

MEASUREMENTS DURING FATIGUE TESTING

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

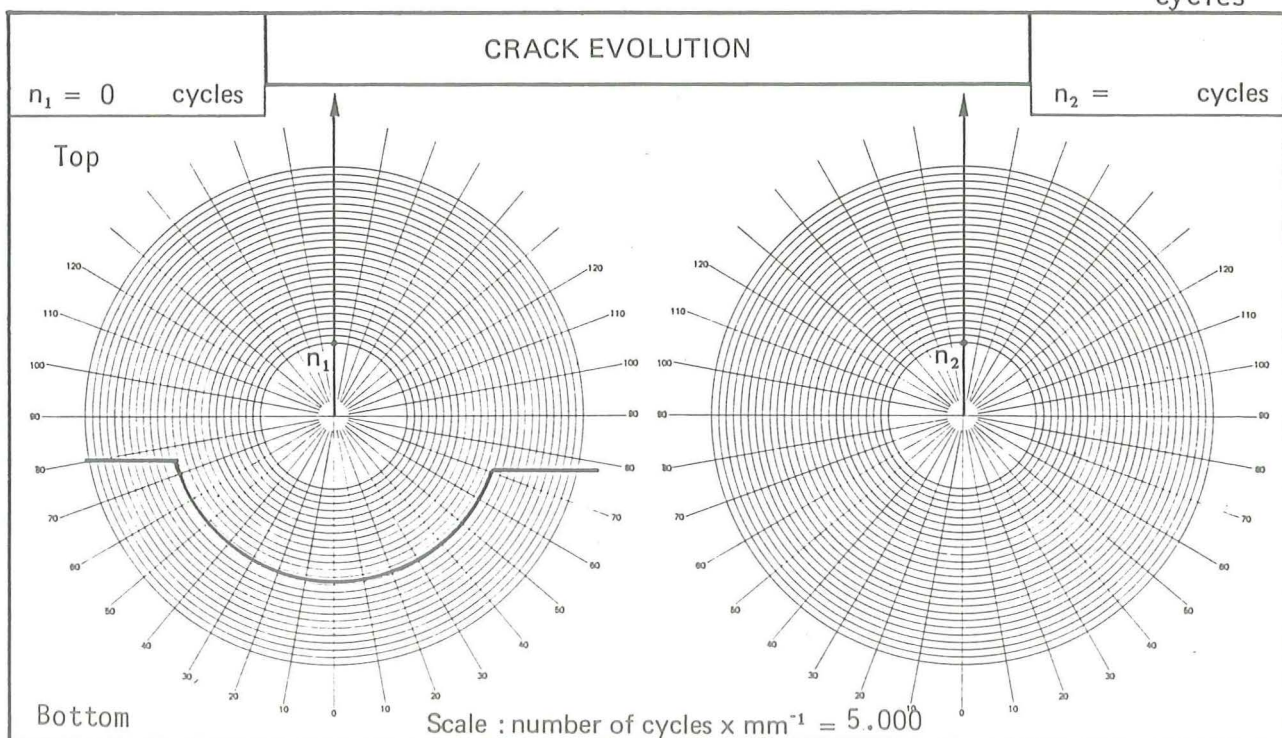
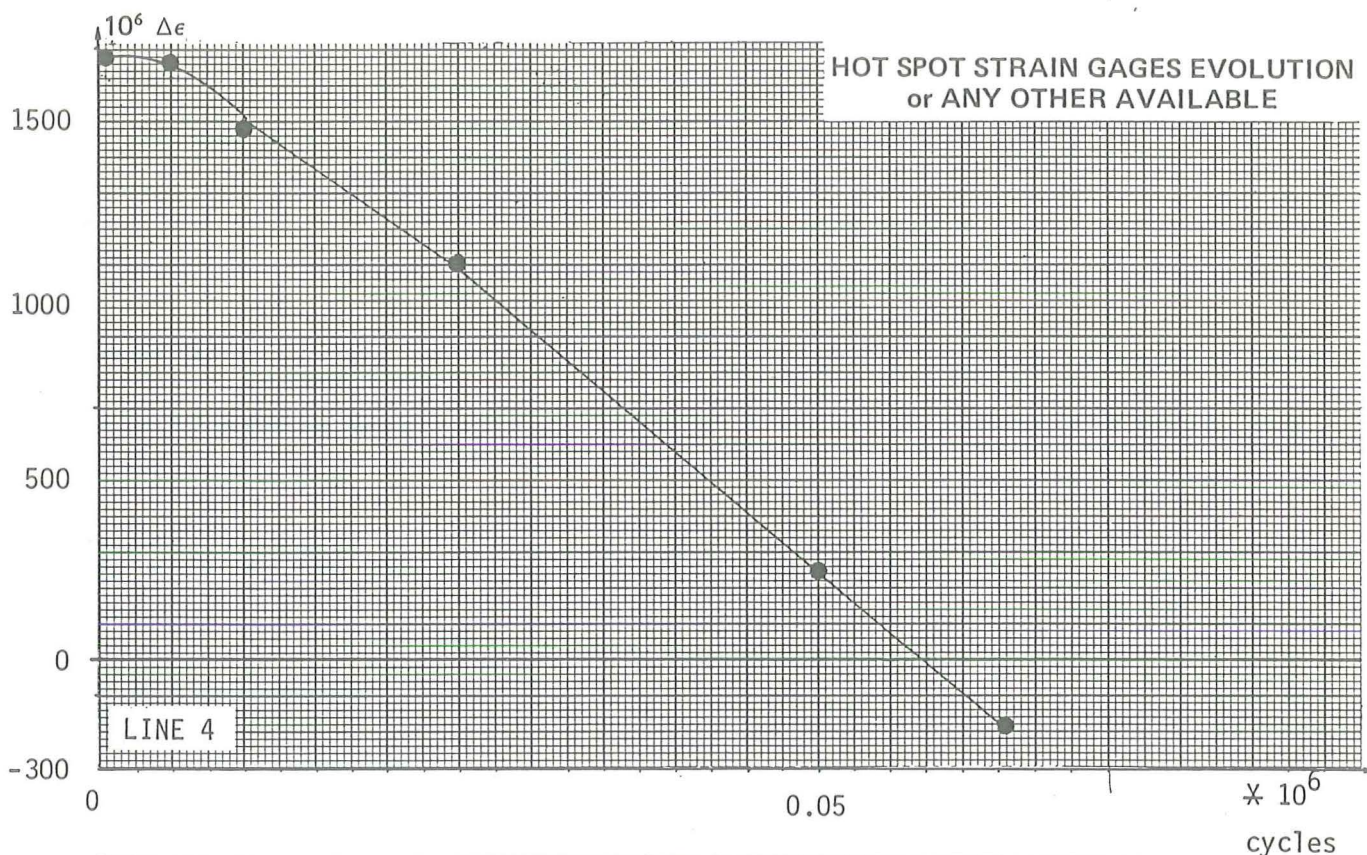
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.25×10^4		6.0×10^4	6.3×10^4	

(1) A : complete failure

B : actuator displacement = ... mm

C : secondary cracking total length = ... mm

D : other reason : ... Reduction of stiffness



OTHER RELEVANT INFORMATIONS

Spec. 1 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	2

GEOMETRY reference values in mm	outside diameter	wall thickness
	D 168.3	T 6.3
	d ₁ 88.9	t ₁ 3.2
	d ₂	t ₂

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C					STD : BS 4350				
	C %	Si %	Mn %	S %	P %	Al %				
	0.22	0.30	1.25	0.012	0.019					

WELDING	Welding process : MMAW , Current : AC Filler materials : 150 AWS - : E 7016 Electrode diameter (mm) : 2.5	
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		
	WELDING PROCEDURE	
	Position	5G
	Nr of runs	2
Energy (kj/m)		
preheat. temp. (° C)	65	
postheat. temp. (° C)	none	
POST WELDING TREATMENT		
Heat treatment - tig or plasma dressing		
Shot peening - grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	426	
Tensile strength σ_U (N/mm ²)	563	

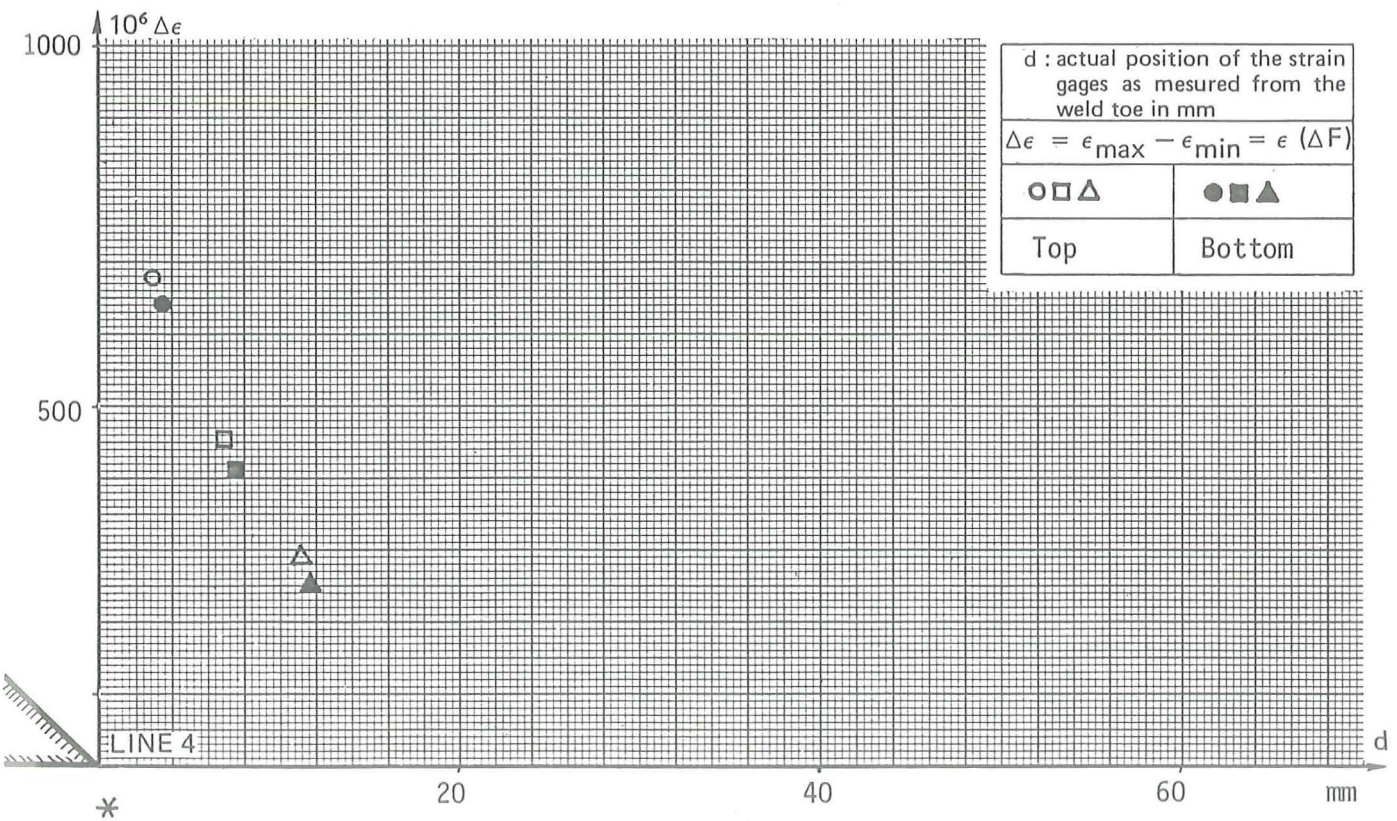
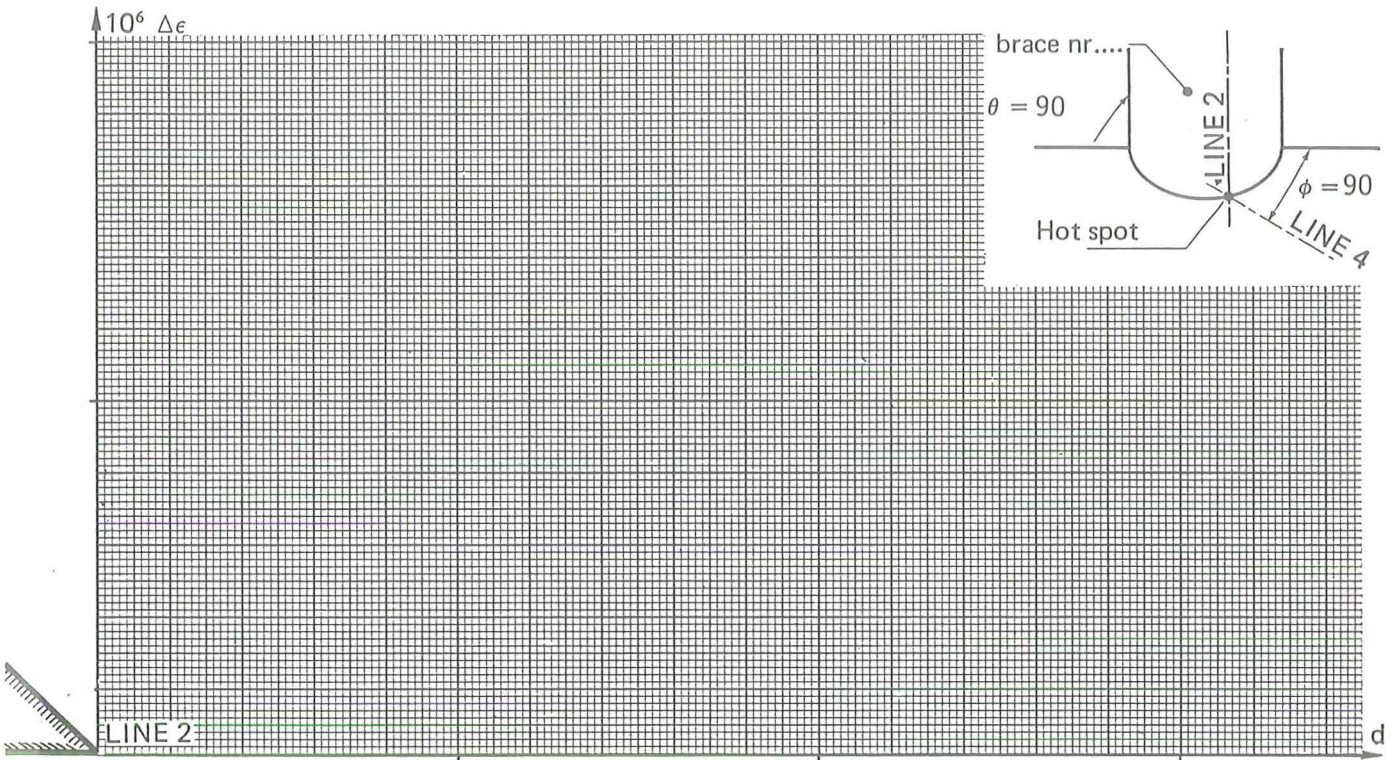
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 300

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	28	0		10	745



* 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.

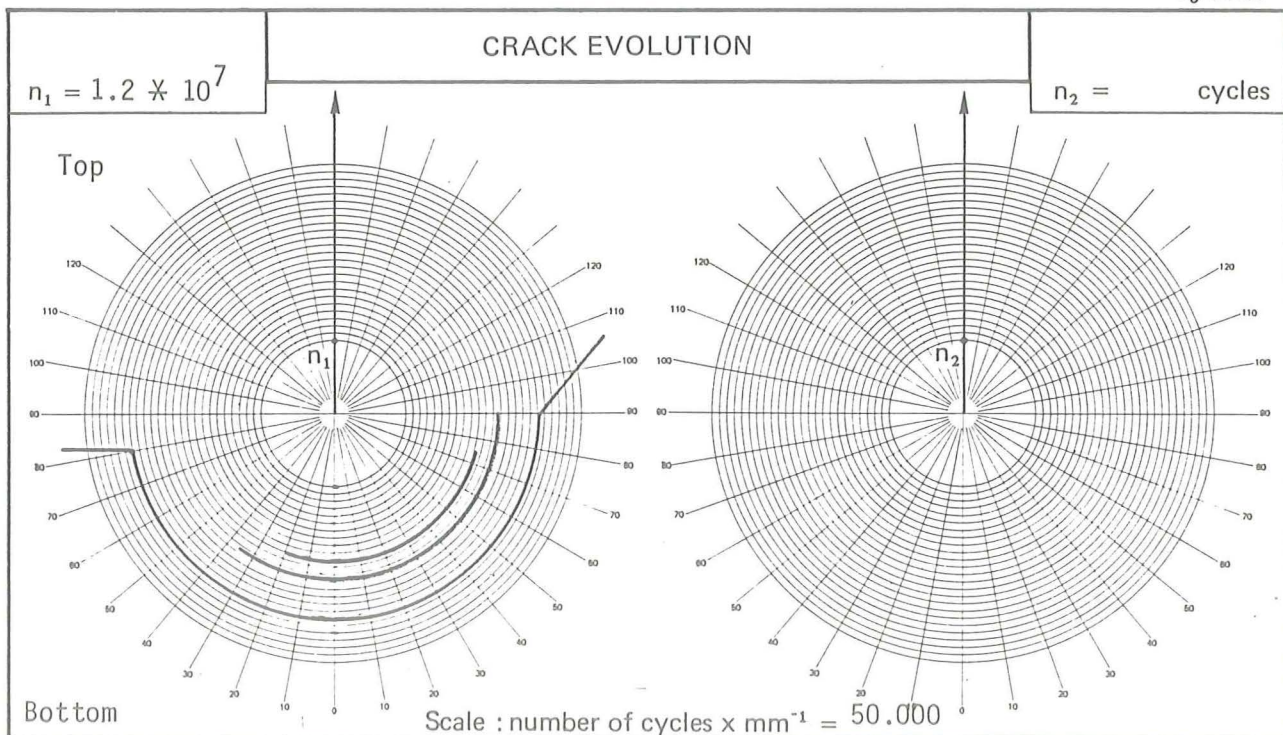
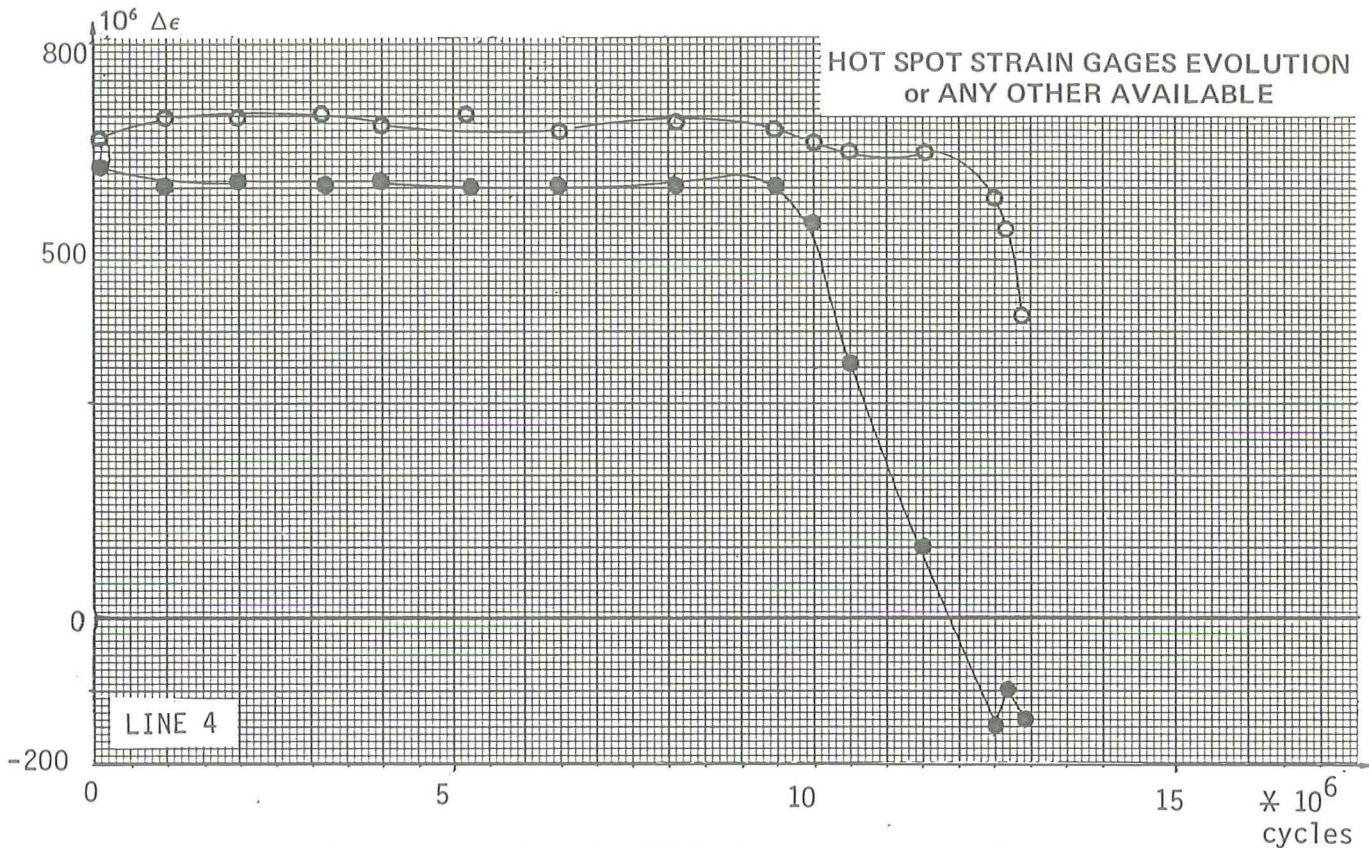
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 70 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.0×10^7	1.25×10^7	1.2×10^7	1.3×10^7	

(1) A : complete failure

C : secondary cracking total length = ... mm

B : actuator displacement = ... mm

D : other reason : ... Reduction of stiffness



OTHER RELEVANT INFORMATIONS

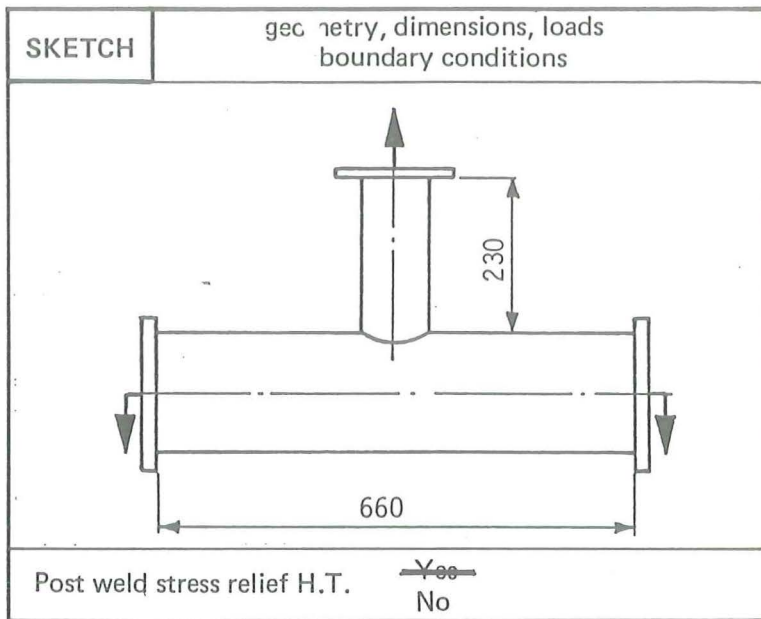
Spec. 2 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	3

GEOMETRY actual values in mm	outside diameter		wall thickness	
	D	168.3	T	6.3
	d ₁	88.9	t ₁	3.2
	d ₂		t ₂	



ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C						STD : BS 4350			
	C %	Si %	Mn %	S %	P %	Al %				
	0.22	0.30	1.25	0.012	0.019					

WELDING	Welding process : MMAW , Current : AC									
	Filler materials : ISO AWS - : E 7016									
	Electrode diameter (mm) : 2.5									
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII						WELDING PROCEDURE				
						Position		5G		
						Nr of runs		2		
						Energy (kj/m)				
preheat. temp. (° C)		65								
postheat. temp. (° C)		none								
POST WELDING TREATMENT										
Heat treatment tig or plasma dressing										
Shot peening grinding										

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

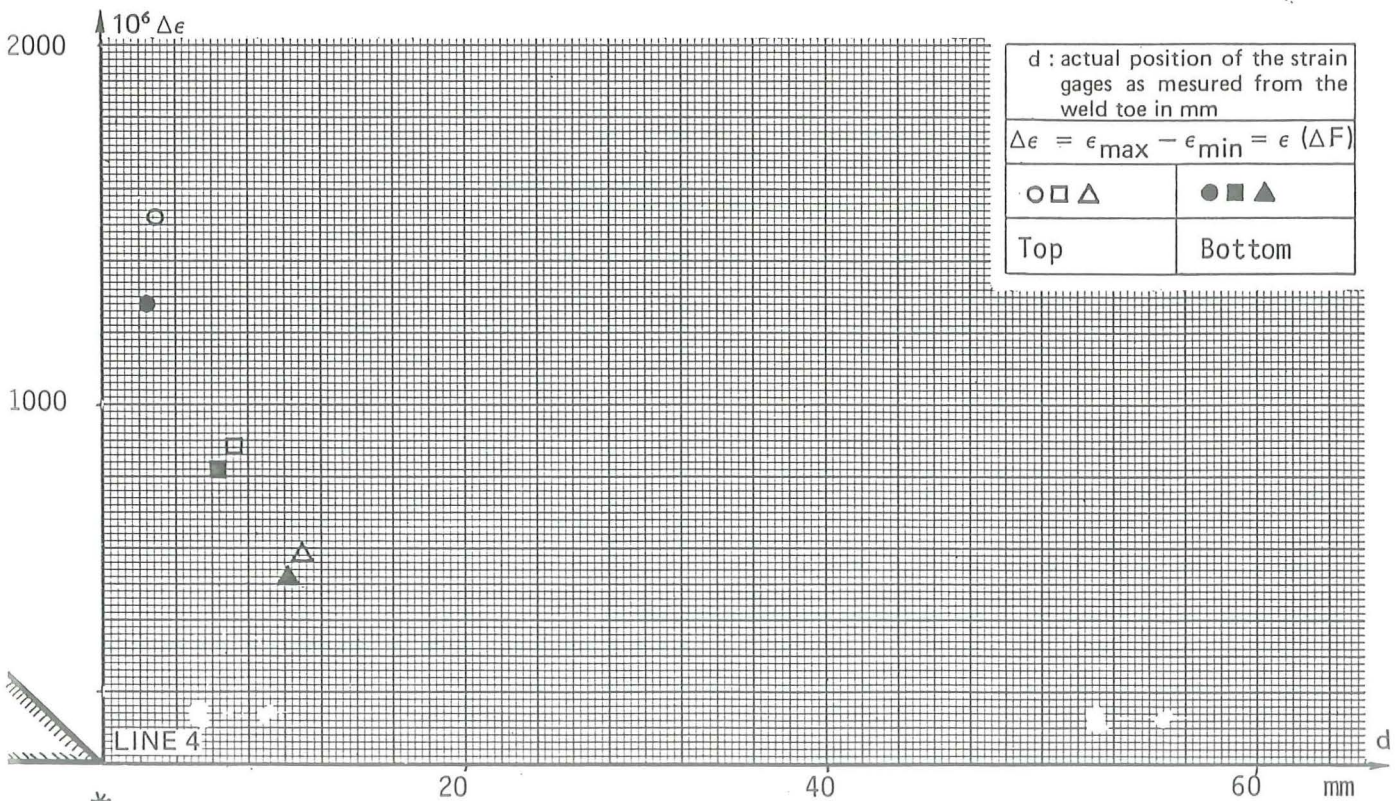
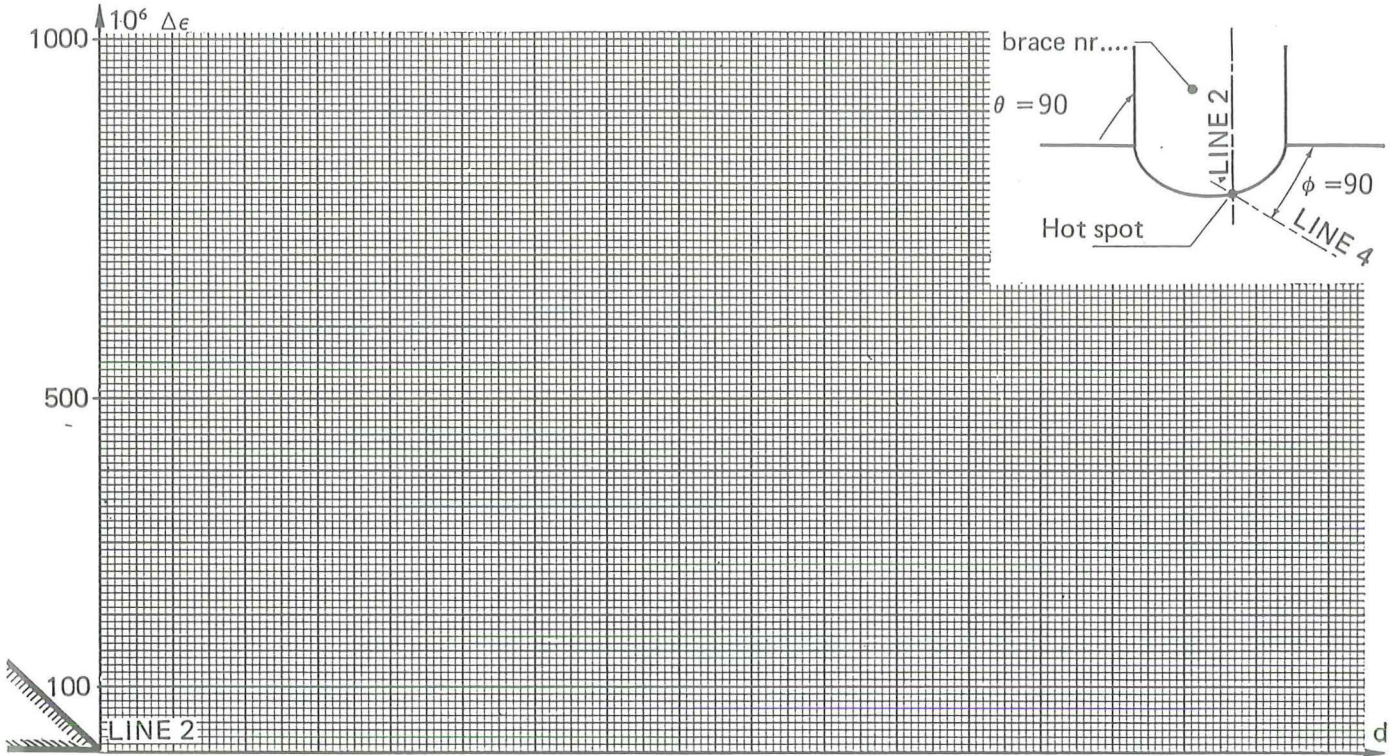
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	426	
Tensile strength σ_U (N/mm ²)	563	

Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 1100 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	50	0		10	1325



* 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.

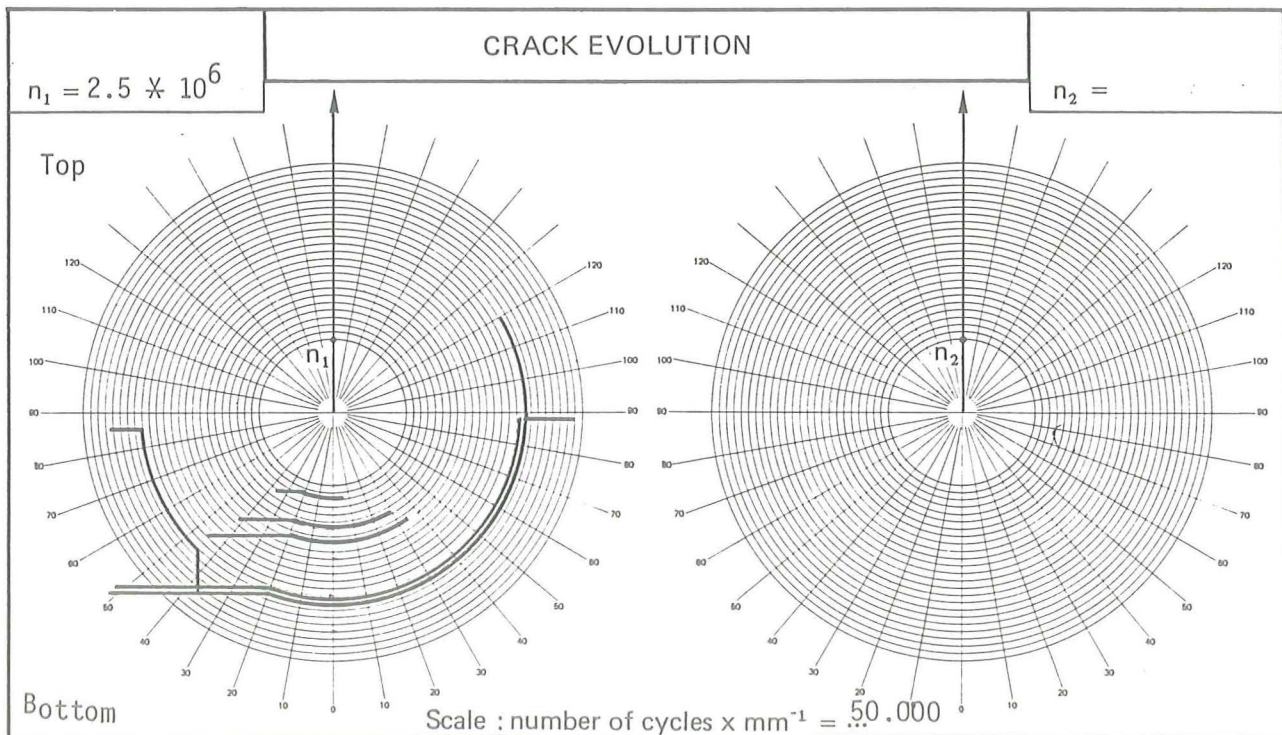
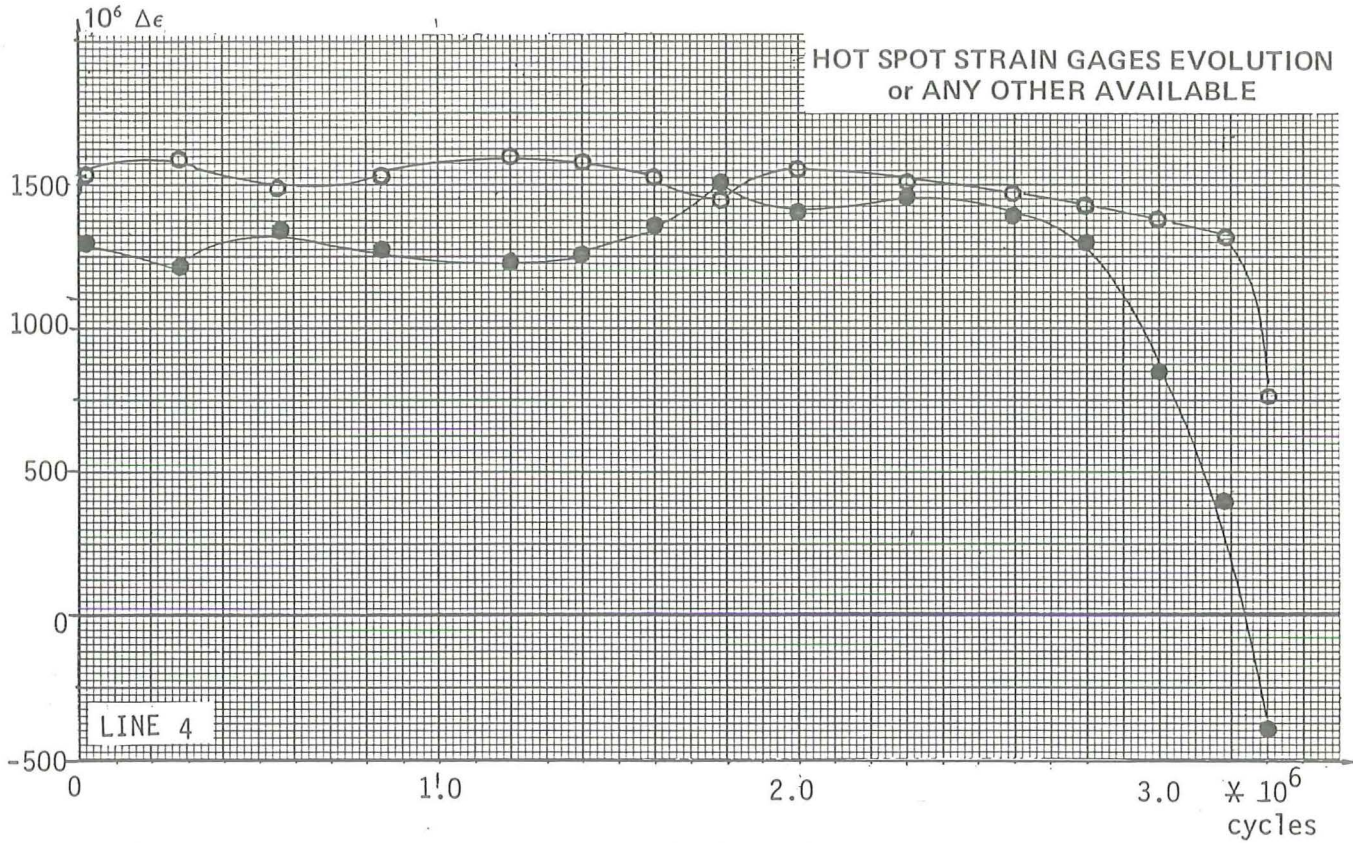
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	2.9×10^6	2.6×10^6	3.0×10^6	3.3×10^6	

(1) A : complete failure,

B : actuator displacement = ... mm

C : secondary cracking total length = ... mm

D : other reason : ... Reduction of stiffness



OTHER RELEVANT INFORMATIONS

Spec. 3 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	4

GEOMETRY actual values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 219.1	t ₁ 8.2
	d ₂	t ₂

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52						STD : API - 5 LX			
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

WELDING	Welding process : MMAW , Current:AC Filler materials : 160 - AWS - ; E 7016 Electrode diameter (mm) : 2.5 to 4
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WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII	Bottom	Top	WELDING PROCEDURE	
			Position	5G
			Nr of runs	3
			Energy (kj/m)	-
		preheat. temp. (° C)	65	
		postheat. temp. (° C)	none	
				POST WELDING TREATMENT
				Heat treatment - tig or plasma dressing
				Sheet peening - grinding

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	394	
Tensile strength σ_u (N/mm ²)	603	

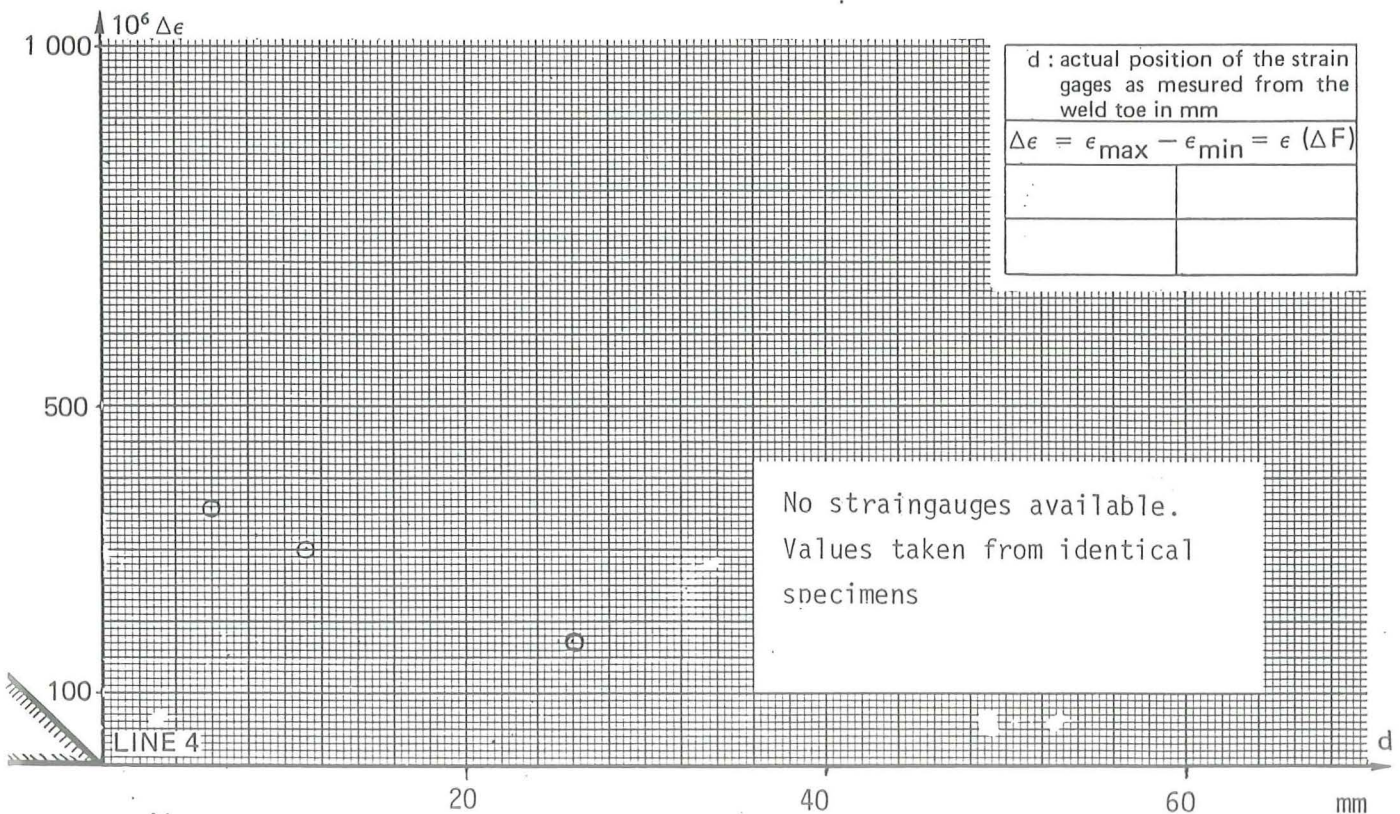
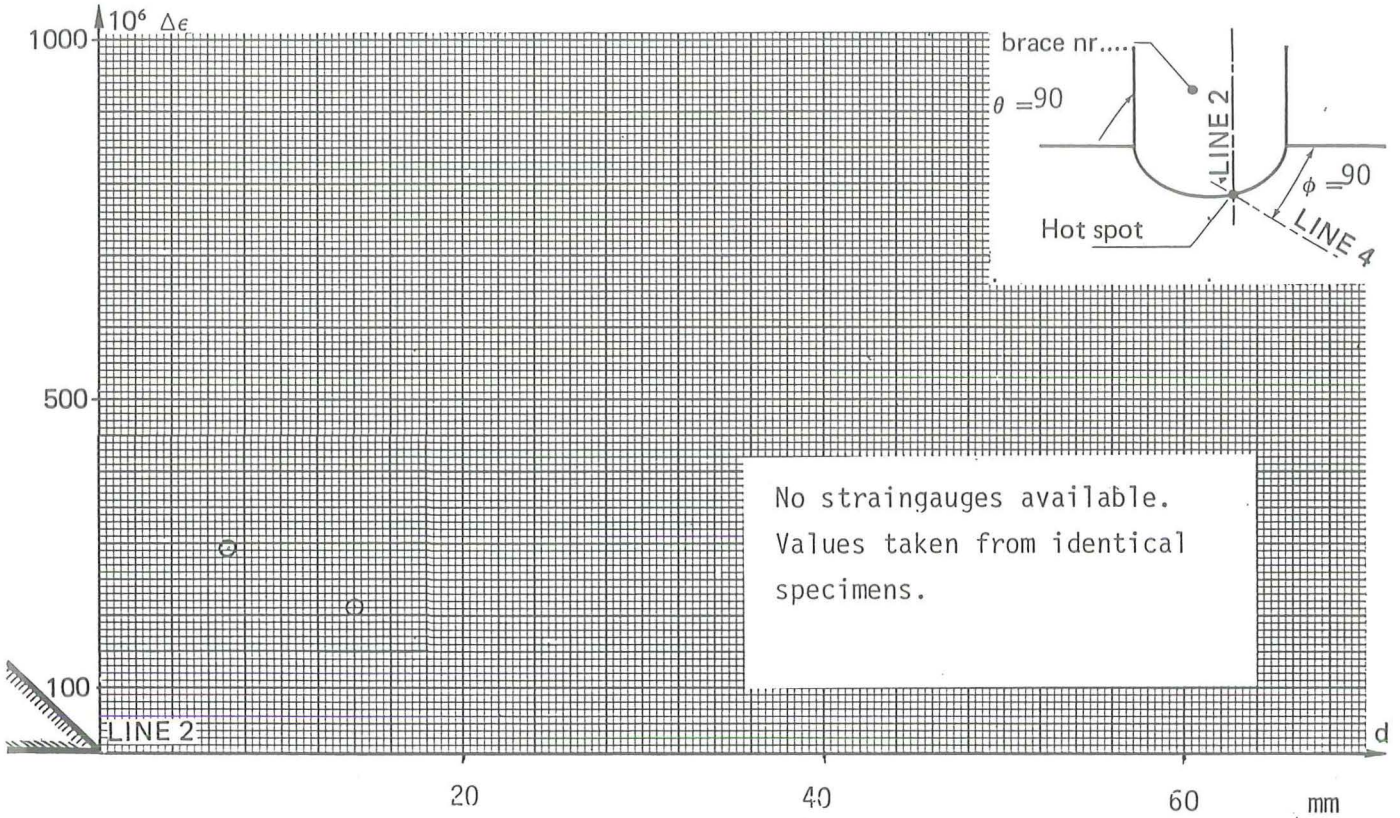
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 4 - page 2

Number of cycles before measurements : . 10 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange*
- 42.5	42.5	-1	-	0.2	435



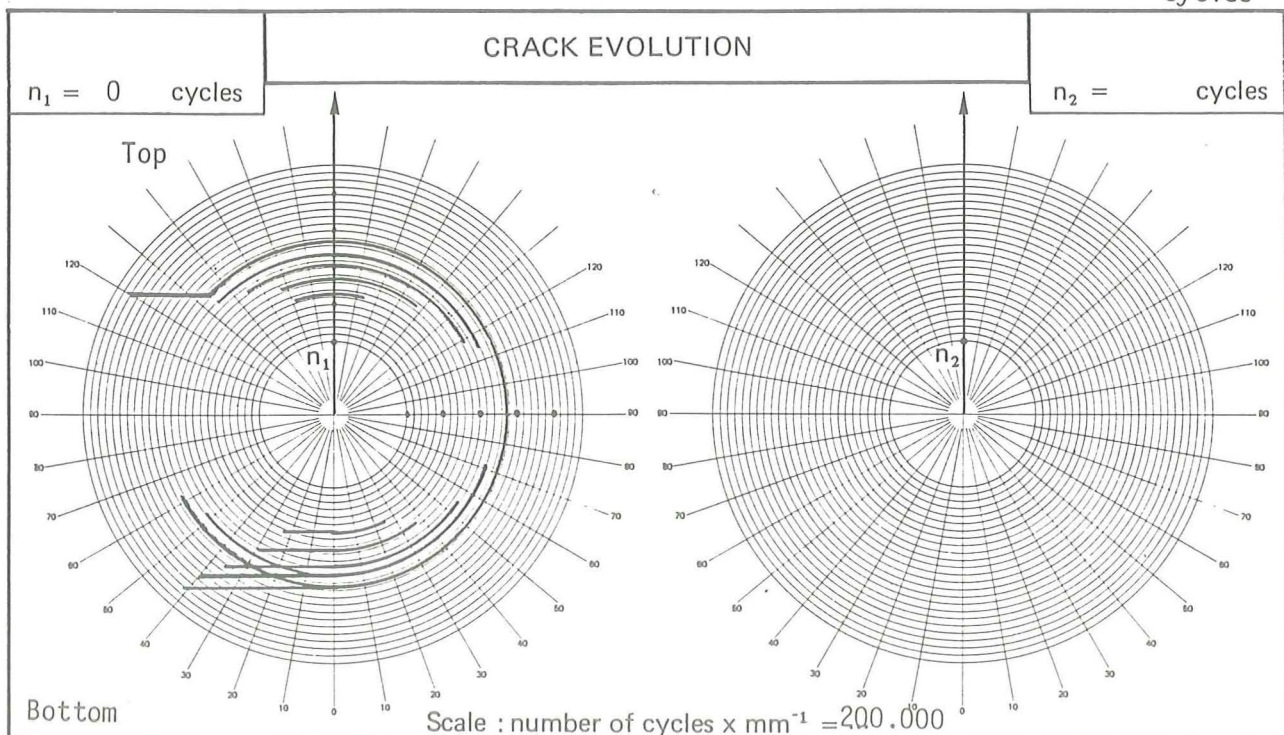
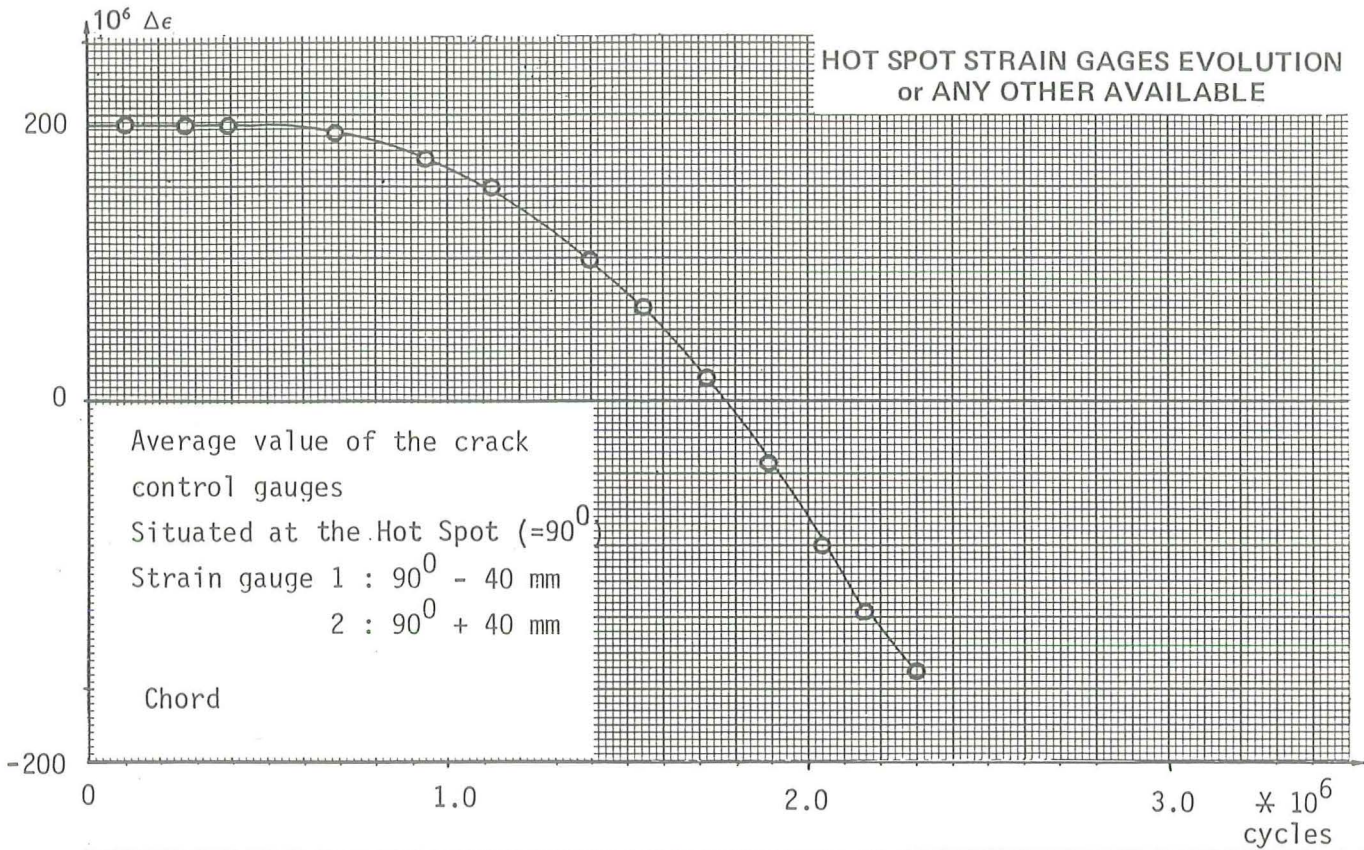
* The calculation has been based on the average SNCF's of the identical specimens.

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 100 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.0×10^6	1.3×10^6	2.2×10^6	2.7×10^6	-

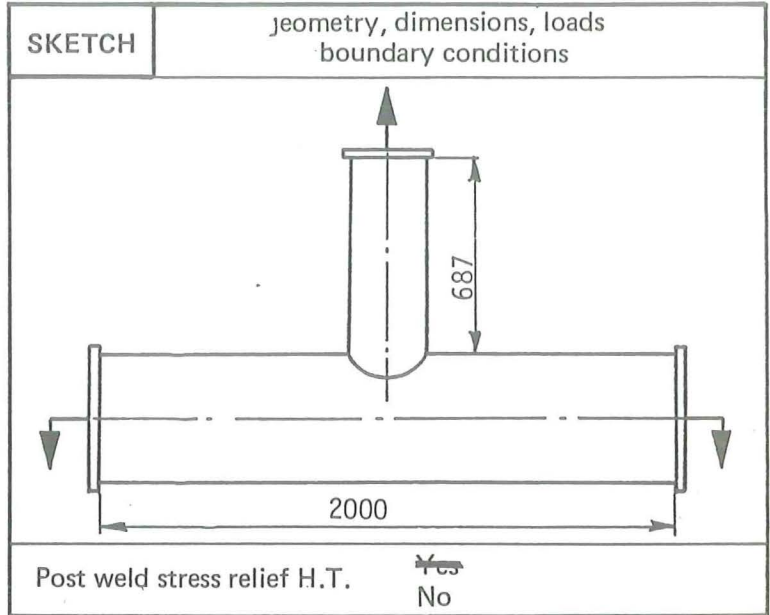
- (1) A : complete failure
 B : actuator displacement = ... mm
 C : secondary cracking total length = ... mm
 D : other reason : Reduction of stiffness



OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	5



GEOMETRY values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 219.1	t ₁ 8.2
	d ₂	t ₂

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52					STD : API - 5 LX				
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

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	3
		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/mm ²)	394	
Tensile strength σ_u (N/mm ²)	603	

Other properties see page 4

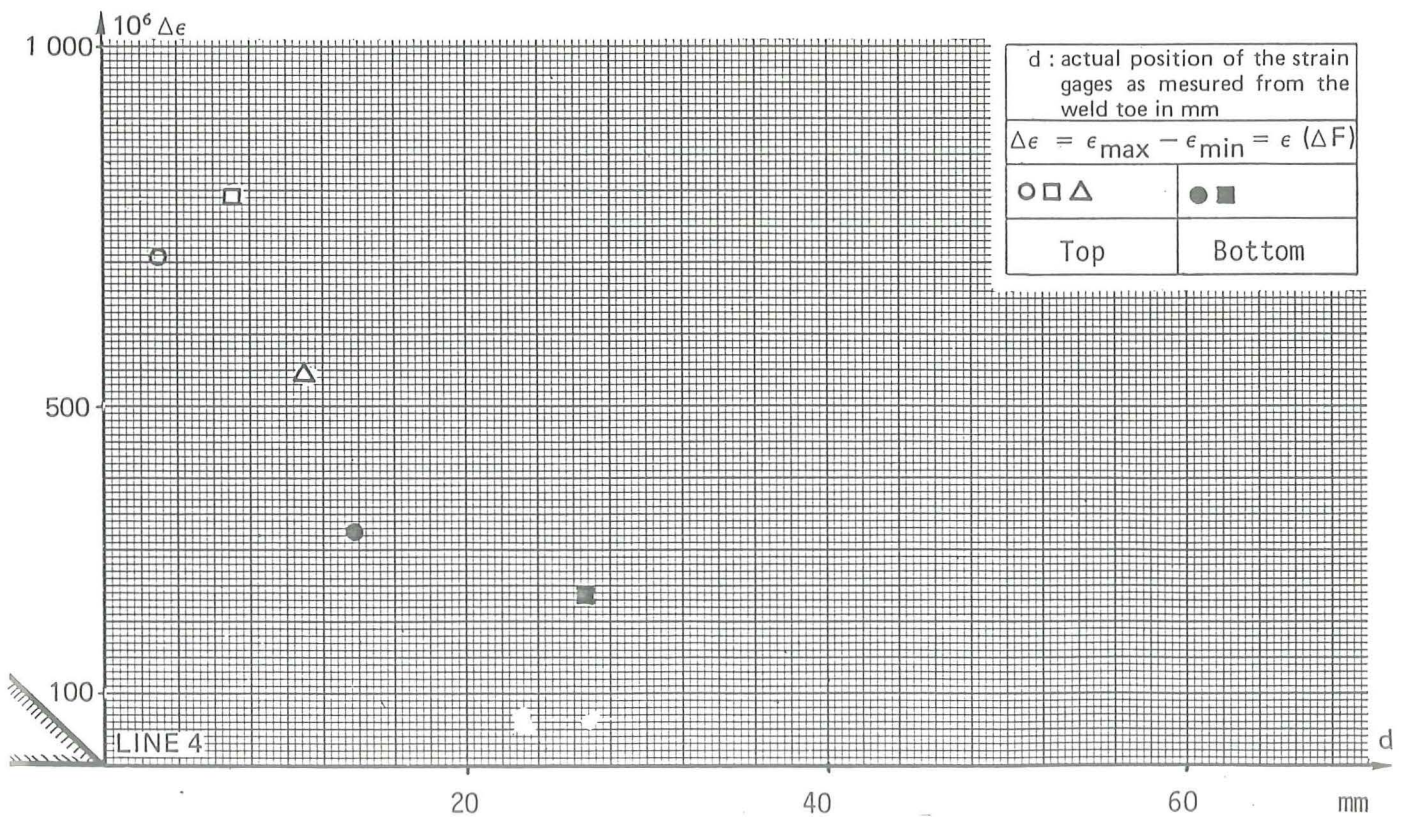
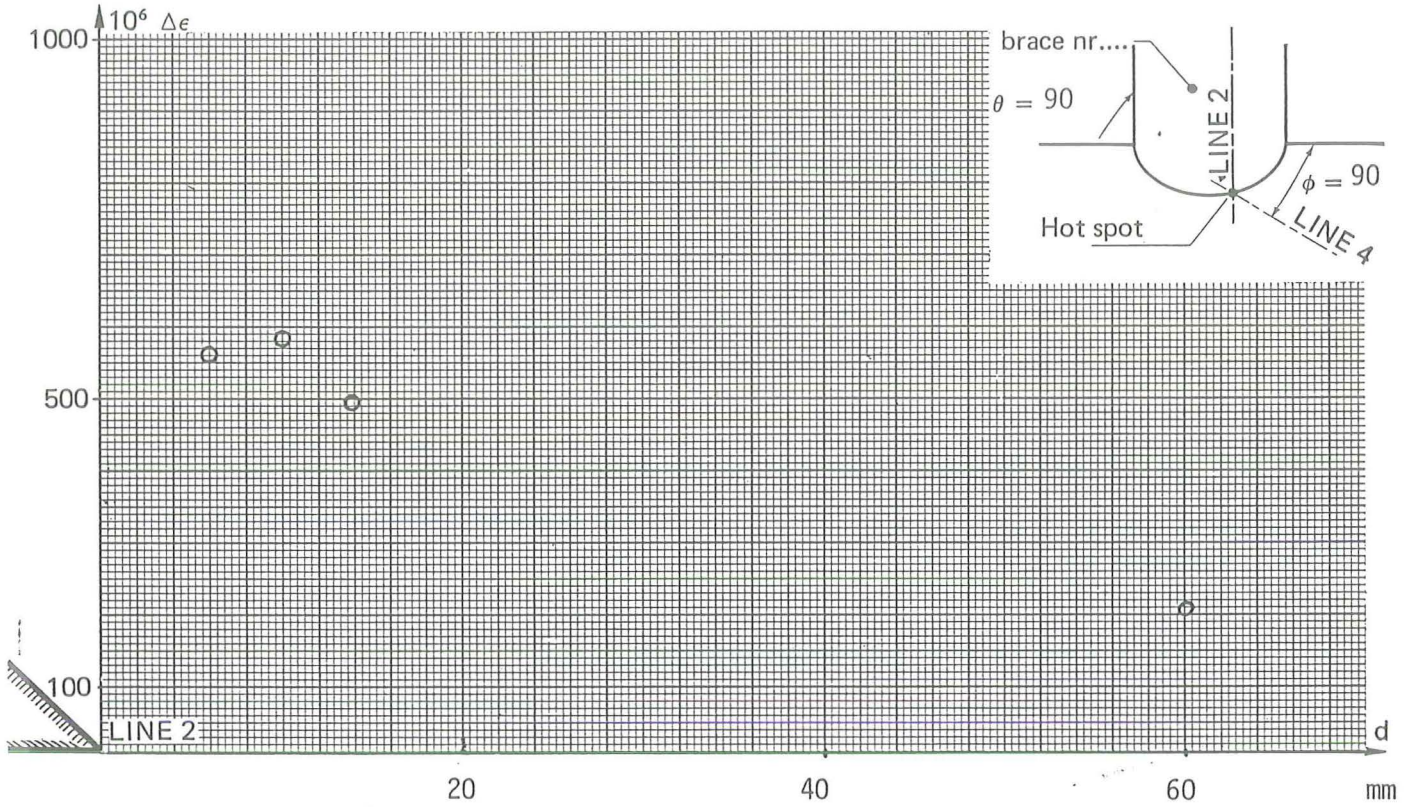
MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 5 - page 2

