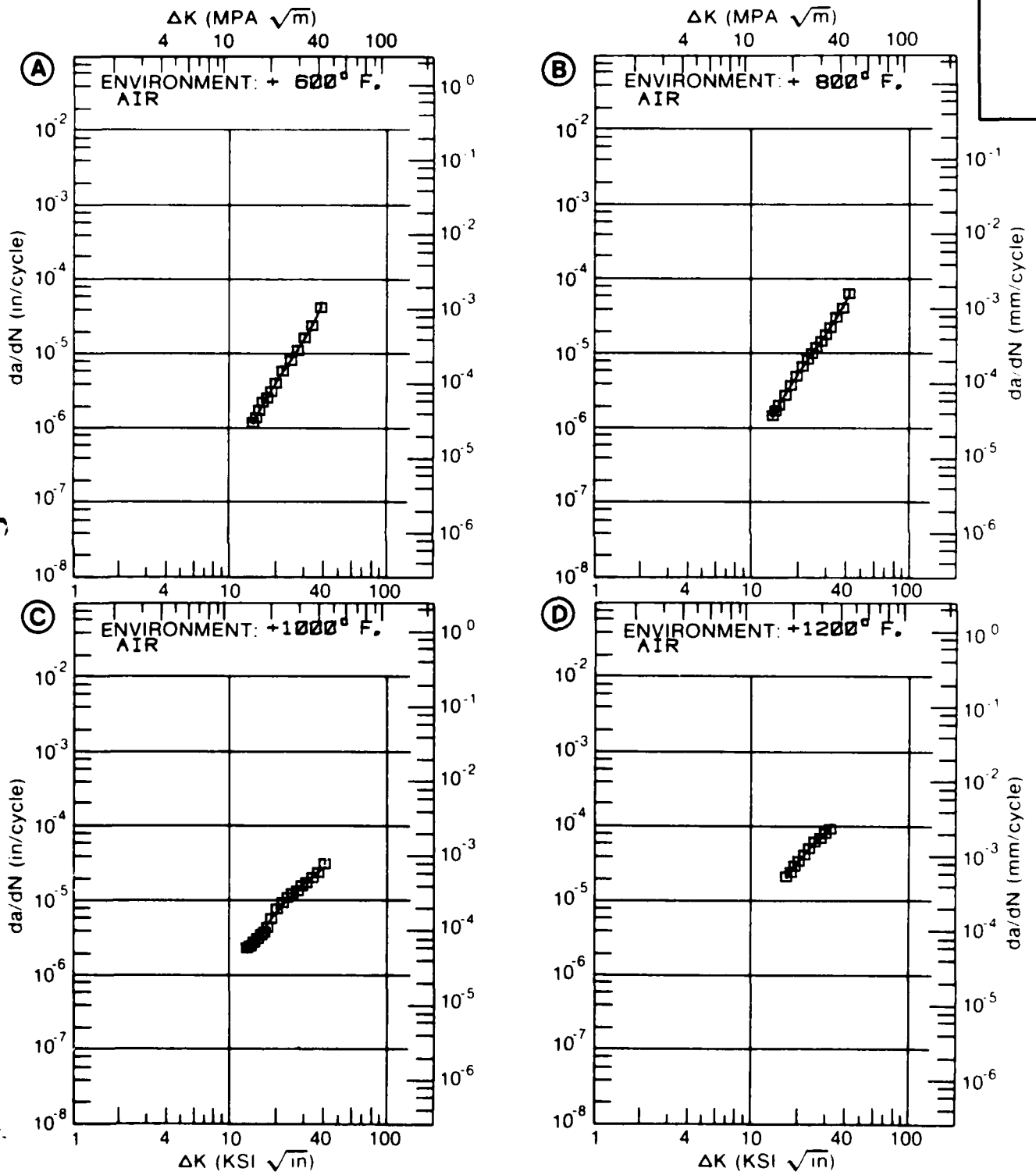



Figure 5.7.3.20

TABLE 5.7.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.21 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.03 | | | |
| DELTA K MIN | A: | 16.37 | 2.25 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 4.80 | | | |
| | | 25.00 | 9.24 | | | |
| | | 30.00 | 14.7 | | | |
| | | 35.00 | 21.9 | | | |
| | | 40.00 | 32.0 | | | |
| DELTA K MAX | A: | 47.47 | 56.9 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 8.74

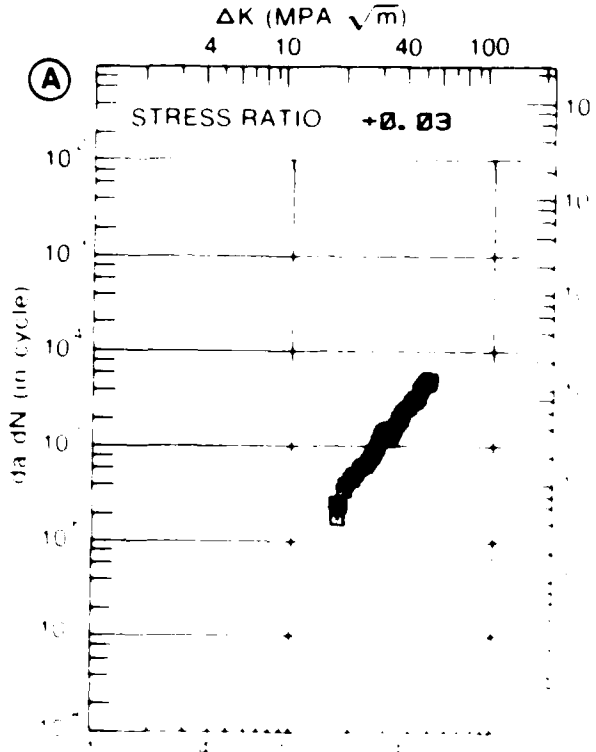
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

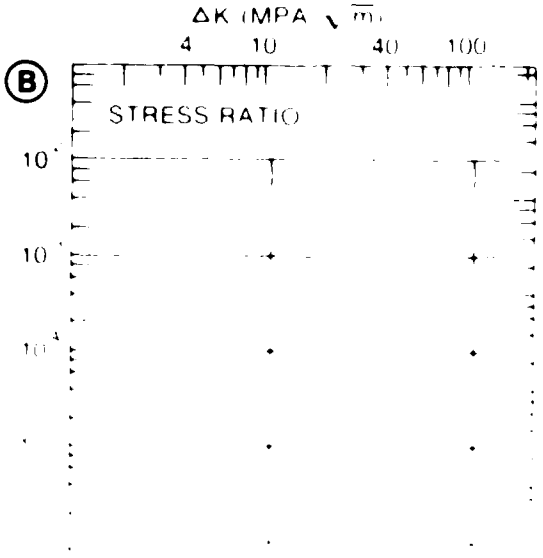
CONDITION HT 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC
FORM 1.19"TH DISK
SPECIMEN TYPE KB BAR
ORIENTATION C-R
FREQUENCY 0.33 HZ
ENVIRONMENT +1000° F, AIR

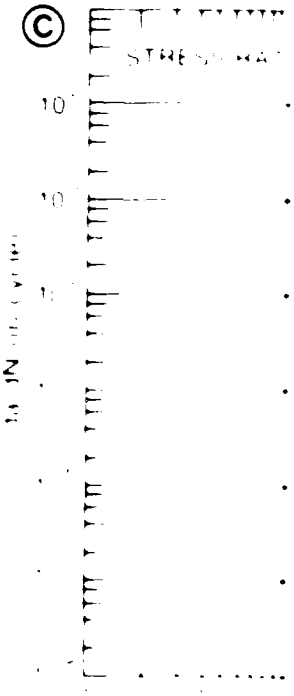
YIELD STRENGTH 150.0 KSI
ULT STRENGTH
SPECIMEN THK 0.250"
SPECIMEN WIDTH 0.900- 0.902"
REFERENCES GE005

NICKEL BASE

INCONEL 718




D

TABLE 5.7.3.22

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.22 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL NICKEL BASE INCONEL 718
CONDITION 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| | | DELTA K (KSI*IN**1/2) | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 300F AIR | E=+ 600F AIR | E=+ 800F AIR | |
| DELTA K MIN | A | 18.27 | .43 | | | |
| | B | 14.38 | | 1.06 | | |
| | C | 14.17 | | | 1.20 | |
| | D | | | | | |
| | | 16.00 | | 1.20 | 1.42 | |
| | | 20.00 | .770 | 2.12 | 2.42 | |
| | | 25.00 | 2.52 | 4.47 | 5.00 | |
| | | 30.00 | 5.44 | 8.76 | 9.86 | |
| | | 35.00 | 9.46 | 15.5 | 17.9 | |
| | | 40.00 | 14.6 | 24.8 | 29.7 | |
| | | 50.00 | | | 64.2 | |
| DELTA K MAX | A | 46.00 | 22.7 | | | |
| | B | 49.55 | | 48.5 | | |
| | C | 50.00 | | | 64.3 | |
| | D | | | | | |
| [illegible] | | | 26.22 | 48.34 | 19.07 | |
| [illegible] | | | | | | |
| [illegible] | | | | | | |
| [illegible] | | | | | | |
| [illegible] | | | | | | |
| [illegible] | | | | | | |

CONDITION/HT: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC
FORM: 1.13- 1.30"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: -0.33
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.251- 0.254"
SPECIMEN WIDTH: 0.903- 0.907"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

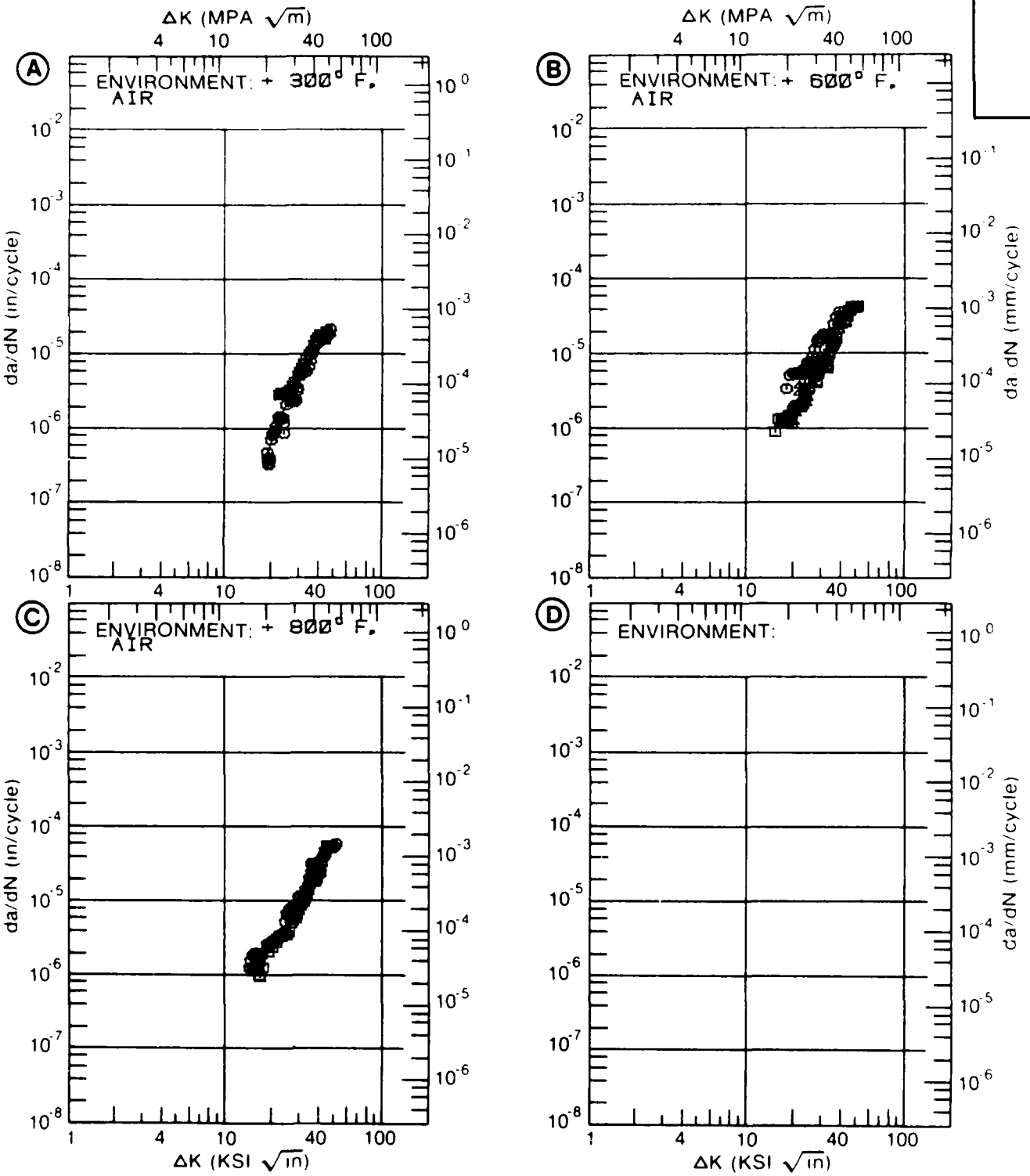



Figure 5.7.3.22

TABLE 5.7.3.23

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.23 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1000F AIR | E=+1200F AIR | | |
| DELTA K MIN | A: | 13.89 | .96 | | | |
| | B: | 17.86 | | 8.13 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 1.68 | | | |
| | | 20.00 | 3.70 | 9.75 | | |
| | | 25.00 | 7.77 | 16.8 | | |
| | | 30.00 | 14.3 | 28.8 | | |
| | | 35.00 | 24.6 | 45.6 | | |
| | | 40.00 | 40.7 | 65.4 | | |
| DELTA K MAX | A: | 48.37 | 89.9 | | | |
| | B: | 48.27 | | 95.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 10.33 | 19.70 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC
FORM: 1.13"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: -0.33
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.252- 0.255"
SPECIMEN WIDTH: 0.905- 0.911"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

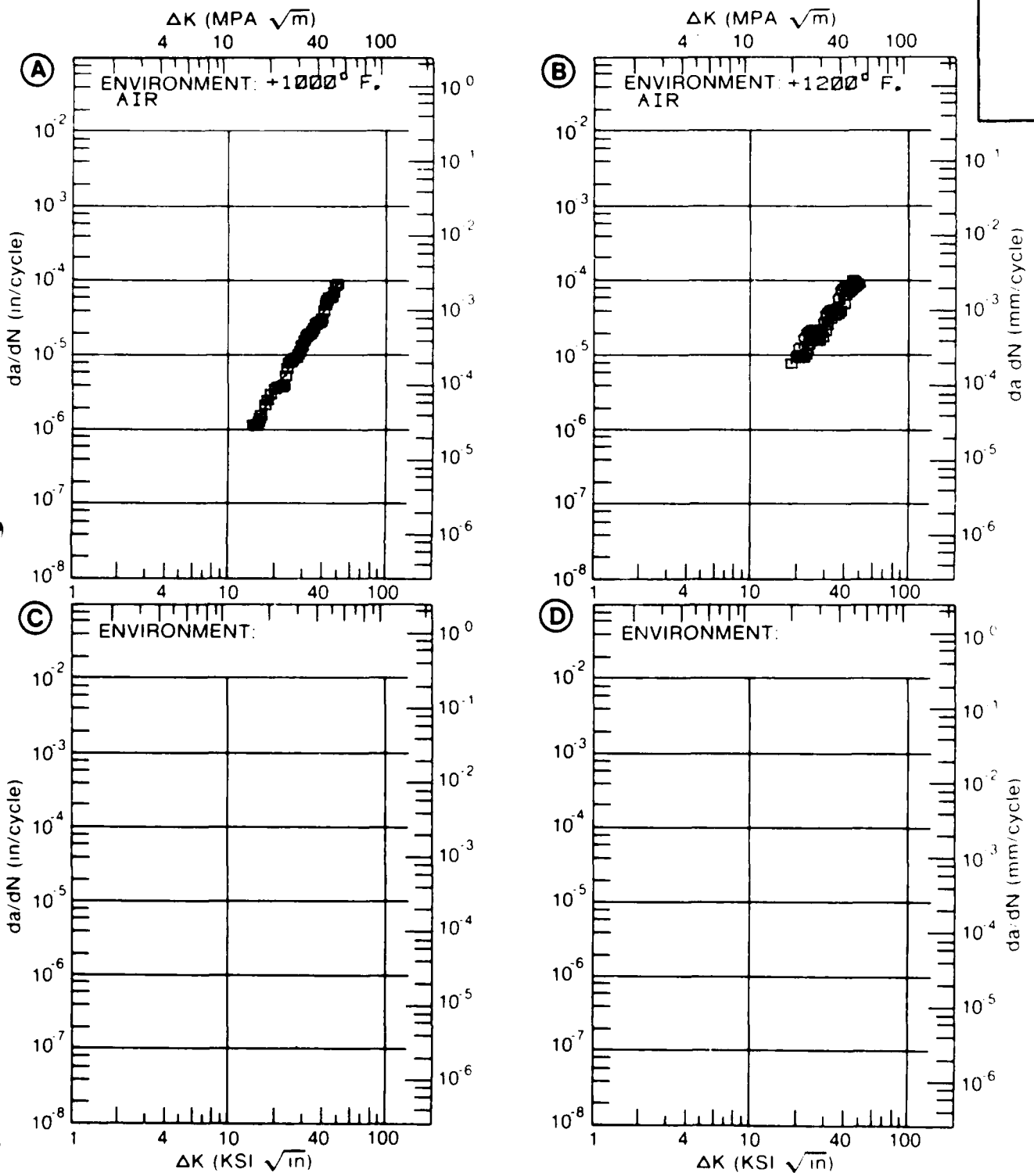



Figure 5.7.3.23

TABLE 5.7.3.24

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.24 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 300F AIR | E=+ 600F AIR | E=+1000F AIR | |
| DELTA K MIN | A: | 15.09 | .485 | | | |
| | B: | 15.82 | | .589 | | |
| | C: | 14.92 | | | 1.28 | |
| | D: | | | | | |
| | | 16.00 | .595 | .626 | 1.70 | |
| | | 20.00 | 1.45 | 1.66 | 3.36 | |
| | | 25.00 | 3.38 | 3.66 | 5.95 | |
| | | 30.00 | 6.13 | 7.64 | 10.8 | |
| | | 35.00 | 11.0 | 13.9 | 19.1 | |
| | | 40.00 | 19.1 | 19.9 | 30.3 | |
| DELTA K MAX | A: | 44.05 | 27.9 | | | |
| | B: | 42.52 | | 21.5 | | |
| | C: | 45.99 | | | 43.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 16.38 | 12.85 | 7.47 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC
FORM: 1.13"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250- 0.252"
SPECIMEN WIDTH: 0.900- 0.906"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

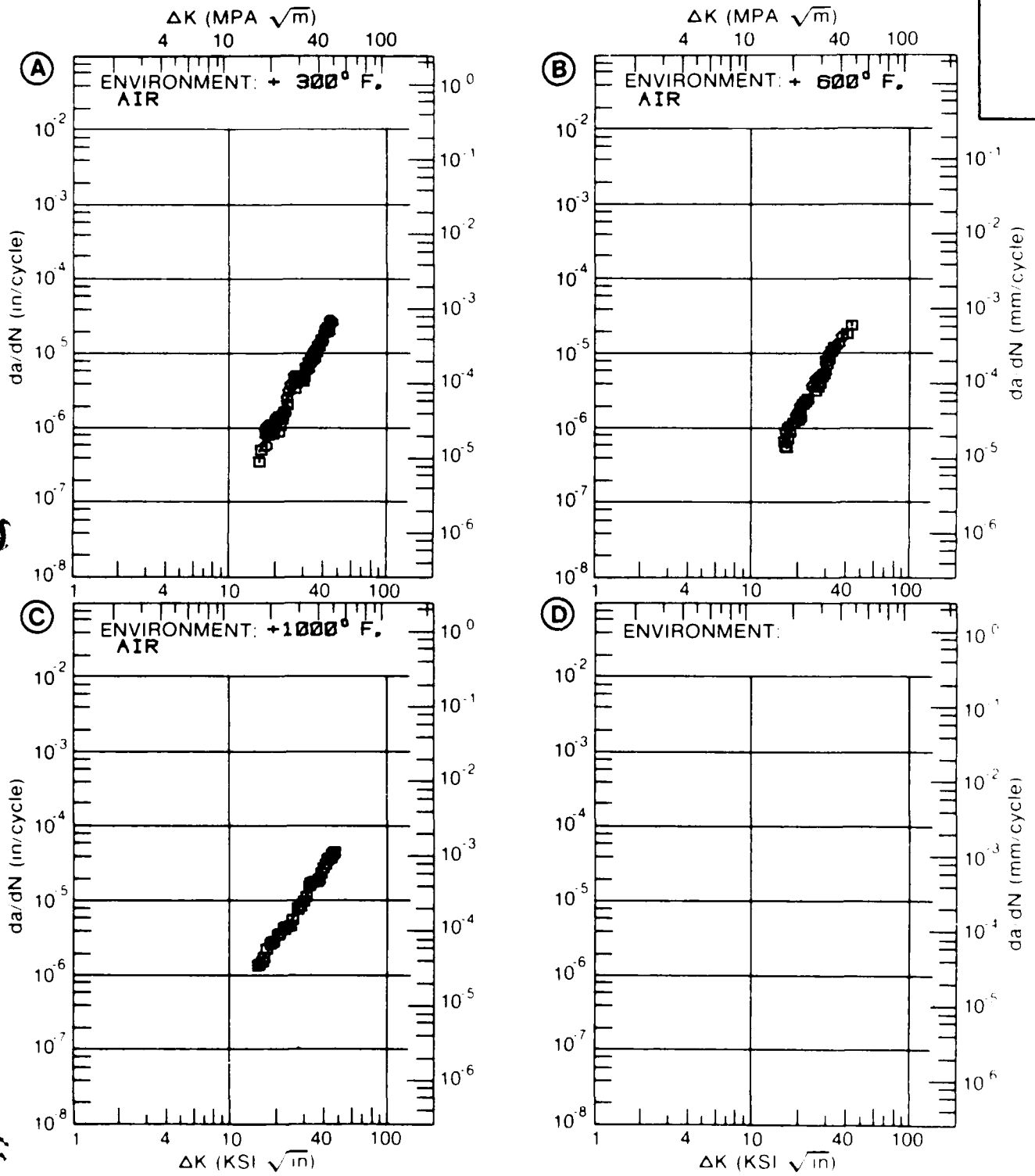



Figure 5.7.3.24

TABLE 5.7.3.25

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.25 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A E=+ 300F AIR | B E=+ 800F AIR | C E=+1000F AIR | D E=+1200F AIR |
|---|---|---|---|---|---|
| DELTA K MIN A: | 19.86 | 1.82 | | | |
| DELTA K MIN B: | 7.10 | | .146 | | |
| DELTA K MIN C: | 14.19 | | | 1.84 | |
| DELTA K MIN D: | 12.99 | | | | 2.42 |
| | 8.00 | | .149 | | |
| | 9.00 | | .221 | | |
| | 10.00 | | .346 | | |
| | 13.00 | | .749 | | 2.44 |
| | 16.00 | | 1.33 | 1.86 | 5.51 |
| | 20.00 | 1.86 | 2.67 | 2.59 | 9.92 |
| | 25.00 | 3.98 | 5.99 | 6.06 | 23.4 |
| | 30.00 | 7.94 | 12.4 | 14.5 | 42.7 |
| | 35.00 | 14.3 | 23.0 | 20.9 | 64.3 |
| | 40.00 | 23.4 | 38.5 | 27.6 | 86.3 |
| DELTA K MAX A: | 47.23 | 40.8 | | | |
| DELTA K MAX B: | 40.11 | | 38.9 | | |
| DELTA K MAX C: | 49.01 | | | 65.2 | |
| DELTA K MAX D: | 46.60 | | | | 114. |
| ROOT MEAN SQUARE PERCENT ERROR | | 6.12 | 15.70 | 21.44 | 21.88 |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC
FORM: 1.13- 1.30"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.03
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250- 0.254"
SPECIMEN WIDTH: 0.902- 0.910"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

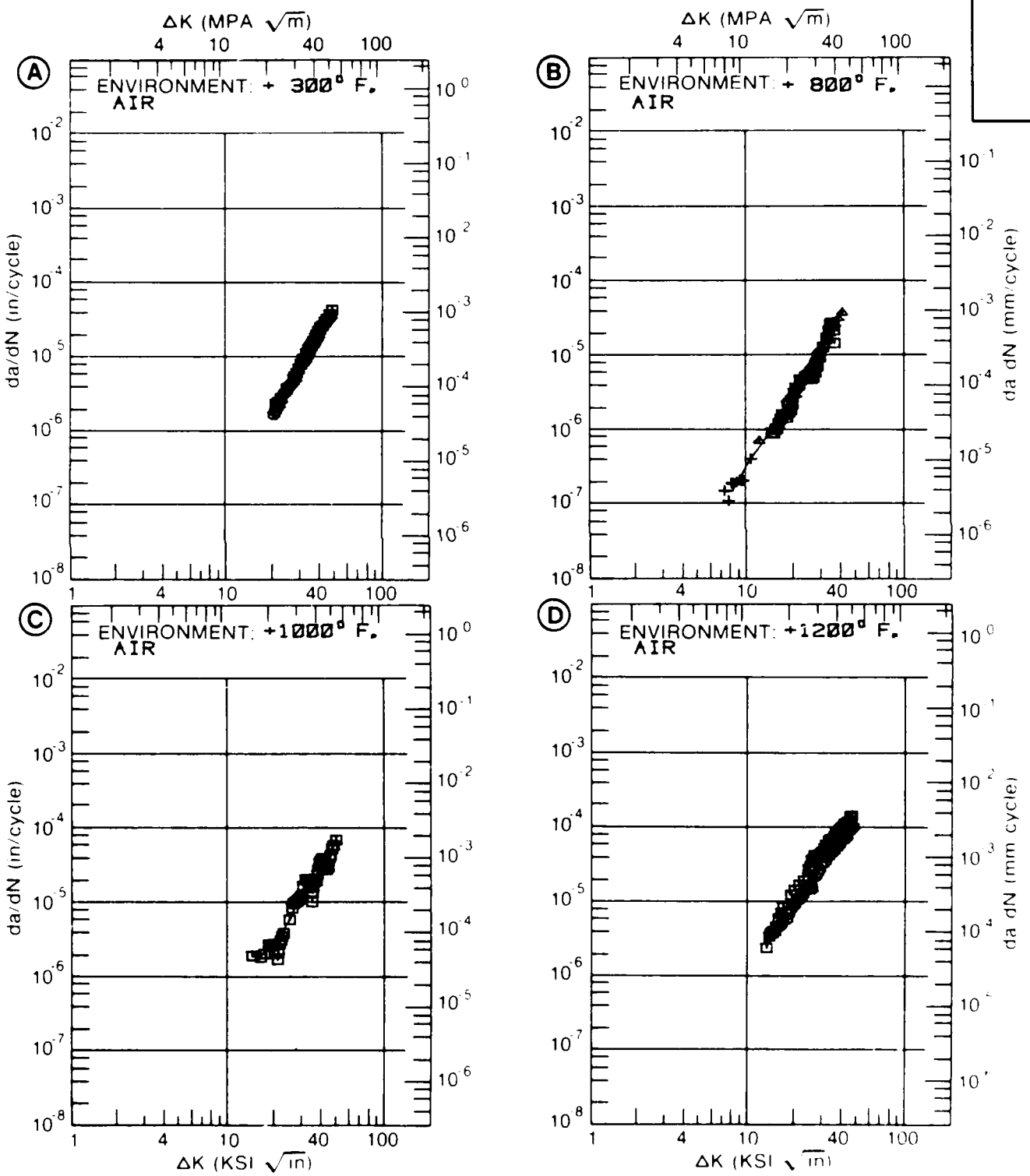



Figure 5.7.3.25

TABLE 5.7.2.26

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.26 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E=+ 300F AIR | E=+ 600F AIR | E=+ 800F AIR | E=+1000F AIR |
| DELTA K MIN | A: | 13.99 | .523 | | | |
| | B: | 17.33 | | 1.33 | | |
| | C: | 15.78 | | | 1.36 | |
| | D: | 12.17 | | | | 2.60 |
| | | 13.00 | | | | 1.81 |
| | | 16.00 | .395 | | 1.41 | 2.69 |
| | | 20.00 | 1.09 | 2.71 | 2.91 | 6.62 |
| | | 25.00 | 2.30 | 6.74 | 6.95 | 12.5 |
| | | 30.00 | 6.19 | 13.8 | 14.4 | 23.0 |
| | | 35.00 | 11.8 | 24.5 | | 54.6 |
| DELTA K MAX | A: | 35.84 | 12.0 | | | |
| | B: | 38.01 | | 31.5 | | |
| | C: | 33.30 | | | 21.3 | |
| | D: | 35.35 | | | | 59.0 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.76 | 16.02 | 15.70 | 20.84 |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC
FORM: 1.13- 1.30"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.25
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250- 0.253"
SPECIMEN WIDTH: 0.900- 0.909"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

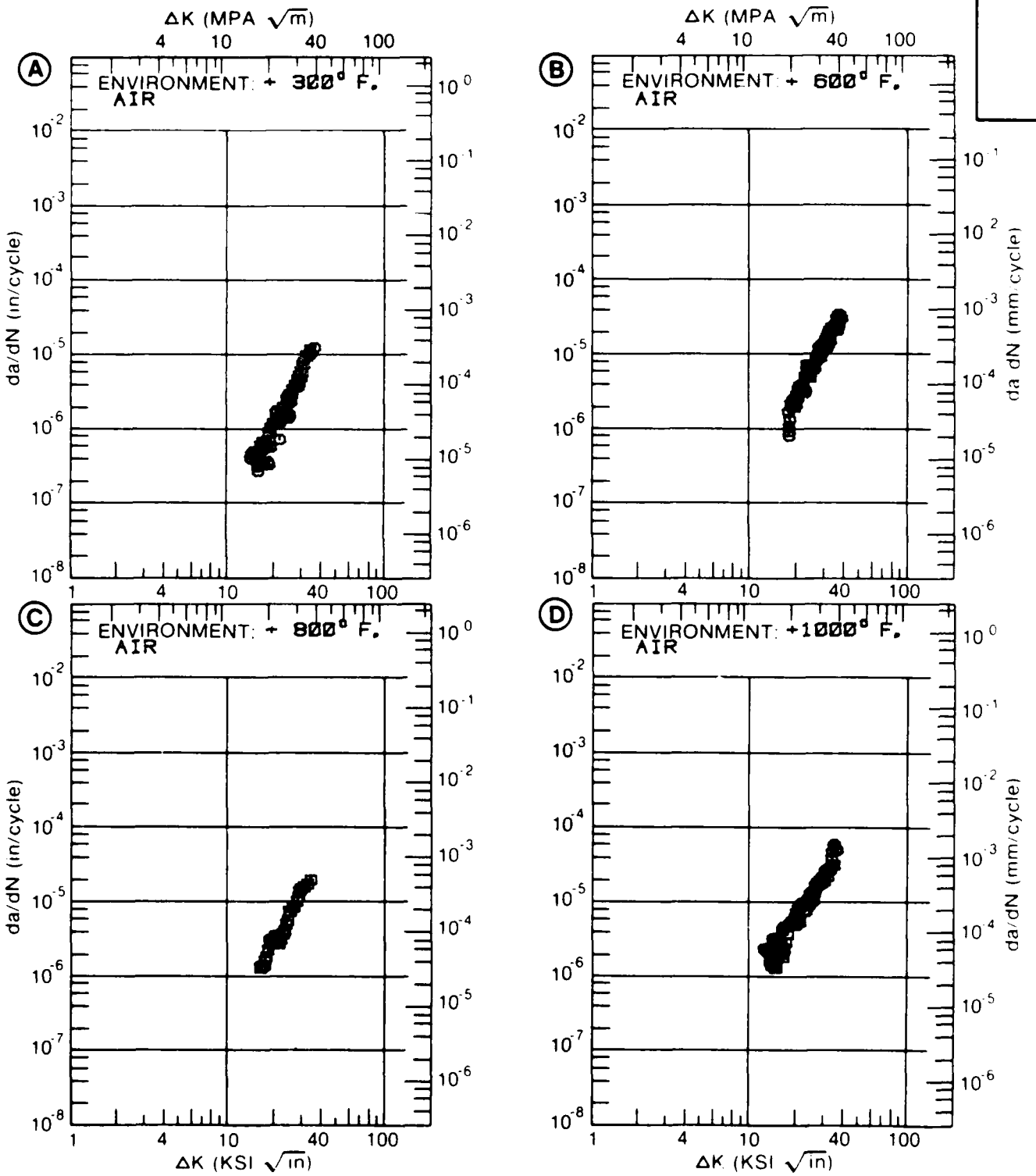



Figure 5.7.3.26

TABLE 5.7.3.27

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.27 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E=+ 300F AIR | E=+ 600F AIR | E=+ 800F AIR | |
| DELTA K MIN | A: | 12.37 | .849 | | | |
| | B: | 12.93 | | 1.09 | | |
| | C: | 11.11 | | | .647 | |
| | D: | | | | | |
| | | 13.00 | .518 | 1.07 | 1.12 | |
| | | 16.00 | 1.08 | 1.95 | 3.31 | |
| | | 20.00 | 3.25 | 3.74 | 5.86 | |
| DELTA K MAX | A: | 23.59 | 6.18 | | | |
| | B: | 23.39 | | 10.2 | | |
| | C: | 21.92 | | | 8.80 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 38.69 | 24.20 | 32.95 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC
FORM: 1.13- 1.30"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.54
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250- 0.255"
SPECIMEN WIDTH: 0.902- 0.922"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

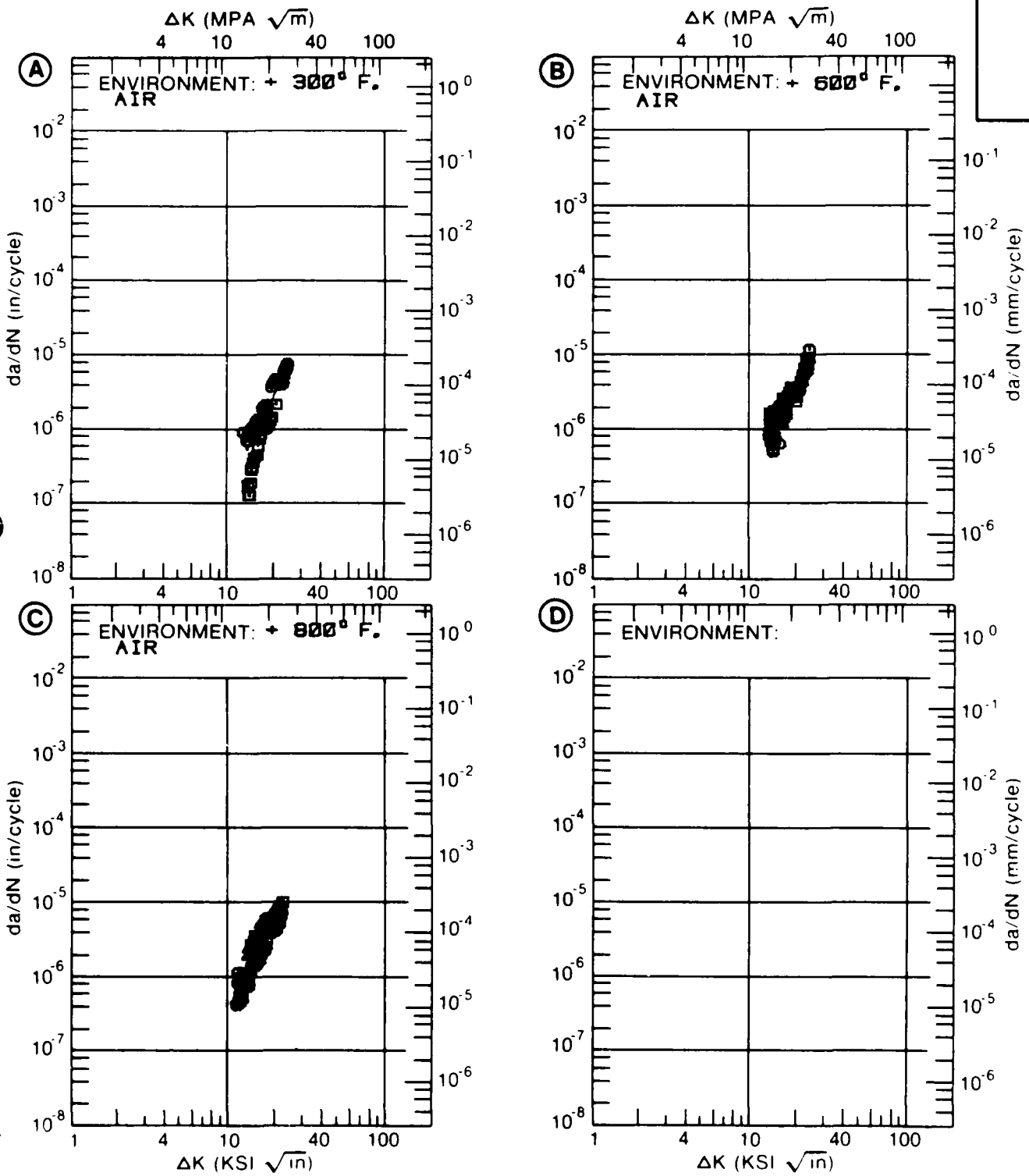



Figure 5.7.3.27

TABLE 5.7.3.28

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.28 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1000F AIR | E=+1200F AIR | | |
| DELTA K MIN | A: | 9.26 | .412 | | | |
| | B: | 8.80 | | .348 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | | .287 | | |
| | | 10.00 | .857 | 2.12 | | |
| | | 13.00 | 2.19 | 5.73 | | |
| | | 16.00 | 4.03 | 8.45 | | |
| | | 20.00 | 8.45 | 16.0 | | |
| DELTA K MAX | A: | 22.64 | 14.3 | | | |
| | B: | 22.63 | | 22.0 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 18.59 | 24.72 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

1750F 1HR Q. 1325F 8HR
CONDITION HT 100F/HR HOLD 8HR. AC
FORM 1.13"TH DISK
SPECIMEN TYPE KB BAR
ORIENTATION C-R
STRESS RATIO +0.54
FREQUENCY 0.33 HZ

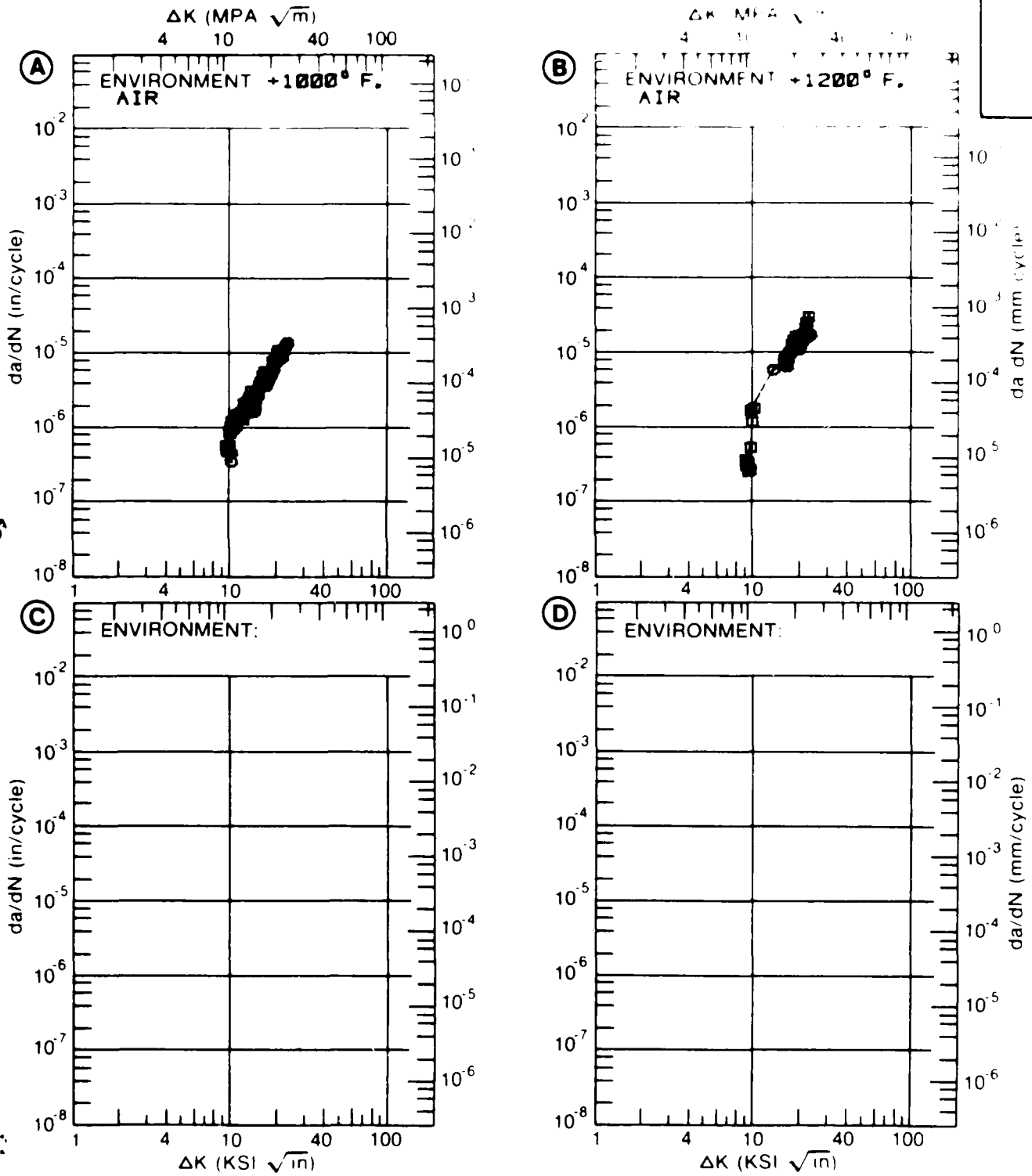



Figure 5.7.3.28

TABLE 5.7.3.29

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.29 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F
8HRS, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR, .33HZ | E=+1200F AIR, .33HZ | E=+1200F AIR, .02HZ | E=+1200F AIR, 5MIN HOLD |
| DELTA K MIN | A: | 12.93 | .0371 | | | |
| | B: | 13.68 | | .172 | | |
| | C: | 19.60 | | | 7.05 | |
| | D: | 19.03 | | | | .615 |
| | | 13.00 | .0525 | | | |
| | | 16.00 | 1.02 | .692 | | |
| | | 20.00 | 2.86 | 3.20 | 8.02 | 1.30 |
| | | 25.00 | 6.85 | 9.59 | 27.7 | 18.0 |
| | | 30.00 | 14.7 | 18.4 | 61.0 | 87.8 |
| | | 35.00 | 32.3 | 28.3 | 106. | 300. |
| | | 40.00 | | 38.5 | 160. | 953. |
| | | 50.00 | | 60.7 | 294. | |
| | | 60.00 | | 88.9 | 472. | |
| | | 70.00 | | 130. | 719. | |
| DELTA K MAX | A: | 39.18 | 324. | | | |
| | B: | 71.33 | | 136. | | |
| | C: | 77.64 | | | 978. | |
| | D: | 41.00 | | | | 1205. |
| ROOT MEAN SQUARE PERCENT ERROR | | | 19.82 | 18.82 | 20.92 | 29.11 |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1780F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC
FORM: 3.80"TH DISK
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY:

YIELD STRENGTH: 171.8 KSI
ULT. STRENGTH: 201.7 KSI
SPECIMEN THK: 0.080"
SPECIMEN WIDTH: 2.000"
REFERENCES: GE008

NICKEL BASE

INCONEL 718

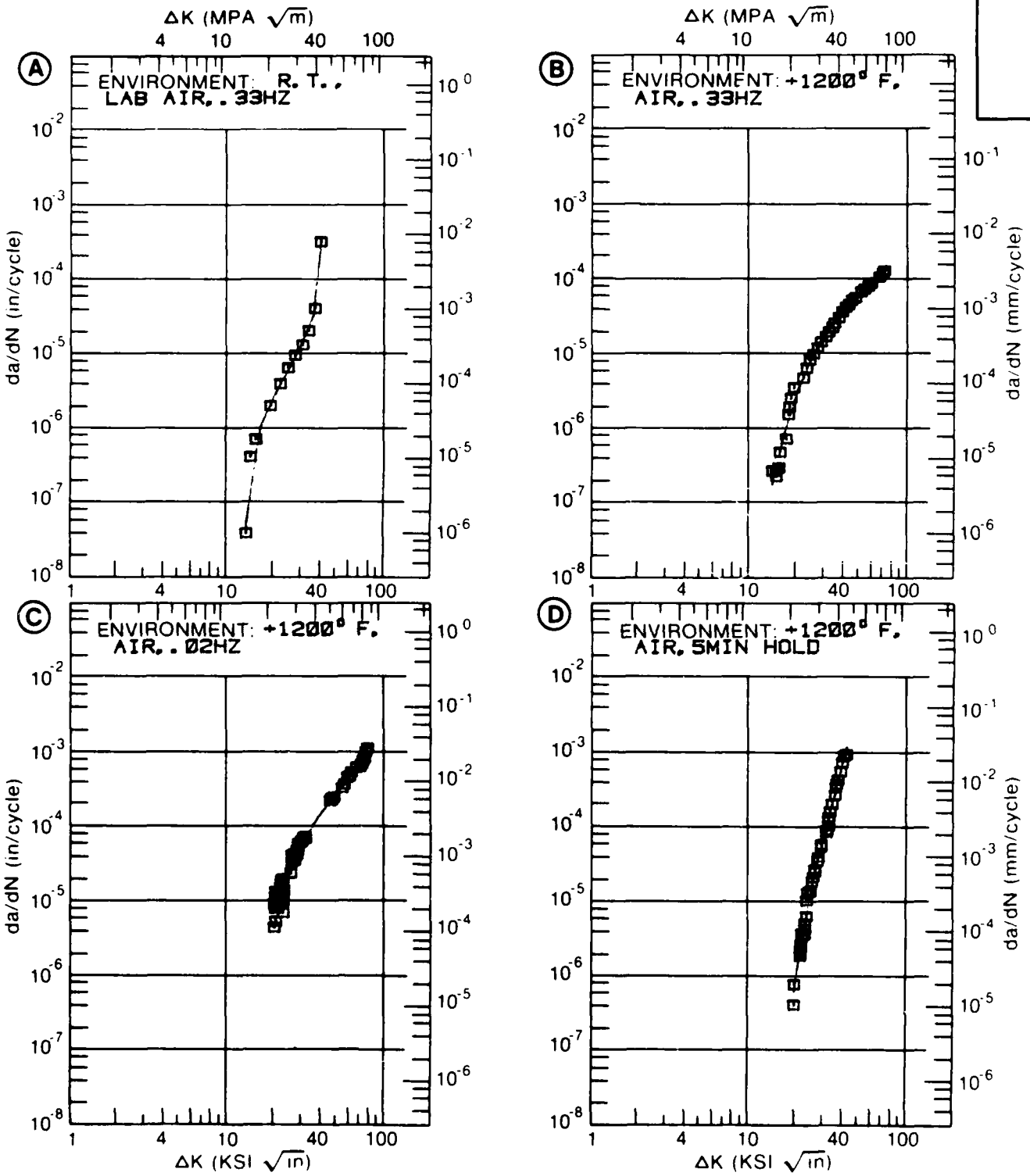



Figure 5.7.3.29

TABLE 5.7.3.80

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.80 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL. NICKEL BASE INCONEL 718
CONDITION: 1760F 1HR WQ, 1325F 8HRS FC TO 1150F 8HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F AIR | | | |
| DELTA K MIN | A: | 13.48 | .203 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 2.44 | | | |
| | | 20.00 | 11.7 | | | |
| | | 25.00 | 24.2 | | | |
| | | 30.00 | 37.5 | | | |
| | | 35.00 | 51.6 | | | |
| | | 40.00 | 67.3 | | | |
| | | 50.00 | 110. | | | |
| DELTA K MAX | A: | 58.25 | 167. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 17.54

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | 2.0 |

CONDITION/HT: 1760F 1HR WQ, 1325F 8HRS FC TO 1150F 8HRS AC
FORM: 3.60"TH DISK
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY: 0.33 HZ
YIELD STRENGTH: 171.6 KSI
ULT. STRENGTH: 201.7 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 0.600"
REFERENCES: GE008

NICKEL BASE

INCONEL 718

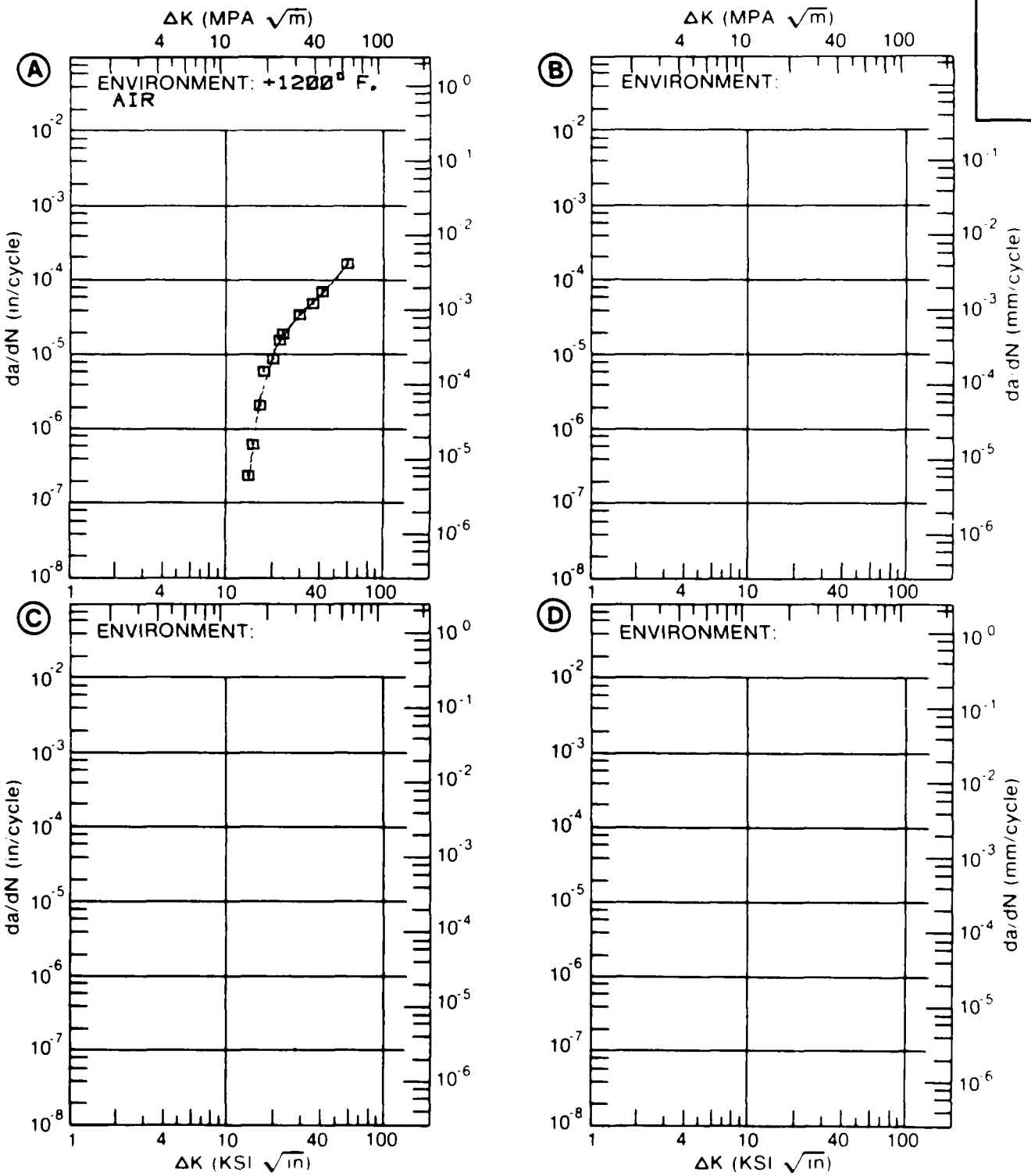



Figure 5.7.3.30

TABLE 5.7.3.31

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.31 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1800F 1HR Q, 1325F 8HRS FC TO 1150F HOLD 8HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E-+1200F AIR | | | |
| DELTA K MIN | A: | 14.80 | 1.41 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 2.35 | | | |
| | | 20.00 | 5.60 | | | |
| | | 25.00 | 11.9 | | | |
| | | 30.00 | 23.7 | | | |
| | | 35.00 | 42.7 | | | |
| | | 40.00 | 66.5 | | | |
| | | 50.00 | 106. | | | |
| DELTA K MAX | A: | 55.00 | 112. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 18.01

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1800F 1HR Q. 1325F 8HRS FC TO 1150F HOLD 8HRS AC
FORM: 4.67"TH FORGING
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 169.2 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250"
SPECIMEN WIDTH 0.600"
REFERENCES: GE001

NICKEL BASE

INCONEL 718

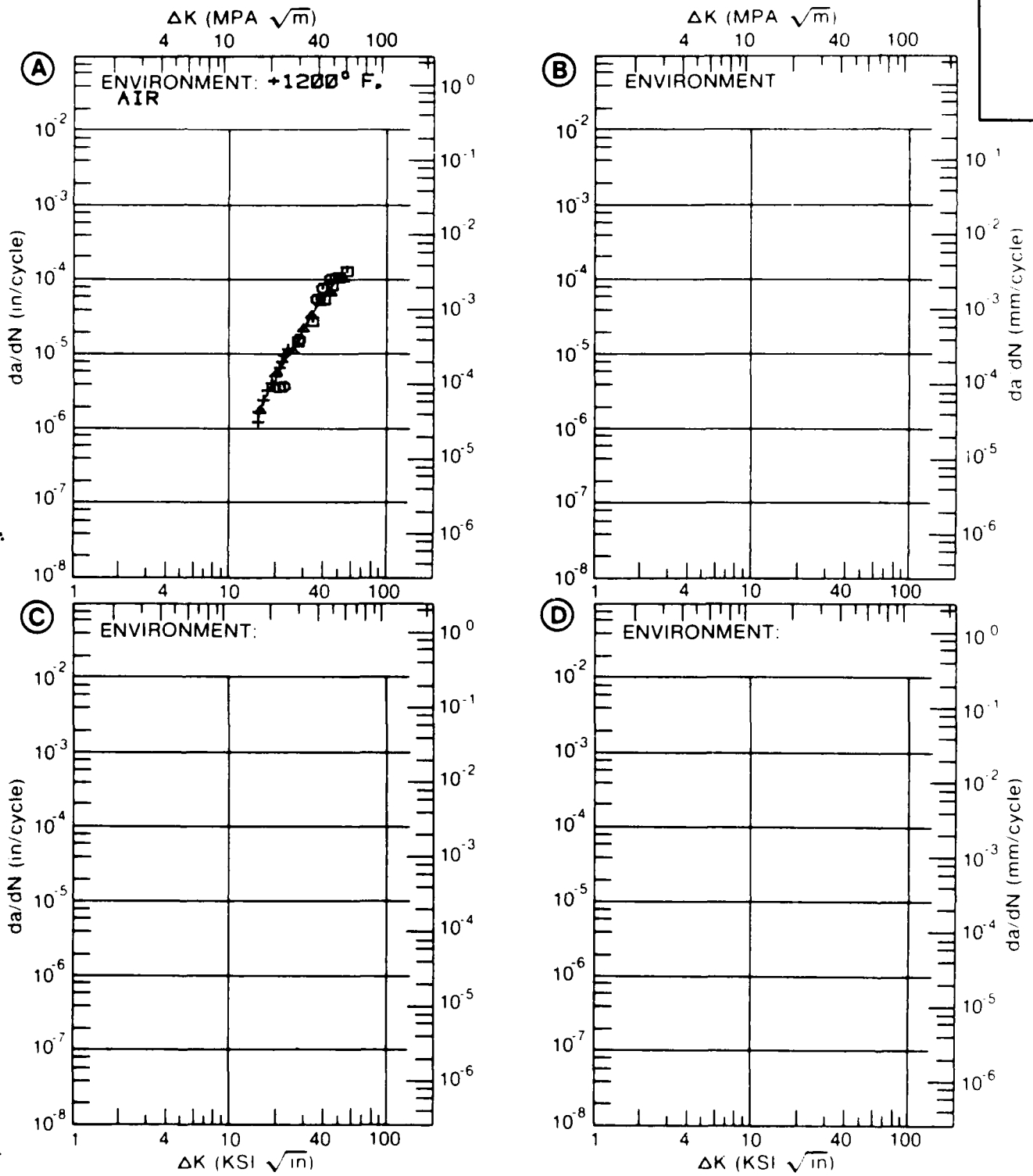



Figure 5.7.3.31

TABLE 5.7.3.32

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.32 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: ST 1850F, 1360F 9HRS, F/C 1175F

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A., 6HZ | E=+ 400F L.H.A., 6HZ | E= R.T. S.T.W., 1HZ | |
| DELTA K MIN | A: | 27.73 | .357 | | | |
| | B: | 25.53 | | .175 | | |
| | C: | 26.20 | | | .345 | |
| | D: | | | | | |
| | | 30.00 | .840 | .963 | .933 | |
| | | 35.00 | 2.09 | 2.41 | 2.57 | |
| | | 40.00 | 3.73 | 4.82 | 4.12 | |
| | | 50.00 | 9.99 | 13.3 | 11.4 | |
| | | 60.00 | 21.2 | 28.5 | 23.2 | |
| DELTA K MAX | A: | 69.11 | 34.8 | | | |
| | B: | 68.07 | | 48.0 | | |
| | C: | 62.69 | | | 27.2 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.46 | 6.32 | 9.48 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: ST 1850F, 1360F 9HRS, F/C 1175F
FORM: 4.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 160.0 KSI
ULT. STRENGTH: 192.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 5.900- 6.000"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

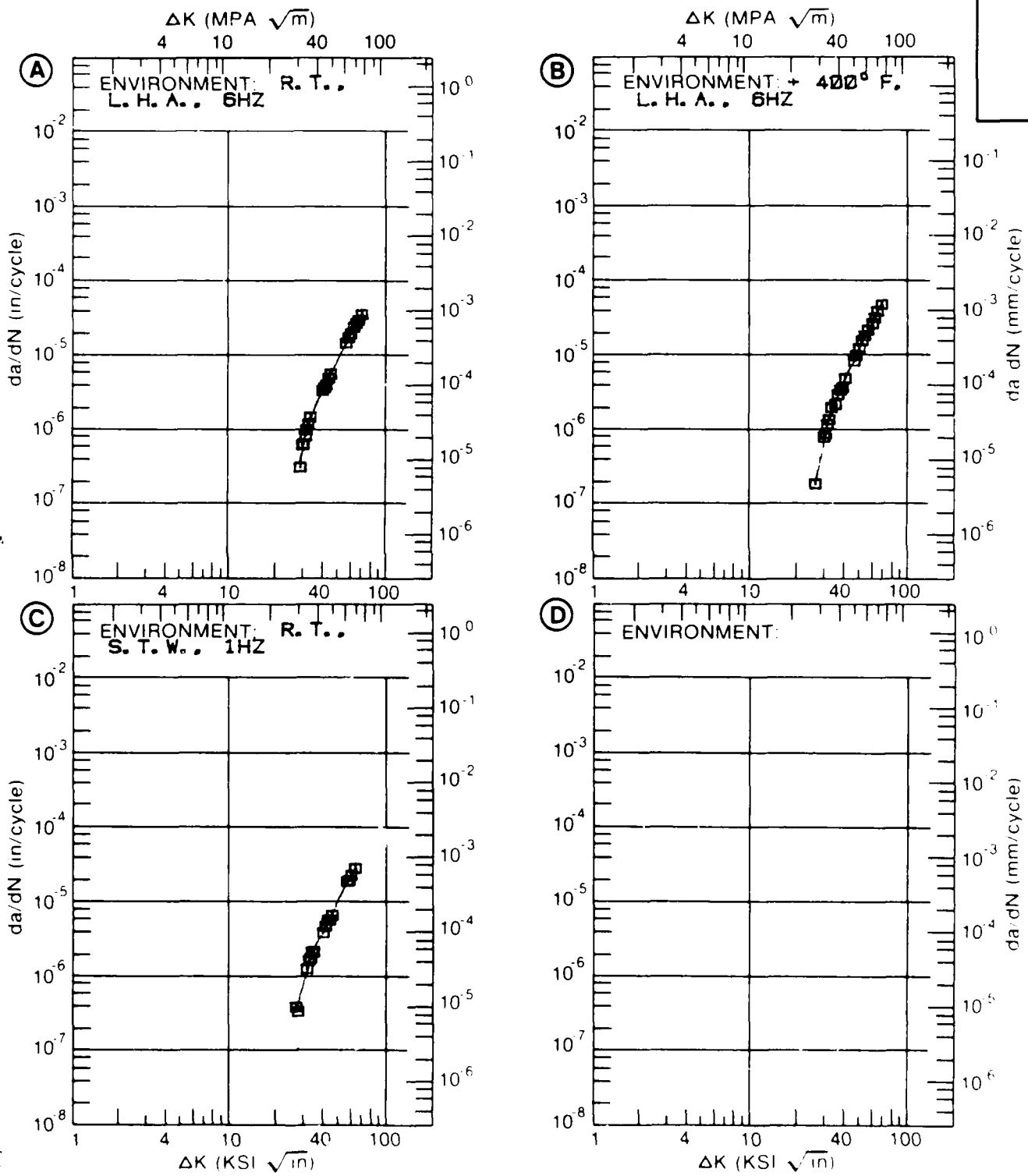



Figure 5.7.3.32

TABLE 5.7.3.33

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.33 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: ST 1850F, 1360F 9HRS F/C 1175F

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. | E=+ 400F L.H.A. | | |
| DELTA K MIN | A: | 19.84 | .710 | | | |
| | B: | 17.85 | | .738 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | .773 | 1.66 | | |
| | | 25.00 | 3.38 | 5.47 | | |
| | | 30.00 | 6.69 | 12.1 | | |
| | | 35.00 | 10.8 | 20.2 | | |
| | | 40.00 | 16.0 | 27.7 | | |
| | | 50.00 | 30.2 | | | |
| DELTA K MAX | A: | 59.27 | 47.0 | | | |
| | B: | 49.30 | | 49.8 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 3.11 | 6.49 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | A | B |
|---|---|---|---|
| | 0.0-0.5 | | |
| | 0.5-0.8 | | 1 |
| | 0.8-1.25 | 1 | |
| | 1.25-2.0 | | |
| | >2.0 | | |

CONDITION/HT: ST 1850F, 1360F 9HRS F/C 1175F
FORM: 4.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
FREQUENCY: 6.00 HZ

YIELD STRENGTH: 160.0 KSI
ULT. STRENGTH: 192.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 5.990- 6.000"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

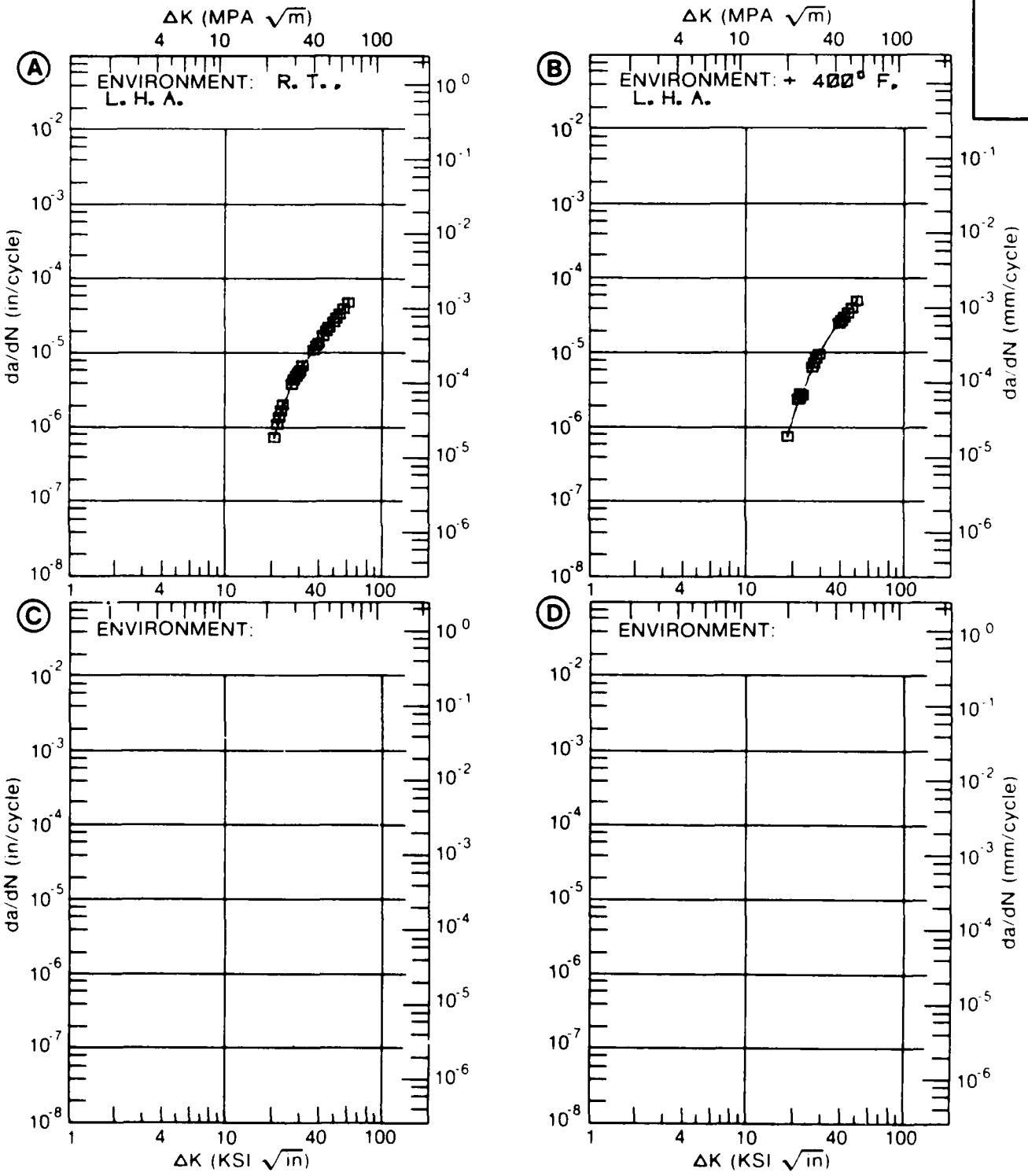



Figure 5.7.3.33

TABLE 5.7.3.34

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.34 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: ST 1850F, 1360F 9HRS, F/C 1175F

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A., 6HZ | E= R.T. S.T.W., 1HZ | E= R.T. S.C.S., 1HZ | |
| DELTA K MIN | A: | 26.21 | .346 | | | |
| | B: | 28.93 | | .394 | | |
| | C: | 31.51 | | | 1.18 | |
| | D: | | | | | |
| | | 30.00 | 1.12 | .631 | | |
| | | 35.00 | 3.13 | 1.93 | 2.18 | |
| | | 40.00 | 6.30 | 2.82 | 3.92 | |
| | | 50.00 | 16.1 | 8.61 | 11.0 | |
| | | 60.00 | 32.9 | 27.8 | 25.8 | |
| | | 70.00 | | 40.5 | 50.3 | |
| | | 80.00 | | 208. | 87.1 | |
| | | 90.00 | | | 154. | |
| DELTA K MAX | A: | 67.39 | 54.8 | | | |
| | B: | 81.34 | | 306. | | |
| | C: | 95.99 | | | 225. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 13.44 | 16.84 | 8.36 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | 1 | | | |
| | | 0.8-1.25 | | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: ST 1850F. 1360F 9HRS. F/C 1175F
FORM: 4.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 160.0 KSI
ULT. STRENGTH: 192.0 KSI
SPECIMEN THK: 0.500- 0.510"
SPECIMEN WIDTH: 7.390- 7.400"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

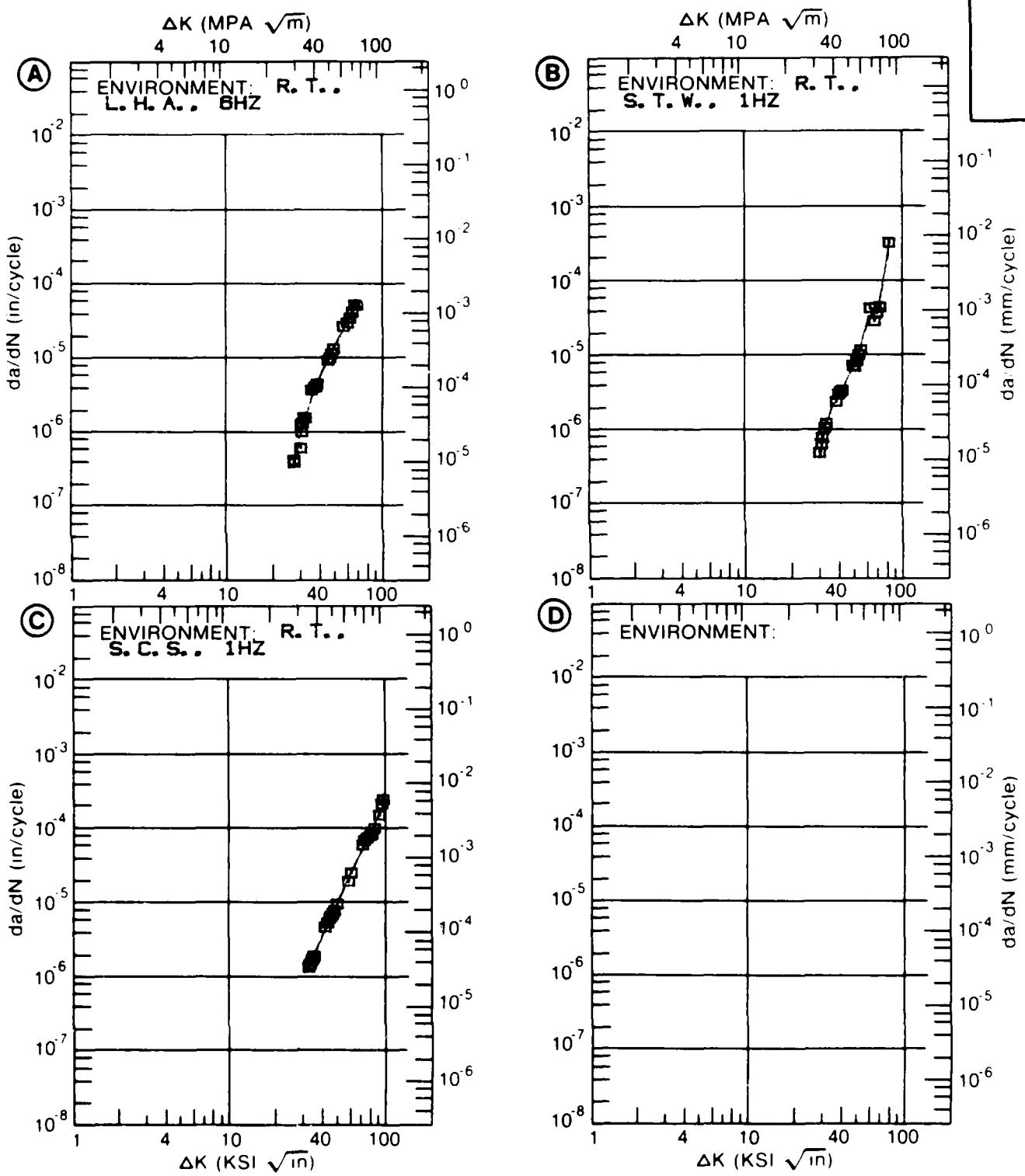



Figure 5.7.3.34

TABLE 5.7.3.35

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.35 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: ST 1850F, 1360F 9HRS, F/C 1175F

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. | E=+ 400F L.H.A. | E= R.T. S.T.W. | |
| DELTA K MIN | A: | 28.21 | 2.84 | | | |
| | B: | 20.07 | | .335 | | |
| | C: | 20.92 | | | .253 | |
| | D: | | | | | |
| | | 25.00 | | 1.23 | 1.02 | |
| | | 30.00 | 3.57 | 2.86 | 2.63 | |
| | | 35.00 | 6.84 | 5.47 | 4.07 | |
| | | 40.00 | 11.4 | 9.81 | 7.38 | |
| | | 50.00 | 27.0 | 29.8 | | |
| | | 60.00 | 78.8 | 74.0 | | |
| | | 70.00 | 277 | | | |
| | | 80.00 | 564. | | | |
| DELTA K MAX | A: | 84.76 | 550. | | | |
| | B: | 61.11 | | 80.0 | | |
| | C: | 43.46 | | | 13.5 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 8.98 | 13.52 | 13.99 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | 1 | | | |
| | | 0.8-1.25 | | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: ST 1850F, 1360F 9HRS, F/C 1175F
FORM: 4.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: S-L
STRESS RATIO: +0.08
FREQUENCY: 1.00- 6.00 HZ

YIELD STRENGTH: 160.0 KSI
ULT. STRENGTH: 192.0 KSI
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 3.770"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

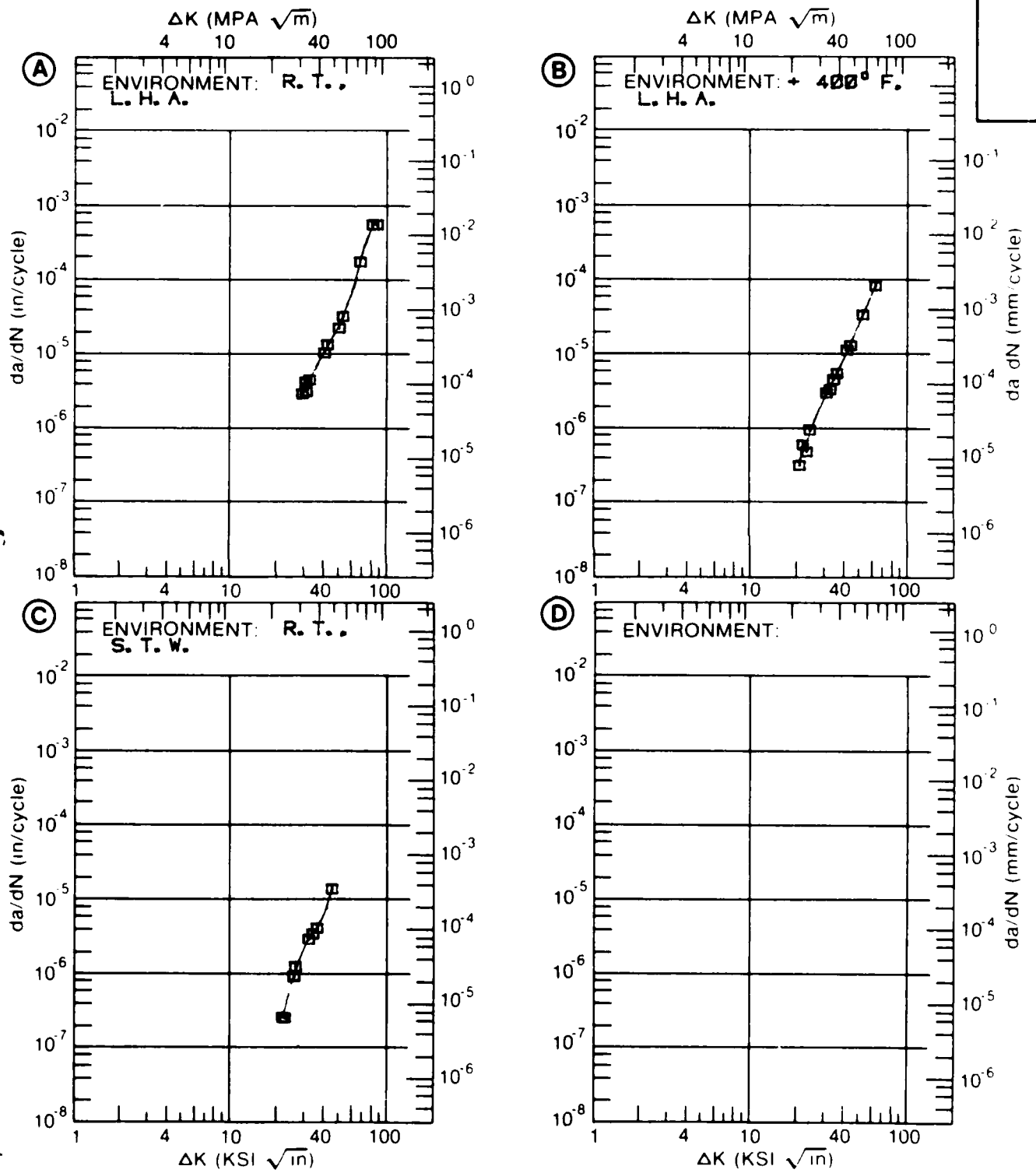



Figure 5.7.3.35

TABLE 5.7.3.36

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.36 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1950F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR, 8.33HZ | E=+ 600F AIR, .67HZ | | |
| DELTA K MIN | A: | 19.66 | 1.02 | | | |
| | B: | 20.46 | | 1.94 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 1.05 | | | |
| | | 25.00 | 1.97 | 3.92 | | |
| | | 30.00 | 3.95 | 7.70 | | |
| | | 35.00 | 7.36 | 13.5 | | |
| | | 40.00 | | 21.1 | | |
| DELTA K MAX | A: | 38.40 | 10.5 | | | |
| | B: | 47.52 | | 34.6 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.50 | 4.32 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1950F AC. 1325F 8HRS. FC TO 1150F. HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 161.1 KSI
ULT. STRENGTH: 198.2 KSI
SPECIMEN THK: 0.490- 0.491"
SPECIMEN WIDTH: 1.992- 1.997"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

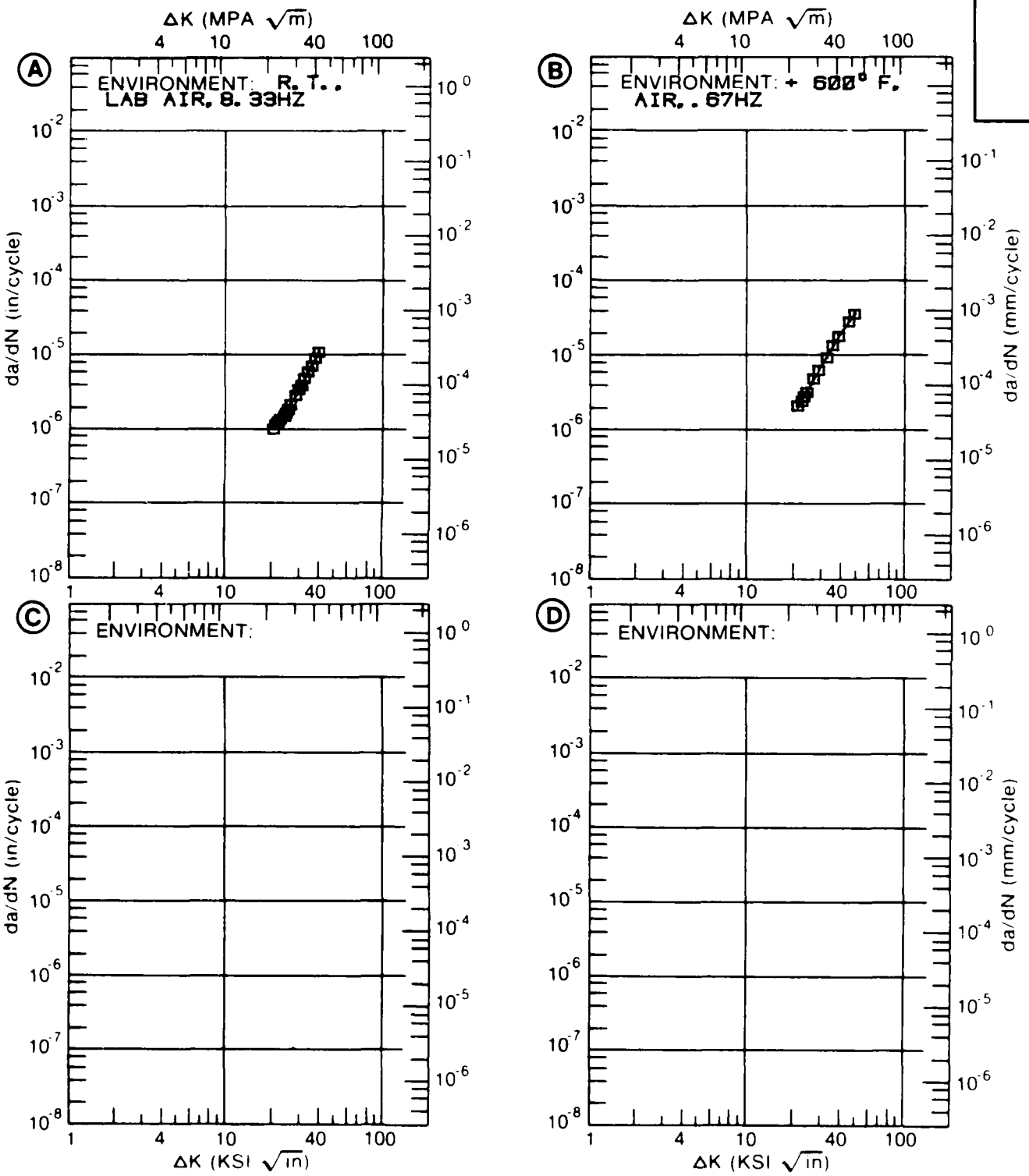



Figure 5.7.3.36

TABLE 5.7.3.37

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.37 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE INCONEL 718
CONDITION: 1950F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN /CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0 05 | | | |
| DELTA K MIN | A: | 21 00 | 4 93 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 25 00 | 7 94 | | | |
| | | 30 00 | [illegible] | | | |
| | | 35 00 | [illegible] | | | |
| | | 40 00 | [illegible] | | | |
| DELTA K MAX | A | 46 50 | [illegible] | | | |
| | B | | | | | |
| | C | | | | | |
| | D | | | | | |

| ROOT MEAN SQUARE PERCENT ERROR | |
|---|---|
| LIFE | 0 0 |
| PREDICTION | 0 5 |
| RATIO | 0 [illegible] |
| SUMMARY | 1 [illegible] |
| (NP/NA) | |

CONDITION/HT: 1950F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 0.67 HZ
ENVIRONMENT: +1000° F, AIR

YIELD STRENGTH: 161.1 KSI
ULT. STRENGTH: 198.2 KSI
SPECIMEN THK: 0.490"
SPECIMEN WIDTH: 1.996- 1.998"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

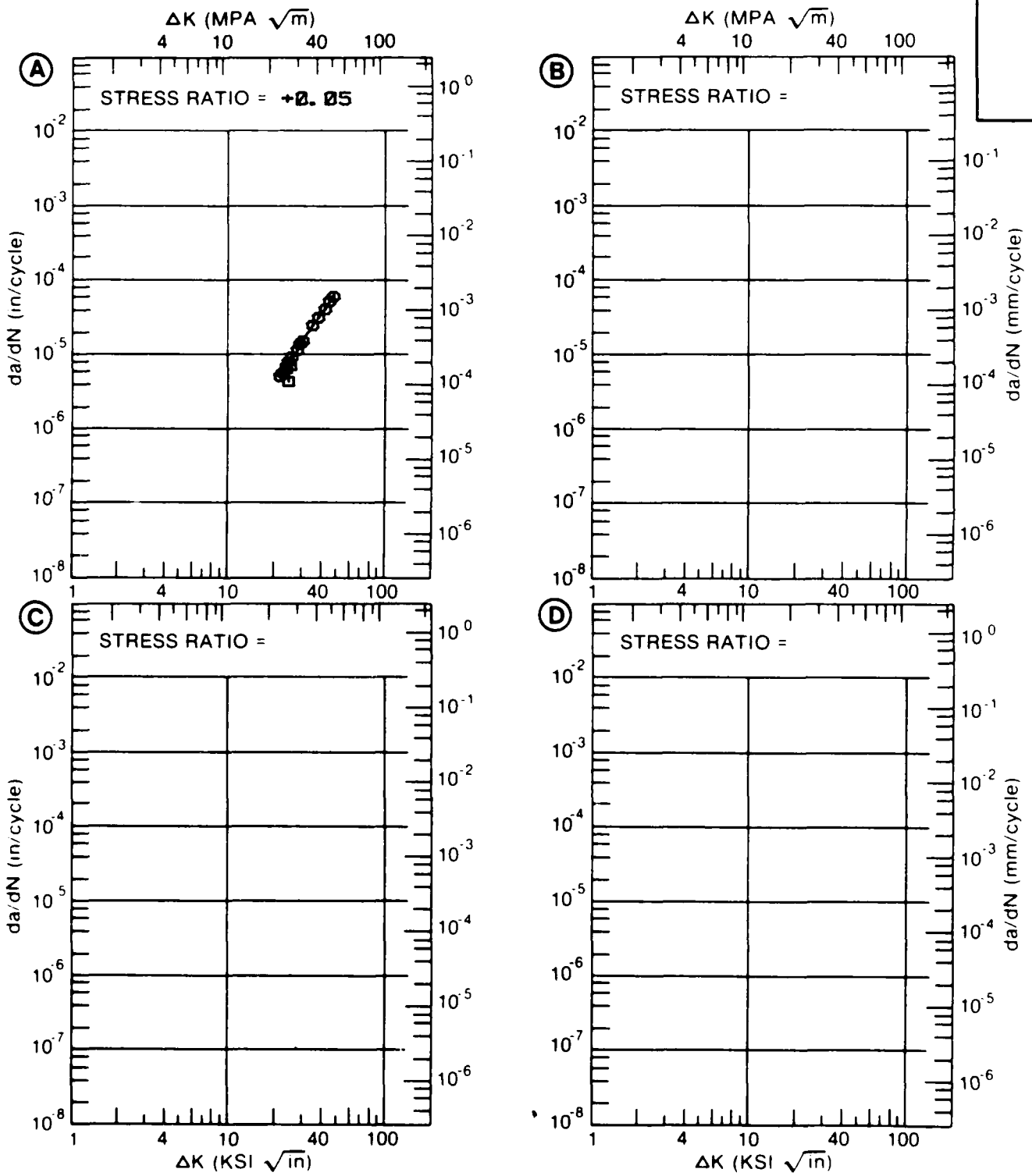



Figure 5.7.3.37

Table 5.7.3.38

NICKEL BASE INCONEL 718 K(ISCC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | ------SPECIMEN-------- WIDTH (IN) W | THICK (IN) B | DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1850F 1.5HR | FB | 4.00 | R.T. | L-T | 160.0 | S.C.S. | 2.000 | 1.000 | DCB | ---- | 103.00 | >166.00 | | | 60180 | 1976 | RI006 |
| OQ,1360F 9HRS, FC TO 1175F | | 4.00 | | | 160.0 | | 2.000 | 1.000 | DCB | ---- | 103.00 | > 86.00 | | | 60180 | 1976 | RI006 |
| 1850F 1.5HR | FB | 4.00 | R.T. | L-T | 160.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 103.00 | > 86.00 | | | 60060 | 1976 | RI006 |
| OQ,1360F 9HRS, FC TO 1175F | | 4.00 | | | 160.0 | | 2.000 | 1.000 | DCB | ---- | 103.00 | >180.00 | | | 119100 | 1976 | RI006 |
| 1850F 1.5HR | FB | 4.00 | R.T. | T-L | 160.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 104.00 | > 89.00 | | | 60060 | 1976 | RI006 |
| OQ,1360F 9HRS, FC TO 1175F | | 4.00 | | | 160.0 | | 2.000 | 1.000 | DCB | ---- | 104.00 | 121.00 | | | 119100 | 1976 | RI006 |
| 1850F 1.5HR | FB | 4.00 | R.T. | S-L | 160.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 104.00 | > 87.00 | | | 60120 | 1976 | RI006 |
| OQ,1360F 9HRS, FC TO 1175F | | 4.00 | | | 160.0 | | 2.000 | 1.000 | DCB | ---- | 104.00 | > 99.00 | | | 76380 | 1976 | RI006 |
| 1880F 1HR AC 1520F 8HR FC 1200F 16HR AC | S | 0.13 | R.T. | --- | ---- | AEROZINE 50 | 1.300 | 0.125 | WOL | ---- | ------ | 80.00* | | | ---- | 1974 | 88700 |
| 1880F 1HR AC 1520F 8HR FC 1200F 16HR AC | S | 0.13 | R.T. | --- | ---- | MARTIN-MARIETTA REFINED GRADE HYDRAZINE | 1.300 | 0.125 | WOL | ---- | ------ | 79.00* | | | ---- | 1974 | 88700 |
| 1880F 1HR AC 1520F 8HR FC 1200F 16HR AC | S | 0.13 | R.T. | --- | ---- | MARTIN-MARIETTA REFINED GRADE HYDRAZINE-2PCT OXYGEN | 1.300 | 0.125 | WOL | ---- | ------ | 79.00* | | | ---- | 1974 | 88700 |
| 1880F 1HR AC 1520F 8HR FC 1200F 16HR AC | S | 0.13 | R.T. | --- | ---- | MATHESON-COLEMAN-BELL 97PCT GRADE HYDRAZINE | 1.300 | 0.125 | WOL | ---- | ------ | 25.80* | | | ---- | 1974 | 88700 |
| 1880F 1HR AC 1520F 8HR FC 1200F 16HR AC | S | 0.13 | R.T. | --- | ---- | PROPELLANT GRADE HYDRAZINE | 1.300 | 0.125 | WOL | ---- | ------ | 87.50* | | | ---- | 1974 | 88700 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

Table 5.8.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100

TEST CONDITIONS

SPECIMEN ORIENTATION Unknown

ENVIRONMENT: AIR AT 800 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | FORGING | -1.00 | 0.17 | | | | | 4.11 | | |
| | FORGING | -0.50 | 0.17 | | | | | 7.09 | | |

Table 5.8.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100

TEST CONDITIONS

SPECIMEN ORIENTATION Unknown

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | FORGING | -1.00 | 0.17 | | | | | 38.5 | | |
| | FORGING | -0.50 | 0.17 | | | | | 40.9 | | |
| | FORGING | 0.10 | | | | | | | 3081 | |
| | FORGING | 0.80 | 0.17 | | | | 10.7 | | | |

Table 5.8.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100

TEST CONDITIONS

SPECIMEN ORIENTATION C R

ENVIRONMENT AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) DELTA K LEVELS (KSI SQRT(IN)) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| | FORGING | 0 10 | 0 01 | | | | 36 9 | 492 | |
| | FORGING | 0 10 | 0 17 | | | | 35 3 | 239 | |
| | FORGING | 0 10 | 0 17 | | | | 27 6 | | |
| | FORGING | 0 10 | 20 00 | | | | 8 16 | | |
| | FORGING | 0 50 | 0 17 | | | 4 63 | 44 1 | | |
| | FORGING | 0 05 | 20 00 | | | | 7 10 | | |
| | FORGING | 0 80 | 0 17 | | | 19 5 | | | |
| | FORGING | 0 80 | 20 00 | | 0 60 | 2 69 | | | |

TABLE 5.8.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE IN100
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN /CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E=+ 800F AIR | E=+1350F AIR | | |
| DELTA K MIN A: | 14.67 | 4.32 | | | |
| DELTA K MIN B: | 7.98 | | 13.7 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 8.00 | | 13.8 | | |
| | 9.00 | | 18.9 | | |
| | 10.00 | | 24.4 | | |
| | 13.00 | | 41.5 | | |
| | 16.00 | 5.39 | 59.2 | | |
| | 20.00 | 10.8 | 84.9 | | |
| | 25.00 | 19.8 | | | |
| DELTA K MAX A: | 27.30 | 22.9 | | | |
| DELTA K MAX B: | 22.70 | | 105 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 3.22 | 3.98 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.50
FREQUENCY: 0.16 HZ

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.401- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

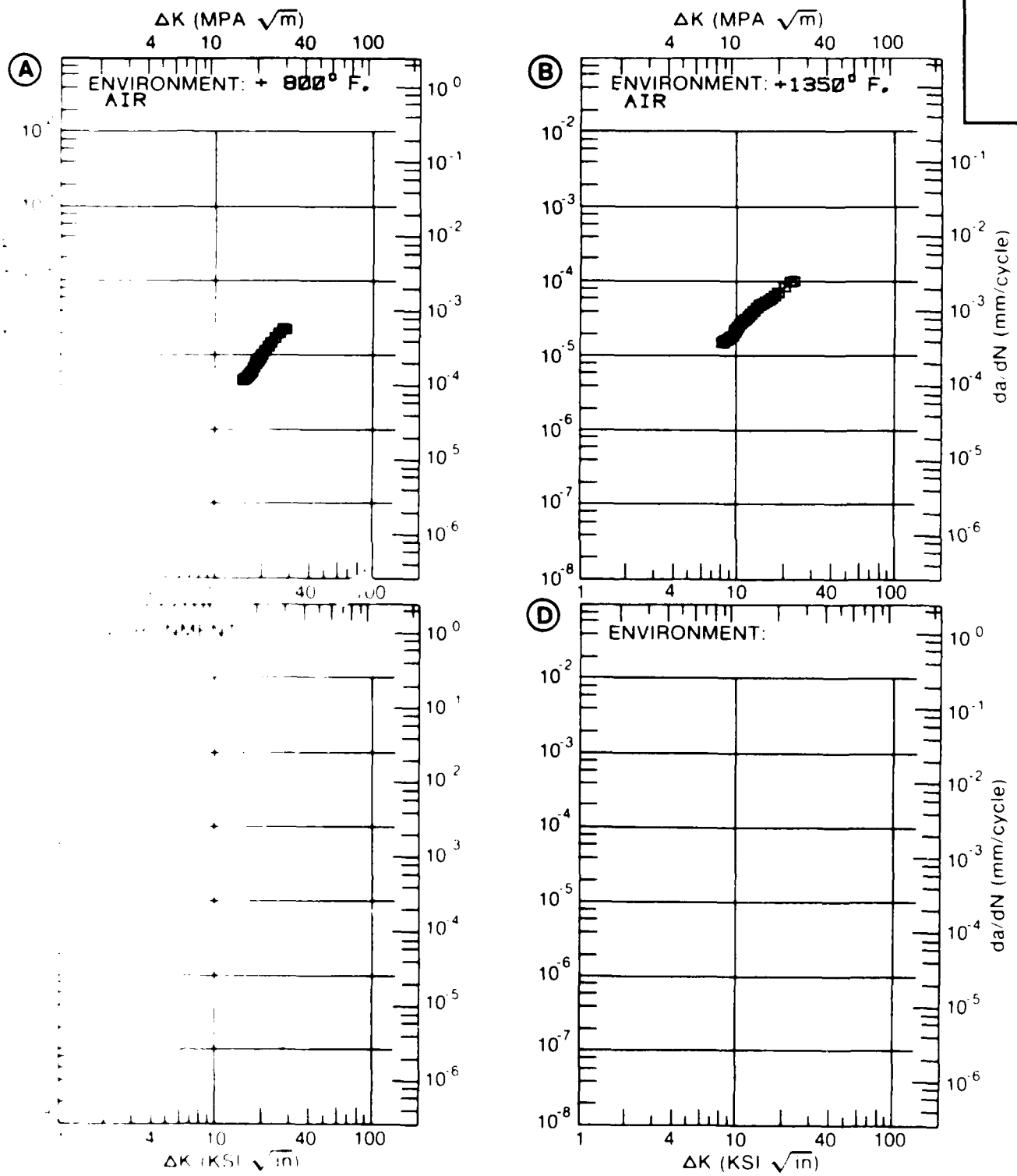



Figure 5.8.3.1

TABLE 5.8.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1100F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.30 | | |
| DELTA K MIN | A: | 14.26 | 12.8 | | | |
| | B: | 14.98 | | 14.8 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 16.7 | 19.8 | | |
| | | 20.00 | 31.7 | 43.3 | | |
| | | 25.00 | 55.3 | 74.7 | | |
| | | 30.00 | 76.9 | 105. | | |
| | | 35.00 | 97.8 | 138. | | |
| | | 40.00 | 123. | 176. | | |
| | | 50.00 | 228. | 289. | | |
| | | 60.00 | | 466. | | |
| | | 70.00 | | 593. | | |
| DELTA K MAX | A: | 52.90 | 289. | | | |
| | B: | 72.77 | | 601. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 9.12 | 21.12 | | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.03; 0.16 HZ
ENVIRONMENT: +1100° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.251- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

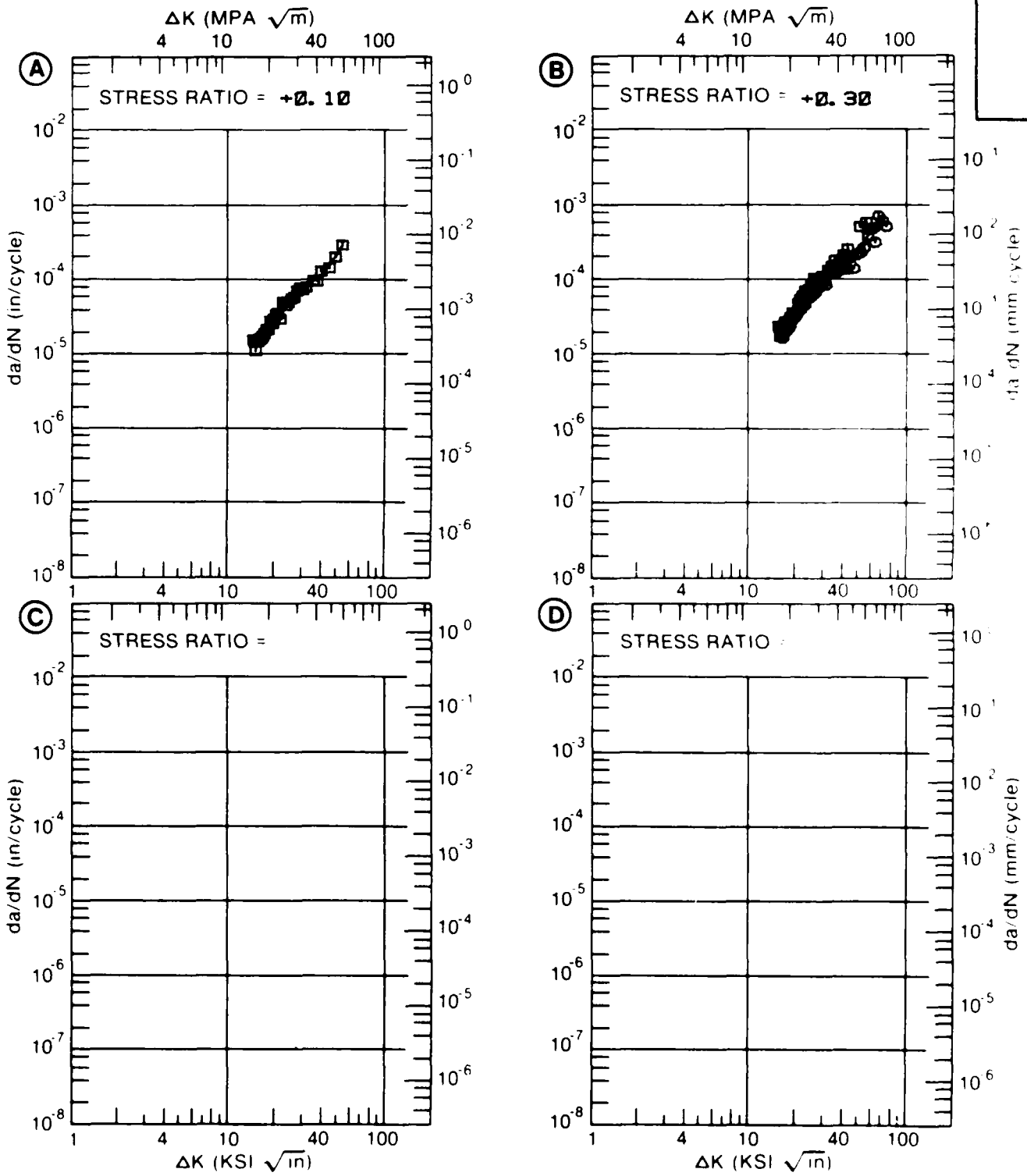



Figure 5.8.3.2

TABLE 5.8.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | R=+0.10 | | |
| DELTA K MIN | A: | 15.48 | 7.64 | | | |
| | B: | 24.21 | | 10.0 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 8.62 | | | |
| | | 20.00 | 26.2 | | | |
| | | 25.00 | 54.9 | 10.6 | | |
| | | 30.00 | 74.2 | 15.5 | | |
| | | 35.00 | 91.0 | | | |
| | | 40.00 | 116. | | | |
| | | 50.00 | 250. | | | |
| DELTA K MAX | A: | 50.85 | 272. | | | |
| | B: | 30.86 | | 15.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 9.69 | 7.90 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.33;20.0HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.108- 0.826"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

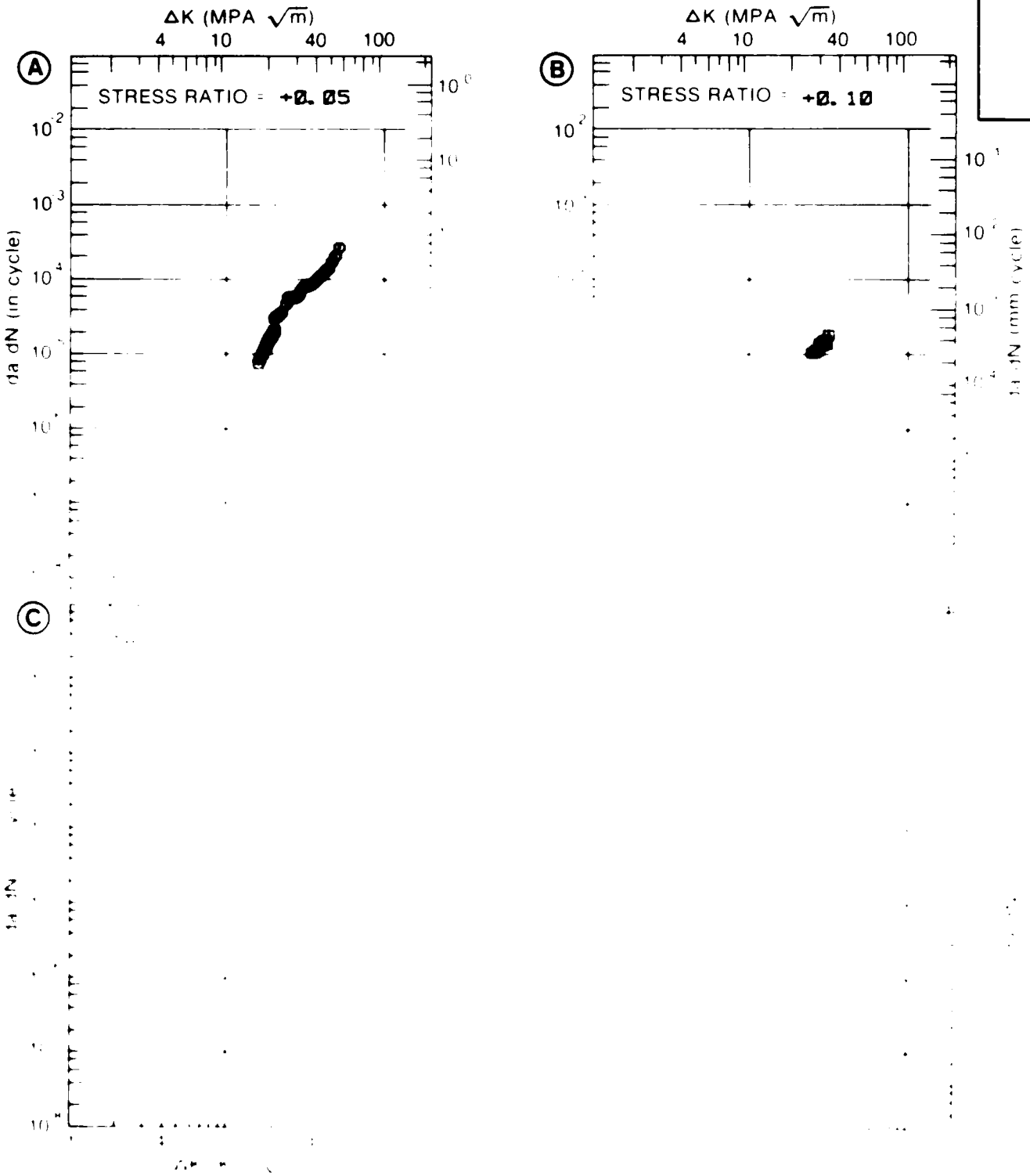


TABLE 5.8.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1350F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 14.82 | 60.0 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 69.9 | | | |
| | | 20.00 | 117. | | | |
| | | 25.00 | 217. | | | |
| | | 30.00 | 378. | | | |
| | | 35.00 | 623. | | | |
| | | 40.00 | 977. | | | |
| DELTA K MAX | A: | 42.68 | 1221. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 11.54

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: MIXED
ENVIRONMENT: +1350° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.246"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

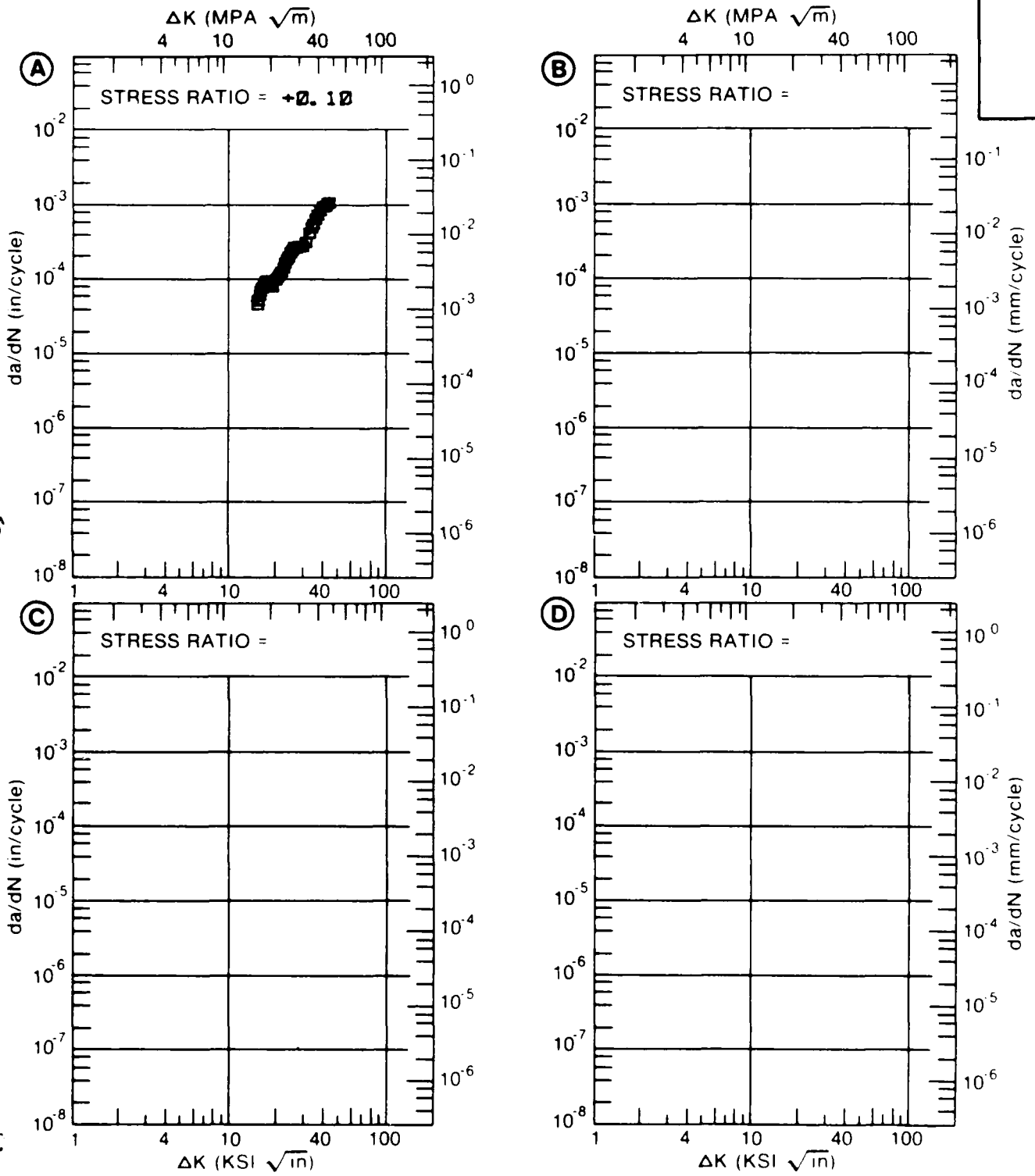



Figure 5.8.3.4

TABLE 5.8.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE IN100
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 300F AIR | E=+ 500F AIR | | |
| DELTA K MIN | A: | 14.09 | .0917 | | | |
| | B: | 14.58 | | .871 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | .556 | 1.30 | | |
| | | 20.00 | 1.42 | 3.12 | | |
| | | 25.00 | 3.59 | 6.47 | | |
| DELTA K MAX | A: | 29.38 | 6.54 | | | |
| | B: | 26.09 | | 7.31 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 15.79 | 8.94 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY: 30.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW003

NICKEL BASE

IN100

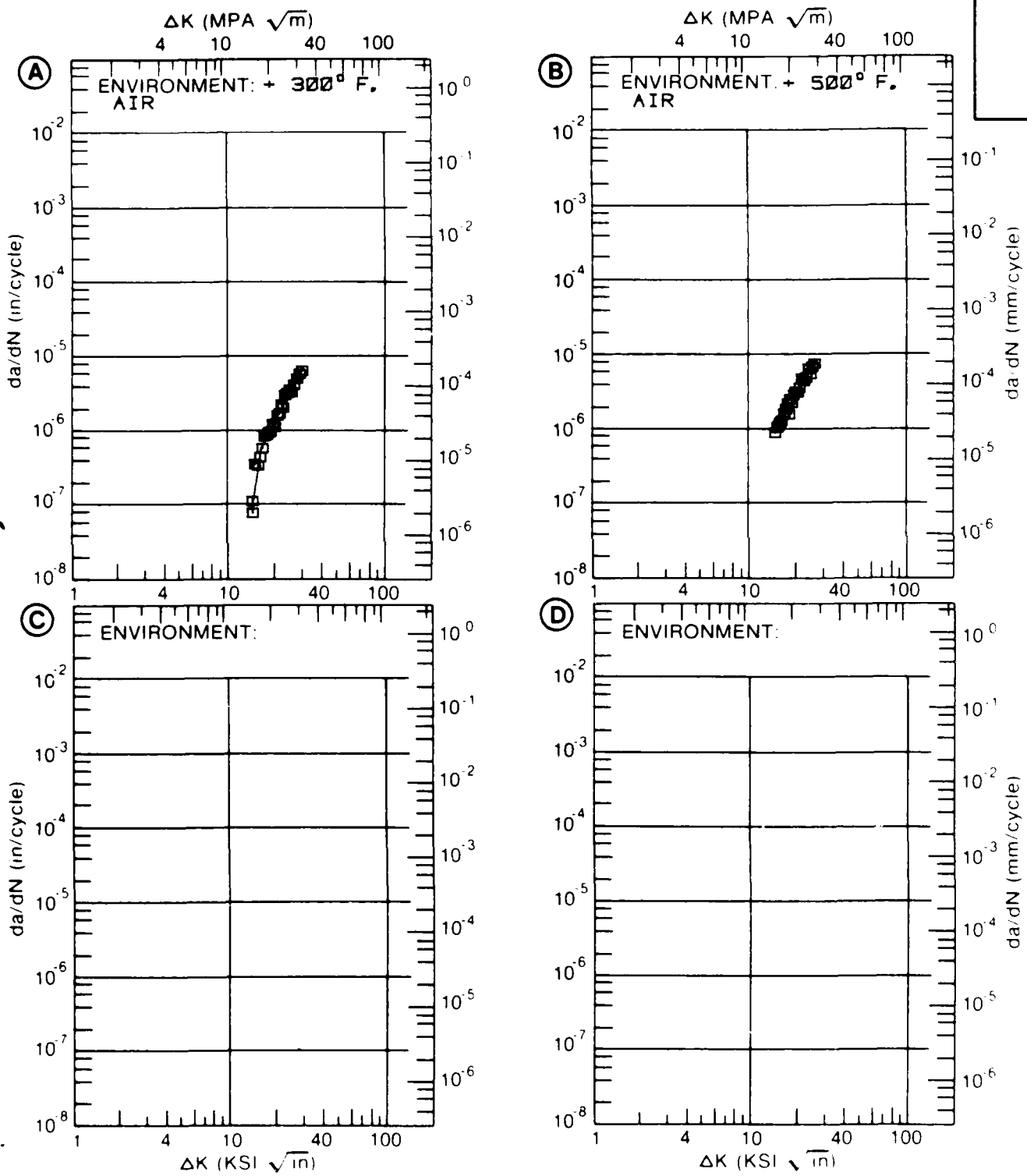



Figure 5.8.3.5

TABLE 5.8.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE IN100
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 800F AIR | E=+1100F AIR | E=+1150F AIR | |
| DELTA K MIN | A: | 16.43 | 3.24 | | | |
| | B: | 14.26 | | 13.2 | | |
| | C: | 17.57 | | | 13.7 | |
| | D: | | | | | |
| | | 16.00 | | 16.4 | | |
| | | 20.00 | 4.71 | 32.2 | 22.2 | |
| | | 25.00 | | 55.4 | | |
| | | 30.00 | | 75.6 | | |
| | | 35.00 | | 96.8 | | |
| | | 40.00 | | 124. | | |
| | | 50.00 | | 227. | | |
| DELTA K MAX | A: | 21.80 | 6.30 | | | |
| | B: | 52.90 | | 279. | | |
| | C: | 23.45 | | | 53.8 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 22.76 | 8.93 | 10.20 | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY: 0.16 HZ

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.250- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

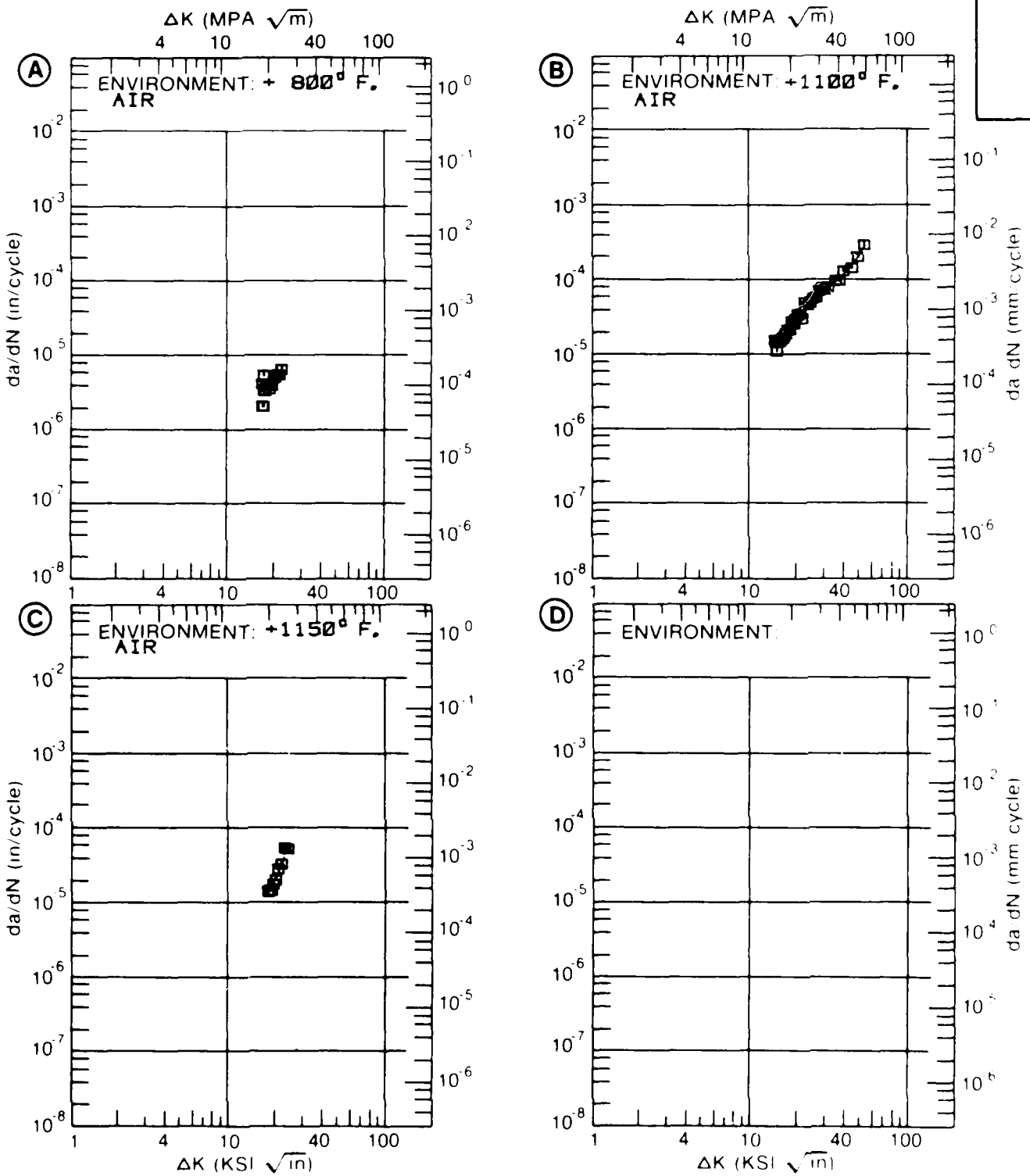



Figure 5.8.3.6

TABLE 5.8.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.7 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=2 MIN HOLD TRAPEZOIDAL | F(HZ)= 0.16 | F(HZ)= 20.00 | |
| DELTA K MIN | A: | 25.35 | 15.9 | | | |
| | B: | 16.43 | | 3.24 | | |
| | C: | 12.40 | | | .919 | |
| | D: | | | | | |
| | | 13.00 | | | 1.02 | |
| | | 16.00 | | | 2.01 | |
| | | 20.00 | | 4.71 | 4.58 | |
| | | 25.00 | | | 8.07 | |
| | | 30.00 | 21.4 | | 13.7 | |
| DELTA K MAX | A: | 30.46 | 16.6 | | | |
| | B: | 21.80 | | 6.30 | | |
| | C: | 30.78 | | | 15.3 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 17.04 | 22.76 | 9.62 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: + 800° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.461- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

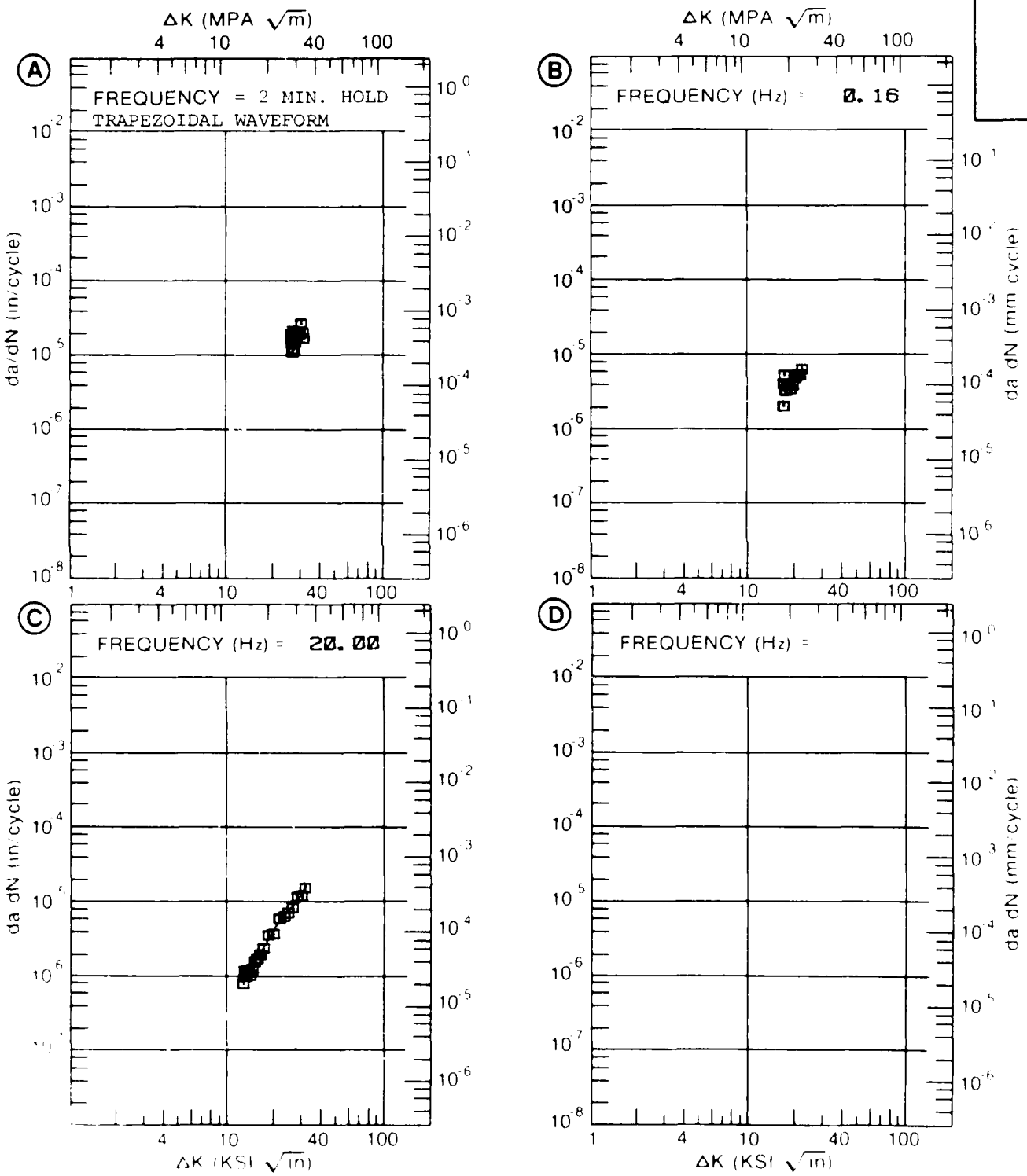



Figure 5.8.3.7

TABLE 5.8.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.8 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | F=2 MIN HOLD TRAPEZOIDAL | | | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 0.00

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.440"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

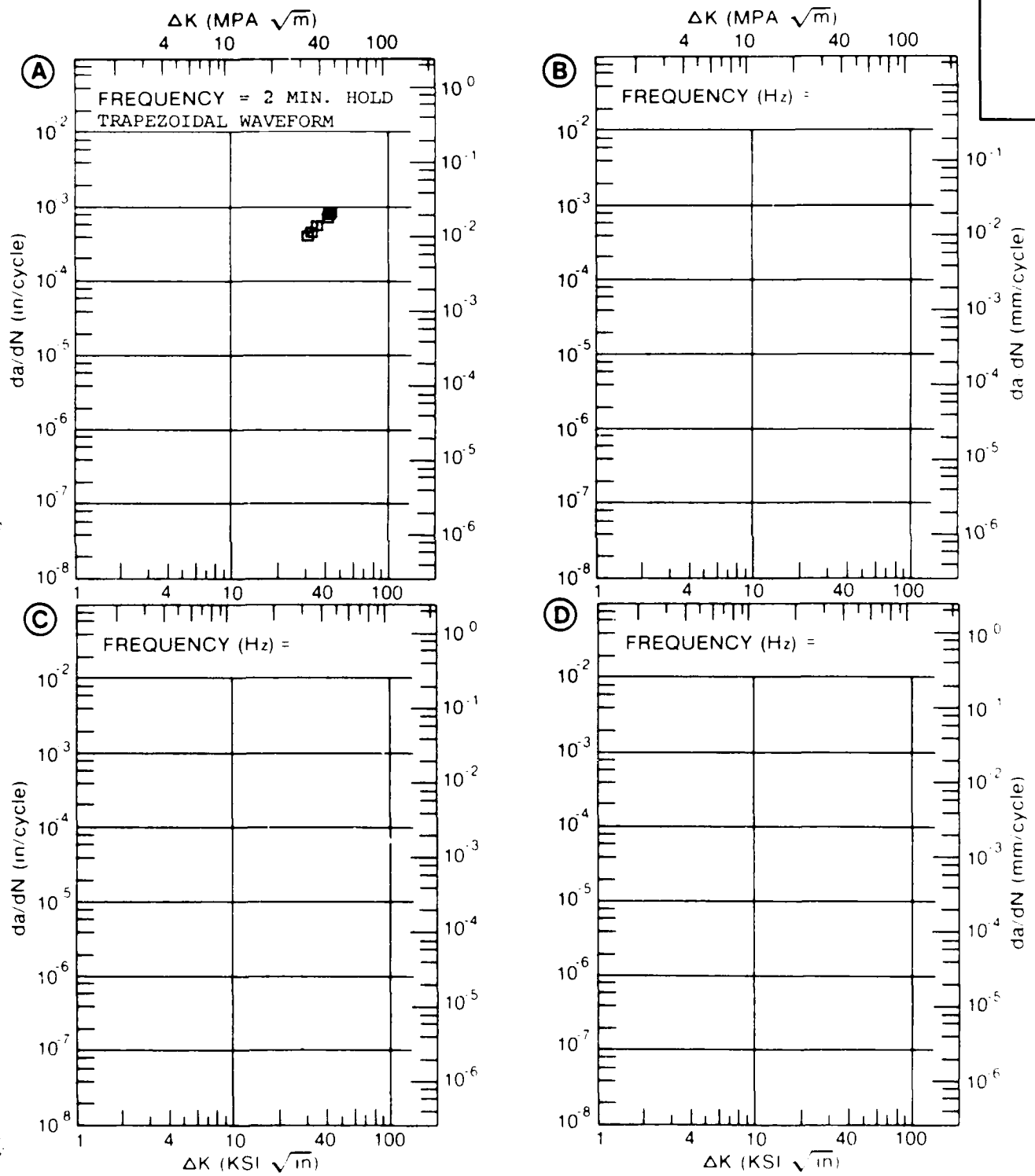



Figure 5.8.3.8

TABLE 5.8.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.9 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=-1.00 | R=-0.50 | | |
| DELTA K MIN | A: | 13.48 | 1.08 | | | |
| | B: | 12.10 | | .532 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | | 1.88 | | |
| | | 16.00 | 1.91 | 4.13 | | |
| | | 20.00 | 4.11 | 7.09 | | |
| | | 25.00 | 11.0 | 15.9 | | |
| | | 30.00 | | 42.5 | | |
| DELTA K MAX | A: | 26.54 | 15.2 | | | |
| | B: | 31.05 | | 43.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.68 | 15.29 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.228- 0.298"
SPECIMEN WIDTH: 0.988- 1.000"
REFERENCES: PW002

NICKEL BASE

IN100

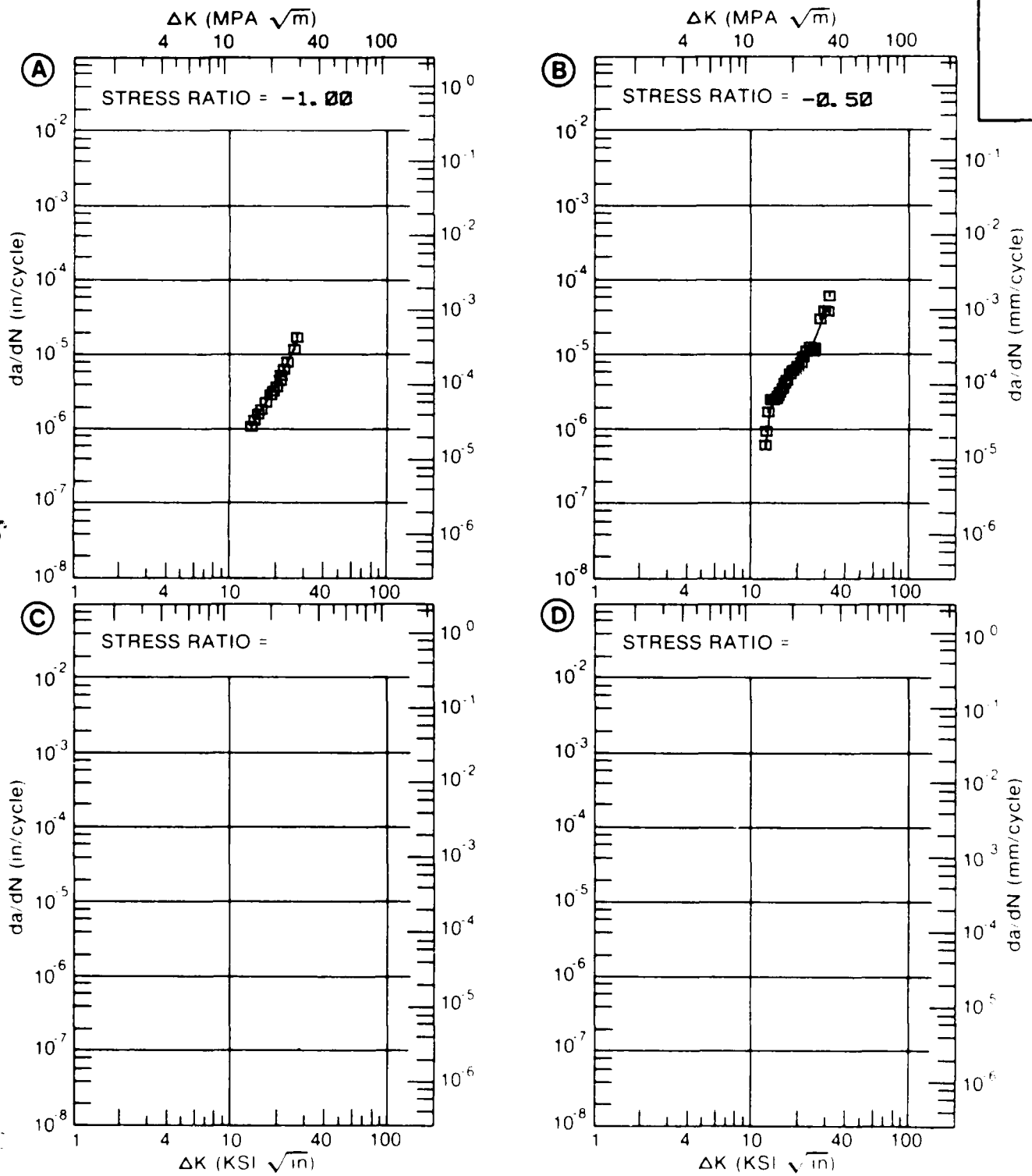



Figure 5.8.3.9

TABLE 5.8.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.10 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=-1.00 | R=-0.50 | | |
| DELTA K MIN | A: | 19.84 | 37.8 | | | |
| | B: | 13.75 | | 11.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | | 21.7 | | |
| | | 20.00 | 38.5 | 40.9 | | |
| | | 25.00 | 62.4 | 73.9 | | |
| | | 30.00 | 91.0 | 128. | | |
| | | 35.00 | 132. | | | |
| | | 40.00 | 196. | | | |
| DELTA K MAX | A: | 42.98 | 253. | | | |
| | B: | 33.24 | | 184. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.79 | 9.03 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH 169.1 KSI
ULT STRENGTH 236.5 KSI
SPECIMEN THK 0.299- 0.309"
SPECIMEN WIDTH 0.995- 1.038"
REFERENCES PW002

NICKEL BASE

IN100

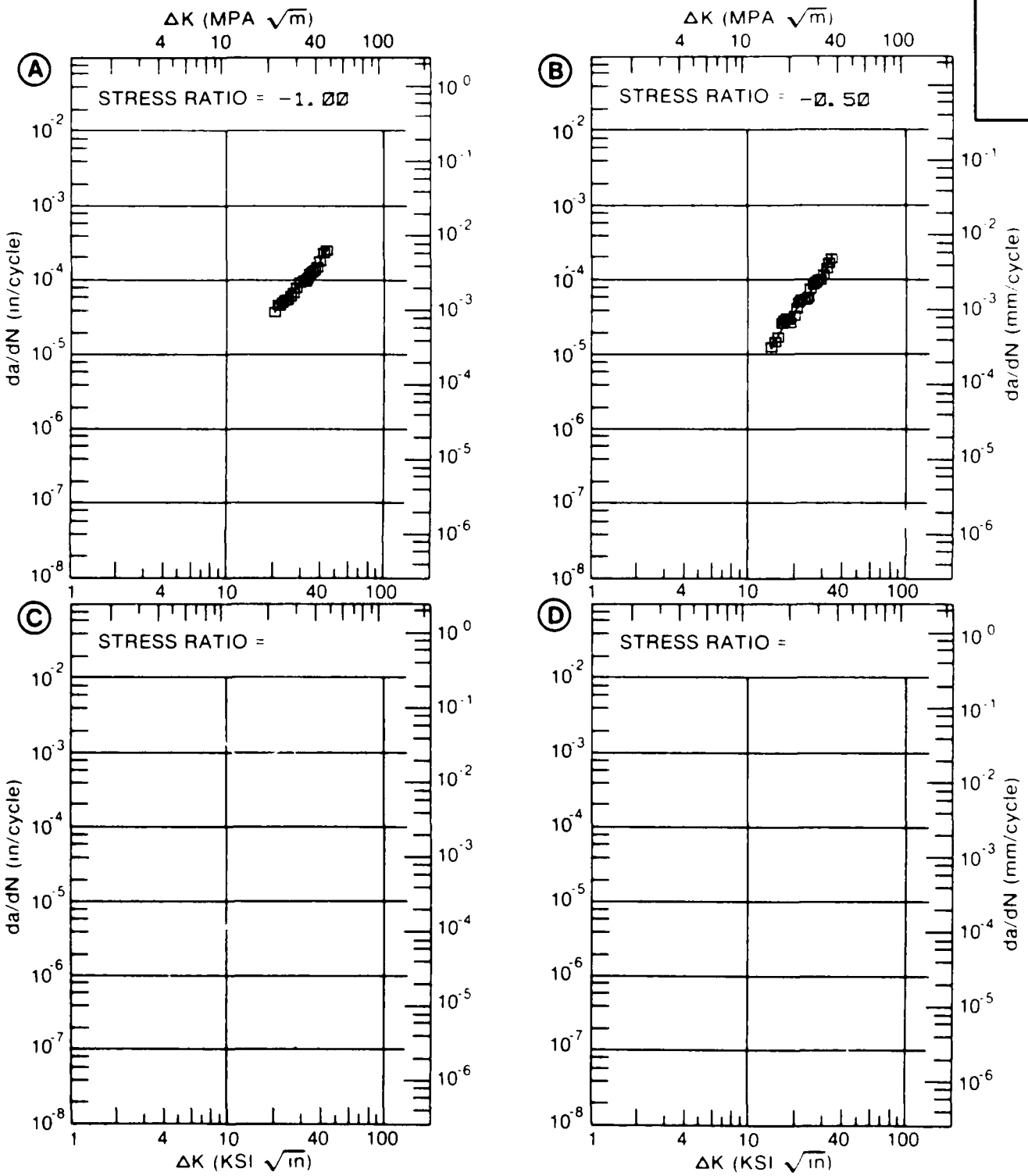



Figure 5.8.3.10

TABLE 5.8.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.11 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.80 | | | |
| DELTA K MIN A: | 5.60 | 2.78 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |
| | 6.00 | 3.03 | | | |
| | 7.00 | 4.04 | | | |
| | 8.00 | 5.61 | | | |
| | 9.00 | 7.82 | | | |
| | 10.00 | 10.7 | | | |
| | 13.00 | 23.4 | | | |
| DELTA K MAX A: | 13.74 | 27.2 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.23

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.302"
SPECIMEN WIDTH: 2.503"
REFERENCES: PW002

NICKEL BASE

IN100

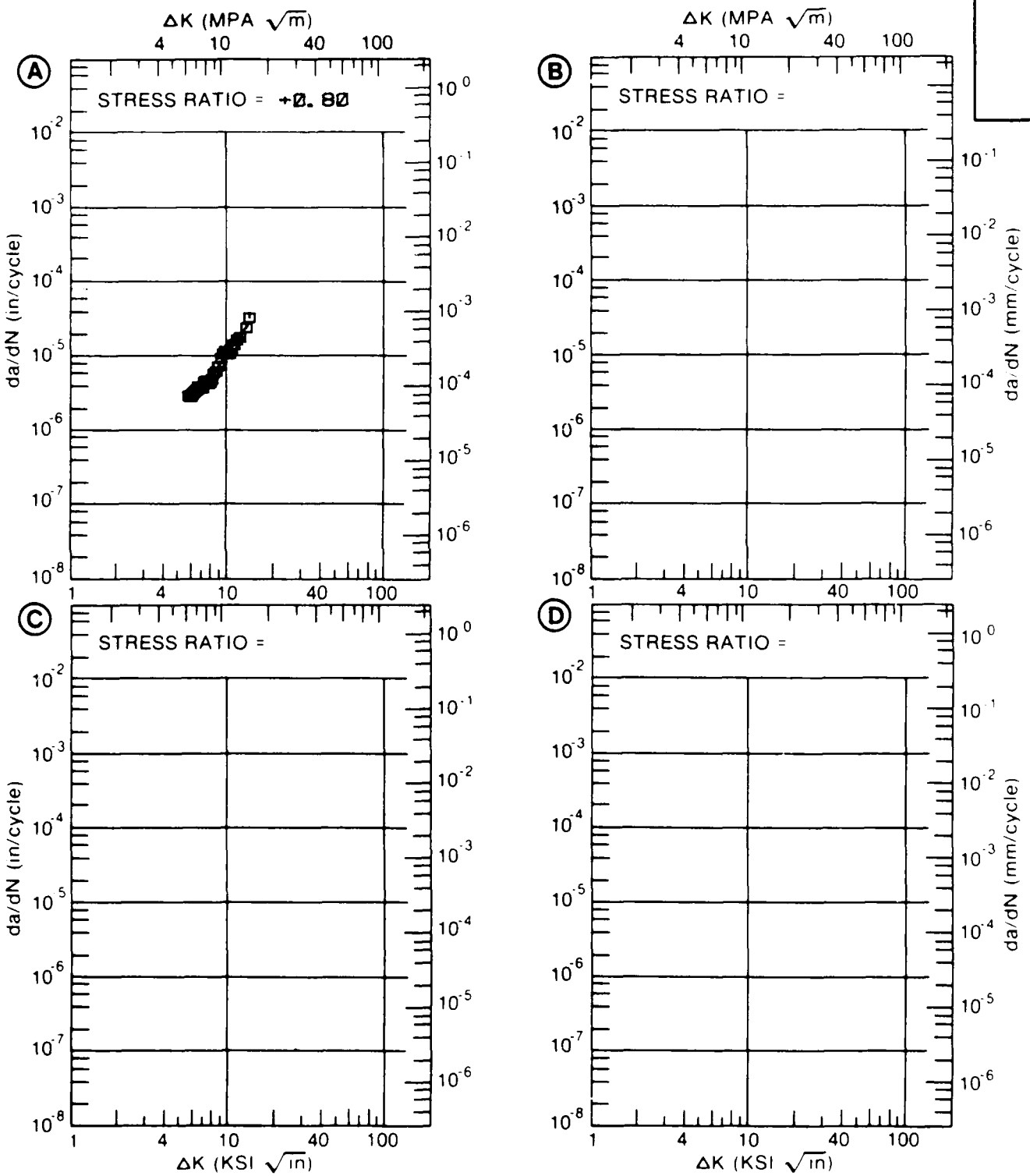



Figure 5.8.3.11

TABLE 5.8.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.12 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=10 MIN HOLD TRAPEZOIDAL | | | |
| DELTA K MIN | A: | 23.52 | 509. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 25.00 | 616. | | | |
| | | 30.00 | 1003. | | | |
| | | 35.00 | 1416. | | | |
| | | 40.00 | 1875. | | | |
| | | 50.00 | 3082. | | | |
| | | 60.00 | 5076. | | | |
| DELTA K MAX | A: | 67.89 | 7719. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 6.81

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.252"
SPECIMEN WIDTH: 2.504"
REFERENCES: PW002

NICKEL BASE

IN100

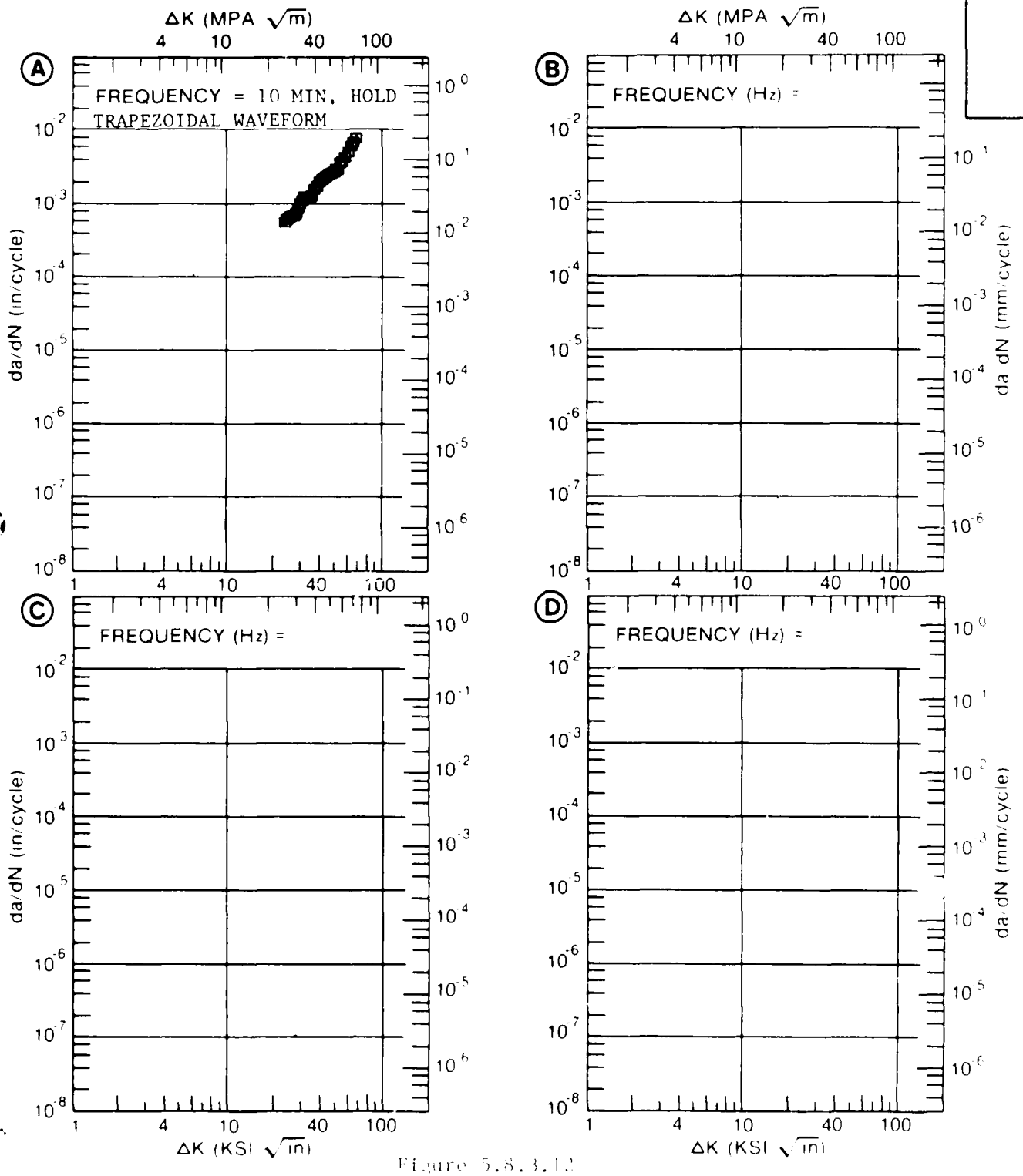



Figure 5.8.3.12

TABLE 5.8.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.13 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1000F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 14.22 | 9.13 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 11.9 | | | |
| | | 20.00 | 17.6 | | | |
| | | 25.00 | 24.6 | | | |
| | | 30.00 | 33.2 | | | |
| | | 35.00 | 45.8 | | | |
| | | 40.00 | 65.2 | | | |
| DELTA K MAX | A: | 41.33 | 72.1 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 2.53

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1000° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.502"
REFERENCES: PW002

NICKEL BASE

IN100

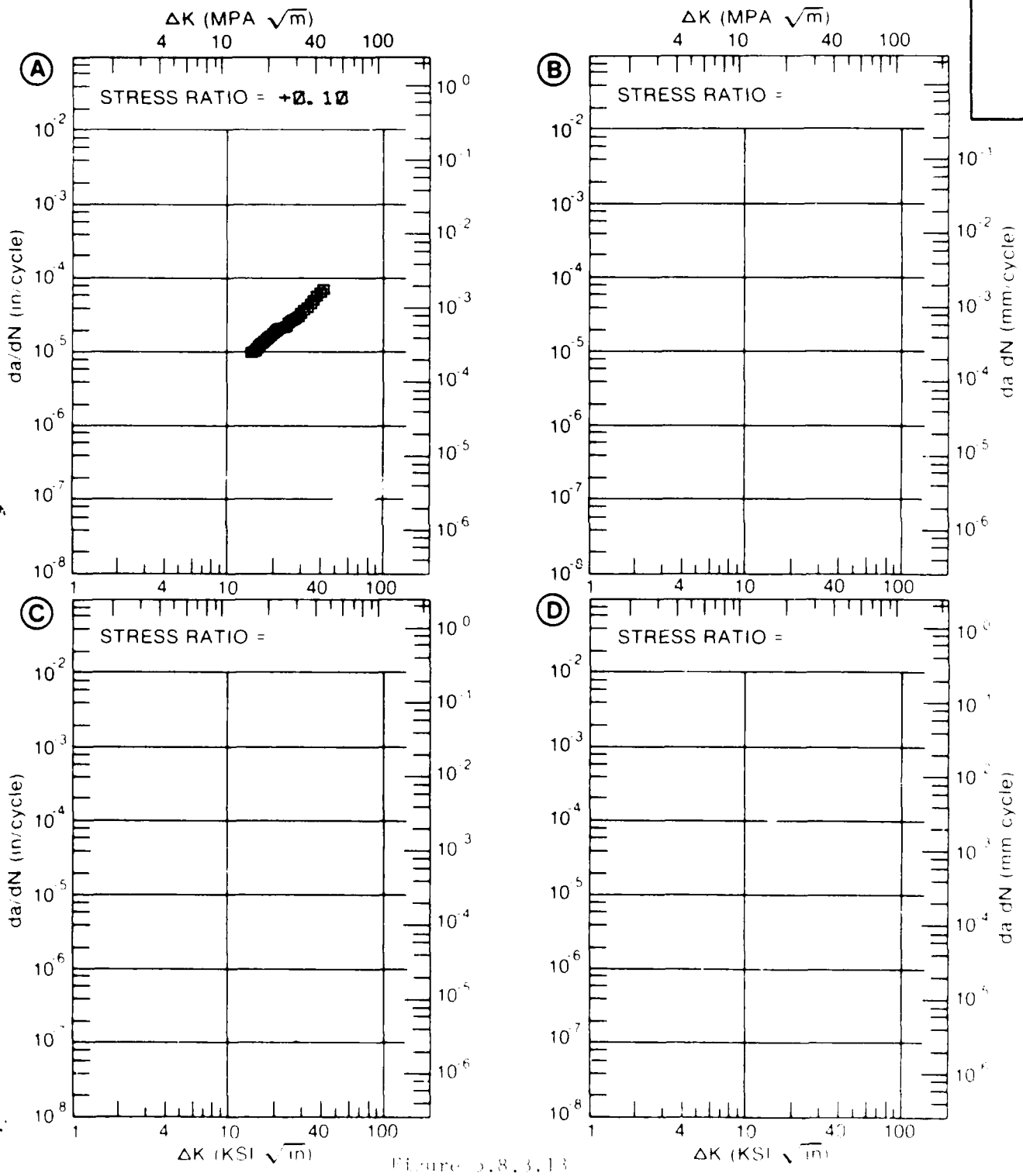



Figure 3.8.3.13

TABLE 5.8.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.14 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | R=+0.10 | | |
| DELTA K MIN | A: | 14.03 | 4.32 | | | |
| | B: | 13.55 | | 3.94 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 4.75 | 4.92 | | |
| | | 20.00 | 7.10 | 8.16 | | |
| | | 25.00 | 12.6 | 15.2 | | |
| | | 30.00 | 20.9 | 25.3 | | |
| | | 35.00 | 30.8 | 36.6 | | |
| | | 40.00 | | 46.6 | | |
| DELTA K MAX | A: | 38.78 | 38.1 | | | |
| | B: | 41.45 | | 49.0 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 12.71 | 17.34 | | |

| | | | |
|---|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | |
| | 0.5-0.8 | | |
| | 0.8-1.25 | 1 | 2 |
| | 1.25-2.0 | | |
| | >2.0 | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 20.00 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.247- 0.442"
SPECIMEN WIDTH: 2.494- 2.508"
REFERENCES: PW002

NICKEL BASE

IN100

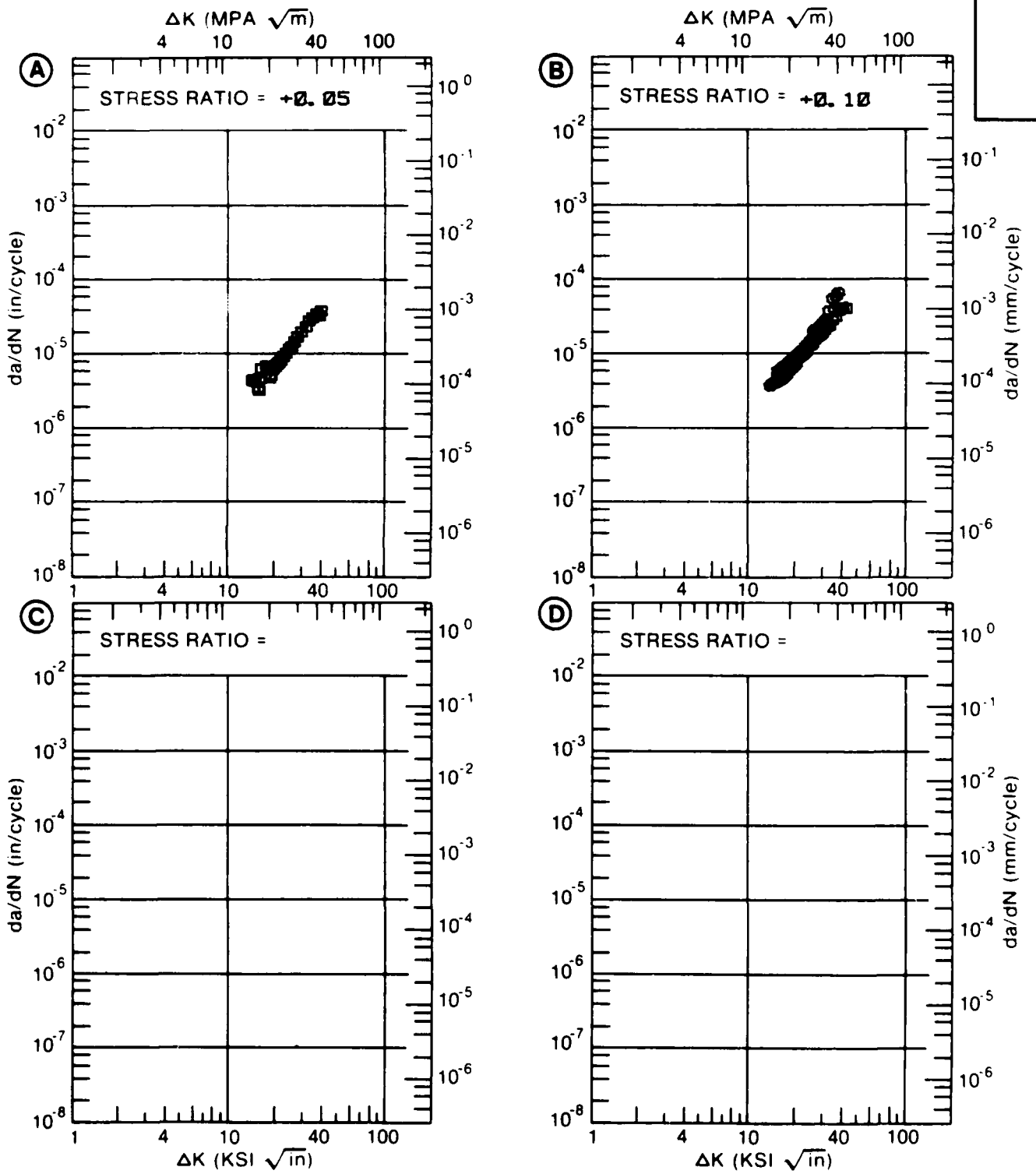



Figure 5.8.3.14

TABLE 5.8.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.15 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 12.89 | 6.18 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 6.36 | | | |
| | | 16.00 | 12.3 | | | |
| | | 20.00 | 27.6 | | | |
| | | 25.00 | 65.3 | | | |
| | | 30.00 | 95.5 | | | |
| DELTA K MAX | A: | 31.93 | 95.6 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 12.43

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: C-R
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.296"
SPECIMEN WIDTH: 0.986"
REFERENCES: PW002

NICKEL BASE

IN100

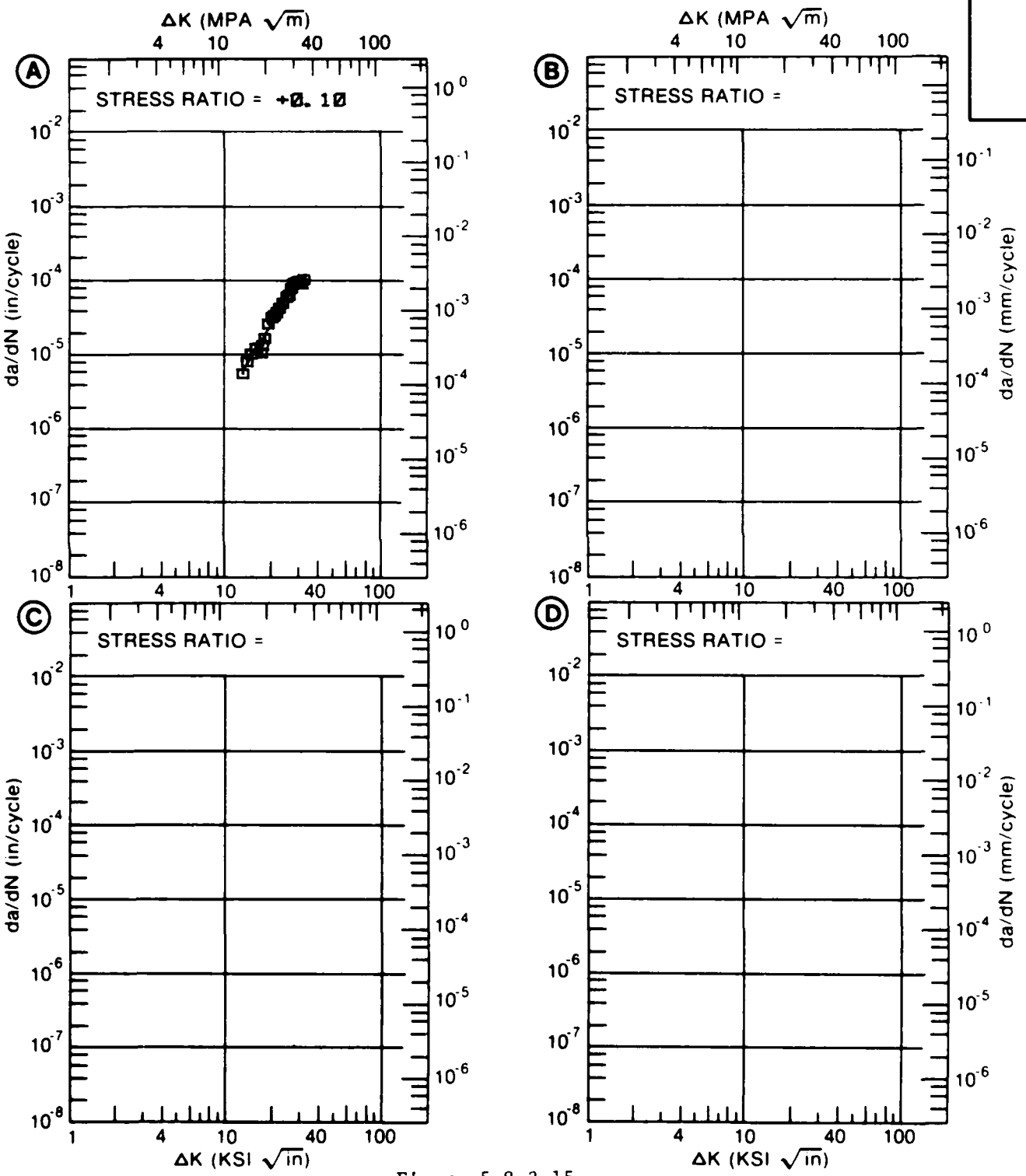



Figure 5.8.3.15

TABLE 5.8.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.16 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.50 | | | |
| DELTA K MIN | A: | 8.06 | 2.41 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | 3.31 | | | |
| | | 10.00 | 4.63 | | | |
| | | 13.00 | 11.5 | | | |
| | | 16.00 | 23.4 | | | |
| | | 20.00 | 44.1 | | | |
| DELTA K MAX | A: | 22.91 | 58.3 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 8.04

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 2 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.500- 0.501"
SPECIMEN WIDTH: 2.496- 2.505"
REFERENCES: PW002

NICKEL BASE

IN100

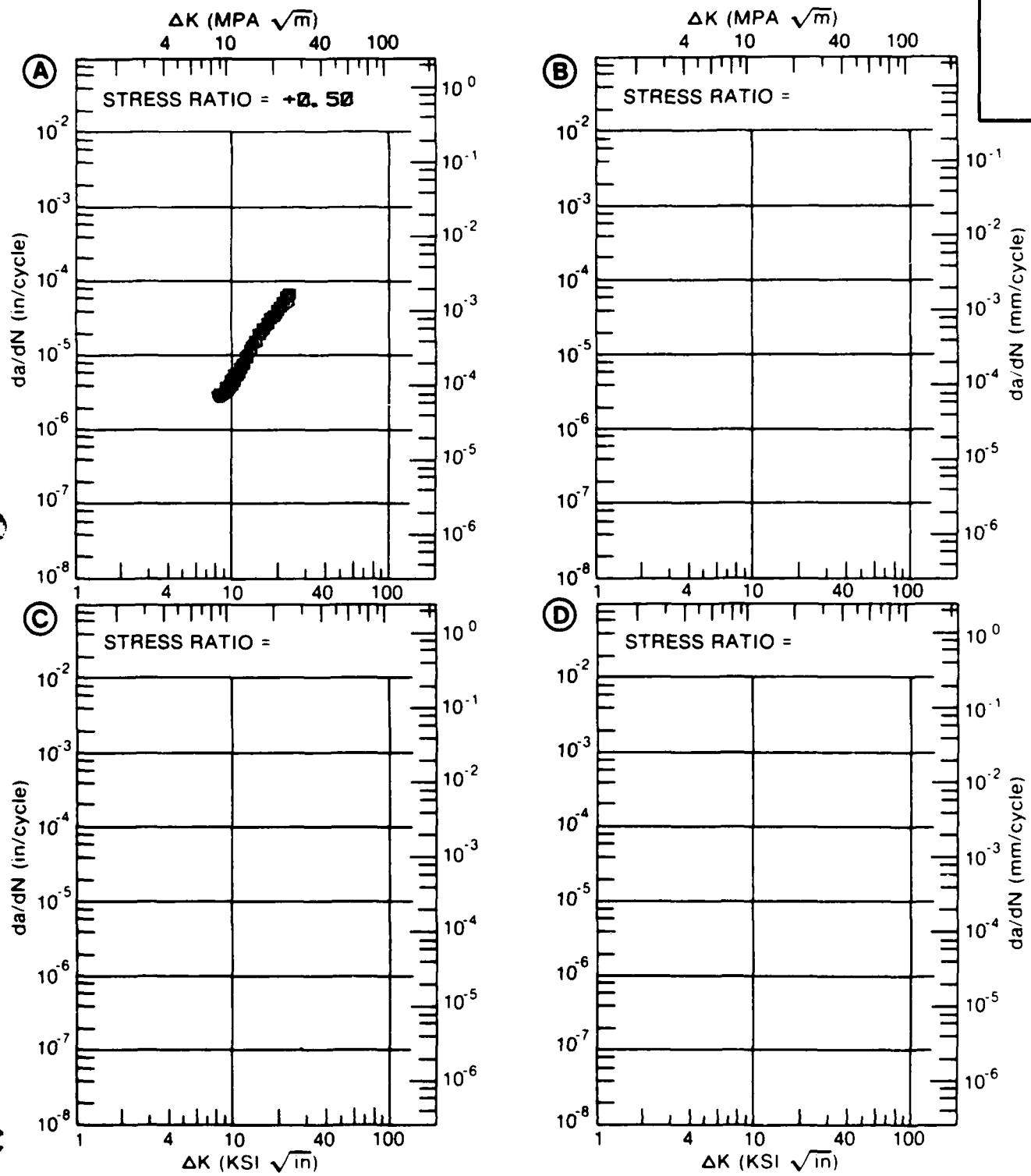



Figure 5.3.3.16

TABLE 5.8.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE IN100
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1300F AIR, 0.17HZ | E=+1350F AIR, 0.01HZ | E=+1350F AIR, 0.17HZ | |
| DELTA K MIN | A: | 20.20 | 39.0 | | | |
| | B: | 27.86 | | 281. | | |
| | C: | 14.68 | | | 16.2 | |
| | D: | | | | | |
| | | 16.00 | | | 24.1 | |
| | | 20.00 | | | 53.3 | |
| | | 25.00 | 70.7 | | 94.7 | |
| | | 30.00 | 110. | 322. | 145. | |
| | | 35.00 | 153. | 452. | 216. | |
| | | 40.00 | 197. | 630. | 329. | |
| | | 50.00 | 280. | 1117. | | |
| | | 60.00 | | 1699. | | |
| DELTA K MAX | A: | 54.45 | 313. | | | |
| | B: | 65.70 | | 2019. | | |
| | C: | 41.46 | | | 375. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.36 | 6.81 | 13.97 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.253- 0.502"
SPECIMEN WIDTH: 2.498- 2.511"
REFERENCES: PW002

