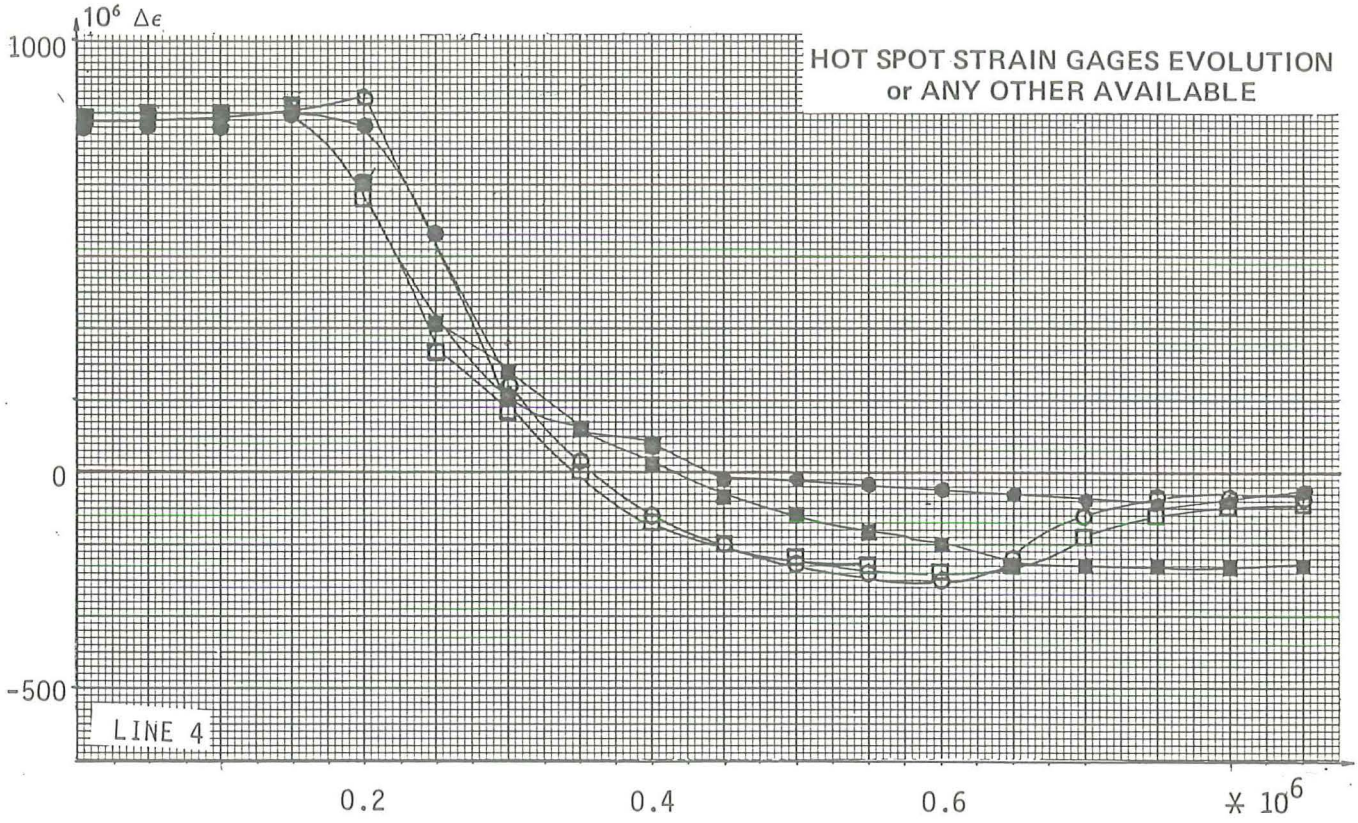
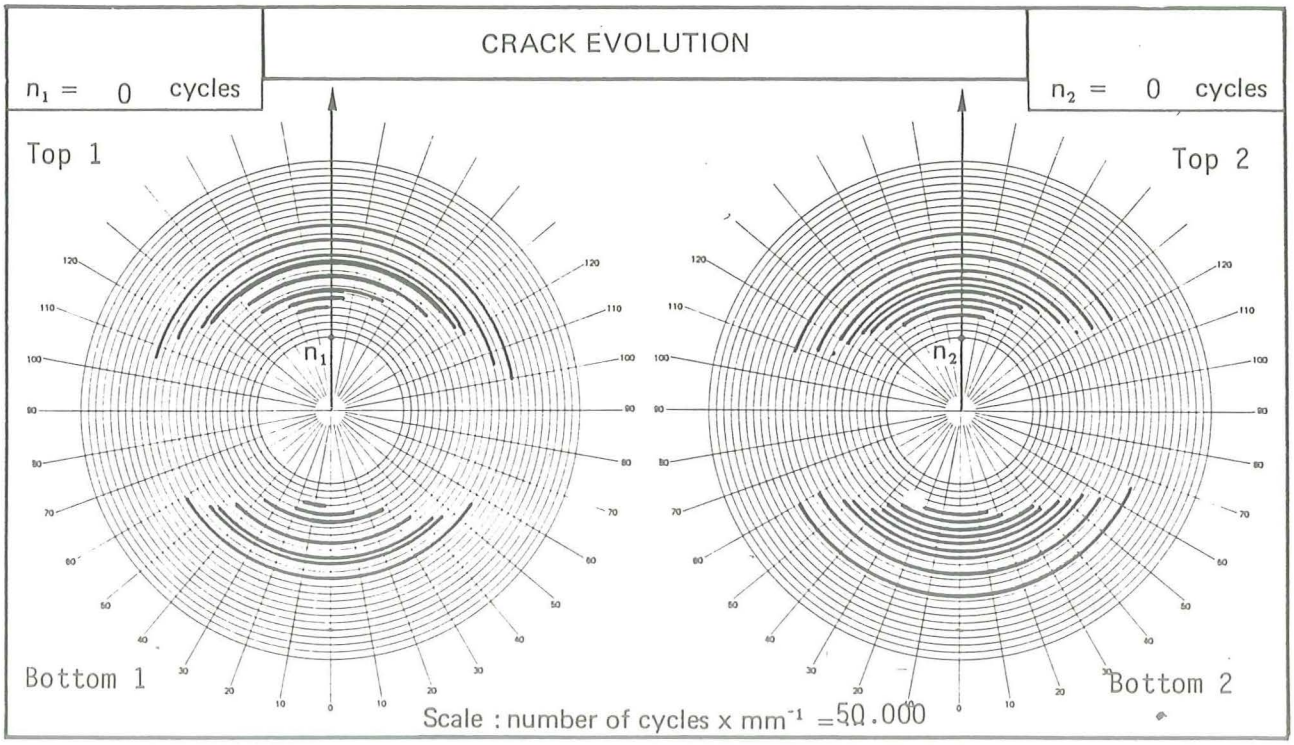
MEASUREMENTS DURING FATIGUE TESTING

FATIGUE TESTING CONDITIONS : in air/~~in sea water~~ — ~~with~~/without protection.

FAILURE CRITERION	$\Delta\epsilon$ — 15 %	Visual crack 45 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.9×10^5	1.5×10^5	7.0×10^5	8.5×10^5	

(1) A : complete failure
B : actuator displacement = ... mm
C : secondary cracking total length = ... mm
D : other reason : Reduction of stiffness





OTHER RELEVANT INFORMATIONS

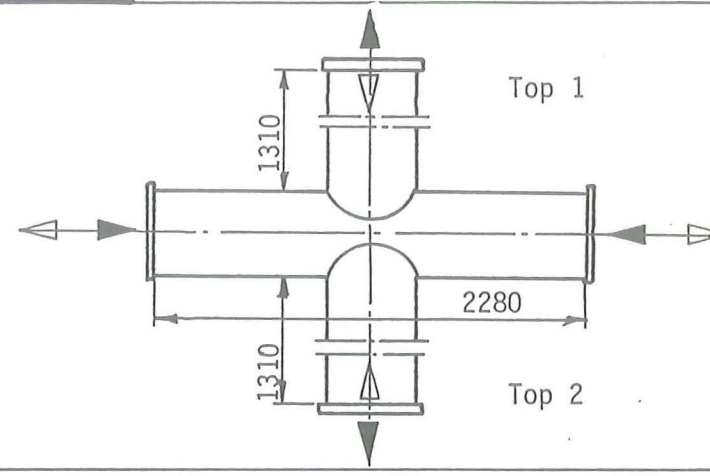
OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	36

GEOMETRY ~~actual~~ values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d_1 457.2	t_1 8.8
	d_2	t_2

SKETCH	geometry, dimensions, loads boundary conditions



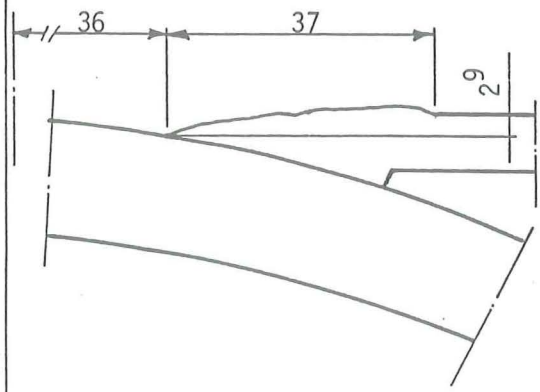
Post weld stress relief H.T. ~~Yes~~ No

ACTUAL PROPERTIES OF CRACKED MEMBER brace (inside)

BASE METAL	Grade : X 60				STD : API - 5 LX						
	C %	Si %	Mn %	S %	P %	Al %					
	0.14	0.30	1.29	0.014	0.020	0.041					

WELDING	Welding process : MMAW , Current : AC Filler materials : – ~~ISO~~ – AWS – : E 7016 Electrode diameter (mm) : 2.4 to 4

WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII



WELDING PROCEDURE	
Position	5G
Nr of runs	5
Energy (kj/m)	-
preheat. temp. (° C)	65
postheat. temp. (° C)	none

POST WELDING TREATMENT

~~Heat treatment tig or plasma dressing~~

~~Shoot peening grinding~~

WELD METAL DEPOSIT	C %	Si %	Mn %	S %	P %	Ni %					

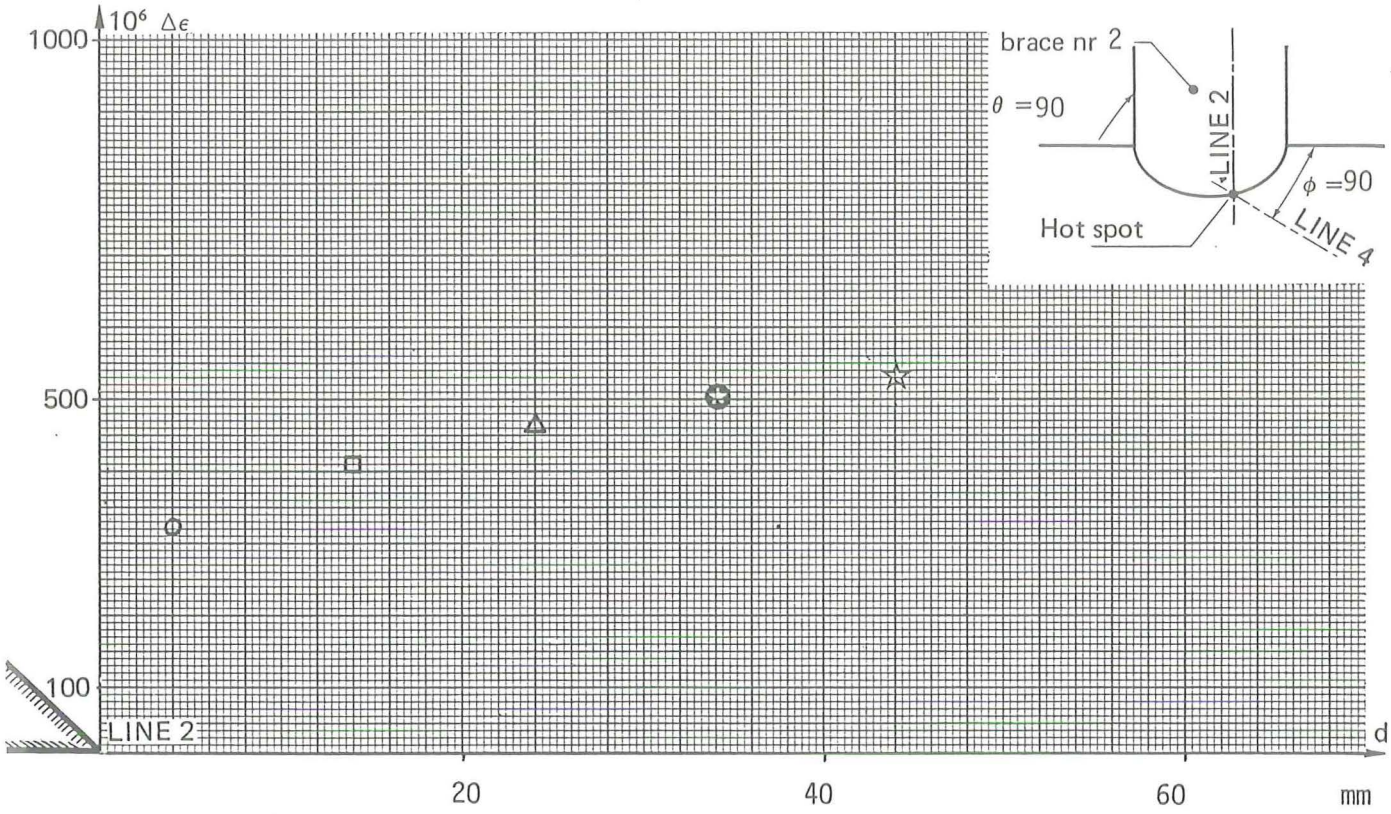
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm²)	482	
Tensile strength σ_u (N/mm²)	580	

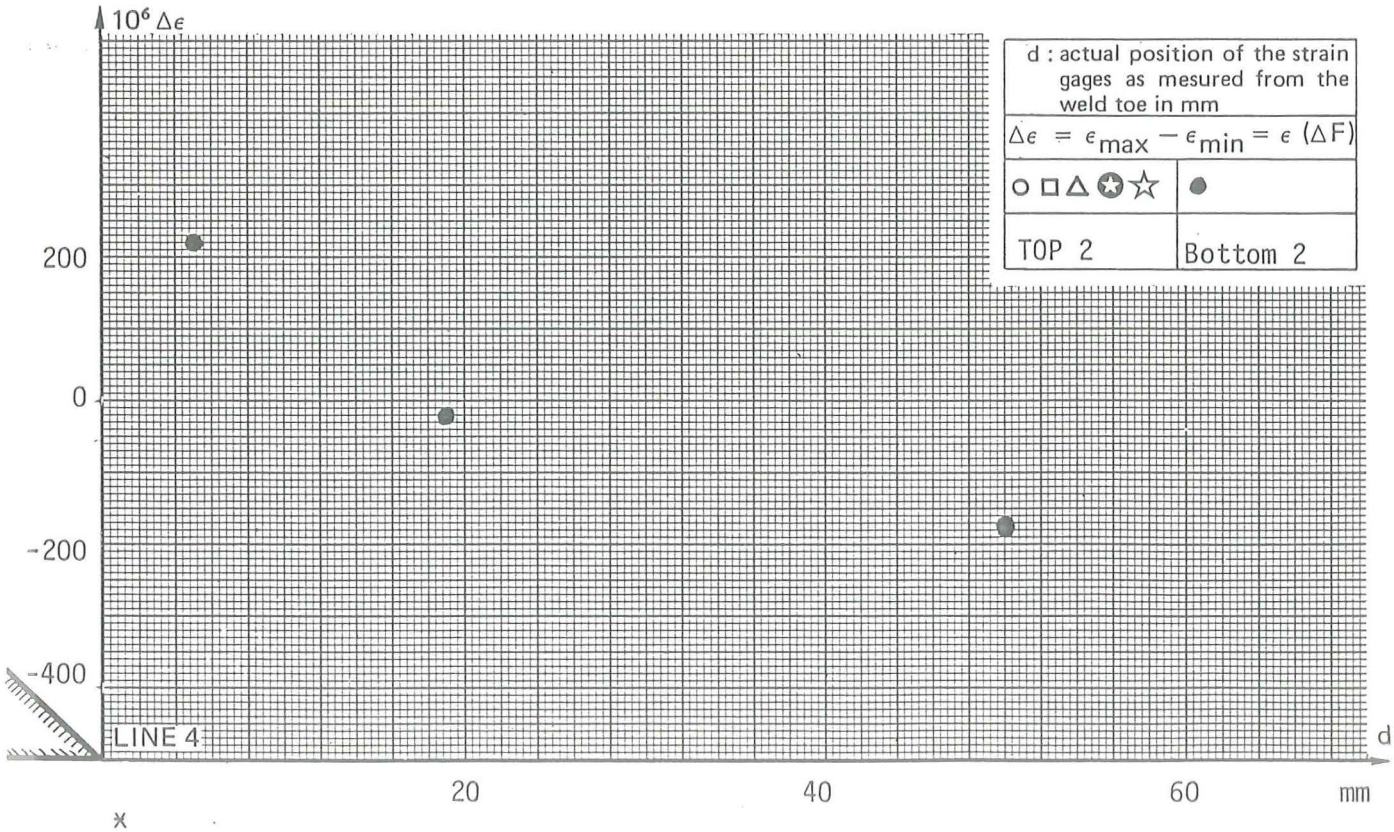
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 40.000 cycles

F_{min}(kN)	F_{max}(kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
-260	260	-1		3	517 (see page 4)





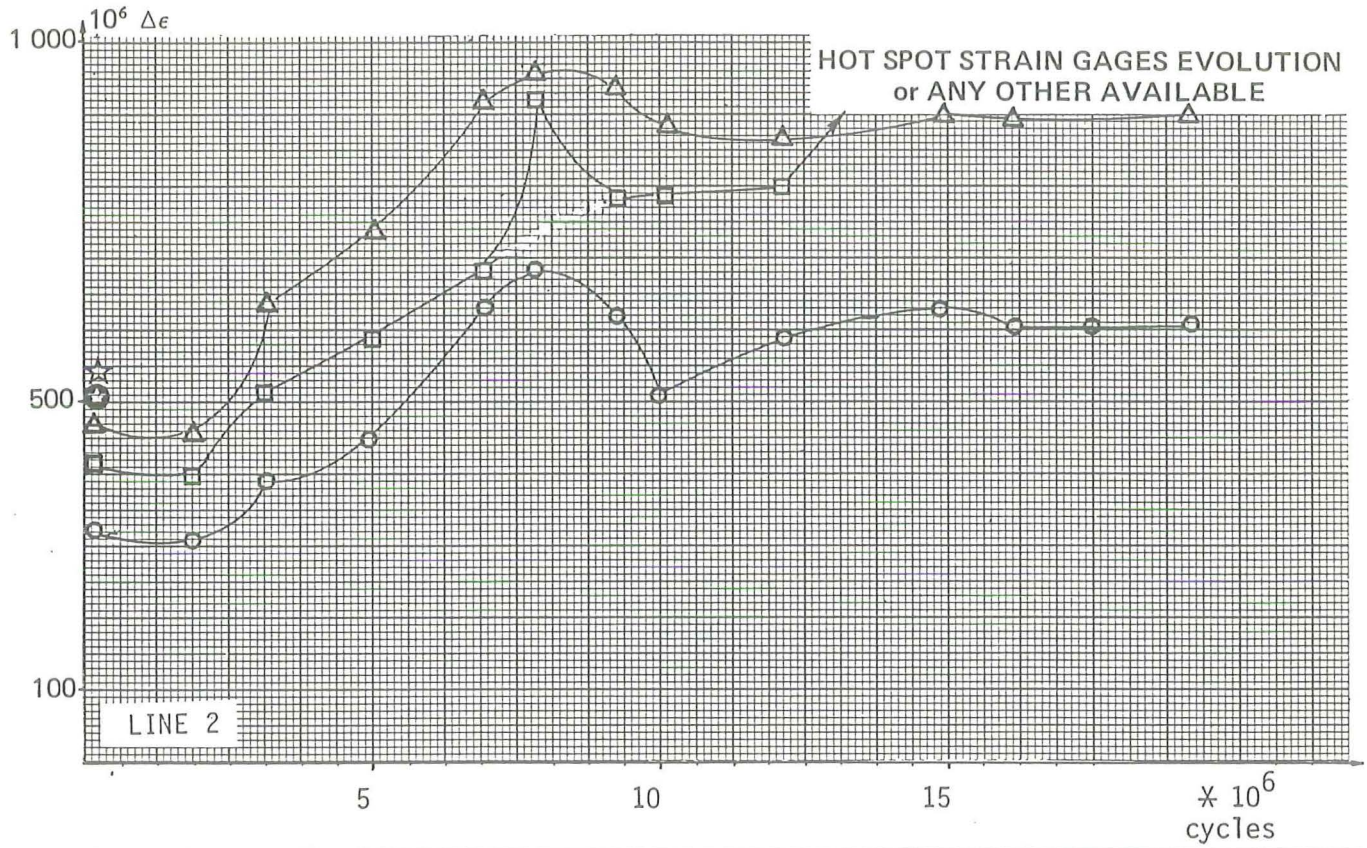
* The calculation has been based on the average SNCF's of the identical specimens

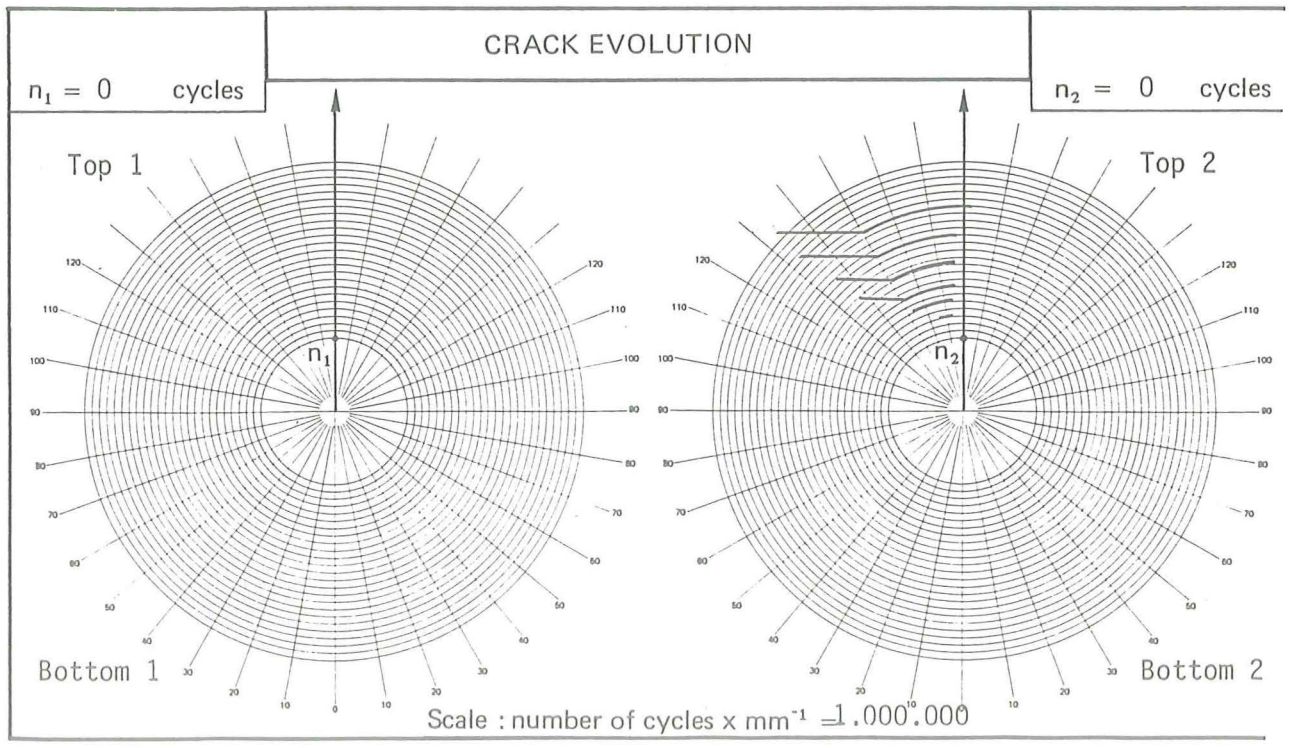
MEASUREMENTS DURING FATIGUE TESTING

FATIGUE TESTING CONDITIONS : in air/~~in sea water~~ – ~~with~~/without protection.

FAILURE CRITERION	$\Delta\epsilon$ – 15 %	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	2.6×10^6	3.2×10^6	1.0×10^7	1.9×10^7	

(1) A : complete failure
B : actuator displacement = ... mm
C : secondary cracking total length = ... mm
D : other reason Reduction of stiffness





OTHER RELEVANT INFORMATIONS

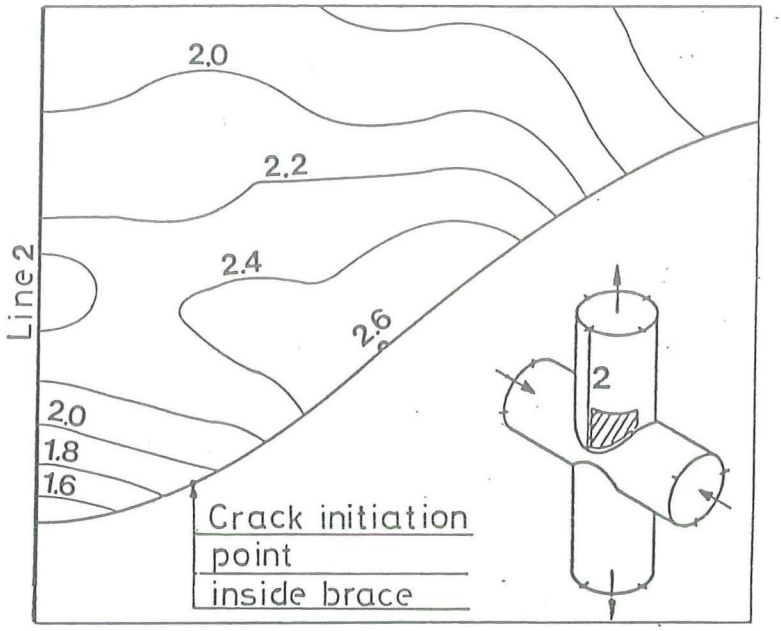


Fig. 1 straindiatribution of X - joint with β=1 and τ=0.55 with chord loading out of phase

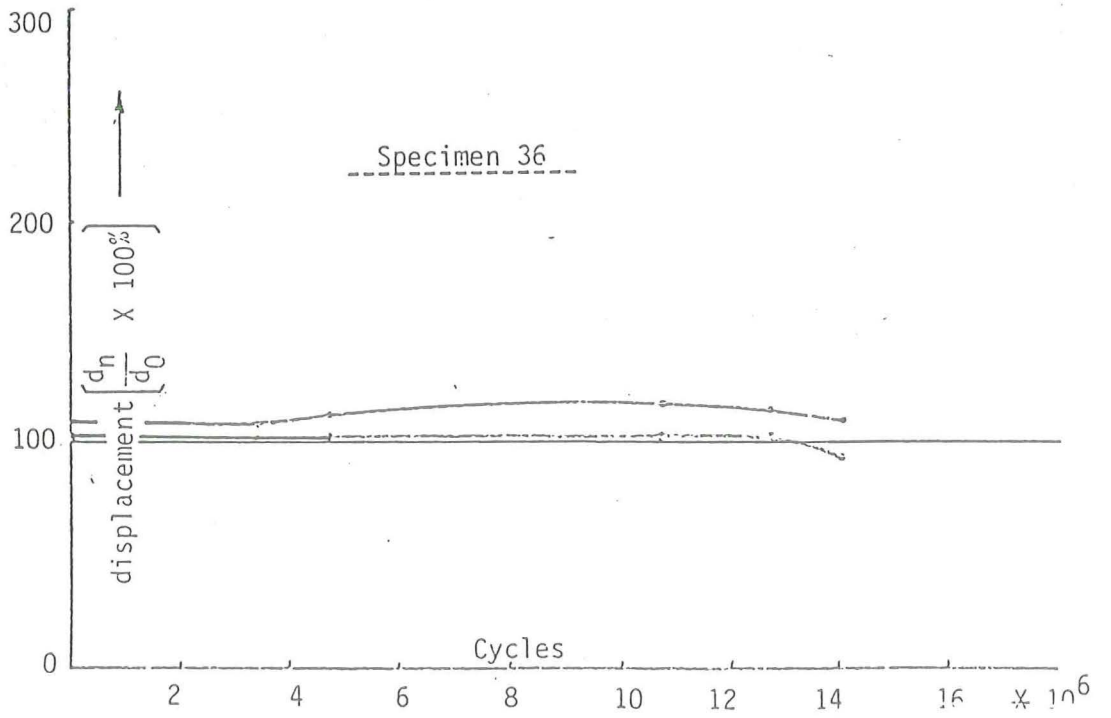


Fig. 2 Evolution of the node elongation per cycle during the test

Explanation HSSR page 2 :

The HSSR which is given on page 2 , has been based on the SNCF at the outside of the brace on line 5 , as shown in fig. 1 .