Number of cycles before measurements : 40180

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange [*]
0	160	0		4	818



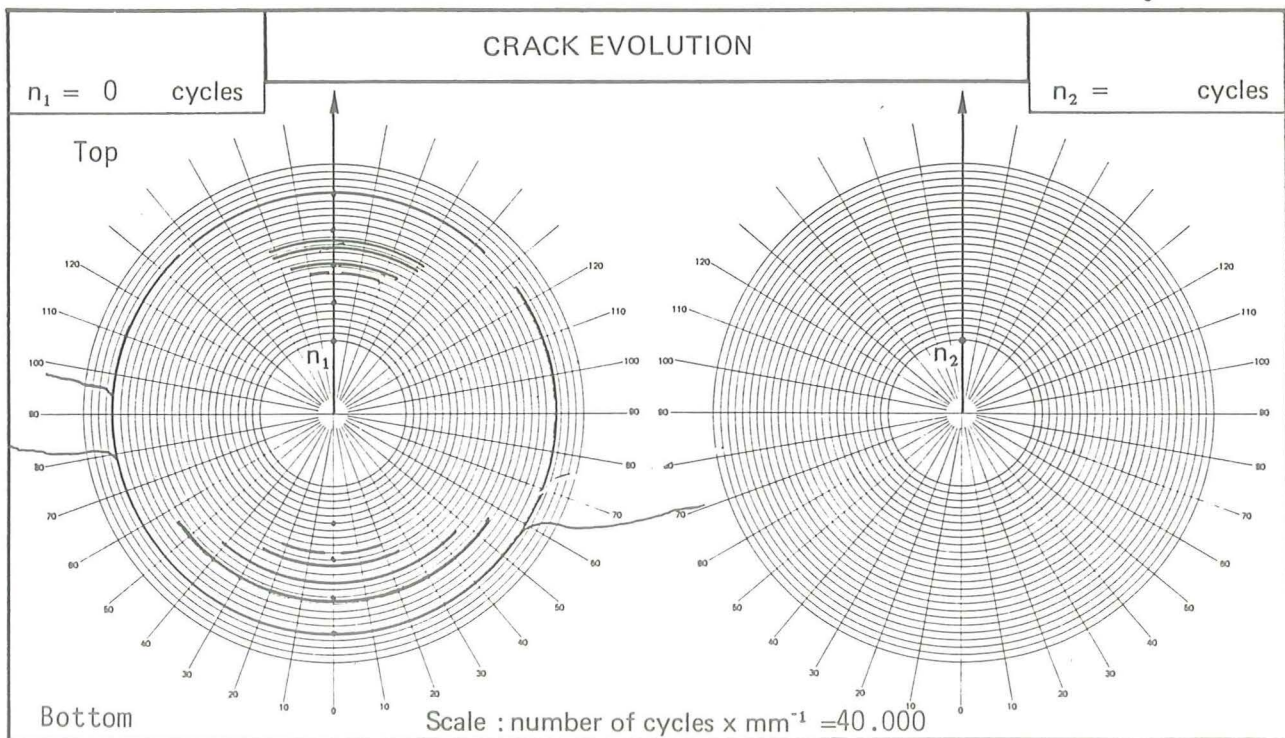
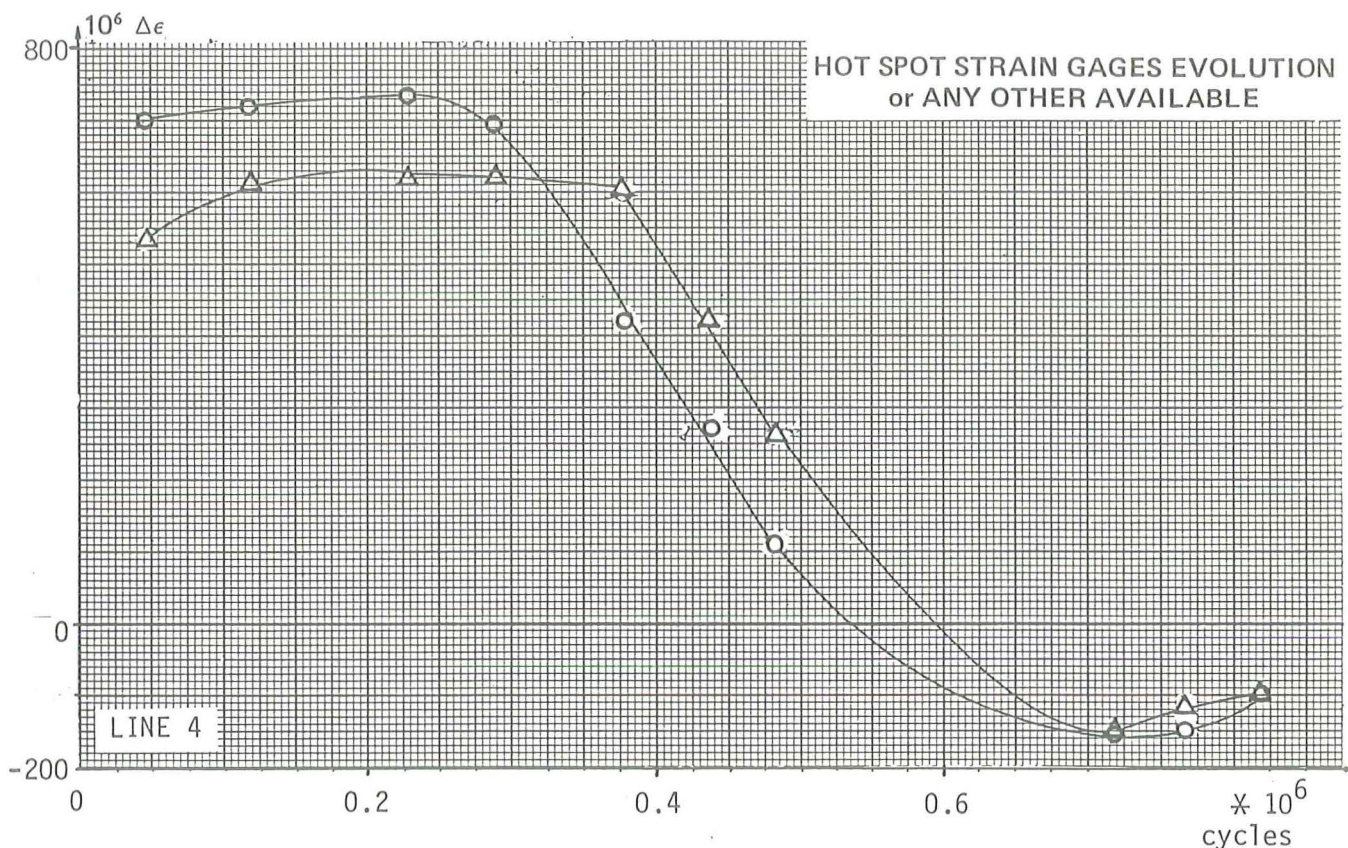
* The calculation has been based on the average SNCF's of the identical specimens

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	3.5×10^5	3.7×10^5	6.8×10^5	8.2×10^5	-

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



OTHER RELEVANT INFORMATIONS

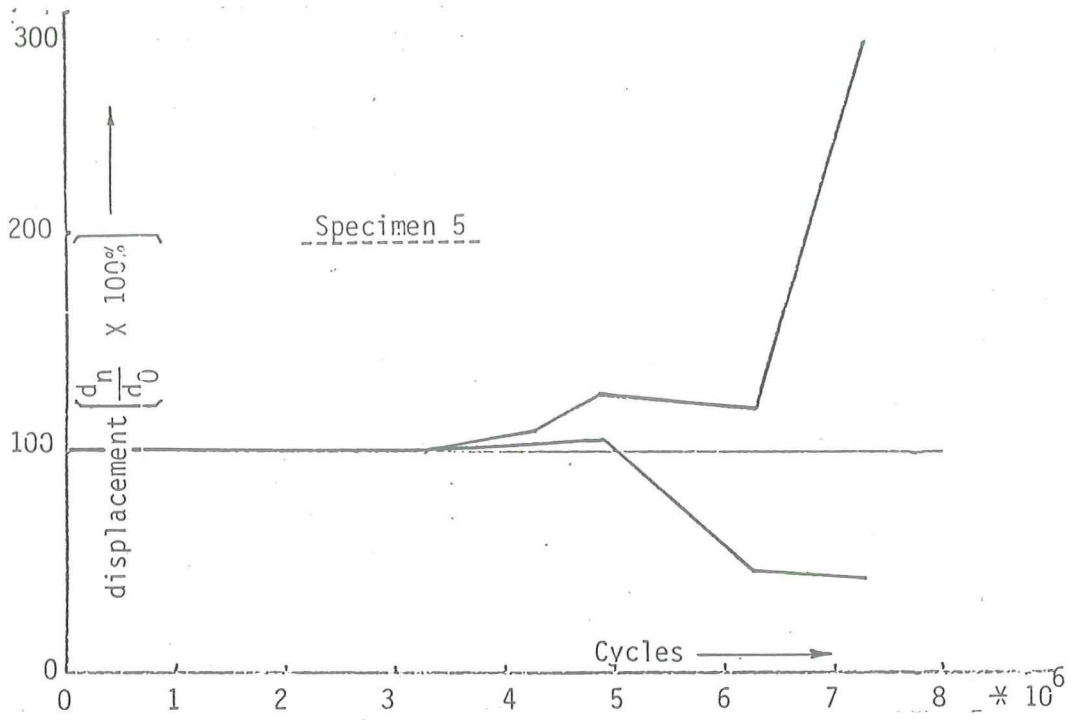


Fig. 1 Evolution of the node elongation per cycle during the test

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	6

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

GEOMETRY nominal actual values in mm	outside diameter	wall thickness		
	D	457.2	T	16
	d ₁	219.1	t ₁	8.2
	d ₂		t ₂	

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52						STD : API - 5 LX			
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

WELDING	Welding process : MMAW , Current : AC Filler materials : ISO AWS : E7016 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	3
Energy (kj/m)	-	
preheat. temp. (° C)	65	
postheat. temp. (° C)	none	
POST WELDING TREATMENT		
Heat treatment tig or plasma dressing		
Chisel peening grinding		

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

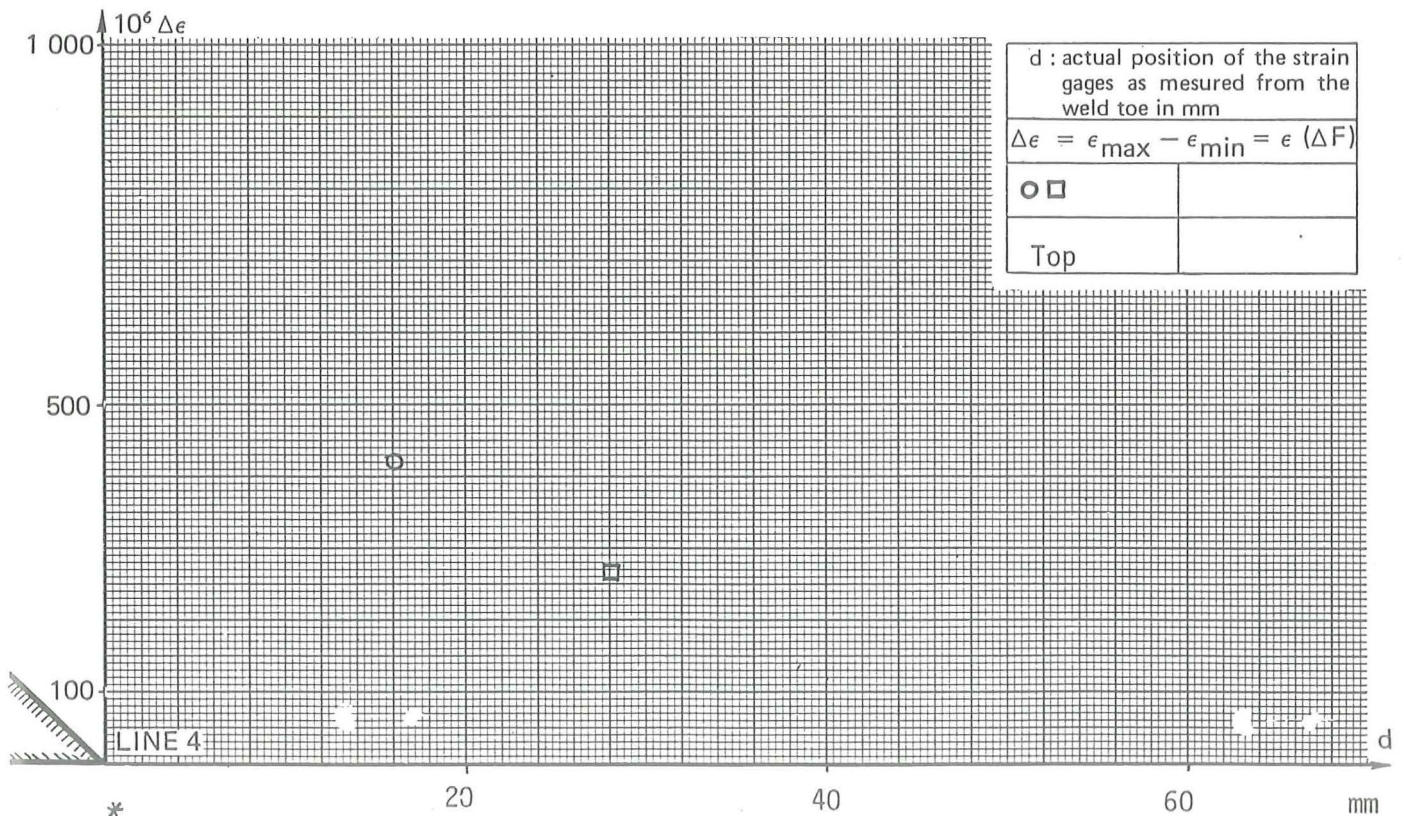
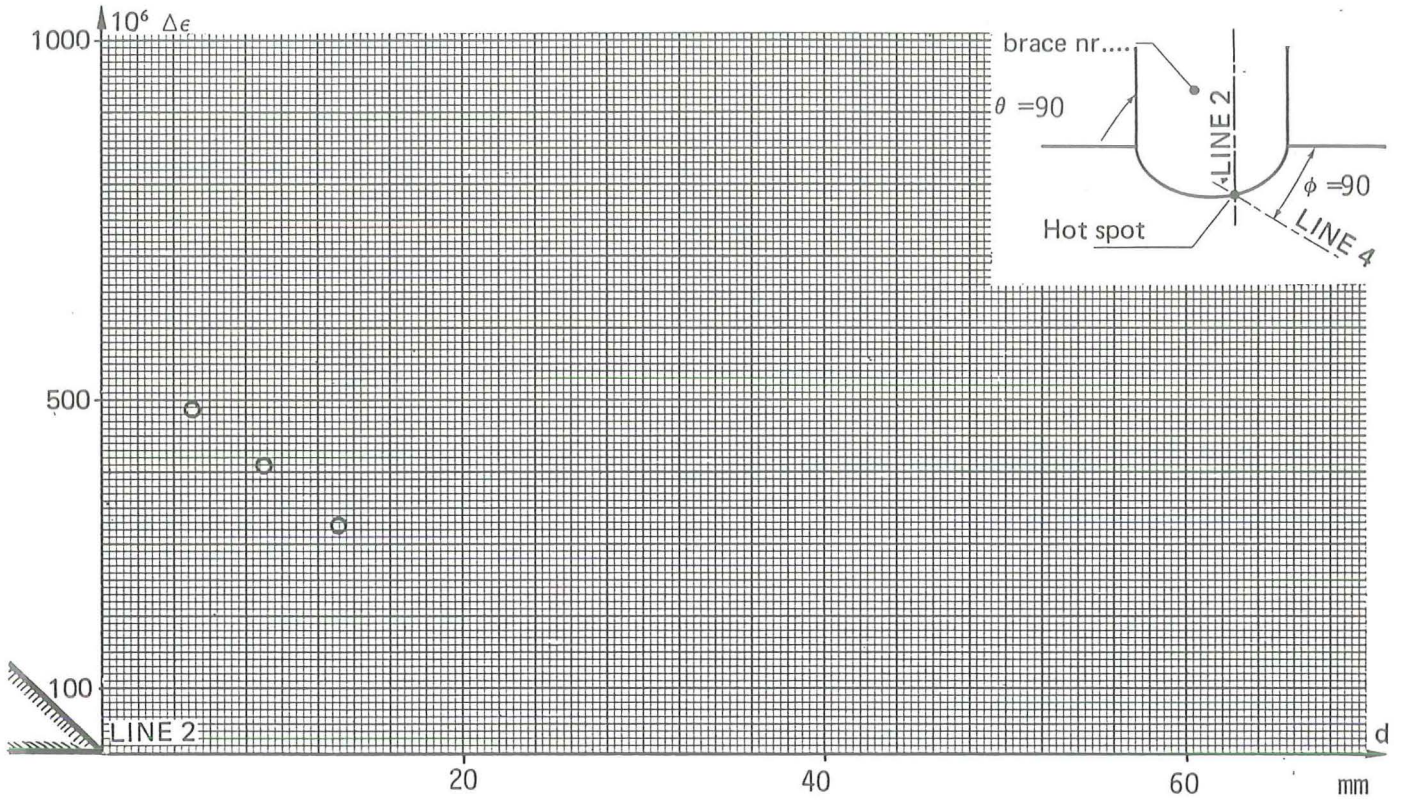
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 16240 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
0	144	0		4	737



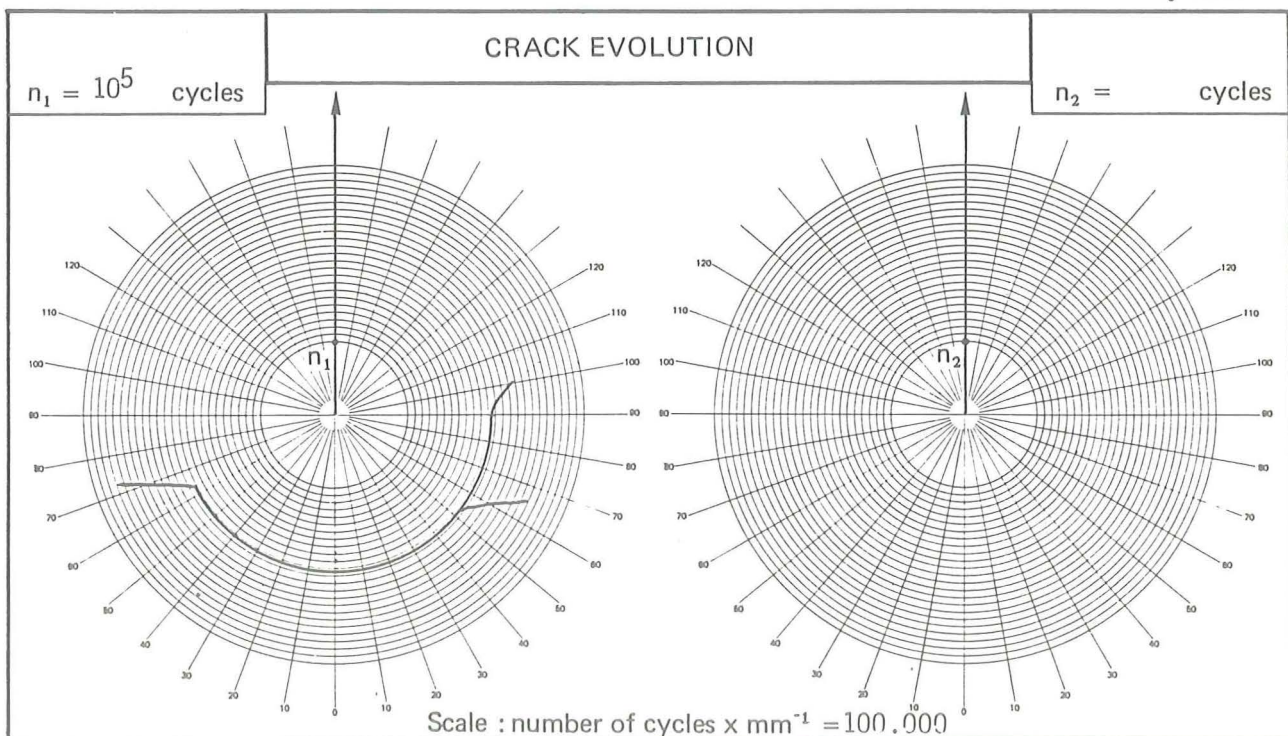
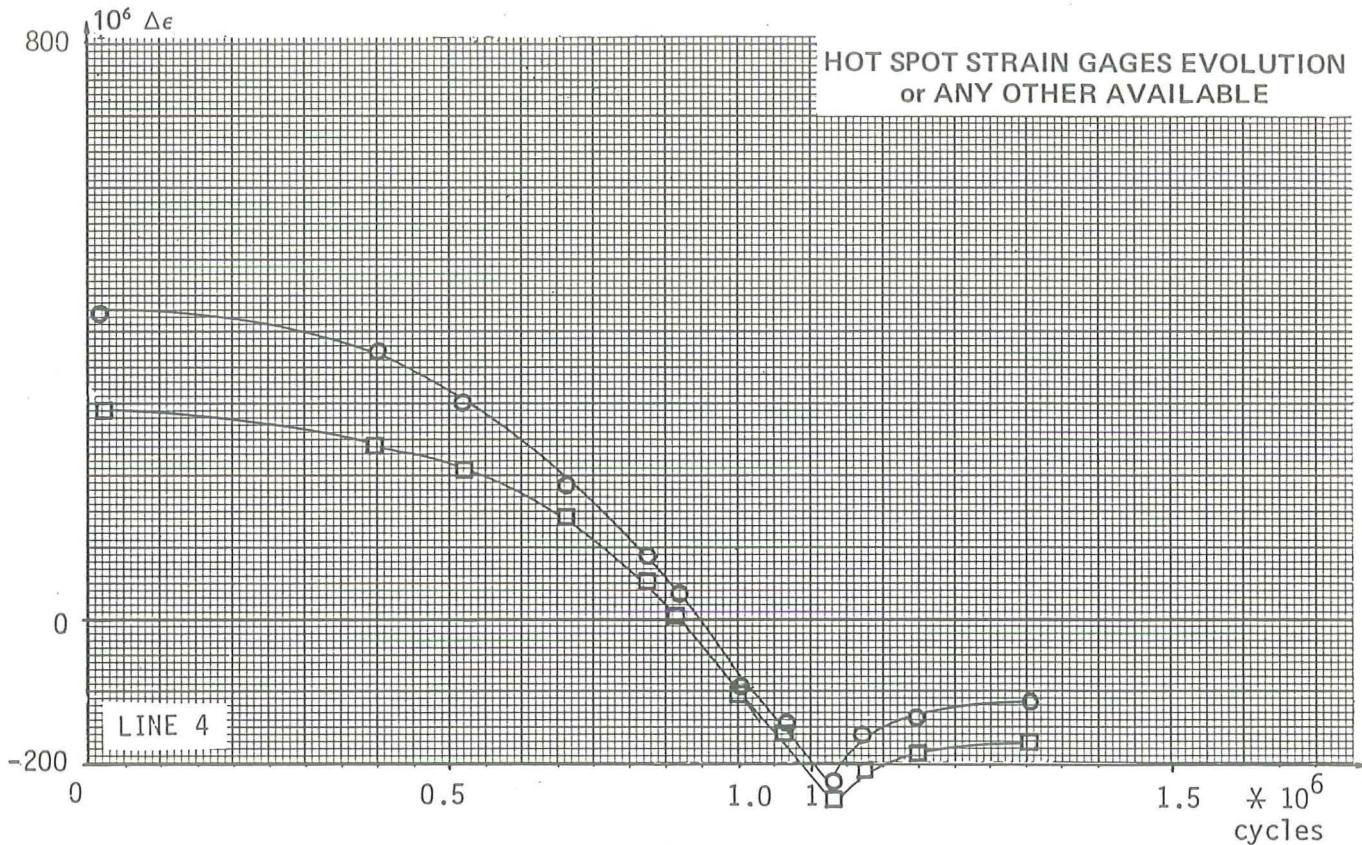
* The calculation has been based on the average SNCF's of the identical specimens

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	4.2×10^5		1.0×10^6	1.3×10^6	-

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

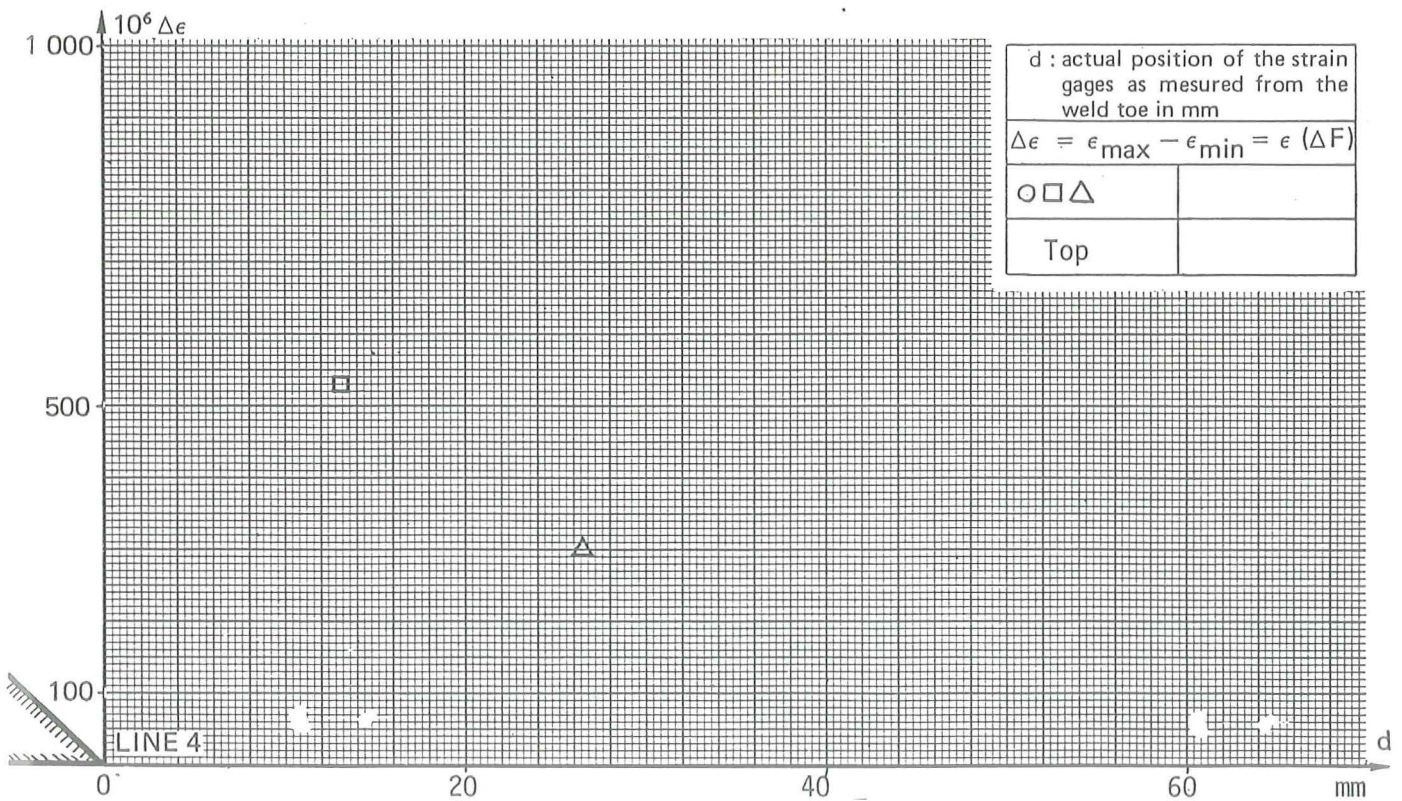
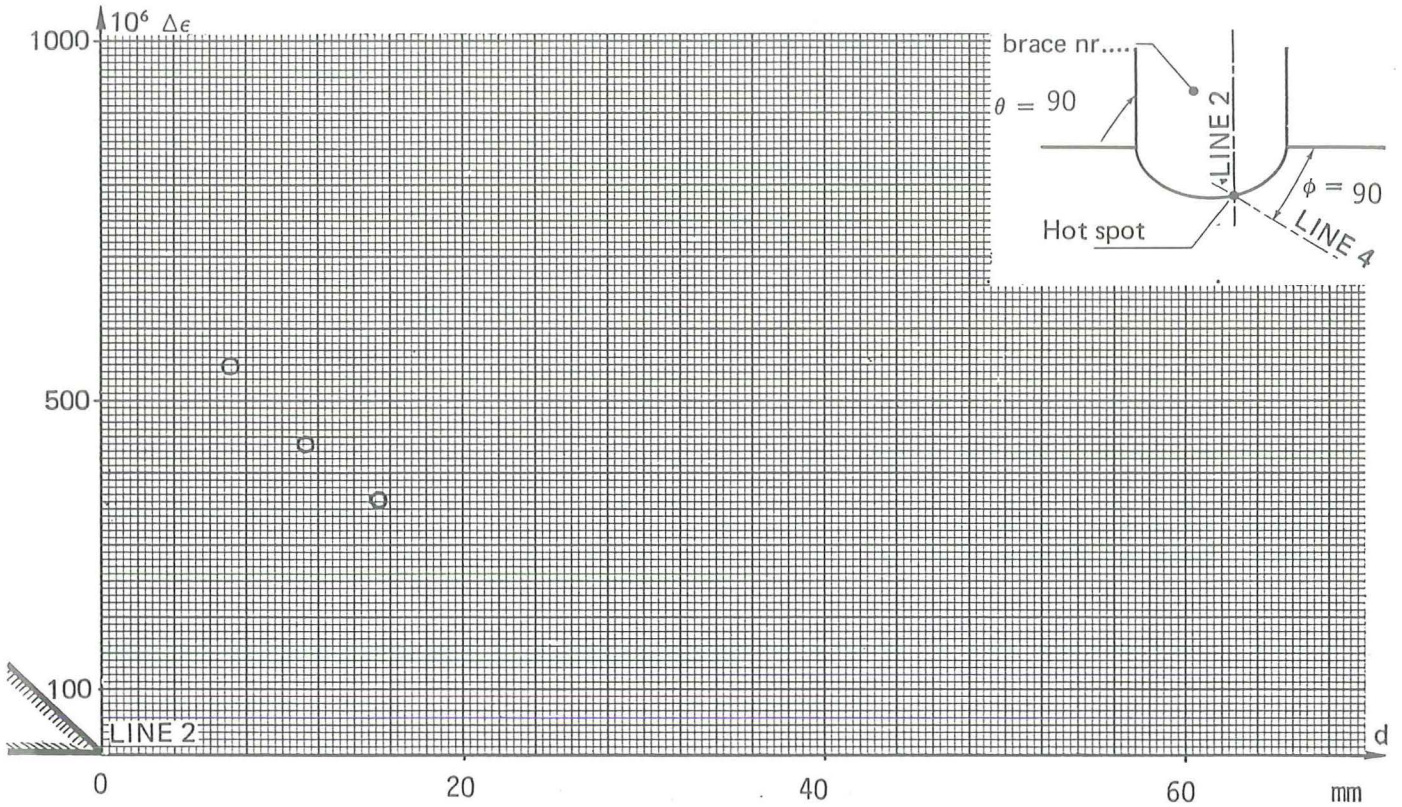


OTHER RELEVANT INFORMATIONS

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 2000 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
0	144	0		4	737



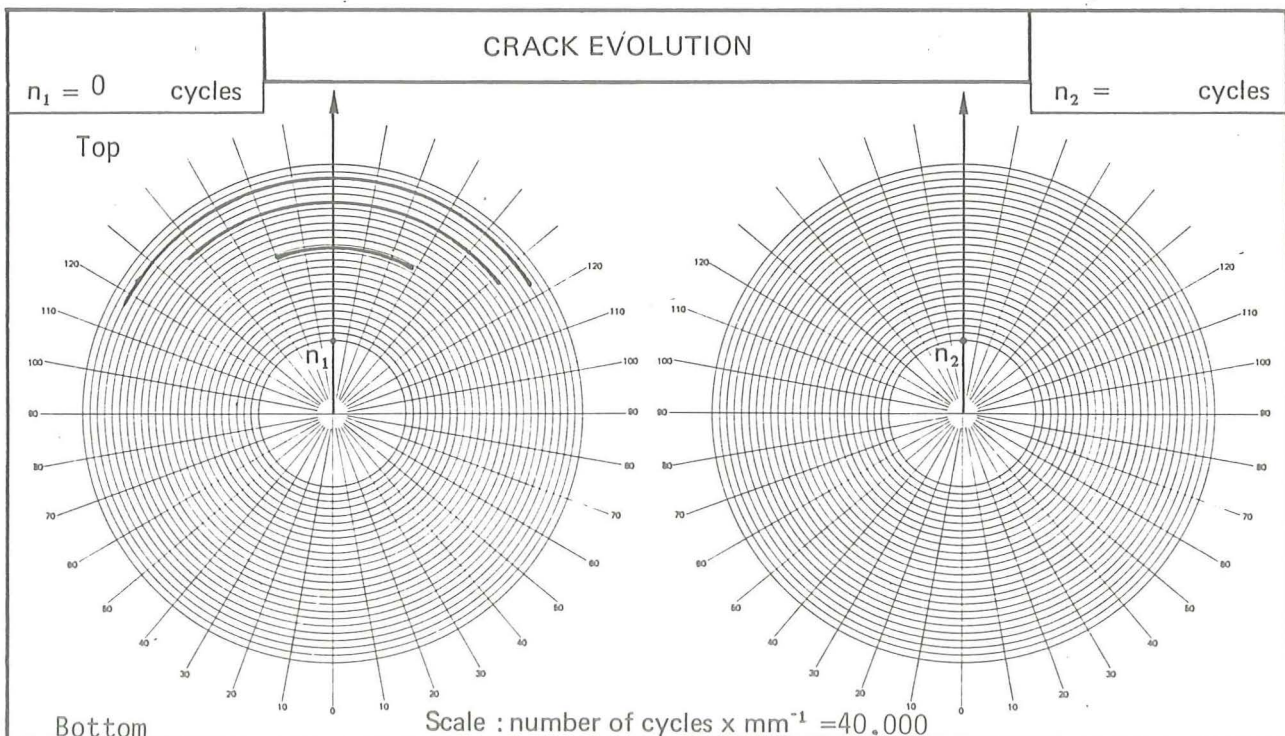
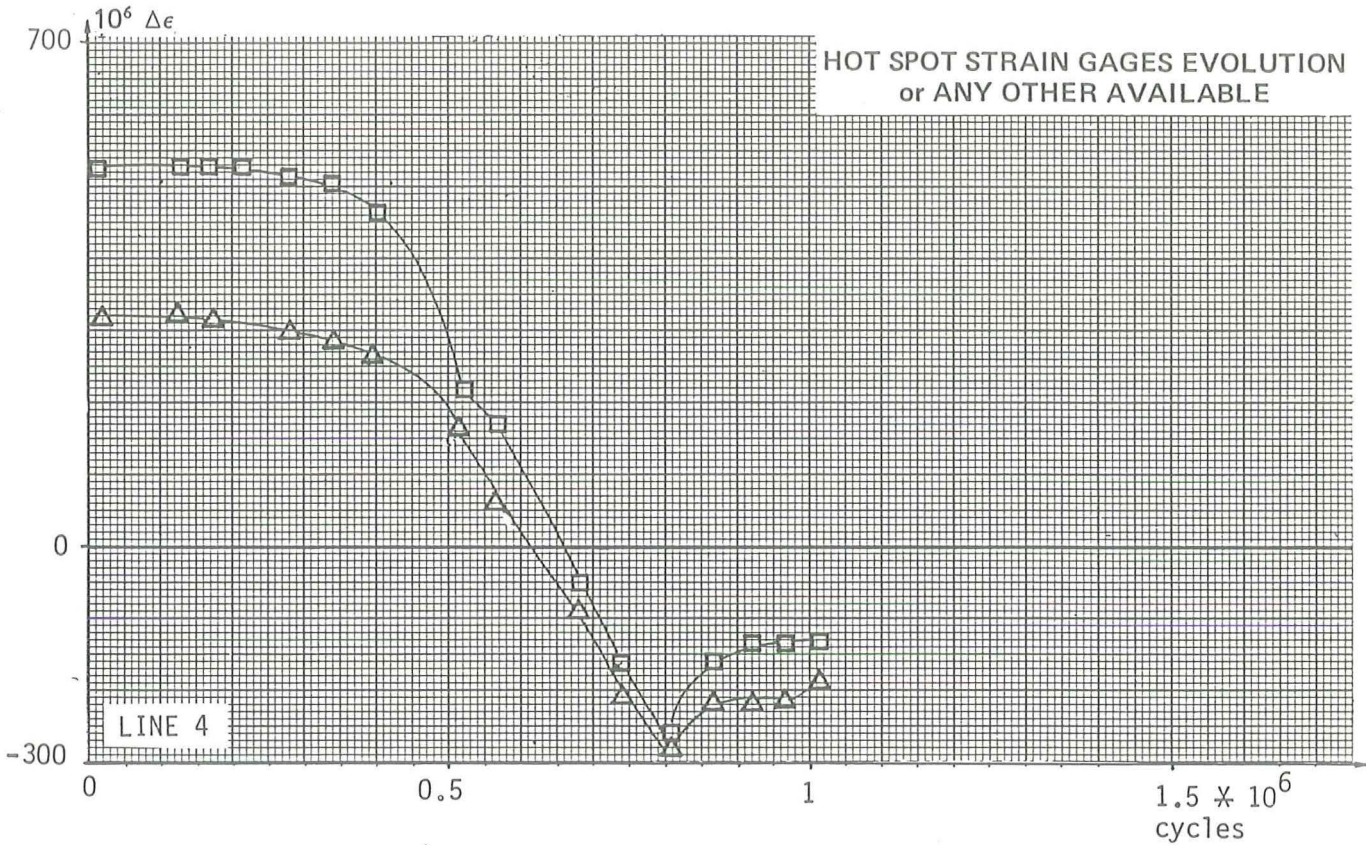
^x The calculation has been based on the average SNCF's of the identical specimens.

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 85 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	4.4×10^5	5.3×10^5	8.4×10^5	1.1×10^6	-

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



OTHER RELEVANT INFORMATIONS

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	8

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

GEOMETRY values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 219.1	t ₁ 8.2
	d ₂	t ₂

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52					STD : API - 5 LX				
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

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	3	
Energy (kj/m)	-	
preheat. temp. (° C)	65	
postheat. temp. (° C)	none	
POST WELDING TREATMENT		
Heat treatment tig or plasma dressing		
Shot peening grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

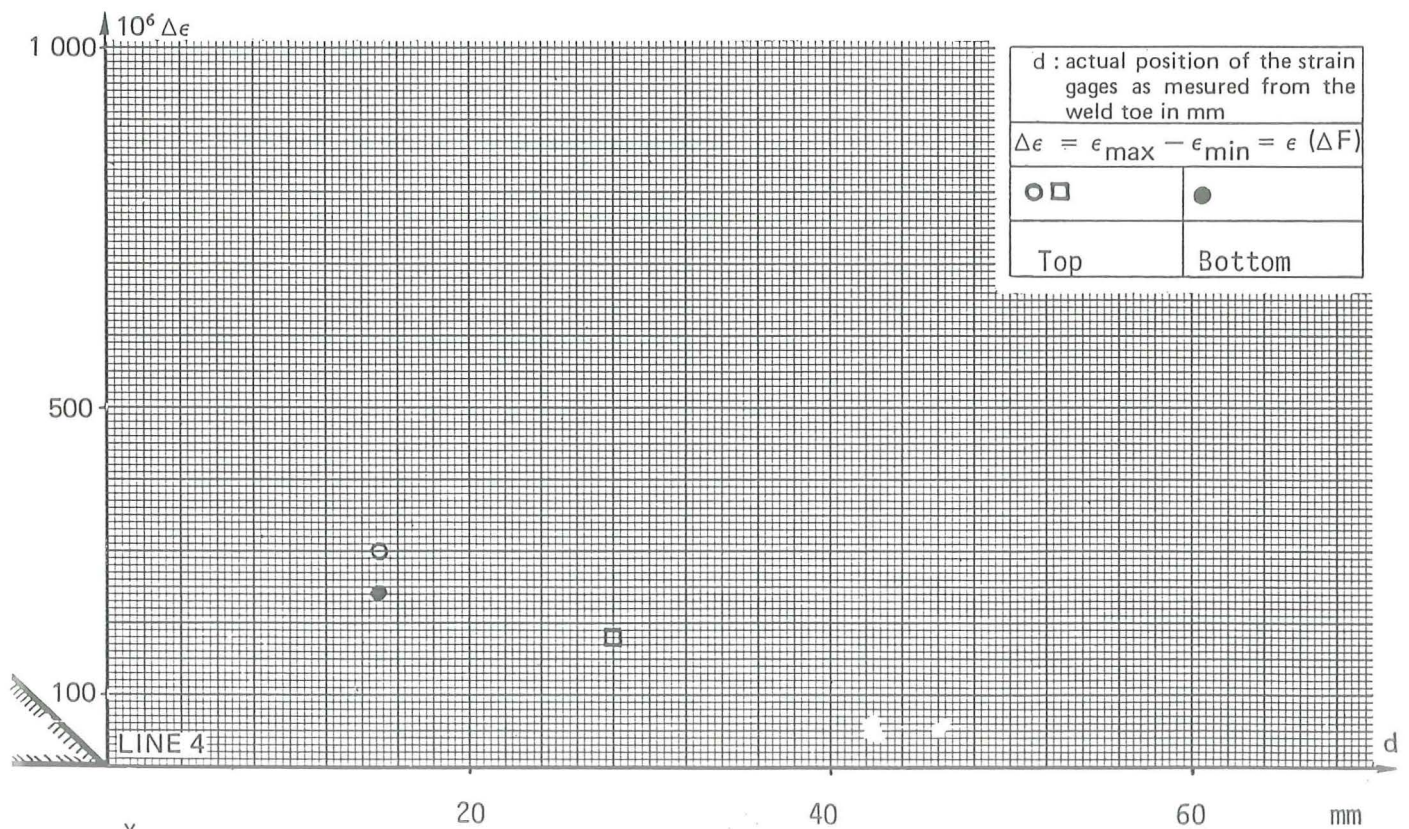
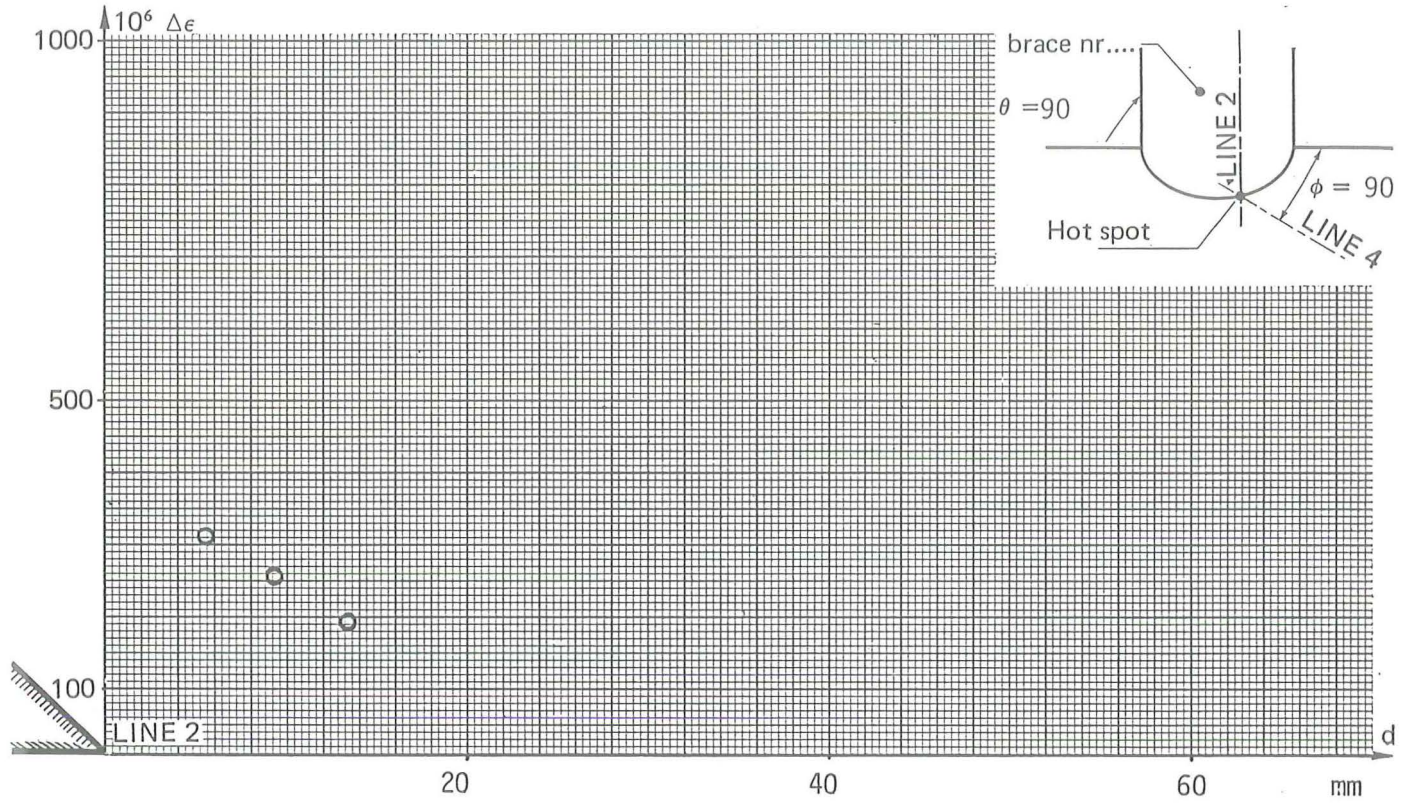
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 12580

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
0	85	0		4	435



^x 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.

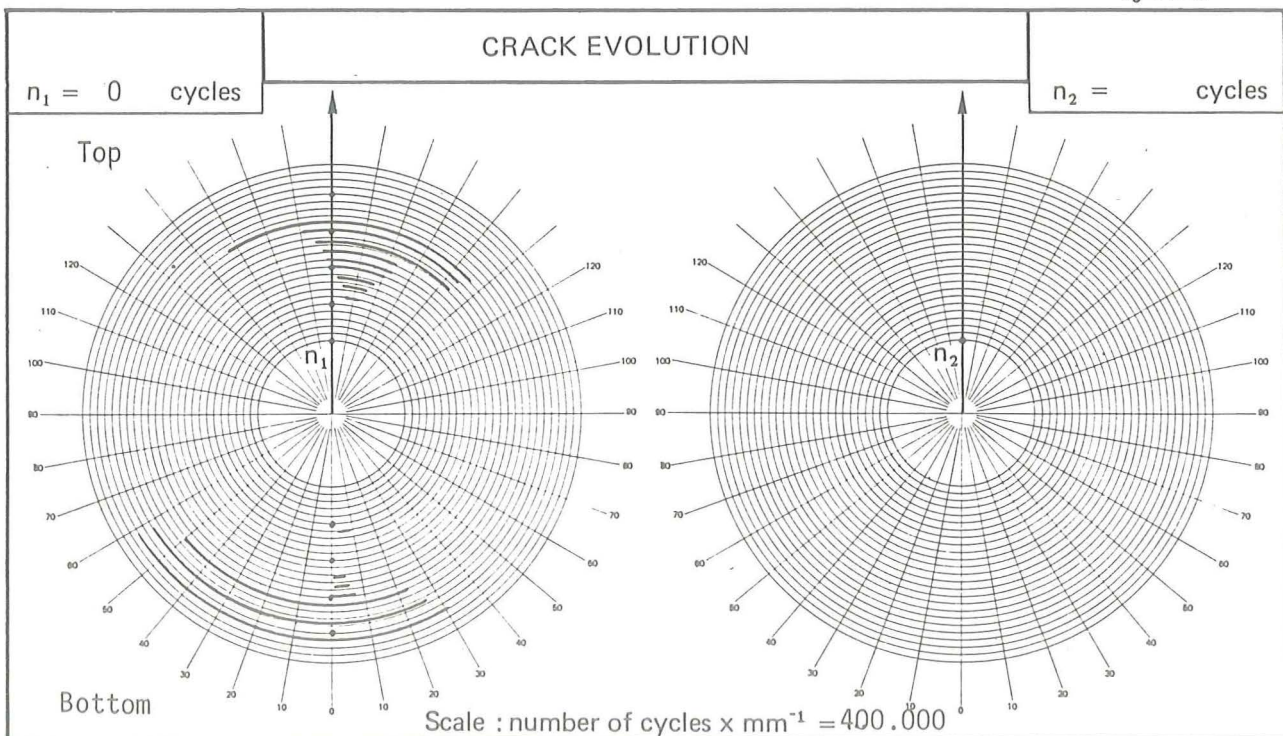
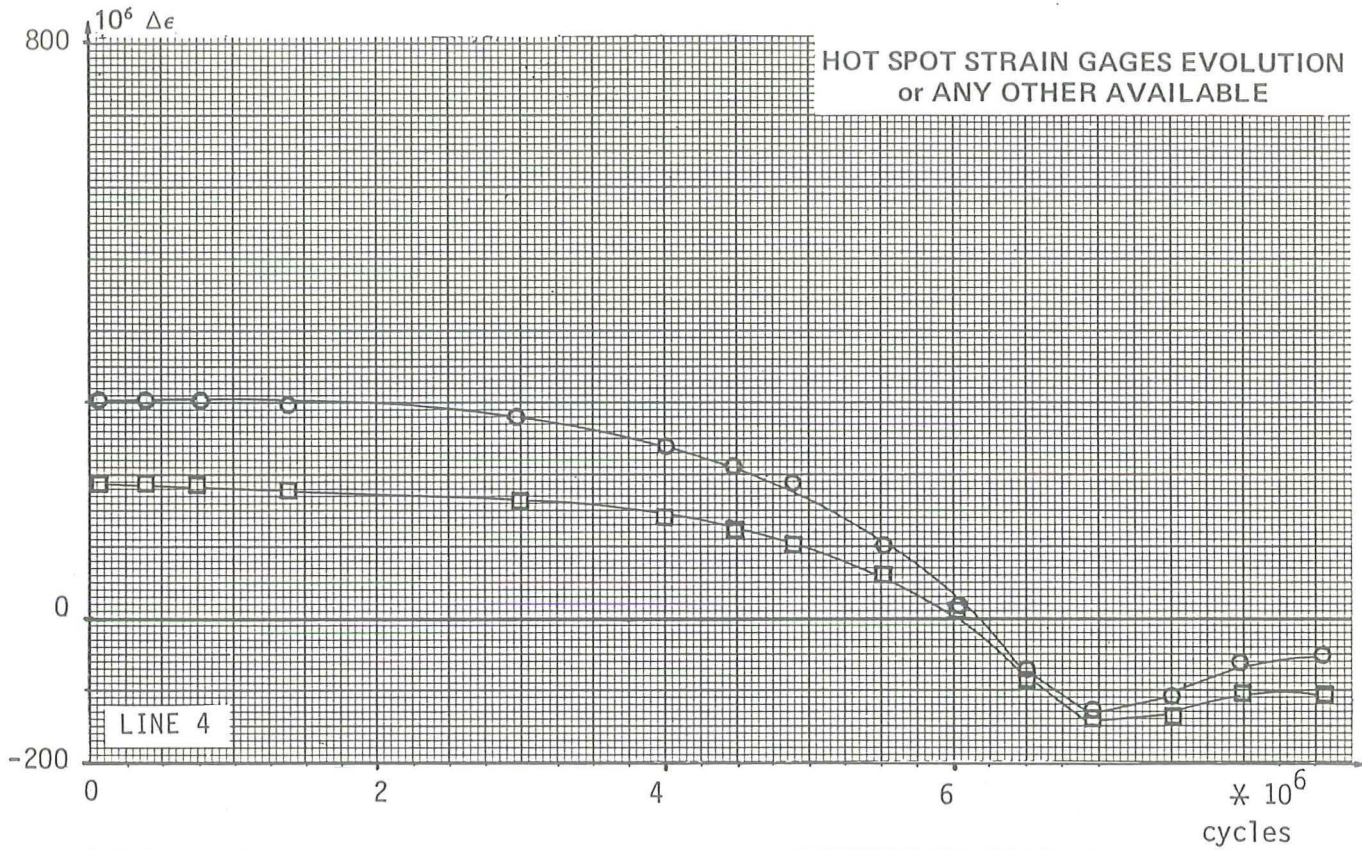
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	3.6×10^6	3.4×10^6	7.5×10^6	8.5×10^6	

(1) A : complete failure

B : actuator displacement = ... mm

C : secondary cracking total length = ... mm

D : other reason : Reduction of stiffness



OTHER RELEVANT INFORMATIONS

Spec. 8 - page 4

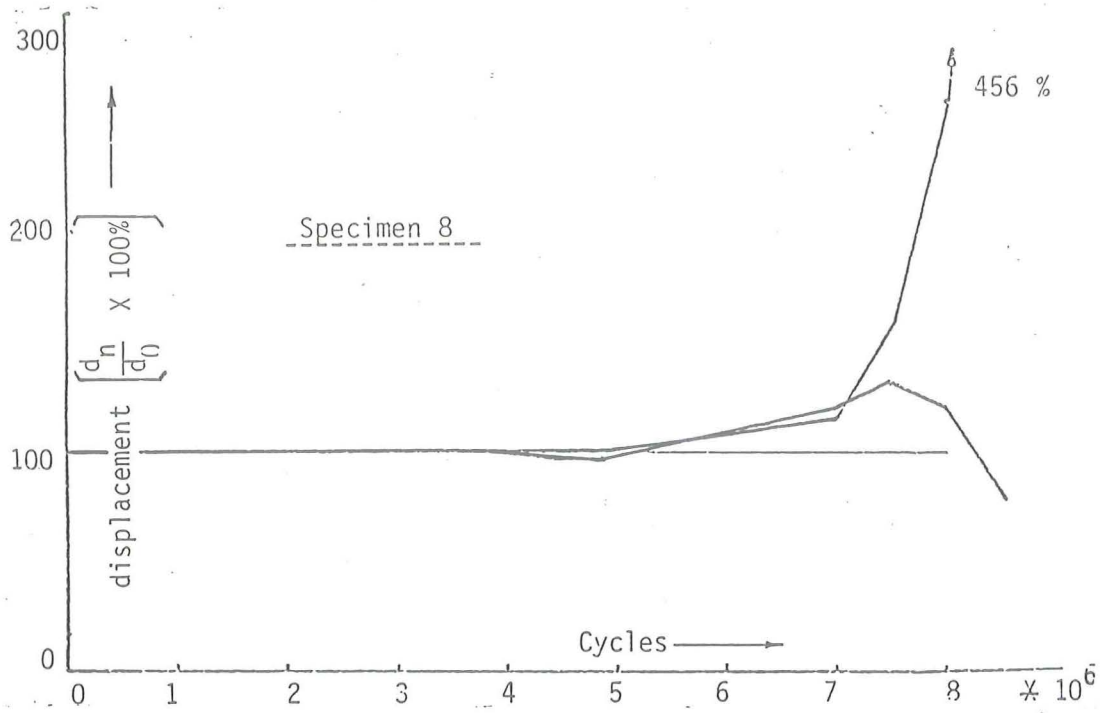


Fig. 1 Evolution of the node elongation per cycle during the test

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	9

GEOMETRY values in mm	outside diameter		wall thickness	
	D	457.2	T	16
	d ₁	219.1	t ₁	8.2
	d ₂		t ₂	

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52						STD : API - 5 LX				
	C %	Si %	Mn %	S %	P %	Al %					
	0,25	0,37	1,14	0,028	0,015						

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																											
		<table border="1" style="width: 100%;"> <thead> <tr> <th colspan="2">WELDING PROCEDURE</th> </tr> </thead> <tbody> <tr> <td>Position</td> <td>5G</td> </tr> <tr> <td>Nr of runs</td> <td>3</td> </tr> <tr> <td>Energy (kj/m)</td> <td>-</td> </tr> <tr> <td>preheat. temp. (° C)</td> <td>65</td> </tr> <tr> <td>postheat. temp. (° C)</td> <td>none</td> </tr> <tr> <th colspan="2">POST WELDING TREATMENT</th> </tr> <tr> <td colspan="2" style="text-align: center;">Heat treatment - tig or plasma dressing</td> </tr> <tr> <td colspan="2" style="text-align: center;">Sheet peening - grinding</td> </tr> </tbody> </table>											WELDING PROCEDURE		Position	5G	Nr of runs	3	Energy (kj/m)	-	preheat. temp. (° C)	65	postheat. temp. (° C)	none	POST WELDING TREATMENT		Heat treatment - tig or plasma dressing	
WELDING PROCEDURE																												
Position	5G																											
Nr of runs	3																											
Energy (kj/m)	-																											
preheat. temp. (° C)	65																											
postheat. temp. (° C)	none																											
POST WELDING TREATMENT																												
Heat treatment - tig or plasma dressing																												
Sheet peening - grinding																												

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

**Other
properties
see page 4**

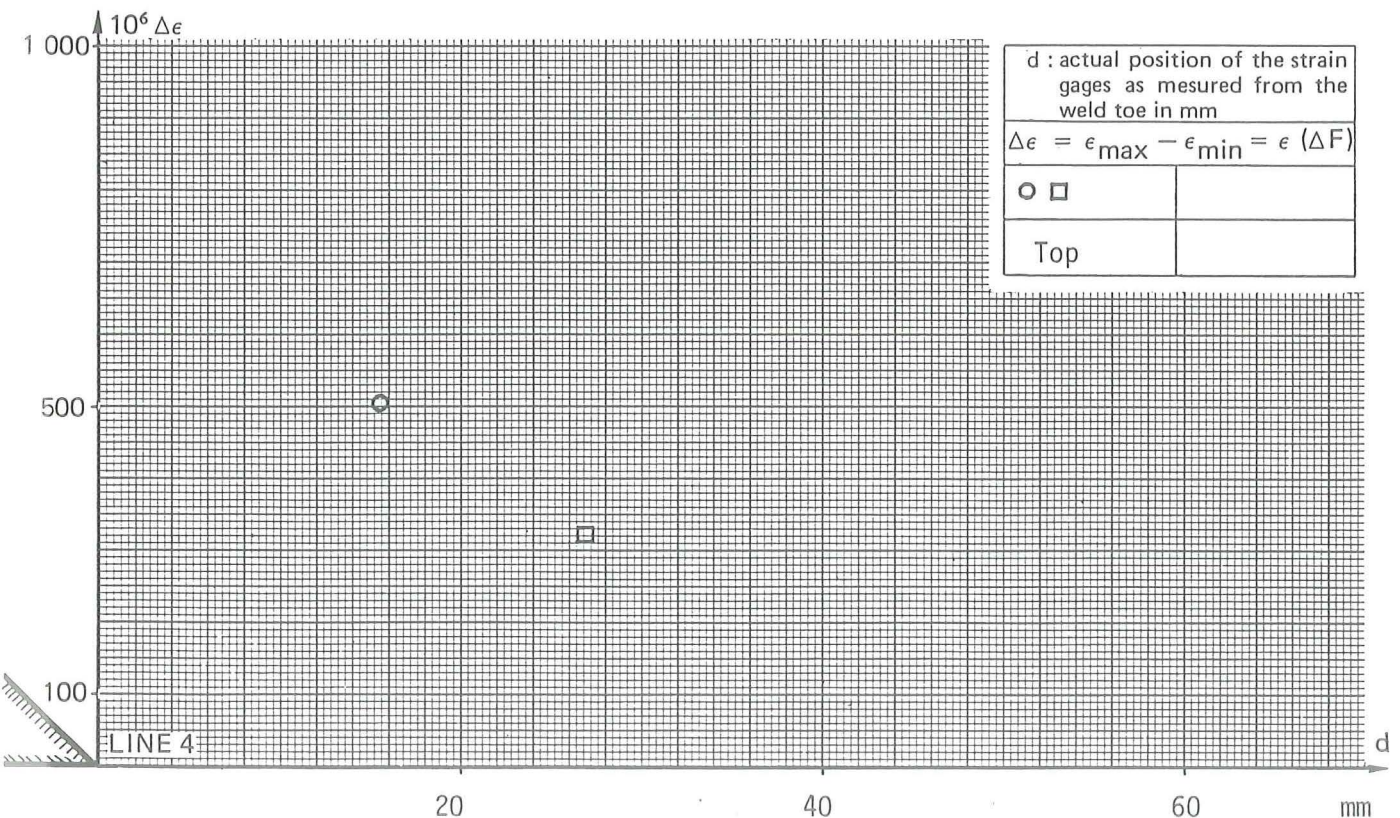
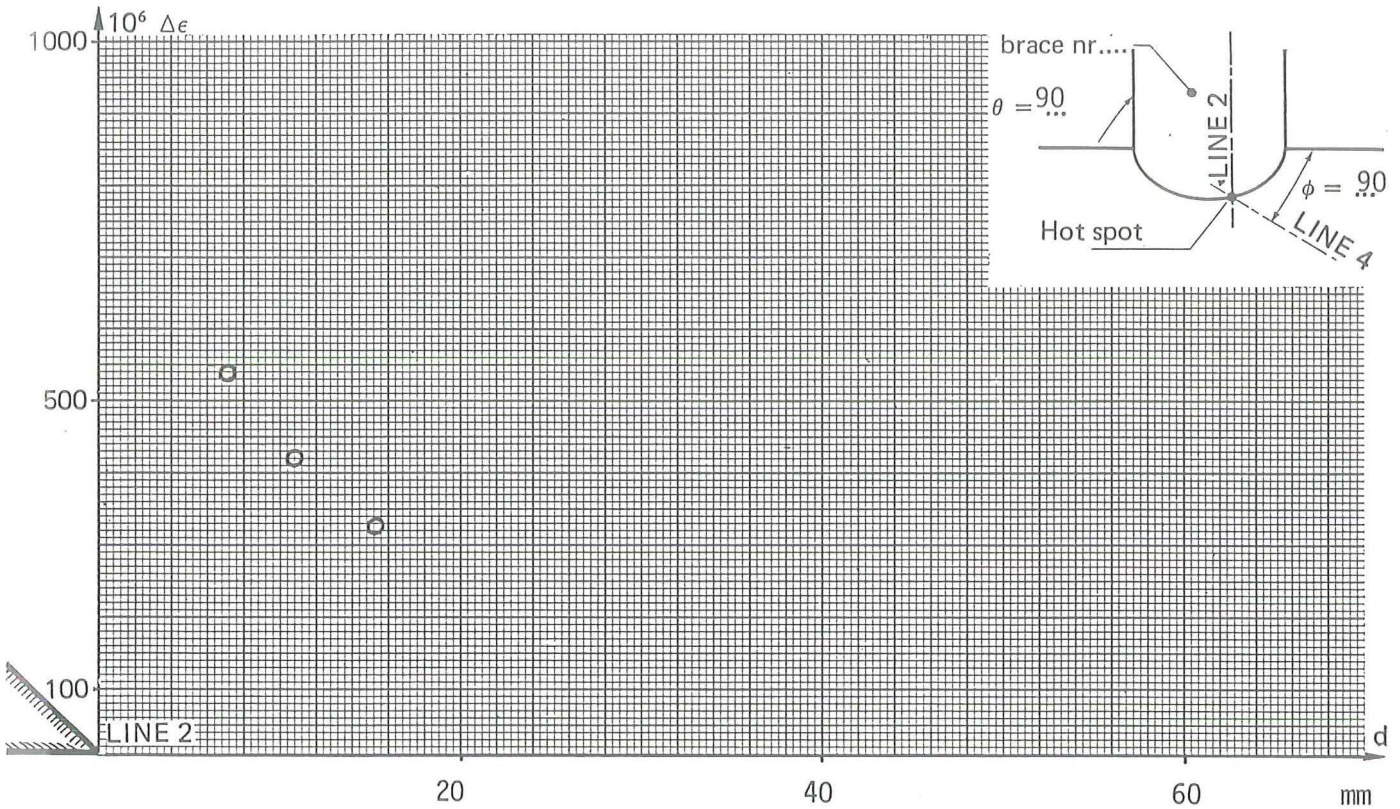
MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 9 - page 2

Number of cycles before measurements : 297600

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
0	160	0		4	818



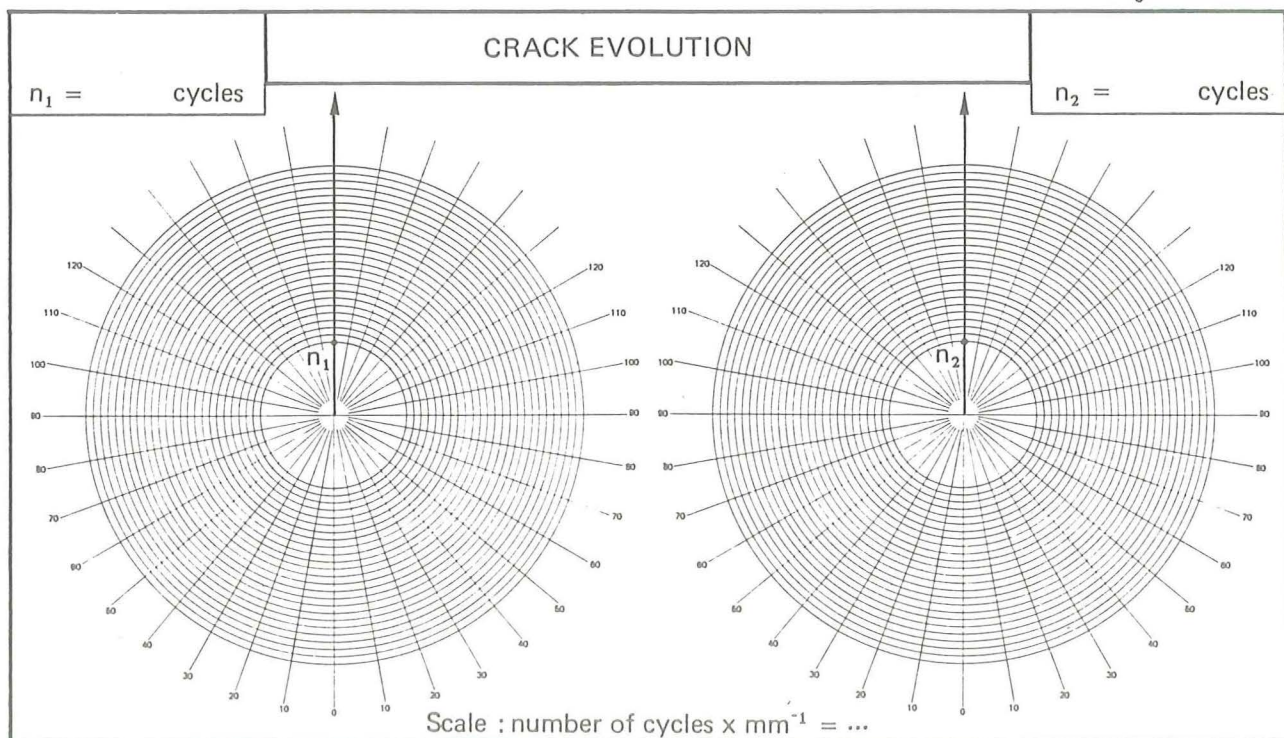
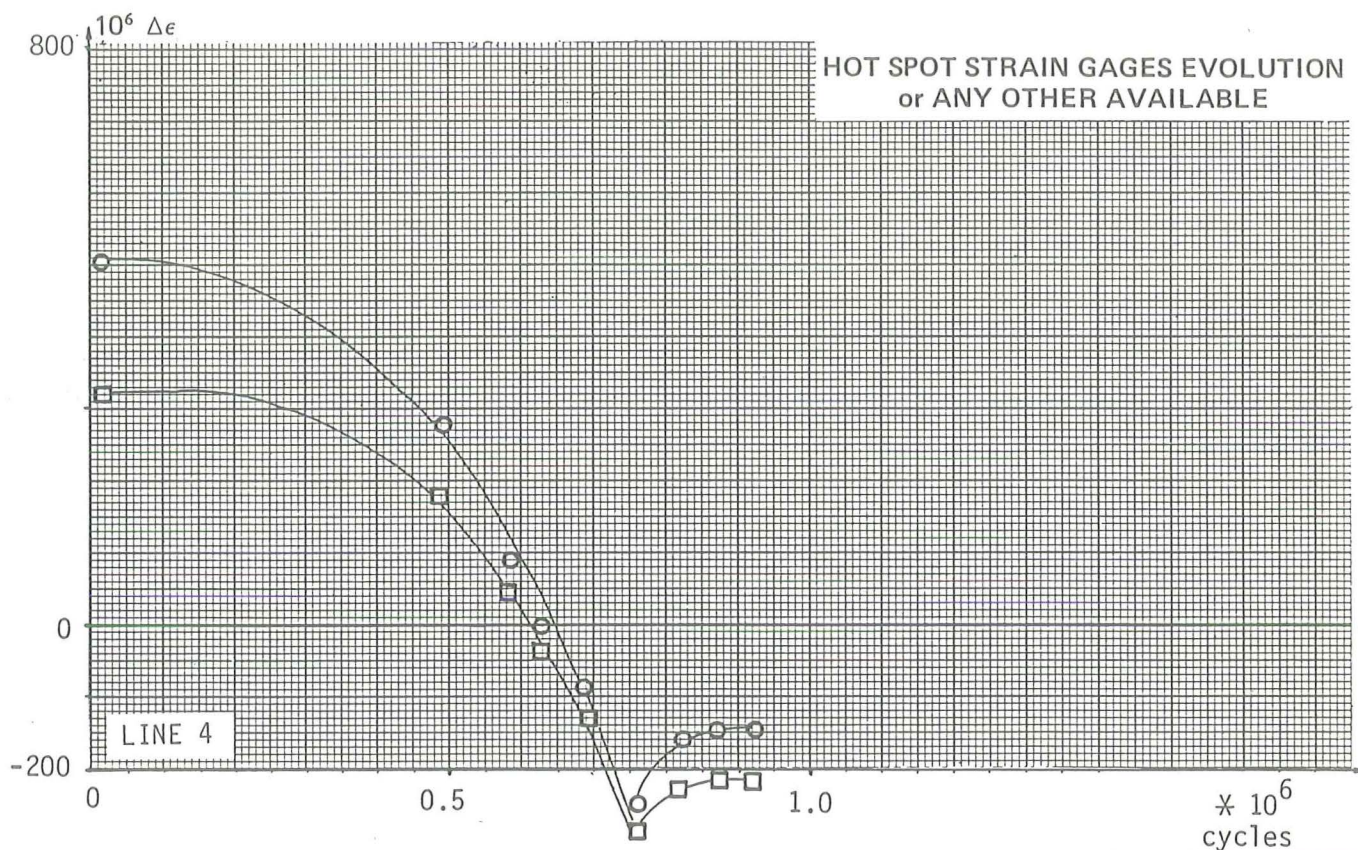
^x The calculation has been based on the average SNCF's of the identical specimens.