NICKEL BASE

IN100

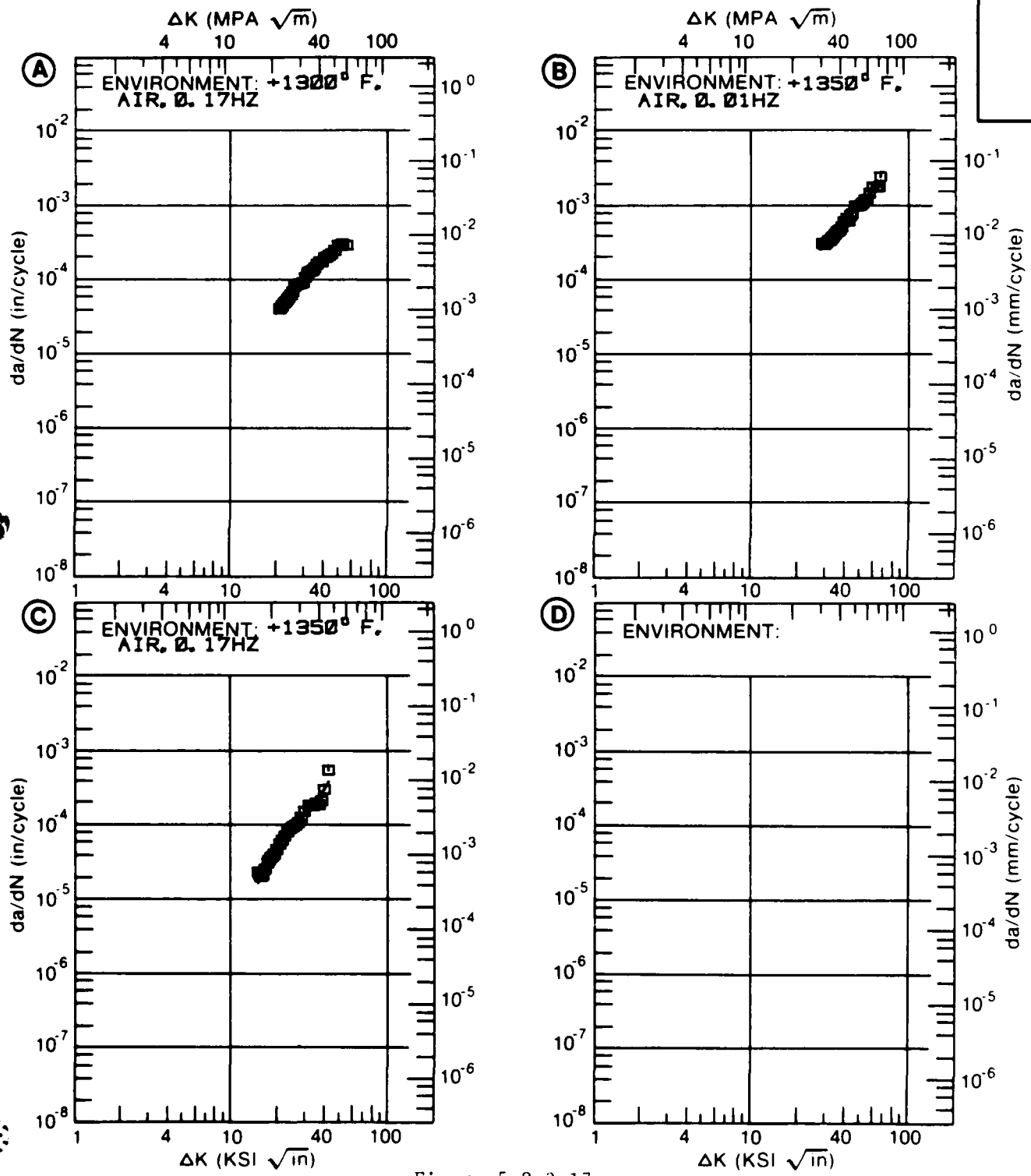



Figure 5.8.3.17

TABLE 5.8.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.18 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.01 | F(HZ)= 0.17 | F(HZ)= 20.00 | |
| DELTA K MIN | A: | 15.43 | 20.0 | | | |
| | B: | 13.17 | | 7.25 | | |
| | C: | 13.55 | | | 3.94 | |
| | D: | | | | | |
| | | 16.00 | 21.5 | 16.9 | 4.92 | |
| | | 20.00 | 36.9 | 35.3 | 8.16 | |
| | | 25.00 | 69.8 | 62.0 | 15.2 | |
| | | 30.00 | 120. | 90.0 | 25.3 | |
| | | 35.00 | 188. | 120. | 36.6 | |
| | | 40.00 | 274. | 153. | 46.6 | |
| | | 50.00 | 492. | 239. | | |
| | | 60.00 | 745. | | | |
| | | 70.00 | 996. | | | |
| | | 80.00 | 1214. | | | |
| | | 90.00 | 1378. | | | |
| DELTA K MAX | A: | 91.39 | 1396. | | | |
| | B: | 57.86 | | 337. | | |
| | C: | 41.45 | | | 49.0 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.27 | 9.73 | 17.34 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 3 | 5 | 2 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.247- 0.870"
SPECIMEN WIDTH: 2.437- 2.511"
REFERENCES: PW006

NICKEL BASE

IN100

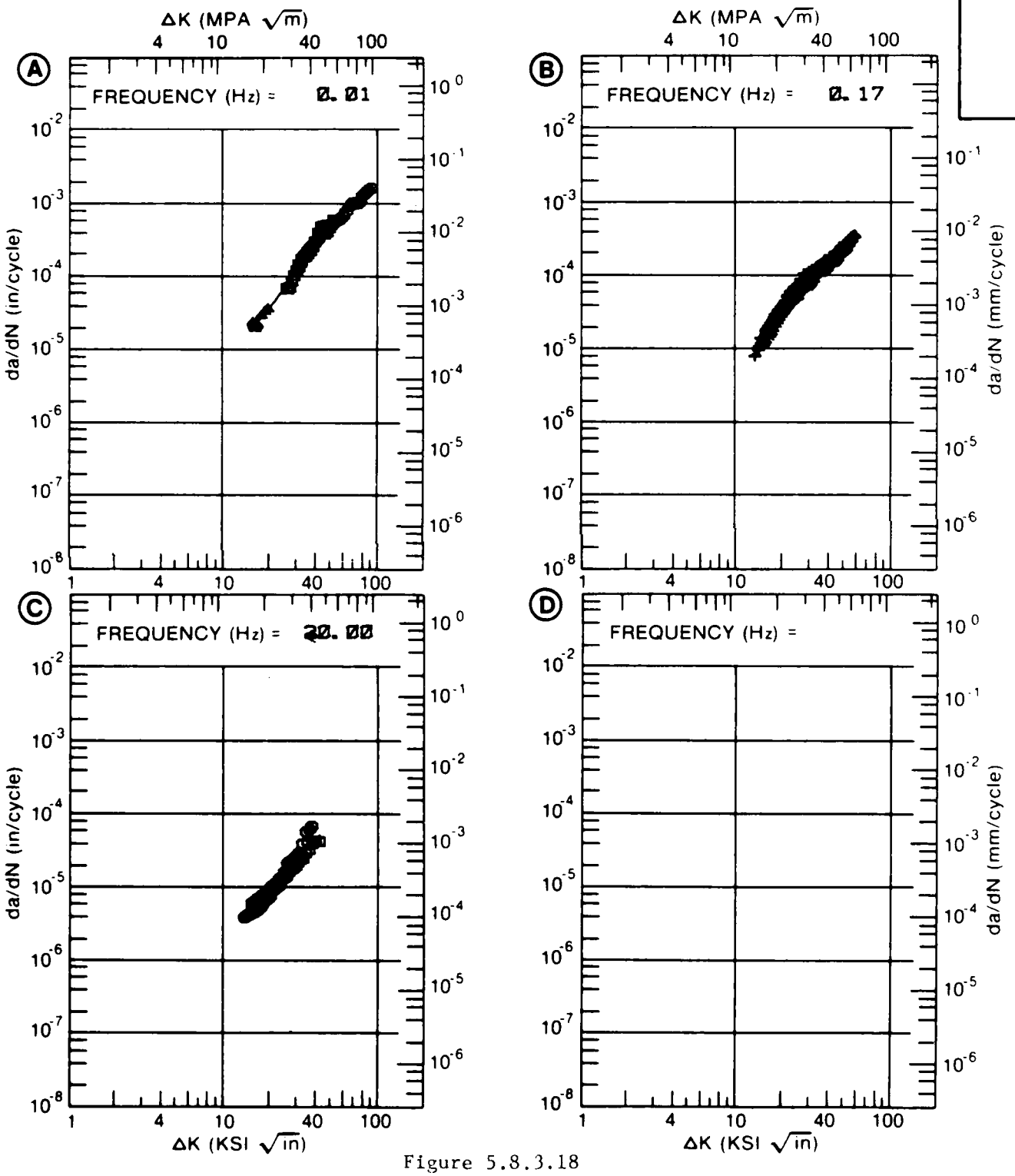



Figure 5.8.3.18

TABLE 5.8.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.19 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A F=1 MIN HOLD TRAPEZOIDAL | B F=2 MIN HOLD TRAPEZOIDAL | C F=10 MIN HOLD TRAPEZOIDAL | D F=20 MIN HOLD TRAPEZOIDAL |
|---|---|---|---|---|---|---|
| DELTA K MIN | A: | 18.78 | 52.1 | | | |
| | B: | 15.61 | | 89.6 | | |
| | C: | 19.39 | | | 203. | |
| | D: | 27.08 | | | | 371. |
| | | 16.00 | | 87.0 | | |
| | | 20.00 | 61.9 | 93.7 | 208. | |
| | | 25.00 | 144. | 156. | 347. | |
| | | 30.00 | 315. | 279. | 703. | 587. |
| | | 35.00 | 559. | 462. | 1363. | 1010. |
| | | 40.00 | 785. | 679. | 2332. | 1466. |
| | | 50.00 | | 1006. | | 2555. |
| | | 60.00 | | | | 4304. |
| DELTA K MAX | A: | 41.45 | 831. | | | |
| | B: | 50.80 | | 1018. | | |
| | C: | 49.73 | | | 4327. | |
| | D: | 67.35 | | | | 6558. |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.62 | 15.60 | 7.60 | 10.08 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 2 | 1 | 1 |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.250- 0.856"
SPECIMEN WIDTH: 2.436- 2.510"
REFERENCES: PW002

NICKEL BASE

IN100

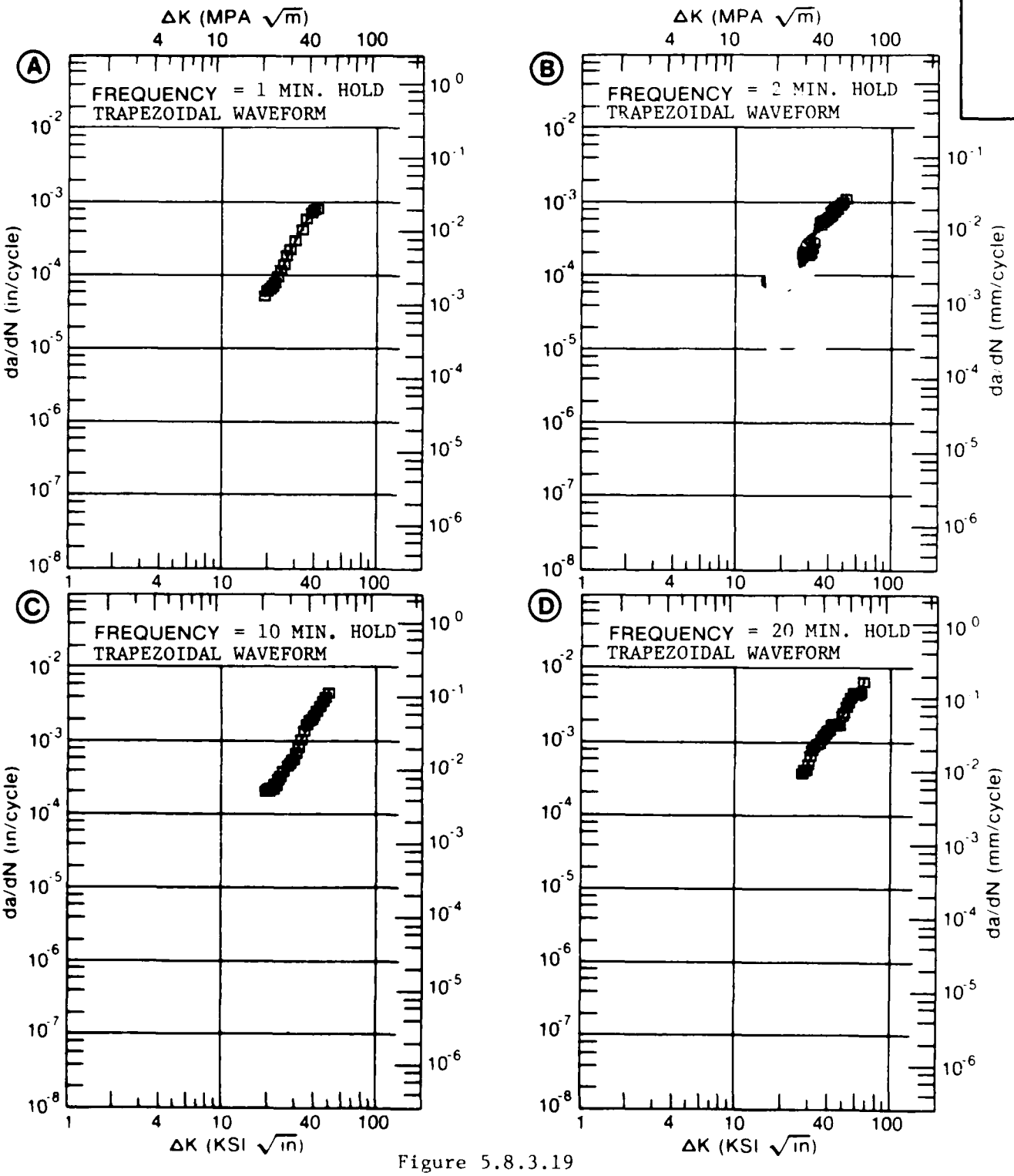



Figure 5.8.3.19

TABLE 5.8.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.20 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1350F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=2 MIN HOLD TRAPEZOIDAL | | | |
| DELTA K MIN | A: | 12.93 | 105. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 107. | | | |
| | | 16.00 | 293. | | | |
| | | 20.00 | 776. | | | |
| DELTA K MAX | A: | 21.29 | 871. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 13.50

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1350° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.436"
SPECIMEN WIDTH: 2.495"
REFERENCES: PW002

NICKEL BASE

IN100

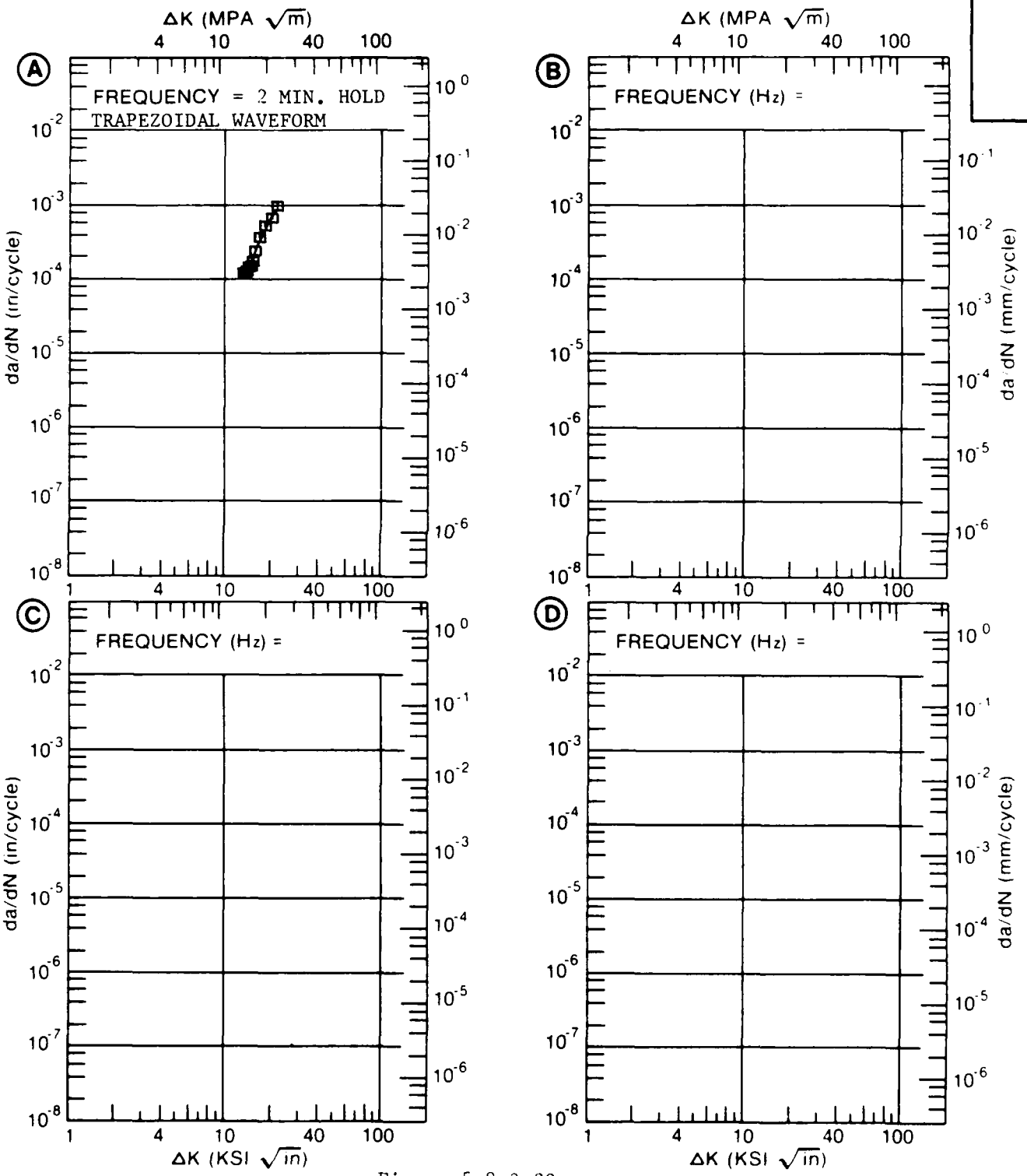



Figure 5.8.3.20

TABLE 5.8.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.21 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.17 | F(HZ)= 20.00 | | |
| DELTA K MIN | A: | 9.28 | 17.5 | | | |
| | B: | 4.39 | | .367 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 5.00 | | .600 | | |
| | | 6.00 | | .977 | | |
| | | 7.00 | | 1.32 | | |
| | | 8.00 | | 1.68 | | |
| | | 9.00 | | 2.11 | | |
| | | 10.00 | 19.5 | 2.69 | | |
| | | 13.00 | 31.8 | | | |
| | | 16.00 | 55.2 | | | |
| DELTA K MAX | A: | 18.16 | 84.6 | | | |
| | B: | 11.78 | | 4.46 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.15 | 6.64 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.80
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.206- 0.503"
SPECIMEN WIDTH: 2.496- 2.498"
REFERENCES: PW002

NICKEL BASE

IN100

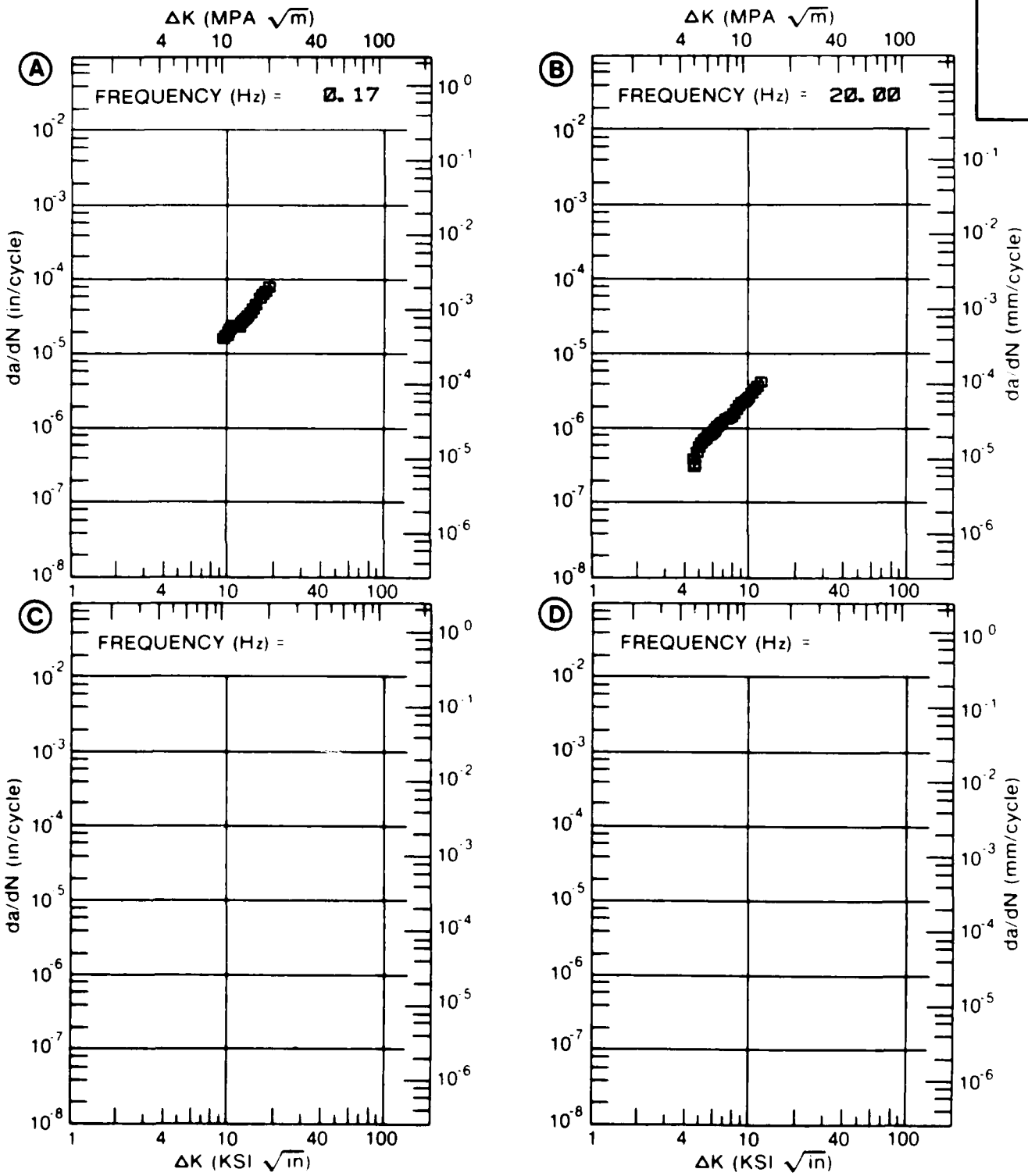



Figure 5.8.3.21

TABLE 5.8.3.22

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE IN100
CONDITION: PRESTRAIN
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 11.89 | 2.42 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 4.10 | | | |
| | | 16.00 | 16.1 | | | |
| DELTA K MAX | A: | 19.36 | 34.1 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 33.86

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: PRESTRAIN
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.288"
SPECIMEN WIDTH: 0.722"
REFERENCES: PW002

NICKEL BASE

IN100

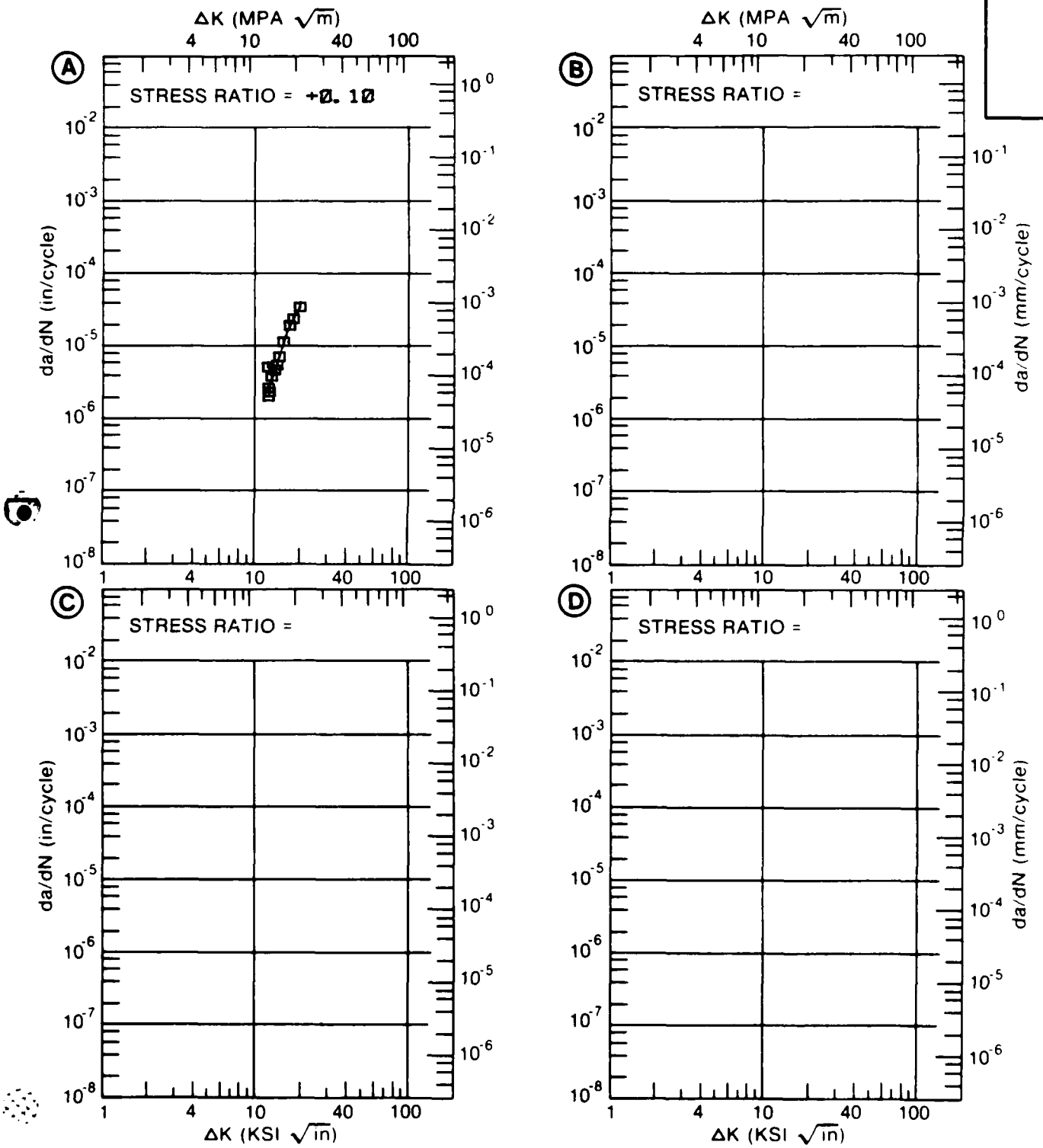



Figure 5.8.3.22

Table 5.9.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100 P/M-C

TEST CONDITIONS:

SPECIMEN ORIENTATION C-R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2050F 2HR OQ, 1600F 67HR AC, 1200F 24HR AC, 1400F 4HR AC | DISK | 0.05 | 0.01 | | | | | 26.9 | | |
| 2050F 2HR OQ, 1600F 67HR AC, 1200F 24HR AC, 1400F 4HR AC | DISK | 0.05 | 0.33 | | | | | 18.5 | | |
| 2050F 2HR OQ, 1600F 67HR AC, 1200F 24HR AC, 1400F 4HR AC | DISK | 0.05 | 20.00 | | | | | 6.16 | | |

TABLE 5.9.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.9.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE IN100 P/ M-G
CONDITION: 2050F 2HR OQ, 1600F .67HR AC, 1200F
24HR AC, 1400F 4HR AC

ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=15 MIN HOLD TRAPEZOIDAL | F(HZ)= 0.01 | F(HZ)= 0.33 | F(HZ)= 20.00 |
| DELTA K MIN | A: | 24.49 | 463. | | | |
| | B: | 13.36 | | 7.57 | | |
| | C: | 13.44 | | | 2.78 | |
| | D: | 15.92 | | | | 4.25 |
| | | 16.00 | | 9.13 | 7.49 | 4.27 |
| | | 20.00 | | 26.9 | 18.5 | 6.16 |
| | | 25.00 | 485. | 58.6 | 34.1 | 10.6 |
| | | 30.00 | 773. | 87.5 | 49.2 | 17.4 |
| | | 35.00 | 1226. | 114. | 64.3 | 26.2 |
| | | 40.00 | 1915. | 157. | 81.4 | 35.9 |
| | | 50.00 | 4412. | | | |
| | | 60.00 | 9530. | | | |
| | | 70.00 | 19994. | | | |
| | | 80.00 | 40505. | | | |
| | | 90.00 | 63096. | | | |
| DELTA K MAX | A: | 97.60 | 64557. | | | |
| | B: | 43.75 | | 214. | | |
| | C: | 46.90 | | | 112. | |
| | D: | 46.70 | | | | 47.6 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 31.42 | 15.26 | 17.71 | 24.67 |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2050F 2HR OQ, 1600F .67HR AC, 1200F 24HR AC, 1400F 4HR AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 158.2 KSI
ULT. STRENGTH: 176.9 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

IN100 P/M-G

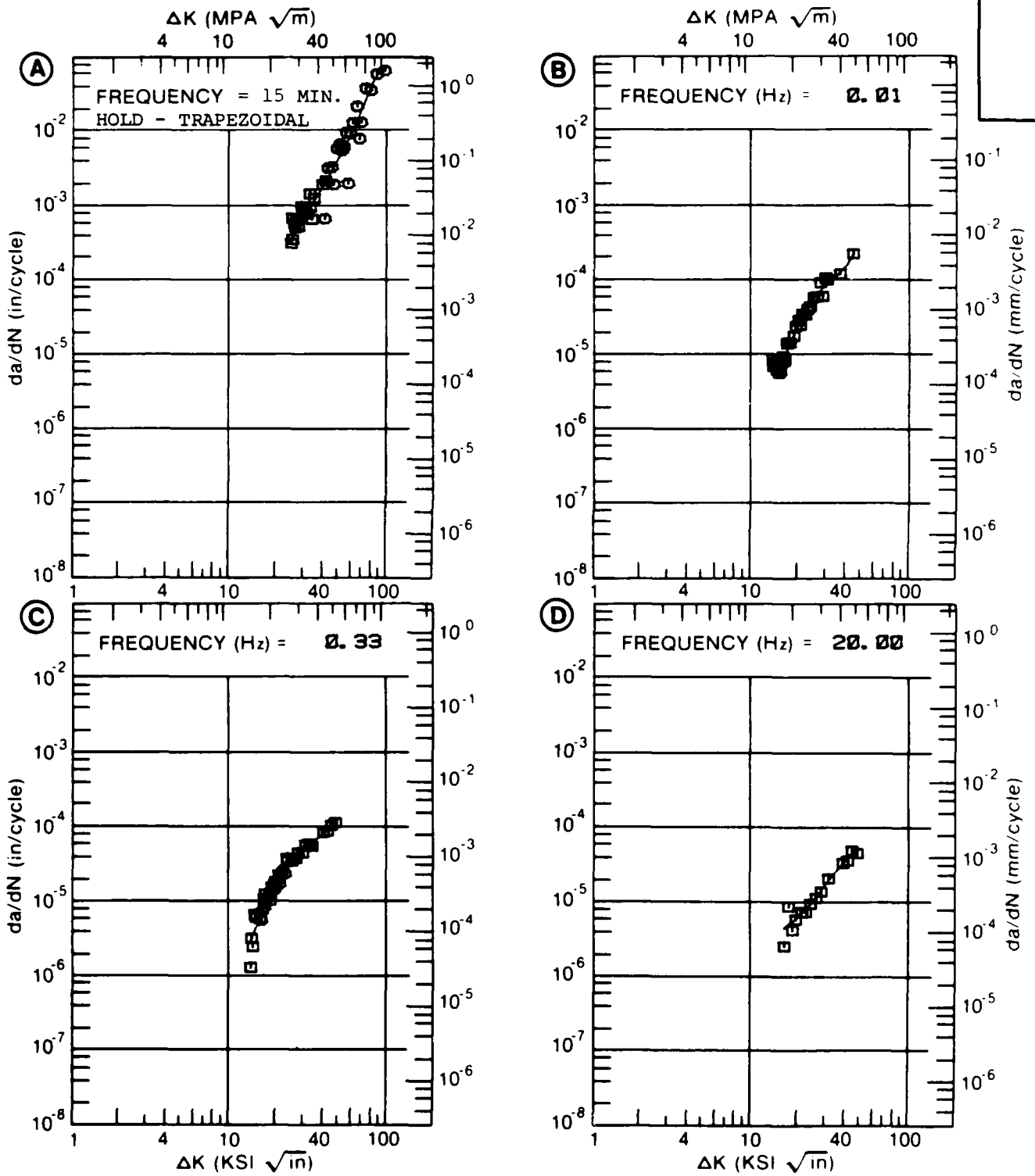



Figure 5.9.3.1

Table 5.10.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE NASA IIB-7 P/M

TEST CONDITIONS

SPECIMEN ORIENTATION: C-R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 16HRS TO 2000F 1HR OQ, 1400F 16HRS AC | DISK | 0.05 | 15 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM | | | | | 3592 | | |
| 1650F 16HRS TO 2000F 1HR OQ, 1400F 16HRS AC | DISK | 0.05 | 0.33 | | | | | 15.8 | 313 | |

TABLE 5.10.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.10.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE NASA IIB -7 P/M
CONDITION: 1650F 16HRS TO 2000F 1HR OQ, 1400F 16HRS AC
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=15 MIN HOLD F(HZ)= 0.33 TRAPEZOIDAL | | | |
| DELTA K MIN | A: | 13.30 | 315. | | | |
| | B: | 14.67 | | 4.87 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 1303. | 5.96 | | |
| | | 20.00 | 3593. | 15.8 | | |
| | | 25.00 | 6526. | 35.6 | | |
| | | 30.00 | 10084. | 60.3 | | |
| | | 35.00 | 16495. | 92.6 | | |
| | | 40.00 | 30610. | 137. | | |
| | | 50.00 | | 313. | | |
| DELTA K MAX | A: | 45.79 | 74742. | | | |
| | B: | 51.24 | | 483. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 70.69 | 16.34 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1650F 16HRS TO 2000F 1HR OQ. 1400F 16HRS AC
FORM: 1.75"TH DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR
YIELD STRENGTH: 208.6 KSI
ULT. STRENGTH: 257.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

NASA IB-7 P/M

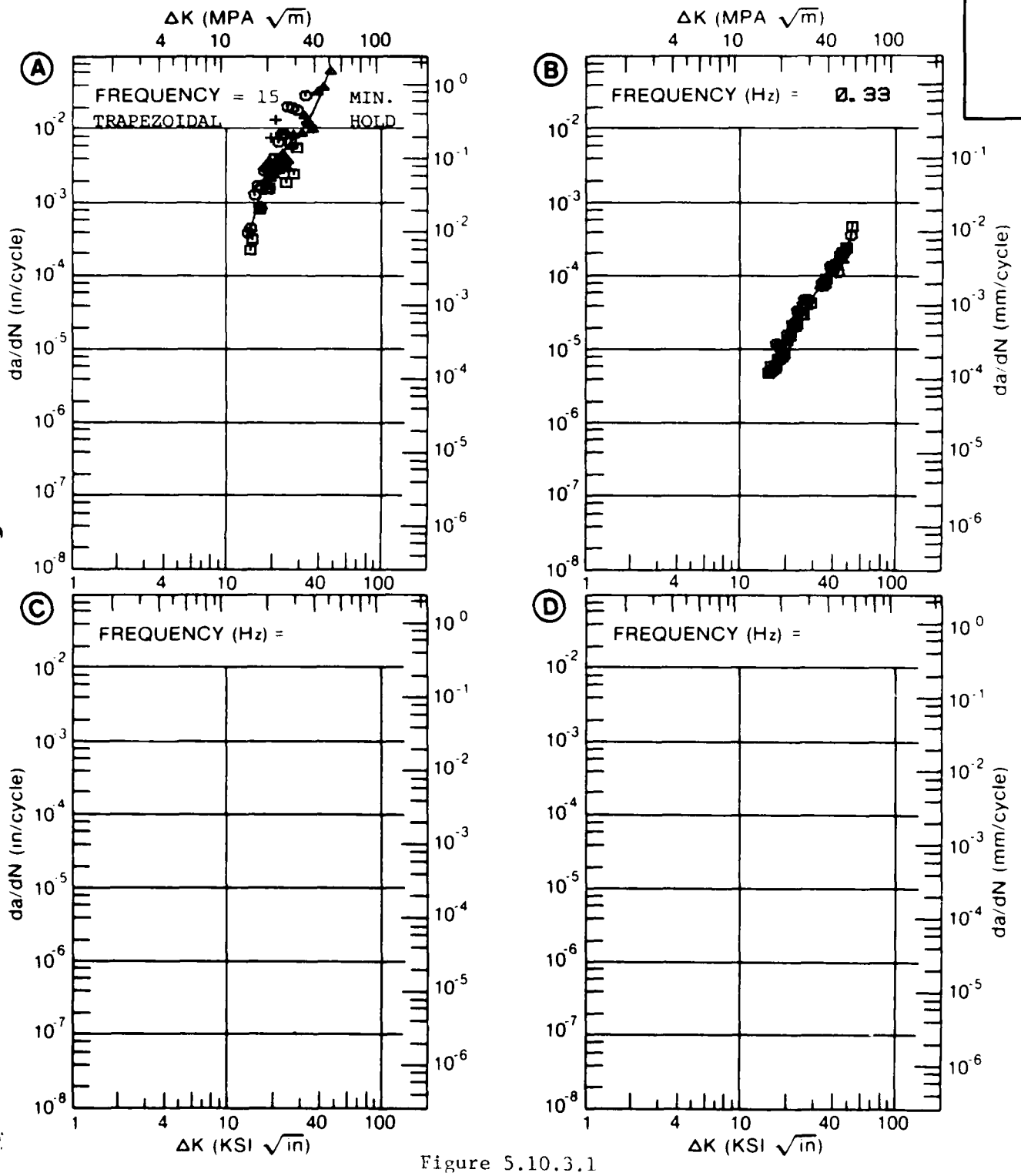



Figure 5.10.3.1

Table 5.11.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE P/M RENE 95

TEST CONDITIONS

SPECIMEN ORIENTATION C-R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC | DISK | 0.00 | 0.33 | | | | | 2.61 | 54.1 | |
| 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC | DISK | 0.00 | 0.02 | | | | | 4.03 | 200 | |

TABLE 5.11.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE RENE 95 (H&F)
CONDITION: 2000F 1HR, SQ AT 1000F, 1400F 16HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F AIR | | | |
| DELTA K MIN | A: | 13.58 | 2.15 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 4.38 | | | |
| | | 20.00 | 10.4 | | | |
| | | 25.00 | 17.9 | | | |
| | | 30.00 | 29.6 | | | |
| | | 35.00 | 49.8 | | | |
| | | 40.00 | 85.6 | | | |
| DELTA K MAX | A: | 45.70 | 141. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 16.33

| | |
|---|---|
| LIFE | 0.0-0 5 |
| PREDICTION | 0.5-0 8 |
| RATIO | 0.8-1 25 |
| SUMMARY | 1.25-2 0 |
| (NP/NA) | >2 0 |

CONDITION/HT: 2000F 1HR, SQ AT 1000F, 1400F 16HRS
FORM: 1.23"TH FORGING
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 171.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 0.600"
REFERENCES: GE001

NICKEL BASE

RENE 95 (H&F)

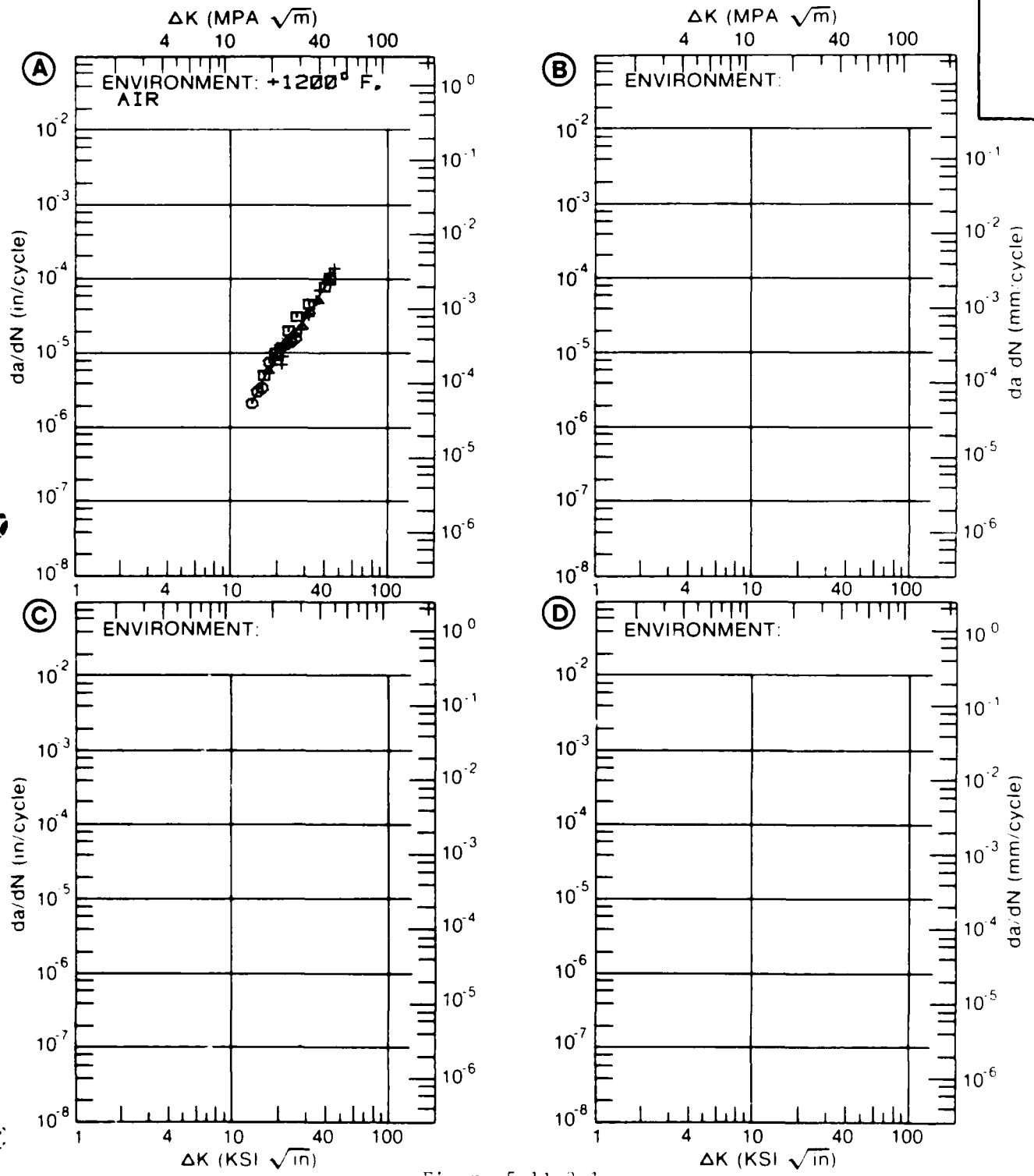



Figure 5.11.3.1

TABLE 5.11.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE P/M RENE 95
CONDITION: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR, .33HZ | E=+1200F AIR, .33HZ | E=+1200F AIR, 5 MIN HOLD | |
| DELTA K MIN | A: | 16.68 | .216 | | | |
| | B: | 17.22 | | .840 | | |
| | C: | 28.18 | | | 59.5 | |
| | D: | | | | | |
| | | 20.00 | .394 | 2.61 | | |
| | | 25.00 | 1.60 | 7.87 | | |
| | | 30.00 | 5.29 | 13.8 | 103. | |
| | | 35.00 | 11.8 | 19.9 | 250. | |
| | | 40.00 | 18.9 | 27.2 | 413. | |
| | | 50.00 | 27.6 | 54.1 | 1093. | |
| | | 60.00 | | 132. | 2403. | |
| | | 70.00 | | | 4006. | |
| | | 80.00 | | | 8368. | |
| DELTA K MAX | A: | 56.41 | 55.2 | | | |
| | B: | 63.62 | | 192. | | |
| | C: | 80.21 | | | 8535. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 24.24 | 27.95 | 7.78 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC
FORM: 2.50"TH DISK
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY:

YIELD STRENGTH: 165.7 KSI
ULT. STRENGTH: 228.6 KSI
SPECIMEN THK: 0.080"
SPECIMEN WIDTH: 2.000"
REFERENCES:GE008

NICKEL BASE

P/M RENE 95

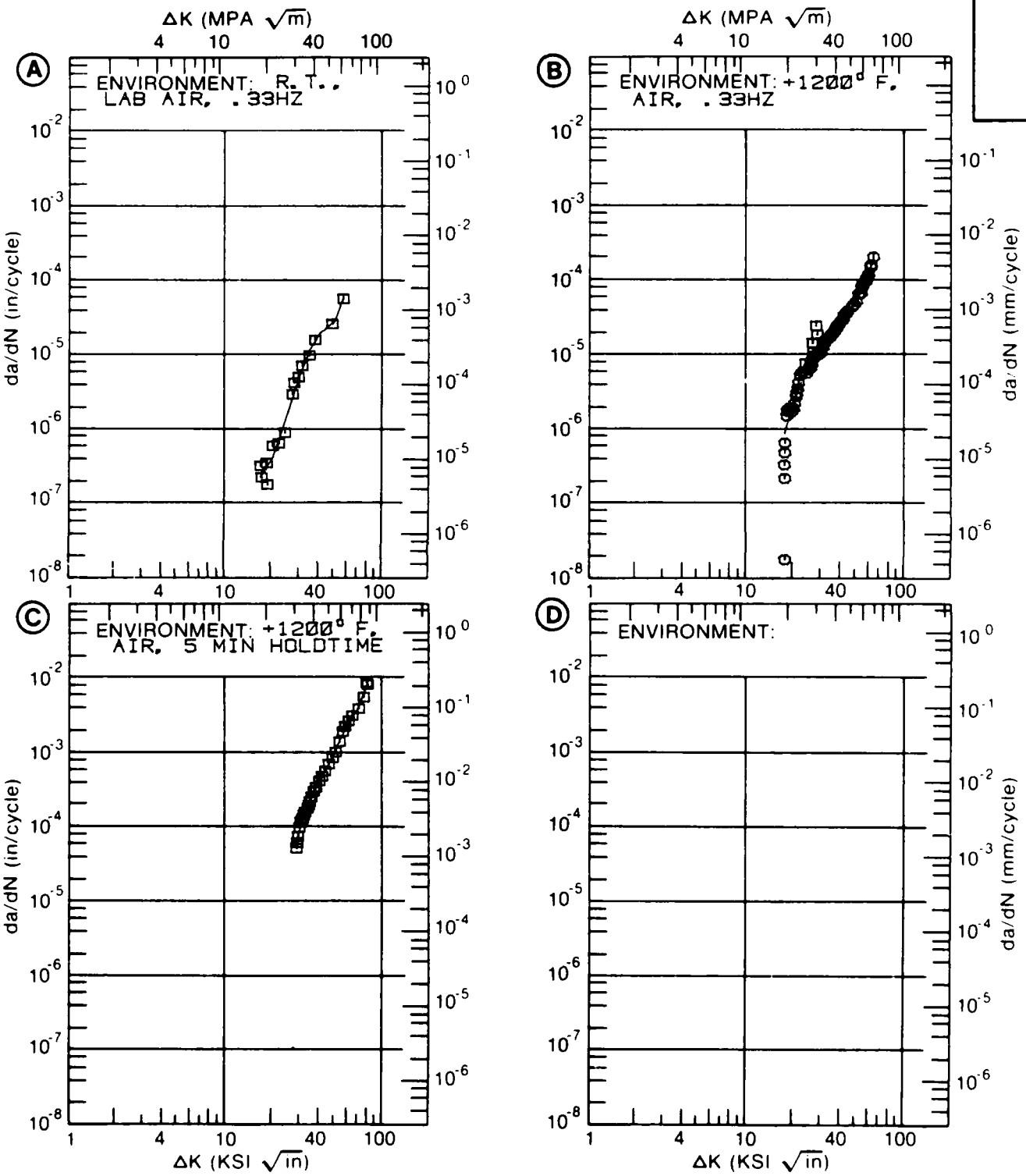



Figure 5.11.3.2

TABLE 5.11.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE P/M RENE 95
CONDITION: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F AIR, .33HZ | E=+1200F AIR, 5 MIN HOLD | | |
| DELTA K MIN | A: | 15.06 | .236 | | | |
| | B: | 24.98 | | 107. | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | .531 | | | |
| | | 20.00 | 5.00 | | | |
| | | 25.00 | 20.1 | 107. | | |
| | | 30.00 | 44.5 | 406. | | |
| | | 35.00 | 82.4 | | | |
| DELTA K MAX | A: | 36.31 | 96.2 | | | |
| | B: | 33.95 | | 2226. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 15.59 | 28.98 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC
FORM: 2.50"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY:

YIELD STRENGTH: 185.7 KSI
ULT. STRENGTH: 228.6 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 0.600"
REFERENCES: GE008

NICKEL BASE

P/M RENE 95

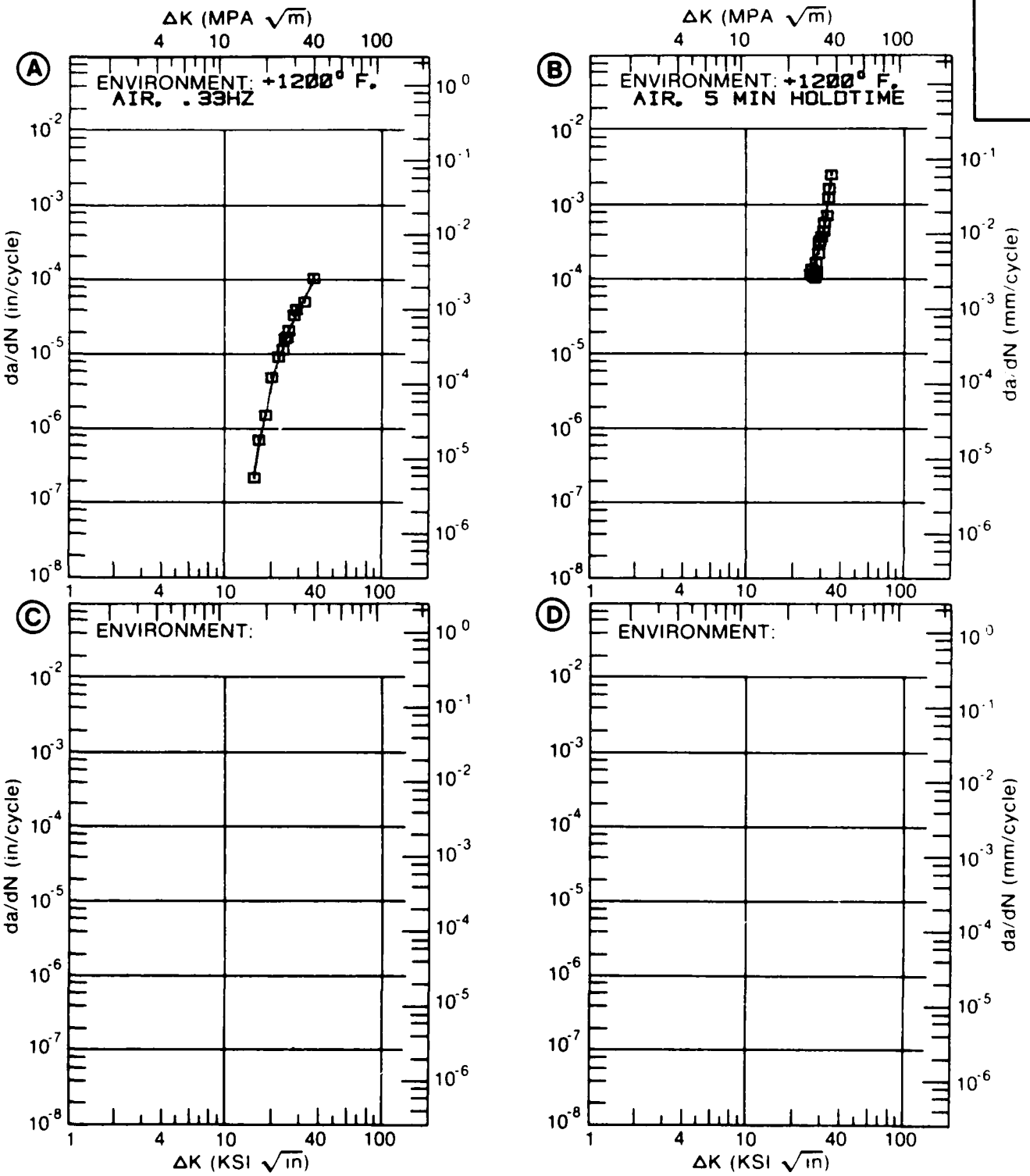



Figure 5.11.3.3

TABLE 5.11.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE P/M RENE 95
CONDITION: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F AIR - .02HZ | E=+1200F ARGON - .33HZ | | |
| DELTA K MIN | A: | 19.55 | 3.45 | | | |
| | B: | 17.82 | | 1.29 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 4.03 | 1.94 | | |
| | | 25.00 | 14.8 | 3.71 | | |
| | | 30.00 | 33.9 | 5.95 | | |
| | | 35.00 | 61.3 | 9.11 | | |
| | | 40.00 | 97.0 | 14.0 | | |
| | | 50.00 | 200. | 35.3 | | |
| | | 60.00 | 369. | | | |
| | | 70.00 | 662. | | | |
| DELTA K MAX | A: | 76.15 | 948. | | | |
| | B: | 51.58 | | 41.3 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.36 | 24.59 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 2080F 1HR AC. 1600F 1HR AC. 1200F 24HRS AC
FORM: 2.50"TH DISK
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY:

YIELD STRENGTH: 165.7 KSI
ULT. STRENGTH: 228.6 KSI
SPECIMEN THK: 0.080"
SPECIMEN WIDTH: 2.000"
REFERENCES: GE008, GE004

NICKEL BASE

P/M RENE 95

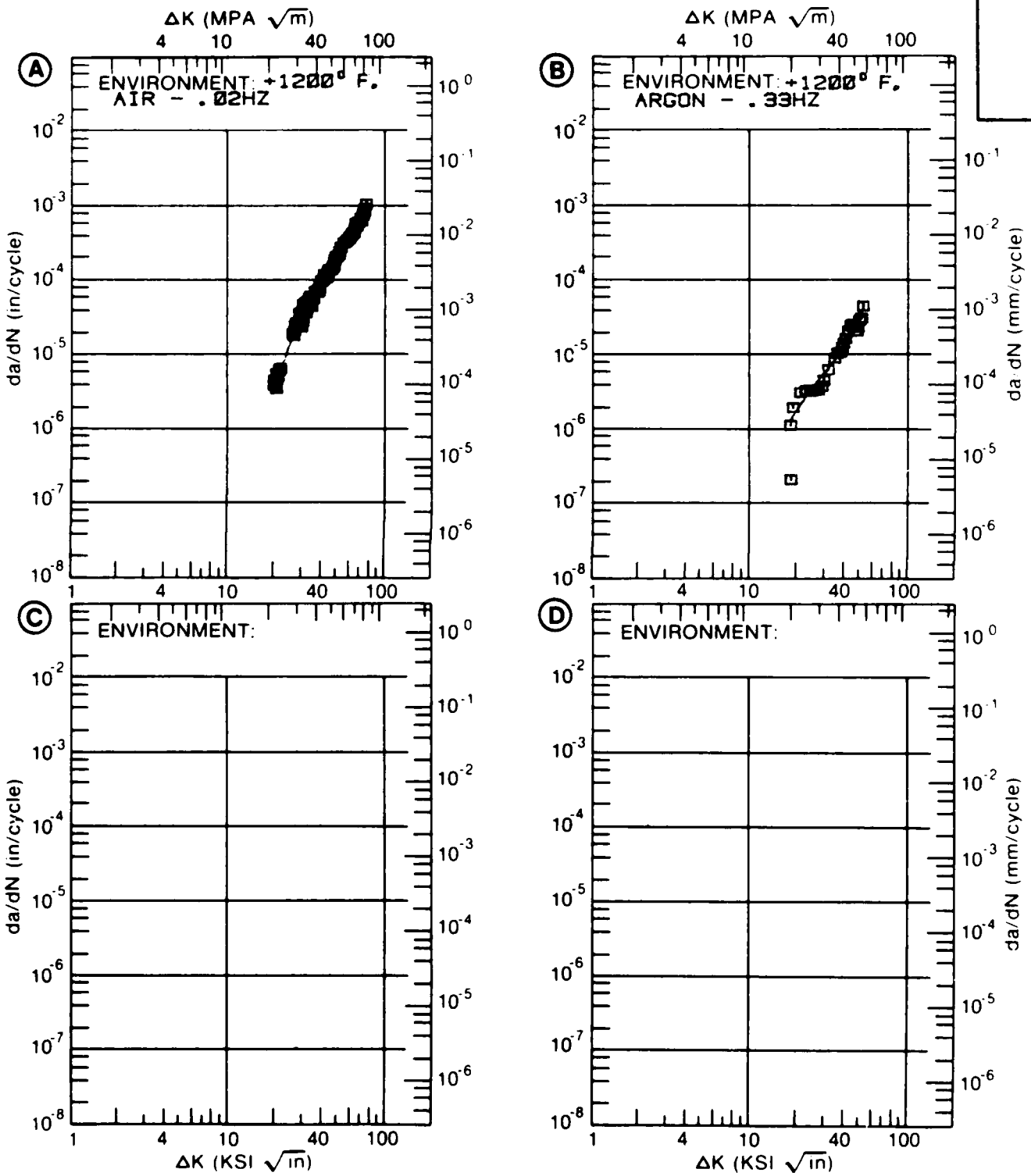



Figure 5.11.3.4

TABLE 5.11.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE P/M RENE 95
CONDITION: 2100F 1HR, SG AT 1000F, 1600F 1HR, 1200F 24HRS, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F AIR | | | |
| DELTA K MIN | A: | 12.70 | 2.95 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 3.24 | | | |
| | | 16.00 | 6.16 | | | |
| | | 20.00 | 9.97 | | | |
| | | 25.00 | 17.0 | | | |
| | | 30.00 | 31.2 | | | |
| | | 35.00 | 58.7 | | | |
| | | 40.00 | 110. | | | |
| | | 50.00 | 179. | | | |
| DELTA K MAX | A: | 56.60 | 708. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 24.46

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2100F 1HR. SQ AT 1000F 1600F 1HR. 1200F 24HRS. AC
FORM: 1.00"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 176.1 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 0.600"
REFERENCES: GE001

NICKEL BASE

P/M RENE 95

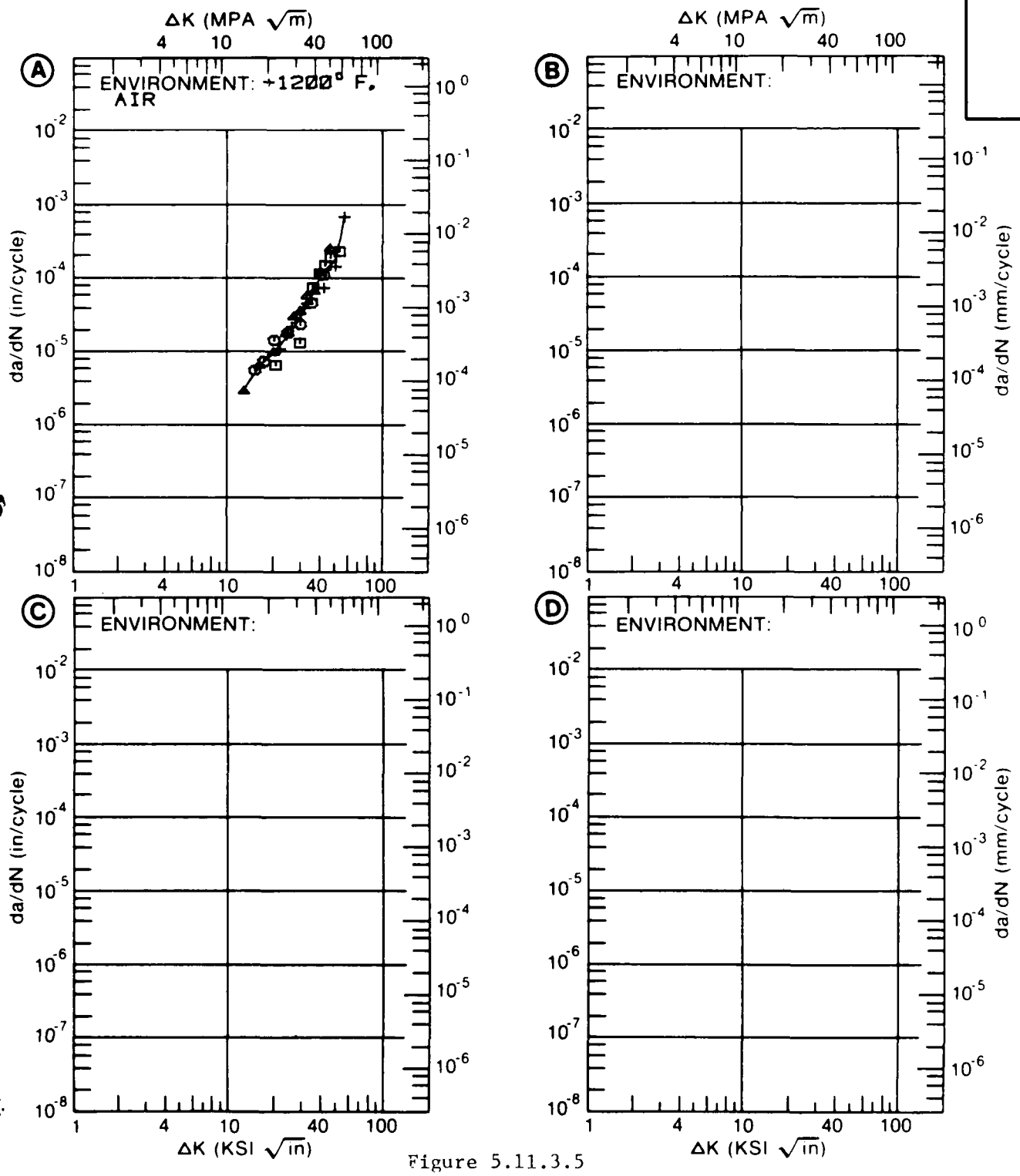



Figure 5.11.3.5

Table 5.12.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN ORIENTATION: Unknown

ENVIRONMENT: LAB AIR AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1850F 2HRS, 1350F 6HRS(FINE GS, SMALL PRECIPITATES) | BILLET | 0.10 | 10.00 | | | | | | 10.7 | |
| 2010F 2HR, 1350F 6HR(COARSE GS, SMALL PRECIPITATES) | BILLET | 0.10 | 10.00 | | | | | | 2.84 | |
| 2010F 2HR, 1600F 24HR(COARSE GS, LARGE PRECIPITATES) | BILLET | 0.10 | 10.00 | | | | | | 9.65 | |

Table 5.12.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN ORIENTATION: Unknown

ENVIRONMENT: AIR AT 800 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | FORGING | -1.00 | 0.17 | | | | | 4.87 | | |
| | FORGING | -0.50 | 0.17 | | | | | 5.56 | | |
| | FORGING | 0.50 | 0.17 | | | | | 5.93 | | |

Table 5.12.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN ORIENTATION Unknown

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | FORGING | -1.00 | 0.17 | | | | | 10.8 | | |
| | FORGING | -0.50 | 0.17 | | | | | 9.57 | | |
| | FORGING | 0.10 | 0.17 | | | | | 12.4 | 95.8 | |
| | FORGING | 0.80 | 0.17 | | | | 3.84 | | | |

Table 5.12.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN ORIENTATION C-R

ENVIRONMENT: AIR AT 1200 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | FORGING | 0.05 | 0.17 | | | | | 8.79 | | |
| | FORGING | 0.05 | 0.33 | | | | | | 49.5 | |
| | FORGING | 0.05 | 20.00 | | | | | 4.36 | | |
| | FORGING | 0.10 | 0.17 | | | | | 10.4 | | |
| | FORGING | 0.10 | 20.00 | | | | | 3.98 | | |
| | FORGING | 0.10 | 20.00 | | | | | 3.71 | | |
| | FORGING | 0.10 | 20.00 | | | | | 3.98 | | |
| | FORGING | 0.80 | 20.00 | | | | 1.28 | | | |
| 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC | DISK | 0.05 | 0.33 | | | | | 8.34 | 44.6 | |
| 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC | DISK | 0.05 | 20.00 | | | | | 3.86 | 29.7 | |

TABLE 5.12.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE WASPALOY
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+1200F AIR | E=+1200F ARGON | | |
| DELTA K MIN | A: | 14.91 | 5.71 | | | |
| | B: | 33.32 | | 18.2 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 6.28 | | | |
| | | 20.00 | 9.44 | | | |
| | | 25.00 | 15.3 | | | |
| | | 30.00 | 22.6 | | | |
| | | 35.00 | 29.8 | 21.9 | | |
| | | 40.00 | | 29.8 | | |
| | | 50.00 | | 35.3 | | |
| DELTA K MAX | A: | 35.87 | 31.0 | | | |
| | B: | 59.56 | | 42.8 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 2.05 | 9.70 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.250- 0.452"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

WASPALOY

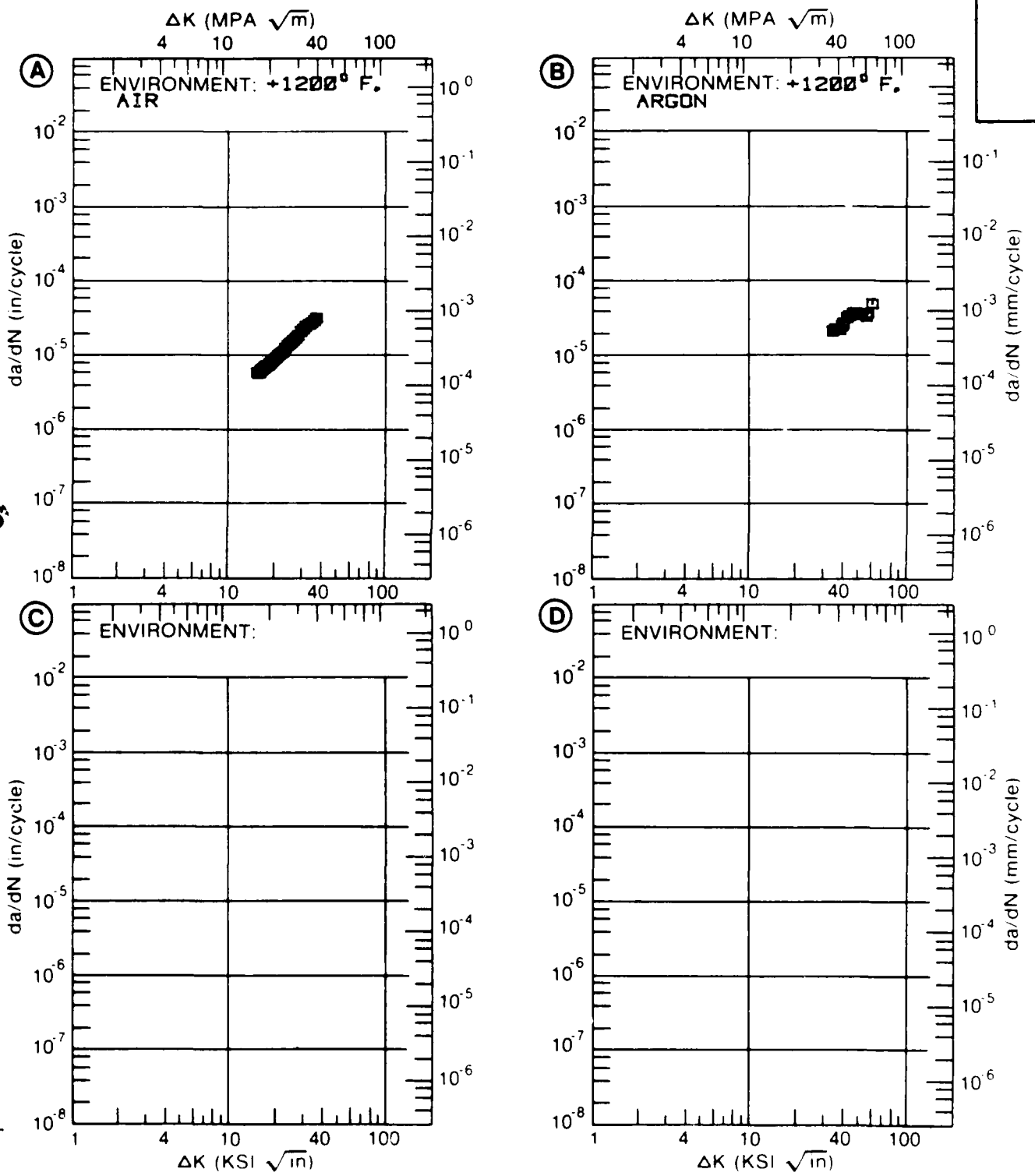



Figure 5.12.3.1

TABLE 5.12.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.2INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=-1.00 | R=-0.50 | R=+0.05 | |
| DELTA K MIN | A: | 15.16 | 1.67 | | | |
| | B: | 16.44 | | 1.37 | | |
| | C: | 21.55 | | | 3.81 | |
| | D: | | | | | |
| | | 16.00 | 2.16 | | | |
| | | 20.00 | 4.87 | 5.56 | | |
| | | 25.00 | 8.78 | 9.24 | 5.56 | |
| | | 30.00 | 14.1 | 14.5 | 8.66 | |
| | | 35.00 | 23.3 | | 13.7 | |
| | | 40.00 | | | 23.2 | |
| DELTA K MAX | A: | 37.90 | 32.1 | | | |
| | B: | 31.61 | | 18.5 | | |
| | C: | 41.48 | | | 27.5 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.42 | 9.14 | 2.64 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 800° F. AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.297- 0.303"
SPECIMEN WIDTH: 0.996- 0.997"
REFERENCES: PW001

NICKEL BASE

WASPALOY

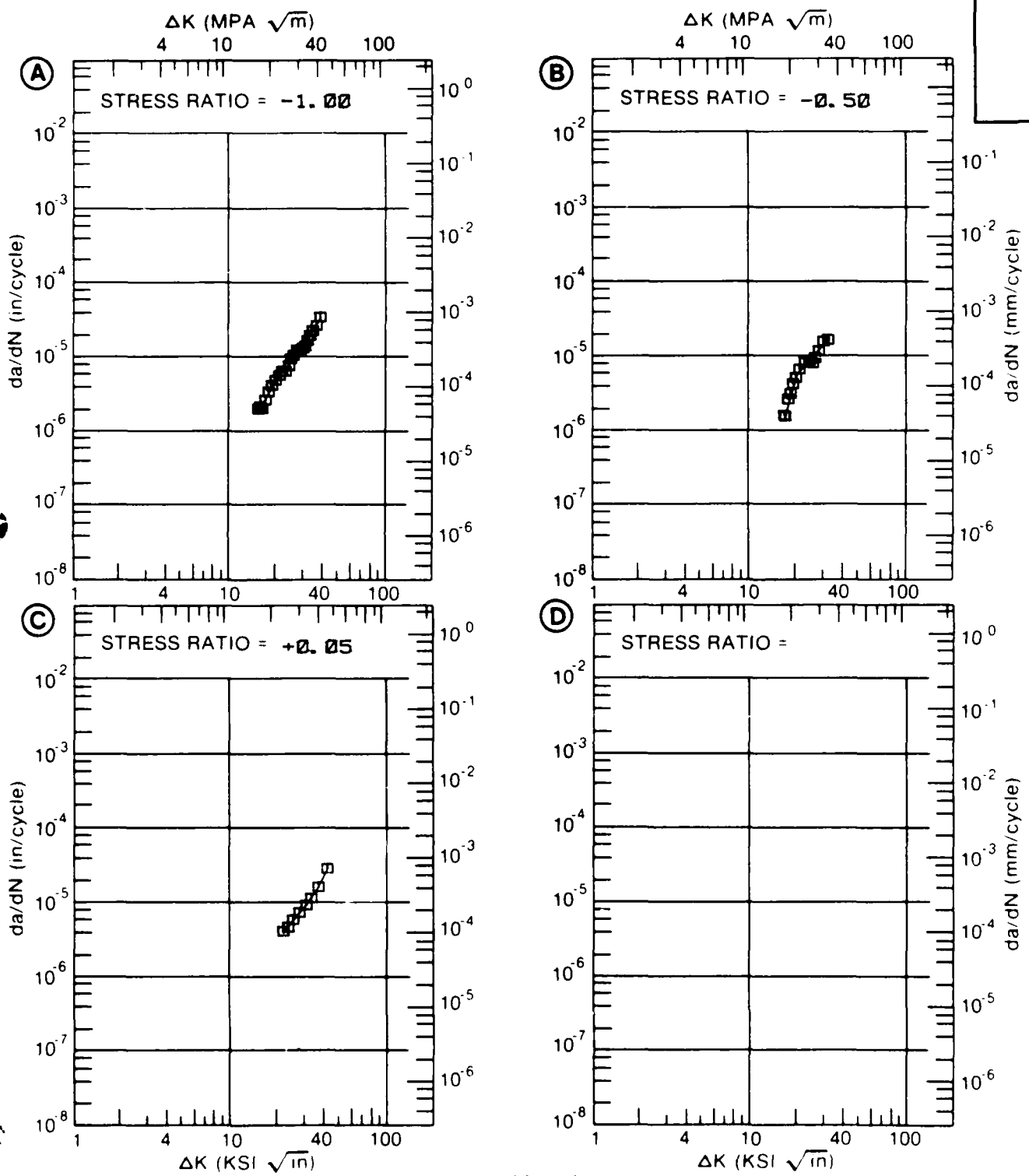



Figure 5.12.3.2

TABLE 5.12.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: + 800F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.50 | R=+0.80 | | |
| DELTA K MIN | A: | 15.92 | 3.93 | | | |
| | B: | 6.02 | | .434 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 7.00 | | .765 | | |
| | | 8.00 | | | | |
| | | 9.00 | | | | |
| | | 10.00 | | | | |
| | | 13.00 | | | | |
| | | 16.00 | 3.96 | | | |
| | | 20.00 | 5.93 | | | |
| | | 25.00 | 10.3 | | | |
| DELTA K MAX | A: | 28.39 | 14.8 | | | |
| | B: | 7.32 | | .791 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 2.90 | 22.36 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.300"
SPECIMEN WIDTH: 0.995- 0.998"
REFERENCES:PW001

NICKEL BASE

WASPALOY

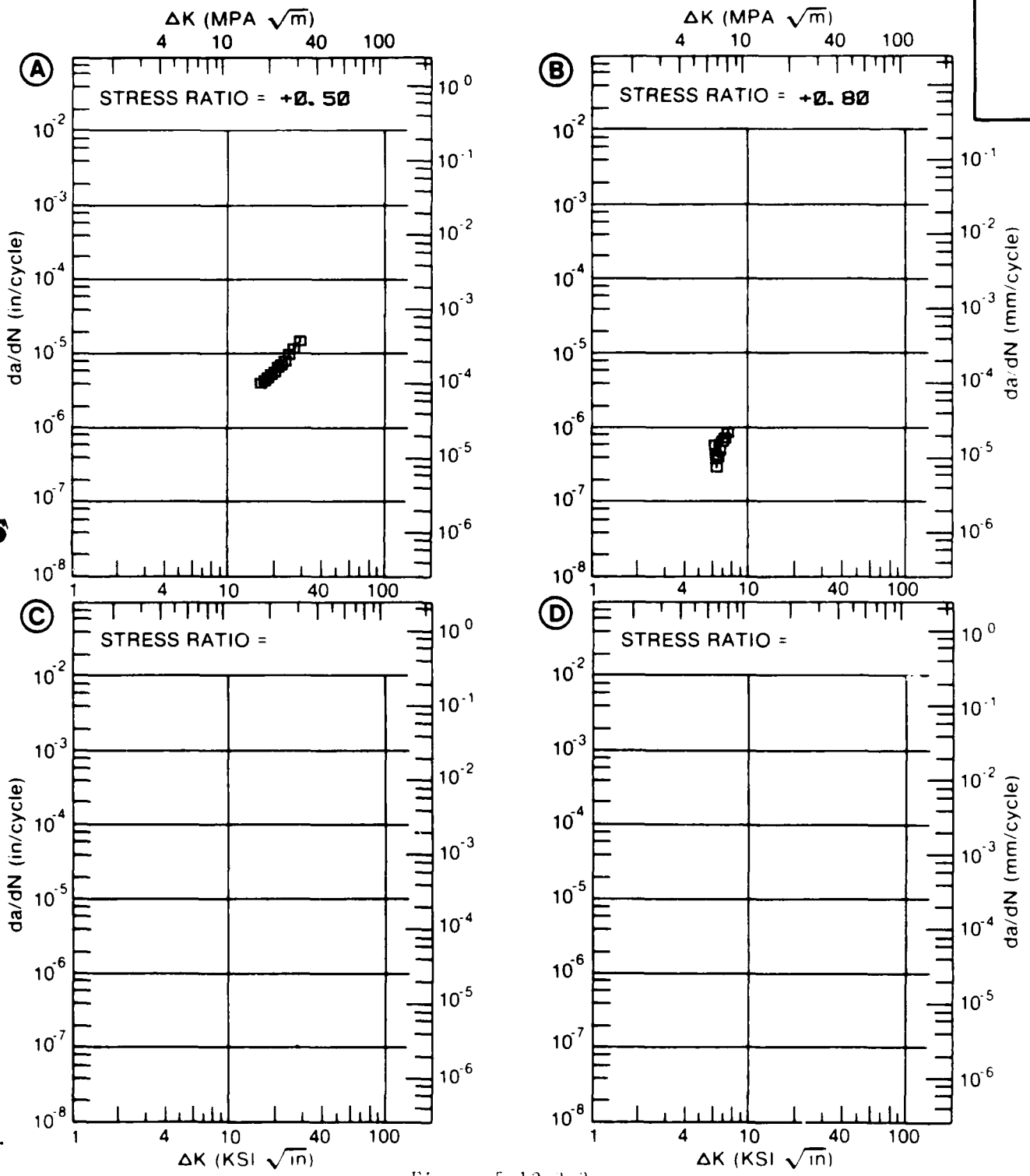



Figure 5.12.3.3

TABLE 5.12.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=-1.00 | R=-0.50 | R=+0.05 | |
| DELTA K MIN | A: | 11.63 | 2.52 | | | |
| | B: | 17.29 | | 7.33 | | |
| | C: | 23.34 | | | 11.6 | |
| | D: | | | | | |
| | | 13.00 | 3.66 | | | |
| | | 16.00 | 6.50 | | | |
| | | 20.00 | 10.8 | 9.57 | | |
| | | 25.00 | 17.1 | 11.4 | 13.6 | |
| | | 30.00 | 25.5 | | 20.4 | |
| | | 35.00 | | | 29.8 | |
| | | 40.00 | | | 44.8 | |
| DELTA K MAX | A: | 31.47 | 28.5 | | | |
| | B: | 27.24 | | 18.7 | | |
| | C: | 43.07 | | | 58.7 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.60 | 9.76 | 3.65 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.298- 0.301"
SPECIMEN WIDTH: 0.997- 0.998"
REFERENCES:PW001

NICKEL BASE

WASPALOY

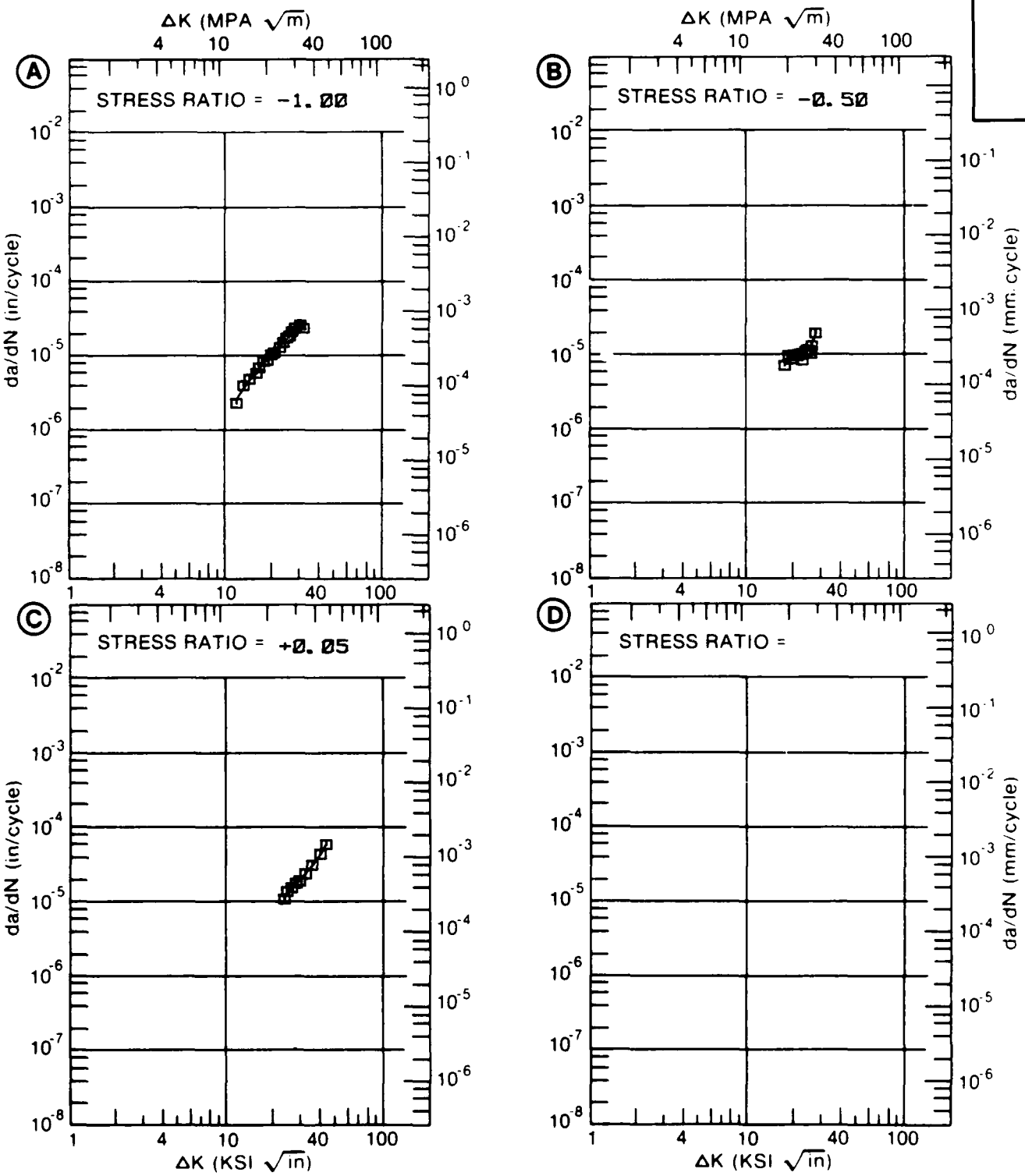



Figure 5.12.3.4

TABLE 5.12.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.13.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.55 | R=+0.80 | |
| DELTA K MIN | A: | 11.83 | 2.23 | | | |
| | B: | | | | | |
| | C: | 5.59 | | | .994 | |
| | D: | | | | | |
| | | 6.00 | | | 1.33 | |
| | | 7.00 | | | 2.07 | |
| | | 8.00 | | | 2.68 | |
| | | 9.00 | | | 3.22 | |
| | | 10.00 | | | 3.84 | |
| | | 13.00 | 3.36 | | | |
| | | 16.00 | 6.69 | | | |
| | | 20.00 | 12.4 | | | |
| | | 25.00 | 20.4 | | | |
| | | 30.00 | 28.4 | | | |
| | | 35.00 | 42.4 | | | |
| | | 40.00 | 66.1 | | | |
| | | 50.00 | 95.8 | | | |
| DELTA K MAX | A: | 51.07 | 94.1 | | | |
| | B: | | | | | |
| | C: | 11.87 | | | 5.72 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 13.15 | 0.00 | 7.13 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.287- 0.300"
SPECIMEN WIDTH: 0.973- 0.998"
REFERENCES: PW001

NICKEL BASE

WASPALOY

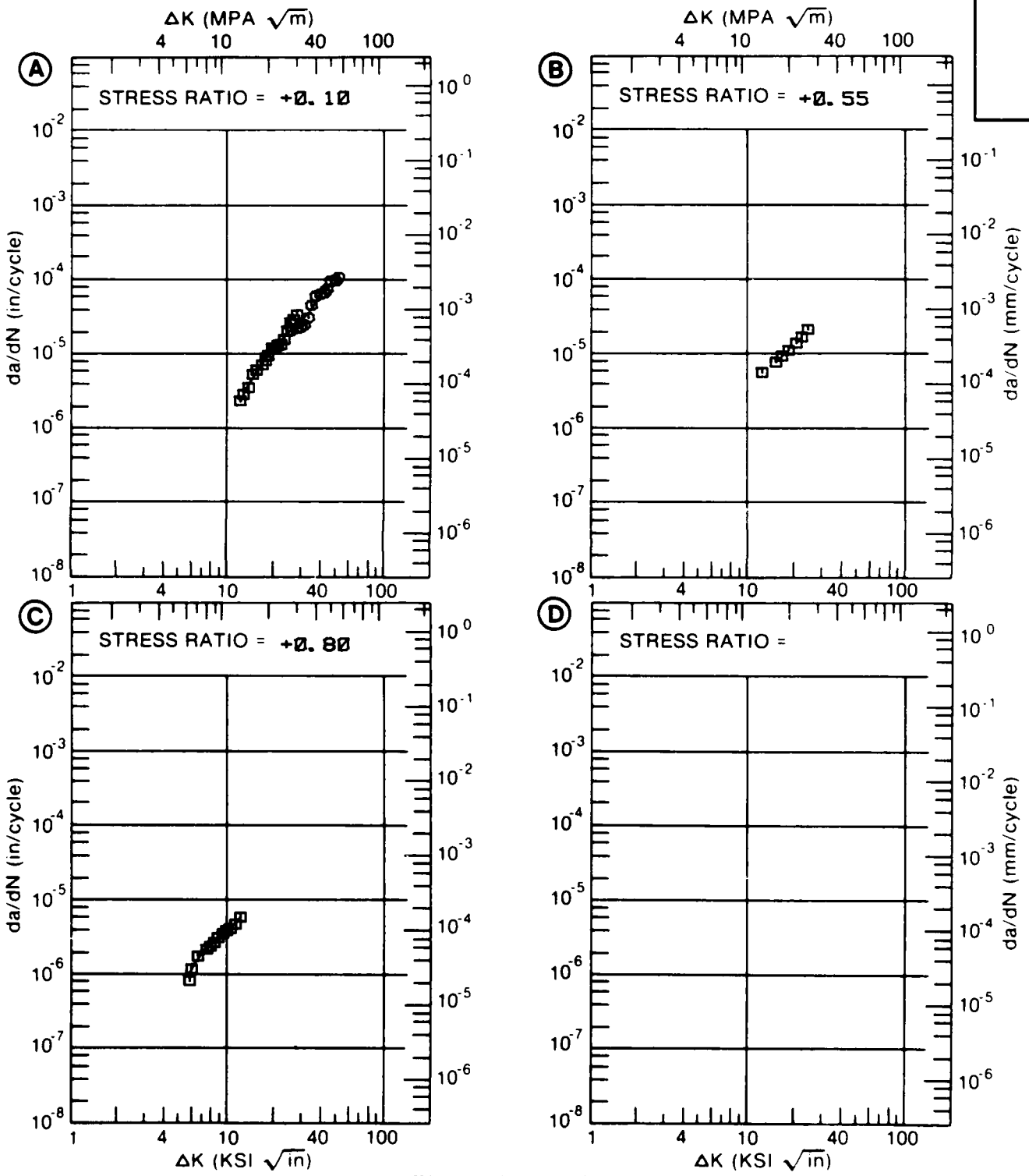



Figure 5.12.3.5

TABLE 5.12.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE WASPALOY
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E=+ 800F AIR | E=+1200F AIR | E=+1350F AIR | |
| DELTA K MIN A: | 21.55 | 3.81 | | | |
| DELTA K MIN B: | 23.34 | | 11.6 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 25.00 | 5.56 | 13.6 | | |
| | 30.00 | 8.66 | 20.4 | | |
| | 35.00 | 13.7 | 29.8 | | |
| | 40.00 | 23.2 | 44.8 | | |
| DELTA K MAX A: | 41.48 | 27.5 | | | |
| DELTA K MAX B: | 43.07 | | 58.7 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 2.64 | 3.65 | 0.00 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.17 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.301- 0.303"
SPECIMEN WIDTH: 0.996- 0.998"
REFERENCES:PW001

NICKEL BASE

WASPALOY

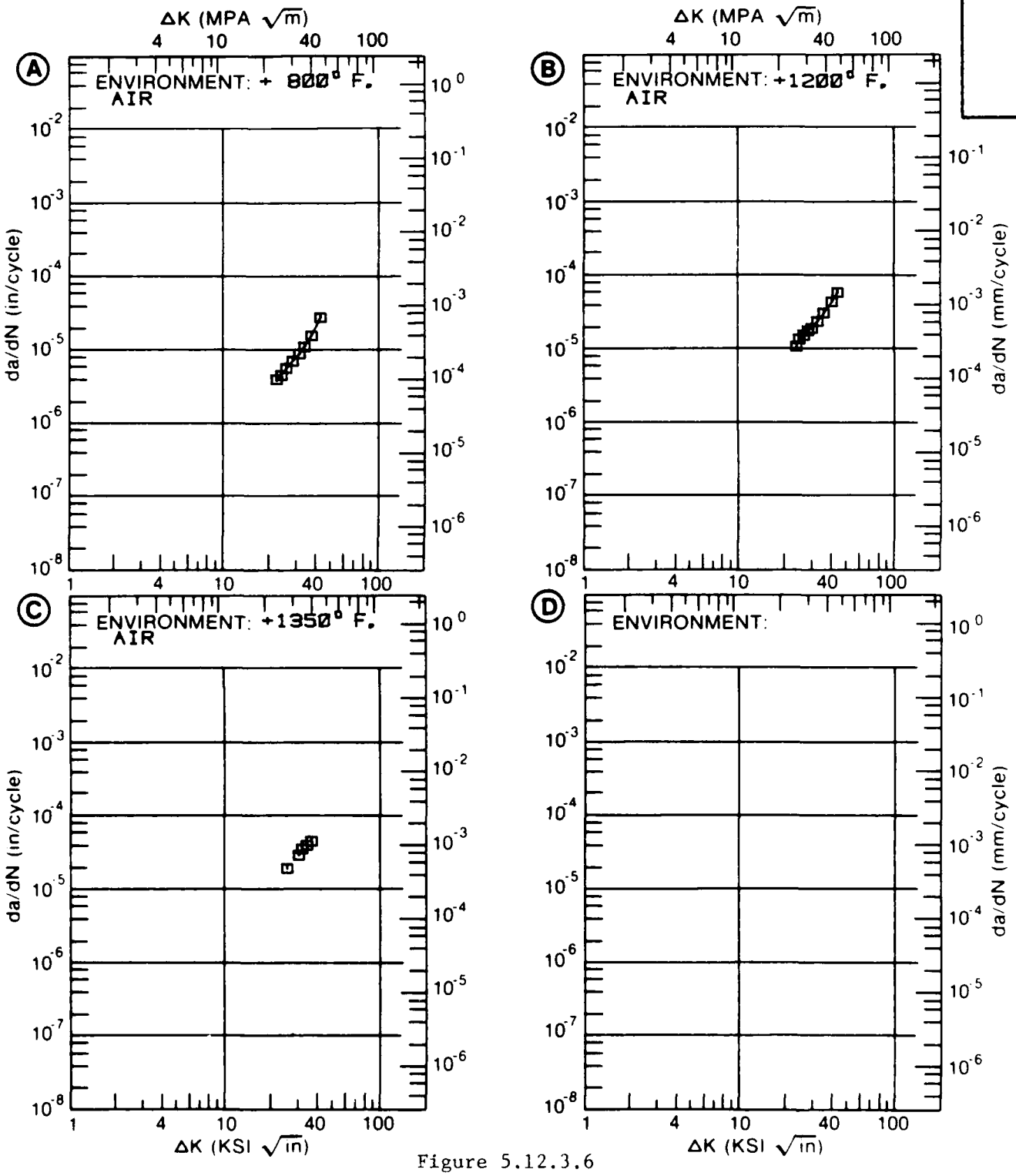



Figure 5.12.3.6

TABLE 5.12.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.80 | | |
| DELTA K MIN | A: | 16.66 | 1.93 | | | |
| | B: | 6.75 | | .761 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 7.00 | | .801 | | |
| | | 8.00 | | .947 | | |
| | | 9.00 | | 1.10 | | |
| | | 10.00 | | 1.28 | | |
| | | 13.00 | | 2.43 | | |
| | | 16.00 | | | | |
| | | 20.00 | 3.98 | | | |
| | | 25.00 | 7.43 | | | |
| | | 30.00 | 11.0 | | | |
| | | 35.00 | 15.1 | | | |
| | | 40.00 | 20.4 | | | |
| DELTA K MAX | A: | 42.08 | 23.2 | | | |
| | B: | 14.64 | | 3.92 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 14.93 | 7.70 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 20.00 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.300- 0.500"
SPECIMEN WIDTH: 2.503- 2.518"
REFERENCES: PW001

NICKEL BASE

WASPALOY

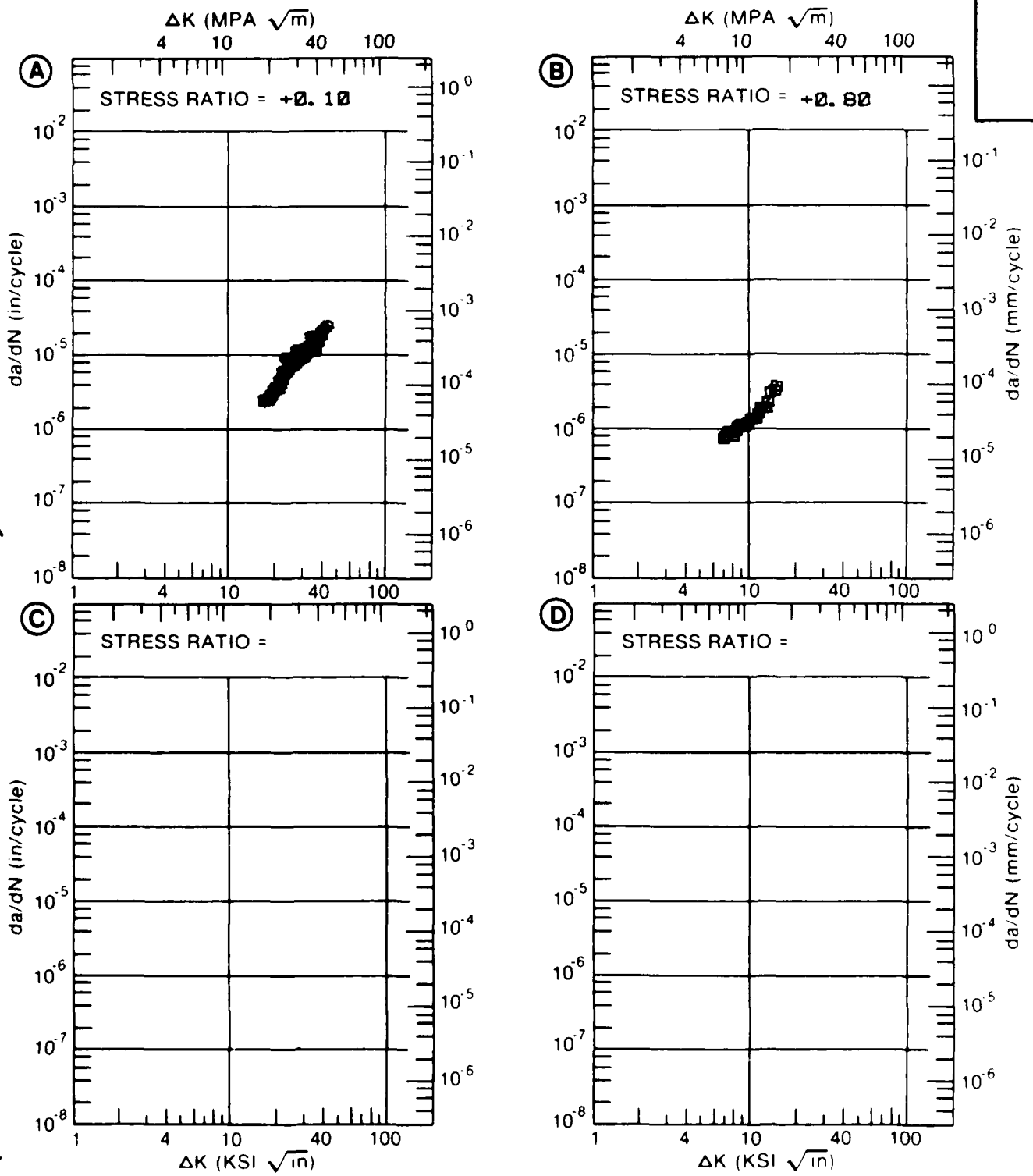



Figure 5.12.3.7

TABLE 5.12.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.8 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1350F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 31.69 | 19.0 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 35.00 | 24.5 | | | |
| | | 40.00 | 39.1 | | | |
| | | 50.00 | 89.5 | | | |
| | | 60.00 | 138. | | | |
| DELTA K MAX | A: | 60.02 | 138. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 11.96

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 2 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY:
ENVIRONMENT: +1350° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.299- 0.300"
SPECIMEN WIDTH: 2.504- 2.511"
REFERENCES: PW001

NICKEL BASE

WASPALOY

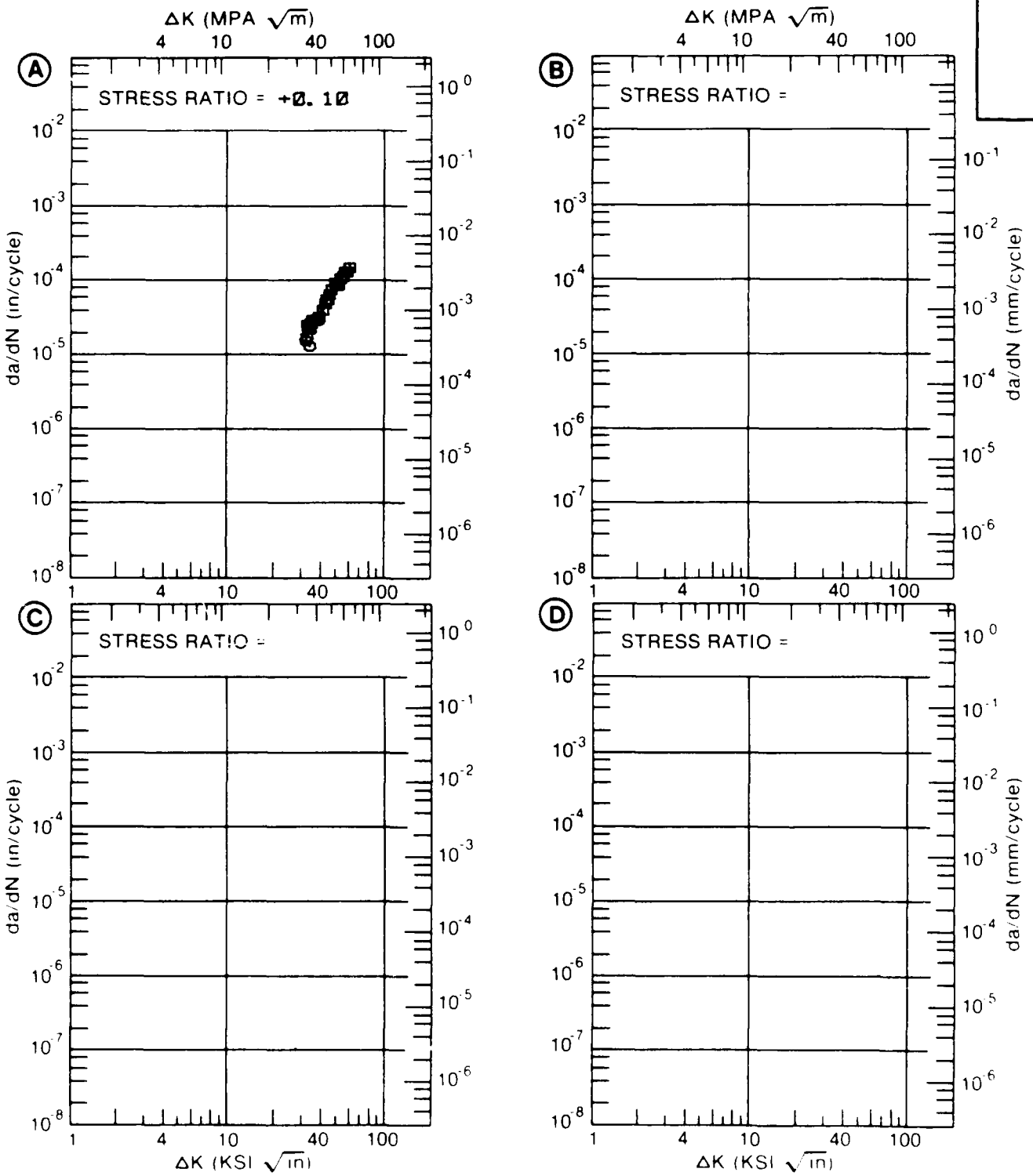



Figure 5.12.3.8

TABLE 5.12.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE WASPALOY
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 800F AIR | E=+1200F AIR | E=+1350F AIR | |
| DELTA K MIN | A: | 19.79 | 1.24 | | | |
| | B: | | | | | |
| | C: | 23.76 | | | 17.5 | |
| | D: | | | | | |
| | | 20.00 | 1.29 | | | |
| | | 25.00 | 2.69 | | 19.0 | |
| | | 30.00 | 4.53 | | 22.5 | |
| | | 35.00 | 7.38 | | 24.1 | |
| | | 40.00 | 10.3 | | 25.8 | |
| | | 50.00 | 11.8 | | 34.3 | |
| DELTA K MAX | A: | 57.73 | 21.1 | | | |
| | B: | | | | | |
| | C: | 56.57 | | | 47.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.40 | 0.00 | 10.70 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.17 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.102- 0.107"
SPECIMEN WIDTH: 2.493- 2.505"
REFERENCES: PW001

NICKEL BASE

WASPALOY

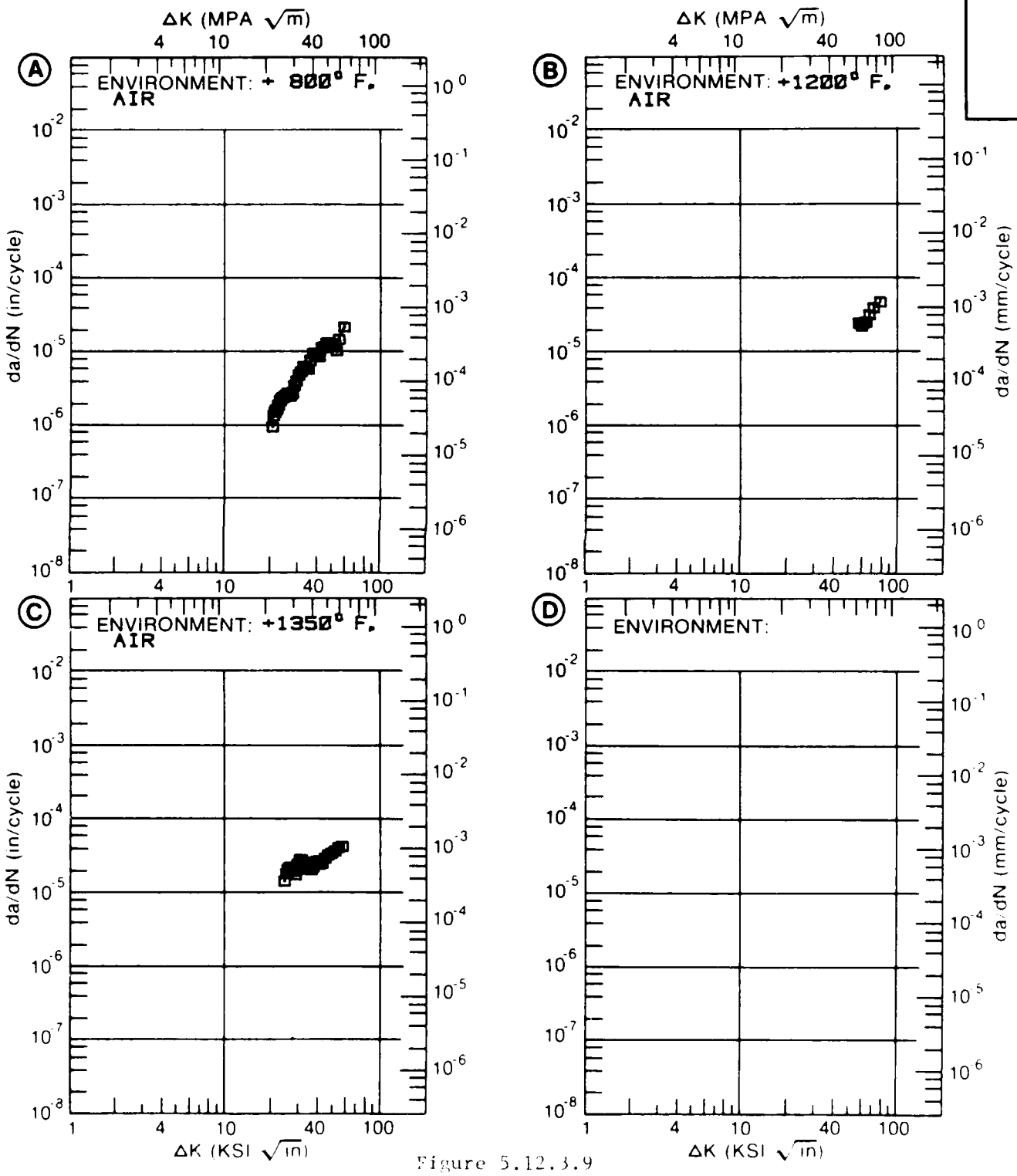



Figure 5.12.3.9

TABLE 5.12.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE WASPALOY
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 800F AIR SP. THK. =. 104" | E=+ 800F AIR SP. THK. =. 298-.499" | | |
| DELTA K MIN | A: | 19.79 | 1.24 | | | |
| | B: | 17.25 | | 1.46 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 1.29 | 3.33 | | |
| | | 25.00 | 2.69 | 6.27 | | |
| | | 30.00 | 4.53 | 9.39 | | |
| | | 35.00 | 7.40 | 13.3 | | |
| | | 40.00 | 10.3 | 19.0 | | |
| | | 50.00 | 11.8 | 33.1 | | |
| DELTA K MAX | A: | 57.73 | 20.9 | | | |
| | B: | 58.47 | | 59.7 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.38 | 17.47 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 3 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.17 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.104- 0.499"
SPECIMEN WIDTH: 2.486- 2.505"
REFERENCES: PW001

NICKEL BASE

WASPALOY

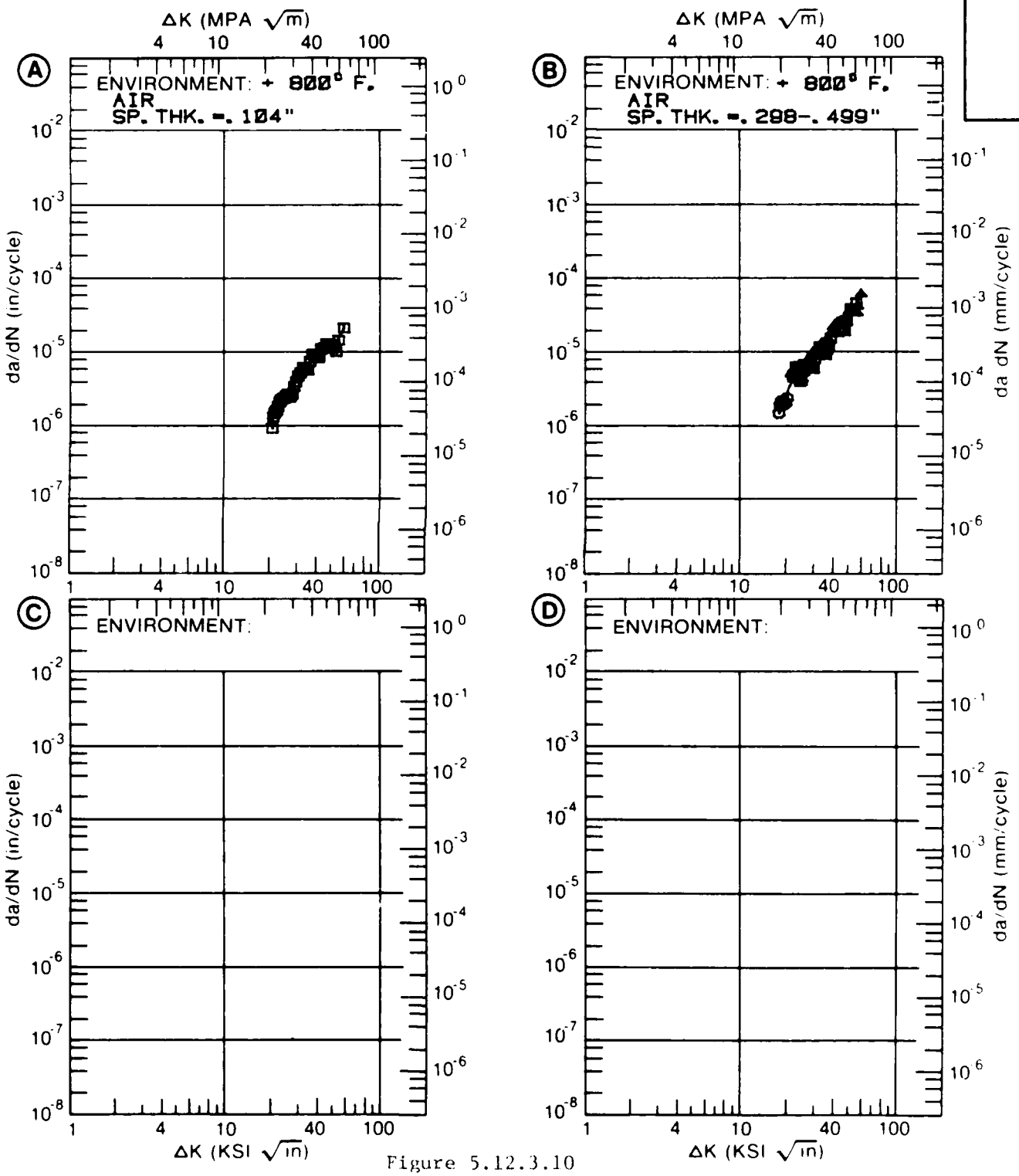



Figure 5.12.3.10

TABLE 5.12.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE WASPALOY
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=+ 800F AIR | E=+1200F AIR | | |
| DELTA K MIN | A: | 20.94 | 2.96 | | | |
| | B: | 16.66 | | 1.93 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | | 3.98 | | |
| | | 25.00 | 4.45 | 7.43 | | |
| | | 30.00 | 6.72 | 11.0 | | |
| | | 35.00 | 9.60 | 15.1 | | |
| | | 40.00 | 13.3 | 20.4 | | |
| DELTA K MAX | A: | 46.62 | 19.9 | | | |
| | B: | 42.08 | | 23.2 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.52 | 14.93 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 2 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY: 20.00 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.302- 0.500"
SPECIMEN WIDTH: 2.508- 2.518"
REFERENCES: PW001

NICKEL BASE

WASPALOY

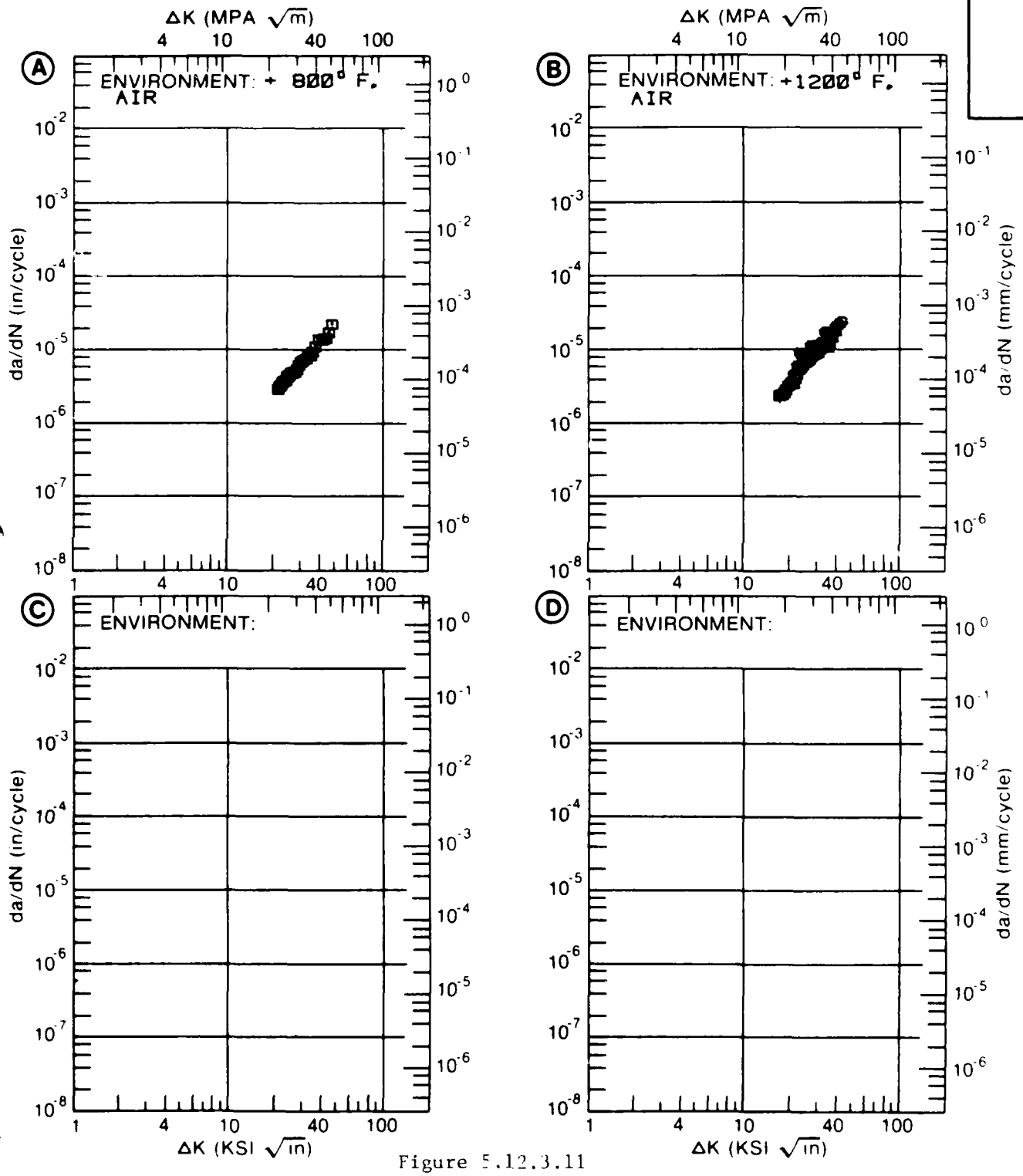



Figure 5.12.3.11

TABLE 5.12.2.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.12 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.17 | F(HZ)= 0.33 | F(HZ)= 20.00 | |
| DELTA K MIN | A: | 17.60 | 6.23 | | | |
| | B: | 29.22 | | 17.0 | | |
| | C: | 18.78 | | | 3.64 | |
| | D: | | | | | |
| | | 20.00 | 8.79 | | 4.36 | |
| | | 25.00 | 13.4 | | 7.38 | |
| | | 30.00 | 19.4 | 18.6 | 10.6 | |
| | | 35.00 | 31.4 | 27.4 | 14.6 | |
| | | 40.00 | | 34.3 | 19.9 | |
| | | 50.00 | | 49.5 | | |
| | | 60.00 | | 82.0 | | |
| | | 70.00 | | 169. | | |
| DELTA K MAX | A: | 37.21 | 40.8 | | | |
| | B: | 76.26 | | 299. | | |
| | C: | 44.85 | | | 27.2 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.03 | 8.60 | 4.94 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 2 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.432- 0.753"
SPECIMEN WIDTH: 2.502- 2.519"
REFERENCES: PW001

NICKEL BASE

WASPALOY

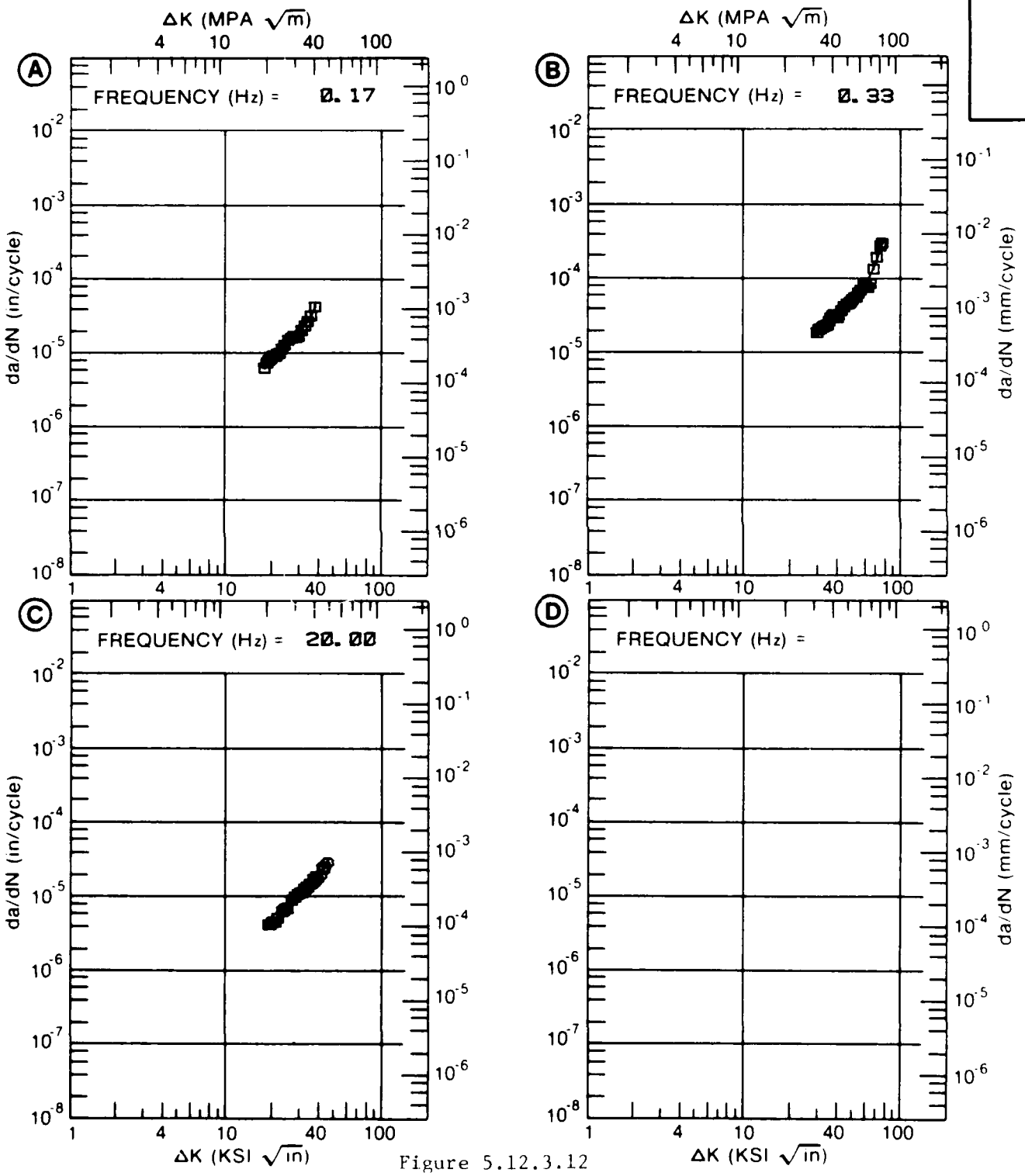



Figure 5.12.3.12

TABLE 5.12.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.13INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A F(HZ)= F=2 MIN HOLD TRAPEZOIDAL | B F(HZ)= F=5 MIN HOLD TRAPEZOIDAL | C F(HZ)= F=15 MIN HOLD TRAPEZOIDAL | D |
|---|---|---|---|---|---|---|
| DELTA K MIN | A: | 23.74 | 18.1 | | | |
| | B: | 44.65 | | 172. | | |
| | C: | 23.65 | | | 17.2 | |
| | D: | | | | | |
| | | 25.00 | 21.8 | | 25.1 | |
| | | 30.00 | 39.5 | | 71.8 | |
| | | 35.00 | 63.4 | | 145. | |
| | | 40.00 | 96.5 | | 245. | |
| | | 50.00 | 215. | 477. | 563. | |
| | | 60.00 | 491. | 861. | 1195. | |
| | | 70.00 | | 1259. | 2595. | |
| | | 80.00 | | | 5946. | |
| DELTA K MAX | A: | 67.17 | 544. | | | |
| | B: | 78.46 | | 2633. | | |
| | C: | 84.43 | | | 8749. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 12.50 | 10.08 | 16.05 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 3 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.316- 0.422"
SPECIMEN WIDTH: 2.504- 2.509"
REFERENCES: PW001

NICKEL BASE

WASPALOY

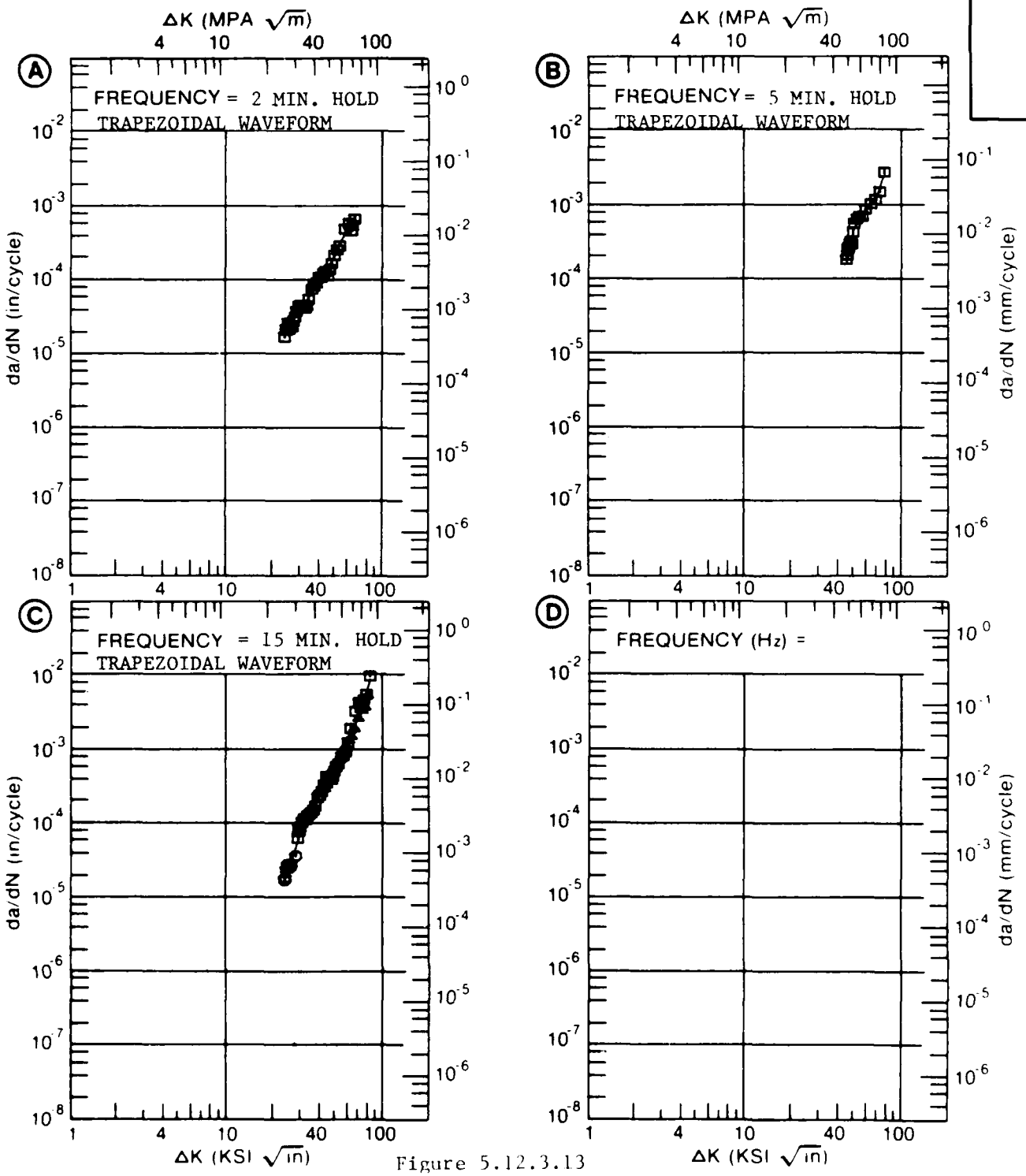



Figure 5.12.3.13

TABLE 5.12.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.14 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.01 | F(HZ)= 0.17 | F(HZ)= 20.00 | |
| DELTA K MIN | A: | 21.41 | 13.6 | | | |
| | B: | 16.71 | | 7.03 | | |
| | C: | 16.66 | | | 2.24 | |
| | D: | | | | | |
| | | 20.00 | | 10.4 | 3.71 | |
| | | 25.00 | 20.9 | 17.1 | 7.90 | |
| | | 30.00 | 31.4 | 25.1 | 11.1 | |
| | | 35.00 | 45.6 | 33.6 | 14.2 | |
| | | 40.00 | 69.5 | 41.5 | 20.9 | |
| DELTA K MAX | A: | 45.95 | 127. | | | |
| | B: | 42.17 | | 44.6 | | |
| | C: | 42.08 | | | 26.1 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 8.12 | 8.21 | 13.97 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 2 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.299- 0.500"
SPECIMEN WIDTH: 0.998- 2.518"
REFERENCES: PW001

NICKEL BASE

WASPALOY

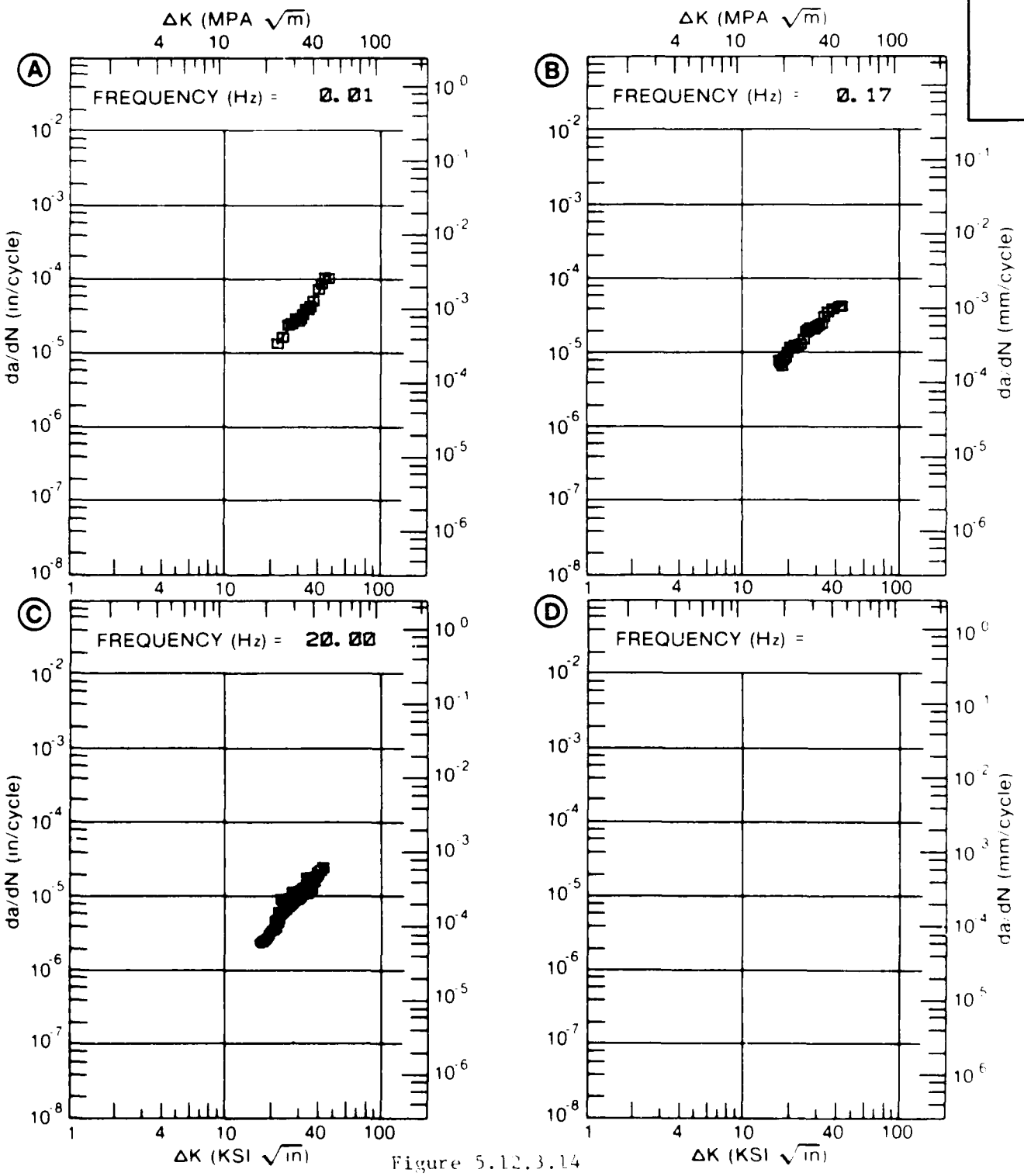



Figure 5.12.3.14

TABLE 5.12.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.15 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION: 1850F 2HRS, 1350F 6HRS(FINE GS, SMALL PRECIPITATES)
ENVIRONMENT: R.T., LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 27.75 | 1.09 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 30.00 | 1.38 | | | |
| | | 35.00 | 2.76 | | | |
| | | 40.00 | 4.58 | | | |
| | | 50.00 | 10.7 | | | |
| DELTA K MAX | A: | 53.11 | 14.5 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 4.51

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1850F 2HRS, 1350F 6HRS (FINE GS, SMALL PRECIPITATES)
FORM: 1.18"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 145.0 KSI
ULT STRENGTH 249.0 KSI
SPECIMEN THK 0.125"
SPECIMEN WIDTH 1.250"
REFERENCES UC001

NICKEL BASE

WASPALOY

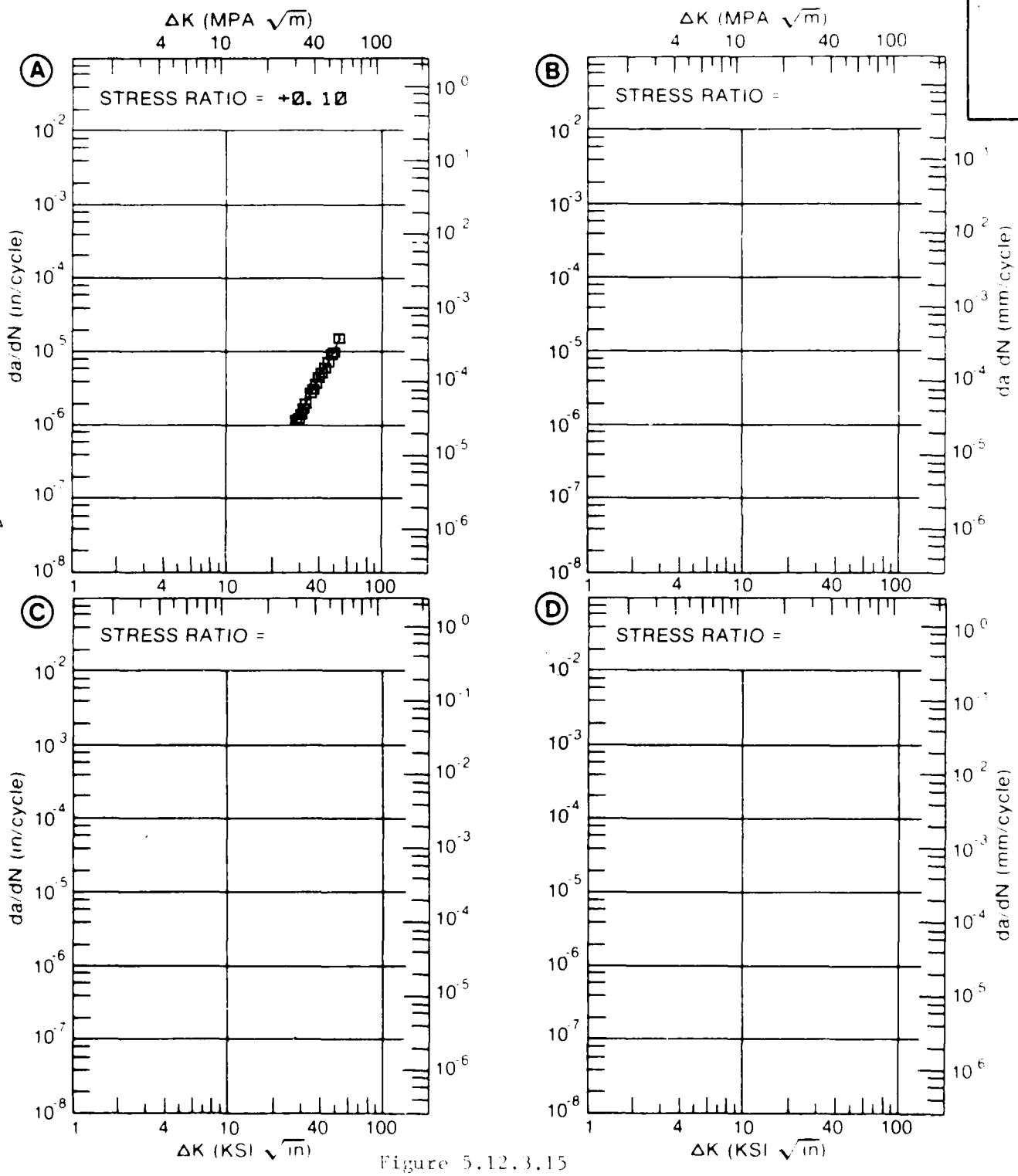



Figure 5.12.3.15

TABLE 5.12.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.16 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION: 1850F 2HR, 1600F 24HR(FINE GS, LARGE PRECIPITATES)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 25.47 | 1.02 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 30.00 | 2.33 | | | |
| | | 35.00 | 4.39 | | | |
| | | 40.00 | 7.12 | | | |
| DELTA K MAX | A: | 45.09 | 10.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 3.40

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT. 1850F 2HR, 1600F 24HR (FINE GS, LARGE PRECIPITATES)
FORM. 1.18"TH BILLET
SPECIMEN TYPE. CT
ORIENTATION:
FREQUENCY. 10.00 HZ
ENVIRONMENT. R.T., LAB AIR

YIELD STRENGTH. 111.5 KSI
ULT. STRENGTH: 228.0 KSI
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 1.250"
REFERENCES: UC001

NICKEL BASE

WASPALOY

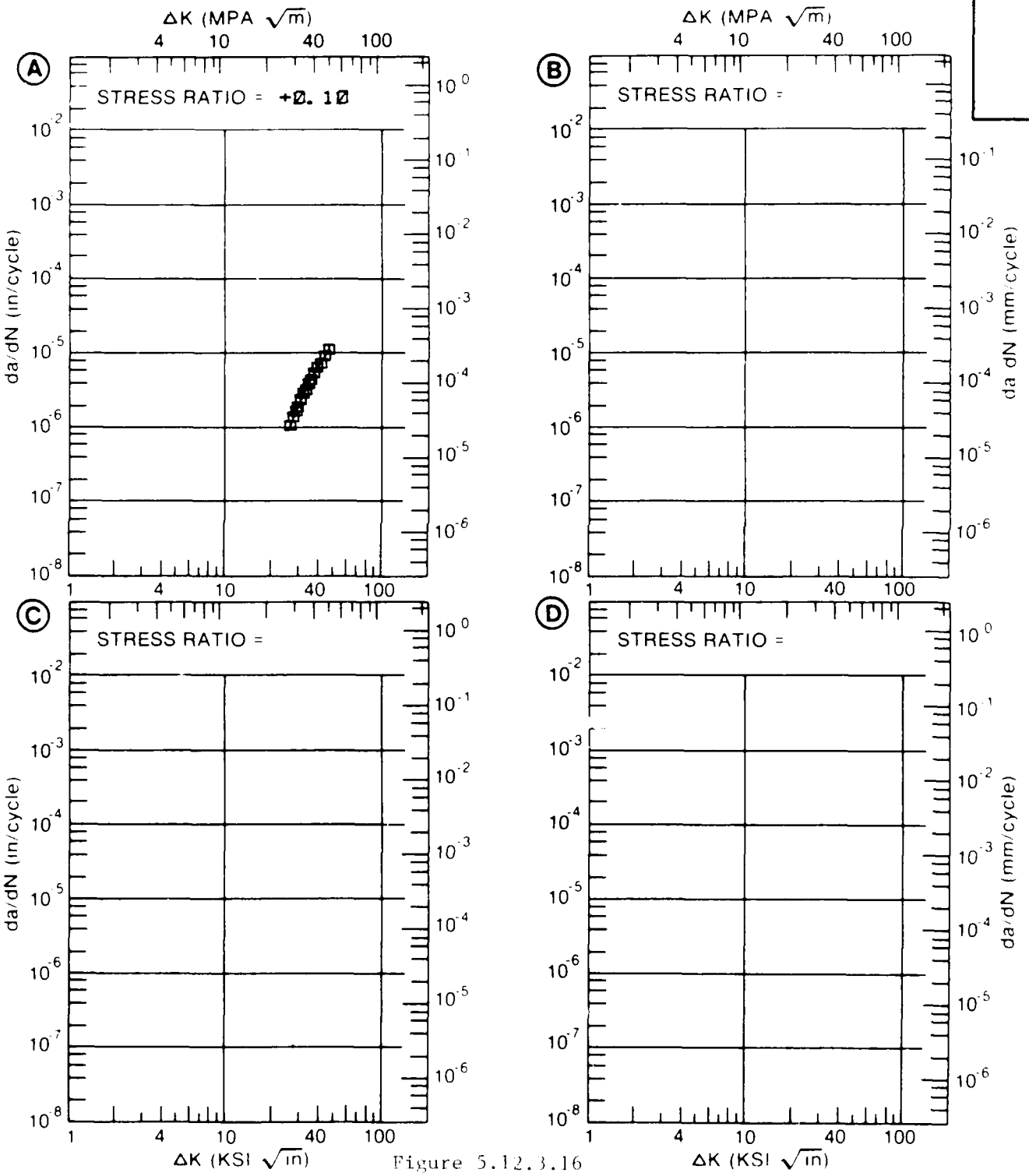



Figure 5.12.3.16

TABLE 5.12.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.17 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE WASPALOY
CONDITION: 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | F(HZ)= 0.33 | F(HZ)= 20.00 | | |
| DELTA K MIN | A: | 11.78 | 2.13 | | | |
| | B: | 19.24 | | 3.55 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 2.88 | | | |
| | | 16.00 | 5.02 | | | |
| | | 20.00 | 8.34 | 3.86 | | |
| | | 25.00 | 12.9 | 6.37 | | |
| | | 30.00 | 18.0 | 9.75 | | |
| | | 35.00 | 23.5 | 13.9 | | |
| | | 40.00 | 29.6 | 18.8 | | |
| | | 50.00 | 44.6 | 29.7 | | |
| | | 60.00 | 66.0 | | | |
| | | 70.00 | 102. | | | |
| | | 80.00 | 191. | | | |
| DELTA K MAX | A: | 89.65 | 450. | | | |
| | B: | 50.41 | | 30.2 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.40 | 14.51 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 153.7 KSI
ULT. STRENGTH: 199.7 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

WASPALOY

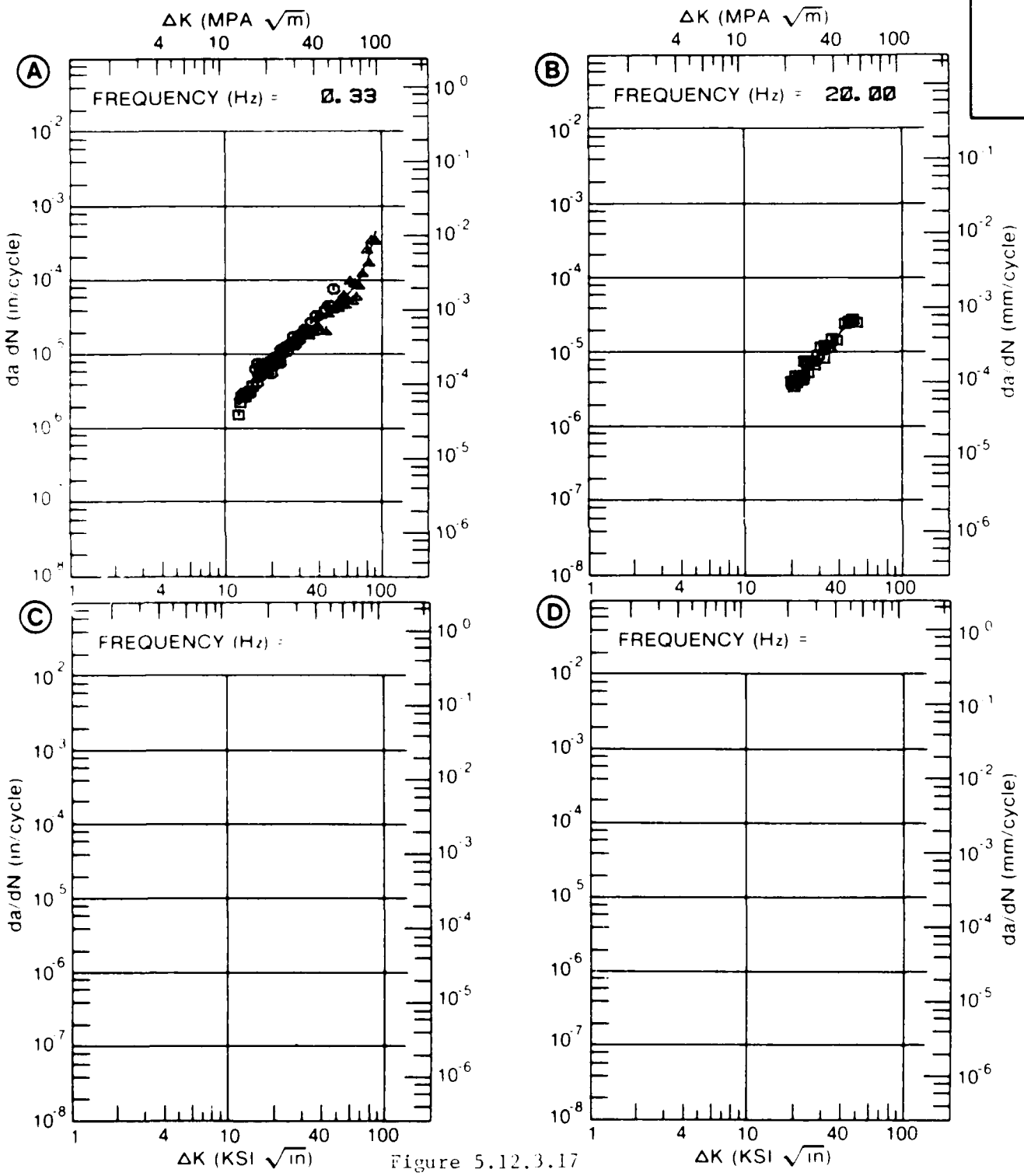



Figure 5.12.3.17

TABLE 5.12.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.18INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE WASPALOY
CONDITION: 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4H
RS AC
ENVIRONMENT: +1200F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F=2 MIN HOLD TRAPEZOIDAL | F=5 MIN HOLD TRAPEZOIDAL | F=15 MIN HOLD TRAPEZOIDAL | |
| DELTA K MIN | A: | 24.46 | 14.4 | | | |
| | B: | 46.10 | | 371. | | |
| | C: | 24.76 | | | 14.5 | |
| | D: | | | | | |
| | | 25.00 | 15.9 | | 15.5 | |
| | | 30.00 | 33.8 | | 47.5 | |
| | | 35.00 | 59.1 | | 105. | |
| | | 40.00 | 92.8 | | 191. | |
| | | 50.00 | 196. | 443. | 478. | |
| | | 60.00 | 383. | 938. | 1008. | |
| | | 70.00 | 734. | 1069. | 2007. | |
| | | 80.00 | 1410. | 1951. | 3939. | |
| | | 90.00 | | | 7765. | |
| DELTA K MAX | A: | 81.37 | 1544. | | | |
| | B: | 82.36 | | 2544. | | |
| | C: | 95.27 | | | 11155. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 41.89 | 26.98 | 33.21 | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT: 1875F 4HRS OQ. 1550F 4HRS AC. 1400F 4HRS AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 153.7 KSI
ULT. STRENGTH: 199.7 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

WASPALOY

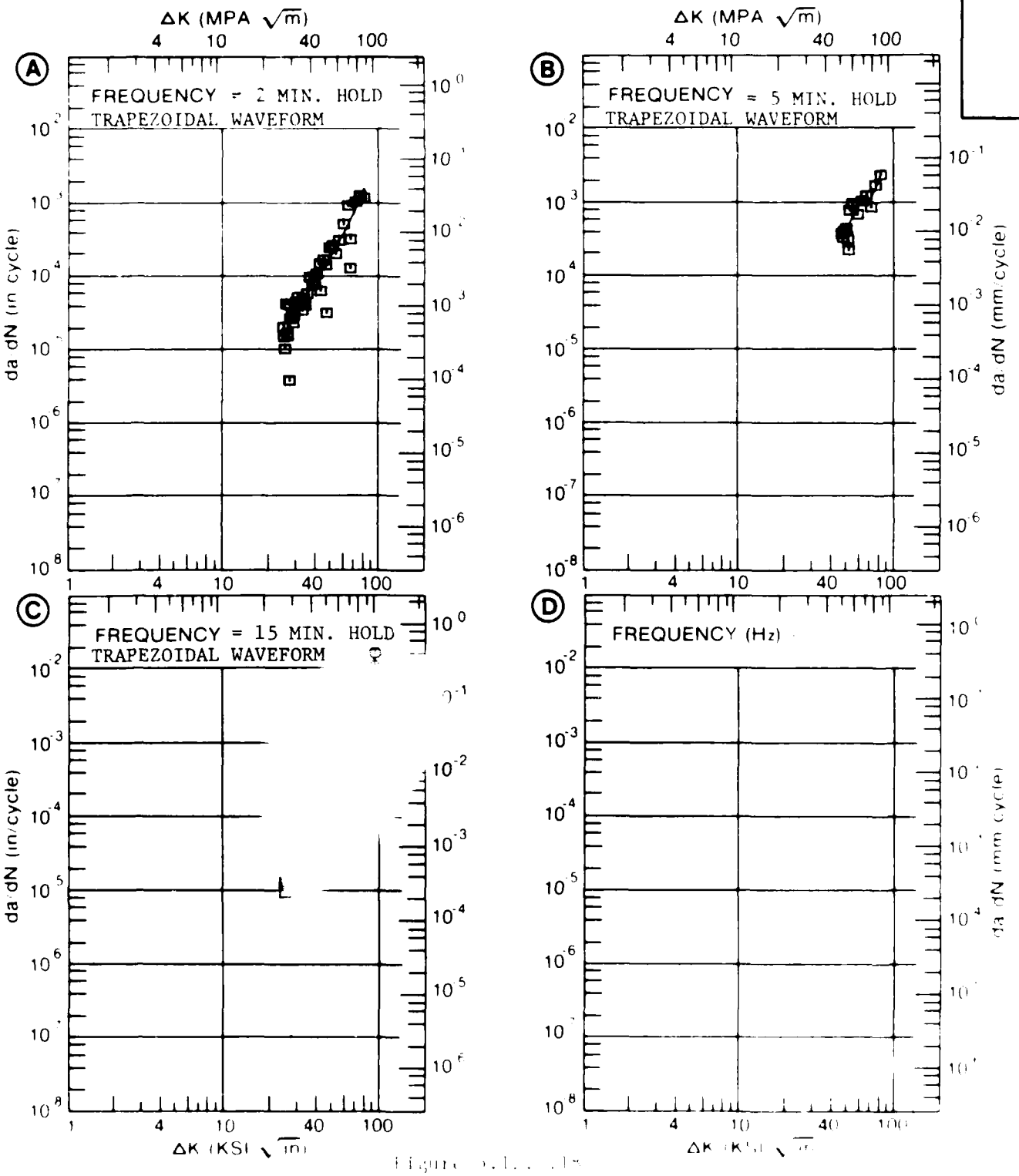



Figure [illegible]

TABLE 5.12.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.19 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION: 2010F 2HR, 1350F 6HR(COARSE GS, SMALL PRECIPITATES)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 43.83 | 1.29 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 50.00 | 2.84 | | | |
| | | 60.00 | 10.1 | | | |
| | | 70.00 | 20.3 | | | |
| DELTA K MAX | A: | 70.45 | 20.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 13.73

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2010F 2HR. 1350F 6HR (COARSE GS. SMALL PRECIPITATES)
FORM: 1.18"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 95.0 KSI
ULT. STRENGTH: 230.5 KSI
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 1.250"
REFERENCES: UC001

NICKEL BASE

WASPALOY

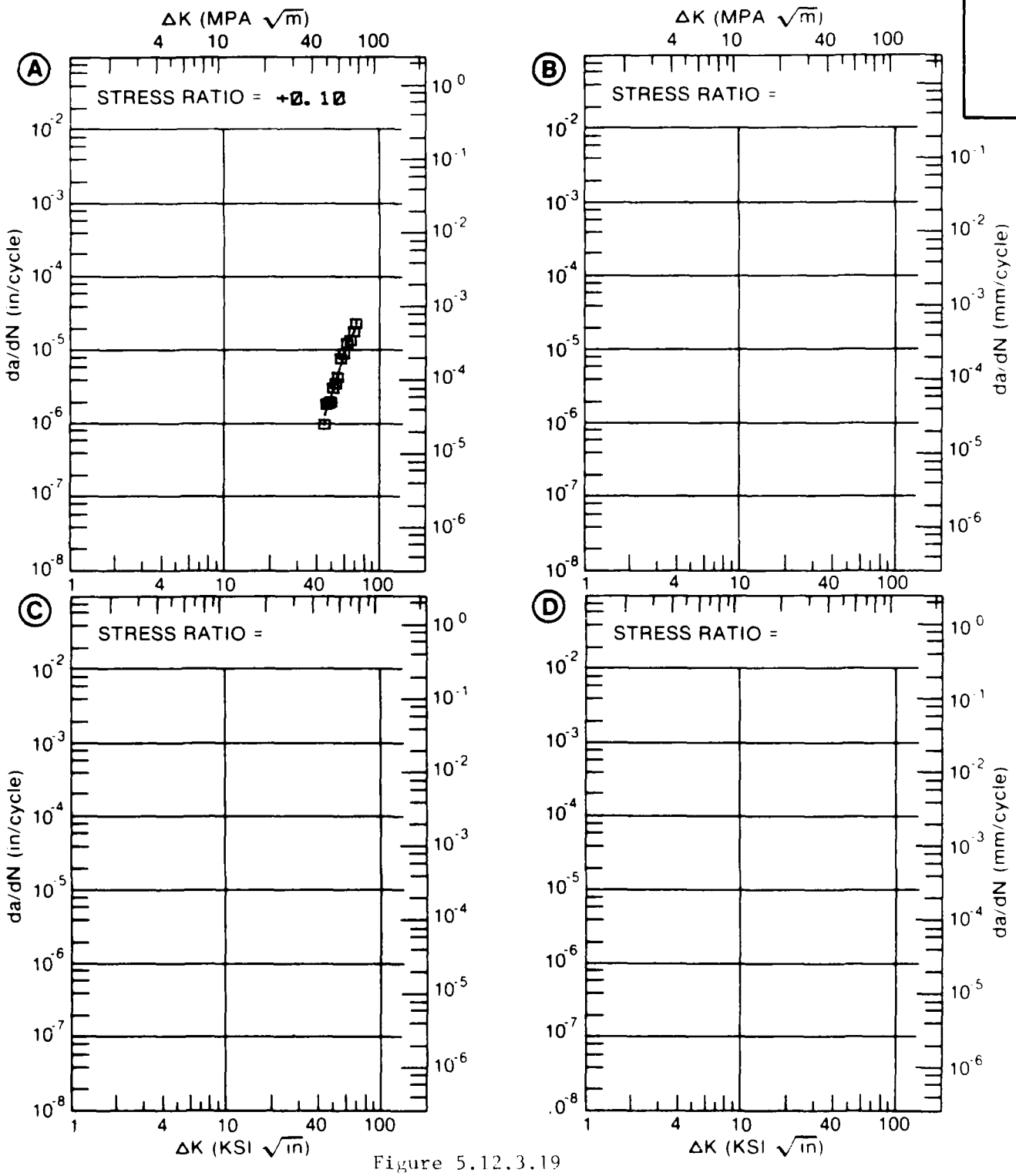



Figure 5.12.3.19

TABLE 5.12.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE5.12.3.20 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE WASPALOY
CONDITION: 2010F 2HR, 1600F 24HR(COARSE GS, LARGE PRECIPITATES)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | | | |
| DELTA K MIN A: | 30.90 | .893 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 35.00 | 1.66 | | | |
| | 40.00 | 3.19 | | | |
| | 50.00 | 9.65 | | | |
| | 60.00 | 25.5 | | | |
| DELTA K MAX A: | 62.77 | 32.9 | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 7.17

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 2010F 2HR, 1600F 24HR (COARSE GS, LARGE PRECIPITATES)
FORM: 1.18"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 96.5 KSI
ULT. STRENGTH: 227.5 KSI
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 1.250"
REFERENCES: UC001

NICKEL BASE

WASPALOY

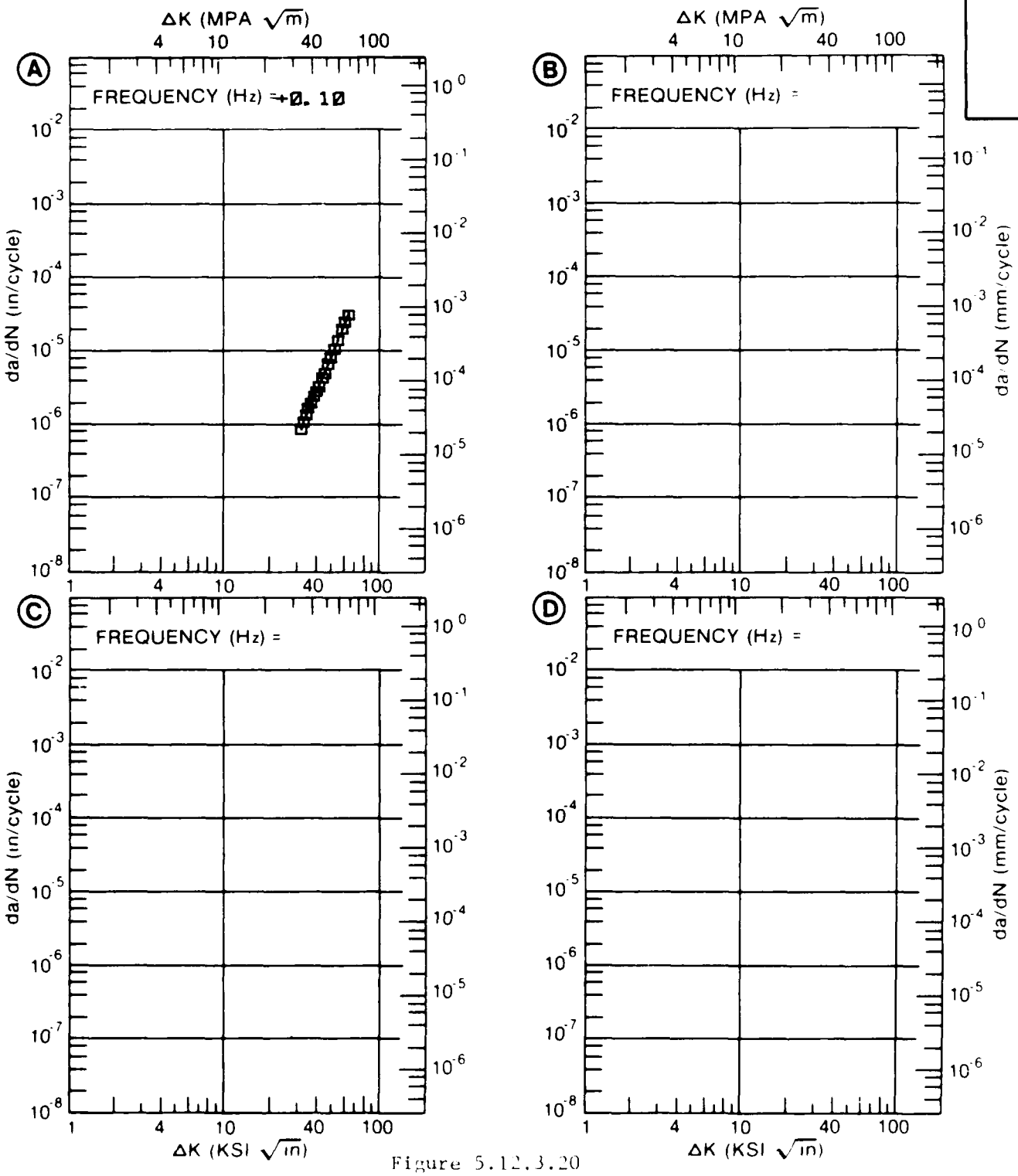



Figure 5.12.3.20

Table 5.13

REFERENCES FOR THE NICKEL BASE ALLOY DATA


60578 Inconel 718 $K_c$

Christian, J.L., Yang, C.T., and Witzell, W.E., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryrogenic Environment," ASD-TDR-62-258, Part III, General Dynamics/Astronautics, December 1964.

88187 Inconel 718 $K_{Ic}$

"Inconel 718 Test Data of September 19, 1973," Shultz Steel Company, South Gate, CA., September 1, 1973.

88579 Inconel 718 da/dN

"B-1 Program da/dN Data for Aluminum Alloys," Rockwell International Corporation; Memorandum to H.D. Moran from E.W. Cawthorne, Battelle's Columbus Laboratories, April 3, 1974.

88700 Inconel 718 $K_{Iscc}$

Gilbreath, W.P., and Adamson, M.J., "The Stress Corrosion Susceptibility of Several Alloys in Hydrazine Fuels," NASA Technical Note, Report NASA TN D-7604, Ames Research Center, Moffett Field, CA., February 1974.

GE001 Inconel 718 da/dN
P/M Rene 95 da/dN

Shanini, V. and Popp, H.G., "Evaluation of Cyclic Behavior of Aircraft Turbine Disk Alloys," General Electric, Evendale, Ohio, Contract No. NAS3-20368, Report No. NASA-CR-159433, June 1978.

GE004 P/M Rene 95 da/dN

"Argon Environment Testing," Thermal-Mechanical Crack Propagation Program; Data Sheets sent from M.S. Gilbert, General Electric Co., Evendale, Ohio, Contract No. F33615-77-C-5193, November 1980.

GE005 Inconel 718 da/dN

"Fatigue Crack Growth Rate Data on Inconel 718 Using $K_B$ Bar Specimens from the TF34 DTA Effort;" Data sent from M.S. Gilbert, General Electric Co., Evendale, Ohio, October 1982.

GE008 Inconel 718 da/dN
P/M Rene 95 da/dN

Domas, P.A., "Crack Propagation Under Thermal Mechanical Cycling," General Electric Co., Aircraft Engine Group, Evendale, Ohio, Contract No. F33615-77-C-5193, November 1979.

HD003 Inconel 600 da/dN

James, L.A., "Fatigue Crack Propagation Behavior of Inconel 600," International Journal of Pressure Vessels and Piping, Vol. 5, 241-259. 1977.

HD005 Inconel 625 da/dN

James, L.A., "The Effect of Temperatures upon the Fatigue Crack Propagation Behavior of Inconel 625," Report HEDL-TME 77-2, Westinghouse Hanford Co., Richland, WA., March 1977.

HD015 Inconel 718 da/dN

James, L.A., "Fatigue Crack Propagation Behavior of Inconel 718," Report HEDL-TME 75-80, Westinghouse Hanford Co., Richland, WA., September 1975.

Table 5.13 (Continued)

HD016 Inconel 718 da/dN

Mills, W.J., and James, L.A., "Effect of Heat Treatment on Elevated Temperature Fatigue-Crack Growth Behavior of Two Heats of Alloy 718," ASME Paper 78-WA/FVP-2, December 1978.

HD017 Inconel 718 da/dN

James, L.A., "The Effect of Product Form Upon the Fatigue-Crack Growth Behavior in Alloy 718," Journal of Engineering Materials and Technology, Vol. 103, 234-239, 1981.

PW001 Waspaloy da/dN

Larsen, J.M., Schwartz, B.J., Annis, C.G. Jr., "Cummulative Damage Fracture Mechanics Under Engine Spectra," Pratt and Whitney Aircraft Group, Government Product Division, West Palm Beach, Fla., Report No. AFML-TR-77-4159, January 1980.

PW002 IN 100 da/dN

Larsen, J.M., Schwartz, B.J., Annis, C.G. Jr., "Cummulative Damage Fracture Mechanics Under Engine Spectra," Pratt and Whitney Aircraft Group, Government Product Division, West Palm Beach, FL., Report No. AFML-TR-77-4159, January 1980.

PW003 Astroloy 901 da/dN
IN 100 da/dN
Incoloy 901 da/dN

Fatigue Crack Growth Rate Data on Titanium and Nickel Base Alloys from B.S. Schwartz, Pratt and Whitney Aircraft Group, Government Product Division, West Palm Beach, FL., July 1982.

PW004 Astroloy P/M da/dN
IN 100 P/M da/dN
NASAIIB-7 P/M da/dN
Waspaloy da/dN

Cowles, B.A., Sims, D.L., Warren, J.R., "Evaluation of the Cyclic Behavior of Aircraft Turbine Disk Alloys," Pratt and Whitney Aircraft Group, United Technologies Corp., West Palm Beach, FL., Contract No. NAS3-20367, Report No. NASA CR-159409, October 1978.

PW006 IN 100 da/dN
Waspaloy da/dN

Fatigue Crack Growth Rate Data on Nickel Base Alloys from Pratt and Whitney Aircraft Group, Government Product Division, West Palm Beach, FL., July

RI006 Inconel 718 $K_{Iscc}$

Ferguson, R.R., Berryman, R.C., "Fracture Mechanics Evaluation of B-1 Materials," Rockwell International B-1 Division, Los Angelos, CA., Contract No. F33657-70-C-0800, Report No. AFML-TR-76-137, October 1976.

UC001 Waspaloy da/dN

Lawless, B., et.al., "The Effect of Microstructure on the FCP and Overload Behavior of Waspaloy at Room Temperature," Dept. of Materials Science and Metallurgical Engineering, University of Cincinnati, December 1980.