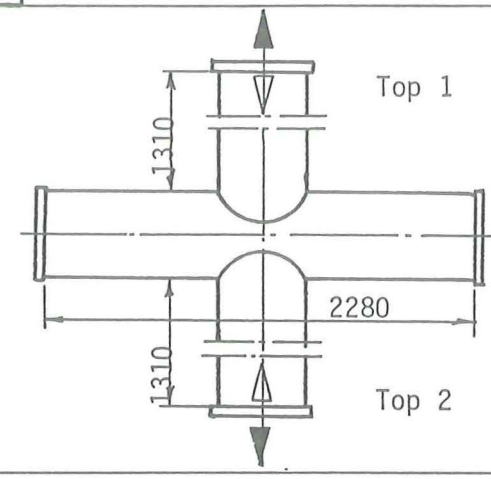
OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	37

GEOMETRY ~~actual~~ values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d_1 457.2	t_1 8.8
	d_2	t_2

SKETCH	geometry, dimensions, loads boundary conditions



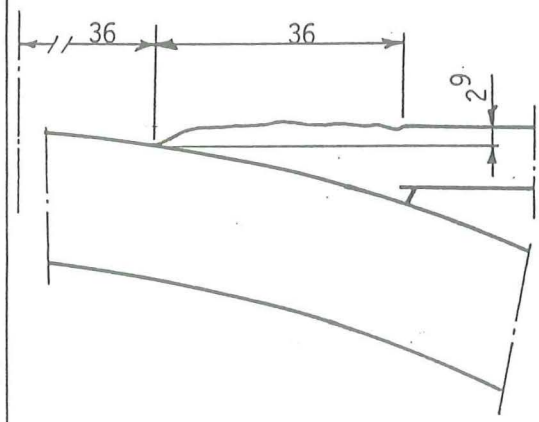
Post weld stress relief H.T. ~~Yes~~ No

ACTUAL PROPERTIES OF CRACKED MEMBER brace (inside)

BASE METAL	Grade : X 60					STD : API - 5 LX					
	C %	Si %	Mn %	S %	P %	Al %					
	0.14	0.30	1.29	0.014	0.020	0.041					

WELDING	Welding process : MMAW , Current : AC Filler materials : — ~~ISO~~ — AWS — : E 7016 Electrode diameter (mm) : 2.5 to 4

WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII



WELDING PROCEDURE	
Position	5G
Nr of runs	5
Energy (kj/m)	-
preheat. temp. (° C)	65
postheat. temp. (° C)	none

POST WELDING TREATMENT

~~Heat treatment — tig or plasma dressing~~

~~Shoot peening — grinding~~

WELD METAL DEPOSIT	C %	Si %	Mn %	S %	P %	Ni %					

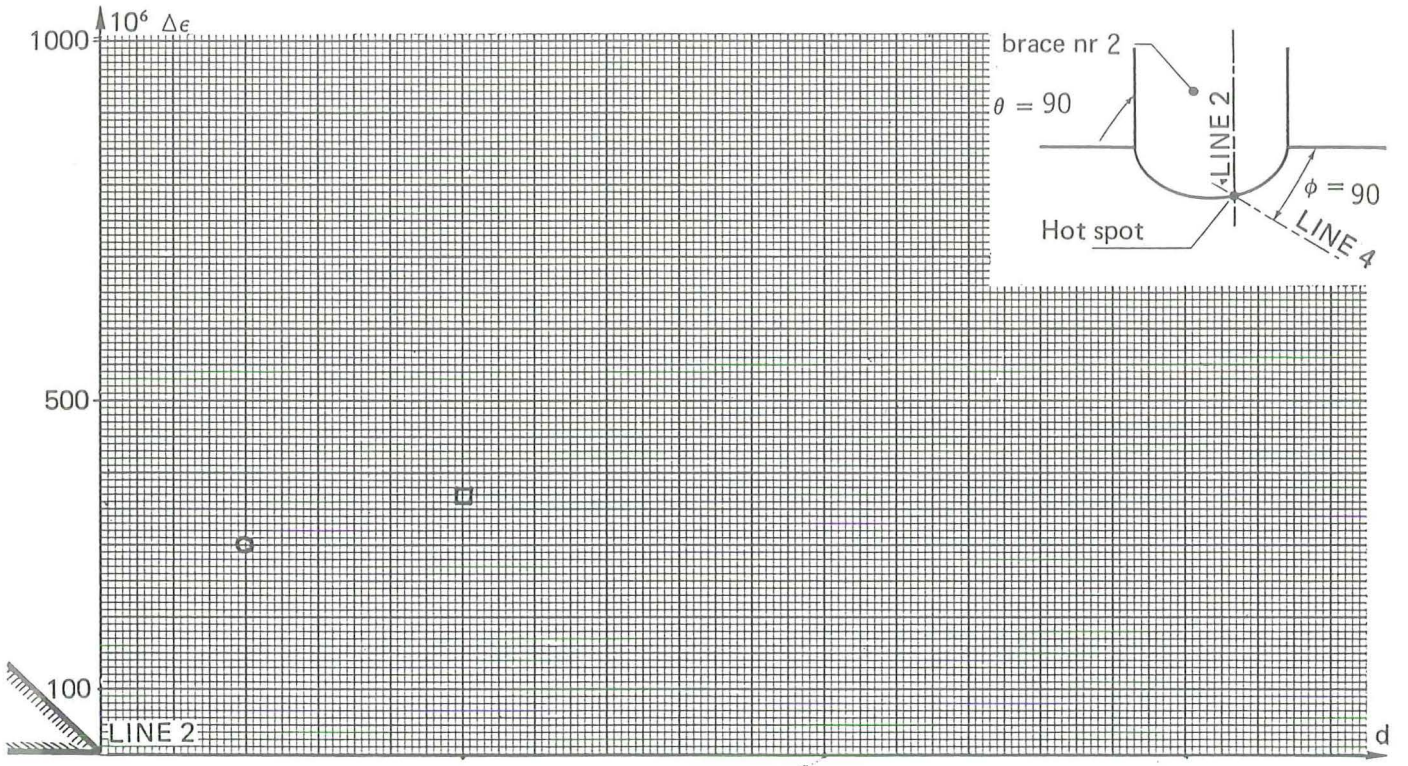
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm²)	482	
Tensile strength σ_u (N/mm²)	580	

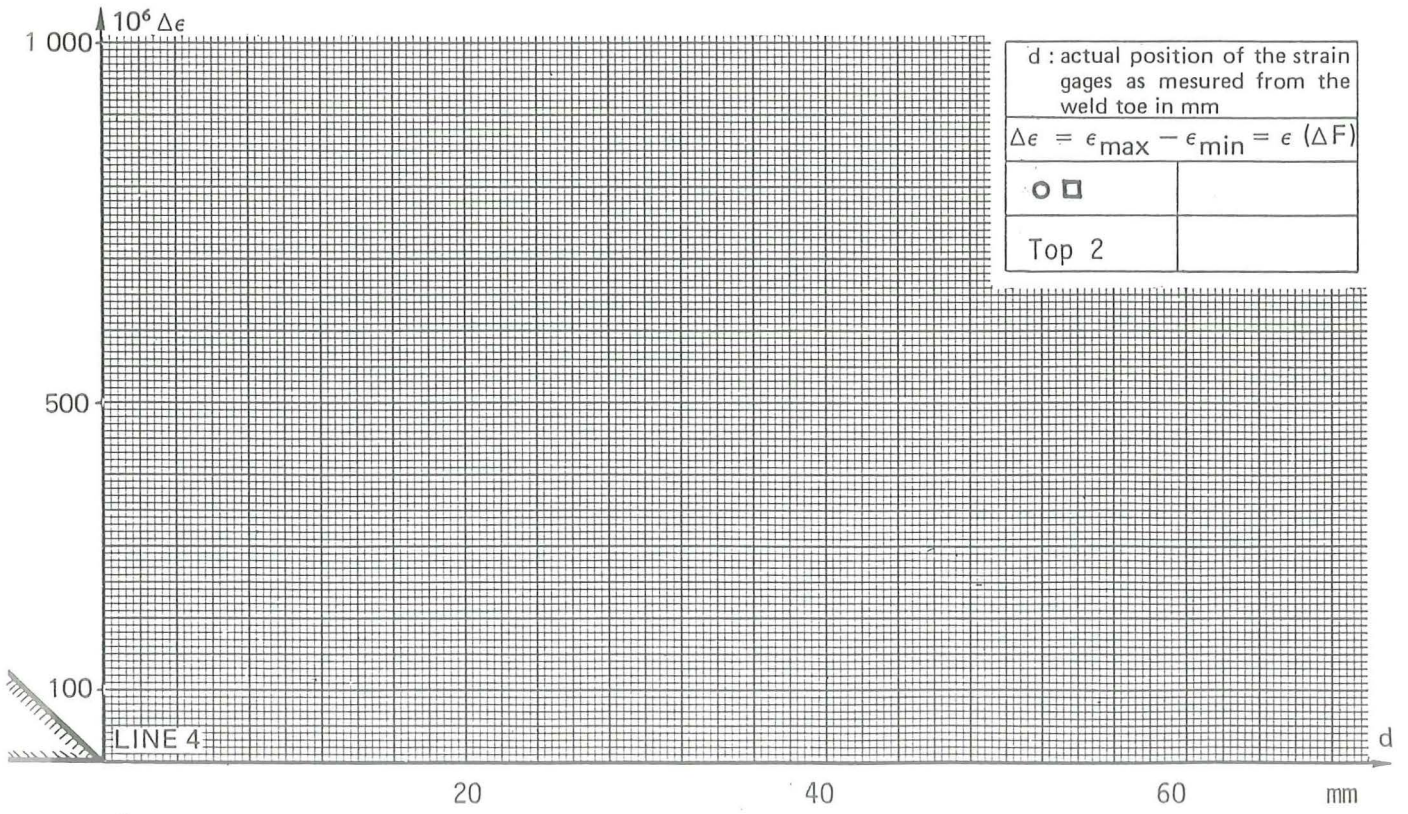
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 10 cycles

F_{min}(kN)	F_{max}(kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange*
-300	300	-1		3	624 (see page 4)





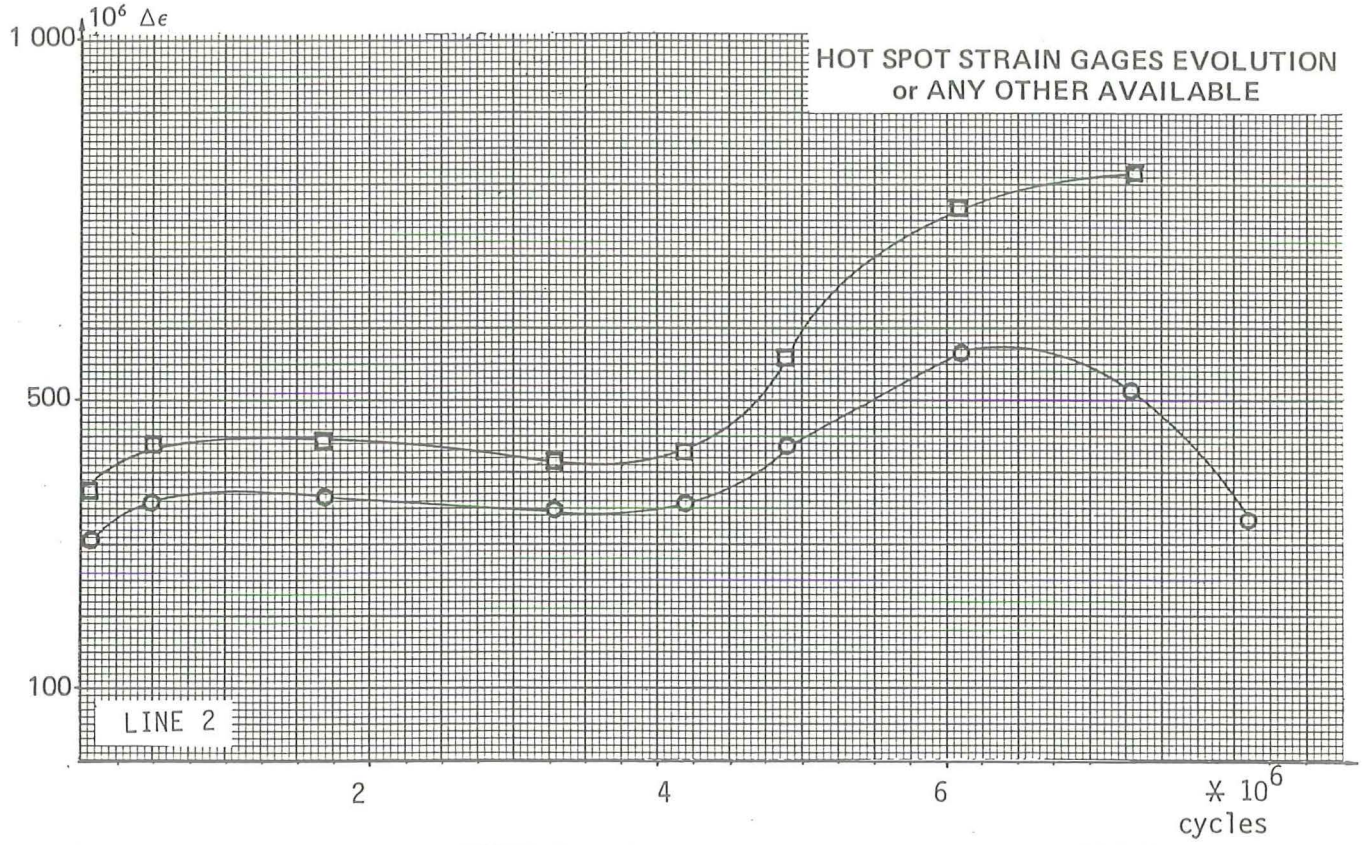
* The calculation has been based on the average SNCF's of the identical specimens.

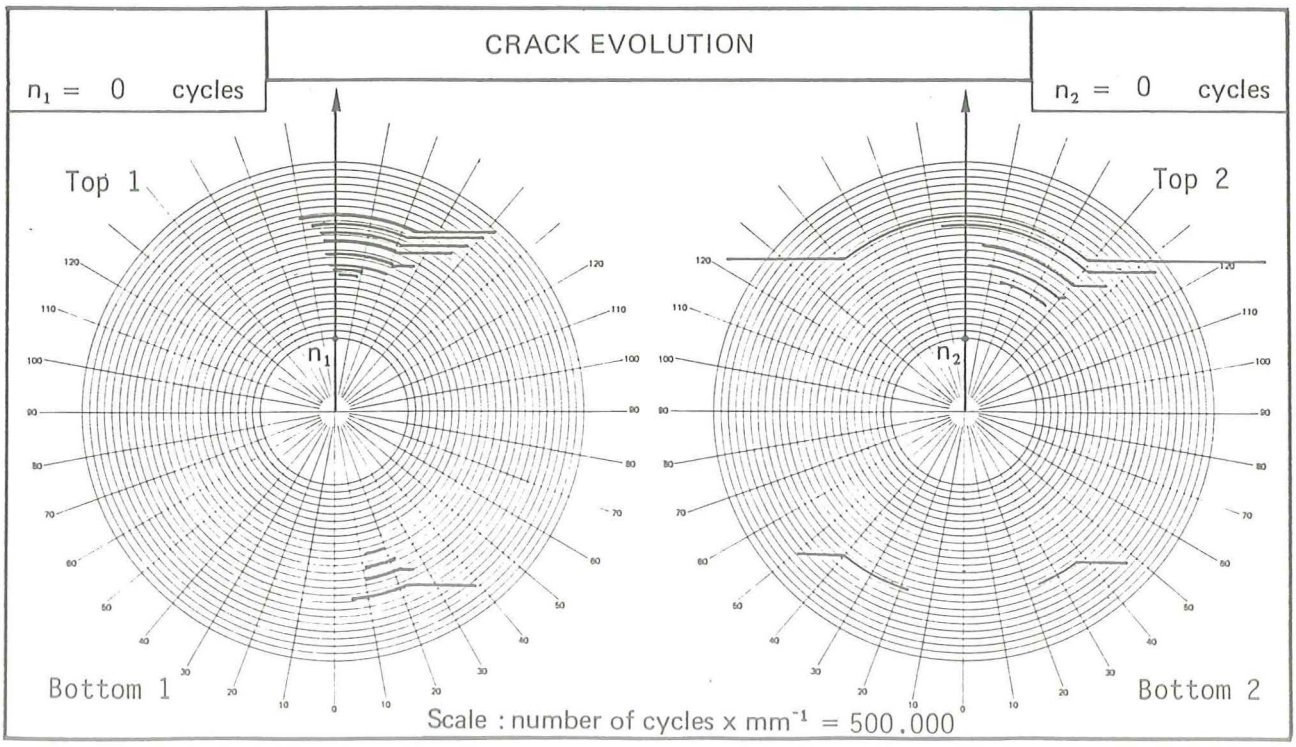
MEASUREMENTS DURING FATIGUE TESTING

FATIGUE TESTING CONDITIONS : in air/~~in sea water~~ — ~~with~~/without protection.

FAILURE CRITERION	$\Delta\epsilon$ + 15 %	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	4.5×10^6	4.3×10^6	6.7×10^6	8.1×10^6	

(1) A : complete failure
B : actuator displacement = ... mm
C : secondary cracking total length = ... mm
D : other reason : Reduction of stiffness





OTHER RELEVANT INFORMATIONS

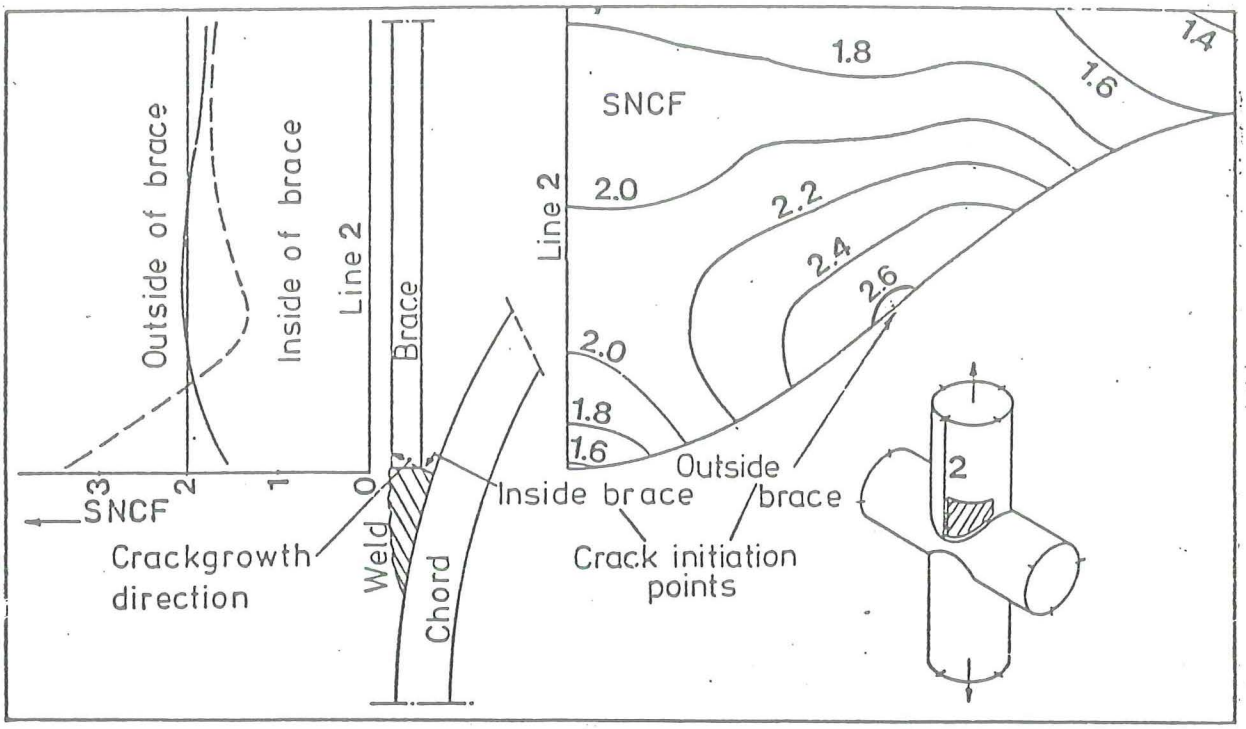


Fig. 1 Straindistribution of X - joints with $\beta=1$ and $\tau=0.55$

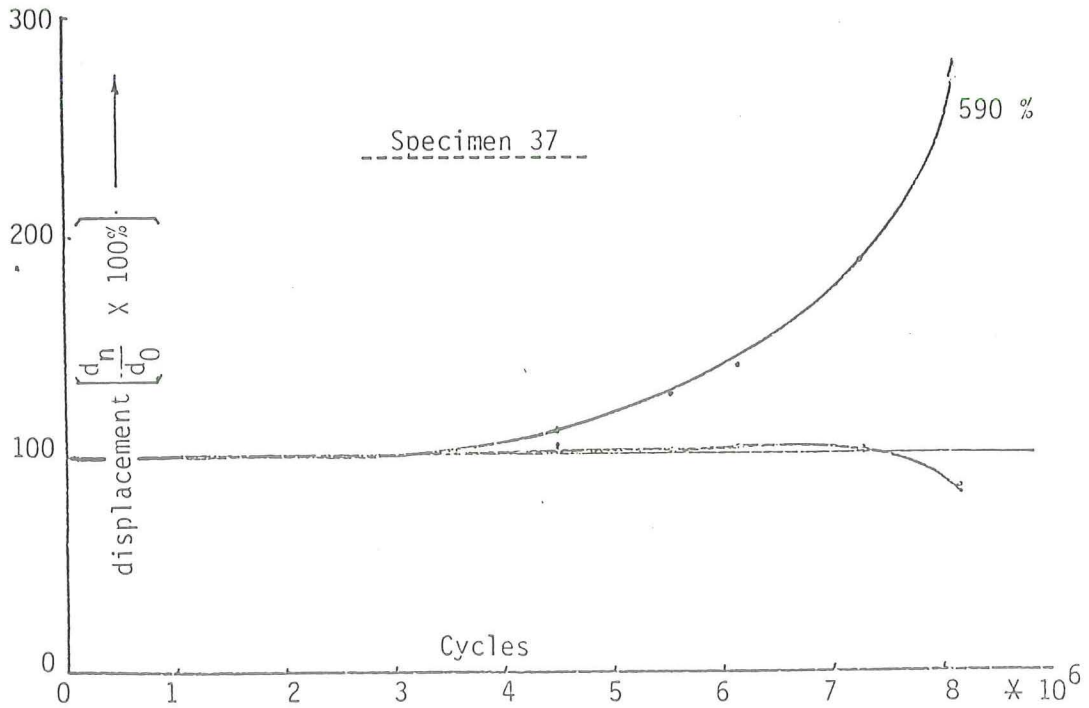


Fig. 2 Evolution of the node elongation per cycle during the test

Explanation HSSR page 2 :

The HSSR which is given on page 2 , has been based on the SNCF at the outside of the brace on line 5 , as shown in fig. 1 .

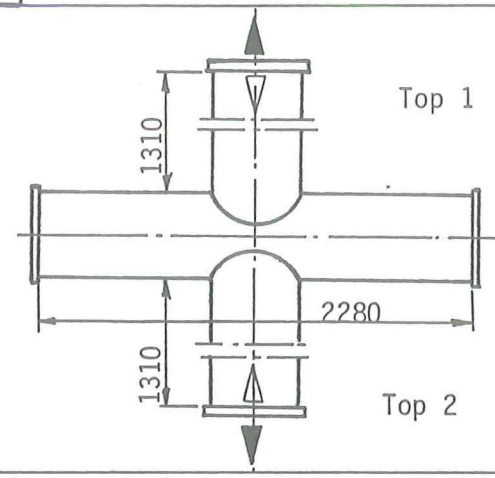
OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	38

GEOMETRY ~~actual~~ values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d_1 457.2	t_1 8.8
	d_2	t_2

SKETCH — geometry, dimensions, loads boundary conditions



Post weld stress relief H.T. ~~Yes~~ No

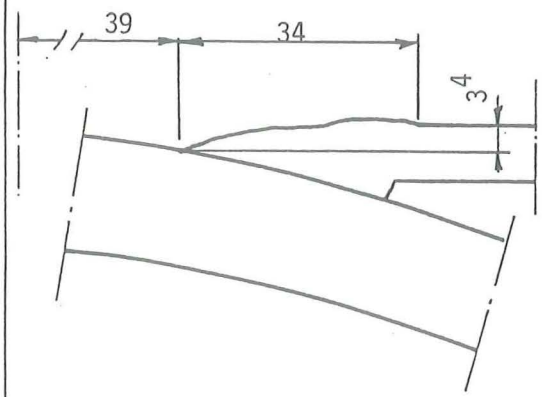
ACTUAL PROPERTIES OF CRACKED MEMBER brace (inside)

BASE METAL	Grade : X 60					STD : API - 5 LX					
	C %	Si %	Mn %	S %	P %	Al %					
	0.14	0.30	1.29	0.014	0.020	0.041					

WELDING

Welding process : MMAW , Current : AC
Filler materials : – ~~ISO~~ – AWS – : E 7016
Electrode diameter (mm) : 2.5 to 4

WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII



WELDING PROCEDURE	
Position	5G
Nr of runs	5
Energy (kj/m)	-
preheat. temp. (° C)	65
postheat. temp. (° C)	none

POST WELDING TREATMENT

~~Heat treatment — tig or plasma dressing~~

~~Shoot peening — grinding~~

WELD METAL DEPOSIT	C %	Si %	Mn %	S %	P %	Ni %					

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm²)	482	
Tensile strength σ_u (N/mm²)	580	

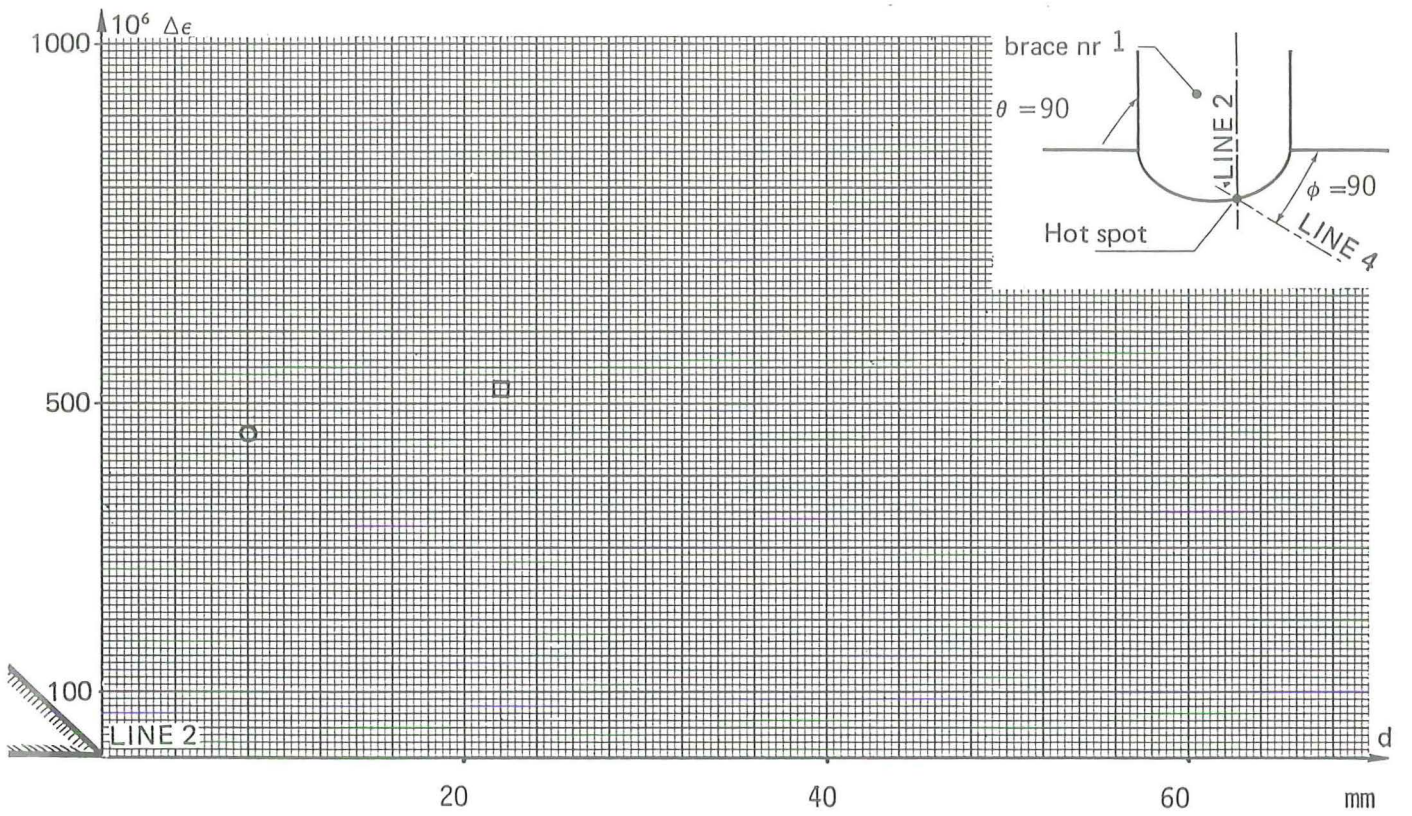
Other properties see page 4

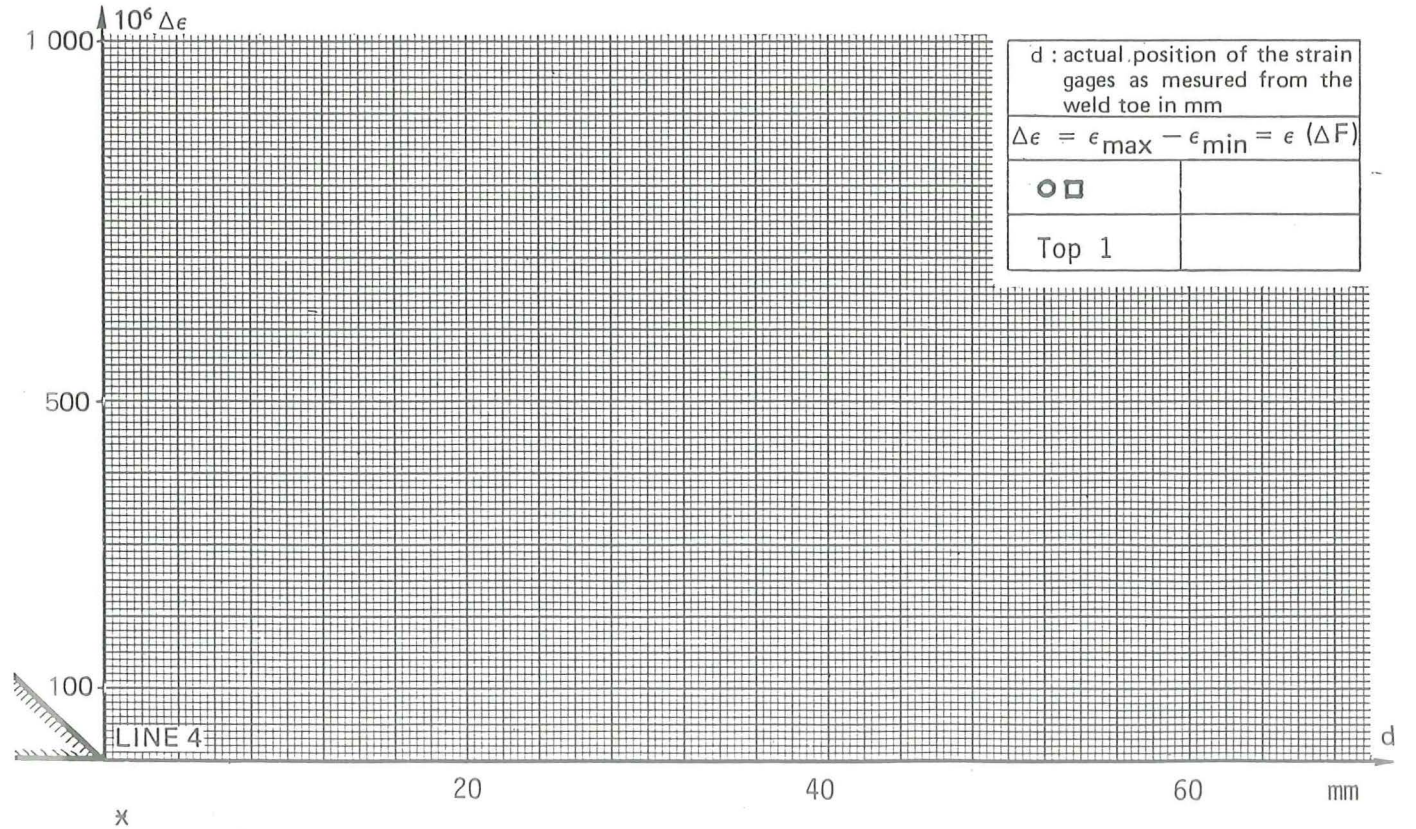
MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 38 - page 2

Number of cycles before measurements : 20.000 cycles

F_{min}(kN)	F_{max}(kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
-287	287	-1		3	594





d : actual position of the strain gages as mesured from the weld toe in mm	
$\Delta\epsilon = \epsilon_{max} - \epsilon_{min} = \epsilon\ (\Delta F)$	
○ □	
Top 1	

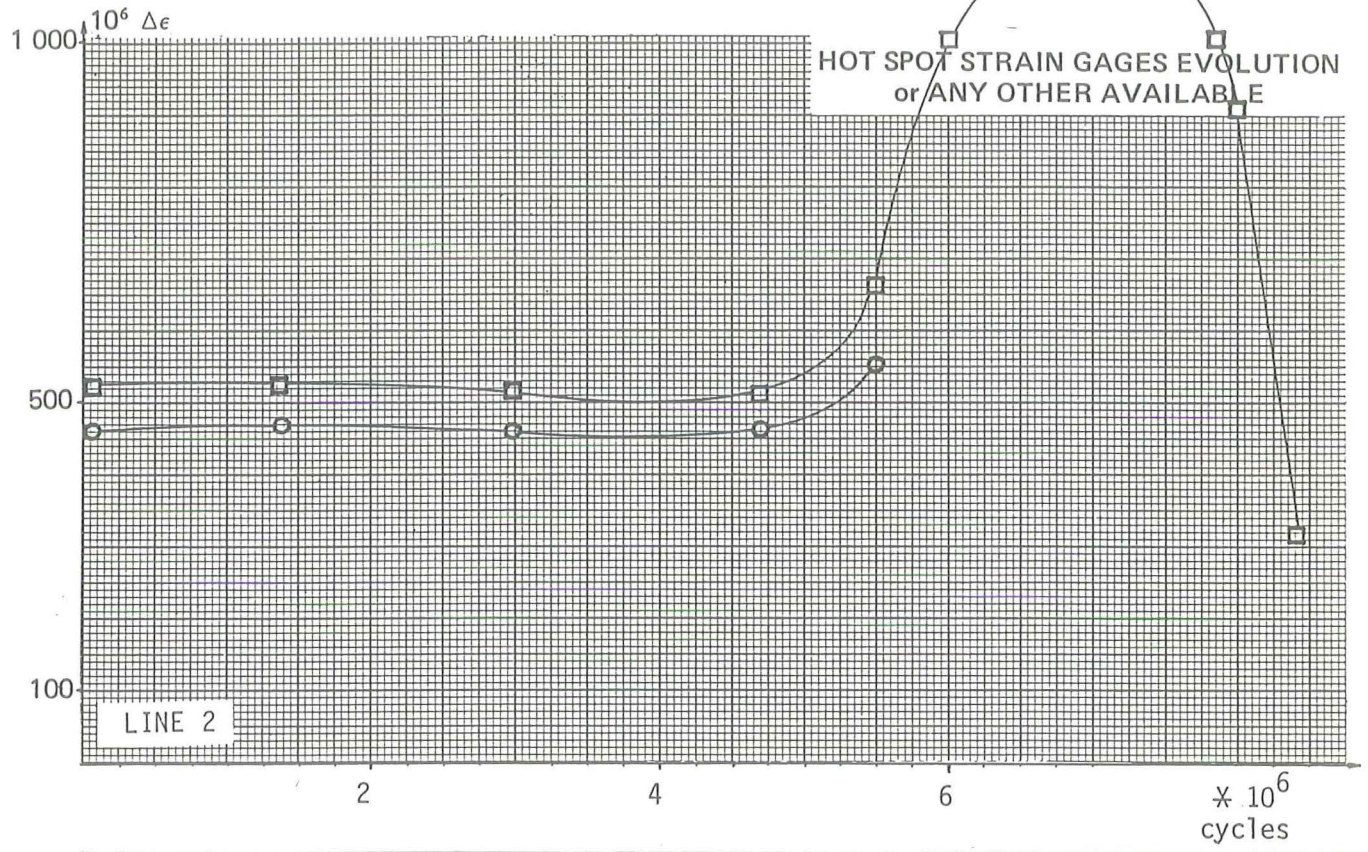
* The calculation has been based on the average SNCF's of the identical specimens.