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	3.2×10^5		7.6×10^5	1.0×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 9 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	10

SKETCH	geometry, dimensions, loads boundary conditions
--------	---

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

GEOMETRY values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 219.1	t ₁ 8.2
	d ₂	t ₂

ACTUAL PROPERTIES OF CRACKED MEMBER

(chord)

BASE METAL	Grade :X 52						STD : API - 5 LX			
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

WELDING	Welding process : MMAW , Current : AC	
	Filler materials : ISO AWS - : E 7015	
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	3
	Energy (kj/m)	-
	preheat. temp. (° C)	65
	postheat. temp. (° C)	none
	POST WELDING TREATMENT	
	Heat treatment tig or plasma dressing	
	Sheet peening grinding	

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

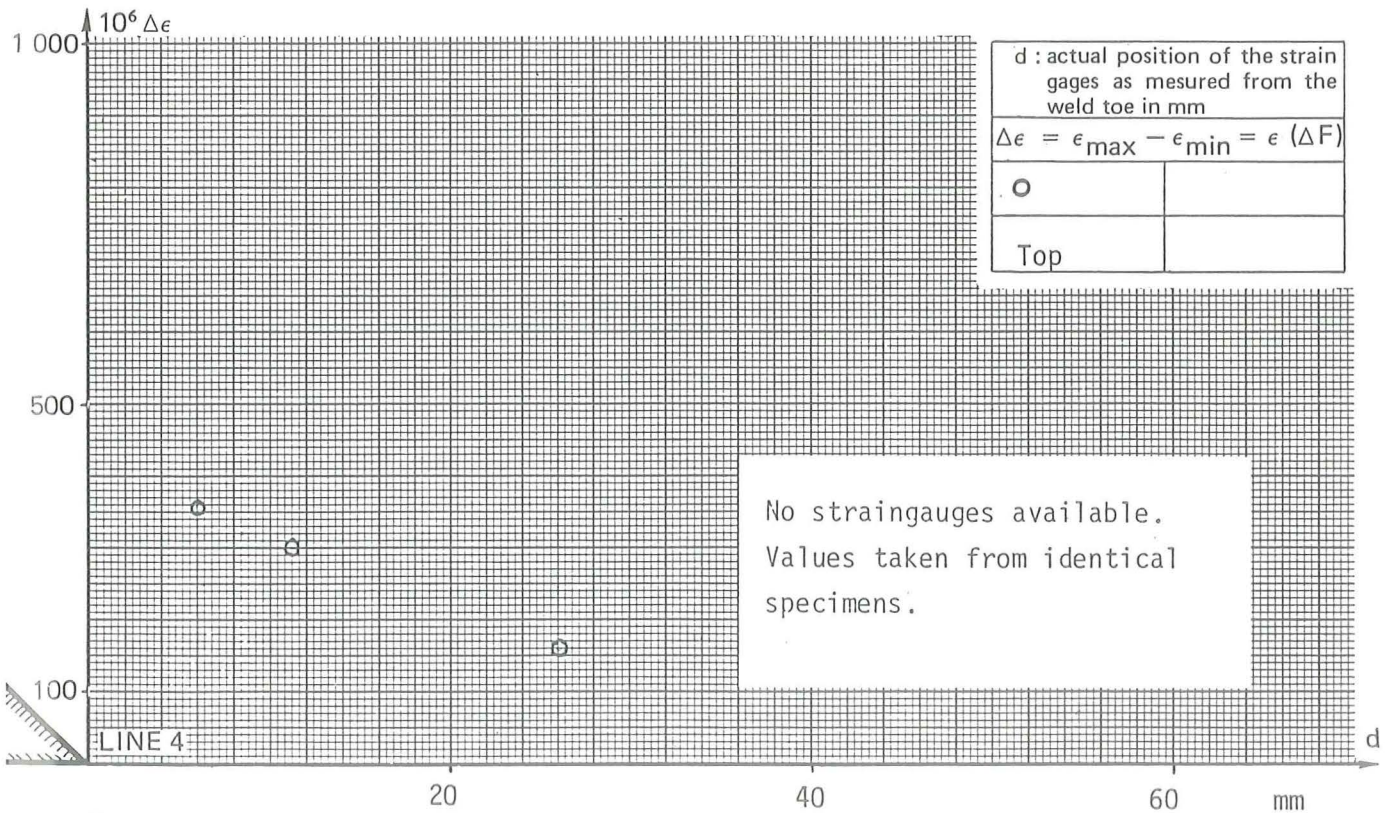
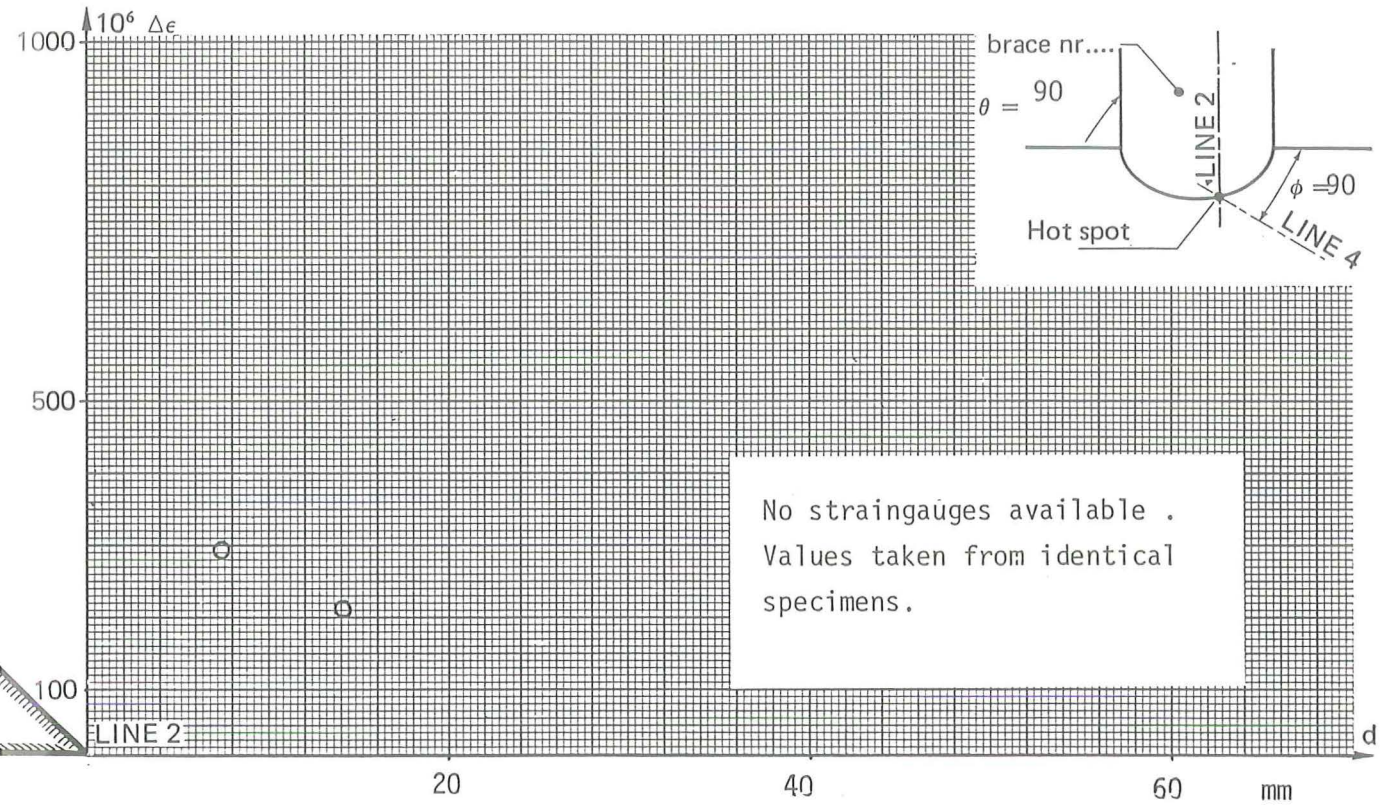
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 20

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
0	85	0		0.2	435



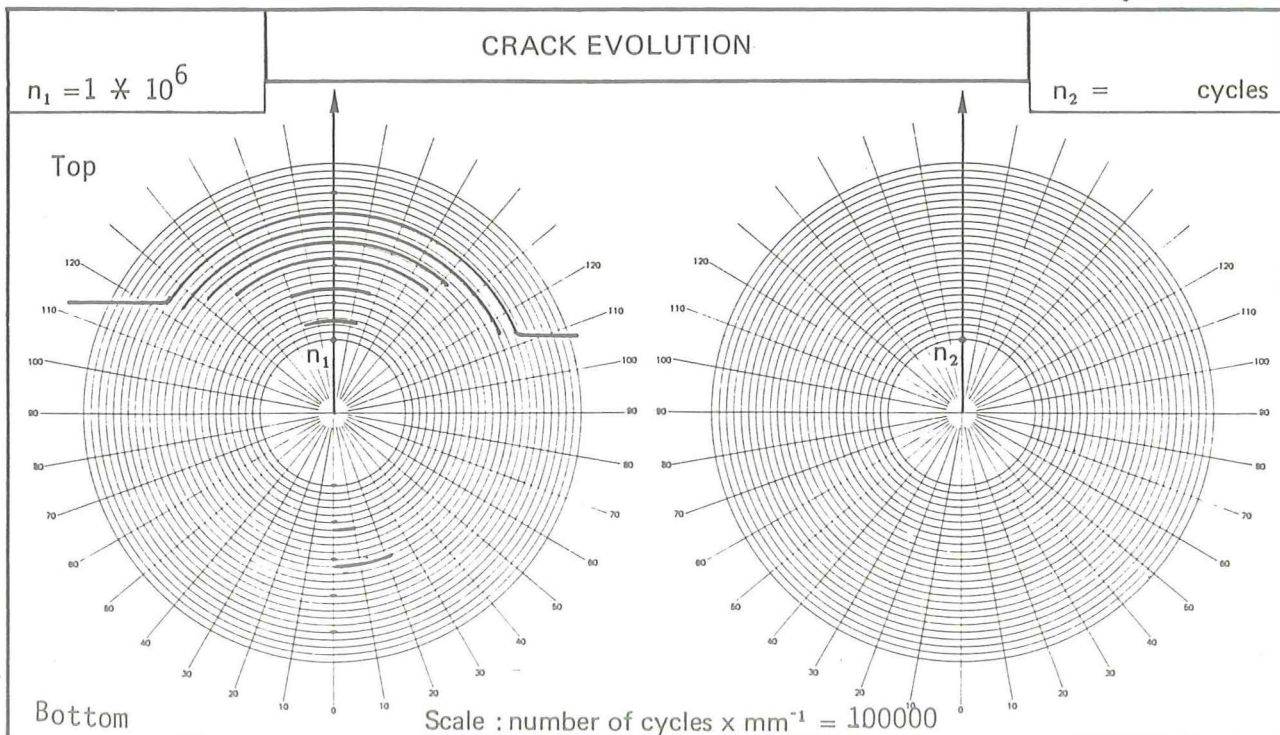
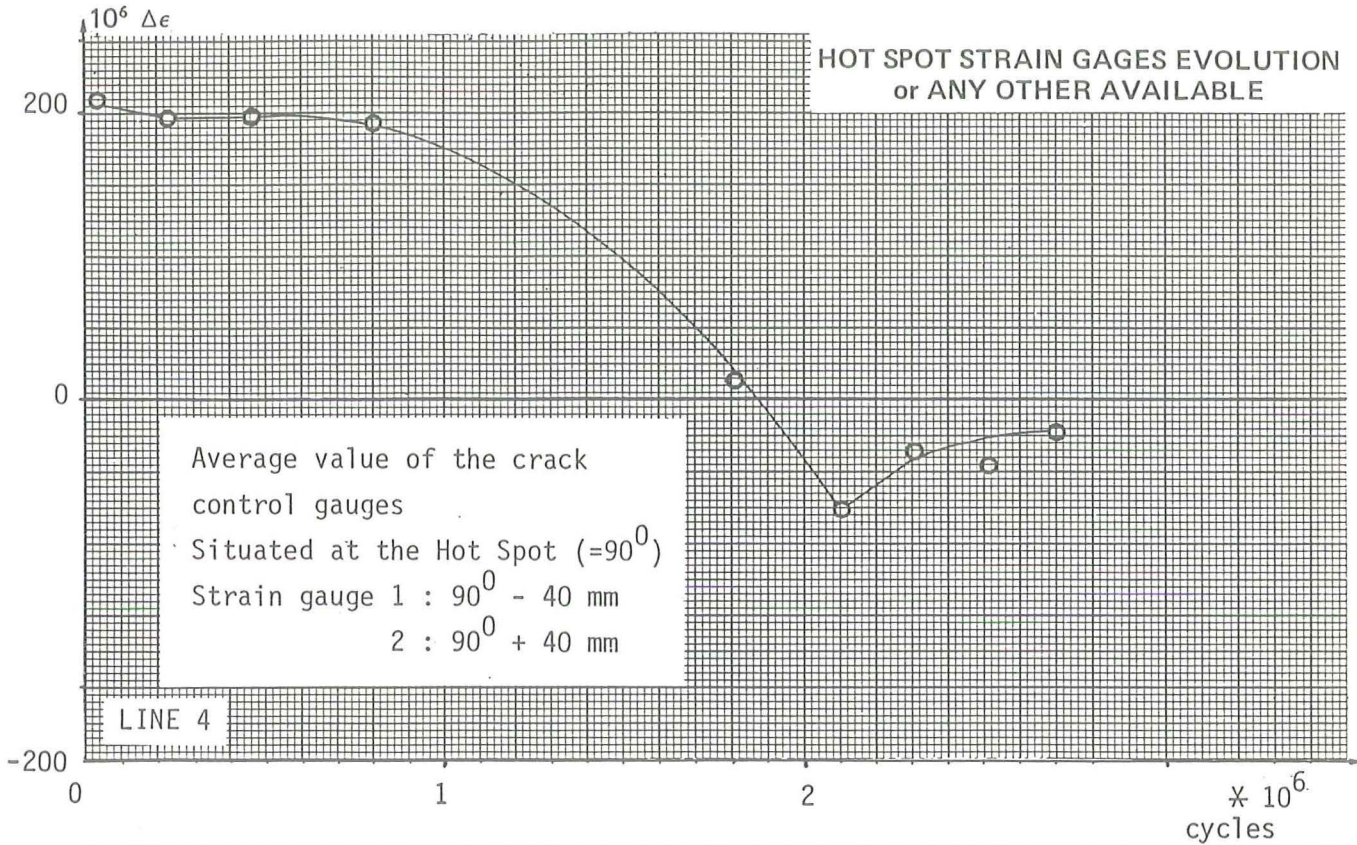
^xThe calculation has been based on the average SNCF's of the identical specimens.

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 75 mm. . .	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1×10^6	1.2×10^6	2.3×10^6	2.8×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 10 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	11

GEOMETRY - actual values in mm	outside diameter	wall thickness
	D	457.2
d ₁	114.3	t ₁ 6.3
d ₂		t ₂

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52						STD : API - 5LX : Din 448/1629				
	C %	Si %	Mn %	S %	P %	Al %					
	0.25	0.37	1.14	0.028	0.015						

WELDING	Welding process : MMAW , Current : AC											
	Filler materials : ISO AWS : E 7016											
	Electrode diameter (mm) :											
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII							WELDING PROCEDURE					
							Position	5G				
							Nr of runs	3				
							Energy (kj/m)	-				
							preheat. temp. (° C)	65				
							postheat. temp. (° C)	none				
							POST WELDING TREATMENT					
							Heat treatment tig or plasma dressing					
							Chill peening grinding					

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	394	
Tensile strength σ_u (N/mm ²)	603	

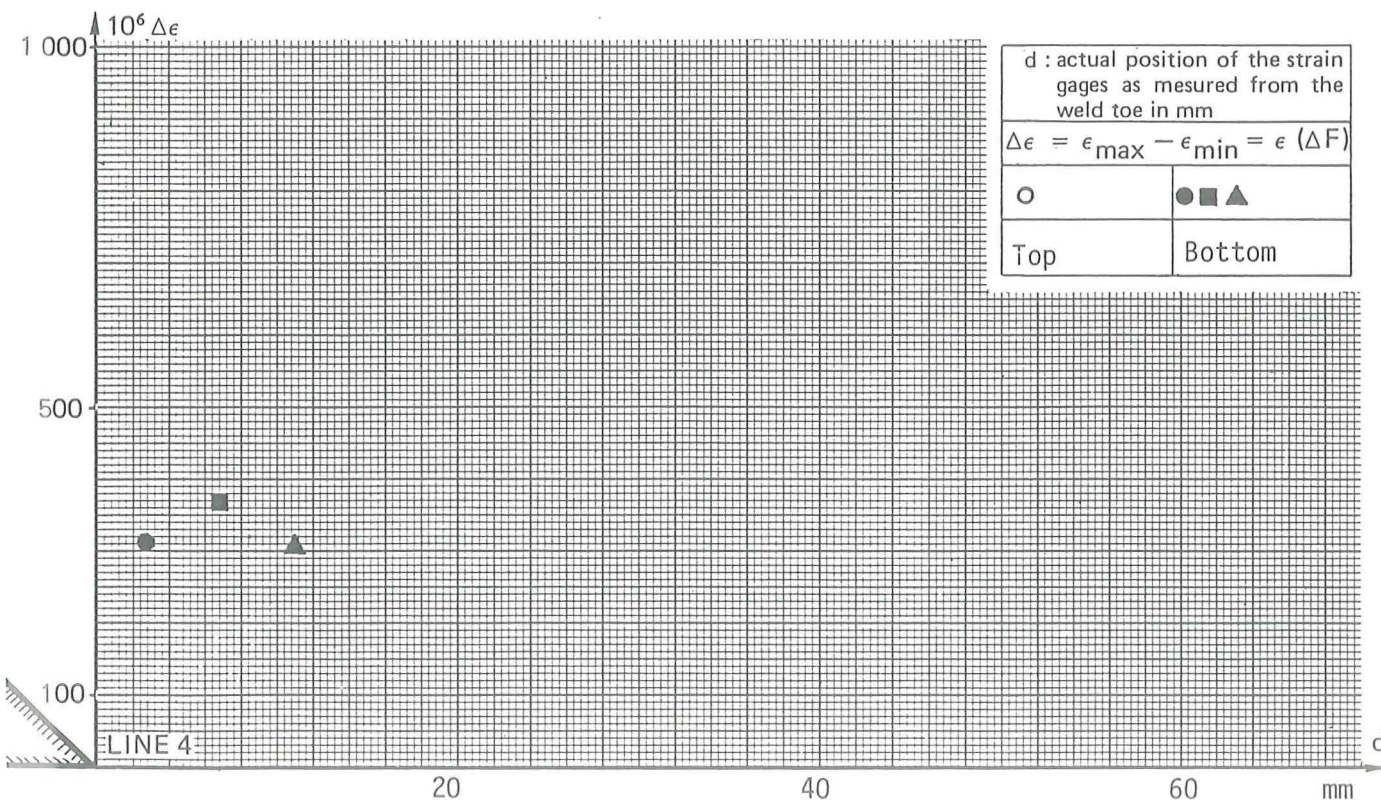
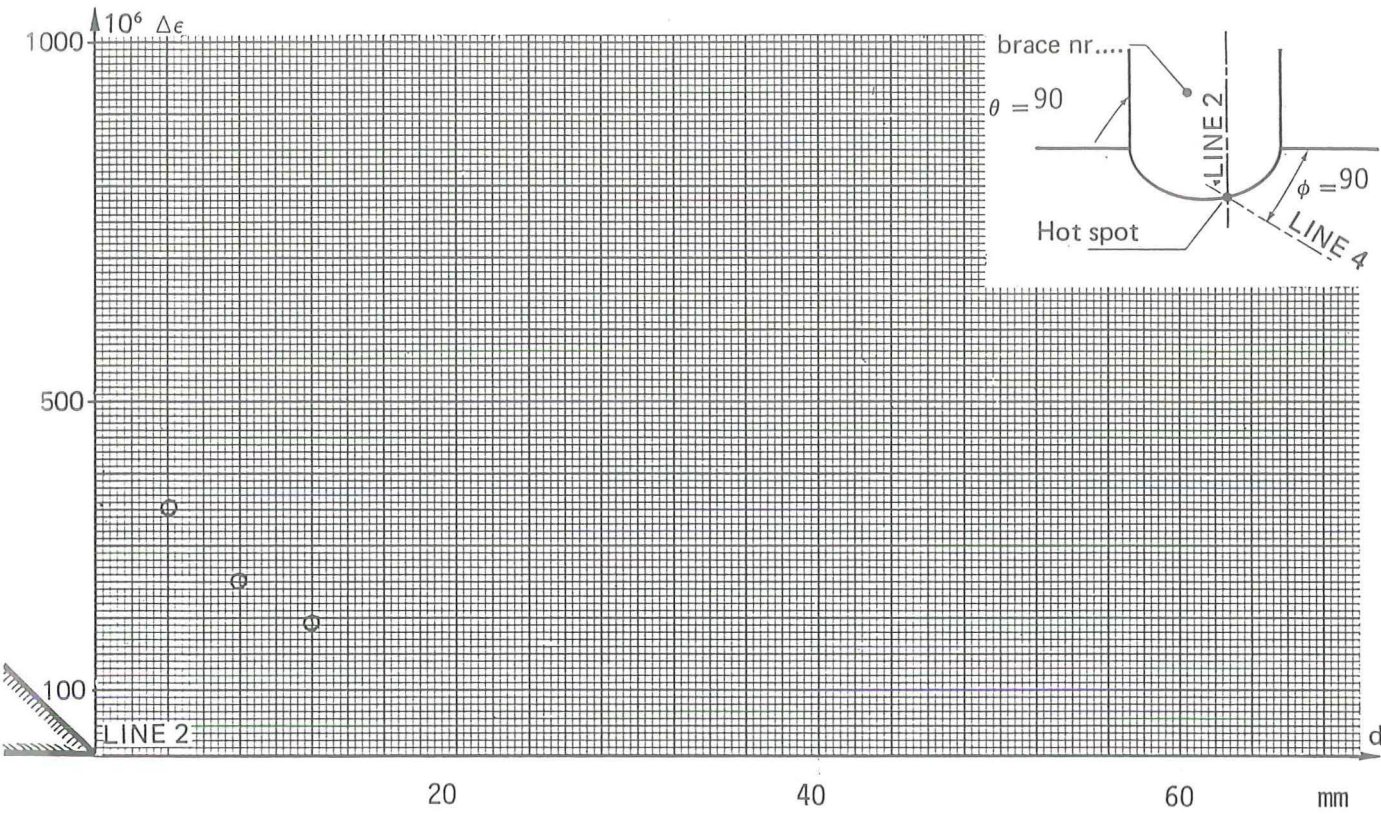
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 11 - page 2

Number of cycles before measurements : 24300 - cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
-28	28	-1		8	488



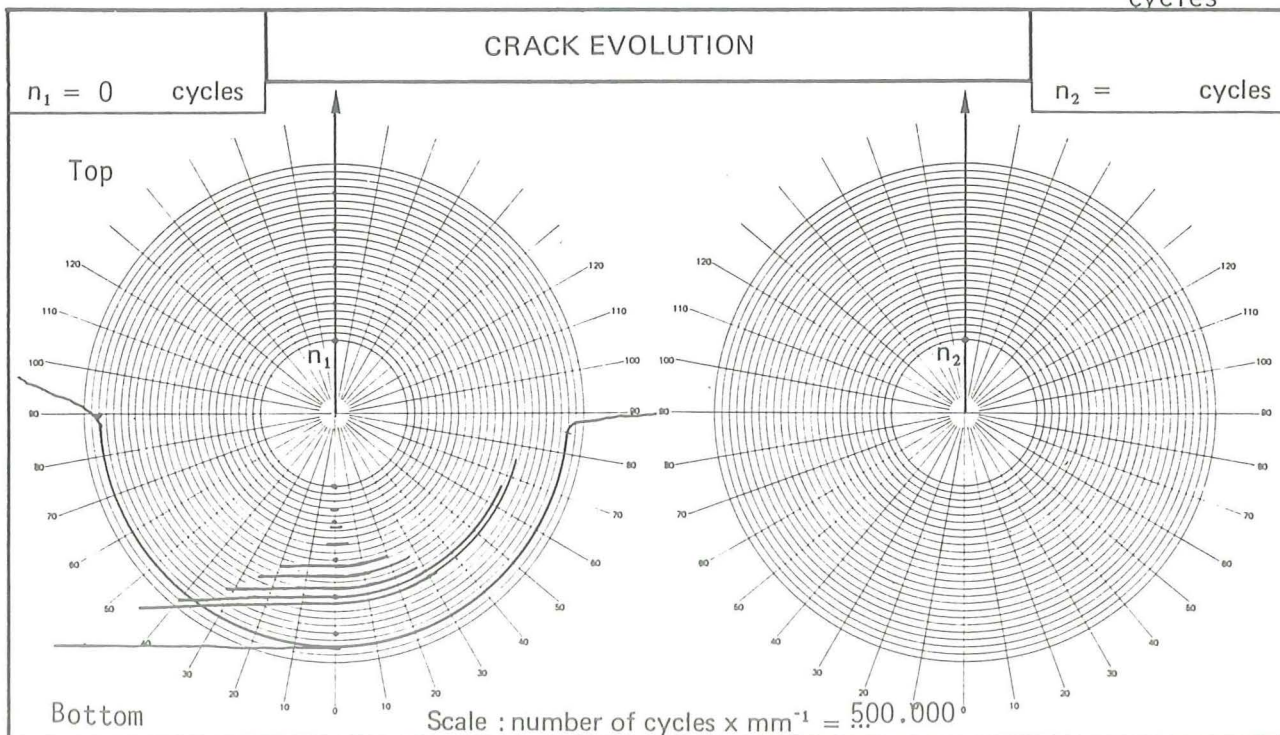
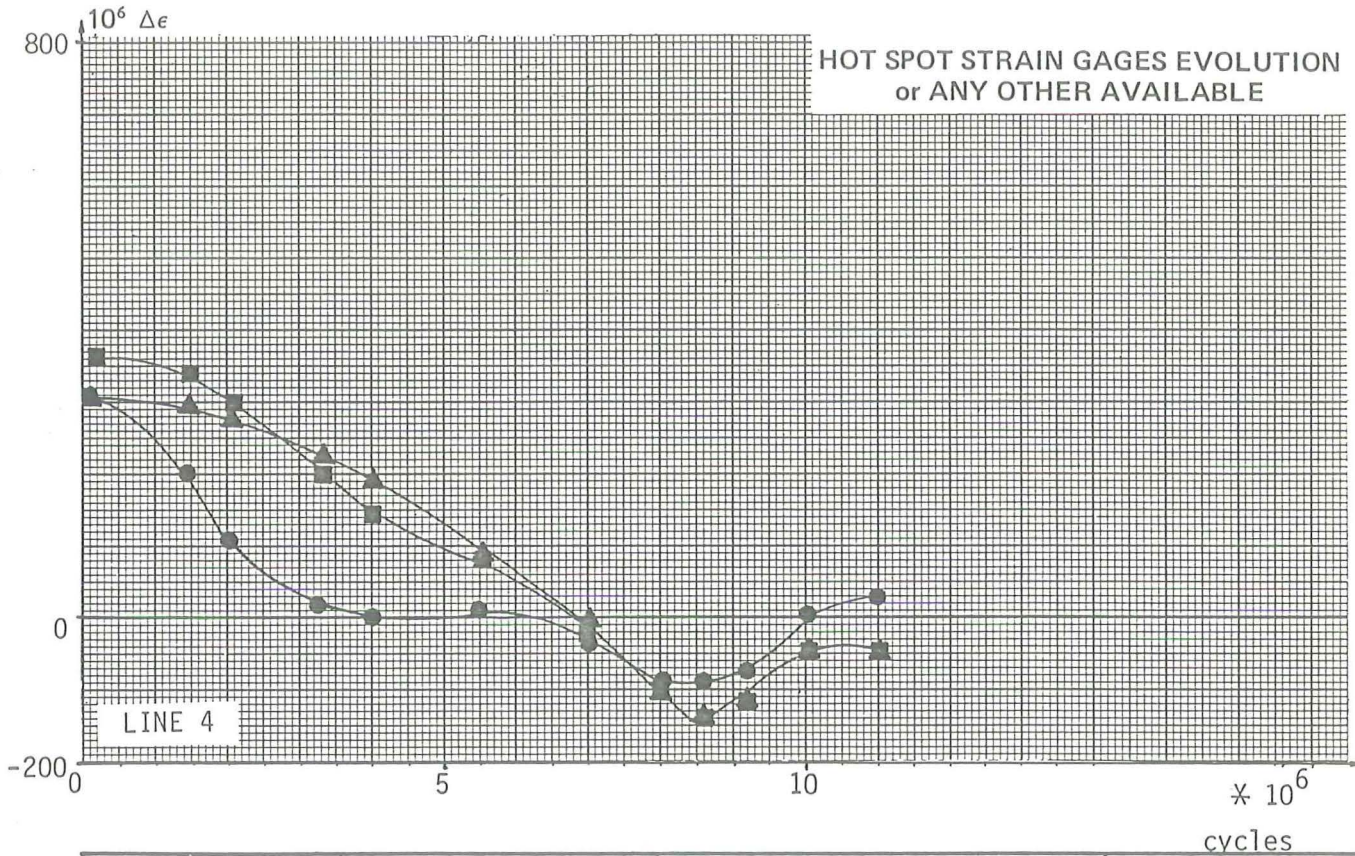
^x The calculation has been based on the average SNCF,s of the identical specimens.

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	2.0×10^6	4.8×10^6	9.0×10^6	1.1×10^7	

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



OTHER RELEVANT INFORMATIONS

Spec. 11 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	12

GEOMETRY actual values in mm	outside diameter		wall thickness	
	D	457.2	T	16
	d ₁	114.3	t ₁	6.3
	d ₂		t ₂	

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52					STD : API - 5 LX : Din 448 / 1629					
	C %	Si %	Mn %	S %	P %	Al %					
	0.25	0.37	1.14	0.028	0.015						

WELDING	Welding process : MMAW , Current : AC	
	Filler materials : ISO AWS - : E 7016	
	Electrode diameter (mm) :	
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		
	WELDING PROCEDURE	
	Position	5G
	Nr of runs	3
Energy (kj/m)	-	
preheat. temp. (° C)	65	
postheat. temp. (° C)	none	
POST WELDING TREATMENT		
Heat treatment tig or plasma dressing		
Sheet pooning grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

**Other
properties
see page 4**

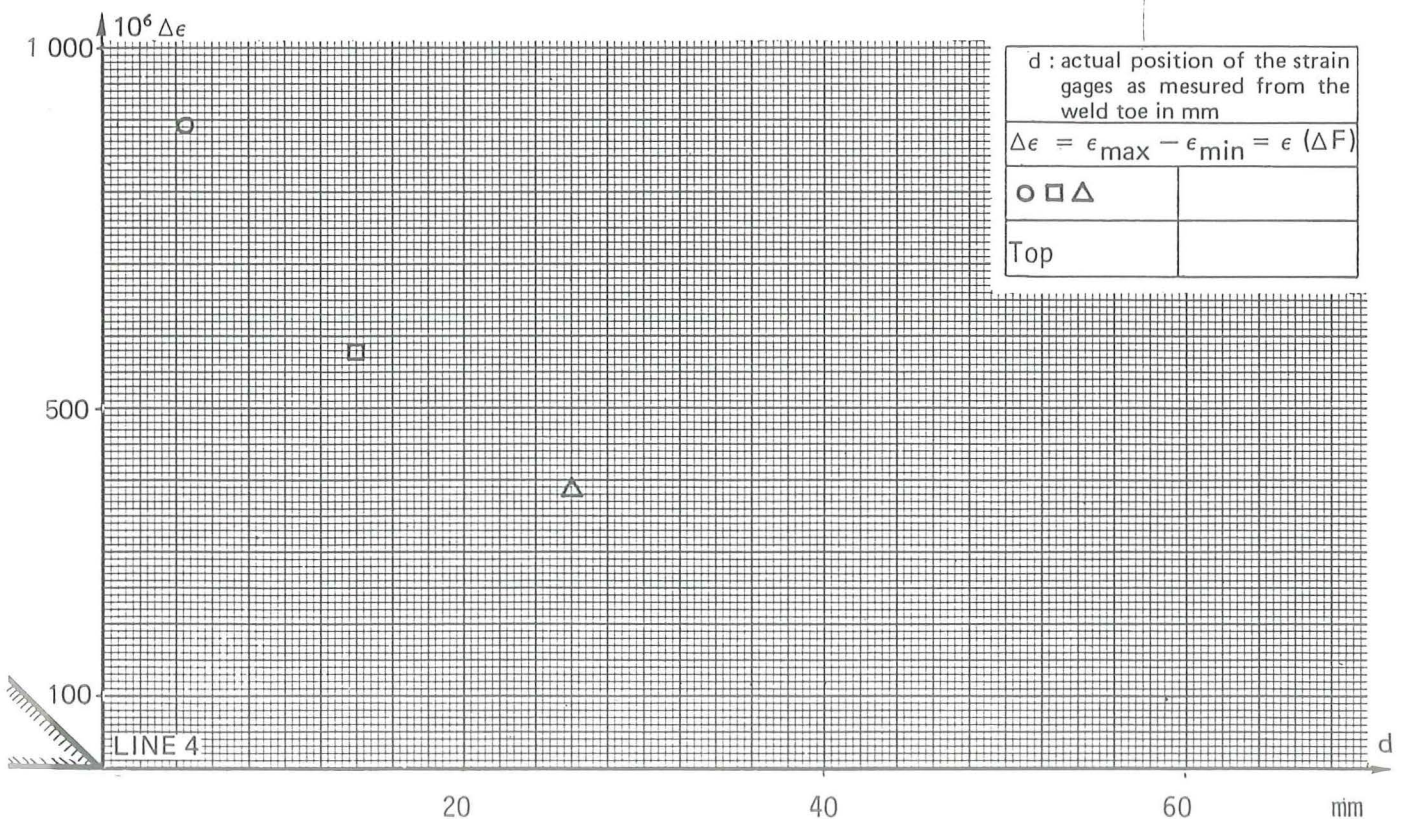
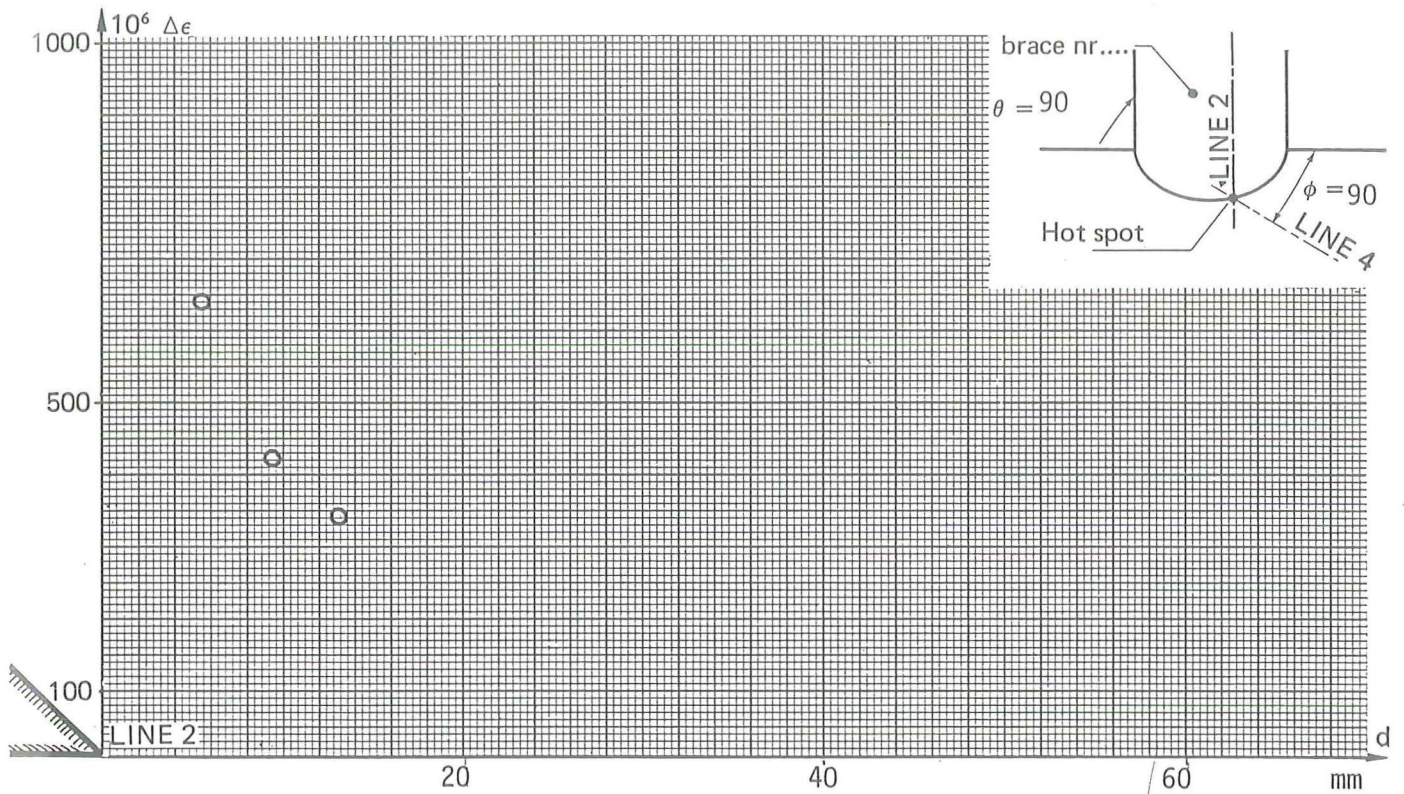
MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 12 - page 2

Number of cycles before measurements : 1050

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
-55	55	-1		3	956



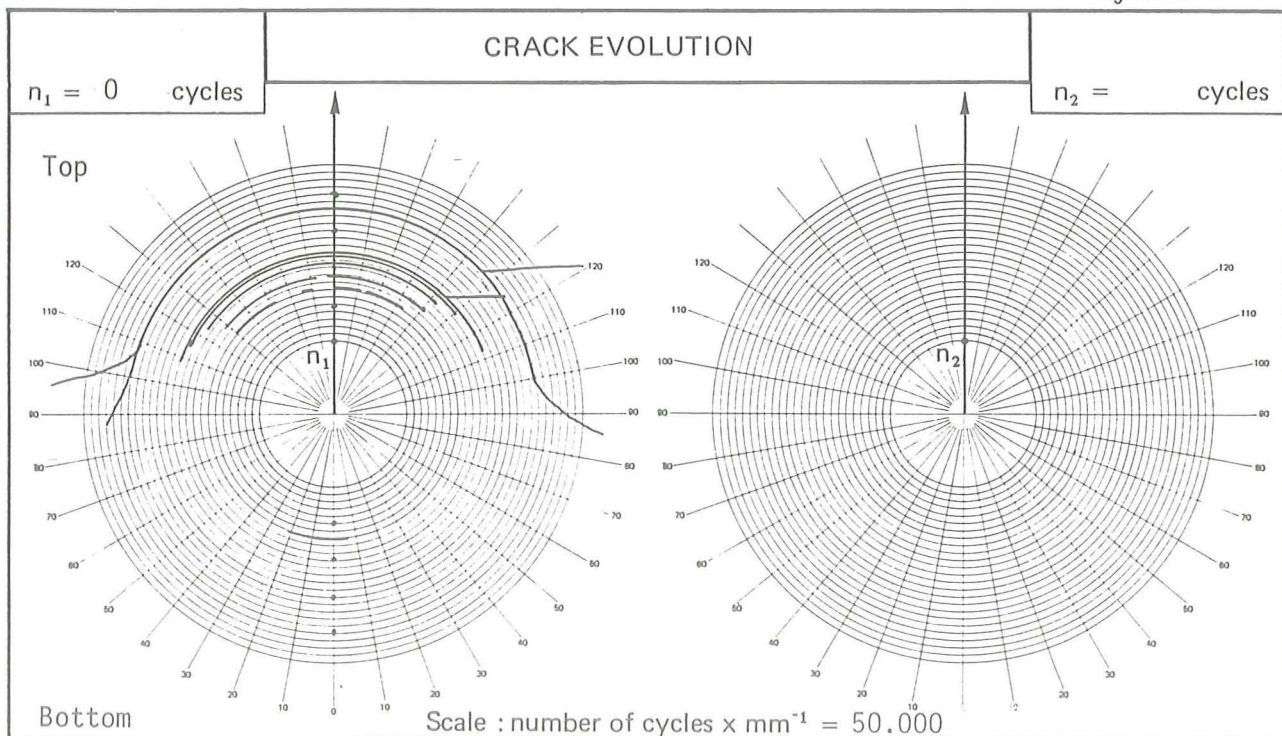
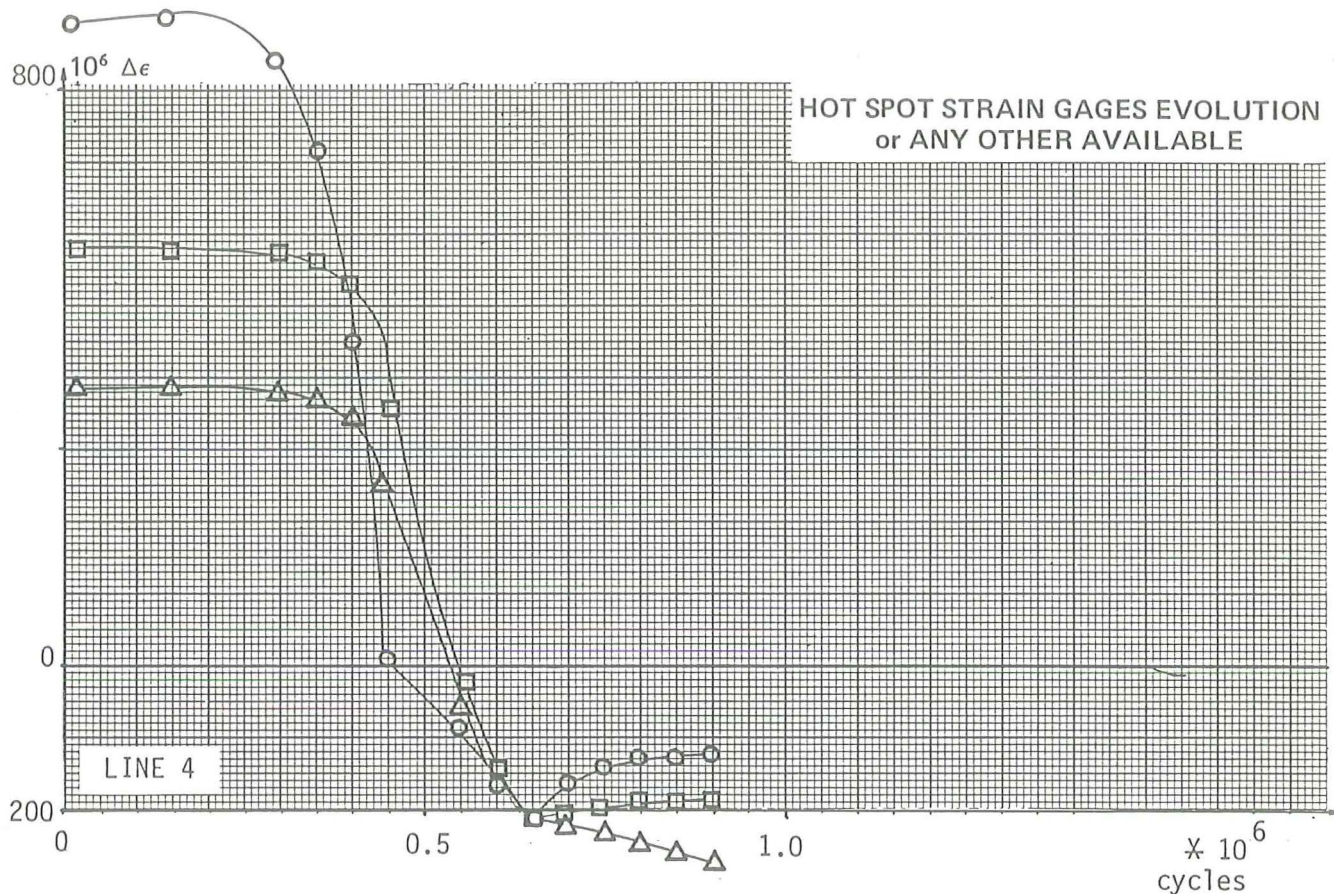
^x The calculation has been based on the average SNCF's of the identical specimens.

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	3.5×10^5		7.0×10^5	9.1×10^5	

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



OTHER RELEVANT INFORMATIONS

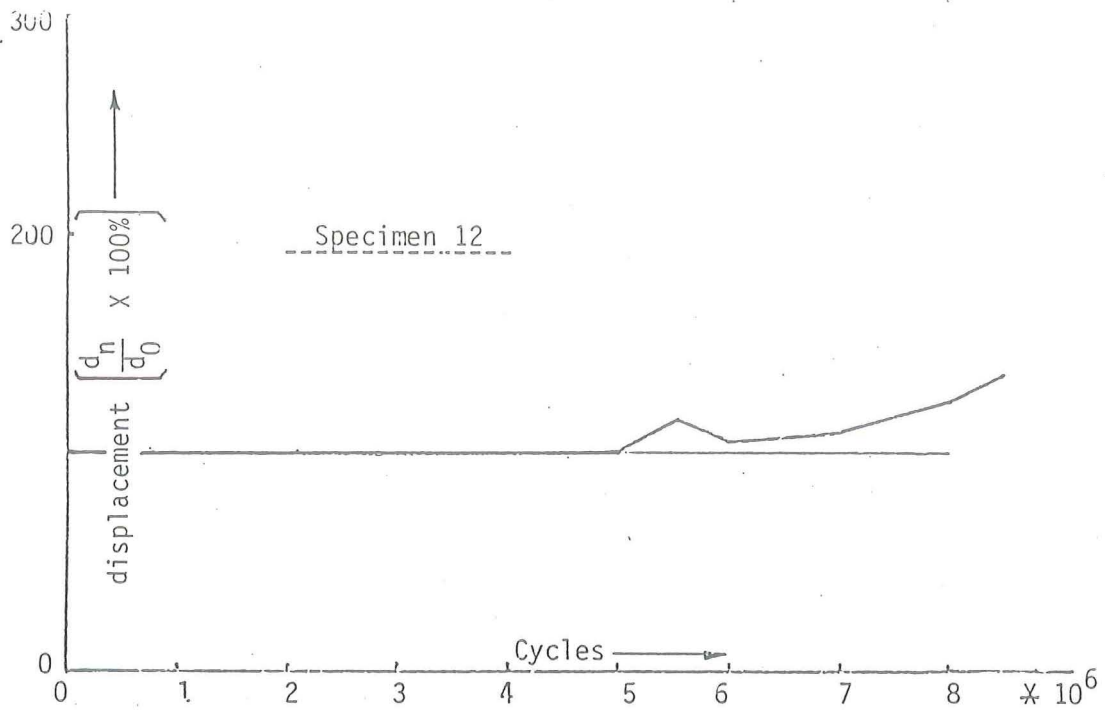


Fig. 1 Evolution of the node elongation per cycle during the test

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	13

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY actual values in mm		outside diameter	wall thickness
	D	914.4	T 32
	d ₁	457.2	t ₁ 16
	d ₂		t ₂

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	9
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 %				

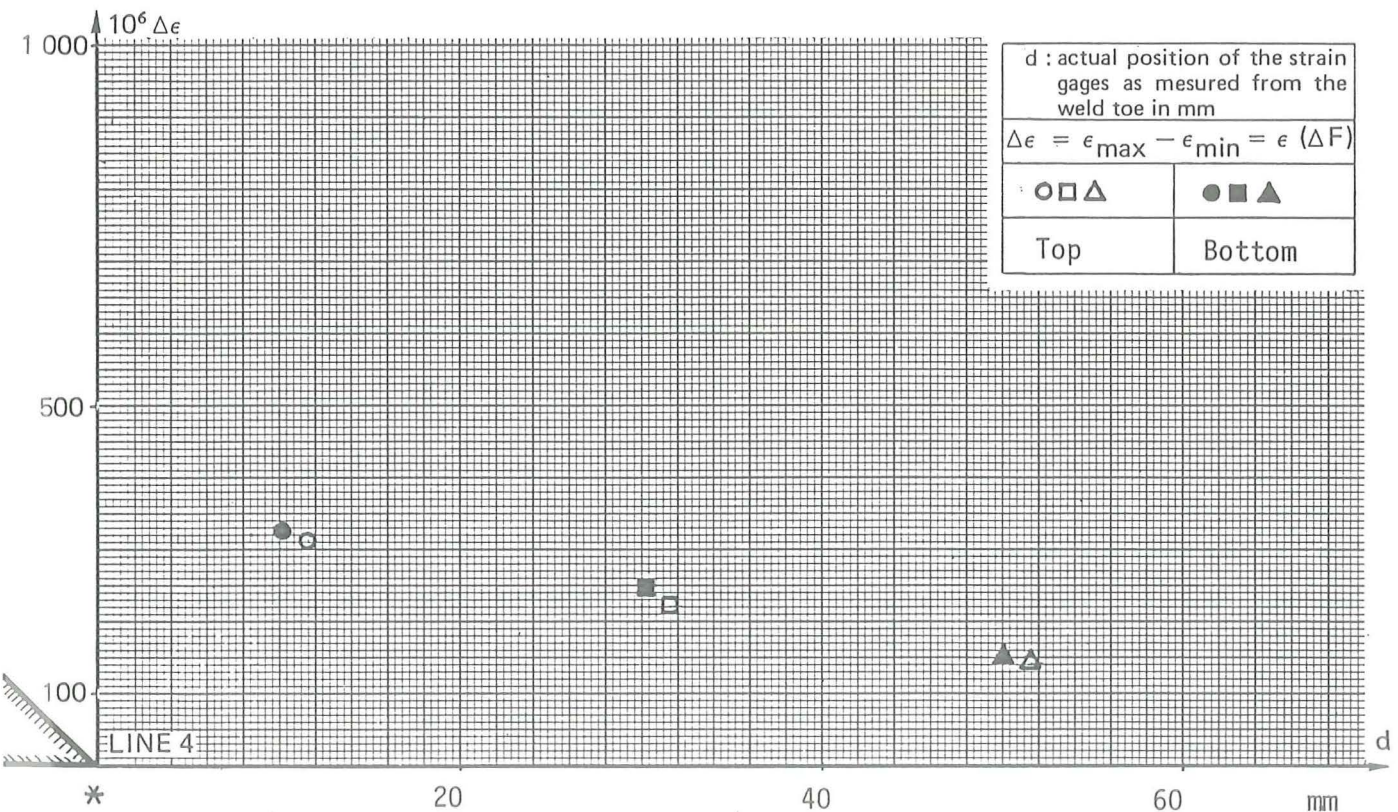
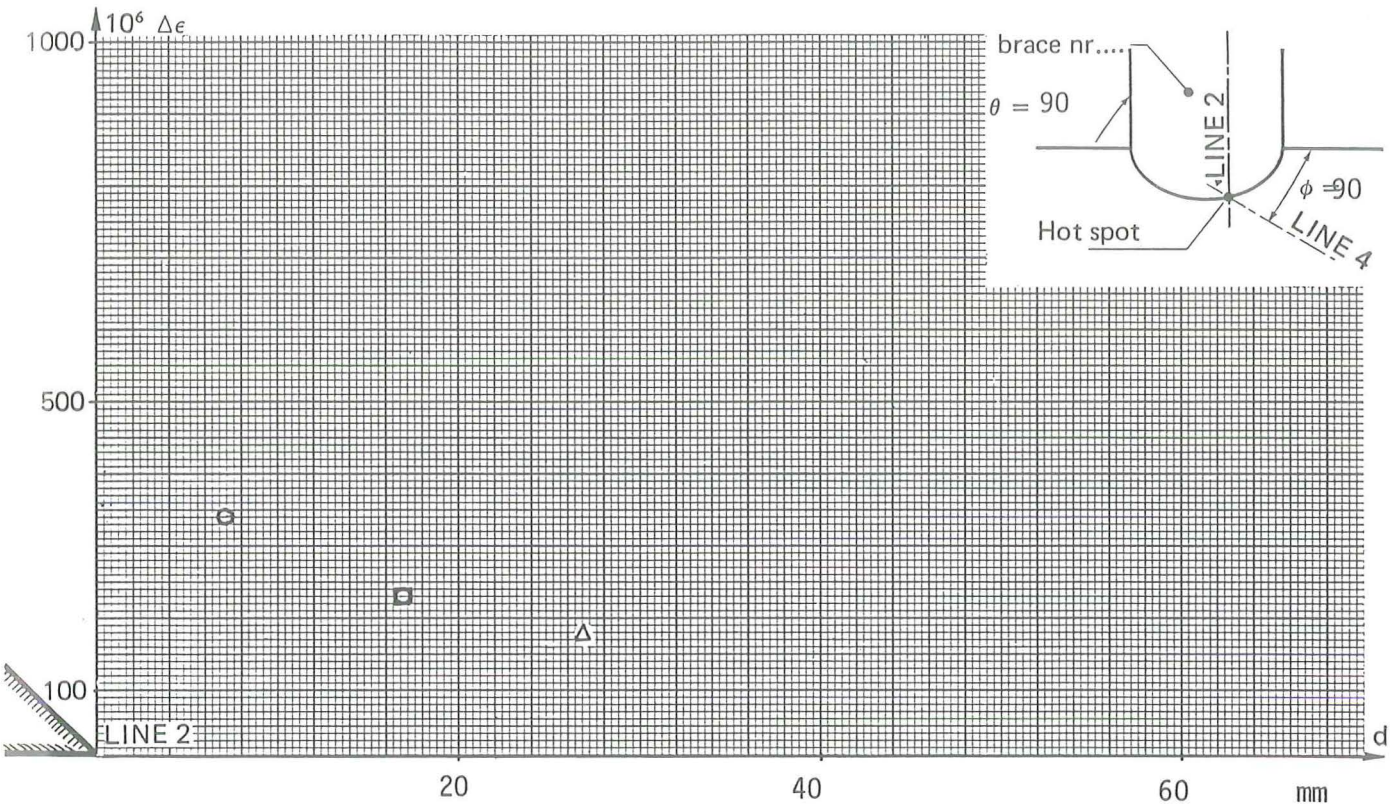
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	366	
Tensile strength σ_U (N/mm ²)	532	

Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 1000 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	270	0		2.8	370



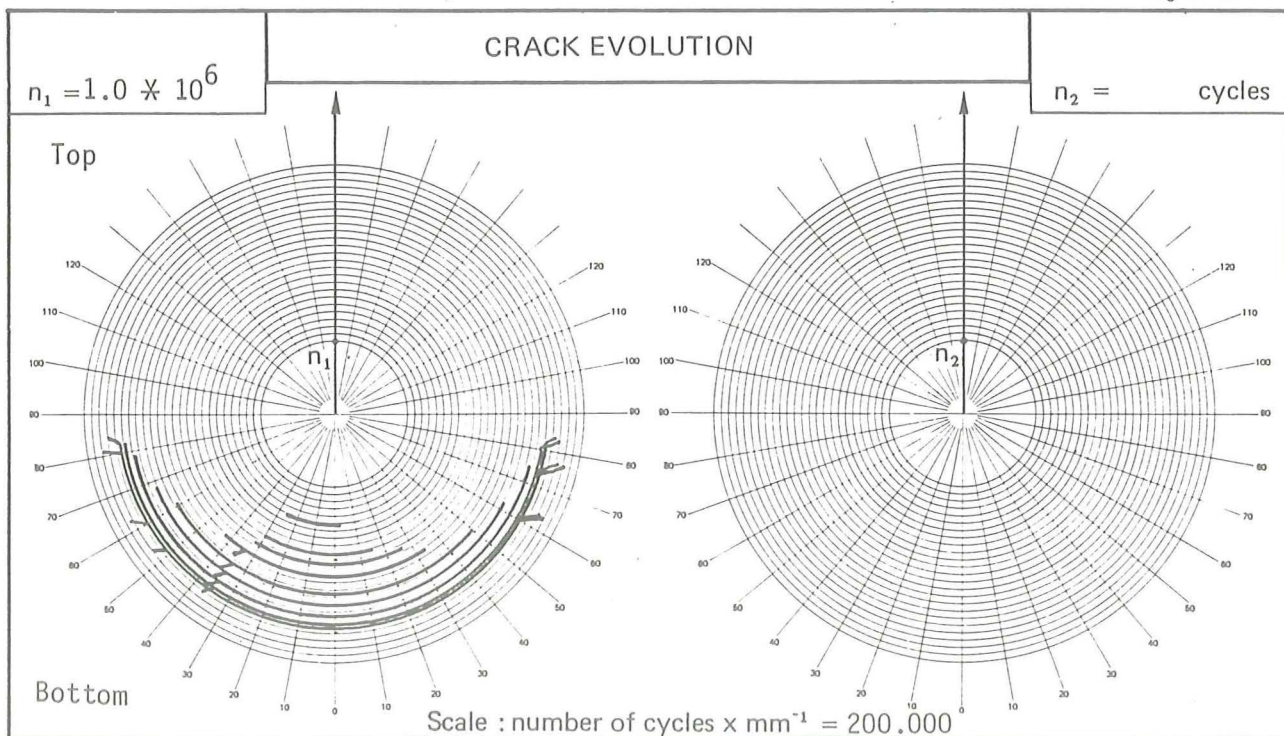
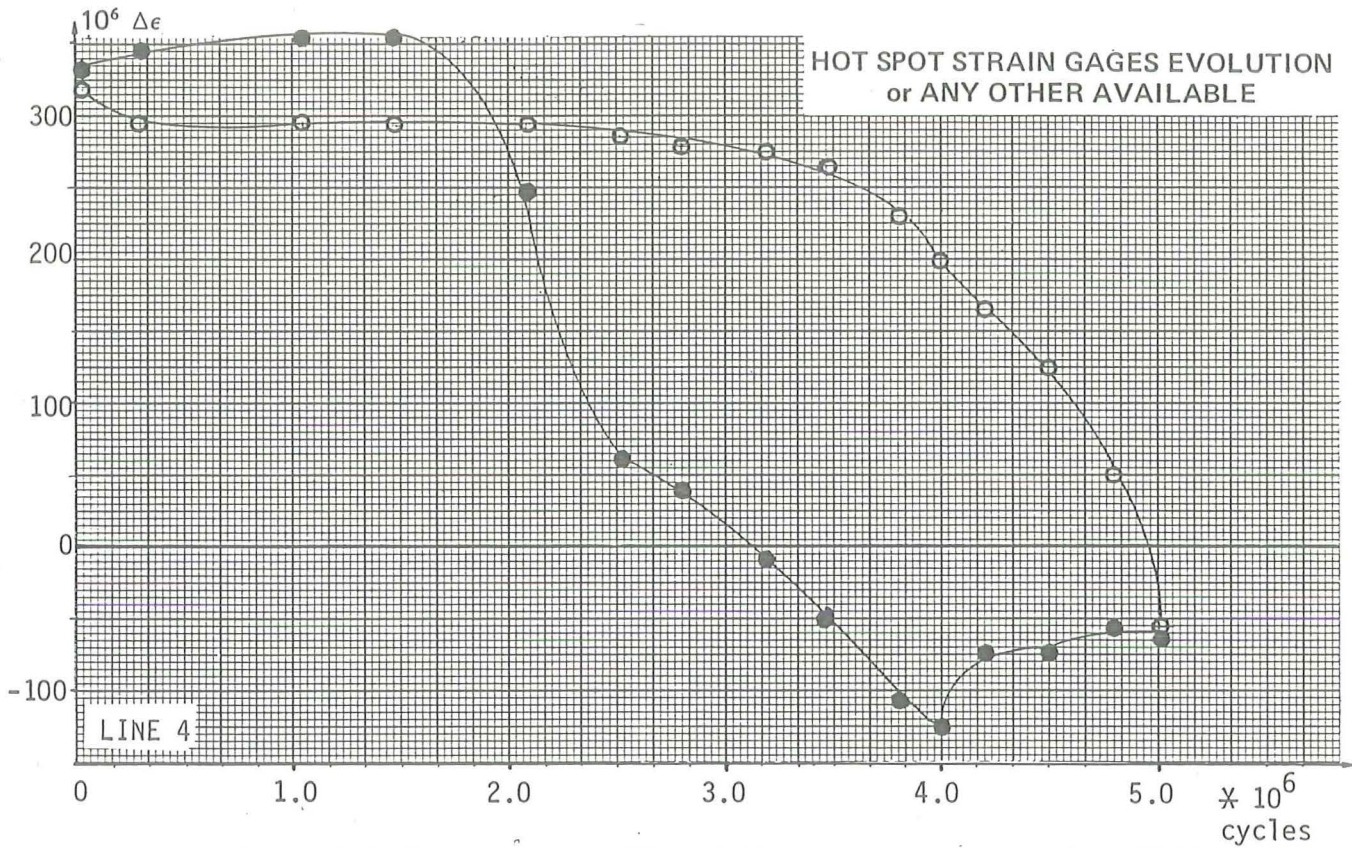
* The calculation has been based on the average SNCF's of the identical specimens