# CHAPTER 6

## ALLOY STEEL SECTIONS

TABLE 6.0.1

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| AF1410 | [illegible] AC [illegible] 100F 1HR AC 950F 5HRS AC | ROUND BAR | | | | x | | |
| | 1550F 1HR, WQ 1500F 1HR, WQ 950F 5HRS, AC | PLATE | x | | | | | |
| AF1410(VIM VAR) | 1650F 1HR WQ 1500F 1HR WQ 950F 5HRS AC | PLATE | | | | x | | |
| A286 | 1800F, 0.5+1 0HR, WQ, 1325F, 16HR, AC | PLATE<br>ROUND BAR | | | | x<br>x | | |
| D6AC | HEAT TREATED TO 46 RC HARDNESS | PLATE | x | | | | | |
| | 1550F AQ 650F 4HR | SHEET | | | | | | x |
| | 1550F AQ 950F 4HR | SHEET | | | | | | x |
| | 1550F 25 MIN OQ 850F 1+1 HR | SHEET | | | | | | x |
| | 1615F 2.25HR, A-BQ 325F, AC, 810-845F 3HR, 1000F 6-6 5HR | FORGING | x | | | | | |
| | 1650F AUS BAY QUENCH 975F, SQ 325F, 1000F 2+2 HR | PLATE | x | | | | | |
| | 1650F AUS-BAY QUENCH 975F, SQ 325F, 1000F 2+2 HR | PLATE<br>FORGING | x<br>x | | | <br>x | | |
| | 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE<br>FORGING | x<br>x | | | x<br>x | | |
| | 1650F, 1 HR FC TO 960F OQ AT 100F, AC, 1025F 2+2 HR | FORGING | x | | | | | |
| | 1650F, 1 HR, FC 1650F 1 HR, OQ, 1025F 2+2 HR | BILLET | x | | | | | |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| D6AC | 1500F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR | BILLET | X | | | | | |
| | 1675F AC 1575F OQ, 400F 2 HR, 1100F 2 HR (RC 42.5) | PLATE | X | | | | | |
| | 1675F AC, 1575F OQ, 400F 2 HR, 800F 2 HR (RC 46.5) | PLATE | X | | | | | |
| | 1675F, AC, 1575F OQ, 400F 2 HR, 500F 2 HR (RC 50) | PLATE | X | | | | | |
| | 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE<br>FORGING | X<br>X | | | X<br>X | | |
| | 1700F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR | BILLET | X | | | | | |
| | 1700F, 1 HR, OQ, 1025F 2+2 HR | BILLET | X | | | | | |
| | 1725F 1 HR, AC 1700F 1 HR, OQ, 1000F 1 HR, 1015F 1 HR | BILLET | X | | | | | |
| | 1725F, 1 HR, AC 1700F 1 HR, OQ, 1100F 2+2 HR | BILLET | X | | | | | |
| | 1725F, 1 HR, AC 1700F 1 HR, OQ, 1025F 2+2 HR | BILLET | X | | | | | |
| | 1725F, 1 HR, AC 1650F 1 HR, FC TO 960F, SQ 350F 0.5 HR, AC, 1025F 2+2 HR | BILLET | X | | | | | |
| HP9-4-20 | ---- | PLATE<br>BAR<br>FORGING | <br><br>X | | | <br>X<br>X | | X<br><br>X |
| | ANNEALED | FORGING | X | | | | | |
| | GTA WELD WELDMENT | PLATE | | | | | | X |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| HP/4-20 | HEAT TREATED | FORGING | X | | | | | |
| | WELDED | WELDMENT | | | | X | | |
| | QUENCHED AND TEMPERED | PLATE | | | | | | X |
| | 1525F OQ, 100F 5HR, 1060F 4+4HR | FORGING | X | | | | | |
| | 1525F 2HRS AC, 100F 2HRS, 1525F 4HRS | BILLET | | | | X | | |
| | 1525F 2HRS OQ, 100F 2HRS, 1025F 4HRS | PLATE<br>BILLET<br>FORGED BAR | | | | X<br>X | | X<br><br>X |
| | 1500F 1-2 HR AC, 1525F 1-2 HR OQ, 100F 2HR, 1050F 4-6HR | FORGING | X | | | | | |
| | 1650F 1-2HR AC, 1525F 1-2 HR AC, -100F 1-2HR, 1025F 4HR | FORGING | X | | | | | |
| | 1600F 1-2HR AC, 1525F 1-2HR OQ, 100F 2HR, 1025F 4-6HR | PLATE<br>FORGING | X<br>X | | | | | |
| | 1550F 1-2HR AC, 1525F 1-2HR OQ, 100F 2HR, 1000F 4-6HR | FORGING | X | | | | | |
| | 1500F 1-2HR, AC1525F 1-2HR, OQ, 100F 2HR, 1050F 4-6HR | FORGING | X | | | | | |
| | 1550F 2HR AC, 1525F 2HR OQ, 1550F 2+2HR AC | FORGING | X | | | | | |
| | 1500F 1-2HR AC 1-2HR, AC, 100F 1-5HR, 1025F 4HR, 1060F 6HR | PLATE | X | | | | | |
| | 1650F 1-2HR, AC 1-2HR, AC, -130F 1-5HR, 1025-1075F 4HR | PLATE | X | | | | | |
| | 1650F, 1-2HR, AC 1-5HR OQ, 1025F 12HR | FORGING | X | | | | | |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| HP9-4-20 | 1450F 4.5HR.AC TO 900F.HELD 0.5HR.AC -100F 1.5HR.1025F 8HR.2 DQ | FORGING | X | | | | | |
| | 1500F 4.5HR.AC 1300F 1.5HR. AC -100F 1.5HR.1025F 4HRS | FORGING | X | | | | | |
| HP9-4-20(CF.MO) | ANNEALED | FORGING | | | | X | | |
| HP 9-4-25(ASD) | 1550F 1 HR OQ 1000F 2+2HR AC | FORGING | X | | | | | |
| HP9-4-30 | --- - | PLATE | | | | X | | |
| | | BAR | | | | X | | |
| | | FORGING | X | | | X | | |
| | HEAT TREATED TO 42 RC HARDNESS | PLATE | X | | | | | |
| | QUENCHED + TEMPERED AT 950F | PLATE | | | | | | X |
| | UTS=220 240KSI | BILLET | | | | X | | |
| | 1525F 2HRS OQ.-100F 1HR. 1025F 2+2HR | FORGED BAR | | | | X | | |
| | 1525F 2HRS OQ.-100F 2HRS. 1025F 2+2HR | FORGED BAR | | | | X | | |
| | 1550F 2HRS OQ. 100F 3HRS. 1000F 2+2HRS | FORGED BAR | | | | X | | |
| | 1525F.OQ.-100F 3HR.1050F 4HR | FORGING | X | | | | | |
| | 1550F 1-2HR AC 1525F 1-2HR OQ. 100F 1-3HR. 1000F 4HR | FORGING | X | | | | | |
| | 1650F 1 2HR AC 1525F 1-2HR OQ.-100F 1-3HR 1025F 4HR | FORGING | X | | | | | |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| HP9-4-30 | 1650F 1-2HR AC 1525F 1-2HR OQ, 100F 1-3HR, 1050F 4HR | FORGING | X | | | | | |
| | 1550F 2HRS AC, 1550F 2HR OQ, -100F 2HR AC, 1000F 4HR, AC, 1000F 4HR, AC | FORGING | X | | | | | |
| | 1650F, 2HR AC 1550F 2HR OQ 1000F 2+2HR AC | FORGING | X | | | | | |
| | 1650F, AC, 1525F 1 2HR, OQ, 100F 1-3HR, 1050F 4HR | FORGING | X | | | | | |
| HP9-4-45 | 1600F 0 5HR AC 1500F 0 33HR AC | SHEET | | | | | | X |
| | 475F | PLATE | | | | | | X |
| HY-TUF | 1700F 1HR AC, 1600F 1HR, 1000F 20 MIN, OQ, 550F 2HR | FORGING | X | | | | | |
| | 1700F 1HR, AC, 1600F 1HR, OQ, 550F 2HR | FORGING | X | | | | | |
| HY-150 | 1500F 1HR WQ | PLATE | | | | | | X |
| HY 180 | SFA (UTS 180KSI) | FORGED BAR | | | | X | | |
| HY 80 | --- | ---- | | | | X | | |
| H11 | -- -- | ---- | | | | | X | |
| | AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | | | | X | | |
| | QUENCHED + TEMPERED AT 1100F | PLATE | | | | | | X |
| | 1325F, 1850F 0 5HR AC, 1060F 2+2HR | SHEET | | | | | | X |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 10NI STEEL | -- - | PLATE | | | | x | | |
| 12 9 (MAR) | (STA 200) | ROUND BAR | x | | | x | | |
| 12NI-5CR (M) | -- - | --- | | | | | | x |
| | | PLATE | | | | | | x |
| | ELECTRIC FURNACE | PLATE | | | | | | x |
| | STA WELDED | WELDMENT | | | | | | x |
| | LOW RESIDUAL | PLATE | | | | | | x |
| | TYS=150 OKSI | PLATE | | | | | | x |
| | TYS=160 OKSI | PLATE | | | | | | x |
| | TYS=170 OKSI | PLATE | | | | | | x |
| | TYS=175 OKSI | PLATE | | | | | | x |
| | 1500F,900F 20HR AC | PLATE | | | | | | x |
| 18NI(180)(MAR) | TYS=170KSI | PLATE | | | | | | x |
| | TYS=175KSI | PLATE | | | | | | x |
| | TYS=180KSI | PLATE | | | | | | x |
| | TYS 185KSI | PLATE | | | | | | x |
| | TYS=190KSI | PLATE | | | | | | x |
| | TYS=195KSI | PLATE | | | | | | x |
| | TYS=200KSI | PLATE | | | | | | x |
| | 1500F 1HR AC 900F,3HR | PLATE | | | | | | x |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 18NI(200)(MAR) | ----- | PLATE | | | | | | X |
| | TYS=215 KSI | PLATE | | | | | | X |
| | WELD CENTER LINE | PLATE | | | | | | X |
| | 1500F 1HR AC 900F 3HR | PLATE | | | | | | X |
| | 1650F 4 5 HR, AC, AGED 1000F 6 HR | PLATE | X | | | | | |
| | 1650F 4 5 HR, AC, AGED 950F 24 HR | PLATE | X | | | | | |
| | 1650F 4 5 HR, AC, AGED 900F 24 HR | PLATE | X | | | | | |
| | 1650F 4 5 HR, AC, AGED 900F 6 HR | FORGING | X | | | | | |
| | 1650F, 4 5 HR, AC, AGED 850F 24 HR | FORGING | X | | | | | |
| | 1650F 900F 3HR AC | PLATE | | | | | | X |
| | 1675F 2HR AC 500F, 15MIN 850F 4HR COOL 250F/MIN | PLATE | | | | | | X |
| 18NI(250)(MAR) | ---- | ---- | | | | | | X |
| | | PLATE | | | | | X | X |
| | AGE 900F 3HR | PLATE | | | | | | X |
| | AGED 900F 3HR AC | PLATE | | | | | | X |
| | TUS=243KSI | BILLET | | | | X | | |
| | TYS=250KSI | PLATE | | | | | | X |
| | TYS=260KSI | PLATE | | | | | | X |

TABLE 6.0.1 (con't)

**AVAILABLE DATA FOR ALLOY STEEL**

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 18NI(250)(MAR) | 1500F AC,850F 6 HR | PLATE | X | | | | | |
| | 1500F AC,900F 24 HR | PLATE | X | | | | | |
| | 1500F AC,950F 6 HR | PLATE | X | | | | | |
| | 1500F 1HR,AC, AGED 900F 3HR, AC | BILLET | X | | | | | |
| | 1500F AC,900F 6 HR | PLATE | X | | | | | |
| | 1650F 1 25HR WQ,1525F 1 25HR WQ,900F 3HR AC | PLATE | | | | | | X |
| | 900F 2HR AC | SHEET | | | | | | X |
| 18NI(280)(MAR) | 1500F 1HR AC 900F 3HR | PLATE | | | | | | X |
| 18NI(300)(MAR) | ----- | ----- | | | | | X | |
| | | SHEET | | X | | | | |
| | | FORGING | | | | X | | |
| | AGED | ----- | | | | X | | |
| | ANNEALED | ----- | | | | X | | |
| | AGE 900F 6HR | FORGING | | | | | | X |
| | AGE 950F 12HR | FORGING | | | | | | X |
| | CRACK PRESTRESSED TO 50 PCT KIC | FORGING | | | | | | X |
| | CRACK PRESTRESSED TO 25 PCT KIC | FORGING | | | | | | X |
| | CRACK PRESTRESSED TO 80 PCT KIC | FORGING | | | | | | X |
| | 1500F 0 5HR AC 900F 3HR | PLATE | | | | | | X |
| | 1500F 2HR 800F 10HR | BAR | | | | | | X |
| | 1500F 2HR 900F 3 5HR | BAR | | | | | | X |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 18NI(300)(MAR) | 1500F 2HR 900F 100HR | BAR | | | | | | X |
| | 1700F, 1500F AGED 900F 6HR | FORGING | | | | | | X |
| | 2300F 1HR 1700F 4HR, 900F 100HR | BAR | | | | | | X |
| | 2300F 1HR 1700F 4HR 800F 10HR | BAR | | | | | | X |
| | 2300F 1HR 1700F 4HR 900F 100HR | BAR | | | | | | X |
| | 2300F 1HR 1700F 4HR 900F 3 5HR | BAR | | | | | | X |
| | 900F 3HR 950F 3HR | FORGING | | | | | | X |
| | 1700F 1HR, AC, 1500F 1 HR, AC, 900F 6 HR | FORGING | X | | | | | |
| | 900 F AGED | PLATE | X | | | | | |
| 18NI(350)(MAR) | AGED 8HR 800F | ---- | | | | | X | |
| | | FORGED BAR | | | | | | X |
| | AGE 900F 3HR | FORGED BAR | | | | | | X |
| | AGE 900F 8HR | FORGED BAR | | | | | | X |
| | 1500F 1HR 800F 8HR | FORGING | | | | | | X |
| | 1500F 1HR 900F 8HR | FORGING | | | | | | X |
| | 1500F 1HR 950F 3HR | FORGING | | | | | | X |
| 300M | ---- | PLATE | | | | | | X |
| | | FORGING | X | | | X | | X |
| | | ---- | | | | | X | |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 300M | AMS 6434 UTS=220-240KSI | PLATE | | X | | | | |
| | UTS-260-280KSI | PLATE | | X | | | | |
| | UTS-280-300KSI | SHEET | | X | | | | |
| | | PLATE | | X | | | | |
| | HEAT TREATED TO 54 RC HARDNESS | PLATE | X | | | | | |
| | UTS-280-300KSI | BAR | | | | X | | |
| | | BILLET | | | | X | | |
| | 1500F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1500F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1500F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1500F 0.5HR OQ 400F 2+2 HR (FINE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1550F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1550F 0.5HR OQ 400F 2+2 HR (FINE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1550F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1550F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1600F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1600F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE) | PLATE | | | | | | X |
| | 1600F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE) | PLATE | | | | | | X |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 300M | 1600F OQ, 575F 2+2HR | SHEET | | | | | X | |
| | 1600F @ 5 HR, SQ, 1000F @ 5-1 0 HR, OQ 80-180F 25 MIN, 575F 2+2HR | FORGING | X | | | | | |
| | 1600F 1 25 HR, OQ, 600F 2+2HR | FORGING | X | | | | | |
| | 1600F 1HR, OQ, 475F 1HR | BAR | X | | | | | |
| | 1600F 1HR, OQ, 1HR, WQ 475F 1HR | BAR | X | | | | | |
| | 1600F 1HR, OQ, 615F 1 HR | BAR | X | | | | | |
| | 1600F 1HR, OQ, 575F 1HR | BAR | X | | | | | |
| | 1600F 1HR, OQ, 745F 1HR | BAR | X | | | | | |
| | 1600F, OQ, 550F 2+2HR | PLATE | X | | | | | |
| | 1650F, 1525F OQ 600F 2+2HR | FORGING | | | | | | X |
| | 1650F, 1600F 1HR OQ 600F 1+1 HR | FORGING | | | | | | X |
| | 1675F AC, 1575F OQ, 800F 2HR (RC 47 5) | PLATE | X | | | | | |
| | 1675F, AC 1575F OQ, 500F 2HR (RC 51 5) | PLATE | X | | | | | |
| | 1675F, AC, 1575F OQ, 1100F 2HR (RC 39) | PLATE | X | | | | | |
| | 1700F 1 5HRS AC, 1600F 1 5HRS OQ, 600F 2+2HRS | FORGING | | | | X | | X |
| | 1700F 1HR AC, 1600F 1HR OQ, 600F 2HR AC (AMS 6419) | PLATE | X | | | | | |
| | 1710F, 1610F 610F | BAR | | | | | | X |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 300M | 2190F 1HR, FC TO 1600F HOLD 0.5HR, OQ, 475F 1HR | BAR | x | | | | | |
| | 2190F 1HR, FC TO 1600F, HOLD 0.5HR, OQ, 615F 1HR | BAR | x | | | | | |
| | 2190F 1HR, FC TO 1600F, HOLD 0.5HR, OQ, 745F 1HR | BAR | x | | | | | |
| | 2190F 1HR, OQ, 400F 1HR | BAR | x | | | | | |
| | 2190F 1HR, OQ, 475F 1HR | BAR | x | | | | | |
| | 2190F 1HR, OQ, 475F 1HR, WQ, 475F 1HR | BAR | x | | | | | |
| | 2190F 1HR, OQ, 615F 1HR | BAR | x | | | | | |
| | 2190F 1HR, OQ, 745F 1HR | BAR | x | | | | | |
| 300M (AM) | 1650F 1 HR, AC, 1550F 1 HR, OQ, 1320F 0.5 HR, 600F 2+2HR, AC | FORGING | x | | | | | |
| 300M (VAR) | 1650F 1 HR, AC, 1550F 1 HR, OQ, 1320F 0.5 HR, 600F 2+2HR, AC | FORGING | x | | | | | |
| 300M(VM) | 1500F OQ, 400F 2+2HR | PLATE | x | | | | | |
| | 1500F, OQ, 550F 2+2HR | PLATE | x | | | | | |
| | 1550F OQ, 400F 2+2HR | PLATE | x | | | | | |
| | 1550F, OQ, 550F 2+2HR | PLATE | x | | | | | |
| | 1600F, OQ, 400F 2+2HR | PLATE | x | | | | | |
| | 1600F, OQ, 550F 2+2HR | PLATE | x | | | | | |
| | 1700F, AC, 1600F 1 HR, OQ, 550F 2+2 HR | BILLET | x | | | | | |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 300M(VM) | 1700F, AC, 1600F 1HR, SQ 925F, OQ, 575F 2+2 HR | BILLET | X | | | | | |
| | 1700F, AC, 1600F 1 HR, SQ 400F, AC, 550F 2+2 HR | BILLET | X | | | | | |
| 4140 | 1550F 1HR OQ 1250F 1HR AC | PLATE | | | | | | X |
| | 1550F 1HR OQ 1000F 1HR AC 1125F 1HR AC | PLATE | | | | | | X |
| | 1600F 1 HR, OQ, 400F 1HR | FORGED BAR | X | | | | | |
| | 1600F 1 HR, OQ, 745F 1HR | FORGED BAR | X | | | | | |
| | 1600F 1 HR, OQ, 535F 1HR | FORGED BAR | X | | | | | |
| | 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR | PLATE | X | | | | | |
| | 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR | PLATE | X | | | | | |
| | 1700F, 1600F OQ 750F 1+1 HR | PLATE | | | | | | X |
| | 1700F, 1600F OQ 600F 1+1 HR | PLATE | | | | | | X |
| | 2010F 1 HR, OQ, 400F 1 HR | FORGED BAR | X | | | | | |
| | 2010F 1 HR, OQ, 475F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1 HR, OQ, 400F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1 HR, OQ, 660F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1 HR, OQ, 615F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1 HR, OQ, 475F 1 HR | FORGED BAR | X | | | | | |
| 4330V | QUENCHED + TEMPERED AT 500F | PLATE | | | | | | X |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 4130V MOD | | BILLET | x | | | x | | |
| | HEAT TREATED TO 46 RC HARDNESS | PLATE | x | | | | | |
| | [illegible] 1 HR/OQ 400F 1 HR | FORGED BAR | x | | | | | |
| | [illegible] 1 HR/OQ 425F 1 HR | FORGED BAR | x | | | | | |
| | [illegible] 1 HR AC 1575F 1 HR/OQ [illegible] HR | BILLET | x | | | | | |
| | [illegible] 1 HR/AC 1575F 1 HR/OQ [illegible] HR | BILLET | x | | | | | |
| 1140 | | ----- | | | | | x | |
| | | SHEET | | | | | | x |
| | | PLATE | | | | | | x |
| | | FORGING | | | | | x | x |
| | HEAT TREATED TO 51 RC HARDNESS | PLATE | x | | | | | |
| | AS TEMPERED | PLATE | | | | x | | |
| | TEMPER 400F 1HR | PLATE | | | | | x | |
| | TEMPERED 400F | ----- | | | | | x | |
| | TYS 125KSI | PLATE | | | | | | x |
| | TYS 150KSI | PLATE | | | | | | x |
| | TYS 175KSI | PLATE | | | | | | x |
| | TYS 200KSI | PLATE | | | | | | x |
| | [illegible] 40KSI | EXTRUSION | | | | | x | |
| | [illegible] 5KSI | PLATE | | | | | | x |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 4140 | UTS = 160 KSI | ROUND BAR | | | | x | | |
| | UTS = 180 KSI | ROUND BAR | x | | | x | | |
| | UTS=180 200KSI | BAR<br>PLATE | | | | x<br>x | | |
| | 1550F OQ 750F 1 25HR | PLATE | | | | | | x |
| | 1550F.OQ. TEMPERED 800F | PLATE | x | | | | | |
| | 1550F.OQ. TEMPERED 500F | PLATE | x | | | | | |
| | 1550F OQ 750F CRACK PRESTRESSED TO 80PCT KIC | PLATE | | | | | | x |
| | 1550F OQ 750F 1HR CRACK PRESTRESSED TO 20PCT KIC | PLATE | | | | | | x |
| | 1550F OQ 750F CRACK PRESTRESSED TO 80PCT KIC | PLATE | | | | | | x |
| | 1550F OQ 750F CRACK PRESTRESSED TO 20PCT KIC | PLATE | | | | | | x |
| | 1550F OQ 750F CRACK PRESTRESSED TO 40PCT KIC | PLATE | | | | | | x |
| | 1575F OQ 675F 4HR | PLATE | | | | | | x |
| | 1575F OQ 800F 4HR | PLATE | | | | | | x |
| | 1500F 1 HR.OQ.400F 1 HR | FORGED BAR | x | | | | | |
| | 1600F 1 HR.OQ 745F 1 HR | FORGED BAR | x | | | | | |
| | 1600F 1 HR.OQ.660F 1 HR | FORGED BAR | x | | | | | |
| | 1600F 1 HR.OQ 535F 1 HR | FORGED BAR | x | | | | | |
| | 1600F 1HR. 1525F . 5HR.OQ AT 150 175F, 900F 1HR | PLATE | x | | | | | |
| | 1600F 1HR OQ 500F 1+1HR | FORGING | | | | | | x |
| | 1600F @ 1525F OQ 400F 2+2HR 1600F @ 1525F OQ | FORGING | | | | | | x |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 4340 | 1650F 1HR AC 1680F 2HR OQ,LN 0 25HR,400F 1+1HR OQ | BAR | | | | | | X |
| | 1650F 1HR AC 1480F 2HR OQ,LN 0 25HR,400F 1+1HR OQ | BAR | | | | | | X |
| | 1650F 1 HR,AC,1525F 1 HR,OQ, 800F 2 HR | BILLET | X | | | | | |
| | 1700F 0 25HR AC 1550F OQ 600F 1+1HR | SHEET | | | | | | X |
| | 1800F 0.600F 1+1HR | FORGING | | | | | | X |
| | 2190F 1HR, FC TO 1600F,HOLD 0 5HR, 400F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1HR, FC TO 1600F,HOLD 0 5HR, 660F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1HR, FC TO 1600F,HOLD 0 5HR, 535F 1 HR | FORGED BAR | X | | | | | |
| | 2190F 1HR,OQ, 475F 1HR | FORGED BAR | X | | | | | |
| | 2190F 1HR,OQ, 535F 1HR | FORGED BAR | X | | | | | |
| | 450F TEMPER | ---- | | | | X | | |
| | 750F TEMPER | ---- | | | | X | | |
| 4340 (AM) | 1600F 1 HR,AC,1550F 1 HR,OQ, 320F 0 5 HR, 400F 2 HR,AC | FORGING | X | | | | | |
| 4340 (DH) | 1550F,OQ, 900F 1 HR | BILLET | X | | | | | |
| | 1600F 1 HR,AC,1550F 1 HR,OQ, 320F 0 5 HR, 400F 2 HR,AC | FORGING | X | | | | | |
| 4340 (VAR) | 1600F 1 HR,AC,1550F 1 HR,OQ, 320F 0 5 HR, 400F 2 HR,AC | FORGING | X | | | | | |
| 4340 (EFM) | 1550F 5HR,400F 4HR | PLATE | | | | | X | |

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

| ALLOY | CONDITION/HT | PRODUCT FORM | KIC | KC | R CURVES | DA/DN | DA/DT | KISCC |
|---|---|---|---|---|---|---|---|---|
| 4340V | | EXTRUSION | | | | | X | |
| 4340(MOD) | 1650F 1HR, 1600F 1HR OQ 1+1 600F (0 09 SI) | BAR | | | | | | X |
| | 1650F 1HR, 1600F 1HR OQ 1+1 400F (0 09 SI) | BAR | | | | | | X |
| | 1800F @ 460F 1+1HR (0 20C) | FORGING | | | | | | X |
| | 1800F @ 500F 1+1HR (0 21C) | FORGING | | | | | | X |
| | 1800F @ 600F 1HR (0 20C) | FORGING | | | | | | X |
| | 1800F @ 650F 1HR (0 24C) | FORGING | | | | | | X |
| | 1800F @ 650F 1+1HR (0 28C) | FORGING | | | | | | X |
| | 1800F @ 700F 1HR (0 21C) | FORGING | | | | | | X |
| | 1800F @ 780F 1+1HR (0 33C) | FORGING | | | | | | X |
| | 1800F @ 800F 1HR (0 46C) | FORGING | | | | | | X |
| | 1800F @ 900F 1HR (0 64C) | FORGING | | | | | | X |
| | 1800F @ 925F 1+1HR (0 53C) | FORGING | | | | | | X |

TABLE 6.0.2

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) L-T SPECIMEN THICK * | L-T MEAN | L-T STD. DEV. | T-L SPECIMEN THICK * | T-L MEAN | T-L STD. DEV. | S-L SPECIMEN THICK * | S-L MEAN | S-L STD. DEV. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AF1410 | 1650F 1HR. WQ. 1500F 1HR. WQ. 950F 5HRS. AC | PLATE | 2.00 | 1.75 | 139.6 | 11.7 | 1.75 | 136.7 | 7.4 | ---- | ---- | ---- |
| D6AC | HEAT TREATED TO 46 RC HARDNESS | PLATE | ----- | ---- | ---- | ---- | 0.70 | 85.8 | 1.8 | ---- | ---- | ---- |
| | 1615F 2.25HR, A-BQ 325F, AC. 310-345F 3HR, 1080F 6-6.5HR | FORGING | ----- | ---- | ---- | ---- | 1.00 | 78.4 | 15.1 | 0.97 | 83.9 | 14.8 |
| | 1650F AUS-BAY QUENCH 975F, BQ 325F, 1000F 2+2 HR | PLATE | 0.80-1.50 | 0.75 | 66.9 | 18.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F AUS-BAY QUENCH 975F, BQ 375F, 1000F 2+2 HR | PLATE | 1.50 | 0.60 | 62.2 | 14.0 | ---- | ---- | ---- | ---- | ---- | ---- |
| | | FORGING | 1.50 | 0.75 | 46.0 | 4.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F, AUS-BAY QUENCH 975F, BQ 400F, 1000F 2+2 HR | PLATE | 0.80 | 0.60 | 64.4 | 12.1 | ---- | ---- | ---- | ---- | ---- | ---- |
| | | FORGING | 0.80-1.50 | 0.60 | 66.2 | 12.3 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F, 1 HR, FC 1650F 1 HR, OQ, 1025F 2+2 HR | BILLET | 7.00 | 1.00 | 78.5 | 4.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR | BILLET | 7.00 | 1.00 | 80.3 | 0.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR | PLATE | 0.80-1.50 | 0.61 | 92.0 | 8.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | | FORGING | 0.80-1.50 | 0.75 | 95.2 | 6.4 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| D6AC | 1700F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR | BILLET | 7.00 | 1.00 | 80.3 | 4.3 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1700F, 1 HR, OQ, 1025F 2+2 HR | BILLET | 7.00-10.00 | 1.00 | 77.3 | 2.6 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1725F 1 HR, AC 1700F 1 HR, OQ, 1000F 1 HR, 1015F 1 HR | BILLET | 7.00 | 1.00 | 77.2 | 2.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1725F, 1 HR, AC 1700F 1 HR, OQ, 1100F 2+2 HR | BILLET | 7.00-10.00 | 1.00 | 101.2 | 6.1 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1725F, 1 HR, AC 1700F 1 HR, OQ, 1025F 2+2 HR | BILLET | 7.00-10.00 | 1.00 | 74.4 | 6.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1725F, 1 HR, AC 1650F 1 HR, FC TO 960F, SQ 350F 0.5 HR, AC 1025F 2+2 HR | BILLET | 7.00 | 1.00 | 75.1 | 10.1 | ---- | ---- | ---- | ---- | ---- | ---- |
| HP 9-4-.20 | ---- | FORGING | 1.25 | 2.00 | 150.6 | 4.5 | 2.00 | 136.3 | 16.0 | ---- | ---- | ---- |
| | ANNEALED | FORGING | 3.00 | 1.00 | 120.6 | 7.3 | 2.00 | 117.7 | 1.9 | ---- | ---- | ---- |
| | HEAT TREATED | FORGING | 3.40-7.00 | 1.50 | 140.7 | 4.5 | 1.46 | 132.3 | 6.6 | ---- | ---- | ---- |
| | 1525F OQ, -100F 1HR, 1065F 4+4HR | FORGING | 4.00 | ---- | ---- | ---- | 1.50 | 111.7 | 2.0 | ---- | ---- | ---- |
| | 1650F 1-2 HR AC, 1525F 1-2 HR OQ, -100F 2HR, 1050F 4-6HR | FORGING | 3.00-3.25 | 1.50 | 133.2 | 3.9 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| HP 9-4-.20 | 1650F 1-2HR AC,1525F 1-2 HR AC,-100F 1-2HR,1025F 4HR | FORGING | 4.00-7.00 | 1.75 | 134.8 | 12.3 | 1.76 | 109.7 | 4.7 | ---- | ---- | ---- |
| | 1650F 1-2HR AC 1525F 1-2HR | PLATE | 2.50 | 2.00 | 121.5 | 29.0 | ---- | ---- | ---- | ---- | ---- | ---- |
| | OQ,-100F 2HR, 1025F 4-6HR | FORGING | 4.00 | 2.00 | 142.8 | 10.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F 1-2HR AC 1525F 1-2HR OQ,-100F 2HR, 1025F 4-6HR | FORGING | 4.00 | 1.51 | 129.1 | 9.7 | 1.51 | 125.3 | 1.8 | ---- | ---- | ---- |
| | 1650F 2HR AC, 1525F 2HR OQ, 1000F 2+2HR AC | FORGING | 4.00 | 1.24 | 94.4 | 4.4 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F,1-2HR,AC 1-2HR,AC,-100F 1.5HR,1025F 4 HR,1060F 6HR | PLATE | 2.50 | 2.00 | 123.5 | 12.0 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F,1-2HR,AC 1.5HR OQ,1025F 12HR | FORGING | 4.00 | 1.55 | 125.5 | 3.5 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F,4.5HR,AC TO 900F,HELD 0.5HR,AC,-100F 1.5HR,1025F 8 HR,A-BQ | FORGING | 4.00 | 1.59 | 128.5 | 0.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1700F 4.5HR,AC 1700F 1.5HR,AC -100F 1.5HR,1 025F 4HRS | FORGING | 4.00 | 1.60 | 140.5 | 0.7 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| HP 9-4-.25(VAR) | 1550F 1 HR.OQ 1000F 2+2HR.AC | FORGING | 3.00 | ---- | ---- | ---- | 2.00 | 98.7 | 4.5 | ---- | ---- | ---- |
| HP 9-4-.30 | HEAT TREATED TO 49 RC HARDNESS | PLATE | 3.25 | ---- | ---- | ---- | 1.01 | 82.5 | 5.0 | ---- | ---- | ---- |
| | 1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR. 1000F 4HR | FORGING | 3.00 | 1.00 | 106.0 | 1.4 | 1.00 | 89.0 | 3.0 | ---- | ---- | ---- |
| | 1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR. 1050F 4HR | FORGING | 3.00 | ---- | ---- | ---- | 1.00 | 87.5 | 0.8 | ---- | ---- | ---- |
| | 1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR 1025F 4HR | FORGING | 3.00 | ---- | ---- | ---- | 1.00 | 93.5 | 0.7 | ---- | ---- | ---- |
| | 1650F, 2HR AC 1550F 2HR OQ 1000F 2+2HR AC | FORGING | 3.25 | 2.02 | 82.0 | 0.0 | ---- | ---- | ---- | ---- | ---- | ---- |
| HY-TUF | 1700F 1HR.AC, 1600F 1HR.OQ, 550F 2HR | FORGING | 6.50 | ---- | ---- | ---- | 1.00 | 111.5 | 2.1 | ---- | ---- | ---- |
| 18NI(200)(MAR) | 1650F 4.5 HR, AC, AGED 1000F 6 HR | PLATE | 4.25 | 2.40 | 102.3 | 1.2 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| 18NI(200)(MAR) | 1650F 4.5 HR, AC, AGED 950F 24 HR | PLATE | 4.25 | 2.40 | 99.3 | 1.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F 4.5 HR, AC, AGED 900F 24 HR | PLATE | 4.25 | 2.40 | 96.5 | 0.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F 4.5 HR, AC, AGED 900F 6 HR | FORGING | 3.00 | 2.40 | 100.3 | 0.6 | ---- | ---- | ---- | ---- | ---- | ---- |
| 18NI(250)(MAR) | 1500F AC, 850F 6 HR | PLATE | 4.25 | 1.80 | 76.0 | 1.9 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1500F AC, 900F 24 HR | PLATE | 2.00 | 1.80 | 80.7 | 1.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1500F AC, 950F 6 HR | PLATE | 2.00 | 1.80 | 84.0 | 2.6 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1500F 1HR, AC, AGED 900F 3HR, AC | BILLET | 1.00-12.00 | 0.50 | 74.3 | 4.2 | 0.80 | 64.1 | 4.4 | ---- | ---- | ---- |
| | 1500F, AC, 900F 6 HR | PLATE | 2.00 | 1.80 | 82.3 | 3.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| 300M | ---- | FORGING | 1.25 | 1.25 | 52.6 | 2.3 | 1.25 | 52.9 | 2.0 | ---- | ---- | ---- |
| | HEAT TREATED TO 54 RC HARDNESS | PLATE | 1.00 | ---- | ---- | ---- | 0.45 | 58.6 | 3.5 | ---- | ---- | ---- |
| | 1600F 1.25 HR, OQ. 600F 2+2HR | FORGING | 3.00 | 0.25 | 54.6 | 2.5 | 0.25 | 50.6 | 1.7 | 0.25 | 54.1 | 1.1 |
| | 1700F 1HR AC, 1600F 1HR OQ, 600F 2HR AC (AMS 6419) | PLATE | 1.00 | 0.50 | 51.8 | 0.7 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| 300M | 2190F 1HR, FC TO 1600F, HOLD 0.5HR, OQ, 475F 1HR | BAR | 0.62 | 0.60 | 47.9 | 3.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| 300M (AM) | 1650F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5 HR, 600F 2+2HR, AC | FORGING | 4.00 | 0.90 | 46.5 | 3.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| 300M (VAR) | 1650F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5 HR, 600F 2+2HR, AC | FORGING | 4.50 | 0.90 | 52.2 | 1.3 | ---- | ---- | ---- | ---- | ---- | ---- |
| 300M(VM) | 1500F, OQ, 400F 2+2HR | PLATE | 0.56 | 0.50 | 48.0 | 17.0 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1500F, OQ, 550F 2+2HR | PLATE | 0.56 | 0.50 | 49.5 | 10.6 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1550F, OQ, 550F 2+2HR | PLATE | 0.56 | 0.50 | 62.9 | 3.5 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1700F, AC, 1600F 1 HR, OQ, 550F 2+2 HR | BILLET | 5.50 | ---- | ---- | ---- | 1.00 | 55.3 | 0.3 | ---- | ---- | ---- |
| | 1700F, AC, 1600F 1 HR, SQ 975F, OQ, 575F 2+2 HR | BILLET | 5.50 | ---- | ---- | ---- | 1.00 | 59.6 | 2.2 | ---- | ---- | ---- |
| | 1700F, AC, 1600F 1 HR, SQ 400F, AC, 550F 2+2 HR | BILLET | 5.50 | ---- | ---- | ---- | 1.00 | 58.0 | 3.4 | ---- | ---- | ---- |
| 4140 | 2010F 1 HR, OQ, 475F 1 HR | FORGED BAR | 0.62 | 0.60 | 52.1 | 7.4 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| 4140 | 2190F 1 HR, OQ, 400F 1 HR | FORGED BAR | 0.62 | 0.60 | 81.1 | 13.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 2190F 1 HR, OQ, 475F 1 HR | FORGED BAR | 0.62 | 0.60 | 66.1 | 2.7 | ---- | ---- | ---- | ---- | ---- | ---- |
| 4330V MOD | HEAT TREATED TO 46 RC HARDNESS | PLATE | 0.62 | ---- | ---- | ---- | 0.75 | 74.7 | 0.8 | ---- | ---- | ---- |
| | 1600F 1 HR, OQ, 535F 1 HR | FORGED BAR | 0.62 | 0.60 | 96.7 | 3.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F 1 HR, AC, 1575F 1 HR, OQ, 800F 2+2 HR | BILLET | 6.00 | 1.00 | 96.1 | 3.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1650F 1 HR, AC, 1575F 1 HR, OQ, 525F 2+2 HR | BILLET | 6.00 | 1.00 | 81.6 | 2.3 | ---- | ---- | ---- | ---- | ---- | ---- |
| 4340 | HEAT TREATED TO 51 RC HARDNESS | PLATE | 0.62 | ---- | ---- | ---- | 0.50 | 51.7 | 1.3 | ---- | ---- | ---- |
| | 1550F, OQ, TEMPERED 800F | PLATE | 1.00 | 0.80 | 76.6 | 4.6 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1550F, OQ, TEMPERED 500F | PLATE | 1.00 | 0.80 | 45.3 | 2.9 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1600F 1 HR, OQ, 535F 1 HR | FORGED BAR | 0.62 | 0.60 | 60.9 | 0.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 1600F 1HR, 1525F 2.5HR, OQ AT 150-175F, 900F 1HR | PLATE | 1.00 | ---- | ---- | ---- | 1.01 | 88.2 | 1.5 | ---- | ---- | ---- |
| | 1650F 1 HR, AC, 1525F 1 HR, OQ, 800F 2 HR | BILLET | 10.00 | 1.00 | 76.3 | 3.6 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | RANGE OF PRODUCT THICKNESSES (IN) | KIC (KSI SQRT(IN)) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L-T | | | T-L | | | S-L | | |
| | | | | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. | SPECIMEN THICK * | MEAN | STD. DEV. |
| 4340 | 2190F 1HR, FC TO 1600F, HOLD 0.5HR, 400F 1 HR | FORGED BAR | 0.62 | 0.60 | 76.8 | 0.1 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 2190F 1HR, FC TO 1600F, HOLD 0.5HR, 660F 1 HR | FORGED BAR | 0.62 | 0.60 | 60.8 | 0.8 | ---- | ---- | ---- | ---- | ---- | ---- |
| | 2190F 1HR, FC TO 1600F, HOLD 0.5HR, 935F 1 HR | FORGED BAR | 0.62 | 0.60 | 60.1 | 3.2 | ---- | ---- | ---- | ---- | ---- | ---- |
| 4340 (AM) | 1600F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5 HR, 400F 2 HR, AC | FORGING | 4.00 | 0.90 | 40.5 | 0.5 | ---- | ---- | ---- | ---- | ---- | ---- |
| 4340 (DH) | 1550F, OQ, 900F 1 HR | BILLET | 1.00 | ---- | ---- | ---- | 1.00 | 66.3 | 6.2 | ---- | ---- | ---- |
| | 1600F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5 HR, 400F 2 HR, AC | FORGING | 4.00 | 0.90 | 51.0 | 3.0 | ---- | ---- | ---- | ---- | ---- | ---- |
| 4340 (VAR) | 1600F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5HR, 400F 2 HR, AC | FORGING | 4.00 | 0.90 | 55.0 | 4.4 | ---- | ---- | ---- | ---- | ---- | ---- |

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.3

PLANE STRESS AND TRANSITIONAL FRACTURE TOUGHNESS OF STEEL ALLOYS (WITHOUT BUCKLING CONSTRAINTS)

| Alloy | Condition/Ht | Test Temp. (°F) | Specimen Orient | Specimen Width (in) | Yield Strength (Ksi) | Specimen Thickness (in) = 0.025 $K_c^*$ (Ksi $\sqrt{in}$) |
|---|---|---|---|---|---|---|
| 18 Ni(300) MAR | ---- | -423 | L-T | 4.0 | 386 | 86.4/7.3 (5) |
| | | -320 | L-T | 2.0 | 336 | 142.6/7.4 (5) |
| | | | | 4.0 | 336 | 124.7/8.0 (5) |
| | | R. T. | L-T | 2.0 | 277 | 132.1/4.3 (5) |
| | | | | 4.0 | 277 | 128.5/3.8 (5) |
| | | | | 18.0 | 277 | 110.3/10.9 (3) |

* Mean/Standard Deviation (No. of Specimens)

TABLE 6.0.4.1

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.02-0.10

FREQUENCY: 0.10-30.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| AF1410 | 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | .10- 30.00 | | .164 | .633 | 4.07 | 29.8 | |
| | 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | .10- 30.00 | | .102 | .636 | 3.60 | 30.7 | 139. |
| AF1410(VIM-VAR) | 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC | PLATE | 0.08 | 30.00 | | | .646 | 3.88 | 27.3 | |
| A286 | 1800F 0.5-1.0HR WQ 1325F 16HR AC | PLATE | 0.05 | 3.00 | | | | 1.59 | 31.8 | |
| D6AC | 1650F A-BQ AT 975F, BQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | .10 | | | | | 65.2 | |
| | 1650F A-BQ AT 975F, BQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | 1.00 | | | | 2.85 | | |
| | 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.10 | 1.00 | | | | 5.61 | 51.3 | |
| HP9-4-20 | ------ | FORGING | 0.02 | 0.10- 20.00 | | | .180 | 1.61 | 18.9 | 126 |
| | | BAR | 0.02 | 10.00 | | | | 3.58 | 33.2 | |

TABLE 6.0.4.1 (con't)

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.02-0.10

FREQUENCY: 0.10-30.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| HP9-4-.20(CEVM) | ANNEALED | FORGING | 0.10 | 5.00-10.00 | | | | 6.19 | 37.0 | |
| HP9-4-.30 | | FORGING | 0.02 | 5.00- 20.00 | | | .399 | 2.99 | 38.9 | |
| | | BAR | 0.02 | 1.00 | | | | | 46.4 | |
| | | BAR | 0.02 | 10.00 | | | | 3.59 | 46.6 | |
| HY-180 | STA (UTS = 180 KSI) | FORGED BAR | 0.10 | 30.00 | | .0986 | .556 | 3.33 | | |
| | STA (UTS = 180 KSI) | FORGED BAR | 0.10 | 10.00 | | | | 4.29 | 30.8 | |
| H11 | AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0.10 | 10.00 | | | | 3.53 | | |
| | AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0.10 | 30.00 | | | .339 | 2.95 | | |
| 12-9-2 MAR | STA 900 | ROUND BAR | 0.10 | 10.00 | | | | 8.17 | | |
| | STA 900 | ROUND BAR | 0.10 | 30.00 | | | .149 | 8.92 | | |

TABLE 6.0.4.1 (con't)

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: LAB AIR AT R.T

STRESS RATIO: 0.02-0.10

FREQUENCY: 0.10-30.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 300M | ----- | FORGING | 0.02 | .10- 20.00 | SP THK=1.25" | | .716 | 3.83 | 82.7 | |
| | TUS = 280 - 300 KSI | FORGING | 0.02 | 10.00 | SP THK=0.25" | | | 3.56 | 47.0 | |
| 4330V(MOD) | ------ | BILLET | 0.02 | 1.00- 30.00 | | | 2.11 | 7.44 | 28.4 | |
| 4340 | MARTEMPERED | PLATE | 0.02 | ---- | | | .492 | 3.12 | 23.0 | 111. |
| | UTS = 160 KSI | ROUND BAR | 0.10 | 7.00 | | | | 2.47 | | |
| | UTS = 180 KSI | ROUND BAR | 0.10 | 20.00- 30.00 | | | .507 | 2.96 | 23.2 | |

TABLE 6.0.4.2

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN ORIENTATION: T-L

ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.02-0.10

FREQUENCY: 0.10-30.00HZ

| ALLOY | CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQUENCY | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) = 2.5 | 5.0 | 10.0 | 20.0 | 50.0 | 100.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| AF1410 | 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | .10- 30.00 | | .134 | .513 | 4.11 | 27.2 | 498. |
| | 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | .10- 30.00 | | | .717 | 4.07 | 28.1 | 149. |
| AF1410(VIM-VAR) | 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC | PLATE | 0.08 | 0.10- 30.00 | | | .711 | 3.95 | 29.3 | |
| A286 | 1800F 0.5-1.0HR WQ, 1325F 16HR AC | PLATE | 0.05 | 3.00 | | | | 1.82 | | |
| HP9-4-.20 | ----- | FORGING | 0.02 | 0.10- 20.00 | | | .242 | 2.99 | 30.7 | 490. |
| HP9-4-.20(CEVM) | ANNEALED | FORGING | 0.10 | 10.00- 15.00 | | | | 6.53 | 42.9 | |
| HP9-4-.30 | ----- | FORGING | 0.02 | 0.10- 20.00 | | | .399 | 3.34 | 45.8 | 1883. |
| 18NI(250)MAR | TUS=243KSI | BILLET | 0.10 | 10.00 | | | 1.16 | 5.91 | 71.0 | |
| 300M | ----- | FORGING | 0.02 | .10- 20.00 | | .118 | .749 | 3.87 | 117. | |

TABLE 6.0.5

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | SPECIMEN ORIENTATION | $K_{ISCC}$ (Ksi$\sqrt{in}$) ENVIRONMENTS: SIMULATED SEA WATER | SEA WATER | DISTILLED WATER | 3.5% NaCl | SUMP TANK WATER |
|---|---|---|---|---|---|---|---|---|
| D6AC | 1550F AQ 650F 4HR | S | L-T | | | 7.0 | | |
| | 1550F AQ 950F 4HR | S | L-T | | | 45.2 | | |
| HP9-4-.20 | GTA Weld | P | --- | 65.0 | | | | |
| | Quenched and Tempered | P | --- | | | | 110.0(2) | |
| | 1525F 2HR OQ -100F 2HR 1025F 4HR | P | L-T | | | | | 105.0(3) |
| | | | T-L | | | | | 97.4(5) |
| | | FB | L-T | | | | | 110.0 |
| | | | T-L | | | | | 107.0(2) |
| | | | S-T | | | | | 78.3(3) |
| HP9-4-.45 | 475F | P | --- | | | | 20.0 | |
| H-11 | Quenched and Tempered at 1100F | P | --- | | | | 30.0 | |
| 12Ni-5Cr-3Mo | Electric Furnace | P | --- | 40.0 | | | | |
| | GTA Welded | W | --- | 33.0 | | | | |
| | Low Residual | P | --- | 108.0 | | | | |
| | 1550F, 900F 20HR AC | P | L-S | | | | 80.0 | |
| | | | T-S | | | | 70.0 | |
| 18Ni(180)(MAR) | TYS=178 KSI | P | --- | 108.0 | | | | |
| | TYS=195 KSI | P | --- | | | | 60.0 | |
| | TYS=200 KSI | P | --- | | | | 105.0 | |
| 18Ni(200)(MAR) | TYS=215 KSI | P | --- | | | | 70.0 | |
| | Weld Center Line | P | L-S | | | | 70.0 | |
| | 1500F 1HR AC 900F 3HR | P | T-S | | | | 39.0 | |
| | 1675F 2HR AC | P | T-S | | | | 48.0 | |
| | 500F 0.25HR 850F 4HR/cool 250F/min | W | T-S | | | | 78.0 | |

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | SPECIMEN ORIENTATION | $K_{ISCC}$ (Ksi$\sqrt{in}$) ENVIRONMENTS: SIMULATED SEA WATER | SEA WATER | DISTILLED WATER | 3.5% NaCl | SUMP TANK WATER |
|---|---|---|---|---|---|---|---|---|
| 18Ni(250)(MAR) | AGE 900F 3HR | P | L-S | | | | 40.5(2) | |
| | AC | | L-T | | | | 45.0 | |
| | TYS=250 KSI | P | --- | | | | 50.0 | |
| | TYS=260 KSI | P | --- | | | | 70.0 | |
| | 1650F 1.25HR WQ 1525F 1.25HR WQ 900F 3HR AC | P | | 36.7 | | | | |
| 18Ni(280)(MAR) | 1500F 1HR AC 900F 3HR | P | --- | | | | 14.0 | |
| 18Ni(300)(MAR) | AGED 900F | F | L-T | | | | 7.0 | |
| | 6HR | | T-L | | | | 6.0(2) | |
| | AGED 950F 12HR | F | T-L | | | | 6.0 | |
| | Crack Prestressed to 50PCT KIC | F | T-L | | | | 5.0 | |
| | Crack Prestressed to 25 PCT KIC | F | T-L | | | | 5.0 | |
| | Crack Prestressed to 80 PCT KIC | F | T-L | | | | 10.0 | |
| | 1500F 0.5HR AC 900F 3HR | P | L-S | | | 48.0(2) | | |
| | 1500F 2HR 800F 10HR | B | L-S | | | 9.0 | | |
| | 1700F, 1500F AGED 900F 6HR | F | T-L | | | | 7.5 | |
| | 900F 3HR 950F 3HR | F | T-L | | | | 5.0 | |
| 18Ni(350)(MAR) | AGE 800F 8HR | FB | --- | | | | 5.0 | |
| | AGE 900F 3HR | FB | --- | | | | 10.0 | |
| | AGE 900F 8HR | FB | --- | | | | 10.0 | |

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | SPECIMEN ORIENTATION | $K_{ISCC}$ (Ksi$\sqrt{in}$) ENVIRONMENTS: SIMULATED SEA WATER | SEA WATER | DISTILLED WATER | 3.5% NaCl | SUMP TANK WATER |
|---|---|---|---|---|---|---|---|---|
| 18Ni(350)(MAR) | 1500F 1HR 800F 8HR | F | L-S | | | | 5.0 | |
| | 1500F 1HR 900F 8HR | F | L-S | | | | 10.0 | |
| | 1500F 1HR 950F 3HR | F | L-S | | | | 10.0 | |
| 300M | 1500F 0.5HR OQ 400F 2+2HR (Coarse Grain) | P | --- | | | | 12.0 | |
| | 1500F 0.5HR OQ 400F 2+2HR (Fine Grain) | P | --- | | | | 12.0 | |
| | 1500F 0.5HR OQ 550F 2+2HR (Coarse Grain) | P | --- | | | | 15.0 | |
| | 1500F 0.5HR OQ 550F 2+2HR (Fine Grain) | P | --- | | | | 15.0 | |
| | 1550F 0.5HR OQ 400F 2+2HR (Coarse Grain) | P | --- | | | | 15.0 | |
| | 1550F 0.5HR OQ 400F 2+2HR (Fine Grain) | P | --- | | | | 15.0 | |
| | 1550F 0.5HR OQ 550F 2+2HR (Coarse Grain) | P | --- | | | | 15.0 | |
| | 1550F 0.5HR OQ 550F 2+2HR (Fine Grain) | P | --- | | | | 15.0 | |
| | 1600F 0.5HR OQ 400F 2+2HR (Coarse Grain) | P | --- | | | | 12.0 | |
| | 1600F 0.5HR OQ 550F 2+2HR (Coarse Grain) | P | --- | | | | 12.0 | |
| | 1600F 0.5HR OQ 550F 2+2HR (Fine Grain) | P | --- | | | | 12.0 | |
| | 1650F, 1600F 1HR OQ 600F 1+1HR | F | L-S | | | | 19.6 | |
| | 1700F 1.5HR AC 1600F 1.5HR OQ 600F 2+2HR | F | S-L | | | | | 15.5(2) |
| | 1710F, 1610F 610F | B | L-T<br>T-L | | | | 17.4(3)<br>17.6(4) | |

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | SPECIMEN ORIENTATION | $K_{ISCC}$ (Ksi$\sqrt{in}$) ENVIRONMENTS: SIMULATED SEA WATER | SEA WATER | DISTILLED WATER | 3.5% NaCl | SUMP TANK WATER |
|---|---|---|---|---|---|---|---|---|
| 4140 | 1700F 1600F OQ 750 1+1HR | P | --- | | | 15.0 | | |
| | 1700F 1600F OQ 600F 1+1HR | P | --- | | | 11.0 | | |
| 4330V | Quenched and Tempered at 500F | P | L-S | | | | 25.0 | |
| 4340 | TYS=150 KSI | P | T-L | | 59.0 | | | |
| | TYS=175 KSI | P | T-L | | 27.0 | | | |
| | TYS=200 KSI | P | T-L | | 10.0 | | | |
| | TYS=225 KSI | P | T-L | | 5.0 | | | |
| | 1350F OQ 750F 1.25HR | P | T-S | | 8.5 | | | |
| | 1550F OQ 750F Crack Prestressed to 80 PCT $K_{Ic}$ | P | --- | | | | 24.0 | |
| | 1550F OQ 750F Crack Prestressed to 60 PCT $K_{Ic}$ | P | --- | | | | 23.0 | |
| | 1550F OQ 750F Crack Prestressed to 40 PCT $K_{Ic}$ | P | --- | | | | 17.0 | |
| | 1550F OQ 750F Crack Prestressed to 20 PCT $K_{Ic}$ | P | --- | | | | 12.0 | |
| | 1550F OQ 750F 1HR | P | --- | | | | 8.0 | |
| | 1575F OQ 675F 4HR | P | --- | | | 9.8 | | |
| | 1575F OQ 800F 4HR | P | --- | | | 9.8 | | |
| | 1600F 1HR OQ 600F 1+1HR | F | --- | | | | 10.0 | |
| | 1650F 1HR AC 1680F 2HR OQ LN 0.25HR 400F 1+1HR OQ | B | L-T | | | | 15.0 | |

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | SPECIMEN ORIENTATION | $K_{ISCC}$ (Ksi$\sqrt{in}$) ENVIRONMENTS: SIMULATED SEA WATER | SEA WATER | DISTILLED WATER | 3.5% NaCl | SUMP TANK WATER |
|---|---|---|---|---|---|---|---|---|
| 4340 | 1650F 1HR AC 1480F 2HR OQ LN 0.25HR 400F 1+1HR OQ | B | L-T | | | | 15.0 | |
| | 1700F 0.25HR AC 1550F OQ 600F 1+1HR | S | --- | | | | 29.0 | |
| | 1800F Q 600F 1+1HR | F | L-S | | | | 25.2(12) | |
| 4340 MOD | 1650F 1HR 1600F 1HR OQ 1+1 600F (0.09 SI) | B | T-L | | | | 18.0 | |
| | 1650F 1HR 1600F 1HR OQ 1+1 400F (0.09 SI) | B | T-L | | | | 13.0 | |
| | 1800F Q 460F 1+1 HR (0.20C) | F | L-S | | | | 56.0 | |
| | 1800F Q 500F 1+1HR (0.21C) | F | L-S | | | | 52.0 | |
| | 1800F Q 600F 1 HR (0.20C) | F | L-S | | | | 72.0 | |
| | 1800F Q 650F 1HR (0.24C) | F | L-S | | | | 62.0 | |
| | 1800F Q 650F 1HR (0.28C) | F | L-S | | | | 35.0 | |
| | 1800F Q 700F 1HR (0.21C) | F | L-S | | | | 42.0 | |
| | 1800F Q 780F 1+1HR (0.33C) | F | L-S | | | | 32.0 | |
| | 1800F Q 800F 1HR (0.46C) | F | L-S | | | | 20.0 | |
| | 1800F Q 900F 1HR (0.64C) | F | L-S | | | | 30.0 | |
| | 1800F Q 925F 1+1HR (0.53C) | F | L-S | | | | 42.0 | |

TABLE 6.1.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL AF1410 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | PLATE | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 1HR. WQ. 1500F 1HR. WQ. 950F 5HRS. AC | 139.6 ± 11.7 (2) | 136.7 ± 7.4 (2) | ----- |

TABLE 6.1.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL AF1410

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | 0.10-30.00 | | | 0.10 | 0.63 | 3.60 | 30.7 | 139 |
| 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | 0.10-30.00 | | | 0.16 | 0.63 | 4.07 | 29.5 | |

TABLE 6.1.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL AF1410

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | 0.10-30.00 | | | 0.13 | 0.51 | 4.11 | 27.2 | 498 |
| 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC | ROUND BAR | 0.02 | 0.10-30.00 | | | | 0.71 | 4.07 | 28.1 | 149 |

TABLE 6.1.2.1

ALLOY STEEL AF1410 K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC | P | 2.00 | - 65 | L-T | 235.7 | 3.500 | 1.750 | CT | ---- | 0.54 | 109.90 | | 1977 | RI001 |
| 1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC | P | 2.00 | R.T | L-T | 228.4 | 3.500 | 1.750 | CT | ---- | 0.82 | 131.30 | | 1977 | RI001 |
| | | 2.00 | | | 228.4 | 3.500 | 1.750 | CT | ---- | 1.04 | 147.80 | | 1977 | RI001 |
| | | | | | | | | | | | | 139.6/ 11.7 | | |
| 1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC | P | 2.00 | - 65 | T-L | 248.6 | 3.500 | 1.750 | CT | ---- | 0.49 | 111.10 | | 1977 | RI001 |
| 1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC | P | 2.00 | R.T. | T-L | 228.4 | 3.500 | 1.750 | CT | ---- | 0.96 | 141.90 | | 1977 | RI001 |
| | | 2.00 | | | 228.4 | 3.500 | 1.750 | CT | ---- | 0.82 | 131.40 | | 1977 | RI001 |
| | | | | | | | | | | | | 136.7/ 7.4 | | |

TABLE 6.1.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.1.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.02 | | | |
| DELTA K MIN A: | 3.88 | .0513 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |
| | 4.00 | .0558 | | | |
| | 5.00 | .102 | | | |
| | 6.00 | .167 | | | |
| | 7.00 | .252 | | | |
| | 8.00 | .357 | | | |
| | 9.00 | .485 | | | |
| | 10.00 | .636 | | | |
| | 13.00 | 1.24 | | | |
| | 16.00 | 2.08 | | | |
| | 20.00 | 3.60 | | | |
| | 25.00 | 6.16 | | | |
| | 30.00 | 9.49 | | | |
| | 35.00 | 13.6 | | | |
| | 40.00 | 18.5 | | | |
| | 50.00 | 30.7 | | | |
| | 60.00 | 46.1 | | | |
| | 70.00 | 64.7 | | | |
| | 80.00 | 86.4 | | | |
| | 90.00 | 111. | | | |
| | 100.00 | 139. | | | |
| | 130.00 | 240. | | | |
| DELTA K MAX A: | 152.83 | 334. | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 18.40

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 4 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: WOL
ORIENTATION: L-T
FREQUENCY: 0.10- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 209.0- 222.0 KSI
ULT. STRENGTH: 243.0- 247.0 KSI
SPECIMEN THK: 0.499- 0.506"
SPECIMEN WIDTH: 2.989- 3.006"
REFERENCES: MA004

ALLOY STEEL

AF1410

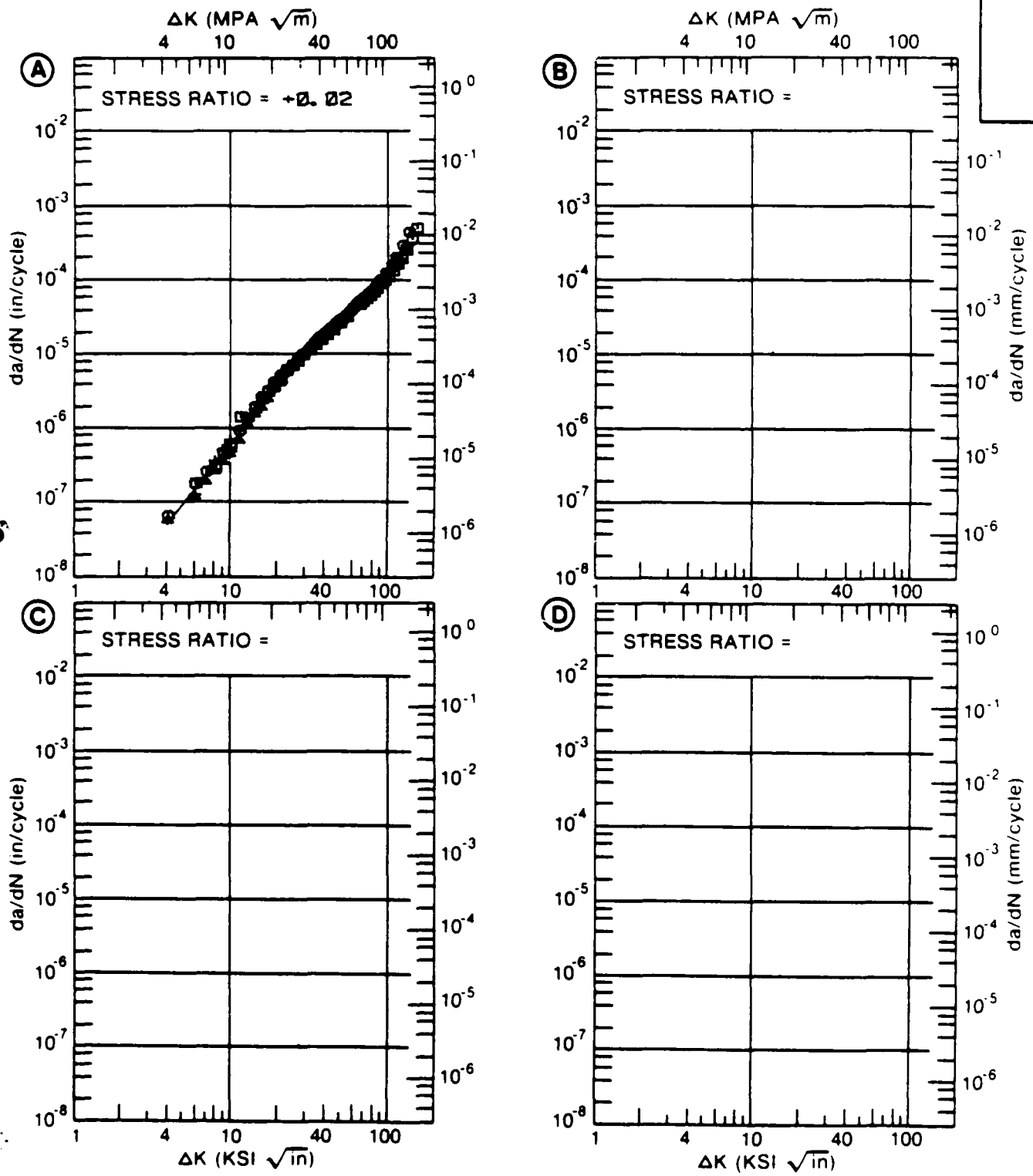



Figure 6.1.3.1

TABLE 6.1.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.1.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.02 | | | |
| DELTA K MIN | A: 5.79 | .117 | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 6.00 | .134 | | | |
| | 7.00 | .233 | | | |
| | 8.00 | .363 | | | |
| | 9.00 | .525 | | | |
| | 10.00 | .717 | | | |
| | 13.00 | 1.46 | | | |
| | 16.00 | 2.44 | | | |
| | 20.00 | 4.07 | | | |
| | 25.00 | 6.60 | | | |
| | 30.00 | 9.66 | | | |
| | 35.00 | 13.3 | | | |
| | 40.00 | 17.5 | | | |
| | 50.00 | 28.1 | | | |
| | 60.00 | 42.0 | | | |
| | 70.00 | 60.1 | | | |
| | 80.00 | 83.1 | | | |
| | 90.00 | 112. | | | |
| | 100.00 | 149. | | | |
| | 130.00 | 320. | | | |
| DELTA K MAX | A: 135.83 | 368. | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 13.68

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 4 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: WOL
ORIENTATION: T-L
FREQUENCY: 0.10- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 211.0- 221.0 KSI
ULT. STRENGTH: 243.0- 249.0 KSI
SPECIMEN THK: 0.498- 0.506"
SPECIMEN WIDTH: 2.979- 2.995"
REFERENCES: MA004

ALLOY STEEL

AF1410

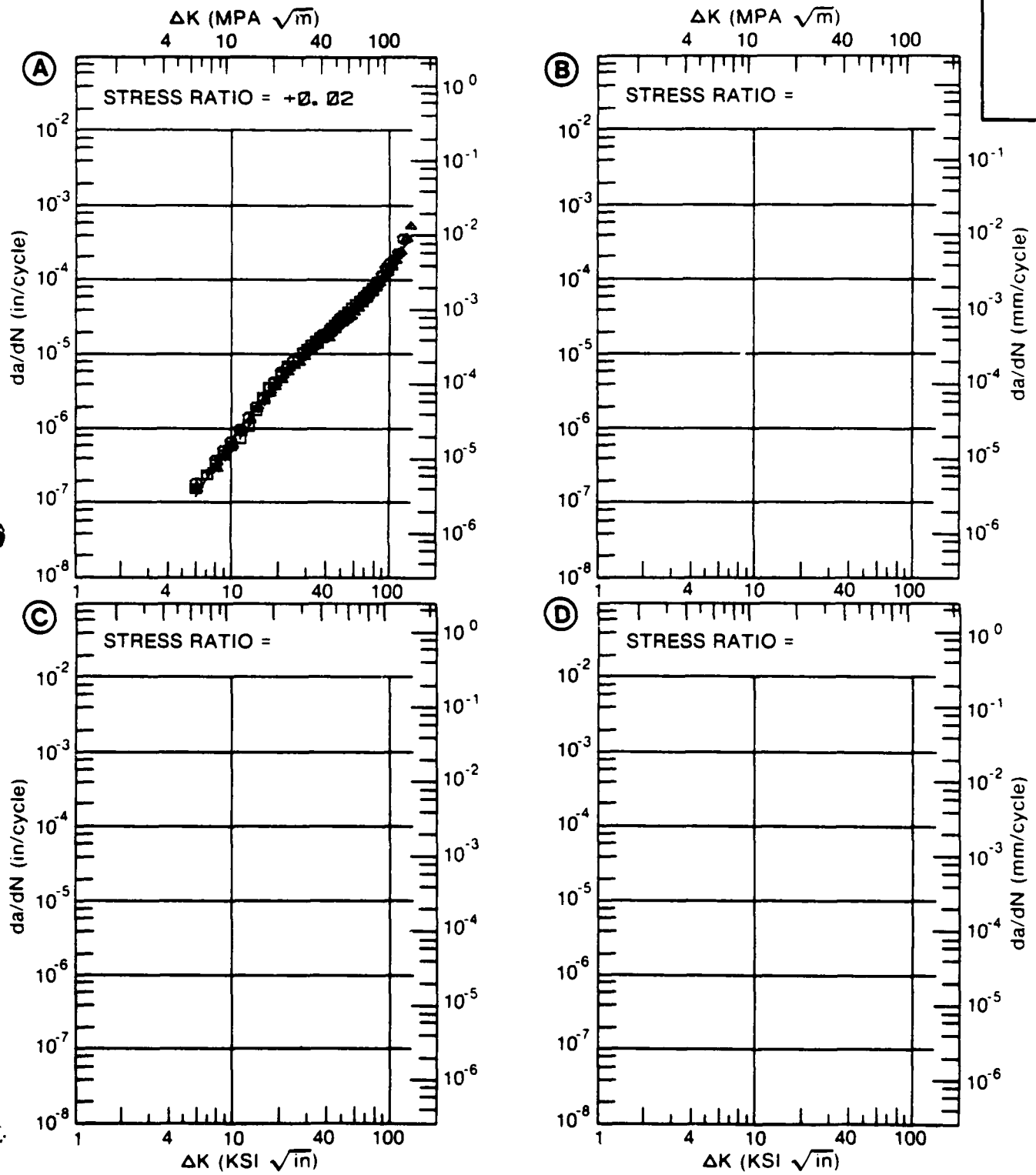



Figure 6.1.3.2

TABLE 6.1.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.1.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.02 | | | |
| DELTA K MIN | A: | 3.95 | .08 | | | |
| | B: | 5 | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 4.00 | .0906 | | | |
| | | 5.00 | .164 | | | |
| | | 6.00 | .194 | | | |
| | | 7.00 | .237 | | | |
| | | 8.00 | .322 | | | |
| | | 9.00 | .452 | | | |
| | | 10.00 | .633 | | | |
| | | 13.00 | 1.45 | | | |
| | | 16.00 | 2.50 | | | |
| | | 20.00 | 4.07 | | | |
| | | 25.00 | 6.31 | | | |
| | | 30.00 | 8.97 | | | |
| | | 35.00 | 12.3 | | | |
| | | 40.00 | 16.6 | | | |
| | | 50.00 | 29.5 | | | |
| | | 60.00 | 52.4 | | | |
| | | 70.00 | 93.5 | | | |
| | | 80.00 | 167. | | | |
| | | 90.00 | 289. | | | |
| DELTA K MAX | A: | 96.86 | 395. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.95

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 2 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
FORM: 4.50"TH ROUND BAR
SPECIMEN TYPE: WOL
ORIENTATION: L-T
FREQUENCY: 0.10- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR
YIELD STRENGTH: 212.0 KSI
ULT. STRENGTH: 240.0 KSI
SPECIMEN THK: 0.501"
SPECIMEN WIDTH: 2.981- 2.983"
REFERENCES: MA004

ALLOY STEEL

AF1410

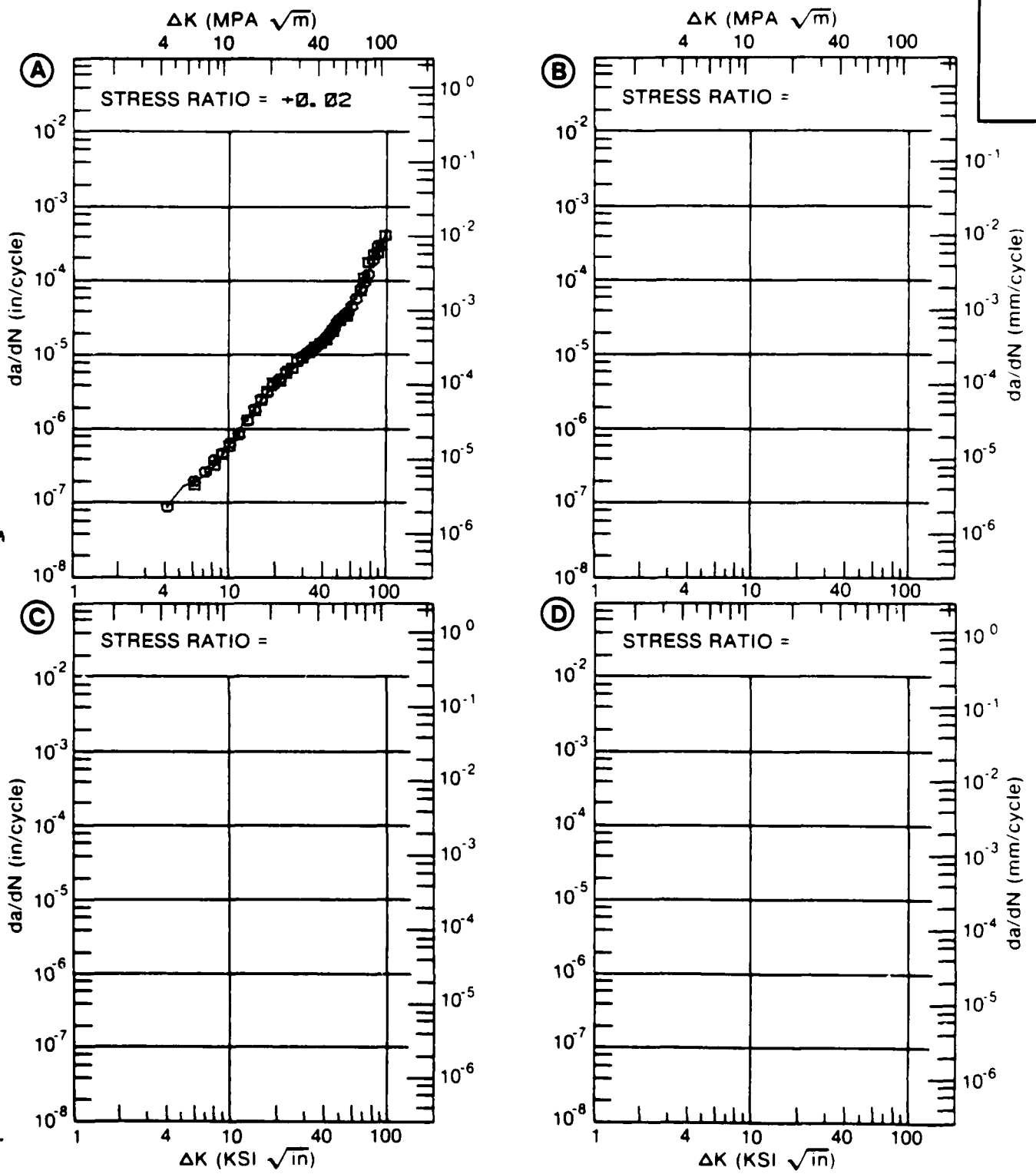



Figure 6.1.3.3

TABLE 6.1.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.1.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.02 | | | |
| DELTA K MIN A: | 3.92 | .071 | | | |
| DELTA K MIN B: | 6 | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 4.00 | .0762 | | | |
| | 5.00 | .134 | | | |
| | 6.00 | .187 | | | |
| | 7.00 | .242 | | | |
| | 8.00 | .308 | | | |
| | 9.00 | .393 | | | |
| | 10.00 | .513 | | | |
| | 13.00 | 1.23 | | | |
| | 16.00 | 2.37 | | | |
| | 20.00 | 4.11 | | | |
| | 25.00 | 6.47 | | | |
| | 30.00 | 9.07 | | | |
| | 35.00 | 12.1 | | | |
| | 40.00 | 15.9 | | | |
| | 50.00 | 27.2 | | | |
| | 60.00 | 46.9 | | | |
| | 70.00 | 82.7 | | | |
| | 80.00 | 148. | | | |
| | 90.00 | 270. | | | |
| | 100.00 | 498. | | | |
| DELTA K MAX A: | 110.17 | 934. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 6.95

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 2 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 1HR AC. -100F 1HR AC. 950F 5HRS AC
FORM: 4.50"TH ROUND BAR
SPECIMEN TYPE: WOL
ORIENTATION: T-L
FREQUENCY: 0.10- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 214.0 KSI
ULT. STRENGTH: 243.0 KSI
SPECIMEN THK: 0.500- 0.505"
SPECIMEN WIDTH: 2.983- 2.984"
REFERENCES: MA004

ALLOY STEEL

AF1410

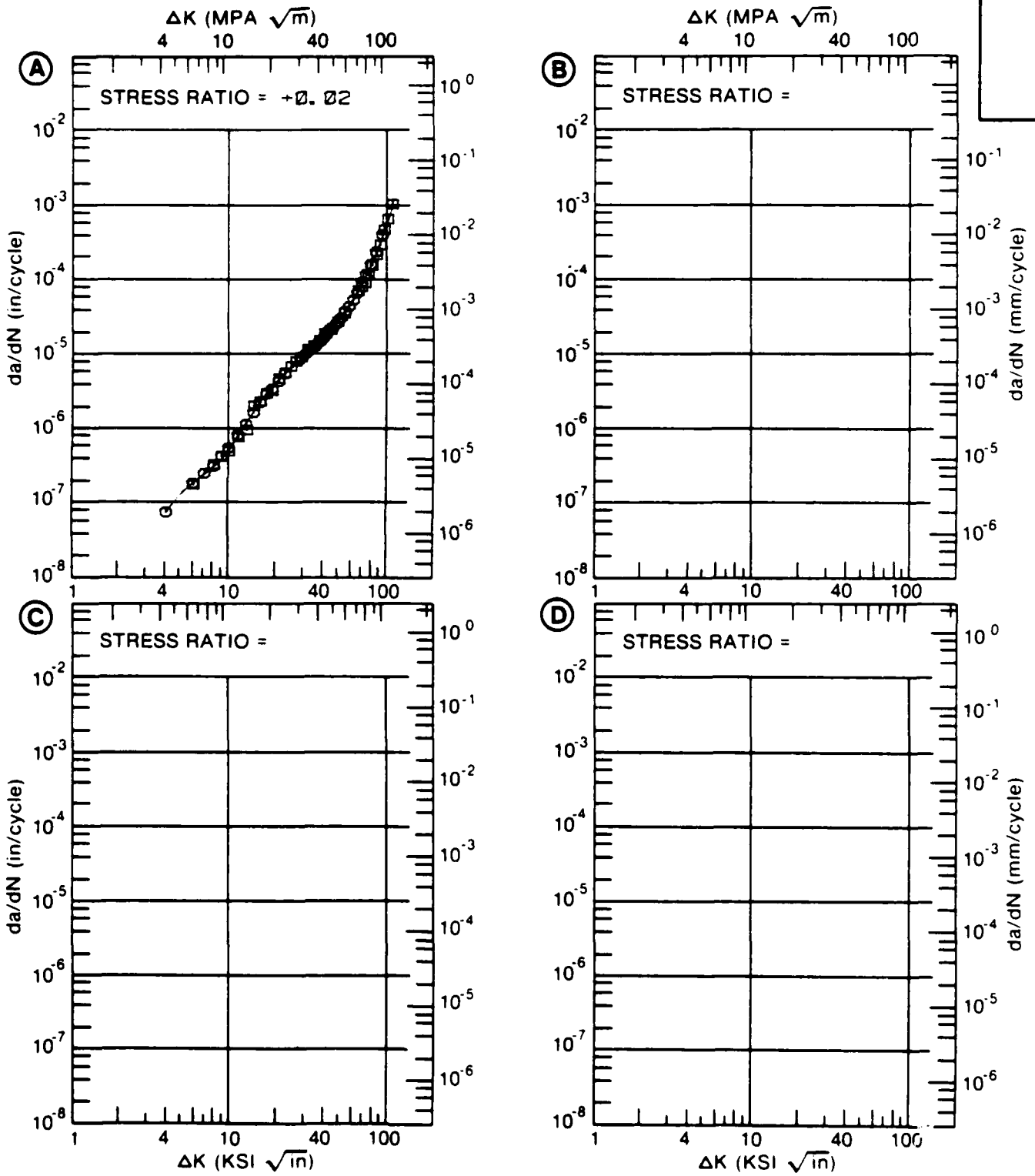



Figure 6.1.3.4

TABLE 6.2.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.2.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL AF1410(VIM-VAR)
CONDITION: 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. LAB AIR 30HZ | E= R.T. S.T.W. 1-30HZ | | |
| DELTA K MIN A: | 8.60 | .409 | | | |
| DELTA K MIN B: | 13.62 | | 2.29 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 9.00 | .471 | | | |
| | 10.00 | .646 | | | |
| | 13.00 | 1.34 | | | |
| | 16.00 | 2.28 | 3.40 | | |
| | 20.00 | 3.88 | 5.49 | | |
| | 25.00 | 6.39 | 8.40 | | |
| | 30.00 | 9.45 | 11.7 | | |
| | 35.00 | 13.1 | 15.4 | | |
| | 40.00 | 17.2 | 19.8 | | |
| | 50.00 | 27.3 | 31.1 | | |
| | 60.00 | 39.9 | 47.4 | | |
| DELTA K MAX A: | 65.69 | 48.3 | | | |
| DELTA K MAX B: | 62.59 | | 52.7 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 4.86 | 9.34 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 2 | | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1650F 1HR WQ. 1500F 1HR WQ. 950F 5HRS AC
FORM: 1.75"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 234.0 KSI
ULT. STRENGTH: 248.1 KSI
SPECIMEN THK: 0.997- 0.998"
SPECIMEN WIDTH: 4.940"
REFERENCES: R1001

ALLOY STEEL

AF1410 (VIM-VAR)

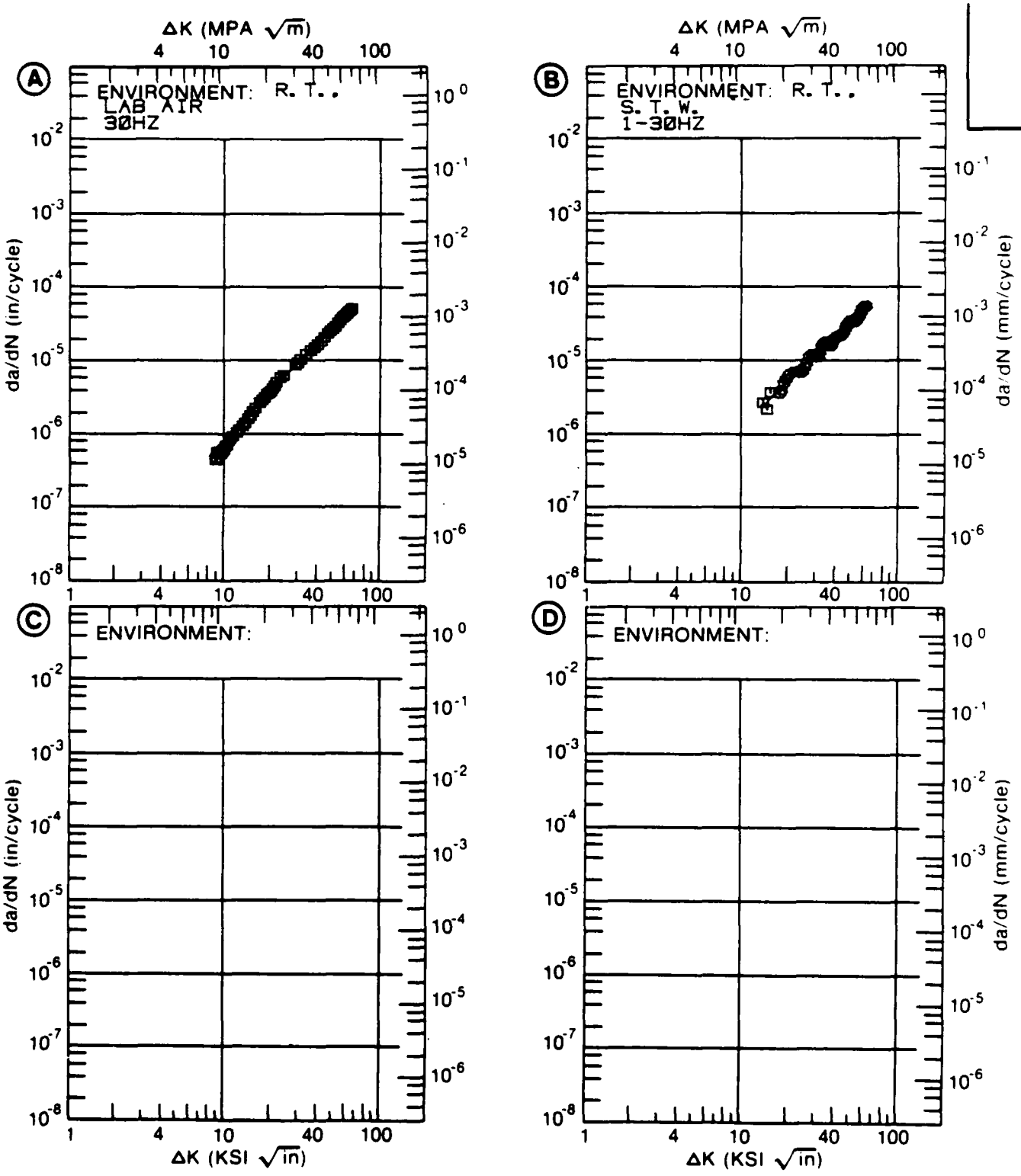



Figure 6.2.3.1

TABLE 6.2.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.2.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL AF1410(VIM-VAR)
CONDITION: 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=- 65F AIR 30HZ | E= R.T. LAB AIR 1-30HZ | E= R.T. 3.5% NACL 1-30HZ | |
| DELTA K MIN | A: | 11.30 | .684 | | | |
| | B: | 9.31 | | .575 | | |
| | C: | 15.28 | | | 2.78 | |
| | D: | | | | | |
| | | 10.00 | | .711 | | |
| | | 13.00 | .947 | 1.45 | | |
| | | 16.00 | 1.53 | 2.40 | 3.09 | |
| | | 20.00 | 2.55 | 3.95 | 4.97 | |
| | | 25.00 | 4.23 | 6.37 | 7.57 | |
| | | 30.00 | 6.33 | 9.36 | 10.5 | |
| | | 35.00 | 8.85 | 13.0 | 14.0 | |
| | | 40.00 | 11.8 | 17.5 | 18.1 | |
| | | 50.00 | | 29.3 | 29.5 | |
| | | 60.00 | | 46.5 | 47.1 | |
| | | 70.00 | | 71.1 | 74.5 | |
| | | 80.00 | | 106. | | |
| | | 90.00 | | 154. | | |
| DELTA K MAX | A: | 49.56 | 18.3 | | | |
| | B: | 93.58 | | 176. | | |
| | C: | 70.51 | | | 76.2 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.10 | 9.36 | 16.05 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | 1 | |
| | | 0.8-1.25 | 1 | 3 | 2 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F 1HR WQ. 1500F 1HR WQ. 950F 5HRS AC
FORM: 1.75"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 234.0- 240.0 KSI
ULT. STRENGTH: 247.8- 258.2 KSI
SPECIMEN THK: 0.997- 1.002"
SPECIMEN WIDTH: 4.940- 4.950"
REFERENCES: RI001

ALLOY STEEL

AF1410 (VIM-VAR)

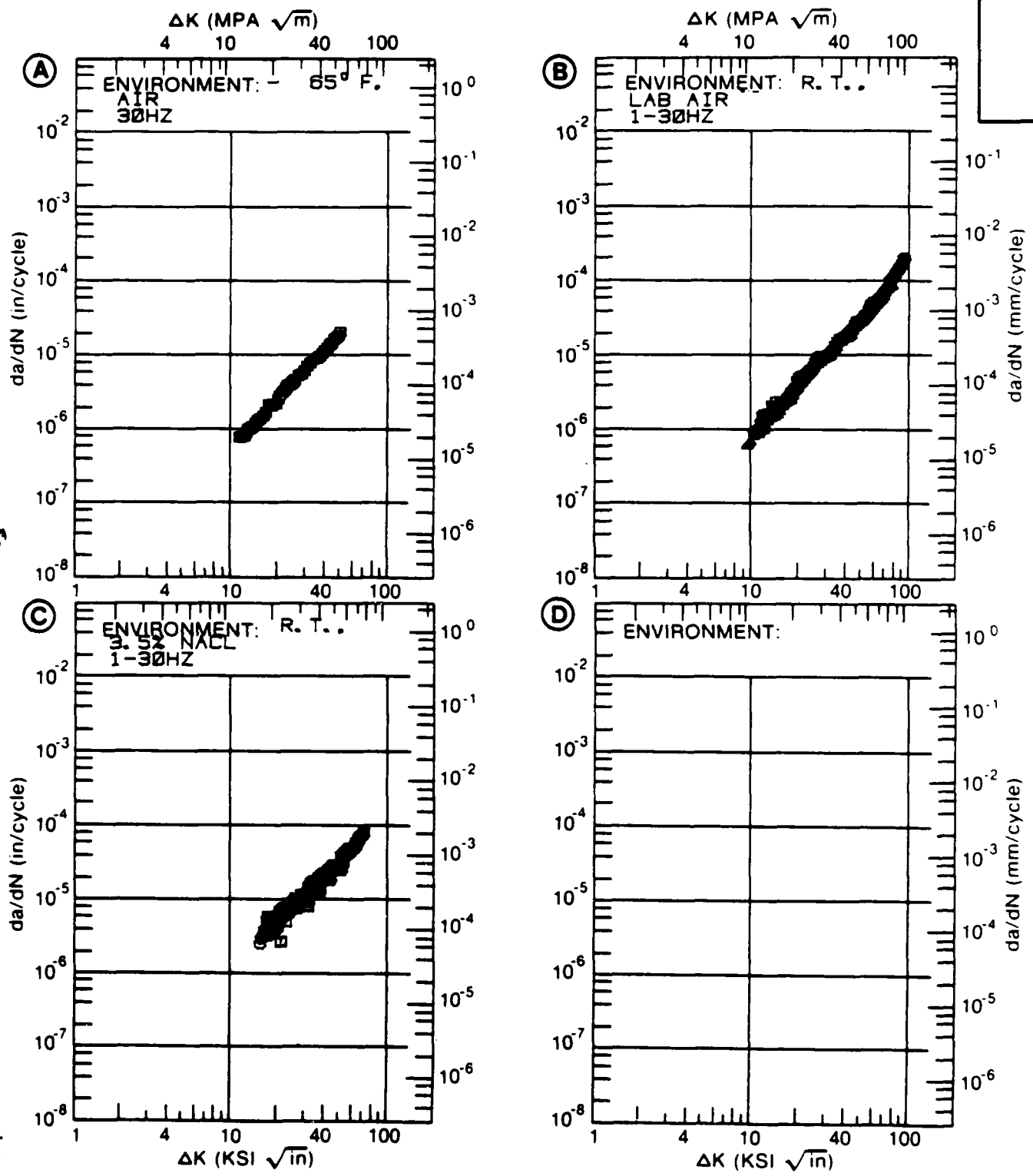



Figure 6.2.3.2

TABLE 6.2.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.2.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL AF1410(VIM-VAR)
CONDITION: 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR 10-30HZ | E= R.T. 3.5% NACL 1-30HZ | | |
| DELTA K MIN | A: | 8.38 | .683 | | | |
| | B: | 19.33 | | 5.72 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | .835 | | | |
| | | 10.00 | 1.11 | | | |
| | | 13.00 | 2.11 | | | |
| | | 16.00 | 3.36 | | | |
| | | 20.00 | 5.35 | 6.08 | | |
| | | 25.00 | 8.40 | 8.95 | | |
| | | 30.00 | 12.1 | 12.9 | | |
| | | 35.00 | 16.6 | 18.9 | | |
| | | 40.00 | 22.0 | 25.5 | | |
| | | 50.00 | 36.1 | 37.8 | | |
| | | 60.00 | 56.1 | | | |
| DELTA K MAX | A: | 68.03 | 77.7 | | | |
| | B: | 56.41 | | 52.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 5.74 | 12.24 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F 1HR WQ. 1500F 1HR WQ. 950F 5HRS AC
FORM: 1.75"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.30
FREQUENCY:

YIELD STRENGTH: 234.0 KSI
ULT. STRENGTH: 247.8 KSI
SPECIMEN THK: 0.998"
SPECIMEN WIDTH: 4.940"
REFERENCES: RI001

ALLOY STEEL

AF1410 (VIM-VAR)

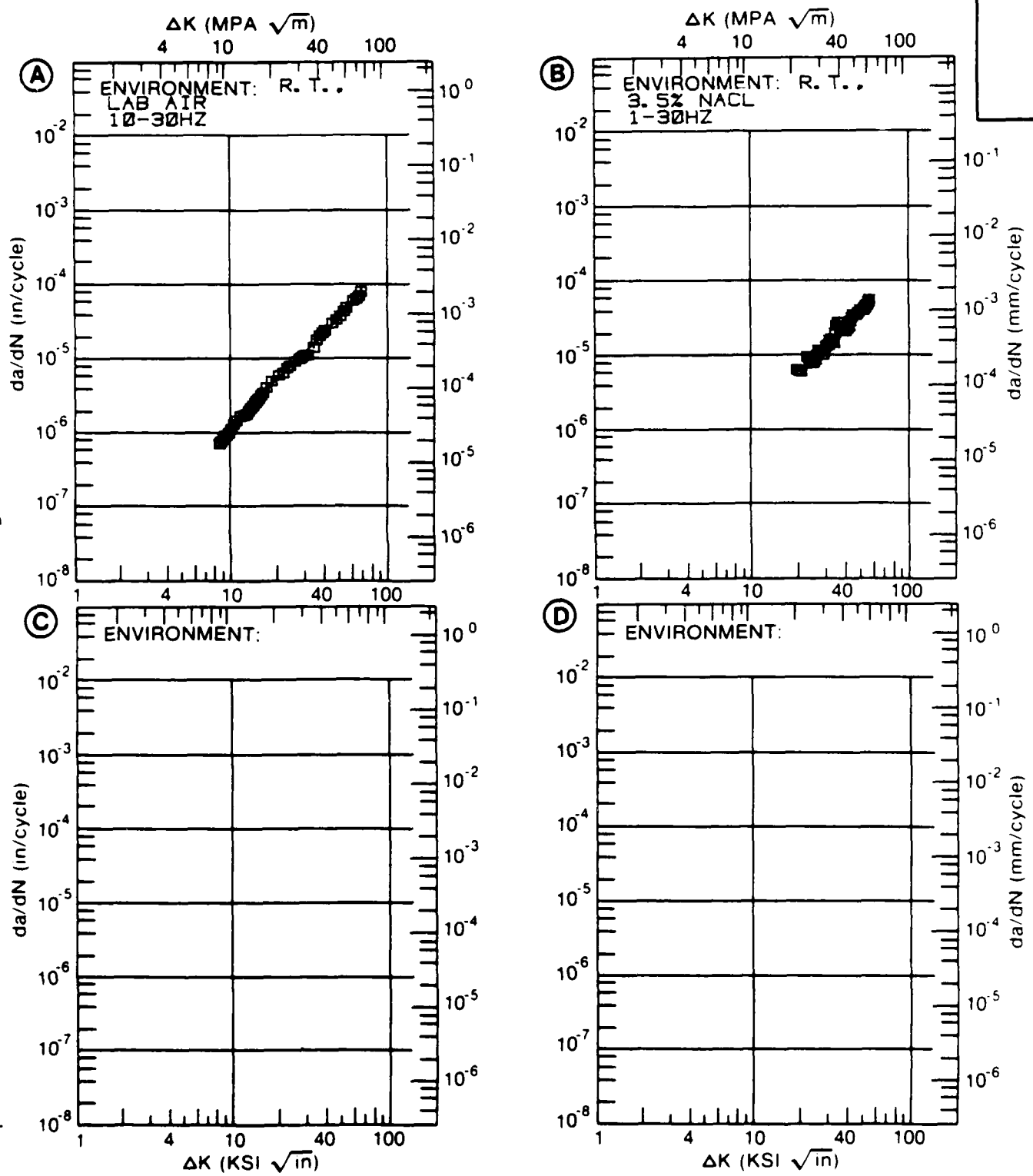



Figure 6.2.3.3

TABLE 6.3.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR, 3HZ | E=+ 600F AIR, .67HZ | E=+ 800F AIR, .67HZ | E=+1000F AIR, .67HZ |
| DELTA K MIN | A: | 14.92 | .474 | | | |
| | B: | 15.66 | | 1.70 | | |
| | C: | 15.62 | | | 2.39 | |
| | D: | 15.26 | | | | 3.96 |
| | | 16.00 | .650 | 1.84 | 2.57 | 4.66 |
| | | 20.00 | 1.59 | 3.94 | 5.01 | 8.86 |
| | | 25.00 | 3.43 | 7.96 | 9.68 | 14.7 |
| | | 30.00 | 6.09 | 13.9 | 16.7 | 21.6 |
| | | 35.00 | 9.79 | 22.2 | 26.6 | 30.5 |
| | | 40.00 | 14.9 | 33.8 | 40.1 | 42.8 |
| | | 50.00 | 31.5 | | | |
| DELTA K MAX | A: | 53.83 | 41.2 | | | |
| | B: | 48.91 | | 66.5 | | |
| | C: | 48.76 | | | 75.7 | |
| | D: | 49.18 | | | | 82.1 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.21 | 3.95 | 4.12 | 2.90 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1800F. 0.5-1.0HR. WQ. 1325F. 16HR. AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 100.0 KSI
ULT. STRENGTH: 159.5 KSI
SPECIMEN THK: 0.484- 0.487"
SPECIMEN WIDTH: 1.997- 2.001"
REFERENCES: HD006

ALLOY STEEL

A286

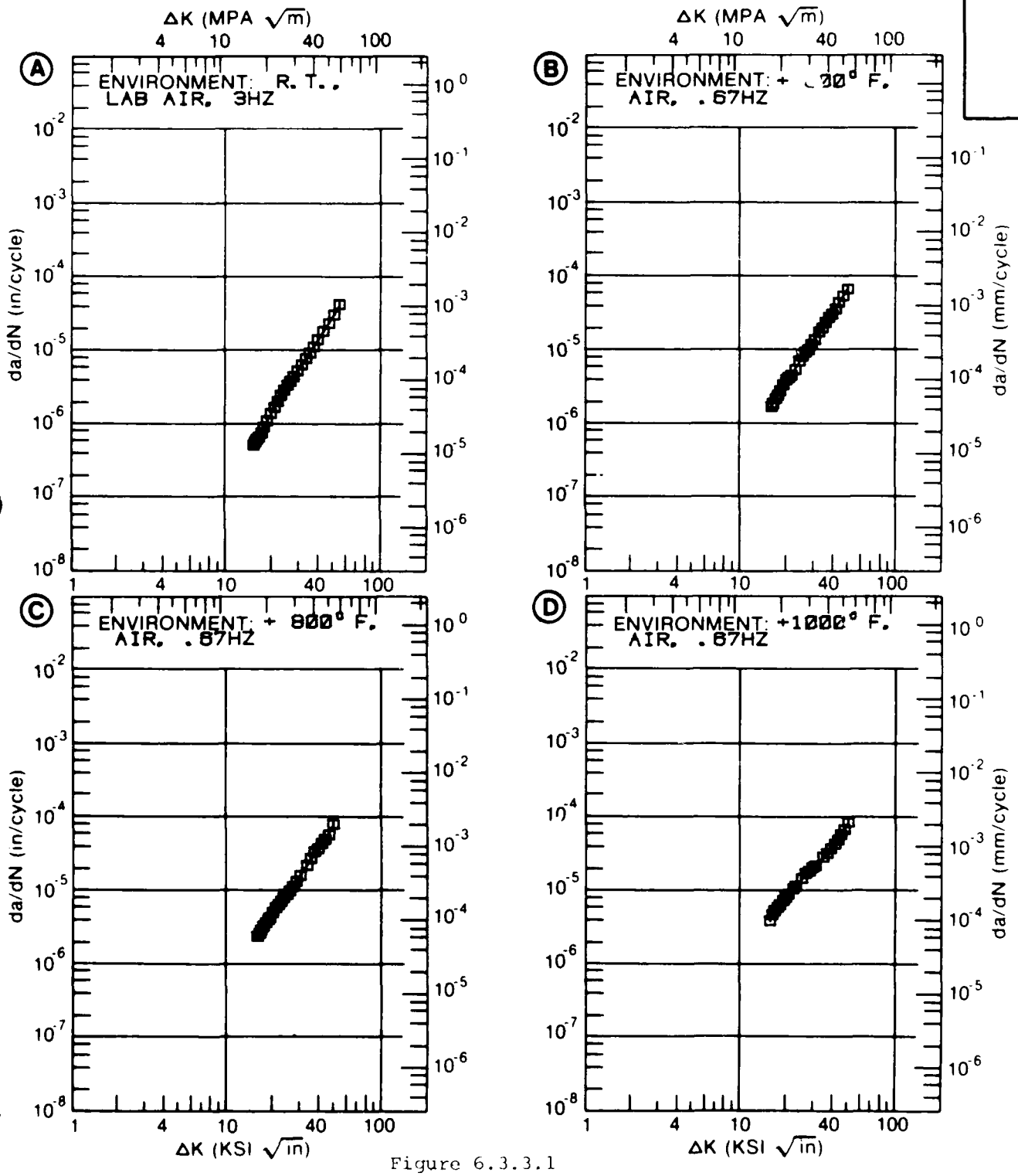



Figure 6.3.3.1

TABLE 6.3.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. LAB AIR, 3HZ | E=+ 600F AIR, .67HZ | E=+ 800F AIR, .67HZ | E=+1000F AIR, .67HZ |
| DELTA K MIN A: | 15.19 | .638 | | | |
| DELTA K MIN B: | 16.25 | | 2.02 | | |
| DELTA K MIN C: | 16.59 | | | 1.93 | |
| DELTA K MIN D: | 15.89 | | | | 6.04 |
| | 16.00 | .785 | | | 6.12 |
| | 20.00 | 1.82 | 3.69 | 3.54 | 9.69 |
| | 25.00 | 3.86 | 7.06 | 6.89 | 15.7 |
| | 30.00 | 6.76 | 12.3 | 11.7 | 24.1 |
| | 35.00 | 10.5 | 20.3 | 18.3 | 36.2 |
| | 40.00 | 15.0 | 32.3 | 27.5 | 53.5 |
| | 50.00 | | 76.6 | 57.6 | |
| DELTA K MAX A: | 45.10 | 20.4 | | | |
| DELTA K MAX B: | 52.49 | | 94.0 | | |
| DELTA K MAX C: | 54.51 | | | 78.9 | |
| DELTA K MAX D: | 48.72 | | | | 104. |
| ROOT MEAN SQUARE PERCENT ERROR | | 4.62 | 5.51 | 6.21 | 3.93 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 100.0 KSI
ULT. STRENGTH: 159.5 KSI
SPECIMEN THK: 0.486- 0.488"
SPECIMEN WIDTH: 1.999- 2.002"
REFERENCES: HD006

ALLOY STEEL

A286

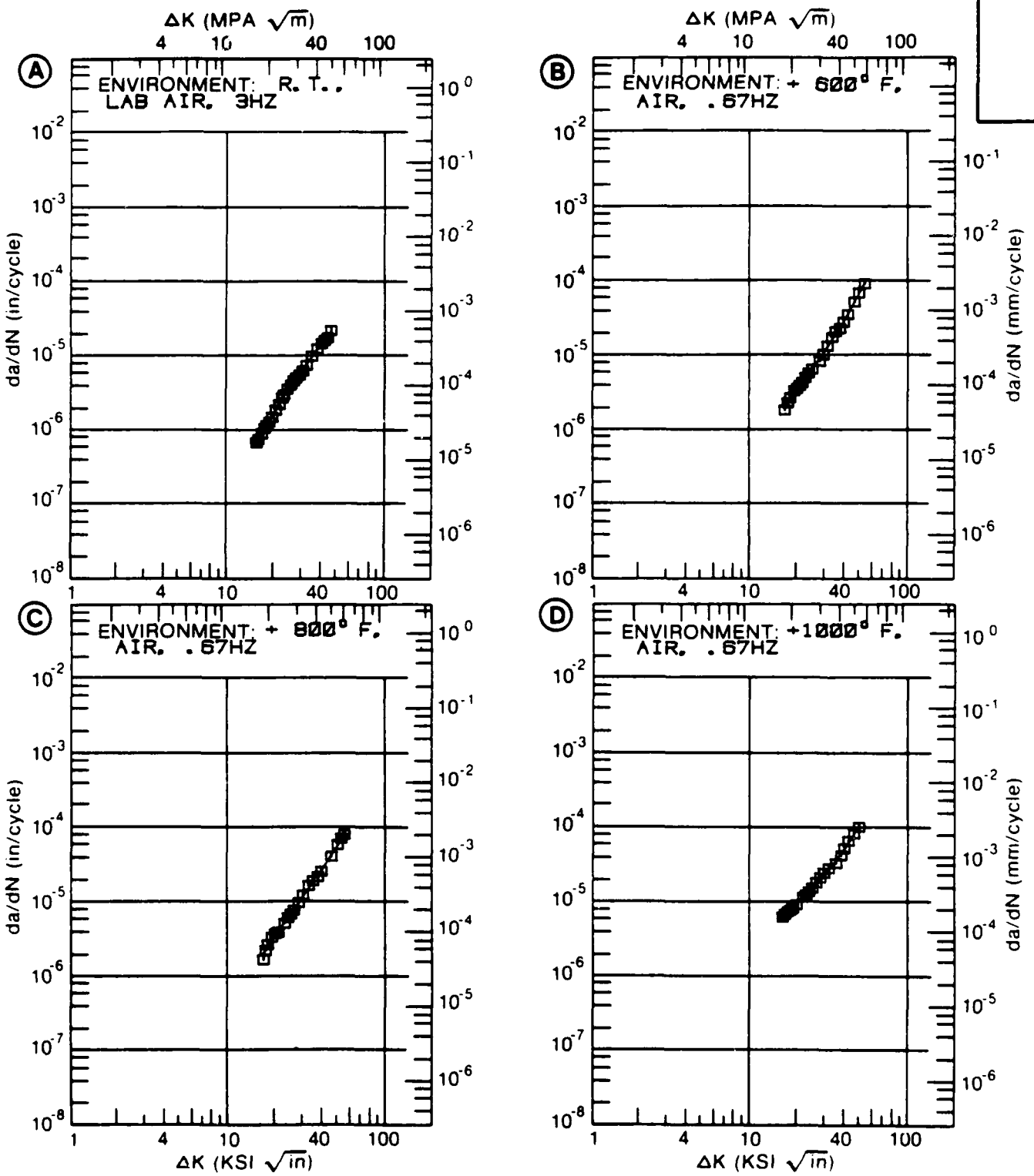



Figure 6.3.3.2

TABLE 6.3.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | E=+1000F AIR | | | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 0.00

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1800F. 0.5-1.0HR. WQ. 1325F. 16HR. AC
FORM: 1.50"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: R-L
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ
YIELD STRENGTH: 136.4 KSI
ULT. STRENGTH: 168.3 KSI
SPECIMEN THK: 0.290"
SPECIMEN WIDTH: 1.153"
REFERENCES: HD006

ALLOY STEEL

A286

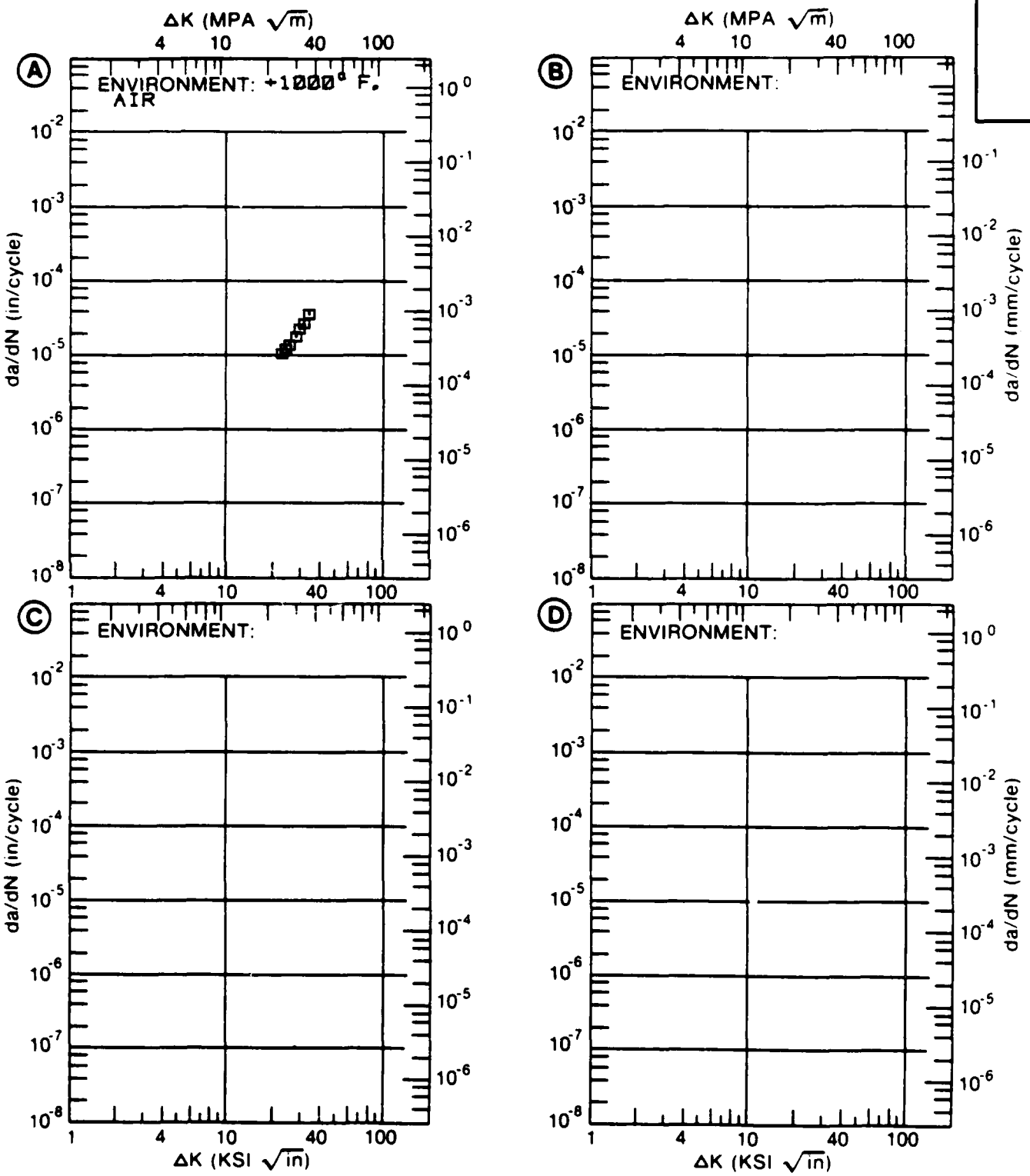



Figure 6.3.3.3

TABLE 6.3.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | E= R.T. LAB AIR, 3HZ | E=+ 600F AIR, .67HZ | | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 0.00 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1800F. 0.5-1.0HR. WQ. 1325F. 16HR. AC
FORM: 1.50"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: R-C
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 136.4 KSI
ULT. STRENGTH: 168.3 KSI
SPECIMEN THK: 0.401- 0.403"
SPECIMEN WIDTH: 0.795- 0.804"
REFERENCES: HD006

ALLOY STEEL

A286

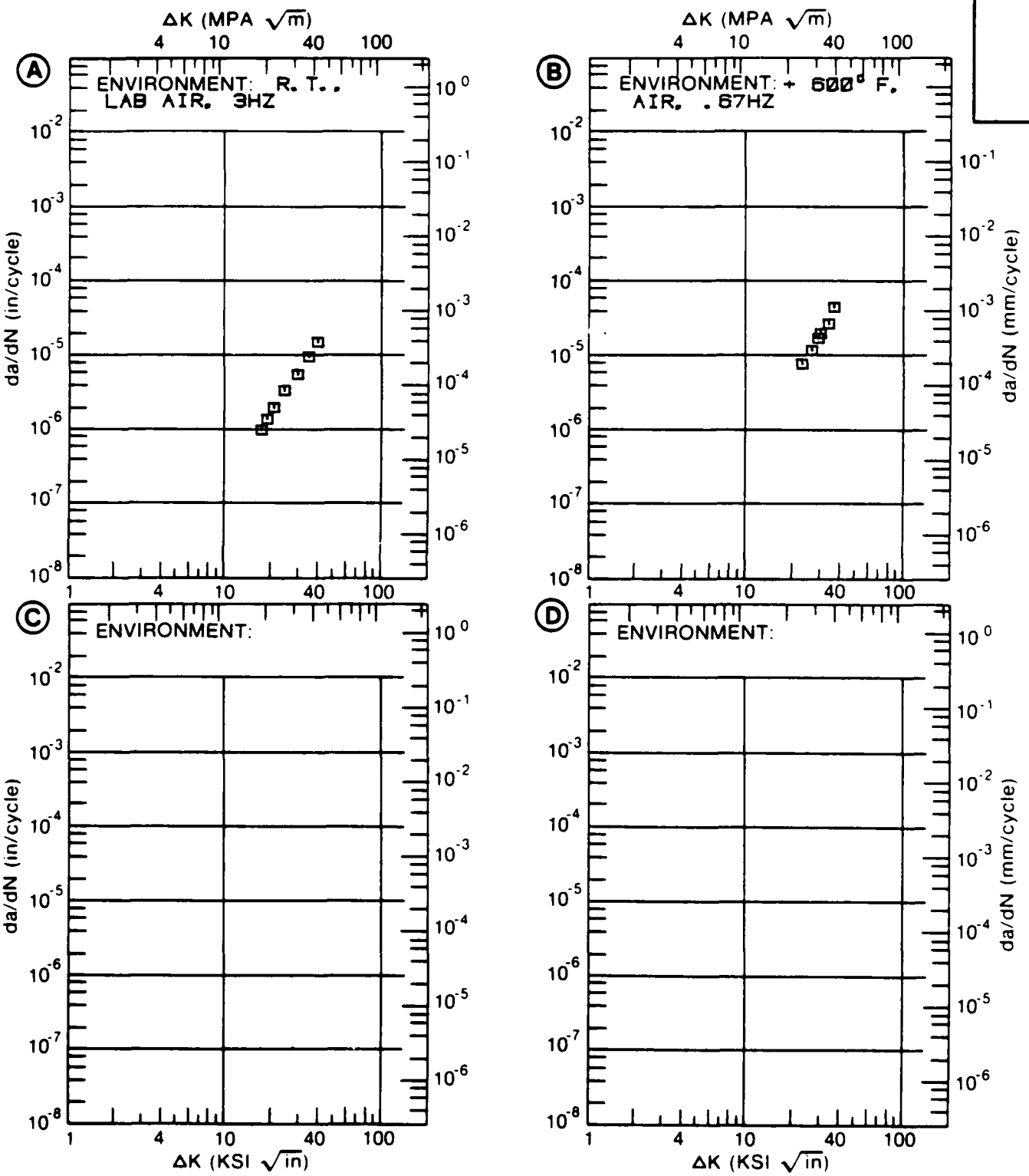



Figure 6.3.3.4

TABLE 6.4.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL D6AC AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| HEAT TREATED TO 46 RC HARDNESS | ----- | 85.8 ± 1.8 (2) | ----- |
| 1650F AUS-BAY QUENCH 975F, SQ 325F, 1000F 2+2 HR | 66.9 ±18.7 (7) | ----- | ----- |
| 1650F AUS-BAY QUENCH 975F, SQ 375F, 1000F 2+2 HR | 62.2 ±14.0 (19) | ----- | ----- |
| 1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR | 64.4 ±12.1 (103) | ----- | ----- |
| 1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR | 92.0 ± 8.2 (30) | ----- | ----- |
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1615F 2.25HR, A-BQ 325F, AC, 310-345F 3HR, 1080F 6-6.5HR | ----- | 78.4 ±15.1 (6) | 83.9 ±14.8 (52) |
| 1650F AUS-BAY QUENCH 975F, SQ 375F, 1000F 2+2 HR | 46.0 ± 4.2 (8) | ----- | ----- |

TABLE 6.4.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL D6AC AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) | |
|---|---|---|---|
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR | 66.2 ±12.3 (53) | ----- | ----- |
| 1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR | 95.2 ± 6.4 (34) | ----- | ----- |
| | **BILLET** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F, 1 HR, FC 1650F 1 HR, OQ, 1025F 2+2 HR | 78.5 ± 4.7 (2) | ----- | ----- |
| 1650F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR | 80.3 ± 0.8 (2) | ----- | ----- |
| 1700F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR | 80.3 ± 4.3 (3) | ----- | ----- |
| 1700F, 1 HR, OQ, 1025F 2+2 HR | 77.3 ± 2.6 (6) | ----- | ----- |
| 1725F 1 HR, AC 1700F 1 HR, OQ, 1000F 1 HR, 1015F 1 HR | 77.2 ± 2.7 (3) | ----- | ----- |
| 1725F, 1 HR, AC 1700F 1 HR, OQ, 1100F 2+2 HR | 101.2 ± 6.1 (6) | ----- | ----- |

TABLE 6.4.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL D6AC AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) | |
|---|---|---|---|
| | BILLET | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1725F, 1 HR, AC<br>1700F 1 HR, OQ,<br>1025F 2+2 HR | 74.4 ± 6.2 (6) | ----- | ----- |
| 1725F, 1 HR, AC<br>1650F 1 HR, FC<br>TO 960F, SQ<br>350F 0.5 HR, AC<br>1025F 2+2 HR | 75.1 ±10.1 (3) | ----- | ----- |

TABLE 6.4.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: DRY AIR AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.09 | 0.10 | | | | | 5.58 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.09 | 1.00 | | | | | 5.24 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.09 | 3.00 | | | | | 5.43 | | |
| 1700F A-BQ AT 975F, OQ AT 1400F, 1000F 2+2HR | PLATE | 0.10 | 0.10 | | | | | 5.28 | 43.9 | |
| 1700F A-BQ AT 975F, OQ AT 1400F, 1000F 2+2HR | PLATE | 0.10 | 1.00 | | | | | 5.88 | 43.4 | |
| 1700F A-BQ AT 975F, OQ AT 1400F, 1000F 2+2HR | PLATE | 0.10 | 3.00 | | | | | 4.86 | 43.3 | |
| 1700F A-BQ, 975F OQ AT 140F, 1000F 2+2HRS | PLATE | 0.50 | 0.10- 3.00 | | | | | 6.18 | | |

TABLE 6.4.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: LAB AIR AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | 0.10 | | | | | | 65.2 | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | 1.00 | | | | | 2.85 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.50 | 1.00 | | | | | 9.29 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.10 | 1.00 | | | | | 5.61 | 51.3 | |

TABLE 6.4.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: JP-4 FUEL AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | 0.10 | | | | | 10.4 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | 1.00 | | | | | 7.44 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.10 | 3.00 | | | | 0.73 | 5.31 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.50 | 1.00 | | | | 2.14 | 9.06 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | PLATE | 0.50 | 3.00 | | | | 1.09 | 6.45 | | |
| 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR | FORGING | 0.10 | 1.00 | | | | 0.47 | 6.36 | | |
| 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR | FORGING | 0.50 | 1.00 | | | | | 5.38 | | |

TABLE 6.4.1.4 (Con't)

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT JP-4 FUEL AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0 50 | 1 00 | | | | | 8.95 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0 50 | 3 00 | | | | | 6.73 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0.10 | 0 10 | | | | | 14 8 | 87 6 | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0 10 | 1.00 | | | | | 8 37 | 37 4 | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0 10 | 3.00 | | | | | 3 73 | 38 7 | |

TABLE 6.4.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT DIST H2O AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR | FORGING | 0.10 | 1.00 | | | | 932 | 7.55 | | |
| 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR | FORGING | 0.50 | 1.00 | | | | | 13.9 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.50 | 1.00 | | | | 2.33 | 12.2 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.50 | 3.00 | | | | 1.43 | 8.56 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.11 | 0.10 | | | | | 23.4 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.11 | 1.00 | | | | | 10.7 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | PLATE | 0.11 | 3.00 | | | | | 5.88 | | |

TABLE 6.4.1.5 (Con't)

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: DIST H2O AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0.10 | 0.10 | | | | | 15.7 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0.10 | 1.00 | | | | | 9.51 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0.10 | 3.00 | | | | | 6.47 | | |
| 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR | FORGING | 0.48 | 1.00 | | | | | 11.4 | | |

TABLE 6.4.2.1

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEAT TREATED | P | ---- | R.T. | T-L | 206.0 | 1.401 | 0.700 | NB | 0.711 | 0.42 | 84.50 | | | 1971 | B4029 |
| TO 46 RC | | ---- | | | 206.0 | 1.400 | 0.700 | NB | 0.717 | 0.45 | 87.00 | | | 1971 | B4029 |
| HARDNESS | | | | | | | | | | | | 85.8/ | 1.8 | | |
| 1615F 2.25HR, | F | ---- | R.T. | L-S | 197.9 | 2.000 | 1.006 | CT | 1.046 | 0.28 | 67.37 | | | 1979 | MD001 |
| A-BQ 325F, AC, | | ---- | | | 198.0 | 2.000 | 1.001 | CT | 1.061 | 0.29 | 68.26 | | | 1979 | MD001 |
| 310-345F 3HR, | | ---- | | | 199.8 | 1.997 | 1.001 | CT | 1.041 | 0.21 | 58.33 | | | 1980 | MD001 |
| 1080F 6-6 5HR | | | | | | | | | | | | 64.7/ | 5.5 | | |
| 1615F 2.25HR, | F | ---- | R.T. | T-L | 198.1 | 2.001 | 1.005 | CT | 1.048 | 0.33 | 72.62 | | | 1979 | MD001 |
| A-BQ 325F, AC, | | ---- | | | 198.1 | 2.000 | 1.005 | CT | 1.072 | 0.55 | 93.00 | | | 1979 | MD001 |
| 310-345F 3HR, | | ---- | | | 198.5 | 2.000 | 1.005 | CT | 1.069 | 0.55 | 93.67 | | | 1979 | MD001 |
| 1080F 6-6 5HR | | ---- | | | 198.5 | 2.000 | 1.001 | CT | 1.060 | 0.49 | 87.89 | | | 1979 | MD001 |
| | | ---- | | | 207.5 | 1.998 | 1.002 | CT | 1.024 | 0.20 | 59.04 | | | 1980 | MD001 |
| | | ---- | | | 207.5 | 1.997 | 1.000 | CT | 1.035 | 0.23 | 64.27 | 78.4/ | 15.1 | 1980 | MD001 |
| 1615F 2.25HR, | F | ---- | R.T. | S-L | 186.7 | 1.999 | 1.005 | CT | 1.042 | 0.71 | 99.54 | | | 1978 | MD001 |
| A-BQ 325F, AC, | | ---- | | | 186.7 | 2.000 | 1.005 | CT | 1.030 | 0.36 | 71.78 | | | 1978 | MD001 |
| 310-345F 3HR, | | ---- | | | 186.7 | 2.000 | 1.005 | CT | 1.045 | 0.55 | 88.32 | | | 1978 | MD001 |
| 1080F 6-6 5HR | | ---- | | | 187.2 | 1.987 | 0.996 | CT | 1.040 | 0.76 | 103.67 | | | 1979 | MD001 |
| | | ---- | | | 187.2 | 1.989 | 0.996 | CT | 1.003 | 0.81 | 106.64 | | | 1978 | MD001 |
| | | ---- | | | 187.2 | 1.990 | 1.002 | CT | 1.021 | 0.76 | 103.25 | | | 1978 | MD001 |
| | | ---- | | | 189.5 | 1.992 | 0.994 | CT | 1.016 | 0.63 | 95.25 | | | 1978 | MD001 |
| | | ---- | | | 189.5 | 1.996 | 0.995 | CT | 1.034 | 0.61 | 93.78 | | | 1978 | MD001 |
| | | ---- | | | 189.5 | 1.994 | 0.994 | CT | 1.023 | 0.63 | 95.37 | | | 1978 | MD001 |
| | | ---- | | | 189.5 | 1.997 | 0.993 | CT | 1.033 | 0.31 | 67.12 | | | 1978 | MD001 |
| | | ---- | | | 189.5 | 1.996 | 1.003 | CT | 1.024 | 0.35 | 71.23 | | | 1978 | MD001 |
| | | ---- | | | 189.5 | 1.993 | 0.994 | CT | 1.012 | 0.34 | 70.02 | | | 1978 | MD001 |
| | | ---- | | | 191.0 | 2.001 | 0.990 | CT | 1.028 | 0.37 | 73.64 | | | 1979 | MD001 |
| | | ---- | | | 191.0 | 1.995 | 0.992 | CT | 1.021 | 0.45 | 81.67 | | | 1979 | MD001 |
| | | ---- | | | 191.0 | 2.002 | 0.991 | CT | 1.027 | 0.46 | 82.63 | | | 1979 | MD001 |
| | | ---- | | | 191.9 | 1.988 | 1.003 | CT | 1.033 | 0.57 | 92.34 | | | 1978 | MD001 |
| | | ---- | | | 191.9 | 1.996 | 1.003 | CT | 1.043 | 0.54 | 89.64 | | | 1978 | MD001 |
| | | ---- | | | 191.9 | 1.994 | 1.002 | CT | 1.035 | 0.50 | 86.37 | | | 1978 | MD001 |
| | | ---- | | | 192.8 | 2.004 | 0.991 | CT | 1.015 | 0.18 | 53.02 | | | 1979 | MD001 |
| | | ---- | | | 192.8 | 2.000 | 0.991 | CT | 1.019 | 0.17 | 51.11 | | | 1979 | MD001 |
| | | ---- | | | 192.8 | 2.000 | 0.991 | CT | 1.037 | 0.16 | 48.96 | | | 1979 | MD001 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1615F 2.25HR, | F | - - | R.T. | S-L | 193.0 | 2.000 | 1.000 | CT | 1.044 | 0.34 | 71.92 | | | 1979 | MD001 |
| A-RQ 225F, AC, | | - - | | | 193.0 | 1.999 | 0.965 | CT | 1.023 | 0.54 | 89.71 | | | 1979 | MD001 |
| 310 345F 3HR, | | - - | | | 193.8 | 2.000 | 0.992 | CT | 1.024 | 0.30 | 68.14 | | | 1977 | MD001 |
| 1080F 6-6.5HR | | - - | | | 193.8 | 2.000 | 1.001 | CT | 1.049 | 0.31 | 69.12 | | | 1977 | MD001 |
| | | - - | | | 193.8 | 1.998 | 1.000 | CT | 1.031 | 0.27 | 64.19 | | | 1978 | MD001 |
| | | - - | | | 194.1 | 2.001 | 0.997 | CT | 1.036 | 0.61 | 96.00 | | | 1980 | MD001 |
| | | - - | | | 194.1 | 1.999 | 0.999 | CT | 1.076 | 0.41 | 78.90 | | | 1980 | MD001 |
| | | - - | | | 194.1 | 1.999 | 0.996 | CT | 1.037 | 0.47 | 84.17 | | | 1980 | MD001 |
| | | - - | | | 194.4 | 1.998 | 1.000 | CT | 1.026 | 0.43 | 80.69 | | | 1978 | MD001 |
| | | - - | | | 194.5 | 2.000 | 1.004 | CT | 1.050 | 0.55 | 91.67 | | | 1977 | MD001 |
| | | - - | | | 194.5 | 2.000 | 1.004 | CT | 1.062 | 0.55 | 91.59 | | | 1977 | MD001 |
| | | - - | | | 195.5 | 1.999 | 1.002 | CT | 1.057 | 0.30 | 68.54 | | | 1979 | MD001 |
| | | - - | | | 195.5 | 2.000 | 1.004 | CT | 1.025 | 0.29 | 67.40 | | | 1979 | MD001 |
| | | - - | | | 196.3 | 1.999 | 1.003 | CT | 1.057 | 0.45 | 83.50 | | | 1979 | MD001 |
| | | - - | | | 196.3 | 2.000 | 1.005 | CT | 1.040 | 0.55 | 92.69 | | | 1979 | MD001 |
| | | - - | | | 196.3 | 1.998 | 1.000 | CT | 1.045 | 0.36 | 75.10 | | | 1978 | MD001 |
| | | - - | | | 196.3 | 2.001 | 1.000 | CT | 1.058 | 0.60 | 96.67 | | | 1977 | MD001 |
| | | - - | | | 196.9 | 1.999 | 1.002 | CT | 1.011 | 0.65 | 101.04 | | | 1978 | MD001 |
| | | - - | | | 196.9 | 1.999 | 1.002 | CT | 1.017 | 0.67 | 102.31 | | | 1979 | MD001 |
| | | - - | | | 196.9 | 1.999 | 1.002 | CT | 1.034 | 0.63 | 99.31 | | | 1978 | MD001 |
| | | - - | | | 200.2 | 1.999 | 1.007 | CT | 1.014 | 0.38 | 78.63 | | | 1978 | MD001 |
| | | - - | | | 200.2 | 1.999 | 1.007 | CT | 1.025 | 0.35 | 75.67 | | | 1978 | MD001 |
| | | - - | | | 200.2 | 1.999 | 1.007 | CT | 1.027 | 0.35 | 75.91 | | | 1978 | MD001 |
| | | - - | | | 201.5 | 1.997 | 0.999 | CT | 1.037 | 0.67 | 104.62 | | | 1978 | MD001 |
| | | - - | | | 201.5 | 1.997 | 0.999 | CT | 1.052 | 0.60 | 99.19 | | | 1978 | MD001 |
| | | - - | | | 201.5 | 1.997 | 1.000 | CT | 1.036 | 0.65 | 103.09 | | | 1978 | MD001 |
| | | - - | | | 202.3 | 2.001 | 0.999 | CT | 1.042 | 0.55 | 95.58 | | | 1977 | MD001 |
| | | - - | | | 202.3 | 2.000 | 1.000 | CT | 1.042 | 0.56 | 95.80 | | | 1977 | MD001 |
| | | - - | | | 202.3 | 2.003 | 1.000 | CT | 1.038 | 0.55 | 95.21 | | | 1977 | MD001 |
| | | - - | | | 202.7 | 2.000 | 1.002 | CT | 1.037 | 0.32 | 73.46 | | | 1980 | MD001 |
| | | - - | | | 202.7 | 1.995 | 1.001 | CT | 1.037 | 0.25 | 65.34 | 83.9/ | 14.8 | 1980 | MD001 |
| 1650F AUS-BAY | P | 1.50 | - 65 | L-T | 228.0 | 1.499 | 0.750 | CT | 0.760 | 0.06 | 35.80 | | | 1972 | 82543 |
| QUENCH 975F,50 | | 0.00 | | | 228.0 | 1.502 | 0.757 | CT | 0.759 | 0.11 | 47.00 | | | 1972 | 82543 |
| 325F,1000F | | 1.50 | | | 228.0 | 1.501 | 0.750 | CT | 0.790 | 0.05 | 31.20 | | | 1972 | 82543 |
| 2+2 HR | | 1.50 | | | 228.0 | 1.499 | 0.750 | CT | 0.854 | 0.05 | 34.10 | 37.0/ | 6.9 | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F AUS-BAY | F | 1 50 | - 40 | L-T | 227.0 | 1.500 | 0.750 | CT | 0.771 | 0.05 | 32.00 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1 50 | | | 227.0 | 1.502 | 0.750 | CT | 0.781 | 0.06 | 36.10 | | | 1972 | 82543 |
| 325F,1000F 2+2 HR | | | | | | | | | | | | 34.1/ | 2.9 | | |
| 1650F AUS-BAY | P | 0 80 | - 20 | L-T | 226.0 | 1.503 | 0.757 | CT | 0.765 | 0.15 | 54.60 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1 50 | | | 226.0 | 1.499 | 0.749 | CT | 0.811 | 0.06 | 34.50 | | | 1972 | 82543 |
| 325F,1000F | | 1 50 | | | 226.0 | 1.500 | 0.750 | CT | 0.786 | 0.06 | 34.60 | | | 1972 | 82543 |
| 2+2 HR | | 0 80 | | | 226.0 | 1.502 | 0.757 | CT | 0.769 | 0.15 | 55.70 | | | 1972 | 82543 |
| | | 1 50 | | | 226.0 | 1.500 | 0.750 | CT | 0.777 | 0.07 | 37.20 | 43.3/ | 10.9 | 1972 | 82543 |
| 1650F AUS-BAY | P | 1 50 | 0 | L-T | 224.0 | 1.499 | 0.750 | CT | 0.789 | 0.10 | 45.60 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1 50 | | | 224.0 | 1.499 | 0.750 | CT | 0.784 | 0.08 | 40.70 | | | 1972 | 82543 |
| 325F,1000F | | 1 50 | | | 224.0 | 1.499 | 0.750 | CT | 0.817 | 0.08 | 39.60 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 42.0/ | 3.2 | | |
| 1650F AUS-BAY | P | 1 50 | 20 | L-T | 222.0 | 1.503 | 0.750 | CT | 0.768 | 0.10 | 44.60 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1 50 | | | 222.0 | 1.500 | 0.750 | CT | 0.837 | 0.08 | 39.60 | | | 1972 | 82543 |
| 325F,1000F | | 1 50 | | | 222.0 | 1.499 | 0.750 | CT | 0.780 | 0.06 | 35.80 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 40.0/ | 4.4 | | |
| 1650F AUS-BAY | P | 1 50 | 40 | L-T | 220.0 | 1.499 | 0.751 | CT | 0.787 | 0.13 | 50.00 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1 50 | | | 220.0 | 1.503 | 0.750 | CT | 0.777 | 0.08 | 38.70 | | | 1972 | 82543 |
| 325F,1000F | | 1 50 | | | 220.0 | 1.502 | 0.748 | CT | 0.815 | 0.11 | 45.50 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 44.7/ | 5.7 | | |
| 1650F AUS-BAY | P | 1 50 | R.T. | L-T | 217.0 | 1.498 | 0.755 | CT | 0.790 | 0.13 | 48.70 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 0 80 | | | 217.0 | 1.504 | 0.757 | CT | 0.767 | 0.35 | 81.00 | | | 1972 | 82543 |
| 325F,1000F | | 0 80 | | | 217.0 | 1.502 | 0.757 | CT | 0.750 | 0.34 | 80.10 | | | 1972 | 82543 |
| 2+2 HR | | 0 80 | | | 217.0 | 1.502 | 0.755 | CT | 0.765 | 0.37 | 83.60 | | | 1972 | 82543 |
| | | 1 50 | | | 217.0 | 1.501 | 0.755 | CT | 0.815 | 0.12 | 46.50 | | | 1972 | 82543 |
| | | 1 50 | | | 217.0 | 1.502 | 0.756 | CT | 0.777 | 0.11 | 45.80 | | | 1972 | 82543 |
| | | 0 80 | | | 217.0 | 1.499 | 0.750 | CT | 0.769 | 0.36 | 82.70 | 66.9/ | 18.7 | 1972 | 82543 |
| 1650F AUS-BAY | P | 1 50 | 175 | L-T | 211.0 | 1.499 | 0.750 | CT | 0.768 | 0.32 | 76.30 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1 50 | | | 211.0 | 1.502 | 0.750 | CT | 0.823 | 0.32 | 75.40 | | | 1972 | 82543 |
| 325F,1000F | | 1 50 | | | 211.0 | 1.498 | 0.750 | CT | 0.763 | 0.30 | 72.50 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 74.7/ | 2.0 | | |
| 1650F AUS-BAY | P | 1 50 | 300 | L-T | 204.0 | 1.496 | 0.751 | CT | 0.763 | 0.61 | 100.80 | | | 1972 | 82543 |
| QUENCH 975F,SQ 325F,1000F 2+2 HR | | | | | | | | | | | | | | | |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F AUS-BAY | P | 1.50 | 300 | L-T | 204.0 | 1.501 | 0.750 | CT | 0.798 | 0.67 | 105.40 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1.50 | | | 204.0 | 1.503 | 0.750 | CT | 0.772 | 0.68 | 106.40 | | | 1972 | 82543 |
| 375F,1000F 2+2 HR | | | | | | | | | | | | 104.2/ | 3.0 | | |
| 1650F AUS-BAY | P | 1.50 | R.T. | L-T | 217.0 | 1.199 | 0.599 | CT | 0.625 | 0.35 | 81.10 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1.50 | | | 217.0 | 1.202 | 0.608 | CT | 0.645 | 0.17 | 56.80 | | | 1972 | 82543 |
| 375F,1000F | | 1.50 | | | 217.0 | 1.200 | 0.605 | CT | 0.619 | 0.12 | 47.40 | | | 1972 | 82543 |
| 2+2 HR | | 1.50 | | | 217.0 | 1.205 | 0.605 | CT | 0.641 | 0.30 | 75.10 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.204 | 0.605 | CT | 0.648 | 0.21 | 62.60 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.199 | 0.608 | CT | 0.612 | 0.14 | 50.40 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.200 | 0.605 | CT | 0.630 | 0.41 | 87.90 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.193 | 0.604 | CT | 0.610 | 0.12 | 46.80 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.195 | 0.605 | CT | 0.621 | 0.26 | 69.40 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.211 | 0.607 | CT | 0.632 | 0.14 | 50.40 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.201 | 0.600 | CT | 0.599 | 0.23 | 66.30 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.203 | 0.608 | CT | 0.623 | 0.12 | 47.70 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.204 | 0.607 | CT | 0.628 | 0.25 | 68.20 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.197 | 0.604 | CT | 0.644 | 0.28 | 72.20 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.198 | 0.605 | CT | 0.636 | 0.18 | 57.80 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.202 | 0.604 | CT | 0.641 | 0.31 | 76.50 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.201 | 0.602 | CT | 0.618 | 0.32 | 77.90 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.196 | 0.608 | CT | 0.642 | 0.09 | 40.20 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.201 | 0.599 | CT | 0.618 | 0.12 | 48.00 | 62.2/ | 14.0 | 1972 | 82543 |
| 1650F AUS-BAY | F | 1.50 | - 65 | L-T | 225.0 | 1.507 | 0.756 | CT | 0.773 | 0.05 | 31.80 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1.50 | | | 225.0 | 1.507 | 0.756 | CT | 0.773 | 0.05 | 31.80 | | | 1972 | 82543 |
| 375F,1000F 2+2 HR | | | | | | | | | | | | 31.8/ | 0.0 | | |
| 1650F AUS-BAY | F | 1.50 | - 20 | L-T | 222.0 | 1.506 | 0.755 | CT | 0.768 | 0.06 | 35.50 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 1.50 | | | 222.0 | 1.506 | 0.755 | CT | 0.758 | 0.06 | 34.50 | | | 1972 | 82543 |
| 375F,1000F | | 1.50 | | | 222.0 | 1.504 | 0.753 | CT | 0.755 | 0.06 | 34.50 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 34.8/ | 0.6 | | |
| 1650F AUS-BAY | F | 1.50 | 0 | L-T | 220.0 | 1.504 | 0.755 | CT | 0.791 | 0.06 | 34.60 | | | 1972 | 82543 |
| QUENCH 975F,SQ 375F,1000F 2+2 HR | | | | | | | | | | | | | | | |
| 1650F AUS-BAY | F | 1.50 | 20 | L-T | 218.0 | 1.506 | 0.755 | CT | 0.782 | 0.08 | 39.00 | | | 1972 | 82543 |
| QUENCH 975F,SQ 375F,1000F 2+2 HR | | | | | | | | | | | | | | | |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F AUS BAY | F | 1 50 | 20 | L-T | 218.0 | 1.503 | 0.751 | CT | 0 785 | 0.06 | 33.50 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 1 50 | | | 218.0 | 1.506 | 0.756 | CT | 0.773 | 0.08 | 39.90 | | | 1972 | 82543 |
| 375F, 1000F 2+2 HR | | | | | | | | | | | | 37.5/ | 3.5 | | |
| 1650F AUS-BAY | F | 1 50 | R T | L-T | 214.0 | 1.503 | 0.755 | CT | 0.794 | 0.11 | 44.70 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 1 50 | | | 214.0 | 1.501 | 0.753 | CT | 0.771 | 0.13 | 48.40 | | | 1972 | 82543 |
| 375F, 1000F | | 1 50 | | | 214.0 | 1.504 | 0.750 | CT | 0.783 | 0.10 | 42.40 | | | 1972 | 82543 |
| 2+2 HR | | 1 50 | | | 214.0 | 1.514 | 0.755 | CT | 0.764 | 0.12 | 46.10 | | | 1972 | 82543 |
| | | 1 50 | | | 214.0 | 1.497 | 0.753 | CT | 0.762 | 0.16 | 54.40 | | | 1972 | 82543 |
| | | 1 50 | | | 214.0 | 1.508 | 0.755 | CT | 0.766 | 0.11 | 45.10 | | | 1972 | 82543 |
| | | 1 50 | | | 214.0 | 1.502 | 0.750 | CT | 0.768 | 0.12 | 46.80 | | | 1972 | 82543 |
| | | 1 50 | | | 214.0 | 1.502 | 0.753 | CT | 0.767 | 0.09 | 40.30 | 46.0/ | 4.2 | 1972 | 82543 |
| 1650F AUS-BAY | F | 1 50 | 175 | L-T | 208.0 | 1.501 | 0.755 | CT | 0.780 | 0.19 | 57.30 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 1 50 | | | 208.0 | 1.503 | 0.750 | CT | 0.775 | 0.33 | 75.60 | | | 1972 | 82543 |
| 375F, 1000F | | 1 50 | | | 208.0 | 1.497 | 0.750 | CT | 0.773 | 0.20 | 59.40 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 64.1/ | 10.0 | | |
| 1650F AUS-BAY | F | 1 50 | 300 | L-T | 201.0 | 1.501 | 0.753 | CT | 0.762 | 0.51 | 90.50 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 1 50 | | | 201.0 | 1.502 | 0.755 | CT | 0.779 | 0.54 | 93.40 | | | 1972 | 82543 |
| 375F, 1000F 2+2 HR | | | | | | | | | | | | 92.0/ | 2.1 | | |
| 1650F, AUS-BAY | P | 0 80 | - 65 | L-T | 228.0 | 1.501 | 0.755 | CT | 0.743 | 0.04 | 30.40 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0 80 | | | 228.0 | 1.503 | 0.751 | CT | 0.748 | 0.06 | 34.70 | | | 1972 | 82543 |
| 400F, 1000F | | 0 80 | | | 228.0 | 1.504 | 0.755 | CT | 0.763 | 0.05 | 31.90 | | | 1972 | 82543 |
| 2+2 HR | | 0 80 | | | 228.0 | 1.504 | 0.758 | CT | 0.763 | 0.05 | 31.80 | | | 1972 | 82543 |
| | | 0 80 | | | 228.0 | 1.507 | 0.759 | CT | 0.758 | 0.07 | 37.30 | 33.2/ | 2.8 | 1972 | 82543 |
| 1650F, AUS-BAY | P | 0 80 | - 40 | L-T | 227.0 | 1.499 | 0.758 | CT | 0.770 | 0.06 | 36.70 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0 80 | | | 227.0 | 1.502 | 0.693 | CT | 0.750 | 0.07 | 37.00 | | | 1972 | 82543 |
| 400F, 1000F | | 0 80 | | | 227.0 | 1.498 | 0.757 | CT | 0.758 | 0.07 | 37.60 | | | 1972 | 82543 |
| 2+2 HR | | 0 80 | | | 227.0 | 1.496 | 0.757 | CT | 0.760 | 0.07 | 38.50 | | | 1972 | 82543 |
| | | 0 80 | | | 227.0 | 1.505 | 0.693 | CT | 0.765 | 0.07 | 37.30 | | | 1972 | 82543 |
| | | 0 80 | | | 228.0 | 1.201 | 0.599 | CT | 0.624 | 0.08 | 41.20 | | | 1972 | 82543 |
| | | 0 80 | | | 228.0 | 1.201 | 0.599 | CT | 0.608 | 0.08 | 41.40 | 38.5/ | 2.0 | 1972 | 82543 |
| 1650F, AUS-BAY | P | 0 80 | - 20 | L-T | 226.0 | 1.501 | 0.757 | CT | 0.748 | 0.08 | 39.10 | | | 1972 | 82543 |
| QUENCH 975F, SQ 400F, 1000F 2+2 HR | | | | | | | | | | | | | | | |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F, AUS-BAY | P | 0.80 | - 20 | L-T | 226.0 | 1.478 | 0.757 | CT | 0.755 | 0.08 | 39.60 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 226.0 | 1.501 | 0.755 | CT | 0.756 | 0.08 | 40.80 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 226.0 | 1.501 | 0.757 | CT | 0.756 | 0.08 | 37.90 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 226.0 | 1.502 | 0.757 | CT | 0.754 | 0.07 | 42.30 | 40.3/ | 1.3 | 1972 | 82543 |
| 1650F, AUS-BAY | P | 0.80 | 0 | L-T | 224.0 | 1.476 | 0.757 | CT | 0.781 | 0.09 | 42.40 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 224.0 | 1.478 | 0.758 | CT | 0.772 | 0.10 | 44.50 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 224.0 | 1.487 | 0.757 | CT | 0.746 | 0.08 | 40.20 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 42.4/ | 2.2 | | |
| 1650F, AUS-BAY | P | 0.80 | 20 | L-T | 222.0 | 1.500 | 0.757 | CT | 0.764 | 0.12 | 47.70 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 222.0 | 1.502 | 0.758 | CT | 0.769 | 0.12 | 47.60 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 222.0 | 1.503 | 0.758 | CT | 0.778 | 0.08 | 40.90 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 45.4/ | 3.9 | | |
| 1650F, AUS-BAY | P | 0.80 | 40 | L-T | 220.0 | 1.502 | 0.758 | CT | 0.770 | 0.15 | 54.30 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 220.0 | 1.501 | 0.758 | CT | 0.773 | 0.14 | 51.30 | | | 1972 | 82543 |
| 400F, 1000F 2+2 HR | | | | | | | | | | | | 52.8/ | 2.1 | | |
| 1650F, AUS-BAY | P | 0.80 | R.T. | L-T | 217.0 | 1.504 | 0.749 | CT | 0.767 | 0.39 | 86.10 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 217.0 | 1.502 | 0.747 | CT | 0.771 | 0.42 | 89.40 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 217.0 | 1.197 | 0.608 | CT | 0.622 | 0.16 | 54.20 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 217.0 | 1.504 | 0.692 | CT | 0.752 | 0.16 | 56.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.197 | 0.606 | CT | 0.622 | 0.28 | 56.10 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.671 | CT | 0.755 | 0.15 | 53.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.503 | 0.750 | CT | 0.768 | 0.14 | 52.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.503 | 0.692 | CT | 0.765 | 0.18 | 59.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.498 | 0.757 | CT | 0.756 | 0.24 | 66.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.754 | CT | 0.762 | 0.36 | 81.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.605 | CT | 0.623 | 0.20 | 61.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.692 | CT | 0.747 | 0.18 | 57.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.750 | CT | 0.756 | 0.16 | 54.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.202 | 0.604 | CT | 0.633 | 0.35 | 80.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.608 | CT | 0.617 | 0.34 | 79.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.200 | 0.607 | CT | 0.624 | 0.35 | 81.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.200 | 0.607 | CT | 0.622 | 0.28 | 73.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.694 | CT | 0.770 | 0.16 | 55.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.607 | CT | 0.624 | 0.36 | 81.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.755 | CT | 0.762 | 0.24 | 66.70 | | | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | -PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F,AUS-BAY | P | 0.80 | R.T. | L-T | 217.0 | 1.505 | 0.692 | CT | 0.762 | 0.19 | 60.20 | | | 1972 | 82543 |
| QUENCH 975F,SQ | | 0.80 | | | 217.0 | 1.498 | 0.757 | CT | 0.771 | 0.29 | 73.60 | | | 1972 | 82543 |
| 400F,1000F | | 0.80 | | | 217.0 | 1.202 | 0.607 | CT | 0.621 | 0.21 | 63.40 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 217.0 | 1.503 | 0.694 | CT | 0.753 | 0.20 | 61.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.496 | 0.756 | CT | 0.747 | 0.45 | 92.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.692 | CT | 0.779 | 0.20 | 61.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.692 | CT | 0.755 | 0.10 | 43.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.203 | 0.608 | CT | 0.625 | 0.29 | 73.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.193 | 0.605 | CT | 0.613 | 0.17 | 57.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.752 | CT | 0.765 | 0.11 | 46.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.695 | CT | 0.762 | 0.10 | 44.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.197 | 0.607 | CT | 0.625 | 0.42 | 88.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.694 | CT | 0.755 | 0.19 | 59.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.203 | 0.600 | CT | 0.635 | 0.18 | 58.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.200 | 0.608 | CT | 0.616 | 0.18 | 58.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.603 | CT | 0.636 | 0.17 | 56.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.751 | CT | 0.729 | 0.32 | 77.10 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.201 | 0.600 | CT | 0.622 | 0.19 | 59.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.605 | CT | 0.621 | 0.44 | 91.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.606 | CT | 0.619 | 0.18 | 58.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.759 | CT | 0.756 | 0.18 | 48.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.608 | CT | 0.622 | 0.14 | 52.10 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.494 | 0.756 | CT | 0.755 | 0.18 | 58.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.200 | 0.607 | CT | 0.620 | 0.31 | 76.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.197 | 0.608 | CT | 0.617 | 0.31 | 76.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.694 | CT | 0.758 | 0.21 | 62.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.754 | CT | 0.766 | 0.37 | 83.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.692 | CT | 0.759 | 0.16 | 55.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.496 | 0.748 | CT | 0.744 | 0.20 | 60.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.693 | CT | 0.776 | 0.17 | 57.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.691 | CT | 0.747 | 0.18 | 59.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.606 | CT | 0.613 | 0.33 | 79.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.753 | CT | 0.765 | 0.14 | 50.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.203 | 0.608 | CT | 0.619 | 0.42 | 88.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.201 | 0.608 | CT | 0.615 | 0.19 | 60.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.498 | 0.753 | CT | 0.781 | 0.13 | 50.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.508 | 0.749 | CT | 0.779 | 0.19 | 59.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.605 | CT | 0.630 | 0.33 | 78.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.605 | CT | 0.630 | 0.18 | 57.80 | | | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F, AUS-BAY | P | 0.80 | R.T. | L-T | 217.0 | 1.203 | 0.606 | CT | 0.621 | 0.24 | 52.80 | | | 1972 | 82543 |
| QUENCH 975F, 50 | | 0.80 | | | 217.0 | 1.505 | 0.694 | CT | 0.753 | 0.20 | 60.90 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 217.0 | 1.504 | 0.692 | CT | 0.741 | 0.16 | 54.50 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 217.0 | 1.202 | 0.605 | CT | 0.630 | 0.32 | 78.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.498 | 0.749 | CT | 0.766 | 0.27 | 71.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.755 | CT | 0.751 | 0.16 | 54.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.497 | 0.757 | CT | 0.749 | 0.18 | 57.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.605 | CT | 0.630 | 0.31 | 76.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.606 | CT | 0.617 | 0.14 | 50.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.758 | CT | 0.777 | 0.32 | 77.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.692 | CT | 0.774 | 0.16 | 55.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.692 | CT | 0.764 | 0.17 | 57.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.196 | 0.605 | CT | 0.620 | 0.22 | 64.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.458 | 0.749 | CT | 0.838 | 0.23 | 66.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.200 | 0.607 | CT | 0.625 | 0.30 | 75.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.750 | CT | 0.764 | 0.15 | 52.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.201 | 0.604 | CT | 0.641 | 0.18 | 58.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.605 | CT | 0.624 | 0.20 | 61.80 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.750 | CT | 0.766 | 0.12 | 48.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.604 | CT | 0.612 | 0.40 | 86.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.498 | 0.754 | CT | 0.768 | 0.23 | 65.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.201 | 0.606 | CT | 0.640 | 0.24 | 66.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.693 | CT | 0.765 | 0.15 | 53.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.757 | CT | 0.787 | 0.16 | 54.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.602 | CT | 0.619 | 0.19 | 60.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.749 | CT | 0.768 | 0.37 | 83.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.692 | CT | 0.762 | 0.15 | 53.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.603 | CT | 0.625 | 0.18 | 59.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.200 | 0.607 | CT | 0.618 | 0.31 | 76.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.603 | CT | 0.629 | 0.15 | 52.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.497 | 0.750 | CT | 0.774 | 0.19 | 60.00 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.600 | CT | 0.638 | 0.31 | 76.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.199 | 0.606 | CT | 0.638 | 0.12 | 47.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.758 | CT | 0.784 | 0.26 | 70.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.505 | 0.759 | CT | 0.770 | 0.19 | 59.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.749 | CT | 0.769 | 0.28 | 72.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.494 | 0.753 | CT | 0.773 | 0.16 | 54.70 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.755 | CT | 0.746 | 0.16 | 55.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.203 | 0.608 | CT | 0.621 | 0.27 | 71.60 | | | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F, AUS BAY | P | 0.80 | R.T. | L-T | 217.0 | 1.200 | 0.605 | CT | 0.621 | 0.21 | 62.30 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 217.0 | 1.199 | 0.605 | CT | 0.630 | 0.20 | 60.80 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 217.0 | 1.199 | 0.608 | CT | 0.635 | 0.20 | 61.60 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 217.0 | 1.501 | 0.753 | CT | 0.773 | 0.13 | 50.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.198 | 0.605 | CT | 0.625 | 0.42 | 89.00 | 64.4/ | 12.1 | 1972 | 82543 |
| 1650F, AUS BAY | P | 0.80 | 120 | L-T | 211.0 | 1.499 | 0.757 | CT | 0.761 | 0.42 | 85.90 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 211.0 | 1.500 | 0.757 | CT | 0.770 | 0.46 | 90.10 | | | 1972 | 82543 |
| 400F, 1000F 2+2 HR | | | | | | | | | | | | 88.0/ | 3.0 | | |
| 1650F, AUS BAY | P | 0.80 | 175 | L-T | 211.0 | 1.505 | 0.758 | CT | 0.775 | 0.47 | 91.90 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 211.0 | 1.502 | 0.758 | CT | 0.784 | 0.44 | 88.60 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 211.0 | 1.506 | 0.758 | CT | 0.779 | 0.44 | 88.10 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 89.5/ | 2.1 | | |
| 1650F, AUS-BAY | P | 0.80 | 300 | L-T | 204.0 | 1.505 | 0.759 | CT | 0.771 | 0.47 | 88.80 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 204.0 | 1.501 | 0.759 | CT | 0.782 | 0.47 | 88.10 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 204.0 | 1.501 | 0.750 | CT | 0.770 | 0.41 | 82.90 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 86.6/ | 3.2 | | |
| 1650F, AUS-BAY | F | 1.50 | - 65 | L-T | 225.0 | 1.502 | 0.756 | CT | 0.784 | 0.06 | 34.00 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 225.0 | 1.500 | 0.749 | CT | 0.760 | 0.06 | 35.70 | | | 1972 | 82543 |
| 400F, 1000F | | 1.50 | | | 225.0 | 1.502 | 0.756 | CT | 0.790 | 0.04 | 29.00 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 225.0 | 1.500 | 0.750 | CT | 0.757 | 0.06 | 33.60 | 33.1/ | 2.9 | 1972 | 82543 |
| 1650F, AUS-BAY | F | 0.80 | - 40 | L-T | 224.0 | 1.495 | 0.694 | CT | 0.753 | 0.09 | 41.60 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 224.0 | 1.497 | 0.693 | CT | 0.776 | 0.08 | 39.80 | | | 1972 | 82543 |
| 400F, 1000F 2+2 HR | | | | | | | | | | | | 40.7/ | 1.3 | | |
| 1650F, AUS-BAY | F | 0.80 | - 20 | L-T | 222.0 | 1.497 | 0.749 | CT | 0.769 | 0.08 | 41.10 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 222.0 | 1.494 | 0.749 | CT | 0.765 | 0.07 | 38.10 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 222.0 | 1.498 | 0.750 | CT | 0.759 | 0.10 | 44.40 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 41.2/ | 3.2 | | |
| 1650F, AUS-BAY | F | 1.50 | 0 | L-T | 220.0 | 1.502 | 0.750 | CT | 0.769 | 0.07 | 36.50 | | | 1972 | 82543 |
| QUENCH 975F, SQ 400F, 1000F 2+2 HR | | | | | | | | | | | | | | | |
| 1650F, AUS-BAY | F | 0.80 | 20 | L-T | 218.0 | 1.499 | 0.750 | CT | 0.757 | 0.10 | 44.60 | | | 1972 | 82543 |
| QUENCH 975F, SQ 400F, 1000F 2+2 HR | | | | | | | | | | | | | | | |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F,AUS-BAY | F | 0.80 | 20 | L-T | 218.0 | 1.490 | 0.750 | CT | 0.751 | 0.11 | 45.60 | | | 1972 | 82543 |
| QUENCH,875F,SQ | | 0.80 | | | 218.0 | 1.499 | 0.750 | CT | 0.761 | 0.11 | 40.00 | | | 1972 | 82543 |
| 400F,1000F 2+2 HR | | | | | | | | | | | | 43.4/ | 3.0 | | |
| 1650F,AUS-BAY | F | 0.80 | R.T. | L-T | 214.0 | 1.200 | 0.607 | CT | 0.618 | 0.24 | 66.10 | | | 1972 | 82543 |
| QUENCH,875F,SQ | | 0.80 | | | 214.0 | 1.200 | 0.607 | CT | 0.625 | 0.34 | 78.60 | | | 1972 | 82543 |
| 400F,1000F | | 0.80 | | | 214.0 | 1.199 | 0.602 | CT | 0.618 | 0.17 | 55.80 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 214.0 | 1.199 | 0.607 | CT | 0.623 | 0.29 | 73.10 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.503 | 0.692 | CT | 0.775 | 0.51 | 96.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.198 | 0.695 | CT | 0.628 | 0.14 | 50.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.201 | 0.603 | CT | 0.619 | 0.28 | 72.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.202 | 0.602 | CT | 0.618 | 0.16 | 55.10 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.201 | 0.599 | CT | 0.623 | 0.29 | 73.20 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.498 | 0.757 | CT | 0.754 | 0.20 | 60.60 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.604 | CT | 0.620 | 0.35 | 79.70 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.750 | CT | 0.762 | 0.18 | 57.90 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.198 | 0.607 | CT | 0.645 | 0.39 | 84.10 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.202 | 0.605 | CT | 0.631 | 0.26 | 68.70 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.202 | 0.603 | CT | 0.624 | 0.37 | 82.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.607 | CT | 0.634 | 0.34 | 79.50 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.202 | 0.602 | CT | 0.620 | 0.15 | 52.00 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.199 | 0.602 | CT | 0.621 | 0.30 | 73.60 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.750 | CT | 0.766 | 0.31 | 75.50 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.498 | 0.696 | CT | 0.747 | 0.18 | 57.40 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.195 | 0.606 | CT | 0.634 | 0.49 | 94.40 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.203 | 0.604 | CT | 0.627 | 0.22 | 64.20 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.199 | 0.603 | CT | 0.618 | 0.34 | 78.40 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.749 | CT | 0.755 | 0.20 | 59.80 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.201 | 0.603 | CT | 0.633 | 0.20 | 60.80 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.199 | 0.603 | CT | 0.617 | 0.34 | 78.40 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.599 | CT | 0.618 | 0.23 | 65.20 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.605 | CT | 0.626 | 0.20 | 60.40 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.199 | 0.603 | CT | 0.623 | 0.17 | 56.20 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.604 | CT | 0.622 | 0.27 | 70.00 | | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.499 | 0.756 | CT | 0.866 | 0.08 | 39.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.201 | 0.603 | CT | 0.615 | 0.15 | 53.10 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.606 | CT | 0.627 | 0.20 | 61.00 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.752 | CT | 0.760 | 0.24 | 66.50 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.502 | 0.749 | CT | 0.784 | 0.22 | 63.10 | | | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F, AUS-BAY | F | 0.80 | R.T. | L-T | 214.0 | 1.198 | 0.608 | CT | 0.626 | 0.36 | 81.00 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 214.0 | 1.499 | 0.750 | CT | 0.766 | 0.20 | 61.00 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 214.0 | 1.502 | 0.692 | CT | 0.767 | 0.48 | 93.60 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 214.0 | 1.200 | 0.603 | CT | 0.631 | 0.24 | 65.70 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.607 | CT | 0.631 | 0.25 | 67.60 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.497 | 0.694 | CT | 0.761 | 0.20 | 60.10 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.197 | 0.607 | CT | 0.635 | 0.20 | 61.20 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.501 | 0.750 | CT | 0.769 | 0.33 | 77.60 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.753 | CT | 0.756 | 0.23 | 64.40 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.202 | 0.603 | CT | 0.626 | 0.15 | 52.90 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.198 | 0.608 | CT | 0.598 | 0.32 | 76.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.605 | CT | 0.620 | 0.14 | 51.30 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.199 | 0.608 | CT | 0.617 | 0.24 | 65.60 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.201 | 0.603 | CT | 0.623 | 0.16 | 54.60 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.502 | 0.750 | CT | 0.775 | 0.16 | 54.50 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.200 | 0.605 | CT | 0.620 | 0.14 | 51.20 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.502 | 0.750 | CT | 0.762 | 0.17 | 55.50 | | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.497 | 0.750 | CT | 0.751 | 0.16 | 53.60 | 66.2/ | 12.3 | 1972 | 82543 |
| 1650F, AUS-BAY | F | 0.80 | 175 | L-T | 208.0 | 1.500 | 0.750 | CT | 0.762 | 0.37 | 80.30 | | | 1972 | 82543 |
| QUENCH 975F, SQ | | 0.80 | | | 208.0 | 1.504 | 0.750 | CT | 0.771 | 0.34 | 77.10 | | | 1972 | 82543 |
| 400F, 1000F | | 0.80 | | | 208.0 | 1.498 | 0.750 | CT | 0.757 | 0.32 | 74.30 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 77.2/ | 3.0 | | |
| 1650F, 1 HR, FC | F | 1.50 | R.T. | -- | 219.0 | 1.000 | 0.500 | CT | 0.500 | 0.39 | 86.90 | | | 1972 | 84277 |
| TO 960F, OQ AT | | 1.50 | | | 219.0 | 1.000 | 0.500 | CT | 0.500 | 0.41 | 88.30 | | | 1972 | 84277 |
| 180F, AC, 1025F | | 1.50 | | | 219.0 | 1.000 | 0.500 | CT | 0.500 | 0.40 | 88.00 | | | 1972 | 84277 |
| 2+2 HR | | | | | | | | | | | | 87.7/ | 0.7 | | |
| 1650F, 1 HR, FC | BT | 7.00 | R.T. | L-T | 210.0 | 2.500 | 1.000 | CT | 1.400 | 0.38 | 81.80 | | | 1972 | 84277 |
| 1650F 1 HR, OQ, | | 7.00 | | | 210.0 | 2.500 | 1.000 | CT | 1.400 | 0.32 | 75.10 | | | 1972 | 84277 |
| 1025F 2+2 HR | | | | | | | | | | | | 78.5/ | 4.7 | | |
| 1650F, 1 HR, FC | BT | 7.00 | R.T. | L-T | 211.0 | 2.500 | 1.000 | CT | 1.400 | 0.36 | 79.70 | | | 1972 | 84277 |
| TO 960F, OQ AT | | 7.00 | | | 211.0 | 2.500 | 1.000 | CT | 1.400 | 0.37 | 80.90 | | | 1972 | 84277 |
| 150F, AC, 1000F 2+2 HR | | | | | | | | | | | | 80.3/ | 0.8 | | |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1675F AC 1575F | P | 1.00 | R.T. | -- | ---- | 1.999 | 1.008 | CT | 1.105 | 0.42 | 78.30 | | | 1973 | 85883 ( 1) |
| QQ,400F 2 HR, | | 1.00 | | | ---- | 1.995 | 1.008 | CT | 1.076 | 0.40 | 76.20 | | | 1973 | 85883 ( 1) |
| 1100F 2 HR | | 1.00 | | | ---- | 1.997 | 1.007 | CT | 1.075 | 0.42 | 77.60 | | | 1973 | 85883 ( 1) |
| (RC 42.5) | | 1.00 | | | ---- | 2.002 | 1.006 | CT | 1.069 | 0.40 | 76.50 | | | 1973 | 85883 ( 1) |
| | | | | | | | | | | | | 77.2/ | 1.0 | | |
| 1675F AC,1575F | P | 1.00 | R.T. | -- | ---- | 1.996 | 1.006 | CT | 1.118 | 0.15 | 53.10 | | | 1973 | 85883 ( 2) |
| QQ,400F 2 HR, | | 1.00 | | | ---- | 1.995 | 1.006 | CT | 1.139 | 0.15 | 53.50 | | | 1973 | 85883 ( 2) |
| 800F 2 HR | | 1.00 | | | ---- | 1.995 | 1.006 | CT | 1.116 | 0.16 | 55.90 | | | 1973 | 85883 ( 2) |
| (RC 46.5) | | 1.00 | | | ---- | 1.992 | 1.006 | CT | 1.097 | 0.14 | 52.20 | | | 1973 | 85883 ( 2) |
| | | | | | | | | | | | | 53.7/ | 1.6 | | |
| 1675F,AC,1575F | P | 1.00 | R.T. | -- | ---- | 1.996 | 1.007 | CT | 1.059 | 0.05 | 35.80 | | | 1973 | 85883 ( 3) |
| QQ,400F 2 HR, | | 1.00 | | | ---- | 2.001 | 1.007 | CT | 1.031 | 0.05 | 34.00 | | | 1973 | 85883 ( 3) |
| 500F 2 HR | | 1.00 | | | ---- | 1.999 | 1.007 | CT | 1.046 | 0.04 | 33.00 | | | 1973 | 85883 ( 3) |
| (RC 50) | | 1.00 | | | ---- | 1.996 | 1.007 | CT | 1.032 | 0.05 | 35.10 | | | 1973 | 85883 ( 3) |
| | | | | | | | | | | | | 34.5/ | 1.2 | | |
| 1700F,AUS-BAY | P | 0.80 | - 65 | L-T | 228.0 | 1.502 | 0.759 | CT | 0.774 | 0.13 | 51.40 | | | 1972 | 82543 |
| QUENCH 975F,QQ | | 0.80 | | | 228.0 | 1.499 | 0.749 | CT | 0.755 | 0.16 | 58.50 | | | 1972 | 82543 |
| 140F,1000F | | 0.80 | | | 228.0 | 1.502 | 0.749 | CT | 0.748 | 0.13 | 52.80 | | | 1972 | 82543 |
| 2+2 HR | | 1.50 | | | 228.0 | 1.502 | 0.755 | CT | 0.763 | 0.11 | 48.70 | | | 1972 | 82543 |
| | | 1.50 | | | 228.0 | 1.502 | 0.750 | CT | 0.759 | 0.10 | 46.40 | | | 1972 | 82543 |
| | | 0.80 | | | 228.0 | 1.501 | 0.759 | CT | 0.780 | 0.17 | 59.80 | | | 1972 | 82543 |
| | | 1.50 | | | 228.0 | 1.506 | 0.750 | CT | 0.753 | 0.09 | 42.20 | | | 1972 | 82543 |
| | | 1.50 | | | 228.0 | 1.502 | 0.750 | CT | 0.759 | 0.10 | 46.40 | | | 1972 | 82543 |
| | | 0.80 | | | 228.0 | 1.506 | 0.759 | CT | 0.774 | 0.15 | 56.40 | 51.4/ | 6.0 | 1972 | 82543 |
| 1700F,AUS BAY | P | 1.50 | - 40 | L-T | 227.0 | 1.501 | 0.750 | CT | 0.768 | 0.09 | 43.70 | | | 1972 | 82543 |
| QUENCH 975F,QQ | | 1.50 | | | 227.0 | 1.499 | 0.754 | CT | 0.772 | 0.11 | 47.90 | | | 1972 | 82543 |
| 140F,1000F | | 1.50 | | | 227.0 | 1.503 | 0.749 | CT | 0.768 | 0.10 | 44.60 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 45.4/ | 2.2 | | |
| 1700F,AUS-BAY | P | 1.50 | - 20 | L-T | 226.0 | 1.502 | 0.752 | CT | 0.779 | 0.14 | 54.00 | | | 1972 | 82543 |
| QUENCH 975F,QQ | | 0.80 | | | 226.0 | 1.500 | 0.755 | CT | 0.759 | 0.28 | 75.20 | | | 1972 | 82543 |
| 140F,1000F 2+2 HR | | | | | | | | | | | | | | | |