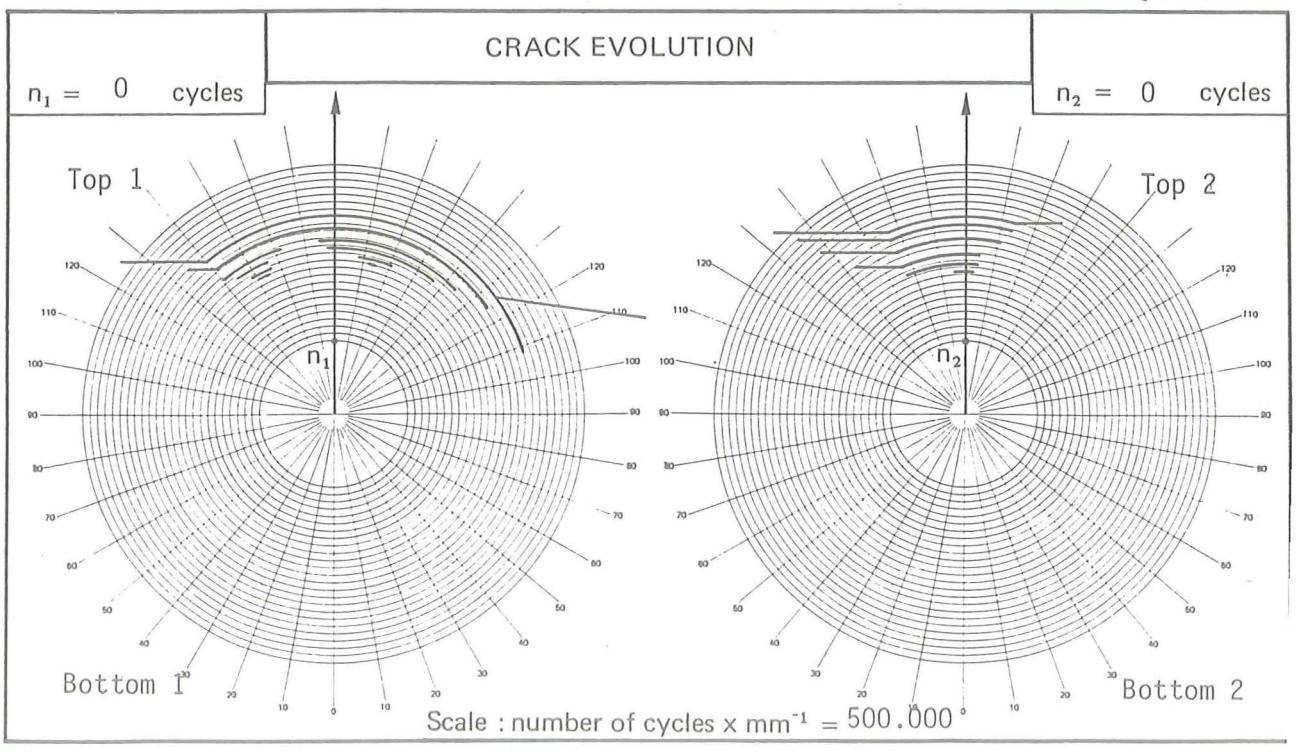
MEASUREMENTS DURING FATIGUE TESTING

FATIGUE TESTING CONDITIONS : in air/~~in sea water~~ ~~with~~/without protection.

FAILURE CRITERION	$\Delta\epsilon$ – 15 %	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	5.2×10^6	5.0×10^6	7.8×10^6	8.5×10^6	

(1) A : complete failure
B : actuator displacement = ... mm
C : secondary cracking total length = ... mm
D : other reason : Reduction of stiffness





OTHER RELEVANT INFORMATIONS

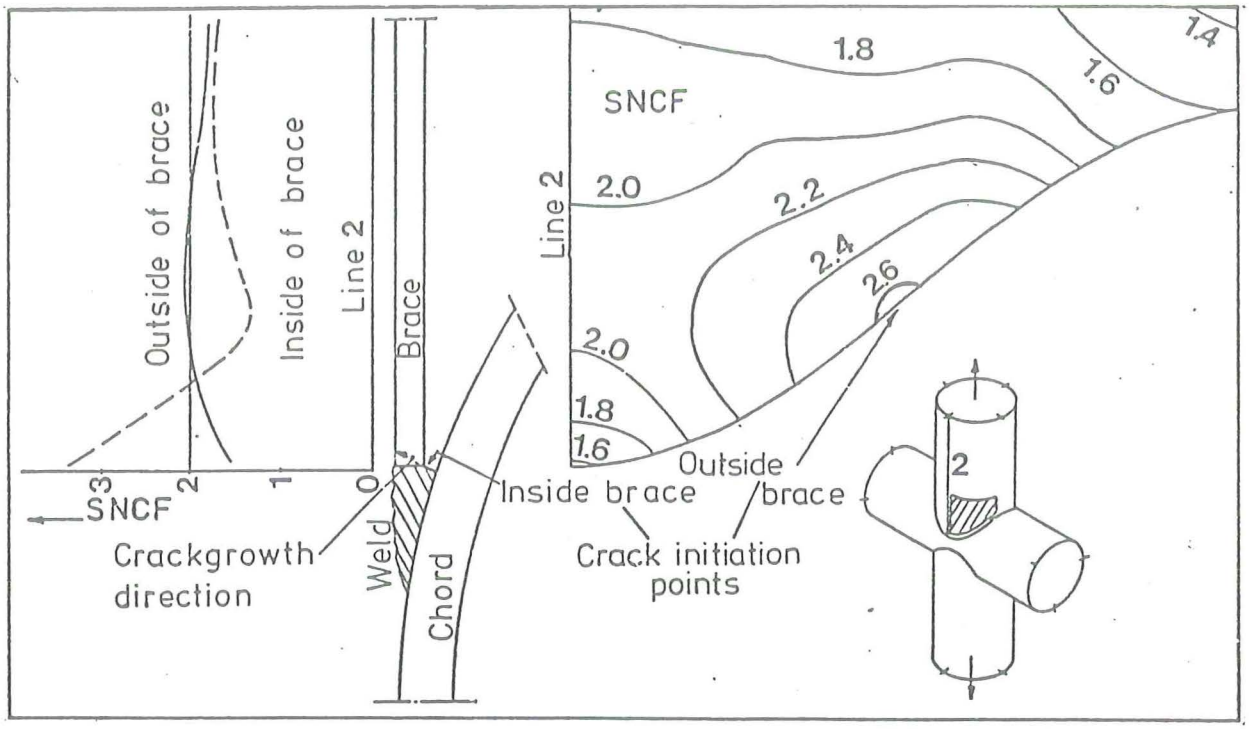


Fig. 1 Straindistribution of X - joints with $\beta=1$ and $\tau=0.55$

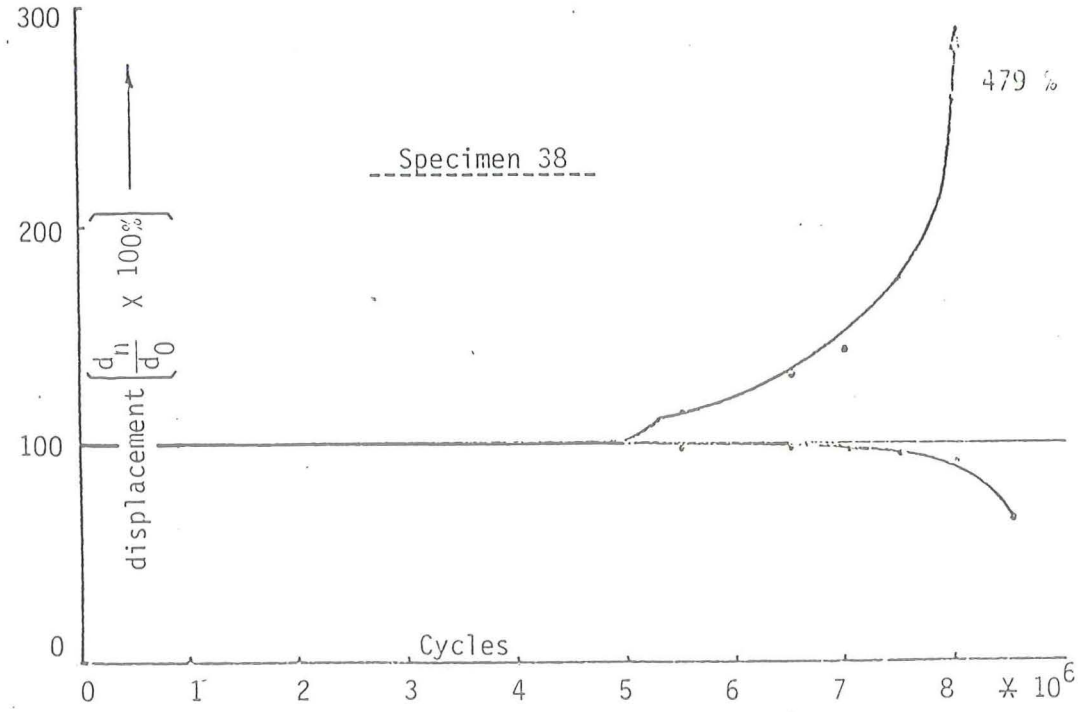


Fig. 2 Evolution of the node elongation per cycle during the test

Explanation HSSR page 2 :

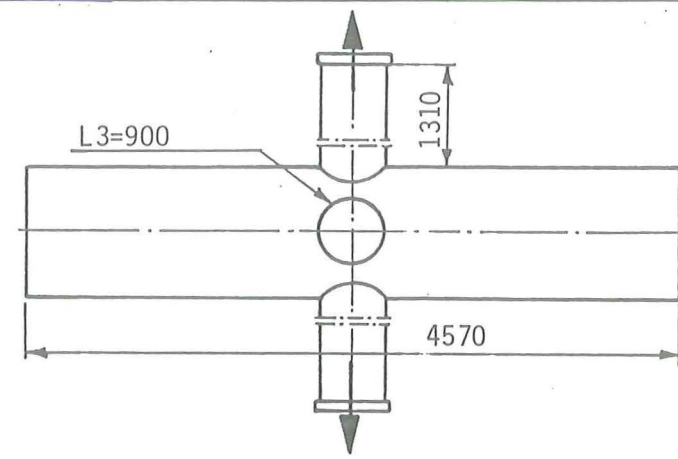
The HSSR which is given on page 2 , has been based on the SNCF at the outside of the brace on line 5 , as shown in fig. 1 .

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	39

SKETCH	geometry, dimensions, loads boundary conditions



Post weld stress relief H.T. ~~Yes~~ No

GEOMETRY ~~actual~~ values in mm

	outside diameter		wall thickness
D	914.4	T	32
d_1	457.2	t_1	16
d_2	457.2	t_2	16

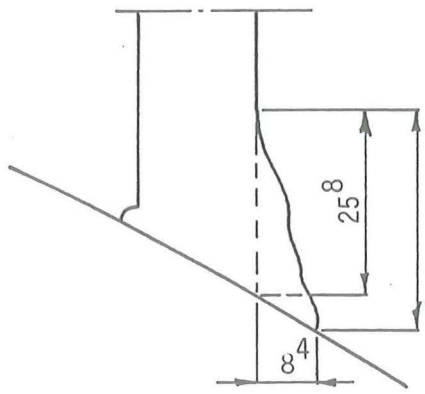
ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : X 52				STD : API - 5LX						
	C %	Si %	Mn %	S %	P %	Al %					
	0.15	0.38	1.29	0.010	0.011	0.027					

WELDING

Welding process : MMAW , Current : AC
Filler materials : – ~~ISO~~ – AWS – ..... : E 7016
Electrode diameter (mm) : 2.5 - 4

WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII



WELDING PROCEDURE	
Position	5G
Nr of runs	6
Energy (kj/m)	
preheat. temp. (° C)	100
postheat. temp. (° C)	none

POST WELDING TREATMENT

~~Heat treatment — tig or plasma dressing~~

~~Shoot peening — grinding~~

WELD METAL DEPOSIT	C %	Si %	Mn %	S %	P %	Ni %					

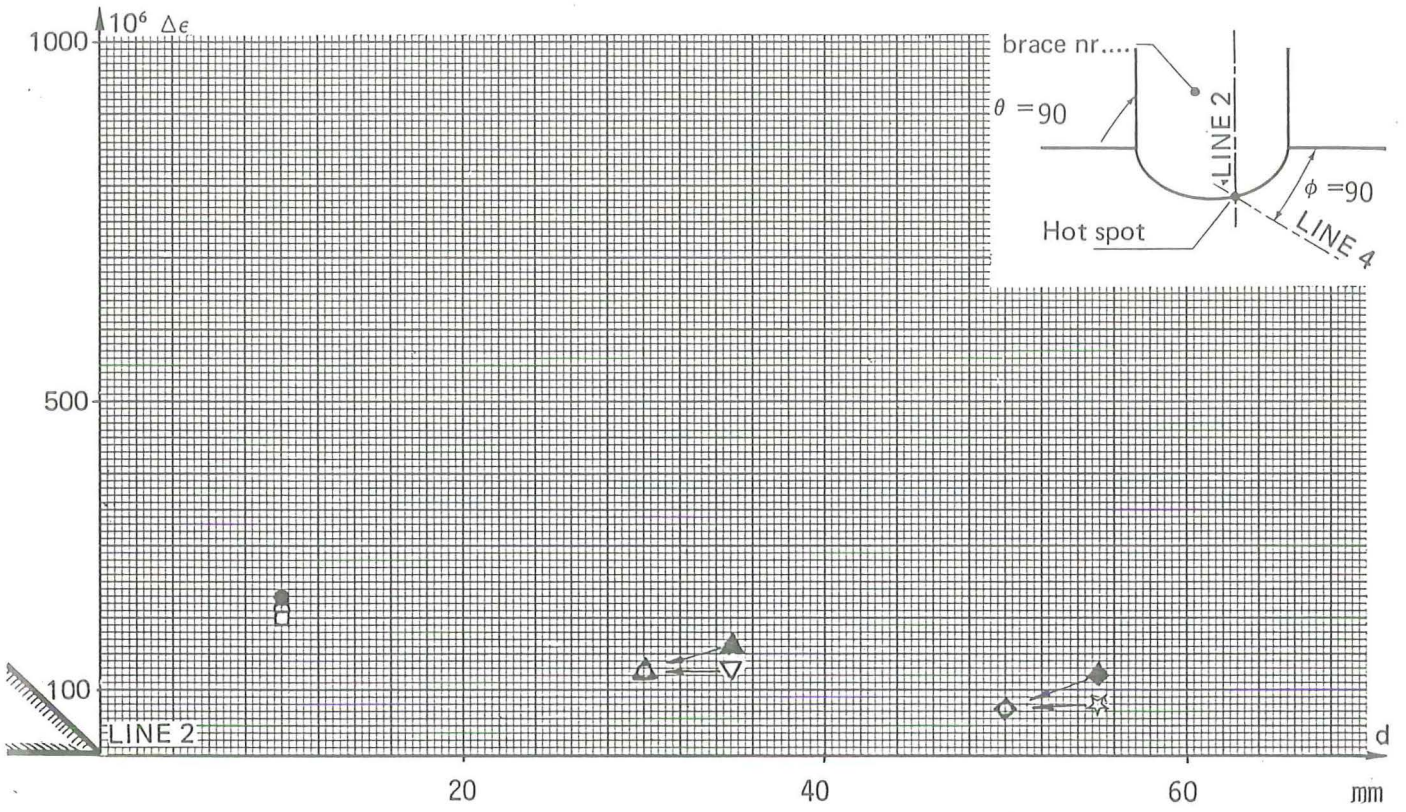
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm²)	366	
Tensile strength σ_u (N/mm²)	532	

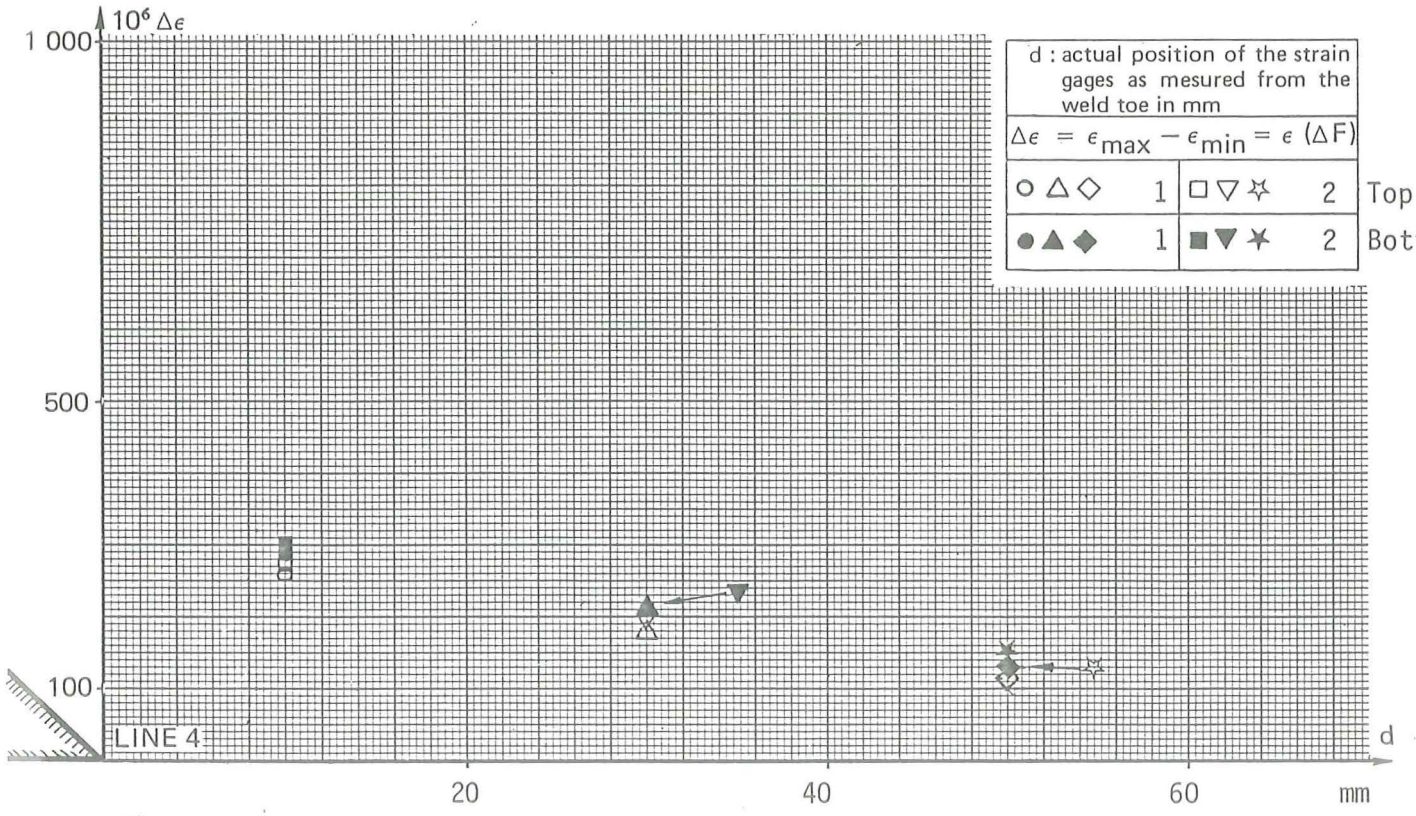
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 10 cycles

F_{min}(kN)	F_{max}(kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	150	0		6	314





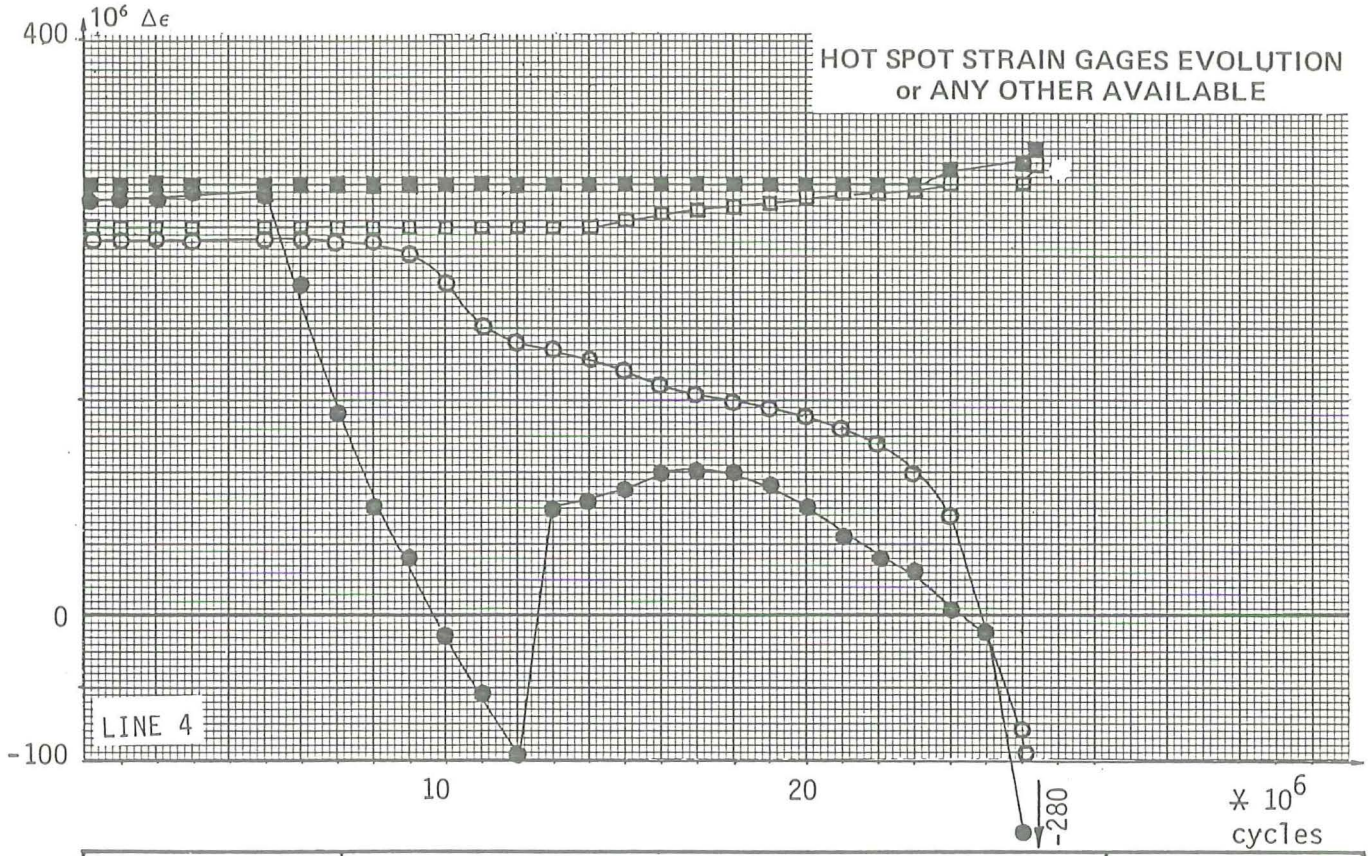
* The calculation has been based on the average SNCF's of the identical specimens

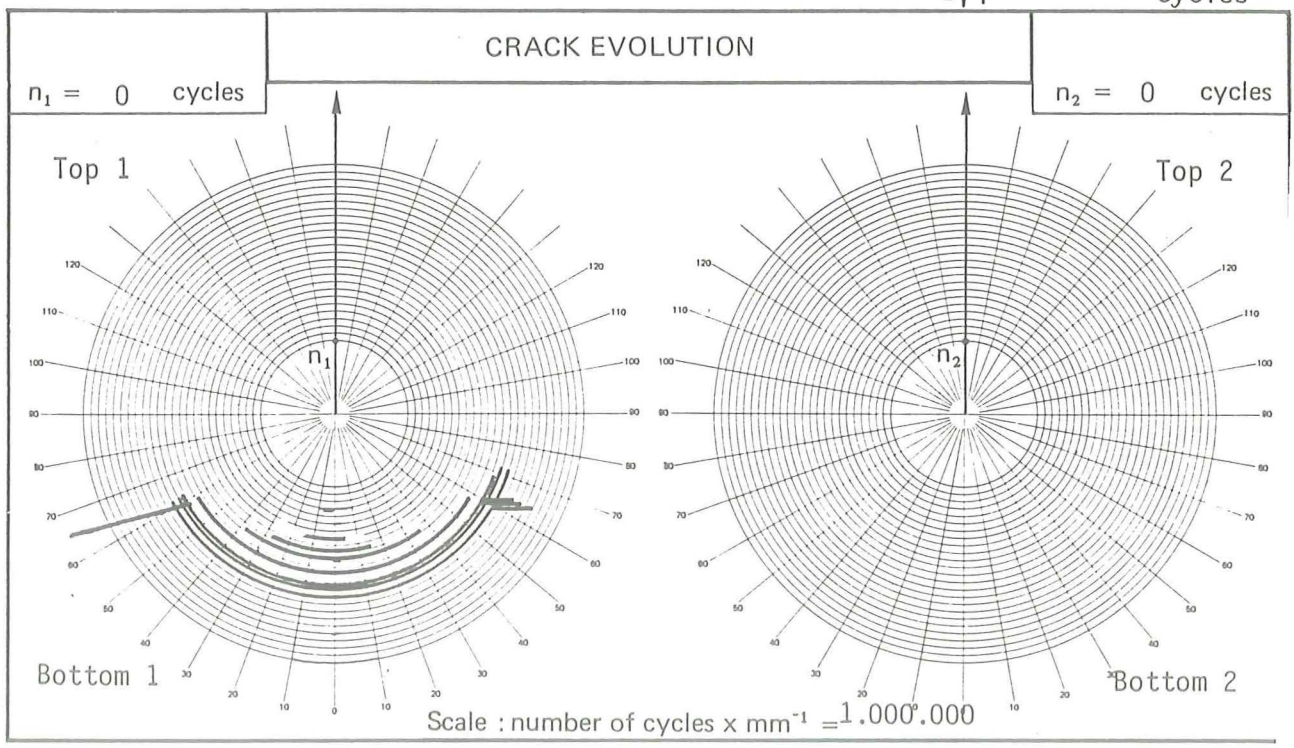
MEASUREMENTS DURING FATIGUE TESTING

FATIGUE TESTING CONDITIONS : in air/~~in sea water~~ — ~~with~~/without protection.

FAILURE CRITERION	$\Delta\epsilon$ — 15 %	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	5.5×10^6	3.0×10^6	2.0×10^7	2.6×10^7	

(1) A : complete failure
B : actuator displacement = ... mm
C : secondary cracking total length = ... mm
D : other reason : Reduction of stiffness





OTHER RELEVANT INFORMATIONS

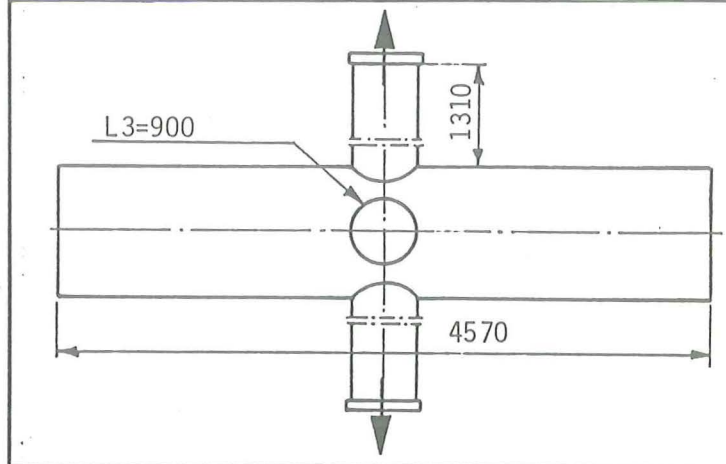
OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	40

GEOMETRY ~~actual~~ values in mm	outside diameter		wall thickness	
	D	914.4	T	32
	d_1	457.2	t_1	16
	d_2	457.2	t_2	16

SKETCH — geometry, dimensions, loads boundary conditions



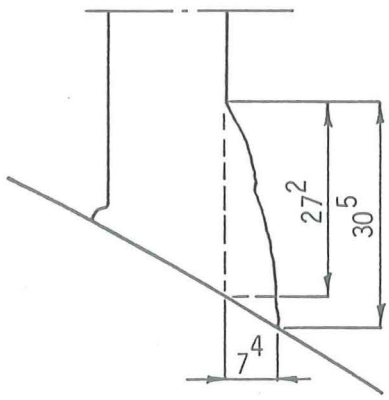
Post weld stress relief H.T. ~~Yes~~ No

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : X 52				STD : API - 5LX						
	C %	Si %	Mn %	S %	P %	Al %					
	0.15	0.38	1.29	0.010	0.011	0.027					

WELDING	Welding process : MMAW , Current : AC Filler materials : – ~~ISO~~ – AWS – ..... : E 7016 Electrode diameter (mm) : 2.5 - 4

WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII



WELDING PROCEDURE	
Position	5G
Nr of runs	6
Energy (kj/m)	
preheat. temp. (° C)	100
postheat. temp. (° C)	none

POST WELDING TREATMENT

~~Heat treatment – tig or plasma dressing~~

~~Shoot peening – grinding~~

WELD METAL DEPOSIT	C %	Si %	Mn %	S %	P %	Ni %					

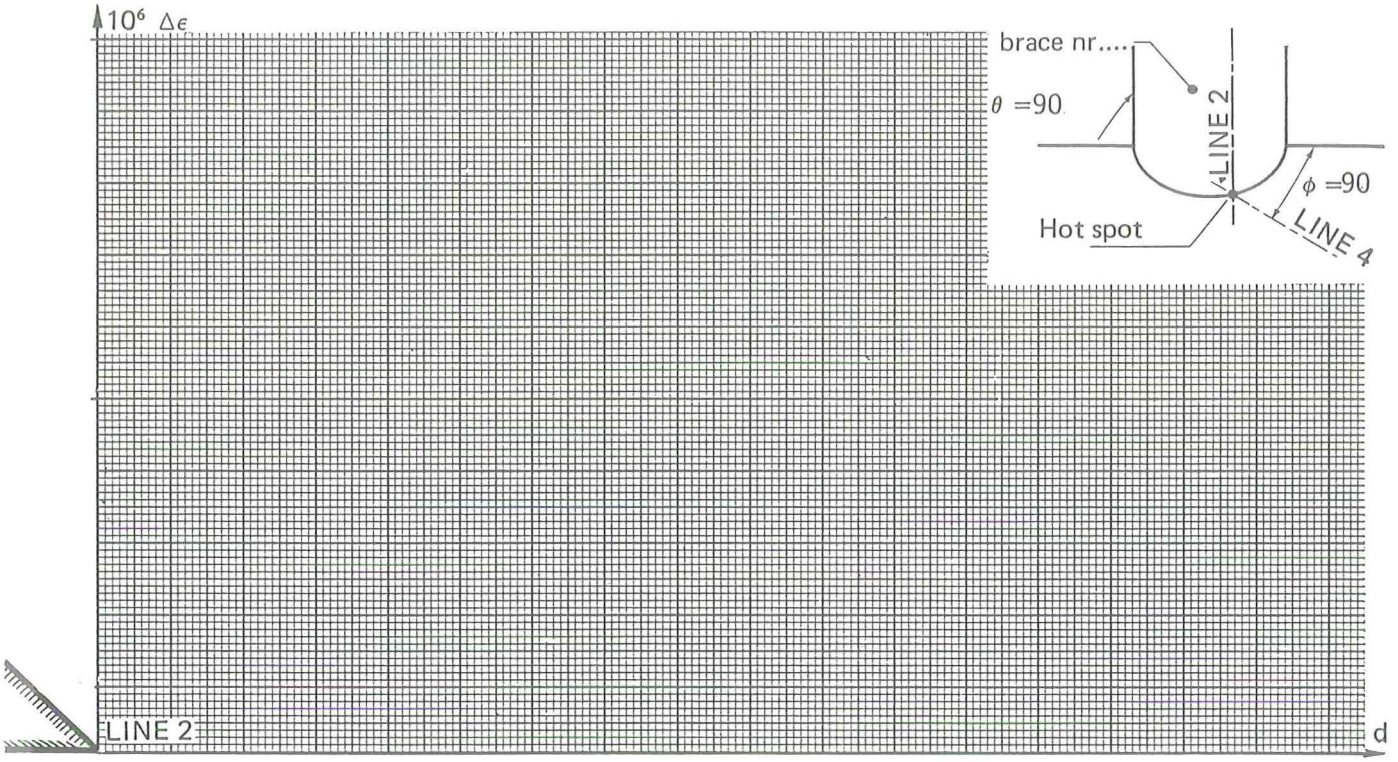
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm²)	366	
Tensile strength σ_u (N/mm²)	532	