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 100 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.9×10^6	2.1×10^6	4.1×10^6	5.0×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 13 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	14

GEOMETRY actual values in mm	outside diameter	wall thickness
	D 914.4	T 32
	d ₁ 457.2	t ₁ 16
	d ₂	t ₂

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	7
	Energy (kj/m)		preheat. temp. (° C)	100
	postheat. temp. (° C)	none	POST WELDING TREATMENT	
		Heat treatment tig or plasma dressing		
		Shot peening grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	366	
Tensile strength σ_U (N/mm ²)	532	

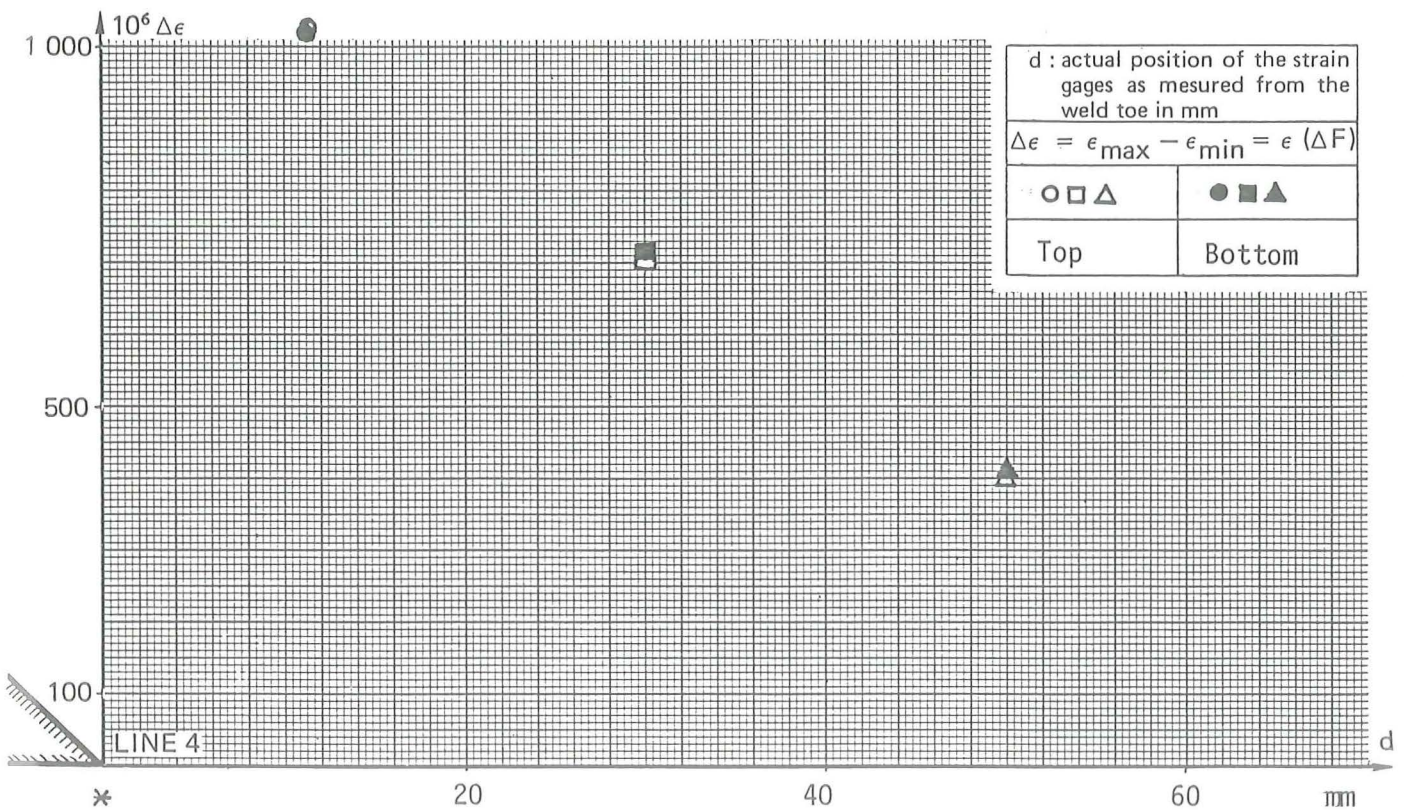
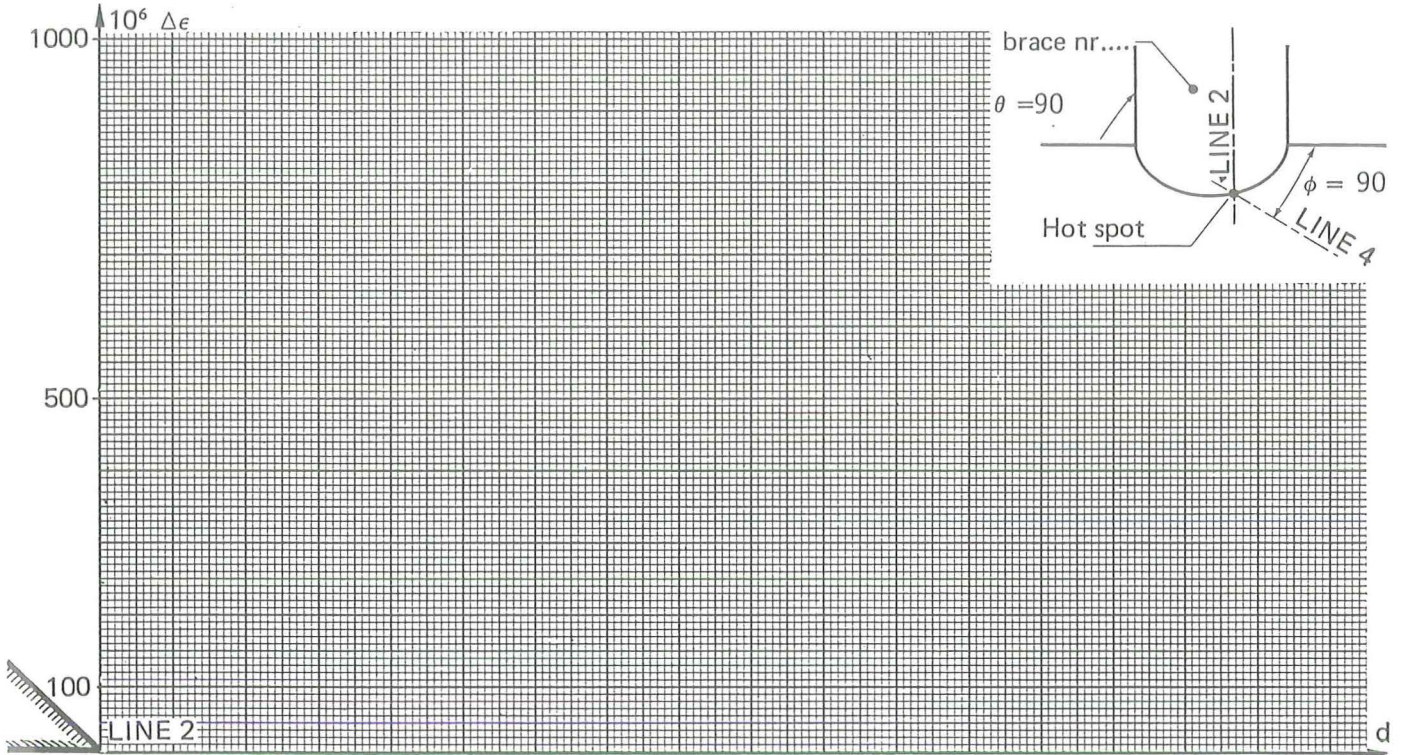
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 540

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	770	0		1.5	1055



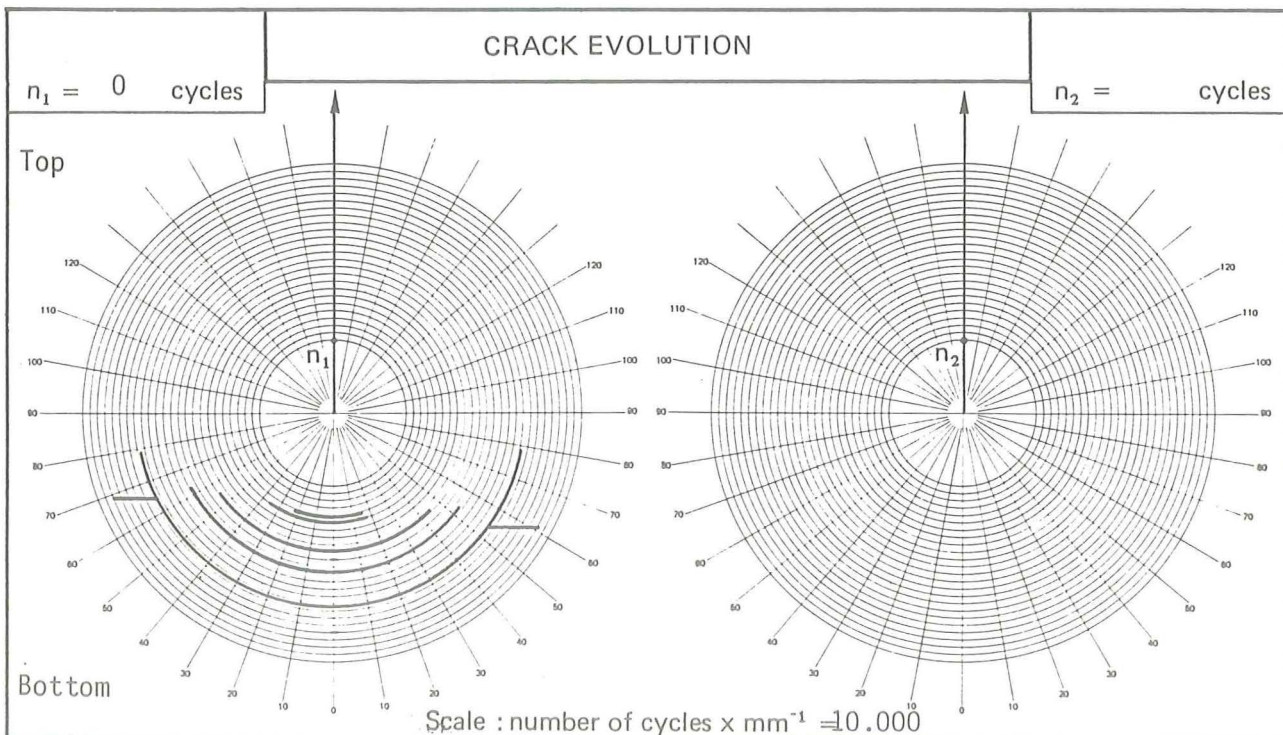
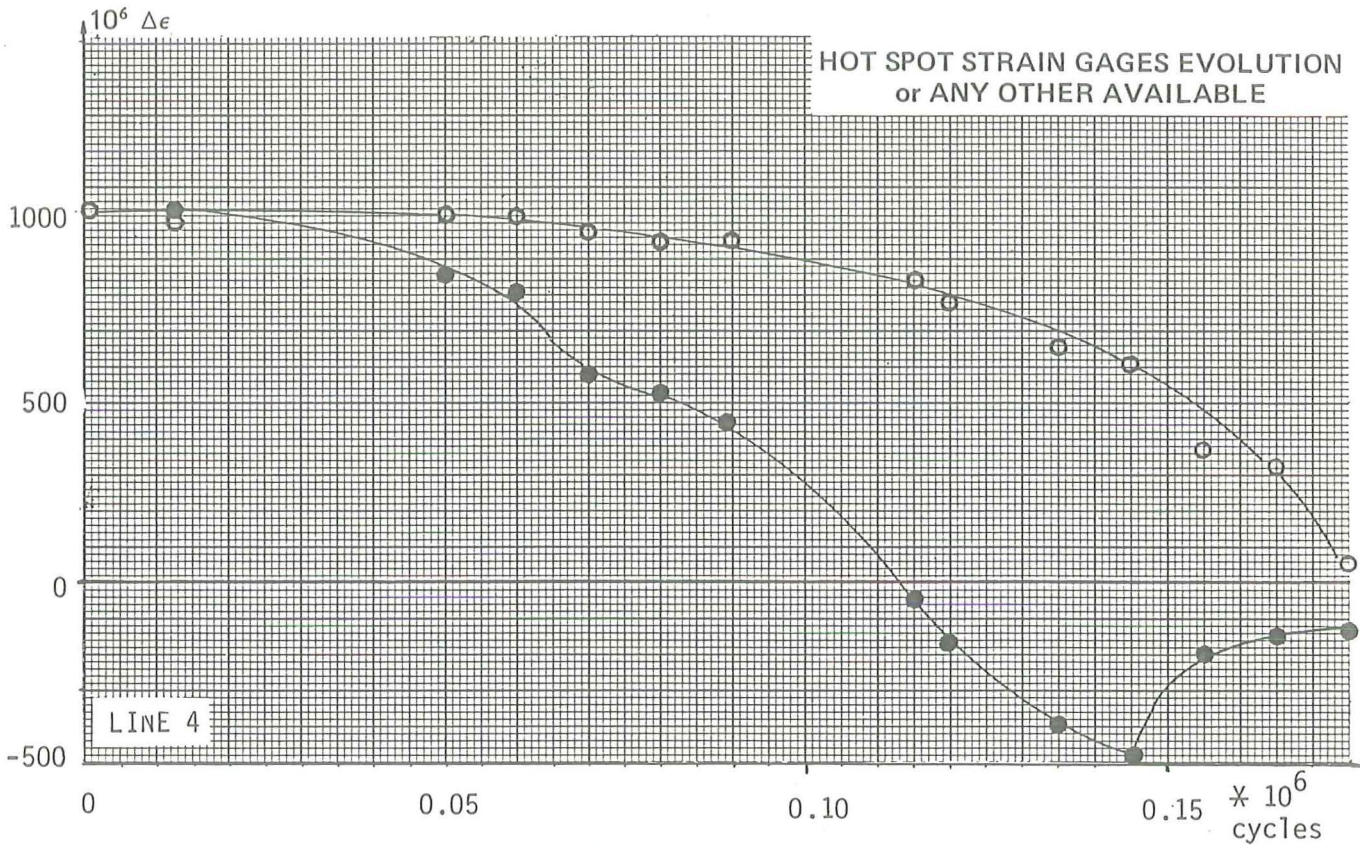
* The calculation has been based on the average SNCF's of the identical specimens

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 150 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	5.0×10^4	5.0×10^4	1.5×10^5	1.7×10^5	

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



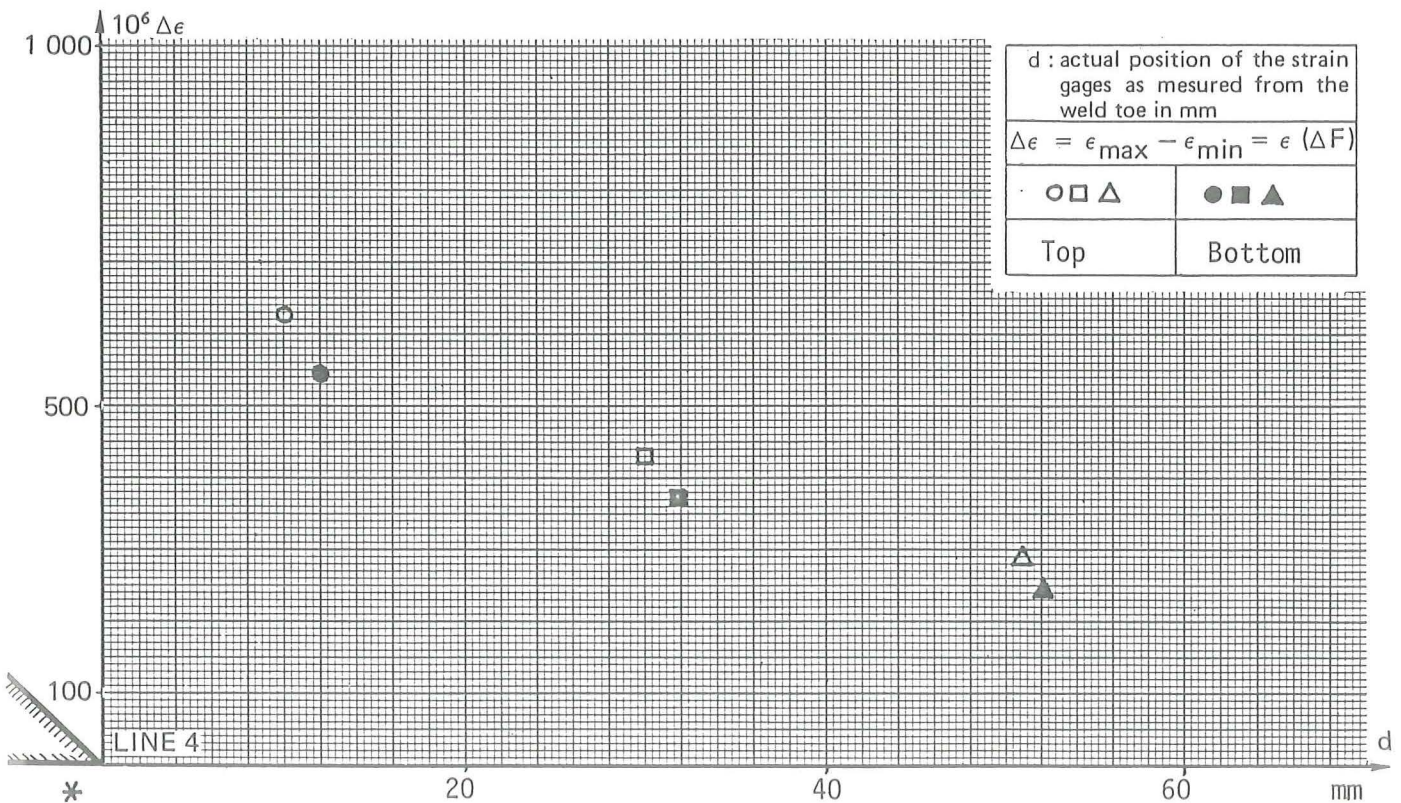
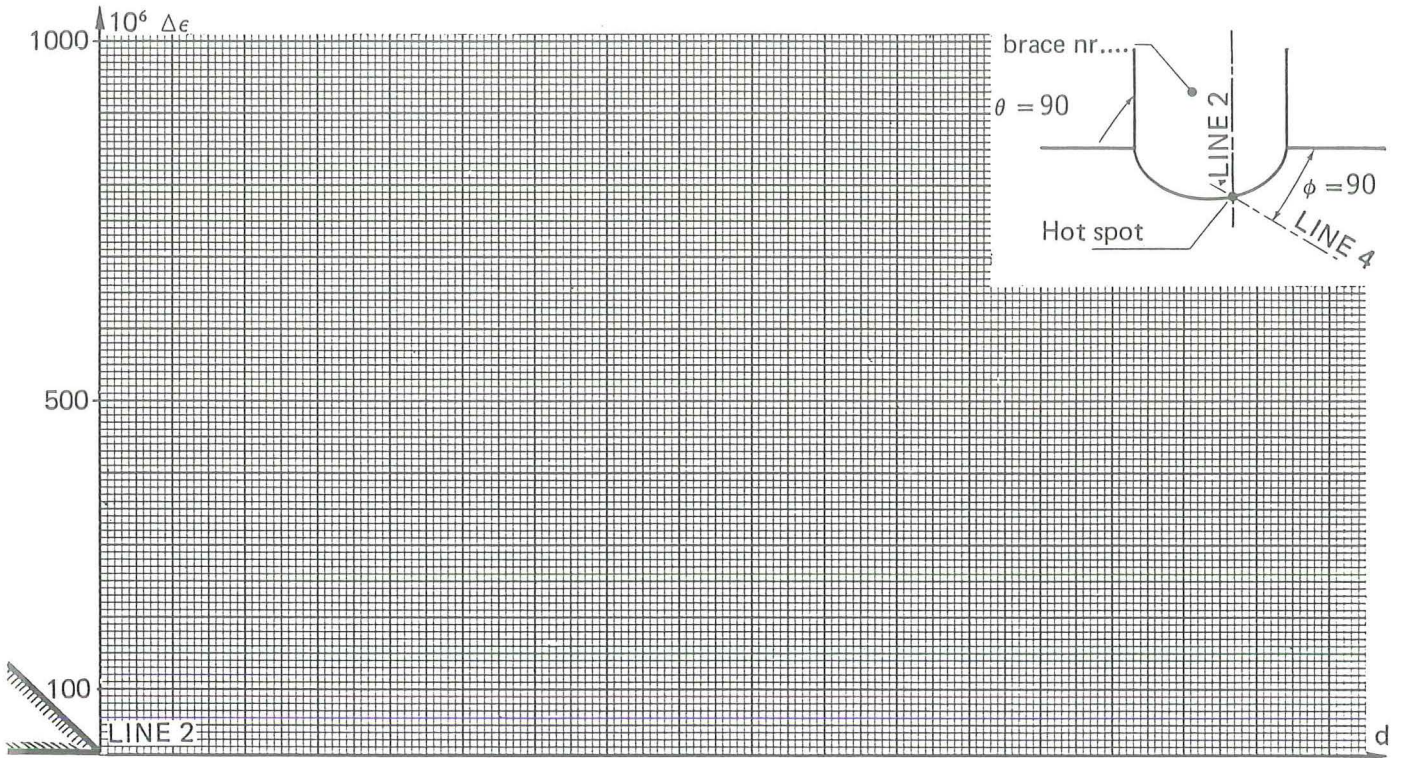
OTHER RELEVANT INFORMATIONS

Spec. 14 - page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 500 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	450	0		2.8	615



d : actual position of the strain gages as measured from the weld toe in mm

$\Delta\epsilon = \epsilon_{max} - \epsilon_{min} = \epsilon (\Delta F)$

○ □ △	● ■ ▲
Top	Bottom

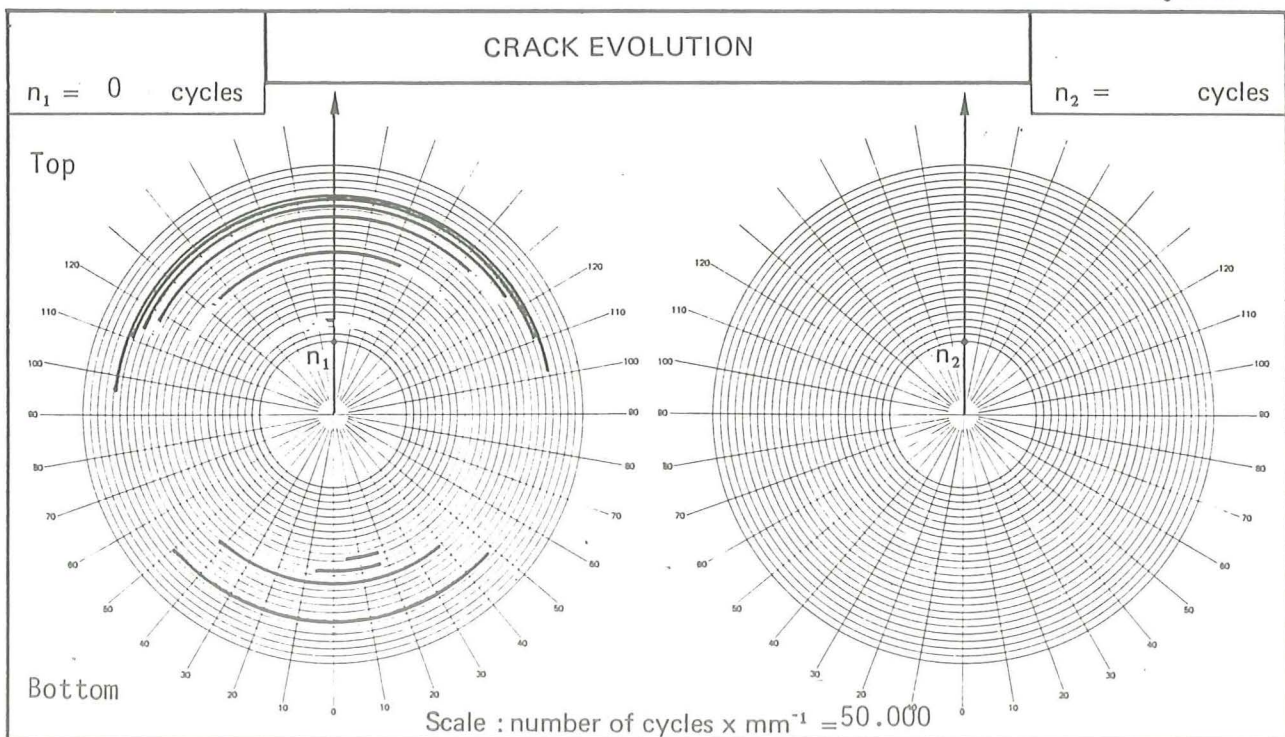
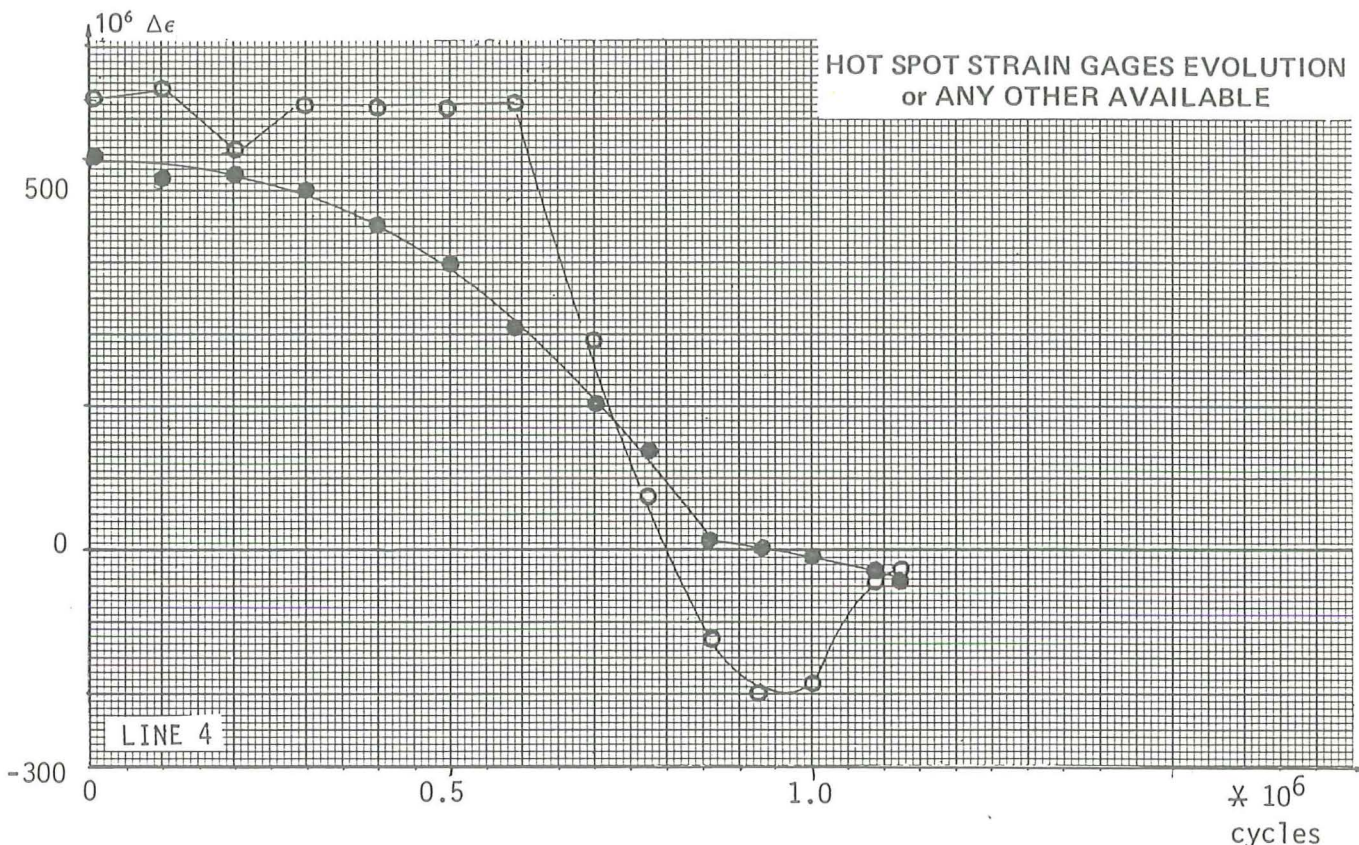
* The calculation has been based on the average SNCF's of the identical specimens

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 60 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	3.7×10^5	4.8×10^5	9.5×10^5	1.3×10^6	

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



OTHER RELEVANT INFORMATIONS

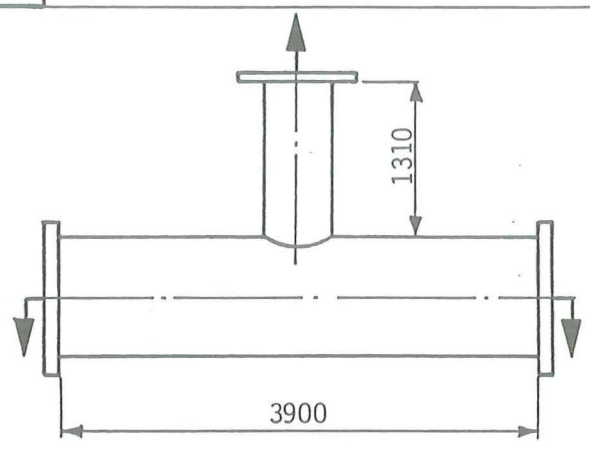
Spec. 15 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

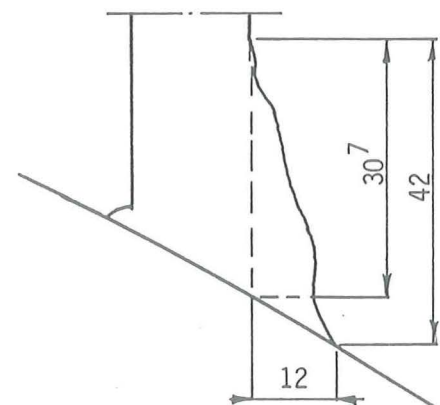
Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	16

GEOMETRY values in mm	outside diameter	wall thickness		
	D	914.4	T	32
	d ₁	457.2	t ₁	16
	d ₂		t ₂	

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 : 160 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/mm ²)	366	
Tensile strength σ_U (N/mm ²)	532	

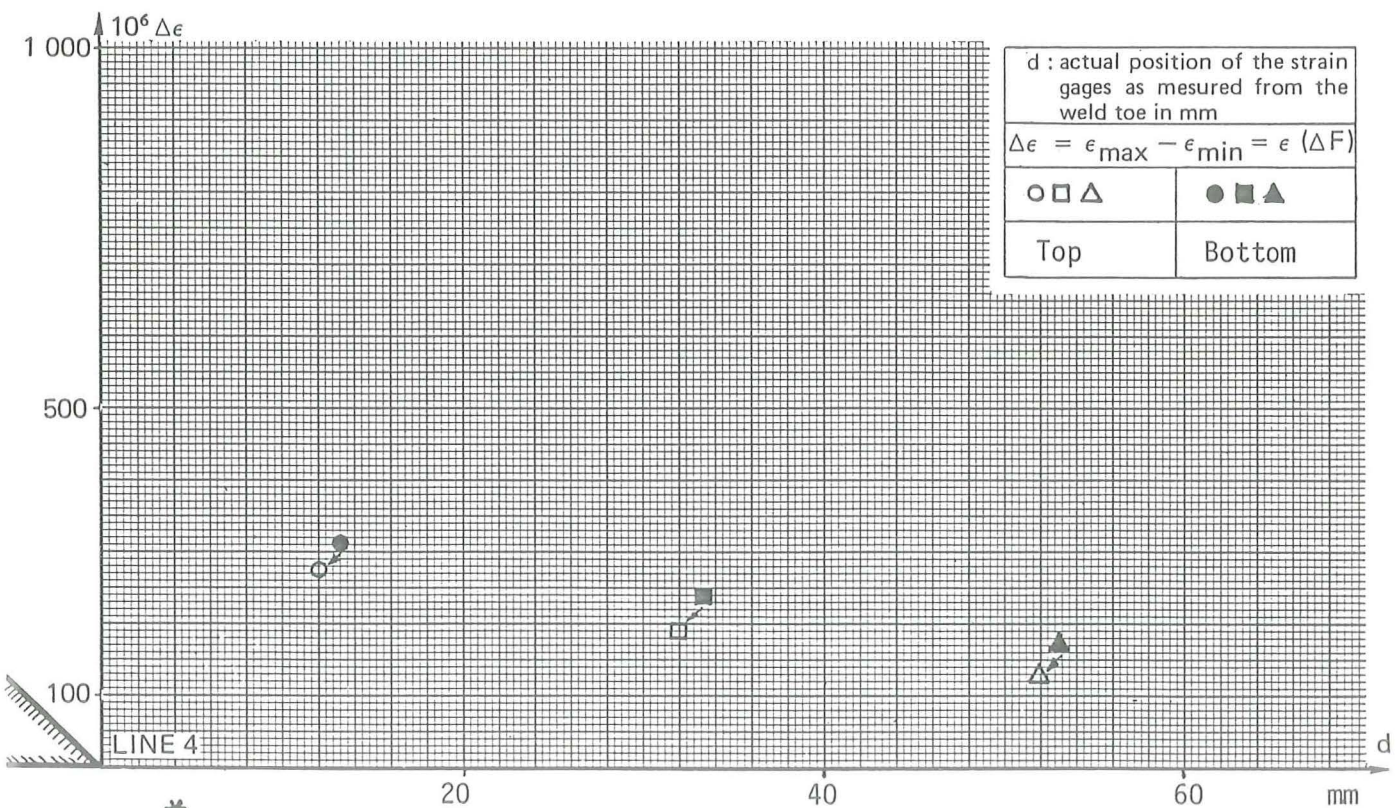
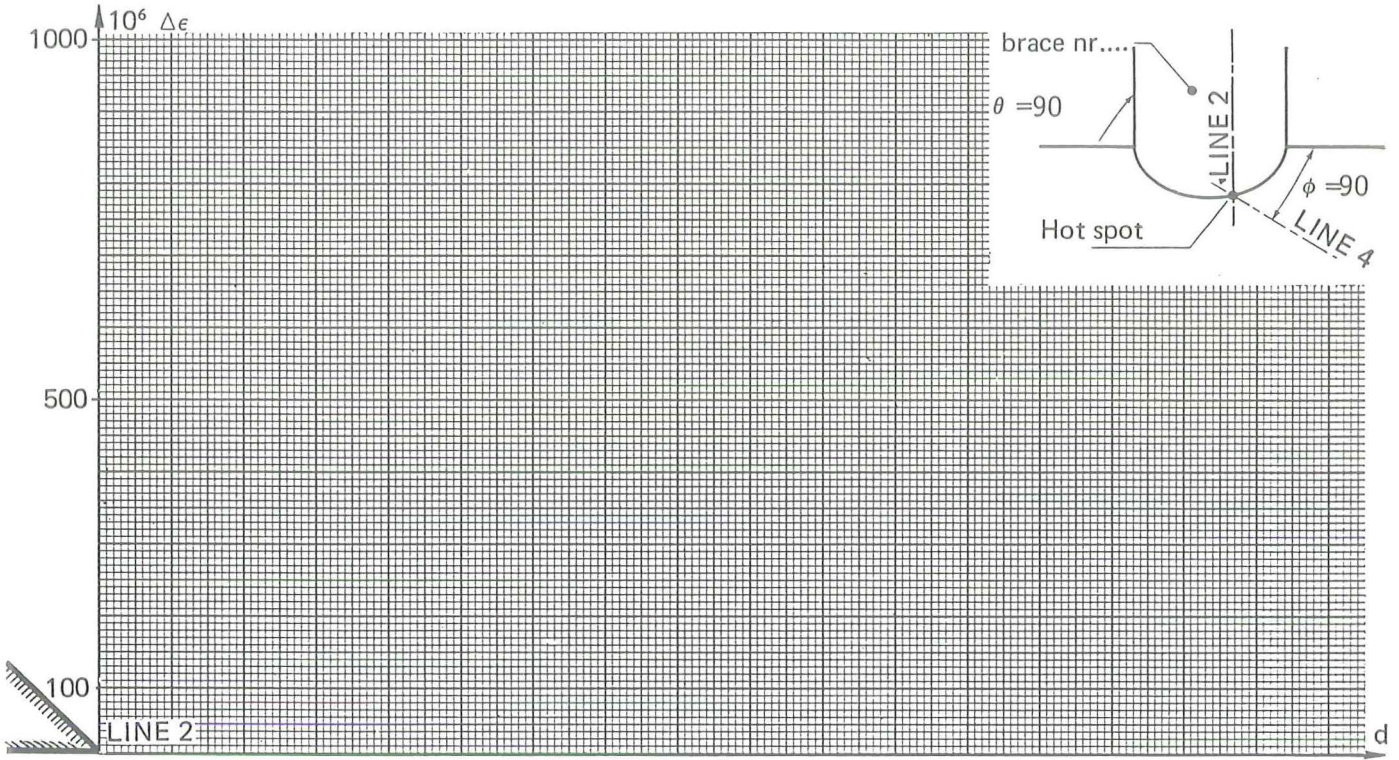
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 50

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	240	0		0.2	325



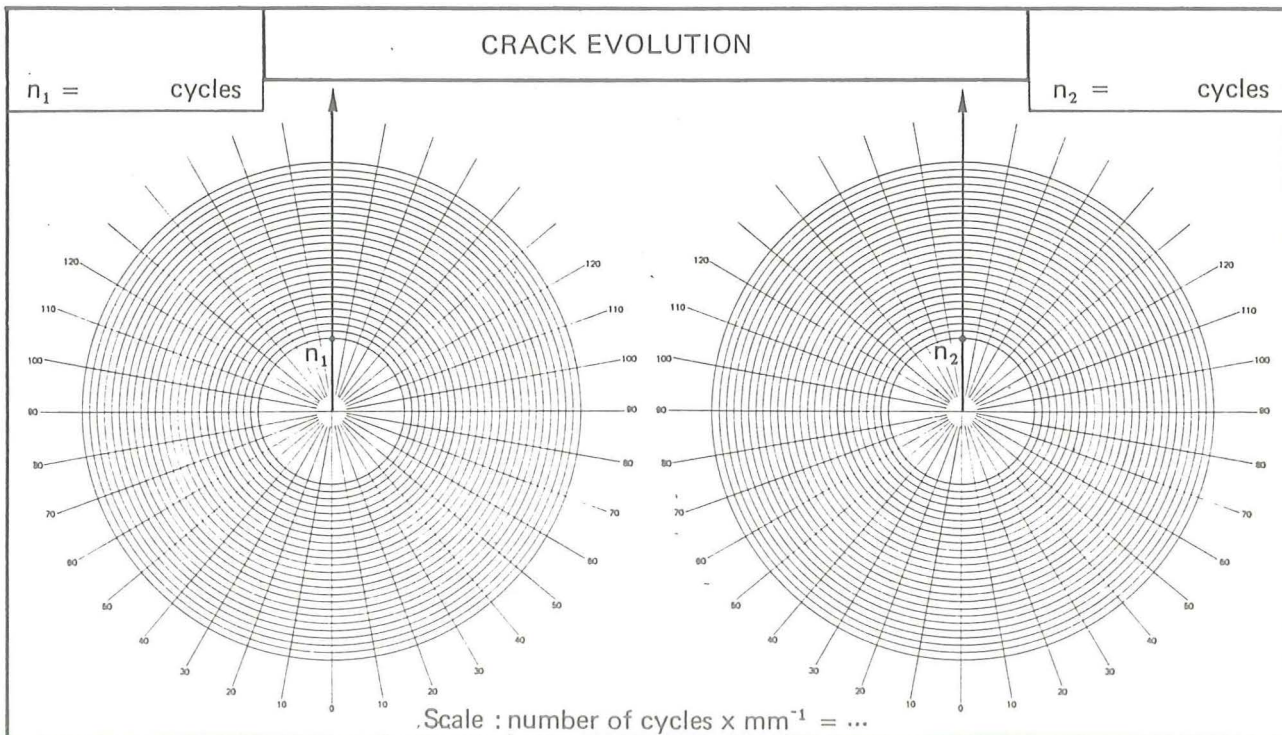
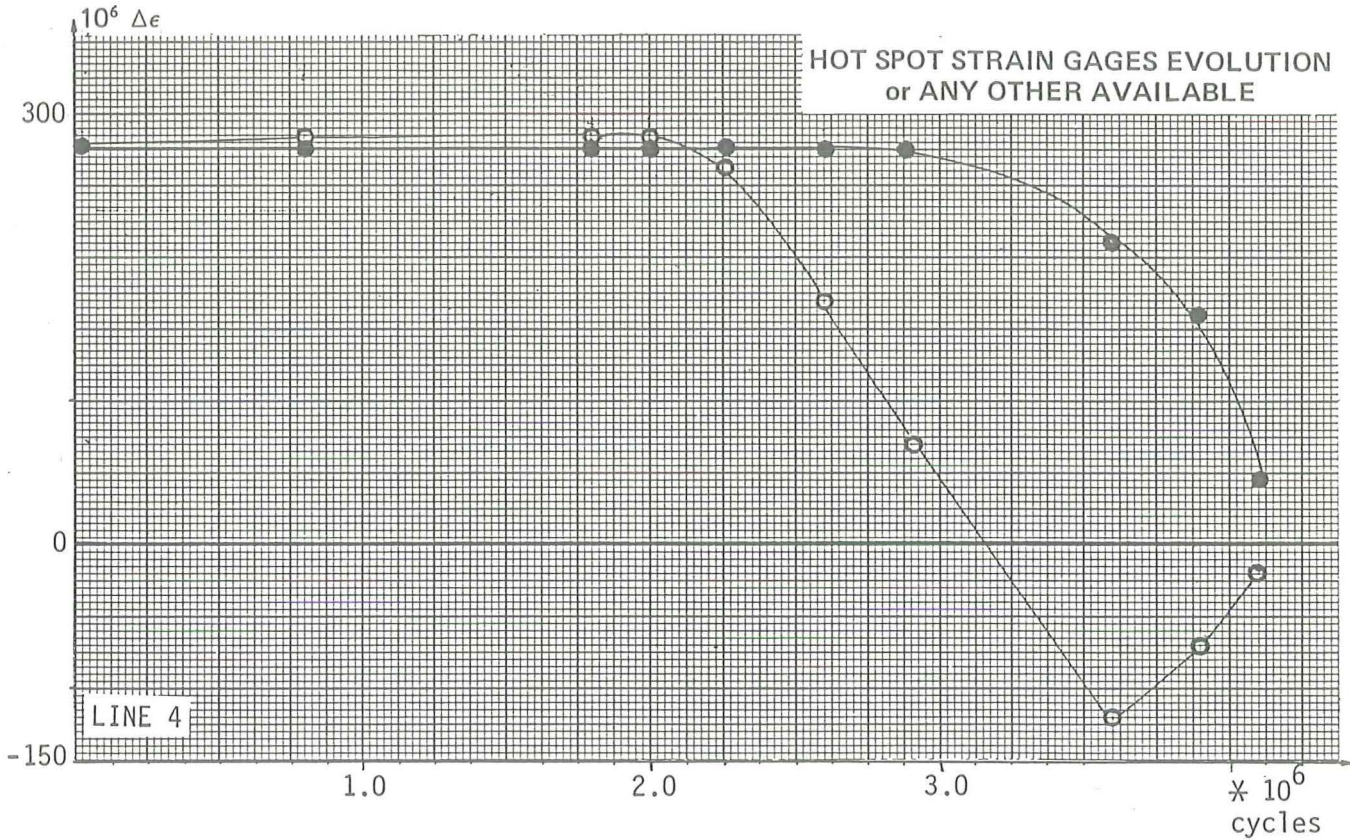
* The calculation has been based on the average SNCF's of the identical specimens

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	2.4×10^6	-	3.9×10^6	4.3×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 16 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	17

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY actual values in mm	outside diameter	wall thickness
	D 914.4	T 32
	d ₁ 457.2	t ₁ 16
	d ₂	t ₂

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 pooning grinding				

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	366	
Tensile strength σ_u (N/mm ²)	532	

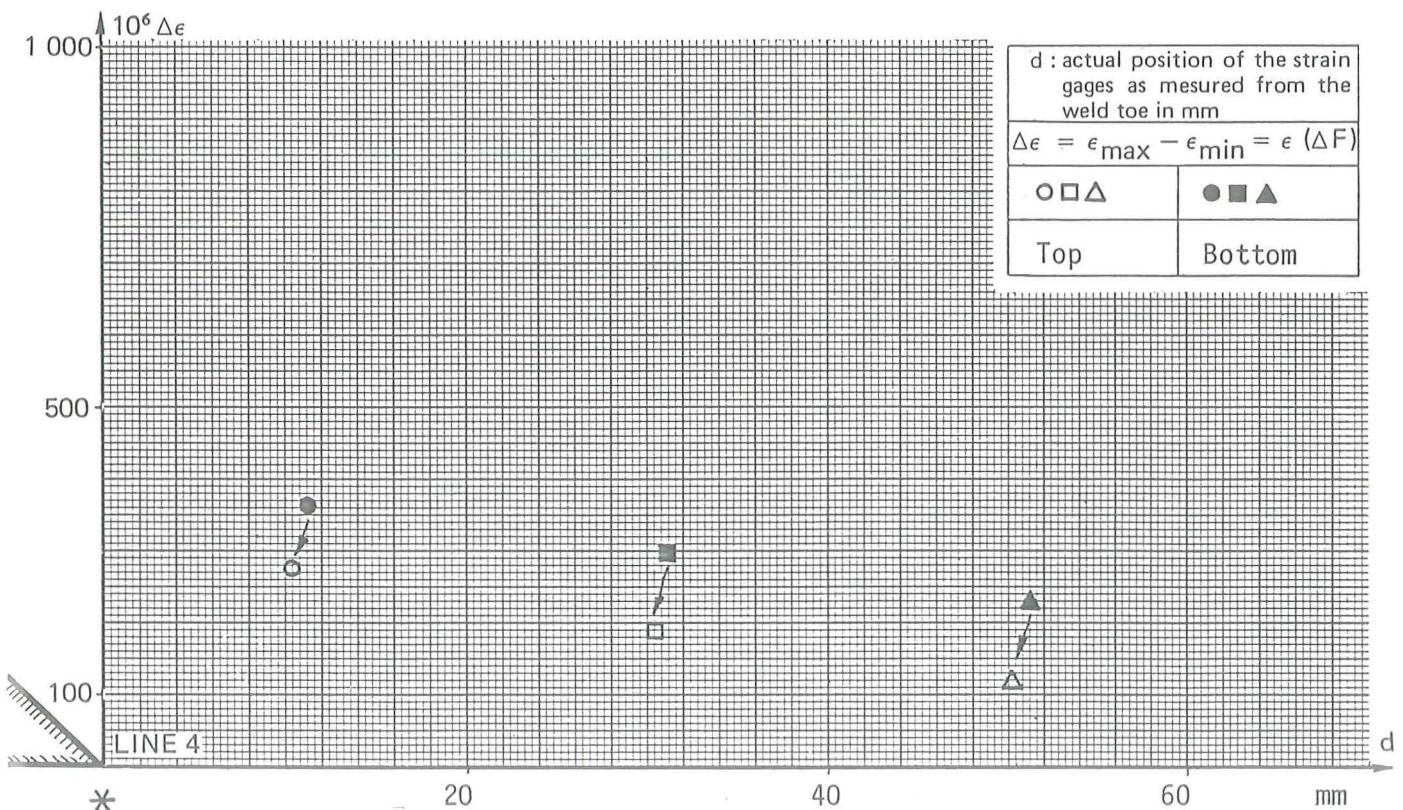
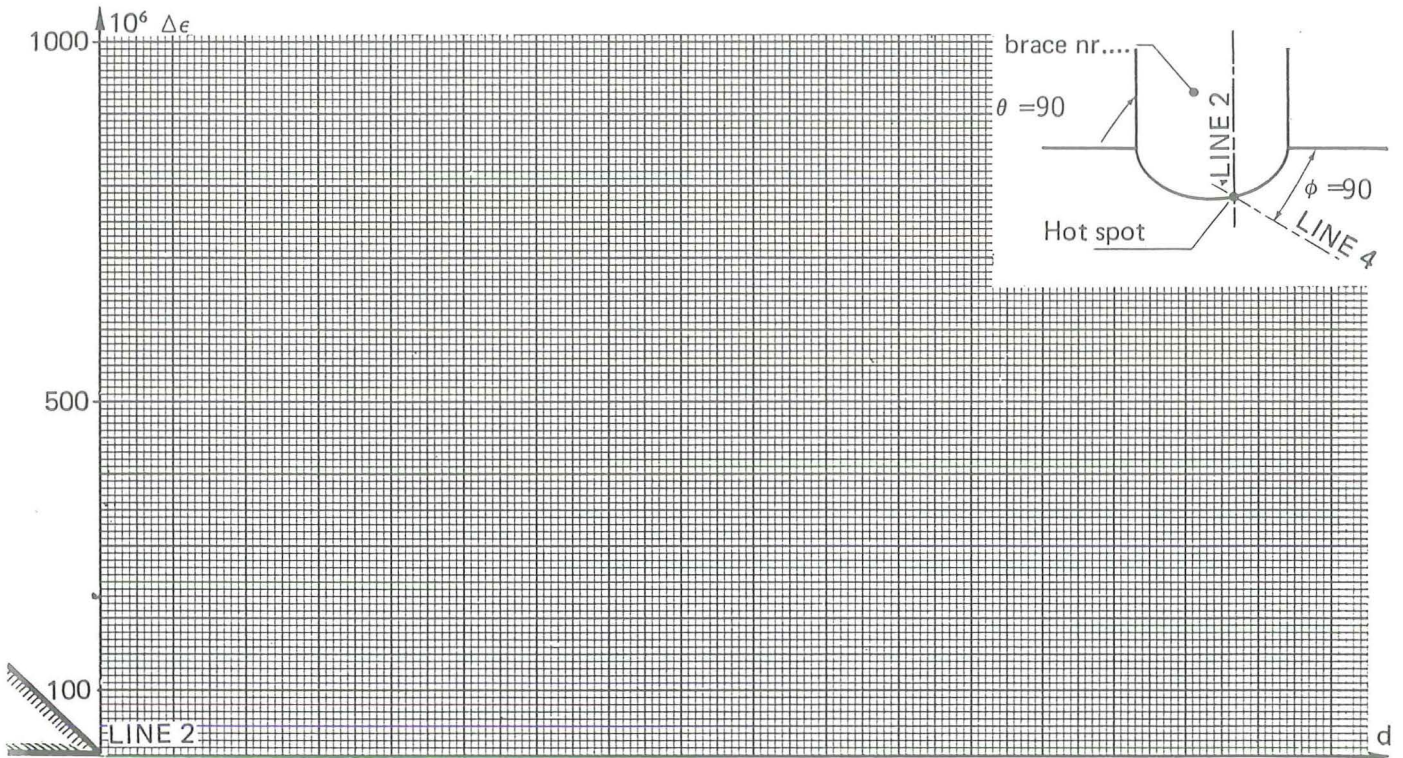
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 17 - page 2

Number of cycles before measurements : 50. cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	240	0		0.2	325



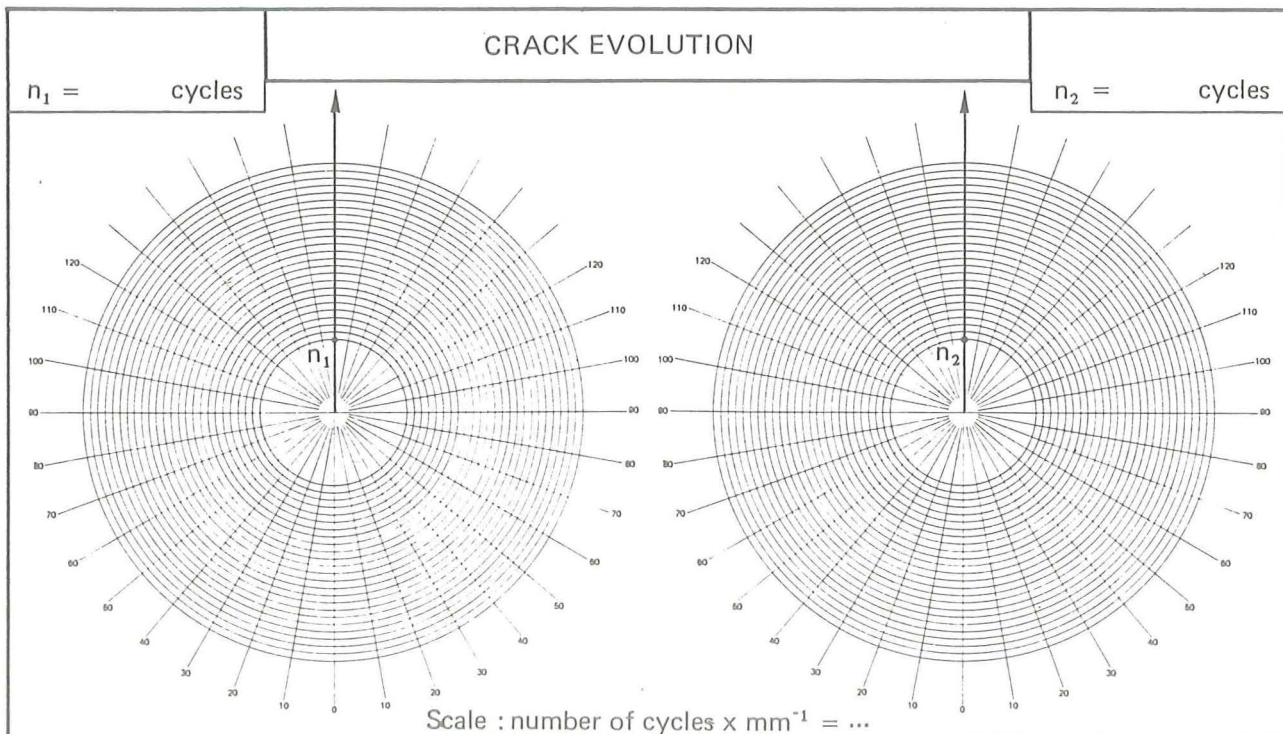
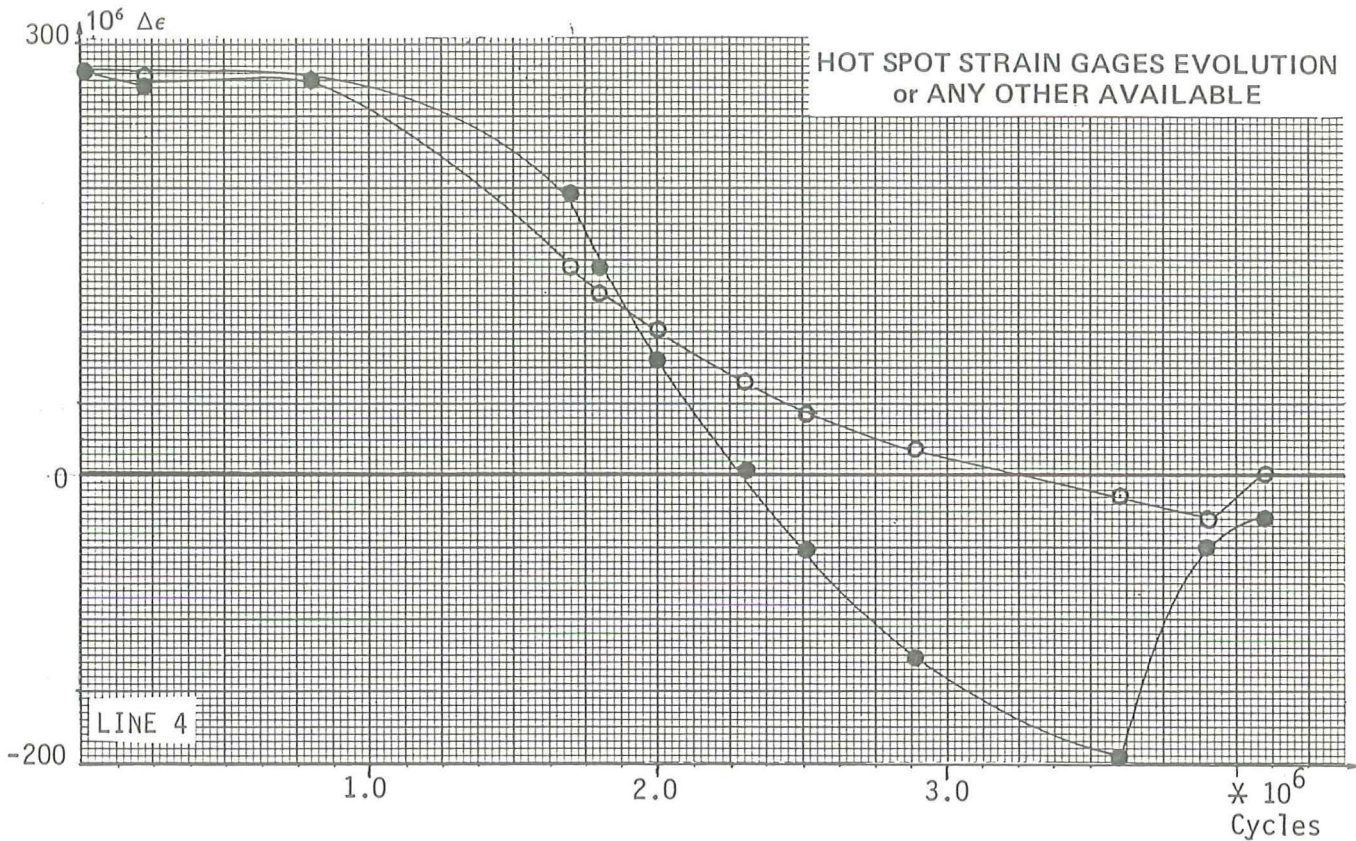
* The calculation has been based on the average SNCF's of the identical specimens

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	1.2×10^6	-	3.7×10^6	4.3×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 17 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	18

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY values in mm	outside diameter	wall thickness
	D 168.3	T 6.3
	d ₁ 88.9	t ₁ 3.2
	d ₂ 88.9	t ₂ 3.2

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C					STD : BS 4350				
	C %	Si %	Mn %	S %	P %	Al %				
	0.22	0.30	1.25	0.012	0.019					

WELDING	Welding process : MMAW , Current : AC Filler materials : ISO AWS - : E 7016 Electrode diameter (mm) : 2.5	
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		
	WELDING PROCEDURE	
	Position	5G
	Nr of runs	2
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/mm ²)	426	
Tensile strength σ_U (N/mm ²)	563	

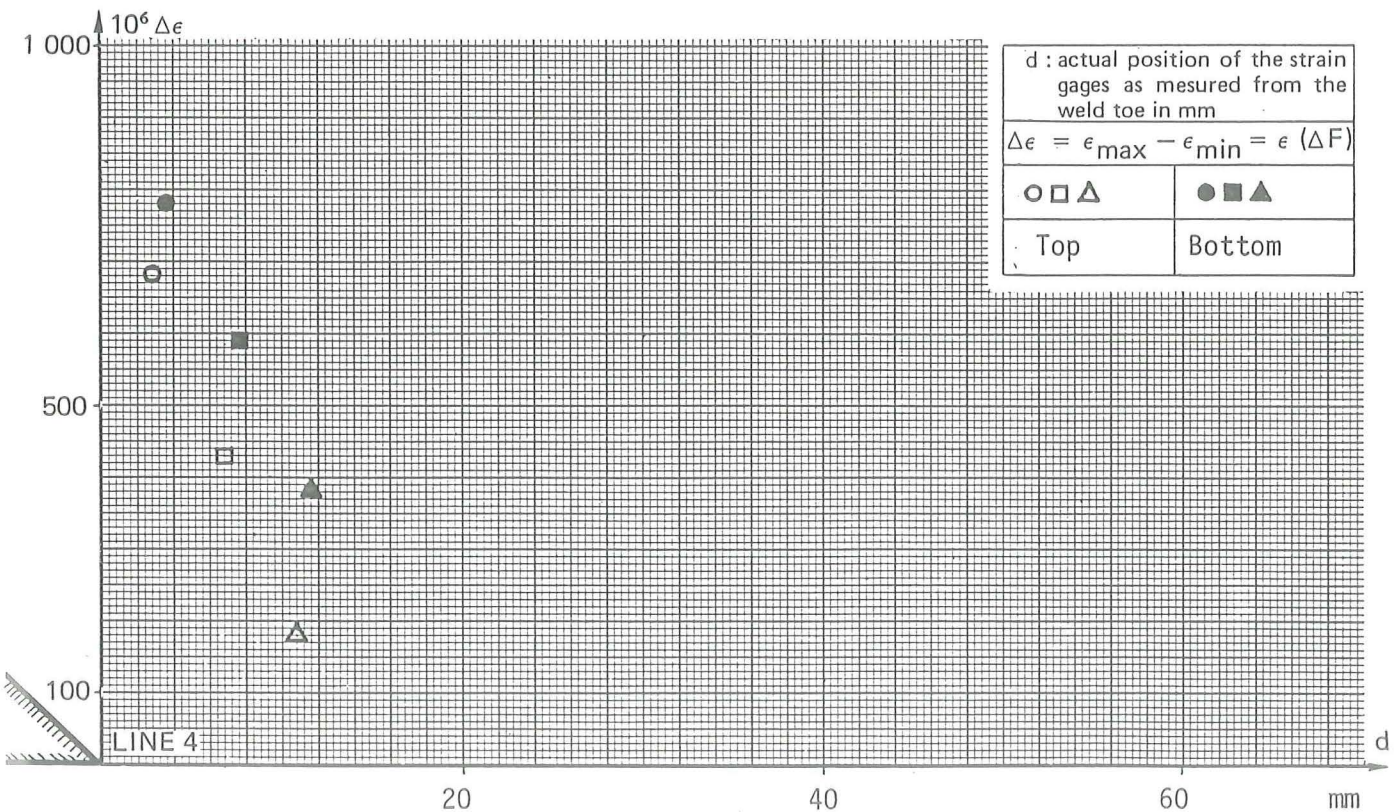
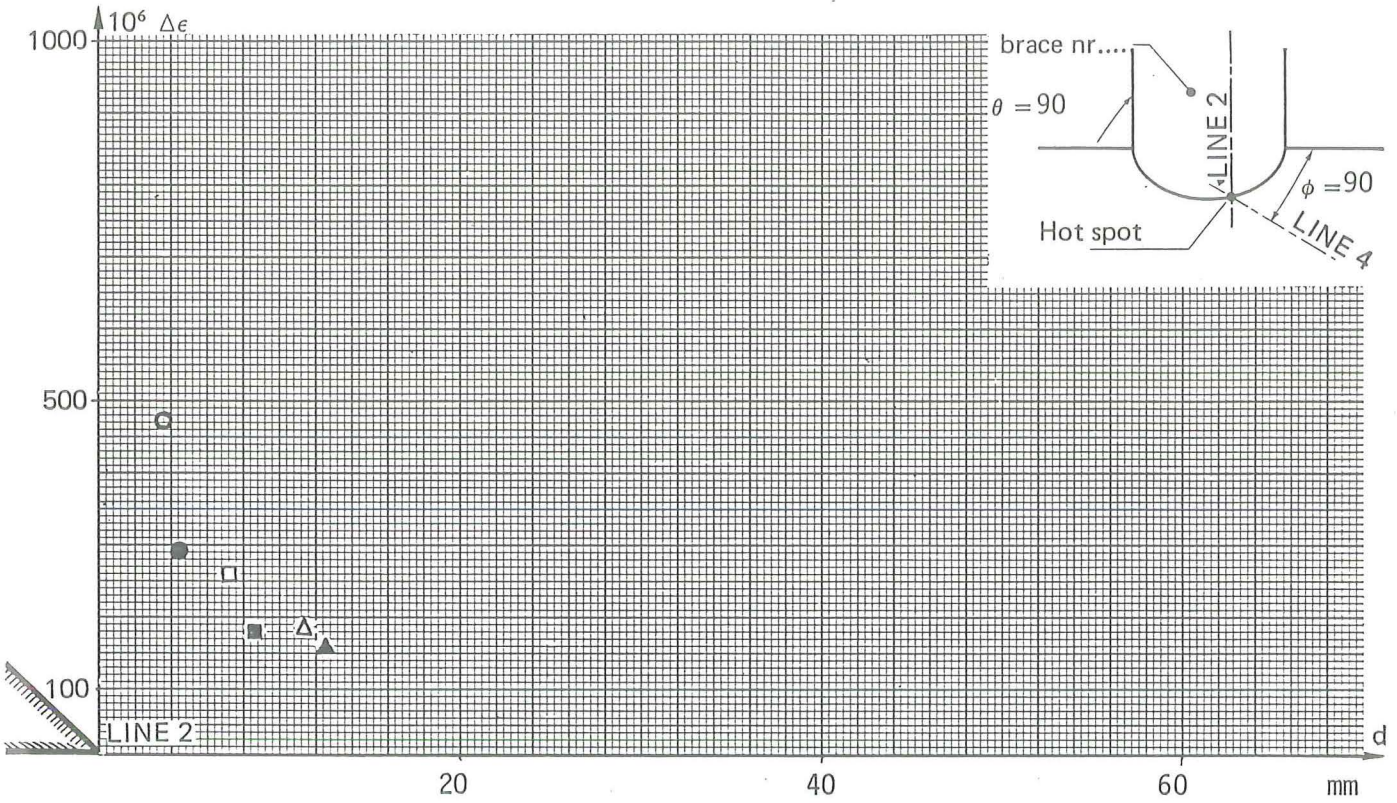
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 30