NOTES
( 1) TYS APPROX 170
( 2) TYS APPROX 220
( 3) TYS APPROX 250

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F, AUS BAY | P | 0.80 | -20 | L-T | 226.0 | 1.504 | 0.749 | CT | 0.756 | 0.24 | 69.30 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 0.80 | | | 226.0 | 1.504 | 0.754 | CT | 0.773 | 0.27 | 74.00 | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 226.0 | 1.501 | 0.750 | CT | 0.763 | 0.12 | 50.40 | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 226.0 | 1.506 | 0.749 | CT | 0.756 | 0.27 | 74.40 | | 1972 | 82543 |
| | | 1.50 | | | 226.0 | 1.501 | 0.750 | CT | 0.763 | 0.12 | 50.40 | | 1972 | 82543 |
| | | 0.80 | | | 226.0 | 1.502 | 0.755 | CT | 0.760 | 0.23 | 67.90 | | 1972 | 82543 |
| | | 1.50 | | | 226.0 | 1.499 | 0.749 | CT | 0.754 | 0.10 | 45.90 | 62.4/ 12.0 | 1972 | 82543 |
| 1700F, AUS BAY | P | 1.50 | 0 | L-T | 224.0 | 1.502 | 0.750 | CT | 0.768 | 0.14 | 53.60 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 224.0 | 1.499 | 0.755 | CT | 0.799 | 0.16 | 56.50 | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 225.0 | 1.503 | 0.750 | CT | 0.767 | 0.15 | 54.80 | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 55.0/ 1.5 | | |
| 1700F, AUS-BAY | P | 1.50 | 20 | L-T | 222.0 | 1.500 | 0.755 | CT | 0.788 | 0.17 | 59.10 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 222.0 | 1.501 | 0.750 | CT | 0.778 | 0.17 | 58.40 | | 1972 | 82543 |
| 140F, 1000F | | 0.80 | | | 222.0 | 1.502 | 0.754 | CT | 0.770 | 0.41 | 89.90 | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 222.0 | 1.504 | 0.755 | CT | 0.770 | 0.35 | 83.70 | | 1972 | 82543 |
| | | 0.80 | | | 222.0 | 1.501 | 0.753 | CT | 0.753 | 0.37 | 85.70 | | 1972 | 82543 |
| | | 1.50 | | | 222.0 | 1.500 | 0.748 | CT | 0.762 | 0.26 | 71.30 | | 1972 | 82543 |
| | | 0.80 | | | 222.0 | 1.504 | 0.754 | CT | 0.765 | 0.39 | 87.20 | 76.5/ 13.5 | 1972 | 82543 |
| 1700F, AUS-BAY | P | 1.50 | 40 | L-T | 220.0 | 1.501 | 0.750 | CT | 0.790 | 0.22 | 66.10 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 220.0 | 1.501 | 0.749 | CT | 0.767 | 0.33 | 80.50 | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 220.0 | 1.499 | 0.752 | CT | 0.779 | 0.21 | 64.50 | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 70.4/ 8.8 | | |
| 1700F, AUS-BAY | P | 0.80 | R.T. | L-T | 217.0 | 1.499 | 0.749 | CT | 0.761 | 0.55 | 101.70 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 0.80 | | | 217.0 | 1.506 | 0.752 | CT | 0.759 | 0.44 | 90.60 | | 1972 | 82543 |
| 140F, 1000F | | 0.80 | | | 217.0 | 1.478 | 0.756 | CT | 0.773 | 0.50 | 97.20 | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 217.0 | 1.500 | 0.749 | CT | 0.755 | 0.48 | 95.10 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.757 | CT | 0.779 | 0.47 | 94.20 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.757 | CT | 0.790 | 0.50 | 97.00 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.202 | 0.607 | CT | 0.624 | 0.46 | 92.80 | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.497 | 0.757 | CT | 0.781 | 0.32 | 77.40 | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.497 | 0.758 | CT | 0.782 | 0.27 | 70.80 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.503 | 0.758 | CT | 0.766 | 0.45 | 92.50 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.504 | 0.750 | CT | 0.791 | 0.49 | 96.30 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.756 | CT | 0.786 | 0.37 | 83.30 | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.501 | 0.757 | CT | 0.759 | 0.52 | 99.10 | | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F, AUS-BAY | P | 0.80 | R.T | L-T | 217.0 | 1.501 | 0.757 | CT | 0.773 | 0.48 | 95.40 | | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 217.0 | 1.503 | 0.758 | CT | 0.779 | 0.45 | 91.70 | | | 1972 | 82543 |
| 140F, 1000F | | 0.80 | | | 217.0 | 1.495 | 0.752 | CT | 0.767 | 0.44 | 91.00 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 217.0 | 1.498 | 0.692 | CT | 0.747 | 0.47 | 93.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.539 | 0.752 | CT | 0.817 | 0.49 | 96.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.201 | 0.607 | CT | 0.621 | 0.44 | 91.40 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.498 | 0.674 | CT | 0.759 | 0.49 | 96.10 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.497 | 0.758 | CT | 0.769 | 0.45 | 92.60 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.503 | 0.756 | CT | 0.755 | 0.49 | 96.30 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.753 | CT | 0.754 | 0.46 | 93.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.502 | 0.749 | CT | 0.759 | 0.45 | 91.90 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.495 | 0.757 | CT | 0.802 | 0.47 | 94.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.758 | CT | 0.792 | 0.44 | 91.20 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.500 | 0.751 | CT | 0.756 | 0.51 | 98.20 | | | 1972 | 82543 |
| | | 1.50 | | | 217.0 | 1.504 | 0.750 | CT | 0.765 | 0.22 | 64.10 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.496 | 0.757 | CT | 0.803 | 0.53 | 100.50 | | | 1972 | 82543 |
| | | 0.80 | | | 217.0 | 1.497 | 0.758 | CT | 0.776 | 0.48 | 94.70 | 92.0/ | 8.2 | 1972 | 82543 |
| 1700F, AUS-BAY | P | 1.50 | 175 | L-T | 211.0 | 1.501 | 0.750 | CT | 0.763 | 0.51 | 95.20 | | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 211.0 | 1.500 | 0.749 | CT | 0.760 | 0.44 | 89.20 | | | 1972 | 82543 |
| 140F, 1000F | | 0.80 | | | 211.0 | 1.499 | 0.752 | CT | 0.752 | 0.45 | 89.30 | | | 1972 | 82543 |
| 2+2 HR | | 1.50 | | | 211.0 | 1.501 | 0.752 | CT | 0.785 | 0.48 | 92.70 | | | 1972 | 82543 |
| | | 0.80 | | | 211.0 | 1.501 | 0.754 | CT | 0.779 | 0.52 | 96.50 | | | 1972 | 82543 |
| | | 0.80 | | | 211.0 | 1.506 | 0.753 | CT | 0.761 | 0.46 | 90.70 | 92.3/ | 3.1 | 1972 | 82543 |
| 1700F, AUS-BAY | P | 1.50 | 300 | L-T | 204.0 | 1.499 | 0.750 | CT | 0.779 | 0.45 | 86.40 | | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 204.0 | 1.499 | 0.754 | CT | 0.790 | 0.50 | 91.30 | | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 204.0 | 1.499 | 0.749 | CT | 0.758 | 0.47 | 88.00 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 88.6/ | 2.5 | | |
| 1700F, AUS-BAY | F | 1.50 | - 65 | L-T | 225.0 | 1.501 | 0.749 | CT | 0.762 | 0.14 | 52.80 | | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 225.0 | 1.500 | 0.753 | CT | 0.758 | 0.08 | 41.10 | | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 225.0 | 1.500 | 0.751 | CT | 0.789 | 0.11 | 47.50 | | | 1972 | 82543 |
| 2+2 HR | | 1.50 | | | 225.0 | 1.501 | 0.752 | CT | 0.760 | 0.09 | 42.60 | | | 1972 | 82543 |
| | | 1.50 | | | 225.0 | 1.501 | 0.752 | CT | 0.760 | 0.09 | 41.90 | | | 1972 | 82543 |
| | | 1.50 | | | 225.0 | 1.502 | 0.751 | CT | 0.783 | 0.11 | 47.30 | 45.5/ | 4.5 | 1972 | 82543 |
| 1700F, AUS-BAY | F | 1.50 | - 20 | L-T | 222.0 | 1.501 | 0.750 | CT | 0.752 | 0.16 | 55.70 | | | 1972 | 82543 |
| QUENCH 975F, OQ 140F, 1000F 2+2 HR | | | | | | | | | | | | | | | |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F, AUS-BAY | F | 1.50 | -20 | L-T | 222.0 | 1.501 | 0.750 | CT | 0.777 | 0.25 | 69.60 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 222.0 | 1.498 | 0.751 | CT | 0.765 | 0.12 | 49.60 | | 1972 | 82543 |
| 140F, 1000F 2+2 HR | | | | | | | | | | | | 58.3/ 10.3 | | |
| 1700F, AUS-BAY | F | 1.50 | 20 | L-T | 218.0 | 1.499 | 0.750 | CT | 0.741 | 0.19 | 60.00 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 218.0 | 1.500 | 0.750 | CT | 0.778 | 0.31 | 76.50 | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 218.0 | 1.503 | 0.752 | CT | 0.770 | 0.21 | 63.10 | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 66.5/ 8.8 | | |
| 1700F, AUS-BAY | F | 0.80 | R.T. | L-T | 214.0 | 1.501 | 0.750 | CT | 0.759 | 0.46 | 91.80 | | 1972 | 82543 |
| QUENCH 975F, OQ | | 0.80 | | | 214.0 | 1.499 | 0.757 | CT | 0.760 | 0.49 | 95.30 | | 1972 | 82543 |
| 140F, 1000F | | 0.80 | | | 214.0 | 1.501 | 0.748 | CT | 0.755 | 0.57 | 102.40 | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 214.0 | 1.494 | 0.757 | CT | 0.758 | 0.47 | 93.00 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.750 | CT | 0.771 | 0.57 | 102.00 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.497 | 0.748 | CT | 0.774 | 0.65 | 109.40 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.752 | CT | 0.769 | 0.56 | 101.70 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.493 | 0.748 | CT | 0.758 | 0.60 | 105.30 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.751 | CT | 0.781 | 0.57 | 102.20 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.497 | 0.750 | CT | 0.755 | 0.53 | 98.60 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.750 | CT | 0.753 | 0.47 | 92.80 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.748 | CT | 0.757 | 0.56 | 100.90 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.504 | 0.751 | CT | 0.770 | 0.39 | 84.90 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.503 | 0.751 | CT | 0.771 | 0.36 | 81.70 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.501 | 0.752 | CT | 0.765 | 0.39 | 84.90 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.498 | 0.750 | CT | 0.762 | 0.53 | 98.50 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.498 | 0.749 | CT | 0.759 | 0.45 | 91.00 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.503 | 0.750 | CT | 0.778 | 0.45 | 90.40 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.498 | 0.757 | CT | 0.767 | 0.53 | 98.50 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.750 | CT | 0.762 | 0.47 | 93.00 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.503 | 0.753 | CT | 0.759 | 0.46 | 92.00 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.751 | CT | 0.814 | 0.50 | 95.80 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.499 | 0.750 | CT | 0.753 | 0.47 | 92.80 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.501 | 0.751 | CT | 0.757 | 0.48 | 93.60 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.749 | CT | 0.759 | 0.46 | 91.60 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.501 | 0.752 | CT | 0.774 | 0.44 | 89.70 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.501 | 0.749 | CT | 0.789 | 0.47 | 92.60 | | 1972 | 82543 |
| | | 1.50 | | | 214.0 | 1.500 | 0.752 | CT | 0.763 | 0.46 | 91.50 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.497 | 0.756 | CT | 0.762 | 0.49 | 94.30 | | 1972 | 82543 |
| | | 0.80 | | | 214.0 | 1.500 | 0.750 | CT | 0.768 | 0.39 | 84.80 | | 1972 | 82543 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F, AUS BAY | F | 0.80 | R.T | L-T | 214.0 | 1.504 | 0.748 | CT | 0.743 | 0.58 | 102.90 | | | 1972 | 82543 |
| QUENCH 975F, OQ | | 0.80 | | | 214.0 | 1.501 | 0.749 | CT | 0.779 | 0.52 | 97.60 | | | 1972 | 82543 |
| 140F, 1000F | | 0.80 | | | 214.0 | 1.501 | 0.750 | CT | 0.758 | 0.51 | 96.50 | | | 1972 | 82543 |
| 2+2 HR | | 0.80 | | | 214.0 | 1.500 | 0.756 | CT | 0.782 | 0.58 | 103.10 | 95.2/ | 6.4 | 1972 | 82543 |
| 1700F, AUS-BAY | F | 1.50 | 175 | L-T | 208.0 | 1.501 | 0.756 | CT | 0.778 | 0.57 | 99.50 | | | 1972 | 82543 |
| QUENCH 975F, OQ | | 1.50 | | | 208.0 | 1.501 | 0.756 | CT | 0.774 | 0.54 | 96.30 | | | 1972 | 82543 |
| 140F, 1000F | | 1.50 | | | 208.0 | 1.500 | 0.755 | CT | 0.762 | 0.54 | 96.70 | | | 1972 | 82543 |
| 2+2 HR | | | | | | | | | | | | 97.5/ | 1.7 | | |
| 1700F, 1 HR, FC | BT | 7.00 | R.T. | L-T | 215.0 | 2.500 | 1.000 | CT | 1.400 | 0.31 | 75.70 | | | 1972 | 84277 |
| TO 960F, OQ AT | | 7.00 | | | 215.0 | 2.500 | 1.000 | CT | 1.400 | 0.38 | 84.30 | | | 1972 | 84277 |
| 150F, AC, 1000F | | 7.00 | | | 215.0 | 2.500 | 1.000 | CT | 1.400 | 0.35 | 80.80 | | | 1972 | 84277 |
| 2+2 HR | | | | | | | | | | | | 80.3/ | 4.3 | | |
| 1700F, 1 HR, OQ, | BT | 7.00 | R.T | L-T | 214.0 | 2.500 | 1.000 | CT | 1.400 | 0.33 | 78.40 | | | 1972 | 84277 |
| 1025F 2+2 HR | | 7.00 | | | 214.0 | 2.500 | 1.000 | CT | 1.400 | 0.36 | 81.10 | | | 1972 | 84277 |
| | | 7.00 | | | 214.0 | 2.500 | 1.000 | CT | 1.400 | 0.33 | 78.10 | | | 1972 | 84277 |
| | | 10.00 | | | 216.0 | 2.500 | 1.000 | CT | 1.400 | 0.30 | 75.30 | | | 1972 | 84277 |
| | | 10.00 | | | 216.0 | 2.500 | 1.000 | CT | 1.400 | 0.32 | 77.10 | | | 1972 | 84277 |
| | | 10.00 | | | 216.0 | 2.500 | 1.000 | CT | 1.400 | 0.29 | 73.70 | 77.3/ | 2.6 | 1972 | 84277 |
| 1725F 1 HR, AC | BT | 7.00 | R.T. | L-T | 213.0 | 2.500 | 1.000 | CT | 1.400 | 0.35 | 80.10 | | | 1972 | 84277 |
| 1700F 1 HR, OQ, | | 7.00 | | | 213.0 | 2.500 | 1.000 | CT | 1.400 | 0.33 | 76.90 | | | 1972 | 84277 |
| 1000F 1 HR, | | 7.00 | | | 213.0 | 2.500 | 1.000 | CT | 1.400 | 0.31 | 74.70 | | | 1972 | 84277 |
| 1015F 1 HR | | | | | | | | | | | | 77.2/ | 2.7 | | |
| 1725F, 1 HR, AC | BT | 7.00 | R.T. | L-T | 200.0 | 2.500 | 1.000 | CT | 1.400 | 0.52 | 91.20 | | | 1972 | 84277 |
| 1700F 1 HR, OQ, | | 7.00 | | | 200.0 | 2.500 | 1.000 | CT | 1.400 | 0.60 | 97.70 | | | 1972 | 84277 |
| 1100F 2+2 HR | | 7.00 | | | 200.0 | 2.500 | 1.000 | CT | 1.400 | 0.74 | 109.00 | | | 1972 | 84277 |
| | | 10.00 | | | 205.0 | 2.500 | 1.000 | CT | 1.400 | 0.63 | 103.00 | | | 1972 | 84277 |

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1725F, 1 HR, AC | BT | 10 00 | R T | L-T | 205.0 | 2 500 | 1.000 | CT | 1.400 | 0 62 | 102.00 | | | 1972 | 84277 |
| 1700F 1 HR, OQ, | | 10 00 | | | 205.0 | 2.500 | 1.000 | CT | 1.400 | 0.65 | 104.00 | | | 1972 | 84277 |
| 1100F 2+2 HR | | | | | | | | | | | | 101.2/ | 6.1 | | |
| 1725F, 1 HR, AC | BT | 7 00 | R T. | L-T | 213.0 | 2.500 | 1.000 | CT | 1.400 | 0.38 | 83.10 | | | 1972 | 84277 |
| 1700F 1 HR, OQ, | | 7 00 | | | 213.0 | 2.500 | 1.000 | CT | 1.400 | 0.31 | 75.50 | | | 1972 | 84277 |
| 1025F 2+2 HR | | 7 00 | | | 213.0 | 2.500 | 1.000 | CT | 1.400 | 0.30 | 73.20 | | | 1972 | 84277 |
| | | 10 00 | | | 217.0 | 2.500 | 1.000 | CT | 1.400 | 0.22 | 64.60 | | | 1972 | 84277 |
| | | 10 00 | | | 217.0 | 2.500 | 1.000 | CT | 1.400 | 0.32 | 77.90 | | | 1972 | 84277 |
| | | 10 00 | | | 217.0 | 2.500 | 1.000 | CT | 1.400 | 0.27 | 71.90 | 74.4/ | 6.2 | 1972 | 84277 |
| 1725F, 1 HR, AC | BT | 7 00 | R.T | L-T | 221.0 | 2.500 | 1.000 | CT | 1.400 | 0.32 | 78.80 | | | 1972 | 84277 |
| 1650F 1 HR, FC | | 7 00 | | | 221.0 | 2.500 | 1.000 | CT | 1.400 | 0.21 | 63.70 | | | 1972 | 84277 |
| TO 960F, SQ | | 7 00 | | | 221.0 | 2.500 | 1.000 | CT | 1.400 | 0.35 | 82.80 | | | 1972 | 84277 |
| 350F 0 5 HR, AC, 1025F 2+2 HR | | | | | | | | | | | | 75.1/ | 10.1 | | |

TABLE 6.4.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 375F, 1000F
2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. JP-4 FUEL 3HZ | E= R.T. DIST H20 1HZ | | |
| DELTA K MIN | A: | 10.07 | .963 | | | |
| | B: | 9.70 | | .930 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | | .932 | | |
| | | 13.00 | 1.83 | 2.25 | | |
| | | 16.00 | | 4.27 | | |
| | | 20.00 | | 7.55 | | |
| | | 25.00 | | 12.2 | | |
| | | 30.00 | | 17.4 | | |
| DELTA K MAX | A: | 14.40 | 3.49 | | | |
| | B: | 30.90 | | 18.3 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 17.19 | 14.86 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR
FORM: 1.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.507"
SPECIMEN WIDTH: 2.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

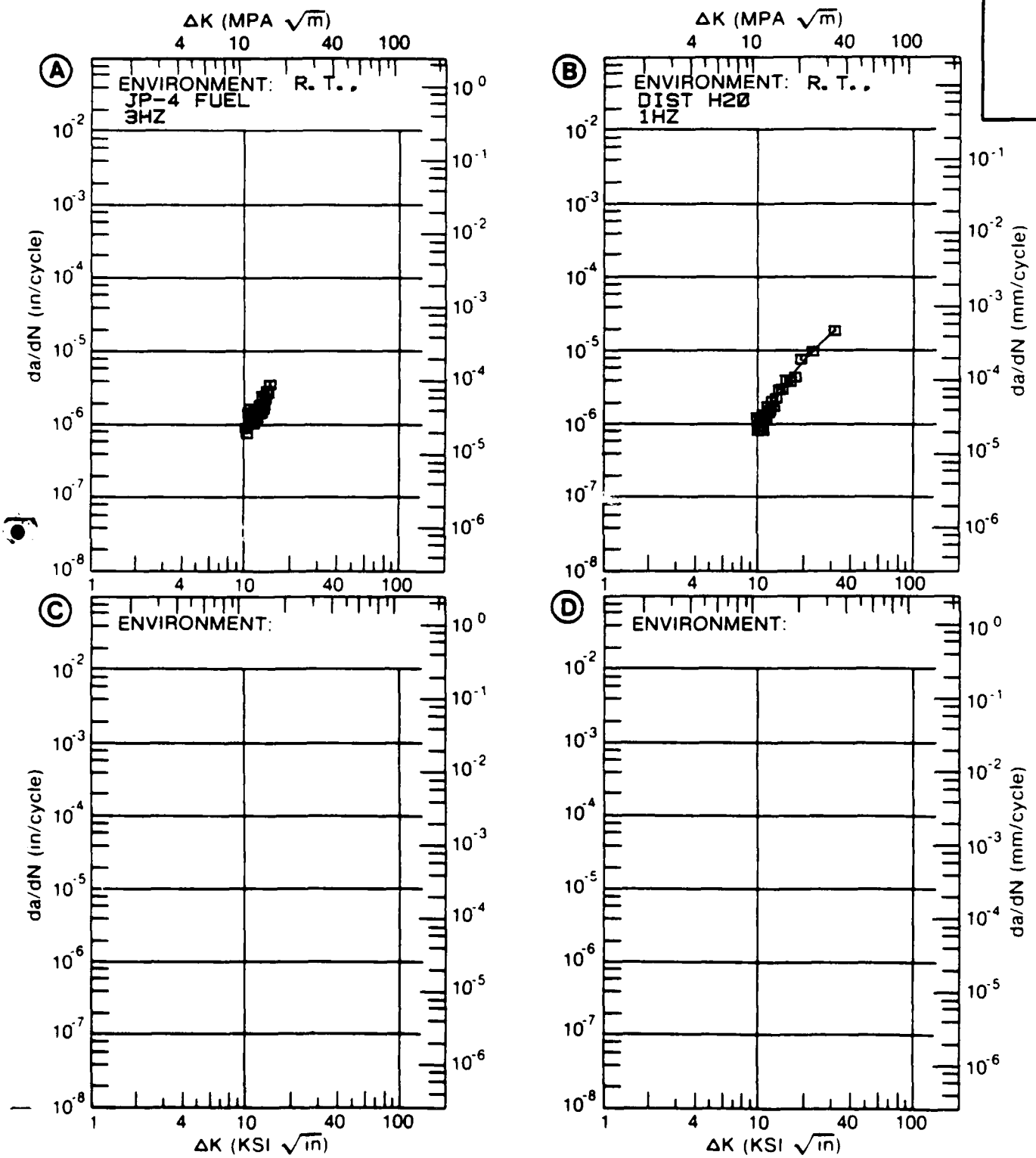



Figure 6.4.3.1

TABLE 6.4.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BG AT 975F, SQ AT 375F, 1000F
2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. JP-4 FUEL | | | |
| DELTA K MIN | A: | 8.99 | .241 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | .243 | | | |
| | | 10.00 | .471 | | | |
| | | 13.00 | 1.81 | | | |
| | | 16.00 | 3.85 | | | |
| | | 20.00 | 6.36 | | | |
| DELTA K MAX | A: | 24.55 | 7.62 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 17.15

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR
FORM: 1.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.507"
SPECIMEN WIDTH: 2.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

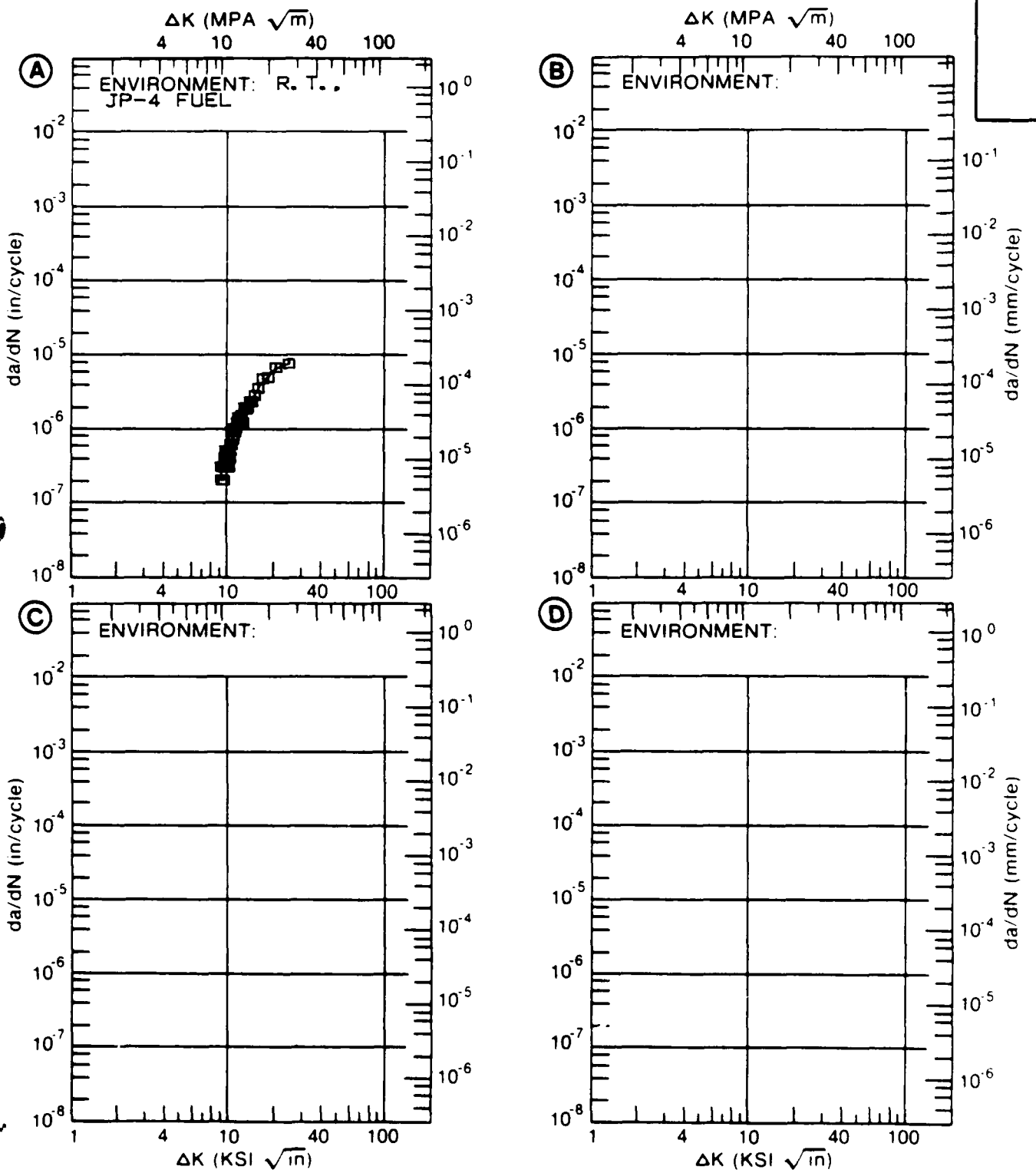



Figure 6.4.3.2

TABLE 6.4.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 375F, 1000F
2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. JP-4 FUEL | E= R.T. DIST H2O | | |
| DELTA K MIN | A: | 10.86 | 1.84 | | | |
| | B: | 10.78 | | 3.22 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 2.05 | 3.99 | | |
| | | 16.00 | 5.70 | 7.97 | | |
| | | 20.00 | | 13.9 | | |
| DELTA K MAX | A: | 19.86 | 18.8 | | | |
| | B: | 22.37 | | 40.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 23.17 | 18.87 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR
FORM: 1.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.506- 0.507"
SPECIMEN WIDTH: 2.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

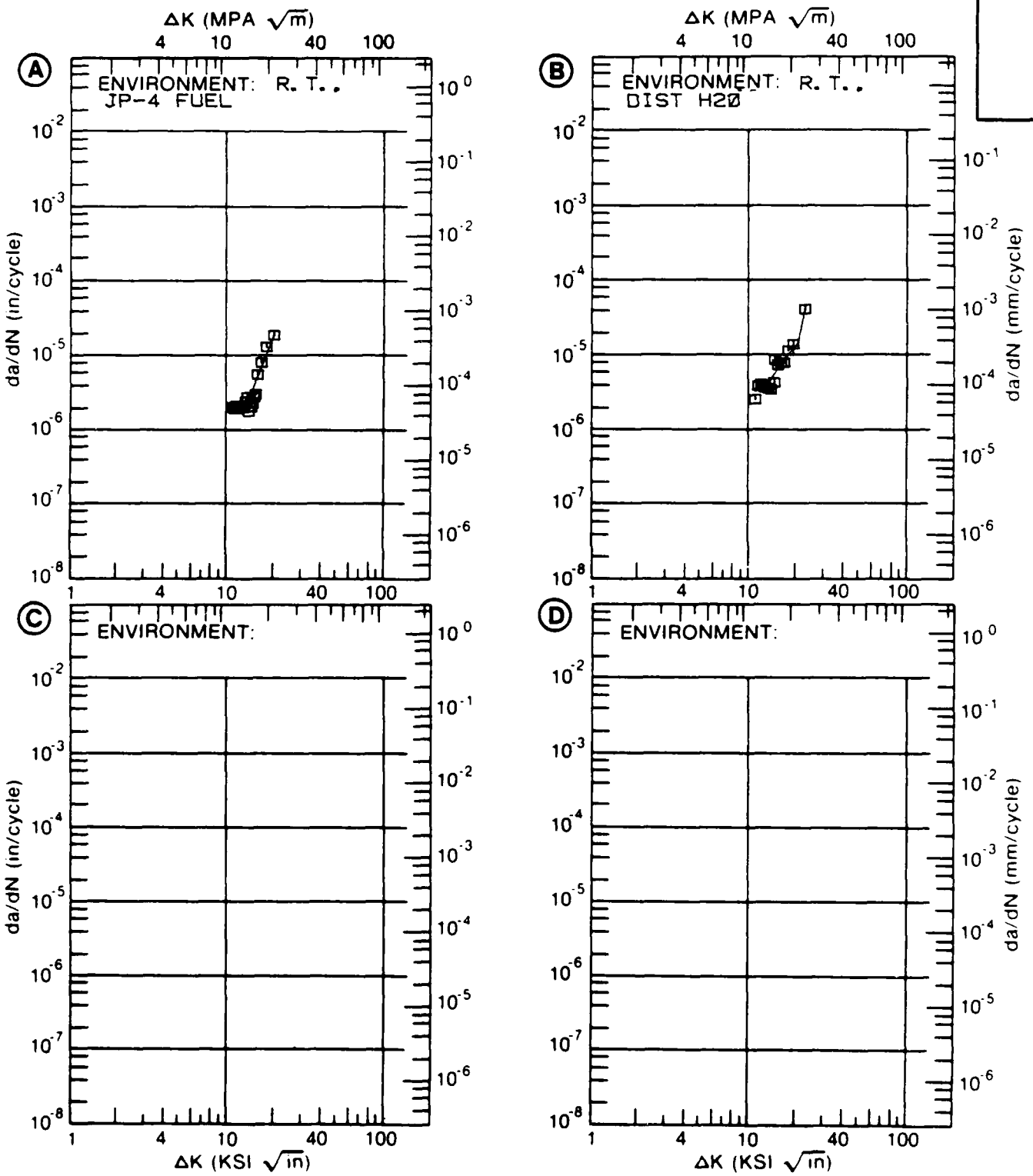



Figure 6.4.3.3

TABLE 6.4.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR
ENVIRONMENT: R.T. , LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 37.20 | 25.7 | | | |
| | B: | 22.01 | | 14.0 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 25.00 | | 14.0 | | |
| | | 30.00 | | 21.7 | | |
| | | 35.00 | | | | |
| | | 40.00 | 28.5 | | | |
| | | 50.00 | 65.2 | | | |
| DELTA K MAX | A: | 52.74 | 71.2 | | | |
| | B: | 31.32 | | 25.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 8.34 | 9.73 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 0.10 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.690"
SPECIMEN WIDTH: 1.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

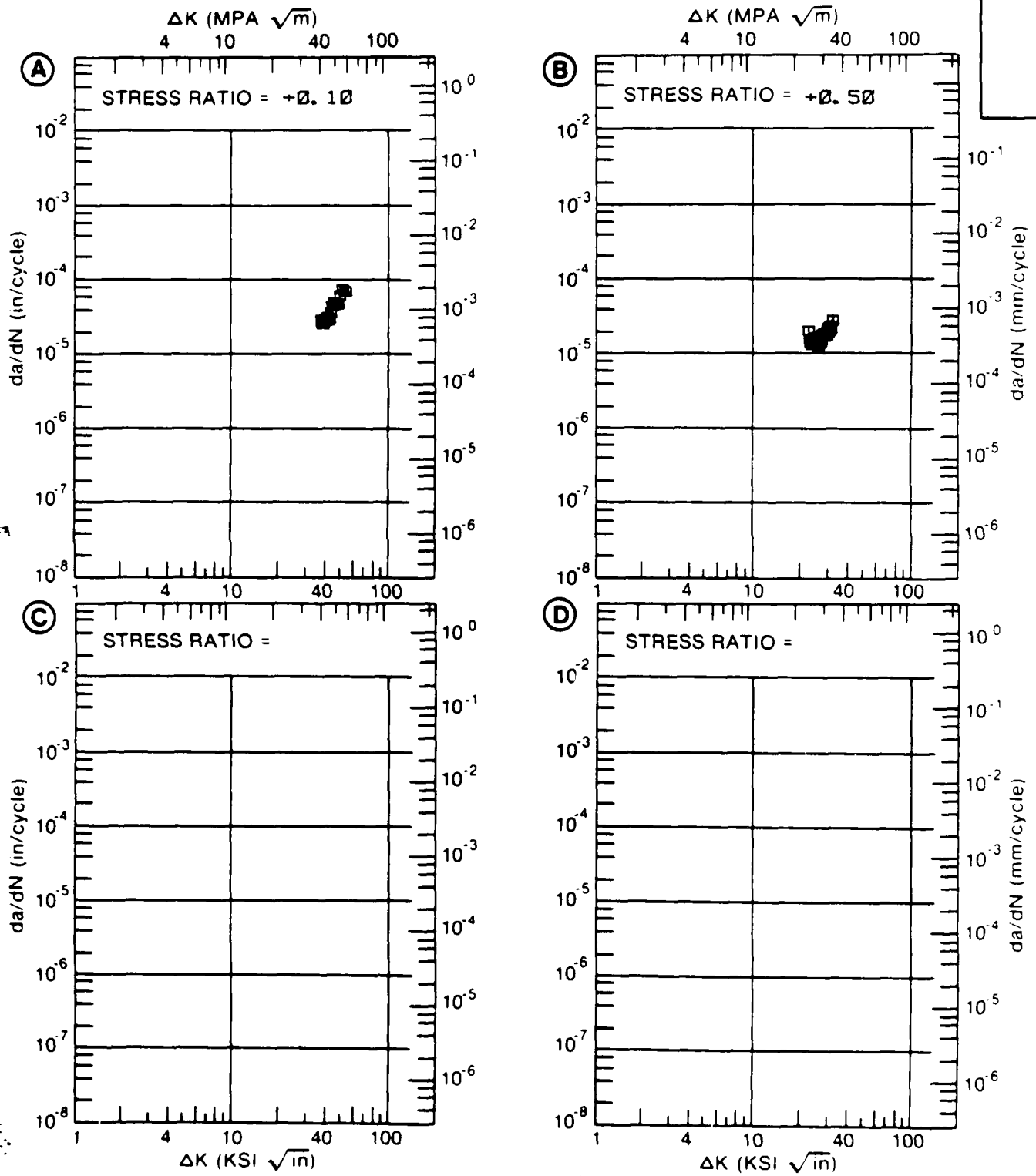



Figure 6.4.3.4

TABLE 6.4.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR
ENVIRONMENT: R.T. , LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 19.32 | 2.28 | | | |
| | B: | 18.50 | | 9.46 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 2.85 | 9.29 | | |
| | | 25.00 | 8.21 | 14.2 | | |
| | | 30.00 | 13.8 | | | |
| | | 35.00 | 19.1 | | | |
| | | 40.00 | 25.5 | | | |
| DELTA K MAX | A: | 47.75 | 42.0 | | | |
| | B: | 26.21 | | 16.8 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 17.60 | 11.10 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | 1 | 1 | | |
| | | 0.5-0.8 | 1 | | | |
| | | 0.8-1.25 | 1 | | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 217.0- 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.690"
SPECIMEN WIDTH: 1.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

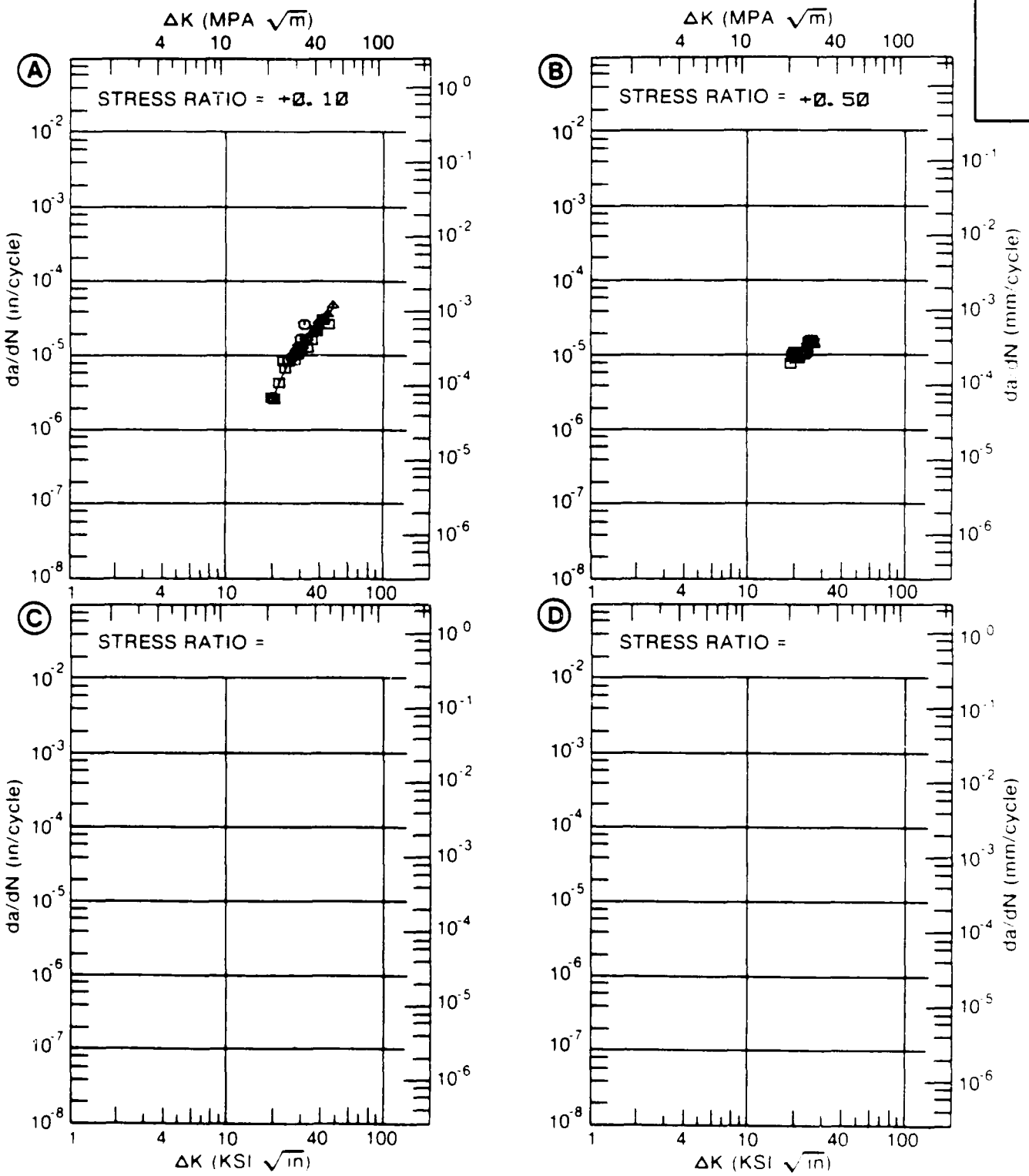



Figure [illegible]

TABLE 6.4.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.6 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR
ENVIRONMENT: R.T. ,DIST H20

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | F(HZ)= 0.10 | F(HZ)= 1.00 | | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 0.00 | | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
ENVIRONMENT: R.T., DIST H20

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.750"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

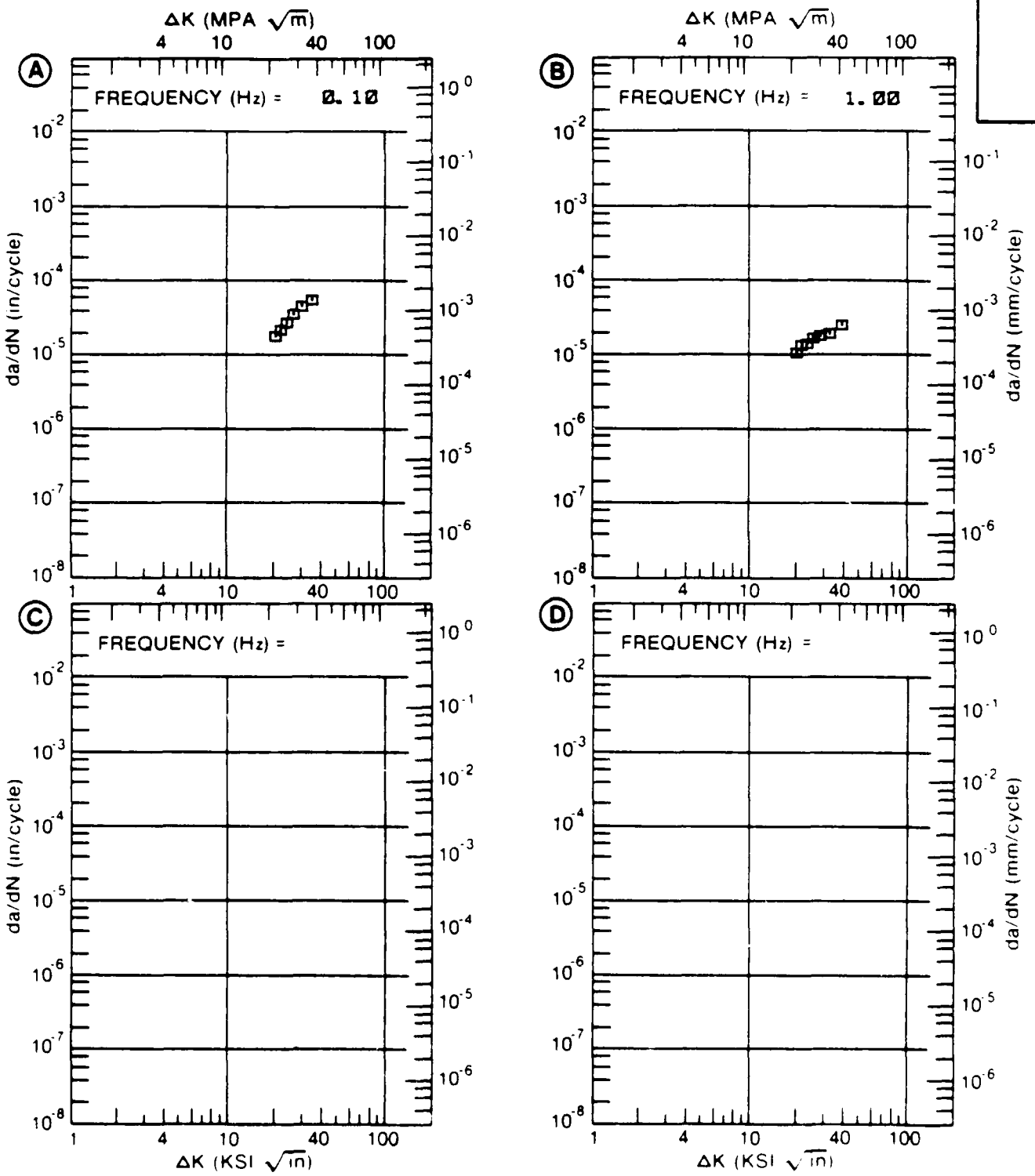


TABLE 6.4.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.7 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR
ENVIRONMENT: R.T. ,DRY AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | 13.47 | 1.39 | | | |
| | B: | 13.43 | | 1.07 | | |
| | C: | 13.52 | | | 1.11 | |
| | D: | | | | | |
| | | 16.00 | 2.79 | 2.45 | 2.59 | |
| | | 20.00 | 5.58 | 5.24 | 5.43 | |
| | | 25.00 | 9.39 | 8.84 | 8.61 | |
| | | 30.00 | 13.3 | 12.2 | 11.5 | |
| | | 35.00 | 17.5 | 15.6 | | |
| DELTA K MAX | A: | 36.15 | 18.6 | | | |
| | B: | 35.22 | | 15.7 | | |
| | C: | 34.37 | | | 14.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.09 | 8.90 | 6.09 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1850F A-BQ AT 975F. SQ AT 400F. 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.09
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.750"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

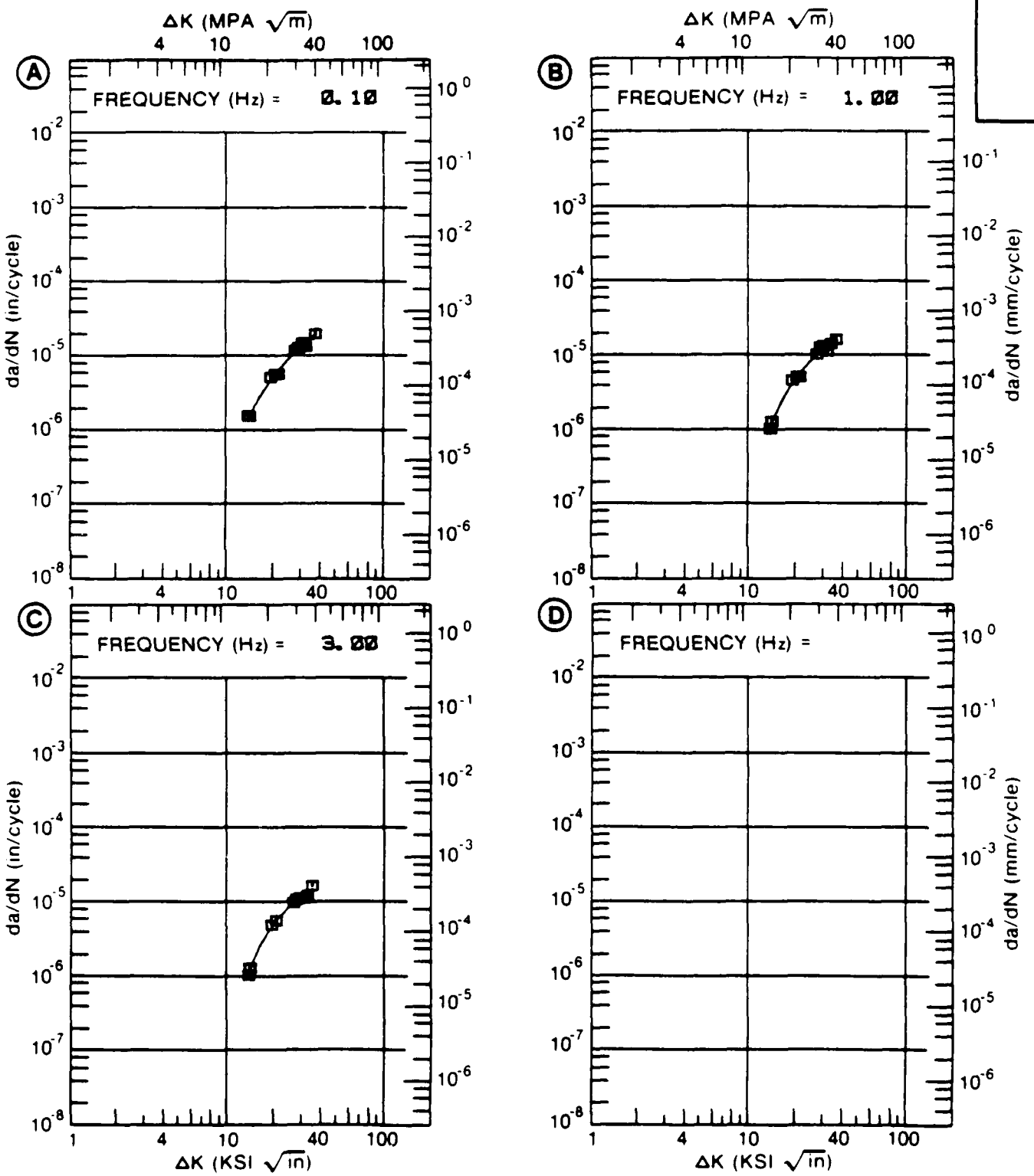



Figure 6.4.3.7

TABLE 6.4.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.8 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR
ENVIRONMENT: R.T. , JP-4 FUEL

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | 10.28 | 2.31 | | | |
| | B: | 10.19 | | 1.01 | | |
| | C: | 9.80 | | | .639 | |
| | D: | | | | | |
| | | 10.00 | | | .736 | |
| | | 13.00 | 3.32 | 2.86 | 2.64 | |
| | | 16.00 | 5.48 | 5.05 | 4.21 | |
| | | 20.00 | 10.4 | 7.44 | 5.31 | |
| | | 25.00 | 20.2 | 9.60 | 6.64 | |
| | | 30.00 | 33.1 | 11.5 | 9.58 | |
| | | 35.00 | 46.7 | 13.7 | | |
| | | 40.00 | 58.2 | | | |
| DELTA K MAX | A: | 49.58 | 67.9 | | | |
| | B: | 36.95 | | 14.8 | | |
| | C: | 34.21 | | | 15.1 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.60 | 13.73 | 15.78 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., JP-4 FUEL

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.751"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

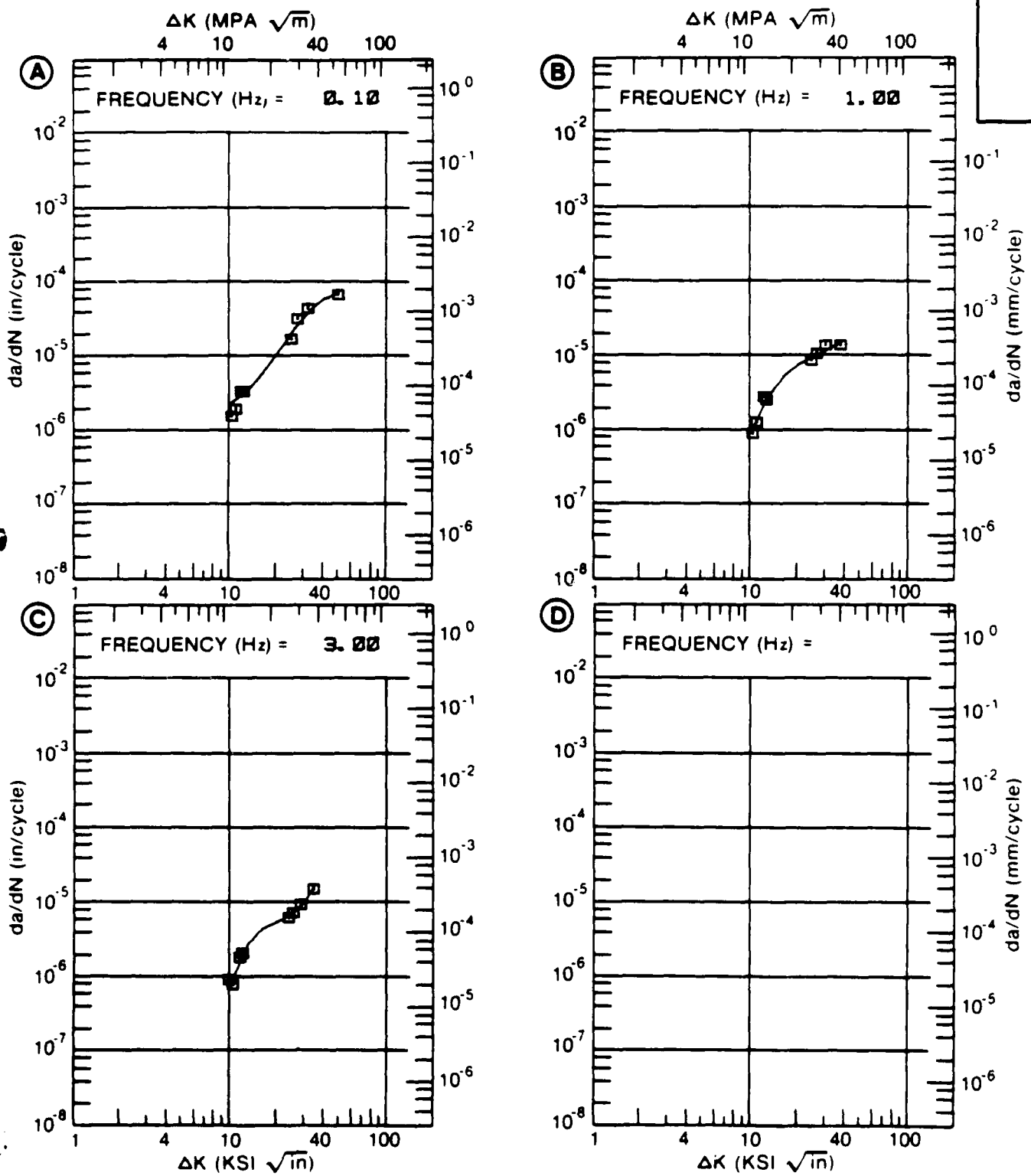



Figure 6.4.3.8

TABLE 6.4.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.9 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR
ENVIRONMENT: R. T. , JP-4 FUEL

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | | | | |
| | B: 9.99 | | 2.13 | | |
| | C: 9.80 | | | .980 | |
| | D: | | | | |
| | 10.00 | | 2.14 | 1.09 | |
| | 13.00 | | 4.58 | 2.83 | |
| | 16.00 | | 6.39 | 4.38 | |
| | 20.00 | | 9.06 | 6.45 | |
| | 25.00 | | 16.4 | 11.0 | |
| DELTA K MAX | A: | | | | |
| | B: 29.90 | | 37.2 | | |
| | C: 27.00 | | | 14.2 | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 8.91 | 12.64 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | | 1 | 1 | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1850F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
ENVIRONMENT: R.T., JP-4 FUEL
YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.758"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

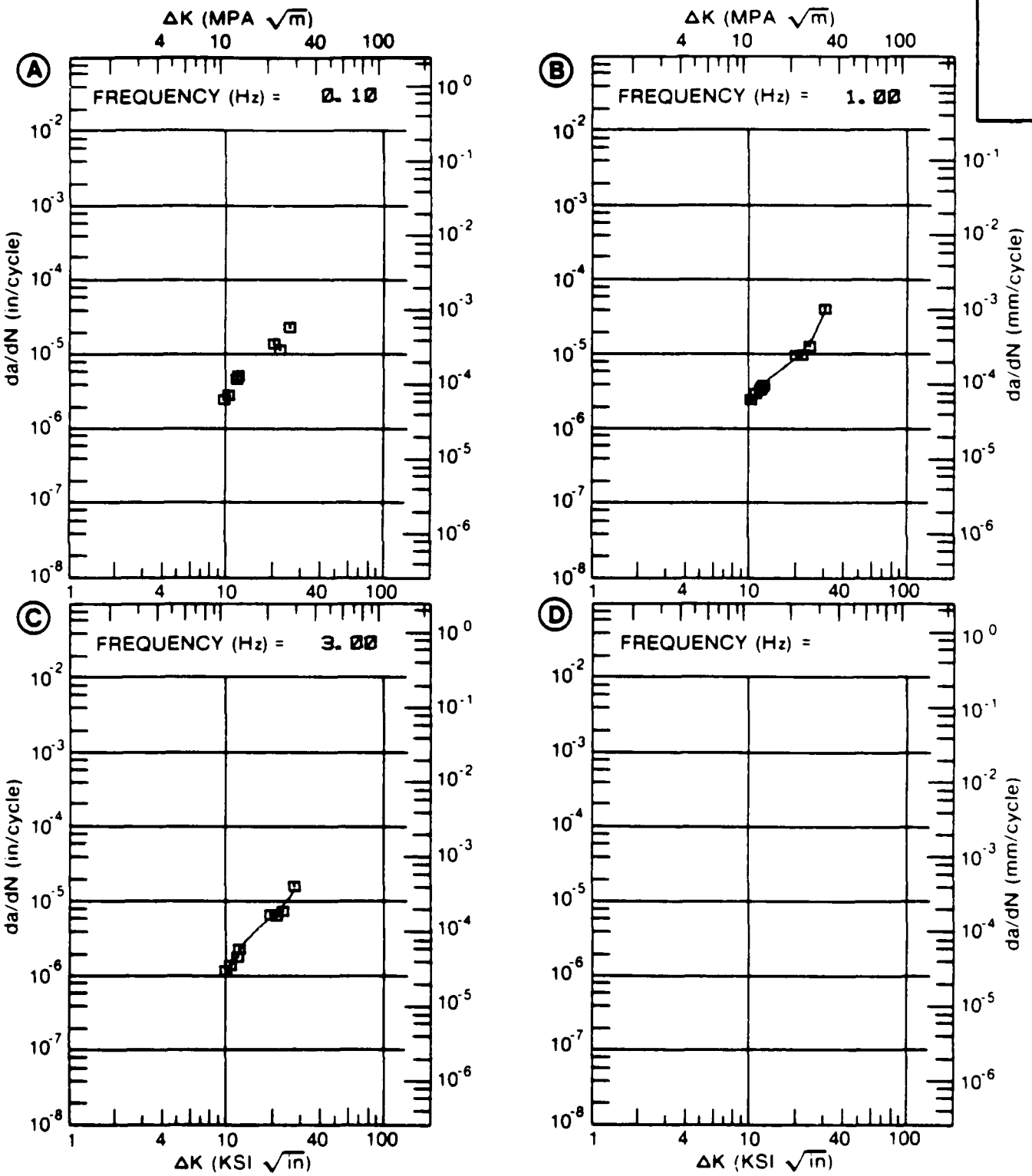



Figure 6.4.3.9

TABLE 6.4.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E= R.T. JP-4 FUEL | | | |
| DELTA K MIN | A: | 14.94 | 3.56 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 3.15 | | | |
| | | 20.00 | 5.38 | | | |
| | | 25.00 | 11.2 | | | |
| DELTA K MAX | A: | 25.91 | 11.5 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 16.96

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

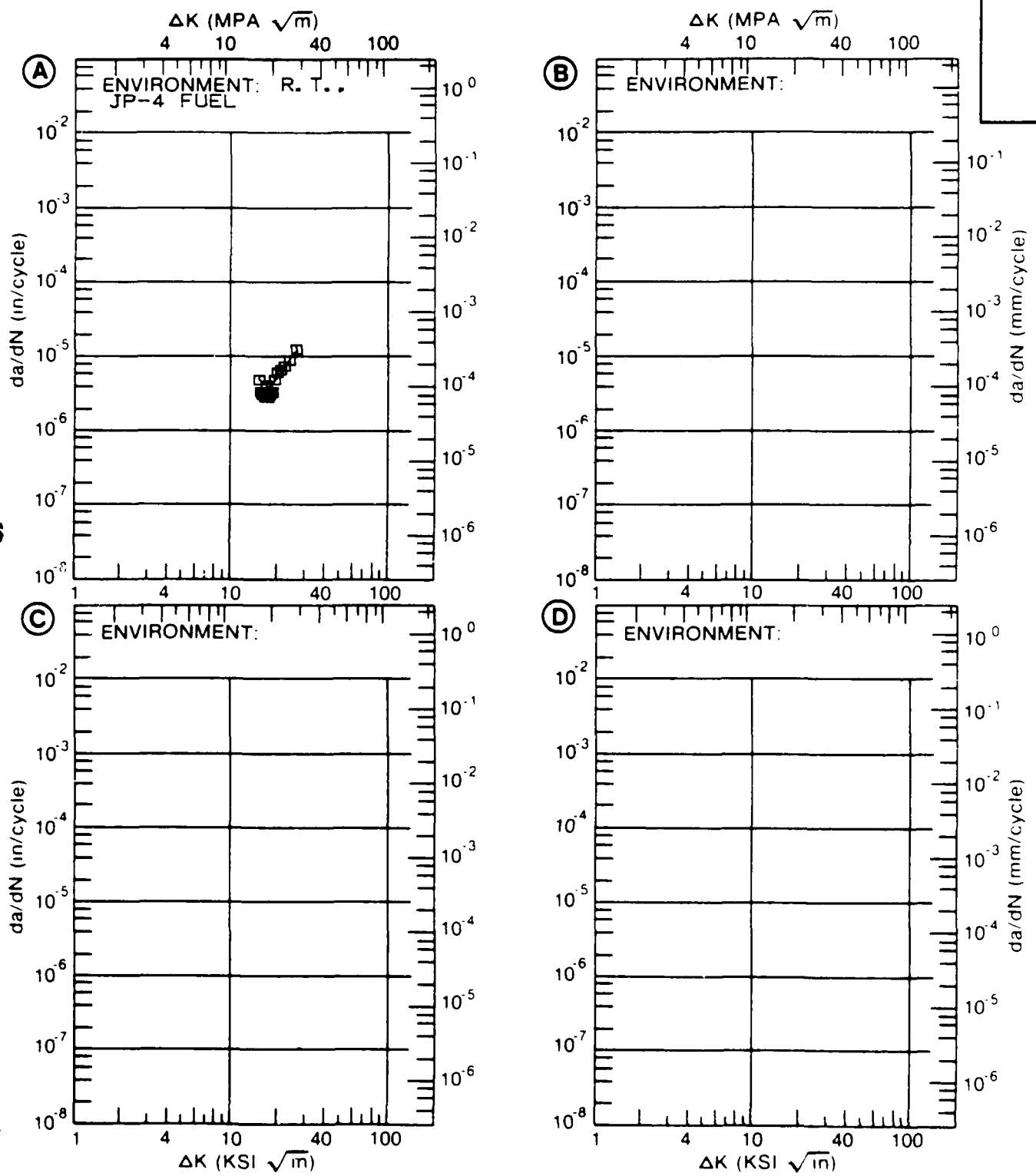



Figure 6.4.3.10

TABLE 6.4.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.11 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R. T. , LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN. /CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0. 10 | | | |
| DELTA K MIN | A: | 19. 72 | 5. 50 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20. 00 | 5. 61 | | | |
| | | 25. 00 | 8. 34 | | | |
| | | 30. 00 | 12. 8 | | | |
| | | 35. 00 | 19. 2 | | | |
| | | 40. 00 | 27. 7 | | | |
| | | 50. 00 | 51. 3 | | | |
| | | 60. 00 | 81. 9 | | | |
| DELTA K MAX | A: | 66. 91 | 105. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 25. 51

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0. 0-0. 5 | |
| | 0. 5-0. 8 | 1 |
| | 0. 8-1. 25 | 2 |
| | 1. 25-2. 0 | |
| | >2. 0 | |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.690"
SPECIMEN WIDTH: 1.500"
REFERENCES: 82543

ALLOY STEEL

D6AC

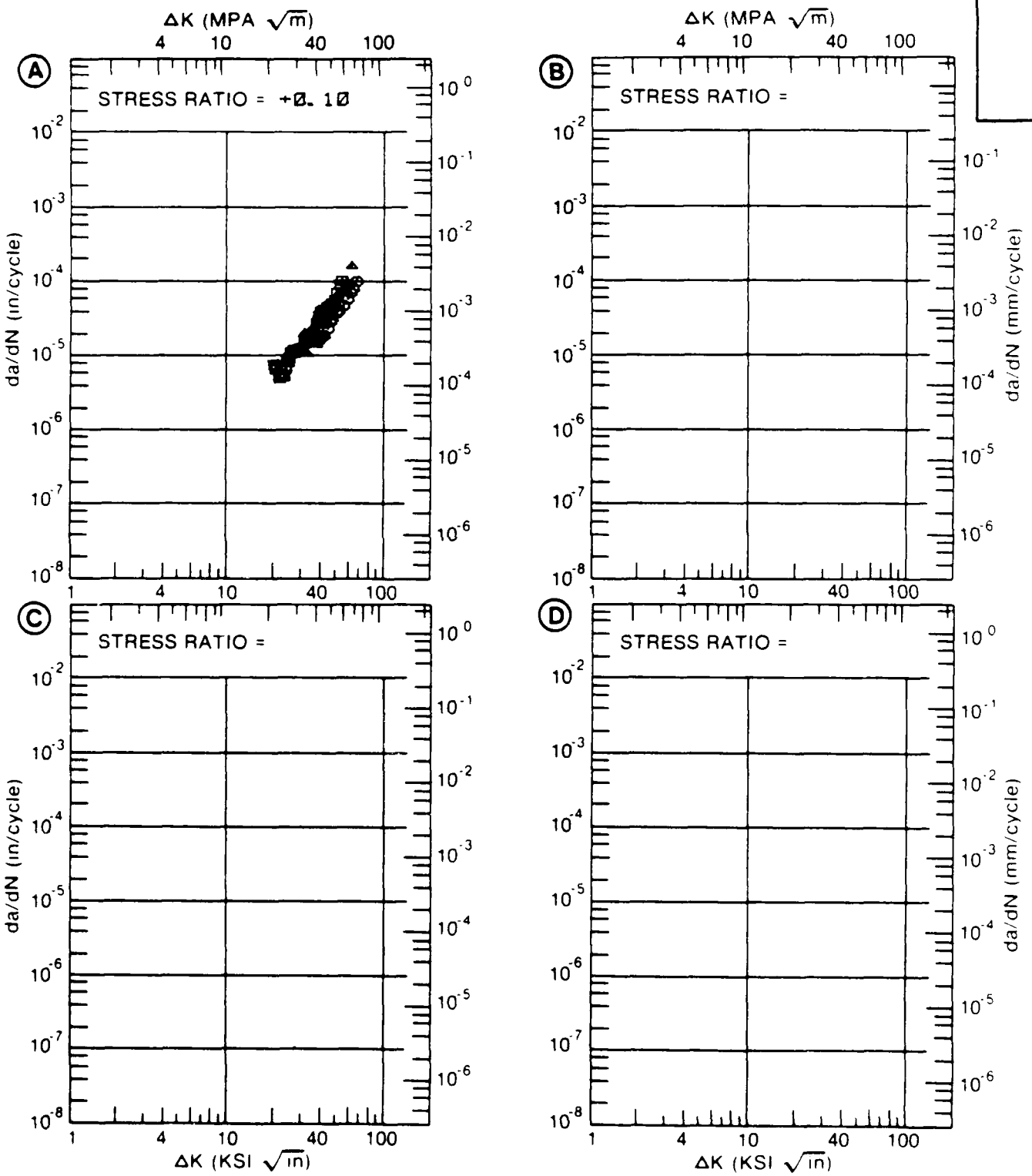



Figure 6.4.3.11

TABLE 6.4.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.12 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ, 975F OQ AT 140F, 1000F 2+2HRS
ENVIRONMENT: R.T. , DRY AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.50 | | | |
| DELTA K MIN | A: | 15.55 | 3.63 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 3.76 | | | |
| | | 20.00 | 6.18 | | | |
| DELTA K MAX | A: | 21.35 | 7.29 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 8.68

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 2 |
| | 1.25-2.0 | 1 |
| | >2.0 | |

CONDITION/HT: 1700F A-BQ, 975F OQ AT 140F, 1000F 2+2HRS
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 0.10- 3.00 HZ
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.751"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

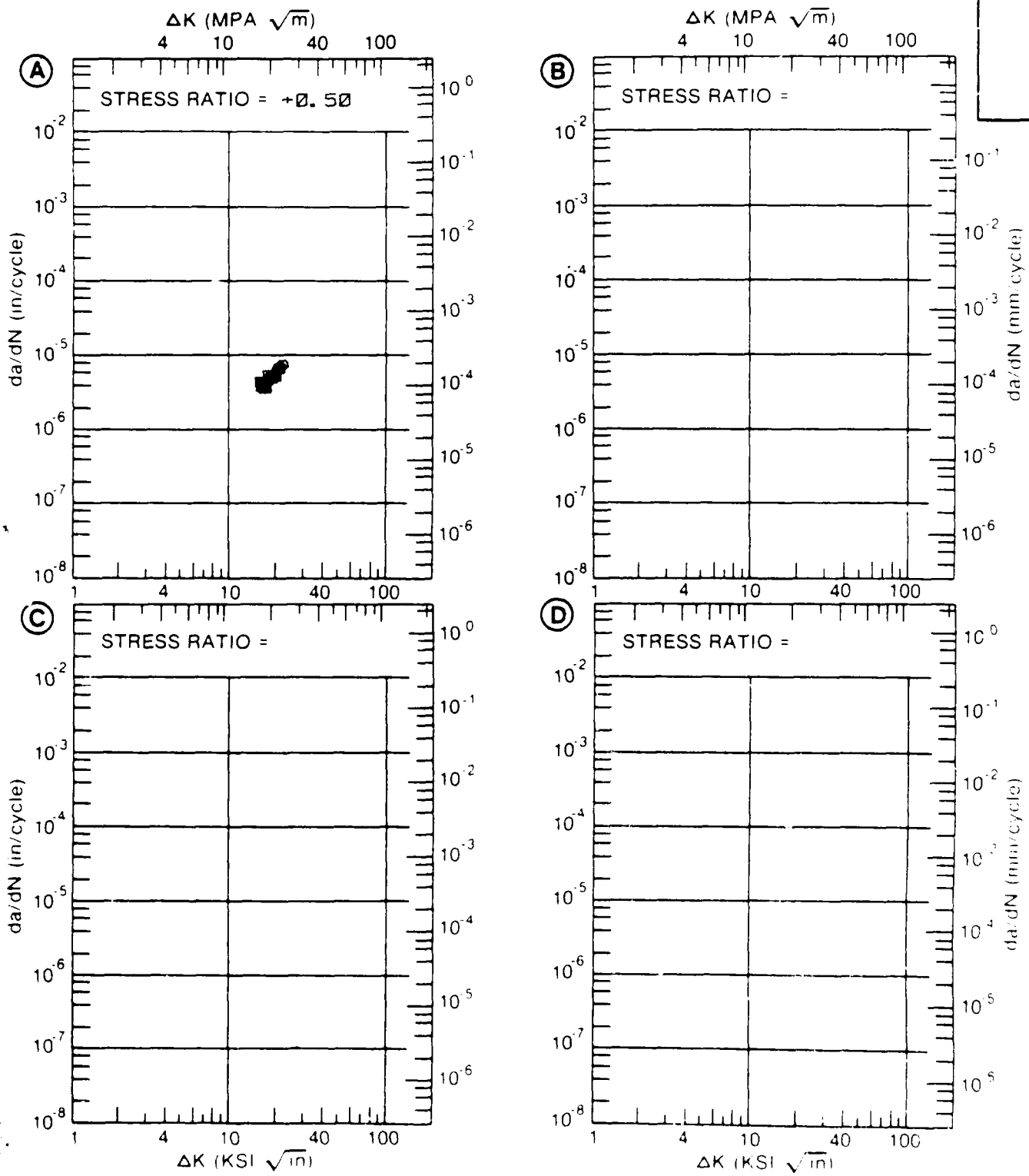


TABLE 6.4.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.13 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R. T. ,DIST H20

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | F(HZ)= 0.10 | F(HZ)= 1.00 | | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 0.00 | | |

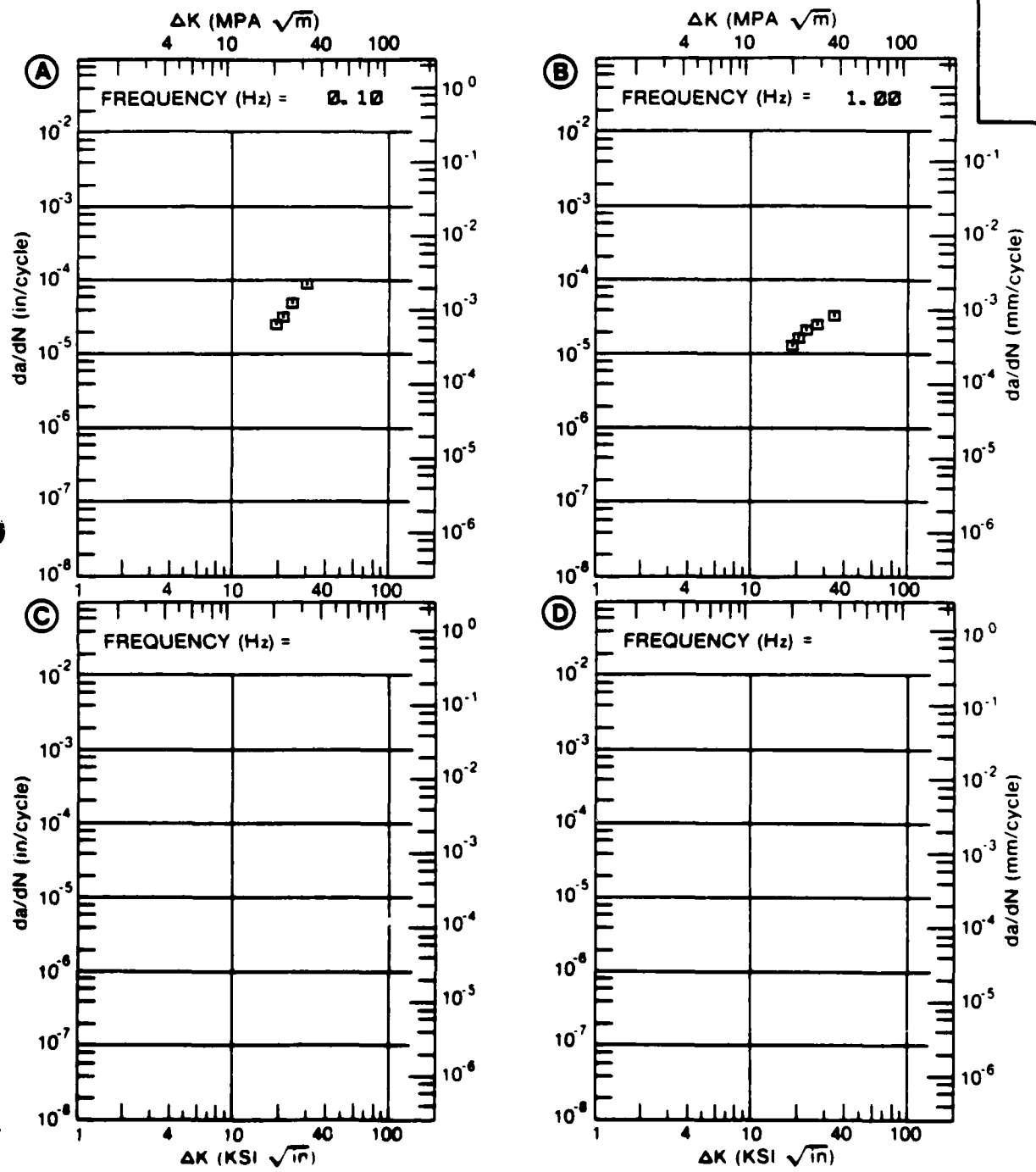
| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
ENVIRONMENT: R.T., DIST H20

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.754"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC




CONDITION/HT 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM 0.80"TH FORGING
SPECIMEN TYPE CT

YIELD STRENGTH 220.0 KSI
ULT STRENGTH 238.0 KSI
SPECIMEN THK 0.750" - 0.753"

ALLOY STEEL

TABLE 6.4.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.14 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R.T. , DRY AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | 19.47 | 4.95 | | | |
| | B: | 12.94 | | 1.27 | | |
| | C: | 12.88 | | | 1.09 | |
| | D: | | | | | |
| | | 13.00 | | 1.26 | 1.14 | |
| | | 16.00 | | 2.61 | 2.52 | |
| | | 20.00 | 5.28 | 5.88 | 4.86 | |
| | | 25.00 | 8.52 | 9.94 | 8.22 | |
| | | 30.00 | 12.3 | 13.6 | 12.1 | |
| | | 35.00 | 17.0 | 17.6 | 16.9 | |
| | | 40.00 | 23.2 | 23.0 | 23.2 | |
| | | 50.00 | 43.9 | 43.4 | 43.3 | |
| | | 60.00 | | 96.3 | 83.0 | |
| | | 70.00 | | 128. | | |
| DELTA K MAX | A: | 57.66 | 73.2 | | | |
| | B: | 70.52 | | 114. | | |
| | C: | 63.32 | | | 104. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.94 | 11.47 | 6.89 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.752"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

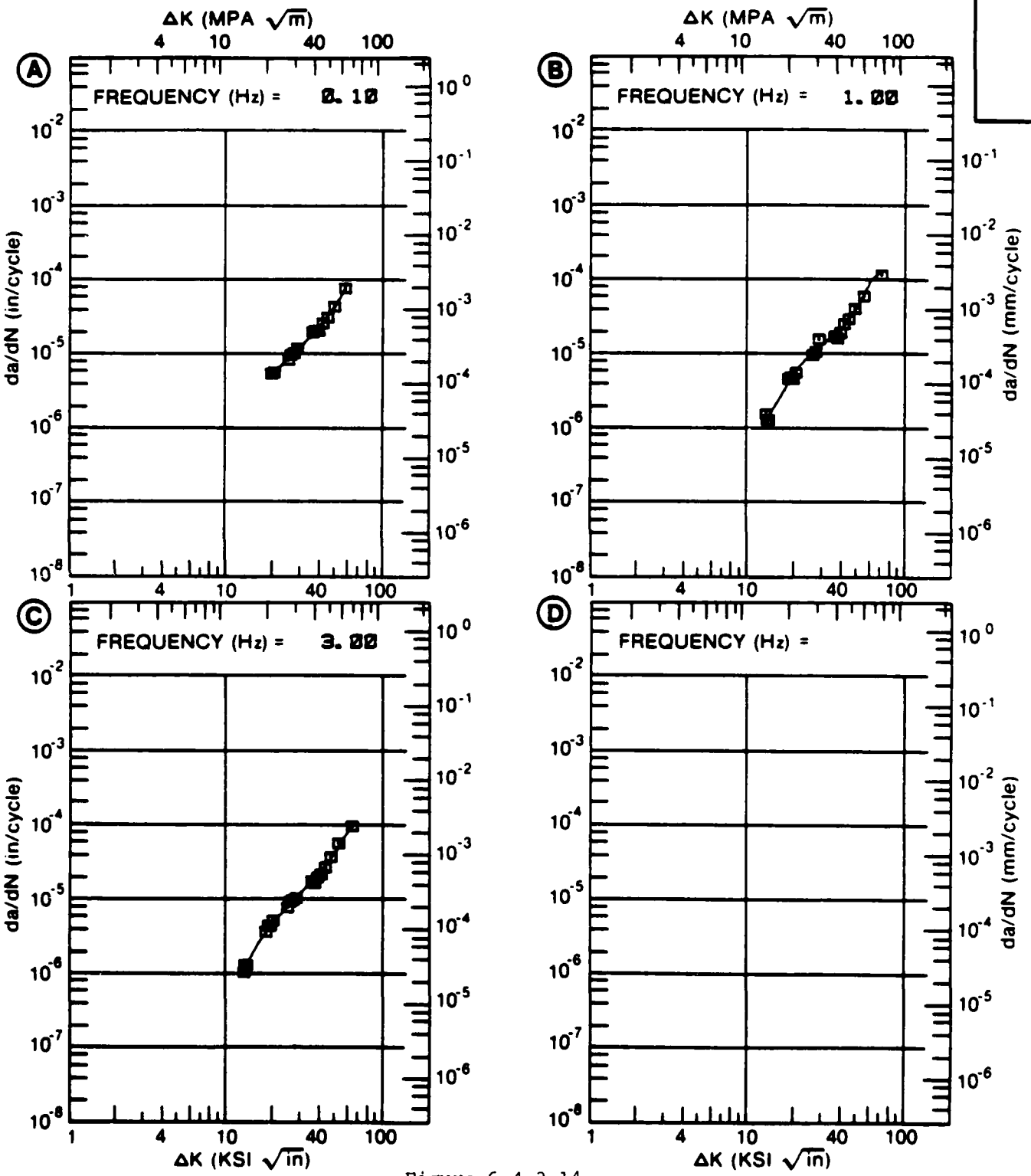



Figure 6.4.3.14

TABLE 6.4.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.15 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R.T. , JP4/H20

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| DELTA K MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 0.00 | 0.00 | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT: 1700F A-BQ AT 975F. OQ AT 140F. 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., JP4/H20

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.741"
SPECIMEN WIDTH: 5.000"
REFERENCES: 62543

ALLOY STEEL

D6AC

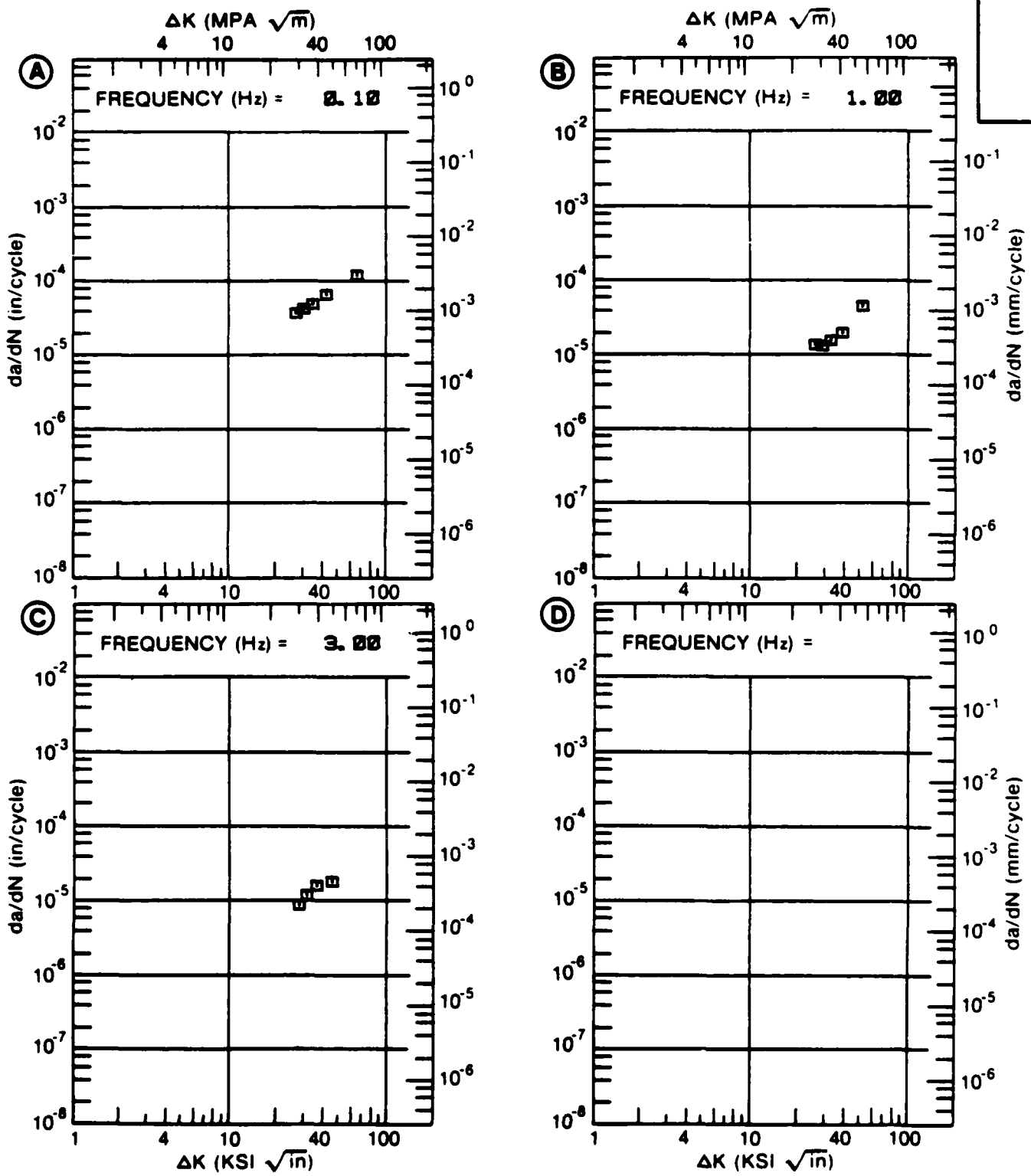



Figure 6.4.3.15

TABLE 6.4.3.16

FATIQUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.16 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R. T. , DIST H2O

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN. /CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 1.00 | F(HZ)= 3.00 | | |
| DELTA K MIN | A: | 9.81 | 2.20 | | | |
| | B: | 9.86 | | 1.32 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | 2.33 | 1.43 | | |
| | | 13.00 | 4.71 | 4.18 | | |
| | | 16.00 | 7.69 | 6.44 | | |
| | | 20.00 | 12.2 | 8.56 | | |
| | | 25.00 | 18.4 | 11.8 | | |
| | | 30.00 | 24.9 | 18.6 | | |
| DELTA K MAX | A: | 33.23 | 29.1 | | | |
| | B: | 30.17 | | 18.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 16.48 | 19.47 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | 1 | | |
| | | >2.0 | 1 | | | |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
ENVIRONMENT: R.T., DIST H20

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.751"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

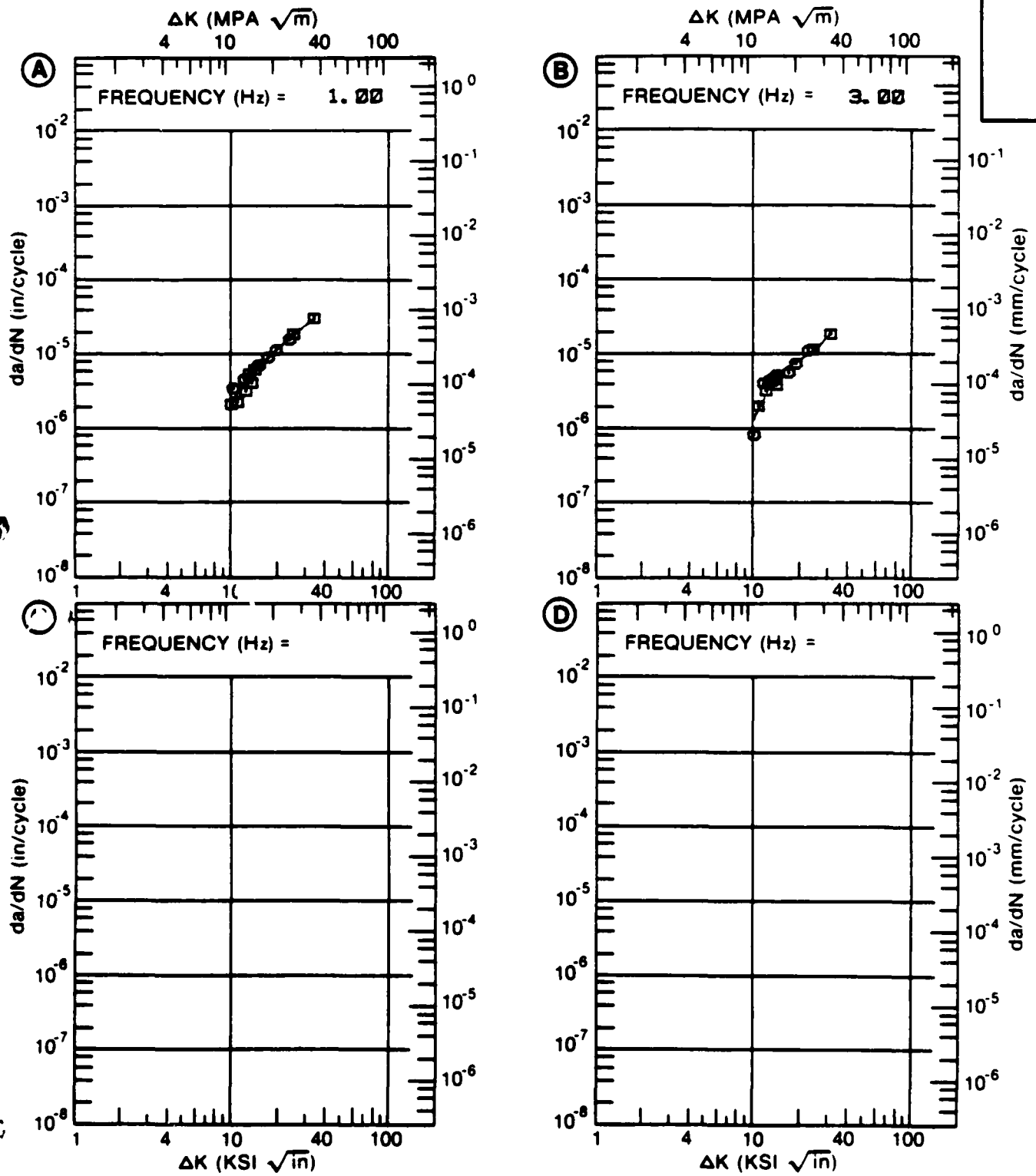



Figure 6.4.3.16

TABLE 6.4.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.17 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R.T. , JP-4 FUEL

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN A: | | | | | |
| B: | 10.80 | | 2.19 | | |
| C: | 10.58 | | | 1.20 | |
| D: | | | | | |
| | 13.00 | | 3.02 | 2.29 | |
| | 16.00 | | 4.92 | 3.93 | |
| | 20.00 | | 8.95 | 6.73 | |
| | 25.00 | | 15.9 | 12.0 | |
| | 30.00 | | 23.4 | 21.0 | |
| | 35.00 | | 29.2 | | |
| DELTA K MAX A: | | | | | |
| B: | 39.01 | | 31.7 | | |
| C: | 33.66 | | | 31.9 | |
| D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 15.29 | 13.65 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | | 1 | 1 | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1700F A-BQ AT 975F OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
ENVIRONMENT: R.T., JP-4 FUEL

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.750"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

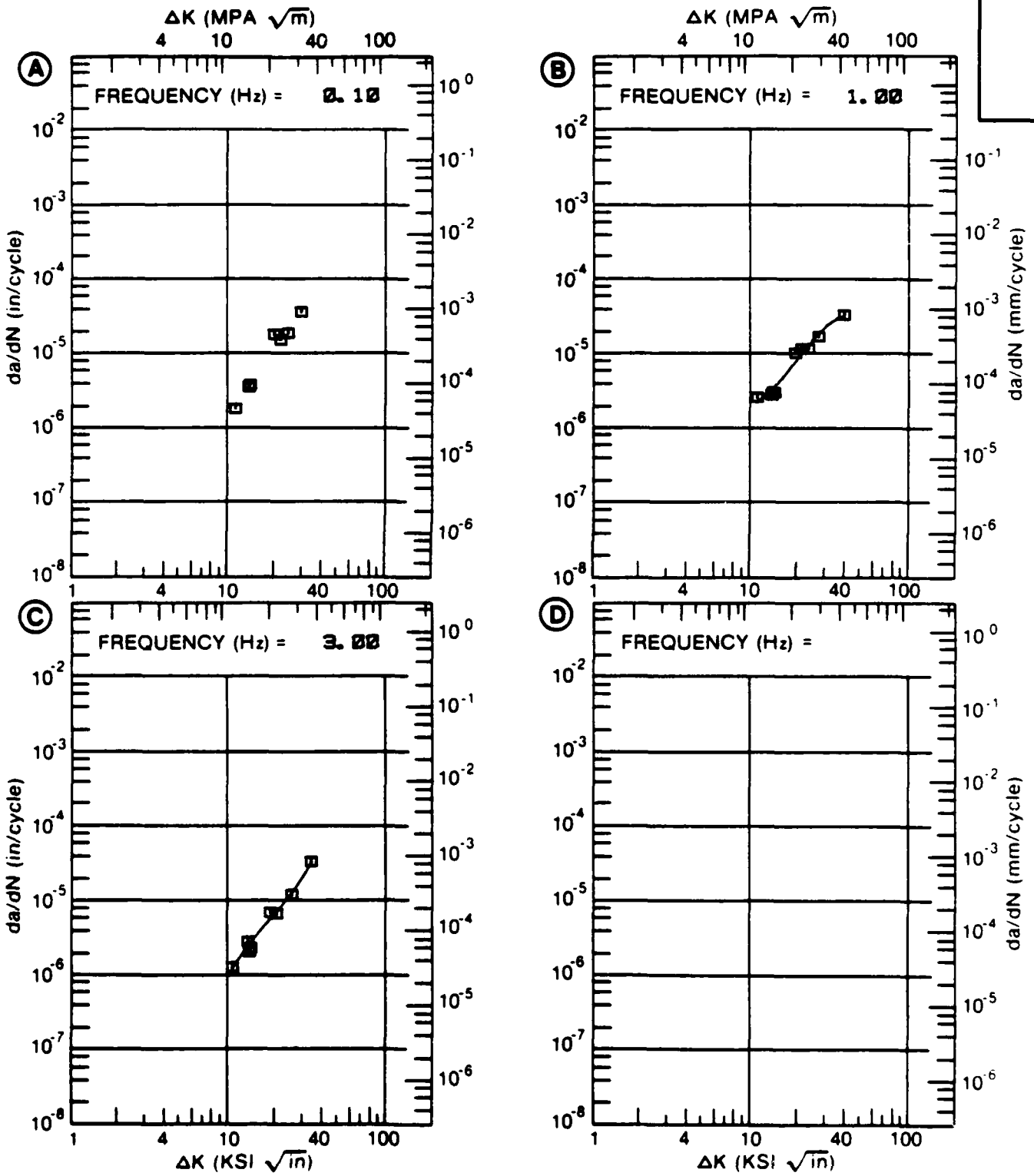



Figure 6.4.3.17

TABLE 6.4.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.18 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R.T. ,DIST H2O

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | 12.13 | 5.69 | | | |
| | B: | 12.01 | | 2.35 | | |
| | C: | 12.24 | | | 2.81 | |
| | D: | | | | | |
| | | 13.00 | 8.66 | 3.25 | 3.40 | |
| | | 16.00 | 16.8 | 6.39 | 4.97 | |
| | | 20.00 | 23.4 | 10.7 | 5.88 | |
| | | 25.00 | 41.1 | 15.6 | 7.59 | |
| | | 30.00 | 71.7 | 20.5 | 12.6 | |
| | | 35.00 | 109. | 26.1 | | |
| | | 40.00 | 140. | | | |
| DELTA K MAX | A: | 46.20 | 151. | | | |
| | B: | 39.73 | | 32.9 | | |
| | C: | 30.48 | | | 13.5 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 16.63 | 15.16 | 34.97 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | | | |
|---|---|---|---|---|
| | 0.0-0.5 | | | |
| | 0.5-0.8 | | | |
| | 0.8-1.25 | 1 | 1 | 1 |
| | 1.25-2.0 | | | |
| | >2.0 | | | |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F, 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.11
ENVIRONMENT: R.T., DIST H20

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.741"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

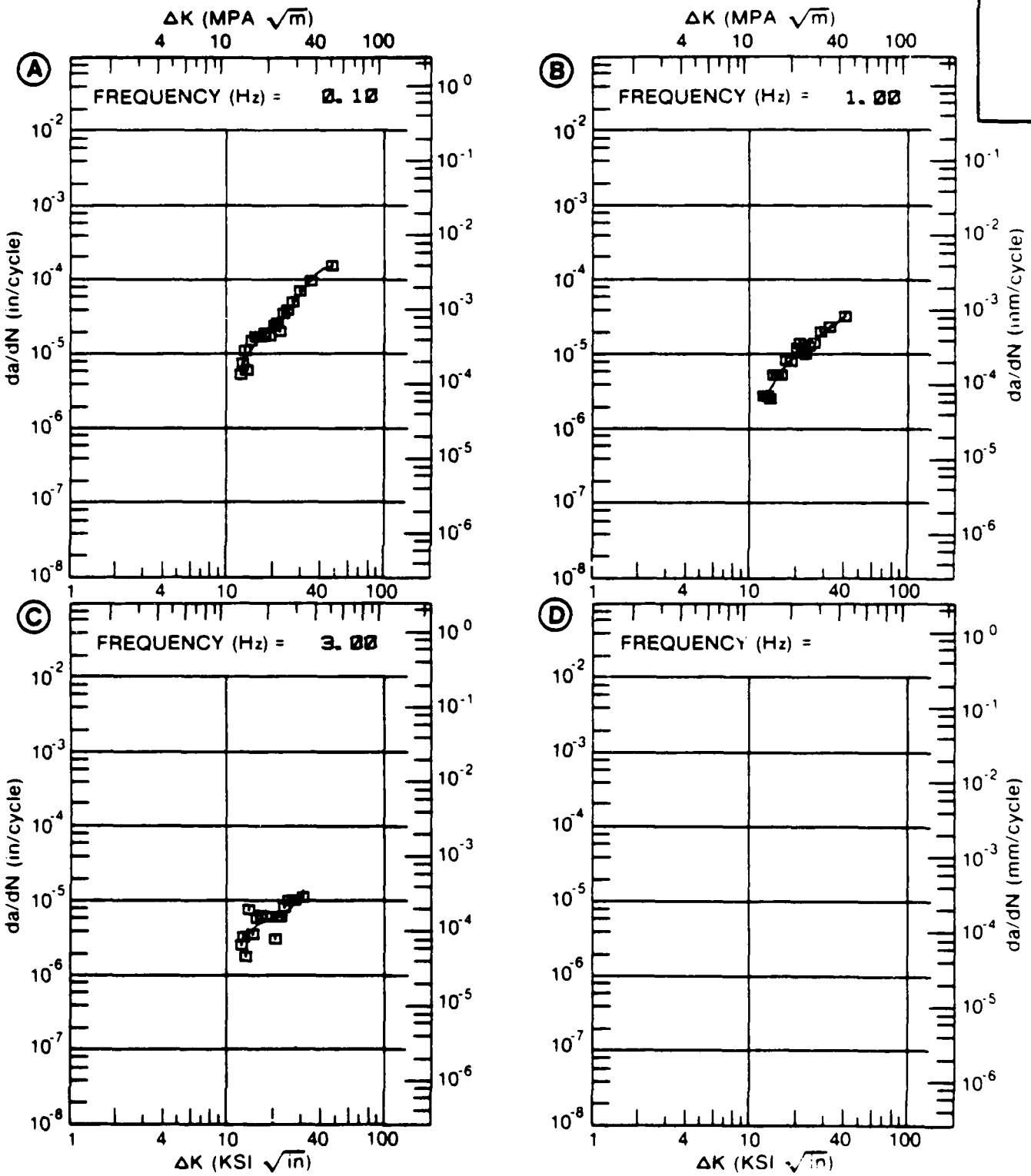



Figure 6.4.3.18

TABLE 6.4.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.19 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. DIST H2O | | | |
| DELTA K MIN | A: | 10.29 | 2.39 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 4.44 | | | |
| | | 16.00 | 7.10 | | | |
| | | 20.00 | 11.4 | | | |
| | | 25.00 | 19.0 | | | |
| | | 30.00 | 30.5 | | | |
| | | 35.00 | 48.8 | | | |
| DELTA K MAX | A: | 37.89 | 64.3 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 19.29

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.48
FREQUENCY: 1.00 HZ
YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.750"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

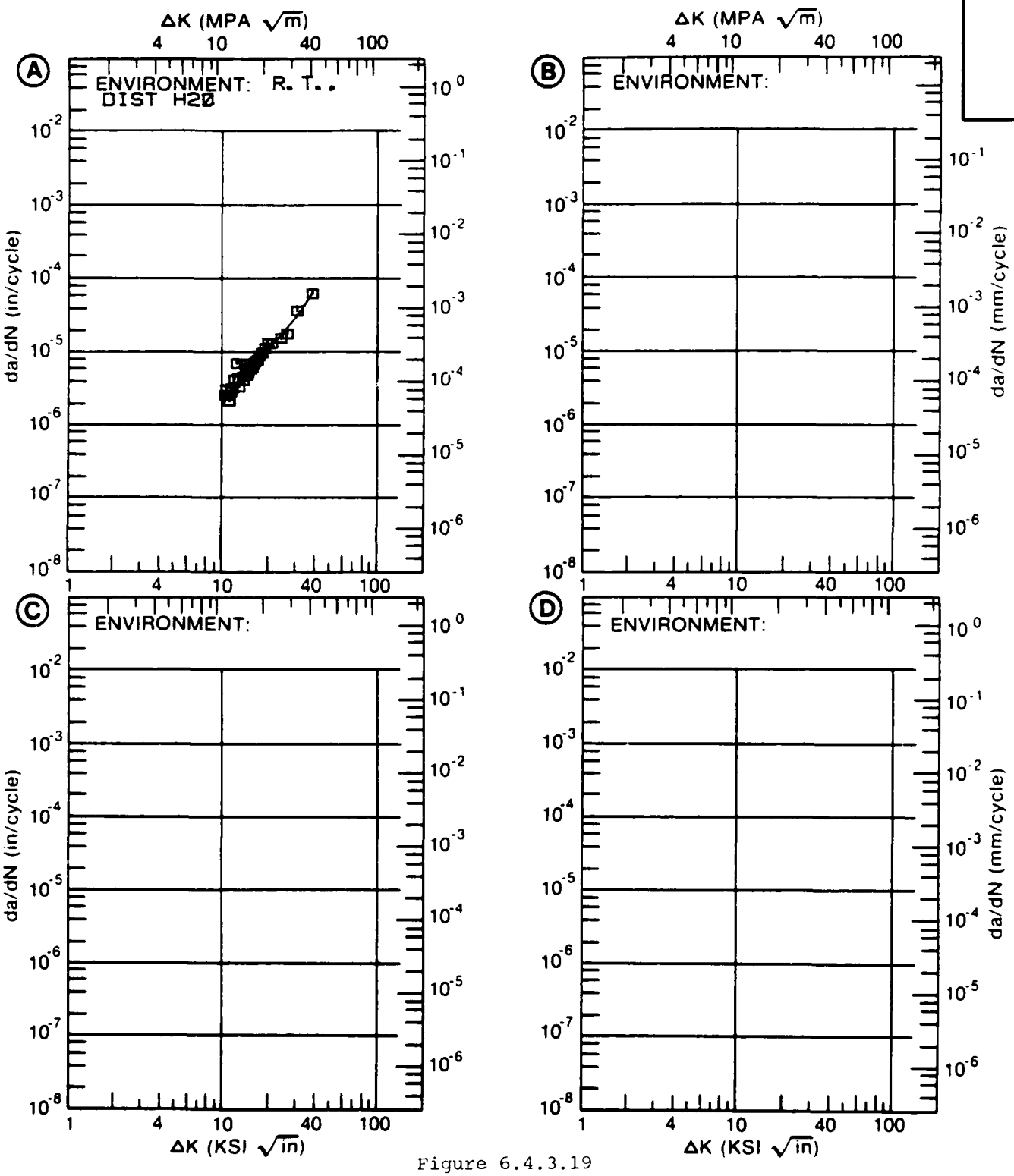



Figure 6.4.3.19

TABLE 6.4.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.20 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R.T. ,DIST H2O

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | 11.33 | 3.18 | | | |
| | B: | 13.93 | | 3.08 | | |
| | C: | 18.38 | | | 6.58 | |
| | D: | | | | | |
| | | 13.00 | 4.80 | | | |
| | | 16.00 | 8.65 | 5.20 | | |
| | | 20.00 | 15.7 | 9.51 | 6.47 | |
| | | 25.00 | 27.8 | 14.3 | 10.6 | |
| | | 30.00 | 43.7 | 18.7 | 15.0 | |
| | | 35.00 | 63.7 | 23.5 | 16.7 | |
| | | 40.00 | 88.2 | 29.7 | | |
| DELTA K MAX | A: | 48.33 | 140. | | | |
| | B: | 41.12 | | 31.4 | | |
| | C: | 38.83 | | | 20.9 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 13.57 | 11.95 | 13.92 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 2 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT 1700F A-BQ ' ' 975F. OQ AT 140F. 1000F 2+2HR
FORM: 0.80"TH FORGING
SPECIMEN TYPE CT
ORIENTATION L-T
STRESS RATIO +0.10
ENVIRONMENT R.T., DIST H20

YIELD STRENGTH 220.0 KSI
ULT STRENGTH 238.0 KSI
SPECIMEN THK 0.750- 0.753"
SPECIMEN WIDTH: 5.000"
REFERENCES 82543

ALLOY STEEL

D6AC

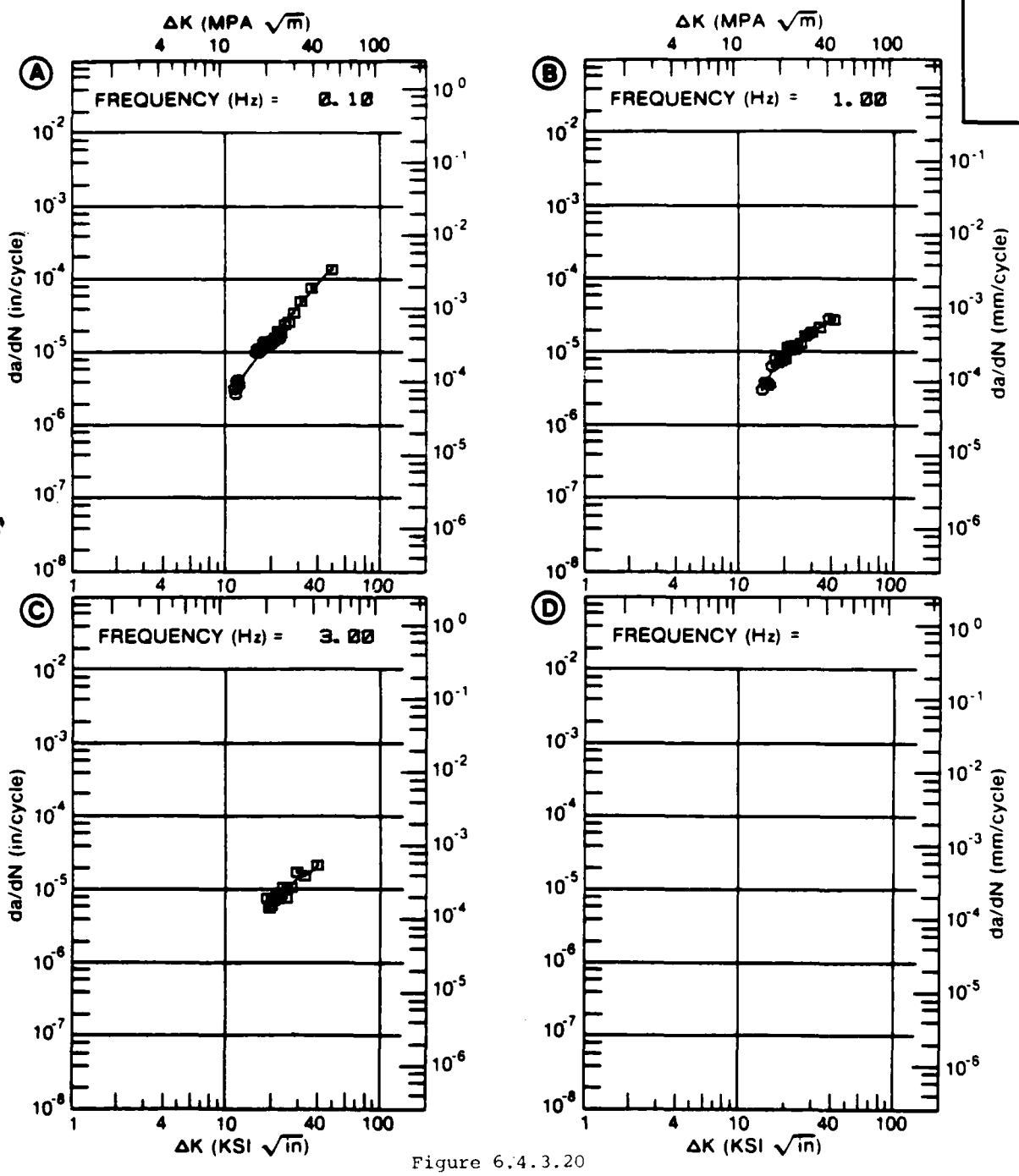



Figure 6.4.3.20

TABLE 6.4.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.21 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
2+2HR
ENVIRONMENT: R.T. , JP-4 FUEL

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 3.00 | |
| DELTA K MIN | A: | 11.55 | 1.25 | | | |
| | B: | 18.43 | | 7.19 | | |
| | C: | 18.87 | | | 3.10 | |
| | D: | | | | | |
| | | 13.00 | 2.52 | | | |
| | | 16.00 | 6.78 | | | |
| | | 20.00 | 14.8 | 8.37 | 3.73 | |
| | | 25.00 | 26.1 | 12.0 | 7.32 | |
| | | 30.00 | 37.2 | 15.7 | 12.1 | |
| | | 35.00 | 48.2 | 19.8 | 17.9 | |
| | | 40.00 | 59.7 | 24.5 | 24.5 | |
| | | 50.00 | 87.6 | 37.4 | 38.7 | |
| | | 60.00 | | | 53.0 | |
| | | 70.00 | | | 66.0 | |
| DELTA K MAX | A: | 58.94 | 123. | | | |
| | B: | 52.16 | | 41.1 | | |
| | C: | 72.93 | | | 69.5 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 17.83 | 6.86 | 17.19 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., JP-4 FUEL

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.750- 0.753"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY STEEL

D6AC

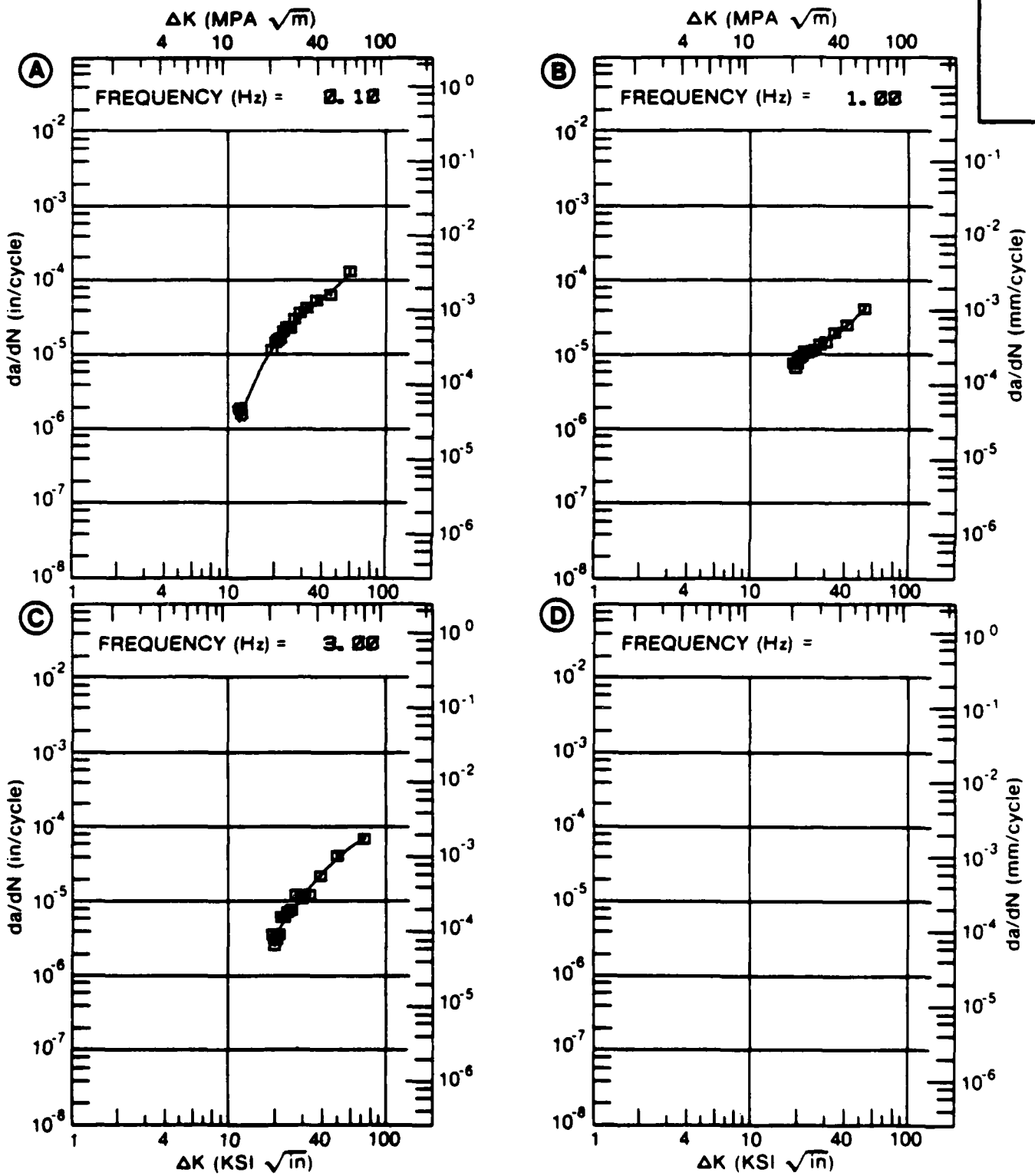



Figure 6.4.3.21

TABLE 6.4.3.22

ALLOY STEEL D6AC K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F AQ 650F 4HR | S | 0.16 | R.T. | L-T | 241.5 | DIST. WATER | 0.750 | 0.165 | CANT* | 0.100 | 61.70 | 7.00 | | | > 4000 | 1965 | 63061 |
| 1550F AQ 950F 4HR | S | 0.16 | R.T. | L-T | 217.3 | DIST. WATER | 0.750 | 0.165 | CANT* | 0.100 | 95.70 | 45.20 | | | > 10000 | 1965 | 63061 |
| 1550F 25MIN OQ 850F 1+1 HR | S | 0.08 | R.T. | L-T | 224.7 | DIST. WATER | 2.000 | 0.050 | CNT | ---- | ------ | 33.00* | | | > 5000 | 1968 | 72283 |
| 1550F 25MIN OQ 850F 1+1 HR | S | 0.08 | R.T. | L-T | 224.7 | 3N NACL | 2.000 | 0.050 | CNT | ---- | ------ | 33.00* | | | > 5000 | 1968 | 72283 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.5.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL HP 9-4-.20 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 1-2HR AC 1525F 1-2HR OQ,-100F 2HR, 1025F 4-6HR | 121.5 ±29.0 (2) | ----- | ----- |
| 1650F, 1-2HR, AC 1-2HR, AC, -100F 1.5HR, 1025F 4 HR, 1060F 6HR | 123.5 ±12.0 (2) | ----- | ----- |
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| ---- | 150.6 ± 4.5 (2) | 136.3 ±16.8 (2) | ----- |
| ANNEALED | 120.6 ± 7.3 (12) | 117.7 ± 1.9 (3) | ----- |
| HEAT TREATED | 140.7 ± 4.5 (10) | 132.3 ± 6.6 (7) | ----- |
| 1525F OQ,-100F 1HR, 1065F 4+4HR | ----- | 111.7 ± 2.0 (2) | ----- |
| 1650F 1-2 HR AC, 1525F 1-2 HR OQ,-100F 2HR, 1050F 4-6HR | 133.2 ± 3.9 (5) | ----- | ----- |
| 1650F 1-2HR AC, 1525F 1-2 HR AC, -100F 1-2HR, 1025F 4HR | 134.8 ±12.3 (5) | 109.7 ± 4.7 (3) | ----- |
| 1650F 1-2HR AC 1525F 1-2HR OQ,-100F 2HR, 1025F 4-6HR | 142.8 ±10.7 (6) | ----- | ----- |

TABLE 6.5.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HP 9-4-.20 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | FORGING | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 1-2HR AC 1525F 1-2HR OQ, -100F 2HR, 1025F 4-6HR | 129.1 ± 9.7 (8) | 125.3 ± 1.8 (6) | ----- |
| 1650F 2HR AC, 1525F 2HR OQ, 1000F 2+2HR AC | 94.4 ± 4.4 (3) | ----- | ----- |
| 1650F, 1-2HR, AC 1.5HR OQ, 1025F 12HR | 125.5 ± 3.5 (2) | ----- | ----- |
| 1650F, 4.5HR, AC TO 900F, HELD 0.5HR, AC, -100F 1.5HR, 1025F 8 HR, A-BQ | 128.5 ± 0.7 (2) | ----- | ----- |
| 1700F 4.5HR, AC 1700F 1.5HR, AC -100F 1.5HR, 1025F 4HRS | 140.5 ± 0.7 (2) | ----- | ----- |

TABLE 6.5.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: L. H. A. AT R. T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| WELDED | WELDMENT | 0.08 | 1.00 | | | | | 0.42 | 22.2 | |
| WELDED | WELDMENT | 0.30 | 6.00 | | | | | 1.02 | 30.4 | |
| WELDED | WELDMENT | 0.50 | 6.00 | | | | | 5.25 | 54.6 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | PLATE | 0.08 | ---- | | | | 0.85 | 5.61 | 31.0 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | PLATE | 0.08 | 6.00 | | | | | 3.99 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.05 | 1.00 | | | | | 6.90 | 32.1 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 0.10 | | | | | 4.58 | 34.3 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 1.00 | | | | | 4.96 | 40.9 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 6.00 | | | | | 4.23 | | |

TABLE 6.5.1.2 (Con't)

FATIQUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 20

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT L H A AT R. T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIQUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 6.00 | | | | 0.68 | 4.88 | 30.6 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 6.00 | | | | 0.57 | 5.85 | 37.4 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 6.00 | | | | | 4.57 | 37.6 | 253 |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 9.00 | | | 0.13 | 0.77 | 5.77 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.30 | 6.00 | | | | 0.77 | 6.11 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.50 | 6.00 | | | | 0.81 | | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.70 | 6.00 | | | | 1.44 | 7.78 | | |

TABLE 6.5.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: 100% HUM AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | PLATE | 0.08 | 7.00 | | | | .932 | 6.26 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 0.10 | | | | | 6.63 | 38.5 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 1.00 | | | | 0.62 | 7.39 | 40.6 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 1.00 | | | | | 9.77 | 46.4 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.30 | 1.00 | | | | 0.95 | 7.69 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.50 | 1.00 | | | | 1.52 | 8.31 | | |

TABLE 6.5.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 20

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: S.T.W AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2 5 | 5 | 10 | 20 | 50 | 100 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | PLATE | 0.08 | 1.00 | | | | 6.94 | | | |
| 1525F 2HRS OQ, 100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 1 00 | | | 0 74 | 5.26 | | | |

TABLE 6.5.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT: L.H.A AT - 65 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | PLATE | 0.08 | 1.00 | | | | | 2.43 | 29.7 | |
| 1525F 2HRS OQ, -100F 2LHRS, 1025F 4HRS | PLATE | 0.08 | 1.00 | | | | 620 | 4.14 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 1.00 | | | | | 3.33 | 27.8 | |

TABLE 6.5.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT L H A AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 2HRS AC, -100F 2HRS, 1025F 4HRS | BILLET | 0.08 | 6.00 | | | | | 4.85 | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | PLATE | 0.08 | 1.00 | | | | | 5.05 | 29.9 | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | BILLET | 0.05 | 1.00 | | | | | | 29.7 | |

TABLE 6.5.2.1

ALLOY STEEL HP 9-4-.20 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | F | 1.25 | R.T. | L-T | 196.5 | 3.995 | 2.000 | CT | 2.065 | 1.53 | 153.80 | | | 1977 | MA005 |
| | | 1.25 | | | 196.5 | 4.002 | 2.000 | CT | 2.118 | 1.40 | 147.39 | 150.6/ | 4.5 | 1977 | MA005 |
| ---------- | F | 1.25 | R.T. | T-L | 198.0 | 4.000 | 1.998 | CT | 2.068 | 1.39 | 148.10 | | | 1977 | MA005 |
| | | 1.25 | | | 198.0 | 3.997 | 2.000 | CT | 2.070 | 0.98 | 124.40 | 136.3/ | 16.8 | 1977 | MA005 |
| ANNEALED | F | 3.00 | R.T. | L-T | 189.0 | 3.000 | 1.504 | CT | 1.529 | 0.93 | 115.40 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 4.005 | 2.001 | CT | 2.049 | 1.00 | 120.00 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 4.009 | 1.504 | CT | 2.038 | 1.15 | 128.39 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 4.005 | 2.001 | CT | 2.068 | 0.96 | 117.69 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 4.000 | 1.505 | CT | 2.033 | 0.99 | 119.19 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 2.003 | 0.997 | CT | 1.041 | 0.80 | 107.30 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 3.000 | 0.998 | CT | 1.522 | 0.94 | 116.10 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 2.000 | 0.998 | CT | 1.037 | 0.94 | 116.00 | | | 1977 | NC001 |
| | | 3.00 | | | 189.0 | 3.001 | 1.503 | CT | 1.531 | 0.97 | 118.30 | | | 1977 | NC001 |
| | | 3.00 | | | 192.0 | 3.995 | 2.000 | CT | 2.033 | 1.19 | 132.50 | | | 1976 | NC001 |
| | | 3.00 | | | 192.0 | 3.992 | 2.000 | CT | 2.059 | 1.09 | 127.30 | | | 1976 | NC001 |
| | | 3.00 | | | 192.0 | 3.996 | 1.999 | CT | 2.013 | 1.13 | 129.30 | 120.6/ | 7.3 | 1976 | NC001 |
| ANNEALED | F | 3.00 | R.T. | T-L | 190.0 | 3.995 | 2.000 | CT | 2.080 | 0.98 | 119.30 | | | 1976 | NC001 |
| | | 3.00 | | | 190.0 | 3.998 | 2.000 | CT | 2.012 | 0.96 | 118.30 | | | 1976 | NC001 |
| | | 3.00 | | | 190.0 | 3.998 | 2.000 | CT | 2.028 | 0.92 | 115.60 | 117.7/ | 1.9 | 1976 | NC001 |
| HEAT TREATED | F | 3.40 | R.T. | L-T | 185.0 | 4.003 | 1.501 | CT | 1.954 | 1.33 | 135.00 | | | 1973 | 85879 |
| | | 4.00 | | | 189.0 | 4.000 | 1.503 | CT | 2.037 | 1.48 | 145.00 | | | 1973 | 85633 |
| | | 4.00 | | | 190.0 | 3.980 | 1.505 | CT | 2.039 | 1.35 | 139.00 | | | 1973 | 85633 |
| | | 4.00 | | | 190.0 | 3.971 | 1.506 | CT | 2.049 | 1.35 | 139.00 | | | 1973 | 85633 |
| | | 4.00 | | | 190.0 | 3.999 | 1.504 | CT | 2.030 | 1.45 | 145.00 | | | 1973 | 85633 |
| | | 4.00 | | | 190.0 | 3.995 | 1.504 | CT | 2.036 | 1.34 | 139.00 | | | 1973 | 85633 |
| | | 4.00 | | | 191.0 | 4.000 | 1.504 | CT | 2.026 | 1.30 | 138.00 | | | 1973 | 85633 |
| | | 4.00 | | | 192.0 | 4.002 | 1.504 | CT | 2.034 | 1.33 | 139.00 | | | 1973 | 85633 |
| | | 4.00 | | | 192.0 | 4.004 | 1.503 | CT | 2.031 | 1.30 | 138.00 | | | 1973 | 85633 |
| | | 7.00 | | | 198.0 | 3.990 | 1.511 | CT | 2.053 | 1.46 | 150.00 | 140.7/ | 4.5 | 1973 | 85857 |
| HEAT TREATED | F | 6.60 | R.T. | T-L | 186.0 | 3.984 | 1.499 | CT | 2.026 | 1.46 | 142.00 | | | 1973 | 85857 |

TABLE 6.5.2.1 (Con't)

ALLOY STEEL HP 9-4- 20 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEAT TREATED | F | 3.40 | R.T. | T-L | 187.0 | 4.000 | 1.501 | CT | 1.985 | 1.22 | 131.00 | | | 1973 | 85879 |
| | | 3.40 | | | 187.0 | 4.004 | 1.502 | CT | 2.011 | 1.22 | 131.00 | | | 1973 | 85879 |
| | | 3.40 | | | 190.0 | 4.005 | 1.499 | CT | 2.021 | 1.36 | 140.00 | | | 1973 | 85879 |
| | | 3.40 | | | 196.0 | 4.002 | 1.484 | CT | 2.054 | 1.12 | 131.00 | | | 1973 | 85857 |
| | | 7.00 | | | 198.0 | 3.989 | 1.464 | CT | 2.033 | 0.97 | 123.00 | | | 1973 | 85857 |
| | | 7.00 | | | 198.0 | 3.986 | 1.507 | CT | 2.038 | 1.07 | 128.00 | 132.3/ | 6.6 | 1973 | 85857 |
| 1525F 00,-100F | F | 4.00 | R.T. | T-L | 179.0 | 3.996 | 1.497 | CT | 2.003 | 0.95 | 110.30 | | | 1974 | 90012 |
| 1HR,1065F | | 4.00 | | | 179.0 | 3.995 | 1.498 | CT | 2.030 | 1.00 | 113.10 | | | 1974 | 90012 |
| 4+4HR | | | | | | | | | | | | 111.7/ | 2.0 | | |
| 1650F 1-2 HR | F | 3.25 | R.T. | L-T | 184.0 | 5.248 | 1.506 | CT | 2.543 | 1.42 | 139.00 | | | 1973 | 86428 |
| AC,1525F 1-2 | | 3.00 | | | 186.0 | 4.495 | 1.505 | CT | 2.277 | 1.26 | 132.00 | | | 1973 | 86428 |
| HR 00,-100F | | 3.25 | | | 189.0 | 4.499 | 1.502 | CT | 2.275 | 1.17 | 129.00 | | | 1973 | 86428 |
| 2HR,1050F | | 3.25 | | | 189.0 | 5.245 | 1.511 | CT | 2.563 | 2.50 | 131.00 | | | 1973 | 86428 |
| 4-6HR | | 3.25 | | | 190.0 | 4.500 | 1.501 | CT | 2.287 | 1.26 | 135.00 | 133.2/ | 3.9 | 1973 | 86428 |
| 1650F 1-2HR | F | 3.70 | - 65 | L-T | 190.0 | 6.000 | 2.000 | CT | ---- | 1.84 | 163.00 | | | 1974 | 90011 |
| AC,1525F 1-2 HR AC,-100F 1-2HR,1025F 4HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR | F | 4.00 | R.T. | L-T | 190.0 | 5.997 | 1.752 | CT | 3.044 | 1.02 | 121.00 | | | 1973 | 85836 |
| AC,1525F 1-2 | | 4.00 | | | 190.0 | 5.999 | 1.756 | CT | 3.054 | 1.04 | 122.00 | | | 1973 | 85836 |
| HR AC,-100F | | 7.00 | | | 190.0 | 5.999 | 1.995 | CT | 2.987 | 1.50 | 147.00 | | | 1973 | 85836 |
| 1-2HR,1025F | | 7.00 | | | 190.0 | 6.002 | 1.991 | CT | 2.979 | 1.42 | 143.00 | | | 1973 | 85836 |
| 4HR | | 7.00 | | | 190.0 | 6.000 | 1.997 | CT | 2.981 | 1.37 | 141.00 | 134.8/ | 12.3 | 1973 | 85836 |
| 1650F 1-2HR | F | 3.70 | - 65 | T-L | 190.0 | 6.000 | 2.000 | CT | ---- | 1.21 | 132.00 | | | 1974 | 90011 |
| AC,1525F 1-2 HR AC,-100F 1-2HR,1025F 4HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR | F | 4.00 | R.T. | T-L | 190.0 | 6.000 | 1.757 | CT | 3.077 | 0.80 | 108.00 | | | 1973 | 85836 |
| AC,1525F 1-2 | | 4.00 | | | 190.0 | 5.999 | 1.755 | CT | 3.071 | 0.78 | 106.00 | | | 1973 | 85836 |
| HR AC,-100F | | 7.00 | | | 190.0 | 6.005 | 1.992 | CT | 3.006 | 0.92 | 115.00 | | | 1973 | 85836 |
| 1-2HR,1025F 4HR | | | | | | | | | | | | 109.7/ | 4.7 | | |

TABLE 6.5.2.1 (Con't)

ALLOY STEEL HP 9-4-.20 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1-2HR AC | P | 2.50 | - 65 | L-T | 195.0 | 6.000 | 2.000 | CT | ---- | 0.75 | 107.00 | | | 1974 | 90011 |
| 1525F 1-2HR | | 2.50 | | | 195.0 | 6.000 | 2.000 | CT | ---- | 0.72 | 105.00 | | | 1974 | 90011 |
| OQ.-100F 2HR, | | 2.50 | | | 195.0 | 6.000 | 2.000 | CT | ---- | 0.53 | 90.00 | | | 1974 | 90011 |
| 1025F 4-6HR | | 2.50 | | | 195.0 | 6.000 | 2.000 | CT | ---- | 0.78 | 109.00 | | | 1974 | 90011 |
| | | 2.50 | | | 195.0 | 6.000 | 2.000 | CT | ---- | 0.54 | 91.00 | 100.4/ | 9.2 | 1974 | 90011 |
| 1650F 1-2HR AC | P | 2.50 | R.T. | L-T | 189.0 | 6.000 | 2.000 | CT | ---- | 0.71 | 101.00 | | | 1974 | 90011 |
| 1525F 1-2HR | | 2.50 | | | 190.0 | 6.000 | 2.002 | CT | 2.905 | 1.53 | 142.00 | | | 1972 | 84306 |
| OQ.-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | 121.5/ | 29.0 | | |
| 1650F 1-2HR AC | P | 2.50 | - 65 | T-L | 195.0 | 6.000 | 2.000 | CT | ---- | 0.60 | 96.00 | | | 1974 | 90011 |
| 1525F 1-2HR | | 2.50 | | | 195.0 | 6.000 | 2.000 | CT | ---- | 0.71 | 104.00 | | | 1974 | 90011 |
| OQ.-100F 2HR, | | 2.50 | | | 195.0 | 6.000 | 2.000 | CT | ---- | 0.56 | 92.00 | | | 1974 | 90011 |
| 1025F 4-6HR | | | | | | | | | | | | 97.3/ | 6.1 | | |
| 1650F 1-2HR AC | F | 3.70 | - 65 | L-T | 190.0 | 5.997 | 1.507 | CT | 2.991 | 1.12 | 127.00 | | | 1973 | 85836 |
| 1525F 1-2HR OQ.-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR AC | F | 4.00 | R.T. | L-T | 186.0 | 6.000 | 2.005 | CT | 2.964 | 1.36 | 140.00 | | | 1973 | 85836 |
| 1525F 1-2HR | | 4.00 | | | 186.0 | 6.000 | 2.010 | CT | 2.986 | 1.27 | 136.00 | | | 1973 | 85836 |
| OQ.-100F 2HR, | | 4.00 | | | 186.0 | 5.998 | 2.010 | CT | 2.975 | 1.42 | 143.00 | | | 1973 | 85836 |
| 1025F 4-6HR | | 4.00 | | | 186.0 | 6.002 | 2.010 | CT | 2.985 | 1.28 | 136.00 | | | 1973 | 85836 |
| | | 4.00 | | | 186.0 | 6.005 | 2.010 | CT | 2.984 | 1.32 | 138.00 | | | 1973 | 85836 |
| | | 4.00 | | | 188.0 | 6.000 | 2.000 | CT | ---- | 1.90 | 164.00 | 142.8/ | 10.7 | 1974 | 90011 |
| 1650F 1-2HR AC | F | 3.00 | R.T. | L-T | 190.0 | 6.000 | 2.000 | CT | ---- | 1.34 | 139.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ.-100F 2HR, 1000F 4-6HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR AC | F | 4.00 | R.T. | L-T | 194.0 | 4.000 | 1.635 | CT | 1.970 | 1.39 | 142.00 | | | 1972 | 84306 |
| 1525F 1-2HR | | 4.00 | | | 194.0 | 3.994 | 1.598 | CT | 2.366 | 1.26 | 135.00 | | | 1972 | 84306 |
| OQ.-100F 2HR, | | 4.00 | | | 194.0 | 4.014 | 1.506 | CT | 1.967 | 1.33 | 141.00 | | | 1972 | 84306 |
| 1025F 4-6HR | | 4.00 | | | 198.0 | 5.000 | 2.000 | CT | ---- | 1.01 | 126.00 | | | 1974 | 90011 |
| | | 4.00 | | | 198.0 | 5.000 | 2.000 | CT | ---- | 0.96 | 123.00 | | | 1974 | 90011 |
| | | 4.00 | | | 198.0 | 5.000 | 2.000 | CT | ---- | 1.08 | 130.00 | | | 1974 | 90011 |
| | | 4.00 | | | 198.0 | 5.000 | 2.000 | CT | ---- | 0.84 | 115.00 | | | 1974 | 90011 |
| | | 4.00 | | | 198.0 | 5.000 | 2.000 | CT | ---- | 0.93 | 121.00 | 129.1/ | 9.7 | 1974 | 90011 |
| 1650F 1-2HR AC | F | 4.00 | 82 | L-T | 190.0 | 6.000 | 1.740 | CT | 2.983 | 1.01 | 121.00 | | | 1973 | 85836 |
| 1525F 1-2HR OQ.-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | | | | |

TABLE 6.5.2.1 (Con't)

ALLOY STEEL HP 9-4-.20 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1-2HR AC | F | 4.00 | 82 | L-T | 190.0 | 6.000 | 1.743 | CT | 2.971 | 1.19 | 131.00 | | | 1973 | 85836 |
| 1525F 1-2HR OQ,-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | 126.0/ | 7.1 | | |
| 1650F 1-2HR AC | F | 4.00 | R.T. | T-L | 190.0 | 6.000 | 2.011 | CT | 2.977 | 1.11 | 126.00 | | | 1973 | 85836 |
| 1525F 1-2HR | | 4.00 | | | 190.0 | 6.002 | 2.004 | CT | 2.963 | 1.11 | 127.00 | | | 1973 | 85836 |
| OQ,-100F 2HR, | | 4.00 | | | 190.0 | 6.002 | 2.010 | CT | 2.961 | 1.03 | 122.00 | | | 1973 | 85836 |
| 1025F 4-6HR | | 4.00 | | | 190.0 | 6.005 | 2.010 | CT | 2.959 | 1.11 | 126.00 | 125.3/ | 2.2 | 1973 | 85836 |
| 1650F 1-2HR AC | F | 3.00 | R.T. | T-L | 190.0 | 6.000 | 2.000 | CT | ---- | 0.72 | 102.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ,-100F 2HR, 1000F 4-6HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR AC | F | 4.00 | R.T. | T-L | 190.0 | 6.006 | 2.006 | CT | 2.970 | 1.10 | 126.00 | | | 1973 | 85836 |
| 1525F 1-2HR | | 4.00 | | | 194.0 | 4.013 | 1.506 | CT | 1.991 | 1.07 | 125.00 | | | 1972 | 84306 |
| OQ,-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | 125.5/ | 0.7 | | |
| 1650F 1-2HR AC | F | 4.00 | 82 | T-L | 185.0 | 6.001 | 1.752 | CT | 3.000 | 0.95 | 114.00 | | | 1973 | 85836 |
| 1525F 1-2HR OQ,-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR AC | F | 4.00 | R.T. | S-T | 190.0 | 3.005 | 1.630 | CT | 1.484 | 0.93 | 116.00 | | | 1973 | 85836 |
| 1525F 1-2HR | | 4.00 | | | 190.0 | 3.003 | 1.632 | CT | 1.496 | 0.89 | 114.00 | | | 1973 | 85836 |
| OQ,-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | 115.0/ | 1.4 | | |
| 1650F 1-2HR,AC | F | 4.00 | R.T. | L-T | 186.0 | 6.003 | 2.010 | CT | 2.963 | 1.32 | 138.00 | | | 1973 | 85836 |
| 1525F 1-2HR,OQ,-100F 2HR, 1025F 4-6HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR,AC | F | 1.70 | R.T. | T-L | 190.0 | 5.260 | 1.501 | CT | 2.628 | 1.43 | 143.00 | | | 1973 | 86428 |
| 1525F 1-2HR,OQ,-100F 2HR,1050F 4-6HR | | | | | | | | | | | | | | | |
| 1650F 2HR AC, | F | 4.00 | R.T. | L-T | 186.0 | 2.516 | 1.240 | CT | 1.171 | 0.63 | 92.80 | | | 1974 | 88136 |
| 1525F 2HR OQ, | | 4.00 | | | 186.0 | 2.523 | 1.244 | CT | 1.136 | 0.72 | 99.40 | | | 1974 | 88136 |
| 1000F 2+2HR AC | | 4.00 | | | 186.0 | 2.510 | 1.247 | CT | 1.146 | 0.60 | 91.10 | 94.4/ | 4.4 | 1974 | 88136 |
| 1650F,1-2HR,AC | P | 2.50 | R.T. | L-T | 189.0 | 6.000 | 2.000 | CT | ---- | 1.22 | 132.00 | | | 1974 | 90011 |
| 1-2HR,AC,-100F 1.5HR,1025F 4HR,1060F 6HR | | | | | | | | | | | | | | | |

TABLE 6.5.2.1 (Con't)

ALLOY STEEL HP 9-4-.20 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F, 1-2HR, AC | P | 2.50 | R.T. | L-T | 189.0 | 6.000 | 2.000 | CT | ---- | 0.92 | 115.00 | | | 1974 | 90011 |
| 1-2HR, AC, -100F 1.5HR, 1025F 4HR, 1060F 6HR | | | | | | | | | | | | 123.5/ | 12.0 | | |
| 1650F, 1-2HR, AC | P | 2.50 | R.T. | T-L | 186.0 | 6.000 | 2.000 | CT | ---- | 0.97 | 116.00 | | | 1974 | 90011 |
| 1-2HR, AC, -130F 1.5HR, 1025-1075F 4HR | | | | | | | | | | | | | | | |
| 1650F, 1-2HR, AC | P | 2.50 | R.T. | T-L | 189.0 | 6.000 | 2.000 | CT | ---- | 1.15 | 128.00 | | | 1974 | 90011 |
| 1-2HR, AC, -100F 1.5HR, 1025F 4HR, 1060F 6HR | | | | | | | | | | | | | | | |
| 1650F, 1-2HR, AC | F | 4.00 | R.T. | L-T | 185.0 | 6.006 | 1.585 | CT | 2.987 | 1.10 | 123.00 | | | 1973 | 85836 |
| 1.5HR OQ, 1025F | | 4.00 | | | 185.0 | 6.007 | 1.546 | CT | 2.996 | 1.19 | 128.00 | | | 1973 | 85836 |
| 12HR | | | | | | | | | | | | 125.5/ | 3.5 | | |
| 1650F, 4.5HR, AC | F | 4.00 | R.T. | L-T | 185.0 | 6.004 | 1.609 | CT | 3.020 | 1.19 | 128.00 | | | 1973 | 85836 |
| TO 900F, HELD | | 4.00 | | | 185.0 | 6.000 | 1.590 | CT | 3.031 | 1.22 | 129.00 | | | 1973 | 85836 |
| O 5HR, AC, -100F 1.5HR, 1025F 8HR, A-BQ | | | | | | | | | | | | 128.5/ | 0.7 | | |
| 1700F 4.5HR, AC | F | 4.00 | R.T. | L-T | 185.0 | 6.003 | 1.596 | CT | 3.006 | 1.45 | 141.00 | | | 1973 | 85836 |
| 1700F 1.5HR, AC | | 4.00 | | | 185.0 | 6.005 | 1.605 | CT | 3.031 | 1.43 | 140.00 | | | 1973 | 85836 |
| ,-100F 1.5HR, 1025F 4HRS | | | | | | | | | | | | 140.5/ | 0.7 | | |

TABLE 6.5.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR 10HZ | E= R.T. 3.5% NACL 1HZ | | |
| DELTA K MIN | A: | 12.17 | .846 | | | |
| | B: | 21.23 | | 5.00 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.04 | | | |
| | | 16.00 | 1.93 | | | |
| | | 20.00 | 3.58 | | | |
| | | 25.00 | 6.40 | 6.42 | | |
| | | 30.00 | 10.1 | 11.8 | | |
| | | 35.00 | 14.6 | 19.9 | | |
| | | 40.00 | 19.9 | 26.7 | | |
| | | 50.00 | 33.2 | 36.6 | | |
| | | 60.00 | 50.0 | 52.3 | | |
| | | 70.00 | | 89.4 | | |
| | | 80.00 | | 133. | | |
| DELTA K MAX | A: | 66.04 | 62.1 | | | |
| | B: | 81.85 | | 137. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.64 | 10.79 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 2.50"TH BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 185.5 KSI
ULT. STRENGTH: 201.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: 88136

ALLOY STEEL

HP9-4-.20

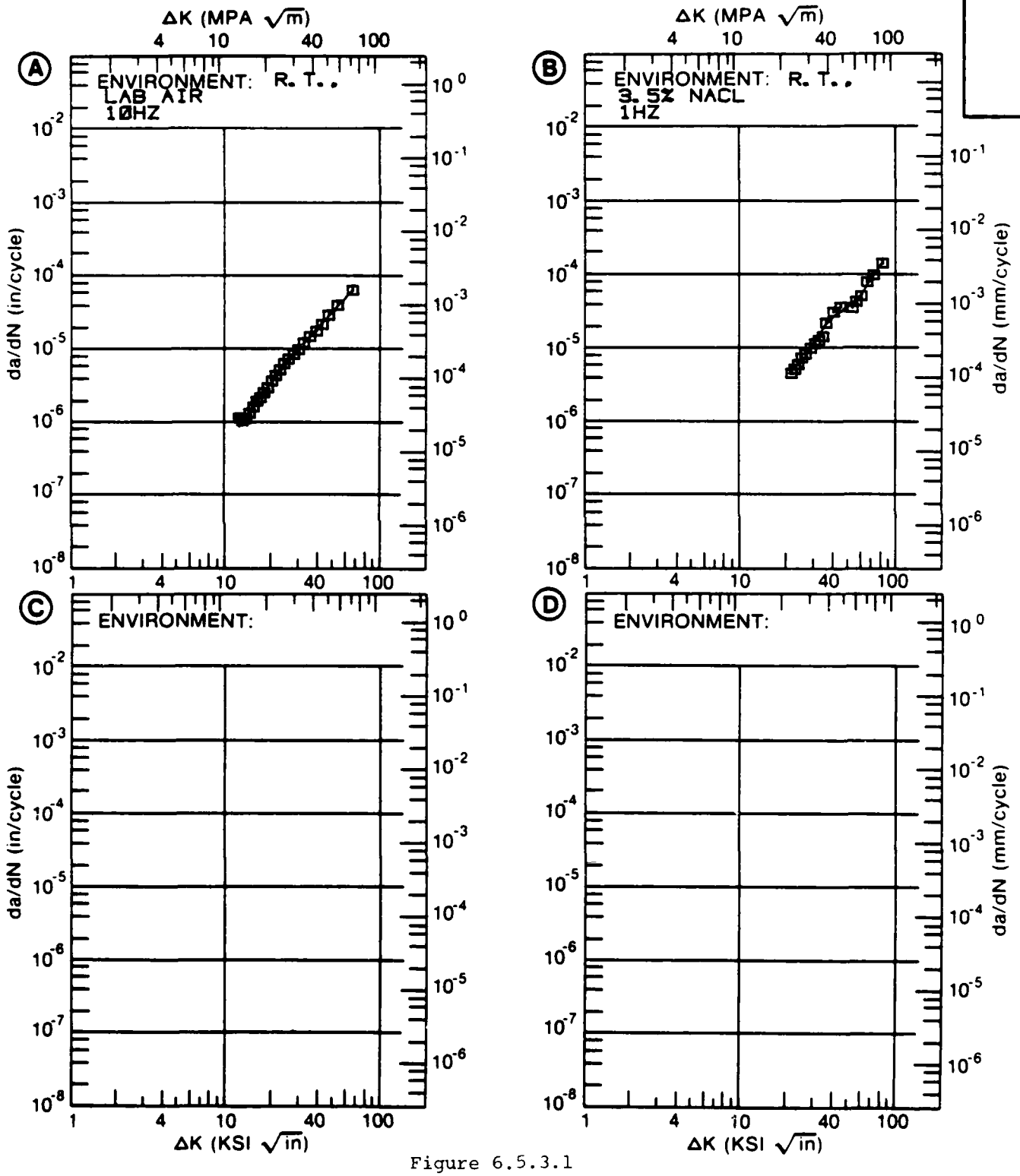



Figure 6.5.3.1

TABLE 6.5.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. LAB AIR .1-20HZ | E= R.T. SIM SEA WATER .1-15HZ | | |
| DELTA K MIN A: | 8.36 | .0938 | | | |
| DELTA K MIN B: | 21.08 | | 2.87 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 9.00 | .123 | | | |
| | 10.00 | .180 | | | |
| | 13.00 | .435 | | | |
| | 16.00 | .833 | | | |
| | 20.00 | 1.61 | | | |
| | 25.00 | 3.01 | 4.77 | | |
| | 30.00 | 4.93 | 8.01 | | |
| | 35.00 | 7.41 | 12.2 | | |
| | 40.00 | 10.5 | 17.4 | | |
| | 50.00 | 18.9 | 31.2 | | |
| | 60.00 | 30.6 | 50.0 | | |
| | 70.00 | 46.3 | 74.4 | | |
| | 80.00 | 66.8 | 105. | | |
| | 90.00 | 93.0 | 144. | | |
| | 100.00 | 126. | 191. | | |
| | 130.00 | 278. | 395. | | |
| | 160.00 | 542. | 727. | | |
| DELTA K MAX A: | 192.57 | 1026. | | | |
| DELTA K MAX B: | 192.73 | | 1299. | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 13.48 | 22.71 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 196.5 KSI
ULT. STRENGTH: 209.5 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005

ALLOY STEEL

HP9-4-.20

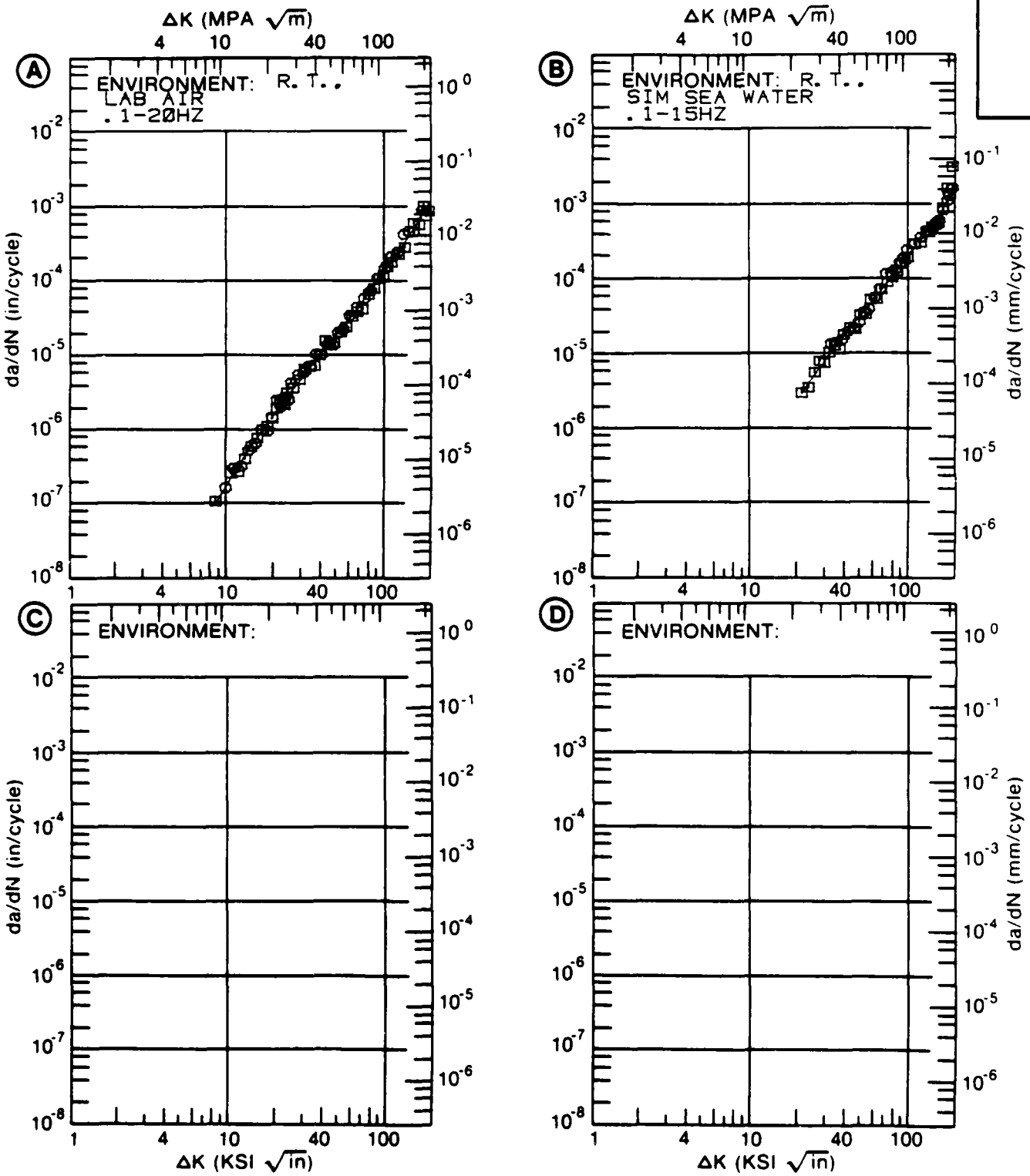



Figure 6.5.3.2

TABLE 6.5.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR .1-20HZ | E= R.T. SIM SEA WATER .1-15HZ | | |
| DELTA K MIN | A: | 8.87 | .131 | | | |
| | B: | 18.18 | | 1.57 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | .141 | | | |
| | | 10.00 | .242 | | | |
| | | 13.00 | .751 | | | |
| | | 16.00 | 1.55 | | | |
| | | 20.00 | 2.99 | 2.31 | | |
| | | 25.00 | 5.31 | 4.97 | | |
| | | 30.00 | 8.25 | 8.36 | | |
| | | 35.00 | 12.0 | 12.4 | | |
| | | 40.00 | 16.7 | 17.2 | | |
| | | 50.00 | 30.7 | 29.9 | | |
| | | 60.00 | 54.5 | 49.4 | | |
| | | 70.00 | 95.3 | 80.3 | | |
| | | 80.00 | 165. | 131. | | |
| | | 90.00 | 285. | 213. | | |
| | | 100.00 | 490. | 350. | | |
| | | 130.00 | | 1599. | | |
| DELTA K MAX | A: | 120.15 | 1437. | | | |
| | B: | 153.57 | | 5368. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 14.01 | 20.32 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: T-L
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 212.5 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005

ALLOY STEEL

HP9-4-.20

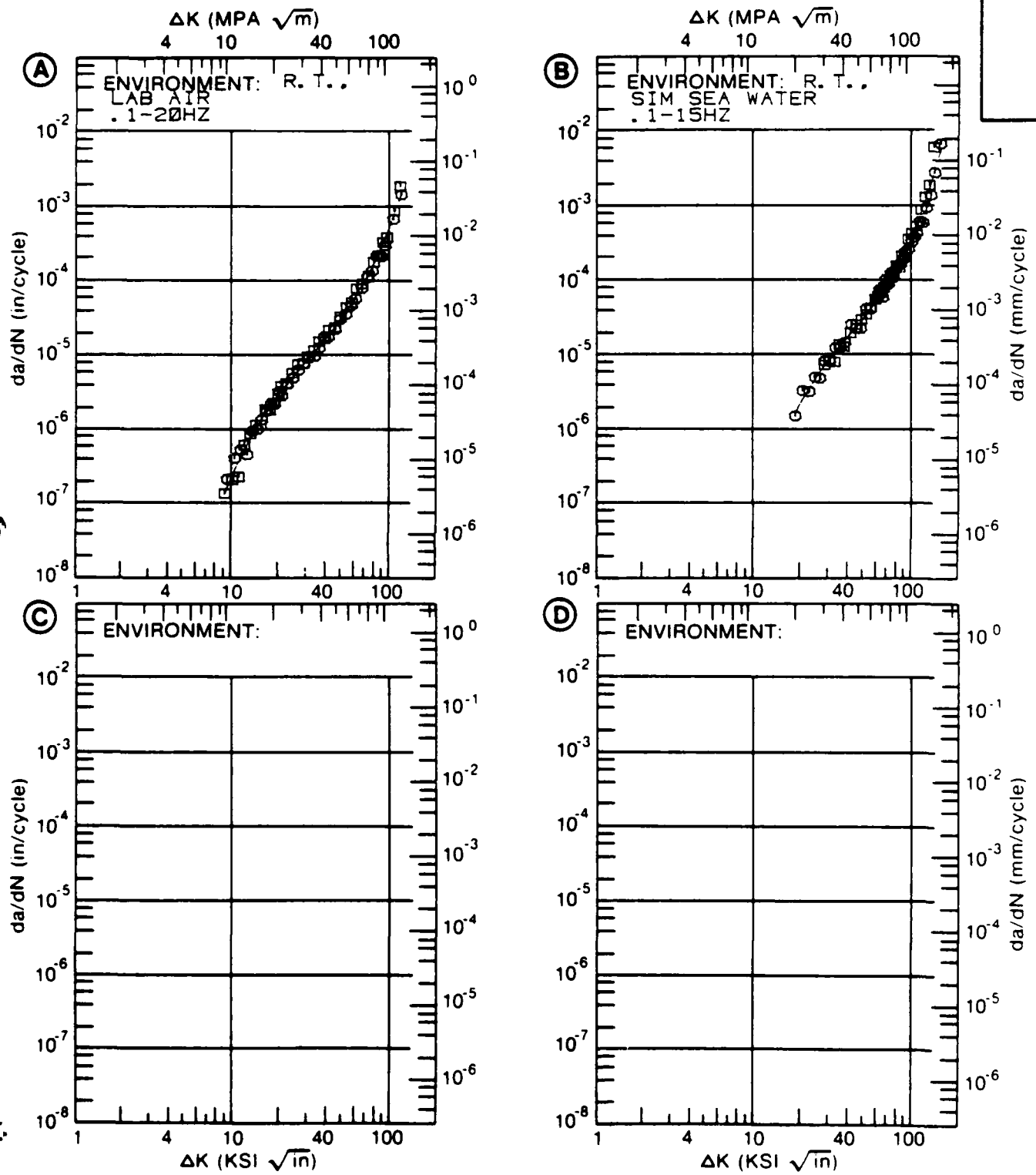



Figure 6.5.3.3

TABLE 6.5.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: WELDED
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.30 | R=+0.50 | | |
| DELTA K MIN | A: | 15.75 | .287 | | | |
| | B: | 11.48 | | .502 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | | .992 | | |
| | | 16.00 | .314 | 2.48 | | |
| | | 20.00 | 1.02 | 5.25 | | |
| | | 25.00 | 2.82 | 9.46 | | |
| | | 30.00 | 5.81 | 14.4 | | |
| | | 35.00 | 10.1 | 20.6 | | |
| | | 40.00 | 15.6 | 28.6 | | |
| | | 50.00 | 30.4 | 54.6 | | |
| | | 60.00 | 50.4 | | | |
| DELTA K MAX | A: | 62.95 | 57.3 | | | |
| | B: | 51.28 | | 59.4 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.61 | 6.65 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: WELDED
FORM: WELDMENT
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.490- 0.500"
SPECIMEN WIDTH: 6.010"
REFERENCES:88579

ALLOY STEEL

HP9-4-.20

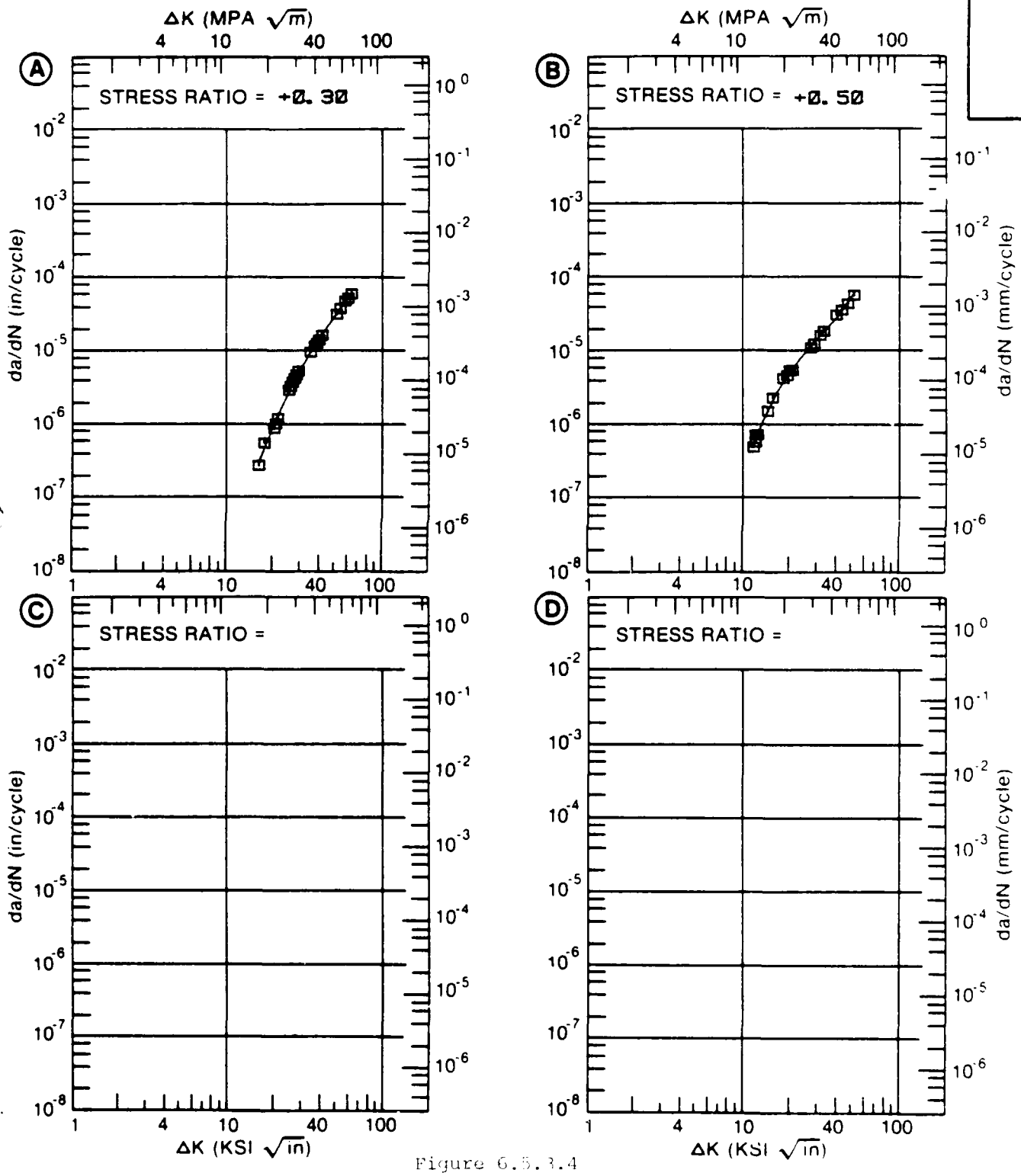



Figure 6.5.3.4

TABLE 6.5.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: WELDED
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | | | |
| DELTA K MIN | A: | 18.87 | .365 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | .422 | | | |
| | | 25.00 | 1.77 | | | |
| | | 30.00 | 4.62 | | | |
| | | 35.00 | 7.55 | | | |
| | | 40.00 | 10.9 | | | |
| | | 50.00 | 22.2 | | | |
| DELTA K MAX | A: | 54.51 | 28.3 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 7.92

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: WELDED
FORM: WELDMENT
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.510"
SPECIMEN WIDTH: 6.000"
REFERENCES 88579

ALLOY STEEL

HP9-4-.20

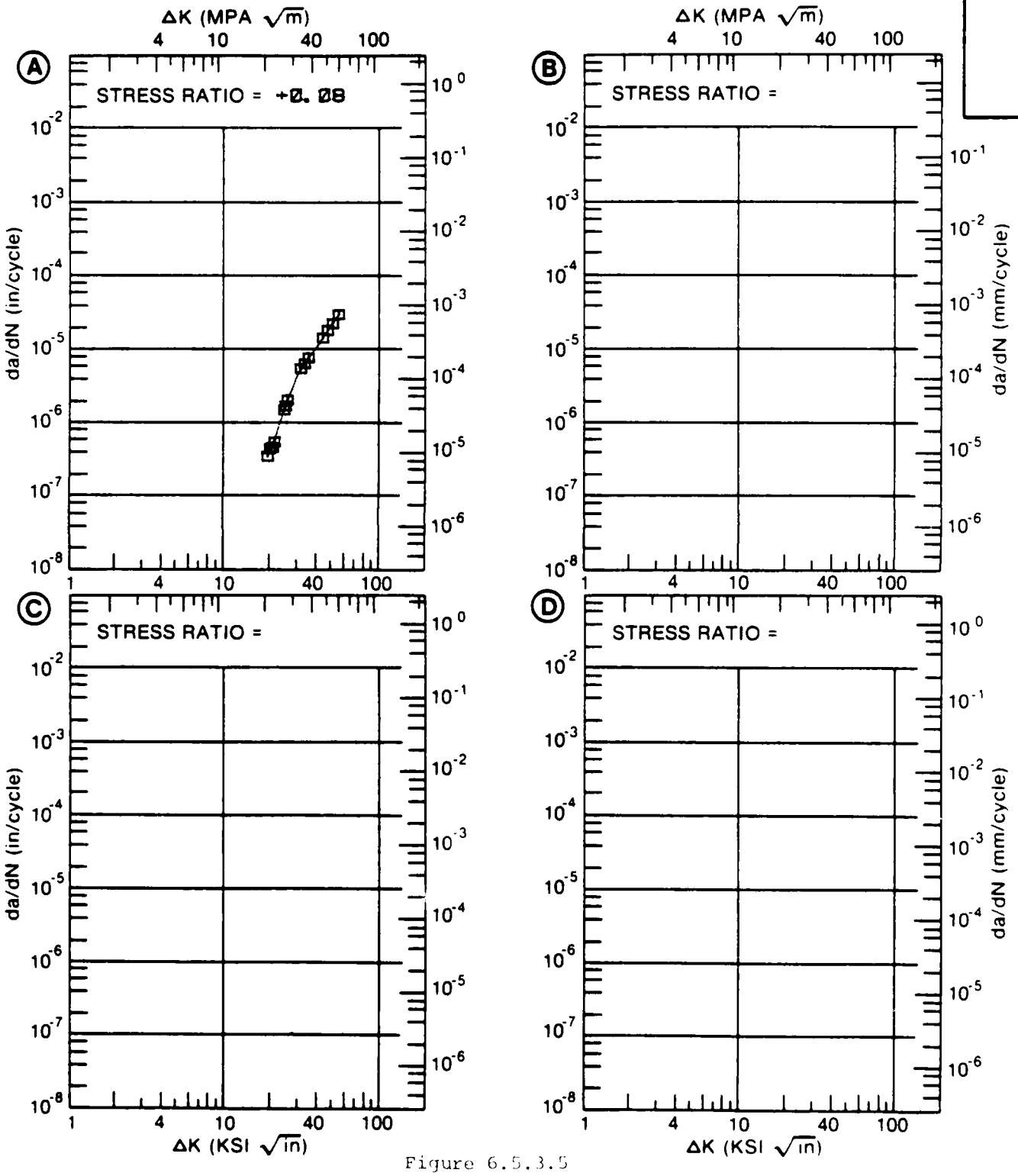



Figure 6.5.3.5

TABLE 6.5.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS AC, -100F 2HRS, 1025F 4HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A., 6HZ | E= R.T. 100% HUM, 1HZ | | |
| DELTA K MIN | A: | 12.74 | 1.41 | | | |
| | B: | 10.61 | | .809 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.48 | 1.72 | | |
| | | 16.00 | 2.49 | 3.26 | | |
| | | 20.00 | 4.23 | 5.77 | | |
| | | 25.00 | 7.09 | 9.51 | | |
| | | 30.00 | 10.8 | 14.0 | | |
| | | 35.00 | 15.3 | 19.5 | | |
| | | 40.00 | 20.8 | 26.3 | | |
| | | 50.00 | | 46.4 | | |
| DELTA K MAX | A: | 48.33 | 32.4 | | | |
| | B: | 54.53 | | 59.4 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.31 | 6.66 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS AC.-100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 176.0 KSI
ULT. STRENGTH: 201.0 KSI
SPECIMEN THK: 0.990"
SPECIMEN WIDTH: 6.000"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.20