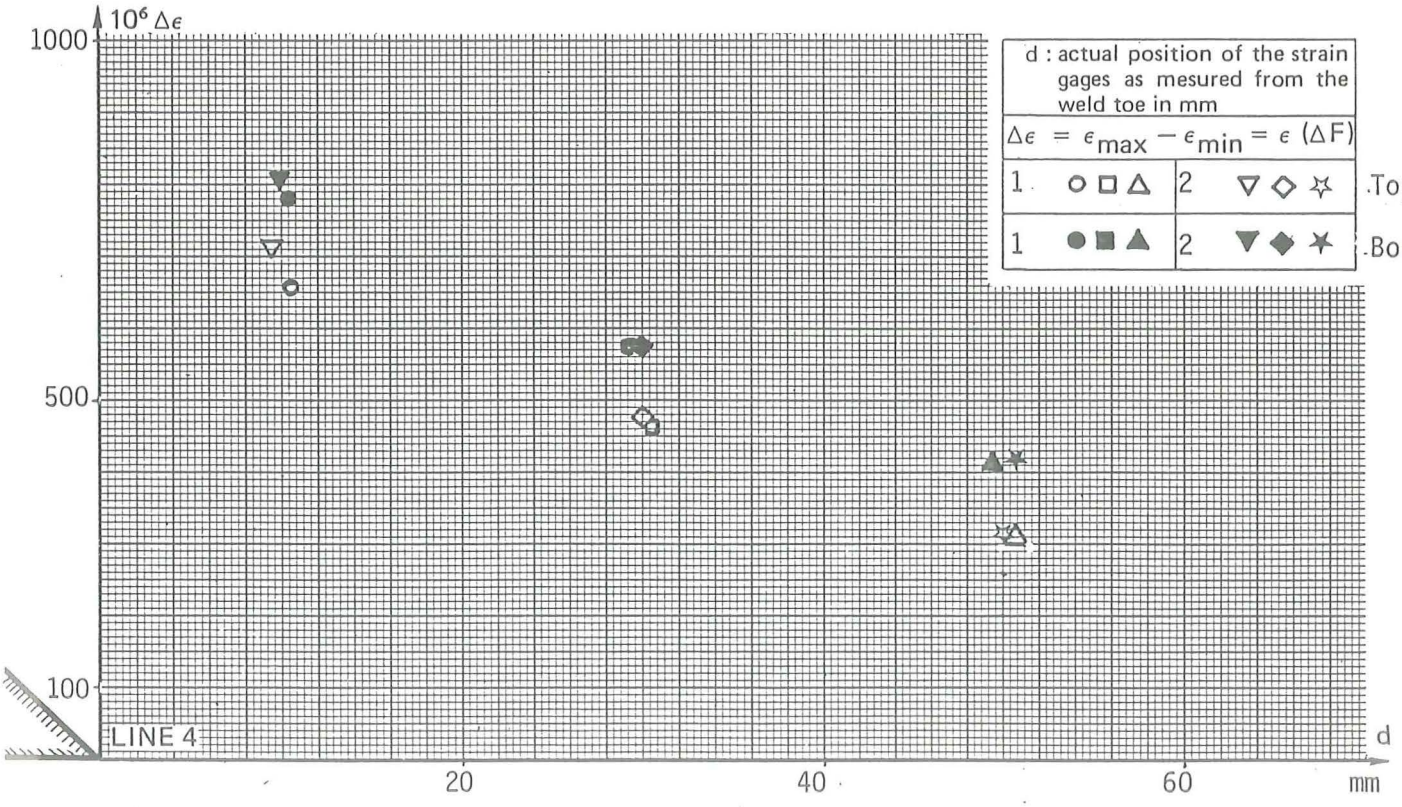
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 1140 cycles

F_{min}(kN)	F_{max}(kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Stainrange *
0	390	0		3	823





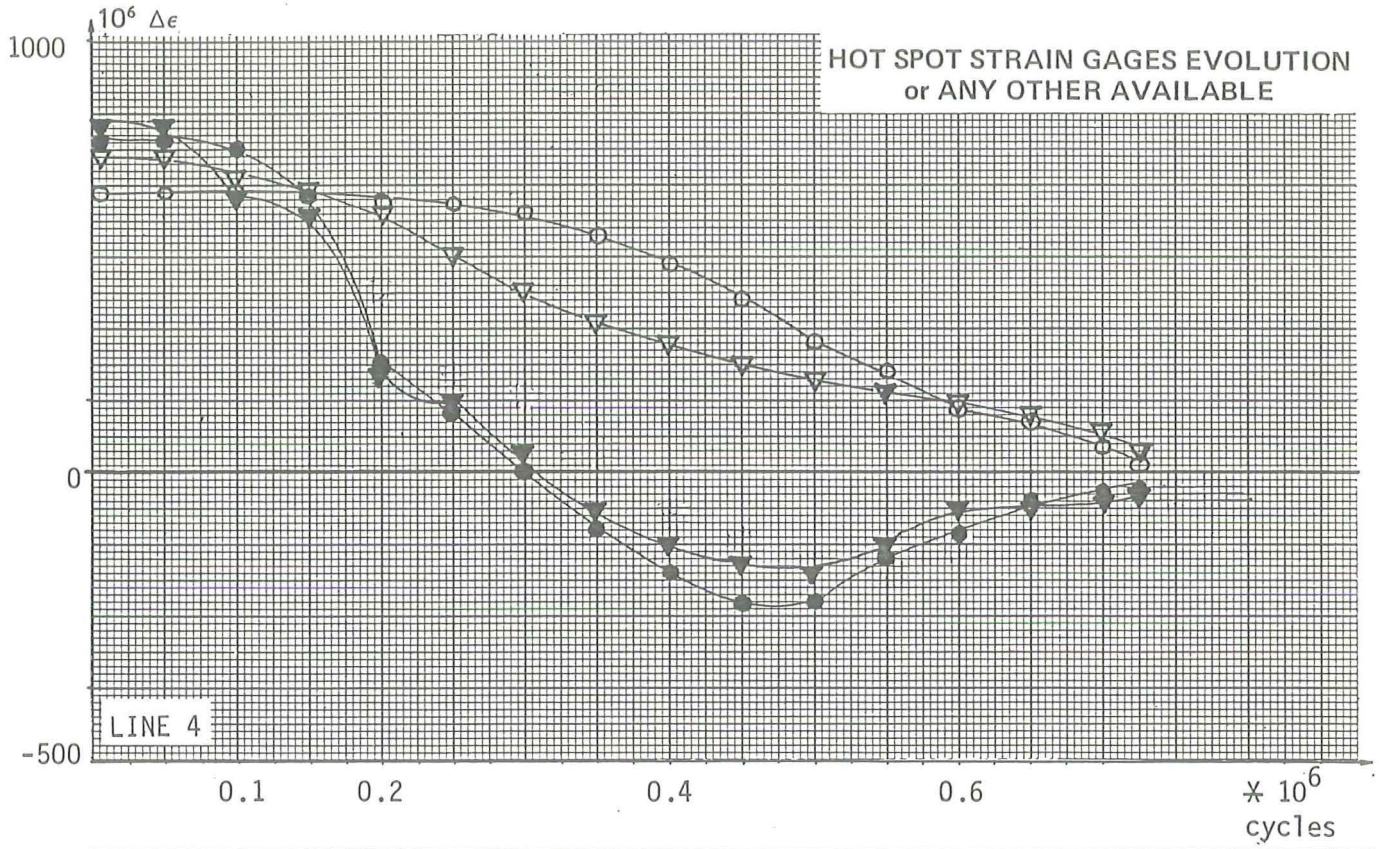
* The calculation has been based on the average SNCF's of the identical specimens

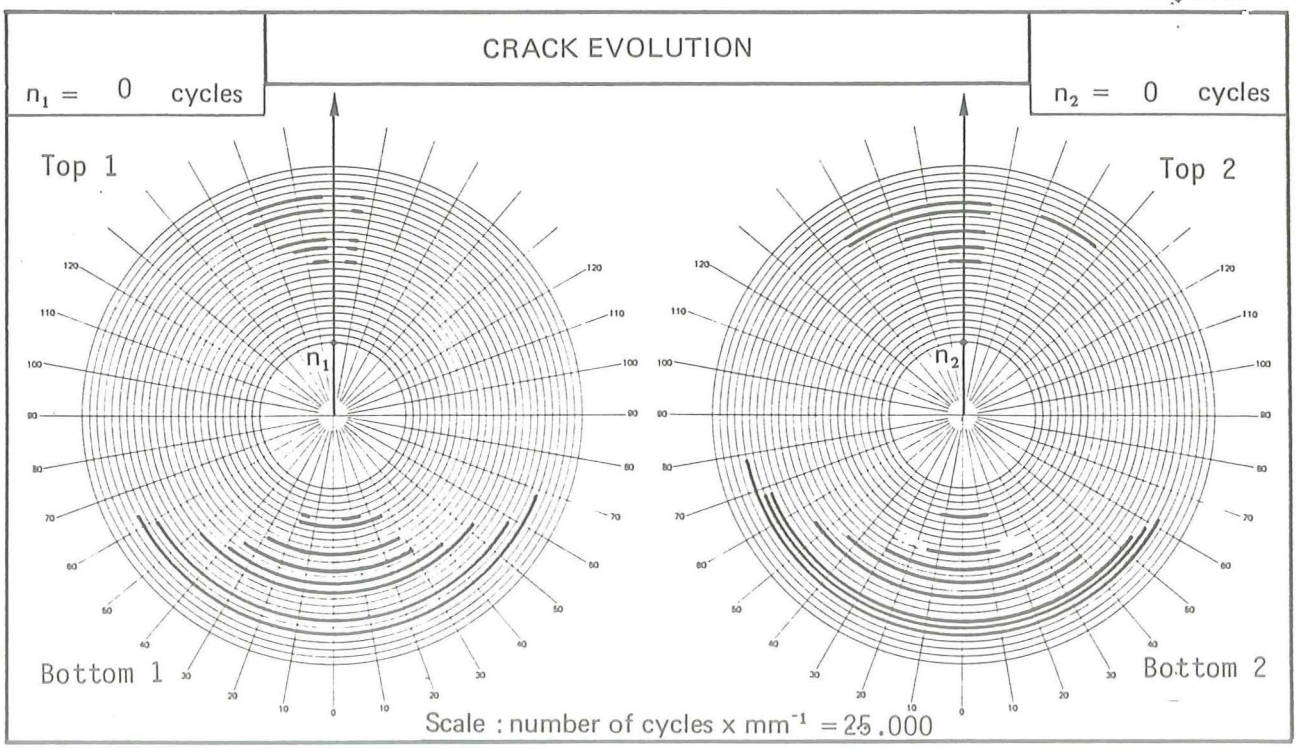
MEASUREMENTS DURING FATIGUE TESTING

FATIGUE TESTING CONDITIONS : in air/~~in sea water~~ — ~~with~~/without protection.

FAILURE CRITERION	$\Delta\epsilon$ — 15 %	Visual crack 42 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	0.9×10^5	1.0×10^5	5.0×10^5	7.3×10^5	

(1) A : complete failure
B : actuator displacement = ... mm
C : secondary cracking total length = ... mm
D : other reason : Reduction of stiffness





OTHER RELEVANT INFORMATIONS

Appendix 3-III

Crack growth diagrams

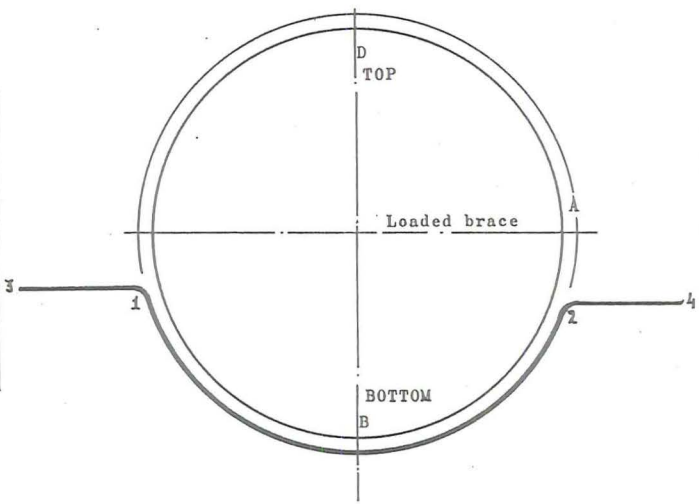
TEST SPECIMEN 1

load range 0 - 84 kN

frequency 10 Hz

N = 63000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	54	54		
3	25	79	63000	63000

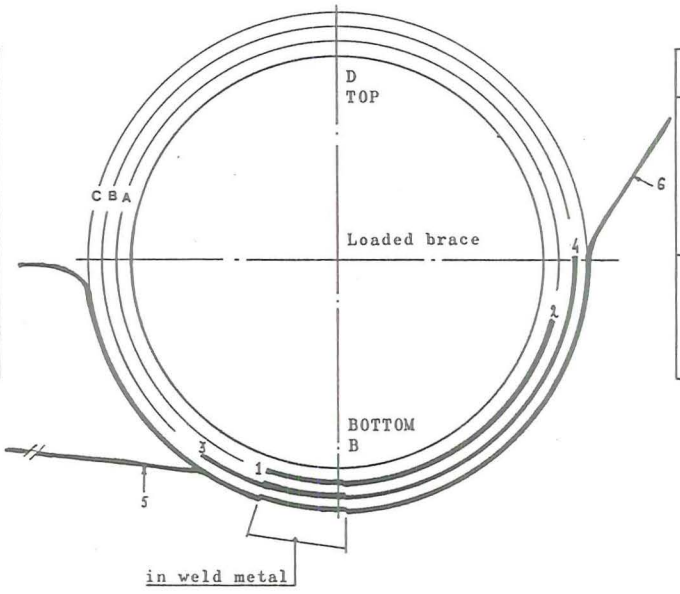


crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	51	51		
4	24	75	63000	63000

A = 63000 cycles

TEST SPECIMEN 2
load range 0 - 28 kN
frequency 10 Hz
N = 12.970.000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	14	14	12500	12500
3	12	26	125	12625
5	15	41	275	12900

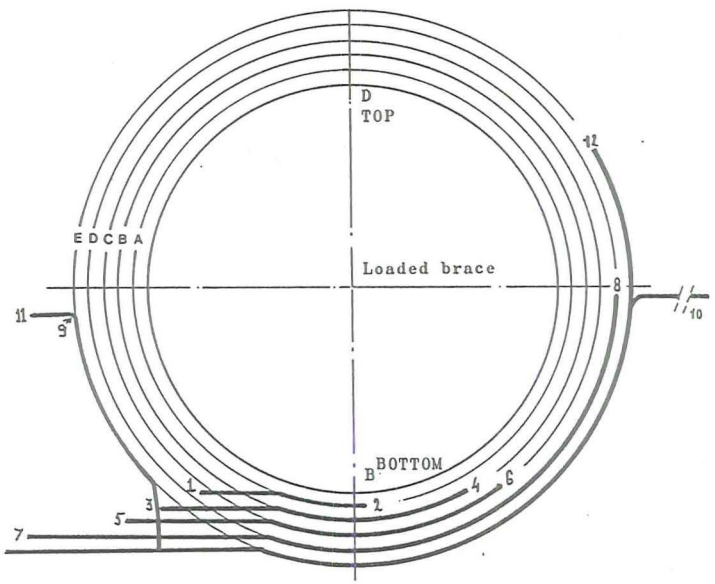


crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	56	56	12500	12500
4	15	71	125	12625
6	36	107	275	12900

A= 12.500.000
B= 12.625.000
C= 12.900.000

TEST SPECIMEN 3
load range 0 - 50 kN
frequency 10 Hz
N = 3.296.000

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	32	32	2580	2580
3	5	37	200	2780
5	5	42	100	2880
7	14	56	400	3280
9	50	82		
11	12	94	15	3295



crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	3	3	2580	2580
4	20	23	200	2780
6	5	28	100	2880
8	40	68	400	3280
10	40	108	15	3295
12	30	98		3295

A = 2.580.000
B = 2.780.000
C = 2.880.000
D = 3.280.000
E = 3.295.000

TEST SPECIMEN 4

load range -42^{5} / 42^{5} kN

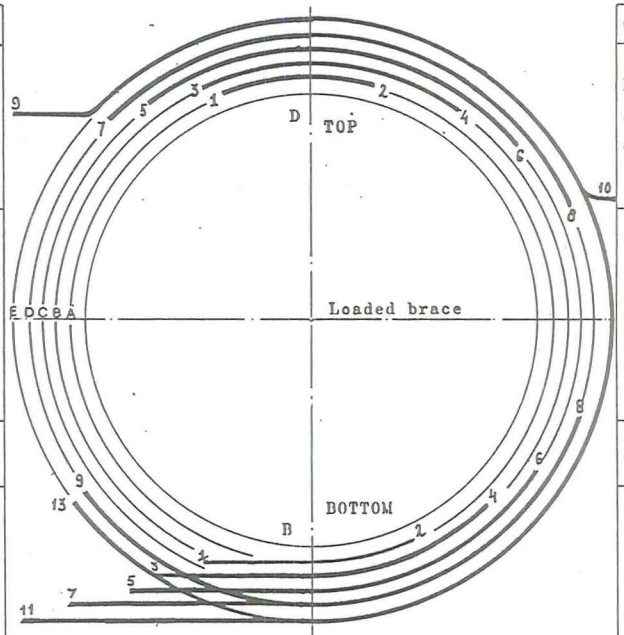
frequentie 0,2 Hz

environment ; SEA WATER

N = 2709656 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	40	40	1298724	1298724
3	8	48	446276	1745000
5	20	68	345704	2090704
7	20	88	380502	2471206
9	56	144	238450	2709656

crack left side of centerline B				
1	51	51	1298724	1298724
3	13	64	446276	1745000
5	18	82	345704	2090704
7	17	99	380502	2471206
9	104	104	380502	2471206
11	10	109	238450	2709656
13	12	116	238450	2709656



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	33	33	1298724	1298724
4	38	71	446276	1745000
6	34	105	345704	2090704
8	27	132	380502	2471206
10	15	147	238450	2709656
	around weld	non	238450	2709656

crack right side of centerline B				
2	48	48	1298724	1298724
4	40	88	446276	1745000
6	22	110	345704	2090704
8	27	137	380502	2471206
	around weld	none	380502	2709656

A = 1298724

B = 1745000

C = 2090704

D = 2471206

E = 2709656

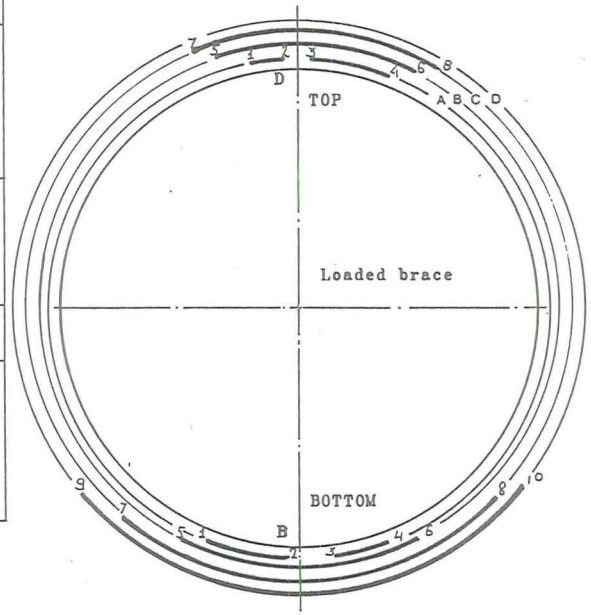
TEST SPECIMEN 5

load range 0 - 160 kN

frequency 4 Hz

N = 777820 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1-2	12	(2) 7	377820	377820
5	23	35	50000	427820
7	9	44	100000	527820
crack left side of centerline B				
1-2	34	(2) 5	377820	377820
5	15	49	50000	427820
7	34	83	100000	527820
9	24	107	100000	627820



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
3-4	34	(3) 5	377820	377820
6	18	52	50000	427820
8	13	65	100000	527820
crack right side of centerline B				
3-4	23	(3) 15	377820	377820
6	27	50	50000	427820
8	40	90	100000	527820
10	17	107	100000	627820

A = 377820 cycles

B = 427820 ,,

C = 527820 ,,

D = 627820 ,,

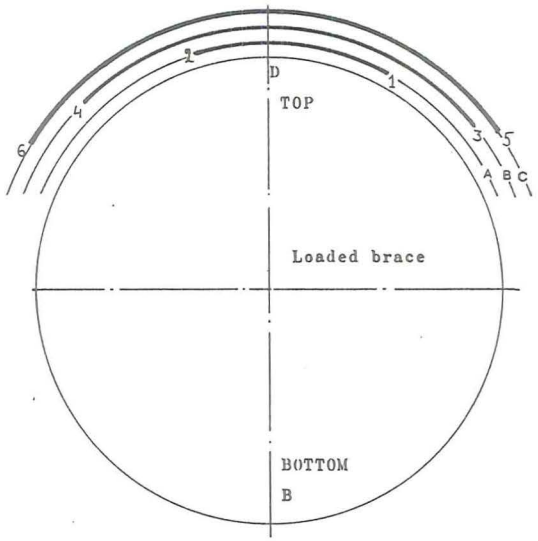
TEST SPECIMEN 7

load range 0 - 144 kN

frequency 4 Hz

N = 1053500 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	36	36	531000	531000
4	50	86	215380	746380
6	45	131	116090	862470



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	49	49	531000	531000
3	46	95	215380	746380
5	21	116	116090	862470

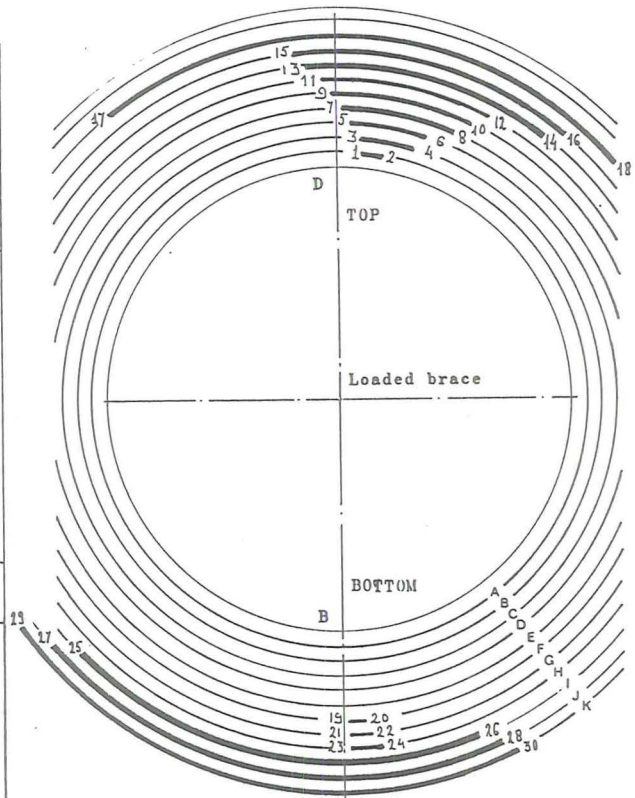
A = 531000 cycles

B = 746380 ,,

C = 862470 ,,

TEST SPECIMEN 8
Load range 0 - 85 kN
frequency 4 Hz
N = 851519 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
9	3	2	469190	4478790
11	3	5	443360	4922150
13	9.8	14.8	592680	5514830
15	3.4	18.2	497320	6012150
17	45.4	63.6	507750	6519900
crack left side of centerline B				
25	93.6	90	507750	6519900
27	10	100	991650	7511550
29	8.8	108.8	1003640	8515190



A= 2390000 cycles
B= 3028000 ,,
C= 3491480 ,,
D= 4009600 ,,
E= 4478790 ,,
F= 4922150 cycles
G= 5514830 ,,
H= 6012150 ,,
I= 6519900 ,,
J= 7511550 ,,
K= 8515190 ,,

crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1-2	6.4	(2) 17.6	2390000	2390000
3-4	17.6	(4) 33.2	638000	3028000
5-6	11	(6) 37.8	463480	3491480
7-8	6.2	(8) 42.2	518120	4009600
10	4.8	46	469190	4478790
12	8	54	443360	4922150
14	22.4	76.4	592680	5514830
16	3.2	79.6	497320	6012150
18	18.4	98	507750	6519900
crack right side of centerline B				
19-20	7.8	(20) 11.4	4922150	4922150
21-22	2.2	(22) 13.6	592680	5514830
23-24	3.2	(24) 16.8	498320	6012150
26	20.6	33.8	507705	6519900
28	8.8	42.6	991650	7511550
30	8.2	50.8	1003640	8515190

TEST SPECIMEN 10

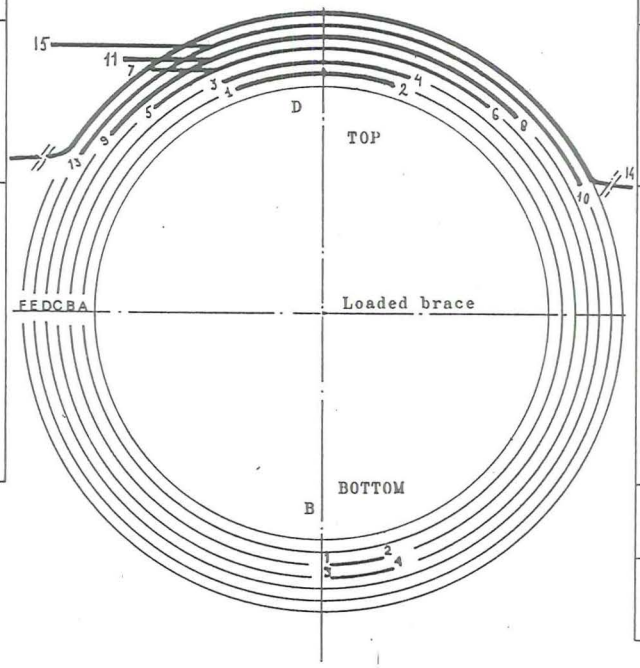
load range 0 - 85 kN

frequentie 0,2 Hz

environment ; SEA WATER

N = 2753276 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to center line (mm)	increase of cycles	total number of cycles
1	41	41	1246706	1246706
3	5	46	498294	1745000
5	33	79	412196	2157196
7	29	75	412196	2157196
9	18	97	190850	2348046
11	11	86	190850	2348046
13	12	109	166780	2514826
15	23	109	166780	2514846
17	72	181	238430	2753276



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	34	34	1246706	1246706
4	4	38	498294	1745000
6	36	74	412196	2157196
8	12	86	190850	2348046
10	36	122	166780	2514826
12	16	102	166780	2514826
14	74	176	238430	2753176
crack rigth side of centerline B				
1-2	15	(2) 18	1745000	1745000
3-4	47	(4) 50	412196	2157196

A = 1246706

B = 1745000

C = 2157196

D = 2348046

E = 2514826

F = 2753176

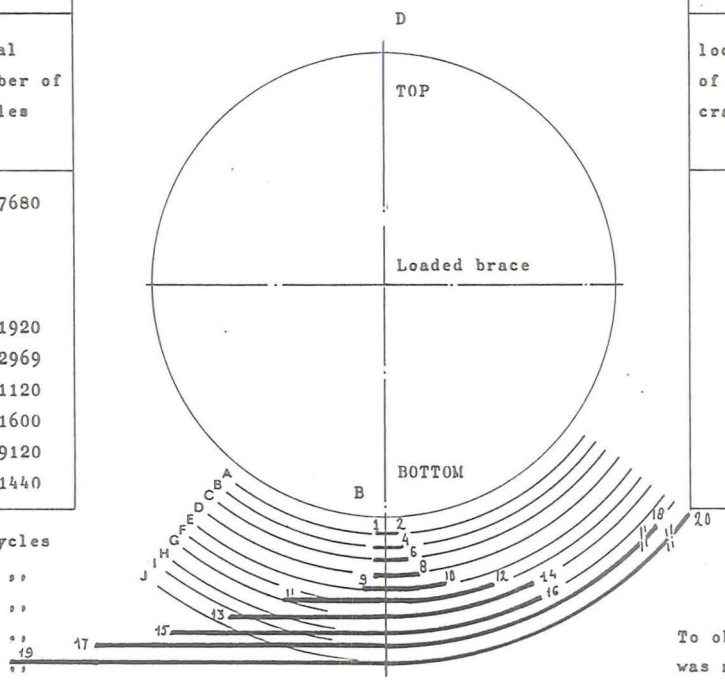
TEST SPECIMEN 11

load range - 28 / + 28 kN

frequency 3 Hz

N = 10566960 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	2	2	1807680	1807680
9	3	5	2304240	4111920
11	15	20	1391049	5502969
13	8	28	878151	6381120
15	9	37	570480	6951600
17	12	49	497520	7449120
19	11	60	532320	7981440



A = 1807680 cycles
B = 2136960 ,,
C = 2522880 ,,
D = 2877840 ,,
E = 4111920 ,,
F = 5502969 ,,
G = 6381120 ,,
H = 6951600 ,,
I = 7449120 ,,
J = 7981440 ,,

crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	3	3	1807680	1807680
4	1	4	329280	2136960
6	1.8	5.8	385920	2522880
8	1.8	7.6	354960	2877840
10	5.4	13	234080	4111920
12	9.5	22.5	1391049	5502960
14	5.5	28	878151	6381120
16	0	28	570480	6951600
18	36	64	497520	7449120
20	12	76	532320	7981440

To observe the crack-growth at the top side was not possible , because the crack was covered by the present gauges

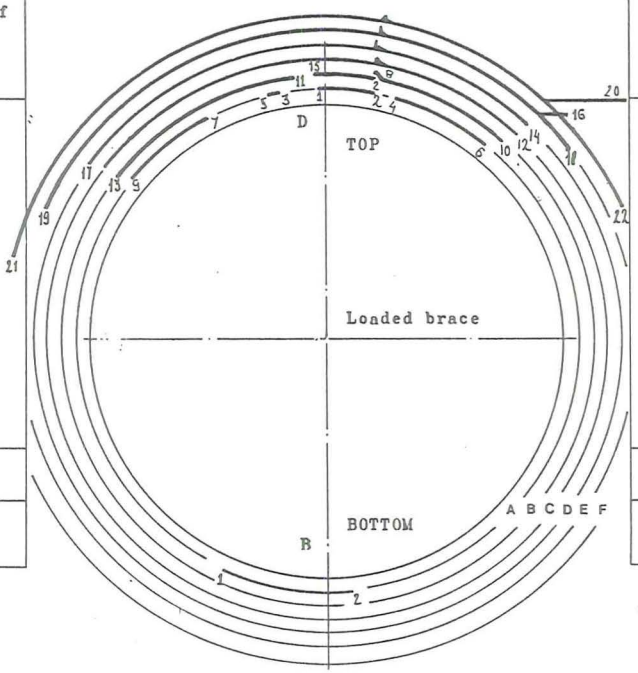
TEST SPECIMEN 12

load range - 28 / + 28 kN

frequency 3 Hz

N = 905720 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	1	1		373000
5-3	1.7	(5) 5.6		373000
9-7	23.9	(9) 52.3		373000
13-11	20.2	(13) 53.3	43000	416000
15	2	3	43000	416000
17	3.2	55.5	90600	506600
19	10.5	66	60400	566000
21	11	77	46000	612000
crack left side of centerline B				
1	22.2	22.2		373000



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	10.8	10.8		373000
4-6	20.6	(6) 34.8		373000
2	0	10.8	43000	416000
8-10	5.6	(10) 37	43000	416000
12	4.4	41	50000	466000
14	2	43	40600	506600
18	9	52	60400	566000
16	6	49	60400	566000
	14.6	66.6	46000	612000
20	10	59	46000	612000
crack right side of centerline B				
2	5	5		373000

A = 373000 cycles

B = 416000 ,,

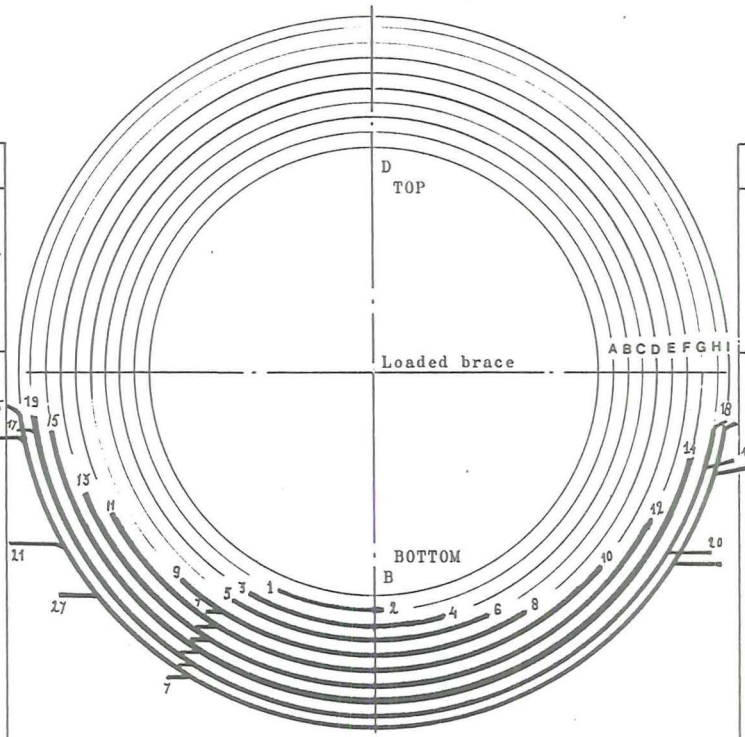
C = 466000 ,,

D = 506000 ,,

E = 566000 ,,

F = 612000 ,,

TEST SPECIMEN 13
load range 0 - 270 kN
frequency 2.8 Hz
N = 5.046.000 cycles



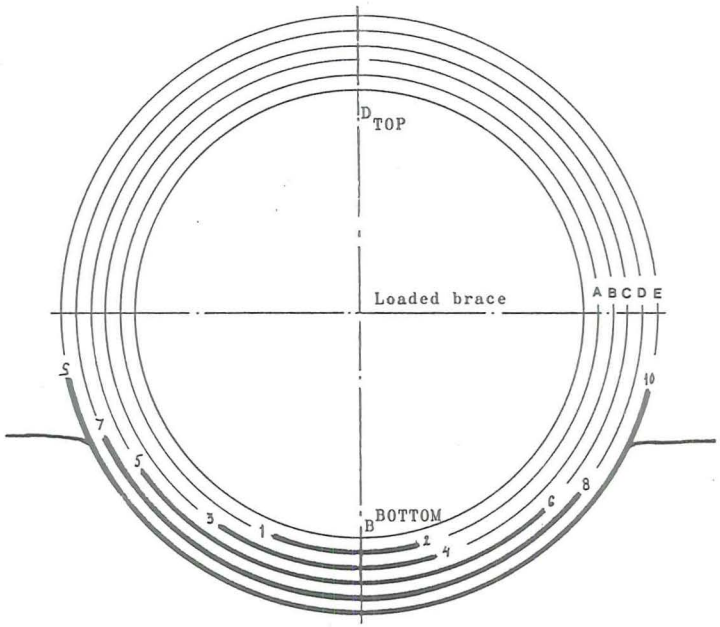
A = 2.080.000
B = 2.878.000
C = 3.173.000
D = 3.467.000
E = 3.995.500
F = 4.222.300
G = 4.545.200
H = 4.825.000
I = 4.915.300