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	35	0		10	870



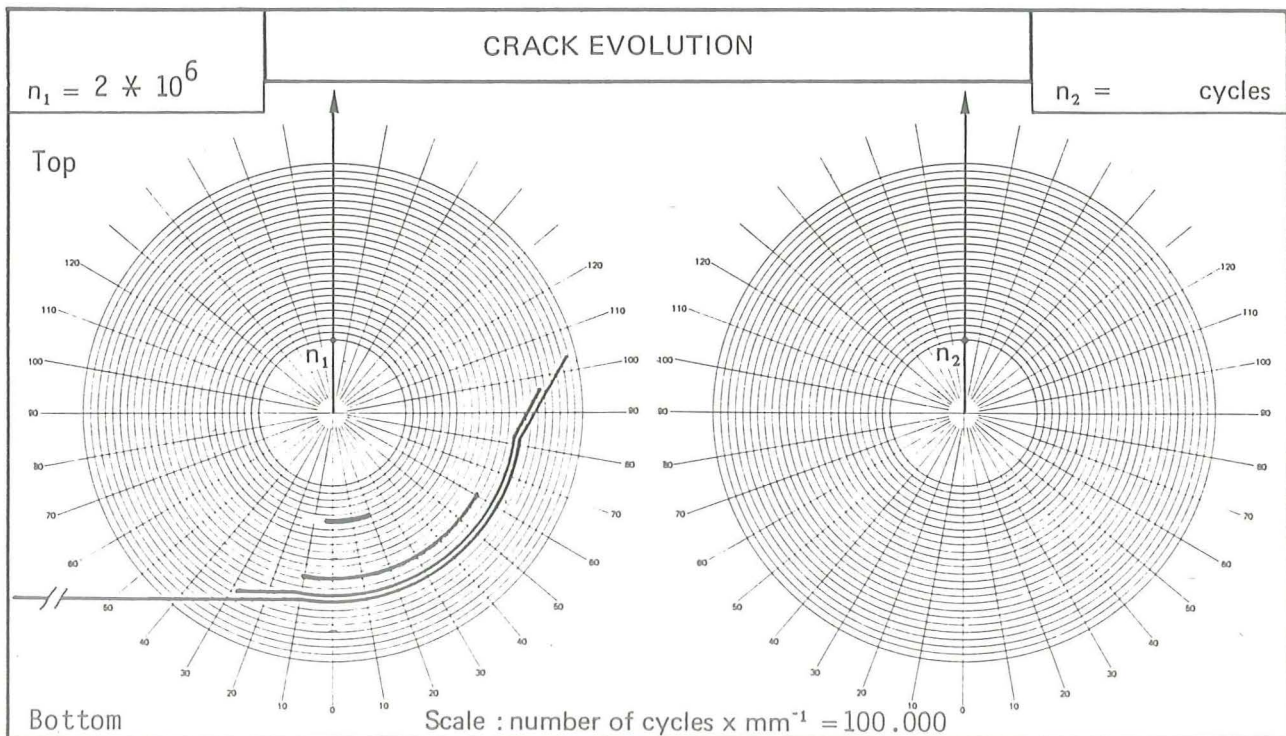
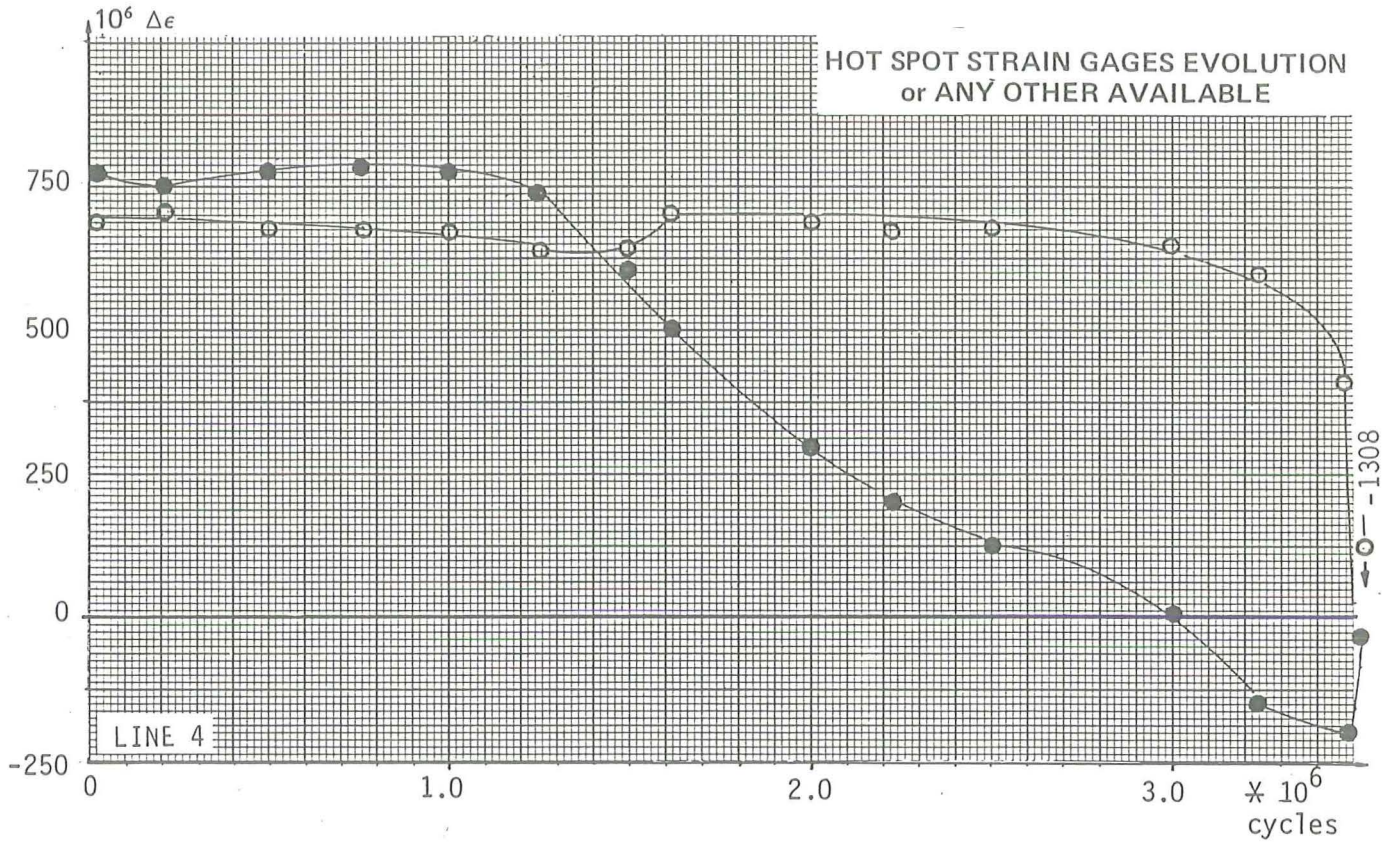
* The calculation has been based on the average SNCF's of the identical specimens

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	1.2×10^6	2.5×10^6	3.0×10^6	3.6×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 18 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	19

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY values in mm	outside diameter	wall thickness		
	D	168.3	T	6.3
	d ₁	88.9	t ₁	3.2
	d ₂	88.9	t ₂	3.2

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C					STD : BS 4350				
	C %	Si %	Mn %	S %	P %	Al %				
	0.22	0.30	1.25	0.012	0.019					

WELDING	Welding process : MMAW , Current : AC	
	Filler materials : ISO AWS - : E 7016	
Electrode diameter (mm) : 2.5		
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		
	WELDING PROCEDURE	
	Position	5G
Nr of runs	2	
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/mm ²)	426	
Tensile strength σ_u (N/mm ²)	563	

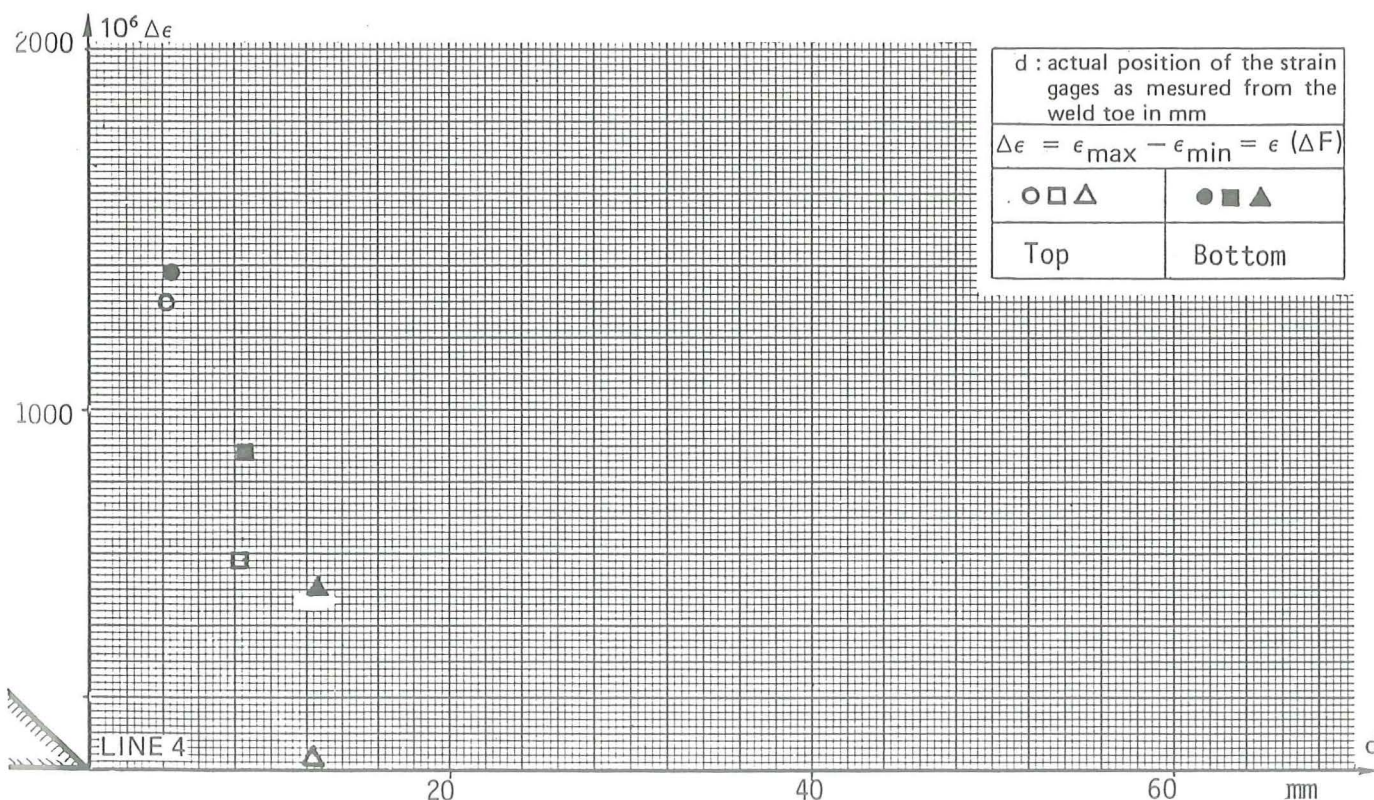
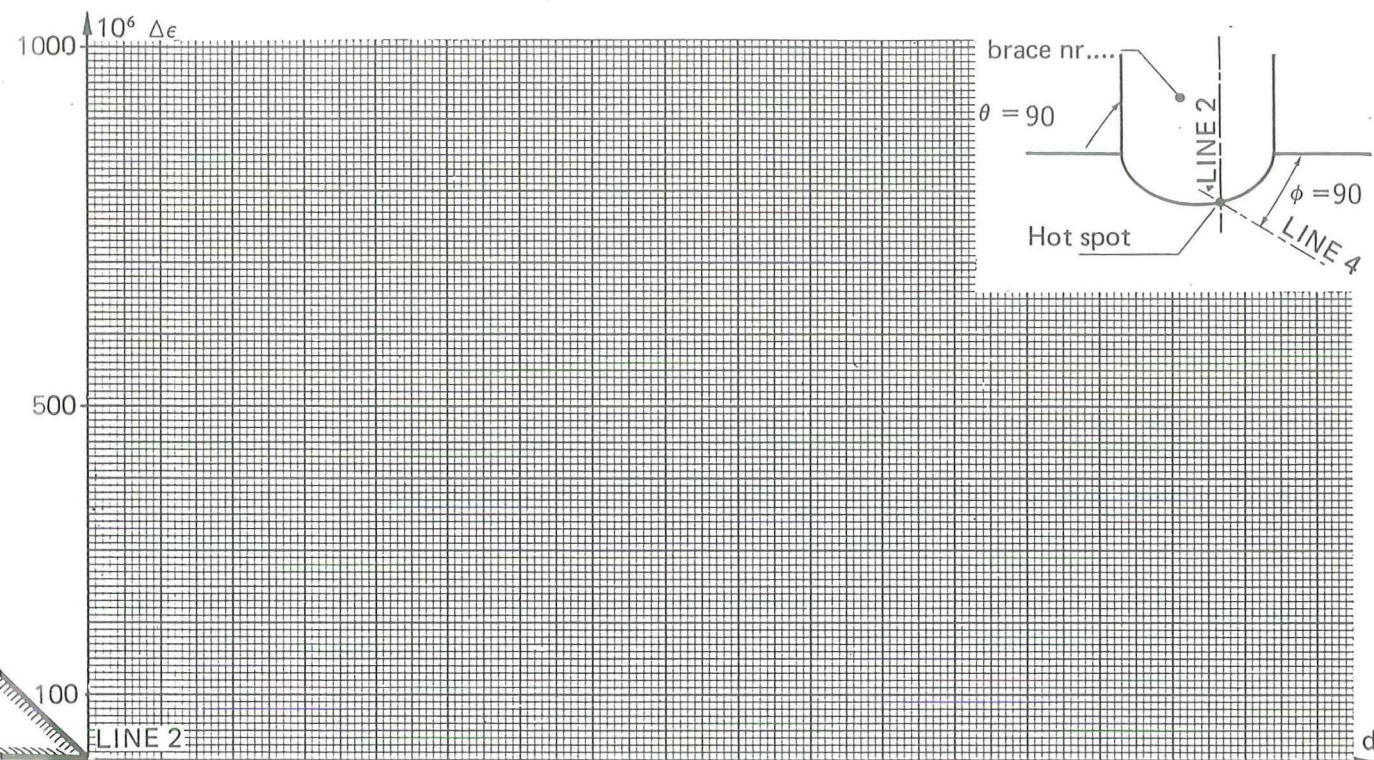
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 120

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	80	0		10	1990



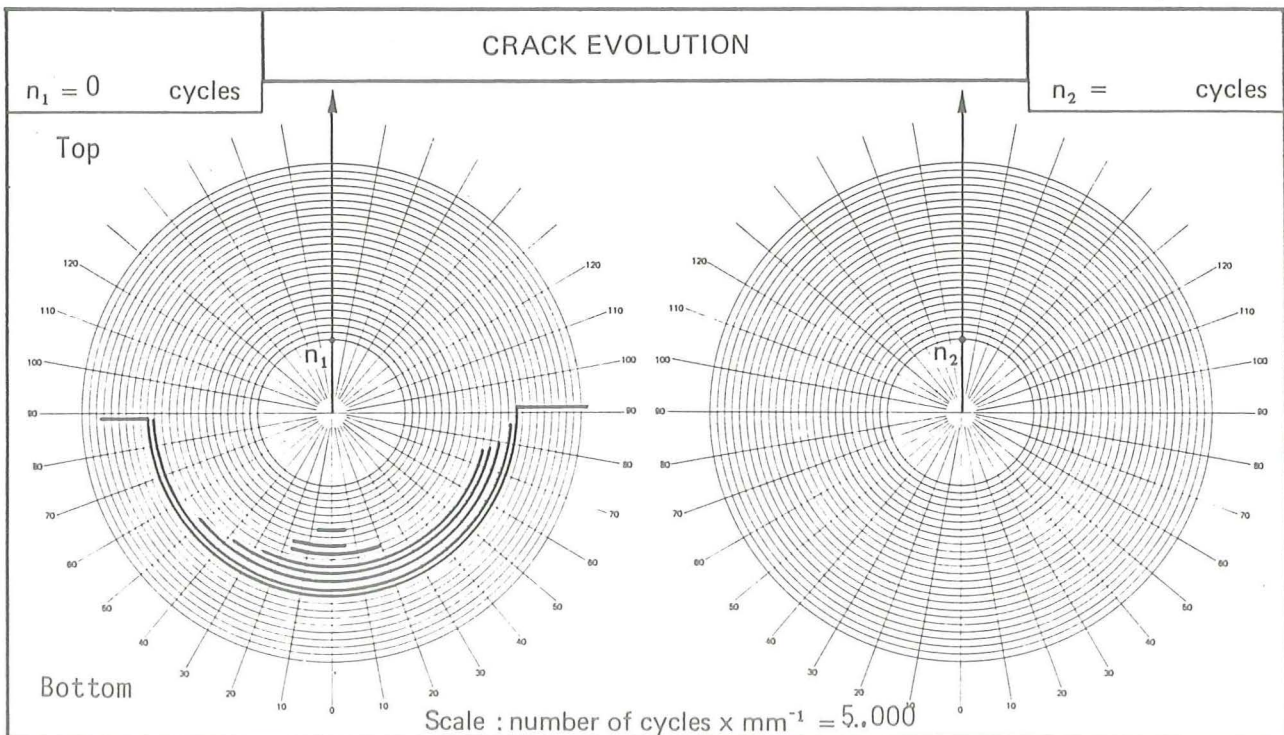
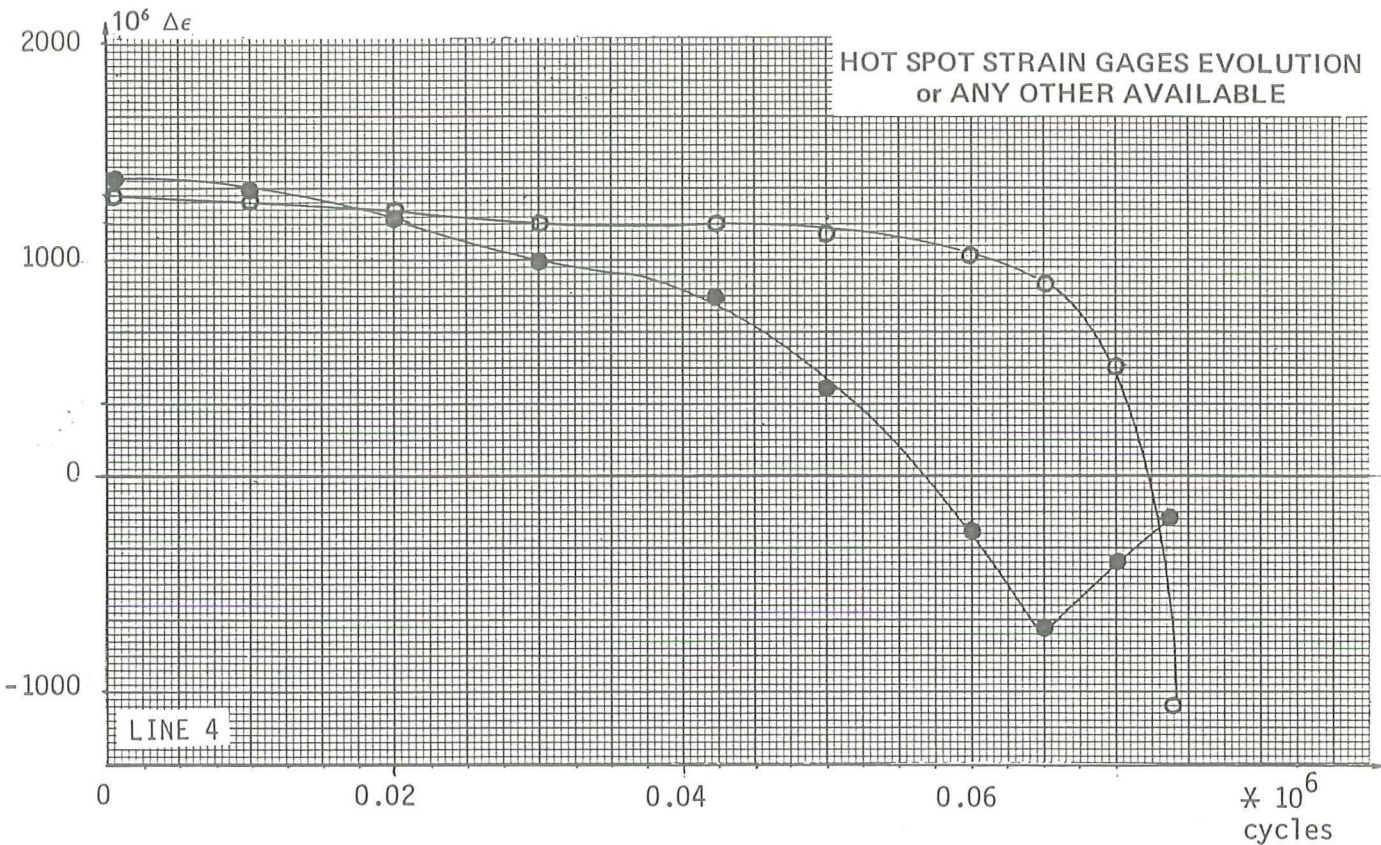
* The calculation has been based on the average SNCF's of the identical specimens

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	2.0×10^4	4.5×10^4	6.0×10^4	7.4×10^4	

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



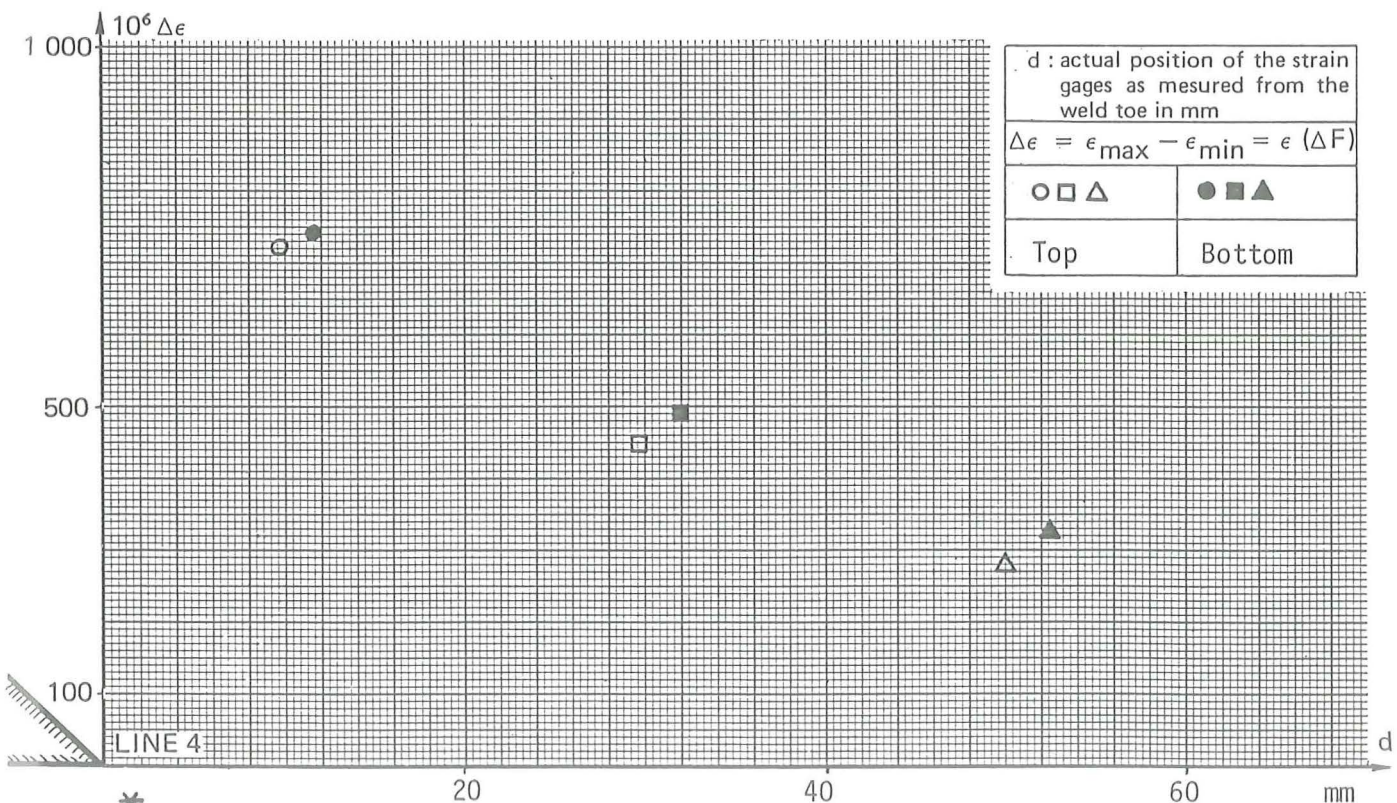
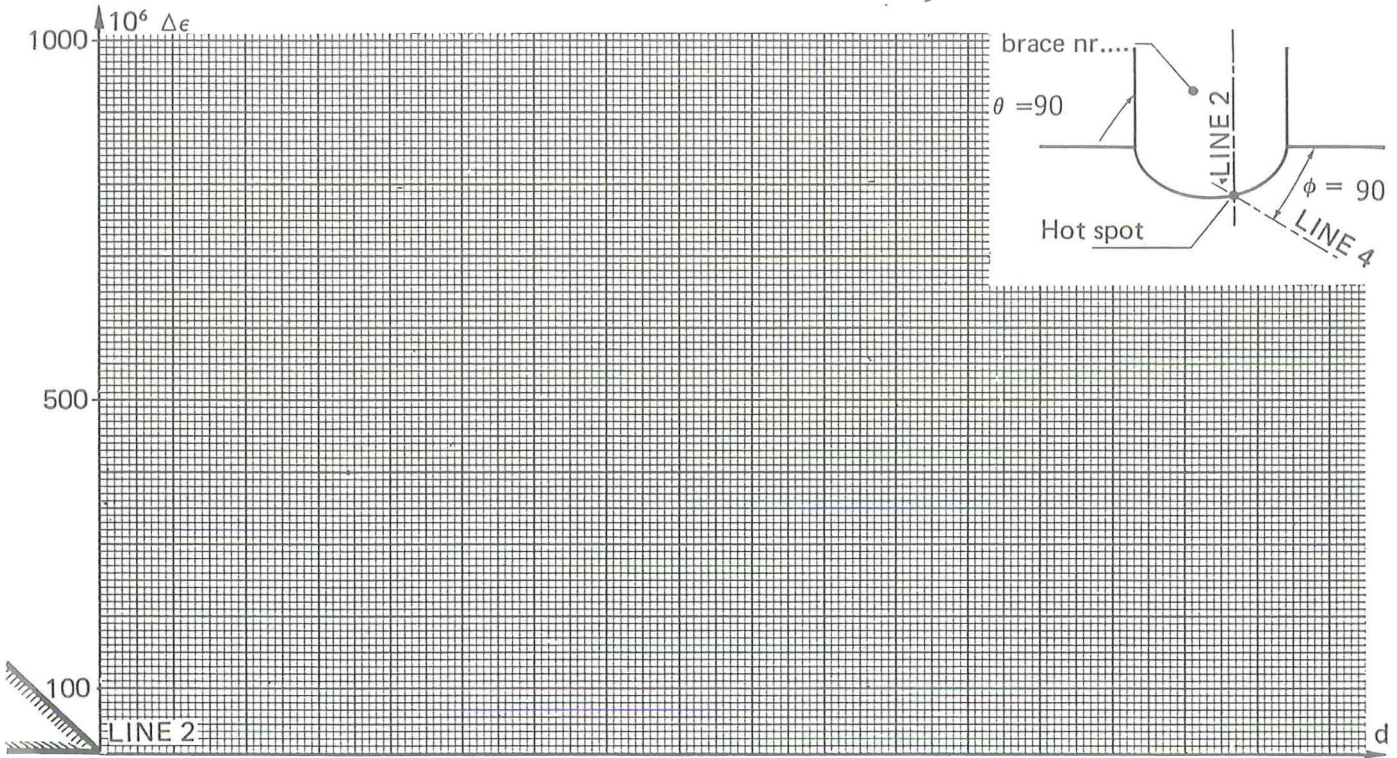
OTHER RELEVANT INFORMATIONS

Spec. 19 - page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 350 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	600	0		2.5	865



* 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.

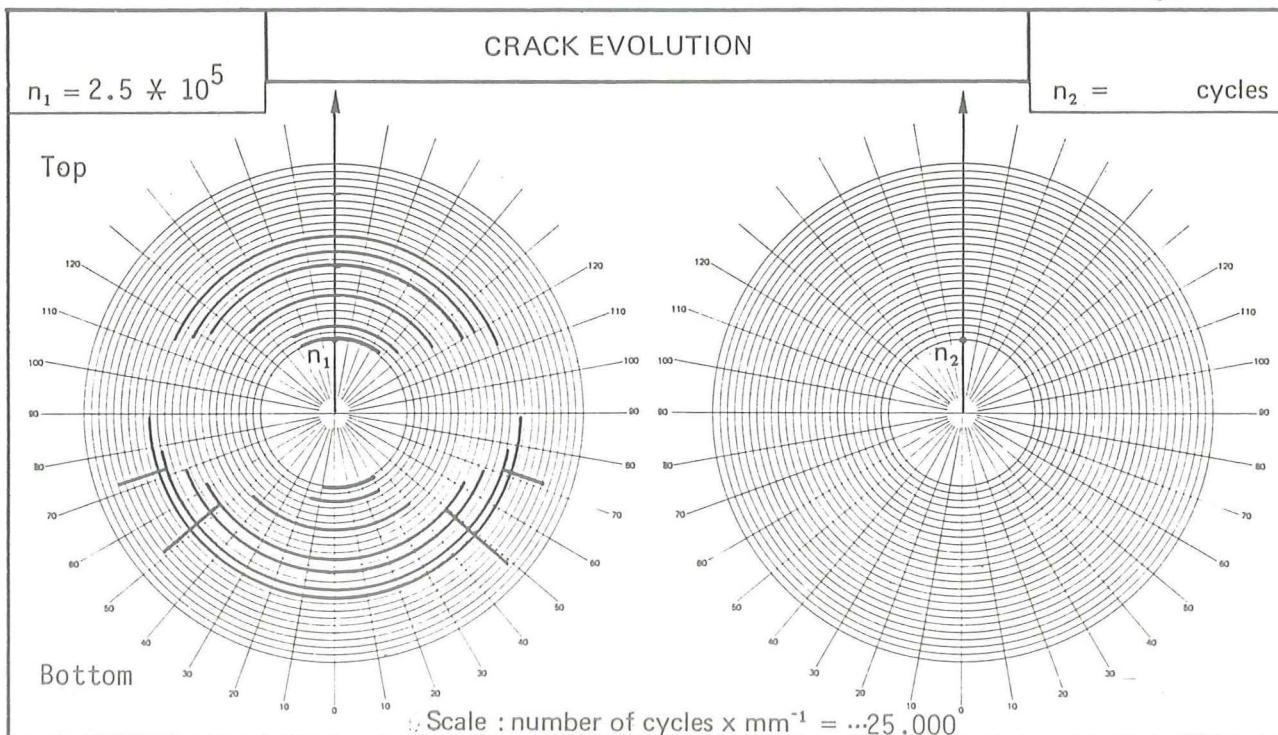
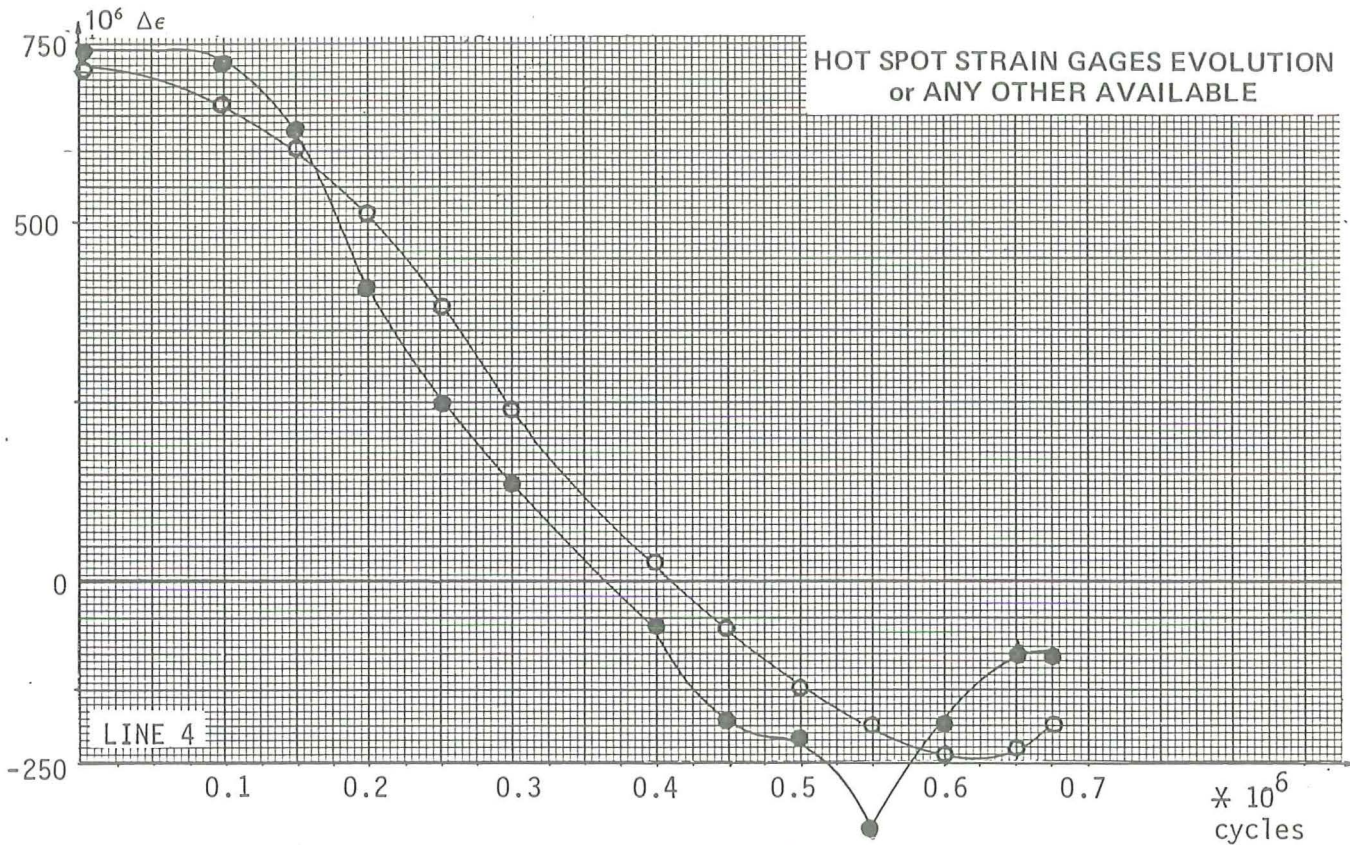
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 235 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.5×10^5	2.5×10^5	4.1×10^5	6.8×10^5	

(1) A : complete failure

C : secondary cracking total length = ... mm

B : actuator displacement = ... mm

D : other reason : ...Reduction of stiffness



OTHER RELEVANT INFORMATIONS

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	21

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

GEOMETRY values in mm	outside diameter	wall thickness
	D	T 32
	d ₁	t ₁ 16
	d 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/mm ²)	366	
Tensile strength σ_U (N/mm ²)	532	

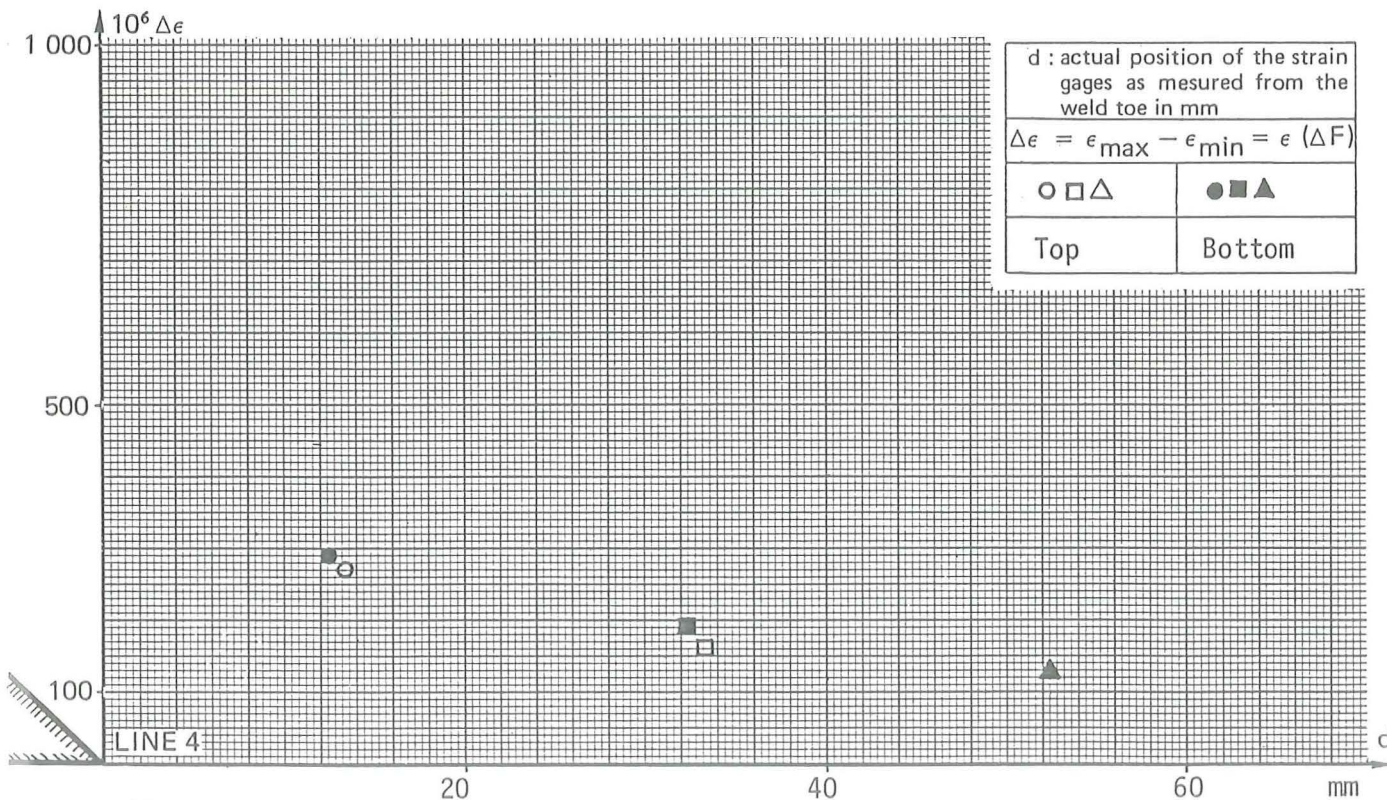
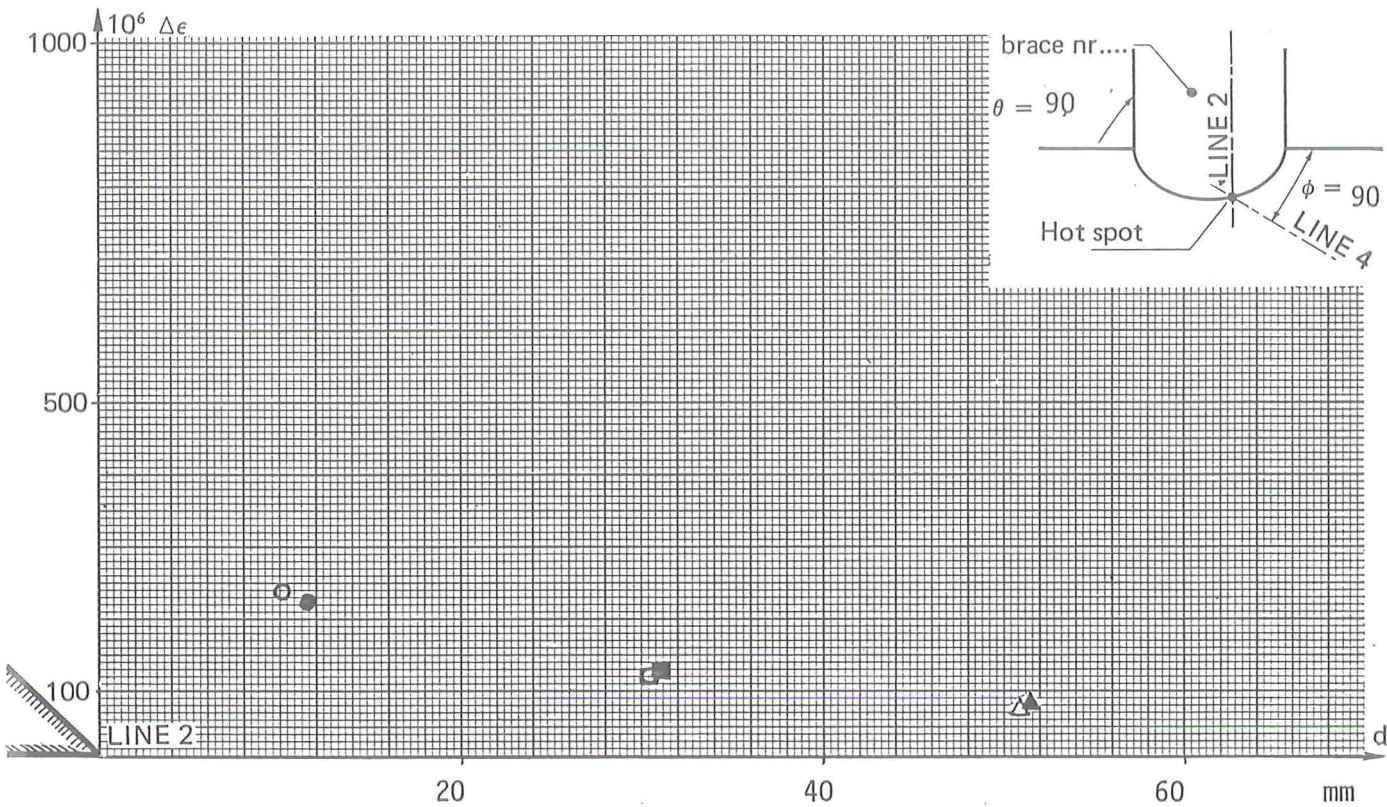
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 210

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapo1. Hot Spot Strainrange *
0	220	0		4	315



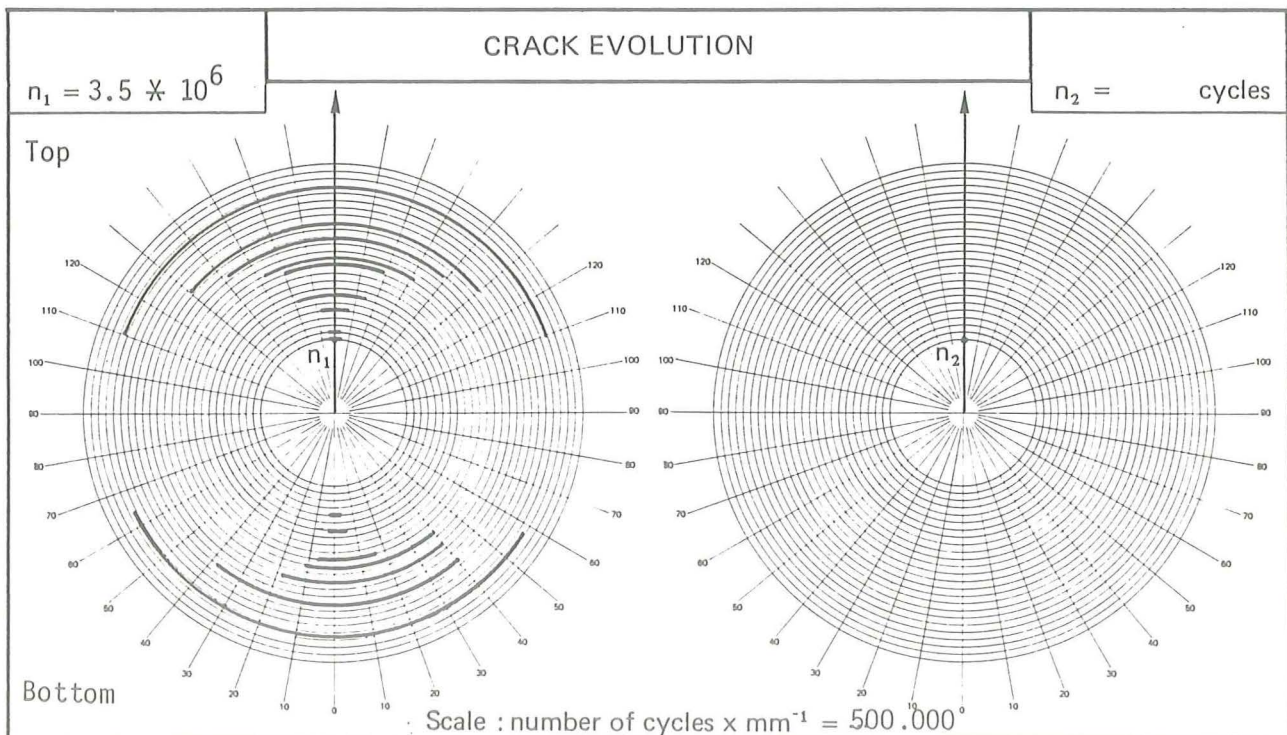
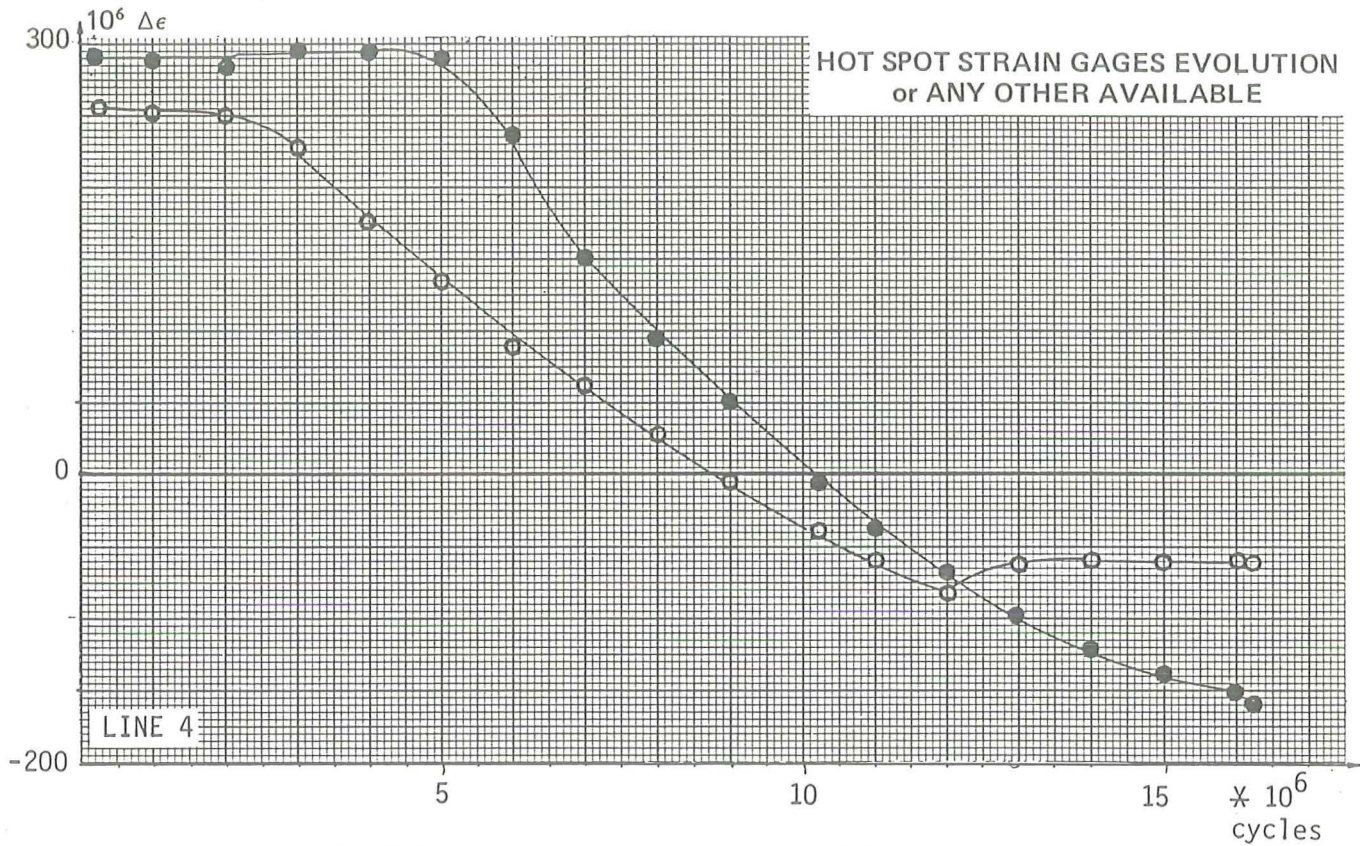
* The calculation has been based on the average SNCF's of the identical specimens

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	3.3×10^6	4.0×10^6	8.1×10^6	1.6×10^7	

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



OTHER RELEVANT INFORMATIONS

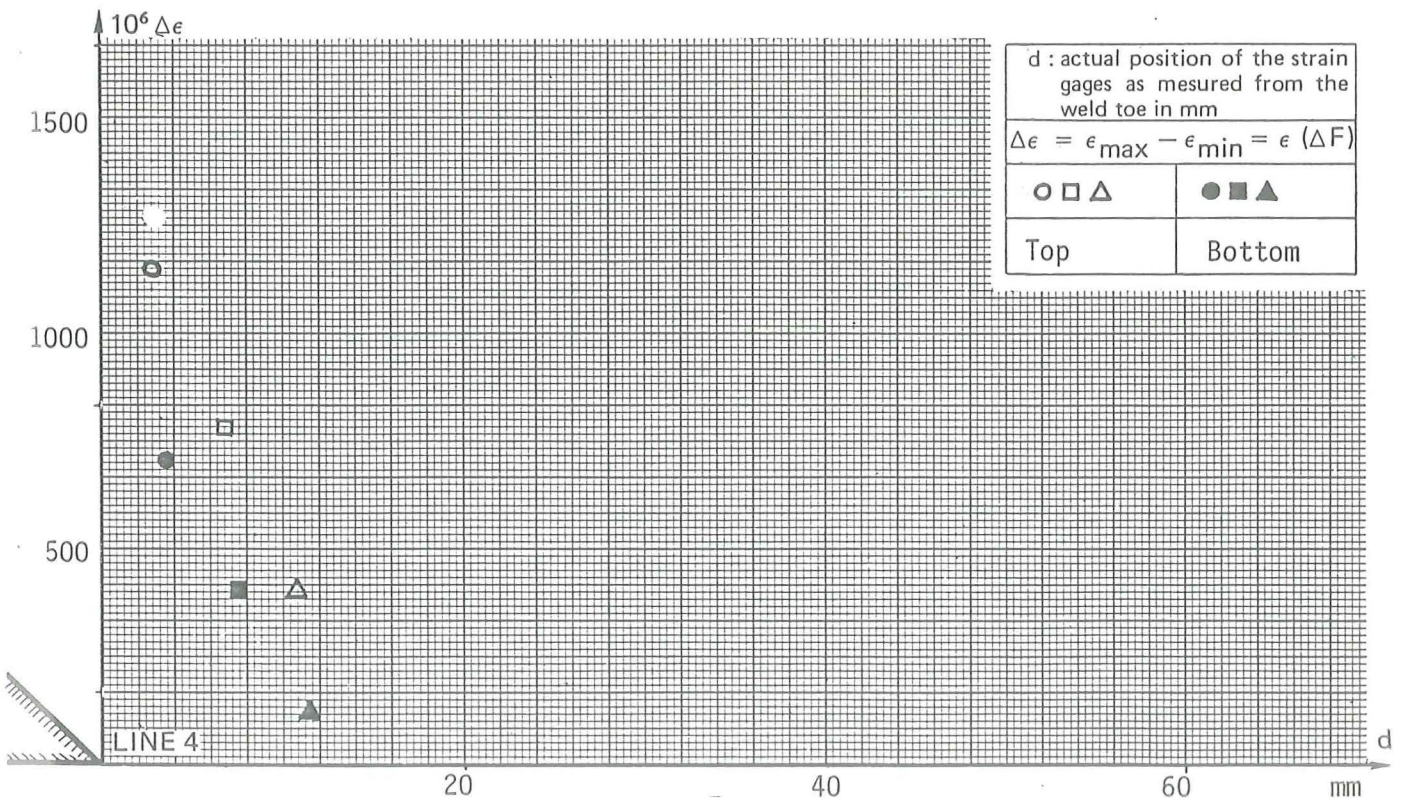
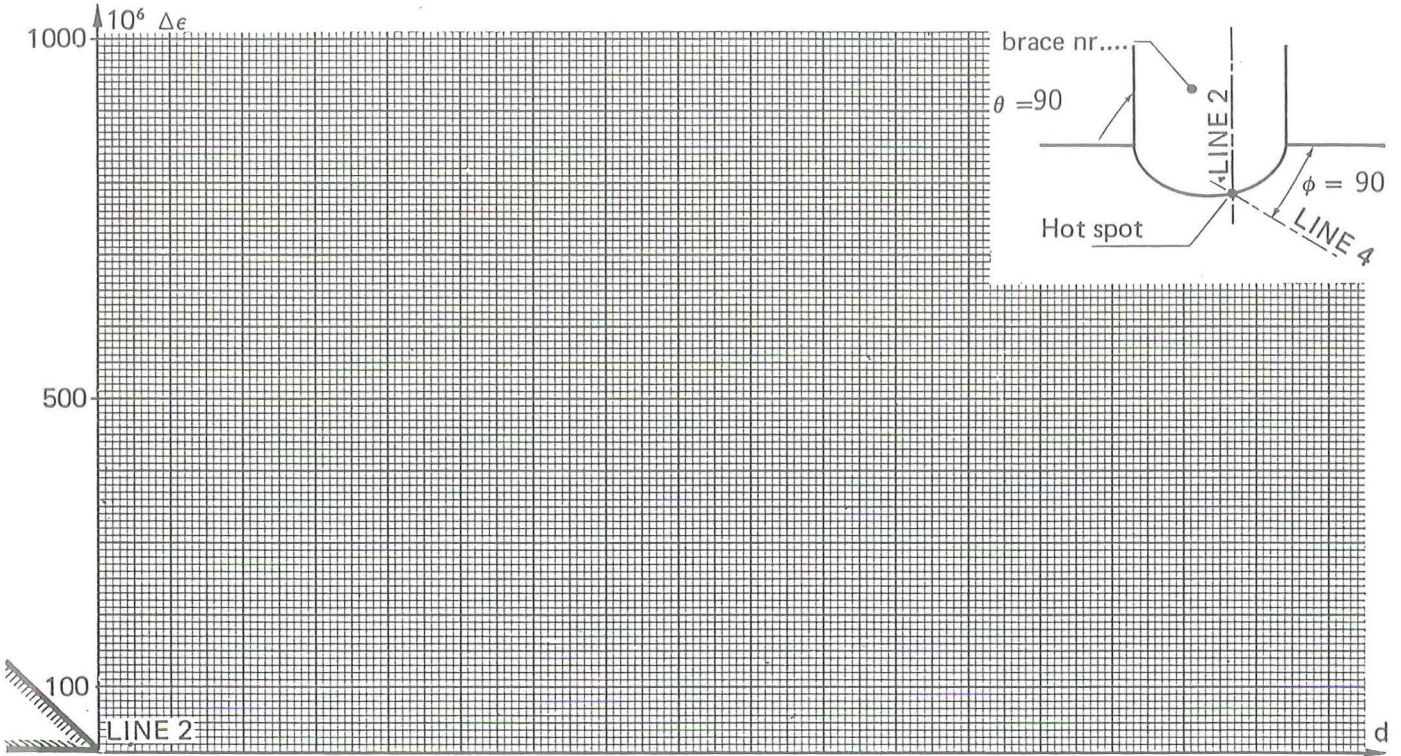
Spec. 21 - page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 50

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	45	0		10	1070



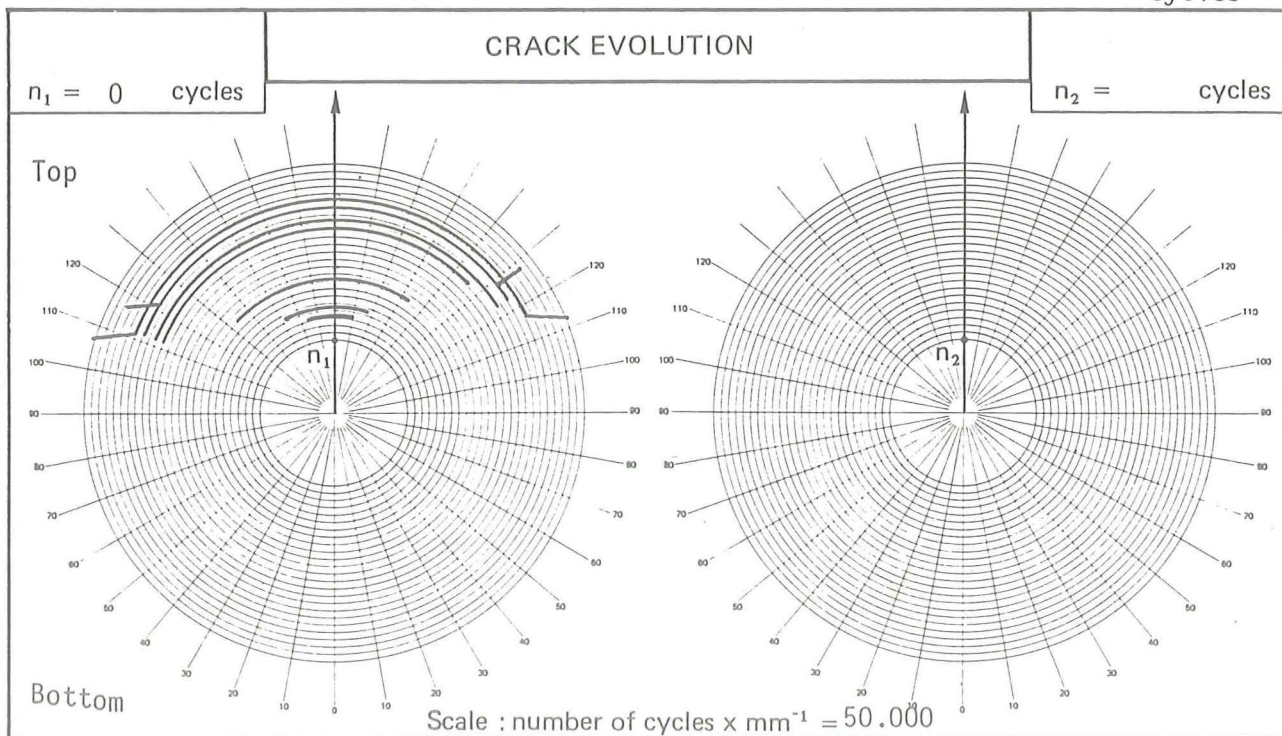
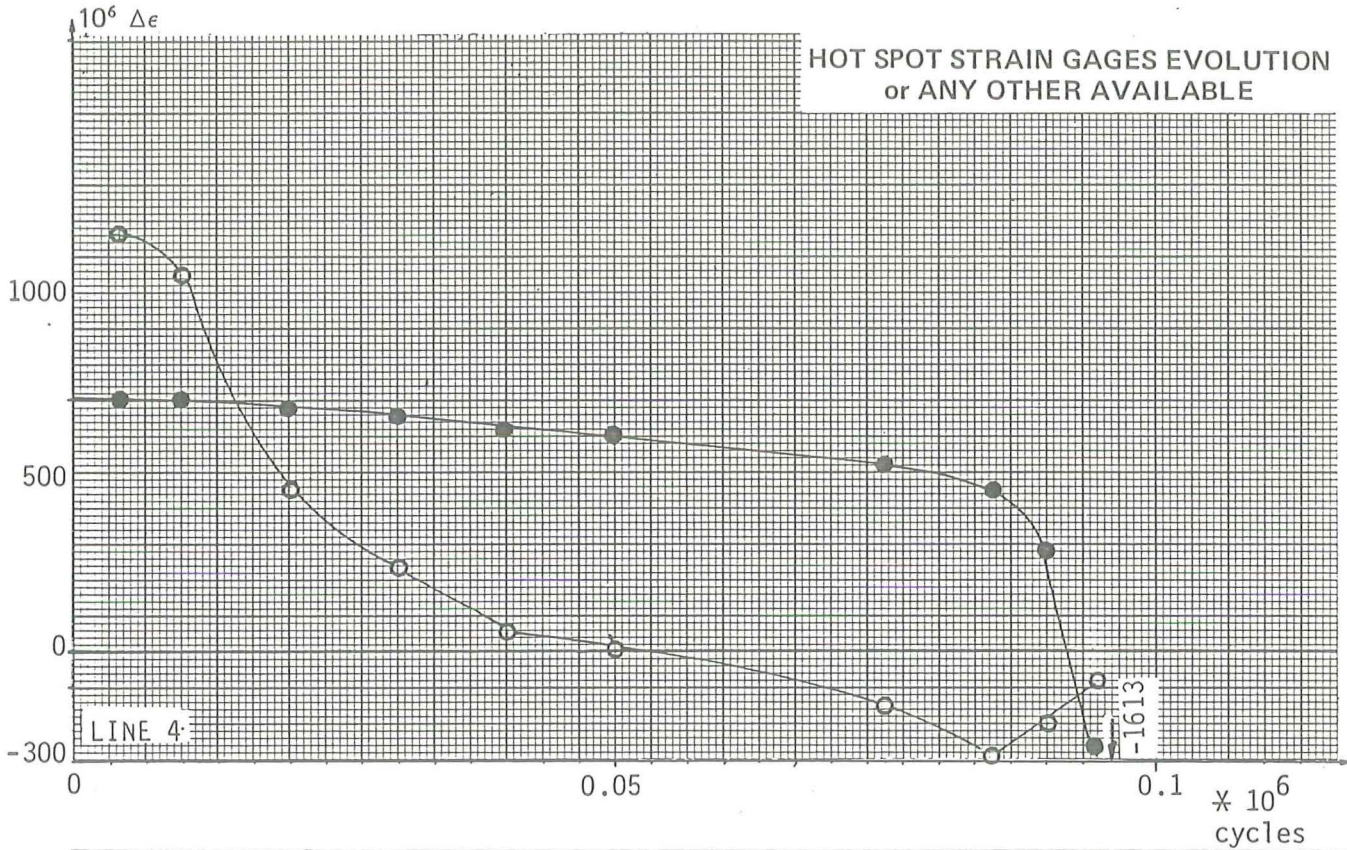
* The calculation has been based on the average SNCF's of the identical specimens

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	1.1×10^5	2.0×10^5	8.8×10^5	9.5×10^5	