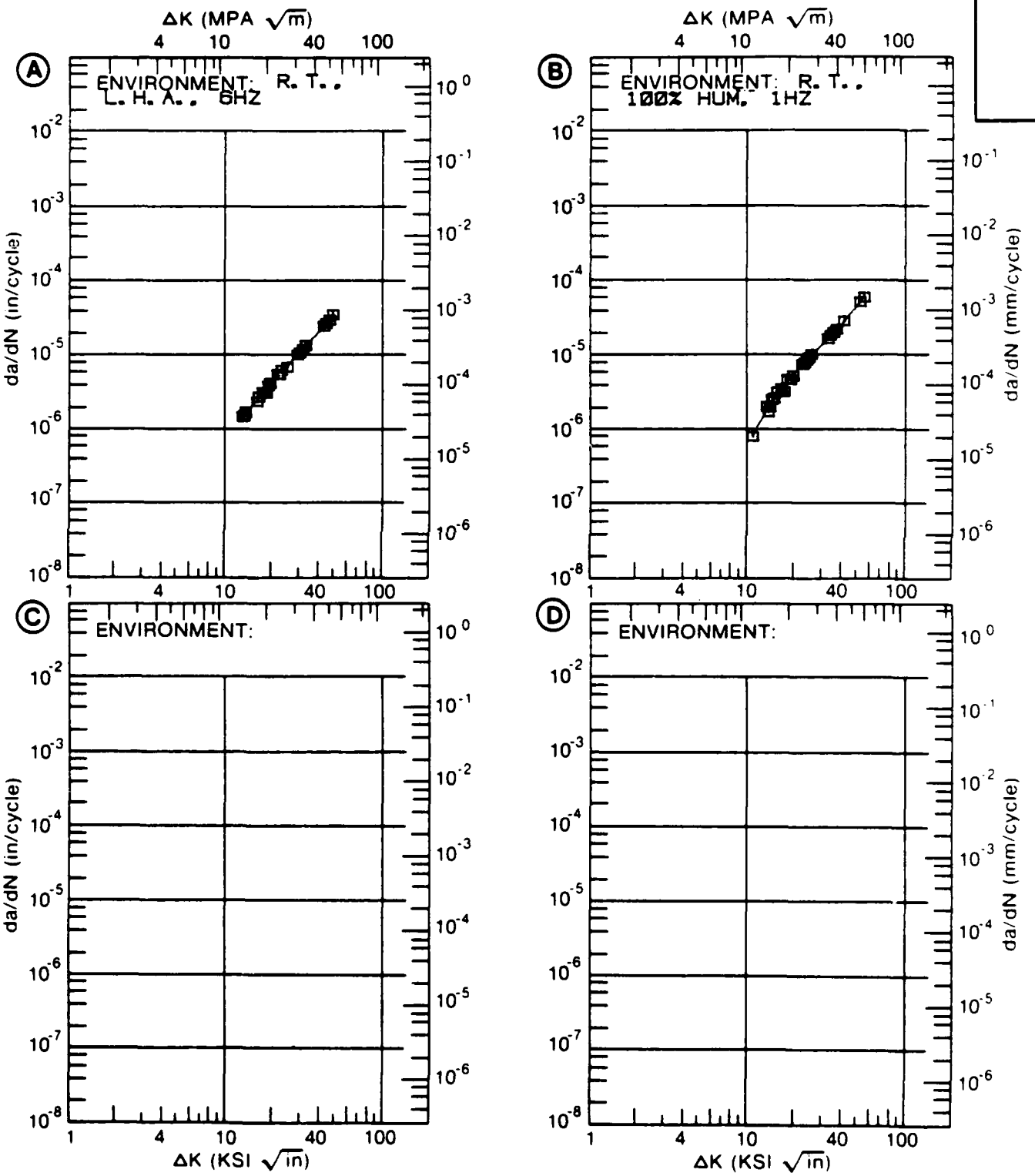



Figure 6.5.3.6

TABLE 6.5.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS AC, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | | | |
| DELTA K MIN | A: | 11.94 | 1.15 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.52 | | | |
| | | 16.00 | 2.77 | | | |
| | | 20.00 | 4.85 | | | |
| | | 25.00 | 8.01 | | | |
| | | 30.00 | 11.8 | | | |
| | | 35.00 | 16.4 | | | |
| | | 40.00 | 21.9 | | | |
| DELTA K MAX | A: | 49.98 | 36.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 3.60

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 2HRS AC. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 178.0 KSI
ULT. STRENGTH: 209.0 KSI
SPECIMEN THK: 0.990"
SPECIMEN WIDTH: 6.000"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.20

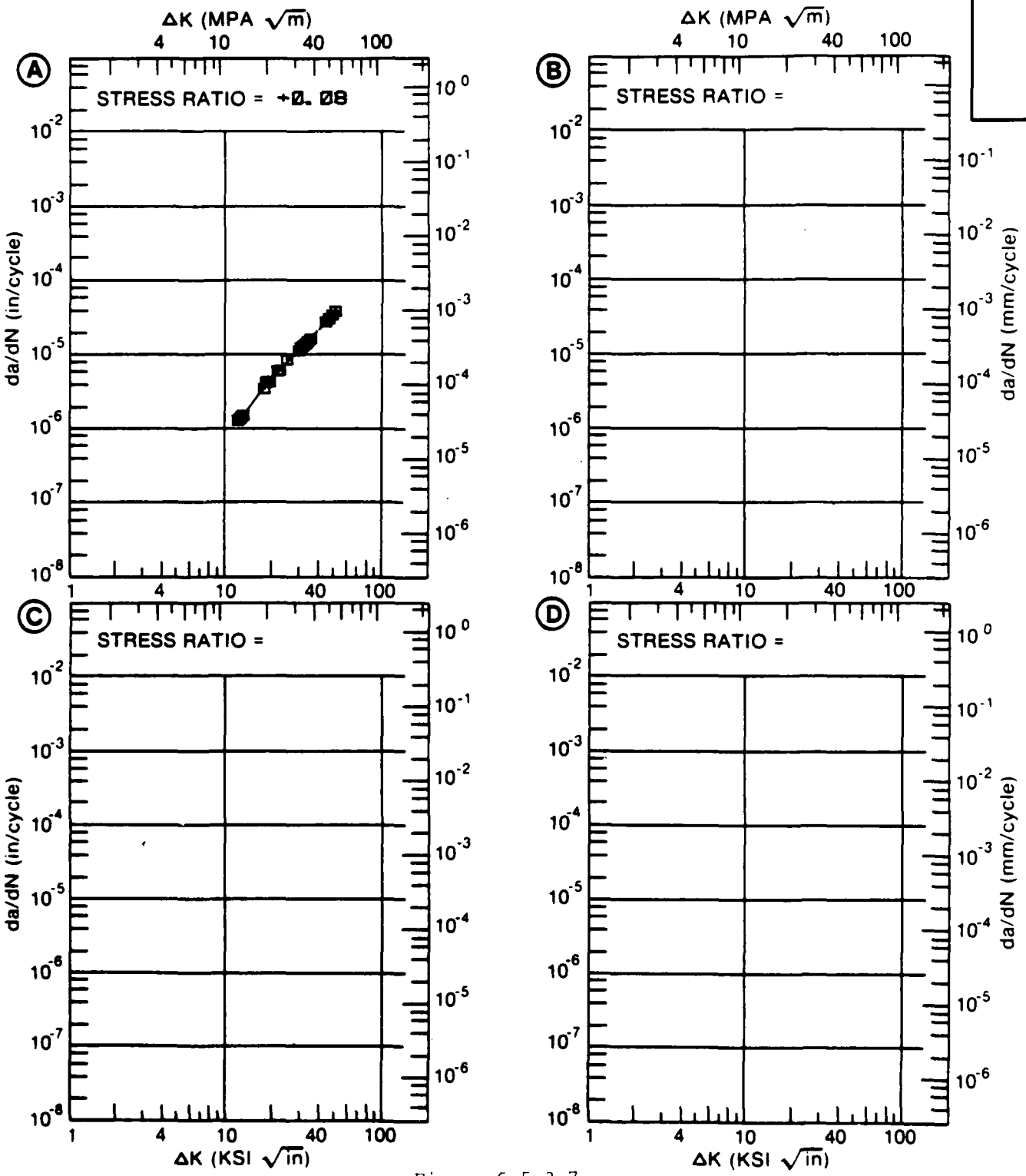



Figure 6.5.3.7

TABLE 6.5.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.8 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. , L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | | | |
| DELTA K MIN | A: | 14.91 | 1.68 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 2.18 | | | |
| | | 20.00 | 3.99 | | | |
| | | 25.00 | 6.04 | | | |
| | | 30.00 | 8.45 | | | |
| | | 35.00 | 12.2 | | | |
| | | 40.00 | 18.9 | | | |
| DELTA K MAX | A: | 46.67 | 37.7 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 8.01

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 189.0 KSI
ULT. STRENGTH: 201.0 KSI
SPECIMEN THK: 0.830"
SPECIMEN WIDTH: 5.990"
REFERENCES 88579

ALLOY STEEL

HP9-4-.20

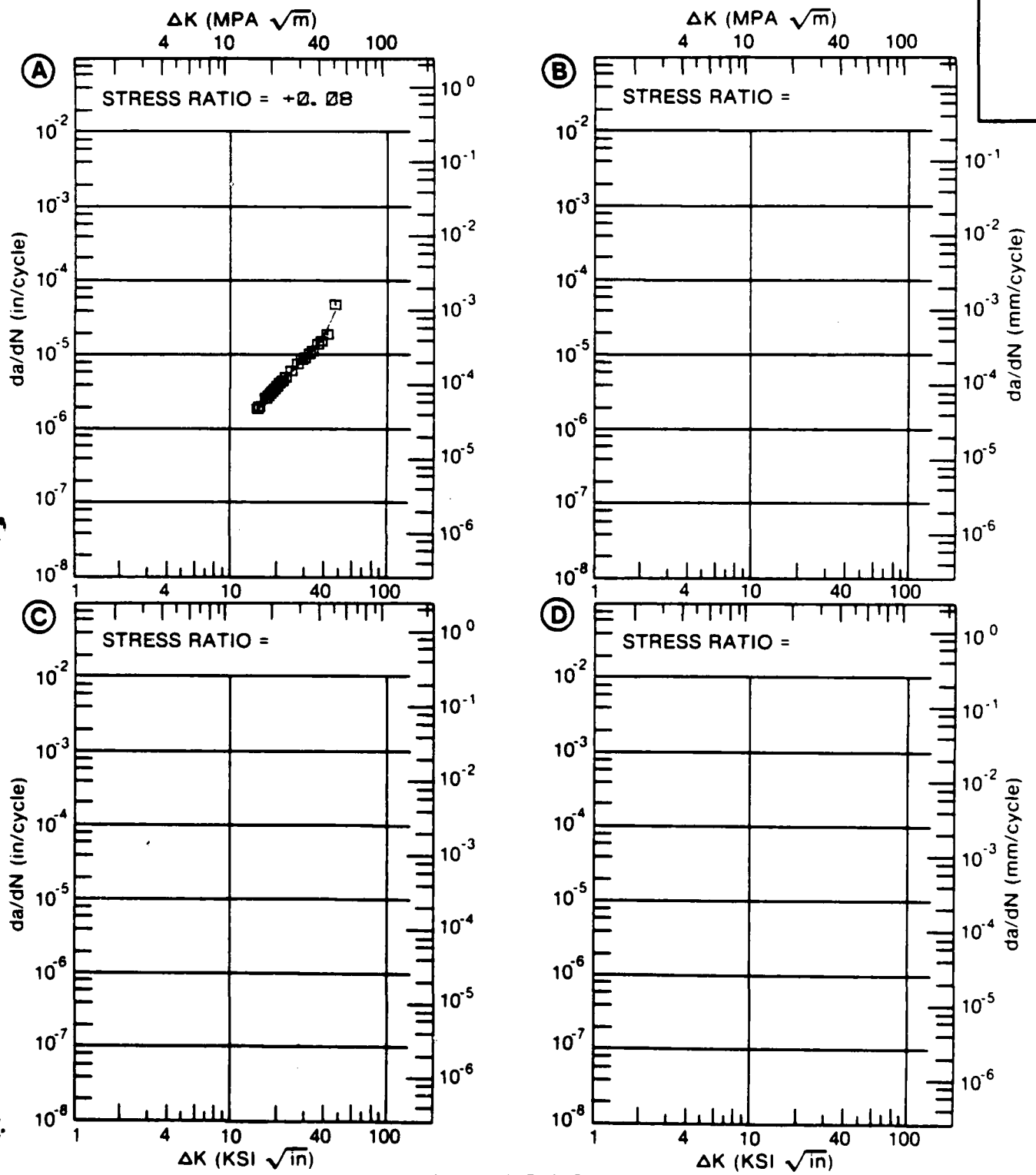



Figure 6.5.3.8

TABLE 6.5.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. 6HZ | E= R.T. DIST. H2O 0.1HZ | | |
| DELTA K MIN | A: | 8.50 | .445 | | | |
| | B: | 12.13 | | 1.92 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | .565 | | | |
| | | 10.00 | .859 | | | |
| | | 13.00 | 2.14 | 2.43 | | |
| | | 16.00 | 3.72 | 4.68 | | |
| | | 20.00 | 5.61 | 8.73 | | |
| | | 25.00 | 7.75 | 15.2 | | |
| | | 30.00 | 10.2 | 22.9 | | |
| | | 35.00 | 13.7 | 31.7 | | |
| | | 40.00 | 18.3 | 41.4 | | |
| | | 50.00 | 31.0 | 64.0 | | |
| | | 60.00 | 48.0 | 90.8 | | |
| | | 70.00 | | 122. | | |
| | | 80.00 | | 159. | | |
| | | 90.00 | | 203. | | |
| | | 100.00 | | 254. | | |
| DELTA K MAX | A: | 65.72 | 59.3 | | | |
| | B: | 106.00 | | 288. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 14.55 | 3.67 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ.-100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 188.0- 189.0 KSI
ULT. STRENGTH: 200.0- 201.0 KSI
SPECIMEN THK: 0.990- 1.000"
SPECIMEN WIDTH: 7.400- 7.410"
REFERENCES:88579

ALLOY STEEL

HP9-4-.20

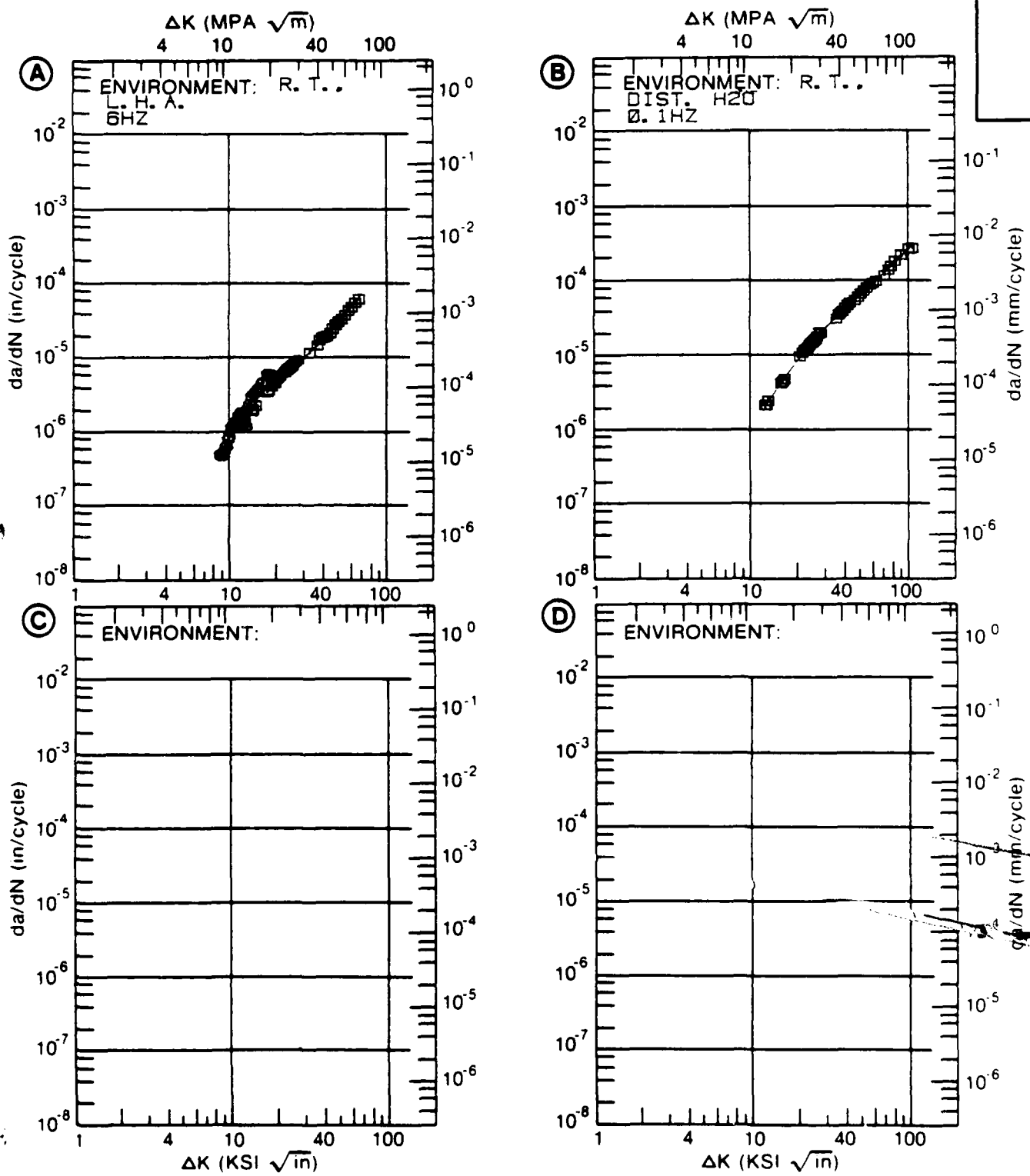



Figure 6.5.3.9

TABLE 6.5.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=- 65F L.H.A. | E= R.T. 100% HUM | E= R.T. S.T.W. | |
| DELTA K MIN | A: | 8.84 | .483 | | | |
| | B: | 8.69 | | .711 | | |
| | C: | 11.00 | | | 1.43 | |
| | D: | | | | | |
| | | 9.00 | .513 | .754 | | |
| | | 10.00 | .719 | .932 | | |
| | | 13.00 | 1.50 | 1.84 | 2.34 | |
| | | 16.00 | 2.47 | 3.37 | 4.08 | |
| | | 20.00 | 4.03 | 6.26 | 6.94 | |
| | | 25.00 | 6.45 | 10.2 | 11.1 | |
| | | 30.00 | 9.55 | | 15.4 | |
| | | 35.00 | 13.6 | | | |
| | | 40.00 | 18.8 | | | |
| | | 50.00 | 34.0 | | | |
| | | 60.00 | 54.2 | | | |
| DELTA K MAX | A: | 66.62 | 68.4 | | | |
| | B: | 26.15 | | 11.0 | | |
| | C: | 34.39 | | | 19.3 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 10.79 | 16.06 | 16.33 | |
| LIFE PREDICTION RATIO (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | [illegible] | | | | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 188.0- 191.0 KSI
ULT. STRENGTH: 200.0- 201.0 KSI
SPECIMEN THK: 0.993- 1.000"
SPECIMEN WIDTH: 7.400"
REFERENCES: 88579, 85837

ALLOY STEEL

HP9-4-.20

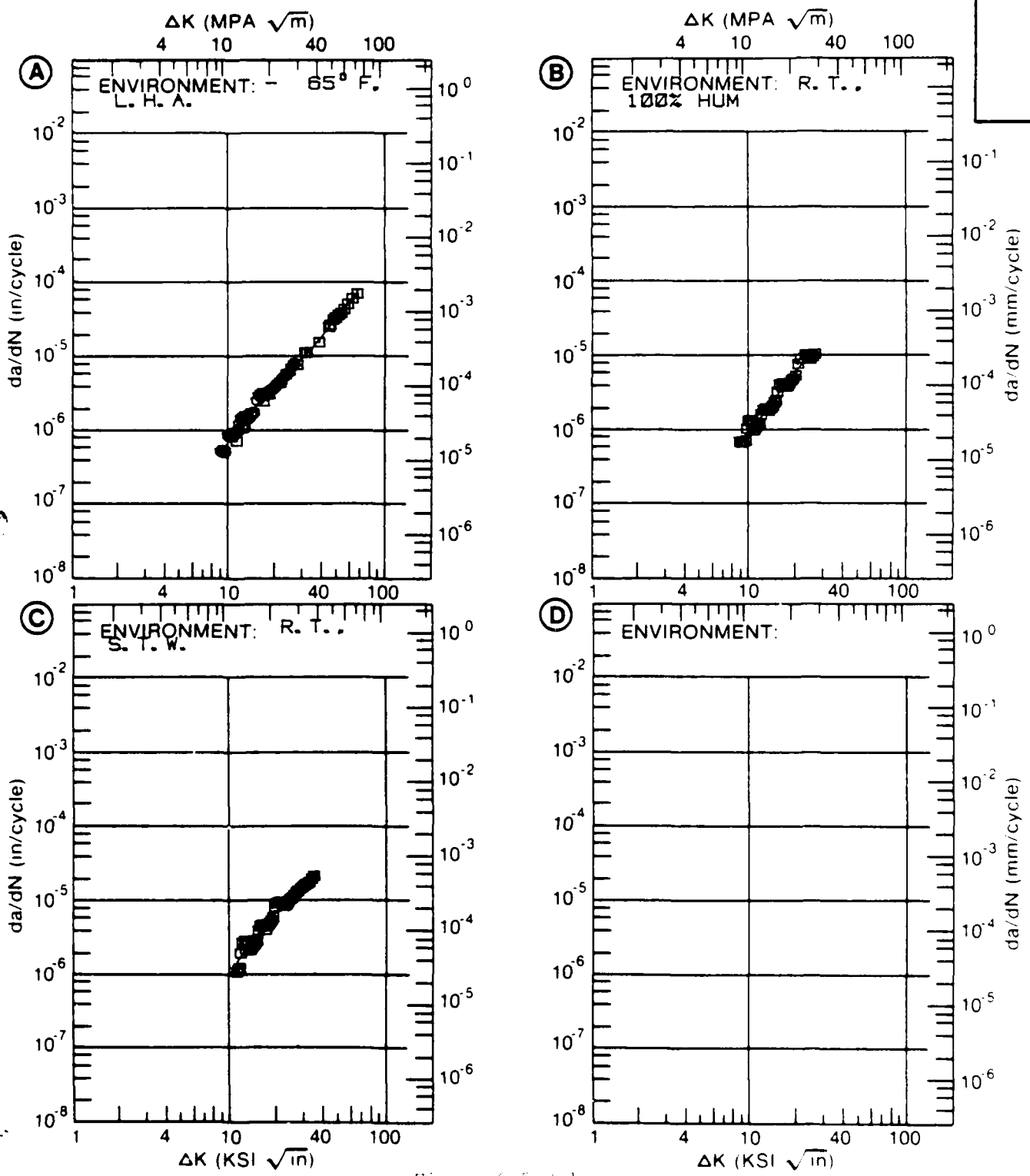



Figure 6.5.4.1

TABLE 6.5.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.11 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: - 65F, L. H. A.

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.08 | | | |
| DELTA K MIN A: | 9.54 | .473 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 10.00 | .620 | | | |
| | 13.00 | 1.29 | | | |
| | 16.00 | 2.31 | | | |
| | 20.00 | 4.14 | | | |
| | 25.00 | 6.65 | | | |
| | 30.00 | 8.61 | | | |
| DELTA K MAX A: | 32.43 | 9.20 | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 10.93

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 1.00 HZ
ENVIRONMENT: - 65° F. L. H. A.

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 200.0 KSI
SPECIMEN THK: 0.993"
SPECIMEN WIDTH: 6.000"
REFERENCES: 85837

ALLOY STEEL

HP9-4-.20

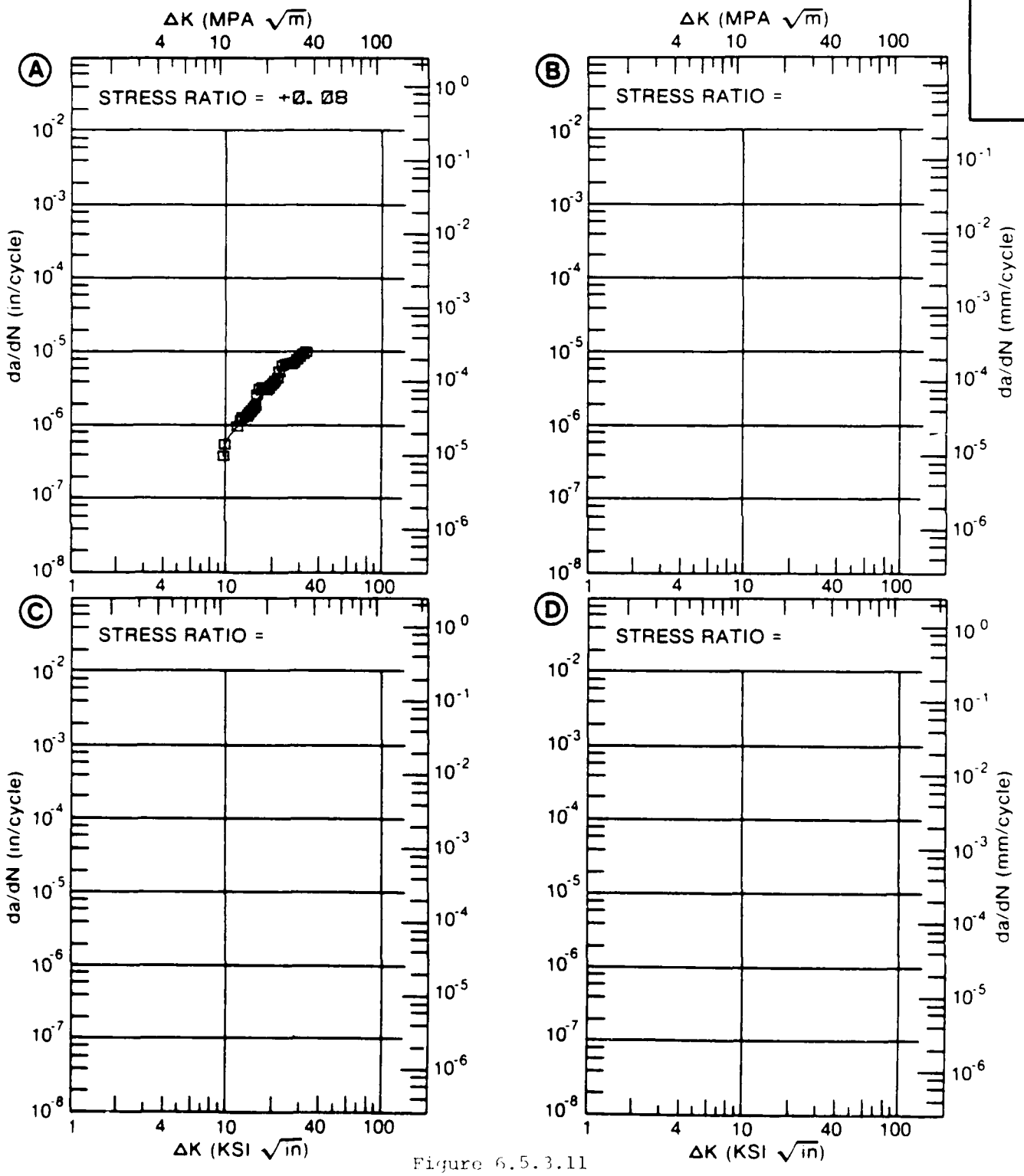



Figure 6.5.3.11

TABLE 6.5.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.12 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=- 65F L.H.A. | E= R.T. L.H.A. | | |
| DELTA K MIN | A: | 13.08 | .738 | | | |
| | B: | 11.34 | | .968 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | | 1.62 | | |
| | | 16.00 | 1.30 | 3.12 | | |
| | | 20.00 | 2.43 | 5.05 | | |
| | | 25.00 | 4.55 | 7.19 | | |
| | | 30.00 | 7.54 | 9.43 | | |
| | | 35.00 | 11.5 | 12.3 | | |
| | | 40.00 | 16.5 | 16.4 | | |
| | | 50.00 | 29.7 | 29.9 | | |
| | | 60.00 | 47.2 | 51.3 | | |
| | | 70.00 | | 80.0 | | |
| DELTA K MAX | A: | 63.48 | 54.3 | | | |
| | B: | 72.79 | | 89.0 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 3.87 | 11.94 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 199.0 KSI
SPECIMEN THK: 0.990"
SPECIMEN WIDTH: 7.400"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.20

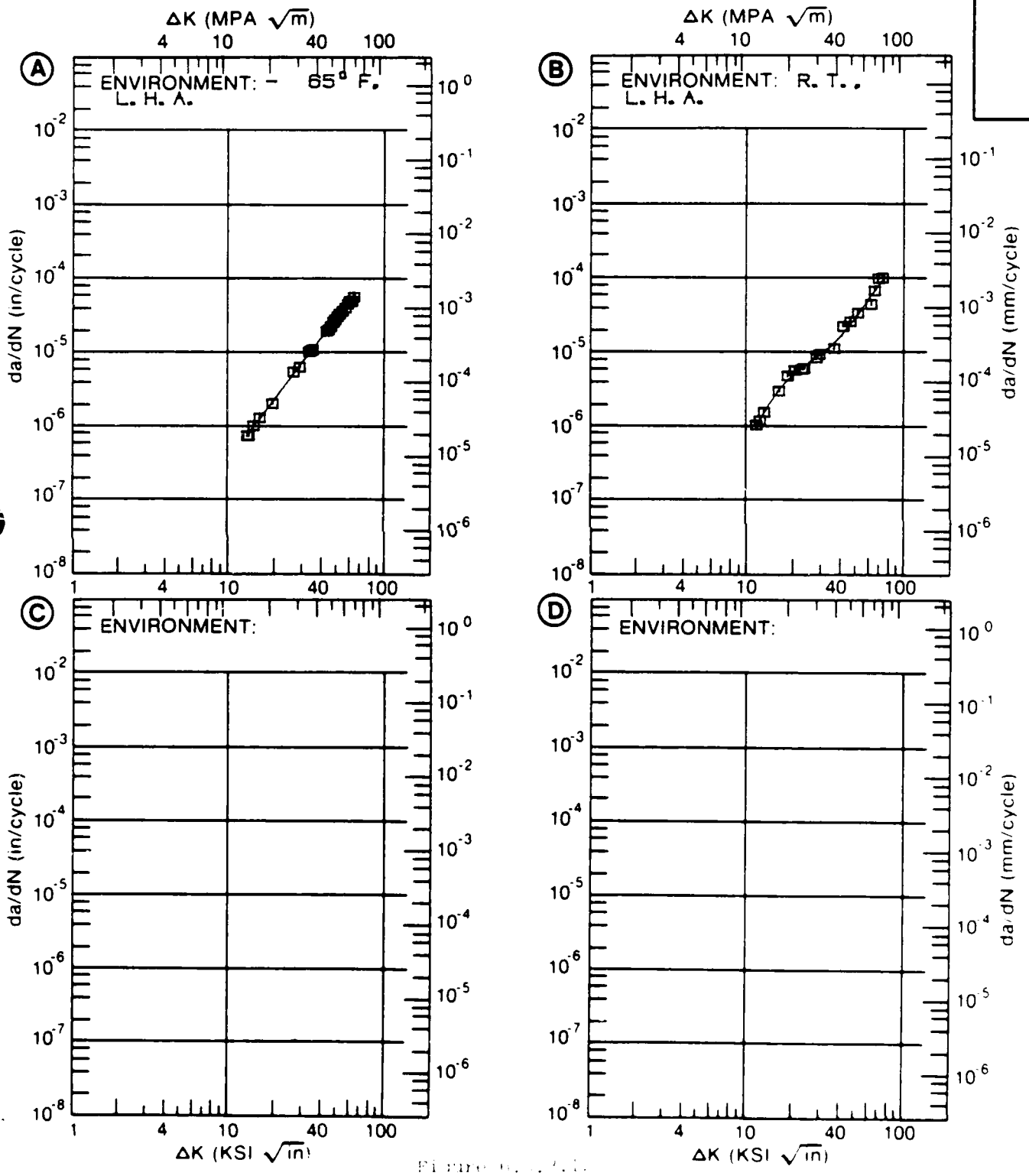



Figure [illegible]

TABLE 6.5.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.13 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. , L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | | | |
| DELTA K MIN | A: | 19.41 | 6.79 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 6.90 | | | |
| | | 25.00 | 8.40 | | | |
| | | 30.00 | 10.8 | | | |
| | | 35.00 | 14.1 | | | |
| | | 40.00 | 18.6 | | | |
| | | 50.00 | 32.1 | | | |
| | | 60.00 | 53.9 | | | |
| | | 70.00 | 87.6 | | | |
| | | 80.00 | 138. | | | |
| | | 90.00 | 212. | | | |
| DELTA K MAX | A: | 95.59 | 266. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 16.27

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 204.0 KSI
SPECIMEN THK: 1.990"
SPECIMEN WIDTH: 5.990"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.20

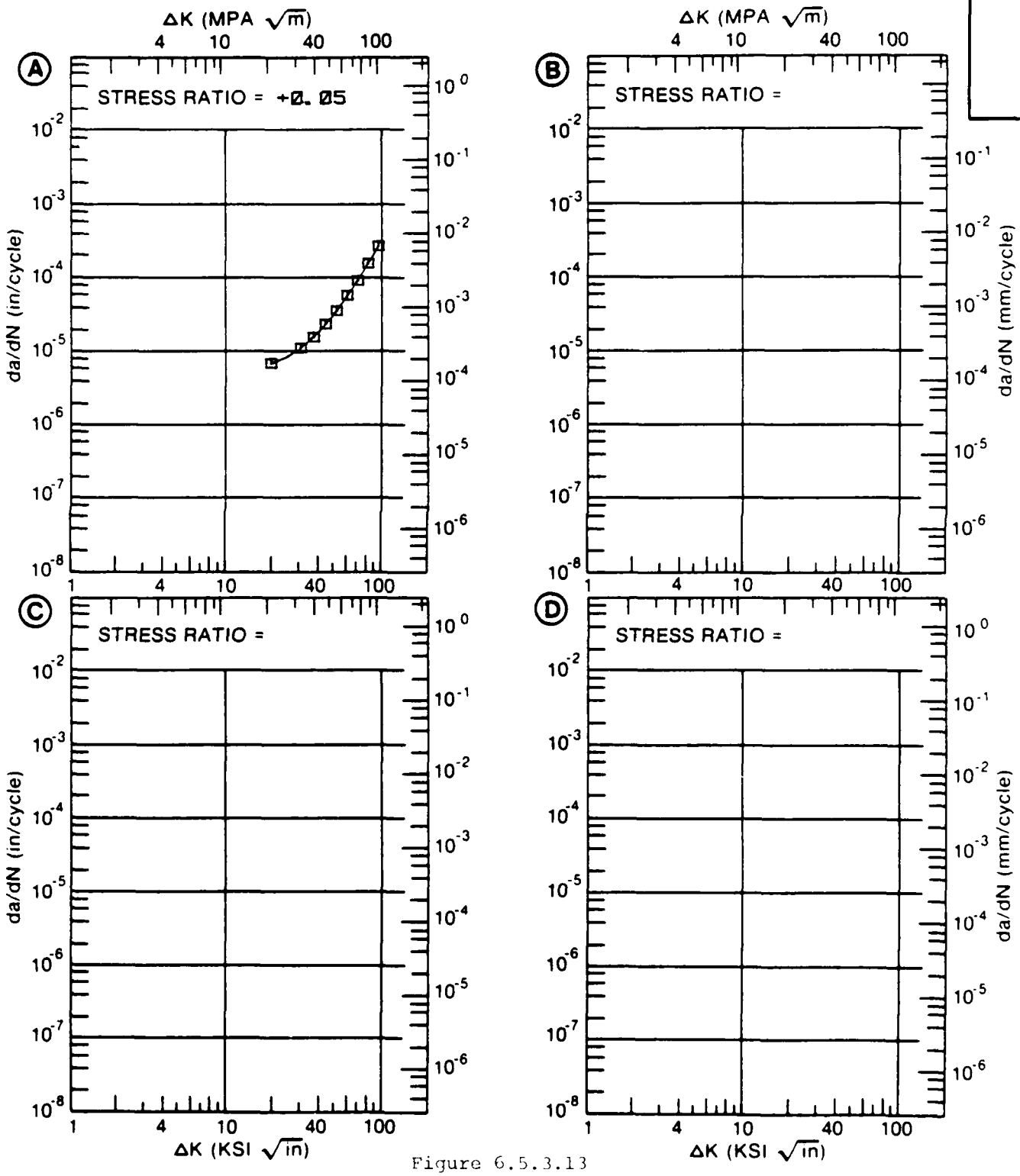



Figure 6.5.3.13

TABLE 6.5.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.14 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.08 | R=+0.30 | R=+0.50 | R=+0.70 |
| DELTA K MIN A: | 12.52 | 1.28 | | | |
| DELTA K MIN B: | 8.62 | | .505 | | |
| DELTA K MIN C: | 9.59 | | | .674 | |
| DELTA K MIN D: | 5.66 | | | | .183 |
| | 6.00 | | | | .197 |
| | 7.00 | | | | .310 |
| | 8.00 | | | | .551 |
| | 9.00 | | .568 | | .943 |
| | 10.00 | | .771 | .819 | 1.44 |
| | 13.00 | 1.43 | 1.76 | 2.07 | 2.87 |
| | 16.00 | 2.58 | 3.35 | 3.43 | 4.54 |
| | 20.00 | 4.57 | 6.11 | | 7.78 |
| | 25.00 | 7.77 | 9.32 | | 13.6 |
| | 30.00 | 11.8 | | | 21.2 |
| | 35.00 | 16.6 | | | |
| | 40.00 | 22.4 | | | |
| | 50.00 | 37.6 | | | |
| | 60.00 | 58.7 | | | |
| | 70.00 | 87.8 | | | |
| | 80.00 | 128. | | | |
| | 90.00 | 181. | | | |
| | 100.00 | 253. | | | |
| DELTA K MAX A: | 102.55 | 275. | | | |
| DELTA K MAX B: | 27.08 | | 10.2 | | |
| DELTA K MAX C: | 19.92 | | | 5.62 | |
| DELTA K MAX D: | 33.41 | | | | 27.3 |
| ROOT MEAN SQUARE PERCENT ERROR | | 4.66 | 16.89 | 2.93 | 17.74 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH: 186.0- 189.0 KSI
ULT. STRENGTH: 203.0- 211.0 KSI
SPECIMEN THK: 0.991- 1.000"
SPECIMEN WIDTH: 6.000- 6.010"
REFERENCES: 88579, 85837

ALLOY STEEL

HP9-4-.20

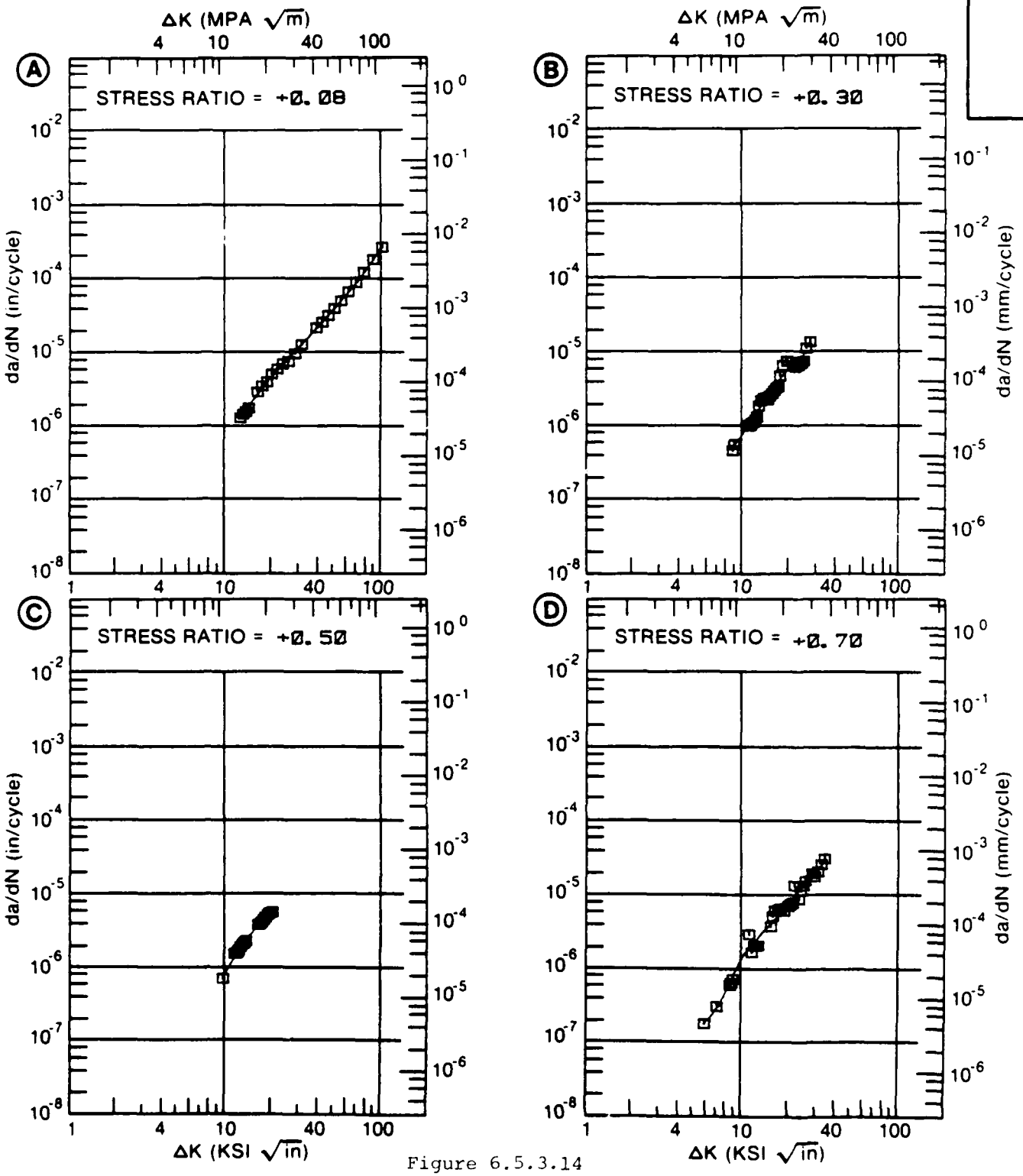



Figure 6.5.3.14

TABLE 6.5.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.15 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,100% HUM

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.30 | R=+0.50 | | |
| DELTA K MIN | A: | 7.60 | .371 | | | |
| | B: | 6.77 | | .615 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 7.00 | | .670 | | |
| | | 8.00 | .371 | .923 | | |
| | | 9.00 | .532 | 1.20 | | |
| | | 10.00 | .958 | 1.52 | | |
| | | 13.00 | 2.77 | 2.80 | | |
| | | 16.00 | 4.68 | 4.90 | | |
| | | 20.00 | 7.69 | 8.31 | | |
| | | 25.00 | 15.0 | | | |
| DELTA K MAX | A: | 25.00 | 15.0 | | | |
| | B: | 23.21 | | 9.80 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 19.42 | 17.66 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., 100% HUM

YIELD STRENGTH: 189.0 KSI
ULT. STRENGTH: 203.0 KSI
SPECIMEN THK: 0.986- 0.987"
SPECIMEN WIDTH: 7.400"
REFERENCES:85837

ALLOY STEEL

HP9-4-.20

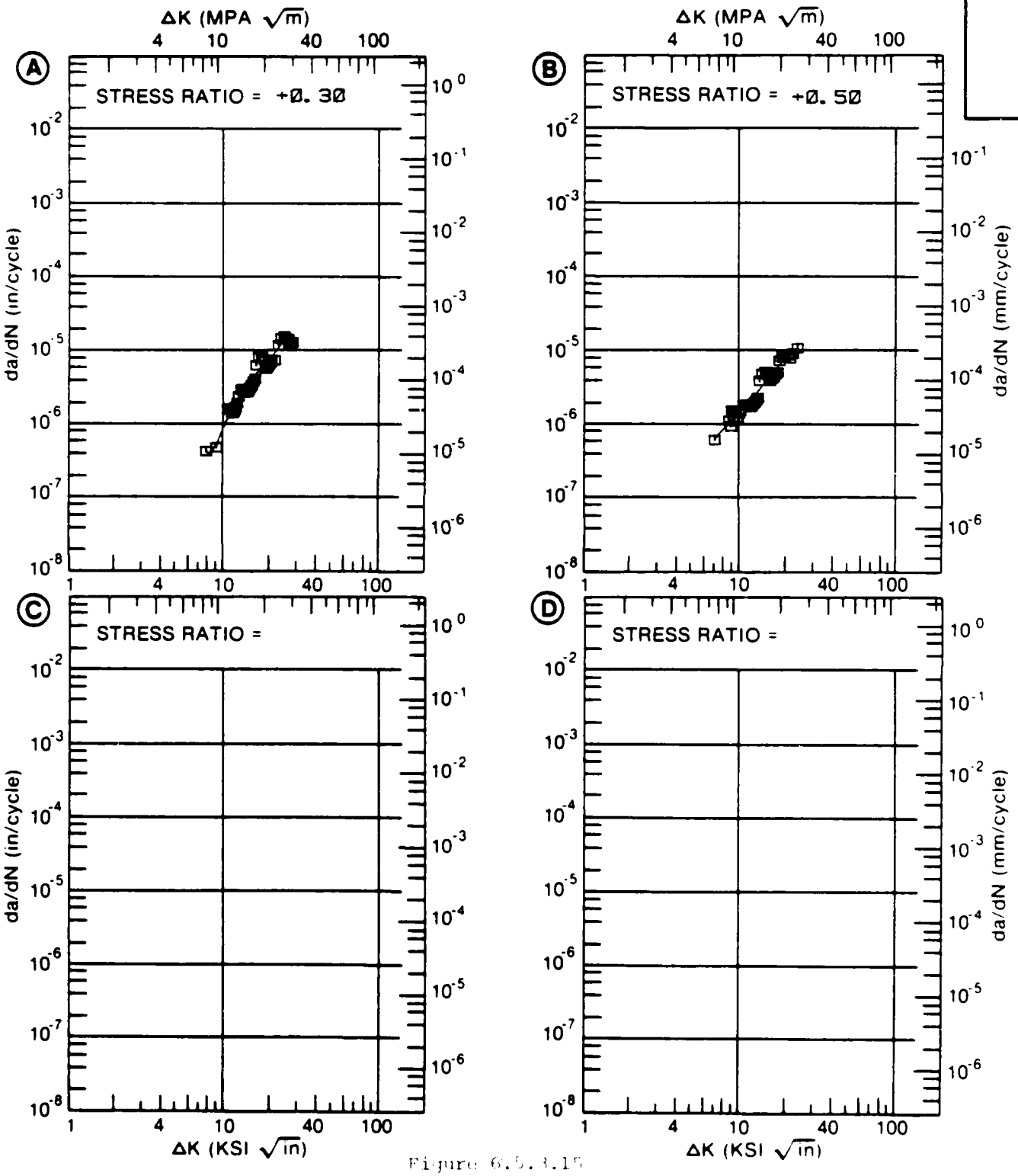



Figure 6.5.3.15

TABLE 6.5.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS

| | | DELTA K (KSI*IN**1/2) | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. SP. THK. =.260" | E= R.T. L.H.A. SP. THK. =.504" | | |
| DELTA K MIN | A: | 8.16 | .393 | | | |
| | B: | 9.68 | | .531 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | .477 | | | |
| | | 10.00 | .688 | .574 | | |
| | | 13.00 | 1.60 | 1.64 | | |
| | | 16.00 | 2.84 | 3.24 | | |
| | | 20.00 | 4.88 | 5.85 | | |
| | | 25.00 | 7.76 | 9.61 | | |
| | | 30.00 | 10.9 | 13.9 | | |
| | | 35.00 | 14.6 | 19.1 | | |
| | | 40.00 | 19.1 | 25.4 | | |
| | | 50.00 | 30.6 | 37.4 | | |
| | | 60.00 | 44.8 | | | |
| DELTA K MAX | A: | 68.23 | 57.6 | | | |
| | B: | 53.22 | | 39.4 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 2.81 | 14.12 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ.-100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 6.00 HZ
YIELD STRENGTH: 186.0 KSI
ULT. STRENGTH: 211.0 KSI
SPECIMEN THK:
SPECIMEN WIDTH: 6.000"
REFERENCES: 88579, 85837

ALLOY STEEL

HP9-4-.20

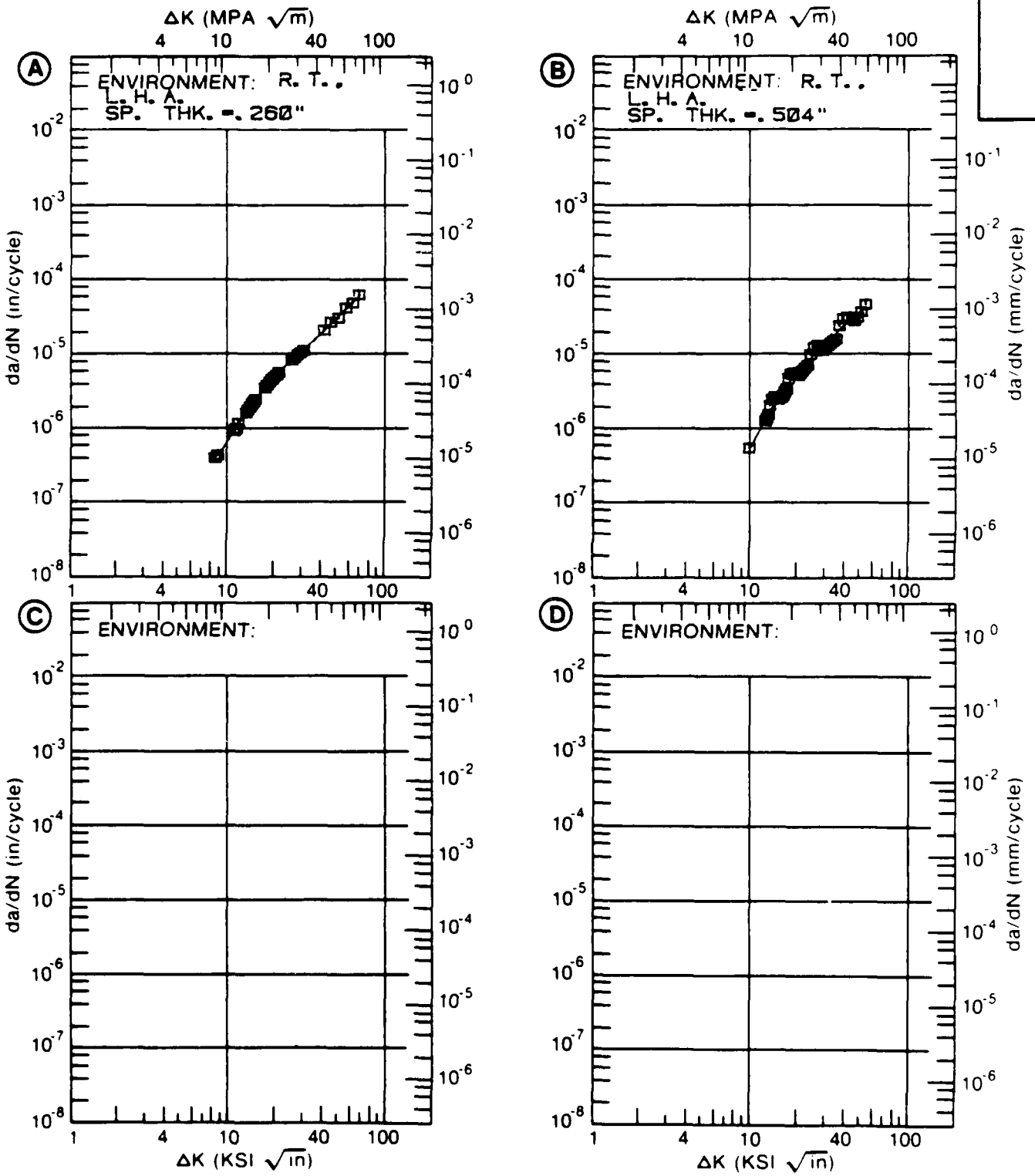



Figure 6.5.3.16

TABLE 6.5.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E=- 65F L.H.A. | E= R.T. L.H.A. | E= R.T. S.C.S. | E= R.T. S.T.W. |
| DELTA K MIN A: | 14.63 | 1.45 | | | |
| DELTA K MIN B: | 12.61 | | 1.35 | | |
| DELTA K MIN C: | 5.66 | | | .101 | |
| DELTA K MIN D: | 5.62 | | | | .144 |
| | 6.00 | | | .123 | .172 |
| | 7.00 | | | .195 | .265 |
| | 8.00 | | | .288 | .388 |
| | 9.00 | | | .416 | .546 |
| | 10.00 | | | .596 | .742 |
| | 13.00 | | 1.49 | 1.53 | 1.59 |
| | 16.00 | 2.05 | 2.77 | 2.97 | 2.87 |
| | 20.00 | | 4.96 | 5.44 | 5.26 |
| | 25.00 | | 8.32 | 8.98 | 9.23 |
| | 30.00 | | 12.6 | 12.6 | 14.0 |
| | 35.00 | | 18.4 | 16.0 | 19.2 |
| | 40.00 | | 26.5 | 19.0 | 24.4 |
| | 50.00 | | 40.9 | | |
| DELTA K MAX A: | 18.90 | 2.64 | | | |
| DELTA K MAX B: | 55.93 | | 41.2 | | |
| DELTA K MAX C: | 41.08 | | | 19.6 | |
| DELTA K MAX D: | 43.29 | | | | 27.8 |
| ROOT MEAN SQUARE PERCENT ERROR | | 12.87 | 13.81 | 13.85 | 6.38 |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | 1 | 1 |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 186.0- 189.0 KSI
ULT. STRENGTH: 203.0- 211.0 KSI
SPECIMEN THK: 0.989- 1.000"
SPECIMEN WIDTH: 6.000"
REFERENCES: 85837, 88579

ALLOY STEEL

HP9-4-.20

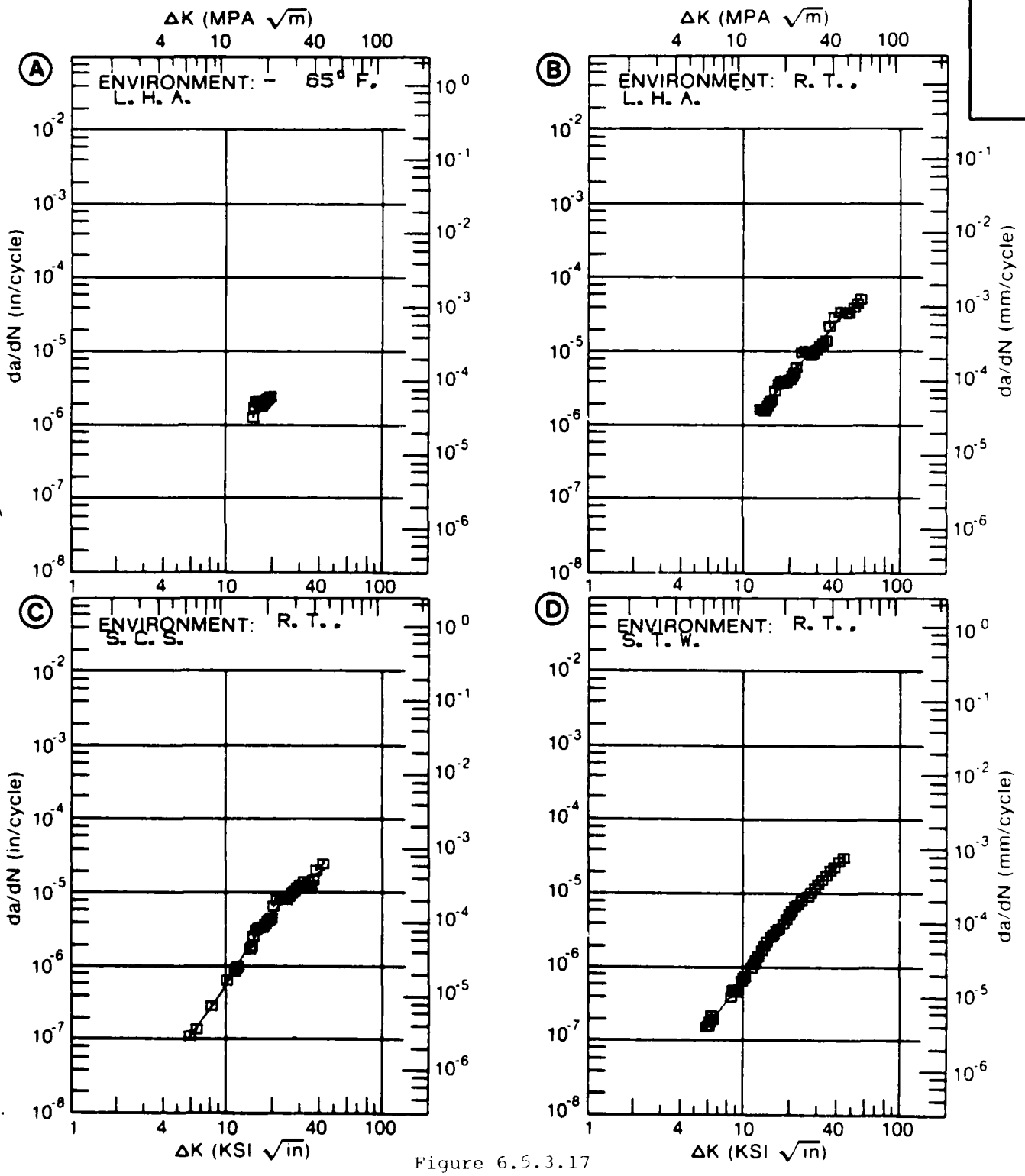



Figure 6.5.3.17

TABLE 6.5.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.18 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 9.00 | | |
| DELTA K MIN | A: | 10.61 | .828 | | | |
| | B: | 3.86 | | .0801 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 4.00 | | .0851 | | |
| | | 5.00 | | .131 | | |
| | | 6.00 | | .199 | | |
| | | 7.00 | | .293 | | |
| | | 8.00 | | .418 | | |
| | | 9.00 | | .578 | | |
| | | 10.00 | | .779 | | |
| | | 13.00 | 1.54 | 1.67 | | |
| | | 16.00 | 2.74 | 3.06 | | |
| | | 20.00 | 4.58 | 5.77 | | |
| | | 25.00 | 7.19 | 10.5 | | |
| | | 30.00 | 10.3 | 16.5 | | |
| | | 35.00 | 14.3 | 23.4 | | |
| | | 40.00 | 19.4 | 30.6 | | |
| | | 50.00 | 34.3 | | | |
| DELTA K MAX | A: | 58.49 | 49.8 | | | |
| | B: | 43.08 | | 35.1 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 2.77 | 5.07 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 186.0 KSI
ULT. STRENGTH: 211.0 KSI
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 6.000"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.20

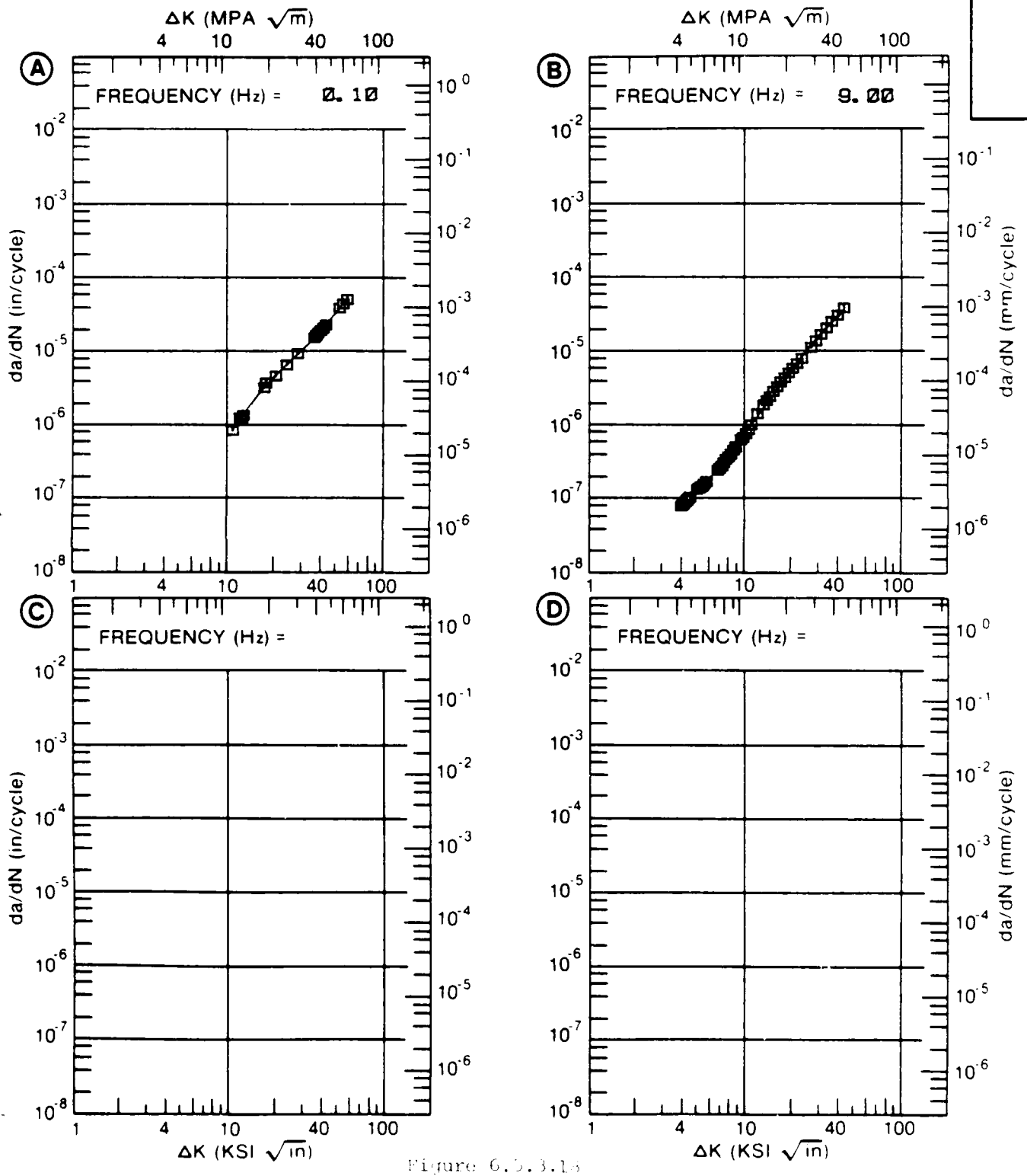



Figure 6.5.3.16

TABLE 6.5.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.19 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,100% HUM

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | | |
| DELTA K MIN | A: | 10.13 | .423 | | | |
| | B: | 9.79 | | .555 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | | .623 | | |
| | | 13.00 | 1.54 | 2.09 | | |
| | | 16.00 | 3.44 | 4.22 | | |
| | | 20.00 | 6.63 | 7.39 | | |
| | | 25.00 | 11.0 | 11.2 | | |
| | | 30.00 | 15.4 | 14.9 | | |
| | | 35.00 | 20.1 | 18.9 | | |
| | | 40.00 | 25.2 | 24.1 | | |
| | | 50.00 | 38.5 | 40.6 | | |
| DELTA K MAX | A: | 55.79 | 49.0 | | | |
| | B: | 59.72 | | 72.6 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.79 | 10.69 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ.-100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
ENVIRONMENT: R.T., 100% HUM

YIELD STRENGTH 186.0- 189.0 KSI
ULT STRENGTH 203.0- 211.0 KSI
SPECIMEN THK 0.989- 1.000"
SPECIMEN WIDTH 6.000"
REFERENCES 88579, 85837

ALLOY STEEL

HP9-4-.20

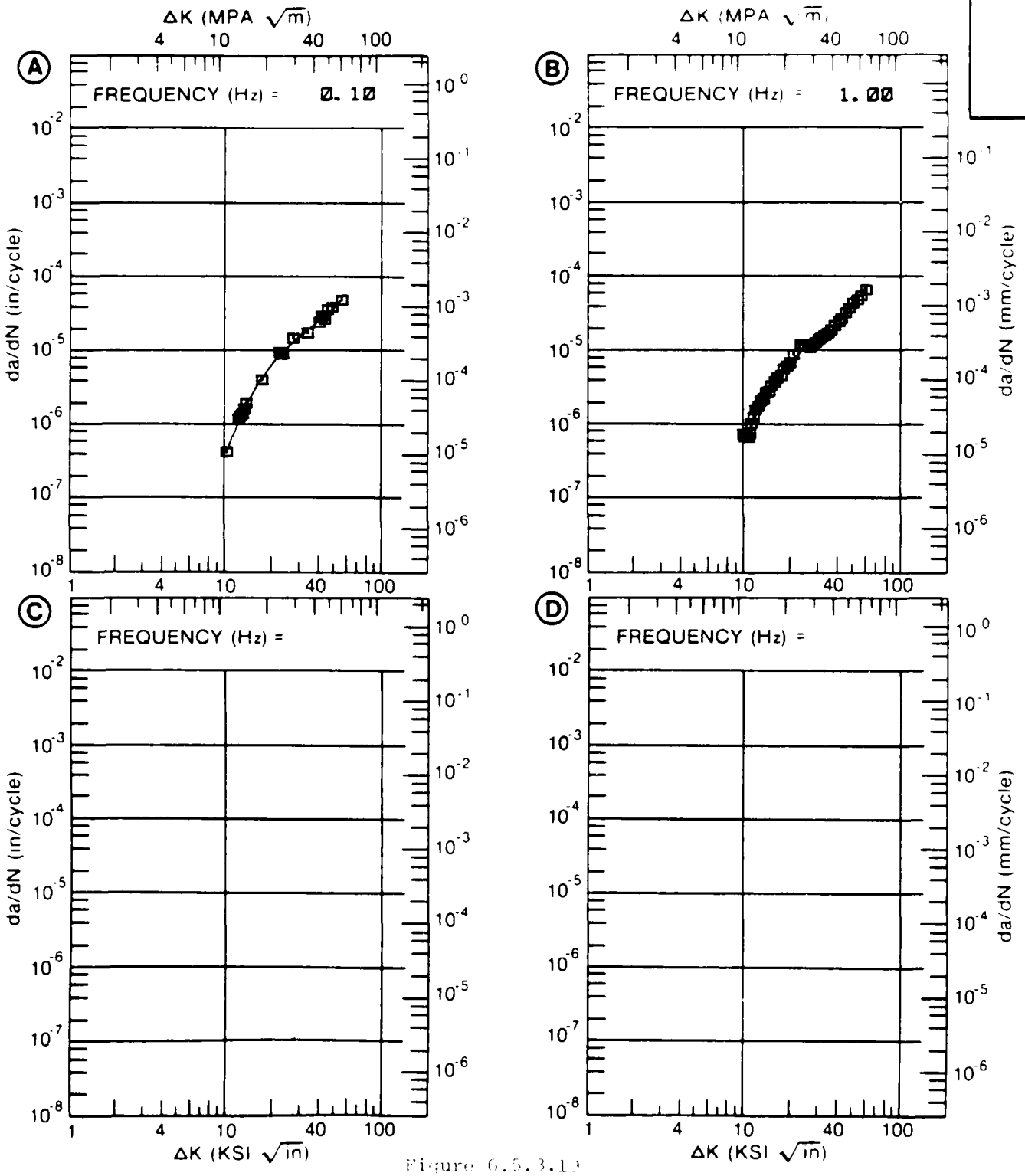



Figure 6.5.3.1

TABLE 6.5.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.20 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: - 65F, L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | | | |
| DELTA K MIN | A: | 17.18 | 2.64 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 3.33 | | | |
| | | 25.00 | 4.96 | | | |
| | | 30.00 | 7.27 | | | |
| | | 35.00 | 10.5 | | | |
| | | 40.00 | 14.9 | | | |
| | | 50.00 | 27.8 | | | |
| | | 60.00 | 47.3 | | | |
| | | 70.00 | 74.3 | | | |
| | | 80.00 | 109. | | | |
| DELTA K MAX | A: | 86.98 | 138. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 4.77

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 1.00 HZ
ENVIRONMENT: - 65° F. L. H. A.

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 204.0 KSI
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 6.000"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.20

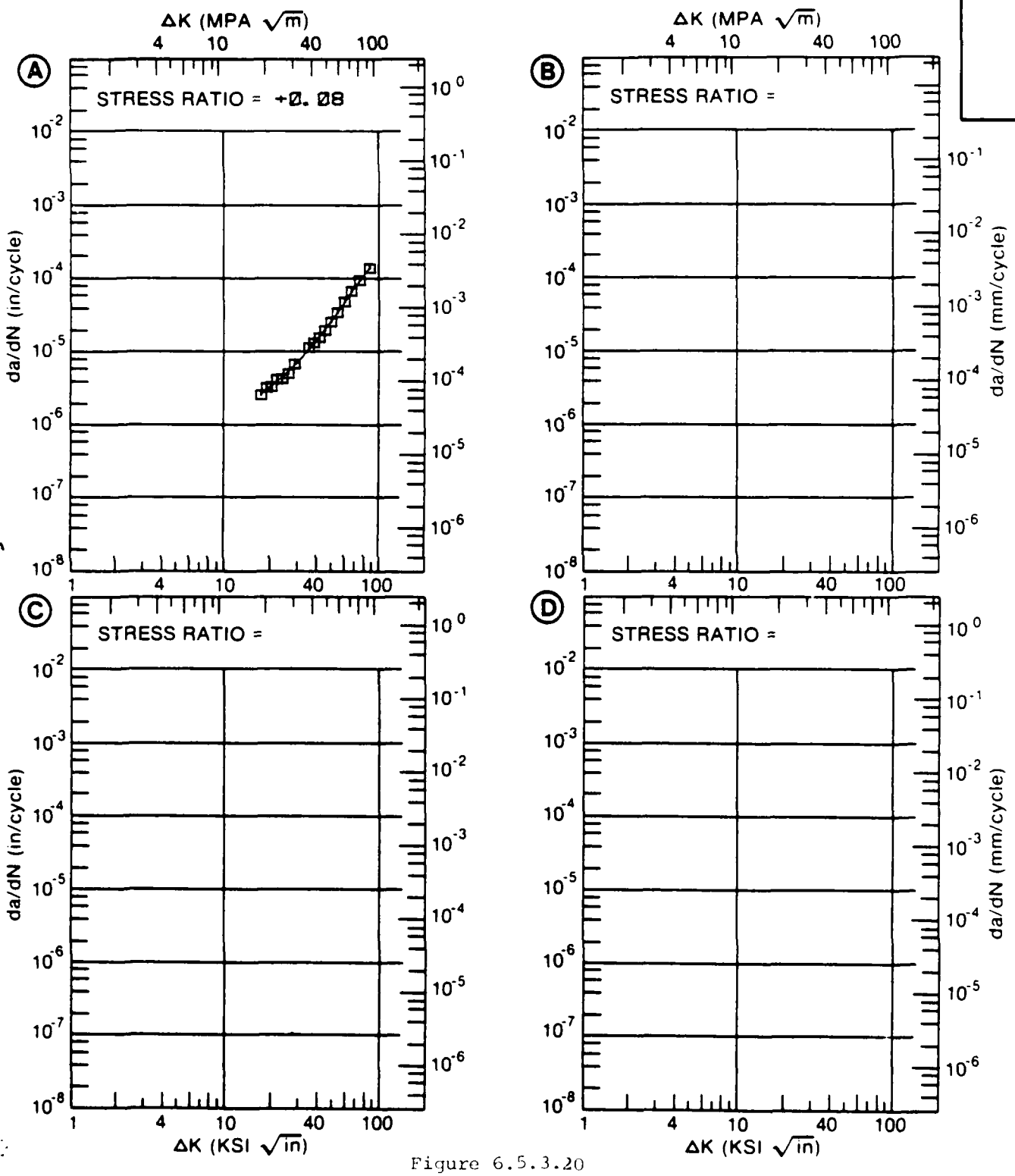



Figure 6.5.3.20

TABLE 6.5.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.21 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. , L.H.A.

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.05 | | | |
| DELTA K MIN A: | 24.44 | 2.98 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 25.00 | 3.70 | | | |
| | 30.00 | 9.15 | | | |
| | 35.00 | 13.3 | | | |
| | 40.00 | 17.9 | | | |
| | 50.00 | 29.7 | | | |
| | 60.00 | 47.1 | | | |
| | 70.00 | 74.0 | | | |
| | 80.00 | 116. | | | |
| | 90.00 | 175. | | | |
| DELTA K MAX A: | 97.82 | 236. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 16.46

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| 0.0-0.5 | |
| 0.5-0.8 | |
| 0.8-1.25 | |
| 1.25-2.0 | 1 |
| >2.0 | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 1.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 204.0 KSI
SPECIMEN THK: 2.000"
SPECIMEN WIDTH: 5.810"
REFERENCES 88579

ALLOY STEEL

HP9-4-.20

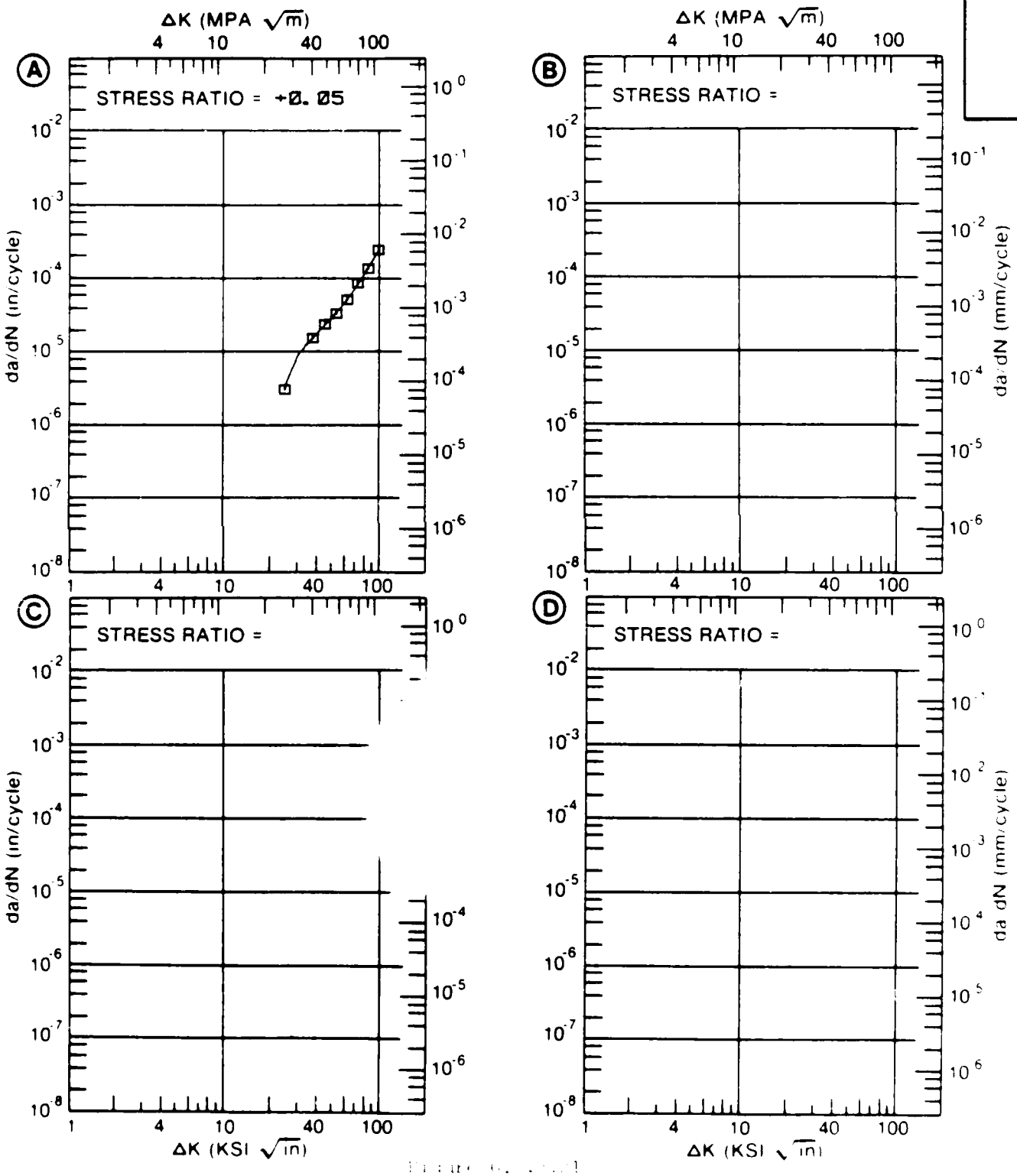


TABLE 6.5.3.22

ALLOY STEEL HP9-4- 20 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | P | 0 50 | R T | --- | ---- | N204-0.2% H20 | 5.500 | 0.500 | TDCB | ---- | 150.00 | 140.00* | | | ---- | 1971 | 80667 |
| ---------- | P | 0 50 | R.T | --- | ---- | SYNTH SEAWATER | ---- | ---- | TDCB | ---- | ------ | 110.00* | | | ---- | 1969 | 74232 |
| ---------- | F | 1 25 | R.T. | T-L | 198.0 | SIM. SEA WATER | 3.083 | 1.247 | BWOL | 1.367 | ------ | 92.80 | | | 195840 | 1977 | MA005 |
| | | 1 25 | | | 198.0 | | 3.088 | 1.250 | BWOL | 1.366 | ------ | 94.50 | | | 195840 | 1977 | MA005 |
| | | | | | | | | | | | | | 93.7/ | 1.2 | | | |
| GTA WELD WELDMENT | P | 0 50 | R.T. | --- | ---- | SYNTH SEAWATER | ---- | ---- | TDCB | ---- | ------ | 65.00 | | | ---- | 1969 | 74232 |
| QUENCHED AND TEMPERED | P | 1.00 | R.T | --- | 180.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 210.00 | 110.00 | | | ---- | 1972 | 83613 |
| | | 1.00 | | --- | 195.0 | | ---- | 1.000 | CANT* | ---- | 200.00 | 110.00 | | | ---- | 1972 | 83613 |
| | | | | | | | | | | | | | 110.0/ | 0.0 | | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | P | 2 50 | R.T. | L-T | 189.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 119.00 | 105.00 | | | 86280 | 1976 | RI006 |
| | | 2 50 | | | 189.0 | | 2.000 | 1.000 | DCB | ---- | 119.00 | 103.00 | | | 86280 | 1976 | RI006 |
| | | 2 50 | | | 189.0 | | 2.000 | 1.000 | DCB | ---- | 119.00 | 107.00 | | | 86280 | 1976 | RI006 |
| | | | | | | | | | | | | | 105.0/ | 2.0 | | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | P | 2.50 | R.T. | T-L | 190.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 119.00 | 97.00 | | | 86280 | 1976 | RI006 |
| | | 2 50 | | | 190.0 | | 2.000 | 1.000 | DCB | ---- | 119.00 | 97.00 | | | 86280 | 1976 | RI006 |
| | | 2.50 | | | 190.0 | | 2.000 | 1.000 | DCB | ---- | 119.00 | 93.00 | | | 86280 | 1976 | RI006 |
| | | 2.50 | | | 190.0 | | 2.000 | 1.000 | DCB | ---- | 119.00 | 104.00 | | | 86280 | 1976 | RI006 |
| | | 2 50 | | | 190.0 | | 2.000 | 1.000 | DCB | ---- | 119.00 | 96.00 | | | 86280 | 1976 | RI006 |
| | | | | | | | | | | | | | 97.4/ | 4.0 | | | |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | FB | 4.00 | R.T. | L-T | 186.0 | S.C.S. | 2.000 | 1.000 | DCB | ---- | 118.00 | >122 00 | | | 60660 | 1976 | RI006 |
| | | 4.00 | | | 186.0 | | 2.000 | 1.000 | DCB | ---- | 118.00 | >129.00 | | | 60180 | 1976 | RI006 |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | FB | 4 00 | R.T. | L-T | 186.0 | S.T.W. | 2.000 | 1 000 | DCB | ---- | 118.00 | >126 00 | | | 86280 | 1976 | RI006 |
| | | 4 00 | | | 186.0 | | 2.000 | 1.000 | DCB | ---- | 118.00 | >129 00 | | | 86280 | 1976 | RI006 |
| | | 4 00 | | | 186.0 | | 2.000 | 1.000 | DCB | ---- | 118.00 | 110.00 | | | 86280 | 1976 | RI006 |
| 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS | FB | 4 00 | R.T. | T-L | 187.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 118.00 | 109 00 | | | 86280 | 1976 | RI006 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.4.3.22 (Con't)

ALLOY STEEL HP9-4-20 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 2HRS OQ, | FB | 4 00 | R T | T-L | 187.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 118.00 | 105 00 | | | 76860 | 1976 | RI006 |
| -100F 2HRS, | | 4 00 | | | 187 0 | | 2.000 | 1.000 | DCB | ---- | 118.00 | <117 00 | | | 86280 | 1976 | RI006 |
| 1025F 4HRS | | | | | | | | | | | | | 107.0/ | 2.8 | | | |
| 1525F 2HRS OQ, | FB | 4 00 | R.T | S-T | ---- | S.T.W. | 2.000 | 1.000 | DCB | ---- | 118.00 | < 97 00 | | | 86280 | 1976 | RI006 |
| -100F 2HRS, | | 4 00 | | | ---- | | 2.000 | 1.000 | DCB | ---- | 118.00 | 79 00 | | | 86280 | 1976 | RI006 |
| 1025F 4HRS | | 4 00 | | | ---- | | 2.000 | 1 000 | DCB | ---- | 118.00 | 81 00 | | | 86280 | 1976 | RI006 |
| | | 4 00 | | | ---- | | 2.000 | 1.000 | DCB | ---- | 118.00 | 75.00 | | | 116820 | 1976 | RI006 |
| | | | | | | | | | | | | | 78.3/ | 3.1 | | | |

TABLE 6.6.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.6.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20(CEVM)
CONDITION: ANNEALED

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR 5-10HZ | E= R.T. SIM. SEA WATER 1-20HZ | | |
| DELTA K MIN | A: | 10.59 | 1.04 | | | |
| | B: | 11.52 | | 1.04 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 2.03 | 1.59 | | |
| | | 16.00 | 3.62 | 3.03 | | |
| | | 20.00 | 6.19 | 5.56 | | |
| | | 25.00 | 9.93 | 9.51 | | |
| | | 30.00 | 14.2 | 14.2 | | |
| | | 35.00 | 18.9 | 19.6 | | |
| | | 40.00 | 24.2 | 25.8 | | |
| | | 50.00 | 37.0 | 40.7 | | |
| | | 60.00 | 53.7 | 59.8 | | |
| | | 70.00 | 75.6 | | | |
| | | 80.00 | 104. | | | |
| DELTA K MAX | A: | 89.69 | 141. | | | |
| | B: | 63.26 | | 67.1 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.22 | 9.60 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 2 | 2 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: ANNEALED
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 191.8 KSI
ULT. STRENGTH: 204.2 KSI
SPECIMEN THK: 0.997- 1.003"
SPECIMEN WIDTH: 7.400"
REFERENCES:NC002

ALLOY STEEL

HP9-4-20 (CEVM)

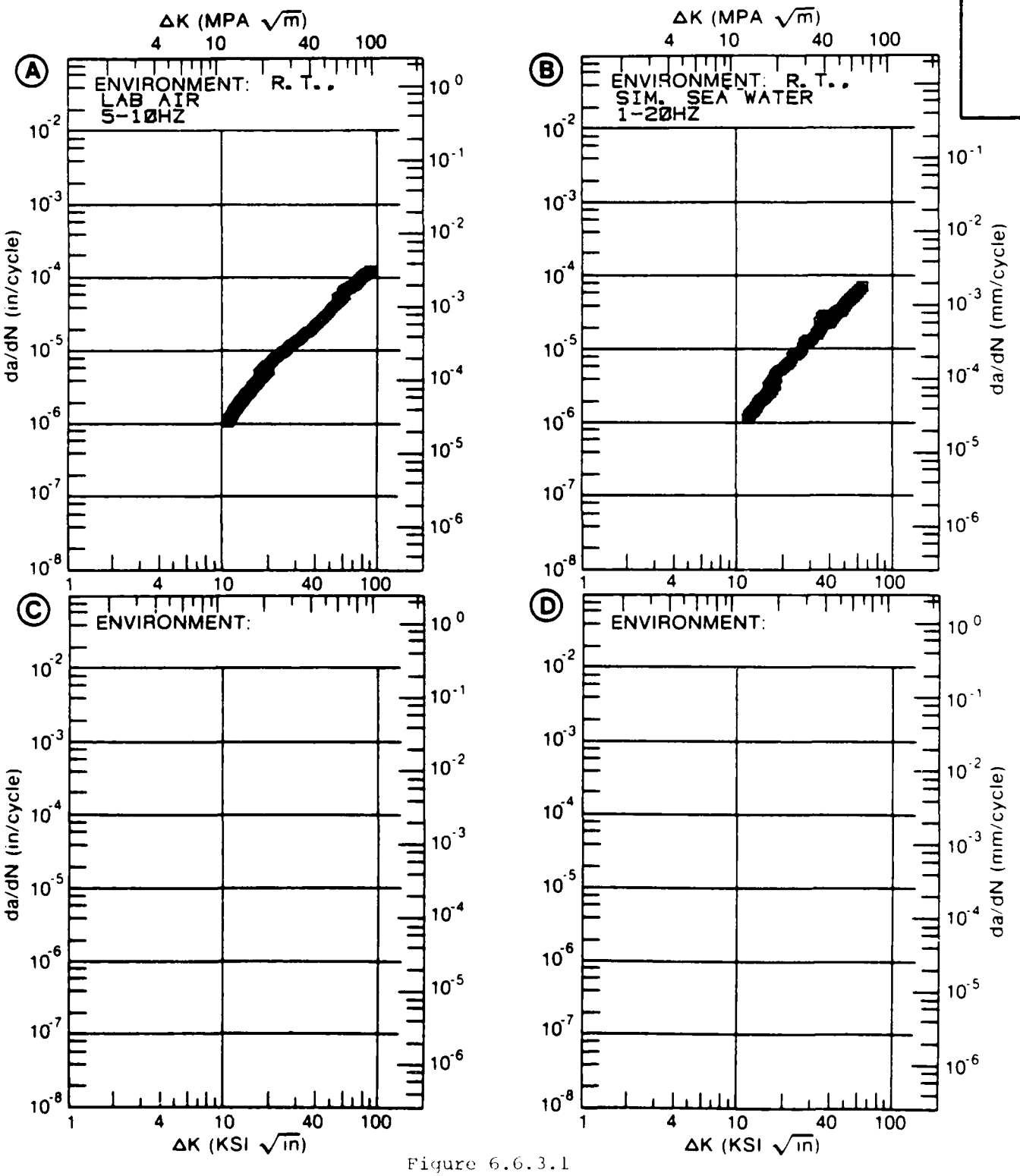



Figure 6.6.3.1

TABLE 6.6.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.6.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.20(CEVM)
CONDITION: ANNEALED

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. LAB AIR 10-15HZ | E= R.T. SIM. SEA WATER 1-10HZ | | |
| DELTA K MIN A: | 10.03 | .928 | | | |
| DELTA K MIN B: | 11.55 | | 1.16 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 13.00 | 2.17 | 1.73 | | |
| | 16.00 | 3.84 | 3.22 | | |
| | 20.00 | 6.53 | 5.78 | | |
| | 25.00 | 10.5 | 9.77 | | |
| | 30.00 | 15.1 | 14.6 | | |
| | 35.00 | 20.5 | 20.2 | | |
| | 40.00 | 26.7 | 26.8 | | |
| | 50.00 | 42.9 | 43.6 | | |
| | 60.00 | 65.7 | 66.6 | | |
| | 70.00 | 98.1 | | | |
| | 80.00 | 144. | | | |
| DELTA K MAX A: | 87.05 | 188. | | | |
| DELTA K MAX B: | 65.98 | | 84.3 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 8.76 | 8.20 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 2 | 2 | | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: ANNEALED
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 192.2 KSI
ULT. STRENGTH: 204.8 KSI
SPECIMEN THK: 1.003- 1.004"
SPECIMEN WIDTH: 7.400"
REFERENCES: NC002

ALLOY STEEL

HP9-4-20 (CEVM)

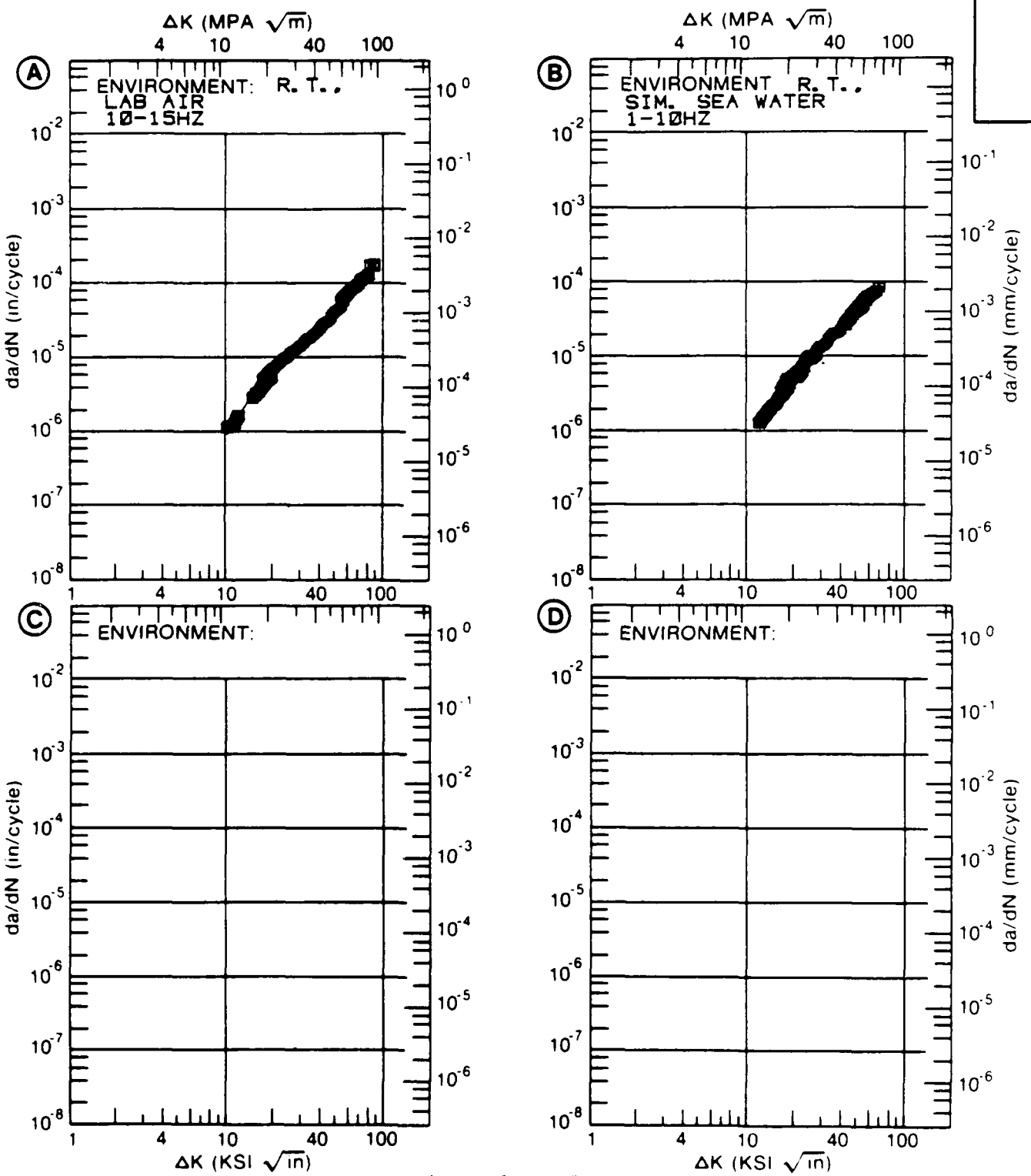



Figure 6.6.3.2

TABLE 6.7.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HP 9-4-.25(VAR) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | | (NUMBER OF SPECIMENS) |
|---|---|---|---|
| | | FORGING | |
| CONDITION/HT | L-T | T-L | S-L |
| 1550F 1 HR,OQ<br>1000F 2+2HR,AC | ----- | 98.9 ± 4.5 (2) | ----- |

TABLE 6.7.2.1

ALLOY STEEL HP 9-4- 25(VAR) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F 1 HR,OQ | F | 3.00 | - 75 | T-L | 187.0 | 5.110 | 2.000 | WOL | 1.834 | 1.09 | 123.00 | | | 196 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 187.0 | 5.110 | 2.000 | WOL | 1.864 | 0.82 | 107.00 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 115.0/ | 11.3 | | |
| 1550F 1 HR,OQ | F | 3.00 | - 40 | T-L | 188.0 | 5.110 | 2.000 | WOL | 1.886 | 0.86 | 110.00 | | | 1966 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 188.0 | 5.110 | 2.000 | WOL | 1.863 | 0.89 | 112.00 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 111.0/ | 1.4 | | |
| 1550F 1 HR,OQ | F | 3.00 | 0 | T-L | 187.0 | 5.110 | 2.000 | WOL | 1.837 | 0.82 | 107.00 | | | 1966 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 187.0 | 5.110 | 2.000 | WOL | 1.879 | 0.79 | 105.00 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 106.0/ | 1.4 | | |
| 1550F 1 HR,OQ | F | 3.00 | 32 | T-L | 187.0 | 5.110 | 2.000 | WOL | 1.868 | 0.79 | 104.00 | | | 1966 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 187.0 | 5.110 | 2.000 | WOL | 1.954 | 0.71 | 99.40 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 101.7/ | 3.3 | | |
| 1550F 1 HR,OQ | F | 3.00 | R.T. | T-L | 175.0 | 5.110 | 2.000 | WOL | 1.822 | 0.75 | 95.70 | | | 1966 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 175.0 | 5.110 | 2.000 | WOL | 1.808 | 0.85 | 102.00 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 98.9/ | 4.5 | | |
| 1550F 1 HR,OQ | F | 3.00 | 100 | T-L | 180.0 | 5.110 | 2.000 | WOL | 1.853 | 0.84 | 104.00 | | | 1966 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 180.0 | 5.110 | 2.000 | WOL | 1.855 | 0.78 | 101.00 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 102.5/ | 2.1 | | |
| 1550F 1 HR,OQ | F | 3.00 | 150 | T-L | 175.0 | 5.110 | 2.000 | WOL | 1.834 | 1.00 | 111.00 | | | 1966 | 76411 ( 1) |
| 1000F 2+2HR,AC | | 3.00 | | | 175.0 | 5.110 | 2.000 | WOL | 1.824 | 0.92 | 106.00 | | | 1966 | 76411 ( 1) |
| | | | | | | | | | | | | 108.5/ | 3.5 | | |

NOTES:
( 1) (VAR)=(VACUUM ARC REMELTED)

TABLE 6.8.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HP 9-4-.30 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| HEAT TREATED TO 49 RC HARDNESS | ----- | 82.5 ± 5.0 ( ) | ----- |
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR, 1000F 4HR | 106.0 ± 1.4 (2) | 89.0 ± 3.0 (3) | ----- |
| 1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR, 1050F 4HR | ----- | 87.5 ± 0.8 (2) | ----- |
| 1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR 1025F 4HR | ----- | 93.5 ± 0.7 (2) | ----- |
| 1650F, 2HR AC 1550F 2HR OQ 1000F 2+2HR AC | 82.0 ± 0.0 (2) | ----- | ----- |

TABLE 6.8.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT L H A AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| UTS=220-240KSI | BILLET | -1.00 | 10.00 | | | | | 3.62 | 30.0 | |
| UTS 220-240KSI | BILLET | 0.00 | 10.00 | | | | | 3.34 | 25.9 | 132 |
| UTS=220-240KSI | BILLET | 0.50 | 10.00 | | | | 0.94 | 6.26 | 49.3 | |
| 1525F 2HRS OQ, 100F 2HRS, 1025F 2+2HR | FORGED BAR | 0.30 | 6.00 | | | | | 4.51 | 98.9 | |
| 1550F 2HRS OQ, 100F 1HR, 1025F 2+2HR | FORGED BAR | 0.08 | 1.00 | | | | 0.89 | 5.04 | | |
| 1550F 2HRS OQ, 100F 1HR, 1025F 2+2HR | FORGED BAR | 0.30 | 6.00 | | | | 1.12 | 7.35 | | |
| 1550F 2HRS OQ, 100F 1HR, 1025F 2+2HR | FORGED BAR | 0.50 | 6.00 | | | | 1.17 | 6.60 | | |

TABLE 6.8.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| --- | FORGING | 0.02 | 5.0-20.0 | | | | 0.39 | 2.99 | 38.9 | |
| | BAR | 0.02 | 1.0 | | | | | | 46.4 | |
| | BAR | 0.02 | 10.0 | | | | | 3.59 | 46.6 | |

TABLE 6.8.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT 3 5% NACL AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 1 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | BAR | 0 02 | 1 0 | | | | | | 42 8 | |
| TUS= 220-240KSI | BILLET | 0 00 | 0 10 | | | | | 6 21 | 36 3 | 260 |
| TUS= 220-240KSI | BILLET | 0 00 | 1 00 | | | | | 4 25 | 41 1 | |
| TUS= 220-240KSI | BILLET | 0 00 | 10 00 | | | | | 2 74 | 27 7 | 266 |
| UTS=220-240KSI | BILLET | -1 00 | 0 10 | | | | | 2 88 | 33 9 | |

TABLE 6.8.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT S.T.W AT R.T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1525F 2HRS OQ, -100F 1HR, 1025F 2+2HR | FORGED BAR | 0.08 | 1.00 | | | | | 5.68 | 62.3 | |
| 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR | FORGED BAR | 0.08 | 0.10 | | | | 3.00 | 13.2 | | |
| 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR | FORGED BAR | 0.30 | 1.00 | | | | 1.06 | 7.45 | | |
| 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR | FORGED BAR | 0.50 | 1.00 | | | | 2.38 | 9.51 | | |
| 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR | FORGED BAR | 0.50 | 1.00 | | | | 1.35 | 7.70 | | |

TABLE 6.8.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT ALT IMMERSION IN SEA WATER AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| TUS=220-240KSI | BILLET | 0 00 | 1 00 | IMMERSED | | | | 4 16 | 34 3 | |
| TUS=220-240KSI | BILLET | 0 00 | 10 00 | IMMERSED | | | | 3 51 | 30 7 | |
| TUS=220-240KSI | BILLET | 0 00 | 1 00 | 1ST HALF DRY CYCLE | | | | 1 62 | 29 7 | |
| TUS=220-240KSI | BILLET | 0 00 | 10 00 | 1ST HALF DRY CYCLE | | | | 3 28 | | |
| TUS=220-240KSI | BILLET | 0 00 | 1 00 | 2ND HALF DRY CYCLE | | | | 2 70 | 25 8 | |
| TUS 220-240KSI | BILLET | 0 00 | 10 00 | 2ND HALF DRY CYCLE | | | | 3 27 | | |

TABLE 6.8.1.7

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT: DRY AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ------ | PLATE | 0.50 | 0.10 | | | | | 7.16 | | |
| | PLATE | 0.80 | 1.00 | | | | 14.7 | | | |

TABLE 6.8.1.8

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.30

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT L H A AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1550F 2HRS OQ, -100F 1HR 1025F 2+2HR | FORGED BAR | 0 08 | 6 00 | | | | | 5 13 | | |
| 1550F 2HRS OQ, -100F 8HRS, 1000F 2+2HRS | FORGED BAR | 0 08 | 6 00 | | | | | 3 58 | 46 7 | |

TABLE 6.8.1.9

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT H20 SATURATED JP4 FUEL AT R.T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- | PLATE | 0.00 | 15.00 | | | | | 2.49 | | |
| | PLATE | 0.10 | 0.10 | | | | | | 67.7 | |
| | PLATE | 0.10 | 1.00 | | | | | | 49.2 | |
| | PLATE | 0.50 | 0.10 | | | | | 8.46 | | |
| | PLATE | 0.50 | 1.00 | | | | | 7.88 | | |

TABLE 6.8.1.10

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT DIST WATER AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- | PLATE | 0 00 | 15 00 | | | | | 2 86 | | |
| | PLATE | 0 10 | 0 10 | | | | | | 336 | |
| | PLATE | 0 10 | 1 00 | | | | | | 51. 7 | |
| | PLATE | 0 50 | 1 00 | | | | | 24. 0 | | |

TABLE 6.8.1.11

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT 3.5% NACL AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- | PLATE | 0.00 | 15.00 | | | | | 3.02 | | |
| | PLATE | 0.10 | 0.10 | | | | | | 114 | |
| | PLATE | 0.10 | 1.00 | | | | | | 53.6 | |
| | PLATE | 0.50 | 0.10 | | | | | 18.7 | | |
| | PLATE | 0.50 | 1.00 | | | | | 11.3 | | |
| | PLATE | 0.80 | 0.10 | | | | 71.3 | 293 | | |

TABLE 6.8.1.12

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT S T W AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- | PLATE | 0 10 | 0 10 | | | | | | 208 | |
| | PLATE | 0 10 | 1 00 | | | | | | 67 0 | |
| | PLATE | 0 50 | 1 00 | | | | | 9 57 | | |
| 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR | FORGED BAR | 0 08 | 1 00 | | | | 0 68 | 4 84 | | |

TABLE 6.8.2.1

ALLOY STEEL HP 9-4-.30 K(IC)

| CONDITION | FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | F | 1.25 | 81 | L-T | 207.5 | 2.529 | 1.245 | CT | 1.273 | 0.65 | 106.10 | | | 1977 | MA005 |
| | | 1.25 | | | 207.5 | 2.519 | 1.245 | CT | 1.263 | 0.67 | 108.19 | 107.1/ | 1.5 | 1977 | MA005 |
| ---------- | F | 1.25 | 81 | T-L | 208.3 | 2.523 | 1.246 | CT | 1.258 | 0.58 | 101.10 | | | 1977 | MA005 |
| | | 1.25 | | | 208.3 | 2.534 | 1.246 | CT | 1.293 | 0.58 | 101.10 | 101.1/ | 0.0 | 1977 | MA005 |
| HEAT TREATED TO 49 RC HARDNESS | P | 3.25 | R.T. | T-L | 189.0 | 2.004 | 1.005 | NB | 0.990 | 0.52 | 86.00 | | | 1971 | 84029 |
| | | 3.25 | | | 189.0 | [illegible] | 1.005 | NB | 1.010 | 0.44 | 78.90 | | | 1971 | 84029 |
| | | | | | | | | | | | | 82.5/ | 5.0 | | |
| 1525F,OQ,-100F 3HR,1050F 4HR | F | 3.00 | - 65 | T-L | 175.0 | 5.000 | 1.900 | CT | ---- | 1.64 | 142.00 | | | 1974 | 90011 |
| 1650F 1-2HR AC | F | 3.00 | - 65 | L-T | 220.0 | 3.000 | 1.000 | CT | ---- | 0.23 | 67.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ | | 3.00 | | | 220.0 | 3.000 | 1.000 | CT | ---- | 0.22 | 66.00 | | | 1974 | 90011 |
| ,-100F 1-3HR, 1000F 4HR | | | | | | | | | | | | 66.5/ | 0.7 | | |
| 1650F 1-2HR AC | F | 3.00 | R.T. | L-T | 205.0 | 3.000 | 1.000 | CT | ---- | 0.80 | 116.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ,-100F 1-3HR 1025F 4HR | | | | | | | | | | | | | | | |
| 1650F 1-2HR AC | F | 3.00 | R.T. | L-T | 206.0 | 3.000 | 1.000 | CT | ---- | 0.65 | 105.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ | | 3.00 | | | 206.0 | 3.000 | 1.000 | CT | ---- | 0.67 | 107.00 | | | 1974 | 90011 |
| ,-100F 1-3HR, 1000F 4HR | | | | | | | | | | | | 106.0/ | 1.4 | | |
| 1650F 1-2HR AC | F | 3.00 | R.T. | T-L | 200.0 | 3.000 | 1.000 | CT | ---- | 0.47 | 87.00 | | | 1972 | 84306 |
| 1525F 1-2HR OQ | | 3.00 | | | 200.0 | 3.000 | 1.000 | CT | ---- | 0.48 | 88.10 | | | 1974 | 90011 |
| ,-100F 1-3HR, 1050F 4HR | | | | | | | | | | | | 87.6/ | 0.8 | | |
| 1650F 1-2HR AC | F | 3.00 | R.T. | T-L | 205.0 | 3.000 | 1.000 | CT | ---- | 0.51 | 93.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ | | 3.00 | | | 205.0 | 3.000 | 1.000 | CT | ---- | 0.52 | 94.00 | | | 1974 | 90011 |
| ,-100F 1-3HR 1025F 4HR | | | | | | | | | | | | 93.5/ | 0.7 | | |
| 1650F 1-2HR AC | F | 3.00 | R.T. | T-L | 206.0 | 3.000 | 1.000 | CT | ---- | 0.43 | 86.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ,-100F 1-3HR, 1000F 4HR | | | | | | | | | | | | | | | |

TABLE 6.8.2.1 (Con't)

ALLOY STEEL HP 9-4- 30 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1-2HR AC | F | 3.00 | R.T. | T-L | 215.0 | 3.000 | 1.000 | CT | ---- | 0.46 | 92.00 | | | 1974 | 90011 |
| 1525F 1-2HR OQ | | 3.00 | | | 215.0 | 3.000 | 1.000 | CT | ---- | 0.43 | 89.00 | | | 1974 | 90011 |
| ,-100F 1-3HR, 1000F 4HR | | | | | | | | | | | | 89.0/ | 3.0 | | |
| 1650F 2HRS AC, | F | ---- | R.T. | --- | 201.8 | 2.008 | 0.997 | CT | 1.024 | 0.80 | 114.20 | | | 1977 | AM002 |
| 1550F 2HR OQ, -100F 2HR AC, 1000F 4HR, AC, 1000F 4HR, AC | | | | | | | | | | | | | | | |
| 1650F, 2HR AC | F | 3.25 | R.T. | L-T | 192.0 | 4.014 | 2.016 | CT | 1.997 | 0.48 | 82.00 | | | 1974 | 88136 |
| 1550F 2HR OQ | | 3.25 | | | 192.0 | 4.003 | 2.015 | CT | 1.933 | 0.48 | 82.00 | | | 1974 | 88136 |
| 1000F 2+2HR AC | | | | | | | | | | | | 82.0/ | 0.0 | | |
| 1650F,AC,1525F | F | 3.00 | R.T. | T-L | 197.0 | 3.000 | 1.000 | CT | ---- | 0.67 | 102.00 | | | 1974 | 90011 |
| 1-2HR,OQ,-100F 1-3HR, 1050F 4HR | | | | | | | | | | | | | | | |

TABLE 6.8.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. H2O SATURATED JP-4 FUEL | E= R.T. DIST. WATER | E= R.T. 3.5% NACL | |
| DELTA K MIN | A: | 16.82 | 1.76 | | | |
| | B: | 14.06 | | .486 | | |
| | C: | 12.13 | | | .768 | |
| | D: | | | | | |
| | | 13.00 | | | .880 | |
| | | 16.00 | | 1.09 | 1.50 | |
| | | 20.00 | 2.49 | 2.86 | 3.02 | |
| | | 25.00 | 4.93 | 5.39 | 6.14 | |
| | | 30.00 | 9.01 | 8.58 | 10.2 | |
| DELTA K MAX | A: | 32.11 | 11.1 | | | |
| | B: | 32.59 | | 10.9 | | |
| | C: | 31.67 | | | 11.6 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.46 | 16.31 | 10.25 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.00
FREQUENCY: 15.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

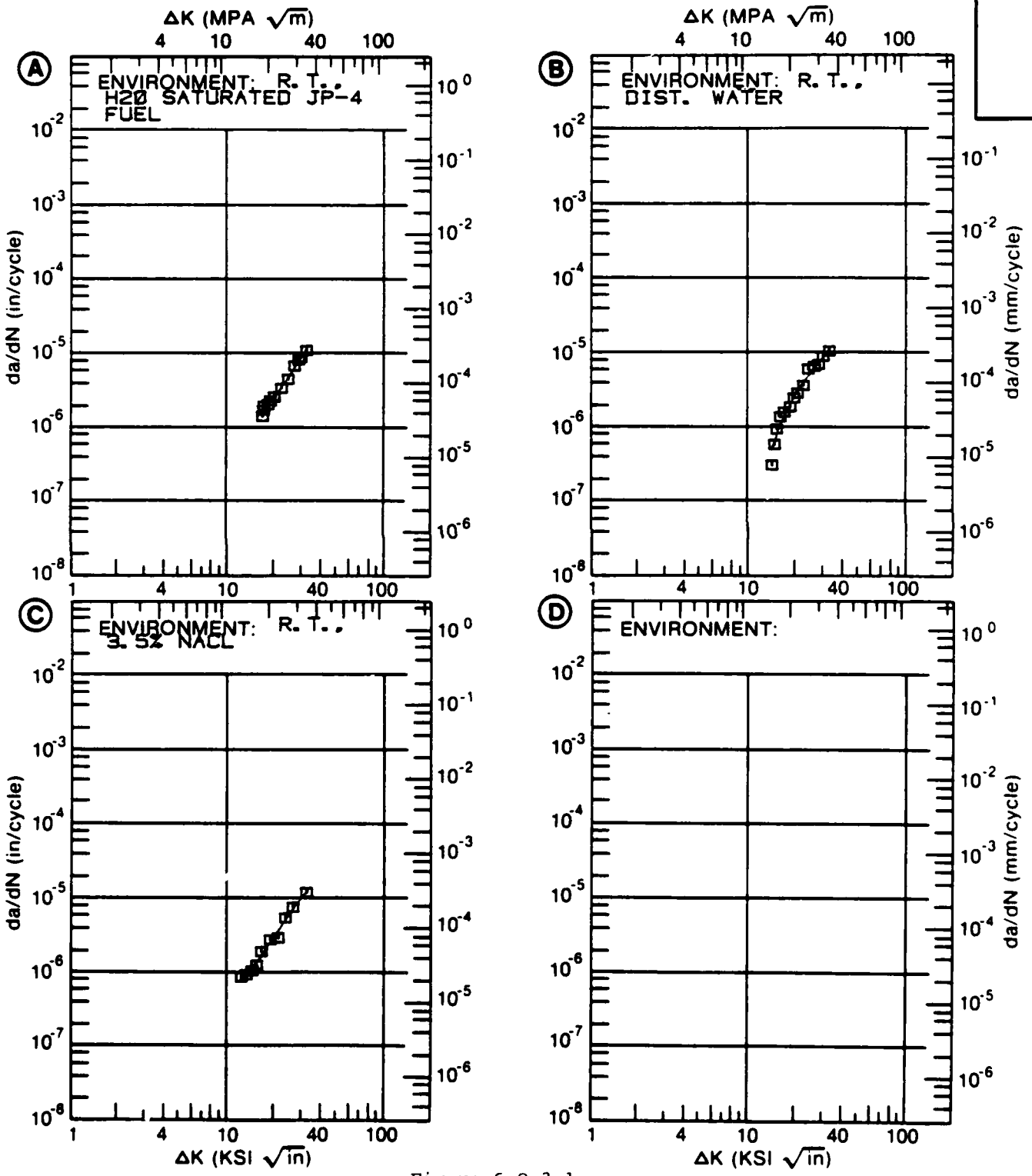



Figure 6.8.3.1

TABLE 6.8.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. H2O SATURATED JP-4 FUEL | E= R.T. ALT. JP-4 FUEL & DIST. WATER | E= R.T. DIST. WATER | |
| DELTA K MIN | A: | 32.39 | 17.4 | | | |
| | B: | 31.49 | | 16.3 | | |
| | C: | 33.22 | | | 25.6 | |
| | D: | | | | | |
| | | 35.00 | 19.8 | 23.3 | 25.7 | |
| | | 40.00 | 25.5 | 32.8 | 28.7 | |
| | | 50.00 | 49.2 | 60.1 | 51.7 | |
| | | 60.00 | 131. | 141. | 136. | |
| | | 70.00 | 480. | 474. | 472. | |
| | | 80.00 | | 2264. | 1984. | |
| DELTA K MAX | A: | 79.89 | 2259. | | | |
| | B: | 82.06 | | 3250. | | |
| | C: | 81.07 | | | 2335. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 15.69 | 20.13 | 13.20 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

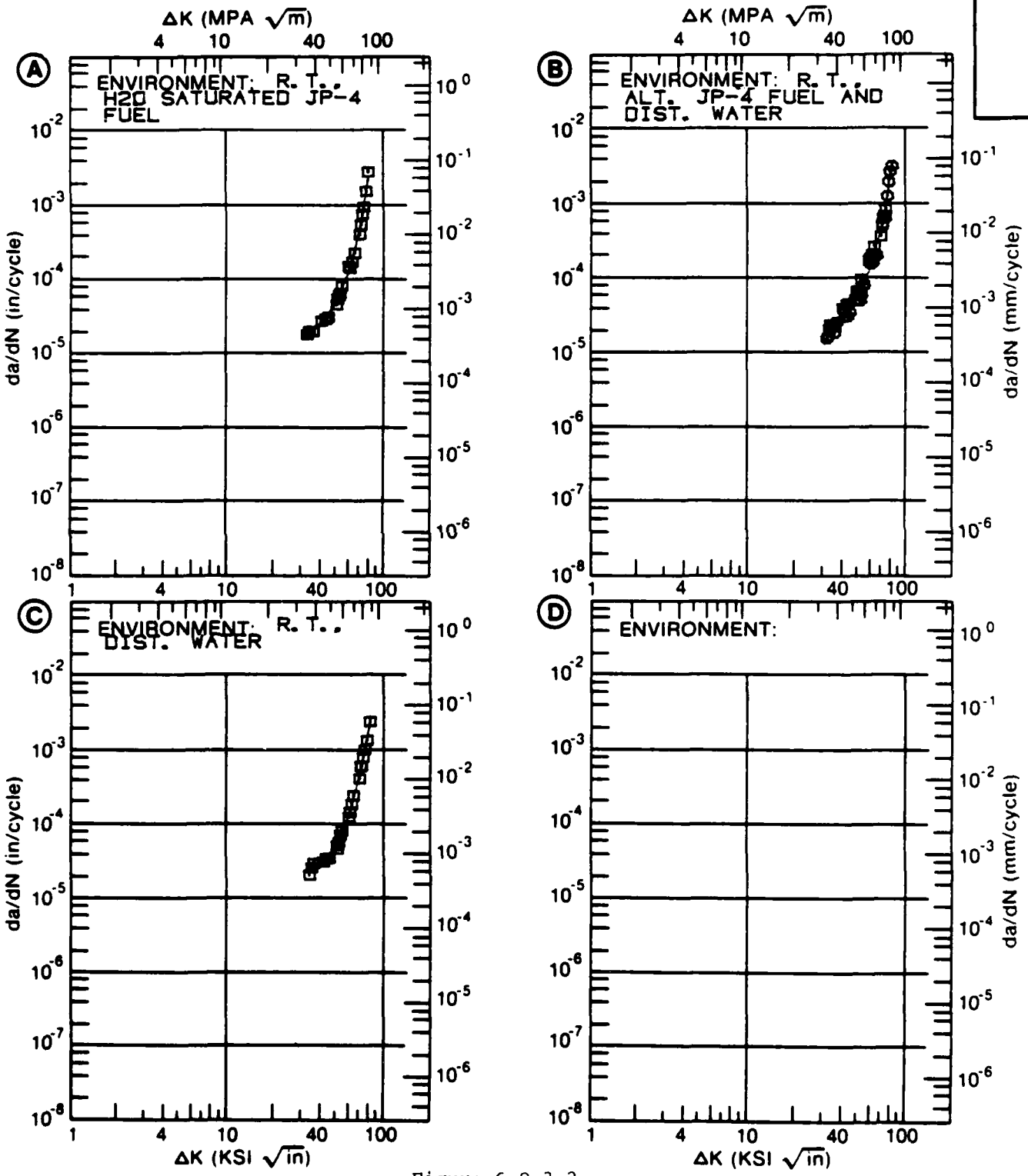



Figure 6.8.3.2

TABLE 6.8.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. 3.5% NACL | E= R.T. S.T.W. | | |
| DELTA K MIN | A: | 33.69 | 16.1 | | | |
| | B: | 33.79 | | 17.7 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 35.00 | 18.3 | 20.1 | | |
| | | 40.00 | 26.9 | 31.2 | | |
| | | 50.00 | 53.6 | 67.0 | | |
| | | 60.00 | 135. | 171. | | |
| | | 70.00 | 478. | 574. | | |
| | | 80.00 | 2374. | | | |
| DELTA K MAX | A: | 81.70 | 3215. | | | |
| | B: | 74.63 | | 1106. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 19.65 | 8.94 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

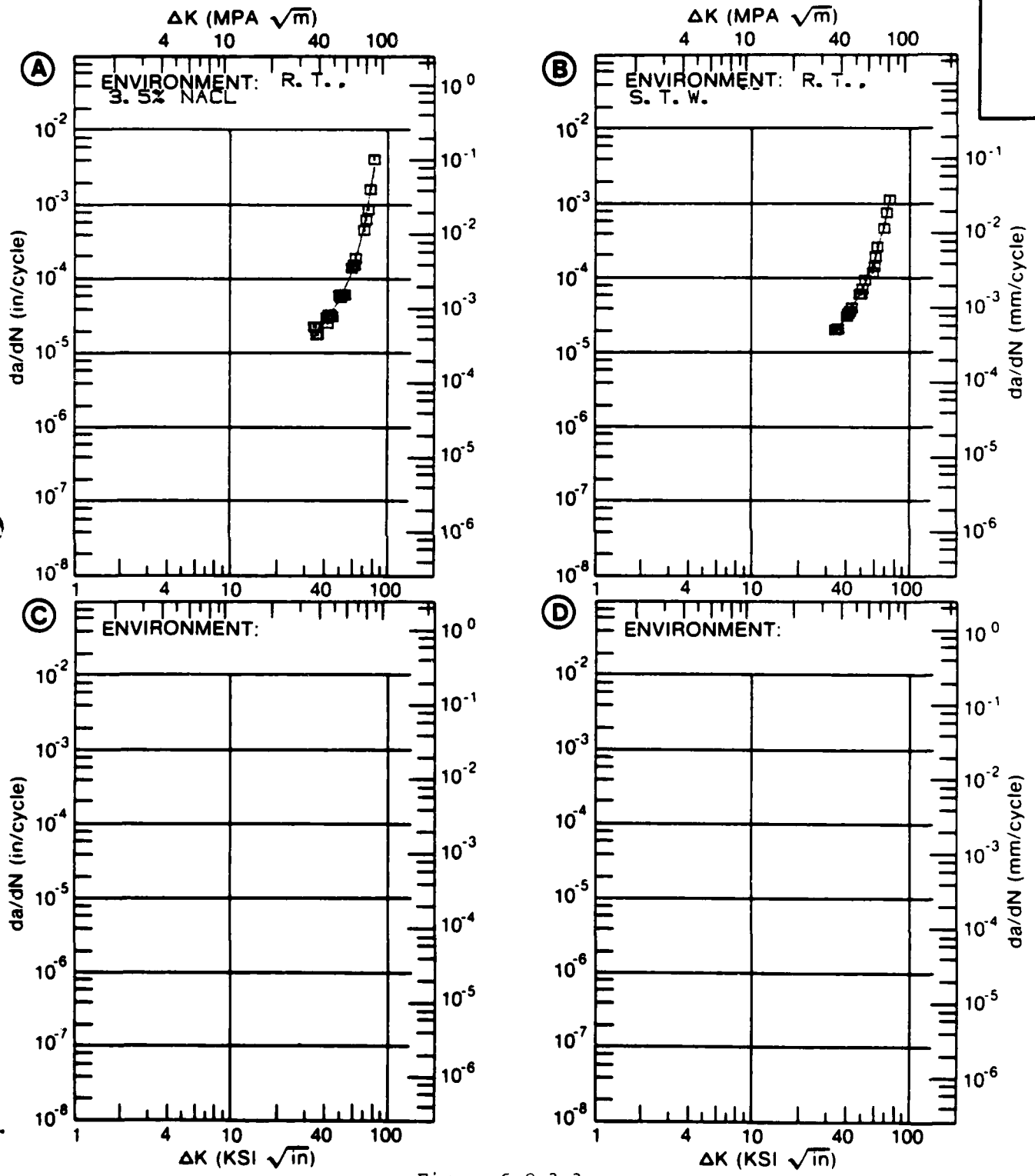



Figure 6.8.3.3

TABLE 6.8.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E= R.T. H20 SATURATED JP-4 FUEL | E= R.T. DIST. WATER | E= R.T. 3.5% NACL | E= R.T. S.T.W. |
| DELTA K MIN | A: | 42.02 | 37.3 | | | |
| | B: | 32.63 | | 172. | | |
| | C: | 33.47 | | | 81.3 | |
| | D: | 32.86 | | | | 74.2 |
| | | 35.00 | | 206. | 84.1 | 104. |
| | | 40.00 | | 264. | 93.6 | 165. |
| | | 50.00 | 67.7 | 336. | 114. | 208. |
| | | 60.00 | 141. | 380. | 135. | 203. |
| | | 70.00 | 510. | 430. | 156. | 214. |
| | | 80.00 | 3795. | | | 268. |
| DELTA K MAX | A: | 81.35 | 5261. | | | |
| | B: | 74.25 | | 459. | | |
| | C: | 74.38 | | | 165. | |
| | D: | 80.85 | | | | 275. |
| ROOT MEAN SQUARE PERCENT ERROR | | | 27.30 | 14.62 | 6.96 | 22.52 |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 0.10 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

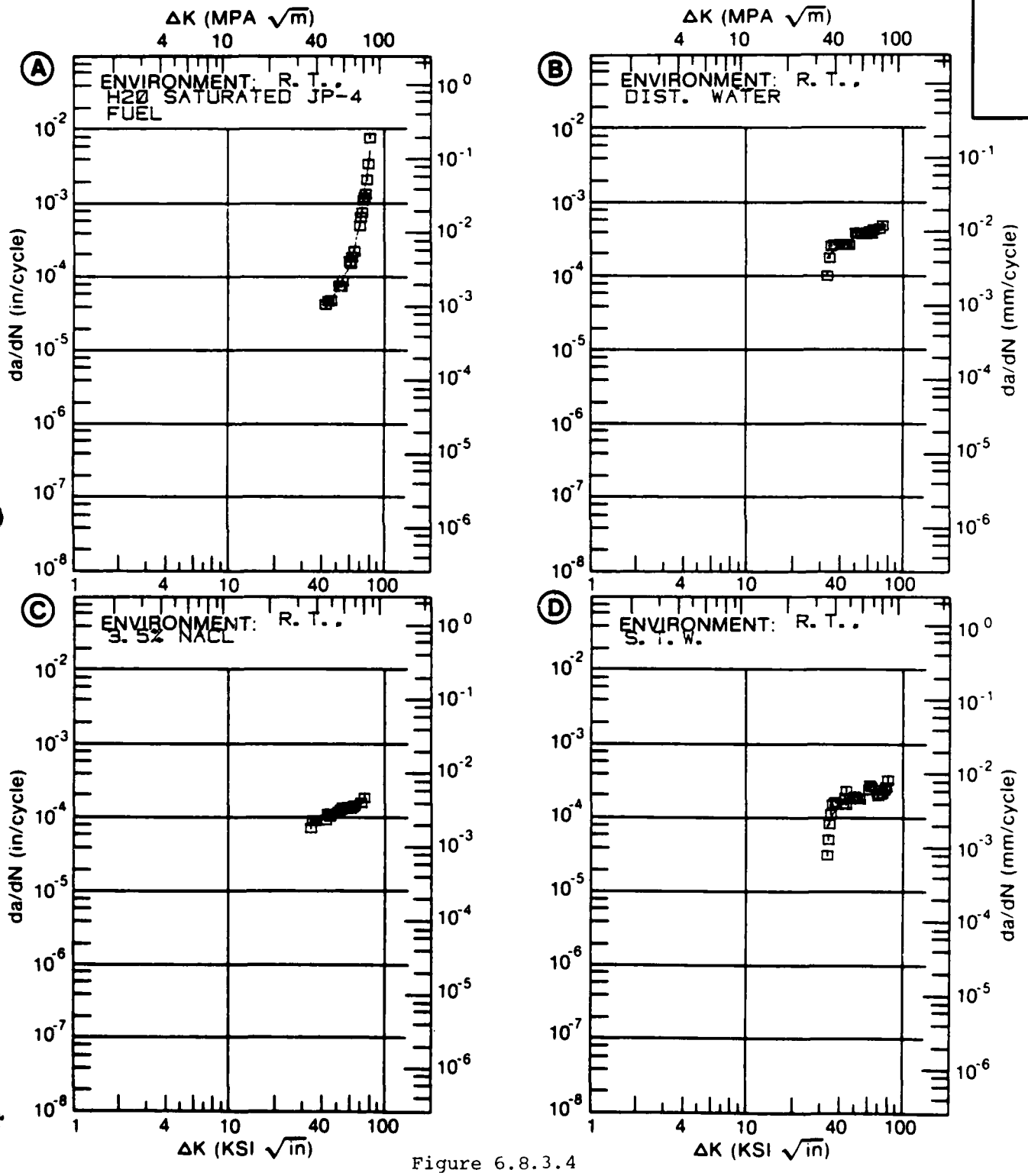



Figure 6.8.3.4

TABLE 6.8.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. 3.5% NACL | E= R.T. S.T.W. | | |
| DELTA K MIN | A: | 17.66 | 7.08 | | | |
| | B: | 17.33 | | 5.32 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 11.3 | 9.57 | | |
| | | 25.00 | 14.4 | 15.8 | | |
| | | 30.00 | 20.4 | 24.4 | | |
| | | 35.00 | 51.2 | 48.1 | | |
| | | 40.00 | 251. | 130. | | |
| DELTA K MAX | A: | 43.14 | 946. | | | |
| | B: | 43.96 | | 360. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 15.04 | 9.73 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

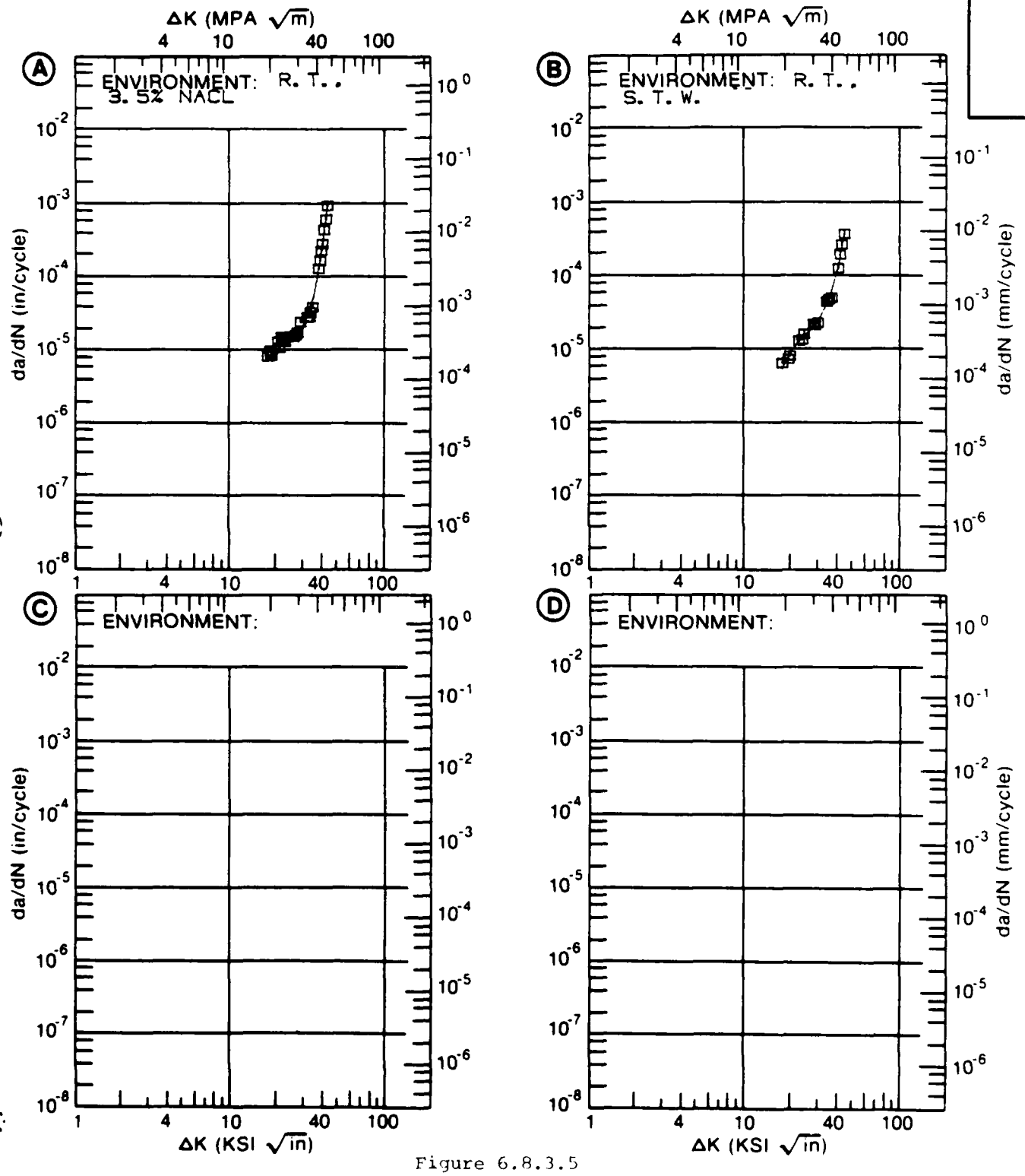



Figure 6.8.3.5

TABLE 6.8.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CLE) A | B | D |
|---|---|---|---|---|---|
| | | | E= R.T. H2O SATURATED JP-4 FUEL | E= R.T. DIST. WATER | |
| DELTA K MIN | A: | 17.61 | 5.31 | | |
| | B: | 17.35 | | 17.0 | |
| | C: | | | | |
| | D: | | | | |
| | | 20.00 | 7.88 | 24.0 | |
| | | 25.00 | 13.0 | 31.8 | |
| | | 30.00 | 24.3 | 37.3 | |
| | | 35.00 | 63.4 | 45.6 | |
| | | 40.00 | 240. | 61.2 | |
| DELTA K MAX | A: | 44.83 | 1210. | | |
| | B: | 42.67 | | 74.9 | |
| | C: | | | | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 23.03 | 12.53 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

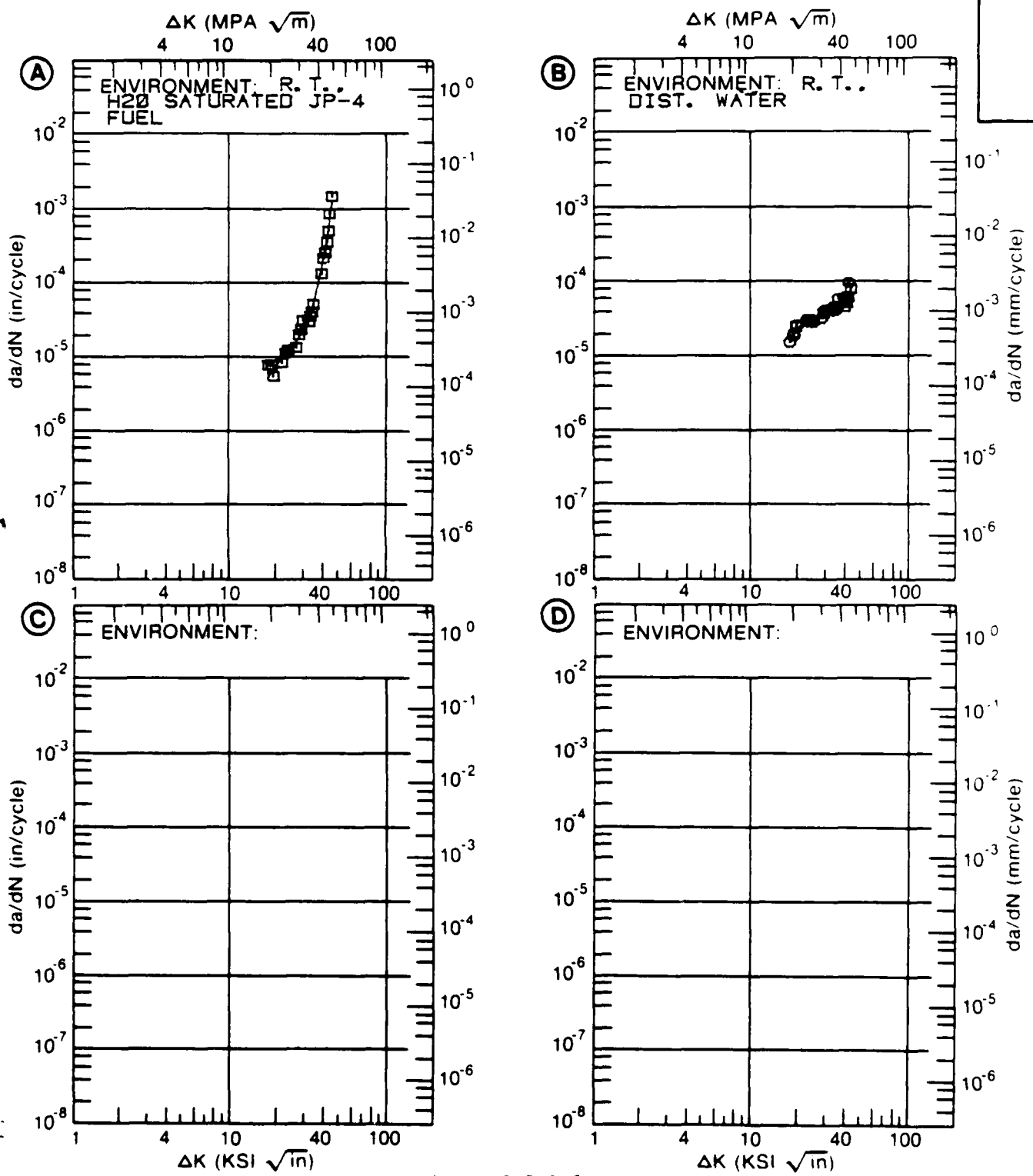



Figure 6.8.3.6

TABLE 6.8.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. DRY AIR | E= R.T. H2O SATURATED JP-4 FUEL | E= R.T. 3.5% NACL | |
| DELTA K MIN | A: | 18.49 | 4.31 | | | |
| | B: | 19.18 | | 7.07 | | |
| | C: | 19.21 | | | 15.1 | |
| | D: | | | | | |
| | | 20.00 | 7.16 | 8.46 | 18.7 | |
| | | 25.00 | 13.2 | 15.5 | 37.6 | |
| | | 30.00 | 19.2 | 25.4 | 48.0 | |
| | | 35.00 | 45.4 | 57.1 | 59.1 | |
| | | 40.00 | 213. | 195. | 82.0 | |
| DELTA K MAX | A: | 46.29 | 3988. | | | |
| | B: | 48.48 | | 4021. | | |
| | C: | 45.63 | | | 145. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 33.08 | 35.71 | 17.05 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.50
FREQUENCY: 0.10 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

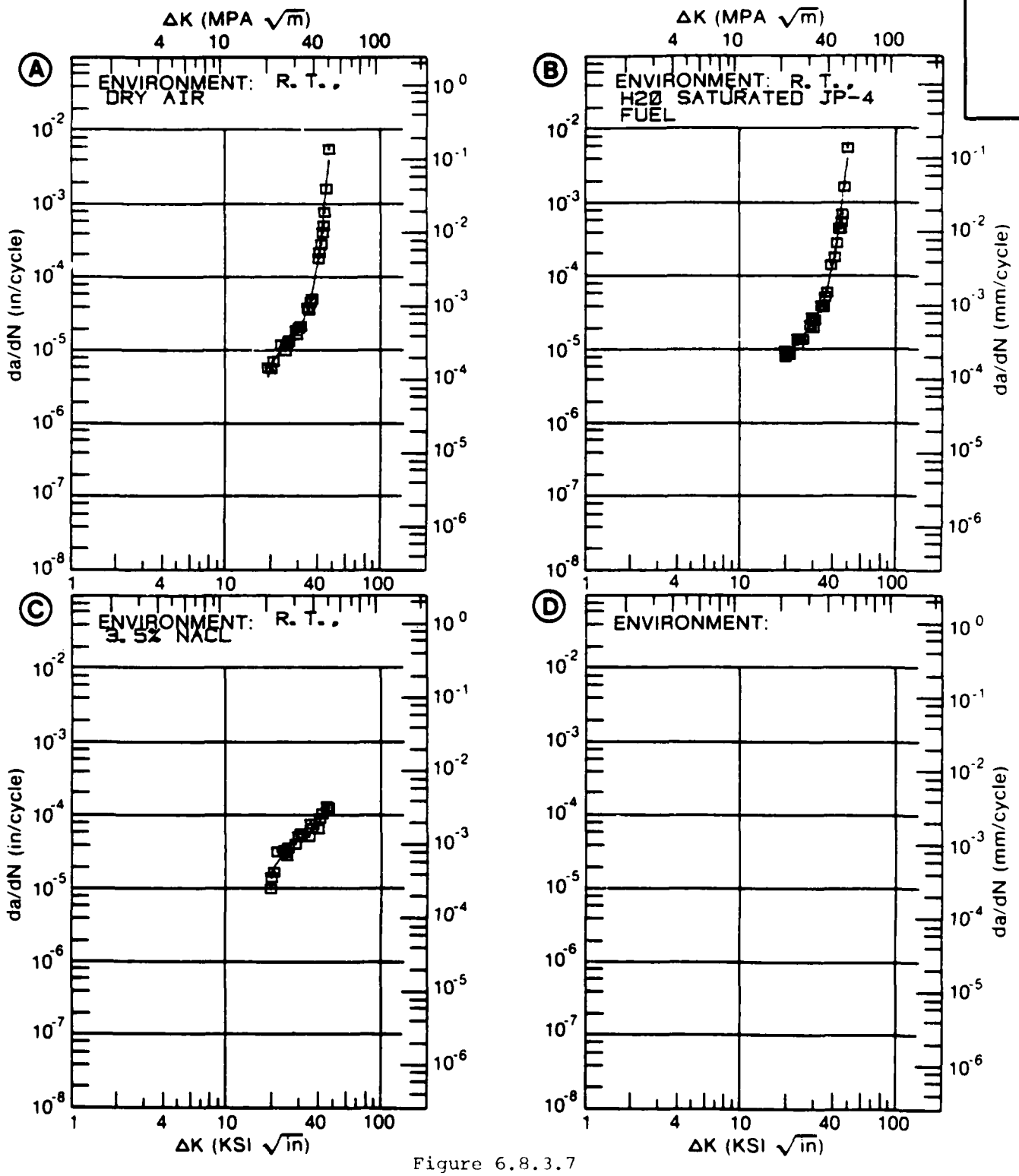



Figure 6.8.3.7

TABLE 6.8.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. DRY AIR | | | |
| DELTA K MIN A: | 7.57 | 5.23 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 8.00 | 8.99 | | | |
| | 9.00 | 12.5 | | | |
| | 10.00 | 14.7 | | | |
| | 13.00 | 35.7 | | | |
| | 16.00 | 320. | | | |
| DELTA K MAX A: | 16.27 | 397. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 31.55

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.80
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

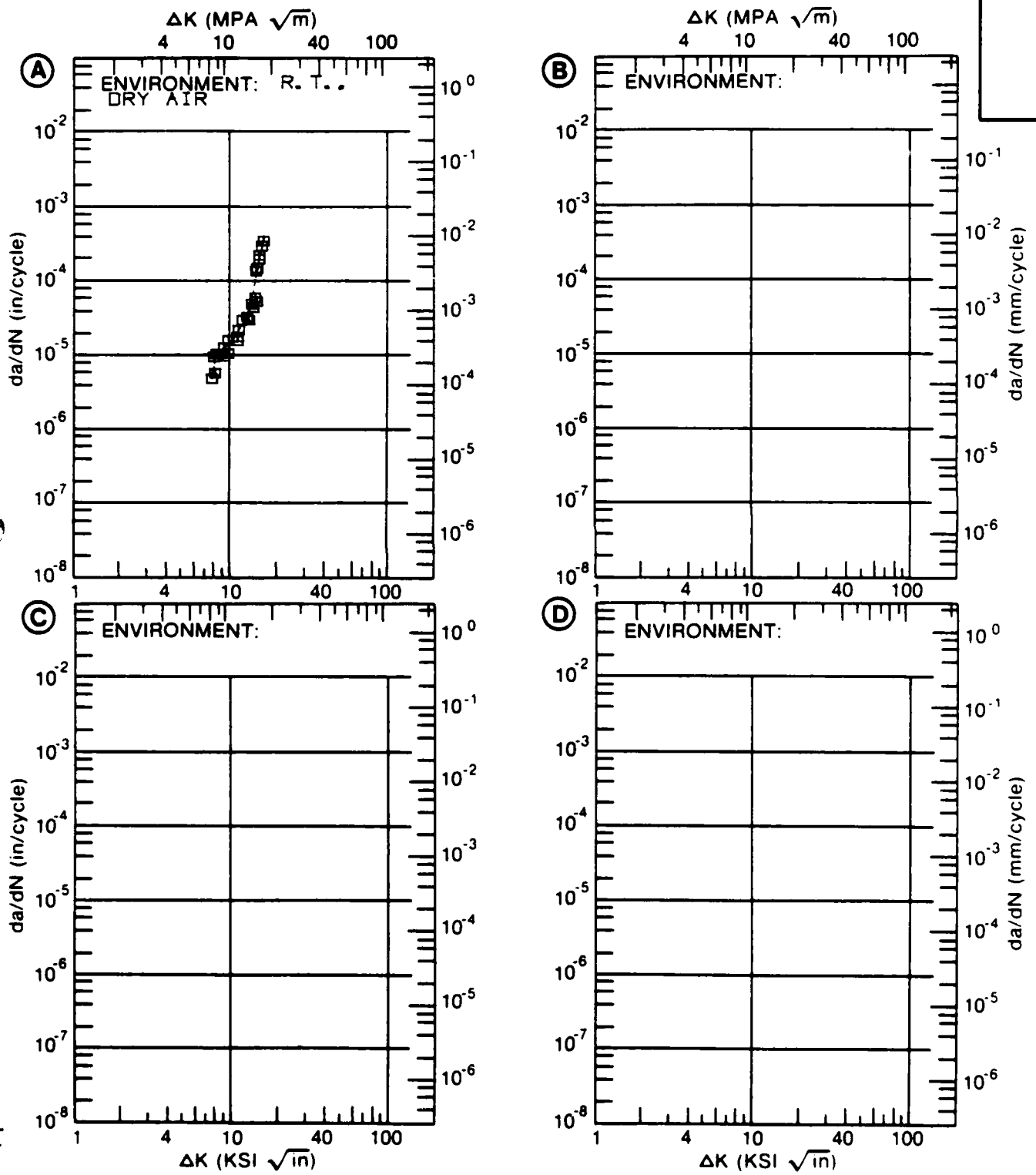



Figure 6.8.3.8

TABLE 6.8.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. 3.5% NACL | | | |
| DELTA K MIN | A: | 7.53 | 9.22 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | 15.6 | | | |
| | | 9.00 | 37.7 | | | |
| | | 10.00 | 71.3 | | | |
| | | 13.00 | 201. | | | |
| | | 16.00 | 287. | | | |
| | | 20.00 | 293. | | | |
| DELTA K MAX | A: | 20.05 | 293. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 23.29

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.80
FREQUENCY: 0.10 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY STEEL

HP9-4-.30

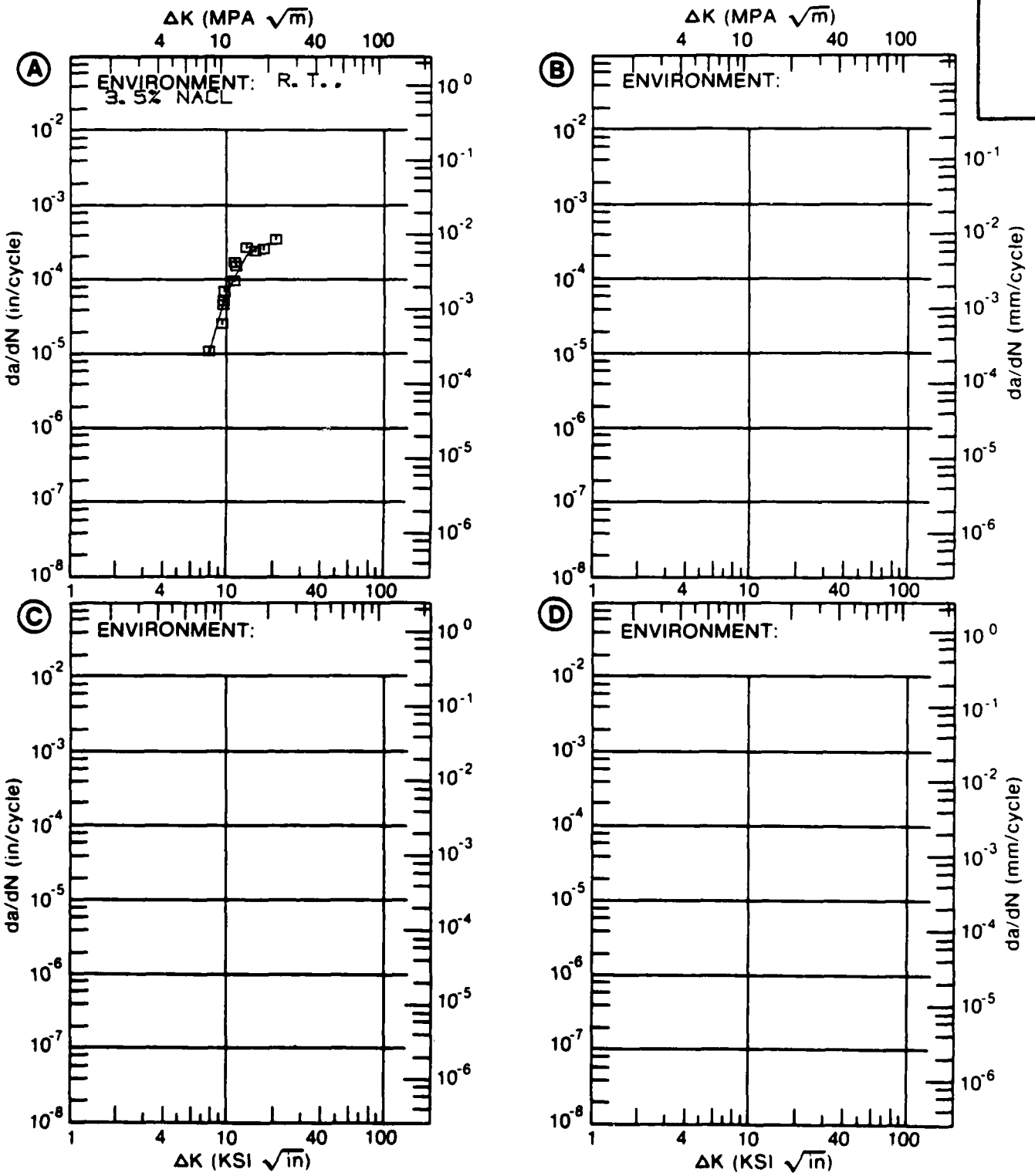



Figure 6.8.3.9

TABLE 6.8.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR 1HZ | E= R.T. LAB AIR 10HZ | E= R.T. 3.5% NACL 1HZ | |
| DELTA K MIN | A: | 21.66 | 6.29 | | | |
| | B: | 12.31 | | .880 | | |
| | C: | 21.78 | | | 5.82 | |
| | D: | | | | | |
| | | 13.00 | | 1.05 | | |
| | | 16.00 | | 1.96 | | |
| | | 20.00 | | 3.59 | | |
| | | 25.00 | 7.96 | 6.34 | 7.60 | |
| | | 30.00 | 11.6 | 10.1 | 11.3 | |
| | | 35.00 | 17.0 | 15.4 | 16.3 | |
| | | 40.00 | 24.4 | 22.6 | 22.9 | |
| | | 50.00 | 46.4 | 46.6 | 42.8 | |
| | | 60.00 | 79.8 | | | |
| | | 70.00 | 126. | | | |
| DELTA K MAX | A: | 75.97 | 159. | | | |
| | B: | 56.90 | | 75.0 | | |
| | C: | 55.81 | | | 59.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 2.86 | 3.82 | 2.80 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | 1 | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 2.50"TH BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 192.5 KSI
ULT. STRENGTH: 228.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: 88136

ALLOY STEEL

HP9-4-.30

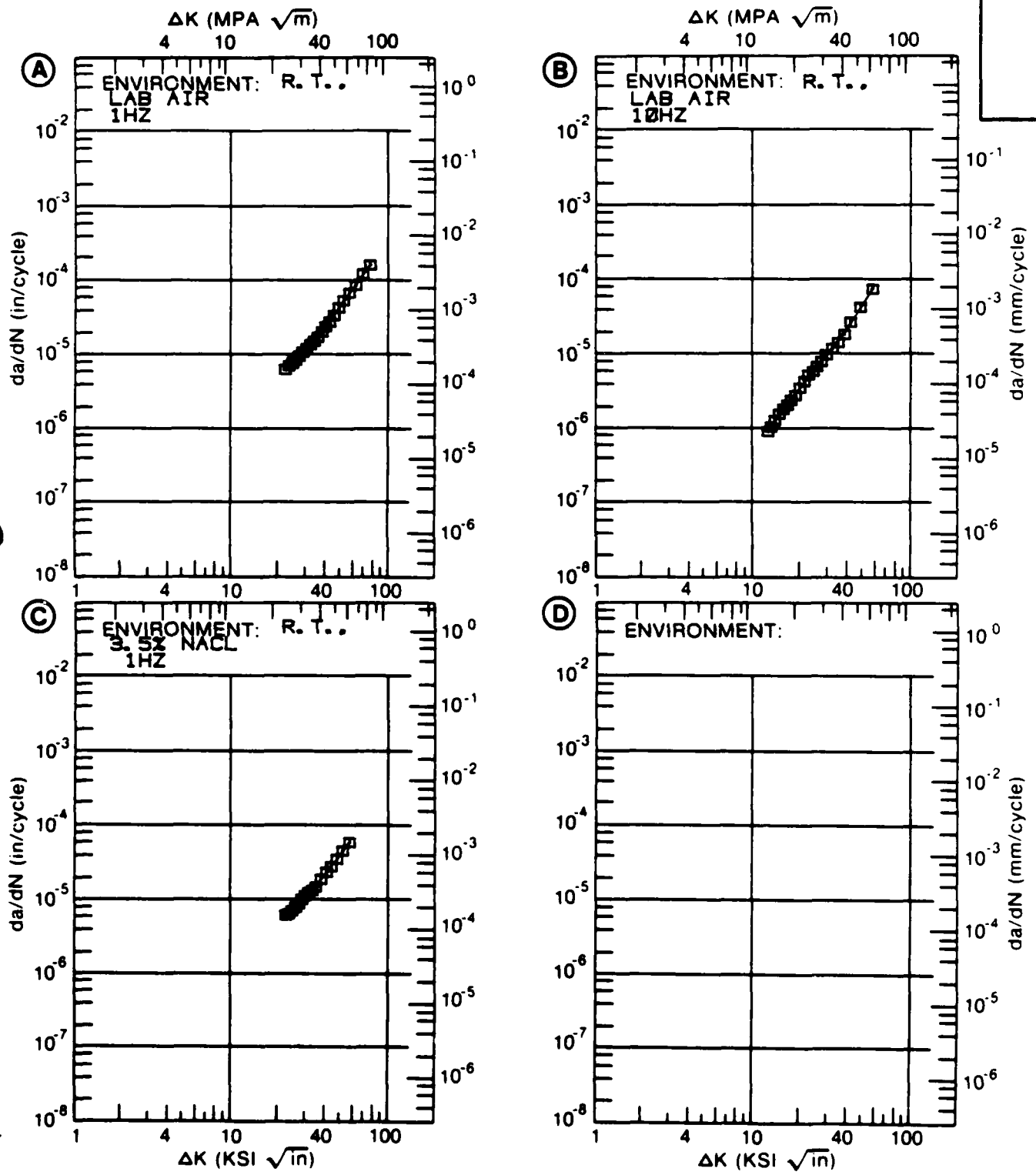



Figure 6.8.3.10

TABLE 6.8.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. LAB AIR 5-20HZ | E= R.T. SIM SEA WATER .1-15HZ | | |
| DELTA K MIN A: | 6.38 | .110 | | | |
| DELTA K MIN B: | 20.13 | | 1.96 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 7.00 | .138 | | | |
| | 8.00 | .200 | | | |
| | 9.00 | .286 | | | |
| | 10.00 | .399 | | | |
| | 13.00 | .901 | | | |
| | 16.00 | 1.63 | | | |
| | 20.00 | 2.99 | | | |
| | 25.00 | 5.40 | 5.37 | | |
| | 30.00 | 8.83 | 9.86 | | |
| | 35.00 | 13.6 | 15.3 | | |
| | 40.00 | 20.0 | 21.6 | | |
| | 50.00 | 38.9 | 37.3 | | |
| | 60.00 | 63.8 | 58.7 | | |
| | 70.00 | 89.2 | 89.4 | | |
| | 80.00 | | 135. | | |
| | 90.00 | | 203. | | |
| | 100.00 | | 306. | | |
| | 130.00 | | 961. | | |
| DELTA K MAX A: | 71.24 | 92.1 | | | |
| DELTA K MAX B: | 139.67 | | 1271. | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 18.91 | 16.17 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 204.5 KSI
ULT. STRENGTH: 230.5 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005

ALLOY STEEL

HP9-4-.30

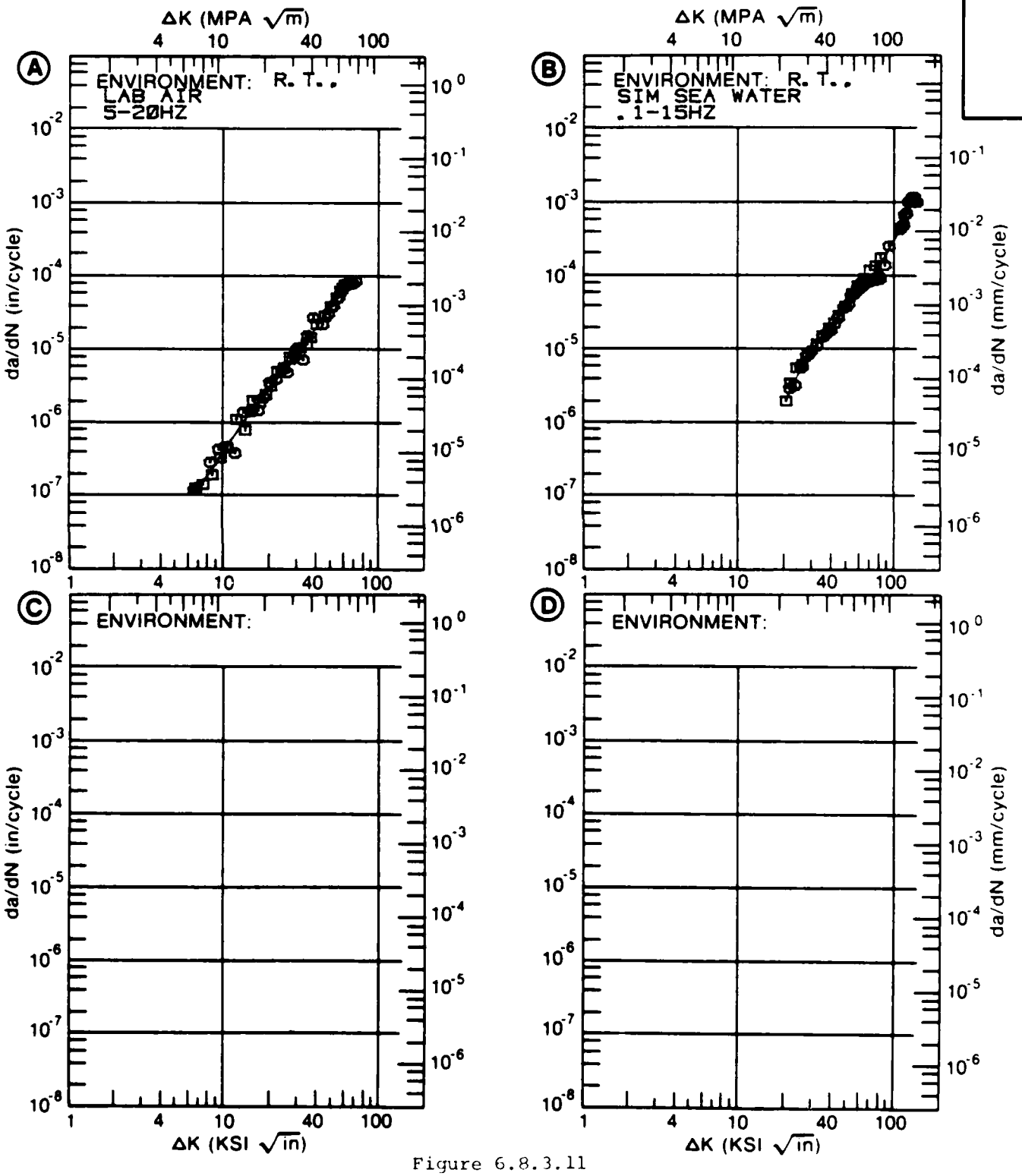



Figure 6.8.3.11

TABLE 6.8.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.12 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR .1-20HZ | E= R.T. SIM SEA WATER .1-15HZ | | |
| DELTA K MIN | A: | 7.13 | .181 | | | |
| | B: | 15.09 | | .791 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | .208 | | | |
| | | 9.00 | .282 | | | |
| | | 10.00 | .399 | | | |
| | | 13.00 | .979 | | | |
| | | 16.00 | 1.82 | .994 | | |
| | | 20.00 | 3.34 | 2.45 | | |
| | | 25.00 | 5.97 | 5.44 | | |
| | | 30.00 | 9.65 | 9.38 | | |
| | | 35.00 | 14.8 | 14.4 | | |
| | | 40.00 | 21.9 | 20.9 | | |
| | | 50.00 | 45.8 | 41.6 | | |
| | | 60.00 | 95.5 | 82.3 | | |
| | | 70.00 | 205. | 166. | | |
| | | 80.00 | 458. | 345. | | |
| | | 90.00 | 996. | 732. | | |
| | | 100.00 | 1883. | 1867. | | |
| DELTA K MAX | A: | 111.38 | 3048. | | | |
| | B: | 110.08 | | 9836. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 20.12 | 19.19 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: T-L
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 206.0 KSI
ULT. STRENGTH: 233.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005

ALLOY STEEL

HP9-4-.30

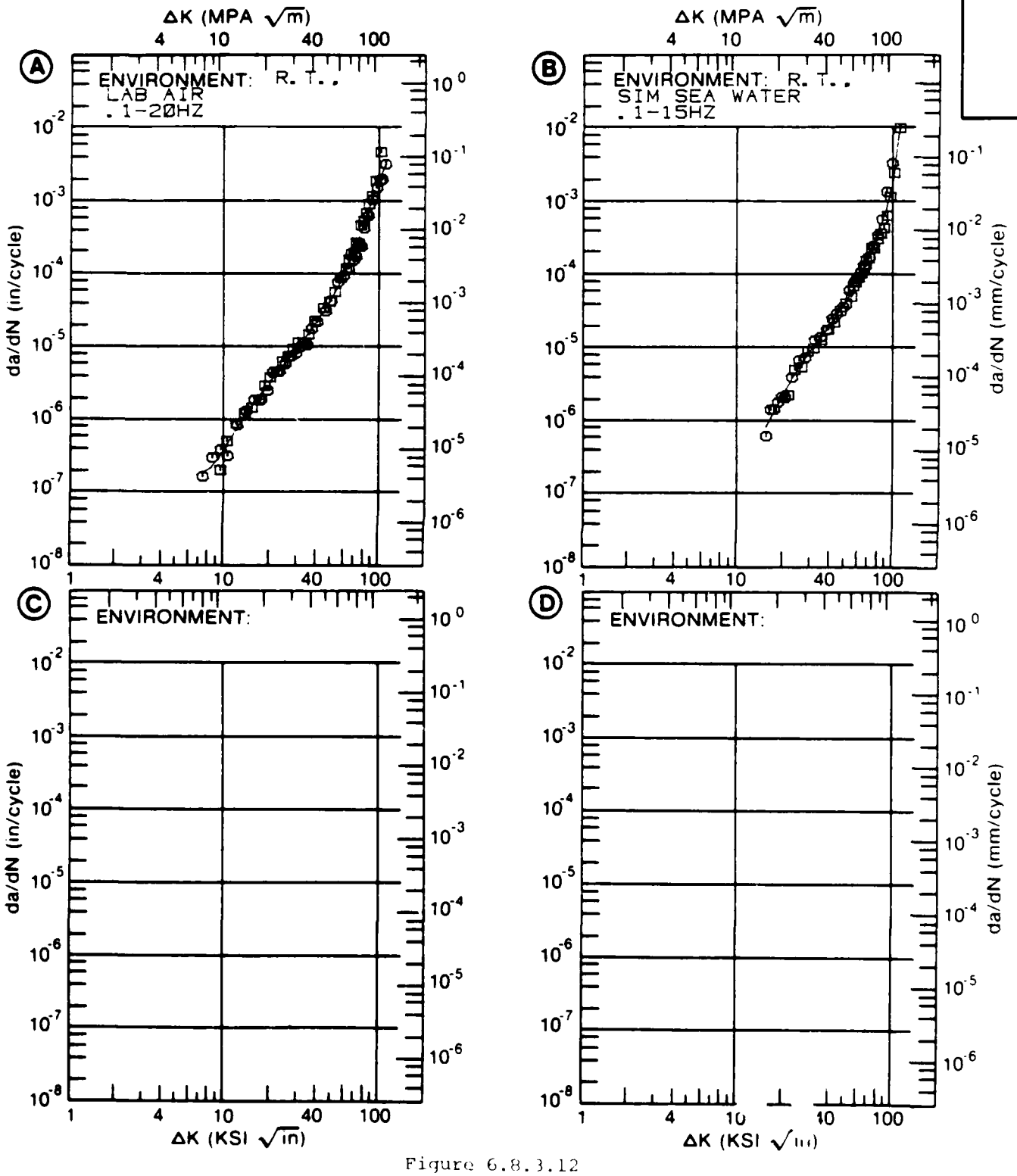



Figure 6.8.3.12

TABLE 6.8.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.13 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: UTS=220-240KSI
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=-1.00 | R=+0.00 | R=+0.50 | |
| DELTA K MIN A: | 11.76 | .708 | | | |
| DELTA K MIN B: | 11.75 | | .562 | | |
| DELTA K MIN C: | 5.78 | | | .191 | |
| DELTA K MIN D: | | | | | |
| | 6.00 | | | .213 | |
| | 7.00 | | | .336 | |
| | 8.00 | | | .497 | |
| | 9.00 | | | .700 | |
| | 10.00 | | | .948 | |
| | 13.00 | 1.01 | .835 | 1.98 | |
| | 16.00 | 1.94 | 1.72 | 3.49 | |
| | 20.00 | 3.62 | 3.34 | 6.26 | |
| | 25.00 | 6.31 | 5.92 | 10.9 | |
| | 30.00 | 9.64 | 8.99 | 16.8 | |
| | 35.00 | 13.6 | 12.5 | 23.8 | |
| | 40.00 | 18.4 | 16.5 | 31.6 | |
| | 50.00 | 30.0 | 25.9 | 49.3 | |
| | 60.00 | 43.0 | 37.9 | | |
| | 70.00 | 61.4 | 53.4 | | |
| | 80.00 | 99.2 | 73.2 | | |
| | 90.00 | | 98.8 | | |
| | 100.00 | | 132. | | |
| DELTA K MAX A: | 85.73 | 141. | | | |
| DELTA K MAX B: | 118.22 | | 283. | | |
| DELTA K MAX C: | 58.56 | | | 65.7 | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 11.42 | 13.18 | 10.66 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: UTS=220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH: 210.5- 212.0 KSI
ULT. STRENGTH: 228.5- 229.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900- 4.000"
REFERENCES: MA007, MA010