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	95	95	2080	2080
3	24	119	798	2878
5	8	127	295	3173
7	18	145	294	3467
9	40	167		3467
11	93	260	528.5	3995.5
13	27	287	226.8	4222.3
15	50	337	322.9	4545.2
17	12	349	279.8	4825
19	30	367		4825
21	60		90.3	4915.3
23	12	361		4915.3
25	14	381		4915,3
27	25			4915.3

crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	5	5	2080	2080
4	59	64	798	2878
6	36	100	295	3173
8	30	130	294	3467
10	82	212	528.5	3995.5
12	52	264	226.8	4222.3
14	50	314	322.9	4545.2
16	30	344	279.8	4825
18	20	334		4825
20	45		90.3	4915.3
22	25	396		4915.3

TEST SPECIMEN 14
load range 0 - 770 kN
frequency 1.5 Hz
N = 179.000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	90	90	50.000	50.000
3	49	139	10.000	60.000
5	92	231	30.000	90.000
7	35	266	24.500	115.000
9	59	325	50.000	165.000

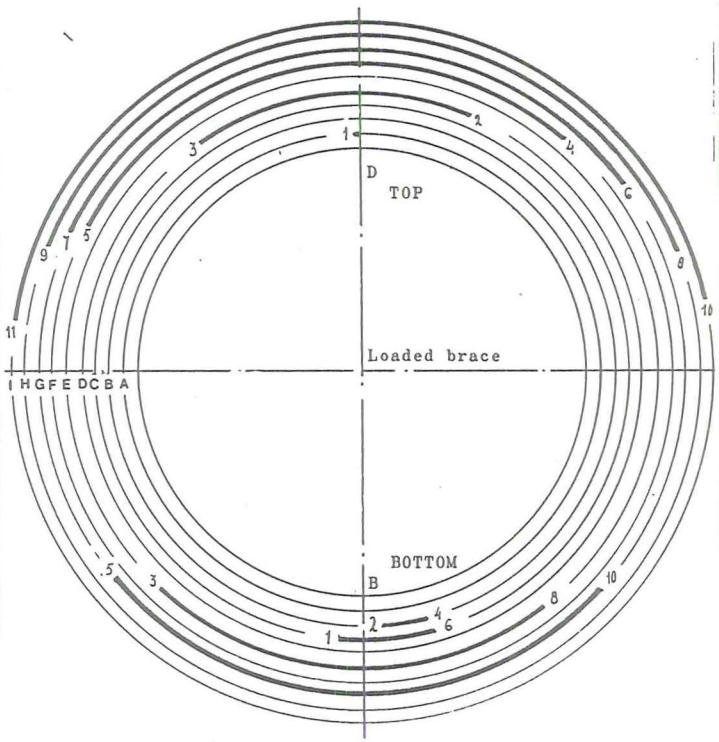


crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	60	60	50.000	50.000
4	13	73	10.000	60.000
6	108	181	30.000	90.000
8	28	209	24.500	115.000
10	107	316	50.000	165.000

A = 50.000
B = 60.000
C = 90.000
D = 115.000
E = 165.000

TEST SPECIMEN 15
load range 0 - 450 kN
frequency 2.8 Hz
N = 1.132.000 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	1	1	140.000	140.000
3	145	146	460.000	600.000
5	112	258	94.000	863.000
7	15	273	64.800	927.000
9	12	285	52.200	980.000
11	60	345	20.000	1000.000
crack left side of centerline B				
1	25	25	587.000	587.000
3	155	180	67.000	654.000
5	30	210	273.000	927.000



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	99	99	600.000	600.000
4	80	179	263.000	863.000
6	55	234	64.800	927.000
8	65	299	52.000	980.000
10	35	334	20.000	1000.000
crack right side of centerline B				
2-4	25	(4)60	480.000	480.000
6	35	60	107.000	587.000
8	100	160	67.000	654.000
10	40	200	273.800	927.000

A = 140.000
B = 480.000
C = 587.000
D = 600.000
E = 654.000
F = 863.000
G = 927.800
H = 980.000
I = 1.000.000

TEST SPECIMEN 18

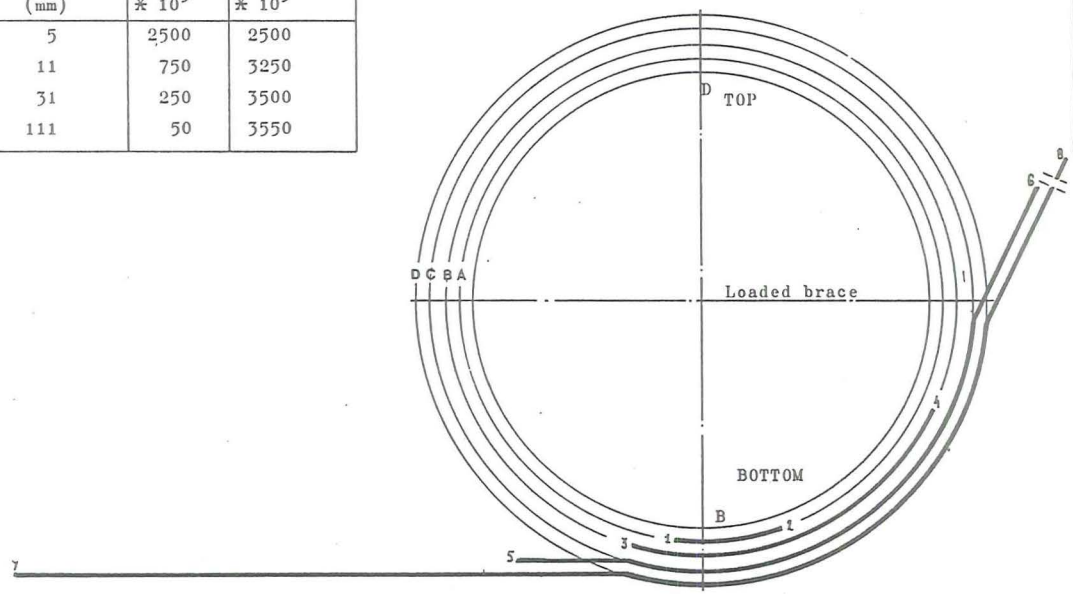
load range 0 - 35 kN

frequency 10 Hz

N = 3.600.000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	5	5	2500	2500
3	6	11	750	3250
5	20	31	250	3500
7	80	111	50	3550

crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	15	15	2500	2500
4	35	50	750	3250
6	50	100	250	3500
8	50	125	50	3550



A = 2.500.000

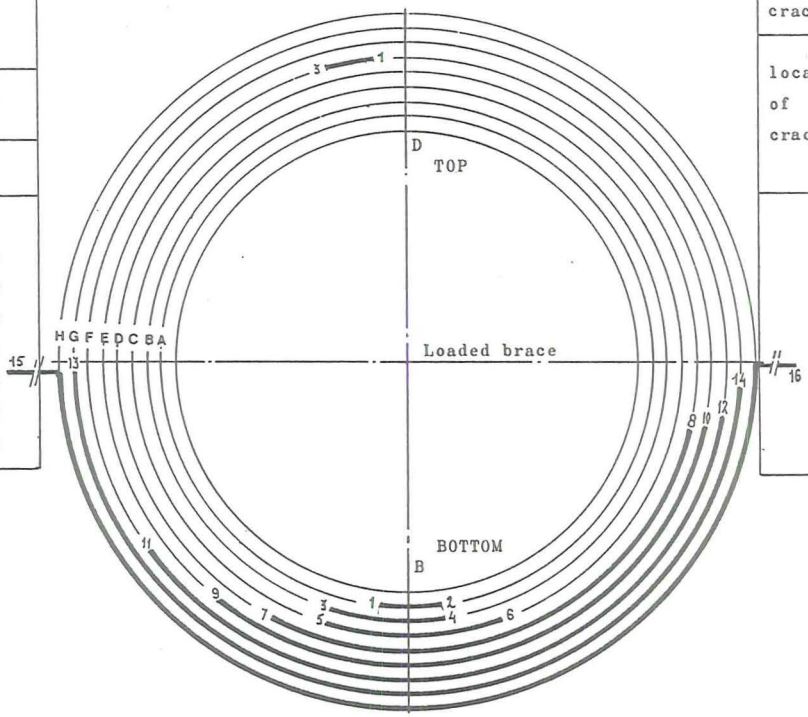
B = 3.250.000

c = 3.500.000

D = 3.550.000

TEST SPECIMEN 19
load range 0 - 80 kN
frequency 10 Hz
N = 74.000

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
(1-3)	6	(3) 11	60.000	60.000
crack left side of centerline B				
1	6	6	30.000	30.000
3	8	14	11.000	41.000
5	0	14	4.000	45.000
7	8	22	10.000	55.000
9	8	30	5.000	60.000
11	24	54	5.000	65.000
13	13	67	5.000	70.000
15	35	102	3.500	73.500



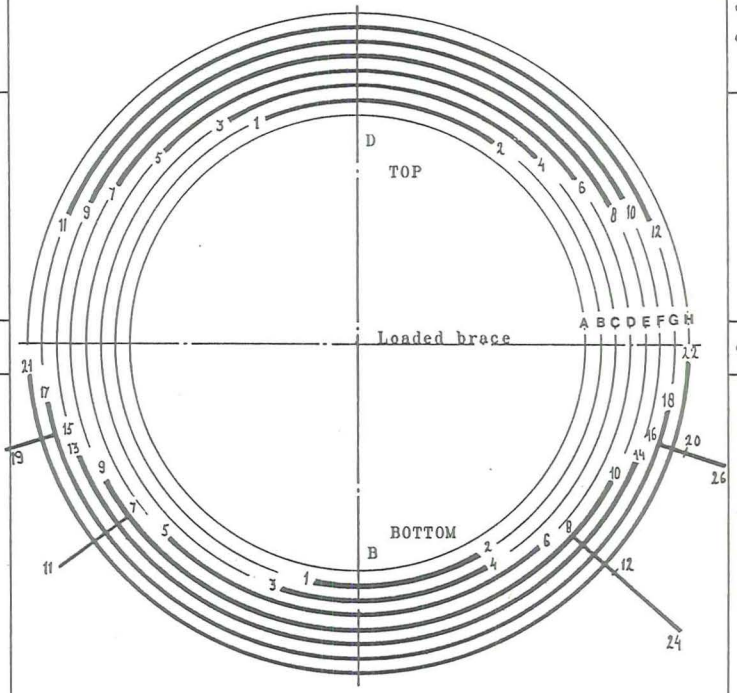
crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	6	6	30.000	30.000
4	0	6	11.000	41.000
6	10	16	4.000	45.000
8	44	60	10.000	55.000
10	8	68	5.000	60.000
12	8	76	5.000	65.000
14	9	85	5.000	70.000
16	35	120	3.500	73.500

A = 30.000
B = 41.000
C = 45.000
D = 55.000
E = 60.000
F = 65.000
G = 70.000
H = 73.500

TEST SPECIMEN 20
load range 0 - 600 kN
frequency 2.5 Hz
N = 680.000

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	92	92	250.000	250.000
3	35	127	40.000	290.000
5	60	187	110.000	400.000
7	48	235	100.000	500.000
9	22	257	50.000	550.000
11	16	273	50.000	600.000

crack left side of centerline B				
1	42	42	250.000	250.000
3	24	66	40.000	290.000
5	122	188	110.000	400.000
7	42	230		
9	21	250	100.000	500.000
11		255		500.000
13	30	281	50.000	550.000
15	19	300		
17	26	326	50.000	600.000
19		330		600.000
21	48	348	25.000	625.000



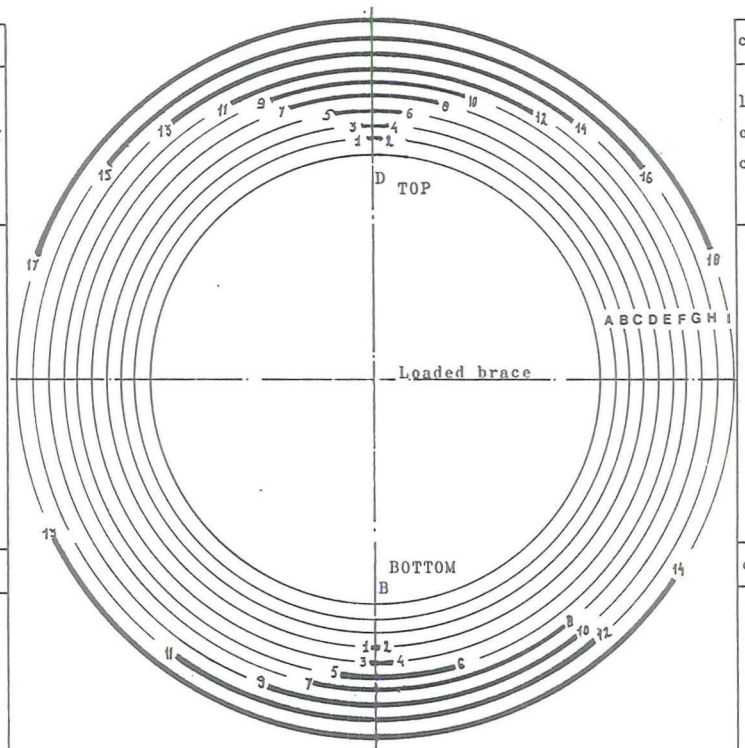
A = 250.000
B = 290.000
C = 400.000
D = 500.000
E = 550.000
F = 600.000
G = 625.000

crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	143	143	250.000	250.000
4	35	178	40.000	290.000
6	42	220	110.000	400.000
8	35	255	100.000	500.000
10	0	255	50.000	550.000
12	20	275	50.000	600.000

crack right side of centerline B				
2	125	125	250.000	250.000
4	0	125	40.000	290.000
6	50	175	110.000	400.000
8	20	195		
10	55	254	100.000	500.000
12		215		500.000
14	22	276	50.000	550.000
16	10	286		
18	37	323	50.000	600.000
20		298		600.000
22	35	358	25.000	625.000
24	24	239		625.000
26	15	313		625.000

TEST SPECIMEN 21
load range 0 - 220 kN
frequency 4 Hz
N = 16.414.800

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	4	4	3.500	3.500
3	2	6	500	4.000
5	25	31	1.500	5.500
7	40	71	1.000	6.500
9	6	77	2.000	8.500
11	32	109	500	9.000
13	40	149	1.223	10.223
15	60	209	1.442	11.675
17	80	289	1.915	13.590
crack left side of centerline B				
1	1	1	5.500	5.500
3	6	7	1.000	6.500
5	17	24	2.000	8.500
7	22	46	500	9.000
9	30	76	1.223	10.223
11	70	146	1.442	11.675
13	125	271	1.915	13.590

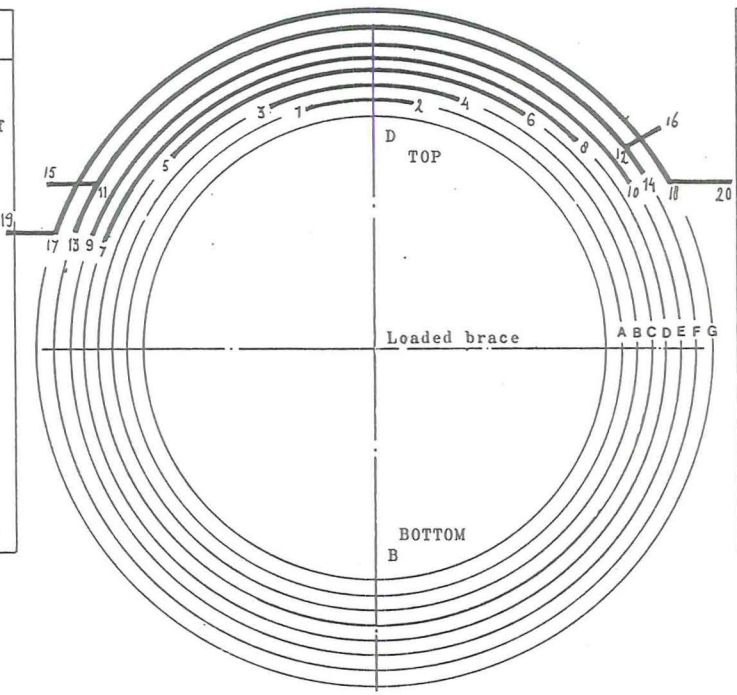


A = 3.500.000
B = 4.000.000
C = 5.500.000
D = 6.500.000
E = 8.500.000
F = 9.000.000
G = 10.223.000
H = 11.675.000
I = 13.590.000

crack rigth side of centerline				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	6	6	3.500	3.500
4	10	16	500	4.000
6	8	24	1.500	5.500
8	28	52	1.000	6.500
10	23	75	2.000	8.500
12	50	125	500	9.000
14	25	150	1.233	10.223
16	70	220	1.442	11.675
18	70	290	1.915	13.590
crack rigth side of centerline B				
2	1	1	5.500	5.500
4	10	11	1.000	6.500
6	49	60	2.000	8.500
8	85	145	500	9.000
10	0	145	1.223	10.223
12	20	165	1.442	11.675
14	70	235	1.915	13.590

TEST SPECIMEN 22
load range 0 - 45 kN
frequency 10 Hz
N = 950.000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	12	12	150.000	150.000
3	6	18	50.000	200.000
5	19	37	200.000	400.000
7	18	55	350.000	750.000
9	0	55	50.000	800.000
11		47		
13	0	55	100.000	900.000
15		57		900.000
17	5	60		
19	25	85	25.000	925.000

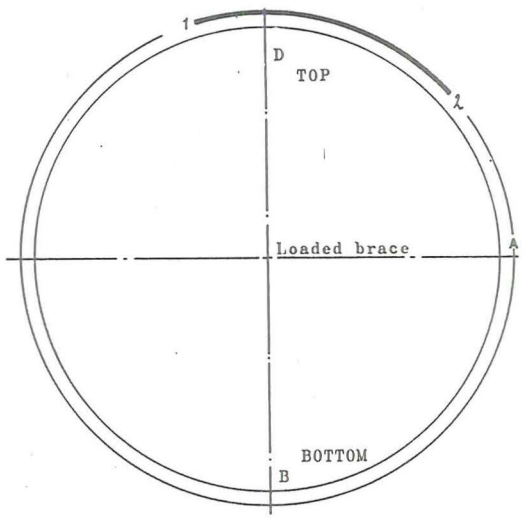


crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	8	8	150.000	150.000
4	7	15	50.000	200.000
6	10	25	200.000	400.000
8	8	33	350.000	750.000
10	10	43	50.000	800.000
12		38		
14	0	43	100.000	900.000
16		46		900.000
18	8	51		
20	20	71	25.000	925.000

A = 150.000
B = 200.000
C = 400.000
D = 750.000
E = 800.000
F = 900.000
G = 925.000

TEST SPECIMEN 23
load range 0 - 32 kN
frequency 10 Hz
N = 2.400.000

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	13	13	2.000	2.000

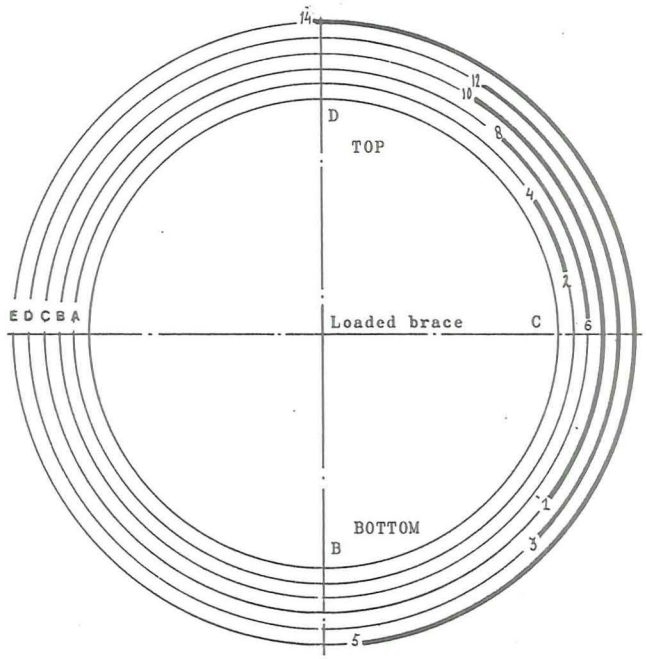


A = 2.000.000

crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	40	40	2.000	2.000

TEST SPECIMEN 24
load range 0 - 4000 Nm
frequency 10 Hz
N = 370.000 cycles

crack left side of centerline C				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	30	30	333.400	333.400
3	6	36	6.600	340.000
5	38	74	25.000	365.000



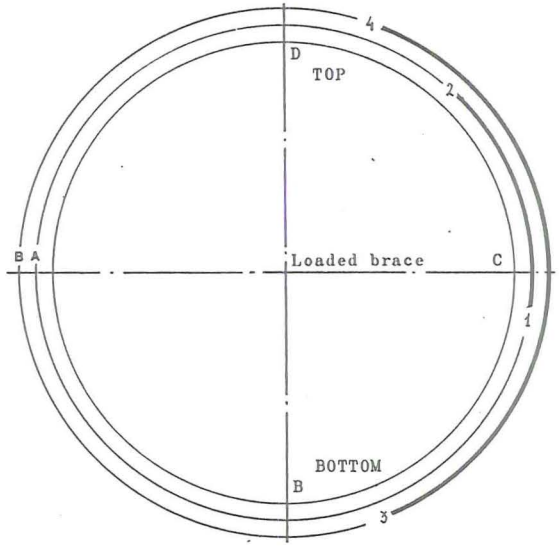
A = 250.000
B = 300.000
C = 333.400
D = 340.000
E = 365.000

crack right side of centerline C				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2-4	25	(4) 37	250.000	250.000
6-8	22	(8) 49	50.000	300.000
10	12	59	33.400	333.400
12	0	59	6.600	340.000
14	35	94	25.000	365.000

TEST SPECIMEN 25
load range 0 - 4500 Nm
frequecy 10 Hz
N = 480.000

crack left side of centerline C				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	6	6	450.000	450.000
3	50	56	20.700	470.700

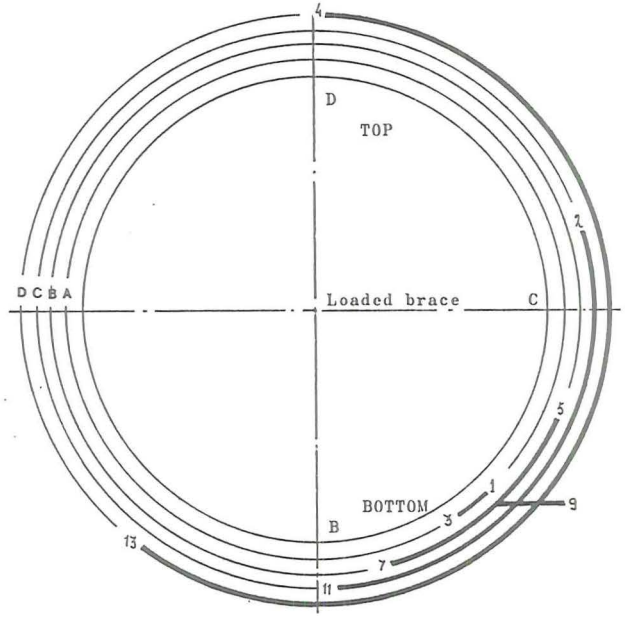
crack right side of centerline C				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	40	40	450.000	450.000
4	18	58		470.700



A = 450.000
B = 470.700

TEST SPECIMEN 26
load range 0 - 841 Nm
frequency 10 Hz
N = 1.700.000

crack left side of centerline C				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1-3	8	(3)48	625	625
5-7	37	(7)63	775	1.400
9		52		
11	28	73	200	1.600
13	30	103	84	1.684

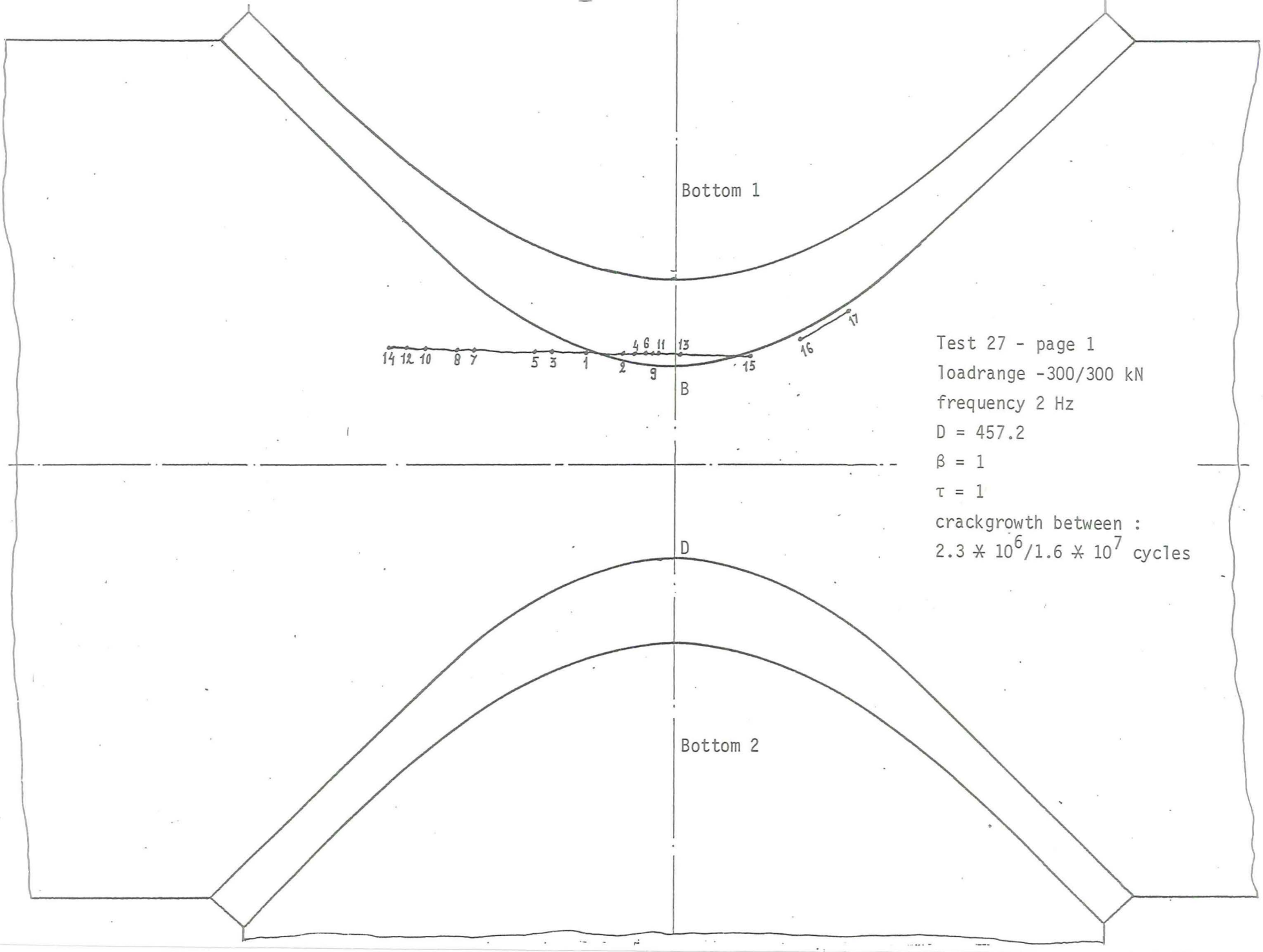


A = 625.000
B = 1.400.000
C = 1.600.000
D = 1.684.000

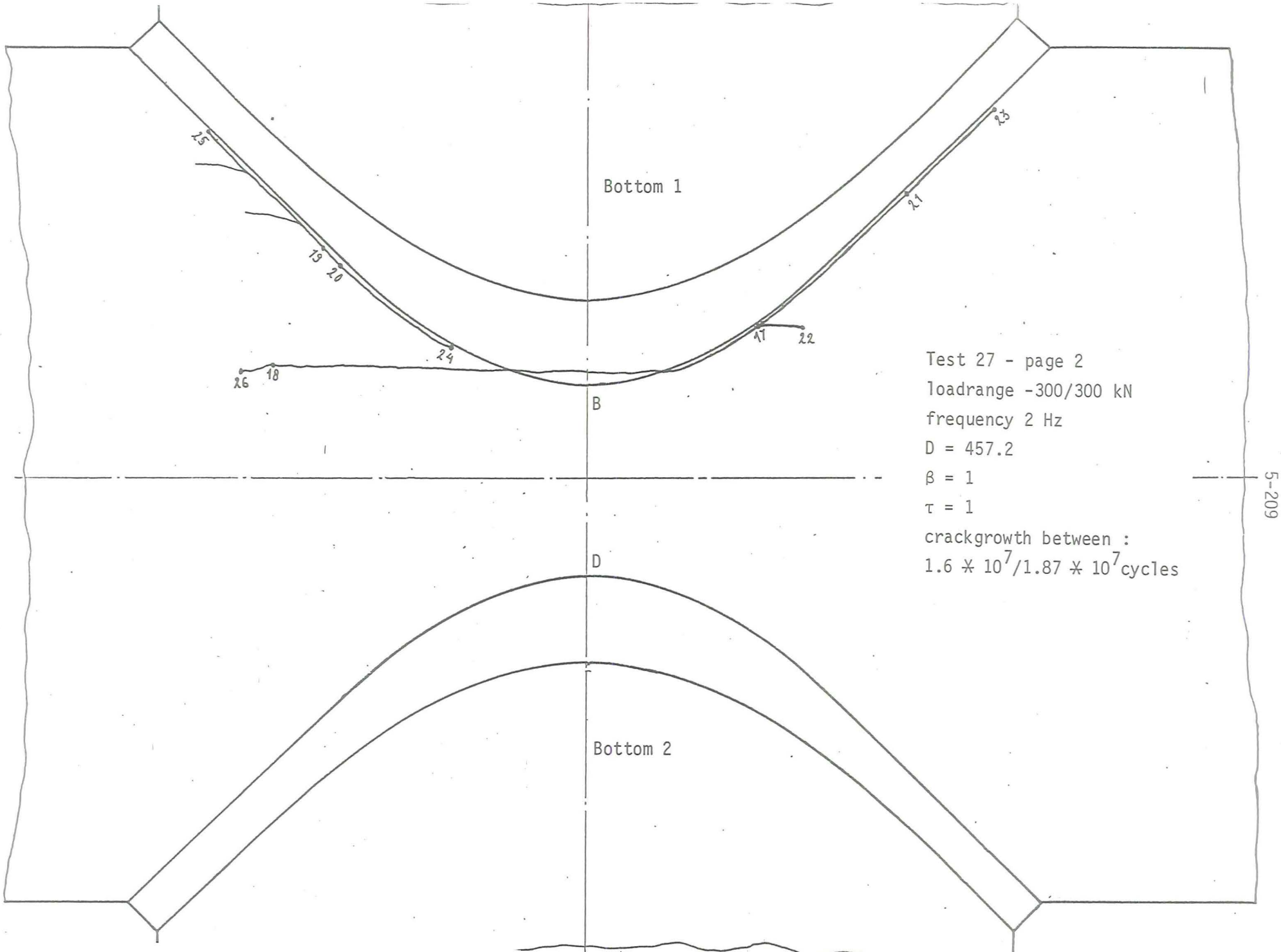
crack right side of centerline C				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	20	20	1.600	1.600
4	58	78	84	1.684