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



OTHER RELEVANT INFORMATIONS

Spec. 22 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	23

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

GEOMETRY actual values in mm	outside diameter	wall thickness
	D 168.3	T 6.3
	d ₁ 88.9	t ₁ 3.2
	d ₂ 88.9	t ₂ 3.2

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C						STD : BS 4350			
	C %	Si %	Mn %	S %	P %	Al %				
	0.22	0.30	1.25	0.012	0.019					

WELDING	Welding process : MMAW , Current : AC	
	Filler materials : ISO AWS - : E 7016	
	Electrode diameter (mm) : 2.5	
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		
	WELDING PROCEDURE	
	Position	5G
Nr of runs	2	
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/mm ²)	426	
Tensile strength σ_U (N/mm ²)	563	

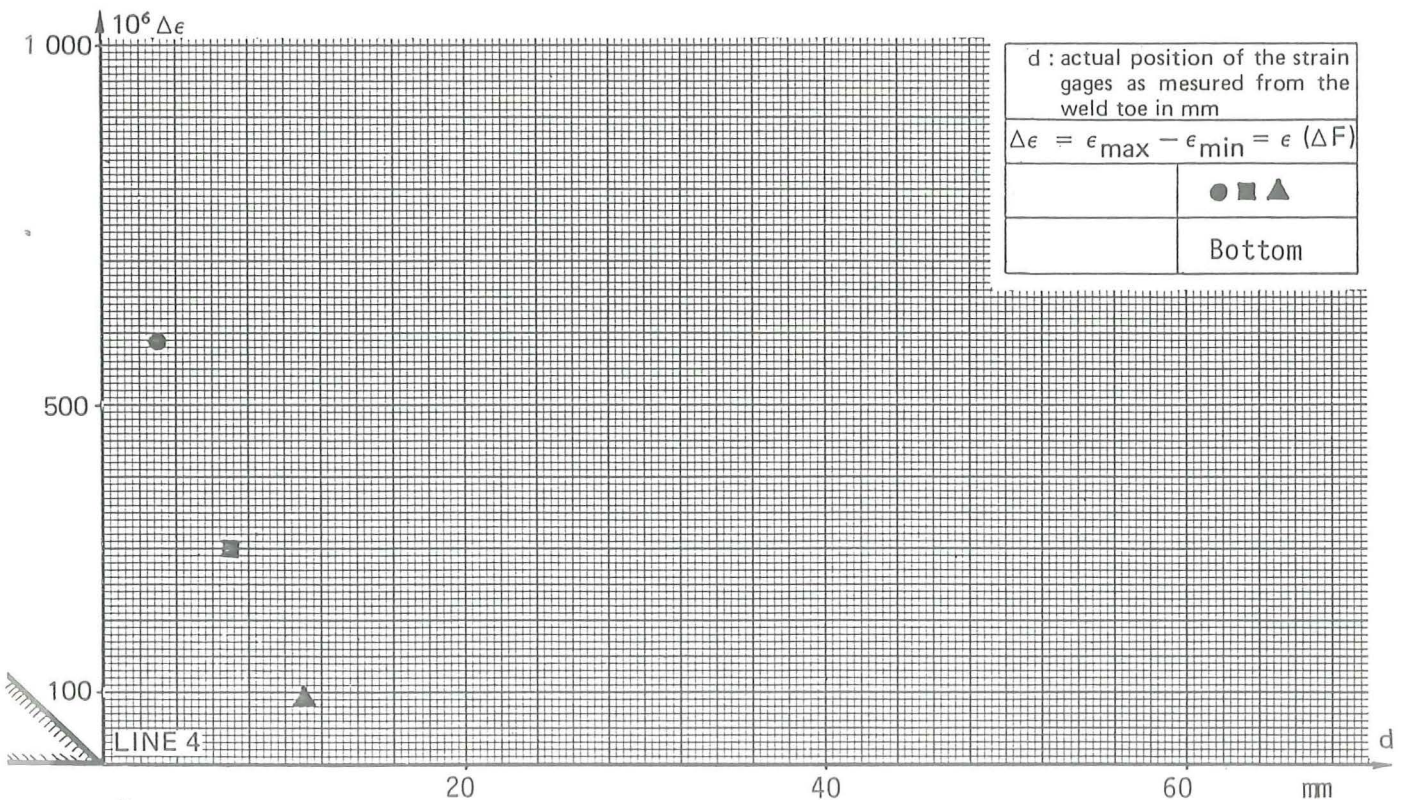
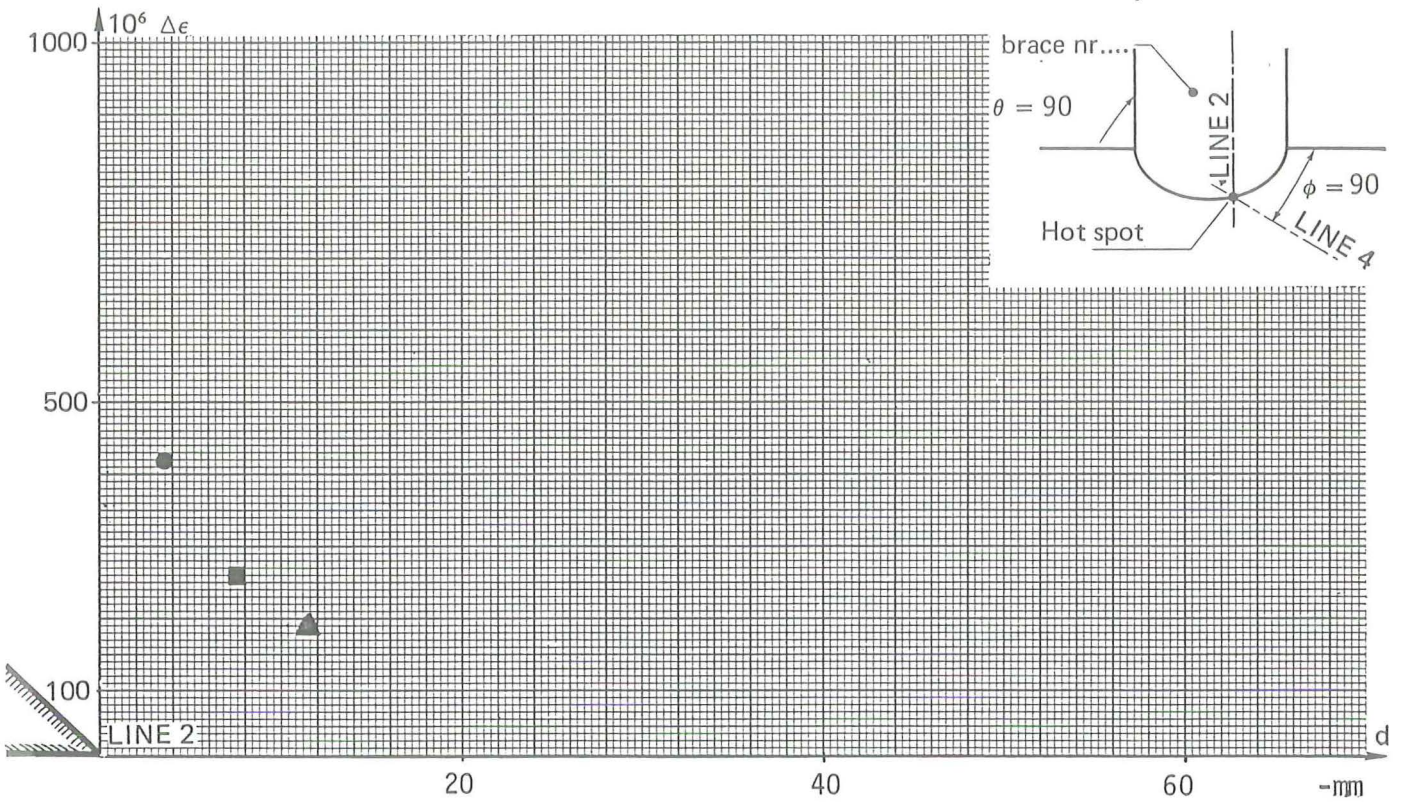
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 590

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	32	0		10	760



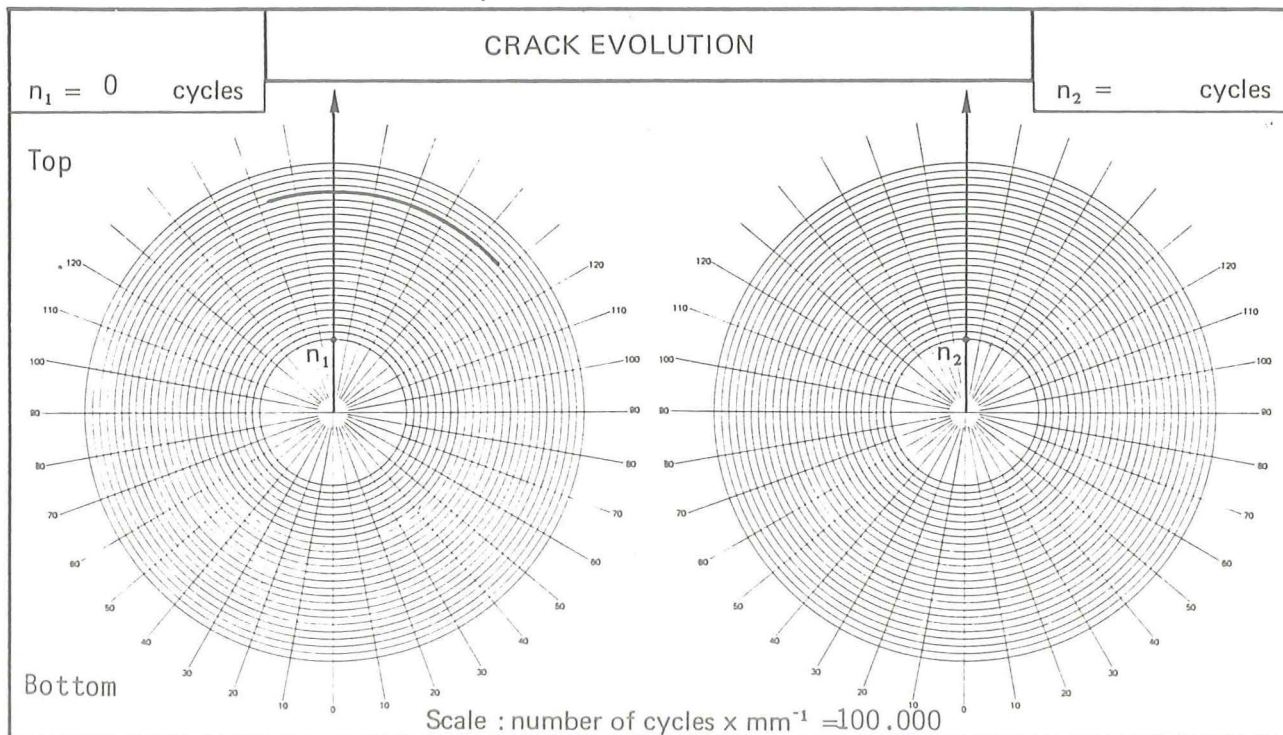
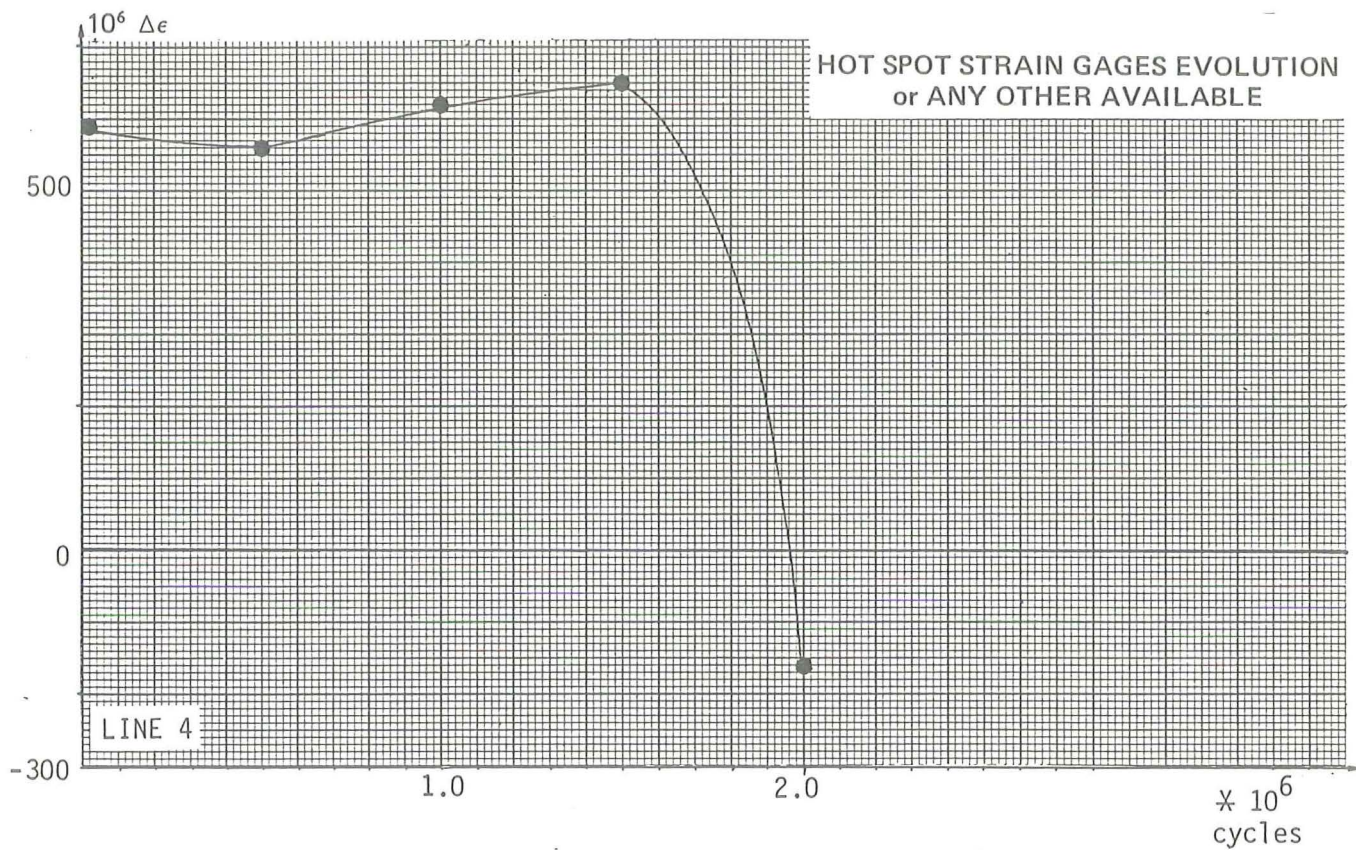
* The calculation has been based on the average SNCF's of the identical specimens

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	1.7×10^6	-	2.0×10^6	2.4×10^6	

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



OTHER RELEVANT INFORMATIONS

Spec. 23 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	T - joint
Loading	In plane bending
Laboratory	TNO - IBBC
Specimen nr.	24

GEOMETRY nominal values in mm	outside diameter	wall thickness	
	D	168.3	T 6.3
	d ₁	88.9	t ₁ 3.2
	d ₂		t ₂

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C					STD : BS 4350					
	C %	Si %	Mn %	S %	P %	Al %					
	0.22	0.30	1.25	0.012	0.019						

WELDING	Welding process : MMAW , Current : AC	
	Filler materials : ES AWS : E 7016	
Electrode diameter (mm) : 2.5		
WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		
	WELDING PROCEDURE	
	Position	5G
	Nr of runs	2
Energy (kj/m)		
preheat. temp. (° C)	65	
postheat. temp. (° C)	none	
POST WELDING TREATMENT		
Heat treatment tig or plasma dressing		
Shot peening grinding		

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

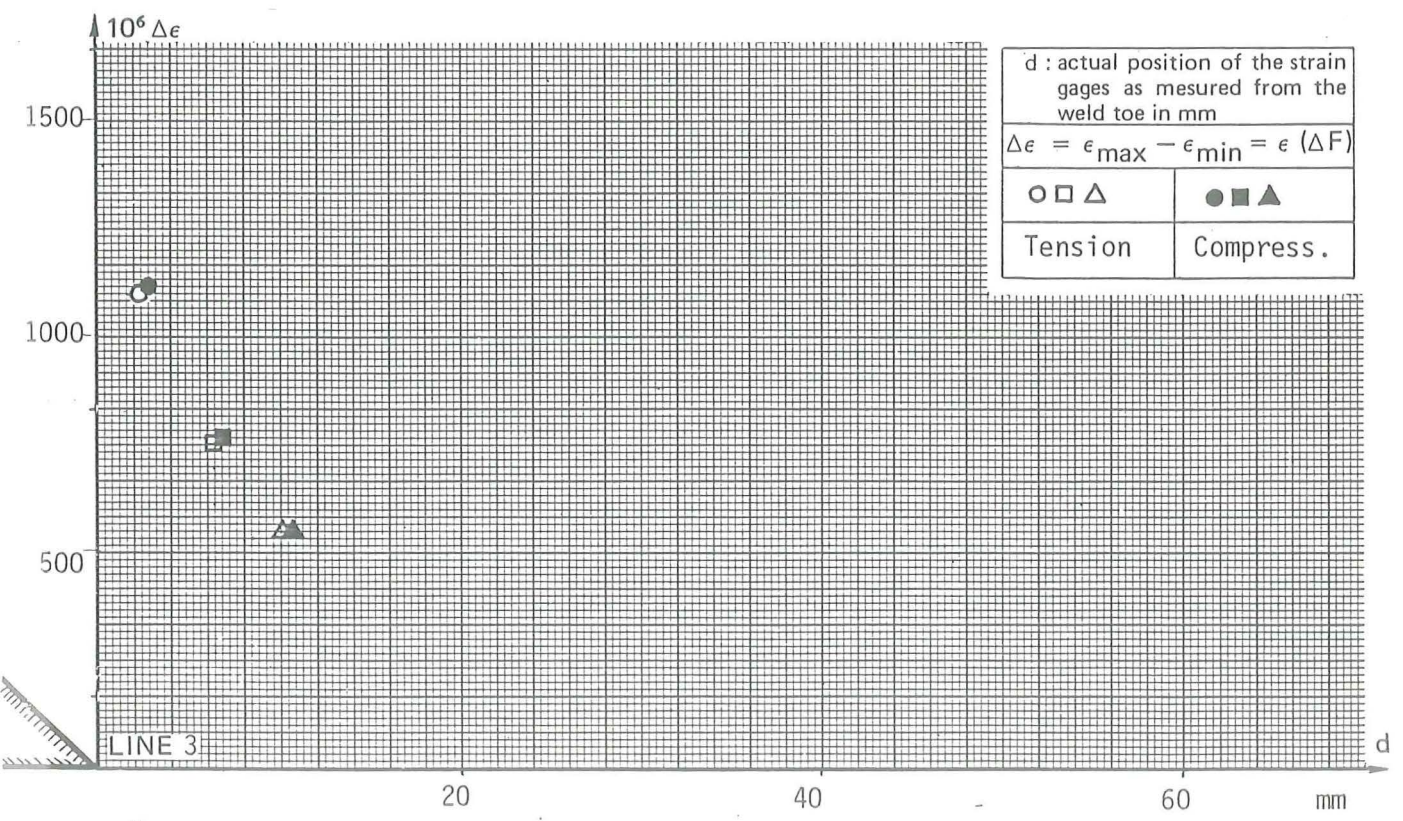
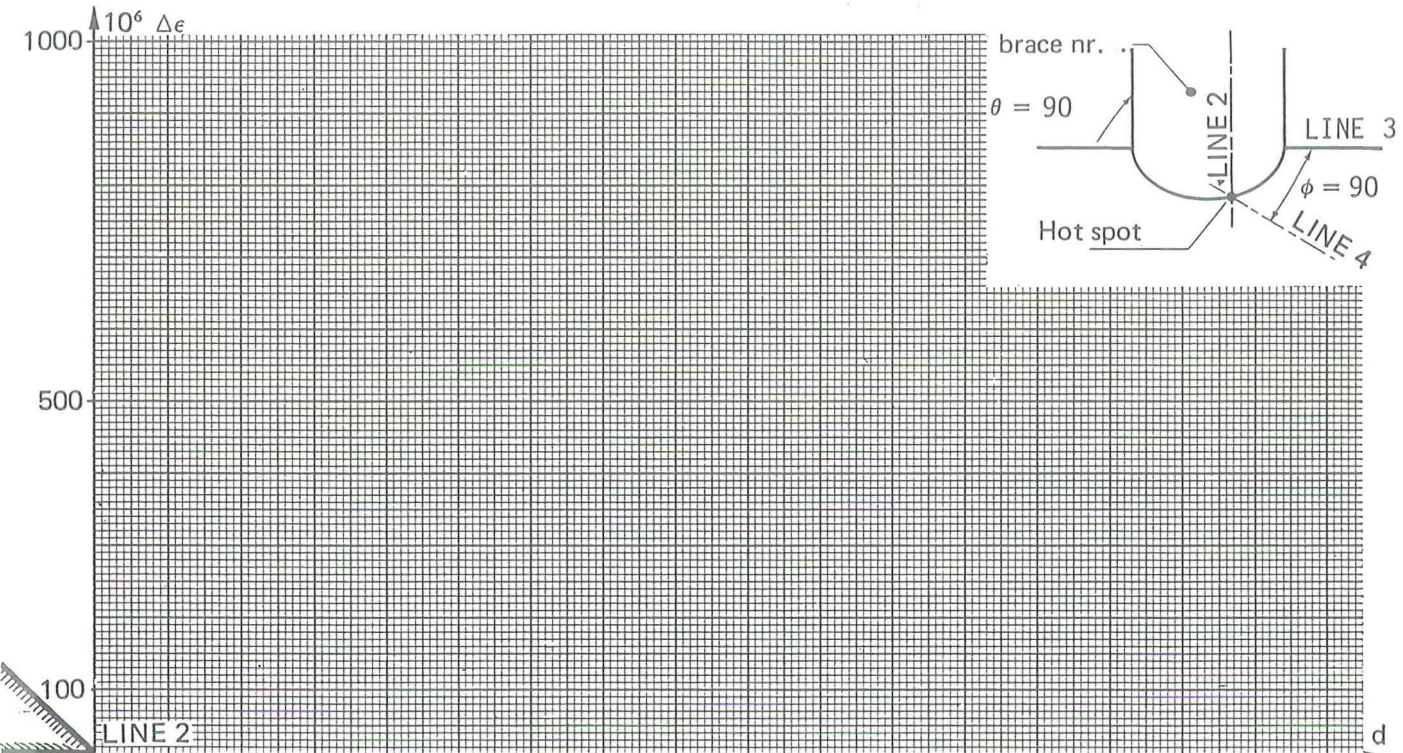
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	426	
Tensile strength σ_u (N/mm ²)	563	

**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 320 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	4000	0		10	1285



* 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.

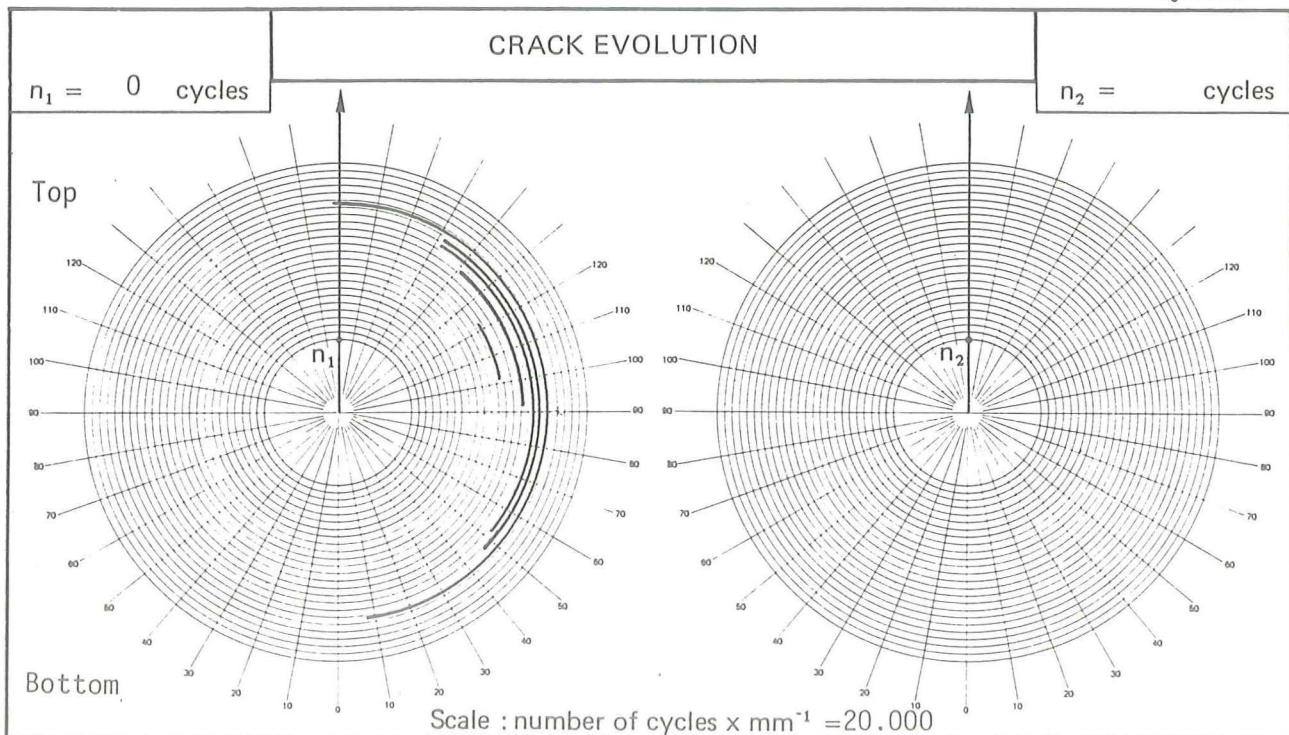
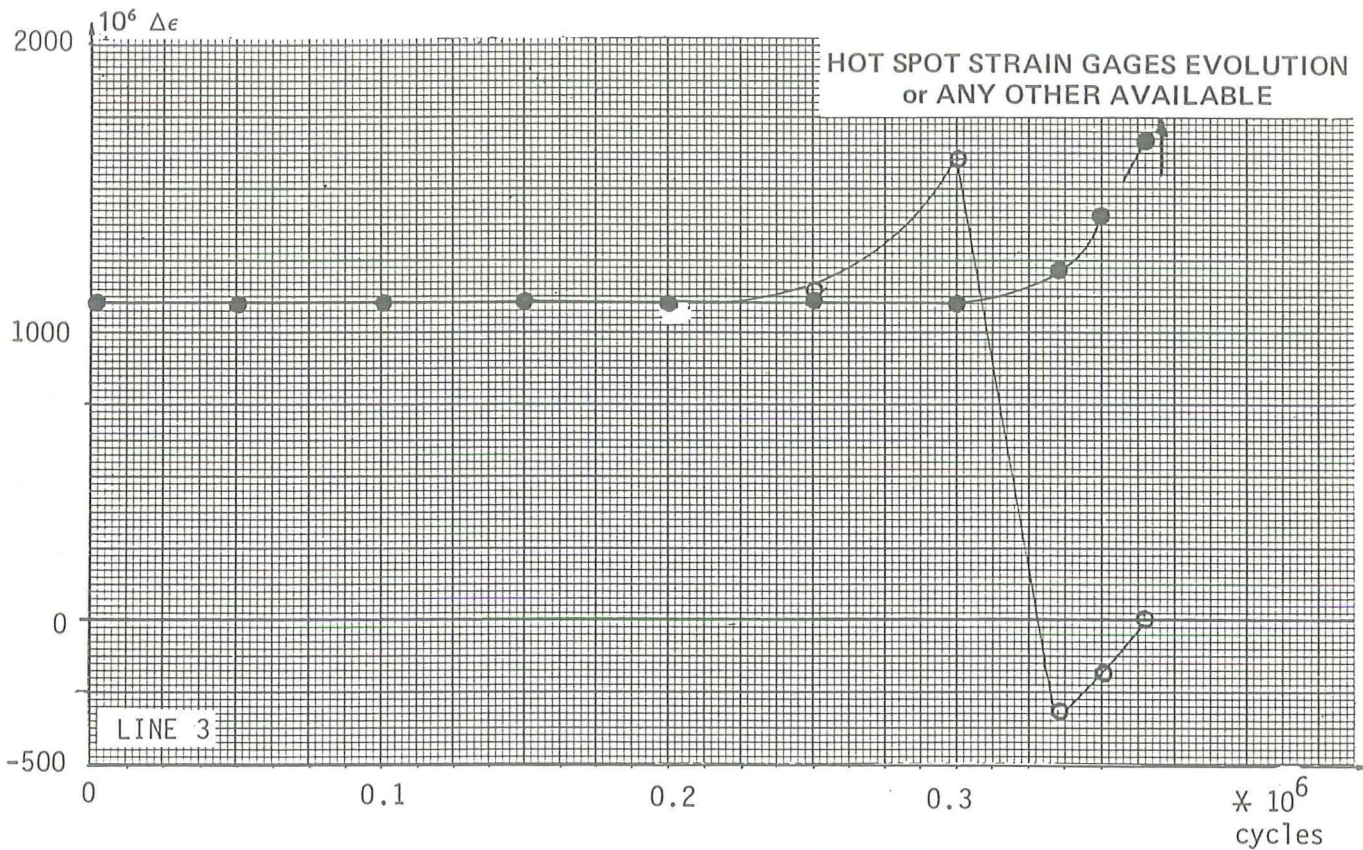
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	3.1×10^5	2.5×10^5	3.3×10^5	3.7×10^5	

(1) A : complete failure

B : actuator displacement = ... mm

C : secondary cracking total length = ... mm

D : other reason : Reduction of stiffness



OFFSHORE TUBULAR JOINT TEST DATA SHEET

Type	T-joint
Loading	In plane bending
Laboratory	TNO - IBBC
Specimen nr.	25

GEOMETRY actual values in mm	outside diameter		wall thickness	
	D	168.3	T	6.3
	d ₁	88.9	t ₁	3.2
	d ₂		t ₂	

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

ACTUAL PROPERTIES OF CRACKED MEMBER

BASE METAL	Grade : 50 C						STD : BS 4350			
	C %	Si %	Mn %	S %	P %	Al %				
	0.22	0.30	1.25	0.012	0.019					

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

WELD BEAD GEOMETRY AT THE HOT SPOT applied STD : ASME VIII		WELDING PROCEDURE	
		Position	5G
		Nr of runs	2
		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/mm ²)	426	
Tensile strength σ_u (N/mm ²)	563	

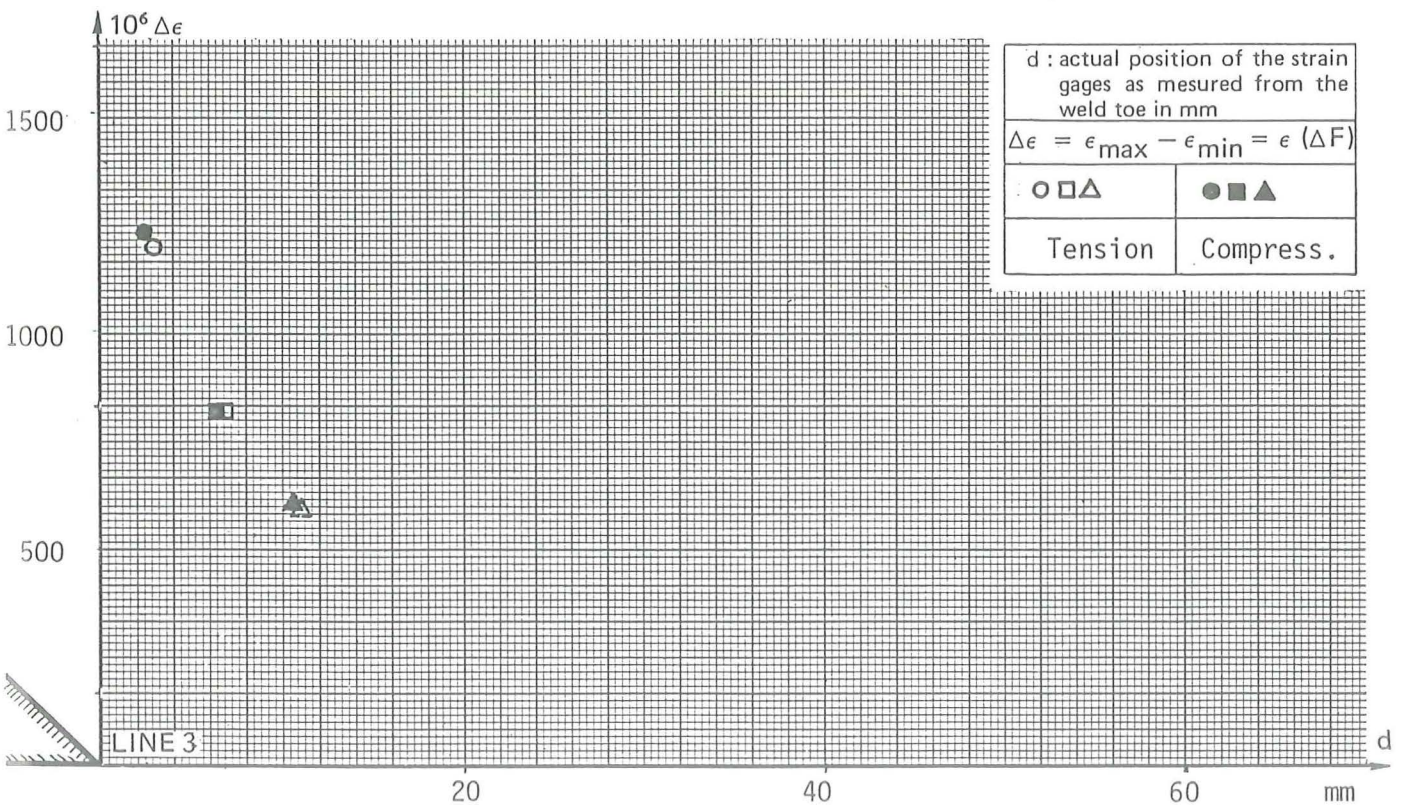
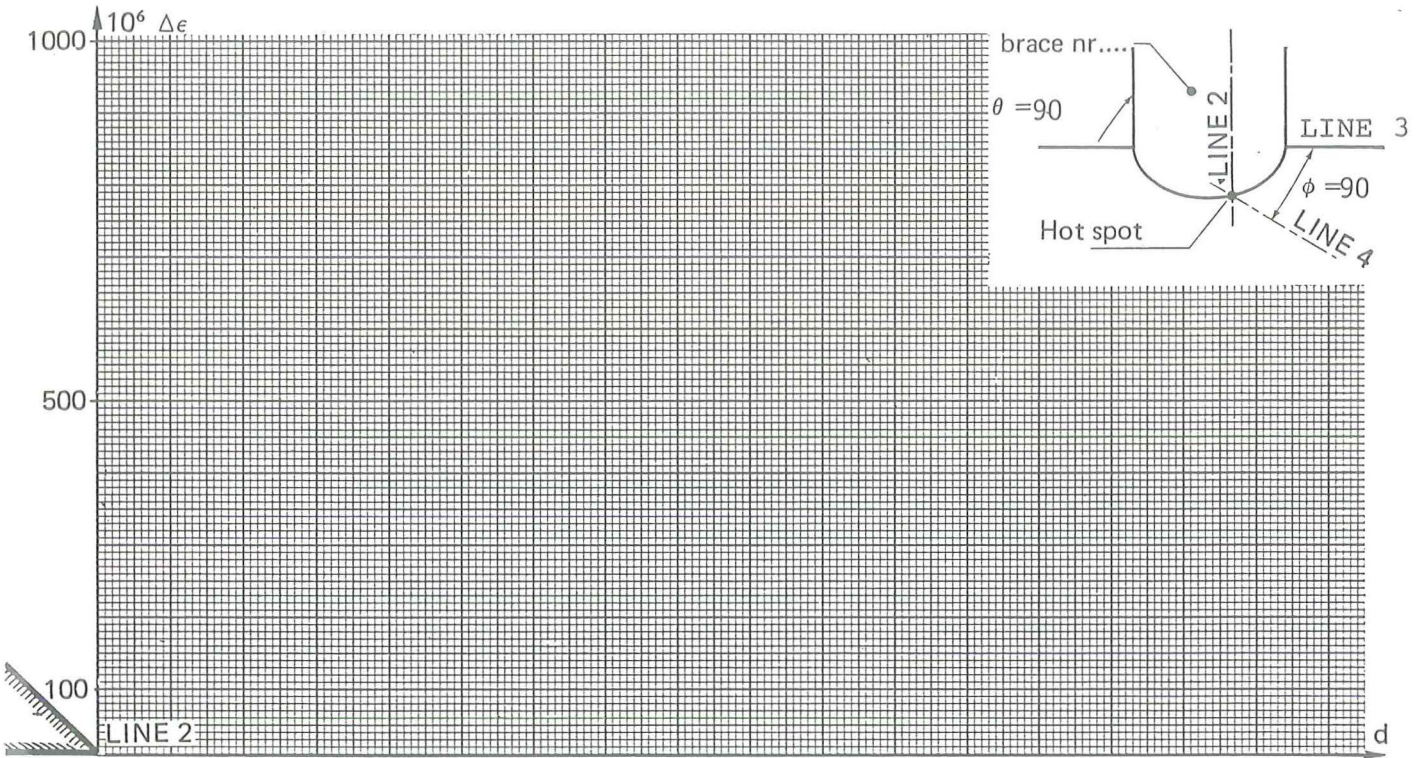
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 320

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	4500	0		10	1445

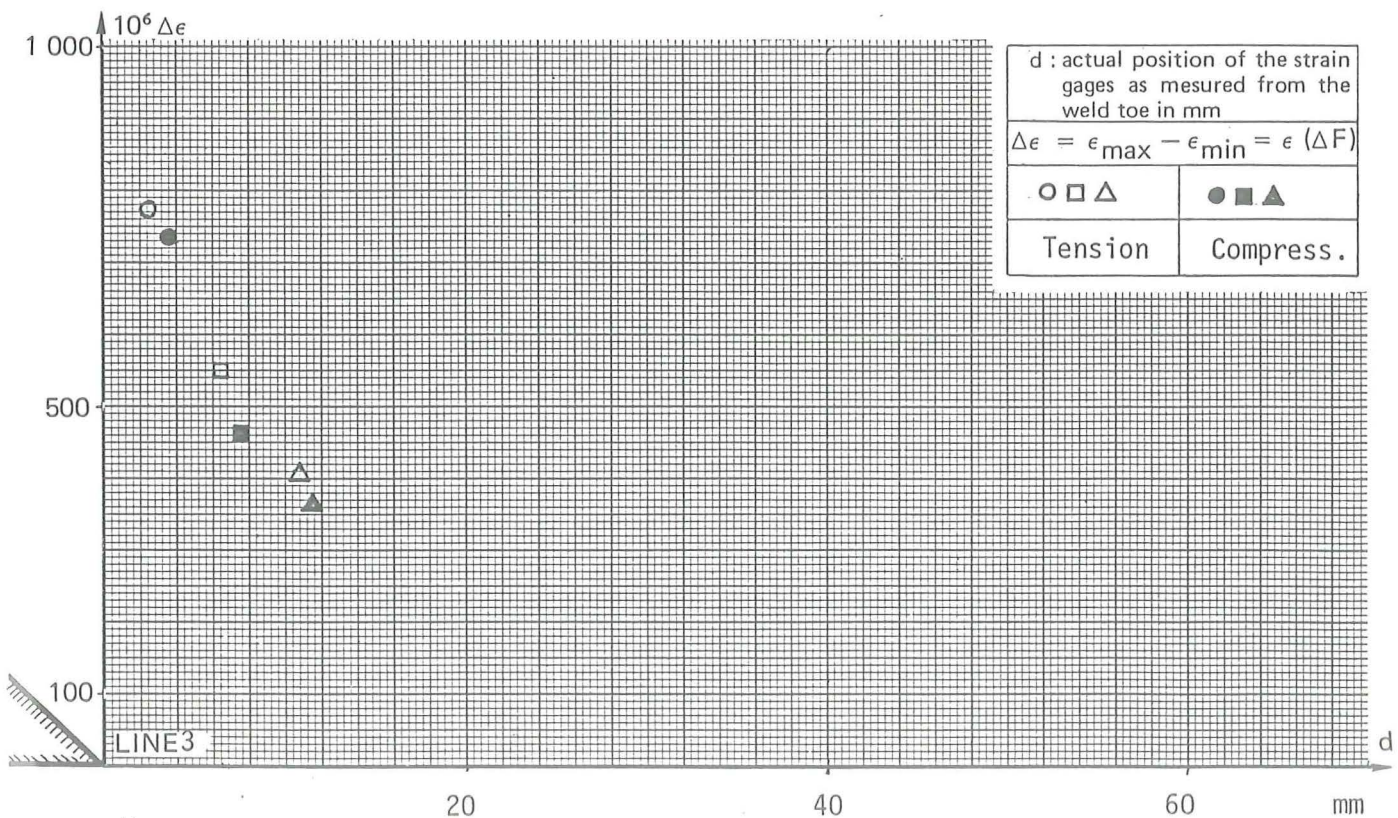
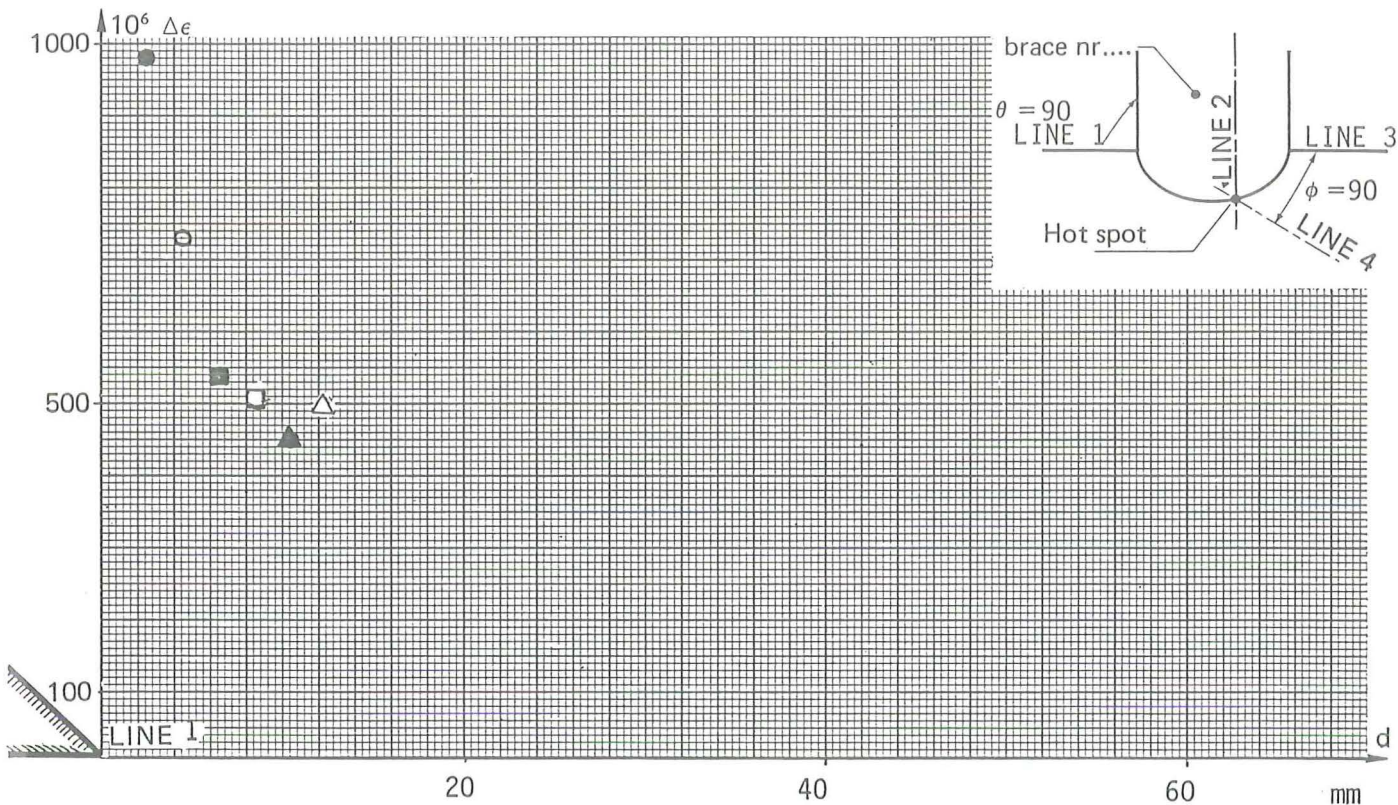


* The calculation has been based on the average SNCF's of the identical specimens

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 140 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange*
0	3150	0		10	1010



* 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.

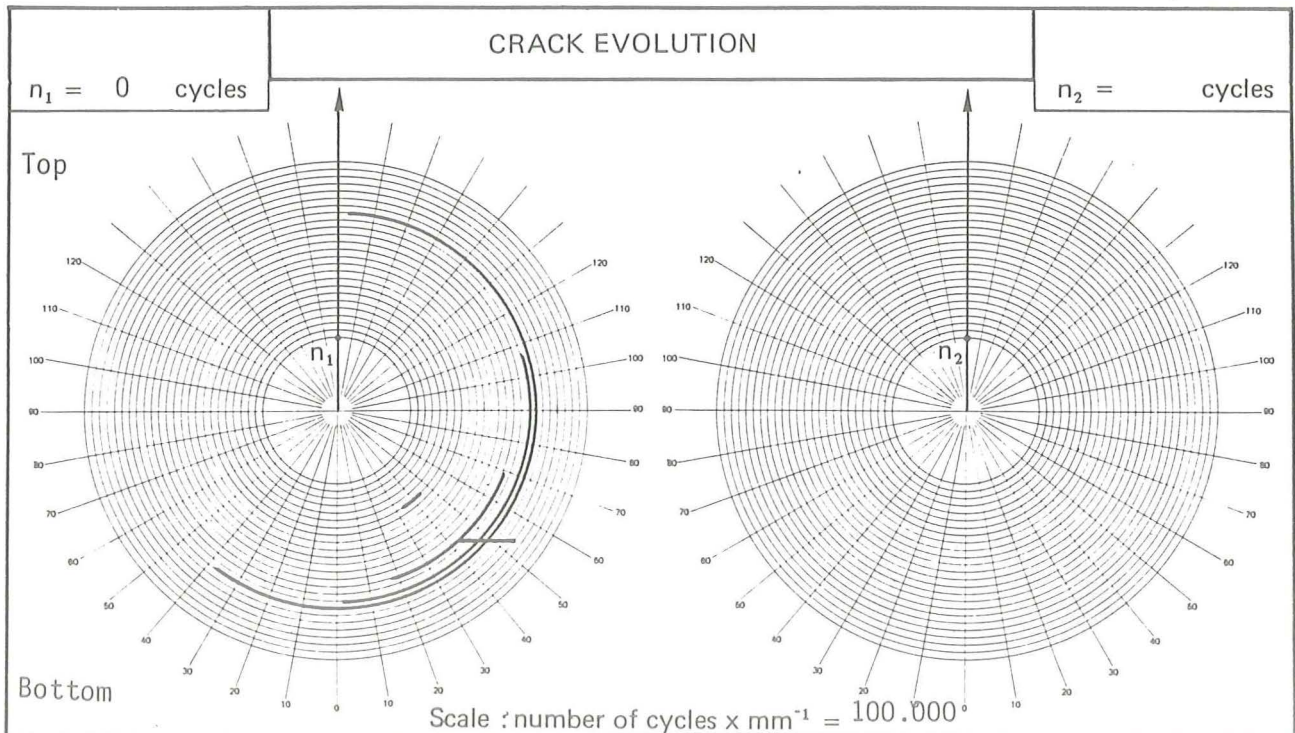
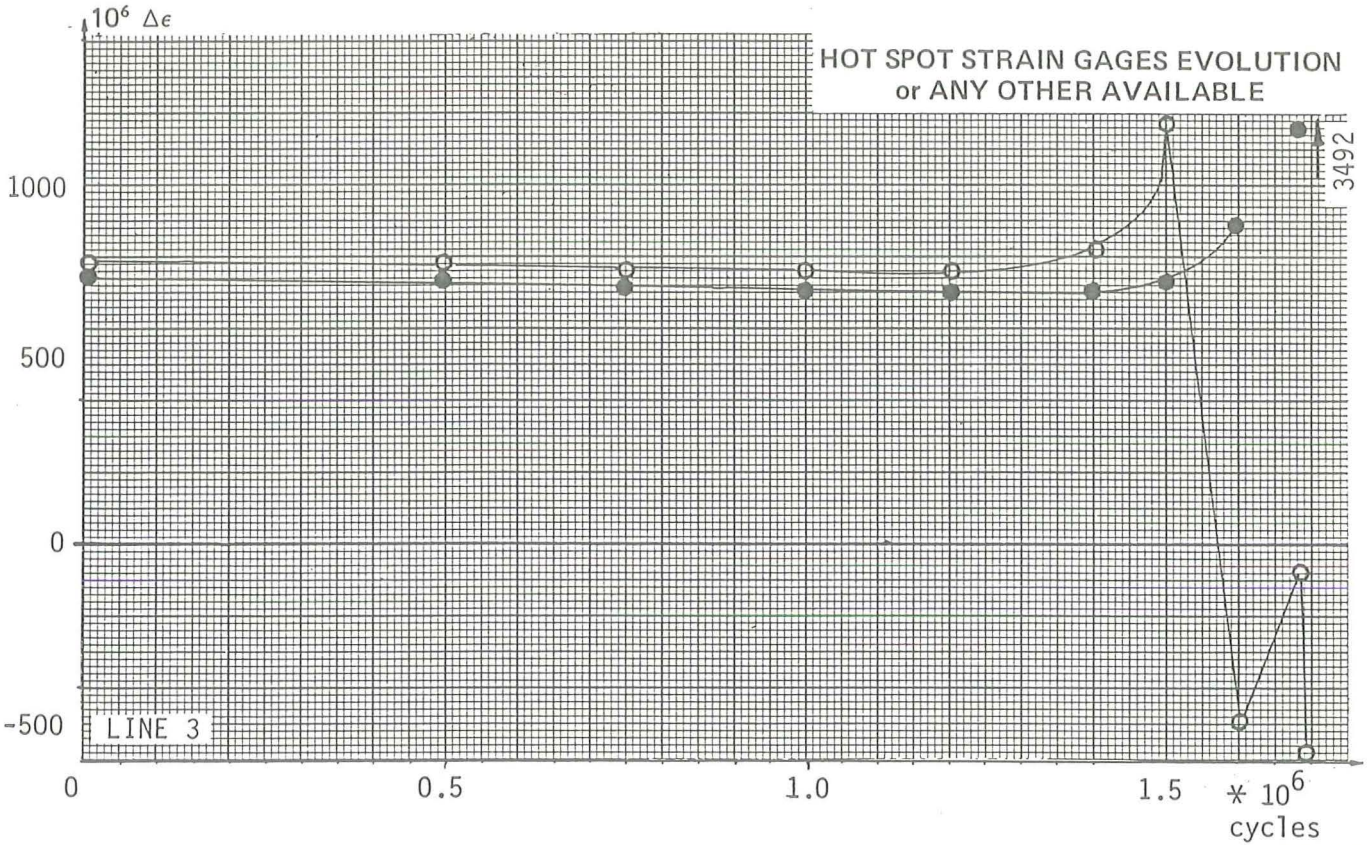
FAILURE CRITERION	$\Delta\epsilon$ - 15 %	Visual crack 8 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.53×10^6	6.2×10^5	1.5×10^6	1.7×10^6	

(1) A : complete failure

C : secondary cracking total length = ... mm

B : actuator displacement = ... mm

D : other reason : ... Reduction of stiffness



OTHER RELEVANT INFORMATIONS

Spec. 26 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	27

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY actual values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 457.2	t ₁ 16
	d ₂	t ₂

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52						STD : API - 5 LX					
	C %	Si %	Mn %	S %	P %	Al %						
	0.25	0.37	1.14	0.028	0.015							

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								8				
Energy (kj/m)								-				
preheat. temp. (° C)		65										
postheat. temp. (° C)		none										
POST WELDING TREATMENT												
Heat treatment tig or plasma dressing												
Shot peening grinding												

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

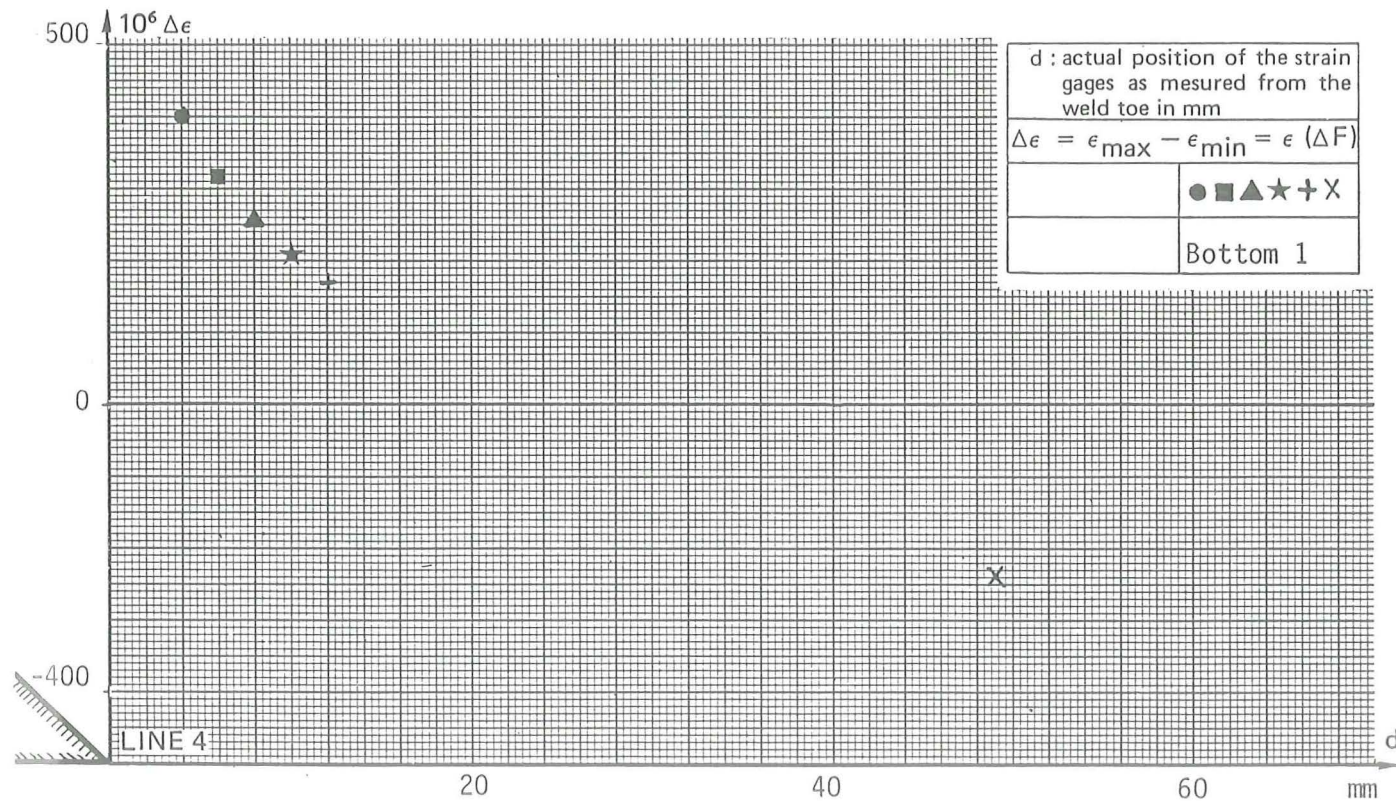
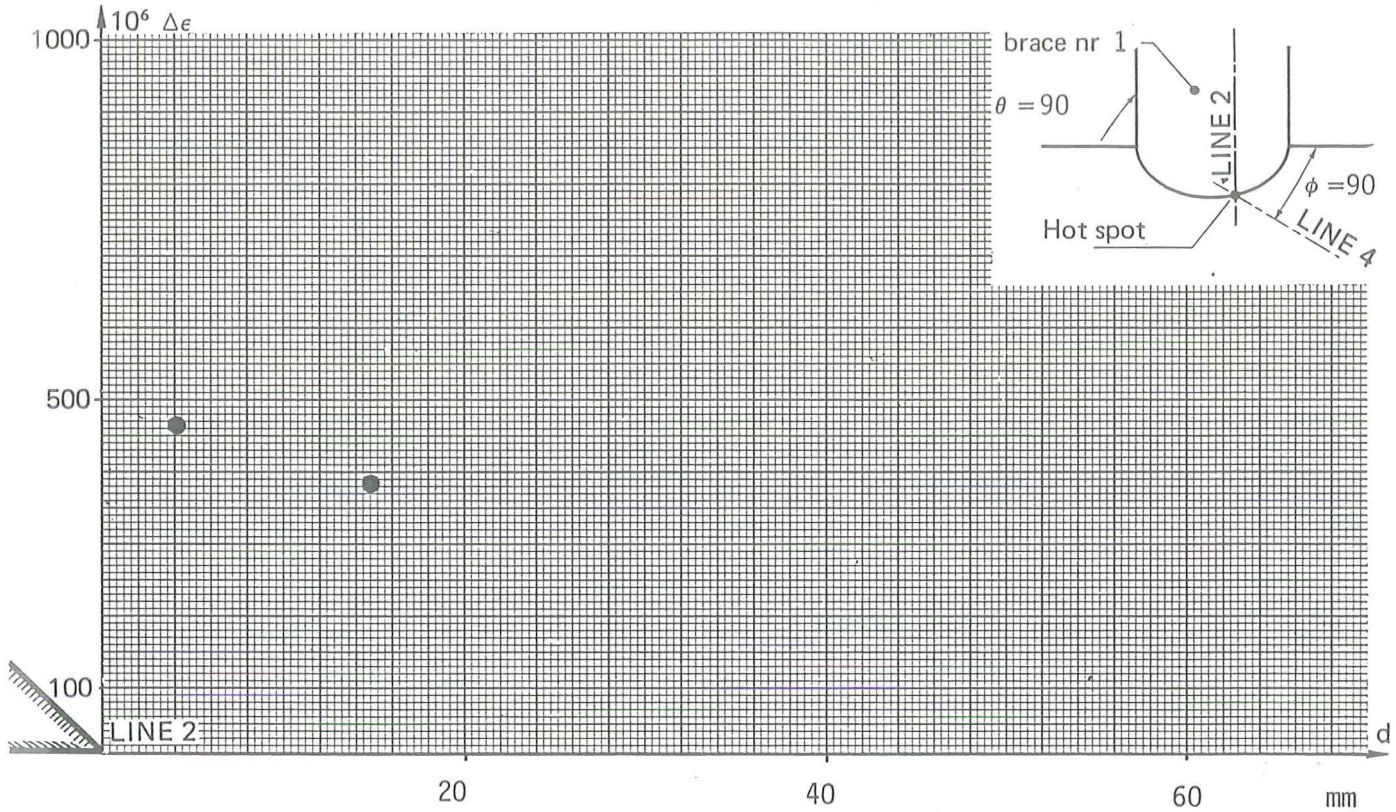
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 27 - page 2

Number of cycles before measurements : 10.000 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
-300	300	-1		2	387 (see page 4)



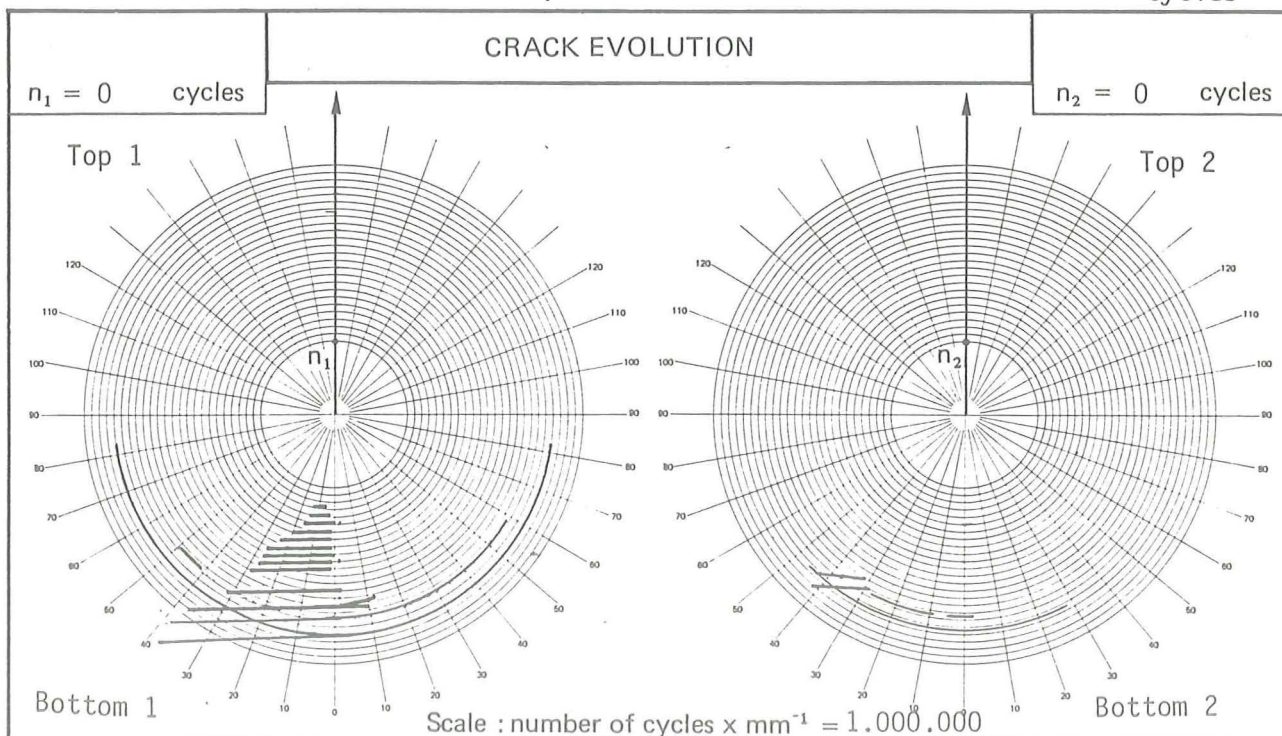
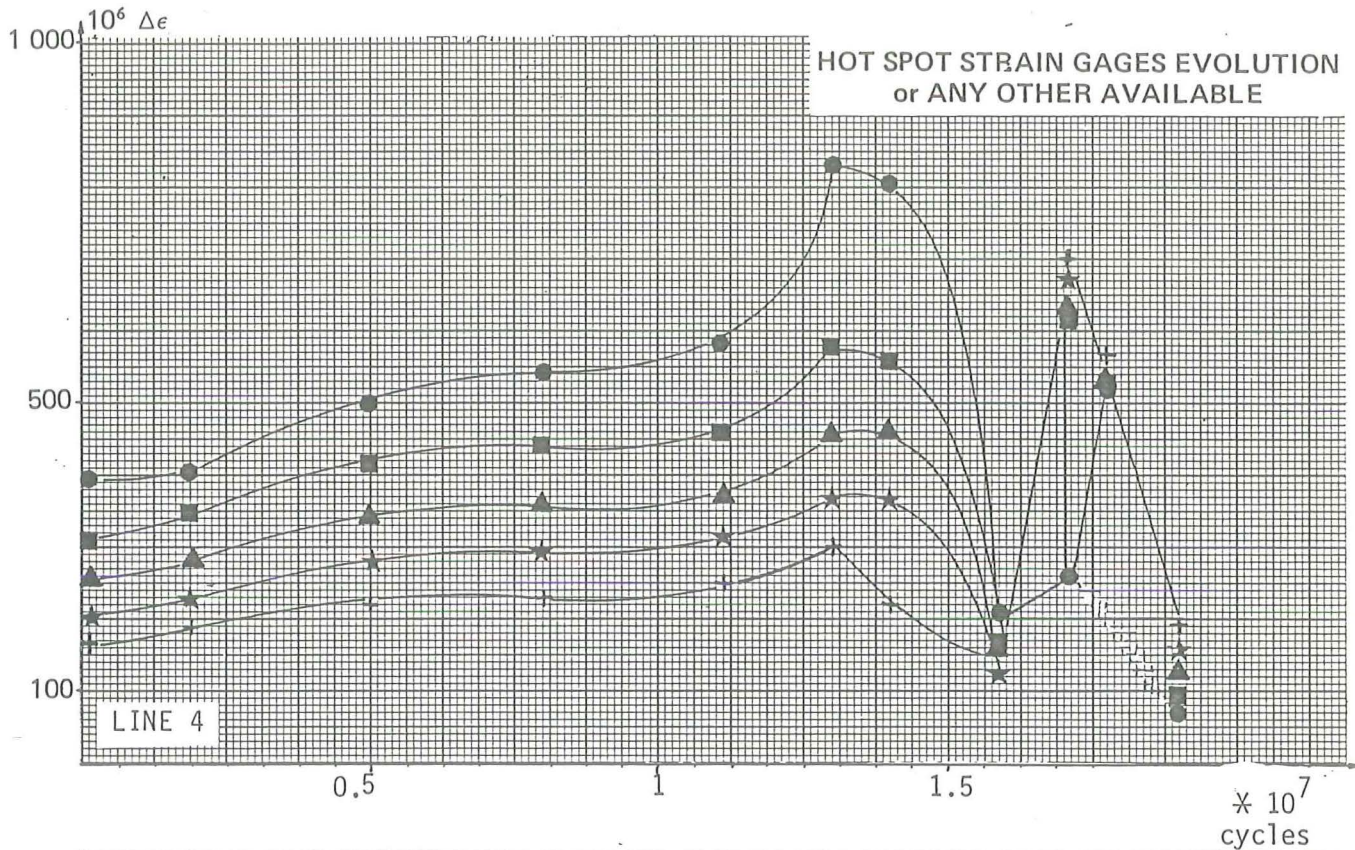
^xThe calculation has been based on the average SNCF's of the identical specimens.