ALLOY STEEL

HP9-4-.30

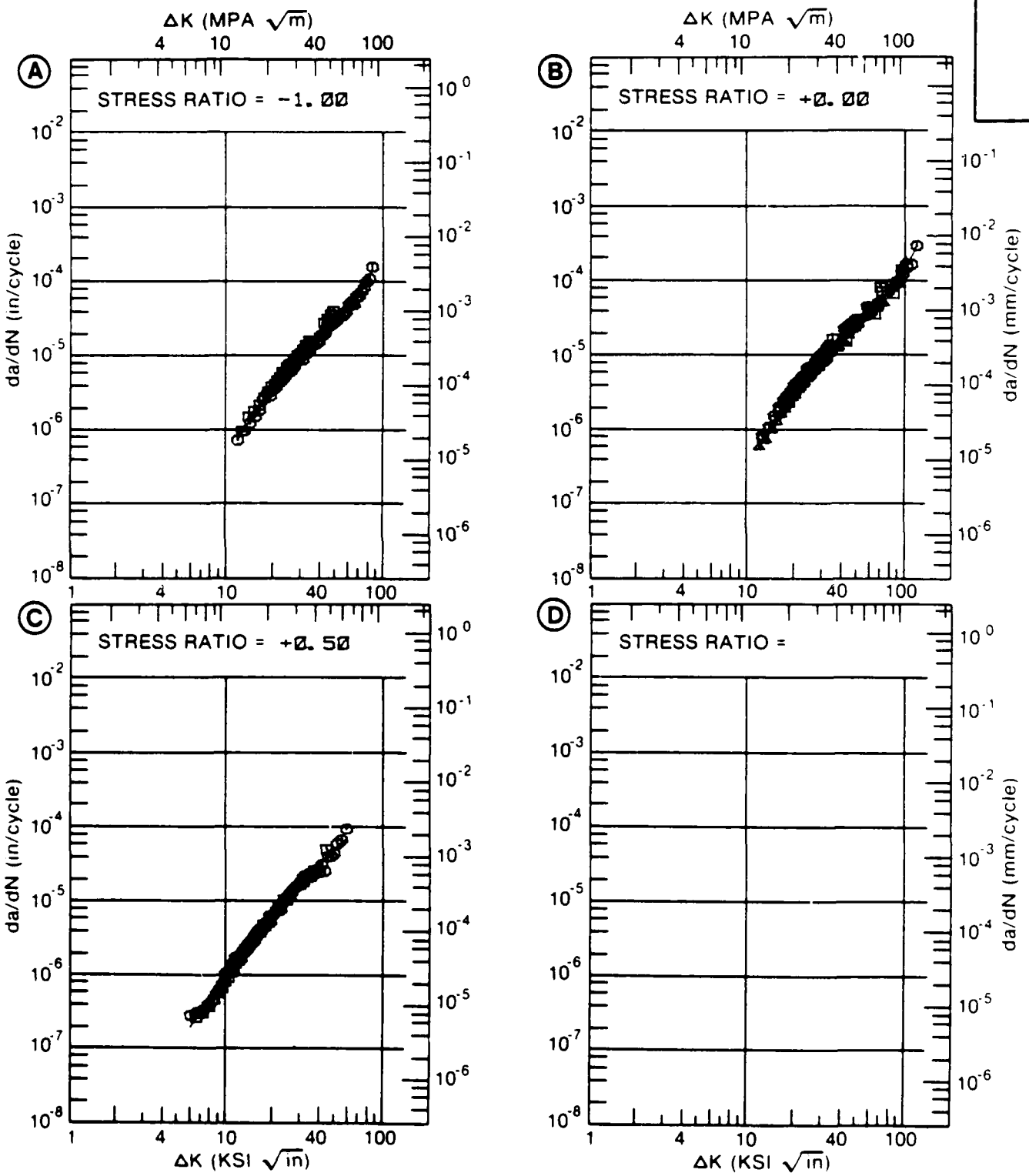



Figure 6.8.3.13

TABLE 6.8.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.14 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: UTS=220-240KSI
ENVIRONMENT: R.T. ,3.5% NACL

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=-1.00 | | | |
| DELTA K MIN | A: | 12.51 | .87 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.02 | | | |
| | | 16.00 | 1.65 | | | |
| | | 20.00 | 2.88 | | | |
| | | 25.00 | 5.84 | | | |
| | | 30.00 | 10.6 | | | |
| | | 35.00 | 16.7 | | | |
| | | 40.00 | 23.0 | | | |
| | | 50.00 | 33.9 | | | |
| | | 60.00 | 45.6 | | | |
| | | 70.00 | 63.7 | | | |
| | | 80.00 | 96.1 | | | |
| | | 90.00 | 158. | | | |
| DELTA K MAX | A: | 93.29 | 189. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 27.30

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: UTS=220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 0.10 HZ
ENVIRONMENT: R.T., 3.5% NACL

YIELD STRENGTH: 212.0 KSI
ULT. STRENGTH: 229.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 4.000"
REFERENCES: MA007

ALLOY STEEL

HP9-4-.30

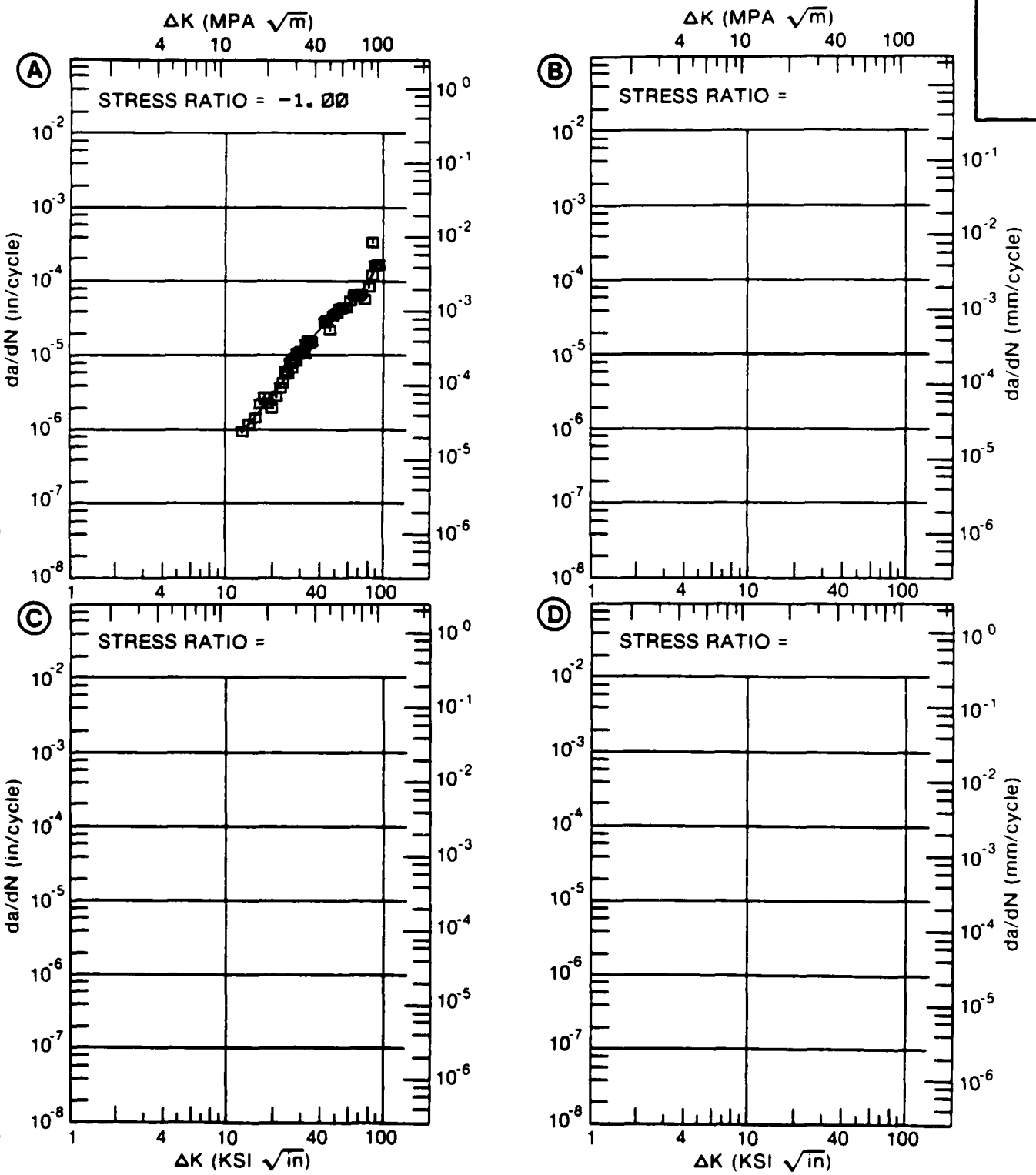



Figure 6.8.3.14

TABLE 6.8.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.15 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: TUS=220-240KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. ALT IMMERSION IN SEA WATER- 1ST HALF DRY CYC | E= R.T. ALT IMMERSION IN SEA WATER- 2ND HALF DRY CYC | E= R.T. ALT IMMERSION IN SEA WATER- IMMERSED | |
| DELTA K MIN | A: | 11.34 | .535 | | | |
| | B: | 11.28 | | .357 | | |
| | C: | 11.21 | | | .416 | |
| | D: | | | | | |
| | | 13.00 | .771 | .665 | .782 | |
| | | 16.00 | 1.62 | 1.54 | 1.72 | |
| | | 20.00 | 3.28 | 3.27 | 3.51 | |
| | | 25.00 | 5.63 | 5.83 | 6.22 | |
| | | 30.00 | 9.59 | 8.63 | 8.97 | |
| | | 35.00 | 12.5 | 13.2 | 12.2 | |
| | | 40.00 | | 18.9 | 16.9 | |
| | | 50.00 | | | 30.7 | |
| DELTA K MAX | A: | 35.32 | 12.1 | | | |
| | B: | 43.89 | | 20.0 | | |
| | C: | 55.99 | | | 36.1 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.34 | 19.96 | 15.01 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: TUS=220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 10.00 HZ

YIELD STRENGTH: 210.5 KSI
ULT. STRENGTH: 228.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900"
REFERENCES: MA010

ALLOY STEEL

HP9-4-.30

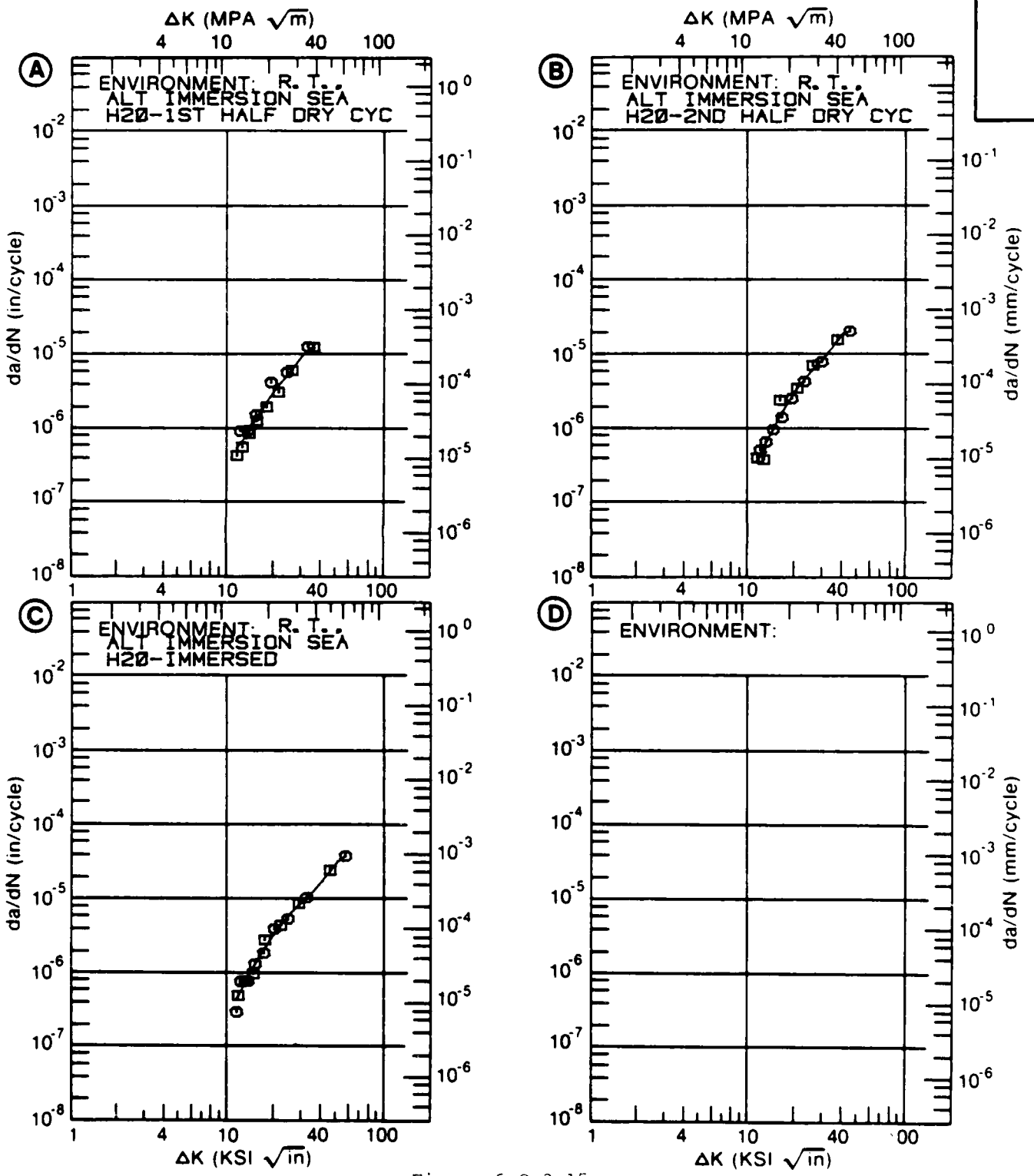



Figure 6.8.3.15

TABLE 6.8.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: TUS=220-240KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. ALT IMMERSION IN SEA WATER- 1ST HALF DRY CYC | E= R.T. ALT IMMERSION IN SEA WATER- 2ND HALF DRY CYC | E= R.T. ALT IMMERSION IN SEA WATER- IMMERSED | |
| DELTA K MIN | A: | 15.92 | .79 | | | |
| | B: | 16.15 | | 1.09 | | |
| | C: | 15.84 | | | 2.32 | |
| | D: | | | | | |
| | | 16.00 | .768 | | 2.40 | |
| | | 20.00 | 1.54 | 2.70 | 4.71 | |
| | | 25.00 | 4.11 | 5.59 | 7.74 | |
| | | 30.00 | 7.80 | 8.98 | 11.4 | |
| | | 35.00 | 12.3 | 12.6 | 16.3 | |
| | | 40.00 | 17.3 | 16.6 | 22.1 | |
| | | 50.00 | 29.0 | 25.8 | 34.4 | |
| | | 60.00 | 43.4 | 38.2 | 43.0 | |
| | | 70.00 | | 55.8 | | |
| DELTA K MAX | A: | 68.44 | 58.9 | | | |
| | B: | 78.64 | | 77.6 | | |
| | C: | 63.89 | | | 44.6 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 46.54 | 44.55 | 39.09 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) |
|---|
| 0.0-0.5 |
| 0.5-0.8 |
| 0.8-1.25 |
| 1.25-2.0 |
| >2.0 |

CONDITION/HT: TUS-220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 210.5 KSI
ULT. STRENGTH: 228.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900"
REFERENCES: MA010

ALLOY STEEL

HP9-4-.30

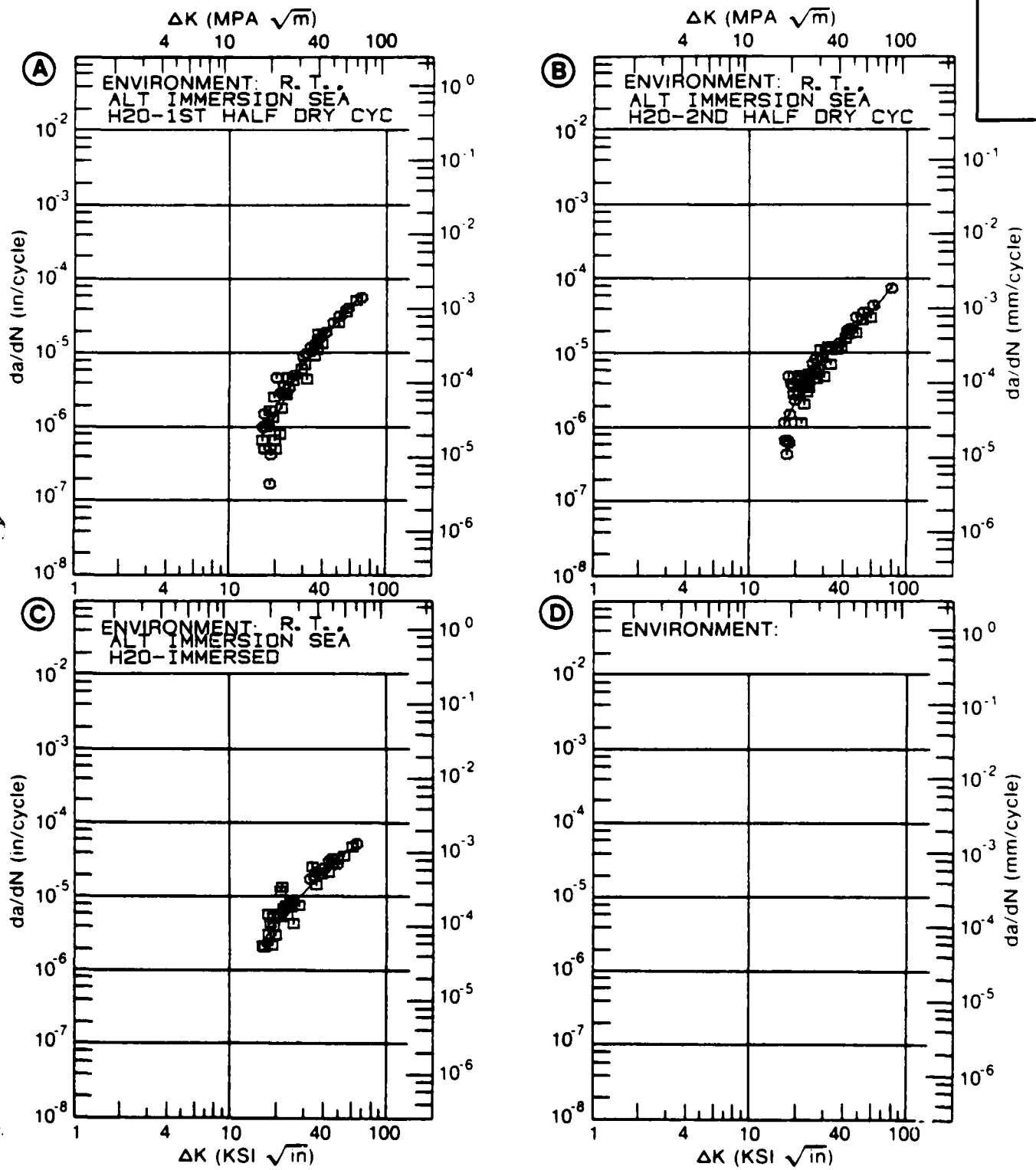



Figure 6.8.3.16

TABLE 6.8.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.17 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: UTS=220-240KSI
ENVIRONMENT: R.T. ,3.5% NACL

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.10 | F(HZ)= 1.00 | F(HZ)= 10.00 | |
| DELTA K MIN | A: | 12.78 | 2.26 | | | |
| | B: | 12.97 | | 1.34 | | |
| | C: | 12.70 | | | .813 | |
| | D: | | | | | |
| | | 13.00 | 2.33 | 1.35 | .859 | |
| | | 16.00 | 3.66 | 2.45 | 1.46 | |
| | | 20.00 | 6.21 | 4.25 | 2.74 | |
| | | 25.00 | 9.50 | 7.00 | 5.25 | |
| | | 30.00 | 12.8 | 10.5 | 8.77 | |
| | | 35.00 | 16.7 | 15.1 | 13.1 | |
| | | 40.00 | 21.6 | 21.3 | 17.8 | |
| | | 50.00 | 36.3 | 41.1 | 27.7 | |
| | | 60.00 | 59.5 | 78.4 | 40.6 | |
| | | 70.00 | 94.7 | 149. | 60.4 | |
| | | 80.00 | 145. | 284. | 93.9 | |
| | | 90.00 | 206. | 540. | 154. | |
| | | 100.00 | 260. | | 266. | |
| DELTA K MAX | A: | 120.03 | 286. | | | |
| | B: | 95.98 | | 791. | | |
| | C: | 107.82 | | | 426. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 43.87 | 7.22 | 12.29 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: UTS=220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
ENVIRONMENT: R.T., 3.5% NACL

YIELD STRENGTH: 212.0 KSI
ULT. STRENGTH: 229.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 4.000"
REFERENCES: MA007

ALLOY STEEL

HP9-4-.30

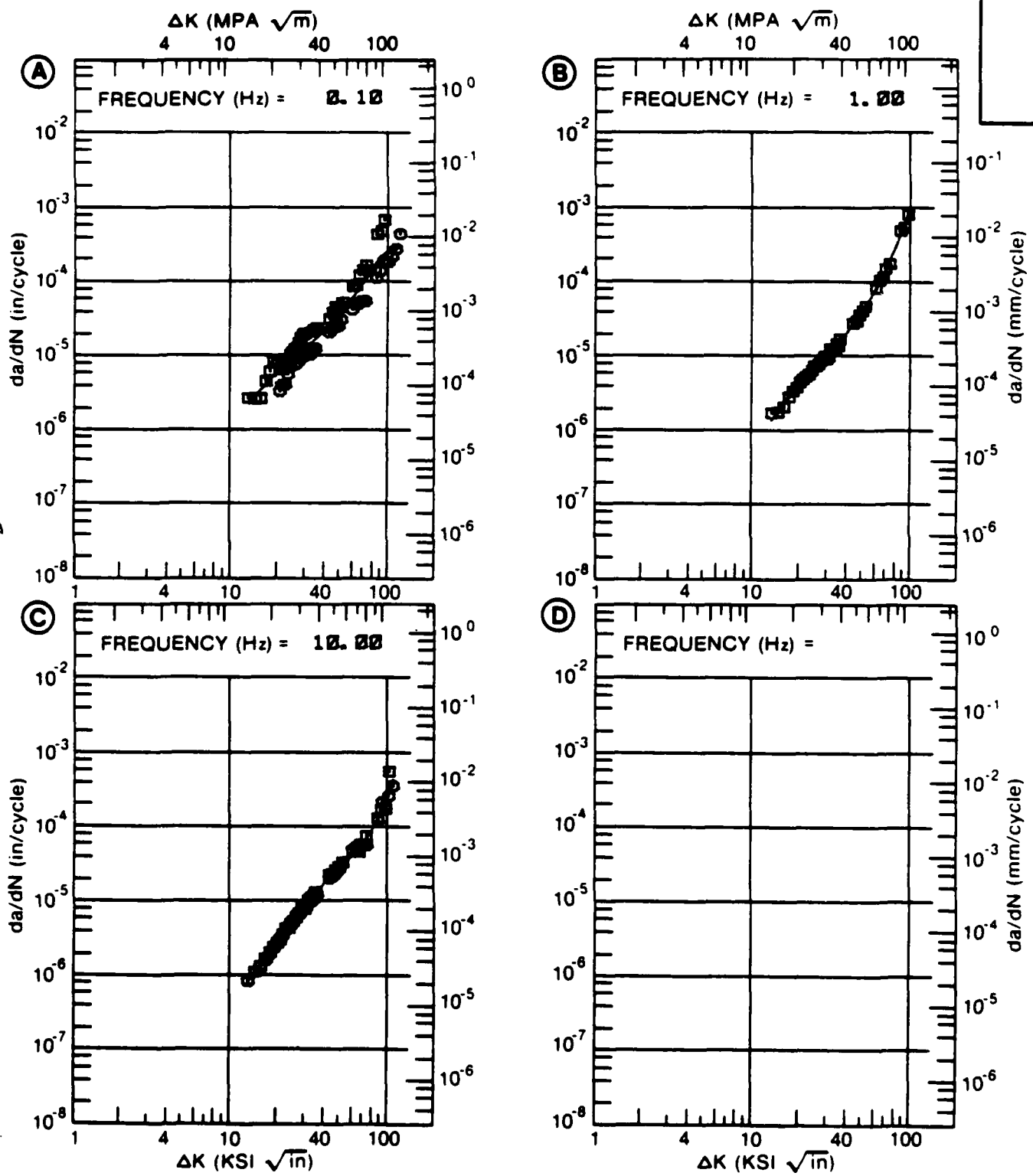



Figure 6.8.3.17

TABLE 6.8.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.18 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1525F 2HRS OQ, -100F 1HR, 1025F 2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. | E= R.T. S.T.W. | | |
| DELTA K MIN | A: | 10.79 | 1.00 | | | |
| | B: | 11.35 | | 1.25 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.69 | 1.98 | | |
| | | 16.00 | 3.91 | 3.50 | | |
| | | 20.00 | | 5.68 | | |
| | | 25.00 | | 8.78 | | |
| | | 30.00 | | 12.8 | | |
| | | 35.00 | | 18.6 | | |
| | | 40.00 | | 27.4 | | |
| | | 50.00 | | 62.3 | | |
| | | 60.00 | | 152. | | |
| | | 70.00 | | 388. | | |
| DELTA K MAX | A: | 19.15 | 4.55 | | | |
| | B: | 73.59 | | 550. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 12.92 | 8.85 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1525F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 216.0 KSI
ULT. STRENGTH: 239.0 KSI
SPECIMEN THK: 0.970- 1.000"
SPECIMEN WIDTH: 4.970- 5.010"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.30

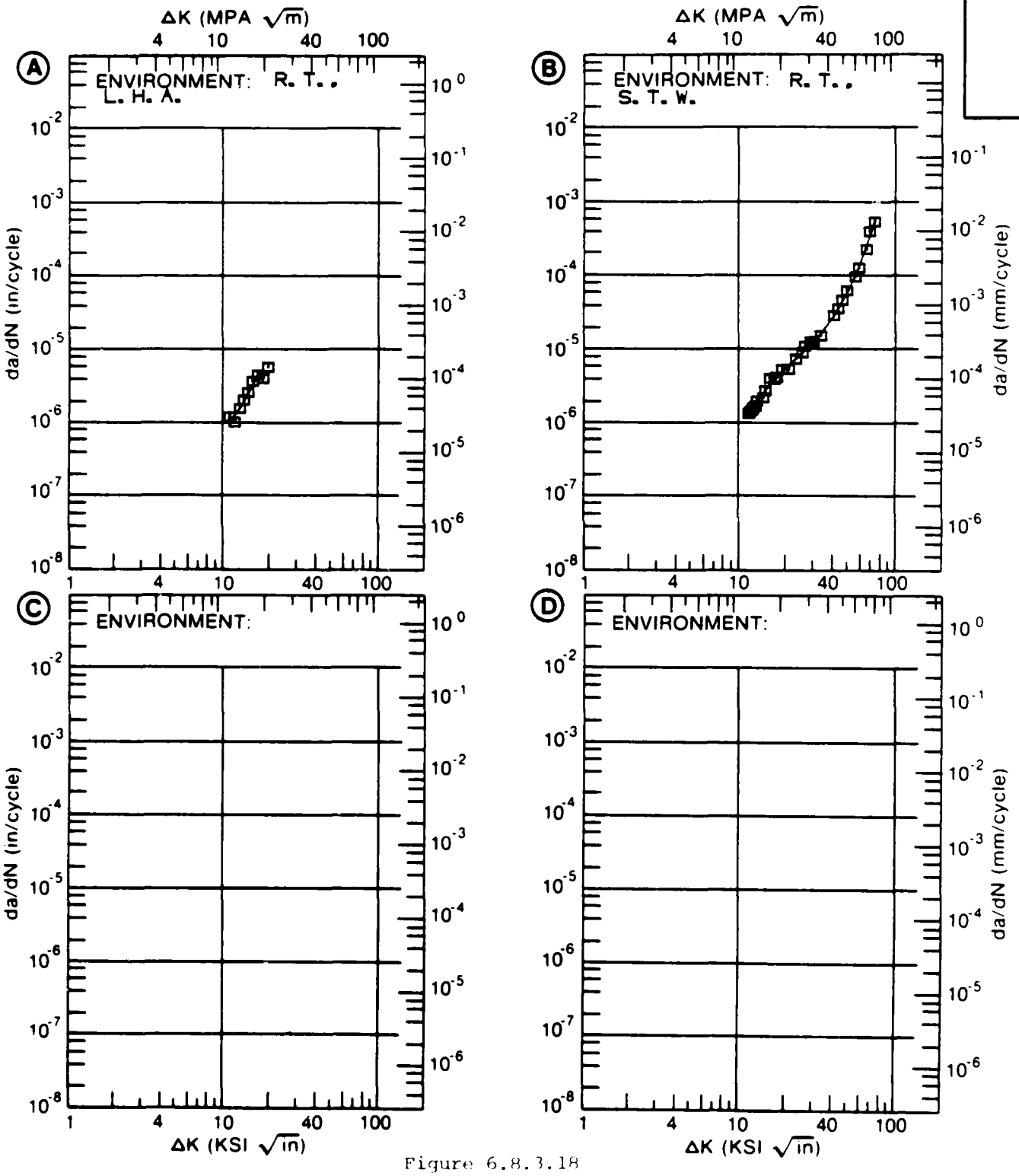



Figure 6.8.3.18

TABLE 6.8.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.19 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1525F 2HRS OQ,-100F 2HRS,1025F 2+2HR
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.30 | | | |
| DELTA K MIN | A: | 11.36 | .756 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.34 | | | |
| | | 16.00 | 2.62 | | | |
| | | 20.00 | 4.51 | | | |
| | | 25.00 | 7.34 | | | |
| | | 30.00 | 11.5 | | | |
| | | 35.00 | 18.6 | | | |
| | | 40.00 | 31.2 | | | |
| | | 50.00 | 98.9 | | | |
| | | 60.00 | 261. | | | |
| DELTA K MAX | A: | 63.58 | 327. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.89

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 216.0 KSI
ULT. STRENGTH: 239.6 KSI
SPECIMEN THK: 0.970"
SPECIMEN WIDTH: 4.970"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.30

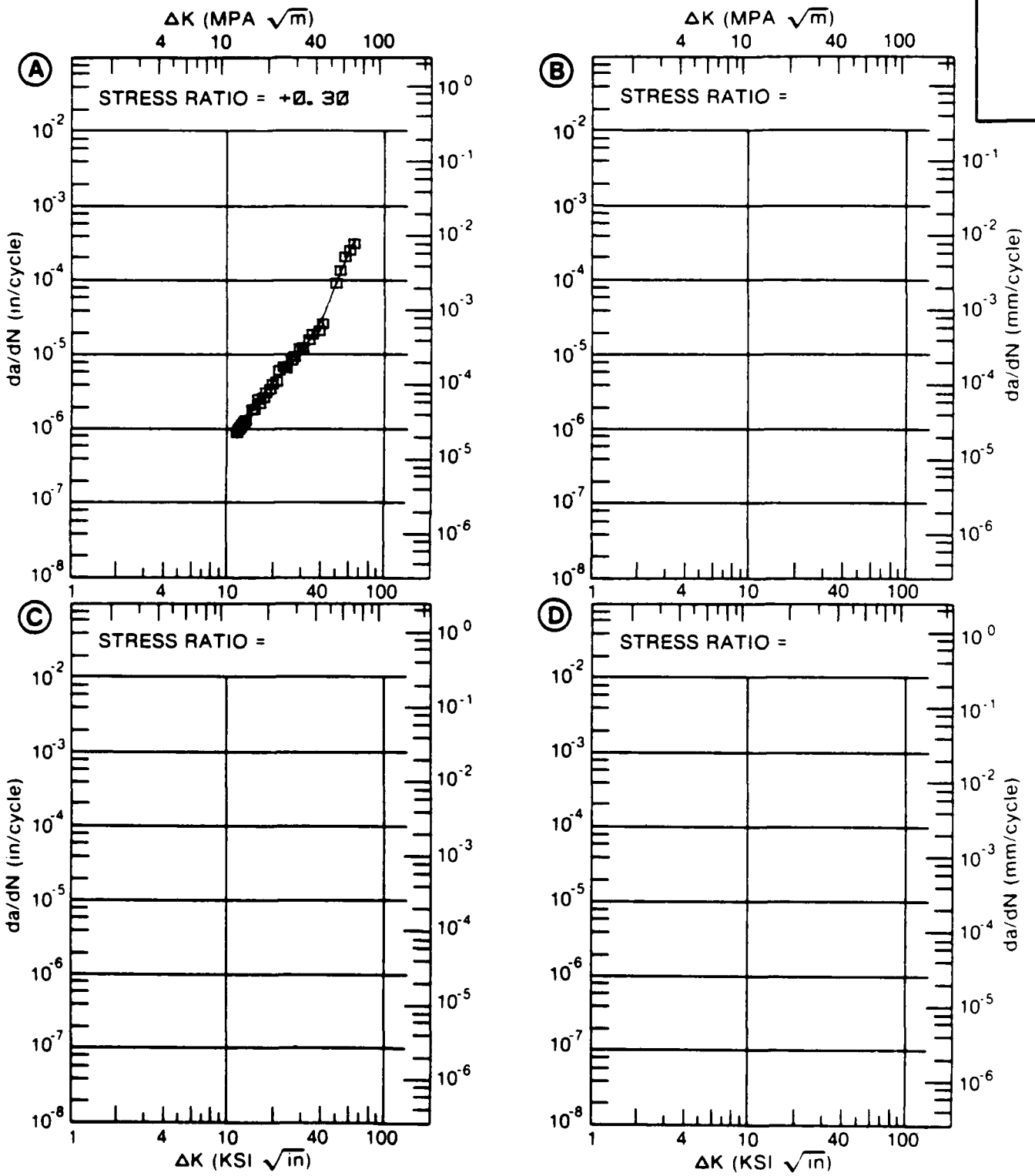



Figure 6.8.3.19

TABLE 6.8.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.20 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.30 | R=+0.50 | | |
| DELTA K MIN | A: | 7.73 | .529 | | | |
| | B: | 7.94 | | .632 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | .581 | .645 | | |
| | | 9.00 | .816 | .880 | | |
| | | 10.00 | 1.12 | 1.17 | | |
| | | 13.00 | 2.52 | 2.36 | | |
| | | 16.00 | 4.51 | 3.99 | | |
| | | 20.00 | 7.35 | 6.60 | | |
| | | 25.00 | 9.57 | 9.91 | | |
| DELTA K MAX | A: | 27.36 | 9.82 | | | |
| | B: | 25.94 | | 10.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 12.81 | 11.39 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.988- 0.993"
SPECIMEN WIDTH: 7.400"
REFERENCES: 85837

ALLOY STEEL

HP9-4-.30

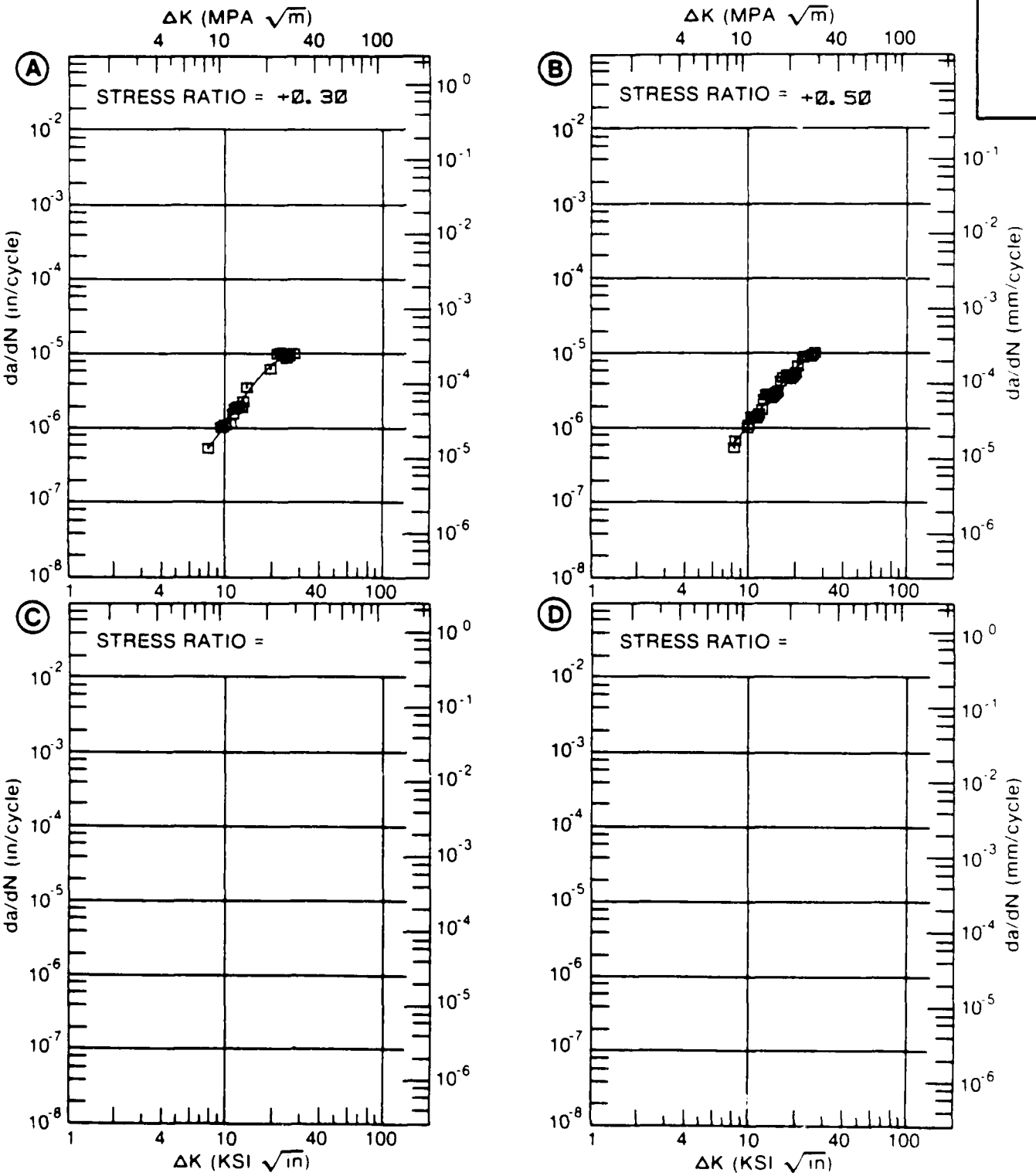



Figure 6.8.3.20

TABLE 6.8.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.21 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | | | |
| DELTA K MIN | A: | 6.05 | .226 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 7.00 | .336 | | | |
| | | 8.00 | .485 | | | |
| | | 9.00 | .669 | | | |
| | | 10.00 | .890 | | | |
| | | 13.00 | 1.78 | | | |
| | | 16.00 | 3.00 | | | |
| | | 20.00 | 5.04 | | | |
| | | 25.00 | 8.05 | | | |
| DELTA K MAX | A: | 29.80 | 11.1 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 17.24

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.992"
SPECIMEN WIDTH: 7.400"
REFERENCES: 85837

ALLOY STEEL

HP9-4-.30

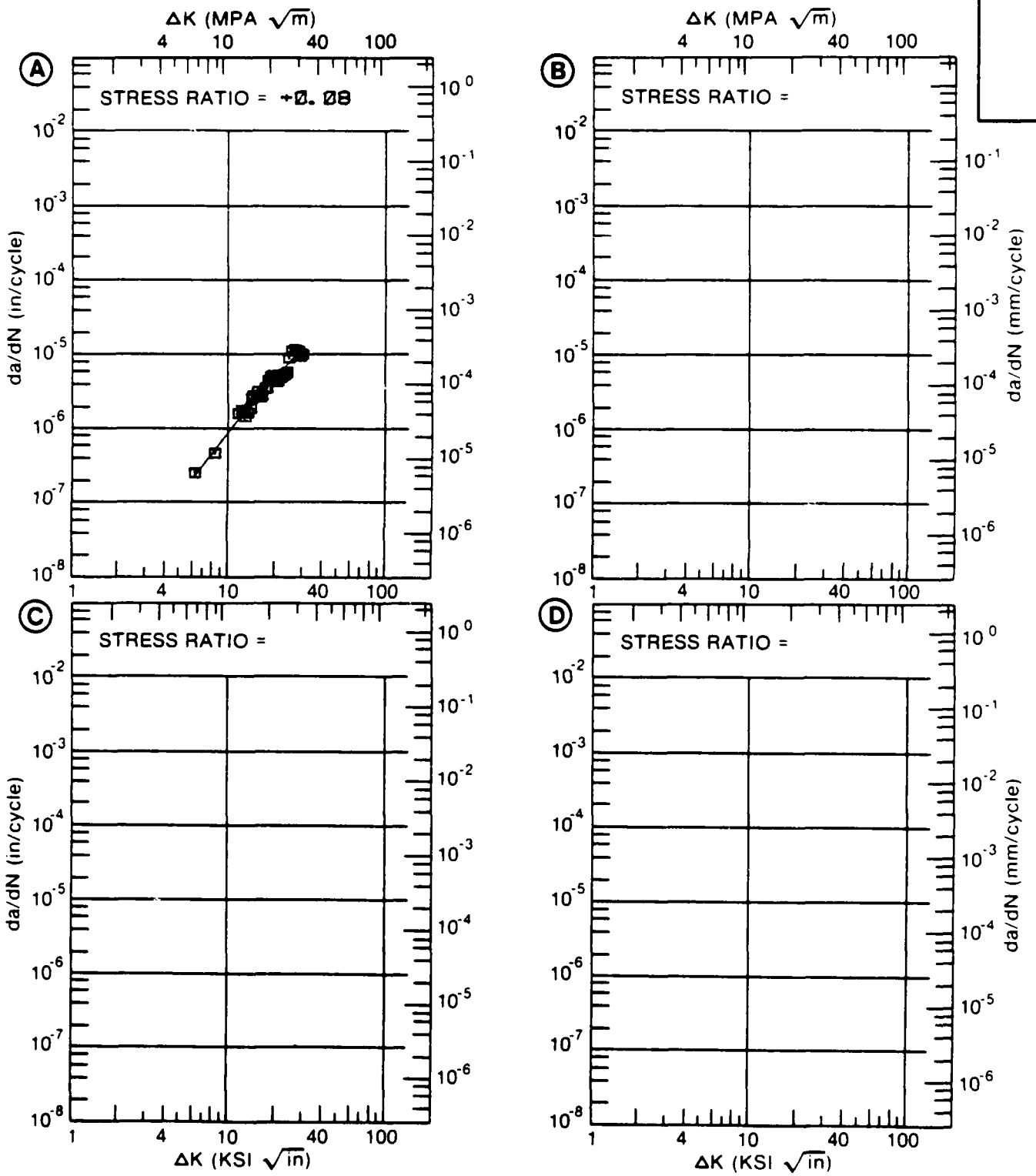



Figure 6.8.3.21

TABLE 6.8.3.22

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.22 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR
ENVIRONMENT: R.T. ,S.T.W.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.30 | R=+0.50 | | |
| DELTA K MIN | A: | 9.12 | .449 | | | |
| | B: | 7.06 | | .454 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | | .920 | | |
| | | 9.00 | | 1.59 | | |
| | | 10.00 | 1.06 | 2.38 | | |
| | | 13.00 | 2.43 | 4.89 | | |
| | | 16.00 | 4.39 | 6.96 | | |
| | | 20.00 | 7.45 | 9.51 | | |
| | | 25.00 | 11.7 | 15.5 | | |
| | | 30.00 | | 25.0 | | |
| | | 35.00 | | 36.3 | | |
| DELTA K MAX | A: | 27.24 | 15.3 | | | |
| | B: | 38.97 | | 62.3 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 10.46 | 17.18 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., S.T.W.

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.990- 0.991"
SPECIMEN WIDTH: 7.400"
REFERENCES: 85837, 88579

ALLOY STEEL

HP9-4-.30

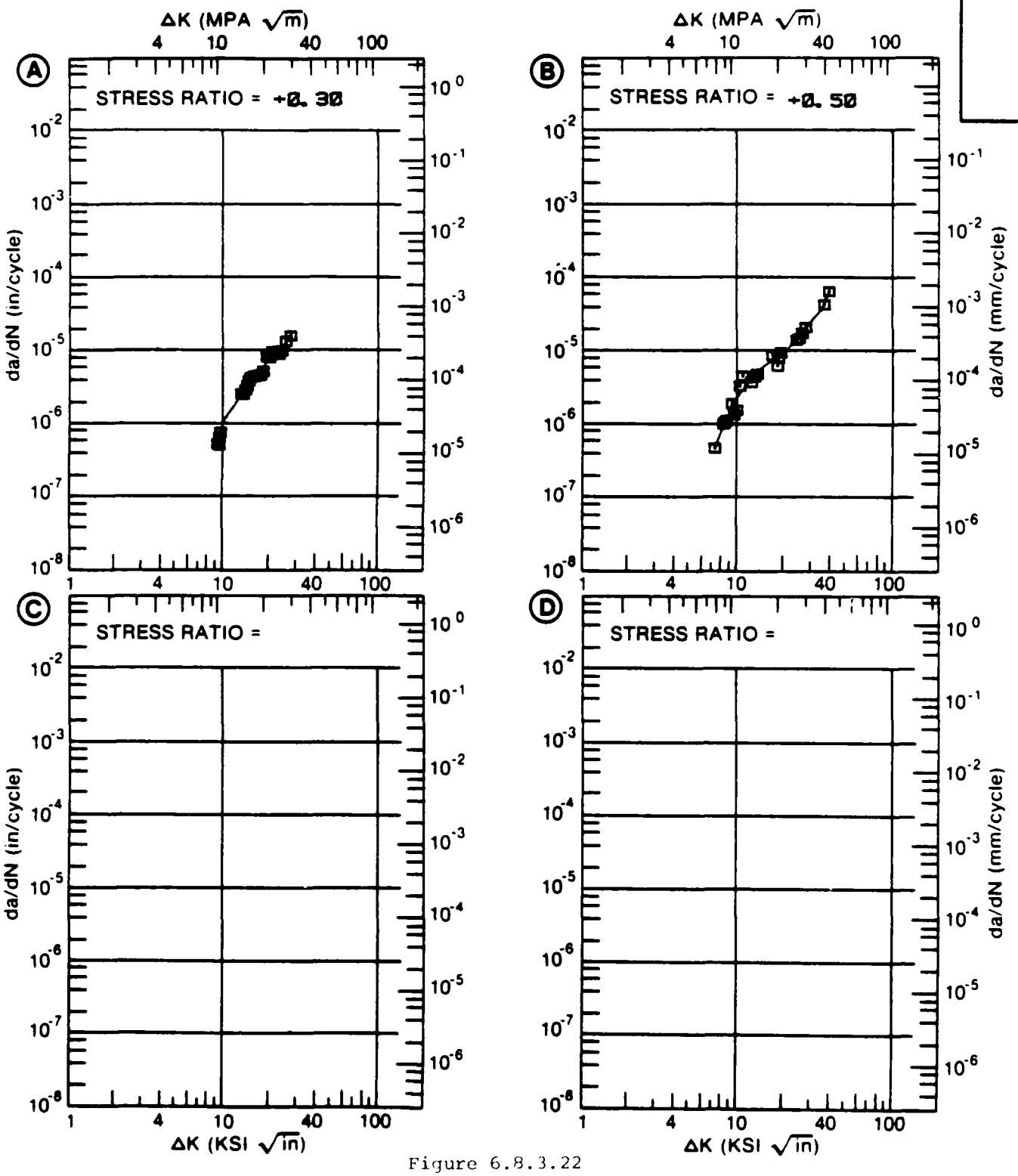



Figure 6.8.3.22

TABLE 6.8.3.23

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.22 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR
ENVIRONMENT: R.T. , S.T.W.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.50 | | | |
| DELTA K MIN | A: | 9.77 | 1.26 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | 1.35 | | | |
| | | 13.00 | 2.65 | | | |
| | | 16.00 | 4.45 | | | |
| | | 20.00 | 7.70 | | | |
| | | 25.00 | 13.3 | | | |
| | | 30.00 | 21.0 | | | |
| | | 35.00 | 31.2 | | | |
| | | 40.00 | 44.4 | | | |
| DELTA K MAX | A: | 47.24 | 69.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 18.04

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., S.T.W.

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.740"
SPECIMEN WIDTH: 7.390"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.30

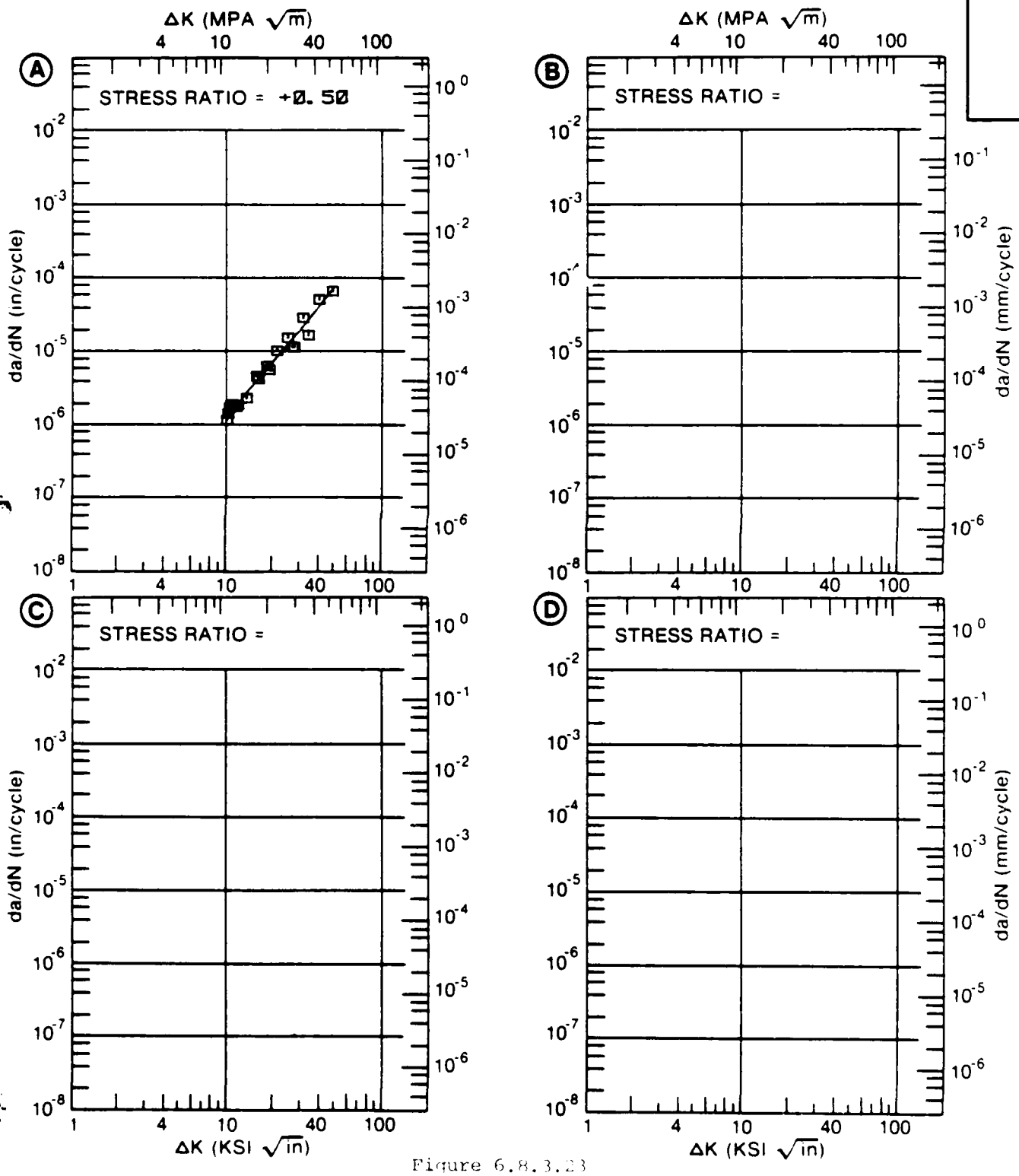



Figure 6.8.3.23

TABLE 6.8.3.24

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.24 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=- 65F L.H.A | | | |
| DELTA K MIN | A: | 9.19 | .482 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | .508 | | | |
| | | 13.00 | 1.23 | | | |
| | | 16.00 | 2.15 | | | |
| | | 20.00 | 3.59 | | | |
| | | 25.00 | 5.91 | | | |
| | | 30.00 | 9.32 | | | |
| DELTA K MAX | A: | 31.92 | 11.1 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 11.36

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 6.00 HZ

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.992"
SPECIMEN WIDTH: 7.400"
REFERENCES: 85837

ALLOY STEEL

HP9-4-.30

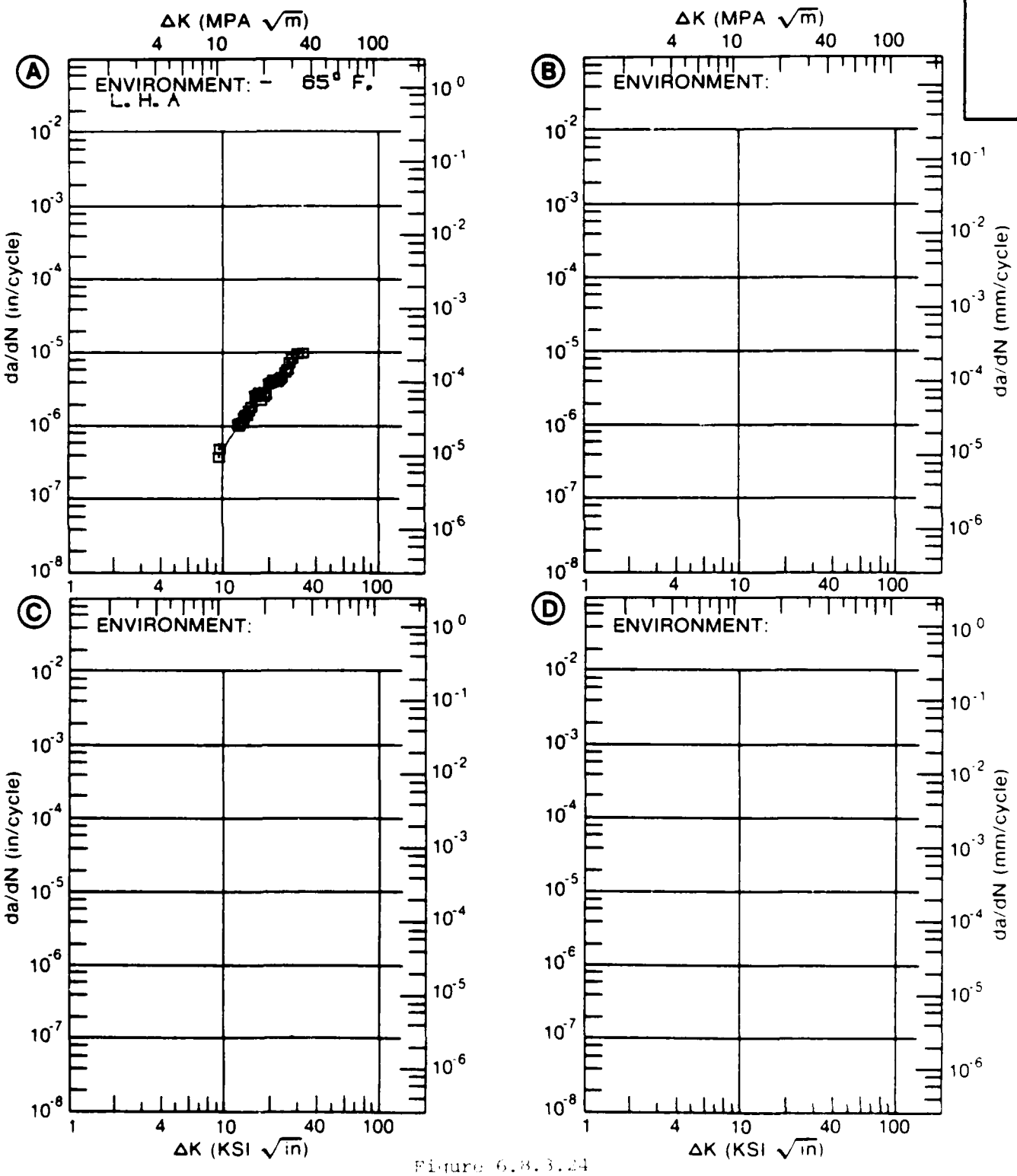



Figure 6.8.3.24

TABLE 6.8.3.25

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.25 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. | E= R.T. S.T.W. | | |
| DELTA K MIN | A: | | | | | |
| | B: | 9.52 | | 1.36 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | | 3.00 | | |
| | | 13.00 | | 5.35 | | |
| | | 16.00 | | 9.17 | | |
| | | 20.00 | | 13.2 | | |
| | | 25.00 | | 19.1 | | |
| | | 30.00 | | 32.3 | | |
| DELTA K MAX | A: | | | | | |
| | B: | 30.92 | | 41.3 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 0.00 | 11.98 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 0.10 HZ

YIELD STRENGTH: 198.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.740- 1.000"
SPECIMEN WIDTH: 7.390- 7.400"
REFERENCES: 98579

ALLOY STEEL

HP9-4-.30

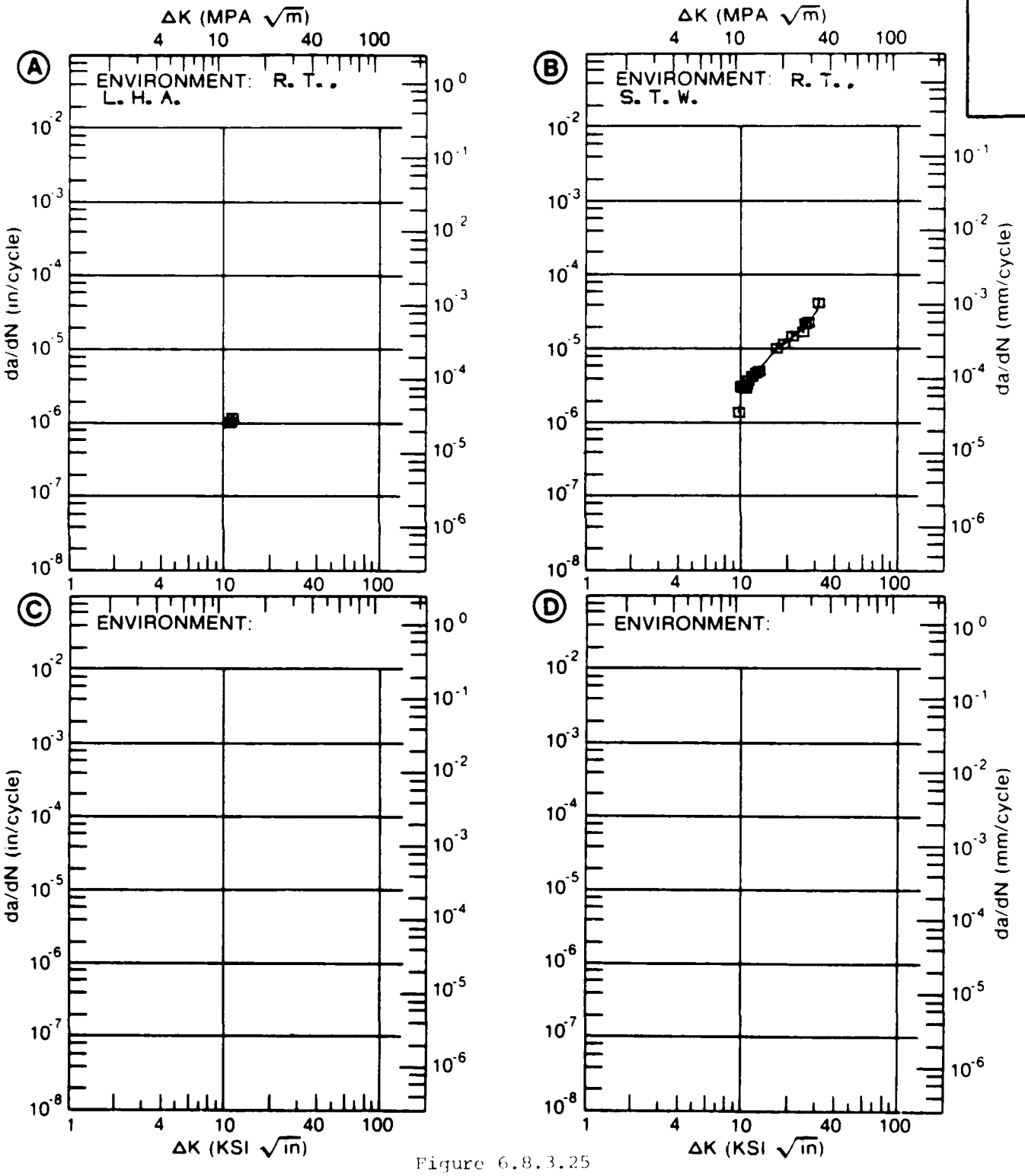



Figure 6.8.3.25

TABLE 6.8.3.26

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.26 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. 6HZ | E= R.T. S.T.W. 1HZ | | |
| DELTA K MIN | A: | 11.36 | 1.18 | | | |
| | B: | 7.33 | | .196 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | | .289 | | |
| | | 9.00 | | .466 | | |
| | | 10.00 | | .688 | | |
| | | 13.00 | 1.67 | 1.60 | | |
| | | 16.00 | 2.89 | 2.81 | | |
| | | 20.00 | 5.13 | 4.84 | | |
| | | 25.00 | 8.51 | 8.07 | | |
| | | 30.00 | 11.9 | 12.2 | | |
| | | 35.00 | | 17.7 | | |
| | | 40.00 | | 24.9 | | |
| DELTA K MAX | A: | 31.16 | 12.6 | | | |
| | B: | 48.54 | | 42.8 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 12.23 | 12.09 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 198.0- 199.0 KSI
ULT. STRENGTH: 220.0- 223.0 KSI
SPECIMEN THK: 0.740- 0.986"
SPECIMEN WIDTH: 6.000- 7.400"
REFERENCES: 85837, 88579

ALLOY STEEL

HP9-4-.30

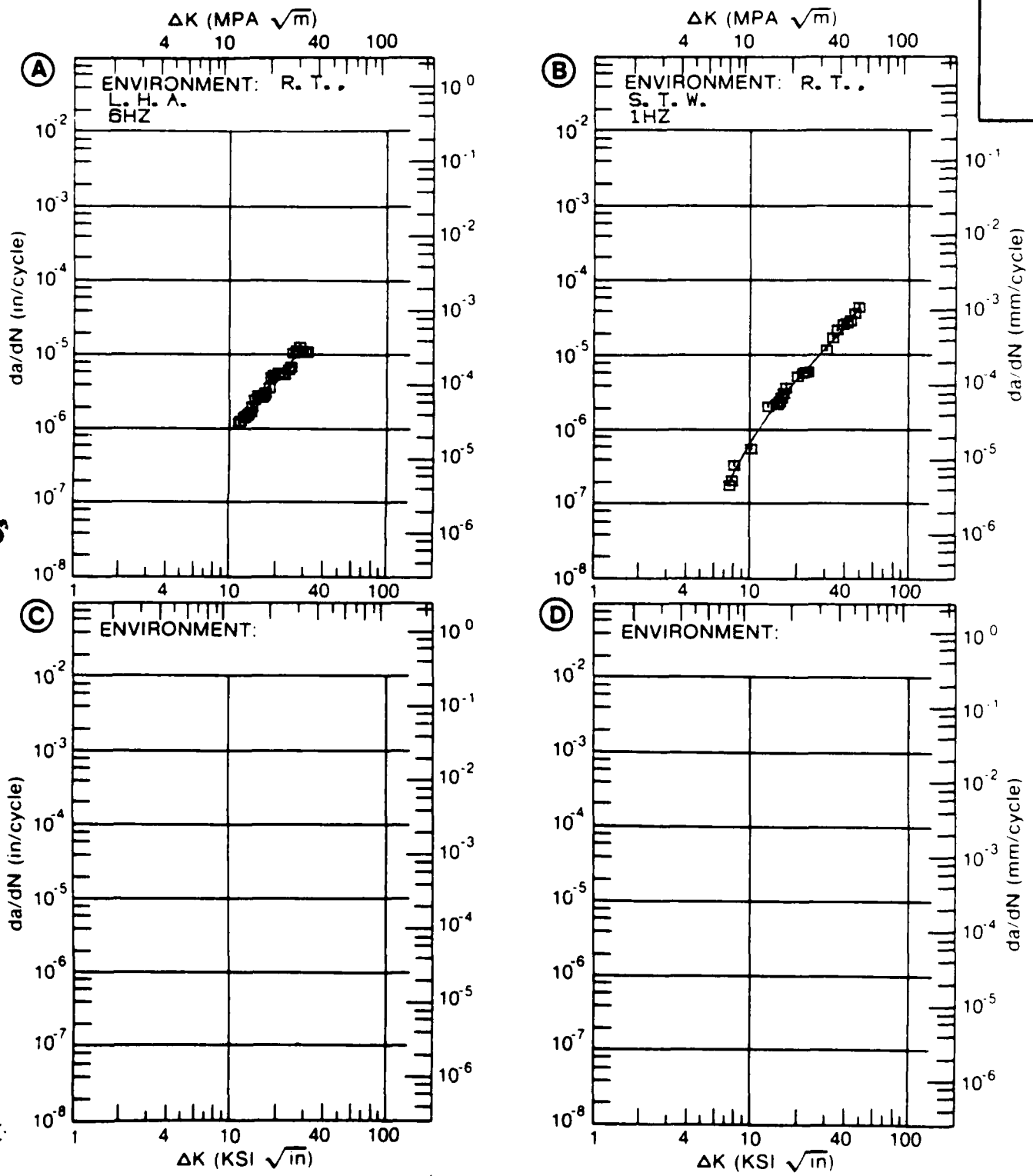



Figure 6.8.3.26

TABLE 6.8.3.27

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.27 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 3HRS, 1000F 2+2HRS
ENVIRONMENT: R.T. , L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.08 | | | |
| DELTA K MIN | A: | 10.28 | .922 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 1.46 | | | |
| | | 16.00 | 2.22 | | | |
| | | 20.00 | 3.58 | | | |
| | | 25.00 | 6.04 | | | |
| | | 30.00 | 9.64 | | | |
| | | 35.00 | 14.8 | | | |
| | | 40.00 | 22.2 | | | |
| | | 50.00 | 46.7 | | | |
| | | 60.00 | 92.3 | | | |
| | | 70.00 | 174. | | | |
| | | 80.00 | 315. | | | |
| DELTA K MAX | A: | 88.40 | 507. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 20.51

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: 1550F 2HRS OQ, -100F 3HRS, 1000F 2+2HRS
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 215.0 KSI
ULT. STRENGTH: 244.0 KSI
SPECIMEN THK: 0.970"
SPECIMEN WIDTH: 4.980"
REFERENCES: 88579

ALLOY STEEL

HP9-4-.30

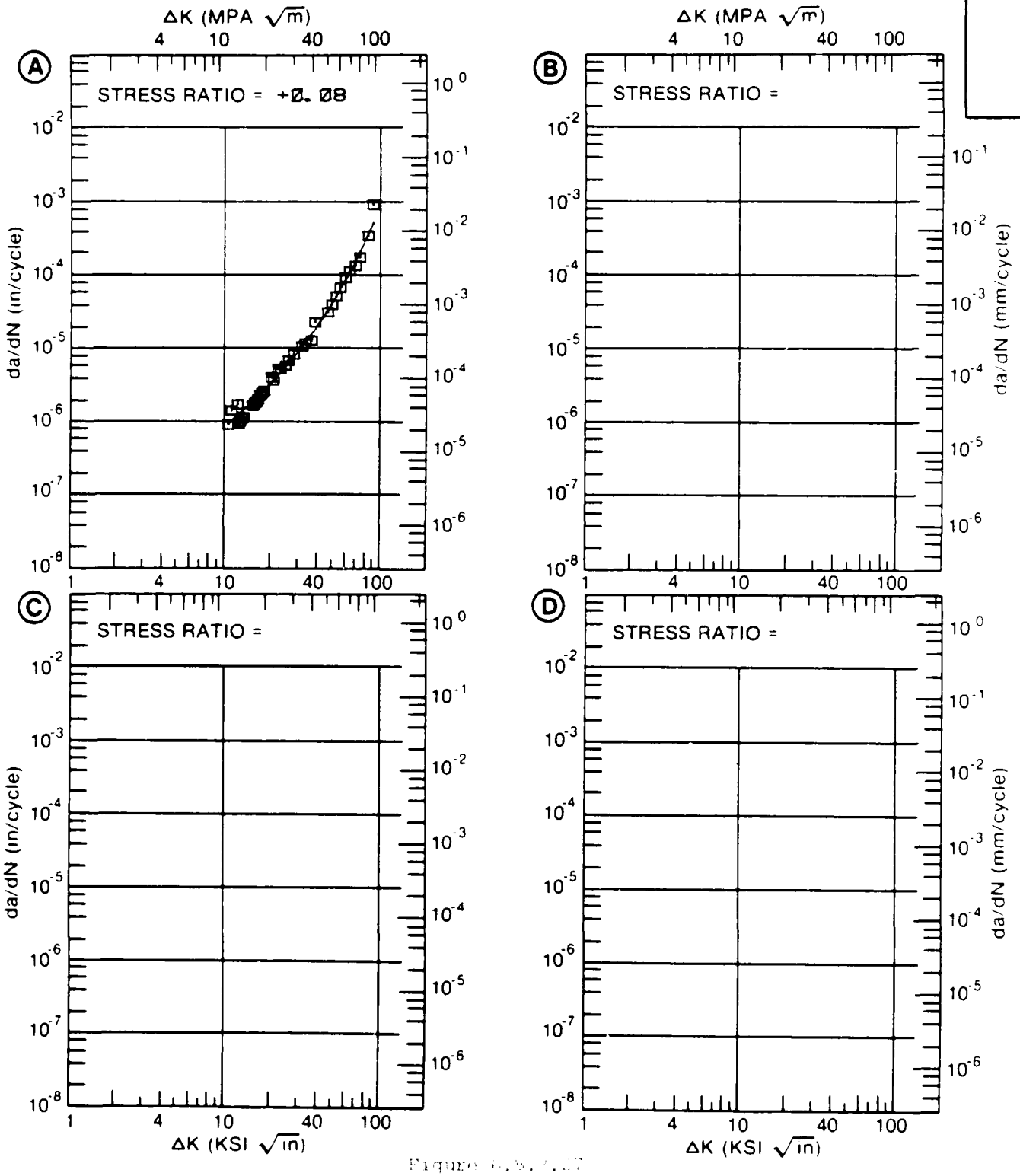



Figure 6.5.7.27

TABLE 6.8.3.28

ALLOY STEEL HP9-4-.30 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| --- | F | 1.25 | R.T. | T-L | 206.0 | SIM. SEA WATER | 3.087 | 1.250 | BWOL | 1.379 | ------ | < 41.60 | | | ---- | 1977 | MA005 |
| | | 1.25 | | | 206.0 | | 3.085 | 1.251 | BWOL | 1.364 | ------ | < 41.30 | | | ---- | 1977 | MA005 |
| --- | F | 1.25 | R.T. | S-T | 204.5 | SIM. SEA WATER | 3.079 | 1.250 | BWOL | 1.355 | ------ | < 38.50 | | | ---- | 1977 | MA005 |
| | | 1.25 | | | 204.5 | | 3.079 | 1.251 | BWOL | 1.365 | ------ | < 38.60 | | | ---- | 1977 | MA005 |
| QUENCHED + TEMPERED AT 950F | P | 0.48 | R.T. | --- | ---- | 3.5 PCT NACL | 1.500 | 0.500 | NB | 0.300 | 116.00 | 35.00* | | | ---- | 1967 | 74302 |
| | | 0.48 | | --- | 231.0 | | 1.500 | 0.480 | NB | ---- | 116.00 | 45.00* | | | ---- | 1967 | 74302 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.9.3.1

ALLOY STEEL HP9-4- 45 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 0.5HR AC S<br>1500F 0.33HR AC | | 0.08 | R.T | --- | 212.5 | DIST. WATER | 2.000 | 0.050 | CNT | ---- | ------ | 88.00* | | | 20000 | 1968 | 72283 |
| 1600F 0.5HR AC S<br>1500F 0.33HR AC | | 0.08 | R.T | --- | 212.5 | 3N NACL | 2.000 | 0.050 | CNT | ---- | ------ | 35.00* | | | > 30000 | 1968 | 72283 |
| 475F | P | 0.48 | R.T | --- | 220.0 | 3.5 PCT NACL | 1.500 | 0.480 | NB | 0.300 | 89.00 | 20.00 | | | ---- | 1971 | 84351 |

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.10.1.J

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HY-TUF AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) |
|---|---|---|

FORGING

| CONDITION/HT | L-T | T-L | S-L |
|---|---|---|---|
| 1700F 1HR, AC, 1600F 1HR, OQ, 550F 2HR | ----- | 111.5 ± 2.1 (2) | ----- |

TABLE 6.10.2.1

ALLOY STEEL HY-TUF K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F 1HR AC, 1600F 1HR+1000F 20 MIN, OQ, 550F 2HR | F | 6.50 | R.T. | L-T | 198.0 | 1.999 | 1.003 | CT | 0.988 | 0.92 | 120.00 | | | 1974 | 91284 |
| 1700F 1HR AC, 1600F 1HR+1000F 20 MIN, OQ, 550F 2HR | F | 6.50 | R.T. | T-L | 200.0 | 1.999 | 1.003 | CT | 0.977 | 0.80 | 113.00 | | | 1974 | 91284 |
| 1700F 1HR, AC, 1600F 1HR, OQ, 550F 2HR | F | 6.50 | R.T. | L-T | 198.0 | 1.999 | 1.000 | CT | 0.983 | 0.86 | 116.00 | | | 1974 | 91284 |
| 1700F 1HR, AC, | F | 6.50 | R.T. | T-L | 198.0 | 1.999 | 1.003 | CT | 0.977 | 0.76 | 110.00 | | | 1974 | 91284 |
| 1600F 1HR, OQ, 550F 2HR | | 6.50 | | | 198.0 | 1.999 | 1.003 | CT | 0.973 | 0.81 | 113.00 | 111.5/ | 2.1 | 1974 | 91284 |

TABLE 6.11.3.1

ALLOY STEEL HY-150 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500F 1HR WQ | P | 1 00 | R.T. | --- | 150.0 | 3.0 PCT NACL | 2.000 | 1.000 | CANT* | 0.200 | ------ | 115.00* | | | > 30000 | 1968 | 73824 |

*NOTE: DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.12.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HY-180

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ. (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| STA (UTS = 180 KSI) | FORGED BAR | 0.10 | 10.00 | | | | | 4.29 | 30.8 | |
| STA (UTS = 180 KSI) | FORGED BAR | 0.10 | 30.00 | | | 0.09 | 0.55 | 3.33 | | |
| STA (UTS = 180 KSI) | FORGED BAR | 0.50 | 10.00 | | | | | 5.61 | | |
| STA (UTS = 180 KSI) | FORGED BAR | 0.50 | 30.00 | | | 0.09 | 0.62 | 4.00 | | |

TABLE 6.12.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.12.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HY-180
CONDITION: STA (UTS = 180KSI)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 2.72 | .0170 | | | |
| | B: | 2.62 | | .0105 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 3.00 | .0232 | .0179 | | |
| | | 3.50 | .0368 | .0313 | | |
| | | 4.00 | .0539 | .0491 | | |
| | | 5.00 | .0986 | .0979 | | |
| | | 6.00 | .158 | .164 | | |
| | | 7.00 | .232 | .248 | | |
| | | 8.00 | .322 | .351 | | |
| | | 9.00 | .430 | .474 | | |
| | | 10.00 | .556 | .620 | | |
| | | 13.00 | 1.07 | 1.21 | | |
| | | 16.00 | 1.82 | 2.11 | | |
| | | 20.00 | 3.33 | 4.00 | | |
| | | 25.00 | 6.36 | 8.07 | | |
| | | 30.00 | 11.2 | | | |
| DELTA K MAX | A: | 31.28 | 12.9 | | | |
| | B: | 26.38 | | 9.67 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 14.34 | 21.78 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: STA (UTS = 180KSI)
FORM: 1.75"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 197.1 KSI
ULT. STRENGTH: 199.6 KSI
SPECIMEN THK: 0.253"
SPECIMEN WIDTH: 1.500"
REFERENCES: DA001

ALLOY STEEL

HY-180

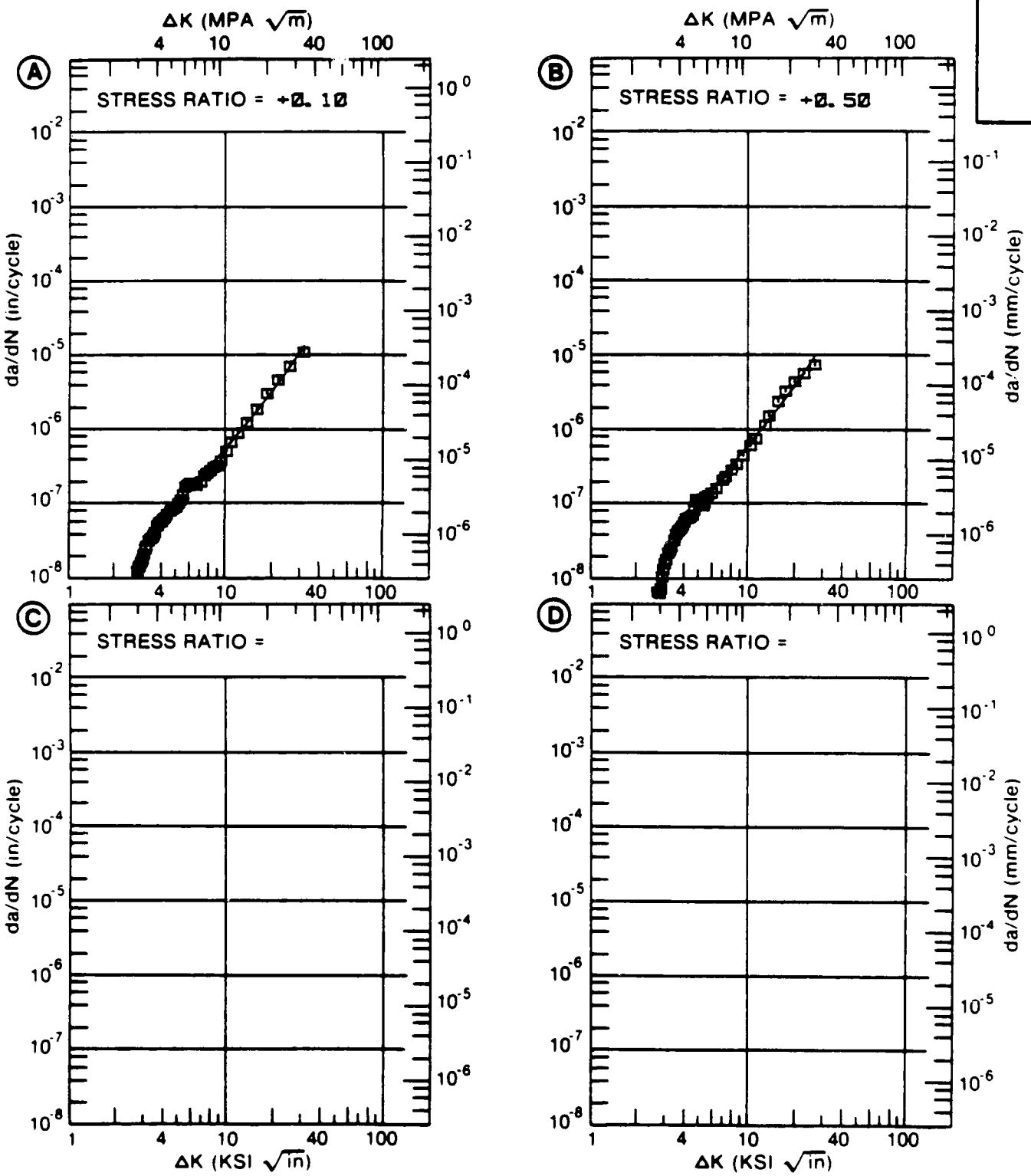



Figure 6.12.3.1

TABLE 6.12.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.12.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HY-180
CONDITION: STA (UTS = 180KSI)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN A: | 11.51 | .645 | | | |
| DELTA K MIN B: | 10.71 | | .899 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 13.00 | 1.10 | 1.84 | | |
| | 16.00 | 2.31 | 3.37 | | |
| | 20.00 | 4.29 | 5.61 | | |
| | 25.00 | 7.04 | 8.57 | | |
| | 30.00 | 10.1 | 11.9 | | |
| | 35.00 | 13.6 | 15.8 | | |
| | 40.00 | 18.0 | 20.6 | | |
| | 50.00 | 30.8 | | | |
| DELTA K MAX A: | 59.28 | 51.3 | | | |
| DELTA K MAX B: | 43.61 | | 25.0 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 3.94 | 5.39 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: STA (UTS = 180KSI)
FORM: 1.75"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 10.00
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 197.1 KSI
ULT. STRENGTH: 199.6 KSI
SPECIMEN THK: 0.377"
SPECIMEN WIDTH: 1.500- 1.501"
REFERENCES: A001

ALLOY STEEL

HY-180

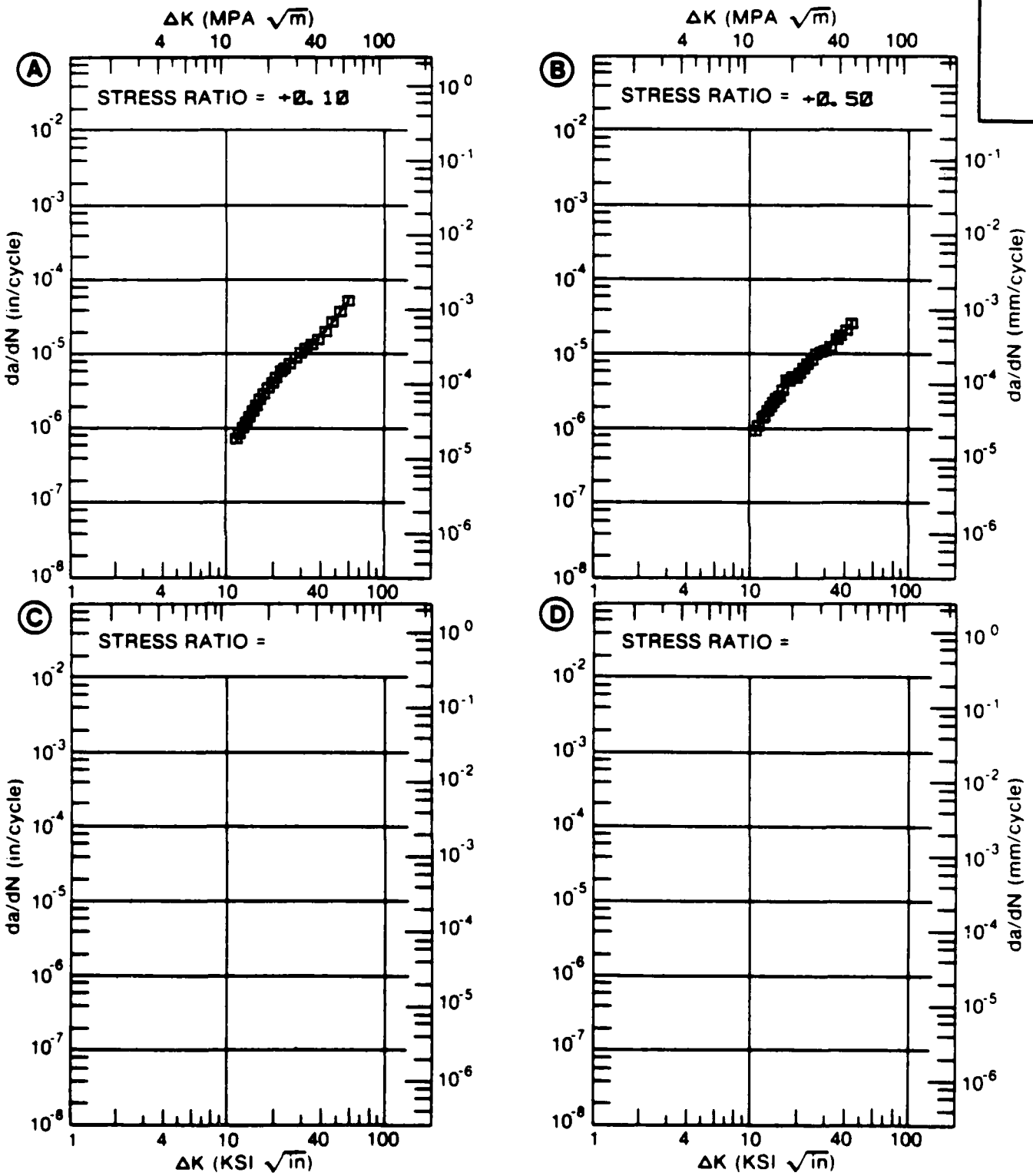



Figure 6.12.3.2

TABLE 6.12.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.12.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL HY-80
CONDITION:
ENVIRONMENT: R.T. ,3.5% NACL

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | | | |
| DELTA K MIN A: | 24.02 | 5.47 | | | |
| DELTA K MIN B: | | | | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 25.00 | 5.88 | | | |
| | 30.00 | 8.35 | | | |
| | 35.00 | 11.6 | | | |
| | 40.00 | 15.8 | | | |
| | 50.00 | 28.1 | | | |
| | 60.00 | 48.0 | | | |
| | 70.00 | 79.2 | | | |
| DELTA K MAX A: | 77.74 | 114. | | | |
| DELTA K MAX B: | | | | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.48

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM:
SPECIMEN TYPE: WOL
ORIENTATION:
FREQUENCY: 0.50 HZ
ENVIRONMENT: R.T., 3.5% NACL

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.400"
SPECIMEN WIDTH: 2.550"
REFERENCES:UD007

ALLOY STEEL

HY-80

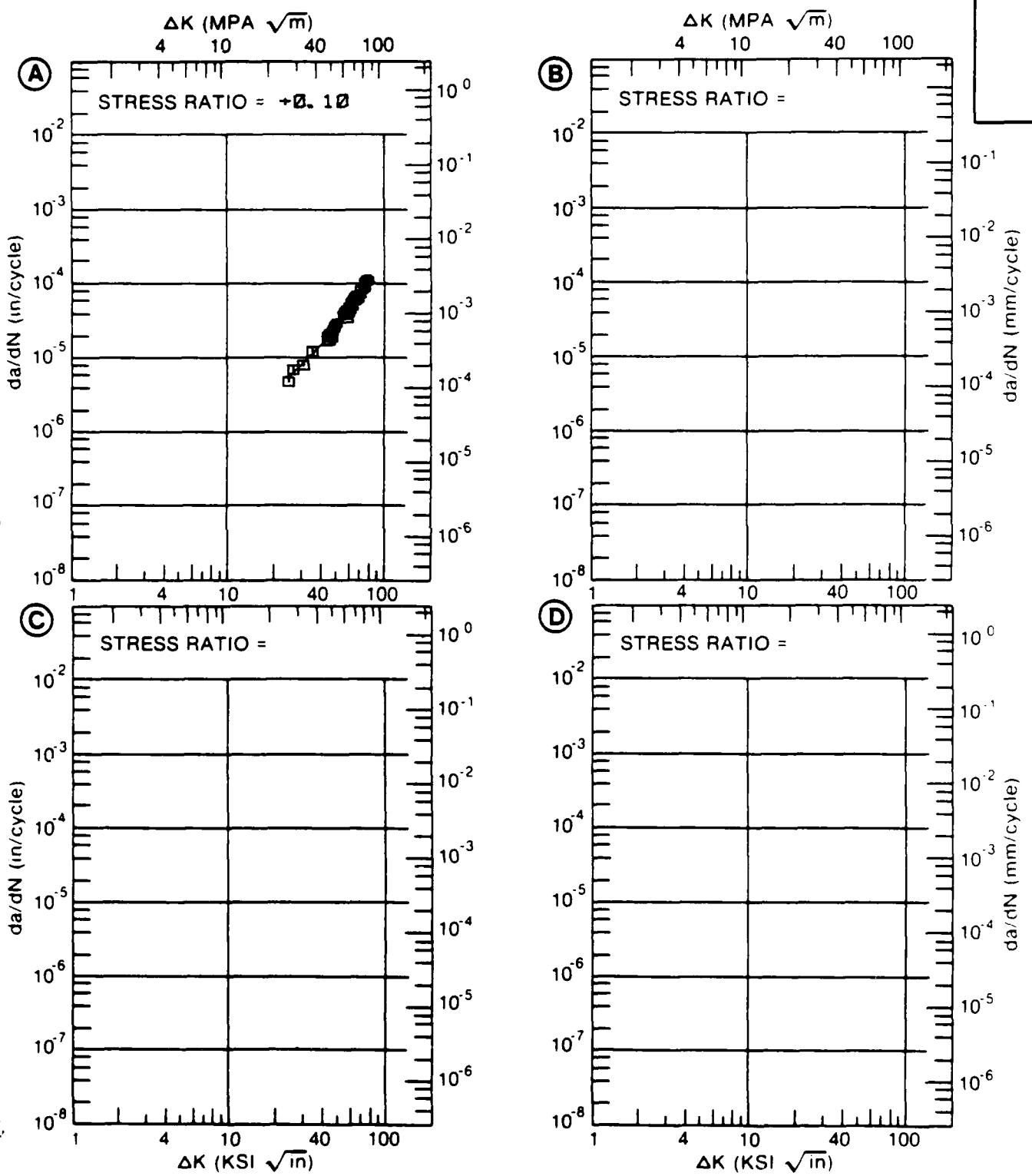



Figure 6.12.3.3

TABLE 6.13.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL H11

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0 10 | 10 00 | | | | | 3 53 | | |
| AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0 10 | 30 00 | | | | 0 33 | 2 95 | | |
| AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0 50 | 10 00 | | | | | 4 94 | | |
| AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0 50 | 30 00 | | | 0 09 | 0 23 | 4 56 | | |

TABLE 6.13.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL H11

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT AIR AT 650 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0.10 | 7.00 | | | | | | 34.6 | |
| AUSTENIZED & TEMPERED (TYS = 220KSI) | ROUND BAR | 0.50 | 7.00 | | | | 1.61 | | | |

TABLE 6.13.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL H11
CONDITION: AUSTENIZED & TEMPERED (TYS = 220KSI)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 6.34 | .0757 | | | |
| | B: | 3.07 | | .0168 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 3.50 | | .0269 | | |
| | | 4.00 | | .0428 | | |
| | | 5.00 | | .0905 | | |
| | | 6.00 | | .163 | | |
| | | 7.00 | .105 | .262 | | |
| | | 8.00 | .163 | .390 | | |
| | | 9.00 | .240 | .549 | | |
| | | 10.00 | .339 | .738 | | |
| | | 13.00 | .791 | 1.49 | | |
| | | 16.00 | 1.51 | 2.52 | | |
| | | 20.00 | 2.95 | 4.56 | | |
| | | 25.00 | 5.52 | | | |
| | | 30.00 | 8.88 | | | |
| | | 35.00 | 12.9 | | | |
| | | 40.00 | 17.4 | | | |
| DELTA K MAX | A: | 44.01 | 21.3 | | | |
| | B: | 23.97 | | 10.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.06 | 13.76 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: AUSTENIZED & TEMPERED (TYS = 220KSI)
FORM: 3.18"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 30.00 HZ
ENVIRONMENT: R.T..LAB AIR

YIELD STRENGTH: 215.4 KSI
ULT. STRENGTH: 258.1 KSI
SPECIMEN THK: 0.256- 0.257"
SPECIMEN WIDTH: 2.002"
REFERENCES: DA001

ALLOY STEEL

H11

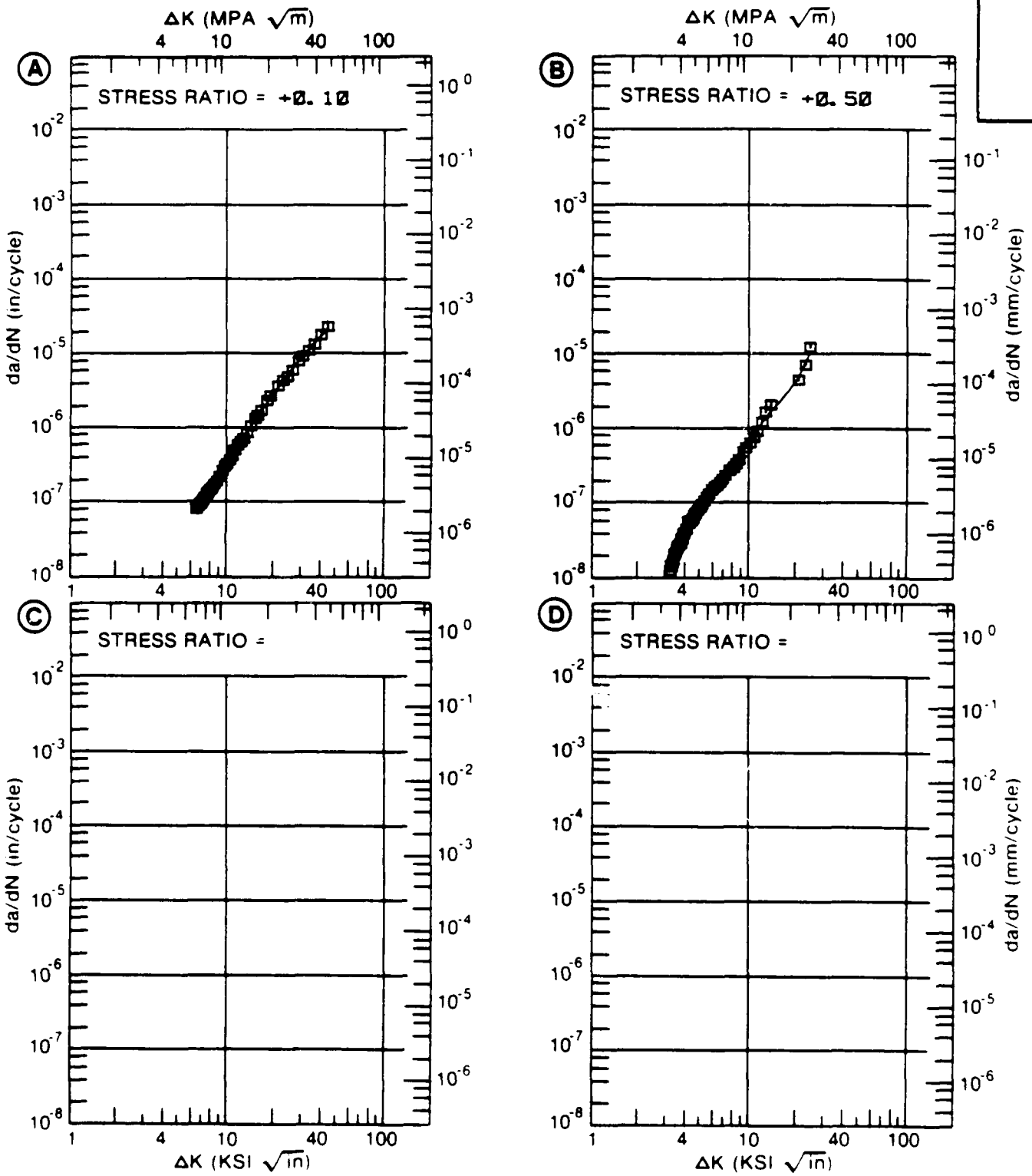



Figure 6.1?.3.1

TABLE 6.13.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL H11
CONDITION: AUSTENIZED & TEMPERED (TYS = 220KSI)
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 12.92 | .949 | | | |
| | B: | 10.54 | | .691 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | .970 | 1.41 | | |
| | | 16.00 | 1.90 | 2.66 | | |
| | | 20.00 | 3.53 | 4.94 | | |
| | | 25.00 | 6.19 | | | |
| | | 30.00 | 9.73 | | | |
| | | 35.00 | 14.5 | | | |
| | | 40.00 | 20.9 | | | |
| DELTA K MAX | A: | 42.50 | 24.9 | | | |
| | B: | 22.18 | | 6.46 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 1.90 | 2.05 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: AUSTENIZED & TEMPERED (TYS = 220KSI)
FORM: 3.18"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 215.4 KSI
ULT. STRENGTH: 258.1 KSI
SPECIMEN THK: 0.488"
SPECIMEN WIDTH: 2.005- 2.010"
REFERENCES: DA001

ALLOY STEEL

H11

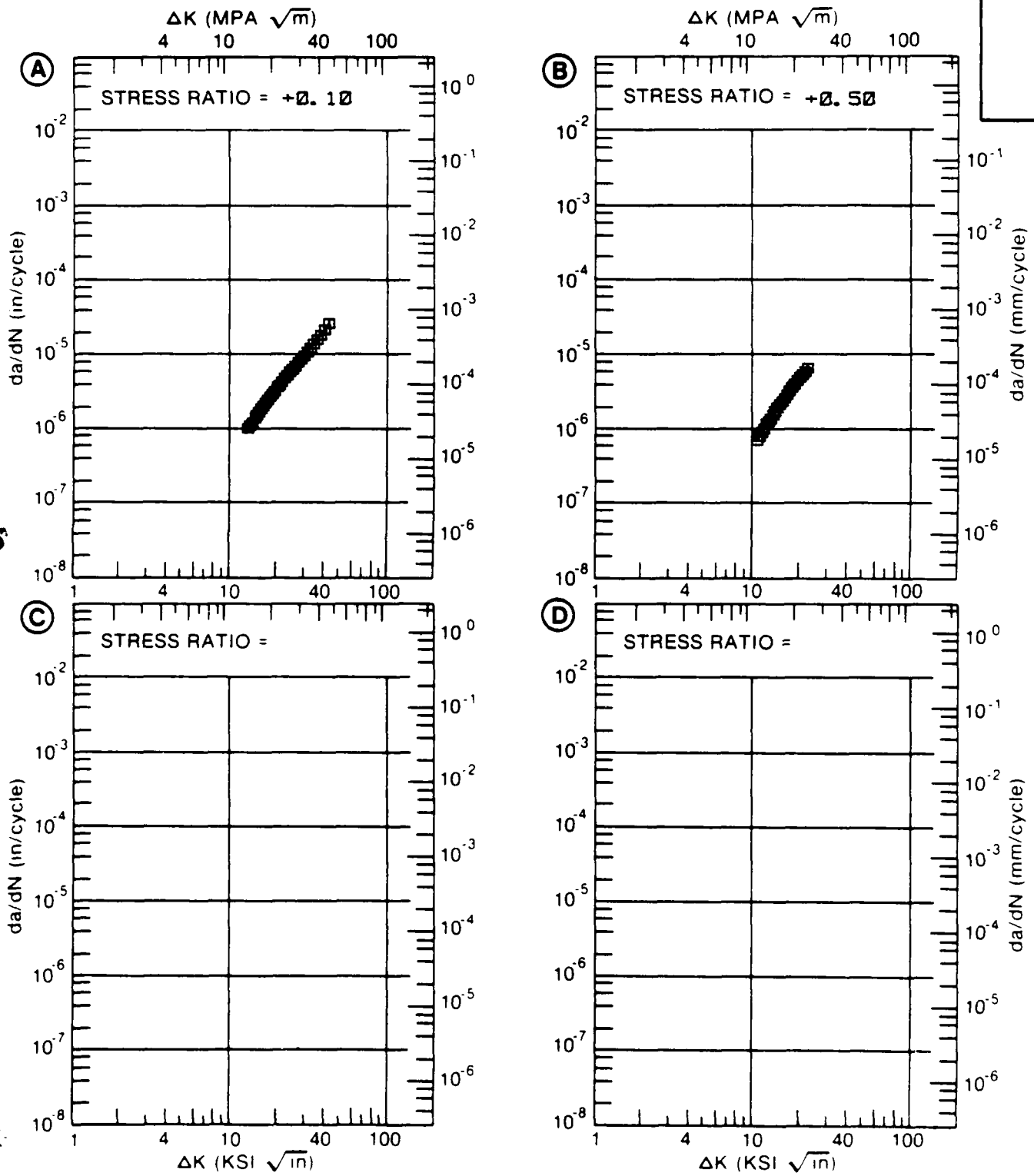



Figure 6.13.3.2

TABLE 6.13.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL H11
CONDITION: AUSTENIZED & TEMPERED (TYS = 220KSI)
ENVIRONMENT: + 650F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 27.33 | 7.00 | | | |
| | B: | 7.01 | | 1.03 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | | 1.17 | | |
| | | 9.00 | | 1.36 | | |
| | | 10.00 | | 1.61 | | |
| | | 13.00 | | 2.97 | | |
| | | 16.00 | | | | |
| | | 20.00 | | | | |
| | | 25.00 | | | | |
| | | 30.00 | 8.83 | | | |
| | | 35.00 | 13.1 | | | |
| | | 40.00 | 18.6 | | | |
| | | 50.00 | 34.6 | | | |
| | | 60.00 | 59.8 | | | |
| | | 70.00 | 97.9 | | | |
| | | 80.00 | 154. | | | |
| DELTA K MAX | A: | 87.90 | 216. | | | |
| | B: | 14.69 | | 4.42 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.82 | 11.15 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: AUSTENIZED & TEMPERED (TYS = 220KSI)
FORM: 3.18"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: + 650° F. AIR

YIELD STRENGTH: 215.4 KSI
ULT. STRENGTH: 258.1 KSI
SPECIMEN THK: 0.257- 0.488"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY STEEL

H11

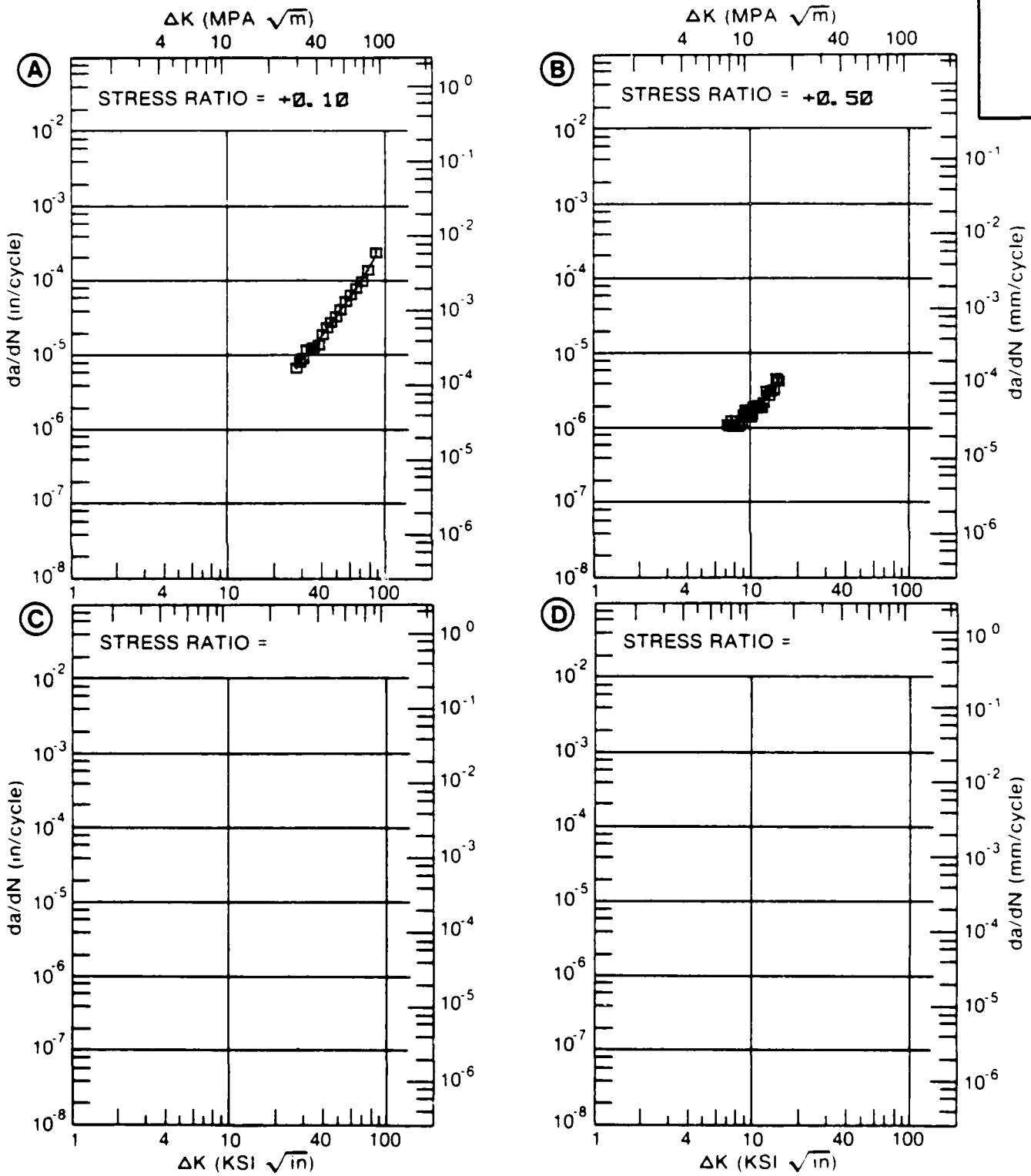



Figure 6.13.3.3

TABLE 6.13.3.4

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL H11
CONDITION:

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= DIST. WATER | E= ARGON, 100% REL HUM | | |
| K MAX MIN | A: | 17.50 | 15.4 | | | |
| | B: | 22.50 | | 876. | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 81.2 | | | |
| | | 25.00 | 573. | 1089. | | |
| | | 30.00 | 1648. | 2424. | | |
| | | 35.00 | 3253. | 3552. | | |
| K MAX MAX | A: | 38.50 | 4763. | | | |
| | B: | 37.00 | | 5024. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 69.12 | 18.74 | | |

CONDITION/HT:
FORM:
SPECIMEN TYPE: CNT
ORIENTATION:
YIELD STRENGTH: 230.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.080- 0.125"
SPECIMEN WIDTH:
CRACK LENGTH ($A_0$):
$K_{ISCC}$:
REFERENCES: 75111, 84309

ALLOY STEEL

H11

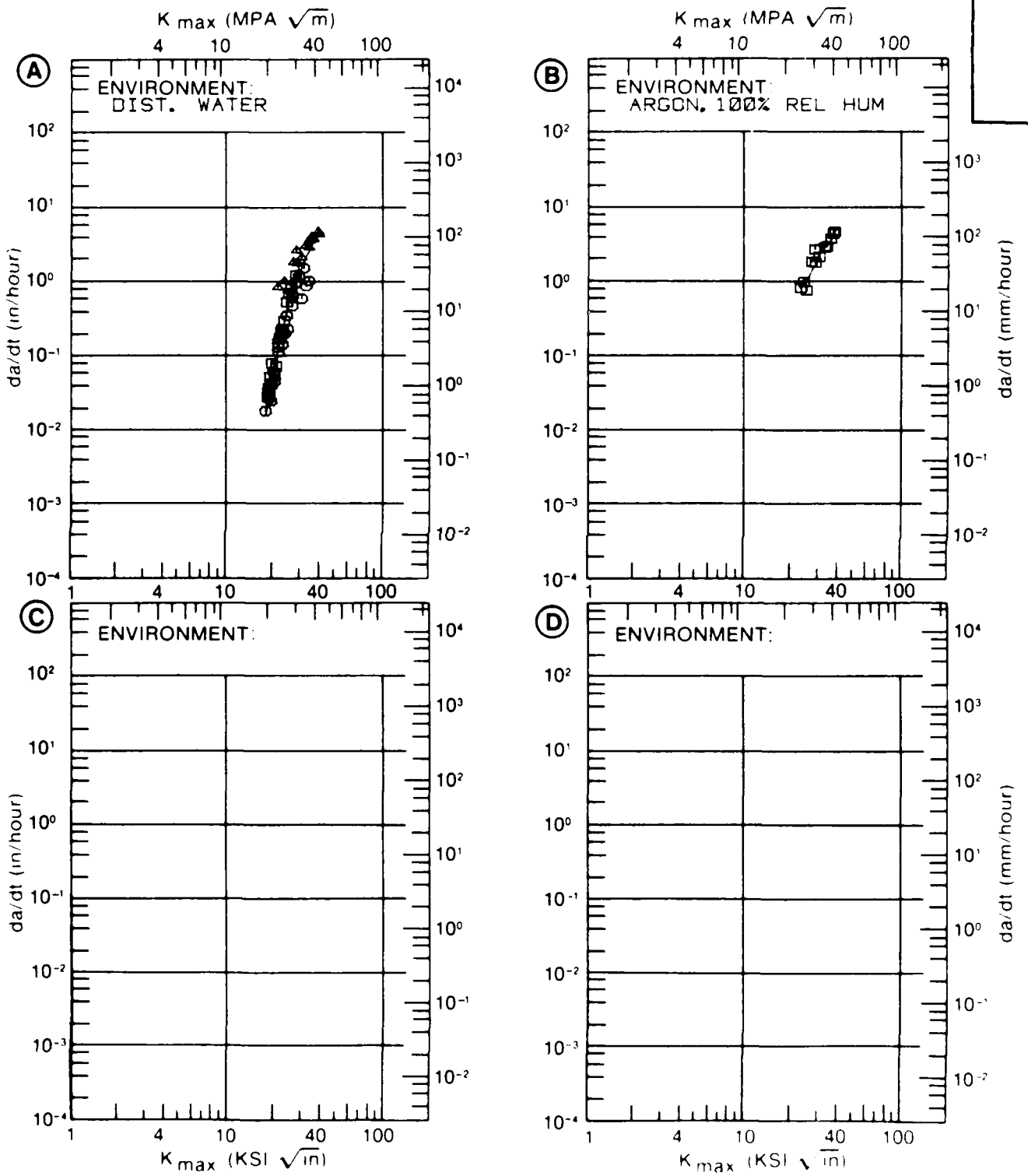



Figure 6.13.3.4

TABLE 6.13.3.5

ALLOY STEEL H11 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QUENCHED + TEMPERED AT 1100F | P | 0.48 | R.T. | --- | 188.0 | 3.5 PCT NACL | 1.500 | 0.480 | -- | ---- | 54.00 | 30.00 | | | ---- | 1971 | 84351 |
| 1325F, 1850F 0.5HR AC, 1060F 2+2HR | S | 0.08 | R.T. | --- | 205.6 | DIST. WATER | 2.000 | 0.050 | CNT | ---- | ------ | 35.00* | | | 4000 | 1968 | 72283 |
| 1325F, 1850F 0.5HR AC, 1060F 2+2HR | S | 0.08 | R.T. | --- | 205.6 | 3N NACL | 2.000 | 0.050 | CNT | ---- | ------ | 28.00* | | | > 20000 | 1968 | 72283 |

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.14.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 10NI STEEL

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT DRY AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ---- | PLATE | 0 10 | 6 00 | | | | | 5 20 | 22 9 | |
| | PLATE | 0 10 | 6 00 | | | | 0 44 | 3 90 | 25 2 | |
| | PLATE | 0 30 | 6 00 | | | | 0 80 | 4 64 | | |
| | PLATE | 0 50 | 6 00 | | | 0 09 | 1 00 | 4 70 | | |
| | PLATE | 0 70 | 6 00 | | | 0 12 | 0 93 | 5 76 | | |

TABLE 6.14.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 10NI STEEL

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT S T W AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | PLATE | 0 10 | 0 10 | | | | | | 43 5 | |
| | PLATE | 0 10 | 1 00 | | | | 0 11 | 2 92 | 40 4 | |
| | PLATE | 0 50 | 0 10 | | | | 1 60 | 13 1 | 85 2 | |
| | PLATE | 0 50 | 1 00 | | | | 0 52 | 6 48 | 48 3 | |

TABLE 6.14.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 10NI STEEL
CONDITION:
ENVIRONMENT: R.T. ,DRY AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN A: | 7.88 | .165 | | | |
| DELTA K MIN B: | 4.05 | | .069 | | |
| DELTA K MIN C: | 2 | | | | |
| DELTA K MIN D: | | | | | |
| | 5.00 | | .0971 | | |
| | 6.00 | | .168 | | |
| | 7.00 | | .294 | | |
| | 8.00 | .177 | .484 | | |
| | 9.00 | .294 | .730 | | |
| | 10.00 | .449 | 1.00 | | |
| | 13.00 | 1.14 | 1.89 | | |
| | 16.00 | 2.15 | 2.89 | | |
| | 20.00 | 3.90 | 4.70 | | |
| | 25.00 | 6.57 | 7.57 | | |
| | 30.00 | 9.64 | 10.4 | | |
| | 35.00 | 13.1 | | | |
| | 40.00 | 16.8 | | | |
| | 50.00 | 25.2 | | | |
| | 60.00 | 35.0 | | | |
| | 70.00 | 46.6 | | | |
| DELTA K MAX A: | 71.09 | 48.0 | | | |
| DELTA K MAX B: | 34.16 | | 12.1 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 33.80 | 24.26 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | | | | |
| | 1.25-2.0 | 1 | 1 | | |
| | >2.0 | | | | |

CONDITION/HT:
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.494"
SPECIMEN WIDTH: 2.494- 2.496"
REFERENCES: 88575

ALLOY STEEL

10NI STEEL

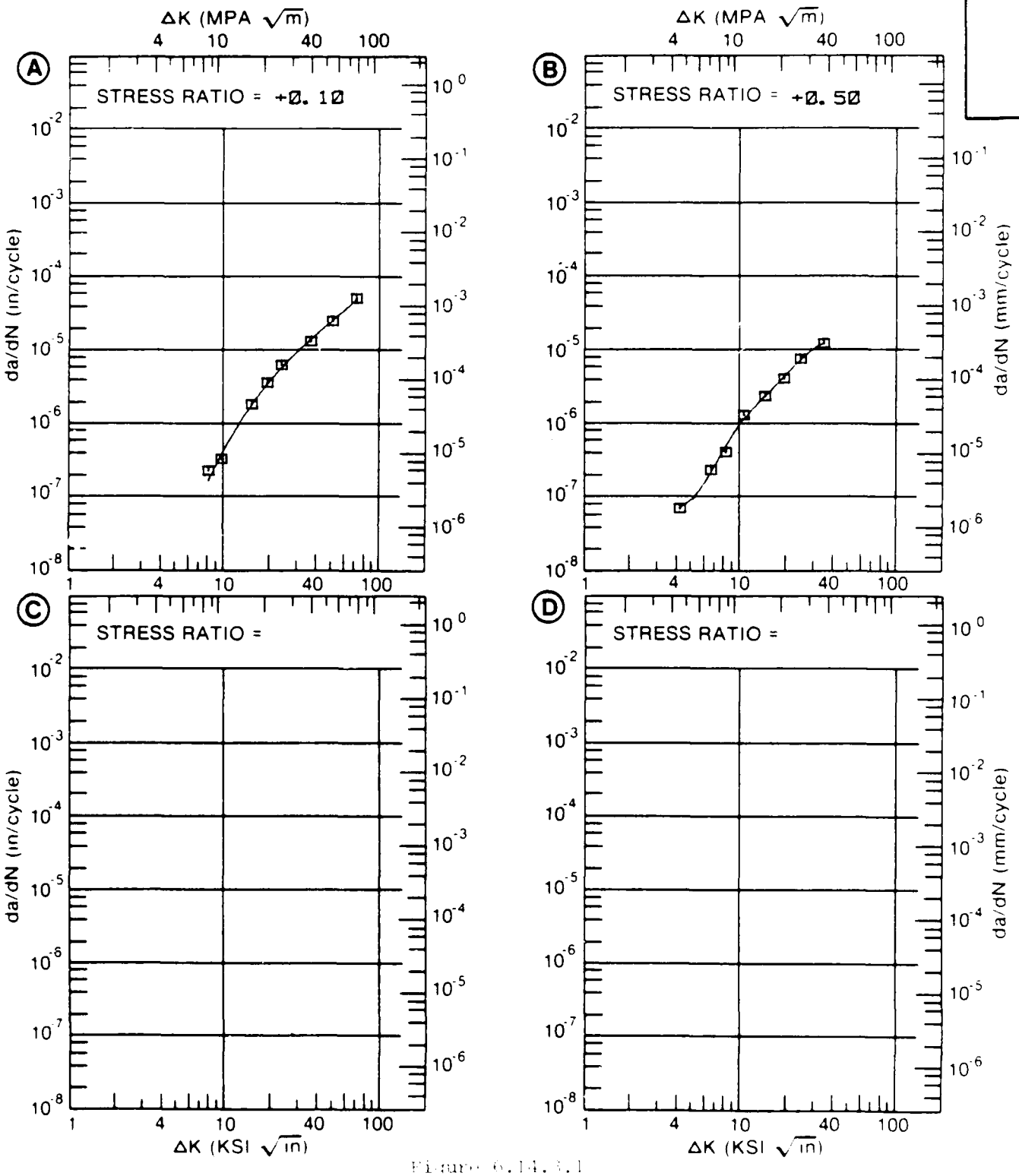



Figure 6.14.3.1

TABLE 6.14.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 10NI STEEL
CONDITION:
ENVIRONMENT: R.T. , S.T.W.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 23.16 | 9.91 | | | |
| | B: | 5.79 | | .0829 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 6.00 | | .106 | | |
| | | 7.00 | | .278 | | |
| | | 8.00 | | .576 | | |
| | | 9.00 | | 1.02 | | |
| | | 10.00 | | 1.60 | | |
| | | 13.00 | | 4.12 | | |
| | | 16.00 | | 7.55 | | |
| | | 20.00 | | 13.1 | | |
| | | 25.00 | 12.8 | 21.2 | | |
| | | 30.00 | 19.9 | 30.7 | | |
| | | 35.00 | 25.5 | 42.1 | | |
| | | 40.00 | 30.5 | 55.3 | | |
| | | 50.00 | 43.5 | 85.2 | | |
| | | 60.00 | | 114. | | |
| DELTA K MAX | A: | 59.08 | 66.0 | | | |
| | B: | 69.37 | | 136. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.88 | 78.50 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | | | |
| | | 1.25-2.0 | | 1 | | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 0.10 HZ
ENVIRONMENT: R.T., S.T.W.

YIELD STRENGTH: 183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.497- 0.516"
SPECIMEN WIDTH: 2.497- 2.498"
REFERENCES: 88575

ALLOY STEEL

10NI STEEL

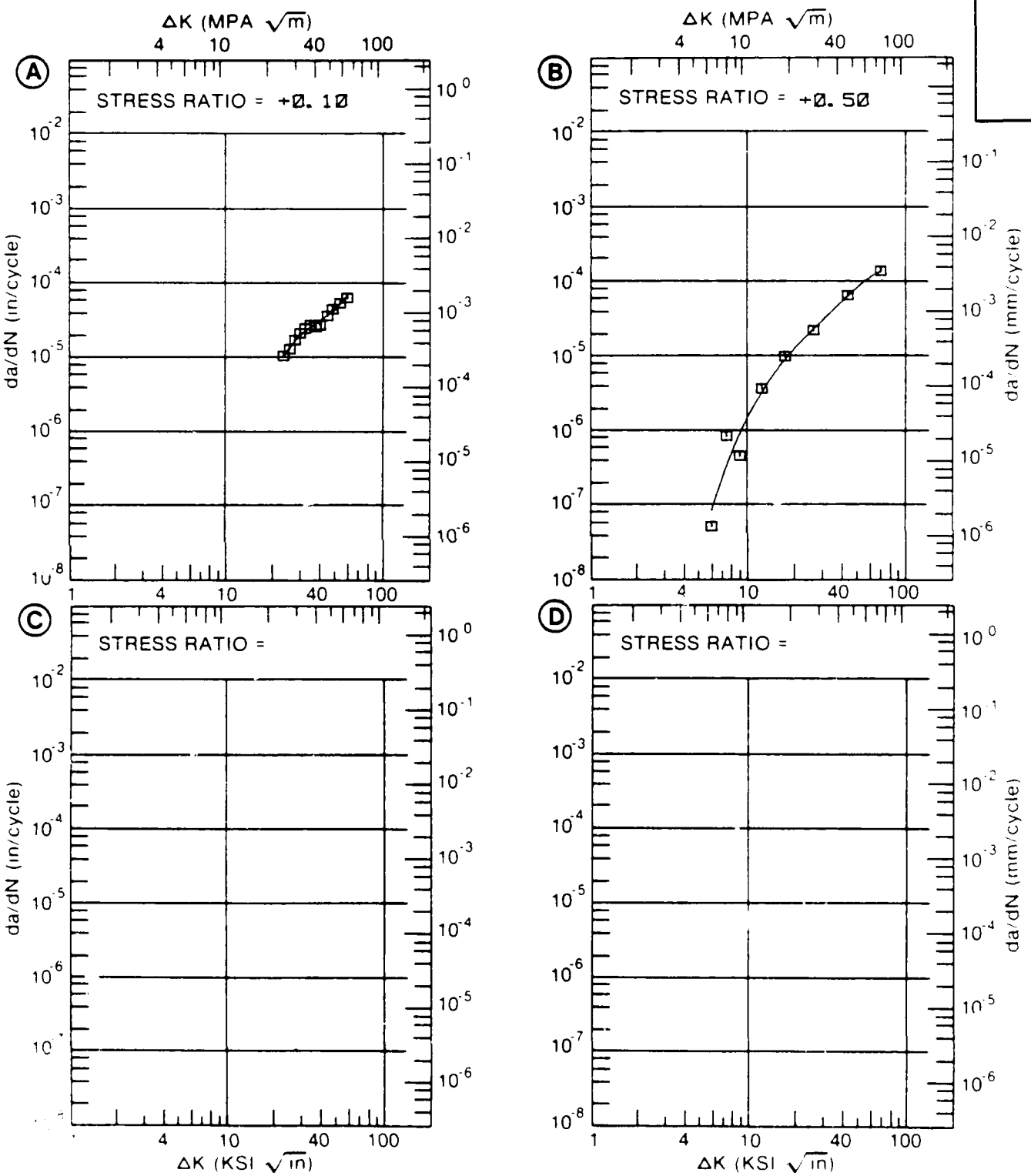


TABLE 6.14.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 10NI STEEL
CONDITION:
ENVIRONMENT: R.T. ,DRY AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A R=+0.10 | B R=+0.30 | C R=+0.70 | D |
|---|---|---|---|---|---|---|
| DELTA K MIN | A: | 11.50 | .739 | | | |
| | B: | 5.39 | | .0561 | | |
| | C: | 3.91 | | | .0937 | |
| | D: | | | | | |
| | | 4.00 | | | .0943 | |
| | | 5.00 | | | .122 | |
| | | 6.00 | | .0993 | .185 | |
| | | 7.00 | | .207 | .290 | |
| | | 8.00 | | .362 | .446 | |
| | | 9.00 | | .563 | .660 | |
| | | 10.00 | | .807 | .931 | |
| | | 13.00 | 1.31 | 1.73 | 2.03 | |
| | | 16.00 | 2.82 | 2.88 | 3.44 | |
| | | 20.00 | 5.20 | 4.64 | 5.76 | |
| | | 25.00 | 8.14 | 7.25 | 9.31 | |
| | | 30.00 | 10.9 | 10.4 | 13.7 | |
| | | 35.00 | 13.5 | 14.4 | 19.3 | |
| | | 40.00 | 16.2 | | 27.3 | |
| | | 50.00 | 22.9 | | | |
| | | 60.00 | 32.6 | | | |
| | | 70.00 | 47.4 | | | |
| DELTA K MAX | A: | 79.57 | 69.3 | | | |
| | B: | 37.57 | | 16.8 | | |
| | C: | 48.99 | | | 55.8 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.23 | 12.49 | 53.40 | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | | | | |
| | | 1.25-2.0 | 1 | 1 | 1 | |
| | | >2.0 | | | | |

CONDITION/HT:
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.754"
SPECIMEN WIDTH: 4.951- 4.998"
REFERENCES: 88575

ALLOY STEEL

10NI STEEL

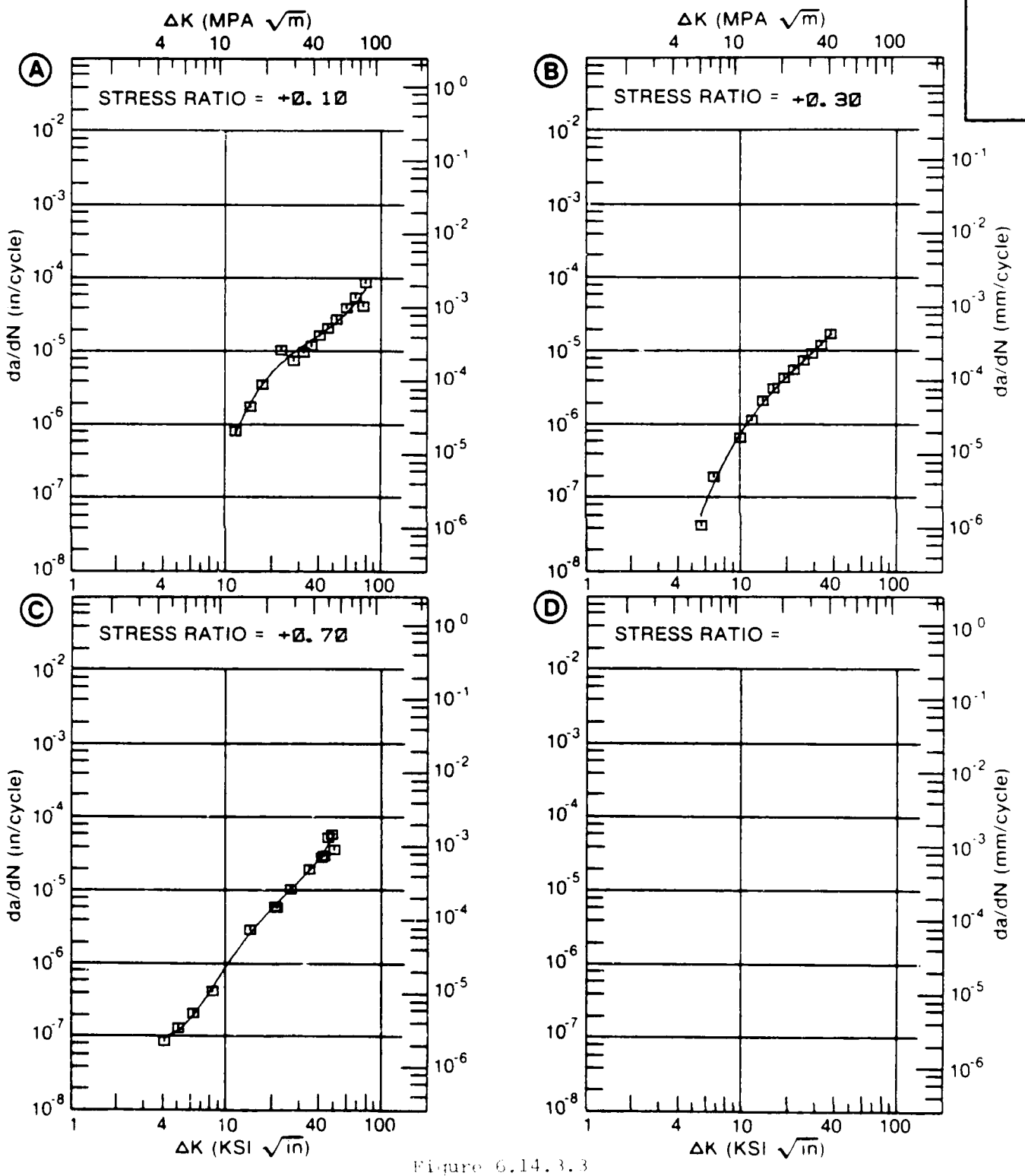



Figure 6.14.3.3

TABLE 6.14.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 10NI STEEL
CONDITION:
ENVIRONMENT: R. T. , S. T. W.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 7.72 | .0224 | | | |
| | B: | 5.73 | | .0357 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 6.00 | | .0456 | | |
| | | 7.00 | | .100 | | |
| | | 8.00 | .0283 | .191 | | |
| | | 9.00 | .0594 | .328 | | |
| | | 10.00 | .111 | .521 | | |
| | | 13.00 | .449 | 1.50 | | |
| | | 16.00 | 1.18 | 3.17 | | |
| | | 20.00 | 2.92 | 6.48 | | |
| | | 25.00 | 6.43 | 12.1 | | |
| | | 30.00 | 11.3 | 18.9 | | |
| | | 35.00 | 17.4 | 26.3 | | |
| | | 40.00 | 24.4 | 33.9 | | |
| | | 50.00 | 40.4 | 48.3 | | |
| | | 60.00 | 58.1 | 60.6 | | |
| | | 70.00 | 76.8 | | | |
| | | 80.00 | 96.1 | | | |
| | | 90.00 | 116. | | | |
| DELTA K MAX | A: | 95.02 | 126. | | | |
| | B: | 68.00 | | 68.6 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 33.58 | 34.04 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | 1 | | | |
| | | >2.0 | 2 | | | |

CONDITION/HT:
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R.T., S.T.W.

YIELD STRENGTH: 183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.750- 0.757"
SPECIMEN WIDTH: 4.993- 5.014"
REFERENCES: 88575

ALLOY STEEL

10NI STEEL

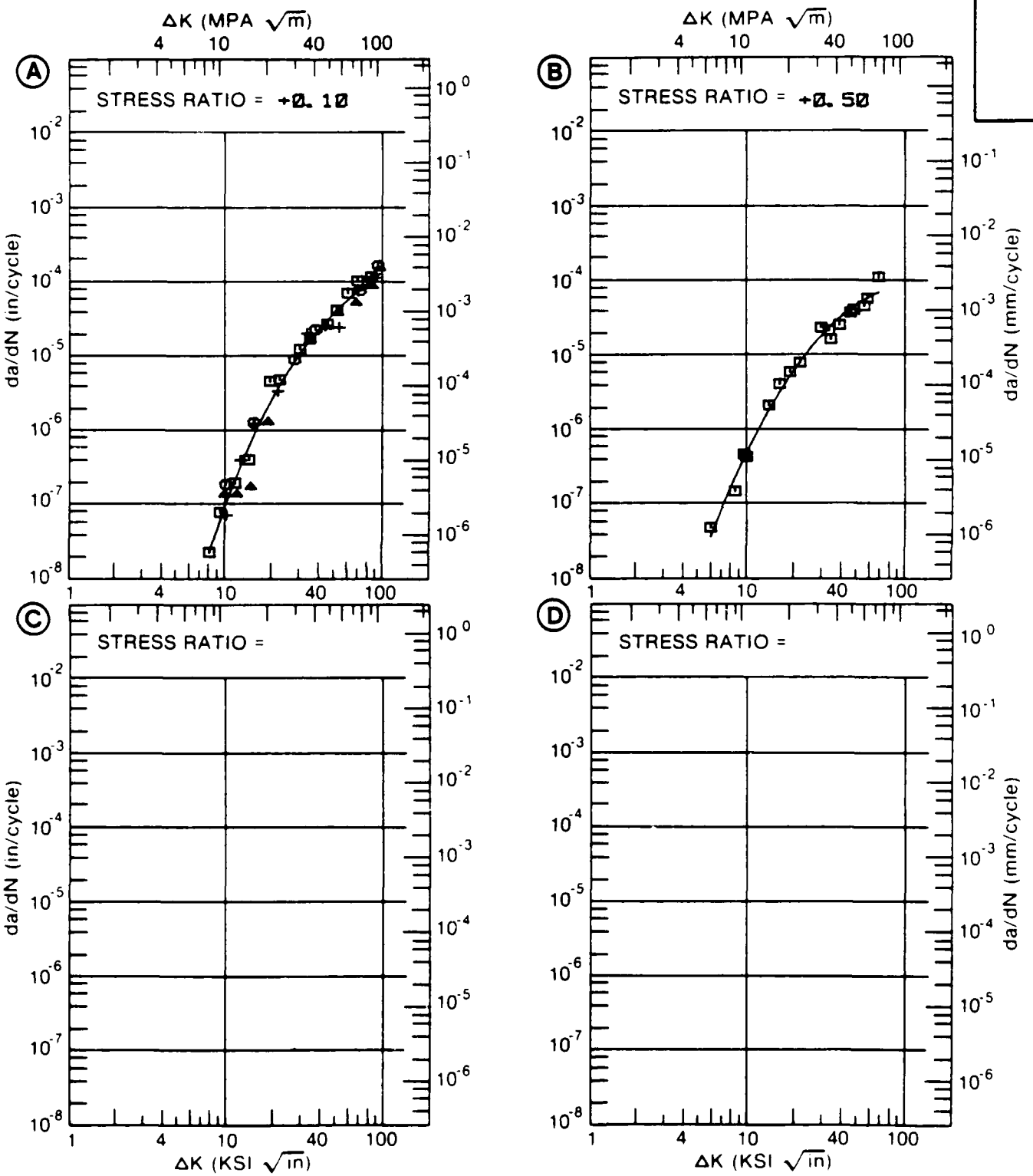



Figure 6.14.3.4

TABLE 6.14.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 10NI STEEL
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. S.T.W. | | | |
| DELTA K MIN | A: | 10.71 | .0314 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | .160 | | | |
| | | 16.00 | .661 | | | |
| | | 20.00 | 2.21 | | | |
| | | 25.00 | 5.63 | | | |
| | | 30.00 | 10.3 | | | |
| | | 35.00 | 15.5 | | | |
| | | 40.00 | 21.2 | | | |
| | | 50.00 | 33.0 | | | |
| | | 60.00 | 46.0 | | | |
| | | 70.00 | 60.9 | | | |
| | | 80.00 | 79.1 | | | |
| | | 90.00 | 102. | | | |
| | | 100.00 | 131. | | | |
| | | 130.00 | 285. | | | |
| DELTA K MAX | A: | 138.84 | 360. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 28.84

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT:
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.755"
SPECIMEN WIDTH: 5.001"
REFERENCES: 88575

ALLOY STEEL

10NI STEEL

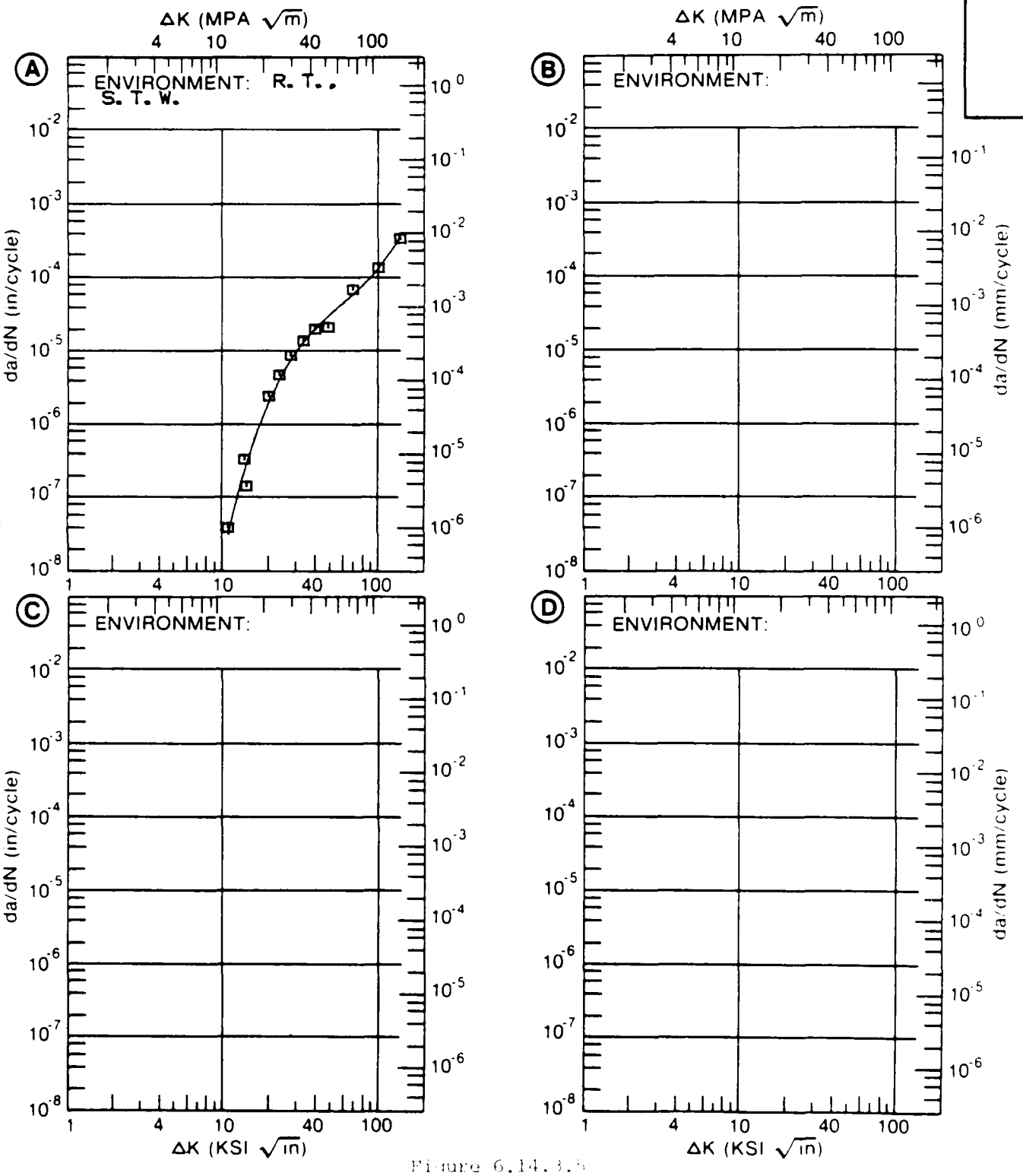



Figure 6.14.3.5

TABLE 6.15.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 12-9-2 MAR

TEST CONDITIONS

SPECIMEN ORIENTATION L-1

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| STA 900 | ROUND BAR | 0 10 | 10 00 | | | | | 8 17 | | |
| STA 900 | ROUND BAR | 0 10 | 30 00 | | | | 0 14 | 8 92 | | |

TABLE 6.15.2.1

ALLOY STEEL 12-9-2(MAR) K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STA 900 | BR | 3.00 | R.T. | L-T | 251.3 | 2.005 | 0.958 | CT | 0.942 | 0.03 | 29.60 | | | 1979 | DA001 |

TABLE 6.15.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.15.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL 12-9-2 MAR
CONDITION: STA 900
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 10.00 SP.THK.=.503" | F(HZ)= 30.00 SP.THK.=.253" | | |
| DELTA K MIN | A: | 12.68 | .730 | | | |
| | B: | 6.95 | | .014 | | |
| | C: | 6 | | | | |
| | D: | | | | | |
| | | 7.00 | | .0154 | | |
| | | 8.00 | | .0401 | | |
| | | 9.00 | | .0829 | | |
| | | 10.00 | | .149 | | |
| | | 13.00 | .863 | .581 | | |
| | | 16.00 | 2.68 | 1.86 | | |
| | | 20.00 | 8.17 | 8.92 | | |
| DELTA K MAX | A: | 23.91 | 27.8 | | | |
| | B: | 21.41 | | 15.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.25 | 14.09 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT STA 900
FORM: 3.00"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 251.3 KSI
ULT. STRENGTH: 257.3 KSI
SPECIMEN THK:
SPECIMEN WIDTH: 1.990- 1.991"
REFERENCES: DA001

ALLOY STEEL

12-9-2 MAR

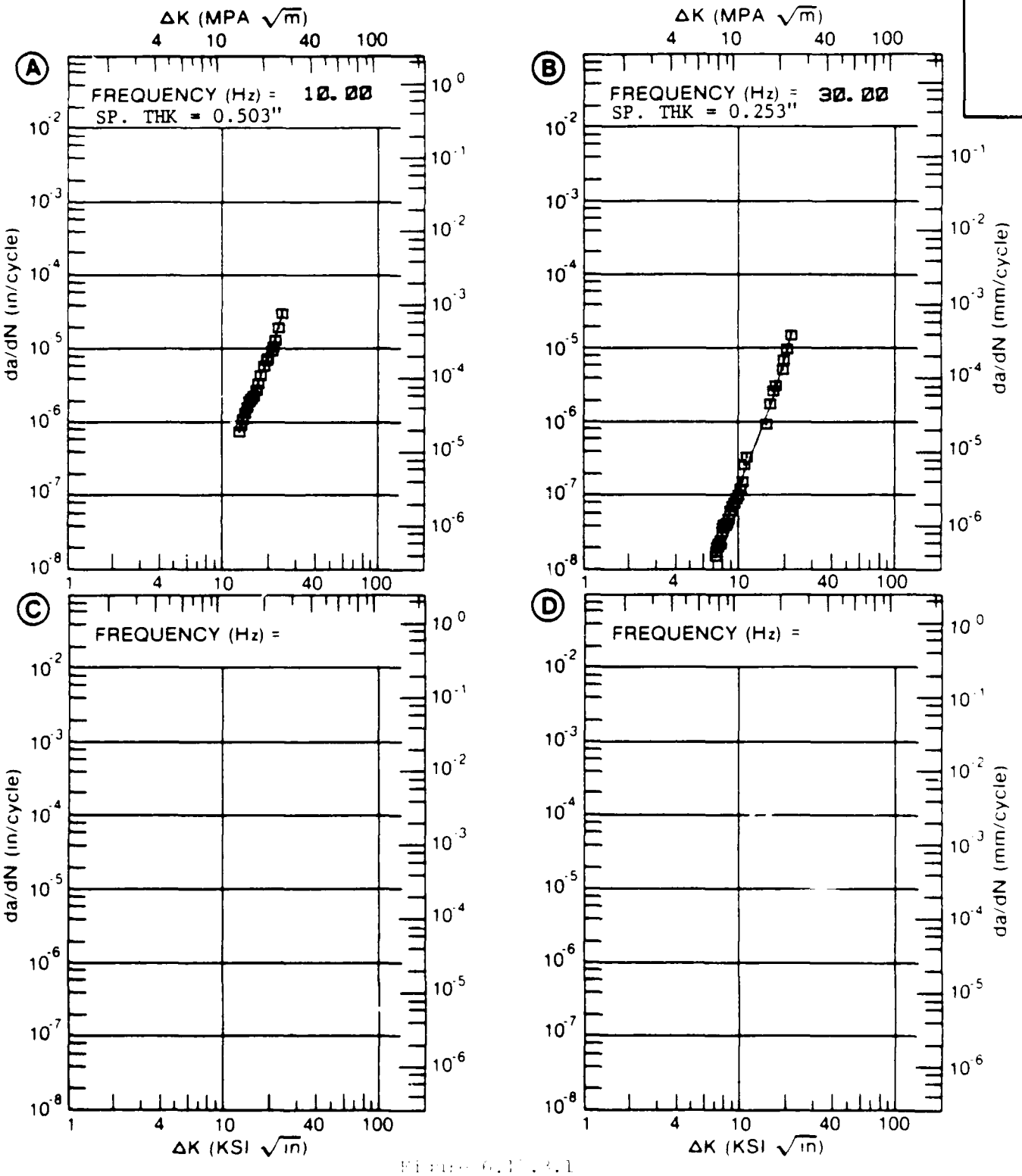



Figure 6.1.2.1

TABLE 6.16.3.1

ALLOY STEEL 12NI-5CR-3MO K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | R T | -- | --- | SYNTH SEAWATER | ---- | ---- | CANT | ---- | ------ | 38.00 | | | ---- | 1969 | 74232 |
| | | | | --- | 184.0 | | ---- | ---- | -- | ---- | ------ | 50.00 | | | ---- | 1969 | 74232 |
| | | | | | | | | | | | | | 44.0/ | 8.5 | | | |
| | | | R T | T-S | 185.0 | 3.5 PCT NACL | ---- | ---- | CANT | ---- | 135.00 | 83.00 | | | 4800 | 1967 | 70887 |
| | P | 1.00 | R T | --- | 185.0 | 3.5 PCT NACL | 3.200 | 1.000 | WOL * | 1.520 | 95.80 | 43.60 | | | ---- | 1969 | 84317 |
| | | 1.00 | | -- | 185.0 | | ---- | ---- | CANT* | ---- | 138.00 | 44.00 | | | ---- | 1969 | 84317 |
| | | 1.00 | | -- | 170.0 | | 3.200 | 1.000 | WOL * | 1.520 | 85.00 | 52.00 | | | ---- | 1969 | 84317 |
| | | 1.00 | | --- | 190.0 | | ---- | ---- | CANT* | ---- | 123.00 | 50.00 | | | ---- | 1969 | 84317 |
| | | | | | | | | | | | | | 47.4/ | 4.2 | | | |
| ELECTRIC FURNACE | P | 1.00 | R T | -- | 176.0 | SYNTH SEAWATER | 1.000 | 1.000 | CANT* | ---- | 130.00 | 40.00 | | | > 60000 | 1966 | 65166 |
| VIA WELDED | W | --- | R T | -- | 178.0 | SYNTH SEAWATER | ---- | ---- | -- | ---- | ------ | 33.00 | | | ---- | 1969 | 74232 |
| LOW-RESIDUAL | P | 1.00 | R T | --- | 183.0 | SYNTH SEAWATER | 1.000 | 1.000 | CANT* | ---- | 169.00 | 108.00 | | | > 60000 | 1966 | 65166 |
| [illegible] 180 GKSI | P | 1.00 | R T | -- | 150.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 150.00 | 130.00* | | | ---- | 1972 | 83613 |
| [illegible] GKSI | P | 1.00 | R T | --- | 160.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 205.00 | 130.00* | | | ---- | 1972 | 83613 |
| [illegible] 170 GKSI | P | 1.00 | R T | -- | 170.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 155.00 | 110.00* | | | ---- | 1972 | 83613 |
| [illegible] 175 GKSI | P | 1.00 | R T | -- | 175.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 140.00 | 105.00* | | | ---- | 1972 | 83613 |

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.16.3.1 (Cont't).