TEST SPECIMEN 27

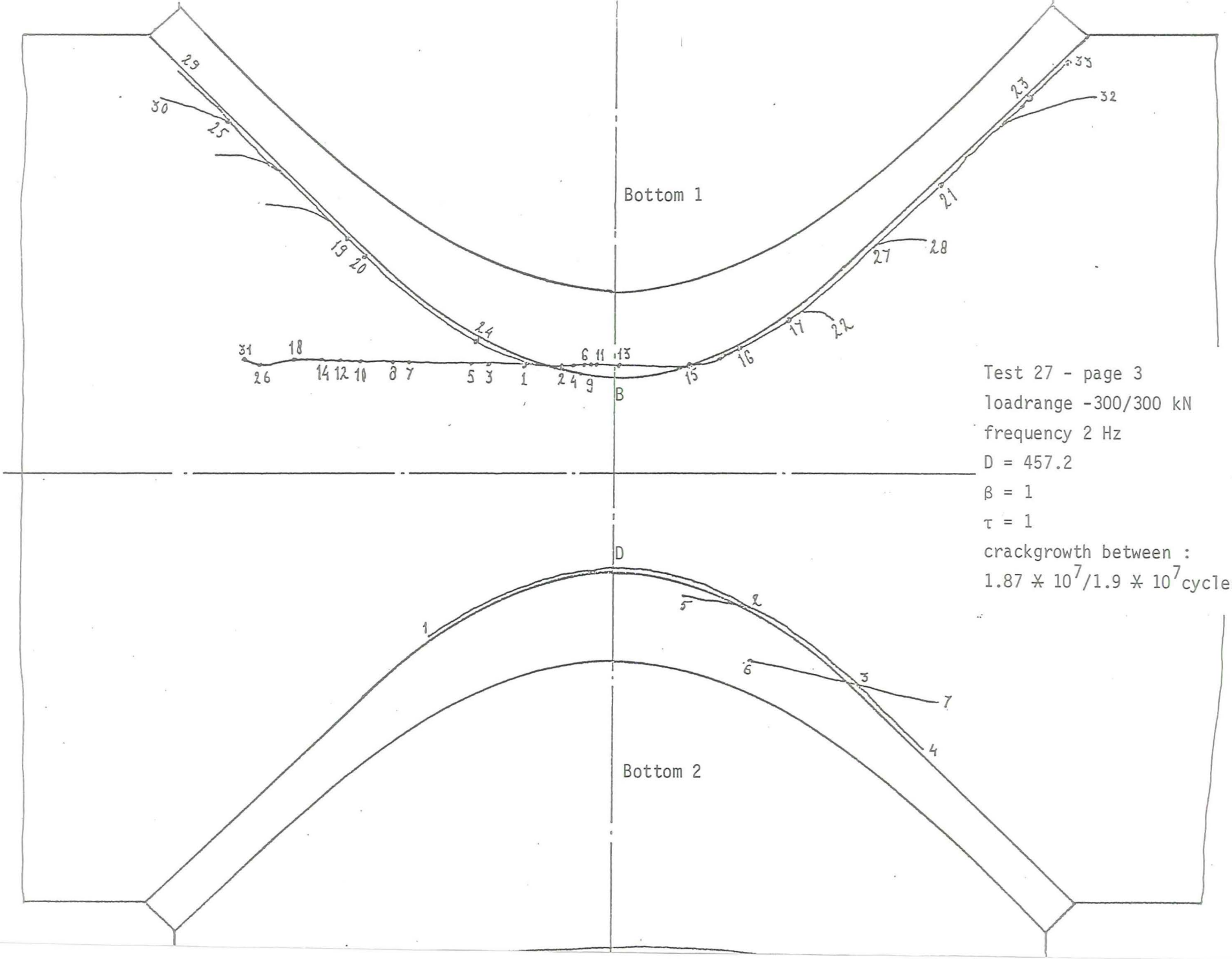
crack left side of centerline B							crack right side of centerline B				
total number of cycles * 10^6	increase of cycles * 10^6	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
2.3	2.3	1	2	48	23	25					
3.8	1.5	3	4	64	17	47					
4.8	1.0	5	6	74	16	58					
8.0	3.2	7	6	108	16	92					
10.0	2.0	8	9	118	12	106					
12.5	2.5	10	11	132	8	124					
14.0	1.5	12		142		142	13		1		1
15.8	1.8	14		150		150	15		40		40
16.0	0.2						16	17	62	88	26
17.0	1.0	18		180		180	21		204		204
		19	20	164	176	12					
18.7	1.7	25	24	70	254	184	17	22	88	142	54
		26		185		185	23		238		238
19.0	0.3	31		192		192	27	28	148	214	66
		29		293		293	33		292		292
		25	30	254	308	546	32		290		290
crack left side of centerline D							crack right side of centerline D				
19.0	19.0	1		104		104	4		190		190
							5	2	70	110	40
							6	3	136	192	56
							7	3	136	186	50



Test 27 - page 1
loadrange -300/300 kN
frequency 2 Hz
D = 457.2
$\beta = 1$
$\tau = 1$
crackgrowth between :
$2.3 \times 10^6 / 1.6 \times 10^7$ cycles



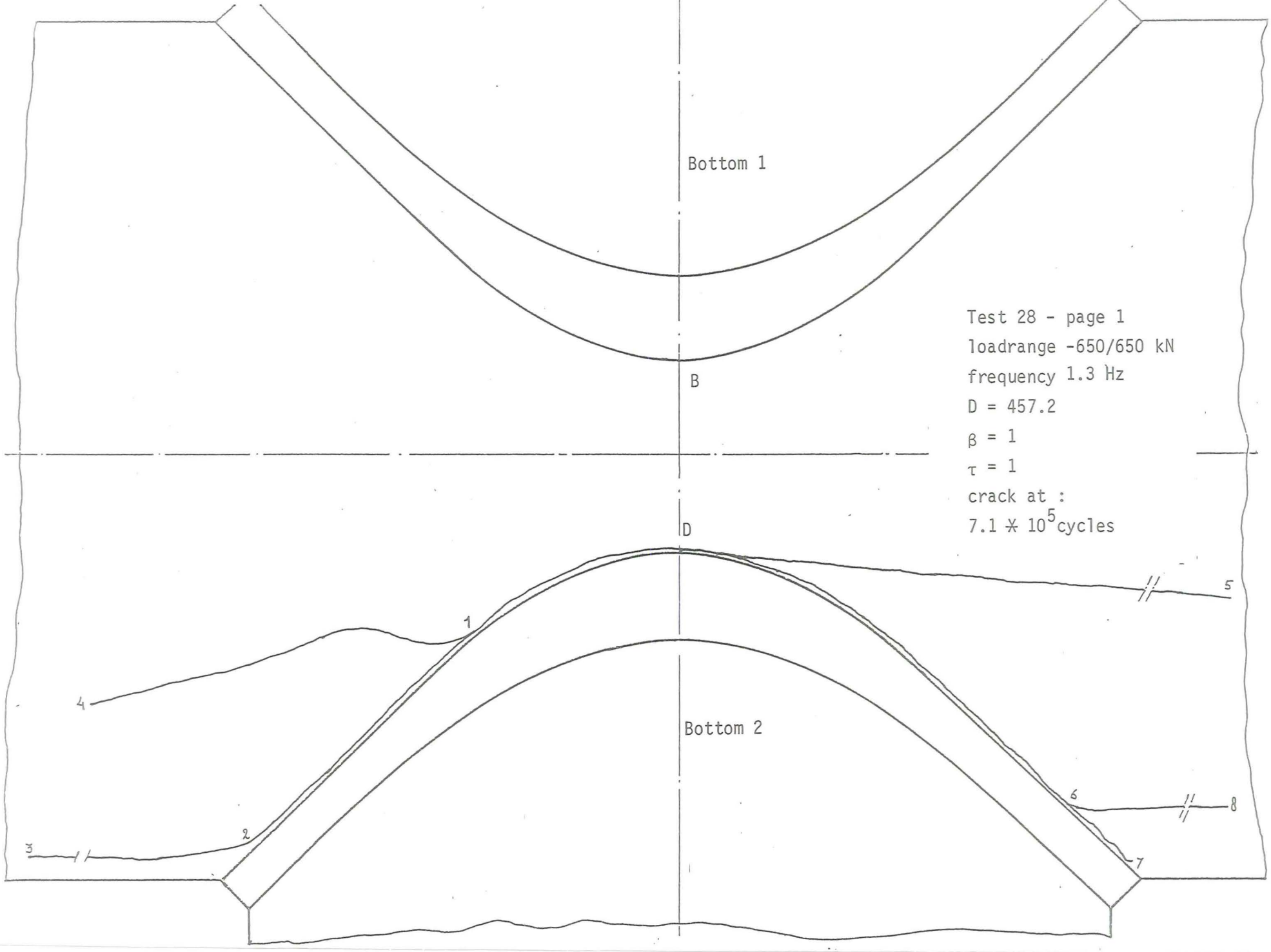
Test 27 - page 2
loadrange -300/300 kN
frequency 2 Hz
D = 457.2
$\beta = 1$
$\tau = 1$
crackgrowth between :
$1.6 \times 10^7 / 1.87 \times 10^7$ cycles



Test 27 - page 3
loadrange -300/300 kN
frequency 2 Hz
D = 457.2
β = 1
τ = 1
crackgrowth between :
$1.87 \times 10^7 / 1.9 \times 10^7$ cycles

TEST SPECIMEN 28

crack left side of centerline D							crack right side of centerline D				
total number of cycles $\times 10^5$	increase of cycles $\times 10^5$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
7.1	7.1	1	4	140	360	220	5		400		400
		2	3	320	470		6	8	230	340	
							7		340		340

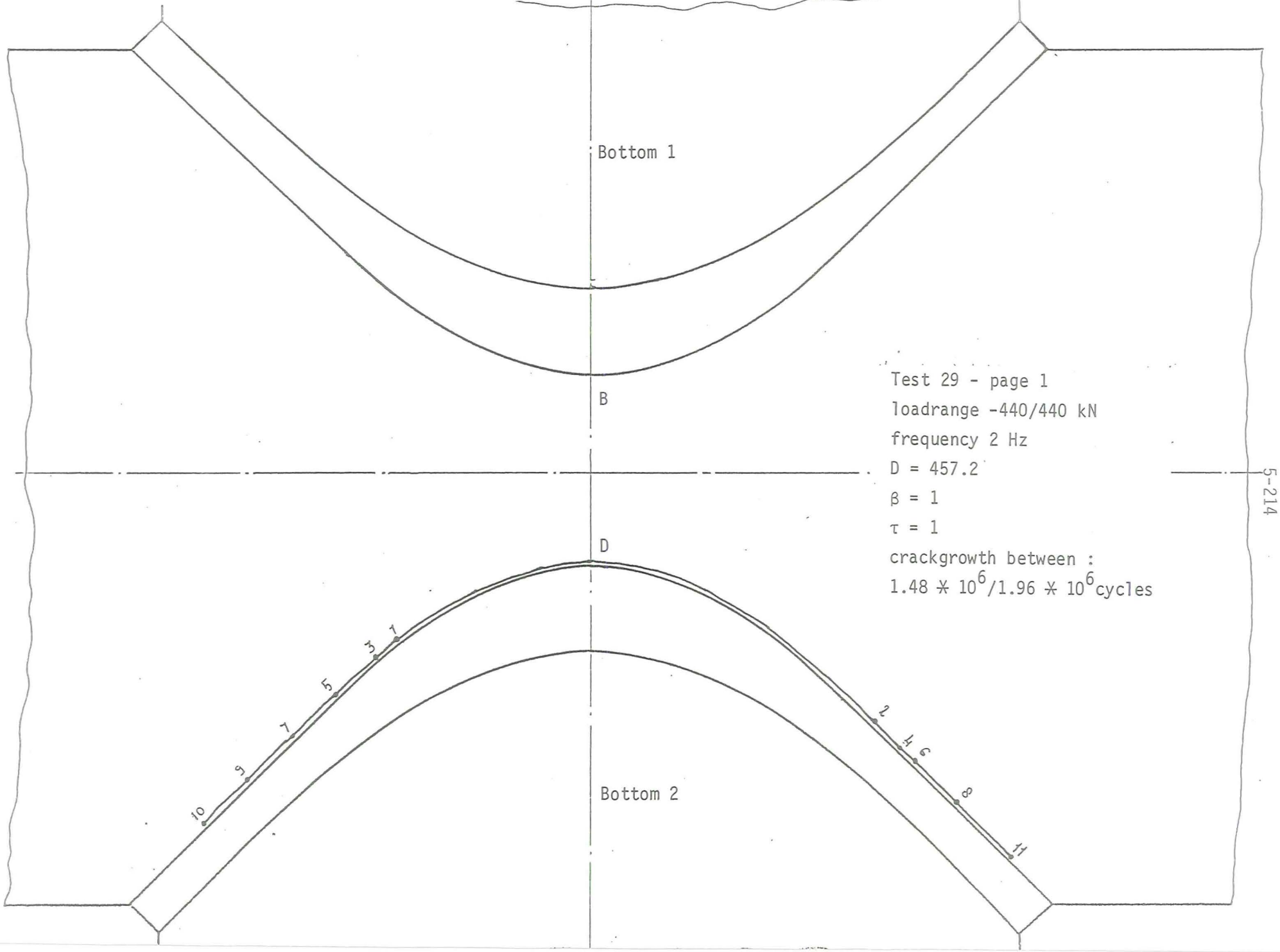


Test 28 - page 1
loadrange -650/650 kN
frequency 1.3 Hz
D = 457.2
$\beta = 1$
$\tau = 1$
crack at :
7.1×10^5 cycles

TEST SPECIMEN 29

Bottom 2

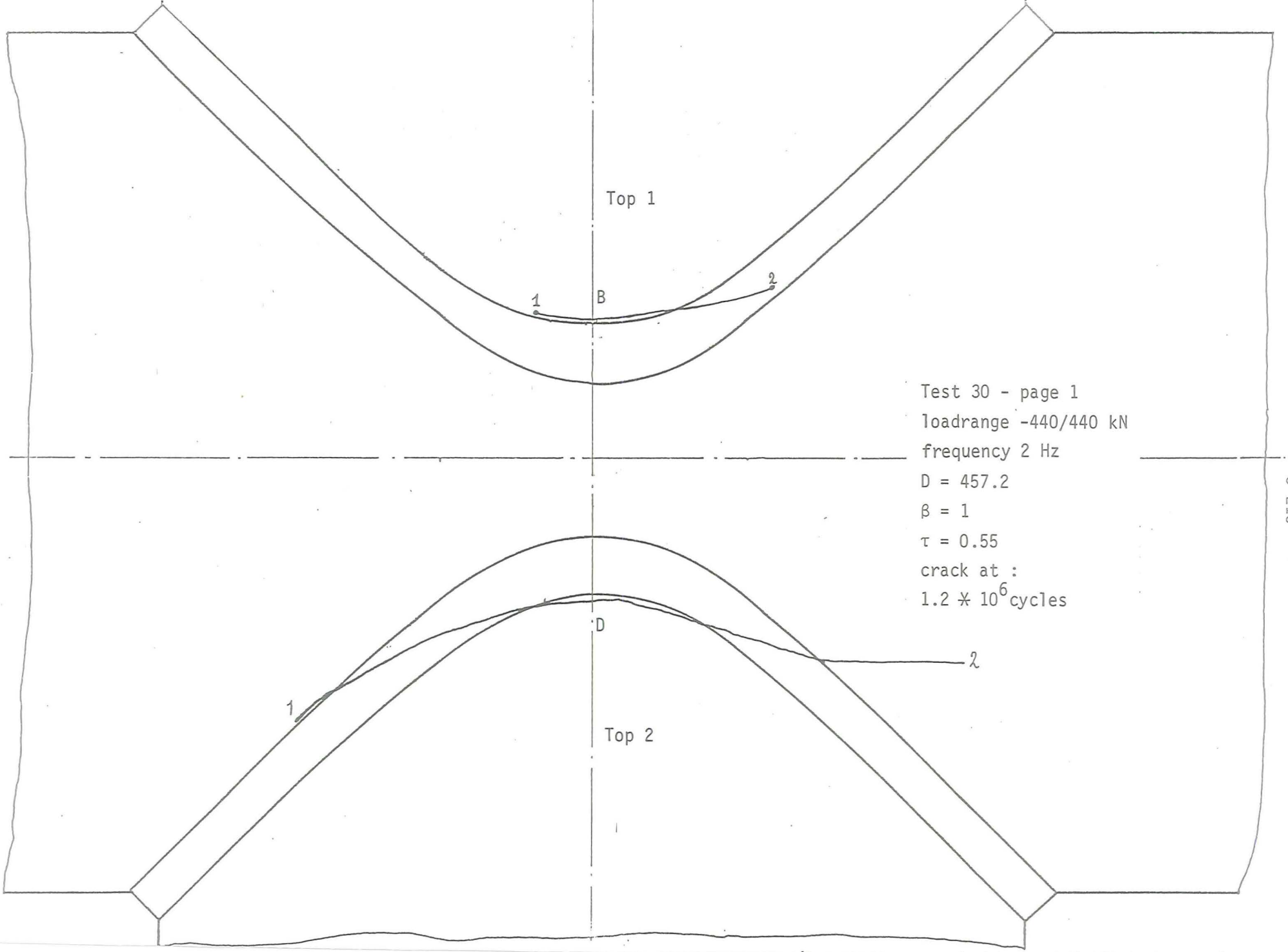
crack left side of centerline D							crack right side of centerline D				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	2	length crack tip to centerline [mm] 1	2	total crack length [mm]	location of crack tip 1	2	length crack tip to centerline [mm] 1	2	total crack length [mm]
1.48	1.48	1		107		107	2		178		178
1.5	0.02	3		124		124	4		203		203
1.6	0.1	5		154		154	6		212		212
1.7	0.1	7		184		184	8		249		249
1.79	0.09	9		204		204					
1.96	0.17	10		234		234	11		279		279



Test 29 - page 1
loadrange -440/440 kN
frequency 2 Hz
D = 457.2
$\beta = 1$
$\tau = 1$
crackgrowth between :
$1.48 \times 10^6 / 1.96 \times 10^6$ cycles

TEST SPECIMEN 30

crack left side of centerline B							crack right side of centerline B				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
1.2	1.2	1		30		30	2		110		110
crack left side of centerline D							crack right side of centerline D				
1.2	1.2	1		150		150	2		200		200


Top 1
1
B
2
Test 30 - page 1
loadrange -440/440 kN
frequency 2 Hz
D = 457.2
β = 1
τ = 0.55
crack at :
1.2 * 10^6 cycles
D
2
1
Top 2

TEST SPECIMEN 31

Top 1

crack left side of centerline B							crack right side of centerline B				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
3.9	3.9	1	2	48	21	27					
4.2	0.3	3	4	61	16	45					
4.6	0.4	5	6	84	14	60					
5.2	0.6	7		110		110					
5.6	0.4	8		133		133					
5.9	0.3	9		146		146					
6.1	0.2	10		156		156					
6.6	0.5	11		172		172					
6.9	0.3	12		180		180					
7.2	0.3	13		187		187	14		17		17
8.0	0.8	15		192		192					
8.3	0.3	16		203		203					
8.5	0.2	17		207		207	18		30		30

TEST SPECIMEN 31

Top 2

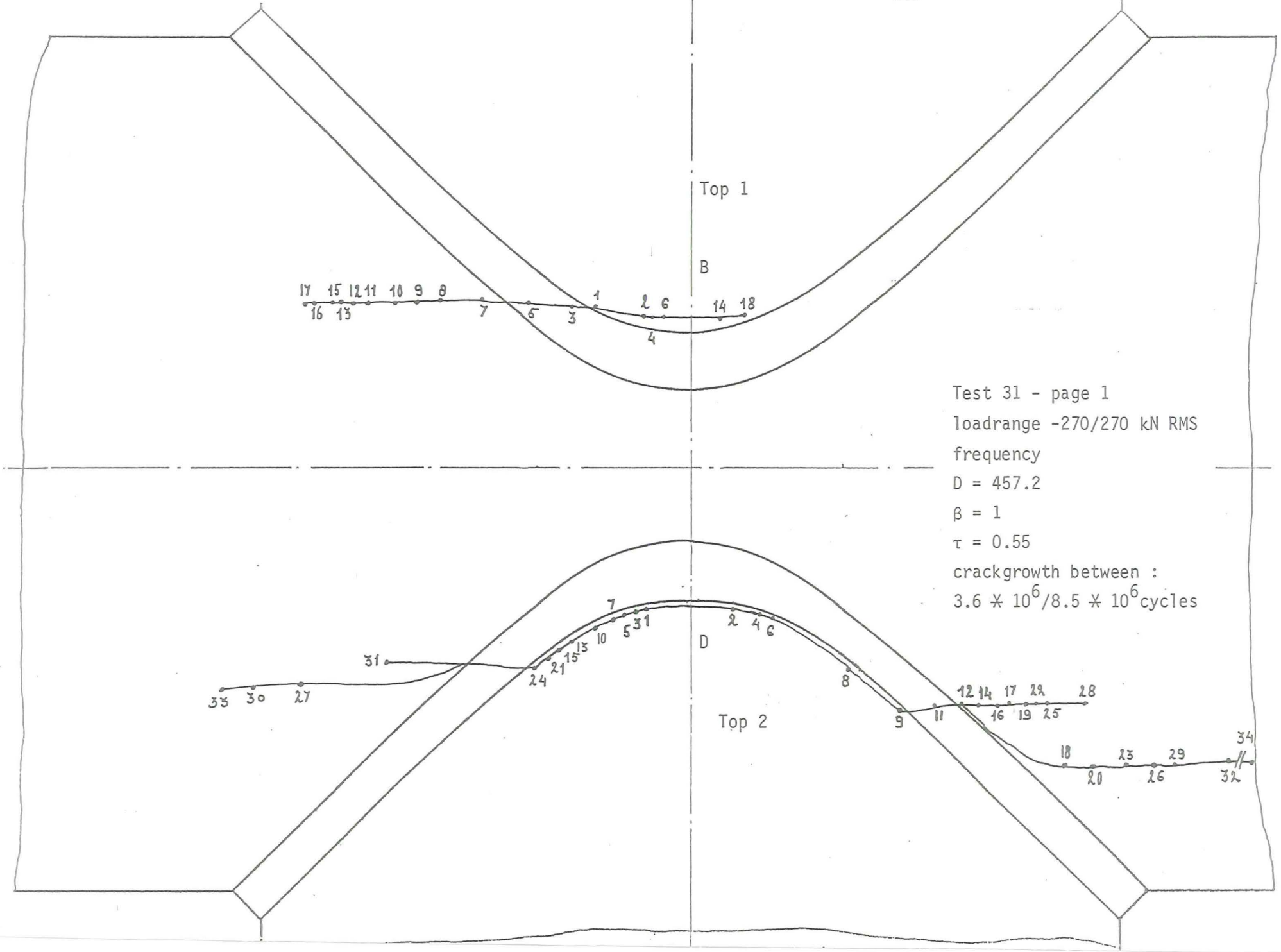
crack left side of centerline B							crack right side of centerline B				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
3.6	3.6	1		27		27	2		24		24
3.8	0.2	3		31		31	4		39		39
3.9	0.1	5		35		35	6		48		48
4.2	0.3	7		43		43	8		98		98
							9		140		140
4.6	0.4	10		53		53	11		151		151
5.2	0.6						12		178		178
5.6	0.4	13		68		68	14		190		190
5.9	0.3	15		76		76	16		200		200
6.1	0.2						17		205		205
6.1							18		230		230
6.6	0.5						19		215		215
6.6							20		245		245
6.9	0.3	21		83		83	22		220		220
6.9							23		260		260
7.2	0.3	24		100		100	25		225		225
7.2							26		275		275
8.0	0.8	27		224		224	28		238		238
8.0							29		289		289
8.3	0.3	30		249		249	32		317		317
8.3		31		177		177					
8.5	0.2	33		261		261	34		339		339

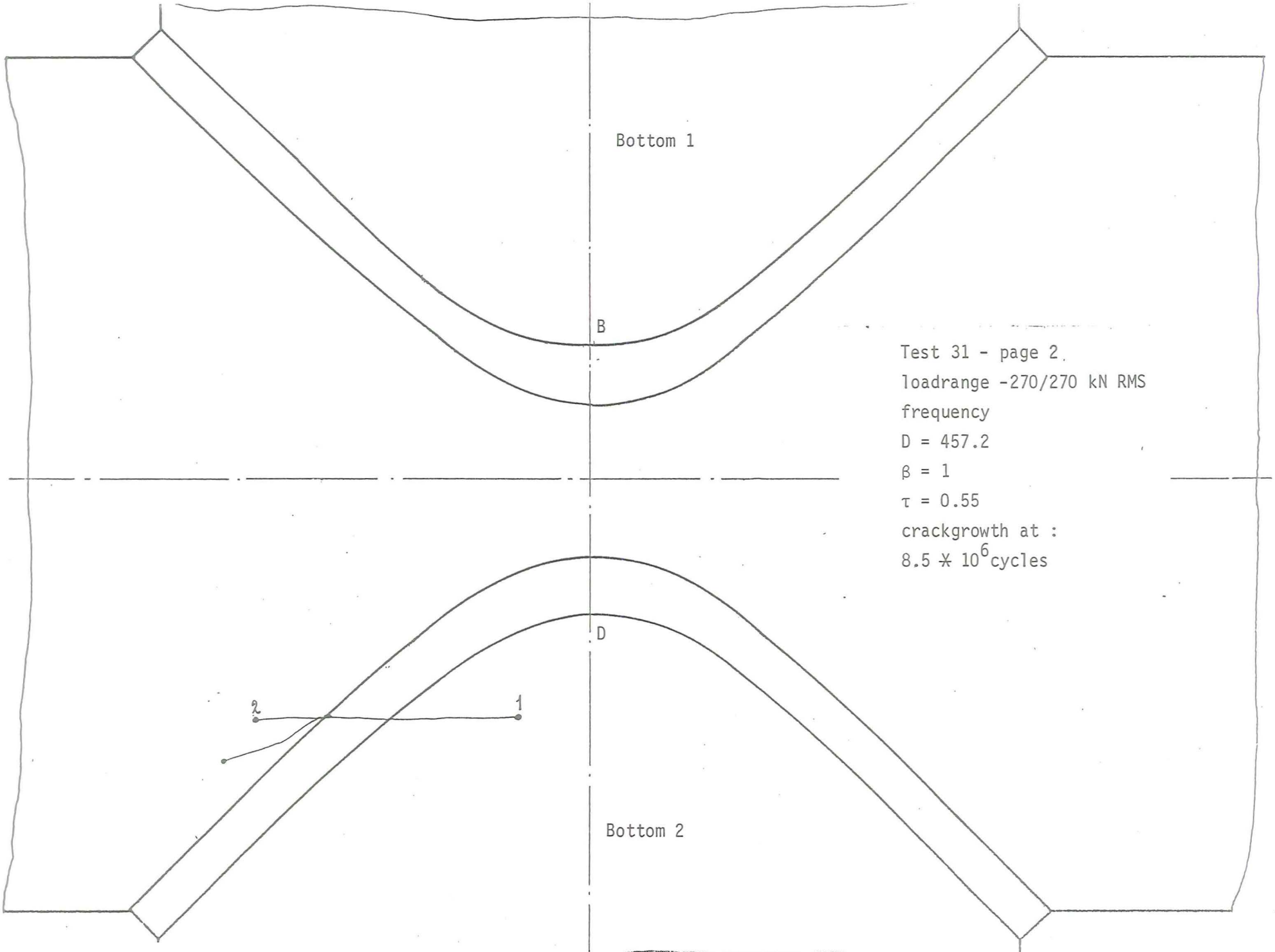
Test 31 - page 1

TEST SPECIMEN 31

Bottom 2

crack left side of centerline D							crack right side of centerline D				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
8.5	8.5	1	2	19	165	146					


Top 1
B
17 15 12 11 10 9 8
16 13
7
5
3
1
2 6
14 18
4
Test 31 - page 1
loadrange -270/270 kN RMS
frequency
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
3.6 ✳ 10^6/8.5 ✳ 10^6cycles
7
31
5
10
13
15
21
24
2 4 6
D
8
33 30 27
12 14 17 29 28
16 19 25
9 11
Top 2
18 23 29 34
20 26 32



Test 31 - page 2.
loadrange -270/270 kN RMS
frequency
D = 457.2
$\beta = 1$
$\tau = 0.55$
crackgrowth at :
8.5×10^6 cycles

TEST SPECIMEN 32

Top

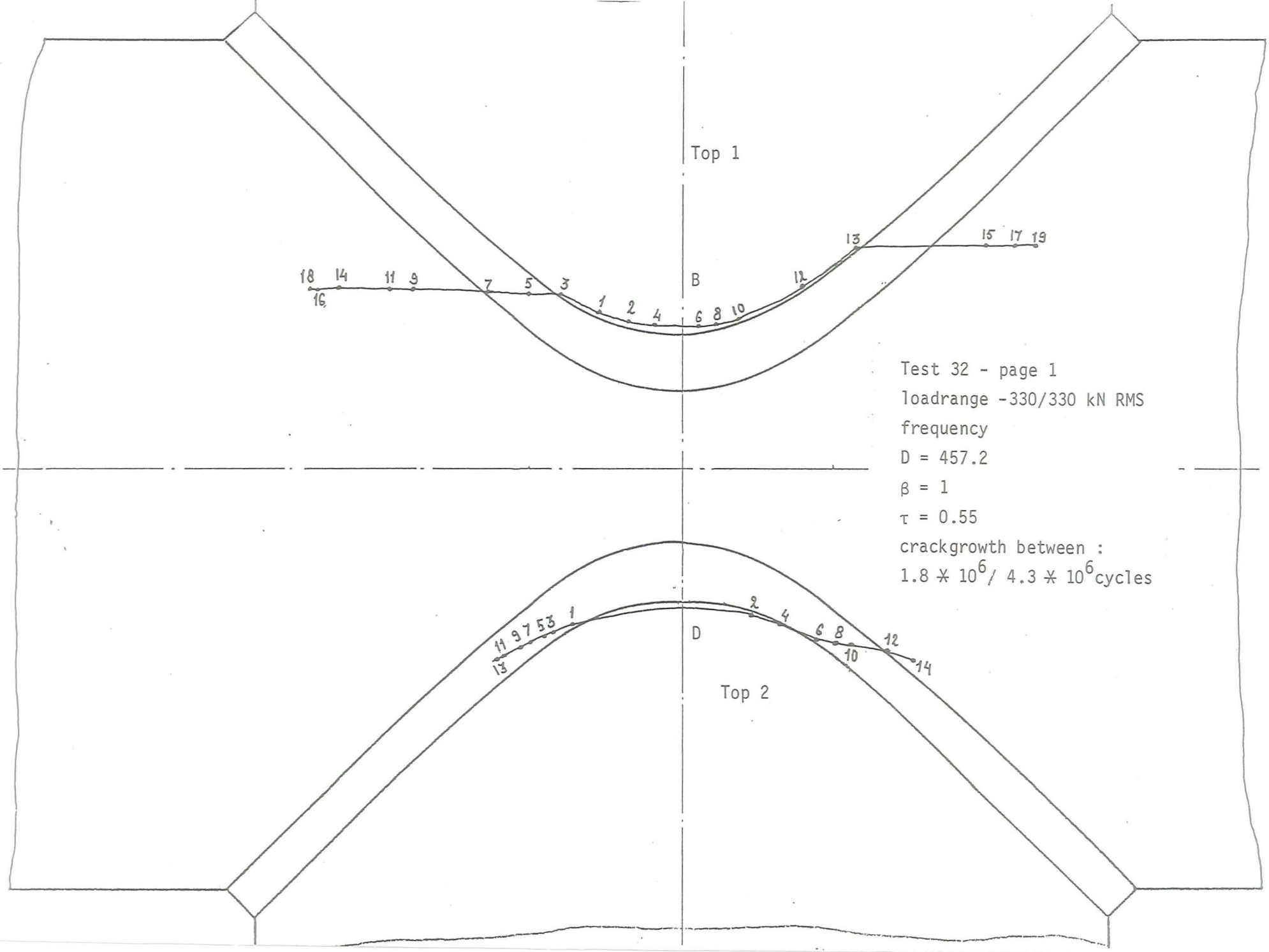
crack left side of centerline B							crack right side of centerline B				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	2	length crack tip to centerline [mm] 1	2	total crack length [mm]	location of crack tip 1	2	length crack tip to centerline [mm] 1	2	total crack length [mm]
1.8	1.8	1	2	47	30	17					
1.9	0.1	3	4	72	17	55					
2.0	0.1	5		88		88	6		6		6
2.4	0.4	7		109		109	8		17		17
2.9	0.5	9		150		150	10		30		30
3.5	0.6	11		163		163	12		69		69
							13		110		110
4.0	0.5	14		190		190	15		176		176
4.2	0.2	16		202		202	17		193		193
4.3	0.1	18		205		205	19		203		203
crack left side of centerline D							crack right side of centerline D				
1.8	1.8	1		60		60	2		40		40
1.9	0.1	3		71		71	4		57		57
2.0	0.1	5		76		76	6		78		78
2.4	0.4	7		85		85	8		90		90
2.9	0.5	9		91		91	10		108		108
3.5	0.6	11		101		101	12		128		128
4.0	0.5	13		106		106	14		142		142