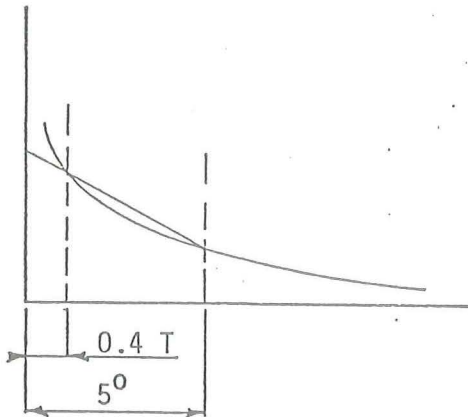
MEASUREMENTS DURING FATIGUE TESTING

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	3.1×10^6	2.3×10^6	1.6×10^7	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

HSSR based on extrapolation through points on a distance of $0,4 T$ and 5^0

HSSR calculated according to the agreement made in Working group III; 258

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab
Specimen nr.	28

GEOMETRY values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 457.2	t ₁ 16
	d ₂ -	t ₂ -

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52					STD : API 5 LX				
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

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	8
Energy (kj/m)	-	
preheat. temp. (° C)	65	
postheat. temp. (° C)	none	
POST WELDING TREATMENT		
Heat treatment tig or plasma dressing		
Sheet peening grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

**Other
properties
see page 4**

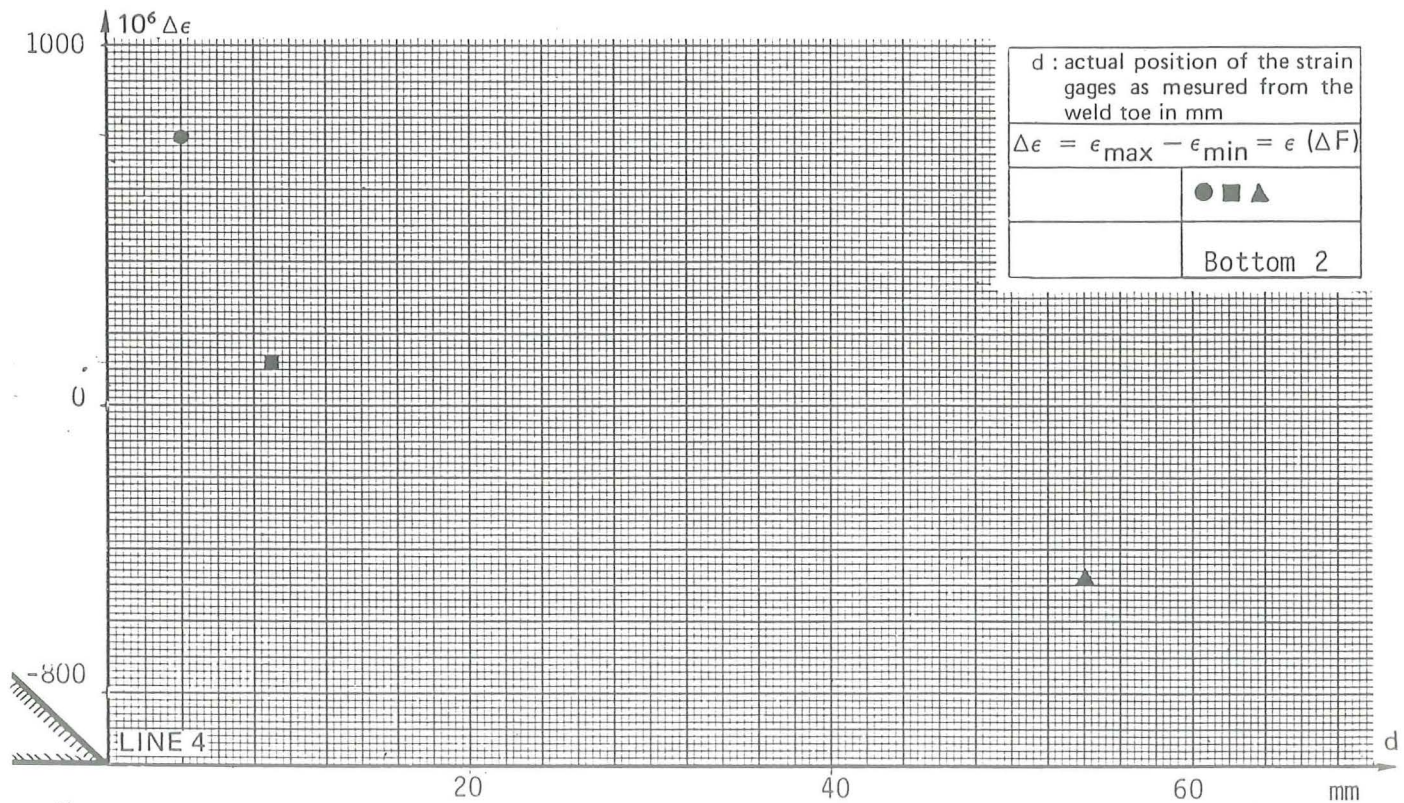
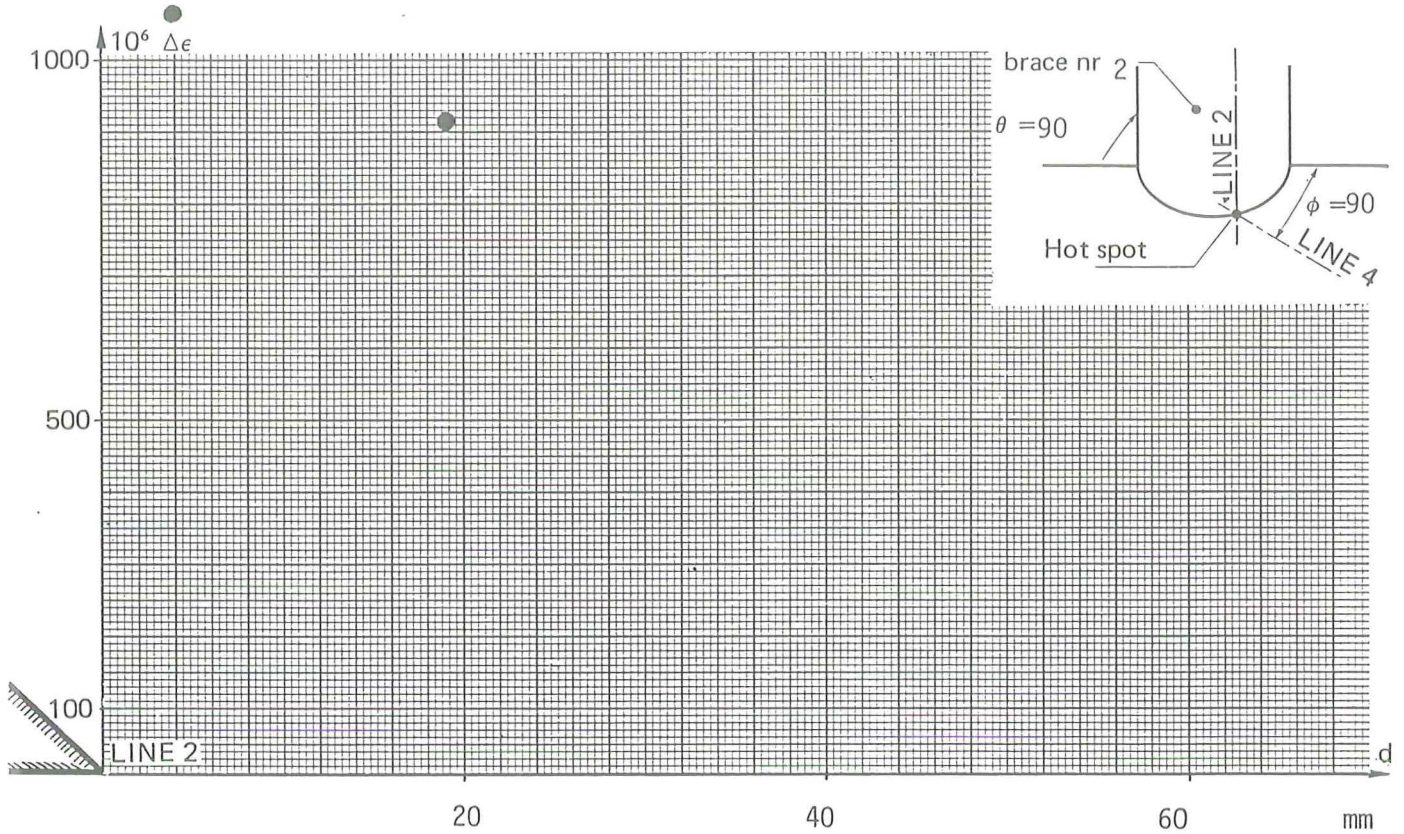
MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 28 - page 2

Number of cycles before measurements : 2000

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
-650	650	-1		1.3	837 (see page 4)



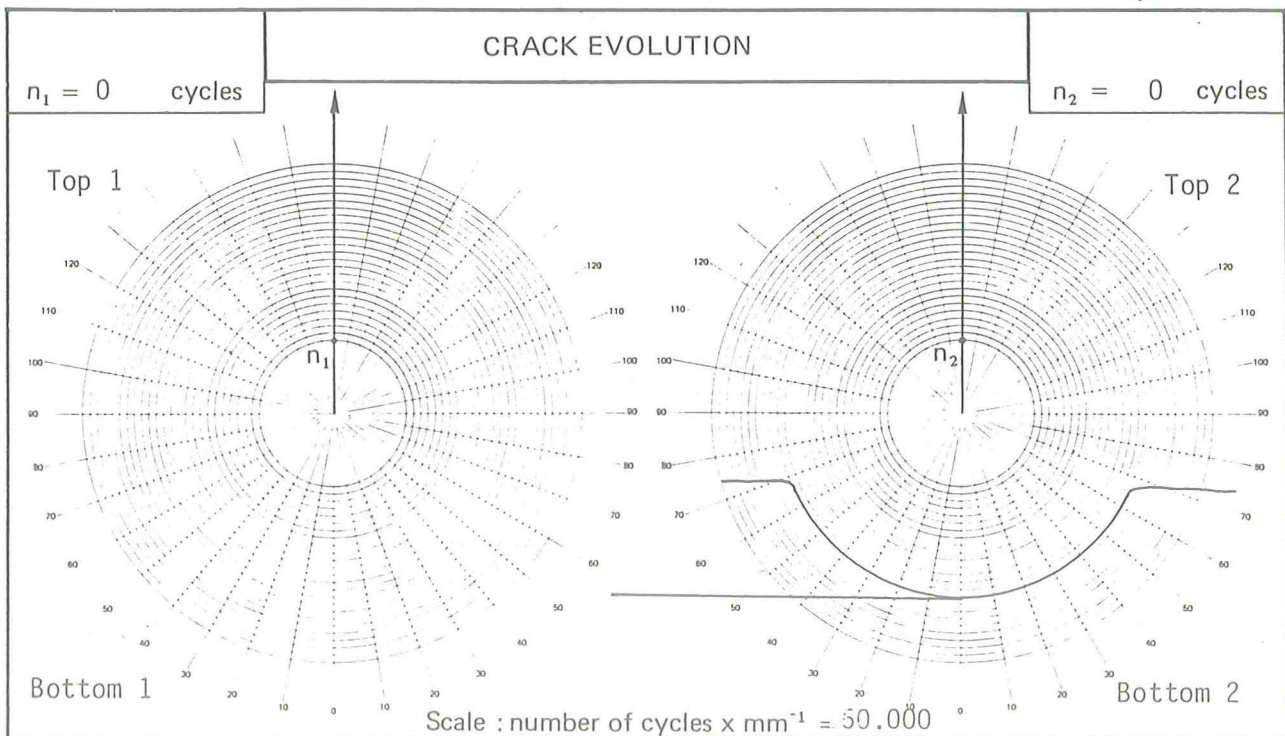
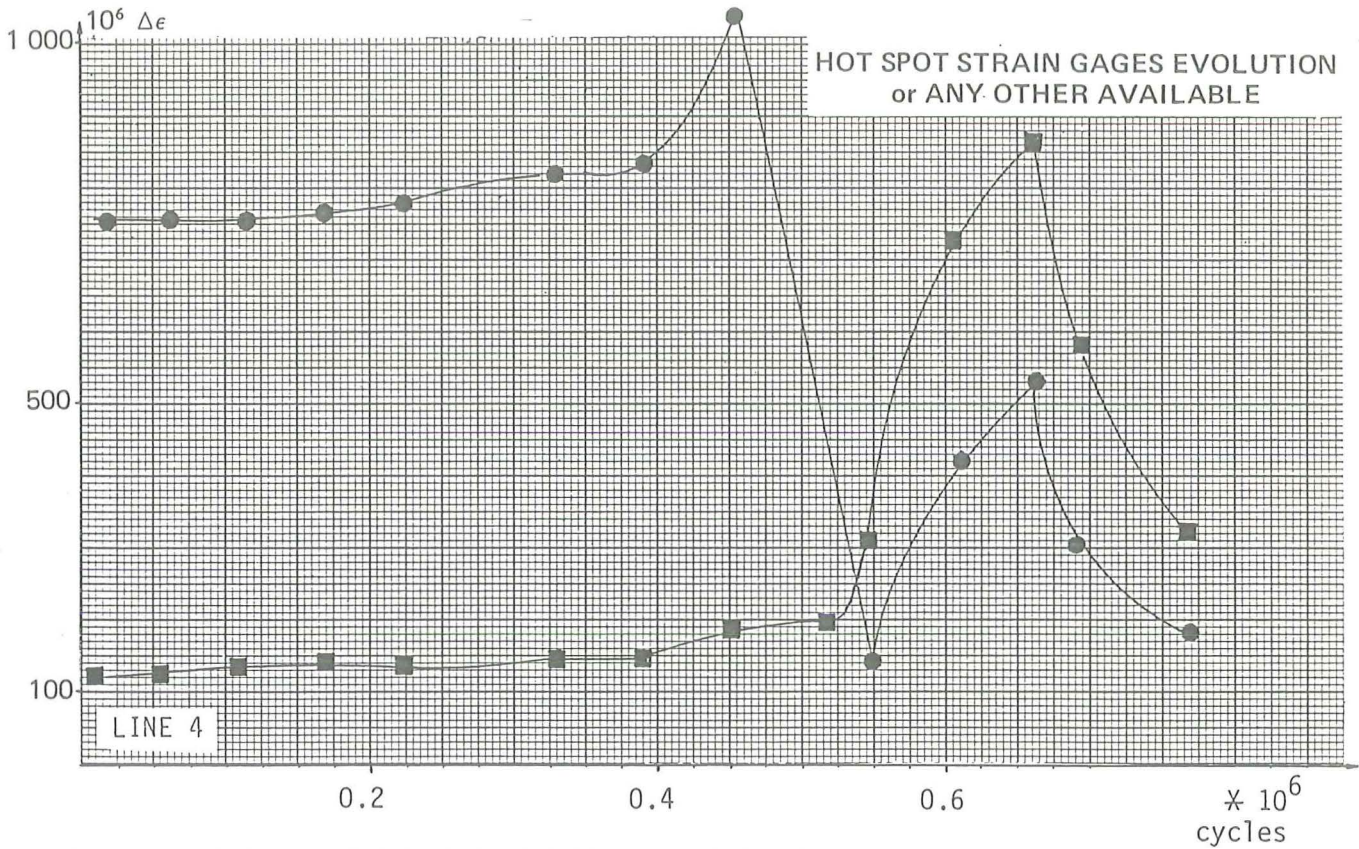
* The calculation has been based on the average SNCF's of the identical specimens.

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	4.1×10^5	-	6.6×10^5	7.7×10^5	

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



OTHER RELEVANT INFORMATIONS

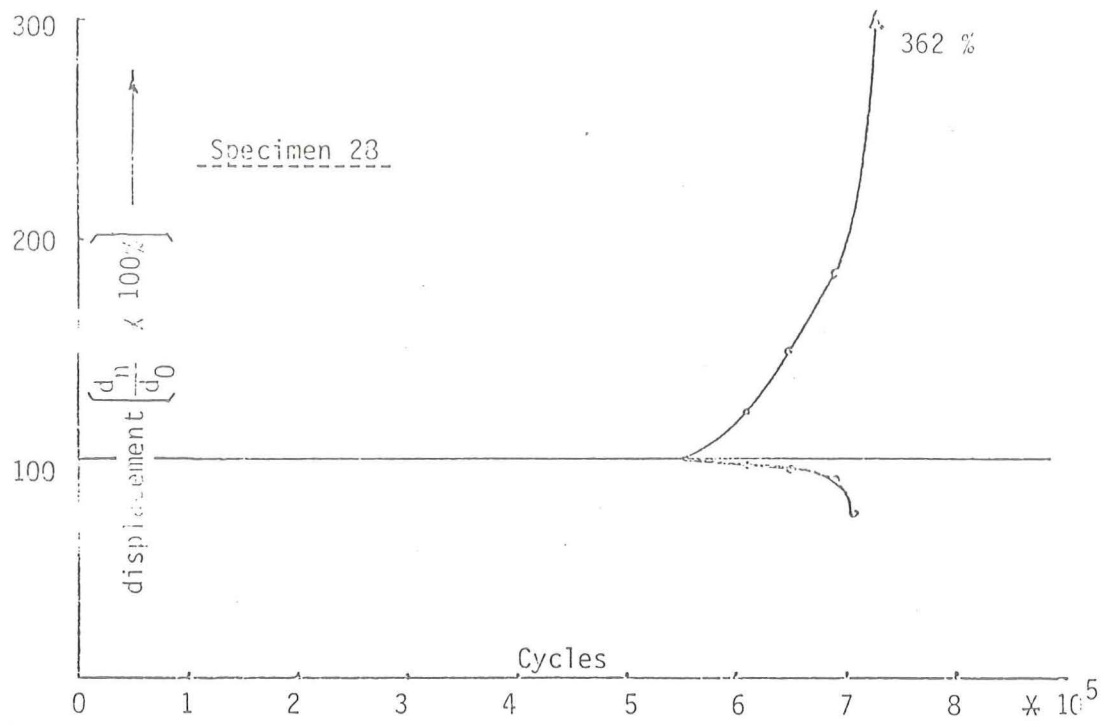
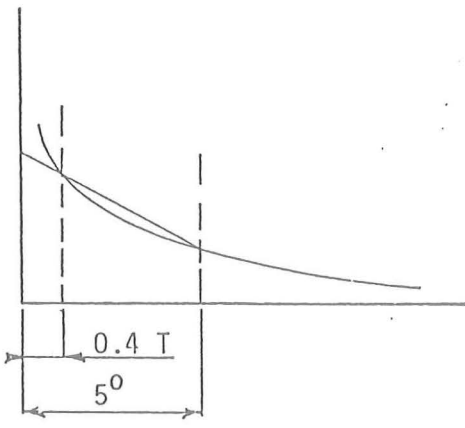


Fig. 1 Evolution of the node elongation per cycle during the test



HSSR based on extrapolation through points on a distance of 0,4 T and 5⁰

HSSR calculated according to the agreement made in Working group III : 558

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	29

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <u>Yes</u> No	

GEOMETRY actual values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 457.2	t ₁ 16
	d ₂	t ₂

ACTUAL PROPERTIES OF CRACKED MEMBER (chord)

BASE METAL	Grade : X 52						STD : API - 5 LX			
	C %	Si %	Mn %	S %	P %	Al %				
	0.25	0.37	1.14	0.028	0.015					

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	8
	Energy (kj/m)	-	
	preheat. temp. (° C)	65	
	postheat. temp. (° C)	none	
		POST WELDING TREATMENT	
		Heat treatment tig or plasma dressing	
		Sheet peening grinding	

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	394	
Tensile strength σ_U (N/mm ²)	603	

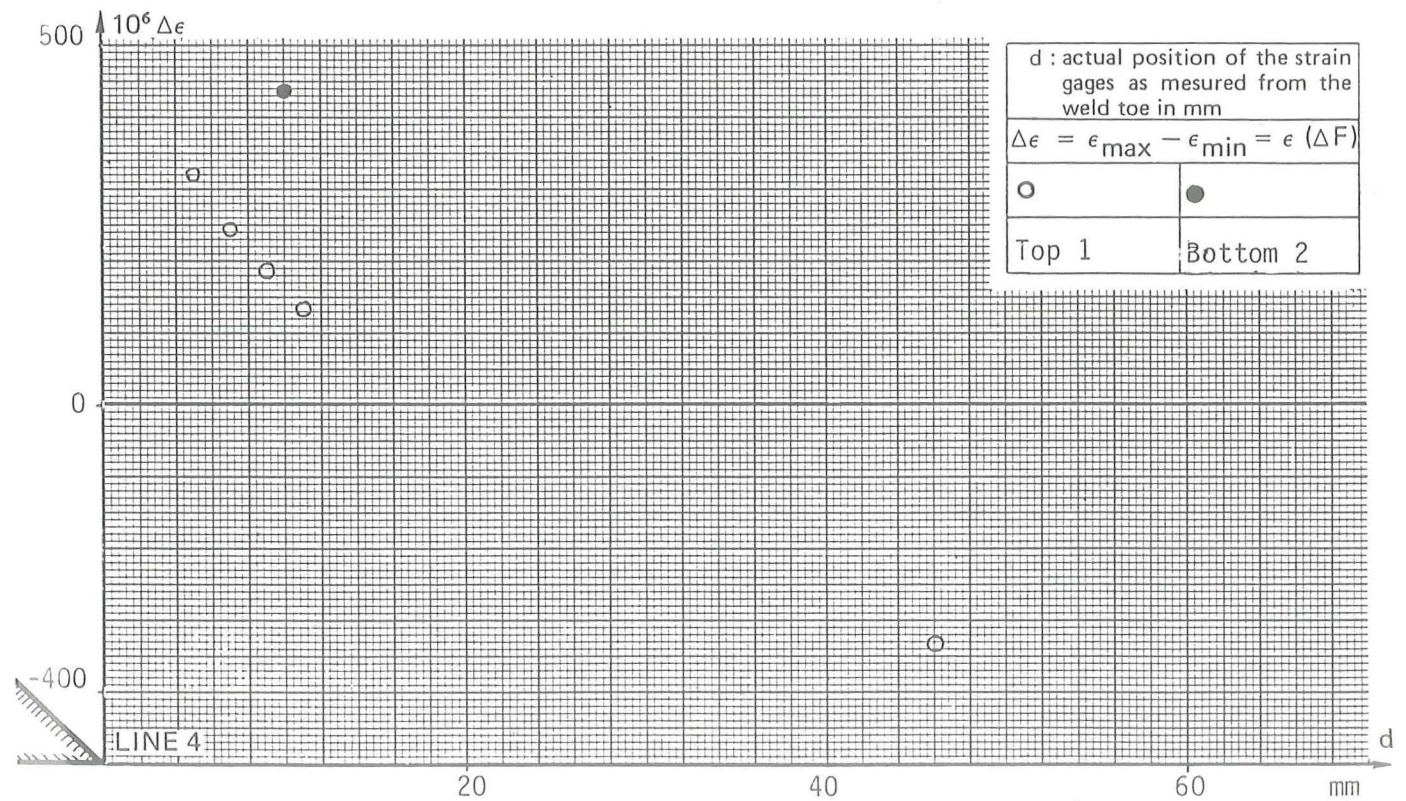
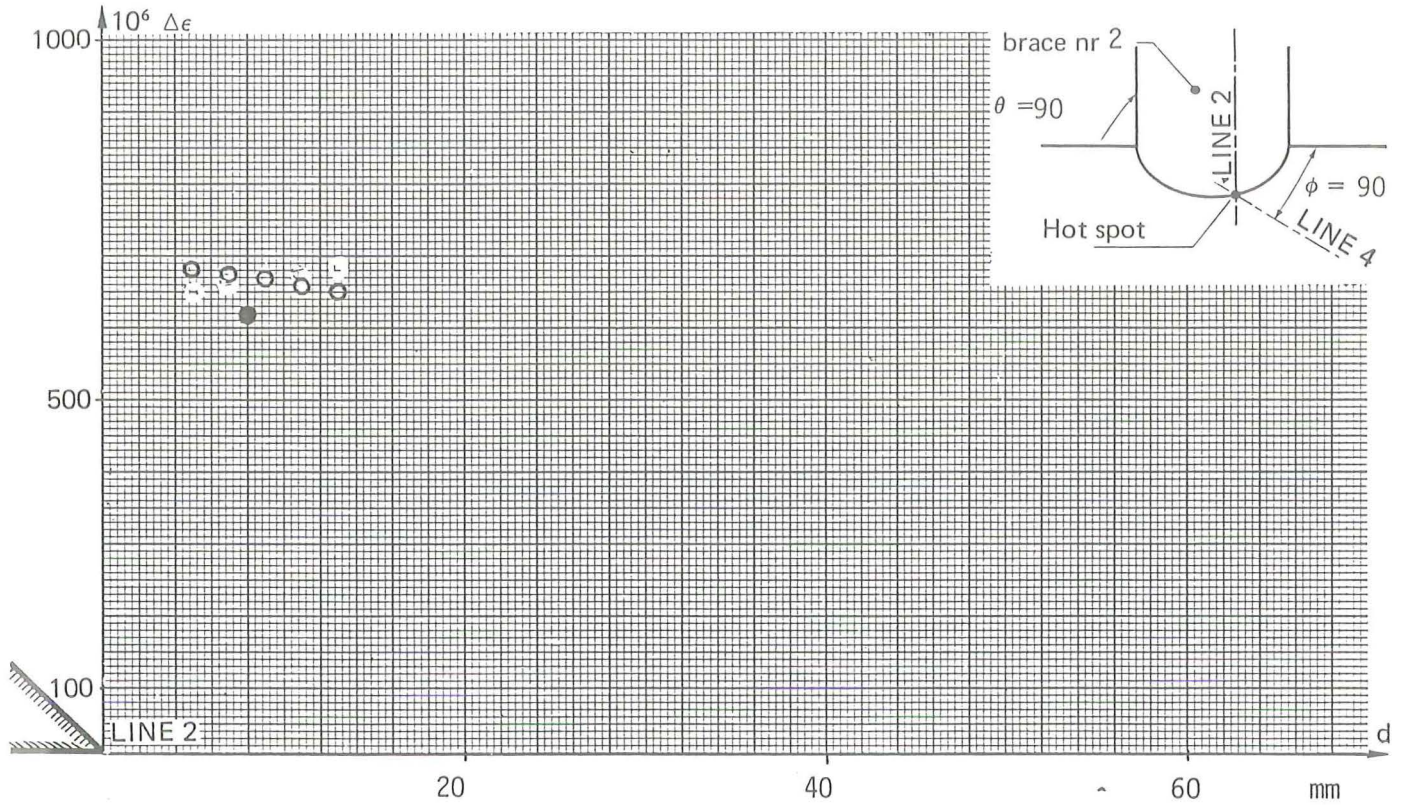
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 29 - 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 ^x
-440	440	-1		2	567 (see page 4)



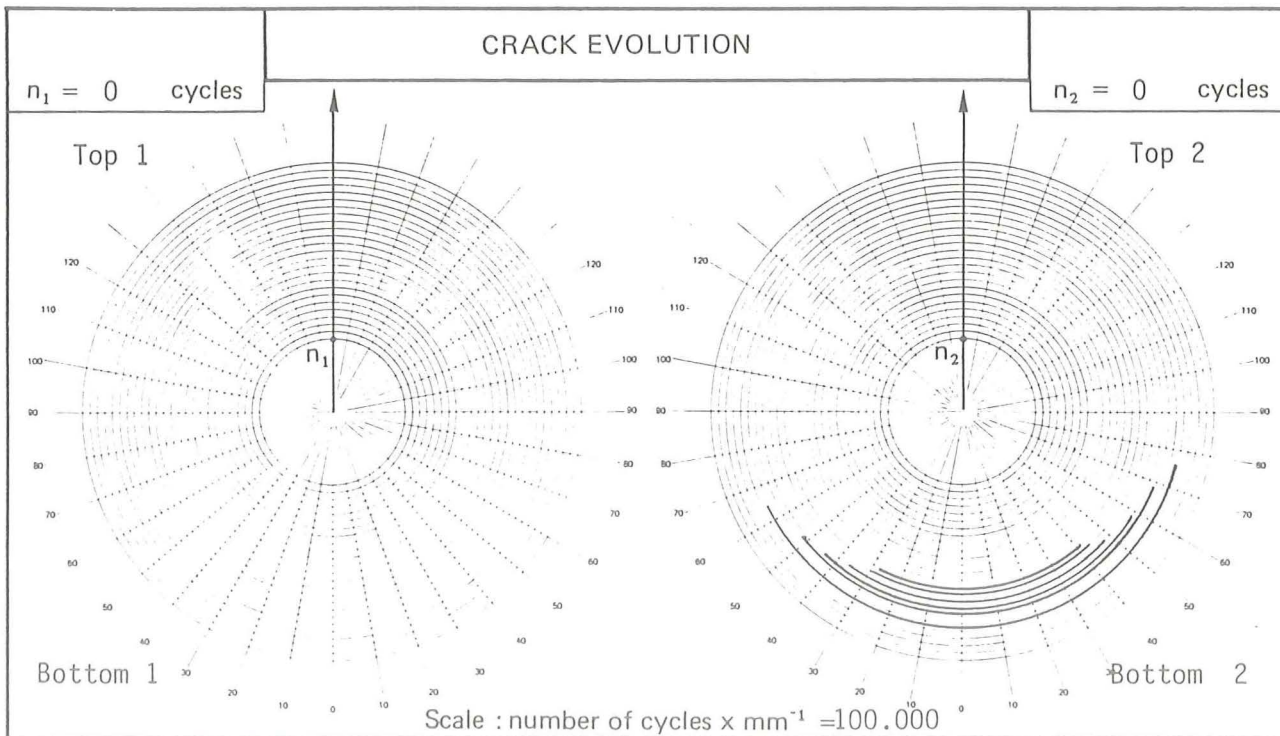
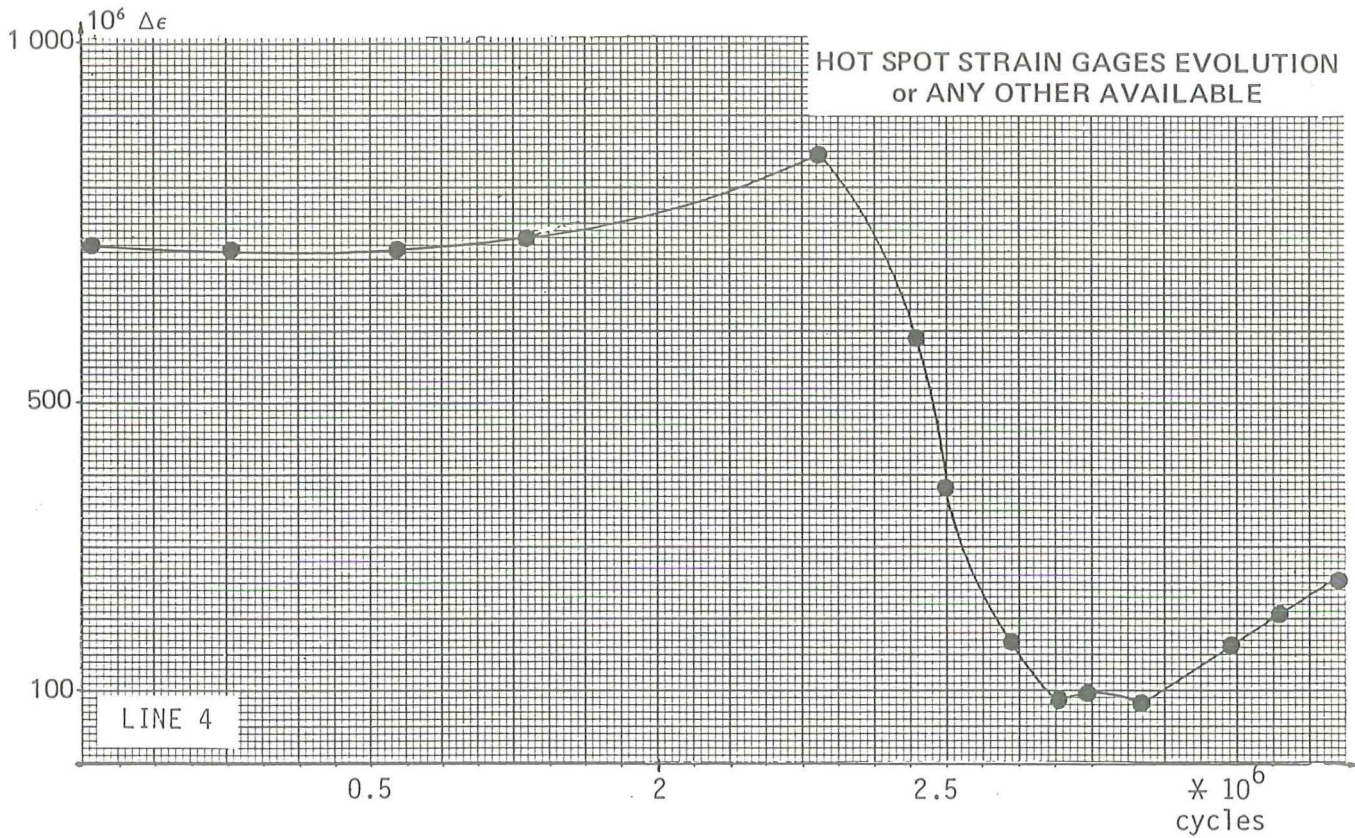
^x The calculation has been based on the average SNCF's of the identical specimens.

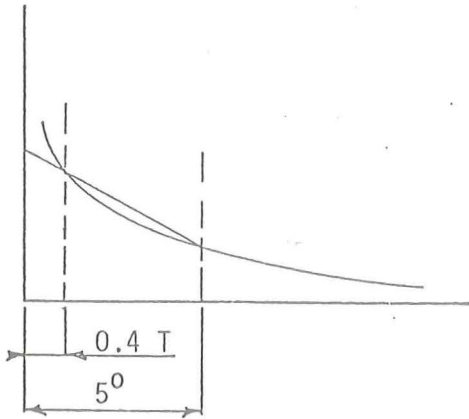
MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon + 15\%$	Visual crack 85 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.1×10^6	1.5×10^6	1.8×10^6	2.2×10^6	

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



OTHER RELEVANT INFORMATIONS

HSSR based on extrapolation through points on a distance of $0,4 T$ and 5^0

HSSR calculated according to the agreement made in Working group III; 378

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	DUT - Stevinlab.
Specimen nr.	30

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. Yes No	

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

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	Top 2	
	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 Sheet peening grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	482	
Tensile strength σ_u (N/mm ²)	580	

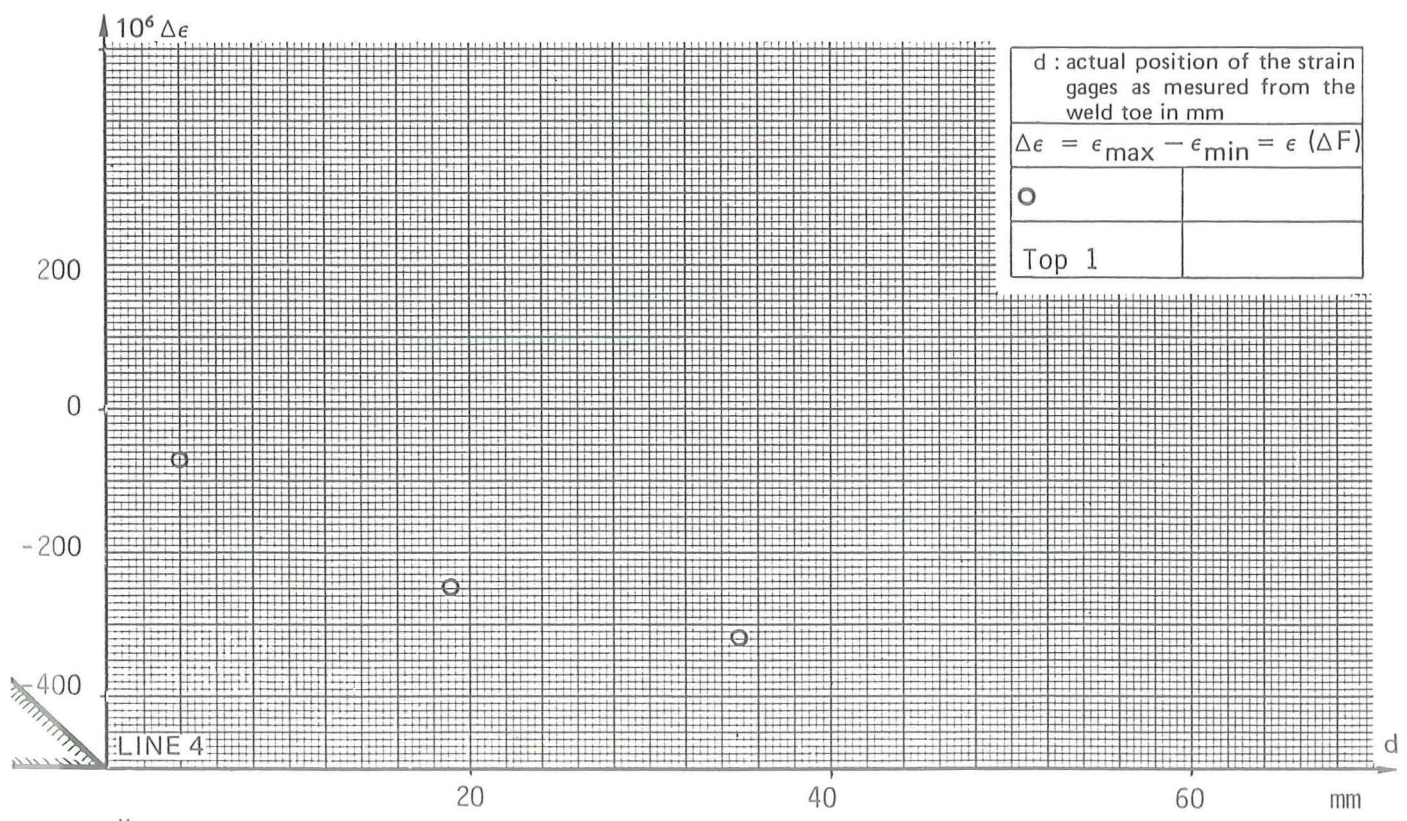
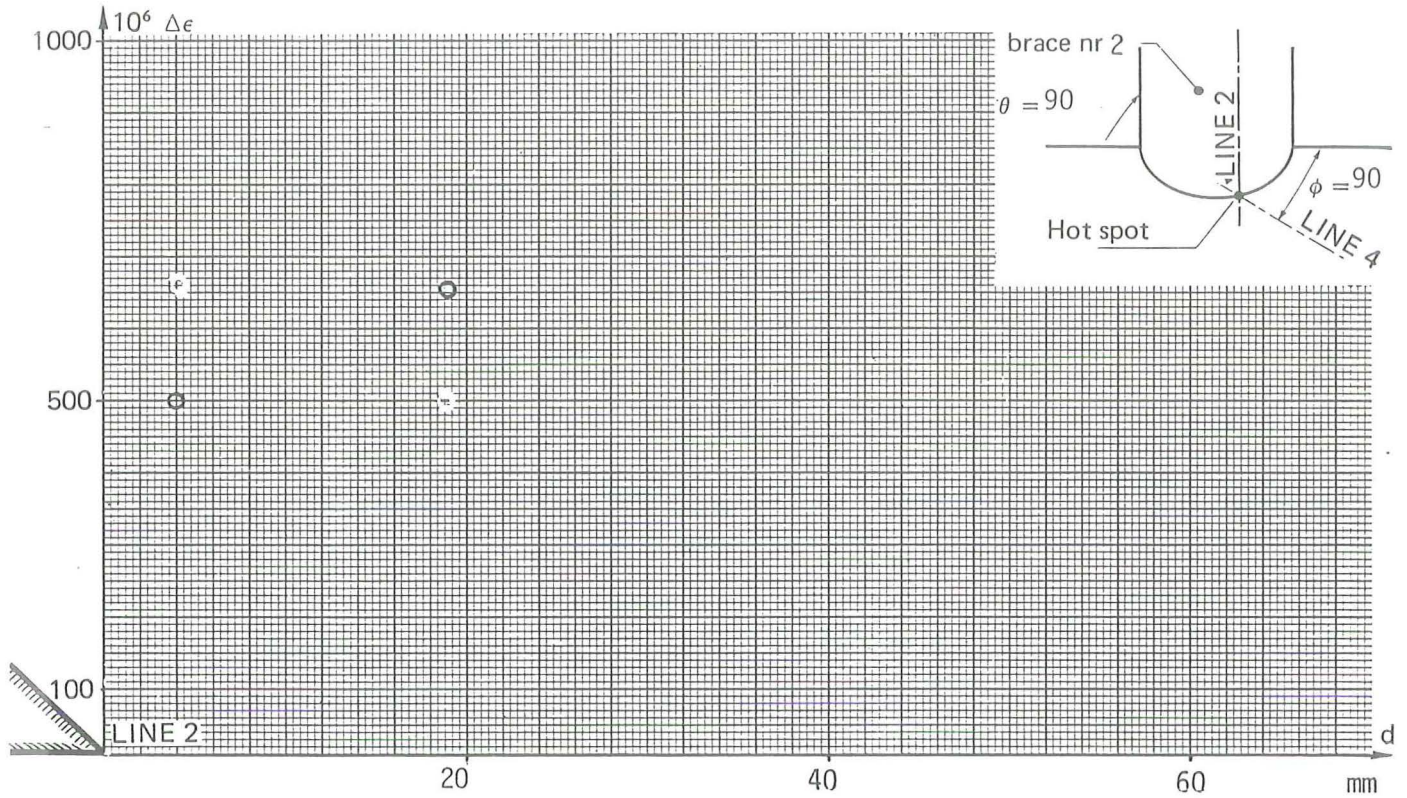
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 30 - 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 \times
-440	440	-1		2	913 (see page 4)



\times 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.

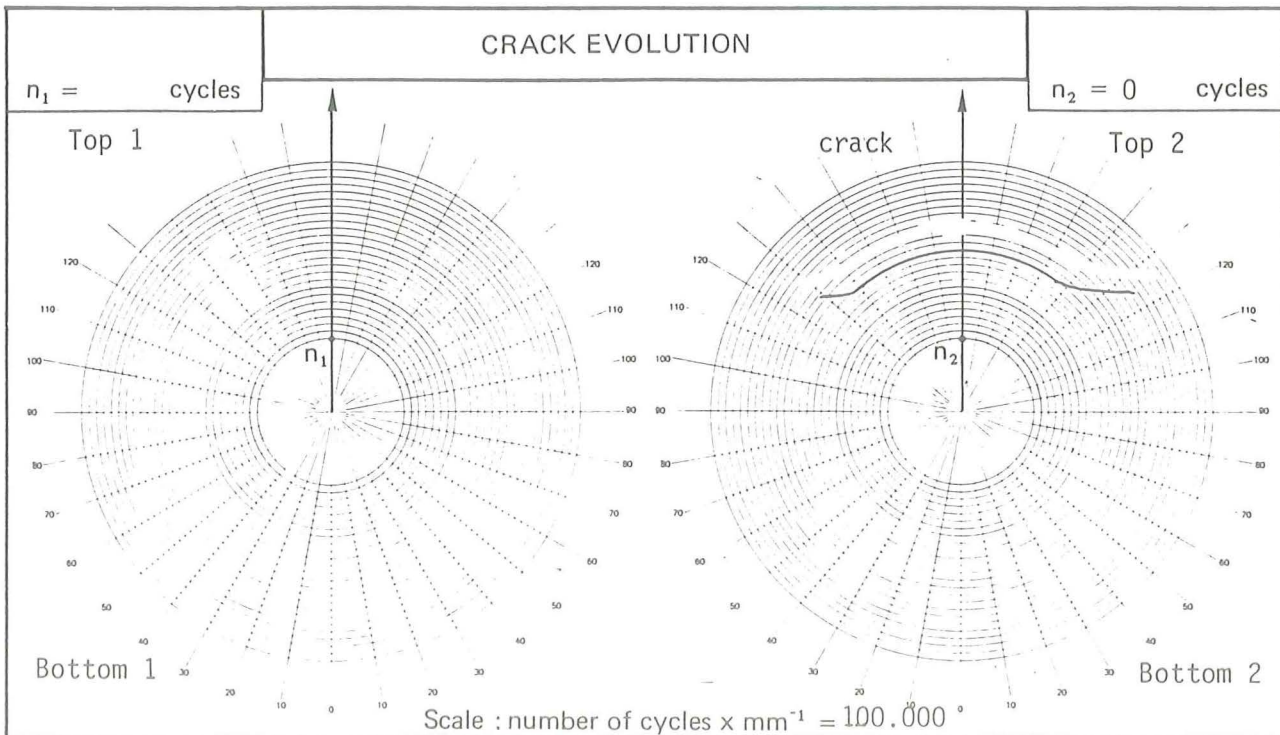
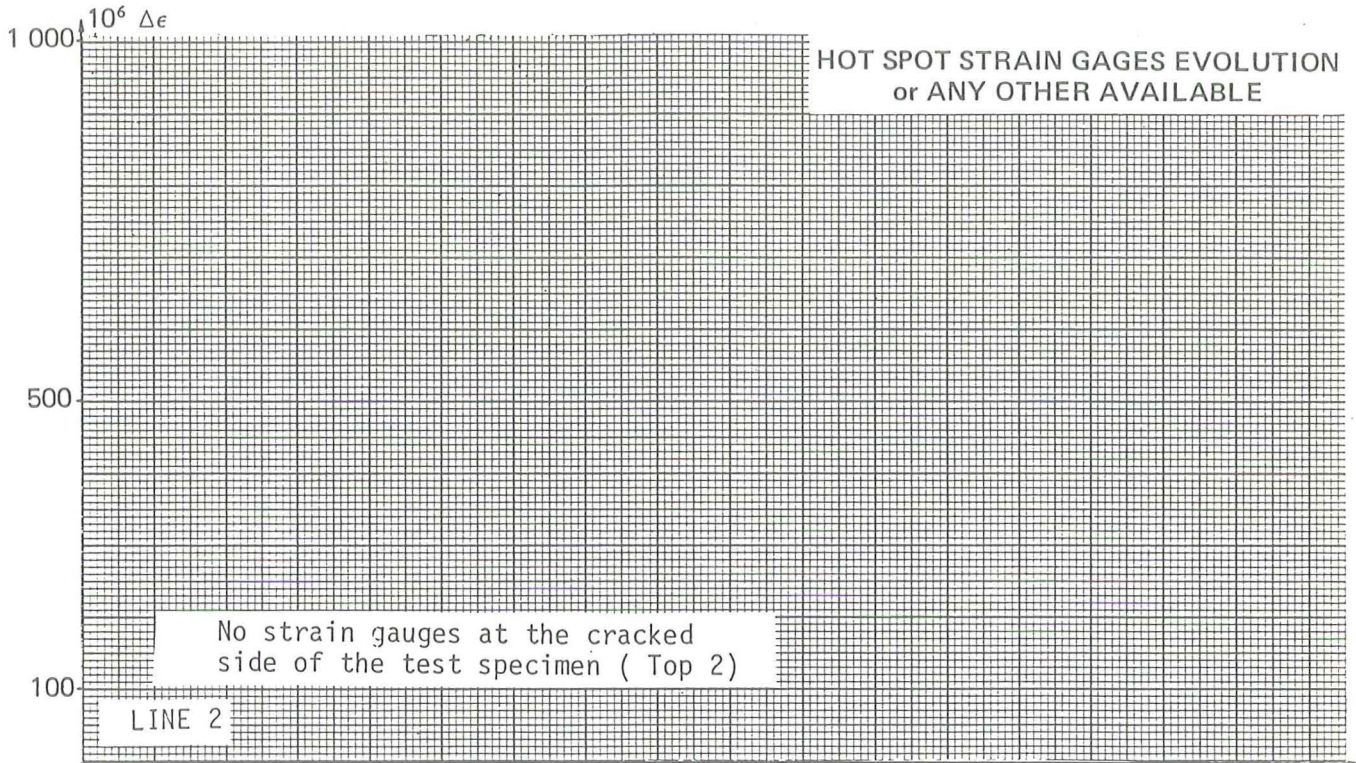
FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack ~ 30 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	-	-	1.0×10^6	1.2×10^6	

(1) A : complete failure

C : secondary cracking total length = ... mm

B : actuator displacement = ... mm

D : other reason : Reduction of stiffness



OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial (random)
Laboratory	DUT - Stevinlab.
Specimen nr.	31

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY <small>actual values in mm</small>	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 457.2	t ₁ 8.8
	d ₂	t ₂

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/mm ²)	482	
Tensile strength σ_u (N/mm ²)	580	

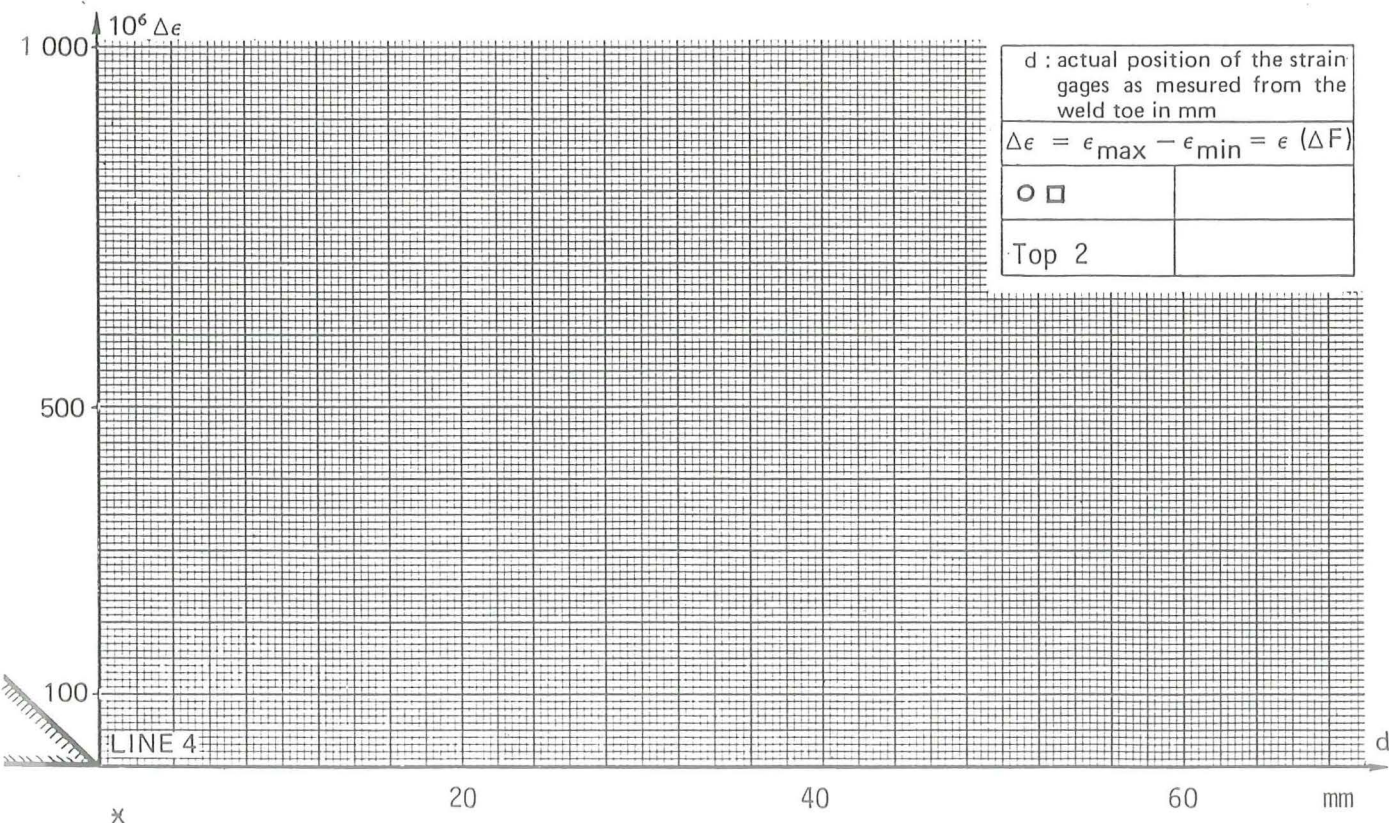
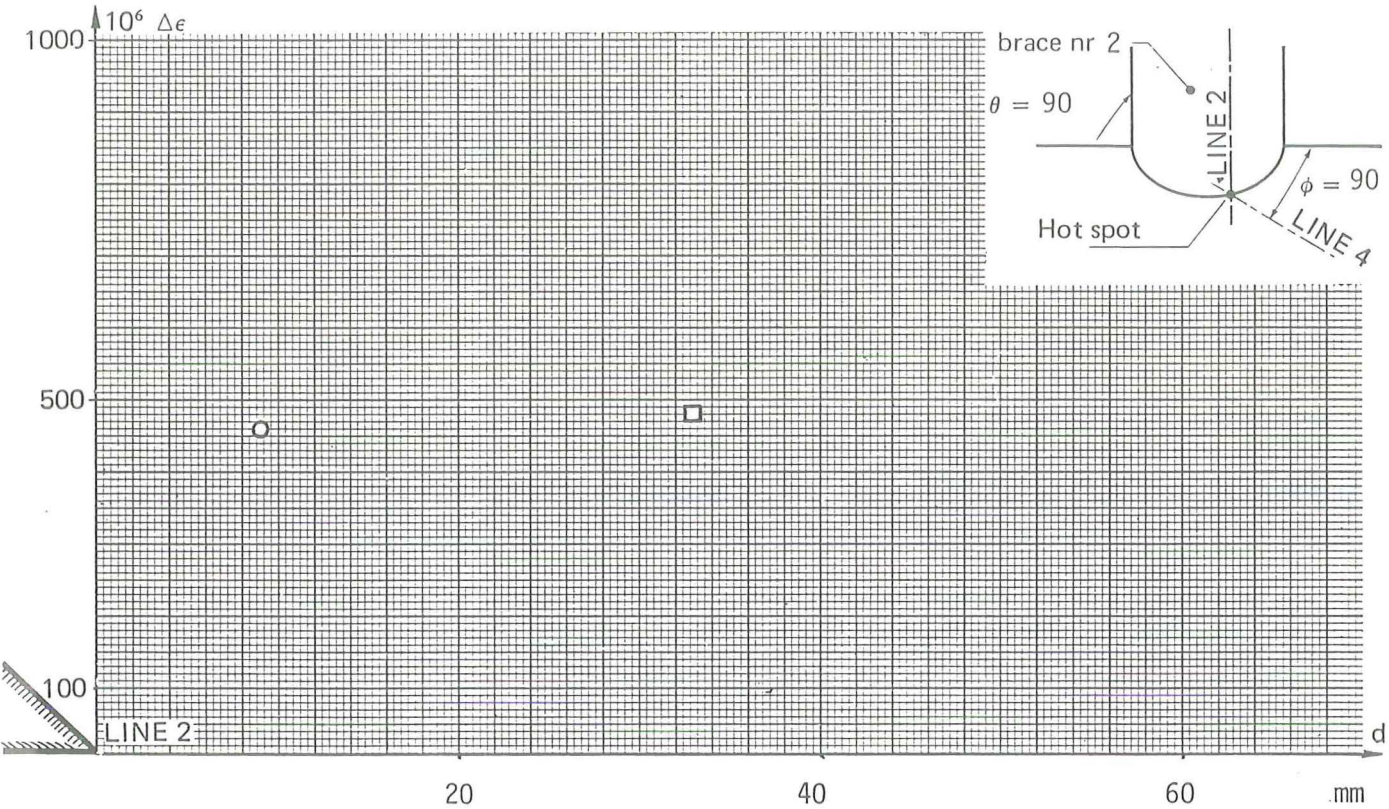
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 20.000

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
-270	270	-1		2	(see page 4)



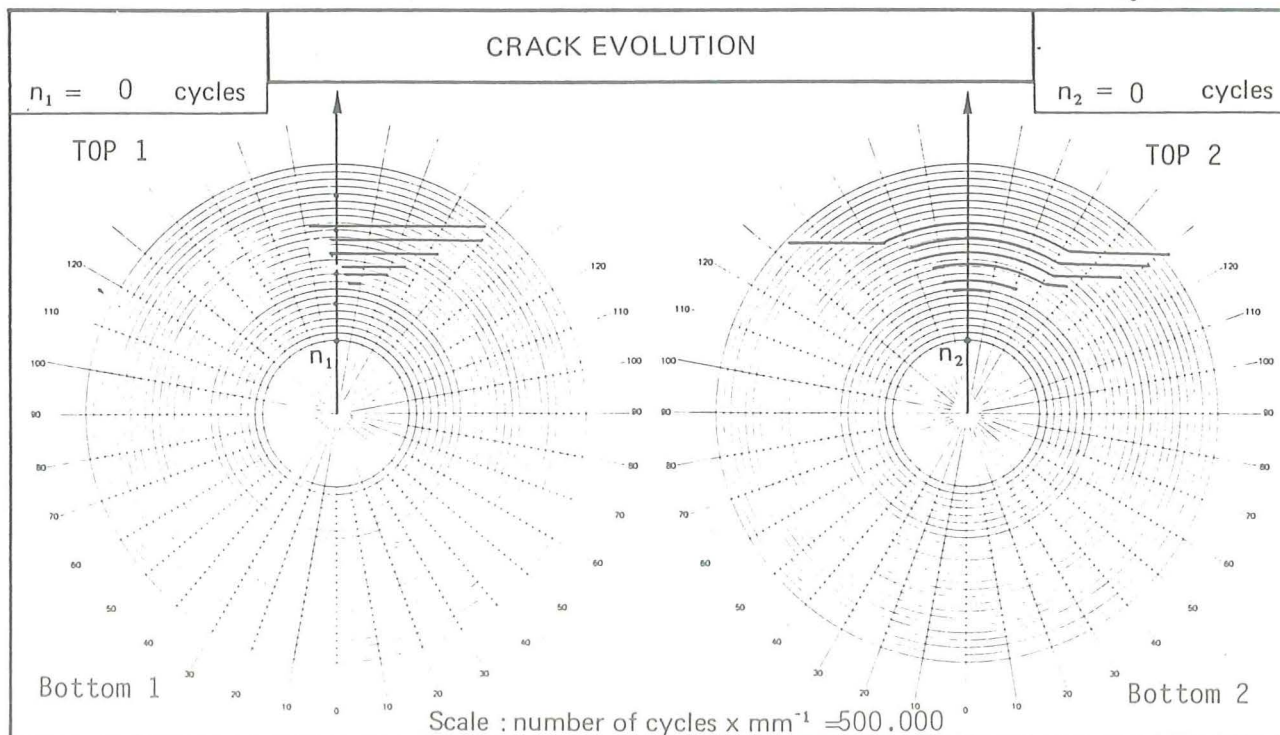
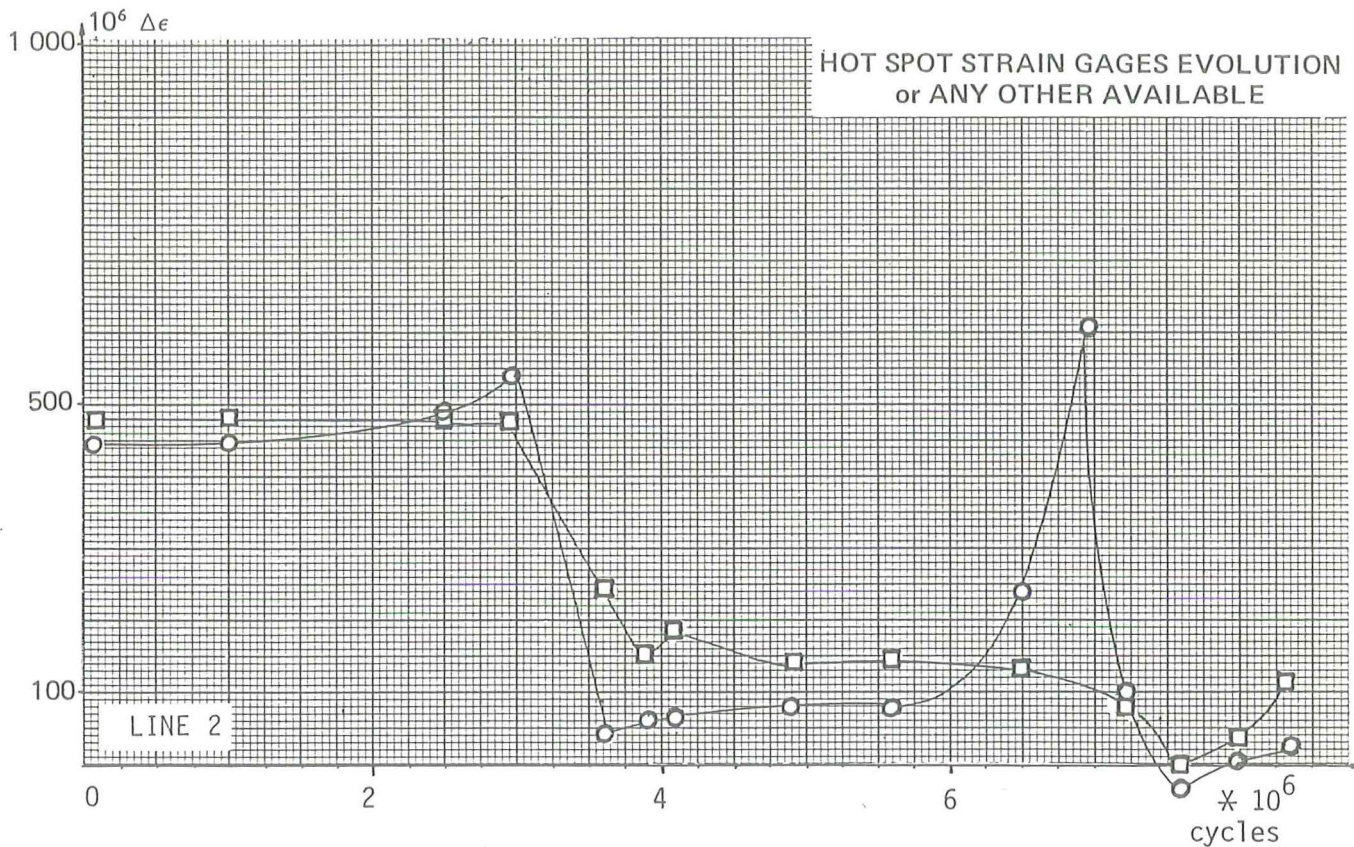
* The calculation has been based on the average SNCF's of the identical specimens.