ALLOY STEEL 12NI-5CR-3MO K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SC) | CRACK LENGTH (IN) A | K(0) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500F,900F 20HR AC | P | 1.00 | R.T. | L-S | 176.0 | 3.5 PCT NACL | 2.500 | 0.500 | CANT* | ---- | 249.00 | 80.00 | | | ---- | 1970 | 84342 |
| 1500F,900F 20HR AC | P | 1.00 | R.T. | T-S | 176.0 | 3.5 PCT NACL | 2.50 | 0.500 | CANT* | ---- | 246.00 | 70.00 | | | ---- | 1970 | 84342 |

TABLE 6.17.3.1

ALLOY STEEL 18NI(180)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | P | 1.00 | R T | - - | 170.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 160.00 | 140.00* | | | ---- | 1972 | 83613 |
| [illegible] | P | 1.00 | R T | - - | 175.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 160.00 | 125.00* | | | ---- | 1972 | 83613 |
| [illegible] | P | 1.00 | R T | --- | 178.0 | SYNTH SEAWATER | 1.000 | 1.000 | CANT* | ---- | 118.00 | 108.00 | | | > 60000 | 1966 | 65166 |
| [illegible] | P | 1.00 | R T | - - | 185.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 180.00 | 130.00* | | | ---- | 1972 | 83613 |
| [illegible] | P | 1.00 | R T | - | 190.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 170.00 | 120.00* | | | ---- | 1972 | 83613 |
| [illegible] | P | 1.00 | R T | --- | 175.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 165.00 | 60.00 | | | ---- | 1972 | 83613 |
| [illegible] | P | 1.00 | R T | - - | 200.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 190.00 | 105.00 | | | ---- | 1972 | 83613 |
| [illegible] | P | - - | R T | 1-S | 177.0 | SEAWATER | ---- | ---- | CANT | ---- | ------ | 143.00* | | | ---- | 1971 | 81004 |
| [illegible] | P | 1.00 | R T | 1 S | 177.0 | 3.5 PCT NACL | ---- | ---- | CANT | ---- | ------ | 130.00* | | | > 30000 | 1971 | 81004 |

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.18.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 18NI(200)(MAR) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 4.5 HR, AC, AGED 1000F 6 HR | 102.3 ± 1.2 (3) | ----- | ----- |
| 1650F 4.5 HR, AC, AGED 950F 24 HR | 99.3 ± 1.2 (3) | ----- | ----- |
| 1650F 4.5 HR, AC, AGED 900F 24 HR | 96.5 ± 0.7 (2) | ----- | ----- |
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 4.5 HR, AC, AGED 900F 6 HR | 100.3 ± 0.6 (3) | ----- | ----- |

TABLE 6.18.2.1

ALLOY STEEL 18NI(200)(MAR) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 4.5 HR, AC, AGED 1000F 6 HR | P | 4.25 | R.T. | L-T | 211.0 | 4.700 | 2.400 | CT | 2.400 | 0.60 | 103.00 | | | 1972 | 83834 ( 1) |
| | | 4.25 | | | 211.0 | 6.310 | 3.900 | CT | 3.220 | 0.60 | 103.00 | | | 1972 | 83834 ( 1) |
| | | 4.25 | | | 211.0 | 7.900 | 3.900 | NB | 3.930 | 0.57 | 101.00 | | | 1972 | 83834 ( 1) |
| | | | | | | | | | | | | 102.3/ | 1.2 | | |
| 1650F 4.5 HR, AC, AGED 950F 24 HR | P | 4.25 | R.T. | L-T | 216.0 | 7.870 | 3.900 | NB | 3.930 | 0.54 | 100.00 | | | 1972 | 83834 ( 1) |
| | | 4.25 | | | 216.0 | 4.720 | 2.400 | CT | 2.390 | 0.54 | 100.00 | | | 1972 | 83834 ( 1) |
| | | 4.25 | | | 216.0 | 6.300 | 3.940 | CT | 3.940 | 0.54 | 98.00 | | | 1972 | 83834 ( 1) |
| | | | | | | | | | | | | 99.3/ | 1.2 | | |
| 1650F 4.5 HR, AC, AGED 900F 24 HR | P | 4.25 | R.T. | L-T | 219.0 | 4.730 | 2.400 | CT | 2.390 | 0.48 | 96.00 | | | 1972 | 83834 ( 1) |
| | | 4.25 | | | 219.0 | 7.890 | 3.900 | NB | 3.940 | 0.49 | 97.00 | | | 1972 | 83834 ( 1) |
| | | | | | | | | | | | | 96.5/ | 0.7 | | |
| 1650F 4.5 HR, AC, AGED 900F 6 HR | F | 3.00 | R.T. | L-T | 210.0 | 6.300 | 3.900 | CT | 3.180 | 0.57 | 100.00 | | | 1972 | 83834 ( 1) |
| | | 3.00 | | | 210.0 | 4.700 | 2.400 | CT | 2.360 | 0.58 | 101.00 | | | 1972 | 83834 ( 1) |
| | | 3.00 | | | 224.0 | 7.900 | 3.900 | CT | 3.880 | 0.57 | 100.00 | | | 1972 | 83834 ( 1) |
| | | | | | | | | | | | | 100.3/ | 0.6 | | |
| 1650F, 4.5 HR, AC, AGED 850F 24 HR | F | 3.00 | R.T. | L-T | 224.0 | 6.300 | 3.900 | CT | 3.160 | 0.33 | 81.00 | | | 1966 | 76411 ( 1) |

NOTES
( 1) VACUUM ARC REMELTED

TABLE 6.18.3.1

ALLOY STEEL 18NI(200)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SQ) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | P | 0.50 | R.T. | L-T | 207.0 | UNSYMMETRICAL DIMETYL HYDRUZINE | 5.500 | 0.500 | TDCB | ---- | 110.00 | 110.00* | | | > 47500 | ---- | 80667 |
| TYS=215KSI | P | 1.00 | R.T. | --- | 215.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 125.00 | 70.00 | | | ---- | 1972 | 83613 |
| WELD CENTER LINE | P | ---- | R.T. | L-S | 215.0 | 3.5 PCT NACL | ---- | ---- | CANT | ---- | 115.00 | 70.00 | | | 19000 | 1967 | 70887 |
| 1500F 1HR AC 700F 3HR | P | 1.00<br>1.00 | R.T. | T-S | 219.0<br>219.0 | 3.5 PCT NACL | ----<br>---- | ----<br>---- | CANT<br>CANT | ----<br>---- | ------<br>------ | 39.00<br>94.00* | | | > 20000<br>> 60000 | 1971<br>1971 | 80824<br>81004 |
| 1650F 700F 3HR AC | P | 1.00 | R.T. | --- | 197.0 | 3.5 PCT NACL | 2.500 | 0.500 | CANT* | ---- | 231.00 | 104.00* | | | ---- | 1970 | 84342 |
| 1675F 2HR AC 500F,15MIN 850F 4HR COOL 250F/MIN | P | ---- | R.T. | T-S | 197.5 | 3.5 PCT NACL | 0.938 | 0.750 | CANT* | 0.250 | 144.00 | 78.00 | | | > 30000 | 1967 | 69162 |
| 1675F 2HR AC 500F,0.25HR 850F 4HR,COOL 250F/MIN | P | 0.94 | R.T. | T-S | 192.6 | 3.5 PCT NACL | 0.938 | 0.750 | CANT* | 0.250 | 146.00 | 48.00 | | | > 39000 | 1967 | 69162 |

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.19.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 18NI(250)(MAR) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1500F AC, 850F 6 HR | 76.0 ± 1.9 (5) | ----- | ----- |
| 1500F AC, 900F 24 HR | 80.7 ± 1.2 (6) | ----- | ----- |
| 1500F AC, 950F 6 HR | 84.0 ± 2.6 (6) | ----- | ----- |
| 1500F, AC, 900F 6 HR | 82.3 ± 3.2 (6) | ----- | ----- |
| | **BILLET** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1500F 1HR, AC, AGED 900F 3HR, AC | 74.3 ± 4.2 (7) | 64.1 ± 4.4 (6) | ----- |

TABLE 6.19.2.1

ALLOY STEEL 18NI(250)(MAR) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500F AC,850F 6 HR | P | 4.25 | R.T. | L-T | 253.0 | 3.750 | 1.800 | NB | 1.800 | 0.22 | 73.00 | | | 1972 | 83834 |
| | | 4.25 | | | 253.0 | 3.000 | 1.800 | CT | 1.800 | 0.22 | 76.00 | | | 1972 | 83834 |
| | | 4.25 | | | 253.0 | 3.000 | 1.800 | CT | 1.800 | 0.24 | 78.00 | | | 1972 | 83834 |
| | | 4.25 | | | 253.0 | 3.000 | 1.800 | CT | 1.800 | 0.23 | 77.00 | | | 1972 | 83834 |
| | | 4.25 | | | 253.0 | 3.750 | 1.800 | NB | 1.800 | 0.22 | 76.00 | 76.0/ | 1.9 | 1972 | 83834 |
| 1500F AC,900F 24 HR | P | 2.00 | R.T. | L-T | 259.0 | 3.000 | 1.800 | CT | 1.800 | 0.24 | 81.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.000 | 1.800 | CT | 1.800 | 0.25 | 82.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.750 | 1.800 | NB | 1.800 | 0.24 | 80.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.750 | 1.800 | NB | 1.800 | 0.25 | 82.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.750 | 1.800 | NB | 1.800 | 0.23 | 79.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.000 | 1.800 | CT | 1.800 | 0.24 | 80.00 | 80.7/ | 1.2 | 1968 | 73612 |
| 1500F AC,950F 6 HR | P | 2.00 | R.T. | L-T | 252.0 | 3.750 | 1.800 | NB | 1.800 | 0.32 | 89.00 | | | 1968 | 73612 |
| | | 2.00 | | | 252.0 | 3.000 | 1.800 | CT | 1.800 | 0.28 | 84.00 | | | 1968 | 73612 |
| | | 2.00 | | | 252.0 | 3.000 | 1.800 | CT | 1.800 | 0.27 | 83.00 | | | 1968 | 73612 |
| | | 2.00 | | | 252.0 | 3.000 | 1.800 | CT | 1.800 | 0.26 | 82.00 | | | 1968 | 73612 |
| | | 2.00 | | | 252.0 | 3.750 | 1.800 | NB | 1.800 | 0.26 | 82.00 | | | 1968 | 73612 |
| | | 2.00 | | | 252.0 | 3.750 | 1.800 | NB | 1.600 | 0.28 | 84.00 | 84.0/ | 2.6 | 1968 | 73612 |
| 1500F 1HR,AC, AGED 900F 3HR, AC | BT | 12.00 | R.T. | L-T | 231.0 | 2.000 | 1.020 | NB | ---- | 0.26 | 74.90 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 231.0 | 2.000 | 1.020 | NB | ---- | 0.24 | 70.90 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 233.0 | 1.000 | 0.500 | CT | ---- | 0.25 | 73.40 | | | 1974 | 90981 ( 1) |
| | | 1.00 | | | 233.0 | 2.000 | 1.020 | NB | ---- | 0.24 | 72.20 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 233.0 | 2.000 | 1.020 | NB | ---- | 0.22 | 69.60 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 233.0 | 1.000 | 0.500 | CT | ---- | 0.27 | 77.20 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 233.0 | 1.000 | 0.500 | CT | ---- | 0.31 | 81.80 | | | 1974 | 90981 ( 1) |
| | | | | | | | | | | | | 74.3/ | 4.2 | | |
| 1500F 1HR,AC, AGED 900F 3HR, AC | BT | 12.00 | R.T. | T-L | 232.0 | 2.000 | 1.020 | NB | ---- | 0.22 | 67.10 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 232.0 | 1.000 | 0.500 | CT | ---- | 0.20 | 65.00 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 232.0 | 1.000 | 0.500 | CT | ---- | 0.22 | 69.20 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 232.0 | 2.000 | 1.020 | NB | ---- | 0.16 | 57.00 | | | 1974 | 90981 ( 1) |
| | | 12.00 | | | 232.0 | 2.000 | 1.020 | NB | ---- | 0.17 | 61.00 | | | 1974 | 90981 ( 1) |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.014C,0.087MN,0.006P,0.07SI,18.6NI,0.10CR,4.75MO0,6.41TI,0.11AL

TABLE 6.19.2.1 (Con't)

ALLOY STEEL 18NI(250)(MAR) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500F 1HR, AC, AGED 900F 3HR, AC | BT | 12.00 | R.T. | T-L | 232.0 | 1.000 | 0.500 | CT | ---- | 0.17 | 61.20 | 64.1/ | 4.4 | 1974 | 90981 ( 1) |
| 1500F, AC, 900F 6 HR | P | 2.00 | R.T. | L-T | 259.0 | 3.000 | 1.800 | CT | 1.800 | 0.23 | 79.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.750 | 1.800 | NB | 1.800 | 0.24 | 81.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.750 | 1.800 | NB | 1.800 | 0.26 | 84.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.000 | 1.800 | CT | 1.800 | 0.24 | 81.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.000 | 1.800 | CT | 1.800 | 0.24 | 81.00 | | | 1968 | 73612 |
| | | 2.00 | | | 259.0 | 3.750 | 1.800 | NB | 1.800 | 0.29 | 88.00 | 82.3/ | 3.2 | 1968 | 73612 |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.014C, 0.087MN, 0.006P, 0.07SI, 18.6NI, 0.10CR, 4.75MOO, 0.41TI, 0.11AL

TABLE 6.19.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.19.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(250)MAR
CONDITION: TUS=243KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R. T. 3. 5%NACL | | | |
| DELTA K MIN | A: | 11. 39 | 2. 23 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13. 00 | 5. 05 | | | |
| | | 16. 00 | 11. 1 | | | |
| | | 20. 00 | 18. 0 | | | |
| | | 25. 00 | 27. 5 | | | |
| | | 30. 00 | 42. 7 | | | |
| | | 35. 00 | 66. 9 | | | |
| | | 40. 00 | 94. 2 | | | |
| DELTA K MAX | A: | 45. 03 | 113. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 12. 81

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0. 0-0. 5 | |
| | 0. 5-0. 8 | |
| | 0. 8-1. 25 | |
| | 1. 25-2. 0 | 1 |
| | >2. 0 | |

CONDITION/HT: TUS=243KSI
FORM: 12.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 232.7 KSI
ULT. STRENGTH: 243.5 KSI
SPECIMEN THK: 1.001"
SPECIMEN WIDTH: 2.554"
REFERENCES: 90981

ALLOY STEEL

18NI (250) MAR

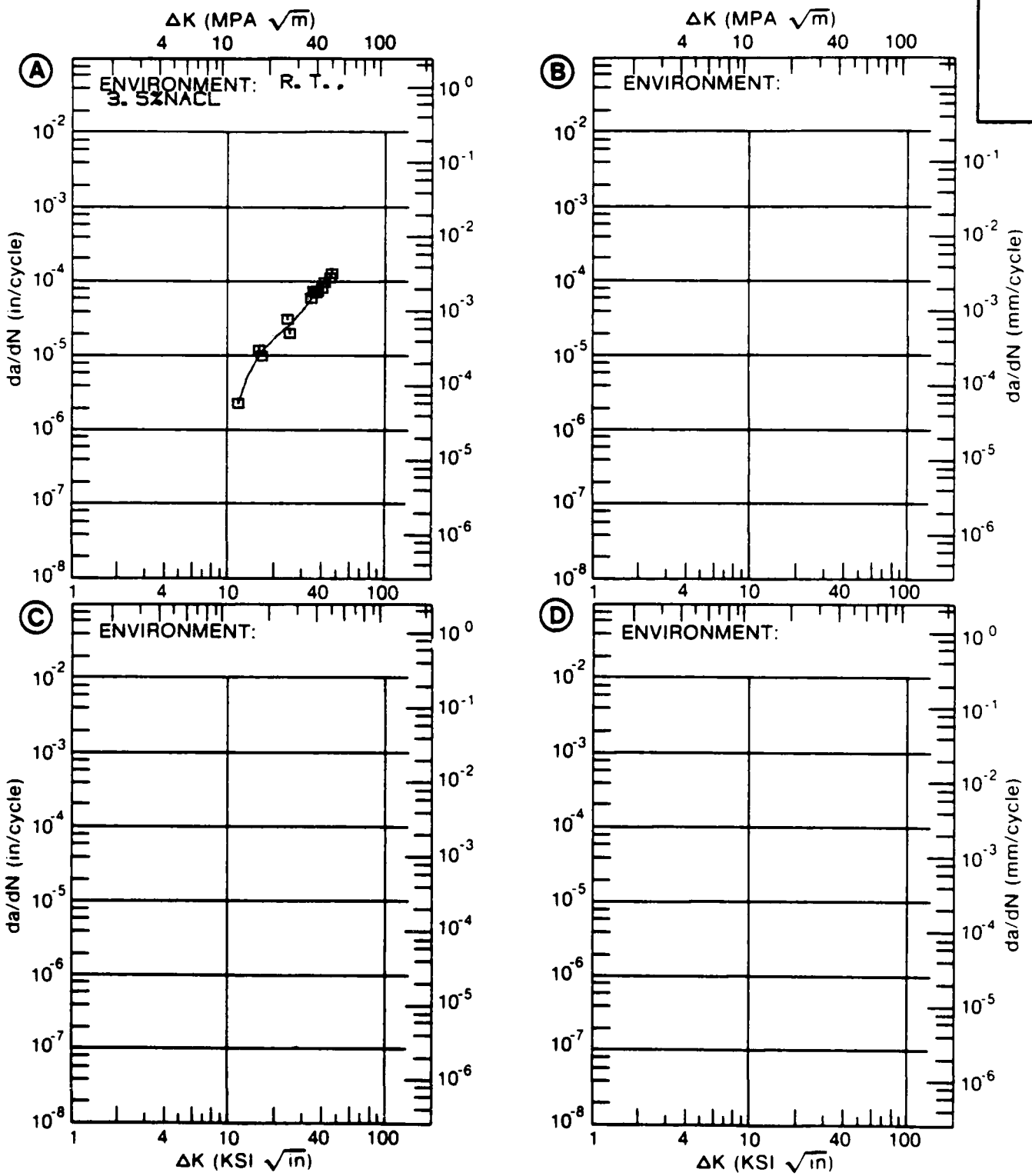



Figure 6.19.3.1

TABLE 6.19.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.19.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(250)MAR
CONDITION: TUS=243KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR | E= R.T. 3.5%NACL | | |
| DELTA K MIN | A: | 7.69 | .290 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | .373 | | | |
| | | 9.00 | .716 | | | |
| | | 10.00 | 1.16 | | | |
| | | 13.00 | 2.73 | | | |
| | | 16.00 | 4.21 | | | |
| | | 20.00 | 5.91 | | | |
| | | 25.00 | 8.16 | | | |
| | | 30.00 | 11.4 | | | |
| | | 35.00 | 16.7 | | | |
| | | 40.00 | 25.7 | | | |
| | | 50.00 | 71.0 | | | |
| DELTA K MAX | A: | 52.78 | 97.0 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 121.19 | 0.00 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 1 |

CONDITION/HT: TUS=243KSI
FORM: 12.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 10.00 HZ

YIELD STRENGTH: 231.8 KSI
ULT. STRENGTH: 243.0 KSI
SPECIMEN THK: 1.000- 1.001"
SPECIMEN WIDTH: 2.553"
REFERENCES: 90981

ALLOY STEEL

18NI (250) MAR

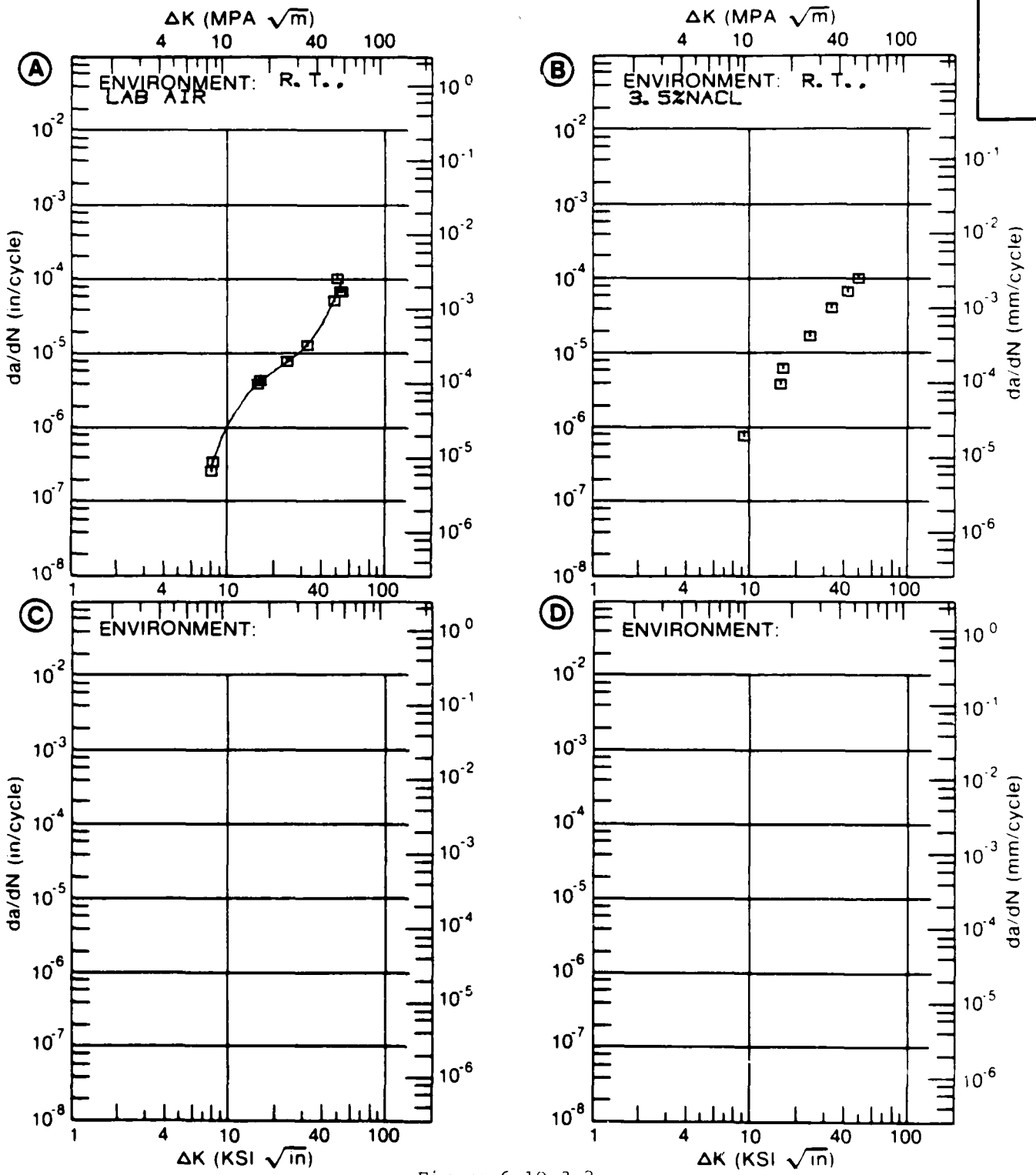



Figure 6.19.3.2

TABLE 6.19.3.3

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.19.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(250)
CONDITION:

| K MAX (KSI*IN**1/2) | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|
| | | E= 3.5% NACL | | | |
| K MAX MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| 200.00 | | | | | |
| K MAX MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 0.00

CONDITION/HT:
FORM:
SPECIMEN TYPE: TDCB
ORIENTATION:
YIELD STRENGTH:
ULT STRENGTH:

SPECIMEN THK:
SPECIMEN WIDTH:
CRACK LENGTH ($A_0$):
$K_{ISCC}$:
REFERENCES:78313

ALLOY STEEL

18NI (250)

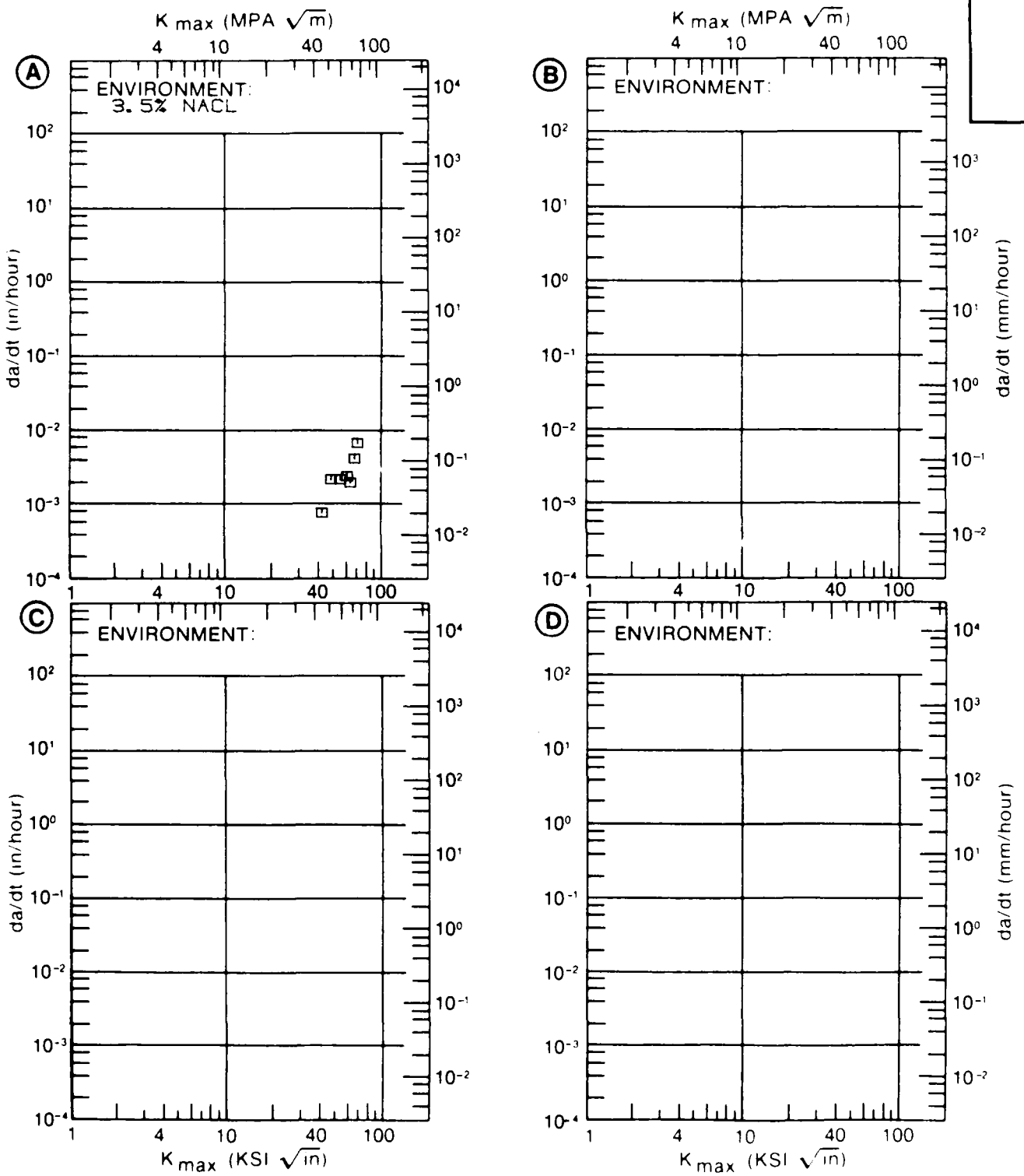



Figure 6.19.3.3

TABLE 6.19.3.4

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.19.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(250)
CONDITION:

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= DEHUMIDIFIED HYDROGEN | E= HYDROGEN | | |
| K MAX MIN | A: | 18.00 | 1494. | | | |
| | B: | 23.10 | | 1403. | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 4145. | | | |
| | | 25.00 | 8724. | 2376. | | |
| | | 30.00 | | 5529. | | |
| | | 35.00 | | 8306. | | |
| | | 40.00 | | 10206. | | |
| | | 50.00 | | 12754. | | |
| K MAX MAX | A: | 29.20 | 11124. | | | |
| | B: | 52.70 | | 13502. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 9.07 | 2.81 | | |

CONDITION/HT:
FORM: 0.3"TH PLATE
SPECIMEN TYPE: CNT
ORIENTATION:
YIELD STRENGTH: 246.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.250"
SPECIMEN WIDTH 2.750"
CRACK LENGTH ($A_0$):
$K_{ISCC}$:
REFERENCES 70887, 84310

ALLOY STEEL

18NI (250)

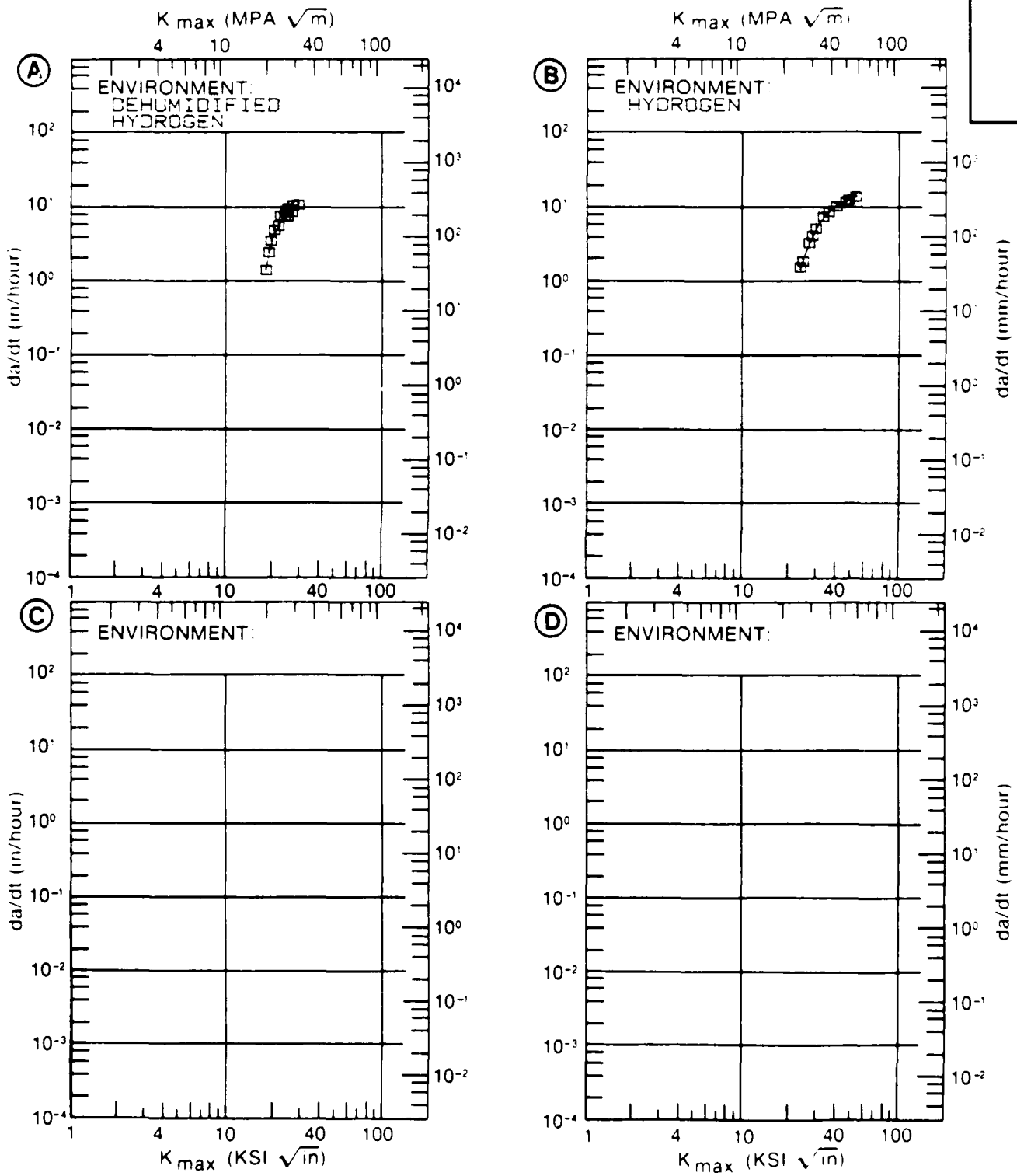



Figure 6.19.3.4

TABLE 6.19.3.5

ALLOY STEEL 18NI(250)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(G) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | P | ---- | R.T. | --- | 259.0 | SYNTH SEAWATER | ---- | ---- | -- | ---- | ------ | 36.50 | | | ---- | 1969 | 74232 |
| | | 1.00 | | --- | 252.0 | | 1.000 | 1.000 | CANT* | ---- | 72.60 | 49.00 | | | > 30000 | 1966 | 65166 |
| | | 1.25 | | --- | 259.0 | | 0.500 | 1.000 | CANT* | 0.170 | 68.00 | 21.00 | | | > 60000 | 1968 | 73829 |
| | | 1.25 | | --- | 259.0 | | 1.000 | 1.000 | CANT* | 0.350 | 78.00 | 37.00 | | | > 60000 | 1968 | 73829 |
| | | 1.25 | | --- | 259.0 | | 3.000 | 1.000 | CANT* | 1.050 | 93.00 | 35.00 | | | > 60000 | 1968 | 73829 |
| | | 1.25 | | --- | 259.0 | | 5.000 | 1.000 | CANT* | 1.750 | 95.00 | 38.00 | | | > 60000 | 1968 | 73829 |
| | | | | | | | | | | | | | 36.1/ | 8.9 | | | |
| AGE 900F 3HR | P | 0.48 | R.T. | L-T | 249.0 | 3.5 PCT NACL | 1.500 | 0.480 | NB | ---- | 92.00 | 45.00 | | | ---- | 1971 | 84351 |
| AGED 900F 3HR | P | 0.50 | R.T. | L-S | ---- | 3.5 PCT NACL | 0.482 | 0.375 | CANT | ---- | ------ | 31.00 | | | > 5000 | 1971 | 80824 |
| AC | | 0.50 | | | ---- | | 0.500 | 0.375 | CANT* | ---- | ------ | 50.00 | | | 7000 | 1971 | 80824 |
| | | | | | | | | | | | | | 40.5/ | 13.4 | | | |
| TYS=250KSI | P | 1.00 | R.T. | --- | 250.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 70.00 | 50.00 | | | ---- | 1972 | 83613 |
| TYS=260KSI | P | 1.00 | R.T. | --- | 260.0 | 3.5 PCT NACL | ---- | 1.000 | CANT* | ---- | 95.00 | 70.00 | | | ---- | 1972 | 83613 |
| 1650F 1.25HR | P | 1.25 | R.T. | --- | 259.0 | SYNTH SEAWATER | 1.000 | 1.000 | CANT* | ---- | 78.00 | 37.00 | | | ---- | 1970 | 78065 |
| WQ,1525F | | 1.25 | | --- | 259.0 | | 3.000 | 1.000 | CANT* | ---- | 93.00 | 35.00 | | | ---- | 1970 | 78065 |
| 1.25HR WQ,900F 3HR AC | | | | | | | | | | | | | 36.0/ | 1.4 | | | |
| 1650F 1.25HR | P | 1.25 | R.T. | --- | 259.0 | SYNTH SEAWATER | 5.000 | 1.000 | CANT* | ---- | 95.00 | 38.00 | | | ---- | 1970 | 78065 |
| WQ,1525F 1.25HR WQ 900F 3HR | | | | | | | | | | | | | | | | | |
| AC | | | | | | | | | | | | | | | | | |
| 900F 2HR AC | S | 0.08 | R.T. | --- | 228.0 | DIST. WATER | 2.000 | 0.050 | CNT | ---- | ------ | 110.00* | | | > 30000 | 1968 | 72283 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KIBCC/TYS)SQUARED

TABLE 6.19.3.5 (Con't)

ALLOY STEEL 18NI(250)(HAR) K(ISCC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | ------SPECIMEN-------- WIDTH (IN) W | THICK (IN) B | DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 900F 2HR AC | S | 0.08 | R.T. | --- | 228.0 | 3.5 PCT NACL | 2.000 | 0.030 | CNT | ---- | ------ | 110.00* | | | 20000 | 1968 | 72283 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.20.3.1

ALLOY STEEL 18NI(280)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(G) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500F 1HR AC 900F 3HR | P | ---- | R.T | --- | 277.0 | 3.5 PCT NACL | 0.750 | 0.750 | CANT | ---- | 60.00 | 14.00 | | | 14400 | 1971 | 82164 |

TABLE 6.21.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 18NI(300)MAR

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT H H A AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- | FORGING | 0.05 | 2.00 | | | | | | 22.2 | |
| | FORGING | 0.67 | 2.00 | | | | 1.51 | 9.38 | | |

TABLE 6.21.2.1

ALLOY STEEL 18NI(300)(MAR) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F 1HR, AC, 1500F 1 HR, AC, 900F 6 HR | F | 10 00 | - 65 | L-R | ---- | 1.000 | 0.500 | NB | 0.500 | ---- | 54.00 | | | 1970 | 78425 |
| 1700F 1HR, AC, 1500F 1 HR, AC, 900F 6 HR | F | 10 00<br>10 00 | R.T. | L-R | 280.0<br>300.0 | 1.000<br>1.000 | 0.500<br>0.500 | NB<br>NB | 0.500<br>0.500 | 0.16<br>0.11 | 71.20<br>64.20 | 67.7/ | 4.9 | 1970<br>1970 | 78425<br>78425 |
| 1700F 1HR, AC, 1500F 1 HR, AC, 900F 6 HR | F | 10 00<br>10 00 | R.T. | R-C | 280.0<br>299.0 | 1.000<br>1.000 | 0.500<br>0.500 | NB<br>NB | 0.500<br>0.500 | 0.18<br>0.11 | 75.50<br>62.50 | 69.0/ | 9.2 | 1970<br>1970 | 78425<br>78425 |
| 900 F AGED | P | 1 00 | R.T | L-T | 276.0 | 0.800 | 0.400 | CT | 0.400 | ---- | ---- | | | 1971 | 86582 ( 1) |

NOTES:
( 1) COMPOSITION(WT PERCENT) 0.017C, 0.05MN, 0.004P, 0.007S, 0.09SI, 18.8NI, 4.95MO, 7.2CB, 0.58TI, 0.13AL

TABLE 6.21.2.2

ALLOY STEEL 18NI(300)MAR K(C)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | CRACK LENGTH INIT (IN) 2A(O) | CRACK LENGTH FINAL (IN) 2A(F) | GROSS STRESS ONSET (KSI) S(O) | GROSS STRESS MAX (KSI) S(MAX) | K(APP) (KSI*SQRT IN) | K(APP) STAN MEAN DEV | K(C) (KSI*SQRT IN) | K(C) STAN MEAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUCKLING OF CRACK EDGES NOT RESTRAINED | | | | | | | | | | | | | | | | | |
| ---------- | S | 0.03 | - 423 | L-T | 386.0 | 4.000 | 0.026 | 1.250 | 1.290 | --- | 63.80 | 95.20 | | 97.12 | | 1964 | 60578 |
| | | 0.03 | | | 386.0 | 4.010 | 0.029 | 1.250 | 1.400 | --- | 56.50 | 84.28 | | 90.70 | | 1964 | 60578 |
| | | 0.03 | | | 386.0 | 4.010 | 0.028 | 1.230 | 1.230 | --- | 55.80 | 82.39 | | 82.39 | | 1964 | 60578 |
| | | 0.03 | | | 386.0 | 4.010 | 0.029 | 1.250 | 1.250 | --- | 55.00 | 82.04 | | 82.04 | | 1964 | 60578 |
| | | 0.03 | | | 386.0 | 4.020 | 0.028 | 1.170 | 1.170 | --- | 55.80 | 79.86 | 84.8/ 6.0 | 79.86 | 86.4/ 7.3 | 1964 | 60578 |
| ---------- | S | 0.03 | - 320 | L-T | 336.0 | 2.020 | 0.025 | 0.590 | 0.590 | --- | 150.00 | 152.50 | | 152.50 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 2.020 | 0.025 | 0.590 | 0.590 | --- | 141.00 | 143.35 | | 143.35 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 2.020 | 0.025 | 0.590 | 0.590 | --- | 141.00 | 143.35 | | 143.35 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 2.020 | 0.025 | 0.580 | 0.580 | --- | 131.00 | 131.80 | | 131.80 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 2.020 | 0.025 | 0.600 | 0.600 | --- | 138.00 | 141.76 | 142.6/ 7.4 | 141.76 | 142.6/ 7.4 | 19.4 | 60578 |
| ---------- | S | 0.03 | - 320 | L-T | 336.0 | 3.950 | 0.026 | 1.230 | 1.230 | --- | 76.50 | 113.18 | | 113.18 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 4.010 | 0.027 | 1.240 | 1.250 | --- | 89.50 | 132.83 | | 133.50 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 4.020 | 0.026 | 1.240 | 1.240 | --- | 88.00 | 130.56 | | 130.56 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 4.020 | 0.027 | 1.240 | 1.240 | --- | 81.90 | 121.51 | | 121.51 | | 1964 | 60578 |
| | | 0.03 | | | 336.0 | 4.020 | 0.027 | 1.240 | 1.240 | --- | 82.50 | 122.40 | 124.1/ 7.9 | 122.40 | 124.2/ 8.0 | 1964 | 60578 |
| ---------- | S | 0.03 | R.T. | L-T | 277.0 | 2.010 | 0.026 | 0.580 | 0.580 | --- | 125.00 | 125.83 | | 125.83 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 2.020 | 0.025 | 0.580 | 0.580 | --- | 130.00 | 130.80 | | 130.80 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 2.020 | 0.025 | 0.580 | 0.580 | --- | 133.00 | 133.81 | | 133.81 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 2.020 | 0.025 | 0.550 | 0.550 | --- | 136.00 | 132.52 | | 132.52 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 2.020 | 0.026 | 0.580 | 0.600 | --- | 134.00 | 134.82 | 131.6/ 3.5 | 137.65 | 132.1/ 4.3 | 1964 | 60578 |
| ---------- | S | 0.03 | R.T. | L-T | 277.0 | 4.000 | 0.028 | 1.240 | 1.240 | --- | 83.80 | 124.41 | | 124.41 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 4.000 | 0.028 | 1.240 | 1.240 | --- | 89.20 | 132.42 | | 132.42 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 4.000 | 0.028 | 1.240 | 1.240 | --- | 87.40 | 129.75 | | 129.75 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 4.000 | 0.028 | 1.240 | 1.260 | --- | 83.00 | 123.22 | | 124.47 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 4.000 | 0.029 | 1.230 | 1.240 | --- | 88.50 | 130.72 | 128.1/ 4.1 | 131.39 | 128.5/ 3.8 | 1964 | 60578 |
| ---------- | S | 0.03 | R.T. | L-T | 277.0 | 17.700 | 0.025 | 5.490 | 5.490 | --- | 34.70 | 108.40 | | 108.40 | | 1964 | 60578 |
| ---------- | S | 0.03 | R.T. | L-T | 277.0 | 18.060 | 0.025 | 5.490 | 5.500 | --- | 33.10 | 103.14 | | 103.26 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 18.100 | 0.022 | 5.470 | 5.470 | --- | 33.70 | 104.74 | | 104.74 | | 1964 | 60578 |
| | | 0.03 | | | 277.0 | 18.100 | 0.025 | 5.480 | 5.480 | --- | 39.50 | 122.91 | 110.3/11.0 | 122.91 | 110.3/10.9 | 1964 | 60578 |

TABLE 6.21.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(300)MAR
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. H.H.A. | | | |
| DELTA K MIN | A: | 20.16 | 2.64 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 25.00 | 6.05 | | | |
| | | 30.00 | 8.81 | | | |
| | | 35.00 | 11.3 | | | |
| | | 40.00 | 14.0 | | | |
| | | 50.00 | 22.2 | | | |
| | | 60.00 | 39.9 | | | |
| DELTA K MAX | A: | 67.79 | 41.0 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 14.25

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 0.13"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.06
FREQUENCY: 2.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 3.000"
REFERENCES:78425

ALLOY STEEL

18NI (300) MAR

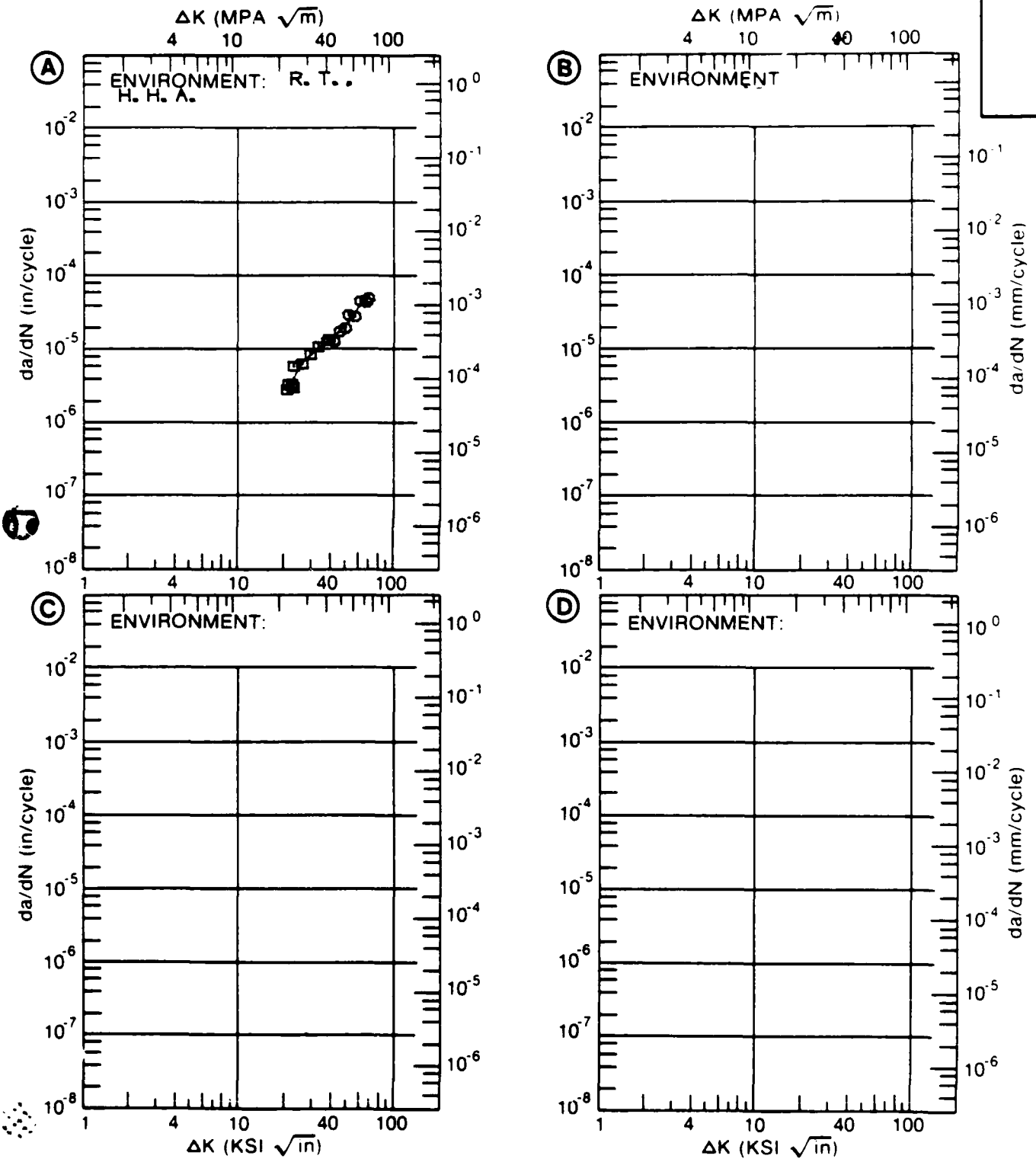



Figure 6.21.3.1

TABLE 6.21.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(300)MAR
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. | E= R.T. H.H.A. | E= R.T. 3.5% NACL | |
| DELTA K MIN | A: | 6.67 | .474 | | | |
| | B: | 6.85 | | .435 | | |
| | C: | 14.61 | | | 3.56 | |
| | D: | | | | | |
| | | 7.00 | .561 | .472 | | |
| | | 8.00 | .847 | .753 | | |
| | | 9.00 | 1.16 | 1.10 | | |
| | | 10.00 | 1.49 | 1.51 | | |
| | | 13.00 | 2.63 | 3.11 | | |
| | | 16.00 | 4.15 | 5.30 | 4.82 | |
| | | 20.00 | 7.42 | 9.38 | 10.2 | |
| DELTA K MAX | A: | 24.71 | 15.1 | | | |
| | B: | 22.98 | | 13.6 | | |
| | C: | 22.60 | | | 16.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.13 | 14.20 | 7.07 | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM: 0.13"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.67
FREQUENCY: 2.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 3.000"
REFERENCES:78425

ALLOY STEEL

18NI (300) MAR

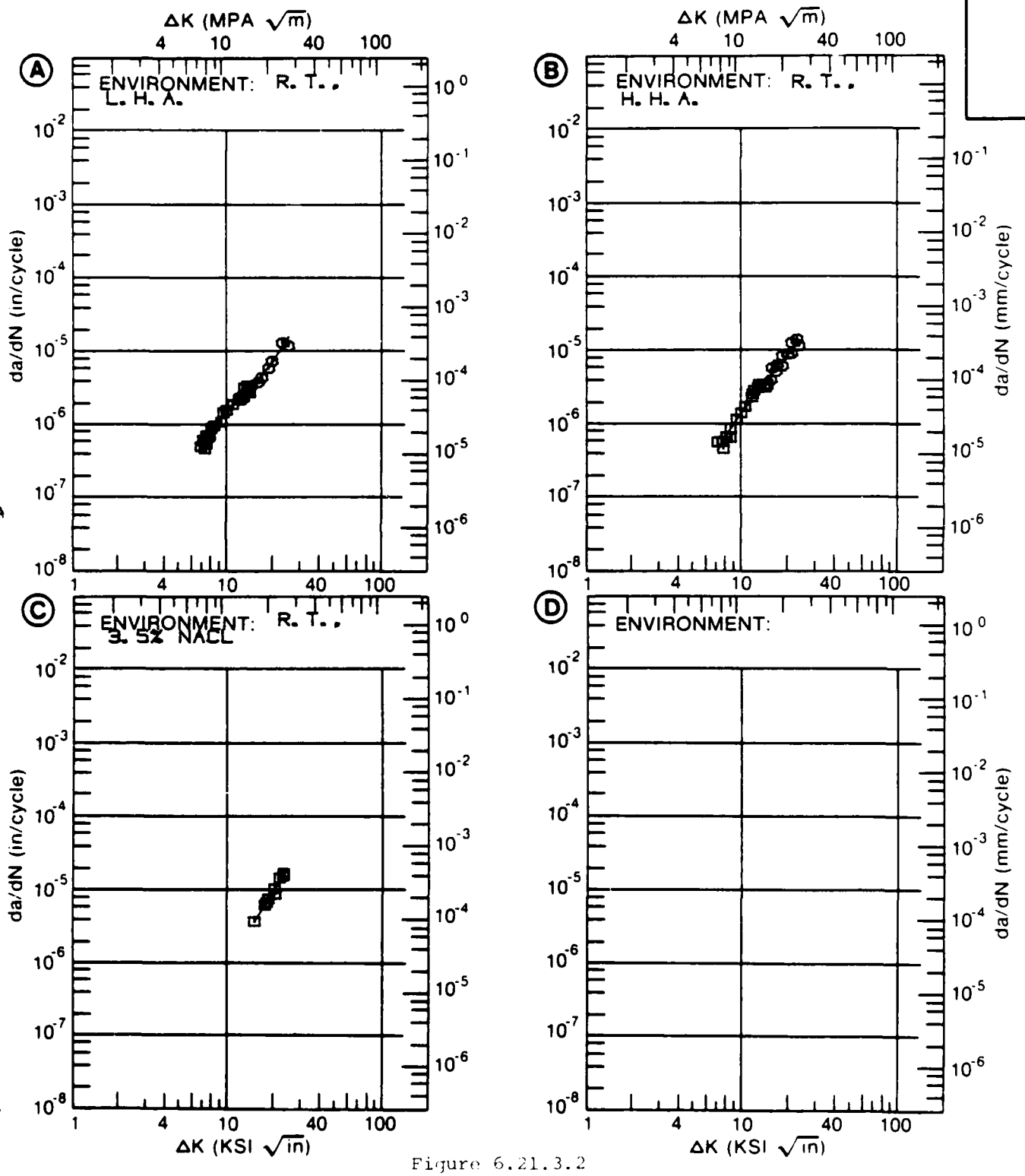



Figure 6.21.3.2

TABLE 6.21.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(300)MAR
CONDITION: AGED

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. AIR | E= R.T. DRY ARGON | | |
| DELTA K MIN | A: | | | | | |
| | B: | 8.77 | | .107 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | | .102 | | |
| | | 10.00 | | .148 | | |
| | | 13.00 | | .529 | | |
| | | 16.00 | | .950 | | |
| | | 20.00 | | 1.97 | | |
| | | 25.00 | | 3.70 | | |
| | | 30.00 | | 4.98 | | |
| DELTA K MAX | A: | | | | | |
| | B: | 30.62 | | 5.05 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 0.00 | 19.14 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: AGED
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 20.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:91838

ALLOY STEEL

18NI (300) MAR

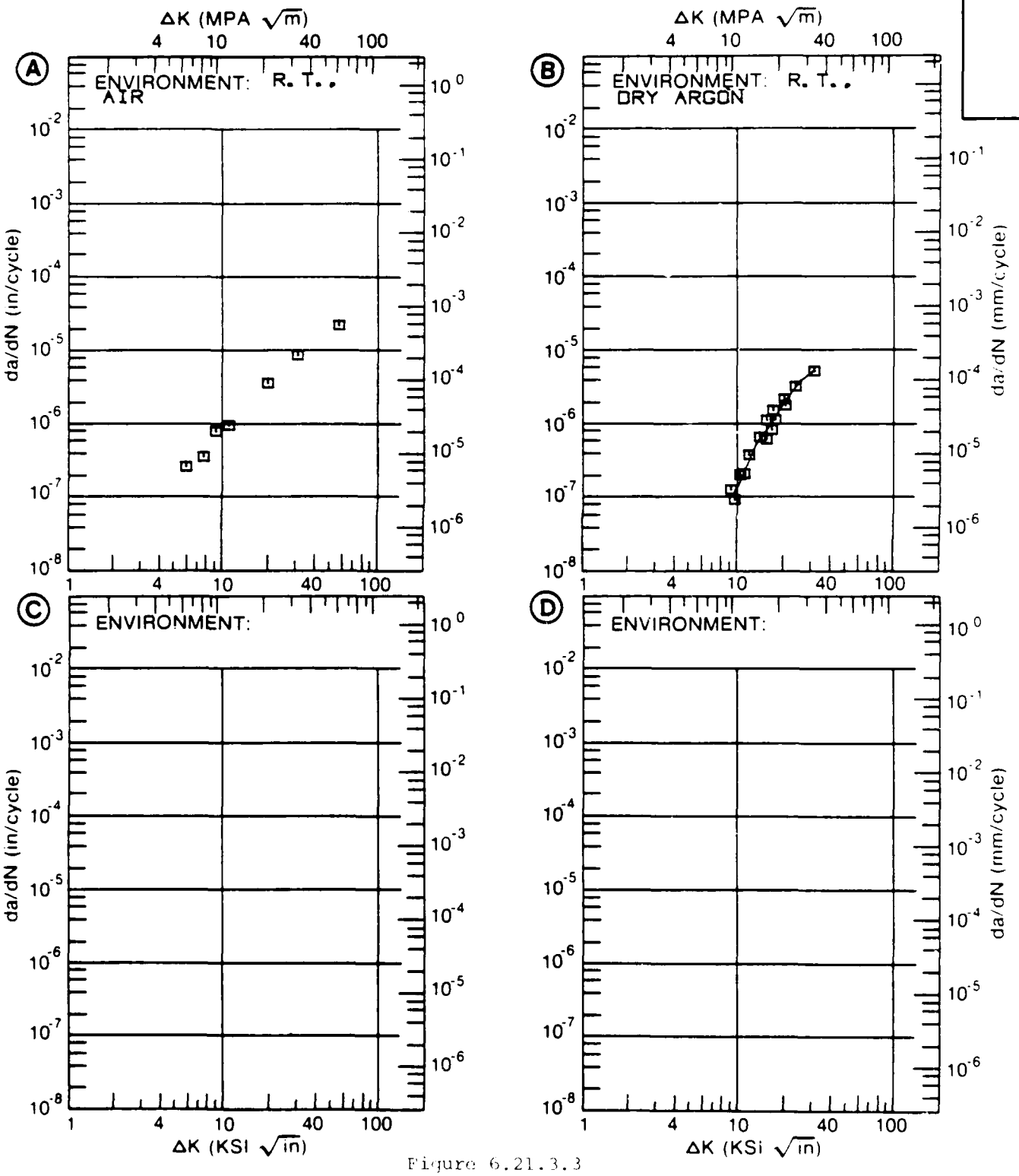



Figure 6.21.3.3

TABLE 6.21.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(300)MAR
CONDITION: ANNEALED

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | E= R.T. AIR | E= R.T. DRY ARGON | | |
| DELTA K MIN A: | | | | | |
| DELTA K MIN B: | 9.05 | | .101 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 10.00 | | .214 | | |
| | 13.00 | | .519 | | |
| | 16.00 | | 1.09 | | |
| | 20.00 | | 2.14 | | |
| | 25.00 | | 3.68 | | |
| | 30.00 | | 5.19 | | |
| | 35.00 | | 6.72 | | |
| | 40.00 | | 8.78 | | |
| DELTA K MAX A: | | | | | |
| DELTA K MAX B: | 44.46 | | 11.7 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 10.47 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: ANNEALED
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 20.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:91838

ALLOY STEEL

18NI (300) MAR

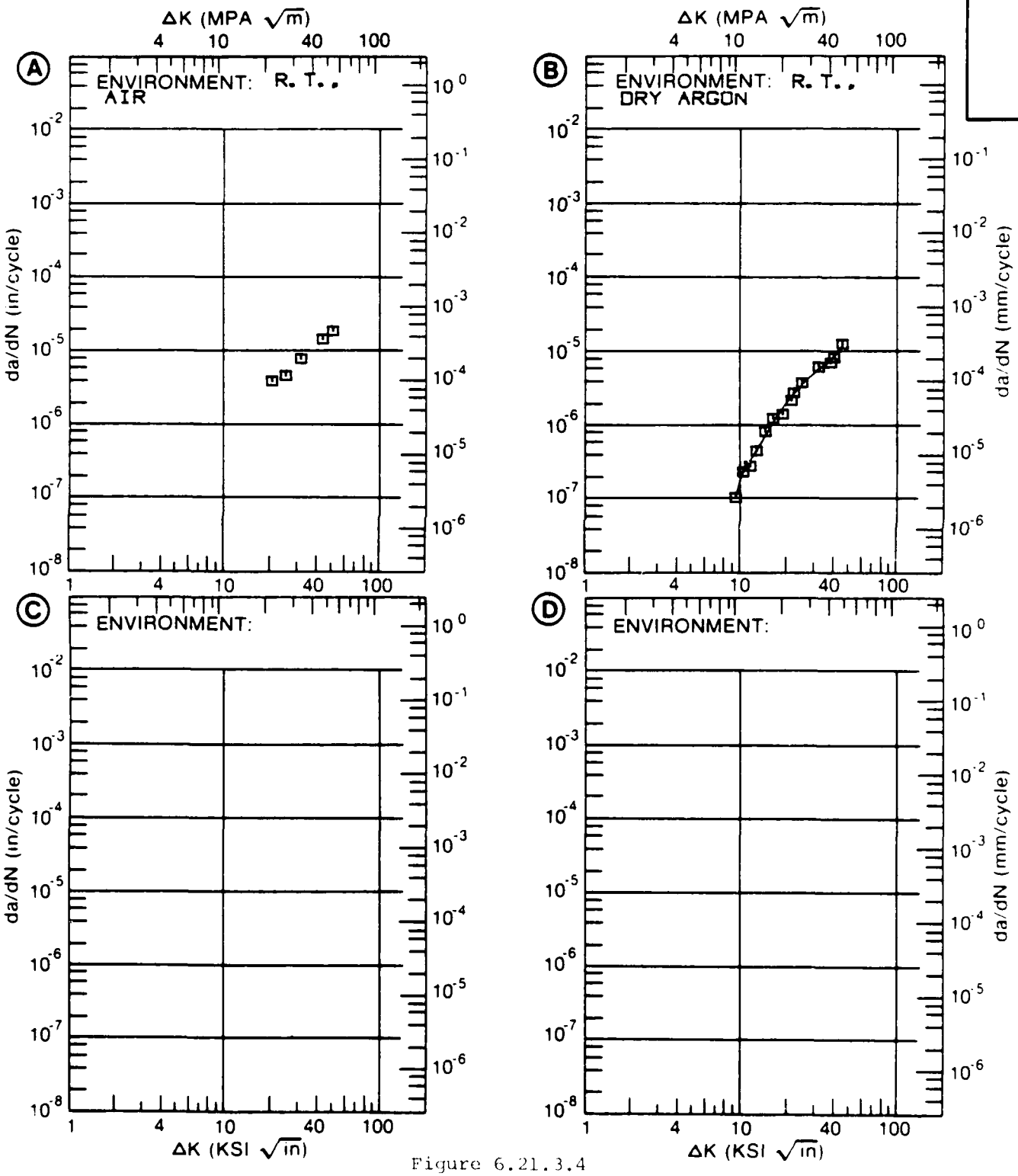



Figure 6.21.3.4

TABLE 6.21.3.5

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(300)
CONDITION:

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= HYDROGEN | E= 3.5% NACL | | |
| K MAX MIN | A: | 12.60 | 920. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 2465. | | | |
| | | 16.00 | 13691. | | | |
| | | 20.00 | 18844. | | | |
| K MAX MAX | A: | 22.20 | 21037. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 8.44 | 0.00 | | |

CONDITION/HT:
FORM:
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 1.500"
CRACK LENGTH ($A_0$):
$K_{ISCC}$:
REFERENCES: 84310, 74719

ALLOY STEEL

18NI (300)

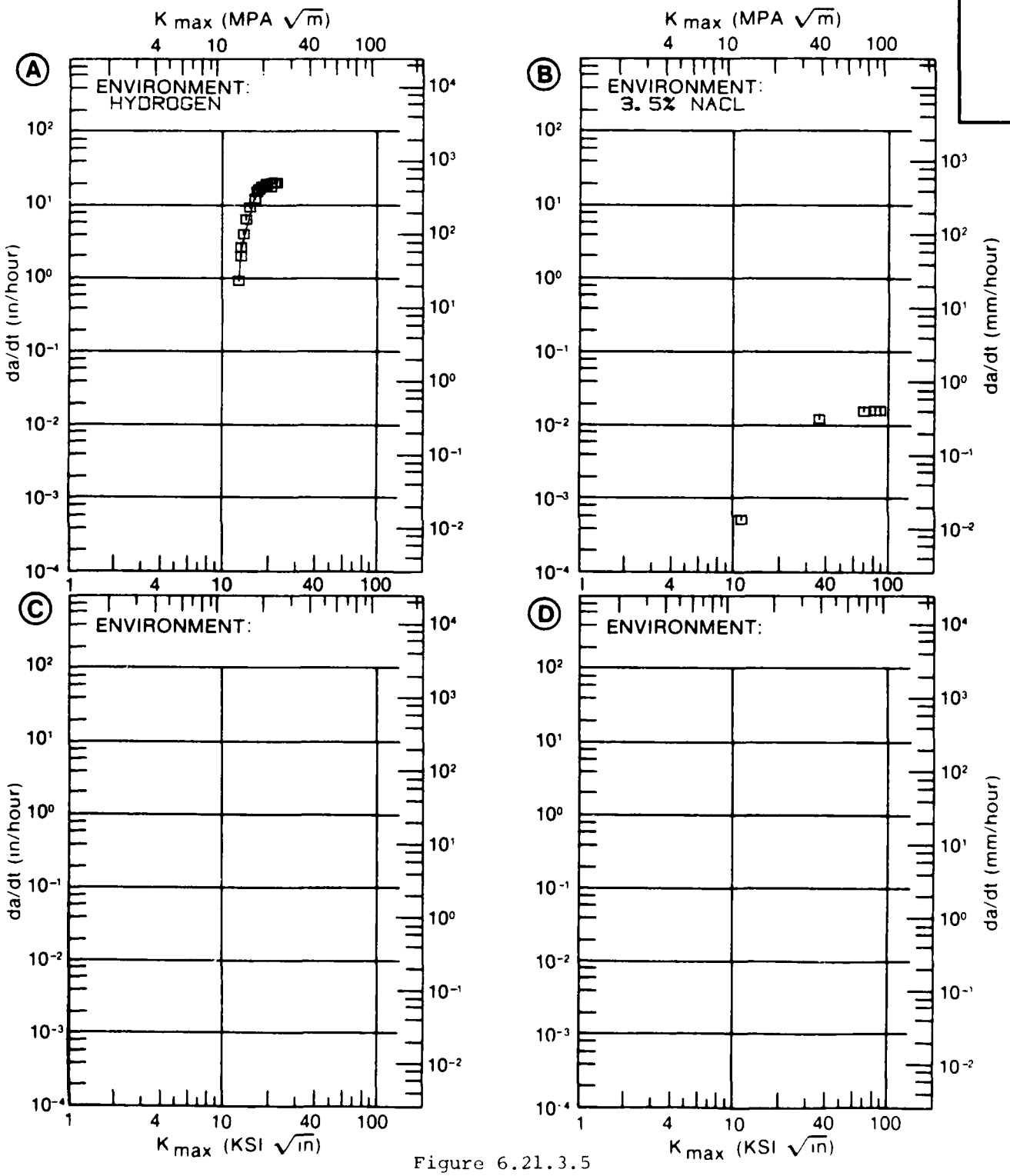



Figure 6.21.3.5

TABLE 6.21.3.6

ALLOY STEEL 18NI(300)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGE 900F 6HR | F | 1.00 | R.T. | L-T | 302.0 | 3.5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 70.00 | 7.00 | | | ---- | 1970 | 78425 |
| AGE 900F 6HR | F | 1.00 | R.T. | T-L | 302.0 | 3.5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 70.00 | 7.00 | | | ---- | 1970 | 78425 |
| | | 9.00 | | | 204.3 | | 1.000 | 0.500 | CANT | ---- | 72.40 | 5.00 | | | ---- | 1972 | 84356 |
| | | | | | | | | | | | | | 6.0/ | 1.4 | | | |
| AGE 950F 12HR | F | 1.00 | R.T. | T-L | 302.0 | 3.5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 68.00 | 6.00 | | | ---- | 1970 | 78425 |
| CRACK PRESTRESSED TO 50 PCT KIC | F | 9.00 | R.T. | T-L | 284.3 | 3.5 PCT NACL | 1.000 | 0.500 | CANT | ---- | 72.40 | 5.00 | | | ---- | 1972 | 84356 |
| CRACK PRESTRESSED TO 25 PCT KIC | F | 9.00 | R.T. | T-L | 284.3 | 3.5 PCT NACL | 1.000 | 0.500 | CANT | ---- | 72.40 | 5.00 | | | ---- | 1972 | 84356 |
| CRACK PRESTRESSED TO 80 PCT KIC | F | 9.00 | R.T. | T-L | 284.3 | 3.5 PCT NACL | 1.000 | 0.500 | CANT | ---- | 72.40 | 10.00 | | | ---- | 1972 | 84356 |
| 1500F 0.5HR AC 700F 3HR | P | 0.25 | R.T. | L-S | 285.8 | DIST. WATER | 1.000 | 0.250 | CANT* | 0.200 | 63.10 | 60.00 | | | > 10000 | 1965 | 63061 |
| | | 0.25 | | | 285.8 | | 1.000 | 0.250 | CANT* | 0.200 | 93.90 | 36.00 | | | > 10000 | 1965 | 63061 |
| | | | | | | | | | | | | | 48.0/ | 17.0 | | | |
| 1500F 2HR 800F 10HR | B | ---- | R.T. | L-S | 280.0 | DIST. WATER | 0.625 | 0.500 | CANT* | ---- | 120.00 | 9.00 | | | > 1500 | 1970 | 77716 |
| 1500F 2HR 800F 10HR | B | ---- | R.T. | L-S | 280.0 | 1N H2SO4 | 0.625 | 0.500 | CANT* | ---- | 120.00 | 10.00 | | | > 1500 | 1970 | 77716 |
| 1500F 2HR 800F 10HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH1.7 | 0.625 | 0.500 | CANT* | ---- | 120.00 | 9.00 | | | > 10000 | 1970 | 77716 |
| 1500F 2HR 800F 10HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH6.3 | 0.625 | 0.500 | CANT* | ---- | 120.00 | 10.00 | | | > 8500 | 1970 | 77716 |

TABLE 6.21.3.6 (Con't)

ALLOY STEEL 18NI(300)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SC) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1500F 2HR 900F 3.5HR | B | ---- | R.T. | L-S | 280.0 | 1.5 PCT NA2CR2O7 | 0.625 | 0.500 | CANT* | ---- | 99.00 | 12.00 | | | ---- | 1970 | 77716 |
| 1500F 2HR 900F 100HR | B | ---- | R.T. | L-S | 280.0 | 1N H2SO4 | 0.625 | 0.500 | CANT* | ---- | 70.00 | 9.00 | | | ---- | 1970 | 77716 |
| 1500F 2HR 900F 100HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL -0.4V TO -1.2V | 0.625 | 0.500 | CANT* | ---- | 70.00 | 9.00 | | | ---- | 1970 | 77716 |
| 1500F 2HR 900F 100HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL O2SAT | 0.625 | 0.500 | CANT* | ---- | 70.00 | 10.00 | | | ---- | 1970 | 77716 |
| 1500F 2HR 900F 100HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH1.7 | 0.625 | 0.500 | CANT* | ---- | 70.00 | 15.00 | | | 10000 | 1970 | 77716 |
| 1500F 2HR 900F 3.5HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH1.7 | 0.625 | 0.500 | CANT* | ---- | 99.00 | 10.00 | | | > 10000 | 1970 | 77716 |
| 1500F 2HR 900F 3.5HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH11 | 0.625 | 0.500 | CANT* | ---- | 99.00 | 12.00 | | | ---- | 1970 | 77716 |
| 1500F 2HR 900F 3.5HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH3.9 | 0.625 | 0.500 | CANT* | ---- | 99.00 | 17.00 | | | ---- | 1970 | 77716 |
| 1500F 2HR 900F 100HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH6.3 | 0.625 | 0.500 | CANT* | ---- | 70.00 | 10.00 | | | > 8500 | 1970 | 77716 |
| 1500F 2HR 900F 3.5HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH6.3 | 0.625 | 0.500 | CANT* | ---- | 99.00 | 8.00 | | | > 8500 | 1970 | 77716 |
| 1500F,1500F AGED 900F 6HR | F | 2.00 | R.T. | T-L | 284.0 | 3.5 PCT NACL | 1.000 | 0.400 | CHAR | ---- | 72.40 | 7.50 | | | > 9000 | 1970 | 78761 |
| 2200F 1HR 1700F 4HR,900F 100HR | B | ---- | R.T. | L-S | 280.0 | 1N H2SO4 | 0.625 | 0.500 | CANT* | ---- | 53.00 | 10.00 | | | ---- | 1970 | 77716 |

TABLE 6.21.3.6 (Con't)

ALLOY STEEL 18NI(300)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2300F 1HR 1700F 4HR 800F 10HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH1.7 | 0.625 | 0.500 | CANT* | ---- | 58.00 | 14.00 | | | > 2500 | 1970 | 77716 |
| 2300F 1HR 1700F 4HR 900F 100HR | B | ---- | R.T | L-S | 280.0 | 3% NACL PH1.7 | 0.625 | 0.500 | CANT* | ---- | 53.00 | 10.00 | | | > 2500 | 1970 | 77716 |
| 2300F 1HR 1700F 4HR 900F 3.5HR | B | ---- | R.T | L-S | 280.0 | 3% NACL PH1.7 | 0.625 | 0.500 | CANT* | ---- | 57.00 | 8.00 | | | > 2500 | 1970 | 77716 |
| 2300F 1HR 1700F 4HR 800F 10HR | B | ---- | R.T | L-S | 280.0 | 3% NACL PH6.3 | 0.625 | 0.500 | CANT* | ---- | 58.00 | 13.00 | | | > 2500 | 1970 | 77716 |
| 2300F 1HR 1700F 4HR 900F 100HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH6.3 | 0.625 | 0.500 | CANT* | ---- | 53.00 | 9.00 | | | > 2500 | 1970 | 77716 |
| 2300F 1HR 1700F 4HR 900F 3.5HR | B | ---- | R.T. | L-S | 280.0 | 3% NACL PH6.3 | 0.625 | 0.500 | CANT* | ---- | 57.00 | 9.00 | | | > 2500 | 1970 | 77716 |
| 900F 3HR 950F 3HR | F | 1.00 | R.T. | T-L | 306.0 | 3.5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 70.00 | 5.00 | | | ---- | 1970 | 78425 |

TABLE 6.22.3.1

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.22.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 18NI(350)
CONDITION: AGED 8HR 800F

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= 3.5% NACL | | | |
| K MAX MIN | A: | 13.00 | 392. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 930. | | | |
| | | 20.00 | 1502. | | | |
| | | 25.00 | 2053. | | | |
| | | 30.00 | 2898. | | | |
| K MAX MAX | A: | 32.00 | 3454. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.79

CONDITION/HT: AGED 8HR 800F
FORM:
SPECIMEN TYPE: NB
ORIENTATION:
YIELD STRENGTH: 330.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.394"
SPECIMEN WIDTH: 0.394"
CRACK LENGTH ($A_O$):
$K_{ISCC}$:
REFERENCES: 74719

ALLOY STEEL

18NI (350)

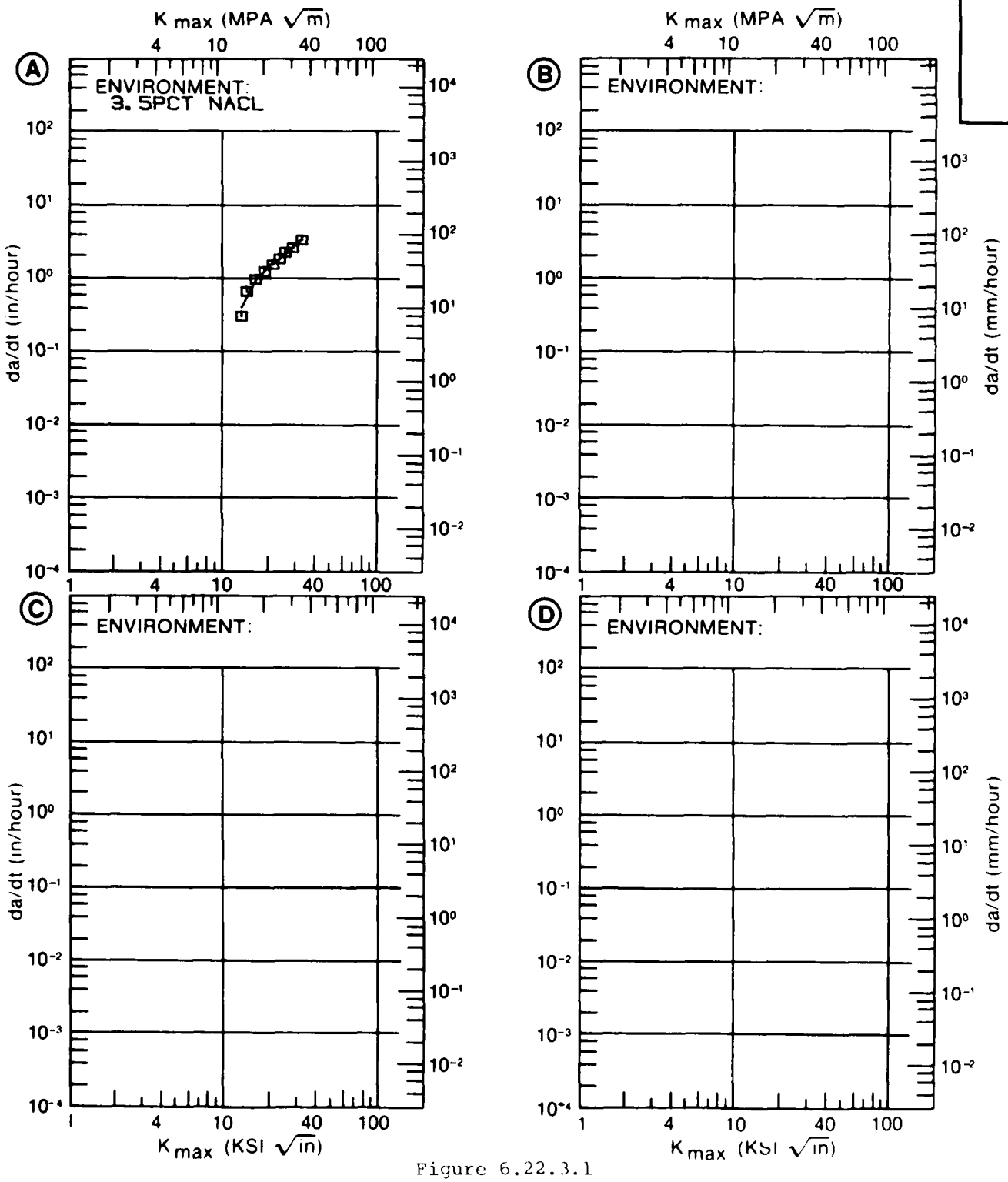



Figure 6.22.3.1

TABLE 6.22.3.2

ALLOY STEEL 18NI(350)(MAR) K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SQ) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGE 800F 8HR | FB | ---- | R. T. | --- | 299.0 | 3.5 PCT NACL | 0.394 | 0.394 | CHAR | ---- | 30.00 | 5.00 | | | ---- | 1971 | 84351 |
| AGE 900F 3HR | FB | ---- | R. T. | --- | 330.0 | 3.5 PCT NACL | 0.394 | 0.394 | CHAR | ---- | 42.00 | 10.00 | | | ---- | 1971 | 84351 |
| AGE 900F 8HR | FB | ---- | R. T. | --- | 335.0 | 3.5 PCT NACL | 0.394 | 0.394 | CHAR | ---- | 36.00 | 10.00 | | | ---- | 1971 | 84351 |
| 1500F 1HR 800F 8HR | F | 4.00 | R. T. | L-S | 299.0 | 3.5 PCT NACL | 0.394 | 0.394 | -- | ---- | 70.10 | 5.00 | | | > 3000 | 1969 | 75677 |
| 1500F 1HR 900F 8HR | F | 4.00 | R. T. | L-S | 325.0 | 3.5 PCT NACL | 0.394 | 0.394 | -- | ---- | 35.00 | 10.00 | | | > 8500 | 1969 | 75677 |
| 1500F 1HR 950F 3HR | F | 4.00 | R. T. | L-S | 325.0 | 3.5 PCT NACL | 0.394 | 0.394 | -- | ---- | 40.00 | 10.00 | | | > 6300 | 1969 | 75677 |

TABLE 6.23.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 300M AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | | (NUMBER OF SPECIMENS) |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| HEAT TREATED TO 54 RC HARDNESS | ----- | 58.6 ± 3.5 (2) | ----- |
| 1700F 1HR AC, 1600F 1HR OQ, 600F 2HR AC (AMS 6419) | 51.8 ± 0.7 (3) | ----- | ----- |
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| ---- | 52.6 ± 2.3 (4) | 52.9 ± 2.0 (4) | ----- |
| 1600F 1.25 HR, OQ, 600F 2+2HR | 54.6 ± 2.5 (4) | 50.6 ± 1.7 (2) | 54.1 ± 1.1 (4) |
| | **BAR** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 2190F 1HR, FC TO 1600F, HOLD 0.5HR, OQ, 475F 1HR | 47.9 ± 3.8 (2) | ----- | ----- |

TABLE 6.23.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: L H A. AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| UTS-280-300KSI | BILLET | -1.00 | 10.00 | | | | | 3.18 | 188 | |
| UTS=280-300KSI | BILLET | 0.00 | 10.00 | | | | | 2.96 | 38.0 | |
| UTS=280-300KSI | BILLET | 0.50 | 10.00 | | | | 0.65 | 6.97 | | |
| 1700F 1.5HRS AC,1600F 1.5HRS OQ,600F 2+2HRS | FORGING | 0.30 | 6.00 | | | | | 4.88 | | |
| 1700F 1.5HRS AC,1600F 1.5HRS OQ,600F 2+2HRS | FORGING | 0.50 | 6.00 | | | | 0.90 | 6.83 | | |
| 1700F 1.5HRS AC,1600F 1.5HRS OQ,600F 2+2HRS | FORGING | 0.08 | 1.00 | | | | | 3.67 | | |
| 1700F 1.5HRS AC,1600F 1.5HRS OQ,600F 2+2HRS | FORGING | 0.08 | 6.00 | | | | 0.65 | 4.03 | | |

TABLE 6.23.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| --- - | FORGING | 0 02 | 0 10-20 00 | | | | 0 71 | 3 83 | 82 7 | |
| TUS-280-300KSI | BAR | -1 00 | 10 00 | | | | | 3 79 | 42 4 | |
| TUS=280-300KSI | BAR | 0 02 | 10 00 | | | | | 3 56 | 47 0 | |
| TUS-280-300KSI | BAR | 0 50 | 10 00 | | | | 1 02 | 6 52 | | |

TABLE 6.23.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT 3.5% NACL AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| TUS 280-300KSI | BILLET | 0.00 | 1.00 | | | | | 4.20 | 105 | |
| TUS=280-300KSI | BILLET | 0.00 | 10.00 | | | | | 2.24 | 100 | |

TABLE 6.23.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT ALT IMMERSION IN SEA WATER-IMMERSED AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| TUS-280-300KSI | BILLET | 0 00 | 1 00 | | | | | 8 04 | | |
| TUS=280-300KSI | BILLET | 0 00 | 10 00 | | | | | 2 61 | | |

TABLE 6.23.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT: ALT IMMERSION IN SEA WATER-1ST HALF DRY CYCLE AT R.T.

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS: (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| TUS-280-300KSI | BILLET | 0.00 | 1.00 | | | | | 7.06 | 50.6 | |
| TUS=280-300KSI | BILLET | 0.00 | 10.00 | | | | | 2.17 | | |

TABLE 6.23.1.7

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT ALT IMMERSION IN SEA WATER-2ND HALF DRY CYCLE AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| TUS=280-300KSI | BILLET | 0.00 | 1.00 | | | | | 2.61 | | |
| TUS=280-300KSI | BILLET | 0.00 | 10.00 | | | | | 2.05 | | |

TABLE 6.23.2.1

ALLOY STEEL 300M K(IC)

| CONDITION | FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | 1.25 | R.T. | T-L | 239.0 | 2.504 | 1.267 | CT | 1.293 | 0.12 | 53.59 | | | 1977 | MA005 |
| | | 1.25 | | | 239.0 | 2.509 | 1.249 | CT | 1.279 | 0.13 | 55.50 | | | 1977 | MA005 |
| | | 1.25 | | | 246.5 | 2.505 | 1.251 | CT | 1.267 | 0.10 | 50.80 | | | 1977 | MA005 |
| | | 1.25 | | | 246.5 | 2.490 | 1.251 | CT | 1.286 | 0.10 | 50.70 | 52.6/ | 2.3 | 1977 | MA005 |
| | F | 1.25 | R.T. | T-L | 240.0 | 2.476 | 1.256 | CT | 1.271 | 0.13 | 55.50 | | | 1977 | MA005 |
| | | 1.25 | | | 240.0 | 2.512 | 1.254 | CT | 1.288 | 0.12 | 53.50 | | | 1977 | MA005 |
| | | 1.25 | | | 246.5 | 2.507 | 1.247 | CT | 1.228 | 0.10 | 51.70 | | | 1977 | MA005 |
| | | 1.25 | | | 246.5 | 2.508 | 1.252 | CT | 1.296 | 0.10 | 50.90 | 52.9/ | 2.0 | 1977 | MA005 |
| HEAT TREATED | F | 1.00 | R.T. | T-L | 250.0 | 0.904 | 0.447 | NB | 0.485 | 0.12 | 56.10 | | | 1971 | 84029 ( 1) |
| 50.54 RC | | 1.00 | | | 250.0 | 0.903 | 0.448 | NB | 0.473 | 0.15 | 61.10 | | | 1971 | 84029 ( 1) |
| HARDNESS | | | | | | | | | | | | 50.6/ | 3.5 | | |
| 1600F 0.5 HR, | F | 5.50 | -65 | -- | 245.0 | 1.505 | 0.747 | CT | 0.752 | 0.10 | 48.40 | | | 1970 | 84280 ( 2) |
| SQ,1000F | | 5.50 | | | 245.0 | 1.503 | 0.750 | CT | 0.758 | 0.10 | 48.00 | | | 1970 | 84280 ( 2) |
| 0.5-1.0 HR, OQ | | 5.50 | | | 245.0 | 1.501 | 0.750 | CT | 0.734 | 0.07 | 41.50 | | | 1970 | 84280 ( 2) |
| RQ-180F 25 MIN,575F 2+2HR | | | | | | | | | | | | 46.0/ | 3.9 | | |
| 1600F 0.5 HR, | F | 5.50 | 0 | -- | 231.0 | 1.499 | 0.745 | CT | 0.735 | 0.14 | 55.30 | | | 1970 | 84280 ( 2) |
| SQ,1000F | | 5.50 | | | 231.0 | 1.503 | 0.746 | CT | 0.742 | 0.16 | 58.70 | | | 1970 | 84280 ( 2) |
| 0.5-1.0 HR, OQ | | 5.50 | | | 231.0 | 1.501 | 0.750 | CT | 0.736 | 0.15 | 57.20 | | | 1970 | 84280 ( 2) |
| RQ-180F 25 MIN,575F 2+2HR | | | | | | | | | | | | 57.1/ | 1.7 | | |
| 1600F 0.5 HR, | F | 5.50 | R.T. | -- | 230.0 | 1.501 | 0.749 | CT | 0.737 | 0.19 | 64.30 | | | 1970 | 84280 ( 2) |
| SQ,1000F | | 5.50 | | | 230.0 | 1.499 | 0.750 | CT | 0.735 | 0.20 | 64.60 | | | 1970 | 84280 ( 2) |
| 0.5-1.0 HR, OQ | | 5.50 | | | 230.0 | 1.504 | 0.750 | CT | 0.739 | 0.20 | 65.70 | | | 1970 | 84280 ( 2) |
| RQ-180F 25 MIN,575F 2+2HR | | | | | | | | | | | | 64.9/ | 0.7 | | |
| 1600F 0.5 HR, | F | 5.50 | 200 | -- | 220.0 | 1.499 | 0.745 | CT | 0.734 | 0.24 | 68.10 | | | 1970 | 84280 ( 2) |
| SQ,1000F | | 5.50 | | | 220.0 | 1.500 | 0.746 | CT | 0.734 | 0.24 | 67.70 | | | 1970 | 84280 ( 2) |
| 0.5-1.0 HR, OQ | | 5.50 | | | 220.0 | 1.502 | 0.749 | CT | 0.729 | 0.25 | 68.90 | | | 1970 | 84280 ( 2) |
| RQ-180F 25 MIN,575F 2+2HR | | | | | | | | | | | | 68.2/ | 0.6 | | |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.43C,0.65MN,0.009P,0.006S,1.65SI,1.77NI,0.82CR,0.08V
( 2) ORIENTATION-L, FORM FLAP TRACK

TABLE 6.23.2.1 (Con't)

ALLOY STEEL 300M K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1600F 1.25 HR, OQ, 600F 2+2HR | F | 3.00 | R.T. | L-T | 237.0 | 1.000 | 0.249 | CT | 0.495 | 0.13 | 51.50 | | | 1973 | 85836 |
| | | 3.00 | | | 237.0 | 1.002 | 0.248 | CT | 0.502 | 0.14 | 53.80 | | | 1973 | 85836 |
| | | 3.00 | | | 237.0 | 1.002 | 0.247 | CT | 0.491 | 0.15 | 56.10 | | | 1973 | 85836 |
| | | 3.00 | | | 237.0 | 1.002 | 0.247 | CT | 0.495 | 0.15 | 57.10 | 54.6/ | 2.5 | 1973 | 85836 |
| 1600F 1.25 HR, OQ, 600F 2+2HR | F | 3.00 | R.T. | T-L | 240.0 | 1.002 | 0.248 | CT | 0.507 | 0.13 | 51.80 | | | 1973 | 85836 |
| | | 3.00 | | | 240.0 | 0.987 | 0.247 | CT | 0.492 | 0.12 | 49.40 | 50.6/ | 1.7 | 1973 | 85836 |
| 1600F 1.25 HR, OQ, 600F 2+2HR | F | 3.00 | R.T. | S-L | 230.0 | 1.005 | 0.248 | CT | 0.496 | 0.14 | 55.10 | | | 1973 | 85836 |
| | | 3.00 | | | 230.0 | 1.002 | 0.248 | CT | 0.497 | 0.13 | 52.80 | | | 1973 | 85836 |
| | | 3.00 | | | 230.0 | 1.004 | 0.247 | CT | 0.504 | 0.14 | 54.90 | | | 1973 | 85836 |
| | | 3.00 | | | 230.0 | 1.000 | 0.248 | CT | 0.485 | 0.14 | 53.60 | 54.1/ | 1.1 | 1973 | 85836 |
| 1600F 1HR, OQ, 475F 1HR | B | 0.62 | R.T. | L-T | 240.0 | 2.000 | 0.600 | CT | 1.000 | 0.05 | 34.80 | | | 1973 | 87241 ( 1) |
| 1600F 1HR, OQ, 1HR, WQ, 475F 1HR | B | 0.62 | R.T. | L-T | 240.0 | 2.000 | 0.600 | CT | 1.000 | 0.05 | 34.30 | | | 1973 | 87241 ( 1) |
| 1600F 1HR, OQ, 615F 1 HR | B | 0.62 | R.T. | L-T | 245.0 | 2.000 | 0.600 | CT | 1.000 | 0.17 | 64.80 | | | 1973 | 87241 ( 1) |
| 1600F 1HR, OQ, 575F 1HR | B | 0.62 | R.T. | L-T | 245.0 | 2.000 | 0.600 | CT | 1.000 | 0.15 | 59.40 | | | 1973 | 87241 ( 1) |
| 1600F 1HR, OQ, 745F 1HR | B | 0.62 | R.T. | L-T | 245.0 | 2.000 | 0.600 | CT | 1.000 | 0.15 | 60.90 | | | 1973 | 87241 |
| 1600F, OQ, 550F 2+2HR | P | 0.56 | R.T. | L-T | 235.0 | 1.500 | 0.500 | NB | ---- | 0.20 | 66.00 | | | 1970 | 78305 ( 2) |
| 1675F AC, 1575F OQ, 800F 2HR (RC 47.5) | P | 1.00 | R.T. | -- | 220.0 | 1.988 | 1.010 | CT | 1.088 | 0.12 | 47.30 | | | 1973 | 85883 ( 3) |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.41C,0.75MN,0.008P,0.002S,1.59SI,1.85NI,0.75CR,0.08V,0.04CU
( 2) COLD ROLLED 50% WITH INTERMEDIATE ANNEALS AT 1275F TO GET FINE GRAIN SIZE
( 3) COMPOSITION(WT PERCENT) 0.38C,0.85MN,0.008P,0.003S,1.61SI,1.80NI,0.89CR,0.08V (ESTIMATED TYS)

TABLE 6.23.2.1 (Con't)

ALLOY STEEL 300M K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1675F AC,1575F | P | 1.00 | R.T. | -- | 220.0 | 1.994 | 1.010 | CT | 1.068 | 0.13 | 47.80 | | | 1973 | 85883 ( 1) |
| OQ,800F 2HR | | 1.00 | | | 220.0 | 1.998 | 1.010 | CT | 1.122 | 0.13 | 50.10 | | | 1973 | 85883 ( 1) |
| (RC 47.5) | | 1.00 | | | 220.0 | 1.995 | 1.010 | CT | 1.081 | 0.13 | 47.60 | | | 1973 | 85883 ( 1) |
| | | | | | | | | | | | | 49.2/ | 1.3 | | |
| 1675F,AC 1575F | P | 1.00 | R.T. | -- | 240.0 | 2.001 | 1.010 | CT | 1.147 | 0.09 | 45.90 | | | 1973 | 85883 ( 1) |
| OQ,500F 2HR | | 1.00 | | | 240.0 | 1.996 | 1.010 | CT | 1.065 | 0.12 | 51.80 | | | 1973 | 85883 ( 1) |
| (RC 51.5) | | 1.00 | | | 240.0 | 1.995 | 1.010 | CT | 1.054 | 0.09 | 46.20 | | | 1973 | 85883 ( 1) |
| | | 1.00 | | | 240.0 | 2.001 | 1.010 | CT | 1.092 | 0.12 | 52.60 | | | 1973 | 85883 ( 1) |
| | | | | | | | | | | | | 49.1/ | 3.6 | | |
| 1675F,AC,1575F | P | 1.00 | R.T. | -- | 200.0 | 1.996 | 1.010 | CT | 1.123 | 0.43 | 82.90 | | | 1973 | 85883 ( 1) |
| OQ,1100F 2HR | | 1.00 | | | 200.0 | 2.000 | 1.009 | CT | 1.103 | 0.36 | 76.20 | | | 1973 | 85883 ( 1) |
| (RC 39) | | 1.00 | | | 200.0 | 1.997 | 1.012 | CT | 1.137 | 0.42 | 81.50 | | | 1973 | 85883 ( 1) |
| | | 1.00 | | | 200.0 | 1.989 | 1.010 | CT | 1.139 | 0.45 | 84.80 | | | 1973 | 85883 ( 1) |
| | | | | | | | | | | | | 81.4/ | 3.7 | | |
| 1700F 1HR AC, | P | 1.00 | R.T. | L-T | 236.0 | 0.991 | 0.501 | NB | 0.485 | 0.12 | 52.00 | | | 1974 | 88136 |
| 1600F 1HR OQ, | | 1.00 | | | 236.0 | 0.995 | 0.502 | NB | 0.491 | 0.12 | 51.00 | | | 1974 | 88136 |
| 600F 2HR AC | | 1.00 | | | 236.0 | 1.000 | 0.500 | NB | 0.490 | 0.12 | 52.40 | | | 1974 | 88136 |
| (AMS 6419) | | | | | | | | | | | | 51.8/ | 0.7 | | |
| 2190F 1HR,FC | B | 0.62 | R.T. | L-T | 235.0 | 2.000 | 0.600 | CT | 1.000 | 0.12 | 50.60 | | | 1973 | 87241 |
| TO 1600F,HOLD | | 0.62 | | | 235.0 | 2.000 | 0.600 | CT | 1.000 | 0.09 | 45.20 | | | 1973 | 87241 |
| 0.5HR,OQ,475F 1HR | | | | | | | | | | | | 47.9/ | 3.8 | | |
| 2190F 1HR,FC | B | 0.62 | R.T. | L-T | 240.0 | 2.000 | 0.600 | CT | 1.000 | 0.12 | 52.70 | | | 1973 | 87241 |
| TO 1600F,HOLD 0.5HR,OQ,615F 1HR | | | | | | | | | | | | | | | |
| 2190F 1HR,FC | B | 0.62 | R.T. | L-T | 240.0 | 2.000 | 0.600 | CT | 1.000 | 0.18 | 63.50 | | | 1973 | 87241 |
| TO 1600F,HOLD 0.5HR,OQ,745F 1HR | | | | | | | | | | | | | | | |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.39C,0.85MN,0.008P,0.005S,1.61SI,1.80NI,0.89CR,0.08V (ESTIMATED TYS)

TABLE 6.23.2.1 (Con't)

ALLOY STEEL 300M K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2190F 1HR,OQ, 400F 1HR | B | 0.62 | R.T. | L-T | 219.0 | 2.000 | 0.600 | CT | 1.000 | 0.29 | 75.00 | | | 1973 | 87241 |
| 2190F 1HR,OQ, 475F 1HR | B | 0.62 | R.T. | L-T | 230.0 | 2.000 | 0.600 | CT | 1.000 | 0.23 | 69.20 | | | 1973 | 87241 |
| 2190F 1HR,OQ, 475F 1HR,WQ,475F 1HR | B | 0.62 | R.T. | L-T | 232.0 | 2.000 | 0.600 | CT | 1.000 | 0.24 | 71.80 | | | 1973 | 87241 |
| 2190F 1HR,OQ, 615F 1HR | B | 0.62 | R.T. | L-T | 236.0 | 2.000 | 0.600 | CT | 1.000 | 0.26 | 75.50 | | | 1973 | 87241 |
| 2190F 1HR,OQ, 745F 1HR | B | 0.62 | R.T. | L-T | 240.0 | 2.000 | 0.600 | CT | 1.000 | 0.24 | 74.70 | | | 1973 | 87241 |

TABLE 6.23.2.2

ALLOY STEEL 300M K(C)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | CRACK LENGTH INIT (IN) 2A(O) | CRACK LENGTH FINAL (IN) 2A(F) | GROSS STRESS ONSET (KSI) S(O) | GROSS STRESS MAX (KSI) S(MAX) | K(APP) (KSI*SQRT IN) | K(APP) MEAN | K(APP) STAN DEV | K(C) (KSI*SQRT IN) | K(C) MEAN | K(C) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUCKLING OF CRACK EDGES RESTRAINED | | | | | | | | | | | | | | | | | | | |
| AMS 6434 | S | 0.13 | R.T. | L-T | 239.0 | 5.000 | 0.119 | 1.880 | ---- | --- | 71.10 | 134.06 | | | ---- | | | 1968 | 73988 |
| UTS-280-300KSI | | 0.13 | | | 239.0 | 5.000 | 0.123 | 2.530 | ---- | --- | 63.30 | 150.78 | | | ---- | | | 1968 | 73988 |
| | | 0.13 | | | 239.0 | 5.000 | 0.130 | 1.170 | ---- | --- | 98.60 | 138.37 | 141.1 | 8.7 | ---- | ----/ | --- | 1968 | 73988 |
| BUCKLING OF CRACK EDGES NOT RESTRAINED | | | | | | | | | | | | | | | | | | | |
| AMS 6434 | P | 0.38 | R.T. | L-T | 209.0 | 5.000 | 0.374 | 1.300 | ---- | --- | 50.40 | 75.18 | | | ---- | | | 1968 | 73988 |
| UTS=220-240KSI | | 0.38 | | | 209.0 | 5.000 | 0.370 | 1.850 | ---- | --- | 35.90 | 66.94 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 209.0 | 5.000 | 0.370 | 1.750 | ---- | --- | 36.10 | 64.82 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 209.0 | 5.000 | 0.374 | 2.440 | ---- | --- | 36.10 | 83.27 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 209.0 | 5.000 | 0.372 | 2.500 | ---- | --- | 30.30 | 71.41 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 209.0 | 5.000 | 0.371 | 1.320 | ---- | --- | 43.20 | 65.02 | 71.1 | 7.2 | ---- | ----/ | --- | 1968 | 73988 |
| BUCKLING OF CRACK EDGES NOT RESTRAINED | | | | | | | | | | | | | | | | | | | |
| AMS 6434 | P | 0.38 | R.T. | L-T | 234.0 | 5.000 | 0.369 | 2.080 | ---- | --- | 33.00 | 66.94 | | | ---- | | | 1968 | 73988 |
| UTS-260-280KSI | | 0.38 | | | 234.0 | 5.000 | 0.368 | 1.710 | ---- | --- | 44.30 | 78.33 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 234.0 | 5.000 | 0.371 | 2.500 | ---- | --- | 27.00 | 63.63 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 234.0 | 5.000 | 0.370 | 1.240 | ---- | --- | 52.40 | 76.04 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 234.0 | 5.000 | 0.374 | 2.540 | ---- | --- | 32.80 | 78.41 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 234.0 | 5.000 | 0.372 | 1.380 | ---- | --- | 41.90 | 64.76 | 71.4 | 7.0 | ---- | ----/ | --- | 1968 | 73988 |
| BUCKLING OF CRACK EDGES NOT RESTRAINED | | | | | | | | | | | | | | | | | | | |
| AMS 6434 | P | 0.38 | R.T. | L-T | 238.0 | 5.000 | 0.372 | 1.900 | ---- | --- | 46.40 | 88.14 | | | ---- | | | 1968 | 73988 |
| UTS=280-300KSI | | 0.38 | | | 238.0 | 5.000 | 0.372 | 2.280 | ---- | --- | 38.30 | 83.46 | | | ---- | | | 1968 | 73988 |
| | | 0.38 | | | 238.0 | 5.000 | 0.372 | 1.050 | ---- | --- | 61.20 | 80.81 | 84.1 | 3.7 | ---- | ----/ | --- | 1968 | 73988 |

TABLE 6.23.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL ALLOY STEEL 300M
CONDITION

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR | E= R.T. SIM SEA WATER | | |
| DELTA K MIN | A | 5.02 | .113 | | | |
| | B | 9.06 | | .488 | | |
| | C | | | | | |
| | D | | | | | |
| | | 6.00 | .192 | | | |
| | | 7.00 | .293 | | | |
| | | 8.00 | .415 | | | |
| | | 9.00 | .555 | | | |
| | | 10.00 | .716 | .740 | | |
| | | 13.00 | 1.33 | 1.51 | | |
| | | 16.00 | 2.18 | 2.17 | | |
| | | 20.00 | 3.83 | 3.30 | | |
| | | 25.00 | 7.04 | 5.90 | | |
| | | 30.00 | 12.2 | 10.8 | | |
| | | 35.00 | 20.5 | 20.0 | | |
| | | 40.00 | 33.3 | 36.9 | | |
| | | 50.00 | 82.7 | 158. | | |
| DELTA K MAX | A | 52.48 | 103. | | | |
| | B | 51.27 | | 548. | | |
| | C | | | | | |
| | D | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 23.32 | 32.26 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY: 0.10- 20.00 HZ

YIELD STRENGTH: 239.0- 246.5 KSI
ULT. STRENGTH: 291.0- 297.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005

ALLOY STEEL

300M

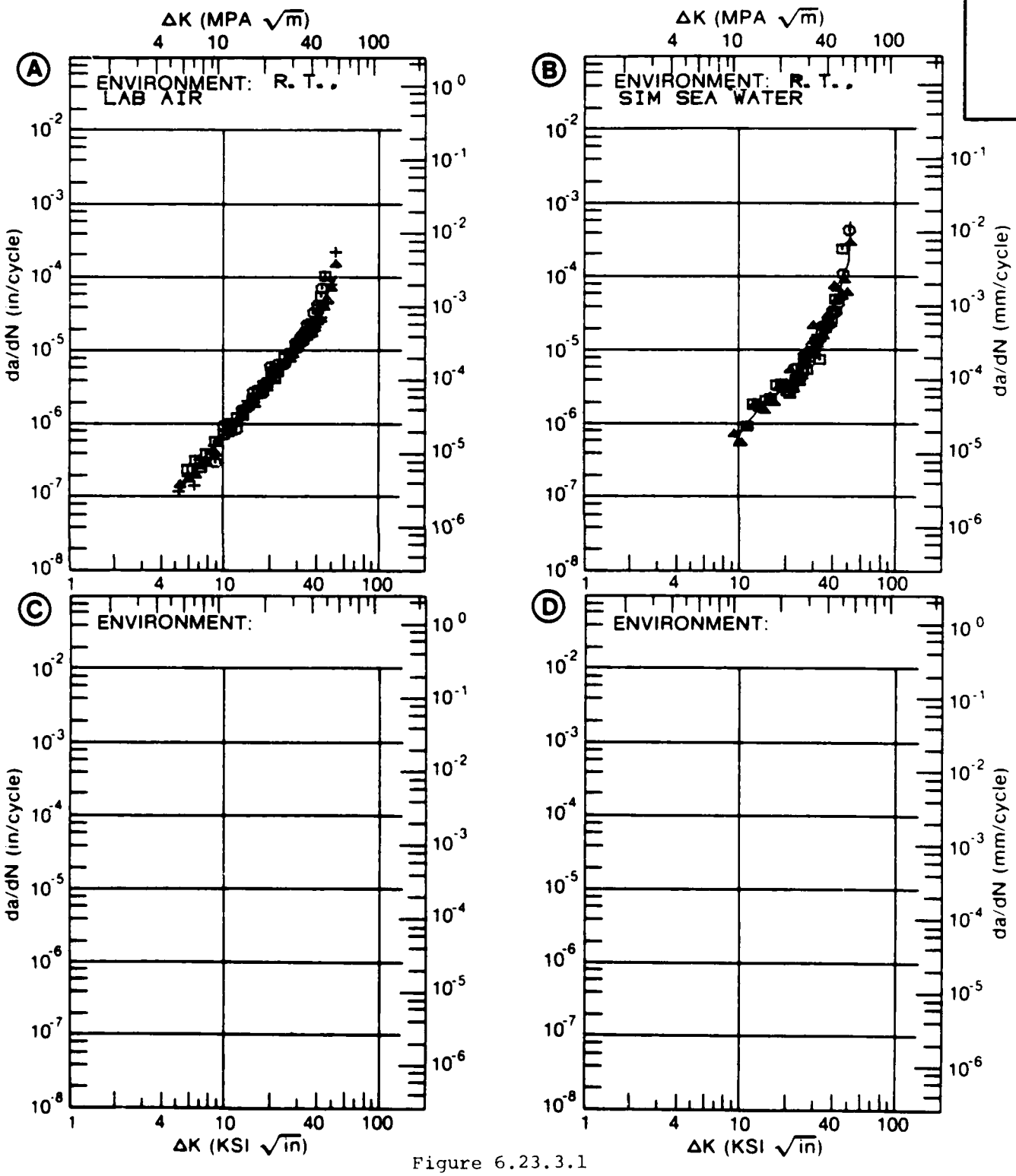



Figure 6.23.3.1

TABLE 6.23.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION:

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR | E= R.T. SIM SEA WATER | | |
| DELTA K MIN | A: | 4.96 | .115 | | | |
| | B: | 7.19 | | .440 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 5.00 | .118 | | | |
| | | 6.00 | .206 | | | |
| | | 7.00 | .315 | | | |
| | | 8.00 | .442 | .560 | | |
| | | 9.00 | .587 | .708 | | |
| | | 10.00 | .749 | .856 | | |
| | | 13.00 | 1.36 | 1.32 | | |
| | | 16.00 | 2.21 | 1.89 | | |
| | | 20.00 | 3.87 | 2.99 | | |
| | | 25.00 | 7.31 | 5.44 | | |
| | | 30.00 | 13.2 | 10.3 | | |
| | | 35.00 | 23.4 | 20.1 | | |
| | | 40.00 | 40.5 | 40.1 | | |
| | | 50.00 | 117. | | | |
| DELTA K MAX | A: | 52.52 | 151. | | | |
| | B: | 48.66 | | 138. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 27.12 | 28.80 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: T-L
STRESS RATIO: +0.02
FREQUENCY: 0.10- 20.00 HZ

YIELD STRENGTH: 240.0- 246.5 KSI
ULT. STRENGTH: 290.5- 299.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005

ALLOY STEEL

300M

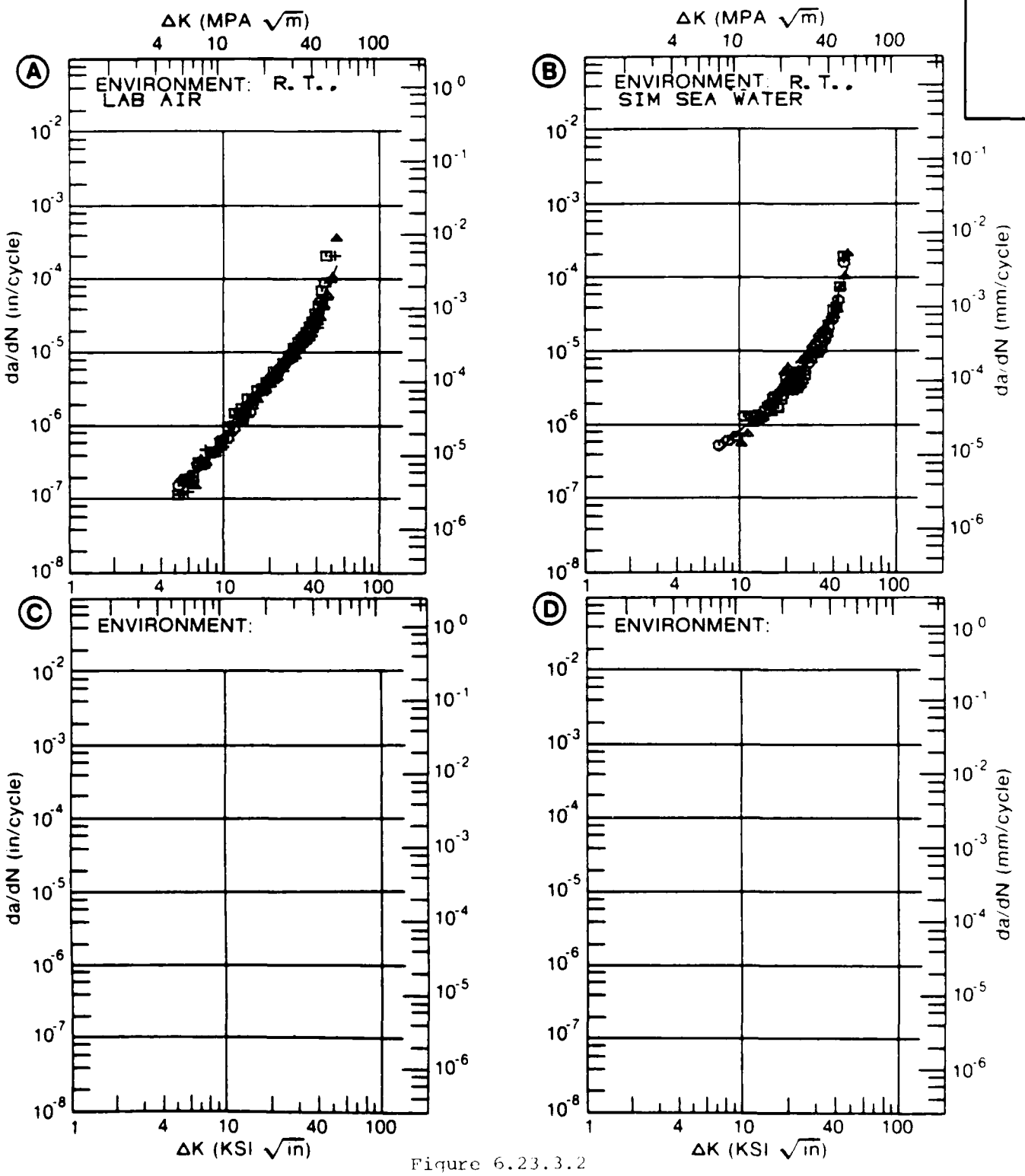



Figure 6.23.3.2

TABLE 6.23.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 300M
CONDITION: TUS=280-300KSI
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A R=-1.00 | B R=+0.02 | C R=+0.50 | D |
|---|---|---|---|---|---|---|
| DELTA K MIN | A: | 12.40 | .968 | | | |
| | B: | 12.11 | | .803 | | |
| | C: | 8.73 | | | .670 | |
| | D: | | | | | |
| | | 9.00 | | | .738 | |
| | | 10.00 | | | 1.02 | |
| | | 13.00 | 1.16 | 1.05 | 2.11 | |
| | | 16.00 | 2.26 | 2.03 | 3.64 | |
| | | 20.00 | 3.79 | 3.56 | 6.52 | |
| | | 25.00 | 5.83 | 5.85 | 12.1 | |
| | | 30.00 | 8.37 | 8.89 | 21.1 | |
| | | 35.00 | 12.1 | 13.3 | | |
| | | 40.00 | 17.8 | 20.0 | | |
| | | 50.00 | 42.4 | 47.0 | | |
| | | 60.00 | 113. | 232. | | |
| DELTA K MAX | A: | 64.78 | 187. | | | |
| | B: | 66.09 | | 2803. | | |
| | C: | 31.97 | | | 46.4 | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 10.81 | 7.40 | 4.65 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: TUS=280-300KSI
FORM: 4.25"TH BAR
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 234.5 KSI
ULT. STRENGTH: 282.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 4.000"
REFERENCES: MA006

ALLOY STEEL

300M

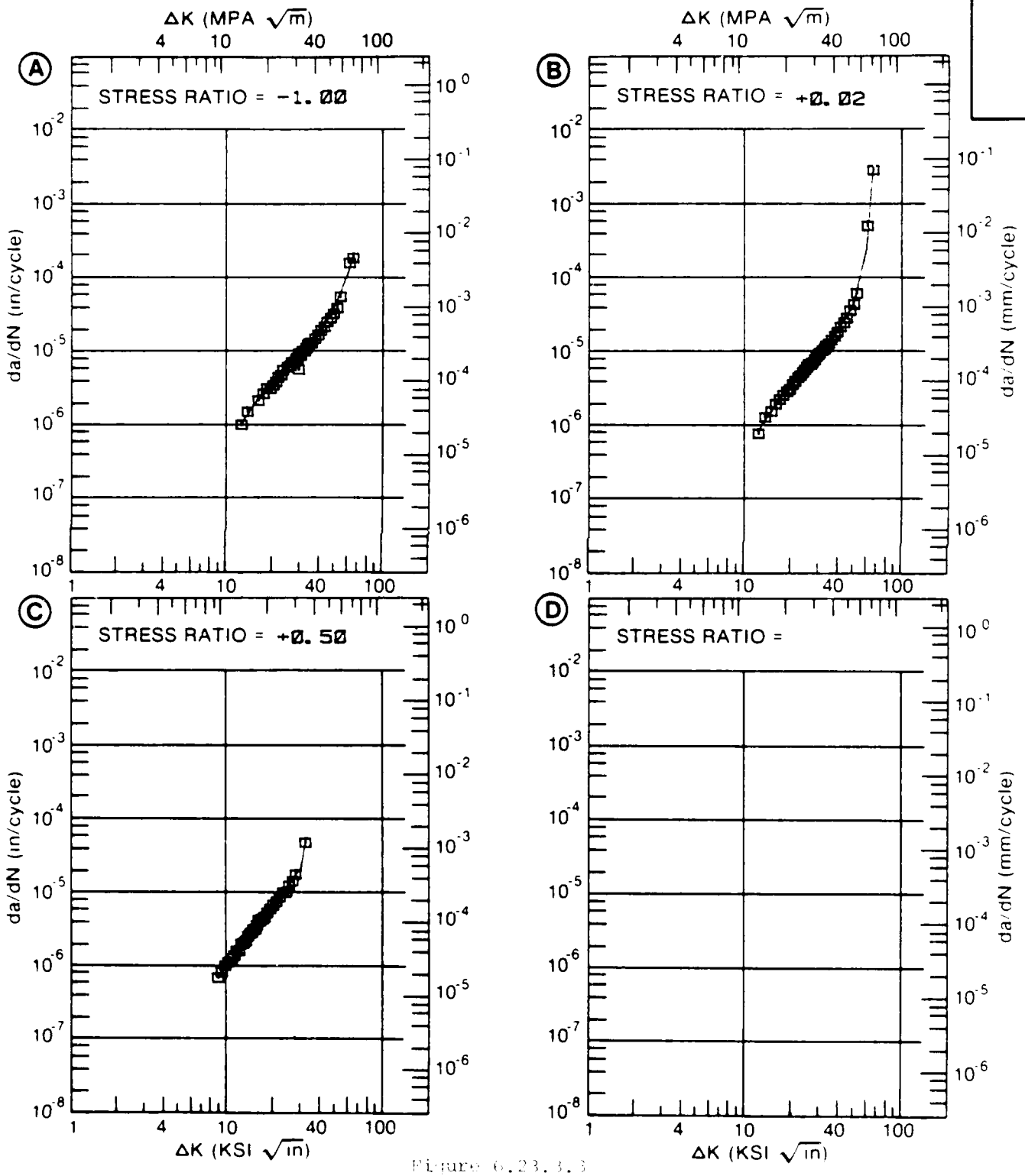



Figure 6.23.3.3

TABLE 6.23.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 300M
CONDITION: UTS=280-300KSI
ENVIRONMENT: R.T. ,L.H.A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=-1.00 | R=+0.00 | R=+0.50 | |
| DELTA K MIN | A: | 11.61 | .39 | | | |
| | B: | 11.83 | | .45 | | |
| | C: | 6.00 | | | .17 | |
| | D: | | | | | |
| | | 7.00 | | | .272 | |
| | | 8.00 | | | .382 | |
| | | 9.00 | | | .508 | |
| | | 10.00 | | | .657 | |
| | | 13.00 | .684 | .664 | 1.32 | |
| | | 16.00 | 1.67 | 1.42 | 2.65 | |
| | | 20.00 | 3.18 | 2.96 | 6.97 | |
| | | 25.00 | 5.47 | 5.73 | 25.1 | |
| | | 30.00 | 9.27 | 9.53 | | |
| | | 35.00 | 17.0 | 14.5 | | |
| | | 40.00 | 34.4 | 20.7 | | |
| | | 50.00 | 188. | 38.0 | | |
| | | 60.00 | | 63.8 | | |
| | | 70.00 | | 102. | | |
| DELTA K MAX | A: | 55.73 | 573. | | | |
| | B: | 79.71 | | 154. | | |
| | C: | 27.15 | | | 286. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 22.63 | 21.35 | 26.95 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: UTS=280-300KSI
FORM: 3.50"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., L.H.A.

YIELD STRENGTH: 248.0- 250.0 KSI
ULT. STRENGTH: 295.5- 298.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900- 4.000"
REFERENCES: MA007, MA010

ALLOY STEEL

300M

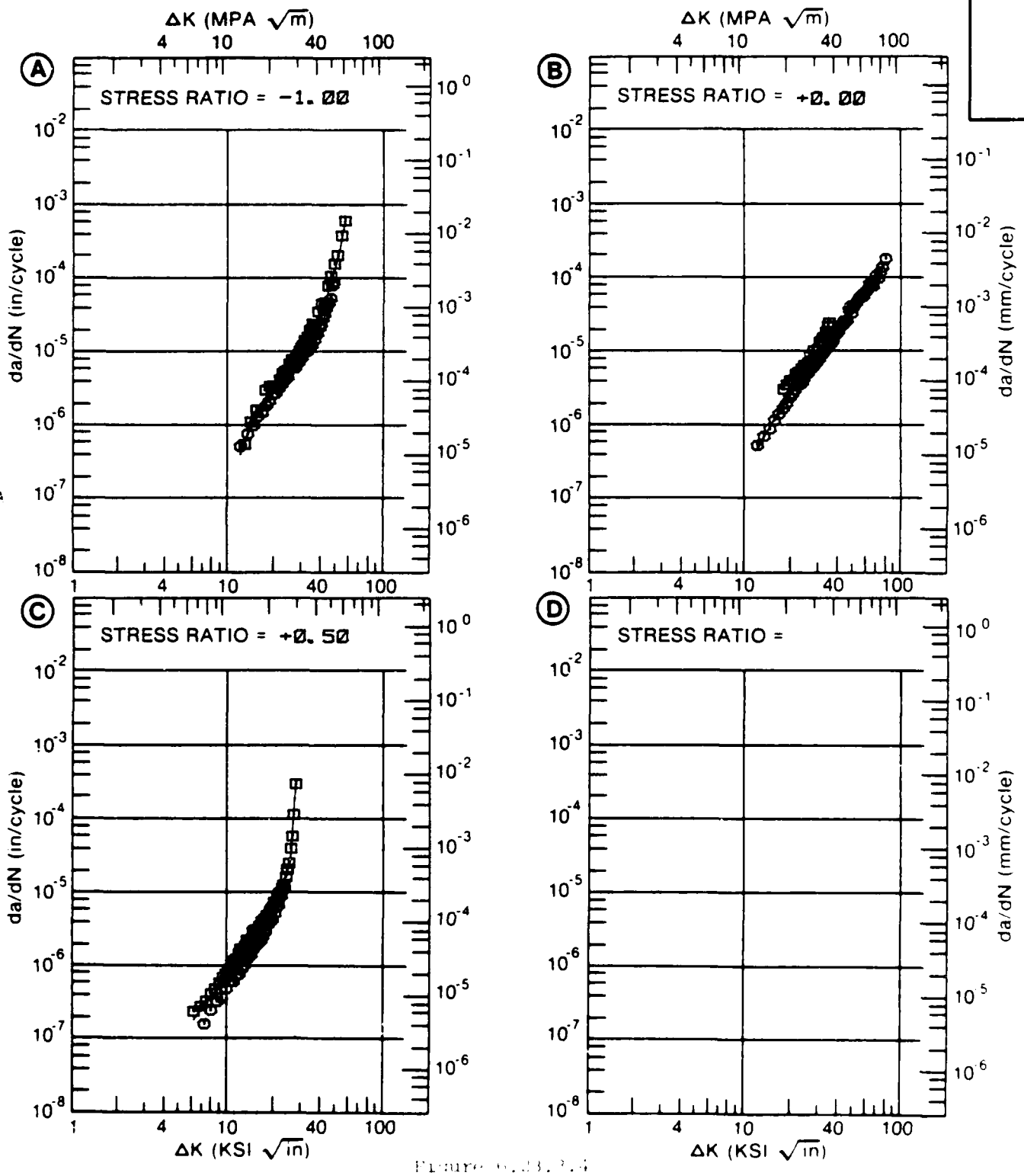



Figure [illegible]

TABLE 6.23.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION: TUS=280-300KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A E= R.T. 3.5% NACL | B E= R.T. ALT IMMERSION IN SEA WATER-IMMERSED | C E= R.T. ALT IMMERSION IN SEA WATER-1ST HALF DRY CYC | D E= R.T. ALT IMMERSION IN SEA WATER-2ND HALF DRY CYC |
|---|---|---|---|---|---|---|
| DELTA K MIN | A: | 16.55 | .723 | | | |
| | B: | 11.30 | | .983 | | |
| | C: | 11.22 | | | .382 | |
| | D: | 11.50 | | | | .386 |
| | | 13.00 | | 1.08 | .543 | .524 |
| | | 16.00 | | 1.51 | 1.01 | .971 |
| | | 20.00 | 2.24 | 2.61 | 2.17 | 2.05 |
| | | 25.00 | 6.17 | 4.99 | 4.65 | 4.41 |
| | | 30.00 | 12.3 | 8.51 | 8.12 | 7.89 |
| | | 35.00 | 21.5 | | 11.9 | 12.1 |
| | | 40.00 | 35.9 | | | 16.5 |
| | | 50.00 | 100. | | | |
| DELTA K MAX | A: | 55.70 | 186. | | | |
| | B: | 32.23 | | 10.4 | | |
| | C: | 37.07 | | | 13.4 | |
| | D: | 40.07 | | | | 16.5 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 39.88 | 8.55 | 18.05 | 19.59 |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: TUS=280-300KSI
FORM: 3.50"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 10.00 HZ

YIELD STRENGTH: 248.0- 250.0 KSI
ULT. STRENGTH: 295.5- 298.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900- 4.000"
REFERENCES: MA007, MA010

ALLOY STEEL

300M

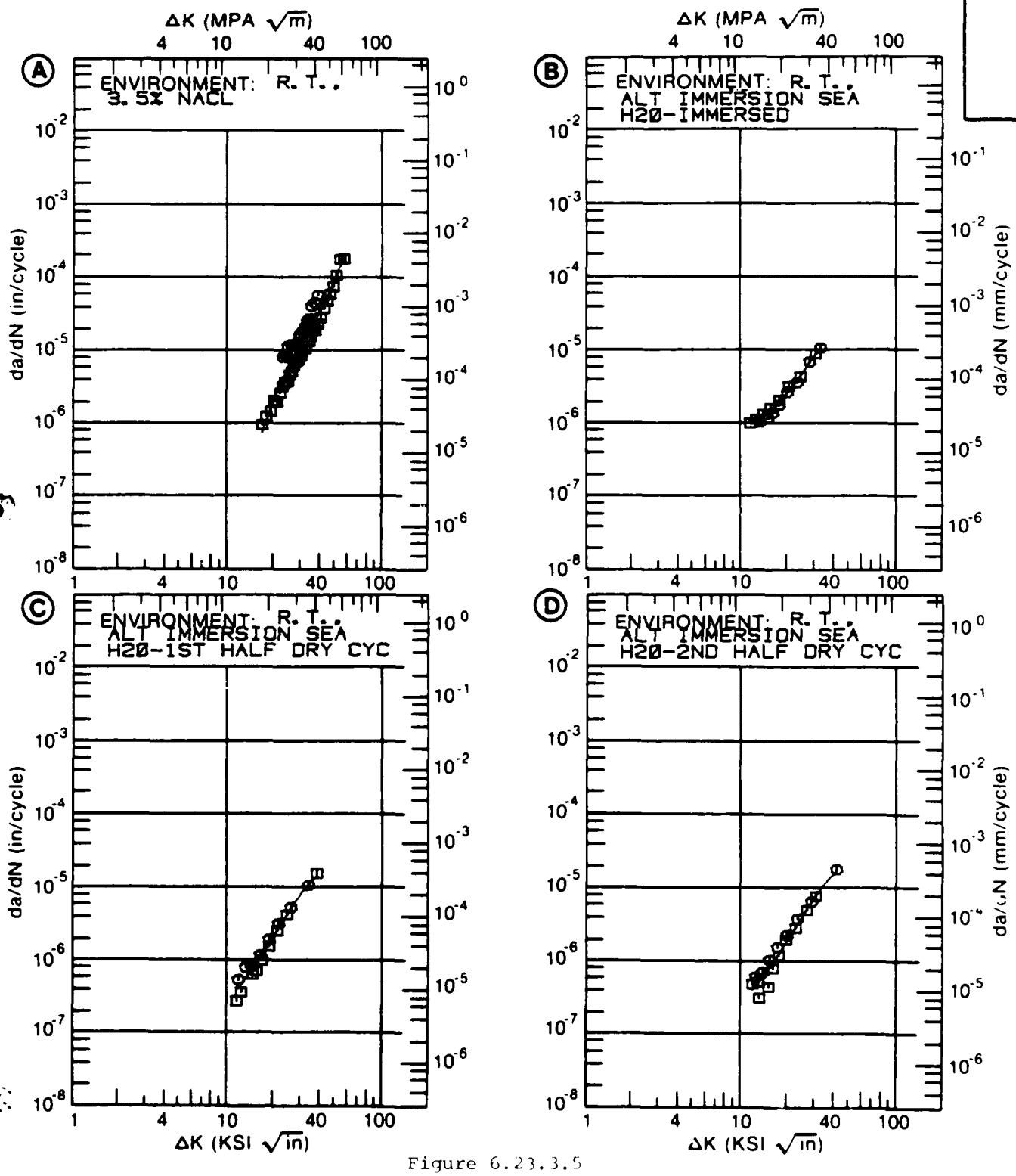



Figure 6.23.3.5

TABLE 6.23.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION: TUS=280-300KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A E= R.T. 3.5% NACL | B E= R.T. ALT IMMERSION IN SEA WATER-IMMERSED | C E= R.T. ALT IMMERSION IN SEA WATER-1ST HALF DRY CYC | D E= R.T. ALT IMMERSION IN SEA WATER-2ND HALF DRY CYC |
|---|---|---|---|---|---|---|
| DELTA K MIN | A: | 18.02 | 2.84 | | | |
| | B: | 14.75 | | 1.68 | | |
| | C: | 14.74 | | | 1.42 | |
| | D: | 14.64 | | | | .575 |
| | | 16.00 | | 2.95 | 2.51 | .955 |
| | | 20.00 | 4.20 | 8.04 | 7.06 | 2.61 |
| | | 25.00 | 7.61 | 12.8 | 11.7 | 5.44 |
| | | 30.00 | 11.4 | 16.0 | 14.8 | 8.94 |
| | | 35.00 | 17.4 | 19.9 | 18.0 | 13.5 |
| | | 40.00 | 28.7 | 27.2 | 23.3 | 19.8 |
| | | 50.00 | 105. | | 50.6 | |
| DELTA K MAX | A: | 57.63 | 367. | | | |
| | B: | 44.10 | | 38.1 | | |
| | C: | 51.60 | | | 59.3 | |
| | D: | 48.51 | | | | 38.8 |
| ROOT MEAN SQUARE PERCENT ERROR | | | 9.87 | 36.02 | 42.11 | 34.38 |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: TUS=280-300KSI
FORM: 3.50"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 248.0- 250.0 KSI
ULT. STRENGTH: 295.5- 298.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900- 4.000"
REFERENCES: MA007, MA010

ALLOY STEEL

300M

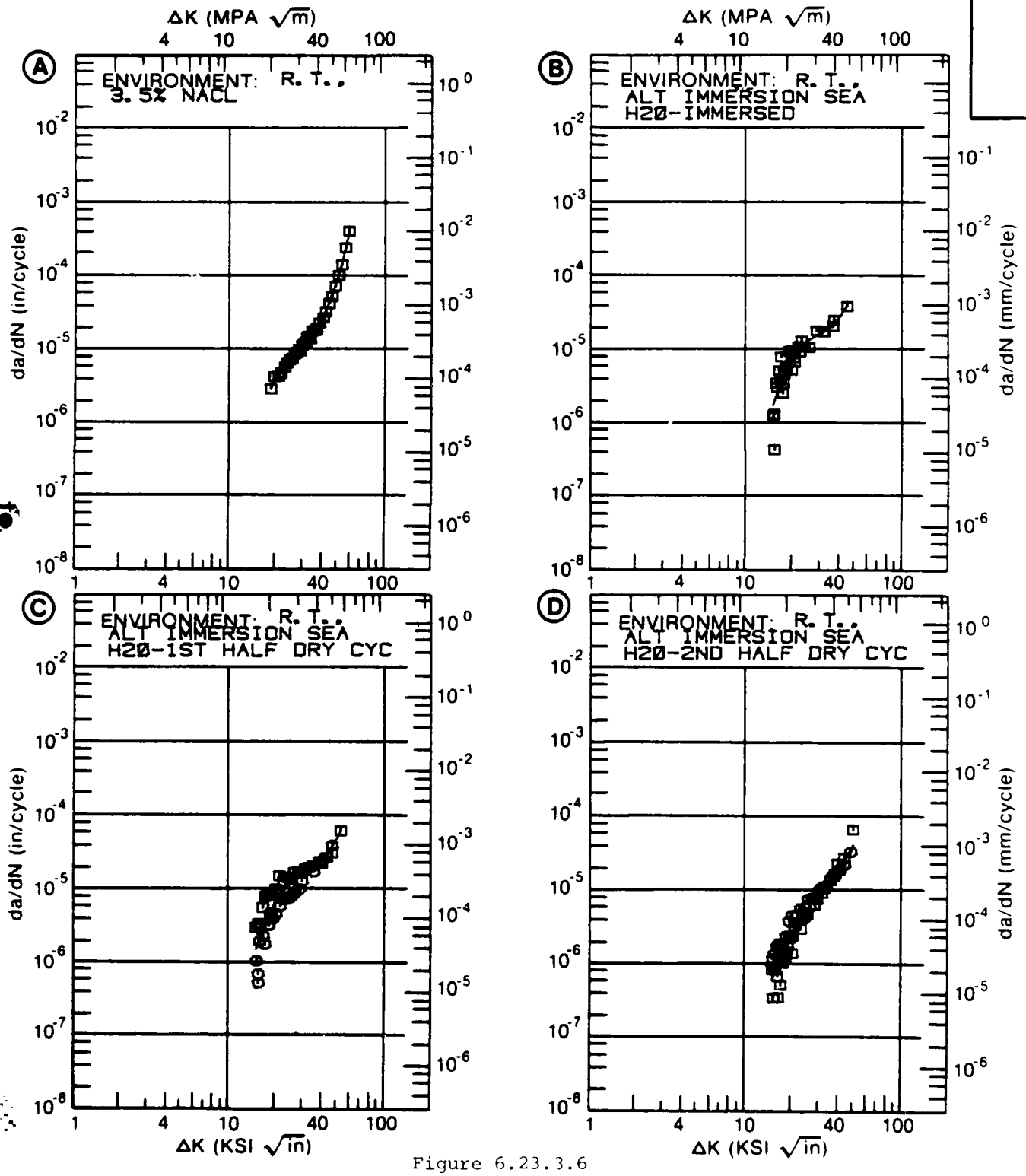



Figure 6.23.3.6

TABLE 6.23.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F 2+2HRS
ENVIRONMENT: R.T. , L.H.A.

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.08 | R=+0.30 | R=+0.50 | |
| DELTA K MIN A: | 5.76 | .191 | | | |
| B: | 10.47 | | .788 | | |
| C: | 9.74 | | | .832 | |
| D: | | | | | |
| | 6.00 | .206 | | | |
| | 7.00 | .283 | | | |
| | 8.00 | .381 | | | |
| | 9.00 | .503 | | | |
| | 10.00 | .651 | | .901 | |
| | 13.00 | 1.28 | 1.52 | 1.84 | |
| | 16.00 | 2.22 | 2.71 | 3.23 | |
| | 20.00 | 4.03 | 4.88 | 6.83 | |
| | 25.00 | 7.18 | 8.69 | | |
| | 30.00 | 11.2 | 15.3 | | |
| DELTA K MAX A: | 30.13 | 11.4 | | | |
| B: | 34.66 | | 30.4 | | |
| C: | 23.72 | | | 14.6 | |
| D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 5.37 | 10.19 | 9.34 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1700F 1.5HRS AC. 1600F 1.5HRS OQ. 600F 2+2HRS
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., L.H.A.
YIELD STRENGTH: 238.0 KSI
ULT. STRENGTH: 287.0 KSI
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 7.400"
REFERENCES: R1006

ALLOY STEEL

300M

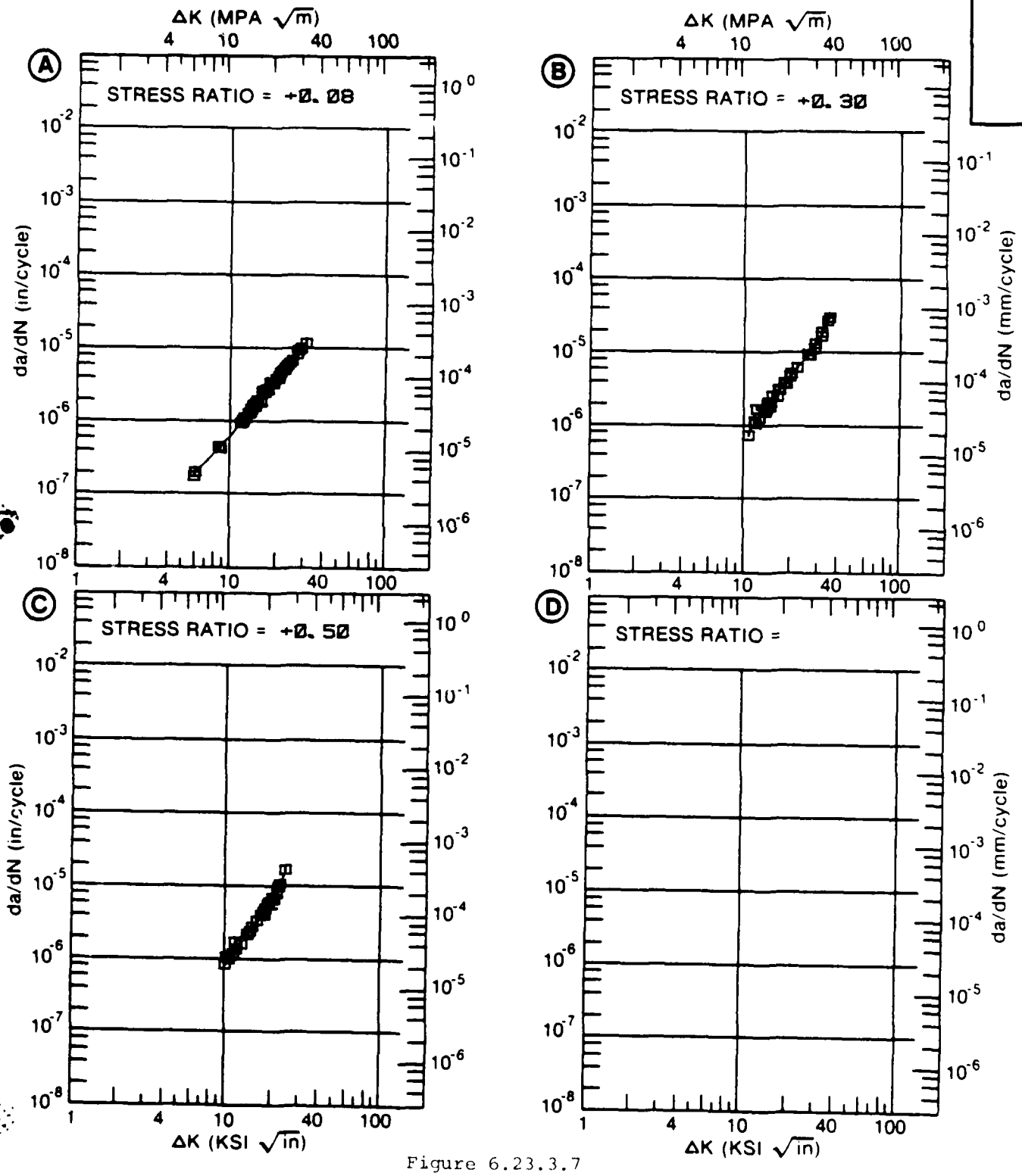



Figure 6.23.3.7

TABLE 6.23.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F 2+2HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=- 65F L.H.A. 6HZ | E= R.T. L.H.A. 1HZ | | |
| DELTA K MIN | A: | 11.83 | .577 | | | |
| | B: | 10.87 | | .744 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | .803 | 1.20 | | |
| | | 16.00 | 1.56 | 2.05 | | |
| | | 20.00 | 3.04 | 3.67 | | |
| | | 25.00 | 5.93 | 6.62 | | |
| | | 30.00 | 10.7 | 10.9 | | |
| | | 35.00 | 18.7 | 16.8 | | |
| DELTA K MAX | A: | 38.05 | 26.0 | | | |
| | B: | 37.57 | | 20.6 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.48 | 10.79 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1700F 1.5HRS AC. 1600F 1.5HRS OQ. 600F 2+2HRS
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 238.0 KSI
ULT. STRENGTH: 287.0 KSI
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 7.400"
REFERENCES: R1006

ALLOY STEEL

300M

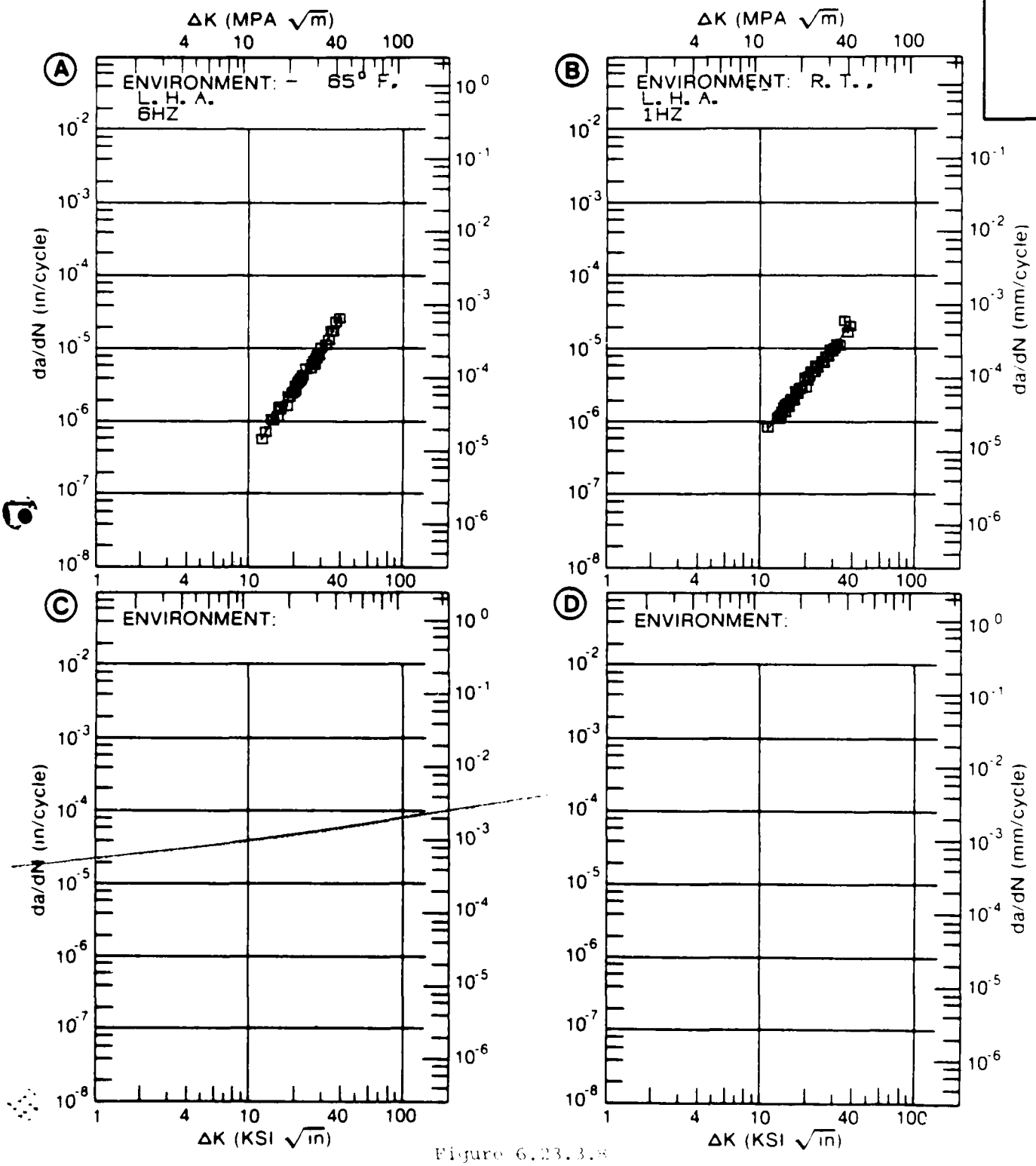



Figure 6.23.3.8

TABLE 6.23.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F 2+2HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. L.H.A. 6HZ | E= R.T. S.T.W. 1HZ | | |
| DELTA K MIN | A: | 10.91 | 698 | | | |
| | B: | 8.05 | | 1.93 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 9.00 | | 3.13 | | |
| | | 10.00 | | 4.28 | | |
| | | 13.00 | 1.34 | 7.12 | | |
| | | 16.00 | 2.41 | 12.0 | | |
| | | 20.00 | 4.01 | | | |
| | | 25.00 | 6.73 | | | |
| | | 30.00 | 11.4 | | | |
| | | 35.00 | 20.1 | | | |
| | | 40.00 | 37.4 | | | |
| DELTA K MAX | A: | 45.45 | 78.3 | | | |
| | B: | 18.47 | | 22.5 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.83 | 10.20 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F 2+2HRS
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 236.0 KSI
ULT. STRENGTH: 281.0 KSI
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 7.400"
REFERENCES: RI006

ALLOY STEEL

300M

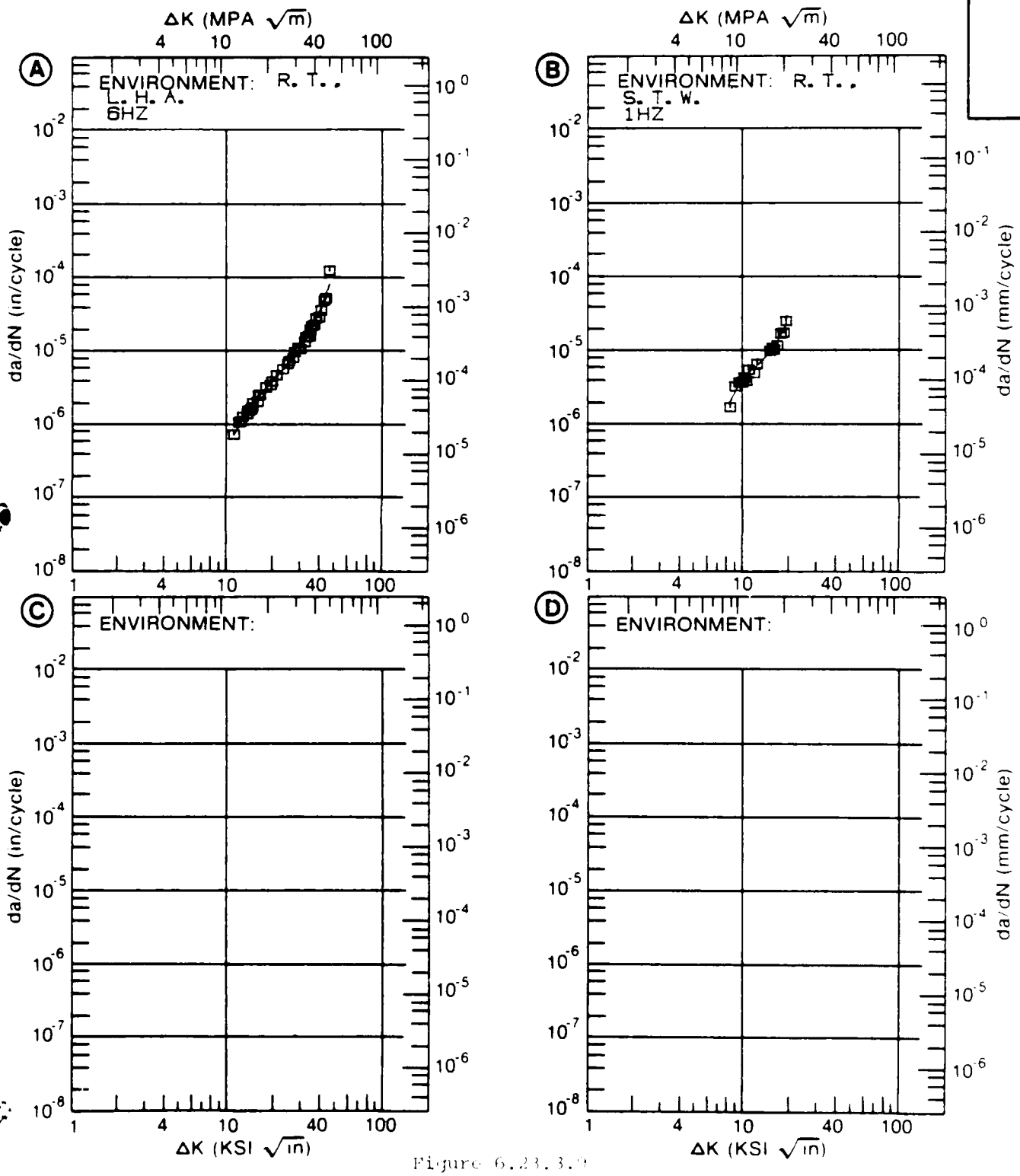



Figure 6.23.3.9

TABLE 6.23.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F 2+2HRS

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E=- 65F L.H.A. 6HZ | E= R.T. L.H.A. 6HZ | E= R.T. S.T.W. 1HZ | |
| DELTA K MIN | A: | 12.73 | .751 | | | |
| | B: | 15.42 | | 2.08 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | .775 | | | |
| | | 16.00 | 1.27 | 2.29 | | |
| | | 20.00 | 2.72 | 4.09 | | |
| | | 25.00 | 5.91 | 7.59 | | |
| | | 30.00 | | 13.6 | | |
| | | 35.00 | | 24.2 | | |
| DELTA K MAX | A: | 29.53 | 9.36 | | | |
| | B: | 36.05 | | 27.3 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 10.41 | 6.22 | 0.00 | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 1700F 1.5HRS AC. 1600F 1.5HRS OQ. 600F 2+2HRS
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: S-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 1.000"
SPECIMEN WIDTH: 3.100"
REFERENCES:R1006

ALLOY STEEL

300M

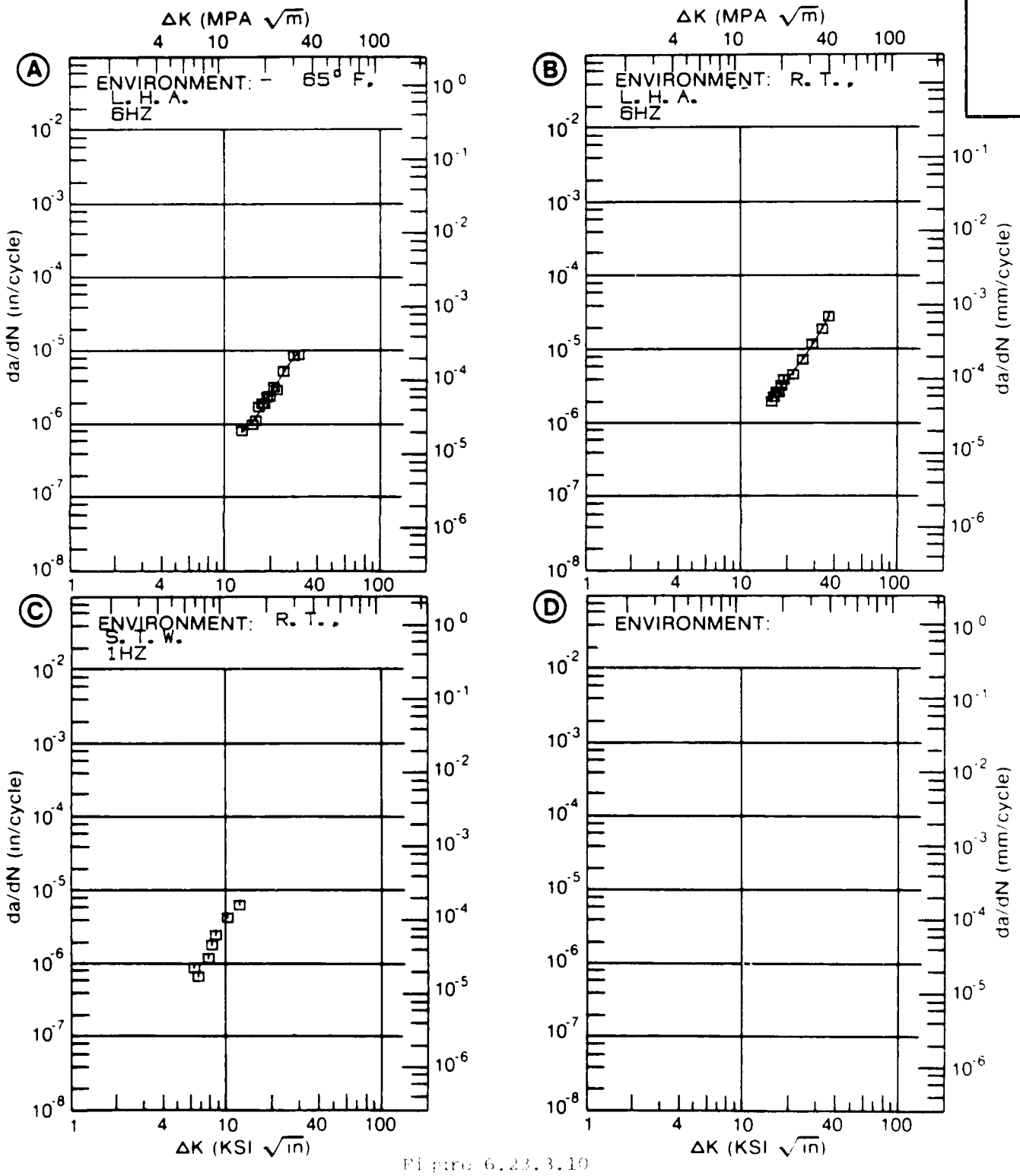



Figure 6.23.3.10

TABLE 6.23.3.11

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION:

| K MAX (KSI*IN**1/2) | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|
| | | E= 3.5% NACL | | | |
| K MAX MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| K MAX MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 0.00

CONDITION/HT:
FORM:
SPECIMEN TYPE: TDCB
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK
SPECIMEN WIDTH
CRACK LENGTH ($A_O$)
$K_{ISCC}$:
REFERENCES 78313

ALLOY STEEL

300M

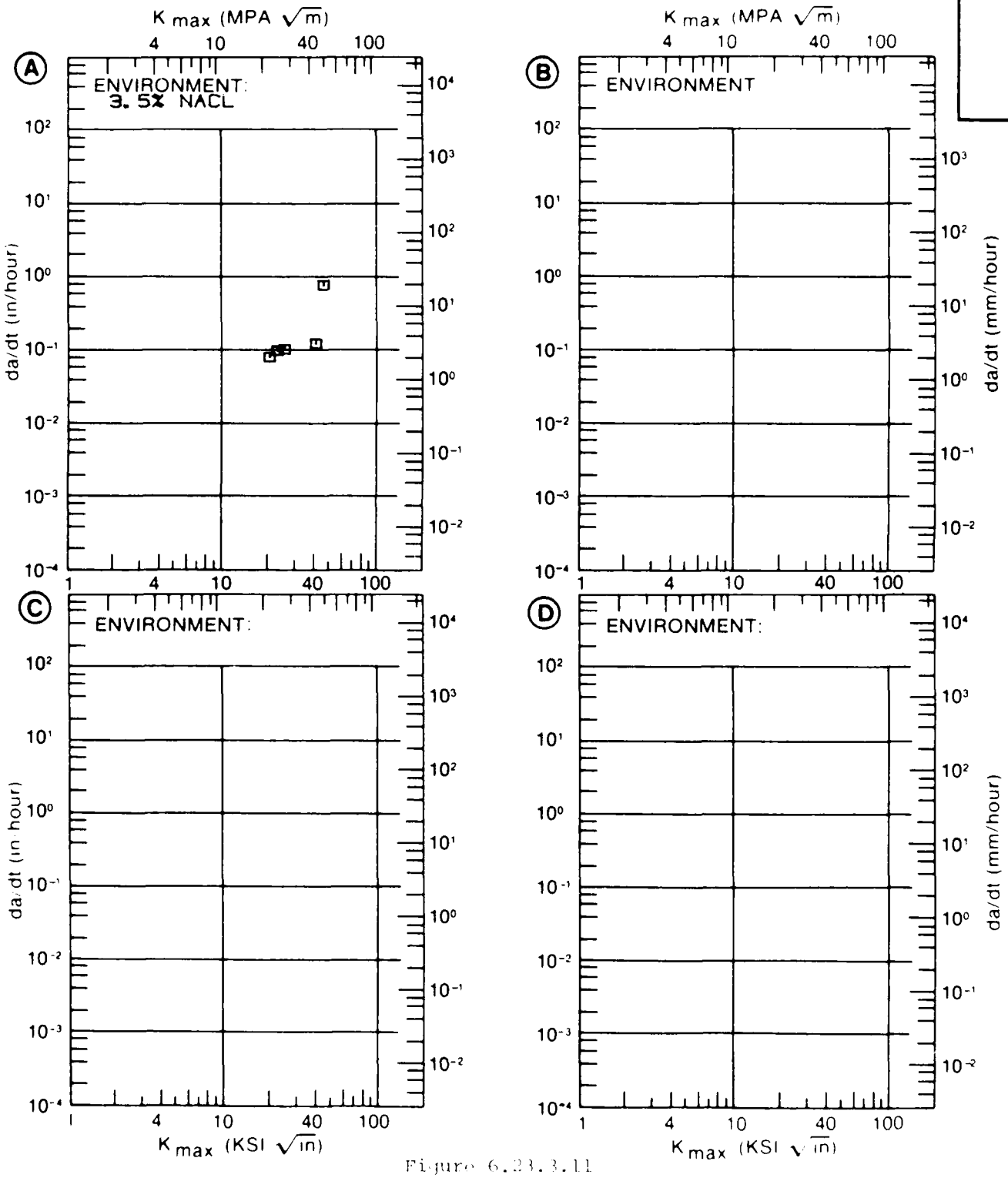



Figure 6.23.3.11

TABLE 6.23.3.12

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.12 INDICATING EFFECT
OF ENVIRONMENT

MATERIAL: ALLOY STEEL 300M
CONDITION: 1600F OQ, 575F 2+2HR

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R. T. DIST. WATER | | | |
| K MAX MIN | A: | 12.80 | 3.10 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 23.7 | | | |
| | | 16.00 | 147. | | | |
| | | 20.00 | 290. | | | |
| | | 25.00 | 368. | | | |
| | | 30.00 | 399. | | | |
| | | 35.00 | 436. | | | |
| | | 40.00 | 490. | | | |
| | | 50.00 | 682. | | | |
| | | 60.00 | 1059. | | | |
| | | 70.00 | 1793. | | | |
| | | 80.00 | 3897. | | | |
| K MAX MAX | A: | 82.00 | 7300. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 34.18

CONDITION/HT: 1600F OQ, 575F 2+2HR
FORM: 0.1"TH SHEET
SPECIMEN TYPE: DCB
ORIENTATION: T-L
YIELD STRENGTH: 245.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.100"
SPECIMEN WIDTH:
CRACK LENGTH ($A_O$):
$K_{ISCC}$:
REFERENCES: 85545

ALLOY STEEL

300M

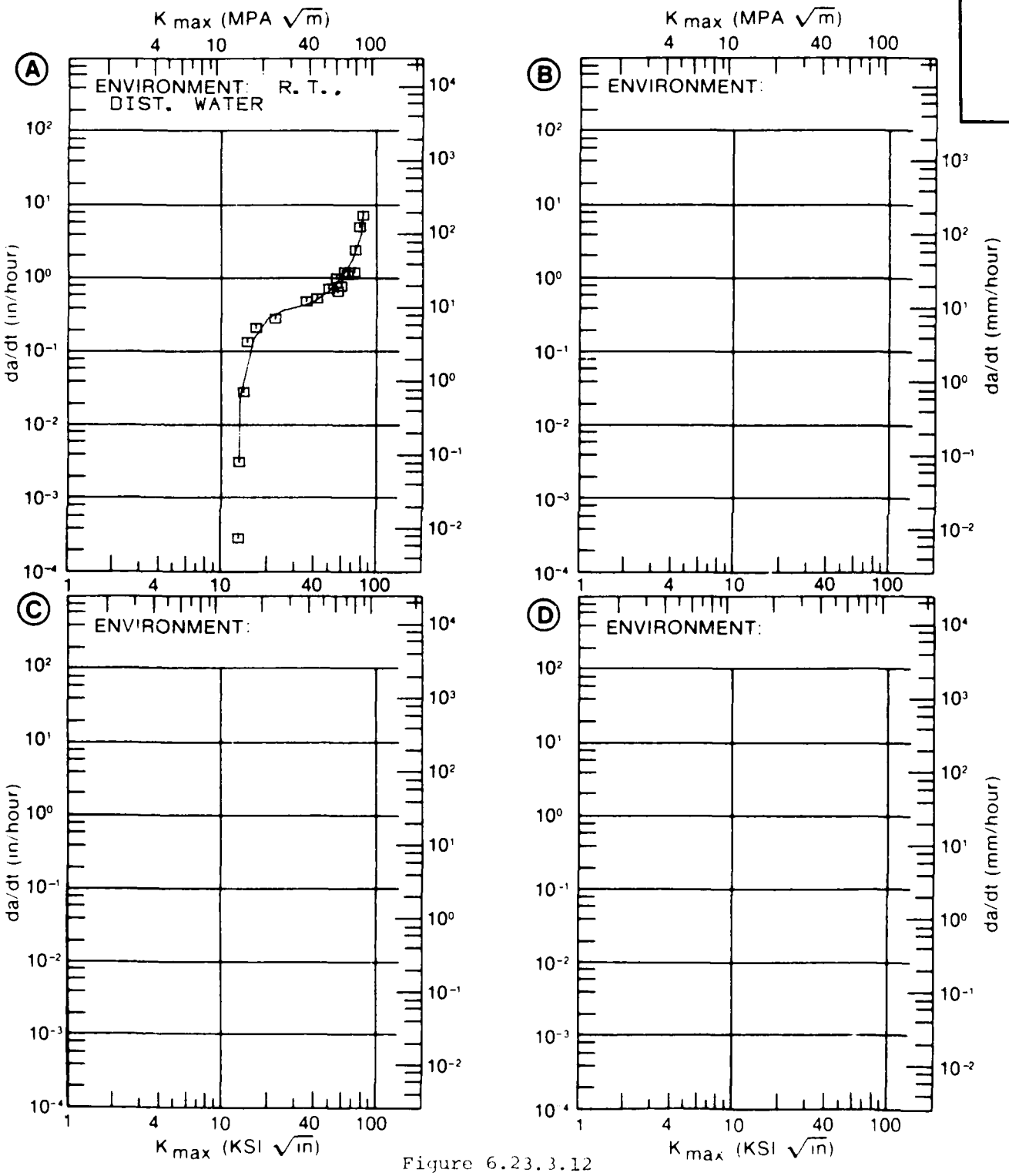



Figure 6.23.3.12

TABLE 6.23.3.13

ALLOY STEEL 300M K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---- | P | ---- | R.T. | --- | 289.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | 0.300 | 89.00 | 12.00 | | | ---- | 1971 | 84351 |
| ---- | P | 0.48 | R.T. | L-S | 236.0 | 3.5 PCT NACL | 1.500 | 0.480 | NB | ---- | 76.00 | 13.00 | | | ---- | 1967 | 74302 |
| ---- | F | 1.25 | R.T. | S-T | 240.2 | SIM. SEA WATER | 3.091 | 1.242 | BWOL | 1.351 | ------ | 15.40 | | | 86400 | 1977 | MA005 |
| | | 1.25 | | | 240.2 | | 3.088 | 1.247 | BWOL | 1.348 | ------ | 15.40 | | | 86400 | 1977 | MA005 |
| | | 1.25 | | | 240.2 | | 3.101 | 1.249 | BWOL | 1.355 | ------ | 15.70 | | | 86400 | 1977 | MA005 |
| | | 1.25 | | | 240.2 | | 3.091 | 1.251 | BWOL | 1.366 | ------ | 15.60 | | | 86400 | 1977 | MA005 |
| | | | | | | | | | | | | | 15.5/ | 0.2 | | | |
| 1500F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 202.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 36.00 | 12.00 | | | ---- | 1970 | 78305 |
| 1500F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 232.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 42.00 | 15.00 | | | ---- | 1970 | 78305 |
| 1500F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 247.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 56.00 | 15.00 | | | ---- | 1970 | 78305 |
| 1500F 0.5HR OQ 400F 2+2 HR (FINE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 245.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 60.00 | 12.00 | | | ---- | 1970 | 78305 |
| 1550F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 248.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 64.00 | 15.00 | | | ---- | 1970 | 78305 |
| 1550F 0.5HR OQ 400F 2+2 HR (FINE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 241.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 53.00 | 15.00 | | | ---- | 1970 | 78305 |
| 1550F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE) | P | 0.56 | R.T. | --- | 246.0 | 3.5 PCT NACL | 1.500 | 0.500 | CANT* | ---- | 60.00 | 15.00 | | | ---- | 1970 | 78305 |

TABLE 6.23.3.13 (Con't)

ALLOY STEEL 300M K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F 0 5HR OQ P 400F 2+2 HR (COARSE GRAINED STRUCTURE) | | 0 56 | R T | --- | 240 0 | 3.5 PCT NACL | 1.500 | 0 500 | CANT* | ---- | 53 00 | 15 00 | | | ---- | 1970 | 78305 |
| 1600F 0 5HR OQ P 400F 2+2 HR (COARSE GRAI STRUCTURE) | | 0 5 | | | | 5 PCT NACL | 1.500 | 0 500 | CANT* | ---- | 67 00 | 12 00 | | | ---- | 1970 | 78305 |
| 1600F 0 5HR OQ P 550F 2+2 HR (COARSE GRAINED STRUCTURE) | | 0 56 | R | | | T NACL | 1.500 | 0 500 | CANT* | ---- | 65.00 | 12 00 | | | ---- | 1970 | 78305 |
| 1500F 0 5HR OQ P 550F 2+2 HR (FINE GRAINED STRUCTURE) | | 0 56 | R T | --- | | T NACL | 1.500 | 0 500 | CANT* | ---- | 65 00 | 12 00 | | | ---- | 1970 | 78305 |
| 1550F 1525F OQ F 400F 2+2HR | | 5 00 | R T | --- | 247.0 | AIR-90PCT RH | 1.500 | 0.480 | PTSC | 0 140 | 73.90 | 71 00 | | | ---- | 1965 | 74718 |
| 1550F 1600F F 400 OQ 600F 1+1 HR | | 4 00 | R T | L-S | 251 5 | 3 5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 63.50 | 19 60 | | | ---- | 1965 | 74718 |
| 1500F 1 5HR F | | 3 00 | R T | L-T | 238 0 | F.C S. | 2 000 | 1 000 | DCB | ---- | 150 00 | 21 00 | | | ---- | 1976 | R1006 |
| A 1500F 1 5HR | | 3 00 | | | 238 0 | | 2.000 | 1 000 | DCB | ---- | 150 00 | 29 00 | | | ---- | 1976 | R1006 |
| OQ 400F 2+2HR | | 3 00 | | | 238 0 | | 2 000 | 1 000 | DCB | ---- | 150 00 | 30 00 | | | ---- | 1976 | R1006 |
| 1500F 1 5HR F | | 3 00 | R T | L-T | 238 0 | S C S | 2 000 | 1 000 | DCB | ---- | 150 00 | 39 00 | | | 116760 | 1976 | R1006 |
| A 1500F 1 5HR | | 3 00 | | | 238 0 | | 2 000 | 1 000 | DCB | ---- | 150.00 | 39 00 | | | 116760 | 1976 | R1006 |
| OQ 400F 2+2HR | | 3 00 | | | 238 0 | | 2 000 | 1 000 | DCB | ---- | 150 00 | 36 00 | | | 116760 | 1976 | R1006 |
| | | | | | | | | | | | | | 38 07 | 1.7 | | | |
| 1500F 1 5HR F 2A 1500F 1 5HR OQ 400F 2+2HR | | 3 00 | R T | L-T | 238 0 | S T W | 2 000 | 1 000 | DCB | ---- | 150 00 | 25 00 | | | ---- | 1976 | R1006 |

TABLE 6.23.3.13 (Con't)

ALLOY STEEL 300M K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F 1 5HR | F | 3 00 | R T | L-T | 238.0 | S.T.W. | 2.000 | 1.000 | DCB | ---- | 150.00 | < 21.00 | | | ---- | 1976 | R1006 |
| AC,1600F 1 5HR OQ,600F 2+2HR | | | | | | | | | | | | | | | | | |
| 1700F 1 5HR | F | 3 00 | R T | S-L | ---- | S.T.W. | 2.000 | 1.000 | DCB | ---- | 150.00 | < 25.00 | | | ---- | 1976 | R1006 |
| AC,1600F 1 5HR | | 3 00 | | | ---- | | 2.000 | 1.000 | DCB | ---- | 150.00 | < 25.00 | | | ---- | 1976 | R1006 |
| OQ,600F 2+2HR | | 3 00 | | | ---- | | 2.000 | 1.000 | DCB | ---- | 150.00 | 16.00 | | | 76200 | 1976 | R1006 |
| | | 3 00 | | | ---- | | 2.000 | 1.000 | DCB | ---- | 150.00 | 15.00 | | | 76200 | 1976 | R1006 |
| | | | | | | | | | | | | | 15.5/ | 0.7 | | | |
| 1710F+1610F | D | 0 63 | R T. | L-T | 250.0 | 3.5 PCT NACL | 1.000 | 0.500 | NB | ---- | 58.90 | 18.00 | | | ---- | 1971 | 84087 |
| 610F | | 0 63 | | | 250.0 | | 1.000 | 0.500 | NB | ---- | 59.80 | 17.60 | | | ---- | 1971 | 84087 |
| | | 0 63 | | | 250.0 | | 1.000 | 0.500 | NB | ---- | 54.70 | 16.70 | | | ---- | 1971 | 84087 |
| | | | | | | | | | | | | | 17.4/ | 0.7 | | | |
| 1710F+1610F | D | 0.63 | R.T. | T-L | 250.0 | 3.5 PCT NACL | ---- | 0.500 | CT | ---- | 61.20 | 18.90 | | | ---- | 1971 | 84087 |
| 610F | | 0 63 | | | 250.0 | | ---- | 0.500 | CT | ---- | 51.50 | 16.30 | | | ---- | 1971 | 84087 |
| | | 0 63 | | | 250.0 | | ---- | 0.500 | CT | ---- | 55.30 | 18.00 | | | ---- | 1971 | 84087 |
| | | 0 63 | | | 250.0 | | ---- | 0.500 | CT | ---- | 55.90 | 17.30 | | | ---- | 1971 | 84087 |
| | | | | | | | | | | | | | 17.6/ | 1.1 | | | |

TABLE 6.24.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 300M (AM) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) |
|---|---|---|

FORGING

| CONDITION/HT | L-T | T-L | S-L |
|---|---|---|---|
| 1650F 1 HR.AC.<br>1550F 1 HR.OQ.<br>-320F 0.5 HR.<br>600F 2+2HR.AC | 46.5 ± 3.8 (3) | ----- | ----- |

TABLE 6.24.2.1

ALLOY STEEL 300M (AM) K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/YS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1 HR,AC, | F | 4.00 | R.T | L-T | 262.0 | 1.800 | 0.900 | NB | ---- | 0.07 | 43.60 | | | 1968 | 73300 ( 1) |
| 1550F 1 HR,OQ, | | 4.00 | | | 262.0 | 1.800 | 0.900 | NB | ---- | 0.07 | 45.10 | | | 1968 | 73300 ( 1) |
| 350F 0.5 HR, | | 4.00 | | | 262.0 | 1.800 | 0.900 | NB | ---- | 0.09 | 50.80 | | | 1968 | 73300 ( 1) |
| 600F 2+2HR,AC | | | | | | | | | | | | 46.5/ | 3.8 | | |

NOTES
( 1) (AM)=AIR MELTED

TABLE 6.25.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 300M (VAR) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) |
|---|---|---|

FORGING

| CONDITION/HT | L-T | T-L | S-L |
|---|---|---|---|
| 1650F 1 HR.AC.<br>1550F 1 HR.OQ.<br>-320F 0.5 HR.<br>600F 2+2HR.AC | 52.2 ± 1.3 (4) | ----- | ----- |

TABLE 6.25.2.1

ALLOY STEEL 300M (VAR) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1 HR,AC, | F | 4 50 | R.T. | L-T | 259.0 | 1.800 | 0.900 | NB | ---- | 0.10 | 51.10 | | | 1968 | 73300 ( 1) |
| 1550F 1 HR,OQ, | | 4 50 | | | 259.0 | 1.800 | 0.900 | NB | ---- | 0.11 | 53.60 | | | 1968 | 73300 ( 1) |
| 320F 0 5 HR, | | 4 50 | | | 259.0 | 1.800 | 0.900 | NB | ---- | 0.11 | 53.00 | | | 1968 | 73300 ( 1) |
| 600F 2+2HR,AC | | 4 50 | | | 259.0 | 1.800 | 0.900 | NB | ---- | 0.10 | 51.20 | | | 1968 | 73300 ( 1) |
| | | | | | | | | | | | | 52.2/ | 1.3 | | |

NOTES
( 1) (VAR)=VACUUM ARC REMELTED

TABLE 6.26.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL 300M(VM) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN)) (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1500F, OQ, 400F 2+2HR | 48.0 ±17.0 (2) | ----- | ----- |
| 1500F, OQ, 550F 2+2HR | 49.5 ±10.6 (2) | ----- | ----- |
| 1550F, OQ, 550F 2+2HR | 62.5 ± 3.5 (2) | ----- | ----- |
| | **BILLET** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1700F, AC, 1600F 1 HR, OQ, 550F 2+2 HR | ----- | 55.3 ± 0.3 (3) | ----- |
| 1700F, AC, 1600F 1 HR, SQ 975F, OQ, 575F 2+2 HR | ----- | 58.6 ± 2.2 (3) | ----- |
| 1700F, AC, 1600F 1 HR, SQ 400F, AC, 550F 2+2 HR | ----- | 58.0 ± 3.4 (3) | ----- |

TABLE 6.26.2.1

ALLOY STEEL 300M(VM) K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN / STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F.00.400F | P | 0.56 | R.T. | L-T | 202.0 | 1.500 | 0.500 | NB | ---- | 0.08 | 36.00 | | 1970 | 78305 ( 1) |
| 24HR | | 0.56 | | | 245.0 | 1.500 | 0.500 | NB | ---- | 0.15 | 60.00 | | 1970 | 78305 ( 2) |
| | | | | | | | | | | | | 48.0/ 17.0 | | |
| 1550F.00.550F | P | 0.56 | R.T. | L-T | 233.0 | 1.500 | 0.500 | NB | ---- | 0.08 | 42.00 | | 1970 | 78305 ( 1) |
| 24HR | | 0.56 | | | 248.0 | 1.500 | 0.500 | NB | ---- | 0.13 | 57.00 | | 1970 | 78305 ( 2) |
| | | | | | | | | | | | | 49.5/ 10.6 | | |
| 1550F.00.400F | P | 0.56 | R.T. | L-T | 242.0 | 1.500 | 0.500 | NB | ---- | 0.12 | 53.00 | | 1970 | 78305 ( 1) |
| 24HR | | | | | | | | | | | | | | |
| 1550F.00.550F | P | 0.56 | R.T. | L-T | 248.0 | 1.500 | 0.500 | NB | ---- | 0.15 | 60.00 | | 1970 | 78305 ( 1) |
| 24HR | | 0.56 | | | 248.0 | 1.500 | 0.500 | NB | ---- | 0.17 | 65.00 | | 1970 | 78305 ( 2) |
| | | | | | | | | | | | | 62.5/ 3.5 | | |
| [illegible] | P | 0.56 | R.T. | L-T | 220.0 | 1.500 | 0.500 | NB | ---- | 0.22 | 66.00 | | 1970 | 78305 ( 1) |
| [illegible] | | | | | | | | | | | | | | |
| [illegible] | P | 0.56 | R.T. | L-T | 233.0 | 1.500 | 0.500 | NB | ---- | 0.20 | 66.00 | | 1970 | 78305 ( 1) |
| [illegible] | BT | 5.50 | R.T. | T-L | 239.0 | 2.500 | 1.000 | CT | ---- | 0.14 | 55.60 | | 1972 | 84278 ( 3) |
| [illegible] | | 5.50 | | | 239.0 | 2.500 | 1.000 | CT | ---- | 0.13 | 55.30 | | 1972 | 84278 ( 3) |
| [illegible] | | 5.50 | | | 239.0 | 2.500 | 1.000 | CT | ---- | 0.13 | 55.00 | | 1972 | 84278 ( 3) |
| | | | | | | | | | | | | 55.3/ 0.3 | | |
| [illegible] | BT | 5.50 | R.T. | T-L | 242.0 | 2.500 | 1.000 | CT | ---- | 0.14 | 56.40 | | 1972 | 84278 ( 3) |
| [illegible] | | 5.50 | | | 242.0 | 2.500 | 1.000 | CT | ---- | 0.15 | 58.50 | | 1972 | 84278 ( 3) |
| [illegible] | | 5.50 | | | 242.0 | 2.500 | 1.000 | CT | ---- | 0.16 | 60.80 | | 1972 | 84278 ( 3) |
| | | | | | | | | | | | | 58.6/ 2.2 | | |
| [illegible] | BT | 5.50 | R.T. | T-L | 244.0 | 2.500 | 1.000 | CT | ---- | 0.13 | 55.40 | | 1972 | 84278 ( 3) |

NOTE

[illegible] (VAC) (VACUUM MELTED) THESE DATA ARE AVERAGE VALUES

[illegible] THESE PLATES WERE HIGH TEMPERATURE ANNEALED AT 1750F TO GET FINE GRAIN SIZE

[illegible] THESE DATA ARE AVERAGE VALUES

[illegible] (VA) = (VACUUM MELTED)

TABLE 6.26.2.1 (Con't)

ALLOY STEEL 300M(VM) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1700F, AC, 1600F | BT | 5.50 | R.T | T-L | 244.0 | 2.500 | 1.000 | CT | ---- | 0.14 | 56.70 | | | 1972 | 84278 ( 1) |
| 1 HR, SQ 400F, | | 5.50 | | | 244.0 | 2.500 | 1.000 | CT | ---- | 0.16 | 61.80 | | | 1972 | 84278 ( 1) |
| AC, 550F 2+2 HR | | | | | | | | | | | | 58.0/ | 3.4 | | |

NOTES
( 1) (VM)-(VACUUM MELTED)

TABLE 6.27.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4140 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) |
|---|---|---|

FORGED BAR

| CONDITION/HT | L-T | T-L | S-L |
|---|---|---|---|
| 2010F 1 HR, OQ, 475F 1 HR | 52.1 ± 7.4 (2) | ----- | ----- |
| 2190F 1 HR, OQ, 400F 1 HR | 81.1 ±13.2 (2) | ----- | ----- |
| 2190F 1 HR, OQ, 475F 1 HR | 66.1 ± 2.7 (2) | ----- | ----- |

TABLE 6.27.2.1

ALLOY STEEL 4140 K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1600F 1 HR,OQ, 400F 1HR | FB | 0.62 | R.T. | L-T | 210.0 | 2.000 | 0.600 | CT | 1.000 | 0.09 | 39.90 | | | 1973 | 87241 ( 1) |
| 1600F 1 HR,OQ, 745F 1HR | FB | 0.62 | R.T. | L-T | 220.0 | 2.000 | 0.600 | CT | 1.000 | 0.13 | 50.60 | | | 1973 | 87241 ( 1) |
| 1600F 1 HR,OQ, 535F 1HR | FB | 0.62 | R.T. | L-T | 230.0 | 2.000 | 0.600 | CT | 1.000 | 0.12 | 50.00 | | | 1973 | 87241 ( 1) |
| 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR | P | 1.00<br>1.00 | -65 | T-L | 176.3<br>176.3 | 2.003<br>2.002 | 0.994<br>0.994 | CT<br>CT | 1.033<br>1.022 | 0.31<br>0.44 | 62.50<br>74.69 | 68.6/ | 8.6 | 1980<br>1980 | MR002<br>MR002 |
| 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR | P | 1.00<br>1.00 | -65 | T-L | 198.1<br>198.1 | 2.001<br>2.003 | 0.994<br>0.994 | CT<br>CT | 1.034<br>1.055 | 0.10<br>0.09 | 41.30<br>38.90 | 40.1/ | 1.7 | 1980<br>1980 | MR002<br>MR002 |
| 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR | P | 1.00 | R.T. | T-L | 159.4 | 2.003 | 0.994 | CT | 1.024 | 0.71 | 85.30 | | | 1980 | MR002 |
| 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR | P | 1.00 | R.T. | T-L | 175.0 | 2.003 | 0.994 | CT | 1.040 | 0.28 | 58.70 | | | 1980 | MR002 |
| 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR | P | 1.00<br>1.00 | 165 | T-L | 156.0<br>156.0 | 2.000<br>1.998 | 0.990<br>0.994 | CT<br>CT | 0.991<br>1.015 | 0.73<br>0.73 | 84.40<br>84.60 | 84.5/ | 0.1 | 1980<br>1980 | MR002<br>MR002 |
| 1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR | P | 1.00<br>1.00 | 165 | T-L | 167.7<br>167.7 | 2.002<br>2.000 | 0.994<br>0.990 | CT<br>CT | 1.045<br>1.037 | 0.44<br>0.38 | 71.10<br>66.19 | 68.6/ | 3.5 | 1980<br>1980 | MR002<br>MR002 |
| 2010F 1 HR,OQ, 400F 1 HR | FB | 0.62 | R.T. | L-T | 200.0 | 2.000 | 0.600 | CT | 1.000 | 0.22 | 59.20 | | | 1973 | 87241 ( 1) |
| 2010F 1 HR,OQ, 475F 1 HR | FB | 0.62 | R.T. | L-T | 210.0 | 2.000 | 0.600 | CT | 1.000 | 0.12 | 46.80 | | | 1973 | 87241 ( 1) |

NOTES

( 1) COMPOSITION(WT PERCENT) 0.40C,0.94MN,0.008P,0.012S,0.28SI,0.09NI,0.90CR,00.17CU

TABLE 6.27.2.1 (Con't)