TEST SPECIMEN 32

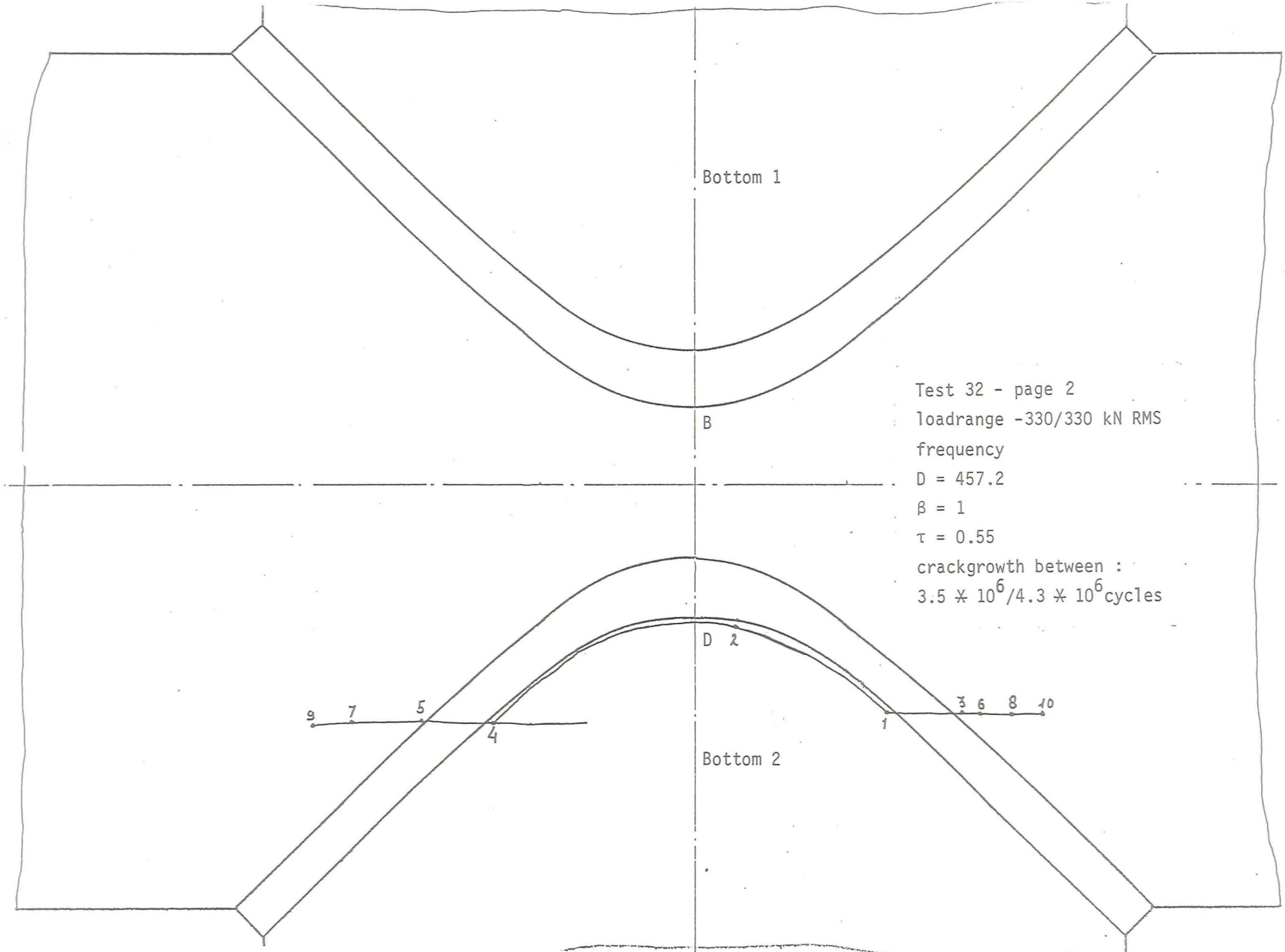
Bottom 2

crack left side of centerline B							crack right side of centerline B				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
							1		125		0
3.5	3.5						2	3	26	163	137
		4		150							
4.0	0.5	5		182		182	6		182		182
4.2	0.2	7		197		197	8		192		192
4.3	0.1	9		240		240	10		215		215

Test 32 - page 2

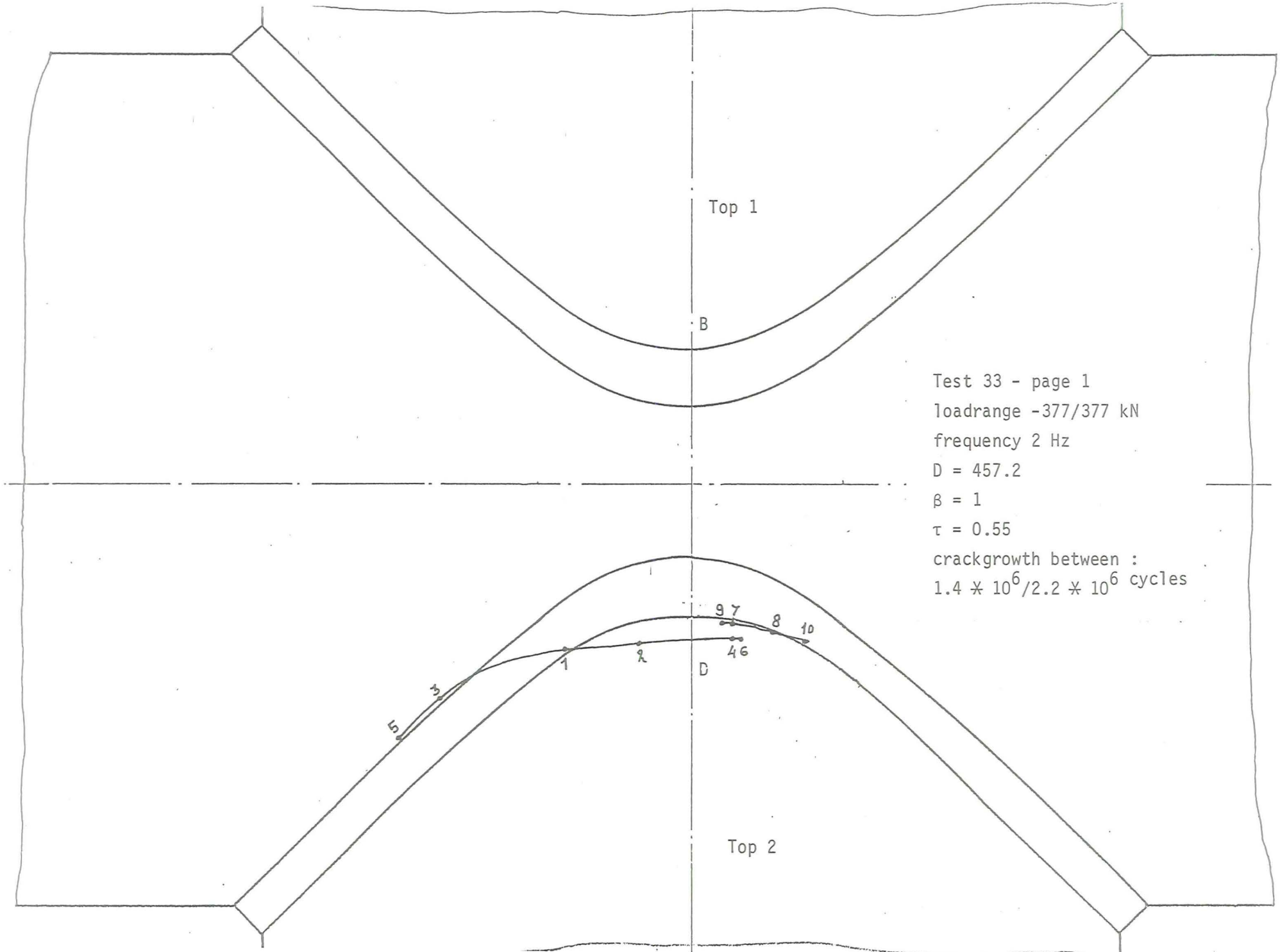


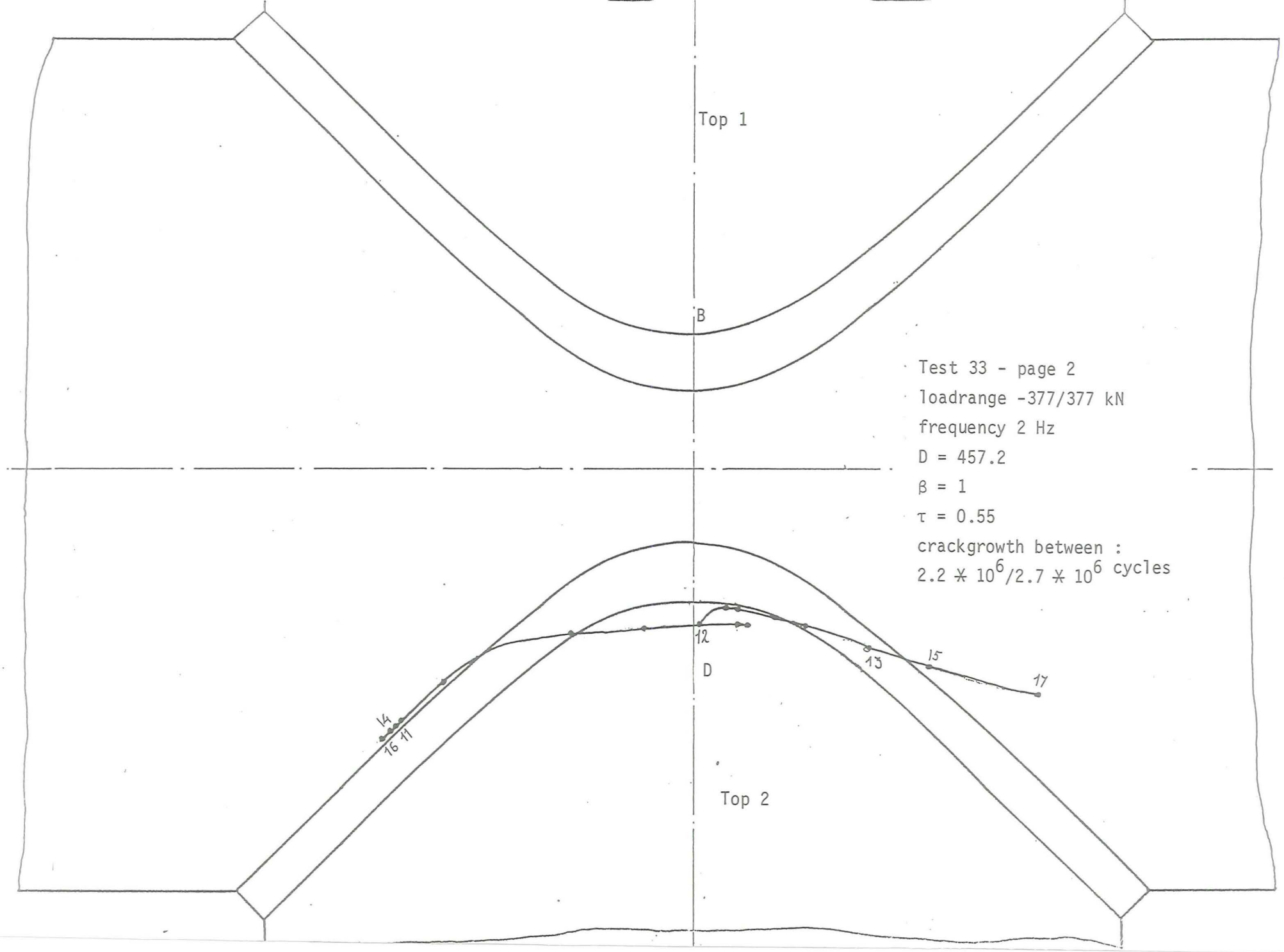
Test 32 - page 1
loadrange -330/330 kN RMS
frequency
D = 457.2
$\beta = 1$
$\tau = 0.55$
crackgrowth between :
$1.8 * 10^6 / 4.3 * 10^6$ cycles


Bottom 1
B
Test 32 - page 2
loadrange -330/330 kN RMS
frequency
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
3.5 ⋕ 10^6/4.3 ⋕ 10^6cycles
D 2
9 7 5 4
1 3 6 8 10
Bottom 2

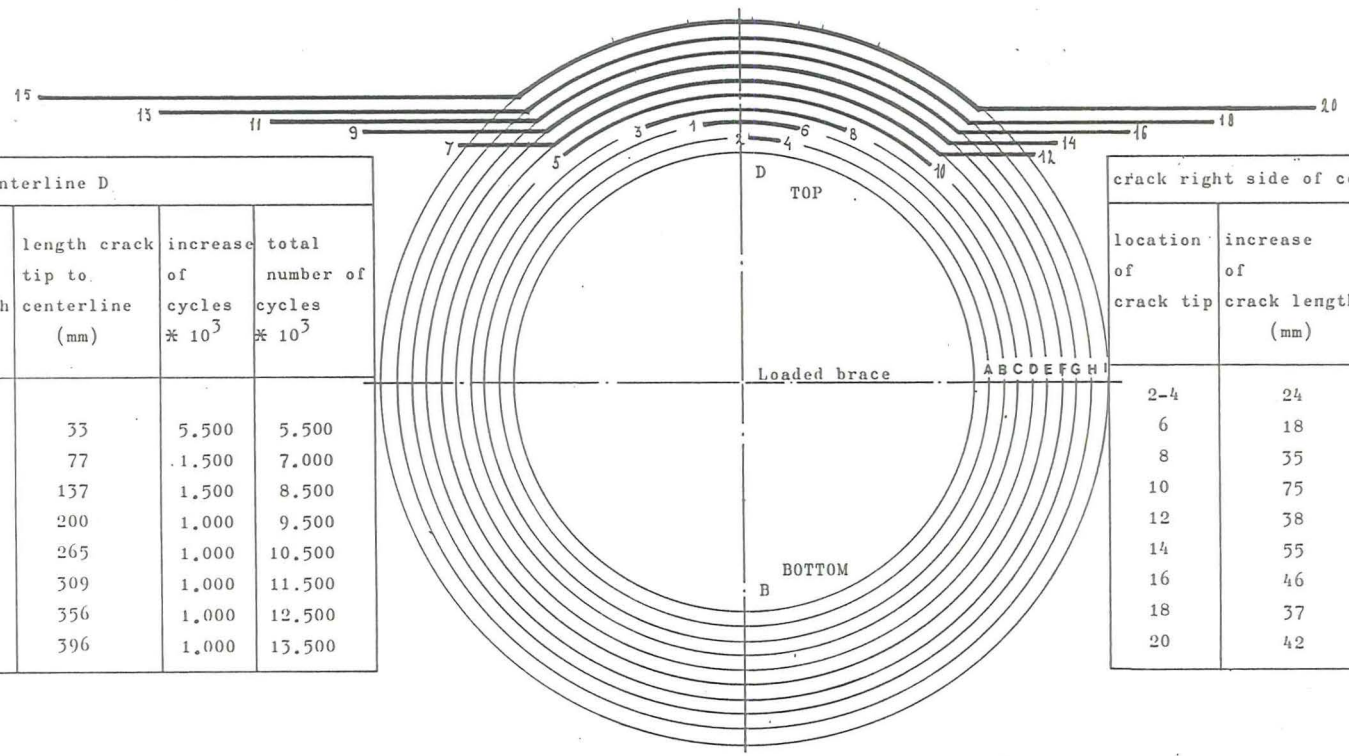
TEST SPECIMEN 33
Top 2

crack left side of centerline D							crack right side of centerline D				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
1.4	1.4	1	2	41	28	13					
1.8	0.4	3		152		152	4		22		22
2.1	0.3	5		180		180	6		26		26
2.1	0						7	8	23	43	20
2.2	0.1						9	10	10	58	41
							12		2		
2.4	0.2	11		184		184	13		90		90
2.6	0.2	14		187		187	15		125		125
2.7	0.1	16		192		192	17		185		185


Top 1
B
Test 33 - page 1
loadrange -377/377 kN
frequency 2 Hz
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
1.4 ✳ 10^6/2.2 ✳ 10^6 cycles
9 7
8
10
4 6
2
1
3
5
D
Top 2


Top 1
B
Test 33 - page 2
loadrange -377/377 kN
frequency 2 Hz
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
2.2 ✳ 10^6/2.7 ✳ 10^6 cycles
12
D
13
15
17
14
16 11
Top 2

TEST SPECIMEN 34
load range 0 - 160 kN
frequency 6 Hz
N = 14.000.000 cycles



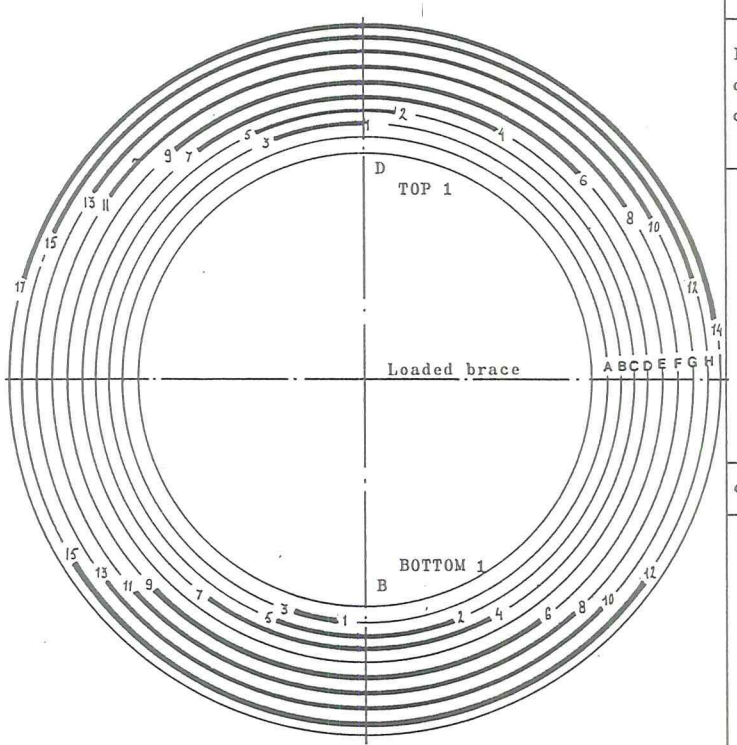
crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
1	33	33	5.500	5.500
3	44	77	1.500	7.000
5	60	137	1.500	8.500
7	63	200	1.000	9.500
9	65	265	1.000	10.500
11	44	309	1.000	11.500
13	47	356	1.000	12.500
15	40	396	1.000	13.500

crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2-4	24	(4)34	4.000	4.000
6	18	52	1.500	5.500
8	35	87	1.500	7.000
10	75	162	1.500	8.500
12	38	200	1.000	9.500
14	55	255	1.000	10.500
16	46	301	1.000	11.500
18	37	338	1.000	12.500
20	42	380	1.000	13.500

A = 4.000.000
B = 5.500.000
C = 7.000.000
D = 8.500.000
E = 9.500.000
F =10.500.000
G =11.500.000
H =12.500.000
I =13.500.000

TEST SPECIMEN 35
load range 0 - 400 kN
frequency 3 Hz
N = 850.000 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1-3	85	85	200.000	200.000
5	11	96	50.000	250.000
7	55	151	50.000	300.000
9	15	166	100.000	400.000
11	62	228	100.000	500.000
13	0	228	50.000	550.000
15	25	253	100.000	650.000
17	58	311	100.000	750.000
crack left side of centerline B				
1-3	45	(3)65	150.000	150.000
5	10	75	50.000	200.000
7	70	145	50.000	250.000
9	40	185	150.000	400.000
11	16	201	100.000	500.000
13	16	217	50.000	550.000
15	25	242	100.000	650.000



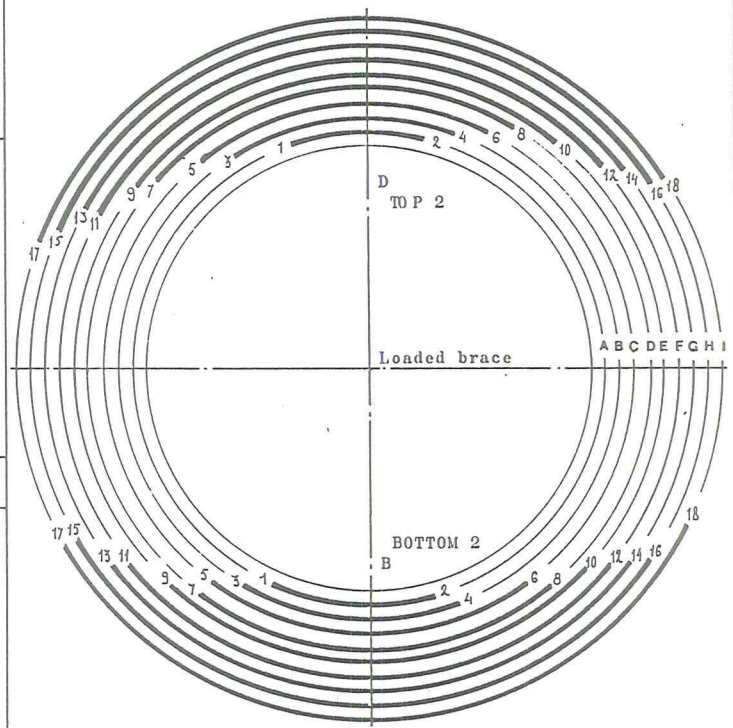
A = 150.000
B = 200.000
C = 250.000
D = 300.000
E = 400.000
F = 500.000
G = 550.000
H = 650.000
I = 750.000

crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	25	25	250.000	250.000
4	95	120	50.000	300.000
6	75	195	100.000	400.000
8	62	257	100.000	500.000
10	13	270	50.000	550.000
12	40	310	100.000	650.000
14	22	332	100.000	750.000
crack right side of centerline B				
2	90	90	200.000	200.000
4	20	110	50.000	250.000
6	48	158	150.000	400.000
8	20	178	100.000	500.000
10	15	193	50.000	550.000
12	35	228	100.000	650.000

TEST SPECIMEN 35
load range 0 - 400
frequency 3 Hz
N = 850.000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	80	80	200.000	200.000
3	55	135	50.000	250.000
5	30	165	50.000	300.000
7	36	201	50.000	350.000
9	14	215	50.000	400.000
11	35	250	50.000	450.000
13	0	250	50.000	500.000
15	25	275	100.000	600.000
17	15	290	150.000	750.000

crack left side of centerline B				
1	100	100	200.000	200.000
3	30	130	50.000	250.000
5	25	155	50.000	300.000
7	0	155	50.000	350.000
9	23	178	50.000	400.000
11	35	213	50.000	450.000
13	10	223	50.000	500.000
15	28	251	100.000	600.000
17	0	251	150.000	750.000



A = 200.000
B = 250.000
C = 300.000
D = 350.000
E = 400.000
F = 450.000
G = 500.000
H = 600.000
I = 750.000

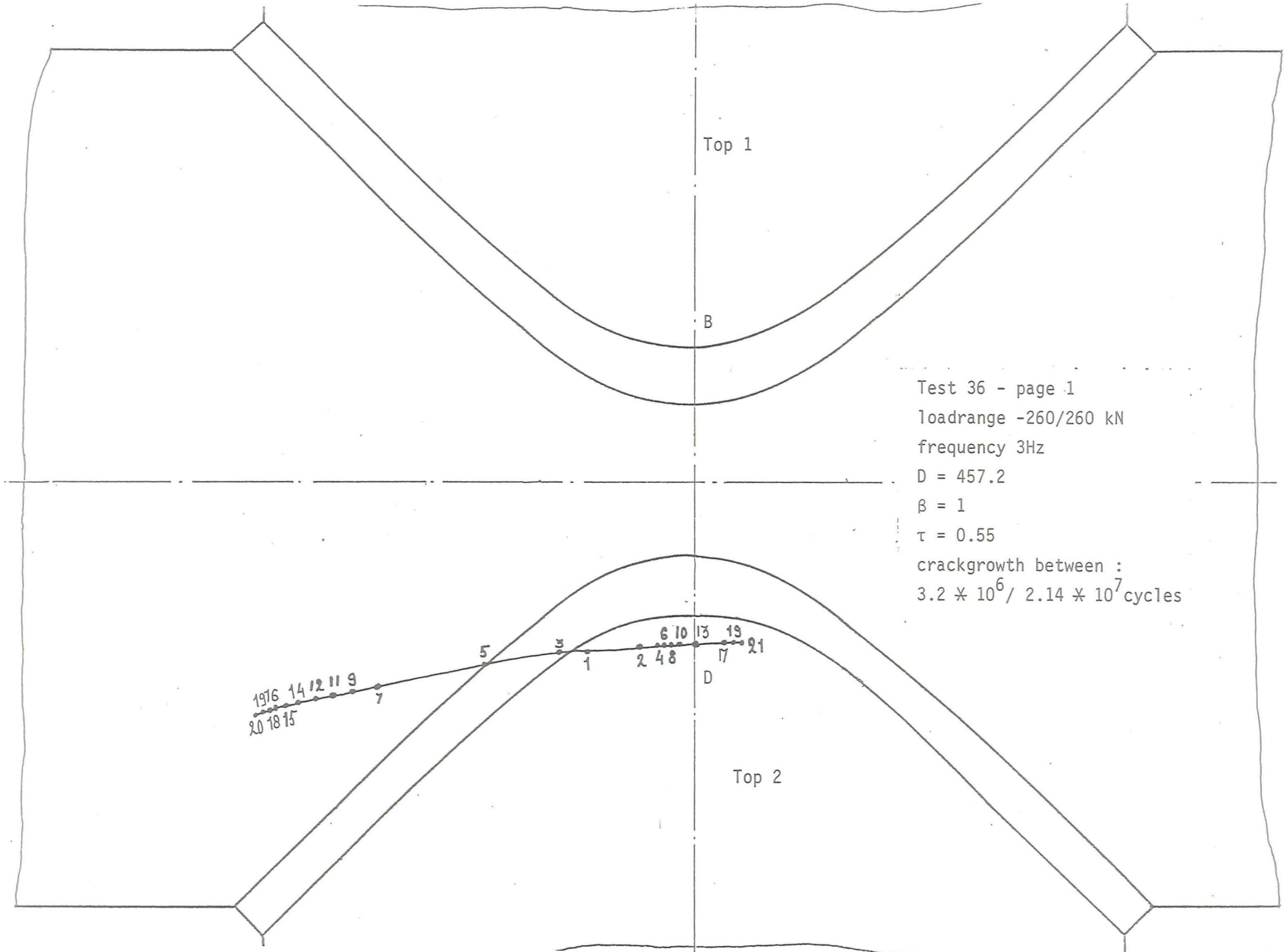
crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	60	60	200.000	200.000
4	26	86	50.000	250.000
6	30	116	50.000	300.000
8	16	132	50.000	350.000
10	38	170	50.000	400.000
12	35	205	50.000	450.000
14	12	217	50.000	500.000
16	22	239	100.000	600.000
18	0	239	150.000	750.000

crack right side of centerline B				
2	65	65	200.000	200.000
4	26	91	50.000	250.000
6	65	156	50.000	300.000
8	12	168	50.000	350.000
10	32	200	50.000	400.000
12	15	215	50.000	450.000
14	10	225	50.000	500.000
16	15	240	100.000	600.000
18	30	270	150.000	750.000

TEST SPECIMEN 36

Top 2

crack left side of centerline D							crack right side of centerline D				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip		length crack tip to centerline [mm]		total crack length [mm]	location of crack tip		length crack tip to centerline [mm]		total crack length [mm]
		1	2	1	2		1	2	1	2	
3.2	3.2	1	2	62	32	30					
4.3	1.1	3	4	95	21	74					
5.0	0.7	5	6	114	18	96					
6.9	1.9	7	8	171	9	162					
8.0	1.1	9	10	186	6	180					
9.6	1.6	11	10	198	6	192					
10.7	1.1	12	13	206	0	206					
13.8	3.1	14		216		216					
16.4	2.6	15		222		222					
18.6	2.2	16		225		225	17		13		13
19.7	1.1	18		227		227	19		15		15
20.3	0.6	20		228		228	21		17		17
21.4	1.1	22		230		230					


Top 1
B
Test 36 - page 1
loadrange -260/260 kN
frequency 3Hz
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
3.2 ✳ 10^6/ 2.14 ✳ 10^7 cycles
5
3
1
2
4
8
6
10
13
19
21
17
D
7
9
11
12
14
16
19
20
18
15
Top 2

TEST SPECIMEN 37

TOP

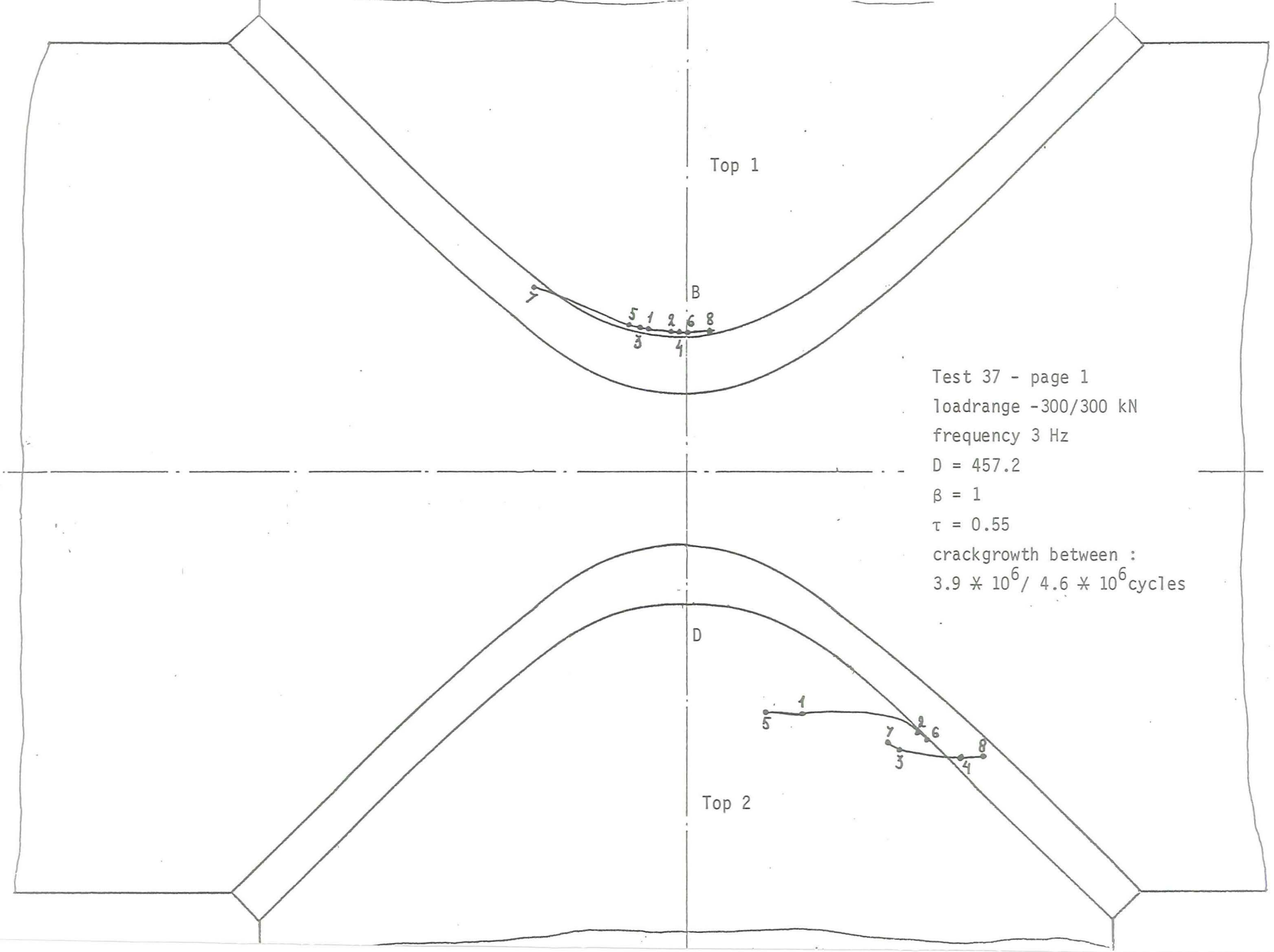
crack left side of centerline B							crack right side of centerline B					
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	
3.9	3.9	1	2	23	10	13						1
4.0	0.1	3	4	26	8	18						
4.2	0.2	5	6	33	1	32						
4.6	0.4	7		89		89	8		11		11	
4.9	0.3	9		113		113	10		15		15	
5.3	0.4	11		117		117	12		18		18	
6.1	0.8	13		162		162	14		20		20	
6.7	0.6	15		179		179	16		22		22	2
7.4	0.7	17		195		195	18		31		31	
8.2	0.8	19		213		213	20		41		41	
crack left side of centerline D							crack right side of centerline D					
4.2	4.2						1	2	62	127	65	
4.2							3	4	115	148	33	1
4.6	0.4						5	6	43	134	91	
4.6							7	8	106	161	55	
4.9	0.3						9	10	34	165	131	
5.3	0.4						11	12	28	169	141	
6.1	0.8						13	14	22	198	176	2
6.7	0.6						15	16	18	212	194	
7.4	0.7	17		39		39	18		234			
8.2	0.8	19		245		245	20		288			