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	3.2×10^6	3.0×10^6	6.5×10^6	8.4×10^6	

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



OTHER RELEVANT INFORMATIONS

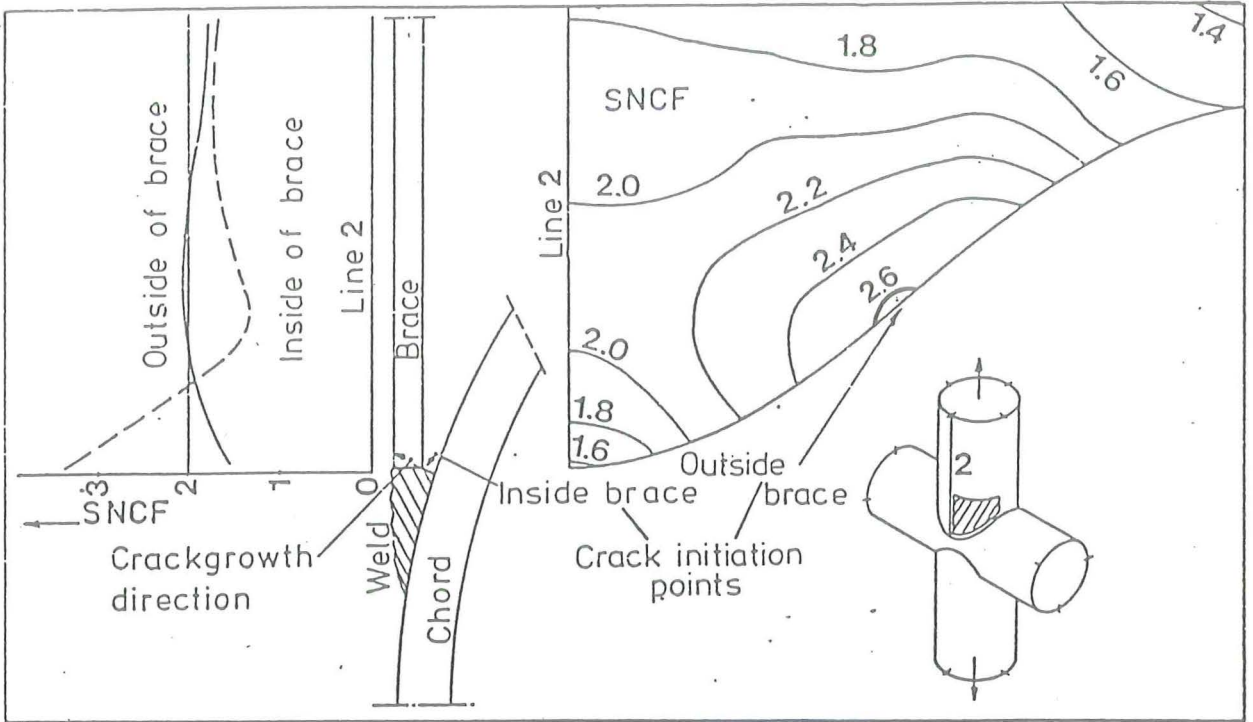


Fig. 1 Strain distribution of X - joints with $\beta=1$ and $\tau=0.55$

The fatigue testing was carried out under random loading.
Crest factor = 4.35

The random signal had a Gaussian probability density function and the distribution function of the amplitudes was a Raleigh distribution.

The strain measurements were carried out under constant amplitude loading with about the same RMS value.

	brace loading		cross section area [mm ²]	$\epsilon_{nom.}$	SNCF	$\epsilon_{hot spot}$
	RMS [kN]	load range [kN]				
Fatigue test	184.07		12396.47	200	2.7	540
Strain measurements	190.8	540	12396.47	207	2.7	559

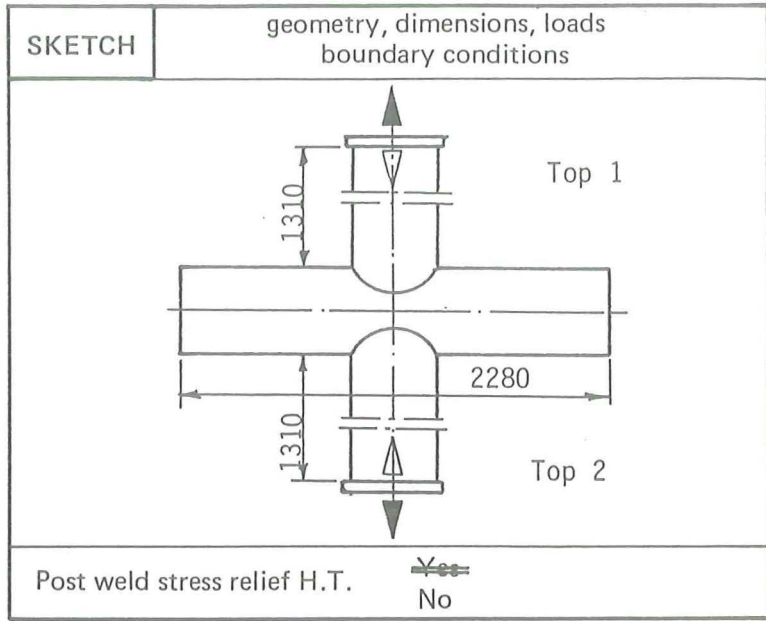
Explanation HSSR page 2 :

The HSSR which is given in the table , 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 (random)
Laboratory	DUT - Stevinlab.
Specimen nr.	32



GEOMETRY values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 457.2	t ₁ 8.8
	d ₂	t ₂

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 Shot peening grinding										

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

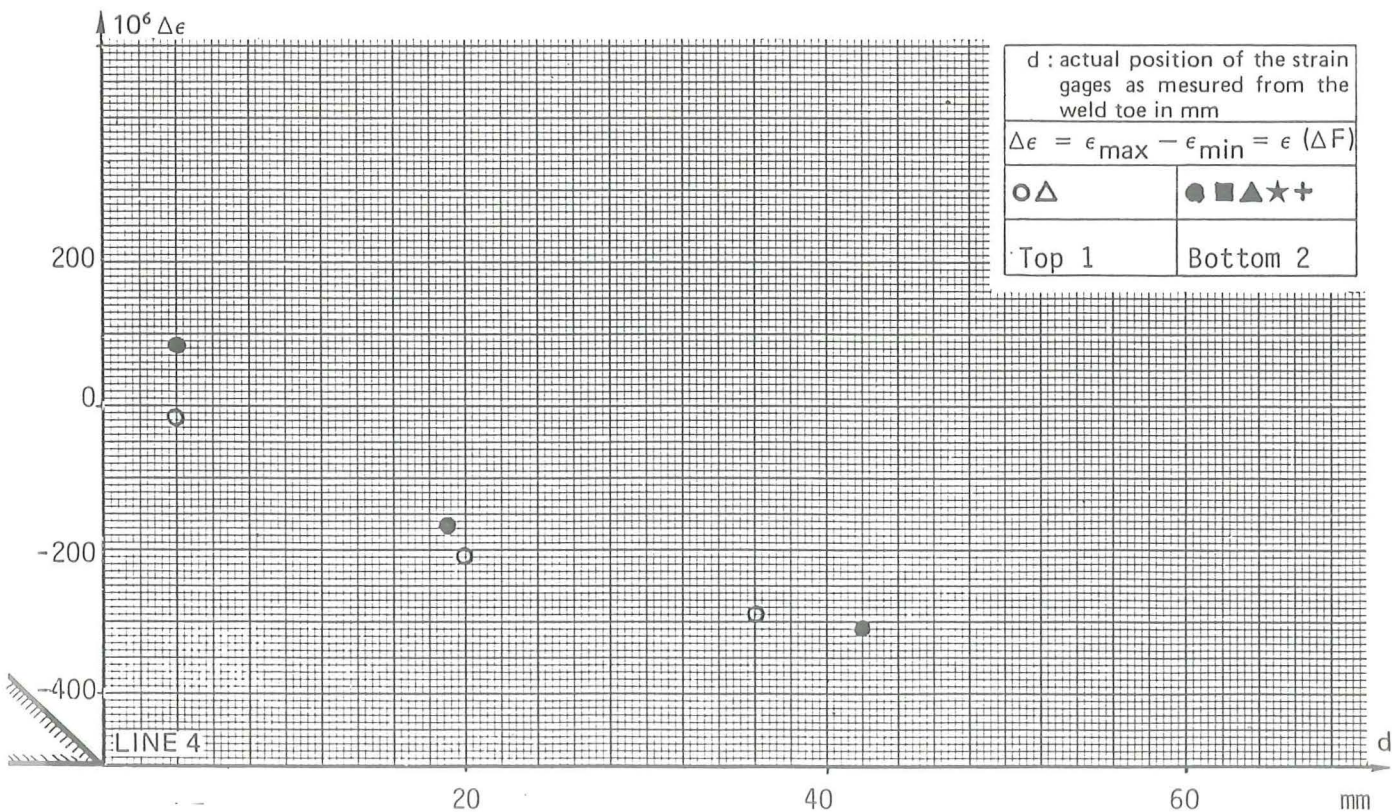
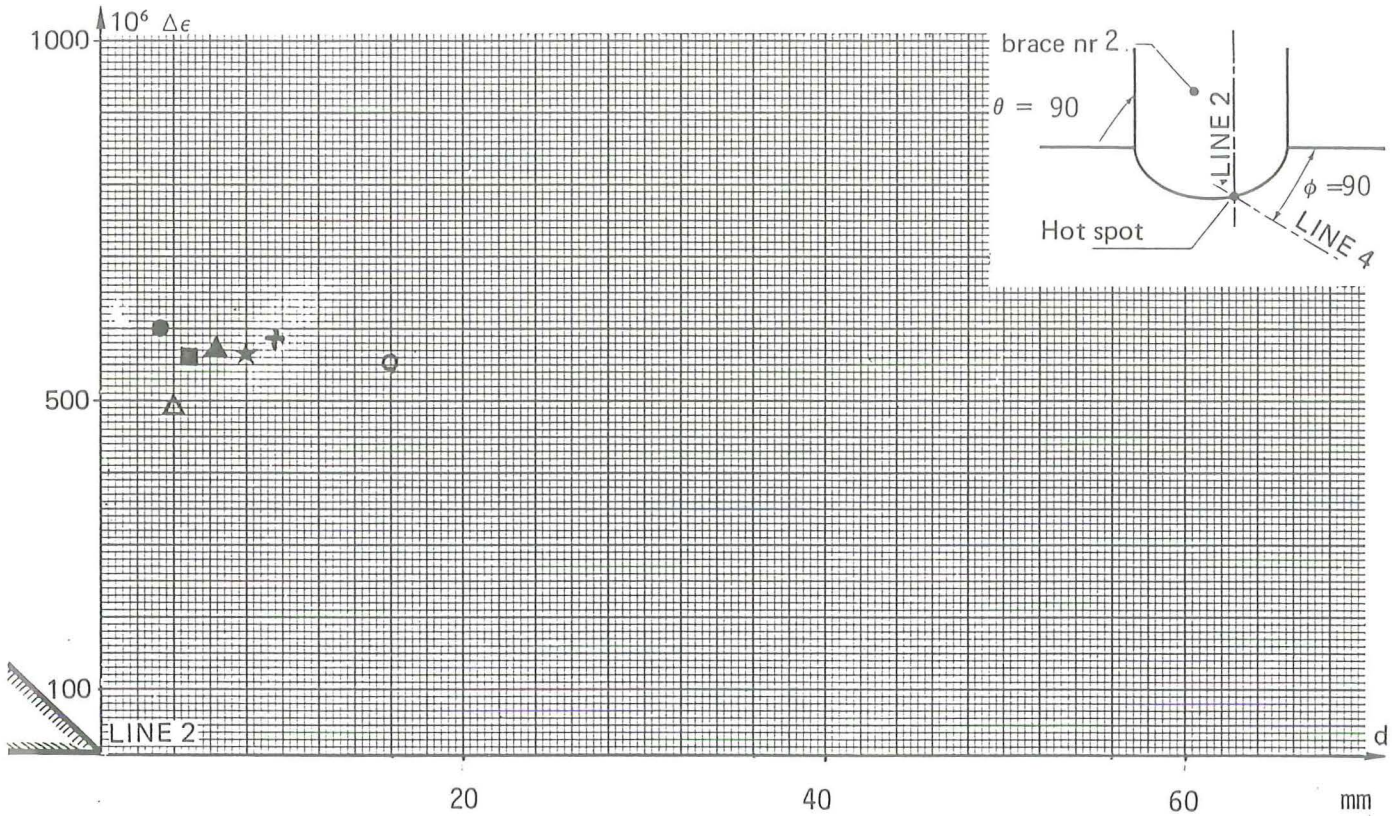
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	482	
Tensile strength σ_u (N/mm ²)	580	

Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 6000 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange \times
-340	340	-1		2	(see page 4)



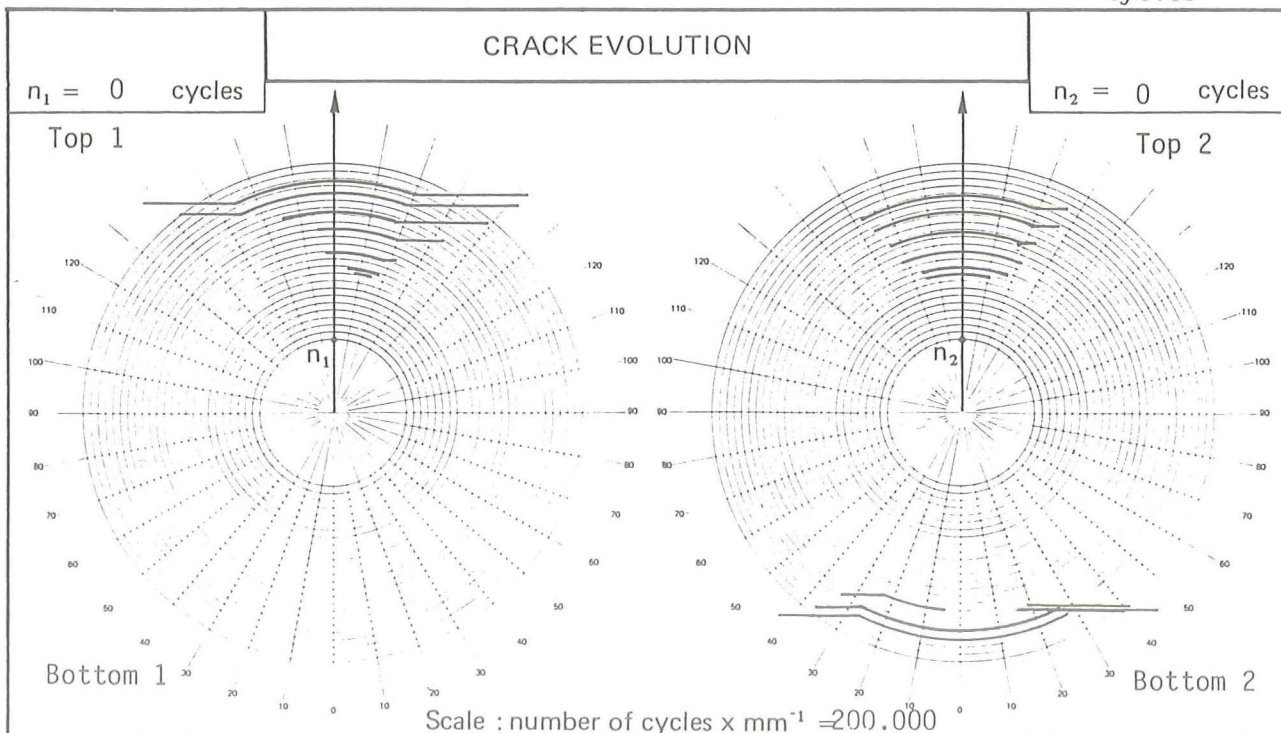
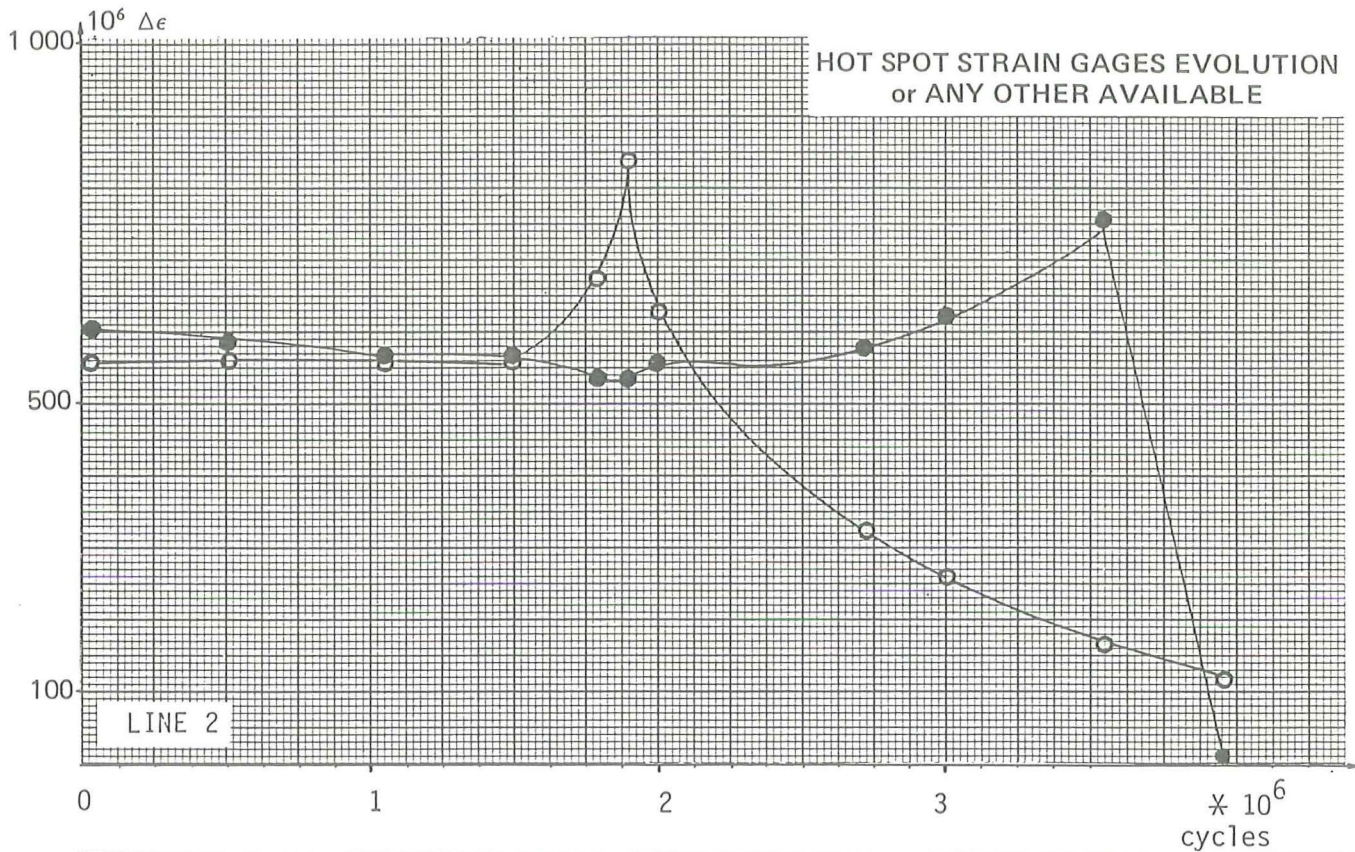
The calculation has been based on the average SNCF's of the identical specimens.

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 20 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.7×10^6	1.8×10^6	2.0×10^6	4.0×10^6	

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



OTHER RELEVANT INFORMATIONS

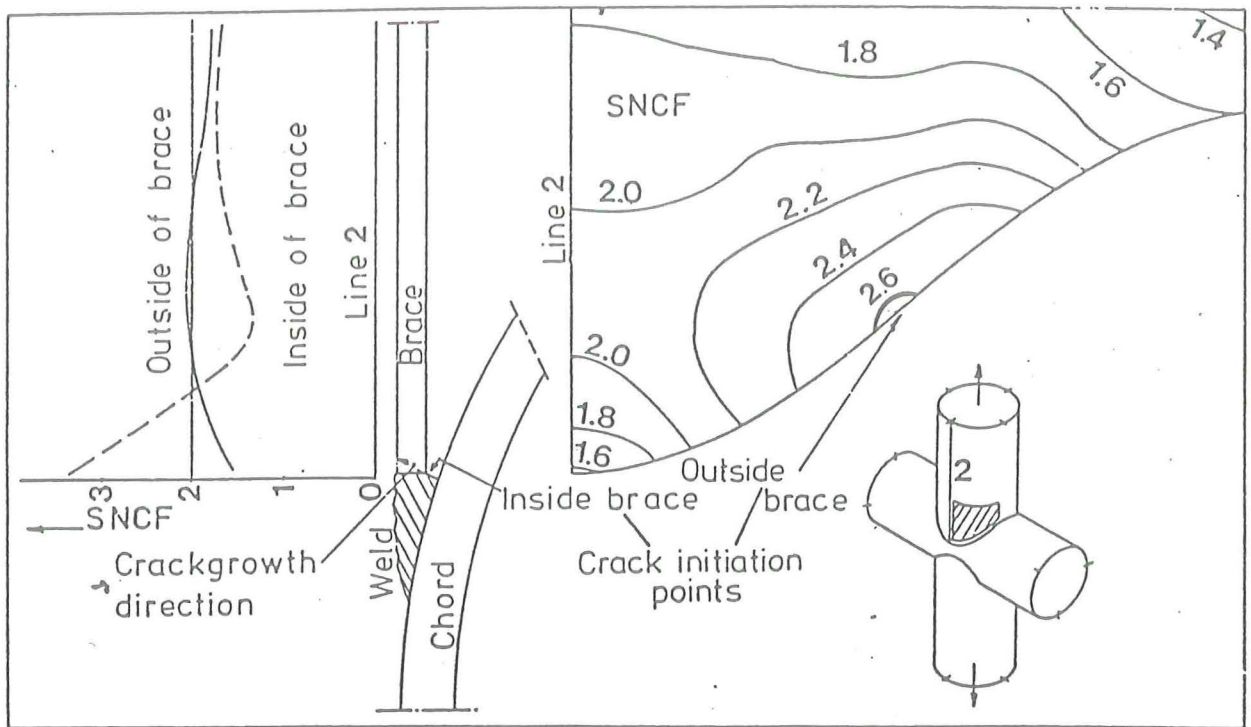


Fig. 1 Strain distribution of X - joints with $\beta=1$ and $\tau=0.55$

The fatigue testing was carried out under random loading.

Crest factor = 4.35

The random signal had a Gaussian probability density function and the distribution function of the amplitudes was a Raleigh distribution.

The strain measurements were carried out under constant amplitude loading with about the same RMS value.

	brace loading		cross section area [mm ²]	$\epsilon_{nom.}$	SNCF	$\epsilon_{hot spot}$
	RMS [kN]	load range [kN]				
Fatigue test	233.34		12396.47	254	2.7	686
Strain measurements	240.4	680	12396.47	261.2	2.7	705

Explanation HSSR page 2 :

The HSSR which is given in the table , 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.	33

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY values in mm	outside diameter	wall thickness
	D 457.2	T 16
	d ₁ 457.2	t ₁ 8.8
	d ₂	t ₂

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
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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		
	Shot peening grinding		

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

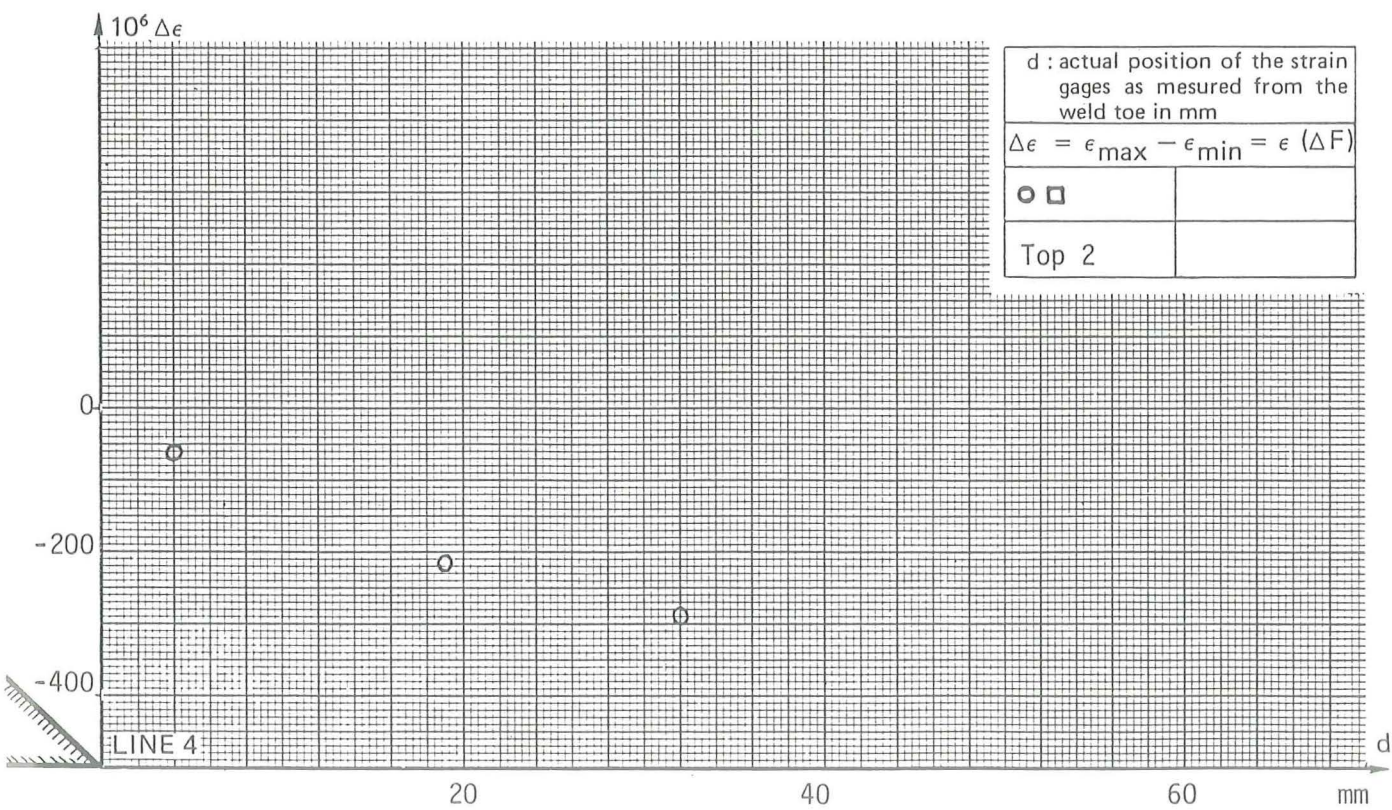
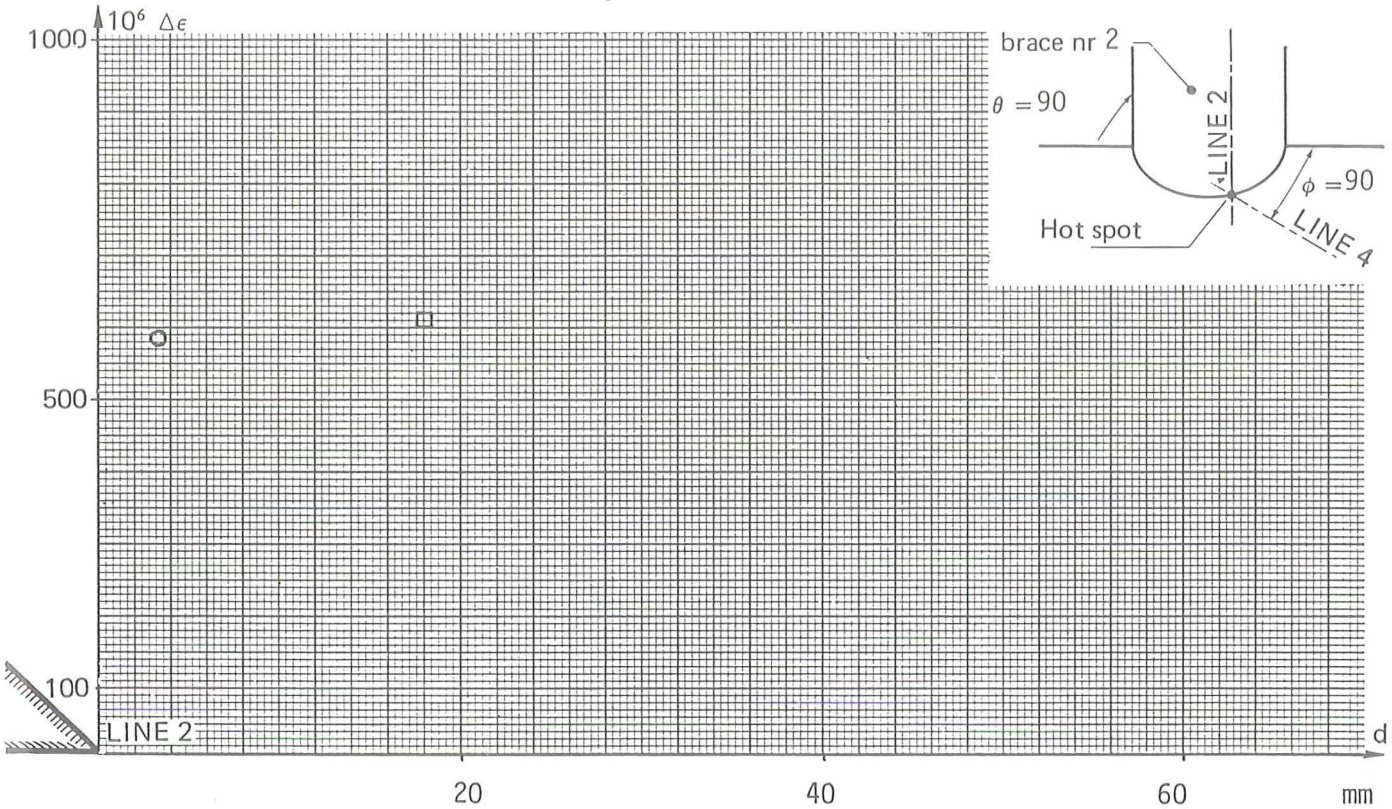
TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	482	
Tensile strength σ_u (N/mm ²)	580	

Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 5000 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange ^x
-377	377	-1		2	783 (see page 4)



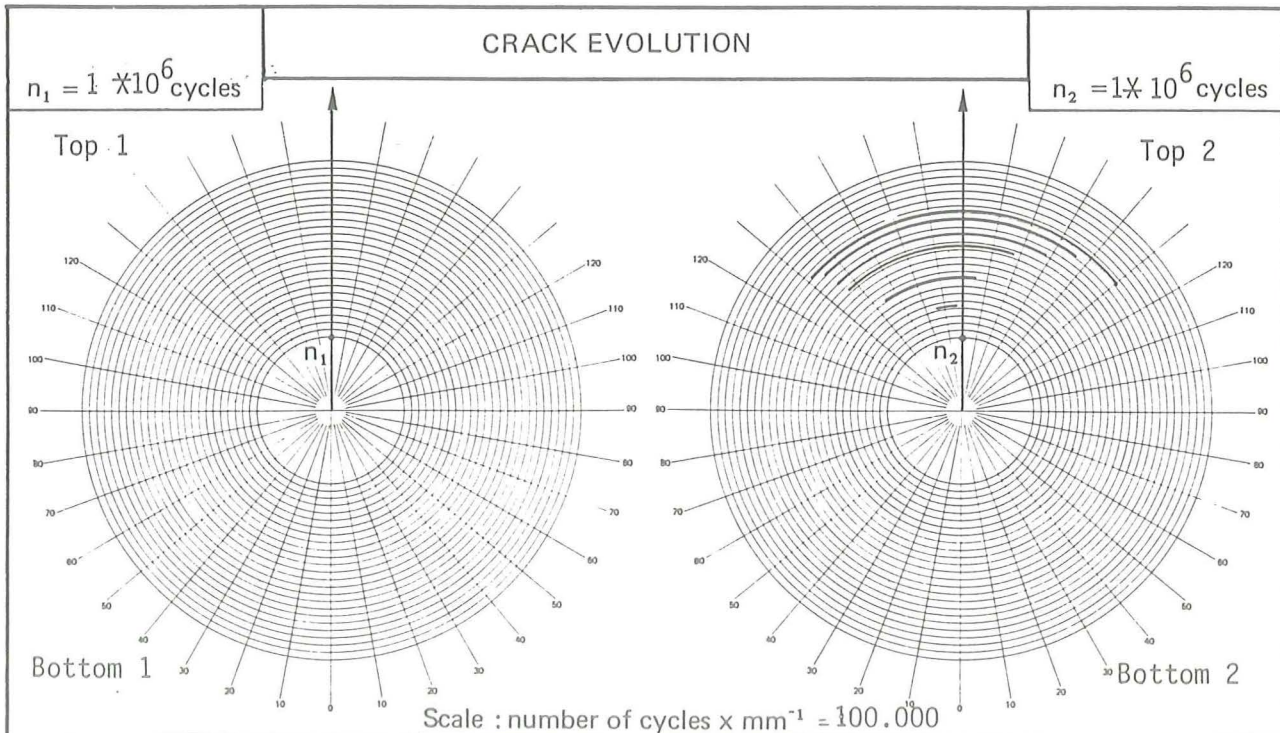
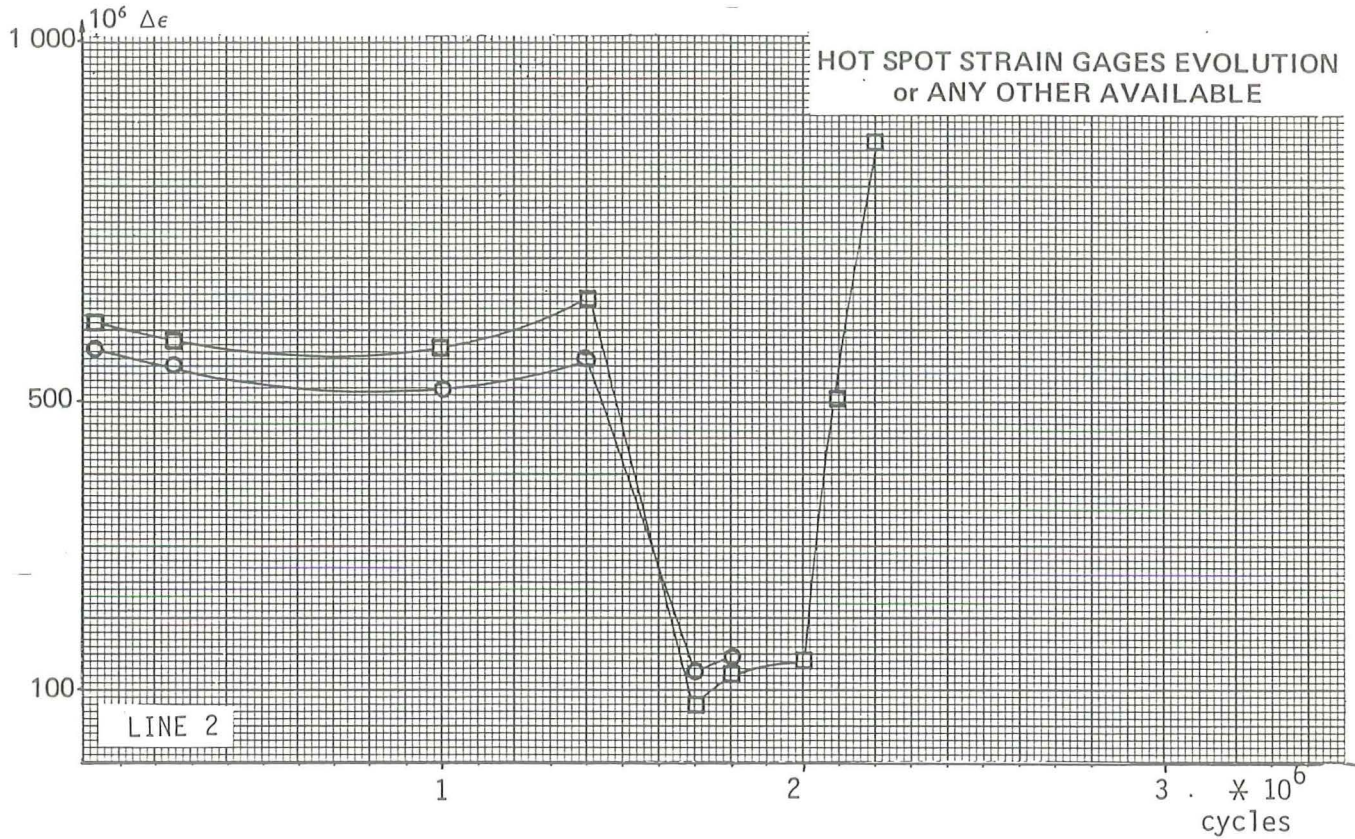
^x The calculation has been based on the average SNCF's of the identical specimens.

MEASUREMENTS DURING FATIGUE TESTING

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

FAILURE CRITERION	$\Delta\epsilon - 15\%$	Visual crack 40 mm	Through crack	End of the test (1)	Static residual strength (kN)
Number of cycles	1.4×10^6	1.4×10^6	2.4×10^6	2.9×10^6	

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



OTHER RELEVANT INFORMATIONS

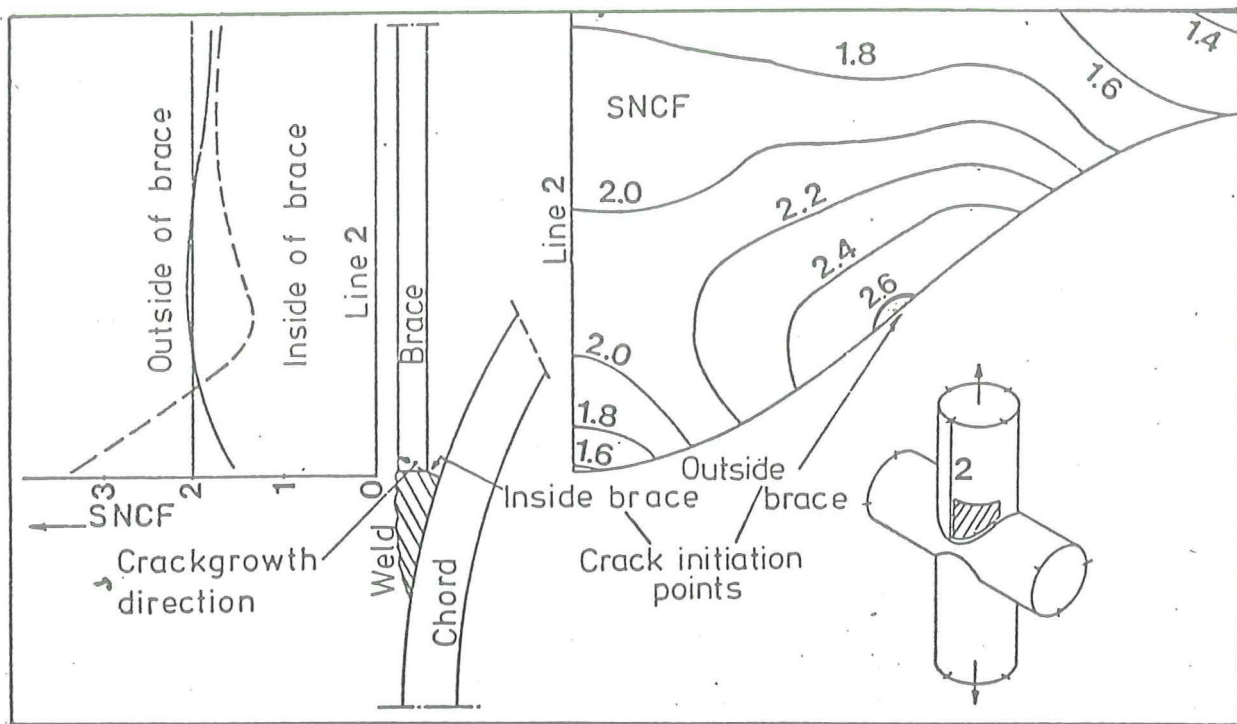


Fig. 1 Strain distribution of X - joints with $\beta=1$ and $\tau=0.55$

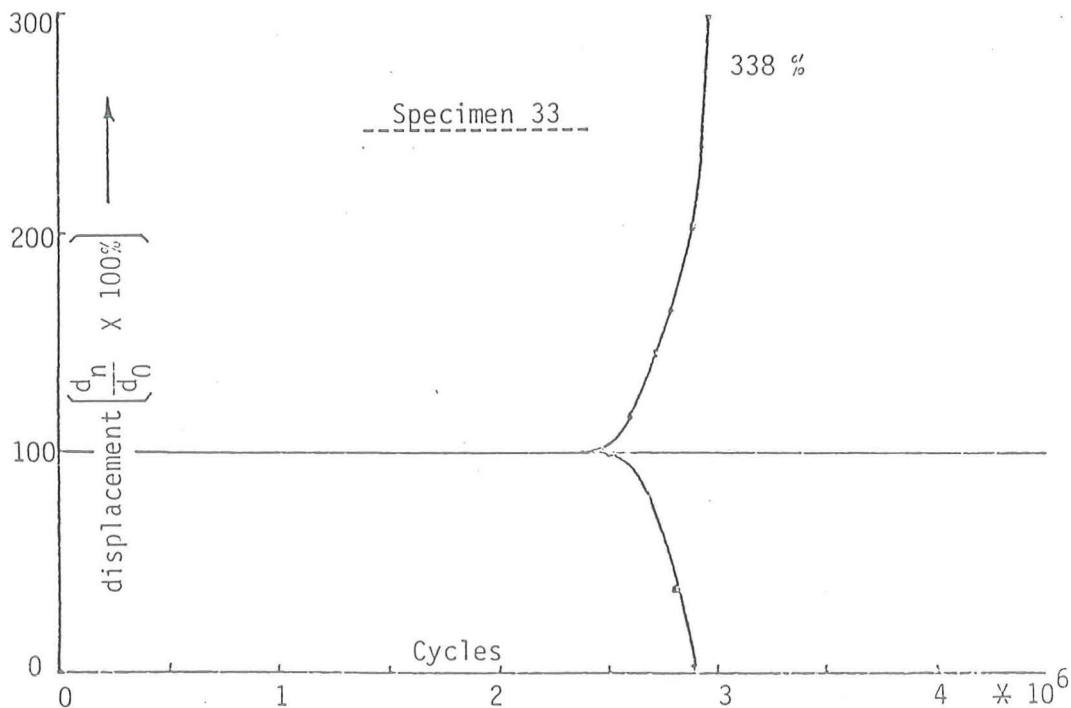


Fig. 2 Evolution of the node elongation per cycle during the test

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.	34

SKETCH	geometry, dimensions, loads boundary conditions
Post weld stress relief H.T. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

GEOMETRY <small>actual values in mm</small>	outside diameter	wall thickness
	D 914.4	T 32
	d ₁ 457.2	t ₁ 16
	d ₂	t ₂

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 : 130 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		
Sheet peening grinding		

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_Y (N/mm ²)	366	
Tensile strength σ_U (N/mm ²)	532	

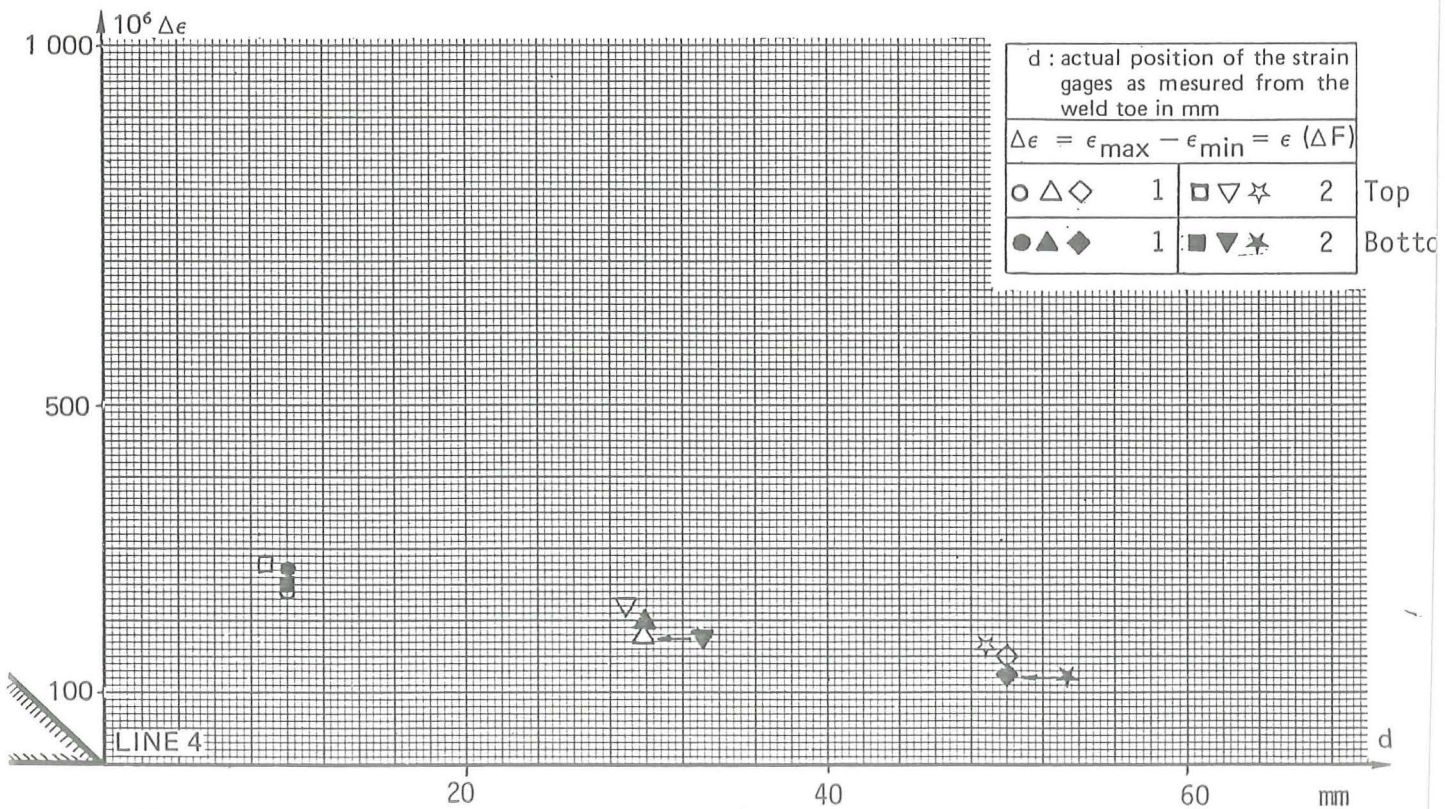
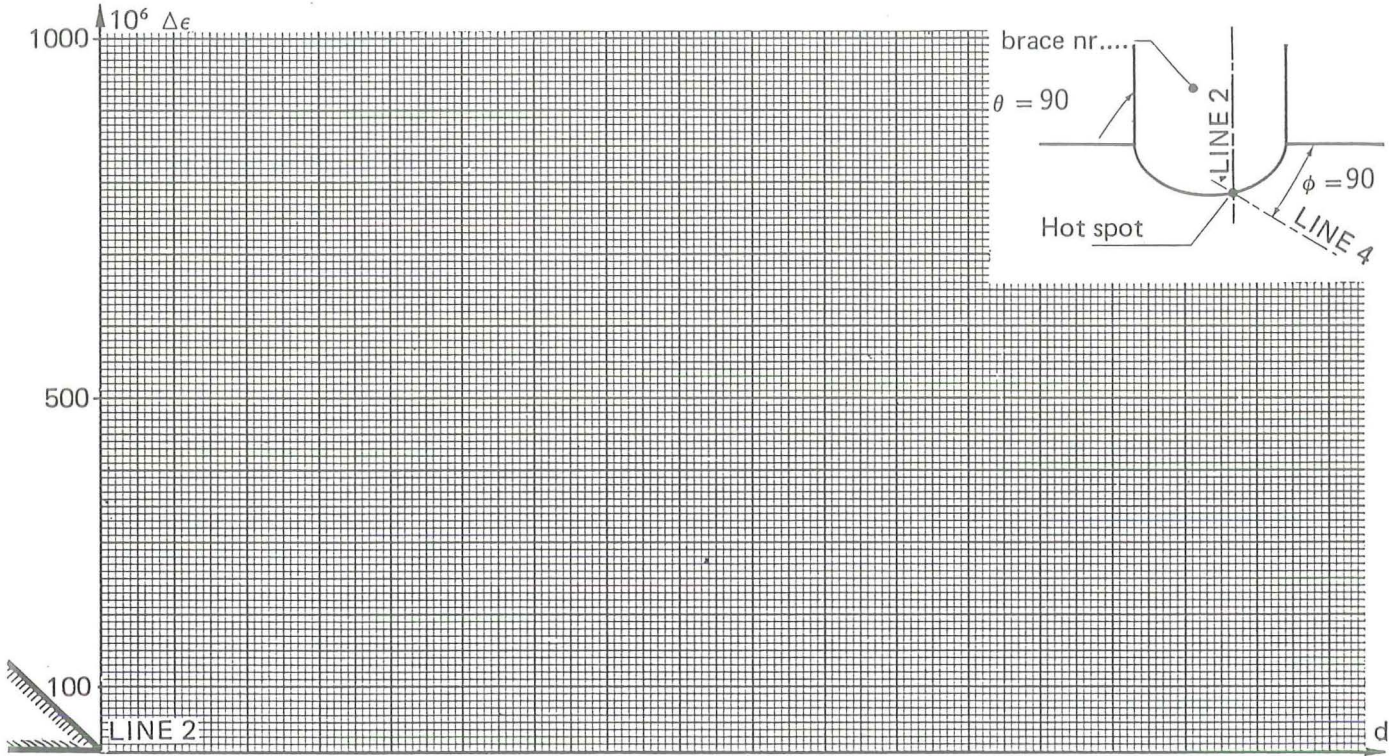
Other properties see page 4

MEASUREMENTS BEFORE FATIGUE TESTING

Spec. 34 - page 2

Number of cycles before measurements : 15 cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	160	0		6	323



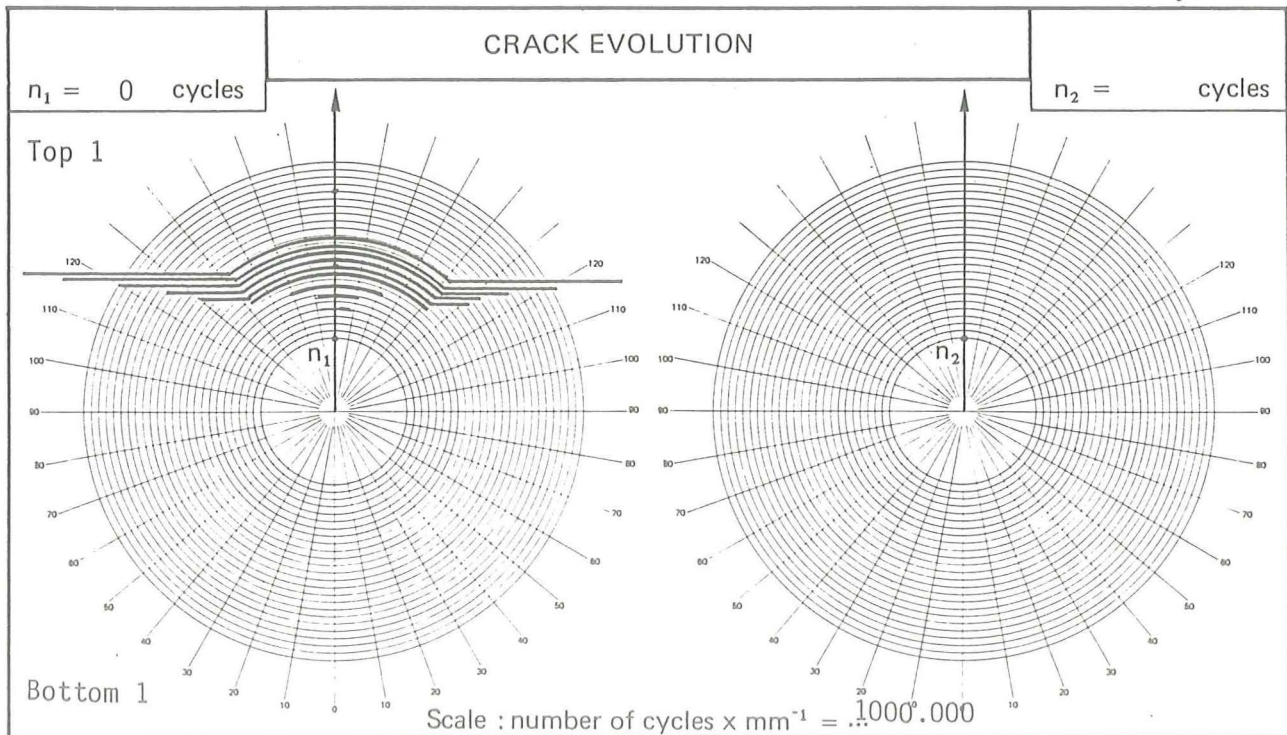
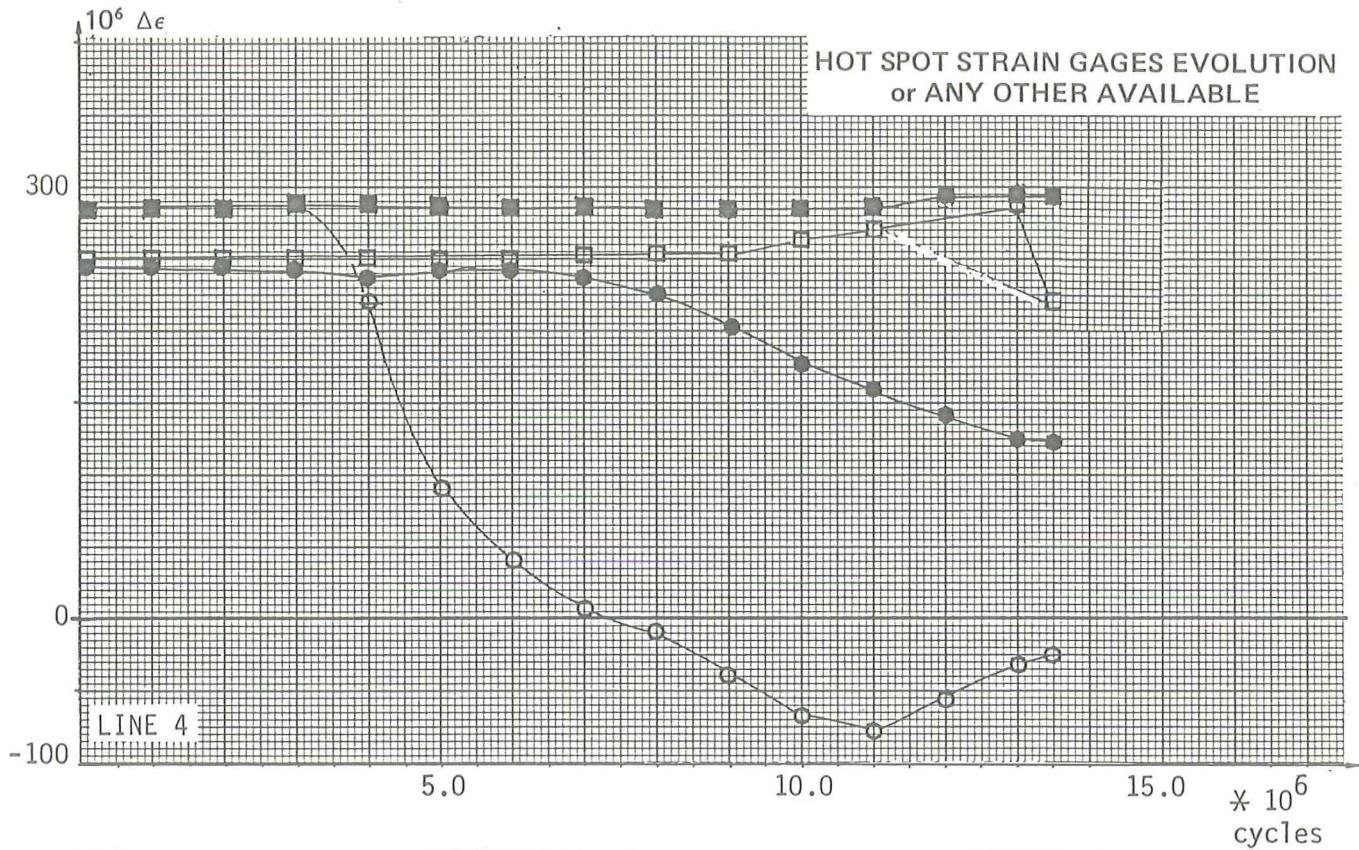
* The calculation has been based on the average SNCF's of the identical specimens

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	3.8×10^6	4.0×10^6	1.2×10^7	1.4×10^7	

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



OTHER RELEVANT INFORMATIONS

Spec. 34 - page 4

OFFSHORE TUBULAR JOINT TEST DATA SHEET

ECSC Pg. F7

Type	X - joint
Loading	Axial
Laboratory	TNO - IBBC
Specimen nr.	35

GEOMETRY values in mm	outside diameter		wall thickness	
	D	914.4	T	32
	d ₁	457.2	t ₁	16
	d ₂		t ₂	

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 : 160 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			
Sheet peening grinding			

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

TENSILE PROPERTIES	Base metal	weld metal
Yield strength σ_y (N/mm ²)	366	
Tensile strength σ_u (N/mm ²)	532	

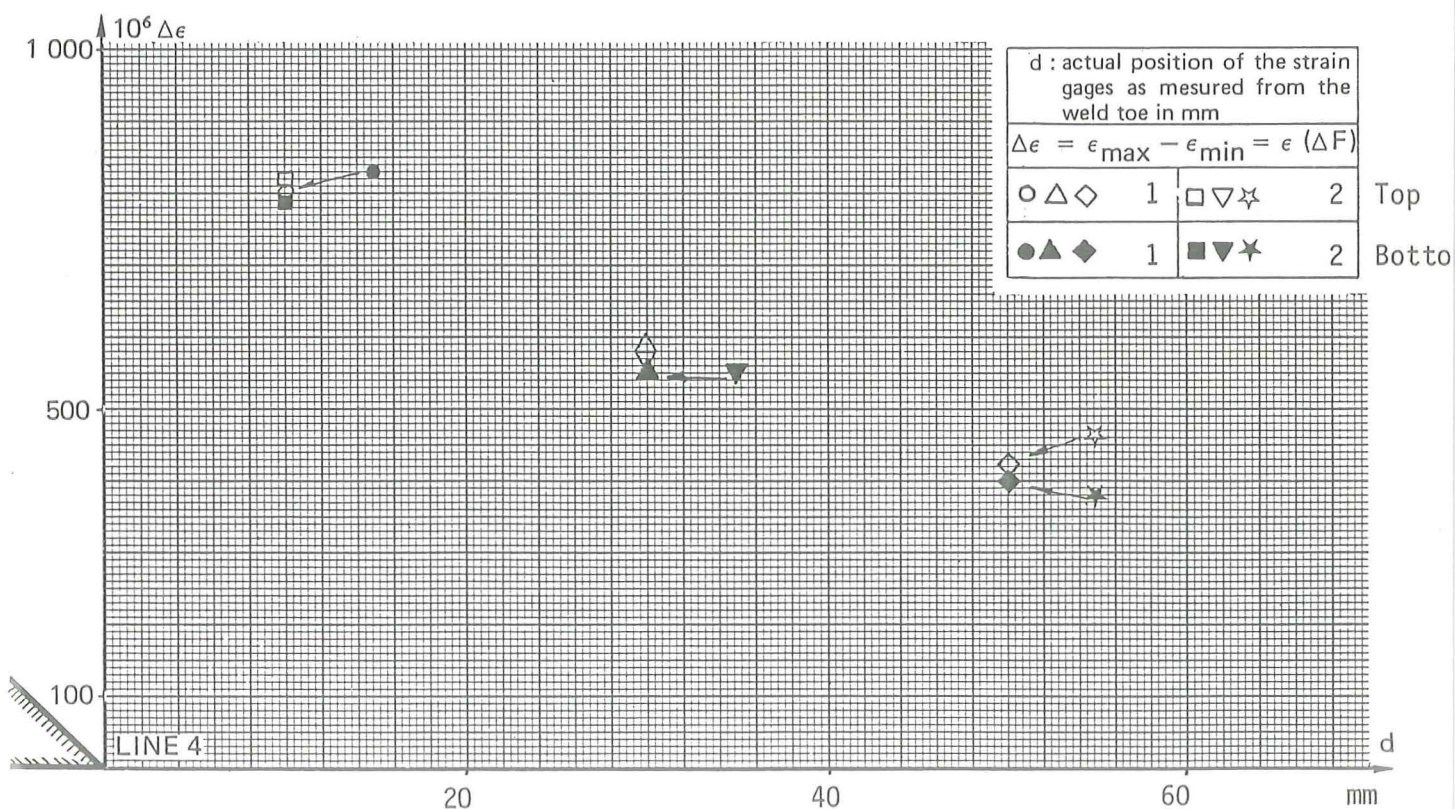
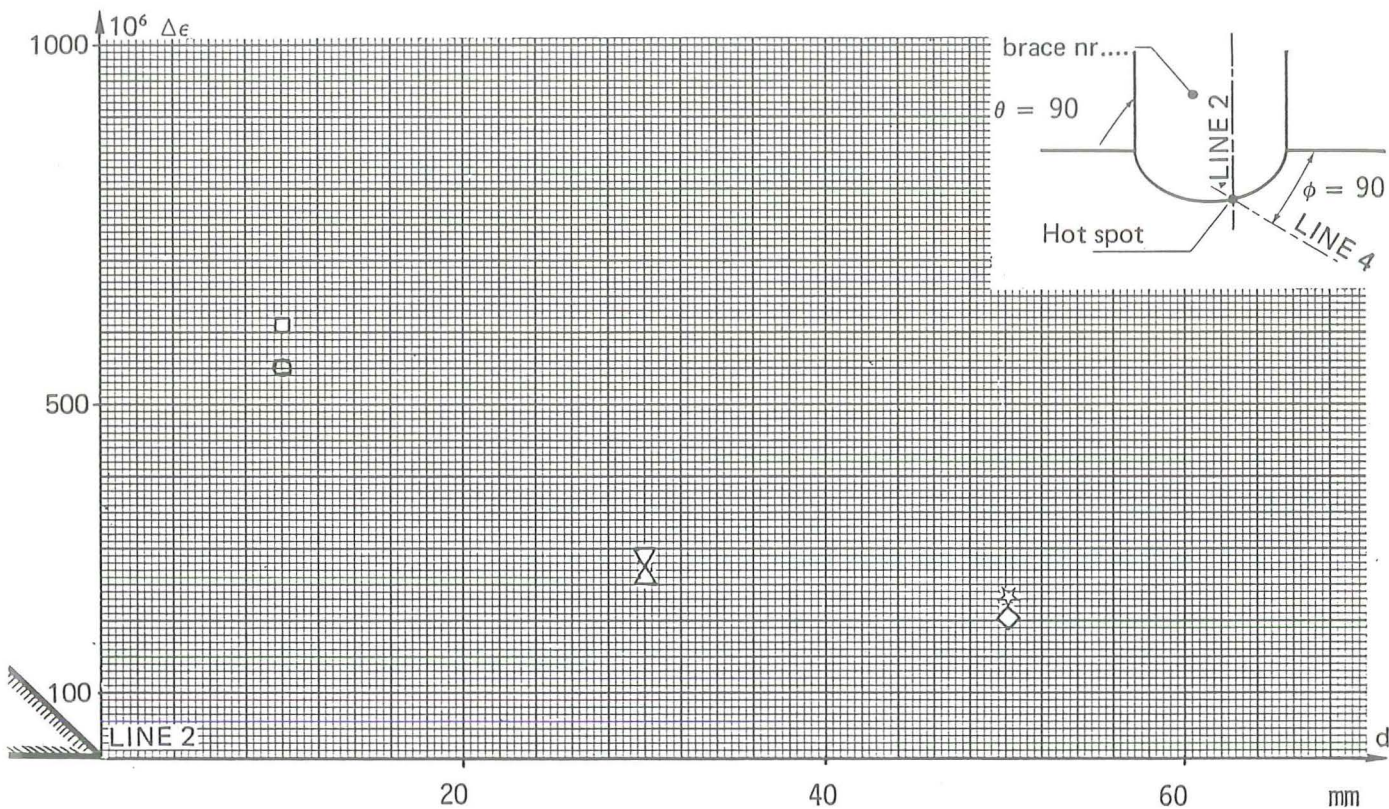
**Other
properties
see page 4**

MEASUREMENTS BEFORE FATIGUE TESTING

Number of cycles before measurements : 80

cycles

F_{min} (kN)	F_{max} (kN)	R_S	T (°C)	Frequencies (Hz)	Extrapol. Hot Spot Strainrange *
0	400	0		3	817



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