ALLOY STEEL 4140 K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN / STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2510F 1 HR,OQ, 475F 1 HR | FB | 0.62 | R T | L-T | 210.0 | 2.000 | 0.600 | CT | 1.000 | 0.19 | 57.30 | 52.1/ 7.4 | 1973 | 87241 ( 1) |
| 2190F 1 HR,OQ, 400F 1 HR | FB | 0.62 | R T | L-T | 200.0 | 2.000 | 0.600 | CT | 1.000 | 0.51 | 90.40 | | 1973 | 87241 ( 1) |
| | | 0.62 | | | 200.0 | 2.000 | 0.600 | CT | 1.000 | 0.32 | 71.70 | 81.1/ 13.2 | 1973 | 87241 ( 1) |
| 2190F 1 HR,OQ, 660F 1 HR | FB | 0.62 | R T | L-T | 202.0 | 2.000 | 0.600 | CT | 1.000 | 0.17 | 53.20 | | 1973 | 87241 ( 1) |
| 2190F 1 HR,OQ, 615F 1 HR | FB | 0.62 | R T | L-T | 205.0 | 2.000 | 0.600 | CT | 1.000 | 0.14 | 48.50 | | 1973 | 87241 ( 1) |
| 2190F 1 HR,OQ, 475F 1 HR | FB | 0.62 | R T. | L-T | 210.0 | 2.000 | 0.600 | CT | 1.000 | 0.26 | 68.00 | | 1973 | 87241 ( 1) |
| | | 0.62 | | | 210.0 | 2.000 | 0.600 | CT | 1.000 | 0.23 | 64.20 | 66.1/ 2.7 | 1973 | 87241 ( 1) |

NOTES

( 1) COMPOSITION(WT PERCENT) 0.40C,0.94MN,0.008P,0.012S,0.28SI,0.09NI,0.90CR,00.17CU

TABLE 6.27.3.1

ALLOY STEEL 4140 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F 1HR OQ 1250F 1HR AC | P | ---- | R.T. | --- | 105.0 | WATER SAT H2S | 3.250 | 1.000 | CT | 1.000 | ------ | 36.00 | | | ---- | 1972 | 84963 |
| 1550F 1HR OQ 1000F 1HR AC, 1125F 1HR AC | P | ---- | R.T. | --- | 147.5 | WATER SAT H2S | 3.250 | 1.000 | CT | 1.000 | ------ | 17.50 | | | ---- | 1972 | 84963 |
| 1700F, 1600F OQ 750F 1+1 HR | P | 0.25 | R.T. | --- | 195.0 | DIST. WATER | 1.000 | 0.250 | CANT* | 0.200 | 49.40 | 15.00 | | | > 6000 | 1965 | 63061 |
| 1700F, 1600F OQ 600F 1+1 HR | P | 0.25 | R.T. | --- | 241.0 | DIST. WATER | 1.000 | 0.250 | CANT* | 0.200 | 40.10 | 11.00 | | | > 7000 | 1965 | 63061 |

TABLE 6.28.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL 4330V MOD AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN)) | | (NUMBER OF SPECIMENS) |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| HEAT TREATED TO 46 RC HARDNESS | ----- | 74.7 ± 0.8 (2) | ----- |
| | **FORGED BAR** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1600F 1 HR, OQ, 535F 1 HR | 96.7 ± 3.8 (2) | ----- | ----- |
| | **BILLET** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1650F 1 HR, AC, 1575F 1 HR, OQ, 800F 2+2 HR | 96.1 ± 3.2 (3) | ----- | ----- |
| 1650F 1 HR, AC, 1575F 1 HR, OQ, 525F 2+2 HR | 81.6 ± 2.3 (6) | ----- | ----- |

TABLE 6.28.2.1

ALLOY STEEL 4330V MOD K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | BT | 2.20 | - 65 | L-T | 194.5 | 2.502 | 1.259 | CT | 1.155 | 0.14 | 45.30 | | | 1974 | MA011 |
| | | 2.20 | | | 194.5 | 2.507 | 1.260 | CT | 1.153 | 0.13 | 44.30 | 44.8/ | 0.7 | 1974 | MA011 |
| ---------- | BT | 2.20 | R.T | L-T | 194.5 | 2.504 | 1.253 | CT | 1.164 | 0.43 | 80.70 | | | 1974 | MA011 |
| HEAT TREATED | P | 0.62 | R.T | T-L | 193.0 | 1.502 | 0.750 | NB | 0.762 | 0.38 | 75.20 | | | 1971 | B4029 |
| TO 46 RC | | 0.62 | | | 193.0 | 1.498 | 0.750 | NB | 0.758 | 0.37 | 74.10 | | | 1971 | B4029 |
| HARDNESS | | | | | | | | | | | | 74.7/ | 0.8 | | |
| 1600F 1 HR,OQ, | FB | 0.62 | R.T. | L-T | 198.0 | 2.000 | 0.600 | CT | 1.000 | 0.49 | 88.00 | | | 1973 | B7241 ( 1) |
| 400F 1 HR | | | | | | | | | | | | | | | |
| 1600F 1 HR,OQ, | FB | 0.62 | R.T | L-T | 202.0 | 2.000 | 0.600 | CT | 1.000 | 0.60 | 99.40 | | | 1973 | B7241 ( 1) |
| 535F 1 HR | | 0.62 | | | 202.0 | 2.000 | 0.600 | CT | 1.000 | 0.54 | 94.00 | | | 1973 | B7241 ( 1) |
| | | | | | | | | | | | | 96.7/ | 3.8 | | |
| 1650F 1 HR,AC, | BT | 6.00 | R.T | L-T | 191.0 | 2.500 | 1.000 | CT | 1.400 | 0.68 | 99.70 | | | 1972 | B4277 |
| 1575F 1 HR,OQ, | | 6.00 | | | 191.0 | 2.500 | 1.000 | CT | 1.400 | 0.60 | 93.80 | | | 1972 | B4277 |
| 900F 2+2 HR | | 6.00 | | | 191.0 | 2.500 | 1.000 | CT | 1.400 | 0.61 | 94.70 | 96.1/ | 3.2 | 1972 | B4277 |
| 1650F 1 HR,AC, | BT | 6.00 | R.T | L-T | 203.0 | 2.500 | 1.000 | CT | 1.400 | 0.48 | 84.20 | | | 1972 | B4277 |
| 1575F 1 HR,OQ, | | 6.00 | | | 203.0 | 2.500 | 1.000 | CT | 1.400 | 0.34 | 77.50 | | | 1972 | B4277 |
| 525F 2+2 HR | | 6.00 | | | 203.0 | 2.500 | 1.000 | CT | 1.400 | 0.45 | 81.20 | | | 1972 | B4277 |
| | | 6.00 | | | 203.0 | 2.500 | 1.000 | CT | 1.400 | 0.46 | 82.20 | | | 1972 | B4277 |
| | | 6.00 | | | 203.0 | 2.500 | 1.000 | CT | 1.400 | 0.39 | 82.80 | | | 1972 | B4277 |
| | | 6.00 | | | 203.0 | 2.500 | 1.000 | CT | 1.400 | 0.38 | 81.60 | 81.6/ | 2.3 | 1972 | B4277 |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.28C,1.02MN,0.009P,0.005S,0.28SI,1.80NI,0.85CR,00.07V,0.01CU

TABLE 6.28.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.28.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4330V (MOD)
CONDITION:
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.02 | | | |
| DELTA K MIN | A: | 9.72 | 1.88 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | 2.11 | | | |
| | | 13.00 | 4.61 | | | |
| | | 16.00 | 6.32 | | | |
| | | 20.00 | 7.44 | | | |
| | | 25.00 | 8.24 | | | |
| | | 30.00 | 9.30 | | | |
| | | 35.00 | 11.2 | | | |
| | | 40.00 | 14.3 | | | |
| | | 50.00 | 28.4 | | | |
| DELTA K MAX | A: | 54.34 | 40.8 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 14.16

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT:
FORM: 2.20"TH BILLET
SPECIMEN TYPE: WOL
ORIENTATION: L-T
FREQUENCY: 1.00- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 194.5 KSI
ULT. STRENGTH: 231.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA011

ALLOY STEEL

4330V (MOD)

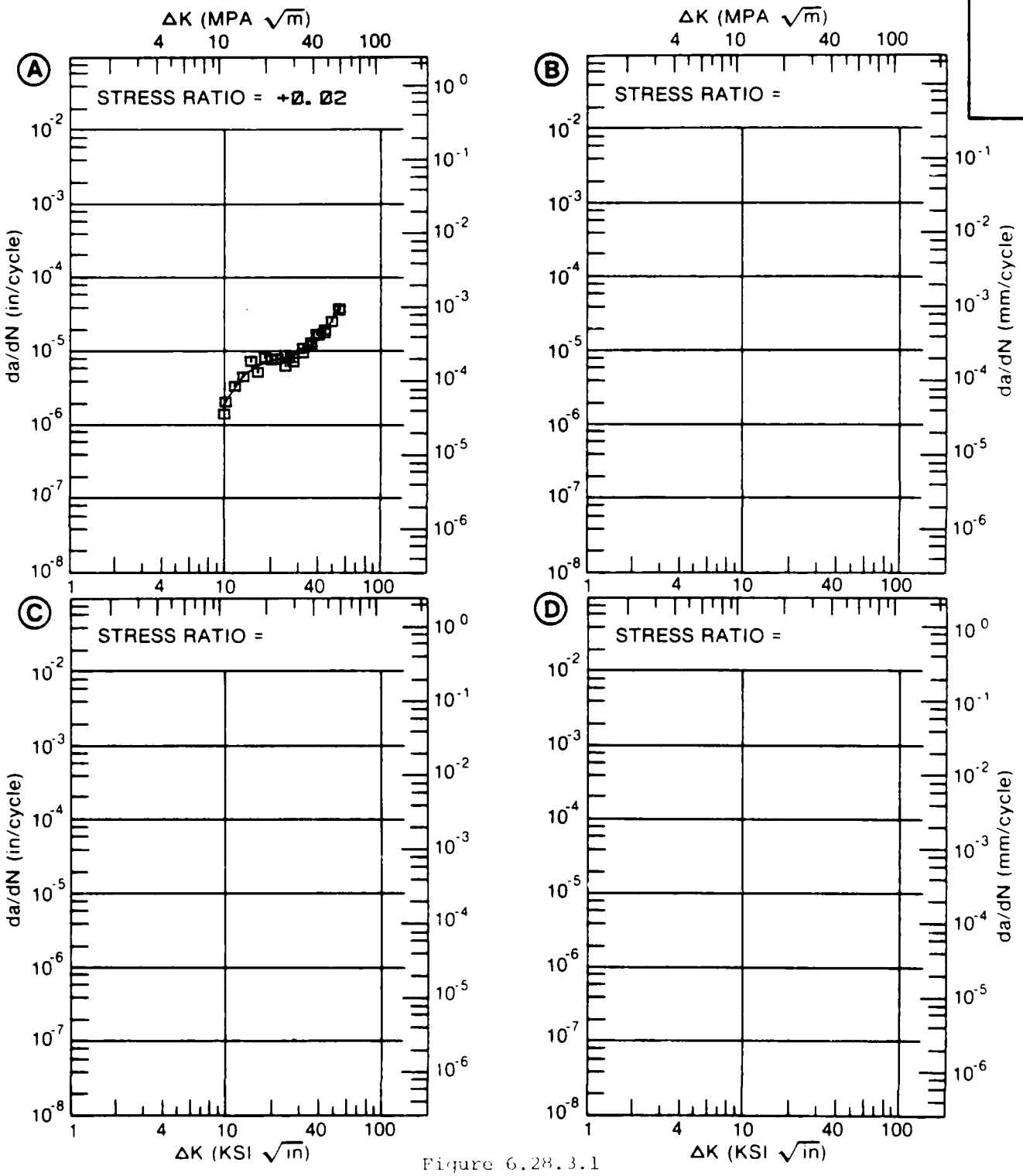



Figure 6.28.3.1

ALLOY STEEL 4[illegible]

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QUENCHED + TEMPERED AT 500F | P | 0.48 | R T | L S | 196 | 0.3.5 PCT NACL | [illegible] | 480 | [illegible] | [illegible] | [illegible] | [illegible] | | | ---- | 1971 | B4351 |

TABLE 6.29.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **PLATE** | | |
| CONDITION/HT | L-T | T-L | S-L |
| HEAT TREATED TO 51 RC HARDNESS | ----- | 51.7 ± 1.3 (2) | ----- |
| 1550F, OQ, TEMPERED 800F | 76.6 ± 4.6 (2) | ----- | ----- |
| 1550F, OQ, TEMPERED 500F | 45.3 ± 2.9 (4) | ----- | ----- |
| 1600F 1HR, 1525F 2.5HR, OQ AT 150-175F, 900F 1HR | ----- | 88.2 ± 1.5 (2) | ----- |
| | **FORGED BAR** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1600F 1 HR, OQ, 535F 1 HR | 60.9 ± 0.8 (2) | ----- | ----- |
| 2190F 1HR, FC TO 1600F, HOLD 0.5HR, 400F 1 HR | 76.8 ± 0.1 (2) | ----- | ----- |
| 2190F 1HR, FC TO 1600F, HOLD 0.5HR, 660F 1 HR | 60.8 ± 0.8 (2) | ----- | ----- |
| 2190F 1HR, FC TO 1600F, HOLD 0.5HR, 535F 1 HR | 60.1 ± 3.2 (2) | ----- | ----- |

TABLE 6.29.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN)) | (NUMBER OF SPECIMENS) |
|---|---|---|

BILLET

| CONDITION/HT | L-T | T-L | S-L |
|---|---|---|---|
| 1650F 1 HR, AC, 1525F 1 HR, OQ, 800F 2 HR | 76.3 ± 3.6 (6) | ----- | ----- |

TABLE 6.29.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 4340

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT LAB AIR AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| MARTEMPERED | PLATE | 0.02 | ---- | | | | 492 | 3.12 | 23.0 | 111.0 |
| UTS = 160 KSI | ROUND BAR | 0.10 | 7.00 | | | | | 2.47 | | |
| UTS = 160 KSI | ROUND BAR | 0.50 | 7.00 | | | 0.09 | | | | |
| UTS = 160 KSI | ROUND BAR | 0.50 | 7.00 | | | | 0.61 | 3.60 | | |
| UTS = 180 KSI | ROUND BAR | 0.10 | 20.00-30.00 | | | | 0.90 | 2.96 | 23.2 | |
| UTS = 180 KSI | ROUND BAR | 0.50 | 7.00 | | | 0.09 | | | | |
| UTS = 180 KSI | ROUND BAR | 0.50 | 7.00 | | | | 0.63 | | | |

TABLE 6.29.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 4340

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT AIR AT 650 F

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2.5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| UTS = 180 KSI | ROUND BAR | 0.10 | 7.00 | | | | | 2.78 | 39.7 | |
| UTS = 180 KSI | ROUND BAR | 0.50 | 7.00 | | | | 0.96 | 5.28 | | |
| UTS = 180 KSI | ROUND BAR | 0.50 | 20.00 | | | | 1.04 | | | |

TABLE 6.29.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 4340

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT H H A AT R T

| CONDITION/HT | PRODUCT FORM | STRESS RATIO | FREQ (HZ) | DELTA K LEVELS (KSI SQRT(IN)) | FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 2 5 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| TUS=180 200KSI | BAR | 0 05 | 3 00 | | | | | 2 94 | 17 8 | |
| TUS 180 200KSI | BAR | 0 50 | 3 00 | | | | 0 71 | 3 78 | | |

TABLE 6.29.2.1

ALLOY STEEL 4340 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEAT TREATED | P | 0.62 | R.T. | T-L | 220.0 | 0.999 | 0.499 | NB | 0.540 | 0.14 | 52.60 | | | 1971 | 84029 |
| TO 51 RC | | 0.62 | | | 220.0 | 0.998 | 0.498 | NB | 0.534 | 0.13 | 50.80 | | | 1971 | 84029 |
| HARDNESS | | | | | | | | | | | | 51.7/ | 1.3 | | |
| UTS = 180 KSI | BR | 4.50 | R.T. | L-T | 192.9 | 2.007 | 0.992 | CT | 0.933 | 0.77 | 107.20 | | | 1979 | DA001 |
| 1550F,OQ, | P | 1.00 | R.T. | L-T | 206.0 | 0.160 | 0.800 | CT | 0.800 | 0.37 | 73.30 | | | 1971 | 86582 |
| TEMPERED 800F | | 1.00 | | | 206.0 | 0.160 | 0.800 | CT | 0.800 | ---- | 79.80 | 76.6/ | 4.6 | 1971 | 86582 |
| 1550F,OQ, | P | 1.00 | R.T. | L-T | 238.0 | 0.160 | 0.800 | CT | 0.800 | ---- | 45.80 | | | 1971 | 86582 |
| TEMPERED 500F | | 1.00 | | | 238.0 | 0.160 | 0.800 | CT | 0.800 | ---- | 46.00 | | | 1971 | 86582 |
| | | 1.00 | | | 238.0 | 0.160 | 0.800 | CT | 0.800 | 0.09 | 41.20 | | | 1971 | 86582 |
| | | 1.00 | | | 238.0 | 0.160 | 0.800 | CT | 0.800 | ---- | 48.00 | 45.3/ | 2.9 | 1971 | 86582 |
| 1600F 1 HR,OQ, | FB | 0.62 | R.T. | L-T | 195.0 | 2.000 | 0.600 | CT | 1.000 | 0.23 | 59.50 | | | 1973 | 87241 ( 1) |
| 400F 1 HR | | | | | | | | | | | | | | | |
| 1600F 1 HR,OQ, | FB | 0.62 | R.T. | L-T | 210.0 | 2.000 | 0.600 | CT | 1.000 | 0.47 | 91.20 | | | 1973 | 87241 ( 1) |
| 745F 1 HR | | | | | | | | | | | | | | | |
| 1600F 1 HR,OQ, | FB | 0.62 | R.T. | L-T | 217.0 | 2.000 | 0.600 | CT | 1.000 | 0.34 | 79.80 | | | 1973 | 87241 ( 1) |
| 660F 1 HR | | | | | | | | | | | | | | | |
| 1600F 1 HR,OQ, | FB | 0.62 | R.T. | L-T | 218.0 | 2.000 | 0.600 | CT | 1.000 | 0.19 | 61.40 | | | 1973 | 87241 ( 1) |
| 535F 1 HR | | 0.62 | | | 218.0 | 2.000 | 0.600 | CT | 1.000 | 0.19 | 60.30 | | | 1973 | 87241 ( 1) |
| | | | | | | | | | | | | 60.9/ | 0.8 | | |
| 1600F 1HR, | P | 1.00 | - 65 | T-L | 190.3 | 1.998 | 1.004 | CT | 1.022 | 0.54 | 89.19 | | | 1980 | MR002 |
| 1525F 2 5HR,OQ | | 1.00 | | | 190.3 | 1.997 | 1.004 | CT | 1.026 | 0.57 | 91.00 | | | 1980 | MR002 |
| AT 150-175F, 900F 1HR | | | | | | | | | | | | 90.1/ | 1.3 | | |
| 1600F 1HR, | P | 1.00 | R.T. | T-L | 179.4 | 2.000 | 1.030 | CT | 1.022 | 0.61 | 89.30 | | | 1980 | MR002 |
| 1525F 2 5HR,OQ AT 150-175F, 900F 1HR | | | | | | | | | | | | | | | |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.40C,0.80MN,0.010S,0.24SI,1.65NI,0.72CR,0.24MO,0.19CU

TABLE 6.29.2.1 (Con't)

ALLOY STEEL 4340 K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1600F 1HR, | P | 1.00 | R.T. | T-L | 179.4 | 1.997 | 1.005 | CT | 1.027 | 0.59 | 87.19 | | | 1980 | MR002 |
| 1525F 2.5HR,OQ AT 150-175F, 900F 1HR | | | | | | | | | | | | 88.2/ | 1.5 | | |
| 1600F 1HR, | P | 1.00 | 165 | T-L | 171.1 | 1.999 | 0.994 | CT | 1.029 | 0.74 | 93.60 | | | 1980 | MR002 |
| 1525F 2.5HR,OQ | | 1.00 | | | 171.1 | 2.010 | 1.030 | CT | 0.990 | 0.55 | 80.50 | | | 1980 | MR002 |
| AT 150-175F, 900F 1HR | | | | | | | | | | | | 87.1/ | 9.3 | | |
| 1650F 1 HR,AC, | BT | 10.00 | R.T. | L-T | 197.0 | 2.500 | 1.000 | CT | 1.400 | 0.37 | 75.80 | | | 1972 | 84277 |
| 1525F 1 HR,OQ, | | 10.00 | | | 197.0 | 2.500 | 1.000 | CT | 1.400 | 0.41 | 79.70 | | | 1972 | 84277 |
| 800F 2 HR | | 10.00 | | | 197.0 | 2.500 | 1.000 | CT | 1.400 | 0.38 | 76.50 | | | 1972 | 84277 |
| | | 10.00 | | | 211.0 | 2.500 | 1.000 | CT | 1.400 | 0.29 | 71.90 | | | 1972 | 84277 |
| | | 10.00 | | | 211.0 | 2.500 | 1.000 | CT | 1.400 | 0.30 | 73.00 | | | 1972 | 84277 |
| | | 10.00 | | | 211.0 | 2.500 | 1.000 | CT | 1.400 | 0.37 | 81.10 | 76.3/ | 3.6 | 1972 | 84277 |
| 2190F 1HR, FC | FB | 0.62 | R.T. | L-T | 195.0 | 2.000 | 0.600 | CT | 1.000 | 0.39 | 76.70 | | | 1973 | 87241 ( 1) |
| TO 1600F,HOLD | | 0.62 | | | 195.0 | 2.000 | 0.600 | CT | 1.000 | 0.39 | 76.90 | | | 1973 | 87241 ( 1) |
| 0.5HR, 400F 1 HR | | | | | | | | | | | | 76.8/ | 0.1 | | |
| 2190F 1HR, FC | FB | 0.62 | R.T. | L-T | 200.0 | 2.000 | 0.600 | CT | 1.000 | 0.24 | 61.40 | | | 1973 | 87241 ( 1) |
| TO 1600F,HOLD | | 0.62 | | | 200.0 | 2.000 | 0.600 | CT | 1.000 | 0.23 | 60.20 | | | 1973 | 87241 ( 1) |
| 0.5HR, 660F 1 HR | | | | | | | | | | | | 60.8/ | 0.8 | | |
| 2190F 1HR, FC | FB | 0.62 | R.T. | L-T | 202.0 | 2.000 | 0.600 | CT | 1.000 | 0.20 | 57.80 | | | 1973 | 87241 ( 1) |
| TO 1600F,HOLD | | 0.62 | | | 202.0 | 2.000 | 0.600 | CT | 1.000 | 0.24 | 62.30 | | | 1973 | 87241 ( 1) |
| 0.5HR, 535F 1 HR | | | | | | | | | | | | 60.1/ | 3.2 | | |
| 2190F 1HR,OQ, | FB | 0.62 | R.T. | L-T | 200.0 | 2.000 | 0.600 | CT | 1.000 | 0.42 | 82.40 | | | 1973 | 87241 ( 1) |
| 475F 1HR | | | | | | | | | | | | | | | |
| 2190F 1HR,OQ, | FB | 0.62 | R.T. | L-T | 202.0 | 2.000 | 0.600 | CT | 1.000 | 0.24 | 62.80 | | | 1973 | 87241 ( 1) |
| 535F 1HR | | | | | | | | | | | | | | | |

NOTES
( 1) COMPOSITION(WT PERCENT) 0.40C,0.80MN,0.010S,0.24SI,1.65NI,0.72CR,0.24MO,0.19CU

TABLE 6.29.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: MARTEMPERED

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R. T. LAB AIR | E= R. T. DIST. WATER | | |
| DELTA K MIN | A: | 7.13 | .209 | | | |
| | B: | 8.73 | | .280 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | .277 | | | |
| | | 9.00 | .373 | .321 | | |
| | | 10.00 | .492 | .495 | | |
| | | 13.00 | 1.00 | 1.14 | | |
| | | 16.00 | 1.75 | 1.91 | | |
| | | 20.00 | 3.12 | 3.21 | | |
| | | 25.00 | 5.33 | 5.49 | | |
| | | 30.00 | 8.04 | 8.51 | | |
| | | 35.00 | 11.2 | 12.2 | | |
| | | 40.00 | 14.7 | 16.3 | | |
| | | 50.00 | 23.0 | 25.7 | | |
| | | 60.00 | 33.3 | 37.4 | | |
| | | 70.00 | 46.2 | 53.0 | | |
| | | 80.00 | 62.7 | 74.5 | | |
| | | 90.00 | 83.9 | 105. | | |
| | | 100.00 | 111. | 148. | | |
| | | 130.00 | 258. | 428. | | |
| | | 160.00 | 603. | 1287. | | |
| DELTA K MAX | A: | 188.45 | 1360. | | | |
| | B: | 189.12 | | 3830. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 21.77 | 20.96 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: MARTEMPERED
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 191.0- 201.5 KSI
ULT. STRENGTH: 196.0- 209.0 KSI
SPECIMEN THK: 0.246- 0.251"
SPECIMEN WIDTH:
REFERENCES: MA012

ALLOY STEEL

4340

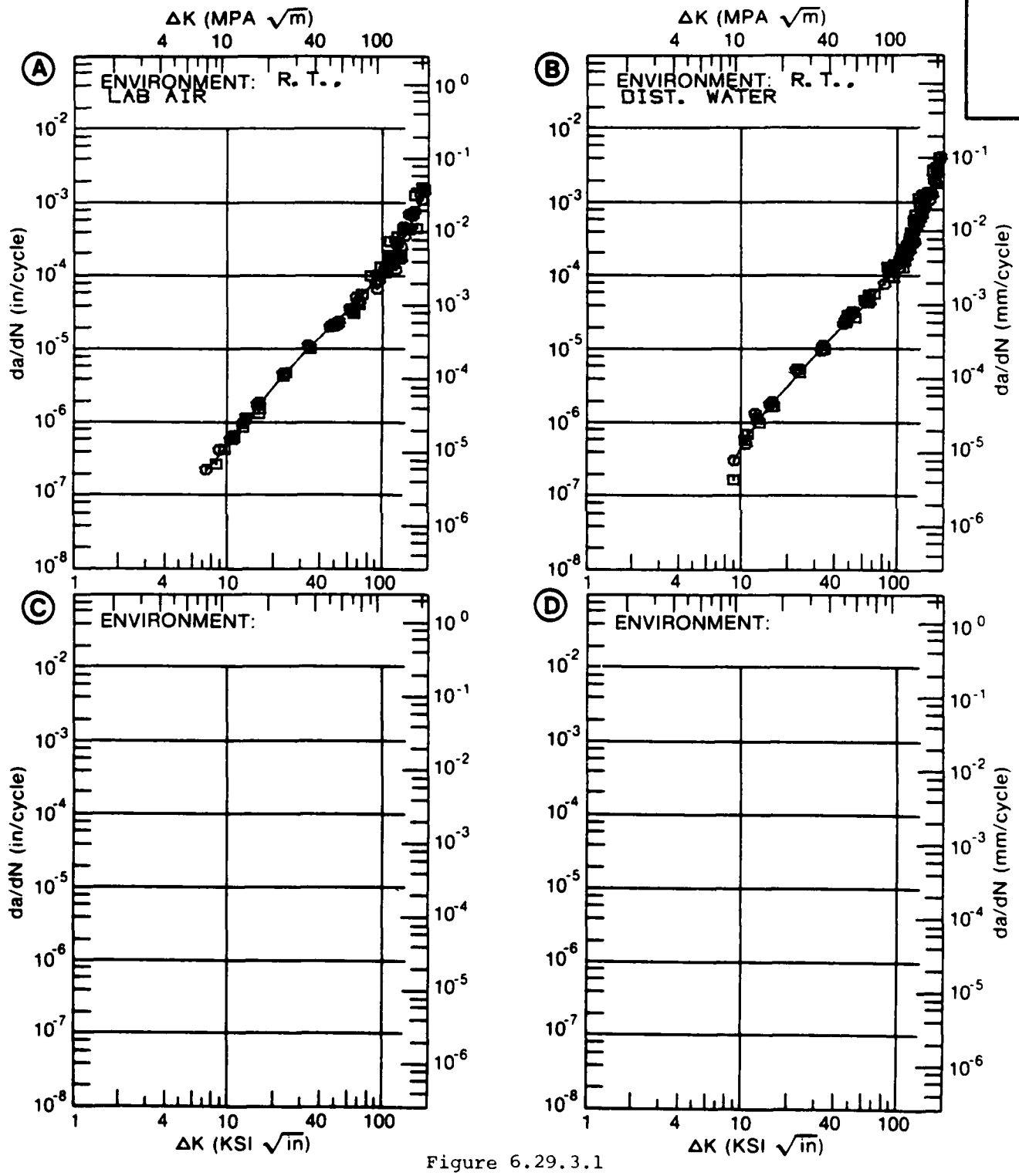



Figure 6.29.3.1

TABLE 6.29.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 160 KSI
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.50 | | | |
| DELTA K MIN | A: | 3.99 | .0454 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 4.00 | .0460 | | | |
| | | 5.00 | .0930 | | | |
| DELTA K MAX | A: | 5.53 | .123 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 3.21

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: UTS = 160 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 158.5 KSI
ULT. STRENGTH: 168.1 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY STEEL

4340

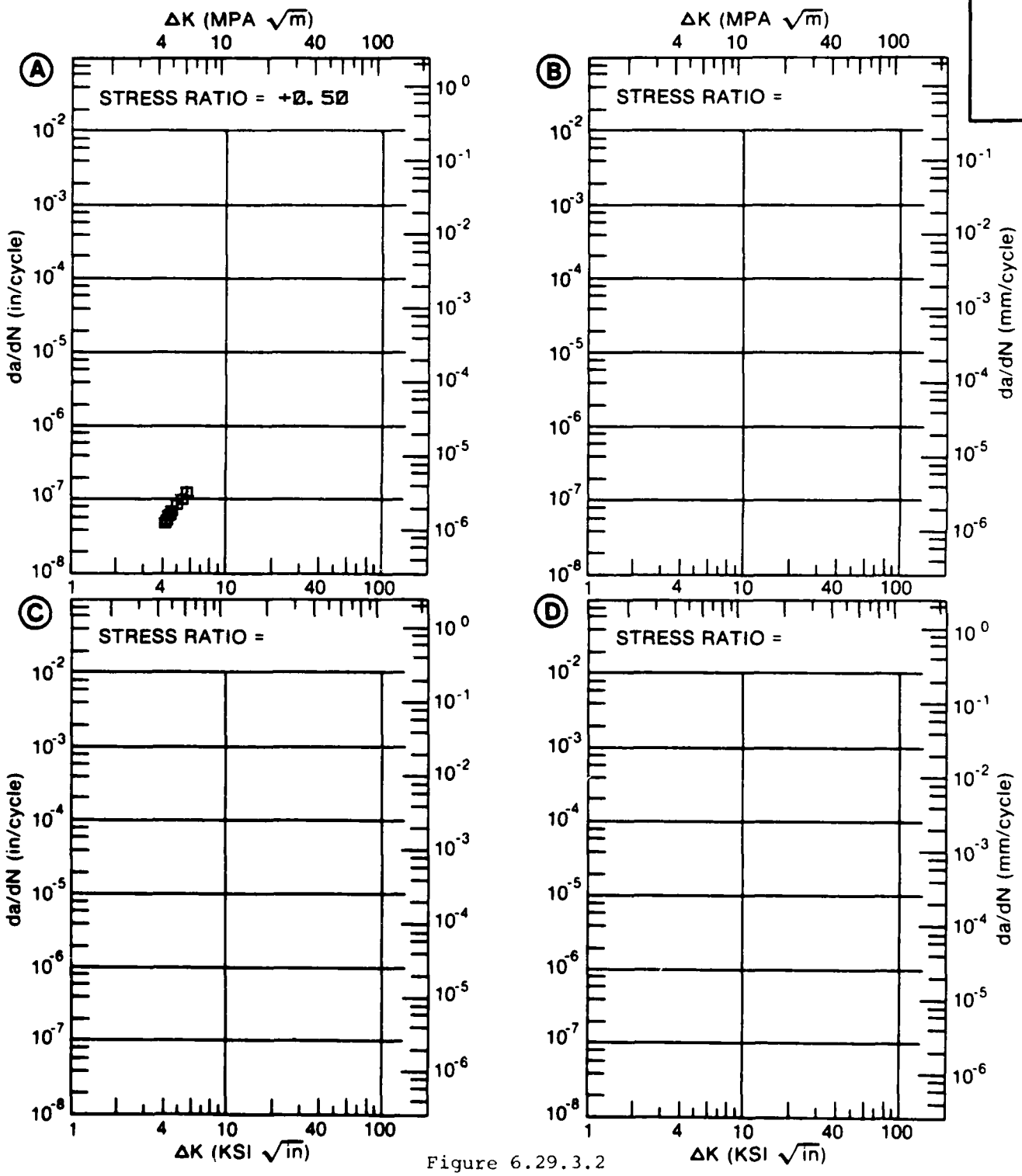



Figure 6.29.3.2

TABLE 6.29.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 160 KSI
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN A: | 12.63 | .780 | | | |
| DELTA K MIN B: | 6.83 | | .229 | | |
| DELTA K MIN C: | | | | | |
| DELTA K MIN D: | | | | | |
| | 7.00 | | .244 | | |
| | 8.00 | | .344 | | |
| | 9.00 | | .466 | | |
| | 10.00 | | .611 | | |
| | 13.00 | .847 | 1.20 | | |
| | 16.00 | 1.44 | 2.05 | | |
| | 20.00 | 2.47 | 3.60 | | |
| | 25.00 | 4.72 | 6.27 | | |
| | 30.00 | | 9.78 | | |
| | 35.00 | | 14.1 | | |
| | 40.00 | | 19.3 | | |
| DELTA K MAX A: | 26.50 | 5.79 | | | |
| DELTA K MAX B: | 47.14 | | 27.9 | | |
| DELTA K MAX C: | | | | | |
| DELTA K MAX D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 5.24 | 6.09 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | | | | |
| | 0.5-0.8 | | | | |
| | 0.8-1.25 | 1 | 1 | | |
| | 1.25-2.0 | | | | |
| | >2.0 | | | | |

CONDITION/HT: UTS = 160 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 158.5 KSI
ULT. STRENGTH: 168.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY STEEL

4340

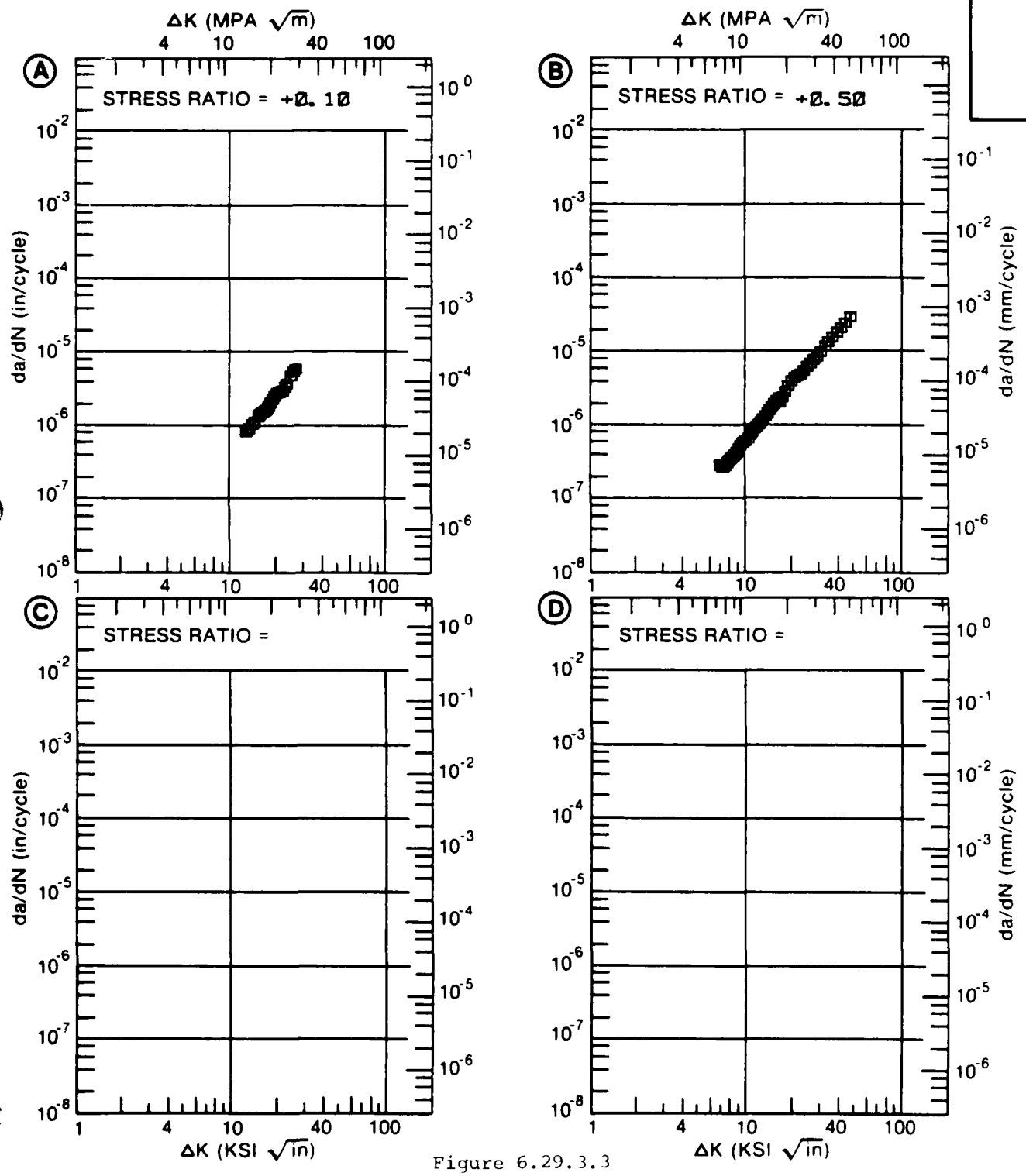



Figure 6.29.3.3

TABLE 6.29.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|
| | | R=+0.10 | | | |
| DELTA K MIN A: | 5.69 | .0439 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |
| | 6.00 | .0586 | | | |
| | 7.00 | .125 | | | |
| | 8.00 | .223 | | | |
| | 9.00 | .351 | | | |
| | 10.00 | .507 | | | |
| | 13.00 | 1.10 | | | |
| | 16.00 | 1.83 | | | |
| | 20.00 | 2.96 | | | |
| | 25.00 | 4.64 | | | |
| | 30.00 | 6.72 | | | |
| | 35.00 | 9.36 | | | |
| | 40.00 | 12.8 | | | |
| | 50.00 | 23.2 | | | |
| | 60.00 | 41.4 | | | |
| DELTA K MAX A: | 64.66 | 54.0 | | | |
| B: | | | | | |
| C: | | | | | |
| D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 37.57

| | | |
|---|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 | 1 |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 20.00- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.251- 0.501"
SPECIMEN WIDTH: 1.975- 1.978"
REFERENCES: DA001

ALLOY STEEL

4340

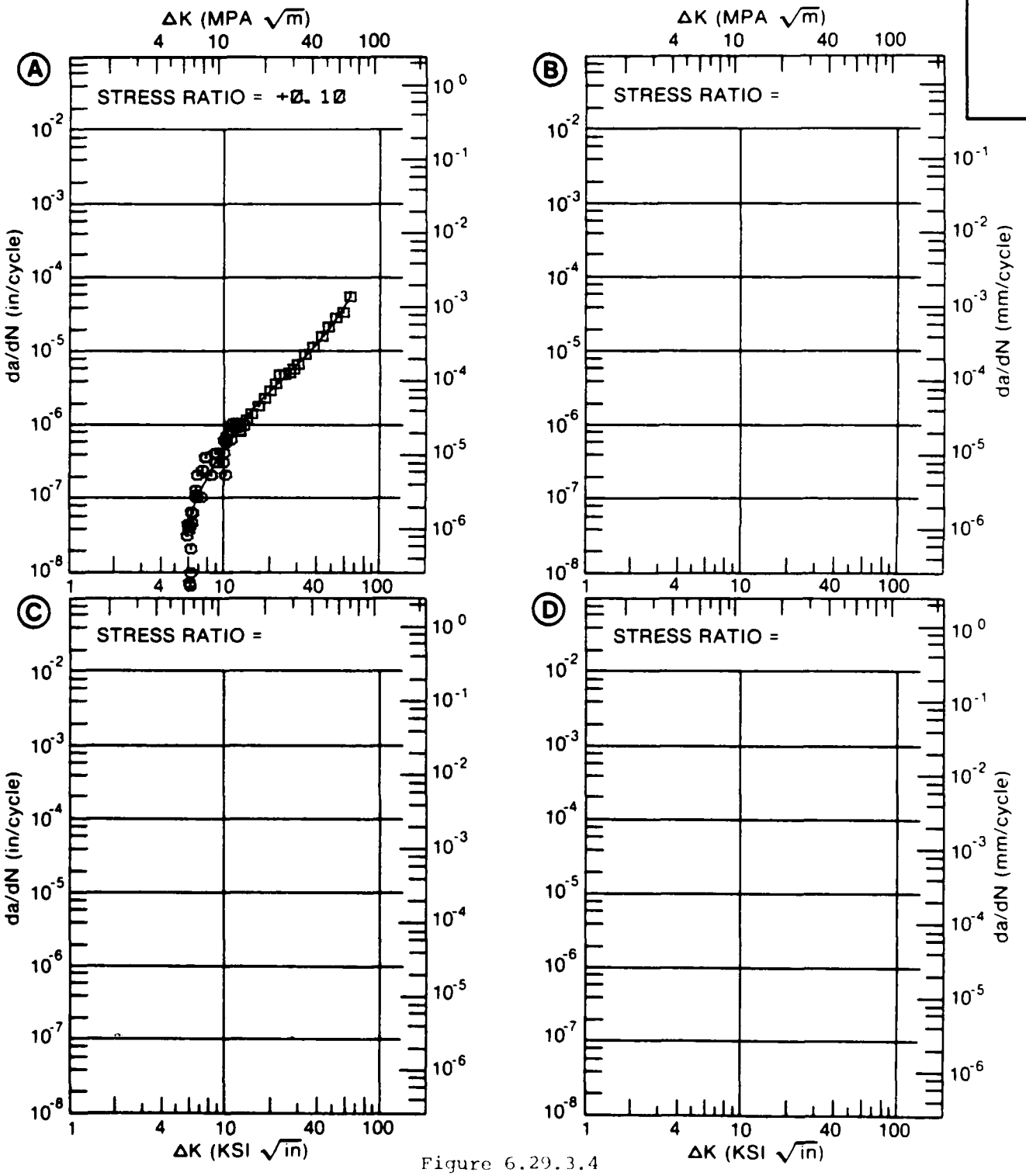



Figure 6.29.3.4

TABLE 6.29.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: R.T. ,LAB AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.50 | | | |
| DELTA K MIN | A: | 6.47 | .198 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 7.00 | .247 | | | |
| | | 8.00 | .356 | | | |
| | | 9.00 | .486 | | | |
| | | 10.00 | .637 | | | |
| | | 13.00 | 1.20 | | | |
| | | 16.00 | 1.92 | | | |
| DELTA K MAX | A: | 17.26 | 2.26 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 5.19

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 1.970"
REFERENCES: DA001

ALLOY STEEL

4340

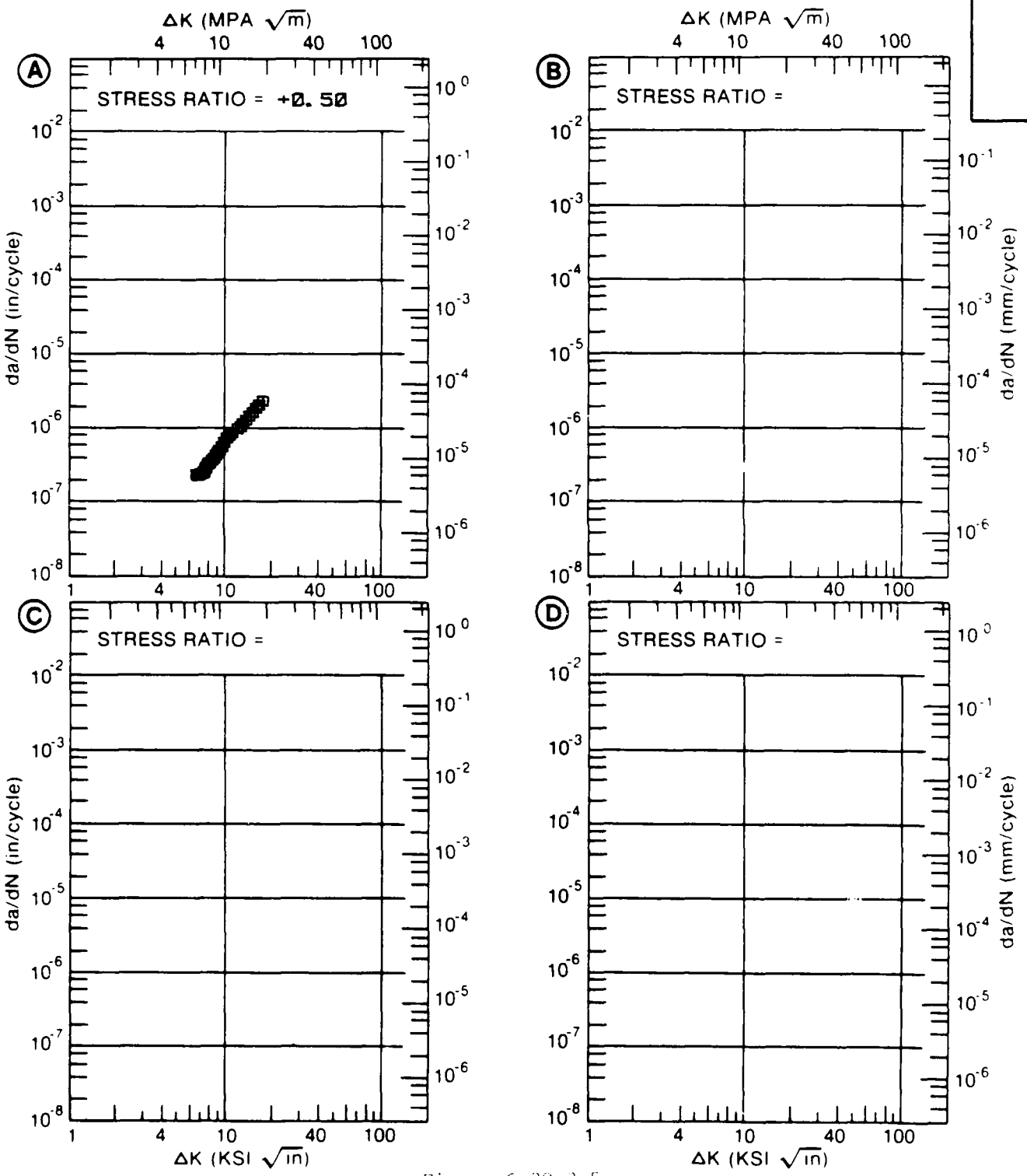



Figure 6.29.3.5

TABLE 6.29.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.6 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: + 650F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | R=+0.50 | | |
| DELTA K MIN | A: | 10.52 | .249 | | | |
| | B: | 7.52 | | .511 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 8.00 | | .675 | | |
| | | 9.00 | | .813 | | |
| | | 10.00 | | 1.04 | | |
| | | 13.00 | .997 | | | |
| | | 16.00 | 1.95 | | | |
| DELTA K MAX | A: | 18.00 | 2.92 | | | |
| | B: | 10.96 | | 2.00 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 15.53 | 11.46 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | 2 | | | |
| | | 0.8-1.25 | | 2 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 20.00 HZ
ENVIRONMENT: + 650° F, AIR

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY STEEL

4340

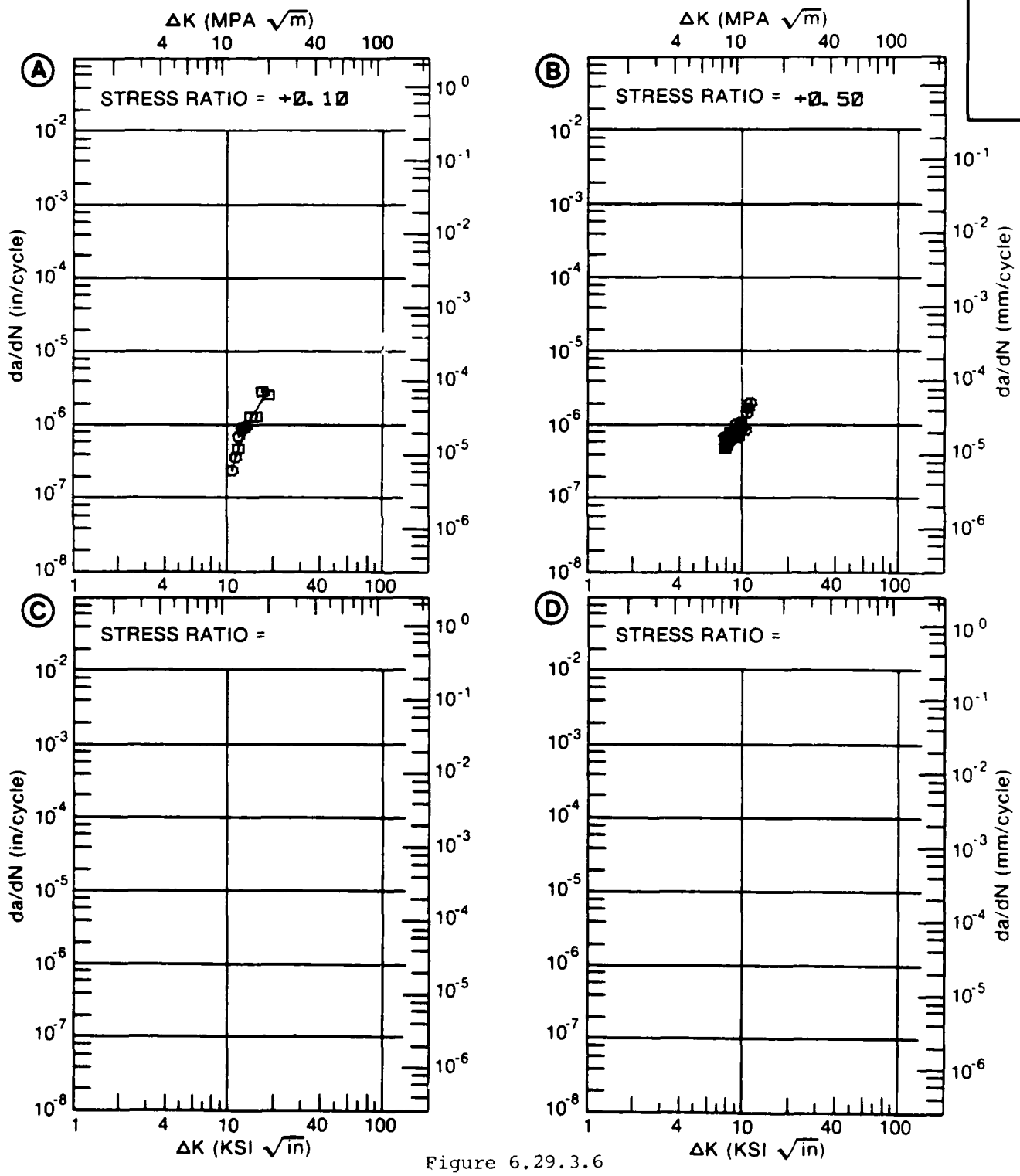



Figure 6.29.3.6

TABLE 6.29.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: + 650F, AIR

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.10 | | | |
| DELTA K MIN | A: | 17.58 | 1.91 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 2.78 | | | |
| | | 25.00 | 5.16 | | | |
| | | 30.00 | 8.47 | | | |
| | | 35.00 | 13.0 | | | |
| | | 40.00 | 19.3 | | | |
| | | 50.00 | 39.7 | | | |
| | | 60.00 | 78.0 | | | |
| | | 70.00 | 149. | | | |
| DELTA K MAX | A: | 73.82 | 190. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 11.96

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | |
|---|---|---|
| | 0.0-0.5 | |
| | 0.5-0.8 | |
| | 0.8-1.25 | 1 |
| | 1.25-2.0 | |
| | >2.0 | |

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: + 650° F, AIR

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY STEEL

4340

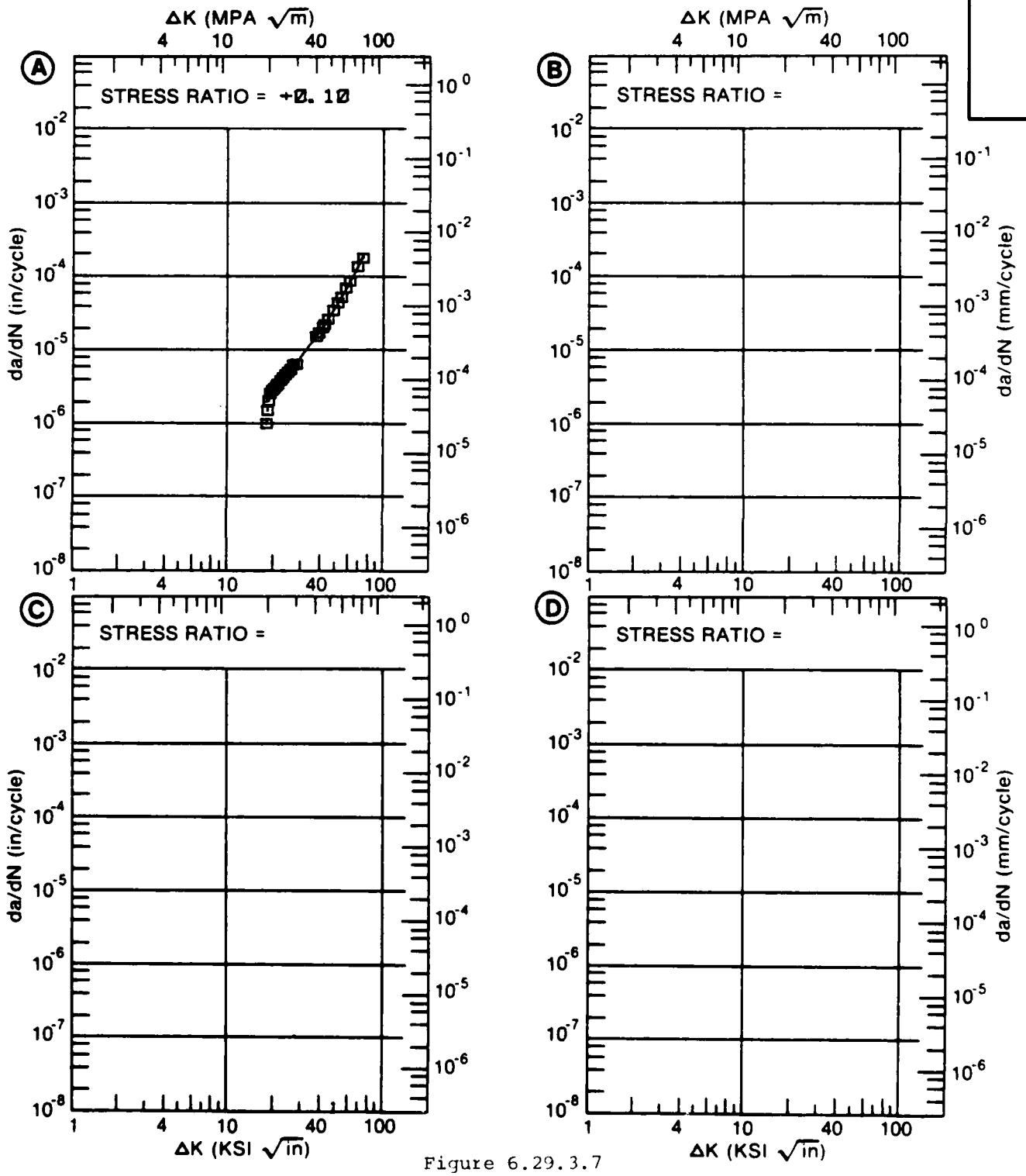



Figure 6.29.3.7

TABLE 6.29.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 180 KSI

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. LAB AIR | E=+ 650F AIR | | |
| DELTA K MIN | A: | 4.08 | .0528 | | | |
| | B: | 5.72 | | .282 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 5.00 | .0924 | | | |
| | | 6.00 | .178 | .317 | | |
| | | 7.00 | | .454 | | |
| | | 8.00 | | .606 | | |
| | | 9.00 | | .773 | | |
| | | 10.00 | | .960 | | |
| | | 13.00 | | 1.68 | | |
| | | 16.00 | | 2.78 | | |
| | | 20.00 | | 5.28 | | |
| DELTA K MAX | A: | 6.20 | .224 | | | |
| | B: | 22.85 | | 8.29 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.27 | 4.65 | | |
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | | 0.0-0.5 | | | | |
| | | 0.5-0.8 | | | | |
| | | 0.8-1.25 | 1 | 1 | | |
| | | 1.25-2.0 | | | | |
| | | >2.0 | | | | |

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
FREQUENCY: 7.00 HZ

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.250- 0.375"
SPECIMEN WIDTH: 1.500- 2.000"
REFERENCES: DA001

ALLOY STEEL

4340

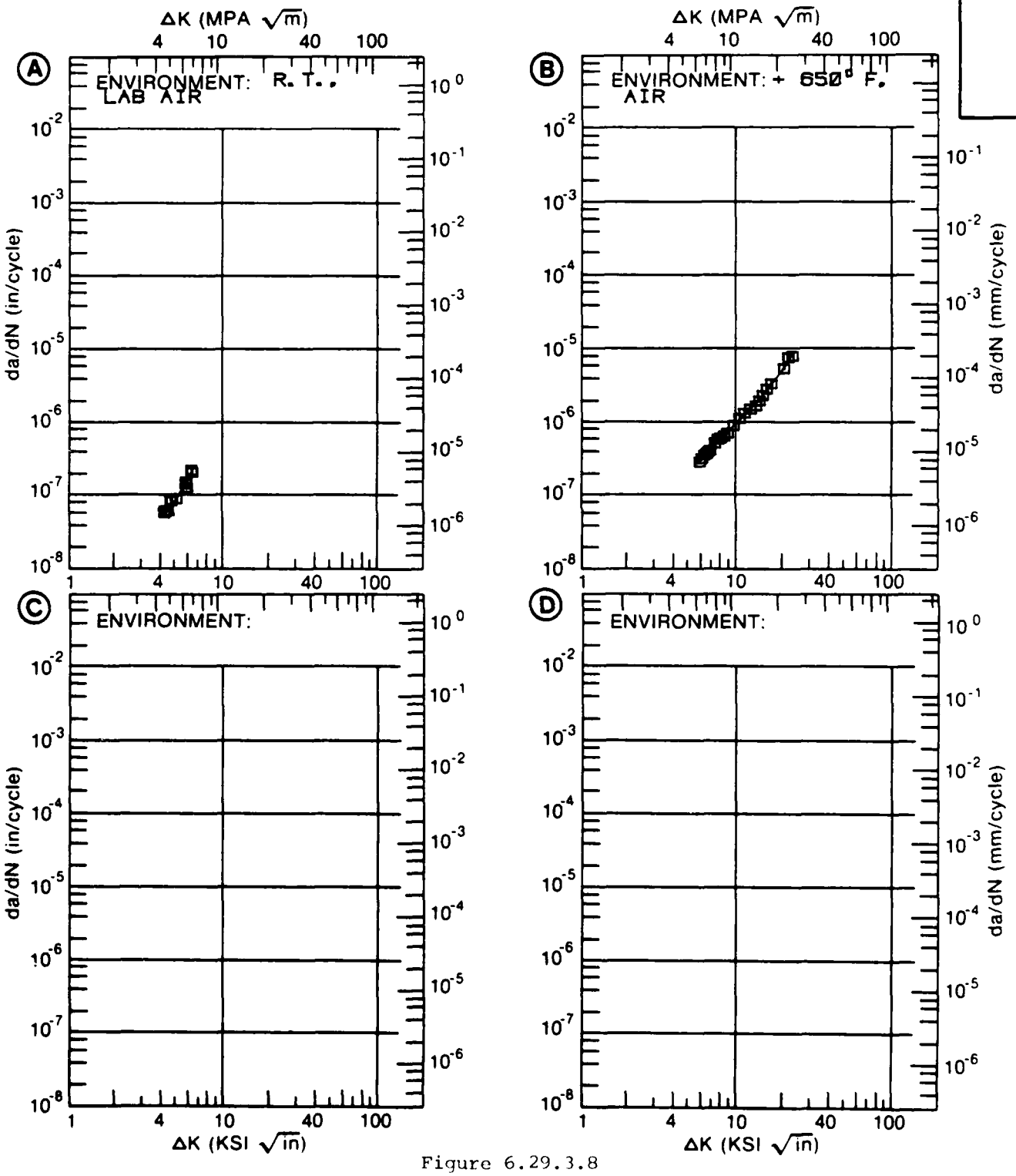



Figure 6.29.3.8

TABLE 6.29.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.9 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS=180-200KSI
ENVIRONMENT: R. T. , H. H. A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.00 | R=+0.50 | | |
| DELTA K MIN | A: | 18.90 | 2.60 | | | |
| | B: | 22.90 | | 4.62 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 2.68 | | | |
| | | 25.00 | 3.87 | 5.83 | | |
| | | 30.00 | 6.12 | 9.11 | | |
| | | 35.00 | 8.98 | 13.4 | | |
| | | 40.00 | 11.6 | 19.7 | | |
| | | 50.00 | | 45.1 | | |
| | | 60.00 | | 115. | | |
| DELTA K MAX | A: | 44.30 | 12.8 | | | |
| | B: | 66.10 | | 214. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 9.44 | 11.17 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: UTS=180-200KSI
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., H.H.A.

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.163"
SPECIMEN WIDTH: 5.000"
REFERENCES:BW002

ALLOY STEEL

4340

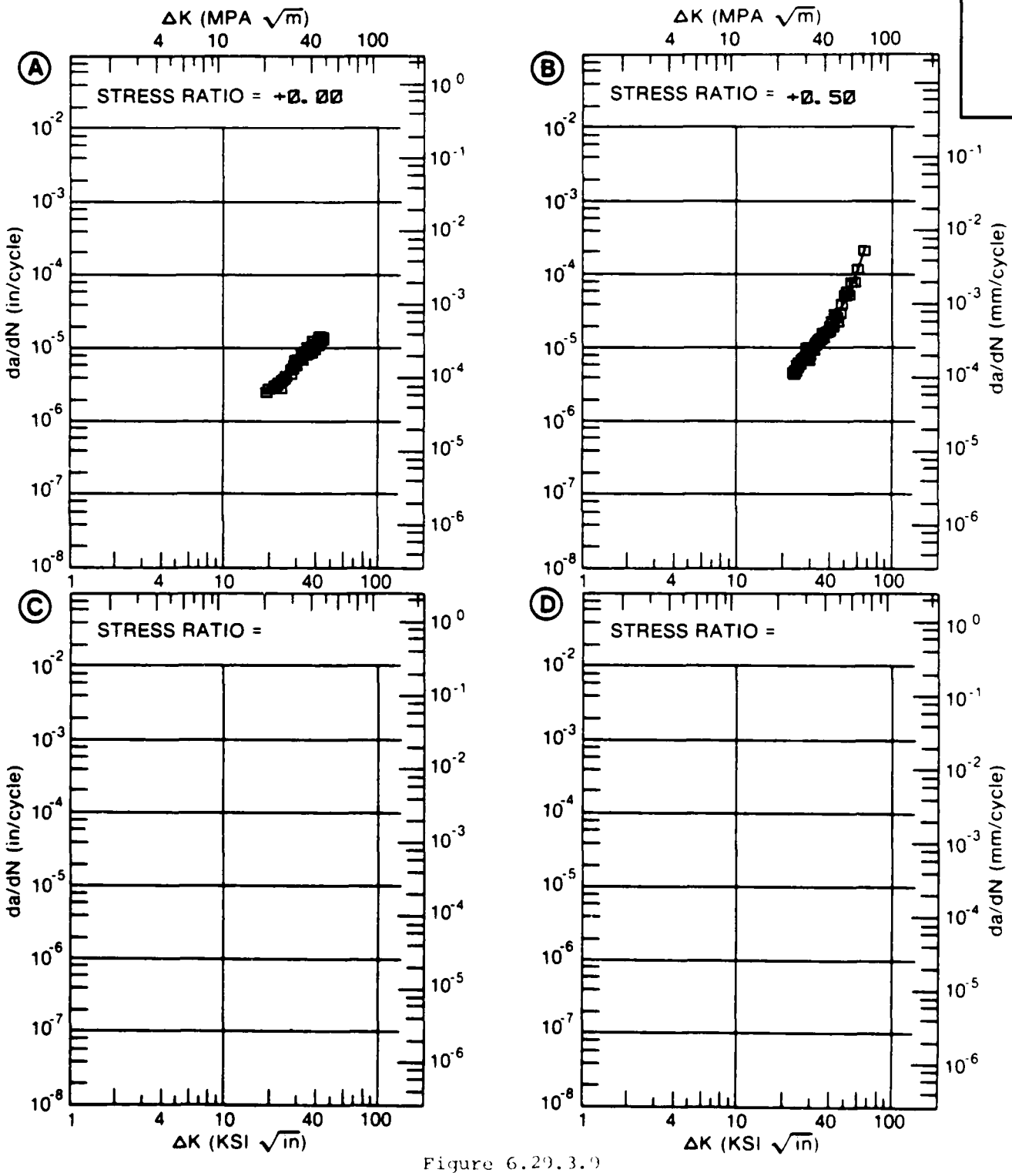



Figure 6.29.3.9

TABLE 6.29.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.10 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: TUS=180-200KSI
ENVIRONMENT: R. T. , H. H. A.

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R=+0.05 | R=+0.50 | | |
| DELTA K MIN | A: | 17.32 | 1.97 | | | |
| | B: | 9.47 | | .647 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 10.00 | | .714 | | |
| | | 13.00 | | 1.29 | | |
| | | 16.00 | | 2.21 | | |
| | | 20.00 | 2.94 | 3.78 | | |
| | | 25.00 | 5.01 | | | |
| | | 30.00 | 7.27 | | | |
| | | 35.00 | 9.66 | | | |
| | | 40.00 | 12.2 | | | |
| | | 50.00 | 17.8 | | | |
| | | 60.00 | 24.4 | | | |
| | | 70.00 | 32.5 | | | |
| | | 80.00 | 42.7 | | | |
| | | 90.00 | 55.5 | | | |
| DELTA K MAX | A: | 93.91 | 61.5 | | | |
| | B: | 24.31 | | 5.43 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 11.52 | 8.24 | | |

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: TUS=180-200KSI
FORM: 1.00"TH BAR
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 3.00 HZ
ENVIRONMENT: R.T., H.H.A.

YIELD STRENGTH: 182.5 KSI
ULT. STRENGTH: 193.7 KSI
SPECIMEN THK: 0.400"
SPECIMEN WIDTH: 4.000"
REFERENCES:BW001

ALLOY STEEL

4340

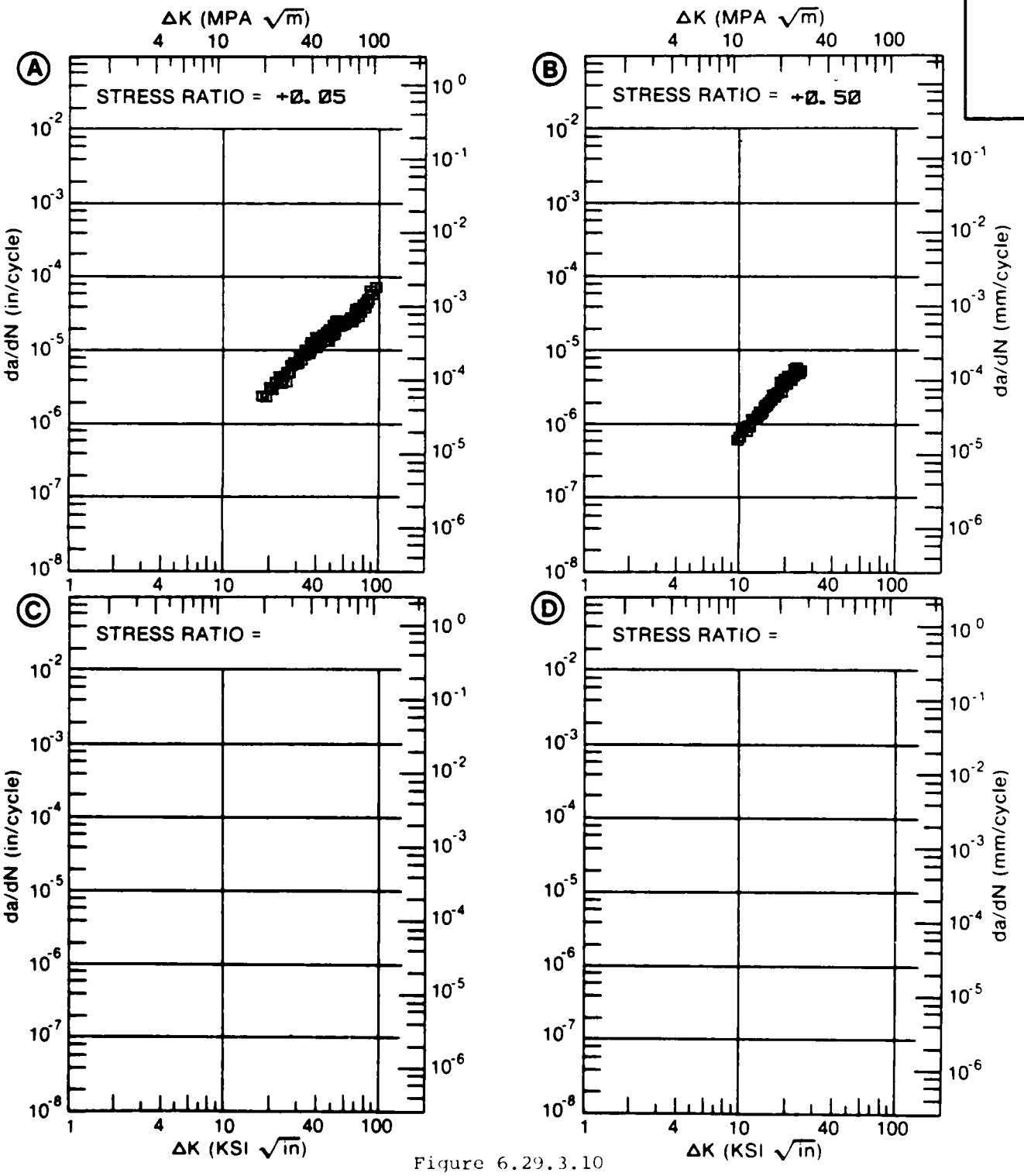



Figure 6.29.3.10

TABLE 6.29.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: 450F TEMPER

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= R.T. DIST. WATER | E= R.T. ARGON | | |
| DELTA K MIN | A: | 10.39 | 174. | | | |
| | B: | 14.27 | | 1.03 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 216. | | | |
| | | 16.00 | 247. | 1.74 | | |
| | | 20.00 | 274. | 3.21 | | |
| | | 25.00 | 298. | 4.48 | | |
| | | 30.00 | 320. | 5.93 | | |
| | | 35.00 | 344. | 8.66 | | |
| | | 40.00 | 372. | 14.6 | | |
| | | 50.00 | 443. | | | |
| | | 60.00 | 542. | | | |
| DELTA K MAX | A: | 60.89 | 553. | | | |
| | B: | 47.16 | | 30.9 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 2.83 | 10.57 | | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT: 450F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
FREQUENCY: 0.40 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY STEEL

4340

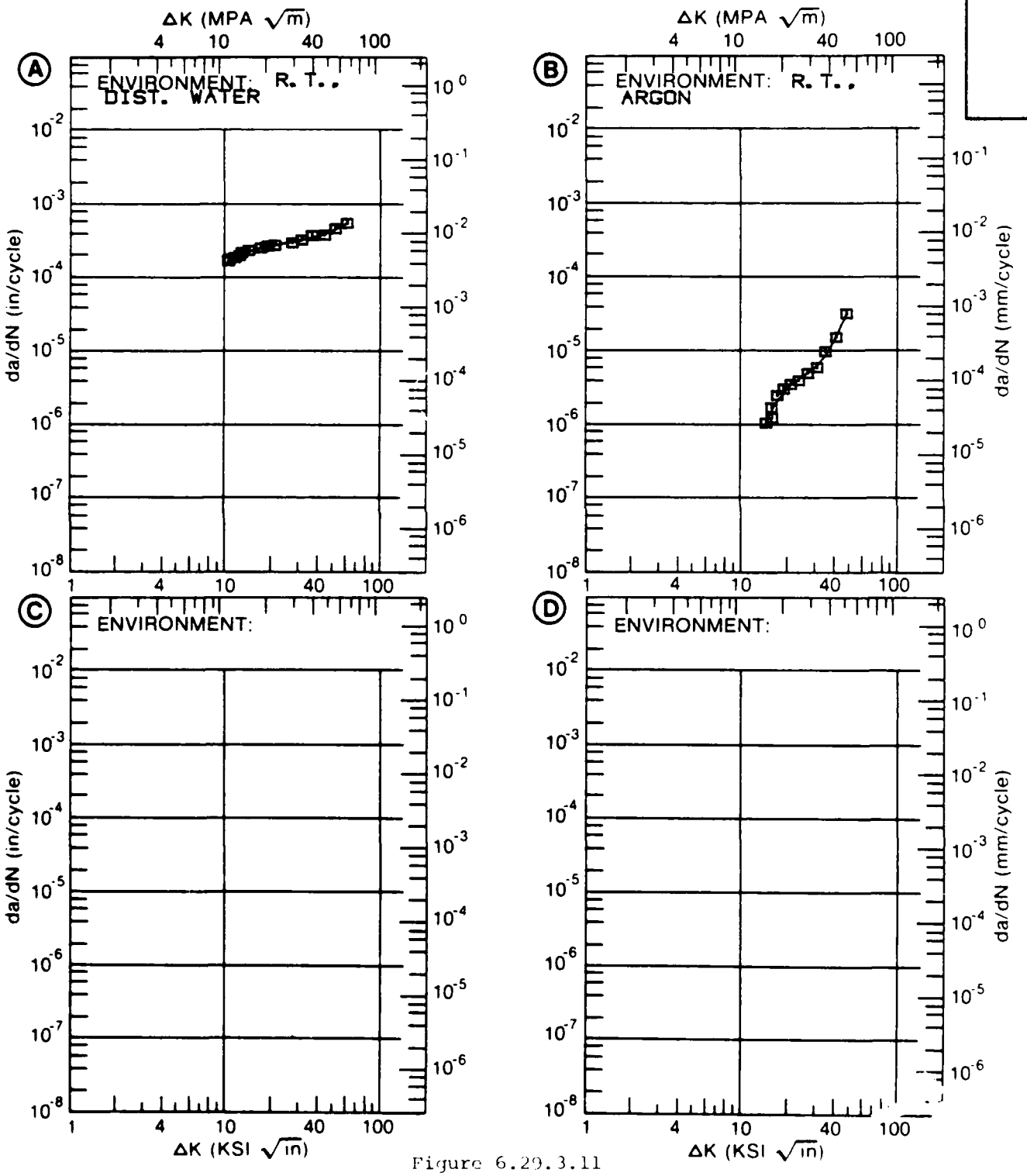



Figure 6.29.3.11

TABLE 6.29.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.12 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: 750F TEMPER
ENVIRONMENT: R.T. , ARGON

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | R= | | | |
| DELTA K MIN | A: | 15.20 | 1.14 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 1.40 | | | |
| | | 20.00 | 2.92 | | | |
| | | 25.00 | 5.08 | | | |
| | | 30.00 | 7.35 | | | |
| | | 35.00 | 9.82 | | | |
| | | 40.00 | 12.7 | | | |
| | | 50.00 | 20.8 | | | |
| | | 60.00 | 34.4 | | | |
| DELTA K MAX | A: | 63.54 | 41.5 | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 10.54

| | |
|---|---|
| LIFE PREDICTION RATIO SUMMARY (NP/NA) | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
FREQUENCY: 0.40 HZ
ENVIRONMENT: R.T., ARGON

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY STEEL

4340

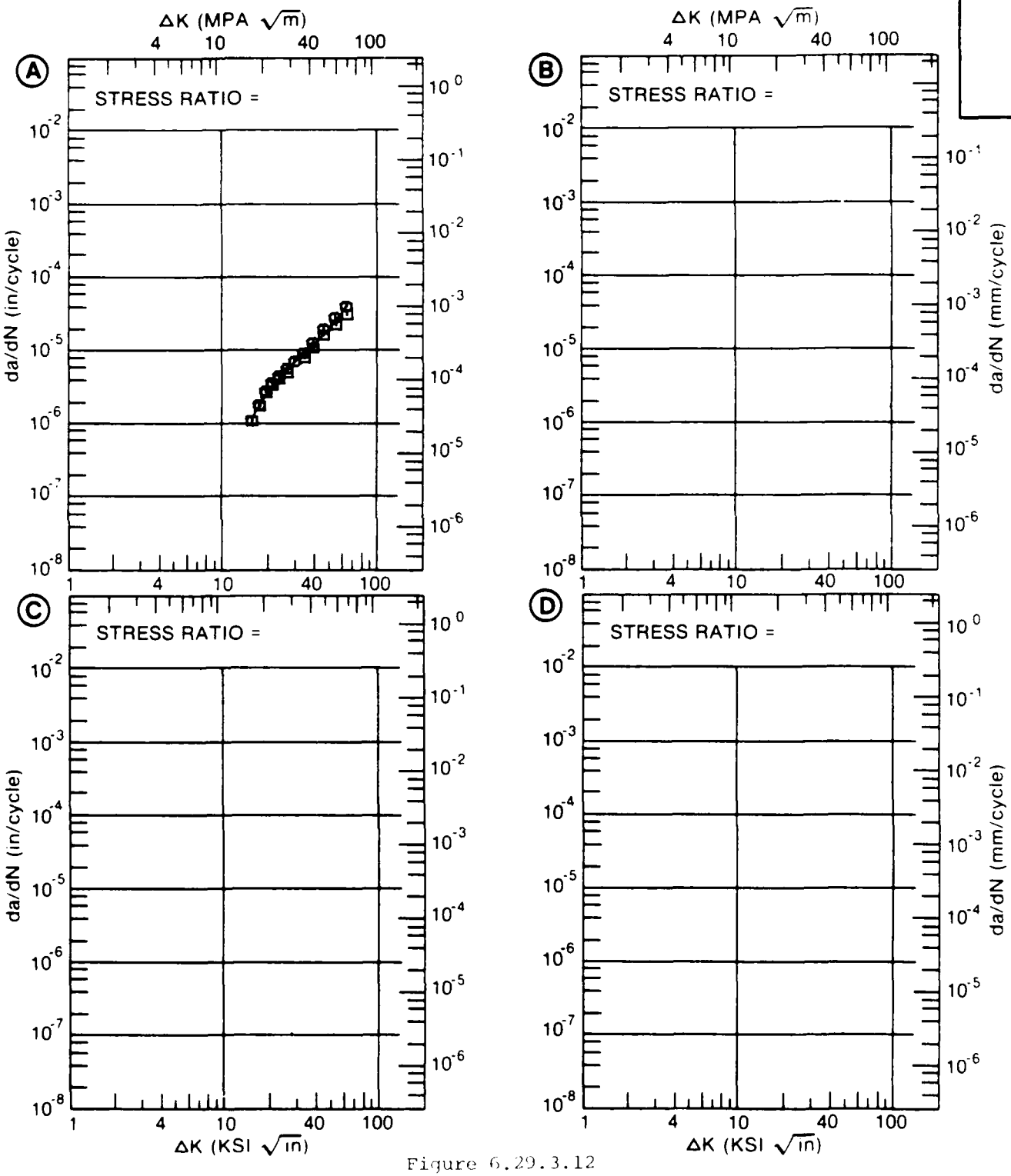



Figure 6.29.3.12

TABLE 6.29.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.13 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL 4340
CONDITION: 750F TEMPER
ENVIRONMENT: + 32F, DIST. WATER

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.04 | F(HZ)= 0.40 | | |
| DELTA K MIN | A: | 15.03 | 37.3 | | | |
| | B: | 15.64 | | 17.7 | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 16.00 | 61.0 | 19.5 | | |
| | | 20.00 | 217. | 38.8 | | |
| | | 25.00 | 426. | 54.4 | | |
| | | 30.00 | 546. | 61.7 | | |
| | | 35.00 | 596. | 66.1 | | |
| | | 40.00 | 623. | 71.1 | | |
| | | 50.00 | 708. | 90.8 | | |
| DELTA K MAX | A: | 52.38 | 745. | | | |
| | B: | 52.38 | | 98.6 | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 18.78 | 6.08 | | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
ENVIRONMENT: + 32° F, DIST. WATER

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY STEEL

4340

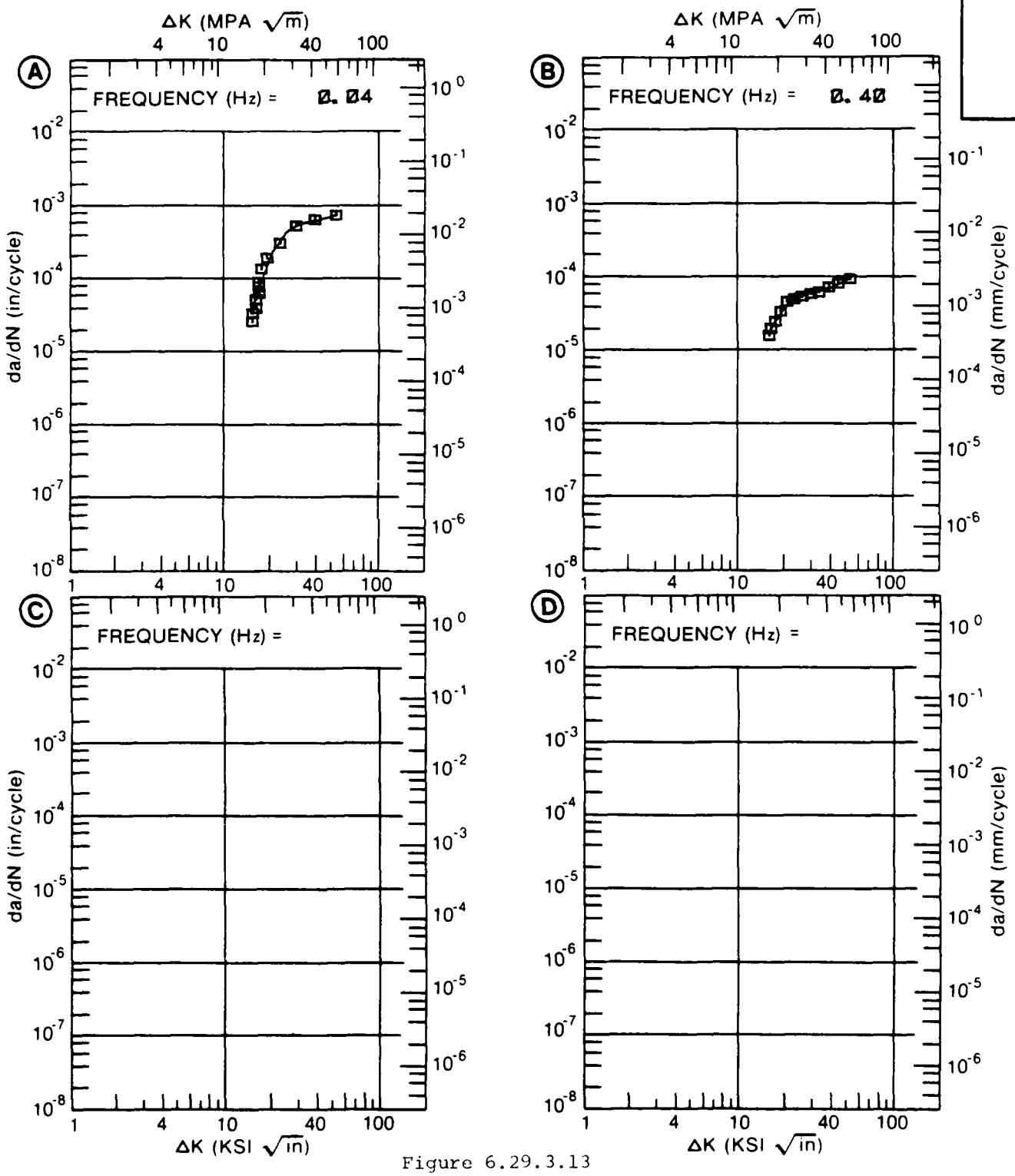



Figure 6.29.3.13

TABLE 6.29.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.14 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL 4340
CONDITION: 750F TEMPER
ENVIRONMENT: R.T. , DIST. WATER

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.04 | F(HZ)= 0.20 | F(HZ)= 0.40 | |
| DELTA K MIN | A: | 12.35 | 374. | | | |
| | B: | 12.41 | | 89.0 | | |
| | C: | 12.64 | | | 55.2 | |
| | D: | | | | | |
| | | 13.00 | 383. | 90.6 | 55.5 | |
| | | 16.00 | 416. | 97.8 | 58.8 | |
| | | 20.00 | 452. | 106. | 65.0 | |
| | | 25.00 | 489. | 116. | 74.8 | |
| | | 30.00 | 522. | 126. | 86.1 | |
| | | 35.00 | 555. | 136. | 98.7 | |
| | | 40.00 | 587. | 147. | 113. | |
| | | 50.00 | | 172. | 144. | |
| | | 60.00 | | 201. | | |
| DELTA K MAX | A: | 47.13 | 633. | | | |
| | B: | 64.55 | | 216. | | |
| | C: | 52.32 | | | 151. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 1.76 | 2.33 | 1.41 | |

| LIFE PREDICTION RATIO SUMMARY (NP/NA) | |
|---|---|
| | 0.0-0.5 |
| | 0.5-0.8 |
| | 0.8-1.25 |
| | 1.25-2.0 |
| | >2.0 |

CONDITION/HT: 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
ENVIRONMENT: R. T., DIST. WATER

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY STEEL

4340

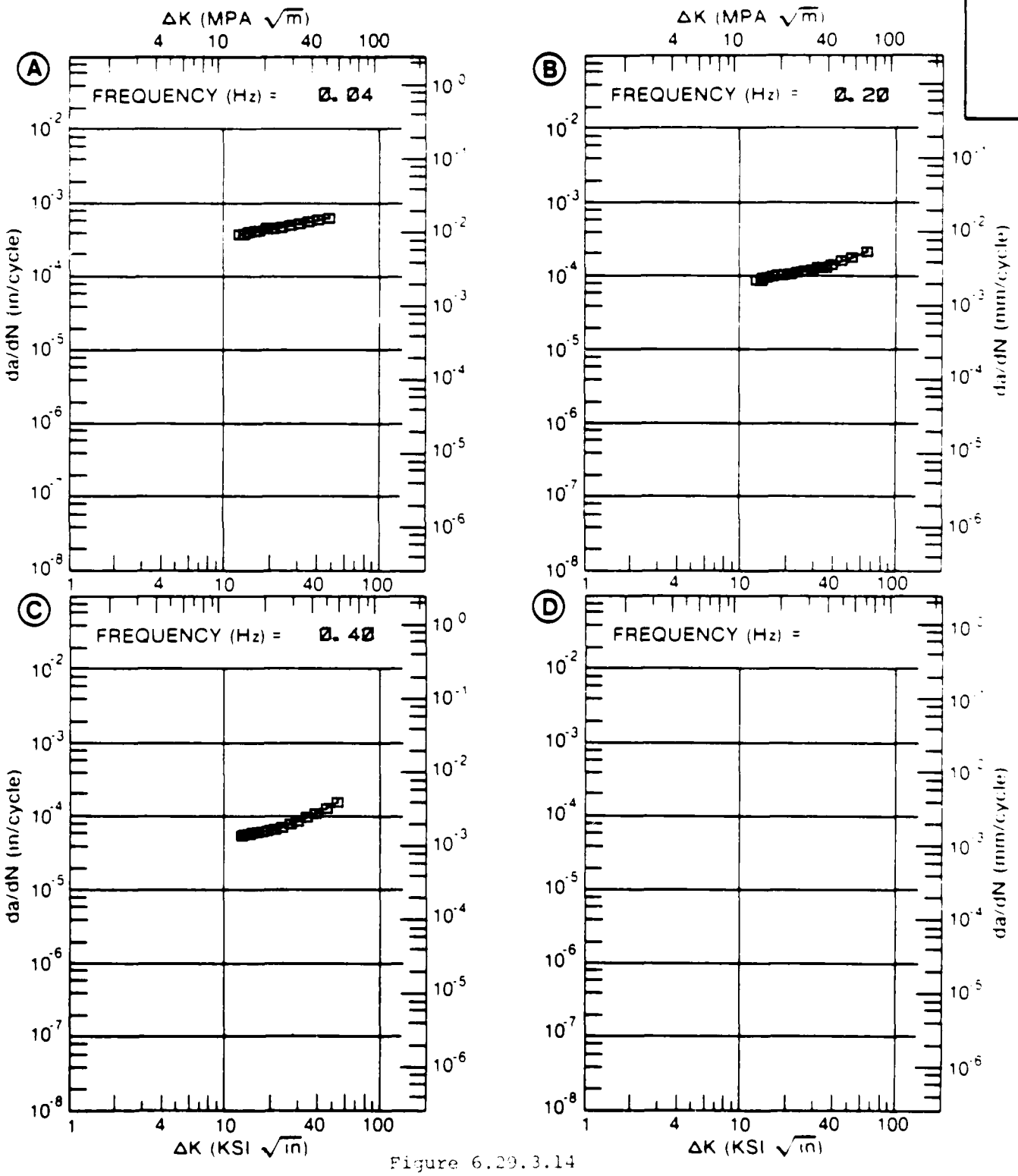



Figure 6.20.3.14

TABLE 6.29.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.15 INDICATING EFFECT
OF FREQUENCY

MATERIAL: ALLOY STEEL 4340
CONDITION: 750F TEMPER
ENVIRONMENT: + 212F, DIST. WATER

| DELTA K (KSI*IN**1/2) | | | DA/DN (10**-6 IN./CYCLE) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | F(HZ)= 0.04 | F(HZ)= 0.40 | | |
| DELTA K MIN | A: | 10.86 | 1604. | | | |
| | B: | 10.49 | | 323. | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | 2025. | 337. | | |
| | | 16.00 | 2608. | 499. | | |
| | | 20.00 | 4019. | 935. | | |
| | | 25.00 | | 1812. | | |
| DELTA K MAX | A: | 20.01 | 4025. | | | |
| | B: | 27.12 | | 2241. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 4.95 | 13.38 | | |

| | |
|---|---|
| LIFE | 0.0-0.5 |
| PREDICTION | 0.5-0.8 |
| RATIO | 0.8-1.25 |
| SUMMARY | 1.25-2.0 |
| (NP/NA) | >2.0 |

CONDITION/HT: 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
ENVIRONMENT: + 212° F, DIST. WATER

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY STEEL

4340

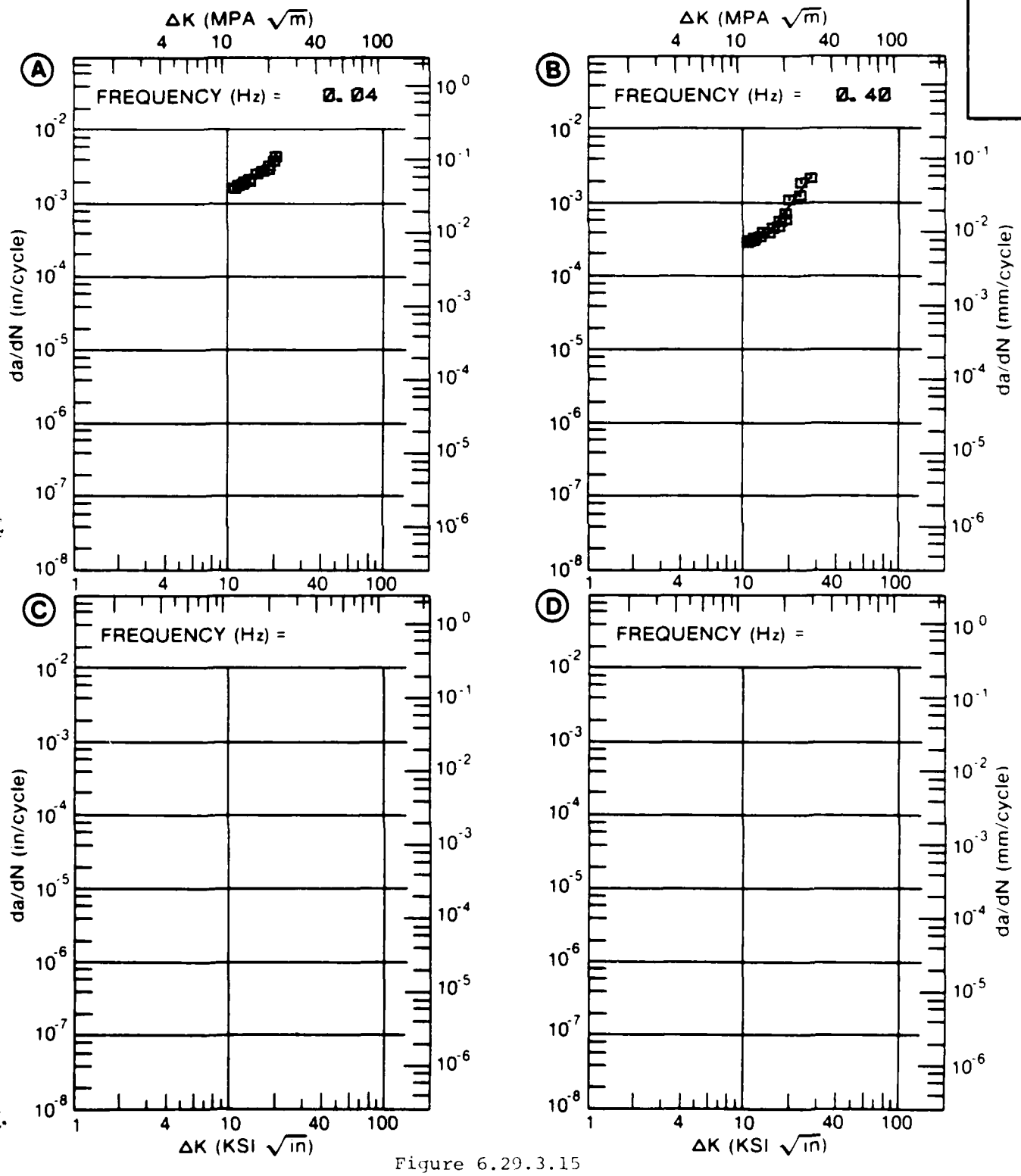



Figure 6.29.3.15

TABLE 6.29.3.16

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION:

| K MAX (KSI*IN**1/2) | | DA/DT (10**-3 IN/HOUR) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | E= HYDROGEN | | | |
| K MAX MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| | 200.00 | | | | |
| K MAX MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |

ROOT MEAN SQUARE PERCENT ERROR 0.00

CONDITION/HT:
FORM:
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK:
SPECIMEN WIDTH:
CRACK LENGTH ($A_o$):
$K_{ISCC}$:
REFERENCES: 84310

ALLOY STEEL

4340

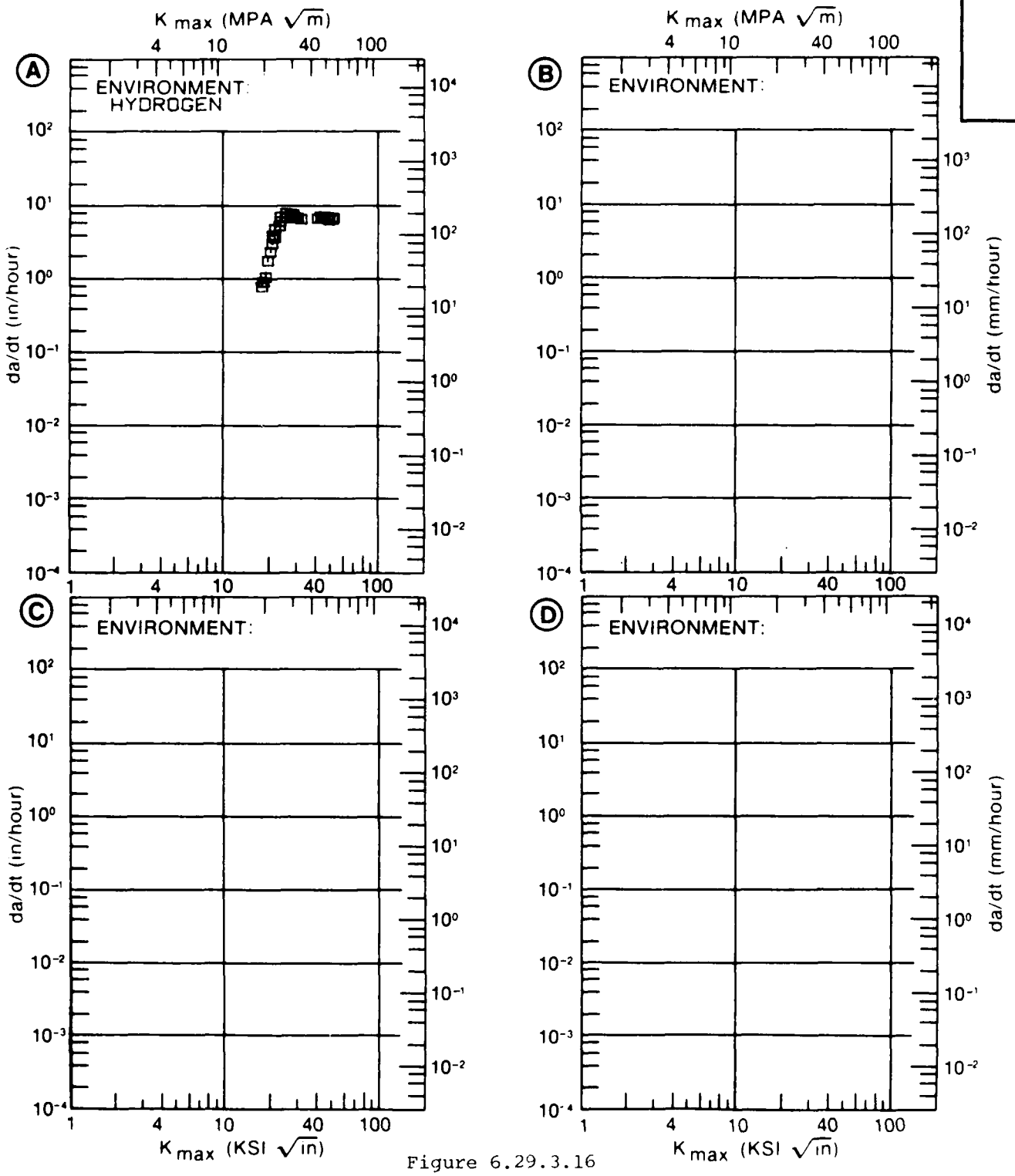



Figure 6.29.3.16

TABLE 6.29.3.17

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION:

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= 3.5% NACL, BUFFERED | E= 3.5% NACL | | |
| K MAX MIN | A: | 20.80 | 441. | | | |
| | B: | 11.00 | | 107. | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 13.00 | | 342. | | |
| | | 16.00 | | 690. | | |
| | | 20.00 | | 832. | | |
| | | 25.00 | 722. | 829. | | |
| | | 30.00 | 764. | 952. | | |
| | | 35.00 | 1105. | 1410. | | |
| | | 40.00 | 2989. | 2717. | | |
| K MAX MAX | A: | 41.50 | 4613. | | | |
| | B: | 42.00 | | 3782. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 18.79 | 43.66 | | |

CONDITION/HT:
FORM: 12.0"TH FORGING
SPECIMEN TYPE: SENT
ORIENTATION:
YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.502"
SPECIMEN WIDTH: 3.000"
CRACK LENGTH ($A_0$):
$K_{ISCC}$: 10.00 KSI (SQRT IN)
REFERENCES: 81814

ALLOY STEEL

4340

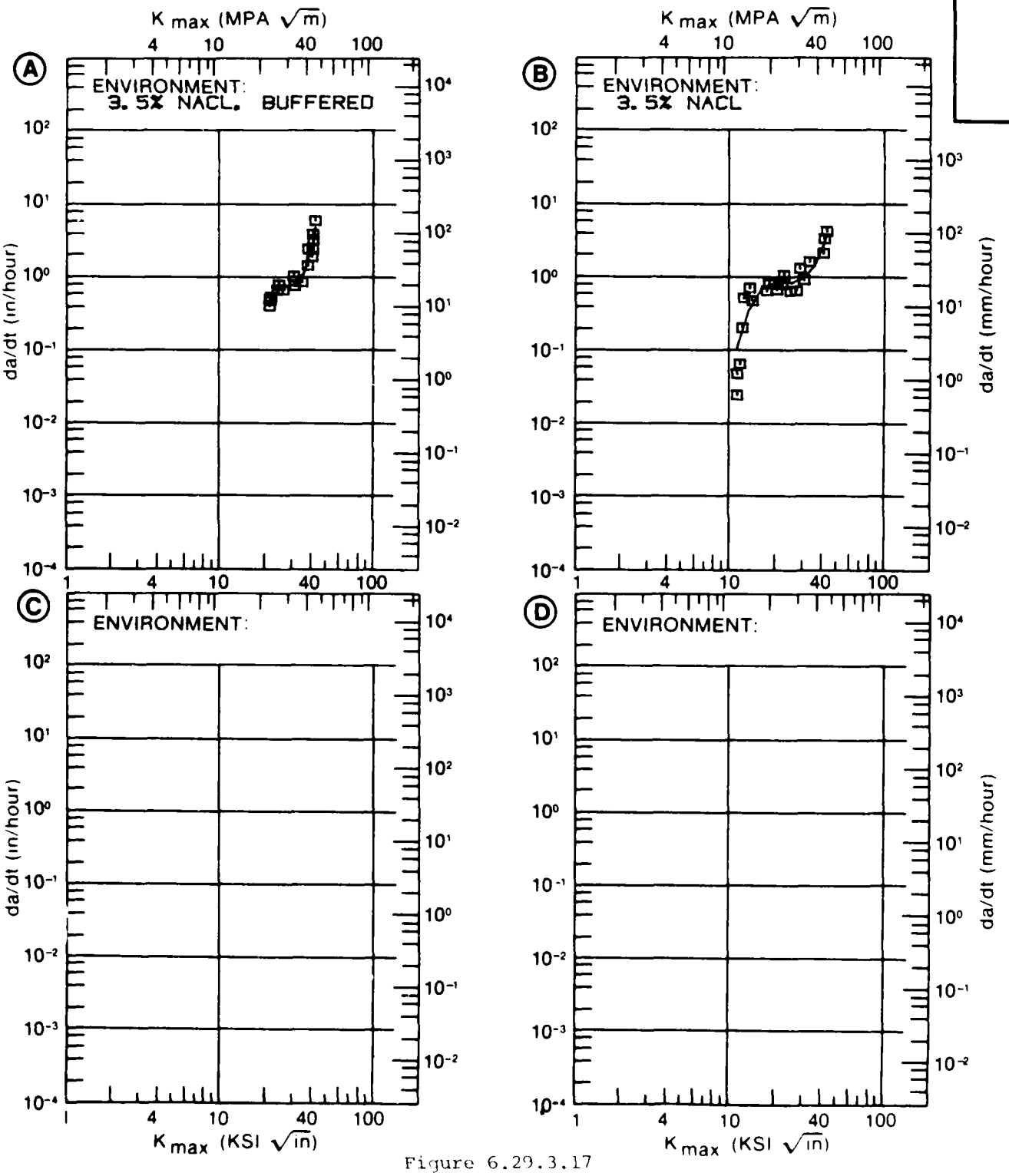



Figure 6.29.3.17

TABLE 6.29.3.18

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.18 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: TEMPER 400F 1HR

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E= DRY ARGON-CNT | E= DIST. WATER-CNT | E= SEAWATER-CANT | E= DRY HYDROGEN-CNT |
| K MAX MIN | A: | 70.00 | .836 | | | |
| | B: | 24.00 | | 224. | | |
| | C: | 18.80 | | | 403. | |
| | D: | 24.00 | | | | 1579. |
| | | 20.00 | | | 421. | |
| | | 25.00 | | 266. | 860. | 2166. |
| | | 30.00 | | 521. | 1630. | 5801. |
| | | 35.00 | | 817. | 2480. | 8872. |
| | | 40.00 | | 1114. | 3517. | 10742. |
| | | 50.00 | | 1610. | 7298. | 13608. |
| | | 60.00 | | 1923. | | |
| | | 70.00 | .836 | 2073. | | |
| | | 80.00 | 1.17 | 2106. | | |
| | | 90.00 | 5.73 | | | |
| K MAX MAX | A: | 95.30 | 25.2 | | | |
| | B: | 88.00 | | 2079. | | |
| | C: | 60.00 | | | 18700. | |
| | D: | 53.00 | | | | 14919. |
| ROOT MEAN SQUARE PERCENT ERROR | | | 36.34 | 11.28 | 7.72 | 3.27 |

CONDITION/HT: TEMPER 400F 1HR
FORM: 0.2"TH PLATE
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH: 195.0- 225.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
CRACK LENGTH ($A_0$):
$K_{ISCC}$:
REFERENCES: 84309, 70887

ALLOY STEEL

4340

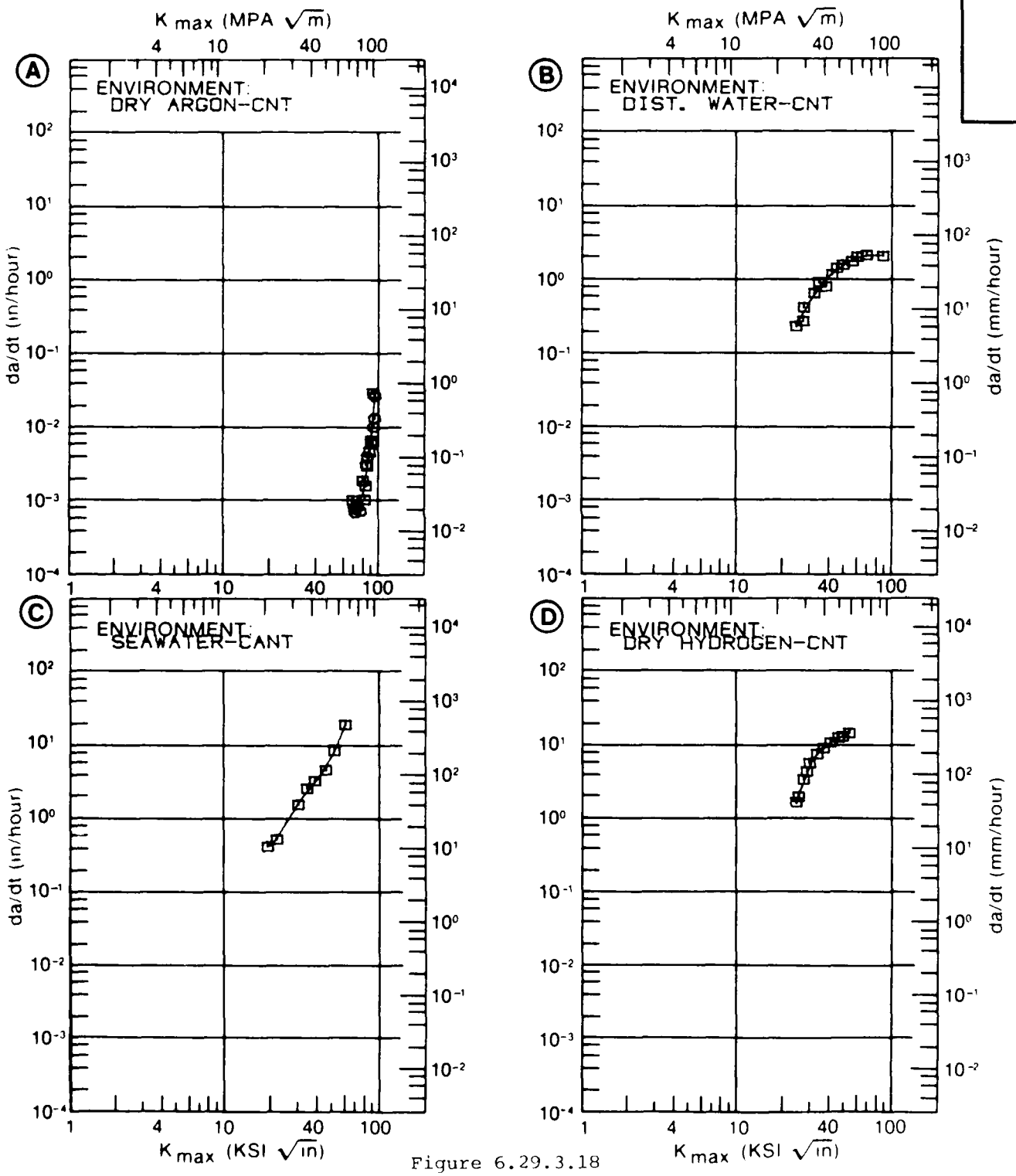



Figure 6.29.3.18

TABLE 6.29.3.19

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.19 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: TEMPER 400F 1HR

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= DIST. WATER; 50F | E= DIST. WATER; 75F | E= DIST. WATER; 127F | E= DIST. WATER; 167F |
| K MAX MIN | A: | 51.00 | 256. | | | |
| | B: | 14.50 | | 83.0 | | |
| | C: | 26.00 | | | 2215. | |
| | D: | 22.50 | | | | 5804. |
| | | 16.00 | | 112. | | |
| | | 20.00 | | 218. | | |
| | | 25.00 | | 412. | | 8072. |
| | | 30.00 | | 663. | 3694. | 11332. |
| | | 35.00 | | 947. | 5200. | 12816. |
| | | 40.00 | | 1236. | 6117. | 13293. |
| | | 50.00 | | 1737. | 6730. | 13718. |
| | | 60.00 | 893. | 2040. | 6825. | 15332. |
| | | 70.00 | 1384. | 2125. | 7099. | |
| | | 80.00 | 1383. | 2033. | | |
| K MAX MAX | A: | 81.00 | 1367. | | | |
| | B: | 84.00 | | 1962. | | |
| | C: | 80.00 | | | 7842. | |
| | D: | 64.00 | | | | 16594. |
| ROOT MEAN SQUARE PERCENT ERROR | | | 10.41 | 9.95 | 10.87 | 10.02 |

CONDITION/HT: TEMPER 400F 1HR
FORM: 0.2"TH PLATE
SPECIMEN TYPE: CNT
ORIENTATION:
YIELD STRENGTH: 195.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
CRACK LENGTH ($A_0$):
$K_{ISCC}$:
REFERENCES 84309

ALLOY STEEL

4340

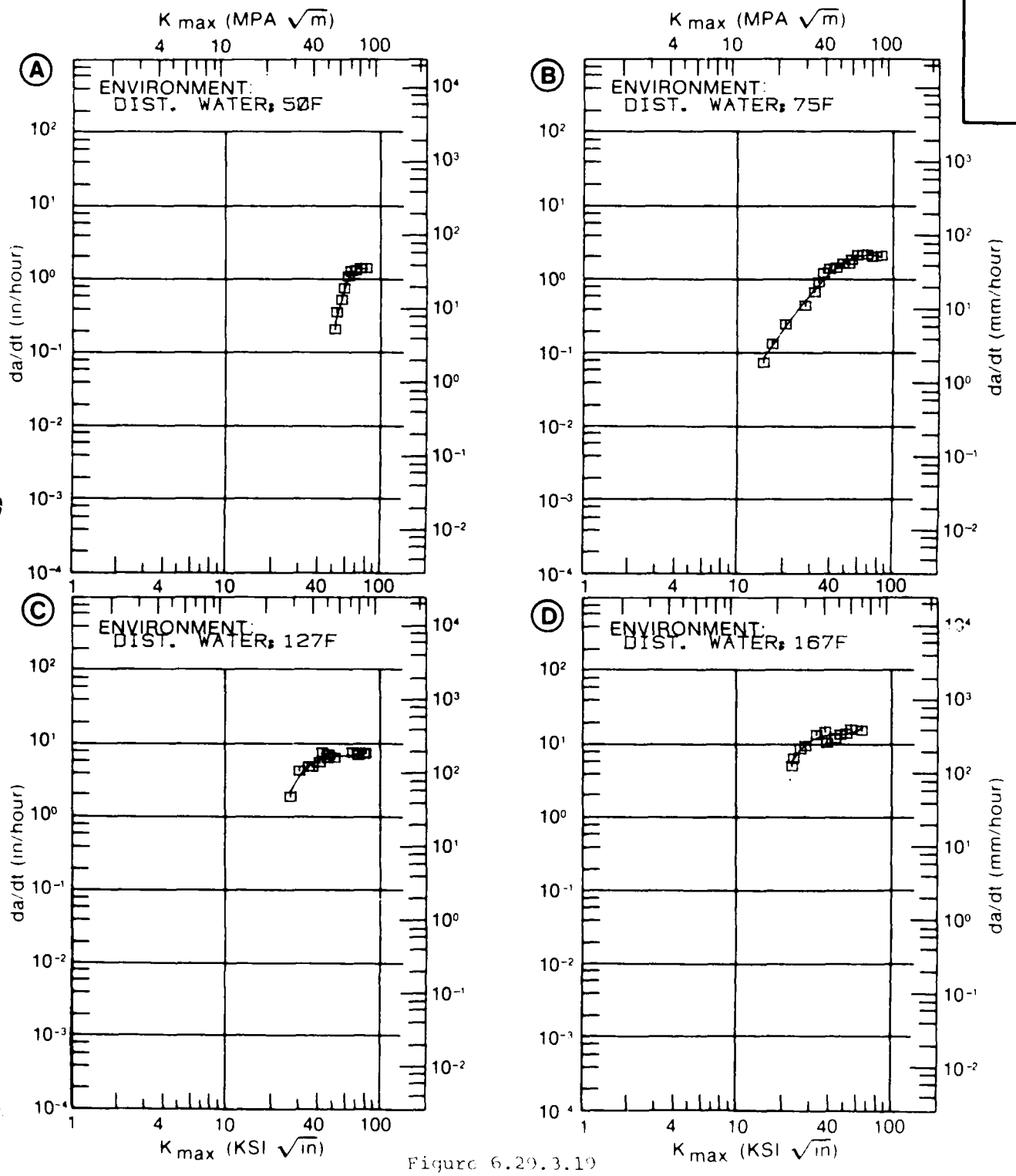



Figure 6.29.3.19

TABLE 6.29.3.20

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.20 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: TEMPERED 400F

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-3 IN/HOUR) | | | |
|---|---|---|---|---|---|---|
| | | | A | B | C | D |
| | | | E= DIST. WATER KI=19KSI SQRT(IN) | E= DIST. WATER KI=24KSI SQRT(IN) | E= DIST. WATER KI=31KSI SQRT(IN) | E= DIST. WATER KI=41KSI SQRT(IN) |
| K MAX MIN | A: | 20.00 | 83.8 | | | |
| | B: | 26.00 | | 300. | | |
| | C: | 33.80 | | | 579. | |
| | D: | | | | | |
| | | 25.00 | 603. | | | |
| | | 30.00 | 900. | 787. | | |
| | | 35.00 | | 1383. | 756. | |
| | | 40.00 | | 1744. | 1533. | |
| | | 50.00 | | | 2341. | |
| | | 60.00 | | | 2553. | |
| K MAX MAX | A: | 33.30 | 1206. | | | |
| | B: | 50.00 | | 2136. | | |
| | C: | 67.50 | | | 2932. | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 7.25 | 6.54 | 8.60 | 0.00 |

CONDITION/HT: TEMPERED 400F
FORM:
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK:
SPECIMEN WIDTH:
CRACK LENGTH ($A_O$):
$K_{ISCC}$:
REFERENCES:84313, 84310

ALLOY STEEL

4340

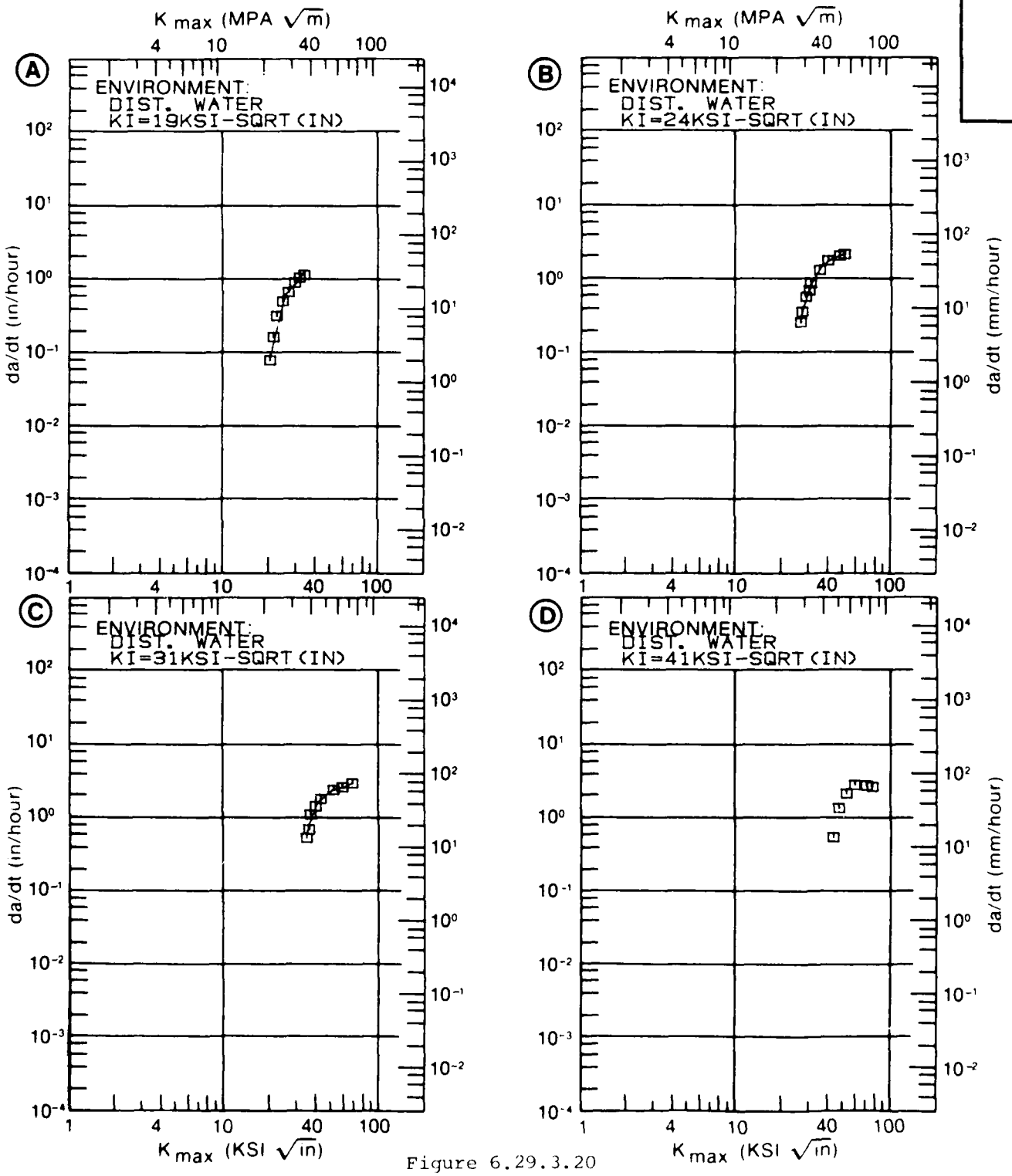



Figure 6.29.3.20

TABLE 6.29.3.21

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.21 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: TYS=200-240KSI

| K MAX (KSI*IN**1/2) | | DA/DT (10**-3 IN/HOUR) | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | | E= 3.5% NACL - .09 WT % SI IN ALLOY | E= 3.5% NACL - .54 WT % SI IN ALLOY | E= 3.5% NACL - 1.08 WT % SI IN ALLOY | E= 3.5% NACL - 1.58 WT % SI IN ALLOY |
| K MAX MIN | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| 200.00 | | | | | |
| K MAX MAX | A: | | | | |
| | B: | | | | |
| | C: | | | | |
| | D: | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | 0.00 | 0.00 | 0.00 | 0.00 |

CONDITION/HT: TYS=200-240KSI
FORM: 1.5"TH EXTRUSION
SPECIMEN TYPE: NB
ORIENTATION: L-S
YIELD STRENGTH: 202.0- 240.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.480"
SPECIMEN WIDTH: 1.500"
CRACK LENGTH ($A_0$):
$K_{ISCC}$: 14.00 KSI (SQRT IN)
REFERENCES: 74718

ALLOY STEEL

4340

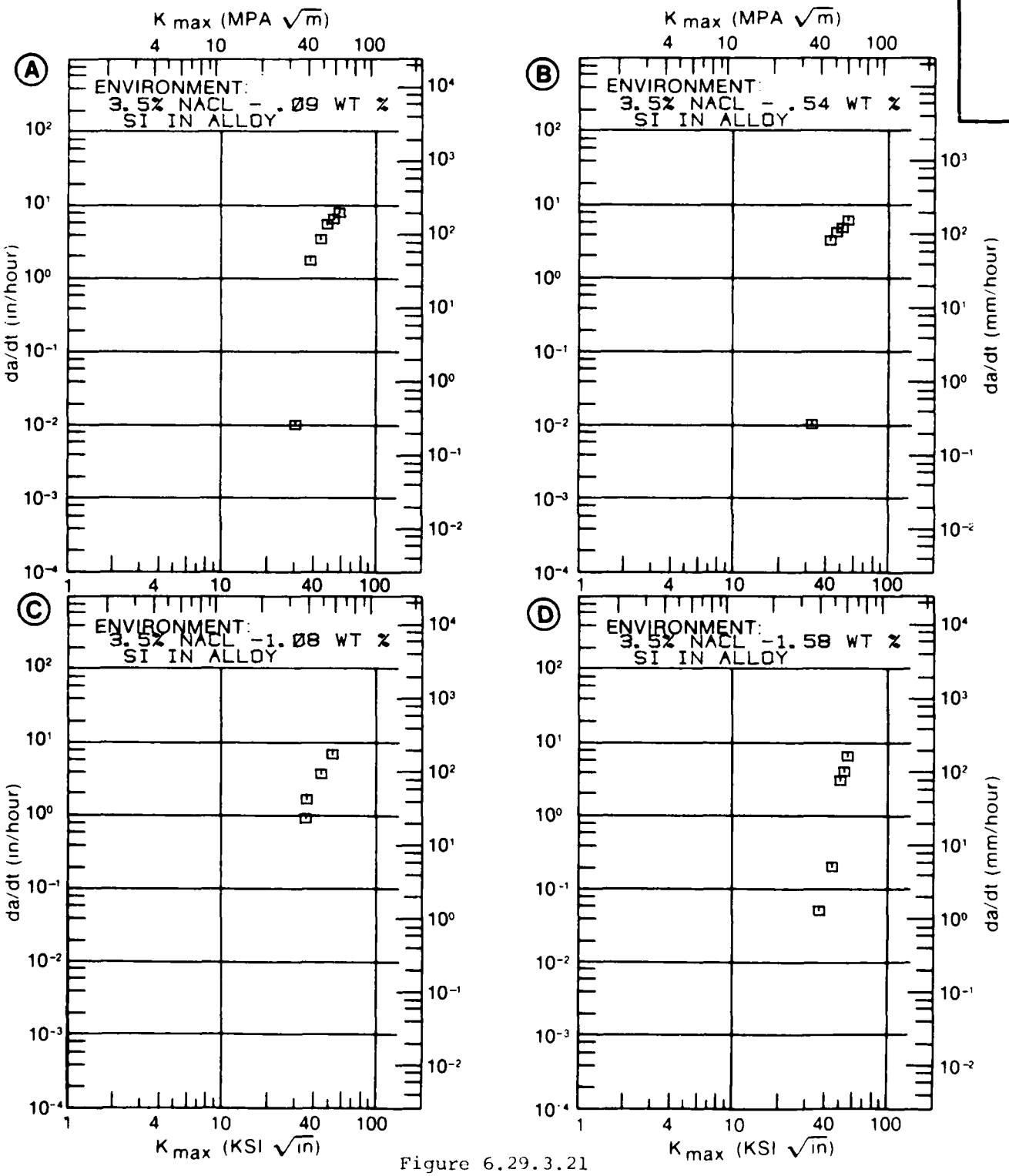



Figure 6.29.3.21

TABLE 6.29.3.22

ALLOY STEEL 4340 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ---------- | S | ---- | R.T. | --- | ---- | 3.5 PCT NACL | ---- | ---- | CNT | ---- | 80.00 | 10.00 | | | ---- | 1968 | 84290 |
| | | ---- | | --- | ---- | | ---- | ---- | PTSC | ---- | 67.00 | 10.00 | | | ---- | 1968 | 84290 |
| | | | | | | | | | | | | | 10.0/ | 0.0 | | | |
| ---------- | P | ---- | R.T. | L-T | ---- | 3.5 PCT NACL | ---- | ---- | CANT | ---- | 57.00 | 10.00 | | | ---- | 1968 | 84290 |
| ---------- | F | 0.40 | R.T. | --- | 200.0 | DIST WATER | 0.394 | 0.394 | CANT* | ---- | 88.00 | 45.00 | | | > 48800 | 1969 | 76972 |
| TYS=125KSI | P | ---- | R.T. | T-L | 125.0 | SEAWATER | ---- | ---- | CANT | ---- | 89.00 | 70.00* | | | ---- | 1967 | 70887 |
| TYS=150KSI | P | ---- | R.T. | T-L | 150.0 | SEAWATER | ---- | ---- | CANT | ---- | 85.00 | 59.00 | | | ---- | 1967 | 70887 |
| TYS=175KSI | P | ---- | R.T. | T-L | 175.0 | SEAWATER | ---- | ---- | CANT | ---- | 75.00 | 27.00 | | | ---- | 1967 | 70887 |
| TYS=200KSI | P | ---- | R.T. | T-L | 200.0 | SEAWATER | ---- | ---- | CANT | ---- | 59.00 | 10.00 | | | ---- | 1967 | 70887 |
| TYS=225KSI | P | ---- | R.T. | T-L | 225.0 | SEAWATER | ---- | ---- | CANT | ---- | 63.00 | 5.00 | | | > 1200 | 1967 | 70887 |
| 1350F OQ 750F 1.25HR | P | 1.00 | R.T. | T-S | 194.0 | 3.5 PCT NACL | 1.000 | 0.400 | CANT | ---- | 72.20 | 8.50 | | | > 20000 | 1970 | 79761 |
| 1550F OQ 750F CRACK PRESTRESSED TO 60PCT KIC | P | 1.00 | R.T. | --- | 194.2 | 3.5 PCT NACL | 1.000 | 0.500 | NB * | ---- | 72.20 | 23.00 | | | > 20000 | 1972 | 84356 |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.29.3.22 (Con't)

ALLOY STEEL 4340 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F OQ 750F 1HR CRACK PRESTRESSED TO 20PCT KIC | P | 1.00 | R.T. | --- | 194.2 | 3.5 PCT NACL | 1.000 | 0.500 | NB * | ---- | 72.20 | 8.00 | | | > 20000 | 1972 | 84356 |
| 1550F OQ 750F CRACK PRESTRESSED TO 80PCT KIC | P | 1.00 | R.T. | --- | 194.2 | 3.5 PCT NACL | 1.000 | 0.500 | NB * | ---- | 72.20 | 24.00 | | | > 20000 | 1972 | 84356 |
| 1550F OQ 750F CRACK PRESTRESSED TO 20PCT KIC | P | 1.00 | R.T. | --- | 194.2 | 3.5 PCT NACL | 1.000 | 0.500 | NB * | ---- | 72.20 | 12.00 | | | > 20000 | 1972 | 84356 |
| 1550F OQ 750F CRACK PRESTRESSED TO 40PCT KIC | P | 1.00 | R.T. | --- | 194.2 | 3.5 PCT NACL | 1.000 | 0.500 | NB * | ---- | 72.20 | 17.00 | | | > 20000 | 1972 | 84356 |
| 1575F OQ 675F 4HR | P | 0.75 | R.T. | --- | 209.6 | DIST WATER | 0.665 | 0.250 | CANT* | 0.125 | 48.80 | 9.80 | | | > 7500 | 1965 | 63061 |
| 1575F OQ 800F 4HR | P | 0.75 | R.T. | --- | 222.4 | DIST WATER | 0.665 | 0.250 | CANT* | 0.125 | 48.60 | 9.80 | | | > 2640 | 1965 | 63061 |
| 1600F 1HR OQ 600F 1+1HR | F | 12.00 | R.T. | --- | 220.0 | 3.5 PCT NACL | 3.000 | 0.502 | SENT | 0.800 | ------ | 10.00 | | | ---- | 1971 | 81814 |
| 1625F Q 1525F | F | 8.00 | R.T. | --- | 212.2 | AIR 90 PCT PH | 1.500 | 0.480 | PTSC | 0.140 | 63.00 | 27.00 | | | 200 | 1965 | 74718 |
| OQ 400F 2+2HR 1625F Q 1525F OQ | | 8.00 | | --- | 220.8 | | 1.500 | 0.480 | PTSC | 0.140 | 63.60 | 57.00 | 42.0/ 21.2 | | 1200 | 1965 | 74718 |

TABLE 6.29.3.22 (Con't)

ALLOY STEEL 4340 K(ISCC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SG) | CRACK LENGTH (IN) A | K(G) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1HR AC 1680F 2HR OQ,LN 0.25HR,400F 1+1HR OQ | B | 1.50 | R.T. | L-T | 245.0 | 3.5 PCT NACL | 1.450 | 0.575 | CANT* | ---- | 51.00 | 15.00 | | | > 3500 | 1969 | 75025 |
| 1650F 1HR AC 1480F 2HR OQ,LN 0.25HR,400F 1+1HR OQ | B | 1.50 | R.T. | L-T | 249.0 | 3.5 PCT NACL | 1.450 | 0.575 | CANT* | ---- | 51.00 | 15.00 | | | > 1800 | 1969 | 75025 |
| 1700F 0.25HR AC 1550F OQ 600F 1+1HR | S | 0.08 | R.T. | --- | 206.0 | DIST WATER | 2.000 | 0.050 | CNT | ---- | ------ | 29.00* | | | > 1000 | 1968 | 72283 |
| 1700F 0.25HR AC 1550F OQ,600F 1+1HR | S | 0.08 | R.T. | --- | 206.0 | 3.5 PCT NACL | 2.000 | 0.050 | CNT | ---- | ------ | 29.00 | | | > 1000 | 1968 | 72283 |
| 1800F Q,600F 1+1HR | F | 1.00 | R.T. | L-S | 210.0 | 3.5 PCT NACL | ---- | 1.000 | CANT | ---- | 82.00 | 30.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 78.00 | 25.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 78.00 | 24.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 78.00 | 23.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 82.00 | 25.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 78.00 | 22.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 82.00 | 25.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 82.00 | 24.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 78.00 | 24.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 82.00 | 31.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 78.00 | 26.00 | | | ---- | 1971 | 80423 |
| | | 1.00 | | | 210.0 | | 1.000 | 1.000 | CANT | ---- | 82.00 | 23.00 | | | ---- | 1971 | 80423 |
| | | | | | | | | | | | | | 25.2/ | 2.7 | | | |

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.30.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 (AM) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | | (NUMBER OF SPECIMENS) |
|---|---|---|---|
| | FORGING | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1600F 1 HR.AC. 1550F 1 HR.OQ. -320F 0.5 HR. 400F 2 HR.AC | 40.5 ± 0.5 (3) | ----- | ----- |

TABLE 6.30.2.1

ALLOY STEEL 4340 (AM) K(IC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | ------SPECIMEN------ WIDTH (IN) W | THICK (IN) B | DESIGN | CRACK LENGTH (IN) A | 2.5* (K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1600F 1 HR, AC, | F | 4.00 | R.T. | L-T | 241.0 | 1.800 | 0.900 | NB | ---- | 0.07 | 41.00 | | | 1968 | 73300 ( 1) |
| 1550F 1 HR, OQ, | | 4.00 | | | 241.0 | 1.800 | 0.900 | NB | ---- | 0.07 | 40.60 | | | 1968 | 73300 ( 1) |
| -320F 0.5 HR, | | 4.00 | | | 241.0 | 1.800 | 0.900 | NB | ---- | 0.07 | 40.00 | | | 1968 | 73300 ( 1) |
| 400F 2 HR, AC | | | | | | | | | | | | 40.57 | 0.5 | | |

NOTES:
( 1) (AM)=AIR MELTED

TABLE 6.31.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 (DH) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS) | | |
|---|---|---|---|
| | **FORGING** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1600F 1 HR.AC. 1550F 1 HR.OQ. -320F 0.5 HR. 400F 2 HR.AC | 51.0 ± 3.0 (7) | ----- | ----- |
| | **BILLET** | | |
| CONDITION/HT | L-T | T-L | S-L |
| 1550F.OQ. 900F 1 HR | ----- | 66.3 ± 6.2 (4) | ----- |

TABLE 6.31.2.1

ALLOY STEEL 4340 (DH) K(IC)

| CONDITION | PRODUCT FORM | PRODUCT THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN / STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1550F, OQ, 900F 1 HR | BT | 1.00 | -100 | L-T | ---- | 2.000 | 1.000 | CT | 1.023 | ---- | 88.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.030 | ---- | 103.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.030 | ---- | 109.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.026 | ---- | 94.00 | 98.5/ 9.3 | 1970 | 84280 |
| 1550F, OQ, 900F 1 HR | BT | 1.00 | -77 | L-T | ---- | 2.000 | 1.000 | CT | 1.045 | ---- | 107.00 | | 1970 | 84280 |
| 1550F, OQ, 900F 1 HR | BT | 1.00 | -60 | T-L | ---- | 2.000 | 1.000 | CT | 1.015 | ---- | 62.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.000 | ---- | 62.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.005 | ---- | 57.00 | 60.3/ 2.9 | 1970 | 84280 |
| 1550F, OQ, 900F 1 HR | BT | 1.00 | R.T. | T-L | ---- | 2.000 | 1.000 | CT | 1.000 | ---- | 75.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.025 | ---- | 66.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.010 | ---- | 63.00 | | 1970 | 84280 |
| | | 1.00 | | | ---- | 2.000 | 1.000 | CT | 1.020 | ---- | 61.00 | 66.3/ 6.2 | 1970 | 84280 |
| 1600F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5 HR, 400F 2 HR, AC | F | 4.00 | R.T. | L-T | 229.0 | 1.800 | 0.900 | NB | ---- | 0.12 | 51.10 | | 1968 | 73300 |
| | | 4.00 | | | 229.0 | 1.800 | 0.900 | NB | ---- | 0.14 | 54.30 | | 1968 | 73300 |
| | | 4.00 | | | 229.0 | 1.800 | 0.900 | NB | ---- | 0.15 | 55.30 | | 1968 | 73300 |
| | | 4.00 | | | 229.0 | 1.800 | 0.900 | NB | ---- | 0.12 | 51.30 | | 1968 | 73300 |
| | | 4.00 | | | 231.0 | 1.800 | 0.900 | NB | ---- | 0.12 | 49.70 | | 1968 | 73300 ( 1) |
| | | 4.00 | | | 231.0 | 1.800 | 0.900 | NB | ---- | 0.10 | 46.90 | | 1968 | 73300 ( 1) |
| | | 4.00 | | | 231.0 | 1.800 | 0.900 | NB | ---- | 0.11 | 48.40 | | 1968 | 73300 ( 1) |
| | | | | | | | | | | | | 51.0/ 3.0 | | |
| 1600F 1 HR, AC, 1550F 1 HR, OQ, -320F 0.5 HR, 400F 2 HR, AC | F | 4.00 | R.T. | T-S | 233.0 | 1.800 | 0.900 | NB | ---- | 0.13 | 52.50 | | 1968 | 73300 ( 1) |
| | | 4.00 | | | 233.0 | 1.800 | 0.900 | NB | ---- | 0.13 | 52.50 | | 1968 | 73300 ( 1) |
| | | 4.00 | | | 233.0 | 1.800 | 0.900 | NB | ---- | 0.13 | 52.50 | | 1968 | 73300 ( 1) |
| | | | | | | | | | | | | 52.5/ 0.0 | | |

NOTES
( 1) (DH)=DEGASED

TABLE 6.32.3.1

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.32.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340(EFM)
CONDITION: 1550F .5HR, 400F 4HR

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-6 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | E= 0.05% SODIUM DICHROMATE | | | |
| K MAX MIN | A: | 19.00 | 340000. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 20.00 | 356822. | | | |
| | | 25.00 | 457075. | | | |
| | | 30.00 | 572661. | | | |
| | | 35.00 | 690962. | | | |
| | | 40.00 | 801767. | | | |
| | | 50.00 | 972434. | | | |
| | | 60.00 | 1053339. | | | |
| K MAX MAX | A: | 65.00 | 1060000. | | | |
| | B: | | | | | |
| | C: | | | | | |
| | D: | | | | | |

ROOT MEAN SQUARE PERCENT ERROR 9.39

CONDITION/HT: 1550F .5HR, 400F 4HR
FORM: 0.5"TH PLATE
SPECIMEN TYPE: TDCB
ORIENTATION: T-L
YIELD STRENGTH: 240.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.300"
SPECIMEN WIDTH: 6.000"
CRACK LENGTH ($A_0$)
$K_{ISCC}$:
REFERENCES: 83611

ALLOY STEEL

4340 (EFM)

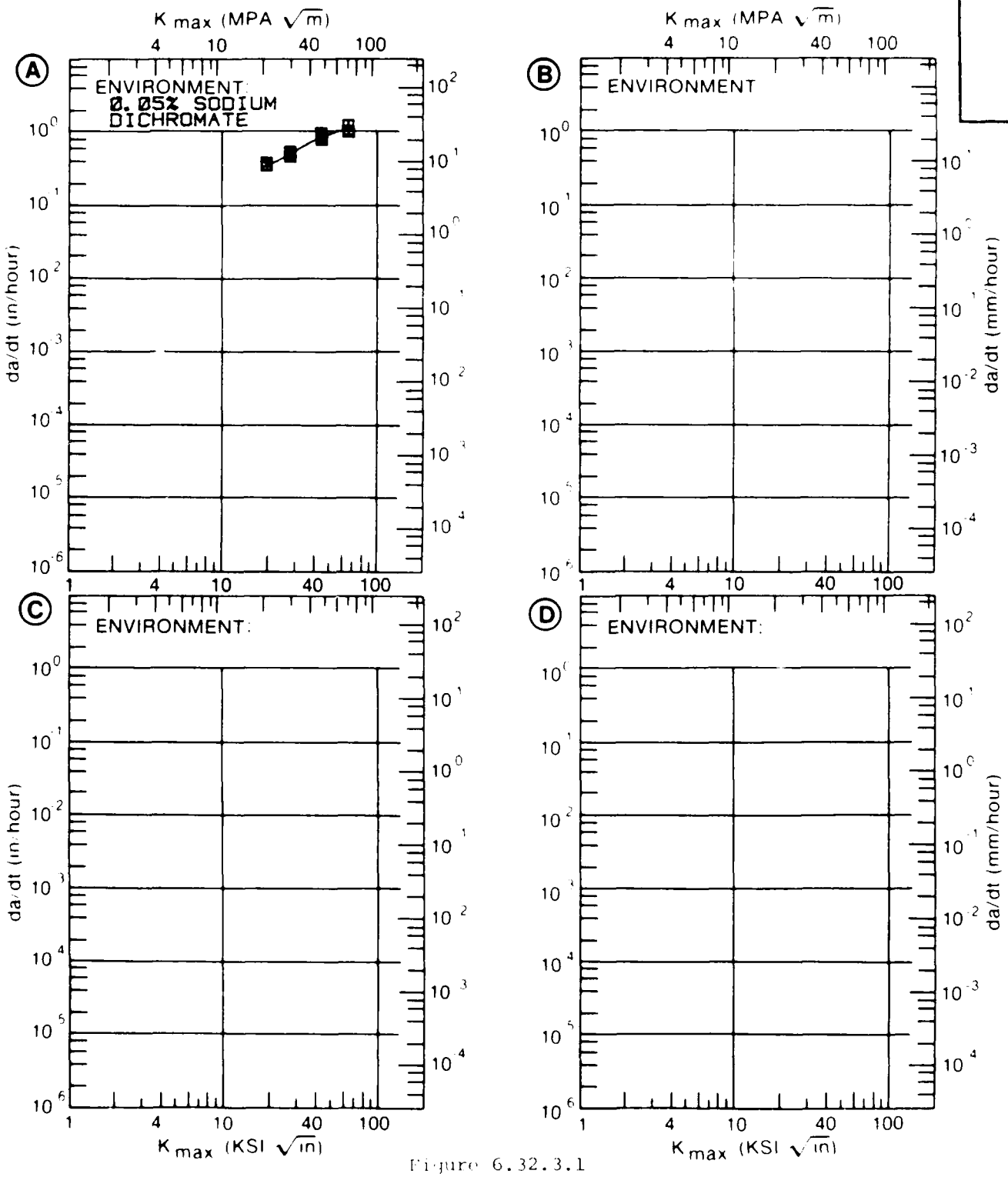



Figure 6.32.3.1

TABLE 6.33.3.1

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.33.3.1 INDICATING EFFECT

OF YIELD STRENGTH

MATERIAL: ALLOY STEEL 4340V
CONDITION:
ENVIRONMENT:

| K MAX (KSI*IN**1/2) | | | DA/DT (10**-6 IN/HOUR) A | B | C | D |
|---|---|---|---|---|---|---|
| | | | Y(KSI)=200.0 | Y(KSI)=186.0 | Y(KSI)=142.0 | |
| K MAX MIN | A: | 41.00 | 25343. | | | |
| | B: | 55.00 | | 885. | | |
| | C: | | | | | |
| | D: | | | | | |
| | | 50.00 | 101411. | | | |
| | | 60.00 | 174099. | 4149. | | |
| | | 70.00 | 234544. | 6304. | | |
| | | 80.00 | | 8155. | | |
| K MAX MAX | A: | 75.00 | 279053. | | | |
| | B: | 85.00 | | 8927. | | |
| | C: | | | | | |
| | D: | | | | | |
| ROOT MEAN SQUARE PERCENT ERROR | | | 6.42 | 3.87 | 0.00 | |

CONDITION/HT:
FORM: 2.4"TH EXTRUSION
SPECIMEN TYPE: CANT
ORIENTATION:
ENVIRONMENT:
ULT STRENGTH:

SPECIMEN THK: 0.394"
SPECIMEN WIDTH: 0.394"
CRACK LENGTH ($A_o$):
$K_{ISCC}$: 103.0, 83.0, 45.0 KSI(SQRT IN)
REFERENCES: 76972

ALLOY STEEL

4340V

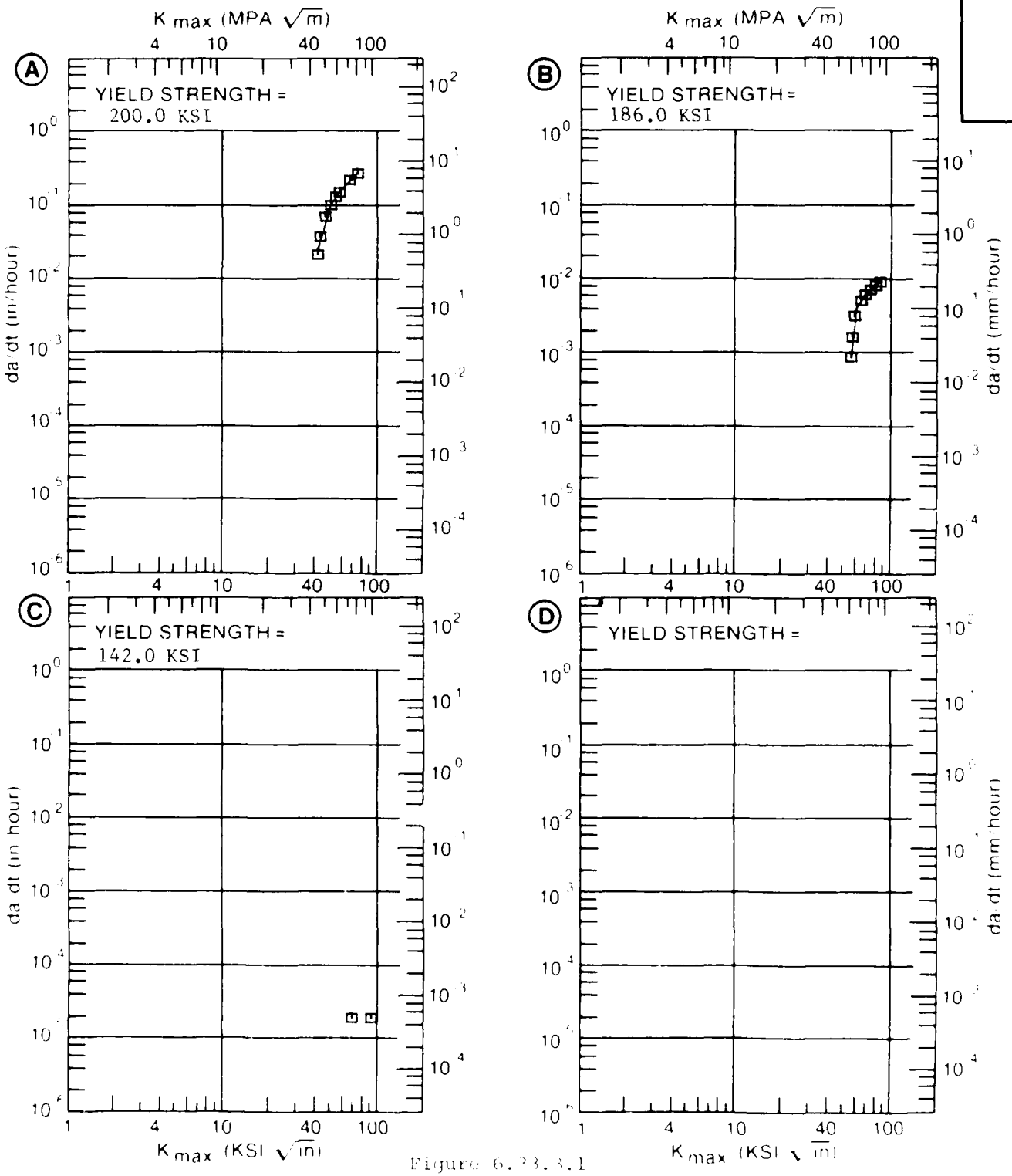



Figure 6.33.3.1

TABLE 6.34.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 (VAR) AT ROOM TEMPERATURE

| CONDITION/HT | MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION | (NUMBER OF SPECIMENS) |
|---|---|---|

FORGING

| CONDITION/HT | L-T | T-L | S-L |
|---|---|---|---|
| 1600F 1 HR.AC.<br>1550F 1 HR.OQ.<br>-320F 0.5 HR.<br>400F 2 HR.AC | 55.0 ± 4.4 (8) | ----- | ----- |

TABLE 6.34.2.1

ALLOY STEEL 4340 (VAR) K(IC)

| CONDITION | PRODUCT FORM | THICK (IN) | TEST TEMP (F) | SPECIMEN ORIENT | YIELD STRENGTH (KSI) | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN | CRACK LENGTH (IN) A | 2.5*(K(IC)/TYS)**2 (IN) | K(IC) (KSI*SQRT IN) | K(IC) MEAN | K(IC) STAN DEV | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1600F 1 HR.AC. | F | 4.00 | R.T. | L-T | 240.0 | 1.800 | 0.900 | NB | ---- | 0.13 | 55.00 | | | 1968 | 73300 ( 1) |
| 1550F 1 HR.OQ. | | 4.00 | | | 240.0 | 1.800 | 0.900 | NB | ---- | 0.16 | 61.30 | | | 1968 | 73300 ( 1) |
| 300F 0.5 HR. | | 4.00 | | | 240.0 | 1.800 | 0.900 | NB | ---- | 0.12 | 51.80 | | | 1968 | 73300 ( 1) |
| 400F 2 HR.AC | | 4.00 | | | 240.0 | 1.800 | 0.900 | NB | ---- | 0.15 | 59.20 | | | 1968 | 73300 ( 1) |
| | | 4.00 | | | 241.0 | 1.800 | 0.900 | NB | ---- | 0.10 | 48.60 | | | 1968 | 73300 |
| | | 4.00 | | | 241.0 | 1.800 | 0.900 | NB | ---- | 0.13 | 54.60 | | | 1968 | 73300 |
| | | 4.00 | | | 241.0 | 1.800 | 0.900 | NB | ---- | 0.11 | 51.10 | | | 1968 | 73300 |
| | | 4.00 | | | 241.0 | 1.800 | 0.900 | NB | ---- | 0.15 | 58.60 | 55.0/ | 4.4 | 1968 | 73300 |

NOTES

( 1) COMPOSITION(WT PERCENT) 0.42C,0.81MN,0.008P,0.004S,0.36SI,1.63NI,0.84CR,0.22MO,0.001AL,0.002CA,0.0022N (VAR)=(VACUUM ARC REMELTED)

TABLE 6.35.3.1

ALLOY STEEL 4340(MOD) K(ISCC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | SPECIMEN WIDTH (IN) W | SPECIMEN THICK (IN) B | SPECIMEN DESIGN (*=SO) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1650F 1HR, 1600F 1HR OQ 1+1 600F (0 09 SI) | B | 1 50 | R T | T-L | 204.2 | 3.5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 78.00 | 18 00 | | | > 5000 | 1965 | 74718 |
| 1650F 1HR, 1600F 1HR OQ 1+1 400F (0.09 SI) | B | 1 50 | R.T | T-L | 201 8 | 3.5 PCT NACL | 1.500 | 0.480 | CANT | ---- | 73.00 | 13.00 | | | > 5000 | 1965 | 74718 |
| 1800F Q 460F 1+1HR (0 20C) | F | 1.00 | R.T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 87.00 | 56.00 | | | ---- | 1971 | 80423 |
| 1800F Q 500F 1+1HR (0 21C) | F | 1 00 | R T | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 87.00 | 52.00 | | | ---- | 1971 | 80423 |
| 1800F Q 600F 1HR (0 20C) | F | 1 00 | R.T | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 98.00 | 72.00 | | | ---- | 1971 | 80423 |
| 1800F Q 650F 1HR (0 24C) | F | 1.00 | R.T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 92.00 | 62.00 | | | ---- | 1971 | 80423 |
| 1800F Q 650F 1+1HR (0 28C) | F | 1 00 | R T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 87.00 | 35.00 | | | ---- | 1971 | 80423 |
| 1800F Q 700F 1HR (0 21C) | F | 1 00 | R.T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 85.00 | 42.00 | | | ---- | 1971 | 80423 |
| 1800F Q 780F 1+1HR (0 33C) | F | 1 00 | R T. | L-S | 195 0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 87.00 | 32 00 | | | ---- | 1971 | 80423 |

TABLE 6.35.3.1 (Con't)

ALLOY STEEL 4340(MOD) K(ISCC)

| CONDITION | --PRODUCT-- FORM | THICK (IN) | TEST TEMP (F) | SPEC OR | YIELD STR (KSI) | ENVIRONMENT | ------SPECIMEN-------- WIDTH (IN) W | THICK (IN) B | DESIGN (*=SQ) | CRACK LENGTH (IN) A | K(Q) (KSI*SQRT IN) | K(ISCC) (KSI*SQRT IN) | MEAN | STAN DEV | TEST TIME (MIN) | DATE | REFER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1800F @ 800F 1HR (0 46C) | F | 1.00 | R.T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 78.00 | 20.00 | | | ---- | 1971 | 80423 |
| 1800F @ 900F 1HR (0 64C) | F | 1.00 | R.T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 65.00 | 30.00 | | | ---- | 1971 | 80423 |
| 1800F @ 925F 1+1HR (0 53C) | F | 1.00 | R.T. | L-S | 195.0 | 3.5 PCT NACL | 1.000 | 1.000 | CANT | ---- | 87.00 | 42.00 | | | ---- | 1971 | 80423 |

# TABLE 6.36

## REFERENCES FOR ALLOY STEEL DATA

60578 18Ni (300)MAR $K_c$

Christian, J. L., Yang, C. T., and Witzell, W. E., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryogenic Environment", ASD-TDR-62-258, Part III, General Dynamics/Astronautics (December 1964).

63061
D6AC $K_{Iscc}$
18Ni(300)MAR $K_{Iscc}$
4140 $K_{Iscc}$
4340 $K_{Iscc}$

Mulherin, J. H., and Hess, E. H., "Stress-Corrosion Susceptibility of Ultrahigh Strength Steel Evaluated in Terms of Fracture Toughness", Technical Report R-1782, Frankford Arsenal, Philadelphia, PA, (November 1965).

65166
12Ni-5Cr-3Mo $K_{Iscc}$
18Ni (180)MAR $K_{Iscc}$
18Ni (250)MAR $K_{Iscc}$

Rolfe, S. T., et al., "Stress-Corrosion Testing of Ultraservice Steels Using Fatigue Cracked Specimens", Paper No. 90, Presented at the 69th Annual Meeting of the American Society for Testing and Materials in Atlantic City, NJ, June 27-July 1, 1966.

69162 18Ni(200)MAR $K_{Iscc}$

Sandoz, G., and Newbegin, R. L., "Stress-Corrosion Cracking Resistance of an 18Ni 200 Grade Maraging Steel Base Plate and Weld", NRL Report 1772, Naval Research Laboratory, Washington, D.C., (March 1967).

70887
12Ni-5Cr-3Mo $K_{Iscc}$
18Ni (200)MAR $K_{Iscc}$
18Ni (250)MAR da/dt
4340 da/dt, $K_{Iscc}$

Peterson, M. H., Brown, B. F., Newbegin, R. L., and Groover, R. E., "Stress Corrosion Cracking of High Strength Steels and Titanium Alloys in Chloride Solutions at Ambient Temperature", Corrosion, 23 (5), 142-148 (May 1967).

72283
D6AC $K_{Iscc}$
HP9-4-.45 $K_{Iscc}$
H11 $K_{Iscc}$
18Ni (250)MAR $K_{Iscc}$
4340 $K_{Iscc}$

Benjamin, W. D., and Steigerwald, E. A., "Environmentally Induced Delayed Failures in Martensitic-High-Strength Steels", Second Yearly Summary Report, AFML-TR-68-80, TRW, Inc., Cleveland, OH, Contract AF33(615)-3651(P) (April 1968).

73300
300M (AM) $K_{Ic}$
300M (VAR) $K_{Ic}$
4340 (AM) $K_{Ic}$
4340 (DH) $K_{Ic}$

Hauser, J. J., et al., "Inclusions in High-Strength Steels, Their Dependence on Processing Variables and Their Effect on Engineering Properties", Report AFML-TR-66-222, Crucible Steel Corporation, Pittsburgh, PA, (August 1968).

TABLE 6.36 (Cont)

73612 18Ni (250)MAR $K_{Ic}$

Srawley, J. E., "Plane Strain Fracture Toughness Tests on Two-Inch-Thick Maraging Steel Plates at Various Strength Levels", NASA TN K-52470, Lewis Research Center, Cleveland, OH, (1968).

73824 HY-150 $K_{Iscc}$

Smith, J. H., and Rolfe, S. T., "Effect of Composition on the $K_{Iscc}$ of Experimental HY-150 Steels", Technical Report No. 39.018-016(10), United States Steel Corporation, Applied Research Laboratory, Monroeville, PA, Contract NObs-94535 (FBM) (December 20, 1968

73829 18Ni (250)MAR $K_{Iscc}$

Novak, S. R., and Rolfe, S. T., "Comparison of Fracture-Mechanics and Normal-Stress Analyses in Stress-Corrosion Testing", Report No. 89.018-026(3), United States Steel Corporation, Applied Research Laboratory, Monroeville, PA, Contract NObs-94535 (FBM) (December 20, 1968).

73988 300M $K_c$

Pendelberry, S. L., Simenz, R. F., and Walker, E. K., "Fracture Toughness and Crack Propagation of 300 M Steel", FAA Technical Report No. DS-68-18 (August 1968).

74232 HP 9-4-.20 $K_{Iscc}$
12Ni-5Cr-3Mo $K_{Iscc}$
18Ni (250)MAR $K_{Iscc}$

Sinclair, G. M., and Rolfe, S. T., "Analytical Procedure for Relating Subcritical Crack Growth to Inspection Requirements", University of Illinois, Urbana, Ill., and United States Steel Corporation, Applied Research Laboratory, Monroeville, PA, Paper presented at the Metals Engineering Conference of ASME, Washington, D.C., on March 31 to April 2, 1969.

74302 HP 9-4-.30 $K_{Iscc}$
300M $K_{Iscc}$

Carter, C. S., "Crack Extension in Several High-Strength Steels Loaded in 3.5% Sodium Chloride Solution", Research Report D6-19770, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (November 1967).

74718 300M $K_{Iscc}$
4340 $K_{Iscc}$, da/dt
4340(MOD) $K_{Iscc}$

Carter, C. S., "The Effect of Silicon on the Stress Corrosion Resistance of Low-Alloy, High-Strength Steels", Research Report D6-23872, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (March 1965).

74719 18Ni (200)MAR da/dt
18Ni (350)MAR da/dt

Carter, C. S., "Stress Corrosion Crack Branching in High-Strength Steels", Research Report D6-23781, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (March 1965).

TABLE 6.36 (Cont)

75025 4340 $K_{Iscc}$

Procter, R. P. M., and Paxton, H. W., "The Effect of Prior Austenite Grain Size on the Stress Corrosion Cracking Susceptibility of A.I.S.I. 4340 Steel", Research Project, Carnegie-Mellon University, Pittsburgh, PA (January 1969).

75111 H11 da/dt

Wei, R. P., and Landes, J. D., "Correlation Between Sustained-Load and Fatigue Crack Growth on High-Strength Steels", Materials Research and Standards, 9 (7), 25-28 (July 1969).

75677 18Ni (350) MAR $K_{Iscc}$

Carter, C. S., "The Effect of Heat Treatment on the Fracture Toughness and Subcritical Crack Growth Characteristics of a 350-Grade Maraging Steel", Report D6-22978, The Boeing Company, Renton, Wash., Contract N00014-66-C0365 (June 1969).

76411 HP 9-4-.25 (VAR) $K_{Ic}$
18Ni (200) MAR $K_{Ic}$

Wessel, E. T., et al., "Engineering Methods for the Design and Selection of Materials Against Fracture", Final Technical Report, Westinghouse Research Laboratories, Pittsburgh, PA, Contract DA-30-069-AMC-602 (T) (June 24, 1966).

76972 4340 $K_{Iscc}$
4340V da/dt

Colangelo, V. J., and Ferguson, M. S., "The Role of the Strain Hardening Exponent in Stress Corrosion Cracking of a High Strength Steel", Corrosion, 25 (12) 509-514 (December 1969).

77716 18Ni(300)MAR $K_{Iscc}$

Stavros, A. J., and Paxton, H. W., "Stress-Corrosion Cracking Behavior of an 18% Ni Maraging Steel", Homer Research Laboratories, Bethlehem Steel Corporation, Bethlehem, PA, and Carnegie-Mellon University, Pittsburgh, PA, ARPA Contract Nonr-760(31) (April 1970).

78065 18Ni (250)MAR $K_{Iscc}$

Novak, S. R., and Rolfe, S. T., "Comparison of Fracture Mechanics and Nominal Stress Analysis in Stress Corrosion Cracking", Corrosion, 26(4) 121-130(April 1970).

78305 300M $K_{Ic}$ $K_{Iscc}$
300M(VM) $K_{Ic}$

Webster, D., "Effect of Grain Refinement on the Microstructure and Mechanical Properties of 4340M", Summary Report D6-25220, The Boeing Company, Seattle, Wash., ARPA Contract N00014-66-C-0365 (April 1970).

78313 18Ni (250)MAR da/dt
300M da/dt

Hyatt, M. V., "Use of Precracked Specimens in Stress-Corrosion Testing of High-Strength Aluminum Alloys", Summary Report D6-24466, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (November 1969).

TABLE 6.36 (Cont)

78425 18Ni (300) MAR $K_{Iscc}$, da/dN

Carter, C. S., "Evaluation of a High-Purity 18Ni (300) Maraging Steel Forging", Report AFML-TR-70-139, The Boeing Company, Renton, Wash., Contract F33615-69-C-1620 (June 1970).

78761 18Ni (300) MAR $K_{Iscc}$
4340 $K_{Iscc}$

Carter, C. S., "Effect of Prestressing on the Stress-Corrosion Resistance of Two High-Strength Steels", Report D6-25275, The Boeing Company, Seattle, Wash., Contract N00014-66-C-0365 (May 1970).

80423 4340 $K_{Iscc}$
4340 (MOD) $K_{Iscc}$

Sandoz, G., "The Effects of Alloying Elements on the Susceptibility to Stress-Corrosion Cracking of Martensitic Steels in Salt Water", ASM Metallurgical Transactions, 2 (4) 1055-1063 (April 1971).

80667 HP 9-4-.20 $K_{Iscc}$
18Ni (200) MAR $K_{Iscc}$

Raymond, L., and Usell, R. J., Jr., "The Effect of $N_2O_4$ and UDMH on Subcritical Crack Growth in Various High-Toughness Low-Strength Steels", Report No. SAMSO-TR-71-106, TR-0059(6250-10)-8, The Aerospace Corporation, El Segundo, CA, Contract F04701-70-C-0059 (June 15, 1971).

80824 18Ni (200) MAR $K_{Iscc}$
18Ni (250) MAR $K_{Iscc}$

Syrett, B. C., "Stress Corrosion Cracking in 18% Ni (250) Maraging Steel", Corrosion, 27 (7), 270-280 (July 1971).

81004 18Ni (180) MAR $K_{Iscc}$
18Ni (200) MAR $K_{Iscc}$

Kenyon, N., Kirk, W. W., and Van Rooyen, D., "Corrosion of 18Ni 180 and 18Ni 200 Maraging Steels in Chloride Environments", Corrosion, 27 (9), 390-400 (September 1971).

81814 4340 $K_{Iscc}$, da/dt

Gallagher, J. P., "Corrosion Fatigue Crack Growth Rate Behavior Above and Below $K_{Iscc}$ in Steels", Journal of Materials, 6 (4) 941-964 (December 1971).

82164 18Ni (280) MAR $K_{Iscc}$

Floreen, S., Hayden, H. W., and Kanyon, N., "Stress Corrosion Cracking Behavior of Maraging Steel Composites", Corrosion, 27 (12), 519-524 (December 1971).

82543 D6AC $K_{Ic}$, da/dN

Feddersen, C. E., et al., "Crack Behavior in D6AC Steel", Report MCIC-72-04, Metals and Ceramics Information Center, Battelle Columbus Laboratories, Columbus, OH (January 1972).

TABLE 6.36 (Cont)

83611 4340 (EFM) da/dt

Dull, D. L., and Raymond, L., "Stress History Effect on Incubation Time for Stress Corrosion Crack Growth in E-4340 HR Steel", Air Force Report No. SAMSO-TR-72-168, Aerospace Report No. TR-0172 (2250-10)-7, The Aerospace Corporation, El Segundo, CA, Contract No. F04701-71-C-0172 (June 15, 1972).

83613 HP 9-4-.20 $K_{Iscc}$
12Ni-5Cr-3Mo $K_{Iscc}$
18Ni (180)MAR $K_{Iscc}$
18Ni (200)MAR $K_{Iscc}$
18Ni (250)MAR $K_{Iscc}$

Sandoz, G., "The Resistance of Some High Strength Steels to Slow Crack Growth in Salt Water", NRL Memorandum Report 2454, Naval Research Laboratory, Washington, D.C. (February 1972).

83834 18Ni (200) MAR $K_{Ic}$
18Ni (250) MAR $K_{Ic}$

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18Ni (250) MAR $K_{Iscc}$
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300M $K_{Iscc}$
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300M $K_{Ic}$

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