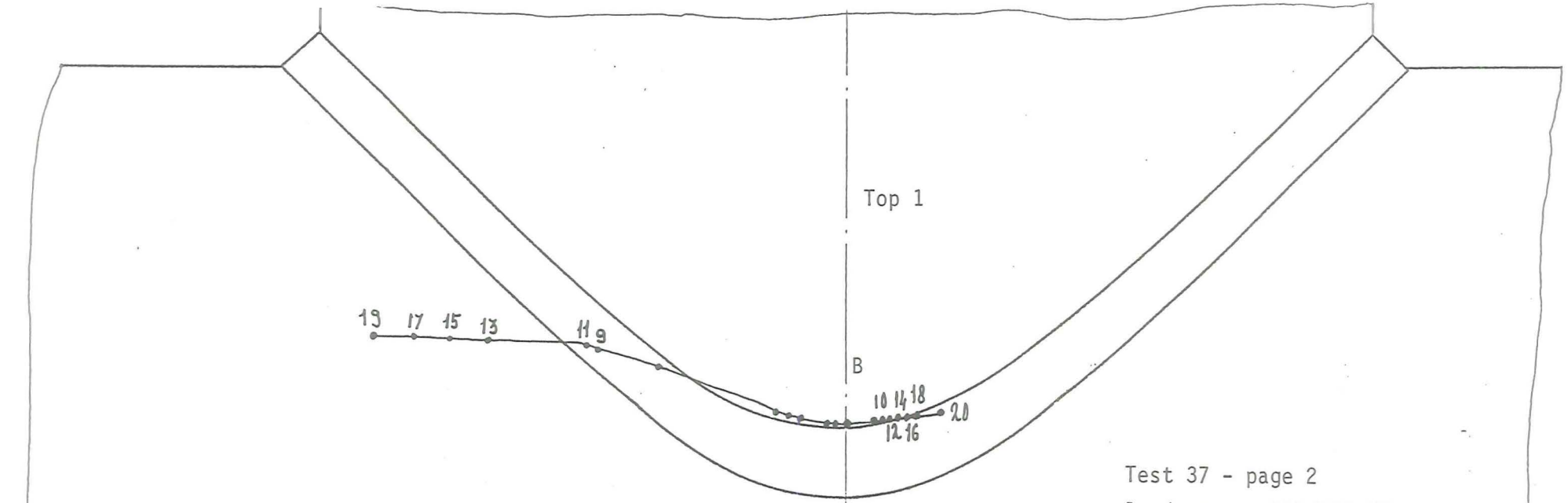
TEST SPECIMEN 37

Bottom

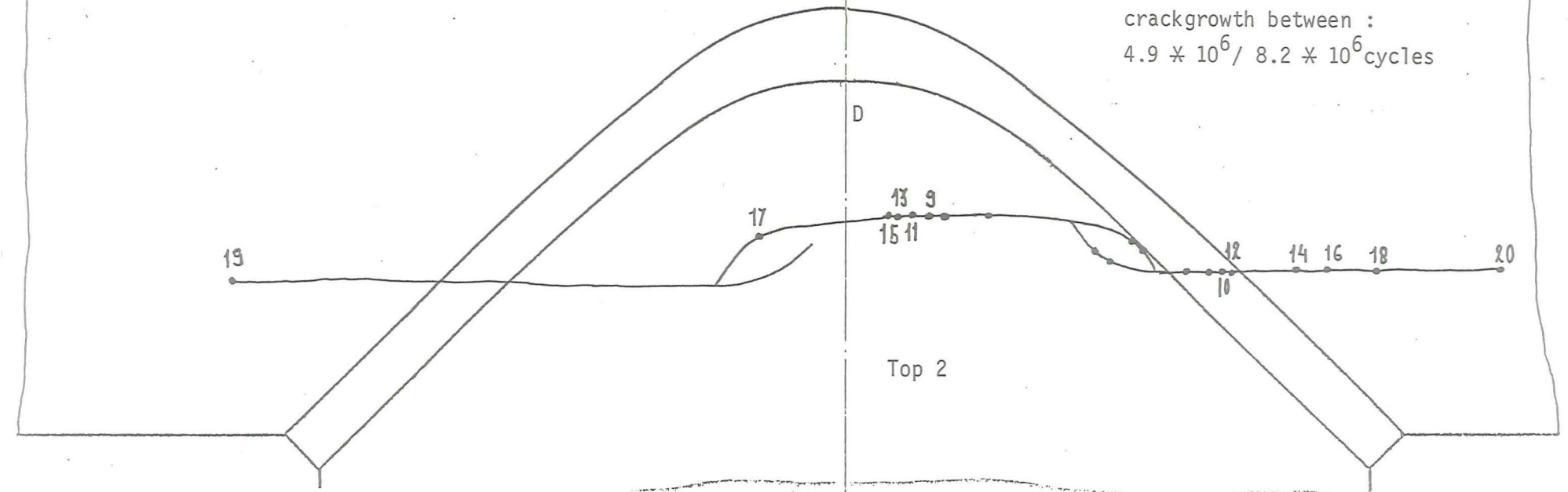
crack left side of centerline B							crack right side of centerline B					
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	
5.3	5.3						1	2	60	73	13	3
6.1	0.8						3	4	52	82	30	
6.7	0.6						5	6	47	93	46	
7.4	0.7						7	8	42	103	61	
8.2	0.8						9	10	30	175	145	
crack left side of centerline D							crack right side of centerline D					
7.4	7.4						1	2	75	190	115	3
8.2	0.8	3	4	108	185	77						
8.2							5	6	60	195	135	

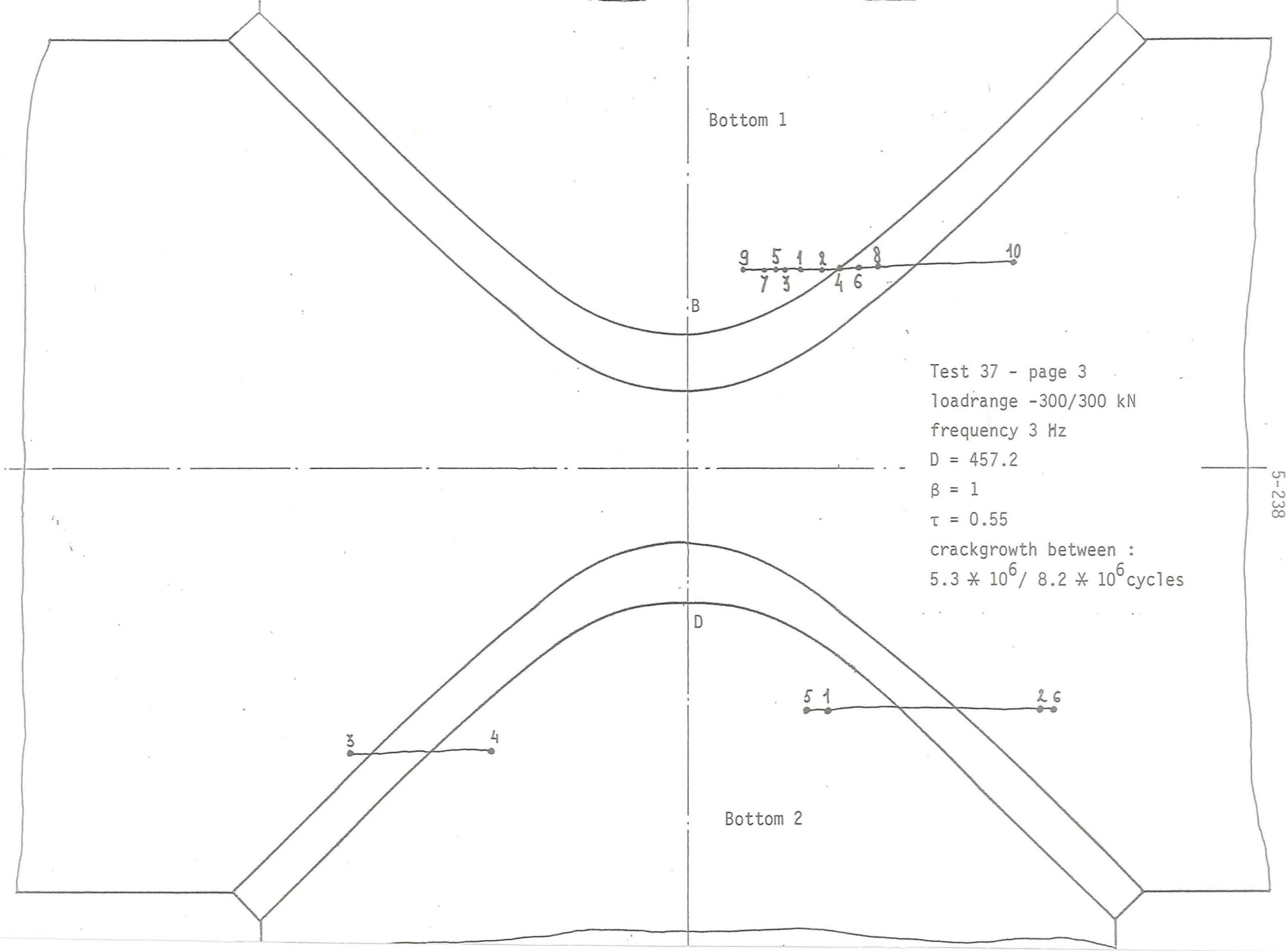
Test 37 - page 3


Top 1
B
7
5
1
2
6
8
3
4
Test 37 - page 1
loadrange -300/300 kN
frequency 3 Hz
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
3.9 * 10^6/ 4.6 * 10^6 cycles
D
5
1
2
6
7
8
3
4
Top 2



Test 37 - page 2
loadrange - 300/300 kN
frequency 3 Hz
D = 457.2
β = 1
τ = 0.55
crackgrowth between :
4.9 * 10^6/ 8.2 * 10^6cycles





Test 37 - page 3
loadrange -300/300 kN
frequency 3 Hz
D = 457.2
$\beta = 1$
$\tau = 0.55$
crackgrowth between :
5.3×10^6/ 8.2×10^6cycles

TEST SPECIMEN 38

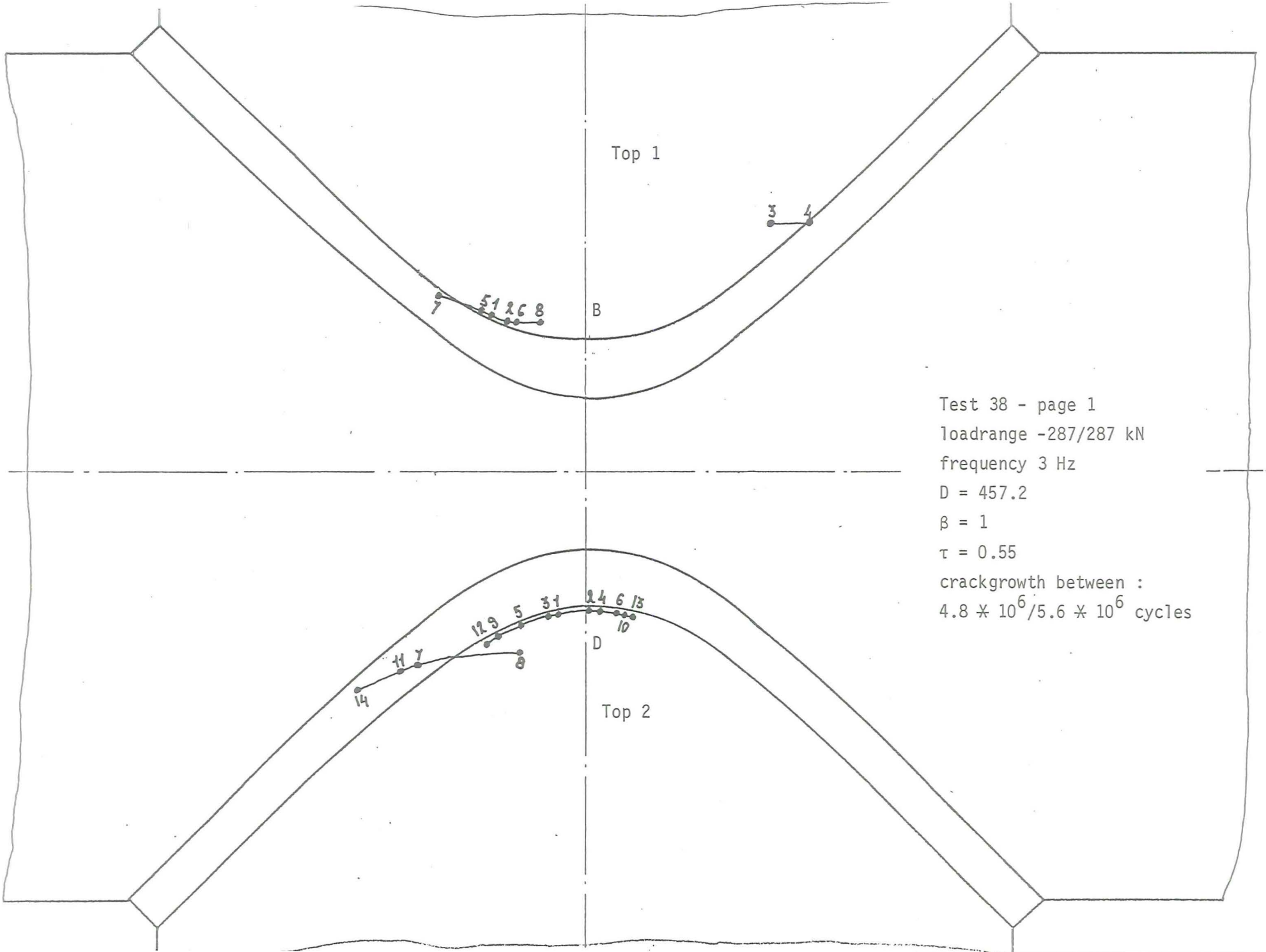
Top 1

crack left side of centerline B							crack right side of centerline B				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
5.3	5.3	1	2	52	40	12	3	4	100	122	22
5.4	0.1	5	6	56	36	20					
5.6	0.2	7	8	86	24	62					
5.8	0.2	9		96		96	10		2		2
5.8							11	12	95	130	35
		13		142		142					
6.7	0.9	14		160		160	16		11		11
6.7		15		156		156	17	18	80	140	60
7.0	0.3	19		184		184	21		20		20
7.0		20		174		174	22	23	54	154	100
7.6	0.6	24		208		208	27		34		34
7.6		25		202		202					
7.6		26		186		186					
7.6		28		14		14	29		176		176
8.1	0.5	30		216		216	33		46		46
8.1		31		252		252					
8.1		32		200		200					
8.1		34		66		66	35		222		222
		36		80		80					
8.5	0.4	37		262		262	40		48		48
8.5		38		314		314	41		240		240
8.5		39		208		208	42		254		254

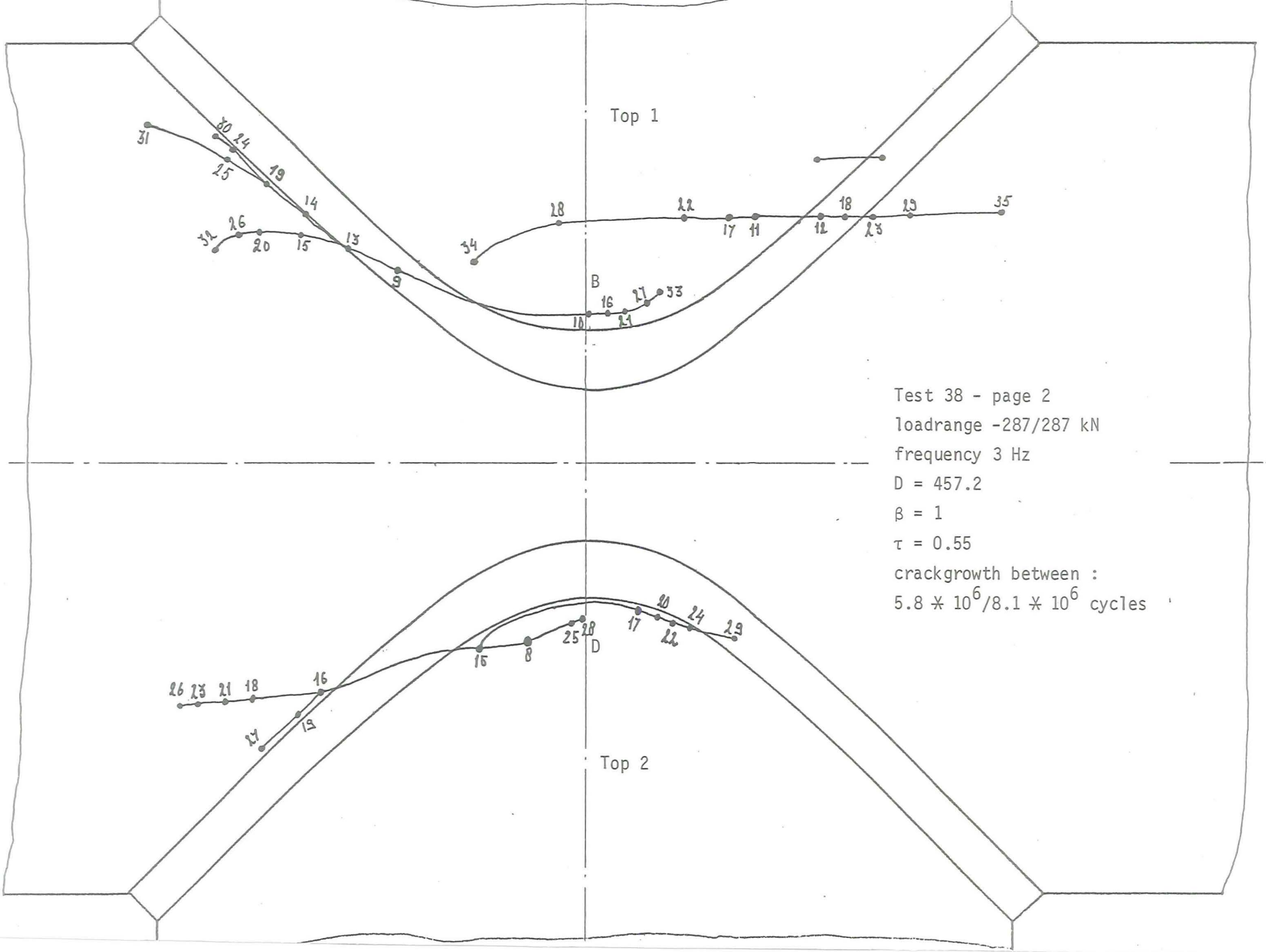
TEST SPECIMEN 38

Top 2

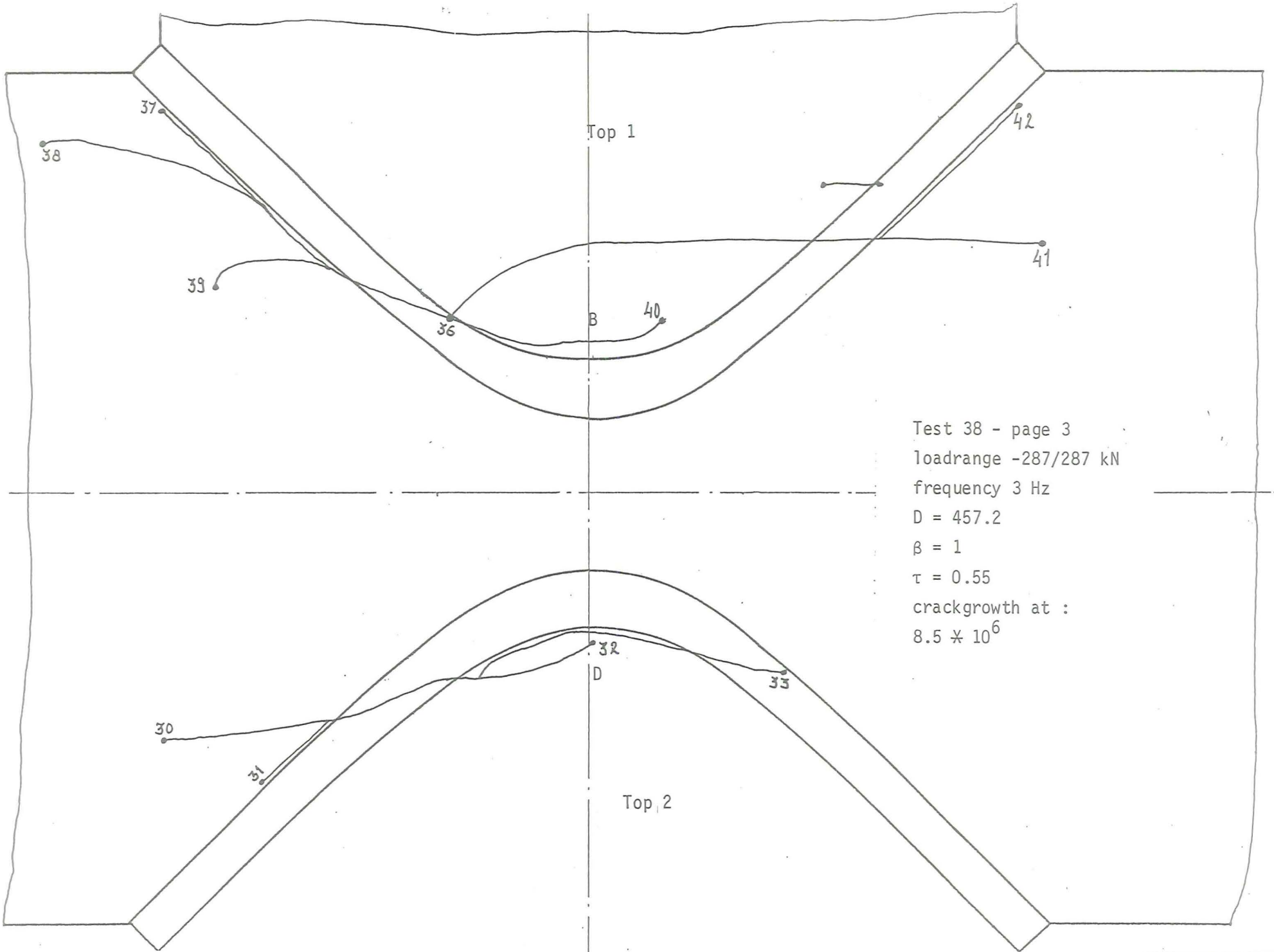
crack left side of centerline D							crack right side of centerline D				
total number of cycles $\times 10^6$	increase of cycles $\times 10^6$	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]	location of crack tip 1	location of crack tip 2	length crack tip to centerline [mm] 1	length crack tip to centerline [mm] 2	total crack length [mm]
4.8	4.8	1		16		16	2		2		2
5.0	0.2	3		23		23	4		6		6
5.3	0.3	5		40		40	6		16		16
5.3		7	8	90	34	56					
5.4	0.1	9		52		52	10		20		20
5.4		11	8	100	34	66					
5.6	0.2	12		60		60	13		26		26
5.6		14	8	120	34	86					
		15		70	70						
5.8	0.2	16		132		132	17		30		30
6.7	0.9	18		158		158	20		40		40
6.7		19		156		156					
7.0	0.3	21		188		188	22		51		51
7.6	0.6	23		202		202	24		56		56
7.6		25		8		8					
8.1	0.5	26		214		214	29		72		72
8.1		27		178		178					
8.1		28		2		2					
8.5	0.4	30		226		226	32		9		9
8.5		31		178		178	33		96		96



Test 38 - page 1
loadrange -287/287 kN
frequency 3 Hz
D = 457.2
$\beta = 1$
$\tau = 0.55$
crackgrowth between :
$4.8 \times 10^6 / 5.6 \times 10^6$ cycles

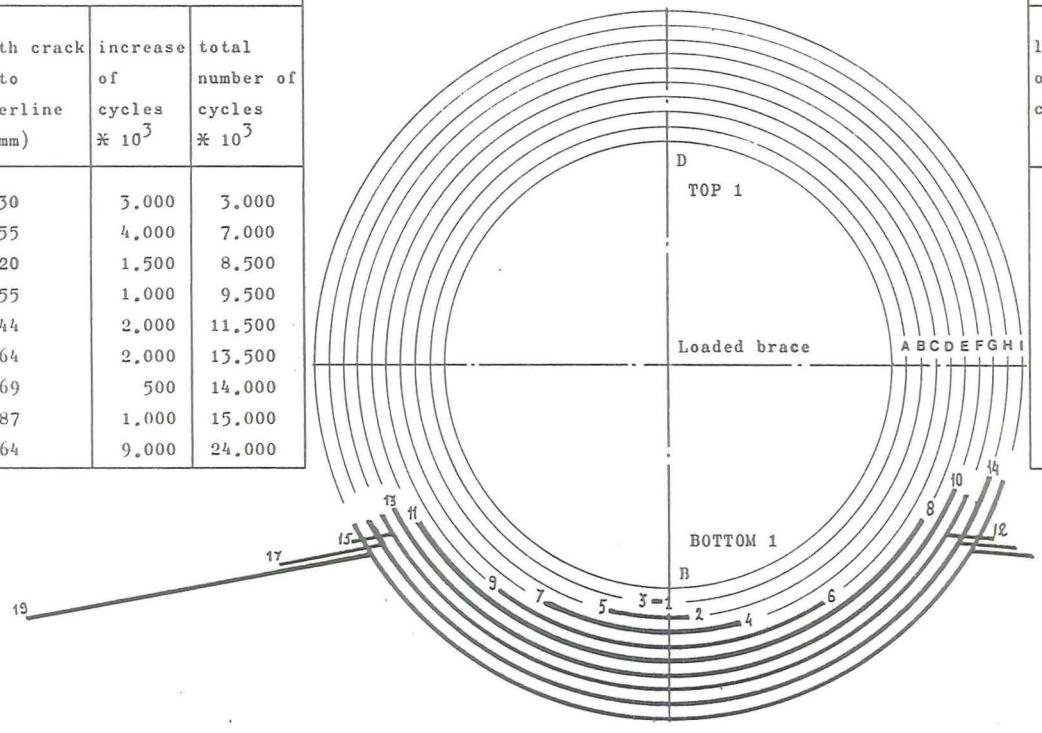


Test 38 - page 2
loadrange -287/287 kN
frequency 3 Hz
D = 457.2
$\beta = 1$
$\tau = 0.55$
crackgrowth between :
$5.8 * 10^6 / 8.1 * 10^6$ cycles


Top 1
37
38
39
36
B
40
41
42
Test 38 - page 3
loadrange -287/287 kN
frequency 3 Hz
D = 457.2
β = 1
τ = 0.55
crackgrowth at :
8.5 ✳ 10^6
32
D
33
30
31
Top 2

TEST SPECIMEN 39
load range 0 -150 kN
frequency 6 Hz
N = 26.000.000 cycles

crack left side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles * 10^3	total number of cycles * 10^3
(1-3)	15	(3)30	3.000	3.000
5	40	55	4.000	7.000
7	65	120	1.500	8.500
9	35	155	1.000	9.500
11	89	244	2.000	11.500
13	20	264	2.000	13.500
15	5	269	500	14.000
17	18	287	1.000	15.000
19	77	364	9.000	24.000



crack right side of centerline B				
location of crack tip	increase of crack length (mm)	length crack tip to centerline. (mm)	increase of cycles * 10^3	total number of cycles * 10^3
2	15	15	7.000	7.000
4	49	64	1.500	8.500
6	76	140	1.000	9.500
8	102	242	2.000	11.500
10	34	276	2.000	13.500
12	20	262	500	14.000
14	25	287	1.000	15.000

A = 3.000.000
B = 7.000.000
C = 8.500.000
D = 9.500.000
E = 11.500.000
F = 13.500.000
G = 14.000.000
H = 15.000.000
I = 24.000.000

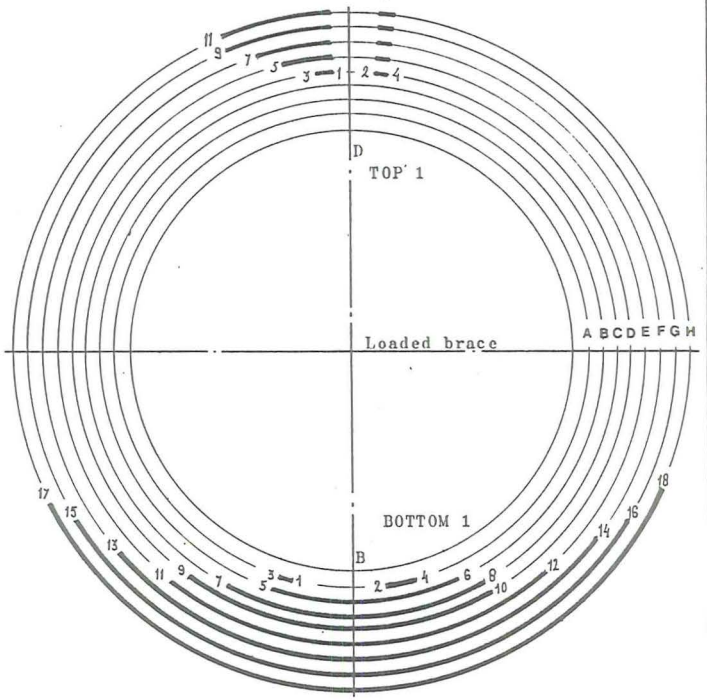
TEST SPECIMEN 40

load range 0 - 390 kN

frequency 3 Hz

N = 730.000 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
(1-3)	15	(3)30	275.000	275.000
5	20	50	50.000	325.000
7	15	65	25.000	350.000
9	20	85	100.000	450.000
11	0	85	50.000	500.000
crack left side of centerline B				
(1-3)	12	(3)60	100.000	100.000
5	63	75	25.000	125.000
7	45	120	100.000	225.000
9	32	152	50.000	275.000
11	11	163	50.000	325.000
13	47	210	25.000	350.000
15	36	246	100.000	450.000
17	22	268	50.000	500.000



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
(2-4)	8	(4)28	275.000	275.000
crack rigth side of centerline B				
(2-4)	30	(4)65	100.000	100.000
6	65	95	25.000	125.000
8	31	126	100.000	225.000
10	0	126	50.000	275.000
12	48	174	50.000	325.000
14	45	219	25.000	350.000
16	25	244	100.000	450.000
18	32	276	50.000	500.000

A = 100.000

B = 125.000

C = 225.000

D = 275.000

E = 325.000

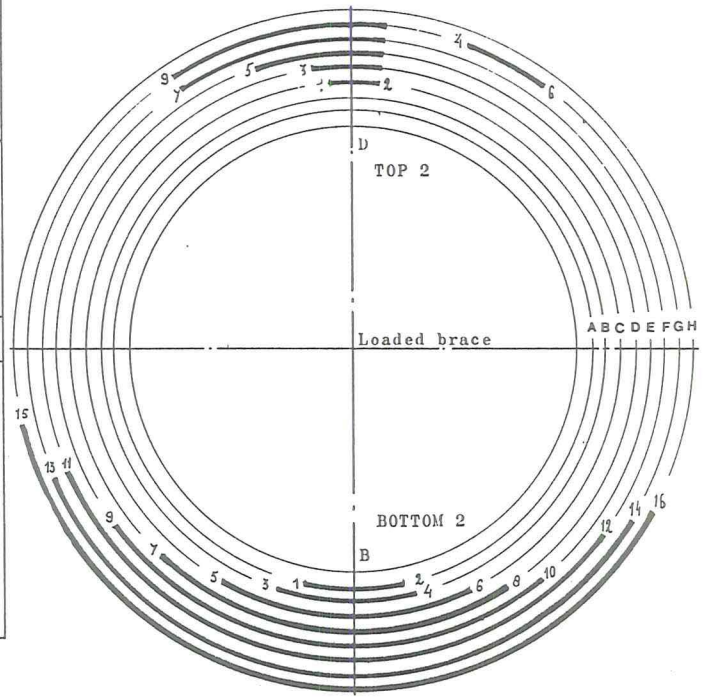
F = 350.000

G = 450.000

H = 500.000

TEST SPECIMEN 40
load range 0 - 390 kN
frequency 3 Hz
N = 730.000 cycles

crack left side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
1	15	15	275.000	275.000
3	14	29	50.000	325.000
5	55	84	50.000	375.000
7	57	141	75.000	450.000
9	0	141	25.000	475.000
crack left side of centerline B				
1	50	50	100.000	100.000
3	30	80	125.000	225.000
5	45	125	50.000	275.000
7	57	182	50.000	325.000
9	40	222	50.000	375.000
11	61	283	75.000	450.000
13	0	283	25.000	475.000
15	38	321	25.000	500.000



crack right side of centerline D				
location of crack tip	increase of crack length (mm)	length crack tip to centerline (mm)	increase of cycles	total number of cycles
2	20	20	275.000	275.000
(4-6)	45	(6)150	200.000	475.000
crack right side of centerline B				
2	45	45	100.000	100.000
4	10	55	125.000	225.000
6	55	110	50.000	275.000
8	30	140	50.000	325.000
10	25	165	50.000	375.000
12	58	223	75.000	450.000
14	20	243	25.000	475.000
16	14	254	25.000	500.000

A = 100.000
B = 225.000
C = 275.000
D = 325.000
E = 375.000
F = 450.000
G = 475.000
H = 500.000

Appendix 3-IV

Mode of failures